LG Electronics

TEST REPORT(SAR)

Certification Of Compliance

Test Report No. : 00431-4525-F4104

EQUIPMENT UNDER TEST

EUT Type :	Fixed Wireless Local Loop Telephone (CDMA)
Model Name(s) :	LSP-350
Manufacturer :	LG Electronics, Inc.
Applicant :	LG Electronics, Inc.
Address :	19-1,Cheongho-Ri, Jinwuy-Myun, Pyungtaik-City, Kyunggi-Do, 451-713 Korea
FCC ID :	BEJLSP350
FCC Rule Part(s) :	§2.1093; FCC/OET Bulletin 65 Supplement C [July 2001]
FCC Classification :	Licensed Non-Broadcast Station Transmitter (TNB)
Application Type :	Certification
Date of EUT Receipt :	November 3, 2004
Date of Test :	November 8, 2004
Date of Issue :	November 12, 2004
Test Result :	PASS

SUMMARY

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE Std. C95.1-1992 and had been tested in accordance with the measurement procedures specified in FCC/OET Bulletin 65 Supplement C (2001) and IEEE 1528 – Dec. 2003.
※ The test results in this test report apply only to sample(s) tested.

Approved by

Kyeom-Soon Kim / General Manager
Standards Gr.
Quality and Reliability Center

Tested by

Cheol-Goo Lee / Research Engineer
Quality Engineering Gr.
Mobile Handset R&D Center

Reviewed by

Eui-Soon Park / Chief Research Engineer
Quality Engineering Gr.
Mobile Handset R&D Center

TABLE OF CONTENTS

1. TEST RESULT SUMMARY

FCC ID :	BEJLSP350
Dates of Test :	November 8, 2004
Date of Issue :	November 12, 2004
Address of Test Site :	60-39, Kasan-Dong, Kumchon-Gu, Seoul 153-801, Korea.
Responsible Test Engineer :	Eui-Soon Park
Test Engineer :	Cheol-Goo Lee
EUT Type :	Fixed Wireless Local Loop Telephone (CDMA)
Tx Frequency :	824.70 ~ 848.31 MHz (CDMA)
Rx Frequency :	869.70 ~ 893.31 MHz (CDMA)
Max. RF Output Power :	0.436 W ERP CDMA (26.4 dBm) : With Battery 0.426 W ERP CDMA (26.3 dBm) : With Charger

Maximum Results Found During SAR Evaluation

1. Body Worn Configuration

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

Frequency		Modulation	Conducted Power(dBm)	Battery	Separation Distance (cm)	Antenna Position	SAR (W/kg)
MHz	Ch.						
824.70	1013	CDMA	24.0	Standard	2.5	Fixed	0.734

2. Measurement Uncertainty

Combine Standard Uncertainty	10.1 (k=1)
Extended Standard Uncertainty	20.2 (k=2, 95% CONFIDENCE LEVEL)

2. DESCRIPTION OF THE DEVICE UNDER TEST

2.1 Antenna Description

Type :	Fixed
Location :	Right the back cover, the top of the device
Configuration :	Half Wavelength Antenna

2.2 Device Description

Manufacturer :	LG Electronics, Inc.
FCC ID :	BEJLSP350
Trade Name :	LG
Model Name(s) :	LSP-350
Serial No :	Identical Prototype [S/N: #3]
EUT Type :	Fixed Wireless Local Loop Telephone (CDMA)
Mode(s) of Operation :	CDMA
Modulation Mode(s) :	CDMA
Duty Cycle :	1
Transmitting Frequency Range :	824.70 ~ 848.31 MHz (CDMA)

3. 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 based on the criteria published by the American National Standards Institute (ANSI) For localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for safety Levels with Respect to Human Exposure to Radio Frequency Electronic Fields, 3 kHz to 300 GHz. (c) 1992 by the institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.[2] The measurement procedure described in IEEE/ANSIC95.3-1992 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave[3] is used for guidance in measuring SAR due to the RF 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, MD20814.[6] SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

SAR Definition

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

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

Figure 2.1 SAR Mathematical Equation

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

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

Where:

- σ = conductivity of the tissue-simulant material (S/m)
- ρ = mass density of the tissue-simulant material (kg/㎥)
- **E** = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relations to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.[6]

4. SAR MEASUREMENT SYSTEM

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.

4.1 SAR Measurement Setup

Robotic System

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 (Stäubli), 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. 4.1)

System Hardware

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 Windows 2000 system and SAR measurement Software DASY4, A/D interface card, monitor, mouse, and keyboard. The Stäubli Robot data acquisition electronic (DAE) circuit that performs the signal amplification, signal multiplexing,
AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. 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.

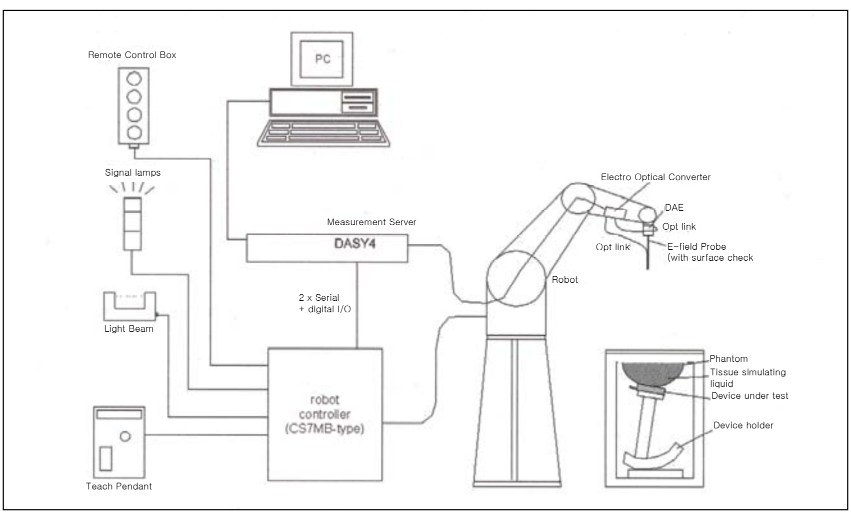


Figure 4.1 SAR Measurement System Setup

System Electronics

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].

4.2 DASY4 E-Field Probe System

The SAR measurements were conducted with the dosimetric probe ET3DV6, designed in the classical triangular configuration [7] (see Fig. 4.2) 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. 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. The approach is stopped at reaching the maximum.

Probe Specifications

Construction: Symmetrical design with triangular core
Built-in optical fiber for surface detection system
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

Calibration: Basic Broad Band Calibration: in air: 10-3000 MHz
Conversion Factors (CF) for HSL 900 and HSL 1800
Additional CF for other liquids and frequencies upon request

Frequency: 10 MHz to 3 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)

Directivity: ± 0.2 dB in HSL (rotation around probe axis)
± 0.4 dB in HSL (rotation normal to probe axis)

Dynamic Range: 5 μW/g to > 100 mW/g; Linearity: ± 0.2 dB

Optical Surface Detection: ± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces

Dimensions: Overall length: 330 mm (Tip: 16 mm)
Tip diameter: 6.8 mm (Body: 12 mm)
Distance from probe tip to dipole centers: 2.7 mm

Application: General dosimetric measurements up to 2.5GHz
Compliance tests of mobile phones
Fast automatic scanning in arbitrary phantoms

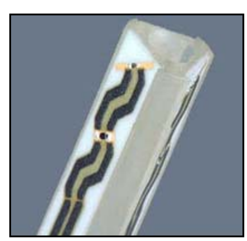


Figure 4.2 Isotropic E-Field Probe

Probe Calibration Process

Dosimetric Assessment Procedure

Each probe is calibrated according to a dosimetric assessment procedure described in [8] with accuracy better than +/- 10%. The spherical isotropy was evaluated with the procedure described in [9] and found to be better than +/-0.25dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe is tested.

Free Space Assessment

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1 GHz (see Fig. 4.3), and in a waveguide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity at the proper orientation with the field. The probe is then rotated 360 degrees.

Temperature Assessment *

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe. (see Fig. 4.4)

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

Where:
Δt = exposure time (30 seconds),
C = heat capacity of tissue (brain or muscle),
ΔT = temperature increase due to RF exposure.
SAR is proportional to $\Delta T/\Delta t$, the initial rate of tissue heating, before thermal diffusion takes place.
Now it’s possible to quantify the electric field in the simulated tissue by equating the thermally derived SAR to the E- field;

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

Where:
σ = simulated tissue conductivity,
ρ = Tissue density (1.25 g/cm3 for brain tissue)

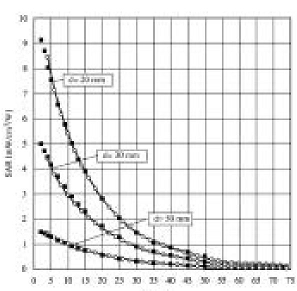


Figure 4.3 E-Field and Temperature measurements at 900MHz [7]

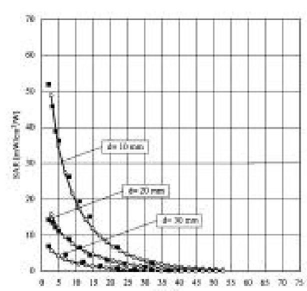


Figure 4.4 E-Field and Temperature measurements at 1.9GHz [7]

4.3 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. (see Fig. 4.5)

Figure 4.5 SAM Twin Phantom

Phantom Specification

Construction:	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.
Shell Thickness:	2 $\pm$ 0.2 mm; Center ear point: 6 $\pm$ 0.2 mm
Filling:	Volume Approx. 25 liters
Dimensions:	Height: adjustable feet; Length: 1000 mm; Width: 500 mm

4.4 Brain & Muscle Simulating Mixture Characterization

The brain and muscle mixtures consist of a viscous gel using hydroxethlcellullose(HEC) gelling agent and saline solution (see Table 4.1). Preservation with a bacteriacide is added and visural 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 Table 4.2)

INGREDIENTS (% by weight)	835MHz		1900MHz	
	Brain	Muscle	Brain	Muscle
De-ionized water	41.45	52.50	54.90	40.40
DGBE	0.000	0.000	44.92	0.000
SUGAR	56.00	45.00	0.000	58.00
SALT	1.450	1.400	0.180	0.500
BACTERIACIDE	0.100	0.100	0.000	0.100
HEC	1.000	1.000	0.000	1.000
Dielectric Constant Target	41.50	55.20	40.00	53.30
Conductivity (S/m) Target	0.900	0.970	1.400	1.520

Table. 4.1 Composition of the Tissue Equivalent Matter

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

Table. 4.2 Head and body tissue parameters by the IEEE SCC-34/SC-2 in P1528

4.5 Device Holder for Transmitters

In combination with the SAM Twin Phantom V4.0, the Mounting Device (see Fig. 4.6) 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.

Figure. 4.6 Device Holder

4.6 Validation Dipole

The reference dipole should have a return loss better than –20 dB (measured in the setup) at the resonant frequency to reduce the uncertainty in the power measurement.

Validation Dipole Specifications

Construction: Symmetrical dipole with l/4 balun. Enables measurement of feedpoint impedance with NWA. Matched for use near flat phantoms filled with head simulating solutions. Includes distance holder and tripod adaptor.

Calibration: Calibrated SAR value for specified position and input power
at the flat phantom in simulating solution

Frequency: 835 MHz, 1900 MHz

Return Loss: > 20 dB at specified validation position

Power Capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz)

Dimensions: D835V2: dipole length: 161 mm;
overall height: 330 mm
D1900V2: dipole length: 68 mm;
overall height: 300 mm

Figure 4.7 Validation Dipole

5. SAR MEASUREMENT PROCEDURE

The evaluation was performed using the following procedure:

1) The SAR measurement was taken at a selected spatial reference point to monitor power variations during testing. This fixed location point was measured and used as a reference value.

2) The SAR distribution at the exposed side of the head was measured at a distance of 3.9mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 15mm x 15mm.

3) Based on the area scan data, the area of the maximum absorption was determined by spline interpolation. Around this point, a volume of 32mm x 32mm x 34mm (fine resolution volume scan, zoom scan) was assessed by measuring 5 x 5 x 7 points. On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure:

   a. The data at the surface was extrapolated, since the center of the dipoles is 2.7mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2mm. The extrapolation was based on a least square algorithm [15]. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.

   b. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions) [15][16]. The volume was integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.

   c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

4) The SAR reference value, at the same location as procedure #1, was re-measured. If the value changed by more than 5%, the evaluation is repeated.

