TEST REPORT

1. Applicant

Name	: Ericsson-LG Co.,Ltd
Address	: 508, Nonhyen-ro, Gangnam-gu, Seoul, REPUBLIC OF KOREA

2. Products

Name	: Wireless Handy Telephone
Model	: GDC-500H
Manufacturer	: Ericsson-LG Co.,Ltd

3. Test Standard	: FCC 47 CFR § 2.1093, RSS-102
4. Test Method	: IEEE 1528, OET Bulletin 65, Supplement C(July 2001)
5. Test Results	: Positive
6. Date of Application	: October 5, 2012
7. Date of Issue	: January 29, 2013

Tested by	Approved by
Jong-gon Ban	Jeong-min Kim
Telecommunication Center Senior Engineer	Telecommunication Center Manager

The test results contained apply only to the test sample(s) supplied by the applicant, and this test report shall not be reproduced in full or in part without approval of the KTL in advance.

Korea Testing Laboratory

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1. GENERAL INFORMATIONS

1.1. Applicant (Client)

Name	Ericsson-LG Co., Ltd.
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Manufacturer	Ericsson-LG Co., Ltd.
Manufacturer Address	508, Nonhyen-ro, Gangnam-gu, Seoul, REPUBLIC OF KOREA

1.2. Equipment (EUT)

Product Name	Wireless Handy Telephone
Model Name	GDC-500H
FCC ID	TUIGDC-500H
IC Number	6241A-GDC500H
Device Category	Part 15 Unlicensed PCS portable Tx held to ear (PUE)
Type of Modulation	UPCS (GFSK) , Bluetooth (GFSK, π /4DQPSK, 8DPSK)
Max. Conducted Power	UPCS : 69 mW, Bluetooth : 1.55 mW
Tx Frequency Range	UPCS : 1921.536 MHz ~ 1928.448 MHz Bluetooth : 2,402 MHz ~ 2,480 MHz
Duty Cycle	UPCS (1:24)
Antenna Type	Internal Antenna
Operating Power	3.7 VDC Battery
RF exposure Category	General Population/Uncontrolled
Maximum 1g SAR	Head : 0.029 mW/g Body : 0.009 mW/g

1.3. Testing Laboratory

Testing Place	Korea Testing Labortory (KTL) 723, Haean-ro, Sangnok-gu, Ansan-si, Gyeonggi-do, KOREA (426-910)
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2. 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 Figure.1)

$$\boxed{SAR = \frac{d}{dt}\left(\frac{dU}{dm}\right) = \frac{d}{dt}\left(\frac{dU}{pdv}\right)}$$

Figure 1. SAR Mathematical Equation

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

$$\text{SAR} = \sigma E^2 / p$$

Where :

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

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

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 realtions 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 reflectinf surfaces, and whether conductive contact is made by the organism with a ground plane.[4]

3. DESCRIPTION OF SAR MEASUREMENT SYSTEM

3.1. SAR Measurement System

These measurements are performed using the DASY4 automated dosimetric assessment system. It is made by Sch- mid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of high precision robotics system (Staubli), robot controller, measurement server, Measurement 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 perfor- ming precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Fig.2).

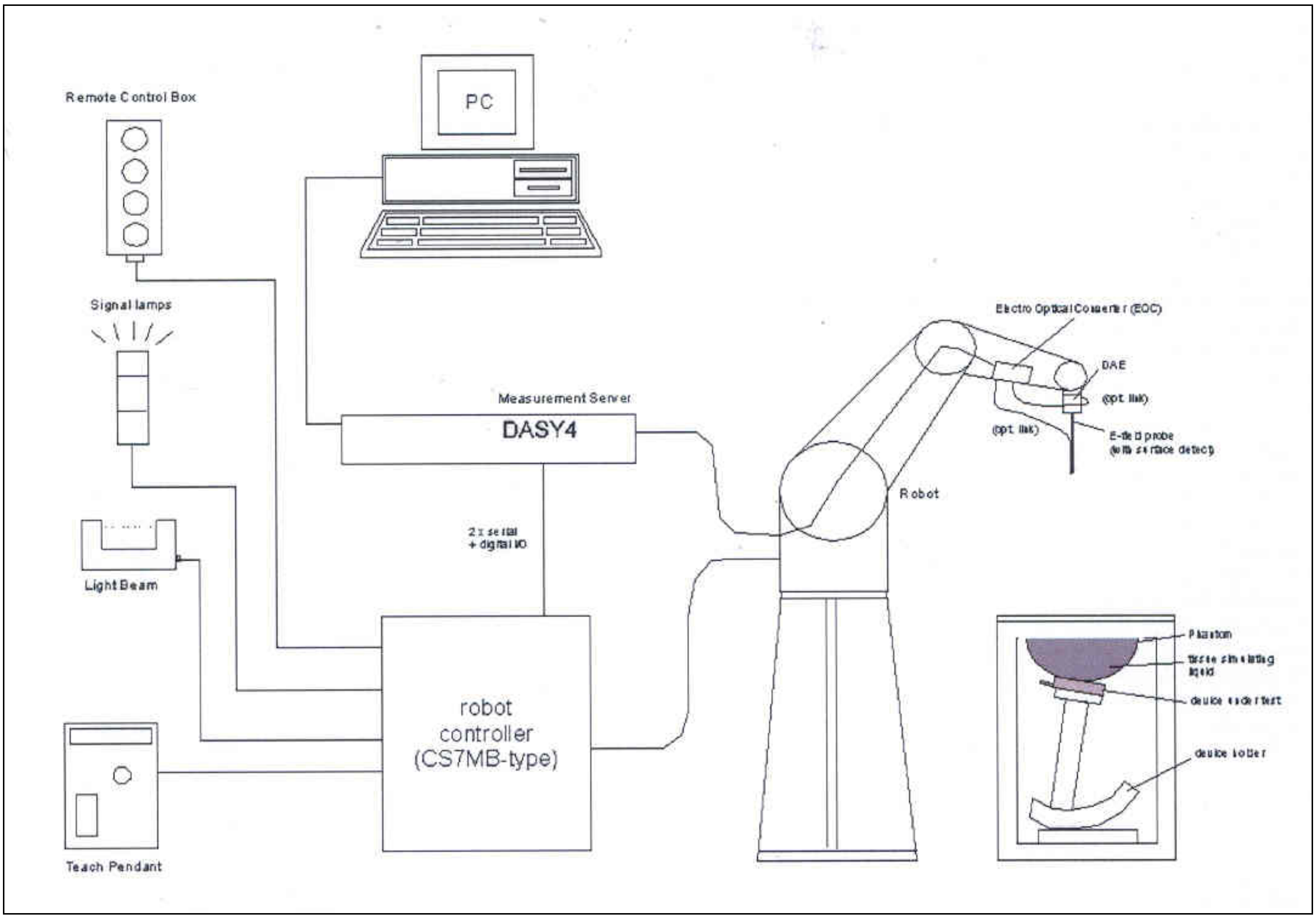


Figure 2. SAR Measurement System

The DAE4 consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for fronta- l 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 [5].

3.2. E-Field Probe Type and Performance

The SAR measurements were conducted with the dosimetric probe designed in the classical triangular configuration [5] and optimised for dosimetric evaluation. The probe has been is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical mortifier line ending at the front of the probe tip. 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 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. The approach is stopped at reaching the maximum.

Figure 3. Probe and DAE

Probe Specifications

Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection System Built-in shielding against static charges
Calibration	In air from 10 MHz to 2.5 GHz In brain and muscle simulating tissue at Frequencies of 450 MHz, 900 MHz and 1.8 GHz (accuracy 8%)
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) 0.4 dB in brain tissue (rotation normal probe axis)
Dynamic	5 uW/g to > 100 mW/g;
Range Linearity	0.2 dB
Surface	0.2 mm repeatability in air and clear liquids
Detection	Over diffuse reflecting surfaces.
Dimensions	Overall length: 337 mm Tip length: 10 mm Body diameter: 10 mm Tip diameter: 4 mm Distance from probe tip to dipole centers: 2.7 mm
Application	General dissymmetry up to 3 GHz Compliance tests of mobile phones/ Fast automatic scanning in arbitrary phantoms

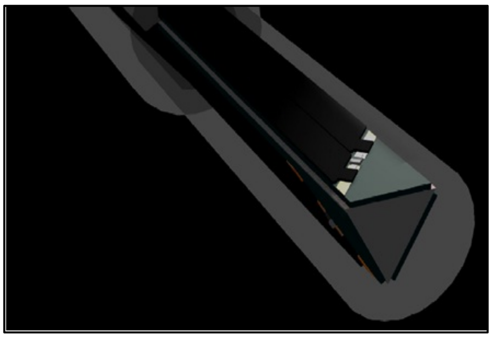


Figure 4. E-Field Probe

3.3. Probe Calibration Process (Dosimetric Assessment Procedure)

Each probe is calibrated according to a dosimetric assessment procedure described [6] with an accuracy better than +/- 10%. The spherical isotropy was evaluated with the procedure described in [7] and found to be better than +/- 0.25dB. The sensitivity parameters (NornX, NornY, NornZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe is tested.

