

SAR Evaluation Report

FCC ID : SY6BCL862S

Project Reference No. : NK2FR128

Product Type : CDMA Mobile Phone

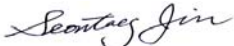
Brand Name : Bellwave

Model : BCL862S

Tested According to : IEEE Standard C95.1 / OET Bulletin 65 Supplement C

Tested Period : Jun. 29. 2005 to Jun. 30. 2005

Tested by Seob Lee  date : July. 1. 2005

Verified by Seonteag.Jin  date : July. 1. 2005

This test results are only related to the item tested.

This test report is only limited to the client company and the product.

This report must not be used by the client to claim product endorsement by any agency of the U.S. Government.

Lab Address : Nemko Korea Co., Ltd

300-2, Osan-Ri, Mohyun-Myun, Yongin-City, Gyunggi-Do, Korea

Phone : 82-31-322-2333

Fax : 82-31-322-2332

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1.General Information

1.1 Applicant

Company Name: Bellwave Co., Ltd
Company Address: 6th FL. Kamco Yangjae Tower 949-3, Dogok-Dong, Gangnam-Gu, Seoul 135-270, Korea
Phone/Fax: Phone: +86-2-3460-9785 / +82-2-3460-9736
Contact Name: Tae-Hyoung Ko

1.2 Manufacturer

Company Name: Shin-Oh Electronics Co., Ltd
Company Address: 729-5 Bonoh-dong, Sangrok-Gu, Ansan-shi, Gyunggi-Do, 426-180 Korea (730-2 : 2nd FA)
Phone/Fax: Phone: +86-2-3460-9785 / +82-2-3460-9736
Contact Name: Tae-Hyoung Ko

1.3 Description of Device

Category: CDMA Mobile Phone
Model Name: BCL862S
Brand Name: Bellwave
Serial Number: 2004506
Frequency of Operation Tx : 824MHz ~ 849MHz, Rx : 869MHz ~ 894MHz
Power Output (Conducted) 0.27W (24.3dBm)
Channel Spacing 1.23MHz
Modulation method Tx : OQPSK Rx : QPSK
Operating Condition -30to +60℃
Power Supply Li-ion Battery: 3.9V DC, 950mAh
Antenna Type Cellular / GPS monopole antenna : input impedance 50 Ω
Dimensions 82.0mm X 49.8mm X 18.0mm
Weight 60.5g
Remarks: -

2. General Test Condition

2.1 Location

Nemko Korea
300-2, Osan-Ri, Mohyun-Myun, Yongin-City, Gyunggi-Do
Phone : 82-31-322-2333 , Fax : 82-31-322-2332

2.2 Operating Environment

Parameters	Recording during test	Accepted deviation
Ambient temperature	20 - 22℃	15 - 30℃
Relative humidity	30 - 60%	20 - 75%

2.3 Test Frequency

CDMA835 Head		CDMA835 Body	
Test Channel	Test Frequency (MHz)	Test Channel	Test Frequency (MHz)
1013	824.70	1013	824.70
0363	835.89	0363	835.89
0777	848.31	0777	848.31

2.4 Support Equipment

Equipment	Manufacturer	Model Name	Serial Number
Laptop	Samsung	SENS640	668391AR311176

3. Description of Test Equipment

3.1 SAR Measurement Setup

Robotic System

Measurements are performed using the DASY4 automated dosimetric assessment system. Which is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of high precision robotics system (Stäubli), robot controller, measurement server, H/P computer, nearfield 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. 3.1).

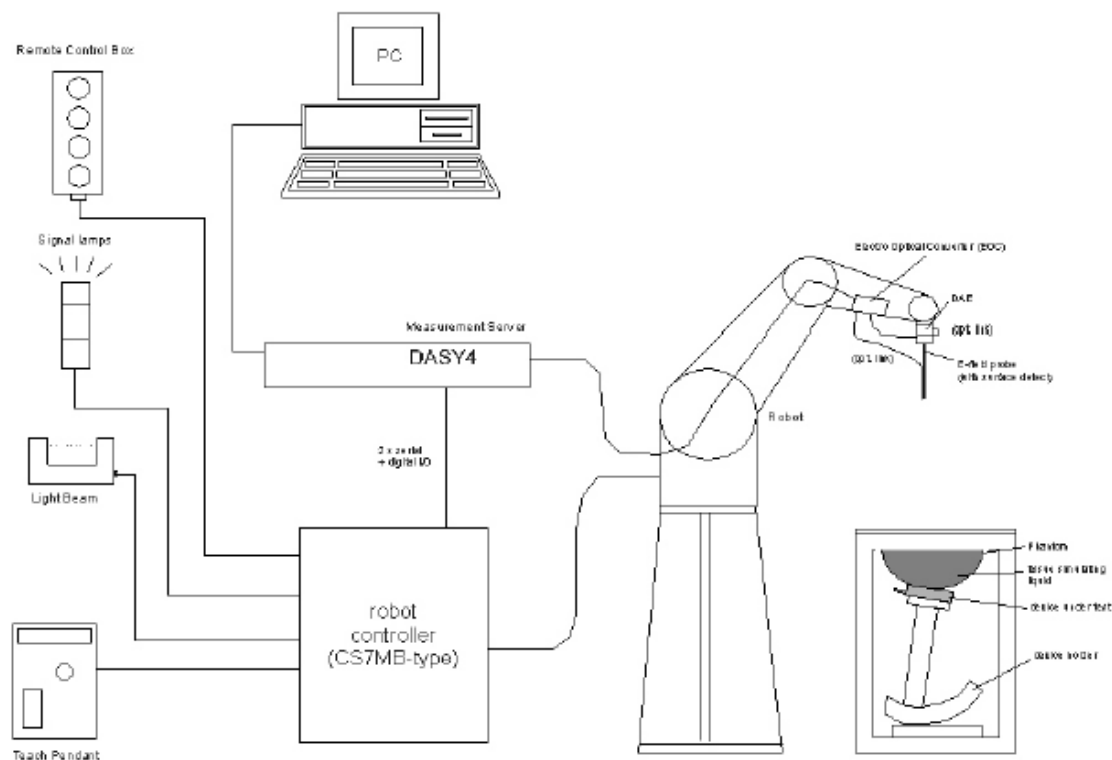


Figure 3.1 SAR Measurement System Setup

System Hardware

A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and a remote control is used to drive the robot motors. The PC consists of the H/P computer with Windows XP system and SAR Measurement Software DASY4, LCD monitor, mouse and keyboard. The Stäubli Robot is connected to the cell controller to allow software manipulation of the robot. A 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 measurement server.

System Electronics

The DAE4 consists of a highly sensitive electrometer-grade preamplifier with autozeroing, a

channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server 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.

3.2 E-field Probe

The SAR measurement were conducted with the dosimetric probe ES3DV3, designed in the classical triangular configuration (see Fig.3.3) 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 multi-fiber line ending at the front of the probe tip (see Fig.3.4). It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface.

Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches 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 a System maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero.

The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting (see Fig.3.2).

The approach is stopped at reaching the maximum.



Figure 3.2 DAE System

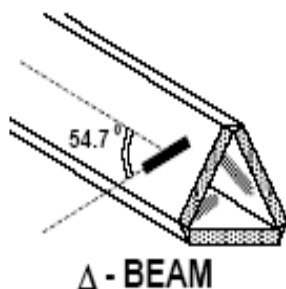


Figure 3.3 Triangular Probe Configuration



Figure 3.4 Probe Thick-Film Technique

Probe Specifications

Construction :	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic DGBE)
Calibration :	Basic Broad Band Calibration In air from 10 MHz to 3.0 GHz In brain and muscle simulating tissue at Frequencies of HSL900, HSL1800 MHz, Calibration certificates please find attached.
Frequency :	10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in HSL (rotation normal to probe axis)
Dynamic Range	5 μ W/g to > 100mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 330mm (Tip : 20mm) Tip diameter: 4.0mm (Body : 12mm) Distance from probe tip to dipole centers: 2.0mm
Application	General dosimetry up to 3 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms
Optical Surface Detection	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces

3.3 SAM Phantom

The SAM Twin Phantom V4.0C is constructed of a 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. 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 Figure 3.5)



Figure 3.5 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 ± 0.2 mm
Filling Volume Approx. 25 liters
Dimensions Height; 830 mm; Length: 1000 mm; Width: 500 mm

3.4 Head & Muscle Simulating Mixture Characterization

The head and muscle mixture consist of a viscous gel using hydroxyethyl-cellulose (HEC) gelling agent and saline solution(see Table 3.1). Preservation with a bacteriacide 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 incorporated in the following table.

Table 3.1 Composition of the Head & Muscle Tissue Equivalent Matter

INGREDIENTS	SIMULATING TISSUE	
	835MHz Head	835MHz Muscle
De-ionised water	51.07%	65.45%
Sugar	47.31%	34.31%
Salt	1.15%	0.62%
Hydroxyethyl Cellulose	0.23%	-
DGBE	-	-
Bacteriacide	0.24%	0.10%
Dielectric Constant Target	41.50	55.20
Conductivity Target (S/M)	0.90	0.97

3.5 Device Holder for Transmitters

In combination with the SAM Twin Phantom V4.0, the Mounting Device (see Fig. 3.6) enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation point is the ear opening.

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 .

To produce the worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.



Figure 3.6Device Holder

3.6 Dipole Validation

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

Frequency	835MHz
Return Loss	< -20 dB at specified validation position
Dimensions	D835V2: dipole length: 161 mm; overall height: 330 mm

4. Measurement Procedure

The mobile phone operating at the maximum power level is placed by a non metallic device holder in the above described positions at a shell phantom of a human being.

The distribution of the electric field strength E is measured in the tissue simulating liquid within the shell phantom.

For this miniaturized field probes with high sensitivity and low field disturbance are used.

Afterwards the corresponding SAR values are calculated with the known electrical conductivity σ and the mass density ρ of the tissue in the SEMCAD software.

The software is able to determine the averaged SAR values(averaging region 1g or 10g) for compliance testing.

The measurements are done by two scans: first a coarse scan determines the region of the maximum SAR, afterwards the averaged SAR is measured in a second scan within the sharp of a cube. The measurement times takes about 15 minutes.

The following steps are used for each test position:

STEP1

Establish a call with the maximum output power with a base station simulator.

The connection between the mobile phone and the base station simulator is established via air interface.

STEP2

Measurement of the local E-Field value at a fixed location.

This value serves as a reference value for calculating a possible power drift.

STEP3

Measurement of the SAR distribution with a grid spacing of 15mm × 15mm and a constant distance to the inner surface of the phantom.

Since the sensors cannot directly measure at the inner phantom surface, the values between the sensors and the inner phantom surface are extrapolated. With this values the area of the maximum SAR is calculated by a interpolation scheme (combination of a least-square fitted function and a weighted average method). Additional peaks within 3dB of the maximum SAR are searched.

STEP4

Around this points, a cube of 32mm×32mm×30mm is assessed by measuring 5×5×7 points. With these data, the peak spatial-average SAR value can be calculated with the SEMCAD software.

STEP 5

The used extrapolation and interpolation routines are all based on the modified Quadratic Shepard's method [DASY4].

STEP 6

Repetition of the E-Field measurement at the fixed location and repetition of the whole procedure if the two results differ by more than $\pm 0.21\text{dB}$.

5. Definition of Reference Points

5.1 EAR Reference Point

Figure 5.1 shows the front, back and side views of SAM. The point “M” is the reference point for the center of mouth, “LE” is the left ear reference point (ERP), and “RE” is the right ERP. The ERPs are 15 mm posterior to the entrance to ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 5.2.



Figure 5.1 Front, back and side view of SAM

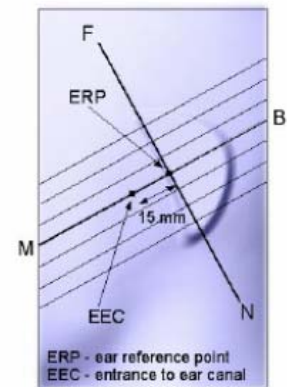


Figure 5.2 Close up side view

The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front) perpendicular to the reference plane and passing through the RE(or LE) is called the Reference Pivoting Line (see Figure 5.3). Line B-M is perpendicular to the N-F line. Both N-F and B-M Lines should be marked on the external phantom shell to facilitate handset positioning. Posterior to the N-F line, the thickness of the phantom shell with the shape of an ear is a flat surface 6 mm thick at the ERPs.

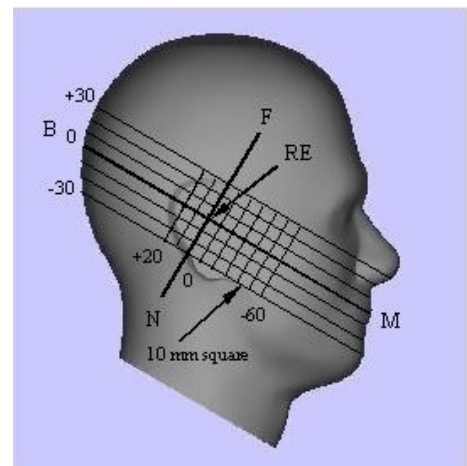


Figure 5.3 Side view of the phantom showing relevant markings

5.2 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. 5.4).

The “test device reference point” was then located at the same level as the center of the ear reference point. The test device was positioned so that the “vertical centerline” was bisecting the front surface of the handset at its 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.

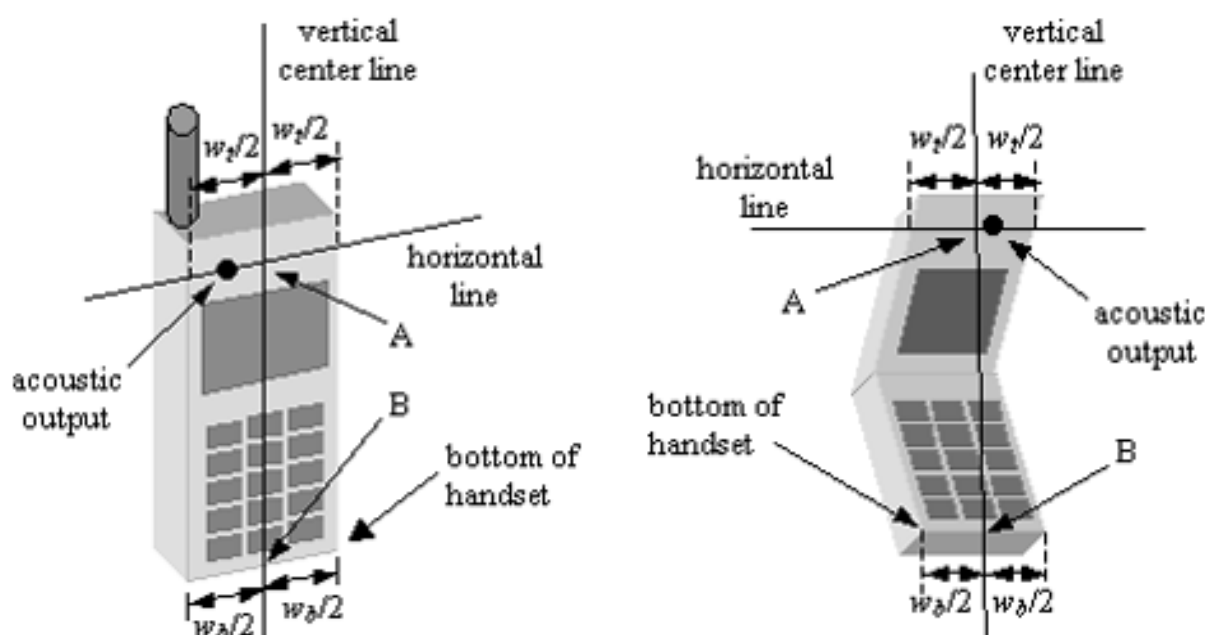


Figure 5.4 Handset vertical and horizontal reference lines

6. Test Configuration Positions

6.1 Cheek/Touch Position

Step 1

The test device was positioned with the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 6.1), 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.