6. DEFINITION OF REFERENCE POINT

6.1 EAR Reference point

Figure 6.1 shows the front, back and side views of the SAM Twin Phantom. The point “M” is the reference point for the center of the mouth, “LE” is the left ear reference point (ERP), and “RE” is the right ERP. The ERPs are 15mm posterior to the entrance to the ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 6.2. 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 RE (or LE) is called the Reference Pivoting Line (see Fig. 6.3). Line 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].

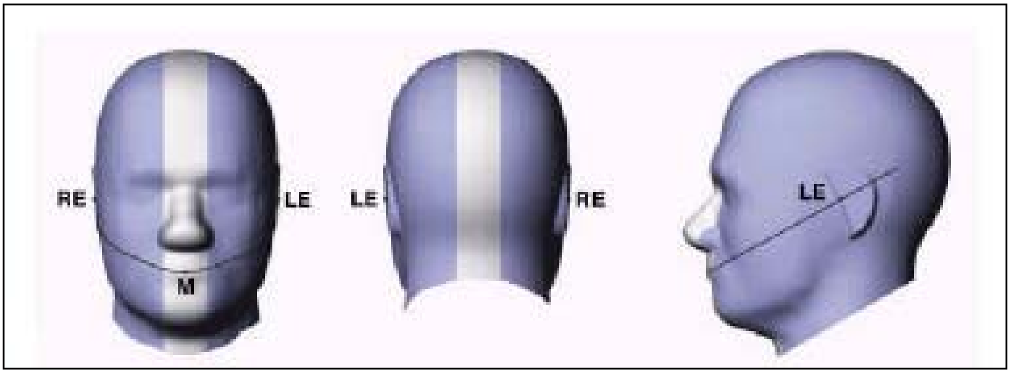


Figure 6.1 Front, back and side view of SAM Twin Phantom

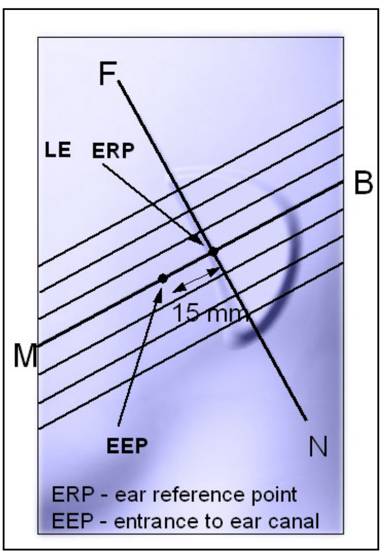


Figure 6.2 Close-up side view of ERP

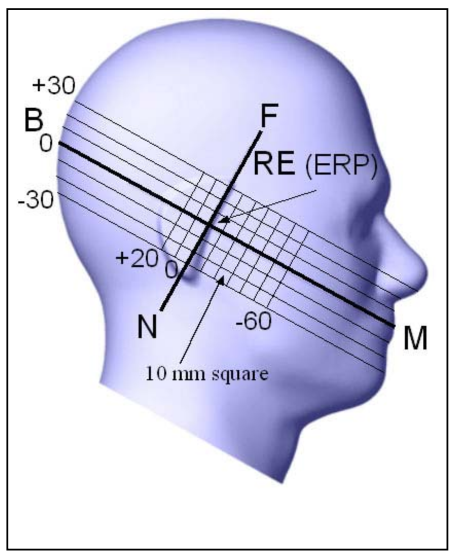


Figure 6.3 Side view of the phantom showing relevant markings

6.2 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. 6.4). The “test device reference point” was than located at the same level as the center of the ear reference point. The test device was positioned so that the “vertical centerline” was bisecting the front surface of the handset at it’s top and bottom edges, positioning the “ear reference point” on the outer surface of the both the left and right head phantoms on the ear reference point.

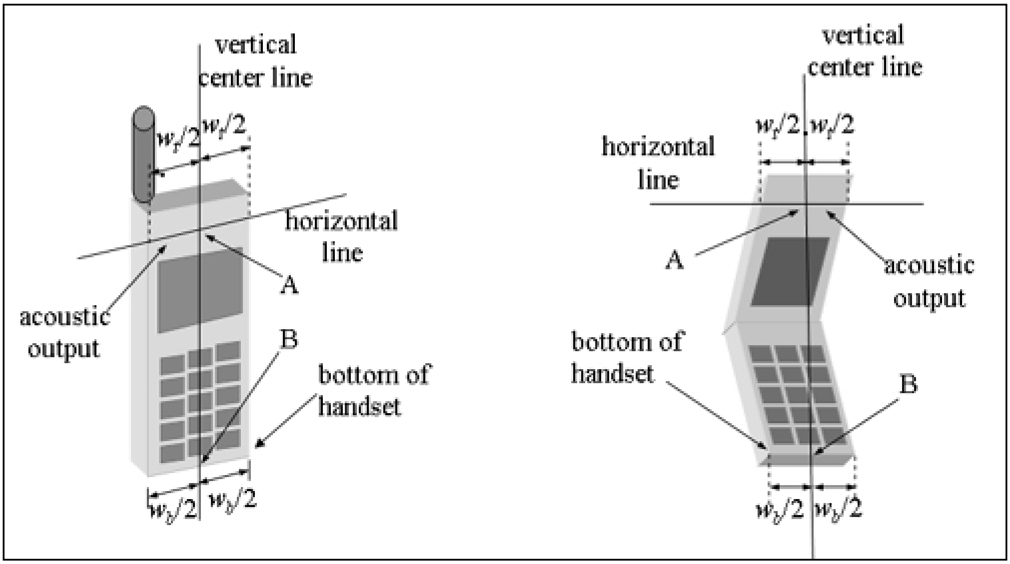


Figure 6.4 Handset Vertical Center & Horizontal Line Reference Points

7. TEST CONFIGURATION POSITIONS

7.1 Positioning for Cheek/Touch

1) Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece, open the cover. (If the phone can also be used with the cover closed ,both configurations must be tested.)
2) Define two imaginary lines on the handset: the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset: the midpoint of the width *wt* of the handset at the level of the acoustic output (point A on Fig. 6.4), and the midpoint of the width *wb* of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Fig. 6.4). 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 Fig. 6.4), 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 Fig. 7.1), 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.
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 below the pinna (cheek). (see Fig. 7.1) The physical angles of rotation should be noted.

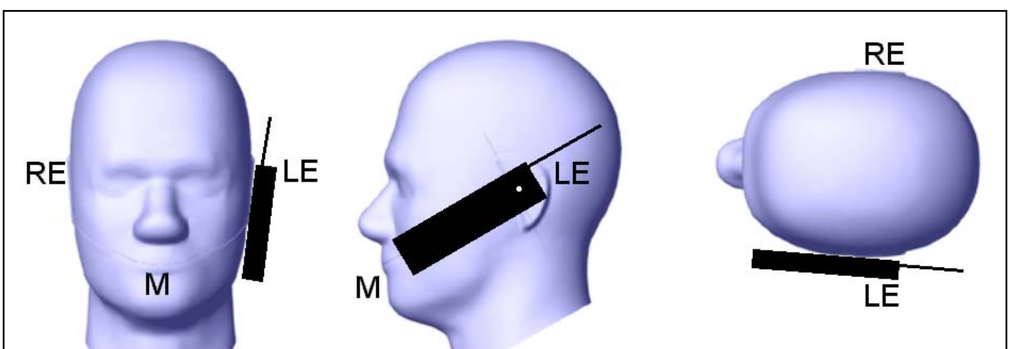


Figure 7.1 Front, Side and Top View of Cheek/Touch Position

7.2 Positioning for Ear / 15° Tilt

With the test device aligned in the "Cheek/Touch Position":

1) 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.
2) Rotate the phone around the horizontal line by 15 degree.
3) 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. (see Fig. 7.2)

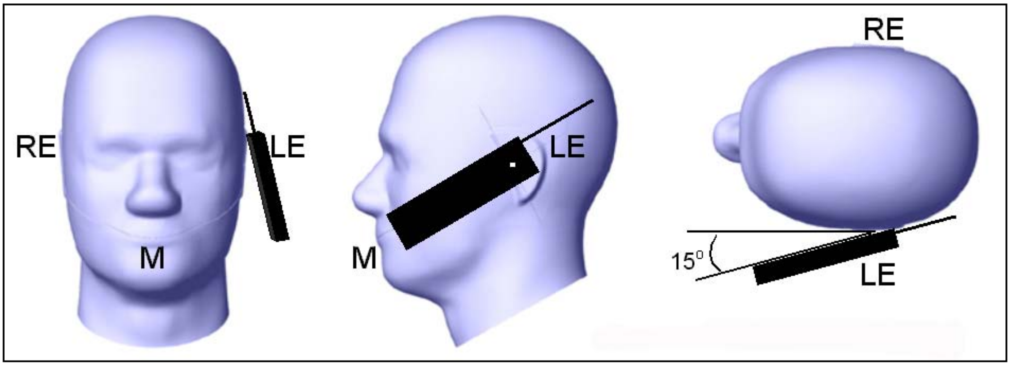


Figure 7.2 Front, Side and Top View of Ear/15 Tilt Position

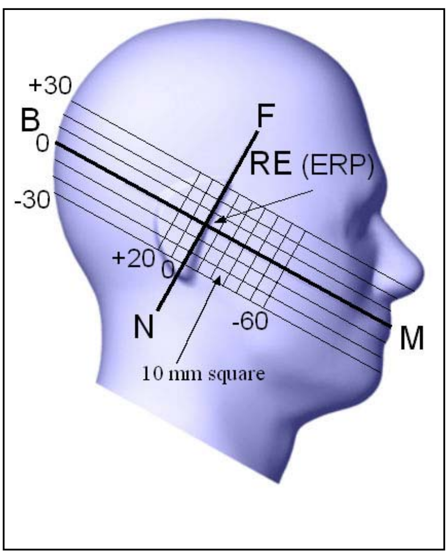


Figure 7.3 Side view of the phantom showing relevant markings

7.3 Body Holster /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. (see Fig. 7.4) 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.

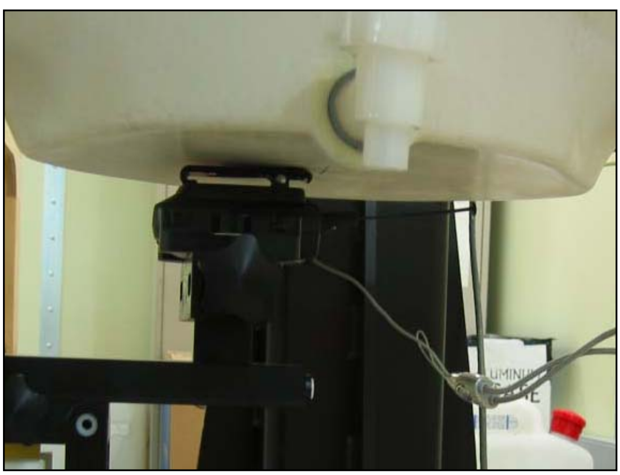


Figure 7.4 Body Holster Configuration

8. MEASUREMENT UNCERTAINTY

	Description	Type	Prob. Dist.	Divider	Ci	Std. Unc	Veff
Measure. Equipment	Probe Calibration	B	Normal	1	1	± 4.[illegible]%	∞
	Axial Isotropy	B	Rectan.	$\sqrt{3}$	$(1-C_p)^{1/2}$	± 1.[illegible]%	∞
	Hemispherical Isotropy	B	Rectan.	$\sqrt{3}$	$C_p^{1/2}$	± [illegible].[illegible]%	∞
	Boundary Effect	B	Rectan.	$\sqrt{3}$	1	± 0.[illegible]%	∞
	Linearity	B	Rectan.	$\sqrt{3}$	1	± 2.7%	∞
	Detection Limits	B	Rectan.	$\sqrt{3}$	1	± 0.0%	∞
	Readout Electronics	B	Normal	1	1	± 1.0%	∞
	Response Time	B	Rectan.	$\sqrt{3}$	1	± 0.0%	∞
	Integration Time	B	Rectan.	$\sqrt{3}$	1	± 0.0%	∞
	RF Ambient Conditions	B	Rectan.	$\sqrt{3}$	1	± 1.7%	∞
	Probe Positioner Mechanical	B	Rectan.	$\sqrt{3}$	1	± 0.[illegible]%	∞
	Probe Positioning w/ Phantom	B	Rectan.	$\sqrt{3}$	1	± 1.7%	∞
	Extrapolation and Integration	B	Rectan.	$\sqrt{3}$	1	± 0.[illegible]%	∞
Test Sample	Device Positioning	A	Normal	1	1	± 2.[illegible]%	71
	Device Holder Uncertainty	B	Normal	1	1	± [illegible].[illegible]%	5
	Drift of Output Power	B	Rectan.	$\sqrt{3}$	1	± 2.[illegible]%	∞
Physical Parameter	Phantom Uncertainty	B	Rectan.	$\sqrt{3}$	1	± 2.[illegible]%	∞
	Liquid Conductivity (Target)	B	Rectan.	$\sqrt{3}$	0.[illegible]	± 1.[illegible]%	∞
	Liquid Conductivity (Measurement)	B	Normal	1	0.[illegible]	± 1.[illegible]%	∞
	Liquid Permittivity (Target)	B	Rectan.	$\sqrt{3}$	0.[illegible]	± 1.7%	∞
	Liquid Permittivity (Measurement)	B	Normal	1	0.[illegible]	± 1.6%	∞
Combined	± 10.1 %						
Expanded	± 20.2 % (k=2)						

Table 8.1 Worst-Case uncertainty budget for DASY4 assessed according to IEEE 1528 - 2003.
The budget is valid for the frequency range 300MHz-3GHz and represents a worst-case analysis.

