



MindWare Technologies Ltd.

Model 50-2303

SAR Evaluation Report #: AVID0001.1

Evaluated to the following SAR Specifications:

FCC 2.1093:2013



Report Prepared By Northwest EMC Inc.

NORTHWEST EMC – (888) 364-2378 – www.nwemc.com

California – Minnesota – Oregon – New York – Washington

CERTIFICATE OF EVALUATION

Last Date of Test: March 12, 2013
MindWare Technologies Ltd.
Model: 50-2303

Applicable Standard

Test Description	Specification	Test Method	Pass/Fail
SAR Evaluation	FCC 2.1093:2013 FCC 15.247:2013 FCC 15.407:2013	FCC OET 65C:2001	Pass
		IEEE Std 1528:2003	
		FCC KDB 447498 D01 v05	
		FCC KDB 248227 D01 v01r02	
		FCC KDB 648474 D04 V01	
		FCC KDB 865664 D01 and D02	

Highest SAR Values

Frequency Bands (GHz)	Body 1g (W/kg)	Limit 1g (W/kg)	Exposure Environment
2.4	0.545	1.6	General Population Uncontrolled
5.2, 5.3, 5.6	0.544		

Deviations From Test Standards

None

Approved By:



Don Facteau, IS Manager



NVLAP Lab Code: 200630-0

Test Facility

The measurement facility used to collect the data is located at:

Northwest EMC, Inc.
22975 NW Evergreen Parkway, Suite 400
Hillsboro, OR 97124

Phone: (503) 844-4066

Fax: 844-3826

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government of the United States of America.

Product compliance is the responsibility of the client, therefore the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. This Report may only be duplicated in its entirety. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test.

REVISION HISTORY

Revision Number	Description	Date	Page Number
00	None		

Barometric Pressure

The recorded barometric pressure has been normalized to sea level.

United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Accredited by A2LA to ISO / IEC Guide 65 as a product certifier. This allows Northwest EMC to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

IC - Recognized by Industry Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with IC.

European Union

European Commission – Validated by the European Commission as a Conformity Assessment Body (CAB) under the EMC directive and as a Notified Body under the R&TTE Directive.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

KCC / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Hong Kong

OFTA – Recognized by OFTA as a CAB for the acceptance of test data.

Vietnam

MIC – Recognized by MIC as a CAB for the acceptance of test data.

Russia

GOST – Accredited by Certinform VNIINMASH, CERTINFO, SAMTES, and Federal CHEC to perform EMC and Hygienic testing for Information Technology products to GOST standards.

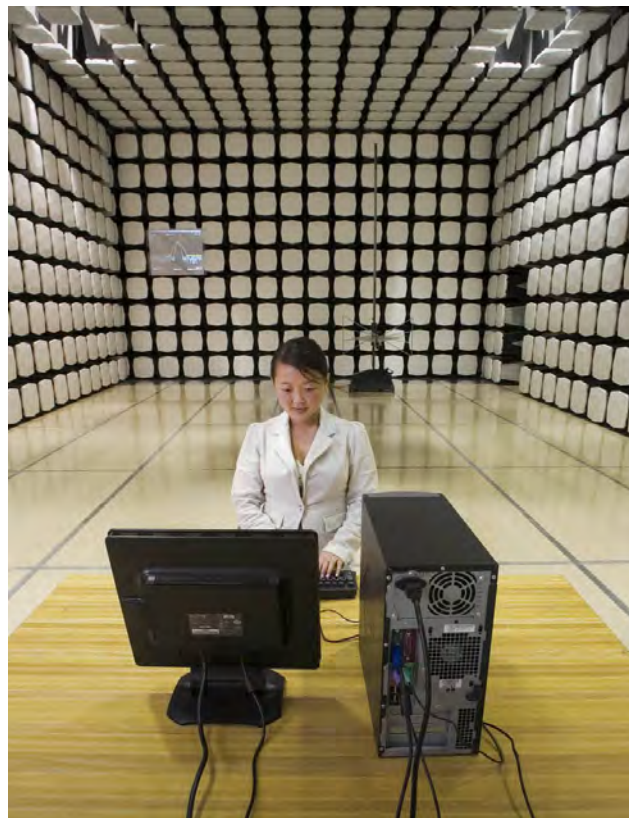
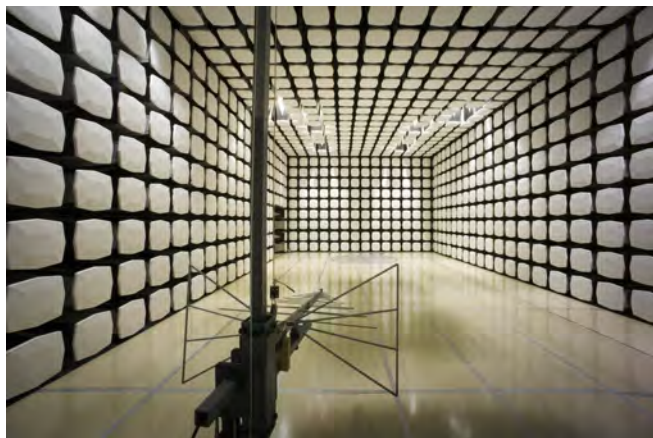
SCOPE

For details on the Scopes of our Accreditations, please visit:

<http://www.nwemc.com/accreditations/>



Oregon Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	California Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	New York Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 685-0796	Minnesota Labs MN01-08 9349 W Broadway Ave. Brooklyn Park, MN 55445 (763) 425-2281	Washington Labs NC01-05, SU02, SU07 19201 120 th Ave. NE Bothell, WA 98011 (425) 984-6600
VCCI				
A-0108	A-0029		A-0109	A-0110
Industry Canada				
2834D-1, 2834D-2	2834B-1, 2834B-2, 2834B-3		2834E-1	2834C-1
NVLAP				
NVLAP Lab Code: 200630-0	NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200629-0



Client and Equipment Under Test (EUT) Information

Company Name:	MindWare Technologies, LTD
Address:	1020F Taylor Station Rd.
City, State, Zip:	Gahanna, OH 43230
Test Requested By:	Craig Morin
Model:	50-2303
First Date of Test:	March 6, 2013
Last Date of Test:	March 12, 2013
Receipt Date of Samples:	December 6, 2012
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT (Equipment Under Test):

The EUT is the Model 50-2302 handheld medical device containing a ConnectBlue OWS451i-04 radio module.

The ConnectBlue OWS451i-04 radio module is an 802.11a/b/g/n radio. It is not capable of 40 MHz channel operation. The frequency range of the 802.11a/b/g/n radio:

- 2412 – 2462 MHz
- 5180 – 5320 MHz
- 5500 – 5700 MHz

In normal operation, the EUT can be held in the hand, or worn on the body. There is no microphone or provision for VOIP communications, so it will never be used near the head.

Testing Objective:

To demonstrate compliance with the SAR requirements of FCC 2.1093.

Scope

KDB 447498 D01 v05, Appendix A contains the SAR test exclusion thresholds for 100 MHz – 6 GHz. The output power of the 802.11a/b/g/n radio is greater than the SAR test exclusion thresholds for all bands, so it does require stand-alone SAR evaluation.

The stand-alone SAR evaluation documented in this report is for the 802.11a/b/g/n portion of the EUT.

Configuration AVID0001- 8

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
DC Power Supply (EUT)	SL Power	MW170KB0503B01	None
Physiology Research Data Collection Device (unit B)	Mindware Technologies Inc.	50-2303	Unit B

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Power (EUT)	No	1.45m	No	DC Power Supply	Physiology Research Data Collection Device
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	3/6/2013	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	3/7/2013	SAR Evaluation	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
3	3/12/2013	SAR Evaluation	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.

2.4 AND 5 GHz Bands

Per FCC KDB 248227, the conducted output power was measured at the “default test channels” and at the “required test channels” in each band. Measurements were made while the EUT transmitted at the lowest, middle and the highest data rates for each channel.

Per FCC KDB 248227, among the channels required for normal testing, SAR must be measured on the highest output channel (highlighted). When the SAR measured on the highest output channel is >0.8 W/kg, SAR evaluation for the other required test channels is necessary.

Output power measurements are on the following pages.

EUT:	50-2302	Work Order:	AVID0001
Serial Number:	0272-01-001019	Date:	3/6/2013
Customer:	MindWare Technologies, LTD	Temperature:	21°C
Attendees:	None	Relative Humidity:	36%
Customer Project:	None	Bar. Pressure:	1004 mb
Tested By:	Carl Engholm, Rod Peloquin	Job Site:	EV06
Power:	110VAC/60Hz	Configuration:	AVID0001-8

TEST SPECIFICATIONS

Specification:	Method:
FCC 2.1093:2013	FCC OET 65C:2001 IEEE 1528: 2003

COMMENTS

Conducted output power

DEVIATIONS FROM TEST STANDARD

None

RESULTS

Channel	Frequency (MHz)	Data Rate (Mbps)	Modulation	Conducted Power (Average)	
				dBm	W
1	2412	1	BPSK	16.1	0.041
		11	CCK	16.2	0.042
		6	OFDM	14.6	0.029
		36	OFDM	14.6	0.029
		54	OFDM	13.9	0.025
		6.5 (MCS0)	OFDM	14.9	0.031
		65 (MCS07)	OFDM	14.0	0.025
6	2437	1	BPSK	16.0	0.040
		11	CCK	16.1	0.041
		6	OFDM	14.5	0.028
		36	OFDM	14.5	0.028
		54	OFDM	13.5	0.022
		6.5 (MCS0)	OFDM	14.8	0.030
		65 (MCS07)	OFDM	13.8	0.024



Tested By

EUT:	50-2302	Work Order:	AVID0001
Serial Number:	0272-01-001019	Date:	3/6/2013
Customer:	MindWare Technologies, LTD	Temperature:	21°C
Attendees:	None	Relative Humidity:	36%
Customer Project:	None	Bar. Pressure:	1004 mb
Tested By:	Carl Engholm, Rod Peloquin	Job Site:	EV06
Power:	110VAC/60Hz	Configuration:	AVID0001-8

TEST SPECIFICATIONS

Specification:	Method:
FCC 2.1093:2013	FCC OET 65C:2001 IEEE 1528: 2003

COMMENTS

Conducted output power

DEVIATIONS FROM TEST STANDARD

None

RESULTS

Channel	Frequency (MHz)	Data Rate (Mbps)	Modulation	Conducted Power (Average)	
				dBm	W
11	2462	1	BPSK	15.9	0.039
		11	CCK	15.9	0.039
		6	OFDM	14.2	0.026
		36	OFDM	14.2	0.026
		54	OFDM	13.2	0.021
		6.5 (MCS0)	OFDM	14.5	0.028
		65 (MCS07)	OFDM	13.4	0.022

Tested By

EUT:	50-2302	Work Order:	AVID0001
Serial Number:	0272-01-001019	Date:	3/6/2013
Customer:	MindWare Technologies, LTD	Temperature:	21°C
Attendees:	None	Relative Humidity:	36%
Customer Project:	None	Bar. Pressure:	1004 mb
Tested By:	Carl Engholm, Rod Peloquin	Job Site:	EV06
Power:	110VAC/60Hz	Configuration:	AVID0001-8

TEST SPECIFICATIONS

Specification:	Method:
FCC 2.1093:2013	FCC OET 65C:2001 IEEE 1528: 2003

COMMENTS

Conducted output power

DEVIATIONS FROM TEST STANDARD

None

RESULTS

Channel	Frequency (MHz)	Data Rate (Mbps)	Modulation	Conducted Power (Average)	
				dBm	W
36	5180	6	OFDM	12.0	0.016
		6.5 (MCS0)	OFDM	4.4	0.003
		65 (MCS07)	OFDM	-2.4	0.001
		13 (MCS08)	OFDM	4.4	0.003
40	5200	6	OFDM	12.0	0.016
		6.5 (MCS0)	OFDM	4.5	0.003
		65 (MCS07)	OFDM	-2.3	0.001
		13 (MCS08)	OFDM	4.7	0.003
44	5220	6	OFDM	12.0	0.016
		6.5 (MCS0)	OFDM	4.8	0.003
		65 (MCS07)	OFDM	-2.2	0.001
		13 (MCS08)	OFDM	4.7	0.003
48	5240	6	OFDM	12.0	0.016
		6.5 (MCS0)	OFDM	4.8	0.003
		65 (MCS07)	OFDM	-2.1	0.001
		13 (MCS08)	OFDM	4.9	0.003



Tested By

EUT:	50-2302	Work Order:	AVID0001
Serial Number:	0272-01-001019	Date:	3/6/2013
Customer:	MindWare Technologies, LTD	Temperature:	21°C
Attendees:	None	Relative Humidity:	36%
Customer Project:	None	Bar. Pressure:	1004 mb
Tested By:	Carl Engholm, Rod Peloquin	Job Site:	EV06
Power:	110VAC/60Hz	Configuration:	AVID0001-8

TEST SPECIFICATIONS

Specification:	Method:
FCC 2.1093:2013	FCC OET 65C:2001 IEEE 1528: 2003

COMMENTS

Conducted output power

DEVIATIONS FROM TEST STANDARD

None

RESULTS

Channel	Frequency (MHz)	Data Rate (Mbps)	Modulation	Conducted Power (Average) dBm	W
52	5260	6	OFDM	12.7	0.019
		6.5 (MCS0)	OFDM	5.1	0.003
		65 (MCS07)	OFDM	-1.8	0.001
		13 (MCS08)	OFDM	5.0	0.003
56	5280	6	OFDM	12.6	0.018
		6.5 (MCS0)	OFDM	5.2	0.003
		65 (MCS07)	OFDM	-1.7	0.001
		13 (MCS08)	OFDM	5.1	0.003
60	5300	6	OFDM	12.5	0.018
		6.5 (MCS0)	OFDM	5.3	0.003
		65 (MCS07)	OFDM	-1.6	0.001
		13 (MCS08)	OFDM	5.2	0.003
64	5320	6	OFDM	12.4	0.017
		6.5 (MCS0)	OFDM	5.4	0.003
		65 (MCS07)	OFDM	-1.4	0.001
		13 (MCS08)	OFDM	5.2	0.003



Tested By

EUT:	50-2302	Work Order:	AVID0001
Serial Number:	0272-01-001019	Date:	3/6/2013
Customer:	MindWare Technologies, LTD	Temperature:	21°C
Attendees:	None	Relative Humidity:	36%
Customer Project:	None	Bar. Pressure:	1004 mb
Tested By:	Carl Engholm, Rod Peloquin	Job Site:	EV06
Power:	110VAC/60Hz	Configuration:	AVID0001-8

TEST SPECIFICATIONS

Specification:	Method:
FCC 2.1093:2013	FCC OET 65C:2001 IEEE 1528: 2003

COMMENTS

Conducted output power

DEVIATIONS FROM TEST STANDARD

None

RESULTS

Channel	Frequency (MHz)	Data Rate (Mbps)	Modulation	Conducted Power (Average) dBm	W
100	5500	6	OFDM	12.0	0.016
		6.5 (MCS0)	OFDM	11.9	0.015
		65 (MCS07)	OFDM	8.6	0.007
		13 (MCS08)	OFDM	12.0	0.016
104	5520	6	OFDM	11.8	0.015
		6.5 (MCS0)	OFDM	11.8	0.015
		65 (MCS07)	OFDM	8.5	0.007
		13 (MCS08)	OFDM	11.9	0.015
108	5540	6	OFDM	11.7	0.015
		6.5 (MCS0)	OFDM	11.7	0.015
		65 (MCS07)	OFDM	8.4	0.007
		13 (MCS08)	OFDM	11.7	0.015
112	5560	6	OFDM	11.6	0.014
		6.5 (MCS0)	OFDM	11.6	0.014
		65 (MCS07)	OFDM	8.3	0.007
		13 (MCS08)	OFDM	11.6	0.014

Rocky Le Pellego

Tested By

EUT:	50-2302	Work Order:	AVID0001
Serial Number:	0272-01-001019	Date:	3/6/2013
Customer:	MindWare Technologies, LTD	Temperature:	21°C
Attendees:	None	Relative Humidity:	36%
Customer Project:	None	Bar. Pressure:	1004 mb
Tested By:	Carl Engholm, Rod Peloquin	Job Site:	EV06
Power:	110VAC/60Hz	Configuration:	AVID0001-8

TEST SPECIFICATIONS

Specification:	Method:
FCC 2.1093:2013	FCC OET 65C:2001 IEEE 1528: 2003

COMMENTS

Conducted output power

DEVIATIONS FROM TEST STANDARD

None

RESULTS

Channel	Frequency (MHz)	Data Rate (Mbps)	Modulation	Conducted Power (Average) dBm	W
116	5580	6	OFDM	11.4	0.014
		6.5 (MCS0)	OFDM	11.5	0.014
		65 (MCS07)	OFDM	8.2	0.007
		13 (MCS08)	OFDM	11.5	0.014
132	5660	6	OFDM	10.6	0.011
		6.5 (MCS0)	OFDM	10.8	0.012
		65 (MCS07)	OFDM	7.1	0.005
		13 (MCS08)	OFDM	10.8	0.012
136	5680	6	OFDM	10.3	0.011
		6.5 (MCS0)	OFDM	10.5	0.011
		65 (MCS07)	OFDM	6.8	0.005
		13 (MCS08)	OFDM	10.5	0.011
140	5700	6	OFDM	9.9	0.010
		6.5 (MCS0)	OFDM	10.1	0.010
		65 (MCS07)	OFDM	6.5	0.004
		13 (MCS08)	OFDM	10.1	0.010

Rod Peloquin

Tested By

Characterization of tissue-equivalent liquid dielectric properties

Per IEEE 1528: 2003, Section 5.2.2, the permittivity and conductivity of the tissue material should be measured at least within 24 hours of any full-compliance test. The measured values must be within +/- 5% of the target values. The temperature variation in the liquid during SAR measurements must be within +/- 2 degrees C of that recorded when the dielectric properties were measured.

The dielectric parameters of the tissue-equivalent liquids were measured within 24 hours of the start of testing using the HP85070E dielectric probe kit. The dielectric measurements were made across the frequency range of the liquid. The attached data sheets show that the dielectric parameters of the liquid were within the required 5% tolerances.

Target values of dielectric parameters

Per FCC OET 65C, Appendix C:

“The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in P1528.”

Target Frequency	Head		Body	
(MHz)	ϵ_r	σ (S/m)	ϵ_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

(ϵ_r = relative permittivity, σ = conductivity and $\rho = 1000 \text{ kg/m}^3$)

Composition of Ingredients for Liquid Tissue Phantoms

Northwest EMC uses tissue-equivalent liquids prepared by SPEAG and confirmed by them to be within +/- 5% from the target values. Their recipes are based upon the following formulations as found in FCC OET 65C, Appendix C:

“The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.”

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

Salt: 99⁺% Pure Sodium Chloride

Sugar: 98⁺% Pure Sucrose

Water: De-ionized, 16 MΩ⁺ resistivity

HEC: Hydroxyethyl Cellulose

DGBE: 99⁺% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]

Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

TISSUE – EQUIVALENT LIQUID

Tissue:	Body	Work Order:	AVID0001
Serial Number:	SAV	Date:	03/07/2013
Customer:	MindWare Technologies, LTD.	Temperature:	22.1°C
Customer Project:	None	Liquid Temperature:	22.5°C
Tested By:	Carl Engholm, Ethan Schoonover	Relative Humidity:	37%
Job Site:	EV08	Bar. Pressure:	5800

TEST SPECIFICATIONS

Specification:	Method:
FCC 2.1093:2013	FCC OET 65C:2001 IEEE Std 1528:2003

RESULTS

	Actual Values		Target Values		Deviation (%)	
Frequency (MHz)	Relative Permittivity	Conductivity	Relative Permittivity	Conductivity	Relative Permittivity	Conductivity
5800	46.5	6.133	48.2	6	3.53	-2.22

Frequency (MHz)	Relative Permittivity	Conductivity
3400	50.6	2.936
3450	50.5	2.995
3550	50.5	3.095
3650	50.3	3.198
3750	50.2	3.293
3850	50.1	3.407
3900	50	3.465
4000	49.9	3.599
4100	49.8	3.723
4200	49.6	3.86
4300	49.4	4.01
4350	49.3	4.077
4450	49.1	4.234
4550	49.1	4.367
4650	48.8	4.509
4750	48.7	4.628
4850	48.5	4.785
4900	48.4	4.849
5000	48.2	4.981
5100	47.9	5.122
5200	47.8	5.273
5300	47.5	5.391
5350	47.4	5.468
5450	47.2	5.607
5550	46.9	5.765
5650	46.7	5.919
5750	46.6	6.081
5800	46.5	6.133
5850	46.3	6.207
5900	46.2	6.293

TISSUE – EQUIVALENT LIQUID

Tissue:	Body	Work Order:	AVID0001
Serial Number:	SAM	Date:	03/13/2013
Customer:	MindWare Technologies, LTD.	Temperature:	20.7°C
Customer Project:	None	Liquid Temperature:	22°C
Tested By:	Carl Engholm, Ethan Schoonover	Relative Humidity:	45%
Job Site:	EV08	Bar. Pressure:	2450

TEST SPECIFICATIONS

Specification:	Method:
FCC 2.1093:2013	FCC OET 65C:2001 IEEE Std 1528:2003

RESULTS

	Actual Values		Target Values		Deviation (%)	
Frequency (MHz)	Relative Permittivity	Conductivity	Relative Permittivity	Conductivity	Relative Permittivity	Conductivity
2450	51.3	2.011	52.7	1.95	2.66	-3.13

Frequency (MHz)	Relative Permittivity	Conductivity
1900	55.4	4.702
1925	56.7	1.042
1950	56.7	0.947
1975	56.7	0.964
2000	56.5	1.003
2025	56.3	1.05
2050	56.1	1.109
2100	55.6	1.233
2125	55.3	1.295
2150	55	1.353
2175	54.7	1.41
2200	54.4	1.465
2225	54.1	1.527
2250	53.9	1.583
2300	53.2	1.694
2325	52.8	1.744
2350	52.5	1.791
2375	52.2	1.841
2400	52	1.898
2425	51.6	1.954
2450	51.3	2.011
2500	50.6	2.104
2525	50.3	2.146
2550	50	2.191
2575	49.6	2.238
2600	49.3	2.284
2625	49	2.325
2675	48.3	2.395
2700	47.9	2.433

REQUIREMENT

Per IEEE 1528, Section 8.2.1, "System checks are performed prior to compliance tests and the results must always be within $\pm 10\%$ of the target value corresponding to the test frequency, liquid, and the source used. The target values are 1 g or 10 g averaged SAR values measured on systems having current system validation and calibration status, and using the system check setup as shown in Figure 14. These target values should be determined using a standard source."

TEST DESCRIPTION

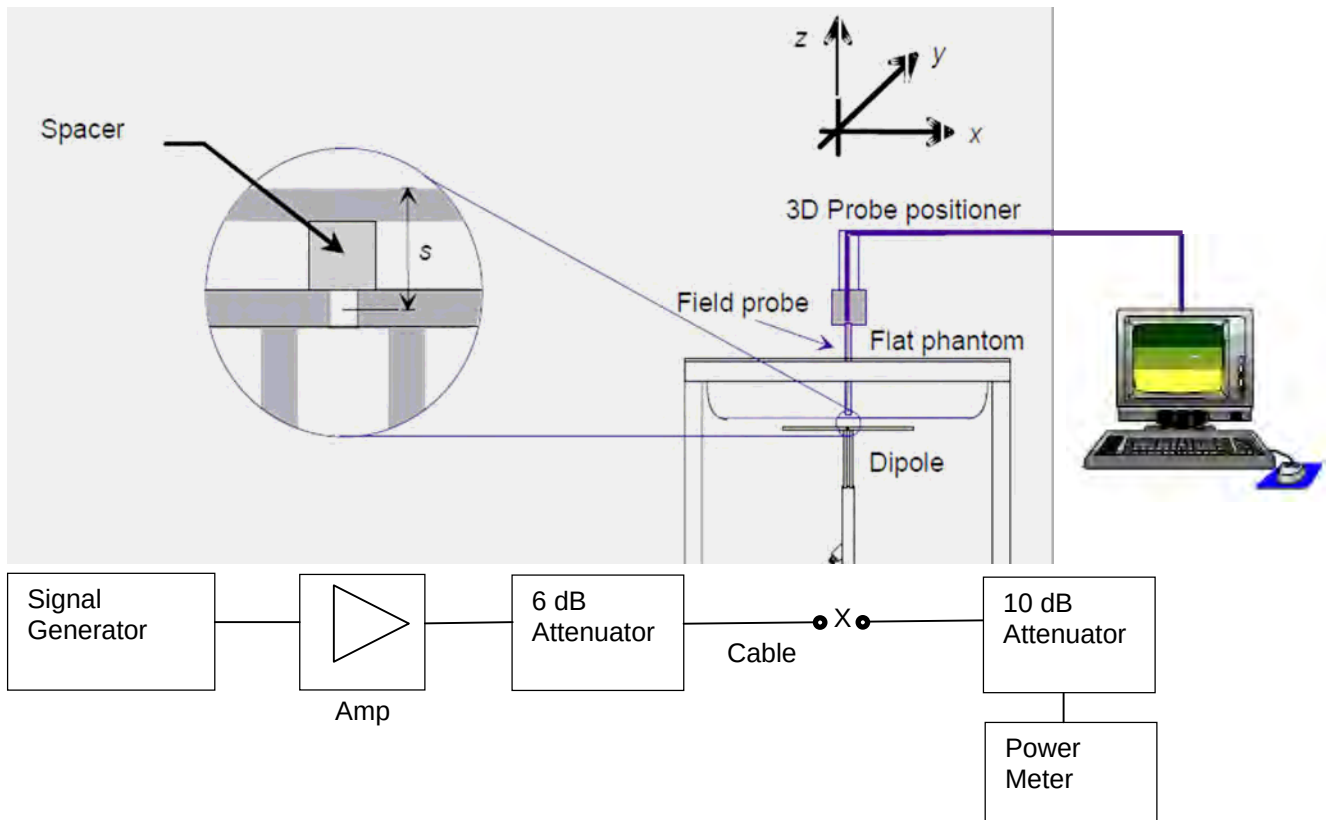
Within 24 hours of a measurement, then every 72 hours thereafter, Northwest EMC used the system validation kit (calibrated reference dipole) to test whether the system was operating within its specifications. The validation was performed in the indicated bands by making SAR measurements of the reference dipole with the phantom filled with the tissue-equivalent liquid. First, a signal generator and power amplifier were used to produce a 100mW level as measured with a power meter at the antenna terminals of the dipole (X). Then, the reference dipole was positioned below the bottom of the phantom and centered with its axis parallel to the longest side of the phantom. A low loss and low relative permittivity spacer was used to establish the correct distance between the center axis of the reference dipole and the liquid.

For the reference dipoles, the spacing distance s is given by:

$s = 15\text{mm}$, $\pm 0.2\text{mm}$ for $300\text{MHz} \leq f \leq 1000 \text{ MHz}$:

$s = 10\text{mm}$, $\pm 0.2\text{mm}$ for $1000\text{MHz} \leq f \leq 6000\text{MHz}$

The measured 1 g and 10 g spatial average SAR values were normalized to a 1W dipole input power for comparison to the calibration data. The results are summarized in the attached table. The deviation is less than 10% in all cases, indicating that the system performance check was within tolerance.



EUT:	50-2303	Work Order:	AVID0001
Customer:	MindWare Technologies, LTD.	Job Site:	EV08
Attendees:	None	Customer Project:	None

TEST SPECIFICATIONS

Specification:	Method:
FCC 2.1093:2013	FCC OET 65C:2001 IEEE Std 1528:2003

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

RESULTS

Date	Liquid part number and frequency	Conducted Power into the Dipole (dBm)	Correction Factor	Measured		Normalized to 1W		Target (Normalized to 1W) Get from Dipole Calibration Certificate		% Difference	
				1g	10g	1g	10g	1g	10g	1g	10g
3/7/2013	MSL 501	19.99	10.02	7.25	2.07	72.64	20.74	75.3	21.0	-3.53	-1.24
3/12/2013	MSL 501	19.97	10.07	7.79	2.17	78.45	21.85	80.7	22.3	-2.79	-2.02
3/13/2013	MSL 2450	19.96	10.09	4.86	2.22	49.04	22.4	50.4	23.7	-2.7	-5.49

Tested By:	Ethan Schoonover	Room Temperature (°C):	21.8°C
Date:	3/7/2013	Liquid Temperature (°C):	23.8°C
Serial Number:	ADM	Humidity (%RH):	37%
Configuration:	N/A	Bar. Pressure (mb):	1018 mb
Comments:	None		

MSL501 5200MHz System Check, 3-7-13

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1066

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5200 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.273$ S/m; $\epsilon_r = 47.754$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

System Check/System Check - Low Channel/Zoom Scan (7x9x7) (8x8x9)/Cube 0: Measurement grid:

$dx=4$ mm, $dy=4$ mm, $dz=2.5$ mm

Reference Value = 54.029 V/m; Power Drift = 0.17 dB

Peak SAR (extrapolated) = 28.2 W/kg

SAR(1 g) = 7.25 W/kg; SAR(10 g) = 2.07 W/kg

Maximum value of SAR (measured) = 15.0 W/kg

System Check/System Check - Low Channel/Area Scan (51x61x1): Interpolated grid: $dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 15.3 W/kg

System Check/System Check - Low Channel/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

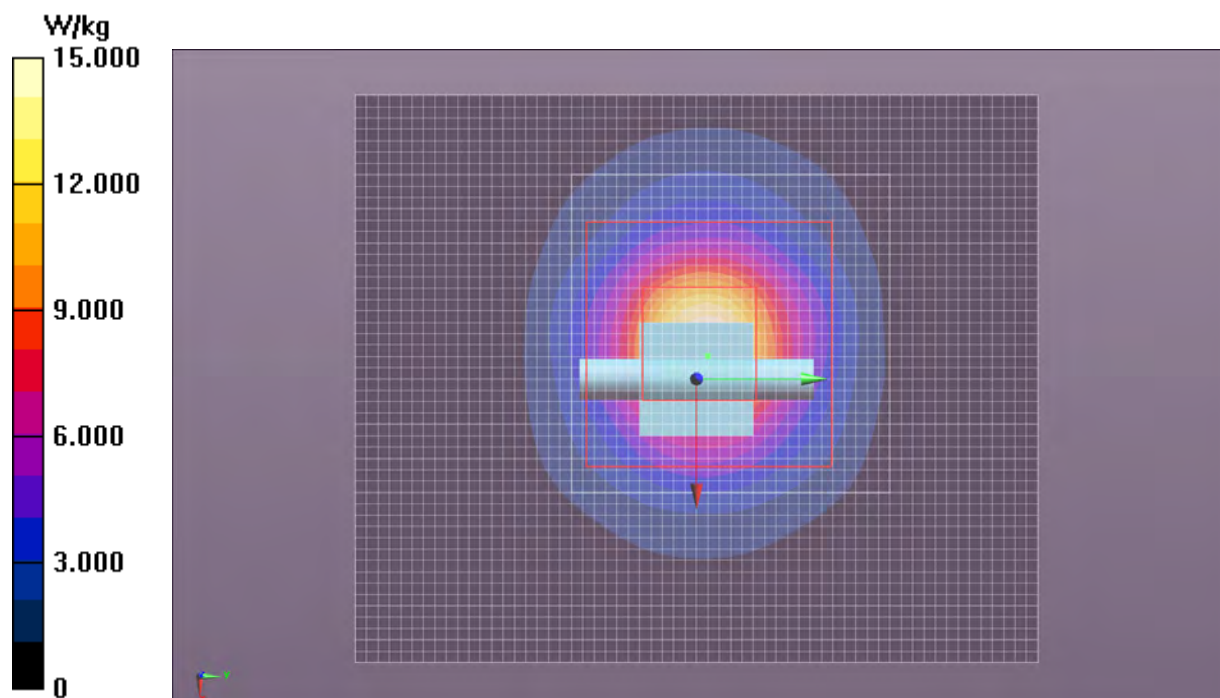
Maximum value of Total (measured) = 24.58 V/m

Maximum value of SAR (measured) = 3.19 W/kg

Approved By

MSL501 5200MHz System Check, 3-7-13



Tested By:	Ethan Schoonover	Room Temperature (°C):	23.5°C
Date:	3/12/2013	Liquid Temperature (°C):	21.8°C
Serial Number:	ADM	Humidity (%RH):	40%
Configuration:	N/A	Bar. Pressure (mb):	1023 mb
Comments:	None		

MSL501 5500MHz System Check, 3-12-13

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1066

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5500 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 5500$ MHz; $\sigma = 5.681$ S/m; $\epsilon_r = 47.016$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

System Check/System Check - Mid Channel/Area Scan (51x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 16.9 W/kg

System Check/System Check - Mid Channel/Zoom Scan (7x9x7) (8x8x9)/Cube 0: Measurement grid:

dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 58.305 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 32.3 W/kg

SAR(1 g) = 7.79 W/kg; SAR(10 g) = 2.17 W/kg

Maximum value of SAR (measured) = 16.7 W/kg

System Check/System Check - Mid Channel/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

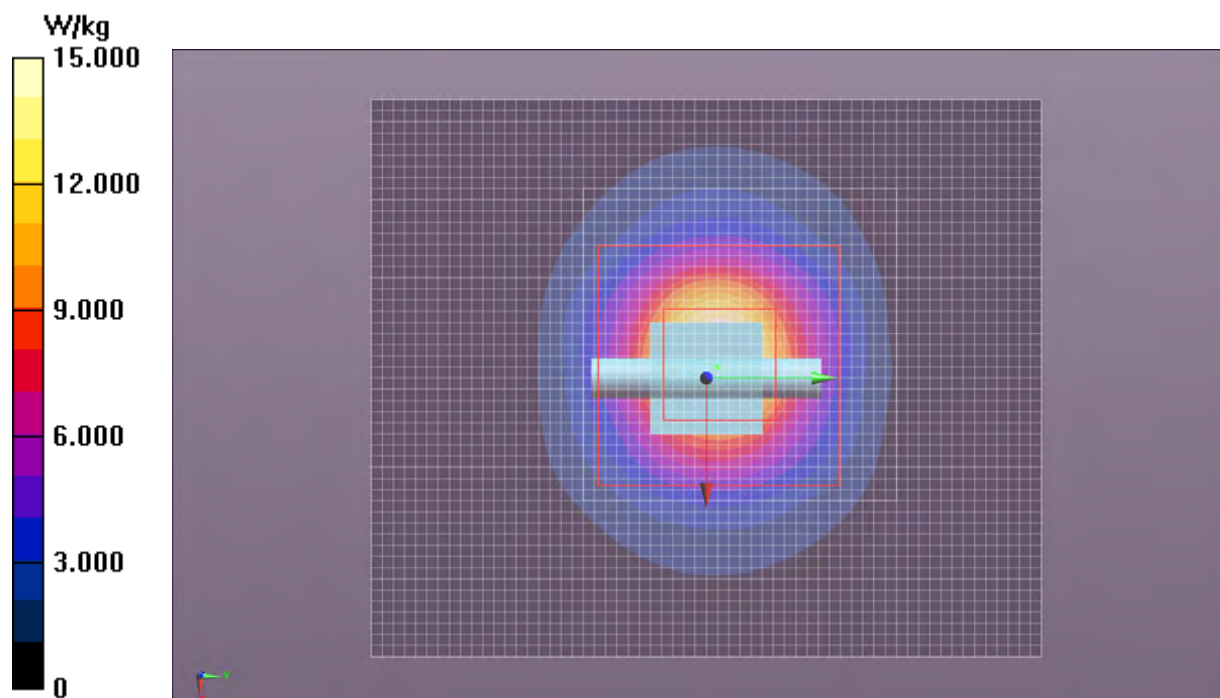
Maximum value of Total (measured) = 24.06 V/m

Maximum value of SAR (measured) = 3.29 W/kg




Approved By

MSL501 5500MHz System Check, 3-12-13



Tested By:	Ethan Schoonover	Room Temperature (°C):	20.7°C
Date:	3/13/2013	Liquid Temperature (°C):	20.9°C
Serial Number:	SAN	Humidity (%RH):	45%
Configuration:	N/A	Bar. Pressure (mb):	1023 mb
Comments:	None		

MSL2450 System Check, 3-13-13

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN: 855

Communication System: CW; Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.011$ S/m; $\epsilon_r = 51.283$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

System Check/System Check/Area Scan (51x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 5.11 W/kg

System Check/System Check/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of Total (measured) = 60.66 V/m

System Check/System Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 48.575 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 10.1 W/kg

SAR(1 g) = 4.86 W/kg; SAR(10 g) = 2.22 W/kg

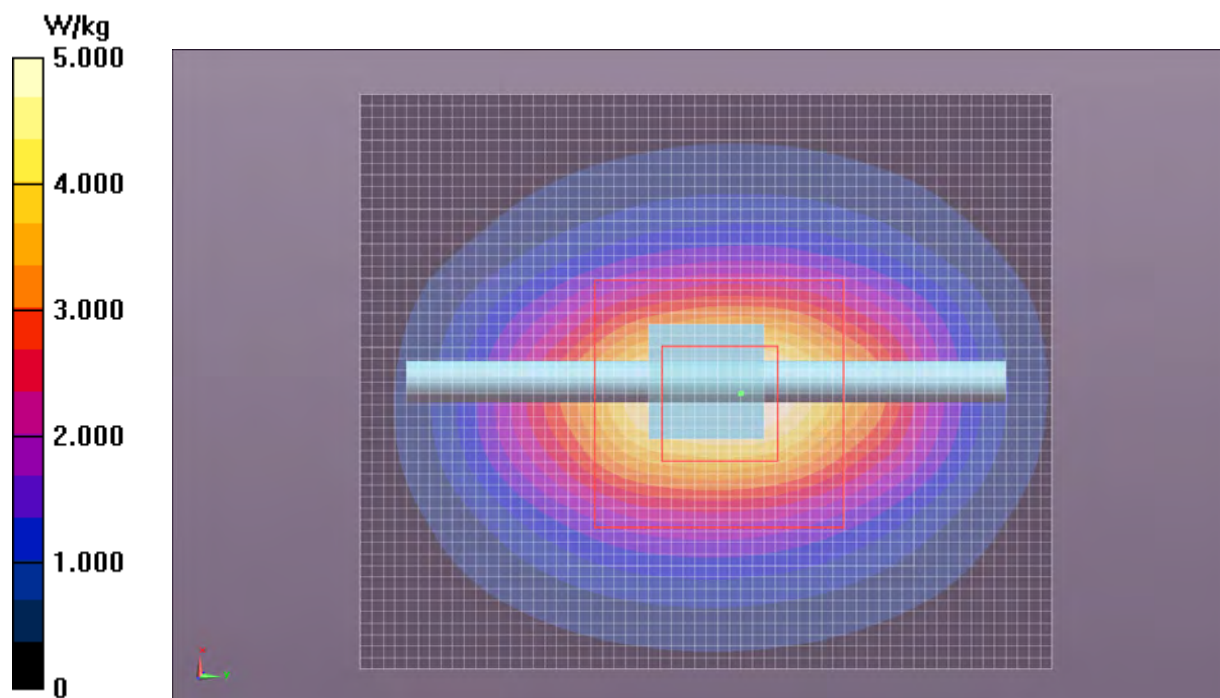
Maximum value of SAR (measured) = 4.82 W/kg

Maximum value of SAR (measured) = 7.40 W/kg

Approved By

MSL2450 System Check, 3-13-13



Test Configurations

In normal operation, the EUT can be held in the hand, or worn on the body. It was tested with 0mm spacing from the body phantom.

Per KDB 248227, among the channels required for normal testing, SAR must be measured on the highest conducted output channel in each band (see highlighted values in the Output Power section of this report). Where the measured SAR on the highest output channel is $> 0.8 \text{ W/kg}$, SAR evaluation for the other channels was performed (reference also KDB 447498 Section 4.3.3).

All testing was performed with the EUT configured in a worst – case configuration and operating mode to produce the highest SAR levels. The EUT used test software that permitted the selection of transmit channel, modulation type, and data rate. The radio module operated continuously at nearly 100% duty cycle at the maximum rated power.

Summary

The following tables summarize the measured SAR values.

SAR TEST DATA

EUT:	50-2303	Work Order:	AVID0001
Customer:	MindWare Technologies, LTD.	Job Site:	EV08
Attendees:	None	Customer Project:	None

TEST SPECIFICATIONS

Specification:	Method:
FCC 2.1093:2013 FCC 15.247:2013 FCC 15.407:2013	FCC OET 65C:2001 IEEE Std 1528:2003 FCC KDB 447498 D01 v05 FCC KDB 248227 D01 V01r02 FCC KDB 648474 D04 V01 FCC 865664 D01 and D02

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

RESULTS

Test Configuration	Frequency Band	Transmit Frequency (MHz)	Transmit Channel	Data Rate (Mbps)	Channel Bandwidth (MHz)	Antenna Port	Accessory	EUT Position	Power Drift During Test (dB)	Measured 1g SAR Level (mW/g)	Test #
Body	2.4	2412	1	11	20	N/A	None	Left	0.18	0.156	1
Body	2.4	2412	1	11	20	N/A	None	Front	-0.14	0.545	2
Body	2.4	2437	6	11	20	N/A	None	Front	0.24	0.424	2a
Body	2.4	2462	11	11	20	N/A	None	Front	0.11	0.351	2b
Body	2.4	2412	1	11	20	N/A	None	Back	Note 2	Note 1	3
Body	2.4	2412	1	11	20	N/A	None	Right	Note 2	Note 1	4

Note 1: Zoom scan measurement was not performed because the area scan results were less than 0.1 mW/g.

Note 2: Power drift measurement was not performed because the area scan results were less than 0.1 mW/g.

Tested By:	Ethan Schoonover	Room Temperature (°C):	23.2
Date:	3/12/2013	Liquid Temperature (°C):	21.2
Serial Number:	0270-01-001127	Humidity (%RH):	43
Configuration:	8	Bar. Pressure (mb):	1021
Comments:	None		

Test 1

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D2450 (2450.0 MHz); Frequency: 2412 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $\sigma = 0 \text{ S/m}$, $\epsilon_r = 1$; $\rho = 1000 \text{ kg/m}^3$, Medium parameters used (interpolated): $f = 2412 \text{ MHz}$; $\sigma = 1.925 \text{ S/m}$; $\epsilon_r = 51.812$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 7.735 V/m

Body/Body/Reference scan (31x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.198 W/kg

Body/Body/Area scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.204 W/kg

Body/Body/Zoom Scan 2 (9x11x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.836 V/m; Power Drift = 0.18 dB

Peak SAR (extrapolated) = 0.276 W/kg

SAR(1 g) = 0.156 W/kg; SAR(10 g) = 0.085 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.191 W/kg

Body/Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.836 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 0.276 W/kg

SAR(1 g) = 0.153 W/kg; SAR(10 g) = 0.082 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

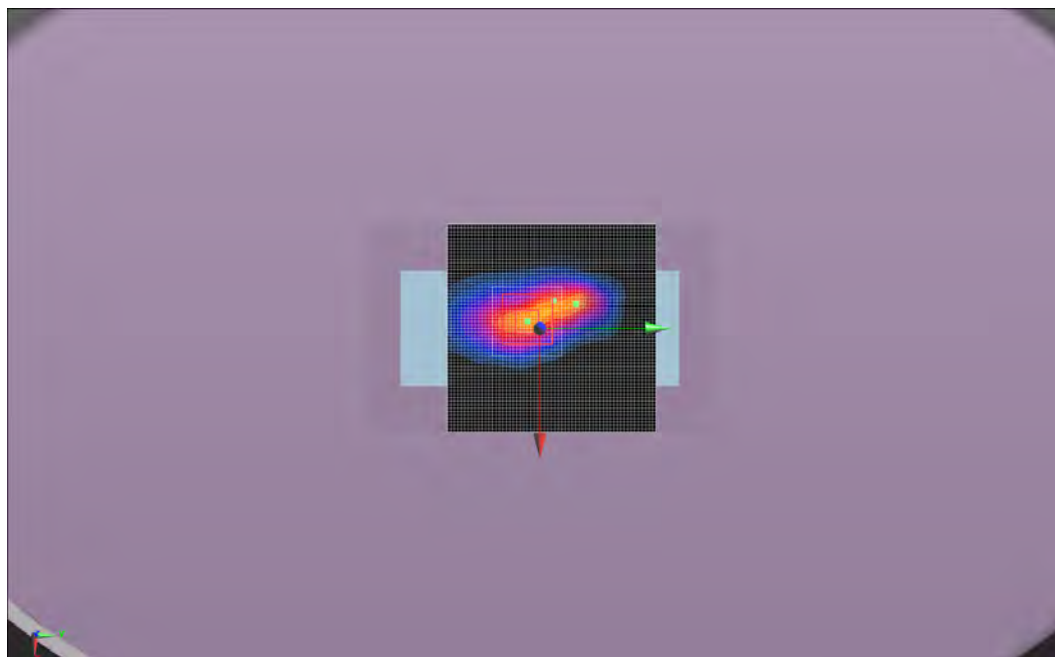
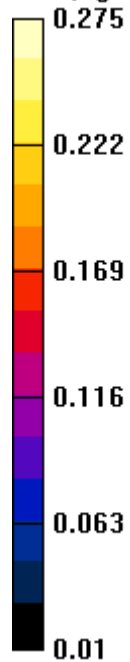
Maximum value of SAR (measured) = 0.194 W/kg

Maximum value of SAR (measured) = 0.115 W/kg

Approved By

Test 1

W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	23.7
Date:	3/12/2013	Liquid Temperature (°C):	21.5
Serial Number:	0270-01-001127	Humidity (%RH):	39
Configuration:	8	Bar. Pressure (mb):	1021
Comments:	None		

Test 2

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D2450 (2450.0 MHz); Frequency: 2412 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³, Medium parameters used (interpolated): $f = 2412$ MHz; $\sigma = 1.925$ S/m; $\epsilon_r = 51.812$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 12.81 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.546 W/kg

Body/Body/Area scan (71x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.661 W/kg

Body/Body/Zoom Scan (7x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 15.892 V/m; Power Drift = -0.14 dB

Peak SAR (extrapolated) = 1.40 W/kg

SAR(1 g) = 0.545 W/kg; SAR(10 g) = 0.248 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

