QUALCOMM
CDMA Technologies

inGeo1 AW FCC SAR Test Report

80-VJ402-3 Rev. A

August 7, 2008

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August 7, 2008
inGeo1 AW FCC SAR Test Report

Contents

Figures

Tables

Revision history

Revision	Date	Description
A	August 2008	Initial release

Overview

Test report reference	80-VJ402-3
Responsible engineer	Mark Ortlieb, Robert Scodellaro
Test engineer	Mark Ortlieb
Date of issue	7 August 2008
Test laboratory	QUALCOMM Incorporated 5775 Morehouse Dr. San Diego CA 92121 General telephone: 1-858-587-1121
Model tested	inGeo™1 AW (AC2116)
Test specification standard(s)	**ANSI/IEEE C95.1-1992** IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz **ANSI/IEEE C95.3-1992** IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields-RF and Microwave **FCC/OET Bulletin 65, including Supplement C**, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields **ANSI/IEEE P1528/D1.2** Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
Results	The device noted above complies with the requirements of the aforementioned standards.

1 Test Summary

1.1 Equipment tested

Equipment tested was the mobile tracking device, model inGeo1 AW (AC2116), serial number 0714CC2B . The device operates in CDMA mode in the US cellular band (band class 0) and US PCS band (band class 1). It is intended for body-worn application only. The device has no voice capability.

While the unit transmits a very low duty cycle (it sends an SMS message once per minute for approximately 3 seconds), it was tested with a 100% duty cycle to simulate a theoretical worst case.

1.2 Maximum (worst case results)

Table 1-1 gives the worst-case 1-g SAR results measured for the test device. All results given reflect only one position: the device's rear face against flat phantom. Table 1-1 lists the worst-case results for the measured SAR when measured 15 mm from the test phantom.

Table 1-1 Worst-case results

Band	Channel	1-g SAR (mW/g)
Band class 0	1013	0.976
Band class 1	25	0.851

1.3 Measurement uncertainty

Measurement uncertainty	
Combined standard uncertainty	12.3%
Expanded standard uncertainty (k = 2)	24.6%

1.4 SAR limits

Table 1-2 gives 1-g body SAR limits for the general public for the frequency range of 10 MHz to 10 GHz, as described in the *FCC OET Bulletin 65 Supplement C*.

Table 1-2 1-gram body SAR limits

1-gram body SAR limits	
Whole body average SAR (mW/g)	0.08 mW/g
Localized SAR (limbs)	1.6 mW/g

2 EUT Description

2.1 General

Table 2-1 General EUT description

Model	inGeo1 AW (AC2116)
Modulation	CDMA
Trade name	QUALCOMM Incorporated
TX frequency	US CDMA band class 0 (US cellular): Ch 1013 (low): 824.7 MHz Ch 383 (middle): 836.49 MHz Ch 777 (high): 848.31 MHz US CDMA band class 1 (US PCS): Ch 25 (low): 1851.25 MHz Ch 600 (middle): 1880 MHz Ch 1175 (high): 1908.75 MHz
Serial number(s)	0714CC2B

2.2 EUT pictures

Rear face

Front face

Bottom end

Top end

Left edge

Right edge

Figure 2-1 inGeo1 AW model pictures

2.3 Antenna description

The inGeo1 AW device uses a folded monopole type antenna.

2.4 Battery

The battery is a 3.7-V Li-ion type battery; model CV90-VA989-1.

2.5 Body worn accessories

No body worn accessories are provided for the device. The device was tested to compliance when used with a belt clip that spaces the unit 15 mm from the body.

3 SAR Test Facility

3.1 General

Table 3-1 General SAR test facility information

General information	
Test location	QUALCOMM Incorporated 5775 Morehouse Dr. San Diego, CA 92121
Temperature range	15 – 35 °C (23 °C actual)
Humidity range	25 – 75% (41% actual)
Pressure	860 – 1060 mbar (1015 mB)

All QUALCOMM dosimetry equipment is operated within a shielded screen room, manufactured by Lindgren RF Enclosures to provide isolation from external EM fields. The E-field probes of the DASY4 system are capable of detecting signals as low as 5 μW/g in the liquid dielectric, and external fields are minimized by the screen room, leaving the phone as the dominate radiation source. The floor of the screen room is reflective, so the phantom bench is placed on four ferrite panels, measuring 2 ft^2 each, to minimize reflected energy that would otherwise re-enter the phantom and combine constructively or destructively with the desired results.

3.2 Dosimetry system

The dosimetry equipment consists of a complete state-of-the-art DASY4 dosimetry system manufactured and calibrated by Schmid & Partner Engineering AG of Zurich, Switzerland. The DASY4 system consists of a six-axis robot, a robot controller, a teach pendant, automation software on a 2.4-GHz Intel Pentium4 computer, data acquisition system, isotropic E-field probe, device positioning holder, and validation kit.

Figure 3-1 shows the robot arm, controller box, and device-positioning holder.

Figure 3-1 DASY4 system: robot arm, controller box, and device positioning holder

3.3 E-field probe

This probe is manufactured by Schmid & Partner, model ET3DV6. It is calibrated by the manufacturer in head tissue simulating liquid at frequencies ranging from 835 MHz to 1.95 GHz. The dynamic range is said by the manufacturer to be 5 µW/gm to approximately 100 mW/g. The probe contains three small dipoles positioned symmetrically on a triangular core to provide for isotropic detection of the field. Each dipole contains a diode at the feed point that converts the RF signal to DC, which is conducted down a high-impedance line to the data acquisition system.

3.4 Phantom

The phantom is the standard anthropomorphic model (SAM) phantom supplied by Schmid & Partner AG, and is designed for compliance to the guidelines provided in standard IEEE P1528. It consists of a left and right side head for simulating phone usage on both sides of the head and as a flat area for simulating phone usage against the body. The phantom is constructed of fiberglass with 2 mm ±0.1mm shell thickness. The DASY4 system uses a homogeneous tissue phantom, based on studies concerning energy absorption of the human head, and the different absorption rates between adults and children. These studies indicated that a homogeneous phantom should overestimate SAR by no more than 15% for 10 averages and should not underestimate SAR.

Figure 3-2 shows the SAM phantom.

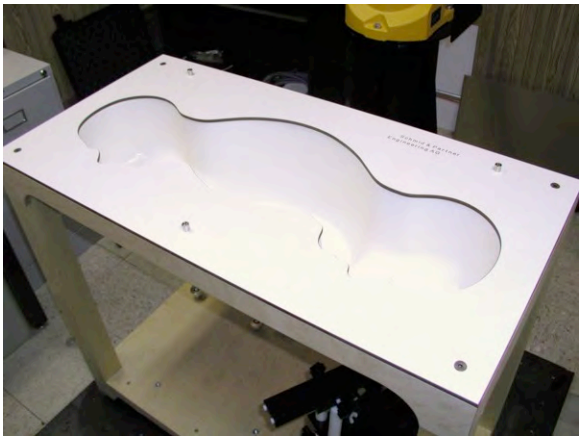


Figure 3-2 SAM phantom

3.5 Liquid dielectric

The tissue-simulating liquid filling the phantom is mixed by the QUALCOMM staff, per the manufacturer's instructions and regulatory standards. There are separate formulas for the various applicable frequencies. Before the test, the permittivity and conductivity were measured with an automated Hewlett-Packard 85070B dielectric probe, in conjunction with an H-P 8752C network analyzer, to monitor permittivity change due to evaporation and settling of ingredients. The electromagnetic parameters of the liquid were maintained, as shown in Table 3-2. The target values were obtained from Supplement C of OET Bulletin 65: *Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions.*

Table 3-2 Tissue dielectric properties at time of testing

		Permittivity (ε_r)				Conductivity (σ)			
Test date	**Frequency (MHz)**	**Measured values**	**Target values**	**Deviation (%)**	**Limit**	**Measured values**	**Target values**	**Deviation (%)**	**Limit**
17-Jul-08	824.7	56.6	55.2	+2.5%	±5%	0.95	0.97	-2.1%	±5%
	836.49	56.4	55.2	+2.1%	±5%	0.95	0.97	-2.1%	±5%
	848.31	56.4	55.2	+2.1%	±5%	0.95	0.97	-2.1%	±5%
18-Jul-08	1851.25	51.9	53.3	-2.6%	±5%	1.47	1.52	-3.3%	±5%
	1880.00	51.8	53.3	-2.8%	±5%	1.50	1.52	-1.3%	±5%
	1908.75	51.7	53.3	-3.0%	±5%	1.54	1.52	+1.3%	±5%

25 L of each of the tissue simulating liquids were prepared using the following proportions of ingredients:

- 835-MHz body tissue simulating liquid
  - Water – 50.8%
  - Sugar – 48.2%
  - Preventol – 0.1%
  - Salt – 0.94%
- 1900-MHz body tissue simulating liquid
  - Water – 70.2%
  - Diethylene glycol monobutyl ether – 29.4%
  - Salt – 0.39%

4 SAR Measurement Procedure

4.1 Call Box Simulator Information

For SAR testing, the device was set to transmit a simulated call using the equipment as described in Table 4-1.

