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SAR Compliace Test Report

APPLICANT NAME & ADDRESS :	DATA & LOCATION OF TESTING
BluebirdSoft Inc 135-890)558-5, Sinsa-Dong, Gangnam-Gu, Seoul, Korea	Dates of testing : 2 April 2007 ~ 9 April 2007 Test Site : ESTECH Co., Ltd.

Test Device :

Models : BIP-1300

FCC ID : SS4BIP13X0

TYPE : Industrial PDA (Prototype)

Test report no :	ESTSAR0704-001	Number of page :	23
Contact person :	Young Tai Ji	Responsible test Engineer :	I.K.Hong
Testing has been Carried out in Accordance with :	IEEE 1528(Dec.2003) Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate(SAR) in the Human Body Due to Wireless Communications Device : Experimental Techniques		
Applicant Type :	Certification		
FCC CLASSIFICATION :	Licensed Non-Broadcast Station Transmitter (TNB)		
FCC Rule Part(s)	§2.1093; FCC/OET Bulletin 65 Supplement C (July 2001)		
Test results :	The Tested device complies with the requirements in respect of all parameters subject to the test. The test results and statements relate only to the items tested. The test report shall not be reproduced recept in full, without written approval of the laboratory.		

Date and Signatures : 9 April2007
Report Prepared By : Engineer/ I.K.Hong
(Signatu

Engineering Manager/ Jay Kim
(Signature)

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1. SUMMARY FOR TEST REPORT

FCC ID	SS4BIP13X0
Date of test	2 April 2007 ~ 9 April 2007
Responsible test engineer	Jay Kim
Measurement performed by	I.K.Hong
EUT Type	Industrial PDA (Prototype)
Tx Frequency	824.70 ~ 848.31 MHz(CDMA850), 1851.25 ~ 1908.75(CDMA1900)
Rx Frequency	869.70 ~ 893.31 MHz(CDMA850), 1931.25 ~ 1988.75(CDMA1900)
Max. RF Output Power	GSM850(24.16 dBm) PCS1900 (24.82 dBm)

1.1 Body Worn Configuration

Max. SAR Measurement

FREQUENCY		Modulation	Conducted Power(dBm)		Separation test position	SAR (W/kg)
MHz	Ch		dBm	Battery		
835.89	363	1XEvDO	24.16	Standard	1.5cm [w/o Holster] Rear	0.158
1880.0	600	1xEvDO	24.82	Standard	1.5cm [w/o Holster] Rear	0.695

1.2 Measurement Uncertainty

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

2. INTRODUCATION

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

The safety limits used for the environmental evaluation measurements arethe criteria published by the based on American National Standards Institute (ANSI) For localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for safety Levels with Respect to Human Exposure to Radio Frequency Electronic Fields, 3 kHz to 300 GHz. (c) 1992 by the institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.[2] The measurement procedure described in IEEE/ANSIC95.3-1992 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave[3] is used for guidance in measuring SAR due to the RF radiationexposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (IC NIRP) in Biological Effects and Exposure Criteria for Radio Frequency Electromagnetic Fields," IC NIRP Report No. 86 (c) IC NIRP, 1986, Bethesda, MD20814.[6] SAR is ameasure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

SAR Definition

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

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

Figure 2.1 SAR Mathematical Equation

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

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

Where:

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

E = mass density of the tissue-simulant material (kg/m^3)

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

3. DESCRIPTION OF THE DEVICE UNDER TEST

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

2.1 Antenna Description

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

2.2 Device Description

FCC ID	FCC ID : SS4BIP13X0
Serial numbers	–
Exposure environment	Uncontrolled exposure
Device category	Portable device
Mode(s) of Operation	1xEvDO
Modulation Mode(s)	CDMA
Duty Cycle	1
Transmitting FreQuency Range(s)	824.70 ~ 848.31 MHz(CDMA850), 1851.25 ~ 1908.75(CDMA1900)
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)	23
Tissue simulating liquid temperature (°C)	23
Humidity (%)	49

4.2 RF Characteristics of The Test Site

Tests were performed in a fully enclosed RF Shielded environment

4.3 Test Signal, Frequencies, And Output Power

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

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

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

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

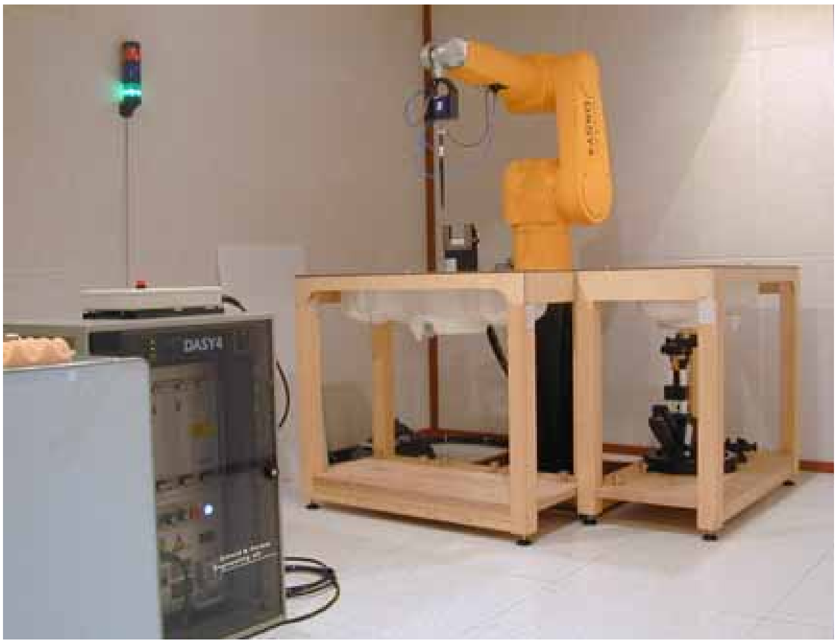

Fig. 4.1 SAR Measurement System

5. DESCRIPTION OF THE TEST EQUIPMENT

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

5.1 Test System Specifications

Test Equipment	Model	Serial Number	Cal.Due Date
DAE	DAE4	551	2007-04-27
E-Field Probe	ET3DV3	3123	2007-10-17
Dipole validation kit	D1900V2	5d058	2007-09-13
	D835V2	475	2007-09-12
Network analyzer	8753ES	MY40000609	2007-10-09
Signal generator	E4432B	GB40050840	2008-03-02
RF Power meter	EPM-442A	GB37170412	2007-10-11
Power Sensor	8481A	3318A90368	2008-03-02
RF Power meter	E4418A	GB38272722	2008-03-02
Power Sensor	8481A	3318A90368	2008-03-02
Dielectric Probe	85070D	US01440154	-
Power Amplifier	BBS3Q7ECK	NONE	2007-12-16
LP Filter	LA-15N	NONE	2007-10-30
	LA-30N	NONE	2007-10-30
Attenuator	8491B	21828	2007-06-03
Dual Directional Coupler	778D	17575	2007-05-02
Wireless Communications Test Set	E5515C	GB42230119	2008-02-07

5.2 SAR Measurement Setup

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

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

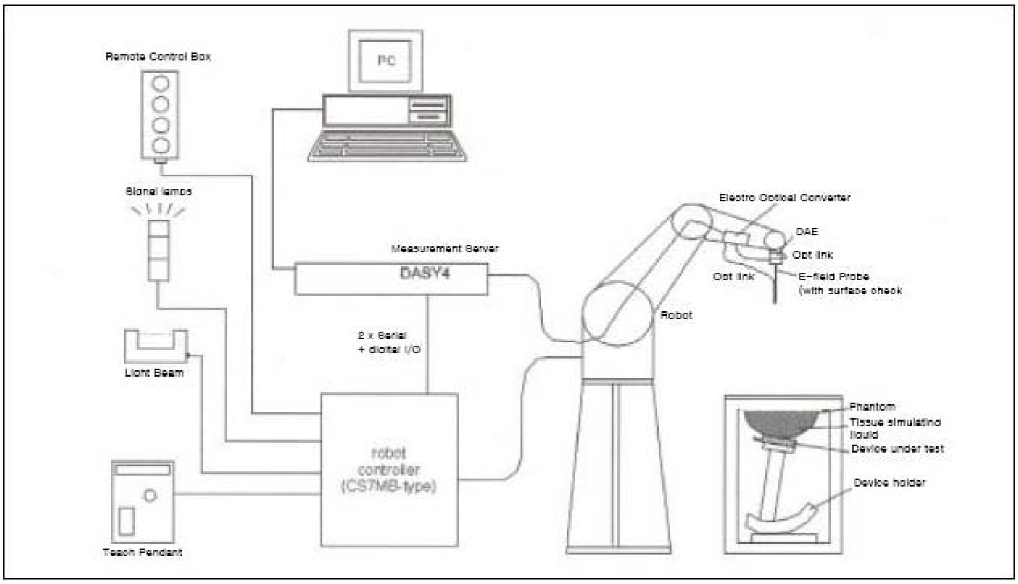

Fig. 5.1 SAR Measurement System Setup

The DAE4 consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gainswitching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the Ethernet Card is accomplished through an optical downlink for data and status
information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in [7].

5.3 DASY4 E-Field Probe System

The SAR measurements were conducted with the dosimetric probe ET3DV6, designed in the classical triangular configuration [7] (see Fig.5.2) and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multifiber line ending at the front of the probe tip. It is connected to the EOC box in the robot arm and provides an automatic detection transmitter, the other half to a synchronized receiver.

5. DESCRIPTION OF THE TEST EQUIPMENT(continued)

As the probe approach the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches coupling is zero. The distance of the coupling maximum to the surface is probe angle. The DASY4 software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting (see Fig. 5.2). The approach is stopped at reaching the maximum.

Isotropic E-Field Probe

Isotropic E-Field Probe for Dosimetric Measurements	
Construction	Symmetrical design with triangular core Interleafed sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., glycol)
Calibration	In air from 10 MHz to 3 GHz In brain and muscle simulating tissue at frequencies of 450 MHz, 900 MHz and 1.8 GHz (accuracy ± 8%) Calibration for other liquids and frequencies upon request
Frequency	10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity	± 0.2 dB in brain tissue (rotation around probe axis) ± 0.3 dB in brain tissue (rotation normal to probe axis)
Dynamic Range	5 μW/g to > 100 mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm Tip length: 20 mm Body diameter: 12 mm Tip diameter: 3.9 mm Distance from probe tip to dipole centers: 2.7 mm

Fig. 5.2 Probe Specifications

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5. DESCRIPTION OF THE TEST EQUIPMENT(continued)

5.4 Phantom & Equivalent Tissues

SAM Phantom

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

Head & Muscle simulation Mixture Characterization

The brain and muscle mixtures consist of a viscous gel using hydroxethlcellullose(HEC) gelling agent and saline solution (see Fig 5.3). Preservation with a bactericide is added and visual inspection is made to make sure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue. The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 have been specified in 1528(Dec.2003) are derived from the issue dielectric parameters computed from
the 4-Cole-Cole equations The mixture characterizations used for the brain and muscle tissue simulation liquids are according to the data by C. Gabriel and G. Hartagrove [13]. (see Fig. 5.3)

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

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

5. DESCRIPTION OF THE TEST EQUIPMENT(continued)

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

Fig. 5.4 Composition of the Tissue Equivalent Matter

Device Holder for Transmitters

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

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

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6. DESCRIPTION OF THE TEST PROCEDURE

6.1 Definition of Reference Point

EAR Reference point

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

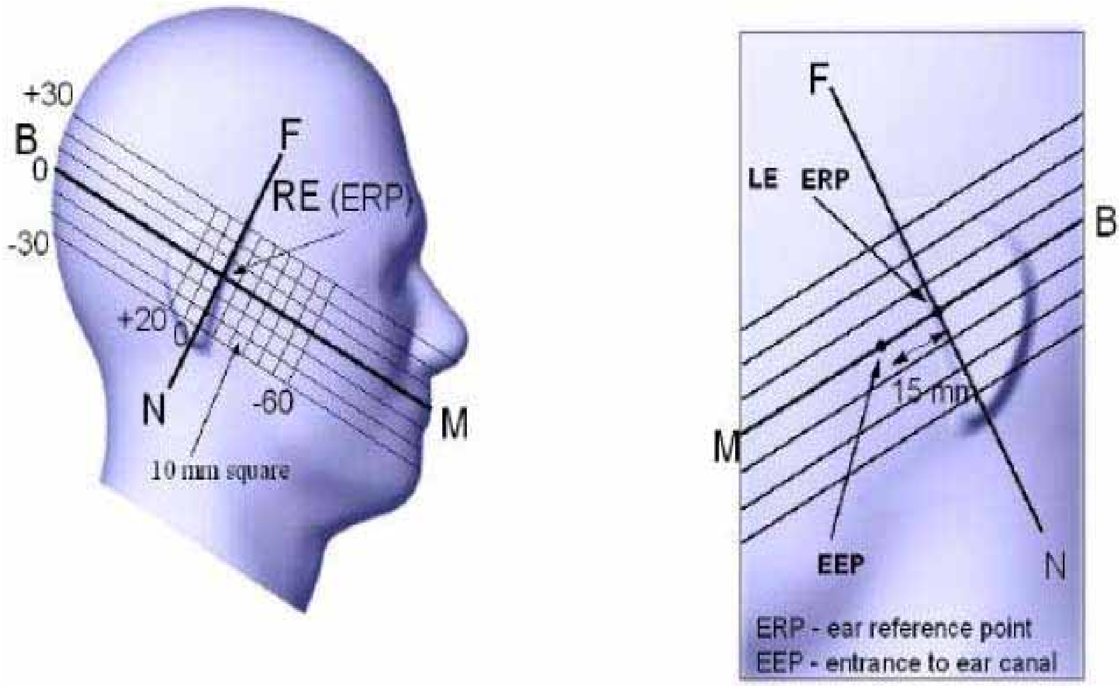

Figure 6.1 Close-up side view of ERP

Handset Reference Points

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

6. DESCRIPTION OF THE TEST PROCEDURE(continued)

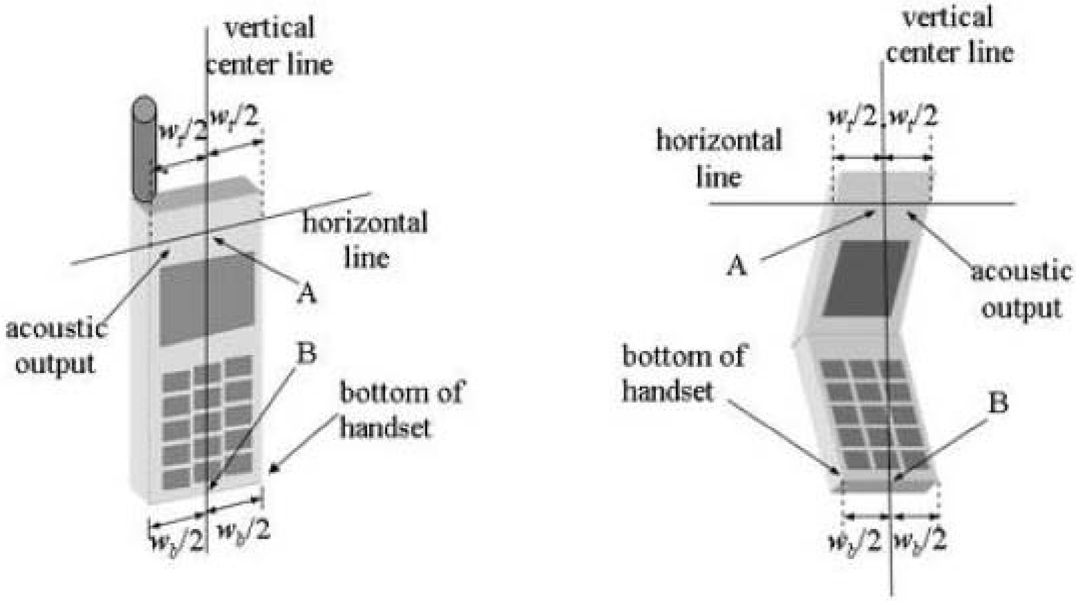

Figure 6.2 Handset Vertical Center & Horizontal Line Reference Points

6.2 Test Configuration Positions
Positioning for Cheek/Touch

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

6. DESCRIPTION OF THE TEST PROCEDURE(continued)

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

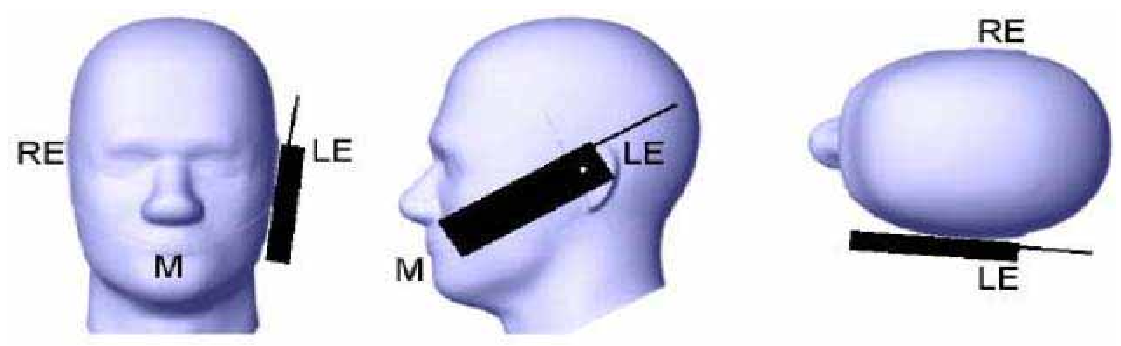

Figure 6.3 “Cheek” or “Touch” Position.