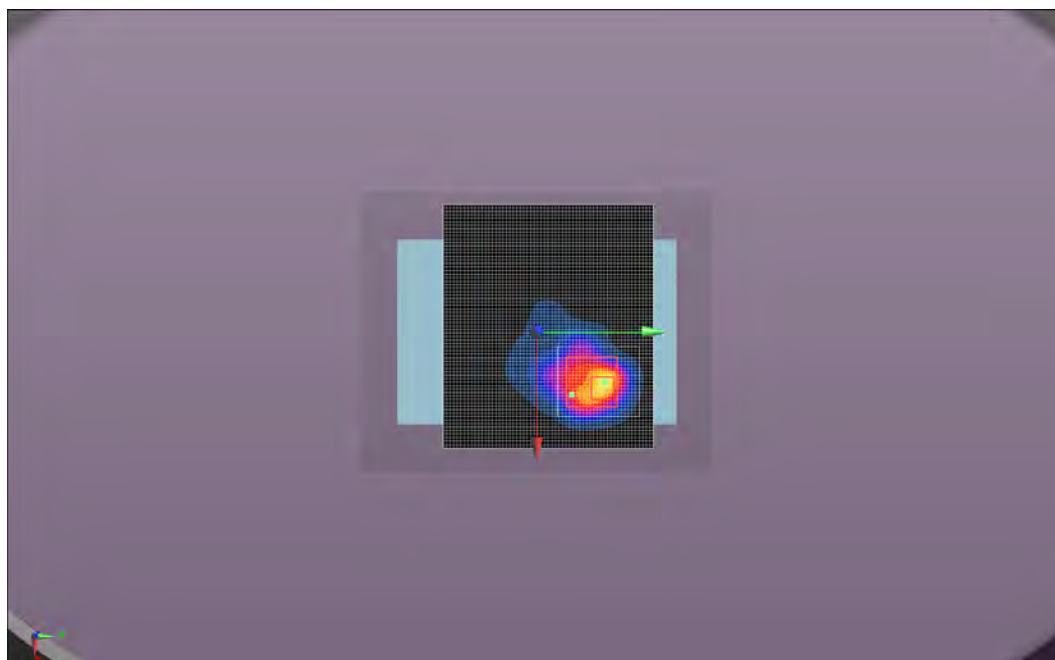
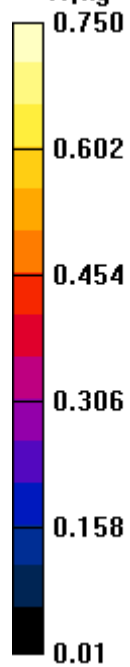
Maximum value of SAR (measured) = 0.754 W/kg




Approved By

Test 2

W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	22.4
Date:	3/12/2013	Liquid Temperature (°C):	21.2
Serial Number:	0270-01-001127	Humidity (%RH):	42
Configuration:	8	Bar. Pressure (mb):	1021
Comments:	None		

Test 2a

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D2450 (2450.0 MHz); Frequency: 2437

MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³, Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.982$ S/m; $\epsilon_r = 51.471$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 11.23 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.377 W/kg

Body/Body/Area scan (71x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.497 W/kg

Body/Body/Zoom Scan (7x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 14.318 V/m; Power Drift = 0.24 dB

Peak SAR (extrapolated) = 1.13 W/kg

SAR(1 g) = 0.424 W/kg; SAR(10 g) = 0.191 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.586 W/kg

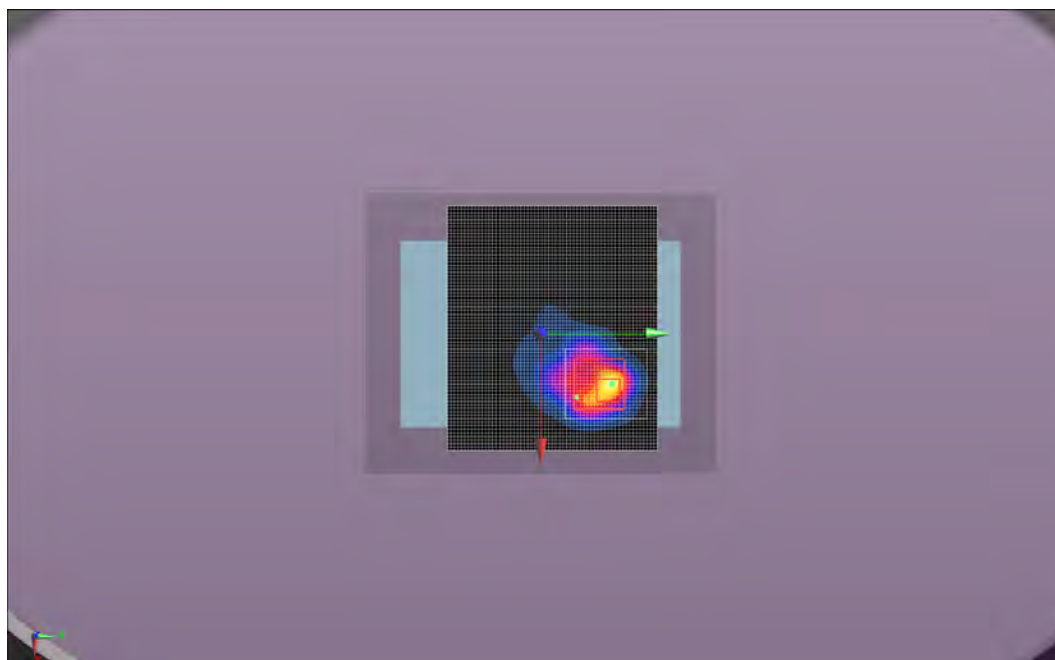
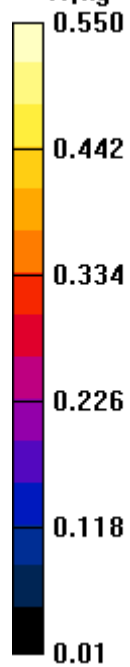
Maximum value of SAR (measured) = 0.250 W/kg




Approved By

Test 2a

W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	22.6
Date:	3/12/2013	Liquid Temperature (°C):	21.1
Serial Number:	0270-01-001127	Humidity (%RH):	44
Configuration:	8	Bar. Pressure (mb):	1021
Comments:	None		

Test 2b

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D2450 (2450.0 MHz); Frequency: 2462 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³, Medium parameters used (interpolated): $f = 2462$ MHz; $\sigma = 2.035$ S/m; $\epsilon_r = 51.114$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 10.04 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.278 W/kg

Body/Body/Area scan (71x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.379 W/kg

Body/Body/Zoom Scan (7x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.551 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 0.993 W/kg

SAR(1 g) = 0.351 W/kg; SAR(10 g) = 0.150 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.464 W/kg

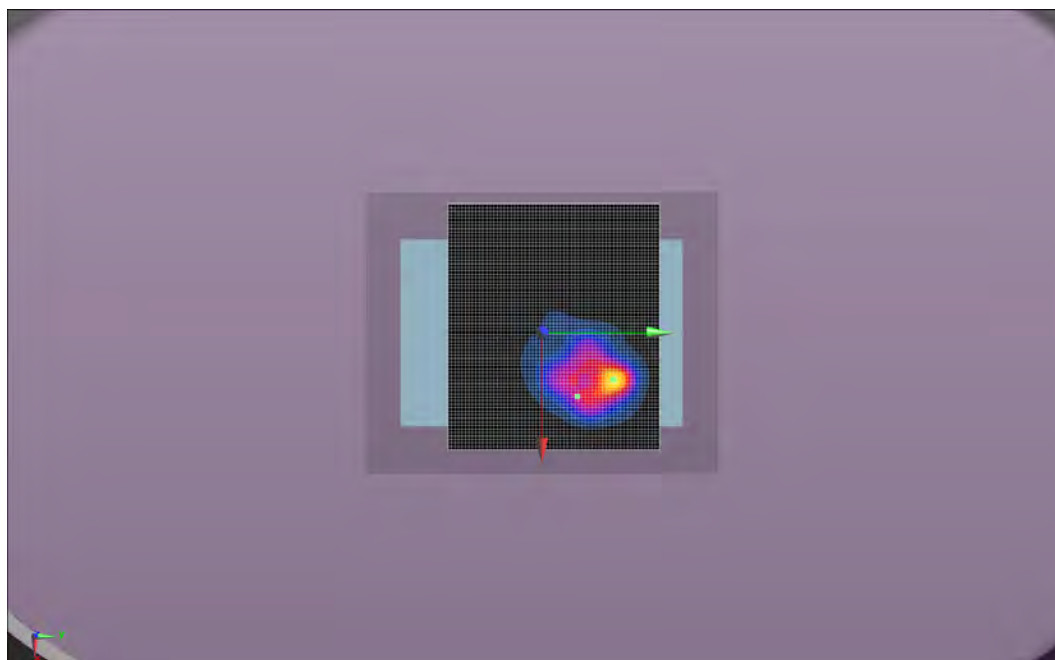
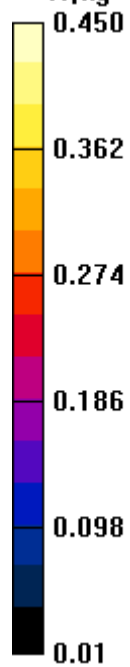
Maximum value of SAR (measured) = 0.205 W/kg




Approved By

Test 2b

W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	22.9
Date:	3/12/2013	Liquid Temperature (°C):	21.1
Serial Number:	0270-01-001127	Humidity (%RH):	43
Configuration:	8	Bar. Pressure (mb):	1021
Comments:	None		

Test 3

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D2450 (2450.0 MHz); Frequency: 2412 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used (interpolated): $f = 2412$ MHz; $\sigma = 1.925$ S/m; $\epsilon_r = 51.812$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0 W/kg

Body/Body/Area scan (71x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Body/Body/Area scan (8x7x1): Measurement grid: dx=15mm, dy=15mm

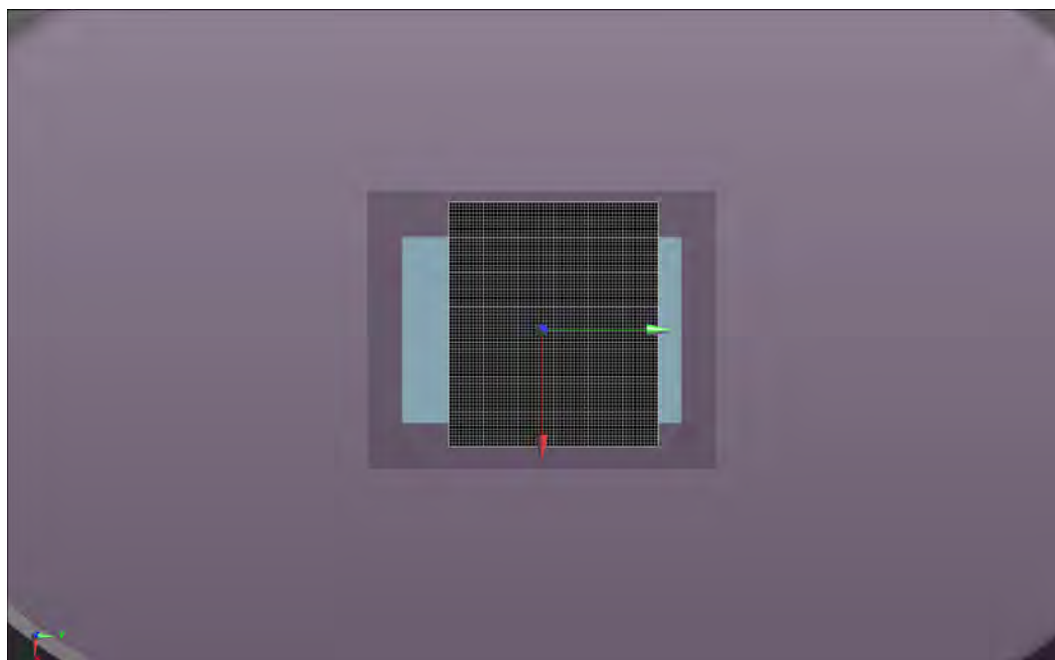
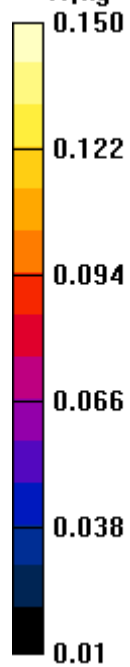
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.00196 W/kg

 
Approved By

Test 3

W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	23.1
Date:	3/12/2013	Liquid Temperature (°C):	21.1
Serial Number:	0270-01-001127	Humidity (%RH):	43
Configuration:	8	Bar. Pressure (mb):	1021
Comments:	None		

Test 4

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D2450 (2450.0 MHz); Frequency: 2412 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used (interpolated): $f = 2412$ MHz; $\sigma = 1.925$ S/m; $\epsilon_r = 51.812$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASYS 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Reference scan (31x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.00540 W/kg

Body/Body/Area scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.0183 W/kg

Body/Body/Area scan (7x7x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

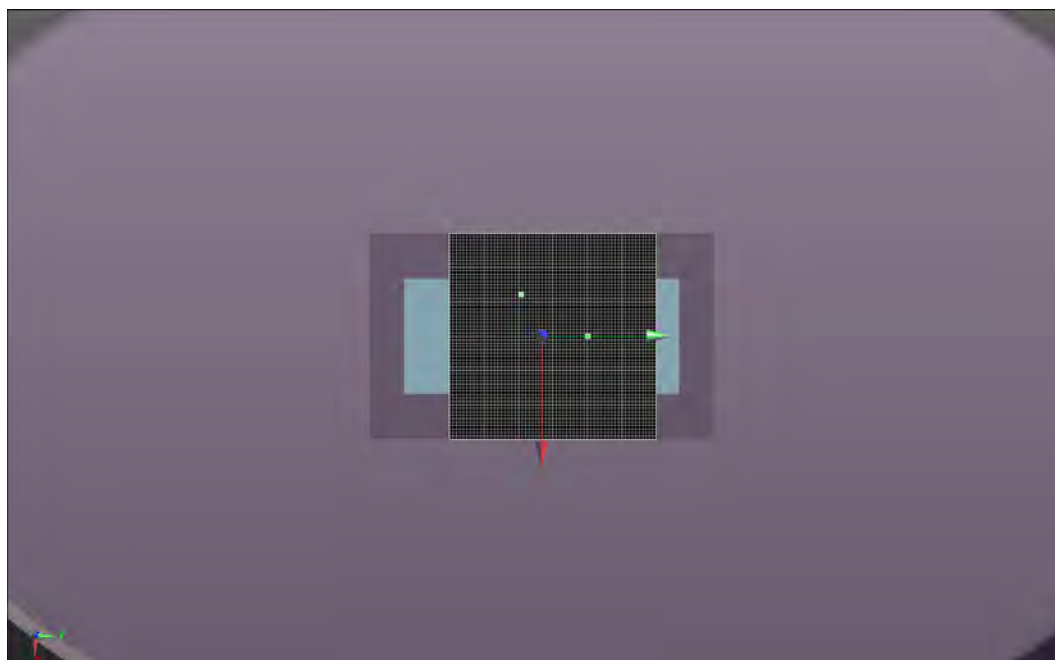
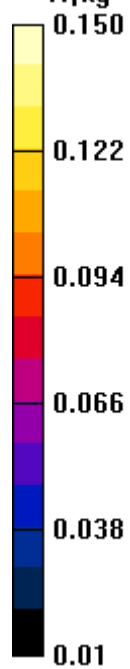
Maximum value of SAR (measured) = 0.0183 W/kg



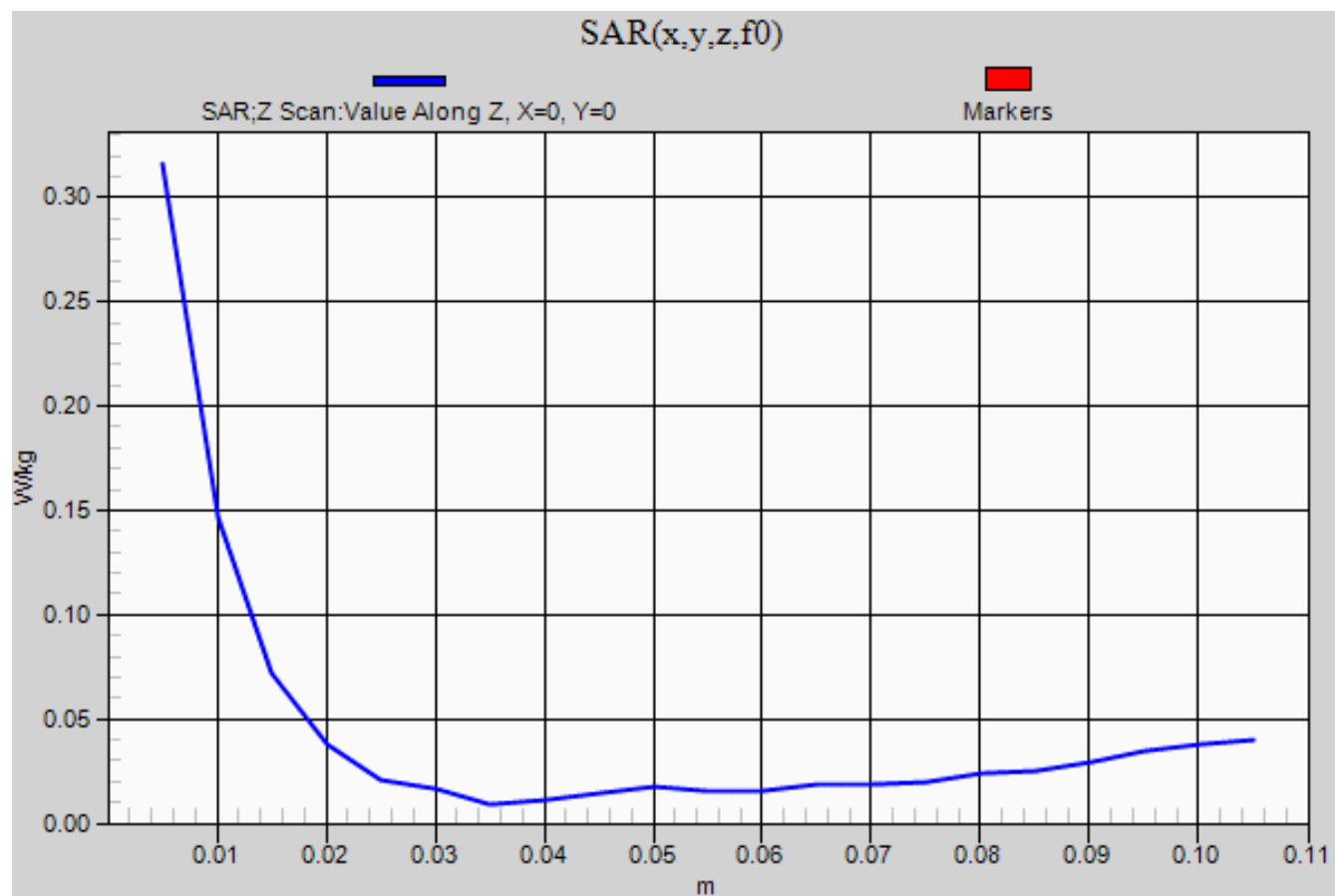

Approved By

Test 4

W/kg



Test 2



EUT:	50-2303	Work Order:	AVID0001
Customer:	MindWare Technologies, LTD.	Job Site:	EV08
Attendees:	None	Customer Project:	None

TEST SPECIFICATIONS

Specification:	Method:
FCC 2.1093:2013 FCC 15.247:2013 FCC 15.407:2013	FCC OET 65C:2001 IEEE Std 1528:2003 FCC KDB 447498 D01 v05 FCC KDB 248227 D01 V01r02 FCC KDB 648474 D04 V01 FCC 865664 D01 and D02

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

RESULTS

Test Configuration	Frequency Band	Transmit Frequency (MHz)	Transmit Channel	Data Rate (Mbps)	Channel Bandwidth (MHz)	Antenna Port	Accessory	EUT Position	Power Drift During Test (dB)	Measured 1g SAR Level (mW/g)	Test #
Body	5.2	5180	36	6	20	N/A	None	Left	0.13	0.397	5
Body	5.2	5180	36	6	20	N/A	None	Front	0.06	0.363	6
Body	5.2	5180	36	6	20	N/A	None	Back	Note 2	Note 1	7
Body	5.2	5180	36	6	20	N/A	None	Right	Note 2	Note 1	8
Body	5.3	5260	52	6	20	N/A	None	Left	-0.08	0.402	9
Body	5.3	5260	52	6	20	N/A	None	Front	0.03	0.427	10
Body	5.3	5280	56	6	20	N/A	None	Front	0.14	0.434	10a
Body	5.3	5320	64	6	20	N/A	None	Front	0.14	0.43	10b
Body	5.3	5260	52	6	20	N/A	None	Back	Note 2	Note 1	11
Body	5.3	5260	52	6	20	N/A	None	Right	Note 2	Note 1	12
Body	5.6	5500	100	6	20	N/A	None	Left	0.1	0.517	13
Body	5.6	5540	108	6	20	N/A	None	Left	0.2	0.544	13a
Body	5.6	5660	132	6	20	N/A	None	Left	0.16	0.419	13b
Body	5.6	5700	140	6	20	N/A	None	Left	0.28	0.334	13c
Body	5.6	5500	100	6	20	N/A	None	Front	0.15	0.395	14
Body	5.6	5540	108	6	20	N/A	None	Front	0.13	0.426	14a
Body	5.6	5660	132	6	20	N/A	None	Front	0.01	0.443	14b
Body	5.6	5700	140	6	20	N/A	None	Front	0.13	0.292	14c
Body	5.6	5500	100	6	20	N/A	None	Back	Note 2	Note 1	15
Body	5.6	5500	100	6	20	N/A	None	Right	Note 2	Note 1	16

Note 1: Zoom scan measurement was not performed because the area scan results were less than 0.1 mW/g.

Note 2: Power drift measurement was not performed because the area scan results were less than 0.1 mW/g.

Tested By:	Ethan Schoonover	Room Temperature (°C):	23.3
Date:	3/7/2013	Liquid Temperature (°C):	22.4
Serial Number:	0270-01-001127	Humidity (%RH):	35
Configuration:	8	Bar. Pressure (mb):	1018
Comments:	None		

Test 5

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5180 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used (interpolated): $f = 5180$ MHz; $\sigma = 5.244$ S/m; $\epsilon_r = 47.783$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Zoom Scan (9x9x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 12.902 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 1.47 W/kg

SAR(1 g) = 0.397 W/kg; SAR(10 g) = 0.122 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.778 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 6.208 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.152 W/kg

Body/Body/Area scan (81x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.811 W/kg

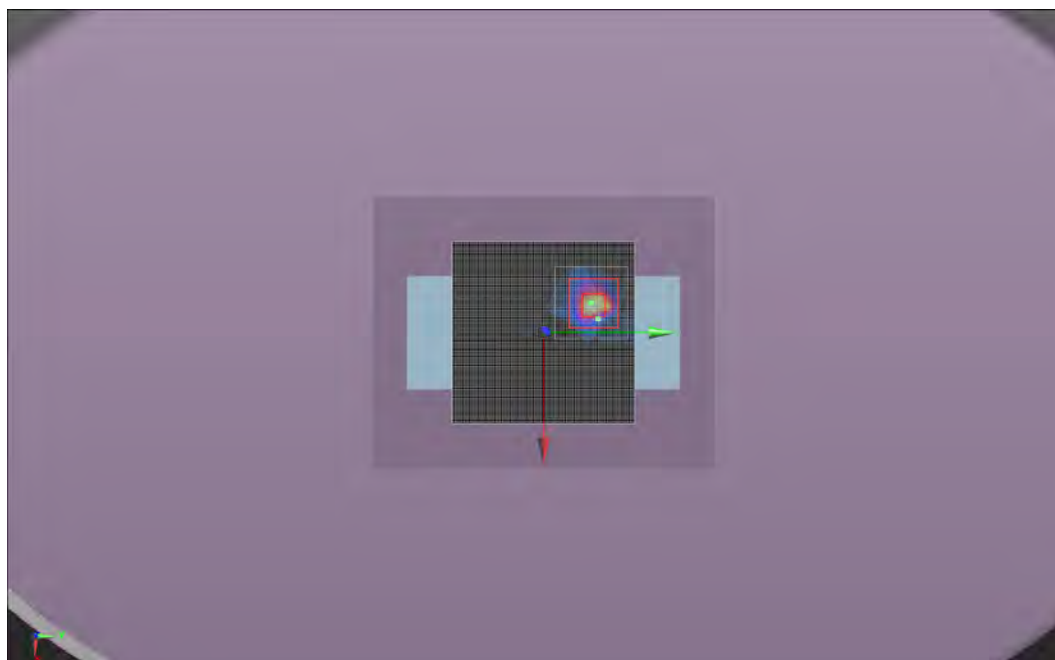
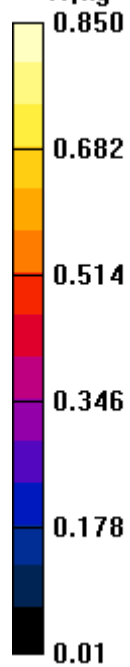
Maximum value of SAR (measured) = 0.202 W/kg




Approved By

Test 5

W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	23.8
Date:	3/7/2013	Liquid Temperature (°C):	22.5
Serial Number:	0270-01-001127	Humidity (%RH):	34
Configuration:	8	Bar. Pressure (mb):	1018
Comments:	None		

Test 6

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5180 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used (interpolated): $f = 5180$ MHz; $\sigma = 5.244$ S/m; $\epsilon_r = 47.783$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Zoom Scan (10x9x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 11.679 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 1.28 W/kg

SAR(1 g) = 0.363 W/kg; SAR(10 g) = 0.151 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.716 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 6.764 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.624 W/kg

Body/Body/Area scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

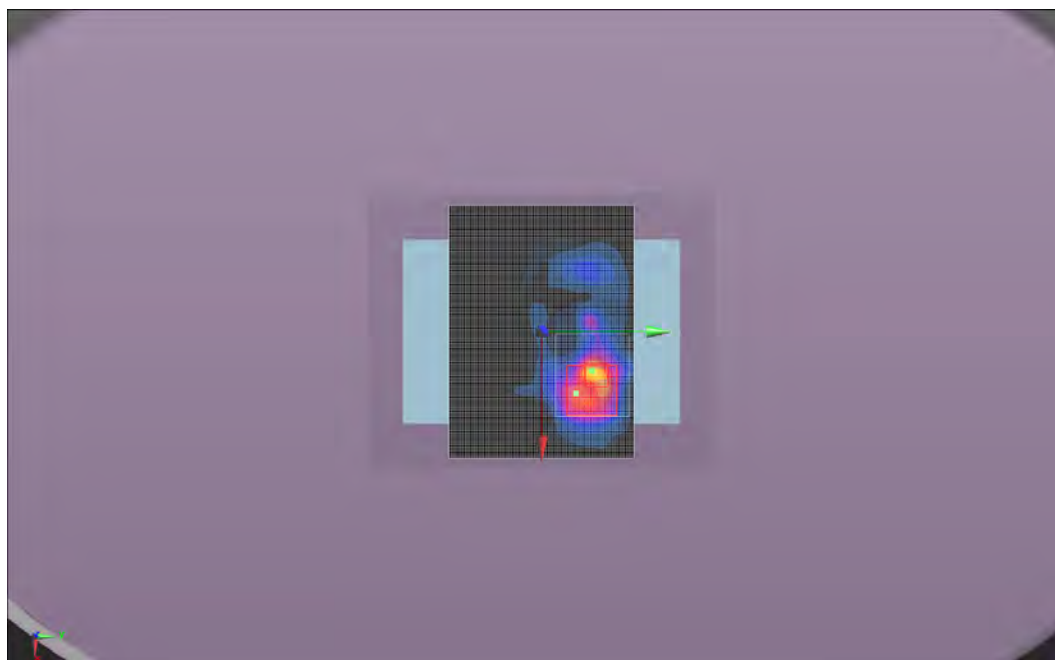
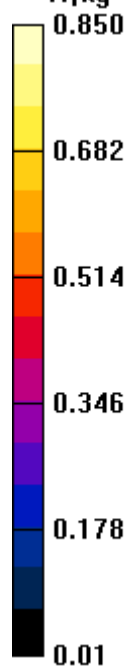
Maximum value of SAR (interpolated) = 0.668 W/kg

Maximum value of SAR (measured) = 0.240 W/kg

 
Approved By

Test 6

W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	24
Date:	3/7/2013	Liquid Temperature (°C):	22.6
Serial Number:	0270-01-001127	Humidity (%RH):	34
Configuration:	8	Bar. Pressure (mb):	1018
Comments:	None		

Test 7

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5180 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used (interpolated): $f = 5180$ MHz; $\sigma = 5.244$ S/m; $\epsilon_r = 47.783$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASYS 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.0189 W/kg

Body/Body/Area scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.000307 W/kg

Body/Body/Area scan (12x9x1): Measurement grid: dx=10mm, dy=10mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

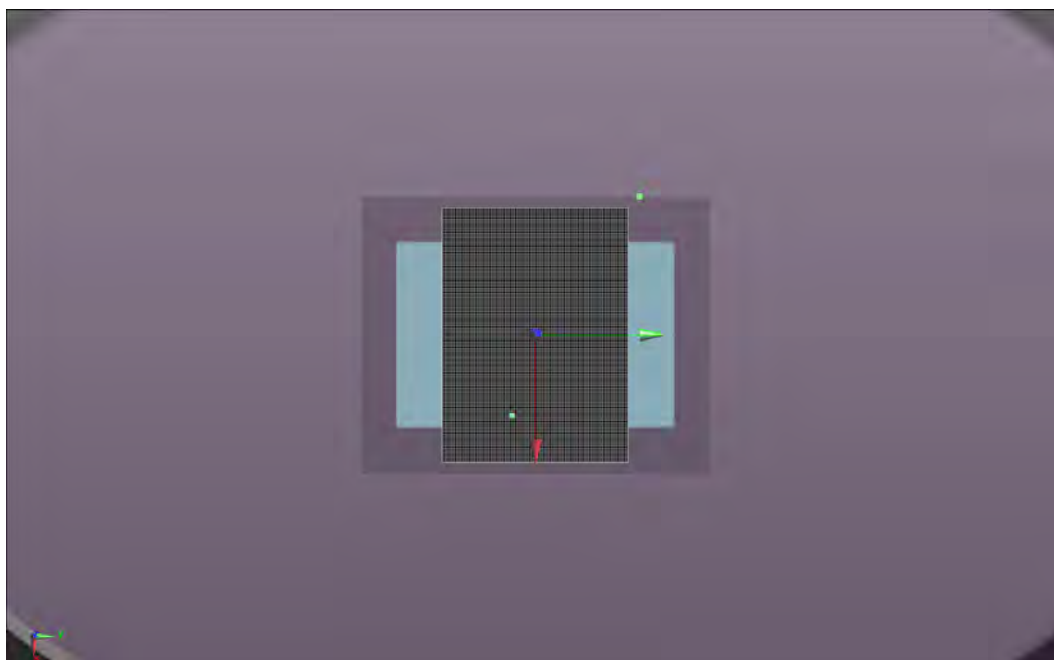
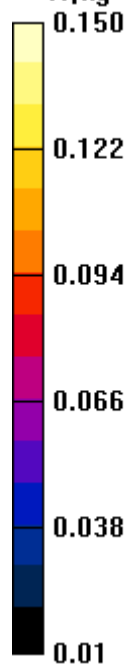
Maximum value of SAR (measured) = 0.0136 W/kg

Approved By

Test 7

W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	23.7
Date:	3/7/2013	Liquid Temperature (°C):	22.4
Serial Number:	0270-01-001127	Humidity (%RH):	34
Configuration:	8	Bar. Pressure (mb):	1018
Comments:	None		

Test 8

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5180 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used (interpolated): $f = 5180$ MHz; $\sigma = 5.244$ S/m; $\epsilon_r = 47.783$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.0339 W/kg

Body/Body/Area scan (81x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.116 W/kg

Body/Body/Area scan (9x9x1): Measurement grid: dx=10mm, dy=10mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

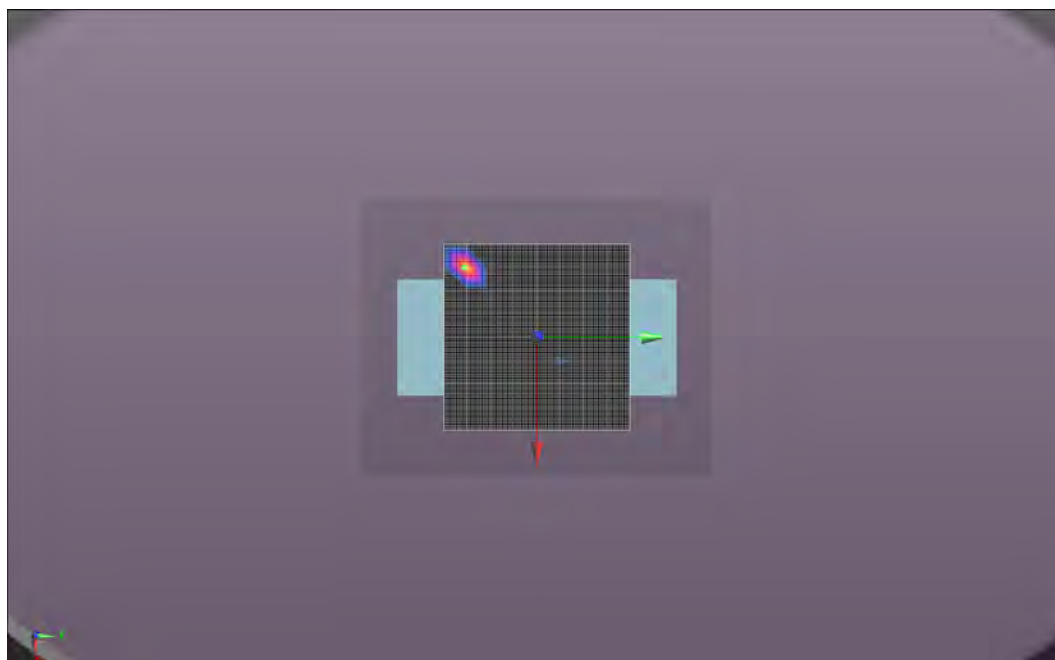
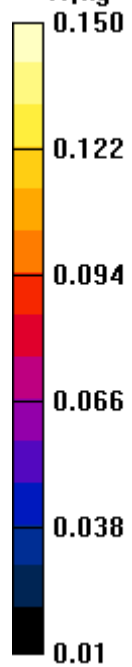
Maximum value of SAR (measured) = 0.114 W/kg




Approved By

Test 8

W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	21.2
Date:	3/7/2013	Liquid Temperature (°C):	23.3
Serial Number:	0270-01-001127	Humidity (%RH):	37
Configuration:	8	Bar. Pressure (mb):	1018
Comments:	None		

Test 9

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5260 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used (interpolated): $f = 5260$ MHz; $\sigma = 5.345$ S/m; $\epsilon_r = 47.644$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 13.842 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 1.76 W/kg

SAR(1 g) = 0.402 W/kg; SAR(10 g) = 0.123 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.796 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 5.950 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.224 W/kg

Body/Body/Area scan (81x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

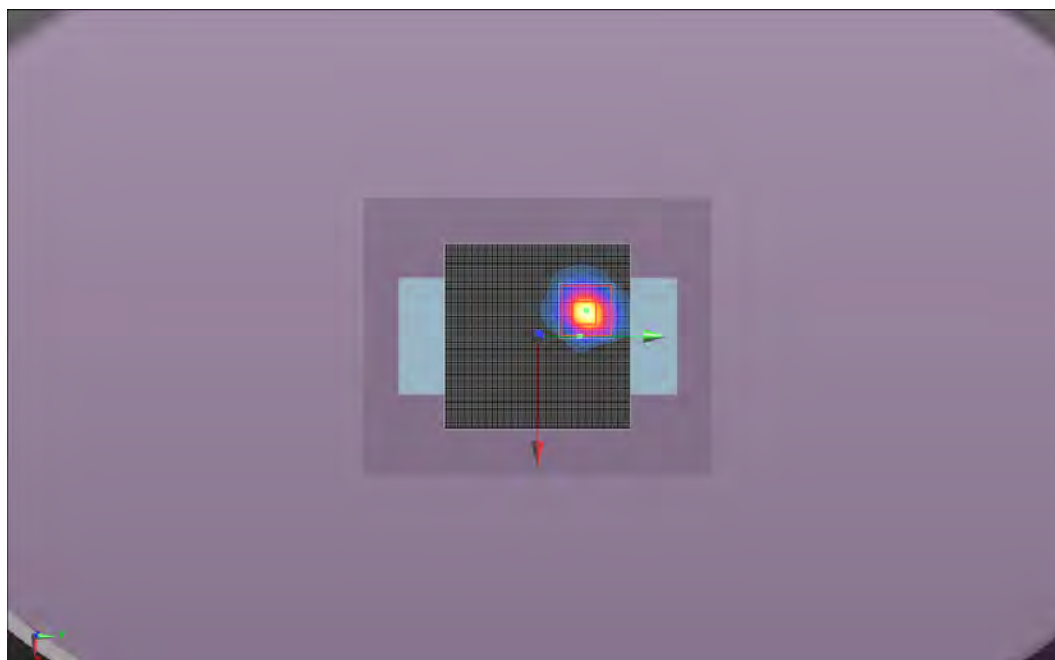
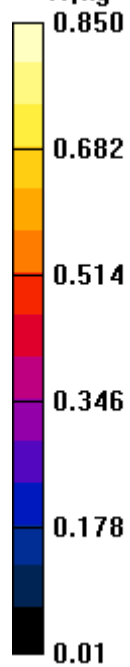
Maximum value of SAR (interpolated) = 0.851 W/kg

Maximum value of SAR (measured) = 0.189 W/kg

 
Approved By

Test 9

W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	23.4
Date:	3/7/2013	Liquid Temperature (°C):	23.9
Serial Number:	0270-01-001127	Humidity (%RH):	36
Configuration:	8	Bar. Pressure (mb):	1018
Comments:	None		

Test 10

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5260 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used (interpolated): $f = 5260$ MHz; $\sigma = 5.345$ S/m; $\epsilon_r = 47.644$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Zoom Scan (10x9x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 13.507 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 1.34 W/kg

SAR(1 g) = 0.427 W/kg; SAR(10 g) = 0.176 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.819 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 6.927 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.639 W/kg

Body/Body/Area scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

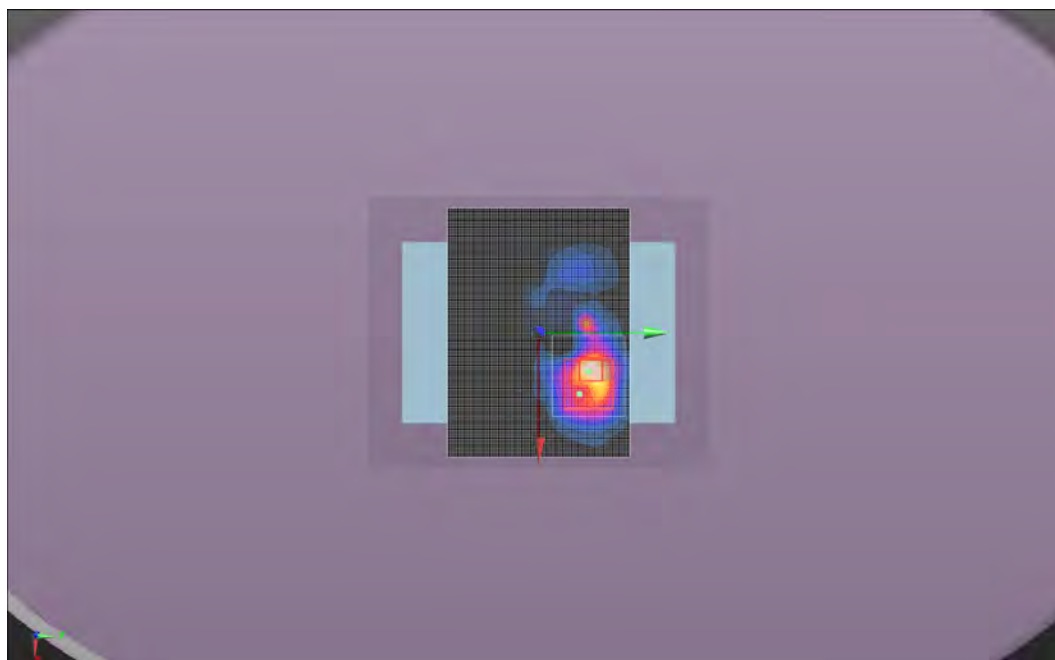
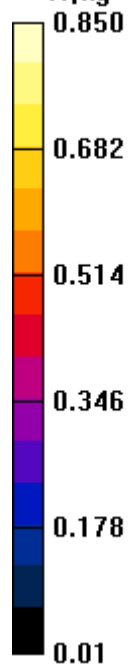
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.877 W/kg

Maximum value of SAR (measured) = 0.256 W/kg

 
Approved By

Test 10
W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	22.1
Date:	3/7/2013	Liquid Temperature (°C):	22.5
Serial Number:	0270-01-001127	Humidity (%RH):	37
Configuration:	8	Bar. Pressure (mb):	1018
Comments:	None		

Test 10a

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5280 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used (interpolated): $f = 5280$ MHz; $\sigma = 5.368$ S/m; $\epsilon_r = 47.583$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASYS 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Zoom Scan (9x9x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 13.986 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 1.38 W/kg

SAR(1 g) = 0.434 W/kg; SAR(10 g) = 0.170 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.801 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 6.561 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.623 W/kg

Body/Body/Area scan (11x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.997 W/kg

Body/Body/Zoom Scan 2 (15x10x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 13.986 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 2.01 W/kg

SAR(1 g) = 0.425 W/kg; SAR(10 g) = 0.169 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

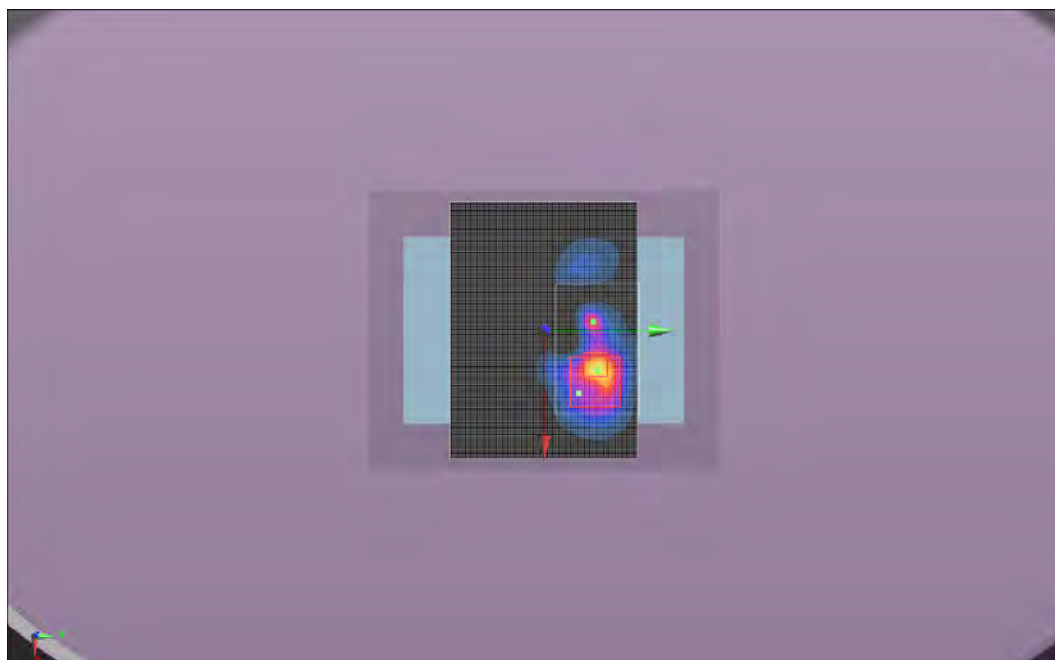
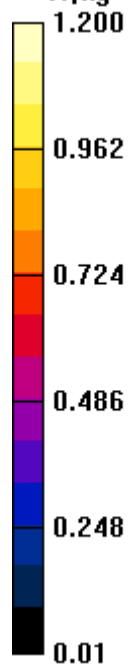
Maximum value of SAR (measured) = 0.841 W/kg

Maximum value of SAR (measured) = 0.231 W/kg




Approved By

Test 10a
W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	21.1
Date:	3/7/2013	Liquid Temperature (°C):	23
Serial Number:	0270-01-001127	Humidity (%RH):	37
Configuration:	8	Bar. Pressure (mb):	1018
Comments:	None		

Test 10b

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5320 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used (interpolated): $f = 5320$ MHz; $\sigma = 5.421$ S/m; $\epsilon_r = 47.472$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASYS 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Zoom Scan (10x9x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 13.850 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 1.49 W/kg

SAR(1 g) = 0.428 W/kg; SAR(10 g) = 0.169 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.824 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 6.789 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.670 W/kg

Body/Body/Area scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 1.02 W/kg

Body/Body/Zoom Scan 2 (15x10x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 13.850 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 1.32 W/kg

SAR(1 g) = 0.430 W/kg; SAR(10 g) = 0.168 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

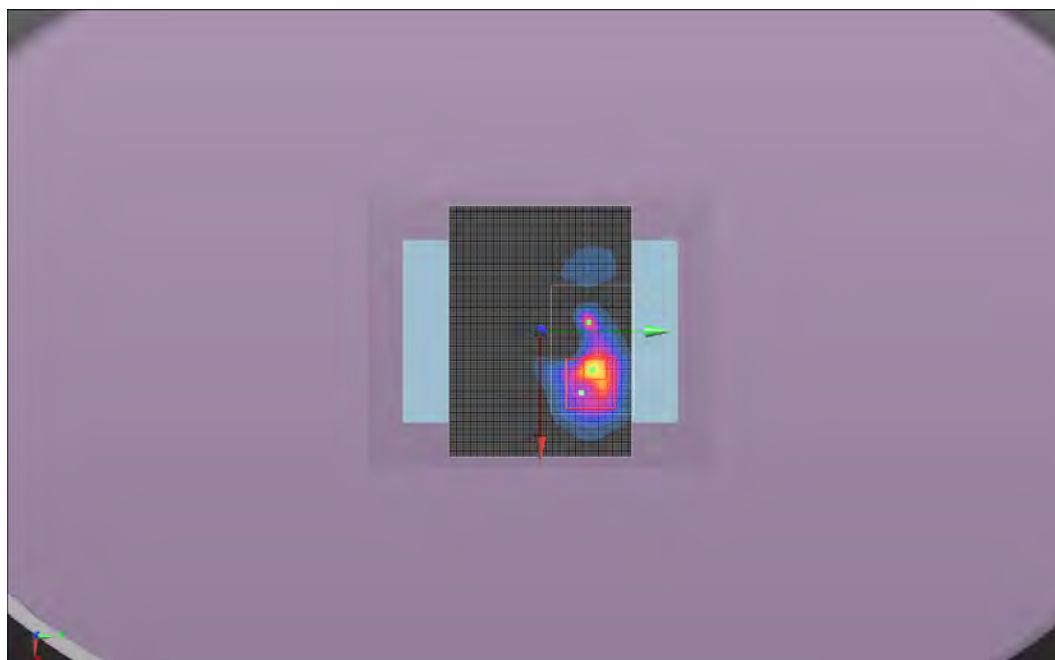
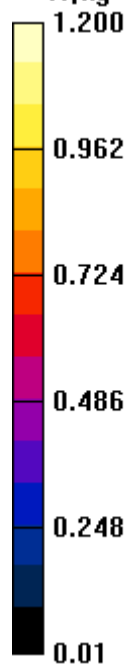
Maximum value of SAR (measured) = 0.854 W/kg

Maximum value of SAR (measured) = 0.250 W/kg




Approved By

Test 10b
W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	24.2
Date:	3/7/2013	Liquid Temperature (°C):	24
Serial Number:	0270-01-001127	Humidity (%RH):	35
Configuration:	8	Bar. Pressure (mb):	1018
Comments:	None		

Test 11

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5260 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used (interpolated): $f = 5260$ MHz; $\sigma = 5.345$ S/m; $\epsilon_r = 47.644$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASYS 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0 W/kg

Body/Body/Area scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.0153 W/kg

Body/Body/Area scan (12x9x1): Measurement grid: dx=10mm, dy=10mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

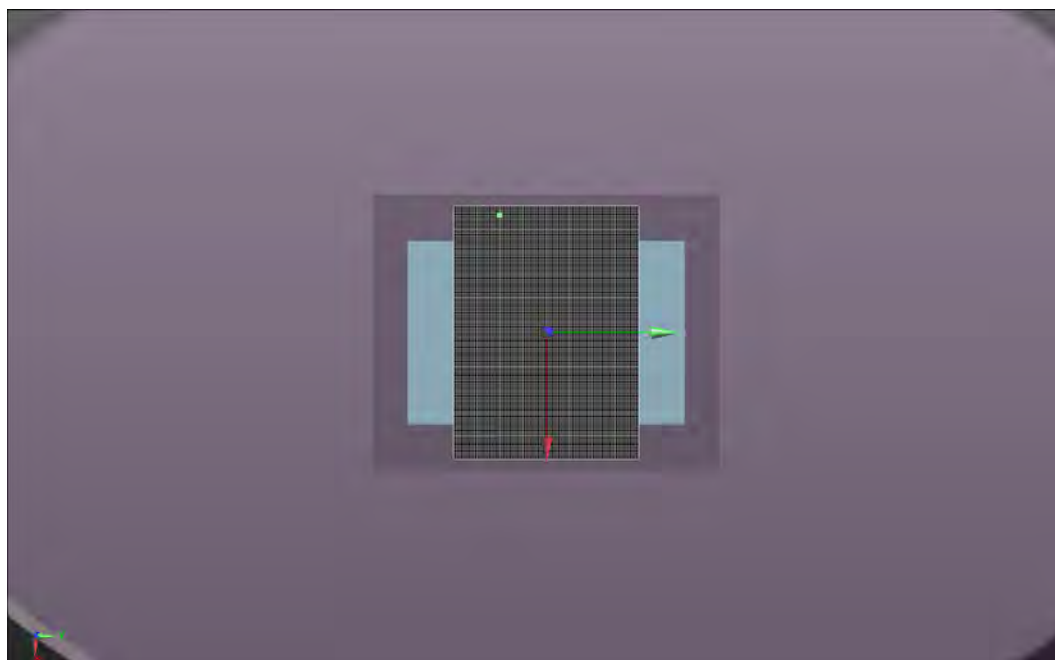
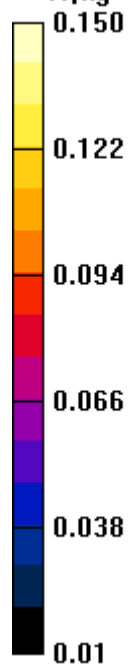
Maximum value of SAR (measured) = 0.0114 W/kg




Approved By

Test 11

W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	20.4
Date:	3/7/2013	Liquid Temperature (°C):	23
Serial Number:	0270-01-001127	Humidity (%RH):	37
Configuration:	8	Bar. Pressure (mb):	1018
Comments:	None		

Test 12

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5260 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used (interpolated): $f = 5260$ MHz; $\sigma = 5.345$ S/m; $\epsilon_r = 47.644$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.0267 W/kg

Body/Body/Area scan (81x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.0219 W/kg

Body/Body/Area scan (9x9x1): Measurement grid: dx=10mm, dy=10mm

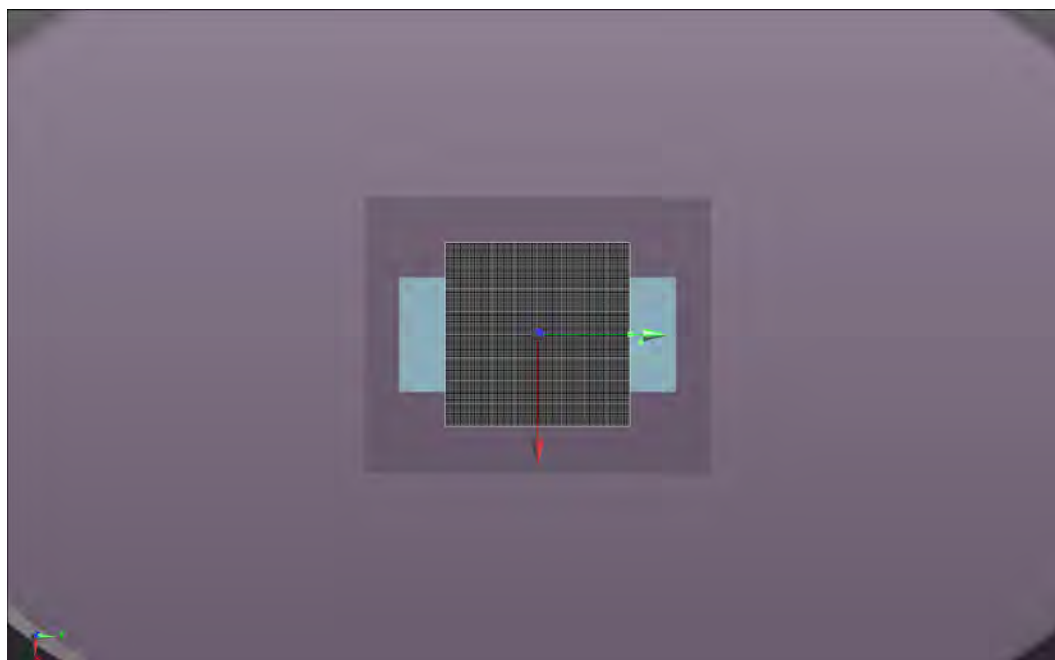
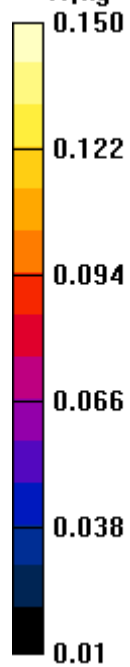
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.0219 W/kg

 
Approved By

Test 12

W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	22
Date:	3/11/2013	Liquid Temperature (°C):	21.4
Serial Number:	0270-01-001127	Humidity (%RH):	40
Configuration:	8	Bar. Pressure (mb):	1029
Comments:	None		

Test 13

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5500 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 5500$ MHz; $\sigma = 5.681$ S/m; $\epsilon_r = 47.016$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Zoom Scan (8x8x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 14.725 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 2.05 W/kg

SAR(1 g) = 0.517 W/kg; SAR(10 g) = 0.166 W/kg

Maximum value of SAR (measured) = 1.02 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of Total (measured) = 6.228 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

Maximum value of SAR (interpolated) = 0.328 W/kg

Body/Body/Area scan (91x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.08 W/kg

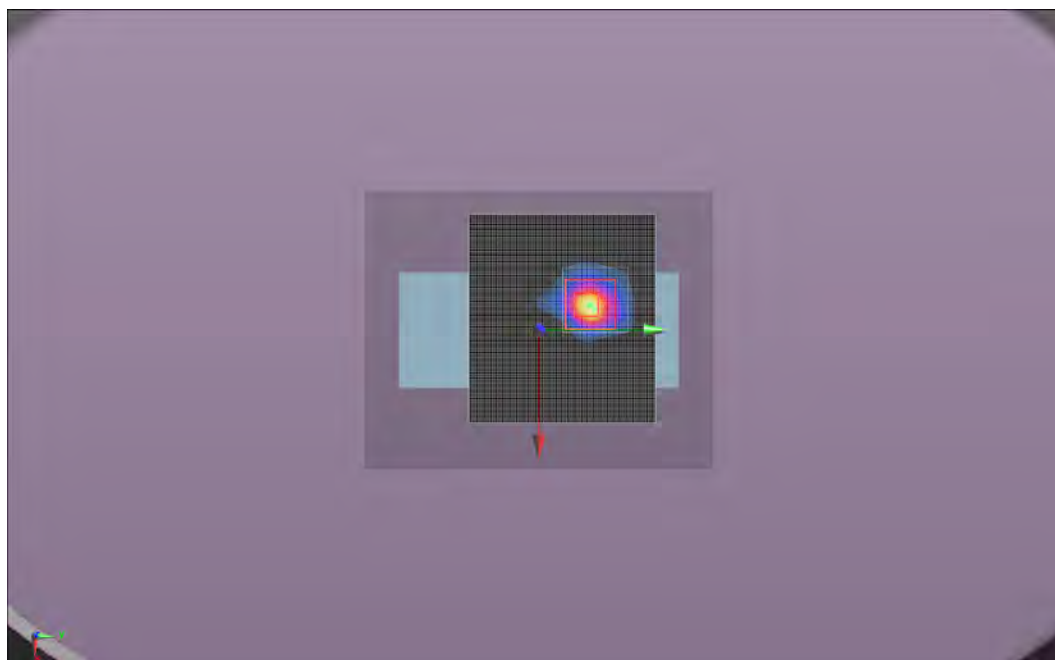
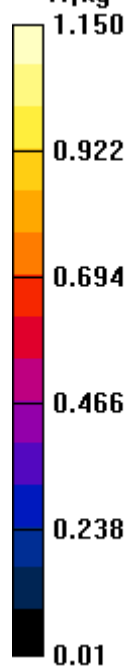
Maximum value of SAR (measured) = 0.220 W/kg




Approved By

Test 13

W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	22.4
Date:	3/11/2013	Liquid Temperature (°C):	21.4
Serial Number:	0270-01-001127	Humidity (%RH):	40
Configuration:	8	Bar. Pressure (mb):	1029
Comments:	None		

Test 13a

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5540 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used (interpolated): $f = 5540$ MHz; $\sigma = 5.748$ S/m; $\epsilon_r = 46.925$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Zoom Scan (8x8x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 15.198 V/m; Power Drift = 0.20 dB

Peak SAR (extrapolated) = 2.18 W/kg

SAR(1 g) = 0.544 W/kg; SAR(10 g) = 0.161 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.09 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 6.400 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.226 W/kg

Body/Body/Area scan (91x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

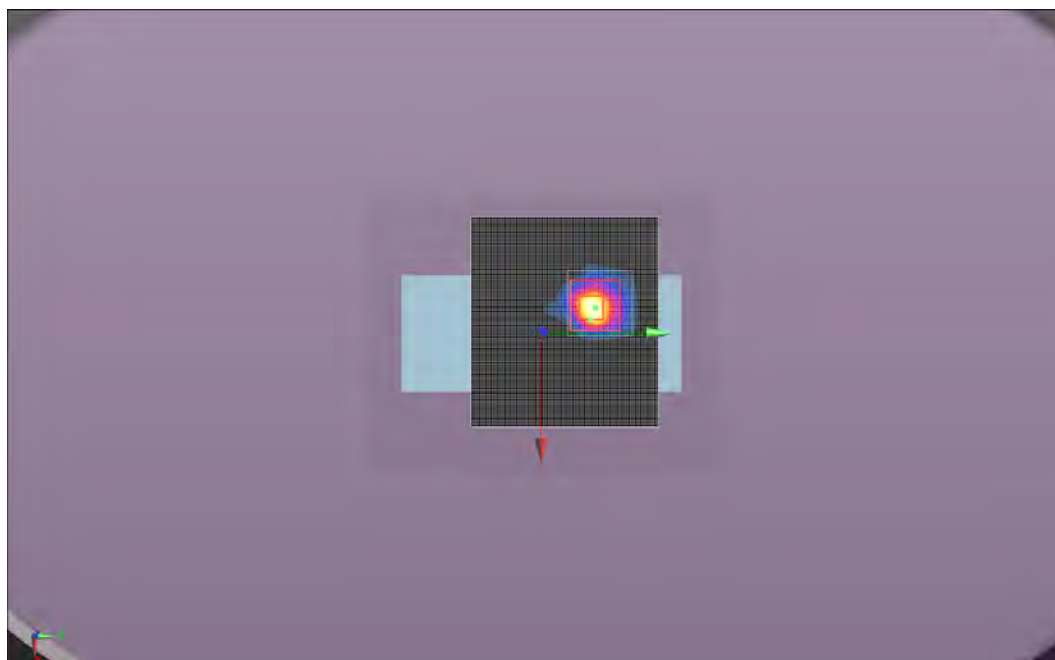
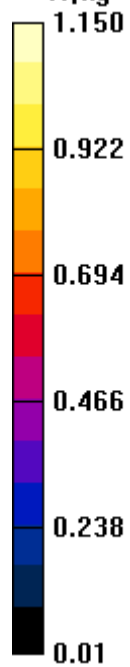
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 1.25 W/kg

Maximum value of SAR (measured) = 0.235 W/kg

 
Approved By

Test 13a
W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	22.6
Date:	3/11/2013	Liquid Temperature (°C):	21.5
Serial Number:	0270-01-001127	Humidity (%RH):	41
Configuration:	8	Bar. Pressure (mb):	1029
Comments:	None		

Test 13b

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5660 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used (interpolated): $f = 5660$ MHz; $\sigma = 5.937$ S/m; $\epsilon_r = 46.661$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Zoom Scan (9x9x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 13.593 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 2.81 W/kg

SAR(1 g) = 0.419 W/kg; SAR(10 g) = 0.119 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.875 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 5.453 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.280 W/kg

Body/Body/Area scan (91x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

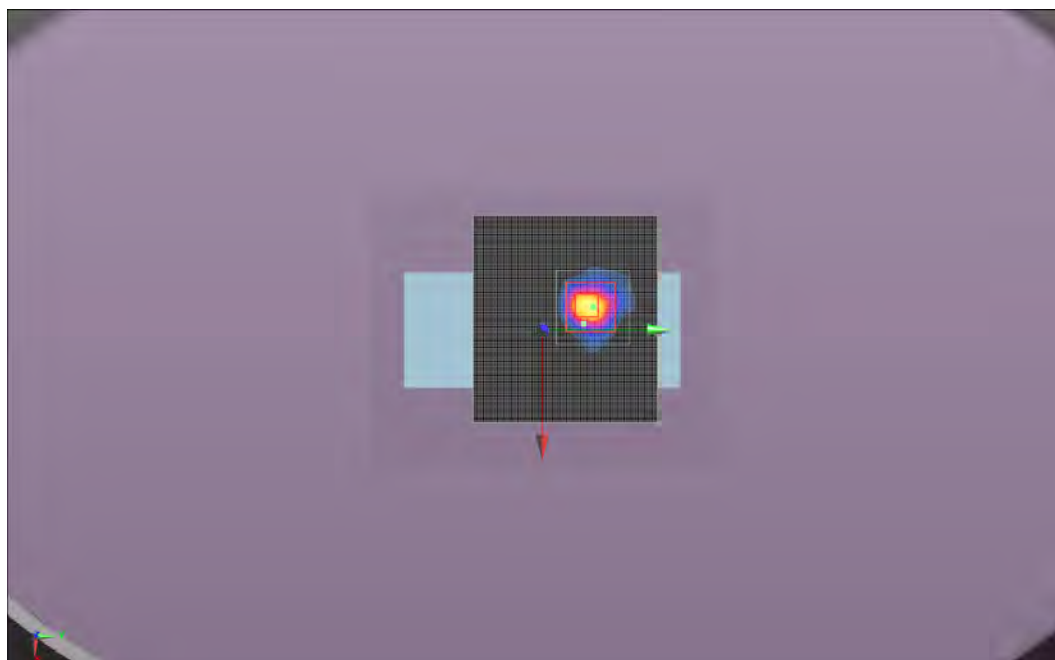
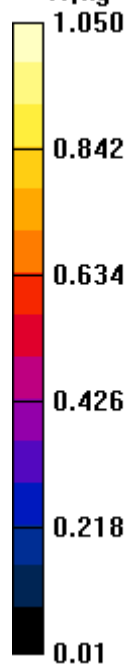
Maximum value of SAR (interpolated) = 0.946 W/kg

Maximum value of SAR (measured) = 0.177 W/kg




Approved By

Test 13b
W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	22.9
Date:	3/11/2013	Liquid Temperature (°C):	21.6
Serial Number:	0270-01-001127	Humidity (%RH):	41
Configuration:	8	Bar. Pressure (mb):	1029
Comments:	None		

Test 13c

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5700 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 5700$ MHz; $\sigma = 6.008$ S/m; $\epsilon_r = 46.598$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Zoom Scan (9x9x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 12.092 V/m; Power Drift = 0.28 dB

Peak SAR (extrapolated) = 1.23 W/kg

SAR(1 g) = 0.334 W/kg; SAR(10 g) = 0.093 W/kg

Maximum value of SAR (measured) = 0.731 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of Total (measured) = 4.868 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

Maximum value of SAR (interpolated) = 0.141 W/kg

Body/Body/Area scan (91x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

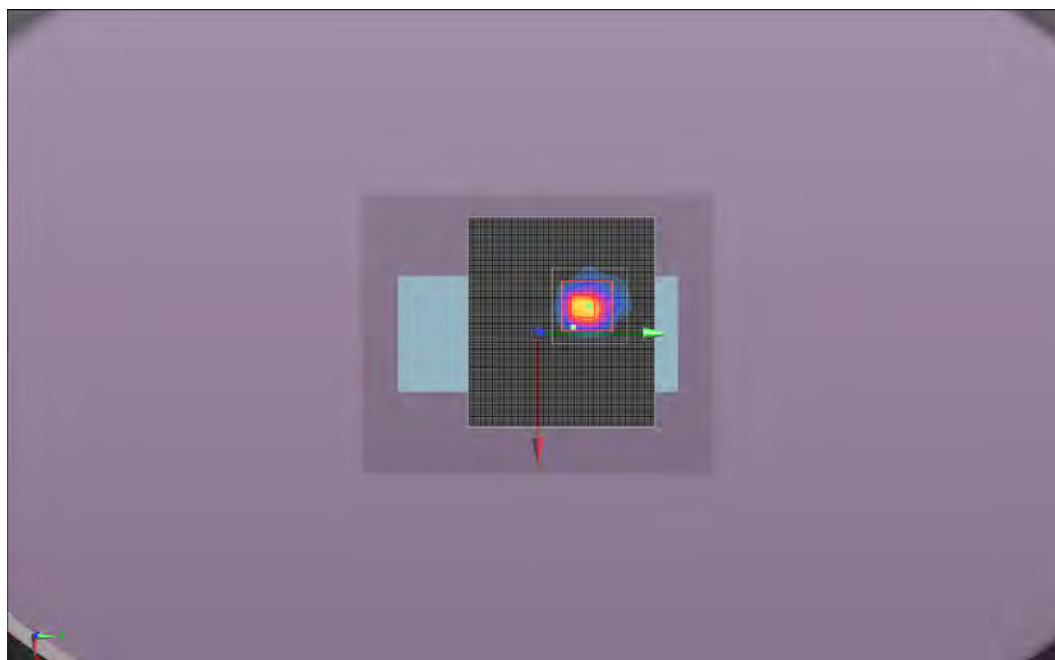
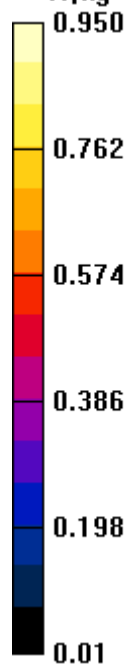
Maximum value of SAR (interpolated) = 0.774 W/kg

Maximum value of SAR (measured) = 0.142 W/kg




Approved By

Test 13c
W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	21.4
Date:	3/11/2013	Liquid Temperature (°C):	21.2
Serial Number:	0270-01-001127	Humidity (%RH):	39
Configuration:	8	Bar. Pressure (mb):	1029
Comments:	None		

Test 14

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5500 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 5500$ MHz; $\sigma = 5.681$ S/m; $\epsilon_r = 47.016$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Zoom Scan (9x9x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 12.991 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 1.33 W/kg

SAR(1 g) = 0.395 W/kg; SAR(10 g) = 0.150 W/kg

Maximum value of SAR (measured) = 0.823 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of Total (measured) = 5.691 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

Maximum value of SAR (interpolated) = 0.712 W/kg

Body/Body/Area scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

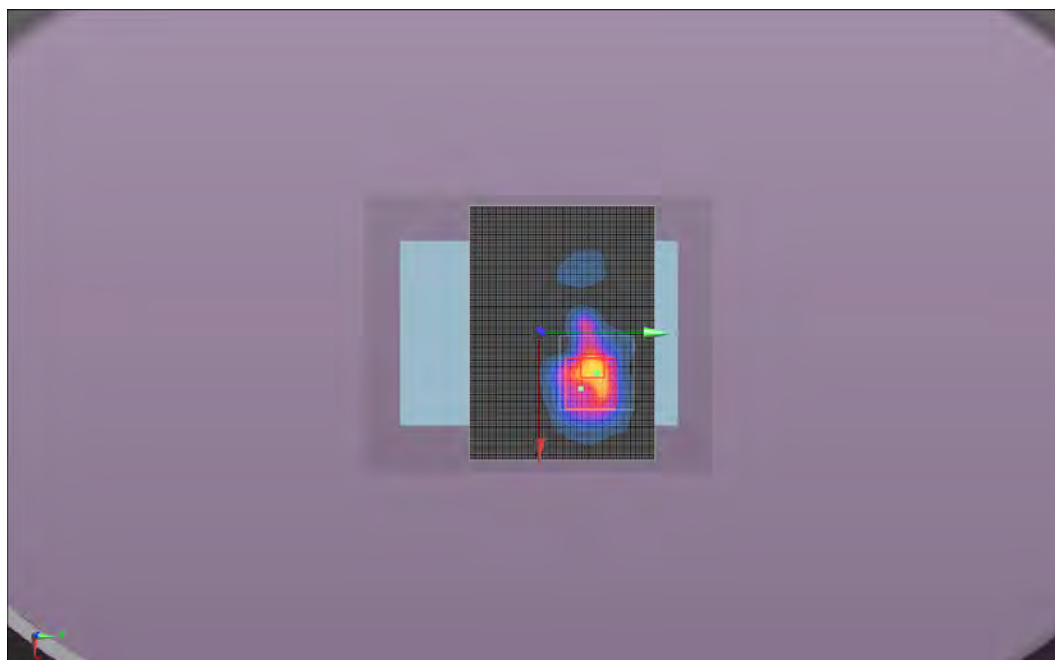
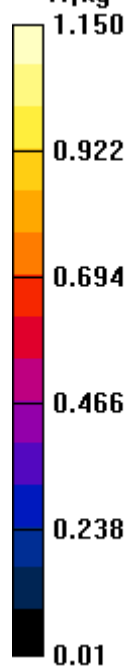
Maximum value of SAR (interpolated) = 0.922 W/kg

Maximum value of SAR (measured) = 0.184 W/kg

 
Approved By

Test 14

W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	22.7
Date:	3/11/2013	Liquid Temperature (°C):	21.9
Serial Number:	0270-01-001127	Humidity (%RH):	40
Configuration:	8	Bar. Pressure (mb):	1029
Comments:	None		

Test 14a

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5540 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used (interpolated): $f = 5540$ MHz; $\sigma = 5.748$ S/m; $\epsilon_r = 46.925$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASYS2 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Zoom Scan (9x9x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 12.676 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 1.63 W/kg

SAR(1 g) = 0.426 W/kg; SAR(10 g) = 0.169 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.847 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 5.776 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.566 W/kg

Body/Body/Area scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.999 W/kg

Body/Body/Zoom Scan 2 (14x9x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 12.676 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 1.37 W/kg

SAR(1 g) = 0.398 W/kg; SAR(10 g) = 0.144 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

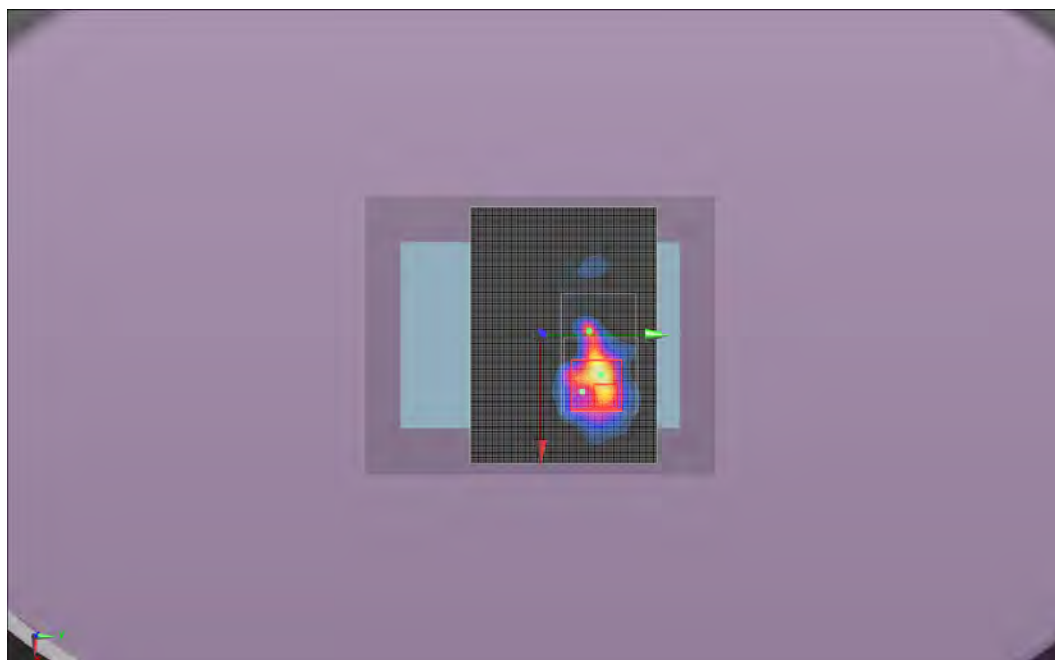
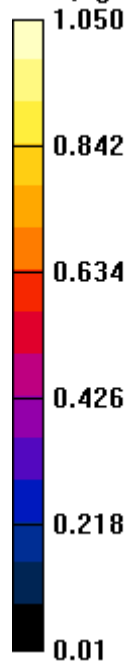
Maximum value of SAR (measured) = 0.880 W/kg

Maximum value of SAR (measured) = 0.192 W/kg




Approved By

Test 14a
W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	21.1
Date:	3/12/2013	Liquid Temperature (°C):	21.2
Serial Number:	0270-01-001127	Humidity (%RH):	44
Configuration:	8	Bar. Pressure (mb):	1023
Comments:	None		

Test 14b

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5660 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used (interpolated): $f = 5660$ MHz; $\sigma = 5.937$ S/m; $\epsilon_r = 46.661$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASYS 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Zoom Scan (9x9x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 12.806 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 1.71 W/kg

SAR(1 g) = 0.443 W/kg; SAR(10 g) = 0.157 W/kg

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.872 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 5.500 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.852 W/kg

Body/Body/Area scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 1.03 W/kg

Body/Body/Zoom Scan 2 (14x9x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 12.806 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 1.38 W/kg

SAR(1 g) = 0.385 W/kg; SAR(10 g) = 0.143 W/kg

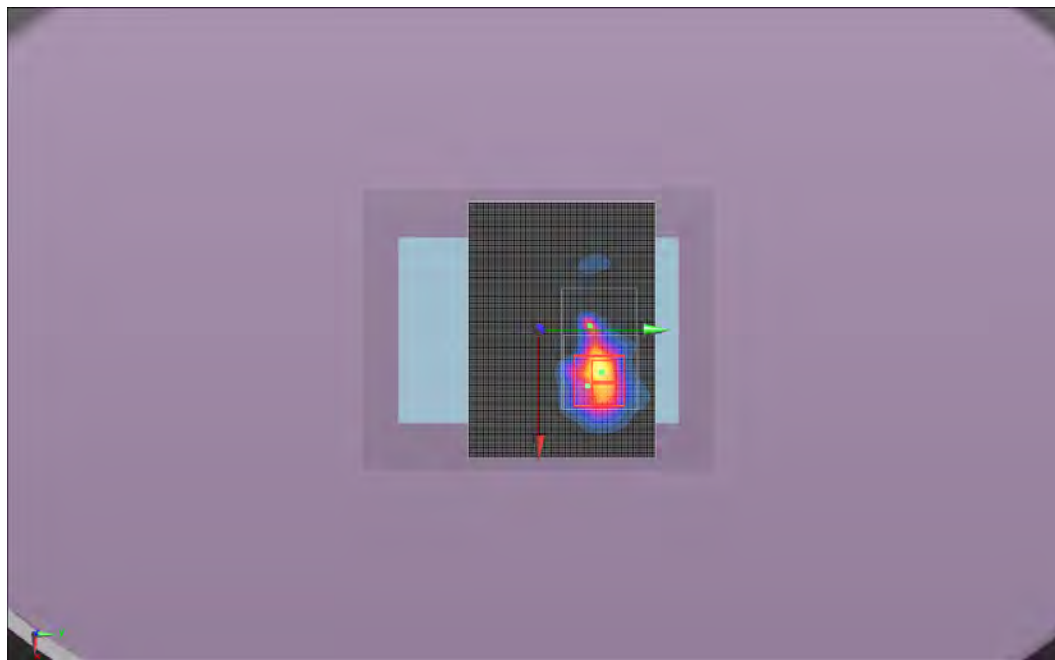
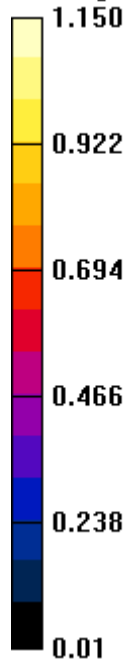
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.785 W/kg

Maximum value of SAR (measured) = 0.180 W/kg

 
Approved By

Test 14b
W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	22.2
Date:	3/12/2013	Liquid Temperature (°C):	21.8
Serial Number:	0270-01-001127	Humidity (%RH):	43
Configuration:	8	Bar. Pressure (mb):	1023
Comments:	None		

Test 14c

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5700 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 5700$ MHz; $\sigma = 6.008$ S/m; $\epsilon_r = 46.598$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Zoom Scan (10x9x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 10.325 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 1.03 W/kg

SAR(1 g) = 0.292 W/kg; SAR(10 g) = 0.101 W/kg

Maximum value of SAR (measured) = 0.627 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of Total (measured) = 4.753 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

Maximum value of SAR (interpolated) = 0.595 W/kg

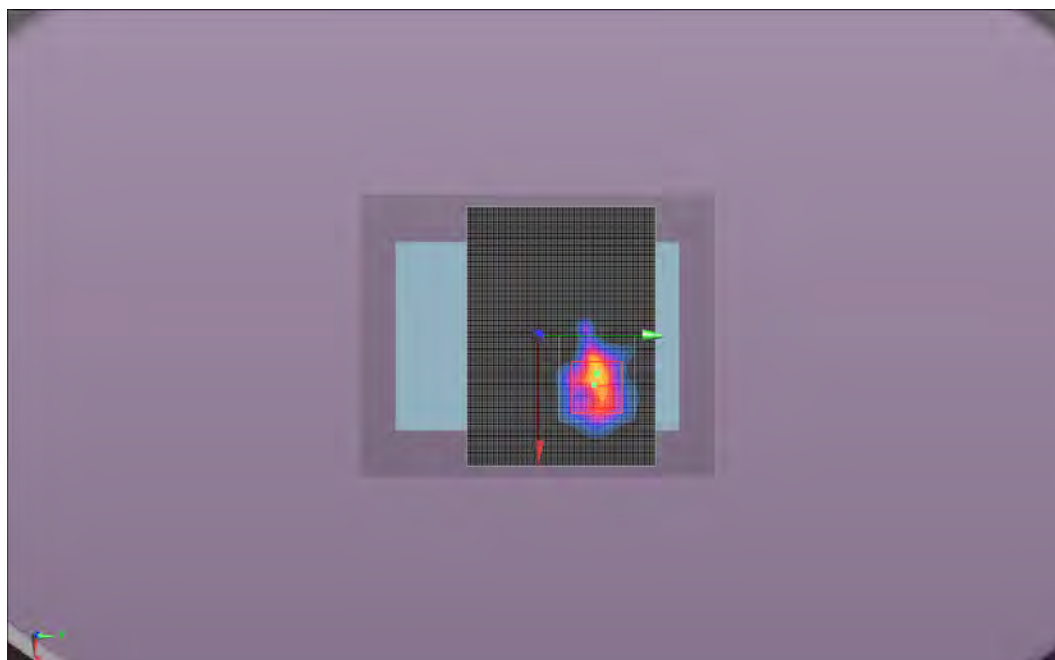
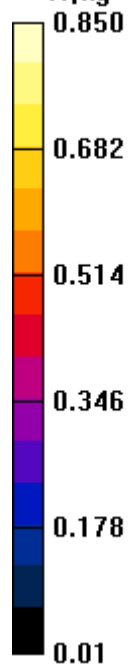
Body/Body/Area scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.658 W/kg

Maximum value of SAR (measured) = 0.136 W/kg

 
Approved By

Test 14c
W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	22.4
Date:	3/11/2013	Liquid Temperature (°C):	21.4
Serial Number:	0270-01-001127	Humidity (%RH):	39
Configuration:	8	Bar. Pressure (mb):	1029
Comments:	None		

Test 15

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5500 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 5500$ MHz; $\sigma = 5.681$ S/m; $\epsilon_r = 47.016$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

Maximum value of SAR (interpolated) = 0.0137 W/kg

Body/Body/Area scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0 W/kg

Body/Body/Area scan (12x9x1): Measurement grid: dx=10mm, dy=10mm

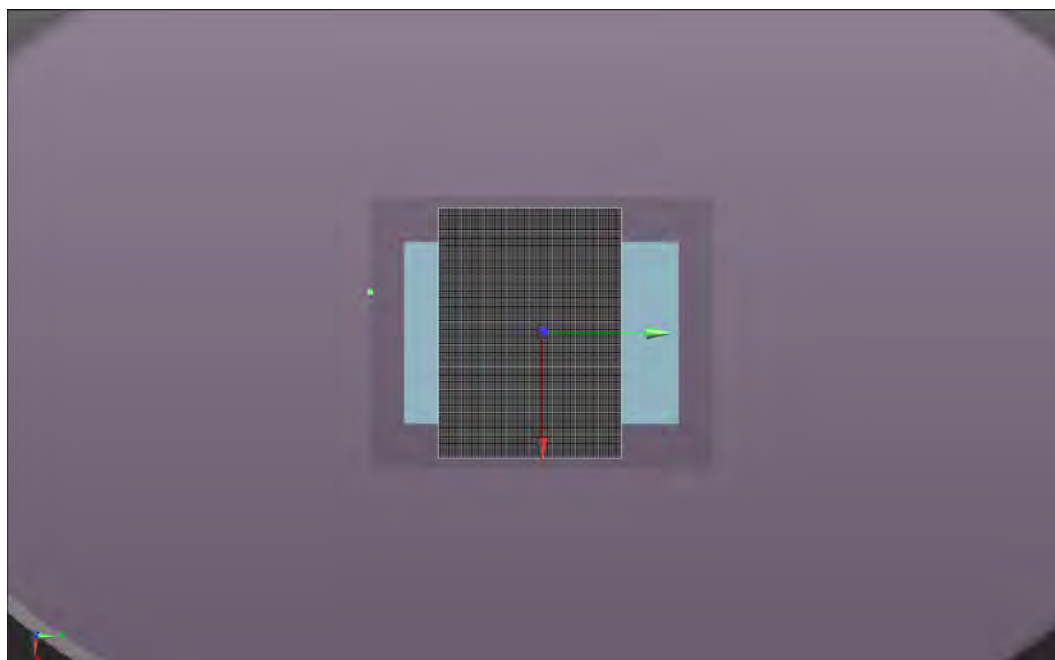
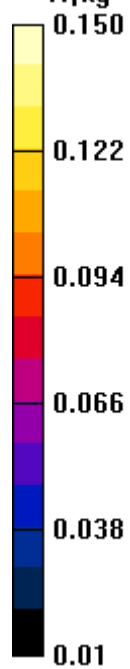
Maximum value of SAR (measured) = 0.00351 W/kg




Approved By

Test 15

W/kg



Tested By:	Ethan Schoonover	Room Temperature (°C):	22.2
Date:	3/11/2013	Liquid Temperature (°C):	21.3
Serial Number:	0270-01-001127	Humidity (%RH):	39
Configuration:	8	Bar. Pressure (mb):	1029
Comments:	None		

Test 16

DUT: Wireless Device; Type: TBD; Serial: 0270-01-001127

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5500 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 5500$ MHz; $\sigma = 5.681$ S/m; $\epsilon_r = 47.016$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Body/Body/Reference scan (41x51x1): Interpolated grid: dx=3.000 mm, dy=3.000 mm

Maximum value of SAR (interpolated) = 0 W/kg

Body/Body/Area scan (91x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.00355 W/kg

Body/Body/Area scan (10x9x1): Measurement grid: dx=10mm, dy=10mm

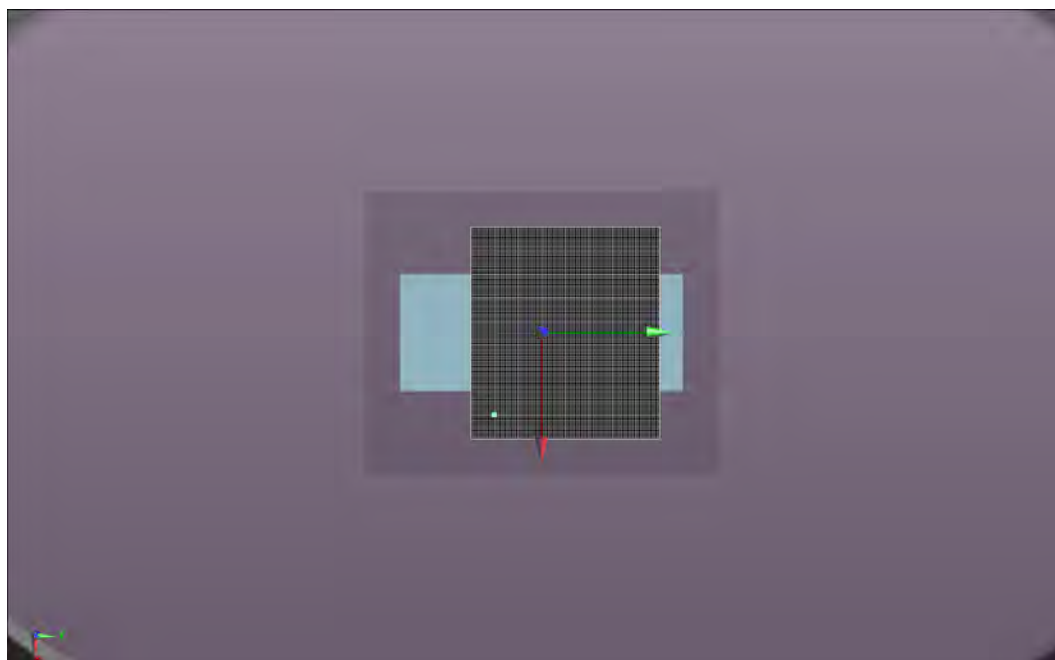
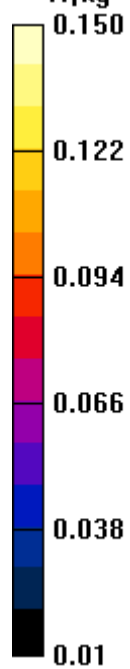
Maximum value of SAR (measured) = 0.00780 W/kg



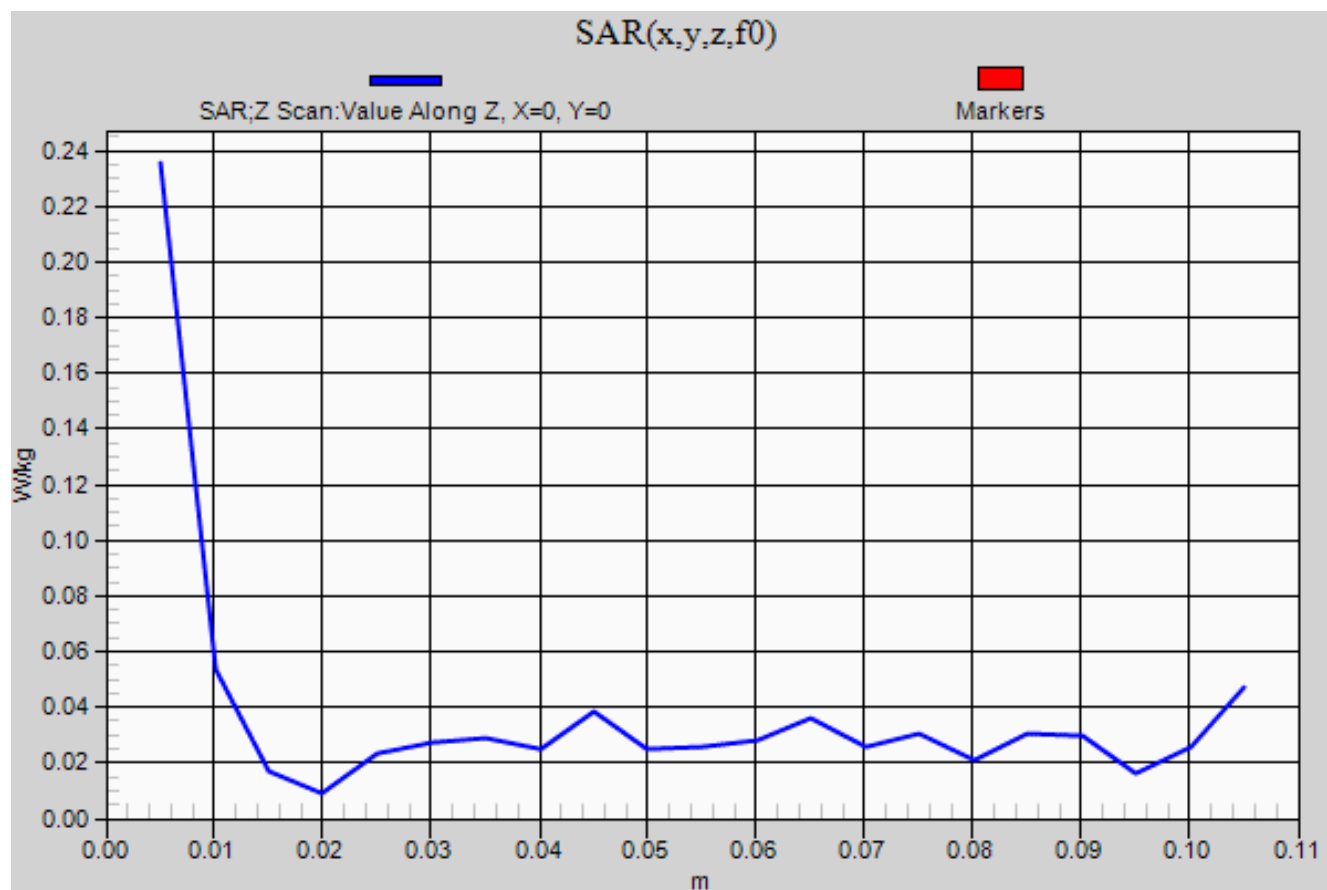

Approved By

Test 16

W/kg



Test 13a

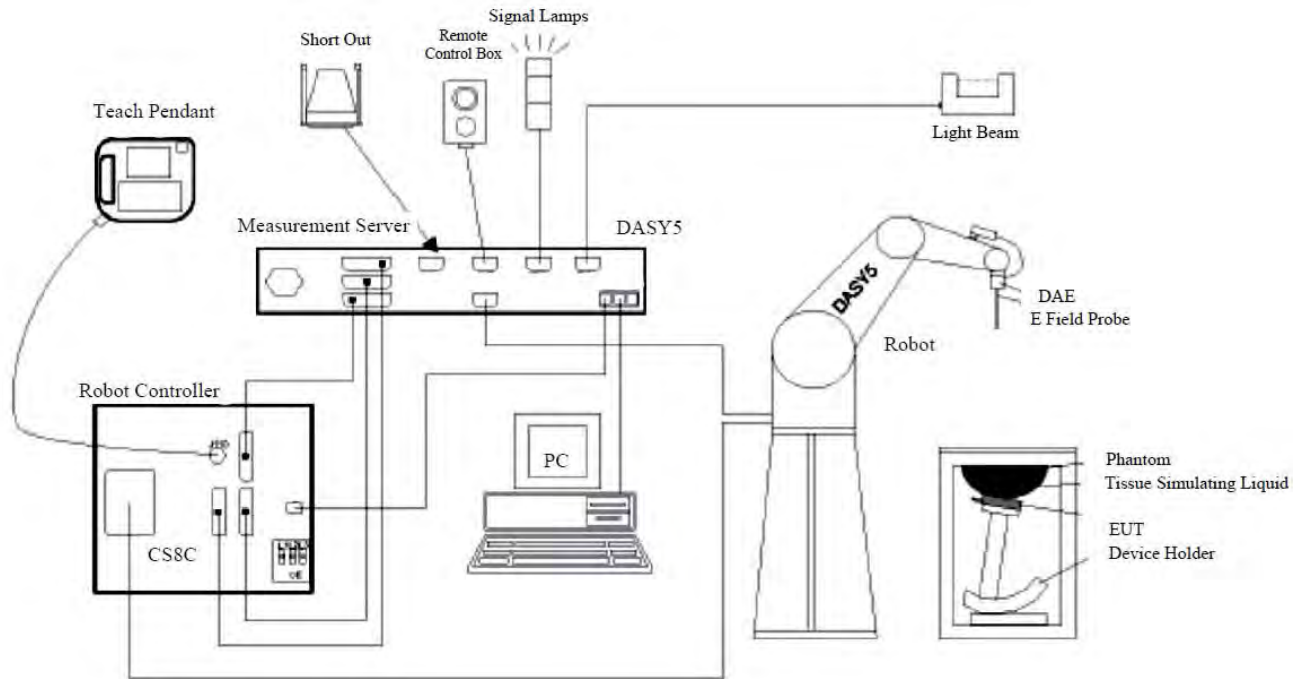


SAR MEASUREMENT SYSTEM

Schmid & Partner Engineering AG, DASY52

Northwest EMC selected the leader in SAR evaluation systems to provide the measurement tools for this evaluation. SPEAG's DASY52 is the fastest and most accurate scanner on the market. It is fully compatible with all world-wide standards for transmitters operating at the ear or within 20cm of the body. It provides full compatibility with IEC 62209-1, IEC 62209-2, IEEE 1528 as well as national adaptations such as FCC OET-65c and Korean Std. MIC #2000-93

The DASY52 system for performing compliance tests consists of the following items:



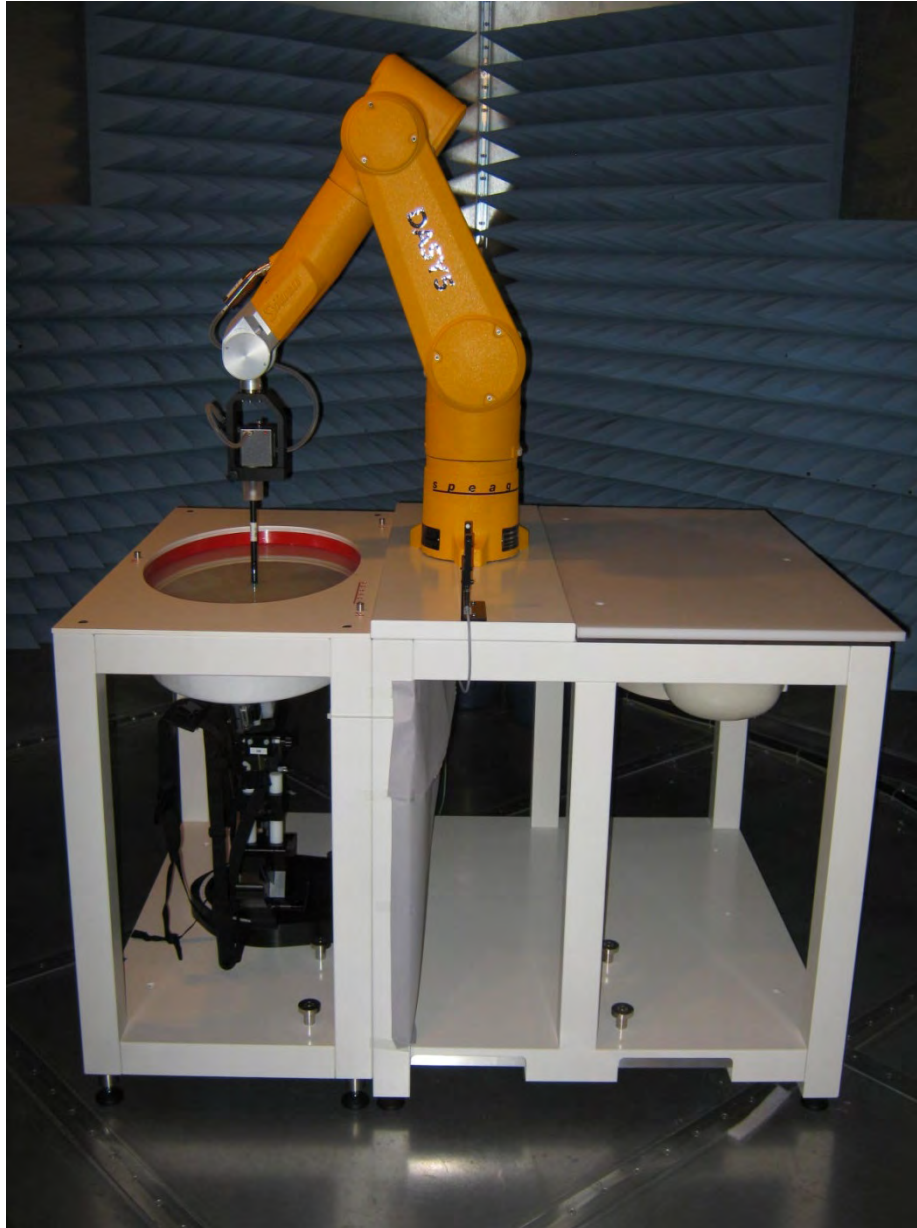
- A standard high precision 6-axis robot (Staubli TX=RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom, oval flat phantom, device holder, tissue simulating liquids, and validation dipole kits.

TEST SITE

Northwest EMC, Lab EV08

The SAR measurement system is located in a semi-anechoic chamber. This provides an ambient free environment that also eliminates reflections.

The chamber is 12 ft wide by 16 ft long x 8 ft high. A dedicated HVAC unit provides +/- 1 degree C temperature control.



TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Antenna, Dipole 2450MHz SAR	SPEAG	D2450V2	ADL	12/10/2012	12 mo
Humidity Temperature Meter	Omegaette	HH311	DTY	03/29/2011	24 mo
Dielectric Probe Kit	Agilent	85070E	IPP	09/08/2010	36 mo
Network Analyzer	Hewlett Packard	N5230A	NAD	06/19/2012	12 mo
Robot Arm	Staeubli	TX60LSPEAG	SAA	NCR	0 mo
Phantom, 2mm Oval ELI4 (Body)	SPEAG	QD OVA 001 BB	SAC	NCR	0 mo
Light Beam Unit	SPEAG	SE UKS 030 AA	SAD	NCR	0 mo
SAR Probe	SPEAG	EX3DV4	SAG	11/14/2012	12 mo
DAE	SPEAG	SD 000 D04 EJ	SAH	11/02/2012	12 mo
Robot Controller	Staeubli	CS8C	SAI	NCR	0 mo
Robot Chasis and power Supply	Staeubli	N/A	SAJ	NCR	0 mo
DASY5 Measurement Server	Staeubli	DAYS5	SAK	NCR	0 mo
Body Solution	SPEAG	MSL 2450	SAM	Within 24 hours of a measurement	
Device Holder	SPEAG	N/A	SAW	NCR	0 mo
Power Sensor	Agilent	E9300H	SQO	06/06/2011	24 mo
Power Meter	Agilent	N1913A	SQR	06/06/2011	24 mo
MXG Analog Signal Generator	Agilent	N5181A	TIG	NCR	0 mo
Amplifier	Mini Circuits	ZVE-3W-83+	TTA	NCR	0 mo
Antenna, Dipole 5.1-5.8GHz SAR	SPEAG	D5GHzV2	ADM	02/07/2013	12 mo
Body Solution	SPEAG	MSL 501	SAV	Within 24 hours of a measurement	

MEASUREMENT UNCERTAINTY BUDGETS PER IEEE 1528:2003

300-3000 MHz Range

Uncertainty Component	Tolerance (+/- %)	Probability Distribution	Divisor	c_i (1g)	c_i (10g)	u_i (1g) (+/-%)	u_i (10g) (+/-%)	v_i
Measurement System								
Probe calibration (k=1)	5.5	normal	1	1	1	5.5	5.5	∞
Axial isotropy	4.7	rectangular	1.732	0.707	0.707	1.9	1.9	∞
Hemispherical isotropy	9.6	rectangular	1.732	0.707	0.707	3.9	3.9	∞
Boundary effect	1.0	rectangular	1.732	1	1	0.6	0.6	∞
Linearity	4.7	rectangular	1.732	1	1	2.7	2.7	∞
System detection limits	1.0	rectangular	1.732	1	1	0.6	0.6	∞
Readout electronics	0.3	normal	1	1	1	0.3	0.3	∞
Response time	0.8	rectangular	1.732	1	1	0.5	0.5	∞
Integration time	2.6	rectangular	1.732	1	1	1.5	1.5	∞
RF ambient conditions - noise	1.7	rectangular	1.732	1	1	1.0	1.0	∞
RF Ambient Reflections	0.0	rectangular	1.732	1	1	0.0	0.0	∞
Probe positioner mechanical tolerance	0.4	rectangular	1.732	1	1	0.2	0.2	∞
Probe positioner with respect to phantom shell	2.9	rectangular	1.732	1	1	1.7	1.7	∞
Extrapolation, interpolation, and integration algorithms for max. SAR evaluation	1.0	rectangular	1.732	1	1	0.6	0.6	∞
Test Sample Related								
Device Positioning	2.9	normal	1	1	1	2.9	2.9	145
Device Holder	3.6	normal	1	1	1	3.6	3.6	5
Power Drift	5.0	rectangular	1.732	1	1	2.9	2.9	∞
Phantom and tissue parameters								
Phantom Uncertainty - shell thickness tolerances	4.0	rectangular	1.732	1	1	2.3	2.3	∞
Liquid conductivity - deviation from target values	5.0	rectangular	1.732	0.64	0.43	1.8	1.2	∞
Liquid conductivity - measurement uncertainty	6.5	normal	1	0.64	0.43	4.2	2.8	∞
Liquid permittivity - deviation from target values	5.0	rectangular	1.732	0.6	0.49	1.7	1.4	∞
Liquid permittivity - measurement uncertainty	3.2	normal	1	0.6	0.49	1.9	1.6	∞
Combined Standard Uncertainty	RSS					11.2	10.6	387
Expanded Measurement Uncertainty (95% Confidence/	normal (k=2)					22.5	21.2	

MEASUREMENT UNCERTAINTY BUDGETS PER IEEE 1528:2003

3000-6000 MHz Range

Uncertainty Component	Tolerance (+/- %)	Probability Distribution	Divisor	c_i (1g)	c_i (10g)	u_i (1g) (+/-%)	u_i (10g) (+/-%)	v_i
Measurement System								
Probe calibration (k=1)	6.55	normal	1	1	1	6.6	6.6	∞
Axial isotropy	4.7	rectangular	1.732	0.707	0.707	1.9	1.9	∞
Hemispherical isotropy	9.6	rectangular	1.732	0.707	0.707	3.9	3.9	∞
Boundary effect	2.0	rectangular	1.732	1	1	1.2	1.2	∞
Linearity	4.7	rectangular	1.732	1	1	2.7	2.7	∞
System detection limits	1.0	rectangular	1.732	1	1	0.6	0.6	∞
Readout electronics	0.3	normal	1	1	1	0.3	0.3	∞
Response time	0.8	rectangular	1.732	1	1	0.5	0.5	∞
Integration time	2.6	rectangular	1.732	1	1	1.5	1.5	∞
RF ambient conditions - noise	1.7	rectangular	1.732	1	1	1.0	1.0	∞
RF Ambient Reflections	0.0	rectangular	1.732	1	1	0.0	0.0	∞
Probe positioner mechanical tolerance	0.8	rectangular	1.732	1	1	0.5	0.5	∞
Probe positioner with respect to phantom shell	9.9	rectangular	1.732	1	1	5.7	5.7	∞
Extrapolation, interpolation, and integration algorithms for max. SAR evaluation	4.0	rectangular	1.732	1	1	2.3	2.3	∞
Test Sample Related								
Device Positioning	2.9	normal	1	1	1	2.9	2.9	145
Device Holder	3.6	normal	1	1	1	3.6	3.6	5
Power Drift	5.0	rectangular	1.732	1	1	2.9	2.9	∞
Phantom and tissue parameters								
Phantom Uncertainty - shell thickness tolerances	4.0	rectangular	1.732	1	1	2.3	2.3	∞
Liquid conductivity - deviation from target values	5.0	rectangular	1.732	0.64	0.43	1.8	1.2	∞
Liquid conductivity - measurement uncertainty	6.5	normal	1	0.64	0.43	4.2	2.8	∞
Liquid permittivity - deviation from target values	5.0	rectangular	1.732	0.6	0.49	1.7	1.4	∞
Liquid permittivity - measurement uncertainty	3.2	normal	1	0.6	0.49	1.9	1.6	∞
Combined Standard Uncertainty	RSS					13.2	12.7	330
Expanded Measurement Uncertainty (95% Confidence/	normal (k=2)					26.5	25.4	



WTD 12.5.23

PROBE CALIBRATION

Probe Calibration

Please see attached calibration data.

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
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 Northwest EMC

Certificate No: EX3-3746_Nov12

CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3746

Calibration procedure(s) QA CAL-01.v8, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: November 14, 2012

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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: November 14, 2012

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



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

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,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:

- 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
- 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:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E^2 -field uncertainty inside TSL (see below **ConvF**).
- NORM(f)_{x,y,z} = NORM_{x,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**.
- DCP_{x,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.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,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 $f \leq 800$ 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 NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe EX3DV4

SN:3746

Manufactured: March 26, 2010
Calibrated: November 14, 2012

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3746

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.49	0.47	0.50	± 10.1 %
DCP (mV) ^B	106.9	94.9	95.5	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc ^E (k=2)
0	CW	0.00	X	0.0	0.0	1.0	159.2	±3.0 %
			Y	0.0	0.0	1.0	155.6	
			Z	0.0	0.0	1.0	159.2	
10061	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	3.60	X	17.25	98.2	29.4	112.3	±3.5 %
			Y	3.25	68.3	18.0	146.5	
			Z	3.72	68.7	17.9	111.5	
10069	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	10.57	X	12.24	71.2	23.8	124.4	±4.4 %
			Y	10.68	68.7	22.7	105.1	
			Z	12.12	70.7	23.6	122.9	
10077	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	11.00	X	11.29	70.7	24.0	106.9	±4.1 %
			Y	10.72	71.0	24.7	131.8	
			Z	11.13	70.1	23.6	105.2	

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 E²-field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3746

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
2450	39.2	1.80	6.70	6.70	6.70	0.44	0.77	± 12.0 %
5200	36.0	4.66	4.95	4.95	4.95	0.37	1.80	± 13.1 %
5300	35.9	4.76	4.65	4.65	4.65	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.60	4.60	4.60	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.43	4.43	4.43	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.37	4.37	4.37	0.39	1.80	± 13.1 %

^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3746

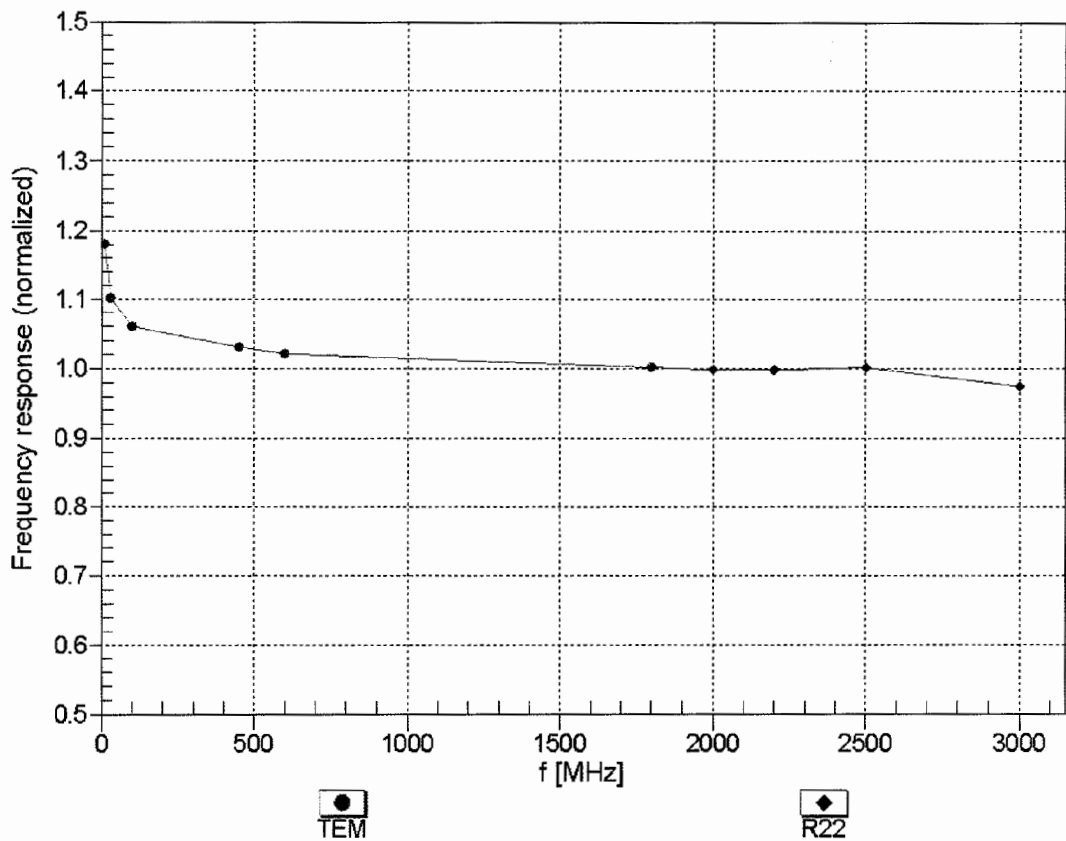
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
2450	52.7	1.95	6.88	6.88	6.88	0.80	0.58	± 12.0 %
5200	49.0	5.30	4.39	4.39	4.39	0.41	1.90	± 13.1 %
5300	48.9	5.42	4.03	4.03	4.03	0.47	1.90	± 13.1 %
5500	48.6	5.65	3.91	3.91	3.91	0.45	1.90	± 13.1 %
5600	48.5	5.77	3.78	3.78	3.78	0.42	1.90	± 13.1 %
5800	48.2	6.00	4.15	4.15	4.15	0.45	1.90	± 13.1 %

^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

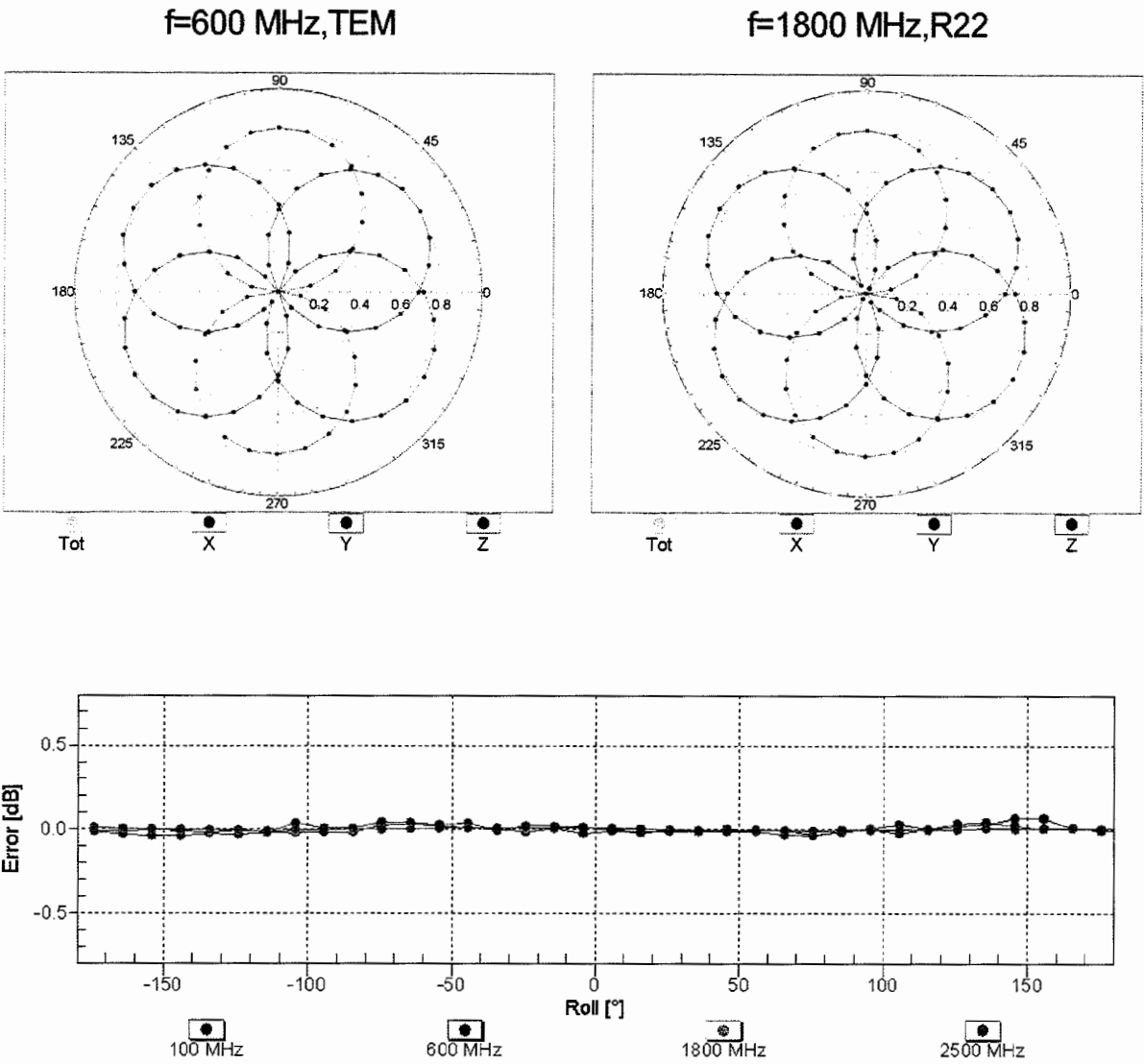
^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



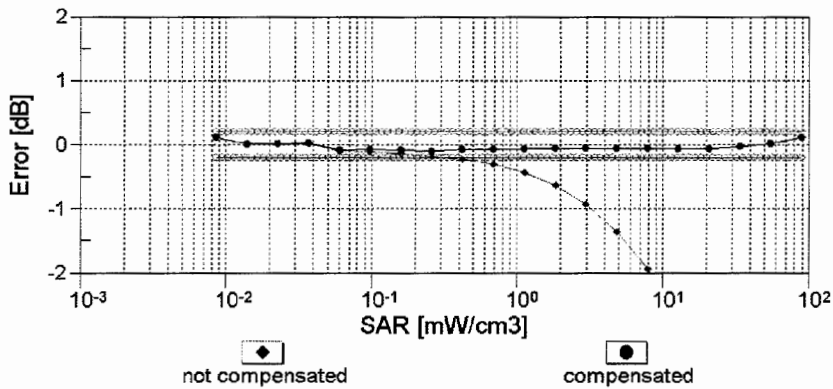
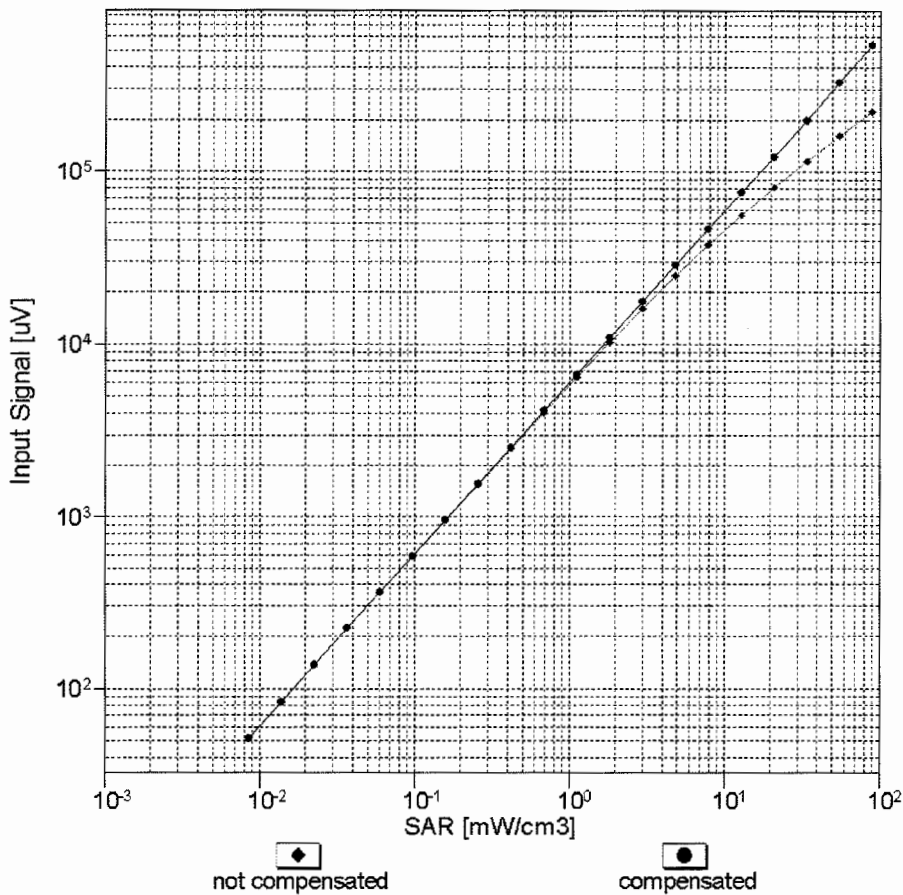
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

Receiving Pattern (ϕ), $\vartheta = 0^\circ$



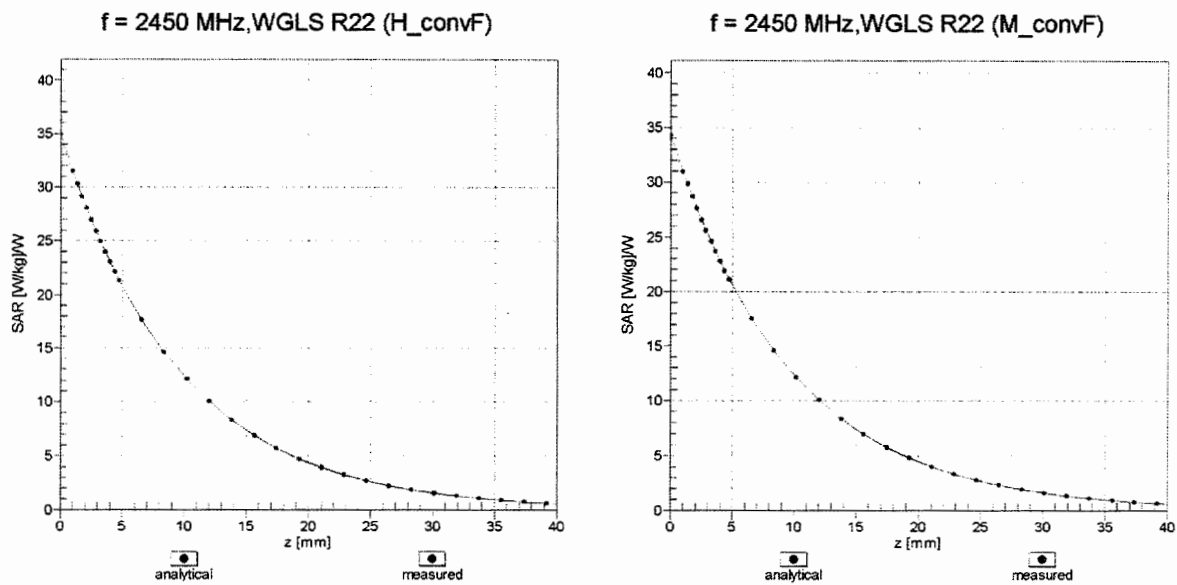
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)

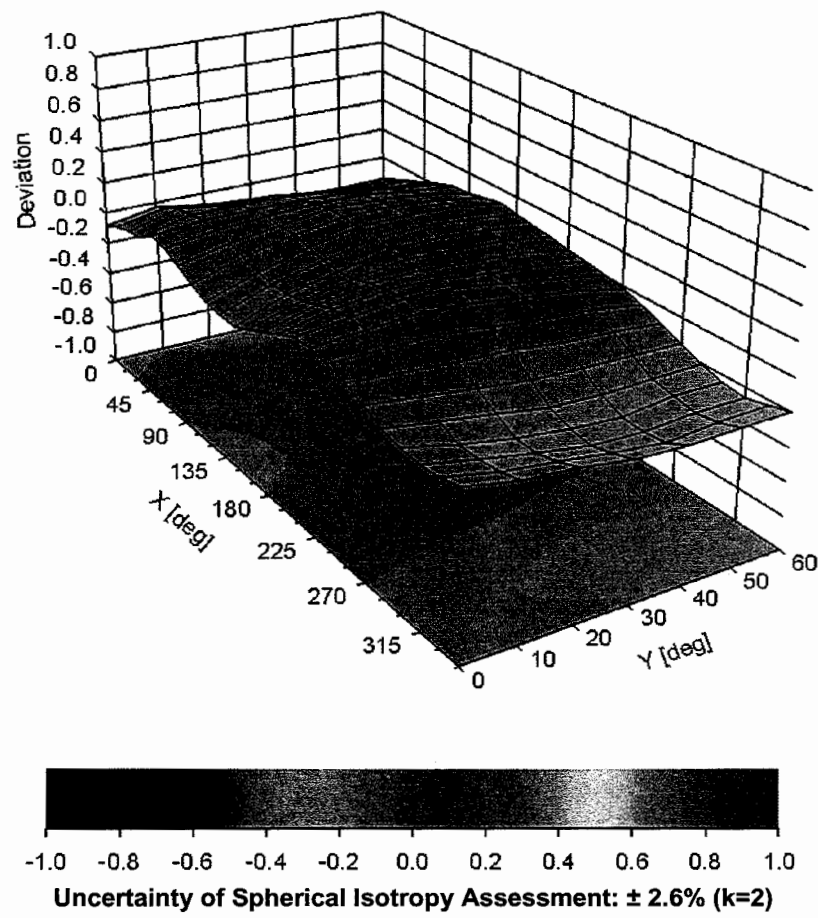


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (ϕ, θ), f = 900 MHz



DASY/EASY - Parameters of Probe: EX3DV4 - SN:3746

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	45.8
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

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
Swiss Calibration Service

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

Accreditation No.: SCS 108

Client Northwest EMC

Certificate No: ES3-3246_Nov12

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3246

Calibration procedure(s) QA CAL-01.v8, QA CAL-12.v7, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: November 13, 2012

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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: November 14, 2012

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,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:

- 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
- 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:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E^2 -field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,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.
- DCP_{x,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.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,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 $f \leq 800$ 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 NORM_{x,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 ES3DV3

SN:3246

Manufactured: May 5, 2009
Calibrated: November 13, 2012

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3246

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	1.40	1.23	1.17	± 10.1 %
DCP (mV) ^B	101.4	101.5	104.1	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc ^E (k=2)
0	CW	0.00	X	0.0	0.0	1.0	166.7	±3.0 %
			Y	0.0	0.0	1.0	150.6	
			Z	0.0	0.0	1.0	144.2	
10021	GSM-FDD (TDMA, GMSK)	9.40	X	27.91	100.0	29.0	126.1	±1.9 %
			Y	23.35	99.6	28.1	130.4	
			Z	26.79	99.6	28.4	147.3	

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 E²-field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3246

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	41.5	0.90	6.10	6.10	6.10	0.28	2.07	± 12.0 %
900	41.5	0.97	6.08	6.08	6.08	0.44	1.50	± 12.0 %
1750	40.1	1.37	5.30	5.30	5.30	0.80	1.27	± 12.0 %
1900	40.0	1.40	5.04	5.04	5.04	0.80	1.17	± 12.0 %

^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3246

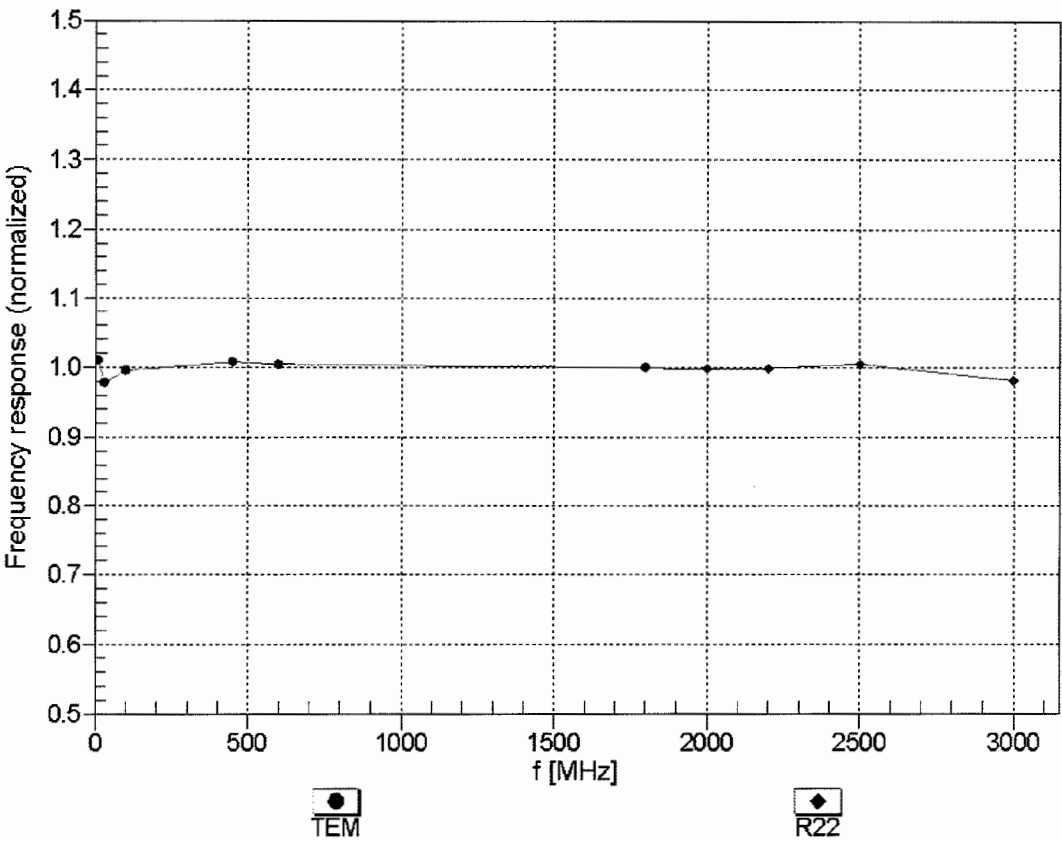
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	56.7	0.94	7.09	7.09	7.09	0.11	1.15	± 13.4 %
835	55.2	0.97	6.10	6.10	6.10	0.40	1.66	± 12.0 %
900	55.0	1.05	6.06	6.06	6.06	0.80	1.18	± 12.0 %
1750	53.4	1.49	4.99	4.99	4.99	0.64	1.39	± 12.0 %
1900	53.3	1.52	4.75	4.75	4.75	0.55	1.59	± 12.0 %

^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

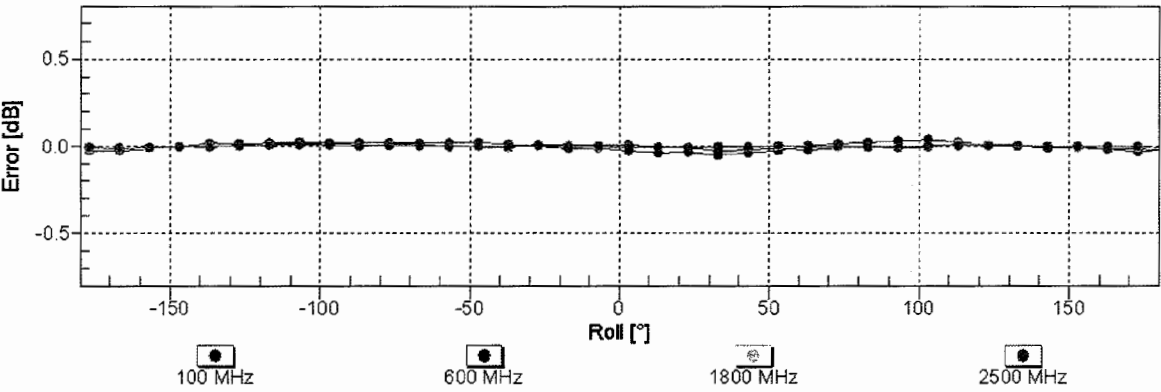
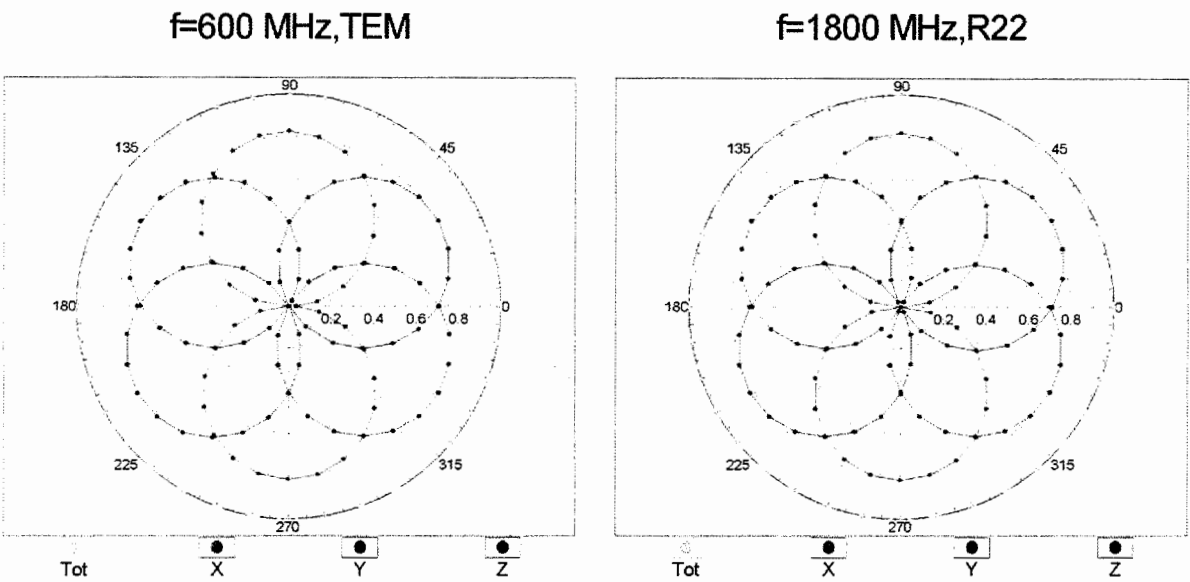
^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



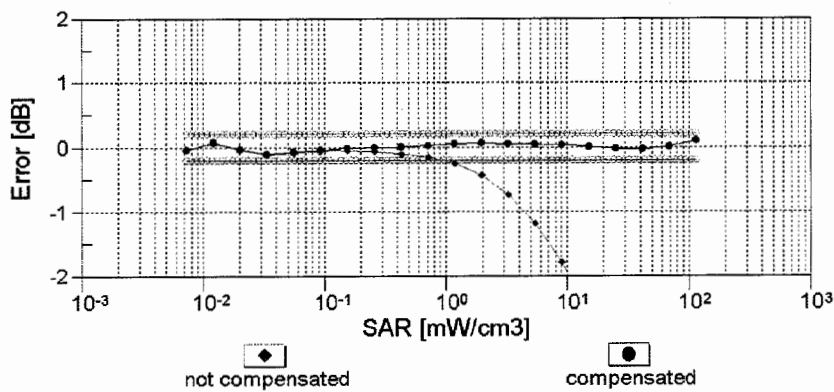
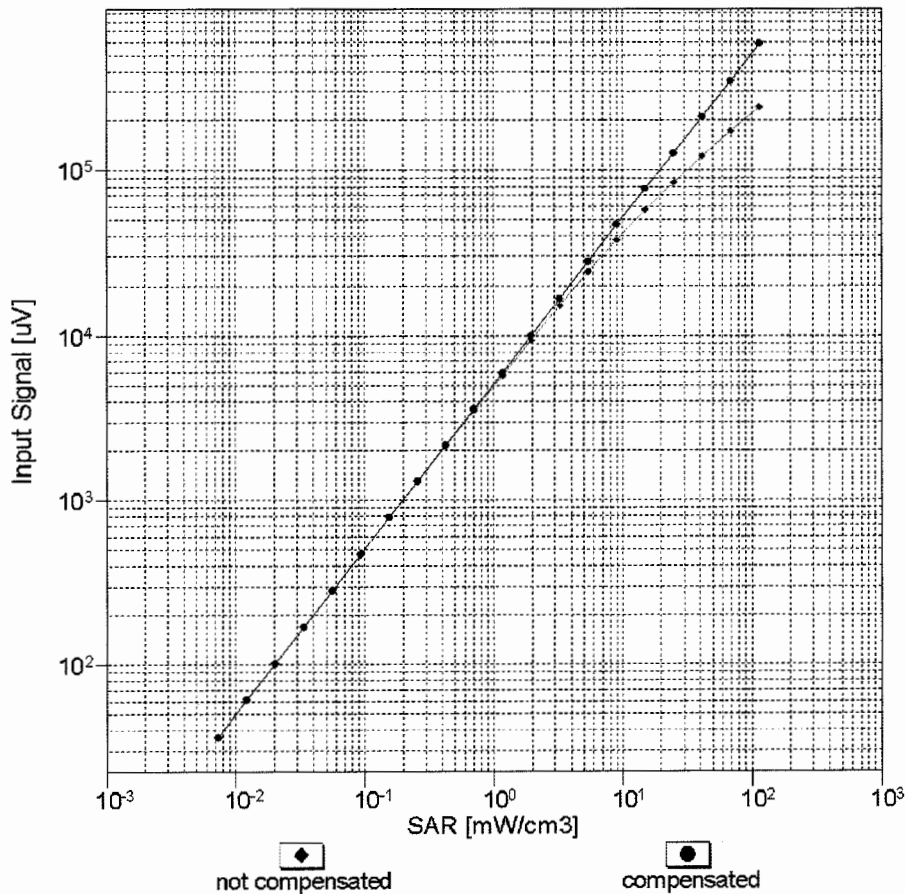
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

Receiving Pattern (ϕ), $\theta = 0^\circ$



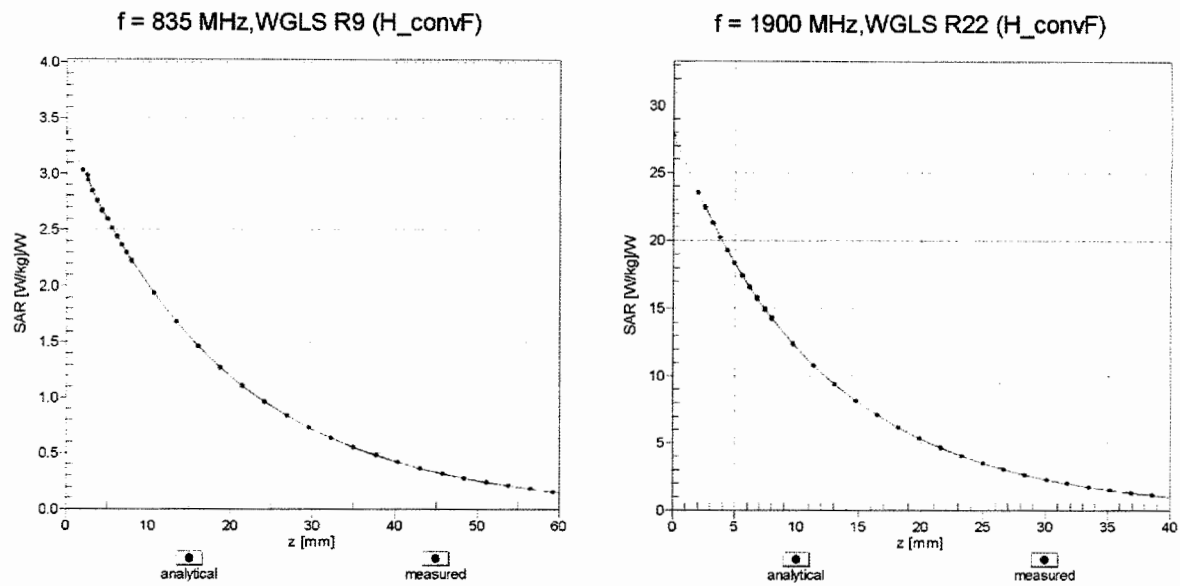
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)



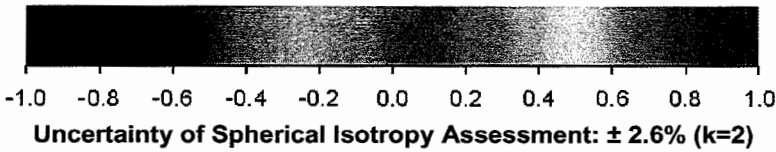
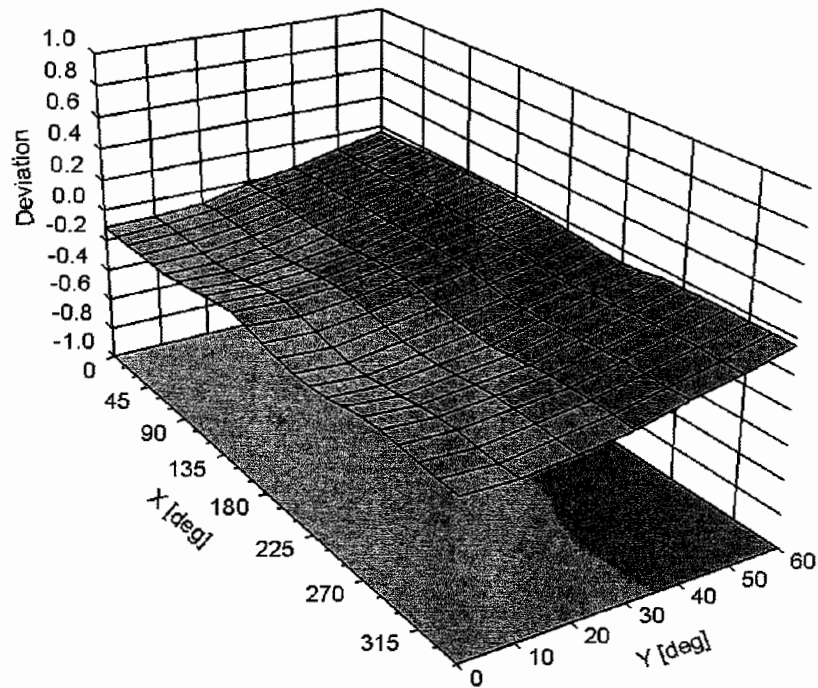
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



DASY/EASY - Parameters of Probe: ES3DV3 - SN:3246

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm