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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 12/07 ~ 12/29
Test Site : ESTECH Co., Ltd. Korea**Test Device :**

Models : RD6330,AD6345

FCC ID : BEJRD6330

TYPE : SINGLE BAND, SINGLE MODE CDMA MOBILE PHONE
(Prototype)

Test report no :

ESTSAR0512-012

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 : 2005/12/29

Report Prepared By : Engineer/ K.H.Kang

(Signature)

Manager Engineer/ Jay Kim

(Signature)

Test report no : ESTSAR0512-012

FCC ID : BEJRD6330

Web : www. estech. co. kr

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1. SUMMARY FOR TEST REPORT

FCC ID	BEJRD6330
Date of test	2005/12/07 ~ 2005/12/29
Responsible test engineer	Jay Kim
Measurement performed by	K.H.Kang
EUT Type	SINGLE BAND, SINGLE MODE CDMA MOBILE PHONE (Prototype)
Tx Frequency	824.70 ~ 848.31 MHz
Rx Frequency	869.70 ~ 893.31 MHz
Max. RF Output Power	CDMA (25 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	25	Standard	Left Touch	—	0.992

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			
848.31	777	CDMA	25	Standard	1.5cm [w/o Holster]	—	1.24

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	Internal Antenna
Location	the top of the device
Radiator Material	Copper

2.2 Device Description

FCC ID	FCC ID : BEJRD6330
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)
test signal method	☐ Base station simulator ☒ Internal test code

2.3 Battery Options

There is only one battery option available for tested device,



4. TEST CONDITIONS

4.1 Ambient Conditions

Ambient Temperature (°C)	22
Tissue simulating liquid temperature (°C)	22
Humidity (%)	45

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.

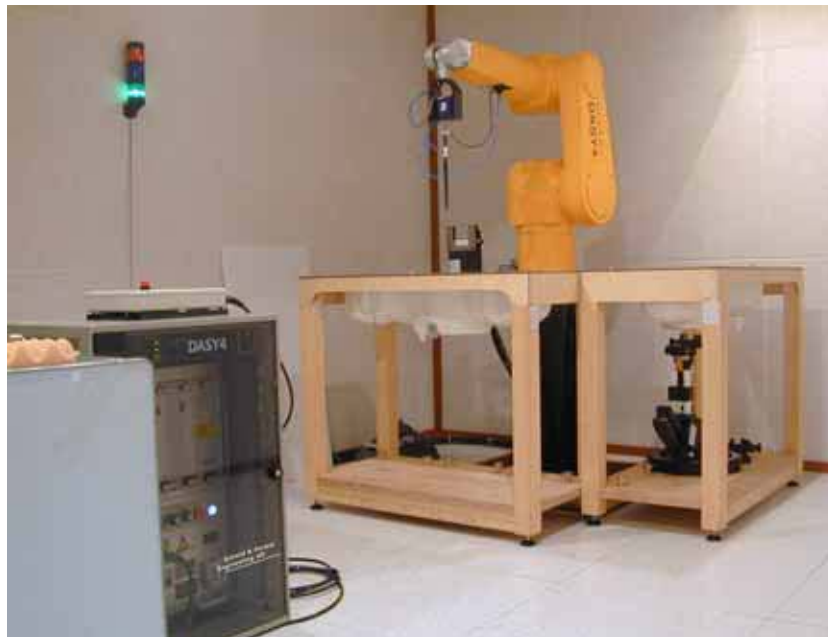


Fig. 4.1 SAR Measurement System



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	2005-10-17
Signal generator	E4421B	GB40052295	2005-03-03
RF Power meter	EPM-442A	GB37170412	2005-10-05
Power Sensor	8481A	3318A90368	2005-10-05
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.

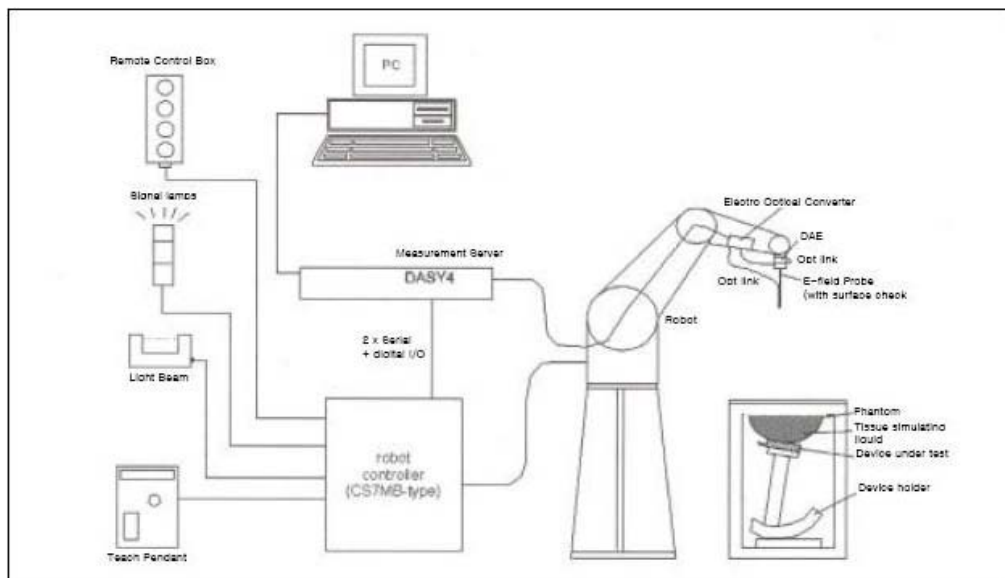


Fig. 5.1 SAR Measurement System Setup

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

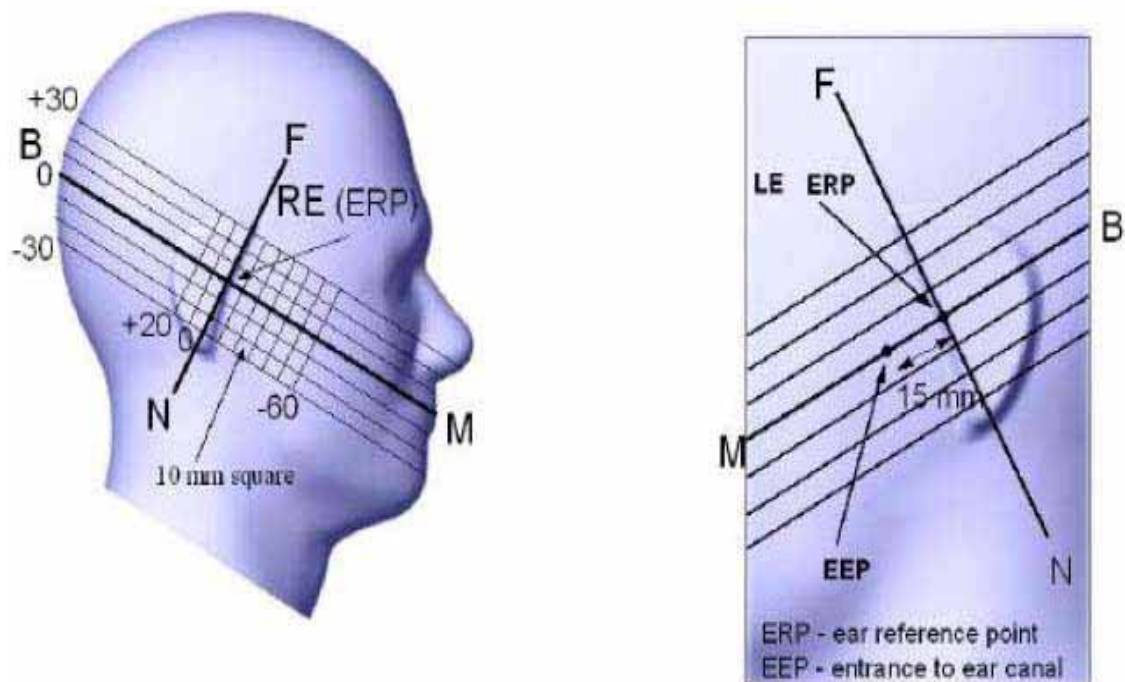


Figure 6.1 Close-up side view of ERP

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)