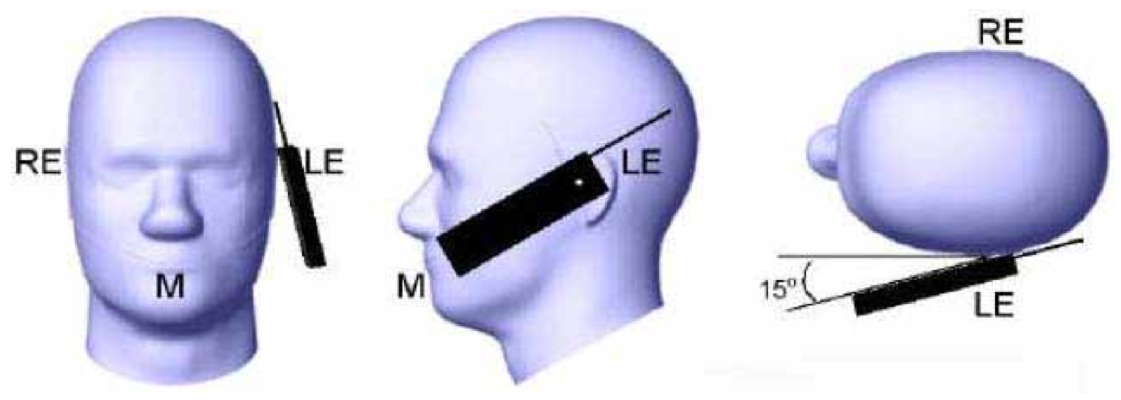

Figure 6.4 “Tilted” Position.

6. DESCRIPTION OF THE TEST PROCEDURE(continued)

Positioning for Ear / 15˚ Tilted

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

Body Holder / Belt Clip Configurations

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

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

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

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

6. DESCRIPTION OF THE TEST PROCEDURE(continued)

6.3 Scan Procedures

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

6.4 SAR Averaging Methods

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

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

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

7. MEASUREMENT UNCERTAINTY

According to CENELEC [17], typical worst-case uncertainty of field measurements is 5 dB.
For well-defined modulation characteristics the uncertainty can be reduced to 3 dB.

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

SAR Measurement Conditions for CDMA2000 1x

These procedures were followed according to FCC"SAR Measurement Procedures for 3G Devices",May2006.

Head SAR Measurement

SAR for head exposure configurations is measured in RC3 with the DUT configured to transmit at full rate using Loopback Service Option S055. SAR for RC1 is not required when the maximum average output of each channel is less than 1/4dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel in RC1 using the exposure configuration that results in the highest SAR for that channel in RC3

Body SAR Measurement

SAR for body exposure configuration is measured on RC3 with the DUT configured to transmit at full rate on FCH with all other code channels disabled using TDSO / SO32. SAR for multiple code channels (FCH + SCHn) is not required when the maximum average output of each RF channel is less than 1/4 dB higher than that measured with FCH at full rate and SCH0 enabled at 9600 bps using the exposure configuration that results in the highest SAR for that channel with FCH only. When multiple code channels are enabled, the DUT output may shift by more than 0.5dB and lead to higher SAR drifts and SCH dropouts.
Body SAR in RC1 is not required when the maximum average output of each channel is less than 1/4dB higher than that measured in RC3.Otherwise,SAR is measured on the maximum output channel in RC1; with Loopback Service Option S055,at full rate, using the body exposure configuration that results in the higiest SAR for that channel in RC3.

SAR Measurement Conditions for CDMA2000 1x

Handsets with EV-DO

For handsets with Ev-Do capabilities, when the maximum average output of each channel in Rev.0 is less than 1/4dB higher than that measured in RC3(1xRTT),body SAR for Ev-Do is not required . Otherwise,SAR for Rev.0 is measured on the maximum output channel at 153.6 kbps using the
body exposure configuration that reasults in the highest SAR for that channel in RC3.SAR for Rev.A is not required when the maximum average output of each channel is less than that measured in Rev.0 or less than 1/4 dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel for Rev. A using a Reverse Data Channel payload size of 4096 bits and a Termination Target of 16 slots defined for Subtype 2 Physical Layer configurations. A Forward Traffic Channel data rate corressponding to the 2-slot version of 307.2 kbps with the ACK Channel transmitting in slots should be configured in the downlink for both ReV. 0 and Rev. A.

(OUTPUT POWER TABLE)

Band	Channel	S02	S02	S055	S055	TDS0S032	1xEvDO
		RC1/1	RC3/3	RC1/1	RC3/3	RC3/3	153.6kbps
CDMA 850	1013	23.88	23.89	23.87	23.81	23.87	23.89
	363	24.01	23.98	24.01	24.00	24.01	24.16
	777	24.27	24.22	24.25	24.29	24.22	24.17

Band	Channel	S02	S02	S055	S055	TDS0S032	1xEvDO
		RC1/1	RC3/3	RC1/1	RC3/3	RC3/3	153.6kbps
CDMA 1900	25	24.06	23.99	24.12	24.10	23.98	24.57
	600	24.41	24.24	24.21	24.36	24.40	24.82
	1175	24.17	24.10	24.13	24.13	24.15	24.70

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FAX: 82-2-867-3204

8. SYSTEM VERIFICATION

Tissue Verification

Table 8.1 Simulated Tissue Verification [5]

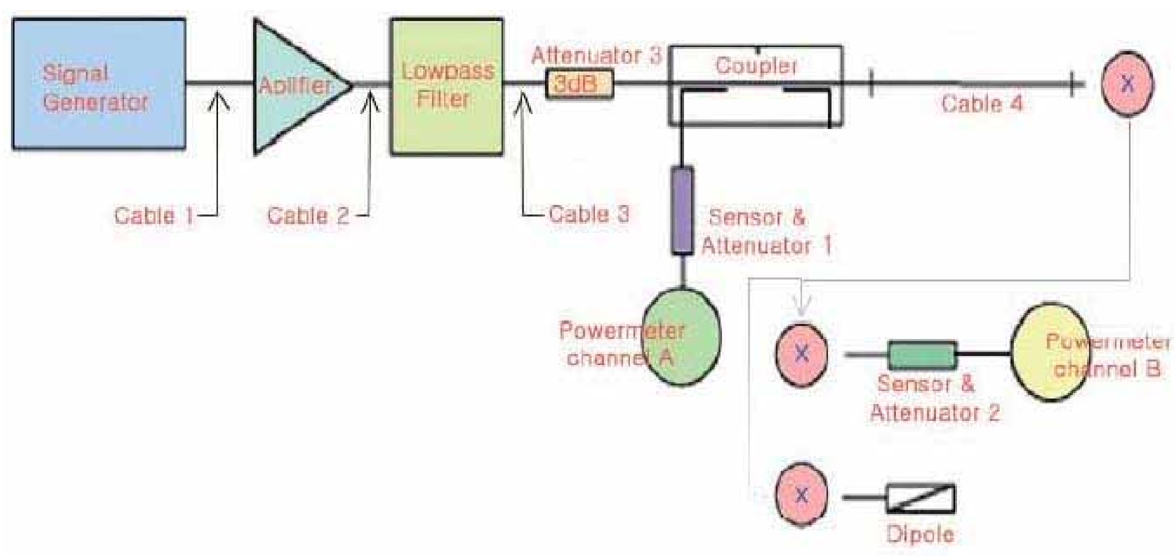
MEASURED TISSUE PARAMETERS										
Liquid Temperature (˚C)			23		Liquid Depth(mm)		150			
Date	2007-04-06		2007-04-06		2007-04-06		2007-04-06			
Tissue	1900MHz Brain		1900MHz Muscle		835MHz Brain		835MHz Muscle			
	Target	Measured	Target	Measured	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε	40	39.05	53.3	54.01	41.5	43.29	55.2	52.89		
Conductivity: σ	1.4	1.392	1.52	1.53	0.9	0.907	0.97	0.951		
Deviation (%)	ε : -2.38% σ : -0.57%		ε : 1.33% σ : 0.66%		ε : 4.31% σ : 0.78%		ε : -4.18% σ : -1.96%			

Test System Validation

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

Table 8.2 System Validation [5]

SYSTEM DIPOLE VALIDATION TARGET & MEASURED						
Tissue	System Validation Kit:	Forward Power (W)	Targeted SAR1g (mW/g)	Measured SAR1g (mW/g)	Deviation (%)	Test Date
1900MHz Brain	D1900V2(S/N :5d058)	1.0	39.7	39	-1.76%	2007-04-06
835MHz Brain	D835V2(S/N:475)	1.0	9.5	9.56	0.63%	2007-04-06



9. RESULTS(continued)

Ambient TEMPERATURE (C) : 23.0
Relative HUMIDITY (%) : 49
Mixture Type : 835MHz Body
Dielectric Constant : 52.89
Conductivity: 0.951

Measurement Results (1xEVDO Cellular BODY SAR without Holster)

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

MEASUREMENT RESULTS (1xEVDO Cellular Body SAR Without Holster)

Frequency		Mod	Conducted Power(dBm)		battery	Device Test position	Lan	BT	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End						
835.89	363	1xEVDO	24.16	24.15	Standard	1.5[w/o Holster] Front	-	-	Fixed	0.034
835.89	363	1xEVDO	24.16	24.25	Standard	1.5[w/o Holster] Rear	-	-	Fixed	0.158
835.89	363	1xEVDO	24.16	24.21	Standard	1.5[w/o Holster] Rear	ON	ON	Fixed	0.155

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

Engineer I.K.Hong

9. RESULTS(continued)

Ambient TEMPERATURE (C) : 23
Relative HUMIDITY (%) : 49
Mixture Type : 1900MHz Body
Dielectric Constant : 54.01
Conductivity: 1.53

Measurement Results (1xEVDO PCS BODY SAR without Holster)

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

MEASUREMENT RESULTS (1xEVDO PCS Body SAR Without Holster)

Frequency		Mod	Conducted Power(dBm)		battery	Device Test position	Lan	BT	Antenna Position	SAR (W/kg)
MHz	Ch.		Begin	End						
1880.00	600	1xEVDO	24.82	24.77	Standard	1.5[w/o Holster] Front	–	–	Fixed	0.136
1880.00	600	1xEVDO	24.82	24.83	Standard	1.5[w/o Holster] Rear	–	–	Fixed	0.695
1880.00	600	1xEVDO	24.82	24.93	Standard	1.5[w/o Holster] Rear	ON	ON	Fixed	0.680

NOTES:
1. The test data were reported the worst-case SAR value with the antenna-head position set in a typical configuration.
2. All modes of operation were investigated and the worst-case are reported.
3. Battery Type : Standard
Justification for reduced test configuration: Per FCC/OET Bulletin 65 Supplement C[July 2001], if the SAR measured at the middle channel for each test configuration (left,light,cheek/touch,tilt/ear, extended and retracted)is at least 3.0dB lower than the SAR limit, testing at the hiah and low channels is optional for such test configration(s).
4. Power Measured : Conducted
5. SAR Measurement System : SPEAG
6. SAR Configuration : Body

Engineer I.K.Hong

10. REFERENCE

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APPENDIX A : Validation Test Data of Tissue

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- Head Tissue(Cellular)

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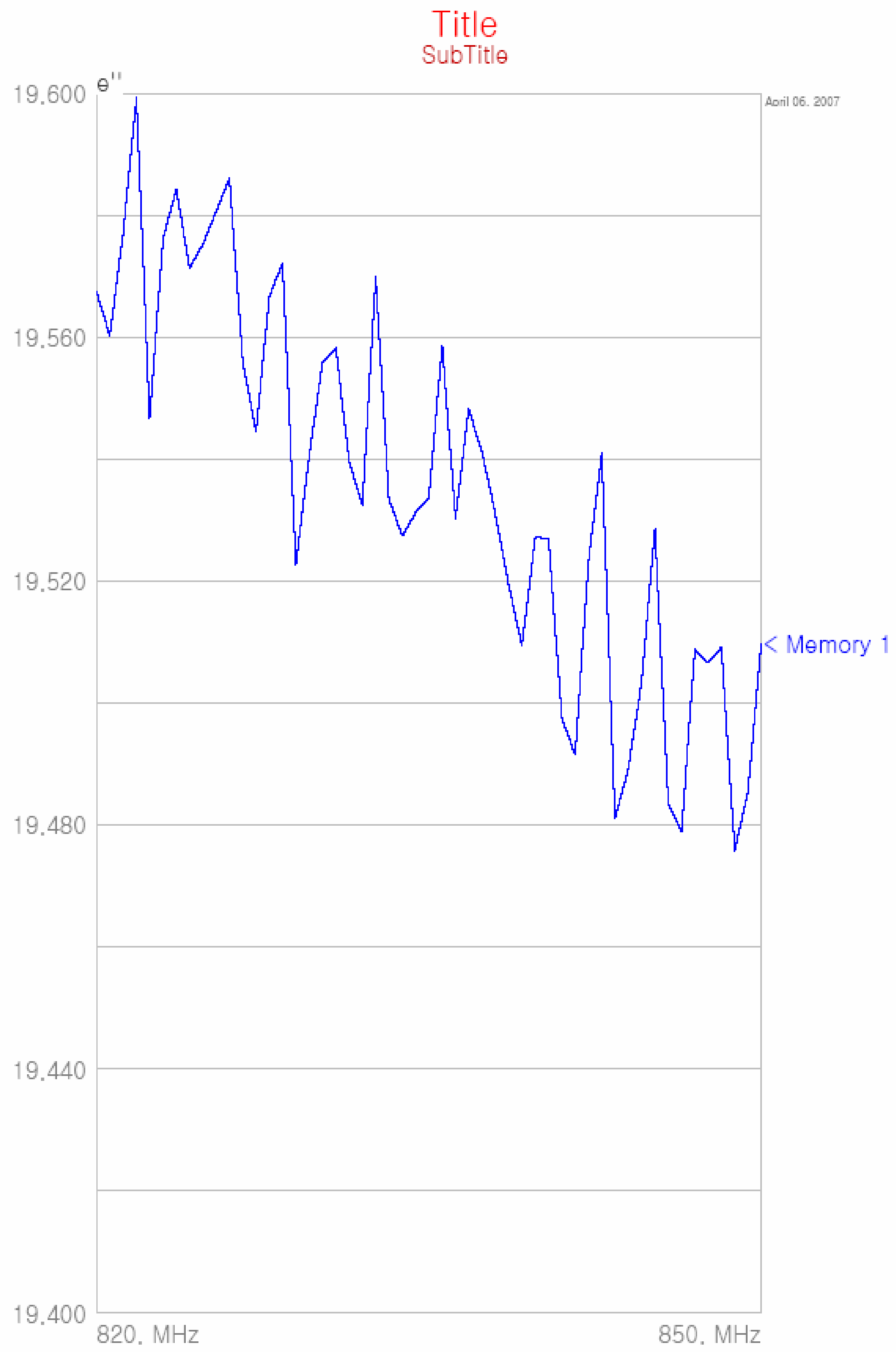

