Portable Cellular Phone SAR Test Report

Tests Requested By:	Motorola Mobility, Inc. 600 N. US Highway 45 Libertyville, IL 60048
Test Report #:	24722-1F Rev A.
Date of Report:	Nov-07-2011, revised on Nov 16, 2011
Date of Test:	Oct-03-2011 to Nov-01-2011
FCC ID #:	IHDP56MB3
Generic Name:	M0C1F
Test Laboratory:	Motorola Mobility, Inc. - ADR Test Services Laboratory 600 N. US Highway 45 Libertyville, IL 60048
Report Author:	Ketal Patel RF Engineer

Accreditation:

This laboratory is accredited to ISO/IEC 17025-2005 to perform the following tests:

Tests:	Procedures:
Electromagnetic Specific Absorption Rate	IEC 62209-1 RSS-102 IEEE 1528 - 2003 FCC OET Bulletin 65 (*including Supplement C*) Australian Communications Authority Radio Communications (Electromagnetic Radiation – Human Exposure) Standard 2003 CENELEC EN 50360 ARIB Std. T-56 (2002)

2404

On the following products or types of products:
Wireless Communications Devices (Examples): Two Way Radios; Portable Phones (including Cellular, Licensed Non-Broadcast and PCS); Low Frequency Readers; and Pagers

Statement of Compliance:

Motorola declares under its sole responsibility that the portable cellular telephone model to which this declaration relates, is in conformity with the appropriate General Population/Uncontrolled RF exposure standards, recommendations and guidelines (FCC 47 CFR §2.1093) as well as with CENELEC en50360:2001 and ANSI / IEEE C95.1. It also declares that the product was tested in accordance with IEEE 1528 / CENELEC EN62209-1 (2006), as well as other appropriate measurement standards, guidelines and recommended practices. Any deviations from these standards, guidelines and recommended practices are noted below:

Motorola's ISO 17025 accreditation scope does not currently include SAR testing in the 5 GHz band. Therefore, SAR testing performed in this band was performed outside of our ISO 17025 accreditation. The general procedures and guidelines provided within; FCC KDB 248227 D01, FCC KDB 648474 D01, FCC KDB 865664 D01 and IEC 62209-2 were utilized for testing.

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Revision History

Revision Version	Date	Notes
Rev. 0	Nov-07-2011	Initial report release.
Rev. A	Nov-16-2011	Various modifications to address TCB inquiries.

1. Introduction

The Motorola Mobility ADR Test Services Laboratory has performed measurements of the maximum potential exposure to the user of the portable cellular phone covered by this test report. The Specific Absorption Rate (SAR) of this product was measured. The portable cellular phone was tested in accordance with [1], [4] and [5]. The SAR values measured for the portable cellular phone are below the maximum recommended levels of 1.6 W/kg in a 1 g average set in [3] and 2.0 W/kg in a 10 g average set in [2].

For ANSI / IEEE C95.1 (1 g), the final stand-alone SAR readings for this phone are given in the table below. For ANSI / IEEE C95.1 (1 g), the final simultaneous-transmission SAR readings for this phone are 1.57 W/kg for head-adjacent use and 0.26 W/kg for body-worn use. These measurements were performed using a Dasy4™ v4.7 system manufactured by Schmid & Partner Engineering AG (SPEAG), of Zurich Switzerland.

Transmit Band	Head SAR (1 g $^{W}/_{kg}$)	Body SAR (1 g $^{W}/_{kg}$)
GSM 1900	**0.40**	**0.17**
Wi-Fi 2.45 GHz	**1.17**	**0.09**

2. Description of the Device Under Test

2.1 Antenna description

Main 1900 MHz Antenna

Type	Internal	
Location	Bottom of Transceiver	
Dimensions	Width	7.20 mm
	Length	55.00 mm

Bluetooth/Wi-Fi 2 GHz Antenna

Type	Internal	
Location	Right-Side Rear of Transceiver	
Dimensions	Width	3.00 mm
	Length	40.00 mm

2.2 Device Signaling[1]

Serial Number(s) (Functional Use)	358952040000507 (GSM/GPRS/EDGE conducted power measurements, GSM/EDGE head/body SAR testing) 358952040008385 (GPRS Conducted Power Measurements, GPRS/Wi-Fin 2.4 MHz head/body SAR testing) 358952040002735 (Wi-Fi 2.4 MHz conducted power measurements)
Production Unit or Identical Prototype (47 CFR §2..908)	Identical Prototype
Device Category	Portable (Mobile Station Class B)
RF Exposure Limits	General Population / Uncontrolled

Mode(s) of Operation	Modulation Mode(s)	Maximum Output Power Setting	Duty Cycle	Transmitting Frequency Range(s)
GSM 900	GMSK	33.0 dBm	1:8	880.2 - 914.8 MHz
GSM 1800	GMSK	29.5 dBm	1:8	1710.2 - 1784.8 MHz
GSM 1900	GMSK	29.5 dBm	1:8	1850.2 - 1909.8 MHz
TD-SCDMA 2017	QPSK	24.5 dBm	1:7.4	2010.8 – 2024.2 MHz
Wi-Fi 802.11b/g/n	BPSK	19.0 dBm	1:1	2412.0 - 2462.5 MHz
Bluetooth	GFSK	8.0 dBm	1:1	2402.0 - 2483.5 MHz

GSM Data Functionality	GPRS/EDGE Class 12 (4 uplink timeslots; 4 downlink timeslots; 5 total timeslots per frame)
	Class B (DTM not supported)

Mode(s) of Operation	GPRS 1900				EDGE 1900			
Modulation	GMSK				8PSK			
Maximum Output Power Setting (dBm)	29.5	26.5	**25.5**	24.0	26.0	23.5	**22.5**	20.5
Time Average Output Power Setting (dBm)	20.5	20.5	**21.2**	21.0	17.0	17.5	**18.2**	17.5
Duty Cycle	1:8	2:8	**3:8**	4:8	1:8	2:8	**3:8**	4:8
Transmitting Frequency Range(s)	1850.2 - 1909.8 MHz				1850.2 - 1909.8 MHz			

2.3 Device Conducted Power Measurements

2.3.1 GSM modes

Band	Channel	Phone Serial Number	Conducted power (dBm) for GSM modes[2]								
			GSM *CS Voice* (1 Slot)	GPRS *PS Data* (1 Slots)	EDGE *PS Data* (1 Slots)	GPRS *PS Data* (2 Slots)	EDGE *PS Data* (2 Slots)	GPRS *PS Data* (3 Slots)	EDGE *PS Data* (3 Slots)	GPRS *PS Data* (4 Slots)	EDGE *PS Data* (4 Slots)
GSM 1900	512	358952040000507	29.70	29.84	25.82	26.65	23.48	25.82	22.62	24.66	20.76
	661		29.37	29.36	25.81	25.96	23.52	25.06	22.59	23.79	20.53
	810		29.48	29.47	25.80	26.18	23.33	25.32	22.40	24.11	20.37
	512	358952040008385	29.52	29.45	N/A	26.55	N/A	25.40	N/A	23.92	N/A
	661		29.48	29.48	N/A	26.60	N/A	25.47	N/A	24.00	N/A
	810		29.57	29.54	N/A	26.65	N/A	25.50	N/A	24.01	N/A

[1] **Bolded** entries indicate data mode configurations of highest time-average power output per band and data mode type, and thus wee utilized for SAR testing in this report.
[2] *CS Voice* denotes circuit-switched transmission for voice calling, and *PS Data* denotes packet-switched transmission for data sessions.

2.3.2 Wi-Fi 802.11 modes

Per "SAR Measurement Procedures for 802.11 a/b/g Transmitters" (FCC KDB 248227), power measurements were performed for 802.11 operational modes. The average conducted power measurements for each mode are shown in the tables below. SAR testing for 802.11 was performed with the transmitter set to the lowest data rate on the default test channels **highlighted in bold** in the tables below. The head and body positions that resulted in the highest SAR values were further tested on the additional channels and higher data rates **highlighted in pink** in the tables below.

Band	Channel	Average Conducted Power (dBm) for 802.11b Mode Data Rates			
		1 Mbps	2 Mbps	5.5 Mbps	11 Mbps
Wi-Fi 2450 MHz	1	**17.33**	17.26	**18.63**	**18.55**
	6	**17.15**	17.28	**18.42**	**18.65**
	11	**17.08**	17.18	**18.35**	**18.41**

Band	Channel	Average Conducted Power (dBm) for 802.11g Mode Data Rates							
		6 Mbps	9 Mbps	12 Mbps	18 Mbps	24 Mbps	36 Mbps	48 Mbps	54 Mbps
Wi-Fi 2450 MHz	1	15.67	15.57	13.15	13.17	13.15	13.12	12.77	12.89
	6	16.52	16.48	14.14	14.09	14.14	14.03	13.7	13.77
	11	15.87	15.88	13.38	13.4	13.44	13.47	13.09	13.15

Band	Channel	Average Conducted Power (dBm) for 802.11n Mode Data Rates (20 MHz Channel, 800 ns Guard Interval)							
		6.5 Mbps	13 Mbps	19.5 Mbps	26 Mbps	39 Mbps	52 Mbps	58.5 Mbps	65 Mbps
Wi-Fi 2450 MHz	1	12.56	13.04	13.11	13.16	13.18	12.82	12.85	11.96
	6	13.47	13.95	13.96	13.95	13.94	13.74	13.73	12.82
	11	12.82	13.25	13.32	13.58	13.5	13.03	13.02	12.21

Band	Channel	Average Conducted Power (dBm) for 802.11n Mode Data Rates (20 MHz Channel, 400 ns Guard Interval)							
		7.2 Mbps	14.4 Mbps	21.6 Mbps	28.8 Mbps	43.3 Mbps	57.7 Mbps	65 Mbps	72.2 Mbps
Wi-Fi 2450 MHz	1	12.54	13.01	13.06	13.06	13.08	12.74	12.69	11.83
	6	13.54	13.91	14.07	14.05	13.96	13.6	13.47	12.74
	11	12.8	13.19	13.19	13.42	13.41	12.96	12.98	12.13

3. Test Equipment Used

3.1 Dosimetric System

The Motorola Mobility ADR Test Services Laboratory utilizes a Dosimetric Assessment System (Dasy4™ v4.7) manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. All the SAR measurements are taken within a shielded enclosure. The overall 10 g RSS uncertainty of the measurement system is ±10.8% (K=1) with an expanded uncertainty of ±21.6% (K=2). The overall 1 g RSS uncertainty of the measurement system is ±11.1% (K=1) with an expanded uncertainty of ±22.2% (K=2). The measurement uncertainty budget is given in Appendix 6. Per IEEE 1528, this uncertainty budget is applicable to the SAR range of 0.4 W/kg to 10 W/kg.

The list of calibrated equipment used for the measurements is shown in the following table.

Description	Serial Number	Cal Date	Cal Due Date
E-Field Probe ES3DV3	3037	Apr-13-2011	Apr-13-2012
DASY4™ DAE V1	650	Jun-20-2011	Jun-20-2012
E-Field Probe ES3DV3	3191	Apr-07-2011	Apr-07-2012
DASY4™ DAE V1	690	Apr-13-2011	Apr-13-2012
S.A.M. Phantom used for 1800/1900/2450 MHz	TP-1162		
S.A.M. Phantom used for 1800/1900/2450 MHz	TP-1160		
Dipole Validation Kit, DV1800V2	272TR	Jul-11-2011	Jul-11-2012
Dipole Validation Kit, DV2450V2	789	Apr-06-2011	Apr-06-2012
Dipole Validation Kit, DV2450V2	788	Jul-12-2011	Jul-12-2012

3.2 Additional Equipment

Description	Serial Number	Cal Date	Cal Due Date
Dielectric Probe Kit HP85070C	US99360070		
Dielectric Probe Kit HP85070E	MY44300245		
Network Analyzer HP8753ES	US39172529	Sep-14-2011	Sep-14-2012
Network Analyzer E5071B	MY42301800	Mar-14-2011	Mar-14-2012
Power Meter E4419B	GB43310686	Feb-28-2011	Feb-28-2013
Power Meter 437B	3125U09525	Feb-28-2011	Feb-28-2013
Power Meter E4419B	GB39510900	Apr-01-2011	Apr-01-2013
Power Sensor #1 - 8481A	MY41096692	Feb-18-2011	Feb-18-2013
Power Sensor #1 - E9301A	MY41495336	Feb-18-2011	Feb-18-2013
Power Sensor #1 - E9301A	MY41497905	Feb-18-2011	Feb-18-2013
Power Sensor #2 - E9301A	US39211008	Aug-16-2011	Aug-16-2012
Power Sensor #2 - E9301A	US39211007	Aug-25-2011	Aug-25-2012
Signal Generator HP8648C	3847U02385	Apr-02-2011	Apr-02-2013
Signal Generator HP8648C	3847A04845	Aug-15-2011	Aug-15-2013

4. Electrical parameters of the tissue simulating liquid

Prior to conducting SAR measurements, the relative permittivity, ε_r, and the conductivity, σ, of the tissue simulating liquids were measured with a HP85070 Dielectric Probe Kit These values, along with the temperature of the simulated tissue are shown in the table below. The recommended limits for permittivity and conductivity are also shown. A mass density of $\rho = 1\ ^{g}/_{cm^3}$ was entered into the system in all the cases. It can be seen that the measured parameters are within tolerance of the recommended limits specified in [1] and [5].

E-field probes calibrated at 1810 MHz were used for "1900 MHz" band (1850 MHz - 1910 MHz) SAR measurements. FCC KDB 450824 provides additional requirements on page 3 of 6 for SAR testing that is performed with probe calibration points that are more than 50 MHz removed from the measured bands. The KDB requires; "(2) When nominal tissue dielectric parameters are specified in the probe calibration data, the tissue dielectric parameters measured for routine measurements should be less than the target Er and higher than the target Sigma values to minimize SAR underestimations". The 1900 MHz simulated tissues listed below meet this criteria.

f (MHz)	Tissue type	Limits / Measured	Dielectric Parameters		
			ε_r	σ (S/m)	Temp (°C)
1880	**Head**	**Measured,** Oct-04-2011	38.7	1.45	20.4
		Recommended Limits	40.0 ±5%	1.40 ±5%	18-25
	Body	**Measured,** Oct-03-2011	50.8	1.58	20
		Recommended Limits	53.3 ±5%	1.52 ±5%	18-25
2450	**Head**	**Measured,** Oct-16-2011	37.4	1.85	21.2
		Measured, Oct-18-2011	37.4	1.85	21.4
		Recommended Limits	39.2 ±10%	1.80 ±5%	18-25
	Body	**Measured,** Nov-01-2011	52.7	1.87	21.7
		Recommended Limits	52.7 ±10%	1.95 ±5%	18-25

The list of ingredients and the percent composition used for the simulated tissues are indicated in the table below.

Ingredient	782 / 835 / 900 MHz Head	782 / 835 / 900 MHz Body	1800 MHz / 1900 MHz Head	1800 MHz / 1900 MHz Body	2450 MHz Head	2450 MHz Body
Sugar	57	44.9	--	--	--	--
DGBE	--	--	47	30.8	--	30
Diacetin	--	--	--	--	51	--
Water	40.45	53.06	52.62	68.8	48.75	70
Salt	1.45	0.94	0.38	0.4	0.15	--
HEC	1	1	--	--	--	--
Bact.	0.1	0.1	--	--	0.1	--

5. System Accuracy Verifications

A system accuracy verification of the DASY4™ was performed using the measurement equipment listed in Section 3.1. The daily system accuracy verification occurs within the flat section of the SAM phantom.

A SAR measurement was performed to verify the measured SAR was within ±10% from the target SAR indicated in Appendix 7. These frequencies are within ±10% of the compliance test mid-band frequency as required in [1] and [5]. The test was conducted on the same days as the measurement of the DUT. Recommended limits for permittivity and conductivity, specified in [5], are shown in the table below. The obtained results from the system accuracy verification are also displayed in the table below. SAR values are normalized to 1 W forward power delivered to the dipole. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values. The distributions of SAR compare well with those of the reference measurements (see Appendix 1). For frequencies below 3 GHz, the simulated tissue depth was verified to be 15.0 cm ± 0.5 cm. Z-axis scans showing the SAR penetration are also included in Appendix 1.

System Accuracy Verification Measurements for Head SAR Measurements						
f (MHz)	Description	SAR (W/kg), 1 gram	Dielectric Parameters		Ambient Temp (°C)	Tissue Temp (°C)
			ε_r	σ (S/m)		
1800	**Measured,** Oct-04-2011	35.55	39.1	1.37	21.0	20.4
	Recommended Limits	37.3	40.0 ±5%	1.40 ±5%	18-25	18-25
2450	**Measured,** Oct-16-2011	60	37.4	1.85	21.5	21.2
	Measured, Oct-17-2011	59.5	37.4	1.85	21.5	21.4
	Recommended Limits	54.6	39.2 ±10%	1.80 ±5%	18-25	18-25

The following probe conversion factors were used on the E-Field probe(s) used with the system accuracy verification measurements for head SAR measurements:

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ES3DV3	3037	1810	5.28	5 of 11
E-Field Probe ES3DV3	3191	2450	4.49	5 of 11

System Accuracy Verification Measurements for Body SAR Measurements						
f (MHz)	Description	SAR (W/kg), 1 gram	Dielectric Parameters		Ambient Temp (°C)	Tissue Temp (°C)
			ε_r	σ (S/m)		
1800	**Measured,** Oct-03-2011	38.4	51.1	1.49	21.0	20.0
	Recommended Limits	37.1	53.3 ±5%	1.52 ±5%	18-25	18-25
2450	**Measured,** Nov-01-2011	53.5	52.7	1.87	21.0	21.7
	Recommended Limits	51.2	52.7 ±10%	1.95 ±5%	18-25	18-25

The following probe conversion factors were used on the E-Field probe(s) used with the system accuracy verification measurements for body SAR measurements:

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ES3DV3	3037	1810	4.88	5 of 11
E-Field Probe ES3DV3	3191	2450	4.11	5 of 11

6. Test Results

The test sample was operated using an actual transmission through a base station simulator. Wi-Fi testing was conducted using manufacturer test mode software, per guidance given in FCC KDB 248227. The base station simulator or test software was set up for the proper channels, transmitter power levels and transmit modes of operation.

The phone was tested in the configurations stipulated in [1], [4] and [5]. The phone was positioned into these configurations using the device holder supplied with the DASY4™ SAR measurement system The default settings for the "coarse" and "cube" scans were chosen and used for measurements. The grid spacing of the coarse scan was set to 15 mm or less as shown in the SAR plots included in Appendices 2 through 4. Please refer to the DASY4™ manual for additional information on SAR scanning procedures and algorithms used.

The DUT covered by this report has a integrated battery (p/n SNN5899A – 1780mAH) that is not intended for removal by the end user.

This battery was used to do all of the SAR testing. The phone was placed in the SAR measurement system with a fully charged battery.

6.1 Head Adjacent Test Results

The SAR results shown in tables 1 through 4 are maximum SAR values averaged over 1 gram of phantom tissue, to demonstrate compliance to [3] and also over 10 grams of phantom tissue, to demonstrate compliance to the [6]. Also shown are the temperature of the simulated tissue after the test, the measured drift and the extrapolated SAR. The exact method of extrapolation is Extrapolated SAR = Measured SAR * $10^{(-drift/10)}$. The SAR reported at the end of the measurement process by the DASY4™ measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process. This is the most conservative SAR because it corresponds to the average output power at the beginning of the SAR test. This extrapolation has been done because when the DUT is operating properly it may exhibit a slump in radiated power and SAR over time. This is verified by measuring the SAR drift after the test.

The left head and right head SAR contour distributions are similar. Because of this similarity, the cheek/touch and 15° tilt test conditions with the highest SAR values in each band are indicated as bold numbers in the following tables and are included in Appendix 2. All other test conditions measured lower SAR values than those included in Appendix 2.

The SAR measurements were performed using the SAM phantoms listed in section 3.1. Since the same phantoms and simulated tissue were used for the system accuracy verification and the device SAR measurements, the Z-axis scans included in Appendix 1 are applicable for verification of simulated tissue depth.

The following probe conversion factors were used on the E-Field probe(s) used for head-adjacent measurements:

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ES3DV3	3037	1810	5.28	5 of 11
E-Field Probe ES3DV3	3191	2450	4.49	5 of 11

Left Head Cheek Position																
f (MHz)	Mode	Battery/ Accessory	Channel	Temp (°C)	Drift (dB)	DUT Power		10 g SAR value			1 g SAR value			Test Plot	
						Measured (dBm)	Power Reduction (dB)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Grid	Plot Page
1880	GSM 1900, CS Voice	SNN5899A	512												
			661	**20.2**	**-0.55**	**29.37**		**0.21**		**0.24**	**0.349**		**0.40**	**5x5x7**	**25**
			810												
	GPRS 1900, Class 11		512												
			661	20.7	-0.0316	25.06		0.171		0.17	0.289		0.29		
			810												
2450	802.11b, 1 Mbps		1	20.7	0.156	17.33		0.215		0.22	0.557		0.56		
			6												
			11												

Table 1: SAR measurement results at the highest possible output power, measured in a head cheek position against the ICNIRP and ANSI SAR Limit.

Right Head Cheek Position															
f (MHz)	Mode	Battery/ Accessory	Channel	Temp (°C)	Drift (dB)	DUT Power		10 g SAR value			1 g SAR value			Test Plot	
						Measured (dBm)	Power Reduction (dB)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Grid	Plot Page
1880	GSM 1900, CS Voice	SNN5899A	512												
			661	20.2	0.15	29.37		0.128		0.13	0.215		0.22		
			810												
2450	802.11b, 1 Mbps		1	20.5	0.148	17.33		0.27		0.27	0.646		0.65		
			6	20.5	0.131	17.15		0.3		0.30	0.725		0.73		
			11	20.1	0.0519	17.08		0.395		0.40	0.957		0.96		
	802.11b, 5.5 Mbps		1	20.4	0.18	18.63		0.255		0.26	0.608		0.61		
			6	20	0.182	18.42		0.314		0.31	0.765		0.77		
			11	**20**	**0.178**	**18.35**		**0.472**		**0.47**	**1.17**		**1.17**	**5x5x7**	**26**
	802.11b, 11 Mbps		1	20.7	0.0168	18.55		0.284		0.28	0.698		0.90		
			6	20	0.088	18.65		0.322		0.32	0.794		0.79		
			11	19.9	-0.0171	18.41		0.396		0.40	0.952		0.96		

Table 2: SAR measurement results at the highest possible output power, measured in a head cheek position against the ICNIRP and ANSI SAR Limit.

Left Head 15° Tilt Position															
f (MHz)	Mode	Battery/ Accessory	Channel	Temp (°C)	Drift (dB)	DUT Power		10 g SAR value			1 g SAR value			Test Plot	
						Measured (dBm)	Power Reduction (dB)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Grid	Plot Page
1880	GSM 1900, CS Voice	SNN5899A	512												
			661	20.2	0.016	29.37		0.0581		0.06	0.102		0.10		
			810												
2450	802.11b, 1 Mbps		1	20.7	0.0384	17.33		0.0388		0.04	0.076		0.08		
			6												
			11												

Table 3: SAR measurement results at the highest possible output power, measured in a head tilt position against the ICNIRP and ANSI SAR Limit.

Right Head 15° Tilt Position															
f (MHz)	Mode	Battery/ Accessory	Channel	Temp (°C)	Drift (dB)	DUT Power		10 g SAR value			1 g SAR value			Test Plot	
						Measured (dBm)	Power Reduction (dB)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Grid	Plot Page
1880	GSM 1900, CS Voice	SNN5899A	512												
			661	**20.2**	**-0.13**	**29.37**		**0.0675**		**0.07**	0.117		**0.12**	**5x5x7**	**27**
			810												
2450	802.11b, 1 Mbps		1	**20.8**	**-0.0197**	**17.33**		**0.0522**		**0.05**	**0.1**		**0.10**	**5x5x7**	**28**
			6												
			11												

Table 4: SAR measurement results at the highest possible output power, measured in a head tilt position against the ICNIRP and ANSI SAR Limit.

6.2 Body Worn Test Results

The SAR results shown in tables 5 through 6 are maximum SAR values averaged over 1 gram of phantom tissue, to demonstrate compliance to [3] and also over 10 grams of phantom tissue, to demonstrate compliance to [6]. Also shown are the temperature of the simulated tissue after the test, the measured drift and the extrapolated SAR. The exact method of extrapolation is Extrapolated SAR = Measured SAR * $10^{(-drift/10)}$. The SAR reported at the end of the measurement process by the DASY4™ measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process. This is the most conservative SAR because it corresponds to the average output power at the beginning of the SAR test. This extrapolation has been done because when the DUT is operating properly it may exhibit a slump in radiated power and SAR over time. This is verified by measuring the SAR drift after the test.

The test conditions that produced the highest SAR values in each band are indicated as bold numbers in the following tables and are included in Appendix 3. All other test conditions measured lower SAR values than those included in Appendix 3.

A "flat" phantom was for the body-worn tests. This "flat" phantom is made out of 1" thick natural High Density Polyethylene with a thickness at the bottom equal to 2.0 mm. It measures 52.7 cm(long) x 26.7 cm(wide) x 21.2 cm(tall).

The simulated tissue depth was verified to be 15.0 cm ± 0.5 cm for frequencies less than 3 GHz, or 10.0 cm ± 0.5 cm for frequencies greater than 3 GHz. The same device holder described in section 6 was used for positioning the phone. Functional accessories were divided into two categories, the ones with metal components and the ones with non-metal components. For non-metallic component accessories, testing was performed on the accessory that displayed the closest proximity to the flat phantom. Each metallic component accessory, if any, was checked for uniqueness of metal component so that each is tested with the device. If multiple accessories shared an identical metal component, only the accessory that dictates the closest spacing to the body was tested. The cellular phone was tested with a headset connected to the device for all body-worn SAR measurements.

There are no body-worn accessories available for this phone at the time of testing thus the device was tested per the Supplement C testing guidelines for devices that do not have body-worn accessories. A separation distance of 25 mm between the device and the flat phantom was used for testing body-worn SAR. The chosen separation distance of 25 mm is utilized in order to support any case or holder accessories offered or to be offered by Motorola for this product. The device was tested with the front and back of the device facing the phantom. Both sides of the device were tested for Body SAR for the purpose of including the SAR evaluation for body-worn accessories that support the device with the front side facing the user.

The cellular phone was also tested in data mode operations. For these tests, a separation distance of 25 mm between the device and the flat phantom was used. The device was tested in the worst-case SAR position and channel configuration from the voice-mode body-worn testing.

The following probe conversion factors were used on the E-Field probe(s) used for the body-worn measurements:

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ES3DV3	3037	1810	4.88	5 of 11
E-Field Probe ES3DV3	3191	2450	4.11	5 of 11

Body-Worn, Front of Phone 25 mm from Phantom																
						DUT Power		10 g SAR value			1 g SAR value			Test Plot	
f (MHz)	Mode	Battery/ Accessory	Channel	Temp (°C)	Drift (dB)	Measured (dBm)	Power Reduction (dB)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Grid	Plot Page
1880	**GSM 1900, CS Voice**	SNN5899A	512												
			661	20.2	0.013	29.37		0.0765		0.08	0.125		0.13		
			810												
2450	**802.11b, 1 Mbps**		1	21.0	-0.144	17.33		0.00775		0.01	0.0166		0.02		
			6												
			11												

Table 5: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.

Body-Worn, Back of Phone 25 mm from Phantom																
f (MHz)	Mode	Battery/ Accessory	Channel	Temp (°C)	Drift (dB)	DUT Power		10 g SAR value			1 g SAR value			Test Plot	
						Measured (dBm)	Power Reduction (dB)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Grid	Plot Page
1880	GSM 1900, CS Voice	SNN5899A	512												
			661	**20.2**	**0.01**	**29.37**		**0.107**		**0.11**	**0.174**		**0.17**	**5x5x7**	**30**
			810												
	GPRS 1900, Class 11		512												
			661	21	-.00321	25.06		0.0994		0.10	0.162		0.16		
			810												
	EDGE 1900, Class 11		512												
			661	20.5	-0.0312	25.59		0.0889		0.09	0.147		0.15		
			810												
2450	802.11b, 1 Mbps		1	21	0.0945	17.33		0.0283		0.03	0.0575		0.06		
			6	21	0.0678	17.15		0.0234		0.02	0.0492		0.05		
			11	21.2	0.00321	17.08		0.0457		0.05	0.0815		0.08		
	802.11b, 5.5 Mbps		1												
			6												
			11	21.2	-0.0338	18.35		0.0445		0.04	0.0802		0.08		
	802.11b, 11 Mbps		1												
			6												
			11	**21**	**-0.0515**	**18.41**		**0.0492**		**0.05**	**0.0876**		**0.09**	**5x5x7**	**31**

Table 6: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.

6.3 Description and Evaluation of Simultaneous Transmitters

Per "SAR Evaluation Considerations for Handsets with Multiple Transmitters and Antennas" (FCC KDB 648474), the necessity of stand-alone and simultaneous SAR testing was evaluated for the licensed and unlicensed transmitters of the device under test.

By device design the GSM transmitters may operate simultaneously with either the Wi-Fi 802.11 transmitter or the Bluetooth transmitter. The separation distance between the Wi-Fi 802.11/Bluetooth antenna and the main antenna is 5.3 cm. Pictorial representation of the antenna locations and separation distances are given in Exhibit 7d.

The Bluetooth transmitter of the device under test can be excluded from stand-alone and simultaneous SAR evaluation, per the highlighted requirements from FCC KDB 648474, as follows:

1. The highest output conducted power measured for Bluetooth on the device under test is 6.6 mW [≤ 24 mW]
2. The separation distance between the Bluetooth antenna and the main antenna is 5.3 cm [≥ 5.0 cm]

For the transmitters requiring stand-alone SAR testing (GSM, and Wi-Fi 802.11), the KDB guidelines direct that if the sum of the 1 g SAR measured for the simultaneously transmitting antennas is less than the SAR limit, SAR measurement for simultaneous transmission is not required. Further, if the SAR-to-peak-location separation ratio for two simultaneously transmitting antennas is less than 0.3 then SAR measurement for simultaneous transmission is likewise not required. Evaluations of the head and body simultaneous SAR summations for the worst-case SAR transmitter configurations are presented in the tables below.

Evaluations for Simultaneous SAR							
Cellular Mode	Wi-Fi Mode	Configuration	Cellular Mode 1 g SAR Value (W/kg)	Wi-Fi Mode 1 g SAR Value (W/kg)	Summation 1 g SAR Value (W/kg)	SAR-to-peak-location Separation Ratio	*Simultaneous Measurements Required?*
GSM 1900, CS Voice	Wi-Fi 2450 802.11b, 5.5 Mbps	Right Cheek with Battery SNN5899A	0.22	1.17	1.39		No
GSM 1900, CS Voice	Wi-Fi 2450 802.11b, 11 Mbps	Body Worn, Back of Phone 25 mm from Phantom with Battery SNN5899A	0.17	0.09	0.26		No

References

[1] CENELEC, en62209-1:2006 “Human Exposure to Radio Frequency Fields From Hand - Held and Body - Mounted Wireless Communication Devices – Human Models, Instrumentation, and Procedures”

[2] CENELEC, en50360:2001 “Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300 MHz – 3 GHz)”.