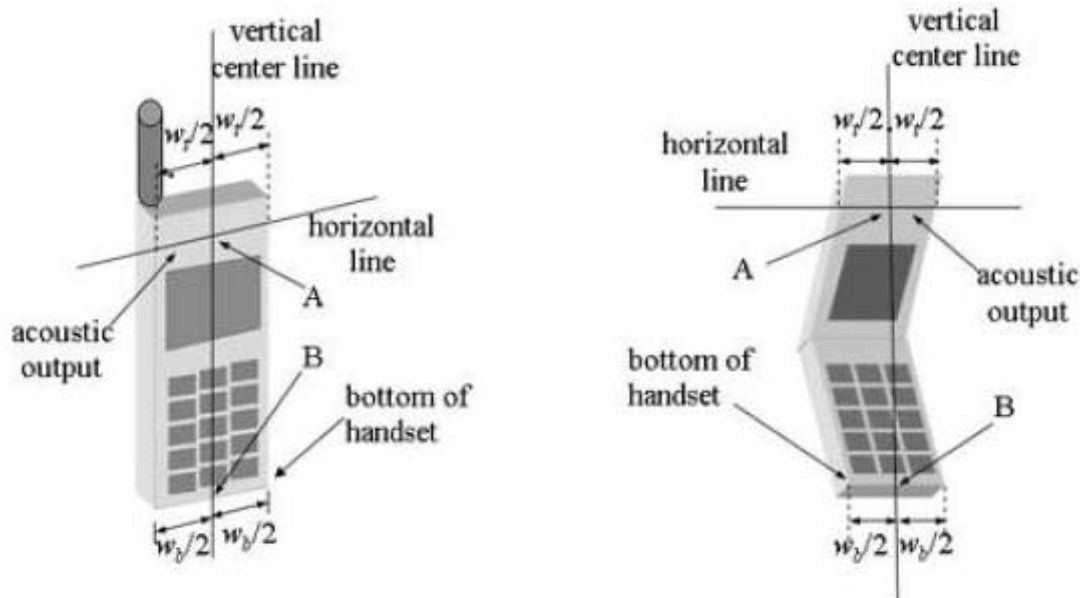


Figure 6.2 Handset Vertical Center & Horizontal Line Reference Points

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

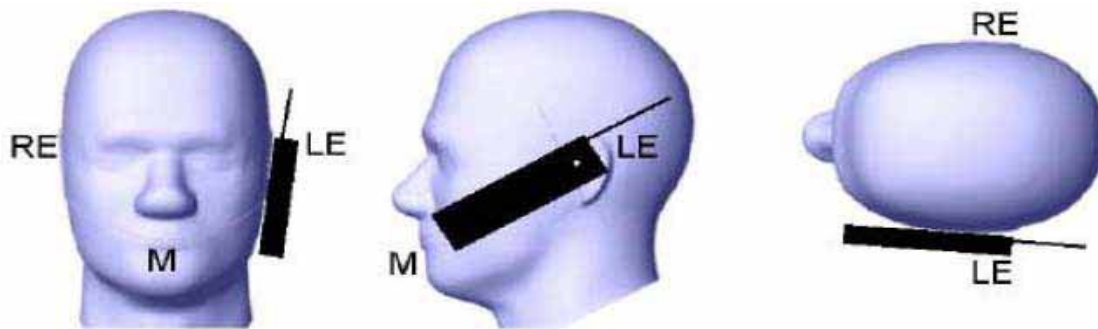


Figure 6.3 "Cheek" or "Touch" Position.

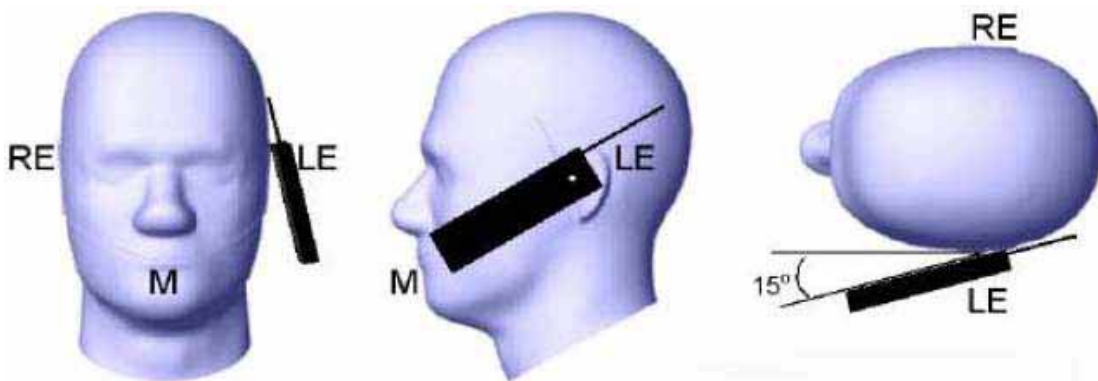


Figure 6.4 "Tilted" Position.



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.



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)			22		Liquid Depth(mm)		150			
Date	2005-12-28		2005-12-28				/ /			
Tissue	835MHz Brain		835MHz Muscle							
	Target	Measured	Target	Measured						
Dielectric Constant: ϵ	41.5	40.6	55.2	53.4						
Conductivity: σ	0.9	0.91	0.97	0.987						
Deviation (%)	ϵ : -2.17% σ : 1.11%		ϵ : -3.26% σ : -1.75%							

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	9.4	1.05%	2005-12-28

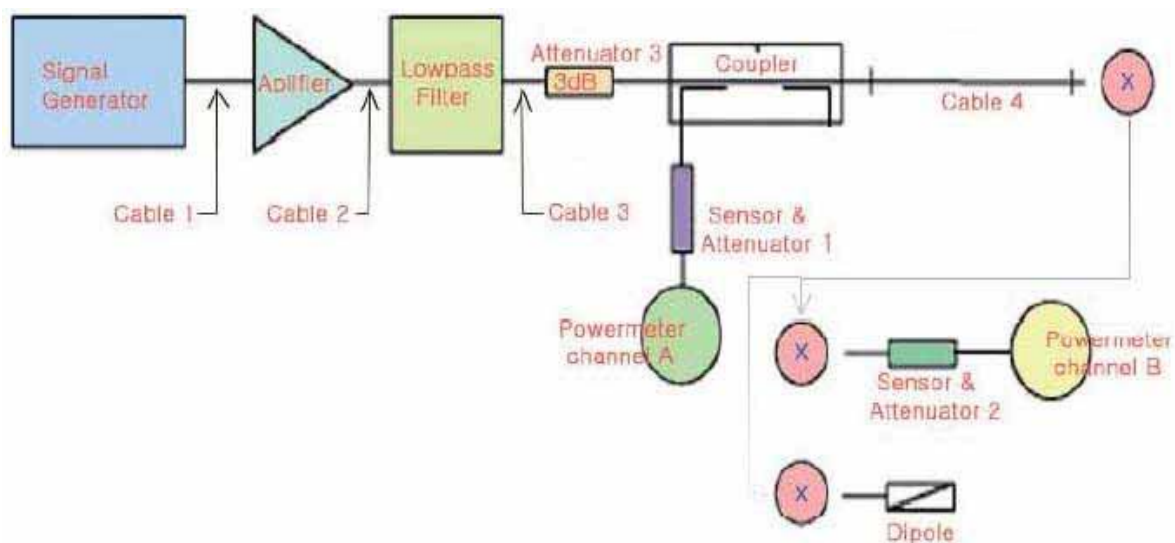


Figure 12.1 Dipole Validation Test Setup



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9. RESULTS(continued)

Ambient TEMPERATURE (C) : 21.0

Relative HUMIDITY (%) : 48

Mixture Type : 835MHz Brain

Dielectric Constant : 40.6

Conductivity: 0.91

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	25.00	24.95	Standard	Cheek Touch	–	0.605
835.89	363	CDMA	25.00	24.87	Standard	Cheek Touch	–	0.848
848.31	777	CDMA	25.00	24.99	Standard	Cheek Touch	–	0.992

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	25.00	24.95	Standard	Cheek Touch	–	0.592
835.89	363	CDMA	25.00	24.96	Standard	Cheek Touch	–	0.816
848.31	777	CDMA	25.00	24.95	Standard	Cheek Touch	–	0.939

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 : ESTSAR0512-012

FCC ID : BEJRD6330

Web : www.estech.co.kr

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9. RESULTS(continued)

Ambient TEMPERATURE (C) : 21.0

Relative HUMIDITY (%) : 48

Mixture Type : 835MHz Brain

Dielectric Constant : 40.6

Conductivity: 0.91

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	25.00	24.94	Standard	Tilt	–	0.459

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	25.00	24.94	Standard	Tilt	–	0.47

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 : ESTSAR0512-012

FCC ID : BEJRD6330

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9. RESULTS(continued)

Ambient TEMPERATURE (C) : 22

Relative HUMIDITY (%) : 49

Mixture Type : 835MHz Body

Dielectric Constant : 53.4

Conductivity: 0.987

Measurement Results (CDMA BODY SAR with 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 (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	25.00	24.81	Standard	1.5[w/o Holster]	—	0.833
835.89	363	CDMA	25.00	24.86	Standard	1.5[w/o Holster]	—	1.020
848.31	777	CDMA	25.00	24.97	Standard	1.5[w/o Holster]	—	1.240

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 : ESTSAR0512-012

FCC ID : BEJRD6330

Web : www.estech.co.kr

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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



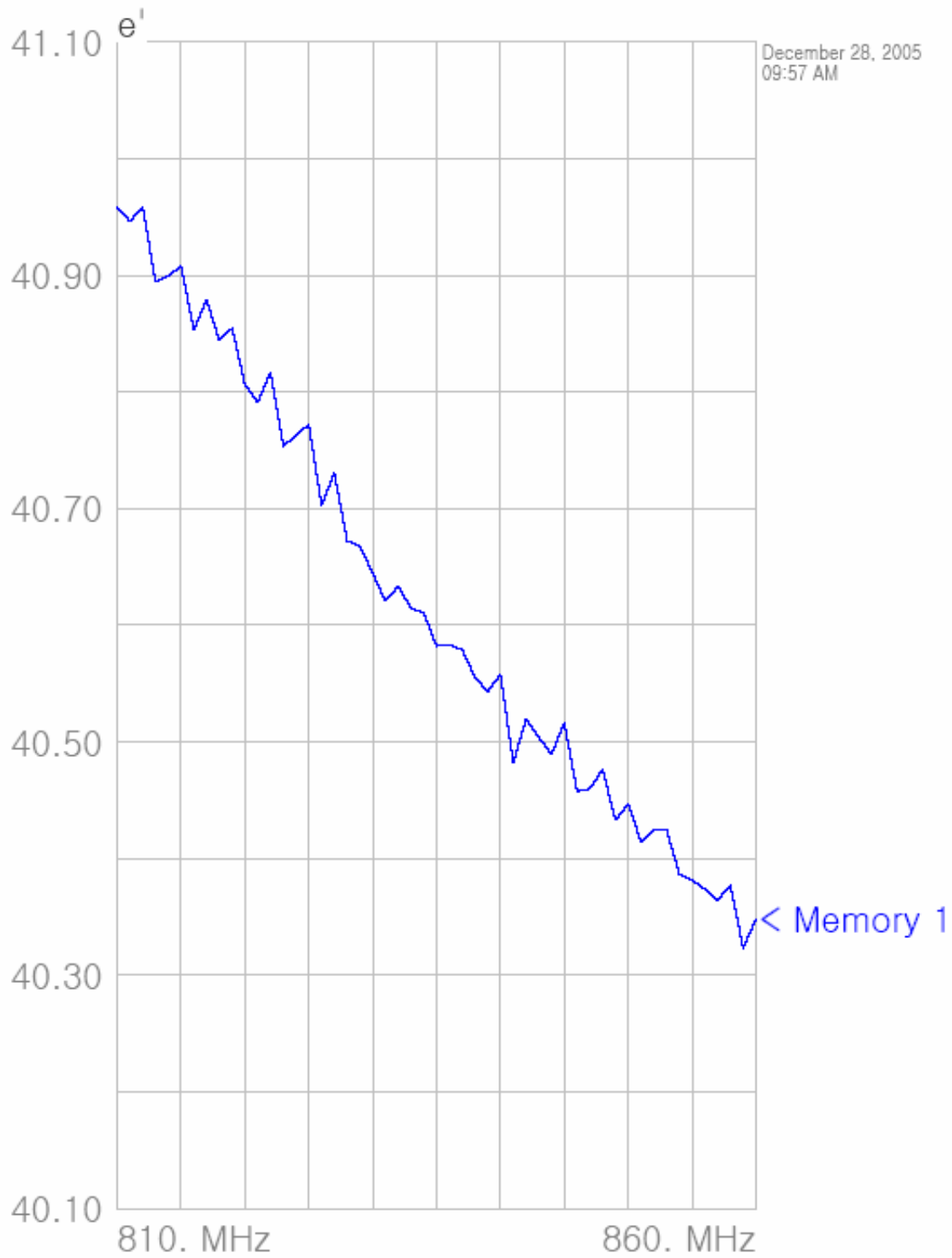
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– Head Tissue

Title
SubTitle





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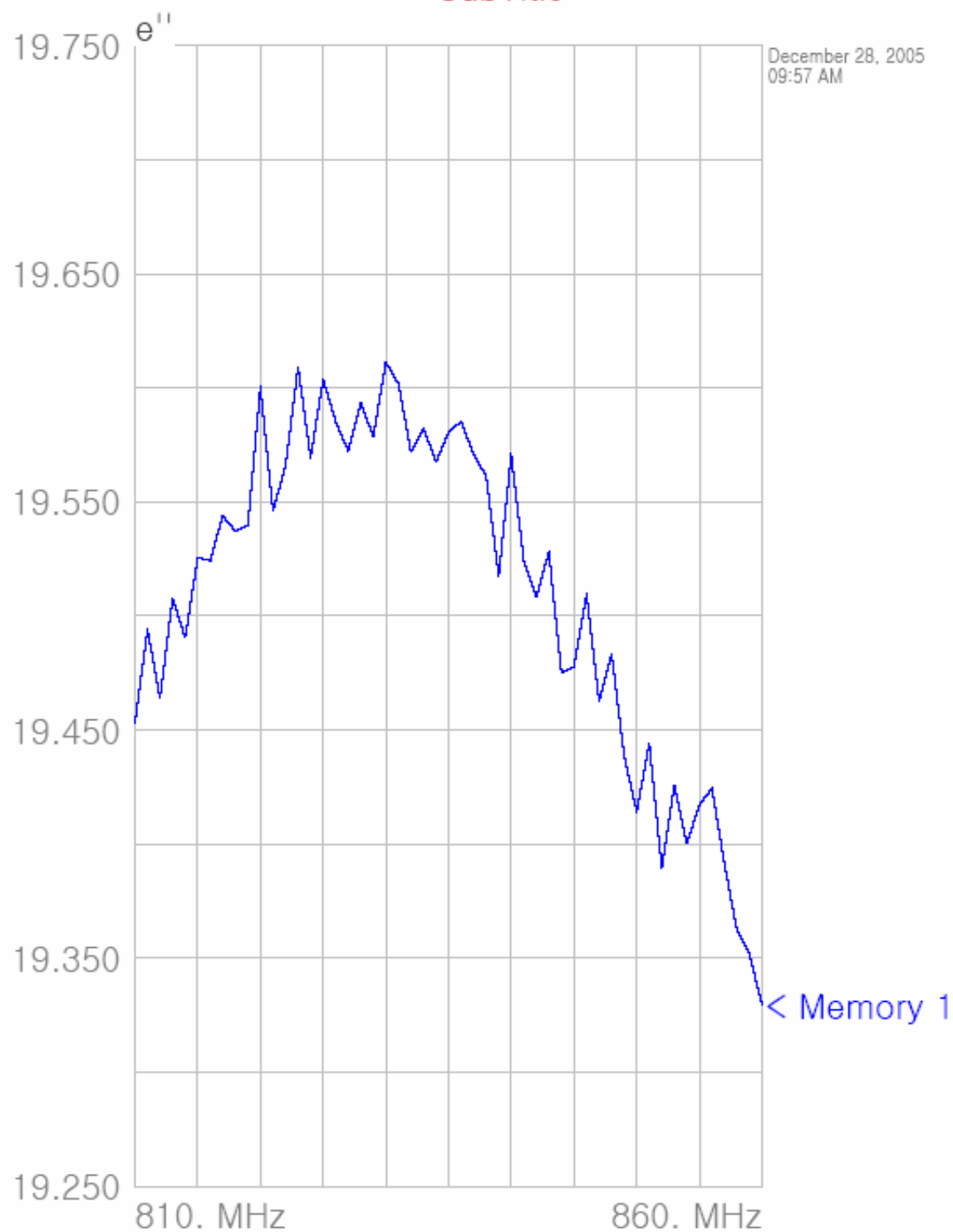
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Title
SubTitle

December 18, 2005 09:57 AM

Frequency	e'	e''
810.000000 MHz	40.9582	19.4534
811.000000 MHz	40.9465	19.4941
812.000000 MHz	40.9588	19.4639
813.000000 MHz	40.8944	19.5080
814.000000 MHz	40.8994	19.4905
815.000000 MHz	40.9079	19.5257
816.000000 MHz	40.8531	19.5243
817.000000 MHz	40.8789	19.5440
818.000000 MHz	40.8442	19.5372
819.000000 MHz	40.8547	19.5397
820.000000 MHz	40.8063	19.6006
821.000000 MHz	40.7909	19.5460
822.000000 MHz	40.8168	19.5656
823.000000 MHz	40.7534	19.6092
824.000000 MHz	40.7633	19.5692
825.000000 MHz	40.7721	19.6039
826.000000 MHz	40.7029	19.5854
827.000000 MHz	40.7307	19.5724
828.000000 MHz	40.6724	19.5934
829.000000 MHz	40.6679	19.5787
830.000000 MHz	40.6447	19.6113
831.000000 MHz	40.6207	19.6019
832.000000 MHz	40.6333	19.5720
833.000000 MHz	40.6148	19.5823
834.000000 MHz	40.6105	19.5676
835.000000 MHz	40.5822	19.5805
836.000000 MHz	40.5833	19.5853
837.000000 MHz	40.5791	19.5707
838.000000 MHz	40.5555	19.5613
839.000000 MHz	40.5433	19.5175
840.000000 MHz	40.5579	19.5710
841.000000 MHz	40.4821	19.5238
842.000000 MHz	40.5196	19.5083
843.000000 MHz	40.5041	19.5282
844.000000 MHz	40.4895	19.4749
845.000000 MHz	40.5163	19.4779
846.000000 MHz	40.4575	19.5097
847.000000 MHz	40.4600	19.4623
848.000000 MHz	40.4764	19.4837
849.000000 MHz	40.4329	19.4387
850.000000 MHz	40.4470	19.4142
851.000000 MHz	40.4140	19.4441
852.000000 MHz	40.4248	19.3895
853.000000 MHz	40.4247	19.4257
854.000000 MHz	40.3869	19.4002
855.000000 MHz	40.3815	19.4172
856.000000 MHz	40.3735	19.4246
857.000000 MHz	40.3645	19.3912
858.000000 MHz	40.3772	19.3621
859.000000 MHz	40.3233	19.3516
860.000000 MHz	40.3482	19.3294



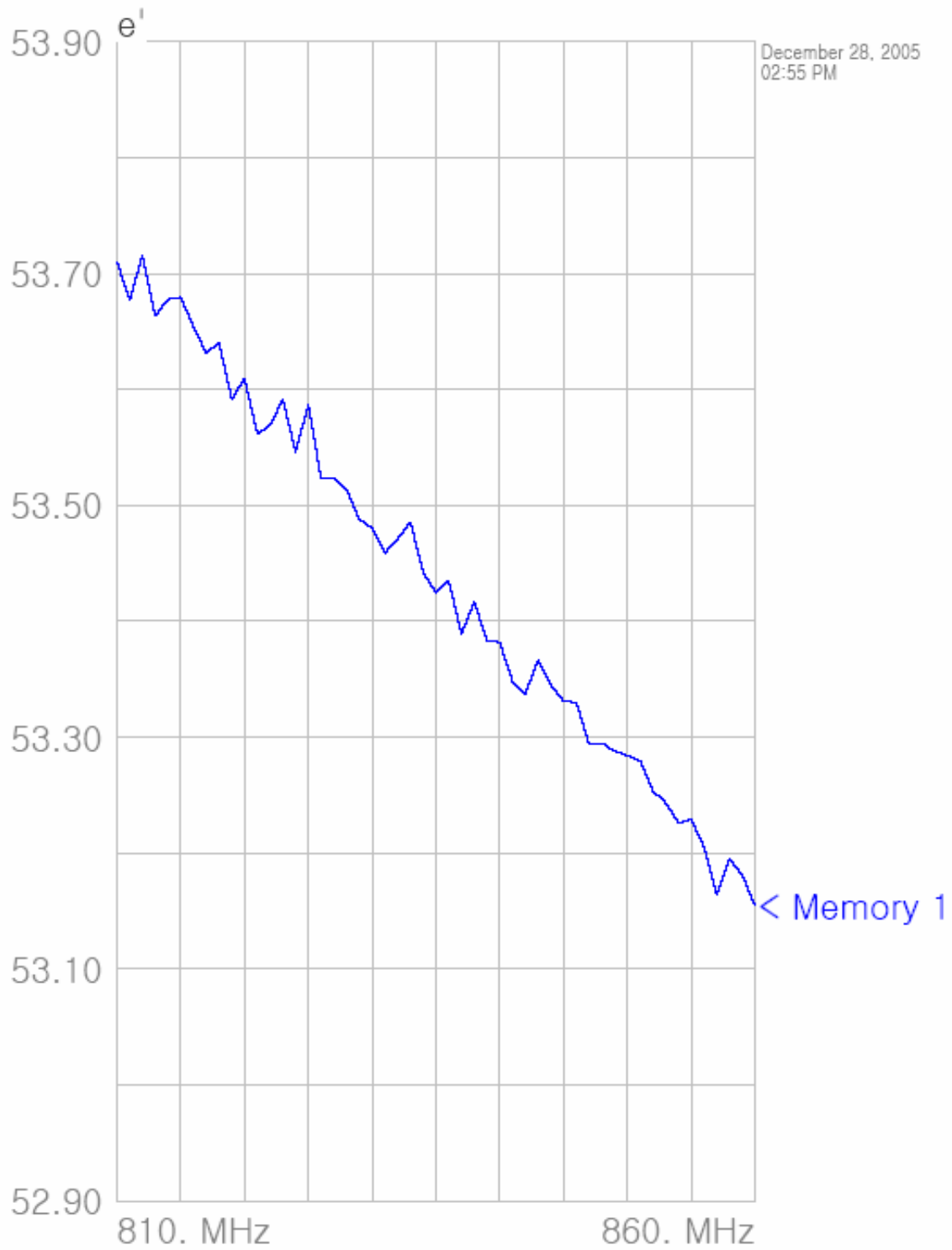
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– Body Tissue

Title
SubTitle



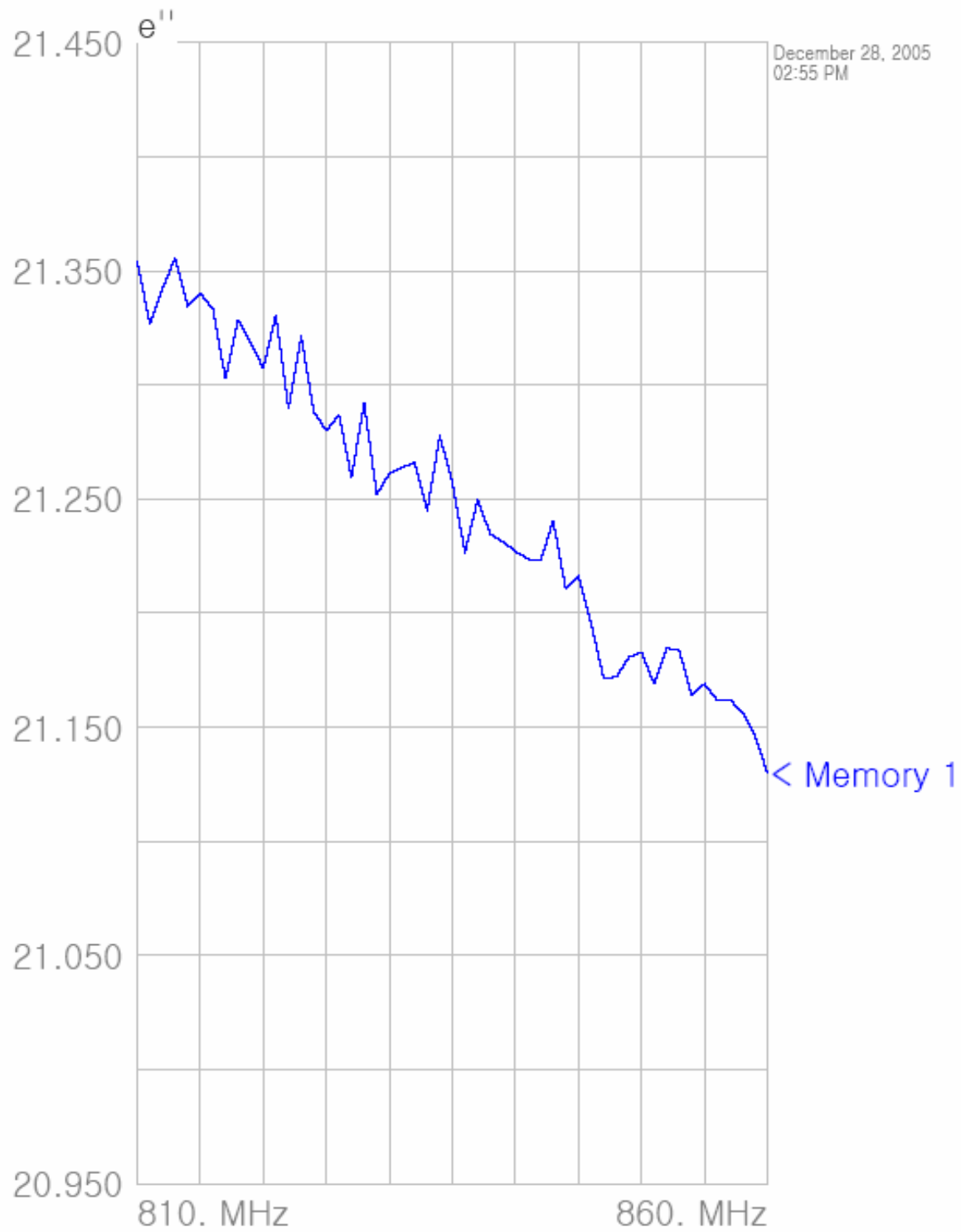


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Title
SubTitle

December 03, 2005 02:55 PM

Frequency	e'	e''
810.000000 MHz	53.7100	21.3539
811.000000 MHz	53.6771	21.3268
812.000000 MHz	53.7157	21.3421
813.000000 MHz	53.6636	21.3557
814.000000 MHz	53.6779	21.3345
815.000000 MHz	53.6795	21.3403
816.000000 MHz	53.6540	21.3332
817.000000 MHz	53.6315	21.3028
818.000000 MHz	53.6402	21.3284
819.000000 MHz	53.5915	21.3185
820.000000 MHz	53.6095	21.3073
821.000000 MHz	53.5617	21.3307
822.000000 MHz	53.5691	21.2897
823.000000 MHz	53.5914	21.3215
824.000000 MHz	53.5459	21.2884
825.000000 MHz	53.5872	21.2799
826.000000 MHz	53.5229	21.2871
827.000000 MHz	53.5241	21.2596
828.000000 MHz	53.5134	21.2920
829.000000 MHz	53.4880	21.2520
830.000000 MHz	53.4802	21.2611
831.000000 MHz	53.4591	21.2639
832.000000 MHz	53.4710	21.2659
833.000000 MHz	53.4856	21.2448
834.000000 MHz	53.4425	21.2777
835.000000 MHz	53.4243	21.2574
836.000000 MHz	53.4354	21.2266
837.000000 MHz	53.3890	21.2497
838.000000 MHz	53.4169	21.2348
839.000000 MHz	53.3831	21.2314
840.000000 MHz	53.3819	21.2271
841.000000 MHz	53.3482	21.2237
842.000000 MHz	53.3374	21.2229
843.000000 MHz	53.3662	21.2405
844.000000 MHz	53.3449	21.2107
845.000000 MHz	53.3312	21.2164
846.000000 MHz	53.3298	21.1959
847.000000 MHz	53.2942	21.1715
848.000000 MHz	53.2950	21.1720
849.000000 MHz	53.2880	21.1807
850.000000 MHz	53.2841	21.1829
851.000000 MHz	53.2797	21.1690
852.000000 MHz	53.2538	21.1847
853.000000 MHz	53.2434	21.1838
854.000000 MHz	53.2261	21.1639
855.000000 MHz	53.2289	21.1690
856.000000 MHz	53.2057	21.1621
857.000000 MHz	53.1635	21.1622
858.000000 MHz	53.1949	21.1567
859.000000 MHz	53.1813	21.1463
860.000000 MHz	53.1547	21.1300



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APPENDIX B : Validation Test Data

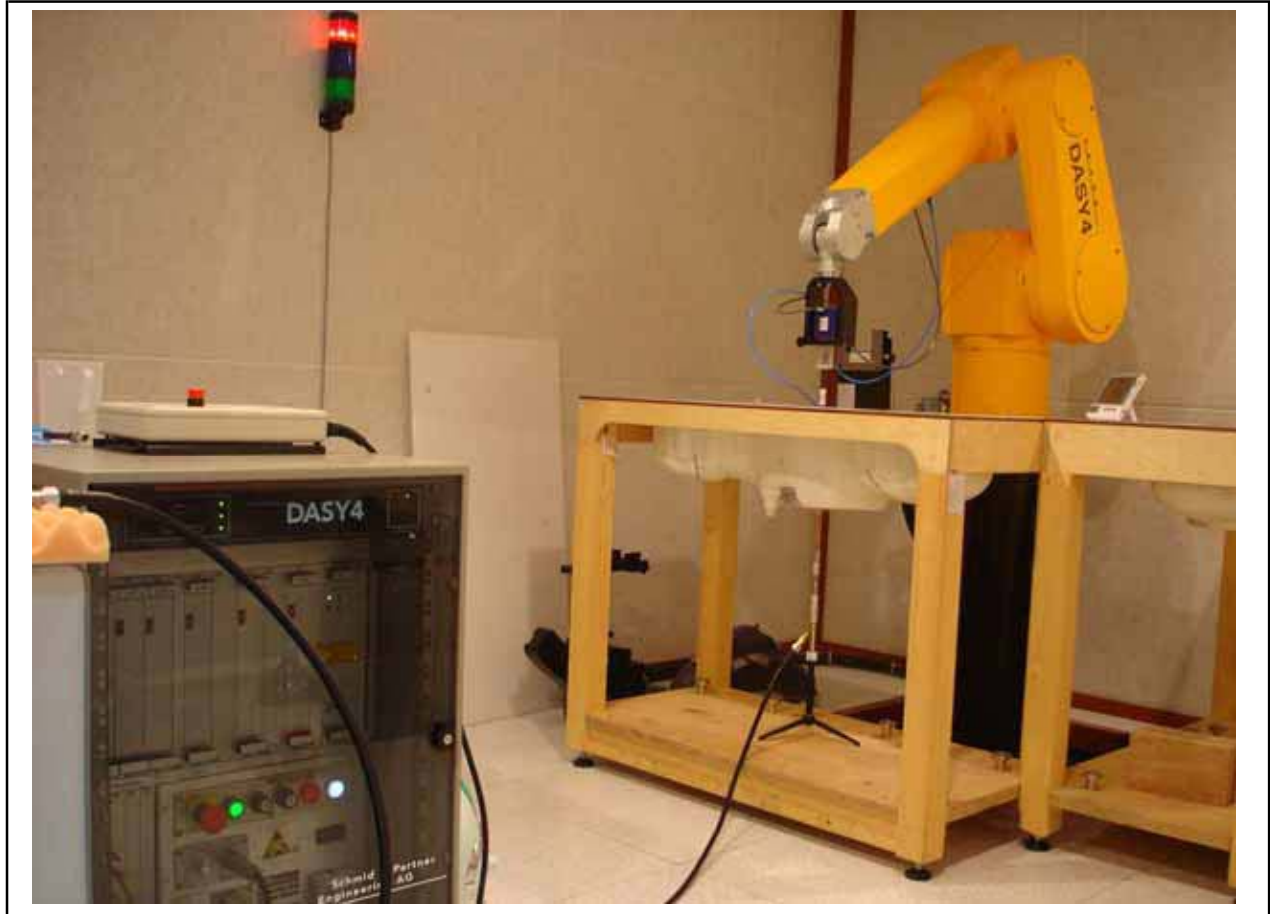


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835MHz Dipole Validation



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FAX: 82-2-867-3204

Date/Time: 12/28/05 10:34:44

Test Laboratory: ESTECH

validation - 1228

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; $\sigma = 0.91$ 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, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112
- Temperature : 22°C, Humidity : 45%

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

Reference Value = 54.9 V/m; Power Drift = -0.0 dB

Maximum value of SAR (interpolated) = 2.58 mW/g

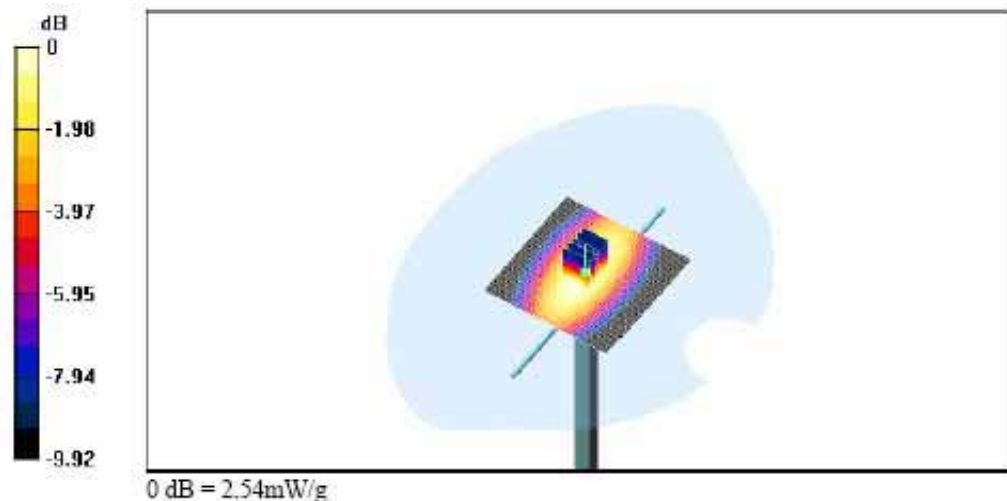
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 54.9 V/m; Power Drift = -0.0 dB

Maximum value of SAR (measured) = 2.54 mW/g

Peak SAR (extrapolated) = 3.54 W/kg

SAR(1 g) = 2.35 mW/g





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APPENDIX C : SAR Test Data

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

Date/Time: 12/28/05 12:38:48

Test Laboratory: ESTECH

CH1013 LEFT TOUCH

DUT: RD6330,AD6345; Type: BAR TYPE; Serial: XXXX

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

Medium parameters used (interpolated): $f = 824.7$ MHz; $\sigma = 0.899$ mho/m; $\epsilon_r = 40.8$; $\rho = 1000$

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, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112
- Temperature : 22 °C, Humidity : 49%

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

Reference Value = 21.4 V/m; Power Drift = -0.0 dB

Maximum value of SAR (interpolated) = 0.672 mW/g

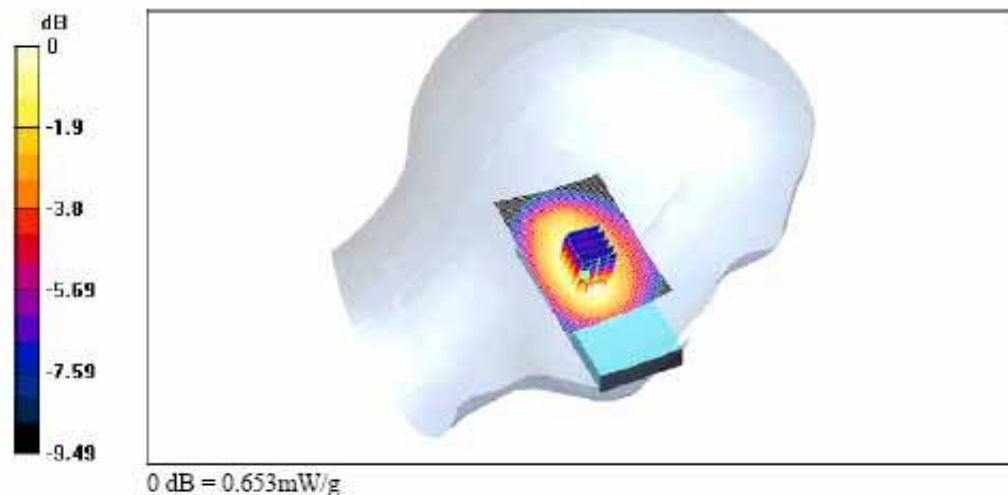
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 21.4 V/m; Power Drift = -0.0 dB

Maximum value of SAR (measured) = 0.653 mW/g

Peak SAR (extrapolated) = 0.883 W/kg

SAR(1 g) = 0.605 mW/g



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Date/Time: 12/28/05 11:03:59

Test Laboratory: ESTECH

CH363 LEFT TOUCH

DUT: RD6330,AD6345; Type: BAR TYPE; Serial: XXXX

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

Medium parameters used (interpolated): $f = 835.89$ MHz; $\sigma = 0.911$ 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, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112
- Temperature : 22 °C, Humidity : 49%