9. ANSI/IEEE C95.1 - 1992 RF EXPOSURE LIMITS

Uncontrolled Environment

UNCONTROLLED ENVIRONMENTS are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

Controlled Environment

CONTROLLED ENVIRONMENTS are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

	UNCONTROLLED ENVIRONMENT **General Population** **(W/kg) or (mW/g)**	**CONTROLLED ENVIRONMENT** **General Population** **(W/kg) or (mW/g)**
SPATIAL PEAK SAR[1] Brain	1.60	8.00
SPATIAL PEAK SAR[2] Whole Body	0.08	0.40
SPATIAL PEAK SAR[3] Hands, Feet, Ankles, Wrists	4.00	20.00

Table 9.1 Safety Limits for Partial Body Exposure [2]

NOTE:

1 The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

2 The Spatial Average value of the SAR averaged over the whole body.

3 The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube)

10. SYSTEM VERIFICATION

Tissue Verification

MEASURED TISSUE PARAMETERS								
Tissue	**835MHz Brain**		**835MHz Muscle**		**1900MHz Brain**		**1900MHz Muscle**	
Date	11/08/2004		11/08/2004		N/A		N/A	
Liquid Temp (°C)	**21.3**		21.7		N/A		N/A	
Liquid Depth (mm)	150 ± 1		150 ± 1		N/A		N/A	
Parameters	Target	Measured	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε	41.5	41.5	55.2	54.3	40.0	N/A	53.3	N/A
Conductivity: σ	0.90	0.89	0.97	0.98	1.40	N/A	1.52	N/A
Deviation (%)	ε : 0 σ : -1.11		ε : -1.63 σ : +1.03		N/A		N/A	

Table 10.1 Simulated Tissue Verification [5]

Test System Validation

Prior to assessment, the system is verified to the ±10% of the specifications at 835MHz and 1900MHz by using the system validation kit(s). (Graphic Plots Attached)

SYSTEM DIPOLE VALIDATION TARGET & MEASURED						
Tissue	**System Validation Kit**	**Date**	**Liquid Temp (°C)**	**Targeted SAR1g (mW/g)**	**Measured SAR1g (mW/g)**	**Deviation (%)**
835MHz Brain	D835V2, S/N: 471	11/08/2004	21.3	2.375	2.48	4.42
1900MHz Brain	D1900V2, S/N: 5d017	N/A	N/A	9.925	N/A	N/A

Table 10.2 System Validation [5]

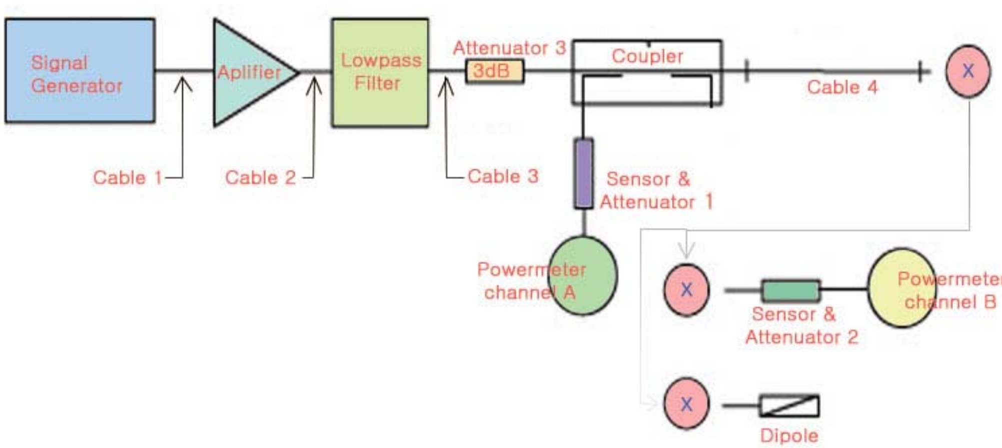
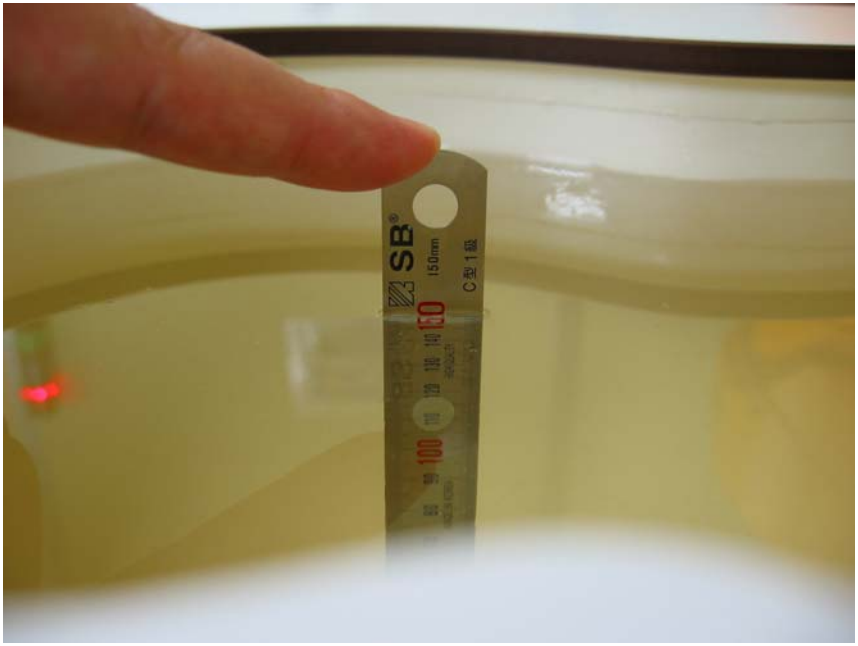
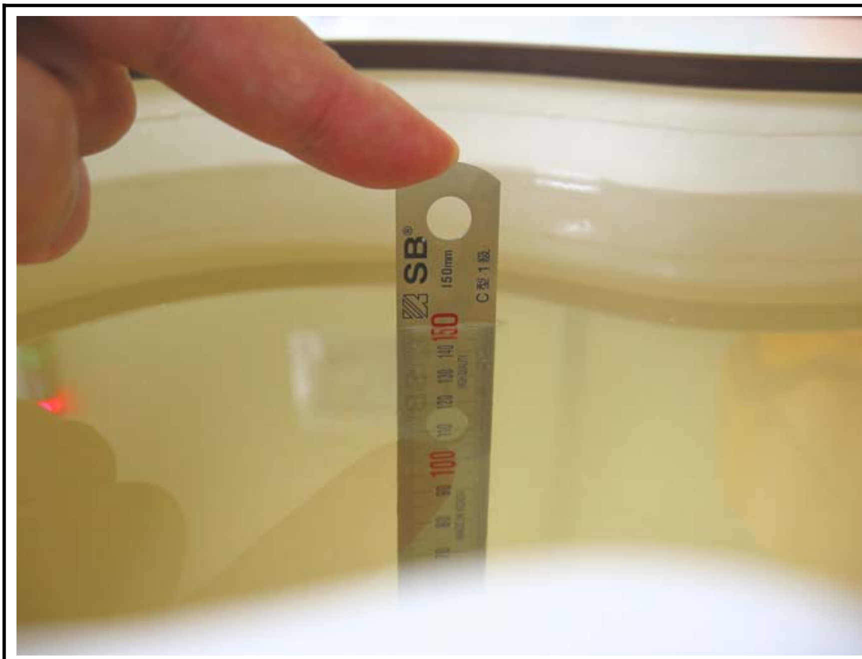


Figure 10.1 Dipole Validation Test Setup

835 MHz Head Tissue Liquid Depth



835 MHz Body Tissue Liquid Depth



11. MEASUREMENT RESULTS

Ambient Conditions

Liquid Tissue Depth (mm): 150 ± 1
Mixture Type: 835MHz Muscle
Dielectric Constant: 54.3
Conductivity: 0.98

Ambient Conditions							
Frequency		Ambient Temperature (°C)		Relative Humidity (%)		Liquid Tissue Temperature (°C)	
MHz	Ch.	Begin	End	Begin	End	Begin	End
824.70	1013	22.2	22.3	55.1	55.3	21.1	21.1
835.89	363	22.5	22.5	55.5	55.6	21.2	21.3
848.31	777	22.7	22.6	55.9	56.9	21.5	21.5

Measurement Results

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 w/o Holster)								
Frequency		Modulation	Conducted Power (dBm)		Battery	Separation Distance (cm)	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
824.70	1013	CDMA	24.02	24.06	Standard	2.5	Fixed	0.734
835.89	363	CDMA	24.00	24.18	Standard	2.5	Fixed	0.64
848.31	777	CDMA	24.00	24.19	Standard	2.5	Fixed	0.523

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].
2. All modes of operation were investigated, and worst-case results are reported.
3. Battery is fully charged for all readings. Standard batteries are the only options.
4. Power Measured : Conducted
5. SAR Measurement System : SPEAG (DASY4)
6. Phantom Configuration : Flat Phantom
7. SAR Configuration : Body
8. Test Signal Call Mode : Manu. Test Codes

Eui - Soon Park
Chief Research Engineer

11. MEASUREMENT RESULTS (Continued)

Ambient Conditions

Liquid Tissue Depth (mm): 150 ± 1
Mixture Type: 835MHz Muscle
Dielectric Constant: 54.3
Conductivity: 0.98

Ambient Conditions							
Frequency		Ambient Temperature (°C)		Relative Humidity (%)		Liquid Tissue Temperature (°C)	
MHz	Ch.	Begin	End	Begin	End	Begin	End
824.70	1013	22.4	22.7	54.9	55.1	21.2	21.3
835.89	363	22.7	22.8	55.2	55.6	21.3	21.6
848.31	777	22.7	22.5	55.9	56.8	21.5	21.5

Measurement Results

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 w/o Holster)								
Frequency		Modulation	Conducted Power (dBm)		Battery	Separation Distance (cm)	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End				
824.70	1013	CDMA	24.06	24.00	With Charger	2.5	Fixed	0.716
835.89	363	CDMA	24.09	23.92	With Charger	2.5	Fixed	0.587
848.31	777	CDMA	24.04	24.16	With Charger	2.5	Fixed	0.546

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supplement C [July 2001].
2. All modes of operation were investigated, and worst-case results are reported.
3. Battery is fully charged for all readings. Standard batteries are the only options.
4. Power Measured : Conducted
5. SAR Measurement System : SPEAG (DASY4)
6. Phantom Configuration : Flat Phantom
7. SAR Configuration : Body
8. Test Signal Call Mode : Manu. Test Codes

Eui - Soon Park
Chief Research Engineer

12. TEST EQUIPMENT

Equipment List and Calibration

Name of Equipment	Manufacturer	Model Type	Serial Number	Cal. Due date
Robot	Stäubli	RX90BL	5R80A1	N/A
SAM Twin Phantom	SPEAG	V4.0	TP-1151	N/A
SAM Twin Phantom	SPEAG	V4.0	TP-1198	N/A
DAE	SPEAG	DAE3	534	12/23/04
E-Field Probe	SPEAG	ET3DV6	1730	12/16/04
Validation Dipole 835MHz	SPEAG	D835V2	471	12/04/04
S-Parameter Network Analyzer	Agilent	8753ES	MY4002948	07/21/05
Dielectric Probe Kit	Agilent	85070D	US01440173	N/A
Signal Generator	Agilent	E4421B	MY41000790	07/21/05
High Power RF Amplifier	EM Power	BBS3Q7ECK	1027	07/21/05
Dual Direction Coupler	Agilent	778D-012	50344	08/12/04
EPM-Series Power Meter	Agilent	E4419B	GB39290607	07/23/05
Power Sensor	Agilent	8481A	MY41092712	07/20/05
Power Sensor	Agilent	8481A	MY41092723	07/20/05
Attenuator	Agilent	8491A	MY39259074	07/20/05
Attenuator	Agilent	8491A	MY39259076	07/20/05
Low Pass Filter 1.5 GHz	Dymstec	LA-15N	–	N/A
Low Pass Filter 3.0 GHz	Dymstec	LA-30N	–	N/A
Thermometer/Hygrometer	SATO	SK-L200TH	8440586	08/02/05

Table 12.1 Test Equipment List and Calibration

NOTE:
The E-field probe was calibrated by SPEAG, by waveguide technique procedure. Dipole Validation measurement is performed by LG Electronics. before each test. The brain simulating material is calibrated by LG Electronics using the dielectric probe system and network analyzer to determine the conductivity and permittivity (dielectric constant) of the brain-equivalent material.

