SAR TEST REPORT

RF EXPOSURE EVALUATION	SPECIFIC ABSORPTION RATE

APPLICANT	OMNEX CONTROL SYSTEMS ULC			
DEVICE UNDER TEST (DUT)	2.4GHz SPREAD SPECTRUM DATA TRANSCEIVER MODULE INSTALLED IN PORTABLE RADIO REMOTE CONTROL CONSOLE			
MODEL(S)	HPD-24RC	2.4GHz Spread Spectrum Data Transceiver Module		
	T42	Portable Radio Remote Control Console		
IDENTIFIER(S)	FCC ID:	IA9HPD-24RC	IC:	1338B-HPD24RC
APPLICATION TYPE	Certification			
STANDARD(S) APPLIED	FCC 47 CFR §2.1093			
	Health Canada Safety Code 6			
PROCEDURE(S) APPLIED	FCC OET Bulletin 65, Supplement C (01-01)			
	Industry Canada RSS-102 Issue 2			
FCC DEVICE CLASSIFICATION	Part 15 Spread Spectrum Transmitter (DSS) - §15C			
IC DEVICE CLASSIFICATION	Low Power License-Exempt Radiocommunication Device (RSS-210)			
RF EXPOSURE CATEGORY	General Population / Uncontrolled			
RF EXPOSURE EVALUATION(S)	Body-worn			
DATE(S) OF EVALUATION(S)	December 19, 2007			
TEST REPORT SERIAL NO.	121807IA9-T880-S15I			
TEST REPORT REV. NO. & DATE	Revision 1.0	Initial Release	January 03, 2008	
TEST REPORT SIGNATORIES	Testing Performed By		Test Report Prepared By	
	Sean Johnston Celltech Labs Inc.		Jonathan Hughes Celltech Labs Inc.	
TEST LAB AND LOCATION	Celltech Compliance Testing and Engineering Lab			
	21-364 Lougheed Road, Kelowna, B.C. V1X 7R8 Canada			
TEST LAB CONTACT INFO.	Tel.: 250-765-7650		Fax: 250-765-7645	
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TEST LAB ACCREDITATION(S)	ilac-MRA A2LA ACCREDITED Certificate No. 2470.01			

DECLARATION OF COMPLIANCE
SAR RF EXPOSURE EVALUATION

Test Lab Information	**Name**	**CELLTECH LABS INC.**	
	Address	21-364 Lougheed Road, Kelowna, British Columbia V1X 7R8 Canada	
Applicant Information	**Name**	**OMNEX CONTROL SYSTEMS ULC**	
	Address	74-1833 Coast Meridian Road, Port Coquitlam, British Columbia V3C 6G5 Canada	
Standard(s) Applied	**FCC**	47 CFR §2.1093	
	IC	Health Canada Safety Code 6	
Procedure(s) Applied	**FCC**	OET Bulletin 65, Supplement C (Edition 01-01)	
	IC	RSS-102 Issue 2	
Device Classification(s)	**FCC**	Part 15 Spread Spectrum Transmitter (DSS)	
	IC	Low Power License-Exempt Radiocommunication Device (RSS-210)	
Device Description	**DUT**	2.4 GHz Spread Spectrum Data Transceiver Module installed in Portable Remote Control Console	
Device Identifier(s)	**FCC ID:**	IA9HPD-24RC	2.4 GHz Spread Spectrum Data Transceiver Module
	IC:	1338B-HPD24RC	2.4 GHz Spread Spectrum Data Transceiver Module
	Model(s)	HPD-24RC	2.4 GHz Spread Spectrum Data Transceiver Module
		T42	Portable Radio Remote Control Console
	Serial No.(s)	None (Pre-Production)	2.4 GHz Spread Spectrum Data Transceiver Module
		1104705	Portable Radio Remote Control Console
Mode(s) of Operation	Frequency Hopping Spread Spectrum (FHSS)		
Transmit Frequency Range(s)	2403.1 - 2478.6 MHz		
No. of Channels	756		
Max. Duty Cycle Tested	50% (Source-Based Time-Averaged)		

Max. RF Output Power Tested	**Peak Conducted Power**		**Channel**	**Frequency**
	0.066 Watts	18.20 dBm	Low	2403.1 MHz
	0.093 Watts	19.68 dBm	Middle	2441.7 MHz
	0.122 Watts	20.86 dBm	High	2478.6 MHz

Antenna Type(s) Tested	Internal			
Battery Type(s) Tested	Nickel-Cadmium	9.6V	1.3Ah	Model: Makita 9000
Body-worn Accessories Tested	None (touch position)			
Audio Accessories Tested	None (not applicable)			

Max. SAR Level(s) Evaluated	**Body-worn**	**0.072 W/kg**	**1g average**	**ANSI/IEEE SAR Limit**	**1.6 W/kg**	**1g average**

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 for the General Population / Uncontrolled Exposure environment. The device was tested in accordance with the measurement standards and procedures specified in FCC OET Bulletin 65, Supplement C (Edition 01-01) and Industry Canada RSS-102 Issue 2. 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.

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

This test report shall not be reproduced partially, or in full, without the prior written approval of Celltech Labs Inc.

Test Report Approved By		
	Sean Johnston	
	Sean Johnston	**Celltech Labs Inc.**

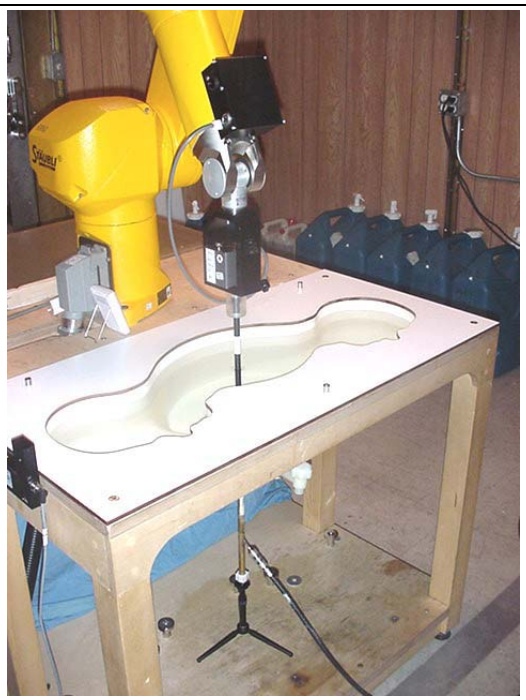
TABLE OF CONTENTS

1.0 INTRODUCTION

This measurement report demonstrates that the OMNEX Control Systems ULC Model: HPD-24RC 2.4GHz Spread Spectrum Transceiver Module installed in Model: T42 Portable Radio Remote Control Console 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]) and IC RSS-102 Issue 2 (see reference [4]) 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 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 various 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 System with SAM Twin Phantom V4.0C

DASY4 Measurement Server

3.0 MEASUREMENT SUMMARY

BODY SAR EVALUATION RESULTS

Freq.	Chan.	Test Mode	Duty Cycle	Crest Factor	Battery Type	DUT Position To Planar Phantom	DUT Spacing To Planar Phantom	Start Power	Measured SAR Levels		ANSI/IEEE SAR Limit	
								Conducted			Uncontrolled	
MHz								dBm	W/kg		W/kg	
2403.1	Low	Modulated Fixed Frequency	50%	1:2	Ni-Cd	Bottom Side	0.0 cm (Touch)	18.20	0.021	Pk	1.6	1g
2441.7	Mid	Modulated Fixed Frequency	50%	1:2	Ni-Cd	Bottom Side	0.0 cm (Touch)	19.68	0.015	Pk	1.6	1g
2478.6	High	Modulated Fixed Frequency	50%	1:2	Ni-Cd	Bottom Side	0.0 cm (Touch)	20.86	0.021	Pk	1.6	1g
2441.7	Mid	Modulated Fixed Frequency	50%	1:2	Ni-Cd	Back Side	1-Point Touch	19.68	0.019	Pk	1.6	1g
2441.7	Mid	Modulated Fixed Frequency	50%	1:2	Ni-Cd	Back Side	2-Point Touch	19.68	0.053	1g	1.6	1g
2403.1	Low	Modulated Fixed Frequency	50%	1:2	Ni-Cd	Back Side	2-Point Touch	18.20	0.032	1g	1.6	1g
2478.6	High	Modulated Fixed Frequency	50%	1:2	Ni-Cd	Back Side	2-Point Touch	20.86	**0.072**	**1g**	1.6	1g

Test Date(s)	December 19, 2007			Relative Humidity	35	%
Measured Fluid Type	2450 MHz Body			Atmospheric Pressure	101.1	kPa
Dielectric Constant ε	IEEE Target	Measured	Deviation	Ambient Temperature	24.0	°C
	52.7 ±5%	50.1	-4.9%	Fluid Temperature	23.5	°C
Conductivity σ (mho/m)	IEEE Target	Measured	Deviation	Fluid Depth	≥ 15	cm
	1.95 ±5%	1.98	+1.6%	ρ (Kg/m^3)	1000	

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 SAR levels measured and reported for the bottom side and back side (1-point touch) test configurations is the Peak (Pk) SAR level measured from the area scan. The 1g-averaged SAR is not measured when the peak SAR value from the area scan evaluation is less than 1% of the 1g average limit. The mathematical formula used to extrapolate the SAR value at the surface from the zoom scan SAR values measured at 5 mm steps leading away from the surface assumes a curving slope (i.e. the SAR values gradually decrease as the probe moves away from the surface). When the peak SAR of a device is so low that the RF noise level is competing with the SAR level, the zoom scan measurements leading away from the surface are no longer a curving slope and the extrapolation formula cannot accurately estimate the 1g average SAR. Therefore the peak value from the area scan is reported in place of the 1g averaged SAR value whenever the peak values are less than 1% of the average limit. This avoids gross uncertainties in the 1g average SAR calculation while maintaining a conservative estimation of the SAR level.
3.	The power drift of the DUT was measured by the DASY4 system during the SAR evaluations at the reference point of the phantom with low SAR. The measured drift levels were inaccurate due to the SAR value at the reference point is close to the measurement noise floor and are therefore not reported above.
4.	The DUT battery was fully charged prior to the SAR evaluations.
5.	The fluid temperature was measured prior to and after the SAR evaluations to ensure the temperature remained within +/-2°C of the fluid temperature reported during the dielectric parameter measurements.
6.	The dielectric parameters of the simulated tissue mixture were measured prior to the SAR evaluations using a Dielectric Probe Kit and a Network Analyzer (see Appendix C).
7.	The SAR evaluations were performed within 24 hours of the system performance check.

4.0 DETAILS OF SAR EVALUATION

The OMNEX Control Systems ULC Model: HPD-24RC 2.4GHz Spread Spectrum Transceiver Module installed in Model: T42 Portable Radio Remote Control Console was compliant for localized Specific Absorption Rate (Uncontrolled Exposure) based on the test provisions and conditions described below. The SAR test setup photographs are shown in Appendix D.

Test Configuration(s)

1. The DUT was tested for body-worn SAR with the bottom side placed parallel to, and touching, the outer surface of the SAM phantom (planar section).
2. The DUT was tested for body-worn SAR with the back side placed parallel to, and touching (1-point touch), the outer surface of the SAM phantom (planar section).
3. The DUT was tested for body-worn SAR with the back side placed parallel to, and touching (2-point touch), the outer surface of the SAM phantom (planar section).
4. The DUT is worn on the body using a shoulder strap accessory. The shoulder strap accessory was not provided for the SAR evaluations and was considered unnecessary to be utilized for the SAR evaluations by Celltech Labs Inc.

Test Mode(s) & Power Level(s)

5. The DUT was placed into test mode using the control panel on the T42 radio remote control console to transmit the transceiver module, disable the frequency hopping and change channels.
6. The DUT was tested at maximum power with a modulated signal on a fixed frequency (frequency hopping disabled) at 50% duty cycle (source-based time-averaged).
7. The peak conducted output power levels of the DUT referenced in this report were measured with a spectrum analyzer prior to the SAR evaluations by LabTest Certification Inc. (please refer to LabTest Report No. 8972-1E for the output power measurement procedures).
8. The DUT battery was fully charged prior to the SAR evaluations.

5.0 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 1 mm grid (42875 interpolated points).

g. A zoom scan volume of 24 mm x 24 mm x 20 mm (7x7x9 points) centered at the peak SAR location determined from the area scan was used and a zoom scan resolution of 4 mm x 4 mm x 2.5 mm was used.

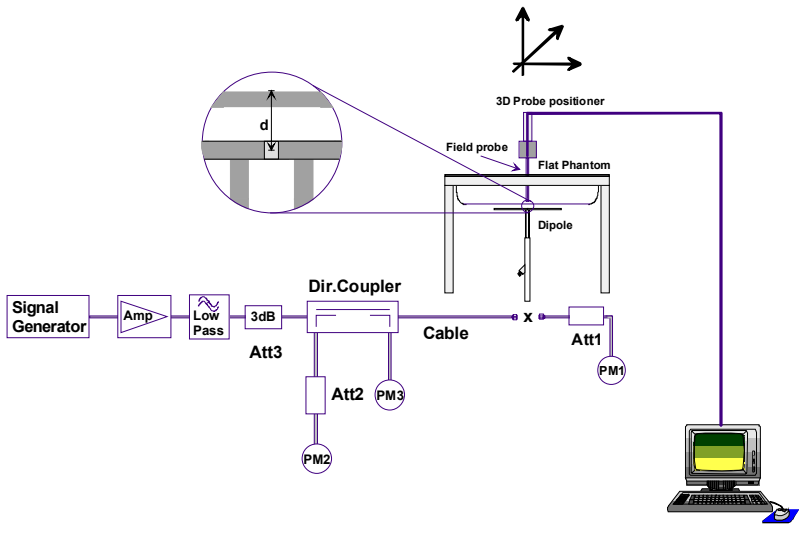
6.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluations a system check was performed at the planar section of the SAM phantom with a 2450 MHz validation dipole (see Appendix B for system performance check test plot). The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using a Dielectric Probe Kit and a 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% from the system validation target SAR value (see Appendix E for system validation procedures).

SYSTEM PERFORMANCE CHECK EVALUATION

Test Date	Equiv. Tissue	SAR 1g (W/kg)			Dielectric Constant ε_r			Conductivity σ (mho/m)			ρ	Amb. Temp.	Fluid Temp.	Fluid Depth	Humid.	Barom. Press.
	Freq. (MHz)	Sys. Val. Target	Meas.	Dev.	Sys. Val. Target	Meas.	Dev.	Sys. Val. Target	Meas.	Dev.	Kg/m^3	°C	°C	cm	%	kPa
Dec 19	Body 2450	13.4 ±10%	13.9	+3.8%	50.1 ±5%	50.1	0.0%	1.99 ±5%	1.98	-0.5%	1000	24.0	23.3	≥ 15	35	101.1

Note(s)		
	1.	The target SAR values are referenced from the System Validation procedures performed by Celltech Labs Inc. (see Appendix E).
	2.	The target dielectric parameters are referenced from the System Validation procedures performed by Celltech Labs Inc. (see Appendix E).
	3.	The fluid temperature was measured prior to and after the system performance check. The fluid temperature remained within +/-2°C of the fluid temperature from the dielectric parameter measurements.
	4.	The SAR evaluations were performed within 24 hours of the system performance check.



System Performance Check Measurement Setup Diagram

2450 MHz Validation Dipole Setup

7.0 SIMULATED EQUIVALENT TISSUES

The simulated tissue mixture consisted of Glycol-monobutyl, water and salt. The tissue mixtures were prepared according to standardized procedures and measured for dielectric parameters (permittivity and conductivity).

SIMULATED TISSUE MIXTURE		
INGREDIENT	2450 MHz Body System Performance Check	2450 MHz Body DUT Evaluation
Water	69.98 %	69.98 %
Glycol Monobutyl	30.00 %	30.00 %
Salt	0.02 %	0.02 %

8.0 SAR SAFETY LIMITS

EXPOSURE LIMITS	SAR (W/kg)	
	General Population / Uncontrolled Exposure	Occupational / Controlled Exposure
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
The Spatial Average value of the SAR averaged over the whole body.		
The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.		
The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.		
Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.		
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.		

9.0 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	Measurement Software: DASY4, V4.7 Build 44
	Postprocessing Software: SEMCAD, V1.8 Build 171
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.	3600
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

10.0 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

11.0 SAM TWIN PHANTOM V4.0C

The SAM twin 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 G for specifications of the SAM phantom V4.0C).

SAM Twin Phantom V4.0C

12.0 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

13.0 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	10Jul07		10Jul08
	-DAE3		00018	370	13Mar07		13Mar08
	-ET3DV6 E-Field Probe		00016	1387	16Mar07		16Mar08
x	-EX3DV4 E-Field Probe		00213	3600	24Jan07		24Jan08
	-300 MHz Validation Dipole		00023	135	08Jun07		08Jun08
	-450 MHz Validation Dipole		00024	136	30Jul07		30Jul08
	-835 MHz Validation Dipole		00022	411	**Brain**	07Jun07	07Jun08
					Body	07Jun07	07Jun08
	-900 MHz Validation Dipole		00020	054	**Brain**	07Jun07	07Jun08
					Body	07Jun07	07Jun08
	-1800 MHz Validation Dipole		00021	247	**Brain**	06Jun07	06Jun08
					Body	06Jun07	06Jun08
	-1900 MHz Validation Dipole		00032	151	**Brain**	06Jun07	06Jun08
					Body	06Jun07	06Jun08
	-2450 MHz Validation Dipole		00025	150	**Brain**	16Jul07	16Jul08
x					**Body**	08Jun07	08Jun08
	5GHz Validation Dipole	-5200 MHz	00126	1031	**Body**	18May07	18May08
		-5500 MHz			**Body**	22May07	22May08
		-5800 MHz			**Brain**	09May07	09May08
					Body	10May07	10May08
x	-SAM Twin 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
	ALS-PR-DIEL Dielectric Probe Kit		00160	260-00953	N/A		N/A
x	HP 85070C Dielectric Probe Kit		00033	US39240170	N/A		N/A
x	Gigatronics 8652A Power Meter		00007	1835272	26Mar07		26Mar08
	Gigatronics 8652A Power Meter		00008	1835267	22Jan07		22Jan08
x	Gigatronics 80701A Power Sensor		00012	1834350	22Jan07		22Jan08
x	Gigatronics 80701A Power Sensor		00014	1833699	22Jan07		22Jan08
	Gigatronics 80701A Power Sensor		00109	1834366	26Mar07		26Mar08
x	HP 8753ET Network Analyzer		00134	US39170292	20Apr07		20Apr08
	HP 8648D Signal Generator		00005	3847A00611	NCR		NCR
x	Rohde & Schwarz SMR20 Signal Generator		00006	100104	NCR		NCR
x	Amplifier Research 5S1G4 Power Amplifier		00106	26235	NCR		NCR
	Amplifier Research 10W1000C Power Amplifier		00041	27887	NCR		NCR
	Nextec NB00383 Microwave Amplifier		00151	0535	NCR		NCR
	HP E4408B Spectrum Analyzer		00015	US39240170	05Feb07		05Feb08

14.0 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 (2450 MHz)	5.9	Normal	1	1	5.9	∞
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	0.2	Rectangular	1.732050808	1	0.1	∞
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	∞
Mech. constraints of robot	0.4	Rectangular	1.732050808	1	0.2	∞
Probe positioning	2.9	Rectangular	1.732050808	1	1.7	∞
Extrapolation & integration	1	Rectangular	1.732050808	1	0.6	∞
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)	1.6	Normal	1	0.64	1.0	∞
Liquid permittivity (target)	5	Rectangular	1.732050808	0.6	1.7	∞
Liquid permittivity (measured)	4.9	Normal	1	0.6	2.9	∞
Combined Standard Uncertainty					**11.00**	
Expanded Uncertainty (k=2)					**22.01**	
Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003 (see reference [5])						

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 (2450 MHz)	5.9	Normal	1	1	5.9	∞
Axial isotropy of the probe	4.7	Rectangular	1.732050808	1	2.7	∞
Spherical isotropy of the probe	0	Rectangular	1.732050808	1	0.0	∞
Spatial resolution	0	Rectangular	1.732050808	1	0.0	∞
Boundary effects	0.2	Rectangular	1.732050808	1	0.1	∞
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	∞
Mech. constraints of robot	0.4	Rectangular	1.732050808	1	0.2	∞
Probe positioning	2.9	Rectangular	1.732050808	1	1.7	∞
Extrapolation & integration	1	Rectangular	1.732050808	1	0.6	∞
Dipole						
Dipole Positioning	2	Normal	1.732050808	1	1.2	∞
Power & Power Drift	4.7	Normal	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)	0.5	Normal	1	0.64	0.3	∞
Liquid permittivity (target)	5	Rectangular	1.732050808	0.6	1.7	∞
Liquid permittivity (measured)	0	Normal	1	0.6	0.0	∞
Combined Standard Uncertainty					**8.76**	
Expanded Uncertainty (k=2)					**17.52**	
Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003 (see reference [5])						

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

[5] 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.

[6] ANSI/IEEE C95.1-2005 - “American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 3 kHz to 300 GHz”, New York: IEEE, April 2006.

APPENDIX A - SAR MEASUREMENT DATA

Date Tested: 12/19/2007

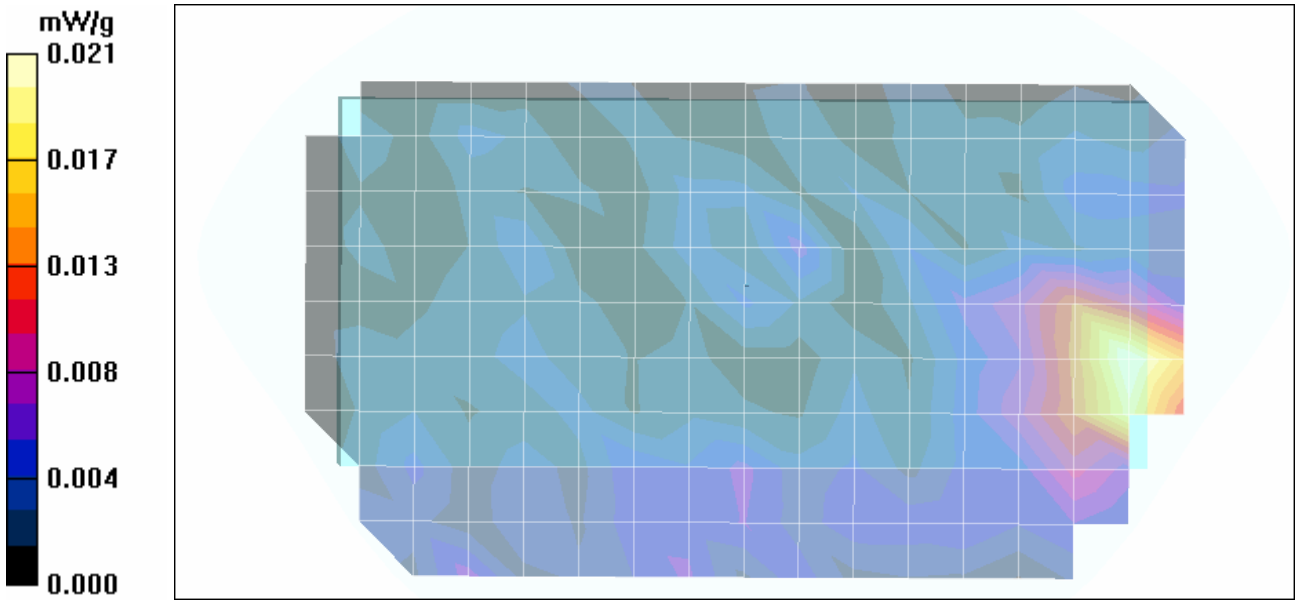
Body SAR - Bottom Side of DUT (0.0 cm Touch Position) - Low Channel - 2403.1 MHz

DUT: Omnex Controls; Type: HPD-24RC Transceiver installed in T42 Remote Control Console; Serial: 1104705

Ambient Temp: 24.0°C; Fluid Temp: 23.5°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Communication System: Mod. Fixed Freq.
RF Output Power: 18.20 dBm (Conducted)
Makita 9000 9.6V, 1.3Ah Ni-Cd Battery Pack
Frequency: 2403.1 MHz; Duty Cycle: 1:2
Medium: M2450 Medium parameters used: f = 2403.1 MHz; σ = 1.98 mho/m; ε_r = 50.1; ρ = 1000 kg/m^3
- Probe: EX3DV4 - SN3600; ConvF(6.31, 6.31, 6.31); Calibrated: 24/01/2007
- Sensor-Surface: 2 mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 10/07/2007
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body SAR - Bottom Side of DUT Touching Planar Phantom - Low Channel - 2403.1 MHz
Area Scan (10x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.021 mW/g



Date Tested: 12/19/2007

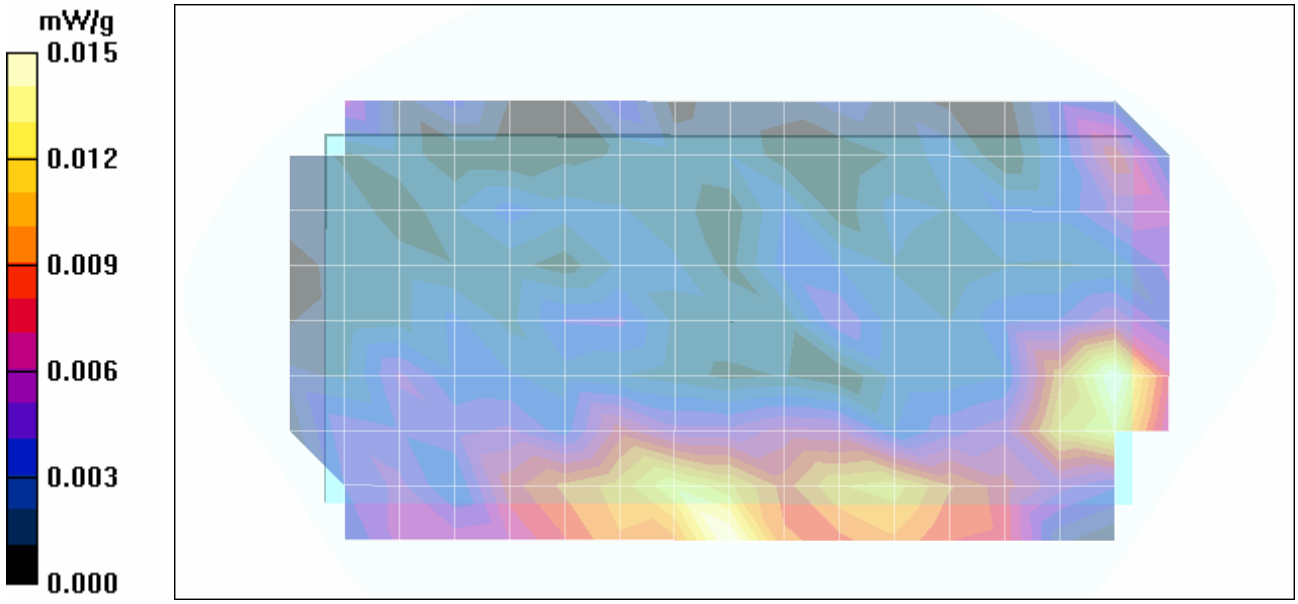
Body SAR - Bottom Side of DUT (0.0 cm Touch Position) - Mid Channel - 2441.7 MHz

DUT: Omnex Controls; Type: HPD-24RC Transceiver installed in T42 Remote Control Console; Serial: 1104705

Ambient Temp: 24.0°C; Fluid Temp: 23.5°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Communication System: Mod. Fixed Freq.
RF Output Power: 19.68 dBm (Conducted)
Makita 9000 9.6V, 1.3Ah Ni-Cd Battery Pack
Frequency: 2441.7 MHz; Duty Cycle: 1:2
Medium: M2450 Medium parameters used: f = 2441.7 MHz; σ = 1.98 mho/m; ε_r = 50.1; ρ = 1000 kg/m^3
- Probe: EX3DV4 - SN3600; ConvF(6.31, 6.31, 6.31); Calibrated: 24/01/2007
- Sensor-Surface: 2 mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 10/07/2007
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body SAR - Bottom Side of DUT Touching Planar Phantom - Mid Channel - 2441.7 MHz
Area Scan (9x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.015 mW/g



Date Tested: 12/19/2007

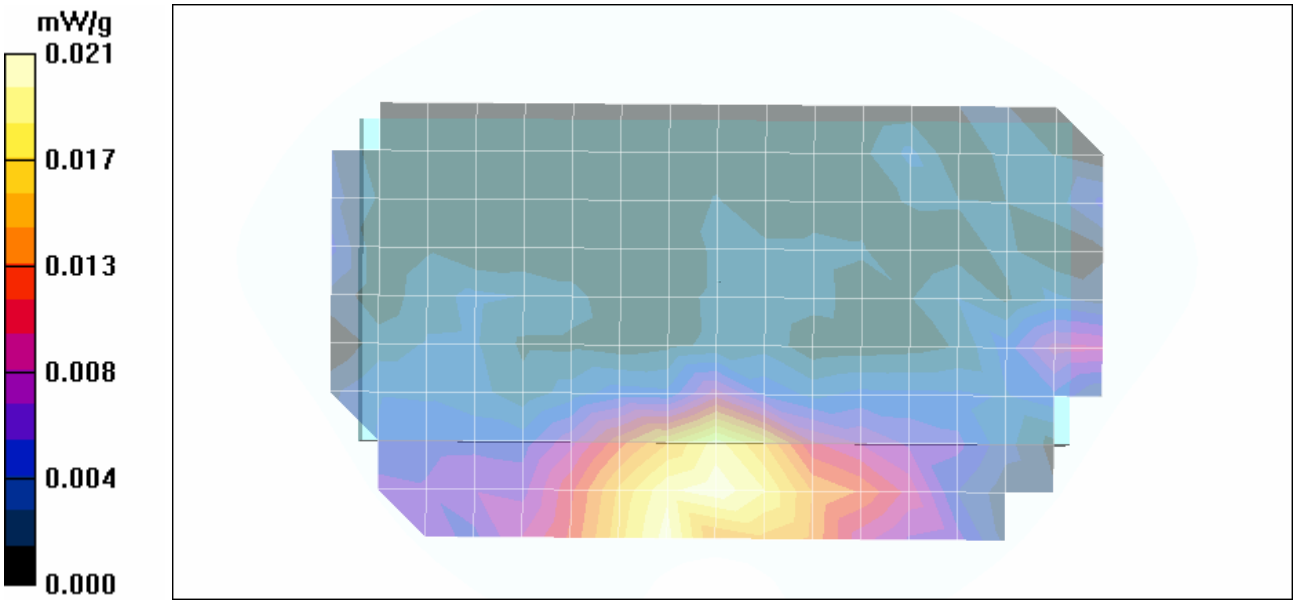
Body SAR - Bottom Side of DUT (0.0 cm Touch Position) - High Channel - 2478.6 MHz

DUT: Omnex Controls; Type: HPD-24RC Transceiver installed in T42 Remote Control Console; Serial: 1104705

Ambient Temp: 24.0°C; Fluid Temp: 23.5°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Communication System: Mod. Fixed Freq.
RF Output Power: 20.86 dBm (Conducted)
Makita 9000 9.6V, 1.3Ah Ni-Cd Battery Pack
Frequency: 2478.6 MHz; Duty Cycle: 1:2
Medium: M2450 Medium parameters used: f = 2478.6 MHz; σ = 1.98 mho/m; ε_r = 50.1; ρ = 1000 kg/m^3
- Probe: EX3DV4 - SN3600; ConvF(6.31, 6.31, 6.31); Calibrated: 24/01/2007
- Sensor-Surface: 2 mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 10/07/2007
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body SAR - Bottom Side of DUT Touching Planar Phantom - High Channel - 2478.6 MHz
Area Scan (10x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.021 mW/g



Date Tested: 12/19/2007

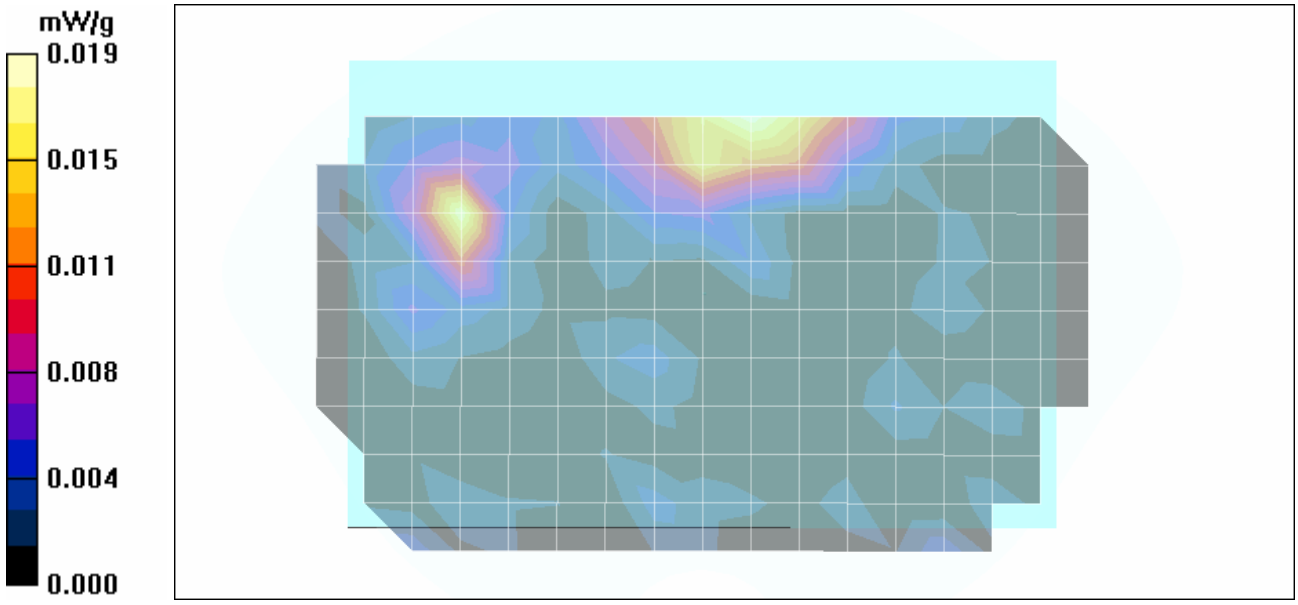
Body SAR - Back Side of DUT (1-Point Touch Position) - Mid Channel - 2441.7 MHz

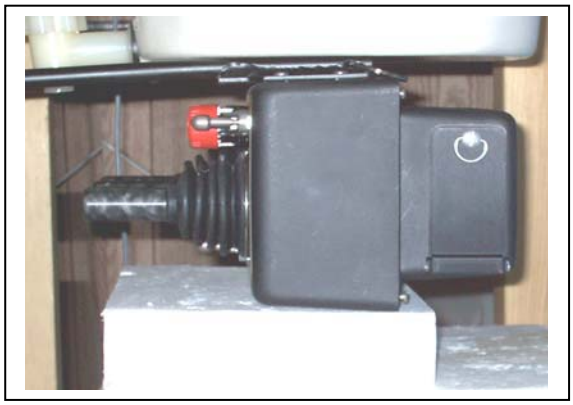
DUT: Omnex Controls; Type: HPD-24RC Transceiver installed in T42 Remote Control Console; Serial: 1104705

Ambient Temp: 24.0°C; Fluid Temp: 23.5°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Communication System: Mod. Fixed Freq.
RF Output Power: 19.68 dBm (Conducted)
Makita 9000 9.6V, 1.3Ah Ni-Cd Battery Pack
Frequency: 2441.7 MHz; Duty Cycle: 1:2
Medium: M2450 Medium parameters used: f = 2441.7 MHz; σ = 1.98 mho/m; ε_r = 50.1; ρ = 1000 kg/m^3
- Probe: EX3DV4 - SN3600; ConvF(6.31, 6.31, 6.31); Calibrated: 24/01/2007
- Sensor-Surface: 2 mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 10/07/2007
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body SAR - Back Side of DUT Touching Planar Phantom (1-Point Touch) - Mid Channel - 2441.7 MHz
Area Scan (10x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.019 mW/g





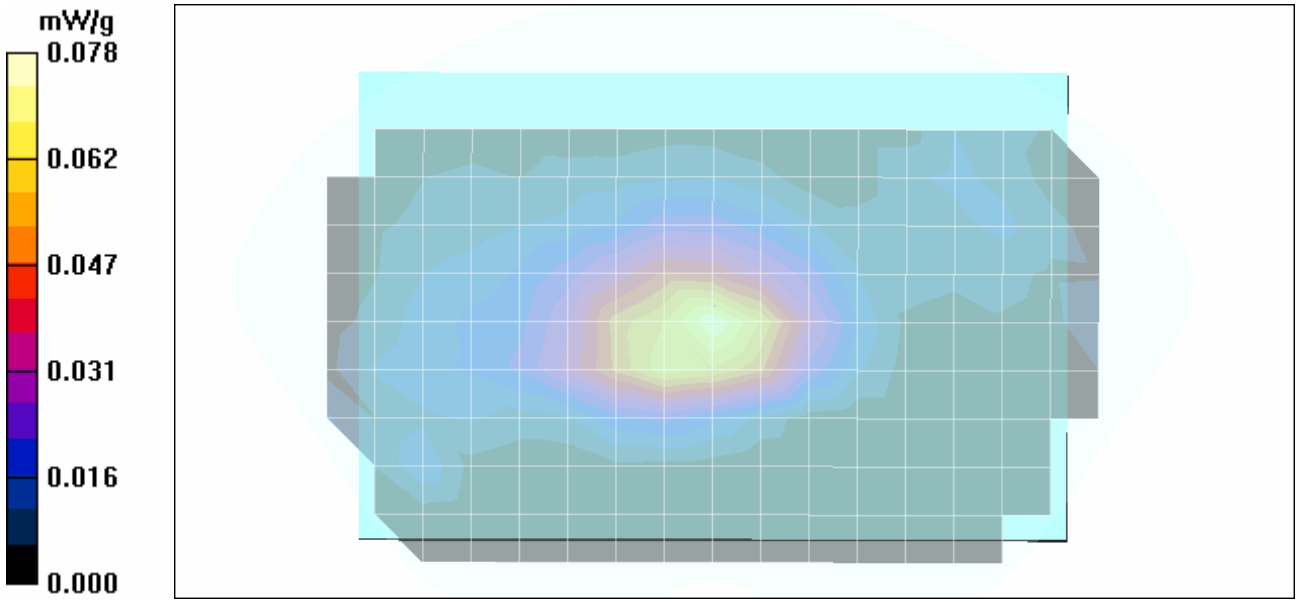
Date Tested: 12/19/2007

Body SAR - Back Side of DUT (2-Point Touch Position) - Mid Channel - 2441.7 MHz

DUT: Omnex Controls; Type: HPD-24RC Transceiver installed in T42 Remote Control Console; Serial: 1104705
Ambient Temp: 24.0°C; Fluid Temp: 23.5°C; Barometric Pressure: 101.1 kPa; Humidity: 35%
Communication System: Mod. Fixed Freq.
RF Output Power: 19.68 dBm (Conducted)
Makita 9000 9.6V, 1.3Ah Ni-Cd Battery Pack
Frequency: 2441.7 MHz; Duty Cycle: 1:2
Medium: M2450 Medium parameters used: f = 2441.7 MHz; σ = 1.98 mho/m; ε_r = 50.1; ρ = 1000 kg/m^3
- Probe: EX3DV4 - SN3600; ConvF(6.31, 6.31, 6.31); Calibrated: 24/01/2007
- Sensor-Surface: 2 mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 10/07/2007
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body SAR - Back Side of DUT Touching Planar Phantom (2-Point Touch) - Mid Channel - 2441.7 MHz
Area Scan (10x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.073 mW/g

Body SAR - Back Side of DUT Touching Planar Phantom (2-Point Touch) - Mid Channel - 2441.7 MHz
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.52 V/m
Peak SAR (extrapolated) = 0.101 W/kg
SAR(1 g) = 0.053 mW/g; SAR(10 g) = 0.031 mW/g
Maximum value of SAR (measured) = 0.078 mW/g



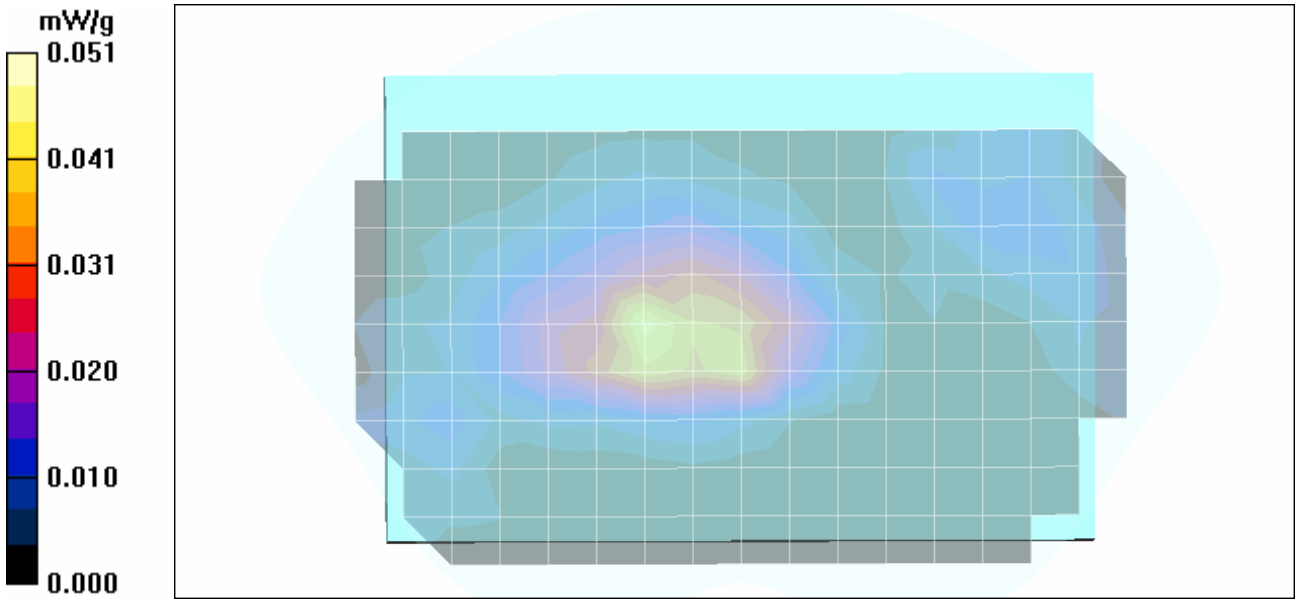
Date Tested: 12/19/2007

Body SAR - Back Side of DUT (2-Point Touch Position) - Low Channel - 2403.1 MHz

DUT: Omnex Controls; Type: HPD-24RC Transceiver installed in T42 Remote Control Console; Serial: 1104705
Ambient Temp: 24.0°C; Fluid Temp: 23.5°C; Barometric Pressure: 101.1 kPa; Humidity: 35%
Communication System: Mod. Fixed Freq.
RF Output Power: 18.20 dBm (Conducted)
Makita 9000 9.6V, 1.3Ah Ni-Cd Battery Pack
Frequency: 2403.1 MHz; Duty Cycle: 1:2
Medium: M2450 Medium parameters used: f = 2403.1 MHz; σ = 1.98 mho/m; ε_r = 50.1; ρ = 1000 kg/m^3
- Probe: EX3DV4 - SN3600; ConvF(6.31, 6.31, 6.31); Calibrated: 24/01/2007
- Sensor-Surface: 2 mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 10/07/2007
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body SAR - Back Side of DUT Touching Planar Phantom (2-Point Touch) - Low Channel - 2403.1 MHz
Area Scan (10x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.042 mW/g

Body SAR - Back Side of DUT Touching Planar Phantom (2-Point Touch) - Low Channel - 2403.1 MHz
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.07 V/m
Peak SAR (extrapolated) = 0.064 W/kg
SAR(1 g) = 0.032 mW/g; SAR(10 g) = 0.018 mW/g
Maximum value of SAR (measured) = 0.051 mW/g

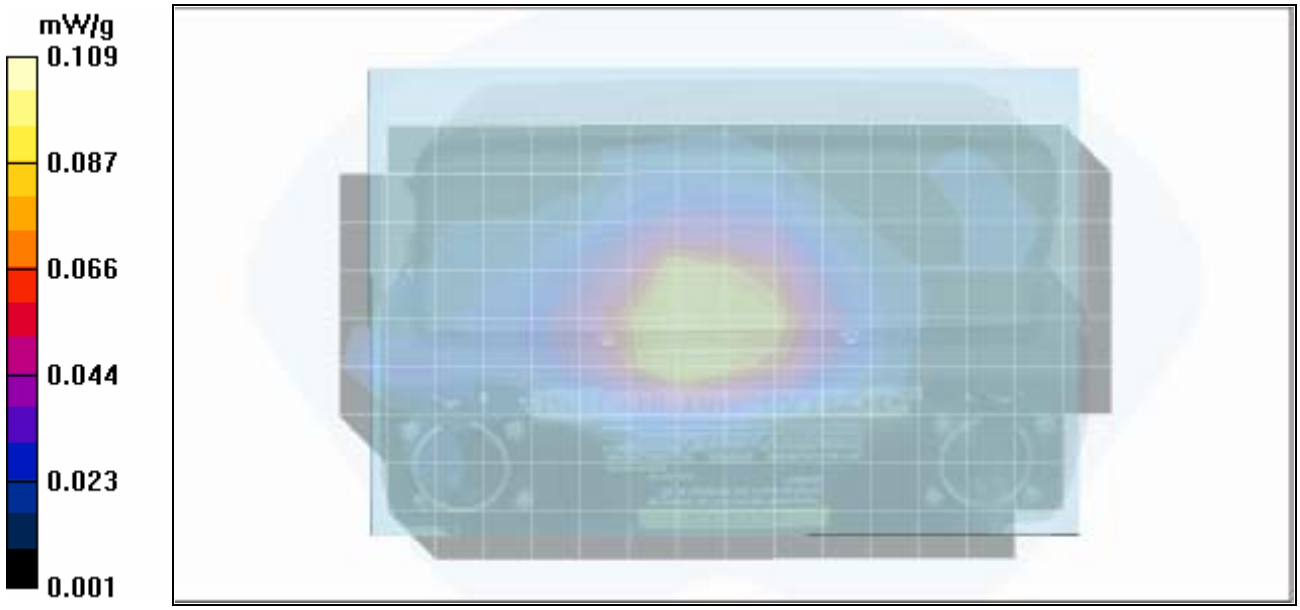


Date Tested: 12/19/2007

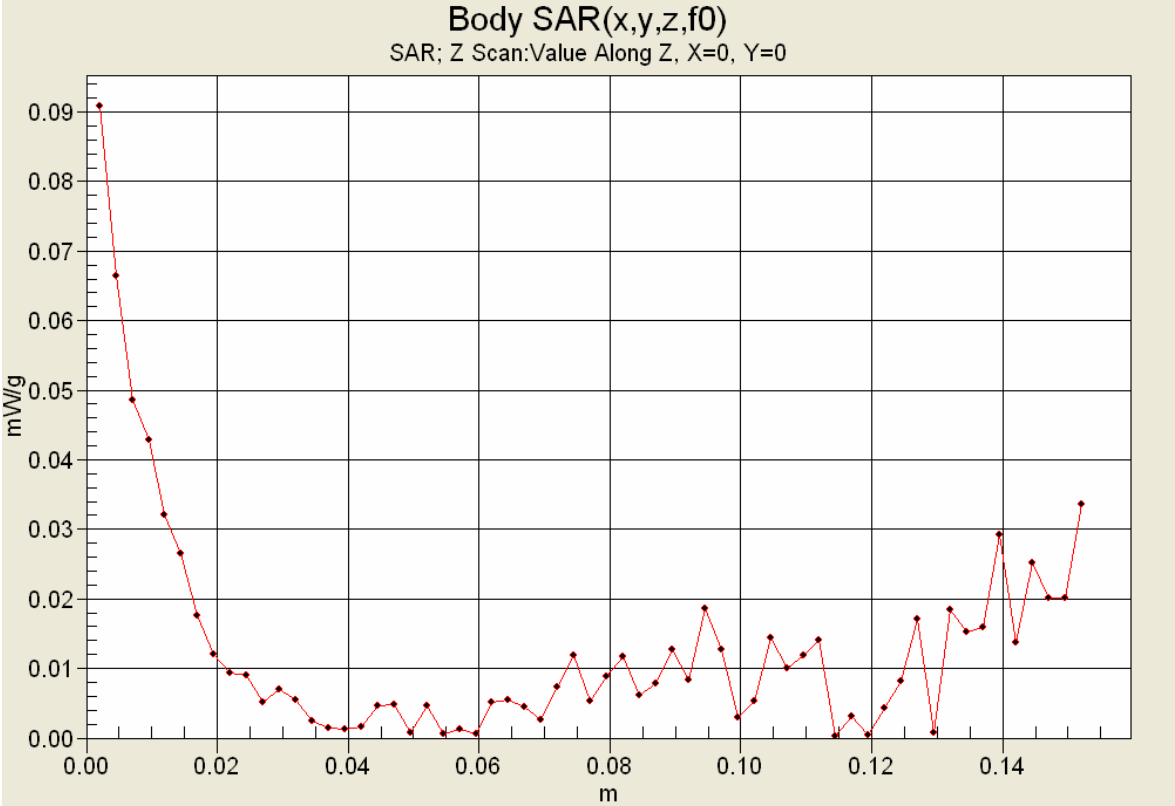
Body SAR - Back Side of DUT (2-Point Touch Position) - High Channel - 2478.6 MHz

DUT: Omnex Controls; Type: HPD-24RC Transceiver installed in T42 Remote Control Console; Serial: 1104705
Ambient Temp: 24.0°C; Fluid Temp: 23.5°C; Barometric Pressure: 101.1 kPa; Humidity: 35%
Communication System: Mod. Fixed Freq.
RF Output Power: 20.86 dBm (Conducted)
Makita 9000 9.6V, 1.3Ah Ni-Cd Battery Pack
Frequency: 2478.6 MHz; Duty Cycle: 1:2
Medium: M2450 Medium parameters used: f = 2478.6 MHz; σ = 1.98 mho/m; ε_r = 50.1; ρ = 1000 kg/m^3
- Probe: EX3DV4 - SN3600; ConvF(6.31, 6.31, 6.31); Calibrated: 24/01/2007
- Sensor-Surface: 2 mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 10/07/2007
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body SAR - Back Side of DUT Touching Planar Phantom (2-Point Touch) - High Channel - 2478.6 MHz
Area Scan (10x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.092 mW/g
Body SAR - Back Side of DUT Touching Planar Phantom (2-Point Touch) - High Channel - 2478.6 MHz
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.50 V/m
Peak SAR (extrapolated) = 0.139 W/kg
SAR(1 g) = 0.072 mW/g; SAR(10 g) = 0.042 mW/g
Maximum value of SAR (measured) = 0.109 mW/g



Z-Axis Scan



Due to the very low SAR level measured in this configuration the Z-axis scan is only reporting noise. The DASY4 software adjusts the scale according to the measured SAR level, which for this evaluation is close to the measurement noise floor.

APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

Date Tested: 12/19/2007

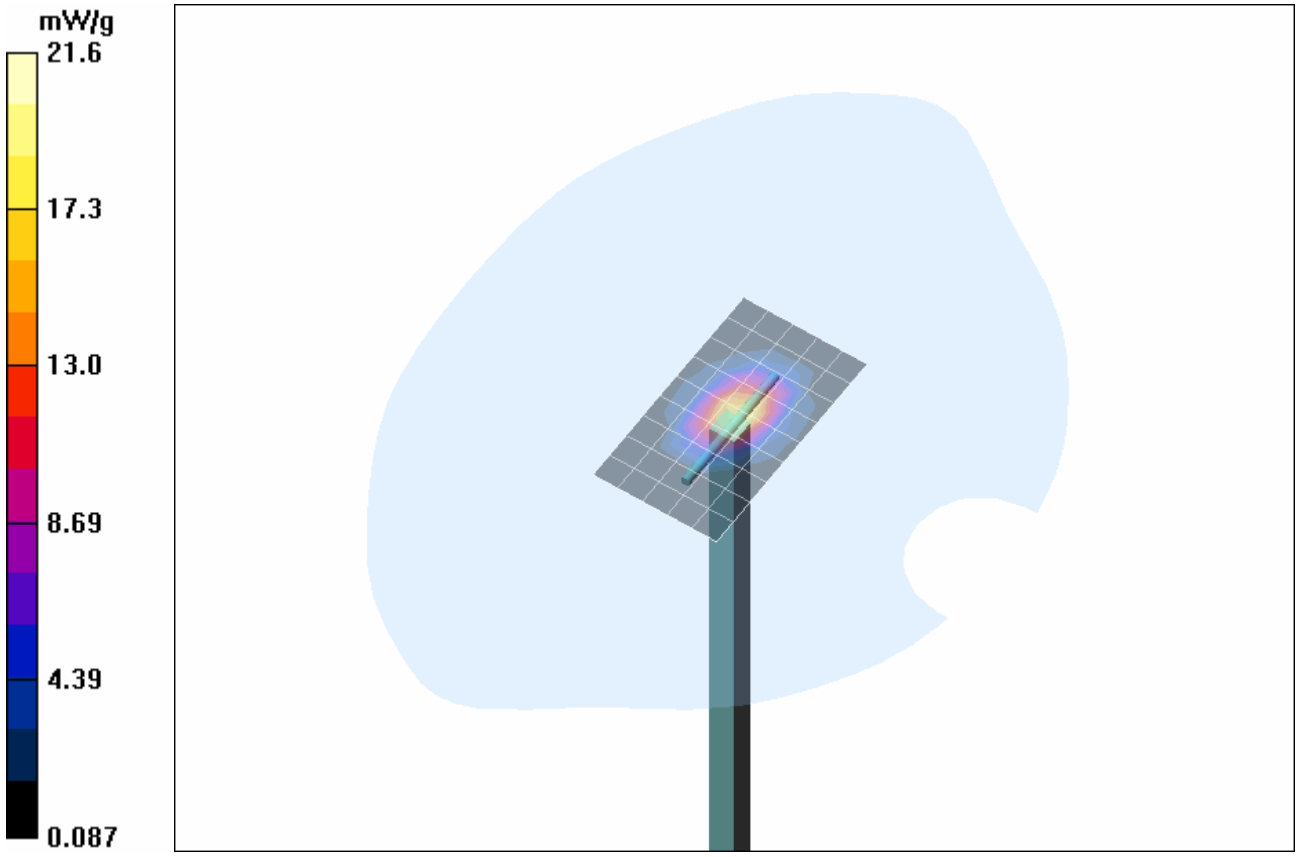
System Performance Check - 2450 MHz Dipole - MSL

DUT: Dipole 2450 MHz; Asset: 00025; Serial: 150; Validation: 06/08/2007

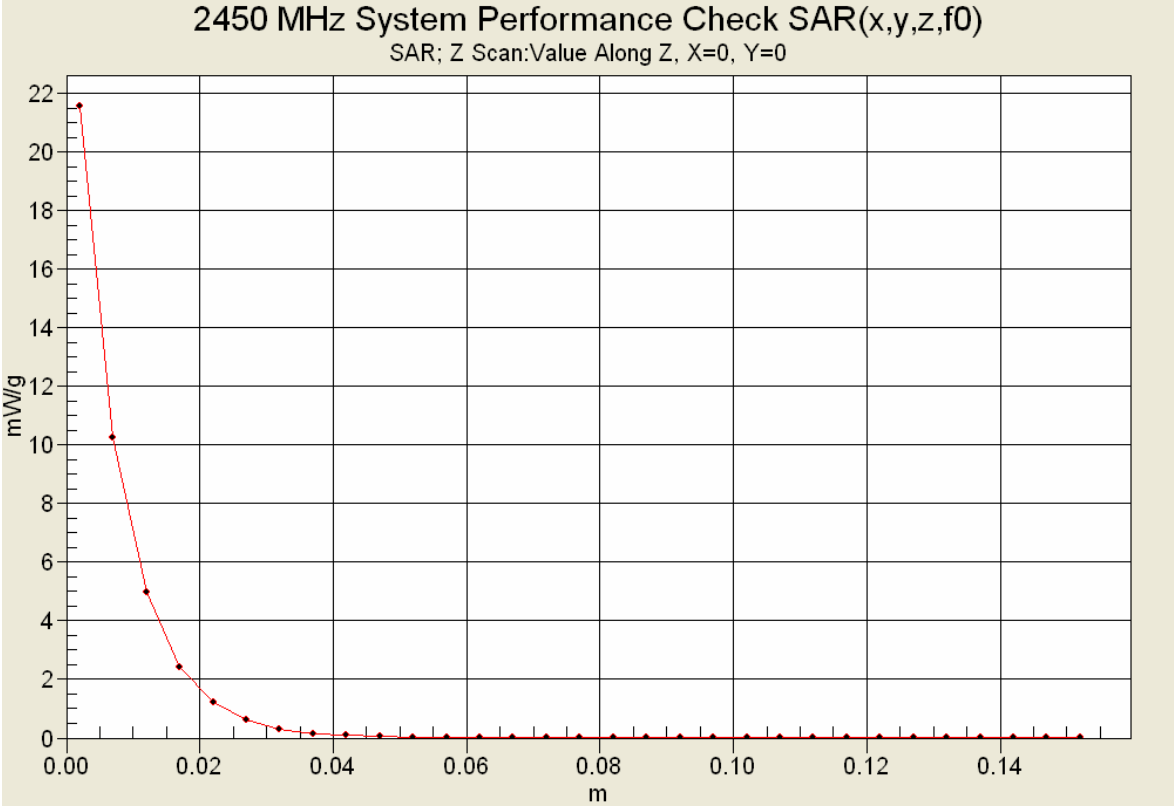
Ambient Temp: 24.0°C; Fluid Temp: 23.3°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2450 MHz; σ = 1.98 mho/m; ε_r = 50.1; ρ = 1000 kg/m^3
- Probe: EX3DV4 - SN3600; ConvF(6.31, 6.31, 6.31); Calibrated: 24/01/2007
- Sensor-Surface: 2 mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 10/07/2007
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

2450 MHz Dipole - System Performance Check/Area Scan (6x10x1):
Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 18.3 mW/g
2450 MHz Dipole - System Performance Check/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 106.6 V/m; Power Drift = -0.079 dB
Peak SAR (extrapolated) = 29.6 W/kg
SAR(1 g) = 13.9 mW/g; SAR(10 g) = 6.19 mW/g
Maximum value of SAR (measured) = 21.6 mW/g



Z-Axis Scan



APPENDIX C - MEASURED FLUID DIELECTRIC PARAMETERS

2450 MHz System Performance Check & DUT Evaluation (Body)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
Wed 19/Dec/2007
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

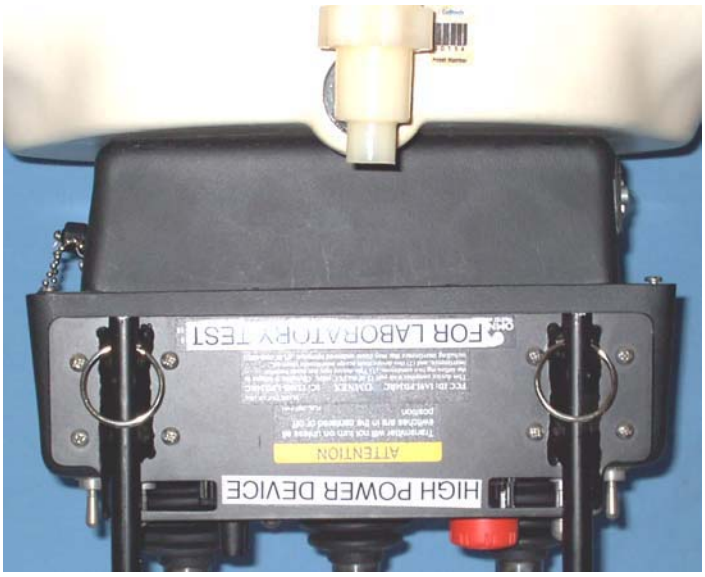
****

Freq	FCC_eB	FCC_sB	Test_e	Test_s
2.3500	52.83	1.85	50.53	1.86
2.3600	52.82	1.86	50.63	1.88
2.3700	52.81	1.87	50.57	1.88
2.3800	52.79	1.88	50.46	1.91
2.3900	52.78	1.89	50.44	1.91
2.4000	52.77	1.90	50.35	1.92
2.4100	52.75	1.91	50.27	1.94
2.4200	52.74	1.92	50.23	1.94
2.4300	52.73	1.93	50.22	1.96
2.4400	52.71	1.94	50.27	1.97
2.4500	52.70	1.95	50.13	1.98
2.4600	52.69	1.96	50.15	1.99
2.4700	52.67	1.98	50.06	2.00
2.4800	52.66	1.99	50.16	2.02
2.4900	52.65	2.01	50.03	2.04
2.5000	52.64	2.02	49.96	2.06
2.5100	52.62	2.04	49.99	2.06
2.5200	52.61	2.05	49.89	2.07
2.5300	52.60	2.06	49.87	2.09
2.5400	52.59	2.08	49.91	2.11
2.5500	52.57	2.09	49.94	2.11

APPENDIX D - SAR TEST SETUP & DUT PHOTOGRAPHS

BODY SAR TEST SETUP PHOTOGRAPHS

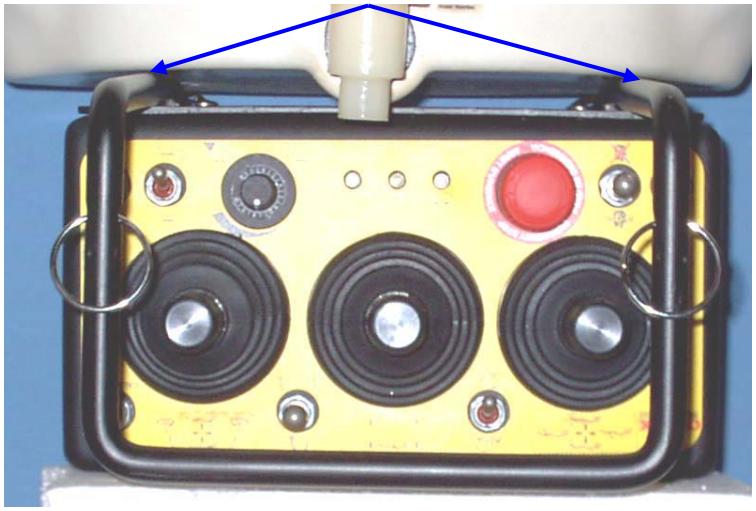
Bottom Side of DUT Touching Planar Phantom

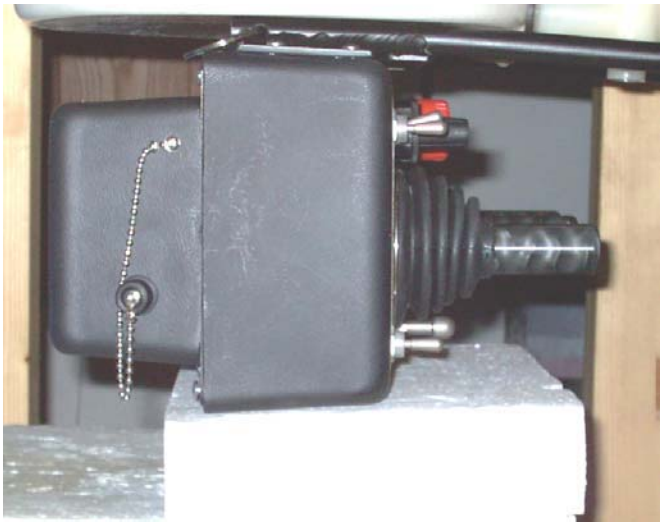


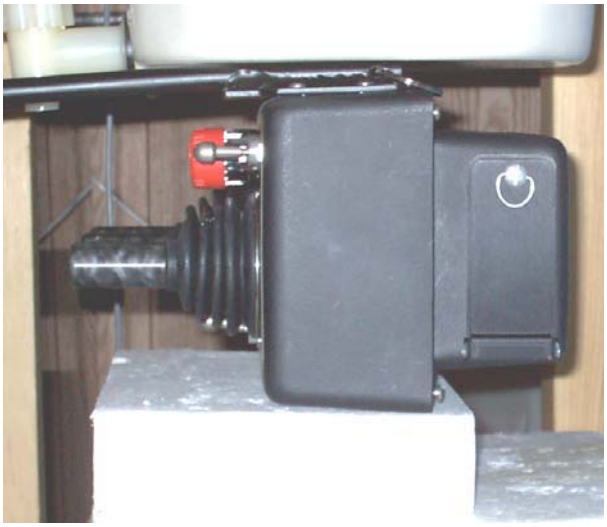
BODY SAR TEST SETUP PHOTOGRAPHS

Back Side of DUT Touching Planar Phantom
1-Point Touch Position

1-Point Touch



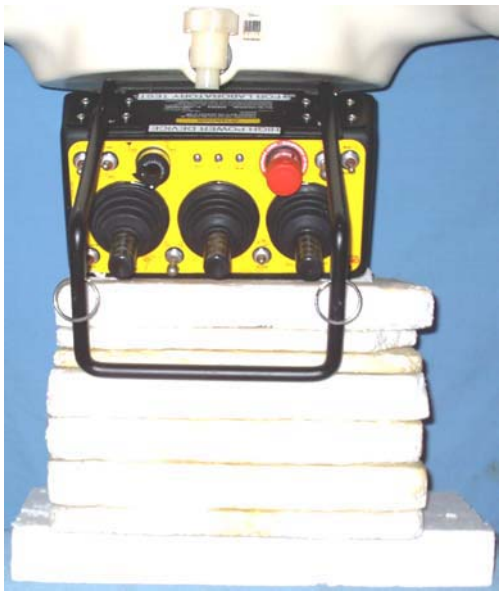


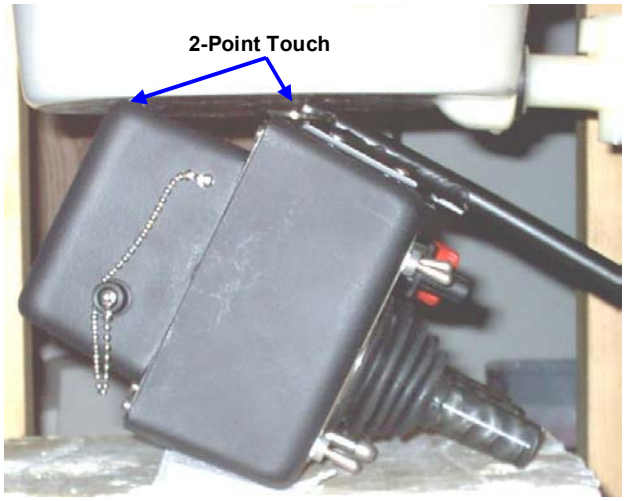


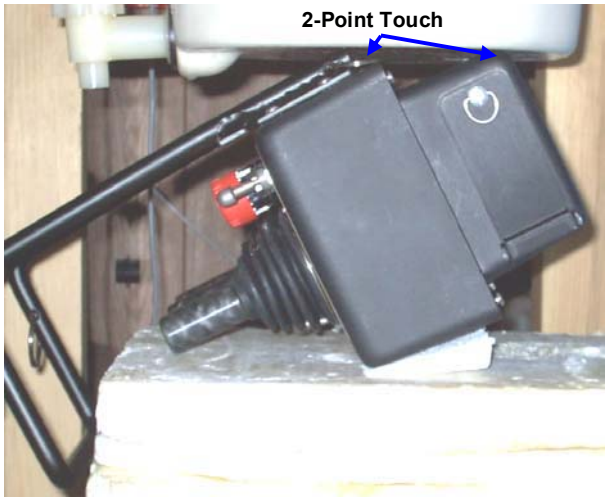
BODY SAR TEST SETUP PHOTOGRAPHS

Back Side of DUT Touching Planar Phantom

2-Point Touch Position







DUT PHOTOGRAPHS

Front Side of T42 Radio Remote Control Console

Back Side of T42 Radio Remote Control Console

Top view of T42 Radio Remote Control Console

DUT PHOTOGRAPHS

Left Side of T42 Radio Remote Control Console

Right Side of T42 Radio Remote Control Console

Bottom Side of T42 Radio Remote Control Console

DUT PHOTOGRAPHS

T42 Battery Housing

Makita 9000 9.6V 1.3Ah Ni-Cd Battery Pack

T42 Battery Door

Ni-Cd Battery Pack installed in T42

APPENDIX E - SYSTEM VALIDATION

2450 MHz SYSTEM VALIDATION

Type:	**2450 MHz Validation Dipole**
Asset Number:	**00025**
Serial Number:	**150**
Place of Validation:	**Celltech Labs Inc.**
Date of Validation:	**June 08, 2007**

Celltech Labs Inc. certifies that the 2450 MHz System Validation was performed on the date indicated above.

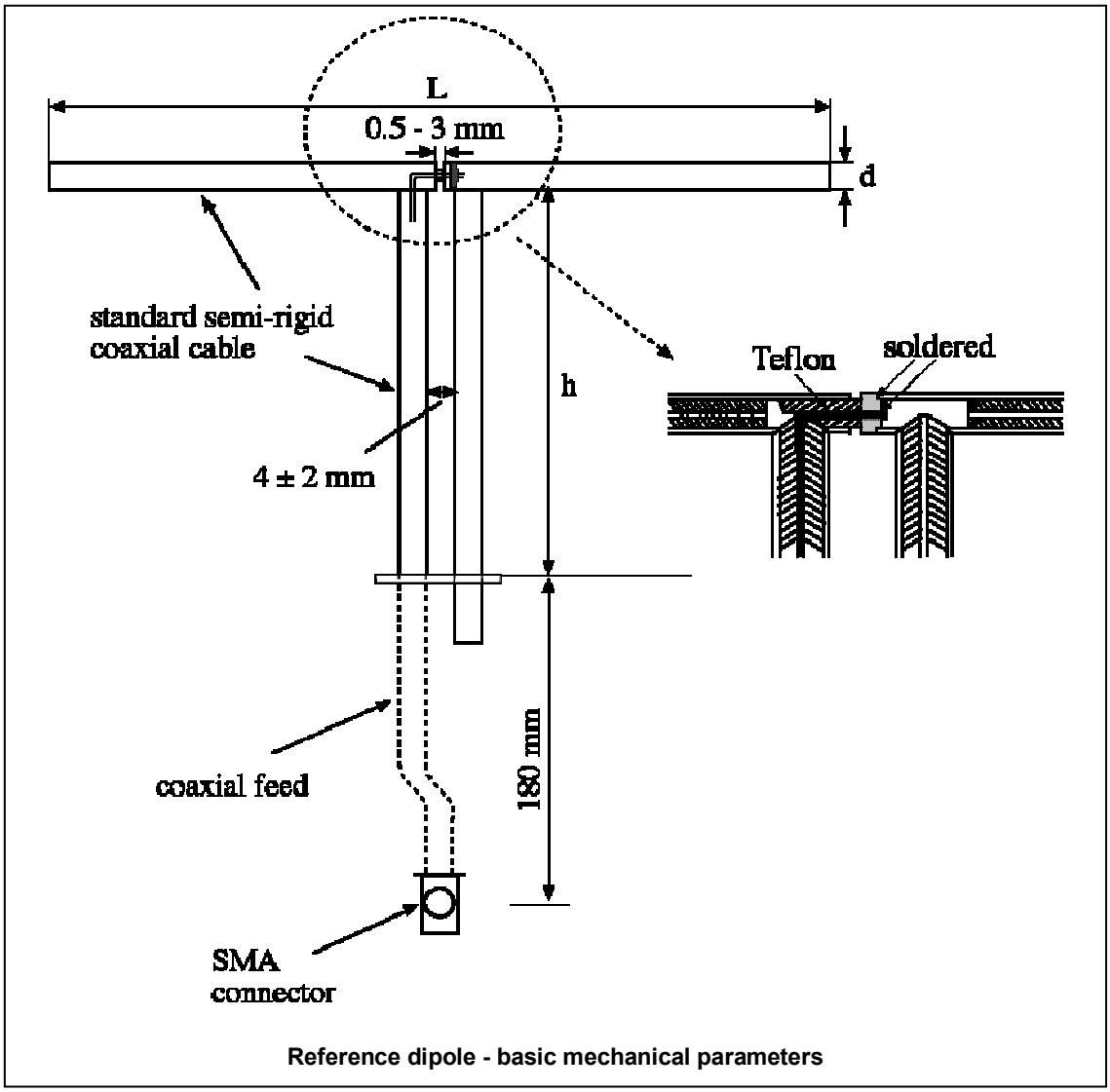
Performed by:	**Cheri Frangiadakis**
Approved by:	**Sean Johnston**

Celltech Labs Inc. 21-364 Lougheed Rd., Kelowna, B.C. V1X 7R8 Canada
Tel. 250-765-7650 • Fax. 250-765-7645 • e-mail: info@celltechlabs.com
www.celltechlabs.com

1. Dipole Construction & Electrical Characteristics

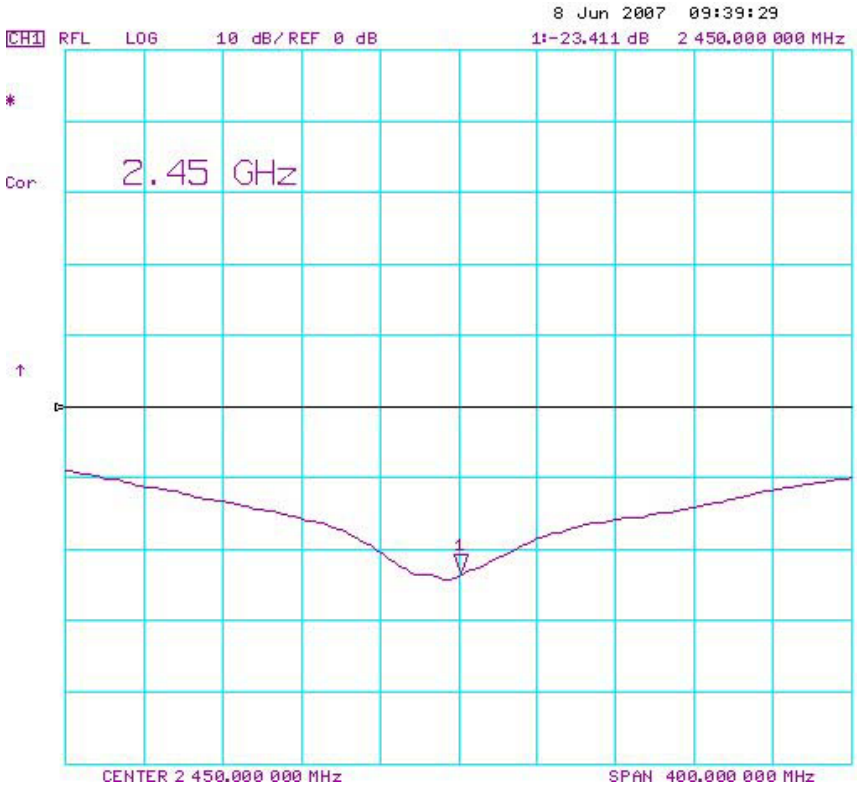
The validation dipole was constructed in accordance with the requirements specified in IEEE Standard 1528-2003 and International Standard IEC 62209-1:2005. The electrical properties were measured using an HP 8753ET Network Analyzer. The network analyzer was calibrated to the validation dipole N-type connector feed point using an HP85032E Type N calibration kit. The dipole was placed parallel to a planar phantom at a separation distance of 10.0mm from the simulating fluid using a loss-less dielectric spacer. The measured input impedance is:

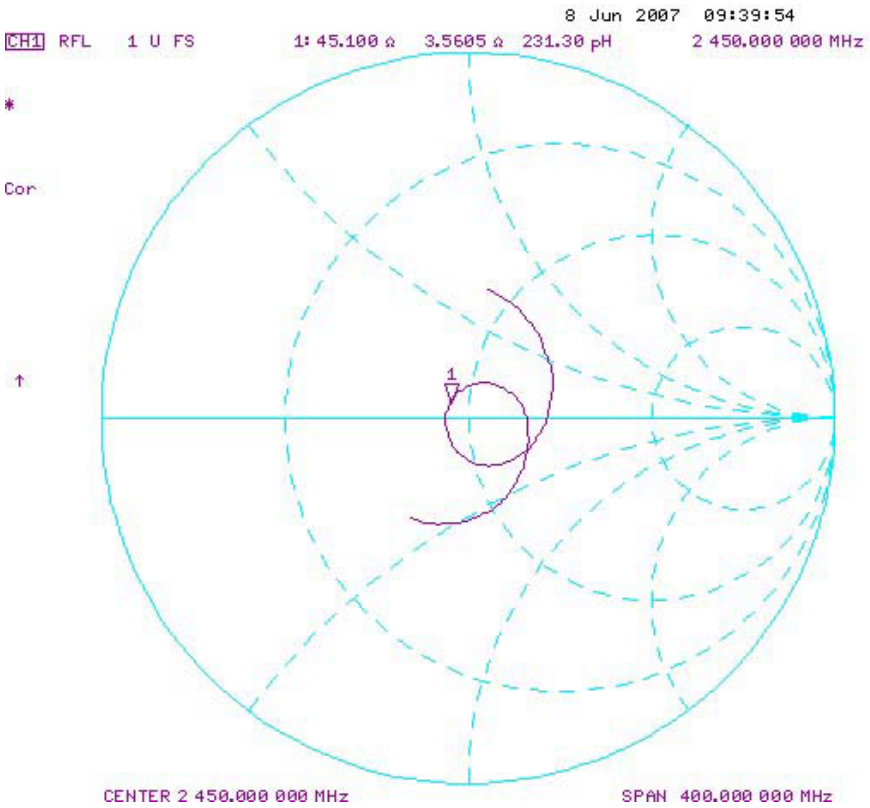
Feed point impedance at 2450 MHz	Re{Z} = 45.100Ω
	Im{Z} = 3.5605Ω
Return Loss at 2450 MHz	-23.411dB



Reference dipole - basic mechanical parameters

2. Validation Dipole VSWR Data





3. Validation Dipole Dimensions

Frequency (MHz)	L (mm)	H (mm)	D (mm)
300	396.0	250.0	6.0
450	270.0	167.0	6.0
835	161.0	89.8	3.6
900	149.0	83.3	3.6
1450	89.1	51.7	3.6
1800	72.0	41.7	3.6
1900	68.0	39.5	3.6
2000	64.5	37.5	3.6
2450	**51.5**	**30.4**	**3.6**
3000	41.5	25.0	3.6

4. Validation Phantom

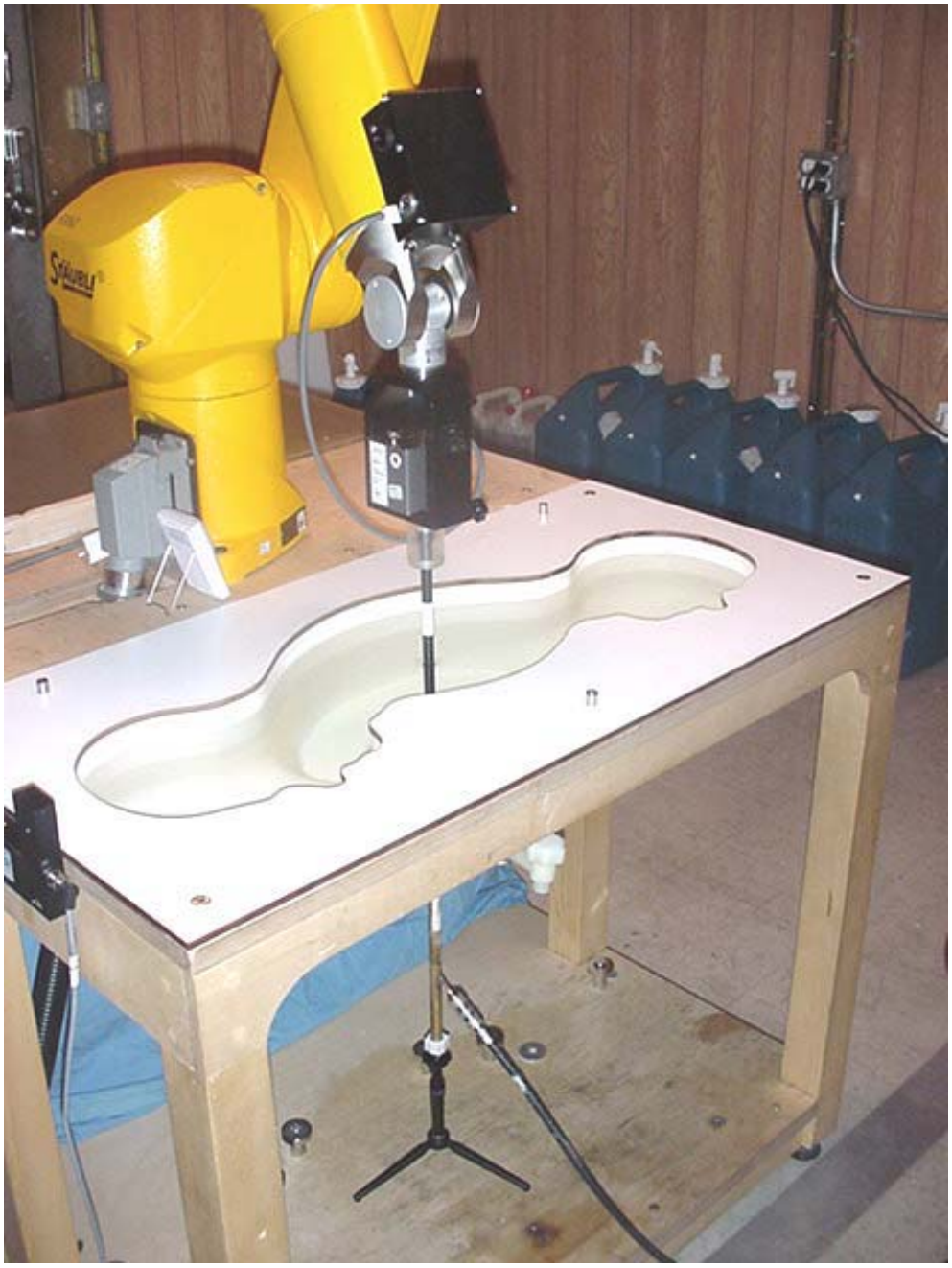
The validation phantom is the SAM (Specific Anthropomorphic Mannequin) phantom manufactured by Schmid & Partner Engineering AG. The SAM phantom is a Fiberglass shell integrated in a wooden table. The shape of the shell corresponds to the phantom defined by SCC34-SC2. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

Shell Thickness: 2.0 ± 0.1 mm
Filling Volume: Approx. 25 liters
Dimensions: 50 cm (W) x 100 cm (L)

SAM Phantom

Fluid Depth (≥ 15.0 cm)

5. 2450 MHz System Validation Setup

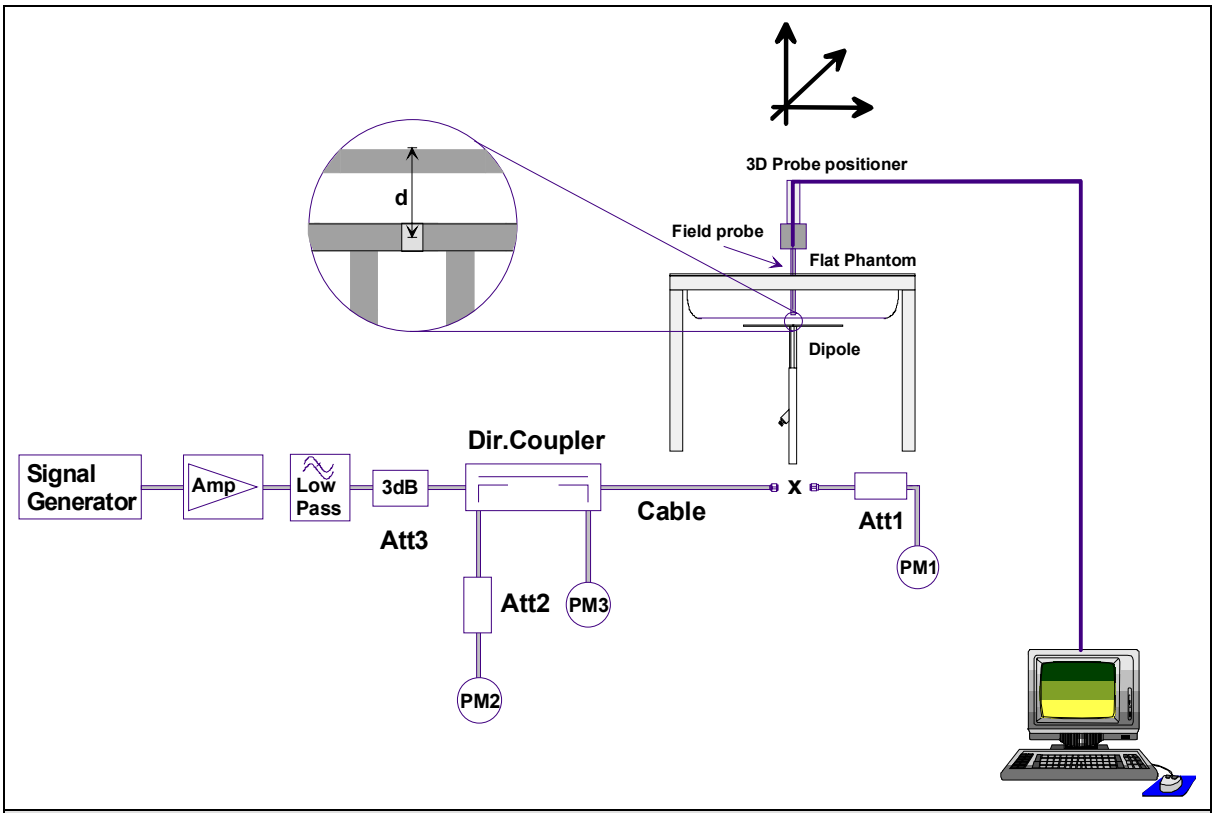


6. 2450 MHz Validation Dipole Setup

7. SAR Measurement

Measurements were made at the planar section of the SAM phantom using a dosimetric E-field probe EX3DV4 (S/N: 3600, conversion factor 6.31). The SAR measurement was performed with the E-field probe in mechanical detection mode only. The setup and determination of the forward power into the dipole was performed using the procedures described below.

First the power meter PM1 (including attenuator Att1) is connected to the cable to measure the forward power at the location of the dipole connector (X). The signal generator is adjusted for the desired forward power at the dipole connector (taking into account the attenuation of Att1) as read by power meter PM2. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2. If the signal generator does not allow adjustment in 0.01dB steps, the remaining difference at PM2 must be taken into consideration. PM3 records the reflected power from the dipole to ensure that the value is not changed from the previous value. The reflected power should be 20dB below the forward power.



System Validation Measurement Setup Diagram

8. Measurement Conditions

The SAM phantom was filled with 2450 MHz Body tissue simulant.

Relative Permittivity: 50.1 (-4.9% deviation from target)
Conductivity: 1.99 mho/m (+2.1% deviation from target)
Fluid Temperature: 21.5 °C (Start of Test) / 21.2 °C (End of Test)
Fluid Depth: ≥ 15.0 cm

Environmental Conditions:
Ambient Temperature: 22.7 °C
Barometric Pressure: 101.1 kPa
Humidity: 31 %

The 2450 MHz Body tissue simulant consisted of the following ingredients:

Ingredient	Percentage by weight	
Water	69.98%	
Glycol Monobutyl	30.00%	
Salt	0.02%	
IEEE Target Dielectric Parameters:	**ε_r = 52.7 (+/-5%)**	**σ = 1.95 S/m (+/-5%)**

9. System Validation SAR Results

SAR @ 0.25W Input averaged over 1g (W/kg)				SAR @ 1W Input averaged over 1g (W/kg)			
SPEAG Target		Measured	Deviation	SPEAG Target		Measured	Deviation
12.8	+/- 10%	13.4	+4.7%	51.2	+/- 10%	53.6	+4.7%
SAR @ 0.25W Input averaged over 10g (W/kg)				**SAR @ 1W Input averaged over 10g (W/kg)**			
SPEAG Target		Measured	Deviation	SPEAG Target		Measured	Deviation
5.93	+/- 10%	6.03	+1.7%	23.7	+/- 10%	24.1	+1.7%

Dipole Type	Distance [mm]	Frequency [MHz]	SAR (1g) [W/kg]	SAR (10g) [W/kg]	SAR (peak) [W/kg]
D300V2	15	300	3.02	2.06	4.36
D450V2	15	450	5.01	3.36	7.22
D835V2	15	835	9.71	6.38	14.1
D900V2	15	900	11.1	7.17	16.3
D1450V2	10	1450	29.6	16.6	49.8
D1500V2	10	1500	30.8	17.1	52.1
D1640V2	10	1640	34.4	18.7	59.4
D1800V2	10	1800	38.5	20.3	67.5
D1900V2	10	1900	39.8	20.8	69.6
D2000V2	10	2000	40.9	21.2	71.5
D2450V2	10	2450	51.2	23.7	97.6
D3000V2	10	3000	61.9	24.8	136.7

Table 32.1: Numerical reference SAR values for SPEAG dipoles and flat phantom filled with body-tissue simulating liquid. Note: All SAR values normalized to 1 W forward power.

System Validation - 2450 MHz Dipole - June 8, 2007

DUT: Dipole 2450 MHz; Asset: 00025; Serial: 150

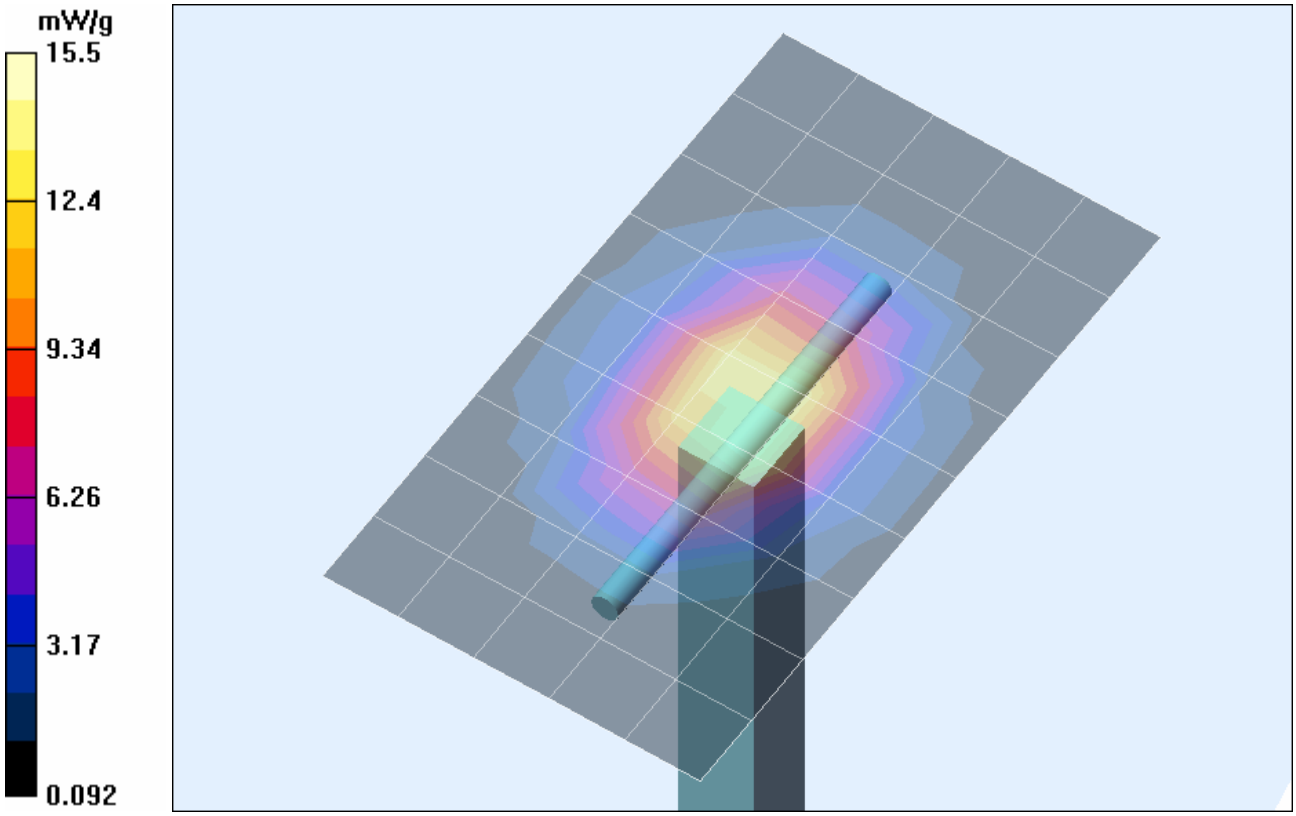
Ambient Temp: 22.7°C; Fluid Temp: 21.5°C; Barometric Pressure: 101.1 kPa; Humidity: 31%

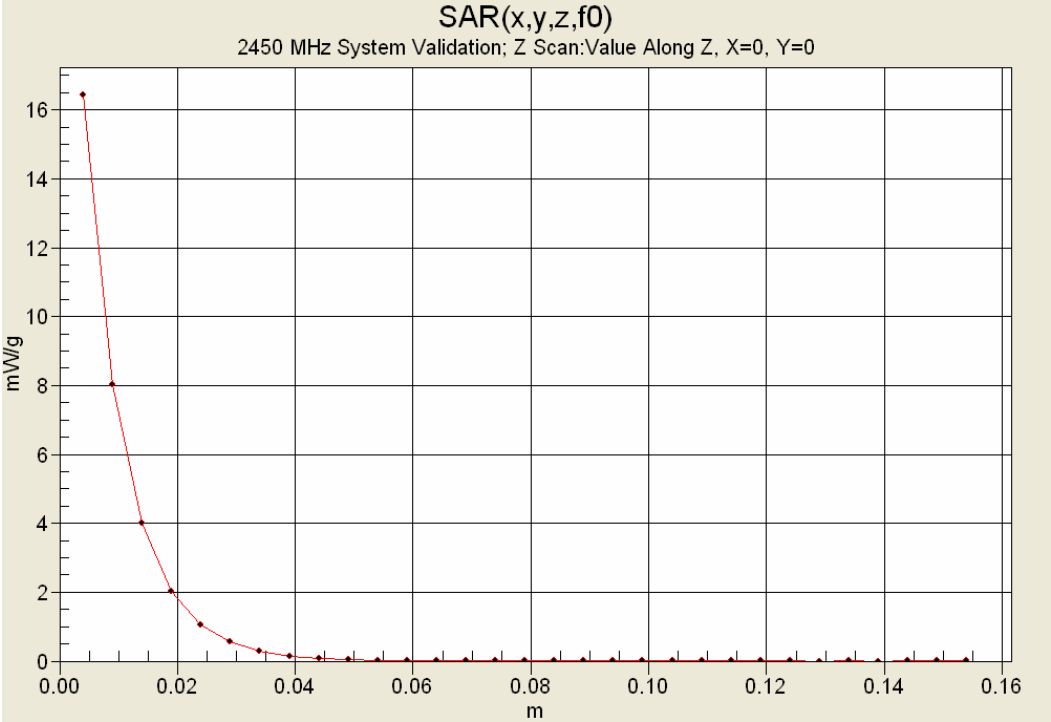
Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2450 MHz; σ = 1.99 mho/m; ε_r = 50.1; ρ = 1000 kg/m^3

- Probe: EX3DV4 - SN3600; ConvF(6.31, 6.31, 6.31); Calibrated: 24/01/2007
- Sensor-Surface: 2 mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 21/06/2006
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

2450 MHz System Validation/Area Scan (6x10x1):
Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 13.1 mW/g

2450 MHz System Validation/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 91.9 V/m; Power Drift = -0.128 dB
Peak SAR (extrapolated) = 28.6 W/kg
SAR(1 g) = 13.4 mW/g; SAR(10 g) = 6.03 mW/g
Maximum value of SAR (measured) = 15.5 mW/g





10. Measured Fluid Dielectric Parameters

System Validation - 2450 MHz (Body)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
Fri 08/Jun/2007
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
2.3500	52.83	1.85	50.39	1.89
2.3600	52.82	1.86	50.32	1.90
2.3700	52.81	1.87	50.28	1.91
2.3800	52.79	1.88	50.28	1.93
2.3900	52.78	1.89	50.31	1.94
2.4000	52.77	1.90	50.26	1.95
2.4100	52.75	1.91	50.24	1.96
2.4200	52.74	1.92	50.21	1.96
2.4300	52.73	1.93	50.21	1.98
2.4400	52.71	1.94	50.13	1.99
2.4500	52.70	1.95	50.09	1.99
2.4600	52.69	1.96	50.01	2.03
2.4700	52.67	1.98	50.10	2.03
2.4800	52.66	1.99	50.12	2.05
2.4900	52.65	2.01	50.09	2.07
2.5000	52.64	2.02	50.08	2.07
2.5100	52.62	2.04	50.03	2.08
2.5200	52.61	2.05	50.02	2.09
2.5300	52.60	2.06	49.93	2.10
2.5400	52.59	2.08	49.87	2.11
2.5500	52.57	2.09	49.78	2.13

11. Measurement Uncertainties

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 (2450 MHz)	5.9	Normal	1	1	5.9	∞
Axial isotropy of the probe	4.7	Rectangular	1.732050808	1	2.7	∞
Spherical isotropy of the probe	0	Rectangular	1.732050808	1	0.0	∞
Spatial resolution	0	Rectangular	1.732050808	1	0.0	∞
Boundary effects	0.2	Rectangular	1.732050808	1	0.1	∞
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	∞
Mech. constraints of robot	0.4	Rectangular	1.732050808	1	0.2	∞
Probe positioning	2.9	Rectangular	1.732050808	1	1.7	∞
Extrapolation & integration	1	Rectangular	1.732050808	1	0.6	∞
Dipole						
Dipole Positioning	2	Normal	1.732050808	1	1.2	∞
Power & Power Drift	4.7	Normal	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)	2.1	Normal	1	0.64	1.3	∞
Liquid permittivity (target)	5	Rectangular	1.732050808	0.6	1.7	∞
Liquid permittivity (measured)	4.9	Normal	1	0.6	2.9	∞
Combined Standard Uncertainty					**9.33**	
Expanded Uncertainty (k=2)					**18.66**	
Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003 and IEC Standard 62209-1:2005						

12. Test Equipment List

TEST EQUIPMENT	ASSET NO.	SERIAL NO.	DATE OF CAL.	CAL. DUE DATE
SPEAG DASY4 Measurement Server	00158	1078	N/A	N/A
SPEAG Robot	00046	599396-01	N/A	N/A
SPEAG DAE4	00019	353	21Jun06	21Jun07
SPEAG EX3DV4 E-Field Probe	00213	3600	24Jan07	24Jan08
2450 MHz Validation Dipole	00025	150	08Jun07	08Jun08
SPEAG SAM Phantom V4.0C	00154	1033	N/A	N/A
ALS-PR-DIEL Dielectric Probe Kit	00160	260-00953	N/A	N/A
Gigatronics 8652A Power Meter	00007	1835272	26Mar07	26Mar08
Gigatronics 80701A Power Sensor	00014	1833699	22Jan07	22Jan08
Gigatronics 80701A Power Sensor	00109	1834366	26Mar07	26Mar08
HP 8753ET Network Analyzer	00134	US39170292	20Apr07	20Apr08
HP 8648D Signal Generator	00005	3847A00611	NCR	NCR
Amplifier Research 5S1G4 Power Amplifier	00106	26235	NCR	NCR

APPENDIX F - PROBE CALIBRATION

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

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

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

Accreditation No.: SCS 108

Client Celitech

Certificate No: EX3-3600_Jan07

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3600
Calibration procedure(s)	QA CAL-01.v5 and QA CAL-14.v3 Calibration procedure for dosimetric E-field probes
Calibration date:	January 24, 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	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41495277	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41498087	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-06 (METAS, No. 217-00592)	Aug-07
Reference 20 dB Attenuator	SN: S5086 (20b)	4-Apr-06 (METAS, No. 251-00558)	Apr-07
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-06 (METAS, No. 217-00593)	Aug-07
Reference Probe ES3DV2	SN: 3013	4-Jan-07 (SPEAG, No. ES3-3013_Jan07)	Jan-08
DAE4	SN: 654	21-Jun-06 (SPEAG, No. DAE4-654_Jun06)	Jun-07

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: January 24, 2007

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

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

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

Accreditation No.: SCS 108

Glossary:

TSL	tissue simulating liquid
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., $\vartheta = 0$ 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) CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ 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 $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *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.

Probe EX3DV4

SN:3600

Manufactured: January 10, 2007
Calibrated: January 24, 2007

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: EX3DV4 SN:3600

Sensitivity in Free Space[A] Diode Compression[B]

NormX	**0.460** ± 10.1%	$\mu V/(V/m)^2$	DCP X	**90** mV
NormY	**0.470** ± 10.1%	$\mu V/(V/m)^2$	DCP Y	**88** mV
NormZ	**0.380** ± 10.1%	$\mu V/(V/m)^2$	DCP Z	**89** mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL **1810 MHz** **Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance		**2.0 mm**	**3.0 mm**
SAR_{be} [%]	Without Correction Algorithm	4.5	3.5
SAR_{be} [%]	With Correction Algorithm	0.2	0.4

TSL **5800 MHz** **Typical SAR gradient: 30 % per mm**

Sensor Center to Phantom Surface Distance		**2.0 mm**	**3.0 mm**
SAR_{be} [%]	Without Correction Algorithm	3.5	2.0
SAR_{be} [%]	With Correction Algorithm	0.1	0.3

Sensor Offset

Probe Tip to Sensor Center	**1.0** mm

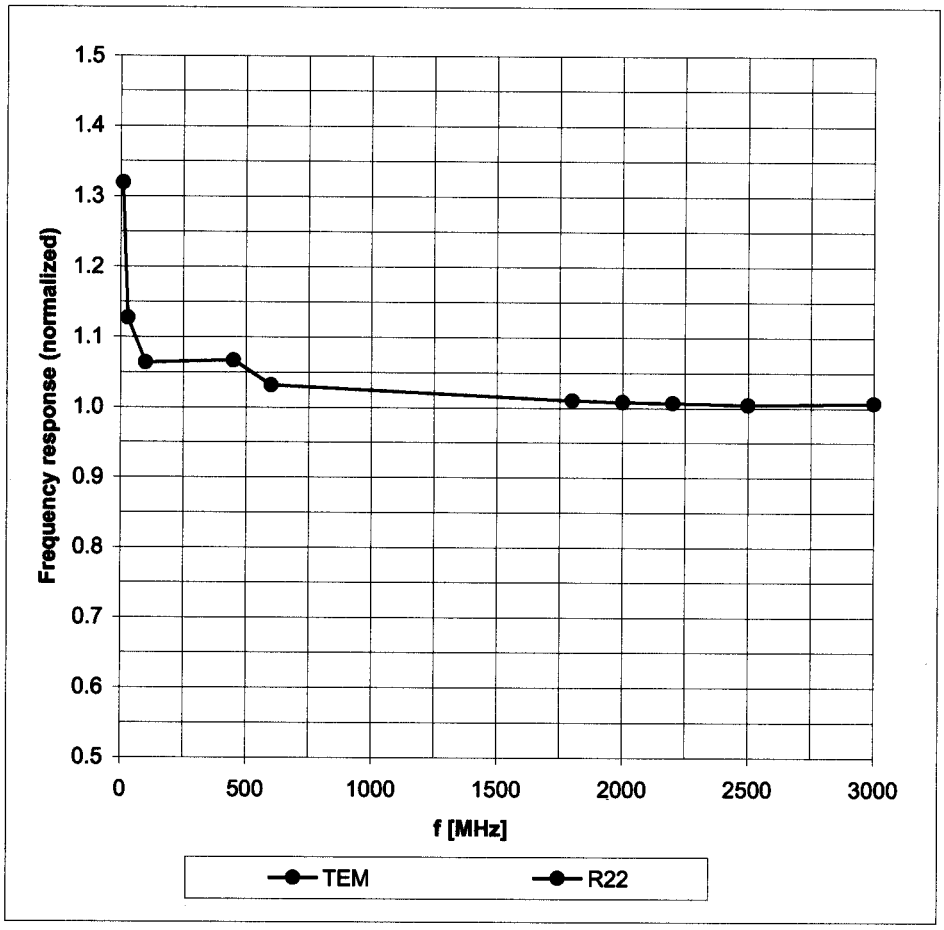
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Page 8).

[B] Numerical linearization parameter: uncertainty not required.

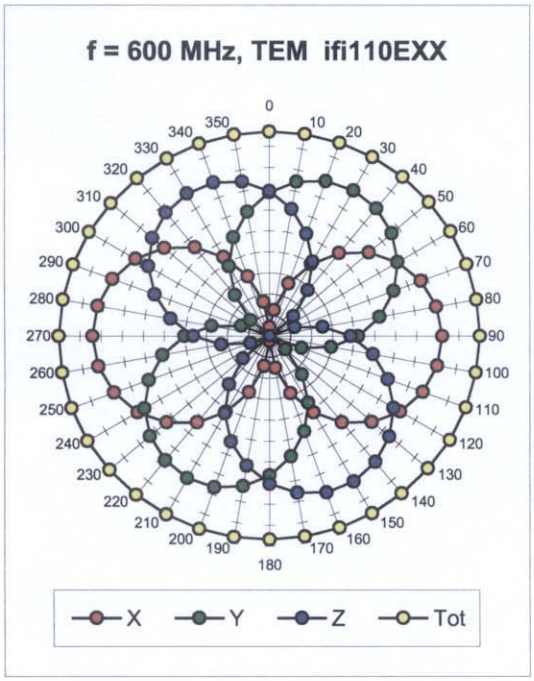
Frequency Response of E-Field

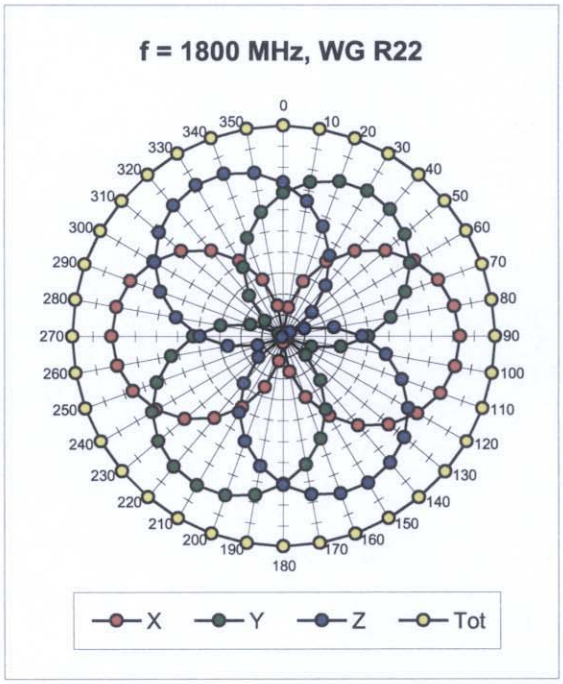
(TEM-Cell:ifi110 EXX, Waveguide: R22)

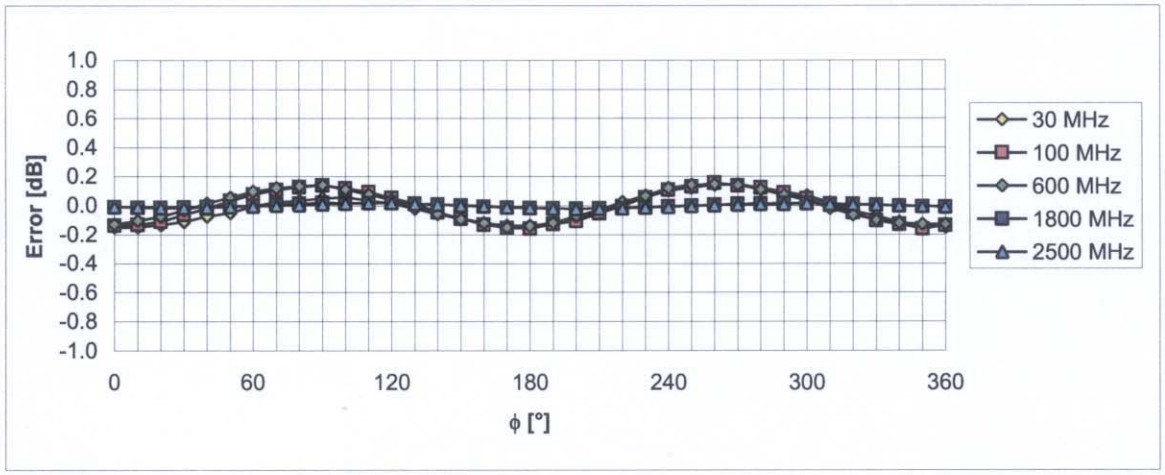


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



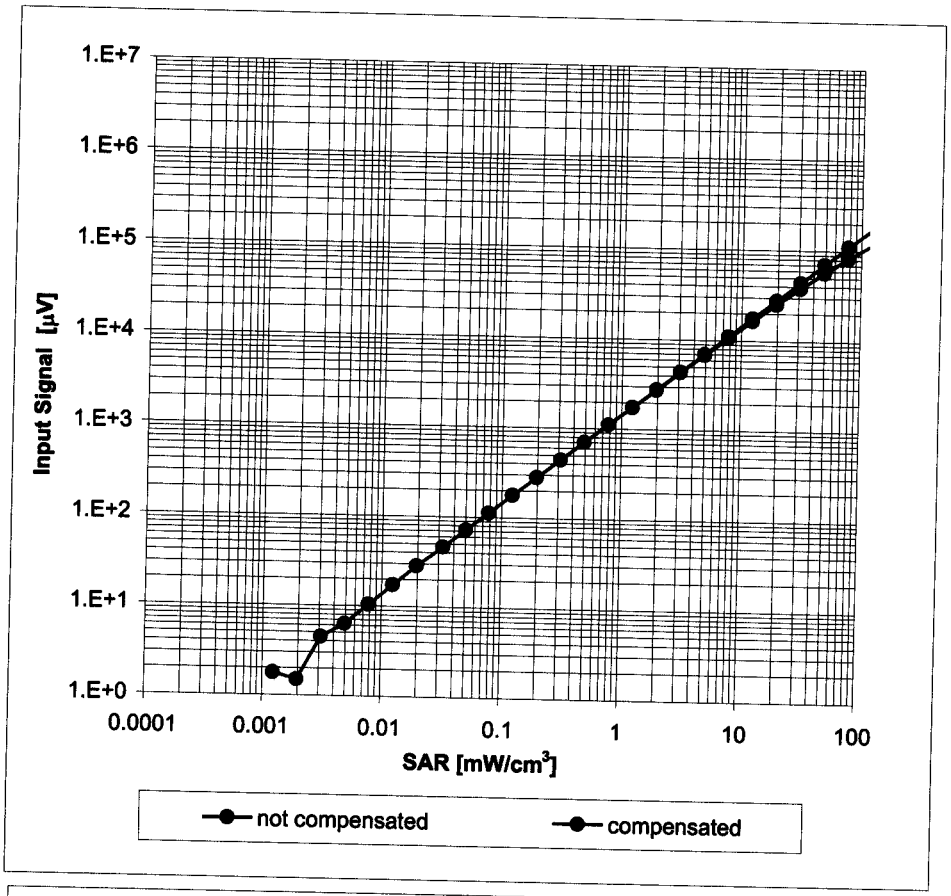


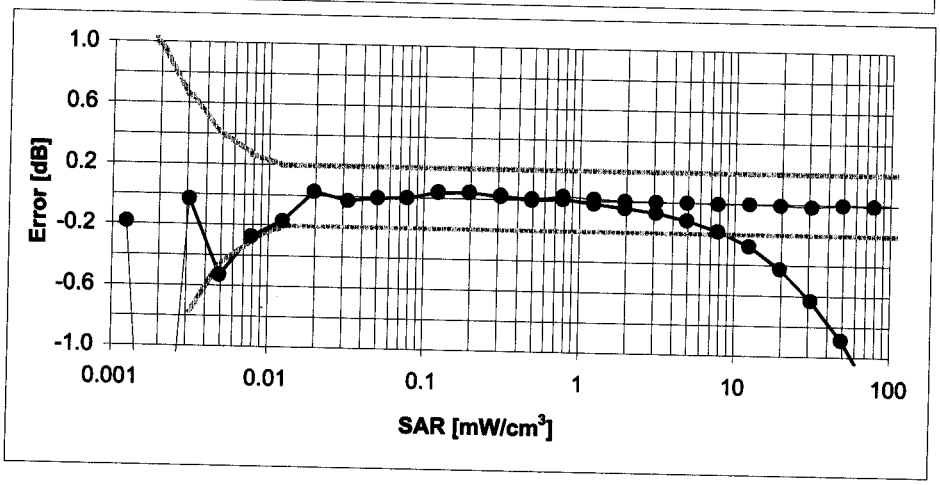


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

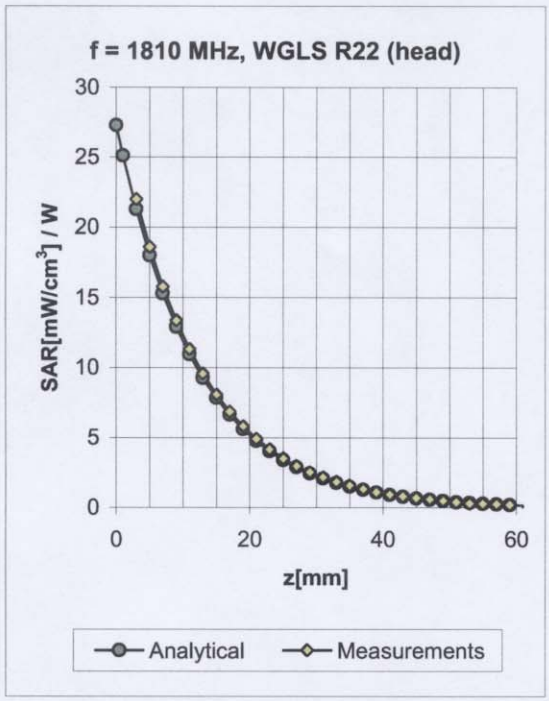
(Waveguide R22, f = 1800 MHz)

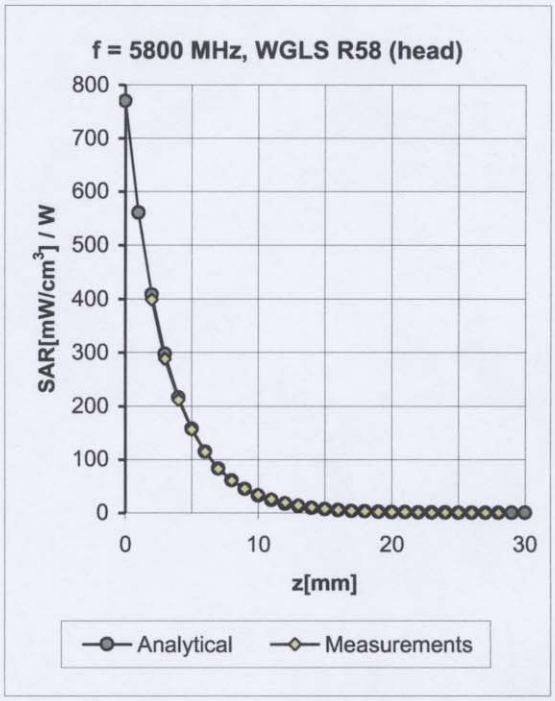




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



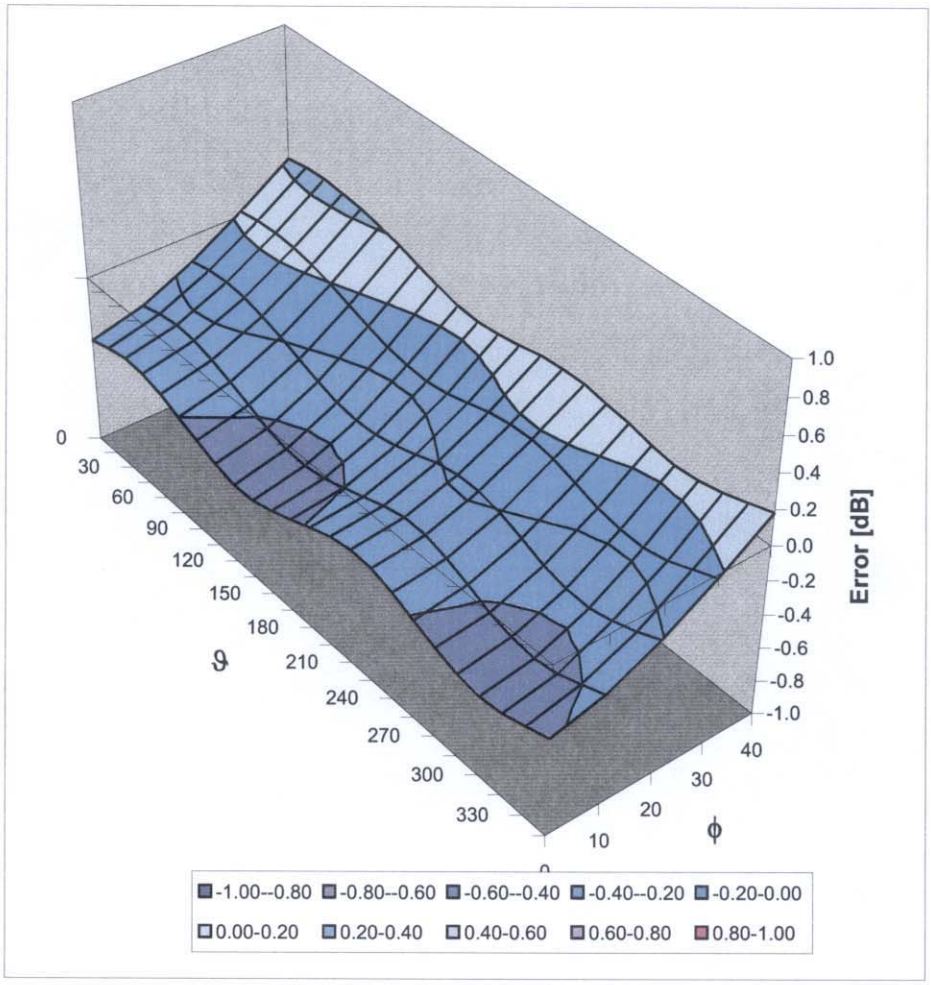


f [MHz]	Validity [MHz][C]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.20	1.01	7.02 ± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.26	1.05	6.59 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.44	1.00	6.37 ± 11.8% (k=2)
5800	± 50 / ± 100	Head	35.3 ± 5%	5.27 ± 5%	0.37	1.65	4.34 ± 13.1% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.24	1.06	6.85 ± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.16	1.35	6.54 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.42	1.00	6.31 ± 11.8% (k=2)
5200	± 50 / ± 100	Body	49.0 ± 5%	5.30 ± 5%	0.35	1.70	4.10 ± 13.1% (k=2)
5500	± 50 / ± 100	Body	48.6 ± 5%	5.65 ± 5%	0.32	1.70	3.95 ± 13.1% (k=2)
5800	± 50 / ± 100	Body	48.2 ± 5%	6.00 ± 5%	0.33	1.70	4.14 ± 13.1% (k=2)

[C] **The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.**

Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

APPENDIX G - SAM PHANTOM CERTIFICATE OF CONFORMITY

Schmid & Partner
Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

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 Schmid & Partner Engineering AG
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