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

Reference Value = 25.1 V/m; Power Drift = -0.1 dB

Maximum value of SAR (interpolated) = 0.952 mW/g

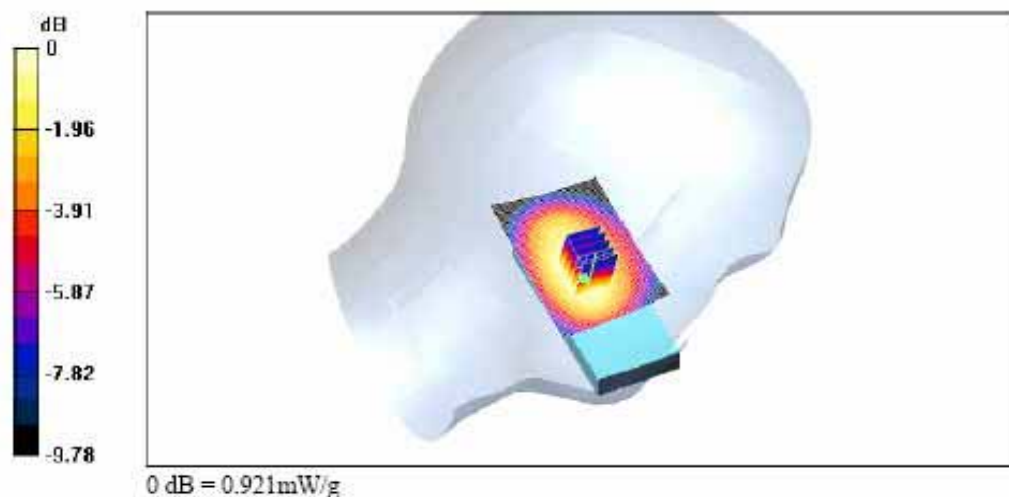
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 25.1 V/m; Power Drift = -0.1 dB

Maximum value of SAR (measured) = 0.921 mW/g

Peak SAR (extrapolated) = 1.2 W/kg

SAR(1 g) = 0.848 mW/g



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Date/Time: 12/28/05 13:56:21

Test Laboratory: ESTECH

CH777 LEFT TOUCH

DUT: RD6330,AD6345; Type: BAR TYPE; Serial: XXXX

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

Medium parameters used (interpolated): $f = 848.31$ MHz; $\sigma = 0.918$ 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, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112
- Temperature : 21 °C, Humidity : 47%

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

Reference Value = 26.2 V/m; Power Drift = -0.0 dB

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

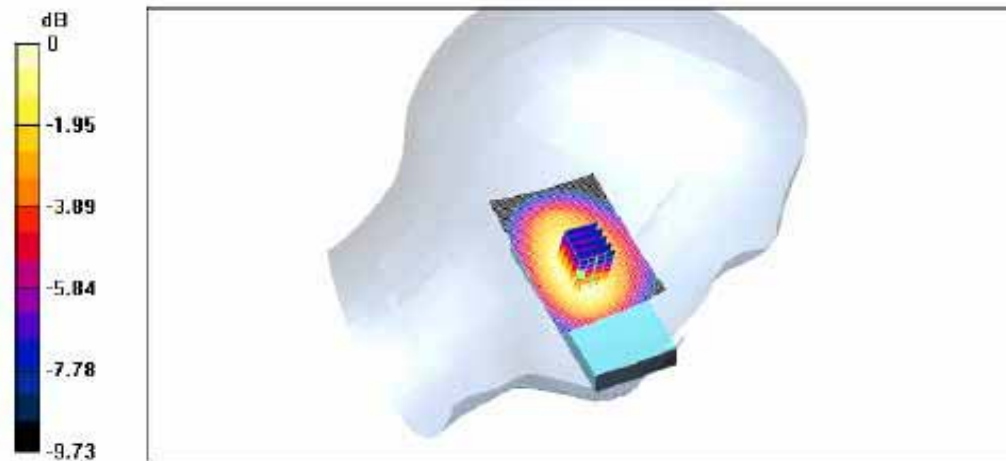
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 26.2 V/m; Power Drift = -0.0 dB

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

Peak SAR (extrapolated) = 1.42 W/kg

SAR(1 g) = 0.992 mW/g



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Date/Time: 12/28/05 13:01:40

Test Laboratory: ESTECH

CH1013 RIGHT TOUCH

DUT: RD6330,AD6345; Type: BAR TYPE; Serial: XXXX

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

Medium parameters used (interpolated): $f = 824.7$ MHz; $\sigma = 0.899$ mho/m; $\epsilon_r = 40.8$; $\rho = 1000$

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, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112
- Temperature : 21 °C, Humidity : 48%

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

Reference Value = 19.8 V/m; Power Drift = -0.0 dB

Maximum value of SAR (interpolated) = 0.639 mW/g

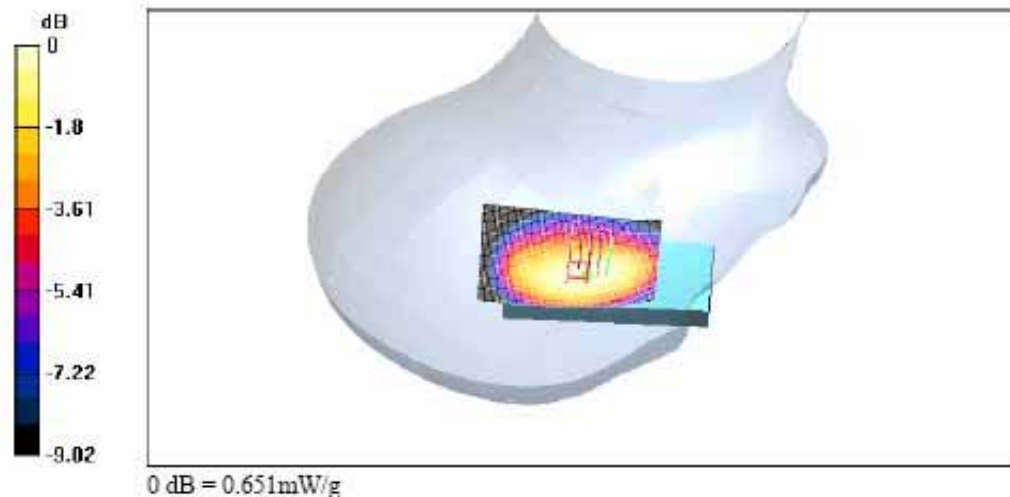
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 19.8 V/m; Power Drift = -0.0 dB

Maximum value of SAR (measured) = 0.651 mW/g

Peak SAR (extrapolated) = 0.846 W/kg

SAR(1 g) = 0.592 mW/g



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Date/Time: 12/28/05 11:24:01

Test Laboratory: ESTECH

CH363 RIGHT TOUCH

DUT: RD6330,AD6345; Type: BAR TYPE; Serial: XXXX

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

Medium parameters used (interpolated): $f = 835.89$ MHz; $\sigma = 0.911$ 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, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112
- Temperature : 21 °C, Humidity : 47%

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

Reference Value = 22.6 V/m; Power Drift = -0.0 dB

Maximum value of SAR (interpolated) = 0.882 mW/g

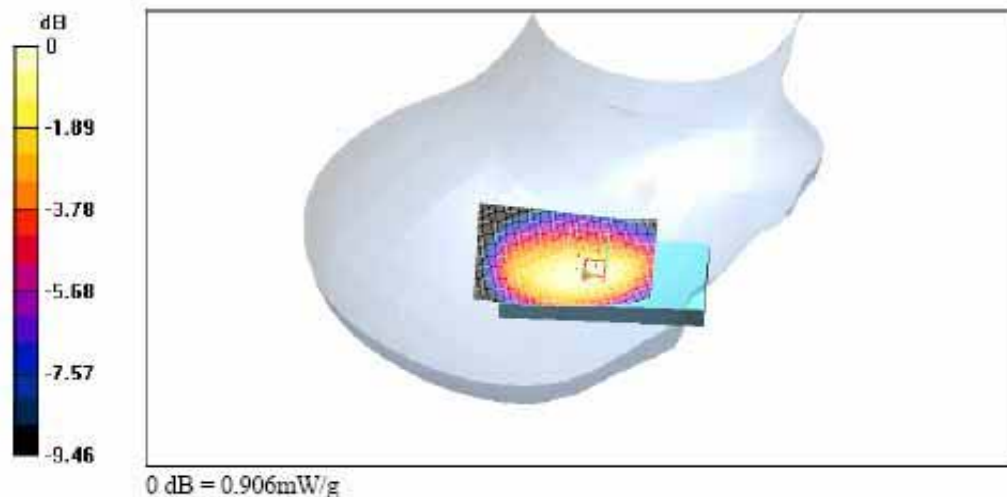
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 22.6 V/m; Power Drift = -0.0 dB

Maximum value of SAR (measured) = 0.906 mW/g

Peak SAR (extrapolated) = 1.25 W/kg

SAR(1 g) = 0.816 mW/g



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Date/Time: 12/28/05 14:20:25

Test Laboratory: ESTECH

CH777 RIGHT TOUCH

DUT: RD6330,AD6345; Type: BAR TYPE; Serial: XXXX

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

Medium parameters used (interpolated): $f = 848.31$ MHz; $\sigma = 0.918$ 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, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112
- Temperature : 21 °C, Humidity : 49%