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APPENDIX A: Validation Test Data

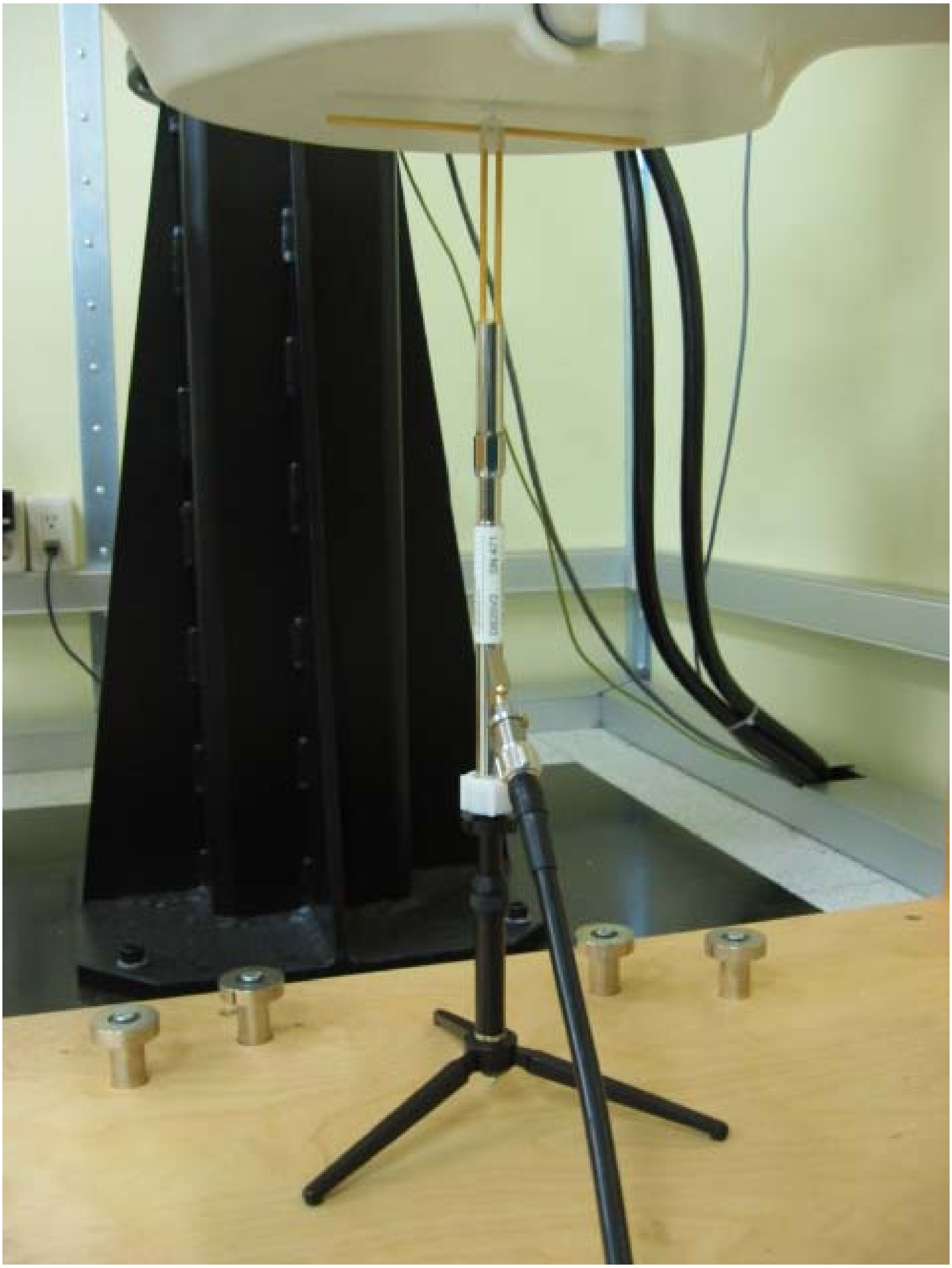


Figure 1 835 MHz Dipole Validation Test Setup

LG Electronics Inc.

DUT: Dipole 835MHz;Type: D835V2;Serial: 471

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: Head 835 MHz;(σ = 0.89 mho/m; ε_r = 41.5; ρ = 1000 kg/m^3)
Phantom section: Flat Section

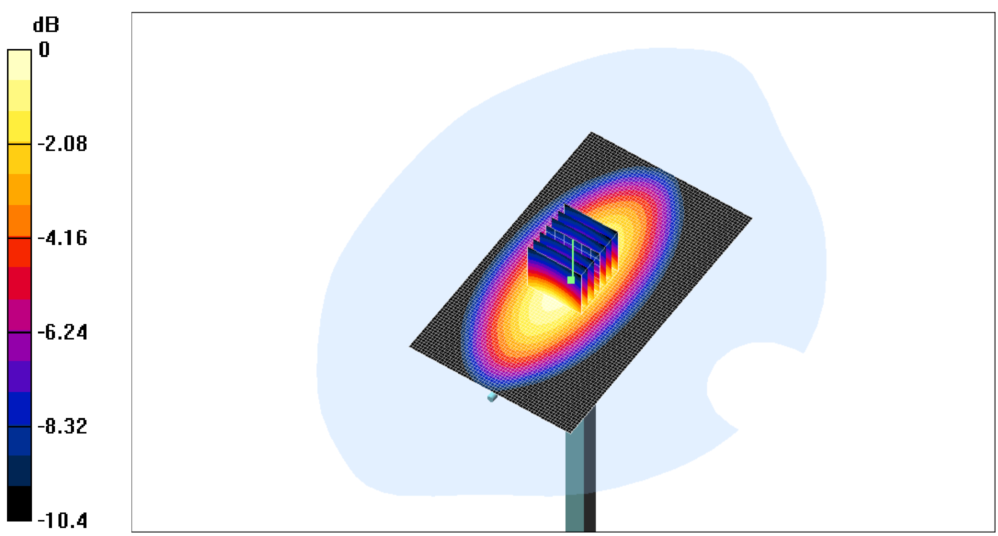
Test Date: 11/08/2004;Ambient Temp: 22.1°C;Tissue Temp: 21.3°C

Probe: ET3DV6 - SN1730;ConvF(6.2, 6.2, 6.2);Calibrated: 2003-12-16
Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
Electronics: DAE3 Sn534;Calibrated: 2003-12-23
Phantom: SAM 835;Type: SAM 4.0;Serial: TP-1151
Measurement SW: DASY4, V4.3 Build 22;Postprocessing SW: SEMCAD, V1.8 Build 127

835 MHz Dipole Validation

Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.69 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.7 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 3.69 W/kg
SAR(1 g) = 2.48 mW/g; SAR(10 g) = 1.61 mW/g
Maximum value of SAR (measured) = 2.67 mW/g



