RF EXPOSURE EVALUATION

SPECIFIC ABSORPTION RATE

SAR TEST REPORT

FOR

ATLINKS USA, INC.

5.8 GHz FHSS CORDLESS TELEPHONE HANDSET

Model(s) for USA	Model(s) for Canada
28031XXX-A	TC28031XXX-A
	28031XXX-A

CLASS II PERMISSIVE CHANGE - NEW RF AMPLIFIER

FCC ID: G9H2-8021A

IC ID: 3765A-28021A

Test Report Serial Number

120805G9H-F702-S15T
Revision 0

Test Report Issue Date

December 20, 2005

Test Lab

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DECLARATION OF COMPLIANCE
SAR RF EXPOSURE EVALUATION

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Applicant Information

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FCC IDENTIFIER:	**G9H2-8021A**
IC IDENTIFER:	**3765A-28021A**
Model No.(s):	**28031XXX-A (USA)** **TC28031XXX-A, 28031XXX-A (Canada)**
Rule Part(s):	**FCC 47 CFR §2.1093; IC RSS-102 Issue 2**
Test Procedure(s):	**FCC OET Bulletin 65, Supplement C (Edition 01-01)** **IEEE Standard 1528-2003**
FCC Device Classification:	**Part 15 Spread Spectrum Transmitter (DSS)**
IC Device Classification:	**Low Power License-Exempt Radiocommunication Device (RSS-210 Issue 6)**
Device Description:	**5.8 GHz FHSS Cordless Telephone Handset**
Transmission System:	**FHSS (Frequency Hopping Spread Spectrum)**
Modulation Scheme(s):	**EDCT TDD/TDMA**
Tx Frequency Range(s):	**5725.809 - 5848.889 MHz**
Max. RF Output Power Tested:	**17.62 mW / 12.46 dBm (Source-Based Time-Averaged) 5848.889 MHz**
Power Measurement Method:	**Radiated Free-Space Power**
Max. Duty Cycle Tested:	**10.5 % (Source-Based Time-Averaged)**
Battery Type(s) Tested:	**Ni-MH 3.6 V, 800 mAh**
Antenna Type(s) Tested:	**Fixed Stubby**
Body-Worn Accessories Tested:	**Plastic Belt-Clip**
Audio Accessories Tested:	**Generic Ear-Microphone**
Max. SAR Level(s) Evaluated:	**Head: 0.0382 W/kg (1g average)** **Body: 0.0939 W/kg (1g average)**
Class II Permissive Change(s):	**New RF Amplifier**

Celltech Labs Inc. declares under its sole responsibility that this wireless portable device was compliant with the Specific Absorption Rate (SAR) RF exposure requirements specified in FCC 47 CFR §2.1093 and Health Canada's Safety Code 6. The device was tested in accordance with the measurement standards and procedures specified in FCC OET Bulletin 65, Supplement C (Edition 01-01), IEEE 1528-2003, and Industry Canada RSS-102 Issue 2 for the General Population / Uncontrolled Exposure environment. All measurements were performed in accordance with the SAR system manufacturer recommendations.

I attest to the accuracy of data. All measurements were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

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The results and statements contained in this report pertain only to the device(s) evaluated.

Tested By:	**Reviewed By:**
Sean Johnston **Compliance Technologist** **Celltech Labs Inc.**	**Spencer Watson** **Senior Compliance Technologist** **Celltech Labs Inc.**

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1.0 INTRODUCTION

This measurement report demonstrates that the ATLINKS USA, INC. Models: 28031XXX-A, TC28031XXX-A Portable 5.8GHz FHSS Cordless Telephone Handset FCC ID: G9H2-8021A, with the Class II Permissive Change(s) described in this report, complies with the SAR (Specific Absorption Rate) RF exposure requirements specified in FCC 47 CFR §2.1093 (see reference [1]), and Health Canada's Safety Code 6 (see reference [2]) for the General Population / Uncontrolled Exposure environment. The test procedures described in FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [3]), IEEE Standard 1528-2003 (see reference [4]), and IC RSS-102 Issue 2 (see reference [5]), were employed. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used, and the various provisions of the rules are included within this test report.

2.0 DESCRIPTION of DEVICE UNDER TEST (DUT)

FCC Rule Part(s)	47 CFR §2.1093			
IC Rule Part(s)	RSS-102 Issue 2			
Test Procedure(s)	FCC OET Bulletin 65, Supplement C (01-01)			
	IC RSS-102 Issue 2			
	IEEE 1528-2003			
FCC Device Classification	Part 15 Spread Spectrum Transmitter			Part 15(C)
IC Device Classification	Low Power License-Exempt Radiocommunication Device			RSS-210 Issue 6
Device Description	Portable 5.8 GHz FHSS Cordless Telephone Handset			
FCC IDENTIFIER	G9H2-8021A			
IC IDENTIFIER	3765A-28021A			
Model No.(s)	**USA**		**Canada**	
	28031XXX-A		TC28031XXX-A	
			28031XXX-A	
Test Sample Serial No.	50001601544HY		Identical Prototype	
Transmission System(s)	FHSS		Frequency Hopping Spread Spectrum	
Modulation Scheme(s)	EDCT TDD/TDMA			
Tx Frequency Range(s)	5725.809 - 5848.889 MHz			
Max. RF Output Power Levels Calculated from Corrected Field Strengths (Source-Based Time Averaged)	11.80 mW	10.72 dBm	Free-Space Power	5725.809 MHz
	11.22 mW	10.50 dBm	Free-Space Power	5788.240 MHz
	17.62 mW	**12.46 dBm**	**Free-Space Power**	**5848.889 MHz**
Max. Duty Cycle Tested	10.5 %	Source-Based Time-Averaged		Crest Factor: 9.52
Battery Type(s) Tested	Ni-MH	3.6 V	800 mAh	
Antenna Type(s) Tested	Fixed Stubby			
Body-Worn Accessories Tested	Plastic Belt-Clip			
Audio Accessories Tested	Generic Ear-Microphone			
Class II Permissive Change	New RF Amplifier			

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3.0 SAR MEASUREMENT SYSTEM

Celltech Labs Inc. SAR measurement facility utilizes the Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY4 measurement system is comprised of the measurement server, robot controller, computer, near-field probe, probe alignment sensor, specific anthropomorphic mannequin (SAM) phantom, and alternate planar phantoms for brain and/or body SAR evaluations. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit 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 DASY4 measurement server. The DAE4 utilizes 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 DASY4 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. The sensor systems are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

DASY4 SAR Measurement System with SAM phantom and 5GHz Fluid Left View

DASY4 Measurement System with SAM Phantom and 5GHz Fluid Right View

4.0 MEASUREMENT SUMMARY

HEAD SAR EVALUATION RESULTS

Freq. (MHz)	Chan.	Test Mode	Battery Type	Antenna Position	Phantom Section	Test Position	DUT SBTA Start Power[2] (mW)	SAR Drift During Test (dB)	Measured SAR 1g (W/kg)
5848.889	139	Modulated Fixed Frequency	Ni-MH	Fixed	Right Ear	Ear/Tilt (15°)	17.62	0.183	**0.0382**
ANSI / IEEE C95.1 1999 - SAFETY LIMIT			**BRAIN: 1.6 W/kg (averaged over 1 gram)**			**Spatial Peak Uncontrolled Exposure / General Population**			

Test Date(s)	December 13, 2005				**Relative Humidity**	30	**%**
Measured Fluid Type	**5800 MHz Brain**				**Atmospheric Pressure**	102.8	**kPa**
Dielectric Constant ε_r	**IEEE Target**		**Measured**	**Deviation**	**Ambient Temperature**	23.9	**°C**
	35.3	**± 5%**	34.7	-1.7%	**Fluid Temperature**	22.3	**°C**
Conductivity σ (mho/m)	**IEEE Target**		**Measured**	**Deviation**	**Fluid Depth**	≥ 15	**cm**
	5.27	**± 5%**	5.10	-3.2%	**ρ (Kg/m^3)**	1000	

BODY SAR EVALUATION RESULTS

Freq. (MHz)	Chan.	Test Mode	Battery Type	Antenna Position	Phantom Section	DUT Position to Planar Phantom	Accessories Tested		Separation Distance to Planar Phantom (cm)	DUT SBTA Start Power[2] (mW)	SAR Drift During Test (dB)	Measured SAR 1g (W/kg)
							Body-Worn	Audio				
5848.889	139	Modulated Fixed Frequency	Ni-MH	Fixed	Planar	Back Side	Plastic Belt-Clip	Generic Ear-Mic	0.7	17.62	-0.213	**0.0939**
ANSI / IEEE C95.1 1999 - SAFETY LIMIT				**BODY: 1.6 W/kg (averaged over 1 gram)**				**Spatial Peak Uncontrolled Exposure / General Population**				

Test Date(s)	December 13, 2005				**Relative Humidity**	30	**%**
Measured Fluid Type	**5800 MHz Body**				**Atmospheric Pressure**	102.9	**kPa**
Dielectric Constant ε_r	**IEEE Target**		**Measured**	**Deviation**	**Ambient Temperature**	24.2	**°C**
	48.2	**± 5%**	47.0	-2.5%	**Fluid Temperature**	22.5	**°C**
Conductivity σ (mho/m)	**IEEE Target**		**Measured**	**Deviation**	**Fluid Depth**	≥ 15	**cm**
	6.00	**± 5%**	5.94	-1.0%	**ρ (Kg/m^3)**	1000	

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MEASUREMENT SUMMARY (Cont.)

Note(s):

1. The measurement results were obtained with the DUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum SAR location of the DUT are reported in Appendix A.
2. The reference output power level was determined prior to the SAR evaluations using free space power measurement method (calculated from corrected field strength levels). The reference output power level reported is source based time-averaged power (SBTA).
3. The SAR test configurations reported on the previous page were determined based on the worst-case Head and Body SAR level configurations from the original FCC Certification SAR evaluations (Celltech Test Report Serial No.: 111705G9H-F695-S15T) as listed below. It was also determined from the free space radiated power measurement results that the high frequency channel (5848.889 MHz) continued to yield the maximum power level (see below table).
   a) Head SAR - Right Ear - Tilt Position (15°) - 5848.889 MHz - Chan. 139 (0.0786 W/kg)
   b) Body-Worn - Back Side of DUT - 5848.889 - Chan. 139 (0.0720 W/kg)
4. The power drifts measured by the DASY4 system for the duration of the SAR evaluations were ≤5% from the start power.
5. The DUT battery was fully charged prior to each SAR evaluation.
6. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the SAR evaluations. The temperatures reported were consistent for all measurement periods.
7. The dielectric parameters of the simulated tissue mixtures were measured prior to the SAR evaluations using an ALS-PR-DIEL Dielectric Probe Kit and an HP 8753ET Network Analyzer (see Appendix C).
8. The SAR evaluations were performed within 24 hours of the system performance check.

Free Space Power Measurements	Project Number:	702		
	Company:	Atlinks USA Inc.	Test Start Date:	11-Dec-05
	Product:	28031	Test End Date:	11-Dec-05

Configuration				Polarity	Distance	Carrier Channel	Frequency	Corrected Field Strength	SA Signal Level (uncorrected)	Duty Cycle		Calculated Carrier Level	
DUT#	Orientation	Battery	Accessory		m		MHz	dBuV/m	dBuV	%	dB	dBm	mW
2	Face Up	NiMH	none	H	3	1	5725.8093	111.94	65.70	10.50	-9.79	6.92	4.92
2	Long Edge Up	NiMH	Ear-mic	H	3	1	5725.8093	113.74	67.50	10.50	-9.79	8.72	7.45
2	Face Up	NiMH	none	V	3	1	5725.8093	111.24	65.00	10.50	-9.79	6.22	4.19
2	Long Edge Up	NiMH	Ear-mic	V	3	1	5725.8093	115.74	69.50	10.50	-9.79	10.72	11.81
2	Face Up	NiMH	none	H	3	71	5788.2400	113.62	67.40	10.50	-9.79	8.60	7.25
2	Long Edge Up	NiMH	Ear-mic	H	3	71	5788.2400	113.92	67.70	10.50	-9.79	8.90	7.76
2	Face Up	NiMH	none	V	3	71	5788.2400	108.72	62.50	10.50	-9.79	3.70	2.34
2	Long Edge Up	NiMH	Ear-mic	V	3	71	5788.2400	115.52	69.30	10.50	-9.79	10.50	11.22
2	Face Up	NiMH	none	H	3	139	5848.8889	117.18	70.90	10.50	-9.79	12.16	16.46
2	Long Edge Up	NiMH	Ear-mic	H	3	139	5848.8889	116.28	70.00	10.50	-9.79	11.26	13.38
2	Face Up	NiMH	none	V	3	139	5848.8889	110.38	64.10	10.50	-9.79	5.36	3.44
2	**Long Edge Up**	**NiMH**	**Ear-mic**	**V**	**3**	**139**	**5848.8889**	**117.48**	**71.20**	**10.50**	**-9.79**	**12.46**	**17.62**

Measurement made at a 3 meter distance, with the EUT placed 1 meter above the ground plane

The battery was fully charged prior to each evaluation

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5.0 DETAILS OF SAR EVALUATION

The ATLINKS USA, INC. Portable 5.8GHz FHSS Cordless Telephone Handset FCC ID: G9H2-8021A, with the Class II Permissive Change(s) described in this report, was compliant for localized Specific Absorption Rate (Uncontrolled Exposure) based on the test provisions and conditions described below. The detailed test setup photographs are shown in Appendix E.