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

Reference Value = 24 V/m; Power Drift = -0.0 dB

Maximum value of SAR (interpolated) = 1.02 mW/g

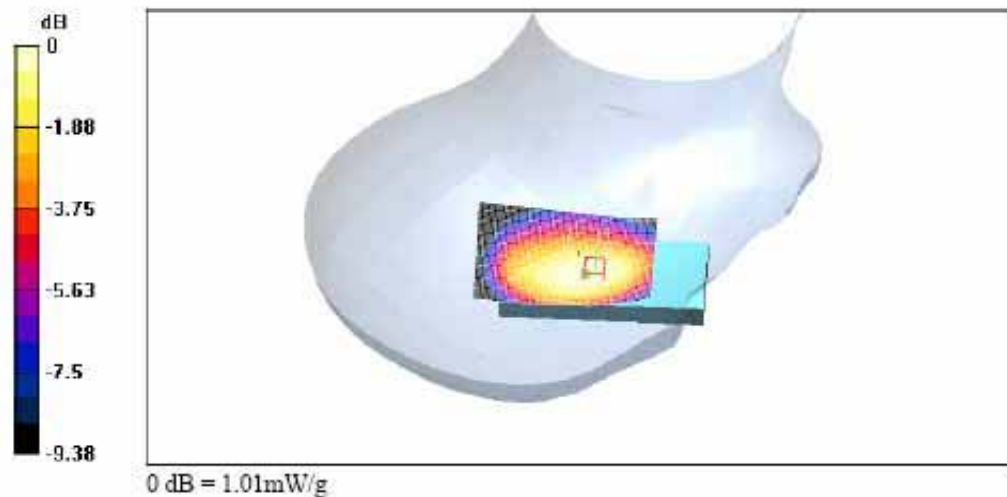
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 24 V/m; Power Drift = -0.0 dB

Maximum value of SAR (measured) = 1.01 mW/g

Peak SAR (extrapolated) = 1.38 W/kg

SAR(1 g) = 0.939 mW/g



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Test Laboratory: ESTECH

CH363 LEFT TILT

DUT: RD6330,AD6345; Type: BAR TYPE; Serial: XXXX

Communication System: CDMA FCC; Frequency: 835.89 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 835.89$ MHz; $\sigma = 0.911$ 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, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112
- Temperature : 21 °C, Humidity : 48%

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

Reference Value = 22.6 V/m; Power Drift = -0.1 dB

Maximum value of SAR (interpolated) = 0.488 mW/g

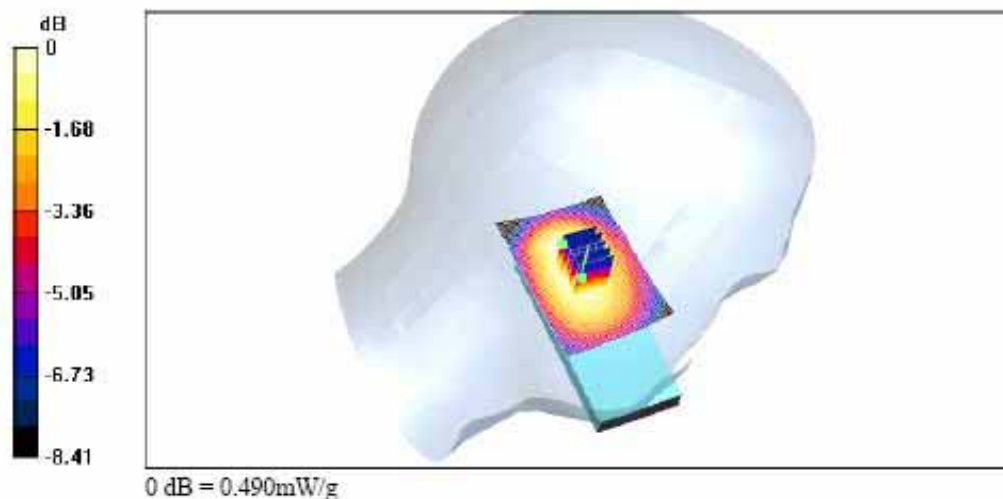
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 22.6 V/m; Power Drift = -0.1 dB

Maximum value of SAR (measured) = 0.490 mW/g

Peak SAR (extrapolated) = 0.613 W/kg

SAR(1 g) = 0.459 mW/g



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Test Laboratory: ESTECH

CH363 RIGHT TILT

DUT: RD6330,AD6345; Type: BAR TYPE; Serial: XXXX

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

Medium parameters used (interpolated): $f = 835.89$ MHz; $\sigma = 0.911$ 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, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112
- Temperature : 21 °C, Humidity : 48%

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

Reference Value = 21.3 V/m; Power Drift = -0.1 dB

Maximum value of SAR (interpolated) = 0.496 mW/g

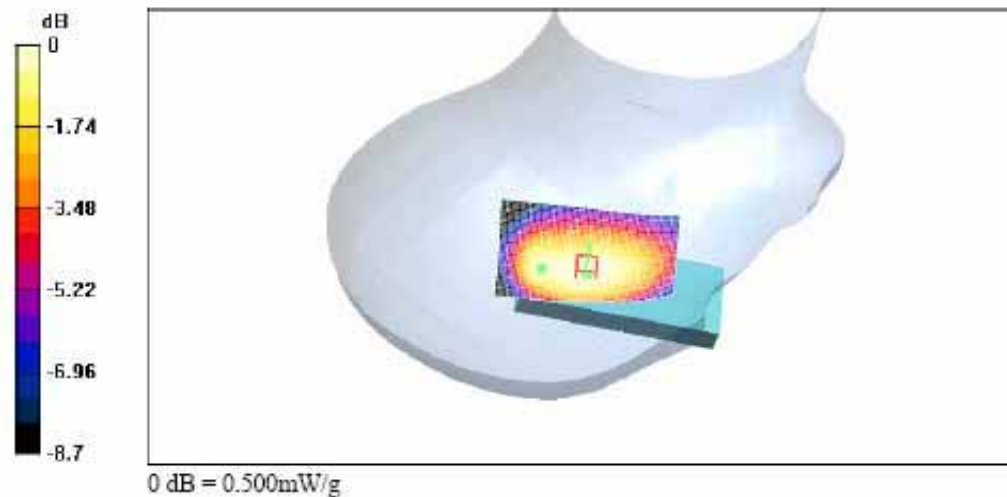
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 21.3 V/m; Power Drift = -0.1 dB

Maximum value of SAR (measured) = 0.500 mW/g

Peak SAR (extrapolated) = 0.615 W/kg

SAR(1 g) = 0.470 mW/g



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Date/Time: 12/28/05 13:56:21

Test Laboratory: ESTECH

CH777 LEFT TOUCH-ZSCAN

DUT: RD6330,AD6345; Type: BAR TYPE; Serial: XXXX

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

Medium parameters used (interpolated): $f = 848.31$ MHz; $\sigma = 0.918$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$

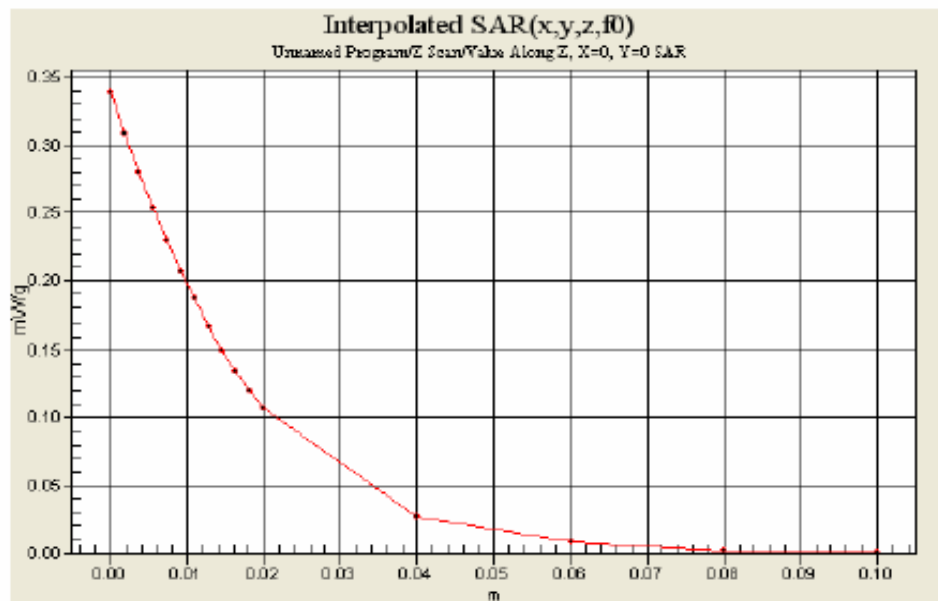
kg/m³

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, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112
- Temperature : 21 °C, Humidity : 47%



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Date/Time: 12/28/05 15:43:50

Test Laboratory: ESTECH

CH1013 BODY

DUT: RD6330,AD6345; Type: BAR TYPE; Serial: XXXX

Communication System: CDMA FCC; Frequency: 824.7 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 824.7$ MHz; $\sigma = 0.976$ mho/m; $\epsilon_r = 53.6$; $\rho = 1000$
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, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112
- Temperature : 22°C, Humidity : 49%

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

Reference Value = 23.7 V/m; Power Drift = -0.2 dB

Maximum value of SAR (interpolated) = 0.885 mW/g

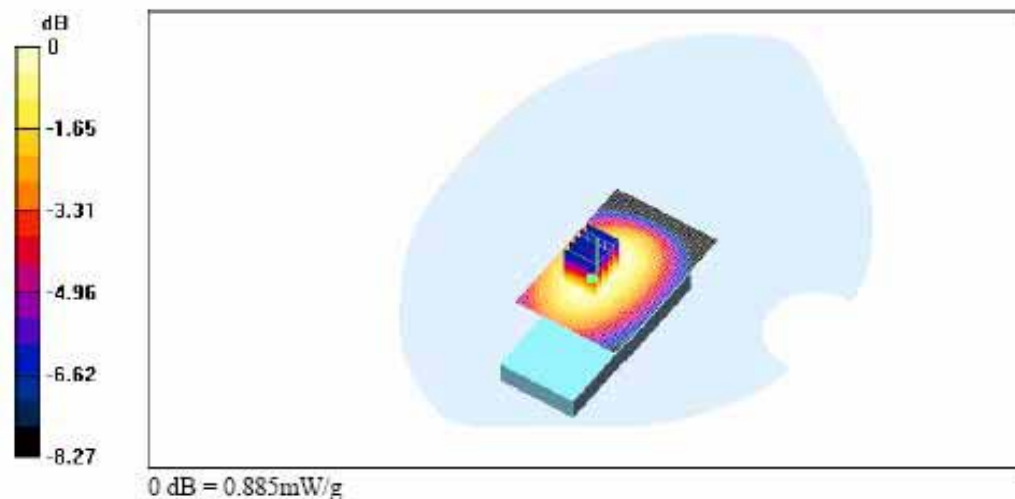
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 23.7 V/m; Power Drift = -0.2 dB

Maximum value of SAR (measured) = 0.885 mW/g

Peak SAR (extrapolated) = 1.08 W/kg

SAR(1 g) = 0.833 mW/g



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CH363 BODY

DUT: RD6330,AD6345; Type: BAR TYPE; Serial: XXXX

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

Medium parameters used (interpolated): $f = 835.89$ MHz; $\sigma = 0.987$ mho/m; $\epsilon_r = 53.4$; $\rho = 1000$

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, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112
- Temperature : 23 °C, Humidity : 49%

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

Reference Value = 26.9 V/m; Power Drift = -0.1 dB

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

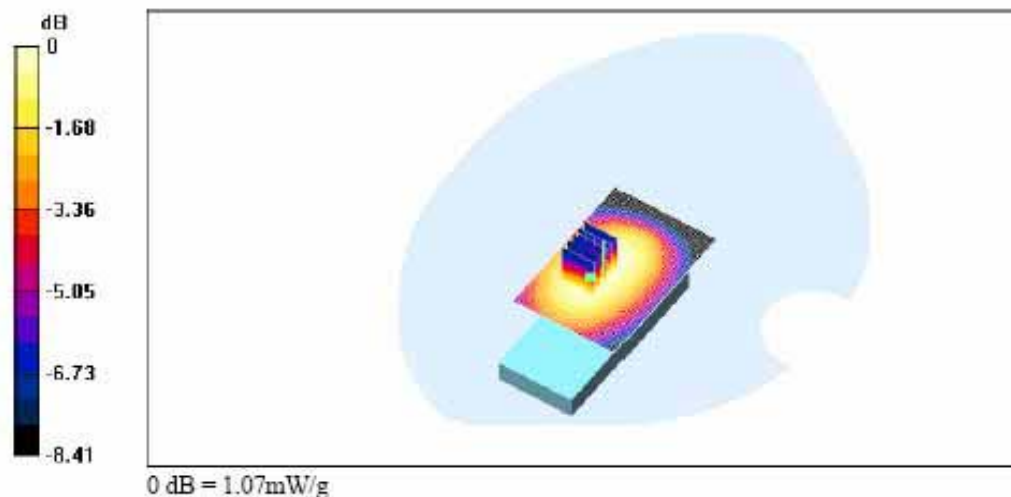
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 26.9 V/m; Power Drift = -0.1 dB

Maximum value of SAR (measured) = 1.07 mW/g

Peak SAR (extrapolated) = 1.32 W/kg

SAR(1 g) = 1.02 mW/g



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Date/Time: 12/28/05 16:11:10

Test Laboratory: ESTECH

CH777 BODY

DUT: RD6330,AD6345; Type: BAR TYPE; Serial: XXXX

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

Medium parameters used (interpolated): $f = 848.31$ MHz; $\sigma = 1$ mho/m; $\epsilon_r = 53.3$; $\rho = 1000$ 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, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112
- Temperature : 22°C, Humidity : 48%

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

Reference Value = 23.8 V/m; Power Drift = -0.0 dB

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

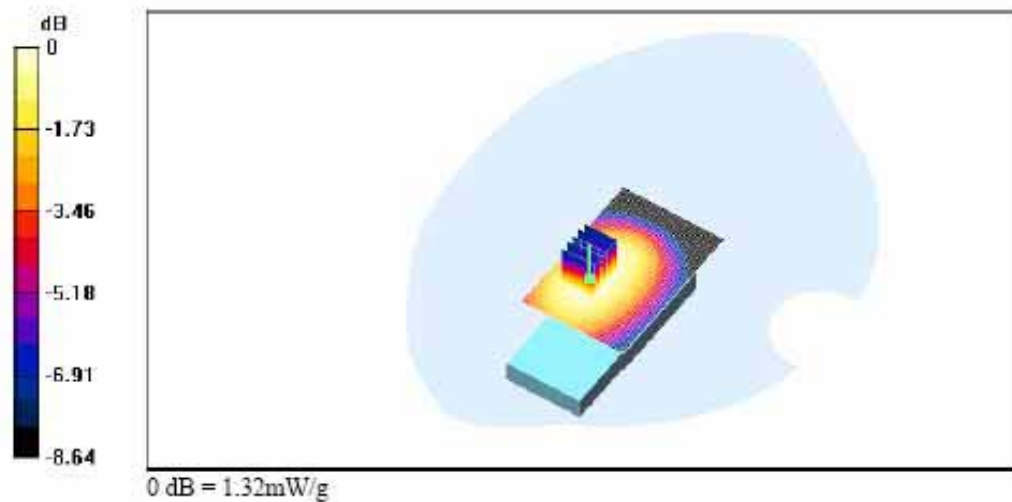
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 23.8 V/m; Power Drift = -0.0 dB

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

Peak SAR (extrapolated) = 1.62 W/kg

SAR(1 g) = 1.24 mW/g



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CH777 BODY-ZSCAN

DUT: RD6330,AD6345; Type: BAR TYPE; Serial: XXXX

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

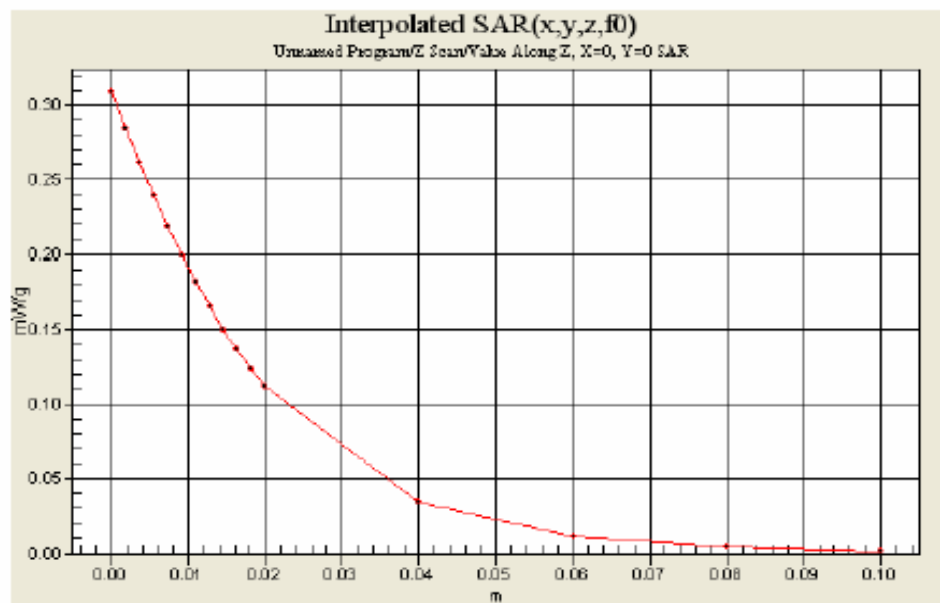
Medium parameters used (interpolated): $f = 848.31$ MHz; $\sigma = 1$ mho/m; $\epsilon_r = 53.3$; $\rho = 1000$ kg/m³

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, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112
- Temperature : 22°C, Humidity : 48%





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APPENDIX D : Calibration Certificates

IMPORTANT NOTICE

USAGE OF PROBES IN ORGANIC SOLVENTS

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

Compatible Probes:

- ET3DV6
- ET3DV6R
- ES3DVx
- ER3DV6
- H3DV6

Important Note for ET3DV6 Probes:

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

s p e a g

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C Service suisse d'étalonnage
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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: **ET3-1748_Jan05**

CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1748**

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

Calibration date: **January 21, 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 E4419B	GB41293874	5-May-04 (METAS, No. 251-00388)	May-05
Power sensor E4412A	MY41495277	5-May-04 (METAS, No. 251-00388)	May-05
Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-04 (METAS, No. 251-00403)	Aug-05
Reference 20 dB Attenuator	SN: S5086 (20b)	3-May-04 (METAS, No. 251-00389)	May-05
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-04 (METAS, No. 251-00404)	Aug-05
Reference Probe ES3DV2	SN: 3013	7-Jan-05 (SPEAG, No. ES3-3013_Jan05)	Jan-06
DAE4	SN: 617	29-Sep-04 (SPEAG, No. DAE4-617_Sep04)	Sep-05

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092180	18-Sep-02 (SPEAG, in house check Oct-03)	In house check: Oct 05
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Dec-03)	In house check: Dec-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-04)	In house check: Nov 05

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Laboratory Technician	
Approved by:	Katja Pckovic	Technical Manager	

Issued: January 21, 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 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
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

- 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

Methods Applied and Interpretation of Parameters:

- **NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E²-field uncertainty inside TSL (see below *ConvF*).
- **NORM(f)_{x,y,z}** = NORM_{x,y,z} * *frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- **DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- **ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * *ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- **Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- **Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.