0 dB = 2.67mW/g

APPENDIX B: SAR Test Setup Photographs

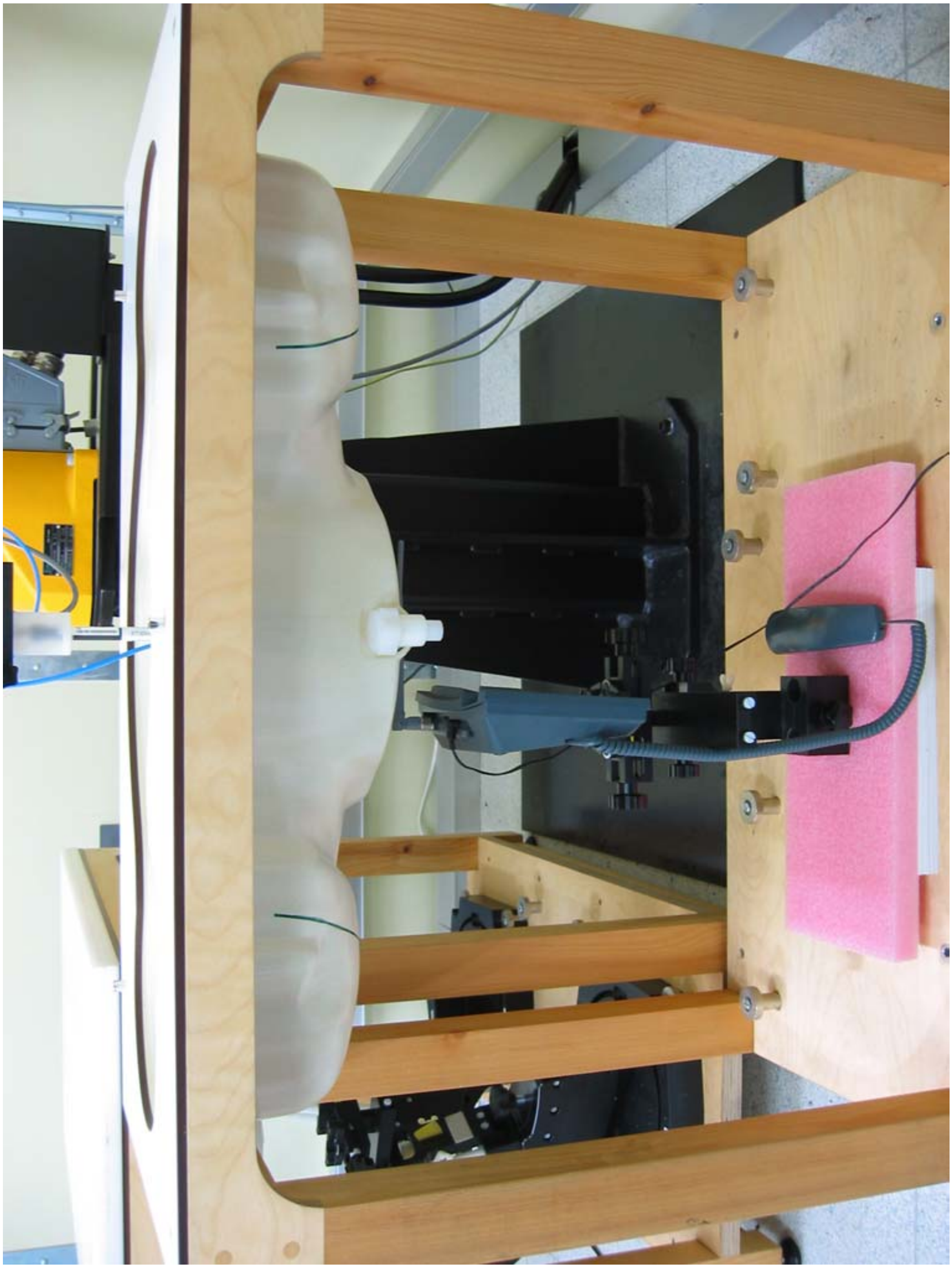


Figure 1 Right Head SAR Test Setup - Cheek Touch Position

Figure 2 Body SAR Test Setup – 2.5cm Separation Distance

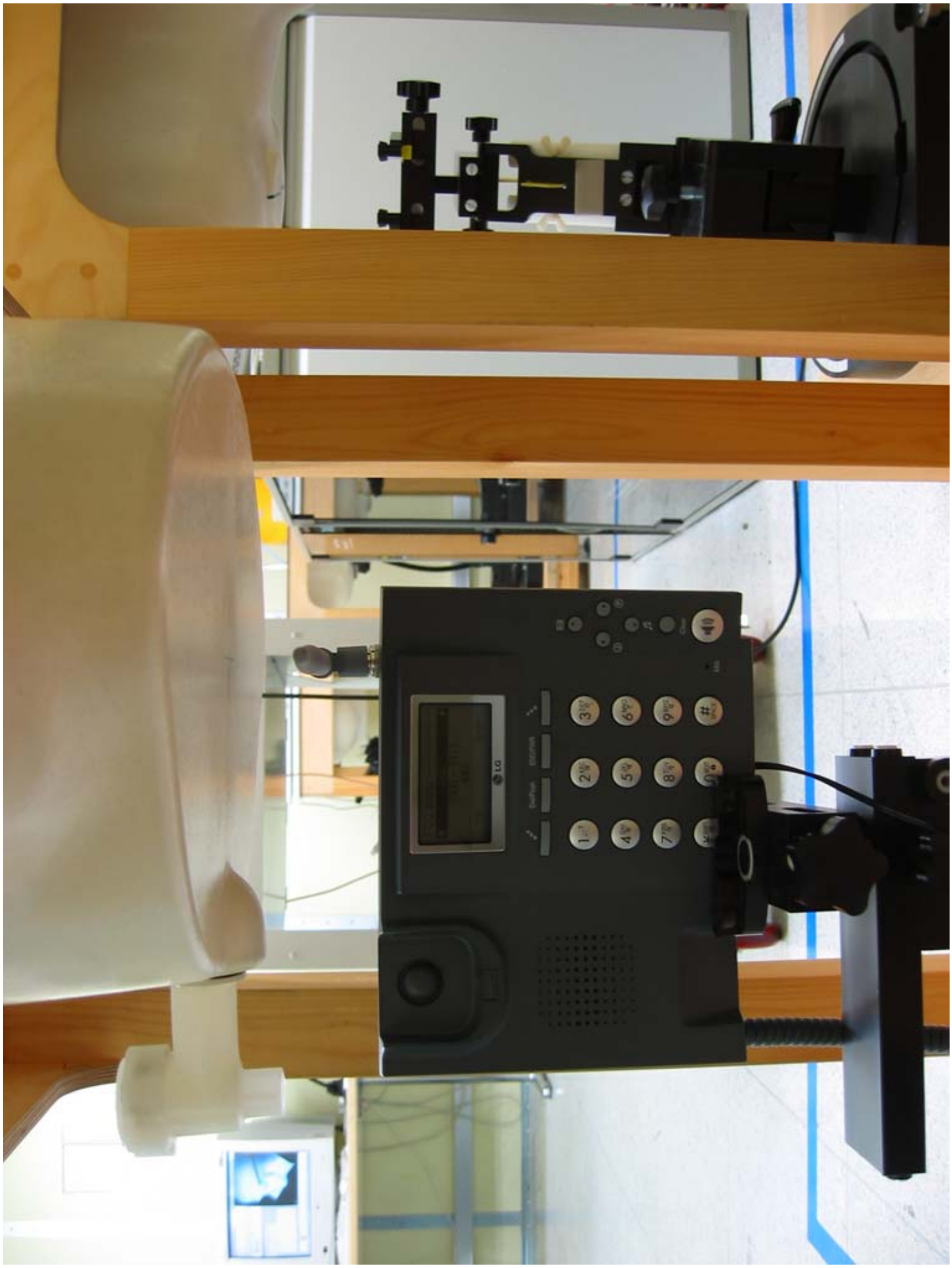


Figure 3 Body SAR Test Setup – 2.5cm Separation Distance

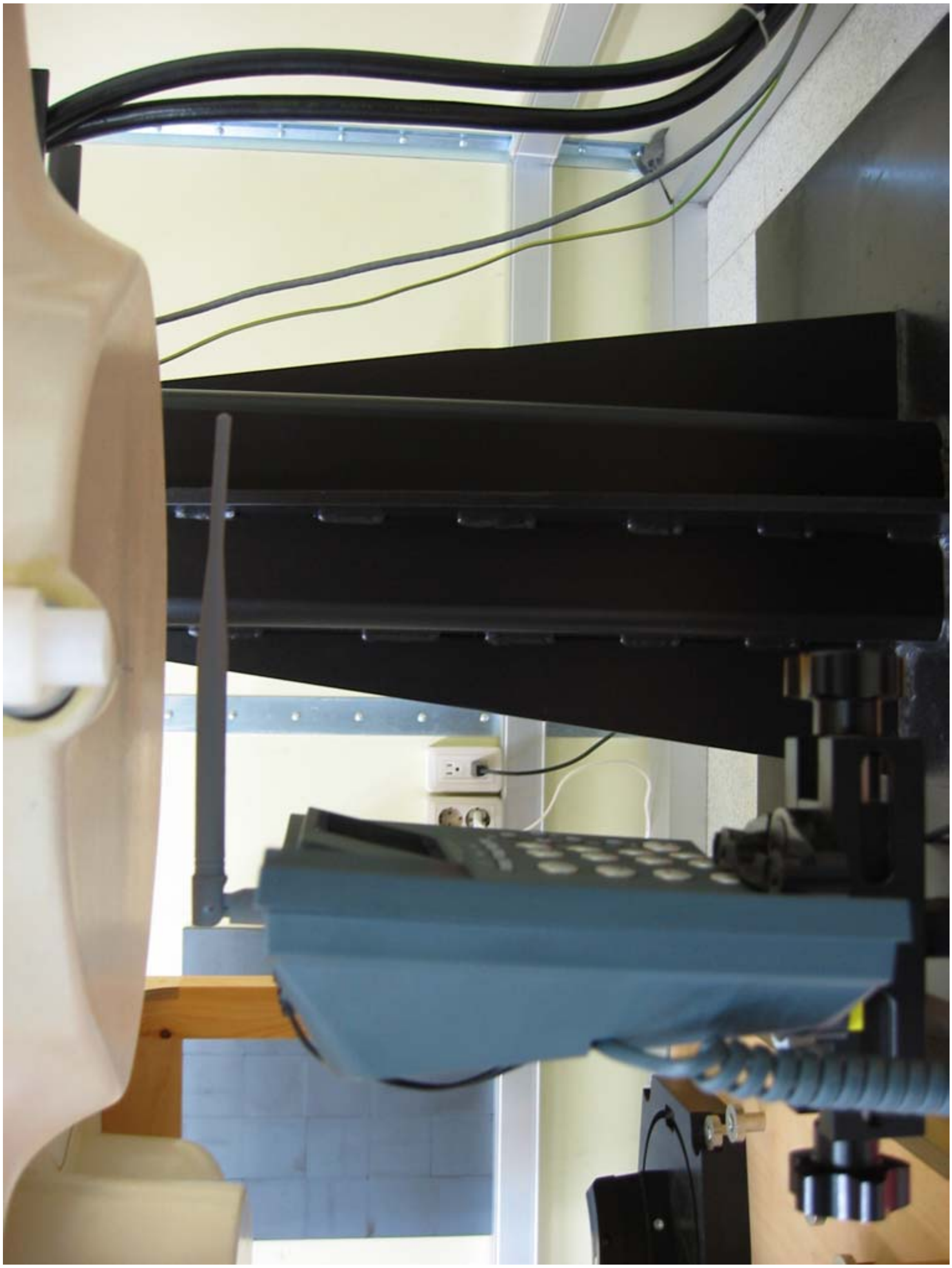


Figure 4 Body SAR Test Setup – 2.5cm Separation Distance

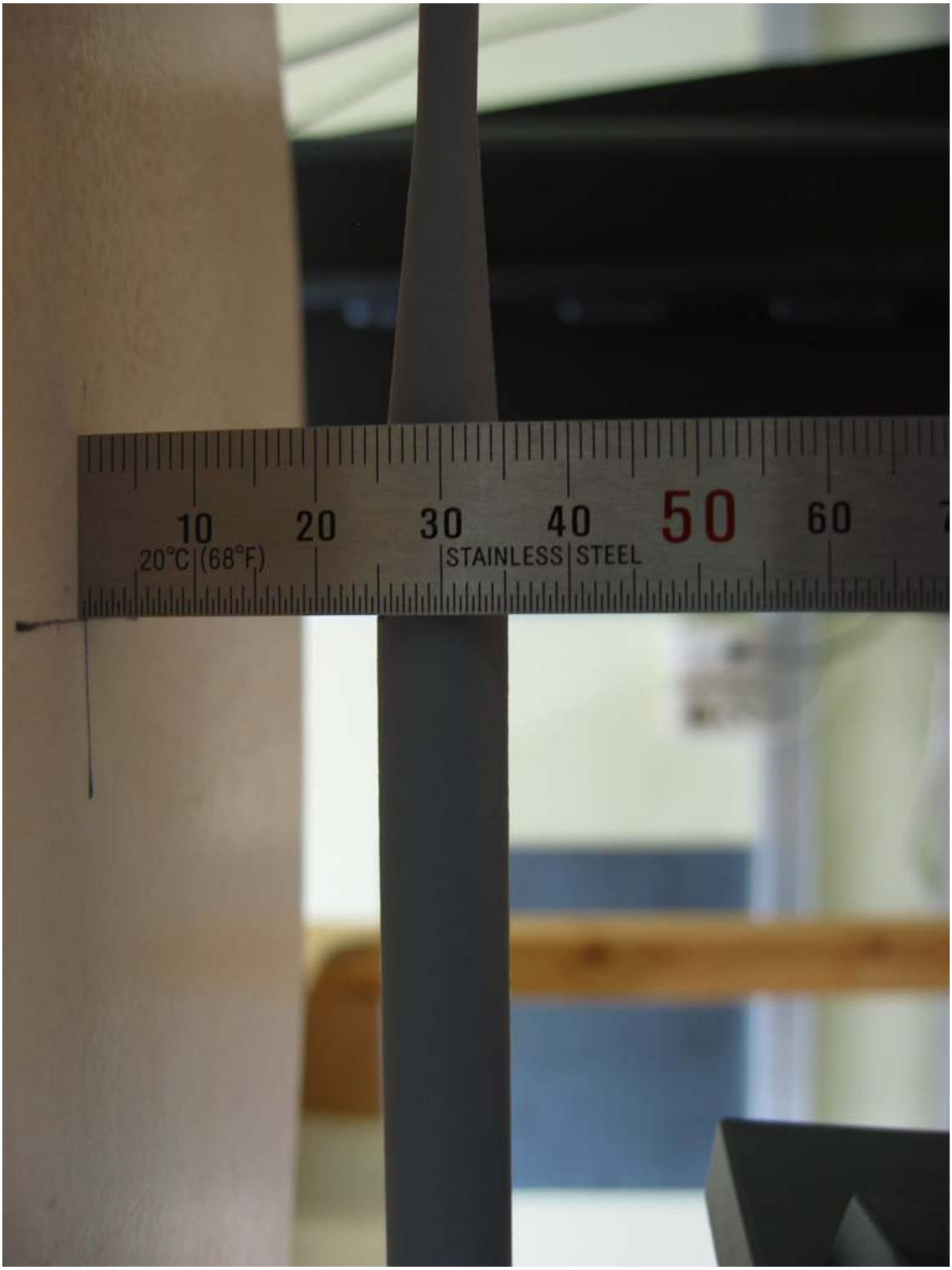


Figure 5 Body SAR Test Setup – 2.5cm Separation Distance

APPENDIX C: SAR Test Data

LG Electronics Inc.