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Title

SubTitle

April 05, 2007

Frequency	e'	e''
820.000000 MHz	43.4616	19.5676
820.590345 MHz	43.4425	19.5603
821.180690 MHz	43.4519	19.5770
821.771035 MHz	43.4414	19.5994
822.361380 MHz	43.4307	19.5468
822.951725 MHz	43.4330	19.5761
823.544195 MHz	43.3971	19.5844
824.136665 MHz	43.3979	19.5714
824.729135 MHz	43.4143	19.5753
825.321605 MHz	43.3884	19.5807
825.914075 MHz	43.3625	19.5861
826.508677 MHz	43.3478	19.5562
827.103280 MHz	43.3810	19.5446
827.697883 MHz	43.3707	19.5668
828.292485 MHz	43.3450	19.5722
828.887088 MHz	43.3246	19.5228
829.483831 MHz	43.3663	19.5406
830.080574 MHz	43.3435	19.5558
830.677317 MHz	43.3276	19.5583
831.274060 MHz	43.3480	19.5397
831.870803 MHz	43.3293	19.5325
832.469694 MHz	43.3025	19.5700
833.068585 MHz	43.2753	19.5335
833.667476 MHz	43.2889	19.5275
834.266367 MHz	43.3053	19.5313
834.865259 MHz	43.2895	19.5338
835.466306 MHz	43.2697	19.5587
836.067352 MHz	43.2873	19.5304
836.668399 MHz	43.2550	19.5483
837.269446 MHz	43.2365	19.5411
837.870493 MHz	43.2278	19.5311
838.473704 MHz	43.2608	19.5194
839.076914 MHz	43.2520	19.5094
839.680125 MHz	43.2199	19.5273
840.283335 MHz	43.2140	19.5270
840.886546 MHz	43.1997	19.4976
841.491927 MHz	43.2132	19.4916
842.097309 MHz	43.2062	19.5232
842.702691 MHz	43.1743	19.5411
843.308073 MHz	43.1929	19.4811
843.913455 MHz	43.1582	19.4893
844.521016 MHz	43.1567	19.5034
845.128577 MHz	43.1532	19.5286
845.736138 MHz	43.1396	19.4835
846.343699 MHz	43.1483	19.4790
846.951260 MHz	43.1463	19.5089
847.561008 MHz	43.1295	19.5067
848.170756 MHz	43.1143	19.5092
848.780504 MHz	43.1145	19.4758
849.390252 MHz	43.1275	19.4856
850.000000 MHz	43.0561	19.5099

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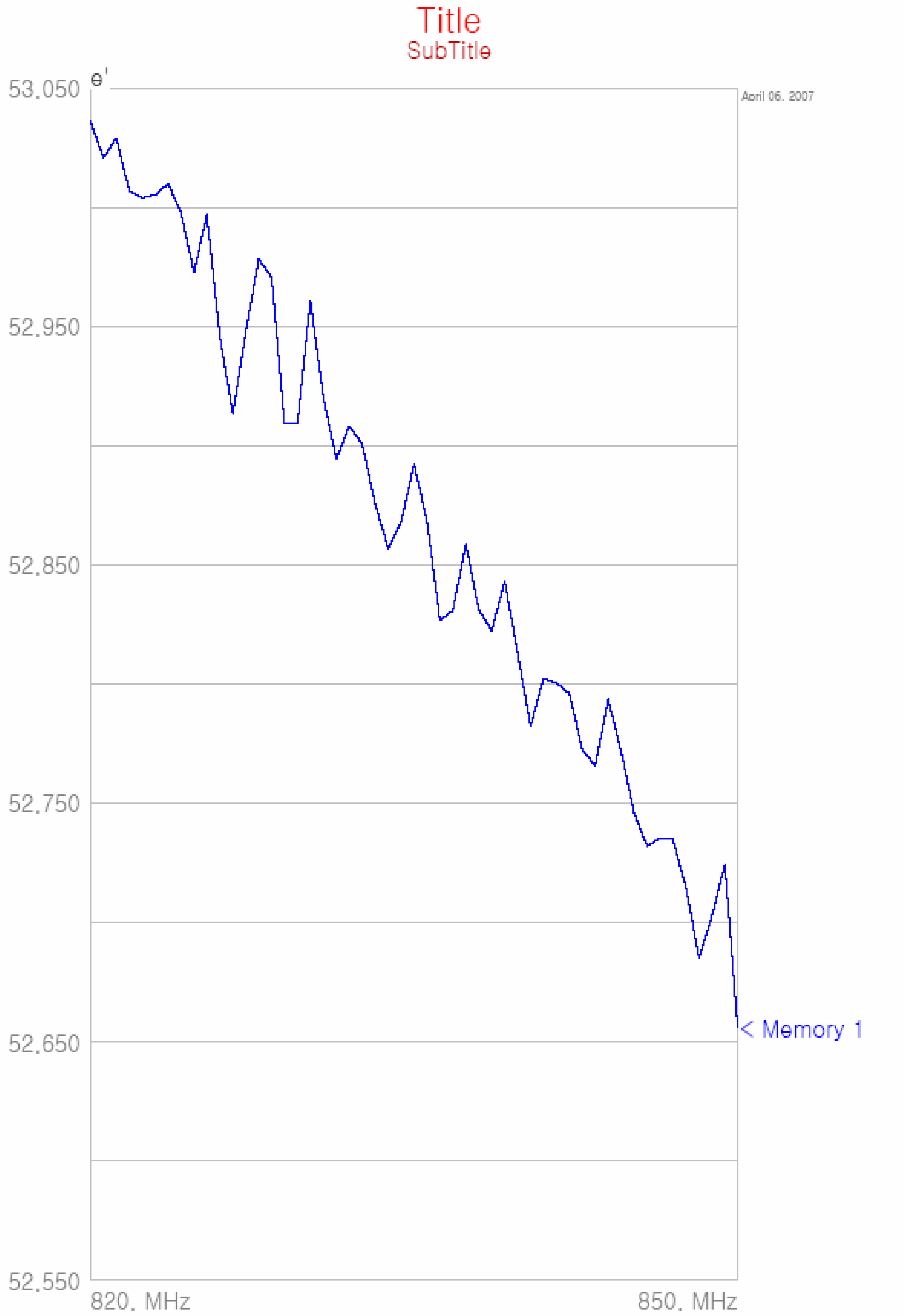
– Cellular Body Tissue



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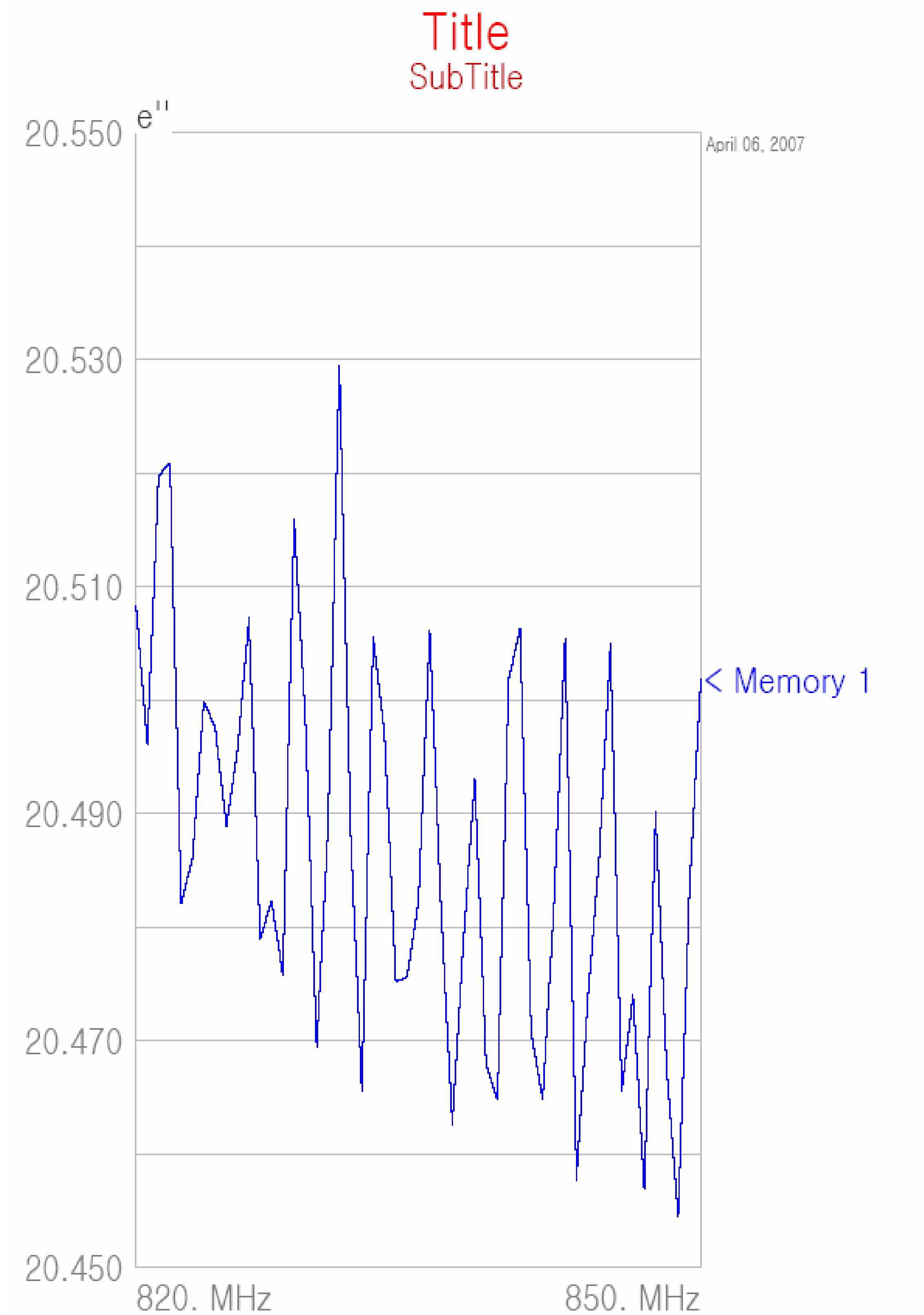

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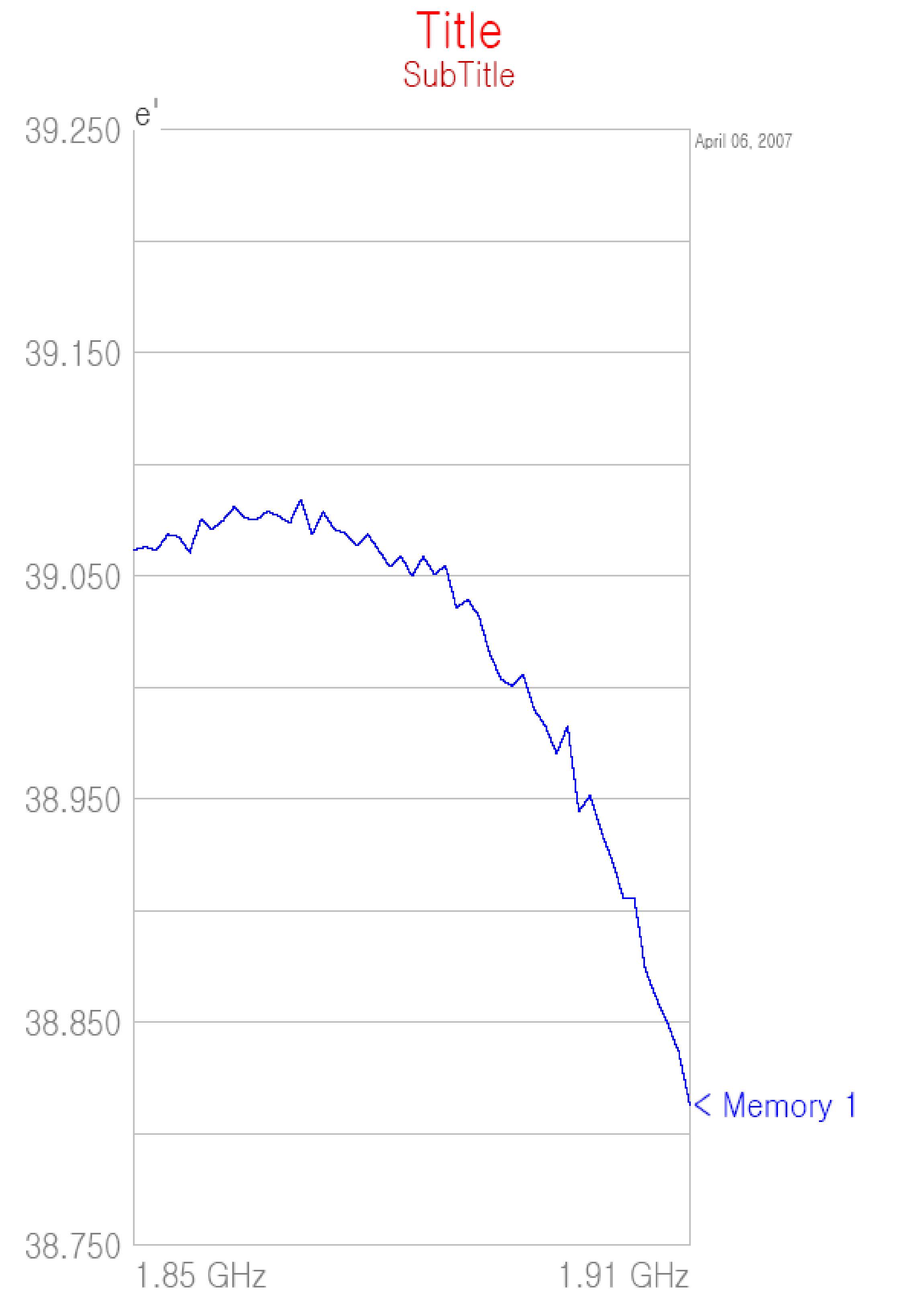
Title