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

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

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

where:

Δt = exposure time (30 seconds),

C = heat capacity of tissue (brain or muscle),

ΔT = temperature increase due to RF exposure.

SAR is proportional to $\Delta T / \Delta t$, the initial rate of tissue heating, before thermal diffusion takes place. Now it's possible to quantify the electric field in the simulated tissue by equating the thermally derived SAR to the E- field;

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

where:

σ = simulated tissue conductivity,

ρ = Tissue density (1.25 g/cm³ for brain tissue)

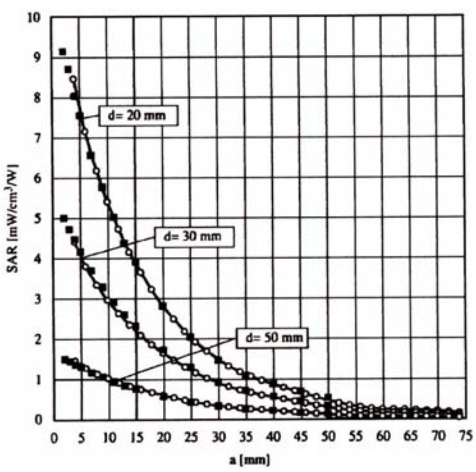


Figure B.1. E-Field and Temperature measurements at 900MHz[5]

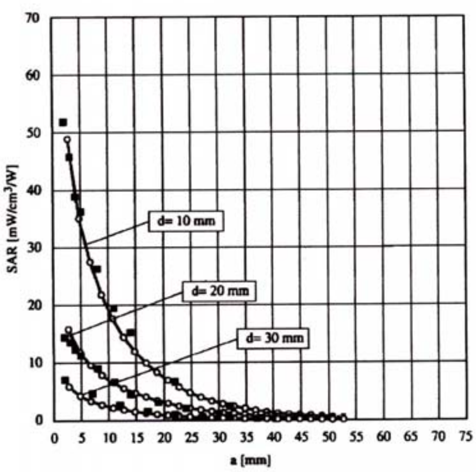


Figure B.2. E -field and temperature measurements at 1.8GHz[5]

3.4. Data Acquisition Electronics

The data acquisition electronics (DAE4) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. The input impedance of the DAE4 box is 200 Mohm; the inputs are symmetrical and floating. Common mode rejection is above 80dB.Transmission to the PC-card is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.
The mechanical probe-mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

3.5. Phantom Properties

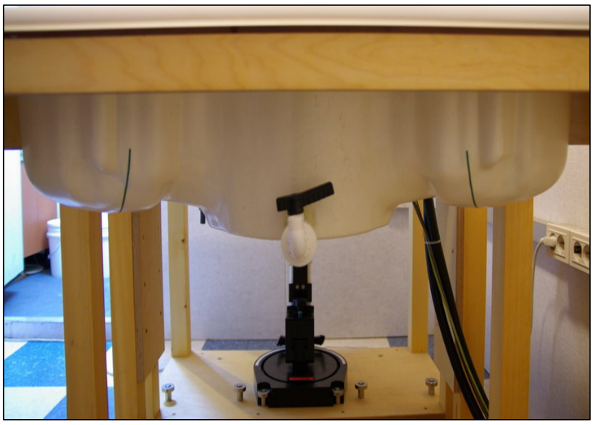


Figure 5. SAM twin phantom

The SAM Phantom 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 [9][10]. 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.

Phantom Properties	Requirement for specific EUT	Measured
Depth of Phantom	> 150 mm	200 mm
Width of flat section	> 10 cm (Twice EUT Width)	20 cm
Length of flat section	> 26 cm (Twice EUT Length)	30 cm
Thickness of flat section	2 mm ± 0.2 mm	2.08 ~ 2.20 mm

Table 1. Flat Section Properties of SAM Twin Phantom

3.6. Device Holder for DASY4

In combination with the SAM Phantom V4.0, the Mounting Device(POM) enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeatable positioned according to the FCC CENELEC 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 produced infinite number of configurations [10]. To produce the Worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.

Figure 6. Device Holder

3.7. Brain & Muscle Simulating Mixture Characteristic

The brain and muscle mixtures consist of a viscous gel using hydroxethylcellulose (HEC) gelling agent and saline solution (see Table 2). Preservation with 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 mixture characterizations used for the brain and muscle tissue simulating liquids are according to the data by C. Gabriel and G. Hartsgrove [11].

Ingredients	1900 MHz Brain	1900 MHz Muscle
Water	55.24%	70.23%
Sugar	-	-
Salt	0.31%	0.29%
DGBE	44.45%	29.47%
Bacteriacide	-	-
HEC	-	-

Table 2 : Composition of Tissue Equivalent Matter

4. SYSTEM VERIFICATION

4.1. Tissue Verification

The dielectric parameters of the brain and muscle simulating liquid were measured prior to SAR assessment using the HP85070D dielectric probe kit and Agilent 8753D Network Analyzer. The actual dielectric parameters are shown in the following table.

Freq. [MHz]	Date	Liquid Temp [°C]	parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
1900 Head	November 1, 2012	21.0	εr	40.0	39.4	-1.5	±5
			σ	1.40	1.38	-1.5	±5
1900 Body	November 2, 2012	21.5	εr	53.3	52.1	-2.3	±5
			σ	1.52	1.54	+1.3	±5

Table 3 : Measured Simulating Liquid Dielectric Values

The humidity and dielectric/ambient temperatures are recorded during the assessment of the tissue material dielectric parameters. The difference between the ambient temperature of the liquid during the dielectric measurement and the temperature during tests was less than |2|°C.

4.2. System Validation

Figure 7. Validation setup

Prior to the SAR assessment, the system validation kit was used to verify that the DASY4 was operating within its specifications. The validation dipoles are highly symmetric and matched at the centre frequency for the specified liquid and distance to the phantom. The accurate distance between the liquid surface and the dipole centre is achieved with a distance holder that snaps onto the dipole.
System validation is performed by feeding a known power level into a reference dipole, set at a know distance from the phantom.
The measured SAR is compared to the theoretically derived level. The reference SAR values are derived using a reference dipole and flat phantom suitable. The forward power into the reference dipole for each SAR validation was adjusted to 250 mW.

These reference SAR values are normalized to 1 W. The measured 1g(10g) SAR should be within 10 % of the expected target reference values shown in table 4 below.

System Validation Kit	Date	Liquid Temp.(˚C)	Ambient Temp.(˚C)	Targeted SAR10g (mW/g)	Measured SAR 10 g (mW/g)	Deviation (%)
D1900V2 S/N: 5d038	November 1, 2012	21.0	21.0	39.7	38.0	-4.3
D1900V2 S/N: 5d038	November 2, 2012	21.5	21.0	39.7	40	+0.7

Table 4 : Deviation from Reference Validation Values

4.3. Justification for Extended SAR Dipole Calibrations

According to maintaining return loss and impedance requirements per extended calibrations in KDB 450824, usage of SAR dipole calibrated less than 2 years ago but more than 1 year ago was confirmed.

KDB 450824 requirements

a) return loss : < -20 dB, within 20% of prior calibration
b) impedance : within 5Ω from prior calibration.

D1900V2 S/N:5d038					
Head/Body	**Date of Measurement**	**Return Loss (dB)**	**Δ%**	**Impedance (Ω)**	**ΔΩ**
Head	**11/25/2010**	-23.5	-	52.9	-
	07/16/2012	-22.2	-6.6	51.5	-1.4
Body	**04/19/2011**	-22.2	-	48.3	-
	07/12/2012	-22.0	-0.2	45.9	-2.4

5.SAR MEASUREMENT PROCEDURE USING DASY4

The SAR evaluation was performed with the SPEAG DASY4 system. A summary of the procedure follows ;

a) A measurement of the SAR value at a fixed location is used as a reference value for assessing the power drop of the EUT. The SAR at this point is measured at the start of the test and then again at the end of the test.

b) The SAR distribution at the exposed side of the phantom is measured at a distance of 3.9 mm from the inner surface of the shell. The area covers the entire dimension of the EUT and the horizontal grid spacing is 15 mm x 15 mm(or 20mm x 20mm). The actual Area Scan has dimensions surrounding the test device. Based on this data, the area of the maximum absorption is determined by Spline interpolation.

c) Around this point, a volume is assessed by measuring 5 x 5 x 7 (7 x 7 x 7) points. On the basis of this data set, the spatial peak SAR value is evaluated with the following procedure ;

(i) The data at the surface are extrapolated, since the centre of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2 mm. The extrapolation is based on a least square algorithm[13]. A polynomial of the fourth order is calculated through the points in z-axes. This polynomial is then used to evaluate the points between the surface and the probe tip.

(ii) The maximum interpolated value is searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g and 10 g) are computed using the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the “Not a knot”- condition (in x, y and z-direction)[13][14]. The volume is integrated with the trapezoidal-algorithm. One thousand points (10 x 10 x 10) are interpolated to calculate the averages.

(iii) All neighbouring volumes are evaluated until no neighbouring volume with a higher average value is found.

(iv) The SAR value at the same location as in Step (a) is again measured (If the value changed by more than 5%, the evaluation is repeated.)