DUT: LSP-350;Type: Single-Mode WLL Phone;Serial: FCC #3

Communication System: CDMA; Frequency: 824.7 MHz;Duty Cycle: 1:1
Medium: Head 835 MHz;(σ = 0.98 mho/m; ε_r = 54.3; ρ = 1000 kg/m^3)
Phantom section: Flat Section

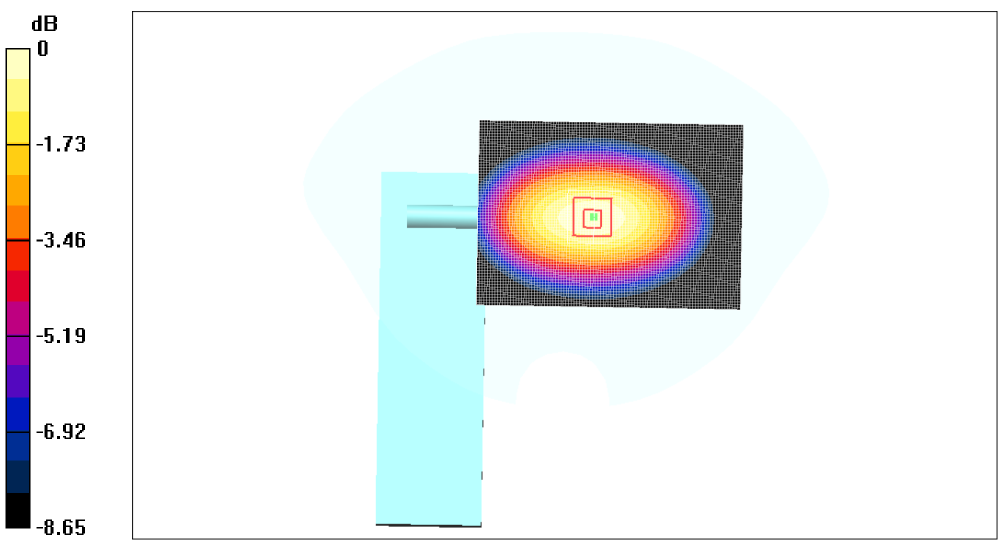
Test Date: 11/08/2004;Ambient Temp: 22.3°C;Tissue Temp: 21.1°C

Probe: ET3DV6 - SN1730;ConvF(6.2, 6.2, 6.2);Calibrated: 2003-12-16
Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
Electronics: DAE3 Sn534;Calibrated: 2003-12-23
Phantom: SAM 835;Type: SAM 4.0;Serial: TP-1151
Measurement SW: DASY4, V4.3 Build 22;Postprocessing SW: SEMCAD, V1.8 Build 127

Body 2.5cm Space, Ch. 1013, Fixed Ant., Battery

Area Scan (101x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.767 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 28 V/m; Power Drift = 0.1 dB
Peak SAR (extrapolated) = 0.974 W/kg
SAR(1 g) = 0.734 mW/g; SAR(10 g) = 0.527 mW/g
Maximum value of SAR (interpolated) = 0.780 mW/g



0 dB = 0.780mW/g

LG Electronics Inc.

DUT: LSP-350;Type: Single-Mode WLL Phone;Serial: FCC #3

Communication System: CDMA; Frequency: 835.89 MHz;Duty Cycle: 1:1
Medium: Head 835 MHz;(σ = 0.98 mho/m; ε_r = 54.3; ρ = 1000 kg/m^3)
Phantom section: Flat Section

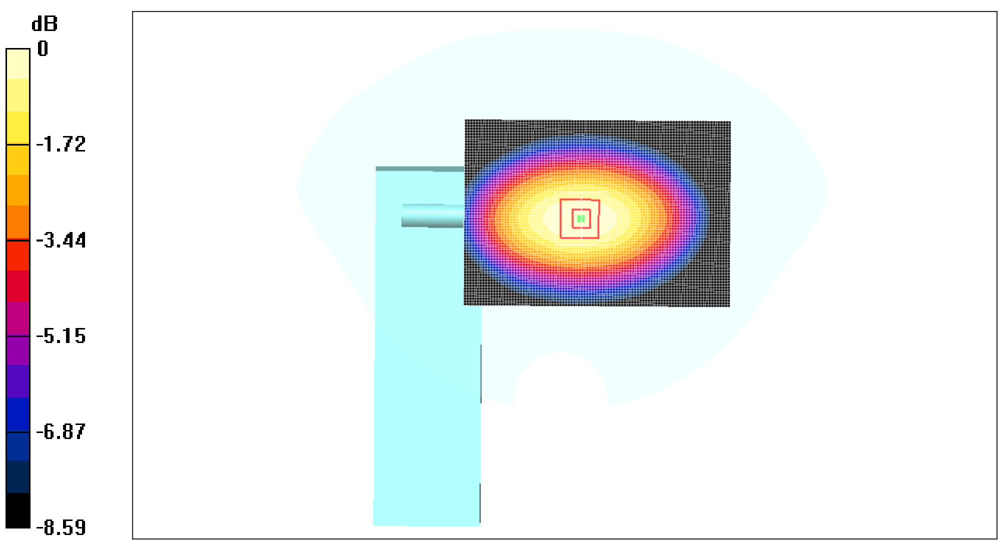
Test Date: 11/08/2004;Ambient Temp: 22.5°C;Tissue Temp: 21.3°C

Probe: ET3DV6 - SN1730;ConvF(6.2, 6.2, 6.2);Calibrated: 2003-12-16
Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
Electronics: DAE3 Sn534;Calibrated: 2003-12-23
Phantom: SAM 835;Type: SAM 4.0;Serial: TP-1151
Measurement SW: DASY4, V4.3 Build 22;Postprocessing SW: SEMCAD, V1.8 Build 127

Body 2.5cm Space, Ch. 363, Fixed Ant., Battery

Area Scan (101x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.681 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 27.1 V/m; Power Drift = 0.0 dB
Peak SAR (extrapolated) = 0.842 W/kg
SAR(1 g) = 0.640 mW/g; SAR(10 g) = 0.462 mW/g
Maximum value of SAR (interpolated) = 0.679 mW/g



0 dB = 0.679mW/g

LG Electronics Inc.

DUT: LSP-350;Type: Single-Mode WLL Phone;Serial: FCC #3

Communication System: CDMA; Frequency: 848.31 MHz;Duty Cycle: 1:1
Medium: Head 835 MHz;(σ = 0.98 mho/m; ε_r = 54.3; ρ = 1000 kg/m^3)
Phantom section: Flat Section

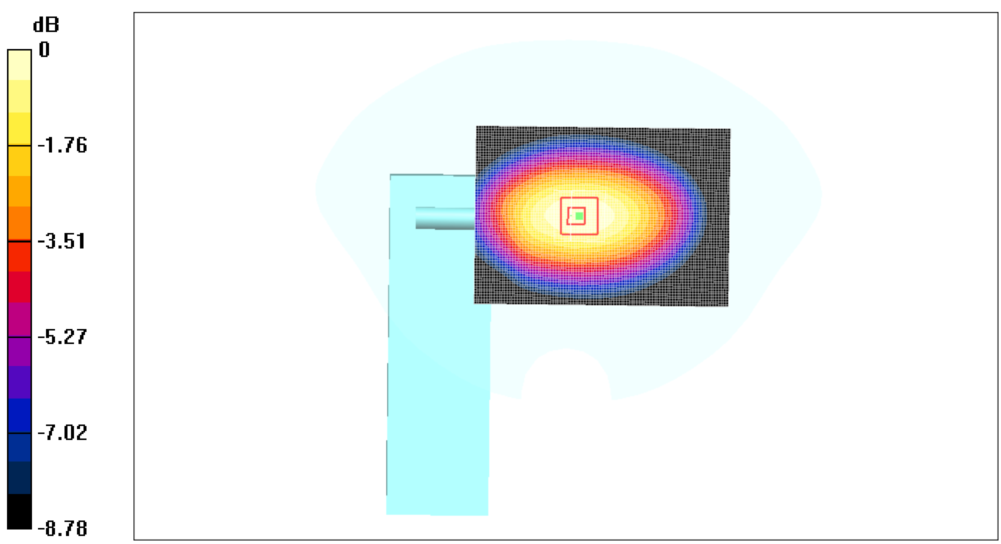
Test Date: 11/08/2004;Ambient Temp: 22.6°C;Tissue Temp: 21.5°C

Probe: ET3DV6 - SN1730;ConvF(6.2, 6.2, 6.2);Calibrated: 2003-12-16
Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
Electronics: DAE3 Sn534;Calibrated: 2003-12-23
Phantom: SAM 835;Type: SAM 4.0;Serial: TP-1151
Measurement SW: DASY4, V4.3 Build 22;Postprocessing SW: SEMCAD, V1.8 Build 127

Body 2.5cm Space, Ch. 777, Fixed Ant., Battery

Area Scan (101x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.557 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 24.3 V/m; Power Drift = 0.1 dB
Peak SAR (extrapolated) = 0.690 W/kg
SAR(1 g) = 0.523 mW/g; SAR(10 g) = 0.377 mW/g
Maximum value of SAR (interpolated) = 0.555 mW/g



0 dB = 0.555mW/g

LG Electronics Inc.

DUT: LSP-350;Type: Single-Mode WLL Phone;Serial: FCC #3

Communication System: CDMA; Frequency: 824.7 MHz;Duty Cycle: 1:1
Medium: Head 835 MHz;(σ = 0.98 mho/m; ε_r = 54.3; ρ = 1000 kg/m^3)
Phantom section: Flat Section

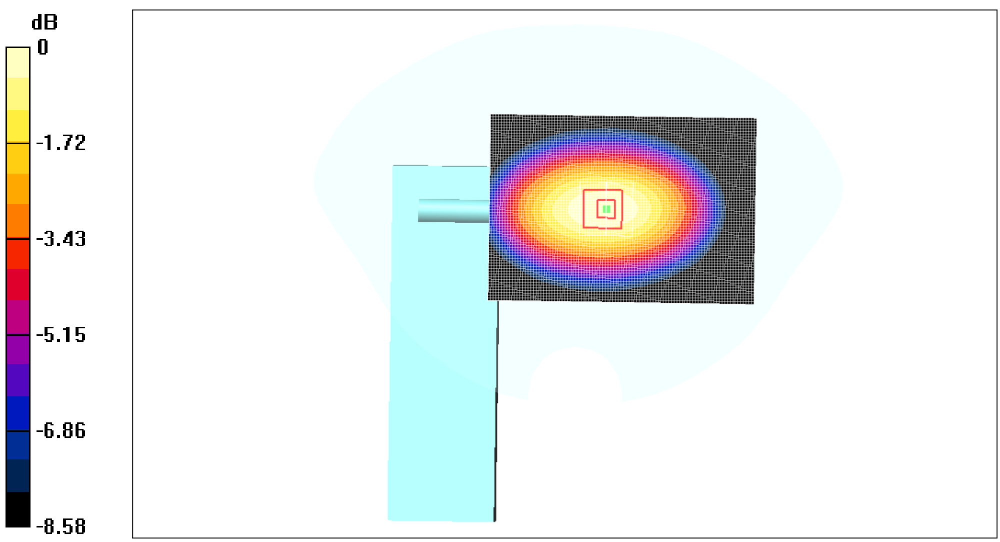
Test Date: 11/08/2004;Ambient Temp: 22.7°C;Tissue Temp: 21.3°C

Probe: ET3DV6 - SN1730;ConvF(6.2, 6.2, 6.2);Calibrated: 2003-12-16
Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
Electronics: DAE3 Sn534;Calibrated: 2003-12-23
Phantom: SAM 835;Type: SAM 4.0;Serial: TP-1151
Measurement SW: DASY4, V4.3 Build 22;Postprocessing SW: SEMCAD, V1.8 Build 127

Body 2.5cm Space, Ch. 1013, Fixed Ant., Charger

Area Scan (101x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.760 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 28.3 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 0.952 W/kg
SAR(1 g) = 0.716 mW/g; SAR(10 g) = 0.514 mW/g
Maximum value of SAR (interpolated) = 0.761 mW/g



0 dB = 0.761mW/g

LG Electronics Inc.

DUT: LSP-350;Type: Single-Mode WLL Phone;Serial: FCC #3

Communication System: CDMA; Frequency: 835.89 MHz;Duty Cycle: 1:1
Medium: Head 835 MHz;(σ = 0.98 mho/m; ε_r = 54.3; ρ = 1000 kg/m^3)
Phantom section: Flat Section

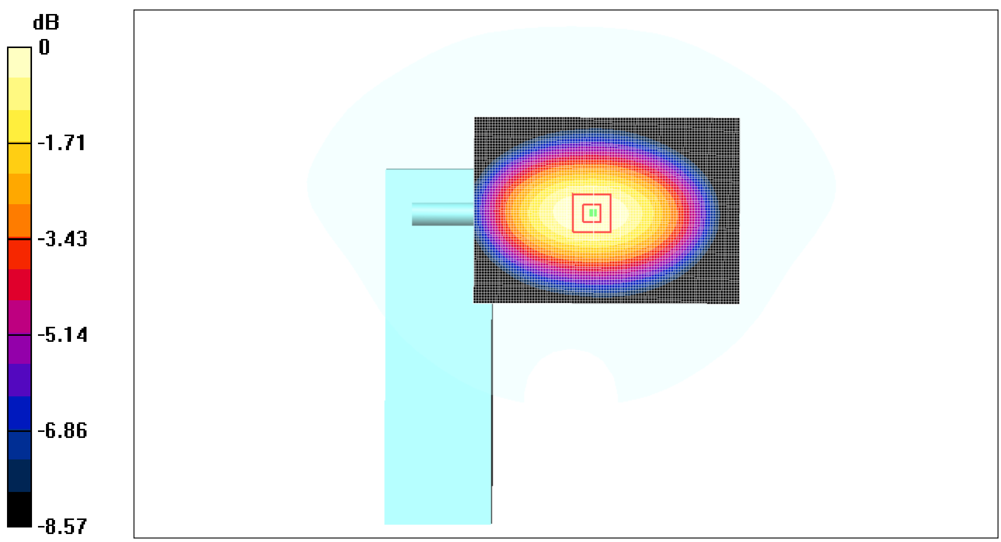
Test Date: 11/08/2004;Ambient Temp: 22.8°C;Tissue Temp: 21.6°C

Probe: ET3DV6 - SN1730;ConvF(6.2, 6.2, 6.2);Calibrated: 2003-12-16
Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
Electronics: DAE3 Sn534;Calibrated: 2003-12-23
Phantom: SAM 835;Type: SAM 4.0;Serial: TP-1151
Measurement SW: DASY4, V4.3 Build 22;Postprocessing SW: SEMCAD, V1.8 Build 127

Body 2.5cm Space, Ch. 363, Fixed Ant., Charger

Area Scan (101x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.633 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 25.8 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 0.781 W/kg
SAR(1 g) = 0.587 mW/g; SAR(10 g) = 0.423 mW/g
Maximum value of SAR (interpolated) = 0.624 mW/g



0 dB = 0.624mW/g

LG Electronics Inc.

DUT: LSP-350;Type: Single-Mode WLL Phone;Serial: FCC #3

Communication System: CDMA; Frequency: 848.31 MHz;Duty Cycle: 1:1
Medium: Head 835 MHz;(σ = 0.98 mho/m; ε_r = 54.3; ρ = 1000 kg/m^3)
Phantom section: Flat Section

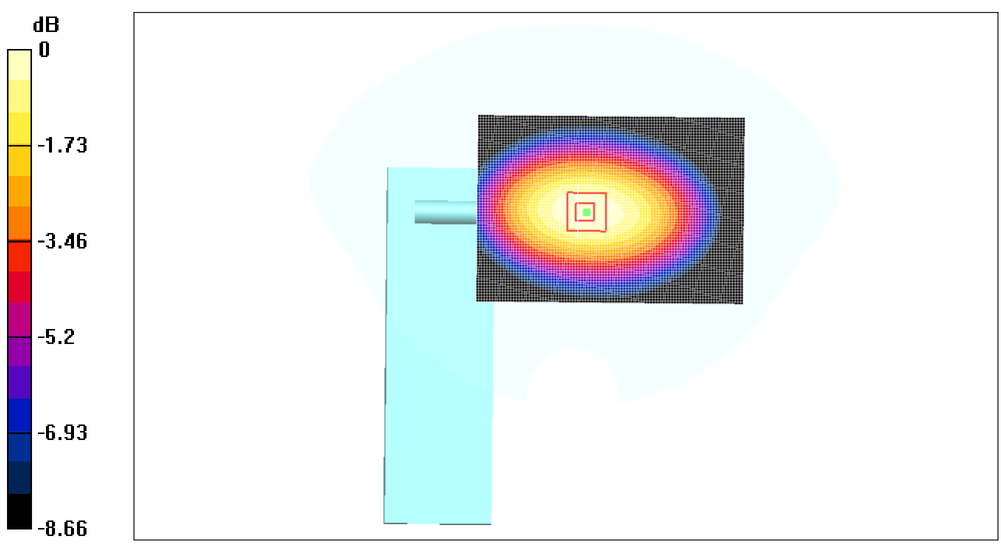
Test Date: 11/08/2004;Ambient Temp: 22.5°C;Tissue Temp: 21.5°C

Probe: ET3DV6 - SN1730;ConvF(6.2, 6.2, 6.2);Calibrated: 2003-12-16
Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
Electronics: DAE3 Sn534;Calibrated: 2003-12-23
Phantom: SAM 835;Type: SAM 4.0;Serial: TP-1151
Measurement SW: DASY4, V4.3 Build 22;Postprocessing SW: SEMCAD, V1.8 Build 127

Body 2.5cm Space, Ch. 777, Fixed Ant., Charger

Area Scan (101x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.577 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 24.9 V/m; Power Drift = 0.1 dB
Peak SAR (extrapolated) = 0.719 W/kg
SAR(1 g) = 0.546 mW/g; SAR(10 g) = 0.393 mW/g
Maximum value of SAR (interpolated) = 0.581 mW/g



0 dB = 0.581mW/g

LG Electronics Inc.

DUT: LSP-350;Type: Single-Mode WLL Phone;Serial: FCC #3

Communication System: CDMA; Frequency: 824.7 MHz;Duty Cycle: 1:1
Medium: Head 835 MHz;(σ = 0.98 mho/m; ε_r = 54.3; ρ = 1000 kg/m^3)
Phantom section: Flat Section

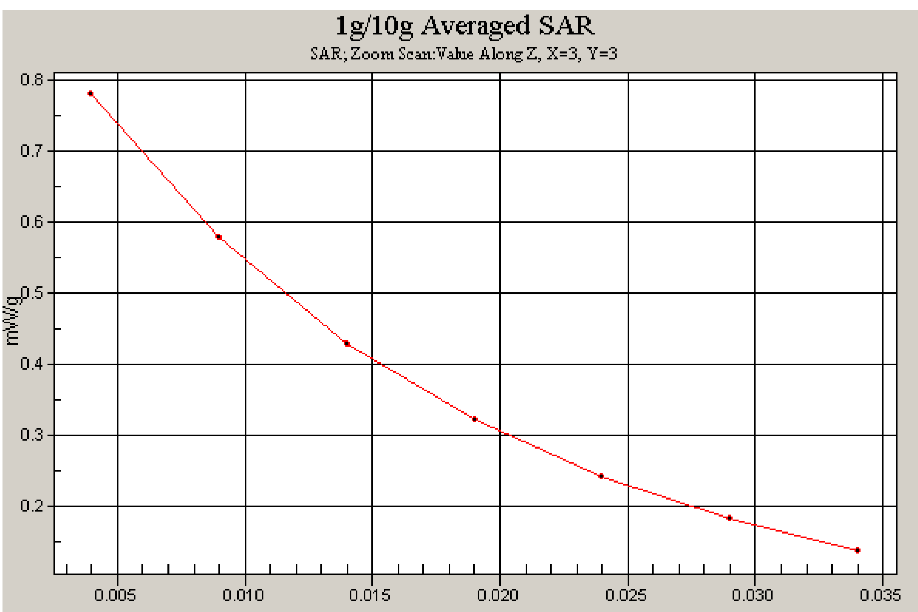
Test Date: 11/08/2004;Ambient Temp: 22.3°C;Tissue Temp: 21.1°C

Probe: ET3DV6 - SN1730;ConvF(6.2, 6.2, 6.2);Calibrated: 2003-12-16
Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
Electronics: DAE3 Sn534;Calibrated: 2003-12-23
Phantom: SAM 835;Type: SAM 4.0;Serial: TP-1151
Measurement SW: DASY4, V4.3 Build 22;Postprocessing SW: SEMCAD, V1.8 Build 127

Body 2.5cm Space, Ch. 1013, Fixed Ant., Battery

Area Scan (101x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.767 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 28 V/m; Power Drift = 0.1 dB
Peak SAR (extrapolated) = 0.974 W/kg
SAR(1 g) = 0.734 mW/g; SAR(10 g) = 0.527 mW/g
Maximum value of SAR (interpolated) = 0.780 mW/g



APPENDIX D: Calibration Certificates

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

Client LG (Dymstec)

CALIBRATION CERTIFICATE

Object(s)	ET3DV6 - SN:1730
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	December 16, 2003
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM E4419B	GB41293874	2-Apr-03 (METAS, No 252-0250)	Apr-04
Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04
Reference 20 dB Attenuator	SN: 5086 (20b)	3-Apr-03 (METAS No. 251-0340	Apr-04
Fluke Process Calibrator Type 702	SN: 6295803	8-Sep-03 (Sintrel SCS No. E-030020)	Sep-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (SPEAG, in house check Oct-03)	In house check: Oct 05
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-03)	In house check: Oct 05

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Technician	N. Vetterli
Approved by:	Katja Pokovic	Laboratory Director	Pokovic Katja

Date issued: December 18, 2003

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

880-KP0301061-A Page 1 (1)

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Probe ET3DV6

SN:1730

Manufactured:	October 1, 2002
Last calibration:	November 20, 2002
Recalibrated:	December 16, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1730

Sensitivity in Free Space

NormX	**1.37**	$\mu V/(V/m)^2$
NormY	**1.59**	$\mu V/(V/m)^2$
NormZ	**1.75**	$\mu V/(V/m)^2$

Diode Compression

DCP X	**94**	mV
DCP Y	**94**	mV
DCP Z	**94**	mV

Sensitivity in Tissue Simulating Liquid

Head 900 MHz ε_r **= 41.5 ± 5%** σ **= 0.97 ± 5% mho/m**

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**6.2** ± 9.5% (k=2)		Boundary effect:	
ConvF Y	**6.2** ± 9.5% (k=2)		Alpha	**0.29**
ConvF Z	**6.2** ± 9.5% (k=2)		Depth	**2.87**

Head 1800 MHz ε_r **= 40.0 ± 5%** σ **= 1.40 ± 5% mho/m**

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**5.1** ± 9.5% (k=2)		Boundary effect:	
ConvF Y	**5.1** ± 9.5% (k=2)		Alpha	**0.44**
ConvF Z	**5.1** ± 9.5% (k=2)		Depth	**2.68**

Boundary Effect

Head 900 MHz Typical SAR gradient: 5 % per mm

Probe Tip to Boundary	**1 mm**	**2 mm**
SAR_{be} [%] Without Correction Algorithm	9.2	5.5
SAR_{be} [%] With Correction Algorithm	0.4	0.5

Head 1800 MHz Typical SAR gradient: 10 % per mm

Probe Tip to Boundary	**1 mm**	**2 mm**
SAR_{be} [%] Without Correction Algorithm	12.3	8.6
SAR_{be} [%] With Correction Algorithm	0.2	0.3

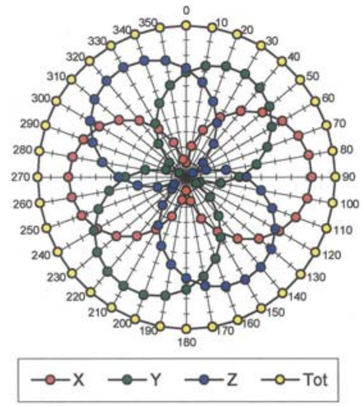
Sensor Offset

Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.4 ± 0.2**	mm

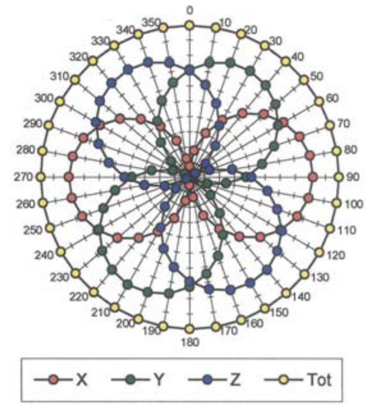
ET3DV6 SN:1730 December 16, 2003

Receiving Pattern (ϕ , θ = 0°

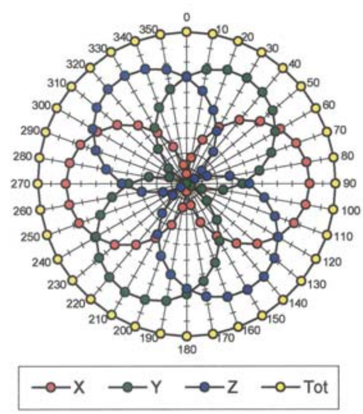
f = 30 MHz, TEM cell ifi110



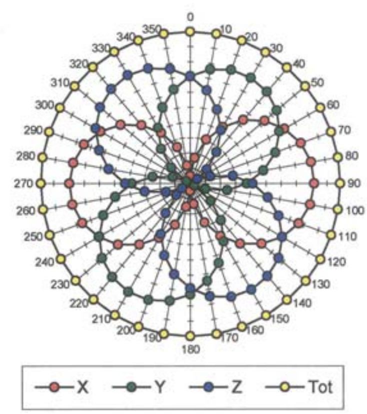
f = 100 MHz, TEM cell ifi110



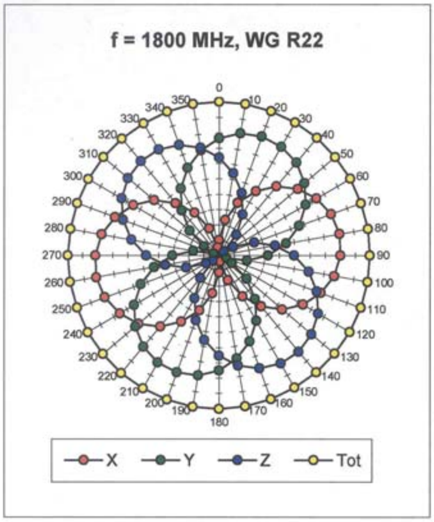
f = 300 MHz, TEM cell ifi110

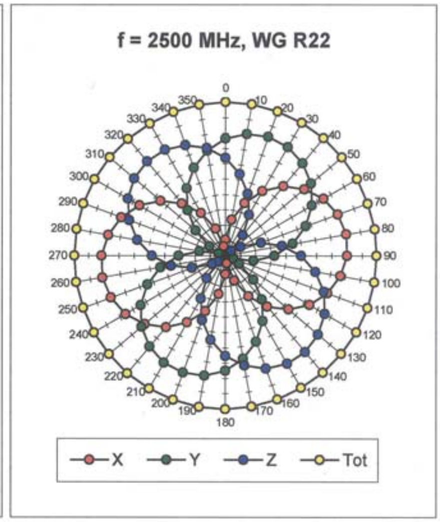


f = 900 MHz, TEM cell ifi110

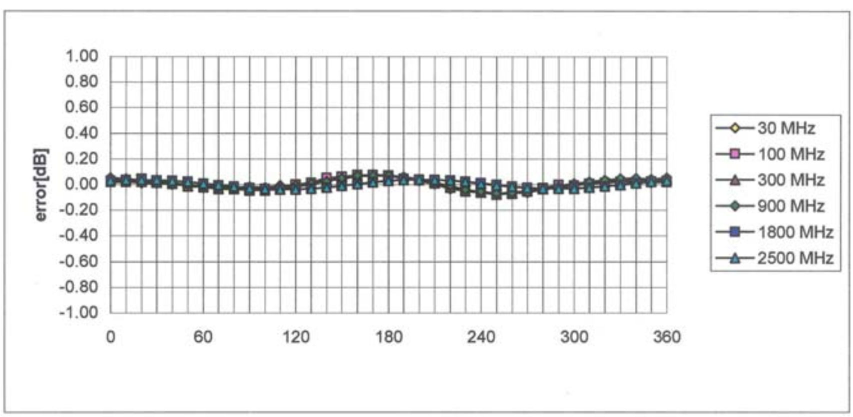


ET3DV6 SN:1730 December 16, 2003



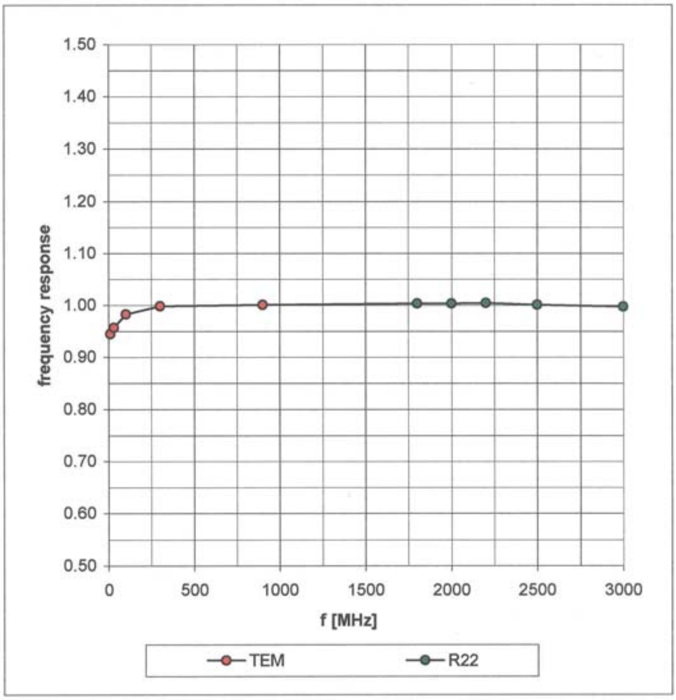


Isotropy Error (ϕ), θ = 0°



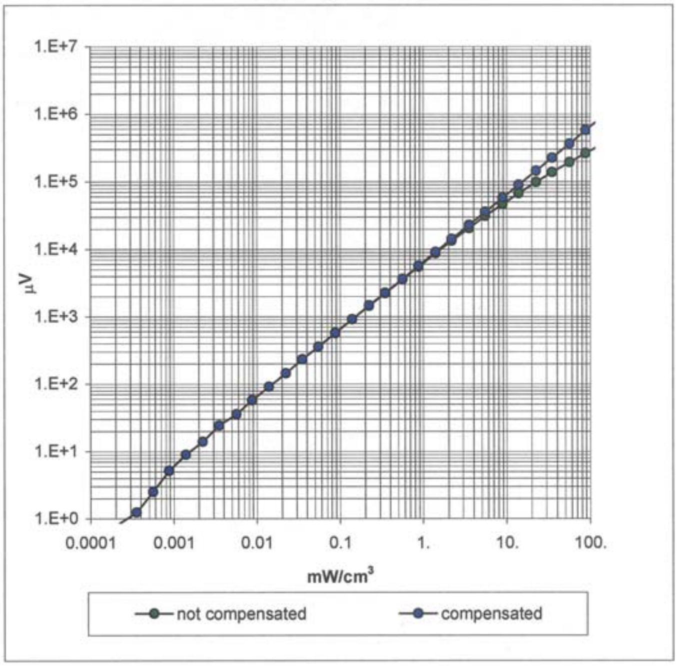
Frequency Response of E-Field

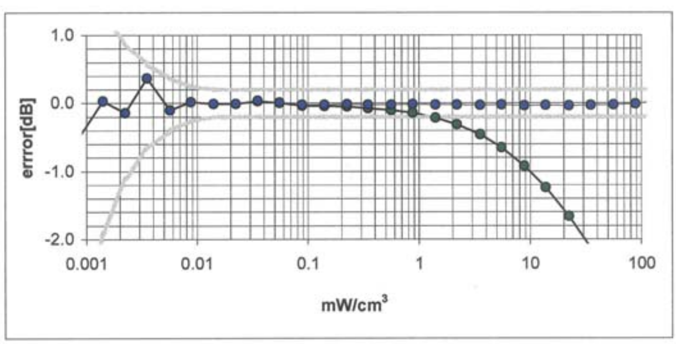
(TEM-Cell:ifi110, Waveguide R22)



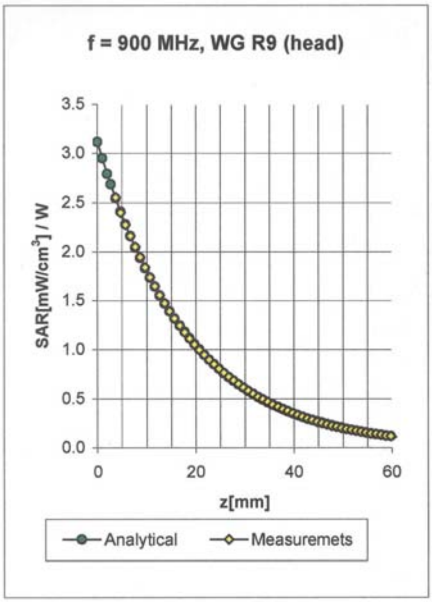
Dynamic Range f(SAR_{brain})

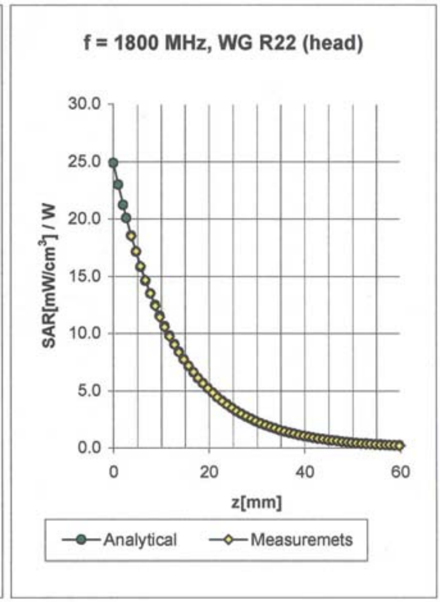
(Waveguide R22)





Conversion Factor Assessment





Head **900 MHz** ε_r **= 41.5 ± 5%** σ **= 0.97 ± 5% mho/m**

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

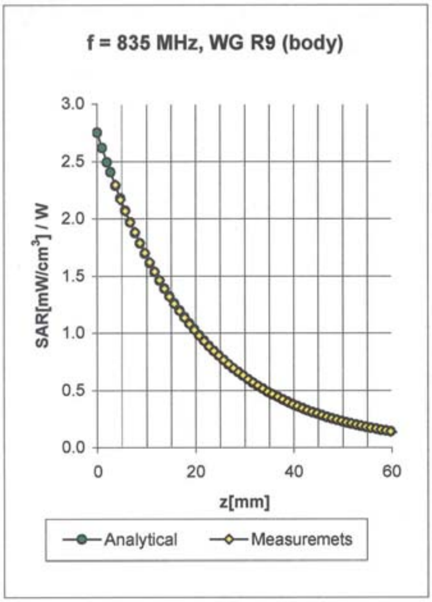
ConvF X	**6.2**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**6.2**	± 9.5% (k=2)	Alpha	**0.29**
ConvF Z	**6.2**	± 9.5% (k=2)	Depth	**2.87**

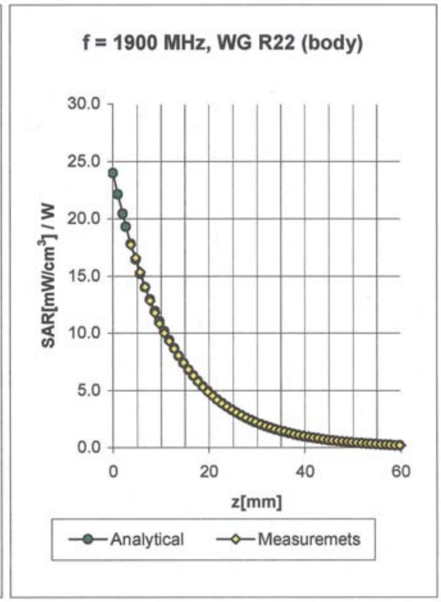
Head **1800 MHz** ε_r **= 40.0 ± 5%** σ **= 1.40 ± 5% mho/m**

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**5.1**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**5.1**	± 9.5% (k=2)	Alpha	**0.44**
ConvF Z	**5.1**	± 9.5% (k=2)	Depth	**2.68**

Conversion Factor Assessment





Body **835 MHz** ε_r **= 55.2 ± 5%** σ **= 0.97 ± 5% mho/m**

Valid for f=750-950 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**6.2**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**6.2**	± 9.5% (k=2)	Alpha	**0.35**
ConvF Z	**6.2**	± 9.5% (k=2)	Depth	**2.52**

Body **1900 MHz** ε_r **= 53.3 ± 5%** σ **= 1.52 ± 5% mho/m**

Valid for f=1800-2000 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**4.4**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**4.4**	± 9.5% (k=2)	Alpha	**0.62**
ConvF Z	**4.4**	± 9.5% (k=2)	Depth	**2.57**

Deviation from Isotropy in HSL

Error (θϕ), f = 900 MHz