SubTitle

April 06, 2007

Frequency	e'	e''
820.000000 MHz	53.0366	20.5083
820.590345 MHz	53.0209	20.4961
821.180690 MHz	53.0291	20.5198
821.771035 MHz	53.0071	20.5209
822.361380 MHz	53.0042	20.4821
822.951725 MHz	53.0054	20.4861
823.544195 MHz	53.0101	20.4999
824.136665 MHz	52.9980	20.4976
824.729135 MHz	52.9727	20.4889
825.321605 MHz	52.9970	20.4957
825.914075 MHz	52.9458	20.5073
826.508677 MHz	52.9136	20.4790
827.103280 MHz	52.9478	20.4823
827.697883 MHz	52.9784	20.4758
828.292485 MHz	52.9706	20.5160
828.887088 MHz	52.9092	20.4963
829.483831 MHz	52.9098	20.4694
830.080574 MHz	52.9607	20.4887
830.677317 MHz	52.9202	20.5295
831.274060 MHz	52.8945	20.4882
831.870803 MHz	52.9084	20.4656
832.469694 MHz	52.9008	20.5056
833.068585 MHz	52.8758	20.4970
833.667476 MHz	52.8570	20.4752
834.266367 MHz	52.8682	20.4756
834.865259 MHz	52.8925	20.4822
835.466306 MHz	52.8684	20.5062
836.067352 MHz	52.8269	20.4817
836.668399 MHz	52.8311	20.4626
837.269446 MHz	52.8589	20.4789
837.870493 MHz	52.8314	20.4931
838.473704 MHz	52.8225	20.4679
839.076914 MHz	52.8433	20.4648
839.680125 MHz	52.8132	20.5018
840.283335 MHz	52.7824	20.5063
840.886546 MHz	52.8024	20.4707
841.491927 MHz	52.8005	20.4649
842.097309 MHz	52.7960	20.4817
842.702691 MHz	52.7722	20.5055
843.308073 MHz	52.7660	20.4577
843.913455 MHz	52.7938	20.4737
844.521016 MHz	52.7715	20.4861
845.128577 MHz	52.7461	20.5050
845.736138 MHz	52.7321	20.4656
846.343699 MHz	52.7355	20.4741
846.951260 MHz	52.7350	20.4569
847.561008 MHz	52.7150	20.4902
848.170756 MHz	52.6854	20.4673
848.780504 MHz	52.7028	20.4545
849.390252 MHz	52.7245	20.4833
850.000000 MHz	52.6560	20.5018

-PCS Head Tissue



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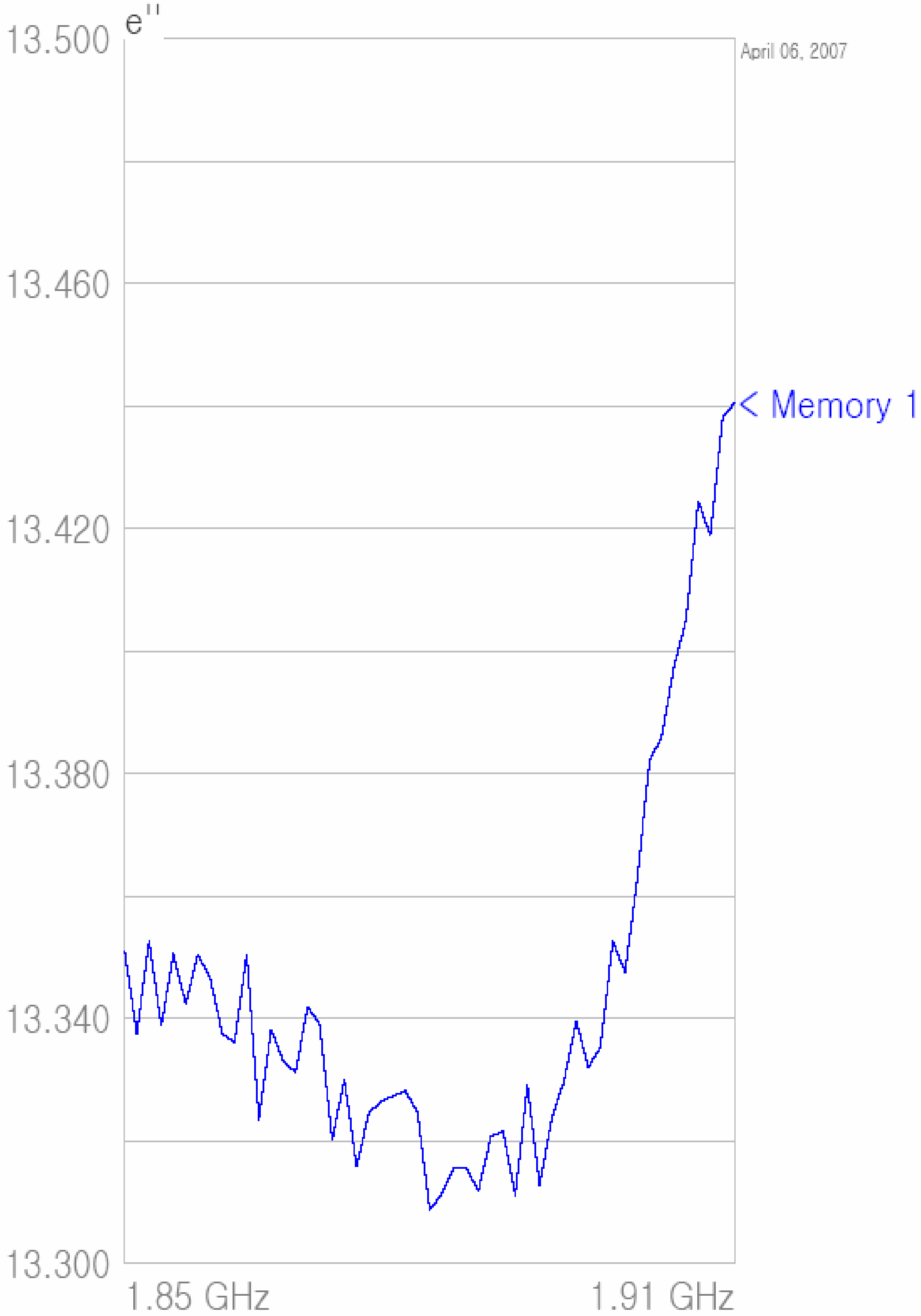
Title
SubTitle



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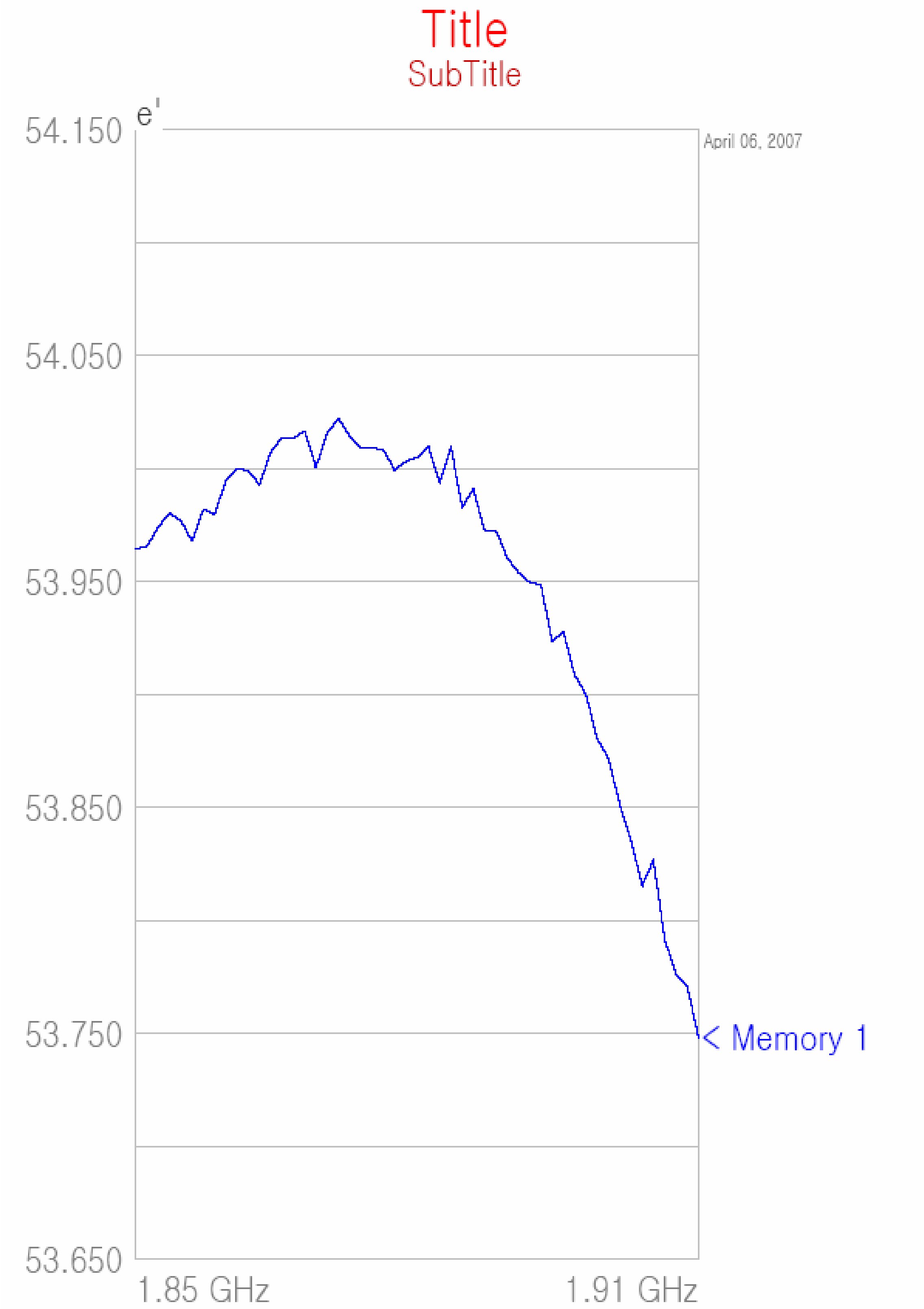
Title

SubTitle

April 09, 2007

Frequency	e'	e''
1.850000000 GHz	39.0618	13.3510
1.851182838 GHz	39.0632	13.3375
1.852365676 GHz	39.0615	13.3528
1.853548514 GHz	39.0687	13.3388
1.854731352 GHz	39.0678	13.3506
1.855914190 GHz	39.0607	13.3424
1.857100809 GHz	39.0755	13.3505
1.858287429 GHz	39.0710	13.3467
1.859474048 GHz	39.0751	13.3375
1.860660667 GHz	39.0811	13.3361
1.861847287 GHz	39.0760	13.3505
1.863037699 GHz	39.0752	13.3235
1.864228112 GHz	39.0792	13.3382
1.865418525 GHz	39.0769	13.3330
1.866608938 GHz	39.0738	13.3312
1.867799351 GHz	39.0844	13.3419
1.868993569 GHz	39.0687	13.3390
1.870187787 GHz	39.0788	13.3201
1.871382006 GHz	39.0711	13.3301
1.872576224 GHz	39.0692	13.3158
1.873770442 GHz	39.0637	13.3245
1.874968479 GHz	39.0689	13.3265
1.876166515 GHz	39.0616	13.3273
1.877364551 GHz	39.0543	13.3282
1.878562587 GHz	39.0590	13.3246
1.879760623 GHz	39.0501	13.3087
1.880962489 GHz	39.0589	13.3114
1.882164355 GHz	39.0508	13.3157
1.883366221 GHz	39.0548	13.3155
1.884568087 GHz	39.0358	13.3119
1.885769953 GHz	39.0395	13.3207
1.886975662 GHz	39.0323	13.3216
1.888181370 GHz	39.0150	13.3110
1.889387078 GHz	39.0038	13.3291
1.890592787 GHz	39.0006	13.3127
1.891798495 GHz	39.0057	13.3236
1.893008058 GHz	38.9901	13.3298
1.894217620 GHz	38.9827	13.3396
1.895427183 GHz	38.9703	13.3320
1.896636746 GHz	38.9825	13.3354
1.897846309 GHz	38.9445	13.3527
1.899059738 GHz	38.9515	13.3476
1.900273168 GHz	38.9357	13.3628
1.901486597 GHz	38.9227	13.3821
1.902700027 GHz	38.9058	13.3861
1.903913456 GHz	38.9055	13.3974
1.905130765 GHz	38.8734	13.4052
1.906348074 GHz	38.8605	13.4245
1.907565383 GHz	38.8495	13.4189
1.908782691 GHz	38.8366	13.4382
1.910000000 GHz	38.8131	13.4406

- PCS Body Tissue



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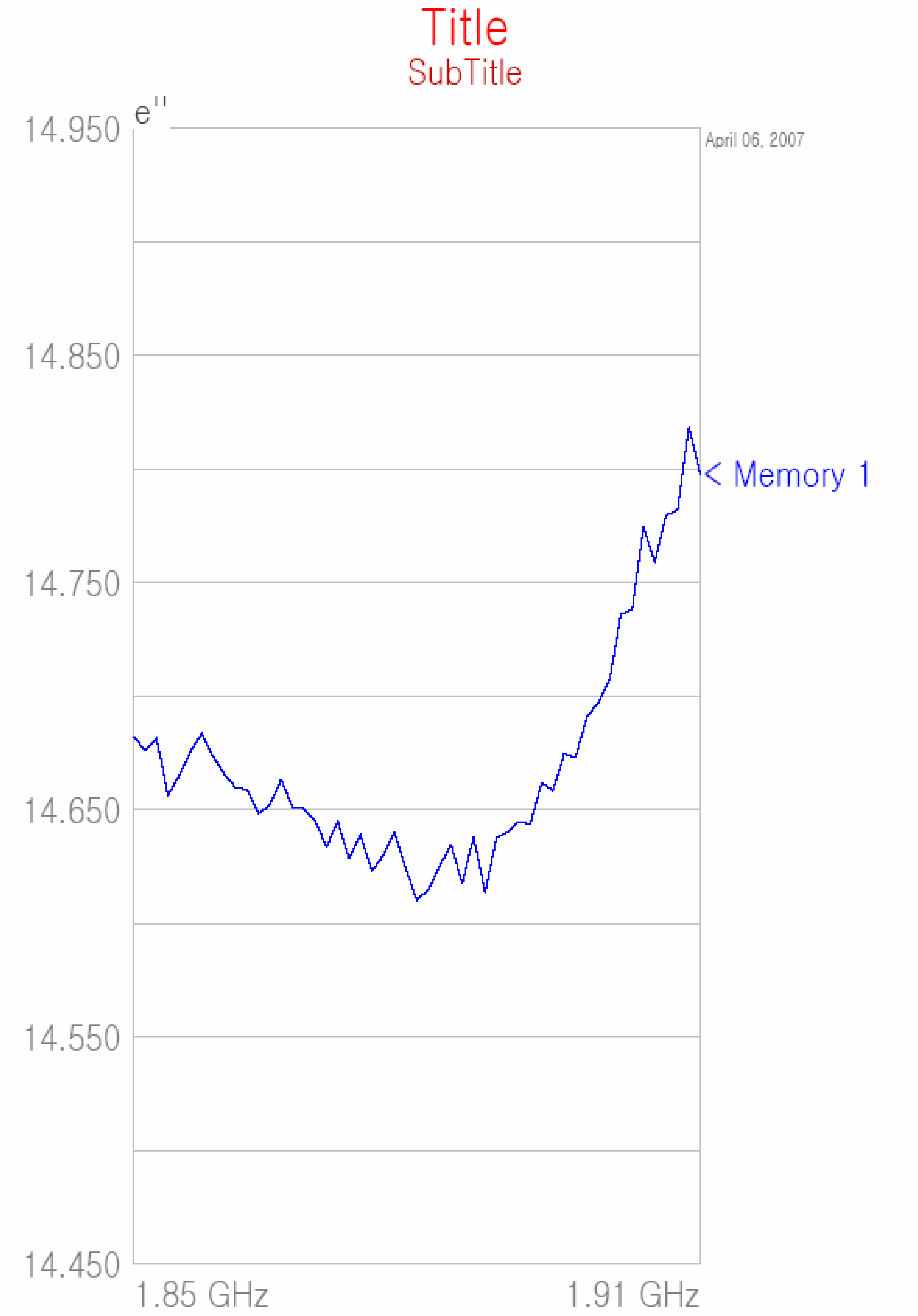