6. DESCRIPTION OF TEST POSITION

SAR measurements were performed in the "cheek" and "tilted" positions on left and right sides of the phantom according to IEEE 1528. Both were measured in the head section of the SAM Twin Phantom.

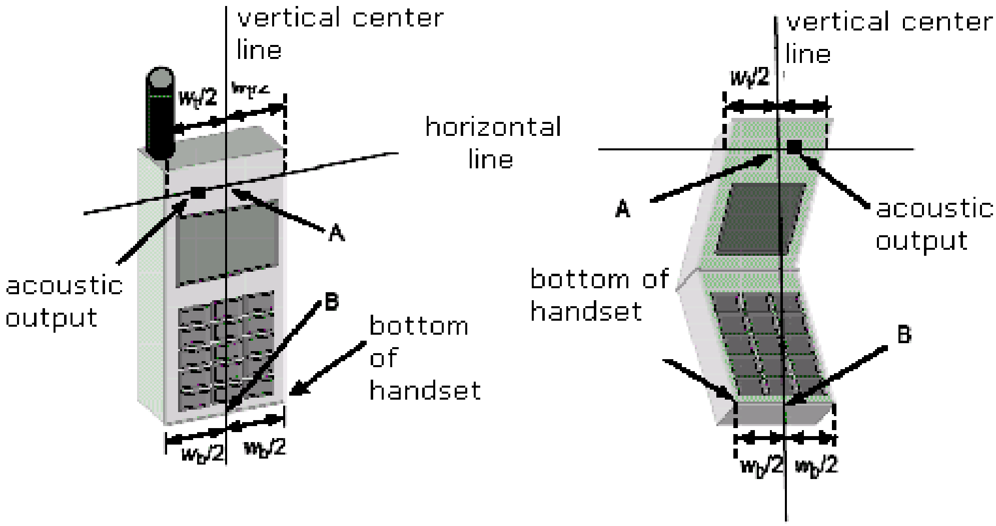


Figure 8. Handset vertical and horizontal reference line

6.1. Cheek Position

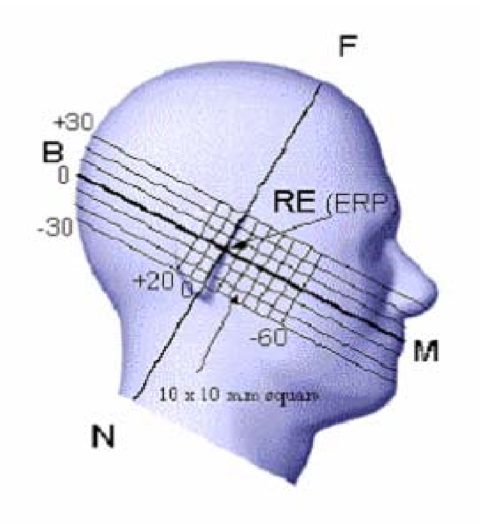


Figure 9. Side view of SAM phantom

The device was positioned with the vertical center line of the body of the device and the horizontal line crossing the center (see Figure 8) of the ear piece in a plane parallel to the sagittal plane of the phantom(see Figure 9). While maintaining the device in this plane, it was aligned the vertical center line with the reference plane containing the three ear and mouth reference points(M, RE and LE) and aligned the center of the ear piece with the line RE-LE. Then device was translated towards the phantom with the ear piece aligned with the line LE-RE until it touched the ear. While maintaining the device in the reference plane and maintaining the device contact with the ear, the bottom of the device was moved until any point on the front side is in contact with the cheek of the phantom.(see Figure 10)

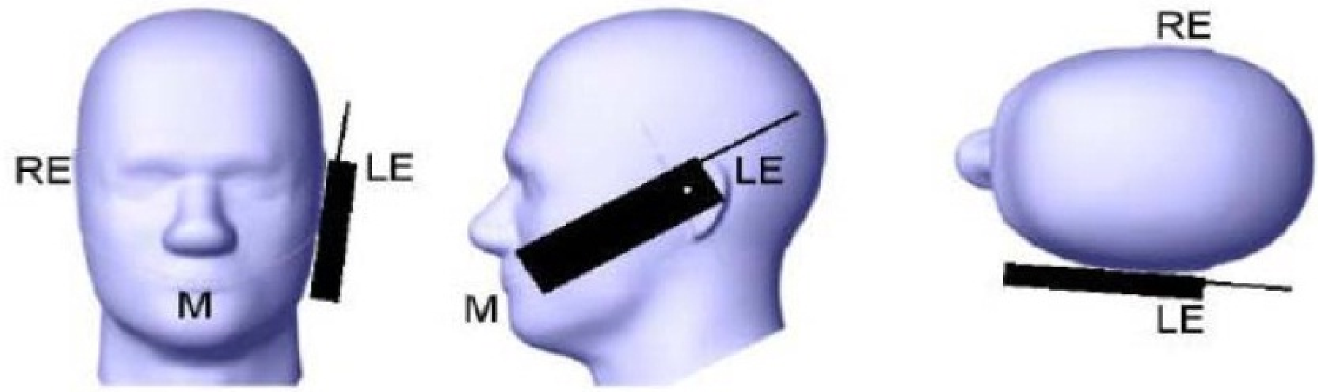


Figure 10. Cheek/Touch Position

6.2. Tilt Position

The device was positioned in the “Cheek” position. While maintaining the device in the reference plane described above cheek position and pivoting against the ear, device was moved outward away from the mouth by an angle of 15 degrees. (see Figure 11)

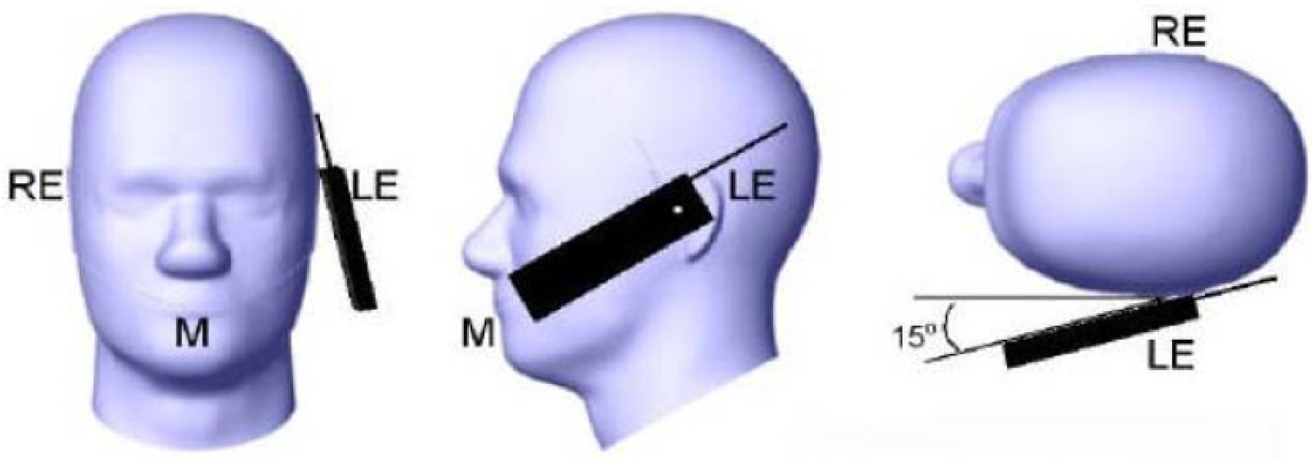


Figure 11. Ear/Tilt Position

6.3. Body Holster/ Belt Clip Configurations

Body-worn operating configurations are tested without 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.

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 tested with the device with each accessory. 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 or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used. Test position spacing was documented.

Transmitters that are designed to operate in front of a person’s face, as the push-to-talk configurations, are test for SAR compliance with the front of the device positioned to face the flat phantom in brain fluid. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

In all cases SAR measurements are performed to investigate the worst-case positioning. Worst-case positioning is then documented and used to perform Body SAR testing.

7.MEASUREMENT UNCERTAINTY

The uncertainty analysis is based on the template listed in the IEEE 1528 for both EUT SAR tests. The measurement uncertainty of a specific device is evaluated independently and the total uncertainty for both evaluations (95 % confidence level) must be less than 25 %.

Uncertainty Component	Uncertainty value (%)	Probability Distribution	Divisor	Ci	Ci ^ 2	Standard Uncertainty(%)	Standard Uncertainty^2	(Standard Uncertainty^2) x ci^2	vi
Measurement System									
Probe Calibration (k=1)	5.90	Normal	1	1	1	5.90	34.81	34.81	∞
Axial Isotropy	4.70	Rectengular	√3	0.7	0.49	2.71	7.34	3.60	∞
Hemispherical Isotropy	9.60	Rectengular	√3	0.7	0.49	5.54	30.69	15.04	∞
Linearity	4.70	Rectengular	√3	1	1	2.71	7.34	7.34	∞
System Detection Limits	1.00	Rectengular	√3	1	1	0.58	0.34	0.34	∞
Boundary Effect	1.00	Rectengular	√3	1	1	0.58	0.34	0.34	∞
Response Time	0.80	Rectengular	√3	1	1	0.46	0.21	0.21	∞
RF Ambient conditions	3.00	Rectengular	√3	1	1	1.73	3.00	3.00	∞
Readout Electronics	0.30	Normal	1	1	1	0.30	0.09	0.09	∞
Integration time	2.60	Rectengular	√3	1	1	1.50	2.25	2.25	∞
Probe positioner	0.40	Rectengular	√3	1	1	0.23	0.05	0.05	∞
Probe positioning	2.90	Rectengular	√3	1	1	1.67	2.79	2.79	∞
Max. SAR evaluation	1.00	Rectengular	√3	1	1	0.58	0.34	0.34	∞
Test Sample Related							**Sub total**	**70.20**	
Device Positioning	1.59	Normal	1	1	1	1.59	2.53	2.53	9
Device Holder Uncertainty	3.60	Normal	1	1	1	3.60	12.96	12.96	∞
Power Drift	5.00	Rectengular	√3	1	1	2.89	8.35	8.35	∞
Phantom and setup							**Sub total**	**23.84**	
Phantom Uncertainty	4.00	Rectengular	√3	1	1	2.31	5.33	5.33	∞
Liquid Conductivity - target value	5.00	Rectengular	√3	0.5	0.25	2.89	8.33	2.08	∞
Liquid Conductivity - Measurement value	2.50	Normal	1	0.5	0.25	2.50	6.25	1.56	∞
Liquid Permittivity - target value	5.00	Rectengular	√3	0.5	0.25	2.89	8.33	2.08	∞
Liquid Pemiittivity - Measurement value	2.50	Normal	1	0.5	0.25	2.50	6.25	1.56	∞
							Sub total	**12.63**	
Cornbined standard Uncertainty (%)							± 10.33	106.67	-
Expanded Uncertainty	(95% CONFIDENCE LEVEL,K=2)							± 20.66	

Table 5. Uncertainty Budget of DASY4

8.FCC RF Exposure Limits

HUMAN EXPOSURE	UNCONTROLLED ENVIRONMENT General Population (W/Kg) or (mW/g)	CONTROLLED ENVIRONMENT Occupational (W/Kg) or (mW/g)
SPATIAL PEAK SAR (Brain)	1.60	8.00
SPATIAL AVERAGE SAR (Whole Body)	0.08	0.40
SPATIAL PEAK SAR (Hand / Feet / Ankle / Wrist)	4.00	20.00

Table. 6 Safety Limits for Partial Body Exposure

NOTE :

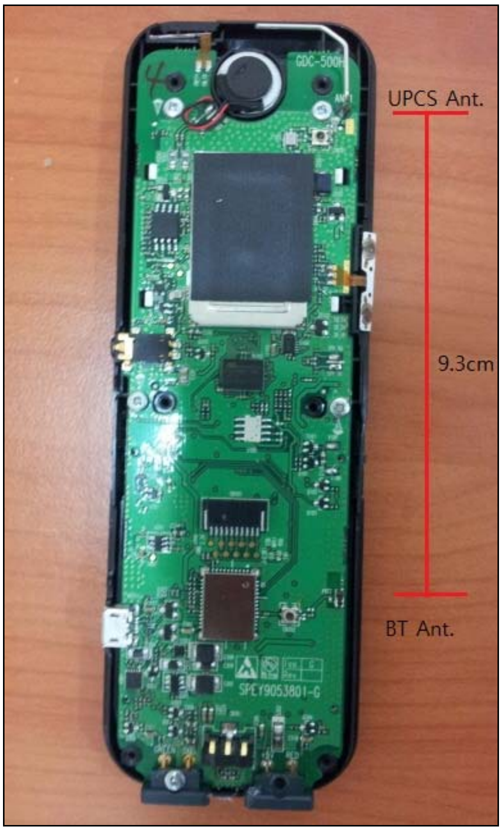
* The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e.as a result of employment or occupation).

9.FCC MULTI-TX & ANTENNA SAR CONSIDERATIONS

9.1. Simultaneous Transmission



1. UPCS & Bluetooth transmit simultaneously in head & body mode.
2. The UPCS RF conducted output power is 69 mW.
3. The BT RF conducted output power is 1.55 mW.

9.2. Standalone SAR test exclusion for Bluetooth

The UPCS standalone SAR was evaluated but the Bluetooth standalone SAR evaluation we excluded according to the formula given in KDB 447498 as below.

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·

[√ f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

* f(GHz) is the RF channel transmit frequency in GHz
* Power and distance are rounded to the nearest mW and mm before calculation
* The result is rounded to one decimal place for comparison

*When the separation distance is ≤5 mm, a test separation distance of 5 mm is used to determine SAR test exclusion according to KDB 648474 D04

1) Head mode: [(1.55 mW)/(5 mm)] ·[√2.45] = 0.2

2) Body mode: [(1.55 mW)/(15 mm)] ·[√2.45] = 0.1

So the standalone SAR evaluations for BT are excluded in Head & Body position.

9.3. Simultaneous SAR test exclusion for Bluetooth

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following in KDB 447498 to determine simultaneous transmission SAR test exclusion as below.

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·
[√f(GHz)/x] W/kg for test separation distances ≤ 50 mm;
where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.

1) Head mode: [(1.55 mW)/(5 mm)] ·[√2.45/7.5] = 0.07 W/kg

2) Body mode: [(1.55 mW)/(15 mm)] ·[√2.45/7.5] = 0.02 W/kg

3) Sum of 1g SAR in Head mode: 0.029(UPCS) + 0.07(BT) = 0.099 W/kg

4) Sum of 1g SAR in Body mode: 0.009(UPCS) + 0.02(BT) = 0.029 W/kg

So the simultaneous SAR evaluations are excluded in Head & Body position.

10.SAR MEASUREMENT RESULTS

10.1. UPCS Head SAR Measurement Results

・Date of Test: November 1, 2012 ・Liquid Temperature (C) : 21.0

・Ambient Temperature (C): 21.0 ・Humidity (%): 46

Mode	Head Position			Frequency		Power		SAR 1g (mW/g)
				MHz	CH	Ref. [V/m]	Drift [dB]	
UPCS	LEFT	Cheek/ Touch	Internal Ant.	1924.992	3	3.09	0.009	0.020
		Ear/Tilt	Internal Ant.	1924.992	3	2.51	0.034	0.012
	RIGHT	Cheek/ Touch	Internal Ant.	1924.992	3	2.70	-0.089	**0.029**
		Ear/Tilt	Internal Ant.	1924.992	3	2.31	0.052	0.015

NOTES:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration
2. All modes of operation were investigated and the worst-case are reported.
3. Justification for reduced test configurations: per FCC/OET Supplement C (July,2001), if the SAR measured at the middle channel for each test configuration (Left, right, cheek/touch, tilt/ear, extended and retracted) is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).
4. Battery was fully charged for all readings.
5. Test Signal Call mode: Base Station Simulator (CMD60)
6. Duty Cycle is 1:24
7. Power reference Values are recorded at the beginning and end of each measurement.
8. Depth of simulation Tissue is 15.0 cm ± 0.2 cm

10.2. UPCS Body SAR Measurement Results

- Date of Test: November 2, 2012
- Ambient Temperature (C): 21.0
- Liquid Temperature (C) : 21.5
- Humidity (%): 47

Mode	Body Position		Frequency		Power		SAR 1g (mW/g)
			MHz	CH	Ref. [V/m]	Drift [dB]	
UPCS	Body without Holster (15mm distance)	Internal Ant.	1924.992	3	2.15	0.057	0.009
		Internal Ant.	1924.992	3	1.84	0.078	0.009

NOTES:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration
2. All modes of operation were investigated and the worst-case are reported.
3. Justification for reduced test configurations: per FCC/OET Supplement C (July,2001), if the SAR measured at the middle channel for each test configuration (Left, right, cheek/touch, tilt/ear, extended and retracted) is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).
4. Battery was fully charged for all readings.
5. Test Signal Call mode: Base Station Simulator (CMD60)
6. Duty Cycle is 1:24
7. Power reference Values are recorded at the beginning and end of each measurement.
8. Depth of simulation Tissue is 15.0 cm ± 0.2 cm

11.CONCLUSION

The SAR evaluation indicates that GDC-500H complies with the RF radiation exposure limits of the FCC & IC. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

12.EQUIPMENT LIST AND CALIBRATION DETAILS

Equipment Type	Manufacturer	Model Number	Serial Number	Calibration Due	Used For this Test
Robot - Six Axes	Staubli	RX60	N/A	N/A	☒
Robot Remote Control	SPEAG	CS7MB	F03/5U96A1 /C/01	N/A	☒
SAM Twin Phantom	SPEAG	TP1276	QD000P40CA	N/A	☒
Flat Phantom V4.4	SPEAG	QD000P44BA, BB	1001, higher	N/A	☐
Data Acquisition Electronics	SPEAG	DAE4	559	2013.01.23	☒
Probe E-Field	SPEAG	ES3DV2	3020	2013.01.26	☒
Antenna Dipole 835 MHz	SPEAG	D835V2	481	2013.03.15	☐
Antenna Dipole 900 MHz	SPEAG	D900V2	194	2013.11.18	☐
Antenna Dipole 1800 MHz	SPEAG	D1800V2	2d066	2014.01.26	☐
Antenna Dipole 1900 MHz	SPEAG	D1900V2	5d038	2013.04.19	☒
Antenna Dipole 1950 MHz	SPEAG	D1950V2	1027	2014.01.24	☐
Antenna Dipole 2450 MHz	SPEAG	D2450V2	746	2014.01.24	☐
High power RF Amplifier	EMPOWER	2057-BBS3Q5KCK	1002D/C0321	2013.02.15	☒
Digital Communication Tester	R&S	CMD60	84289/006	2013.02.16	☒
Signal Generator	Agilent	8648C	3629U00868	2013.02.07	☒
RF Power Meter Dual	Hewlett Packard	E4419A	GB37170495	2013.02.08	☒
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	8481A	US37299851	2013.02.16	☒
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	8481A	3318A92872	2013.02.16	☒
S-Parameter Network Analyzer	Agilent	8753D	3410A07251	2013.03.13	☒
Dual Directional Coupler	Hewlett Packard	778D	1144AO4576	2013.02.13	☒
Directional Coupler	Agilent	773D	MY28390213	2013.02.13	☒
Bluetooth Test Set	Anritsu	MT8852B	6K00006994	2013.01.28	☐

APPENDIX A. SAR PLOTS

- Test Laboratory: KTL

- D1900V2: HEAD 1900MHz Validation

- Test Date: November 1, 2012

- Measured Liquid Temperature: 21.0 ℃, Ambient Temperature: 21.0 ℃

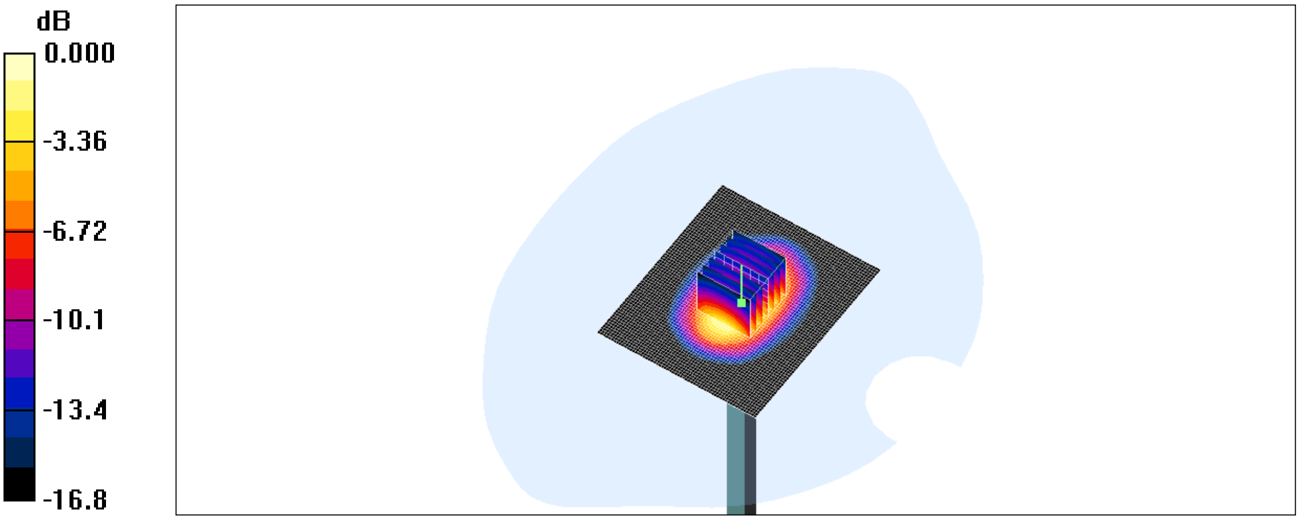
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL1900 Medium parameters used: f = 1900 MHz; σ = 1.38 mho/m; ε_r = 39.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3020; ConvF(5, 5, 5); Calibrated: 2012-01-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn559; Calibrated: 2012-01-23
- Phantom: SAM Twin Phantom_1800MHz; Type: SAM; Serial: TP-1433
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (61x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 12.8 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.1 V/m; Power Drift = -0.204 dB
Peak SAR (extrapolated) = 17.4 W/kg
SAR(1 g) = 9.50 mW/g; SAR(10 g) = 5.02 mW/g
Maximum value of SAR (measured) = 10.8 mW/g



0 dB = 10.8mW/g

- Test Laboratory: KTL

- Model: GDC-500H

- Position: LEFT CHEEK TOUCH

- Test Date: December 1, 2012

- Measured Liquid Temperature: 21.0 ℃, Ambient Temperature: 21.0 ℃

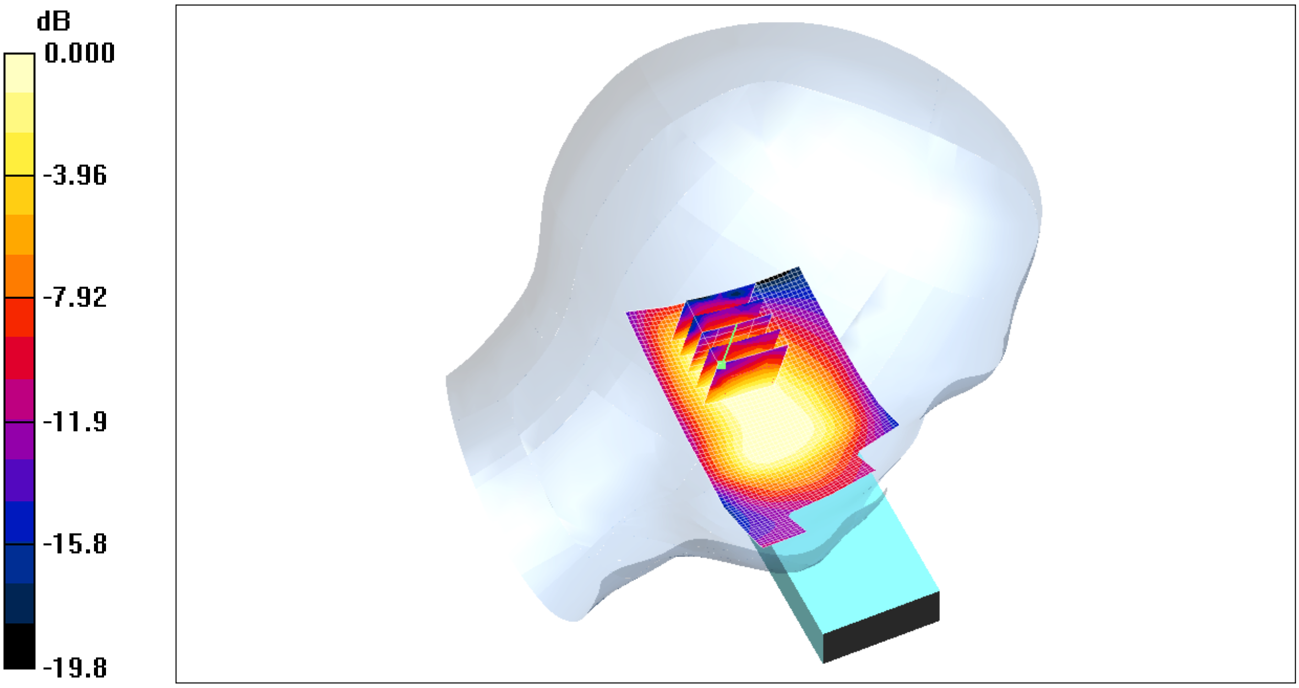
Communication System: UPCS1900; Frequency: 1924.99 MHz;Duty Cycle: 1:24
Medium: HSL1900 Medium parameters used: f = 1924.99 MHz; σ = 1.38 mho/m; ε_r = 39.2; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3020; ConvF(5, 5, 5); Calibrated: 2012-01-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn559; Calibrated: 2012-01-23
- Phantom: SAM Twin Phantom_1800MHz; Type: SAM; Serial: TP-1433
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (41x91x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.024 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.09 V/m; Power Drift = 0.009 dB
Peak SAR (extrapolated) = 0.032 W/kg
SAR(1 g) = 0.020 mW/g; SAR(10 g) = 0.012 mW/g
Maximum value of SAR (measured) = 0.020 mW/g



0 dB = 0.020mW/g

- Test Laboratory: KTL

- Model: GDC-500H

- Position: LEFT EAR TILT

- Test Date: December 1, 2012

- Measured Liquid Temperature: 21.0 ℃, Ambient Temperature: 21.0 ℃

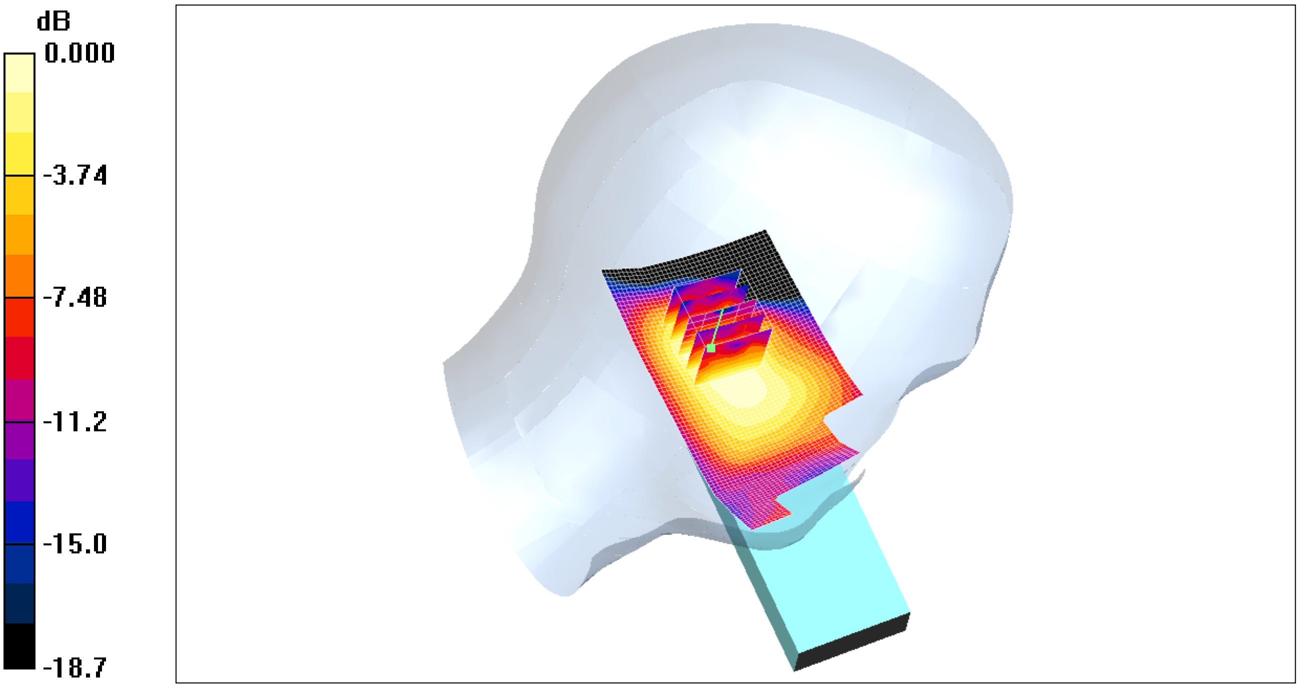
Communication System: UPCS1900; Frequency: 1924.99 MHz;Duty Cycle: 1:24
Medium: HSL1900 Medium parameters used: f = 1924.99 MHz; σ = 1.38 mho/m; ε_r = 39.2; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3020; ConvF(5, 5, 5); Calibrated: 2012-01-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn559; Calibrated: 2012-01-23
- Phantom: SAM Twin Phantom_1800MHz; Type: SAM; Serial: TP-1433
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (41x81x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.016 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.51 V/m; Power Drift = 0.034 dB
Peak SAR (extrapolated) = 0.019 W/kg
SAR(1 g) = 0.012 mW/g; SAR(10 g) = 0.00697 mW/g
Maximum value of SAR (measured) = 0.012 mW/g



0 dB = 0.012mW/g

- Test Laboratory: KTL
- Model: GDC-500H
- Position: RIGHT CHEEK TOUCH
- Test Date: December 1, 2012
- Measured Liquid Temperature: 21.0 ℃, Ambient Temperature: 21.0 ℃

Communication System: UPCS1900; Frequency: 1924.99 MHz;Duty Cycle: 1:24
Medium: HSL1900 Medium parameters used: f = 1924.99 MHz; σ = 1.38 mho/m; ε_r = 39.2; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

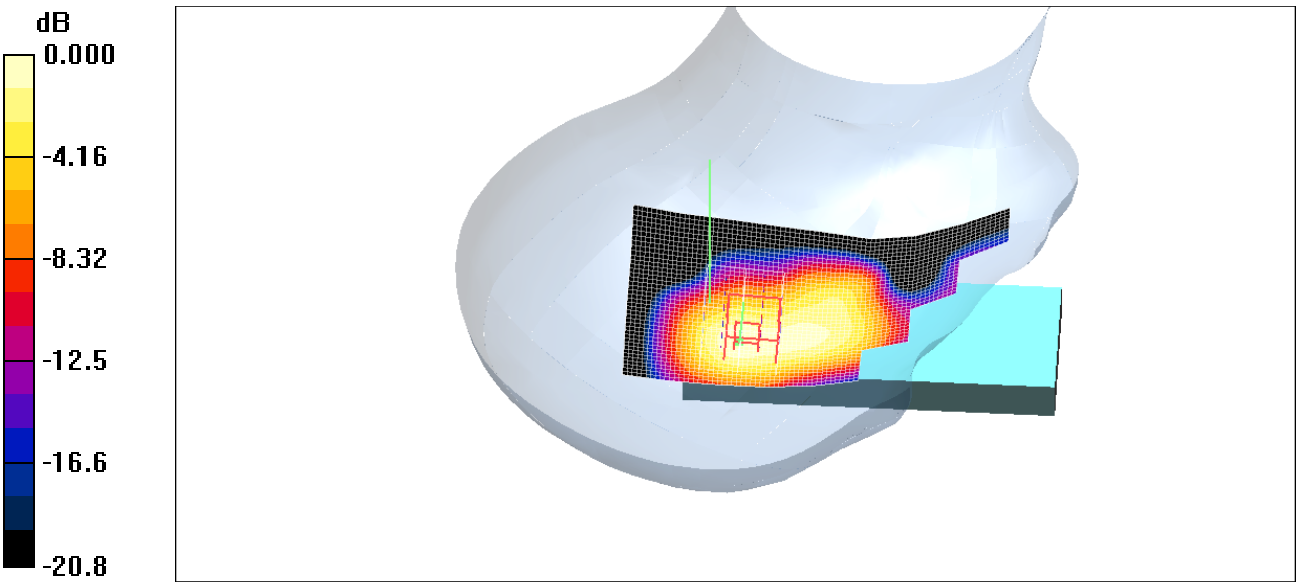
DASY4 Configuration:

- Probe: ES3DV2 - SN3020; ConvF(5, 5, 5); Calibrated: 2012-01-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn559; Calibrated: 2012-01-23
- Phantom: SAM Twin Phantom_1800MHz; Type: SAM; Serial: TP-1433
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

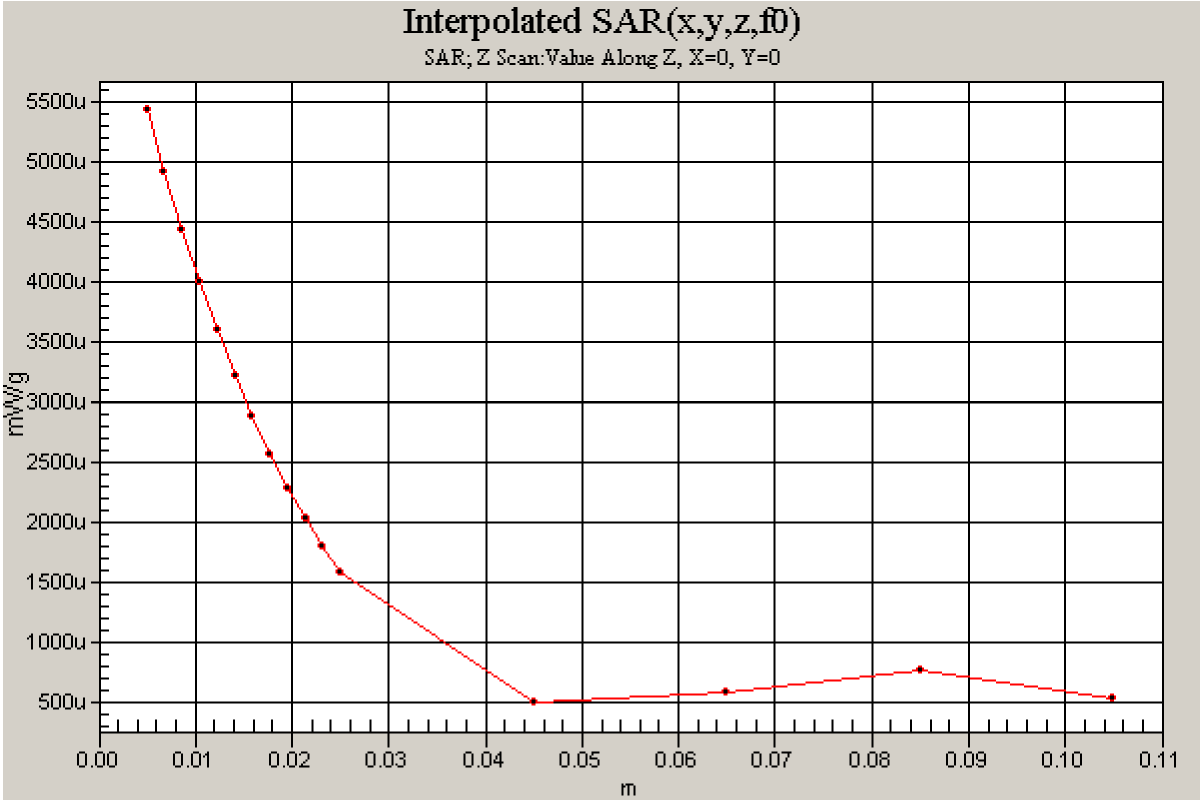
Area Scan (41x81x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.031 mW/g

Z Scan (1x1x16): Measurement grid: dx=20mm, dy=20mm, dz=20mm
Maximum value of SAR (interpolated) = 0.005 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.70 V/m; Power Drift = -0.089 dB
Peak SAR (extrapolated) = 0.051 W/kg
SAR(1 g) = 0.029 mW/g; SAR(10 g) = 0.016 mW/g
Maximum value of SAR (measured) = 0.031 mW/g



0 dB = 0.031mW/g


Interpolated SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
5500u
5000u
4500u
4000u
3500u
3000u
2500u
2000u
1500u
1000u
500u
mW/g
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11
m

- Test Laboratory: KTL

- Model: GDC-500H

- Position: RIGHT EAR TILT

- Test Date: December 1, 2012

- Measured Liquid Temperature: 21.0 ℃, Ambient Temperature: 21.0 ℃

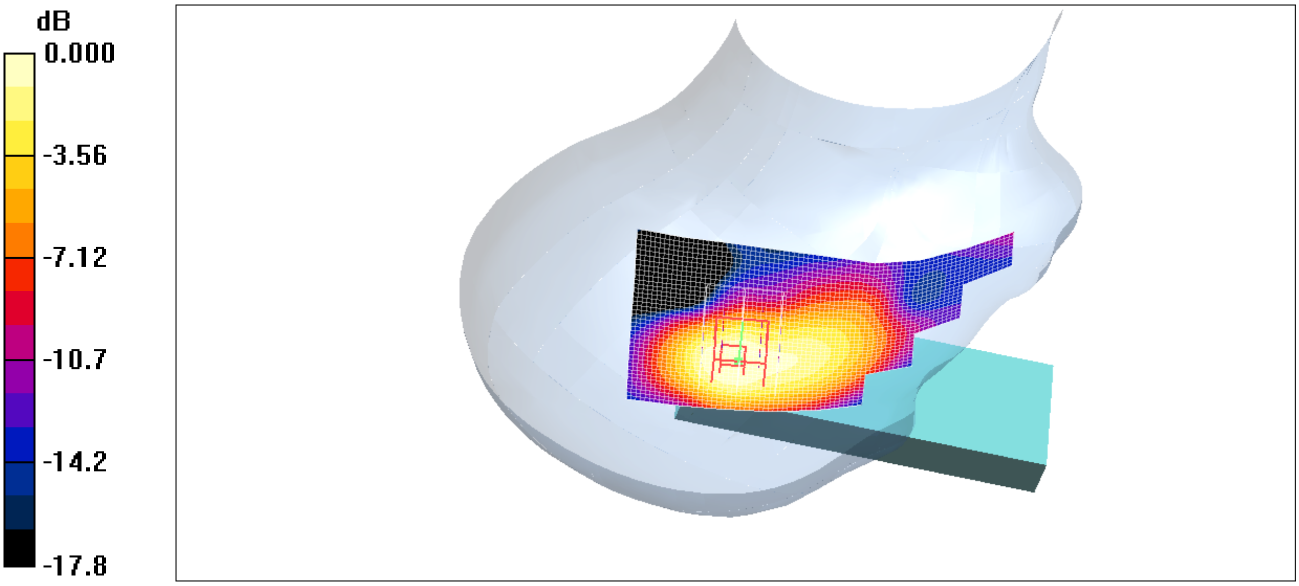
Communication System: UPCS1900; Frequency: 1924.99 MHz;Duty Cycle: 1:24
Medium: HSL1900 Medium parameters used: f = 1924.99 MHz; σ = 1.38 mho/m; ε_r = 39.2; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3020; ConvF(5, 5, 5); Calibrated: 2012-01-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn559; Calibrated: 2012-01-23
- Phantom: SAM Twin Phantom_1800MHz; Type: SAM; Serial: TP-1433
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (41x81x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.018 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.31 V/m; Power Drift = 0.052 dB
Peak SAR (extrapolated) = 0.025 W/kg
SAR(1 g) = 0.015 mW/g; SAR(10 g) = 0.0086 mW/g
Maximum value of SAR (measured) = 0.015 mW/g



0 dB = 0.015mW/g

- Test Laboratory: KTL

- D1900V2: BODY 1900MHz Validation

- Test Date: November 2, 2012

- Measured Liquid Temperature: 21.5 ℃, Ambient Temperature: 21.0 ℃

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: MSL1900 Medium parameters used: f = 1900 MHz; σ = 1.54 mho/m; ε_r = 52.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

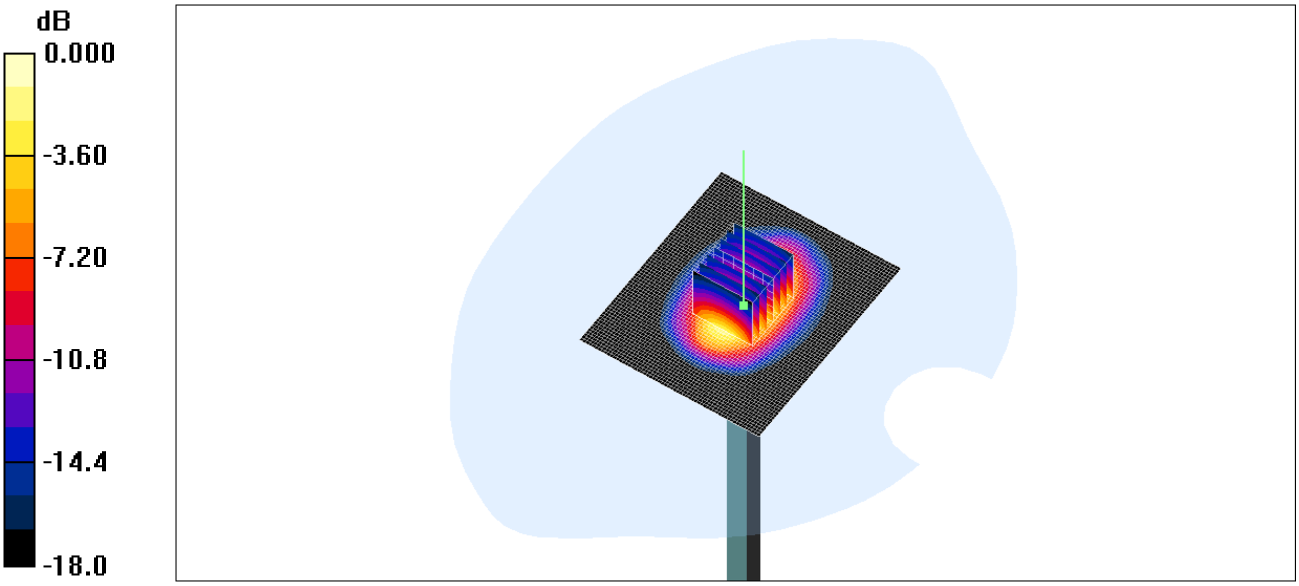
DASY4 Configuration:

- Probe: ES3DV2 - SN3020; ConvF(4.44, 4.44, 4.44); Calibrated: 2012-01-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn559; Calibrated: 2012-01-23
- Phantom: SAM Twin Phantom_1800MHz; Type: SAM; Serial: TP-1433
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

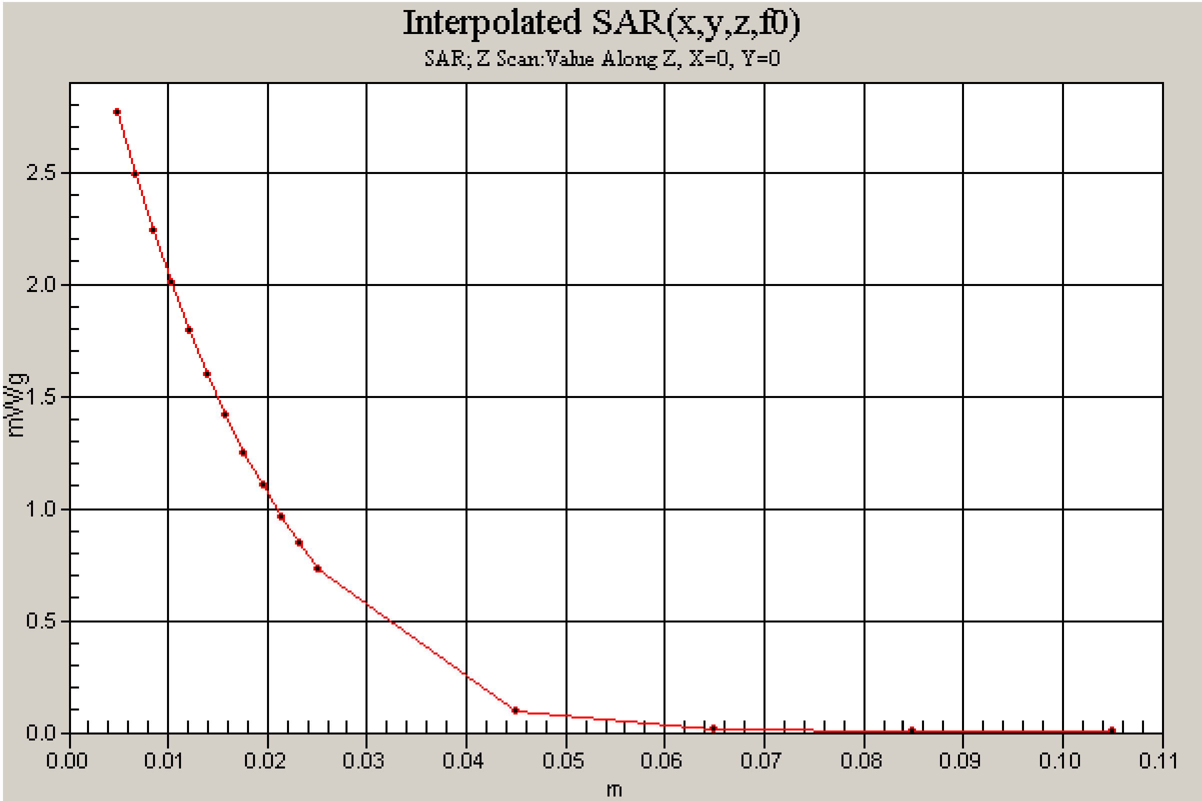
Area Scan (61x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 12.3 mW/g

Z Scan (1x1x16): Measurement grid: dx=20mm, dy=20mm, dz=20mm
Maximum value of SAR (interpolated) = 2.74 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 87.3 V/m; Power Drift = -0.003 dB
Peak SAR (extrapolated) = 18.2 W/kg
SAR(1 g) = 10.0 mW/g; SAR(10 g) = 5.2 mW/g
Maximum value of SAR (measured) = 11.3 mW/g



0 dB = 11.3mW/g


Interpolated SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
mW/g
2.5
2.0
1.5
1.0
0.5
0.0
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11
m

- Test Laboratory: KTL

- Model: GDC-500H

- Position: BODY FRONT FACING PHANTOM

- Test Date: December 2, 2012

- Measured Liquid Temperature: 21.5 ℃, Ambient Temperature: 21.0 ℃

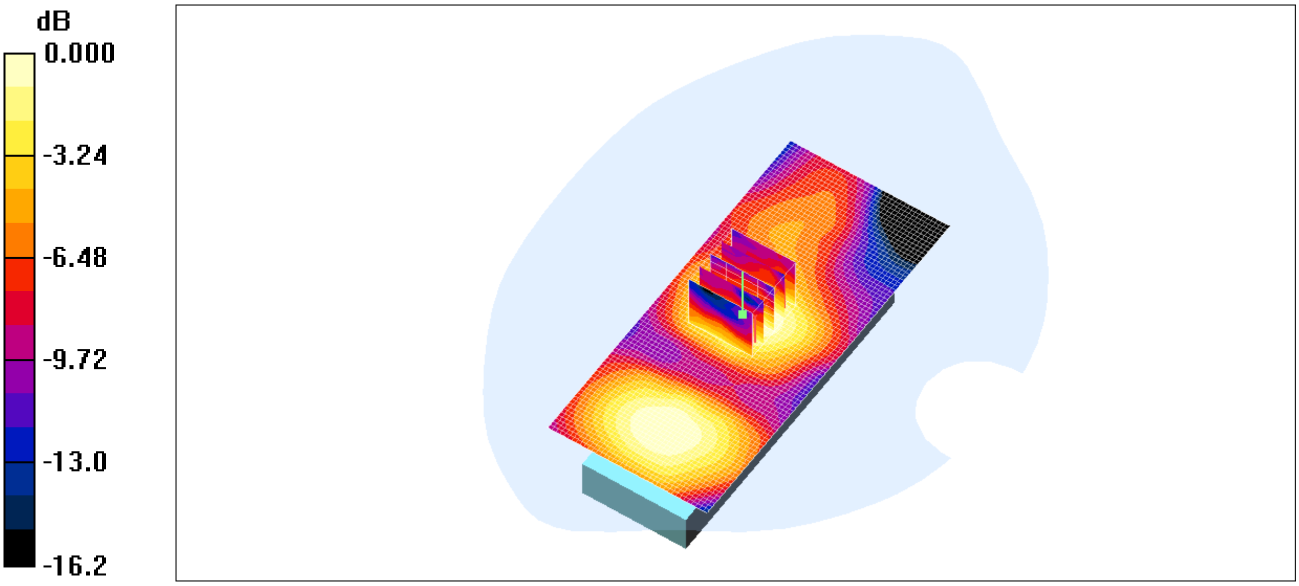
Communication System: UPCS1900; Frequency: 1924.99 MHz;Duty Cycle: 1:24
Medium: HSL1900 Medium parameters used: f = 1924.99 MHz; σ = 1.56 mho/m; ε_r = 52.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3020; ConvF(5, 5, 5); Calibrated: 2012-01-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn559; Calibrated: 2012-01-23
- Phantom: SAM Twin Phantom_1800MHz; Type: SAM; Serial: TP-1433
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (41x91x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.010 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.15 V/m; Power Drift = 0.057 dB
Peak SAR (extrapolated) = 0.015 W/kg
SAR(1 g) = 0.00928 mW/g; SAR(10 g) = 0.00578 mW/g
Maximum value of SAR (measured) = 0.010 mW/g



0 dB = 0.010mW/g

- Test Laboratory: KTL

- Model: GDC-500H

- Position: BODY REAR FACING PHANTOM

- Test Date: December 2, 2012

- Measured Liquid Temperature: 21.5 ℃, Ambient Temperature: 21.0 ℃

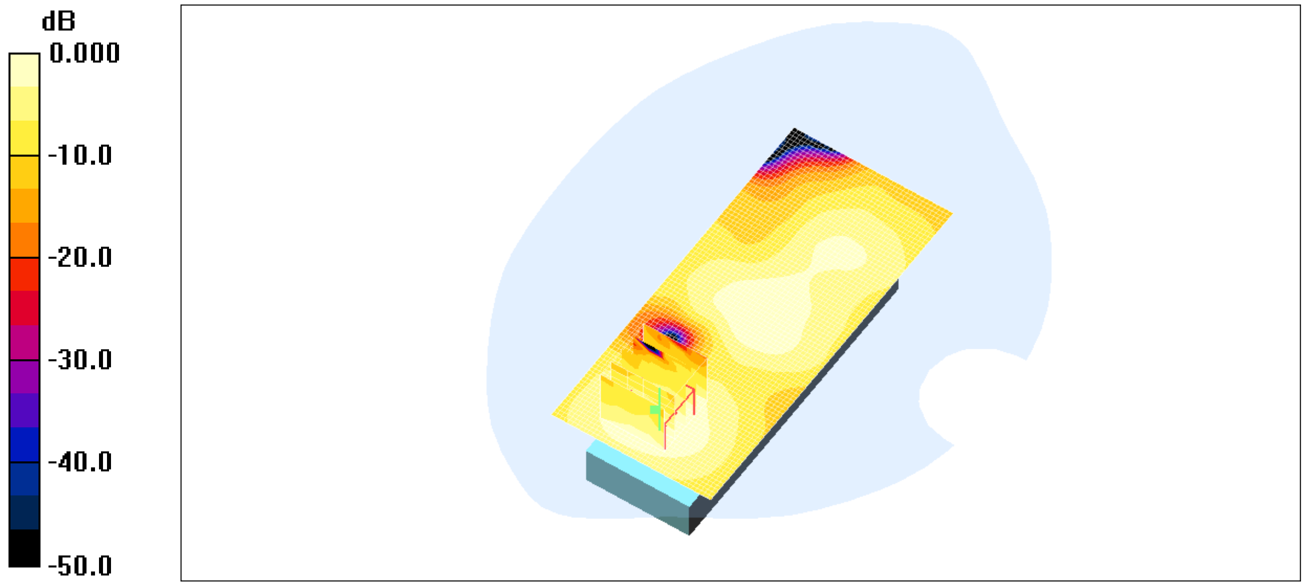
Communication System: UPCS1900; Frequency: 1924.99 MHz;Duty Cycle: 1:24
Medium: HSL1900 Medium parameters used: f = 1924.99 MHz; σ = 1.56 mho/m; ε_r = 52.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3020; ConvF(5, 5, 5); Calibrated: 2012-01-26
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn559; Calibrated: 2012-01-23
- Phantom: SAM Twin Phantom_1800MHz; Type: SAM; Serial: TP-1433
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (41x91x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 0.010 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.84 V/m; Power Drift = 0.078 dB
Peak SAR (extrapolated) = 0.014 W/kg
SAR(1 g) = 0.00899 mW/g; SAR(10 g) = 0.00566 mW/g
Maximum value of SAR (measured) = 0.010 mW/g



0 dB = 0.010mW/g