



MOTOROLA

Portable Hand-Held Device SAR Test Report

Tests Requested By: Motorola Mobility, Inc.
600 N. US Highway 45
Libertyville, IL 60048

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Date of Report: Oct 17, 2011
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FCC ID #: IHDP56MJ3
Generic Name: M0BA1

Test Laboratory: Motorola Mobility, Inc. - ADR Test Services Laboratory
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This laboratory is accredited to ISO/IEC 17025-2005 to perform the following tests:

Accreditation:



2404

Tests:

Electromagnetic Specific Absorption Rate

Procedures:

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)

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

Motorola declares under its sole responsibility that the portable hand-held device 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:

Statement of Compliance:

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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This test report shall not be reproduced except in full, without written approval of the laboratory. The results and statements contained herein relate only to the items tested. The names of individuals involved may be mentioned only in connection with the statements or results from this report. Motorola encourages all feedback, both positive and negative, on this test report.

Table of Contents

1. Introduction	3
2. Description of the Device Under Test	3
2.1 Antenna description	3
2.2 Device Signaling	3
2.3 Device Conducted Power Measurements	4
2.3.1 Wi-Fi 802.11 modes	4
3. Test Equipment Used	6
3.1 Dosimetric System	6
3.2 Additional Equipment	6
4. Electrical parameters of the tissue simulating liquid	7
5. System Accuracy Verification	8
6. Test Results	8
6.1 Body Worn Test Results	9
References	12
Appendix 1: SAR distribution comparison for the system accuracy verification	
Appendix 2: SAR distribution plots for Body Configuration	
Appendix 3: Measurement Uncertainty Budget	
Appendix 4: Probe Calibration Certificate	
Appendix 5: Dipole Characterization Certificate	

Revision History

Revision Version	Date	Notes
Rev. 0	Oct 10, 2011	Initial report release.
Rev. A	Oct 17, 2011	Correct Typo on Cal date in section 3.1

1. Introduction

The Motorola Mobility ADR Test Services Laboratory has performed measurements of the maximum potential exposure to the user of the portable Hand-Held Device covered by this test report. The Specific Absorption Rate (SAR) of this product was measured. The portable Hand-Held Device was tested in accordance with [1], [4] and [5]. The SAR values measured for the portable Hand-Held Device 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 device are given in the table below. These measurements were performed using a Dasy4™ v4.7 system manufactured by Schmid & Partner Engineering AG (SPEAG), of Zurich Switzerland.

Summary of Stand-Alone SAR Results	
Transmit Band	Body SAR (1 g ^W /kg)
Wi-Fi 2.45 GHz	1.39
Wi-Fi 5.2 GHz	1.52
Wi-Fi 5.8 GHz	0.53

2. Description of the Device Under Test

2.1 Antenna description

Bluetooth/Wi-Fi 2.45 / 5 GHz Antenna

Type	Internal	
Location	Right Edge of Transceiver	
Dimensions	Width	3.67 mm
	Length	18.9 mm

2.2 Device Signaling¹

Serial Number(s) (Functional Use)	KFLC110069 (Wi-Fi SAR testing)
Production Unit or Identical Prototype (47 CFR §2.908)	Identical Prototype
Device Category	Portable / Mobile Station
RF Exposure Limits	General Population / Uncontrolled

Mode(s) of Operation	Modulation Mode(s)	Maximum Output Power Setting	Duty Cycle	Transmitting Frequency Range(s)
2.45 GHz Wi-Fi 802.11b/g/n	BPSK	15.5 dBm	1:1	2412.0 - 2462.5 MHz
5 GHz Wi-Fi 802.11a/n	BPSK	16.4 dBm	1:1	5180.0 - 5240.0 MHz, 5745.0 - 5805.0 MHz
Bluetooth	GFSK	7.71 dBm	1:1	2402.0 - 2483.5 MHz

¹ **Bolded** entries indicate data mode configurations of highest time-average power output per band and data mode type, and thus were utilized for SAR testing in this report.

2.3 Device Conducted Power Measurements

2.3.1 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 conducted power measurements for each mode are shown in the tables below. SAR testing for 802.11 was performed within each transmit band (2.5 GHz, 5.2 GHz, 5.8 GHz) with the transmitter set to the lowest data rate on the default test channels **highlighted in bold** in the tables below. The body positions that resulted in the highest SAR values were further tested on the additional channels within that sub-transmit band. Also the body positions that resulted in the highest SAR values were further tested with the higher data rates **highlighted in blue** in the tables below because of the conducted power difference. Due to the relatively large number of data rates with measured conducted power exceeding the lowest data rate conducted power by more than 0.25 dB, there will be a large number of tests performed on the configuration that results in the highest measured SAR for the lowest data rate.

Band	Channel	Conducted Power (Max AVG in dBm) for 802.11b Mode Data Rates			
		1 Mbps	2 Mbps	5.5 Mbps	11 Mbps
Wi-Fi 2450 MHz	1	12.36	12.50	13.55	13.43
	6	12.24	12.32	13.33	13.42
	11	13.20	13.38	14.30	14.40

Band	Channel	Conducted Power (Max AVG in 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	12.48	12.50	12.44	12.50	11.36	11.34	11.92	12.00
	6	12.80	12.78	12.82	12.80	11.92	11.87	12.63	12.49
	11	13.51	13.67	13.66	13.66	12.57	12.59	13.15	13.23

Band	Channel	Conducted Power (Max AVG in 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	15.06	14.87	14.93	14.42	14.54	12.9	12.79	11.46
	6	15.12	14.97	14.99	14.64	14.73	13.22	13.18	11.87
	11	15.45	15.36	15.43	15.07	15.13	13.74	13.54	12.10

Band	Channel	Conducted Power (Max AVG in 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	15.06	14.79	14.85	14.49	14.36	12.96	12.91	11.50
	6	15.12	14.96	15.19	14.69	14.75	13.28	13.27	11.92
	11	15.45	15.34	15.51	14.97	14.98	13.72	13.68	12.16

Band	Channel	Conducted Power (Max AVG in dBm) for 802.11a Mode Data Rates							
		6 Mbps	9 Mbps	12 Mbps	18 Mbps	24 Mbps	36 Mbps	48 Mbps	54 Mbps
Wi-Fi 5210 MHz	36	15.41	15.44	14.55	14.51	13.89	13.9	12.07	12.09
	40	16.09	16.03	15.11	15.02	14.55	14.45	12.64	12.63
	44	15.51	15.46	14.54	14.59	13.93	14.03	12.14	12.07
	48	15.34	15.32	14.35	14.38	13.76	13.76	11.97	11.97
Wi-Fi 5775 MHz	149	15.48	15.52	14.53	14.71	13.86	13.81	11.84	11.78
	153	15.22	15.14	14.18	14.15	13.4	13.51	11.39	11.33
	157	15.66	15.72	14.5	14.63	13.85	13.86	11.81	11.86
	161	15.93	15.89	14.87	14.87	14.16	14.23	12.17	12.07
	165	15.73	15.67	15.75	15.75	15.58	15.57	13.99	13.98

Band	Channel	Conducted Power (Max AVG in 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 5210 MHz	36	15.65	14.66	14.70	14.19	14.17	12.16	12.3	11.26
	40	16.35	15.20	15.26	14.68	14.81	12.72	12.83	11.85
	44	15.86	14.81	14.77	14.19	14.20	12.25	12.26	11.28
	48	15.78	14.69	14.66	14.15	14.06	12.17	12.10	11.24
Wi-Fi 5775 MHz	149	15.42	14.04	14.21	13.59	13.54	11.44	11.30	10.36
	153	14.96	13.71	13.87	13.09	13.22	10.86	11.06	9.79
	157	15.33	14.28	14.4	13.64	13.72	11.44	11.47	10.27
	161	15.69	14.63	14.65	14.00	14.01	11.73	11.72	10.61
	165	15.54	15.56	15.57	15.46	15.44	13.80	13.88	12.82

Band	Channel	Conducted Power (Max AVG in 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 5210 MHz	36	15.49	14.41	14.51	13.96	13.98	12.15	12.02	11.05
	40	16.19	15.09	15.08	14.55	14.55	12.58	12.57	11.57
	44	15.56	14.51	14.53	14.04	14.02	12.11	12.19	11.16
	48	15.49	14.45	14.35	13.79	13.88	11.88	11.93	10.92
Wi-Fi 5775 MHz	149	15.25	14.18	14.29	13.75	13.64	11.58	11.38	10.28
	153	14.94	13.83	13.77	13.30	13.34	11.10	11.11	9.85
	157	15.54	14.24	14.35	13.66	13.82	11.53	11.70	10.45
	161	15.87	14.59	14.67	14.01	14.03	11.82	11.86	10.73
	165	15.60	15.56	15.61	15.53	15.59	13.88	13.98	12.89

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 $\pm 10.8\%$ (K=1) with an expanded uncertainty of $\pm 21.6\%$ (K=2). The overall 1 g RSS uncertainty of the measurement system is $\pm 11.1\%$ (K=1) with an expanded uncertainty of $\pm 22.2\%$ (K=2). The measurement uncertainty budget is given in Appendix 5. 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
DASY4™ DAE V1	376	Aug-31-2011	Aug-31-2012
E-Field Probe ES3DV3	3124	Aug-23-2011	Aug-23-2012
DASY4™ DAE V1	434	Jan-13-2011	Jan-13-2012
E-Field Probe ES3DV3	3115	Jan-12-2011	Jan-12-2012
DASY4™ DAE V1	440	Nov-11-2010	Nov-11-2011
E-Field Probe EX3DV4	3728	May 20, 2011	May 20, 2012
Dipole Validation Kit, DV2450V2	863	Mar-17-2011	Mar-17-2013
Dipole Validation Kit, DV2450V2	740	Mar-17-2011	Mar-17-2013
Dipole Validation Kit, D5GHzV2	1098	Jan-07-2011	Jan-07-2012

3.2 Additional Equipment

Description	Serial Number	Cal Date	Cal Due Date
Signal Generator HP8648C	3847A04982	Nov-18-2009	Nov-18-2011
Power Meter E4419B	GB39510900	Mar-28-2011	Mar-28-2013
Power Sensor #1 - E9301A	US39211007	Aug-16-2011	Aug-16-2012
Power Sensor #2 - E9301A	US39211008	Aug-16-2011	Aug-16-2012
Signal Generator HP8648C	3847A04632	Aug-13-2011	Aug-13-2013
Power Meter E4419B	GB39511087	Dec-22-2009	Dec-22-2011
Power Sensor #1 - E9301A	US39211006	Oct-25-2010	Oct-25-2011
Power Sensor #2 - E9301A	US39210934	Oct-25-2010	Oct-25-2011
Signal Generator HP8648C	3847A04843	Mar-28-2011	Mar-28-2013
Power Meter E4419B	GB39511084	Mar-28-2011	Mar-28-2013
Power Sensor #1 - E9301A	US39210929	Mar-31-2011	Mar-31-2012
Power Sensor #2 - E9301A	US39210930	Mar-31-2011	Mar-31-2012
Network Analyzer HP8753ES	US39171846	May-19-2011	May-19-2012
Dielectric Probe Kit HP85070C	US99360070		

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 $\rho = 1 \text{ g/cm}^3$ 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].

f (MHz)	Tissue type	Limits / Measured	Dielectric Parameters		
			ϵ_r	σ (S/m)	Temp (°C)
2450	Body	Measured, Sep-6-2011	52.1	1.90	19.7
		Measured, Oct-7-2011	51.1	1.92	19.9
		Recommended Limits	52.7 ±5%	1.95 ±5%	18-25
5210	Body	Measured, Sep-21-2011	49.1	5.89	19.7
		Measured, Sep-28-2011	48.4	5.91	19.9
		Recommended Limits	49.0 ±10%	5.31 ±5%	18-25
5785	Body	Measured, Sep-28-2011	47.1	6.77	20.5
		Measured, Sep-29-2011	47.0	6.75	20.1
		Recommended Limits	48.2 ±10%	5.98 ±5%	18-25

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

Ingredient	835 MHz / 900 MHz Head	835 MHz / 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	--

All 5.2 GHz and 5.8 GHz SAR testing was performed using HSL 3500/5800 and MSL 3500/5800 tissue simulating liquids from Schmid & Partner Engineering AG. Prior to conducting SAR measurements, the relative permittivity, ϵ_r , and the conductivity, σ , of the liquids was measured. The conductivity of the purchased liquids was determined to be at the high compared to the target parameter. SPEAG is investigating why the values consistently measure high. Since they measured on the conservative side of the target window, all subsequent 5.2 GHz and 5.8 GHz SAR tests were also on the conservative side of their uncertainty window.

5. System Accuracy Verification

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 $\pm 10\%$ from the target SAR indicated in Appendix 6. These frequencies are within $\pm 10\%$ 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 $15.0 \text{ cm} \pm 0.5 \text{ cm}$. For frequencies above 3 GHz, the simulated tissue depth was verified to be $10 \text{ cm} \pm 0.5 \text{ cm}$. Z-axis scans showing the SAR penetration are also included in Appendix 1.

f (MHz)	Description	SAR (W/kg), 1 gram	Dielectric Parameters		Ambient Temp (°C)	Tissue Temp (°C)
			ϵ_r	σ (S/m)		
2450	Measured, Sep-6-2011	55.0	52.1	1.90	21.1	19.8
	Recommended Limits	52.8	$52.7 \pm 10\%$	$1.95 \pm 5\%$	18-25	18-25
	Measured, Oct-7-2011	55.0	51.1	1.92	21.2	21.0
	Recommended Limits	51.3	$52.7 \pm 5\%$	$1.95 \pm 5\%$	18-25	18-25
5200	Measured, Sep-21-2011	85.4	49.1	5.88	20.1	20.0
	Measured, Sep-28-2011	81.2	48.5	5.89	21.2	20.5
	Recommended Limit	77.5	$49.0 \pm 10\%$	$5.30 \pm 5\%$	18-25	18-25
5800	Measured, Sep-28-2011	78.2	47.1	6.79	21.2	20.5
	Measured, Sep-29-2011	76.1	46.9	6.76	21.0	20.0
	Recommended Limits	73.1	$48.2 \pm 10\%$	$6.00 \pm 5\%$	18-25	18-25

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

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ES3DV3	3115	2450	4.12	6 of 11
E-Field Probe ES3DV3	3124	2450	4.21	6 of 11
E-Field Probe EX3DV4	3728	5200	4.16	6 of 11
		5800	3.76	6 of 11

6. Test Results

Wi-Fi testing was conducted using manufacturer test mode software, per guidance given in FCC KDB 248227. The test software was set up for the proper channels, transmitter power levels and transmit modes of operation.

The portable hand-held device was tested in the configurations stipulated in [1], [4] and [5]. The portable hand-held device 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 portable hand-held device model covered by this report has an internal battery that is not replaceable by the end user. This battery was used to do all of the SAR testing. The battery was charged prior to each test.

6.1 Body Test Results

The SAR results shown in tables 1 and 2 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, the measured conducted output power levels, power reduction amount (when applicable), the measured SAR corrected for probe calibration (when applicable), and the extrapolated SAR. The exact method of extrapolation is:

$$\text{Extrapolated SAR} = (\text{Measured or Corrected SAR}) * 10^{(-\text{drift}/10)}$$

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 requisite test positions for the DUT were chosen per the guidance provided in FCC KDB 447498 D01. The DUT was tested with the back surface of the device facing the phantom with no separation for all transmitters requiring test. The DUT was also tested along the edges of the device in which an antenna is located within 5 cm of that edge. Pictorial representation of the antenna locations and separation distances are given in section 1 above.

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 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 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 DUT.

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

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ES3DV3	3115	2450	4.12	6 of 11
E-Field Probe ES3DV3	3124	2450	4.21	6 of 11
E-Field Probe EX3DV4	3728	5200	4.16	6 of 11
		5800	3.76	6 of 11

Body, Back Surface of DUT 0 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
2450	802.11b, 1 Mbps	Internal	1	20.5	0.0143	12.36		0.348		0.35	0.82		0.82		
			6	20.5	0.024	12.24		0.379		0.38	0.895		0.90		
			11	20.5	-0.107	13.20		0.471		0.48	1.13		1.16		
	1		20.5	0.0253	13.55		0.385		0.39	0.92		0.92			
	802.11b, 5.5 Mbps		6	19.8	0.0795	13.33		0.435		0.44	1.05		1.05		
			11	19.9	-0.154	14.30		0.486		0.50	1.18		1.22		
			1	20.0	0.0262	13.43		0.344		0.34	0.812		0.81		
	802.11b, 11 Mbps		6	20.0	0.0211	13.42		0.385		0.39	0.923		0.92		
			11	20.0	0.0356	14.40		0.448		0.45	1.07		1.07		
			6	20.5	-0.184	12.80		0.344		0.36	0.809		0.84		
	802.11g, 6 Mbps		11	20.6	0.0373	13.51		0.459		0.46	1.13		1.13		
			6	20.0	-0.039	12.78		0.509		0.51	1.38		1.39	5x5x7	27
	802.11g, 9 Mbps		11	20.0	-0.0428	13.67		0.496		0.50	1.21		1.22		
			6	20.0	0.0832	12.82		0.379		0.38	0.904		0.90		
	802.11g, 12 Mbps		11	20.5	0.122	13.66		0.427		0.43	1.03		1.03		
			6	20.2	0.003	12.80		0.367		0.37	0.881		0.88		
	802.11g, 18 Mbps		11	20.2	-0.0668	13.66		0.46		0.47	1.12		1.14		
			6	20.0	-0.0183	12.63		0.299		0.30	0.717		0.72		
	802.11n, 7.2 Mbps		1	20.5	-0.0052	15.06		0.345		0.35	0.821		0.82		
			6	20.5	0.0937	15.12		0.386		0.39	0.927		0.93		
			11	20.2	0.0156	15.45		0.435		0.44	1.04		1.04		
	802.11n, 14.4 Mbps		1	19.9	0.0393	14.87		0.333		0.33	0.808		0.81		
			6	20.0	0.0218	14.97		0.404		0.40	0.995		1.00		
			11	20.0	0.0548	15.36		0.425		0.43	1.04		1.04		
	802.11n, 21.7 Mbps		1	19.7	0.107	14.93		0.314		0.31	0.75		0.75		
			6	19.7	0.0696	14.99		0.345		0.35	0.83		0.83		
			11	19.7	0.194	15.43		0.432		0.43	1.06		1.06		
	802.11n, 28.9 Mbps		1	19.7	-0.0152	14.42		0.252		0.25	0.606		0.61		
			6	19.7	0.106	14.64		0.277		0.28	0.674		0.67		
			11	19.7	0.017	15.07		0.291		0.29	0.706		0.71		
	802.11n, 43.3 Mbps		1	19.7	0.0012	14.54		0.218		0.22	0.52		0.52		
			6	20.2	-0.0416	14.73		0.272		0.27	0.653		0.66		
			11	20.2	-0.118	15.13		0.322		0.33	0.779		0.80		
	802.11n, 57.8 Mbps		1	20.2	0.0316	12.90		0.374		0.37	0.901		0.90		
			6	20.0	0.0346	13.22		0.271		0.27	0.65		0.65		
			11	20.2	0.0208	13.74		0.522		0.52	1.29		1.29		
	802.11n, 65 Mbps		1	20.5	0.0112	12.79		0.373		0.37	0.901		0.90		
			6	20.2	-0.0786	13.18		0.275		0.28	0.657		0.67		
			11	20.1	-0.0601	13.54		0.289		0.29	0.705		0.71		
	802.11n, 6.5 Mbps		1	20.5	0.0067	15.06		0.35		0.35	0.835		0.84		
			6	20.5	0.0449	15.12		0.387		0.39	0.932		0.93		
			11	20.5	0.0526	15.45		0.379		0.38	0.901		0.90		
802.11n, 13 Mbps	1	20.2	0.0296	14.79		0.33		0.33	0.792		0.79				
	6	20.0	-0.0445	14.96		0.357		0.36	0.855		0.86				
	11	20.2	-0.063	15.34		0.446		0.45	1.08		1.10				
802.11n, 19.5 Mbps	1	20.2	0.0135	14.85		0.331		0.33	0.803		0.80				
	6	20.0	0.199	15.19		0.385		0.39	0.93		0.93				
			11	20.2	0.0699	15.51		0.408		0.41	0.993		0.99		

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

Body, Back Surface of DUT 0 mm from Phantom (continued)															
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
2450	802.11n, 26 Mbps	Internal	1	20.2	0.0503	14.49		0.251		0.25	0.606		0.61		
			6	20.0	0.0172	14.69		0.381		0.38	0.927		0.93		
			11	20.5	0.0606	14.97		0.341		0.34	0.833		0.83		
	802.11n, 39 Mbps		1	20.0	0.11	14.36		0.197		0.20	0.467		0.47		
			6	20.8	0.11	14.75		0.227		0.23	0.669		0.67		
			11	20.0	-0.0661	14.98		0.217		0.22	0.511		0.52		
	802.11n, 39 Mbps		1	20.5	-0.0965	12.96		0.269		0.28	0.653		0.67		
			6	20.0	0.0124	13.28		0.276		0.28	0.664		0.67		
			11	20.0	0.02	13.72		0.375		0.38	0.921		0.92		
	802.11n, 39 Mbps		1	20.0	-0.0568	12.91		0.239		0.24	0.573		0.58		
			6	20.0	0.155	13.27		0.319		0.32	0.787		0.79		
			11	20.0	-0.031	13.68		0.285		0.29	0.688		0.69		
5210	802.11a, 6 Mbps	36													
		40	20.0	1.26	16.09		0.107		0.11	0.427		0.43			
		44	20.0	-0.623	15.51		0.119		0.14	0.494		0.57	7x7x12	28	
		48													
5785	802.11a, 6 Mbps	149	20.0	-0.0901	15.48		0.0849		0.09	0.357		0.36			
		153	19.8	-0.125	15.22		0.133		0.14	0.519		0.53	7x7x12	29	
		157	19.8	-0.0547	15.66		0.124		0.14	0.469		0.47			
		161	19.8	0.122	15.93		0.103		0.10	0.423		0.42			

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

Body, Right Edge of DUT 0 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
2450	802.11b, 1 Mbps	Internal	1												
			6												
11	19.6		0.0578	13.20		0.131		0.13	0.31		0.31	5x5x7	30		
5210	802.11a, 6 Mbps		36	20.3	0.133	15.41		0.255		0.26	1.15		1.15		
			40	20.4	0.0663	16.09		0.241		0.24	1.06		1.06		
			44	20.4	0.0417	15.51		0.279		0.28	1.24		1.24		
	48		20.3	0.0404	15.34		0.247		0.25	1.09		1.09			
	802.11n, 7.2 Mbps		36												
			40	19.8	-0.189	16.35		0.222		0.23	0.996		1.04		
44			19.8	-0.537	15.86		0.293		0.33	1.32		1.49			
5785	802.11a, 6 Mbps		48	19.8	0.144	15.78		0.321		0.32	1.52		1.52	7x7x12	31
			149	19.8	-0.0396	15.48		0.0572		0.06	0.247		0.25	7x7x12	32
		153													
		157													
161	19.8	0.334	15.93		0.0556		0.06	0.244		0.24					

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

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 comparison for the system accuracy verification

Test Laboratory: Motorola 2450 MHz System Performance Check

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:863

Procedure Notes: PM1 Power = 200 mW Refl.Pwr PM3 = -19.04 dB [Sim.Temp@SPC](#) = 19.8C Room Temp @ SPC = 21.1C

Communication System: CW - Dipole; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: Validation *BODY Tissue* ; Medium parameters used: $f = 2450$ MHz; $\sigma = 1.9$ mho/m; $\epsilon_r = 52.1$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3115; ConvF(4.12, 4.12, 4.12); Calibrated: 1/12/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#_6 - Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (4x15x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 7.82 mW/g

Daily SPC Check/0-Degree 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 80.4 V/m; Power Drift = -0.001 dB

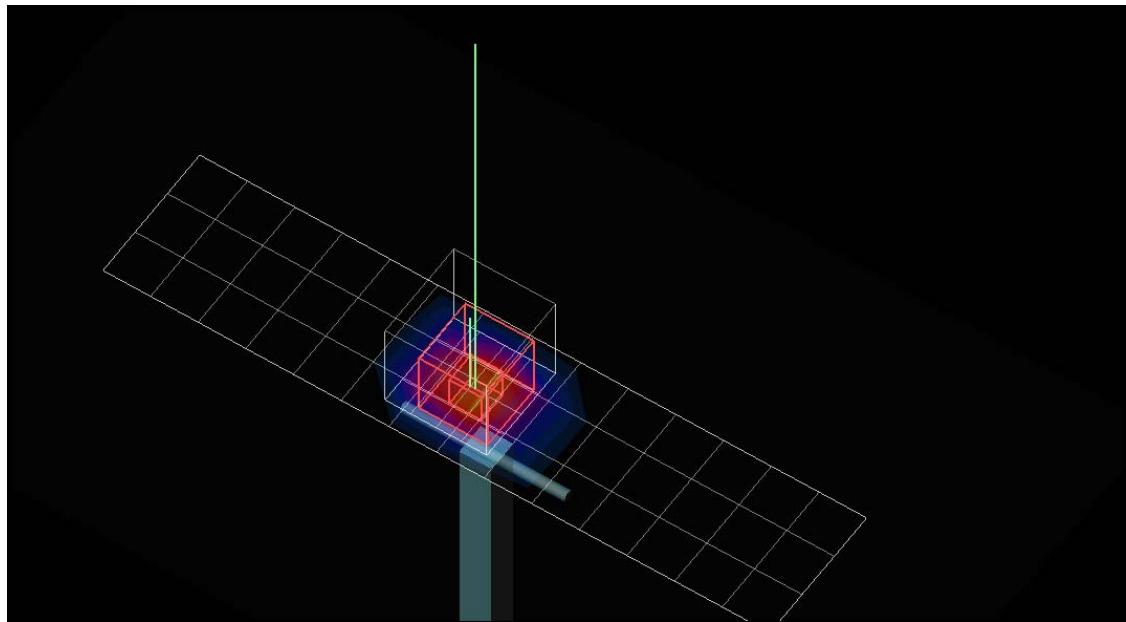
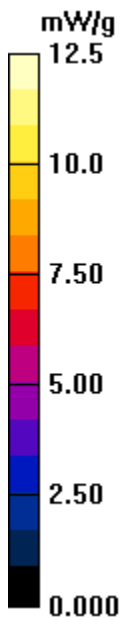
Peak SAR (extrapolated) = 23.6 W/kg

SAR(1 g) = 11 mW/g; SAR(10 g) = 5.07 mW/g

Maximum value of SAR (measured) = 12.4 mW/g

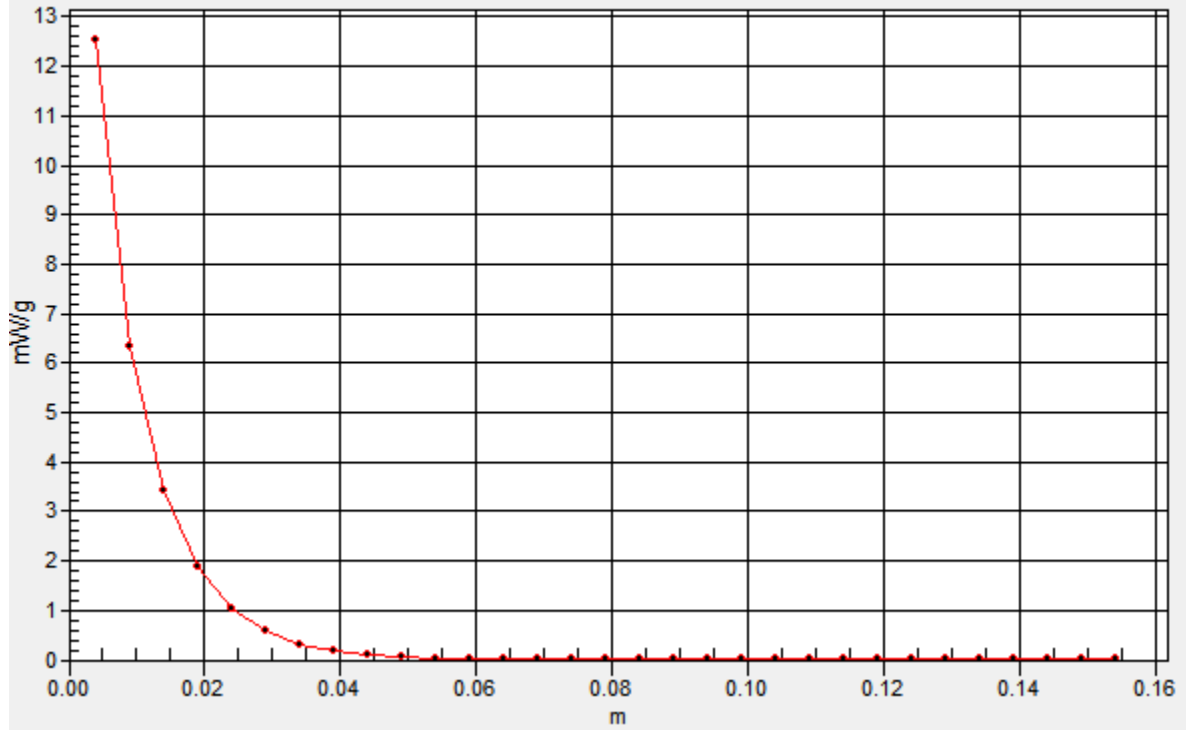
Daily SPC Check/Z-Axis Retraction (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of SAR (measured) = 12.5 mW/g



SAR(x,y,z,f0)

SAR; Z-Axis Retraction: Value Along Z, X=0, Y=0



Test Laboratory: Motorola Mobility 2450 MHz System Performance Check

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:740

Procedure Notes: PM1 Power =200 mW Refl.Pwr PM3 = -23.20 dB [Sim.Temp@SPC](#) = 21.0C Room Temp @ SPC = 21.2C

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1

Medium: Validation *BODY Tissue* ; Medium parameters used: $f = 2450$ MHz; $\sigma = 1.92$ mho/m; $\epsilon_r = 51.1$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3124; ConvF(4.21, 4.21, 4.21); Calibrated: 8/23/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 8/31/2011
- Phantom: R#-1, Triple Flat Phantom 5.1C (Rev.3); Type: QD 000 P51 CA; Serial: n/a;
- ; SEMCAD X Version 14.4.5 (3634)

DASY5, Triple Flat System Performance Check Template - Rev.3 (19-Sept-11)/Daily SPC Check/Dipole Area Scan (4x15x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 10.871 mW/g

DASY5, Triple Flat System Performance Check Template - Rev.3 (19-Sept-11)/Daily SPC Check/0-Degree 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 76.695 V/m; Power Drift = -0.02 dB

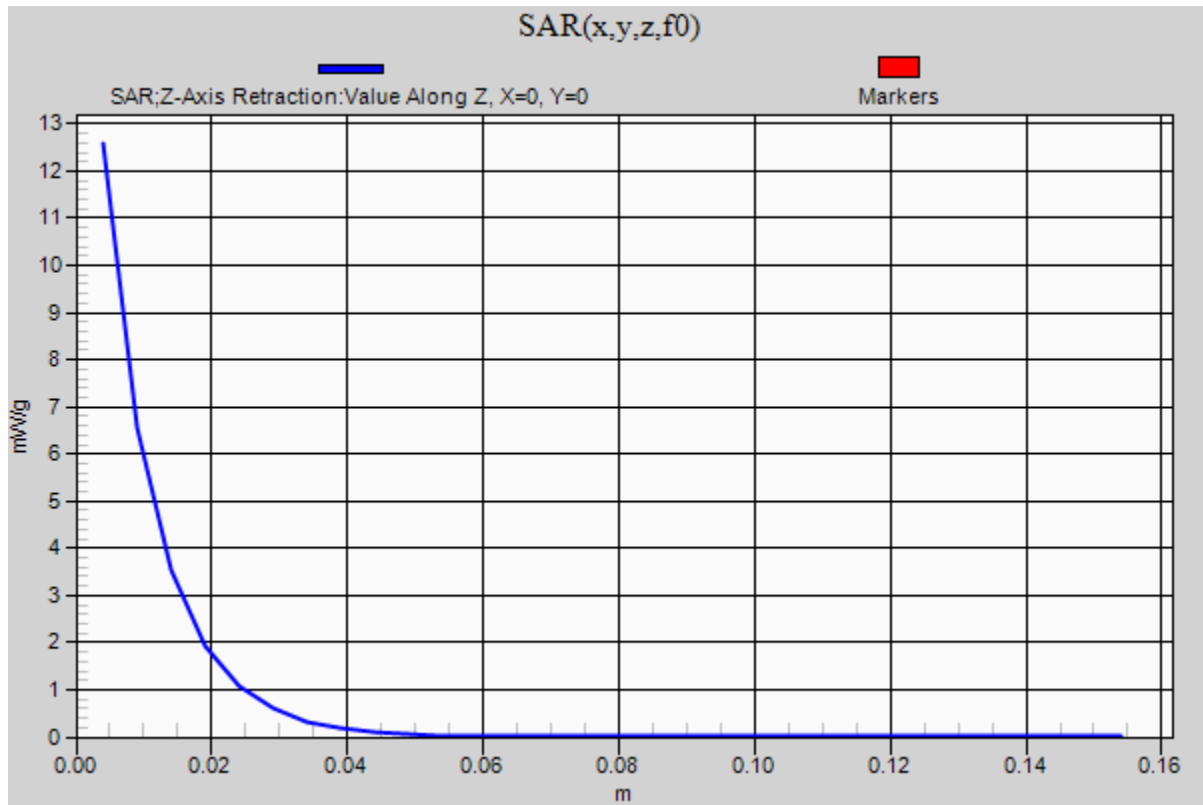
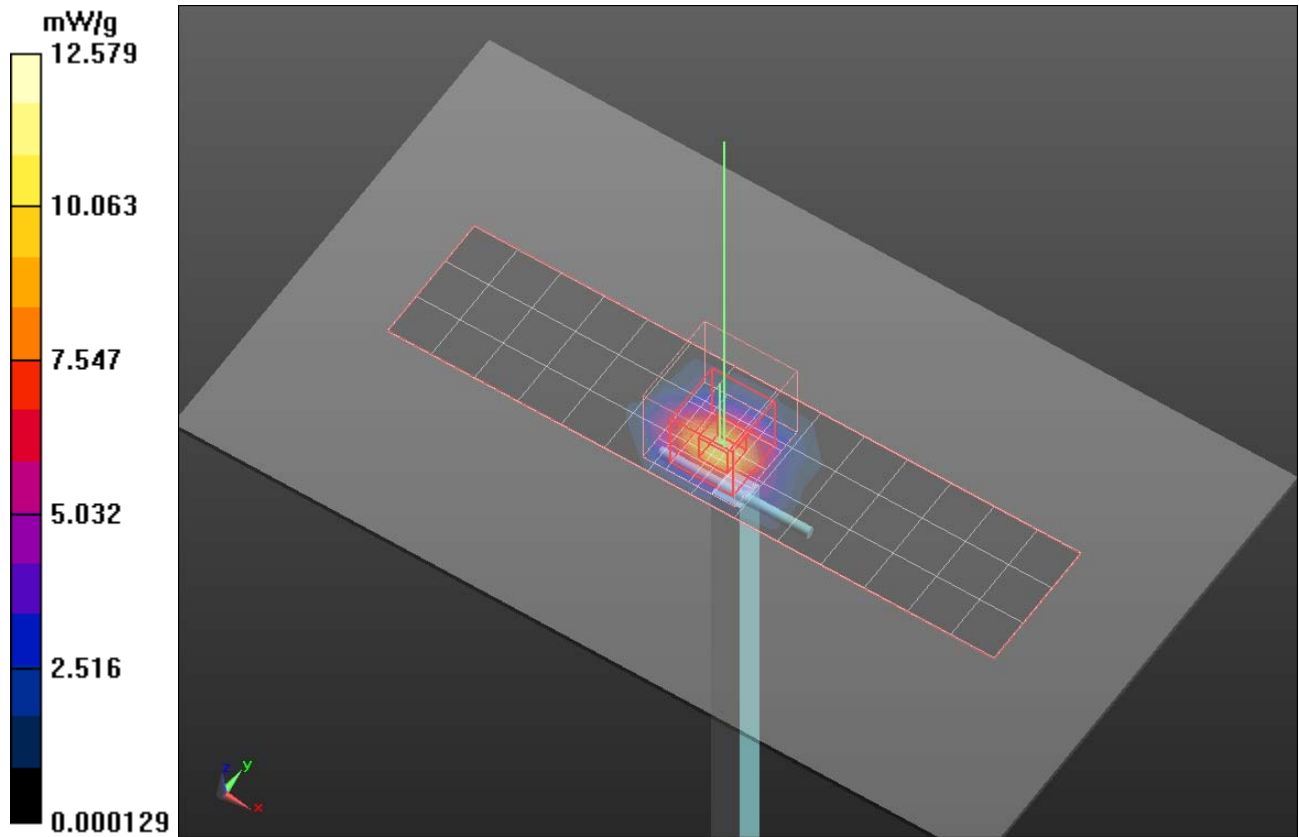
Peak SAR (extrapolated) = 22.374 W/kg

SAR(1 g) = 11 mW/g; SAR(10 g) = 5.17 mW/g

Maximum value of SAR (measured) = 12.604 mW/g

DASY5, Triple Flat System Performance Check Template - Rev.3 (19-Sept-11)/Daily SPC Check/Z-Axis Retraction (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of SAR (measured) = 12.579 mW/g



Test Laboratory: Motorola 5200 MHz System Performance Check

DUT: Dipole 5-6GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1098

Procedure Notes: PM1 Power = 101 mW Refl.Pwr PM3 = -19.3dB [Sim.Temp@SPC](#) = 20.5°C Room Temp @ SPC = 20.1°C

Communication System: CW - Dipole; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium: Validation *BODY Tissue* ; Medium parameters used: $f = 5200$ MHz; $\sigma = 5.88$ mho/m; $\epsilon_r = 49.1$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: EX3DV4 - SN3728; ConvF(4.16, 4.16, 4.16); Calibrated: 5/20/2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn440; Calibrated: 11/11/2010
- Phantom: R#3 - Triple Flat Phantom 5.1C (rev.2); Type: QD 000 P51 CA; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (22x5x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 14.3 mW/g

Daily SPC Check/0-Degree, 7x7x12 Cube (7x7x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

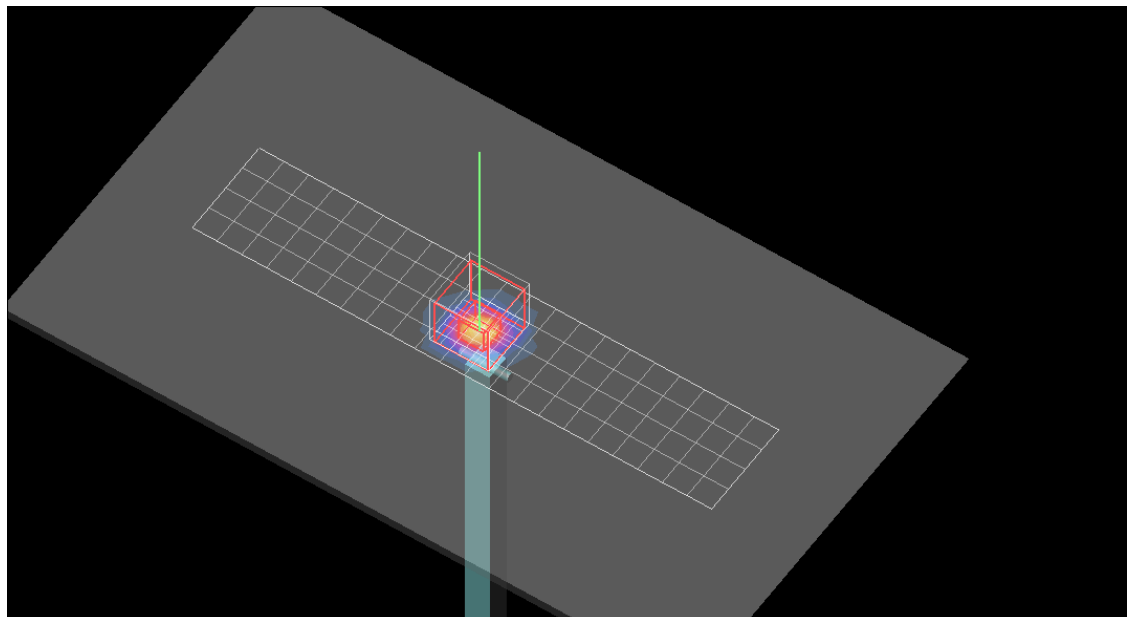
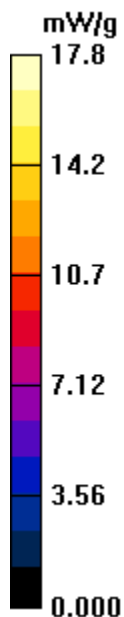
Reference Value = 59.2 V/m; Power Drift = -0.012 dB

Peak SAR (extrapolated) = 32.1 W/kg

SAR(1 g) = 8.54 mW/g; SAR(10 g) = 2.41 mW/g

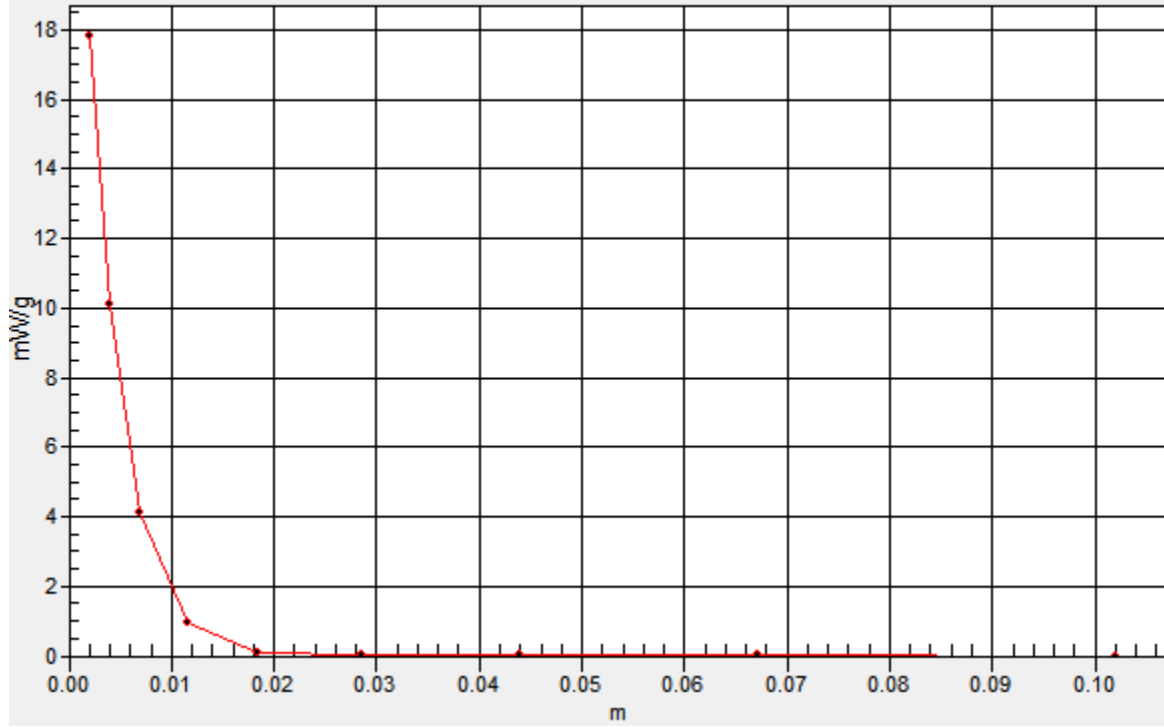
Maximum value of SAR (measured) = 17.8 mW/g

Daily SPC Check/Z-Axis Retraction, Graded 1.5 (1x1x9): Measurement grid: dx=20mm, dy=20mm, dz=2mm



SAR(x,y,z,f0)

SAR; Z-Axis Retraction, Graded 1.5: Value Along Z, X=0, Y=0



Test Laboratory: Motorola 5200 MHz System Performance Check

DUT: Dipole 5-6GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1098

Procedure Notes: PM1 Power = 100 mW Refl.Pwr PM3 = -19.30 dB [Sim.Temp@SPC](#) = 20.5C Room Temp @ SPC = 21.2C

Communication System: CW - Dipole; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium: Validation *BODY Tissue* ; Medium parameters used: $f = 5200$ MHz; $\sigma = 5.89$ mho/m; $\epsilon_r = 48.5$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: EX3DV4 - SN3728; ConvF(4.16, 4.16, 4.16); Calibrated: 5/20/2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn440; Calibrated: 11/11/2010
- Phantom: R3 Triple Flat Phantom 5.1C (Rev.3); Type: QD 000 P51 CA; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (22x5x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 16.2 mW/g

Daily SPC Check/0-Degree, 7x7x12 Cube (7x7x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 53.3 V/m; Power Drift = 0.013 dB

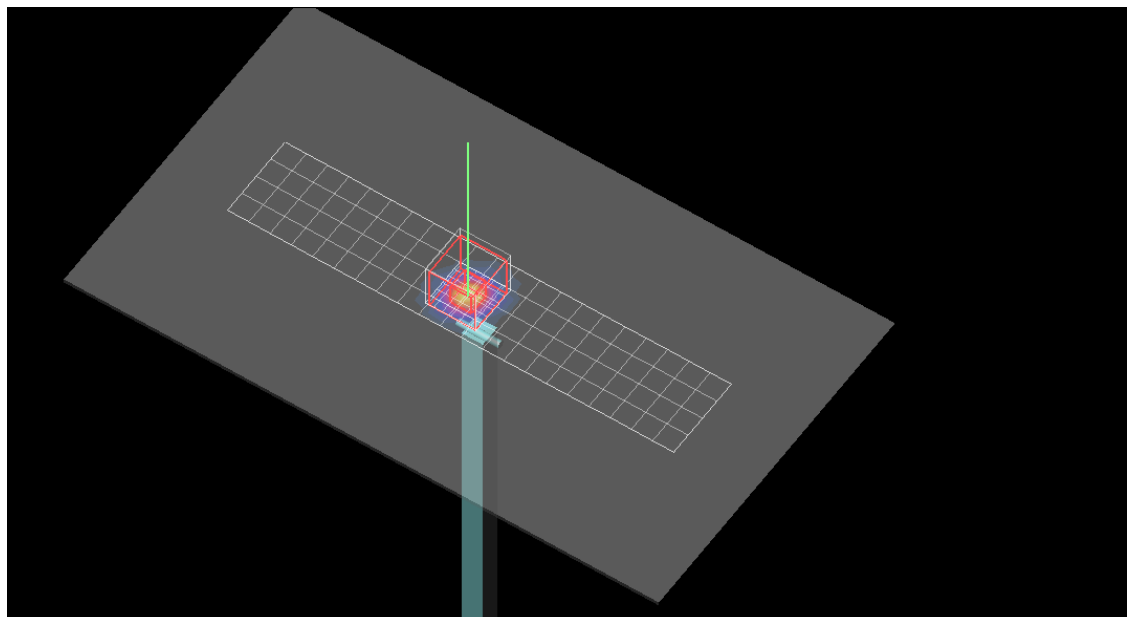
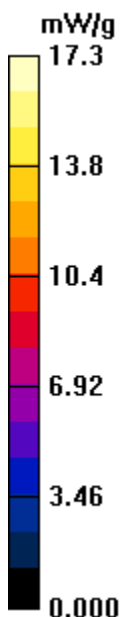
Peak SAR (extrapolated) = 31.5 W/kg

SAR(1 g) = 8.12 mW/g; SAR(10 g) = 2.29 mW/g

Maximum value of SAR (measured) = 17.2 mW/g

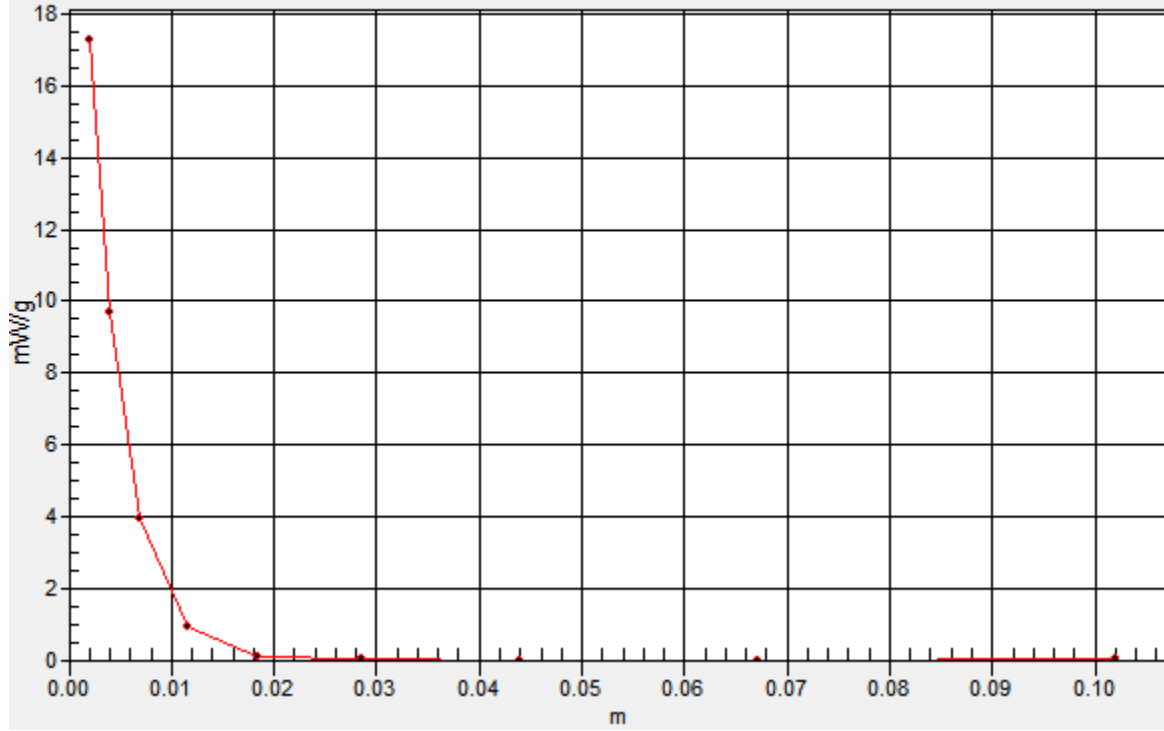
Daily SPC Check/Z-Axis Retraction, Graded 1.5 (1x1x9): Measurement grid: dx=20mm, dy=20mm, dz=2mm

Maximum value of SAR (measured) = 17.3 mW/g



SAR(x,y,z,f0)

SAR; Z-Axis Retraction, Graded 1.5: Value Along Z, X=0, Y=0



Test Laboratory: Motorola 5800 MHz System Performance Check

DUT: Dipole 5-6GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1098

Procedure Notes: PM1 Power = 100 mW Refl.Pwr PM3 = -21.40 dB [Sim.Temp@SPC](#) = 20.5C Room Temp @ SPC = 21.2C

Communication System: CW - Dipole; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: Validation *BODY Tissue* ; Medium parameters used: $f = 5800$ MHz; $\sigma = 6.79$ mho/m; $\epsilon_r = 47.1$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: EX3DV4 - SN3728; ConvF(3.76, 3.76, 3.76); Calibrated: 5/20/2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn440; Calibrated: 11/11/2010
- Phantom: R3 Triple Flat Phantom 5.1C (Rev.3); Type: QD 000 P51 CA; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (22x5x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 16.1 mW/g

Daily SPC Check/0-Degree, 7x7x12 Cube (7x7x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 50.0 V/m; Power Drift = -0.104 dB

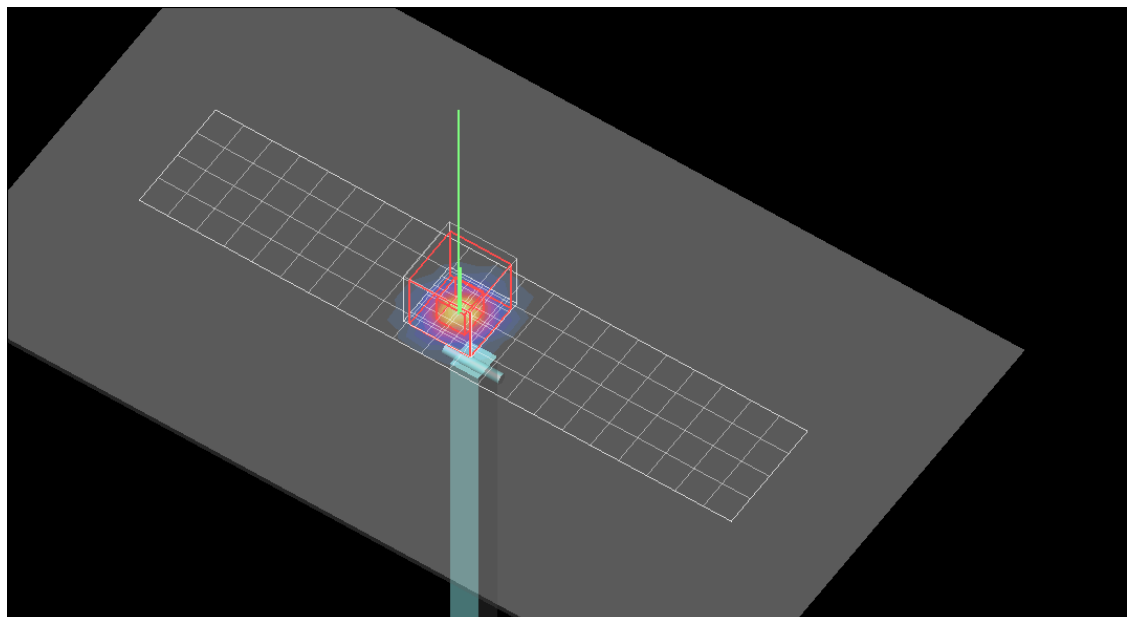
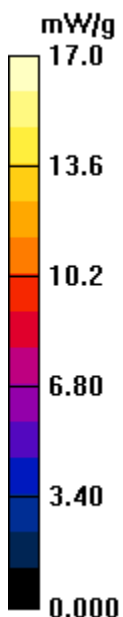
Peak SAR (extrapolated) = 33.3 W/kg

SAR(1 g) = 7.82 mW/g; SAR(10 g) = 2.21 mW/g

Maximum value of SAR (measured) = 16.9 mW/g

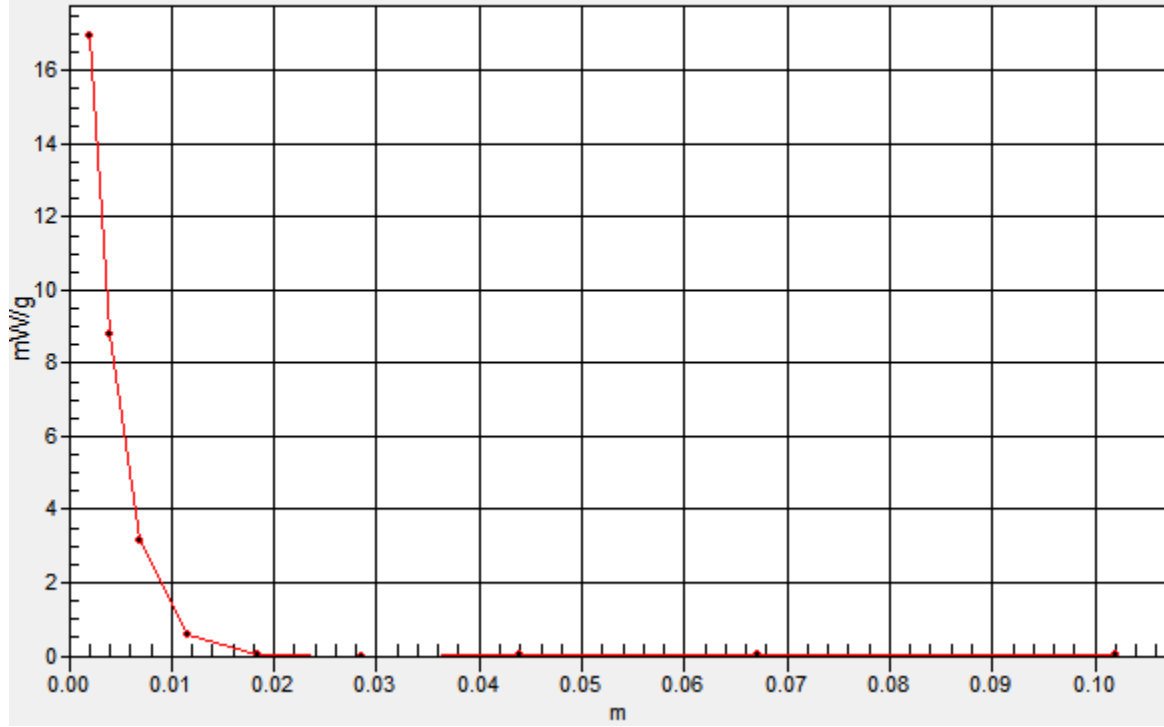
Daily SPC Check/Z-Axis Retraction, Graded 1.5 (1x1x9): Measurement grid: dx=20mm, dy=20mm, dz=2mm

Maximum value of SAR (measured) = 17.0 mW/g



SAR(x,y,z,f0)

SAR; Z-Axis Retraction, Graded 1.5: Value Along Z, X=0, Y=0



Test Laboratory: Motorola 5800 MHz System Performance Check

DUT: Dipole 5-6GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1098

Procedure Notes: PM1 Power = 100 mW Refl.Pwr PM3 = -21.75 dB [Sim.Temp@SPC](#) = 20.0C Room Temp @ SPC = 21.0C

Communication System: CW - Dipole; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: Validation *BODY Tissue* ; Medium parameters used: $f = 5800$ MHz; $\sigma = 6.76$ mho/m; $\epsilon_r = 46.9$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: EX3DV4 - SN3728; ConvF(3.76, 3.76, 3.76); Calibrated: 5/20/2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn440; Calibrated: 11/11/2010
- Phantom: R3 Triple Flat Phantom 5.1C (Rev.3); Type: QD 000 P51 CA; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (22x5x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 15.7 mW/g

Daily SPC Check/0-Degree, 7x7x12 Cube (7x7x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 51.8 V/m; Power Drift = 0.036 dB

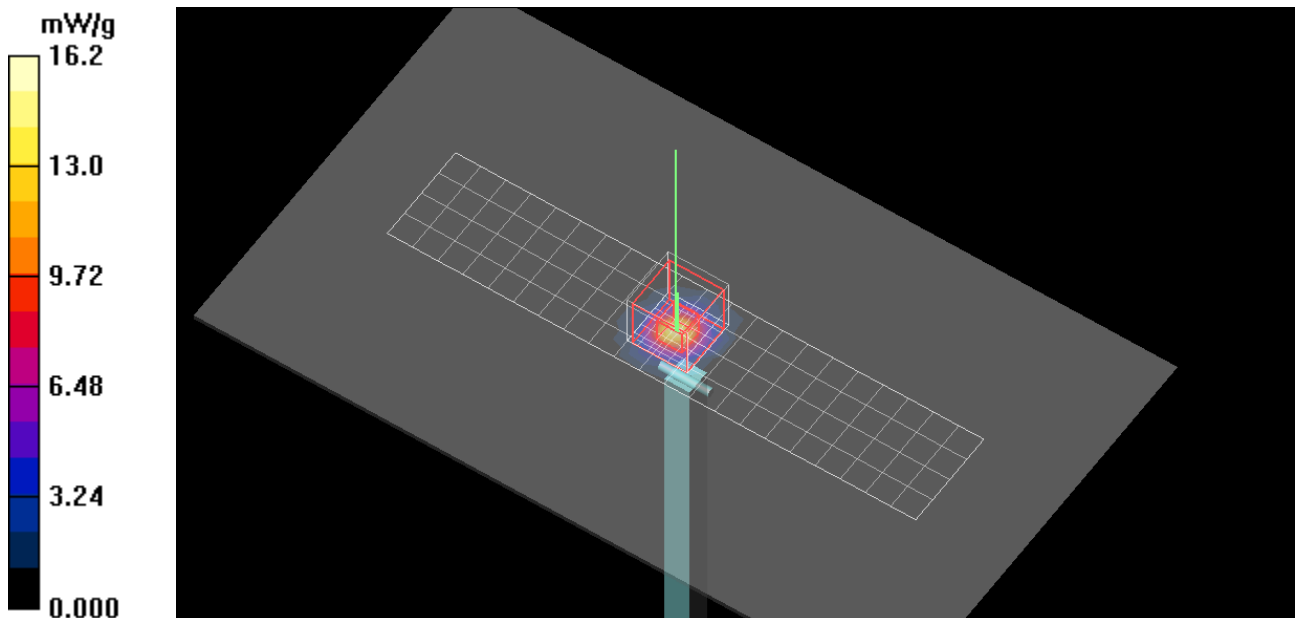
Peak SAR (extrapolated) = 31.4 W/kg

SAR(1 g) = 7.61 mW/g; SAR(10 g) = 2.15 mW/g

Maximum value of SAR (measured) = 16.3 mW/g

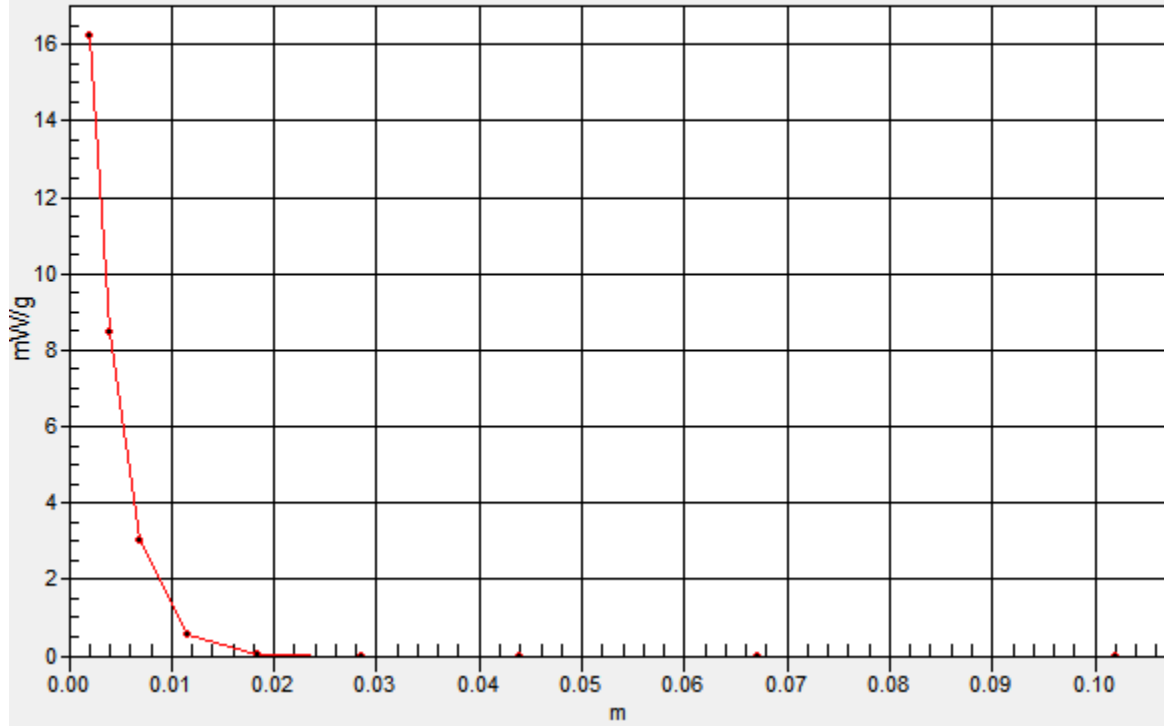
Daily SPC Check/Z-Axis Retraction, Graded 1.5 (1x1x9): Measurement grid: dx=20mm, dy=20mm, dz=2mm

Maximum value of SAR (measured) = 16.2 mW/g



SAR(x,y,z,f0)

SAR; Z-Axis Retraction, Graded 1.5: Value Along Z, X=0, Y=0



Appendix 2

SAR distribution plots for Body Configuration

Test Laboratory: Motorola Mobility - 2450 MHz WiFi Back Surface

DUT: Serial: KFLC110069, FCC ID: IHDP56MJ3

Procedure 802.11g 9Mbps Chn 6 Battery Model #: INTERNAL Test Configuration = Back surface of DUT 0mm from Phantom

Communication System: Custom IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps); Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 Glycol Body; Medium parameters used: $f = 2450$ MHz; $\sigma = 1.92$ mho/m; $\epsilon_r = 51.1$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3124; ConvF(4.21, 4.21, 4.21); Calibrated: 8/23/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 8/31/2011
- Phantom: R#-1, Triple Flat Phantom 5.1C (Rev.3); Type: QD 000 P51 CA; Serial: n/a;
- SEMCAD X Version 14.4.5 (3634)

DASY5, Triple Flat Phone Template - Rev.3 (19-Sept-11)/Triple Flat Phone Template/Area Scan - Full Body (15mm) (19x11x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 1.479 mW/g

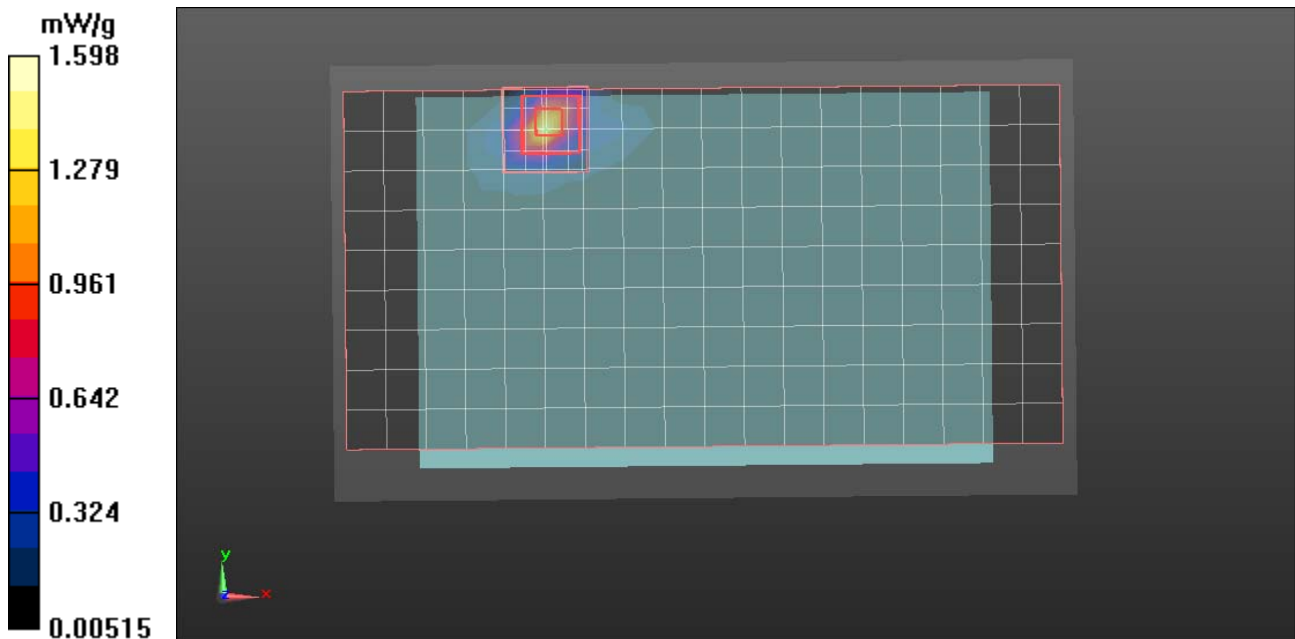
DASY5, Triple Flat Phone Template - Rev.3 (19-Sept-11)/Triple Flat Phone Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 5.650 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 4.298 W/kg

SAR(1 g) = 1.38 mW/g; SAR(10 g) = 0.509 mW/g

Maximum value of SAR (measured) = 1.598 mW/g



Test Laboratory: Motorola Mobility - 5200 MHz WiFi Back Surface

DUT: Serial: KFLC110069, FCC ID: IHDP56MJ3

Procedure Notes: 802.11a 6Mbps Chn 44 Battery Model #: INTERNAL Tester Initials: ron Accessory Model # = Back Surface 0mm from Phantom

Communication System: 5210MHz Band - 802.11a; Frequency: 5220 MHz; Duty Cycle: 1:1

Medium: 5-6 GHz SPEAG Tissue BODY; Medium parameters used: $f = 5210$ MHz; $\sigma = 5.89$ mho/m; $\epsilon_r = 49.1$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: EX3DV4 - SN3728; ConvF(4.16, 4.16, 4.16); Calibrated: 5/20/2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn440; Calibrated: 11/11/2010
- Phantom: R#3 - Triple Flat Phantom 5.1C (rev.2); Type: QD 000 P51 CA; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

TRIPLE Flat Phone Against Flat Section/Area Scan - Full Body (10mm) (27x16x1): Measurement

grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.946 mW/g

TRIPLE Flat Phone Against Flat Section/7x7x12 Zoom Scan (5-6GHz) (7x7x6)/Cube 0:

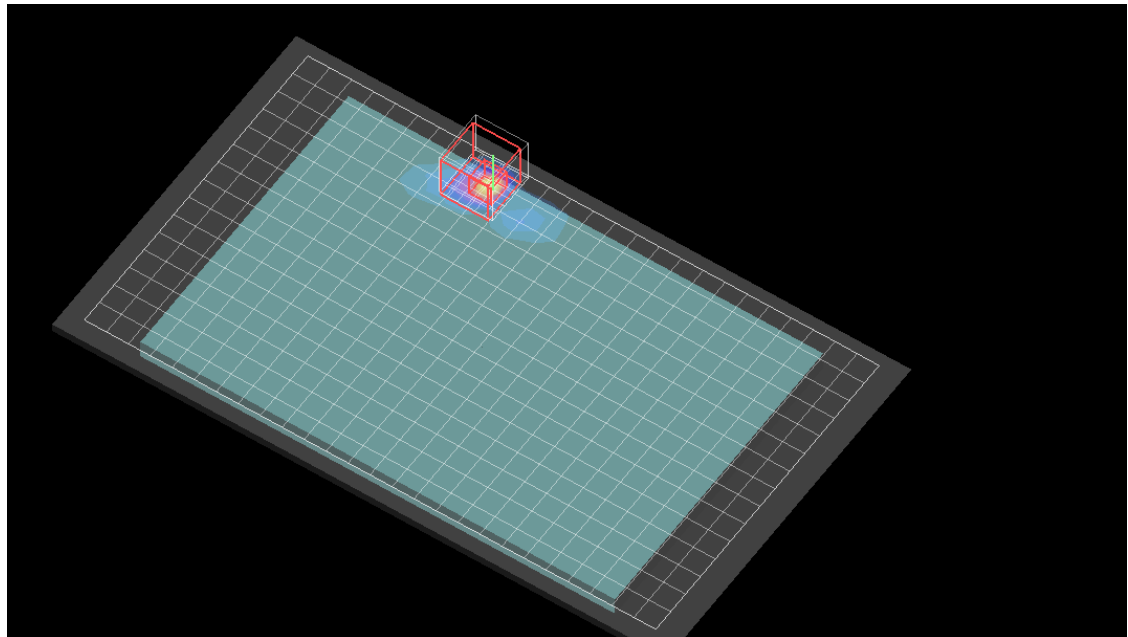
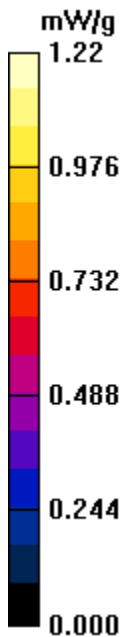
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 0.412 V/m; Power Drift = -0.623 dB

Peak SAR (extrapolated) = 2.59 W/kg

SAR(1 g) = 0.494 mW/g; SAR(10 g) = 0.119 mW/g

Maximum value of SAR (measured) = 1.22 mW/g



Test Laboratory: Motorola Mobility - 5800 MHz WiFi Back Surface

DUT: Serial: KFLC110069, FCC ID: IHDP56MJ3

Procedure Notes: 802.11 a 6 Mbps Chn 153 Battery Model #: INTERNAL Test Configuration = BACK Surface 0mm from Phantom

Communication System: 5785MHz Band - 802.11a; Frequency: 5765 MHz; Duty Cycle: 1:1

Medium: 5-6 GHz SPEAG Tissue BODY; Medium parameters used: $f = 5785$ MHz; $\sigma = 6.75$ mho/m; $\epsilon_r = 47$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: EX3DV4 - SN3728; ConvF(3.76, 3.76, 3.76); Calibrated: 5/20/2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn440; Calibrated: 11/11/2010
- Phantom: R3 Triple Flat Phantom 5.1C (Rev.3); Type: QD 000 P51 CA; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

TRIPLE Flat Phone Against Flat Section/Area Scan - Full Body (10mm) (27x16x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.771 mW/g

TRIPLE Flat Phone Against Flat Section/7x7x12 Zoom Scan (5-6GHz) (7x7x6)/Cube 0:

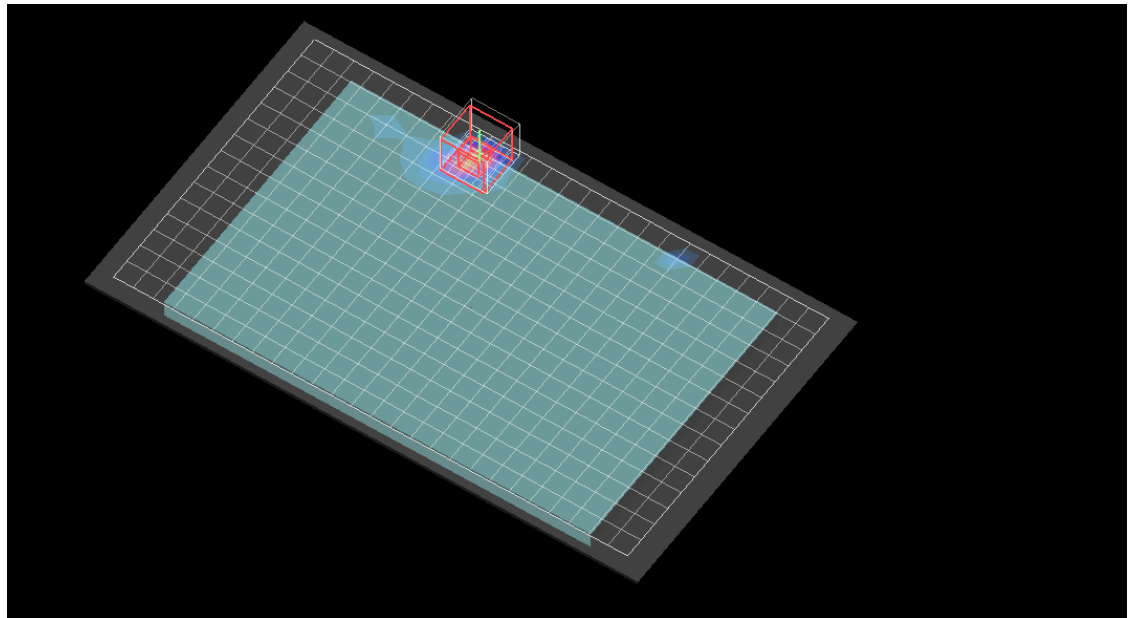
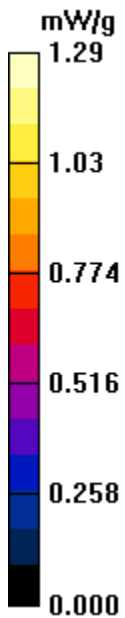
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 2.74 V/m; Power Drift = -0.125 dB

Peak SAR (extrapolated) = 2.87 W/kg

SAR(1 g) = 0.519 mW/g; SAR(10 g) = 0.133 mW/g

Maximum value of SAR (measured) = 1.29 mW/g



Test Laboratory: Motorola Mobility - 2450 MHz WiFi - Right Edge

DUT: Serial: KFLC110069, FCC ID: IHDP56MJ3

Procedure Notes: 802.11b 1 Mbps Chn 11 Battery Model #: Internal Test Configuration: Right Edge 0mm from Flat Phantom

Communication System: Wi-Fi 2450; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium: 2450 Glycol Body; Medium parameters used: $f = 2450$ MHz; $\sigma = 1.9$ mho/m; $\epsilon_r = 52.1$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3115; ConvF(4.12, 4.12, 4.12); Calibrated: 1/12/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#_6 - Triple Flat Phantom 5.1; Type: Triple Flat Phantom 5.1;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Triple Flat Phone Template/Tablet Long Edge Area Scan - Body (10mm) (28x8x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.278 mW/g

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

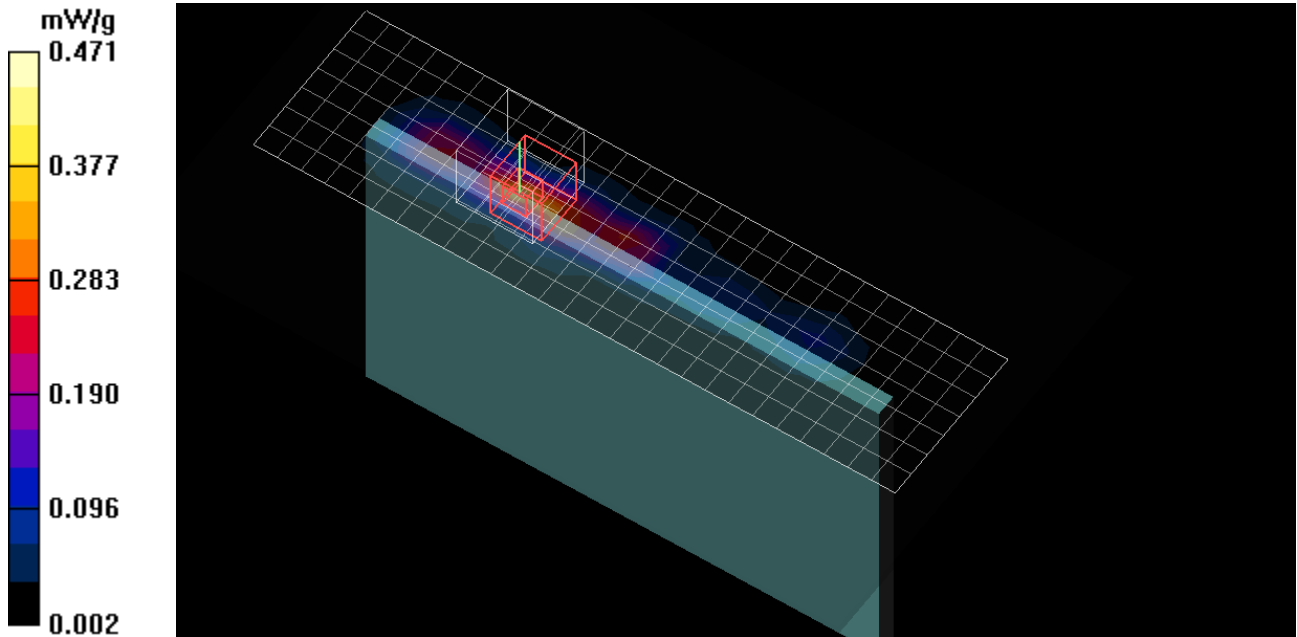
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 15.6 V/m; Power Drift = 0.058 dB

Peak SAR (extrapolated) = 0.790 W/kg

SAR(1 g) = 0.310 mW/g; SAR(10 g) = 0.131 mW/g

Maximum value of SAR (measured) = 0.471 mW/g



Test Laboratory: Motorola Mobility - 5200 MHz WiFi Right Edge

DUT: Serial: KFLC110069, FCC ID: IHDP56MJ3

Procedure Notes: 802.11n 7.2 Mbps Chn 48 Battery Model #: INTERNAL Test Configuration = Right Edge of DUT 0mm from Phantom

Communication System: 5210MHz Band - 802.11a; Frequency: 5240 MHz; Duty Cycle: 1:1

Medium: 5-6 GHz SPEAG Tissue BODY; Medium parameters used: $f = 5210$ MHz; $\sigma = 5.91$ mho/m; $\epsilon_r = 48.4$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: EX3DV4 - SN3728; ConvF(4.16, 4.16, 4.16); Calibrated: 5/20/2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn440; Calibrated: 11/11/2010
- Phantom: R3 Triple Flat Phantom 5.1C (Rev.3); Type: QD 000 P51 CA; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

TRIPLE Flat Phone Against Flat Section/Tablet Long Edge Area Scan - Body (10mm) (27x8x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 3.28 mW/g

TRIPLE Flat Phone Against Flat Section/7x7x12 Zoom Scan (5-6GHz) (7x7x6)/Cube 0:

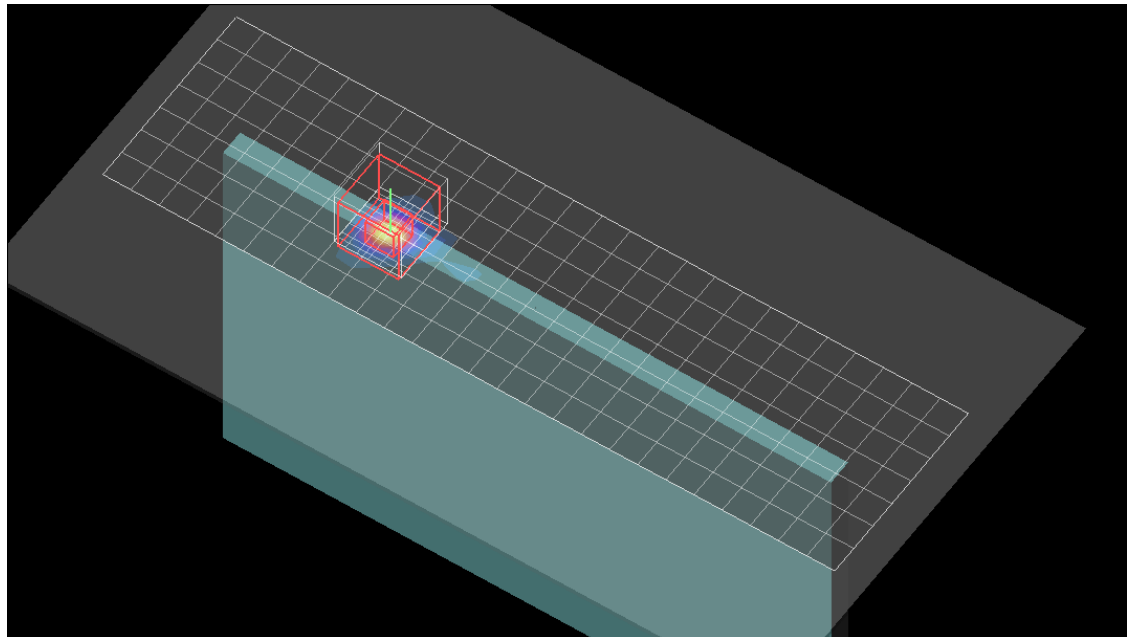
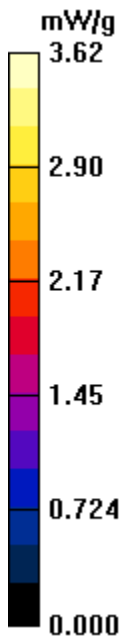
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 16.2 V/m; Power Drift = 0.144 dB

Peak SAR (extrapolated) = 6.96 W/kg

SAR(1 g) = 1.52 mW/g; SAR(10 g) = 0.321 mW/g

Maximum value of SAR (measured) = 3.62 mW/g



Test Laboratory: Motorola Mobility - 5800 MHz WiFi Right Edge

DUT: Serial: KFLC110069, FCC ID: IHDP56MJ3

Procedure Notes: 802.11a 6 Mbps Chn 149 Battery Model #: INTERNAL Test Configuration = Right Edge 0mm from Phantom

Communication System: 5785MHz Band - 802.11a; Frequency: 5745 MHz; Duty Cycle: 1:1

Medium: 5-6 GHz SPEAG Tissue BODY; Medium parameters used: $f = 5785$ MHz; $\sigma = 6.77$ mho/m; $\epsilon_r = 47.1$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: EX3DV4 - SN3728; ConvF(3.76, 3.76, 3.76); Calibrated: 5/20/2011
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn440; Calibrated: 11/11/2010
- Phantom: R3 Triple Flat Phantom 5.1C (Rev.3); Type: QD 000 P51 CA; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

TRIPLE Flat Phone Against Flat Section/Tablet Long Edge Area Scan - Body (10mm) (27x8x1):

Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.532 mW/g

TRIPLE Flat Phone Against Flat Section/7x7x12 Zoom Scan (5-6GHz) (7x7x6)/Cube 0:

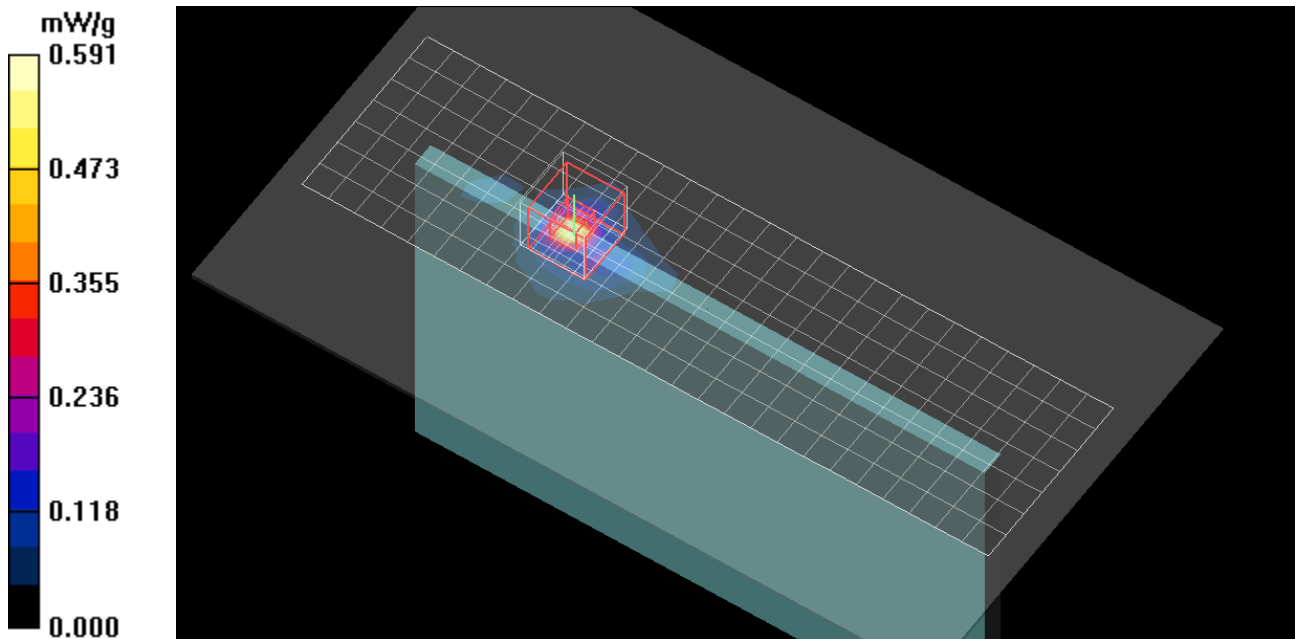
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 8.73 V/m; Power Drift = -0.040 dB

Peak SAR (extrapolated) = 1.09 W/kg

SAR(1 g) = 0.247 mW/g; SAR(10 g) = 0.057 mW/g

Maximum value of SAR (measured) = 0.591 mW/g



Appendix 3

Measurement Uncertainty Budget

Uncertainty Budget for Device Under Test, for 2 GHz to 3 GHz

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	$e = f(d,k)$	<i>f</i>	<i>g</i>	$h = c \times f / e$	$i = c \times g / e$	<i>k</i>
Uncertainty Component	Description IEEE1528(2003) / IEC62209-1(2005)	Tol. (± %)	Prob Dist	Div.	<i>c_i</i> (1 g)	<i>c_i</i> (10 g)	1 g <i>u_i</i> (±%)	10 g <i>u_i</i> (±%)	<i>v_i</i>
Measurement System									
Probe Calibration [ES3DV3]	E.2.1 / 7.2.1	5.5	N	1.00	1	1	5.5	5.5	∞
Axial Isotropy	E.2.2 / 7.2.1.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2 / 7.2.1.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3 / 7.2.1.5	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4 / 7.2.1.3	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5 / 7.2.1.4	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6 / 7.2.1.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7 / 7.2.1.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8 / 7.2.1.8	1.1	R	1.73	1	1	0.6	0.6	∞
RF Ambient Conditions - Noise	E.6.1 / 7.2.3.6	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1 / 7.2.3.6	3.0	R	1.73	1	1	1.7	1.7	∞
Probe Positioner Mech. Tolerance	E.6.2 / 7.2.2.1	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t Phantom	E.6.3 / 7.2.2.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5 / 7.2.4	3.4	R	1.73	1	1	2.0	2.0	∞
Test sample Related									
Test Sample Positioning	E.4.2 / 7.2.2.4	3.4	N	1.00	1	1	3.4	3.4	79
Device Holder Uncertainty	E.4.1 / 7.2.2.4.2	4.5	N	1.00	1	1	4.5	4.5	11
SAR drift	6.6.2 / 7.2.3.5	0.0	R	1.73	1	1	0.0	0.0	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1 / 7.2.2.2	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2 / 7.2.3.3	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3 / 7.2.3.3	2.5	N	1.00	0.64	0.43	1.6	1.1	6
Liquid Permittivity (target)	E.3.2 / 7.2.3.4	10.0	R	1.73	0.6	0.49	3.5	2.8	∞
Liquid Permittivity (measurement)	E.3.2 / 7.2.3.4	2.3	N	1.00	0.6	0.49	1.4	1.1	6
Combined Standard Uncertainty			RSS				11	11	392
Expanded Uncertainty (95% CONFIDENCE LEVEL)			<i>k</i> =2				22	22	

Uncertainty Budget for Device Under Test for 3 to 6 GHz

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e = f(d,k)</i>	<i>f</i>	<i>g</i>	<i>h = c x f / e</i>	<i>i = c x g / e</i>	<i>k</i>
Uncertainty Component	Description IEC62209- 2(2010)	Tol. (± %)	Prob Dist	Div.	<i>c_i</i> (1 g)	<i>c_i</i> (10 g)	1 g <i>u_i</i> (±%)	10 g <i>u_i</i> (±%)	<i>v_i</i>
Measurement System									
Probe Calibration [EX3DV4]	7.2.2.1	6.6	N	1.00	1	1	6.6	6.6	∞
Axial Isotropy	7.2.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	7.2.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	7.2.2.6	2.0	R	1.73	1	1	1.2	1.2	∞
Linearity	7.2.2.5	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	7.2.2	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	7.2.2.7	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	7.2.2.8	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	7.2.2.9	1.1	R	1.73	1	1	0.6	0.6	∞
RF Ambient Conditions - Noise	7.2.4.5	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	7.2.4.5	3.0	R	1.73	1	1	1.7	1.7	∞
Probe Positioner Mech. Tolerance	7.2.3.1	1.0	R	1.73	1	1	0.6	0.6	∞
Probe Positioning w.r.t Phantom	7.2.3.3	4.0	R	1.73	1	1	2.3	2.3	∞
Max. SAR Evaluation (ext., int., avg.)	7.2.5.3	4.0	R	1.73	1	1	2.3	2.3	∞
Test sample Related									
Test Sample Positioning	7.2.3.4	3.4	N	1.00	1	1	3.4	3.4	79
Device Holder Uncertainty	7.2.3.4	4.5	N	1.00	1	1	4.5	4.5	11
SAR drift	7.2.2.10	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	7.2.3.2	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)		5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	7.2.4.3	3.4	N	1.00	0.64	0.43	2.2	1.5	6
Liquid Permittivity (target)		10.0	R	1.73	0.6	0.49	3.5	2.8	∞
Liquid Permittivity (measurement)	7.2.4.3	2.6	N	1.00	0.6	0.49	1.6	1.3	6
Combined Standard Uncertainty									
			RSS				13	12	566
Expanded Uncertainty (95% CONFIDENCE LEVEL)									
			<i>k</i> =2				25	24	

Appendix 4

Probe Calibration Certificate



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: **EX3-3728_May11**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3728**

Calibration procedure(s) **QA CAL-01.v7, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v3
Calibration procedure for dosimetric E-field probes**

Calibration date: **May 20, 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	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	3-May-11 (No. DAE4-654_May11)	May-12
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

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

Issued: May 20, 2011

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 E²-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}** 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 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:3728

Manufactured: October 19, 2009
Calibrated: May 20, 2011

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3728

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V/m})^2$) ^A	0.48	0.45	0.51	$\pm 10.1 \%$
DCP (mV) ^B	99.5	100.3	100.3	

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	110.9	$\pm 1.9 \%$
			Y	0.00	0.00	1.00	113.4	
			Z	0.00	0.00	1.00	115.0	

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

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

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the 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:3728

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)
5200	36.0	4.66	4.64	4.64	4.64	0.42	1.80	± 13.1 %
5300	35.9	4.76	4.34	4.34	4.34	0.42	1.80	± 13.1 %
5600	35.5	5.07	4.01	4.01	4.01	0.50	1.80	± 13.1 %
5800	35.3	5.27	4.13	4.13	4.13	0.45	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:3728

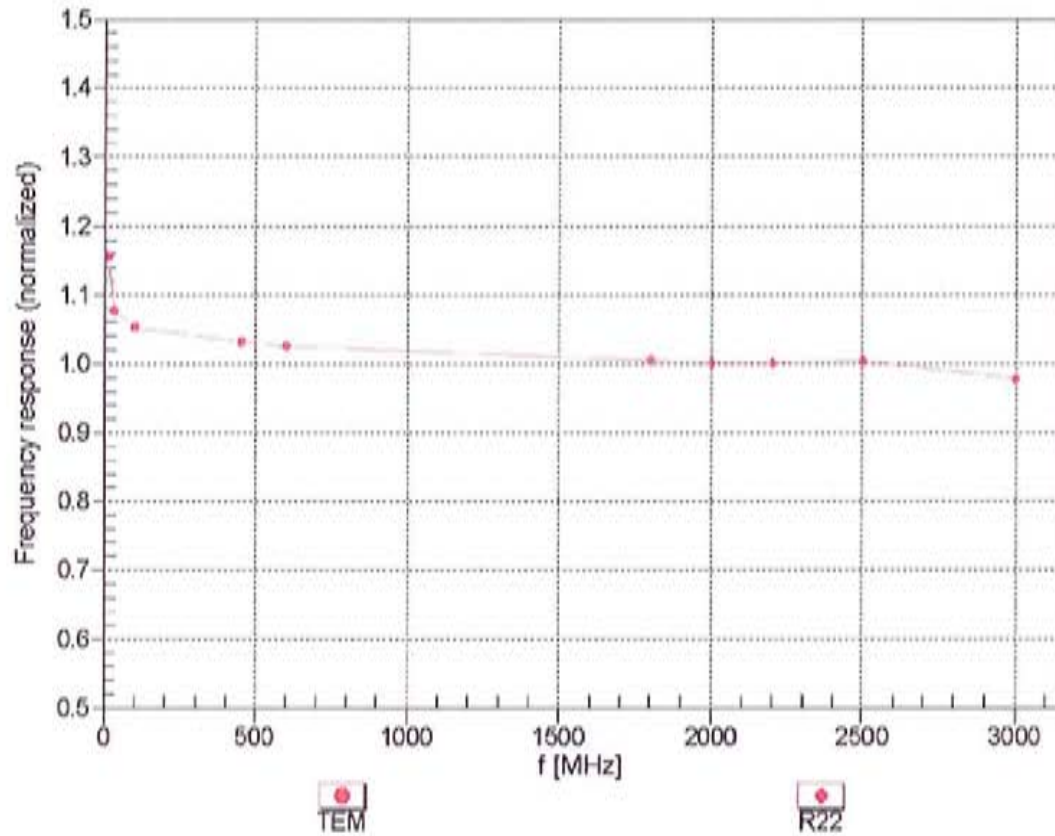
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
5200	49.0	5.30	4.16	4.16	4.16	0.50	1.90	± 13.1 %
5300	48.9	5.42	3.91	3.91	3.91	0.52	1.90	± 13.1 %
5600	48.5	5.77	3.41	3.41	3.41	0.55	1.90	± 13.1 %
5800	48.2	6.00	3.76	3.76	3.76	0.55	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.

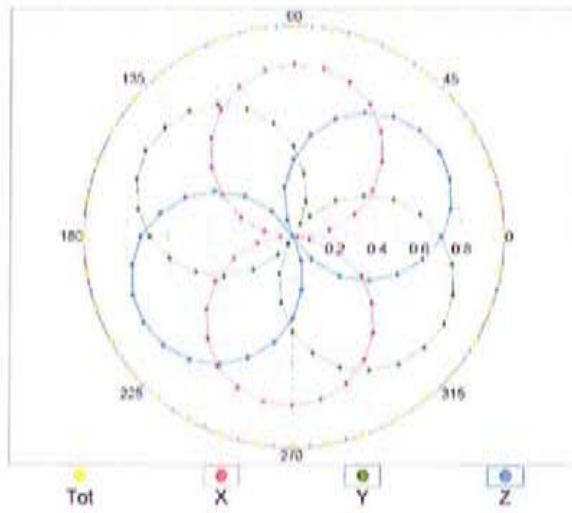
Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



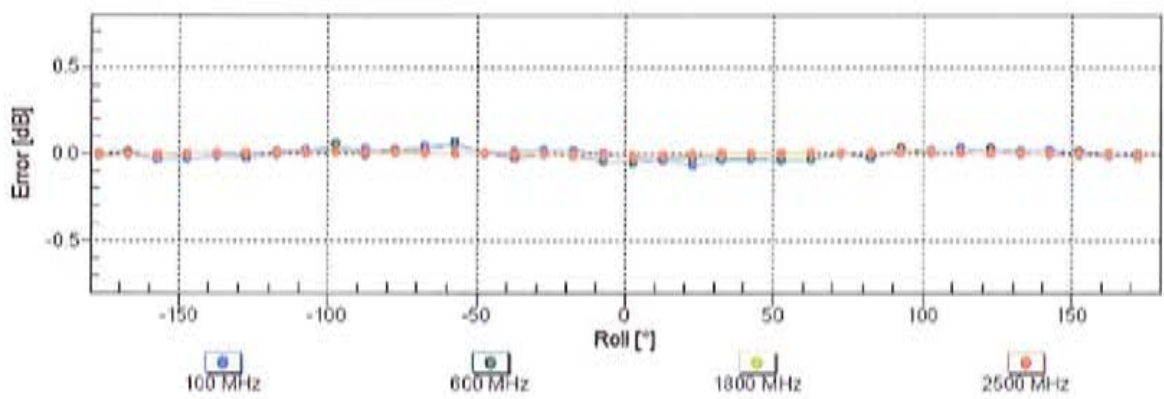
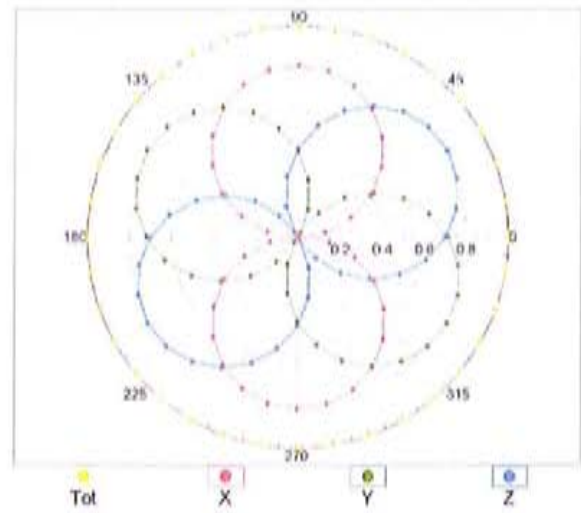
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

f=600 MHz, TEM

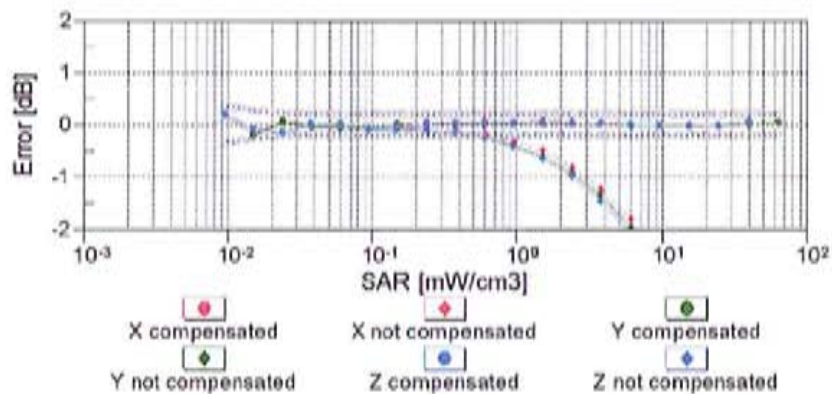
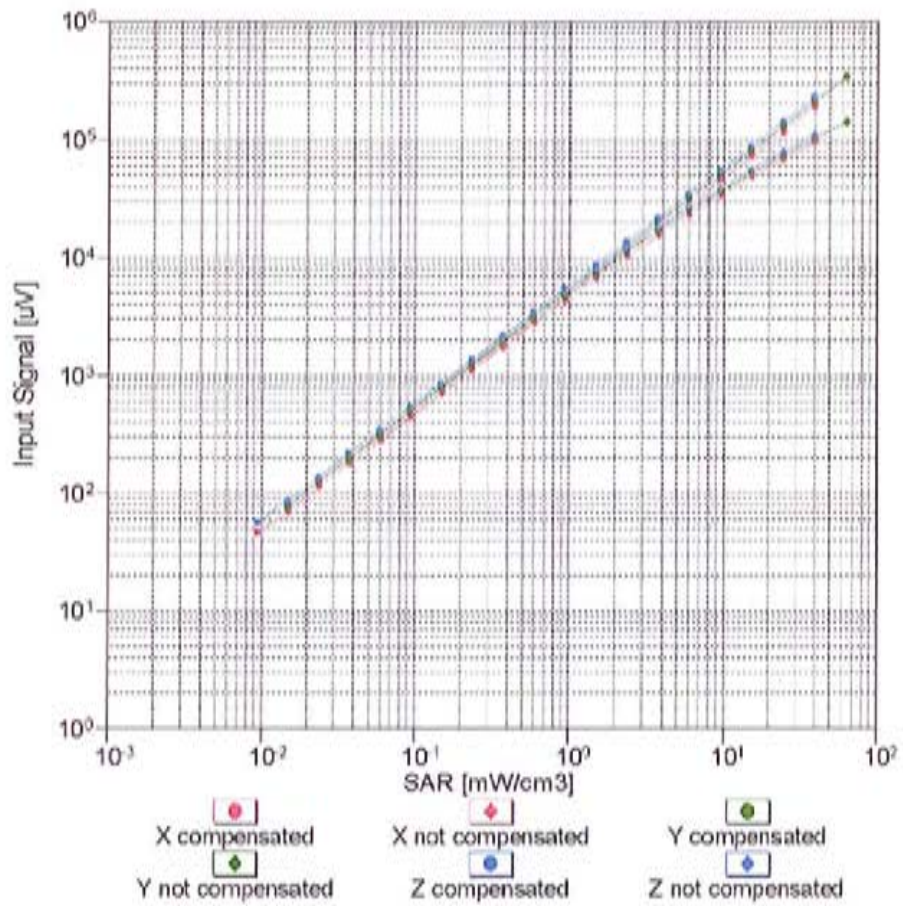


f=1800 MHz, R22



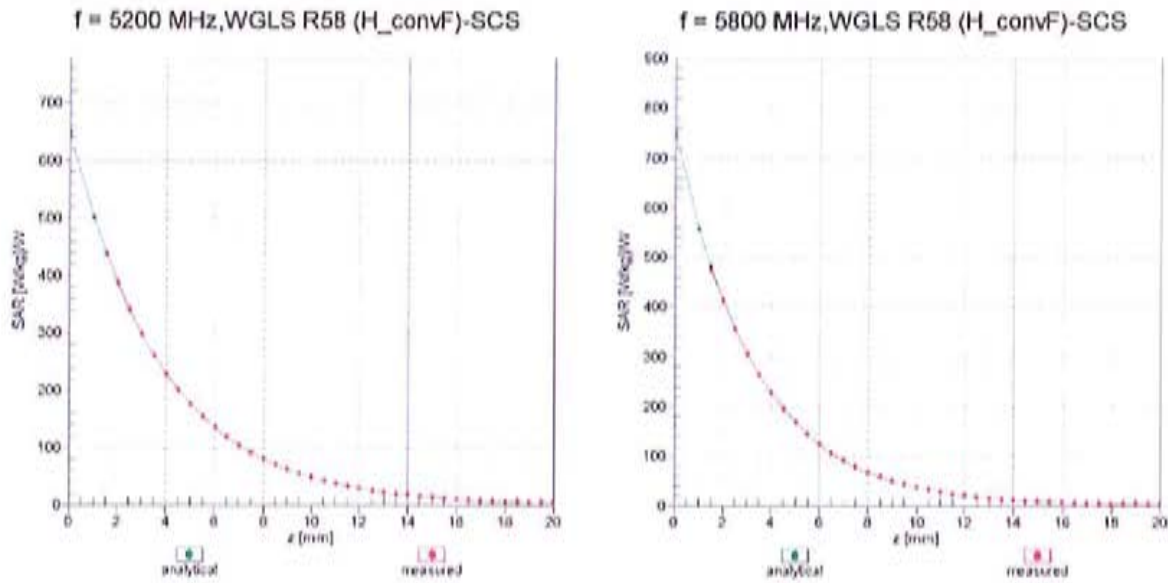
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

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



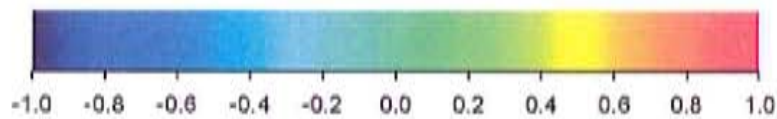
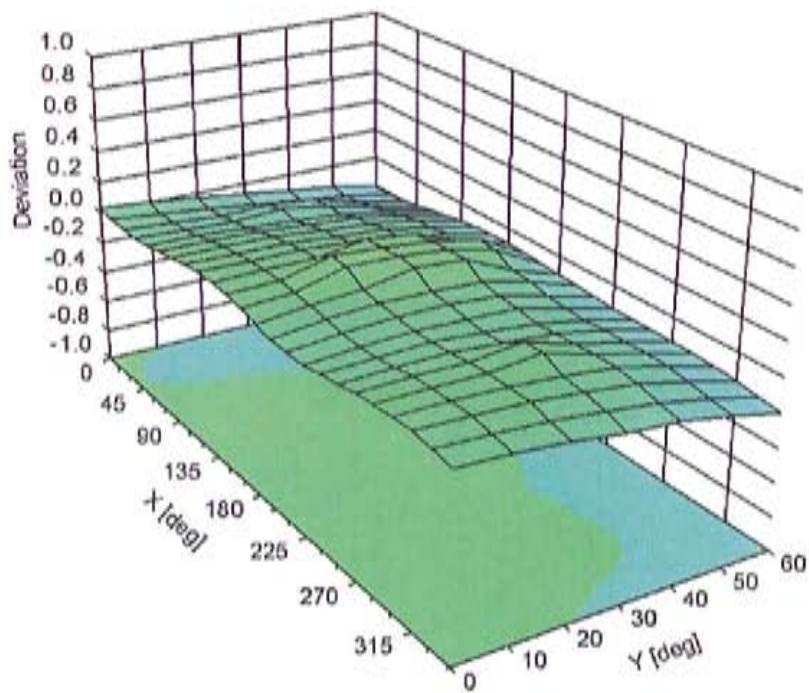
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ (k=2)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3728**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	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



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Accreditation No.: SCS 108

Client **Motorola MDb**

Certificate No: **ES3-3124_Aug11**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3124**

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

Calibration date: **August 23, 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	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	3-May-11 (No. DAE4-654_May11)	May-12
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:	Kalja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: August 23, 2011

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Accreditation No.: SCS 108

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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 E²-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:3124

Manufactured: July 11, 2006
Calibrated: August 23, 2011

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3124

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V/m})^2$) ^A	1.26	1.30	1.30	$\pm 10.1 \%$
DCP (mV) ^B	100.9	98.2	100.9	

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	116.0	$\pm 2.7 \%$
			Y	0.00	0.00	1.00	109.7	
			Z	0.00	0.00	1.00	115.4	

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:3124

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)
750	41.9	0.89	6.26	6.26	6.26	1.00	1.00	± 12.0 %
835	41.5	0.90	6.08	6.08	6.08	1.00	1.00	± 12.0 %
1810	40.0	1.40	5.03	5.03	5.03	1.00	1.12	± 12.0 %
1950	40.0	1.40	4.83	4.83	4.83	1.00	1.12	± 12.0 %
2450	39.2	1.80	4.40	4.40	4.40	1.00	1.12	± 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:3124

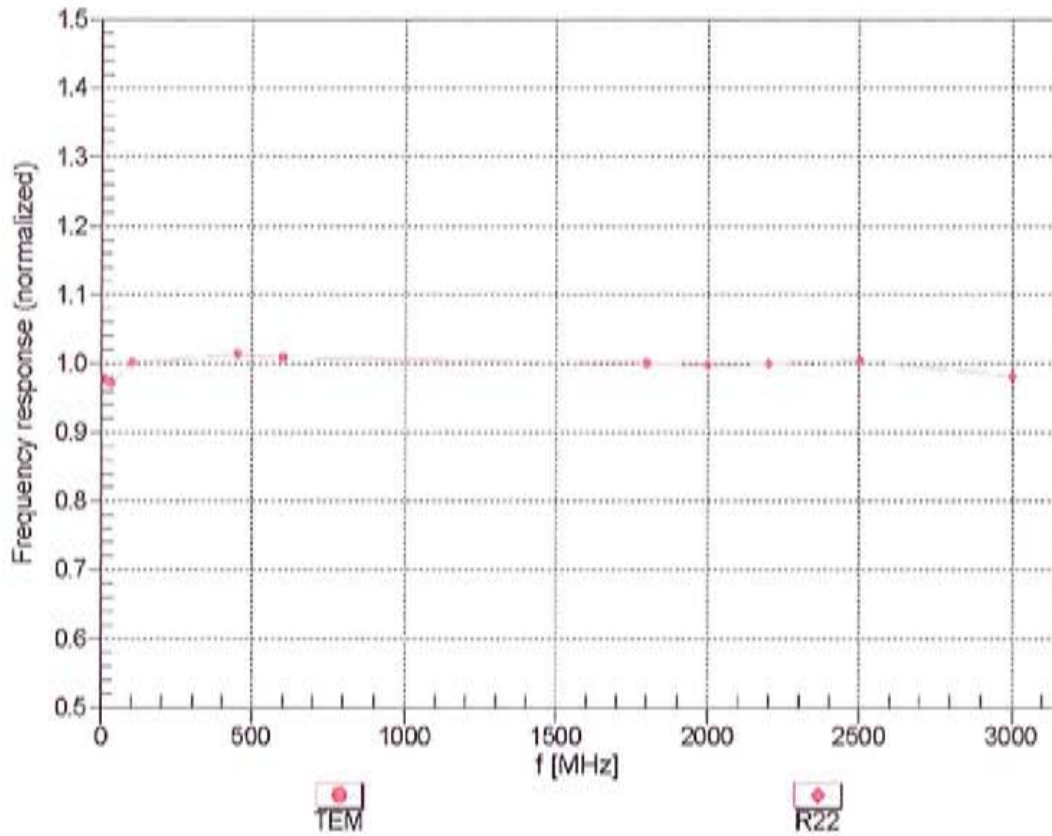
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^c	Relative Permittivity ^f	Conductivity (S/m) ^f	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.09	6.09	6.09	1.00	1.00	± 12.0 %
835	55.2	0.97	6.04	6.04	6.04	1.00	1.00	± 12.0 %
1810	53.3	1.52	4.69	4.69	4.69	1.00	1.18	± 12.0 %
1950	53.3	1.52	4.70	4.70	4.70	1.00	1.16	± 12.0 %
2450	52.7	1.95	4.21	4.21	4.21	1.00	1.00	± 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.

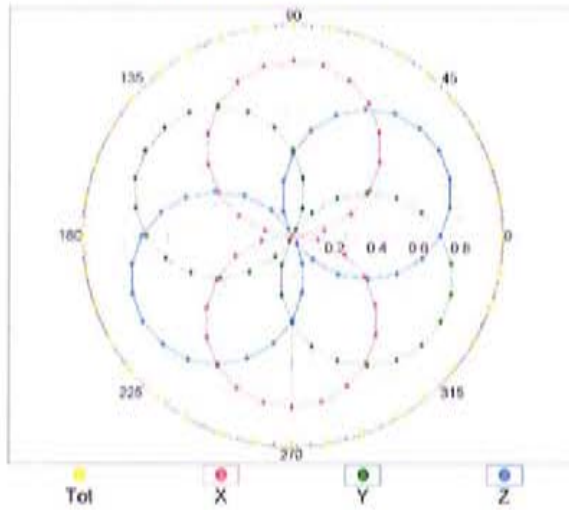
Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



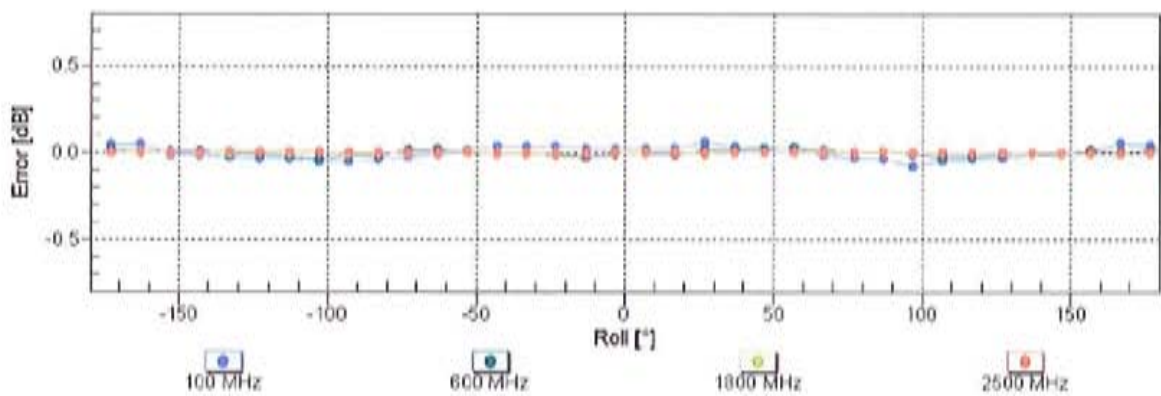
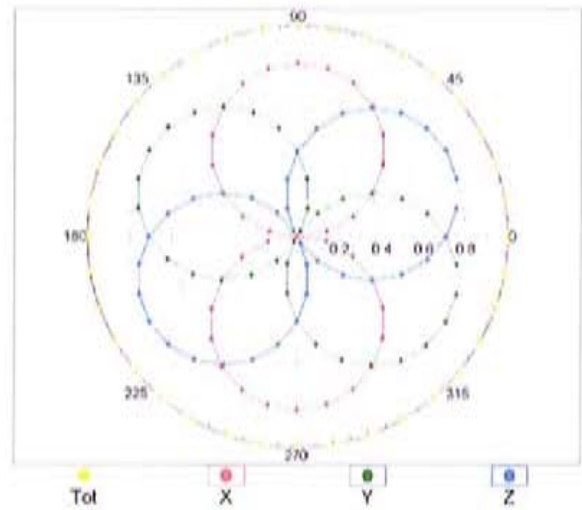
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

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

f=600 MHz, TEM

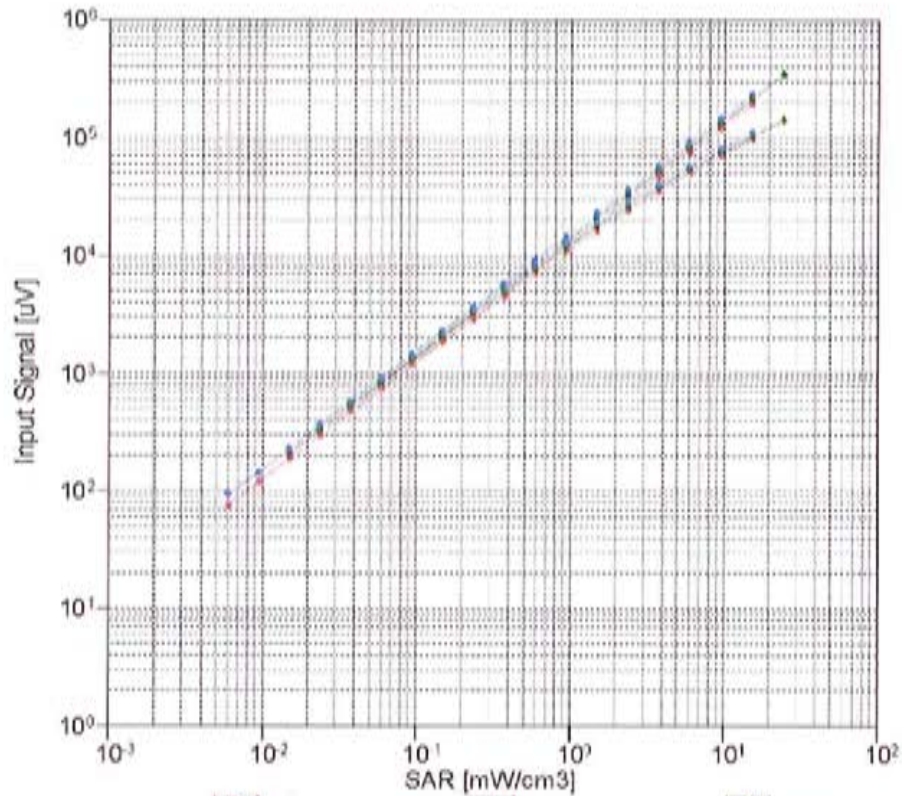


f=1800 MHz, R22

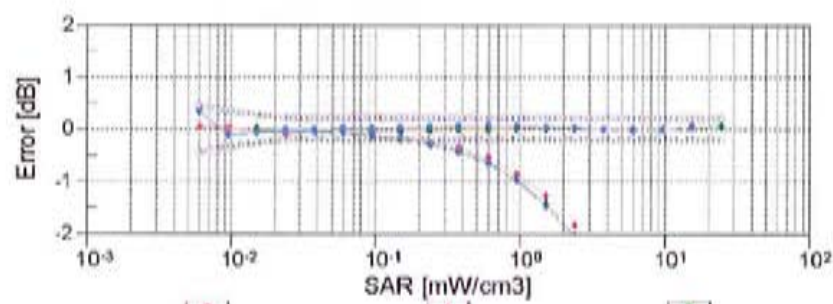


Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

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



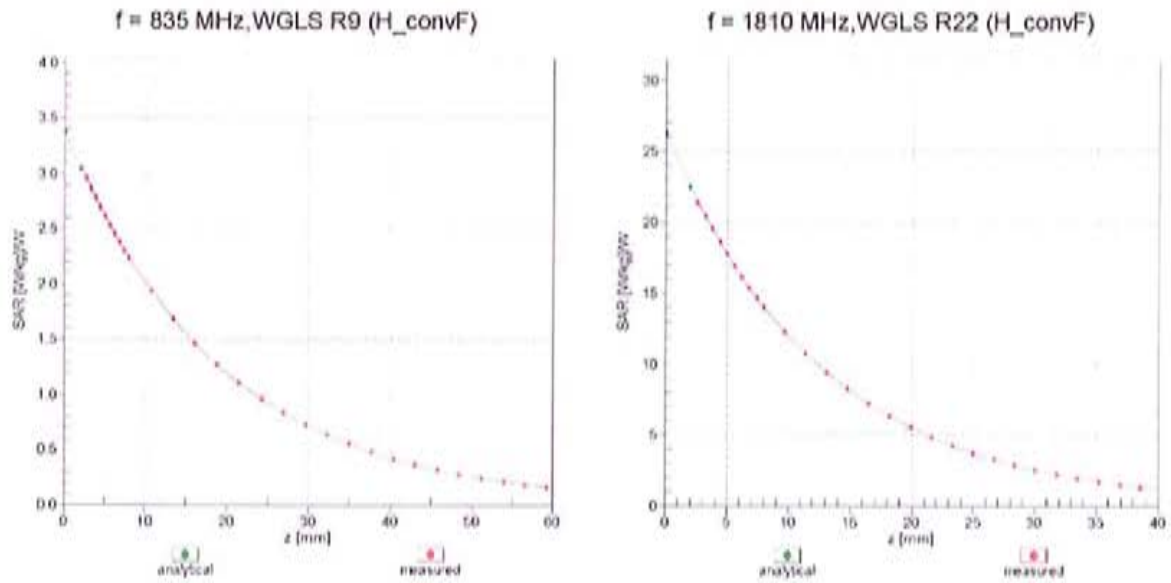
● X compensated	◆ X not compensated	● Y compensated
◆ Y not compensated	● Z compensated	◆ Z not compensated



● X compensated	◆ X not compensated	● Y compensated
◆ Y not compensated	● Z compensated	◆ Z not compensated

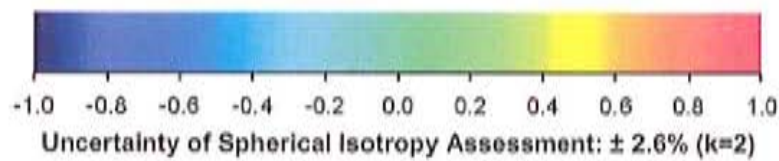
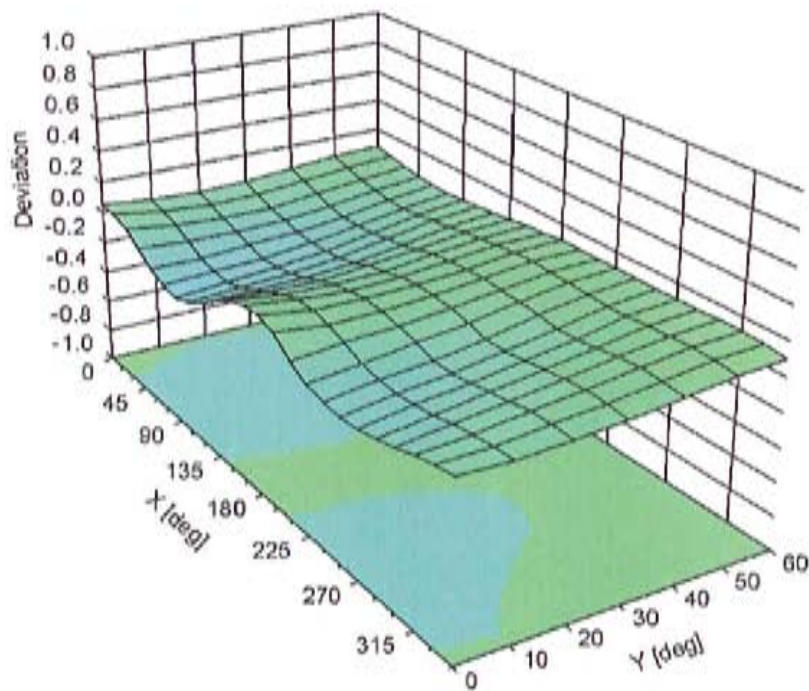
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), f = 900 MHz



DASY/EASY - Parameters of Probe: ES3DV3 - SN:3124

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



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Accreditation No.: SCS 108

Client **Motorola MDb**

Certificate No: **ES3-3115_Jan11**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3115**

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

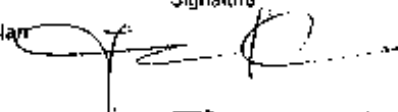
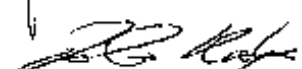
Calibration date: **January 12, 2011**

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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41283874	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01150)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dac10)	Dec-11
DAE4	SN: 660	20-Apr-10 (No. DAE4-660_Apr10)	Apr-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390685	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: January 13, 2011

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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 effect the E^2 -field uncertainty inside TSL (see below ConvF).
- NORM(ϑ)_{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.
- 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:3115

Manufactured:	March 6, 2006
Last calibrated:	January 19, 2010
Recalibrated:	January 12, 2011

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ES3DV3 SN:3115**Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	1.29	1.30	1.18	± 10.1%
DCP (mV) ^B	100.2	102.3	101.3	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc ^C (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	113.4	± 2.4 %
			Y	0.00	0.00	1.00	150.5	
			Z	0.00	0.00	1.00	142.6	

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

^B Numerical linearization parameter; uncertainty not required.

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

DASY/EASY - Parameters of Probe: ES3DV3 SN:3115

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz)	Validity (MHz)^c	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
835	± 50 / ± 100	41.5 ± 5%	0.90 ± 5%	5.87	5.87	5.87	0.34	1.74 ± 11.0%
1810	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	5.02	5.02	5.02	0.43	1.62 ± 11.0%
1950	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	4.80	4.80	4.80	0.62	1.36 ± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	4.39	4.39	4.39	0.94	1.13 ± 11.0%

^c The validity of ± 100 MHz only applies for DASY v1.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

DASY/EASY - Parameters of Probe: ES3DV3 SN:3115

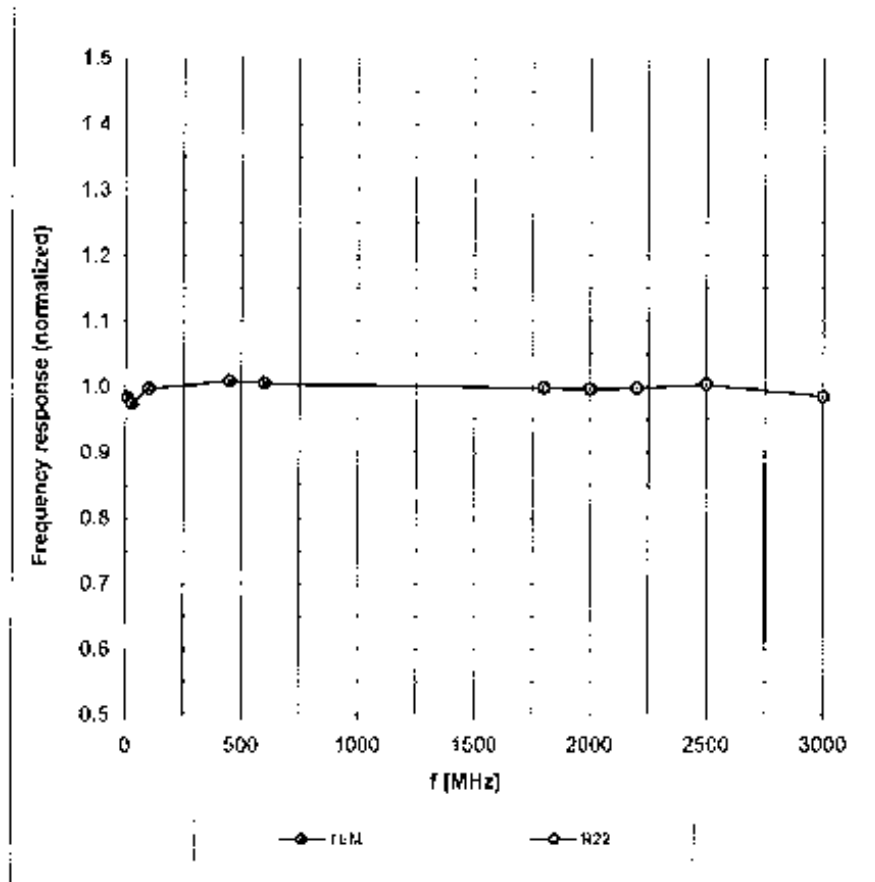
Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz] ^c	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
835	± 50 / ± 100	55.2 ± 5%	0.97 ± 5%	5.88	5.88	5.88	0.57	1.41 ± 11.0%
1810	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.61	4.61	4.61	0.33	2.26 ± 11.0%
1950	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.57	4.57	4.57	0.36	2.19 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	4.12	4.12	4.12	0.99	0.75 ± 11.0%

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

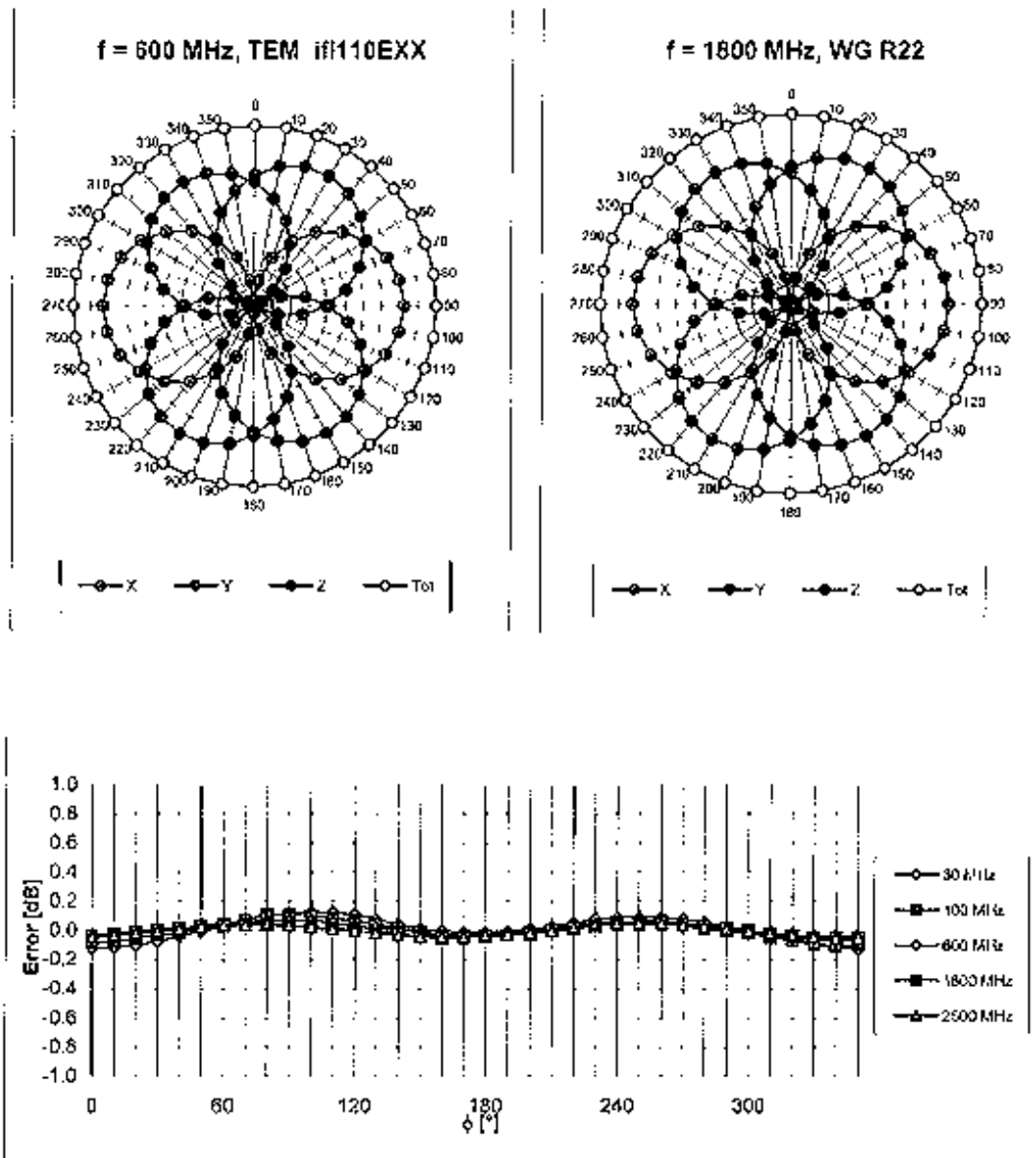
Frequency Response of E-Field

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



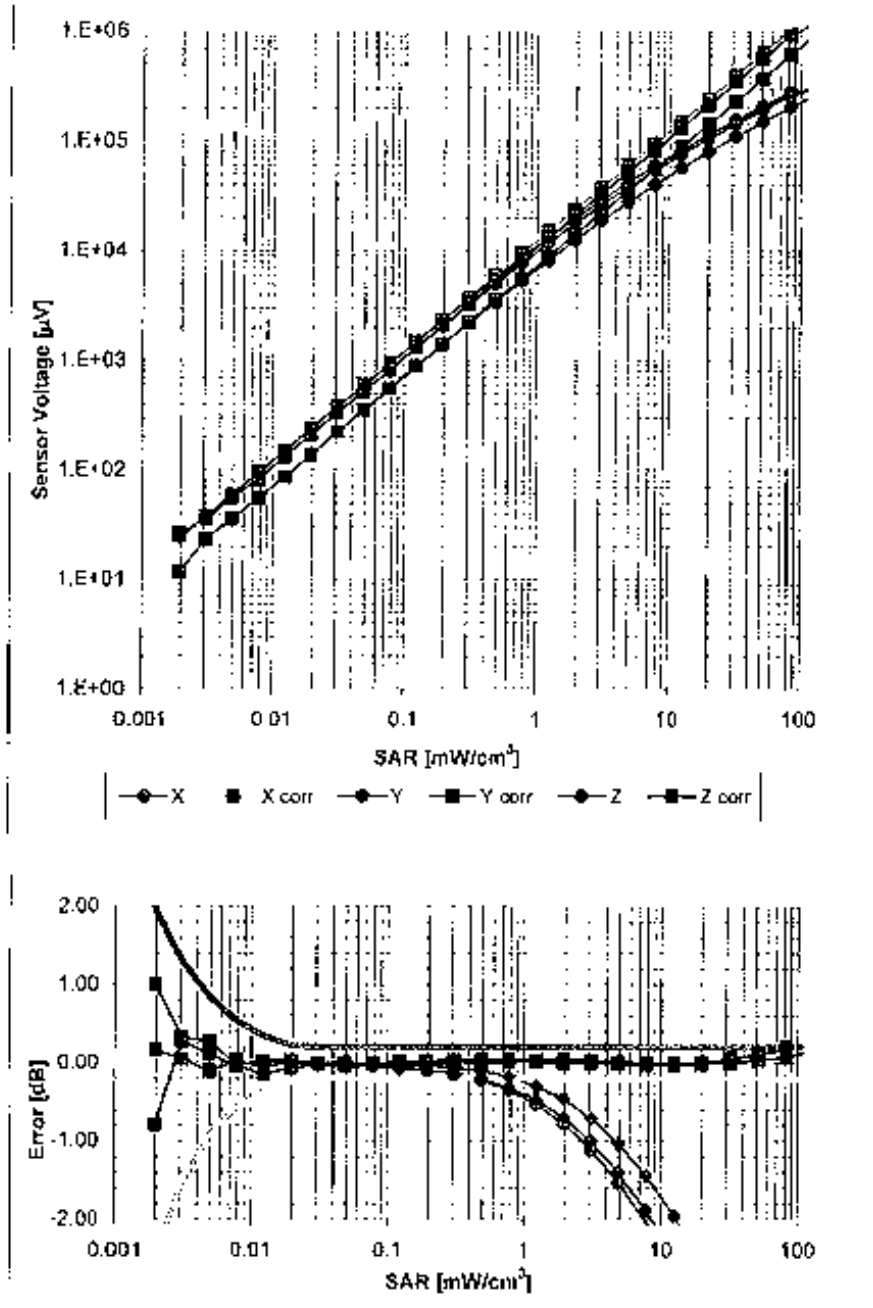
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

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



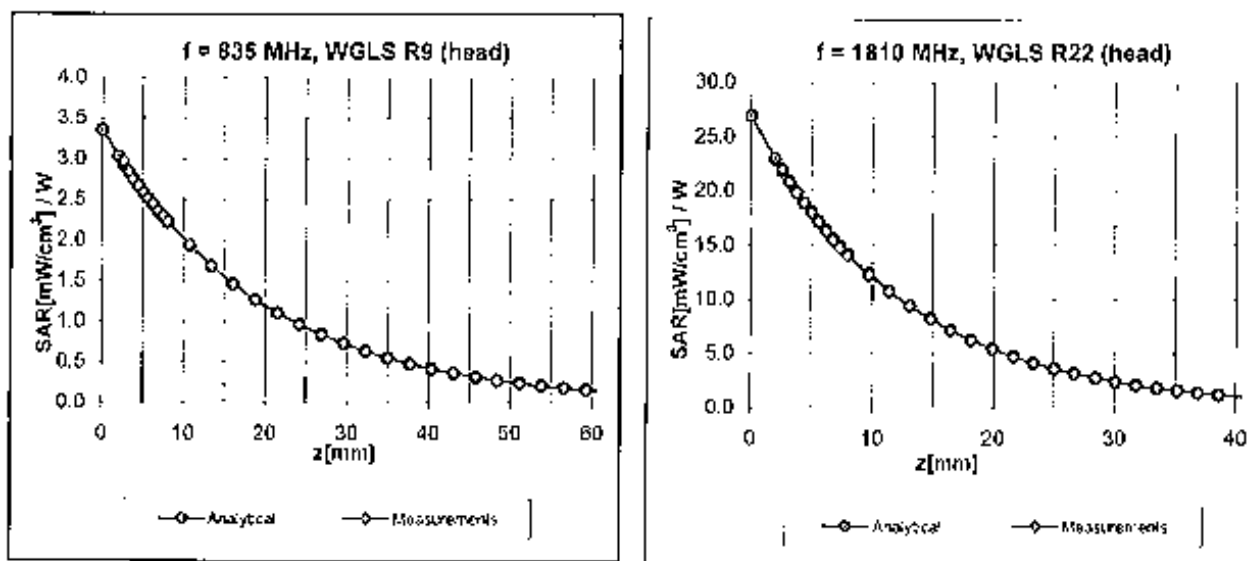
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

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



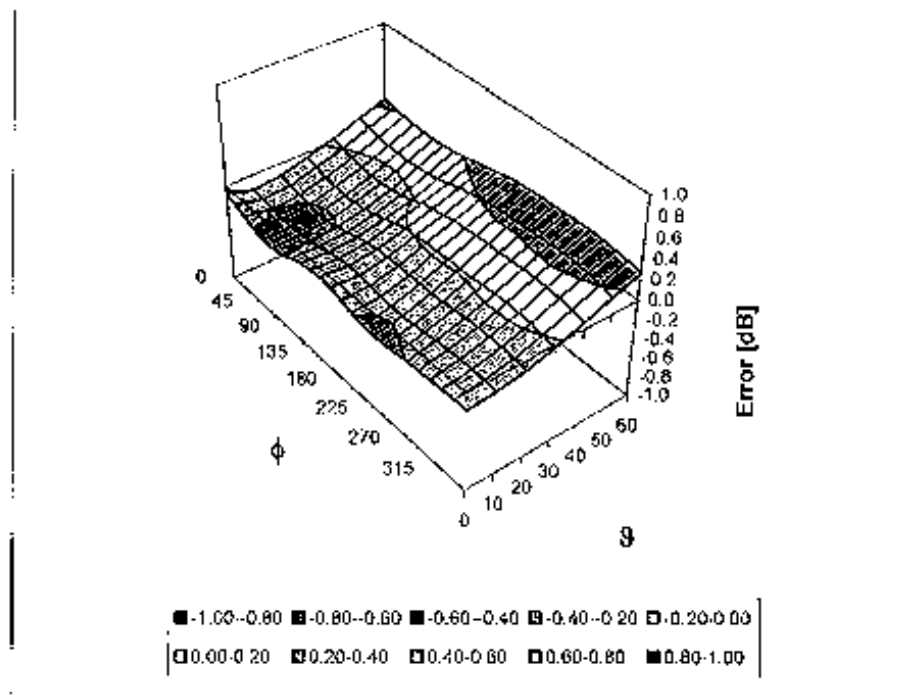
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in HSL

Error (ϕ , θ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: $\pm 2.8\%$ (k=2)

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

Appendix 5

Dipole Characterization Certificate



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: **D2450V2-863_Mar11**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 863**

Calibration procedure(s) **QA CAL-05.v8
Calibration procedure for dipole validation kits**

Calibration date: **March 17, 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 EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: March 17, 2011

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

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V52.6.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	38.7 \pm 6 %	1.72 mho/m \pm 6 %
Head TSL temperature during test	(22.0 \pm 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 mW / g
SAR normalized	normalized to 1W	53.2 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	54.2 mW / g \pm 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.23 mW / g
SAR normalized	normalized to 1W	24.9 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	25.1 mW / g \pm 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.5 ± 6 %	1.92 mho/m ± 6 %
Body TSL temperature during test	(21.0 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.2 mW / g
SAR normalized	normalized to 1W	52.8 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	52.8 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.11 mW / g
SAR normalized	normalized to 1W	24.4 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	24.4 mW / g ± 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.1 Ω + 2.9 j Ω
Return Loss	- 27.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.5 Ω + 5.2 j Ω
Return Loss	- 25.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.165 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	April 23, 2010

DASY5 Validation Report for Head TSL

Date/Time: 17.03.2011 13:48:21

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:863

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: HSL U12 BB

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.72$ mho/m; $\epsilon_r = 38.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.4 Build (2829)

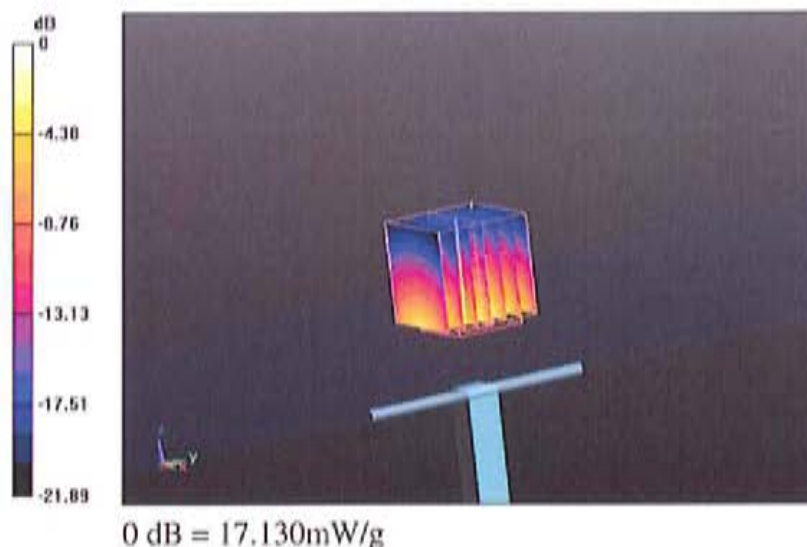
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe) /Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 104.8 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 27.215 W/kg

SAR(1 g) = 13.3 mW/g; SAR(10 g) = 6.23 mW/g

Maximum value of SAR (measured) = 17.128 mW/g

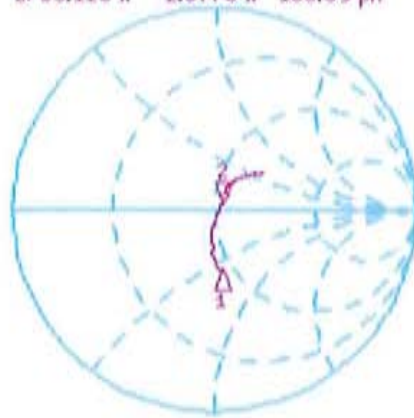


Impedance Measurement Plot for Head TSL

17 Mar 2011 10:52:35

CH1 S11 1 U FS 2: 53.113 Ω 2: 8770 Ω 186.89 pH 2 450.000 000 MHz

*
De1
CA

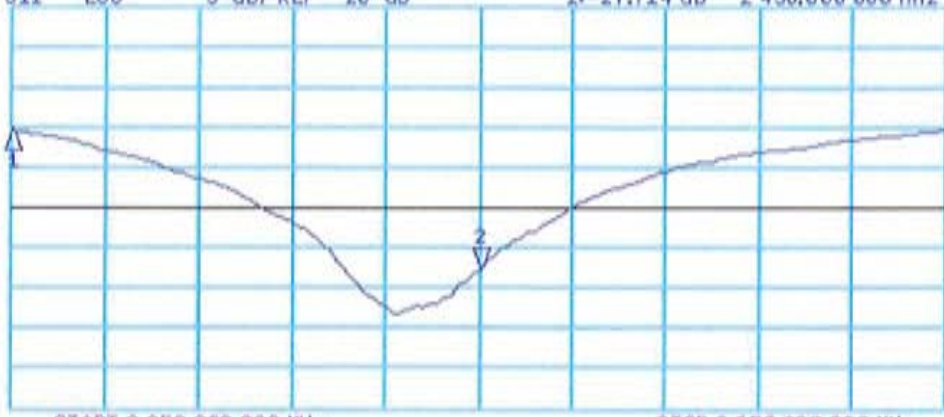


CH1 Markers
1: 44.096 Ω
-29.182 Ω
2: 25000 GHz

Avg
16
↑

CH2 S11 LOG 5 dB/REF -20 dB 2: -27.714 dB 2 450.000 000 MHz

CA
Avg
16
↑



CH2 Markers
1: -10.394 dB
2: 25000 GHz

START 2 250.000 000 MHz

STOP 2 650.000 000 MHz

DASY5 Validation Report for Body TSL

Date/Time: 08.03.2011 15:14:58

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:863

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: MSL U12 BB

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.93$ mho/m; $\epsilon_r = 51.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.31, 4.31, 4.31); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.4 Build (2829)

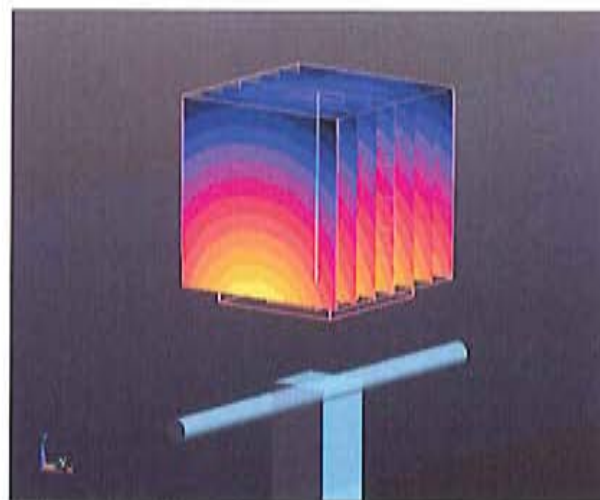
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.651 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 27.947 W/kg

SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.11 mW/g

Maximum value of SAR (measured) = 17.459 mW/g

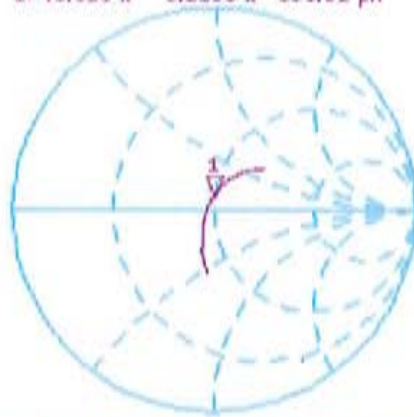


0 dB = 17.460mW/g

Impedance Measurement Plot for Body TSL

8 Mar 2011 18:09:08
[CH1] S11 1 U FS 1:48.518 ω 5.2188 ω 339.02 ρ H 2 450.000 000 MHz

*
Del
Cor



avg
16

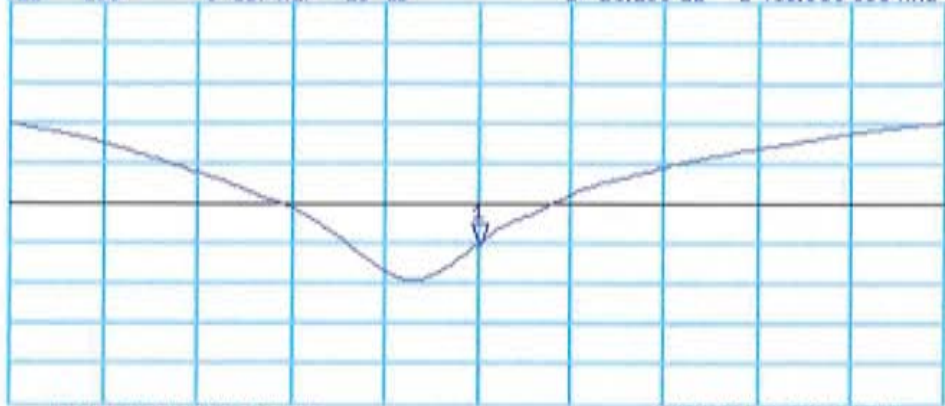
↑

CH2 S11 LOG 5 dB/REF -20 dB 1:-25,200 dB 2 450.000 000 MHz

Cor

avg
16

↑



START 2 250.000 000 MHz

STOP 2 650.000 000 MHz



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Motorola MDB**

Certificate No: **D2450V2-740_Mar11**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 740**

Calibration procedure(s) **QA CAL-05.v8
Calibration procedure for dipole validation kits**

Calibration date: **March 17, 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 $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 08327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by: **Claudio Leubler** Name: Claudio Leubler Function: Laboratory Technician

Signature

Approved by: **Katja Pokovic** Name: Katja Pokovic Function: Technical Manager

Issued: March 21, 2011

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

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V52.6.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	38.7 \pm 6 %	1.72 mho/m \pm 6 %
Head TSL temperature during test	(22.0 \pm 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.2 mW / g
SAR normalized	normalized to 1W	52.8 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	53.8 mW /g \pm 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.16 mW / g
SAR normalized	normalized to 1W	24.6 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	24.8 mW /g \pm 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.5 ± 6 %	1.92 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.8 mW / g
SAR normalized	normalized to 1W	51.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	51.3 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.88 mW / g
SAR normalized	normalized to 1W	23.5 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	23.5 mW / g ± 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.3 Ω + 2.6 j Ω
Return Loss	- 27.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.9 Ω + 5.3 j Ω
Return Loss	- 25.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.164 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 18, 2003

DASY5 Validation Report for Head TSL

Date/Time: 17.03.2011 12:12:34

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:740

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: HSL U12 BB

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.72$ mho/m; $\epsilon_r = 38.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.4 Build (2829)

Head/d=10mm, Pin=250 mW, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 100.2 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 26.990 W/kg

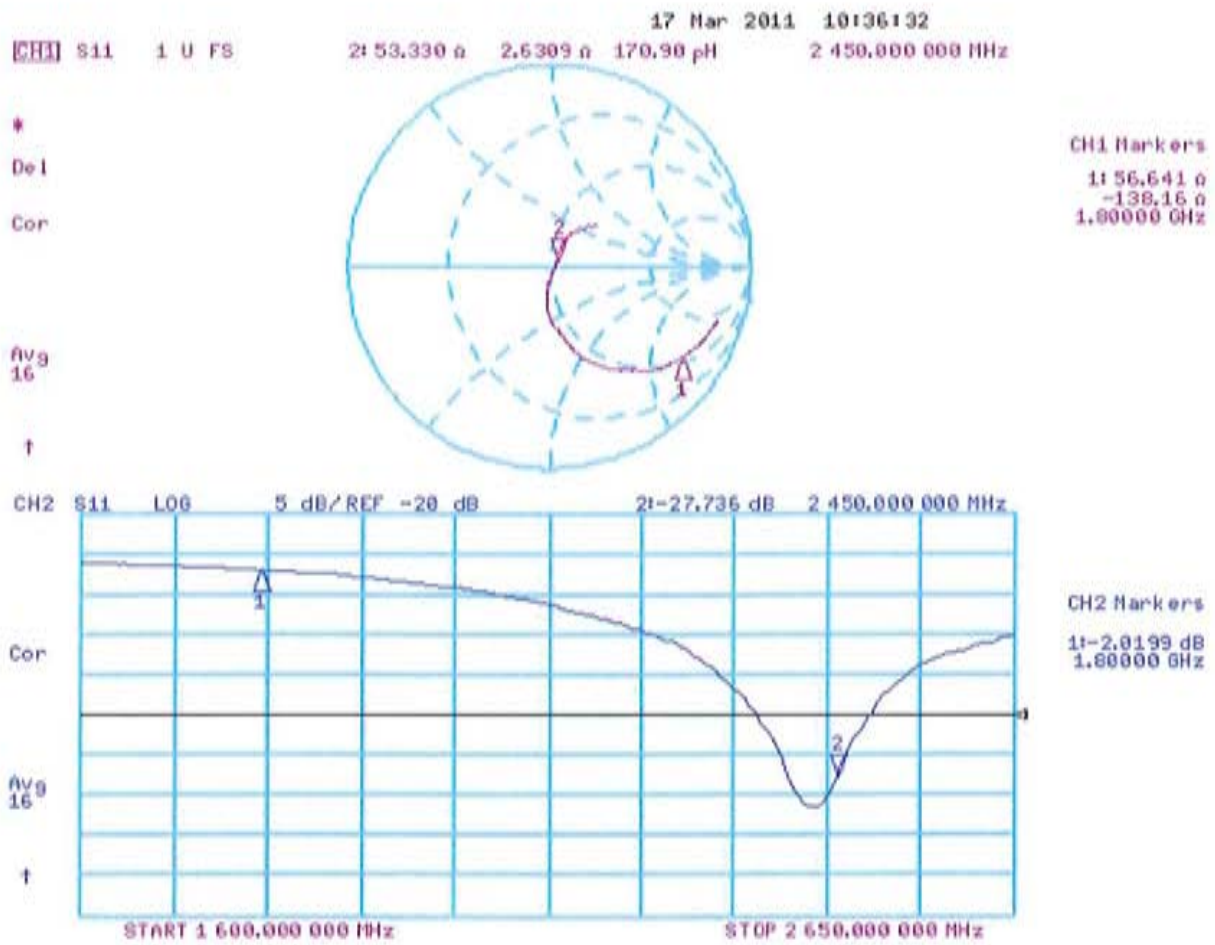
SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.16 mW/g

Maximum value of SAR (measured) = 17.012 mW/g



0 dB = 17.010mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 17.03.2011 14:38:41

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:740

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: MSL U12 BB

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.92$ mho/m; $\epsilon_r = 51.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.31, 4.31, 4.31); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.4 Build (2829)

Body/d=10mm, Pin=250 mW, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.402 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 27.038 W/kg

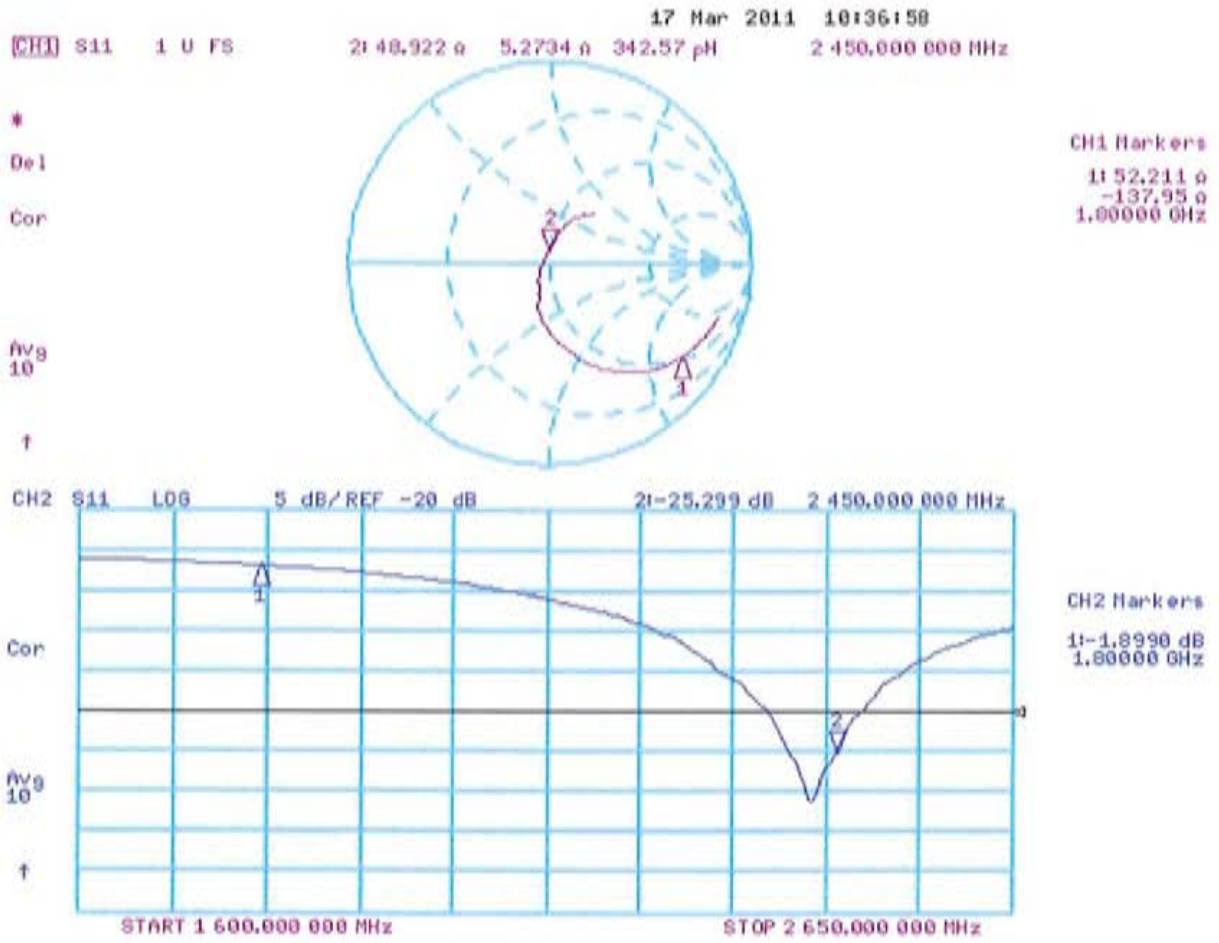
SAR(1 g) = 12.8 mW/g; SAR(10 g) = 5.88 mW/g

Maximum value of SAR (measured) = 16.855 mW/g



0 dB = 16.850mW/g

Impedance Measurement Plot for Body TSL





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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Motorola MD6**

Certificate No: **D5GHzV2-1098_Jan11**

CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN: 1098**

Calibration procedure(s) **QA CAL-22.v1
Calibration procedure for dipole validation kits between 3-6 GHz**

Calibration date: **January 07, 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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe EX3DV4	SN: 3503	05-Mar-10 (No. EX3-3503_Mar10)	Mar-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by: **Jeton Kasrati** Name: **Jeton Kasrati** Function: **Laboratory Technician**

Approved by: **Ketja Pokovic** Name: **Ketja Pokovic** Function: **Technical Manager**

Signature

Issued: January 11, 2011

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



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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- a) IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010
- b) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- c) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V52.6
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Area Scan resolution	dx, dy = 10 mm	
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 2.0 mm	
Frequency	5200 MHz \pm 1 MHz 5800 MHz \pm 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	35.3 \pm 6 %	4.50 mho/m \pm 6 %
Head TSL temperature during test	(22.0 \pm 0.2) °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	condition	
SAR measured	100 mW input power	8.28 mW / g
SAR normalized	normalized to 1W	82.8 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	82.5 mW / g \pm 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.35 mW / g
SAR normalized	normalized to 1W	23.5 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	23.4 mW / g \pm 19.5 % (k=2)

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.5 ± 6 %	5.17 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	condition	
SAR measured	100 mW input power	8.22 mW / g
SAR normalized	normalized to 1W	82.2 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	82.2 mW / g ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 mW / g
SAR normalized	normalized to 1W	23.1 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	23.1 mW / g ± 19.5 % (k=2)

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.2 ± 6 %	5.37 mho/m ± 6 %
Body TSL temperature during test	(21.5 ± 0.2) °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	condition	
SAR measured	100 mW input power	7.81 mW / g
SAR normalized	normalized to 1W	78.1 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	77.5 mW / g ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW Input power	2.17 mW / g
SAR normalized	normalized to 1W	21.7 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	21.5 mW / g ± 19.5 % (k=2)

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.1 ± 6 %	6.14 mho/m ± 6 %
Body TSL temperature during test	(21.5 ± 0.2) °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	condition	
SAR measured	100 mW input power	7.37 mW / g
SAR normalized	normalized to 1W	7.37 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	73.1 mW / g ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.01 mW / g
SAR normalized	normalized to 1W	20.1 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	19.9 mW / g ± 19.5 % (k=2)

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	51.3 Ω - 8.8 j Ω
Return Loss	-21.2 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	55.1 Ω - 0.6 j Ω
Return Loss	-26.2 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	51.4 Ω - 7.4 j Ω
Return Loss	-22.6 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	55.3 Ω + 1.5 j Ω
Return Loss	-25.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.206 ns
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After long term use with 40 W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 24, 2010

DASY5 Validation Report for Head TSL

Date/Time: 07.01.2011 12:59:58

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1098

Communication System: CW; Frequency: 5200 MHz; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: HSL 5000

Medium parameters used: $f = 5200$ MHz; $\sigma = 4.5$ mho/m; $\epsilon_r = 35.3$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5800$ MHz; $\sigma = 5.17$ mho/m; $\epsilon_r = 35.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3503; ConvH(5.36, 5.36, 5.36), ConvF(4.85, 4.85, 4.85), ConvF(4.74, 4.74, 4.74); Calibrated: 05.03.2010
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAF4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

Pin=100mW/d=10mm, f=5200 MHz//Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 66.501 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 31.519 W/kg

SAR(1 g) = 8.28 mW/g; SAR(10 g) = 2.35 mW/g

Maximum value of SAR (measured) = 16.048 mW/g

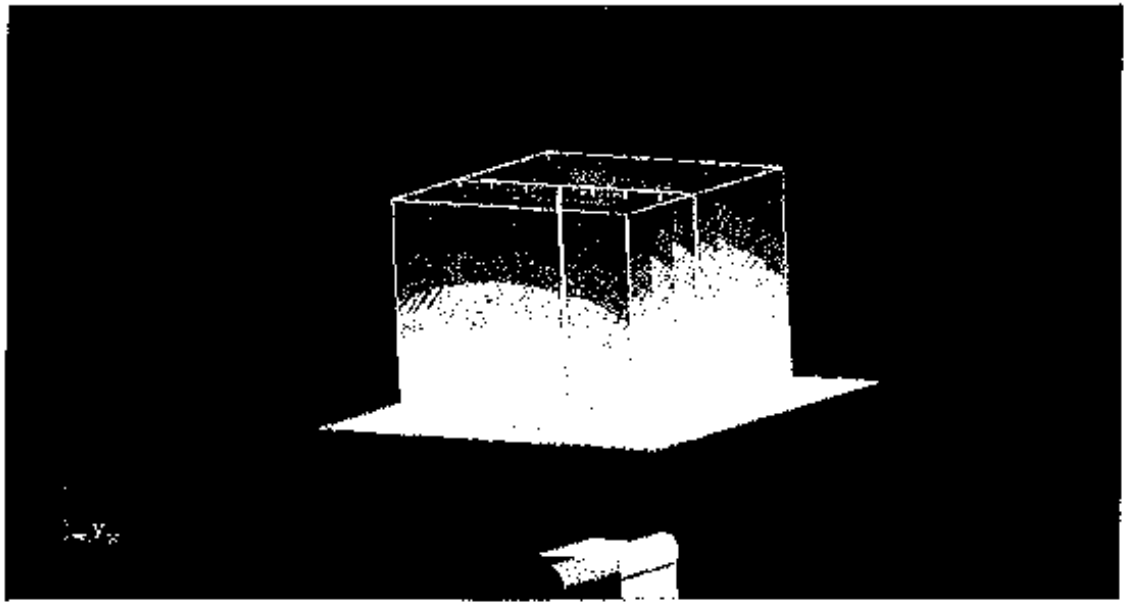
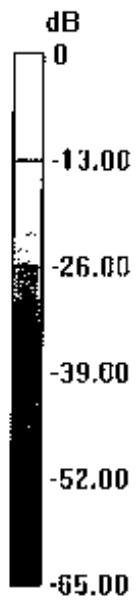
Pin=100mW/d=10mm, f=5800 MHz//Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 62.703 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 34.812 W/kg

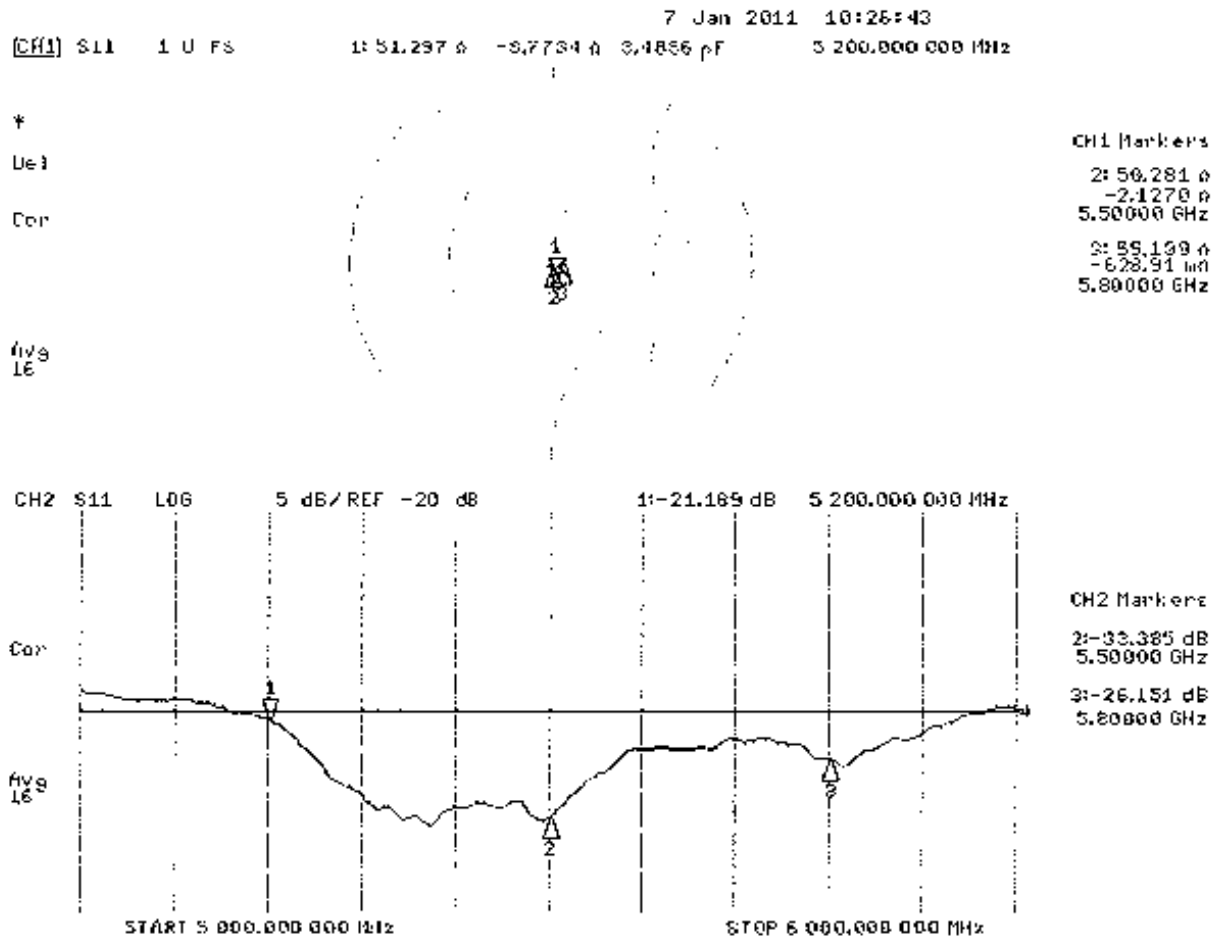
SAR(1 g) = 8.22 mW/g; SAR(10 g) = 2.31 mW/g

Maximum value of SAR (measured) = 16.262 mW/g



0 dB = 16.260mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 06.01.2011 13:18:41

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1098

Communication System: CW; Frequency: 5200 MHz, Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: MSL 5000 MHz

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.4$ mho/m; $\epsilon_r = 47.2$; $\rho = 1000$ kg/m³

Medium parameters used: $f = 5800$ MHz; $\sigma = 6.18$ mho/m; $\epsilon_r = 46.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.88, 4.88, 4.88), ConvF(4.37, 4.37, 4.37), ConvF(4.57, 4.57, 4.57); Calibrated: 05.03.2010
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DA4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

Pin=100mW/d=10mm, f=5200 MHz/Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 59.9 V/m; Power Drift = -0.00278 dB

Peak SAR (extrapolated) = 31.1 W/kg

SAR(1 g) = 7.81 mW/g; SAR(10 g) = 2.17 mW/g

Maximum value of SAR (measured) = 15.2 mW/g

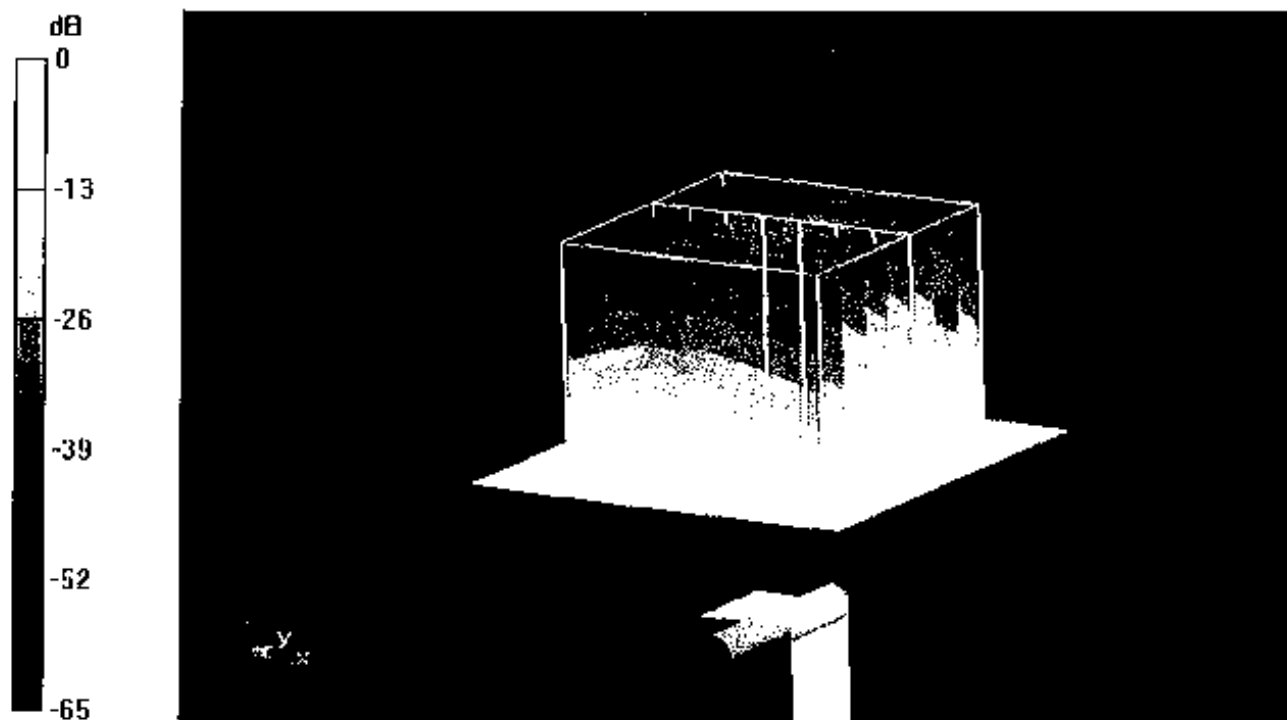
Pin=100mW/d=10mm, f=5800 MHz/Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 54.4 V/m; Power Drift = -0.029 dB

Peak SAR (extrapolated) = 35.4 W/kg

SAR(1 g) = 7.37 mW/g; SAR(10 g) = 2.01 mW/g

Maximum value of SAR (measured) = 14.5 mW/g

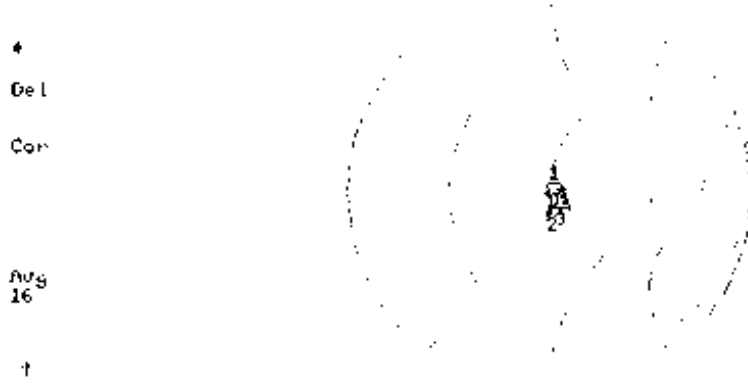


0 dB = 14.5mW/g

Impedance Measurement Plot for Body TSL

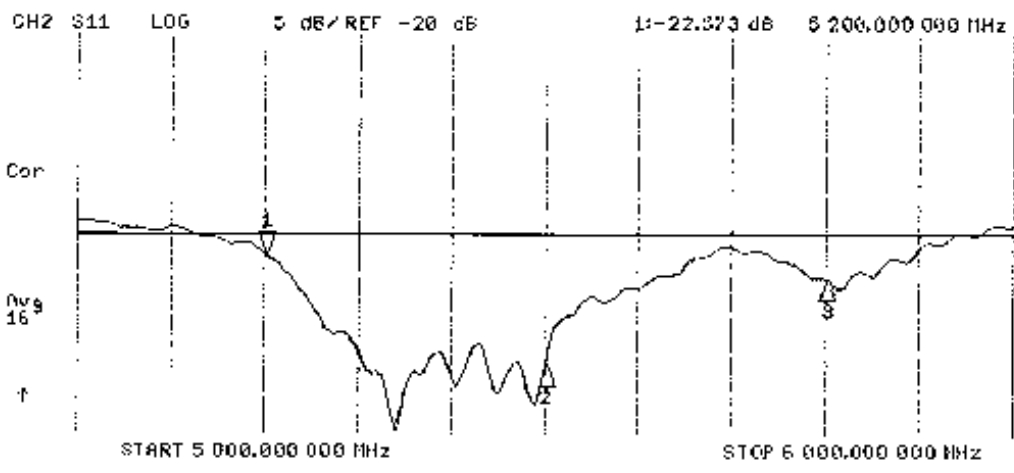
6 Jan 2011 10:43:28

CH1 S11 1 0 FS 1: 51.385 Ω -7.4316 R 4.1184 pF 5 200.000 000 MHz



CH1 Markers

1: 50.912 Ω
 -1.2090 Ω
 5.50000 GHz
 2: 55.250 Ω
 1.5234 Ω
 5.80000 GHz



CH2 Markers

1: -22.373 dB
 5 200.000 000 MHz
 2: -36.482 dB
 5.50000 GHz
 3: -25.689 dB
 5.80000 GHz