[3] ANSI / IEEE, C95.1 1992 Edition “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”

[4] FCC OET Bulletin 65 Supplement C 01-01

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

[6] ICNIRP Guidelines “Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz)”

Appendix 1

SAR distribution comparisons for System Accuracy Verifications

Date/Time: 10/4/2011 8:26:46 AM

Test Laboratory: Motorola Mobility 1800 MHz System Performance Check

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:272TR;
Procedure Notes: PM1 Power = 200mW Pwr PM3 = -27dB Sim.Temp@SPC = 20.4C Room Temp @ SPC = 21.C

Communication System: CW; Frequency: 1800 MHz; Communication System Channel Number: 0; Duty Cycle: 1:1
Medium: Validation *HEAD Tissue* ; Medium parameters used: f = 1800 MHz; σ = 1.37 mho/m; ε_r = 39.1; ρ = 1000 kg/m^3

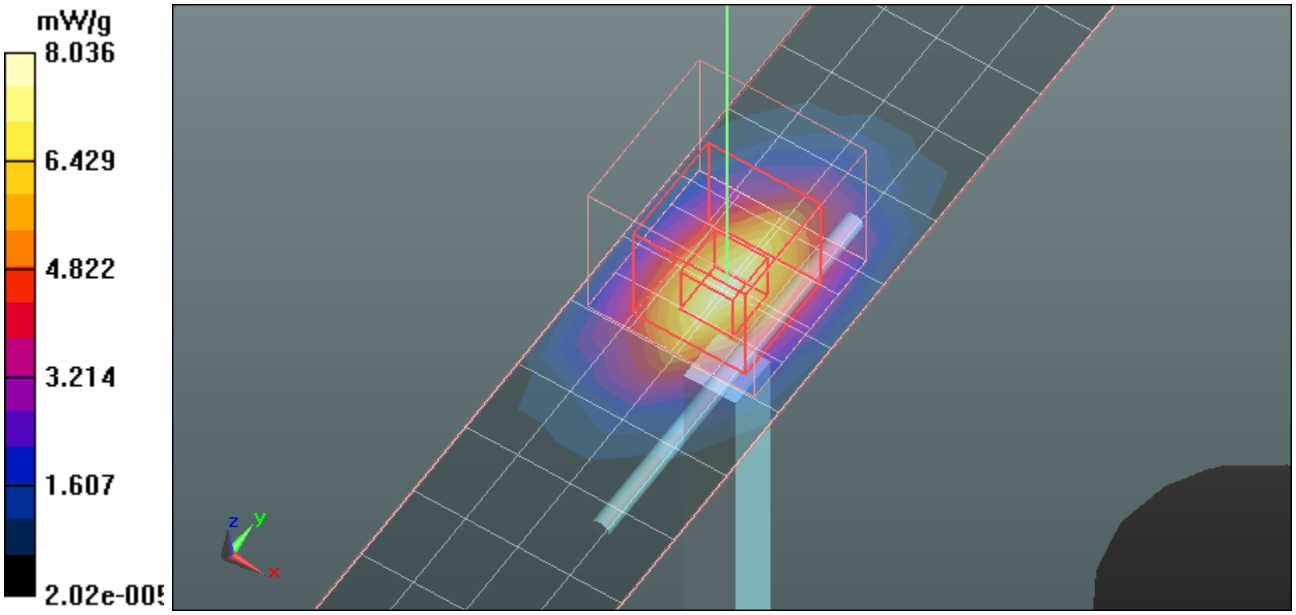
DASY4 Configuration:

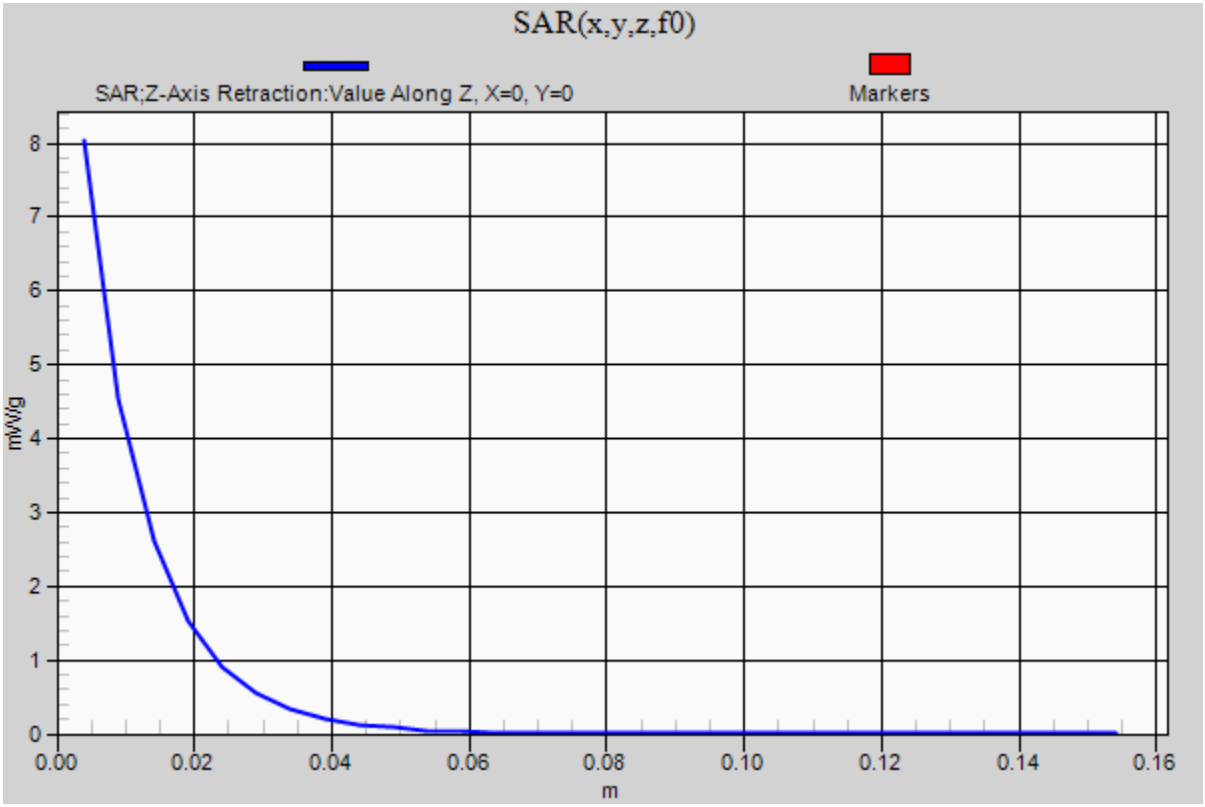
- Probe: ES3DV3 - SN3037; ConvF(5.28, 5.28, 5.28); Calibrated: 4/13/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn650; Calibrated: 6/20/2011
- Phantom: R#4_ Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1162;
- ; SEMCAD X Version 14.4.5 (3634)

DASY5, SAM - System Performance Check Template, Rev.2 (12-Sept-11)/Daily SPC Check/Dipole Area Scan (5x15x1): Measurement grid: dx=10mm, dy=15mm
Maximum value of SAR (measured) = 7.986 mW/g

DASY5, SAM - System Performance Check Template, Rev.2 (12-Sept-11)/Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 77.935 V/m; Power Drift = -0.0013 dB
Peak SAR (extrapolated) = 12.608 W/kg
SAR(1 g) = 7.11 mW/g; SAR(10 g) = 3.76 mW/g
Maximum value of SAR (measured) = 8.028 mW/g

DASY5, SAM - System Performance Check Template, Rev.2 (12-Sept-11)/Daily SPC Check/Z-Axis Retraction (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 8.036 mW/g


mW/g
8.036
6.429
4.822
3.214
1.607
2.02e-005


SAR(x,y,z,f0)
SAR;Z-Axis Retraction:Value Along Z, X=0, Y=0
Markers
mW/g
m
0
1
2
3
4
5
6
7
8
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16

Date/Time: 10/16/2011 12:07:01 PM

Test Laboratory: MOTOROLA MOBILITY 2450 System Performance Check

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:789;
Procedure Notes: PM1 Power = 200 mW Refl.Pwr PM3 = -23.9 dB Sim.Temp@SPC = 21.2 Room Temp @ SPC = 21.5

Communication System: CW - Dipole; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: Validation *HEAD Tissue* ; Medium parameters used: f = 2450 MHz; σ = 1.85 mho/m; ε_r = 37.4; ρ = 1000 kg/m^3

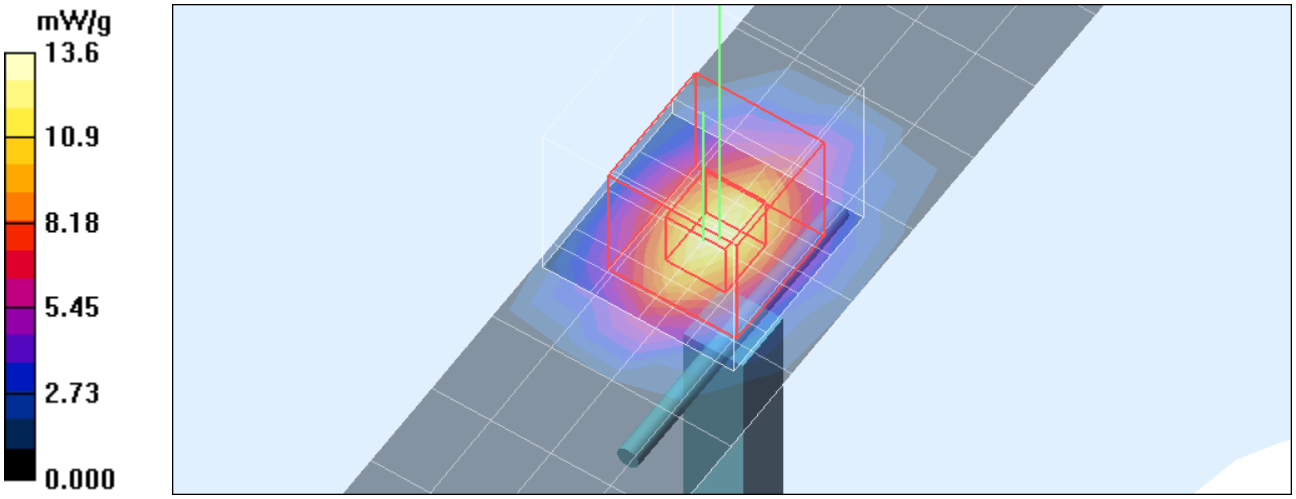
DASY4 Configuration:

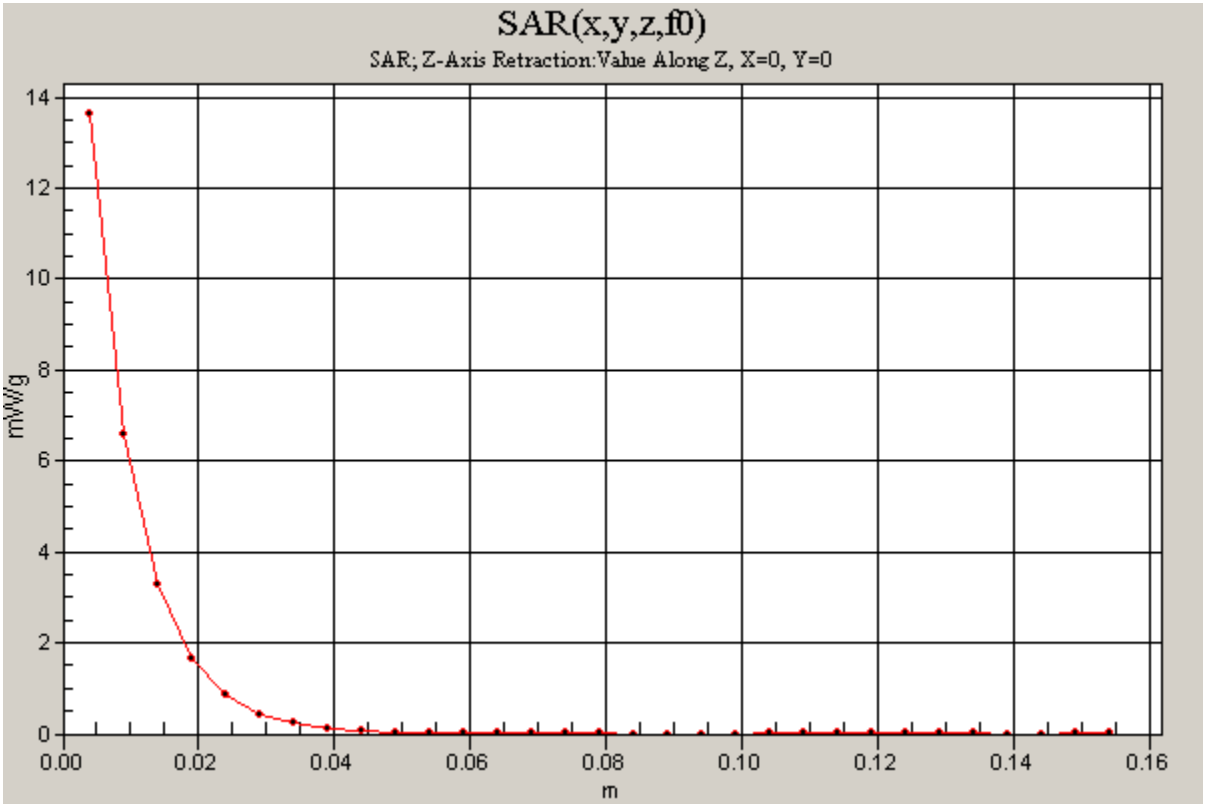
- Probe: ES3DV3 - SN3191; ConvF(4.49, 4.49, 4.49); Calibrated: 4/7/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn690; Calibrated: 4/13/2011
- Phantom: R11_ Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1160;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (5x15x1): Measurement grid: dx=10mm, dy=15mm
Maximum value of SAR (measured) = 13.1 mW/g

Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 85.7 V/m; Power Drift = -0.030 dB
Peak SAR (extrapolated) = 25.5 W/kg
SAR(1 g) = 12 mW/g; SAR(10 g) = 5.55 mW/g
Maximum value of SAR (measured) = 13.3 mW/g

Daily SPC Check/Z-Axis Retraction (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 13.6 mW/g


mW/g
13.6
10.9
8.18
5.45
2.73
0.000


SAR(x,y,z,f0)
SAR; Z-Axis Retraction:Value Along Z, X=0, Y=0
mW/g
m
0
2
4
6
8
10
12
14
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16

Date/Time: 10/17/2011 4:44:47 PM

Test Laboratory: MOTOROLA 2450 MHz System Performance Check

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:789;
Procedure Notes: PM1 Power = 200 mW Refl.Pwr PM3 = -25.7 dB Sim.Temp@SPC =21.4 Room Temp @ SPC = 21.5

Communication System: CW - Dipole; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: Validation *HEAD Tissue* ; Medium parameters used: f = 2450 MHz; σ = 1.85 mho/m; ε_r = 37.4; ρ = 1000 kg/m^3