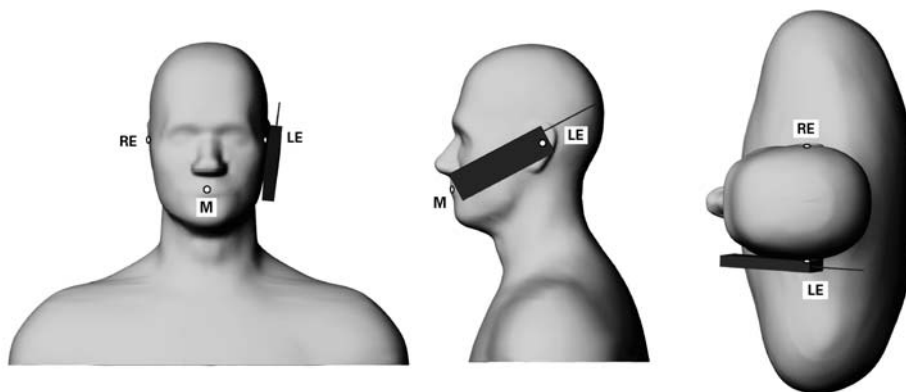


Figure 6.1 Front, Side and Top View of Cheek/Touch Position

Step 2

The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the ear.

Step 3

While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the plane normal to MB-NF including the line MB (reference plane).

Step 4

Rotate the handset around the vertical centerline until the phone (horizontal line) was symmetrical with respect to the line NF.

Step 5

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, the handset was rotated about the line NF until any point on the handset made contact with a phantom point below the ear cheek. (See Figure 5.2)

6.2 EAR/Tilt 15° Position

With the test device aligned in the “Cheek/Touch Position”:

Step 1

Repeat steps 1 to 5 of 5.2 to place the device in the “Cheek/Touch Position”

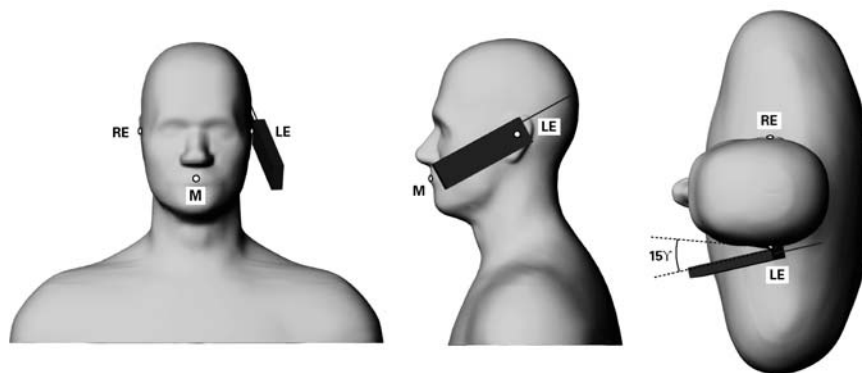


Figure 6.2 Front, side and Top View of Ear/Tilt 15° Position

Step 2

While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15 degree.

Step 3

The phone was then rotated around the horizontal line by 15 degree.

Step 4

While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the phone touches the head.

(In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced.

The tilted position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head. (See Figure 6.2)

6.3 Body-worn and Other Configurations

6.3.1 Phantom Requirement

For body-worn and other configurations a flat phantom shall be used which is comprised of material with electrical properties similar to the corresponding tissues.

6.3.2 Test Position

The body-worn configurations shall be tested with the supplied accessories (belt-clips, holsters, etc.) attached to the device in normal use configuration. Devices with a headset output shall be tested with a connected headset. Since the Supplement C to OET Bulletin 65 was mainly issued for mobile phones it is only a guideline and therefore some requirements are not usable or practical for devices other than mobile phones.

6.3.3 Test to be Performed

For purpose of determining test requirements, accessories may be divided into two categories: those that do not contain metallic components and those that do. For multiple accessories that do not contain metallic components, the device may be tested only with that accessory which provides the closest spacing to the body.

For multiple accessories that contain metallic components, the device must be tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component, only the accessory that provides the closest spacing to the body must be tested.

If the manufacturer provides none body accessories, a separation distance of 1.5 cm between the back of the device and the flat phantom is recommended. Other separation distances may be used, but they shall not exceed 2.5cm. In these cases, the device may use body-worn accessories that provide a separation distance greater than that tested for the device provided however that the accessory contains no metallic components.

For devices with retractable antenna, the SAR test shall be performed with the antenna fully extended and fully retracted. Other factors that may affect the exposure shall also be tested. For example, optional antennas or optional battery packs which may significantly change the volume, lengths, flip open/closed, etc. of the device or any other accessories which might have the potential to considerably increase the peak spatial-average SAR value.

The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at the middle channel for each test configuration is at least 3.0dB lower than the SAR limit, testing at the high and low channel is optional.

7. Measurement Uncertainty

DASY4 Uncertainty Budget According to IEEE 1528 [1]								
Error Description	Uncertainty value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v_i) v_{eff}
Measurement System								
Probe Calibration	±5.9 %	N	1	1	1	±5.9 %	±5.9 %	∞
Axial Isotropy	±4.7 %	R	√3	0.7	0.7	±1.9 %	±1.9 %	∞
Hemispherical Isotropy	±9.6 %	R	√3	0.7	0.7	±3.9 %	±3.9 %	∞
Boundary Effects	±1.0 %	R	√3	1	1	±0.6 %	±0.6 %	∞
Linearity	±4.7 %	R	√3	1	1	±2.7 %	±2.7 %	∞
System Detection Limits	±1.0 %	R	√3	1	1	±0.6 %	±0.6 %	∞
Readout Electronics	±0.3 %	N	1	1	1	±0.3 %	±0.3 %	∞
Response Time	±0.8 %	R	√3	1	1	±0.5 %	±0.5 %	∞
Integration Time	±2.6 %	R	√3	1	1	±1.5 %	±1.5 %	∞
RF Ambient Conditions	±3.0 %	R	√3	1	1	±1.7 %	±1.7 %	∞
Probe Positioner	±0.4 %	R	√3	1	1	±0.2 %	±0.2 %	∞
Probe Positioning	±2.9 %	R	√3	1	1	±1.7 %	±1.7 %	∞
Max. SAR Eval.	±1.0 %	R	√3	1	1	±0.6 %	±0.6 %	∞
Test Sample Related								
Device Positioning	±2.9 %	N	1	1	1	±2.9 %	±2.9 %	145
Device Holder	±3.6 %	N	1	1	1	±3.6 %	±3.6 %	5
Power Drift	±5.0 %	R	√3	1	1	±2.9 %	±2.9 %	∞
Phantom and Setup								
Phantom Uncertainty	±4.0 %	R	√3	1	1	±2.3 %	±2.3 %	∞
Liquid Conductivity (target)	±5.0 %	R	√3	0.64	0.43	±1.8 %	±1.2 %	∞
Liquid Conductivity (meas.)	±2.5 %	N	1	0.64	0.43	±1.6 %	±1.1 %	∞
Liquid Permittivity (target)	±5.0 %	R	√3	0.6	0.49	±1.7 %	±1.4 %	∞
Liquid Permittivity (meas.)	±2.5 %	N	1	0.6	0.49	±1.5 %	±1.2 %	∞
Combined Std. Uncertainty						±10.8 %	±10.6 %	330
Expanded STD Uncertainty						±21.6 %	±21.1 %	

Table 21.6: Worst-Case uncertainty budget for DASY4 assessed according to IEEE 1528 [1]. The budget is valid for the frequency range 300 MHz - 3 GHz and represents a worst-case analysis. For specific tests and configurations, the uncertainty could be considerable smaller.

8. System Verification

8.1 Tissue Verification

For the measurement of the following parameters the HP 85070E dielectric probe kit is used, representing the open-ended slim form probe measurement procedure.

The measured values should be within $\pm 5\%$ of the recommended values given by the IEEE Standard C95.1 / OET Bulletin 65 Supplement C.

Table 8.1 Measured Tissue Parameters

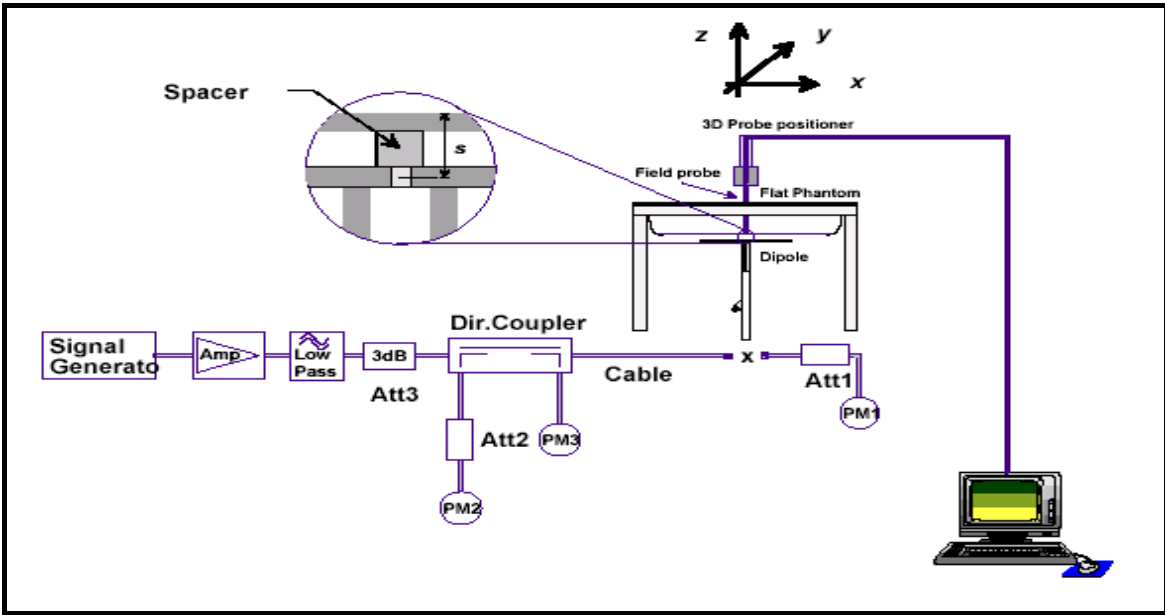
	835MHz Head		835MHz Muscle	
Date	Jun 29, 2005		Jun 29, 2005	
Liquid Temperature(°C)	20.8°C		21.5°C	
	Recommended Value	Measured Value	Recommended Value	Measured Value
Dielectric Constant (ϵ)	41.50 ± 2.075	42.5	55.20 ± 2.760	54.0
Conductivity(σ)	0.90 ± 0.045	0.901	0.97 ± 0.048	0.986

8.2 Test System Validation

The simplified performance check was realized using the dipole validation kits.
The input power of the dipole antennas were 250mW and they were placed under the flat Part of the SAM phantoms.
The target and measured results are listed in the table 8.2

Table 8.2 System Validation Results

Tissue	Date	Liquid Temperature(°C)	Targeted SAR (mW/g)	Measured SAR	Deviation (%)
			1g	1g	1g
Head	Jun 29 2005	21.1°C	2.375	2.300	-3.16
Muscle	Jun 29 2005	20.5°C	2.375	2.450	3.16



Dipole Validation Test Setup

8.3 Measurement Result of Test Data(CDMA835 Head Validation)

Date/Time: 2005-06-29 8:40:07 Date/Time: 2005-06-29 8:44:27

Test Laboratory: Nemko Korea

File Name: [Head validation.da4](#)

DUT: Dipole 835 MHz Type: D835V2 Serial: D835V2 - SN:4d017

Communication System: CW Frequency: 835 MHz

Duty Cycle: 1:1 Phantom section: Flat Section

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.901 \text{ mho/m}$; $\epsilon_r = 42.5$; $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

Probe: ES3DV3 - SN3068; ConvF(5.91, 5.91, 5.91); Calibrated: 2005-04-11

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn672; Calibrated: 2005-03-02

Phantom: SAM with CRP; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Validation/Area Scan (7x7x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (measured) = 2.33 mW/g

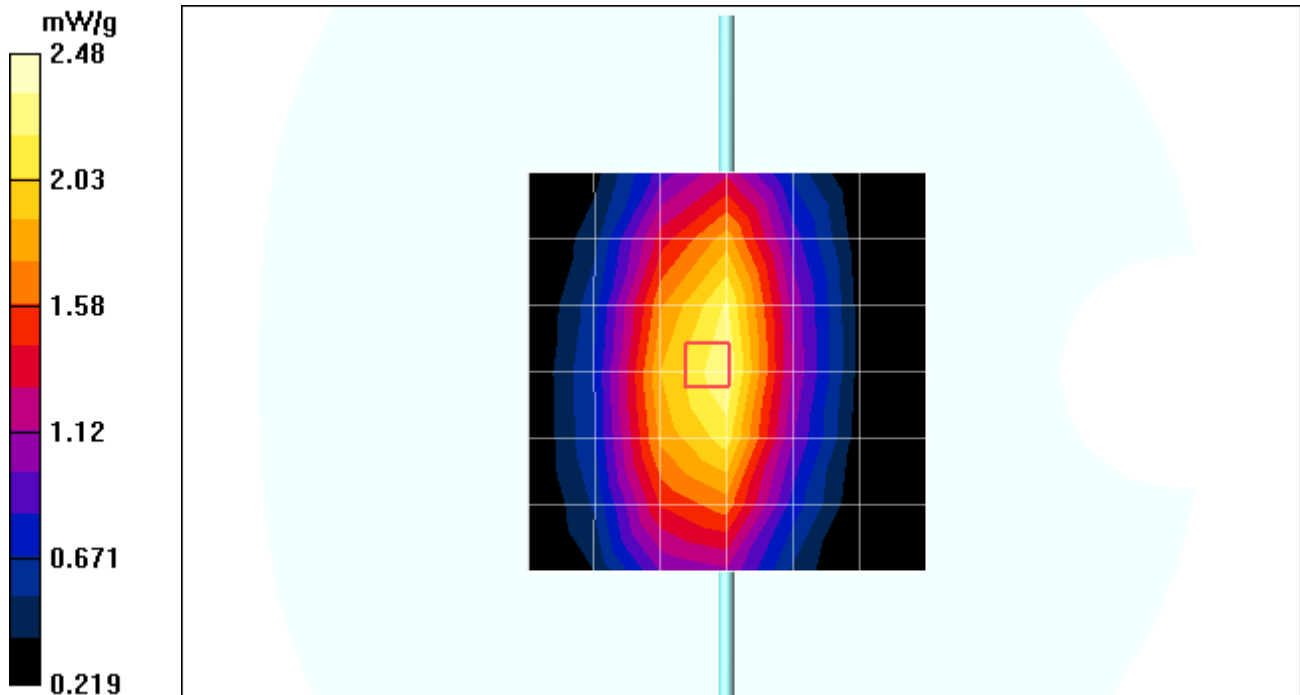
Validation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 51.5 V/m; Power Drift = 0.018 dB

Peak SAR (extrapolated) = 3.44 W/kg

SAR(1 g) = 2.3 mW/g

Maximum value of SAR (measured) = 2.48 mW/g



8.4 Measurement Result of Test Data (CDMA835 Muscle Validation)

Date/Time: 2005-06-29 7:20:29 Date/Time: 2005-06-29 7:24:48

Test Laboratory: Nemko Korea

File Name: [Muscle validation.da4](#)

DUT: Dipole 835 MHz Type: D835V2 Serial: D835V2 - SN:4d017 Applicant Name : Bellwave

Communication System: CW Frequency: 835 MHz

Duty Cycle: 1:1 Phantom section: Flat Section

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.986 \text{ mho/m}$; $\epsilon_r = 54$; $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

Probe: ES3DV3 - SN3068; ConvF(5.9, 5.9, 5.9); Calibrated: 2005-04-11

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn672; Calibrated: 2005-03-02

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Validation/Area Scan (7x7x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (measured) = 2.63 mW/g

