FCC SAR TEST REPORT

RF EXPOSURE EVALUATION | SPECIFIC ABSORPTION RATE

APPLICANT / MANUFACTURER	DTC COMMUNICATIONS INC. (dba COBHAM SURVEILLANCE)		
DEVICE UNDER TEST (DUT)	WIRELESS BODY-WORN VIDEO VEST COFDM TRANSMITTER		
DEVICE MODEL(S)	VMD-TX-100-S		
TRANSMIT FREQUENCY RANGE	2451.0 - 2482.5 MHz		
MANUF. RATED OUTPUT POWER	20 dBm	100 mW	Average Conducted
DUT MODULATION TYPE(S)	QPSK	16-QAM	64-QAM
DUT BANDWIDTH MODE(S)	Ultra-Narrow	Narrow	DVB-T
DUT OPERATING BANDWIDTHS	1.25 MHz	2.5 MHz	6, 7, 8 MHz
DEVICE IDENTIFIER(S)	FCC ID:	H25VMDTX100S	
APPLICATION TYPE	FCC TCB Certification		
APPLICABLE RULE PART(S)	FCC Part 90		
STANDARD(S) APPLIED	FCC 47 CFR §2.1093		
PROCEDURE(S) APPLIED	FCC OET Bulletin 65, Supplement C (01-01)		
	FCC KDB 447498 D01v04		
	IEEE 1528-2003		
	IEC 62209-2 (Draft)		
FCC DEVICE CLASSIFICATION	Licensed Non-Broadcast Transmitter Worn on Body (TNT)		
RF EXPOSURE LIMIT(S) APPLIED	Uncontrolled / General Population		
RF EXPOSURE EVALUATION(S)	Body-worn		
DATE(S) OF EVALUATION	December 21, 2009		
TEST REPORT SERIAL NO.	121409H25-T997-S90C		
TEST REPORT REVISION NO.	Revision 1.1	See Page 4	March 18, 2010
	Revision 1.0	Initial Release	January 20, 2010
TEST REPORT SIGNATORIES	Testing Performed By	Test Report Prepared By	
	Sean Johnston - Celltech Labs	Jon Hughes - Celltech Labs	
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)	ISO/IEC 17025:2005 (A2LA Test Lab Certificate No. 2470.01)		

DECLARATION OF COMPLIANCE
SAR RF EXPOSURE EVALUATION

Test Lab Information	**Name**	**CELLTECH LABS INC.**					
	Address	21-364 Lougheed Road, Kelowna, B.C. V1X 7R8 Canada					
Applicant Information	**Name**	**DTC COMMUNICATIONS INC. (dba COBHAM SURVEILLANCE)**					
	Address	486 Amherst Street, Nashua, New Hampshire 03063 United States					
Standard(s) Applied	**FCC**	47 CFR §2.1093					
Procedure(s) Applied	**FCC**	OET Bulletin 65, Supplement C	KDB 447498 D01v04				
	IEEE	1528-2003					
	IEC	62209-2 (Draft)					
Device Classification(s)	**FCC**	Licensed Non-Broadcast Transmitter Worn on Body (TNT) - Part 90					
Device Identifier(s)	**FCC ID:**	H25VMDTX100S					
Device Model(s)	VMD-TX-100-S						
Test Sample Serial No.	TT000991 (Identical Prototype)						
Device Description	Wireless Body-worn Video Vest COFDM Transmitter						
Transmitter Hardware Revision No.	Revision 2						
Transmitter Software Revision No.	Revision 1.3						
DUT Modulation Type(s)	QPSK, 16-QAM, 64-QAM						
DUT Bandwidths & Modes	1.25 MHz - Ultra Narrow	2.5 MHz - Narrow	6, 7, 8 MHz - DVB-T				
Transmitter Frequency Range	2451.0 - 2482.5 MHz						
VMD Transmitter Box Dimensions	L 64 mm x W 47 mm x H 11 mm						
RF Output Power Levels Tested	BW Mode	Bandwidth	Freq. MHz	Channel	dBm	mW	Method
	Ultra Narrow	1.25 MHz	2451.0	Low	20.0	100.0	Average Conducted
			2466.0	Mid	20.2	104.7	
			2482.5	High	20.4	109.7	
Antenna Type(s) Tested	Dual Patch Antenna	L 50 mm x W 50 mm x H 7 mm	P/N: 4045006-1				
Antenna Cable Length(s)	28.8 cm (VMD to Splitter)	30 cm (Patch Antenna 1)	64 cm (Patch Antenna 2)				
Battery Type(s) Tested	AA x9	13.5 VDC	Energizer Lithium Battery Pack	P/N: 4045214			
Body-worn Accessories Tested	VidiVest	No Metal Components	P/N: 1088185				
Accessories Connected to DUT	**Audio**	Microphone	**Video**	Camera			
Max. SAR Level(s) Evaluated	Body-worn	**0.087 W/kg**	1g average	General Population / Uncontrolled Exp.			
FCC Spatial Peak SAR Limit	Body-worn	1.6 W/kg	1g average				

Celltech Labs Inc. declares under its sole responsibility that this wireless portable device has demonstrated compliance with the Specific Absorption Rate (SAR) RF exposure requirements specified in FCC 47 CFR §2.1093 for the Uncontrolled / General Population Exposure environment. The device was tested in accordance with the measurement procedures specified in FCC OET Bulletin 65, Supplement C (Edition 01-01), IEEE Standard 1528-2003 and IEC International Standard 62209-2 (Draft). 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**	**Celltech Labs Inc.**

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REVISION HISTORY		
REVISION NO.	**DESCRIPTION**	**RELEASE DATE**
1.1	Corrected Model Listing (all pages)	March 18, 2010
1.0	Initial Release	January 20, 2010

1.0 INTRODUCTION

This measurement report demonstrates that the DTC Communications Inc. Model: VMD-TX-100-S Wireless Body-worn Video Vest COFDM Transmitter complies with the SAR (Specific Absorption Rate) RF exposure requirements specified in FCC 47 CFR §2.1093 (see reference [1]) under the General Population / Uncontrolled Exposure limit. The measurement procedures described in FCC OET Bulletin 65, Supplement C 01-01 (see reference [2]), IEEE Standard 1528-2003 (see reference [3]) and International Draft Standard IEC 62209-2 (see reference [4]) were employed. A description of the device, 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 head 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 a controller with a built in VME-bus computer.

3.0 RF CONDUCTED OUTPUT POWER MEASUREMENTS

MEASURED RF CONDUCTED OUTPUT POWER LEVELS

Test Frequency (MHz)	Test Channel	1.25 MHz Bandwidth		Measurement Method
		dBm	mW	
2451.0	Low	20.0	100.0	Average Conducted
2466.0	Middle	20.2	104.7	Average Conducted
2482.5	High	20.4	109.7	Average Conducted

Notes

1. The RF conducted output power levels of the DUT were measured by Celltech prior to the SAR evaluations using a Gigatronics 8652A Universal Power Meter.
2. The 2.5 MHz, 6 MHz, 7 MHz and 8 MHz bandwidths were also measured and were the same or lower than above.

4.0 SAR PROBE CALIBRATION & MEASUREMENT FREQUENCIES

The following procedures are recommended for measurements at 150 MHz - 3 GHz to minimize probe calibration and tissue dielectric parameter discrepancies. In general, SAR measurements below 300 MHz should be within ±50 MHz of the probe calibration frequency. At 300 MHz to 3 GHz, measurements should be within ±100 MHz of the probe calibration frequency. Measurements exceeding 50% of these intervals, ±25 MHz < 300 MHz and ±50 MHz ≥300 MHz, require additional steps (per FCC KDB 450824 D01 v01r01, SAR Probe Calibration and System Verification Considerations for Measurements at 150 MHz - 3 GHz - see reference [6]).

Probe Calibration Freq.	Device Measurement Freq.	Frequency Interval	±50 MHz ≥ 300 MHz
2450 MHz	2451.0 MHz	1 MHz	< 50 MHz
	2466.0 MHz	16 MHz	< 50 MHz
	2482.5 MHz	32.5 MHz	< 50 MHz
The probe calibration and measurement frequency interval is < 50 MHz; therefore the additional steps are not required.			

5.0 SIMULATED EQUIVALENT TISSUES

The simulated equivalent tissue recipe in the table below are derived from the SAR system manufacturer's suggested recipe in the DASY4 manual (see reference [7]) in accordance with the procedures and requirements specified in IEEE Standard 1528-2003 (see reference [3]). The ingredient percentage may have been adjusted minimally in order to achieve the appropriate target dielectric parameters within the specified tolerance.

SIMULATED EQUIVALENT TISSUE MIXTURE	
INGREDIENT	2450 MHz BODY
Water	69.98 %
Glycol Monobutyl	30.00 %
Salt	0.02 %

6.0 SAR LIMITS

SAR RF EXPOSURE LIMITS			
FCC 47 CFR 2.1093	Health Canada Safety Code 6	(General Population / Uncontrolled Exposure)	(Occupational / Controlled Exposure)
Spatial Average (averaged over the whole body)		0.08 W/kg	0.4 W/kg
Spatial Peak (averaged over any 1 g of tissue)		1.6 W/kg	8.0 W/kg
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)		4.0 W/kg	20.0 W/kg
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.			

7.0 SAR MEASUREMENT SUMMARY

BODY SAR MEASUREMENT SUMMARY

Test Date	Freq. MHz	Ch.	Crest Factor	Test Mode	Bandwidth	Battery Type	Accessory Type(s)	Antenna Type	Antenna Distance to Planar Phantom	Cond. Power Before Test dBm	SAR Drift During Test dB	Measured SAR 1g average
Dec 21	2451.0	Low	1:1	QPSK	1.25 MHz	Lithium AA	VidiVest Microphone Video Camera	Dual Patch 1	Touch	20.0	-0.07	0.077 W/kg
Dec 21	2466.0	Mid	1:1	QPSK	1.25 MHz				Touch	20.2	0.202	0.075 W/kg
Dec 21	2482.5	High	1:1	QPSK	1.25 MHz				Touch	20.4	0.108	**0.087 W/kg**
Dec 21	2451.0	Low	1:1	QPSK	1.25 MHz	Lithium AA	VidiVest Microphone Video Camera	Dual Patch 2	Touch	20.0	0.249	0.034 W/kg
Dec 21	2466.0	Mid	1:1	QPSK	1.25 MHz				Touch	20.2	0.038	0.037 W/kg
Dec 21	2482.5	High	1:1	QPSK	1.25 MHz				Touch	20.4	-0.313	0.040 W/kg

SAR LIMIT(S)	BODY	SPATIAL PEAK	RF EXPOSURE CATEGORY
FCC 47 CFR 2.1093	1.6 W/kg	averaged over 1 gram	General Population / Uncontrolled

Date(s) of Measurements	December 21, 2009					Ambient Temperature	24.1	°C
Fluid Dielectric Parameters	IEEE Target - 2450 MHz			2470 MHz Measured	Deviation	Fluid Temperature	23.1	°C
Dielectric Constant ε_r	BODY	52.7	±5%	51.2	-2.8%	Fluid Depth	≥ 15	cm
						Relative Humidity	35	%
Conductivity σ (mho/m)	BODY	1.95	±5%	2.03	+4.1%	Atmospheric Pressure	101.1	kPa
						ρ (Kg/m^3)	1000	

8.0 DETAILS OF SAR EVALUATION

1. Detailed measurement data and plots showing the maximum SAR location of the DUT are reported in Appendix A.
2. The DUT was tested for body-worn SAR with dual patch antenna 1 placed inside the rear upper right side pouch of the VidiVest. The back side of the antenna was facing parallel to the SAM phantom (planar section) and the outer section of the rear antenna VidiVest pouch was touching the outer surface of the SAM phantom (planar section).
3. The DUT was tested for body-worn SAR with dual patch antenna 2 placed inside the front upper left side pouch of the VidiVest. The back side of the antenna was facing parallel to the SAM phantom (planar section) and the outer section of the front antenna VidiVest pouch was touching the outer surface of the SAM phantom (planar section).
4. The SAR evaluations were performed with the VMD transmitter and battery pack placed in the appropriate pouch located at the bottom rear side of the VidiVest. The battery pack, microphone and video camera accessories were connected to the VMD transmitter via multi-I/O cable.
5. The DUT was evaluated for SAR with fully charged Lithium AA batteries installed in the battery pack for each test.
6. The conducted power levels were measured prior to the SAR evaluations using a Gigatronics 8652A Universal Power Meter according to the procedures described in FCC 47 CFR §2.1046.
7. The power drift of the DUT was measured by the DASY4 system for the duration of the SAR evaluations.
8. The DUT was evaluated for SAR at the maximum output power level and modulated continuous transmit test mode programmed prior to the SAR evaluations via programming cable, PC and proprietary software provided by customer.
9. The fluid temperature was measured prior to and after the SAR evaluations and the temperature remained within +/- 2°C of the fluid temperature reported during the dielectric parameter measurements.
10. The dielectric parameters of the simulated tissue mixtures were measured prior to the SAR evaluations using a Dielectric Probe Kit and a Network Analyzer (see Appendix C).

9.0 SAR 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.

c. An area scan was determined as follows:

d. 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.

e. 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:

f. 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 was set to 3.0 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.

g. 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).

h. For frequencies < 3 GHz a zoom scan volume of 24 mm x 24 mm x 24 mm (7x7x7 points) centered at the peak SAR location determined from the area scan was used and a zoom scan resolution of 5 mm x 5 mm x 5 mm was used.

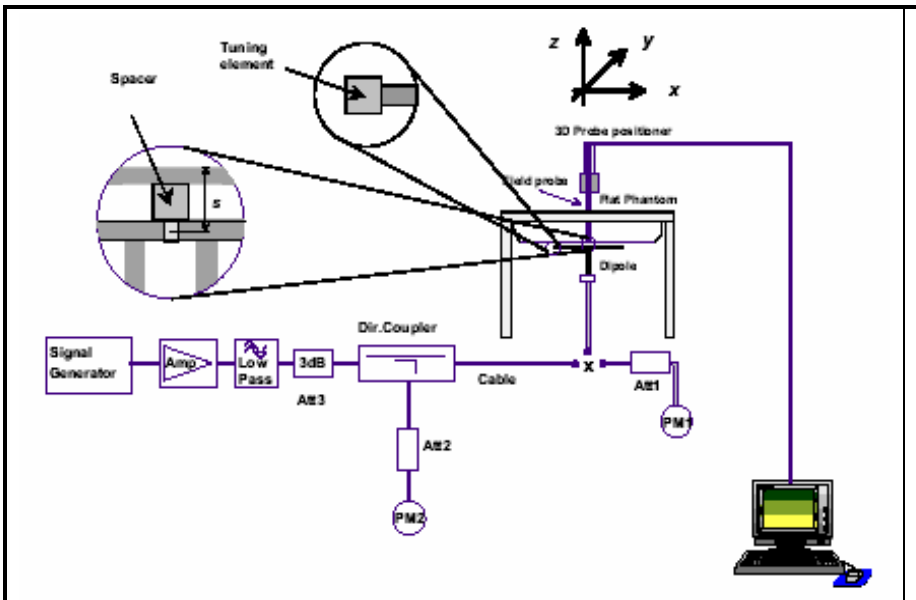
10.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluations a daily system check was performed at the planar section of the SAM phantom with a 2450MHz SPEAG dipole (see Appendix B for system performance check test plot) in accordance with the procedures described in IEEE Standard 1528-2003 (see reference [3]). A forward power of 250 mW was applied to the dipole and the system was verified to a tolerance of ±10% from the system manufacturer's dipole calibration target SAR value (see Appendix E for system manufacturer's dipole calibration procedures).

SYSTEM PERFORMANCE CHECK EVALUATION

Test Date	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)
	2450 MHz	SPEAG Target	Meas.	Dev.	SPEAG Target	Meas.	Dev.	SPEAG Target	Meas.	Dev.						
Dec 21	BODY	12.9 ±10%	13.4	+3.9%	54.4 ± 5%	51.7	-5.0%	1.98 ± 5%	2.02	+2.0%	1000	24.1	23.1	≥ 15	35	101.1

Notes	
	1. The target SAR values are the measured values from the dipole calibration performed by SPEAG (see Appendix E).
	2. The target dielectric parameters are the measured values from the dipole calibration performed by SPEAG (see Appendix E).
	3. The fluid temperature was measured prior to and after the system performance check to ensure the temperature remained within +/-2°C of the fluid temperature reported during the dielectric parameter measurements.
	4. 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).



System Performance Check Measurement Setup (IEEE Standard 1528-2003)

2450 MHz Validation Dipole Setup

11.0 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

12.0 PROBE SPECIFICATIONS (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 □W/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

13.0 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 Twin Phantom V4.0C).

SAM Twin Phantom V4.0C

14.0 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. For evaluation of devices with a larger footprint (e.g. Laptop PC, Tablet PC), or to avoid perturbation due to device holder clamps for devices with a smaller footprint, a Plexiglas platform is attached to the device holder.

Device Holder

15.0 TEST EQUIPMENT LIST

TEST EQUIPMENT		ASSET NO.	SERIAL NO.	PREVIOUS CALIBRATION	CALIBRATION DUE DATE
USED	DESCRIPTION				
x	Schmid & Partner DASY4 System	-	-	-	-
x	-DASY4 Measurement Server	00158	1078	CNR	CNR
x	-Robot	00046	599396-01	CNR	CNR
x	-DAE4	00019	353	28Apr09	28Apr10
x	-EX3DV4 E-Field Probe	00213	3600	28Apr09	28Apr10
x	-D2450V2 Validation Dipole	00219	825	17Apr09	17Apr10
x	-SAM Twin Phantom V4.0C	00154	1033	CNR	CNR
x	HP 85070C Dielectric Probe Kit	00033	none	CNR	CNR
x	HP E4408B Spectrum Analyzer	00015	US39240170	23Apr08	28Apr10
x	Gigatronics 8652A Power Meter	00007	1835272	23Apr08	28Apr10
x	Gigatronics 80701A Power Sensor	00014	1833699	23Apr08	28Apr10
x	HP 8753ET Network Analyzer	00134	US39170292	28Apr08	28Apr10
x	Rohde & Schwarz SMR20 Signal Generator	00006	100104	CNR	CNR
x	Amplifier Research 5S1G4 Power Amplifier	00106	26235	CNR	CNR
Abbr.	CNR = Calibration Not Required				

16.0 MEASUREMENT UNCERTAINTIES

UNCERTAINTY BUDGET FOR DEVICE EVALUATION

Uncertainty Component	IEEE 1528 Section	Uncertainty Value ±%	Probability Distribution	Divisor	ci 1g	ci 10g	Uncertainty Value ±% (1g)	Uncertainty Value ±% (10g)	V_i or V_{eff}
Measurement System									
Probe Calibration (2450 MHz)	E.2.1	5.5	Normal	1	1	1	5.5	5.5	∞
Axial Isotropy	E.2.2	4.7	Rectangular	1.732050808	0.7	0.7	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	Rectangular	1.732050808	0.7	0.7	3.9	3.9	∞
Boundary Effect	E.2.3	1	Rectangular	1.732050808	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	Rectangular	1.732050808	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1	Rectangular	1.732050808	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	Normal	1	1	1	0.3	0.3	∞
Response Time	E.2.7	0.8	Rectangular	1.732050808	1	1	0.5	0.5	∞
Integration Time	E.2.8	2.6	Rectangular	1.732050808	1	1	1.5	1.5	∞
RF Ambient Conditions	E.6.1	3	Rectangular	1.732050808	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	Rectangular	1.732050808	1	1	0.2	0.2	∞
Probe Positioning wrt Phantom Shell	E.6.3	2.9	Rectangular	1.732050808	1	1	1.7	1.7	∞
Extrapolation, interpolation & integration algorithms for max. SAR evaluation	E.5	1	Rectangular	1.732050808	1	1	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	2.9	Normal	1	1	1	2.9	2.9	12
Device Holder Uncertainty	E.4.1	3.6	Normal	1	1	1	3.6	3.6	8
SAR Drift Measurement	6.6.2	5	Rectangular	1.732050808	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4	Rectangular	1.732050808	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5	Rectangular	1.732050808	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measured)	E.3.3	4.1	Normal	1	0.64	0.43	2.6	1.8	∞
Liquid Permittivity (target)	E.3.2	5	Rectangular	1.732050808	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measured)	E.3.3	2.8	Normal	1	0.6	0.49	1.7	1.4	∞
Combined Standard Uncertainty			**RSS**				**10.81**	**10.45**	
Expanded Uncertainty (95% Confidence Interval)			**k=2**				**21.62**	**20.91**	

Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003

17.0 REFERENCES

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

[2] 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.

[3] 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.

[4] International Standard IEC 62209-2 Draft (106-62209-2-CDV_090323) - “Human exposure to radio frequency fields from hand-held & body-mounted wireless comm. devices - Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (30 MHz to 6 GHz)”.

[5] Federal Communications Commission, Office of Engineering and Technology - “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”; KDB 447498 D01v04: November 2009.

[6] Federal Communications Commission, Office of Engineering and Technology - “Application Note: SAR Probe Calibration and System Verification Considerations for Measurements at 150 MHz - 3 GHz”; KDB 450824 D01 v01r01: January 2007.

[7] Schmid & Partner Engineering AG - DASY4 Manual V4.6, Chapter 17 Application Note, Body Tissue Recipe: Sept. 2005.

APPENDIX A - SAR MEASUREMENT DATA

Date Tested: 12/21/2009

Body-worn SAR - Dual Patch Antenna 1 - 2451.0 MHz

DUT: DTC VMD-TX-100-S; Type: Wireless Body-worn Video Vest COFDM Transmitter; Serial: TT000991

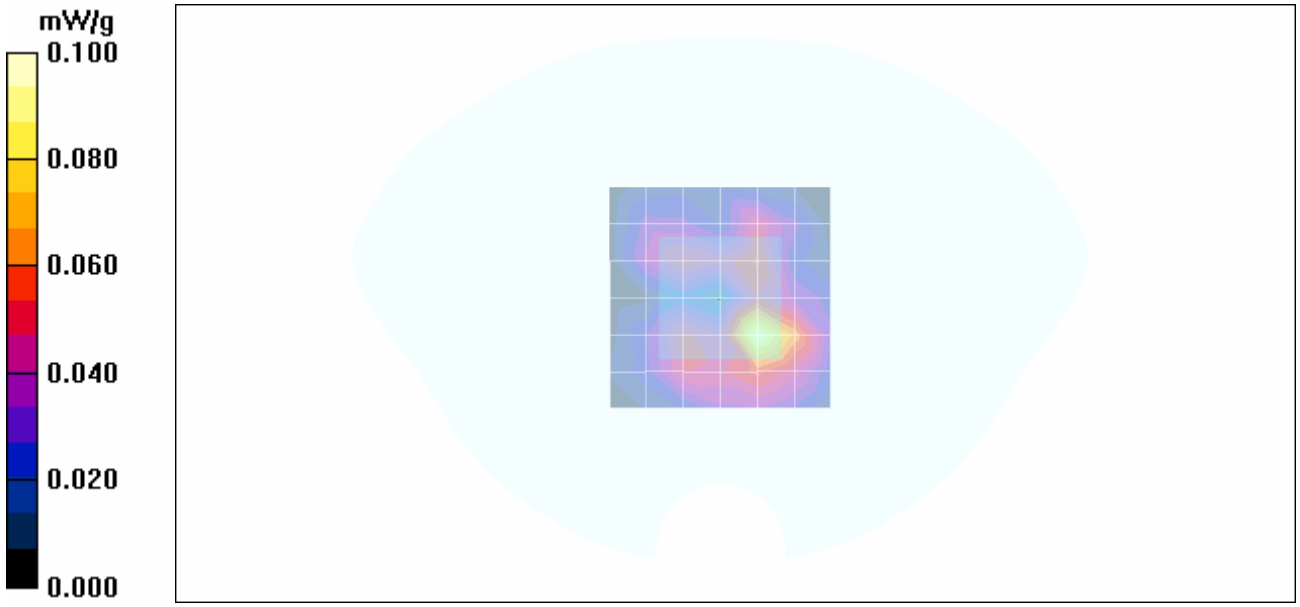
Body-worn Accessory: VidiVest; Audio Accessory: Microphone; Video Accessory: Camera

Ambient Temp: 24.1°C; Fluid Temp: 23.1°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Communication System: COFDM
Frequency: 2451 MHz; Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2451 MHz; σ = 2.03 mho/m; ε_r = 51.2; ρ = 1000 kg/m^3

- Probe: EX3DV4 - SN3600; ConvF(6.25, 6.25, 6.25); Calibrated: 28/04/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 28/04/2009
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body-worn SAR - DUT Transmitter & Dual-Patch Antenna 1 inside VidiVest - Touch Position
Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.094 mW/g
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.06 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.180 W/kg
SAR(1 g) = 0.077 mW/g; SAR(10 g) = 0.036 mW/g
Maximum value of SAR (measured) = 0.100 mW/g



Date Tested: 12/21/2009

Body-worn SAR - Dual Patch Antenna 1 - 2466.0 MHz

DUT: DTC VMD-TX-100-S; Type: Wireless Body-worn Video Vest COFDM Transmitter; Serial: TT000991

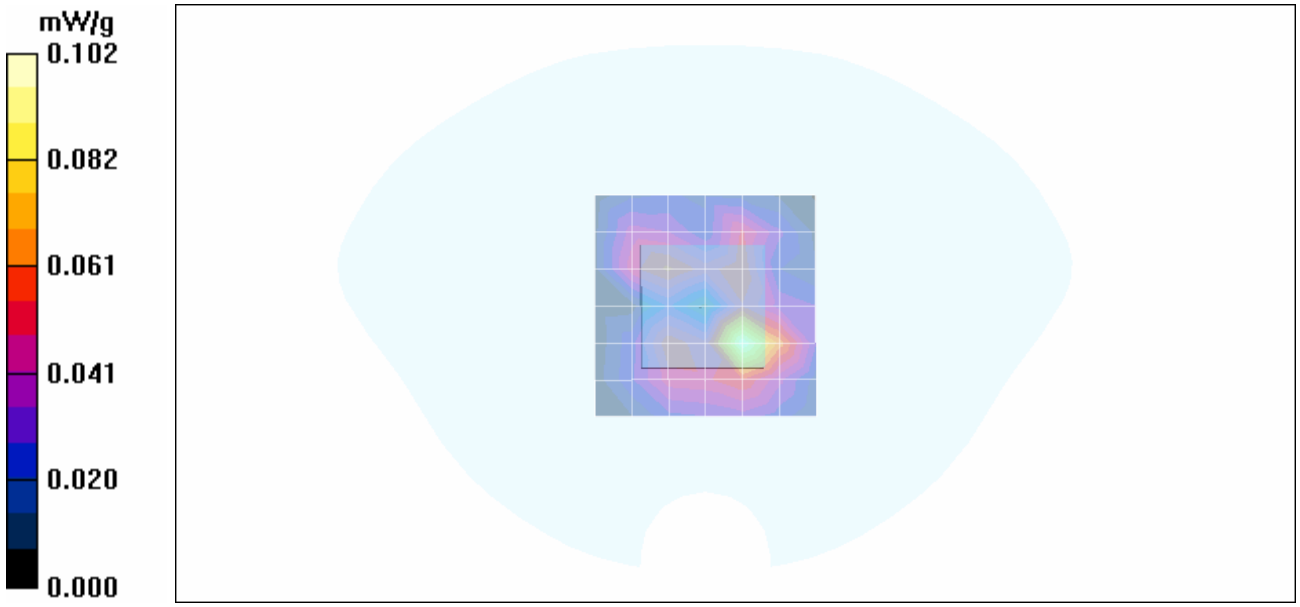
Body-worn Accessory: VidiVest; Audio Accessory: Microphone; Video Accessory: Camera

Ambient Temp: 24.1°C; Fluid Temp: 23.1°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Communication System: COFDM
Frequency: 2466 MHz; Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2466 MHz; σ = 2.03 mho/m; ε_r = 51.2; ρ = 1000 kg/m^3

- Probe: EX3DV4 - SN3600; ConvF(6.25, 6.25, 6.25); Calibrated: 28/04/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 28/04/2009
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body-worn SAR - DUT Transmitter & Dual-Patch Antenna 1 inside VidiVest - Touch Position
Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.102 mW/g
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.50 V/m; Power Drift = 0.202 dB
Peak SAR (extrapolated) = 0.174 W/kg
SAR(1 g) = 0.075 mW/g; SAR(10 g) = 0.034 mW/g



Date Tested: 12/21/2009

Body-worn SAR - Dual Patch Antenna 1 - 2482.5 MHz

DUT: DTC VMD-TX-100-S; Type: Wireless Body-worn Video Vest COFDM Transmitter; Serial: TT000991

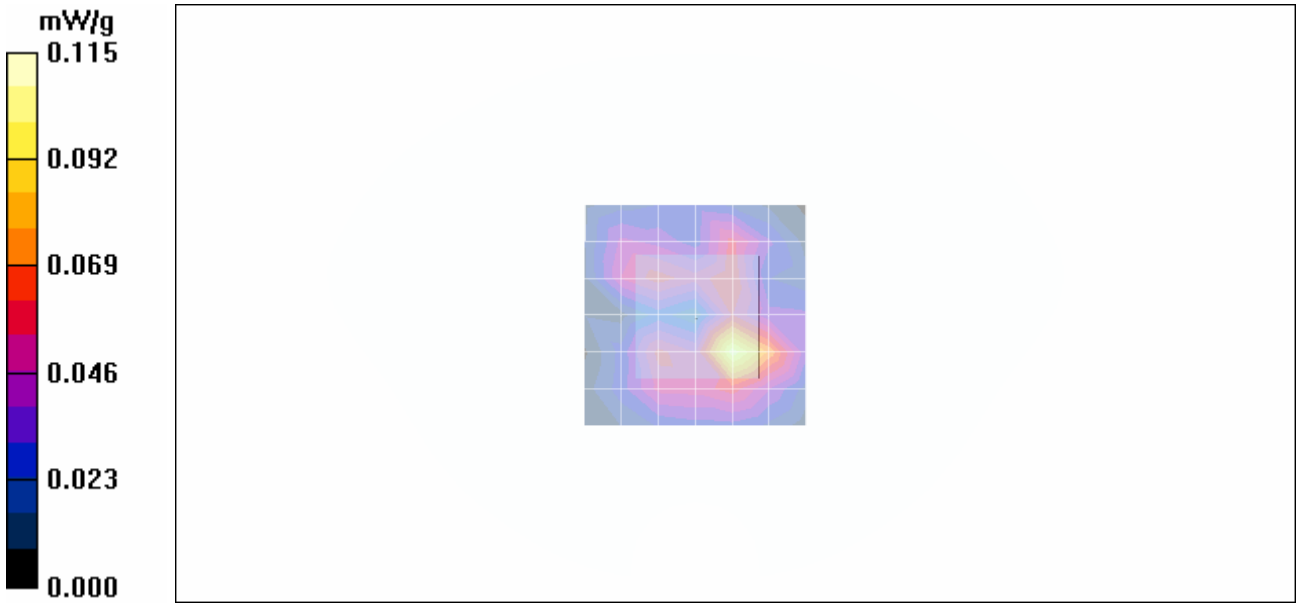
Body-worn Accessory: VidiVest; Audio Accessory: Microphone; Video Accessory: Camera

Ambient Temp: 24.1°C; Fluid Temp: 23.1°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

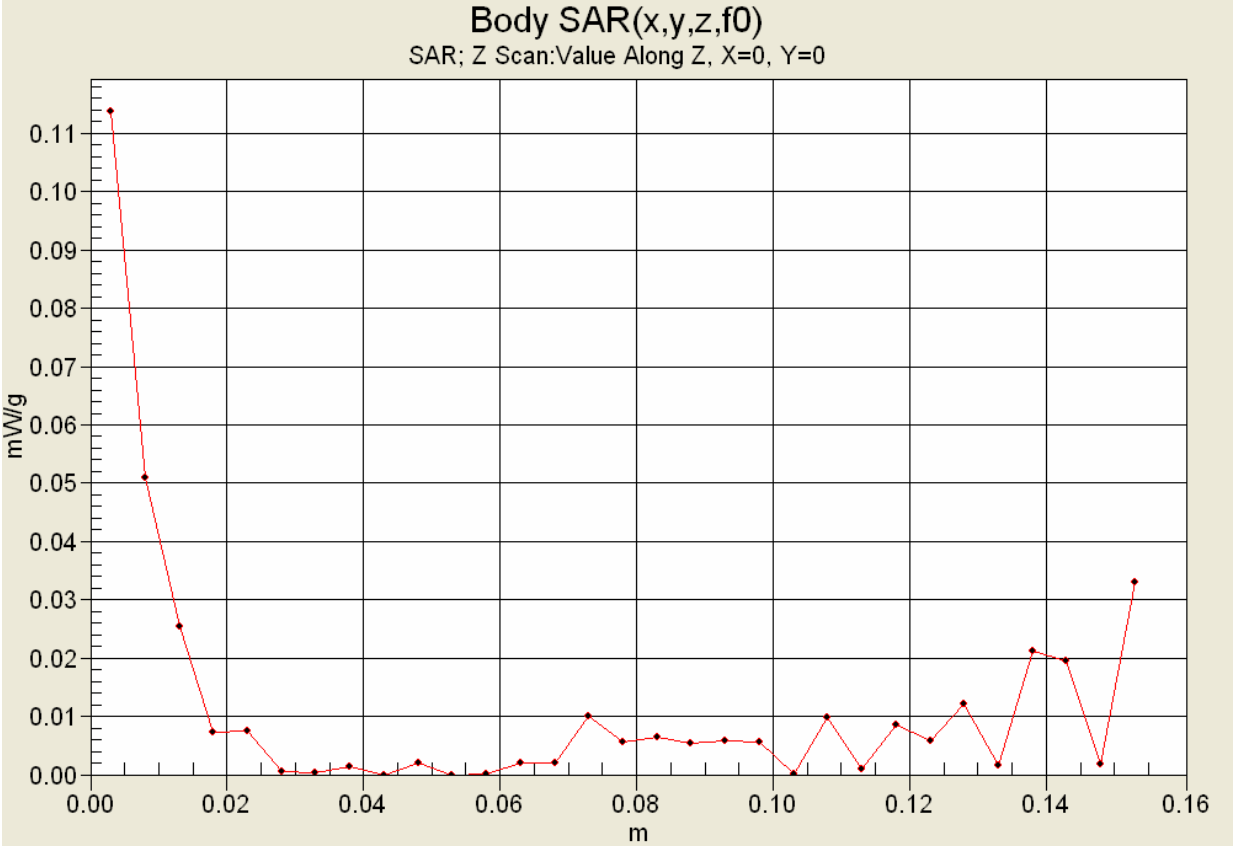
Communication System: COFDM
Frequency: 2482.5 MHz; Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2482.5 MHz; σ = 2.03 mho/m; ε_r = 51.2; ρ = 1000 kg/m^3

- Probe: EX3DV4 - SN3600; ConvF(6.25, 6.25, 6.25); Calibrated: 28/04/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 28/04/2009
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body-worn SAR - DUT Transmitter & Dual-Patch Antenna 1 inside VidiVest - Touch Position
Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.105 mW/g
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.85 V/m; Power Drift = 0.108 dB
Peak SAR (extrapolated) = 0.206 W/kg
SAR(1 g) = 0.087 mW/g; SAR(10 g) = 0.040 mW/g
Maximum value of SAR (measured) = 0.115 mW/g



Z-Axis Scan



Due to the very low SAR level measured, 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.

Date Tested: 12/21/2009

Body-worn SAR - Dual Patch Antenna 2 - 2451.0 MHz

DUT: DTC VMD-TX-100-S; Type: Wireless Body-worn Video Vest COFDM Transmitter; Serial: TT000991

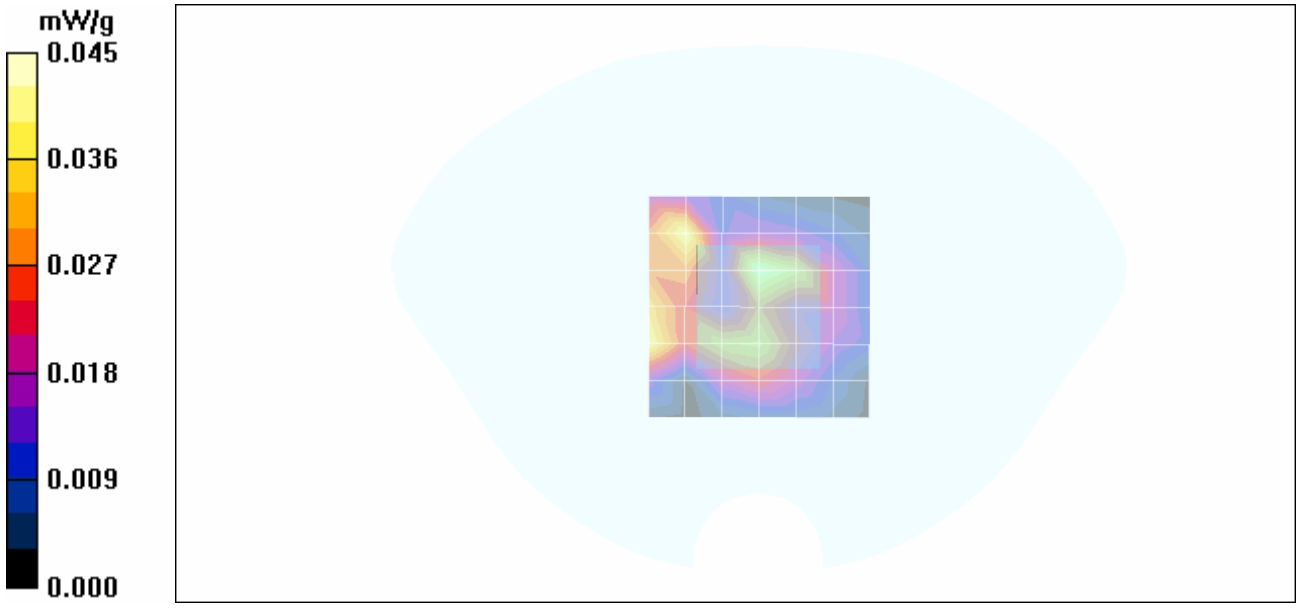
Body-worn Accessory: VidiVest; Audio Accessory: Microphone; Video Accessory: Camera

Ambient Temp: 24.1°C; Fluid Temp: 23.1°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Communication System: COFDM
Frequency: 2451 MHz; Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2451 MHz; σ = 2.03 mho/m; ε_r = 51.2; ρ = 1000 kg/m^3

- Probe: EX3DV4 - SN3600; ConvF(6.25, 6.25, 6.25); Calibrated: 28/04/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 28/04/2009
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body-worn SAR - DUT Transmitter & Dual-Patch Antenna 2 inside VidiVest - Touch Position
Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.042 mW/g
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.57 V/m; Power Drift = 0.249 dB
Peak SAR (extrapolated) = 0.121 W/kg
SAR(1 g) = 0.034 mW/g; SAR(10 g) = 0.016 mW/g
Maximum value of SAR (measured) = 0.045 mW/g



Date Tested: 12/21/2009

Body-worn SAR - Dual Patch Antenna 2 - 2466.0 MHz

DUT: DTC VMD-TX-100-S; Type: Wireless Body-worn Video Vest COFDM Transmitter; Serial: TT000991

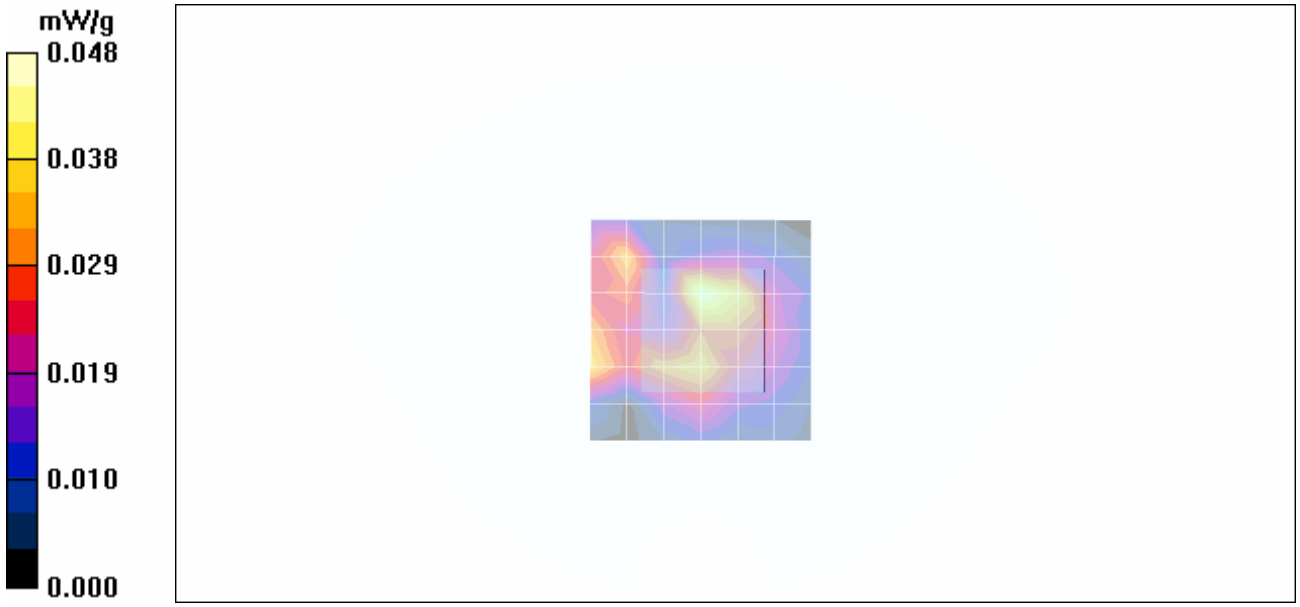
Body-worn Accessory: VidiVest; Audio Accessory: Microphone; Video Accessory: Camera

Ambient Temp: 24.1°C; Fluid Temp: 23.1°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Communication System: COFDM
Frequency: 2466 MHz; Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2466 MHz; σ = 2.03 mho/m; ε_r = 51.2; ρ = 1000 kg/m^3

- Probe: EX3DV4 - SN3600; ConvF(6.25, 6.25, 6.25); Calibrated: 28/04/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 28/04/2009
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body-worn SAR - DUT Transmitter & Dual-Patch Antenna 2 inside VidiVest - Touch Position
Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.046 mW/g
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.76 V/m; Power Drift = 0.038 dB
Peak SAR (extrapolated) = 0.077 W/kg
SAR(1 g) = 0.037 mW/g; SAR(10 g) = 0.017 mW/g
Maximum value of SAR (measured) = 0.048 mW/g



Date Tested: 12/21/2009

Body-worn SAR - Dual Patch Antenna 2 - 2482.5 MHz

DUT: DTC VMD-TX-100-S; Type: Wireless Body-worn Video Vest COFDM Transmitter; Serial: TT000991

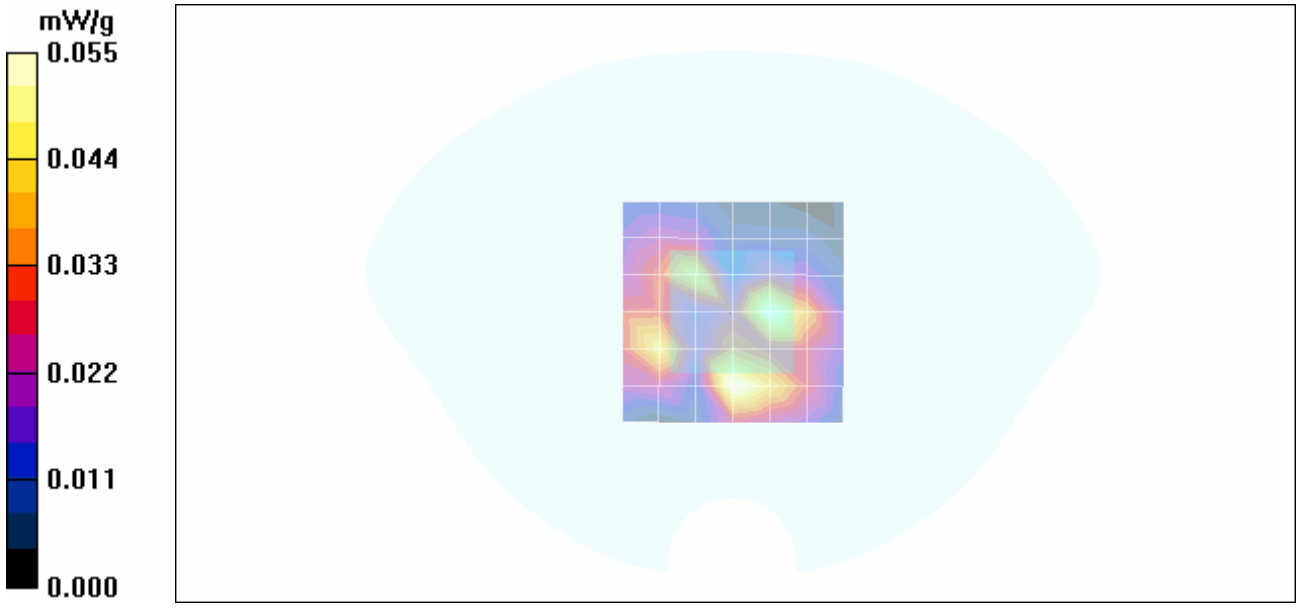
Body-worn Accessory: VidiVest; Audio Accessory: Microphone; Video Accessory: Camera

Ambient Temp: 24.1°C; Fluid Temp: 23.1°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

Communication System: COFDM
Frequency: 2482.5 MHz; Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2482.5 MHz; σ = 2.03 mho/m; ε_r = 51.2; ρ = 1000 kg/m^3

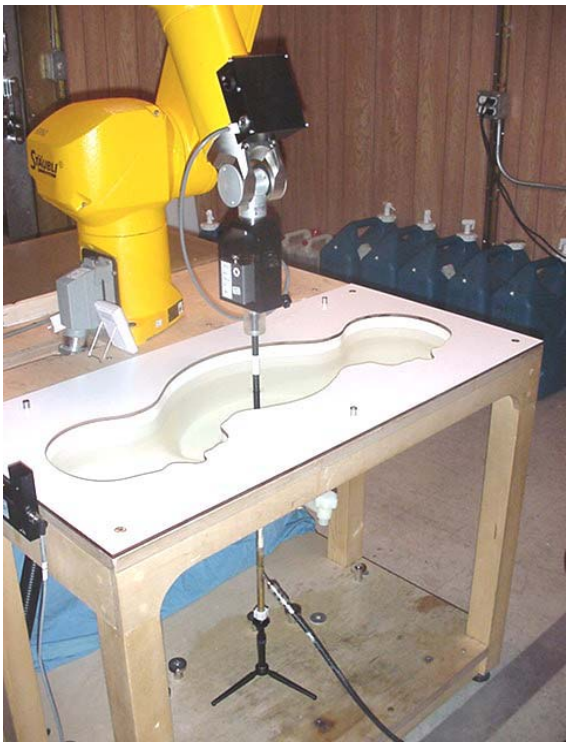
- Probe: EX3DV4 - SN3600; ConvF(6.25, 6.25, 6.25); Calibrated: 28/04/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 28/04/2009
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body-worn SAR - DUT Transmitter & Dual-Patch Antenna 2 inside VidiVest - Touch Position
Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.058 mW/g
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.31 V/m; Power Drift = -0.313 dB
Peak SAR (extrapolated) = 0.087 W/kg
SAR(1 g) = 0.040 mW/g; SAR(10 g) = 0.020 mW/g
Maximum value of SAR (measured) = 0.055 mW/g



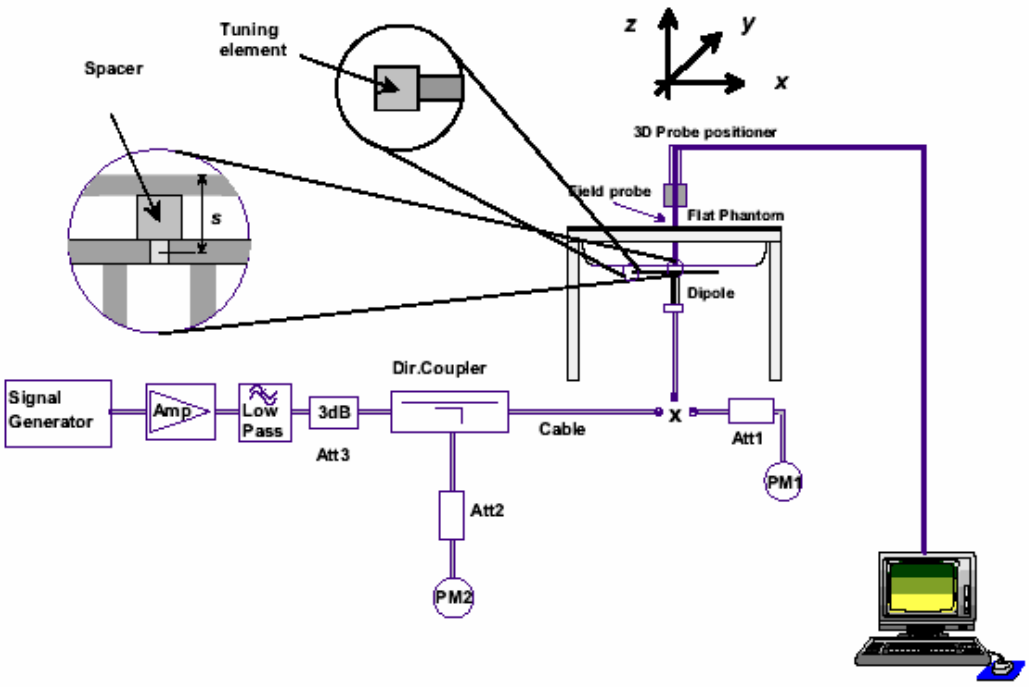
APPENDIX B - SYSTEM PERFORMANCE CHECK

SYSTEM PERFORMANCE CHECK MEASUREMENT SETUP



DASY4 System with SAM Phantom V4.0C & 2450 MHz Fluid

2450 MHz Validation Dipole Setup



System Performance Check Measurement Setup Diagram (IEEE Standard 1528-2003)

Date Tested: 12/21/2009

System Performance Check - 2450 MHz Dipole - MSL

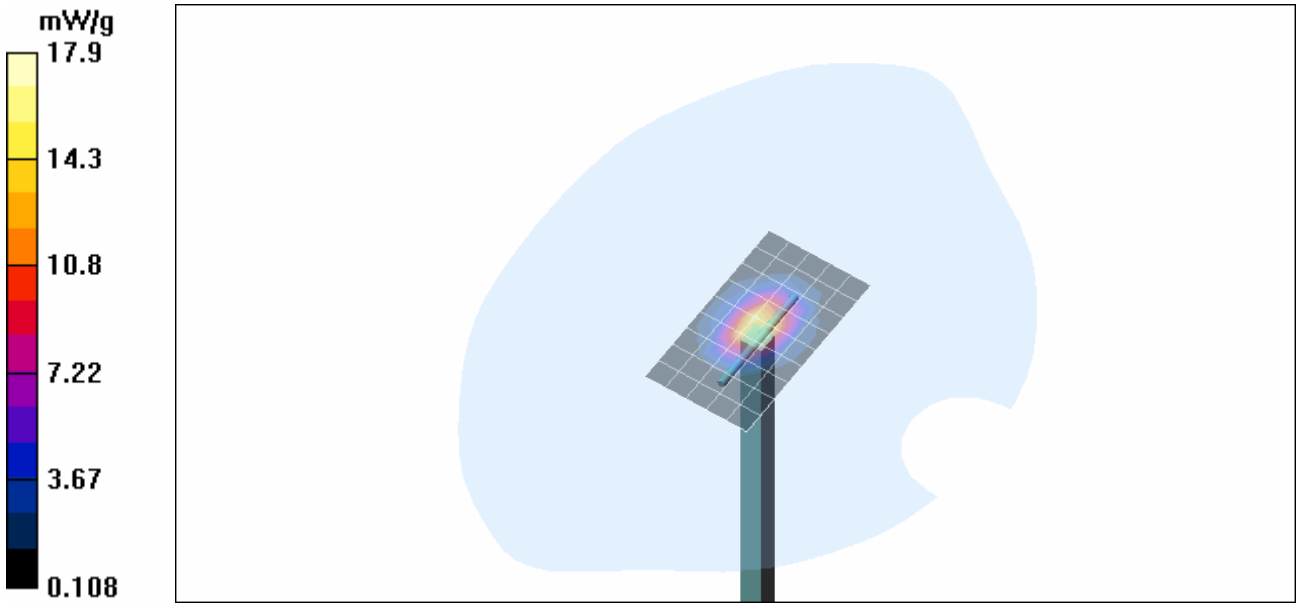
DUT: Dipole D2450V2; Asset: 00219; Serial: 825; Calibration: 04/17/2009

Ambient Temp: 24.1°C; Fluid Temp: 23.1°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

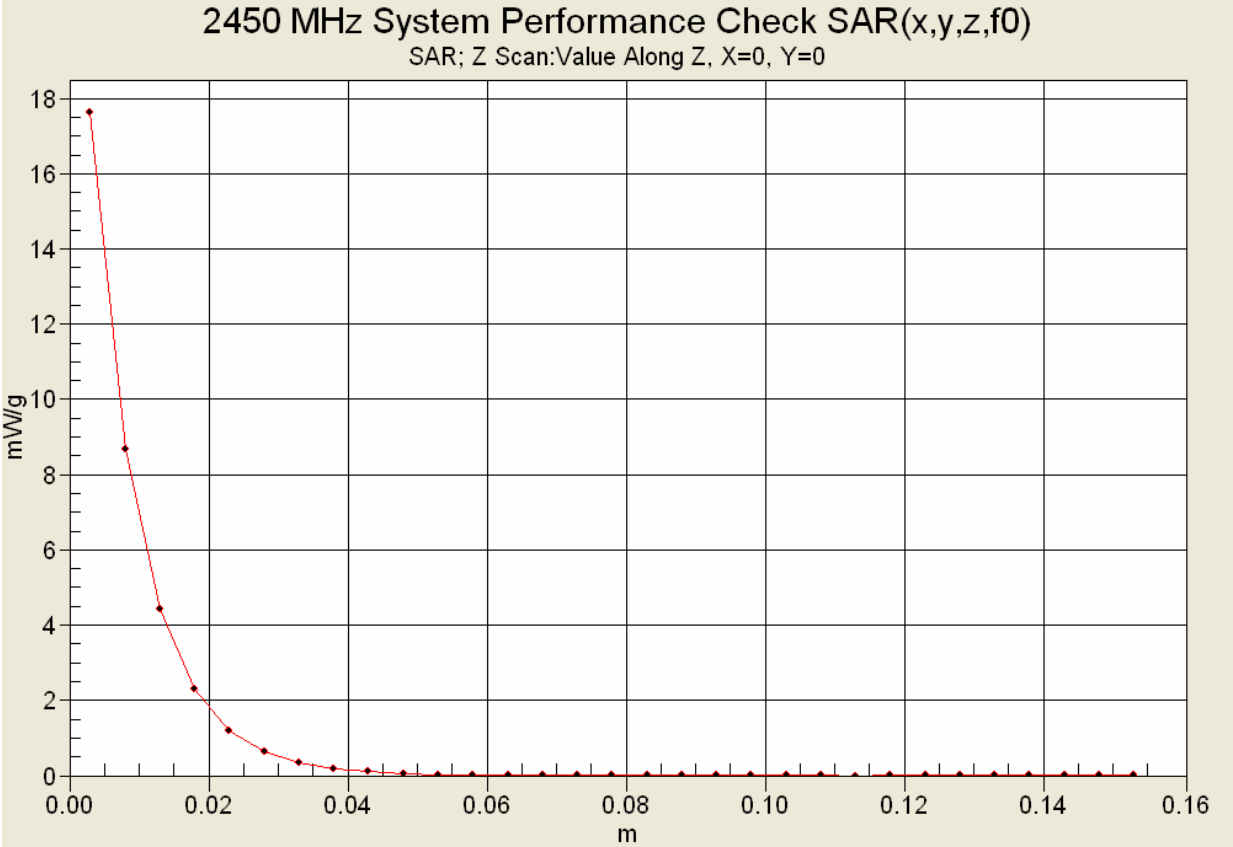
Communication System: CW
Forward Conducted Power: 250 mW
Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2450 MHz; σ = 2.02 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3

- Probe: EX3DV4 - SN3600; ConvF(6.25, 6.25, 6.25); Calibrated: 28/04/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 28/04/2009
- Phantom: SAM 4.0; Type: Fiberglas; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

System Performance Check - 2450 MHz Dipole
Area Scan (6x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 15.0 mW/g
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.1 V/m; Power Drift = 0.037 dB
Peak SAR (extrapolated) = 27.9 W/kg
SAR(1 g) = 13.4 mW/g; SAR(10 g) = 6.18 mW/g
Maximum value of SAR (measured) = 17.9 mW/g



Z-Axis Scan



APPENDIX C - MEASURED FLUID DIELECTRIC PARAMETERS

2450 MHz System Performance Check & 2470 MHz DUT Evaluation (Body)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
21/Dec/2009
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

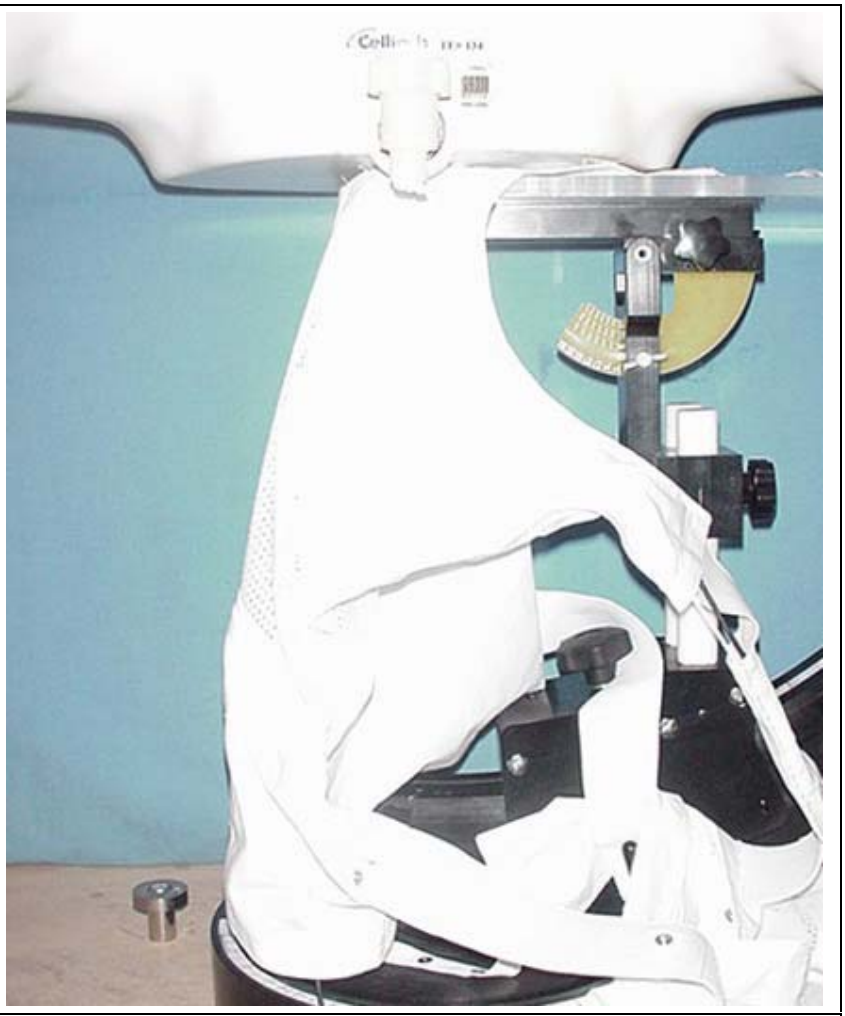
****

Freq	FCC_eB	FCC_sB	Test_e	Test_s
2.3500	52.83	1.85	51.51	1.88
2.3600	52.82	1.86	51.53	1.90
2.3700	52.81	1.87	51.59	1.89
2.3800	52.79	1.88	51.59	1.91
2.3900	52.78	1.89	51.52	1.97
2.4000	52.77	1.90	51.51	1.96
2.4100	52.75	1.91	51.50	1.97
2.4200	52.74	1.92	51.59	1.97
2.4300	52.73	1.93	51.39	1.97
2.4400	52.71	1.94	51.60	2.00
2.4500	52.70	1.95	51.70	2.02
2.4600	52.69	1.96	51.39	2.03
2.4700	52.67	1.98	51.21	2.03
2.4800	52.66	1.99	51.39	2.04
2.4900	52.65	2.01	51.31	2.05
2.5000	52.64	2.02	51.19	2.07
2.5100	52.62	2.04	51.37	2.10
2.5200	52.61	2.05	51.20	2.10
2.5300	52.60	2.06	51.13	2.13
2.5400	52.59	2.08	51.08	2.12
2.5500	52.57	2.09	51.13	2.18

APPENDIX D - SAR TEST SETUP & DUT PHOTOGRAPHS

BODY-WORN SAR TEST SETUP PHOTOGRAPHS

DUT Patch Antenna inside VidiVest Touching Planar Section of SAM Phantom

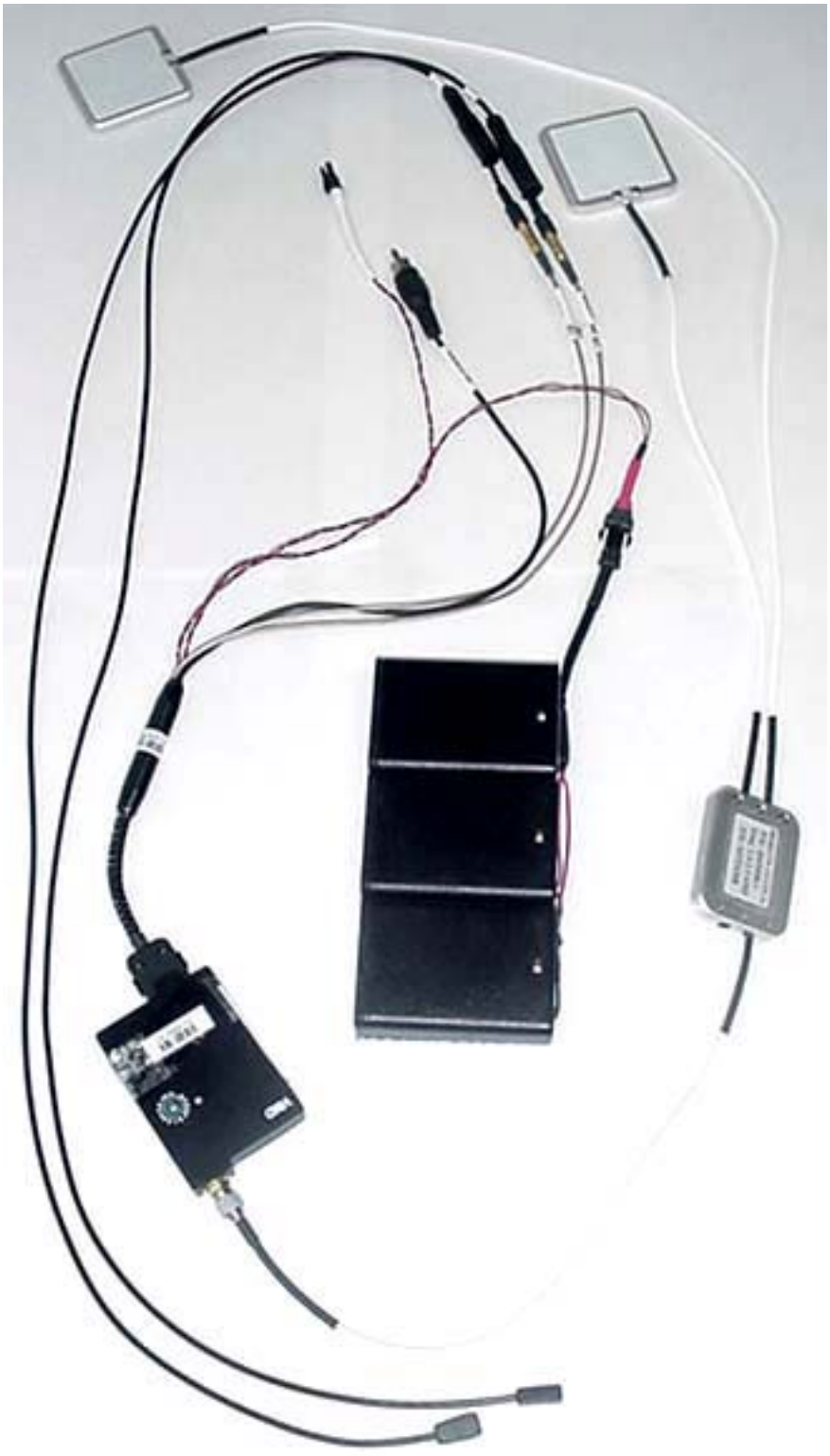


DUT PHOTOGRAPHS

Front Side of VidiVest (P/N: 1088185) - Dual Patch Antenna 2 Location

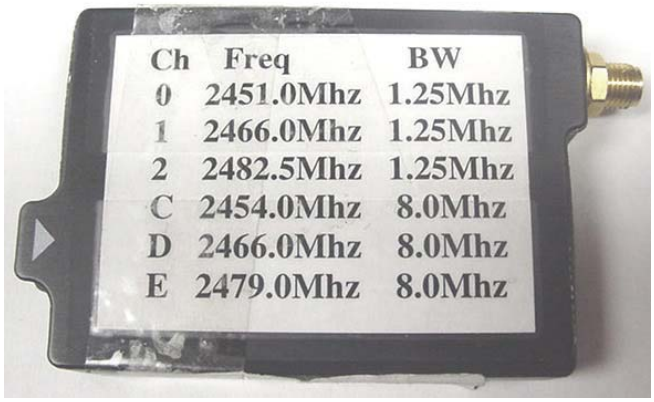
Back Side of VidiVest (P/N: 1088185) - Dual Patch Antenna 1 Location

DUT PHOTOGRAPHS



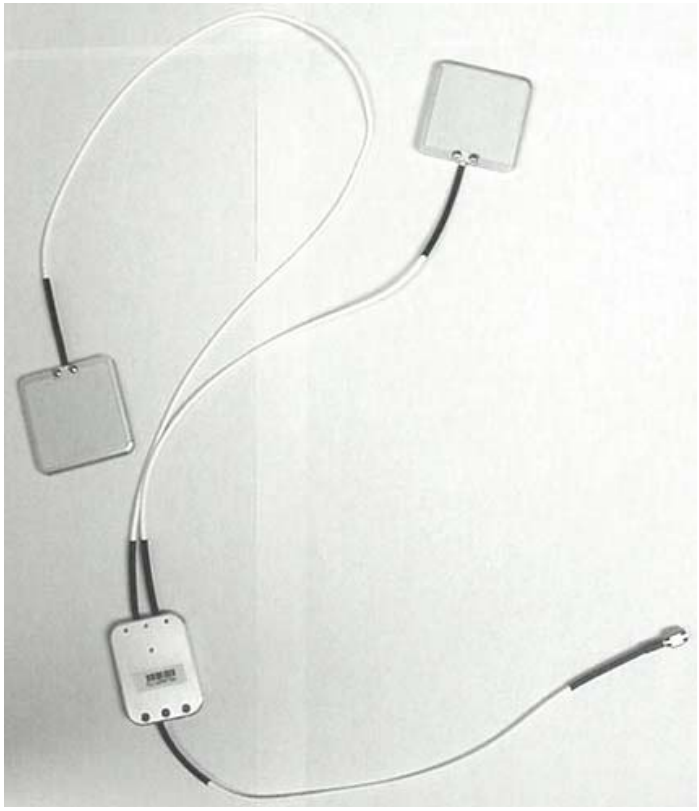
DUT Components & Assembly

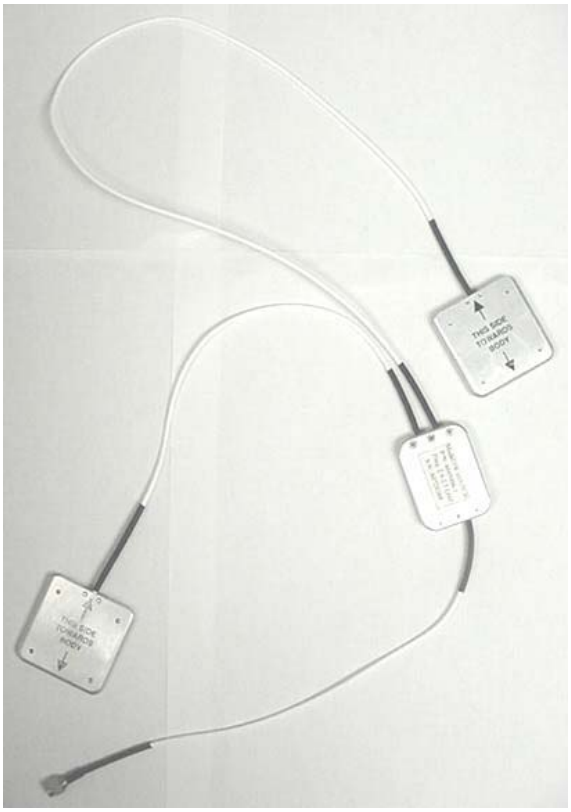
DUT PHOTOGRAPHS



VMD Transmitter

DUT PHOTOGRAPHS





Patch Antenna 1 Front & Back Sides	Patch Antenna 2 Front & Back Sides	Splitter

DUT PHOTOGRAPHS

Lithium AA Battery Pack (P/N: 4045214)

APPENDIX E - DIPOLE 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 Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client Celltech

Certificate No: D2450V2-825_Apr09

CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 825

Calibration procedure(s): QA CAL-05.v7
Calibration procedure for dipole validation kits

Calibration date: April 17, 2009

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 EPM-442A	GB37480704	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: 5086 (20g)	31-Mar-09 (No. 217-01025)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ES3DV2	SN: 3025	28-Apr-08 (No. ES3-3025_Apr08)	Apr-09
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 22, 2009

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

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

b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V5.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.0 ± 6 %	1.82 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.6 mW / g
SAR normalized	normalized to 1W	54.4 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**53.7 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.29 mW / g
SAR normalized	normalized to 1W	25.2 mW / g
SAR for nominal Head TSL parameters [1]	normalized to 1W	**25.0 mW /g ± 16.5 % (k=2)**

[1] Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.4 ± 6 %	1.98 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 0.2) °C	—	—

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.9 mW / g
SAR normalized	normalized to 1W	51.6 mW / g
SAR for nominal Body TSL parameters [2]	normalized to 1W	**51.6 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.05 mW / g
SAR normalized	normalized to 1W	24.2 mW / g
SAR for nominal Body TSL parameters [2]	normalized to 1W	**24.2 mW /g ± 16.5 % (k=2)**

[2] Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.5 Ω + 4.7 jΩ
Return Loss	- 24.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.2 Ω + 5.6 jΩ
Return Loss	- 24.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.160 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 11, 2008

DASY5 Validation Report for Head TSL

Date/Time: 17.04.2009 12:17:23

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN825

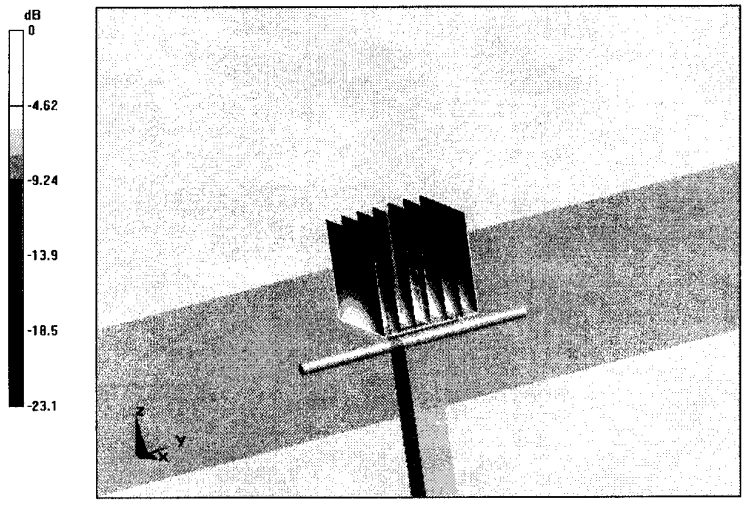
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL U10 BB
Medium parameters used: f = 2450 MHz; σ = 1.82 mho/m; ε_r = 38; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.4, 4.4, 4.4); Calibrated: 28.04.2008
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

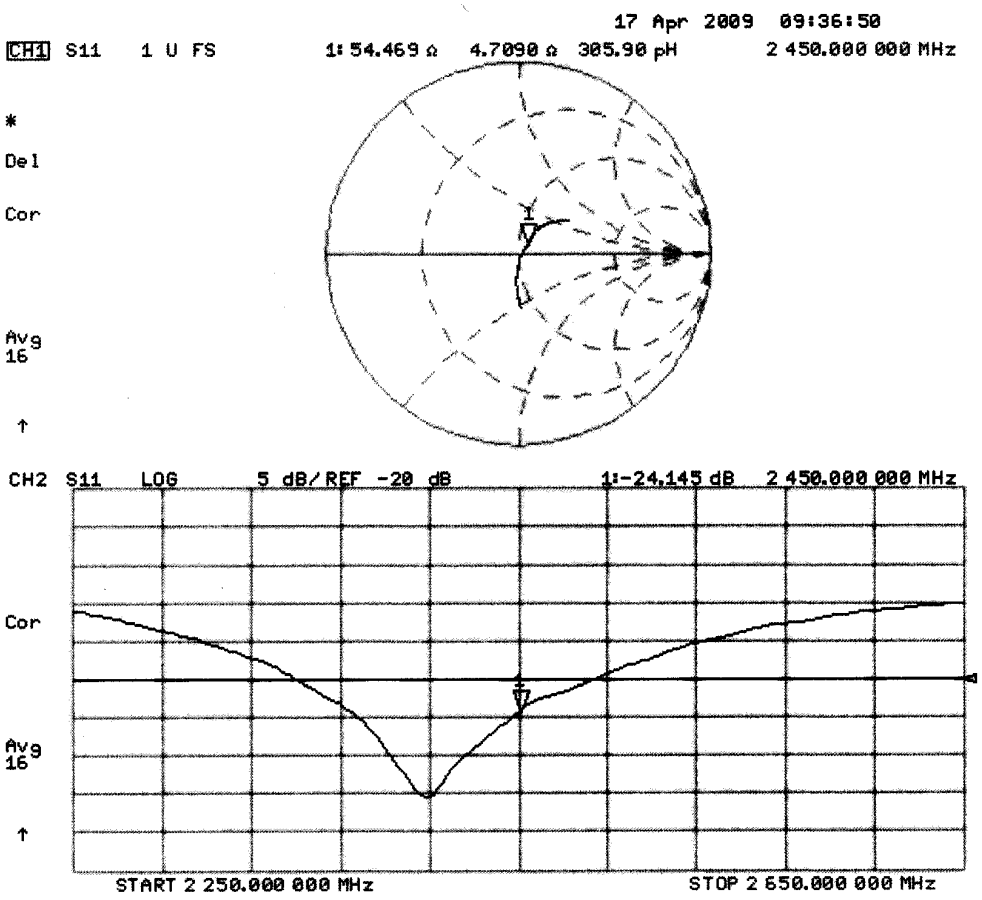
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 97.1 V/m; Power Drift = 0.026 dB
Peak SAR (extrapolated) = 28.4 W/kg
SAR(1 g) = 13.6 mW/g; SAR(10 g) = 6.29 mW/g
Maximum value of SAR (measured) = 17.7 mW/g



0 dB = 17.7mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 17.04.2009 14:54:34

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:825

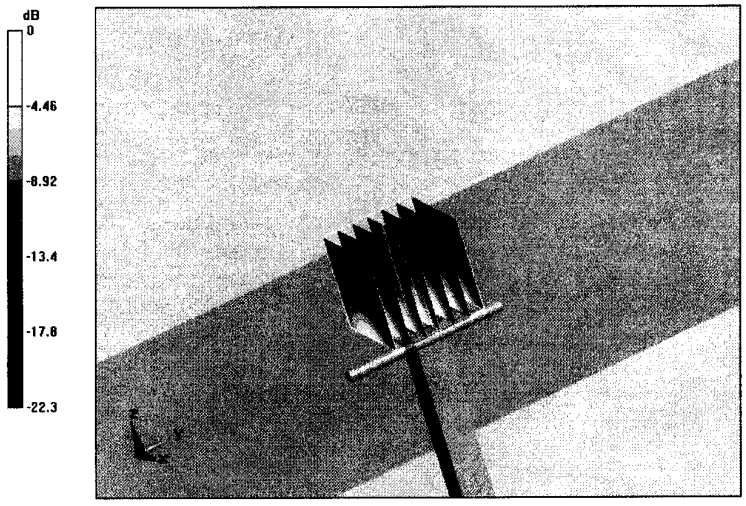
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL U10 BB
Medium parameters used: f = 2450 MHz; σ = 1.98 mho/m; ε_r = 54.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.07, 4.07, 4.07); Calibrated: 28.04.2008
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

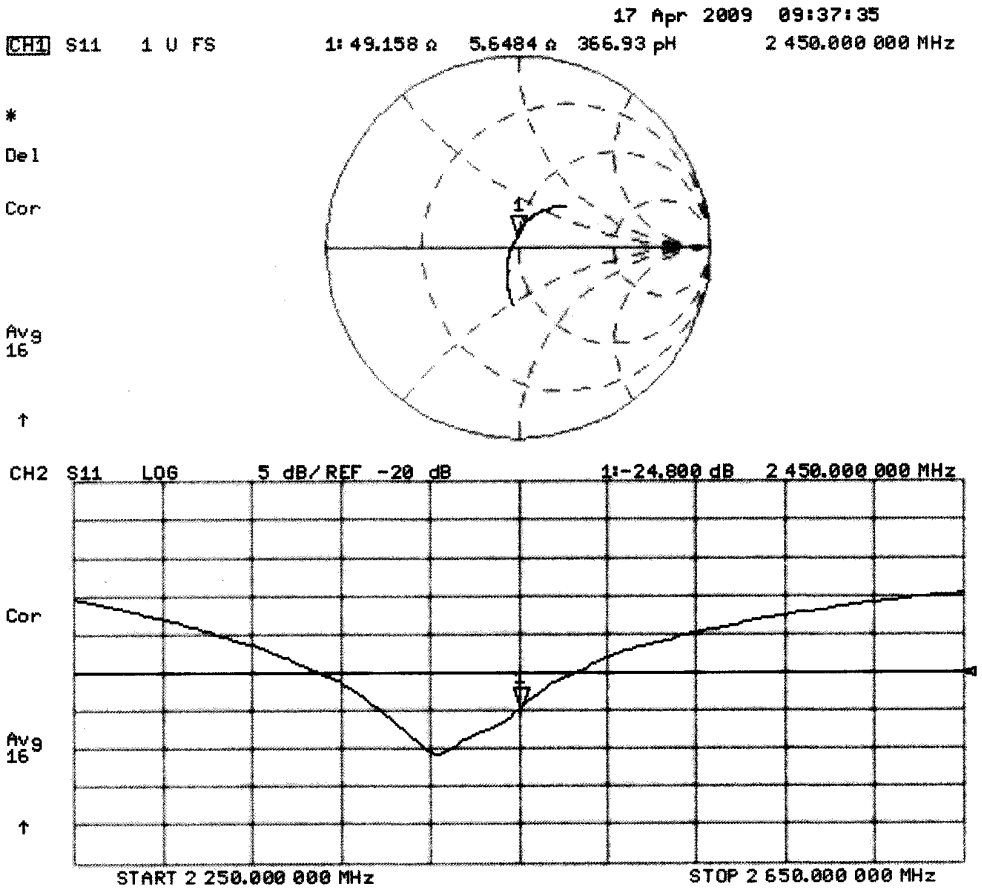
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 91.6 V/m; Power Drift = 0.046 dB
Peak SAR (extrapolated) = 26.1 W/kg
SAR(1 g) = 12.9 mW/g; SAR(10 g) = 6.05 mW/g
Maximum value of SAR (measured) = 16.6 mW/g



0 dB = 16.6mW/g

Impedance Measurement Plot for Body TSL



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

Accreditation No.: SCS 108

Client Celltech

Certificate No: EX3-3600_Apr09

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3600

Calibration procedure(s): QA CAL-01.v6, QA CAL-14.v3 and QA CAL-23.v3
Calibration procedure for dosimetric E-field probes

Calibration date: April 28, 2009

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 (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe ES3DV2	SN: 3013	2-Jan-09 (No. ES3-3013_Jan09)	Jan-10
DAE4	SN: 660	9-Sep-08 (No. DAE4-660_Sep08)	Sep-09

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

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

Issued: April 28, 2009

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

Accreditation No.: SCS 108

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	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) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ 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
Last calibrated:	April 19, 2008
Recalibrated:	April 28, 2009

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	**0.51** ± 10.1%	$\mu V/(V/m)^2$	DCP X	**90** mV
NormY	**0.51** ± 10.1%	$\mu V/(V/m)^2$	DCP Y	**89** mV
NormZ	**0.40** ± 10.1%	$\mu V/(V/m)^2$	DCP Z	**90** 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	7.6	3.9
SAR_{be} [%]	With Correction Algorithm	0.6	0.3

TSL **5200 MHz** **Typical SAR gradient: 25 % per mm**

Sensor Center to Phantom Surface Distance		**2.0 mm**	**3.0 mm**
SAR_{be} [%]	Without Correction Algorithm	19.9	10.2
SAR_{be} [%]	With Correction Algorithm	0.5	0.3

Sensor Offset

Probe Tip to Sensor Center	**1.0** mm

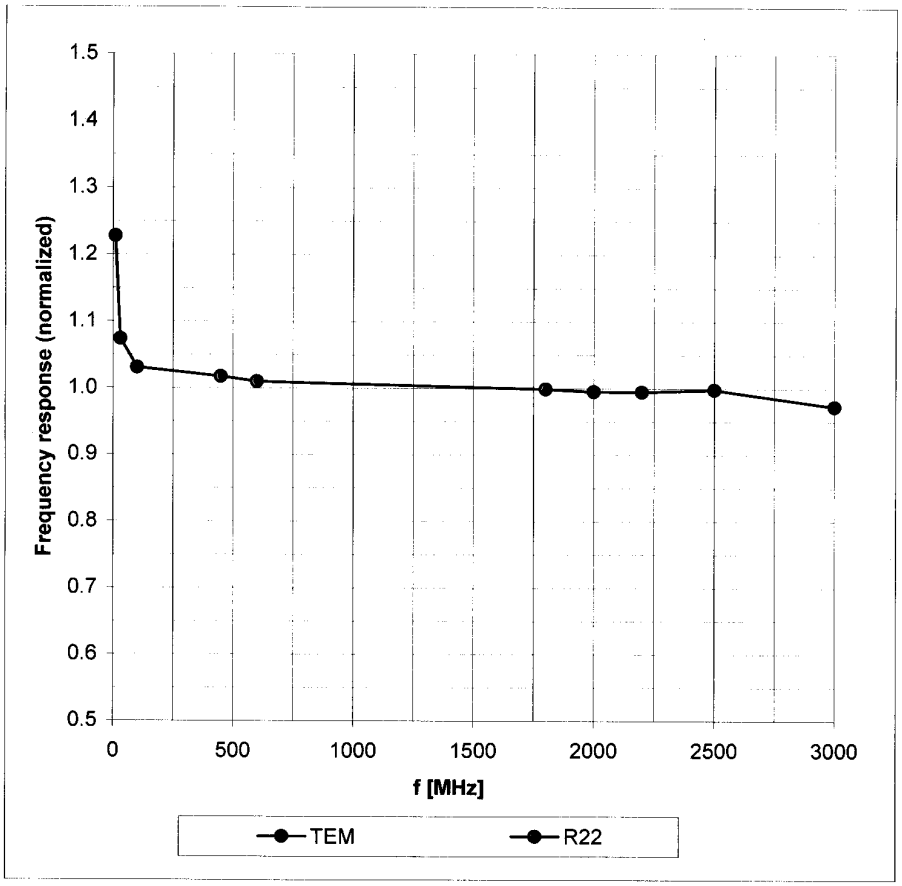
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[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.

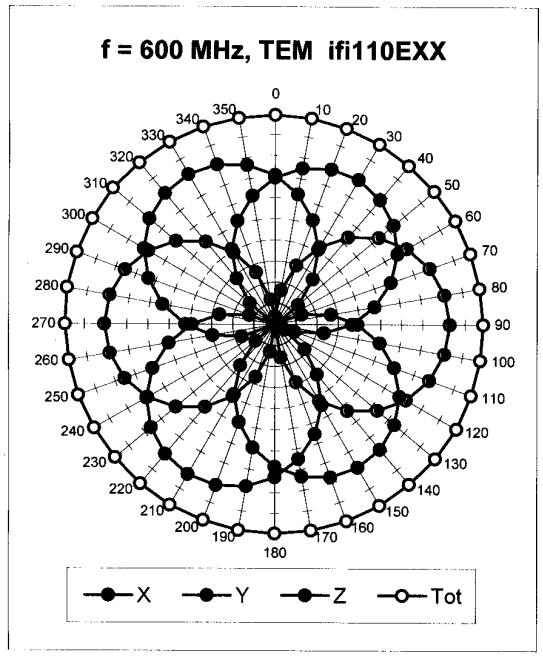
Frequency Response of E-Field

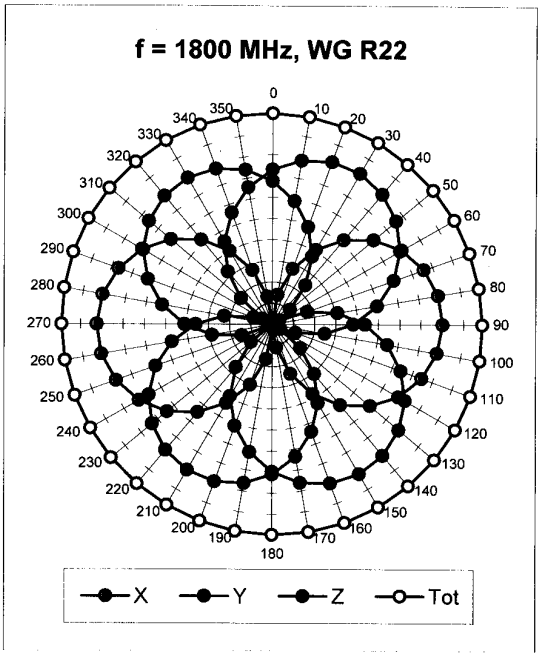
(TEM-Cell:ifi110 EXX, Waveguide: R22)

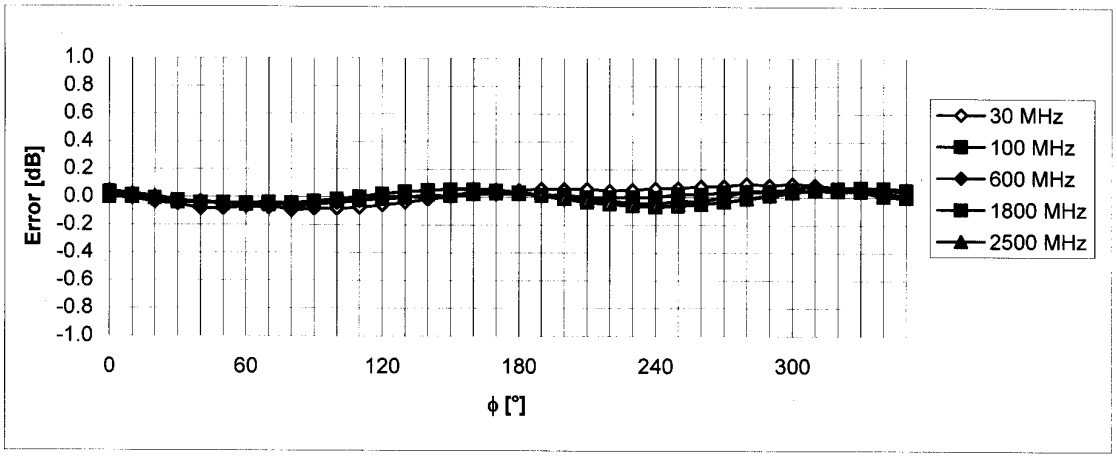


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



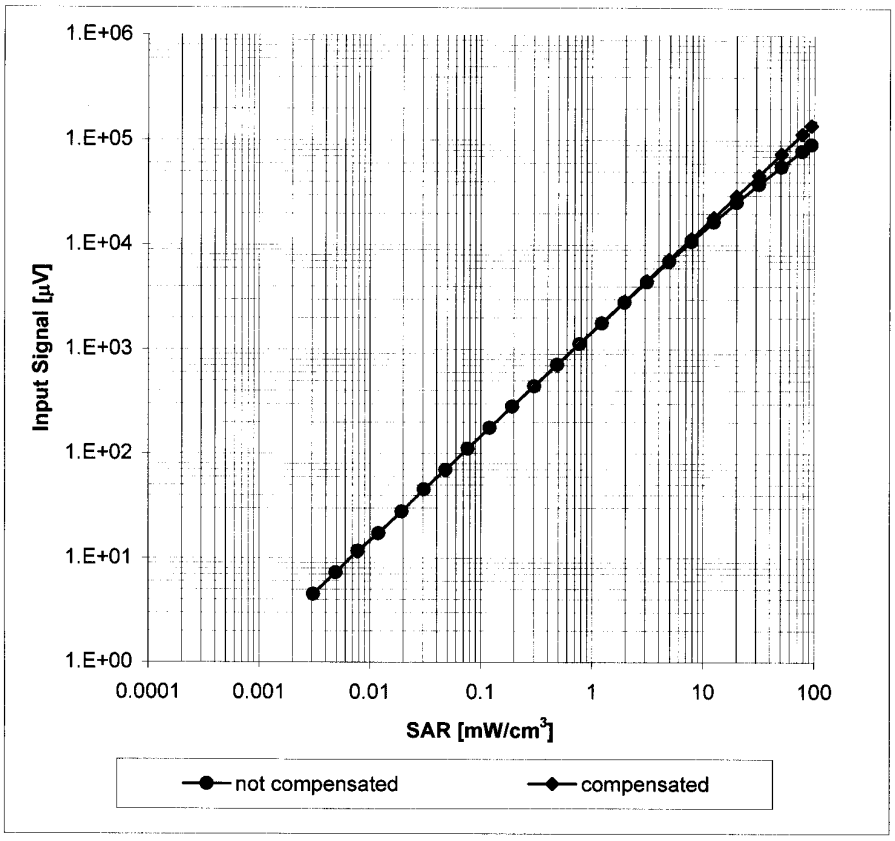


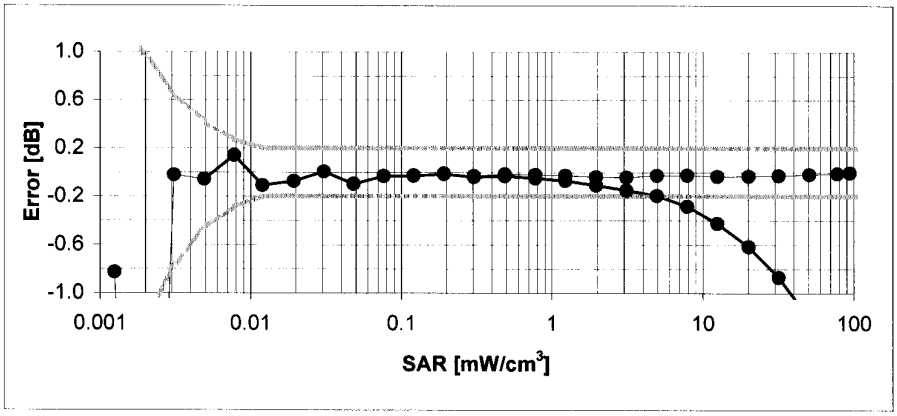


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

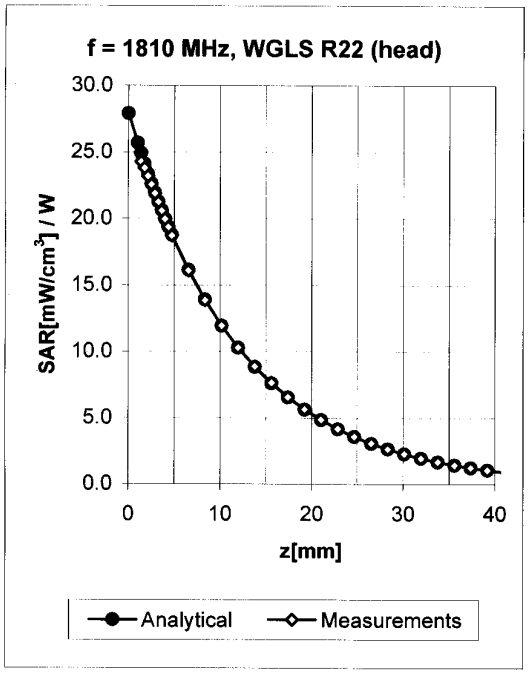
(Waveguide R22, f = 1800 MHz)

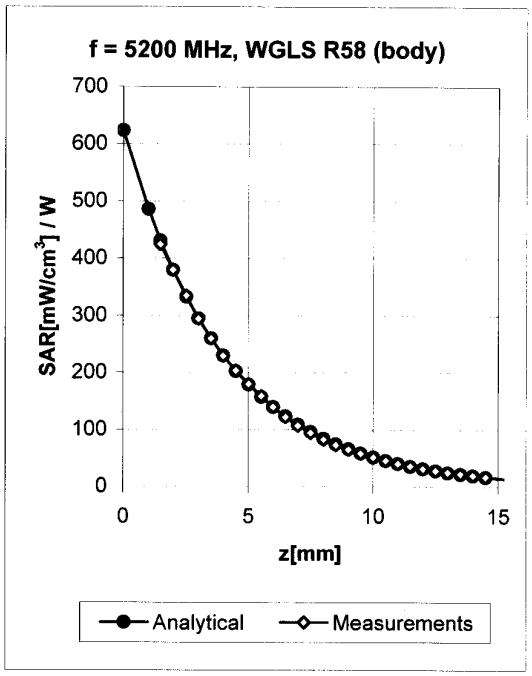




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



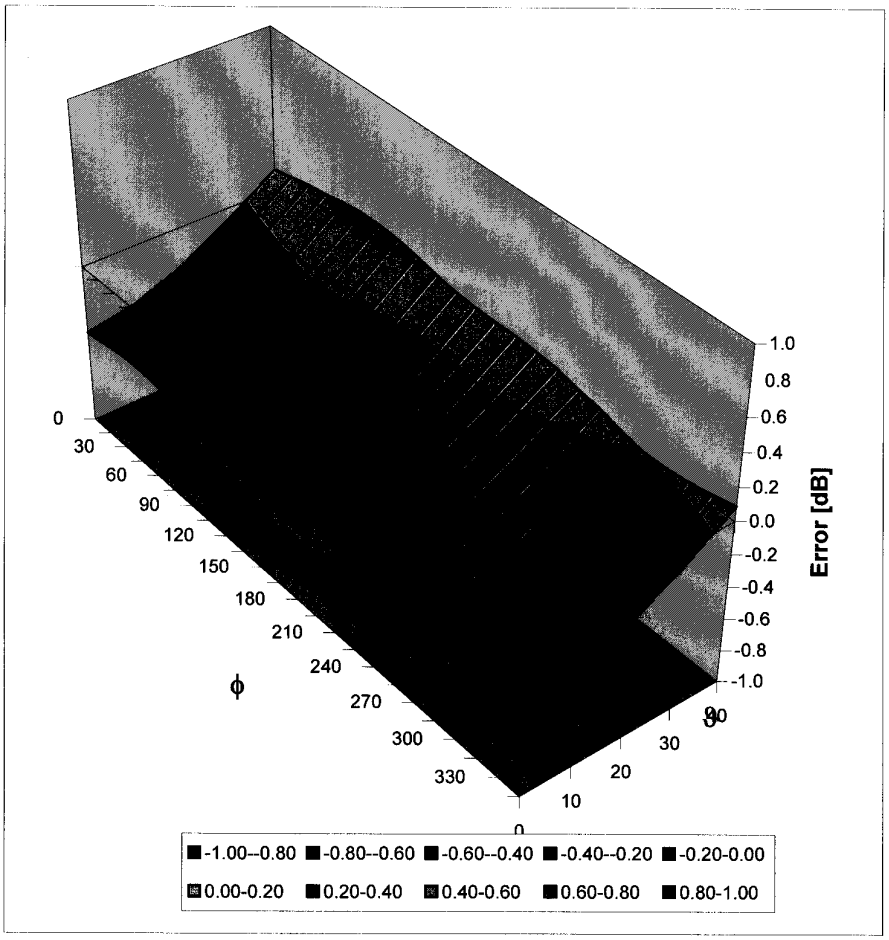


f [MHz]	Validity [MHz][C]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.70	0.61	6.77 ± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.66	0.62	6.62 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.50	0.90	6.30 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.66	0.71	6.68 ± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.39	0.92	6.64 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.30	1.06	6.25 ± 11.0% (k=2)
5200	± 50 / ± 100	Body	49.0 ± 5%	5.30 ± 5%	0.50	1.80	3.93 ± 13.1% (k=2)
5500	± 50 / ± 100	Body	48.6 ± 5%	5.65 ± 5%	0.55	1.80	3.70 ± 13.1% (k=2)
5800	± 50 / ± 100	Body	48.2 ± 5%	6.00 ± 5%	0.60	1.80	3.65 ± 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
Zeughausstrasse 43, CH-8004 Zurich
Tel. +41 1 245 97 00, Fax +41 1 245 97 79