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Title

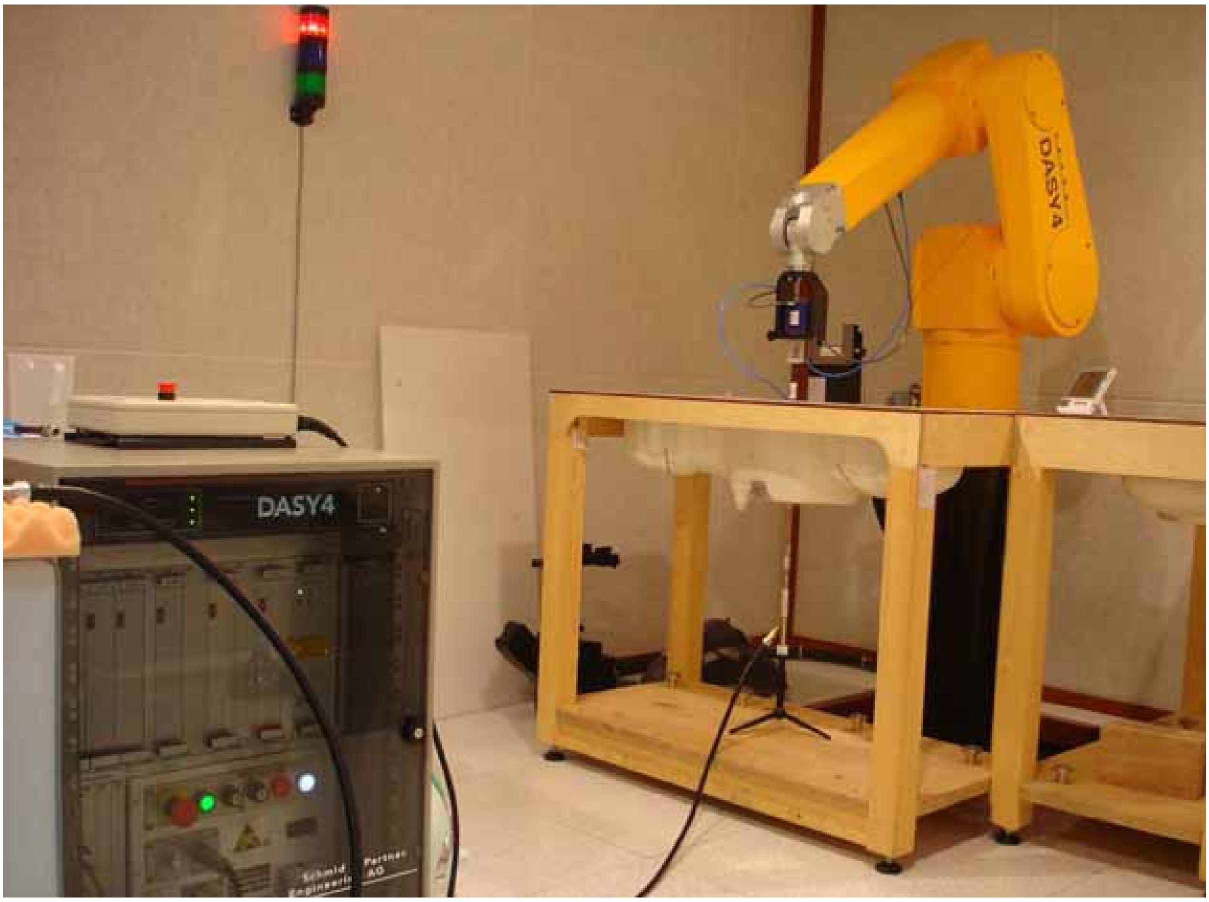
SubTitle

April 06, 2007

Frequency	e'	e''
1.850000000 GHz	53.9646	14.6822
1.851182838 GHz	53.9658	14.6759
1.852365676 GHz	53.9743	14.6816
1.853548514 GHz	53.9804	14.6562
1.854731352 GHz	53.9771	14.6652
1.855914190 GHz	53.9680	14.6759
1.857100809 GHz	53.9822	14.6837
1.858287429 GHz	53.9799	14.6734
1.859474048 GHz	53.9948	14.6657
1.860660667 GHz	54.0000	14.6596
1.861847287 GHz	53.9992	14.6589
1.863037699 GHz	53.9930	14.6484
1.864228112 GHz	54.0075	14.6522
1.865418525 GHz	54.0139	14.6634
1.866608938 GHz	54.0136	14.6512
1.867799351 GHz	54.0167	14.6506
1.868993569 GHz	54.0007	14.6454
1.870187787 GHz	54.0157	14.6337
1.871382006 GHz	54.0223	14.6449
1.872576224 GHz	54.0144	14.6284
1.873770442 GHz	54.0094	14.6391
1.874968479 GHz	54.0093	14.6229
1.876166515 GHz	54.0083	14.6298
1.877364551 GHz	53.9995	14.6403
1.878562587 GHz	54.0033	14.6242
1.879760623 GHz	54.0050	14.6101
1.880962489 GHz	54.0099	14.6152
1.882164355 GHz	53.9936	14.6253
1.883366221 GHz	54.0098	14.6347
1.884568087 GHz	53.9829	14.6176
1.885769953 GHz	53.9912	14.6381
1.886975662 GHz	53.9723	14.6136
1.888181370 GHz	53.9728	14.6376
1.889387078 GHz	53.9606	14.6402
1.890592787 GHz	53.9542	14.6448
1.891798495 GHz	53.9498	14.6437
1.893008058 GHz	53.9487	14.6619
1.894217620 GHz	53.9235	14.6583
1.895427183 GHz	53.9282	14.6747
1.896636745 GHz	53.9087	14.6731
1.897846309 GHz	53.9000	14.6910
1.899059738 GHz	53.8803	14.6970
1.900273168 GHz	53.8719	14.7072
1.901486597 GHz	53.8516	14.7361
1.902700027 GHz	53.8358	14.7384
1.903913456 GHz	53.8153	14.7749
1.905130765 GHz	53.8269	14.7590
1.906348074 GHz	53.7917	14.7798
1.907565383 GHz	53.7761	14.7820
1.908782691 GHz	53.7709	14.8189
1.910000000 GHz	53.7484	14.7981

APPENDIX B : Validation Test Data

Dipole Validation



ESTECH Co., Ltd.
Rm.1015, World Venture Center II,
426-5, Gasan-dong, Geumcheon-gu,
Seoul, 153-803, Korea
TEL: 82-2-867-3201
FAX: 82-2-867-3204

- Cellular Validation

Date: 2007-04-06

Test Laboratory: ESTECH

VALIDATION

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

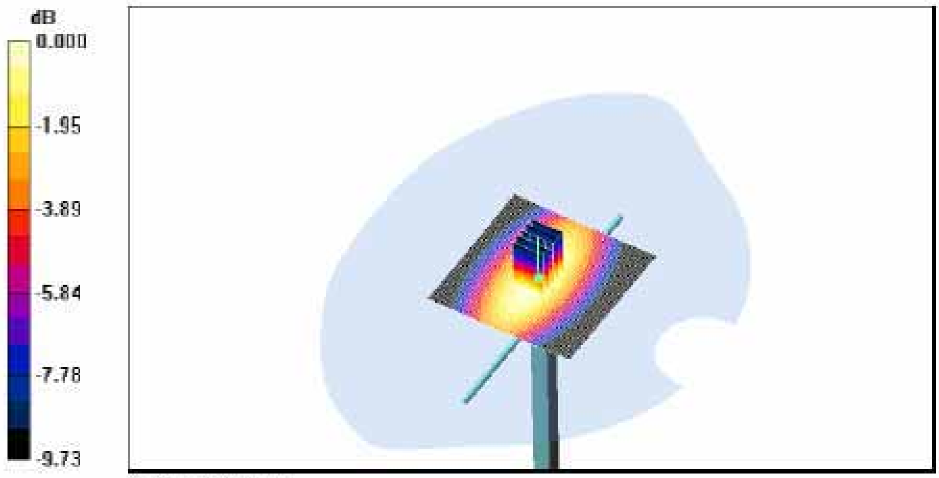
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.907 mho/m; ε_r = 43.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.42, 6.42, 6.42); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 23℃, Humidity : 49%

Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.57 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.6 V/m; Power Drift = -0.017 dB
Peak SAR (extrapolated) = 3.54 W/kg
SAR(1 g) = 2.39 mW/g
Maximum value of SAR (measured) = 2.59 mW/g



0 dB = 2.59mW/g

ESTECH Co., Ltd.
Rm.1015, World Venture Center II,
426-5, Gasan-dong, Geumcheon-gu,
Seoul, 153-803, Korea
TEL: 82-2-867-3201
FAX: 82-2-867-3204

– PCS Validation

Date: 2007-04-09

Test Laboratory: ESTECH

VALIDATION

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

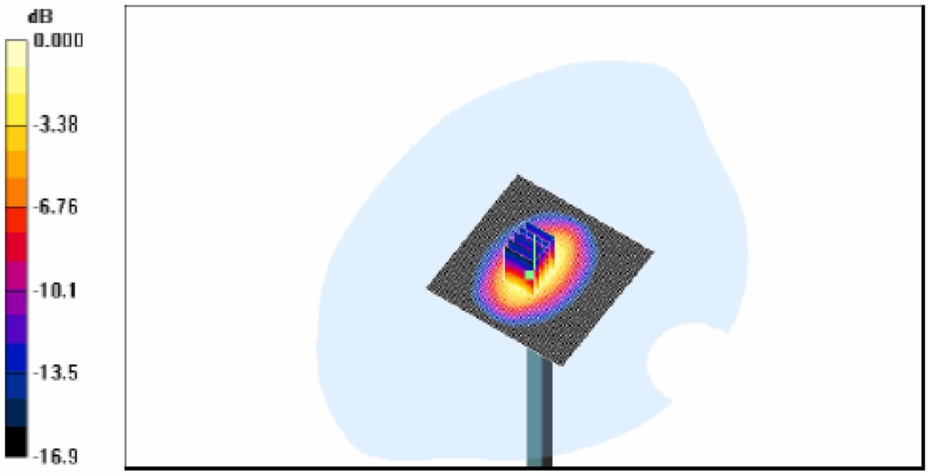
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900.4 MHz; σ = 1.41 mho/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(5.08, 5.08, 5.08); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM MIC 1800Mhz; Type: SAM MIC 1800MHz; Serial: TP-1263
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 23℃, Humidity : 49%

Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 11.4 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.1 V/m; Power Drift = -0.019 dB
Peak SAR (extrapolated) = 18.4 W/kg
SAR(1 g) = 9.75 mW/g
Maximum value of SAR (measured) = 11.0 mW/g



0 dB = 11.0mW/g

APPENDIX C：SAR Test Data

ESTECH Co., Ltd.
Rm.1015, World Venture Center II,
426-5, Gasan-dong, Geumcheon-gu,
Seoul, 153-803, Korea
TEL: 82-2-867-3201
FAX: 82-2-867-3204

- 1xEVDO Cellular

Date: 2007-04-06

Test Laboratory: ESTECH

BODY FRONT 363

DUT: BIP-1300; Type: BAR TYPE; Serial: XXXX

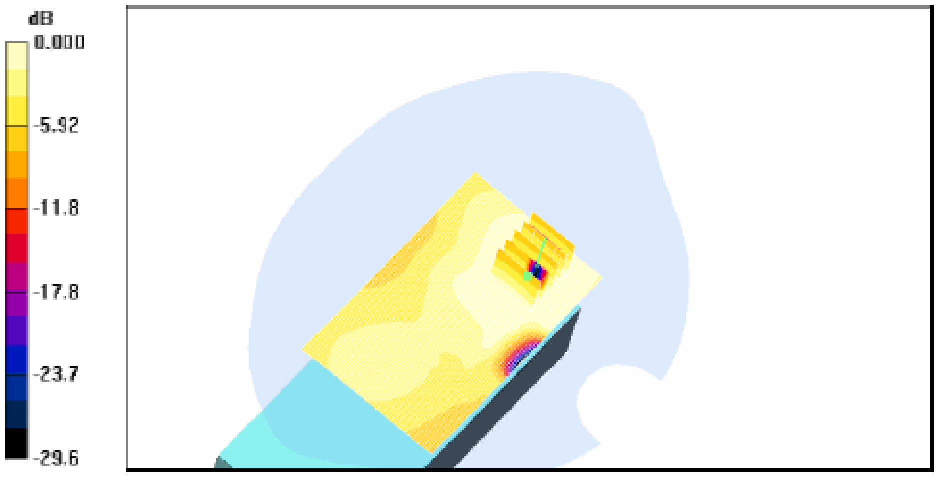
Communication System: CDMA FCC; Frequency: 835.89 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 835.89 MHz; σ = 0.953 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.32, 6.32, 6.32); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 23℃, Humidity : 49%

Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.036 mW/g

Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm
Reference Value = 5.55 V/m; Power Drift = -0.008 dB
Peak SAR (extrapolated) = 0.046 W/kg
SAR(1 g) = 0.034 mW/g
Maximum value of SAR (measured) = 0.035 mW/g



0 dB = 0.035mW/g

ESTECH Co., Ltd.
Rm.1015, World Venture Center II,
426-5, Gasan-dong, Geumcheon-gu,
Seoul, 153-803, Korea
TEL: 82-2-867-3201
FAX: 82-2-867-3204

Date: 2007-04-06

Test Laboratory: ESTECH

BODY REAR 363

DUT: BIP-1300; Type: BAR TYPE; Serial: XXXX

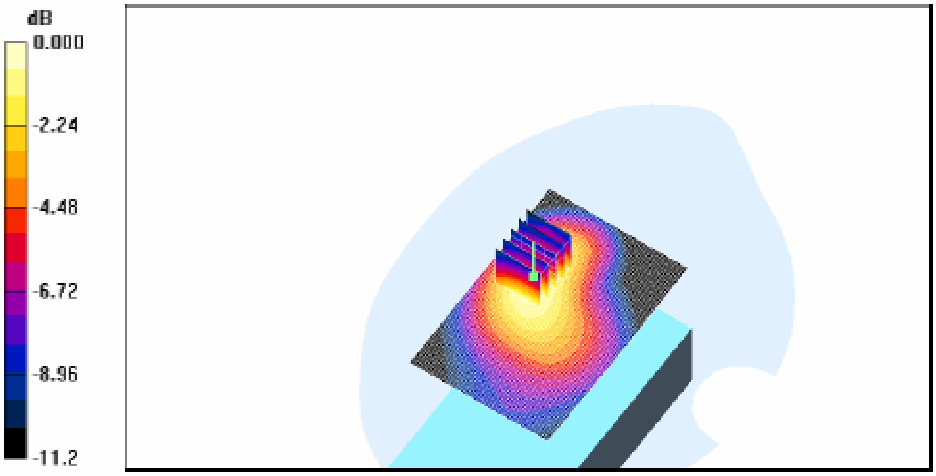
Communication System: CDMA FCC; Frequency: 835.89 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 835.89 MHz; σ = 0.953 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.32, 6.32, 6.32); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 23℃, Humidity : 49%

Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.166 mW/g

Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm
Reference Value = 7.86 V/m; Power Drift = 0.090 dB
Peak SAR (extrapolated) = 0.241 W/kg
SAR(1 g) = 0.158 mW/g
Maximum value of SAR (measured) = 0.167 mW/g



0 dB = 0.167mW/g

ESTECH Co., Ltd.
Rm.1015, World Venture Center II, 426-5, Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea
TEL: 82-2-867-3201
FAX: 82-2-867-3204