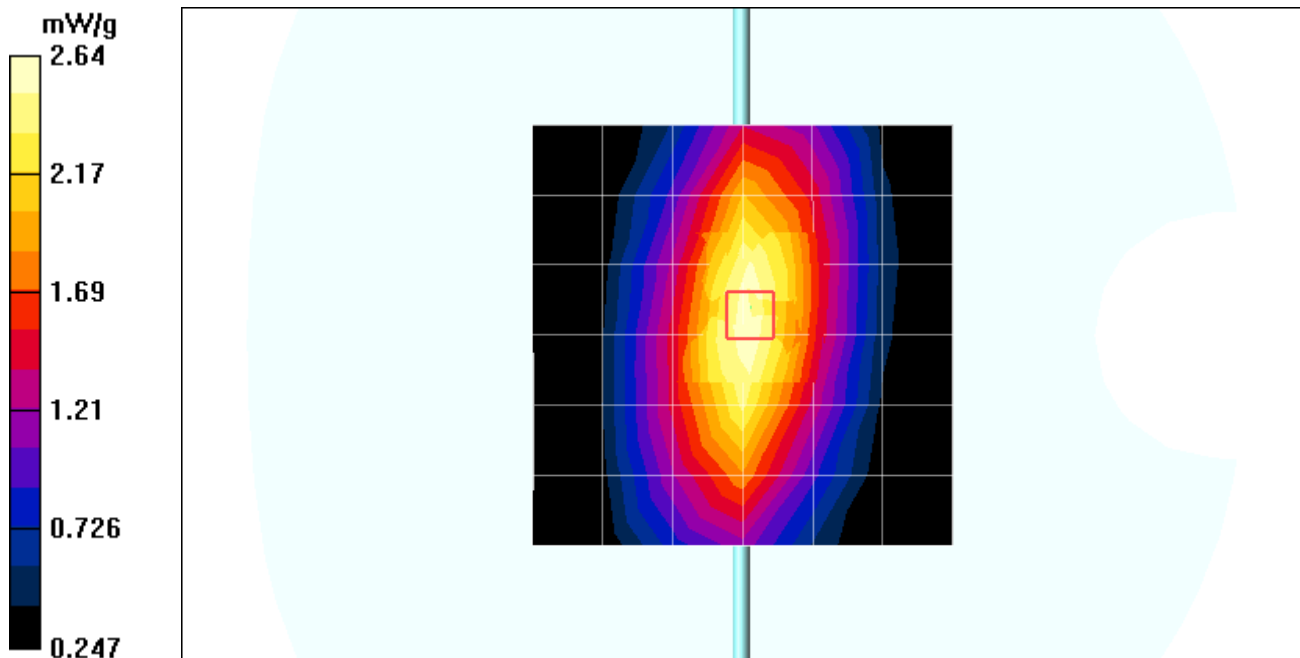
Validation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 53.0 V/m; Power Drift = -0.110 dB

Peak SAR (extrapolated) = 3.60 W/kg

SAR(1 g) = 2.45 mW/g

Maximum value of SAR (measured) = 2.64 mW/g



9. SAR Measurement Results

Procedures Used To Establish Test Signal

The handset was placed into simulated call mode (CDMA) using manufacturers test codes. Such test signals offer a consistent means for testing SAR and are recommended for evaluating SAR.

Output Power

	FREQUENCY		Power (dBm)	Power (mW)
	CH	MHz		
CDMA	1013	824.70	24.03	253
	0363	835.89	24.51	283
	0777	848.31	24.39	275

Maximum SAR

1g

Mode	CH	Frequency	Position	Antenna	SAR Limit W/kg	Measured SAR W/kg	Result
Head	0777	848.31	Right/ Touch	Left/ Fixed	1.6	1.370	Passed
Muscle	0777	848.31	Flat/ Touch	Left/ Fixed	1.6	1.200	Passed

Device Test Conditions

The handset is battery operated. Each SAR measurement was taken with a fully charged battery. In order to verify that the device was tested at full power, conducted output power measurements were performed before and after each SAR measurement to confirm the output power. If a conducted power deviation of more than 5% occurred, the test was repeated.

EUT Handset Reference Points

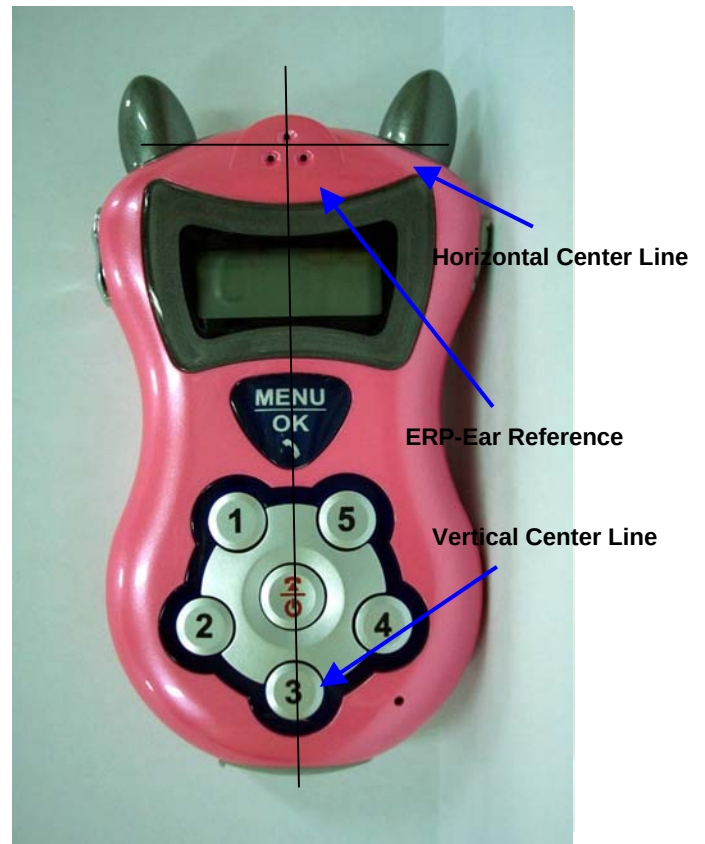


Figure 9.1 Handset Reference Points

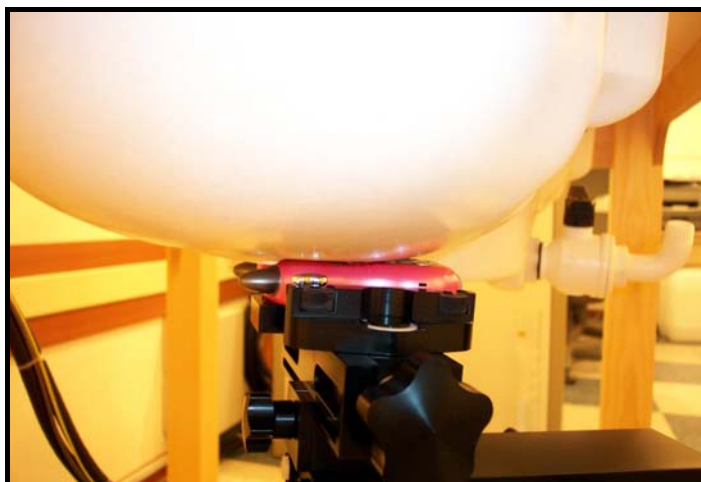
9.1 SAR Data Summary (CDMA835 Right Head Touch Position)

Date of Test : Jun. 29. 2005
Mixture Type: 835MHz Head
Tissue Depth: 15.0 cm

Modulation	FREQUENCY		Power Drift(dB)	Device Test Position	Antenna Position	SAR (W/kg)
	CH	MHz				1g
CDMA	1013	824.70	-0.064	Cheek / Touch	Left/ Fixed	1.320
	0363	835.89	0.190	Cheek / Touch	Left/ Fixed	0.743
	0777	848.31	0.155	Cheek / Touch	Left/ Fixed	1.370

Notes:

- The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration.
- All modes of operation were investigated, and worst-case results are reported.
- Battery is fully charged for all readings.
- SAR Measurement System ☒ DASY4
- Phantom Configuration ☐ Left Head ☐ Flat Phantom ☒ Right Head
- SAR Configuration ☒ Head ☐ Body ☐ Hand
- Test Signal Call Mode ☒ Manu. Test Codes ☐ Base Station Simulator
- Battery Option ☒ Standard Type ☐ Slim Type



**Figure 9.1 Right Head SAR Test Setup
-- Cheek / Touch Position --**

Measurement Result of Test Data (CDMA835 Right Head Touch Position)

Date/Time: 2005-06-29 10:59:24 Date/Time: 2005-06-29 11:03:03

Test Laboratory: Nemko Korea

File Name: [CH 1013 RH Touch Position.da4](#)

DUT: BCL862S Type: Bar Type Serial: 2004506 Applicant Name : Bellwave

Communication System: CDMA Frequency: 824.7 MHz

Duty Cycle: 1:1 Phantom section: Right Section

Medium parameters used (interpolated): $f = 824.7 \text{ MHz}$; $\sigma = 0.89 \text{ mho/m}$; $\epsilon_r = 42.7$; $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

Probe: ES3DV3 - SN3068; ConvF(5.91, 5.91, 5.91); Calibrated: 2005-04-11

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn672; Calibrated: 2005-03-02

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

CDMA 1013 Right Touch/Area Scan (5x8x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Maximum value of SAR (measured) = 1.33 mW/g

CDMA 1013 Right Touch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

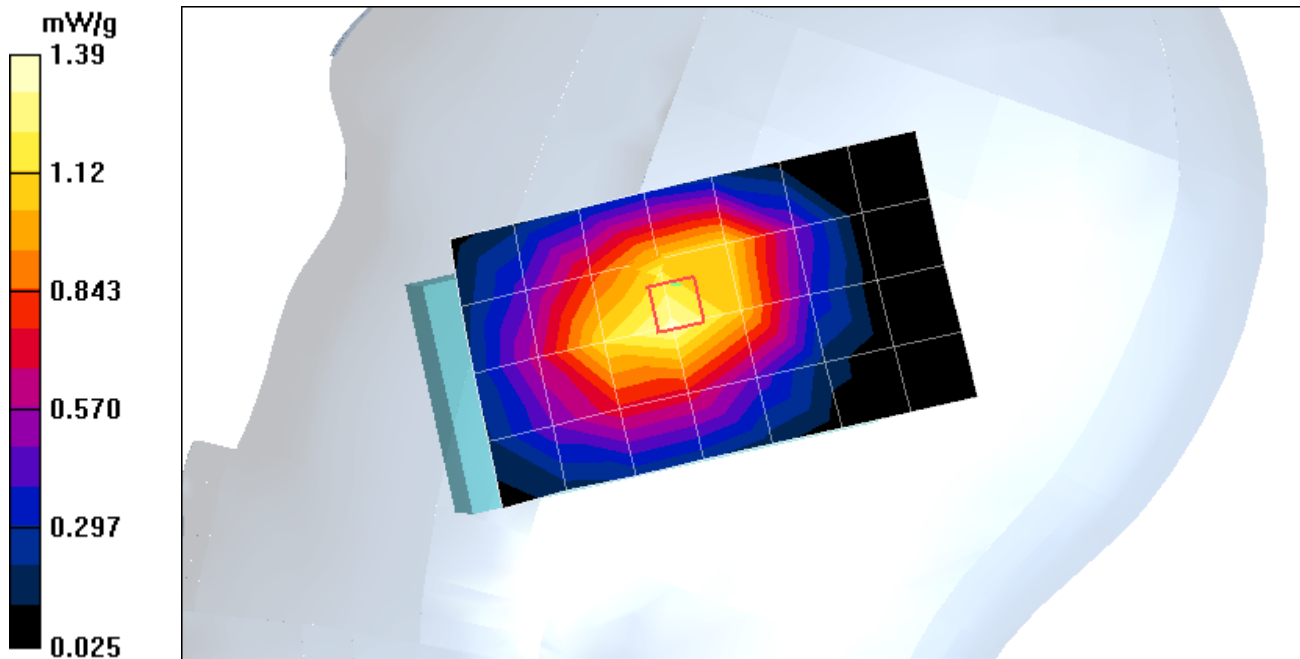
Reference Value = 27.7 V/m; Power Drift = -0.064 dB

Peak SAR (extrapolated) = 2.63 W/kg

SAR(1 g) = 1.32 mW/g

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

Maximum value of SAR (measured) = 1.39 mW/g



Date/Time: 2005-06-29 9:58:03Date/Time: 2005-06-29 10:01:42

Test Laboratory: Nemko Korea

File Name: [CH 363 RH Touch Position.da4](#)

DUT: BCL862S Type: Bar Type Serial: 2004506 Applicant Name : Bellwave

Communication System: CDMA Frequency: 835.89 MHz

Duty Cycle: 1:1 Phantom section: Right Section

Medium parameters used (interpolated): $f = 835.89 \text{ MHz}$; $\sigma = 0.902 \text{ mho/m}$; $\epsilon_r = 42.5$; $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

Probe: ES3DV3 - SN3068; ConvF(5.91, 5.91, 5.91); Calibrated: 2005-04-11

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn672; Calibrated: 2005-03-02

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

CDMA 363 Right Touch/Area Scan (5x8x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

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

CDMA 363 Right Touch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

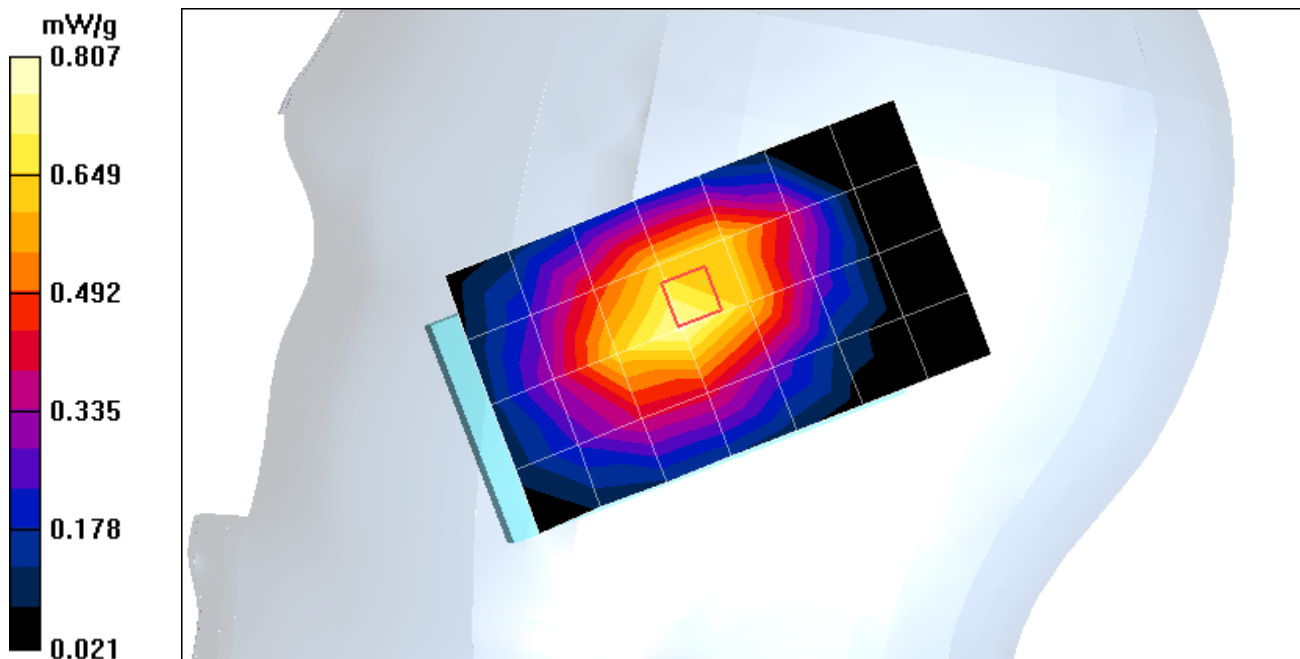
Reference Value = 21.7 V/m; Power Drift = 0.190 dB

Peak SAR (extrapolated) = 1.40 W/kg

SAR(1 g) = 0.743 mW/g

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

Maximum value of SAR (measured) = 0.807 mW/g



Date/Time: 2005-06-29 11:35:45Date/Time: 2005-06-29 11:39:23

Test Laboratory: Nemko Korea

File Name: [CH 777 RH Touch Position.da4](#)

DUT: BCL862S Type: Bar Type Serial: 2004506 Applicant Name : Bellwave

Communication System: CDMA Frequency: 848.31 MHz

Duty Cycle: 1:1 Phantom section: Right Section

Medium parameters used (interpolated): $f = 848.31$ MHz; $\sigma = 0.918$ mho/m; $\epsilon_r = 42.3$; $\rho = 1000$ kg/m³

DASY4 Configuration:

Probe: ES3DV3 - SN3068; ConvF(5.91, 5.91, 5.91); Calibrated: 2005-04-11

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn672; Calibrated: 2005-03-02

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

CDMA 777 Right Touch/Area Scan (5x8x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 1.34 mW/g

CDMA 777 Right Touch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

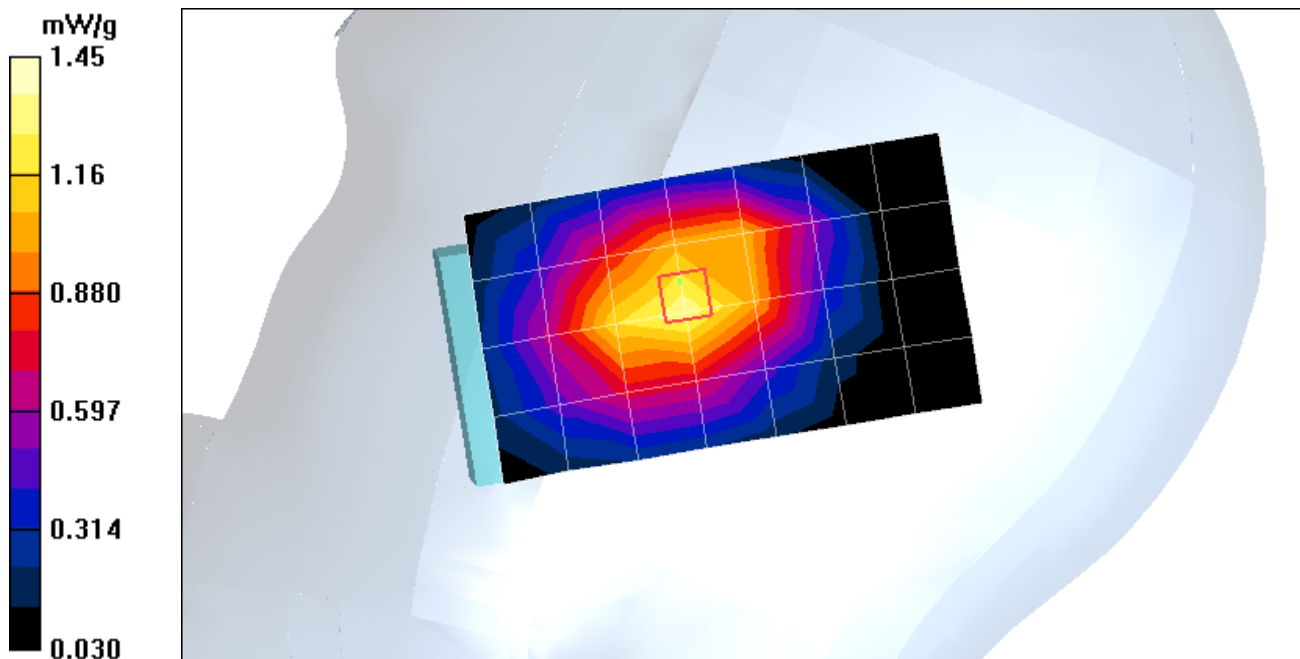
Reference Value = 27.2 V/m; Power Drift = 0.155 dB

Peak SAR (extrapolated) = 2.48 W/kg

SAR(1 g) = 1.37 mW/g

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

Maximum value of SAR (measured) = 1.45 mW/g



9.2 SAR Data Summary (CDMA835 Right Head Tilted Position)

Date of Test : Jun. 29. 2005
Mixture Type: 835MHz Head
Tissue Depth: 15.0 cm

Modulation	FREQUENCY		Power Drift(dB)	Device Test Position	Antenna Position	SAR (W/kg)
	CH	MHz				1g
CDMA	0363	835.89	0.143	Cheek / Tilted	Left/ Fixed	1.110

Notes:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration.
2. All modes of operation were investigated, and worst-case results are reported.
3. Battery is fully charged for all readings.
4. SAR Measurement System ☒ DASY4
5. Phantom Configuration ☐ Left Head ☐ Flat Phantom ☒ Right Head
6. SAR Configuration ☒ Head ☐ Body ☐ Hand
7. Test Signal Call Mode ☒ Manu. Test Codes ☐ Base Station Simulator
8. Battery Option ☒ Standard Type ☐ Slim Type



**Figure 9.2 Right Head SAR Test Setup
-- Ear / Tilted Position --**

Measurement Result of Test Data (CDMA835 Right Head Tilted Position)

Date/Time: 2005-06-29 12:00:37 Date/Time: 2005-06-29 12:04:16

Test Laboratory: Nemko Korea

File Name: [CH 363 RH Tilted Position.da4](#)

DUT: BCL862S Type: Bar Type Serial: 2004506 Applicant Name : Bellwave

Communication System: CDMA Frequency: 835.89 MHz

Duty Cycle: 1:1 Phantom section: Right Section

Medium parameters used (interpolated): $f = 835.89 \text{ MHz}$; $\sigma = 0.902 \text{ mho/m}$; $\epsilon_r = 42.5$; $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

Probe: ES3DV3 - SN3068; ConvF(5.91, 5.91, 5.91); Calibrated: 2005-04-11

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn672; Calibrated: 2005-03-02

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

CDMA 363 Right Tilted/Area Scan (5x8x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Maximum value of SAR (measured) = 0.698 mW/g

CDMA 363 Right Tilted/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

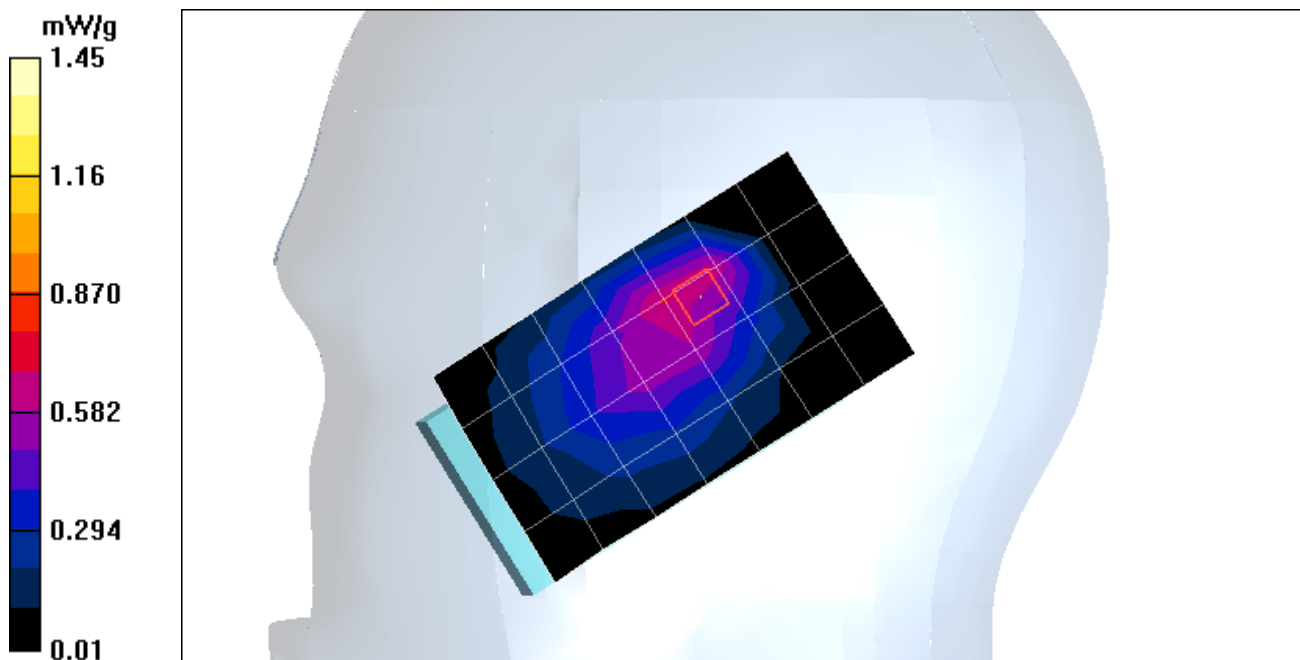
Reference Value = 21.1 V/m; Power Drift = 0.143 dB

Peak SAR (extrapolated) = 3.52 W/kg

SAR(1 g) = 1.11 mW/g

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

Maximum value of SAR (measured) = 1.45 mW/g



9.3 SAR Data Summary (CDMA835 Left Head Touch Position)

Date of Test : Jun. 29. 2005
Mixture Type: 835MHz Head
Tissue Depth: 15.0 cm

Modulation	FREQUENCY		Power Drift(dB)	Device Test Position	Antenna Position	SAR (W/kg)
	CH	MHz				1g
CDMA	1013	824.70	-0.040	Cheek / Touch	Left/ Fixed	0.725
	0363	835.89	-0.141	Cheek / Touch	Left/ Fixed	0.681
	0777	848.31	-0.082	Cheek / Touch	Left/ Fixed	1.120

Notes:

- The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration.
- All modes of operation were investigated, and worst-case results are reported.
- Battery is fully charged for all readings.
- SAR Measurement System ☒ DASY4
- Phantom Configuration ☒ Left Head ☐ Flat Phantom ☐ Right Head
- SAR Configuration ☒ Head ☐ Body ☐ Hand
- Test Signal Call Mode ☒ Manu. Test Codes ☐ Base Station Simulator
- Battery Option ☒ Standard Type ☐ Slim Type

**Figure 9.3 Left Head SAR Test Setup
-- Cheek / Touch Position --**



Measurement Result of Test Data (CDMA835 Left Head Touch Position)

Date/Time: 2005-06-29 2:23:32 Date/Time: 2005-06-29 2:27:12

Test Laboratory: Nemko Korea

File Name: [CH 1013 LH Touch Position.da4](#)

DUT: BCL862S Type: Bar Type Serial: 2004506 Applicant Name : Bellwave

Communication System: CDMA Frequency: 824.7 MHz

Duty Cycle: 1:1 Phantom section: Left Section

Medium parameters used (interpolated): $f = 824.7 \text{ MHz}$; $\sigma = 0.89 \text{ mho/m}$; $\epsilon_r = 42.7$; $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

Probe: ES3DV3 - SN3068; ConvF(5.91, 5.91, 5.91); Calibrated: 2005-04-11

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn672; Calibrated: 2005-03-02

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

CDMA 1013 Left Touch Position/Area Scan (5x8x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Maximum value of SAR (measured) = 0.764 mW/g

CDMA 1013 Left Touch Position/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

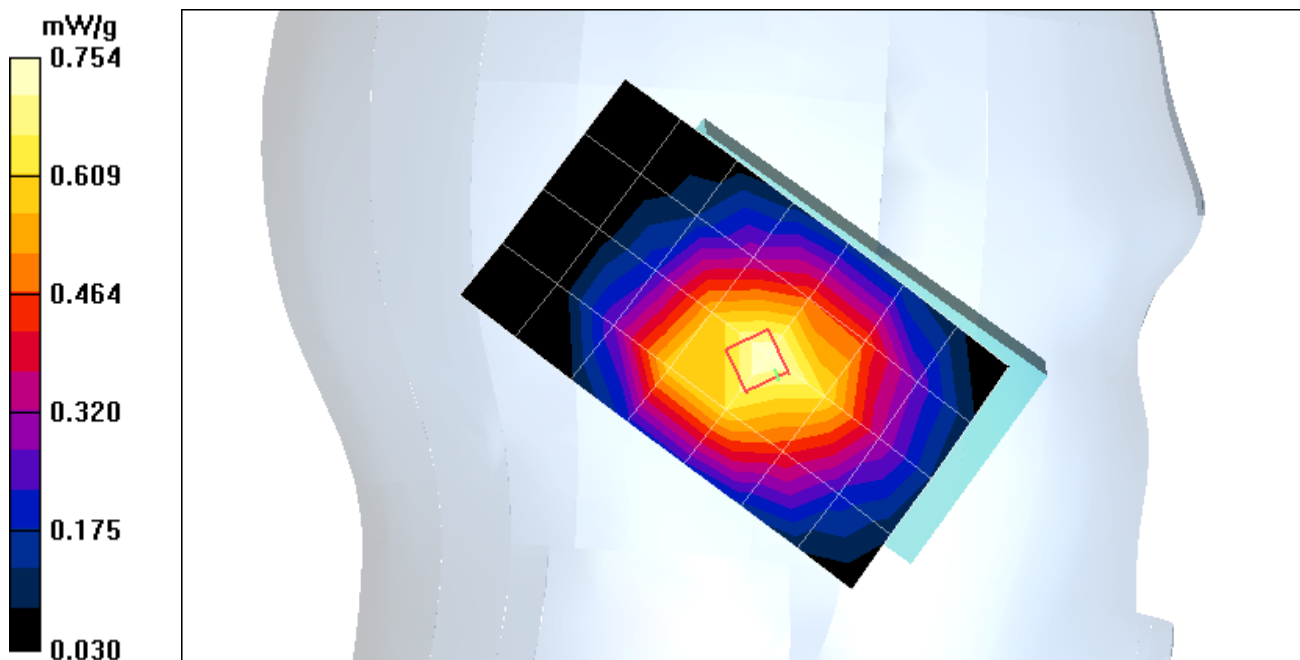
Reference Value = 21.3 V/m; Power Drift = -0.040 dB

Peak SAR (extrapolated) = 1.01 W/kg

SAR(1 g) = 0.725 mW/g

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

Maximum value of SAR (measured) = 0.754 mW/g



Date/Time: 2005-06-29 1:54:51Date/Time: 2005-06-29 1:58:32

Test Laboratory: Nemko Korea

File Name: [CH 363 LH Touch Position.da4](#)

DUT: BCL862S Type: Bar Type Serial: 2004506 Applicant Name : Bellwave

Communication System: CDMA Frequency: 835.89 MHz

Duty Cycle: 1:1 Phantom section: Left Section

Medium parameters used (interpolated): $f = 835.89 \text{ MHz}$; $\sigma = 0.902 \text{ mho/m}$; $\epsilon_r = 42.5$; $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

Probe: ES3DV3 - SN3068; ConvF(5.91, 5.91, 5.91); Calibrated: 2005-04-11

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn672; Calibrated: 2005-03-02

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

CDMA 363 Left Touch Position/Area Scan (5x8x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Maximum value of SAR (measured) = 0.769 mW/g

CDMA 363 Left Touch Position/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

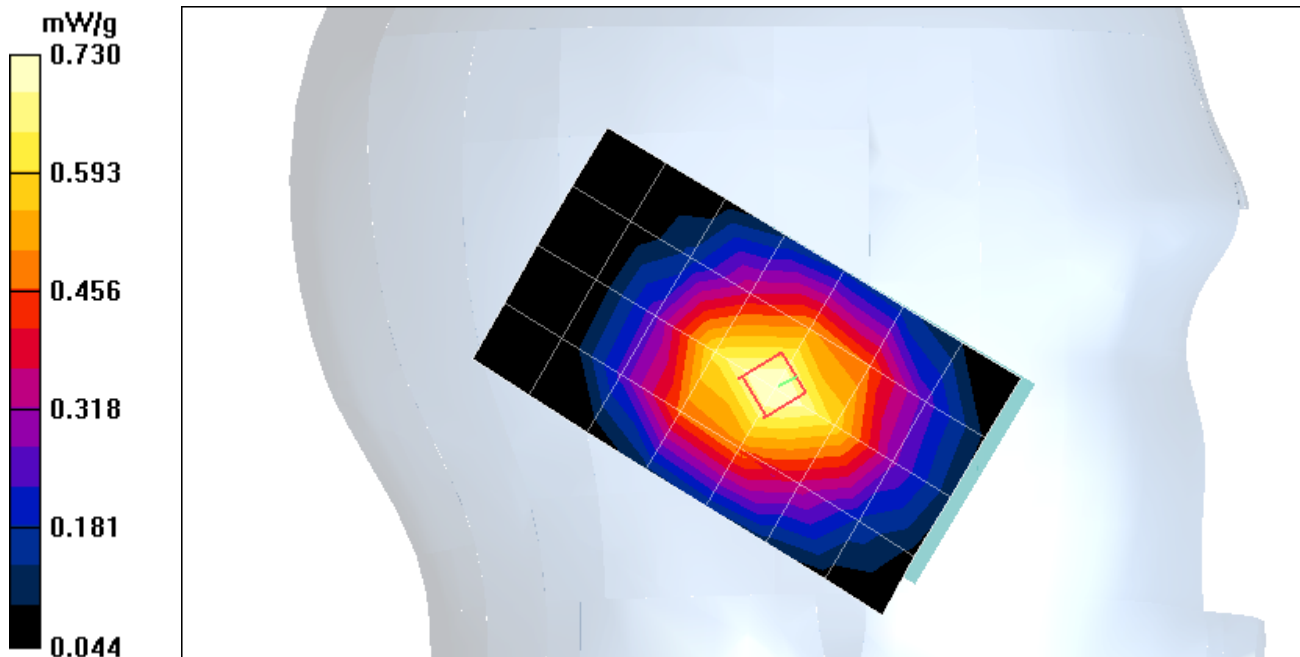
Reference Value = 22.5 V/m; Power Drift = -0.141 dB

Peak SAR (extrapolated) = 0.959 W/kg

SAR(1 g) = 0.681 mW/g

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

Maximum value of SAR (measured) = 0.730 mW/g



Date/Time: 2005-06-29 2:56:06 Date/Time: 2005-06-29 2:59:47

Test Laboratory: Nemko Korea

File Name: [CH 777 LH Touch Position.da4](#)

DUT: BCL862S Type: Bar Type Serial: 2004506 Applicant Name : Bellwave

Communication System: CDMA Frequency: 848.31 MHz

Duty Cycle: 1:1 Phantom section: Left Section

Medium parameters used (interpolated): $f = 848.31$ MHz; $\sigma = 0.918$ mho/m; $\epsilon_r = 42.3$; $\rho = 1000$ kg/m³

DASY4 Configuration:

Probe: ES3DV3 - SN3068; ConvF(5.91, 5.91, 5.91); Calibrated: 2005-04-11

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn672; Calibrated: 2005-03-02

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

CDMA 777 Left Touch Position/Area Scan (5x8x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 1.24 mW/g

CDMA 777 Left Touch Position/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

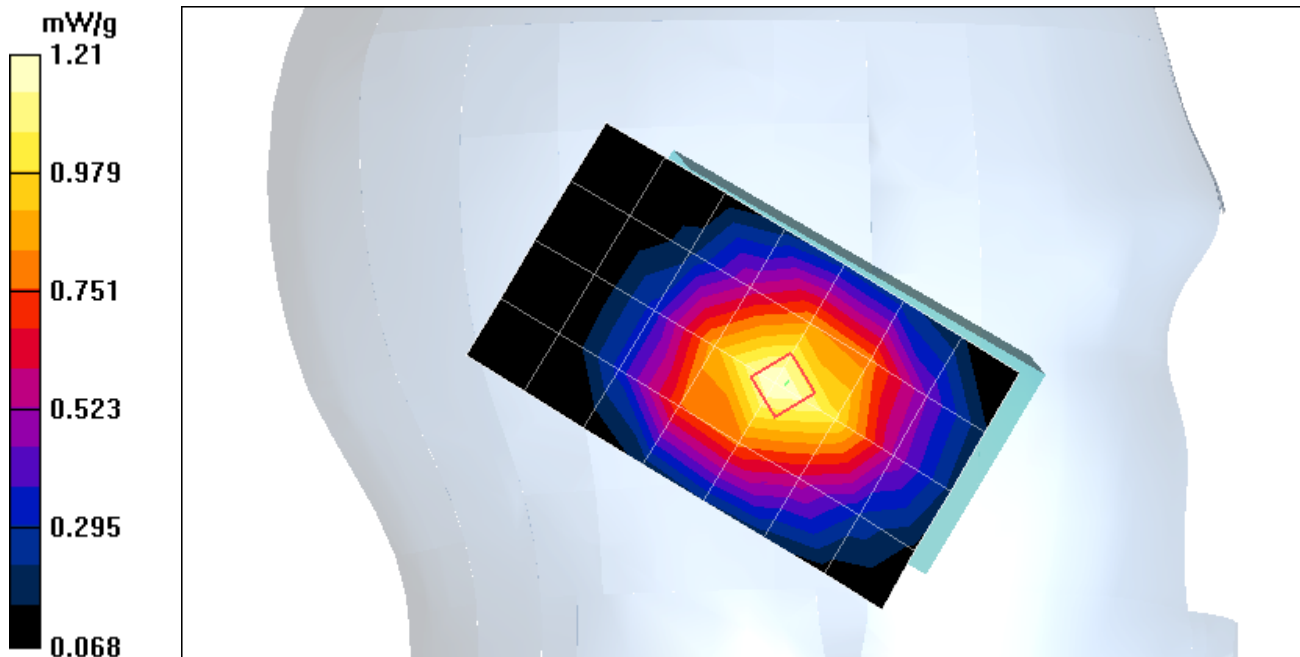
Reference Value = 26.3 V/m; Power Drift = -0.082 dB

Peak SAR (extrapolated) = 1.59 W/kg

SAR(1 g) = 1.12 mW/g

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

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



9.4 SAR Data Summary (CDMA835 Left Head Tilted Position)

Date of Test : Jun. 29. 2005
Mixture Type: 835MHz Head
Tissue Depth: 15.0 cm

Modulation	FREQUENCY		Power Drift(dB)	Device Test Position	Antenna Position	SAR (W/kg)
	CH	MHz				1g
CDMA	0363	835.89	0.197	Cheek / Tilted	Left/ Fixed	0.602

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 worst-case results are reported.
3. Battery is fully charged for all readings.
4. SAR Measurement System ☒ DASY4
5. Phantom Configuration ☒ Left Head ☐ Flat Phantom ☐ Right Head
6. SAR Configuration ☒ Head ☐ Body ☐ Hand
7. Test Signal Call Mode ☒ Manu. Test Codes ☐ Base Station Simulator
8. Battery Option ☒ Standard Type ☐ Slim Type

Figure 9.4 Left Head SAR Test Setup
-- Ear / Tilted Position --



Measurement Result of Test Data (CDMA835 Left Head Tilted Position)

Date/Time: 2005-06-29 2:07:26 Date/Time: 2005-06-29 2:11:08

Test Laboratory: Nemko Korea

File Name: [CH 363 LH Tilted Position.da4](#)

DUT: BCL862S Type: Bar Type Serial: 2004506 Applicant Name : Bellwave

Communication System: CDMA Frequency: 835.89 MHz

Duty Cycle: 1:1 Phantom section: Left Section

Medium parameters used (interpolated): $f = 835.89 \text{ MHz}$; $\sigma = 0.902 \text{ mho/m}$; $\epsilon_r = 42.5$; $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

Probe: ES3DV3 - SN3068; ConvF(5.91, 5.91, 5.91); Calibrated: 2005-04-11

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn672; Calibrated: 2005-03-02

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

CDMA 363 Left Tilted Position/Area Scan (5x8x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Maximum value of SAR (measured) = 0.556 mW/g

CDMA 363 Left Tilted Position/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

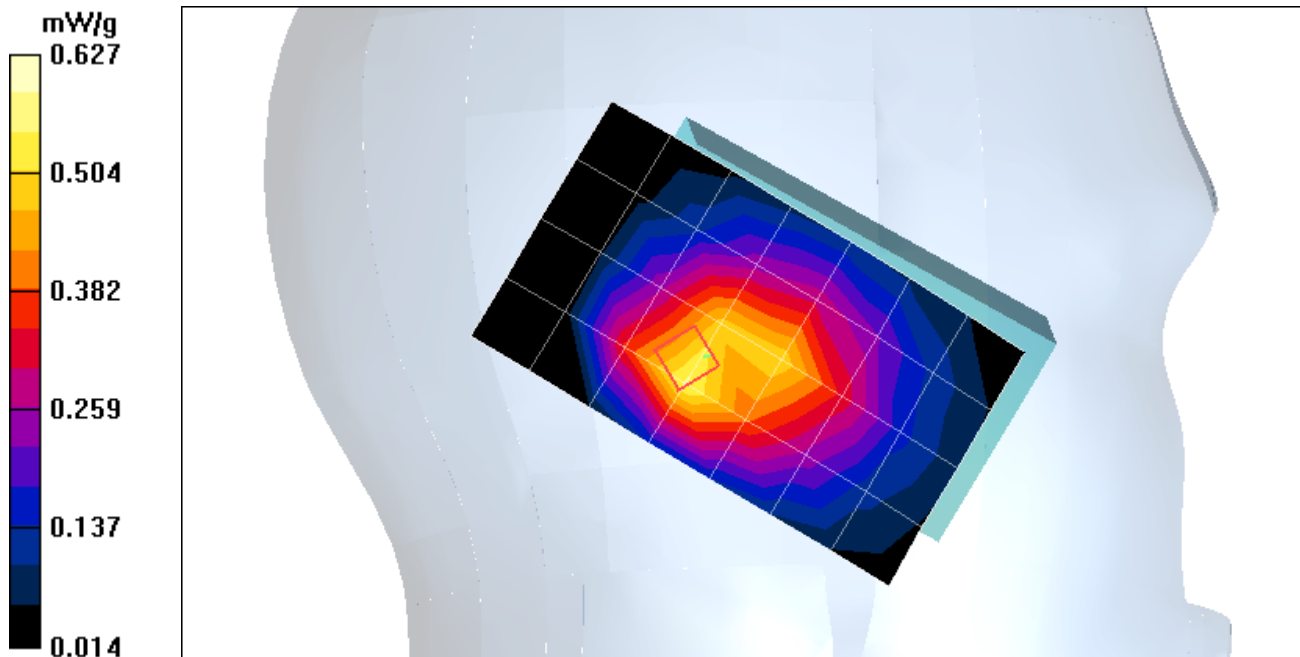
Reference Value = 19.9 V/m; Power Drift = 0.197 dB

Peak SAR (extrapolated) = 1.19 W/kg

SAR(1 g) = 0.602 mW/g

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

Maximum value of SAR (measured) = 0.627 mW/g



9.5 SAR Data Summary (CDMA835 Muscle -15mm Distance- Position)

Date of Test : Jun. 29. 2005
Mixture Type: 835MHz Muscle
Tissue Depth: 15.3 cm

Modulation	FREQUENCY		Power Drift(dB)	Device Test Position	Antenna Position	SAR (W/kg)
	CH	MHz				1g
CDMA	1013	824.70	0.087	15mm Distance	Left/ Fixed	0.229
	0363	835.89	-0.017	15mm Distance	Left/ Fixed	0.156
	0777	848.31	0.124	15mm Distance	Left/ Fixed	0.262

Notes:

- The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration.
- All modes of operation were investigated, and worst-case results are reported.
- Battery is fully charged for all readings.
- SAR Measurement System ☒ DASY4
- Phantom Configuration ☐ Left Head ☒ Flat Phantom ☐ Right Head
- SAR Configuration ☐ Head ☒ Muscle ☐ Hand
- Test Signal Call Mode ☒ Manu. Test Codes ☐ Base Station Simulator
- Battery Option ☒ Standard Type ☐ Slim Type



**Figure 9.5 Muscle SAR Test Setup
-- 15mm Distance Position --**

Measurement Result of Test Data (CDMA835 Muscle -15mm Distance- Position)

Date/Time: 2005-06-29 9:00:05 Date/Time: 2005-06-29 9:04:28

Test Laboratory: Nemko Korea

File Name: [CH 1013 Muscle 15mm.da4](#)

DUT: BCL862S Type: Bar Type Serial: 2004506 Applicant Name : Bellwave

Communication System: CDMA Frequency: 824.7 MHz

Duty Cycle: 1:1 Phantom section: Flat Section

Medium parameters used (interpolated): $f = 824.7 \text{ MHz}$; $\sigma = 0.975 \text{ mho/m}$; $\epsilon_r = 54.1$; $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

Probe: ES3DV3 - SN3068; ConvF(5.9, 5.9, 5.9); Calibrated: 2005-04-11

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn672; Calibrated: 2005-03-02

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

CDMA 1013 Body 15mm/Area Scan (7x7x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Maximum value of SAR (measured) = 0.233 mW/g

CDMA 1013 Body 15mm/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

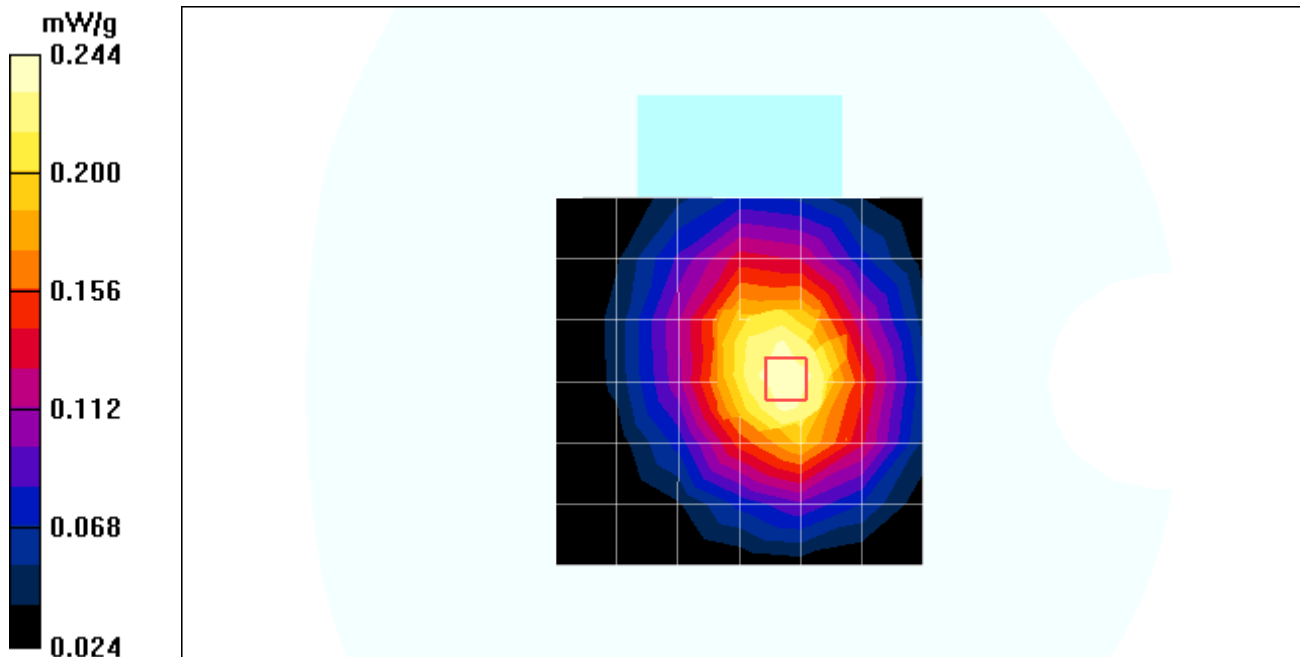
Reference Value = 14.7 V/m; Power Drift = 0.087 dB

Peak SAR (extrapolated) = 0.310 W/kg

SAR(1 g) = 0.229 mW/g

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

Maximum value of SAR (measured) = 0.244 mW/g



Date/Time: 2005-06-29 8:45:33 Date/Time: 2005-06-29 8:49:53

Test Laboratory: Nemko Korea

File Name: [CH 363 Muscle 15mm.da4](#)

DUT: BCL862S Type: Bar Type Serial: 2004506 Applicant Name : Bellwave

Communication System: CDMA Frequency: 835.89 MHz

Duty Cycle: 1:1 Phantom section: Flat Section

Medium parameters used (interpolated): $f = 835.89 \text{ MHz}$; $\sigma = 0.987 \text{ mho/m}$; $\epsilon_r = 54$; $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

Probe: ES3DV3 - SN3068; ConvF(5.9, 5.9, 5.9); Calibrated: 2005-04-11

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn672; Calibrated: 2005-03-02

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

CDMA 363 Body 15mm/Area Scan (7x7x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Maximum value of SAR (measured) = 0.157 mW/g

CDMA 363 Body 15mm/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

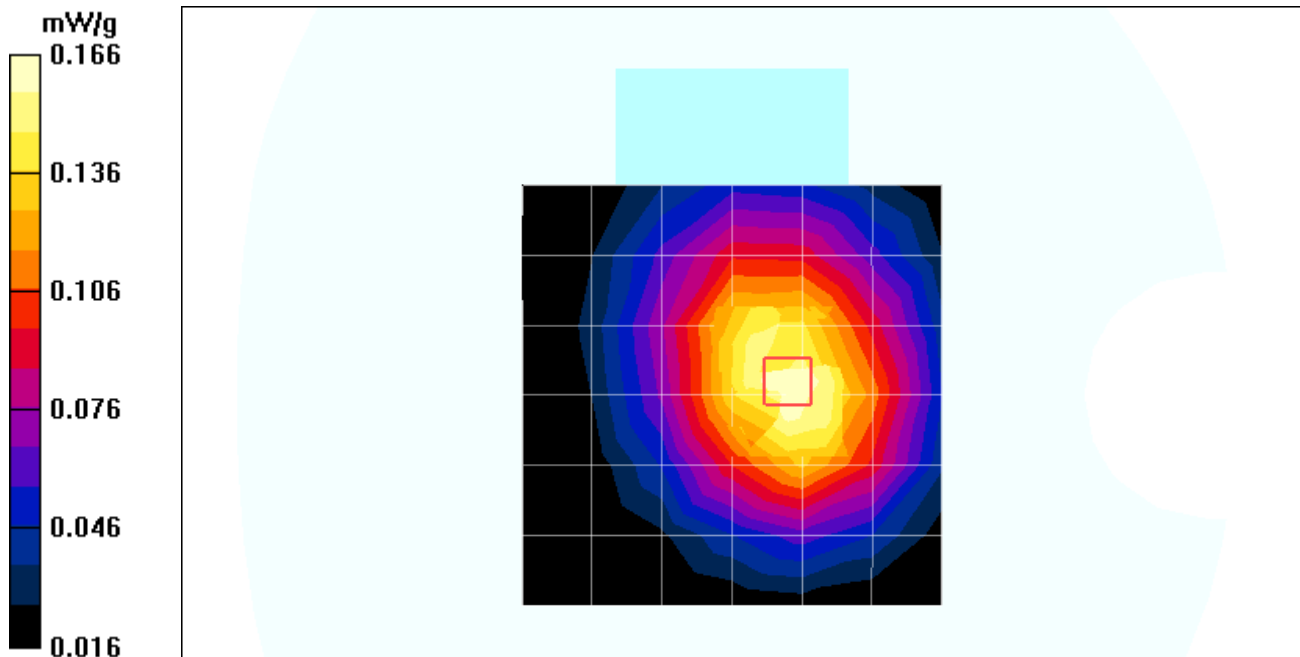
Reference Value = 11.9 V/m; Power Drift = -0.017 dB

Peak SAR (extrapolated) = 0.211 W/kg

SAR(1 g) = 0.156 mW/g

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

Maximum value of SAR (measured) = 0.166 mW/g



Date/Time: 2005-06-29 9:31:53Date/Time: 2005-06-29 9:36:14

Test Laboratory: Nemko Korea

File Name: [CH 777 Muscle 15mm.da4](#)

DUT: BCL862S Type: Bar Type Serial: 2004506 Applicant Name : Bellwave

Communication System: CDMA Frequency: 848.31 MHz

Duty Cycle: 1:1 Phantom section: Flat Section

Medium parameters used (interpolated): $f = 848.31$ MHz; $\sigma = 0.998$ mho/m; $\epsilon_r = 53.9$; $\rho = 1000$ kg/m³

DASY4 Configuration:

Probe: ES3DV3 - SN3068; ConvF(5.9, 5.9, 5.9); Calibrated: 2005-04-11

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn672; Calibrated: 2005-03-02

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

CDMA 777 Body 15mm/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 0.269 mW/g

CDMA 777 Body 15mm/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

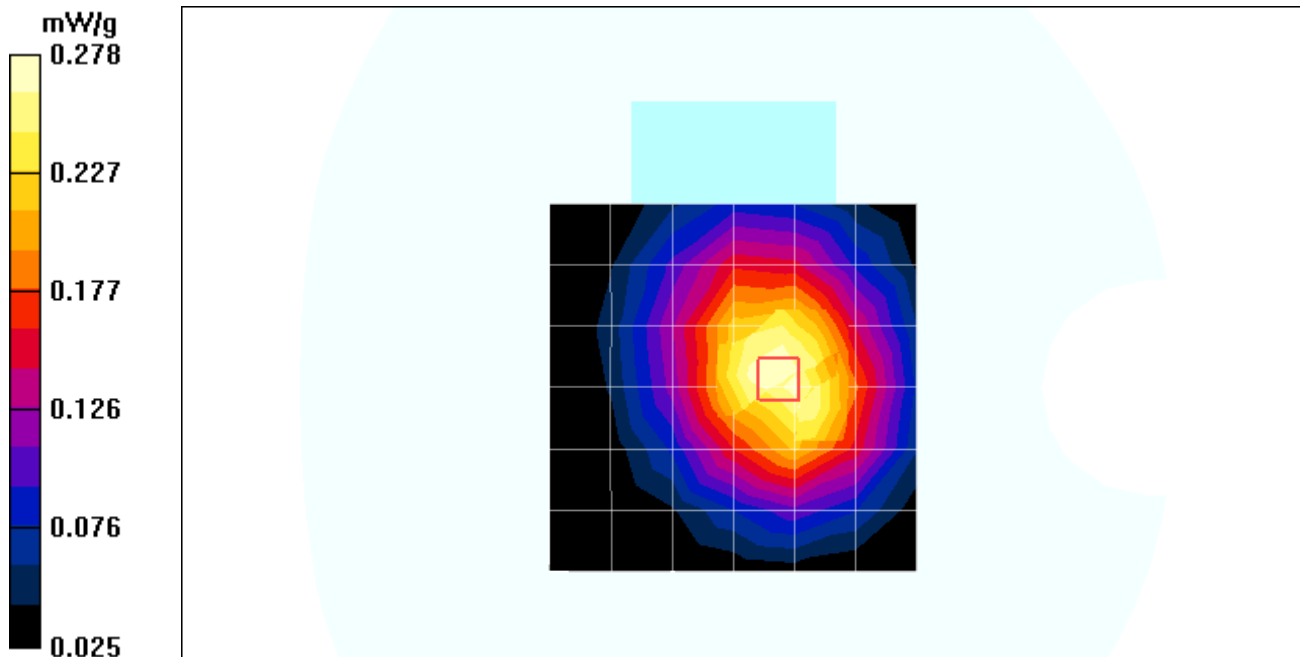
Reference Value = 15.4 V/m; Power Drift = 0.124 dB

Peak SAR (extrapolated) = 0.356 W/kg

SAR(1 g) = 0.262 mW/g

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

Maximum value of SAR (measured) = 0.278 mW/g



9.6 SAR Data Summary (CDMA835 Muscle -15mm Distance- with headset Position)

Date of Test : Jun. 30. 2005
Mixture Type: 835MHz Muscle
Tissue Depth: 15.3 cm

Modulation	FREQUENCY		Power Drift(dB)	Device Test Position	Antenna Position	SAR (W/kg)
	CH	MHz				1g
CDMA	0777	848.31	0.187	15mm Distance with Headset	Left/ Fixed	0.193

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 worst-case results are reported.
3. Battery is fully charged for all readings.
4. SAR Measurement System ☒ DASY4
5. Phantom Configuration ☐ Left Head ☒ Flat Phantom ☐ Right Head
6. SAR Configuration ☐ Head ☒ Muscle ☐ Hand
7. Test Signal Call Mode ☒ Manu. Test Codes ☐ Base Station Simulator
8. Battery Option ☒ Standard Type ☐ Slim Type

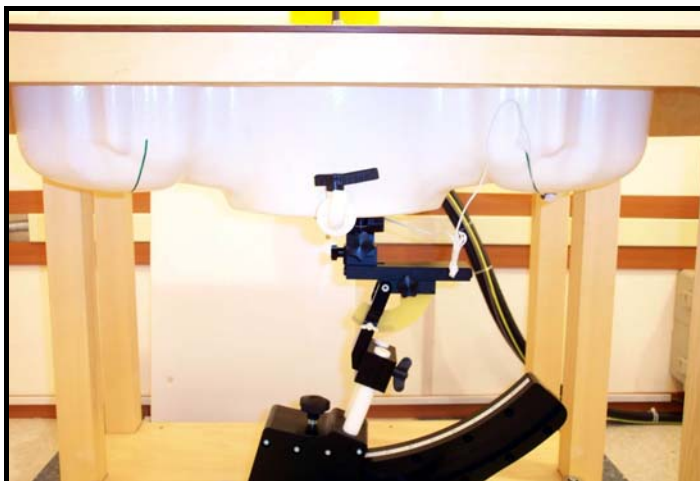


Figure 9.6 Muscle SAR Test Setup
-- 15mm Distance with headset Position --

Measurement Result of Test Data (CDMA835 Muscle -15mm Distance- Position)

Date/Time: 2005-06-30 9:22:45 Date/Time: 2005-06-30 9:27:04

Test Laboratory: Nemko Korea

File Name: [CH 777 Muscle 15mm with headset.da4](#)

DUT: BCL862S Type: Bar Type Serial: 2004506 Applicant Name : Bellwave

Communication System: CDMA Frequency: 848.31 MHz

Duty Cycle: 1:1 Phantom section: Flat Section

Medium parameters used (interpolated): $f = 848.31$ MHz; $\sigma = 0.998$ mho/m; $\epsilon_r = 53.9$; $\rho = 1000$ kg/m³

DASY4 Configuration:

Probe: ES3DV3 - SN3068; ConvF(5.9, 5.9, 5.9); Calibrated: 2005-04-11

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn672; Calibrated: 2005-03-02

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

CDMA 777 Body 15mm with headset/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 0.195 mW/g

CDMA 777 Body 15mm with headset/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

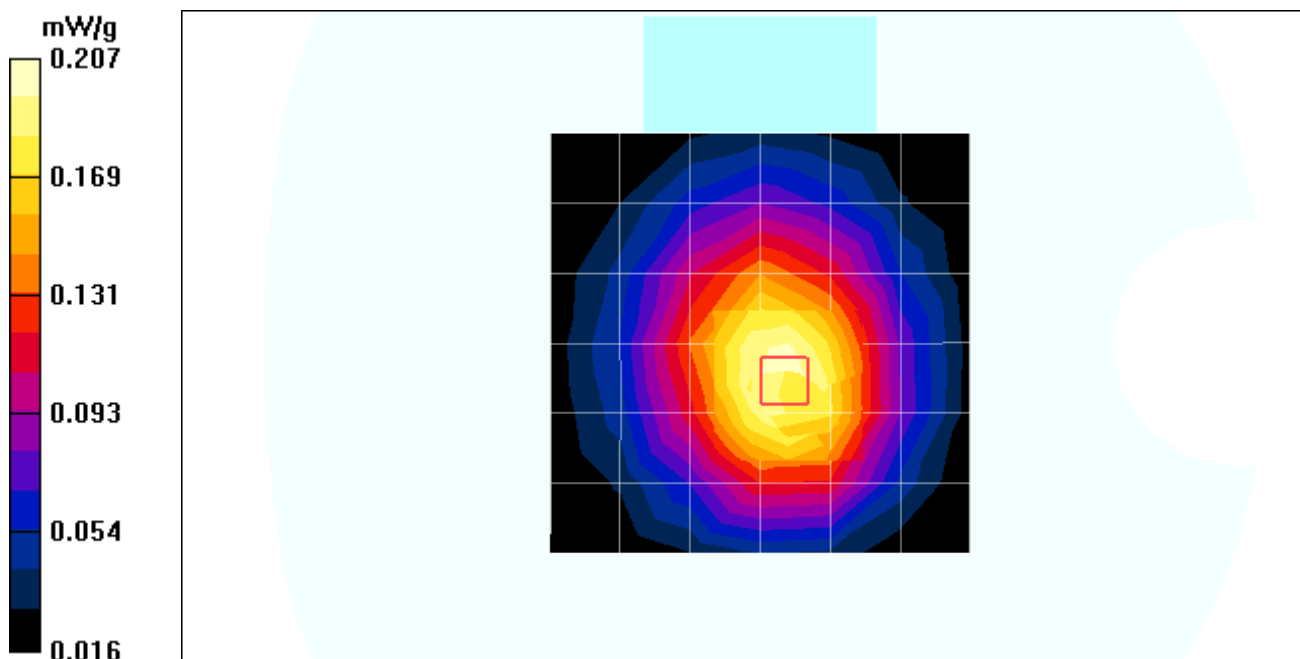
Reference Value = 14.0 V/m; Power Drift = 0.187 dB

Peak SAR (extrapolated) = 0.268 W/kg

SAR(1 g) = 0.193 mW/g

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

Maximum value of SAR (measured) = 0.207 mW/g



9.7 SAR Data Summary (CDMA835 Muscle Touch Position)

Date of Test : Jun. 29. 2005 to Jun. 30. 2005
Mixture Type: 835MHz Muscle
Tissue Depth: 15.3 cm

Modulation	FREQUENCY		Power Drift(dB)	Device Test Position	Antenna Position	SAR (W/kg)
	CH	MHz				1g
CDMA	1013	824.70	0.042	Body / Touch	Left/ Fixed	1.170
	0363	835.89	-0.045	Body / Touch	Left/ Fixed	0.722
	0777	848.31	-0.119	Body / Touch	Left/ Fixed	1.200

Notes:

- The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration.
- All modes of operation were investigated, and worst-case results are reported.
- Battery is fully charged for all readings.
- SAR Measurement System ☒ DASY4
- Phantom Configuration ☐ Left Head ☒ Flat Phantom ☐ Right Head
- SAR Configuration ☐ Head ☒ Muscle ☐ Hand
- Test Signal Call Mode ☒ Manu. Test Codes ☐ Base Station Simulator
- Battery Option ☒ Standard Type ☐ Slim Type



**Figure 9.5 Muscle SAR Test Setup
-- Touch Position --**

Measurement Result of Test Data (CDMA835 Muscle Touch Position)

Date/Time: 2005-06-30 9:04:39 Date/Time: 2005-06-30 9:08:58

Test Laboratory: Nemko Korea

File Name: [CH 1013 Touch.da4](#)

DUT: BCL862S Type: Bar Type Serial: 2004506 Applicant Name : Bellwave

Communication System: CDMA Frequency: 824.7 MHz

Duty Cycle: 1:1 Phantom section: Flat Section

Medium parameters used (interpolated): $f = 824.7$ MHz; $\sigma = 0.975$ mho/m; $\epsilon_r = 54.1$; $\rho = 1000$ kg/m³

DASY4 Configuration:

Probe: ES3DV3 - SN3068; ConvF(5.9, 5.9, 5.9); Calibrated: 2005-04-11

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn672; Calibrated: 2005-03-02

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

CDMA 1013 Body Touch/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 1.16 mW/g

CDMA 1013 Body Touch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

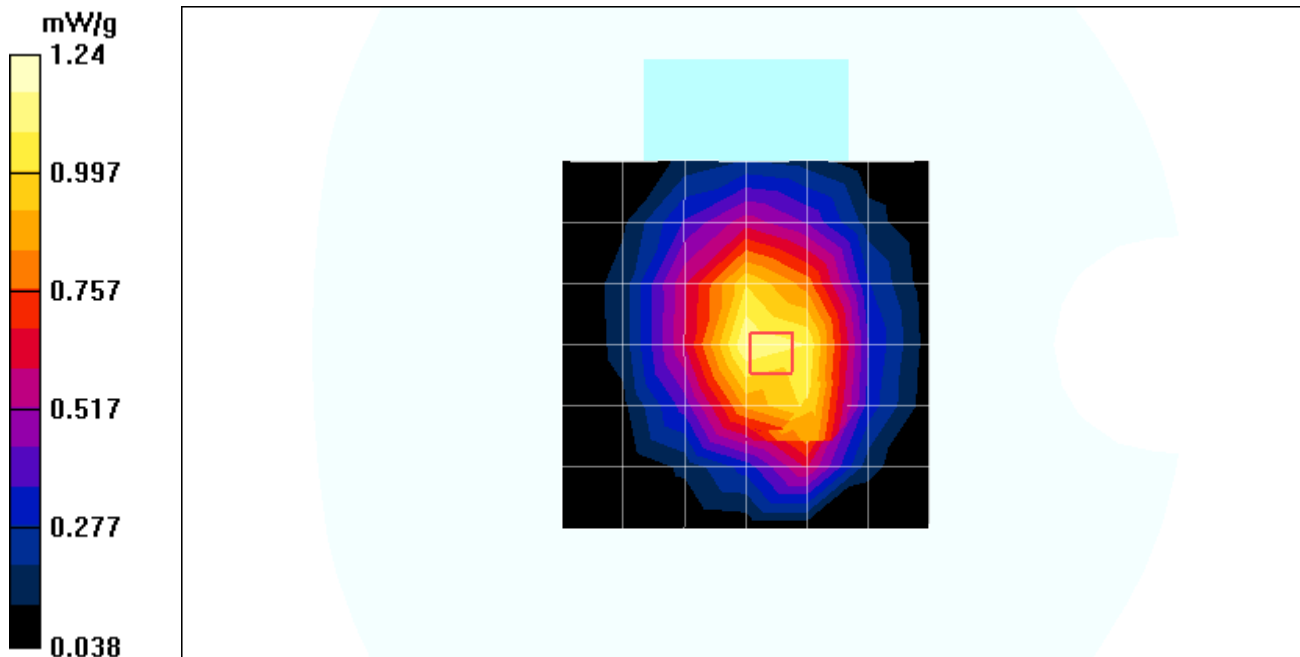
Reference Value = 35.3 V/m; Power Drift = 0.042 dB

Peak SAR (extrapolated) = 1.72 W/kg

SAR(1 g) = 1.17 mW/g

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

Maximum value of SAR (measured) = 1.24 mW/g



Date/Time: 2005-06-29 11:09:20Date/Time: 2005-06-29 11:13:37

Test Laboratory: Nemko Korea

File Name: [CH 363 Touch.da4](#)

DUT: BCL862S Type: Bar Type Serial: 2004506 Applicant Name : Bellwave

Communication System: CDMA Frequency: 835.89 MHz

Duty Cycle: 1:1 Phantom section: Flat Section

Medium parameters used (interpolated): $f = 835.89 \text{ MHz}$; $\sigma = 0.987 \text{ mho/m}$; $\epsilon_r = 54$; $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

Probe: ES3DV3 - SN3068; ConvF(5.9, 5.9, 5.9); Calibrated: 2005-04-11

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn672; Calibrated: 2005-03-02

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

CDMA 363 Body Touch/Area Scan (7x7x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Maximum value of SAR (measured) = 0.742 mW/g

CDMA 363 Body Touch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

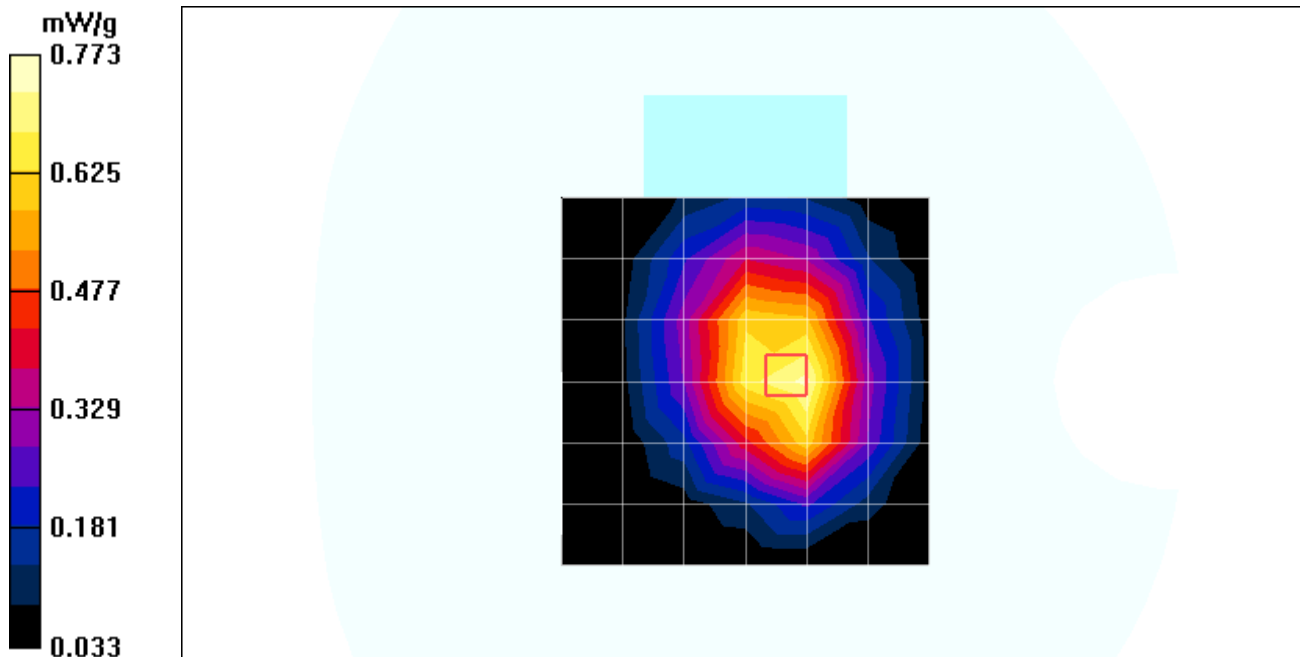
Reference Value = 26.1 V/m; Power Drift = -0.045 dB

Peak SAR (extrapolated) = 1.06 W/kg

SAR(1 g) = 0.722 mW/g

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

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



Date/Time: 2005-06-29 10:43:52 Date/Time: 2005-06-29 10:48:14

Test Laboratory: Nemko Korea

File Name: [CH 777 Touch.da4](#)

DUT: BCL862S Type: Bar Type Serial: 2004506 Applicant Name : Bellwave

Communication System: CDMA Frequency: 848.31 MHz

Duty Cycle: 1:1 Phantom section: Flat Section

Medium parameters used (interpolated): $f = 848.31$ MHz; $\sigma = 0.998$ mho/m; $\epsilon_r = 53.9$; $\rho = 1000$ kg/m³

DASY4 Configuration:

Probe: ES3DV3 - SN3068; ConvF(5.9, 5.9, 5.9); Calibrated: 2005-04-11

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn672; Calibrated: 2005-03-02

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

CDMA 777 Body Touch/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm

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

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

CDMA 777 Body Touch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

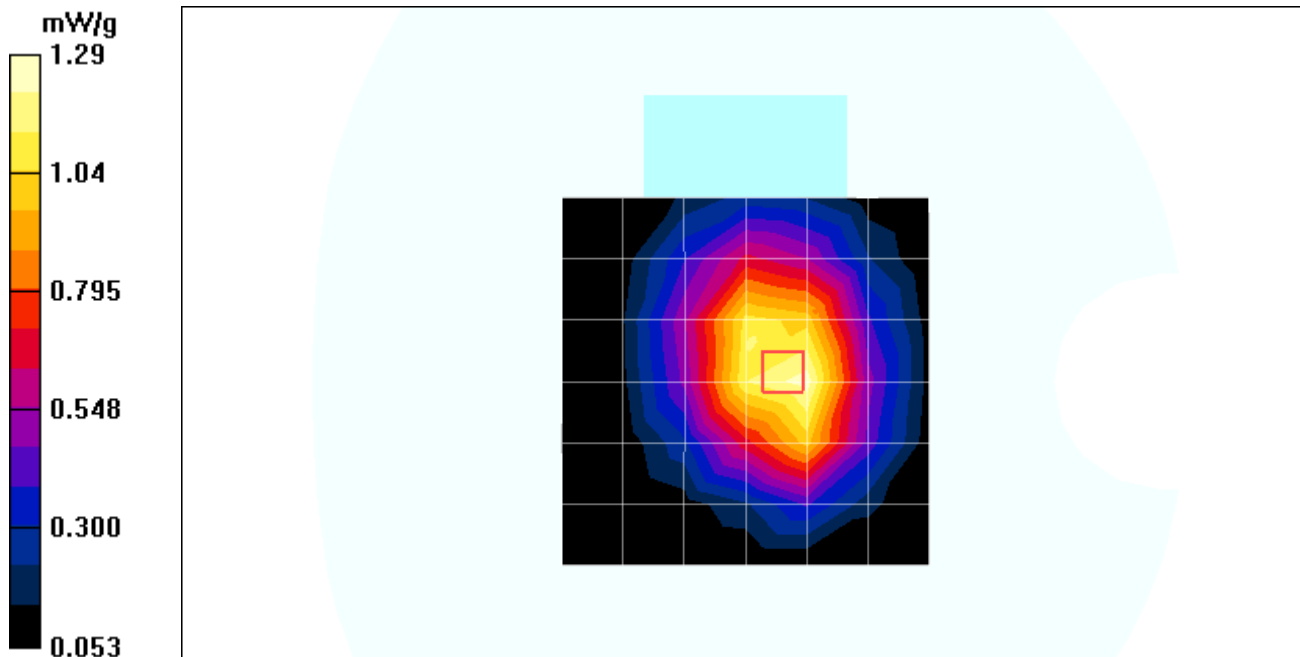
Reference Value = 34.3 V/m; Power Drift = -0.119 dB

Peak SAR (extrapolated) = 1.76 W/kg

SAR(1 g) = 1.2 mW/g

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

Maximum value of SAR (measured) = 1.29 mW/g



9.8 SAR Data Summary (CDMA835 Muscle Touch Position with headset)

Date of Test : Jun. 29. 2005
Mixture Type: 835MHz Muscle
Tissue Depth: 15.3 cm

Modulation	FREQUENCY		Power Drift(dB)	Device Test Position	Antenna Position	SAR (W/kg)
	CH	MHz				1g
CDMA	0777	848.31	-0.168	Body / Touch	Left/ Fixed	1.020

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 worst-case results are reported.
3. Battery is fully charged for all readings.
4. SAR Measurement System ☒ DASY4
5. Phantom Configuration ☐ Left Head ☒ Flat Phantom ☐ Right Head
6. SAR Configuration ☐ Head ☒ Muscle ☐ Hand
7. Test Signal Call Mode ☒ Manu. Test Codes ☐ Base Station Simulator
8. Battery Option ☒ Standard Type ☐ Slim Type

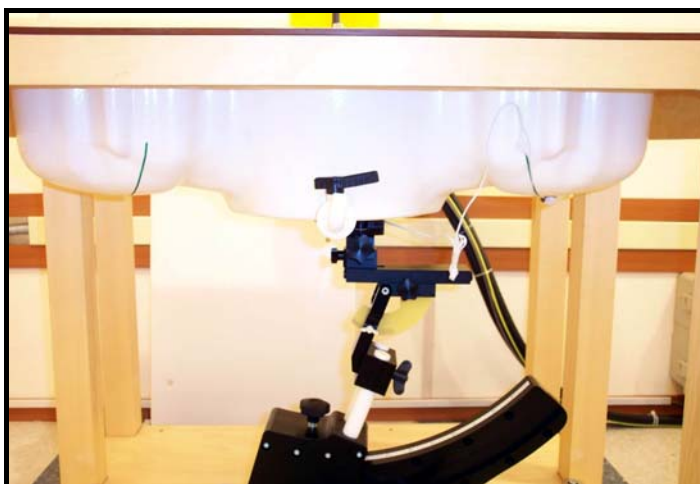


Figure 9.6 Muscle SAR Test Setup
-- Touch Position with headset --

Measurement Result of Test Data (CDMA835 Touch Position with Headset)

Date/Time: 2005-06-29 10:10:05 Date/Time: 2005-06-29 10:14:25

Test Laboratory: Nemko Korea

File Name: [CH 777 Touch with headset.da4](#)

DUT: BCL862S Type: Bar Type Serial: 2004506 Applicant Name : Bellwave

Communication System: CDMA Frequency: 848.31 MHz

Duty Cycle: 1:1 Phantom section: Flat Section

Medium parameters used (interpolated): $f = 848.31 \text{ MHz}$; $\sigma = 0.998 \text{ mho/m}$; $\epsilon_r = 53.9$; $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

Probe: ES3DV3 - SN3068; ConvF(5.9, 5.9, 5.9); Calibrated: 2005-04-11

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn672; Calibrated: 2005-03-02

Phantom: SAM Phantom; Type: SAM; Serial: TP-1358

Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

CDMA 777 Body Touch with headset/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 1.12 mW/g

CDMA 777 Body Touch with headset/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

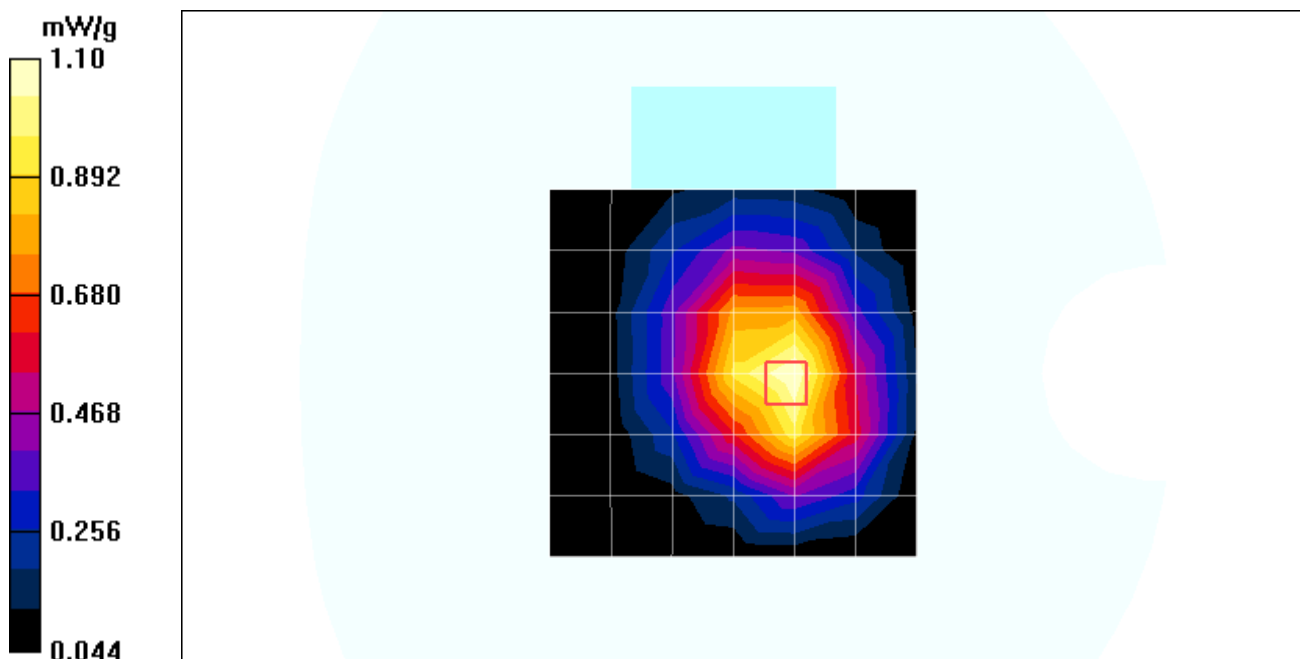
Reference Value = 30.8 V/m; Power Drift = -0.168 dB

Peak SAR (extrapolated) = 1.55 W/kg

SAR(1 g) = 1.02 mW/g

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

Maximum value of SAR (measured) = 1.10 mW/g



10. SAR Test Equipment

Equipment Calibration

Table 10.1 Test Equipment Calibration

Description	Model	Serial No.	Calibration Date
Staubli Robot Unit	RX60L	F05/51E1A1/A/01	Mar. 2005
Data Acquisition Electronics	DAE4	672	Mar. 2005
E-Field Probe	ES3DV3	3068	Apr. 2005
Electro-Optical Converter	EOC3	398	Mar. 2005
SAM Twin Phantom V4.0C	TP-1358	SM 00 T02 DA	Mar. 2005
Validation Dipole Antenna	D450V2	1022	Mar. 2005
Validation Dipole Antenna	D835V2	4d017	Apr. 2005
Validation Dipole Antenna	D900V2	1d016	Apr. 2005
Validation Dipole Antenna	D1800V2	2d111	Apr. 2005
Validation Dipole Antenna	D1900V2	5d059	Apr. 2005
Validation Dipole Antenna	D2450V2	774	Apr. 2005
Wireless Communications Test Set	8960 Series 10	GB43193659	Jun. 2005
Dielectric Probe Kit	85070E	MY44300121	Apr. 2005
Network Analyzer	8753ES	US39171172	Mar. 2005
Power Amplifier	NKRFSPA	NK00SP18	Jun. 2005
Power Meter	437B	2912U01687	Dec. 2004
Power Sensor	8481A	836019/028	Aug. 2004
Power Meter	NRVS	835360/002	Dec. 2004
Power Sensor	NRV-Z32	836019/028	Dec. 2004
Series Signal Generator	E4436B	US39260598	Jan. 2005

Note:

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

11. References

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- [2] Federal Communications Commission, OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01), *Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields*, July 2001.
- [3] ANSI/IEEE C95.3 – 1991, *IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave*, New York: IEEE, 1992.
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- [5] ANSI/IEEE C95.1 – 1991, *American National Standard Safety levels with respect to human exposure to radio frequency electromagnetic fields, 300kHz to 100GHz*, New York: : IEEE, Aug. 1992.
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- [9] K. Pokovic, T.Schmid, N. Kuster, *Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies*, ICECOM97, Oct. 1997, pp. 120-124.
- [10] G.Hartsgrrove, A. raszewski, A. Surowiec, *Simulated Biological Materials for Electromagnetic Radiation Absorption Studies*, University of Ottawa, Bioelectromagnetics, Canada: 1987, pp. 29-36
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- [13] K. Pokovic, T.Schmid, N. Kuster, *E-field Probe with improved isotropy in brain simulating liquids*, Proceedings of the ELMAR, Zadar, June 23-25, 1996, pp. 172-175.
- [14] Schmid & Partner Engineering AG, Application Note: Data Storage and Evaluation, June 1998, p2.
- [15] V. Hombach, K.Meier, M. Burkhardt, E. Kuhn, N. Kuster, *The Dependence of EM Energy Absorption upon Human Head Modeling at 900MHz*, IEEE Transaction on Microwave Theory and Techniques, vol 44 no. 10, Oct. 1996, pp. 1865-1873.
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- [17] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp.645-652.

APPENDIX A

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 (p). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Fig. A.1).

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

Figure A.1 SAR Mathematical Equation

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

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

Where :

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

Note:

The primary factors that control rate or 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.

SAR Limit

In this report the comparison between the measured data and exposure limits defined in the ICNIRP Guidelines is made using the spatial peak SAR: the power level of the device under test guarantees that the whole body averaged SAR is not exceeded

Having in mind a worst-case consideration, the SAR limit is valid for general public exposure and for exposure times longer than 6 minutes [ICNIRP 1998].
According to Table 1 the SAR values have to be averaged over a mass of 10g with the shape of a cube

Table .1 Relevant spatial peak SAR limit averaged over a mass of 1g / 10g

Standard	SAR Limit [W/kg]
OET Bulletin 65 Supplement C	1.6

APPENDIX B : Probe Calibration

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



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

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

Accreditation No.: **SCS 108**

Client **Nemko (Dymstec)**

Certificate No: **ES3-3068_Apr05**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3068**

Calibration procedure(s) **QA CAL-01.v5 and QA CAL-12.v4
Calibration procedure for dosimetric E-field probes**

Calibration date: **April 11, 2005**

Condition of the calibrated item **In Tolerance**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	5-May-04 (METAS, No. 251-00388)	May-05
Power sensor E4412A	MY41495277	5-May-04 (METAS, No. 251-00388)	May-05
Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-04 (METAS, No. 251-00403)	Aug-05
Reference 20 dB Attenuator	SN: S5086 (20b)	3-May-04 (METAS, No. 251-00389)	May-05
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-04 (METAS, No. 251-00404)	Aug-05
Reference Probe ES3DV2	SN: 3013	7-Jan-05 (SPEAG, No. ES3-3013_Jan05)	Jan-06
DAE4	SN: 617	19-Jan-05 (SPEAG, No. DAE4-617_Jan05)	Jan-06

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

Calibrated by:

Approved by:

Name: Nico Vetterli

Katja Pokovic

Function: Laboratory Technician

Technical Manager

Signature: 



Issued: April 12, 2005

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

Certificate No: ES3-3068_Apr05

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



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

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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001

Methods Applied and Interpretation of Parameters:

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

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April 11, 2005

Probe ES3DV3

SN:3068

Manufactured:	December 14, 2004
Calibrated:	April 11, 2005

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

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DASY - Parameters of Probe: ES3DV3 SN:3068

Sensitivity in Free Space^A

Diode Compression^B

NormX	1.31 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	97 mV
NormY	1.18 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	97 mV
NormZ	1.19 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	97 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	5.8	2.5
SAR _{be} [%]	With Correction Algorithm	0.0	0.2

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	7.9	4.7
SAR _{be} [%]	With Correction Algorithm	0.1	0.3

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 E²-field uncertainty inside TSL (see Page 8).

^B Numerical linearization parameter: uncertainty not required.

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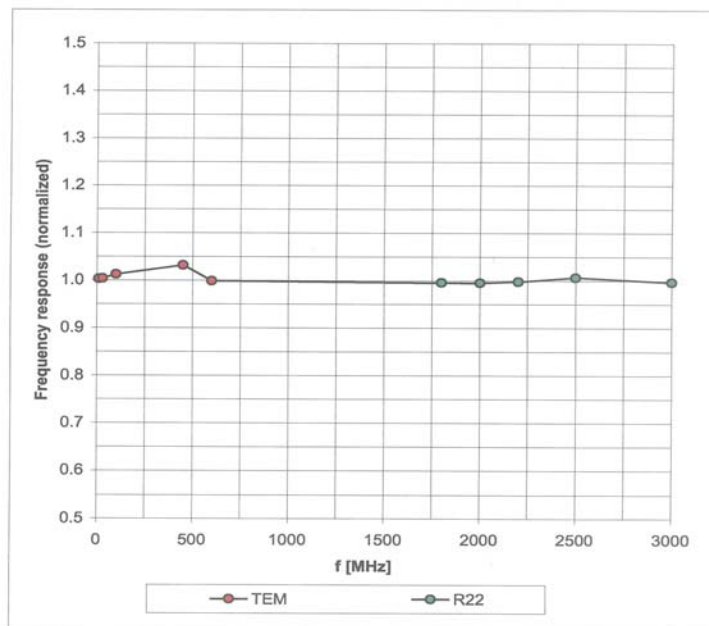
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Frequency Response of E-Field

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

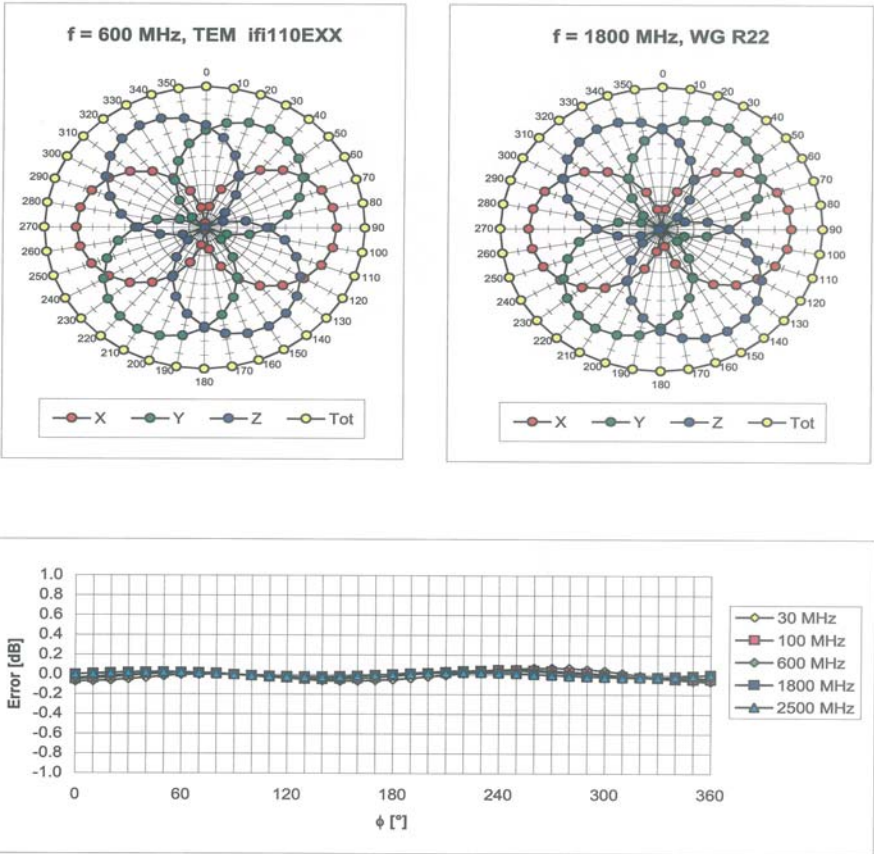


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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Receiving Pattern (ϕ), $\theta = 0^\circ$

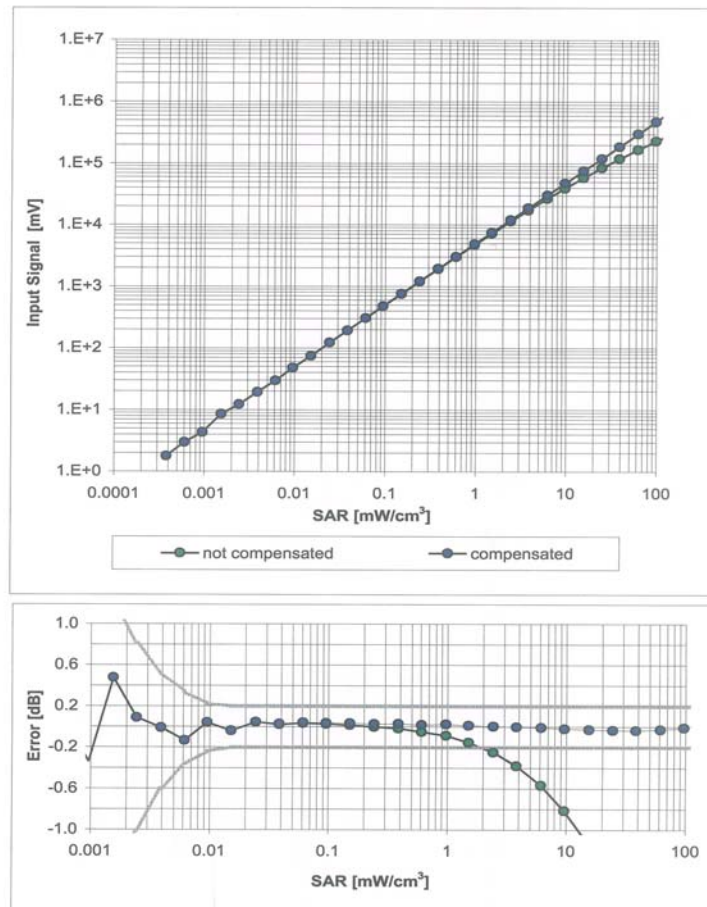


Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

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Dynamic Range f(SAR_{head})
(Waveguide R22, f = 1800 MHz)



Uncertainty of Linearity Assessment: $\pm 0.6\%$ (k=2)

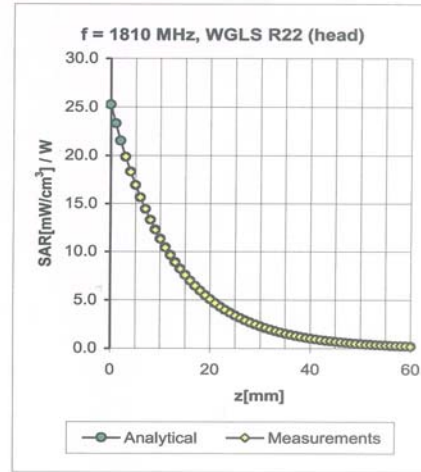
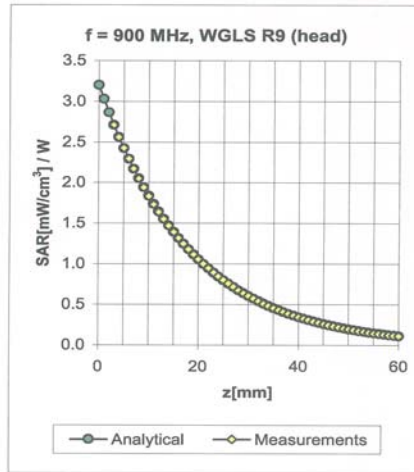
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Conversion Factor Assessment



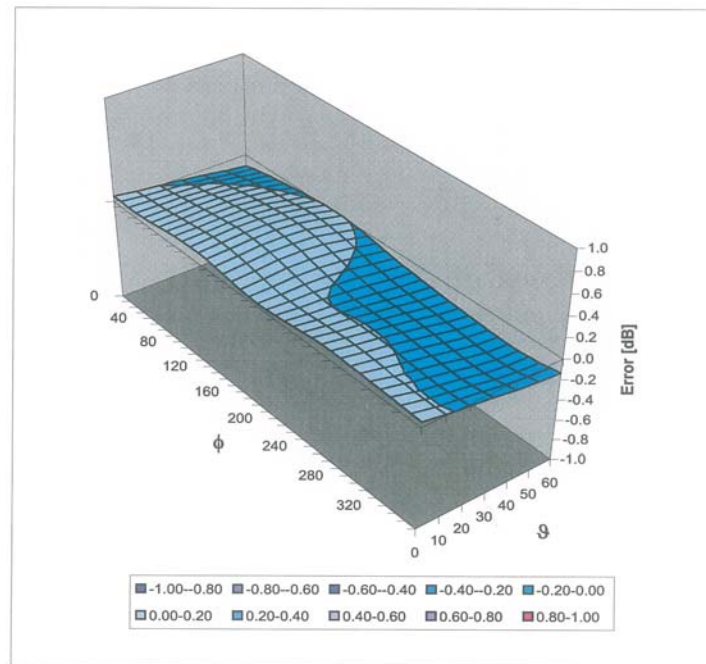
f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
450	± 50 / ± 100	Head	43.5 ± 5%	0.87 ± 5%	0.02	1.20	6.57 ± 13.3% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.53	1.32	5.91 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.25	2.40	4.88 ± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.29	2.21	4.67 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.47	1.55	4.35 ± 11.8% (k=2)
450	± 50 / ± 100	Body	56.7 ± 5%	0.94 ± 5%	0.02	1.21	6.33 ± 13.3% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	0.51	1.39	5.90 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.23	3.29	4.57 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.71	1.24	4.07 ± 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.

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Deviation from Isotropy in HSL
Error (ϕ , ϑ), $f = 900$ MHz



Uncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ ($k=2$)

APPENDIX C : Photographs of EUT

Front View Of EUT



Rear View Of EUT



Top View Of EUT



Base View Of EUT



Side View Of EUT



Side View Of EUT



Label View Of EUT

