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TEST REPORT ON SAR

Model Tested: SCH-I589
FCC ID (Requested): A3LSCHI589
Job No: FI-258
Report No: FI-258-S1

- Abstract -

This document reports on SAR Tests carried out in accordance with FCC/OET Bulletin 65, Supplement C(June 2001).

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1. GENERAL INFORMATION

Test Dates : Nov.04, 2011 ~ Nov.07, 2011
Manufacturer : SAMSUNG ELECTRONICS Co., Ltd.
Address : 416 Maetan3-Dong, Suwon City, Korea
Test Standard : §2.1093; FCC/OET Bulletin 65, Supplement C(June 2001)
FCC Classification : Licensed Portable Transmitter Held to Ear (PCE)
Digital Transmitter System (DTS)
Tested for : FCC/TCB Certification

2. DESCRIPTION OF DEVICE

Test Sample : Cellular CDMA Phone with Bluetooth, Ev-DO and WLAN
Model Number : SCH-I589
Serial Number : Identical prototype (S/N : # FI-258-B)
Tx Freq.Range: 824.70 ~ 848.31 MHz (CDMA)
2400 ~ 2483.5 MHz (WLAN)
Rx Freq.Range: 869.70 ~ 893.31 MHz (CDMA)
2400 ~ 2483.5 MHz (WLAN)
Antenna Manufacturer : SKYCROSS
Model No.: B110180
EV-DO Support (Revision : A)
Antenna Dimensions : 53.5 X 16.46 X 8.6 (mm)
Separation distance between Main and Bluetooth antenna : 3mm

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3. DESCRIPTION OF TEST EQUIPMENT

3.1 SAR Measurement Setup

Robotic System

Measurements are performed using the DASY4 (or DASY5) 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, Samsung computer, near-field probe, probe alignment sensor, and the SAM twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Fig. 3.1).

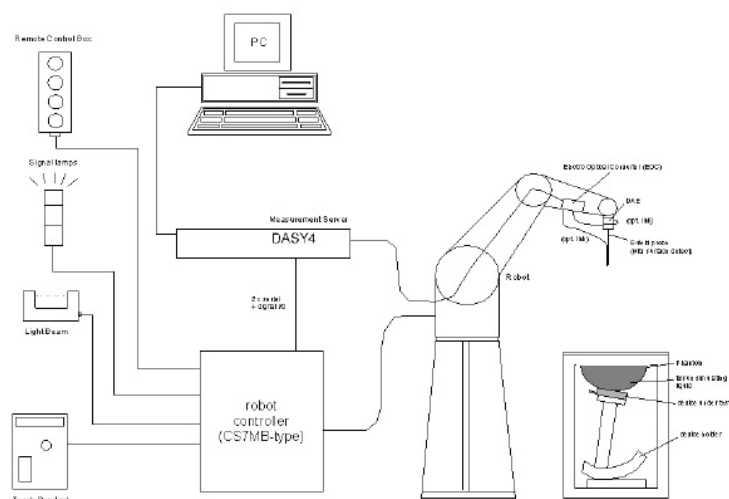


Figure 3.1 SAR Measurement System Setup

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 Samsung computer with Windows XP system and SAR Measurement Software DASY4 (or DASY5), 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.

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System Electronics

The DAE4(or DAE3) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit. Transmission to the 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 ES3DV2, ES3DV3, EX3DV4 and ET3DV6, 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. 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

Figure 3.2 DAE System stopped at reaching the maximum.

Probe Specifications

Construction Symmetrical design with triangular core
 Interleaved sensors
 Built-in shielding against static charges
 PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

Calibration Basic Broad Band Calibration in air: 10-3000 MHz
 Conversion Factors (CF) for HSL 900 and HSL 1800

Additional CF for other liquids and frequencies upon request

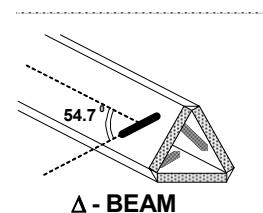


Figure 3.3 Triangular Probe Configuration

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Frequency 10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)

Directivity **[ES3DV3], [ET3DV6]**
 ± 0.2 dB in HSL (rotation around probe axis)
 ± 0.3 dB in tissue material (rotation normal to probe axis)
[EX3DV4]
 ± 0.3 dB in HSL (rotation around probe axis)
 ± 0.5 dB in tissue material (rotation normal to probe axis)

Dynamic Range **[ES3DV3], [ET3DV6]**
 $5\mu\text{W/g}$ to $> 100\text{mW/g}$; Linearity: $\pm 0.2\text{dB}$
[EX3DV4]
 $10\mu\text{W/g}$ to $> 100\text{ mW/g}$; Linearity: ± 0.2 dB

Dimensions **[ES3DV3], [ES3DV2]**
Overall length: 330 mm (Tip: 20 mm)
Tip diameter: 3.9 mm (Body: 12 mm)
Distance from probe tip to dipole centers: 2.1 mm
[EX3DV4]
Overall length: 330 mm (Tip: 20 mm)
Tip diameter: 2.5 mm (Body: 12 mm)
Typical distance from probe tip to dipole centers: 1 mm
[ET3DV6]
Overall length: 330mm
Tip length: 16mm
Body diameter: 12mm
Tip diameter: 6.8mm
Distance from probe tip to dipole centers: 2.7mm



[ES3DV3] ,[ES3DV2]



[EX3DV4]

Application **[ES3DV3], [ES3DV2]**

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General dosimetry up to 5 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones

[EX3DV4]

High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30 %.



[ET3DV6]

[ET3DV6]

General dosimetry up to 3 GHz
Compliance tests of mobile phones
Fast automatic scanning in arbitrary phantoms

Optical
Surface
Detection

[ET3DV6]

± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces

3.3 Phantom

SAM Twin Phantom

The SAM Twin Phantom V4.0 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)



Figure3.5 SAM Twin Phantom

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SAM Twin Phantom Specification

Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-2003, EN 62209-1. 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.
Shell Thickness	2 ± 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	Height: 810 mm; Length: 1000 mm; Width: 500 mm

Modular Flat Phantom

The Modular Flat Phantom V5.1 is constructed of a fiberglass shell integrated in a wooden table. Also It consists of three identical flat phantoms (modules) which can be installed and removed separately without emptying the liquid, as well as a wooden support.. It enables the dosimetric evaluation of 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 3.6)



Figure 3.6 Modular Flat Phantom

Modular Flat Phantom Specification

Construction	The shell corresponds to the specifications of IEEE 1528-2003. It enables the dosimetric evaluation of body mounted usage above 800 MHz at the flat phantom region. A cover prevents evaporation of the liquid		
Shell Thickness	2 ± 0.2 mm		
Filling Volume	Approx. 10 liters		
Dimension	Wooden support - Height: 810 mm; Length: 830 mm; Width: 500 mm Each Module - Height:190 mm; Length: 200 mm; width: 300 mm		

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3.4 Brain Simulating Mixture Characterization

The brain mixtures consist of a viscous gel using hydroxethylcellulose (HEC) gelling agent and saline solution (see Table 3.1). Preservation with a bactericide is added and visual inspection is made to make sure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue.

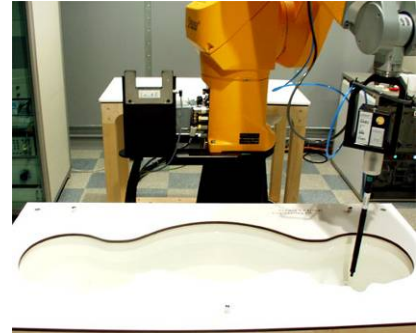


Figure 3.7 Simulated Tissue

Table 3.1 Composition of the Brain Tissue Equivalent Matter

INGREDIENTS	835MHz Brain	835MHz Muscle	2450MHz Brain	2450MHz Muscle
WATER	40.19%	50.75%	71.88%	73.4%
SUGAR	57.90%	48.21%	-	-
SALT	1.48%	0.94%	0.16%	0.06%
DGBE	-	-	7.99%	26.54%
Triton X-100	-	-	19.97%	-
BACTERIACIDE	0.18%	0.10%	-	-
HEC	0.25%	-	-	-
Dielectric Constant Target	41.5	55.2	39.2	52.7
Conductivity Target (S/m)	0.9	0.97	1.8	1.95

3.5 Device Holder for Transmitters

In combination with the Twin SAM Phantom V4.0, the Mounting Device (see Fig. 3.7) enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is

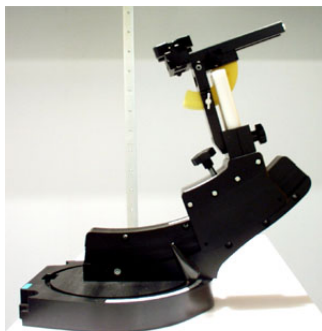


Figure 3.8 Device Holder

the ear opening. The devices can be easily, accurately and repeatedly be positioned according to the EN 50360:2001 and FCC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

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

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3.6 Validation Dipole

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

Frequency	835, 2450 MHz
Return Loss	< -20 dB at specified validation position
Dimensions	D835V2: dipole length: 161 mm; overall height: 330 mm D2450V2: dipole length: 51.8 mm; overall height: 300 mm

Note:

Usage of SAR dipoles calibrated less than 2 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibration in KDB 450824

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3.7 Equipment Calibration

Table 3.2 Test Equipment Calibration

Type	Calibration Due Date	Serial No.
SPEAG E-Field Probe ES3DV2	May.20, 2012	3017
SPEAG DAE4	Feb.22, 2012	486
SPEAG Validation Dipole D835V2	Feb.23, 2013	4d050
SPEAG Validation Dipole D2450V2	Apr.19, 2013	708
Stäubli Robot TX90XL	Not Required	F06/546ZA1/A/01
SPEAG SAM Twin Phantom	Not Required	TP-1457
SPEAG SAM Twin Phantom	Not Required	TP-1425
Modular Phantom	Not Required	MP-1007
E4438C Signal Generator	Jan.26, 2012	MY45094010
NRVD Dual Channel Power Meter	Feb.07, 2012	836416/028
NRV-Z53 Thermal Power Sensor	Feb.07, 2012	835324/001
NRV-Z53 Thermal Power Sensor	Feb.07, 2012	835324/006
E4419B Power Meter	Nov.30, 2011	GB43312299
E9300B Power Sensor	Jan.28, 2012	MY41495557
BBS3Q7ECK Power Amp	Jan.20, 2012	1052
HP-8753ES Network Analyzer	Apr.27, 2012	US39173712
HP85070C Dielectric Probe Kit	Not Required	US99360087
DASY5 S/W (ver 5.0)	Not Required	-
E4440A Spectrum Analyzer	Feb.24, 2012	MY45304704
778D Dual Directional Coupler	May.20, 2012	18862
777D Dual Directional Coupler	Mar.24, 2012	07526
Base Station Simulator	Dec.20, 2011	GB46490112

NOTE:

The E-field probe was calibrated by SPEAG, by temperature measurement procedure. Dipole Validation measurement is performed by Samsung Lab. before each test. (see § 7.2) The brain simulating material is calibrated by Samsung using the dielectric probe system and network analyzer to determine the conductivity and permittivity (dielectric constant) of the brain-equivalent material. (see § 7.1)

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4. SAR MEASUREMENT PROCEDURE

The evaluation was performed using the following procedure.

STEP 1

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

STEP 2

The SAR distribution at the exposed side of the head was measured at a distance of 3.9mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 20mm x 20mm. Based on the area scan data, the area of the maximum absorption was determined by spline interpolation.

STEP 3

Around this point, a volume of 32mm x 32mm x 30mm (fine resolution volume scan, zoom scan) was assessed by measuring 5 x 5 x 7 points. On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure:

The data at the surface was extrapolated, since the center of the dipoles is 2.7mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y, and z directions). The volume was integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

STEP 4

The SAR value at the same location as in step 1 was again measured.

(If the value changed by more than 5%, the evaluation is repeated.)

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5. DESCRIPTION OF TEST POSITION

5.1 SAM Phantom Shape

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

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.

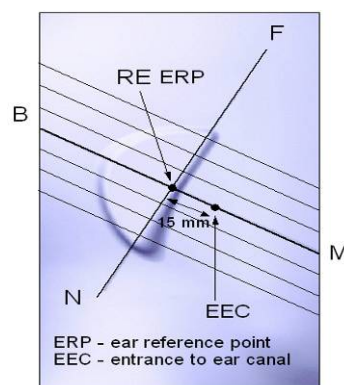


Figure 5.2 Close up side view

5.2 “cheek” Position

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 tip and bottom edges, positioning the “ear reference point” on the outer surface of the both the left and right head

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phantoms on the ear reference point

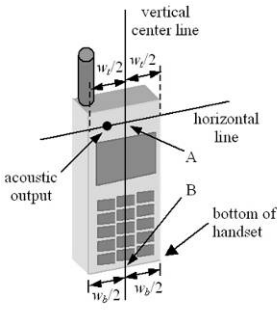


Figure 5.4 Handset vertical and horizontal reference lines

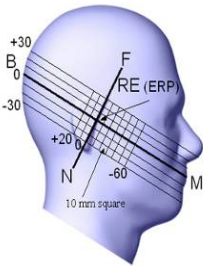
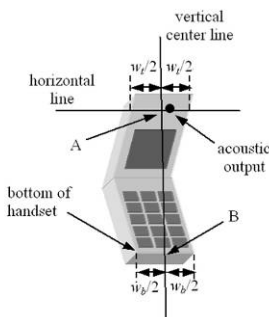


Figure 5.3 Side view of the phantom showing relevant markings

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 5.5), 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

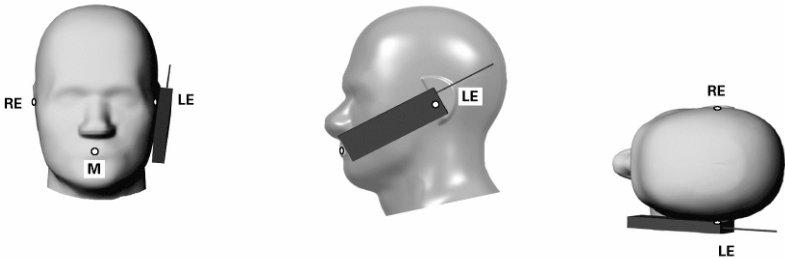


Figure 5.5 Front, Side and Top View of Cheek/Touch Position

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

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Rotate the handset around the vertical centerline until the phone (horizontal line) was symmetrical was 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.

5.3 “tilted” Position

With the test device aligned in the “cheek” position :

Step 1

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

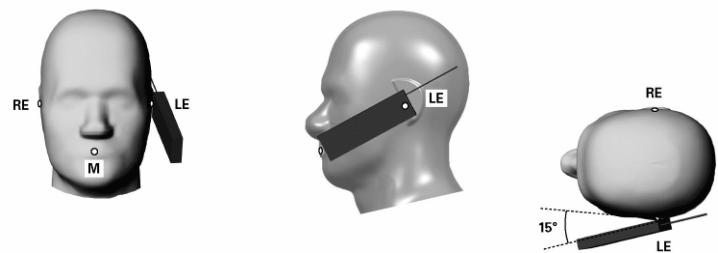


Figure 5.6 Front, side and Top View of Ear/Tilt 15° Position

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

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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.

5.4 Body Holster/Belt Clip Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 5.7). A device with a headset output is tested with a headset connected to the device. Body dielectric parameters are used.

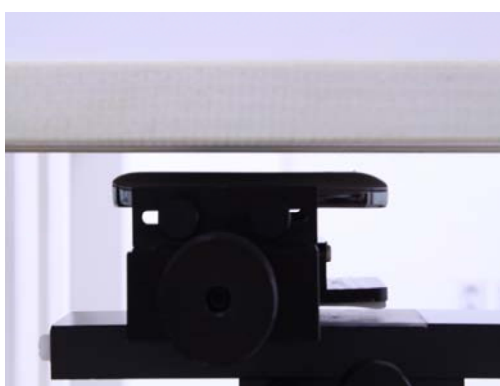


Figure 5.7 Body Belt Clip and Holster Configurations

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are supplied with the device, the device is tested with each accessory that contains unique metallic component. If multiple accessory 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 where a separation distance between the back of the device and the flat phantom is used.