Date: 2007-04-06

Test Laboratory: ESTECH

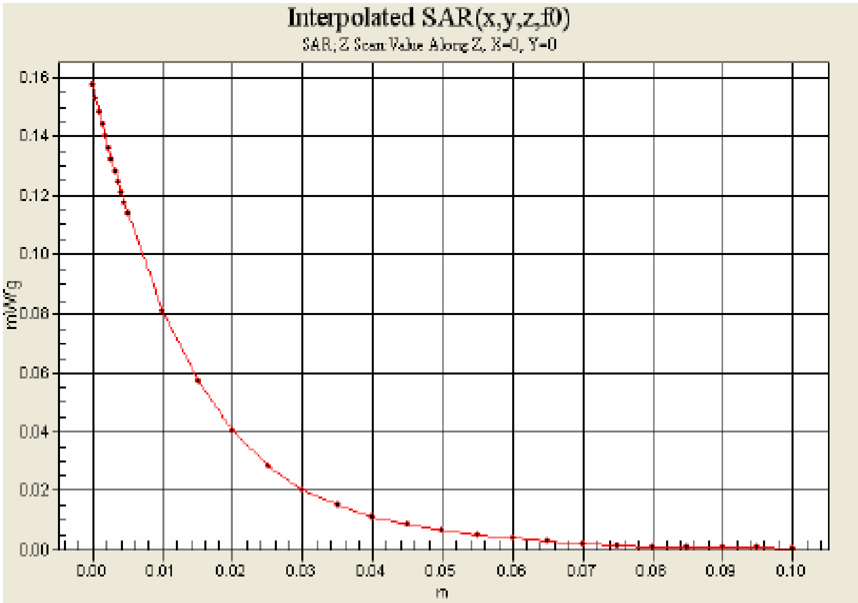
BODY REAR 363

DUT: BIP-1300; 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; σ = 0.953 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.32, 6.32, 6.32); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 23℃, Humidity : 49%



ESTECH Co., Ltd.
Rm.1015, World Venture Center II, 426-5, Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea
TEL: 82-2-867-3201
FAX: 82-2-867-3204

Date: 2007-04-06

Test Laboratory: ESTECH

BODY REAR BT LAN 363

DUT: BIP-1300; Type: BAR TYPE; Serial: XXXX

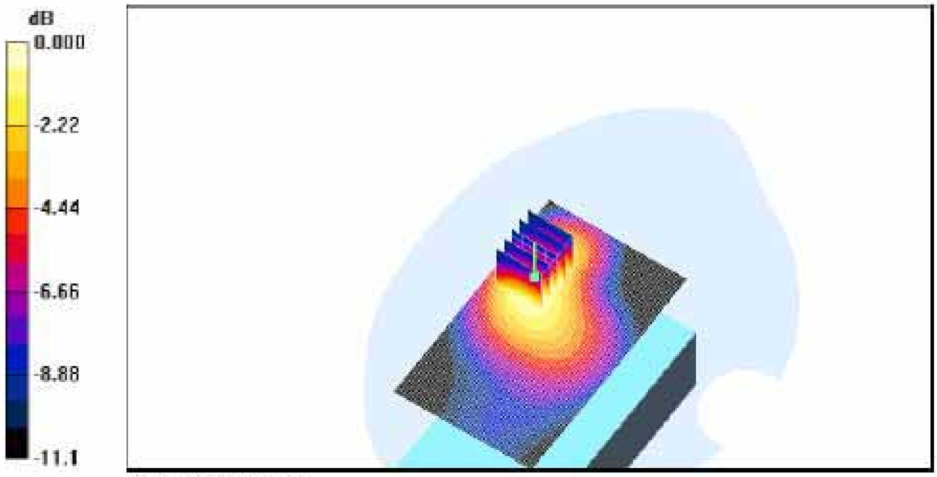
Communication System: CDMA FCC; Frequency: 835.89 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 835.89 MHz; σ = 0.953 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(6.32, 6.32, 6.32); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM 835MHz; Type: SAM 835MHz; Serial: TP-1262
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 23℃, Humidity : 49%

Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.162 mW/g

Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm
Reference Value = 7.67 V/m; Power Drift = 0.052 dB
Peak SAR (extrapolated) = 0.226 W/kg
SAR(1 g) = 0.155 mW/g
Maximum value of SAR (measured) = 0.169 mW/g



0 dB = 0.169mW/g

'– 1xEVDO PCS

Date: 2007-04-06

Test Laboratory: ESTECH

BODY FRONT 600

DUT: BIP-1300; Type: BAR TYPE; Serial: XXXX

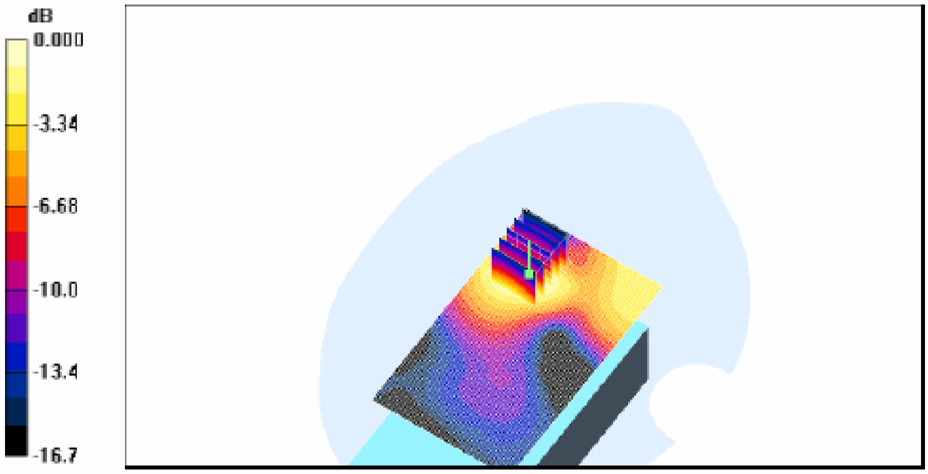
Communication System: PCS FCC; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; σ = 1.53 mho/m; ε_r = 54; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.65, 4.65, 4.65); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM MIC 1800Mhz; Type: SAM MIC 1800MHz; Serial: TP-1263
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 23℃, Humidity : 49%

Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.159 mW/g

Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm
Reference Value = 4.88 V/m; Power Drift = -0.048 dB
Peak SAR (extrapolated) = 0.226 W/kg
SAR(1 g) = 0.136 mW/g
Maximum value of SAR (measured) = 0.145 mW/g



0 dB = 0.145mW/g

ESTECH Co., Ltd.
Rm.1015, World Venture Center II,
426-5, Gasan-dong, Geumcheon-gu,
Seoul, 153-803, Korea
TEL: 82-2-867-3201
FAX: 82-2-867-3204

Date: 2007-04-06

Test Laboratory: ESTECH

BODY REAR 600

DUT: BIP-1300; Type: BAR TYPE; Serial: XXXX

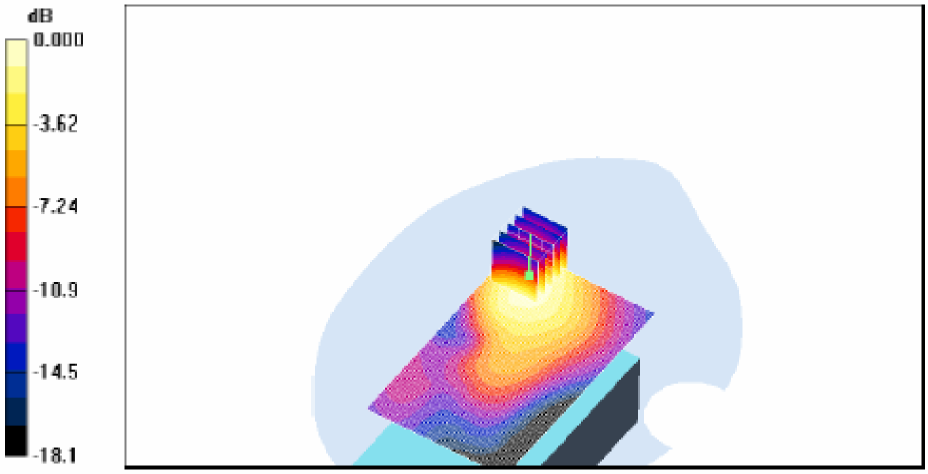
Communication System: PCS FCC; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; σ = 1.53 mho/m; ε_r = 54; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.65, 4.65, 4.65); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM MIC 1800Mhz; Type: SAM MIC 1800MHz; Serial: TP-1263
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 23℃, Humidity : 49%

Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.770 mW/g

Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm
Reference Value = 15.1 V/m; Power Drift = 0.011 dB
Peak SAR (extrapolated) = 1.14 W/kg
SAR(1 g) = 0.695 mW/g
Maximum value of SAR (measured) = 0.743 mW/g



0 dB = 0.743mW/g

Date: 2007-04-06

Test Laboratory: ESTECH

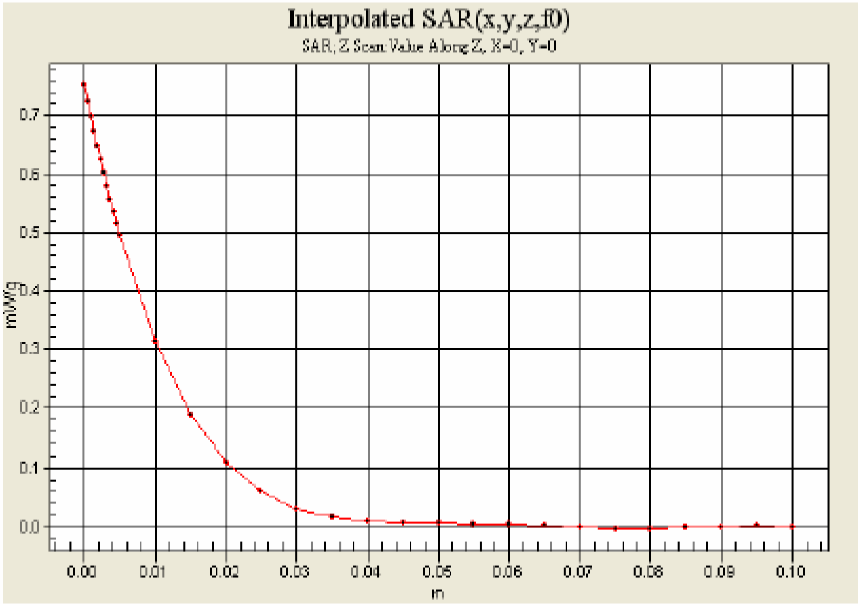
BODY REAR 600

DUT: BIP-1300; Type: BAR TYPE; Serial: XXXX

Communication System: PCS FCC; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; $\sigma = 1.53$ mho/m; $\varepsilon_r = 54$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.65, 4.65, 4.65); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM MIC 1800Mhz; Type: SAM MIC 1800MHz; Serial: TP-1263
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 23℃, Humidity : 49%



ESTECH Co., Ltd.
Rm.1015, World Venture Center II,
426-5, Gasan-dong, Geumcheon-gu,
Seoul, 153-803, Korea
TEL: 82-2-867-3201
FAX: 82-2-867-3204

Date: 2007-04-06

Test Laboratory: ESTECH

BODY REAR BT LAN 600

DUT: BIP-1300; Type: BAR TYPE; Serial: XXXX

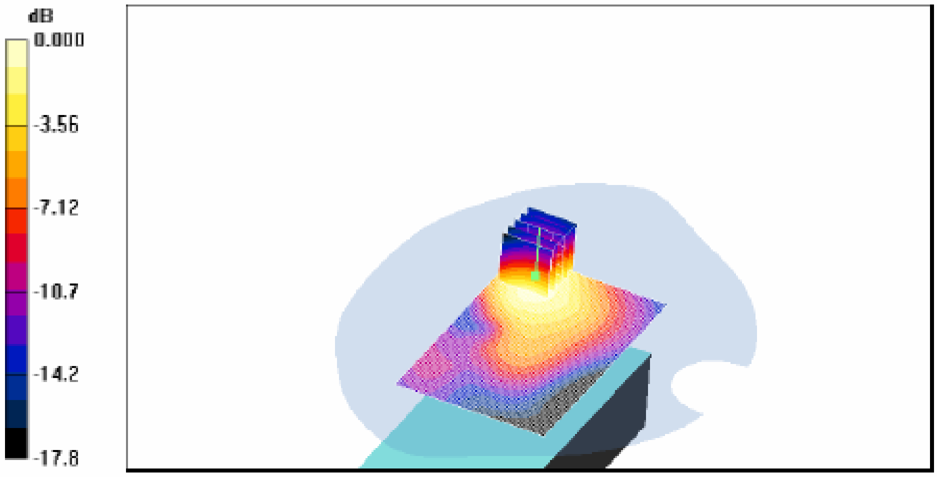
Communication System: PCS FCC; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; σ = 1.53 mho/m; ε_r = 54; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.65, 4.65, 4.65); Calibrated: 2006-10-17
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2006-04-27
- Phantom: SAM MIC 1800Mhz; Type: SAM MIC 1800MHz; Serial: TP-1263
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161
- Temperature : 23℃, Humidity : 49%

Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.797 mW/g

Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=6mm
Reference Value = 14.9 V/m; Power Drift = 0.108 dB
Peak SAR (extrapolated) = 1.14 W/kg
SAR(1 g) = 0.680 mW/g
Maximum value of SAR (measured) = 0.748 mW/g



0 dB = 0.748mW/g

APPENDIX D : Calibration Certificates

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

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

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

Accreditation No.: SCS 108

Client **Estech (Dymstec)**

Certificate No: D1900V2-5d058_Sep06

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d058
Calibration procedure(s)	QA CAL-05.v6 Calibration procedure for dipole validation kits
Calibration date:	September 13, 2006
Condition of the calibrated item	In Tolerance

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	04-Oct-05 (METAS, No. 251-00516)	Oct-06
Power sensor HP 8481A	US37292783	04-Oct-05 (METAS, No. 251-00516)	Oct-06
Reference 20 dB Attenuator	SN: 5086 (20g)	10-Aug-06 (METAS, No 217-00591)	Aug-07
Reference 10 dB Attenuator	SN: 5047.2 (10r)	10-Aug-06 (METAS, No 217-00591)	Aug-07
Reference Probe ET3DV6	SN: 1507	28-Oct-05 (SPEAG, No. ET3-1507_Oct05)	Oct-06
DAE4	SN: 601	15-Dec-05 (SPEAG, No. DAE4-601_Dec05)	Dec-06
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-05)	In house check: Oct-07
RF generator Agilent E4421B	MY41000675	11-May-05 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov-06

	Name	Function	Signature
Calibrated by:	Marcel Fehr	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 20, 2006

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY4	V4.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.6 ± 6 %	1.41 mho/m ± 6 %
Head TSL temperature during test	(22.4 ± 0.2) °C	----	----

.