Table 4-1 Call Box Simulator Information and Settings

Make	Agilent	
Model	8960	
Cal Date	6/17/2007	
Serial Number	GB44052409	
Software Revision	GSM TA	E1968A-101
	GPRS TA	E1968A-102
	EGPRS TA	E1968A-103
	WCDMA	E1963A
	HSDPA TEST MODES	E1963A-403
	HSuPA TEST MODES	E1963A-413
	cdma 2000 TA	E1962B
	1xEV-DO TA	E1966A
	1xEV-DO FTM TA	E1976A
	1xEV-DO Release A	E1966A-102
	1xEV-DO RelA FTM	E1976A-102
Power Control	All Up bits	
Fundamental Channel Test Mode	RC3, SO55	

4.2 EUT power verification

To verify transmit power settings, the device was placed into a call according to Section 4.1 and conducted power was measured using a power meter. Measured RF conducted power is listed in Table 4-2.

Table 4-2 EUT-conducted power measurements

	Band class 0 (US cellular)			Band class 1 (US PCS)		
	Channel			Channel		
Serial number	**1013**	**383**	**777**	**25**	**600**	**1175**
0714CC2B	23.97	24.07	23.84	24.06	23.81	23.95

4.3 Test positions

The inGeo1 AW device is only intended to be operated in one position, with respect to human exposure, which is when installed on a belt clip with no metal that spaces the unit at least 15 mm from the user, with the rear of the unit oriented toward the user. Because of this, the phantom was filled with body-simulating medium, and the device was positioned 15 mm from the flat part of the phantom, with its rear face oriented toward the phantom.

Section 6 shows photographs of the device as it was tested in this position.

4.4 Scan procedure

The scan routine is set up as follows:

- Power verification measurement
- Area scan
- 7 x 7 x 7 cube (zoom) scan (if more than one maxima is detected, cubes are applied to all)
- Power verification retest (drift)

Both 1-g and 10-g measurements are handled with the same scan process.

4.5 Test program

The sample devices were all tested in low, middle and high channels for both bands tested, in the position described in Section 4.3 .

5 Measurement Uncertainty

The possible errors included in this measurement arise from device positioning uncertainty, device manufacturing uncertainty, liquid dielectric permittivity uncertainty, liquid dielectric conductivity uncertainty, and uncertainty due to disturbance of the fields by the probe.

Table 5-1 Measurement uncertainty

	Uncertainty value (± %)	Prob. dist	Div.	(ci) 1 g	(ci) 10 g	Std. unc. (1g) (± %)	Std. unc. (10 g)	(vi) veff
Measurement system								
Probe calibration	4.8	N	1	1	1	4.8	4.8	∞
Axial isotropy	4.7	R	√3	0.7	0.7	1.9	1.9	∞∞
Hemispherical isotropy	9.6	R	√3	0.7	0.7	3.9	3.9	∞∞
Boundary effects	1	R	√3	1	1	0.6	0.6	∞∞
Linearity	4.7	R	√3	1	1	2.7	2.7	∞∞
System detection limits	1	R	√3	1	1	0.6	0.6	∞∞
Readout electronics	1	N	1	1	1	1.0	1.0	∞∞
Response time	0.8	R	√3	1	1	0.5	0.5	∞∞
Integration time	2.6	R	√3	1	1	1.5	1.5	∞∞
Rf ambient conditions	3	R	√3	1	1	1.7	1.7	∞∞
Probe positioner	0.4	R	√3	1	1	0.2	0.2	∞∞
Probe positioning	2.9	R	√3	1	1	1.7	1.7	∞∞
Maximum SAR evaluation	1	R	√3	1	1	0.6	0.6	∞∞
Test sample related			€					
Device positioning	2.9	N	1	1	1	2.9	2.9	145
Device holder	3.6	N	1	1	1	3.6	3.6	5
Power drift	5	R	√3	1	1	2.9	2.9	∞∞∞
Phantom and setup								
Phantom uncertainty	4	R	√3	1	1	2.3	2.3	∞∞
Liquid conductivity (target)	5	R	√3	0.64	0.43	1.8	1.2	∞∞
Liquid conductivity (measured)	2.5	N	1	0.64	0.43	1.6	1.1	∞∞
Liquid permittivity (target)	5	R	√3	0.6	0.49	1.7	1.4	∞∞
Liquid permittivity (measured)	2.5	N	1	0.6	0.49	1.5	1.2	∞∞
Combined std. uncertainty						10.3 %	10.0 %	330
Expanded std. uncertainty						20.6 %	20.1 %	

6 Test Setup Photos

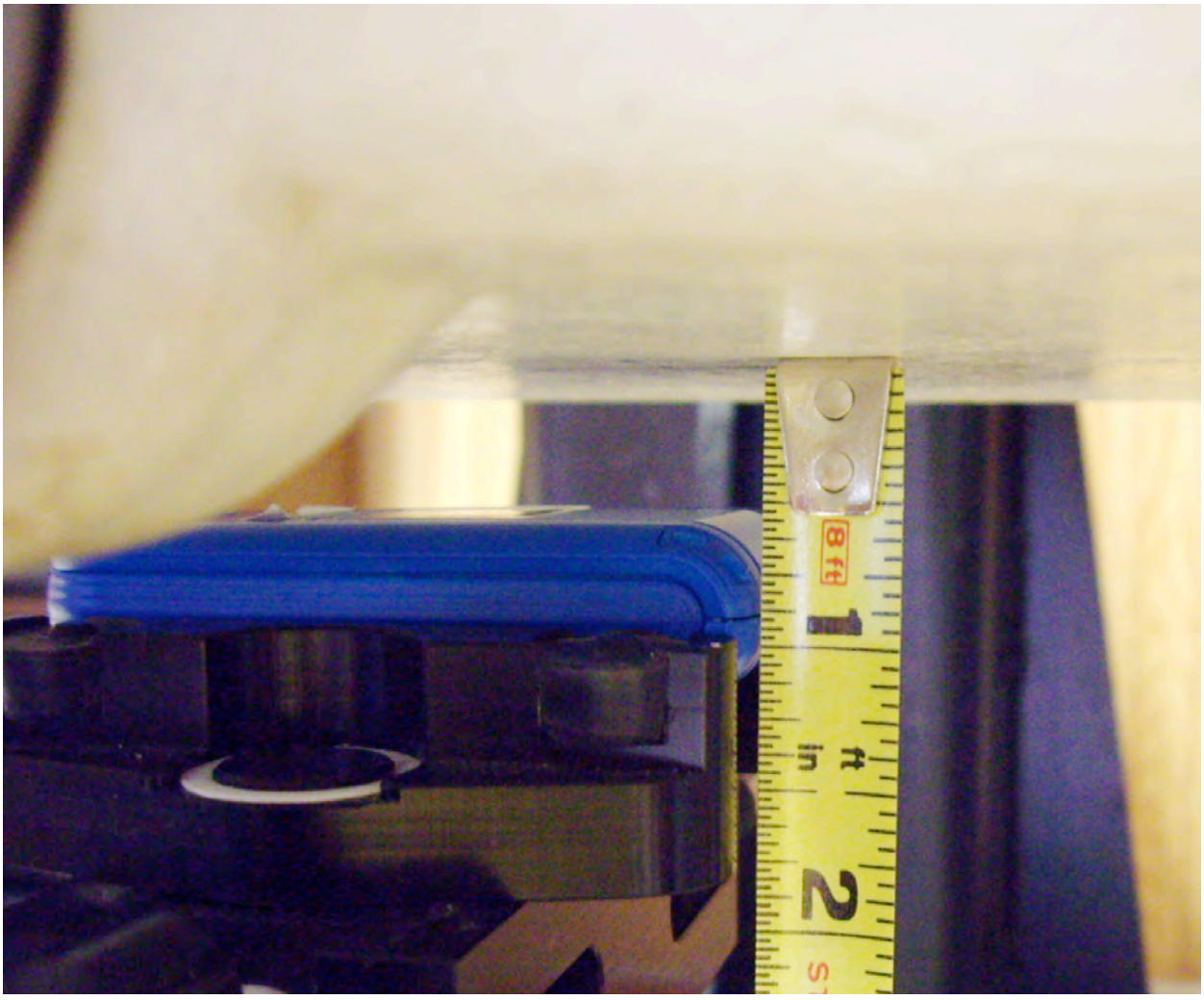


Figure 6-1 InGeo1 AW device positioned with respect to flat phantom (view 1)

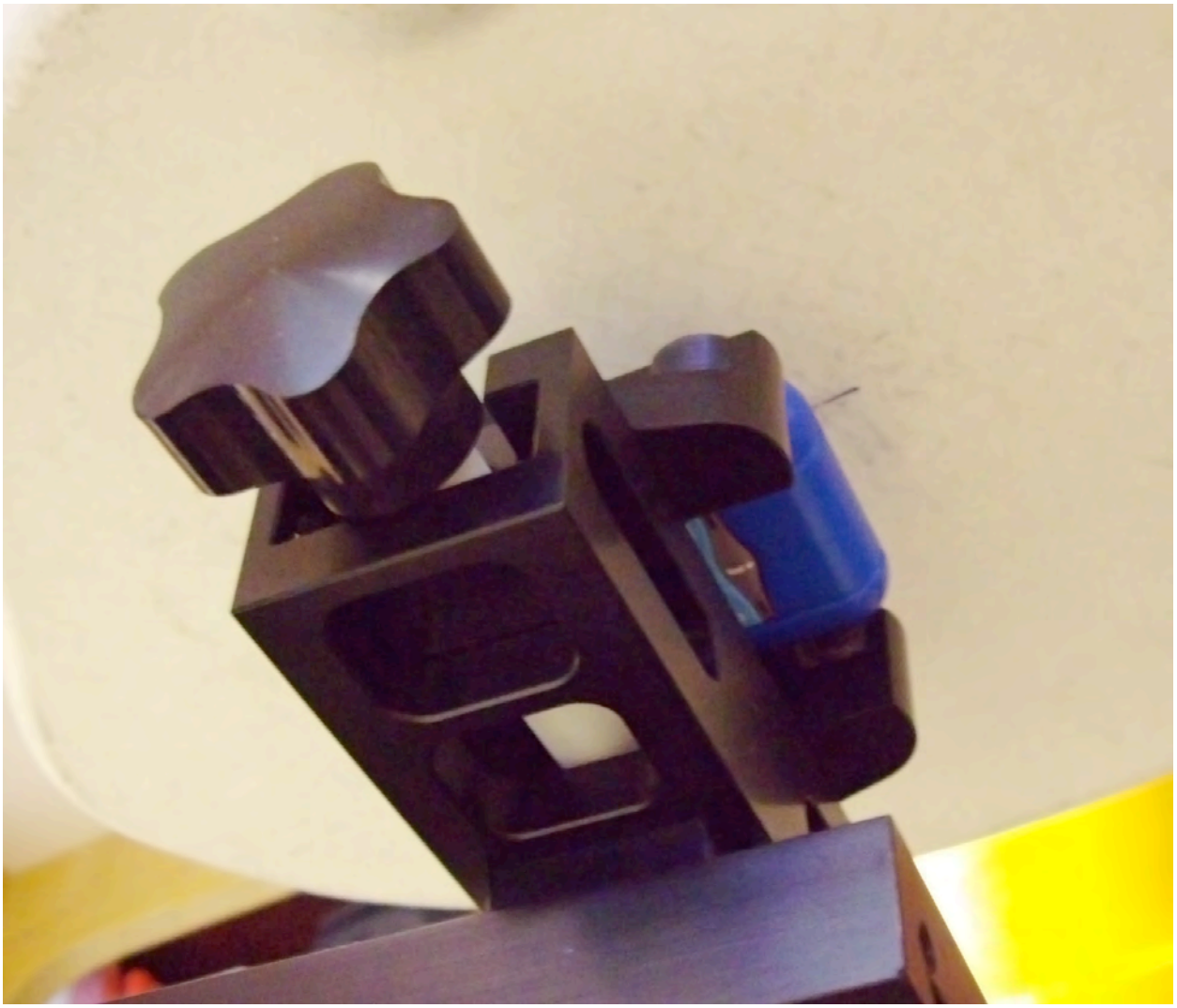


Figure 6-1 InGeo1 AW device positioned with respect to flat phantom (view 2)

7 Validations

7.1 General validation procedure

Validation scans were performed at the beginning of testing of each test program day. A validation dipole antenna was selected that roughly matched the center frequency of the bands being tested (i.e., 835 MHz and 1900 MHz). A CW sine wave with a matching frequency is then applied to the antenna from a signal generator through an amplifier for a power level of 20 dBm. Measurements were then scaled to 30 dBm, normalized to nominal tissue dielectric parameters and compared to manufacturer values derived in the same way. Validation SAR has a tolerance of ±10%.

7.2 Validation data

Table 7-1 gives SAR data for validation test scans performed on the days of testing. Antenna input power was set at 20 dBm (power level measured by power meter at the load end of the input cable).

Table 7-1 Validation SAR data

Date	Frequency	Measured 1-g SAR (mW/g)	SAR scaled to 30 dBm and tissue normalized*	Target validation 1-g SAR at 30 dBm and tissue normalized	Deviation (%)
17-Jul-08	835	0.932	9.56	9.27	+3.1%
18-Jul-08	1900	3.92	38.8	37.20	+4.3%

Note: *SAR values normalized to nominal tissue dielectric parameters per DASY4 manual, Ch. 22, SAR Sensitivities

7.3 Validation plots

The following pages show the validation test plots.

Date/Time: 7/17/2008 9:45:11 AM

Test Laboratory: QUALCOMM Incorporated

20080717_Val835_20dBm_muscle

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:465

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: MSL835 Medium parameters used (interpolated): f = 835 MHz; σ = 0.951 mho/m; εr = 56.4; ρ = 1000 kg/m3
Phantom section: Flat Section

DASY4 Configuration:

* Probe: ET3DV6 - SN1733; ConvF(6.57, 6.57, 6.57); Calibrated: 9/4/2007
* Sensor-Surface: 4mm (Mechanical Surface Detection)
* Electronics: DAE3 Sn400; Calibrated: 3/5/2008
* Phantom: SAM with CRP; Type: SAM;
* Measurement SW: DASY4, V4.7 Build 55;

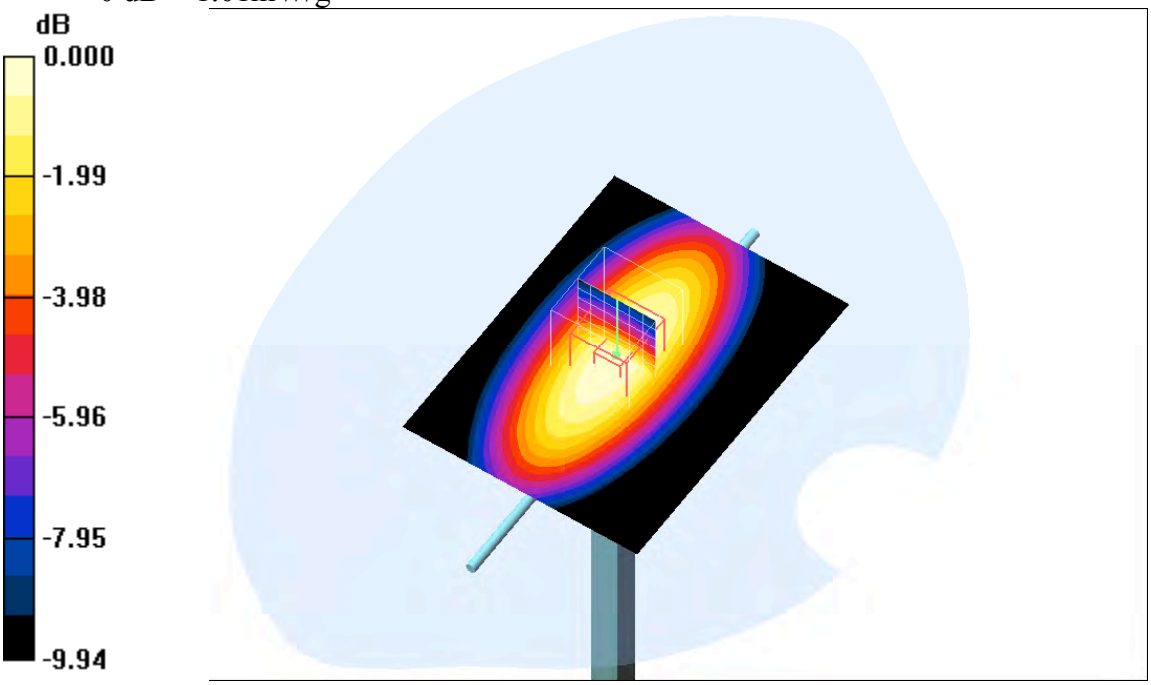
d=15mm, Pin=20 dBm/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.01 mW/g

d=15mm, Pin=20 dBm/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 34.0 V/m; Power Drift = -0.012 dB
Peak SAR (extrapolated) = 1.31 W/kg
SAR(1 g) = 0.932 mW/g; SAR(10 g) = 0.619 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.01 mW/g

0 dB = 1.01mW/g



Date/Time: 7/18/2008 8:48:22 AM

Test Laboratory: QUALCOMM Incorporated

20080718_Val1900_20dBm_muscle

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d019

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: MSL1800 Medium parameters used (interpolated): f = 1900 MHz; σ = 1.53 mho/m; εr = 51.7; ρ = 1000 kg/m3
Phantom section: Flat Section