Transmitters that are designed to operate in front of a person's face, as in push-to-talk

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configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessory(ies), Including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

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

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

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5.5 SAR Testing Configurations

Table 5.1 Mobile Hotspot Sides for SAR testing

Mode	Back	Front	Top	Bottom	Right	Left
CDMA	Yes	Yes	No	Yes	Yes	Yes
WIFI	Yes	Yes	No	Yes	No	Yes

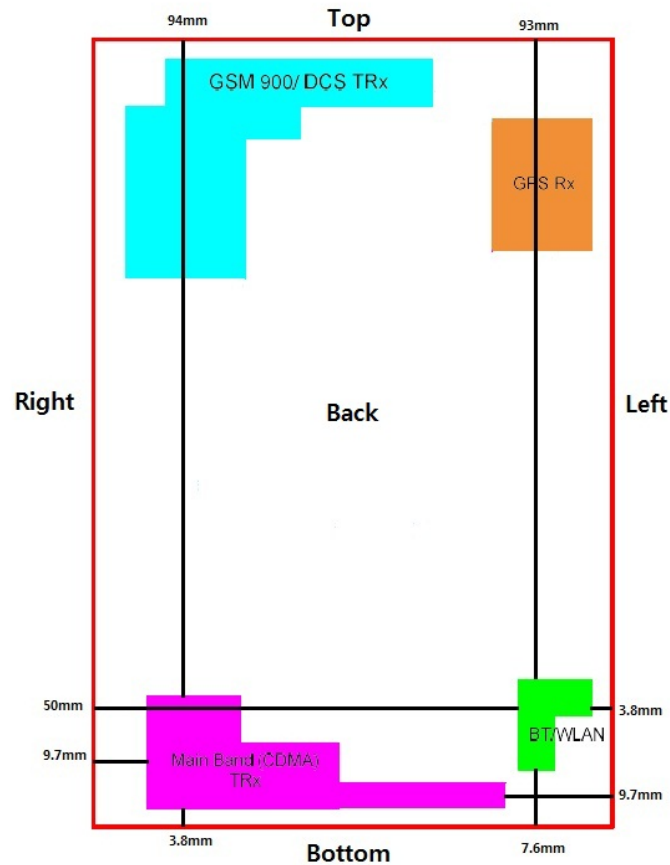


Figure 5.8 Identification of Sides for SAR testing, as viewed from back of device

Note : Per FCC KDB Publication 941225, the edges with antennas within 2.5cm are required to be evaluated for SAR. See Figure 5.8 for distances of the actual device

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6. MEASUREMENT UNCERTAINTY

Table 6.1 Uncertainty Budget at 835MHz

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	c_i	Standard uncertainty (±%)	v_i^2 or v_{eff}
Measurement System						
Probe Calibration	11.00	normal	2.000	1	5.50	∞
Axial Isotropy	4.70	rectangular	1.732	0.7	1.90	∞
Hemispherical Isotropy	9.60	rectangular	1.732	0.7	3.88	∞
Linearity	4.70	rectangular	1.732	1	2.71	∞
System Detection Limits	0.25	rectangular	1.732	1	0.14	∞
Boundary effects	1.00	rectangular	1.732	1	0.58	∞
Readout electronics	0.30	normal	1.000	1	0.30	∞
Response time	0.80	rectangular	1.732	1	0.46	∞
RF ambient conditions	3.00	rectangular	1.732	1	1.73	∞
Integration time	1.73	rectangular	1.732	1	1.00	∞
Mechanical constrains of robot	1.50	rectangular	1.732	1	0.87	∞
Probe positioning	2.90	rectangular	1.732	1	1.67	∞
Extrapolation and integration	1.00	rectangular	1.732	1	0.58	∞
Test Sample Related						
Test Sample positioning	1.12	normal	1.000	1	1.12	14
Device holded uncertainty	3.44	normal	1.000	1	3.44	∞
Power Drift	5.00	rectangular	1.732	1	2.89	∞
Phantom and Setup						
Modular Phantom uncertainty	5.62	normal	1.000	1	5.62	2
Phantom uncertainty	4.00	rectangular	1.732	1	2.31	∞
Liquid conductivity (deviation from target)	5.00	rectangular	1.732	0.64	1.85	∞
Liquid conductivity (measurement error)	0.38	normal	1.000	0.64	0.24	∞
Liquid permittivity (deviation from target)	5.00	rectangular	1.732	0.6	1.73	∞
Liquid permittivity (measurement error)	5.44	normal	1.000	0.6	3.26	∞
Combined Standard Uncertainty		Normal	-	-	11.84	172776
Extended Standard Uncertainty(K=2.00)					23.69	172776

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Table 6.2 Uncertainty Budget at 2450MHz

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	C _i	Standard uncertainty (±%)	v_i^2 or v_{eff}
Measurement System						
Probe Calibration	11.00	normal	2.000	1	5.00	∞
Axial Isotropy	4.70	rectangular	1.732	0.7	1.90	∞
Hemispherical Isotropy	9.60	rectangular	1.732	0.7	3.88	∞
Linearity	4.70	rectangular	1.732	1	2.71	∞
System Detection Limits	0.25	rectangular	1.732	1	0.14	∞
Boundary effects	1.00	rectangular	1.732	1	0.58	∞
Readout electronics	0.30	normal	1.000	1	0.30	∞
Response time	0.80	rectangular	1.732	1	0.46	∞
RF ambient conditions	3.00	rectangular	1.732	1	1.73	∞
Integration time	0.00	rectangular	1.732	1	0.00	∞
Mechanical constrains of robot	1.50	rectangular	1.732	1	0.87	∞
Probe positioning	2.90	rectangular	1.732	1	1.67	∞
Extrapolation and integration	1.00	rectangular	1.732	1	0.58	∞
Test Sample Related						
Test Sample positioning	4.22	normal	1.000	1	4.22	14
Device holded uncertainty	3.44	normal	1.000	1	3.44	∞
Power Drift	5.00	rectangular	1.732	1	2.89	∞
Phantom and Setup						
Modular Phantom uncertainty	2.32	Normal	1.0001	1	2.32	2
Phantom uncertainty	4.00	rectangular	1.732	1	2.31	∞
Liquid conductivity (deviation from target)	5.00	rectangular	1.732	0.64	1.85	∞
Liquid conductivity (measurement error)	2.04	normal	1.000	0.64	1.30	∞
Liquid permittivity (deviation from target)	5.00	rectangular	1.732	0.6	1.73	∞
Liquid permittivity (measurement error)	4.27	normal	1.000	0.6	2.56	∞
Combined Standard Uncertainty		Normal	-	-	11.32	728
Extended Standard Uncertainty(K=2.00)					22.64	728

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7. SYSTEM VERIFICATION

7.1 Tissue Verification

Table 7.1 MEASURED TISSUE PARAMETERS

	835MHz Head		835MHz Body		2450MHz Head		2450MHz Body	
	Target	Measured	Target	Measured	Target	Measured	Target	Measured
Date	Nov.04, 2011		Nov.04, 2011		Nov.07, 2011		Nov.07, 2011	
Liquid Temperature(°C)	22.1		22.0		22.2		22.2	
Dielectric Constant: ϵ'	41.5	41.7	55.2	55.2	39.2	38.1	52.7	51.1
Conductivity:	0.9	0.89	0.97	0.97	1.8	1.84	1.95	1.94
Tissue Batch Number	835DF4001C		835B2001L		2450MF4001B		2450B2001B	

The measured value must be within $\pm 5\%$ of the target value.

7.2 Test System Validation

Prior to assessment, the system is verified to the $\pm 10\%$ of the specification at 835MHz and 2450MHz by using the system validation kit(s). (see Appendix D, Graphic Plot Attached)

Table 7.2 System Validation Results

System Validation Kit	Tissue	Targeted SAR _{1g} (mW/g)	Normalized SAR _{1g} (mW/g)	Measured SAR _{1g} (mW/g)	Deviation (%)	Date	Liquid Temperature(°C)	Ambient Temperature(°C)	Input Power(mW)
4d050	835MHz Brain	9.61	10.2	1.02	6.14	Nov.04, 2011	22.3	22.5	100
4d050	835MHz Muscle	10.0	9.89	0.989	-1.10	Nov.04, 2011	22.2	22.6	100
708	2450MHz Brain	55.8	55.9	5.59	0.18	Nov.07, 2011	22.0	22.3	100
708	2450MHz Muscle	51.2	49.4	4.94	-3.52	Nov.07, 2011	22.1	22.2	100

*Validation was measured with input power 100 mW and normalized to 1W.

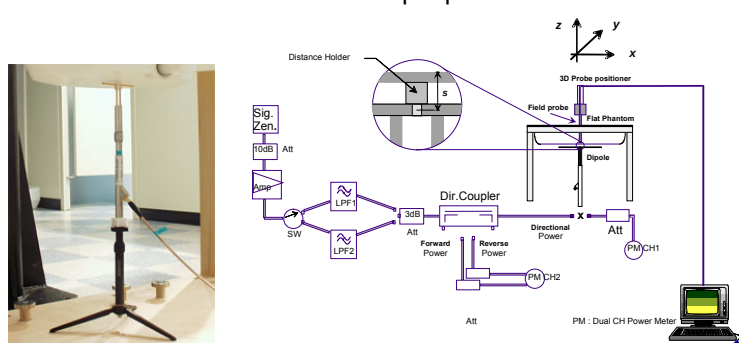


Figure 7.1 Dipole Validation Test Setup

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8. SAR MEASUREMENT RESULTS

Procedures Used To Establish Test Signal

The handset was placed into a simulated call using a base station simulator in a shielded chamber.

Such test signals offer a consistent means for testing SAR and are recommended for evaluating SAR. SAR measurements were taken with a fully charged battery. In order to verify that the device was tested and maintained at full power, this was configured with the base station simulator. The SAR measurement software calculates a reference point at the start and end of the test to check for power drifts. If conducted power deviations of more than 5% occurred, the tests were repeated.

SAR Measurement Conditions for CDMA2000 1x

These procedures were followed according to FCC "SAR Measurement Procedures for 3G Devices", Oct 2007.

Output Power Verification

See 3GPP2 C.S0011/TIA-98-E as recommended by "SAR Measurement Procedures for 3G Devices", Oct 2007.

Maximum output power is verified on the High, Middle and Low channels according to procedures defined in section 4.4.5.2 of 3GPP2 C.S0011/TIA-98-E. SO55 tests were measured with power control bits in "All Up" condition.

1. If the mobile station supports Reverse TCH RC 1 and Forward TCH RC 1, set up a call using Fundamental Channel Test Mode 1 (RC=1/1) with 9600 bps data rate only.
2. Under RC1, C.S0011 Table 4.4.5.2-1 (Table 8-1) parameters were applied.
3. If the MS supports the RC 3 Reverse FCH, RC3 Reverse SCH0 and demodulation of RC 3, 4, or 5, set up a call using Supplemental Channel Test Mode 3 (RC 3/3) with 9600 bps Fundamental Channel and 9600 bps SCH0 data rate.
4. Under RC3, C.S0011 Table 4.4.5.2-2 (Table 8-2) was applied.
5. FCHs were configured at full rate for maximum SAR with "All Up" power control bits.

Parameter	Units	Value
$\hat{I}_{or}$	dBm/1.23 MHz	-104
$\frac{Pilot E_c}{I_{or}}$	dB	-7
$\frac{Traffic E_c}{I_{or}}$	dB	-7.4

Table 8.1

Parameters for Max. Power for RC1

Parameter	Units	Value
$\hat{I}_{or}$	dBm/1.23 MHz	-86
$\frac{Pilot E_c}{I_{or}}$	dB	-7
$\frac{Traffic E_c}{I_{or}}$	dB	-7.4

Table 8-2

Parameters for Max. Power for RC3

Head SAR Measurement

SAR for head exposure configurations is measured in RC3 with the DUT configured to transmit at full rate using Loopback Service Option SO55. SAR for RC1 is not required when the maximum average output of each channel is less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel in RC1 using the exposure configuration that results in the highest SAR for that channel in RC3.

Body SAR Measurements

SAR for body exposure configurations is measured in RC3 with the DUT configured to

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transmit at full rate on FCH with all other code channels disabled using TDSO / SO32. SAR for multiple code channels (FCH + SCHn) is not required when the maximum average output of each RF channel is less than ¼ dB higher than that measured with FCH only. Otherwise, SAR is measured on the maximum output channel (FCH + SCHn) with FCH at full rate and SCH0 enabled at 9600 bps using the exposure configuration that results in the highest SAR for that channel with FCH only. When multiple code channels are enabled, the DUT output may shift by more than 0.5 dB and lead to higher SAR drifts and SCH dropouts.

Body SAR in RC1 is not required when the maximum average output of each channel is less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel in RC1; with Loopback Service Option SO55, at full rate, using the body exposure configuration that results in the highest SAR for that channel in RC3.

Handsets with EV-DO

For handsets with Ev-Do capabilities, when the maximum average output of each channel in Rev. 0 is less than ¼ dB higher than that measured in RC3 (1x RTT), body SAR for Ev-Do is not required. Otherwise, SAR for Rev. 0 is measured on the maximum output channel at 153.6 kbps using the body exposure configuration that results in the highest SAR for that channel in RC3. SAR for Rev. A is not required when the maximum average output of each channel is less than that measured in Rev. 0 or less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel for Rev. A using a Reverse Data Channel payload size of 4096 bits and a Termination Target of 16 slots defined for Subtype 2 Physical Layer configurations. A Forward Traffic Channel data rate corresponding to the 2-slot version of 307.2 kbps with the ACK Channel transmitting in all slots should be configured in the downlink for both Rev. 0 and Rev. A.

Table 8-3 Max. Power Output Table for SCH-I589

Band	Channel	CDMA2000 RC	SO2	SO55	TDSO SO32	TDSO SO32	1x EV-DO	1x EV-DO
					(F-SCH)	(+SCH)		Rev.A
CDMA	1013	RC1	24.58	24.63	-	-	24.52	24.78
		RC3	24.55	24.63	24.53	24.51		
	384	RC1	24.51	24.58	-	-	24.41	24.68
		RC3	24.56	24.55	24.45	24.55		
	777	RC1	24.64	24.57	-	-	24.44	24.64
		RC3	24.49	24.48	24.48	24.47		

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Table 8.4 IEEE 802.11b Output Power

Freq [MHz]	Channel	Data Rate [Mbps]	Average Power (dBm)	Peak Power (dBm)
2412	1	1	14.47	16.64
		2	14.69	17.04
		5.5	14.44	16.81
		11	14.58	16.75
2437	6	1	14.71	16.86
		2	14.69	16.89
		5.5	14.73	16.90
		11	14.70	16.87
2462	11	1	14.03	16.46
		2	14.16	16.54
		5.5	14.15	16.53
		11	14.19	16.61

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Table 8.5 IEEE 802.11gOutput Power

Freq [MHz]	Channel	Data Rate [Mbps]	Average Power (dBm)	Peak Power (dBm)
2412	1	6	13.01	19.46
		9	12.90	19.34
		12	12.97	19.55
		18	13.05	19.21
		24	13.09	20.50
		36	13.35	20.58
		48	13.41	20.73
		54	13.43	20.71
2437	6	6	13.03	19.36
		9	13.00	19.41
		12	13.02	19.52
		18	13.10	19.11
		24	13.19	20.48
		36	13.56	21.07
		48	13.66	20.81
		54	13.56	21.35
2462	11	6	12.62	19.08
		9	12.82	19.30
		12	12.66	19.29
		18	12.81	19.03
		24	12.54	20.16
		36	12.80	20.26
		48	12.86	20.03
		54	12.94	20.51

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Table 8.6 IEEE 802.11n Output Power

Freq [MHz]	Channel	MCS Index	Data Rate [Mbps]	Average Power (dBm)	Peak Power (dBm)
2412	1	0	6.5/7.2	10.87	17.65
		1	13/14.40	10.99	17.94
		2	19.5/21.70	11.08	17.89
		3	26/28.90	9.54	16.91
		4	29/43.3	10.87	17.93
		5	52/57.80	10.72	18.08
		6	58.50/65	10.86	18.69
		7	65/72.2	10.78	18.45
2437	6	0	6.5/7.2	11.25	18.04
		1	13/14.40	11.17	18.21
		2	19.5/21.70	11.24	18.04
		3	26/28.90	9.48	16.87
		4	29/43.3	10.91	18.12
		5	52/57.80	11.02	18.28
		6	58.50/65	11.04	18.80
		7	65/72.2	11.07	18.67
2462	11	0	6.5/7.2	10.85	17.67
		1	13/14.40	10.79	17.90
		2	19.5/21.70	10.92	17.78
		3	26/28.90	9.06	16.44
		4	29/43.3	10.55	17.70
		5	52/57.80	10.61	18.10
		6	58.50/65	10.72	18.47
		7	65/72.2	10.73	18.48

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Simultaneous Transmission

Refer to the FCC OET document, 'SAR Evaluation Considerations for Handsets with Multiple Transmitters and Antennas' (Feb 2008)

Table 8.7 Output Power Thresholds for Unlicensed Transmitters

	2.45	5.15 - 5.35	5.47 - 5.85	GHz
P Ref	12	6	5	mW
Device output power should be rounded to the nearest mW to compare with values specified in this table				

Table 8.8 Summary of SAR Evaluation Requirements for Cell phones with Multiple Transmitters

	Individual Transmitter	Simultaneous Transmission
Licensed Transmitters	<u>Routine evaluation required</u>	SAR not required: Unlicensed only o when stand-alone 1-g SAR is not required and antenna is > 5 cm from other antennas Licensed & Unlicensed o when the sum of the 1-g SAR is <1.6 W/kg for all simultaneous transmitting antennas o when SAR to antenna separation ratio of simultaneous transmitting antenna pair is < 0.3 SAR required: Licensed & Unlicensed antenna pairs with SAR to antenna separation ratio ≥ 0.3; test is only required for the configuration that results in the highest SAR in standalone configuration for each wireless mode and exposure condition Note: simultaneous transmission exposure conditions for head and body can be different for different style phones; therefore, different test requirements may apply
Unlicensed Transmitters	When there is no simultaneous transmission – o output < 60/f: SAR not required o output $\geq 60/f$: stand-alone SAR required When there is simultaneous transmission – Stand-alone SAR not required when O output $\leq 2 \cdot P_{Ref}$ and antenna is > 5.0 cm from other antennas O output $\leq P_{Ref}$ and antenna is ≥ 2.5 cm from other antennas O output $\leq P_{Ref}$ and antenna is < 2.5 cm from other antennas, each with either output power $\leq P_{Ref}$ or 1-g SAR < 1.2 W/kg Otherwise stand-alone SAR is required When stand-alone SAR is required o test SAR on highest output channel for each wireless mode and exposure condition o if SAR for highest output channel is > 50% of SAR limit, evaluate all channels according to normal procedures	

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Table 8.9 Simultaneous Transmission Scenario (Held to Ear)

Simult Tx	Configuration	CDMA SAR(W/Kg)	WIFI SAR (W/Kg)	Σ SAR (W/Kg)
Head SAR	Right Cheek	0.429	0.072	0.501
	Right Tilt	0.285	0.036	0.321
	Left Cheek	0.421	0.175	0.596
	Left Tilt	0.250	0.032	0.282

Table 8.11 Simultaneous Transmission Scenario (Body-Worn)

Simult Tx	Configuration	CDMA SAR(W/Kg)	WIFI SAR (W/Kg)	Σ SAR (W/Kg)
Body SAR	Back	0.710	0.041	0.751

Table 8.12 Simultaneous Transmission Scenario (Hotspot)

Simult Tx	Configuration	CDMA SAR(W/Kg)	WIFI SAR (W/Kg)	Σ SAR (W/Kg)
Body SAR	Back	0.729	0.041	0.77
	Front	0.522	0.020	0.542
	Top	-	-	-
	Bottom	0.091	0.018	0.109
	Left	0.209	0.038	0.247
	Right	0.302	-	0.302

Note: “-” SAR results shown in the table are zero for summation purposes. SAR was not required to be measured due to exclusions mentioned in Section 5.5.