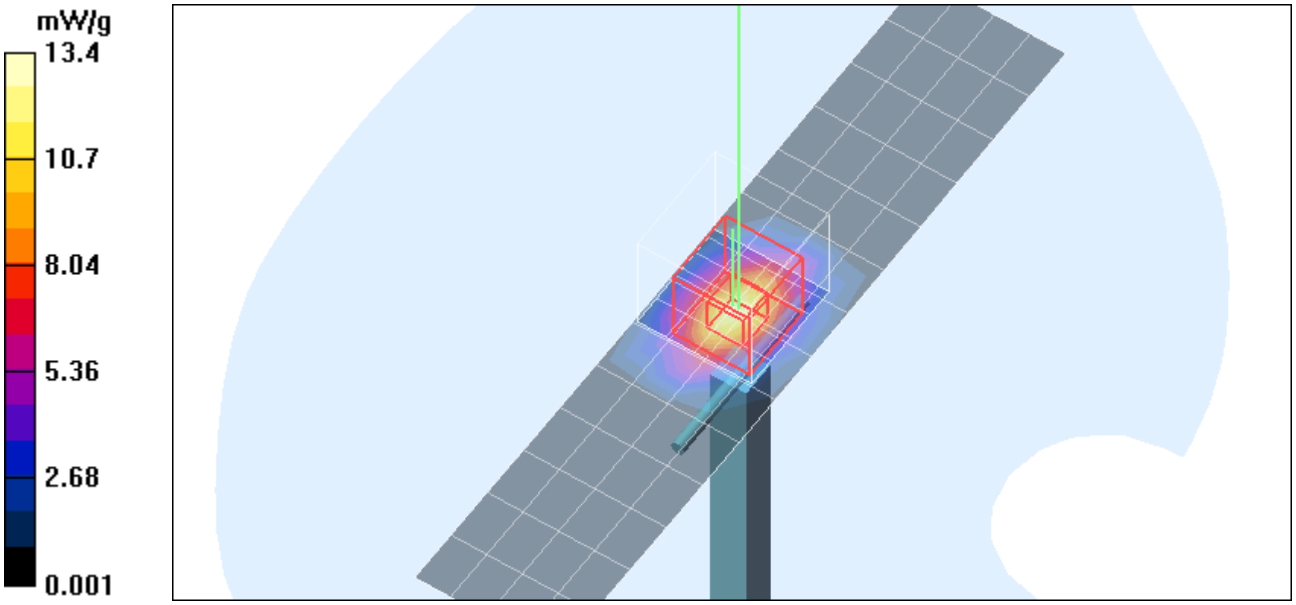
DASY4 Configuration:

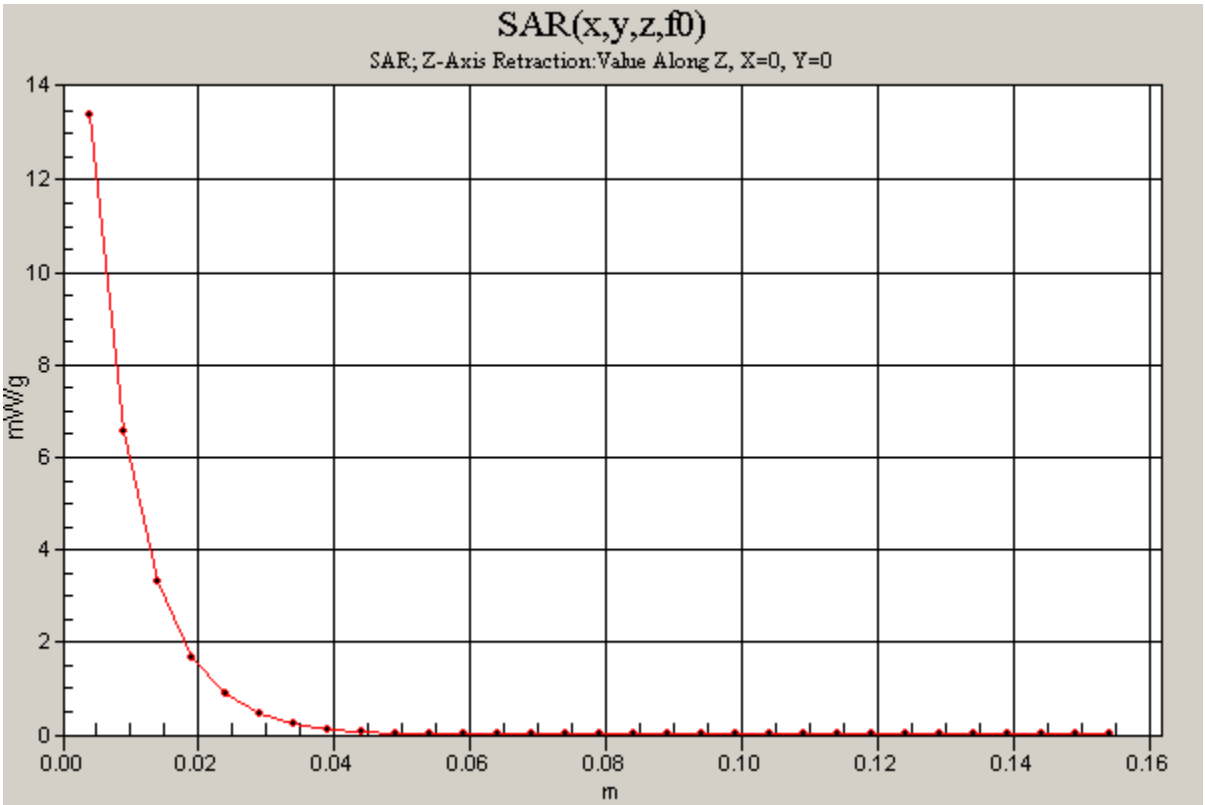
- Probe: ES3DV3 - SN3191; ConvF(4.49, 4.49, 4.49); Calibrated: 4/7/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn690; Calibrated: 4/13/2011
- Phantom: R11_ Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1160;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (5x15x1): Measurement grid: dx=10mm, dy=15mm
Maximum value of SAR (measured) = 13.0 mW/g

Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 85.4 V/m; Power Drift = 0.026 dB
Peak SAR (extrapolated) = 25.4 W/kg
SAR(1 g) = 11.9 mW/g; SAR(10 g) = 5.47 mW/g
Maximum value of SAR (measured) = 13.3 mW/g

Daily SPC Check/Z-Axis Retraction (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 13.4 mW/g


mW/g
13.4
10.7
8.04
5.36
2.68
0.001


SAR(x,y,z,f0)
SAR; Z-Axis Retraction:Value Along Z, X=0, Y=0
mW/g
14
12
10
8
6
4
2
0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
m

Date/Time: 10/3/2011 11:57:38 AM

Test Laboratory: Motorola Mobility 1800 MHz System Performance Check

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:272TR;
Procedure Notes: PM1 Power = 200mW Refl.Pwr PM3 = -27.5dB Sim.Temp@SPC = 20.C Room Temp @ SPC = 21.C

Communication System: CW; Frequency: 1800 MHz; Duty Cycle: 1:1
Medium: Validation *BODY Tissue* ; Medium parameters used: f = 1800 MHz; σ = 1.49 mho/m; ε_r = 51.1; ρ = 1000 kg/m^3

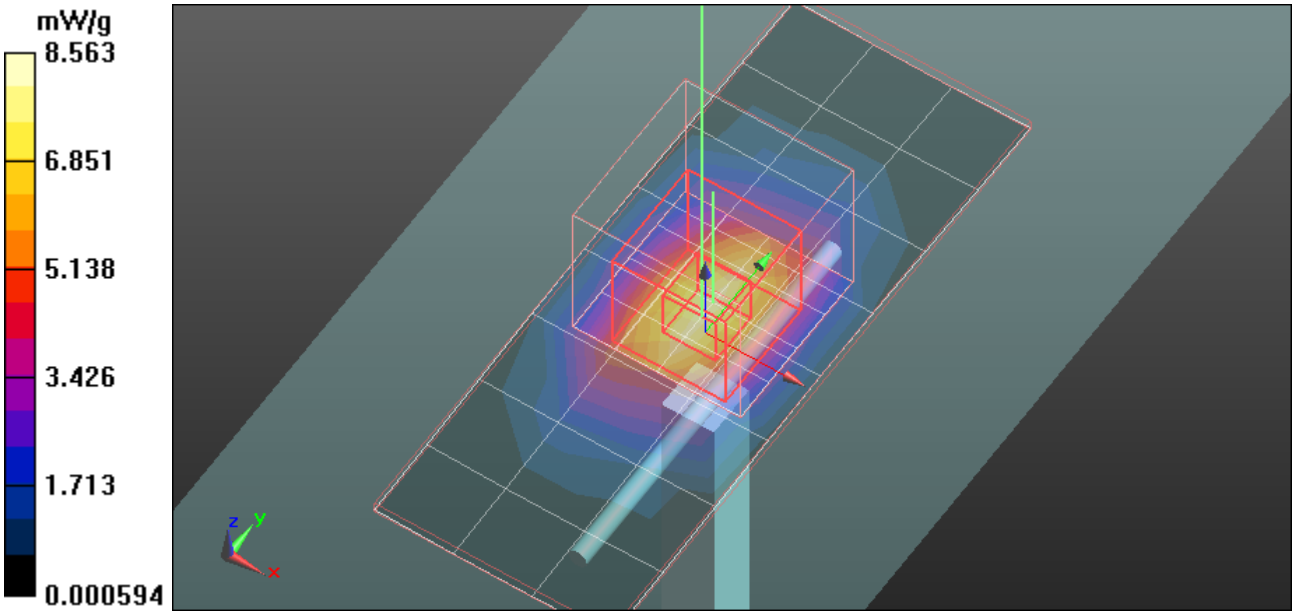
DASY4 Configuration:

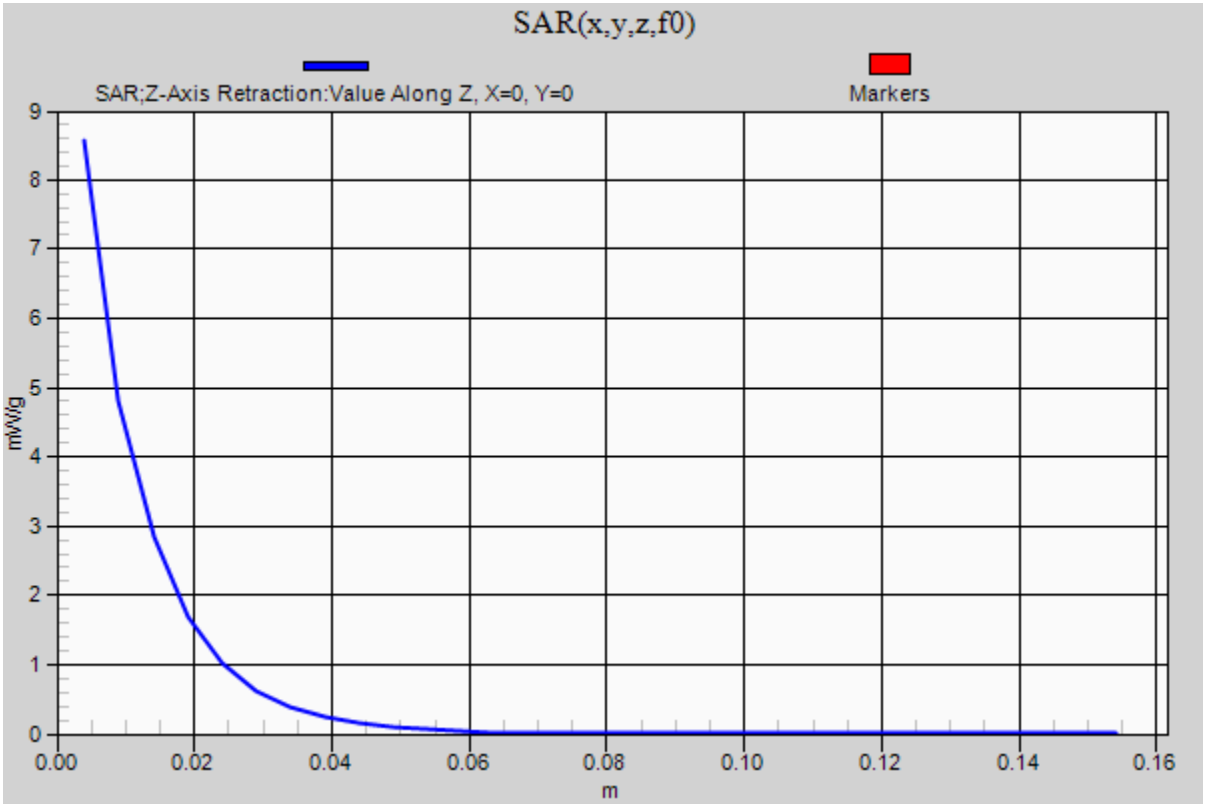
- Probe: ES3DV3 - SN3037; ConvF(4.88, 4.88, 4.88); Calibrated: 4/13/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn650; Calibrated: 6/20/2011
- Phantom: R#4_ Section 2, Amy Twin, Rev1 (24-Aug-11); Type: DASY5 Amy Twin Flat; Serial: n/a;
- ; SEMCAD X Version 14.4.5 (3634)

DASY5, Amy Twin - System Performance Check Template, Rev.1 (7-Sept-11)/Daily SPC Check/Dipole Area Scan (9x4x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 6.124 mW/g

DASY5, Amy Twin - System Performance Check Template, Rev.1 (7-Sept-11)/Daily SPC Check/0-Degree 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 76.841 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 14.118 W/kg
SAR(1 g) = 7.68 mW/g; SAR(10 g) = 4.07 mW/g
Maximum value of SAR (measured) = 8.533 mW/g

DASY5, Amy Twin - System Performance Check Template, Rev.1 (7-Sept-11)/Daily SPC Check/Z-Axis Retraction (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 8.563 mW/g


mW/g
8.563
6.851
5.138
3.426
1.713
0.000594


SAR(x,y,z,f0)
SAR;Z-Axis Retraction:Value Along Z, X=0, Y=0
Markers
mW/g
m
0
1
2
3
4
5
6
7
8
9
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16

Date/Time: 11/1/2011 4:11:37 PM

Test Laboratory: MOTOROLA 2450 MHz System Performance Check

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:788;
Procedure Notes: Power = 200 mW Refl.Pwr PM3 = -30.36dB Sim.Temp@SPC = 21.7 Room Temp @ SPC =21

Communication System: CW - Dipole; Frequency: 2450 MHz: Duty Cycle: 1:1
Medium: Validation *BODY Tissue* ; Medium parameters used: f = 2450 MHz; σ = 1.87 mho/m; ε_r = 52.7; ρ = 1000 kg/m^3

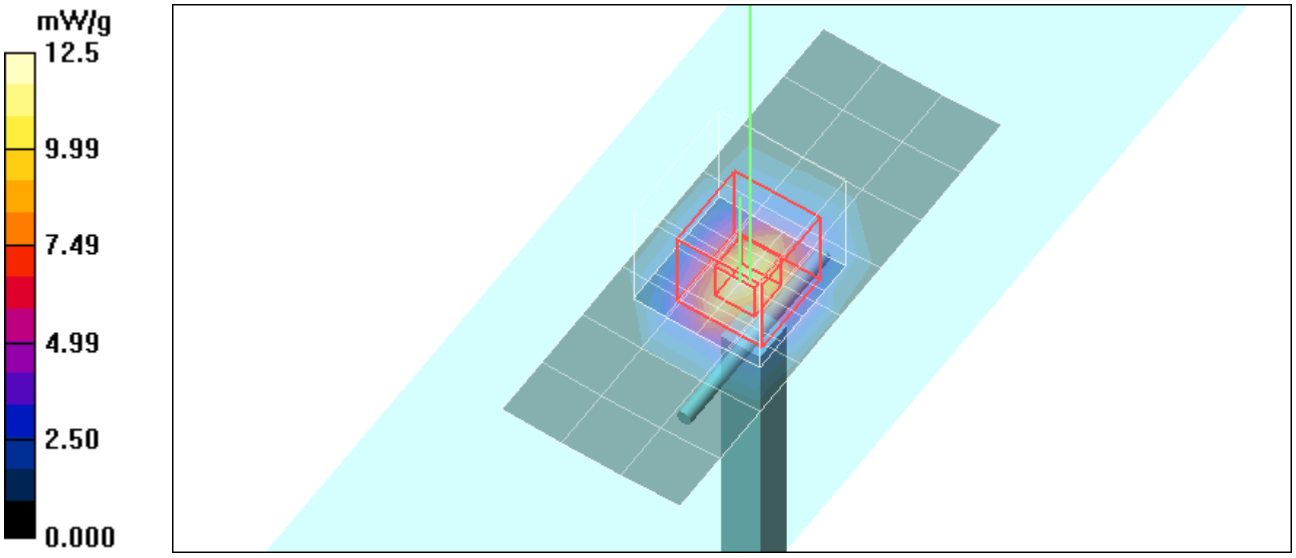
DASY4 Configuration:

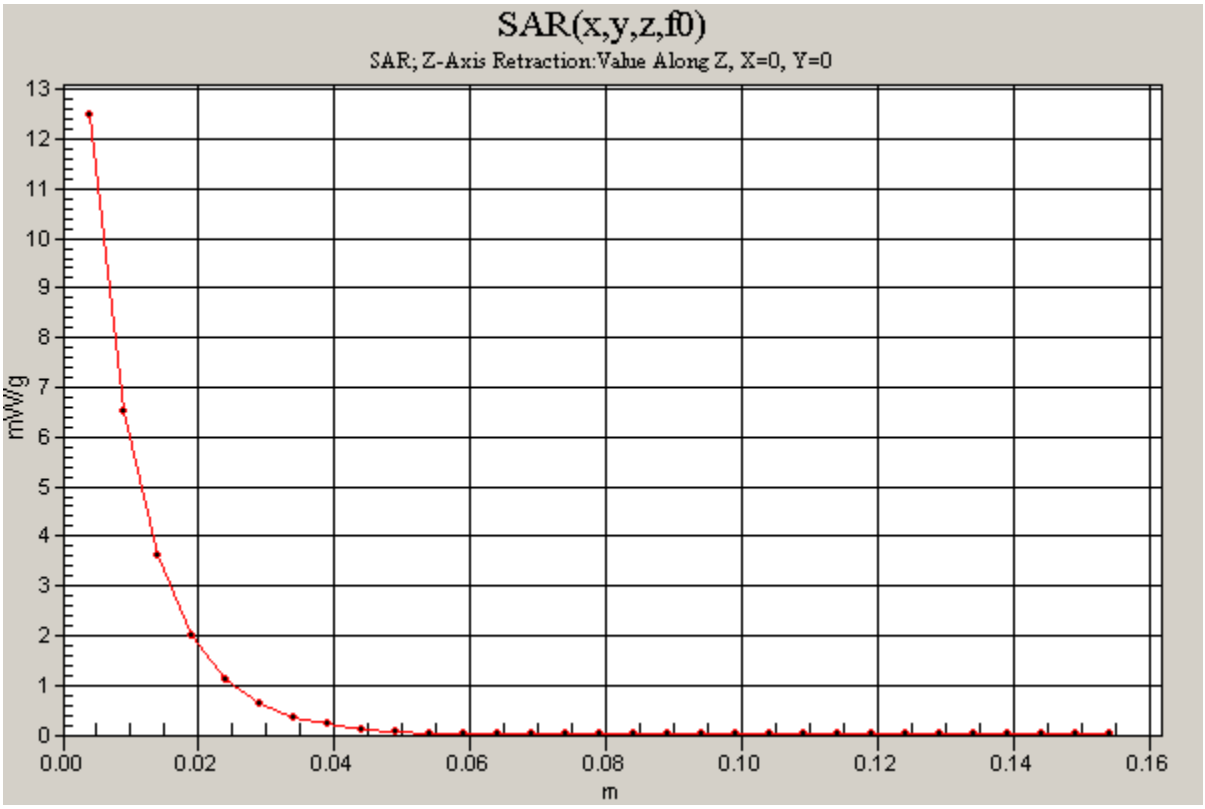
- Probe: ES3DV3 - SN3191; ConvF(4.11, 4.11, 4.11); Calibrated: 4/7/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn690; Calibrated: 4/13/2011
- Phantom: R11_ Section 2, Amy Twin, Rev3 (3-Feb-10); Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (9x4x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 8.20 mW/g

Daily SPC Check/0-Degree 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 80.5 V/m; Power Drift = 0.132 dB
Peak SAR (extrapolated) = 21.9 W/kg
SAR(1 g) = 10.7 mW/g; SAR(10 g) = 5.04 mW/g
Maximum value of SAR (measured) = 12.1 mW/g

Daily SPC Check/Z-Axis Retraction (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 12.5 mW/g


mW/g
12.5
9.99
7.49
4.99
2.50
0.000


SAR(x,y,z,f0)
SAR; Z-Axis Retraction:Value Along Z, X=0, Y=0
mW/g
m
0
1
2
3
4
5
6
7
8
9
10
11
12
13
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16

Appendix 2

SAR distribution plots for Head Adjacent Test Results

Test Laboratory: Motorola Mobility GSM 1900 Cheek Touch

DUT: Serial: 358952040000507; FCC ID: IHDP59MB3
Procedure Notes: Pwr Step: 0 Battery Model #: INTERNAL Test Configuration: CHEEK

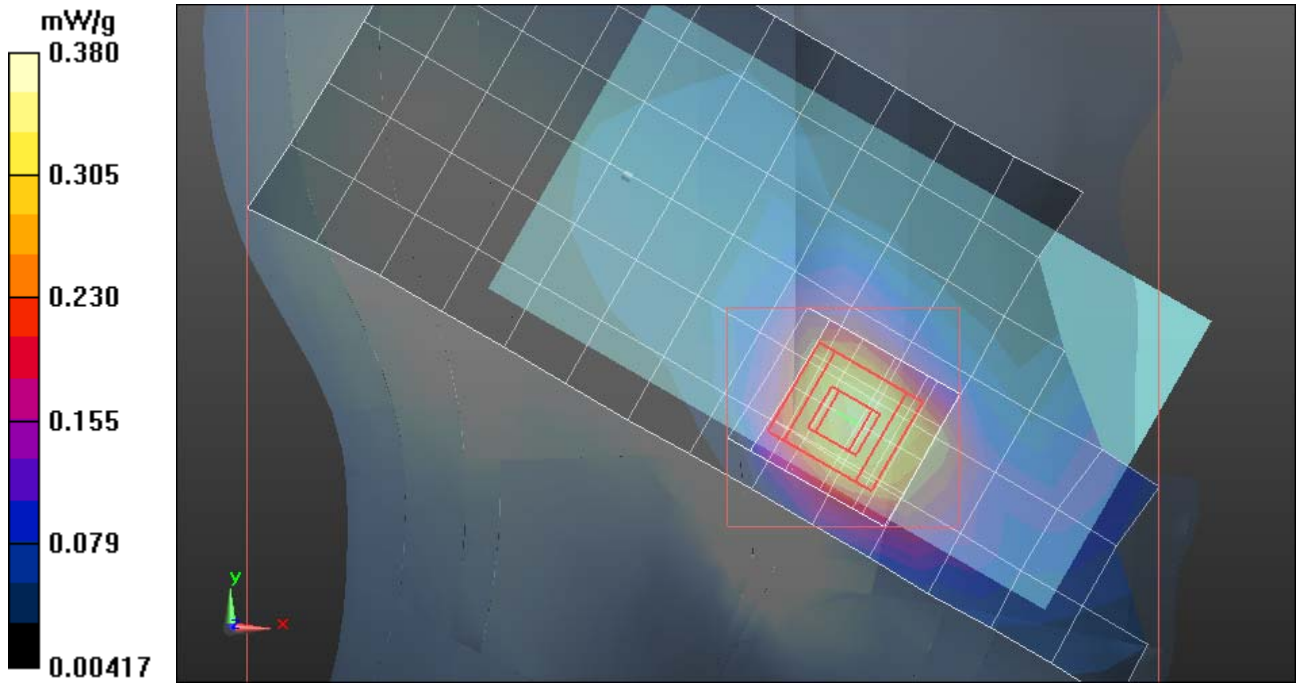
Communication System: Custom GSM for MMI; Frequency: 1880 MHz; Communication System Channel Number: 661; Duty Cycle: 1:8.30042
Medium: Regular Glycol Head 1750/1880; Medium parameters used: f = 1880 MHz; σ = 1.45 mho/m; ε_r = 38.7; ρ = 1000 kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3037; ConvF(5.28, 5.28, 5.28); Calibrated: 4/13/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn650; Calibrated: 6/20/2011
- Phantom: R#4_ Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1162;
- SEMCAD X Version 14.4.5 (3634)

DASY5, SAM - Phone against Left Head Template, Rev.3 (29-Sept-11)/Left Head Template/Area Scan - Normal (15mm) (7x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.341 mW/g

DASY5, SAM - Phone against Left Head Template, Rev.3 (29-Sept-11)/Left Head Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.377 V/m; Power Drift = -0.55 dB
Peak SAR (extrapolated) = 0.530 W/kg
SAR(1 g) = 0.349 mW/g; SAR(10 g) = 0.210 mW/g
Maximum value of SAR (measured) = 0.380 mW/g



Date/Time: 10/18/2011 11:15:17 AM

Test Laboratory: MOTOROLA 2450 MHz WiFi Cheek Touch

DUT: Serial: 58952040008385; FCCID: IHDP56MB3
Procedure Notes: Wi-Fi 802.11b 5.5Mbps Chn 11 Battery Model: INTERNAL Test Configuration: Cheek Touch

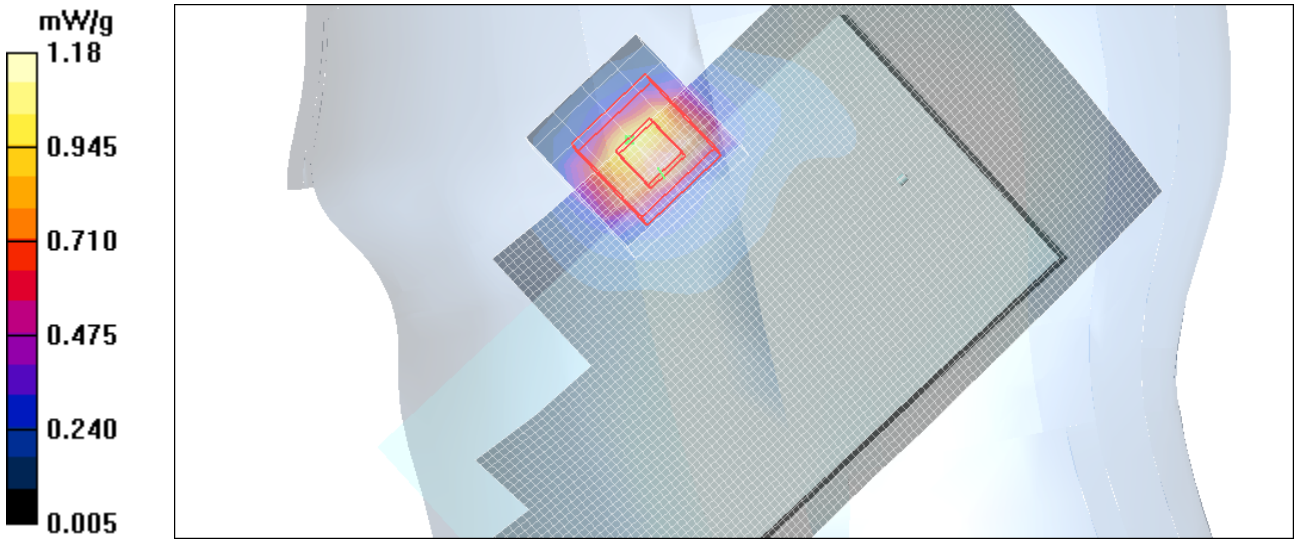
Communication System: Wi-Fi 2450; Frequency: 2462 MHz; Communication System Channel Number: 11; Duty Cycle: 1:1
Medium: 2450 Glycol Head; Medium parameters used: f = 2450 MHz; σ = 1.85 mho/m; ε_r = 37.4; ρ = 1000 kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3191; ConvF(4.49, 4.49, 4.49); Calibrated: 4/7/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn690; Calibrated: 4/13/2011
- Phantom: R11_ Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1160;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Right Head Template/Area Scan - Normal (15mm) (61x161x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.13 mW/g

Right Head Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.69 V/m; Power Drift = 0.178 dB
Peak SAR (extrapolated) = 2.90 W/kg
SAR(1 g) = 1.17 mW/g; SAR(10 g) = 0.472 mW/g
Maximum value of SAR (measured) = 1.18 mW/g



Test Laboratory: Motorola Mobility GSM 1900 15 Degree Tilt

DUT: Serial: 358952040000507; FCC ID: IHDP56MB3
Procedure Notes: Pwr Step: 0 Battery Model #: INTERNAL Test Configuration: 15 Degree TILT

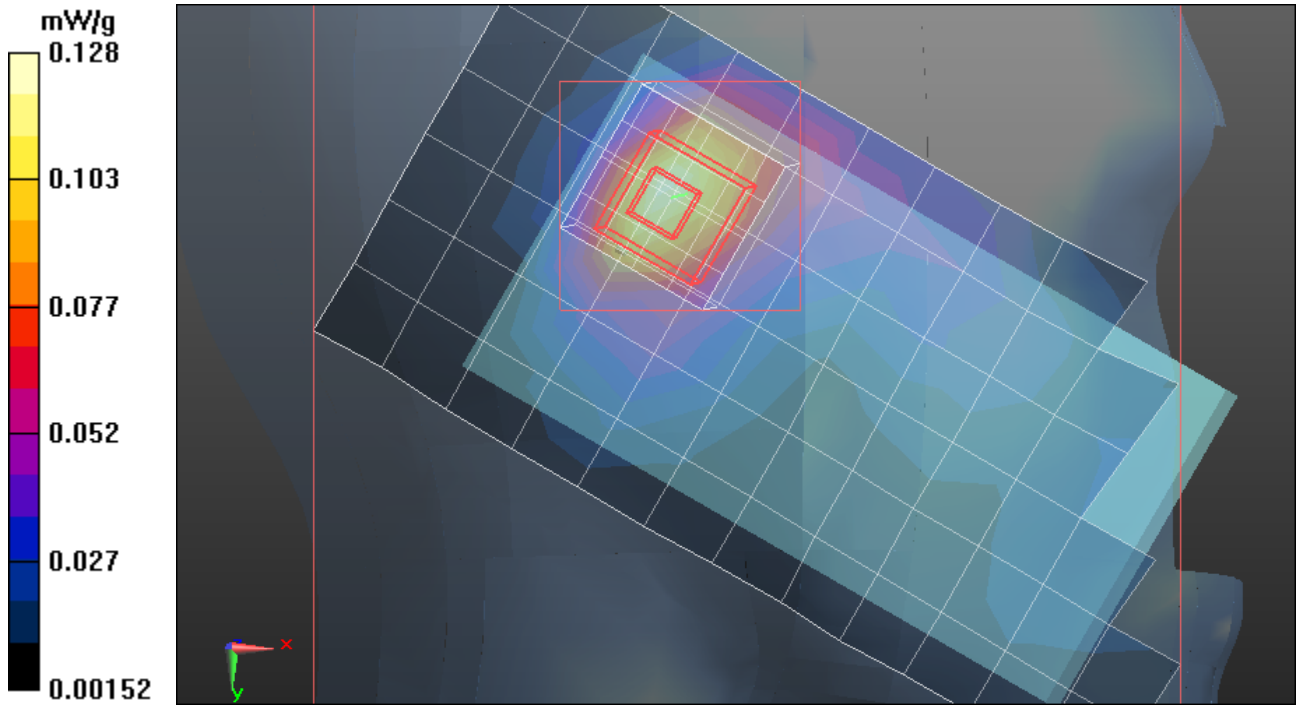
Communication System: Custom GSM for MMI; Frequency: 1880 MHz; Communication System Channel Number: 661; Duty Cycle: 1:8.30042
Medium: Regular Glycol Head 1750/1880; Medium parameters used: f = 1880 MHz; σ = 1.45 mho/m; ε_r = 38.7; ρ = 1000 kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3037; ConvF(5.28, 5.28, 5.28); Calibrated: 4/13/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn650; Calibrated: 6/20/2011
- Phantom: R#4_ Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1162;
- SEMCAD X Version 14.4.5 (3634)

DASY5, SAM - Phone against RIGHT head template - Rev.2 (29-Sept-11)/Right Head Template/Area Scan - Normal (15mm) (7x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.126 mW/g

DASY5, SAM - Phone against RIGHT head template - Rev.2 (29-Sept-11)/Right Head Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.464 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 0.187 W/kg
SAR(1 g) = 0.117 mW/g; SAR(10 g) = 0.068 mW/g
Maximum value of SAR (measured) = 0.128 mW/g



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Test Laboratory: Motorola 2450 MHz WiFi 15 Degree Tilt

DUT: Dinara; Serial: 58952040008385; FCC ID: IHDP56MB3
Procedure Notes: Wi-Fi 802.11b 1Mbps Chn 1 Battery Model: INTERNAL Test Configuration: 15 Degree Tilt

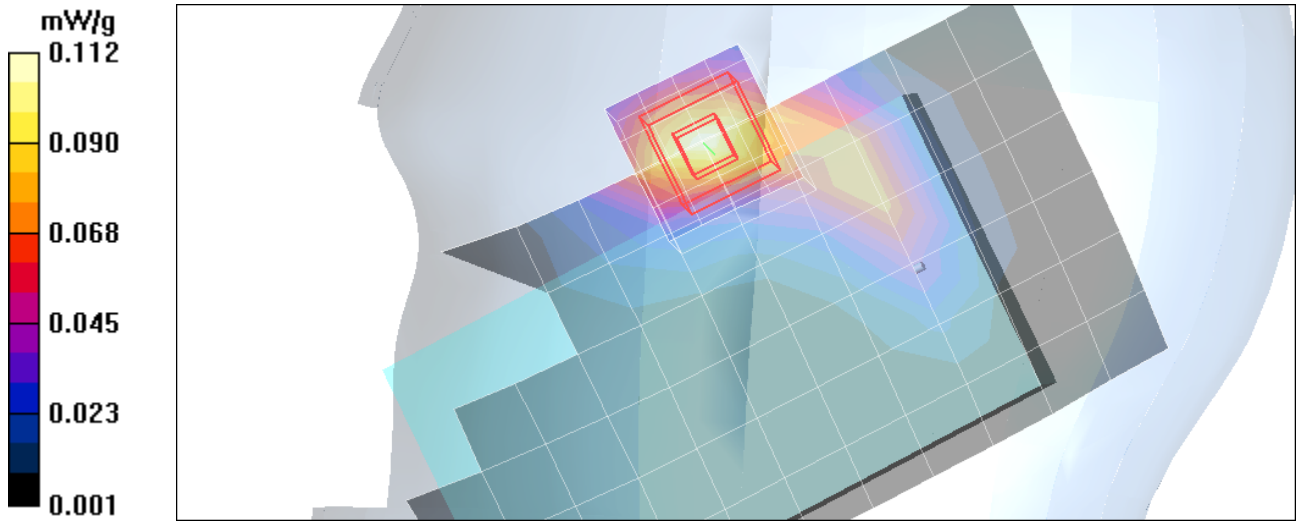
Communication System: Wi-Fi 2450; Frequency: 2412 MHz; Communication System Channel Number: 1; Duty Cycle: 1:1
Medium: 2450 Glycol Head; Medium parameters used: f = 2450 MHz; σ = 1.85 mho/m; ε_r = 37.4; ρ = 1000 kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3191; ConvF(4.49, 4.49, 4.49); Calibrated: 4/7/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn690; Calibrated: 4/13/2011
- Phantom: R11_ Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1160;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Right Head Template/Area Scan - Normal (15mm) (7x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.113 mW/g

Right Head Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.45 V/m; Power Drift = -0.020 dB
Peak SAR (extrapolated) = 0.191 W/kg
SAR(1 g) = 0.100 mW/g; SAR(10 g) = 0.052 mW/g
Maximum value of SAR (measured) = 0.112 mW/g



Appendix 3

SAR distribution plots for Body Worn Test Results

Test Laboratory: Motorola Mobility GSM 1900 Body Worn

DUT: Serial: 358952040000507; FCC ID: IHDP56MB3
Procedure Notes: Pwr Step: 0 Battery Model: INTERNAL Test Configuration: back 25mm

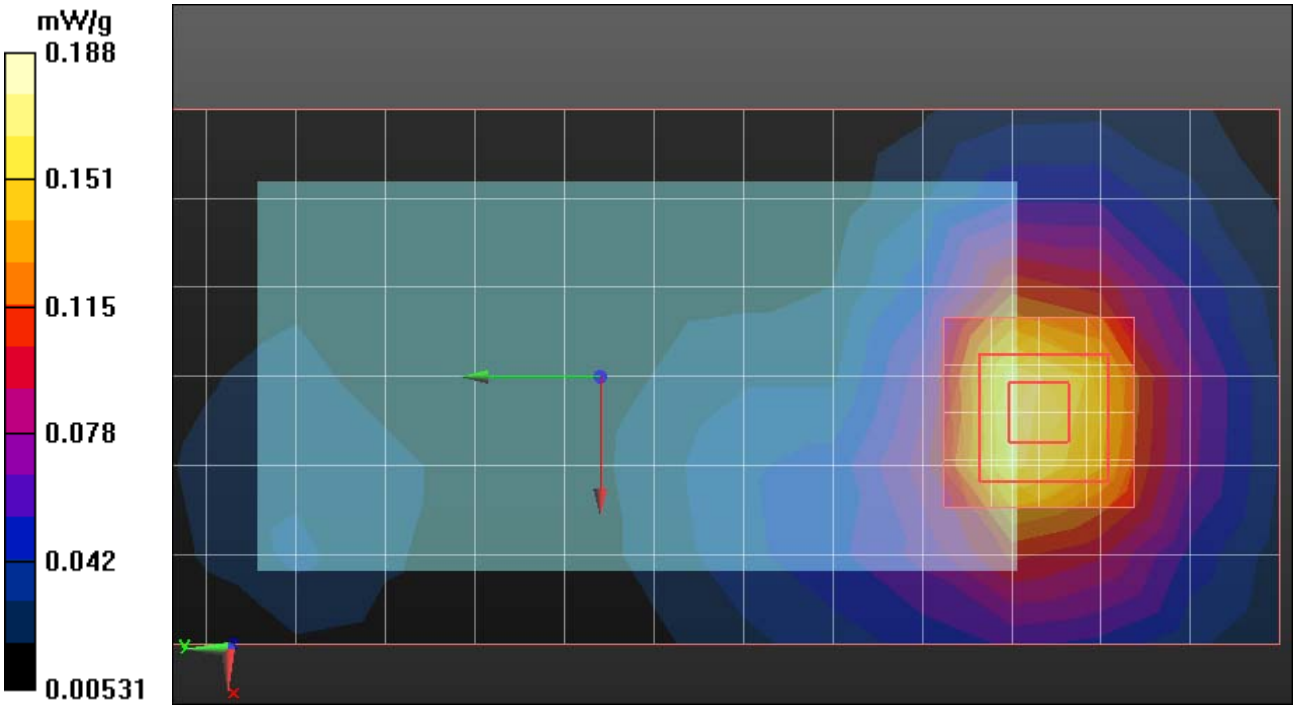
Communication System: Custom GSM for MMI; Frequency: 1880 MHz; Communication System Channel Number: 661; Duty Cycle: 1:8.30042
Medium: Regular Glycol Body 1750/1880; Medium parameters used: f = 1880 MHz; σ = 1.58 mho/m; ε_r = 50.8; ρ = 1000 kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3037; ConvF(4.88, 4.88, 4.88); Calibrated: 4/13/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn650; Calibrated: 6/20/2011
- Phantom: R#4_ Section 2, Amy Twin, Rev1 (24-Aug-11); Type: DASY5 Amy Twin Flat; Serial: n/a;
- SEMCAD X Version 14.4.5 (3634)

DASY5, Amy Twin Phone Template - Rev.1 (7-Sept-11)/Amy Twin Phone Template/Area Scan - Normal Extended Body (15mm) (16x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.172 mW/g

DASY5, Amy Twin Phone Template - Rev.1 (7-Sept-11)/Amy Twin Phone Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.296 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.281 W/kg
SAR(1 g) = 0.174 mW/g; SAR(10 g) = 0.107 mW/g
Maximum value of SAR (measured) = 0.188 mW/g



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Test Laboratory: MOTOROLA 2450 MHz WiFi Body Worn

DUT: Serial: 58952040008385; FCC ID: IHDP56MB3
Procedure Notes: Pwr Step: 11Mbps Chn Battery Model: Internal Test Configuration: FRONT OF PHONE 25MM FROM PHANTOM

Communication System: Wi-Fi 2450; Frequency: 2462 MHz; Communication System Channel Number: 11; Duty Cycle: 1:1
Medium: 2450 Glycol Body; Medium parameters used: f = 2450 MHz; σ = 1.87 mho/m; ε_r = 52.7; ρ = 1000 kg/m^3

DASY4 Configuration:

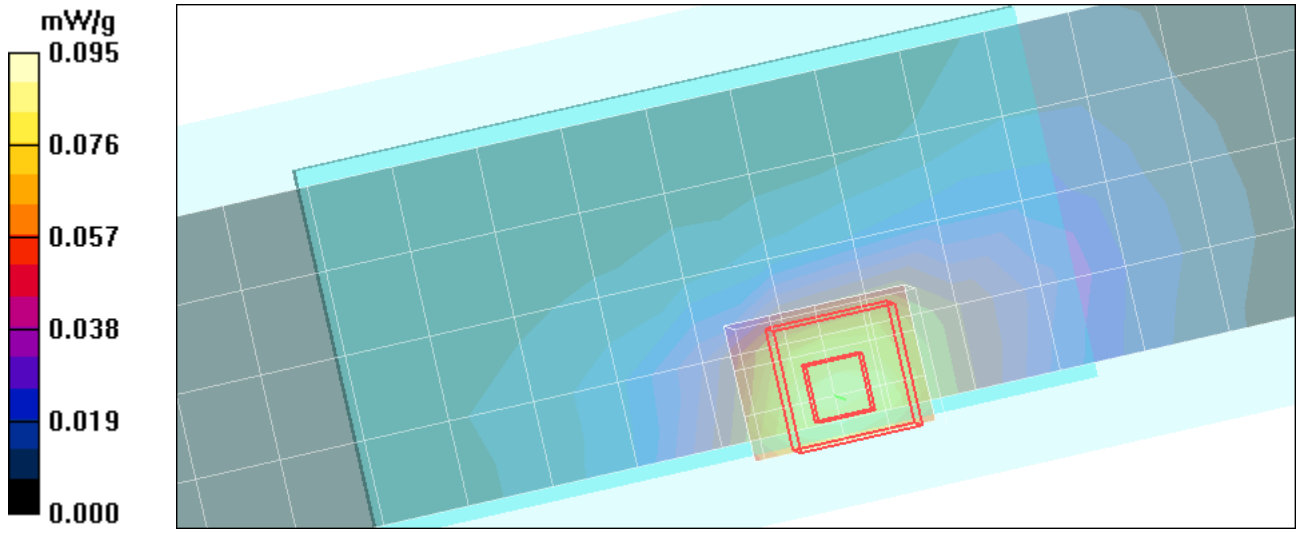
- Probe: ES3DV3 - SN3191; ConvF(4.11, 4.11, 4.11); Calibrated: 4/7/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn690; Calibrated: 4/13/2011
- Phantom: R11_ Section 2, Amy Twin, Rev3 (3-Feb-10); Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Amy Twin Phone Template/Area Scan - Normal Extended Body (15mm) (16x7x1):

Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.082 mW/g

Amy Twin Phone Template/5x5x7 Zoom Scan (<=3GHz), - to correct max out (5x5x7)/Cube 0:

Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.91 V/m; Power Drift = -0.052 dB
Peak SAR (extrapolated) = 0.152 W/kg
SAR(1 g) = 0.088 mW/g; SAR(10 g) = 0.049 mW/g
Maximum value of SAR (measured) = 0.095 mW/g



Appendix 4

Measurement Uncertainty Budget

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	**IEEE 1528 section**	**Tol. (± %)**	**Prob Dist**	**Div.**	**c_i (1 g)**	**c_i (10 g)**	**1 g u_i (±%)**	**10 g u_i (±%)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	5.9	N	1.00	1	1	5.9	5.9	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	1.1	R	1.73	1	1	0.6	0.6	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mech. Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
Test sample Related									
Test Sample Positioning	E.4.2	3.2	N	1.00	1	1	3.2	3.2	29
Device Holder Uncertainty	E.4.1	4.0	N	1.00	1	1	4.0	4.0	8
SAR drift	6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	1.4	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	N	1.00	0.6	0.49	1.1	0.9	∞
Combined Standard Uncertainty			RSS				11.1	10.8	411
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				22.2	21.6	

Appendix 5

Probe Calibration Certificate

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

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

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

Accreditation No.: **SCS 108**

Client **Motorola MDb**

Certificate No: **ES3-3037_Apr11/2**

CALIBRATION CERTIFICATE (Replacement of No: ES3-3037_Apr11)

Object	ES3DV3 - SN:3037
Calibration procedure(s)	QA CAL-01.v7, QA CAL-23.v4, QA CAL-25.v3 Calibration procedure for dosimetric E-field probes
Calibration date:	April 13, 2011

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	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41495277	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41498087	31-Mar-11 (No. 217-01372)	Apr-12
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-11 (No. 217-01369)	Apr-12
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Reference 30 dB Attenuator	SN: S5129 (30b)	29-Mar-11 (No. 217-01370)	Apr-12
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
DAE4	SN: 654	23-Apr-10 (No. DAE4-654_Apr10)	Apr-11
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: July 26, 2011

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

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

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,y,z: A, B, C* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ES3DV3

SN:3037

Manufactured: August 21, 2003
Calibrated: April 13, 2011

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3037

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.14	0.85	0.97	± 10.1 %
DCP (mV)[B]	106.0	104.5	103.5	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	146.0	±2.5 %
			Y	0.00	0.00	1.00	119.8	
			Z	0.00	0.00	1.00	129.2	

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 E^2-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:3037

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [G]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	41.5	0.90	6.15	6.15	6.15	0.98	1.08	± 12.0 %
1810	40.0	1.40	5.28	5.28	5.28	0.64	1.47	± 12.0 %
1950	40.0	1.40	5.02	5.02	5.02	0.69	1.34	± 12.0 %
2450	39.2	1.80	4.51	4.51	4.51	0.65	1.36	± 12.0 %

[G] 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:3037

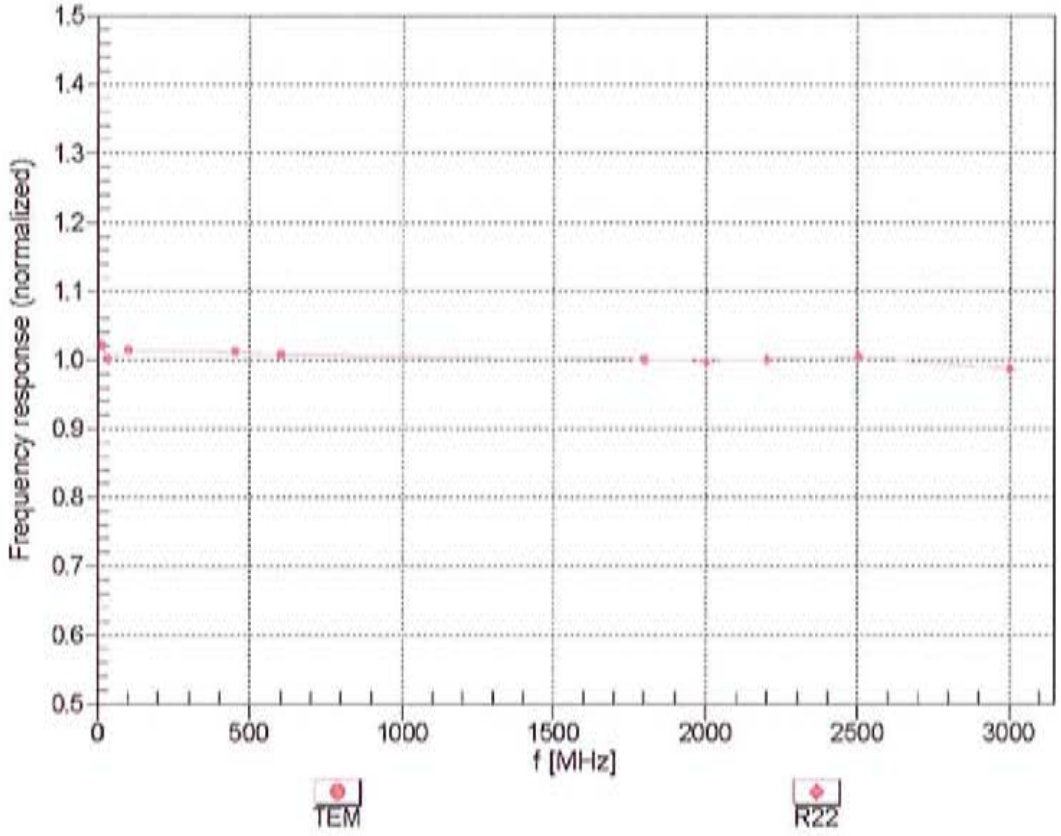
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [G]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	55.2	0.97	6.08	6.08	6.08	1.00	1.10	± 12.0 %
1810	53.3	1.52	4.88	4.88	4.88	0.68	1.22	± 12.0 %
1950	53.3	1.52	4.81	4.81	4.81	0.80	1.25	± 12.0 %
2450	52.7	1.95	4.24	4.24	4.24	0.79	1.18	± 12.0 %

[G] 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

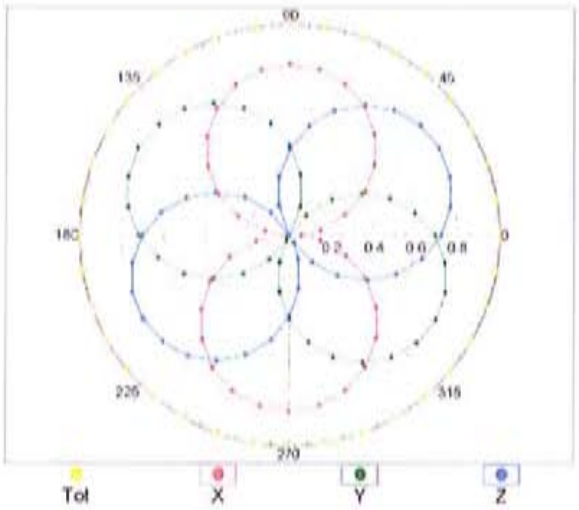
(TEM-Cell:ifi110 EXX, Waveguide: R22)



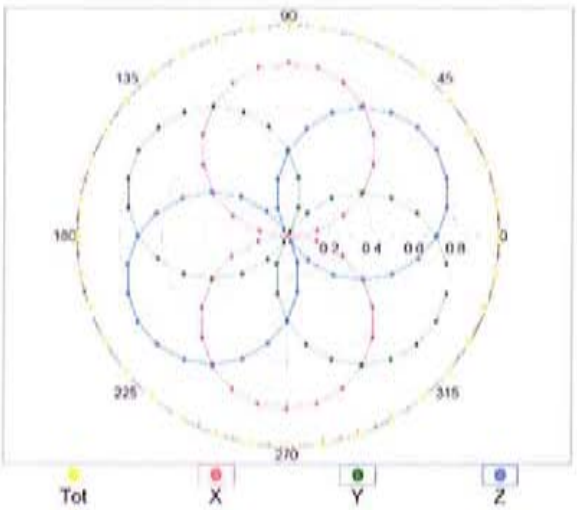
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

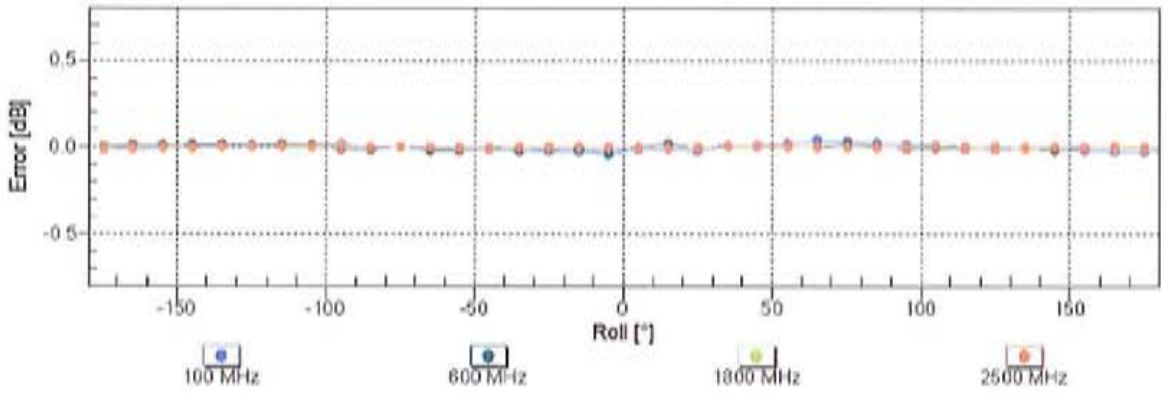
Receiving Pattern (ϕ), $\vartheta = 0°$

f=600 MHz,TEM



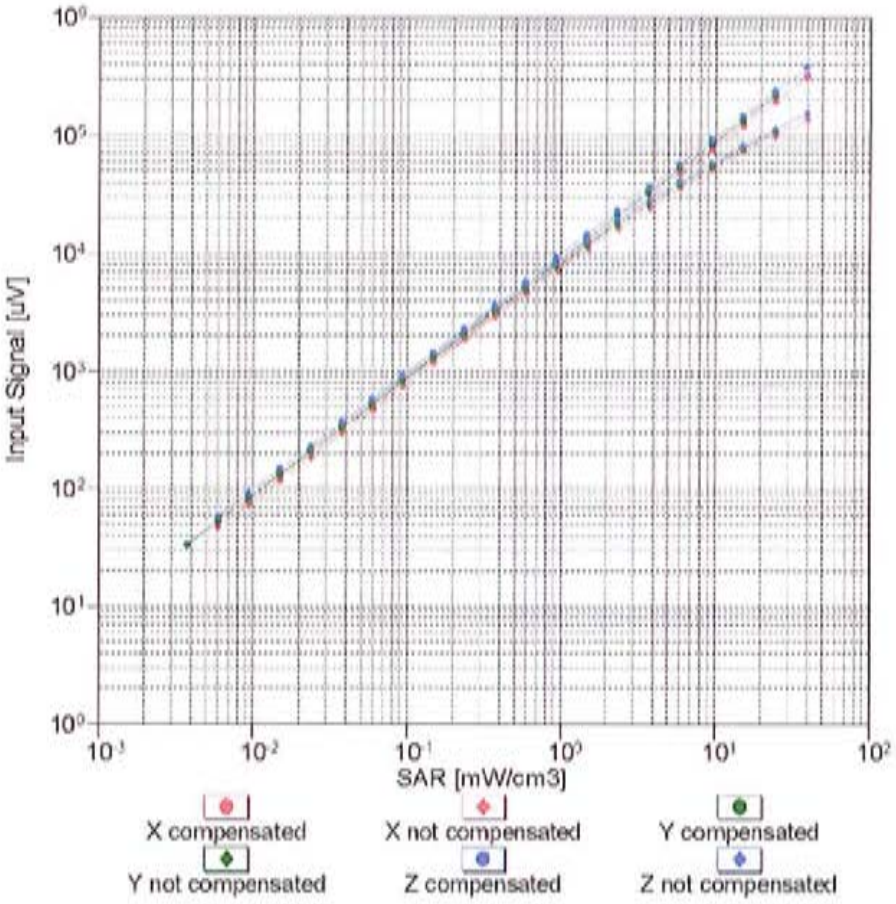
f=1800 MHz,R22

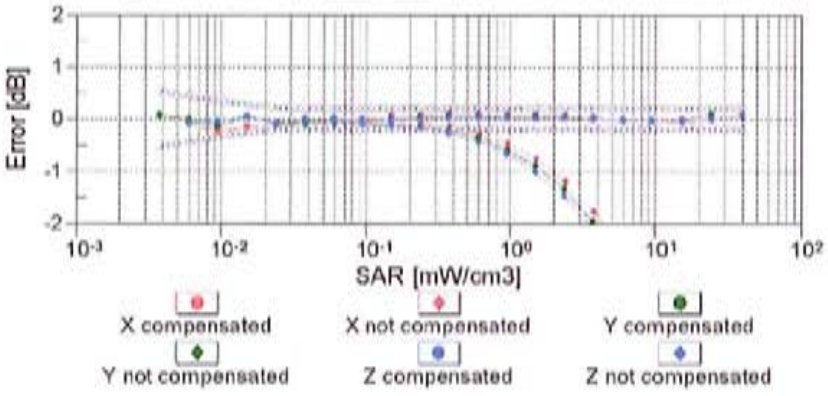




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

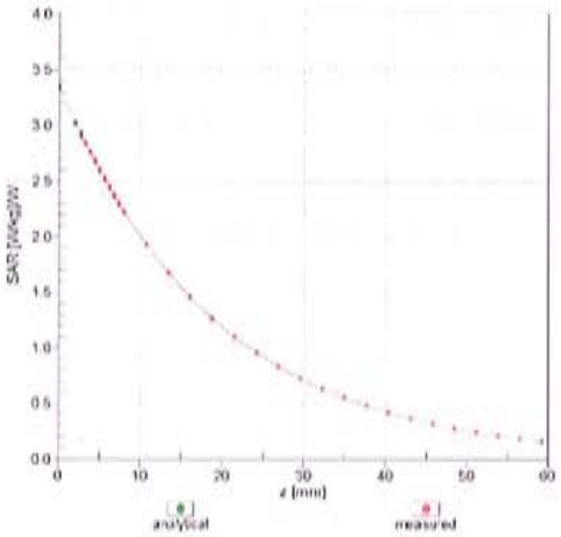




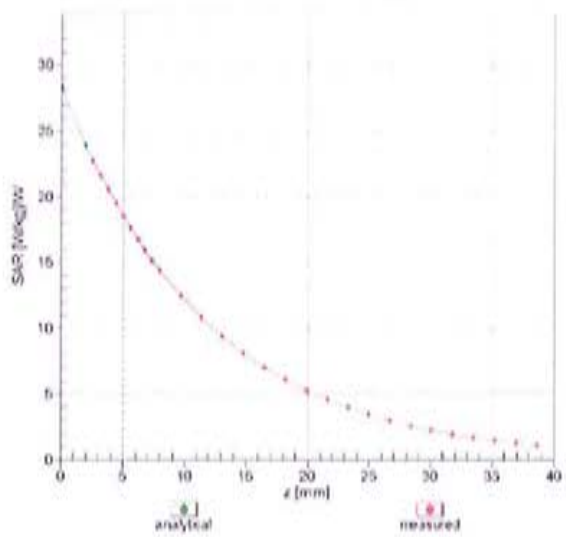
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

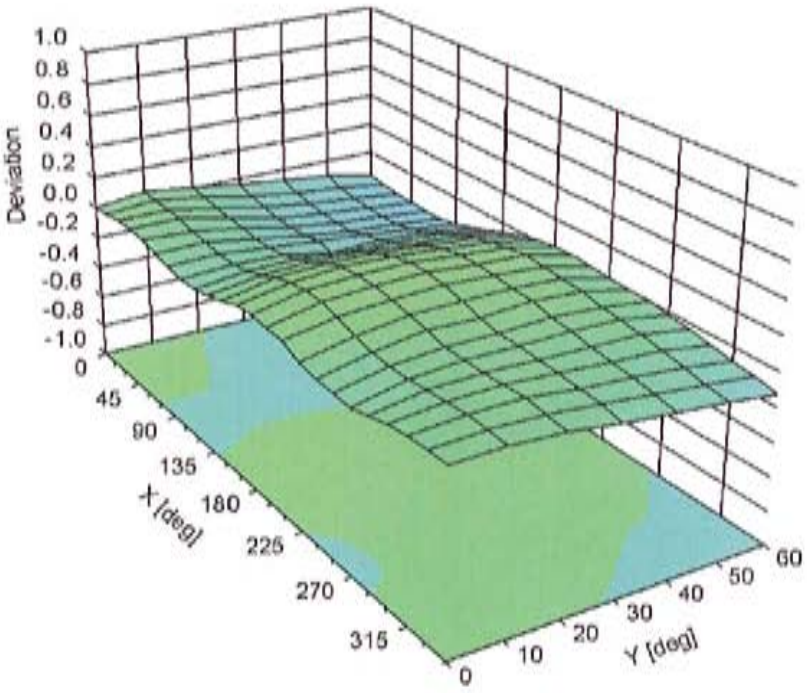


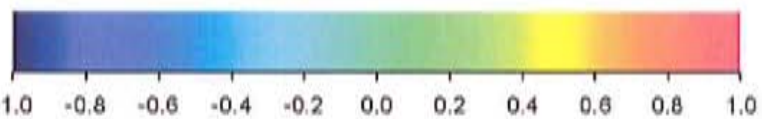
f = 1950 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3037

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
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

Calibration Laboratory of
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Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
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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 Motorola Beijing

Certificate No: ES3-3191_Apr11

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3191

Calibration procedure(s): QA CAL-01.v7, QA CAL-23.v4, QA CAL-25.v3
Calibration procedure for dosimetric E-field probes

Calibration date: April 7, 2011

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	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41495277	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41498087	31-Mar-11 (No. 217-01372)	Apr-12
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-11 (No. 217-01369)	Apr-12
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Reference 30 dB Attenuator	SN: S5129 (30b)	29-Mar-11 (No. 217-01370)	Apr-12
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
DAE4	SN: 654	23-Apr-10 (No. DAE4-654_Apr10)	Apr-11
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 14, 2011

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

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Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z* are numerical linearization parameters in dB assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media.
- *VR:* VR is the validity range of the calibration related to the average diode voltage or DAE voltage in mV.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ES3DV3

SN:3191

Manufactured: June 16, 2008
Calibrated: April 7, 2011

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3191

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (μV/(V/m)^2)[A]	1.31	1.30	1.36	± 10.1 %
DCP (mV)[B]	88.8	97.6	91.4	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	107.9	±2.7 %
			Y	0.00	0.00	1.00	113.8	
			Z	0.00	0.00	1.00	113.6	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the 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:3191

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	6.15	6.15	6.15	0.99	1.11	± 12.0 %
1810	40.0	1.40	5.21	5.21	5.21	0.75	1.30	± 12.0 %
1950	40.0	1.40	5.01	5.01	5.01	0.86	1.19	± 12.0 %
2450	39.2	1.80	4.49	4.49	4.49	0.70	1.34	± 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.

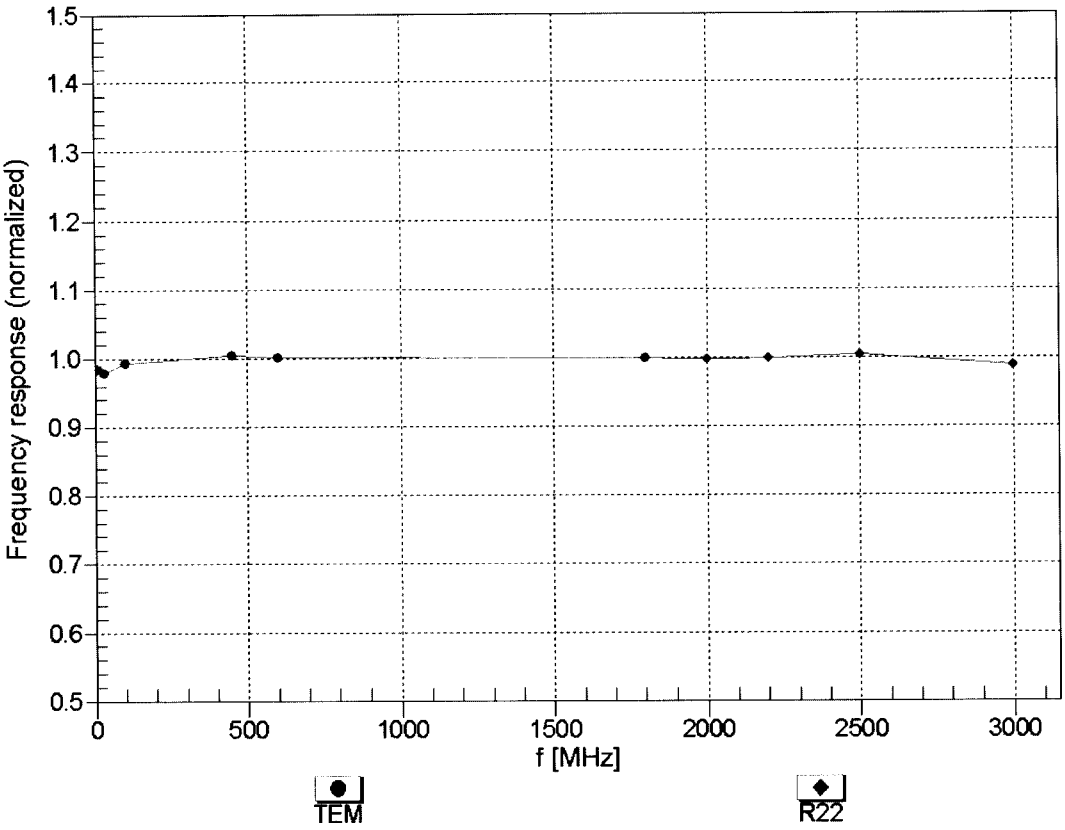
DASY/EASY - Parameters of Probe: ES3DV3- SN:3191

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)
835	55.2	0.97	6.10	6.10	6.10	0.99	1.13	± 12.0 %
1810	53.3	1.52	4.76	4.76	4.76	0.86	1.25	± 12.0 %
1950	53.3	1.52	4.69	4.69	4.69	0.81	1.25	± 12.0 %
2450	52.7	1.95	4.11	4.11	4.11	0.88	1.10	± 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.

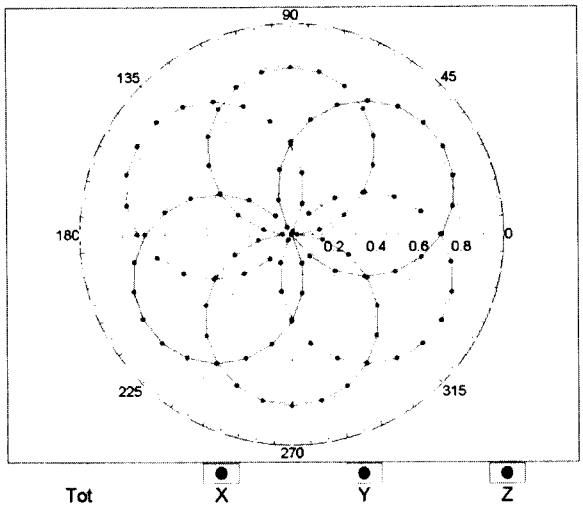
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



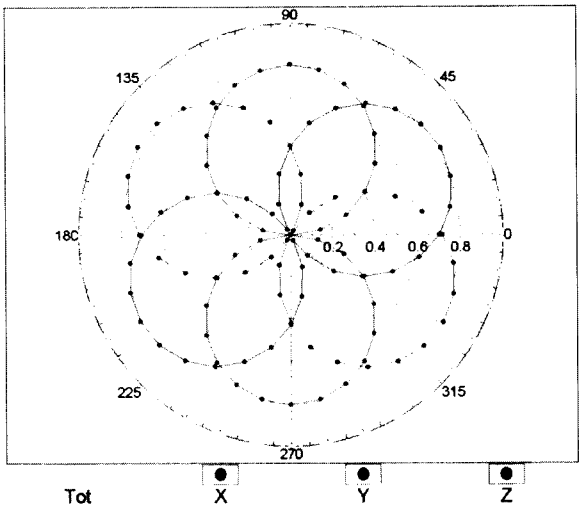
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

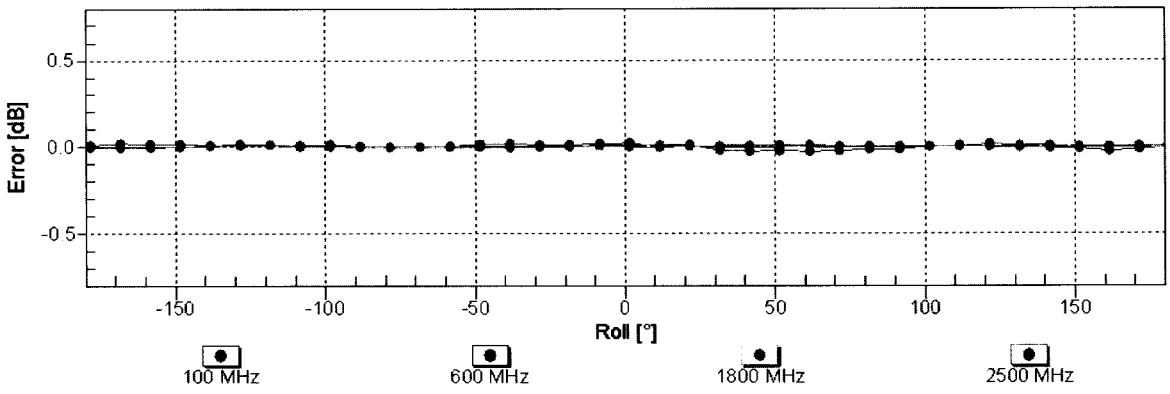
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



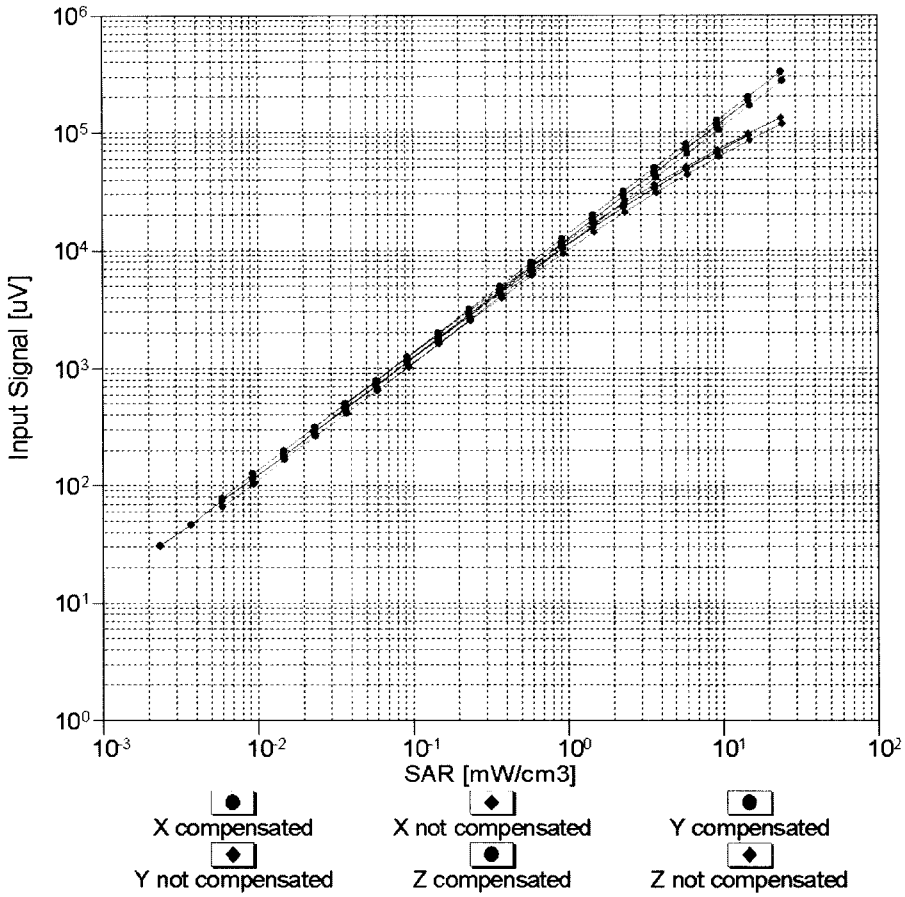
f=1800 MHz,R22

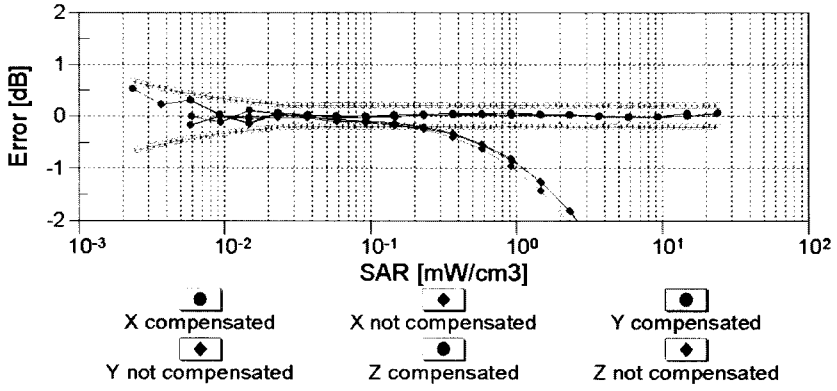




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

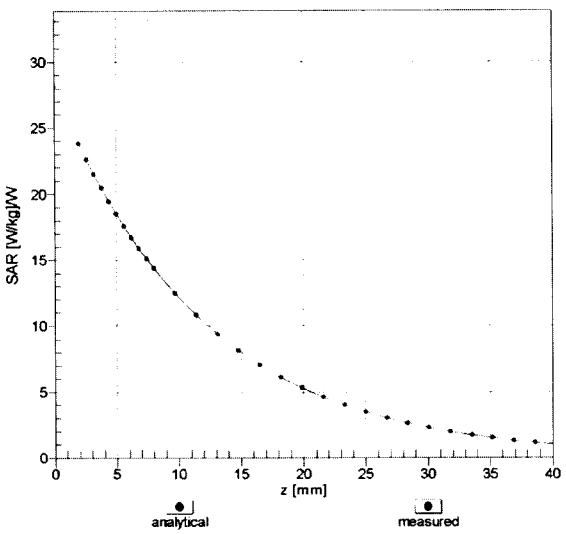




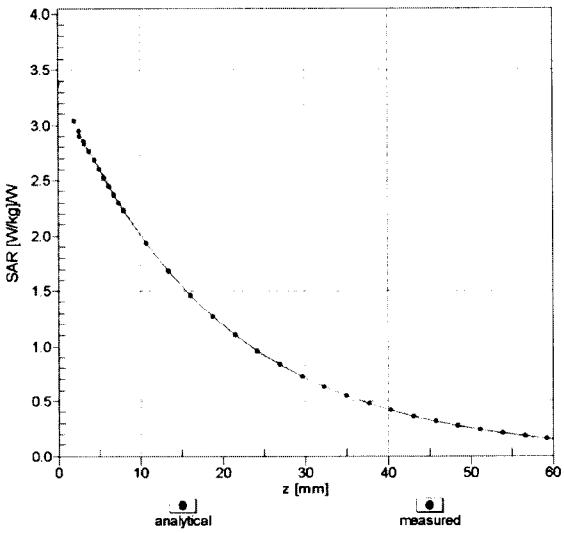
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 1950 MHz,WGLS R22 (H_convF)

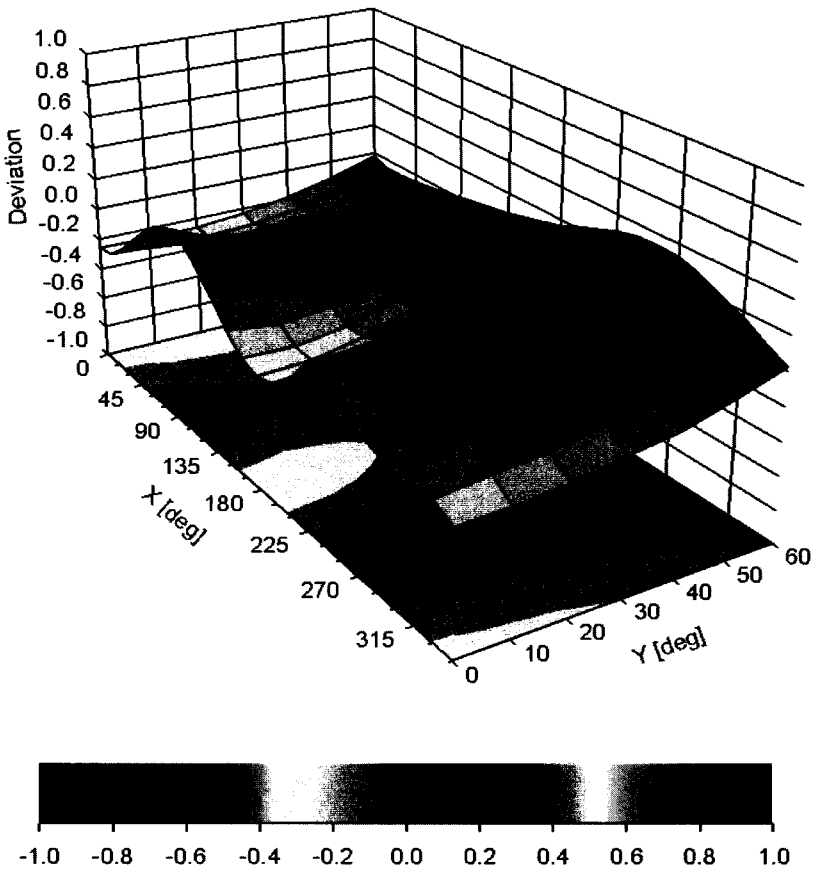


f = 835 MHz,WGLS R9 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3191

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
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

Date: 12.07.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 788

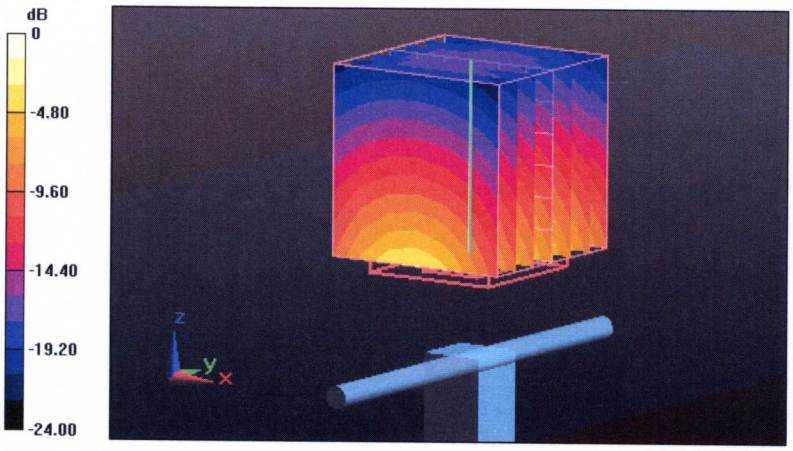
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.028 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 26.823 W/kg
SAR(1 g) = 13 mW/g; SAR(10 g) = 6.02 mW/g
Maximum value of SAR (measured) = 17.108 mW/g



0 dB = 17.110mW/g

Impedance Measurement Plot for Body TSL