Ear-held Configuration

1) The DUT was tested in an ear-held configuration at the right head section of the SAM phantom (right ear, ear/tilt position).

a) The handset was placed in the device holder 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, with the center of the earpiece touching the center of the ear spacer of the SAM phantom.

b) With the handset positioned parallel to the cheek, the test device reference point was aligned to the ear reference point on the head phantom, and the vertical centerline was aligned to the phantom reference plane (initial ear position).

c) While maintaining the three alignments, the body of the handset was gradually adjusted to each of the following test position:

- Ear/Tilt Position: With the phone aligned in the Cheek/Touch position, the handset was tilted away from the mouth with respect to the test device reference point by 15 degrees.

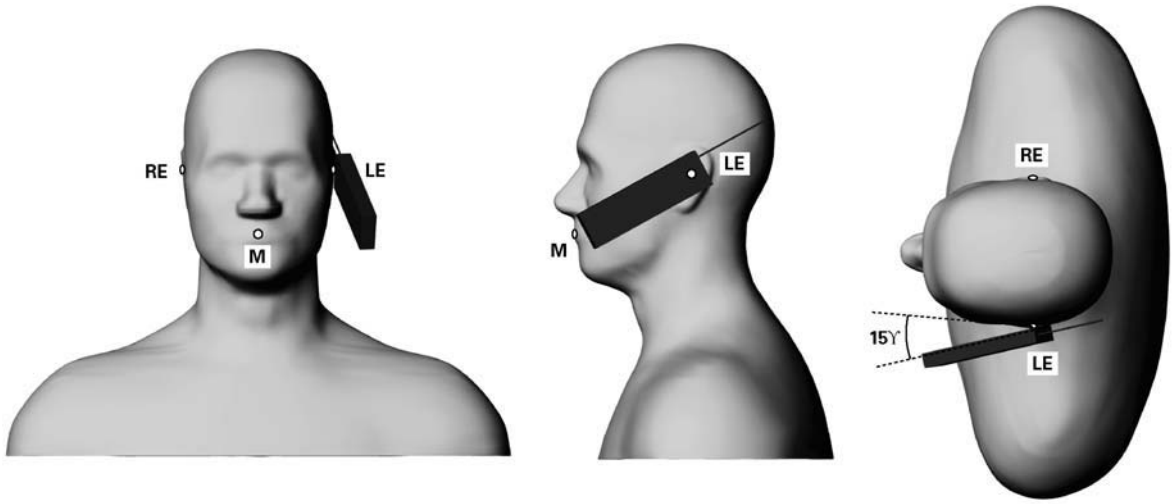

Figure 1. Phone position 2, "tilted position." The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated (Shoulders are shown for illustration only).

DETAILS OF SAR EVALUATION (Cont.)

Body-worn Configuration

2) The DUT was tested in a body-worn configuration with the back of the handset placed parallel to the outer surface of the SAM phantom (planar section). The attached plastic belt-clip accessory was touching the outer surface of the SAM phantom (planar section) and provided a 0.7 cm separation distance from the back of the handset to the SAM phantom (planar section).
3) A generic ear-microphone audio accessory was connected to the DUT for the duration of the body-worn test.

DUT Test Modes & Power Settings

4) The DUT was programmed in test mode via internal software controlled by the keypad.
5) SAR measurements were performed with the DUT transmitting at maximum power in 1 time slot on a fixed frequency with a modulated signal and a 10.5% source-based time-averaged duty cycle (crest factor: 1:9.52).
6) The conducted power level(s) of the DUT could not be measured for the SAR evaluation due to a non-detachable antenna. The DUT was evaluated for SAR at the maximum conducted power level preset by the manufacturer.
7) The RF output power reference levels of the DUT were evaluated prior to the SAR evaluations using the free-space power measurement method (output power calculated from measured field strengths) using Celltech Labs' 3-meter OATS in accordance with the measurement procedures described in ANSI TIA/EIA-603-C-2004.
8) The power drift of the DUT during the SAR evaluations was measured by the DASY4 system.
9) The DUT battery was fully charged prior to each SAR evaluation.

6.0 EVALUATION PROCEDURES

a. (i) The evaluation was performed in the applicable area of the phantom depending on the type of device being tested. For devices held to the ear during normal operation, both the left and right ear positions were evaluated using the SAM phantom.

   (ii) For body-worn and face-held devices a planar phantom was used.

b. The SAR was determined by a pre-defined procedure within the DASY4 software. Upon completion of a reference and optical surface check, the exposed region of the phantom was scanned near the inner surface with a grid spacing of 15mm x 15mm.

   An area scan was determined as follows:

c. Based on the defined area scan grid, a more detailed grid is created to increase the points by a factor of 10. The interpolation function then evaluates all field values between corresponding measurement points.

d. A linear search is applied to find all the candidate maxima. Subsequently, all maxima are removed that are >2 dB from the global maximum. The remaining maxima are then used to position the cube scans.

   A 1g and 10g spatial peak SAR was determined as follows:

e. Extrapolation is used to determine the values between the dipole center of the probe and the surface of the phantom. This data cannot be measured because the center of the dipole sensors is 1.0 mm away from the probe tip and the distance between the probe, and the boundary must be larger than 25% of the probe diameter. The probe diameter is 2.4 mm. In the DASY4 software, the distance between the sensor center and phantom surface is set to 2.0 mm. This provides a distance of 1.0 mm between the probe tip and the surface. The extrapolation of the values between the dipole center and the surface of the phantom was based on trivariate quadratics computed from the previously calculated 3D interpolated points nearest the phantom surface.

f. Interpolated data is used to calculate the average SAR over 1g and 10g cubes by spatially discretizing the entire measured cube. The volume used to determine the averaged SAR is a 1mm grid (42875 interpolated points).

g. A zoom scan volume of 32 mm x 32 mm x 30 mm (5x5x7 points) centered at the peak SAR location determined from the area scan is used for all zoom scans for devices with a transmit frequency < 800 MHz. Zoom scans for frequencies ≥ 800 MHz are determined with a scan volume of 30 mm x 30 mm x 30 mm (7x7x7 points) to ensure complete capture of the peak spatial-average SAR.

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EVALUATION PROCEDURES (Cont.)

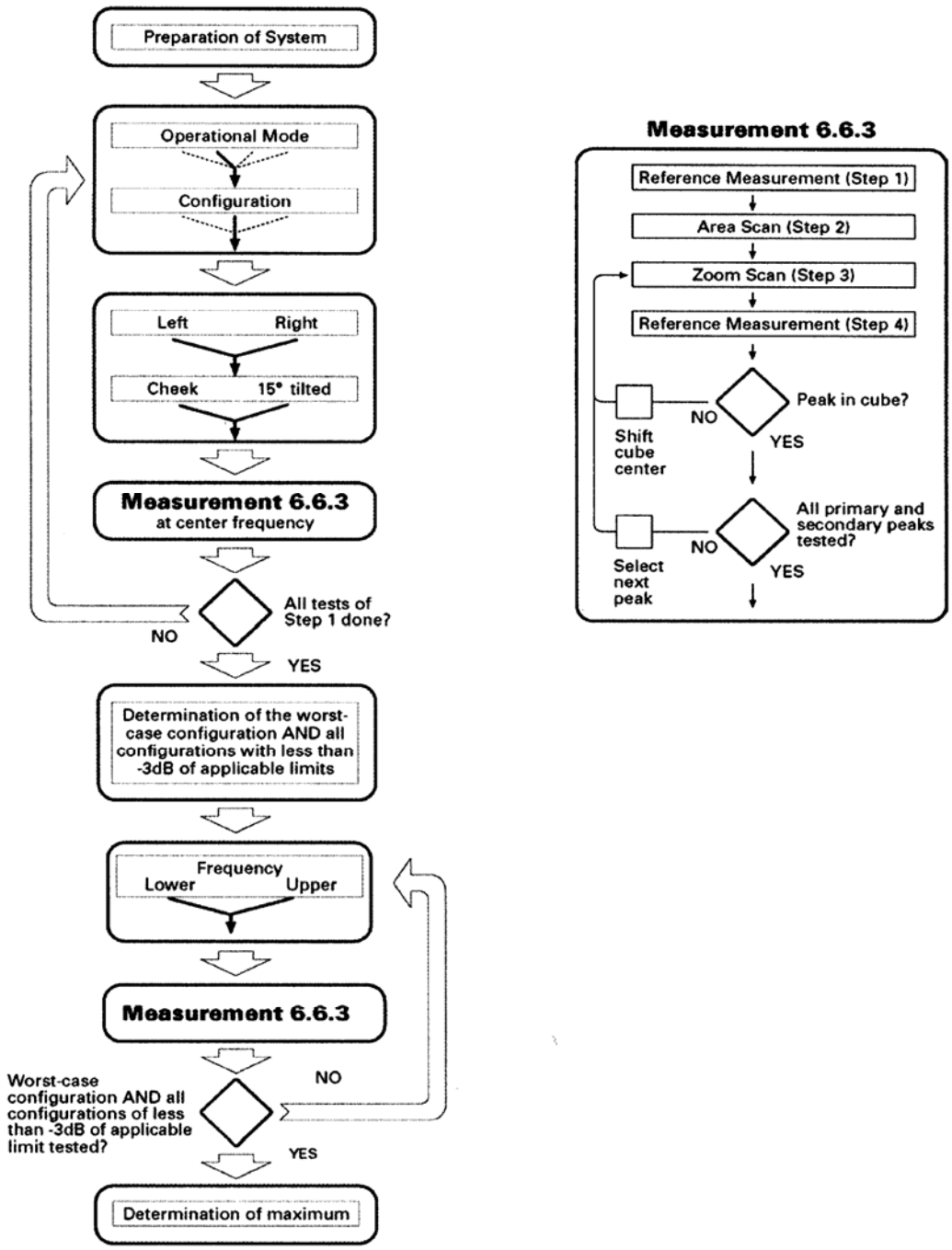

Figure 2. Flow Chart for determining the largest peak spatial-average SAR from all device configurations per IEEE Standard 1528-2003 (see reference [4]).

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7.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluation a system check was performed in the planar section of the SAM phantom with a SPEAG D5GHzV2 validation dipole (see Appendix F for system validation procedures). The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using an ALS-PR-DIEL Dielectric Probe Kit and an HP 8753ET Network Analyzer (see Appendix C). A forward power of 250 mW was applied to the dipole and the system was verified to a tolerance of ±10% (see Appendix B for system performance check test plot). See table at bottom of page for system manufacturer's reference SAR values from the DASY 4 Manual, March 2005 (see reference [6]).

SYSTEM PERFORMANCE CHECK EVALUATION

Test Date	5.8GHz Equiv. Tissue	SAR 1g (W/kg)			Dielectric Constant ε_r			Conductivity σ (mho/m)			ρ (Kg/m^3)	Amb. Temp. (°C)	Fluid Temp. (°C)	Fluid Depth (cm)	Humid. (%)	Barom. Press. (kPa)
		Target	Meas.	Dev.	IEEE Target	Meas.	Dev.	IEEE Target	Meas.	Dev.						
12/13/05	**Brain**	**19.5 ±10%**	19.3	-1.0%	**35.3 ±5%**	34.7	-1.7%	**5.27 ±5%**	5.10	-3.2%	1000	23.9	22.3	≥ 15	30	102.8

Note(s):
1. The ambient and fluid temperatures were measured prior to, and during, the fluid dielectric parameter check and the system performance check. The temperatures listed in the table above were consistent for all measurement periods.

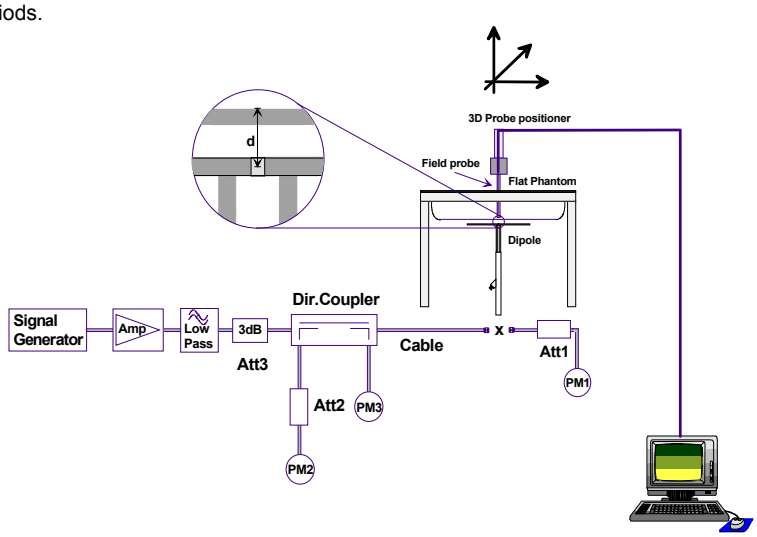

Figure 3. System Performance Check Setup Diagram

D5GHzV2 Dipole Setup

Reference SAR values

The reference SAR values were calculated using finite-difference time-domain FDTD method (feed-point impedance set to 50 Ω) and the mechanical dimensions of the D5GHzV2 dipole (manufactured by SPEAG).

f (GHz)	Head Tissue			Body Tissue		
	SAR_{1g}	SAR_{10g}	SAR_{peak}	SAR_{1g}	SAR_{10g}	SAR_{peak}
5.0	72.9	20.7	285.6	68.1	19.2	260.3
5.1	74.6	21.1	297.5	78.8	19.6	272.3
5.2	76.5	21.6	310.3	71.8	20.1	284.7
5.5	83.3	23.4	349.4	79.1	22.0	326.3
5.8	78.0	21.9	340.9	74.1	20.5	324.7

Table 27.2: Numerical reference SAR values for D5GHzV2 dipole and flat phantom.

D5GHzV2 Dipole

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8.0 SIMULATED EQUIVALENT TISSUES

The 5.8GHz simulated tissue mixtures provided by the SAR system manufacturer (SPEAG) are listed below. The dielectric parameters of the tissue mixture (permittivity and conductivity) were measured prior to the SAR evaluations. See Appendix D for manufacturer's fluid data sheet.

SIMULATED TISSUE MIXTURES			
INGREDIENT	System Performance Check & DUT Evaluation		
	5.8 GHz Brain	5.8 GHz Body	5 GHz Fluid
Water	64 - 78%	64 - 78%	
Mineral Oil	11 - 18%	11 - 18%	
Emulsifiers	9 - 15%	9 - 15%	
Additives and Salt	2 - 3%	2 - 3%	

9.0 SAR SAFETY LIMITS

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 1 g of tissue)	1.60	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

Notes:
1. Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.
2. Controlled environments are defined as locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.

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10.0 ROBOT SYSTEM SPECIFICATIONS

Specifications

POSITIONER: Stäubli Unimation Corp. Robot Model: RX60L
Repeatability: 0.02 mm
No. of axis: 6

Data Acquisition Electronic (DAE) System

Cell Controller

Processor: AMD Athlon XP 2400+
Clock Speed: 2.0 GHz
Operating System: Windows XP Professional

Data Converter

Features: Signal Amplifier, multiplexer, A/D converter, and control logic
Software: DASY4 software
Connecting Lines: Optical downlink for data and status info.
Optical uplink for commands and clock

DASY4 Measurement Server

Function: Real-time data evaluation for field measurements and surface detection
Hardware: PC/104 166MHz Pentium CPU; 32 MB chipdisk; 64 MB RAM
Connections: COM1, COM2, DAE, Robot, Ethernet, Service Interface

E-Field Probe

Model: EX3DV4
Serial No.: 3547
Construction: Symmetrical design with triangular core
Frequency: 10 MHz to 6 GHz
Linearity: ±0.2 dB (30 MHz to 3 GHz)

Phantom(s)

Type: SAM V4.0C
Shell Material: Fiberglass
Thickness: 2.0 ±0.1 mm
Volume: Approx. 25 liters

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11.0 PROBE SPECIFICATION (EX3DV4)

Construction:	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g. DGBE)
Calibration:	Basic Broadband Calibration in air: 10-3000 MHz Conversion Factors (CF) for HSL 900 and HSL 1750
Frequency:	10 MHz to >6 GHz; Linearity: ±0.2 dB (30 MHz to 3 GHz)
Directivity:	±0.3 dB in HSL (rotation around probe axis) ±0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range:	10 μW/g to >100 mW/g; Linearity: ±0.2 dB (noise: typically < 1 μW/g)
Dimensions:	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1.0 mm
Application:	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 than 30%.

EX3DV4 E-Field Probe

12.0 SAM PHANTOM V4.0C

The SAM phantom V4.0C is a fiberglass shell phantom with a 2.0 mm (+/-0.2 mm) shell thickness for left and right head and flat planar area integrated in a wooden table. The shape of the fiberglass shell corresponds to the phantom defined by SCC34-SC2. The device holder positions are adjusted to the standard measurement positions in the three sections (see Appendix H for specifications of the SAM phantom V4.0C).

SAM Phantom

13.0 DEVICE HOLDER

The DASY4 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections.

Device Holder

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14.0 TEST EQUIPMENT LIST

TEST EQUIPMENT		ASSET NO.	SERIAL NO.	DATE CALIBRATED		CALIBRATION DUE DATE
USED	DESCRIPTION					
x	Schmid & Partner DASY4 System	-	-	-		-
x	-DASY4 Measurement Server	00158	1078	N/A		N/A
x	-Robot	00046	599396-01	N/A		N/A
x	-DAE4	00019	353	15Jun05		15Jun06
	-DAE3	00018	370	25Jan05		25Jan06
	-ET3DV6 E-Field Probe	00016	1387	18Mar05		18Mar06
	-ET3DV6 E-Field Probe	00017	1590	20May05		20May06
x	-EX3DV4 E-Field Probe	00125	3547	21Jan05		21Jan06
	-300MHz Validation Dipole	00023	135	25Oct05		25Oct06
	-450MHz Validation Dipole	00024	136	25Oct05		25Oct06
	-835MHz Validation Dipole	00022	411	**Brain**	30Mar05	30Mar06
				Body	12Apr05	12Apr06
	-900MHz Validation Dipole	00020	054	**Brain**	10Jun05	10Jun06
				Body	10Jun05	10Jun06
	-1800MHz Validation Dipole	00021	247	**Brain**	14Jun05	14Jun06
				Body	14Jun05	14Jun06
	-1900MHz Validation Dipole	00032	151	**Brain**	17Jun05	17Jun06
				Body	22Apr05	22Apr06
	-2450MHz Validation Dipole	00025	150	**Brain**	20Sep05	20Sep06
				Body	22Apr05	22Apr06
x	-5000MHz Validation Dipole	00126	1031	**Brain**	11Jan05	11Jan06
				Body	11Jan05	11Jan06
x	-SAM Phantom V4.0C	00154	1033	N/A		N/A
	-Barski Planar Phantom	00155	03-01	N/A		N/A
	-Plexiglas Side Planar Phantom	00156	161	N/A		N/A
	-Plexiglas Validation Planar Phantom	00157	137	N/A		N/A
	HP 85070C Dielectric Probe Kit	00033	N/A	N/A		N/A
x	ALS-PR-DIEL Dielectric Probe Kit	00160	260-00953	N/A		N/A
x	Gigatronics 8652A Power Meter	00110	1835801	16Apr05		16Apr06
	Gigatronics 8652A Power Meter	00008	1835267	29Apr05		29Apr06
x	Gigatronics 80701A Power Sensor	00012	1834350	12Sep05		12Sep06
x	Gigatronics 80701A Power Sensor	00014	1833699	07Sep05		07Sep06
	Gigatronics 80701A Power Sensor	00109	1834366	16Apr05		16Apr06
x	HP 8753ET Network Analyzer	00134	US39170292	04May05		04May06
x	HP 8648D Signal Generator	00005	3847A00611	29Apr05		29Apr06
x	Rohde & Schwarz SMR40 Signal Generator	00006	100104	12Apr05		12Apr06
x	Amplifier Research 5S1G4 RF Amplifier	00106	26235	N/A		N/A

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15.0 MEASUREMENT UNCERTAINTIES

UNCERTAINTY BUDGET FOR DEVICE EVALUATION						
Error Description	**Uncertainty Value ±%**	**Probability Distribution**	**Divisor**	**ci 1g**	**Uncertainty Value ±% (1g)**	**V_i or V_{eff}**
Measurement System						
Probe calibration	6.8	Normal	1	1	6.8	∞
Axial isotropy of the probe	4.7	Rectangular	1.732050808	0.7	1.9	∞
Spherical isotropy of the probe	9.6	Rectangular	1.732050808	0.7	3.9	∞
Spatial resolution	0	Rectangular	1.732050808	1	0.0	∞
Boundary effects	2	Rectangular	1.732050808	1	1.2	∞
Probe linearity	4.7	Rectangular	1.732050808	1	2.7	∞
Detection limit	1	Rectangular	1.732050808	1	0.6	∞
Readout electronics	0.3	Normal	1	1	0.3	∞
Response time	0.8	Rectangular	1.732050808	1	0.5	∞
Integration time	2.6	Rectangular	1.732050808	1	1.5	∞
RF ambient conditions	3	Rectangular	1.732050808	1	1.7	∞
RF ambient reflections	3	Rectangular	1.732050808	1	1.7	∞
Mech. constraints of robot	0.8	Rectangular	1.732050808	1	0.5	∞
Probe positioning	5.7	Rectangular	1.732050808	1	3.3	∞
Extrapolation & integration	4	Rectangular	1.732050808	1	2.3	∞
Test Sample Related						
Device positioning	2.9	Normal	1	1	2.9	12
Device holder uncertainty	3.6	Normal	1	1	3.6	8
Power drift	5	Rectangular	1.732050808	1	2.9	∞
Phantom and Setup						
Phantom uncertainty	4	Rectangular	1.732050808	1	2.3	∞
Liquid conductivity (target)	5	Rectangular	1.732050808	0.64	1.8	∞
Liquid conductivity (measured)	2.5	Normal	1	0.64	1.6	∞
Liquid permittivity (target)	5	Rectangular	1.732050808	0.6	1.7	∞
Liquid permittivity (measured)	2.5	Normal	1	0.6	1.5	∞
Combined Standard Uncertainty					**12.05**	
Expanded Uncertainty (k=2)					**24.09**	

Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003 (see reference [4])

MEASUREMENT UNCERTAINTIES (Cont.)

UNCERTAINTY BUDGET FOR SYSTEM VALIDATION						
Error Description	**Uncertainty Value ±%**	**Probability Distribution**	**Divisor**	**ci 1g**	**Uncertainty Value ±% (1g)**	**V_i or V_{eff}**
Measurement System						
Probe calibration	6.8	Normal	1	1	6.8	∞
Axial isotropy of the probe	4.7	Rectangular	1.732050808	1	2.7	∞
Spherical isotropy of the probe	9.6	Rectangular	1.732050808	1	5.5	∞
Spatial resolution	0	Rectangular	1.732050808	1	0.0	∞
Boundary effects	2	Rectangular	1.732050808	1	1.2	∞
Probe linearity	4.7	Rectangular	1.732050808	1	2.7	∞
Detection limit	1	Rectangular	1.732050808	1	0.6	∞
Readout electronics	0.3	Normal	1	1	0.3	∞
Response time	0	Rectangular	1.732050808	1	0.0	∞
Integration time	0	Rectangular	1.732050808	1	0.0	∞
RF ambient conditions	3	Rectangular	1.732050808	1	1.7	∞
RF ambient reflections	3	Rectangular	1.732050808	1	1.7	∞
Mech. constraints of robot	0.8	Rectangular	1.732050808	1	0.5	∞
Probe positioning	9.9	Rectangular	1.732050808	1	5.7	∞
Extrapolation & integration	4	Rectangular	1.732050808	1	2.3	∞
Dipole						
Device positioning	2	Rectangular	1.732050808	1	1.2	∞
Power & Power Drift	4.7	Rectangular	1.732050808	1	2.7	∞
Phantom and Setup						
Phantom uncertainty	4	Rectangular	1.732050808	1	2.3	∞
Liquid conductivity (target)	5	Rectangular	1.732050808	0.64	1.8	∞
Liquid conductivity (measured)	2.5	Normal	1	0.64	1.6	∞
Liquid permittivity (target)	5	Rectangular	1.732050808	0.6	1.7	∞
Liquid permittivity (measured)	2.5	Normal	1	0.6	1.5	∞
Combined Standard Uncertainty					**11.75**	
Expanded Uncertainty (k=2)					**23.50**	

Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003 (see reference [4])

16.0 REFERENCES

[1] Federal Communications Commission, “Radiofrequency radiation exposure evaluation: portable devices”, Rule Part 47 CFR §2.1093: 1999.

[2] Health Canada, “Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz”, Safety Code 6: 1999.

[3] Federal Communications Commission, “Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields”, OET Bulletin 65, Supplement C (Edition 01-01), FCC, Washington, D.C.: June 2001.

[4] IEEE Standard 1528-2003, “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”: December 2003.

[5] Industry Canada, “Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)”, Radio Standards Specification RSS-102 Issue 2: November 2005.

[6] Schmid & Partner Engineering AG, “DASY4 Manual V4.5”: March 2005.

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APPENDIX A - SAR MEASUREMENT DATA

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Date Tested: 12/13/2005

Head SAR - Right Ear - Tilt Position (15°)

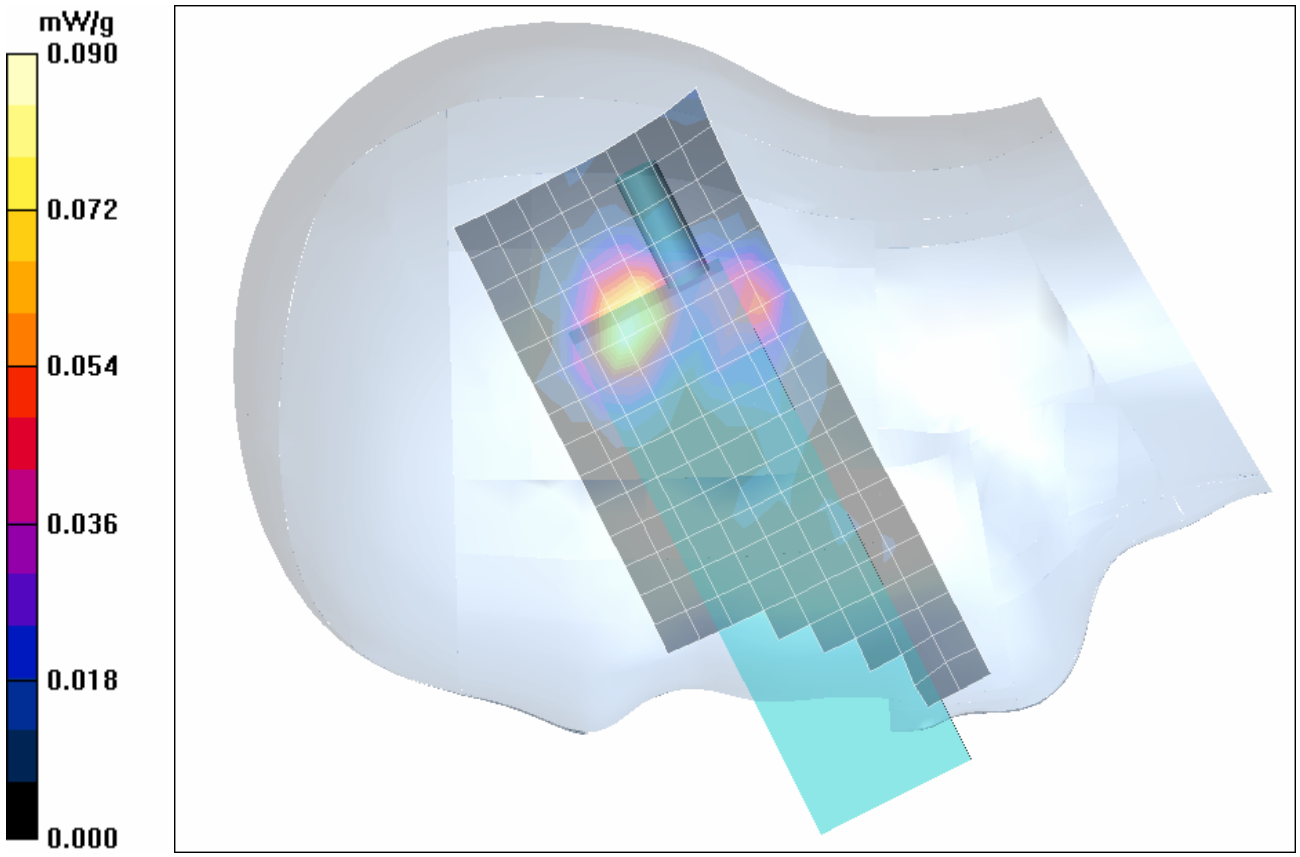
DUT: Atlinks Model: 28031XXX-A; Type: Portable 5.8GHz FHSS Cordless Telephone Handset; Serial: 50001601544HY

Ambient Temp: 23.9 °C; Fluid Temp: 22.3 °C; Barometric Pressure: 102.8 kPa; Humidity: 30%

Communication System: Modulated Fixed Frequency
3.6V, 800mAh NiMH Battery Pack
RF Output Power: 17.62 mW (Free-Space)
Frequency: 5848.889 MHz; Channel 139; Duty Cycle: 1:9.52
Medium: HSL5200-5800 (σ = 5.10 mho/m; ε_r = 34.7; ρ = 1000 kg/m^3)
- Probe: EX3DV4 - SN3547; ConvF(4.71, 4.71, 4.71); Calibrated: 21/01/2005
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Head SAR - Right Ear - Tilt Position (15°) - High Channel/Area Scan (9x22x1):
Measurement grid: dx=10mm, dy=10mm

Head SAR - Right Ear - Tilt Position (15°) - High Channel/Zoom Scan (8x8x8)/Cube 0:
Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 4.34 V/m; Power Drift = 0.183 dB
Peak SAR (extrapolated) = 0.160 W/kg
SAR(1 g) = 0.0382 mW/g; SAR(10 g) = 0.014 mW/g



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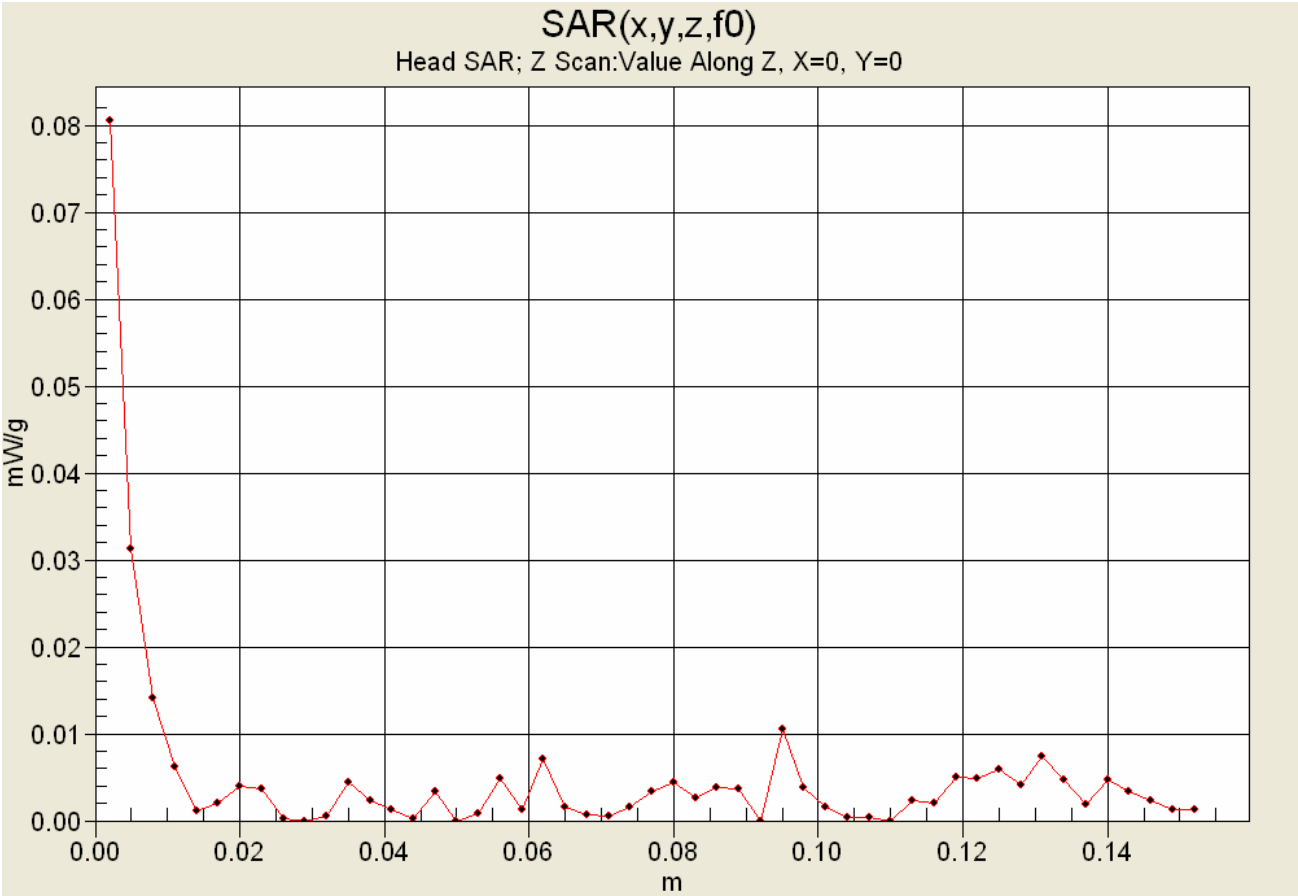
Z-Axis Scan



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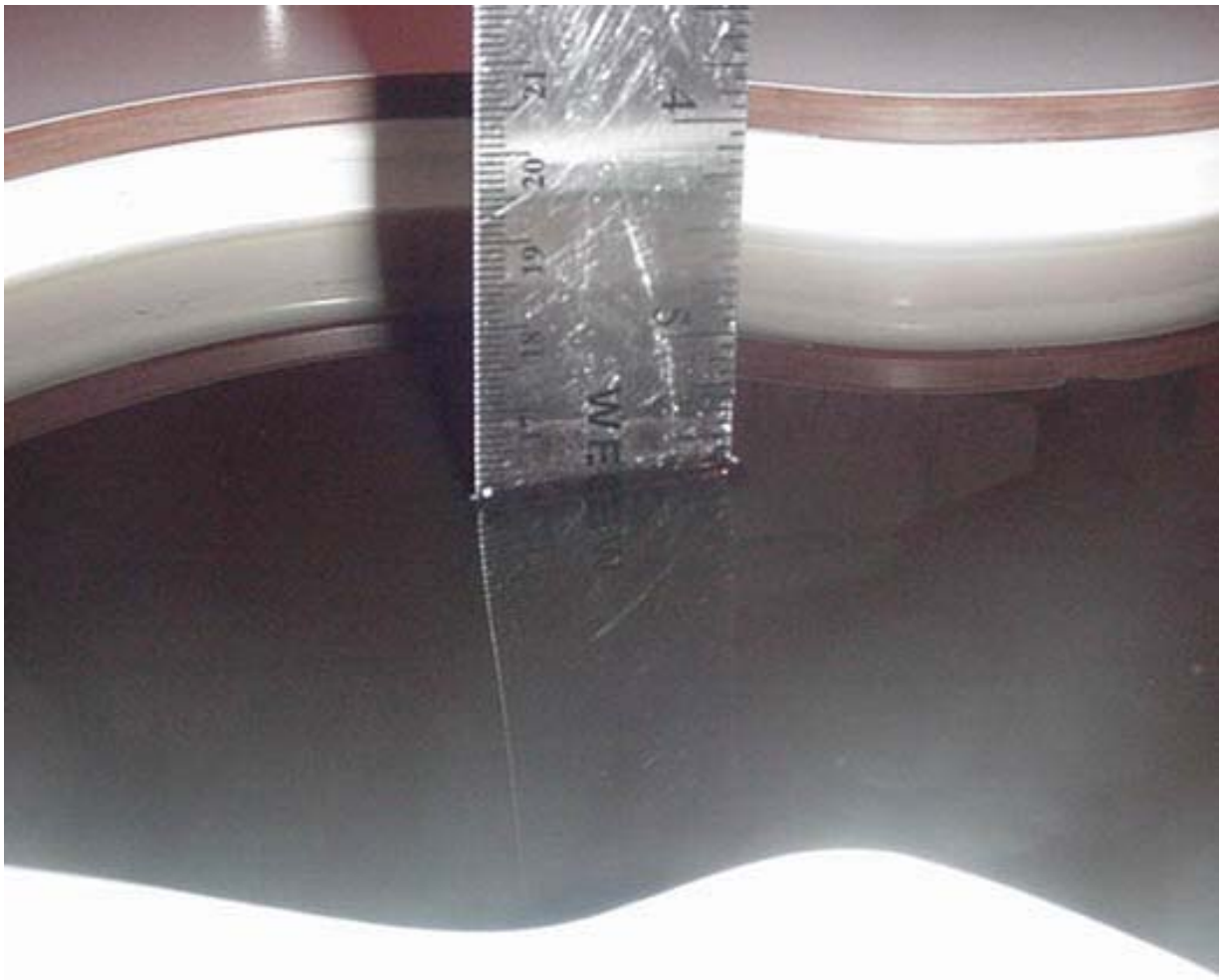
Fluid Depth (≥15cm)



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Date Tested: 12/13/2005

Body-Worn SAR - Back Side of DUT

DUT: Atlinks Model: 28031XXX-A; Type: Portable 5.8GHz FHSS Cordless Telephone Handset; Serial: 50001601544HY

Body-Worn Accessory: Plastic Belt-Clip; Audio Accessory: Generic Ear-Microphone

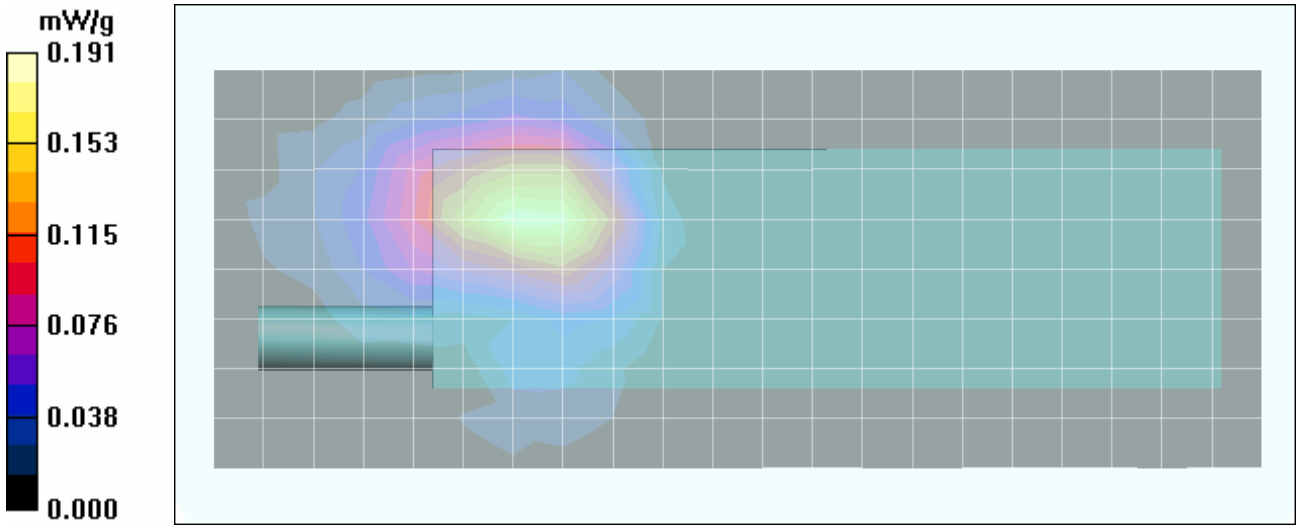
Ambient Temp: 24.2 °C; Fluid Temp: 22.5 °C; Barometric Pressure: 102.9 kPa; Humidity: 30%

Communication System: Modulated Fixed Frequency
3.6V, 800mAh NiMH Battery Pack
RF Output Power: 17.62 mW (Free-Space)
Frequency: 5848.889 MHz; Channel 139; Duty Cycle: 1:9.52
Medium: M5200-5800 (σ = 5.94 mho/m; ε_r = 47.0; ρ = 1000 kg/m^3)

- Probe: EX3DV4 - SN3547; ConvF(4.59, 4.59, 4.59); Calibrated: 21/01/2005
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

Body-Worn SAR - 0.7 cm Belt-Clip Separation Distance to planar phantom - High Channel/Area Scan (9x22x1):
Measurement grid: dx=10mm, dy=10mm

Body-Worn SAR - 0.7 cm Belt-Clip Separation Distance to planar phantom - High Channel/Zoom Scan (8x8x8)/Cube 0:
Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 6.00 V/m; Power Drift = -0.213 dB
Peak SAR (extrapolated) = 0.295 W/kg
SAR(1 g) = 0.0939 mW/g; SAR(10 g) = 0.036 mW/g



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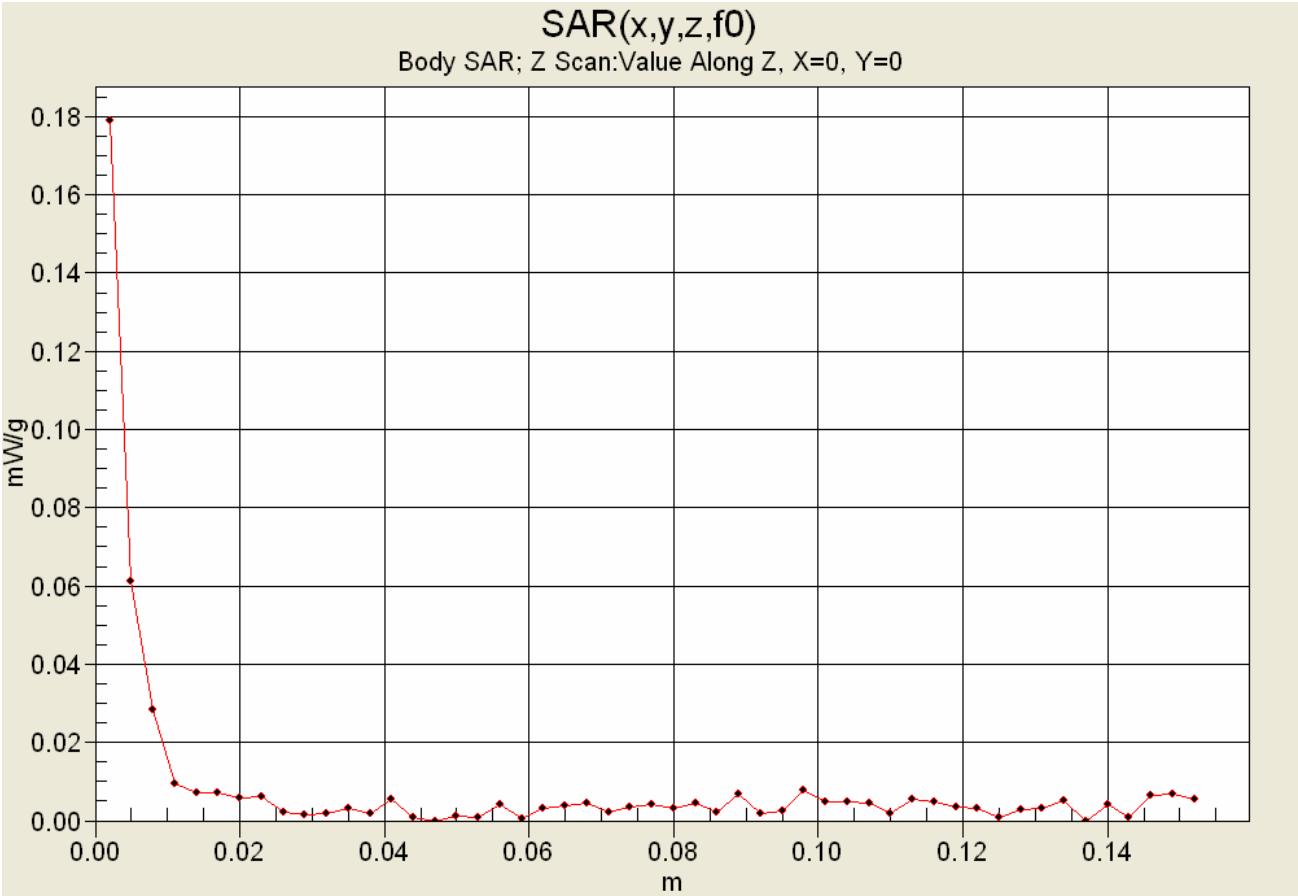
Z-Axis Scan



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Fluid Depth (≥15cm)

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APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

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Date Tested: 12/13/2005

System Performance Check (Brain) - 5800 MHz Dipole

DUT: Dipole 5GHz; Model: D5GHzV2; Type: System Performance Check; Serial: 1031; Calibrated: 01/11/2005

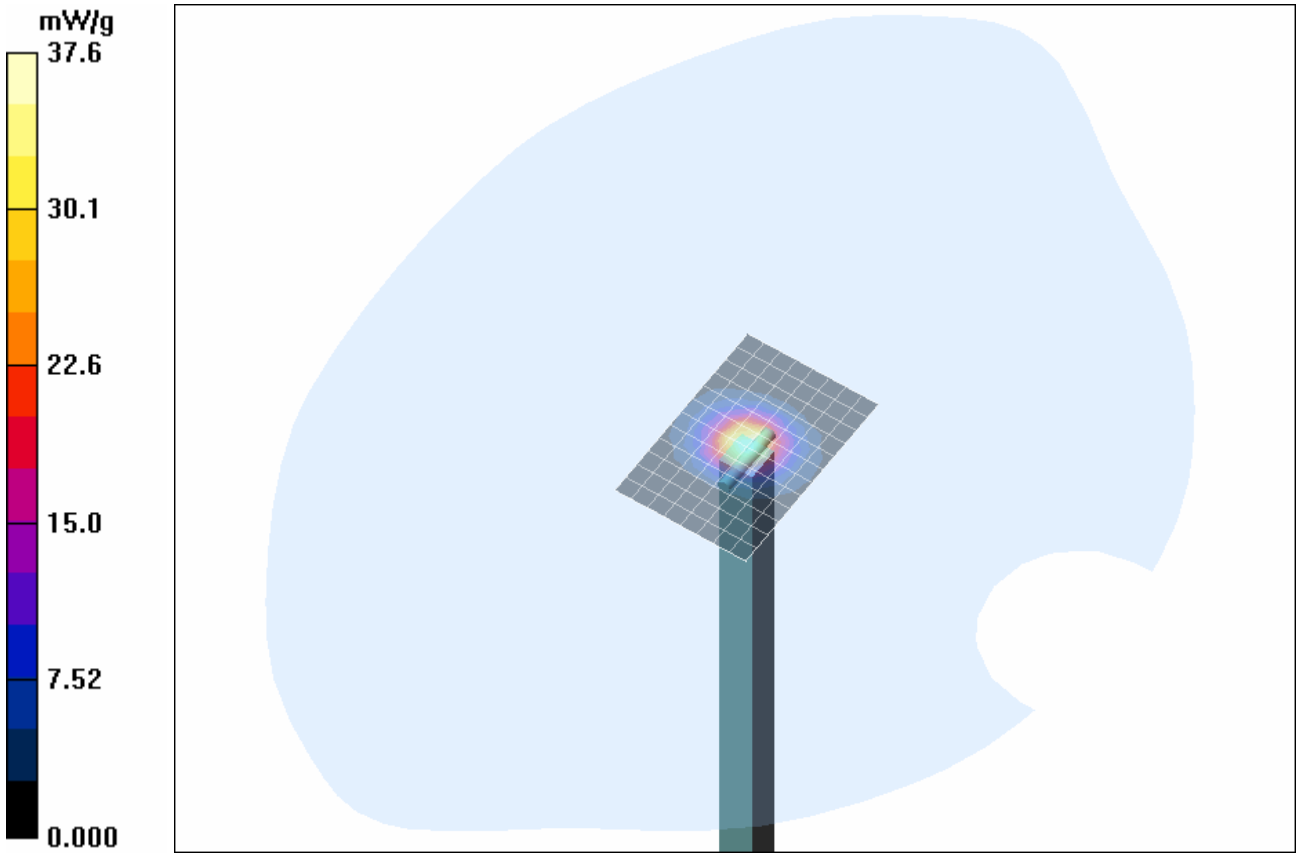
Ambient Temp: 23.9 °C; Fluid Temp: 22.3 °C; Barometric Pressure: 102.8 kPa; Humidity: 30%

Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 5800 MHz; Duty Cycle: 1:1
Medium: HSL5200-5800 (σ = 5.1 mho/m; ε_r = 34.7; ρ = 1000 kg/m^3)

- Probe: EX3DV4 - SN3547; ConvF(4.71, 4.71, 4.71); Calibrated: 21/01/2005
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

5800 MHz Dipole - System Performance Check/Area Scan (9x13x1):
Measurement grid: dx=5mm, dy=5mm

5800 MHz Dipole - System Performance Check/Zoom Scan 2 (8x8x8)/Cube 0:
Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 97.7 V/m; Power Drift = 0.050 dB
Peak SAR (extrapolated) = 80.7 W/kg
SAR(1 g) = 19.3 mW/g; SAR(10 g) = 5.43 mW/g



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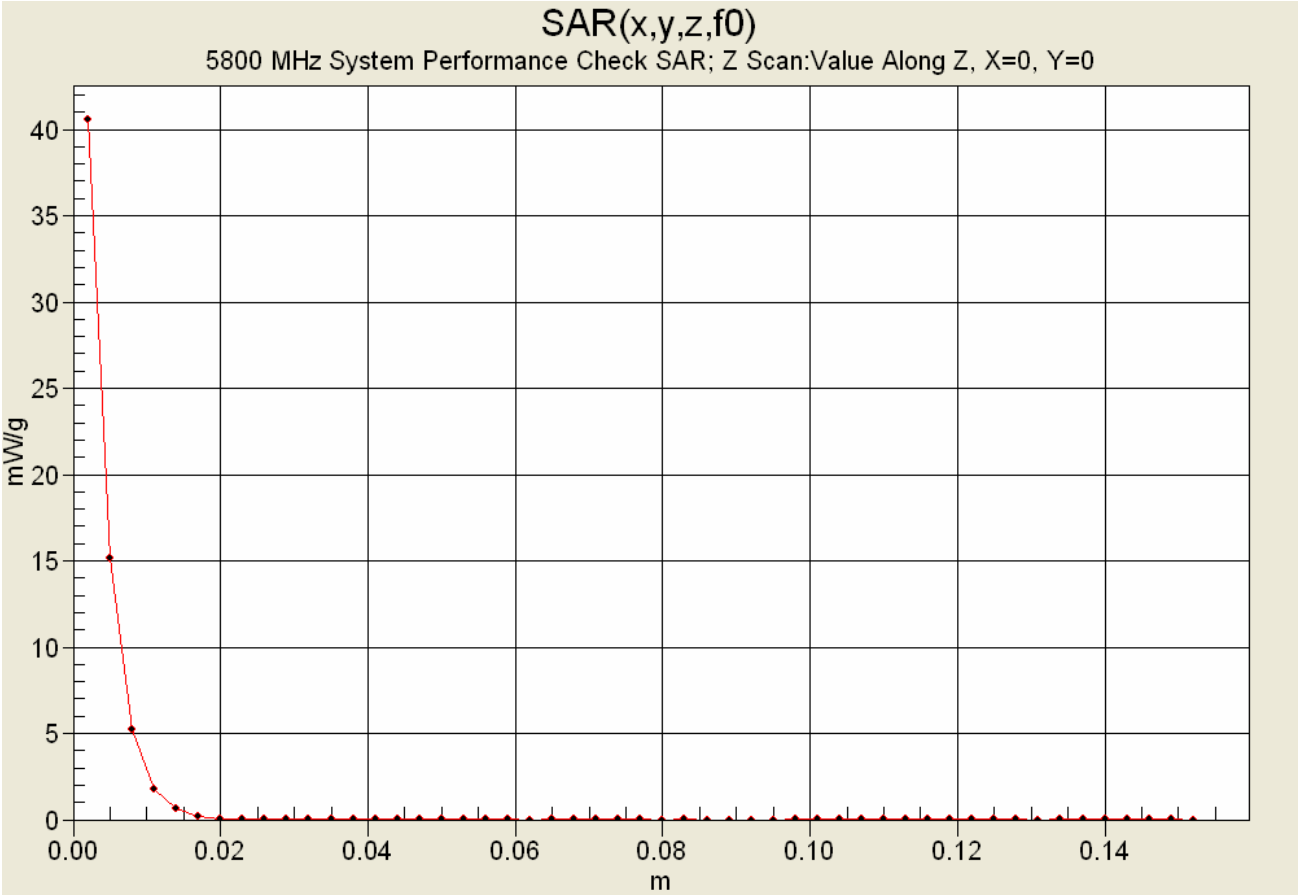
Z-Axis Scan



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APPENDIX C - MEASURED FLUID DIELECTRIC PARAMETERS

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5800 MHz System Performance Check & DUT Evaluation (Head)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
Tue 13/Dec/2005
Frequency(GHz)
FCC_eH FCC OET 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC OET 65 Supplement C (June 2001) Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
5.7000	35.41	5.17	34.83	5.05
5.7100	35.40	5.18	34.88	4.98
5.7200	35.39	5.19	35.02	5.06
5.7300	35.38	5.20	34.75	5.05
5.7400	35.37	5.21	34.73	5.04
5.7500	35.36	5.22	34.72	5.02
5.7600	35.35	5.23	34.77	5.09
5.7700	35.33	5.24	34.80	5.00
5.7800	35.32	5.25	34.91	5.03
5.7900	35.31	5.26	34.52	5.04
5.8000	35.30	5.27	34.73	5.10
5.8100	35.29	5.28	34.64	5.14
5.8200	35.28	5.29	34.57	5.12
5.8300	35.27	5.30	34.67	5.16
5.8400	35.25	5.31	34.60	5.15
5.8500	35.24	5.32	34.67	5.07
5.8600	35.23	5.33	34.57	5.13
5.8700	35.22	5.34	34.53	5.17
5.8800	35.21	5.35	34.30	5.18
5.8900	35.20	5.36	34.58	5.14
5.9000	35.19	5.37	33.54	4.59

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5800 MHz DUT Evaluation (Body)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
Tue 13/Dec/2005
Frequency(GHz)
FCC_eH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma
FCC_eB FCC Limits for Body Epsilon
FCC_sB FCC Limits for Body Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eB	FCC_sB	Test_e	Test_s
5.7000	48.34	5.88	47.22	5.90
5.7100	48.32	5.89	47.20	5.78
5.7200	48.31	5.91	47.03	5.92
5.7300	48.30	5.92	47.06	5.89
5.7400	48.28	5.93	46.77	5.88
5.7500	48.27	5.94	46.83	5.90
5.7600	48.25	5.95	46.81	5.91
5.7700	48.24	5.96	46.72	5.84
5.7800	48.23	5.98	46.97	5.80
5.7900	48.21	5.99	46.78	5.95
5.8000	48.20	6.00	46.99	5.94
5.8100	48.19	6.01	46.85	6.03
5.8200	48.17	6.02	46.65	6.00
5.8300	48.16	6.04	46.87	6.05
5.8400	48.15	6.05	46.75	6.03
5.8500	48.13	6.06	46.83	6.03
5.8600	48.12	6.07	46.81	6.09
5.8700	48.10	6.08	46.58	6.06
5.8800	48.09	6.09	46.37	6.05
5.8900	48.08	6.11	46.67	6.11
5.9000	48.06	6.12	45.26	5.29

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APPENDIX D - MANUFACTURER'S TISSUE SIMULANT DATA SHEET

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Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Material Safety Data Sheet

1 Identification of the substance and of the manufacturer / origin

Item	Head Tissue Simulation Liquid HSL5800 Muscle Tissue Simulation Liquid MSL 5800
Type No	SL AAH 580, SL AAM 580
Series No	N/A
Manufacturer / Origin	Schmid & Partner Engineering AG Zeughausstrasse 43 8004 Zürich Switzerland Phone +41 1 245 9700, Fax +41 1 245 9779, support@speag.com

Use of the substance:
Liquid simulating physical parameters of Head or Muscle Tissue in the RF range to 6GHz.

2 Composition / Information on ingredients

The Item is composed of the following ingredients:

Water	64 - 78%
Mineral Oil	11 - 18%
Emulsifiers	9 - 15%
Additives and Salt	2 - 3%

Safety relevant ingredients according to EU directives:

CAS-No 107-41-5	< 4%	2-Methyl-2,4-pentandiol (Hexylene Glycol): Xi irritant, R36/38 irritant for eyes and skin
CAS-No 770-35-4	< 2%	1-Phenoxy-2-propanol (Propylene Glycol Phenyl Ether): Xi irritant, R36 irritant for eyes
CAS-No 93-83-4	< 2%	N,N-bis(2-Hydroxyethyl)oleamide: Xi irritant, R36/38 irritant for eyes and skin
CAS-No 9004-95-9	< 0.5%	Polyethylene glycol cetyl ether: Xi irritant, R22 harmful if swallowed, R36/38 irritant for eyes and skin R50 Very toxic to aquatic organisms

According to EU guidelines and Swiss rules, the product is not a dangerous mixture and therefore not required to be marked by symbols.

3 Hazards identification

Identification not required.

4 First aid measures

The product reacts slightly alkaline.

After skin contact:	Wash with fresh water and mild sope
After eye contact:	Rinse out with plenty of water for several minutes with the eyelid held open. Consult an ophthalmologist if necessary.
After ingestion:	Do not induce vomiting. Get medical attention.

5 Fire-fighting measures

Firefighting media	CO_2, foam, dry chemical
Combustion products	Carbon oxides, nitrogen and traces of oxides of chlorine and sulfur, HCl

Due to the high water content, the liquid is self-extinguishing.

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6 Accidental release measures

Person-related precaution measures: wash with water and mild soap.
Environmental-protection measures: do not allow to enter sewerage system.
Procedures for cleaning / absorption: Use oil-binding agents., forward for disposal. Spills may cause slippery conditions.

7 Handling and storage

Handling: Keep in open container only for minimum required time in order to avoid water evaporation.
Storage: tightly closed, between >0 to 40°C. Avoid direct solar irradiation of the storage containers.

8 Exposure controls / personal protection

Protection measures are not generally required. For eye protection, industrial safety glasses are recommended.
Personal hygiene and clean working practices are sufficient.

9 Physical and chemical properties

Form:	liquid
Colour:	medium to dark brown, transparent to opaque
Odour:	almost odourless / slightly oily
pH-Value:	slightly alcalic
Boiling point:	100°C
Density:	1g/cm^3

10 Stability and reactivity

Conditions to be avoided: heating above 40°C
The product contains water and is not compatible with strong oxidizers or magnesium.

11 Toxicological information

LD50 > 40 g/kg
Further data: the product should be handled with the care usual when dealing with chemicals

12 Ecological information

Contains mineral oil. Do not allow to enter waters, waste water, or soil!

13 Disposal considerations

Disposal is possible by splitting the mineral oil from the emulsion with absorbing agents, with salt or ultra-filtration. Dispose as other mineral oil containing products according to local regulations.
Product packing must be disposed of in compliance with respect national regulations.

14 Transport information

Not subject to transport regulations.

15 Regulatory information

No special labelling required.

16 Other information

Release date:	6.1.2005
Responsible:	FB

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APPENDIX E - SAR TEST SETUP PHOTOGRAPHS

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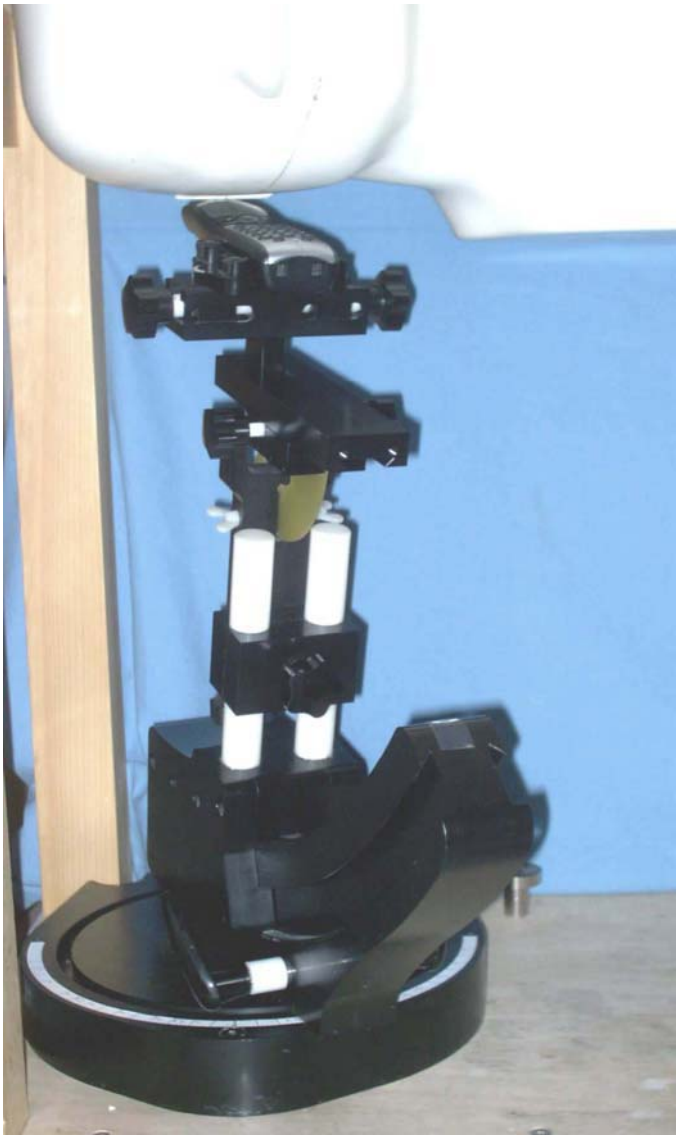
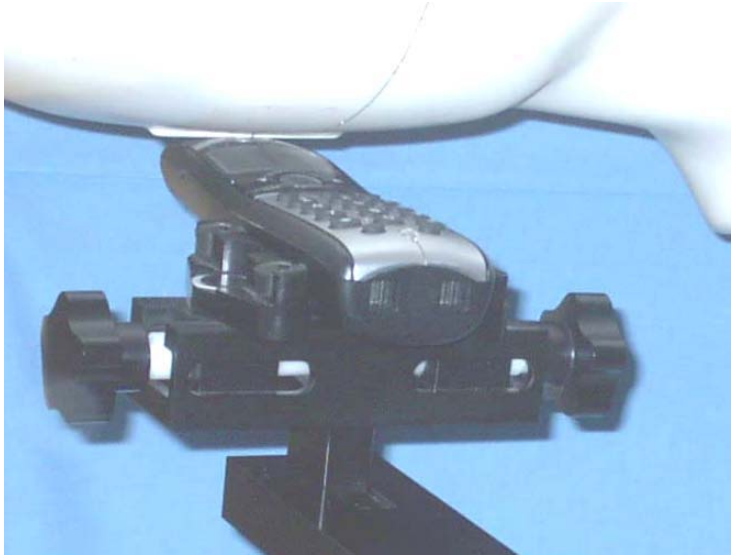
HEAD SAR TEST SETUP PHOTOGRAPHS

Right Head Section / Ear-Tilt Position (15°)





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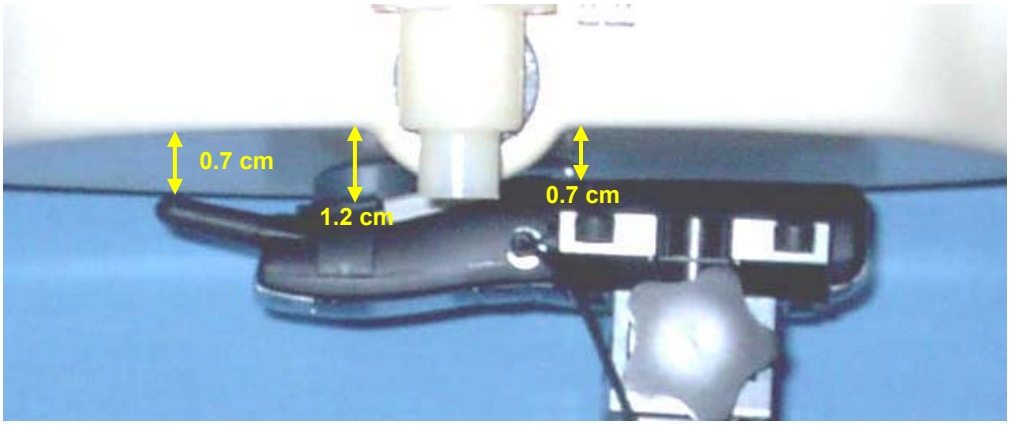
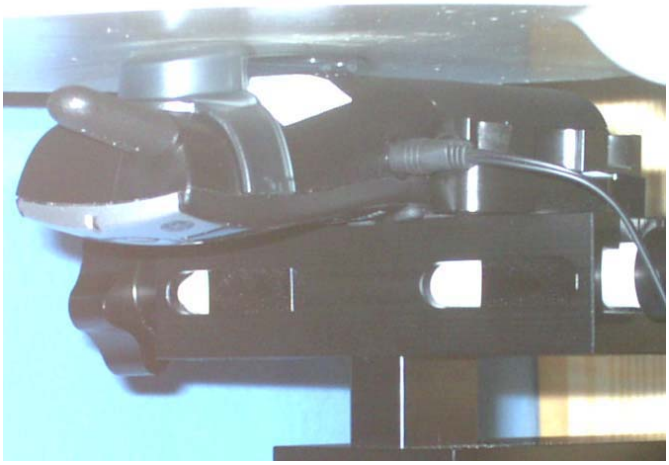
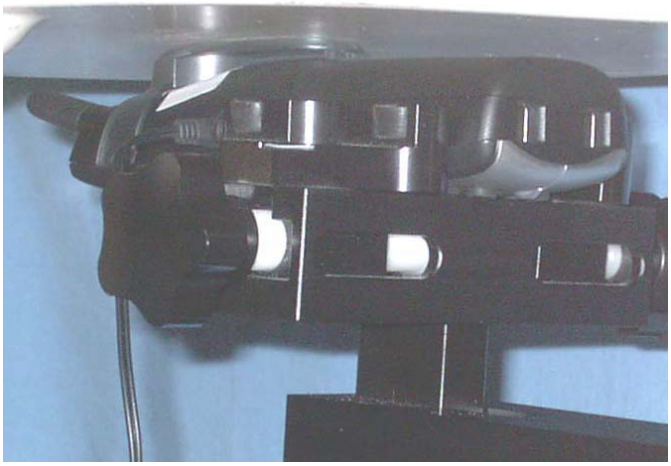
BODY-WORN SAR TEST SETUP PHOTOGRAPHS

0.7 cm Belt-Clip Spacing from Back of DUT to Planar Phantom with Plastic Belt-Clip and Generic Ear-Microphone Accessories







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DUT PHOTOGRAPHS

Front of DUT

Back of DUT

Back of DUT with Belt-Clip

Top end of DUT

Bottom end of DUT

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DUT PHOTOGRAPHS

Left Side of DUT with plastic belt-clip

Right Side of DUT with plastic belt-clip

Plastic Belt-Clip Accessory

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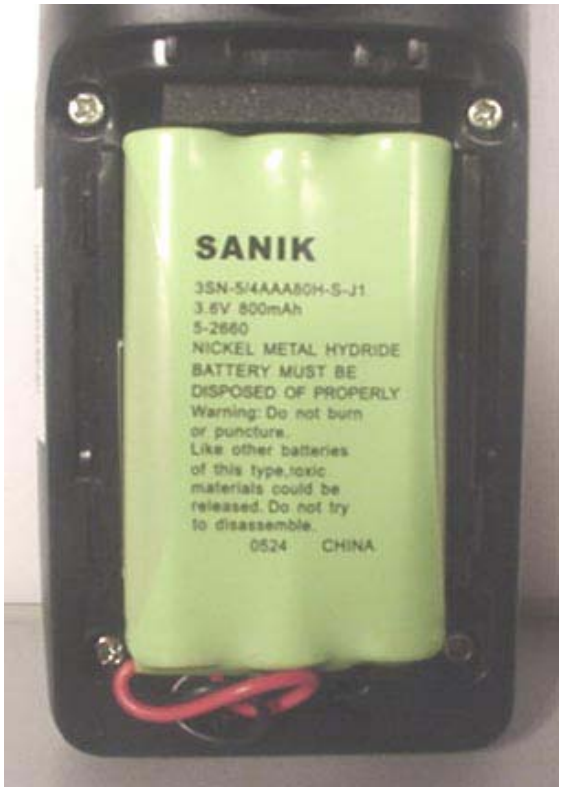
DUT PHOTOGRAPHS

DUT Battery Compartment



DUT with NiMH Battery 3.6 V, 800 mAh

NiMH Battery 3.6 V, 800 mAh

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DUT PHOTOGRAPHS

DUT with Generic Ear-Microphone Accessory

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APPENDIX F - SYSTEM VALIDATION

2005 Celltech Labs Inc. This document is not to be reproduced in whole or in part without the prior written permission of Celltech Labs Inc.

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

Client **Celltech**

CALIBRATION CERTIFICATE

Object(s)	D5GHzV2 - SN:1031
Calibration procedure(s)	QA CAL-05.v2 Calibration procedure for dipole validation kits
Calibration date:	January 11, 2005
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

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)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM E4419B	GB41293874	5-May-04 (METAS, No 251-00388)	May-05
Power sensor E4412A	MY41495277	5-May-04 (METAS, No 251-00388)	May-05
Reference 20 dB Attenuator	SN: 5086 (20b)	3-May-04 (METAS, No 251-00389)	May-05
Power sensor HP 8481A	MY41092180	18-Sep-02 (SPEAG, in house check Oct-03)	In house check: Oct 05
RF generator R&S SMT06	100058	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-04)	In house check: Nov 05

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Laboratory Director	
Approved by:	Fin Bomholt	R&D Director	

Issued: January 14, 2005

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

DASY

Dipole Validation Kit

Type: D5GHzV2

Serial: 1031

Manufactured: July 9, 2004
Calibrated: January 11, 2005

1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with **head simulating solution** of the following electrical parameters:

Frequency:	**5200 MHz**	
Relative Dielectricity	**36.5**	± 5%
Conductivity	**4.64 mho/m**	± 5%
Frequency:	**5500 MHz**	
Relative Dielectricity	**35.9**	± 5%
Conductivity	**4.97 mho/m**	± 5%
Frequency:	**5800 MHz**	
Relative Dielectricity	**35.4**	± 5%
Conductivity	**5.28 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe EX3DV3 - SN:3503 was used for the measurements. The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. Lossless spacer was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 10mm was aligned with the dipole. Special 8x8x8 fine cube was chosen for cube integration (dx=dy=4.3mm, dz=3mm). Distance between probe sensors and phantom surface was set to 2.0 mm. The dipole input power (forward power) was 250 mW ± 3 %. The results are normalized to 1W input power.

2. SAR Measurement with DASY System

Standard SAR-measurements were performed according to the measurement conditions described in section 1. The results (see figures supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured at **5200 MHz (Head Tissue)** with the dosimetric probe EX3DV3 SN:3503 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**81.2 mW/g** ± 20.3 % (k=2)[1]
averaged over 10 cm^3 (10 g) of tissue:	**22.8 mW/g** ± 19.8 % (k=2)[1]

[1] Target dipole values determined by FDTD (feedpoint impedance set to 50 Ohm). The values are SAR_1g=76.5 mW/g, SAR_10g=21.6 mW/g and SAR_peak=310.3 mW/g.

The resulting averaged SAR-values measured **at 5500 MHz (Head Tissue)** with the dosimetric probe EX3DV3 SN:3503 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**84.8 mW/g** ± 20.3 % (k=2)[2]
averaged over 10 cm^3 (10 g) of tissue:	**23.6 mW/g** ± 19.8 % (k=2)[2]

The resulting averaged SAR-values measured **at 5800 MHz (Head Tissue)** with the dosimetric probe EX3DV3 SN:3503 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**79.2 mW/g** ± 20.3 % (k=2)[3]
averaged over 10 cm^3 (10 g) of tissue:	**22.3 mW/g** ± 19.8 % (k=2)[3]

3. Dipole Transformation Parameters

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint (please refer to the graphics attached to this document). The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.196 ns**	(one direction)
Transmission factor:	**0.955**	(voltage transmission, one direction)

4. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with **body simulating solution** of the following electrical parameters:

Frequency:	**5200 MHz**	
Relative Dielectricity	**48.6**	± 5%
Conductivity	**5.17 mho/m**	± 5%

Frequency:	**5500 MHz**	
Relative Dielectricity	**48.0**	± 5%
Conductivity	**5.55 mho/m**	± 5%

Frequency:	**5800 MHz**	
Relative Dielectricity	**47.4**	± 5%
Conductivity	**5.95 mho/m**	± 5%

[2] Target dipole values determined by FDTD (feedpoint impedance set to 50 Ohm). The values are SAR_1g=83.3 mW/g, SAR_10g=23.4 mW/g and SAR_peak=349.4 mW/g.
[3] Target dipole values determined by FDTD (feedpoint impedance set to 50 Ohm). The values are SAR_1g=78.0 mW/g, SAR_10g=21.9 mW/g and SAR_peak=340.9 mW/g.

The DASY4 System with a dosimetric E-field probe EX3DV3 - SN:3503 was used for the measurements. The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. Lossless spacer was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 10mm was aligned with the dipole. The 8x8x8 fine cube was chosen for cube integration (dx=dy=4.3mm, dz=3mm). Distance between probe sensors and phantom surface was set to 2.0 mm. The dipole input power (forward power) was 250 mW ± 3 %. The results are normalized to 1W input power.

5. SAR Measurement with DASY System

Standard SAR-measurements were performed according to the measurement conditions described in section 4. The results (see figures supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured at **5200 MHz (Body Tissue)** with the dosimetric probe EX3DV3 SN:3503 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**80.0 mW/g** ± 20.3 % (k=2)[4]
averaged over 10 cm^3 (10 g) of tissue:	**22.4 mW/g** ± 19.8 % (k=2)[4]

The resulting averaged SAR-values measured **at 5500 MHz (Body Tissue)** with the dosimetric probe EX3DV3 SN:3503 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**78.8 mW/g** ± 20.3 % (k=2)[5]
averaged over 10 cm^3 (10 g) of tissue:	**21.8 mW/g** ± 19.8 % (k=2)[5]

The resulting averaged SAR-values measured **at 5800 MHz (Body Tissue)** with the dosimetric probe EX3DV3 SN:3503 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**73.6 mW/g** ± 20.3 % (k=2)[6]
averaged over 10 cm^3 (10 g) of tissue:	**20.5 mW/g** ± 19.8 % (k=2)[6]

[4] Target dipole values determined by FDTD (feedpoint impedance set to 50 Ohm). The values are SAR_1g=71.8 mW/g, SAR_10g=20.1 mW/g and SAR_peak=284.7 mW/g.
[5] Target dipole values determined by FDTD (feedpoint impedance set to 50 Ohm). The values are SAR_1g=79.1 mW/g, SAR_10g=22.0 mW/g and SAR_peak=326.3 mW/g.
[6] Target dipole values determined by FDTD (feedpoint impedance set to 50 Ohm). The values are SAR_1g=74.1 mW/g, SAR_10g=20.5 mW/g and SAR_peak=324.7 mW/g.

6. Handling

Do not apply excessive force to the dipole arms, because they might bend. Bending of the dipole arms stresses the soldered connections near the feedpoint leading to a damage of the dipole.

7. Design

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

Small end caps have been added to the dipole arms in order to increase frequency bandwidth at the position as explained in Sections 1 and 4.

8. Power Test

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Date/Time: 01/11/05 11:57:53

SPEAG Calibration Laboratory

DUT: Dipole 5GHz; Serial: D5GHzV2 - SN:1031

DASY4 Configuration:

- Communication System: CW-5GHz; Frequency: 5200 MHzFrequency: 5800 MHzFrequency: 5500 MHz; Duty Cycle: 1:1
- Probe: EX3DV3 - SN3503; ConvF(5.7, 5.7, 5.7)ConvF(5, 5, 5); Calibrated: 1/8/2005
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Medium: HSL5800; Medium parameters used: f = 5200 MHz; σ = 4.64 mho/m; ε_r = 36.5; ρ = 1000 kg/m^3 Medium parameters used: f = 5800 MHz; σ = 5.28 mho/m; ε_r = 35.4; ρ = 1000 kg/m^3 Medium parameters used: f = 5500 MHz; σ = 4.97 mho/m; ε_r = 35.9; ρ = 1000 kg/m^3

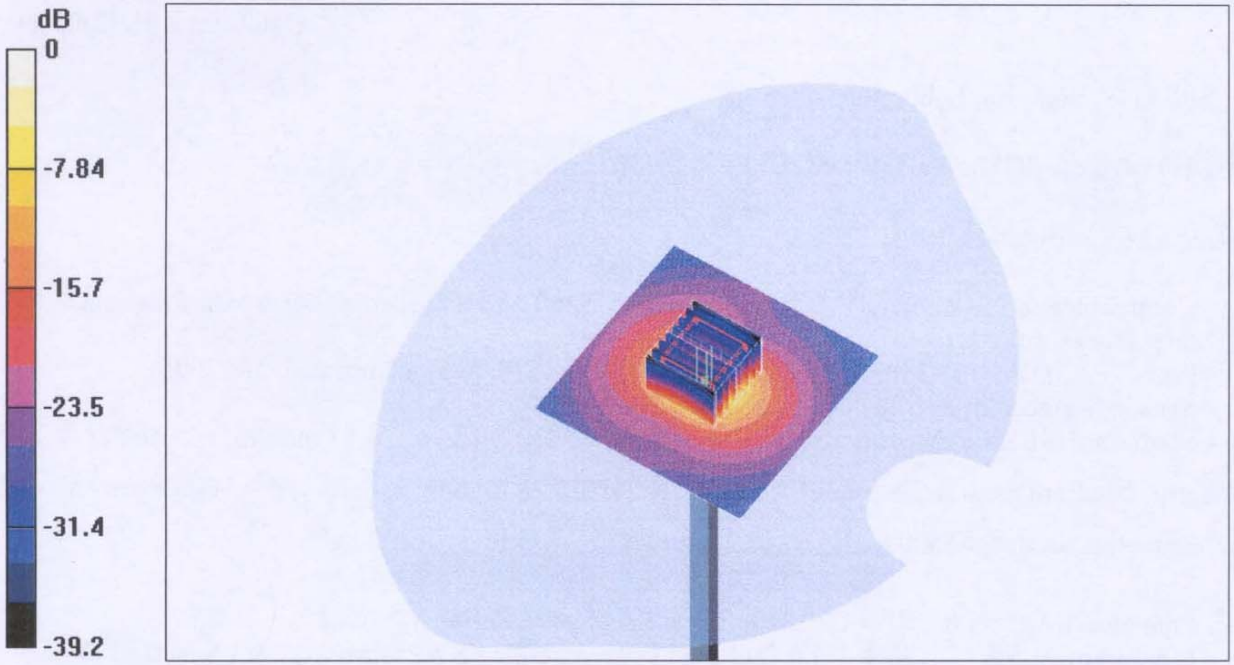
- Phantom: SAM with CRP - TP:1312; Type: SAM v4.0; Serial: TP:1312
- Measurement SW: DASY4, V4.4 Build 10; Postprocessing SW: SEMCAD, V1.8 Build 133

d=10mm, Pin=250mW, f=5200 MHz 2/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 43.3 mW/g

d=10mm, Pin=250mW, f=5800 MHz/Zoom Scan (8x8x8), dist=2mm (8x8x8)/Cube 0:
Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 78.3 V/m; Power Drift = 0.0 dB
Peak SAR (extrapolated) = 85.1 W/kg
SAR(1 g) = 19.8 mW/g; SAR(10 g) = 5.57 mW/g
Maximum value of SAR (measured) = 39.8 mW/g

d=10mm, Pin=250mW, f=5500 MHz/Zoom Scan (8x8x8), dist=2mm (8x8x8)/Cube 0:
Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 84.1 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 86.2 W/kg
SAR(1 g) = 21.2 mW/g; SAR(10 g) = 5.91 mW/g
Maximum value of SAR (measured) = 41 mW/g

d=10mm, Pin=250mW, f=5200 MHz 2/Zoom Scan (8x8x8), dist=2mm (8x8x8)/Cube 0:
Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 85.4 V/m; Power Drift = 0.0 dB
Peak SAR (extrapolated) = 79.4 W/kg
SAR(1 g) = 20.3 mW/g; SAR(10 g) = 5.7 mW/g
Maximum value of SAR (measured) = 39.4 mW/g



0 dB = 39.4mW/g

Date/Time: 01/11/05 18:28:50

SPEAG Calibration Laboratory

DUT: Dipole 5GHz; Serial: D5GHzV2 - SN:1031

DASY4 Configuration:

- Communication System: CW-5GHz; Frequency: 5200 MHzFrequency: 5800 MHzFrequency: 5500 MHz; Duty Cycle: 1:1
- Probe: EX3DV3 - SN3503; ConvF(5, 5, 5)ConvF(4.6, 4.6, 4.6); Calibrated: 1/8/2005
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Medium: MSL5800; Medium parameters used: f = 5200 MHz; σ = 5.17 mho/m; ε_r = 48.6; ρ = 1000 kg/m^3 Medium parameters used: f = 5800 MHz; σ = 5.95 mho/m; ε_r = 47.4; ρ = 1000 kg/m^3 Medium parameters used: f = 5500 MHz; σ = 5.55 mho/m; ε_r = 48; ρ = 1000 kg/m^3

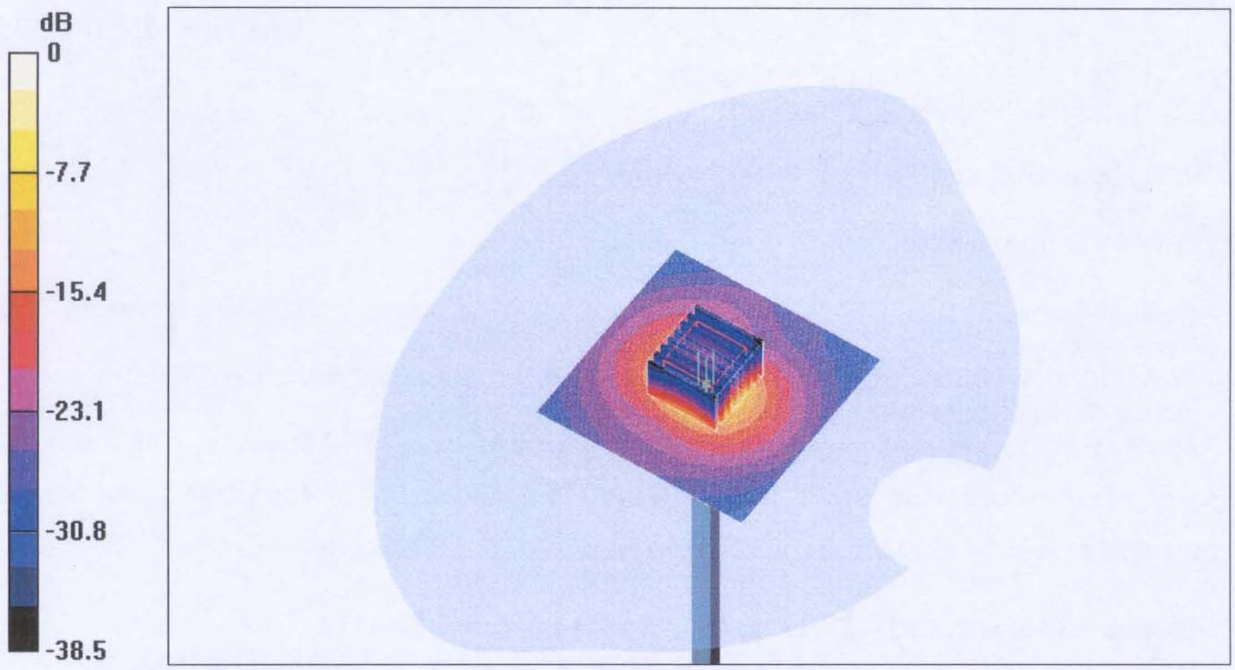
- Phantom: SAM with CRP - TP:1312; Type: SAM v4.0; Serial: TP:1312
- Measurement SW: DASY4, V4.4 Build 10; Postprocessing SW: SEMCAD, V1.8 Build 133

d=10mm, Pin=250mW, f=5200 MHz 2/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 41 mW/g

d=10mm, Pin=250mW, f=5800 MHz/Zoom Scan (8x8x8), dist=2mm (8x8x8)/Cube 0:
Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 71.2 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 77 W/kg
SAR(1 g) = 18.4 mW/g; SAR(10 g) = 5.13 mW/g
Maximum value of SAR (measured) = 35.6 mW/g

d=10mm, Pin=250mW, f=5500 MHz/Zoom Scan (8x8x8), dist=2mm (8x8x8)/Cube 0:
Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 76 V/m; Power Drift = 0.1 dB
Peak SAR (extrapolated) = 77.9 W/kg
SAR(1 g) = 19.7 mW/g; SAR(10 g) = 5.44 mW/g
Maximum value of SAR (measured) = 37.9 mW/g

d=10mm, Pin=250mW, f=5200 MHz 2/Zoom Scan (8x8x8), dist=2mm (8x8x8)/Cube 0:
Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 79.9 V/m; Power Drift = 0.1 dB
Peak SAR (extrapolated) = 73.5 W/kg
SAR(1 g) = 20 mW/g; SAR(10 g) = 5.6 mW/g
Maximum value of SAR (measured) = 38.4 mW/g



0 dB = 38.4mW/g

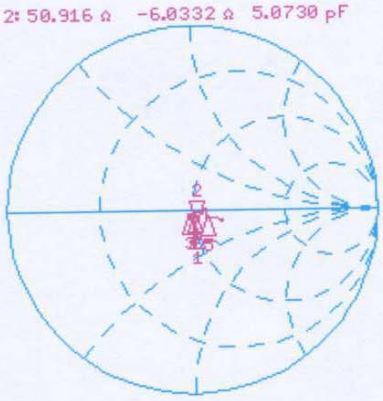
1031
Head

12 Jul 2004 10:53:35

CH1 S11 1 U FS 2: 50.916 Ω -6.0332 Ω 5.0730 pF 5 200.000 000 MHz

Del
Smo
Cor

Avg
16



CH1 Markers

1: 49.930 Ω
-11.264 Ω
5.10000 GHz

3: 47.152 Ω
-3.0586 Ω
5.30000 GHz

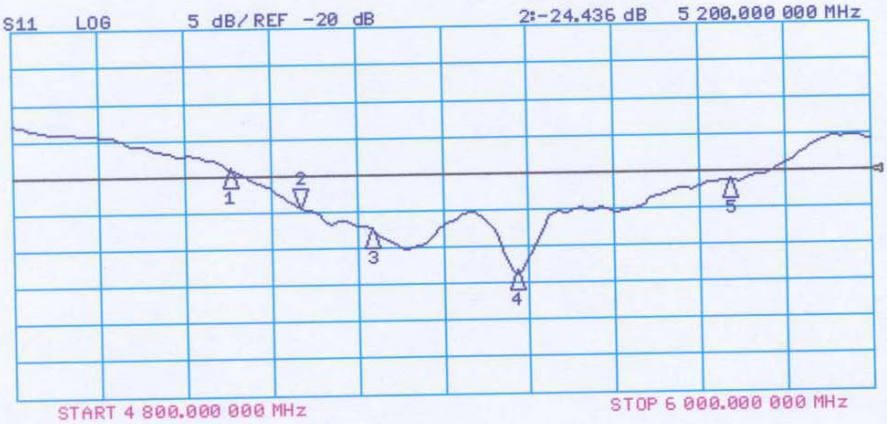
4: 50.043 Ω
-2.0957 Ω
5.50000 GHz

5: 57.963 Ω
-4.8223 Ω
5.80000 GHz

CH2 S11 LOG 5 dB/ REF -20 dB 2:-24.436 dB 5 200.000 000 MHz

Smo
Cor

Avg
16



CH2 Markers

1:-19.046 dB
5.10000 GHz

3:-27.480 dB
5.30000 GHz

4:-33.587 dB
5.50000 GHz

5:-21.271 dB
5.80000 GHz

START 4 800.000 000 MHz STOP 6 000.000 000 MHz

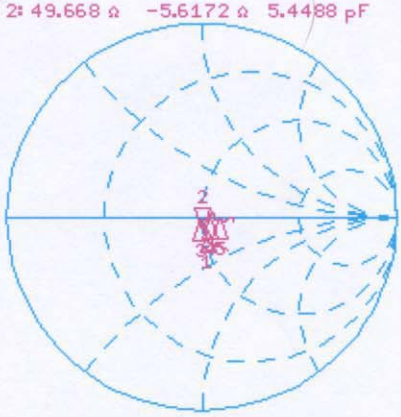
1031
Body

21 Oct 2004 15:50:50

CH1 S11 1 U FS 2: 49.668 Ω -5.6172 Ω 5.4488 pF 5 200.000 000 MHz

Del
Smo
Cor

Avg
16



CH1 Markers

1: 51.498 Ω
-8.3184 Ω
5.10000 GHz

3: 48.629 Ω
-1.7617 Ω
5.30000 GHz

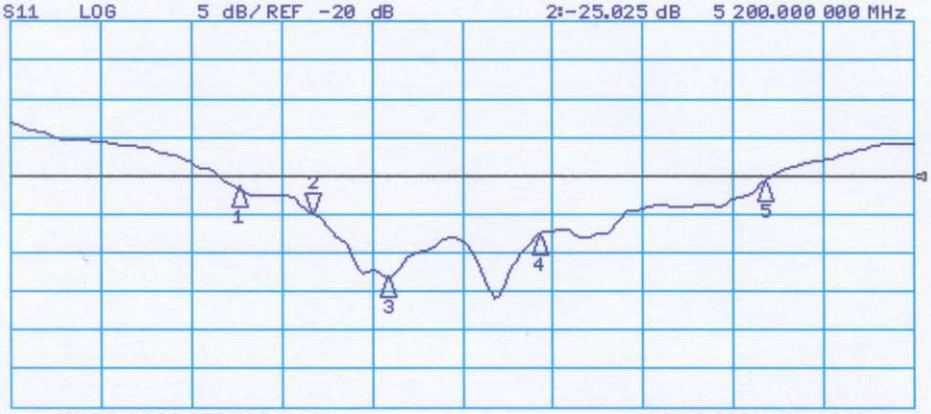
4: 53.945 Ω
-1.4863 Ω
5.50000 GHz

5: 59.777 Ω
-2.0469 Ω
5.80000 GHz

CH2 S11 LOG 5 dB/ REF -20 dB 2:-25.025 dB 5 200.000 000 MHz

Smo
Cor

Avg
16



CH2 Markers

1:-21.639 dB
5.10000 GHz

3:-33.132 dB
5.30000 GHz

4:-27.753 dB
5.50000 GHz

5:-20.781 dB
5.80000 GHz

START 4 800.000 000 MHz STOP 6 000.000 000 MHz

APPENDIX H - SAM PHANTOM CERTIFICATE OF CONFORMITY

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Certificate of conformity / First Article Inspection

Item	SAM Twin Phantom V4.0
Type No	QD 000 P40 BA
Series No	TP-1002 and higher
Manufacturer / Origin	Untersee Composites Hauptstr. 69 CH-8559 Fruthwilen Switzerland

Tests

The series production process used allows the limitation to test of first articles.
Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been retested using further series units (called samples).

Test	Requirement	Details	Units tested
Shape	Compliance with the geometry according to the CAD model.	IT'IS CAD File (*)	First article, Samples
Material thickness	Compliant with the requirements according to the standards	2mm +/- 0.2mm in specific areas	First article, Samples
Material parameters	Dielectric parameters for required frequencies	200 MHz – 3 GHz Relative permittivity < 5 Loss tangent < 0.05.	Material sample TP 104-5
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards	Liquid type HSL 1800 and others according to the standard.	Pre-series, First article

Standards

[1] CENELEC EN 50361
[2] IEEE P1528-200x draft 6.5
[3] IEC PT 62209 draft 0.9
(*) The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of [1] and [3].

Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standard [1] and draft standards [2] and [3].

Date 18.11.2001

Signature / Stamp

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