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	condition	
SAR measured	250 mW input power	9.33 mW / g
SAR normalized	normalized to 1W	37.3 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**36.5 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.95 mW / g
SAR normalized	normalized to 1W	19.8 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**19.5 mW / g ± 16.5 % (k=2)**

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

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.9 Ω + 3.4 jΩ
Return Loss	- 24.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 19, 2004

DASY4 Validation Report for Head TSL

Date/Time: 13.09.2006 15:41:51

Test Laboratory: SPEAG, Zurich, Switzerland

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

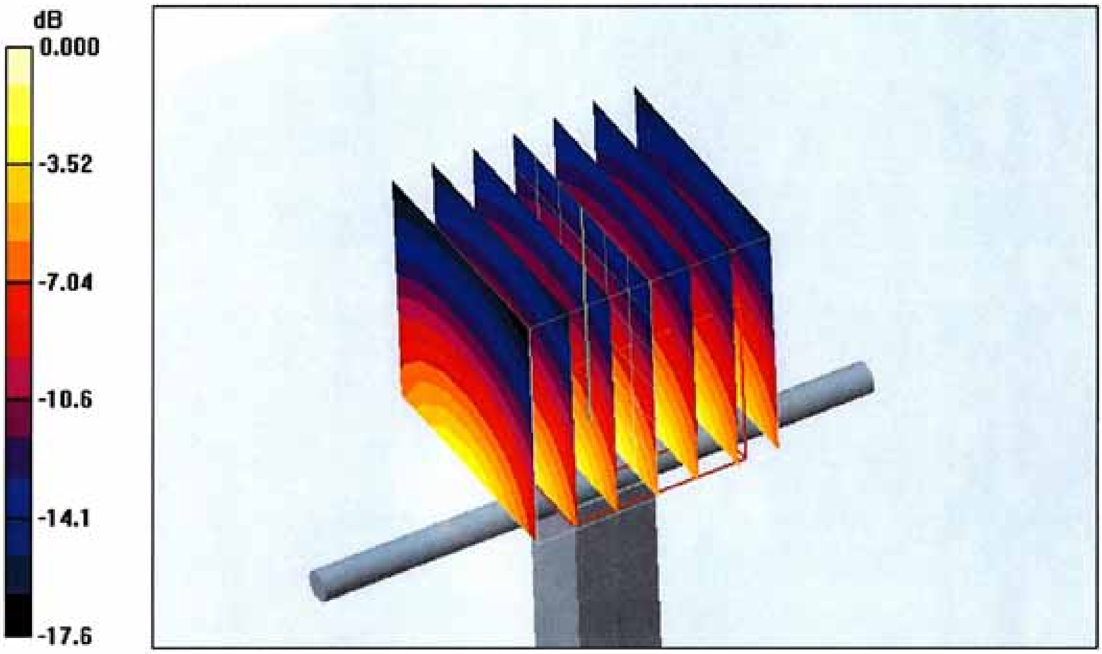
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL U10 BB;
Medium parameters used: f = 1900 MHz; σ = 1.41 mho/m; ε_r = 38.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (HF); ConvF(4.74, 4.74, 4.74); Calibrated: 28.10.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 15.12.2005
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; ;
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

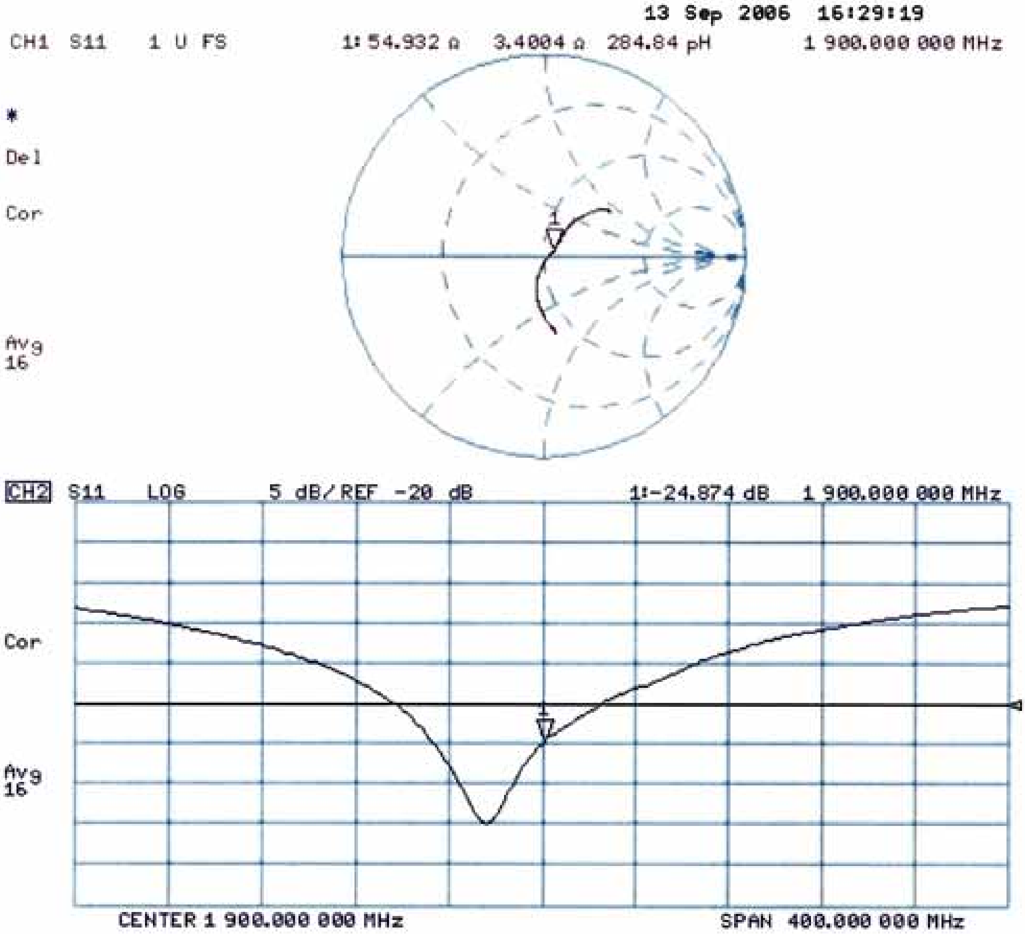
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 92.6 V/m; Power Drift = -0.015 dB
Peak SAR (extrapolated) = 15.8 W/kg
SAR(1 g) = 9.33 mW/g; SAR(10 g) = 4.95 mW/g
Maximum value of SAR (measured) = 10.5 mW/g



0 dB = 10.5mW/g

Impedance Measurement Plot for Head TSL



Calibration Laboratory of
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Accreditation No.: SCS 108

Client **Estech (Dymstec)**

Certificate No: D835V2-475_Sep06

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 475
Calibration procedure(s)	QA CAL-05.v6 Calibration procedure for dipole validation kits
Calibration date:	September 12, 2006
Condition of the calibrated item	In Tolerance

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	04-Oct-05 (METAS, No. 251-00516)	Oct-06
Power sensor HP 8481A	US37292783	04-Oct-05 (METAS, No. 251-00516)	Oct-06
Reference 20 dB Attenuator	SN: 5086 (20g)	10-Aug-06 (METAS, No 217-00591)	Aug-07
Reference 10 dB Attenuator	SN: 5047.2 (10r)	10-Aug-06 (METAS, No 217-00591)	Aug-07
Reference Probe ET3DV6	SN 1507	28-Oct-05 (SPEAG, No. ET3-1507_Oct05)	Oct-06
DAE4	SN 601	15-Dec-05 (SPEAG, No. DAE4-601_Dec05)	Dec-06

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-05)	In house check: Oct-07
RF generator Agilent E4421B	MY41000675	11-May-05 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov-06

	Name	Function	Signature
Calibrated by:	Mike Meili	Laboratory Technician	M.Meili
Approved by:	Katja Pokovic	Technical Manager	[signature]

Issued: September 13, 2006

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY4	V4.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

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

.

SAR result with Head TSL

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

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

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

Appendix

Antenna Parameters with Head TSL

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

General Antenna Parameters and Design

Electrical Delay (one direction)	1.383 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	November 15, 2002

DASY4 Validation Report for Head TSL

Date/Time: 12.09.2006 18:38:05

Test Laboratory: SPEAG, Zurich, Switzerland

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

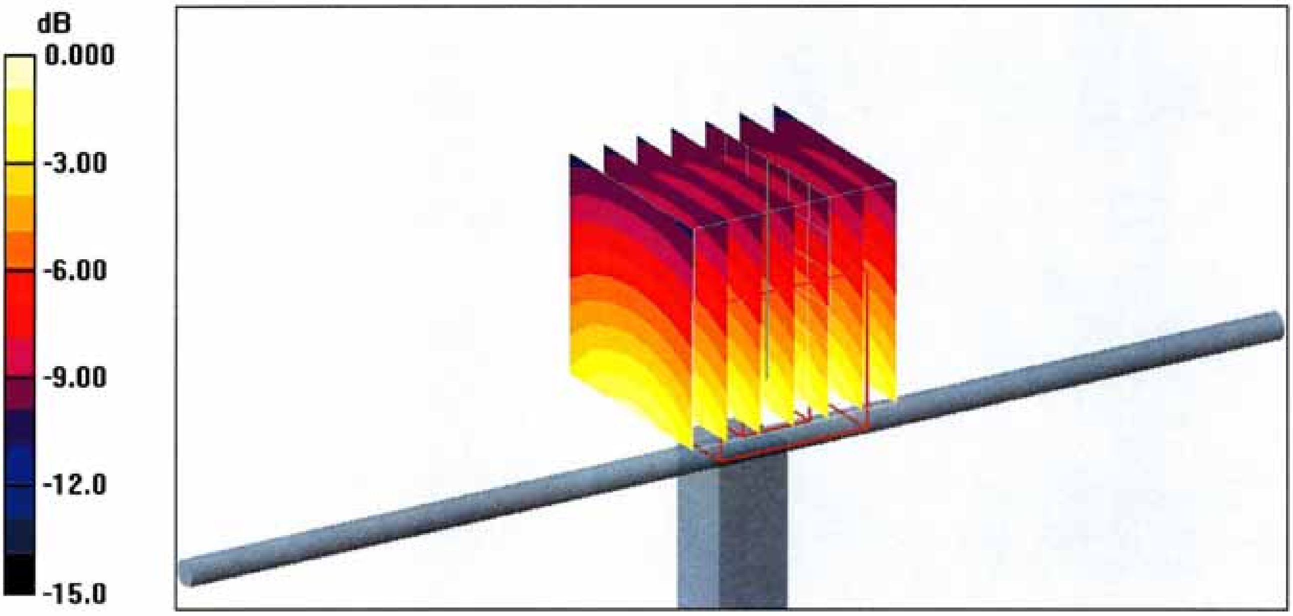
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: HSL 900 MHz;
Medium parameters used: f = 835 MHz; σ = 0.893 mho/m; ε_r = 42.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

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

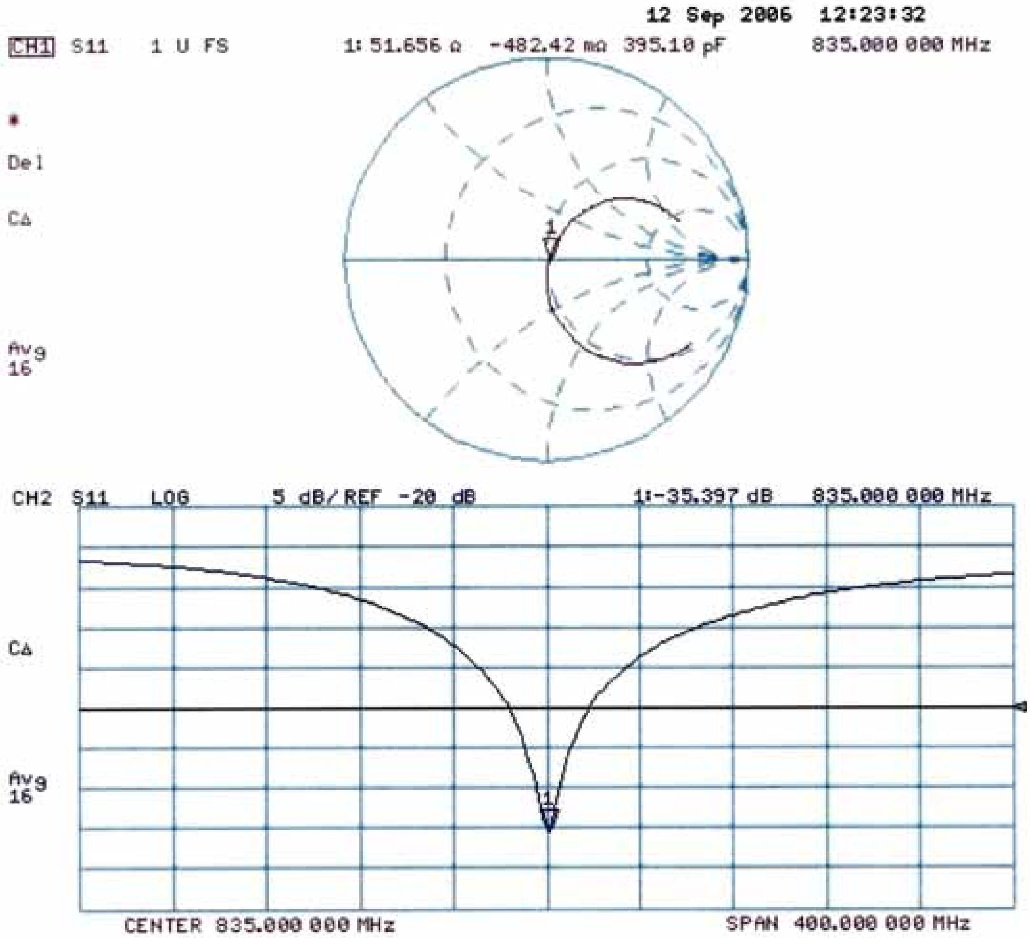
Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.6 V/m; Power Drift = -0.033 dB
Peak SAR (extrapolated) = 3.41 W/kg
SAR(1 g) = 2.29 mW/g; SAR(10 g) = 1.49 mW/g
Maximum value of SAR (measured) = 2.48 mW/g



0 dB = 2.48mW/g

Impedance Measurement Plot for Head TSL



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IMPORTANT NOTICE

USAGE OF PROBES IN ORGANIC SOLVENTS

Diethylene Gycol 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
- EX3DVx
- ER3DV6
- H3DV6

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

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Accreditation No.: SCS 108

Client **Estech (Dymstec)**

Certificate No: ES3-3123_Oct06

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3123
Calibration procedure(s)	QA CAL-01.v5 Calibration procedure for dosimetric E-field probes
Calibration date:	October 17, 2006
Condition of the calibrated item	In Tolerance

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41495277	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41498087	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-06 (METAS, No. 217-00592)	Aug-07
Reference 20 dB Attenuator	SN: S5086 (20b)	4-Apr-06 (METAS, No. 251-00558)	Apr-07
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-06 (METAS, No. 217-00593)	Aug-07
Reference Probe ES3DV2	SN: 3013	2-Jan-06 (SPEAG, No. ES3-3013_Jan06)	Jan-07
DAE4	SN: 654	21-Jun-06 (SPEAG, No. DAE4-654_Jun06)	Jun-07

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov 06

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: October 17, 2006

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

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConF	sensitivity in TSL / NORMx,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., ϑ = 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:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,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*.
- *DCPx,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 ≤ 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 *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ES3DV3

SN:3123

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

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ES3DV3 SN:3123

Sensitivity in Free Space[A]

NormX	**1.31** ± 10.1%	$\mu V/(V/m)^2$
NormY	**1.34** ± 10.1%	$\mu V/(V/m)^2$
NormZ	**1.10** ± 10.1%	$\mu V/(V/m)^2$

Diode Compression[B]

DCP X	**96** mV
DCP Y	**94** mV
DCP Z	**96** mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL 900 MHz Typical SAR gradient: 5 % per mm

Sensor Center to Phantom Surface Distance		**3.0 mm**	**4.0 mm**
SAR_{be} [%]	Without Correction Algorithm	5.7	2.3
SAR_{be} [%]	With Correction Algorithm	0.0	0.1

TSL 1810 MHz Typical SAR gradient: 10 % per mm

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

Sensor Offset

Probe Tip to Sensor Center **2.0** mm

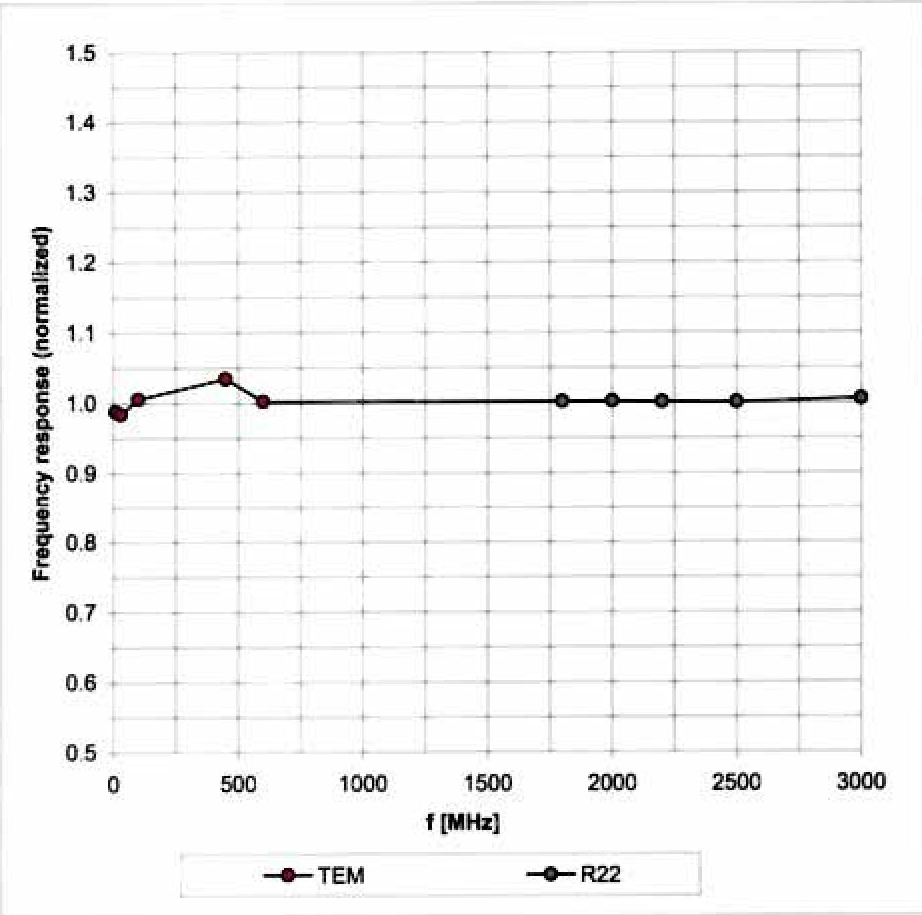
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Page 8).

[B] Numerical linearization parameter: uncertainty not required.

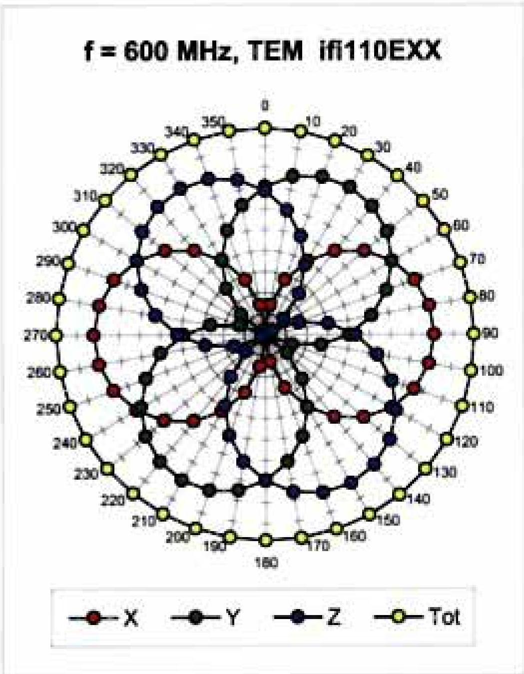
Frequency Response of E-Field

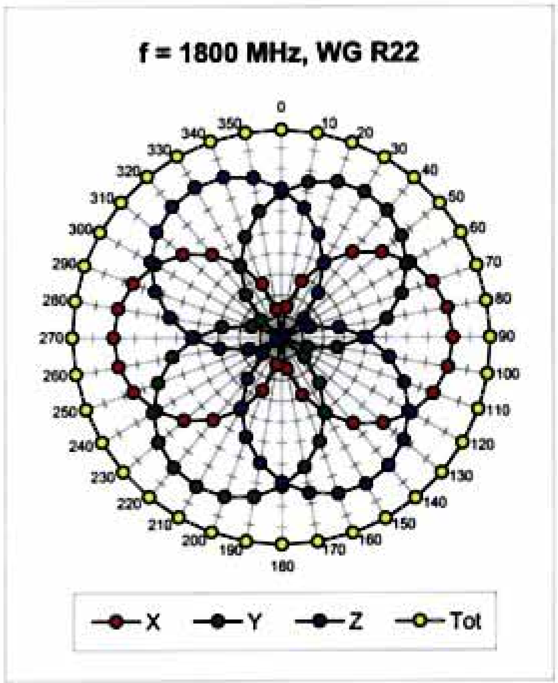
(TEM-Cell:ifi110 EXX, Waveguide: R22)

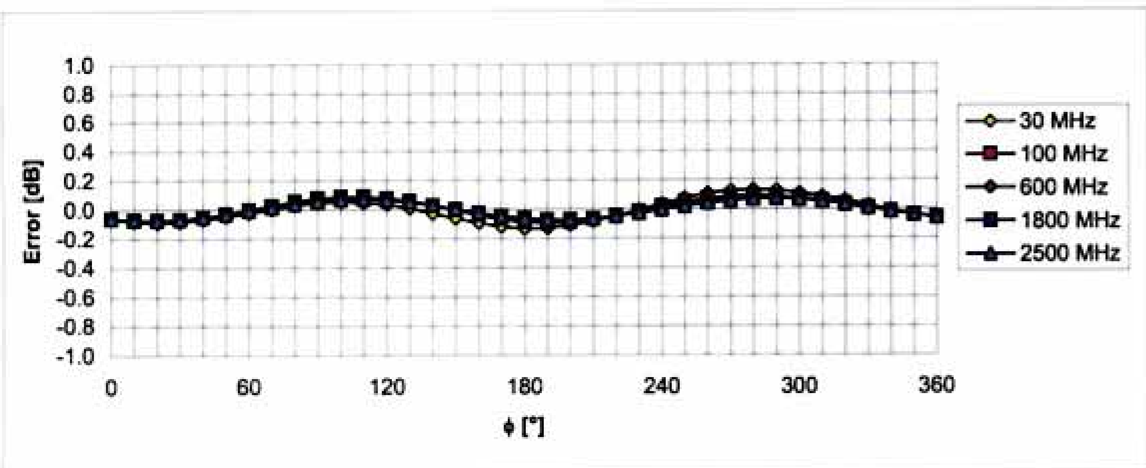


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



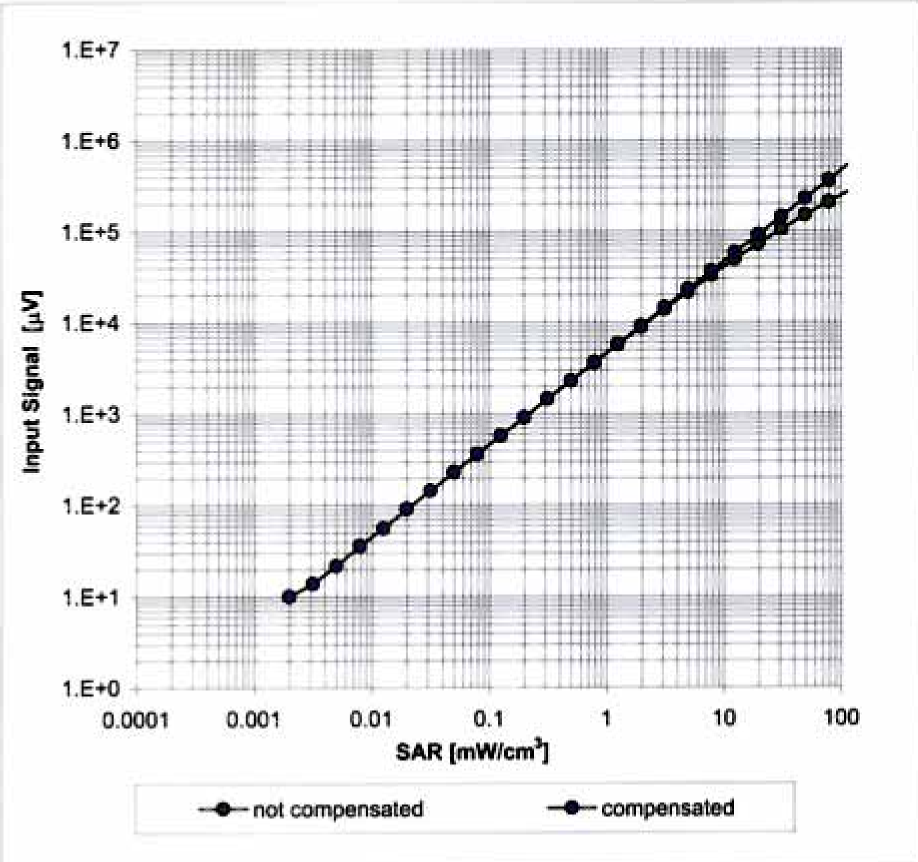


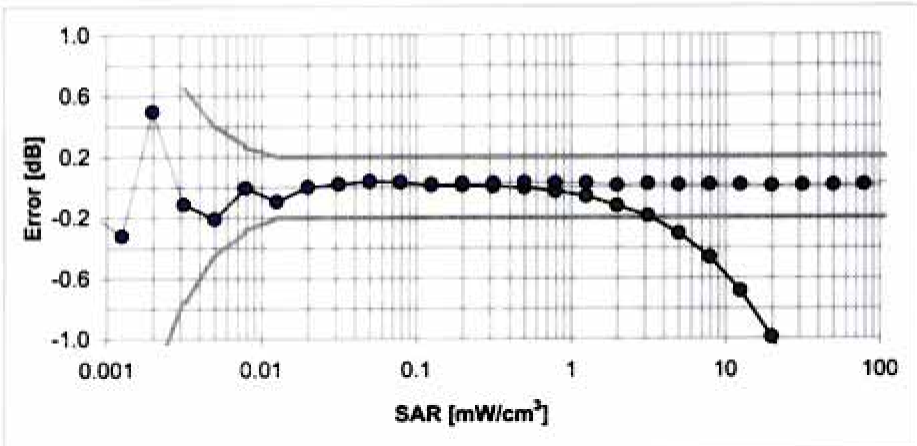


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

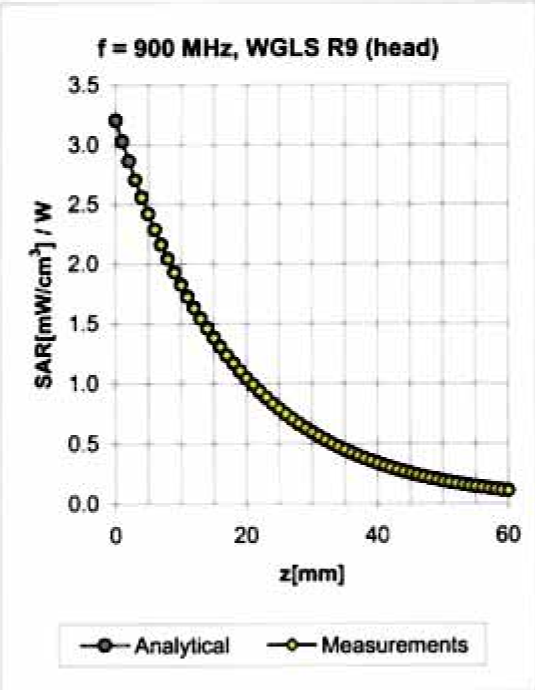
(Waveguide R22, f = 1800 MHz)

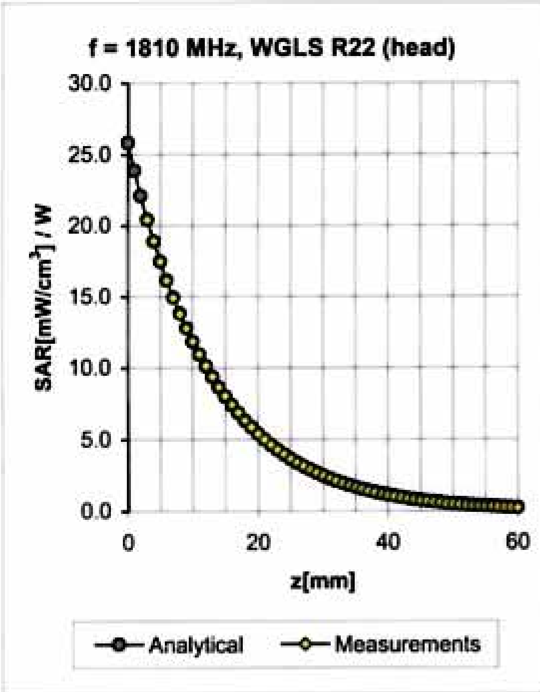




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



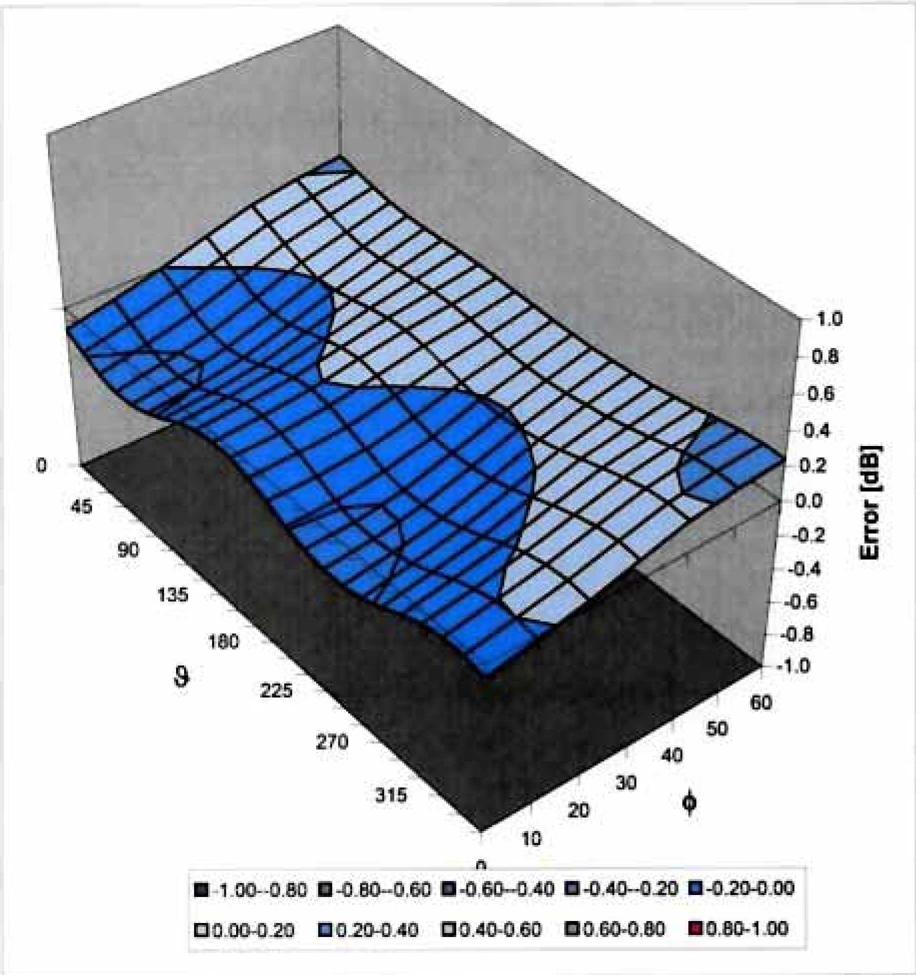


f [MHz]	Validity [MHz][C]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	1.00	1.09	6.42	± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.92	1.16	5.23	± 11.0% (k=2)
1900	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.79	1.29	5.08	± 11.0% (k=2)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

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

Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)