SAR TEST REPORT (FCC/IC)

RF EXPOSURE EVALUATION | SPECIFIC ABSORPTION RATE

APPLICANT / MANUFACTURER	KENWOOD USA CORPORATION		
DEVICE UNDER TEST (DUT)	PORTABLE FM UHF PUSH-TO-TALK RADIO TRANSCEIVER		
DEVICE MODEL(S)	TK-3312-2 (FCC/IC)	TK-3317-2 (FCC only)	
MANUF. RATED OUTPUT POWER	5 Watts (Conducted)	Max. Tolerance Spec.: +0.2 W	
TRANSMIT FREQUENCY RANGE	FCC	406.1 - 470.0 MHz	
	IC	406.1 - 430.0 MHz	
		450.0 - 470.0 MHz	
DEVICE IDENTIFIER(S)	FCC ID:ALH413801	IC: 282D-413801	
APPLICATION TYPE(S)	FCC TCB Certification	IC CB 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)		
	FCC KDB 447498 D01v04		
	FCC KDB Inquiry Track No. 407503		
	IC RSS-102 Issue 4		
	IEEE 1528-2003		
	IEC 62209-1:2005		
	IEC 62209-2 (Draft)		
FCC DEVICE CLASSIFICATION	Licensed Non-Broadcast Transmitter Held to Face (TNF)		
IC DEVICE CLASSIFICATION	Land Mobile Radio Transmitter/Receiver (27.41-960 MHz)		
RF EXPOSURE CATEGORY	Occupational / Controlled		
RF EXPOSURE EVALUATION(S)	Face-held & Body-worn		
DATE OF SAMPLE RECEIPT	June 28, 2010		
DATE(S) OF EVALUATION	June 29-30, July 01-03, August 04, 2010		
TEST REPORT SERIAL NO.	062810ALH-T1034-S90U		
TEST REPORT REVISION NO.	Revision 1.0	Initial Release	August 19, 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 Laboratory		
	21-364 Lougheed Road, Kelowna, B.C. V1X 7R8 Canada		
TEST LAB CONTACT INFO.	Tel.: 250-765-7650	Fax: 250-765-7645	
	info@celltechlabs.com	www.celltechlabs.com	
TEST LAB ACCREDITATION(S)	ISO/IEC 17025:2005 (A2LA Test Lab Certificate No. 2470.01)		

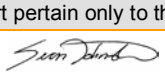
DECLARATION OF COMPLIANCE - SAR RF EXPOSURE EVALUATION (FCC/IC)

Test Lab Information	**Name**	**CELLTECH LABS INC.**				
	Address	21-364 Lougheed Road, Kelowna, B.C. V1X 7R8 Canada				
Applicant Information	**Name**	**KENWOOD USA CORPORATION**				
	Address	3970 Johns Creek Court, Suite 100, Suwanee, GA 30024 United States				
Standard(s) Applied	**FCC**	47 CFR §2.1093		**IC:**	Health Canada Safety Code 6	
Procedure(s) Applied	**FCC**	OET Bulletin 65, Supplement C		**FCC**	KDB 447498 D01v04	
	FCC	KDB Inquiry Track No. 407503		**IC:**	RSS-102 Issue 4	
	IEEE	1528-2003	**IEC**	62209-1:2005	**IEC**	62209-2 (Draft)
Device Classification(s)	**FCC**	Licensed Non-Broadcast Transmitter Held to Face (TNF) - FCC Part 90				
	IC	Land Mobile Radio Transmitter/Receiver (27.41-960 MHz) - RSS-119 Issue 10				
Device Identifier(s)	**FCC ID:**	ALH413801		**IC**	282D-413801	
Device Model(s)	TK-3312-2 (FCC/IC), TK-3317-2 (IC) - Note: Models are electrically and mechanically identical					
Test Sample Serial No.	No. 02 (Identical Prototype)	**Hardware Rev. No.**	1.0	**Firmware Rev. No.**	1.0	
Device Description	Portable FM UHF Push-To-Talk (PTT) Radio Transceiver					
Device Frequency Range(s)	**FCC**	406.1 - 470.0 MHz	**IC**	406.1 - 430.0 MHz	450.0 - 470.0 MHz	
Manufacturer's Rated Output Power	5 Watts (Conducted)		**Max. Tolerance Spec.**	+ 0.2 Watts		
RF Output Power Level(s) Tested	37.08 dBm	5.1 Watts	406.1 MHz	Average Conducted		
	37.16 dBm	5.2 Watts	421.0 MHz	Average Conducted		
	37.16 dBm	5.2 Watts	435.0 MHz	Average Conducted		
	37.08 dBm	5.1 Watts	440.0 MHz	Average Conducted		
	37.08 dBm	5.1 Watts	450.0 MHz	Average Conducted		
	37.08 dBm	5.1 Watts	455.0 MHz	Average Conducted		
	37.08 dBm	5.1 Watts	460.0 MHz	Average Conducted		
	37.08 dBm	5.1 Watts	470.0 MHz	Average Conducted		
Antenna Type(s) Tested	Detachable Stub	P/N: KRA-17M	450-490 MHz	Nc = 3	Length: 79 mm	
	Detachable Stub	P/N: KRA-23M	440-490 MHz	Nc = 3	Length: 80 mm	
	Detachable Stub	P/N: KRA-23M3	400-450 MHz	Nc = 4	Length: 80 mm	
	Detachable Whip	P/N: KRA-27M	440-490 MHz	Nc = 3	Length: 149 mm	
	Detachable Whip	P/N: KRA-27M3	400-450 MHz	Nc = 4	Length: 171 mm	
Battery Type(s) Tested	Ni-MH	7.2 V	1500 mAh	P/N: KNB-29N		
	Li-ion	7.4 V	2000 mAh	P/N: KNB-45L		
Body-worn Accessories Tested	Metal Belt-Clip			P/N: KBH-10		
Audio Accessories Tested	Speaker-Microphone P/N: KMC-48GPS		Over-the-Head Headset P/N: KHS-10-OH			
	2-Wire Ear-bud with PTT Mic P/N: KHS-23		2-Wire Palm-Mic Kit P/N: KHS-8BL			
Max. SAR Level(s) Evaluated	Face-held	**6.30 W/kg**	1g	50% PTT duty cycle	Occupational / Controlled Exp.	
	Body-worn	**7.25 W/kg**	1g	50% PTT duty cycle	Occupational / Controlled Exp.	
FCC/IC Spatial Peak SAR Limit	Head/Body	8.0 W/kg	1g	50% PTT duty cycle	Occupational / Controlled Exp.	

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 and Health Canada Safety Code 6 for the Occupational / Controlled Exposure environment. The device was tested in accordance with the measurement procedures specified in FCC OET Bulletin 65, Supplement C (Edition 01-01), Industry Canada RSS-102 Issue 4, IEEE Standard 1528-2003, IEC International Standard 62209-1:2005 and IEC International Draft Standard 62209-2 (106-62209-2-CDV_090323). 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.

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

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REVISION HISTORY			
REVISION NO.	**DESCRIPTION**	**IMPLEMENTED BY**	**RELEASE DATE**
1.0	Initial Release	Jon Hughes	August 19, 2010

1.0 INTRODUCTION

This measurement report demonstrates that the Kenwood USA Corporation Models: TK-3312-2, TK-3317-2 Portable FM UHF PTT Radio Transceiver complies with the SAR (Specific Absorption Rate) RF exposure requirements FCC 47 CFR §2.1093 (see reference [1]) and Health Canada's Safety Code 6 (see reference [2]) for the Occupational / Controlled Exposure environment. The measurement procedures described in FCC OET Bulletin 65, Supplement C 01-01 (see reference [3]), IC RSS-102 Issue 4 (see reference [4]), IEEE Standard 1528-2003 (see reference [5]), IEC Standard 62209-1:2005 (see reference [6]) and Draft Standard IEC 62209-2 (see reference [7]) 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	Mode	dBm	Watts	Method
406.1 MHz	CW	37.08	5.1	Average Conducted
421.0 MHz	CW	37.16	5.2	Average Conducted
435.0 MHz	CW	37.16	5.2	Average Conducted
440.0 MHz	CW	37.08	5.1	Average Conducted
450.0 MHz	CW	37.08	5.1	Average Conducted
455.0 MHz	CW	37.08	5.1	Average Conducted
460.0 MHz	CW	37.08	5.1	Average Conducted
470.0 MHz	CW	37.08	5.1	Average Conducted

Notes

1. The test channels were selected in accordance with the procedures specified in FCC KDB 447498 Section 6) c).
2. 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 at the external antenna connector of the DUT.

4.0 FCC POWER THRESHOLDS FOR PTT DEVICES ($f \leq 0.5$ GHz)

FCC SAR Evaluation Power Thresholds for PTT Devices, $f \leq 0.5$ GHz*			Manufacturer's Rated RF Output Power	
Exposure Conditions	***P* mW (General Population)**	***P* mW (Occupational)**	**100% PTT Duty Cycle**	**50% PTT Duty Cycle**
Held to face, $d \geq 2.5$ cm	250	**1250**	5 Watts	**2.5 Watts**
Body-worn, $d \geq 1.5$ cm	200	1000		
Body-worn, $d \geq 1.0$ cm	150	**750**	5 Watts	**2.5 Watts**
1. The time-averaged output power, corresponding to the required PTT duty factor, is compared with these thresholds. 2. The closest distance between the user and the device or its antenna is used to determine the power thresholds. * Per FCC KDB 447498 D01v04 Section 5)b)i) (see reference [8]).			1. The conducted output power level of the DUT exceeds the FCC threshold for SAR evaluation requirement.	

5.0 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 [9]).

Probe Calibration Freq.	Device Measurement Freq.	Frequency Interval	±50 MHz (≥ 300 MHz)
450 MHz	406.1 MHz	43.9 MHz	< 50 MHz
	421.0 MHz	29 MHz	< 50 MHz
	435.0 MHz	15 MHz	< 50 MHz
	440.0 MHz	10 MHz	< 50 MHz
	450.0 MHz	0 MHz	< 50 MHz
	455.0 MHz	5 MHz	< 50 MHz
	460.0 MHz	10 MHz	< 50 MHz
	470.0 MHz	20 MHz	< 50 MHz
Note: Probe calibration and measurement frequency interval is < 50 MHz; therefore the additional steps were not required.			

6.0 NO. OF TEST CHANNELS (N_c)

Antenna Part No.	Antenna Frequency Range	Test Frequency Range	N_c	Test Frequencies
KRA-17M	450 - 490 MHz	450.0 - 470.0 MHz	3	450.0, 460.0, 470.0 MHz
KRA-23M	440 - 490 MHz	440.0 - 470.0 MHz	3	440.0, 455.0, 470.0 MHz
KRA-23M3	400 - 450 MHz	406.1 - 450.0 MHz	4	406.1, 421.0, 435.0, 450.0 MHz
KRA-27M	440 - 490 MHz	440.0 - 470.0 MHz	3	440.0, 455.0, 470.0 MHz
KRA-27M3	400 - 450 MHz	406.1 - 450.0 MHz	4	406.1, 421.0, 435.0, 450.0 MHz
Note: The number of test channels per antenna frequency range was calculated in accordance with the procedures specified in FCC KDB 447498 Section 6) c).				

7.0 SAR MEASUREMENT SUMMARY

FACE-HELD SAR EVALUATION RESULTS

Test Date	FCC Test Procedure Description	Test Freq.	Antenna Type	Antenna Part No.	Battery Part No.	Device Distance to Planar Phantom		Cond. Power Before Test	Measured SAR 1g (W/kg) PTT Duty Cycle		SAR Drift During Test	Scaled SAR with droop 1g (W/kg) PTT Duty Cycle	
		MHz				DUT	Antenna	Watts	100%	50%	dB	100%	50%
Jul 02	HIGHEST SAR SEARCH PROCEDURE	460.0	Stub	KRA-17M	KNB-29N	2.5 cm	3.3 cm	5.1	10.9	5.45	-0.340	11.8	5.89
Jul 02					KNB-45L	2.5 cm	3.3 cm	5.1	11.5	5.75	-0.400	12.6	**6.30**
Jul 02		455.0	Stub	KRA-23M	KNB-29N	2.5 cm	3.3 cm	5.1	8.73	4.37	-0.607	10.0	5.02
Jul 02					KNB-45L	2.5 cm	3.3 cm	5.1	8.95	4.48	-0.421	9.86	4.93
Jul 02		421.0	Stub	KRA-23M3	KNB-29N	2.5 cm	3.3 cm	5.2	7.88	3.94	-1.21	10.4	5.21
Jul 02					KNB-45L	2.5 cm	3.3 cm	5.2	7.97	3.99	-0.643	9.24	4.62
Jul 02		435.0			KNB-29N	2.5 cm	3.3 cm	5.2	5.94	2.97	-0.758	7.07	3.54
Jul 02					KNB-45L	2.5 cm	3.3 cm	5.2	5.87	2.94	-0.298	6.29	3.14
Jul 03		455.0	Whip	KRA-27M	KNB-29N	2.5 cm	3.3 cm	5.1	8.13	4.07	-0.632	9.40	4.70
Jul 03					KNB-45L	2.5 cm	3.3 cm	5.1	7.56	3.78	-0.217	7.95	3.97
Jul 03		421.0	Whip	KRA-27M3	KNB-29N	2.5 cm	3.3 cm	5.2	6.74	3.37	-0.151	6.98	3.49
Jul 03					KNB-45L	2.5 cm	3.3 cm	5.2	6.38	3.19	-0.190	6.67	3.33
Jul 03		435.0			KNB-29N	2.5 cm	3.3 cm	5.2	4.79	2.40	-0.210	5.03	2.51
Jul 03					KNB-45L	2.5 cm	3.3 cm	5.2	4.87	2.44	-0.215	5.12	2.56
Jul 02	REMAINING TEST CHAN. REDUCTION	450.0	Stub	KRA-17M	KNB-45L	2.5 cm	3.3 cm	5.1	7.75	3.88	-0.384	8.47	4.23
Jul 02		470.0				2.5 cm	3.3 cm	5.1	9.28	4.64	-0.303	9.95	4.98
Jul 02		440.0	Stub	KRA-23M	KNB-45L	2.5 cm	3.3 cm	5.1	9.02	4.51	-0.249	9.55	4.78
Jul 02		470.0				2.5 cm	3.3 cm	5.1	7.74	3.87	-0.437	8.56	4.28
Jul 02		406.1	Stub	KRA-23M3	KNB-45L	2.5 cm	3.3 cm	5.1	8.59	4.30	-0.502	9.64	4.82
Jul 02		450.0				2.5 cm	3.3 cm	5.1	9.43	4.72	0.018	-	-
Jul 03		440.0	Whip	KRA-27M	KNB-29N	2.5 cm	3.3 cm	5.1	6.74	3.37	-0.315	7.25	3.62
Jul 03		470.0				2.5 cm	3.3 cm	5.1	7.50	3.75	-0.402	8.23	4.11
Jul 03		406.1	Whip	KRA-27M3	KNB-29N	2.5 cm	3.3 cm	5.1	6.54	3.27	-0.535	7.40	3.70
Jul 03		450.0				2.5 cm	3.3 cm	5.1	4.29	2.15	-0.351	4.65	2.33

SAR LIMIT(S)		HEAD	SPATIAL PEAK	RF EXPOSURE CATEGORY
FCC 47 CFR 2.1093	Health Canada Safety Code 6	8.0 W/kg	averaged over 1 gram	Occupational / Controlled

Test Date	Fluid Type	Ambient Temp.	Fluid Temp.	Fluid Depth	Atmospheric Pressure	Relative Humidity	ρ (Kg/m^3)
Jul 02	450 Head	24.0°C	23.0 °C	≥ 15 cm	101.1 kPa	35%	1000
Jul 03	450 Head	24.0°C	23.0 °C	≥ 15 cm	101.1 kPa	35%	1000

SAR MEASUREMENT SUMMARY (CONT.)

BODY-WORN SAR EVALUATION RESULTS

Test Date	FCC Test Proc. Desc.	Test Freq.	Antenna Part. No.	Battery Part No.	Accessory Type(s)		Device Distance to Planar Phantom (cm)		Cond. Power Before Test	Measured SAR 1g (W/kg) PTT Duty Cycle		SAR Drift During Test	Scaled SAR with droop 1g (W/kg) PTT Duty Cycle	
		MHz			Body	Audio	DUT	ANT.	Watts	100%	50%	dB	100%	50%
Jun 29	Baseline	460.0	KRA-17M	KNB-29N	None	None	1.3	3.2	5.1	11.6	5.80	-0.466	12.9	6.46
Jun 29		455.0	KRA-23M	KNB-29N	None	None	1.3	3.1	5.1	8.68	4.34	-0.603	9.97	4.99
Jun 29		421.0	KRA-23M3	KNB-29N	None	None	1.3	3.1	5.2	6.67	3.34	-0.789	8.00	4.00
Jun 29		435.0		KNB-29N	None	None	1.3	3.1	5.2	6.01	3.01	-1.23	7.98	3.99
Jun 29		455.0	KRA-27M	KNB-29N	None	None	1.3	3.1	5.1	9.72	4.86	-0.402	10.7	5.33
Jun 29		421.0	KRA-27M3	KNB-29N	None	None	1.3	3.1	5.2	7.47	3.74	-0.608	8.59	4.30
Jun 29		435.0		KNB-29N	None	None	1.3	3.1	5.2	5.64	2.82	-0.297	6.04	3.02
Jun 29	Highest SAR Search Proc.	460.0	KRA-17M	KNB-29N	Belt-Clip	Headset	1.3	3.2	5.1	11.4	5.70	-0.558	13.0	6.48
Jun 29						Ear-bud	1.3	3.2	5.1	11.7	5.85	-0.635	13.5	6.77
Jun 29						Palm-Mic	1.3	3.2	5.1	12.3	6.15	-0.722	14.5	**7.26**
Jun 29						Spkr-Mic	1.3	3.2	5.1	11.2	5.60	-0.464	12.5	6.23
Jun 29				KNB-45L		Headset	1.3	3.2	5.1	11.4	5.70	-0.334	12.3	6.16
Jun 29						Ear-bud	1.3	3.2	5.1	11.4	5.70	-0.299	12.2	6.11
Jun 29						Palm-Mic	1.3	3.2	5.1	11.4	5.70	-0.349	12.4	6.18
Jun 29						Spkr-Mic	1.3	3.2	5.1	11.3	5.65	-0.406	12.4	6.20
Jun 29		455.0	KRA-23M	KNB-29N	Belt-Clip	Headset	1.3	3.1	5.1	8.47	4.24	-0.579	9.68	4.84
Jun 29						Ear-bud	1.3	3.1	5.1	8.65	4.33	-0.553	9.83	4.91
Jun 29						Palm-Mic	1.3	3.1	5.1	8.63	4.32	-0.613	9.94	4.97
Jun 29						Spkr-Mic	1.3	3.1	5.1	8.53	4.27	-0.490	9.55	4.77
Jun 29				KNB-45L		Headset	1.3	3.1	5.1	8.68	4.34	-0.523	9.79	4.90
Jun 29						Ear-bud	1.3	3.1	5.1	8.84	4.42	-0.340	9.56	4.78
Jun 29						Palm-Mic	1.3	3.1	5.1	8.45	4.23	-0.376	9.21	4.61
Jun 29						Spkr-Mic	1.3	3.1	5.1	8.62	4.31	-0.399	9.45	4.72
Jun 29		421.0	KRA-23M3	KNB-29N	Belt-Clip	Headset	1.3	3.1	5.2	7.03	3.52	-0.889	8.63	4.31
Jun 30						Ear-bud	1.3	3.1	5.2	8.48	4.24	-0.626	9.80	4.90
Jun 30						Palm-Mic	1.3	3.1	5.2	7.78	3.89	-0.774	9.30	4.65
Jun 30						Spkr-Mic	1.3	3.1	5.2	7.49	3.75	-0.614	8.63	4.31
Jun 30				KNB-45L		Headset	1.3	3.1	5.2	7.51	3.76	0.018	-	-
Jun 30						Ear-bud	1.3	3.1	5.2	8.29	4.15	-0.323	8.93	4.47
Jun 30						Palm-Mic	1.3	3.1	5.2	7.26	3.63	-0.508	8.16	4.08
Jun 30						Spkr-Mic	1.3	3.1	5.2	8.14	4.07	-0.440	9.01	4.50
Jun 30		435.0		KNB-29N		Headset	1.3	3.1	5.2	6.24	3.12	-0.865	7.62	3.81
Jun 30						Ear-bud	1.3	3.1	5.2	6.44	3.22	-0.338	6.96	3.48
Jun 30						Palm-Mic	1.3	3.1	5.2	5.69	2.85	-0.597	6.53	3.26
Jun 30						Spkr-Mic	1.3	3.1	5.2	5.74	2.87	-0.643	6.66	3.33
Jun 30				KNB-45L		Headset	1.3	3.1	5.2	5.78	2.89	-0.608	6.65	3.32
Jun 30						Ear-bud	1.3	3.1	5.2	6.26	3.13	-0.843	7.60	3.80
Jun 30						Palm-Mic	1.3	3.1	5.2	5.88	2.94	-0.688	6.89	3.43
Jun 30						Spkr-Mic	1.3	3.1	5.2	6.05	3.03	-0.556	6.88	3.44

SAR LIMIT(S)		BODY	SPATIAL PEAK	RF EXPOSURE CATEGORY
FCC 47 CFR 2.1093	Health Canada Safety Code 6	8.0 W/kg	averaged over 1 gram	Occupational / Controlled

Test Date	Fluid Type	Ambient Temp.	Fluid Temp.	Fluid Depth	Atmospheric Pressure	Relative Humidity	ρ (Kg/m^3)
Jun 29	450 Body	23.5 °C	23.0 °C	≥ 15 cm	101.1 kPa	35%	1000
Jun 30	450 Body	23.0 °C	23.0 °C	≥ 15 cm	101.1 kPa	35%	1000

SAR MEASUREMENT SUMMARY (CONT.)

BODY-WORN SAR EVALUATION RESULTS

Test Date	FCC Test Proc. Desc.	Test Freq.	Antenna Part. No.	Battery Part No.	Accessory Type(s)		Device Distance to Planar Phantom		Cond. Power Before Test	Measured SAR 1g (W/kg) PTT Duty Cycle		SAR Drift During Test	Scaled SAR with droop 1g (W/kg) PTT Duty Cycle	
		MHz			Body	Audio	DUT	ANT.	Watts	100%	50%	dB	100%	50%
Jun 30	Highest SAR Search Proc.	455.0	KRA-27M	KNB-29N	Belt-Clip	Headset	1.3	3.0	5.1	10.9	5.45	-0.555	12.4	6.19
Jun 30						Ear-bud	1.3	3.0	5.1	10.9	5.45	-0.610	12.5	6.27
Jun 30						Palm-Mic	1.3	3.0	5.1	10.2	5.10	-0.493	11.4	5.71
Jun 30						Spkr-Mic	1.3	3.0	5.1	10.0	5.00	-0.500	11.2	5.61
Jun 30				KNB-45L		Headset	1.3	3.0	5.1	10.2	5.10	-0.220	10.7	5.37
Jun 30						Ear-bud	1.3	3.0	5.1	10.5	5.25	-0.433	11.6	5.80
Jun 30						Palm-Mic	1.3	3.0	5.1	10.2	5.10	-0.345	11.0	5.52
Jun 30						Spkr-Mic	1.3	3.0	5.1	9.83	4.92	-0.339	10.6	5.31
Jun 30		421.0	KRA-27M3	KNB-29N		Headset	1.3	3.0	5.2	7.40	3.70	-0.463	8.23	4.12
Jun 30						Ear-bud	1.3	3.0	5.2	8.52	4.26	-0.641	9.88	4.94
Jul 01						Palm-Mic	1.3	3.0	5.2	8.27	4.14	-0.647	9.60	4.80
Jul 01						Spkr-Mic	1.3	3.0	5.2	7.75	3.88	-0.638	8.98	4.49
Jul 01				KNB-45L		Headset	1.3	3.0	5.2	7.86	3.93	-0.445	8.71	4.35
Jul 01						Ear-bud	1.3	3.0	5.2	8.17	4.09	-0.302	8.76	4.38
Jul 01						Palm-Mic	1.3	3.0	5.2	7.87	3.94	-0.369	8.57	4.28
Jul 01						Spkr-Mic	1.3	3.0	5.2	7.67	3.84	-0.423	8.46	4.23
Jul 01		435.0		KNB-29N		Headset	1.3	3.0	5.2	6.43	3.22	-0.501	7.22	3.61
Jul 01						Ear-bud	1.3	3.0	5.2	6.68	3.34	-0.524	7.54	3.77
Jul 01						Palm-Mic	1.3	3.0	5.2	6.76	3.38	-0.519	7.62	3.81
Jul 01						Spkr-Mic	1.3	3.0	5.2	5.94	2.97	-0.488	6.65	3.32
Jul 01				KNB-45L		Headset	1.3	3.0	5.2	6.15	3.08	-0.341	6.65	3.33
Jul 01						Ear-bud	1.3	3.0	5.2	6.89	3.45	-0.279	7.35	3.67
Jul 01						Palm-Mic	1.3	3.0	5.2	6.45	3.23	-0.366	7.02	3.51
Jul 01						Spkr-Mic	1.3	3.0	5.2	5.61	2.81	-0.349	6.08	3.04
Jul 01	Remain. Test Chan. Redux	450.0	KRA-17M	KNB-29N	Belt-Clip	Palm-Mic	1.3	3.2	5.1	12.0	6.00	-0.607	13.8	6.90
Jul 01		470.0					1.3	3.2	5.1	10.7	5.35	-0.557	12.2	6.08
Jul 01		440.0	KRA-23M	KNB-45L		Ear-bud	1.3	3.1	5.1	9.24	4.62	-0.300	9.90	4.95
Aug 04		470.0					1.3	3.1	5.1	8.39	4.20	-0.566	9.56	4.78
Jul 01		406.1	KRA-23M3	KNB-29N		Ear-bud	1.3	3.1	5.1	8.99	4.50	-0.131	9.27	4.63
Jul 01		450.0					1.3	3.1	5.1	4.48	2.24	-0.726	5.30	2.65
Jul 02		440.0	KRA-27M	KNB-29N		Headset	1.3	3.0	5.1	9.89	4.95	-0.326	10.7	5.33
Jul 02		470.0					1.3	3.0	5.1	9.36	4.68	-0.463	10.4	5.21
Jul 02		406.1	KRA-27M3	KNB-29N		Ear-bud	1.3	3.0	5.1	8.74	4.37	-0.528	9.87	4.93
Jul 02		450.0					1.3	3.0	5.1	5.40	2.70	-0.396	5.92	2.96
Aug 04		450.0	KRA-17M	KNB-29N		Headset	1.3	3.2	5.1	10.6	5.30	-0.757	12.6	6.31
Aug 04		470.0					1.3	3.2	5.1	10.3	5.15	-0.521	11.6	5.81
Aug 04		450.0	KRA-17M	KNB-29N		Ear-bud	1.3	3.2	5.1	11.4	5.70	-0.794	13.7	6.85
Aug 04		470.0					1.3	3.2	5.1	10.5	5.25	-0.441	11.6	5.81
Aug 04		450.0	KRA-17M	KNB-29N		Spkr-Mic	1.3	3.2	5.1	10.6	5.30	-0.759	12.6	6.31
Aug 04		470.0					1.3	3.2	5.1	10.8	5.40	-0.688	12.7	6.33

SAR LIMIT(S)		BODY	SPATIAL PEAK	RF EXPOSURE CATEGORY
FCC 47 CFR 2.1093	Health Canada Safety Code 6	8.0 W/kg	averaged over 1 gram	Occupational / Controlled

Test Date	Fluid Type	Ambient Temp.	Fluid Temp.	Fluid Depth	Atmospheric Pressure	Relative Humidity	ρ (Kg/m^3)
Jun 30	450 Body	23.0 °C	23.0 °C	≥ 15 cm	101.1 kPa	35%	1000
Jul 01	450 Body	23.5 °C	23.5°C	≥ 15 cm	101.1 kPa	35%	1000
Jul 02	450 Body	24.0 °C	23.0 °C	≥ 15 cm	101.1 kPa	35%	1000
Aug 04	450 Body	22.0 °C	23.0 °C	≥ 15 cm	101.1 kPa	35%	1000

SAR MEASUREMENT SUMMARY (CONT.)

SAR LEVELS SCALED TO KENWOOD MAXIMUM TOLERANCE SPECIFICATION

Test Config.	Freq. (MHz)	Antenna Part No.	Battery Part No.	Meas. Cond. Pwr. (Watts)	SAR Level 1g (W/kg)	Scaling to 5.2 Watts	Scaled SAR 1g (W/kg)
Face-held	460.0	KRA-17M	KNB-29N	5.1	5.89	+ 0.08 dB	6.01
Face-held	460.0	KRA-17M	KNB-45L	5.1	6.30	+ 0.08 dB	6.42
Face-held	455.0	KRA-23M	KNB-29N	5.1	5.02	+ 0.08 dB	5.09
Face-held	455.0	KRA-23M	KNB-45L	5.1	4.93	+ 0.08 dB	5.02
Face-held	455.0	KRA-27M	KNB-29N	5.1	4.70	+ 0.08 dB	4.79
Face-held	455.0	KRA-27M	KNB-45L	5.1	3.97	+ 0.08 dB	4.05
Face-held	450.0	KRA-17M	KNB-45L	5.1	4.23	+ 0.08 dB	4.32
Face-held	470.0	KRA-17M	KNB-45L	5.1	4.98	+ 0.08 dB	5.07
Face-held	440.0	KRA-23M	KNB-45L	5.1	4.78	+ 0.08 dB	4.87
Face-held	470.0	KRA-23M	KNB-45L	5.1	4.28	+ 0.08 dB	4.36
Face-held	406.1	KRA-23M3	KNB-45L	5.1	4.82	+ 0.08 dB	4.91
Face-held	450.0	KRA-23M3	KNB-45L	5.1	4.72	+ 0.08 dB	4.81
Face-held	440.0	KRA-27M	KNB-29N	5.1	3.62	+ 0.08 dB	3.70
Face-held	470.0	KRA-27M	KNB-29N	5.1	4.11	+ 0.08 dB	4.20
Face-held	406.1	KRA-27M3	KNB-29N	5.1	3.70	+ 0.08 dB	3.77
Face-held	450.0	KRA-27M3	KNB-29N	5.1	2.33	+ 0.08 dB	2.37

Notes:

1. The SAR levels reported are based on 50% PTT duty factor includng SAR droop.
2. The scaled SAR levels are below the FCC/IC Occupational SAR Limit of 8.0 W/kg.

SAR MEASUREMENT SUMMARY (CONT.)

SAR LEVELS SCALED TO KENWOOD MAXIMUM TOLERANCE SPECIFICATION

Test Config.	Freq. (MHz)	Antenna Part No.	Battery Part No.	Meas. Cond. Pwr. (Watts)	SAR Level 1g (W/kg)	Scaling to 5.2 Watts	Scaled SAR 1g (W/kg)
Body-worn	460.0	KRA-17M	KNB-29N	5.1	6.46	+ 0.08 dB	6.58
Body-worn	455.0	KRA-23M	KNB-29N	5.1	4.99	+ 0.08 dB	5.08
Body-worn	455.0	KRA-27M	KNB-29N	5.1	5.33	+ 0.08 dB	5.45
Body-worn	460.0	KRA-17M	KRA-29N	5.1	6.48	+ 0.08 dB	6.62
Body-worn	460.0	KRA-17M	KNB-29N	5.1	6.77	+ 0.08 dB	6.88
Body-worn	460.0	KRA-17M	KNB-29N	5.1	7.26	+ 0.08 dB	7.39
Body-worn	460.0	KRA-17M	KNB-29N	5.1	6.23	+ 0.08 dB	6.37
Body-worn	460.0	KRA-17M	KNB-45L	5.1	6.16	+ 0.08 dB	6.26
Body-worn	460.0	KRA-17M	KNB-45L	5.1	6.11	+ 0.08 dB	6.21
Body-worn	460.0	KRA-17M	KNB-45L	5.1	6.18	+ 0.08 dB	6.32
Body-worn	460.0	KRA-17M	KNB-45L	5.1	6.20	+ 0.08 dB	6.32
Body-worn	455.0	KRA-23M	KNB-29N	5.1	4.84	+ 0.08 dB	4.93
Body-worn	455.0	KRA-23M	KNB-29N	5.1	4.91	+ 0.08 dB	5.01
Body-worn	455.0	KRA-23M	KNB-29N	5.1	4.97	+ 0.08 dB	5.06
Body-worn	455.0	KRA-23M	KNB-29N	5.1	4.77	+ 0.08 dB	4.87
Body-worn	455.0	KRA-23M	KNB-45L	5.1	4.90	+ 0.08 dB	4.99
Body-worn	455.0	KRA-23M	KNB-45L	5.1	4.78	+ 0.08 dB	4.87
Body-worn	455.0	KRA-23M	KNB-45L	5.1	4.61	+ 0.08 dB	4.70
Body-worn	455.0	KRA-23M	KNB-45L	5.1	4.72	+ 0.08 dB	4.82
Body-worn	455.0	KRA-27M	KNB-29N	5.1	6.19	+ 0.08 dB	6.32
Body-worn	455.0	KRA-27M	KNB-29N	5.1	6.27	+ 0.08 dB	6.37
Body-worn	455.0	KRA-27M	KNB-29N	5.1	5.71	+ 0.08 dB	5.81
Body-worn	455.0	KRA-27M	KNB-29N	5.1	5.61	+ 0.08 dB	5.70
Body-worn	455.0	KRA-27M	KNB-45L	5.1	5.37	+ 0.08 dB	5.45
Body-worn	455.0	KRA-27M	KNB-45L	5.1	5.80	+ 0.08 dB	5.91
Body-worn	455.0	KRA-27M	KNB-45L	5.1	5.52	+ 0.08 dB	5.60
Body-worn	455.0	KRA-27M	KNB-45L	5.1	5.31	+ 0.08 dB	5.40
Body-worn	450.0	KRA-17M	KNB-29N	5.1	6.90	+ 0.08 dB	7.03
Body-worn	470.0	KRA-17M	KNB-29N	5.1	6.08	+ 0.08 dB	6.21
Body-worn	440.0	KRA-23M	KNB-45L	5.1	4.95	+ 0.08 dB	5.04
Body-worn	470.0	KRA-23M	KNB-45L	5.1	4.78	+ 0.08 dB	4.87
Body-worn	406.1	KRA-23M3	KNB-29N	5.1	4.63	+ 0.08 dB	4.73
Body-worn	450.0	KRA-23M3	KNB-29N	5.1	2.65	+ 0.08 dB	2.70
Body-worn	440.0	KRA-27M	KNB-29N	5.1	5.33	+ 0.08 dB	5.45
Body-worn	470.0	KRA-27M	KNB-29N	5.1	5.21	+ 0.08 dB	5.30
Body-worn	406.1	KRA-27M3	KNB-29N	5.1	4.93	+ 0.08 dB	5.03
Body-worn	450.0	KRA-27M3	KNB-29N	5.1	2.96	+ 0.08 dB	3.02
Body-worn	450.0	KRA-17M	KNB-29N	5.1	6.31	+ 0.08 dB	6.43
Body-worn	470.0	KRA-17M	KNB-29N	5.1	5.81	+ 0.08 dB	5.92
Body-worn	450.0	KRA-17M	KNB-29N	5.1	6.85	+ 0.08 dB	6.98
Body-worn	470.0	KRA-17M	KNB-29N	5.1	5.81	+ 0.08 dB	5.92
Body-worn	450.0	KRA-17M	KNB-29N	5.1	6.31	+ 0.08 dB	6.43
Body-worn	470.0	KRA-17M	KNB-29N	5.1	6.33	+ 0.08 dB	6.45

Notes:
1. The SAR levels reported are based on 50% PTT duty factor including SAR droop.
2. The scaled SAR levels are below the FCC/IC Occupational SAR Limit of 8.0 W/kg.

8.0 FLUID DIELECTRIC PARAMETERS

421 MHz Body – June 29				435 MHz Body – June 29				455 MHz Body – June 29				460 MHz Body – June 29			
Dielectric Constant ε_r				Dielectric Constant ε_r				Dielectric Constant ε_r				Dielectric Constant ε_r			
450 Target		Inter.	Dev.	450 Target		Inter.	Dev.	450 Target		Inter.	Dev.	450 Target		Meas.	Dev.
56.7	± 5%	56.2	-0.9%	56.7	± 5%	56.1	-1.0%	56.7	± 5%	55.7	-1.8%	56.7	± 5%	55.5	-2.1%
Conductivity σ (mho/m)				Conductivity σ (mho/m)				Conductivity σ (mho/m)				Conductivity σ (mho/m)			
450 Target		Inter.	Dev.	450 Target		Inter.	Dev.	450 Target		Inter.	Dev.	450 Target		Meas.	Dev.
0.94	± 5%	0.90	-4.0%	0.94	± 5%	0.91	-3.0%	0.94	± 5%	0.93	-1.1%	0.94	± 5%	0.94	0.0%
421 MHz Body – June 30				**435 MHz Body – June 30**				**455 MHz Body – June 30**				**406.1 MHz Body – July 1**			
Dielectric Constant ε_r				Dielectric Constant ε_r				Dielectric Constant ε_r				Dielectric Constant ε_r			
450 Target		Inter.	Dev.	450 Target		Inter.	Dev.	450 Target		Inter.	Dev.	450 Target		Inter.	Dev.
56.7	± 5%	56.9	+0.3%	56.7	± 5%	57.0	+0.5%	56.7	± 5%	56.2	-0.9%	56.7	± 5%	57.0	+0.5%
Conductivity σ (mho/m)				Conductivity σ (mho/m)				Conductivity σ (mho/m)				Conductivity σ (mho/m)			
450 Target		Inter.	Dev.	450 Target		Inter.	Dev.	450 Target		Inter.	Dev.	450 Target		Inter.	Dev.
0.94	± 5%	0.92	-2.1%	0.94	± 5%	0.93	-1.1%	0.94	± 5%	0.94	0.0%	0.94	± 5%	0.91	-3.0%
421 MHz Body – July 1				**435 MHz Body – July 1**				**440 MHz Body – July 1**				**450 MHz Body – July 1**			
Dielectric Constant ε_r				Dielectric Constant ε_r				Dielectric Constant ε_r				Dielectric Constant ε_r			
450 Target		Inter.	Dev.	450 Target		Inter.	Dev.	450 Target		Meas.	Dev.	450 Target		Meas.	Dev.
56.7	± 5%	57.3	+1.0%	56.7	± 5%	57.0	+0.7%	56.7	± 5%	57.0	+0.5%	56.7	± 5%	56.9	+0.3%
Conductivity σ (mho/m)				Conductivity σ (mho/m)				Conductivity σ (mho/m)				Conductivity σ (mho/m)			
450 Target		Inter.	Dev.	450 Target		Inter.	Dev.	450 Target		Meas.	Dev.	450 Target		Meas.	Dev.
0.94	± 5%	0.91	-3.0%	0.94	± 5%	0.93	-1.1%	0.94	± 5%	0.93	-1.1%	0.94	± 5%	0.93	-1.1%
470 MHz Body – July 1				**406.1 MHz Body – July 2**				**440 MHz Body – July 2**				**450 MHz Body – July 2**			
Dielectric Constant ε_r				Dielectric Constant ε_r				Dielectric Constant ε_r				Dielectric Constant ε_r			
450 Target		Meas.	Dev.	450 Target		Inter.	Dev.	450 Target		Meas.	Dev.	450 Target		Meas.	Dev.
56.7	± 5%	56.2	-0.9%	56.7	± 5%	58.0	+2.3%	56.7	± 5%	57.0	+0.5%	56.7	± 5%	56.9	+0.3%
Conductivity σ (mho/m)				Conductivity σ (mho/m)				Conductivity σ (mho/m)				Conductivity σ (mho/m)			
450 Target		Meas.	Dev.	450 Target		Inter.	Dev.	450 Target		Meas.	Dev.	450 Target		Meas.	Dev.
0.94	± 5%	0.96	+2.1%	0.94	± 5%	0.91	-3.0%	0.94	± 5%	0.94	0.0%	0.94	± 5%	0.94	0.0%
470 MHz Body – July 2				**406.1 MHz Head – July 2**				**421 MHz Head – July 2**				**435 MHz Head – July 2**			
Dielectric Constant ε_r				Dielectric Constant ε_r				Dielectric Constant ε_r				Dielectric Constant ε_r			
450 Target		Meas.	Dev.	450 Target		Inter.	Dev.	450 Target		Inter.	Dev.	450 Target		Inter.	Dev.
56.7	± 5%	56.1	-1.0%	43.5	± 5%	45.2	+3.9%	43.5	± 5%	45.5	+4.6%	43.5	± 5%	45.1	+3.7%
Conductivity σ (mho/m)				Conductivity σ (mho/m)				Conductivity σ (mho/m)				Conductivity σ (mho/m)			
450 Target		Meas.	Dev.	450 Target		Inter.	Dev.	450 Target		Inter.	Dev.	450 Target		Inter.	Dev.
0.94	± 5%	0.95	+1.1%	0.87	± 5%	0.83	-4.6%	0.87	± 5%	0.84	-3.4%	0.87	± 5%	0.85	-2.3%
440 MHz Head – July 2				**450 MHz Head – July 2**				**455 MHz Head – July 2**				**460 MHz Head – July 2**			
Dielectric Constant ε_r				Dielectric Constant ε_r				Dielectric Constant ε_r				Dielectric Constant ε_r			
450 Target		Meas.	Dev.	450 Target		Meas.	Dev.	450 Target		Inter.	Dev.	450 Target		Meas.	Dev.
43.5	± 5%	45.1	+3.7%	43.5	± 5%	44.9	+3.2%	43.5	± 5%	45.0	+3.4%	43.5	± 5%	45.0	+3.4%
Conductivity σ (mho/m)				Conductivity σ (mho/m)				Conductivity σ (mho/m)				Conductivity σ (mho/m)			
450 Target		Meas.	Dev.	450 Target		Meas.	Dev.	450 Target		Inter.	Dev.	450 Target		Meas.	Dev.
0.87	± 5%	0.85	-2.3%	0.87	± 5%	0.87	0.0%	0.87	± 5%	0.88	+1.1%	0.87	± 5%	0.88	+1.1%

FLUID DIELECTRIC PARAMETERS (CONT.)

470 MHz Head – July 2				406.1 MHz Head – July 3				421 MHz Head – July 3				435 MHz Head – July 3			
Dielectric Constant ε_r				Dielectric Constant ε_r				Dielectric Constant ε_r				Dielectric Constant ε_r			
450 Target		Meas.	Dev.	450 Target		Inter.	Dev.	450 Target		Inter.	Dev.	450 Target		Inter.	Dev.
43.5	± 5%	44.2	+1.6%	43.5	± 5%	45.2	+3.9%	43.5	± 5%	45.4	+4.4%	43.5	± 5%	45.4	+4.4%
Conductivity σ (mho/m)				Conductivity σ (mho/m)				Conductivity σ (mho/m)				Conductivity σ (mho/m)			
450 Target		Meas.	Dev.	450 Target		Inter.	Dev.	450 Target		Inter.	Dev.	450 Target		Inter.	Dev.
0.87	± 5%	0.88	+1.1%	0.87	± 5%	0.83	-4.6%	0.87	± 5%	0.86	-1.1%	0.87	± 5%	0.85	-2.3%

440 MHz Head – July 3				450 MHz Head – July 3				455 MHz Head – July 3				470 MHz Head – July 3			
Dielectric Constant ε_r				Dielectric Constant ε_r				Dielectric Constant ε_r				Dielectric Constant ε_r			
450 Target		Meas.	Dev.	450 Target		Meas.	Dev.	450 Target		Inter.	Dev.	450 Target		Meas.	Dev.
43.5	± 5%	45.4	+4.4%	43.5	± 5%	45.1	+3.7%	43.5	± 5%	45.0	+3.4%	43.5	± 5%	44.6	+2.5%
Conductivity σ (mho/m)				Conductivity σ (mho/m)				Conductivity σ (mho/m)				Conductivity σ (mho/m)			
450 Target		Meas.	Dev.	450 Target		Meas.	Dev.	450 Target		Inter.	Dev.	450 Target		Meas.	Dev.
0.87	± 5%	0.85	-2.3%	0.87	± 5%	0.88	+1.1%	0.87	± 5%	0.88	+1.1%	0.87	± 5%	0.89	+2.3%

450 MHz Body – August 4				470 MHz Body – August 4			
Dielectric Constant ε_r				Dielectric Constant ε_r			
450 Target		Meas.	Dev.	450 Target		Inter.	Dev.
56.7	± 5%	56.9	+0.3%	56.7	± 5%	56.9	+0.3%
Conductivity σ (mho/m)				Conductivity σ (mho/m)			
450 Target		Meas.	Dev.	450 Target		Inter.	Dev.
0.94	± 5%	0.95	+1.1%	0.94	± 5%	0.97	+3.2%

9.0 DETAILS OF SAR EVALUATION

1. The number of test frequencies and the test channels evaluated for SAR were selected in accordance with the procedures described in FCC KDB 447498 Section 6)c).
2. The DUT was evaluated for SAR based on the test plan accepted by the FCC per KDB Inquiry Tracking No. 407503.
3. The face-held SAR evaluations were performed with the front of the radio placed parallel to the outer surface of the planar phantom. A 2.5 cm spacing was maintained between the front side of the DUT and the outer surface of the planar phantom.
4. The "Baseline" body-worn SAR evaluations were performed without any body-worn and audio accessories attached to the DUT. The baseline SAR evaluations were performed with the equivalent air-gap separation distance that the belt-clip accessory provides when attached to the back of the radio (battery parallel to phantom).
5. The "Highest SAR Search Procedure" and "Remaining Test Channel Reduction" body-worn SAR evaluations were performed with the belt-clip body-worn accessory attached to the DUT and touching the outer surface of the planar phantom (battery parallel to phantom). The SAR evaluations were performed with the audio accessory connected to the DUT as described in this report.
6. The audio accessories utilized for the body-worn SAR were selected based on evaluating one of each of the optional audio accessory variations per Kenwood's disclosed accessory listing (speaker-microphone, headset, earpiece, and wire kit). This method of selection for SAR test reduction was accepted by the FCC prior to testing (KDB #407503).
7. The area scan evaluation was performed with a fully charged battery. After the area scan was completed the radio was cooled down and the battery was replaced with a fully charged battery prior to the zoom scan evaluation.
8. A SAR-versus-Time power droop evaluation was performed in the test configuration that reported the maximum scaled SAR level (body-worn). See Appendix A (SAR Test Plots) for SAR-versus-Time power droop evaluation plot.
9. 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.
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).
11. The DUT was tested at the maximum conducted output power level preset by the manufacturer in unmodulated continuous transmit operation (Continuous Wave mode at 100% duty cycle) with the transmit key constantly depressed. For a push-to-talk device the 50% duty cycle compensation reported assumes a transmit/receive cycle of equal time base.

10.0 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.
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 find the points between the dipole center of the probe and the surface of the phantom. This data cannot be measured, since the center of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.4 mm (see probe calibration document in Appendix F). The extrapolation was based on trivariate quadratics computed from the previously calculated 3D interpolated points nearest the phantom surface.

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

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

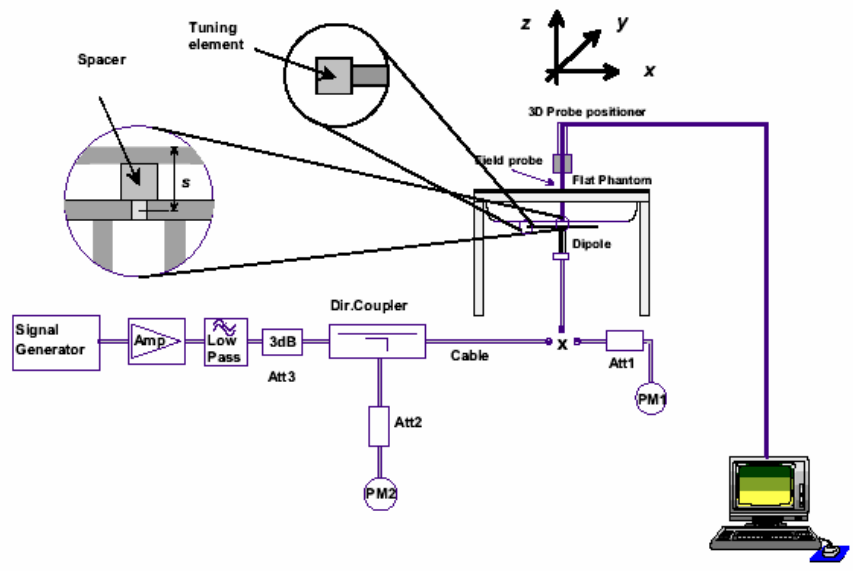
11.0 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluations, daily system checks were performed with a planar phantom and SPEAG 450 MHz dipole (see Appendix B) in accordance with the procedures described in IEEE Standard 1528-2003 (see reference [3]). 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 for measured fluid dielectric parameters). A forward power of 398 mW was applied to the dipole and the system was verified to a tolerance of ±10% from the SAR system manufacturer's dipole calibration target SAR value (see Appendix E for system manufacturer's dipole calibration procedures).

SYSTEM PERFORMANCE CHECK EVALUATIONS

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)
	Freq. (MHz)	SPEAG Target	Meas.	Dev.	SPEAG Target	Meas.	Dev.	SPEAG Target	Meas.	Dev.						
Jun 29	Body 450	1.78 ±10%	1.95	+9.6%	56.7 ±5%	55.9	-1.4%	0.94 ±5%	0.91	-3.2%	1000	23.5	23.0	≥ 15	35	101.1
Jun 30	Body 450	1.78 ±10%	1.95	+9.6%	56.7 ±5%	55.9	-1.4%	0.94 ±5%	0.94	0.0%	1000	23.0	23.0	≥ 15	35	101.1
Jul 01	Body 450	1.78 ±10%	1.89	+6.2%	56.7 ±5%	56.9	+0.4%	0.94 ±5%	0.93	-1.1%	1000	23.5	23.5	≥ 15	35	101.1
Jul 02	Body 450	1.78 ±10%	1.93	+8.4%	56.7 ±5%	56.9	+0.4%	0.94 ±5%	0.94	0.0%	1000	24.0	23.0	≥ 15	35	101.1
Jul 03	Head 450	1.87 ±10%	1.90	+1.6%	43.5 ±5%	45.1	+3.7%	0.87 ±5%	0.88	+1.1%	1000	24.0	23.0	≥ 15	35	101.1
Aug 04	Body 450	1.78 ±10%	1.90	+6.7%	56.7 ±5%	56.9	+0.4%	0.94 ±5%	0.95	+1.1%	1000	22.0	23.0	≥ 15	35	101.1

Notes		
	1.	The target SAR values are the measured values from the SAR system manufacturer's dipole calibration (see Appendix E).
	2.	The target dielectric parameters are the nominal values from the SAR system manufacturer's dipole calibration (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)

SPEAG 450 MHz Validation Dipole Setup

12.0 SIMULATED EQUIVALENT TISSUES

The simulated equivalent tissue recipes in the table below are derived from the SAR system manufacturer's suggested recipes in the DASY4 manual (see references [10] and [11]) 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 TISSUE MIXTURES		
INGREDIENT	**450 MHz HEAD**	**450 MHz BODY**
Water	38.56 %	52.00 %
Sugar	56.32 %	45.65 %
Salt	3.95 %	1.75 %
HEC	0.98 %	0.50 %
Bactericide	0.19 %	0.10 %

13.0 SAR LIMITS

SAR RF EXPOSURE LIMITS		
FCC 47 CFR 2.1093	**General Population**	**Occupational**
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.		

14.0 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	ET3DV6
Serial No.	1590
Construction	Triangular core fiber optic detection system
Frequency	10 MHz to 6 GHz
Linearity	±0.2 dB (30 MHz to 3 GHz)
Evaluation Phantom	
Type	Barski Planar Phantom
Shell Material	Fiberglass
Thickness	2.0 ±0.1 mm
Volume	Approx. 70 liters
Validation Phantom	
Type	Barski Planar Phantom
Shell Material	Fiberglass
Thickness	2.0 ±0.1 mm
Volume	Approx. 70 liters

15.0 PROBE SPECIFICATION (ET3DV6)

Construction:	Symmetrical design with triangular core; Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, glycol)
Calibration:	In air from 10 MHz to 2.5 GHz In head simulating tissue at frequencies of 900 MHz and 1.8 GHz (accuracy ± 8%)
Frequency:	10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity:	± 0.2 dB in head tissue (rotation around probe axis) ± 0.4 dB in head tissue (rotation normal to probe axis)
Dynamic Range:	5 μW/g to > 100 mW/g; Linearity: ± 0.2 dB
Surface Detect:	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces
Dimensions:	Overall length: 330 mm; Tip length: 16 mm; Body diameter: 12 mm; Tip diameter: 6.8 mm Distance from probe tip to dipole centers: 2.7 mm
Application:	General dosimetry up to 3 GHz; Compliance tests of mobile phone

ET3DV6 E-Field Probe

16.0 BARSKI PLANAR PHANTOM

The Barski Planar Phantom is a fiberglass shell phantom with a 2.0 mm (+/-0.2mm) thick device measurement area at the center of the phantom for SAR evaluations of devices with a larger surface area than the planar section of the SAM phantom. The planar phantom is integrated in a wooden table. The planar phantom was used for the DUT SAR evaluations and the system performance check evaluations. See Appendix G for dimensions and specifications of the planar phantom.

Barski Planar Phantom

17.0 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 evaluations of larger devices a Plexiglas platform is attached to the device holder.

Device Holder

18.0 TEST EQUIPMENT LIST

TEST EQUIPMENT		ASSET NO.	SERIAL NO.	DATE CALIBRATED	CALIBRATION INTERVAL
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	27Apr10	Annual
x	-ET3DV6 E-Field Probe	00017	1590	16Jul09	Annual
				15Jul10	Annual
x	-SPEAG D450V3 Validation Dipole	00217	1068	18Jan10	Biennial
x	-Barski Planar Phantom	00155	03-01	CNR	CNR
x	HP 85070C Dielectric Probe Kit	00033	none	CNR	CNR
x	Gigatronics 8652A Power Meter	00007	1835272	04May10	Biennial
x	Gigatronics 80701A Power Sensor	00014	1833699	04May10	Biennial
x	HP 8753ET Network Analyzer	00134	US39170292	04May10	Biennial
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				

19.0 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 (450 MHz)	E.2.1	6.65	Normal	1	1	1	6.65	6.65	∞
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	4.6	Normal	1	0.64	0.43	2.9	2.0	∞
Liquid Permittivity (target)	E.3.2	5	Rectangular	1.732050808	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measured)	E.3.3	4.6	Normal	1	0.6	0.49	2.8	2.3	∞
Combined Standard Uncertainty			**RSS**				**11.72**	**11.28**	
Expanded Uncertainty (95% Confidence Interval)			**k=2**				**23.44**	**22.56**	

Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003

20.0 REFERENCES

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

[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 (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)”, Radio Standards Specification RSS-102 Issue 4: March 2010.

[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] IEC International Standard 62209-1:2005 - “Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures.”

[7] 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)”.

[8] Federal Communications Commission, Office of Engineering and Technology - “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”; KDB 447498 D01 v04: November 2009.

[9] 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.

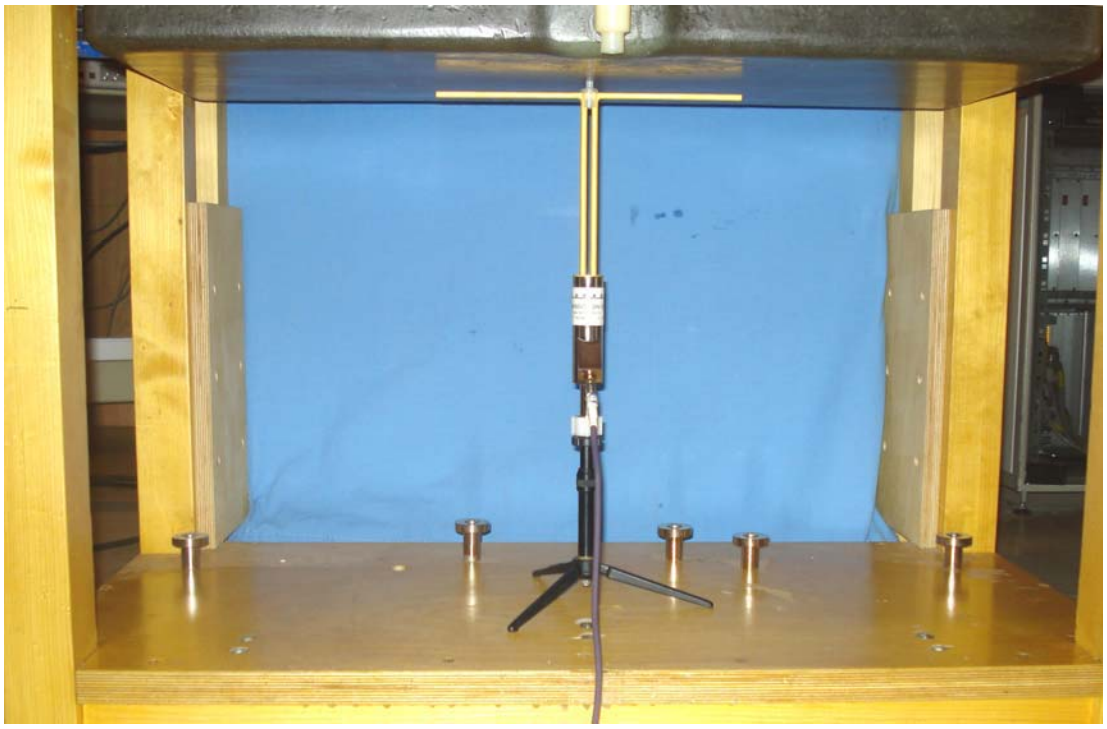
[10] Schmid & Partner Engineering AG - DASY4 Manual V4.6, Chapter 16 Application Note, Head Tissue Recipe: Sept. 2005.

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

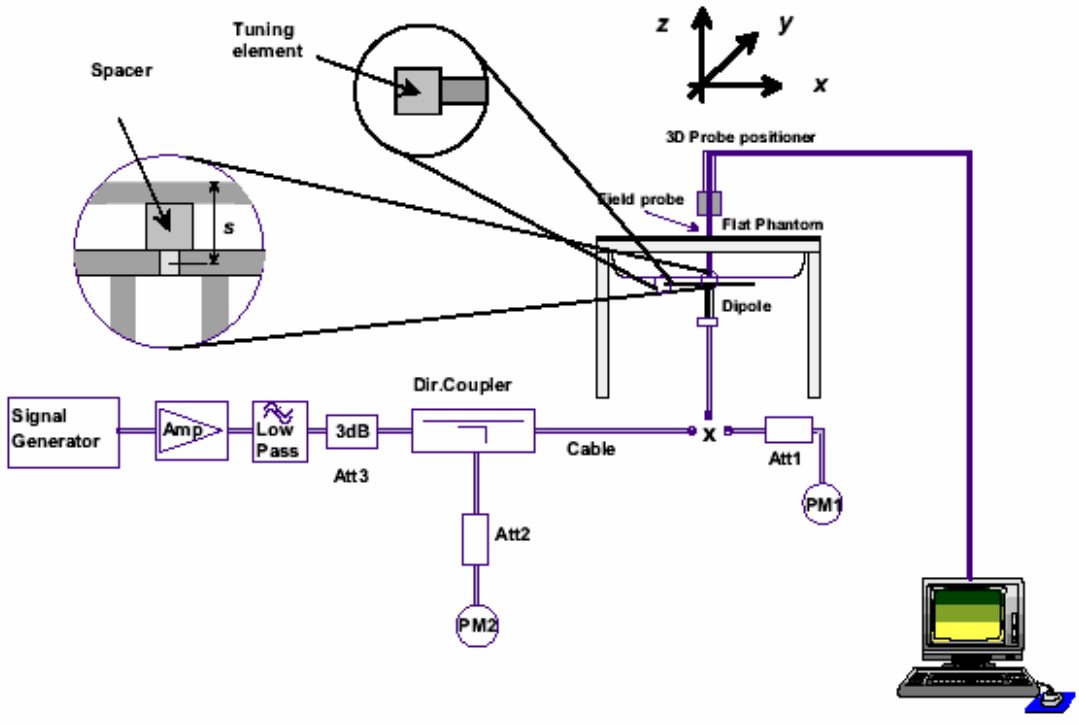
[12] ISO/IEC 17025 - “General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:2005).”

APPENDIX B - SYSTEM PERFORMANCE CHECK DATA

SYSTEM PERFORMANCE CHECK MEASUREMENT SETUP



SPEAG 450 MHz Validation Dipole with Fiberglas Validation Phantom



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

Date Tested: 06/29/2010

System Performance Check - 450 MHz Dipole - Body

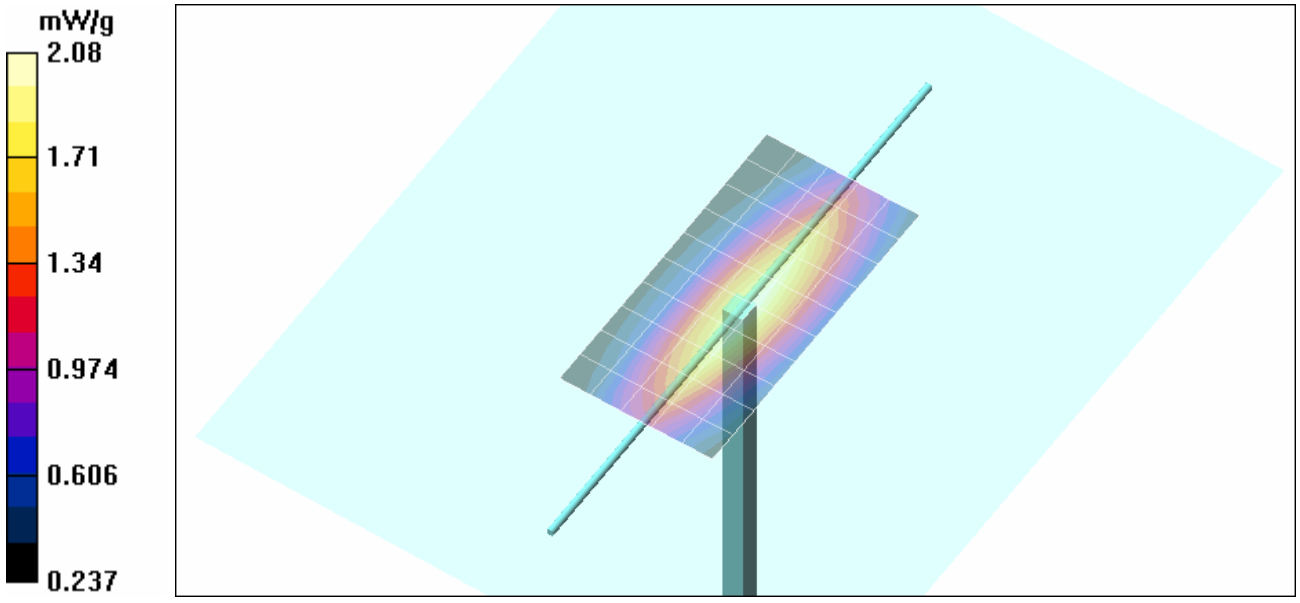
DUT: Dipole D450V3; Asset: 00217; Serial: 1068; Calibration: 01/18/2010

Ambient Temp: 23.5°C; Fluid Temp: 23.0°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

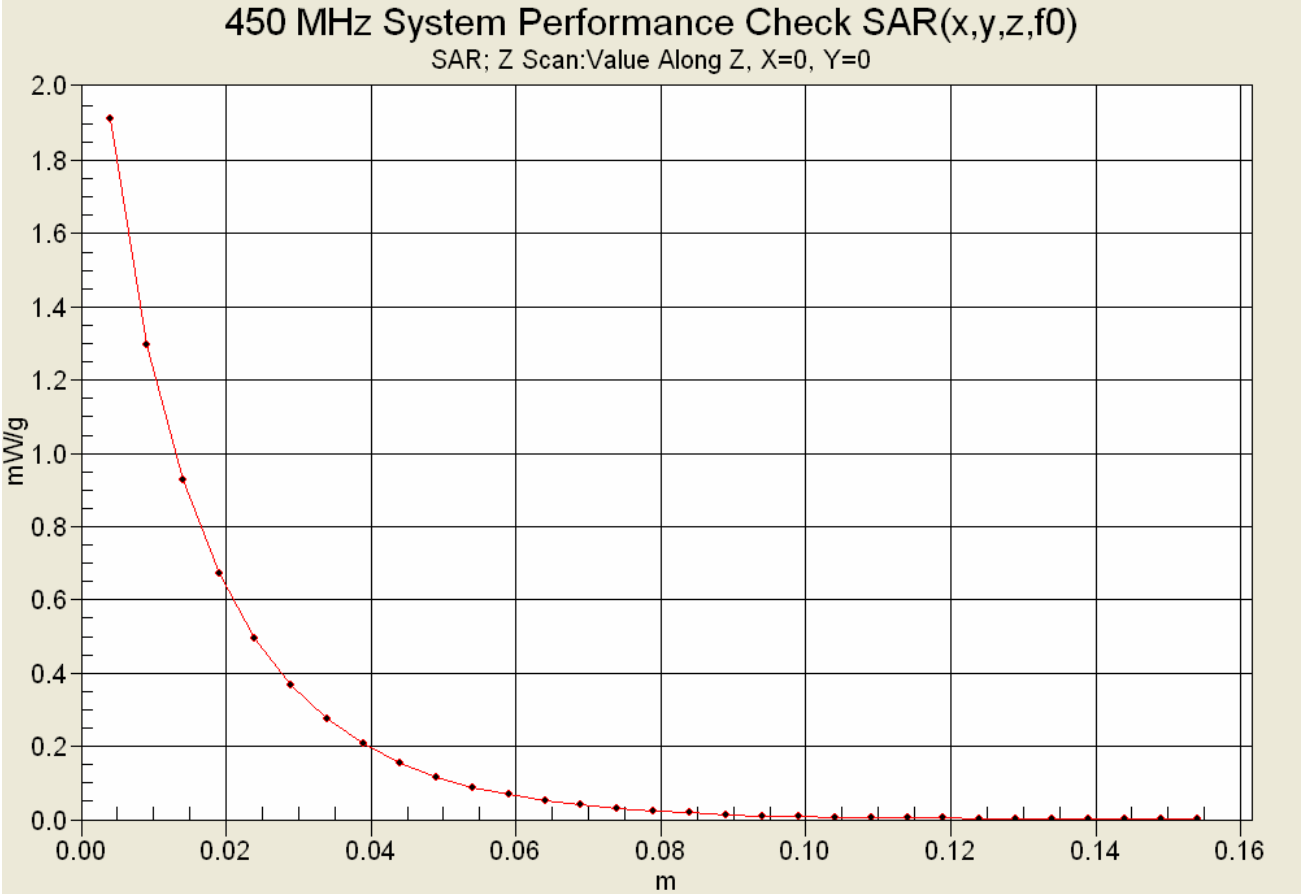
Communication System: CW
Forward Conducted Power: 398 mW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: MSL450 Medium parameters used: f = 450 MHz; σ = 0.91 mho/m; ε_r = 55.9; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(7.34, 7.34, 7.34); Calibrated: 16/07/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 27/04/2010
- Phantom: Barski Industries; Type: Fiberglas Planar; Serial: 03-01
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

System Performance Check - 450 MHz Dipole
Head d=15mm Pin=398mW 2/Area Scan (6x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 2.08 mW/g
Head d=15mm Pin=398mW 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 45.9 V/m; Power Drift = -0.023 dB
Peak SAR (extrapolated) = 3.08 W/kg
SAR(1 g) = 1.95 mW/g; SAR(10 g) = 1.3 mW/g
Maximum value of SAR (measured) = 2.08 mW/g



Z-Axis Scan


450 MHz System Performance Check SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
mW/g
m
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16

Date Tested: 06/30/2010

System Performance Check - 450 MHz Dipole - Body

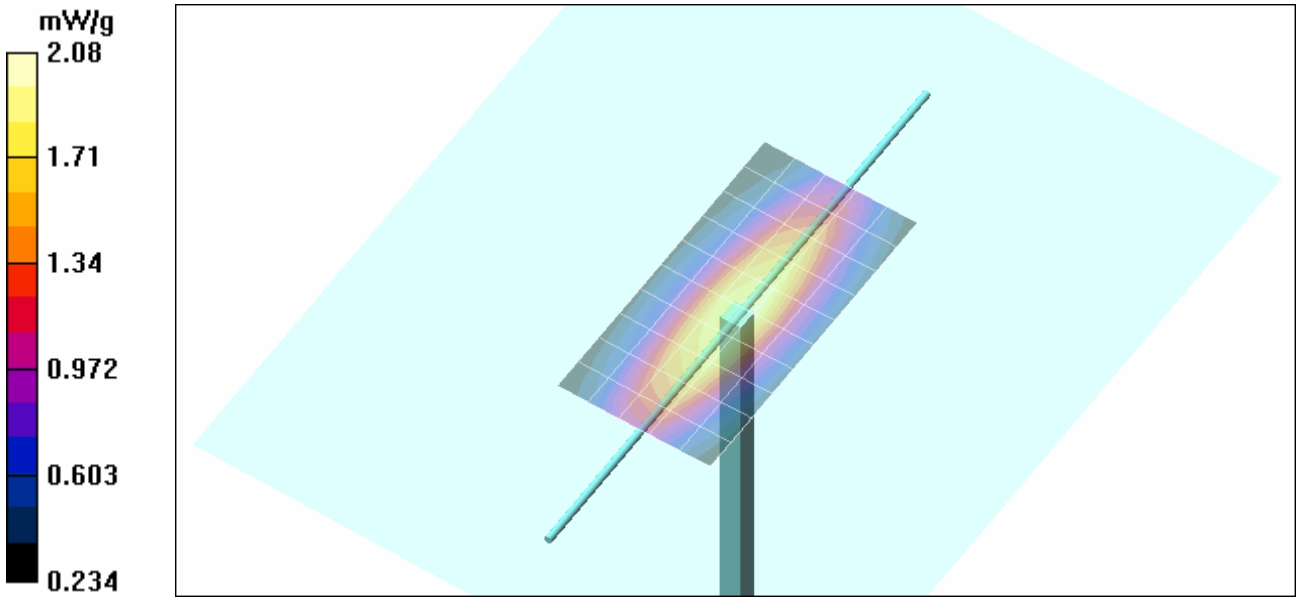
DUT: Dipole D450V3; Asset: 00217; Serial: 1068; Calibration: 01/18/2010

Ambient Temp: 23.0°C; Fluid Temp: 23.0°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

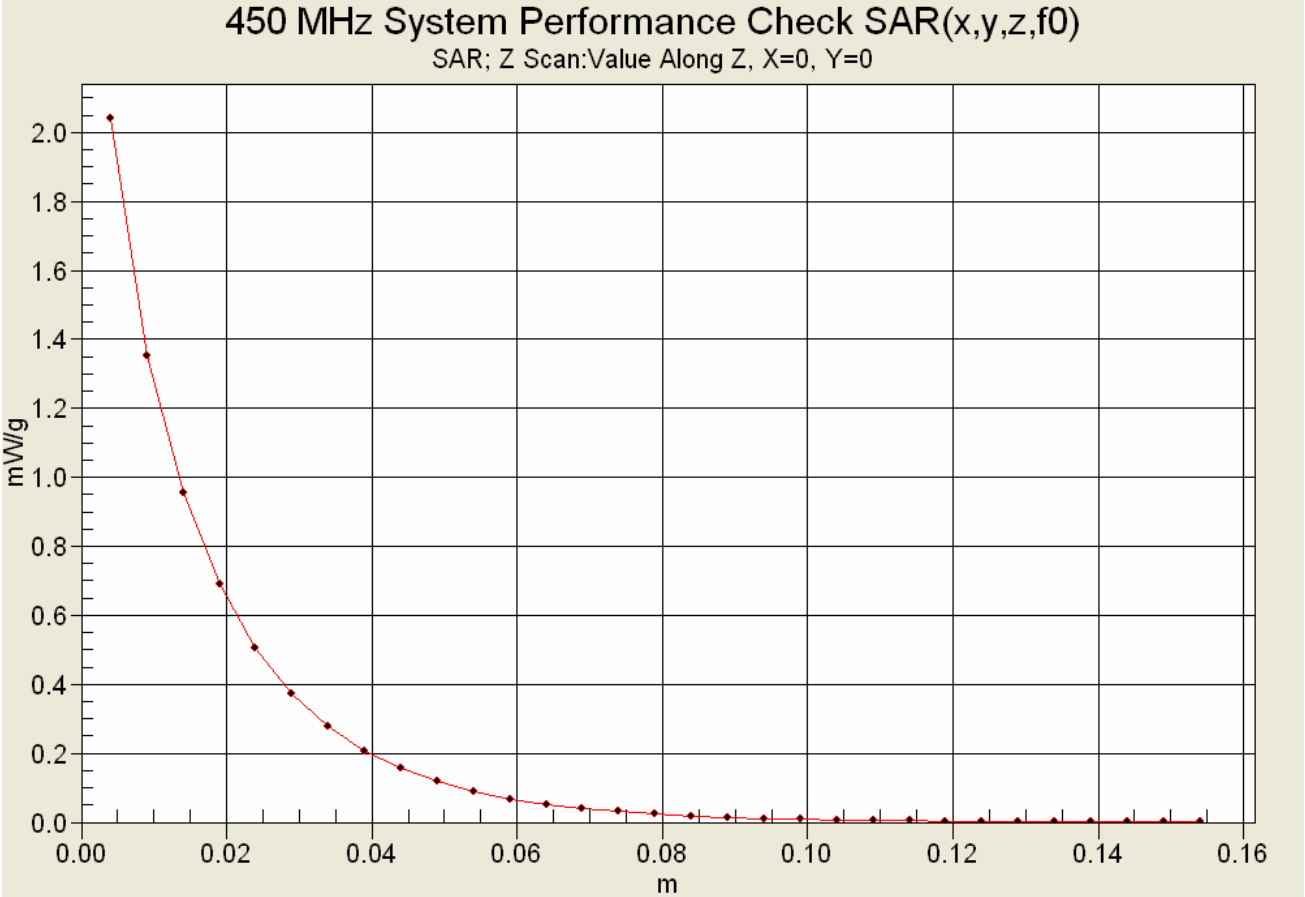
Communication System: CW
Forward Conducted Power: 398 mW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: MSL450 Medium parameters used: f = 450 MHz; σ = 0.94 mho/m; ε_r = 55.9; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(7.34, 7.34, 7.34); Calibrated: 16/07/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 27/04/2010
- Phantom: Barski Industries; Type: Fiberglas Planar; Serial: 03-01
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

System Performance Check - 450 MHz Dipole
Head d=15mm Pin=398mW 2/Area Scan (6x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.99 mW/g
Head d=15mm Pin=398mW 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 47.0 V/m; Power Drift = -0.008 dB
Peak SAR (extrapolated) = 3.08 W/kg
SAR(1 g) = 1.95 mW/g; SAR(10 g) = 1.3 mW/g
Maximum value of SAR (measured) = 2.08 mW/g



Z-Axis Scan



Date Tested: 07/01/2010

System Performance Check - 450 MHz Dipole - Body

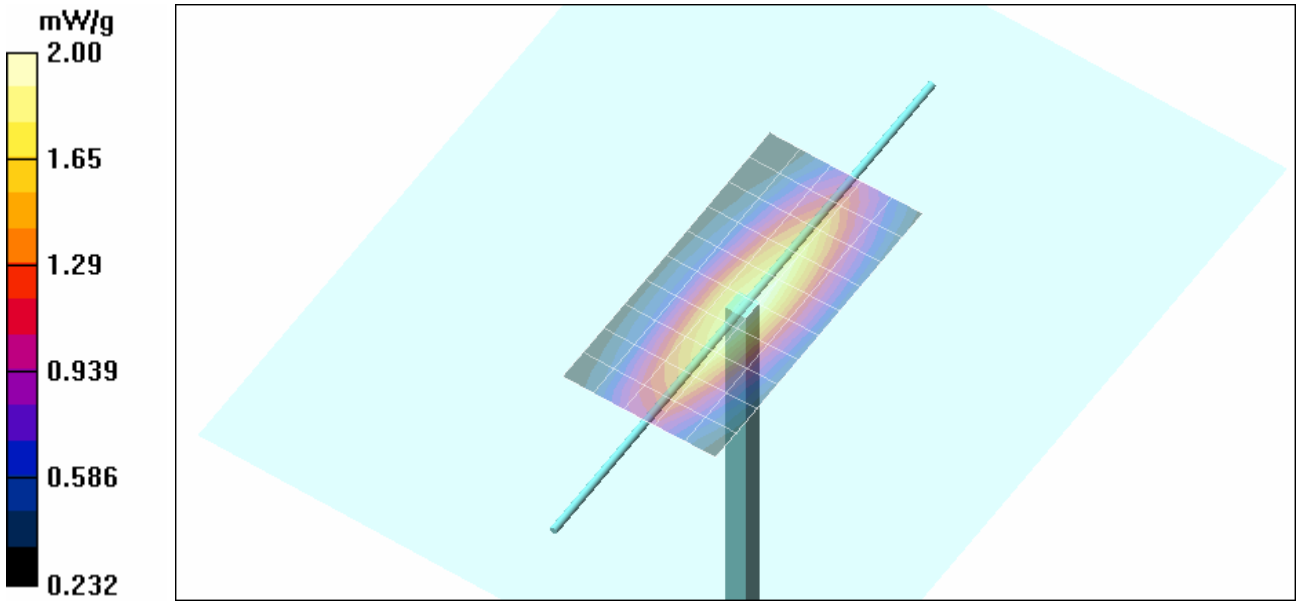
DUT: Dipole D450V3; Asset: 00217; Serial: 1068; Calibration: 01/18/2010

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

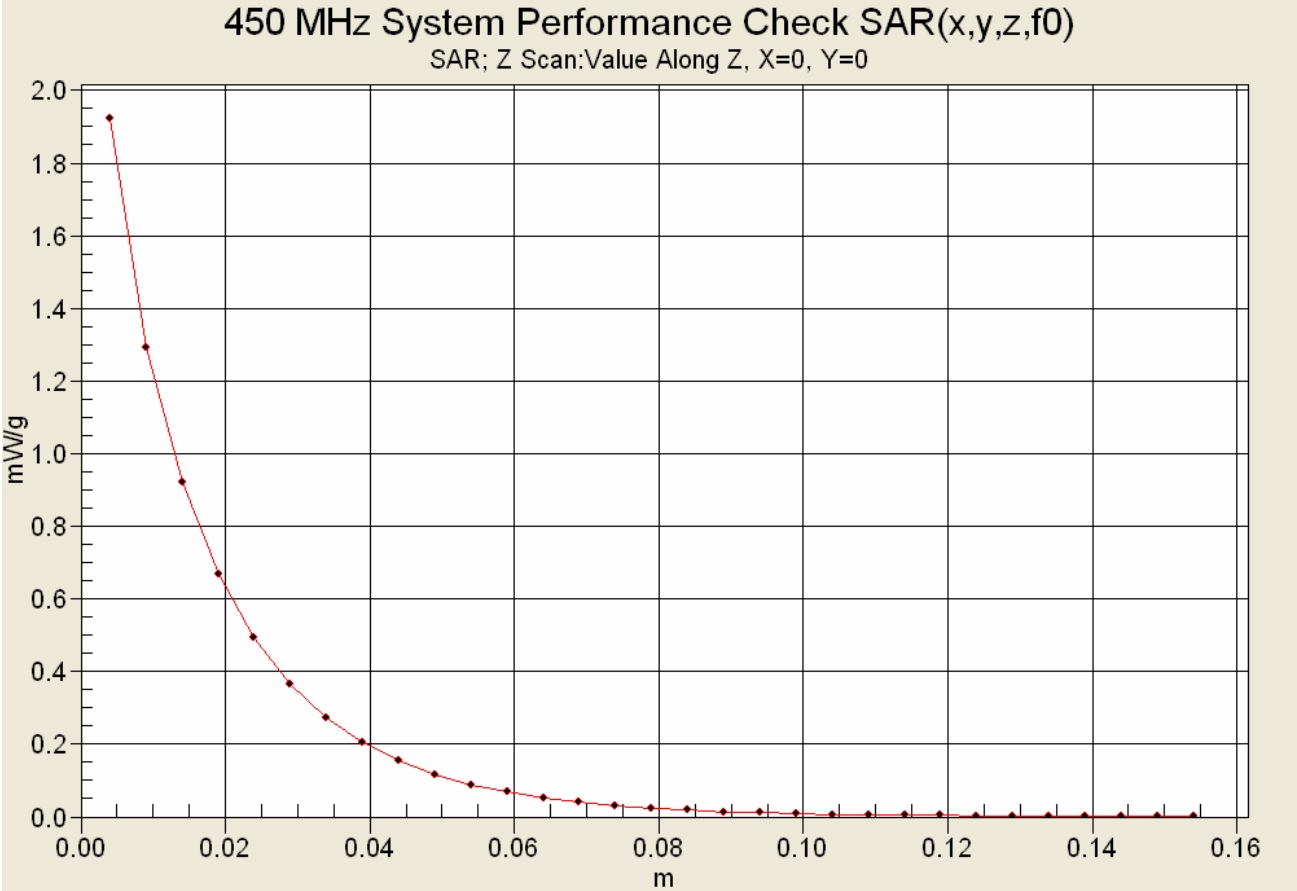
Communication System: CW
Forward Conducted Power: 398 mW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: MSL450 Medium parameters used: f = 450 MHz; σ = 0.93 mho/m; ε_r = 56.9; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(7.34, 7.34, 7.34); Calibrated: 16/07/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 27/04/2010
- Phantom: Barski Industries; Type: Fiberglas Planar; Serial: 03-01
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

System Performance Check - 450 MHz Dipole
Head d=15mm Pin=398mW 2/Area Scan (6x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.99 mW/g
Head d=15mm Pin=398mW 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 45.8 V/m; Power Drift = 0.046 dB
Peak SAR (extrapolated) = 2.97 W/kg
SAR(1 g) = 1.89 mW/g; SAR(10 g) = 1.26 mW/g
Maximum value of SAR (measured) = 2.00 mW/g



Z-Axis Scan



Date Tested: 07/02/2010

System Performance Check - 450 MHz Dipole - Body

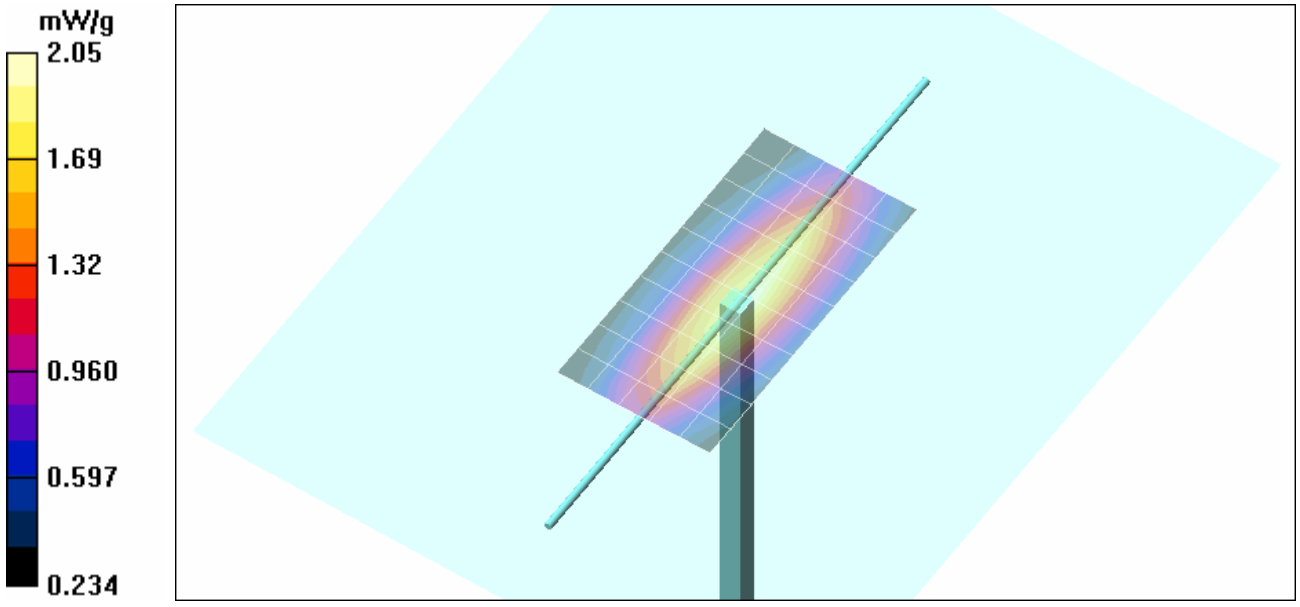
DUT: Dipole D450V3; Asset: 00217; Serial: 1068; Calibration: 01/18/2010

Ambient Temp: 24.0°C; Fluid Temp: 23.0°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

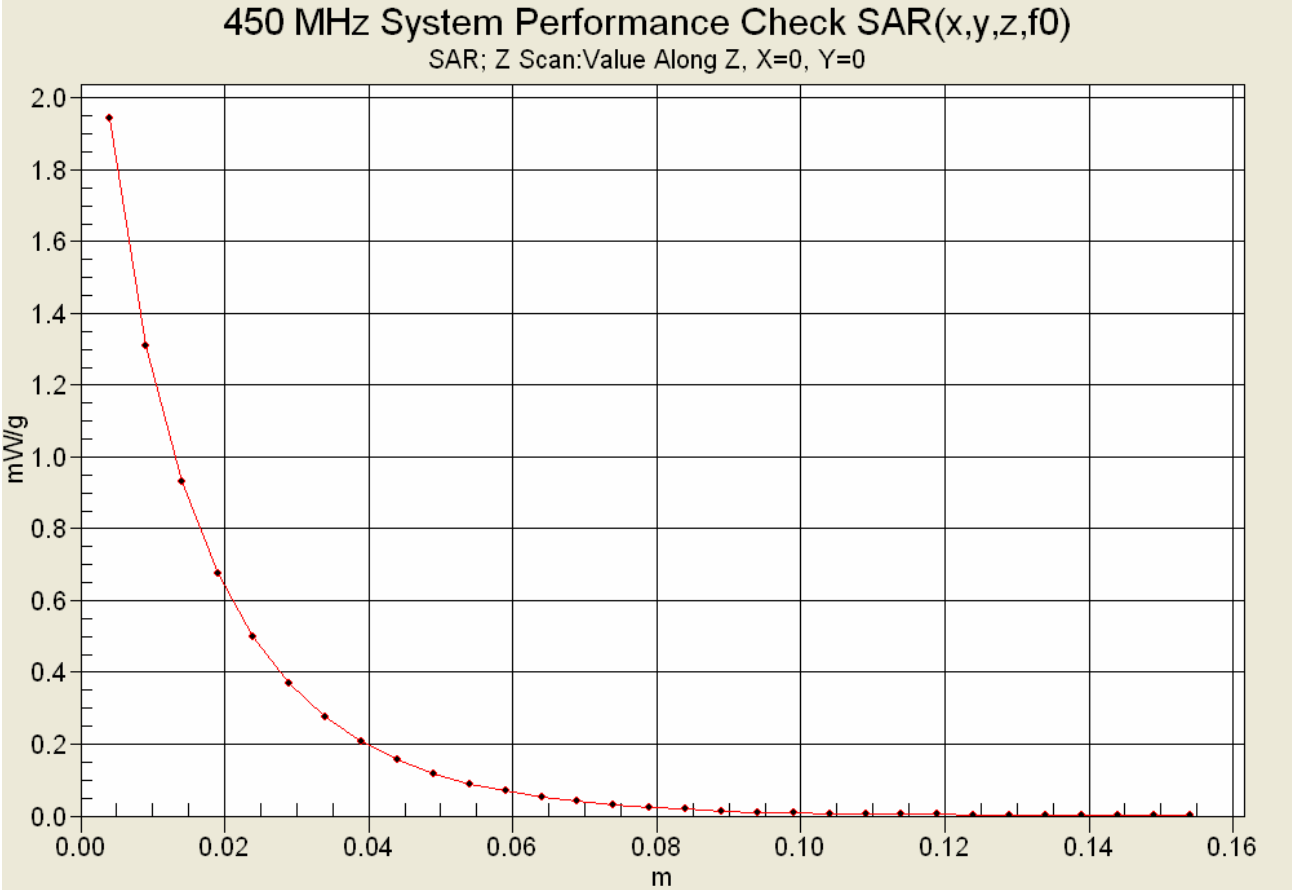
Communication System: CW
Forward Conducted Power: 398 mW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: MSL450 Medium parameters used: f = 450 MHz; σ = 0.94 mho/m; ε_r = 56.9; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(7.34, 7.34, 7.34); Calibrated: 16/07/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 27/04/2010
- Phantom: Barski Industries; Type: Fiberglas Planar; Serial: 03-01
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

System Performance Check - 450 MHz Dipole
Head d=15mm Pin=398mW 2/Area Scan (6x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 2.02 mW/g
Head d=15mm Pin=398mW 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 45.9 V/m; Power Drift = 0.029 dB
Peak SAR (extrapolated) = 3.04 W/kg
SAR(1 g) = 1.93 mW/g; SAR(10 g) = 1.28 mW/g
Maximum value of SAR (measured) = 2.05 mW/g



Z-Axis Scan



Date Tested: 07/03/2010

System Performance Check - 450 MHz Dipole - Head

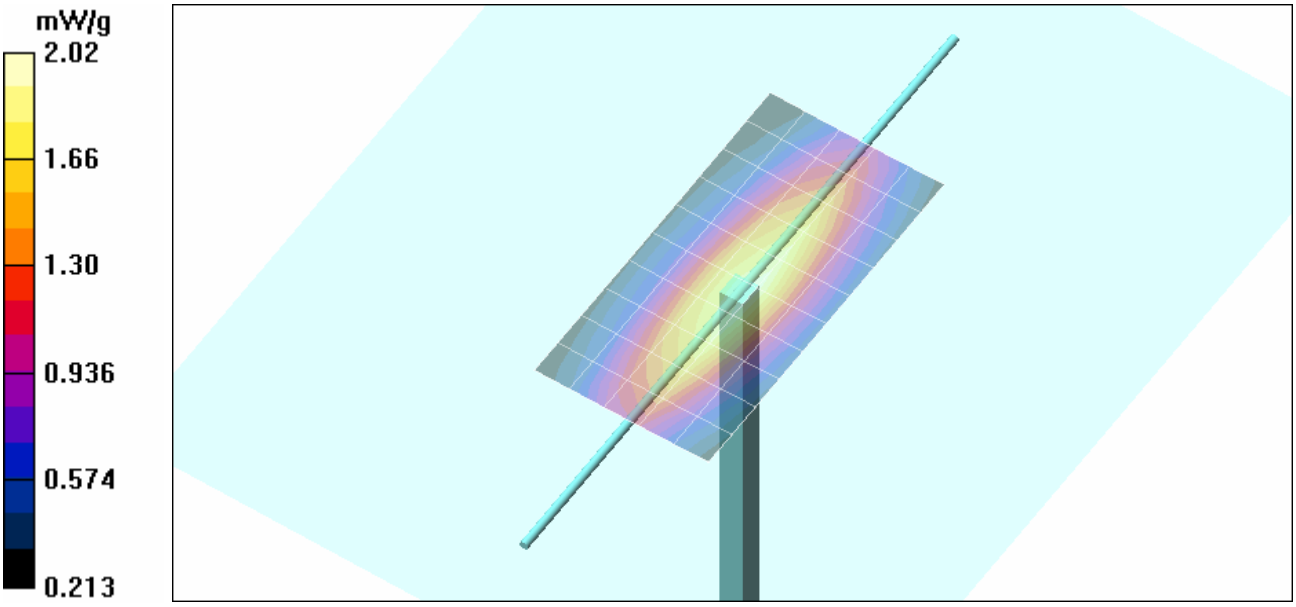
DUT: Dipole D450V3; Asset: 00217; Serial: 1068; Calibration: 01/18/2010

Ambient Temp: 24.0°C; Fluid Temp: 23.0°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

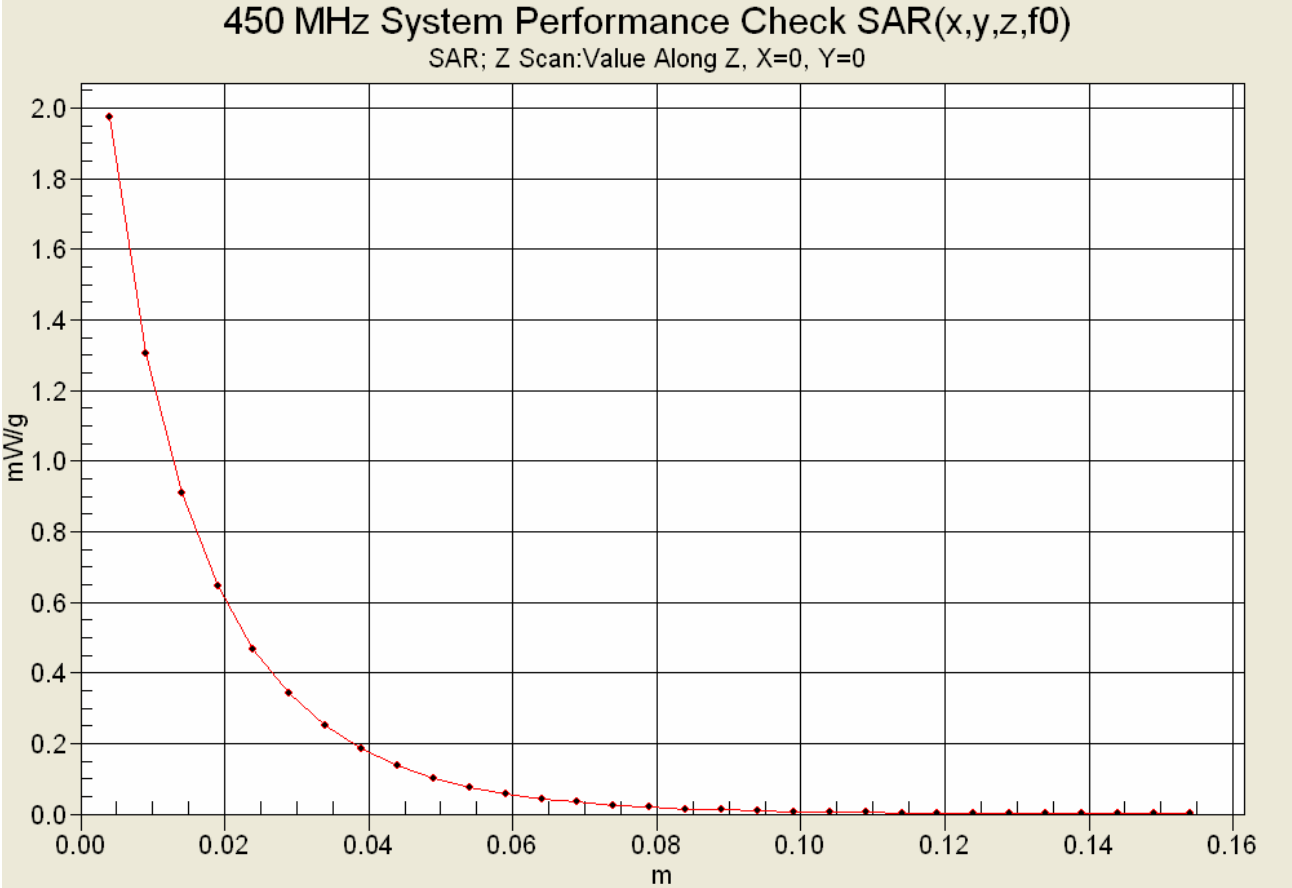
Communication System: CW
Forward Conducted Power: 398 mW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450 Medium parameters used: f = 450 MHz; σ = 0.88 mho/m; ε_r = 45.1; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(7.34, 7.34, 7.34); Calibrated: 16/07/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 27/04/2010
- Phantom: Barski Industries; Type: Fiberglas Planar; Serial: 03-01
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

System Performance Check - 450 MHz Dipole
Head d=15mm Pin=398mW/Area Scan (6x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.98 mW/g
Head d=15mm Pin=398mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 48.0 V/m; Power Drift = 0.045 dB
Peak SAR (extrapolated) = 2.99 W/kg
SAR(1 g) = 1.9 mW/g; SAR(10 g) = 1.26 mW/g
Maximum value of SAR (measured) = 2.02 mW/g



Z-Axis Scan


450 MHz System Performance Check SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
mW/g
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
m

Date Tested: 08/04/2010

System Performance Check - 450 MHz Dipole - Body

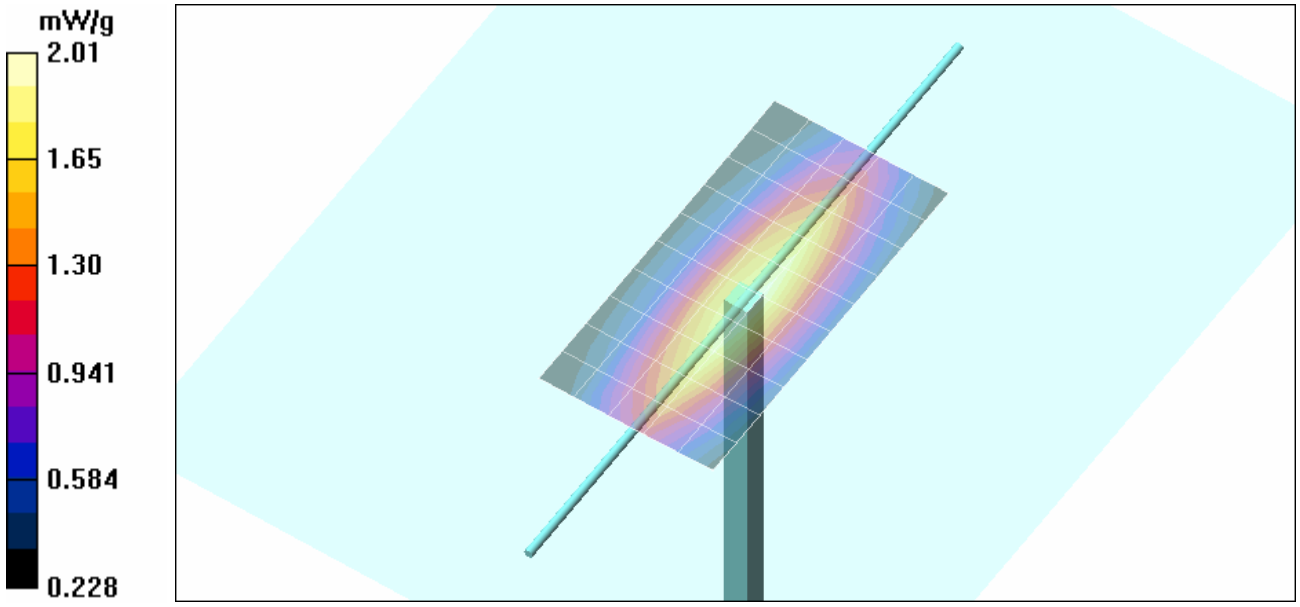
DUT: Dipole D450V3; Asset: 00217; Serial: 1068; Calibration: 01/18/2010

Ambient Temp: 22.0°C; Fluid Temp: 23.0°C; Barometric Pressure: 101.1 kPa; Humidity: 35%

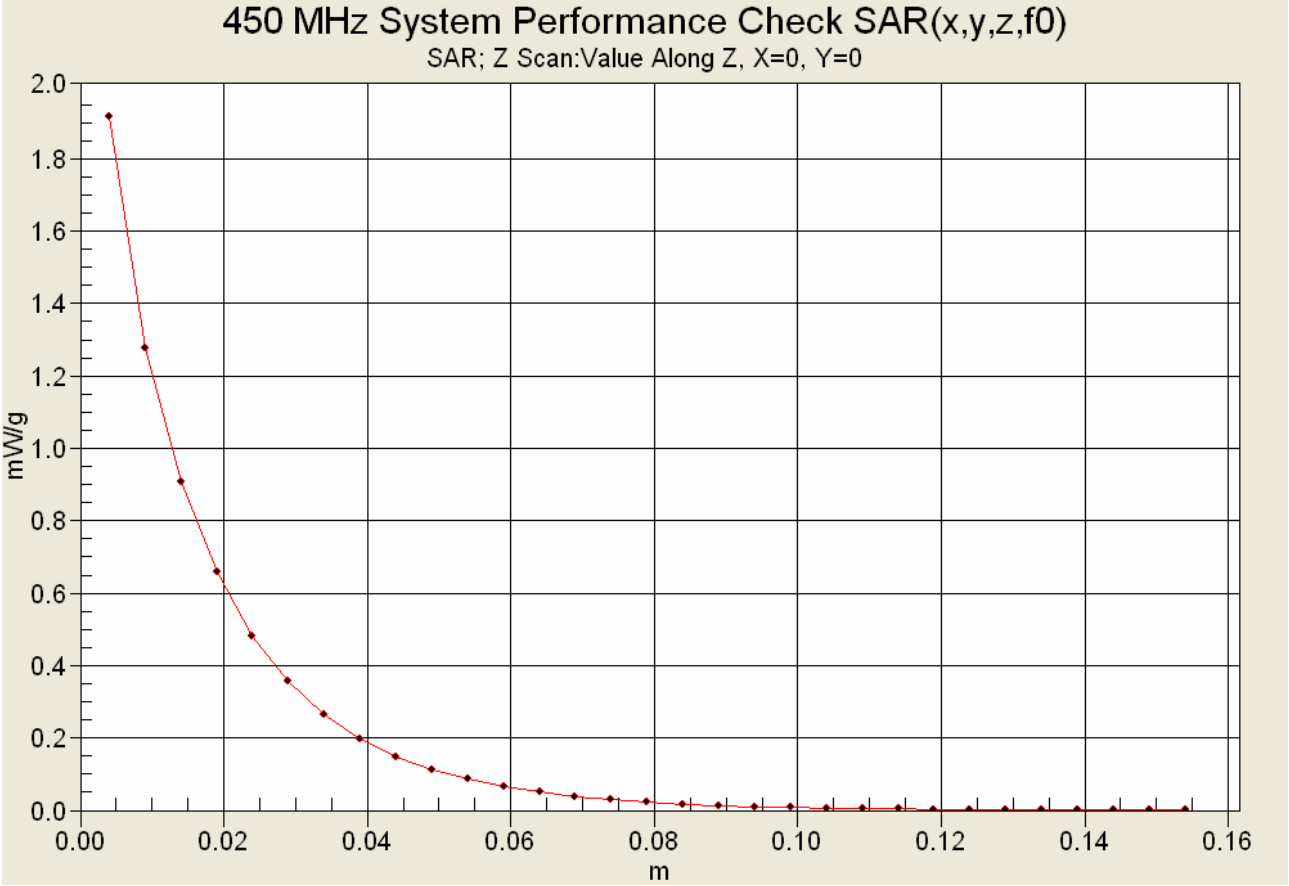
Communication System: CW
Forward Conducted Power: 398 mW
Frequency: 450 MHz; Duty Cycle: 1:1
Medium: MSL450 Medium parameters used: f = 450 MHz; σ = 0.95 mho/m; ε_r = 56.9; ρ = 1000 kg/m^3

- Probe: ET3DV6 - SN1590; ConvF(7.73, 7.73, 7.73); Calibrated: 15/07/2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 27/04/2010
- Phantom: Barski Industries; Type: Fiberglas Planar; Serial: 03-01
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

System Performance Check - 450 MHz Dipole
Body d=15mm Pin=398mW/Area Scan (6x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.97 mW/g
Body d=15mm Pin=398mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 44.9 V/m; Power Drift = 0.087 dB
Peak SAR (extrapolated) = 3.05 W/kg
SAR(1 g) = 1.9 mW/g; SAR(10 g) = 1.26 mW/g
Maximum value of SAR (measured) = 2.01 mW/g



Z-Axis Scan



APPENDIX C - MEASURED FLUID DIELECTRIC PARAMETERS

450 MHz System Performance Check & DUT Evaluations (Body)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
29/Jun/2010
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_eH	FCC_sH	Test_e	Test_s
0.3500	57.70	0.93	57.52	0.84
0.3600	57.60	0.93	56.98	0.85
0.3700	57.50	0.93	56.71	0.84
0.3800	57.40	0.93	56.40	0.85
0.3900	57.30	0.93	56.58	0.85
0.4000	57.20	0.93	57.04	0.88
0.4100	57.10	0.93	57.10	0.90
0.4200	57.00	0.94	56.23	0.90
0.4300	56.90	0.94	56.23	0.91
0.4400	56.80	0.94	55.86	0.91
0.4500	56.70	0.94	55.88	0.91
0.4600	56.66	0.94	55.54	0.94
0.4700	56.62	0.94	55.91	0.92
0.4800	56.58	0.94	55.47	0.93
0.4900	56.54	0.94	55.78	0.95
0.5000	56.51	0.94	55.30	0.95
0.5100	56.47	0.94	55.69	0.96
0.5200	56.43	0.95	55.57	0.98
0.5300	56.39	0.95	55.27	0.98
0.5400	56.35	0.95	55.08	0.99
0.5500	56.31	0.95	55.16	1.00

450 MHz System Performance Check & DUT Evaluations (Body)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
30/Jun/2010
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
0.3500	57.70	0.93	58.23	0.86
0.3600	57.60	0.93	58.26	0.87
0.3700	57.50	0.93	57.58	0.87
0.3800	57.40	0.93	57.74	0.87
0.3900	57.30	0.93	57.74	0.88
0.4000	57.20	0.93	57.30	0.89
0.4100	57.10	0.93	56.97	0.91
0.4200	57.00	0.94	56.89	0.92
0.4300	56.90	0.94	56.83	0.90
0.4400	56.80	0.94	57.01	0.93
0.4500	56.70	0.94	55.90	0.94
0.4600	56.66	0.94	56.58	0.94
0.4700	56.62	0.94	55.81	0.95
0.4800	56.58	0.94	56.33	0.96
0.4900	56.54	0.94	56.37	0.95
0.5000	56.51	0.94	56.34	0.97
0.5100	56.47	0.94	55.61	0.96
0.5200	56.43	0.95	55.40	0.99
0.5300	56.39	0.95	55.65	1.00
0.5400	56.35	0.95	55.34	1.01
0.5500	56.31	0.95	55.63	1.02

450 MHz System Performance Check & DUT Evaluations (Body)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
01/Jul/2010
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
0.3500	57.70	0.93	57.99	0.88
0.3600	57.60	0.93	58.27	0.88
0.3700	57.50	0.93	57.65	0.89
0.3800	57.40	0.93	57.26	0.89
0.3900	57.30	0.93	57.23	0.89
0.4000	57.20	0.93	57.61	0.90
0.4100	57.10	0.93	57.14	0.92
0.4200	57.00	0.94	57.29	0.91
0.4300	56.90	0.94	56.80	0.92
0.4400	56.80	0.94	57.02	0.93
0.4500	56.70	0.94	56.89	0.93
0.4600	56.66	0.94	56.49	0.97
0.4700	56.62	0.94	56.16	0.96
0.4800	56.58	0.94	56.12	0.98
0.4900	56.54	0.94	56.25	0.98
0.5000	56.51	0.94	56.07	0.99
0.5100	56.47	0.94	56.28	0.99
0.5200	56.43	0.95	55.88	1.00
0.5300	56.39	0.95	55.75	1.00
0.5400	56.35	0.95	55.44	1.00
0.5500	56.31	0.95	55.10	1.03

450 MHz System Performance Check & DUT Evaluations (Body)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
02/Jul/2010
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
0.3500	57.70	0.93	58.40	0.89
0.3600	57.60	0.93	58.18	0.88
0.3700	57.50	0.93	58.02	0.88
0.3800	57.40	0.93	57.99	0.89
0.3900	57.30	0.93	57.92	0.89
0.4000	57.20	0.93	57.64	0.90
0.4100	57.10	0.93	57.74	0.91
0.4200	57.00	0.94	57.44	0.92
0.4300	56.90	0.94	56.68	0.92
0.4400	56.80	0.94	56.95	0.94
0.4500	56.70	0.94	56.86	0.94
0.4600	56.66	0.94	55.82	0.96
0.4700	56.62	0.94	56.10	0.95
0.4800	56.58	0.94	56.55	0.98
0.4900	56.54	0.94	56.18	0.97
0.5000	56.51	0.94	56.25	0.99
0.5100	56.47	0.94	56.25	0.98
0.5200	56.43	0.95	56.06	1.00
0.5300	56.39	0.95	55.61	1.00
0.5400	56.35	0.95	55.87	1.01
0.5500	56.31	0.95	55.21	1.02

450 MHz DUT Evaluations (Head)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
02/Jul/2010
Frequency (GHz)
FCC_eH FCC OET 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC OET 65 Supplement C (June 2001) Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
0.3500	44.70	0.87	47.30	0.77
0.3600	44.58	0.87	47.11	0.78
0.3700	44.46	0.87	47.22	0.80
0.3800	44.34	0.87	46.98	0.80
0.3900	44.22	0.87	46.22	0.81
0.4000	44.10	0.87	45.16	0.82
0.4100	43.98	0.87	45.30	0.83
0.4200	43.86	0.87	45.50	0.84
0.4300	43.74	0.87	45.05	0.85
0.4400	43.62	0.87	45.07	0.85
0.4500	43.50	0.87	44.90	0.87
0.4600	43.45	0.87	45.04	0.88
0.4700	43.40	0.87	44.15	0.88
0.4800	43.34	0.87	44.22	0.89
0.4900	43.29	0.87	44.06	0.90
0.5000	43.24	0.87	43.87	0.91
0.5100	43.19	0.87	43.97	0.92
0.5200	43.14	0.88	43.80	0.93
0.5300	43.08	0.88	43.54	0.92
0.5400	43.03	0.88	43.41	0.95
0.5500	42.98	0.88	43.60	0.97

450 MHz System Performance Check & DUT Evaluations (Head)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
03/Jul/2010
Frequency (GHz)
FCC_eH FCC OET 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC OET 65 Supplement C (June 2001) Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
0.3500	44.70	0.87	47.59	0.78
0.3600	44.58	0.87	47.07	0.80
0.3700	44.46	0.87	47.12	0.81
0.3800	44.34	0.87	46.37	0.80
0.3900	44.22	0.87	46.57	0.82
0.4000	44.10	0.87	45.29	0.82
0.4100	43.98	0.87	45.16	0.83
0.4200	43.86	0.87	45.41	0.86
0.4300	43.74	0.87	45.39	0.85
0.4400	43.62	0.87	45.40	0.85
0.4500	43.50	0.87	45.14	0.88
0.4600	43.45	0.87	44.94	0.88
0.4700	43.40	0.87	44.55	0.89
0.4800	43.34	0.87	44.67	0.89
0.4900	43.29	0.87	44.62	0.91
0.5000	43.24	0.87	44.26	0.91
0.5100	43.19	0.87	44.07	0.93
0.5200	43.14	0.88	43.87	0.93
0.5300	43.08	0.88	43.95	0.93
0.5400	43.03	0.88	44.08	0.96
0.5500	42.98	0.88	43.50	0.96

450 MHz System Performance Check & DUT Evaluations (Body)

****

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
04/Aug/2010
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
0.3500	57.70	0.93	57.64	0.88
0.3600	57.60	0.93	57.97	0.90
0.3700	57.50	0.93	57.86	0.89
0.3800	57.40	0.93	57.67	0.90
0.3900	57.30	0.93	57.52	0.92
0.4000	57.20	0.93	57.48	0.92
0.4100	57.10	0.93	57.69	0.93
0.4200	57.00	0.94	57.22	0.93
0.4300	56.90	0.94	56.87	0.94
0.4400	56.80	0.94	57.16	0.94
0.4500	56.70	0.94	56.85	0.95
0.4600	56.66	0.94	56.83	0.96
0.4700	56.62	0.94	56.86	0.97
0.4800	56.58	0.94	56.31	0.98
0.4900	56.54	0.94	56.34	0.98
0.5000	56.51	0.94	55.86	1.00
0.5100	56.47	0.94	56.49	1.02
0.5200	56.43	0.95	56.02	1.02
0.5300	56.39	0.95	55.93	1.03
0.5400	56.35	0.95	55.59	1.03
0.5500	56.31	0.95	55.80	1.04

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: D450V3-1068_Jan10

CALIBRATION CERTIFICATE

Object: D450V3 - SN: 1068

Calibration procedure(s): QA CAL-15.v5
Calibration Procedure for dipole validation kits below 800 MHz

Calibration date: January 18, 2010

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	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
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ET3DV6 (LF)	SN: 1507	03-Jul-09 (No. ET3-1507_Jul09)	Jul-10
DAE4	SN: 654	04-May-09 (No. DAE4-654_May09)	May-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	04-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-09)	In house check: Oct-10

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	i.V.
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 20, 2010

Glossary:

TSL	tissue simulating liquid
ConF	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 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	V5.2
Extrapolation	Advanced Extrapolation	
Phantom	ELI4 Flat Phantom	Shell thickness: 2 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Area Scan Resolution	dx, dy = 15 mm	
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	43.5	0.87 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	44.2 ± 6 %	0.86 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	condition	
SAR measured	398 mW input power	1.87 mW / g
SAR normalized	normalized to 1W	4.70 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**4.76 mW / g ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	398 mW input power	1.25 mW / g
SAR normalized	normalized to 1W	3.14 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**3.17 mW / g ± 17.6 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	56.7	0.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.1 ± 6 %	0.90 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	condition	
SAR measured	398 mW input power	1.78 mW / g
SAR normalized	normalized to 1W	4.47 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**4.58 mW / g ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	398 mW input power	1.19 mW / g
SAR normalized	normalized to 1W	2.99 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**3.06 mW / g ± 17.6 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	57.5 Ω - 5.9 jΩ
Return Loss	- 21.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	54.8 Ω - 9.3 jΩ
Return Loss	- 20.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.350 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	July 16, 2009

Date/Time: 1/18/2010 10:59:37 AM

DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN:1068

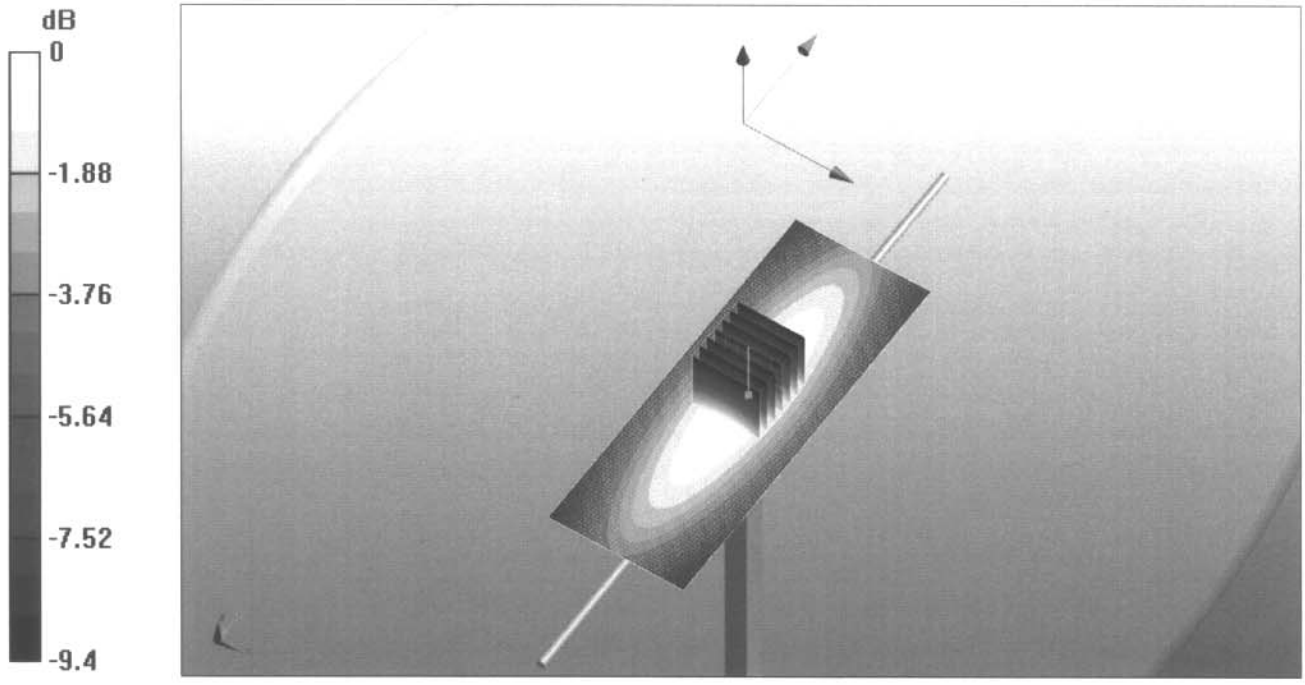
Communication System: CW; Frequency: 450 MHz; Duty Cycle: 1:1
Medium: HSL450
Medium parameters used: f = 450 MHz; σ = 0.86 mho/m; ε_r = 44.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ET3DV6 - SN1507 (LF); ConvF(6.66, 6.66, 6.66); Calibrated: 7/3/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 5/4/2009
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 57

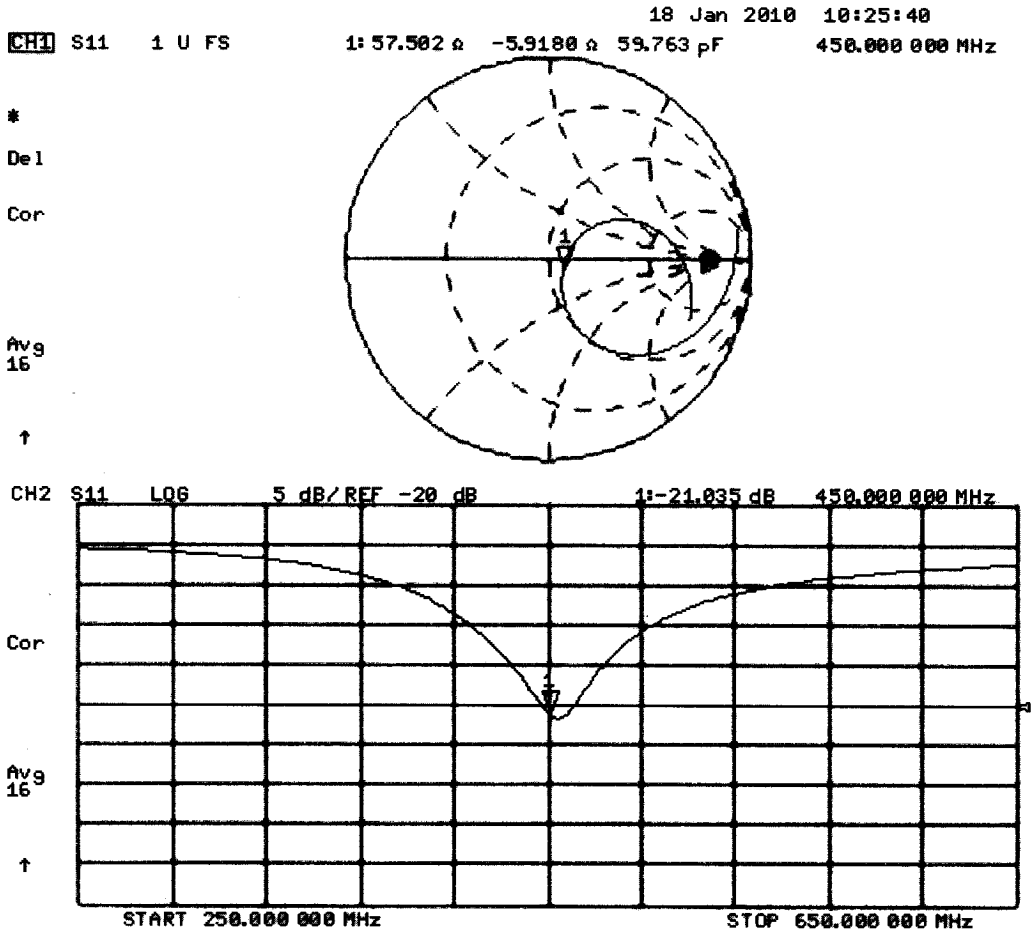
Head/d=15mm, Pin=398mW/Area Scan (41x111x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.99 mW/g

Head/d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 50.2 V/m; Power Drift = -0.020 dB
Peak SAR (extrapolated) = 2.78 W/kg
SAR(1 g) = 1.87 mW/g; SAR(10 g) = 1.25 mW/g
Maximum value of SAR (measured) = 2 mW/g



0 dB = 2mW/g

Impedance Measurement Plot for Head TSL



Date/Time: 1/18/2010 1:24:11 PM

DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN:1068

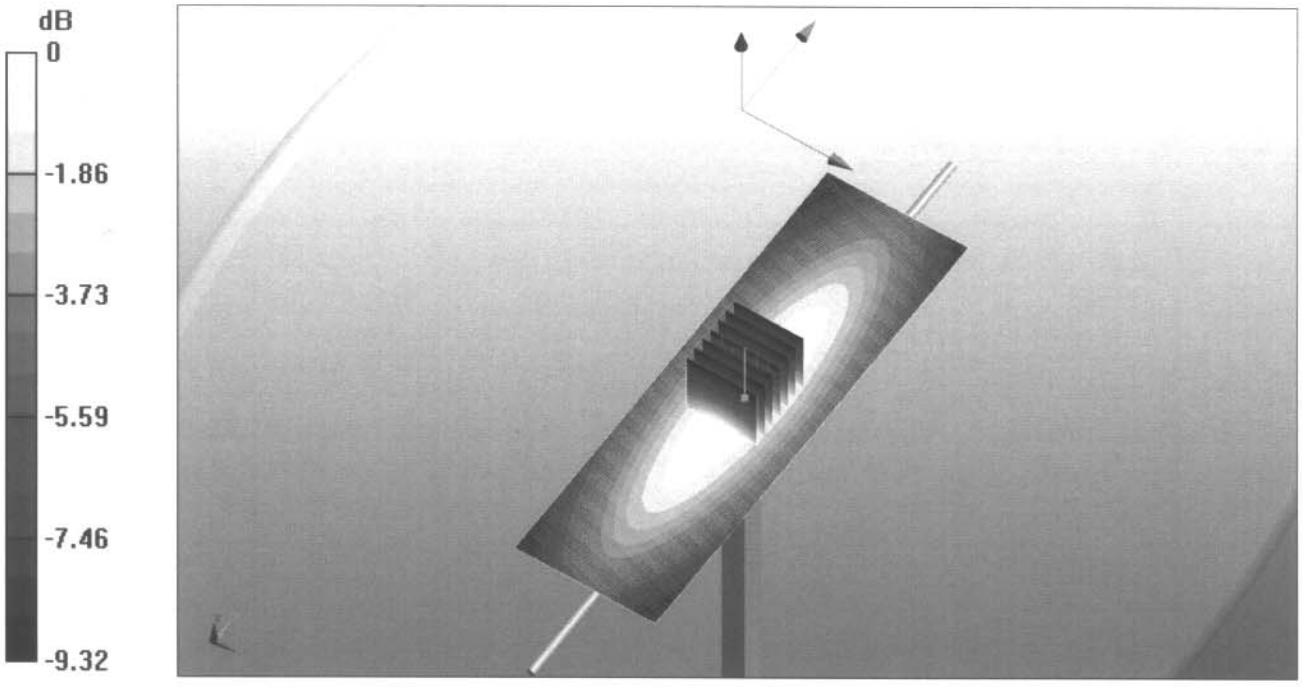
Communication System: CW; Frequency: 450 MHz; Duty Cycle: 1:1
Medium: MSL450
Medium parameters used: f = 450 MHz; σ = 0.9 mho/m; ε_r = 54.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ET3DV6 - SN1507 (LF); ConvF(7.11, 7.11, 7.11); Calibrated: 7/3/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 5/4/2009
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- Measurement SW: DASY5, V5.2 Build 162; SEMCAD X Version 14.0 Build 57

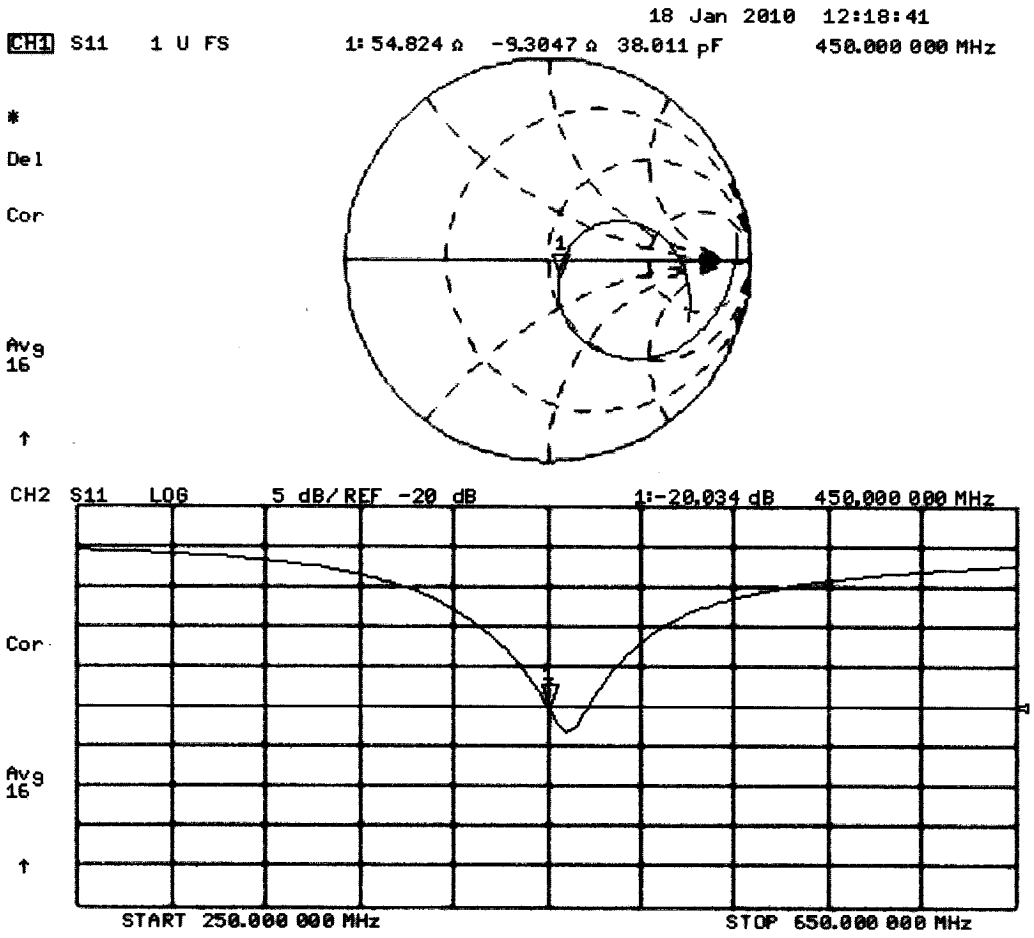
Body/d=15mm, Pin=398mW/Area Scan (61x201x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.9 mW/g

Body/d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 47.4 V/m; Power Drift = -0.034 dB
Peak SAR (extrapolated) = 2.71 W/kg
SAR(1 g) = 1.78 mW/g; SAR(10 g) = 1.19 mW/g
Maximum value of SAR (measured) = 1.9 mW/g



0 dB = 1.9mW/g

Impedance Measurement Plot for Body TSL



APPENDIX F - PROBE CALIBRATION

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

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Accreditation No.: SCS 108

Client **Celltech**

Certificate No: ET3-1590_Jul09

CALIBRATION CERTIFICATE

Object	ET3DV6 - SN:1590
Calibration procedure(s)	QA CAL-01.v6, QA CAL-12.v5, QA CAL-23.v3 and QA CAL-25.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	July 16, 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:	Marcel Fehr	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 16, 2009

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

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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 ET3DV6

SN:1590

Manufactured:	March 19, 2001
Last calibrated:	July 21, 2008
Recalibrated:	July 16, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1590

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

NormX	**1.83** ± 10.1%	$\mu V/(V/m)^2$	DCP X	**90** mV
NormY	**2.02** ± 10.1%	$\mu V/(V/m)^2$	DCP Y	**95** mV
NormZ	**1.73** ± 10.1%	$\mu V/(V/m)^2$	DCP Z	**85** mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL **835 MHz** **Typical SAR gradient: 5 % per mm**

Sensor Center to Phantom Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	9.9	6.3
SAR_{be} [%]	With Correction Algorithm	0.9	0.6

Sensor Offset

Probe Tip to Sensor Center	**2.7** mm

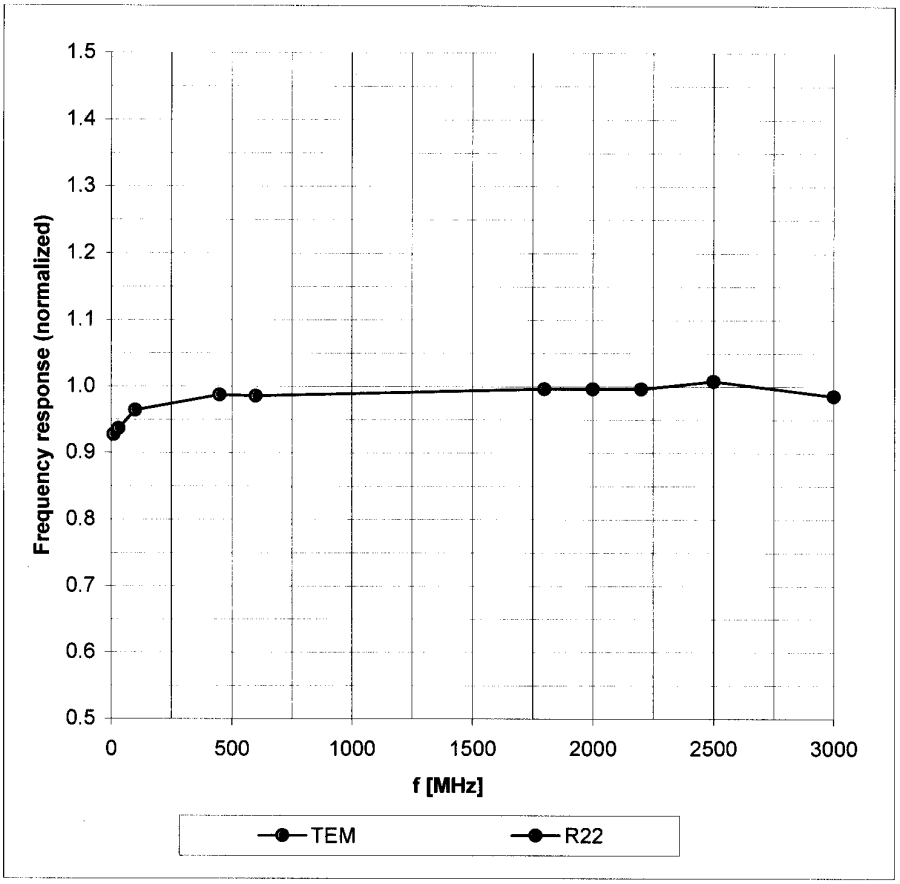
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[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.

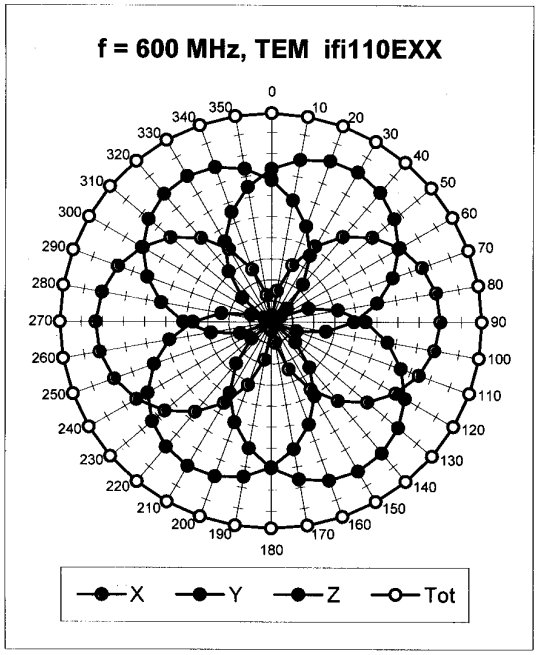
Frequency Response of E-Field

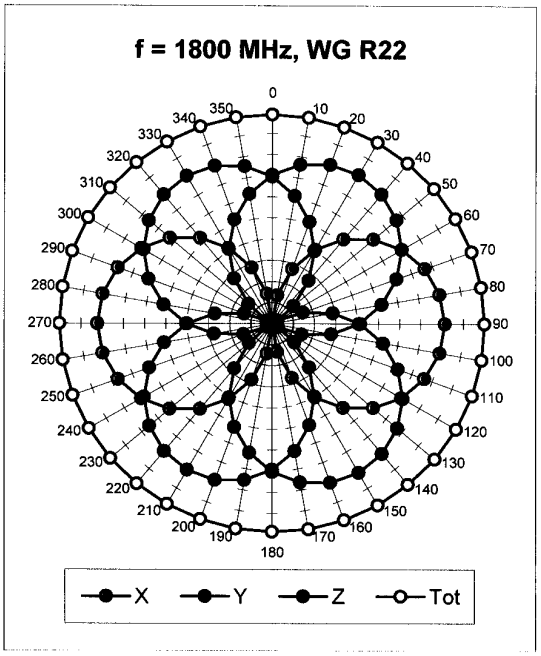
(TEM-Cell:ifi110 EXX, Waveguide: R22)

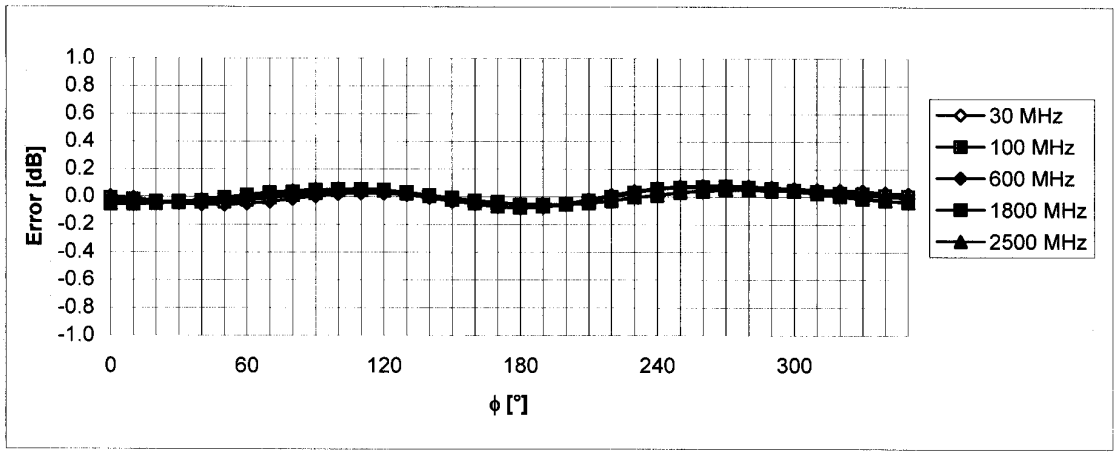


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



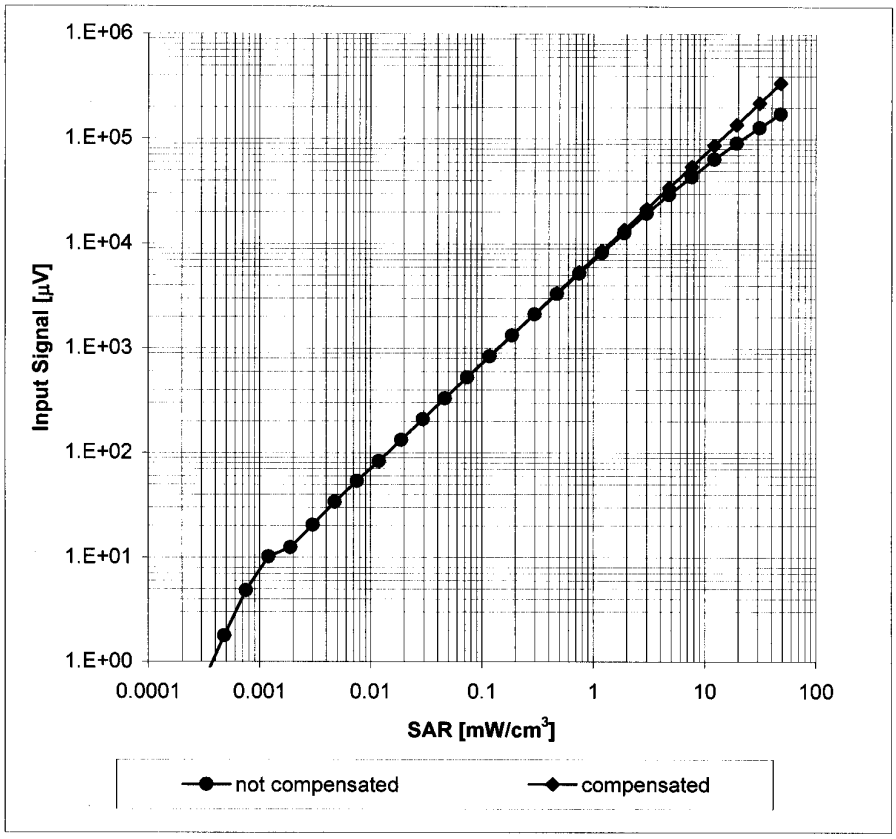


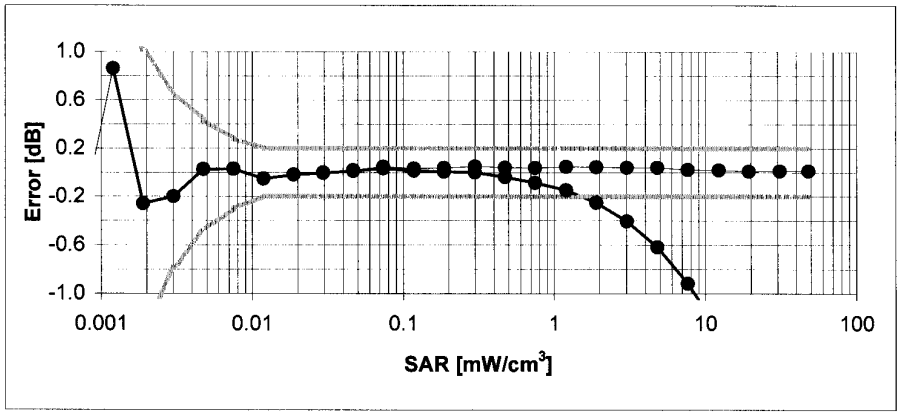


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

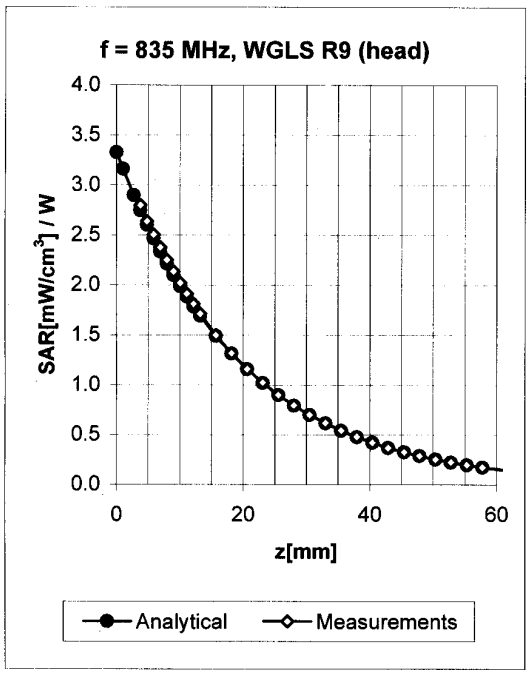
(Waveguide R22, f = 1800 MHz)

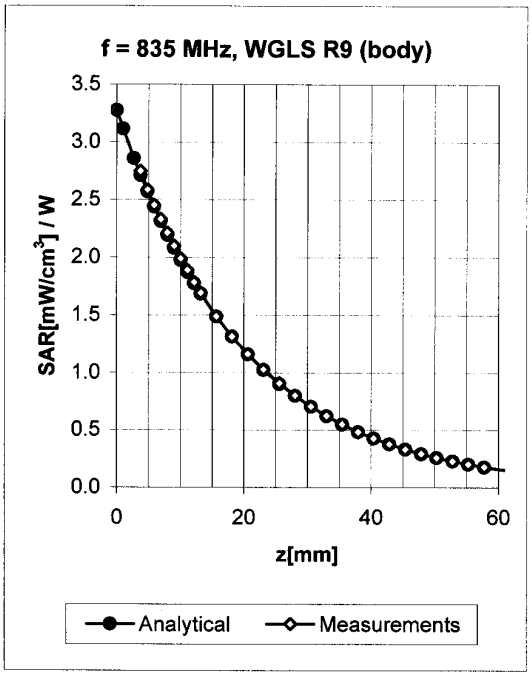




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



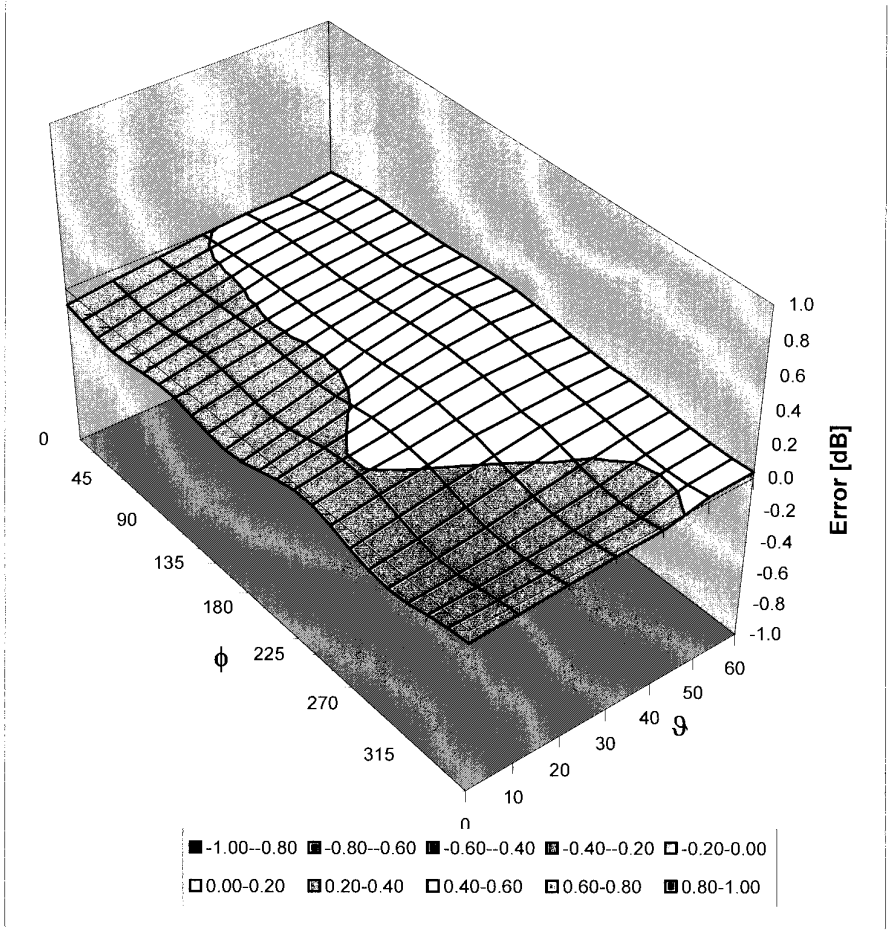


f [MHz]	Validity [MHz][c]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
450	± 50 / ± 100	Head	43.5 ± 5%	0.87 ± 5%	0.29	1.90	7.34 ± 13.3% (k=2)
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	0.37	2.32	6.59 ± 11.0% (k=2)
450	± 50 / ± 100	Body	56.7 ± 5%	0.94 ± 5%	0.22	1.91	7.34 ± 13.3% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	0.30	2.77	6.34 ± 11.0% (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)

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Accreditation No.: SCS 108

Client **Celltech**

Certificate No: ET3-1590_Jul10

CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1590**

Calibration procedure(s) **QA CAL-01.v6, QA CAL-12.v6, QA CAL-23.v3 and QA CAL-25.v2**
Calibration procedure for dosimetric E-field probes

Calibration date: **July 15, 2010**

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-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10
DAE4	SN: 660	20-Apr-10 (No. DAE4-660_Apr10)	Apr-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10

	Name	Function	Signature
Calibrated by	**Jeton Kastrati**	**Laboratory Technician**	
Approved by:	**Katja Pokovic**	**Technical Manager**	

Issued: July 15, 2010

Calibration Laboratory of
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Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accredited by the Swiss Accreditation Service (SAS)
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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
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

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 $\vartheta = 0$ ($f \le 900$ 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 with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,y,z: A, B, C* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \le 800$ 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 ET3DV6

SN:1590

Manufactured:	March 19, 2001
Last calibrated:	July 16, 2009
Recalibrated:	July 15, 2010

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ET3DV6 SN:1590

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.86	2.06	1.77	± 10.1%
DCP (mV)[B]	91.4	92.4	83.5	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	300.0	± 1.5%
			Y	0.00	0.00	1.00	300.0	
			Z	0.00	0.00	1.00	300.0	

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

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

[B] Numerical linearization parameter: uncertainty not required.

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

DASY/EASY - Parameters of Probe: ET3DV6 SN:1590

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
450	± 50 / ± 100	43.5 ± 5%	0.87 ± 5%	7.25	7.25	7.25	0.20	2.19 ± 13.3%
835	± 50 / ± 100	41.5 ± 5%	0.90 ± 5%	6.27	6.27	6.27	0.32	2.49 ± 11.0%
900	± 50 / ± 100	41.5 ± 5%	0.97 ± 5%	6.12	6.12	6.12	0.27	2.86 ± 11.0%

[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

DASY/EASY - Parameters of Probe: ET3DV6 SN:1590

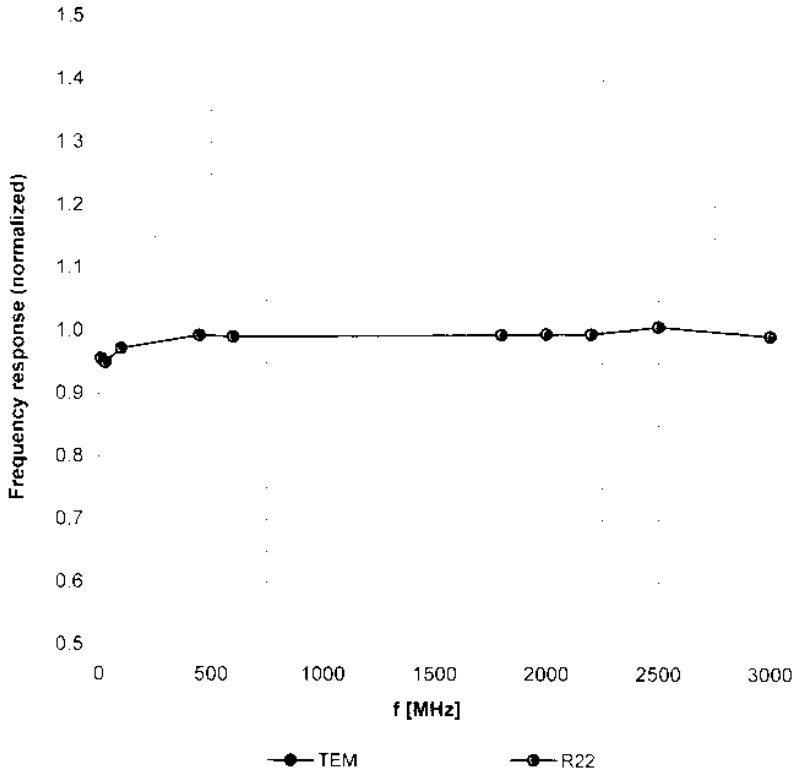
Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
450	± 50 / ± 100	56.7 ± 5%	0.94 ± 5%	7.73	7.73	7.73	0.13	2.06 ± 13.3%
835	± 50 / ± 100	55.2 ± 5%	0.97 ± 5%	6.33	6.33	6.33	0.22	3.60 ± 11.0%
900	± 50 / ± 100	55.0 ± 5%	1.05 ± 5%	6.15	6.15	6.15	0.28	2.94 ± 11.0%

[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.

Frequency Response of E-Field

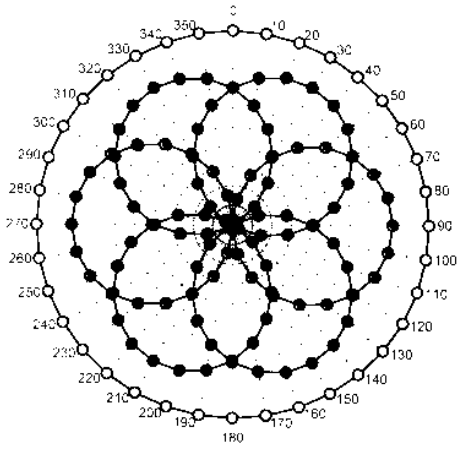
(TEM-Cell:ifi110 EXX, Waveguide: R22)



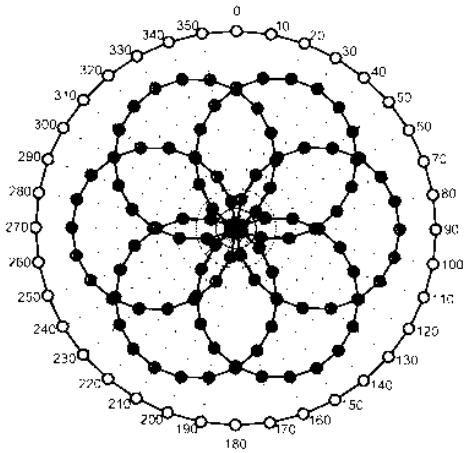
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

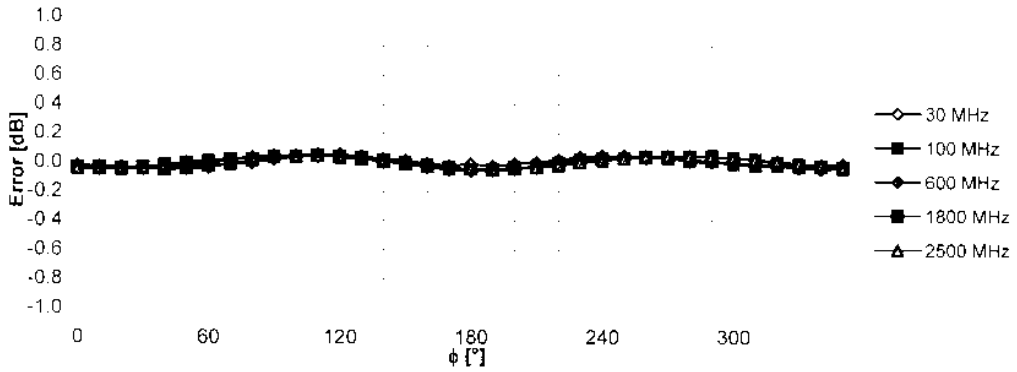
Receiving Pattern (ϕ), ϑ = 0°

f = 600 MHz, TEM ifi110EXX



f = 1800 MHz, WG R22

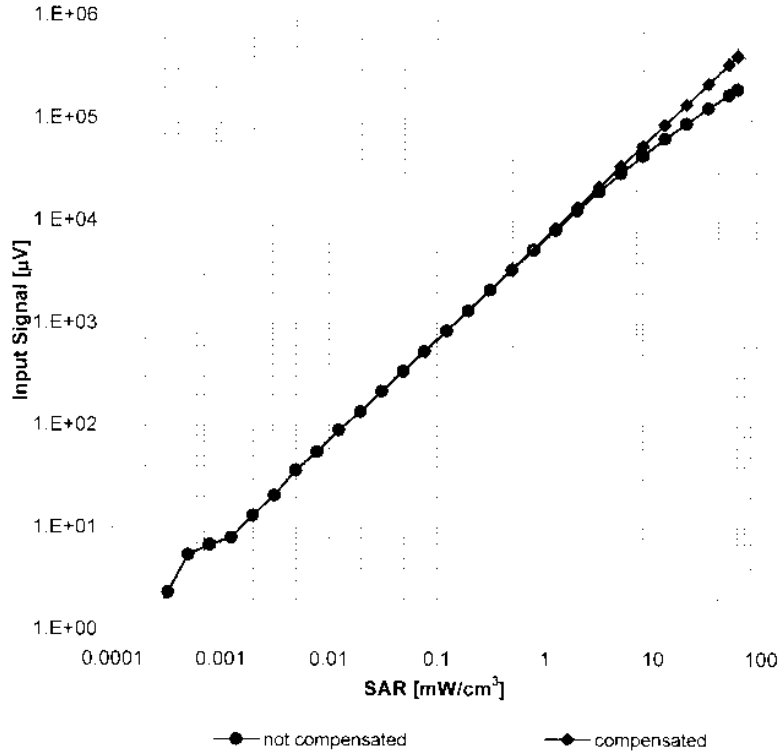


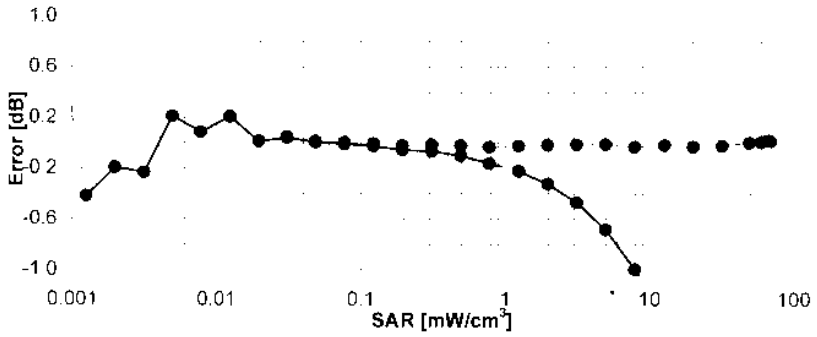


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

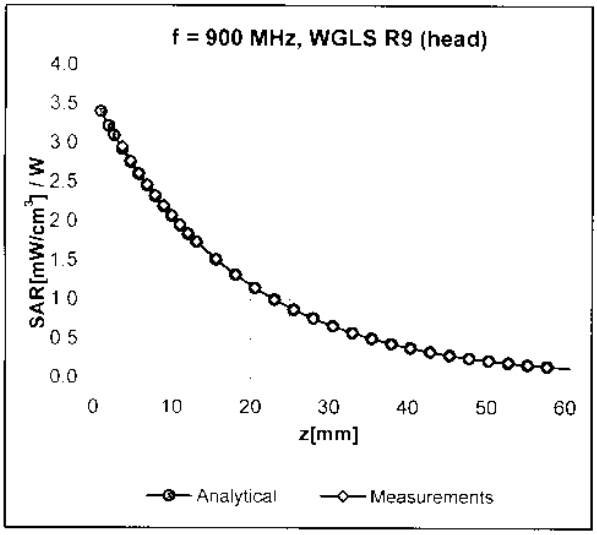
(Waveguide R22, f = 1800 MHz)

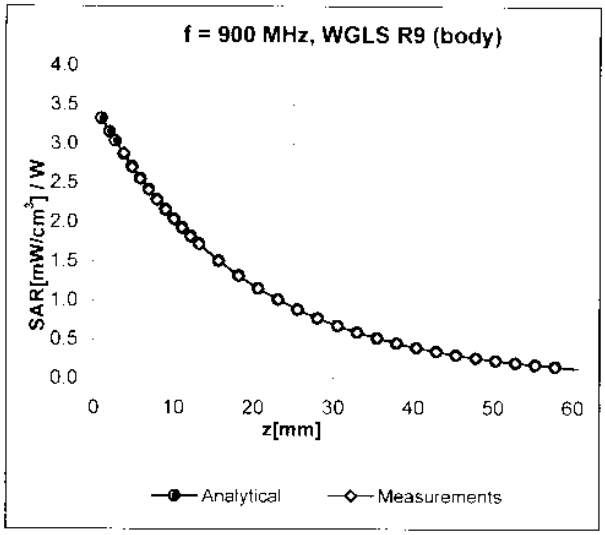




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

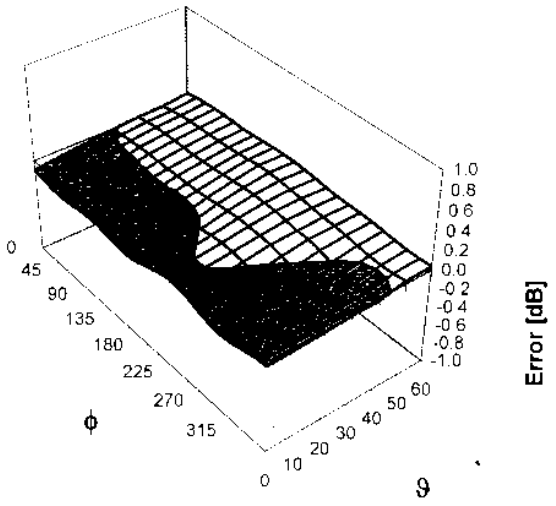
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	enabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	6.8 mm
Probe Tip to Sensor X Calibration Point	2.7 mm
Probe Tip to Sensor Y Calibration Point	2.7 mm
Probe Tip to Sensor Z Calibration Point	2.7 mm
Recommended Measurement Distance from Surface	4 mm

APPENDIX G - BARSKI PHANTOM CERTIFICATE OF CONFORMITY

2378 Westlake Road
Kelowna, B.C. Canada
V1Z-2V2

BARSKI INDUSTRIES (1985) LTD.

Ph. # 250-769-6848
Fax # 250-769-6334
E-mail: barskiind@shaw.ca
Web: www.bcfiberglass.com

FIBERGLASS FABRICATORS

Certificate of Conformity

Item : Flat Planar Phantom Unit # 03-01
Date: June 16, 2003
Manufacturer: Barski Industries (1985 Ltd)

Test	Requirement	Details
Shape	Compliance to geometry according to drawing	Supplied CAD drawing
Material Thickness	Compliant with the requirements	2mm +/- 0.2mm in measurement area
Material Parameters	Dielectric parameters for required frequencies Based on Dow Chemical technical data	100 MHz-5 GHz Relative permittivity<5 Loss Tangent<0.05

Conformity

Based on the above information, we certify this product to be compliant to the requirements specified.

Signature: _____

Daniel Chailler

Fiberglass Planar Phantom - Top View

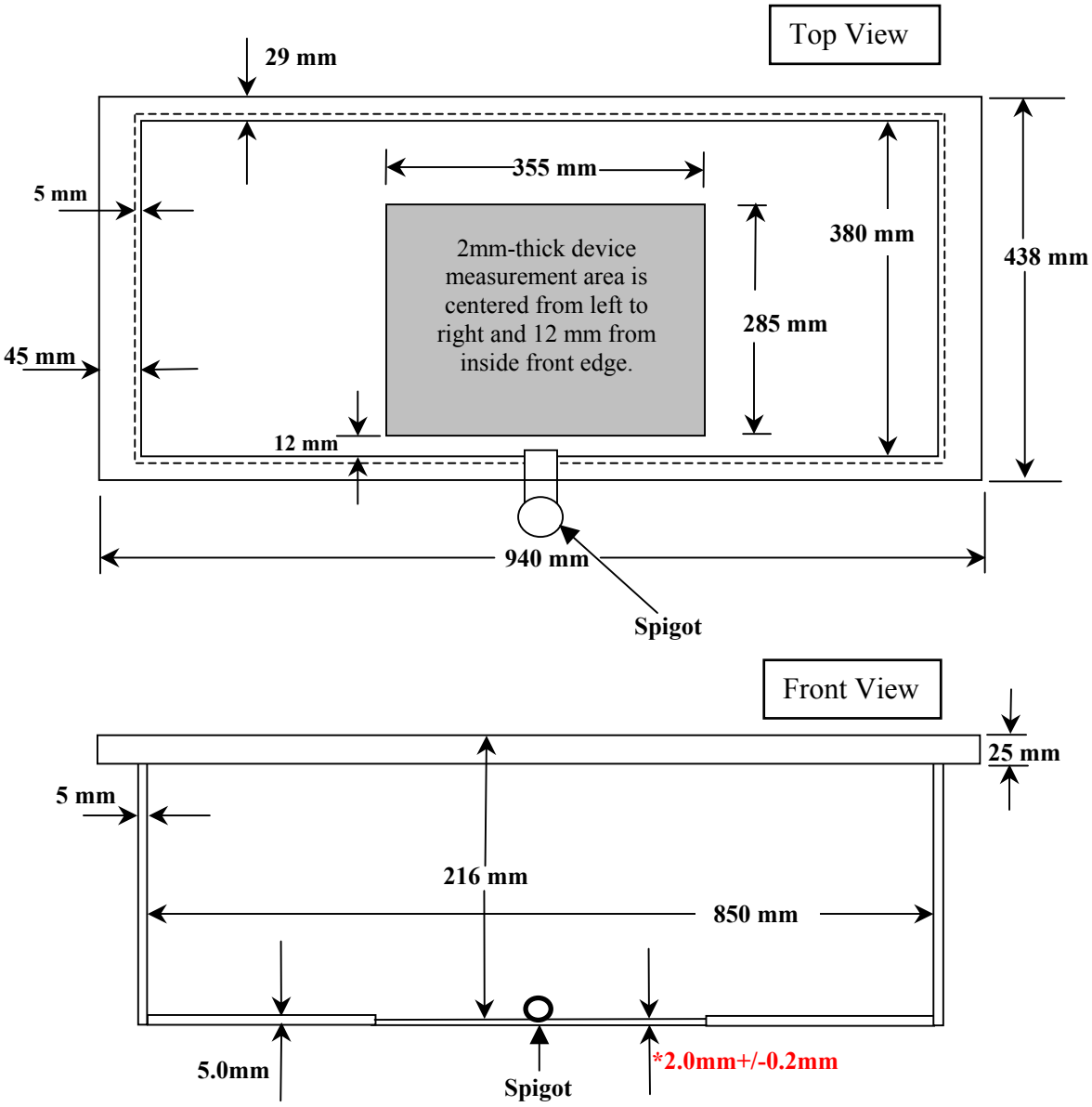
Fiberglass Planar Phantom - Front View

Fiberglass Planar Phantom - Back View

Fiberglass Planar Phantom - Bottom View

Dimensions of Fiberglass Planar Phantom

(Manufactured by Barski Industries Ltd. - Unit# 03-01)



Note: Measurements that aren't repeated for the opposite sides are the same as the side measured. This drawing is not to scale.