Multiple Antenna/Transmission Information for SCH-I589

The separation between the main antenna and the Bluetooth antennas is 3mm. RF Conducted Power of Bluetooth Tx is 5.5mW. RF Conducted Power of WLAN is 29.58mW.

Based on the output power, antenna separation distance, and Body SAR of the dominant transmitter, a stand-alone BT SAR test is not required while for WLAN it is required.

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Conclusion

The above numerical summed SAR was below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit. Therefore, no volumetric SAR summation is required per FCC KDB Publication 648474

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8.1 CDMA Head SAR Results

Frequency		Mode	Conducted		Side	Test Position	Antenna Type	Battery	Drift (dB)	SAR Level (W/kg)
MHz	Ch		Start	End						
836.52	384	CDMA	24.52	24.54	Right	Cheek/Touch	Intenna	Standard	-0.006	0.429
836.52	384	CDMA	24.53	24.56	Right	Ear/Tilt 15°	Intenna	Standard	-0.036	0.285
836.52	384	CDMA	24.57	24.55	Left	Cheek/Touch	Intenna	Standard	0.062	0.421
836.52	384	CDMA	24.53	24.56	Left	Ear/Tilt 15°	Intenna	Standard	0.021	0.250
ANSI / IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population						1.6W/kg (mW/g) averaged over 1 gram				

NOTES:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [June 2001].
2. All modes of operation were investigated, and the worst-case results are reported.
3. Tissue parameters and temperatures are listed on the SAR plot.
4. Liquid tissue depth is 15.2 ± 0.2 cm
5. Battery is fully charged for all readings.
6. Head SAR was tested under RC3/SO55.
7. Test Configuration ☐ Manu. Test Codes ☒ Base Station Simulator
8. Justification for reduced test configurations: Per FCC/OET Bulletin 65 Supplement C (June, 2001), if the SAR measured at the middle channel for each test configuration (left, right, cheek/touch, tilt/ear, extended and retracted) is least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).

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8.2 CDMA Body-Worn SAR Results(Without Holster)

Frequency		Mode	Conducted Power		Test Position	Separation Distance	Antenna Type	Battery	Drift (dB)	SAR Level (W/kg)
MHz	Ch		Start	End						
836.52	384	CDMA	24.50	24.51	Back	1.0 cm	Intenna	Standard	-0.119	0.710
ANSI / IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population						1.6W/kg (mW/g) averaged over 1 gram				

NOTES:

- The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [June 2001].
- All modes of operation were investigated, and the worst-case results are reported.
- Tissue parameters and temperatures are listed on the SAR plot.
- Liquid tissue depth is 15.2 ± 0.2 cm
- Battery is fully charged for all readings.
- Body SAR was tested under RC3/SO32.
- Test Configuration ☐ With Holster ☒ Without Holster
- Justification for reduced test configurations: Per FCC/OET Bulletin 65 Supplement C (June, 2001), if the SAR measured at the middle channel for each test configuration (left, right, cheek/touch, tilt/ear, extended and retracted) is least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).
- Body SAR was tested under RC3/SO32 with FCH only since FCH+SCH modes are not greater than 0.25dB of the FCH only mode per KDB Publication 941225 D01.

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8.3 CDMA Hotspot SAR Results

Frequency		Mode	Conducted Power		Test Position	Separation Distance	Antenna Type	Battery	Drift (dB)	SAR Level (W/kg)
MHz	Ch		Start	End						
836.52	384	EVDO.0	24.41	24.42	Back	1.0 cm	Intenna	Standard	-0.050	0.686
836.52	384	EVDO.A	24.68	24.63	Back	1.0 cm	Intenna	Standard	-0.062	0.729
836.52	384	EVDO.0	24.42	24.39	Front	1.0 cm	Intenna	Standard	-0.035	0.522
836.52	384	EVDO.0	24.38	24.40	Bottom	1.0 cm	Intenna	Standard	0.044	0.091
836.52	384	EVDO.0	24.41	24.42	Left	1.0 cm	Intenna	Standard	-0.100	0.209
836.52	384	EVDO.0	24.41	24.43	Right	1.0 cm	Intenna	Standard	-0.003	0.302
ANSI / IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population						1.6W/kg (mW/g) averaged over 1 gram				

NOTES:

- The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [June 2001].
- All modes of operation were investigated, and the worst-case results are reported.
- Tissue parameters and temperatures are listed on the SAR plot.
- Liquid tissue depth is 15.2 ± 0.2 cm
- Battery is fully charged for all readings.
- Body SAR was tested under RC3/SO32.
- Test Configuration ☐ With Holster ☒ Without Holster
- Justification for reduced test configurations: Per FCC/OET Bulletin 65 Supplement C (June, 2001), if the SAR measured at the middle channel for each test configuration (left, right, cheek/touch, tilt/ear, extended and retracted) is least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).
- Body SAR was tested at 1cm distance because battery operated personal wireless routers(hotspots) enable multiple Wi-Fi connections, per KDB 941225 D06. but position 'Top' was not tested because antenna distance was > 2.5cm.
- Per FCC KDB Publication 941225 D01, CDMA Hotspot Body SAR was tested under EVDO Rev.0. Per FCC 3G Guidance. TDSO32 RC3 tests were not required since the maximum average output of each channel in RC3(1x RTT) was not more than 1/4dB higher than that measured Rev.0. But, SAR for Rev.A was additionally tested because the maximum average output power of each channel was more than 1/4dB higher than that measured in Rev.0.

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8.4 WLAN Head SAR Results

Frequency		Mode	Conducted		Side	Test Position	Antenna Type	Battery	Drift (dB)	SAR Level (W/kg)
MHz	Ch		Start	End						
2437	6	WLAN	14.72	14.76	Right	Cheek/Touch	Intenna	Standard	0.196	0.072
2437	6	WLAN	14.72	14.73	Right	Ear/Tilt 15°	Intenna	Standard	0.058	0.036
2437	6	WLAN	14.76	14.74	Left	Cheek/Touch	Intenna	Standard	0.181	0.175
2437	6	WLAN	14.76	14.69	Left	Ear/Tilt 15°	Intenna	Standard	0.140	0.032
ANSI / IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population						1.6W/kg (mW/g) averaged over 1 gram				

NOTES:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [June 2001].
2. All modes of operation were investigated, and the worst-case results are reported.
3. Tissue parameters and temperatures are listed on the SAR plot.
4. Liquid tissue depth is $15.2 \pm 0.2\text{cm}$
5. Battery is fully charged for all readings.
6. Test Configuration ☒ Manu. Test Codes ☐ Base Station Simulator
7. Justification for reduced test configurations for WIFI channels per KDB 248227 and April 2010 FCC/TCB Meeting Notes: Highest average RF output power channel for the lowest data rate were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers were not greater than 0.25 dB than that of the corresponding channel in the lowest data rate IEEE 802.11b mode.

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8.5 WLAN Body SAR Results

Frequency		Mode	Conducted Power		Test Position	Separation Distance	Antenna Type	Battery	Drift (dB)	SAR Level (W/kg)
MHz	Ch		Start	End						
2437	6	WLAN	14.66	14.65	Back	1.0 cm	Intenna	Standard	-0.117	0.041
2437	6	WLAN	14.64	14.68	Front	1.0 cm	Intenna	Standard	0.068	0.020
2437	6	WLAN	14.64	14.67	Bottom	1.0 cm	Intenna	Standard	-0.094	0.018
2437	6	WLAN	14.66	14.63	Left	1.0 cm	Intenna	Standard	0.173	0.038
ANSI / IEEE C95.1 1992 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population						1.6W/kg (mW/g) averaged over 1 gram				

NOTES:

- The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp.C [June 2001].
- All modes of operation were investigated, and the worst-case results are reported.
- Tissue parameters and temperatures are listed on the SAR plot.
- Liquid tissue depth is 15.2 ± 0.2 cm
- Battery is fully charged for all readings.
- Test Configuration ☐ With Holster ☒ Without Holster
- Justification for reduced test configurations for WIFI channels per KDB 248227 and April 2010 FCC/TCB Meeting Notes: Highest average RF output power channel for the lowest data rate were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers were not greater than 0.25 dB than that of the corresponding channel in the lowest data rate IEEE 802.11b mode.
- Body SAR was tested at 1cm distance because battery operated personal wireless routers(hotspots) enable multiple Wi-Fi connections, per KDB 941225 D06. but position 'Top' and 'Right' was not tested because antenna distance was > 2.5cm.
- Per FCC KDB Publication 941225 D06, when the same wireless modes and device transmission configurations are required for body-worn accessories and hotspot mode, it is not necessary to additionally test body-worn accessory SAR for the same device orientation. Therefore, the hotspot data for the back side configuration additionally shows body-worn compliance.

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9. CONCLUSION

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

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because innumerable factors may interact to determine the specific biological outcome of an exposure to electromagnetic fields, any protection guide shall consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.

The highest reported SAR values are as follows:

CDMA: Head: 0.429W/Kg : Body-worn: 0.710W/Kg, Hotspot: 0.729W/Kg

WLAN: Head: 0.175W/Kg : Body-worn: 0.041W/Kg, Hotspot: 0.041W/Kg

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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.

APPENDIX B

Probe Calibration Process

Dosimetric Assessment Procedure

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

Free Space Assessment

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1 GHz (see Fig. B.1), 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.

Temperature Assessment

E-field temperature correlation calibration is performed in a flat phantom flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe (see Fig. B.2).

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

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

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;

where:

σ = simulated tissue conductivity

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

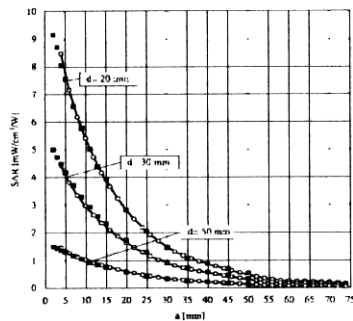


Figure B.1. E-Field and Temperature measurements at 900MHz

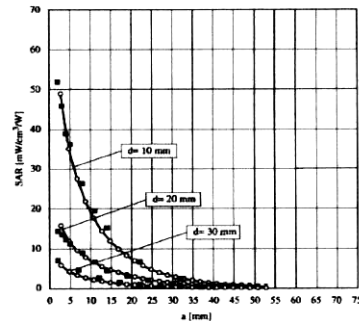


Figure B.2. E-Field and temperature measurements at 1.9GHz

APPENDIX C

ANSI/IEEE C95.1 – 1992 RF EXPOSURE LIMITS

Uncontrolled Environment

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

Controlled Environment

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

Table C.1 Safety Limits for Partial Body Exposure

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

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

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

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

APPENDIX D

The Validation Measurements

DUT: Dipole 835 MHz; Serial: 4d050

Program Name: 835MHz Dipole Validation 2010.11.04

Procedure Name: 835MHz @ 100mW

Meas. Ambient Temp(celsius)-22.5,Tissue Temp(celsius)-22.3;Test Date-04/Nov/2011

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 835$ MHz; $\sigma = 0.89$ mho/m; $\epsilon_r = 41.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(6.39, 6.39, 6.39); Calibrated: 2010-05-25
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: SAM PHANTOM #1; Type: SAM; Serial: TP-1457
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

835MHz @ 100mW/Area Scan (51x51x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 1.11 mW/g

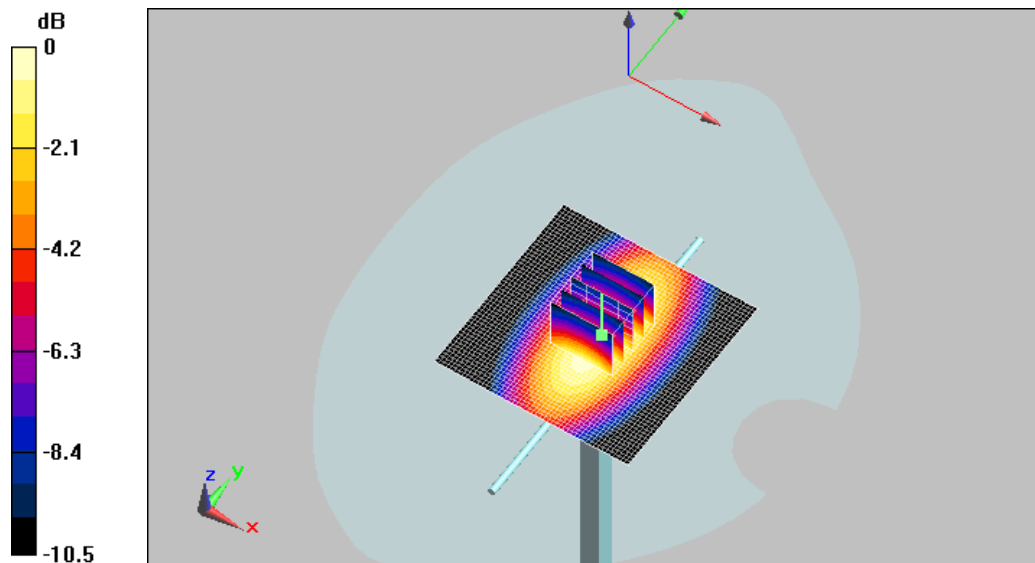
835MHz @ 100mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 35.3 V/m; Power Drift = -0.052 dB

Peak SAR (extrapolated) = 1.52 W/kg

SAR(1 g) = 1.02 mW/g; SAR(10 g) = 0.672 mW/g

Maximum value of SAR (measured) = 1.1 mW/g



0 dB = 1.1mW/g

DUT: Dipole 835 MHz; Serial: 4d050

Program Name: 835MHz Dipole Validation 2010.11.04

Procedure Name: 835MHz @ 100mW 2

Meas. Ambient Temp(celsius)-22.6,Tissue Temp(celsius)-22.2;Test Date-04/Nov/2011

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.97 \text{ mho/m}$; $\epsilon_r = 55.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Center Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(6.2, 6.2, 6.2); Calibrated: 2010-05-25
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: MP-1007
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

835MHz @ 100mW 2/Area Scan (51x51x1): Measurement grid: $dx=20\text{mm}$, $dy=20\text{mm}$

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

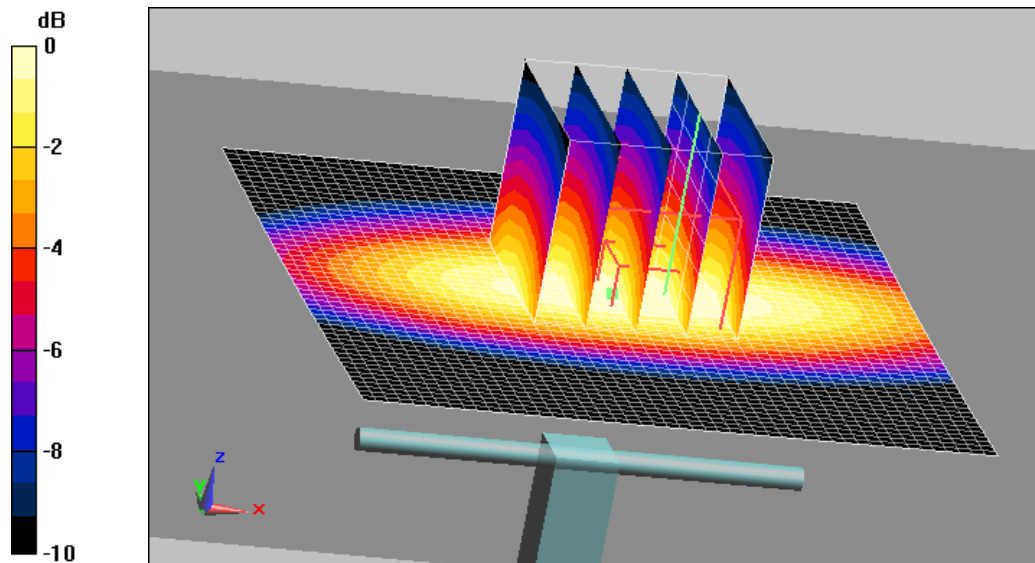
835MHz @ 100mW 2/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 32.1 V/m; Power Drift = 0.011 dB

Peak SAR (extrapolated) = 1.42 W/kg

SAR(1 g) = 0.989 mW/g; SAR(10 g) = 0.659 mW/g

Maximum value of SAR (measured) = 1.06 mW/g



0 dB = 1.06mW/g

DUT: Dipole 2450 MHz; Serial: D2450V2 - SN:708

Program Name: 2450MHz Dipole Head Validation 2011.11.07

Procedure Name: 2450MHz @ 100mW

Meas. Ambient Temp(celsius)-22.3,Tissue Temp(celsius)-22.0;Test Date-07/Nov/2011

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.84$ mho/m; $\epsilon_r = 38.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(4.28, 4.28, 4.28); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: SAM PHANTOM #2; Type: SAM; Serial: TP-1425
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

2450MHz @ 250mW/Area Scan (51x51x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 8.54 mW/g

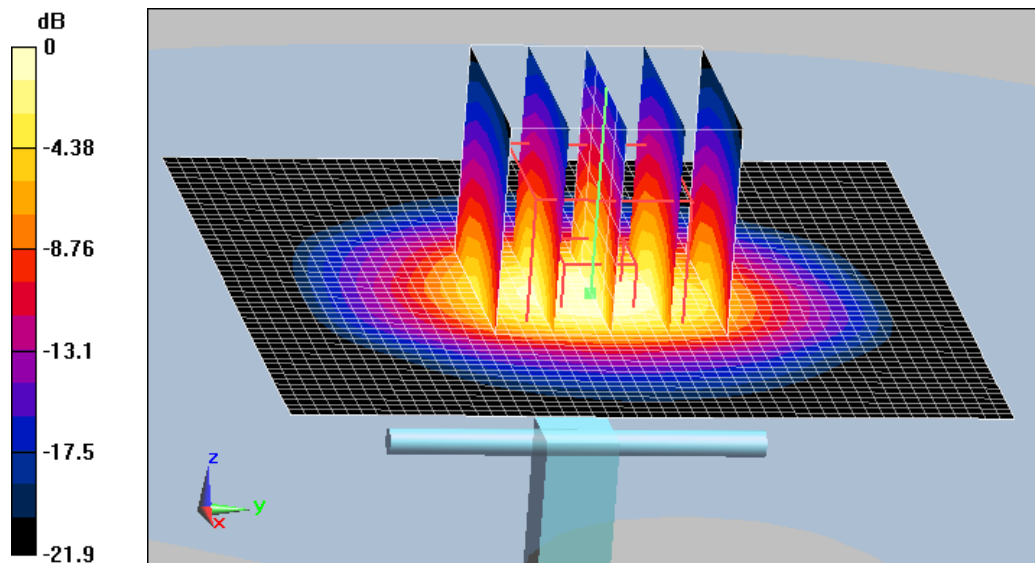
2450MHz @ 250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 58.8 V/m; Power Drift = 0.0056 dB

Peak SAR (extrapolated) = 11.6 W/kg

SAR(1 g) = 5.59 mW/g; SAR(10 g) = 2.62 mW/g

Maximum value of SAR (measured) = 6.3 mW/g



0 dB = 6.3mW/g

DUT: Dipole 2450 MHz; Serial: 708

Program Name: 2450MHz Dipole Body Validation 2011.11.07

Procedure Name: 2450MHz @ 100mW

Meas. Ambient Temp(celsius)-22.2,Tissue Temp(celsius)-22.1;Test Date-07/Nov/2011

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.94$ mho/m; $\epsilon_r = 51.1$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(3.83, 3.83, 3.83); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: MP-1007
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

2450MHz @ 100mW/Area Scan (51x51x1): Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 7.52 mW/g

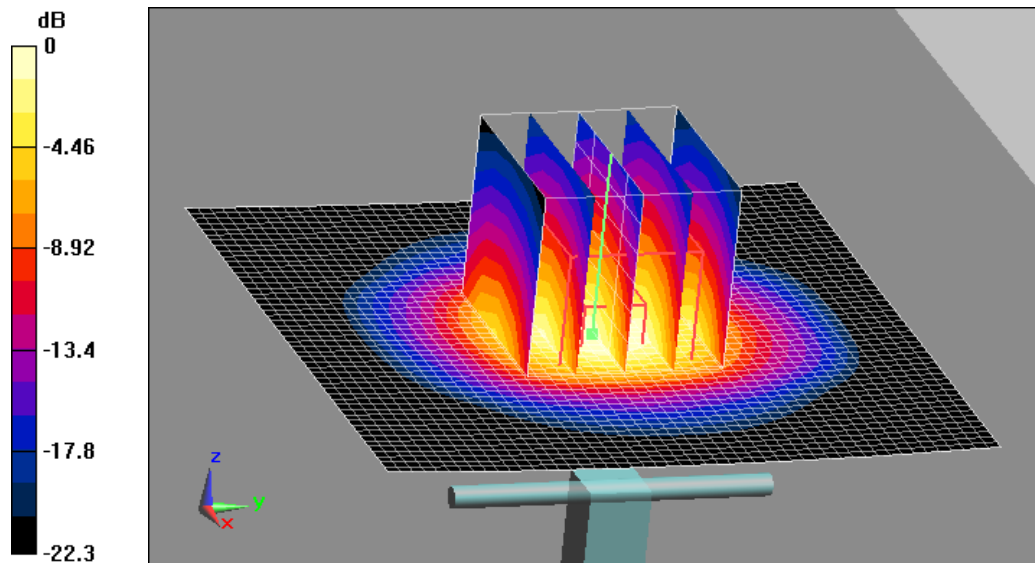
2450MHz @ 100mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 53.7 V/m; Power Drift = -0.032 dB

Peak SAR (extrapolated) = 10.4 W/kg

SAR(1 g) = 4.94 mW/g; SAR(10 g) = 2.28 mW/g

Maximum value of SAR (measured) = 5.54 mW/g



0 dB = 5.54mW/g

APPENDIX E

Plots of The SAR Measurements

DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 CDMA Right (Job No. : FI-258)

Procedure Name: Cheek, Ch.0384, Ant. Intenna, Bat. Standard

Meas. Ambient Temp(celsius)-22.5,Tissue Temp(celsius)-22.3;Test Date-04/Nov/2011

Communication System: CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 836.52$ MHz; $\sigma = 0.89$ mho/m; $\epsilon_r = 41.7$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(6.31, 6.31, 6.31); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: SAM PHANTOM #1; Type: SAM; Serial: TP-1457
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Cheek, Ch.0384, Ant. Intenna, Bat. Standard/Area Scan 2 (51x71x1): Measurement grid:

dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.459 mW/g

Cheek, Ch.0384, Ant. Intenna, Bat. Standard/Zoom Scan (5x5x7)/Cube 0: Measurement

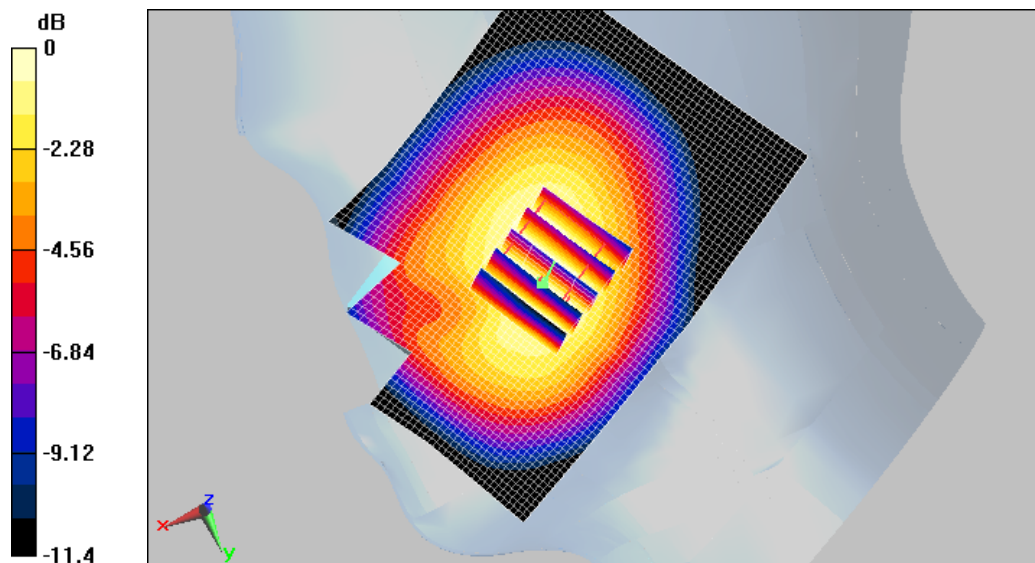
grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 20.7 V/m; Power Drift = -0.00603 dB

Peak SAR (extrapolated) = 0.637 W/kg

SAR(1 g) = 0.429 mW/g; SAR(10 g) = 0.296 mW/g

Maximum value of SAR (measured) = 0.451 mW/g



0 dB = 0.451mW/g

DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 CDMA Right (Job No. : FI-258)

Procedure Name: Tilt, Ch.0384, Ant. Intenna, Bat. Standard

Meas. Ambient Temp(celsius)-22.5,Tissue Temp(celsius)-22.3;Test Date-04/Nov/2011

Communication System: CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 836.52$ MHz; $\sigma = 0.89$ mho/m; $\epsilon_r = 41.7$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(6.31, 6.31, 6.31); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: SAM PHANTOM #1; Type: SAM; Serial: TP-1457
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Tilt, Ch.0384, Ant. Intenna, Bat. Standard/Area Scan (51x71x1): Measurement grid:

dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.312 mW/g

Tilt, Ch.0384, Ant. Intenna, Bat. Standard/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

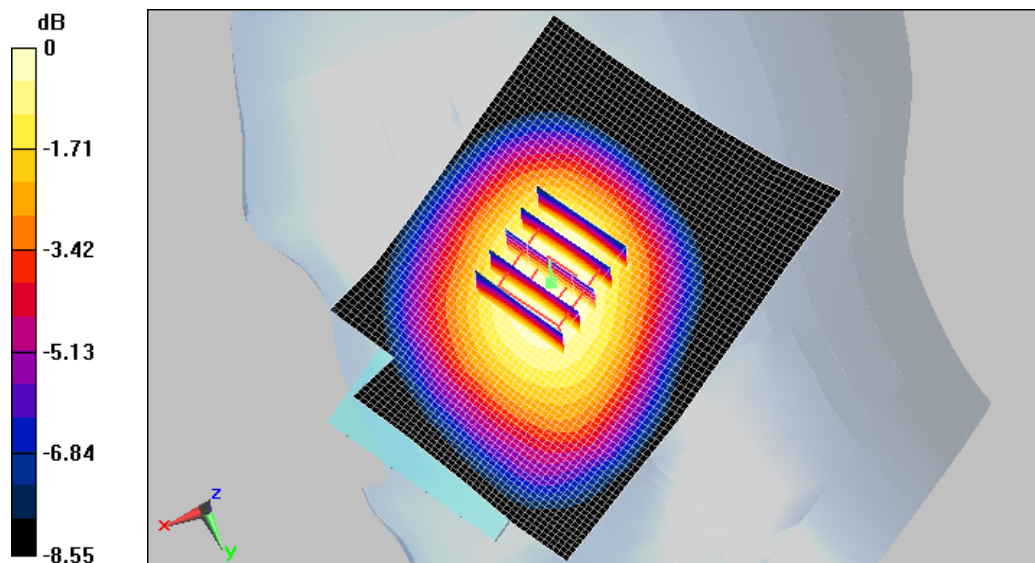
dx=8mm, dy=8mm, dz=5mm

Reference Value = 11.8 V/m; Power Drift = -0.036 dB

Peak SAR (extrapolated) = 0.349 W/kg

SAR(1 g) = 0.285 mW/g; SAR(10 g) = 0.218 mW/g

Maximum value of SAR (measured) = 0.298 mW/g



0 dB = 0.298mW/g

DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 CDMA Left (Job No. : FI-258)

Procedure Name: Cheek, Ch.0384, Ant. Intenna, Bat. Standard

Meas. Ambient Temp(celsius)-22.5,Tissue Temp(celsius)-22.3;Test Date-04/Nov/2011

Communication System: CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 836.52$ MHz; $\sigma = 0.89$ mho/m; $\epsilon_r = 41.7$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(6.31, 6.31, 6.31); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: SAM PHANTOM #1; Type: SAM; Serial: TP-1457
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Cheek, Ch.0384, Ant. Intenna, Bat. Standard/Area Scan (51x71x1): Measurement grid:

$dx=20$ mm, $dy=20$ mm

Maximum value of SAR (interpolated) = 0.430 mW/g

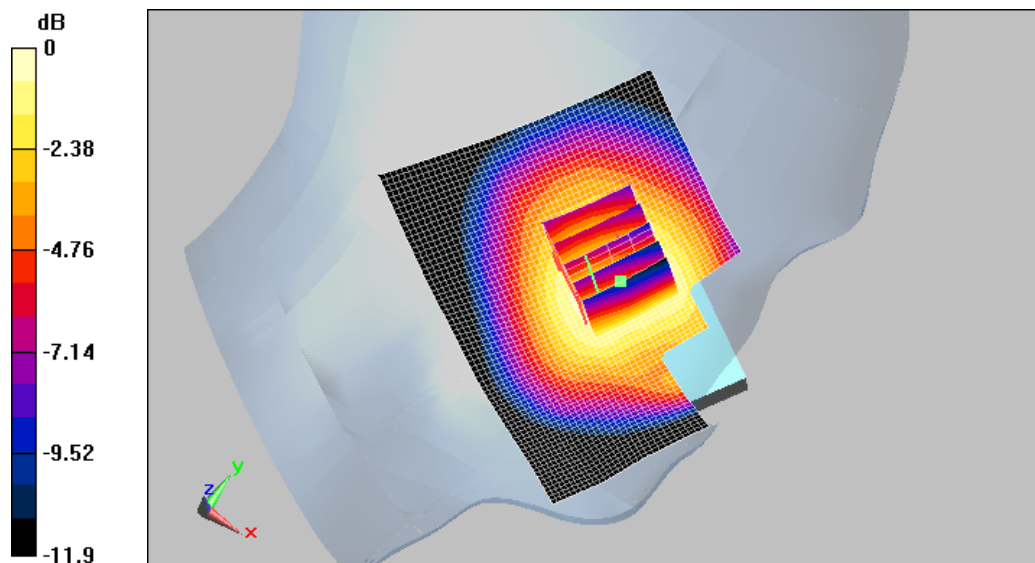
Cheek, Ch.0384, Ant. Intenna, Bat. Standard/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 22 V/m; Power Drift = 0.062 dB

Peak SAR (extrapolated) = 0.539 W/kg

SAR(1 g) = 0.421 mW/g; SAR(10 g) = 0.307 mW/g

Maximum value of SAR (measured) = 0.442 mW/g



0 dB = 0.442mW/g

DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 CDMA Left (Job No. : FI-258)

Procedure Name: Tilt, Ch.0384, Ant. Intenna, Bat. Standard

Meas. Ambient Temp(celsius)-22.5,Tissue Temp(celsius)-22.3;Test Date-04/Nov/2011

Communication System: CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 836.52$ MHz; $\sigma = 0.89$ mho/m; $\epsilon_r = 41.7$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(6.31, 6.31, 6.31); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: SAM PHANTOM #1; Type: SAM; Serial: TP-1457
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Tilt, Ch.0384, Ant. Intenna, Bat. Standard/Area Scan (51x71x1): Measurement grid:

dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.268 mW/g

Tilt, Ch.0384, Ant. Intenna, Bat. Standard/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

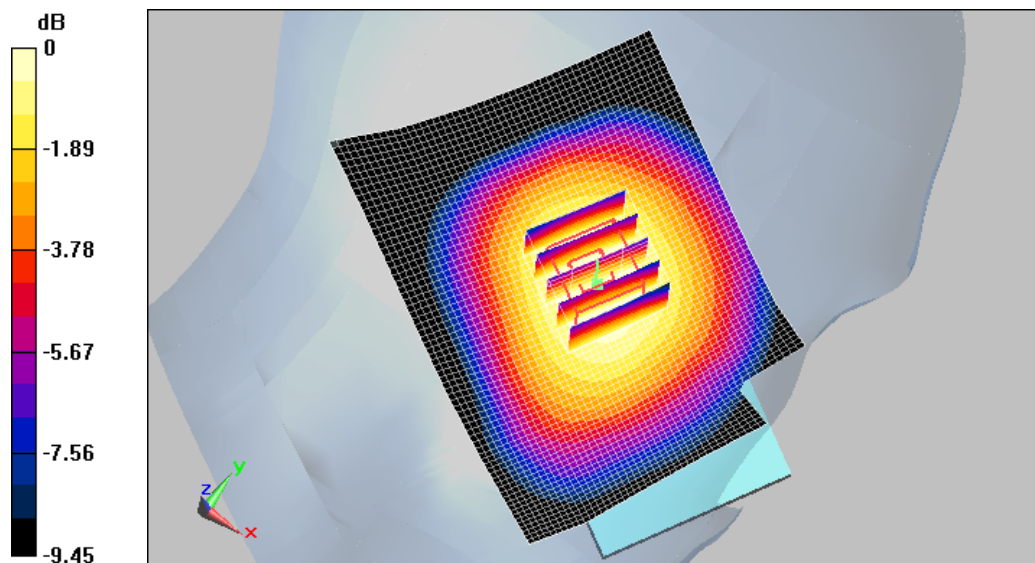
dx=8mm, dy=8mm, dz=5mm

Reference Value = 13.4 V/m; Power Drift = 0.021 dB

Peak SAR (extrapolated) = 0.312 W/kg

SAR(1 g) = 0.250 mW/g; SAR(10 g) = 0.191 mW/g

Maximum value of SAR (measured) = 0.263 mW/g



0 dB = 0.263mW/g

DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 CDMA Right (Job No. : FI-258)

Procedure Name: Cheek, Ch.0384, Ant. Intenna, Bat. Standard

Meas. Ambient Temp(celsius)-22.5,Tissue Temp(celsius)-22.3;Test Date-04/Nov/2011

Communication System: CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 836.52$ MHz; $\sigma = 0.89$ mho/m; $\epsilon_r = 41.7$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(6.31, 6.31, 6.31); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: SAM PHANTOM #1; Type: SAM; Serial: TP-1457
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Cheek, Ch.0384, Ant. Intenna, Bat. Standard/Area Scan 2 (51x71x1): Measurement grid:

$dx=20$ mm, $dy=20$ mm

Maximum value of SAR (interpolated) = 0.459 mW/g

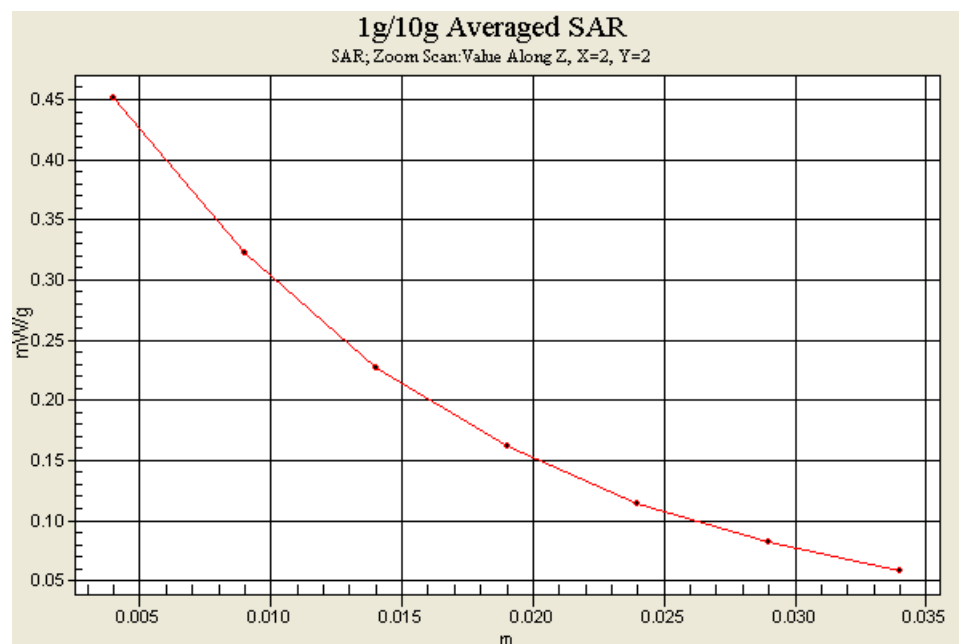
Cheek, Ch.0384, Ant. Intenna, Bat. Standard/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 20.7 V/m; Power Drift = -0.006 dB

Peak SAR (extrapolated) = 0.637 W/kg

SAR(1 g) = 0.429 mW/g; SAR(10 g) = 0.296 mW/g

Maximum value of SAR (measured) = 0.451 mW/g



DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 CDMA Body (Job No. : FI-258)

Procedure Name: Body, Ch. 384, Ant. Intenna, Bat. Standard, Back, Body-worn

Meas. Ambient Temp(celsius)-22.6,Tissue Temp(celsius)-22.2;Test Date-04/Nov/2011

Communication System: CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 836.6$ MHz; $\sigma = 0.97$ mho/m; $\epsilon_r = 55.2$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(6.21, 6.21, 6.21); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: MP-1007
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Body, Ch. 384, Ant. Intenna, Bat. Standard, Back, Body-worn/Area Scan (51x71x1):

Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.770 mW/g

Body, Ch. 384, Ant. Intenna, Bat. Standard, Back, Body-worn/Zoom Scan (5x5x7)/Cube 0:

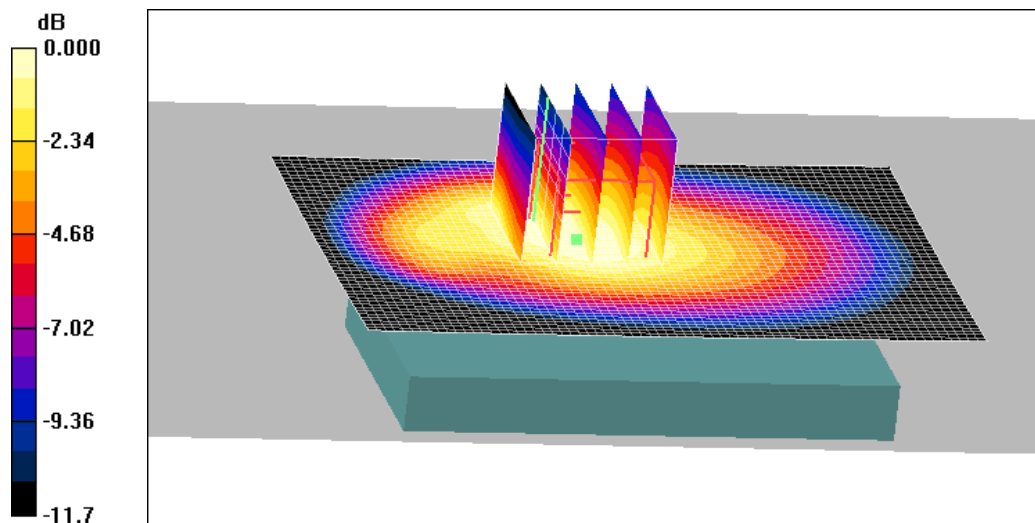
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 26.2 V/m; Power Drift = -0.119 dB

Peak SAR (extrapolated) = 1.06 W/kg

SAR(1 g) = 0.710 mW/g; SAR(10 g) = 0.481 mW/g

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



0 dB = 0.754mW/g

DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 CDMA Body (Job No. : FI-258)

Procedure Name: Body, Ch. 384, Ant. Intenna, Bat. Standard, Back, Body-worn

Meas. Ambient Temp(celsius)-22.6,Tissue Temp(celsius)-22.2;Test Date-04/Nov/2011

Communication System: CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 836.6$ MHz; $\sigma = 0.97$ mho/m; $\epsilon_r = 55.2$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(6.21, 6.21, 6.21); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: MP-1007
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Body, Ch. 384, Ant. Intenna, Bat. Standard, Back, Body-worn/Area Scan (51x71x1):

Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.770 mW/g

Body, Ch. 384, Ant. Intenna, Bat. Standard, Back, Body-worn/Zoom Scan (5x5x7)/Cube 0:

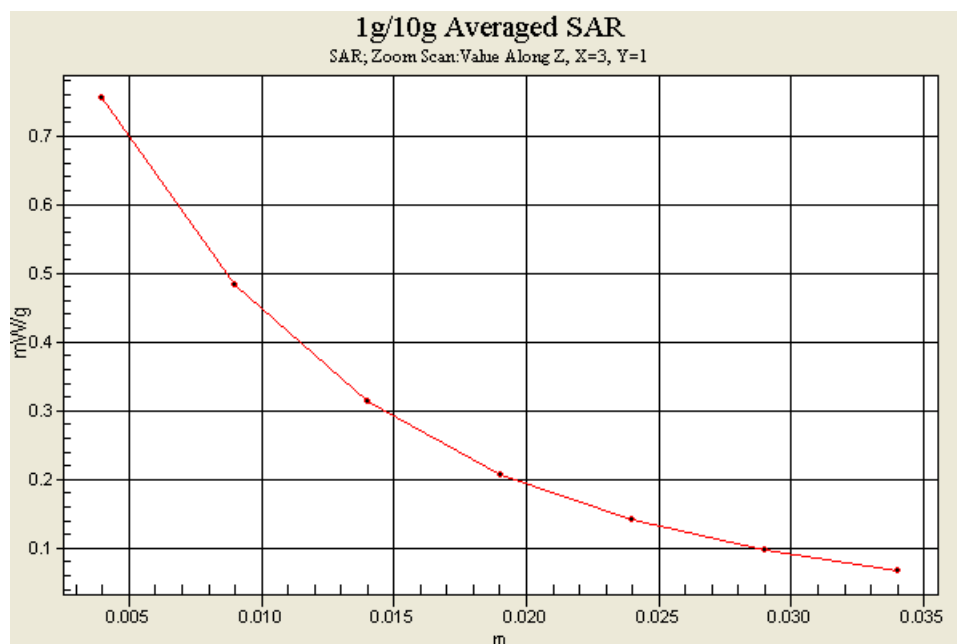
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 26.2 V/m; Power Drift = -0.119 dB

Peak SAR (extrapolated) = 1.06 W/kg

SAR(1 g) = 0.710 mW/g; SAR(10 g) = 0.481 mW/g

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



DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 CDMA Body (Job No. : FI-258)

Procedure Name: Body, Ch. 384, Ant. Intenna, Bat. Standard, Back

Meas. Ambient Temp(celsius)-22.6,Tissue Temp(celsius)-22.2;Test Date-04/Nov/2011

Communication System: CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 836.6$ MHz; $\sigma = 0.97$ mho/m; $\epsilon_r = 55.2$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(6.21, 6.21, 6.21); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: MP-1007
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Body, Ch. 384, Ant. Intenna, Bat. Standard, Back/Area Scan (51x71x1): Measurement grid:
dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.746 mW/g

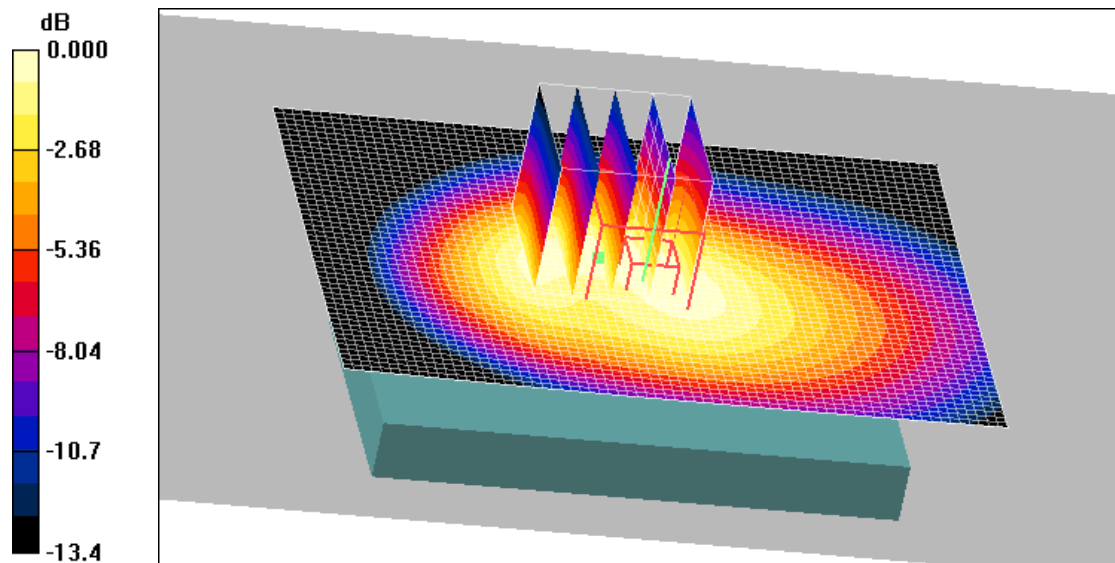
Body, Ch. 384, Ant. Intenna, Bat. Standard, Back/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 28.4 V/m; Power Drift = -0.050 dB

Peak SAR (extrapolated) = 1.07 W/kg

SAR(1 g) = 0.686 mW/g; SAR(10 g) = 0.442 mW/g

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



0 dB = 0.730mW/g

DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 CDMA Body (Job No. : FI-258)

**Procedure Name: Body, Ch. 384, Ant. Intenna, Bat. Standard, Back, Hotspot, EVDO.A
Meas. Ambient Temp(celsius)-22.6,Tissue Temp(celsius)-22.2;Test Date-04/Nov/2011**

Communication System: CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 836.6$ MHz; $\sigma = 0.97$ mho/m; $\epsilon_r = 55.2$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(6.21, 6.21, 6.21); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: MP-1007
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Body, Ch. 384, Ant. Intenna, Bat. Standard, Back, Hotspot/Area Scan (51x71x1):

Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.767 mW/g

Body, Ch. 384, Ant. Intenna, Bat. Standard, Back, Hotspot/Zoom Scan (5x5x7)/Cube 0:

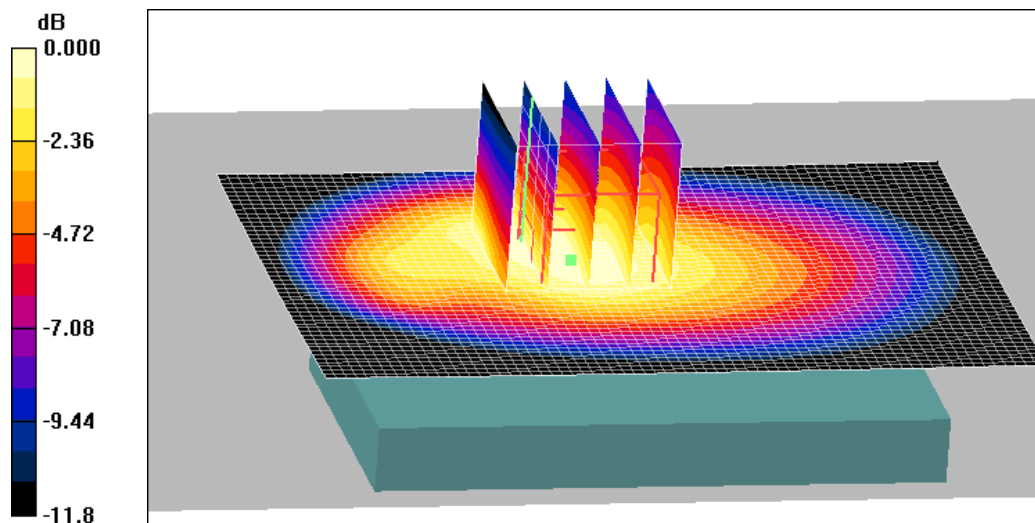
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 26.3 V/m; Power Drift = -0.062 dB

Peak SAR (extrapolated) = 1.12 W/kg

SAR(1 g) = 0.729 mW/g; SAR(10 g) = 0.493 mW/g

Maximum value of SAR (measured) = 0.782 mW/g



0 dB = 0.782mW/g

DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 CDMA Body (Job No. : FI-258)

Procedure Name: Body, Ch. 384, Ant. Intenna, Bat. Standard, Front, Hotspot

Meas. Ambient Temp(celsius)-22.6,Tissue Temp(celsius)-22.2;Test Date-04/Nov/2011

Communication System: CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 836.6$ MHz; $\sigma = 0.97$ mho/m; $\epsilon_r = 55.2$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(6.21, 6.21, 6.21); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: MP-1007
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Body, Ch. 384, Ant. Intenna, Bat. Standard, Front, Hotspot/Area Scan (51x71x1):

Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.540 mW/g

Body, Ch. 384, Ant. Intenna, Bat. Standard, Front, Hotspot/Zoom Scan (5x5x7)/Cube 0:

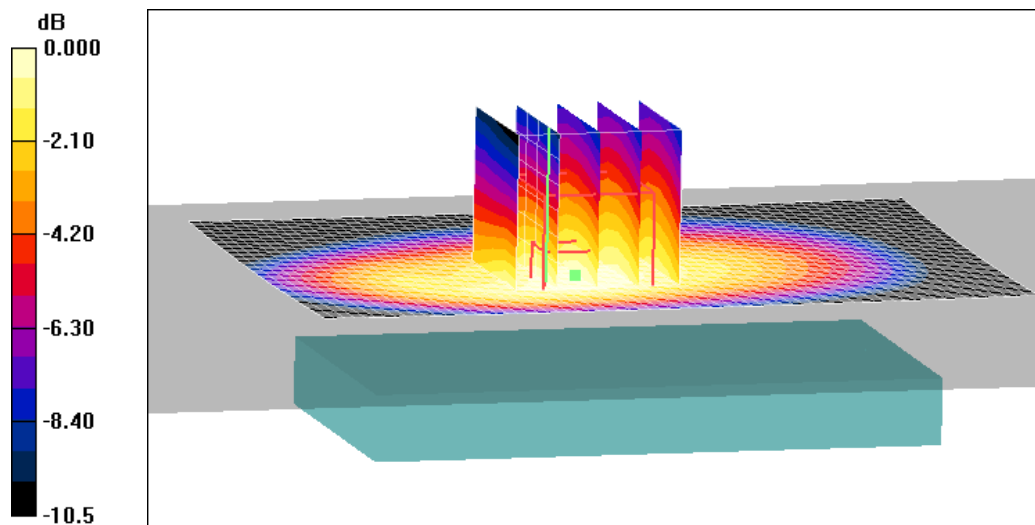
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 21.6 V/m; Power Drift = -0.035 dB

Peak SAR (extrapolated) = 0.718 W/kg

SAR(1 g) = 0.522 mW/g; SAR(10 g) = 0.368 mW/g

Maximum value of SAR (measured) = 0.549 mW/g



0 dB = 0.549mW/g

DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 CDMA Body (Job No. : FI-258)

Procedure Name: Body, Ch. 384, Ant. Intenna, Bat. Standard, Bottom, Hotspot

Meas. Ambient Temp(celsius)-22.6,Tissue Temp(celsius)-22.2;Test Date-04/Nov/2011

Communication System: CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 836.6$ MHz; $\sigma = 0.97$ mho/m; $\epsilon_r = 55.2$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(6.21, 6.21, 6.21); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: MP-1007
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Body, Ch. 384, Ant. Intenna, Bat. Standard, Bottom, Hotspot/Area Scan (41x61x1):

Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.090 mW/g

Body, Ch. 384, Ant. Intenna, Bat. Standard, Bottom, Hotspot/Zoom Scan (5x5x7)/Cube 0:

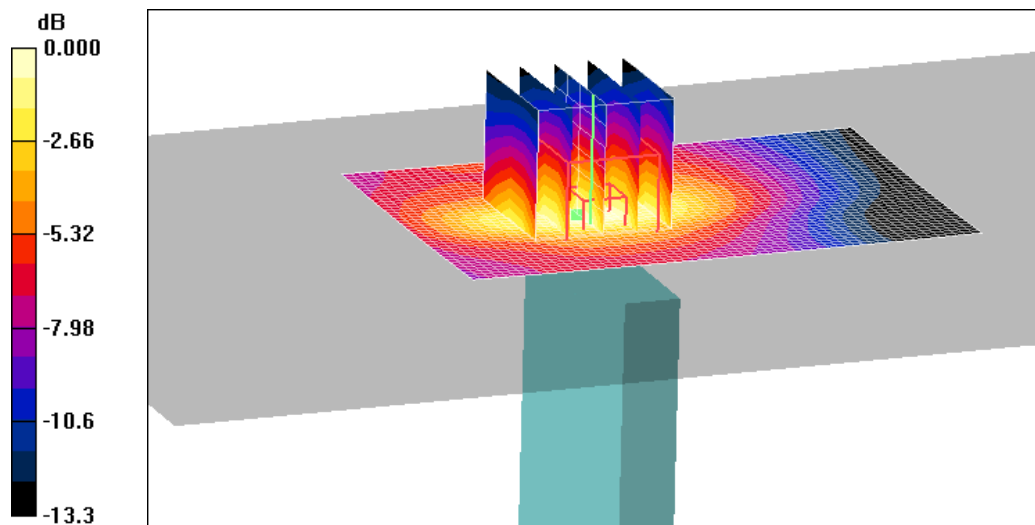
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 8.39 V/m; Power Drift = 0.044 dB

Peak SAR (extrapolated) = 0.152 W/kg

SAR(1 g) = 0.091 mW/g; SAR(10 g) = 0.051 mW/g

Maximum value of SAR (measured) = 0.094 mW/g



0 dB = 0.094mW/g

DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 CDMA Body (Job No. : FI-258)

Procedure Name: Body, Ch. 384, Ant. Intenna, Bat. Standard, Left, Hotspot

Meas. Ambient Temp(celsius)-22.6,Tissue Temp(celsius)-22.2;Test Date-04/Nov/2011

Communication System: CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 836.6$ MHz; $\sigma = 0.97$ mho/m; $\epsilon_r = 55.2$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(6.21, 6.21, 6.21); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: MP-1007
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Body, Ch. 384, Ant. Intenna, Bat. Standard, Left, Hotspot/Area Scan (41x71x1):

Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.231 mW/g

Body, Ch. 384, Ant. Intenna, Bat. Standard, Left, Hotspot/Zoom Scan (5x5x7)/Cube 0:

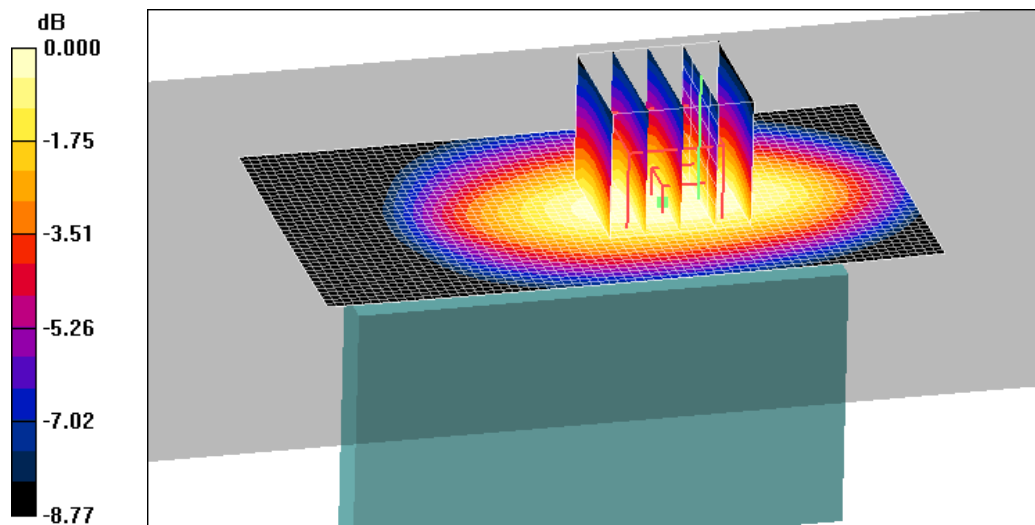
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 14.8 V/m; Power Drift = -0.100 dB

Peak SAR (extrapolated) = 0.284 W/kg

SAR(1 g) = 0.209 mW/g; SAR(10 g) = 0.148 mW/g

Maximum value of SAR (measured) = 0.221 mW/g



0 dB = 0.221mW/g

DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 CDMA Body (Job No. : FI-258)

Procedure Name: Body, Ch. 384, Ant. Intenna, Bat. Standard, Right, Hotspot

Meas. Ambient Temp(celsius)-22.6,Tissue Temp(celsius)-22.2;Test Date-04/Nov/2011

Communication System: CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 836.6$ MHz; $\sigma = 0.97$ mho/m; $\epsilon_r = 55.2$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(6.21, 6.21, 6.21); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: MP-1007
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Body, Ch. 384, Ant. Intenna, Bat. Standard, Right, Hotspot/Area Scan (41x71x1):

Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.329 mW/g

Body, Ch. 384, Ant. Intenna, Bat. Standard, Right, Hotspot/Zoom Scan (5x5x7)/Cube 0:

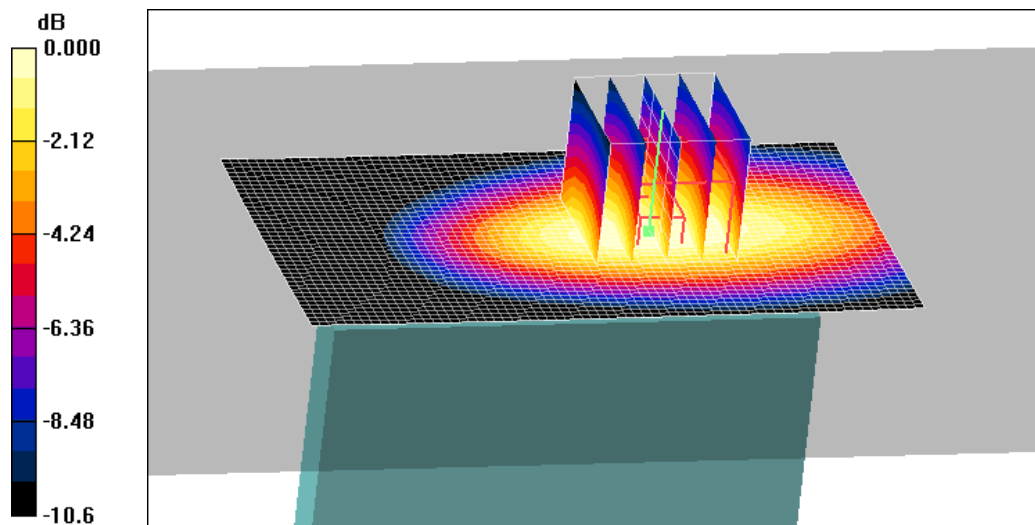
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 17.1 V/m; Power Drift = -0.003 dB

Peak SAR (extrapolated) = 0.421 W/kg

SAR(1 g) = 0.302 mW/g; SAR(10 g) = 0.206 mW/g

Maximum value of SAR (measured) = 0.324 mW/g



0 dB = 0.324mW/g

DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 CDMA Body (Job No. : FI-258)

**Procedure Name: Body, Ch. 384, Ant. Intenna, Bat. Standard, Back, Hotspot, EVDO.A
Meas. Ambient Temp(celsius)-22.6,Tissue Temp(celsius)-22.2;Test Date-04/Nov/2011**

Communication System: CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 836.6$ MHz; $\sigma = 0.97$ mho/m; $\epsilon_r = 55.2$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(6.21, 6.21, 6.21); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: MP-1007
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Body, Ch. 384, Ant. Intenna, Bat. Standard, Back, Hotspot/Area Scan (51x71x1):

Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.767 mW/g

Body, Ch. 384, Ant. Intenna, Bat. Standard, Back, Hotspot/Zoom Scan (5x5x7)/Cube 0:

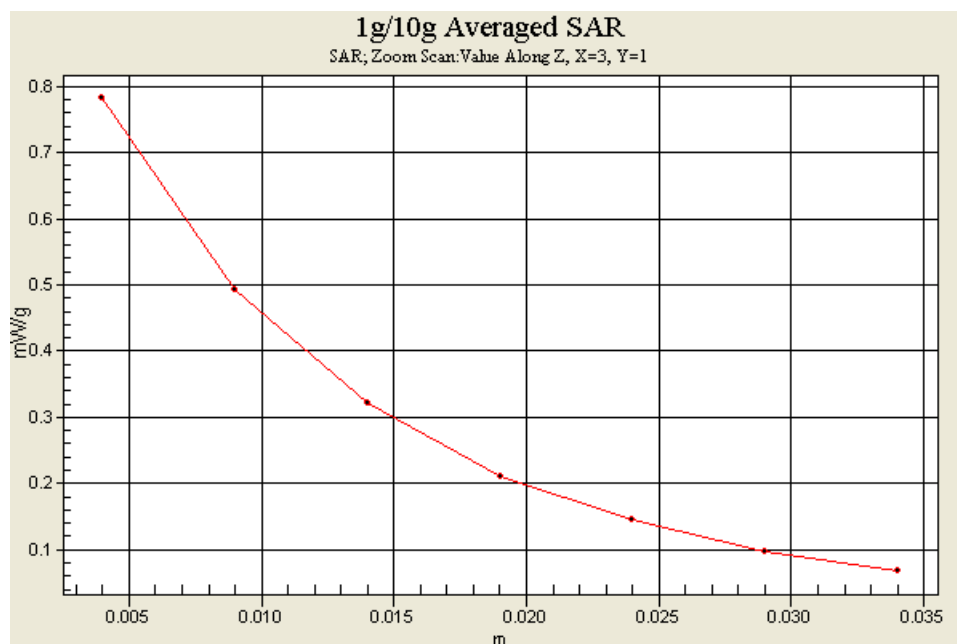
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 26.3 V/m; Power Drift = -0.062 dB

Peak SAR (extrapolated) = 1.12 W/kg

SAR(1 g) = 0.729 mW/g; SAR(10 g) = 0.493 mW/g

Maximum value of SAR (measured) = 0.782 mW/g



DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 WLAN Right(Job No. : FI-258)

Procedure Name: Cheek, Ch.06, Ant.Intenna, Bat.Standard 1Mbps

Meas. Ambient Temp(celsius)-22.3,Tissue Temp(celsius)-22.0;Test Date-07/Nov/2011

Communication System: WLAN; Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.84$ mho/m; $\epsilon_r = 38.1$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(4.28, 4.28, 4.28); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: SAM PHANTOM #2; Type: SAM; Serial: TP-1425
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Cheek, Ch.06, Ant.Intenna, Bat.Standard 1Mbps/Area Scan (51x71x1): Measurement grid:

dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.080 mW/g

Cheek, Ch.06, Ant.Intenna, Bat.Standard 1Mbps/Zoom Scan 2 2 (5x5x7)/Cube 0:

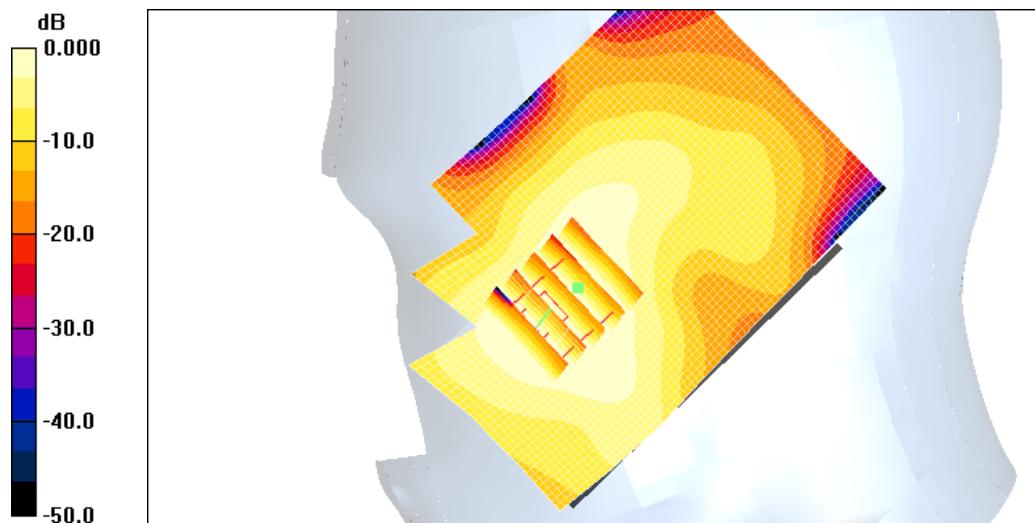
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.00 V/m; Power Drift = 0.196 dB

Peak SAR (extrapolated) = 0.135 W/kg

SAR(1 g) = 0.072 mW/g; SAR(10 g) = 0.040 mW/g

Maximum value of SAR (measured) = 0.078 mW/g



0 dB = 0.078mW/g

DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 WLAN Right(Job No. : FI-258)

Procedure Name: Tilted, Ch.06, Ant.Intenna, Bat.Standard 1Mbps

Meas. Ambient Temp(celsius)-22.3,Tissue Temp(celsius)-22.0;Test Date-07/Nov/2011

Communication System: WLAN; Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.84$ mho/m; $\epsilon_r = 38.1$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(4.28, 4.28, 4.28); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: SAM PHANTOM #2; Type: SAM; Serial: TP-1425
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Tilted, Ch.06, Ant.Intenna, Bat.Standard 1Mbps/Area Scan (51x71x1): Measurement grid:

dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.036 mW/g

Tilted, Ch.06, Ant.Intenna, Bat.Standard 1Mbps/Zoom Scan (5x5x7)/Cube 0: Measurement

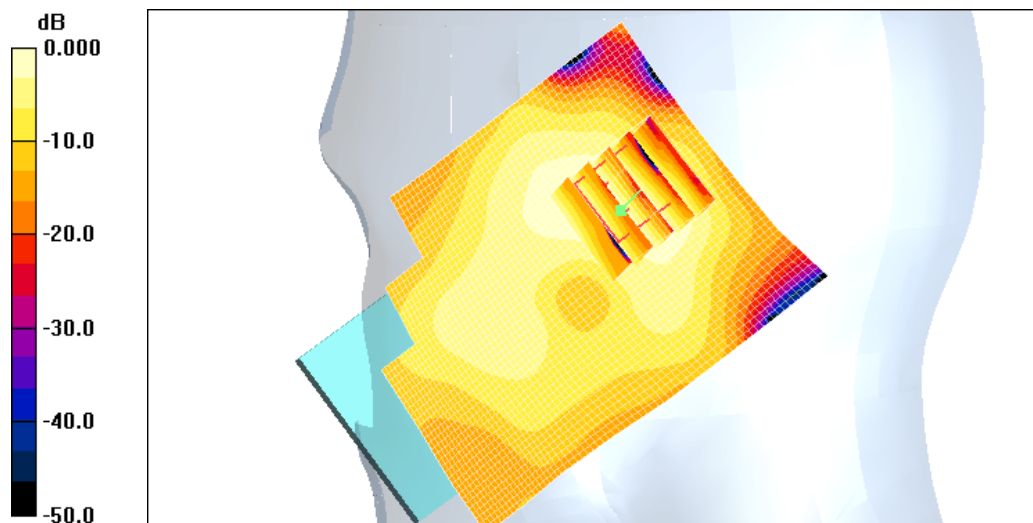
grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.63 V/m; Power Drift = 0.058 dB

Peak SAR (extrapolated) = 0.074 W/kg

SAR(1 g) = 0.036 mW/g; SAR(10 g) = 0.018 mW/g

Maximum value of SAR (measured) = 0.039 mW/g



0 dB = 0.039mW/g

DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 WLAN Left(Job No. : FI-258)