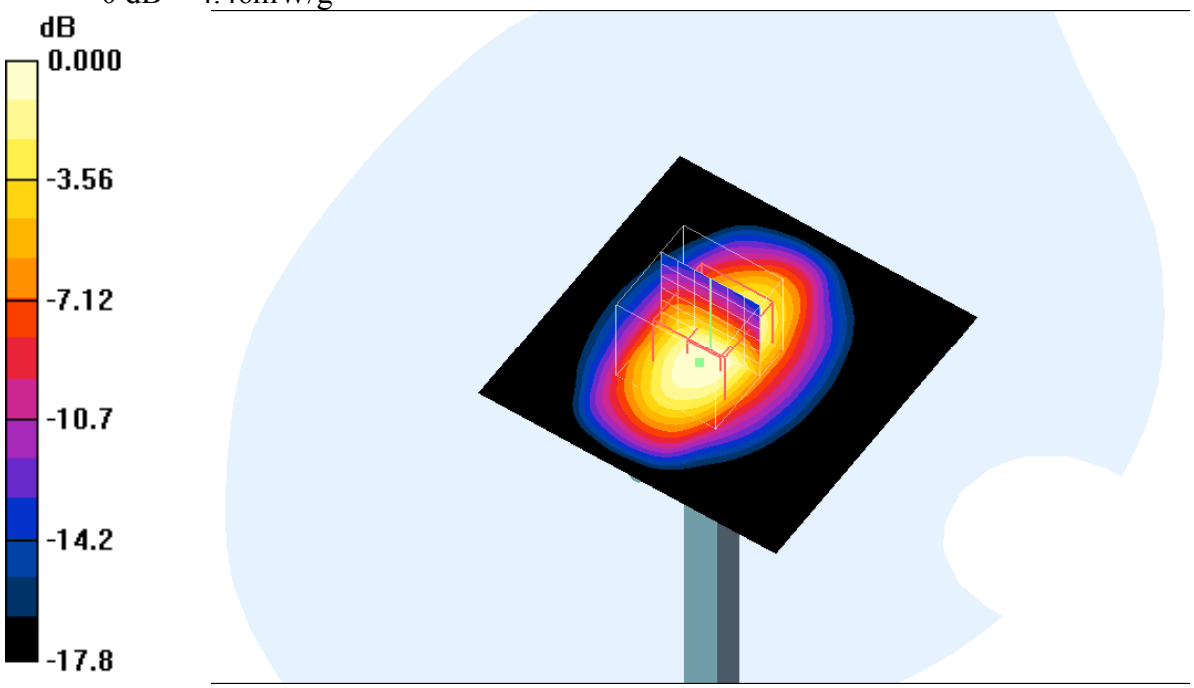
DASY4 Configuration:

* Probe: ET3DV6 - SN1733; ConvF(4.71, 4.71, 4.71); Calibrated: 9/4/2007
* Sensor-Surface: 4mm (Mechanical Surface Detection)
* Electronics: DAE3 Sn400; Calibrated: 3/5/2008
* Phantom: SAM with CRP; Type: SAM;
* Measurement SW: DASY4, V4.7 Build 55;

d=10mm, Pin=20 dBm/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 4.88 mW/g

d=10mm, Pin=20 dBm/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.6 V/m; Power Drift = 0.010 dB
Peak SAR (extrapolated) = 6.62 W/kg
SAR(1 g) = 3.92 mW/g; SAR(10 g) = 2.09 mW/g
Maximum value of SAR (measured) = 4.46 mW/g

0 dB = 4.46mW/g



8 Test Data

8.1 Numerical data

Table 8-1 shows 1-g SAR test data for the inGeo1 AW device.

Table 8-1 1 gram SAR data

Band	Channel	1-g SAR (mW/g)
BC0	1013	0.976
	383	0.663
	777	0.706
BC1	25	0.851
	600	0.545
	1175	0.459

8.2 Plots

The following sections show the SAR plots for the inGeo1 AW device.

8.2.1 CDMA Band Class 0 (U.S cellular)

Date/Time: 7/17/2008 2:14:21 PM

Test Laboratory: QUALCOMM Incorporated

20080717_inGeo1AW_1x-cell

DUT: inGeo1AW; Type: phone; Serial: 0714CC2B

Communication System: CDMA835; Frequency: 824.7 MHz;Duty Cycle: 1:1
Medium: MSL835 Medium parameters used (interpolated): f = 824.7 MHz; σ = 0.953 mho/m; εr = 56.6; ρ = 1000 kg/m3
Phantom section: Flat Section

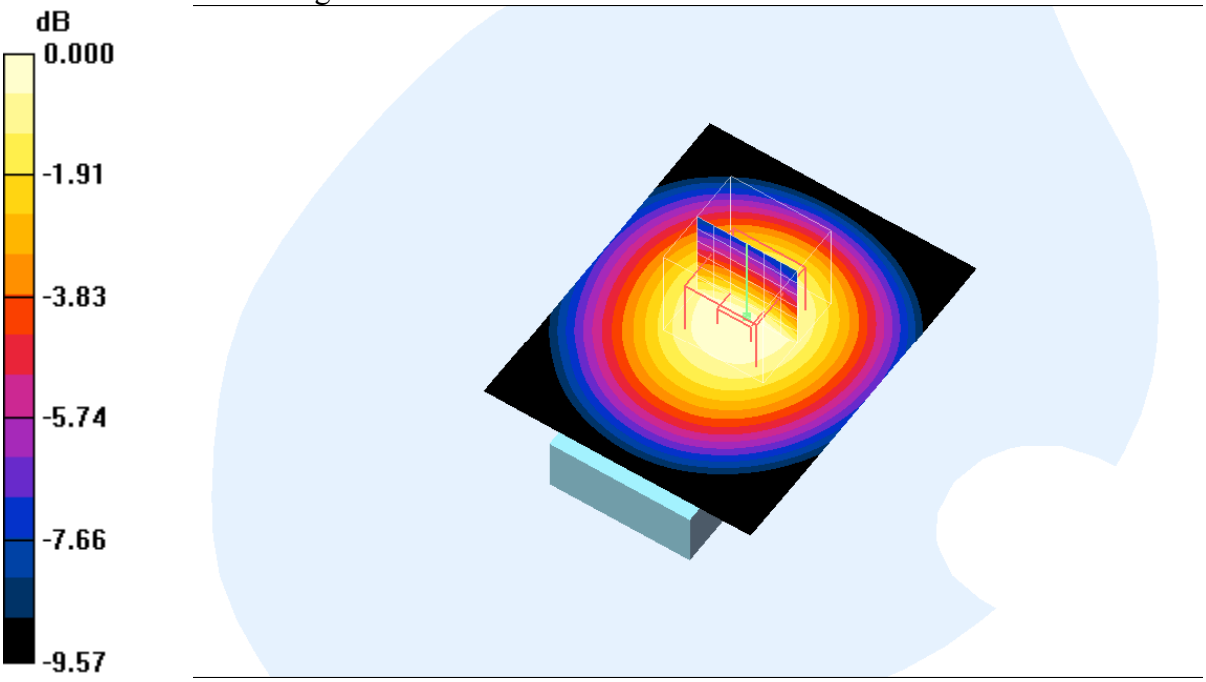
DASY4 Configuration:

* Probe: ET3DV6 - SN1733; ConvF(6.57, 6.57, 6.57); Calibrated: 9/4/2007
* Sensor-Surface: 4mm (Mechanical Surface Detection)
* Electronics: DAE3 Sn400; Calibrated: 3/5/2008
* Phantom: SAM with CRP; Type: SAM;
* Measurement SW: DASY4, V4.7 Build 55;

Flat, 15mm - Low/Area Scan (81x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.10 mW/g

Flat, 15mm - Low/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 34.4 V/m; Power Drift = 0.017 dB
Peak SAR (extrapolated) = 1.22 W/kg
SAR(1 g) = 0.974 mW/g; SAR(10 g) = 0.695 mW/g
Maximum value of SAR (measured) = 1.04 mW/g

0 dB = 1.04mW/g



Date/Time: 7/17/2008 10:51:43 AM

Test Laboratory: QUALCOMM Incorporated

20080717_InGeo1AW_1x-cell

DUT: InGeo1AW; Type: phone; Serial: 0714CC2B

Communication System: CDMA835; Frequency: 836.49 MHz;Duty Cycle: 1:1
Medium: MSL835 Medium parameters used: f = 836.5 MHz; σ = 0.951 mho/m; εr = 56.4; ρ = 1000 kg/m3
Phantom section: Flat Section

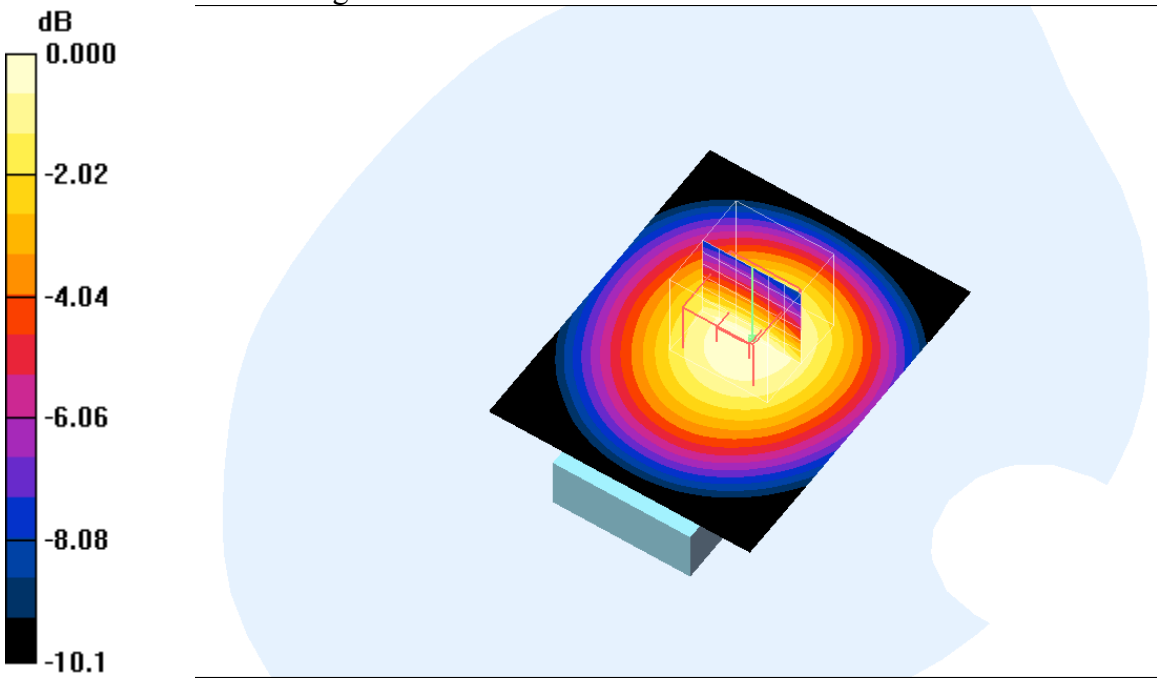
DASY4 Configuration:

* Probe: ET3DV6 - SN1733; ConvF(6.57, 6.57, 6.57); Calibrated: 9/4/2007
* Sensor-Surface: 4mm (Mechanical Surface Detection)
* Electronics: DAE3 Sn400; Calibrated: 3/5/2008
* Phantom: SAM with CRP; Type: SAM;
* Measurement SW: DASY4, V4.7 Build 55;

Flat, 15mm - Middle/Area Scan (81x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.714 mW/g

Flat, 15mm - Middle/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 26.1 V/m; Power Drift = 0.158 dB
Peak SAR (extrapolated) = 0.832 W/kg
SAR(1 g) = 0.653 mW/g; SAR(10 g) = 0.466 mW/g
Maximum value of SAR (measured) = 0.705 mW/g

0 dB = 0.705mW/g



Date/Time: 7/17/2008 11:08:34 AM

Test Laboratory: QUALCOMM Incorporated

20080717_InGeo1AW_1x-cell

DUT: InGeo1AW; Type: phone; Serial: 0714CC2B

Communication System: CDMA835; Frequency: 848.31 MHz;Duty Cycle: 1:1
Medium: MSL835 Medium parameters used: f = 848.8 MHz; σ = 0.95 mho/m; εr = 56.4; ρ = 1000 kg/m3
Phantom section: Flat Section

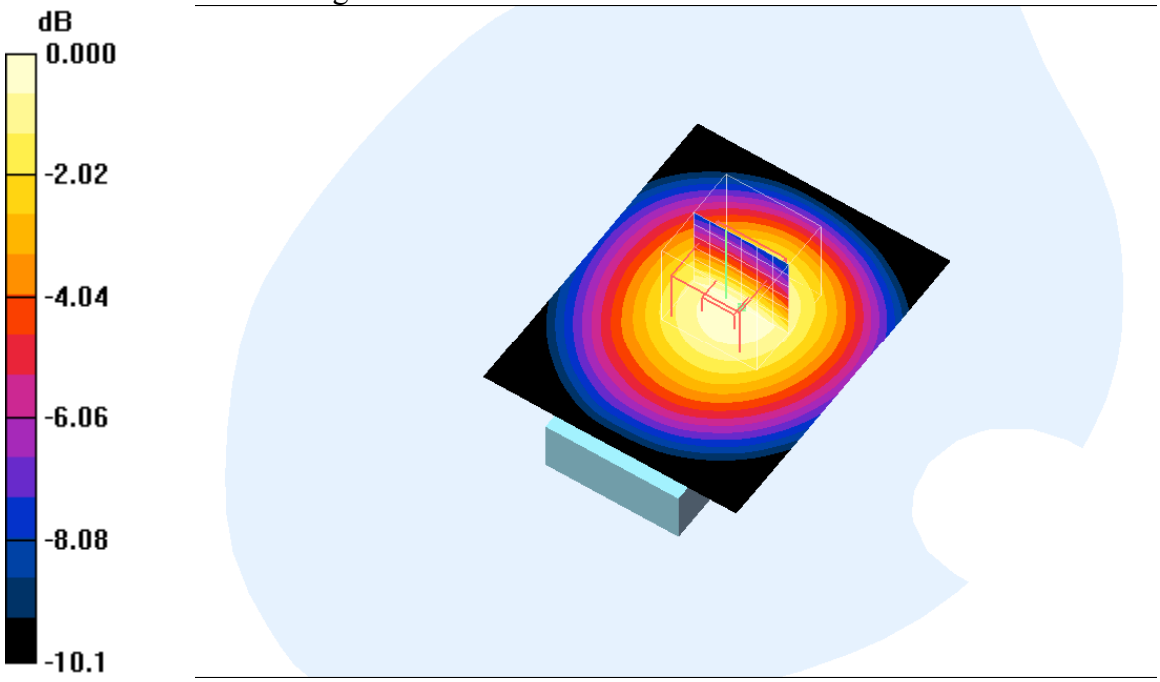
DASY4 Configuration:

* Probe: ET3DV6 - SN1733; ConvF(6.57, 6.57, 6.57); Calibrated: 9/4/2007
* Sensor-Surface: 4mm (Mechanical Surface Detection)
* Electronics: DAE3 Sn400; Calibrated: 3/5/2008
* Phantom: SAM with CRP; Type: SAM;
* Measurement SW: DASY4, V4.7 Build 55;

Flat, 15mm - High/Area Scan (81x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.717 mW/g

Flat, 15mm - High/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 26.6 V/m; Power Drift = 0.135 dB
Peak SAR (extrapolated) = 0.864 W/kg
SAR(1 g) = 0.689 mW/g; SAR(10 g) = 0.491 mW/g
Maximum value of SAR (measured) = 0.729 mW/g

0 dB = 0.729mW/g



8.2.2 CDMA Band Class 1 (US PCS)

Date/Time: 7/18/2008 9:13:29 AM

Test Laboratory: QUALCOMM Incorporated

20080718_InGeo1AW_1x-PCS

DUT: InGeo1AW; Type: phone; Serial: 0714CC2B

Communication System: CDMA 1x PCS; Frequency: 1851.25 MHz;Duty Cycle: 1:1
Medium: M1800 Medium parameters used: f = 1851.25 MHz; σ = 1.47 mho/m; εr = 51.9; ρ = 1000 kg/m3
Phantom section: Flat Section

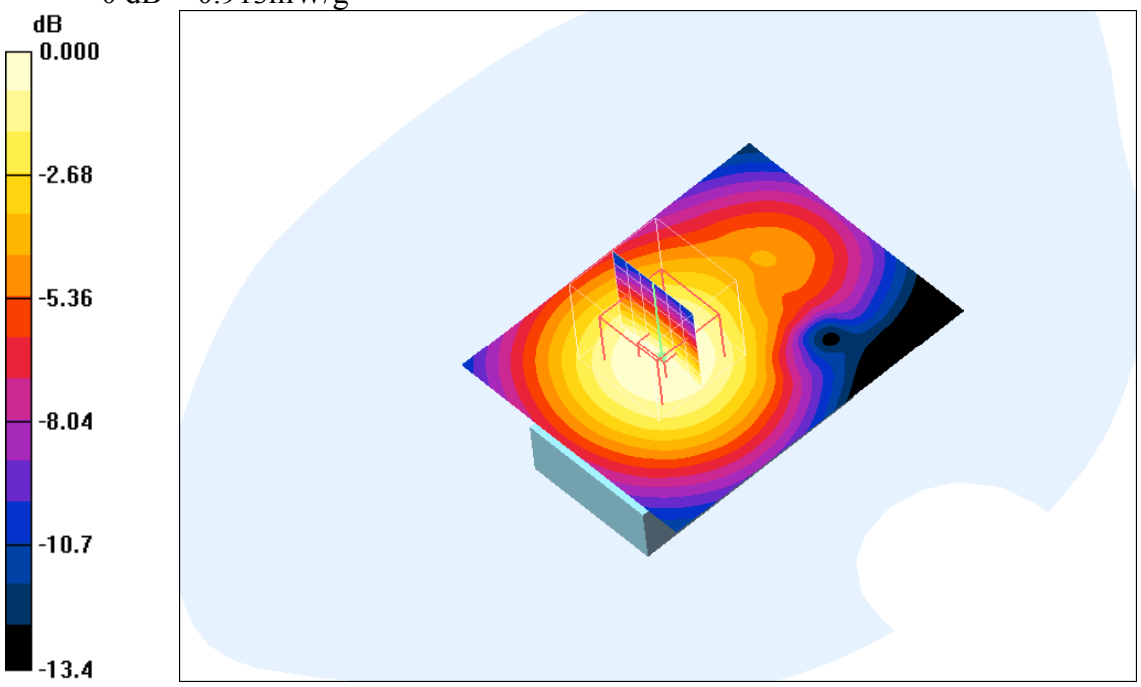
DASY4 Configuration:

* Probe: ET3DV6 - SN1733; ConvF(4.71, 4.71, 4.71); Calibrated: 9/4/2007
* Sensor-Surface: 4mm (Mechanical Surface Detection)
* Electronics: DAE3 Sn400; Calibrated: 3/5/2008
* Phantom: SAM with CRP; Type: SAM;
* Measurement SW: DASY4, V4.7 Build 55;

Flat, 15mm - Low/Area Scan (81x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.949 mW/g

Flat, 15mm - Low/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 26.0 V/m; Power Drift = -0.029 dB
Peak SAR (extrapolated) = 1.26 W/kg
SAR(1 g) = 0.851 mW/g; SAR(10 g) = 0.559 mW/g
Maximum value of SAR (measured) = 0.913 mW/g

0 dB = 0.913mW/g



Date/Time: 7/18/2008 9:51:26 AM

Test Laboratory: QUALCOMM Incorporated

20080718_InGeo1AW_1x-PCS

DUT: InGeo1AW; Type: phone; Serial: 0714CC2B

Communication System: CDMA 1x PCS; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: M1800 Medium parameters used: f = 1880 MHz; σ = 1.5 mho/m; εr = 51.8; ρ = 1000 kg/m3
Phantom section: Flat Section

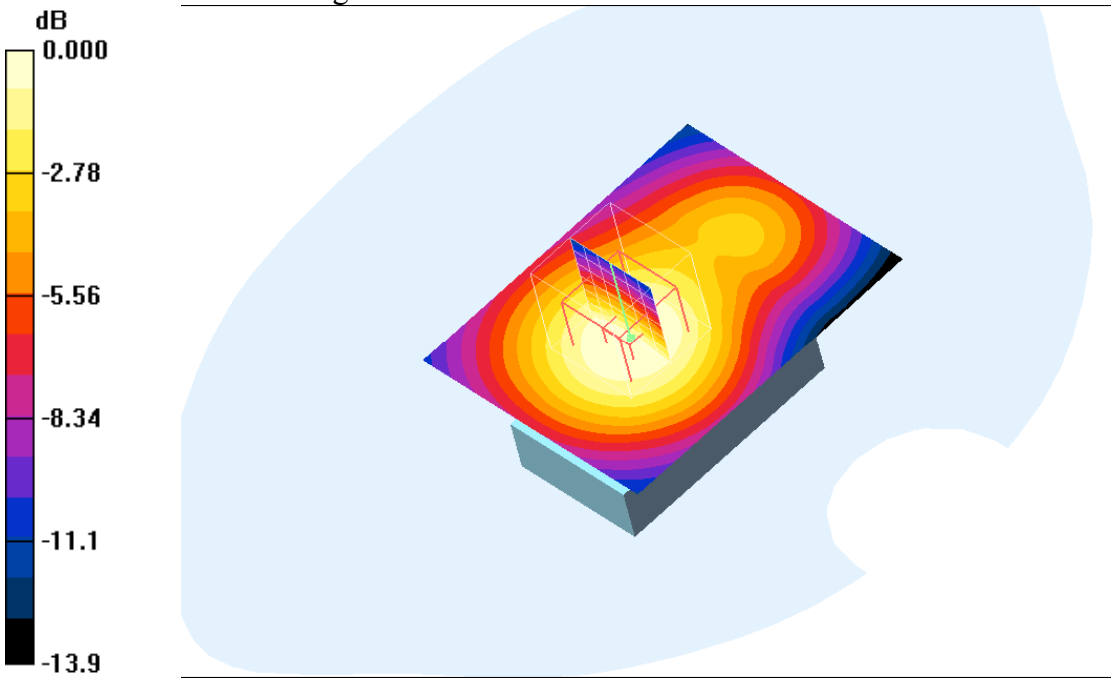
DASY4 Configuration:

* Probe: ET3DV6 - SN1733; ConvF(4.71, 4.71, 4.71); Calibrated: 9/4/2007
* Sensor-Surface: 4mm (Mechanical Surface Detection)
* Electronics: DAE3 Sn400; Calibrated: 3/5/2008
* Phantom: SAM with CRP; Type: SAM;
* Measurement SW: DASY4, V4.7 Build 55;

Flat, 15mm - Middle/Area Scan (81x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.615 mW/g

Flat, 15mm - Middle/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 22.1 V/m; Power Drift = 0.099 dB
Peak SAR (extrapolated) = 0.797 W/kg
SAR(1 g) = 0.545 mW/g; SAR(10 g) = 0.352 mW/g
Maximum value of SAR (measured) = 0.589 mW/g

0 dB = 0.589mW/g



Date/Time: 7/18/2008 10:33:39 AM

Test Laboratory: QUALCOMM Incorporated

20080718_InGeo1AW_1x-PCS

DUT: InGeo1AW; Type: phone; Serial: 0714CC2B

Communication System: CDMA 1x PCS; Frequency: 1908.75 MHz;Duty Cycle: 1:1
Medium: M1800 Medium parameters used: f = 1908.75 MHz; σ = 1.54 mho/m; εr = 51.7; ρ = 1000 kg/m3
Phantom section: Flat Section

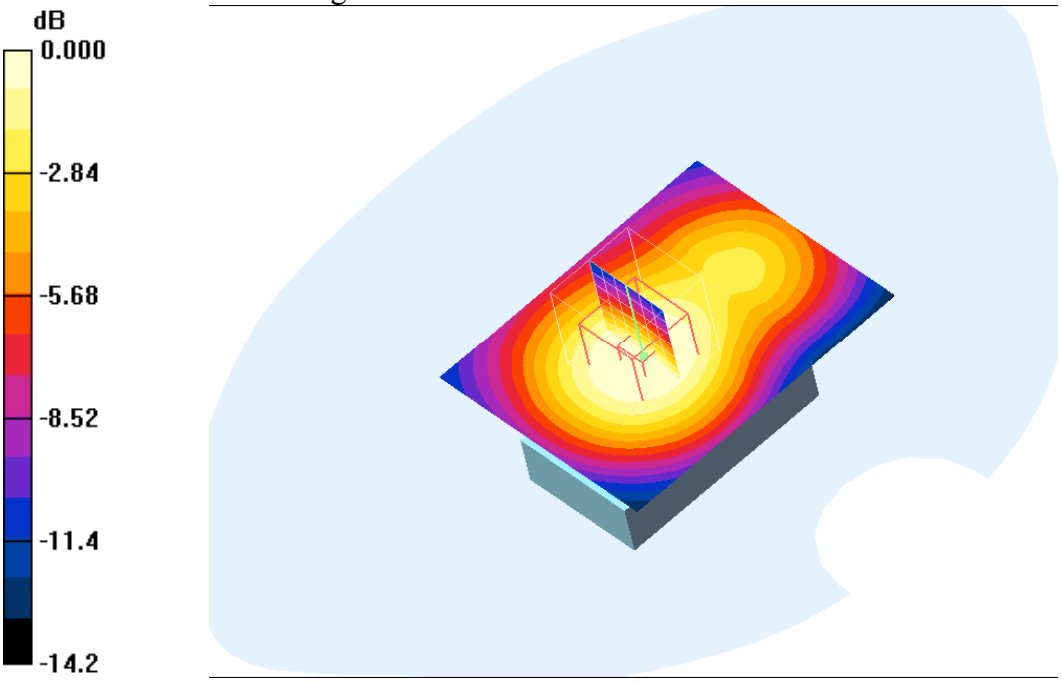
DASY4 Configuration:

* Probe: ET3DV6 - SN1733; ConvF(4.71, 4.71, 4.71); Calibrated: 9/4/2007
* Sensor-Surface: 4mm (Mechanical Surface Detection)
* Electronics: DAE3 Sn400; Calibrated: 3/5/2008
* Phantom: SAM with CRP; Type: SAM;
* Measurement SW: DASY4, V4.7 Build 55;

Flat, 15mm - High/Area Scan (81x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.559 mW/g

Flat, 15mm - High/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 21.2 V/m; Power Drift = -0.008 dB
Peak SAR (extrapolated) = 0.658 W/kg
SAR(1 g) = 0.459 mW/g; SAR(10 g) = 0.296 mW/g
Maximum value of SAR (measured) = 0.493 mW/g

0 dB = 0.493mW/g



9 System Specifications and Calibration

Figure 9-1 shows the Schmid & Partner DASY4 system diagram.

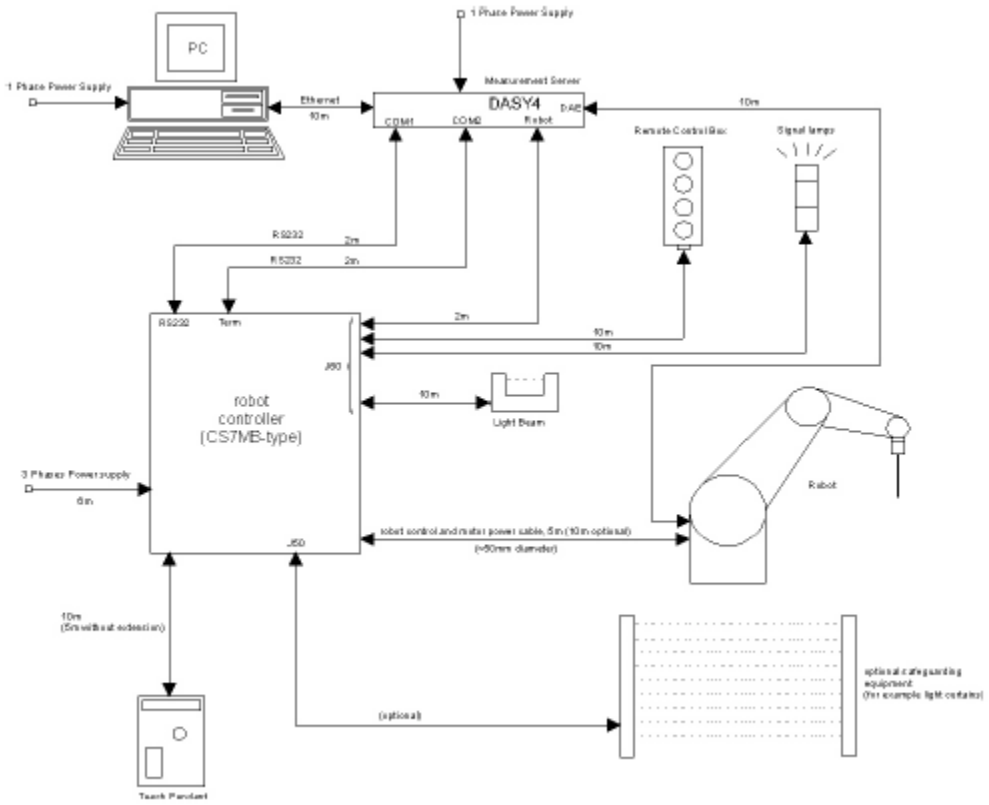


Figure 9-1 DASY4 system diagram, from S&P Applications Notes System Description and Setup

Table 9-1 Data acquisition

Processor	Intel Pentium 4, 2.40 GHz
Operating system	MS Windows® XP
Software	DASY4 V4.2.37.0, Schmid & Partners Eng. AG, Switzerland SEMCAD V1.6 build 115
Surface detection	Optical and mechanical

Table 9-2 E-Field probe

Offset tip to sensor center	2.7 mm
Offset surface to probe tip	1.8 ± 0.2
Frequency	30 MHz to 3.0 GHz
Dynamic range	5 µW/g to 100 mW/g
Isotropy	±0.15 dB (in brain liquid)

Table 9-3 Phantom

Dielectric	US cellular band: Homogeneous sugar/salt/cellulose liquid US PCS band: Homogeneous water/glycol/salt liquid
Shell	2 mm ± 0.2 mm polyester fiber glass
Ear	Integral model per SAM phantom specification

Table 9-4 Calibration

Equipment Mfr & Type	**Serial number**	**Last Calibrated**	**Next Calibration**
Schmid & Partner Engineering AG Dosimetric E-field Probe, ET3DV5	1733	09/04/2007	09/04/2008
Schmid & Partner Engineering AG dipole validation kit, D1900V2	5d019	11/28/2007	11/28/2008
Schmid & Partner Engineering AG dipole validation kit, D835V2	466	11/24/2007	11/24/2008
Schmid & Partner Engineering AG Data Acquisition Electronics, DAE3 V1	400	03/05/2008	03/05/2009
Agilent Wireless Com Test Set, E5515C	MY47510396	04/03/2008	04/03/2009
Gigatronics 8541C RF Power Meter	K82228	9/21/07	9/21/2008
Hewlett-Packard 8714C Vector Network Analyzer	US38171129	4/3/2008	4/2/2009
Hewlett-Packard 85070E Dielectric Probe System	N/A	N/A	N/A
835 MHz Body Tissue Simulating Liquid	N/A	August 2006	N/A
1900 MHz Body Tissue Simulating Liquid	N/A	August 2006	N/A

10 Calibration Data

The following pages show calibration certification data for the Schmid & Partner AG DASY3 SAR system.

m e t a s

metrology and accreditation switzerland

Based on the Accreditation and Designation Ordinance dated 17 June 1996 (as of 9 December 2003) and on the advice of the Federal Accreditation Commission, the Swiss Accreditation Service (SAS) grants to

Schmid & Partner Engineering AG
Zeughausstrasse 43
CH-8004 Zürich

the accreditation as

Calibration Laboratory for Specific Electric and Magnetic RF Fields and SAR Measurements

in accordance with the Standard ISO/IEC 17025. The ranges and measurement uncertainties are listed in the Official SCS-Directory of the Accredited Calibration Laboratories.

Accreditation mark and number: SCS 108

Date of accreditation: 17 September 2004

The accreditation is valid until: 16 September 2009

CH-3003 Berne-Wabern, 17 September 2004

Swiss Accreditation Service

The Head

Hanspeter Ischi

SAS is a signatory of the multilateral agreements of the European co-operation for Accreditation (EA) for calibration, testing, inspection and certification of products, personnel, quality and environmental management systems, of the International Accreditation Forum (IAF) for quality management systems and of the International Laboratory Accreditation Cooperation (ILAC) for calibration and testing.

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Office fédéral de métrologie et d'accréditation
Ufficio federale di metrologia e di accreditamento
Swiss Federal Office of Metrology and Accreditation

Eidg. Justiz- und Polizeidepartement
Département fédéral de justice et police
Dipartimento federale di giustizia e polizia
Swiss Federal Department of Justice and Police

m e t a s

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Schweizerische Akkreditierungsstelle
Service d'accréditation suisse
Servizio di accreditamento svizzero
Swiss Accreditation Service

Accreditation number SCS 108

SCS Directory

Calibration Laboratory for Specific Electric and Magnetic RF Fields and SAR Measurements

Schmid & Partner
Engineering AG
Zeughausstrasse 43
8004 Zürich
Phone 044/ 245 97 00
Fax 044/ 245 97 79

Head of laboratory : Dr. Katja Pokovic
Deputy of head of laboratory : Dr. Fin Bomholt
Responsible person for QA : Prof. Dr. Niels Kuster
First accreditation (d,m,y) : 17.09.2004
Last accreditation (d,m,y) : 17.09.2004

Measured Quantity:

Electric field
Magnetic field
Specific Absorption Rate (SAR)
Temperature
DC Voltage

Change:

Staff :
Scope extension : 01.10.2005
Address :
Edition : **SCS108/D**

The reported expanded 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%.

Measured Quantity Instrument	Range	Conditions of measurements	Best Measurement Capability BMC at (22 ± 3) °C	Remarks
Electric field Calibration of E-field probes	0.8 V/m ... 800 V/m	10 MHz ... 3 GHz	5,1 %	e.g. ER3DV6x, EF3DVx, EU2DVx, EE3DVx
Magnetic field Calibration of H-field probes	2 mA/m ... 2 A/m	10 MHz ... 3 GHz	5,1 %	e.g. H2DVx, H3DVx
Specific absorption rate (SAR) Calibration of dosimetric E-field probes	E* field (typical[1]) 0,5 V/m ... 500 V/m	300 MHz ... 450 MHz	6,7 % (13,3 % for SAR)	e.g. ET3DVx, ES3DVx, EX3DVx, ET1DVx, EU2DVx Temperature transfer calibration *) As example, the indicated range corresponds to 0,2 mW/kg - 200 W/kg for head tissue simulating liquid and f = 450 MHz

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Calibration Laboratory for Specific Electric and Magnetic RF Fields and SAR Measurements

The reported expanded 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%.

Measured Quantity Instrument	Range	Conditions of measurements	Best Measurement Capability BMC at (22 ± 3) °C	Remarks
Specific absorption rate (SAR)				e.g. ET3DVx, ES3DVx, EX3DVx, ET1DVx, EU2DVx
Calibration of dosimetric E-field probes	E* field (typical[1]) 0,45 V/m ... 450 V/m	800 MHz ... 2 GHz	5,5% (11,0 % for SAR)	Waveguide analytical calibration *) As example, the indicated range corresponds to 0,2 mW/kg - 200 W/kg for head tissue simulating liquid and f = 1800 MHz
	E* field (typical[1]) 0,4 V/m ... 400 V/m	2,45 GHz	5,9 % (11,8 % for SAR)	Waveguide analytical calibration *) As example, the indicated range corresponds to 0,2 mW/kg - 200 W/kg for head tissue simulating liquid and f = 2450 MHz
Specific absorption rate (SAR)				e.g. EX3DVx, ET1DVx
	E* field (typical[1]) 0,4 V/m ... 450 V/m	3 GHz ... 6 GHz	6,5 % (13,1 % for SAR)	Waveguide analytical calibration *) As example, the indicated range corresponds to 0,2 mW/kg - 200 W/kg for head tissue simulating liquid and f = 5200 MHz
Calibration of temperature SAR probes	0 °C ... +60 °C	Tissue simulating Liquids	0,15 K (5 % temperature gradient for SAR)	As example, the temperature gradient of T1Vx probe can be determined to 5 %, which is also contribution to SAR accuracy. (Noise is dominating the lower SAR threshold to typically 0,2 W/kg)

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The reported expanded 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%.

Measured Quantity Instrument	Range	Conditions of measurements	Best Measurement Capability BMC at (22 ± 3) °C	Remarks
Calibration of test system validation dipoles	SAR* 1 g and 10 g per 1 W input power	300 MHz ... 450 MHz	18,1 % for SAR 1 g 17,6 % for SAR 10 g	e.g. D835V2 - D3000V2 according to IEEE 1528-2003, for 1 g and 10 g SAR *) SAR given (as example) for head tissue simulating liquid
		835 MHz ... 3 GHz	17,0 % for SAR 1 g 16,5 % for SAR 10 g	
Calibration of test system validation dipoles	SAR* 1 g and 10 g per 1 W input power	3 GHz ... 6 GHz	19,9 % for SAR 1 g 19,5 % for SAR 10 g	e.g. D3500V2 – D5GHzV2 according to IEC 62209-2, for 1 g and 10 g SAR *) SAR given (as example) for head tissue simulating liquid
Calibration of dipoles in air	E* field per 0.1 W input power 30 V/m ... 300 V/m H* field per 0.1 W input power 0.07 A/m ... 0.7 A/m	800 MHz 3000 MHz	12.8 % for E field 8.2 % for H field	e.g. CD835V3 – CD2450V3 according to ANSI PC63.19-2001, for E field and H field
DC Voltage Calibration of readout units for field and SAR probes	2 mV 200 mV		0,65% 0,06 %	e.g. DAE3Vx, DAE4Vx, DAEasyVx

[1] Slightly depending on the frequency and probe type

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Federal Department of Economic Affairs DEA

State Secretariat for Economic Affairs SECO
Swiss Accreditation Service SAS

Accreditation number **SCS 108**
Numero d'accreditamento

Accreditation Standard ISO/IEC 17025:2005
Norma d'accreditamento ISO/IEC

SCS Directory
Registro SCS

Calibration Laboratory for Specific Electric and Magnetic RF Fields and SAR measurements

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Fax +41 44 245 97 79
mailto:info@speag.com
http://www.speag.com

Head of laboratory	:	Dr. Katja Pokovic
Deputy of head of laboratory	:	Dr. Fin Bomholt
Responsible person for QA	:	Prof. Dr. Niels Kuster
First accreditation (d,m,y)	:	17.09.2004
Last accreditation (d,m,y)	:	17.09.2004
Actual version	:	http://www.sas.ch/

Measured Quantities:

Electric field
Magnetic field
Specific **A**bsorption **R**ate (**SAR**)
Temperature
DC Voltage

Change:

Staff	:	
Scope extension	:	01.10.05, 01.04.08
Address	:	
Edition	:	**SCS108/G**

The given extended measurement uncertainty is the standard uncertainty of the measurement multiplied by an extension factor k = 2, which corresponds to a confidence level of about 95% for a normal distribution.

Measured Quantity Instrument	Range	Condition of measurement	Best Measurement Capability CMC at (22 ± 3) °C	Remarks
Electric field				
Calibration of E-field probes	0.8 V/m … 800 V/m	10 MHz … 3 GHz	5,1 %	e.g. ER3DV6x, EF3DVx, EU2DVx, EE3DVx
Magnetic field				
Calibration of H-field probes	2 mA/m … 2 A/m	10 MHz … 3 GHz	5,1 %	e.g. H2DVx, H3DVx
Calibration of sensitivity for magnetic field probes in the audio range	0,001 ... 0,1 V/(A/m)	1 kHz 0,1 ... 1 A/m	2,2 %	e.g. AM1DVx
Calibration of magnetic field simulator	-30 ... +40 dB A/m	1 kHz		e.g. TMFS (Telephone Magnetic Field Simulator)

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Measured Quantity Instrument	Range	Condition of measurement	Best Measurement Capability CMC at (22 ± 3) °C	Remarks
Specific absorption rate (SAR)				e.g. ET3DVx, ES3DVx, EX3DVx, ET1DVx, EU2DVx
Calibration of dosimetric E-field probes	E* field (typical[1]) 0,5 V/m … 500 V/m	300 MHz … 450 MHz	6,7 % (13,3 % for SAR)	Temperature transfer calibration *) As example, the indicated range corresponds to 0,2 mW/kg … 200 W/kg for head tissue simulating liquid and f = 450 MHz
	E* field (typical[1])			e.g. ET3DVx, ES3DVx, EX3DVx, ET1DVx, EU2DVx
Calibration of dosimetric E-field probes	0,45 V/m … 450 V/m	800 MHz ... 3 GHz	5,5 % (11 % for SAR)	Waveguide analytical calibration *) As example, the indicated range corresponds to 0,2 mW/kg … 200 W/kg for head tissue simulating liquid and f = 1800 MHz
	E* field (typical[1]) 0,4 V/m … 450 V/m	3 GHz … 6 GHz	6,5 % (13,1 % for SAR)	e.g. EX3DVx, ET1DVx Waveguide analytical calibration *) As example, the indicated range corresponds to 0,2 mW/kg … 200 W/kg for head tissue simulating liquid and f = 5200 MHz
Calibration of temperature SAR probes	0 °C ... + 60 °C	Tissue simulating Liquids	0,15 K (5 % temperature gradient for SAR)	As example, the temperature gradient of T1Vx and T1V3LAB probes can be determined to 5 %, which is also contribution to SAR accuracy. (Noise is dominating the lower SAR threshold to typically 0,2 W/kg)

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Measured Quantity Instrument	Range	Condition of measurement	Best Measurement Capability CMC at (22 ± 3) °C	Remarks
Calibration of test system validation dipoles	SAR* 1 g and 10 g per 1 W input power	300 MHz … 450 MHz	18,1 % for SAR 1 g 17,6 % for SAR 10 g	e.g. D835V2 … D3000V2 according to IEEE 1528-2003, for 1 g and 10 g SAR
		835 MHz … 3 GHz	17,0 % for SAR 1 g 16,5 % for SAR 10 g	*) SAR given (as example) for head tissue simulating liquid
	SAR* 1 g and 10 g per 1 W input power	3 GHz … 6 GHz	19,9 % for SAR 1 g 19,5 % for SAR 10 g	e.g. D3500V2 … D5GHzV2 according to IEC 62209-2, for 1 g and 10 g SAR *) SAR given (as example) for head tissue simulating liquid
Calibration of dipoles in air	E* field per 0,1 W input power 30 V/m … 300 V/m	800 MHz … 3 GHz	12,8 % for E field	e.g. CD835V3 … CD2450V3 according to ANSI PC 63,19 2001, for E field and H field
	H* field per 0,1 W input power 0,07 A/m … 0,7 A/m		8,2 % for H field	
DC Voltage Calibration of readout units for field and SAR probes	2 mV 200 mV		0,65 % 0,06 %	e.g. DAE3Vx, DAE4Vx, DAEasyVx

[1] Slightly depending on the frequency and probe type

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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 Qualcomm USA

Certificate No: ET3-1733_Sep07

CALIBRATION CERTIFICATE

Object	ET3DV6 - SN:1733
Calibration procedure(s)	QA CAL-01.v6 and QA CAL-12.v5 Calibration procedure for dosimetric E-field probes
Calibration date:	September 4, 2007
Condition of the calibrated item	In Tolerance

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Power sensor E4412A	MY41495277	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Power sensor E4412A	MY41498087	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Reference 3 dB Attenuator	SN: S5054 (3c)	8-Aug-07 (METAS, No. 217-00719)	Aug-08
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-07 (METAS, No. 217-00671)	Mar-08
Reference 30 dB Attenuator	SN: S5129 (30b)	8-Aug-07 (METAS, No. 217-00720)	Aug-08
Reference Probe ES3DV2	SN: 3013	4-Jan-07 (SPEAG, No. ES3-3013_Jan07)	Jan-08
DAE4	SN: 654	20-Apr-07 (SPEAG, No. DAE4-654_Apr07)	Apr-08

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

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

Issued: September 4, 2007

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

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

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) 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:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

ET3DV6 SN:1733 **September 4, 2007**

Probe ET3DV6

SN:1733

Manufactured:	September 27, 2002
Last calibrated:	September 22, 2006
Recalibrated:	September 4, 2007

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)