Procedure Name: Cheek, Ch.06, Ant.Intenna, Bat.Standard 1Mbps

Meas. Ambient Temp(celsius)-22.3,Tissue Temp(celsius)-22.0;Test Date-07/Nov/2011

Communication System: WLAN; Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.84$ mho/m; $\epsilon_r = 38.1$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(4.28, 4.28, 4.28); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: SAM PHANTOM #2; Type: SAM; Serial: TP-1425
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Cheek, Ch.06, Ant.Intenna, Bat.Standard 1Mbps/Area Scan (51x71x1): Measurement grid:

dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.181 mW/g

Cheek, Ch.06, Ant.Intenna, Bat.Standard 1Mbps/Zoom Scan (5x5x7)/Cube 0: Measurement

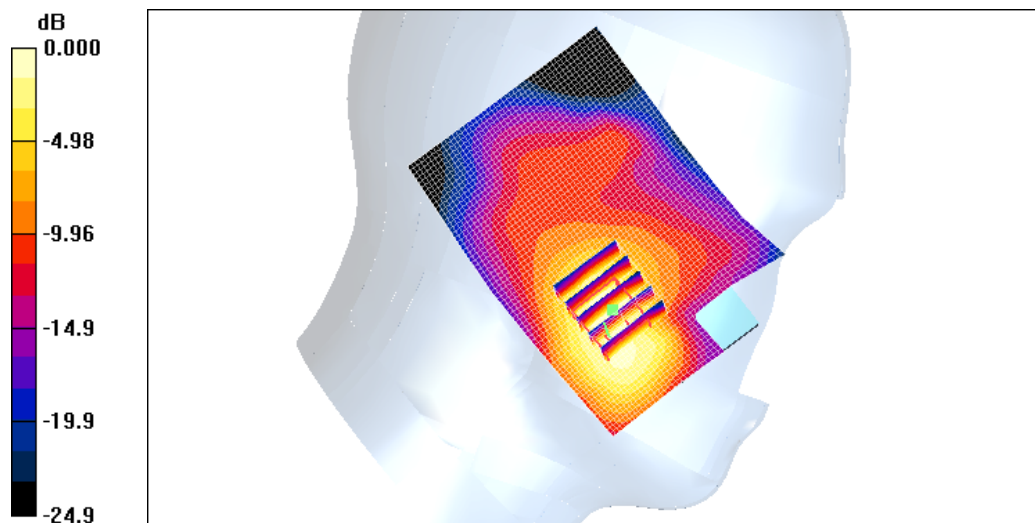
grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 5.87 V/m; Power Drift = 0.181 dB

Peak SAR (extrapolated) = 0.350 W/kg

SAR(1 g) = 0.175 mW/g; SAR(10 g) = 0.088 mW/g

Maximum value of SAR (measured) = 0.182 mW/g



0 dB = 0.182mW/g

DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 WLAN Left(Job No. : FI-258)

Procedure Name: Tilted, Ch.06, Ant.Intenna, Bat.Standard 1Mbps

Meas. Ambient Temp(celsius)-22.3,Tissue Temp(celsius)-22.0;Test Date-07/Nov/2011

Communication System: WLAN; Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.84$ mho/m; $\epsilon_r = 38.1$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(4.28, 4.28, 4.28); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: SAM PHANTOM #2; Type: SAM; Serial: TP-1425
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Tilted, Ch.06, Ant.Intenna, Bat.Standard 1Mbps/Area Scan (51x71x1): Measurement grid:

dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.030 mW/g

Tilted, Ch.06, Ant.Intenna, Bat.Standard 1Mbps/Zoom Scan (5x5x7)/Cube 0: Measurement

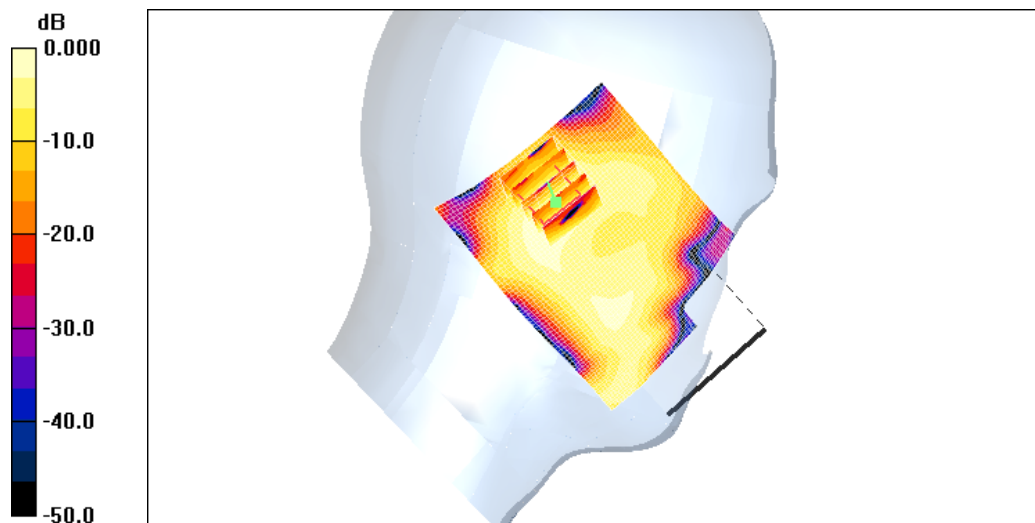
grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.40 V/m; Power Drift = 0.140 dB

Peak SAR (extrapolated) = 0.068 W/kg

SAR(1 g) = 0.032 mW/g; SAR(10 g) = 0.015 mW/g

Maximum value of SAR (measured) = 0.036 mW/g



0 dB = 0.036mW/g

DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 WLAN Left(Job No. : FI-258)

Procedure Name: Cheek, Ch.06, Ant.Intenna, Bat.Standard 1Mbps

Meas. Ambient Temp(celsius)-22.3,Tissue Temp(celsius)-22.0;Test Date-07/Nov/2011

Communication System: WLAN; Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.84$ mho/m; $\epsilon_r = 38.1$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(4.28, 4.28, 4.28); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: SAM PHANTOM #2; Type: SAM; Serial: TP-1425
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Cheek, Ch.06, Ant.Intenna, Bat.Standard 1Mbps/Area Scan (51x71x1): Measurement grid:

dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.181 mW/g

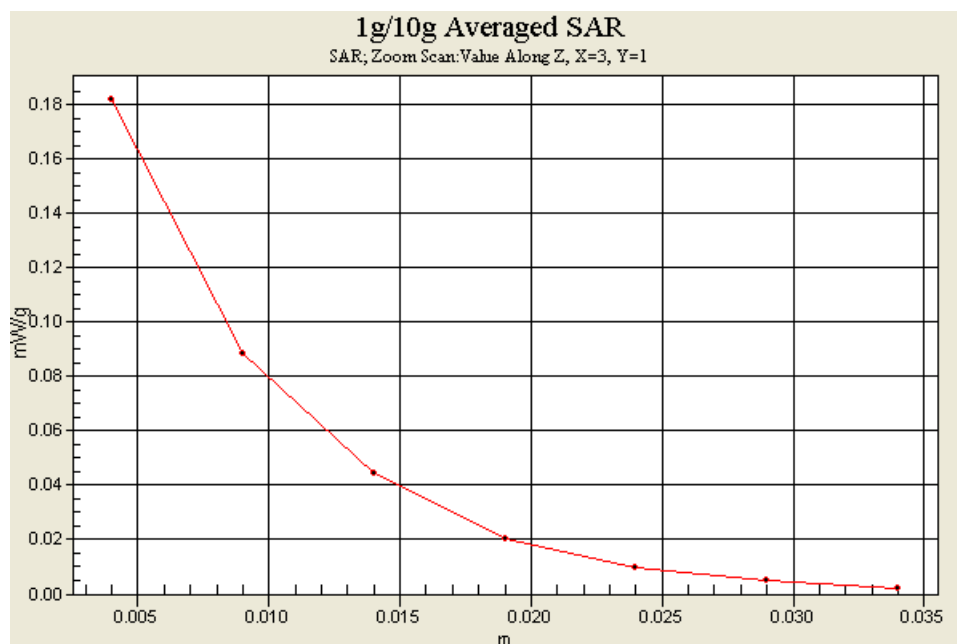
Cheek, Ch.06, Ant.Intenna, Bat.Standard 1Mbps/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 5.87 V/m; Power Drift = 0.181 dB

Peak SAR (extrapolated) = 0.350 W/kg

SAR(1 g) = 0.175 mW/g; SAR(10 g) = 0.088 mW/g

Maximum value of SAR (measured) = 0.182 mW/g



DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 WLAN Body (Job No. : FI-258)

Procedure Name: Body, Ch.06, Ant.Intenna, Bat.Standard Back 1Mbps

Meas. Ambient Temp(celsius)-22.2,Tissue Temp(celsius)-22.1;Test Date-07/Nov/2011

Communication System: WLAN; Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.94$ mho/m; $\epsilon_r = 51.1$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(3.83, 3.83, 3.83); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: MP-1007
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Body, Ch.06, Ant.Intenna, Bat.Standard Back 1Mbps/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.045 mW/g

Body, Ch.06, Ant.Intenna, Bat.Standard Back 1Mbps/Zoom Scan (5x5x7)/Cube 0:

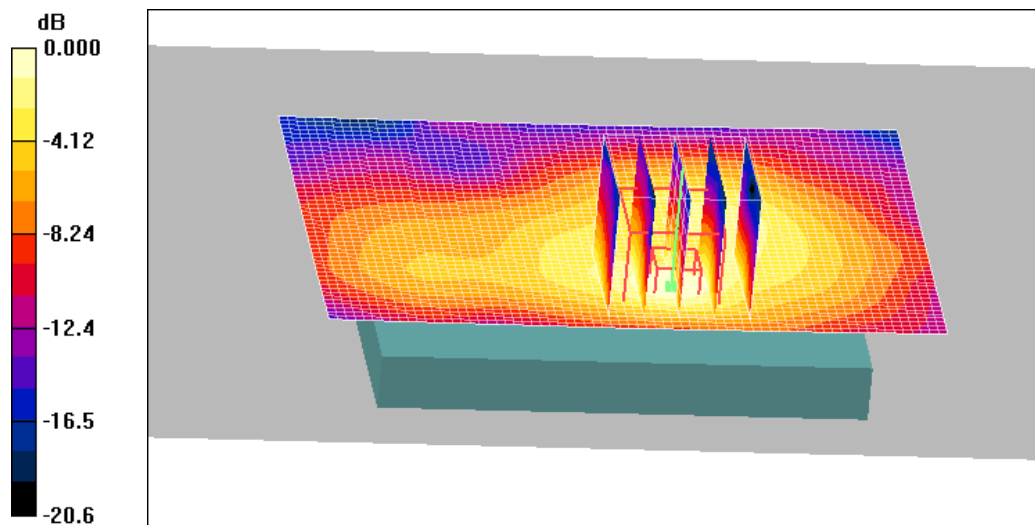
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.14 V/m; Power Drift = -0.117 dB

Peak SAR (extrapolated) = 0.084 W/kg

SAR(1 g) = 0.041 mW/g; SAR(10 g) = 0.020 mW/g

Maximum value of SAR (measured) = 0.044 mW/g



0 dB = 0.044mW/g

DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 WLAN Body (Job No. : FI-258)

Procedure Name: Body, Ch.06, Ant.Intenna, Bat.Standard Front 1Mbps

Meas. Ambient Temp(celsius)-22.2,Tissue Temp(celsius)-22.1;Test Date-07/Nov/2011

Communication System: WLAN; Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.94$ mho/m; $\epsilon_r = 51.1$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(3.83, 3.83, 3.83); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: MP-1007
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Body, Ch.06, Ant.Intenna, Bat.Standard Front 1Mbps/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.023 mW/g

Body, Ch.06, Ant.Intenna, Bat.Standard Front 1Mbps/Zoom Scan (5x5x7)/Cube 0:

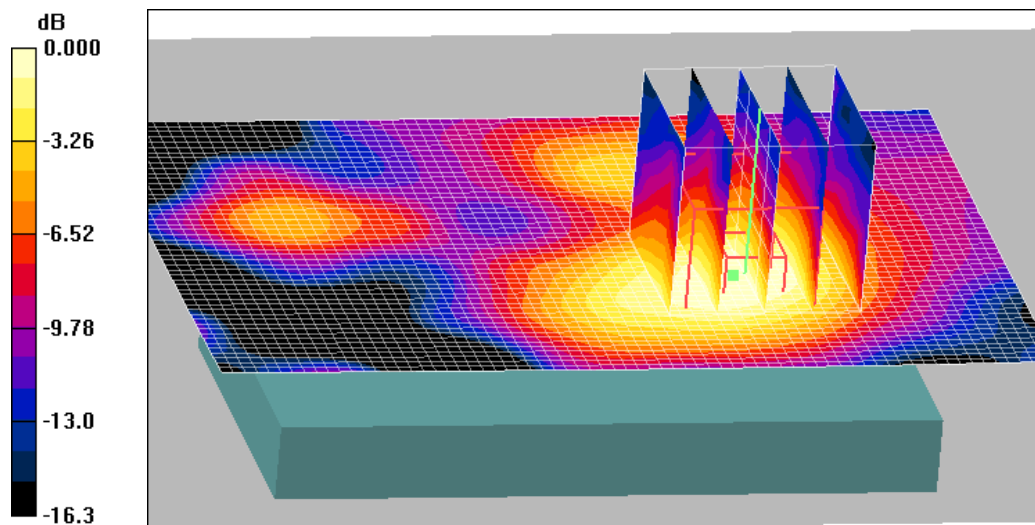
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.63 V/m; Power Drift = 0.068 dB

Peak SAR (extrapolated) = 0.037 W/kg

SAR(1 g) = 0.020 mW/g; SAR(10 g) = 0.011 mW/g

Maximum value of SAR (measured) = 0.021 mW/g



0 dB = 0.021mW/g

DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 WLAN Body (Job No. : FI-258)

Procedure Name: Body, Ch.06, Ant.Intenna, Bat.Standard Bottom 1Mbps

Meas. Ambient Temp(celsius)-22.2,Tissue Temp(celsius)-22.1;Test Date-07/Nov/2011

Communication System: WLAN; Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.94$ mho/m; $\epsilon_r = 51.1$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(3.83, 3.83, 3.83); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: MP-1007
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Body, Ch.06, Ant.Intenna, Bat.Standard Bottom 1Mbps/Area Scan (41x61x1):

Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.022 mW/g

Body, Ch.06, Ant.Intenna, Bat.Standard Bottom 1Mbps/Zoom Scan (5x5x7)/Cube 0:

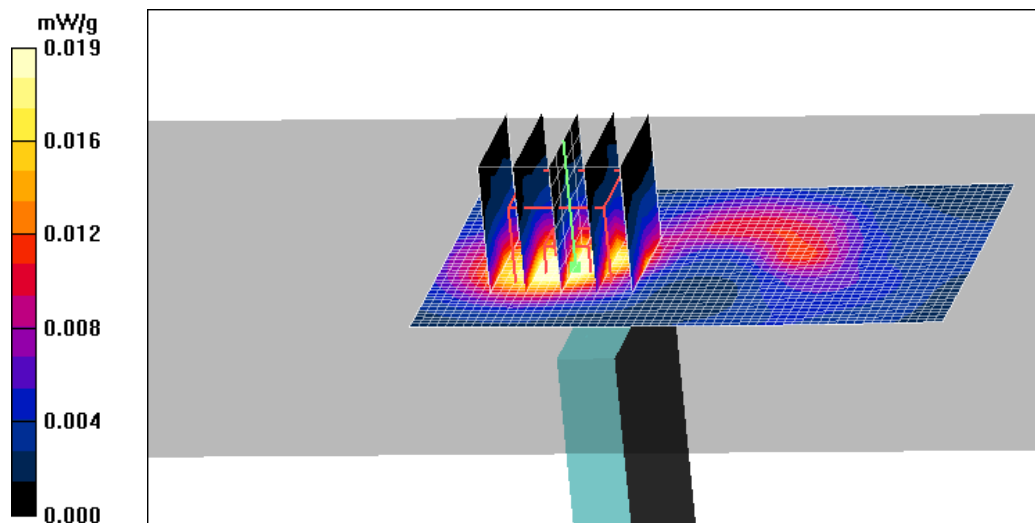
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.40 V/m; Power Drift = -0.094 dB

Peak SAR (extrapolated) = 0.034 W/kg

SAR(1 g) = 0.018 mW/g; SAR(10 g) = 0.00978 mW/g

Maximum value of SAR (measured) = 0.019 mW/g



DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 WLAN Body (Job No. : FI-258)

Procedure Name: Body, Ch.06, Ant.Intenna, Bat.Standard Left 1Mbps

Meas. Ambient Temp(celsius)-22.2,Tissue Temp(celsius)-22.1;Test Date-07/Nov/2011

Communication System: WLAN; Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.94$ mho/m; $\epsilon_r = 51.1$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(3.83, 3.83, 3.83); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: MP-1007
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Body, Ch.06, Ant.Intenna, Bat.Standard Left 1Mbps/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.043 mW/g

Body, Ch.06, Ant.Intenna, Bat.Standard Left 1Mbps/Zoom Scan (5x5x7)/Cube 0:

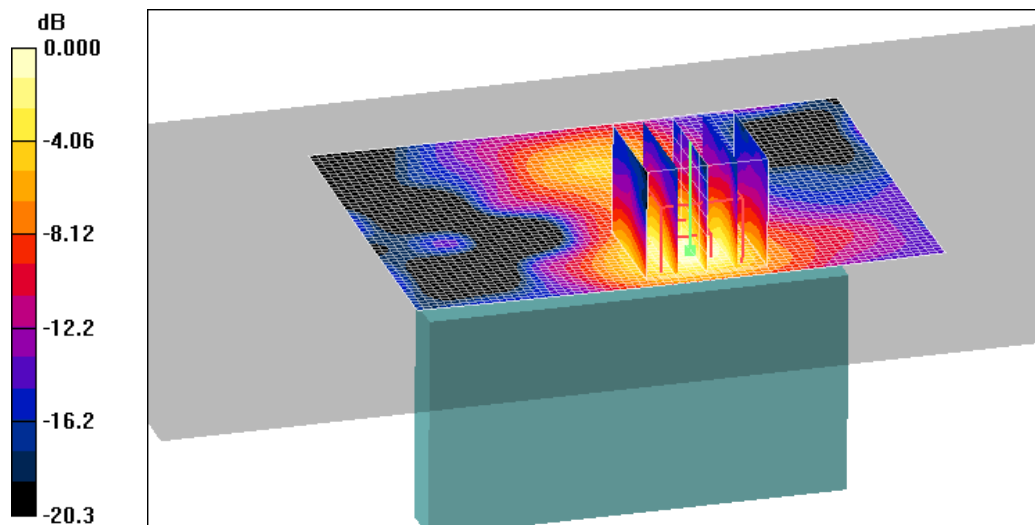
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.80 V/m; Power Drift = 0.173 dB

Peak SAR (extrapolated) = 0.080 W/kg

SAR(1 g) = 0.038 mW/g; SAR(10 g) = 0.018 mW/g

Maximum value of SAR (measured) = 0.043 mW/g



0 dB = 0.043mW/g

DUT: SCH-I589; Serial: FI-258-B

Program Name: SCH-I589 WLAN Body (Job No. : FI-258)

Procedure Name: Body, Ch.06, Ant.Intenna, Bat.Standard Back 1Mbps

Meas. Ambient Temp(celsius)-22.2,Tissue Temp(celsius)-22.1;Test Date-07/Nov/2011

Communication System: WLAN; Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.94$ mho/m; $\epsilon_r = 51.1$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY4 Configuration:

- Probe: ES3DV2 - SN3017; ConvF(3.83, 3.83, 3.83); Calibrated: 2011-05-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn486; Calibrated: 2011-02-22
- Phantom: Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1; Serial: MP-1007
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Body, Ch.06, Ant.Intenna, Bat.Standard Back 1Mbps/Area Scan (51x71x1): Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 0.045 mW/g

Body, Ch.06, Ant.Intenna, Bat.Standard Back 1Mbps/Zoom Scan (5x5x7)/Cube 0:

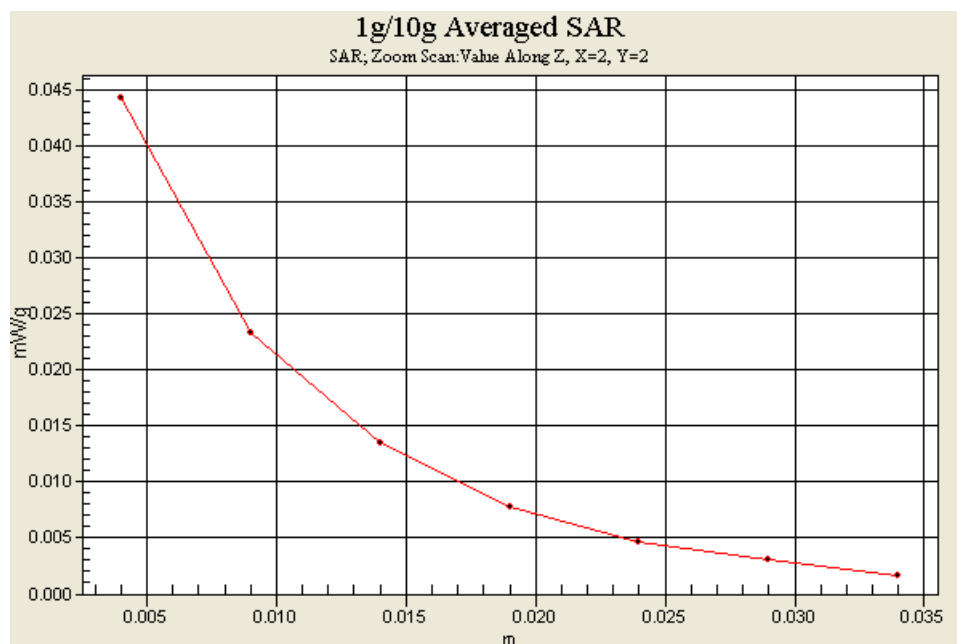
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.14 V/m; Power Drift = -0.117 dB

Peak SAR (extrapolated) = 0.084 W/kg

SAR(1 g) = 0.041 mW/g; SAR(10 g) = 0.020 mW/g

Maximum value of SAR (measured) = 0.044 mW/g



APPENDIX F

Probe Calibration



Accredited by the Swiss Accreditation Service (SAS)
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 **Samsung (Dymstec)**

Certificate No: **ES3-3017_May11**

CALIBRATION CERTIFICATE

Object **ES3DV2 - SN:3017**

Calibration procedure(s) **QA CAL-01.v7, QA CAL-23.v4, QA CAL-25.v3
Calibration procedure for dosimetric E-field probes**

Calibration date: **May 20, 2011**

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 (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41498087	31-Mar-11 (No. 217-01372)	Apr-12
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-11 (No. 217-01369)	Apr-12
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Reference 30 dB Attenuator	SN: S5129 (30b)	29-Mar-11 (No. 217-01370)	Apr-12
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
DAE4	SN: 654	3-May-11 (No. DAE4-654_May11)	May-12
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
Issued: May 23, 2011			
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
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
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

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 affect the E^2 -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 with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}** are numerical linearization parameters in dB assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media.
- VR**: VR is the validity range of the calibration related to the average diode voltage or DAE voltage in mV.
- 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.

Probe ES3DV2

SN:3017

Manufactured: December 5, 2002
Calibrated: May 20, 2011

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3017

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	1.65	1.68	1.71	$\pm 10.1 \%$
DCP (mV) ^B	99.7	98.4	99.8	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc ^E (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	132.3	$\pm 3.0 \%$
			Y	0.00	0.00	1.00	128.9	
			Z	0.00	0.00	1.00	137.6	

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

^A The uncertainties of NormX,Y,Z do not affect the E^2 -field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3017

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.55	6.55	6.55	0.46	1.43	± 12.0 %
850	41.5	0.92	6.31	6.31	6.31	0.56	1.21	± 12.0 %
1750	40.1	1.37	5.30	5.30	5.30	0.46	1.40	± 12.0 %
1900	40.0	1.40	5.03	5.03	5.03	0.43	1.49	± 12.0 %
2000	40.0	1.40	5.01	5.01	5.01	0.44	1.39	± 12.0 %
2300	39.5	1.67	4.60	4.60	4.60	0.40	1.49	± 12.0 %
2450	39.2	1.80	4.28	4.28	4.28	0.41	1.47	± 12.0 %
2600	39.0	1.96	4.12	4.12	4.12	0.42	1.50	± 12.0 %

^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: ES3DV2- SN:3017

Calibration Parameter Determined in Body Tissue Simulating Media

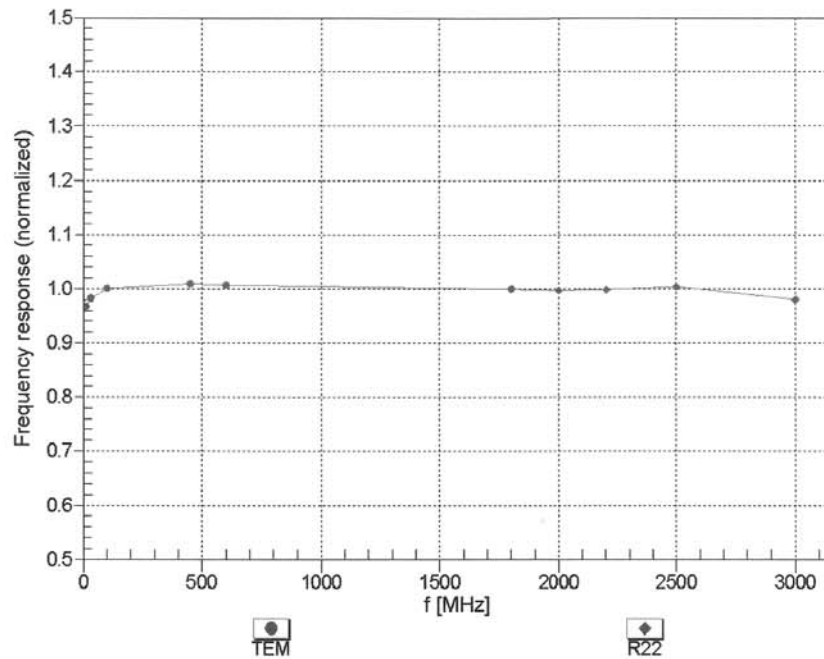
f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.34	6.34	6.34	0.61	1.26	± 12.0 %
850	55.2	0.99	6.21	6.21	6.21	0.69	1.17	± 12.0 %
1750	53.4	1.49	4.90	4.90	4.90	0.46	1.58	± 12.0 %
1900	53.3	1.52	4.53	4.53	4.53	0.41	1.62	± 12.0 %
2000	53.3	1.52	4.48	4.48	4.48	0.36	1.80	± 12.0 %
2300	52.9	1.81	4.06	4.06	4.06	0.38	1.54	± 12.0 %
2450	52.7	1.95	3.83	3.83	3.83	0.52	1.09	± 12.0 %
2600	52.5	2.16	3.67	3.67	3.67	0.41	1.30	± 12.0 %

^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

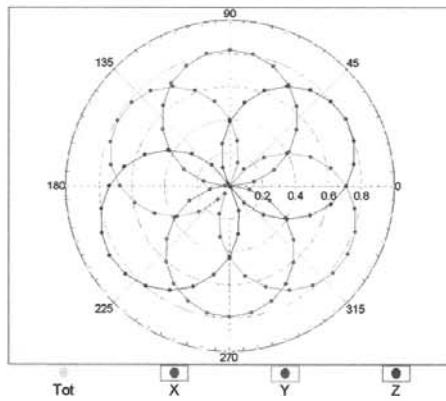
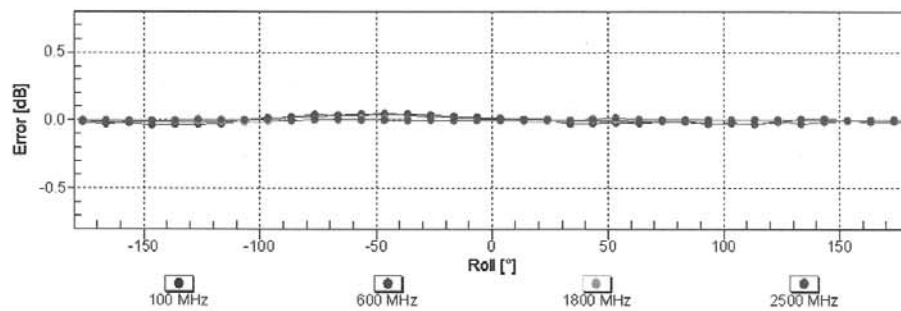
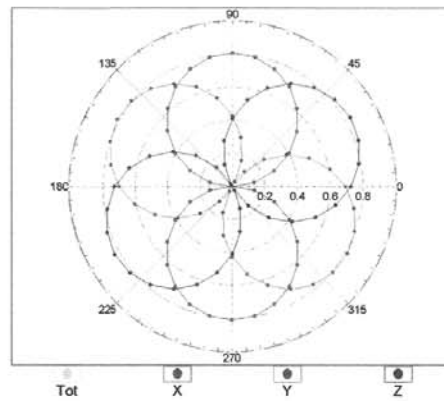
^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

Frequency Response of E-Field

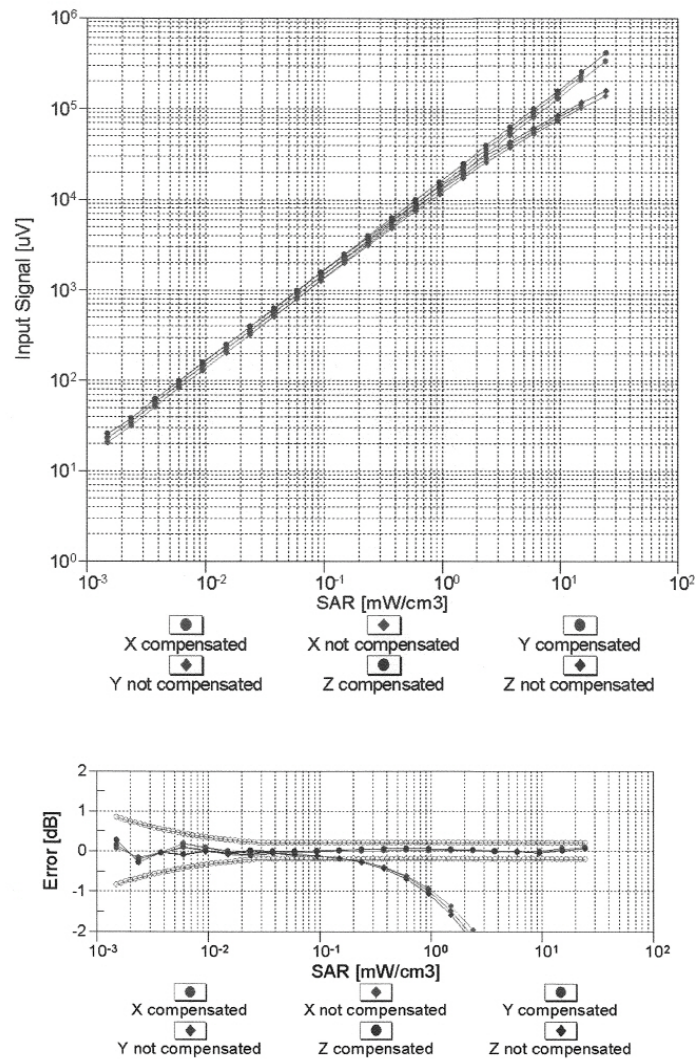
(TEM-Cell:ifi110 EXX, Waveguide: R22)



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

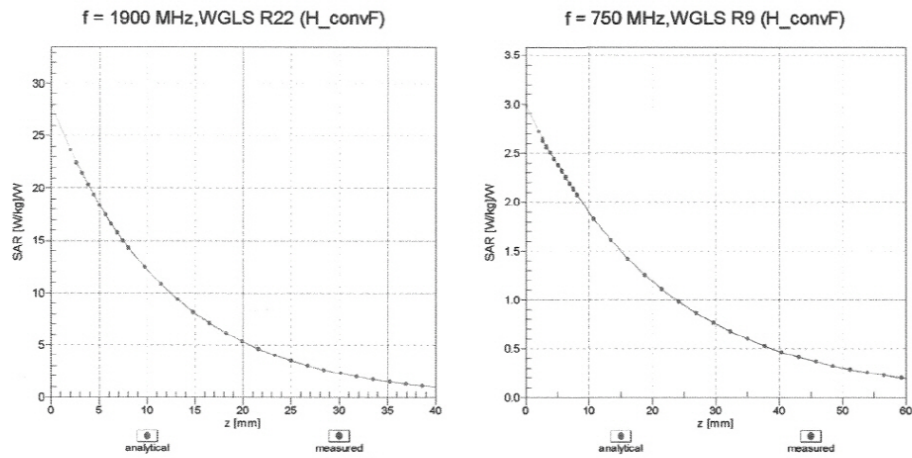
Receiving Pattern (ϕ), $\theta = 0^\circ$ **f=600 MHz,TEM****f=1800 MHz,R22****Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)**

Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)



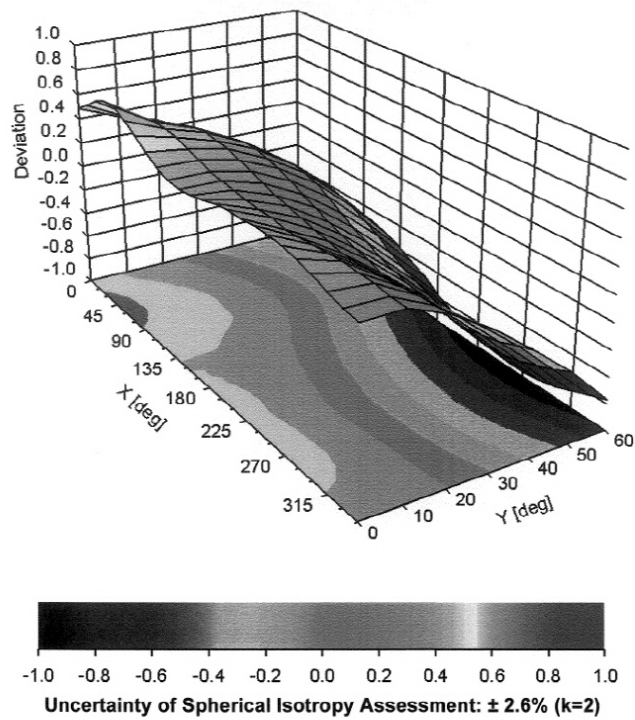
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900 \text{ MHz}$



DASY/EASY - Parameters of Probe: ES3DV2 - SN:3017**Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm