



MOTOROLA

Portable Cellular Phone SAR Test Report

Tests Requested By: Motorola Mobile Devices
600 N. US Highway 45
Libertyville, IL 60048

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Date of Report: Dec-15-2009
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Test Laboratory: Motorola Mobile Devices Business Product Safety & Compliance Laboratory
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This laboratory is accredited to ISO/IEC 17025-2005 to perform the following tests:

Accreditation: 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)



TESTING CERT #2518-02

On the following products or types of products:

Wireless Communications Devices (Examples): Two Way Radios; Portable Phones (including Cellular, Licensed Non-Broadcast and PCS); Low Frequency Readers; and Pagers

Statement of Compliance:

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

(none)

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1. Introduction

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

For ANSI / IEEE C95.1 (1 g), the final SAR reading for this phone is 0.65 W/kg for head-adjacent use and 1.12 W/kg for body-worn use. These measurements were performed using a Dasy4™ v4.7 system manufactured by Schmid & Partner Engineering AG (SPEAG), of Zurich Switzerland.

2. Description of the Device Under Test

2.1 Antenna description

Type	Internal	
Location	Bottom Rear of Transceiver	
Dimensions	Length	55.9 mm
	Width	1.3 mm
Configuration	Loop Antenna	

2.2 Device description

Serial Number(s)	352296030006264							
Mode(s) of Operation	GSM 850	GSM 900	GSM 1800	GSM 1900	WCDMA 1700	WCDMA 2100	Wi-Fi 802.11b/g	Bluetooth
Modulation Mode(s)	GSMK	GSMK	GSMK	GSMK	QPSK	QPSK	BPSK	GFSK
Maximum Output Power Setting	33.0 dBm	33.0 dBm	30.0 dBm	30.0 dBm	24.0 dBm	24.0 dBm	20 dBm	10 dBm
Duty Cycle	1:8	1:8	1:8	1:8	1:1	1:1	1:1	1:1
Transmitting Frequency Range(s)	824.2 - 848.8 MHz	880.2 - 914.8 MHz	1710.2 - 1784.8 MHz	1850.2 - 1909.8 MHz	1712.4 - 1752.6 MHz	1922.4 - 1977.6 MHz	2412.0 - 2462.5 MHz	2402.0 - 2483.5 MHz
Production Unit or Identical Prototype (47 CFR §2.908)	Identical Prototype							
Device Category	Portable							
RF Exposure Limits	General Population / Uncontrolled							

Mode(s) of Operation	GPRS 850				GPRS 900				GPRS 1800				GPRS 1900			
Modulation	GMSK				GMSK				GMSK				GMSK			
Maximum Output Power Setting	33.0	31.0	29.0	27.0	33.0	31.0	29.0	27.0	30.0	28.0	26.0	24.0	30.0	28.0	26.0	24.0
Duty Cycle	1:8	2:8	3:8	4:8	1:8	2:8	3:8	4:8	1:8	2:8	3:8	4:8	1:8	2:8	3:8	4:8
Transmitting Frequency Range(s)	824.2 - 848.8 MHz				880.2 - 914.8 MHz				1710.2 - 1784.8 MHz				1850.2 - 1909.8 MHz			

Mode(s) of Operation	EDGE 850				EDGE 900				EDGE 1800				EDGE 1900			
Modulation	8PSK				8PSK				8PSK				8PSK			
Maximum Output Power Setting	27.5	25.5	23.5	21.5	27.5	25.5	23.5	21.5	26.5	24.5	22.5	20.5	26.5	24.5	22.5	20.5
Duty Cycle	1:8	2:8	3:8	4:8	1:8	2:8	3:8	4:8	1:8	2:8	3:8	4:8	1:8	2:8	3:8	4:8
Transmitting Frequency Range(s)	824.2 - 848.8 MHz				880.2 - 914.8 MHz				1710.2 - 1784.8 MHz				1850.2 - 1909.8 MHz			

Note: Bolded entries indicate data mode configurations of highest time-average power output per band and data mode type.

3. Test Equipment Used

3.1 Dosimetric System

The Motorola Mobile Devices Business Product Safety & Compliance 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 Due Date
DASY4™ DAE V1	639	Sep-17-2010
E-Field Probe ES3DV3	3184	Sep-18-2010
S.A.M. Phantom used for 800/900 MHz	TP-1131	
S.A.M. Phantom used for 1800/1900/2450 MHz	TP-1250	
Dipole Validation Kit, DV835V2	436TR	Oct-13-2010
Dipole Validation Kit, DV1800V2	272TR	Apr-01-2010
Dipole Validation Kit, DV2450V2	740	Apr-01-2010

3.2 Additional Equipment

Description	Serial Number	Cal Due Date
Signal Generator HP8648C	3847A04844	Jan-29-2010
Power Meter E4419B	GB39511086	Jun-12-2010
Power Sensor #1 - E9301A	US39210934	Apr-23-2010
Power Sensor #2 - E9301A	US39211006	Apr-22-2010
Network Analyzer HP8753ES	US39172529	Jun-11-2010
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)
835	Head	Measured, Dec-05-2009	41.7	0.91	20.0
		Recommended Limits	41.5 $\pm$ 5%	0.90 $\pm$ 5%	18-25
	Body	Measured, Dec-05-2009	54.0	0.98	21.1
		Recommended Limits	55.2 $\pm$ 5%	0.97 $\pm$ 5%	18-25
1730	Head	Measured, Dec-07-2009	39.7	1.37	19.5
		Recommended Limits	40.1 $\pm$ 5%	1.36 $\pm$ 5%	18-25
	Body	Measured, Dec-07-2009	51.2	1.52	19.6
		Recommended Limits	53.5 $\pm$ 5%	1.48 $\pm$ 5%	18-25
1880	Head	Measured, Dec-06-2009	38.3	1.45	19.8
		Recommended Limits	40.0 $\pm$ 5%	1.40 $\pm$ 5%	18-25
	Body	Measured, Dec-06-2009	50.8	1.58	19.5
		Recommended Limits	53.3 $\pm$ 5%	1.52 $\pm$ 5%	18-25
2450	Head	Measured, Dec-08-2009	36.2	1.82	19.9
		Recommended Limits	39.2 $\pm$ 10%	1.80 $\pm$ 5%	18-25
	Body	Measured, Dec-08-2009	48.4	1.99	18.8
		Recommended Limits	52.7 $\pm$ 10%	1.95 $\pm$ 5%	18-25

The list of ingredients and the percent composition used for the tissue simulates 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	--

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). The tissue stimulant depth was verified to be 15.0 cm $\pm$ 0.5 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)		
835	Measured, Dec-04-2009	9.60	42.5	0.92	20.6	20.0
	Measured, Dec-05-2009	9.575	41.7	0.91	21.1	20.0
	Recommended Limits	9.69	41.5 $\pm 5\%$	0.90 $\pm 5\%$	18-25	18-25
1800	Measured, Dec-06-2009	36.175	38.1	1.36	20.37	19.8
	Measured, Dec-07-2009	38.65	39.4	1.44	20.6	19.5
	Measured, Dec-09-2009	38.10	39.6	1.49	20.2	19.4
	Recommended Limits	37.91	40.0 $\pm 5\%$	1.40 $\pm 5\%$	18-25	18-25
2450	Measured, Dec-08-2009	52.75	36.2	1.82	20.7	19.9
	Recommended Limits	56.68	39.2 $\pm 10\%$	1.80 $\pm 5\%$	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	3184	835	6.26	8 of 9
		1810	5.14	8 of 9
		2450	4.44	8 of 9

6. Test Results

The test sample was operated using an actual transmission through a base station simulator. The base station simulator was set up to the proper channel, transmitter power level and transmit mode of operation. The phone was tested in the configurations stipulated in [1], [4] and [5]. The phone was positioned into these configurations using the device holder supplied with the DASY4™ SAR measurement system. The measured dielectric constant of the material used for the device holder is less than 2.9 and the loss tangent is less than 0.02 ($\pm 30\%$) at 850 MHz. The default settings for the “coarse” and “cube” scans were chosen and used for measurements. The grid spacing of the course scan was set to 15 mm or less as shown in the SAR plots included in Appendix 2 and 3. Please refer to the DASY4™ manual for additional information on SAR scanning procedures and algorithms used.

The Cellular Phone model covered by this report has the following battery options:
Model SNN5843A - 1390 mAH Battery

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

Per the “SAR Measurement Procedures for 3G Devices” released in October, 2007, 12.2 kbps RMC, 12.2 kbps AMR, HS-DPCCH Sub-test 1-4, and E-DCH Sub-test 1-5 modes were considered. The conducted power measurements (per section 5.2 of 3GPP TS 34.121) for each mode are shown in the table below.

Band	Channel	Conducted power (dBm) for WCDMA modes		Conducted Power (dBm) for WCDMA – HSDPA (Rel 5) Modes				Conducted Power (dBm) for WCDMA – HSPA (HSUPA/HSDPA-Rel 6) Modes				
		RMC	AMR	Subtest 1	Subtest 2	Subtest 3	Subtest 4	Subtest 1	Subtest 2	Subtest 3	Subtest 4	Subtest 5
WCDMA 1700	1312	24.11	24.15	24.21	24.13	24.16	24.16	24.27	24.18	24.22	24.29	24.28
	1413	23.99	24.02	24.06	23.90	23.87	23.97	24.12	24.05	24.03	23.96	23.97
	1513	23.93	23.98	24.03	24.02	23.93	24.09	24.08	24.15	24.04	24.14	24.01

This product utilizes the following mechanism for Maximum Power Reduction (MPR)

The device supports MPR to solve linearity issues (ACLR or SEM) due to the higher peak-to-average ratios (PAR) of the HSUPA signal. This prevents saturating the full range of the TX DAC inside of the device and provides a reduced power output to the RF transceiver chip according to the Cubic Metric (a function of the combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH).

When E-DPDCH channels are present, the beta gains on those channels are reduced first to try to get the power under the allowed limit. If the beta gains are lowered as far as possible, then a hard limiting is applied at the maximum allowed level.

The SW currently recalculates the cubic metric every time the beta gains on the E-DPDCH are reduced. The cubic metric will likely get lower each time this is done. However, there is no reported reduction of maximum output power in the HSUPA mode since the device also provides a mechanism to compensate for the power back-off by increasing the gain of TX_AGC in the transceiver (PA) device.

The end effect is that the DUT output power is identical to the case where there is no MPR in the device.

6.1 Head Adjacent Test Results

The SAR results shown in tables 1 through 4 are maximum SAR values averaged over 1 gram of phantom tissue, to demonstrate compliance to [3] and also over 10 grams of phantom tissue, to demonstrate compliance to the [6]. Also shown are the measured conducted output power levels, the temperature of the simulated tissue after the test, the measured drift and the extrapolated SAR. The exact method of extrapolation is $\text{New SAR} = \text{Old SAR} * 10^{(-\text{drift}/10)}$. 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 left head and right head SAR contour distributions are similar. Because of this similarity, the cheek/touch and 15° tilt test conditions with the highest SAR values in each band are indicated as bold numbers in the following tables and are included in Appendix 2. All other test conditions measured lower SAR values than those included in Appendix 2. The tables below also include the highest SAR value summations for primary and secondary co-located transmitters, with the results indicated in italics.

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 to be 15.0 cm ± 0.5 cm.

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

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ES3DV3	3184	835	6.26	8 of 9
		1810	5.14	8 of 9
		1950	4.94	8 of 0
		2450	4.44	8 of 9

Left Head Cheek Position								
<i>f</i> (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
GSM 850	Channel 128	33.25						
	Channel 190	33.20	20.0	-0.112	0.094	0.10	0.152	0.16
	Channel 251	32.80						
GSM 1900	Channel 512	30.07						
	Channel 661	30.13	19.9	-0.046	0.129	0.13	0.214	0.22
	Channel 810	29.86						
WCDMA 1700	Channel 1312	24.11						
	Channel 1413	23.99	19.3	-0.047	0.406	0.41	0.643	0.65
	Channel 1513	23.93						
WI-FI 2450	Channel 1							
	Channel 6	17.81	19.6	-0.130	0.180	0.19	0.355	0.37
	Channel 11							
<i>GSM 850 + WI-FI</i>						0.29		0.53
<i>GSM 1900 + WI-FI</i>						0.32		0.59
<i>WCDMA 1700 +WI-FI</i>						0.60		1.02

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

Right Head Cheek Position								
<i>f</i> (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
GSM 850	Channel 128	33.25						
	Channel 190	33.20	20.0	-0.112	0.101	0.10	0.137	0.14
	Channel 251	32.80						
GSM 1900	Channel 512	30.07						
	Channel 661	30.13	19.8	0.008	0.105	0.11	0.166	0.17
	Channel 810	29.86						
WCDMA 1700	Channel 1312	24.11						
	Channel 1413	23.99	19.4	-0.184	0.325	0.34	0.475	0.50
	Channel 1513	23.93						
WI-FI 2450	Channel 1							
	Channel 6	17.81	19.6	-0.037	0.194	0.20	0.397	0.40
	Channel 11							
<i>GSM 850 + WI-FI</i>						0.30		0.54
<i>GSM 1900 + WI-FI</i>						0.31		0.57
<i>WCDMA 1700 +WI-FI</i>						0.54		0.90

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

Left Head 15° Tilt Position								
<i>f</i> (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
GSM 850	Channel 128	33.25						
	Channel 190	33.20	20.0	-0.128	0.059	0.06	0.078	0.08
	Channel 251	32.80						
GSM 1900	Channel 512	30.07						
	Channel 661	30.13	19.9	-0.031	0.074	0.07	0.119	0.12
	Channel 810	29.86						
WCDMA 1700	Channel 1312	24.11						
	Channel 1413	23.99	19.4	0.017	0.241	0.24	0.362	0.36
	Channel 1513	23.93						
WI-FI 2450	Channel 1							
	Channel 6	17.81	19.6	-0.065	0.203	0.21	0.421	0.43
	Channel 11							
<i>GSM 850 + WI-FI</i>						0.27		0.51
<i>GSM 1900 + WI-FI</i>						0.28		0.55
<i>WCDMA 1700 +WI-FI</i>						0.45		0.79

Table 3: SAR measurement results at the highest possible output power, measured in a head 15° Tilt position against the ICNIRP and ANSI SAR Limit.

Right Head 15° Tilt Position								
<i>f</i> (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
GSM 850	Channel 128	33.25						
	Channel 190	33.20	20.0	-0.019	0.051	0.05	0.066	0.07
	Channel 251	32.80						
GSM 1900	Channel 512	30.07						
	Channel 661	30.13	19.9	-0.045	0.065	0.07	0.103	0.10
	Channel 810	29.86						
WCDMA 1700	Channel 1312	24.11						
	Channel 1413	23.99	19.4	-0.067	0.245	0.25	0.378	0.38
	Channel 1513	23.93						
WI-FI 2450	Channel 1							
	Channel 6	17.81	19.6	-0.044	0.164	0.17	0.322	0.33
	Channel 11							
<i>GSM 850 + WI-FI</i>						0.22		0.40
<i>GSM 1900 + WI-FI</i>						0.24		0.43
<i>WCDMA 1700 +WI-FI</i>						0.42		0.71

Table 4: SAR measurement results at the highest possible output power, measured in a head 15° Tilt position against the ICNIRP and ANSI SAR Limit.

6.2 Body Worn Test Results

The SAR results shown in tables 5 through 9 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 measured conducted output power levels, the temperature of the test facility during the test, the temperature of the tissue simulate after the test, the measured drift and the extrapolated SAR. The exact method of extrapolation is $\text{New SAR} = \text{Old SAR} * 10^{(-\text{drift}/10)}$. 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 test conditions that produced the highest SAR values in each band are indicated as bold numbers in the following tables and are included in Appendix 3. All other test conditions measured lower SAR values than those included in Appendix 3. The tables below also include the highest SAR value summations for primary and secondary co-located transmitters, with the results indicated in italics.

A “flat” phantom was for the body-worn tests. This “flat” phantom is made out of 1” thick natural High Density Polyethylene with a thickness at the bottom equal to 2.0 mm. It measures 52.7 cm(long) x 26.7 cm(wide) x 21.2 cm(tall). The measured dielectric constant of the material used is less than 2.3 and the loss tangent is less than 0.0046 at frequencies up to 2.184 GHz.

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

There are no body-worn accessories available for this phone at the time of testing thus the device was tested per the Supplement C testing guidelines for devices that do not have body-worn accessories. A separation distance of 15 mm between the device and the flat phantom was used for testing body-worn SAR. The device was tested with the front and back of the device facing the phantom.

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

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

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ES3DV3	3184	835	6.08	8 of 9
		1810	4.84	8 of 9
		1950	4.81	8 of 0
		2450	4.28	8 of 9

Body-Worn; Front of Phone 15 mm from Phantom								
f (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
GSM 850	Channel 128	33.25						
	Channel 190	33.20	21.1	-0.187	0.078	0.08	0.118	0.12
	Channel 251	32.80						
GSM 1900	Channel 512	30.07						
	Channel 661	30.13	19.6	-0.015	0.104	0.10	0.178	0.18
	Channel 810	29.86						
WCDMA 1700	Channel 1312	24.11						
	Channel 1413	23.99	19.5	-0.077	0.393	0.40	0.638	0.65
	Channel 1513	23.93						
WI-FI 2450	Channel 1							
	Channel 6	17.81	19.0	-0.041	0.045	0.05	0.084	0.09
	Channel 11							
Bluetooth 2450	Channel 0							
	Channel 39	9.06	18.4	1.47	0.00000888	0.00	0.0000435	0.00
	Channel 78							
GSM 850 + WI-FI						0.13		0.21
GSM 1900 + WI-FI						0.15		0.27
WCDMA 1700 + WI-FI						0.45		0.74

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

Body-Worn; Back of Phone 15 mm from Phantom								
f (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
GSM 850	Channel 128	33.25						
	Channel 190	33.20	21.2	-0.114	0.072	0.07	0.104	0.11
	Channel 251	32.80						
GSM 1900	Channel 512	30.07						
	Channel 661	30.13	19.6	0.009	0.200	0.20	0.332	0.33
	Channel 810	29.86						
WCDMA 1700	Channel 1312	24.11	19.5	-0.024	0.695	0.70	1.11	1.12
	Channel 1413	23.99	19.5	-0.061	0.524	0.53	0.835	0.85
	Channel 1513	23.93	19.5	-0.196	0.605	0.63	0.968	1.01
WI-FI 2450	Channel 1							
	Channel 6	17.81	19.0	0.086	0.048	0.05	0.089	0.09
	Channel 11							
Bluetooth 2450	Channel 0							
	Channel 39	9.06	18.2	3.37	0.000258	0.00	0.000606	0.00
	Channel 78							
GSM 850 + WI-FI						0.12		0.20
GSM 1900 + WI-FI						0.25		0.42
WCDMA 1700 + WI-FI						0.75		1.21

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

Body-Worn; <i>Noted Facing of Phone 25 mm from Phantom</i>								
f (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
WI-FI 2450 <i>Front of Phone</i>	Channel 1							
	Channel 6	17.81	18.9	-0.141	0.016	0.02	0.029	0.03
	Channel 11							
WI-FI 2450 <i>Back of Phone</i>	Channel 1							
	Channel 6	17.81	19.0	0.025	0.020	0.02	0.036	0.04
	Channel 11							

Table 7: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.

GPRS Class 10 (2 Uplink Timeslots) Body-Worn; <i>Noted Facing of Phone 25 mm from Phantom</i>								
f (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
GSM 850 <i>Front of Phone</i>	Channel 128	31.21						
	Channel 190	31.20	21.1	0.031	0.066	0.07	0.089	0.09
	Channel 251	30.74						
GSM 1900 <i>Back of Phone</i>	Channel 512	28.12						
	Channel 661	28.14	19.8	-0.017	0.070	0.07	0.107	0.11
	Channel 810	27.91						
GSM 850 + WI-FI						0.09		0.12
GSM 1900 + WI-FI						0.09		0.15

Table 8: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.

EDGE Class 10 (2 Uplink Timeslots) Body-Worn; <i>Noted Facing of Phone 25 mm from Phantom</i>								
f (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
GSM 850 <i>Front of Phone</i>	Channel 128	25.77						
	Channel 190	25.63	21.1	0.117	0.016	0.02	0.024	0.02
	Channel 251	25.29						
GSM 1900 <i>Back of Phone</i>	Channel 512	24.60						
	Channel 661	24.64	19.6	-0.143	0.030	0.03	0.047	0.05
	Channel 810	24.39						
GSM 850 + WI-FI						0.04		0.05
GSM 1900 + WI-FI						0.05		0.09

Table 9: SAR measurement results at the highest possible output power, measured in a body-worn 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 1999 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 - Dec-04-09 835 MHz

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 436TR; FCC ID: IHDP56KC6

Procedure Notes: 835 MHz System Performance Check; Dipole Sn# 436(TR); Input Power = 200 mW

Sim.Temp@meas = 20.4°C; Sim.Temp@SPC = 20.0°C; Room Temp @ SPC = 20.6°C

Communication System: CW - Dipole; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: VALIDATION Only

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.92 \text{ mho/m}$; $\epsilon_r = 42.5$; $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(6.26, 6.26, 6.26); Calibrated: 9/18/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn639; Calibrated: 9/17/2009
- Phantom: R#4 Sugar SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1131;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (4x9x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$; Maximum value of SAR (measured) = 1.93 mW/g

Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0:

Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 49.7 V/m; Power Drift = -0.159 dB; Peak SAR (extrapolated) = 2.78 W/kg

SAR(1 g) = 1.95 mW/g; SAR(10 g) = 1.28 mW/g; Maximum value of SAR (measured) = 2.12 mW/g

Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0:

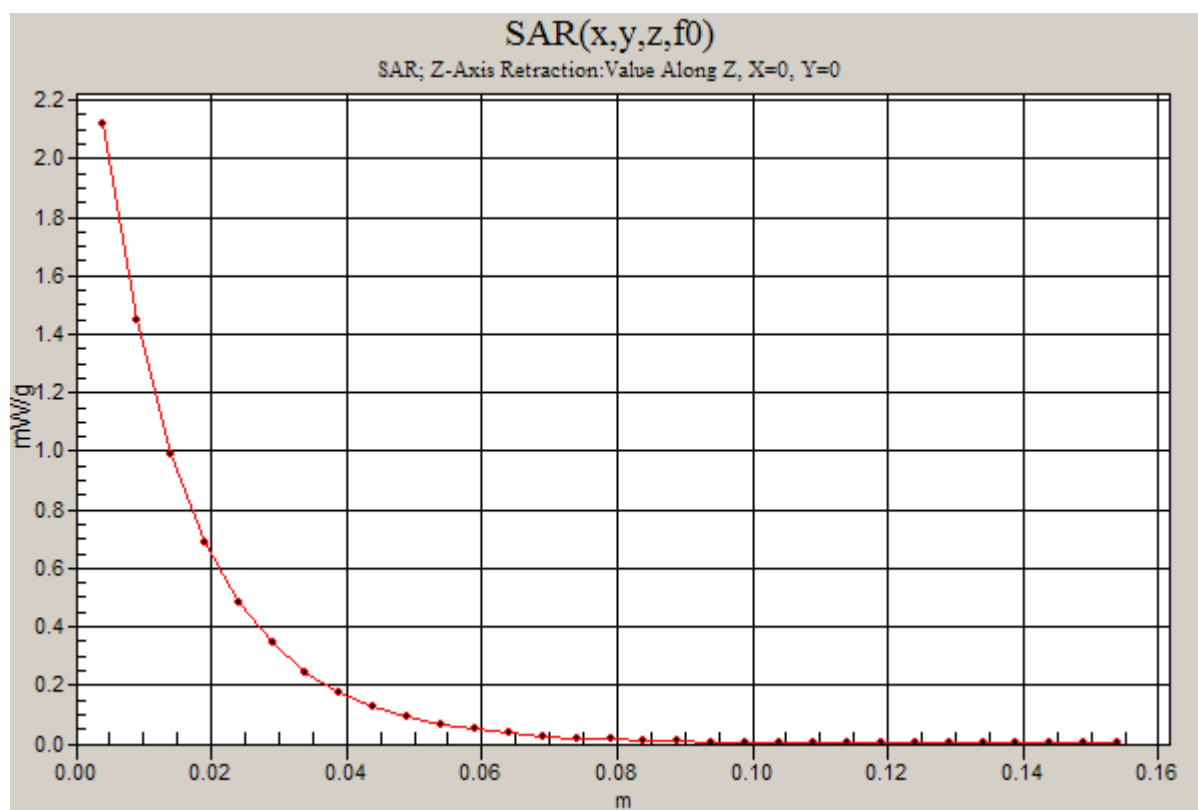
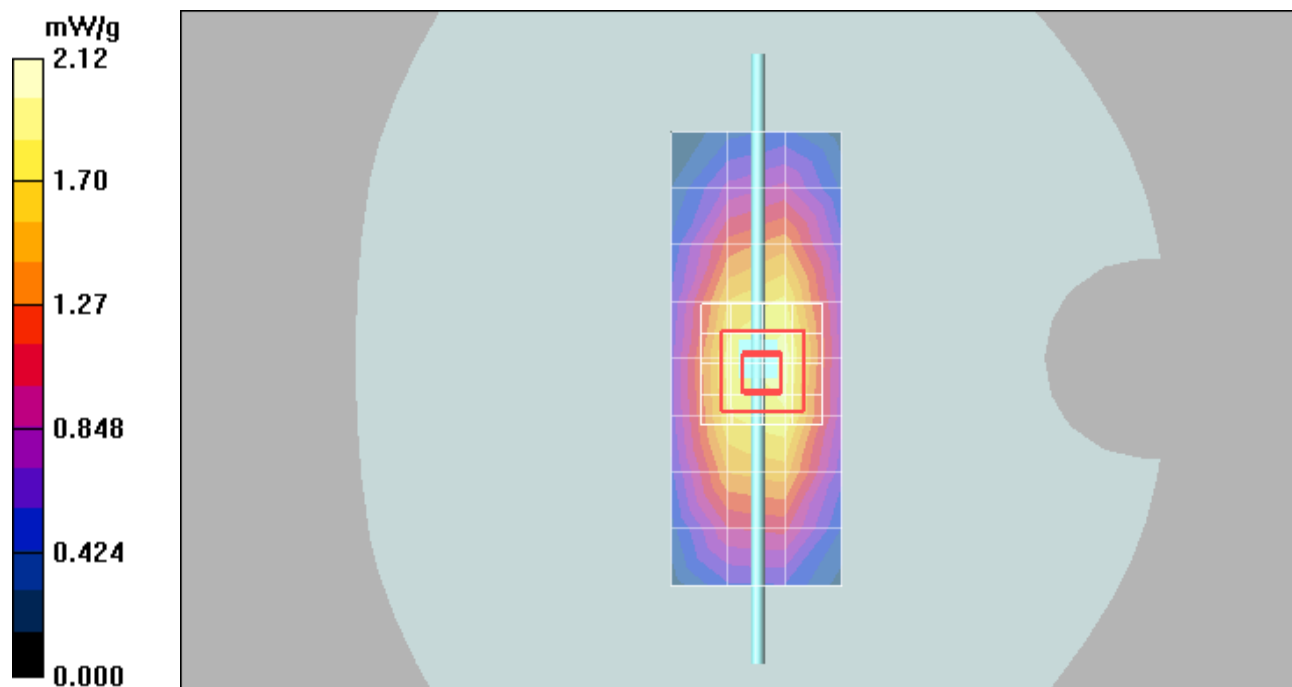
Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 49.7 V/m; Power Drift = -0.159 dB; Peak SAR (extrapolated) = 2.69 W/kg

SAR(1 g) = 1.89 mW/g; SAR(10 g) = 1.24 mW/g; Maximum value of SAR (measured) = 2.05 mW/g

Daily SPC Check/Z-Axis Retraction (1x1x31):

Measurement grid: $dx=20\text{mm}$, $dy=20\text{mm}$, $dz=5\text{mm}$



Test Laboratory: Motorola - Dec-05-09 835 MHz

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 436TR; FCC ID: IHDP56KC6

Procedure Notes: 835 MHz System Performance Check; Dipole Sn# 436tr; Input Power = 200 mW

Sim.Temp@meas = 20°C; Sim.Temp@SPC = 20°C; Room Temp @ SPC = 21.1°C

Communication System: CW - Dipole; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: VALIDATION Only

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.91 \text{ mho/m}$; $\epsilon_r = 41.7$; $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(6.26, 6.26, 6.26); Calibrated: 9/18/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn639; Calibrated: 9/17/2009
- Phantom: R#4 Sugar SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1131;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (4x9x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$; Maximum value of SAR (measured) = 1.91 mW/g

Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0:

Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 49.1 V/m; Power Drift = -0.015 dB; Peak SAR (extrapolated) = 2.77 W/kg

SAR(1 g) = 1.94 mW/g; SAR(10 g) = 1.28 mW/g; Maximum value of SAR (measured) = 2.09 mW/g

Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0:

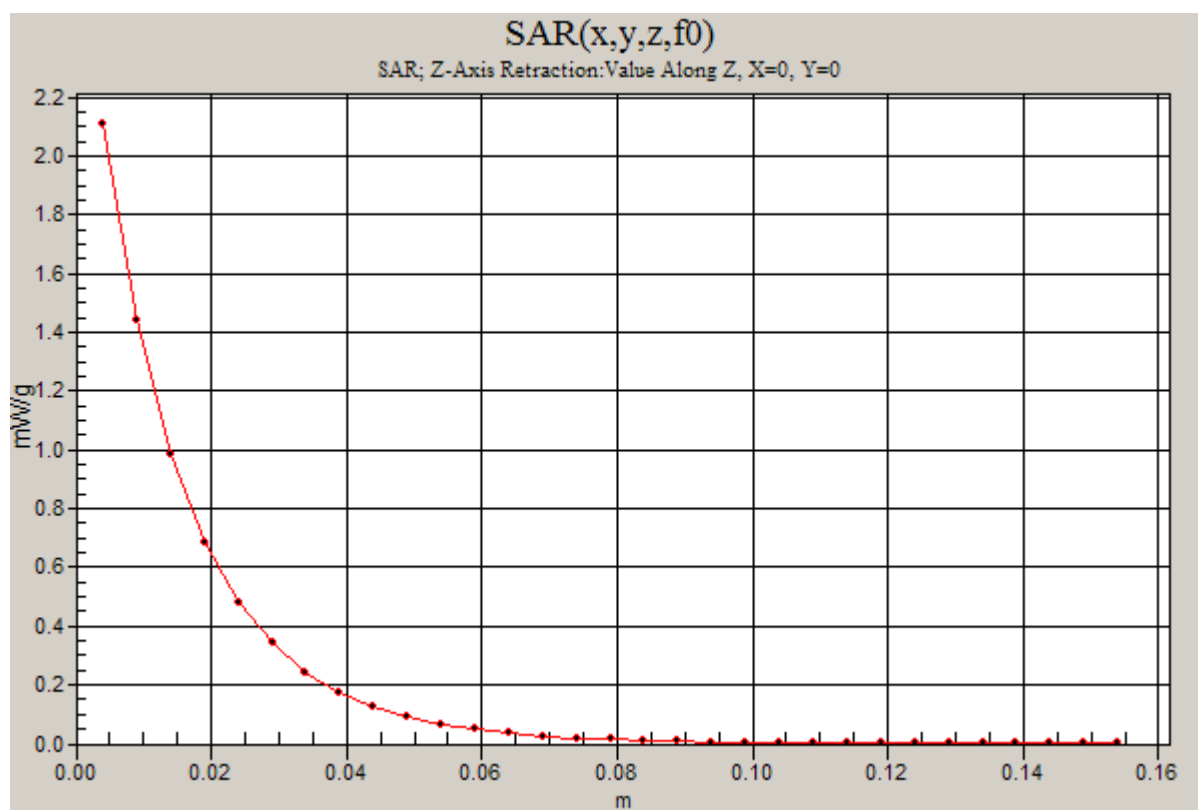
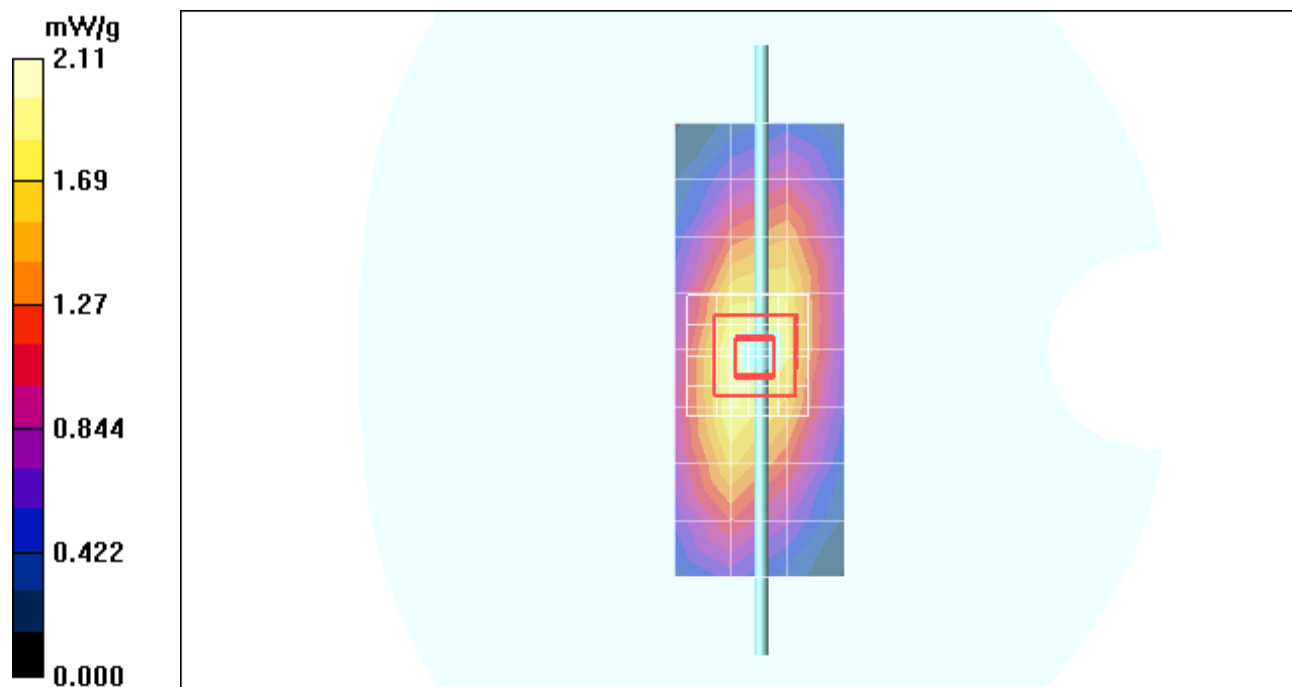
Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 49.1 V/m; Power Drift = -0.015 dB; Peak SAR (extrapolated) = 2.71 W/kg

SAR(1 g) = 1.89 mW/g; SAR(10 g) = 1.25 mW/g; Maximum value of SAR (measured) = 2.03 mW/g

Daily SPC Check/Z-Axis Retraction (1x1x31):

Measurement grid: $dx=20\text{mm}$, $dy=20\text{mm}$, $dz=5\text{mm}$; Maximum value of SAR (measured) = 2.11 mW/g



Test Laboratory: Motorola - Dec-06-09 1800 MHz

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 272TR; FCC ID: IHDP56KC6

Procedure Notes: 1800 MHz System Performance Check; Dipole Sn# 272TR; Input Power = 200 mW

Sim.Temp@meas = 19.8°C; Sim.Temp@SPC = 19.8°C; Room Temp @ SPC = 20.7°C

Communication System: CW - Dipole; Frequency: 1800 MHz; Duty Cycle: 1:1

Medium: VALIDATION Only

Medium parameters used: $f = 1800$ MHz; $\sigma = 1.36$ mho/m; $\epsilon_r = 38.1$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.14, 5.14, 5.14); Calibrated: 9/18/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn639; Calibrated: 9/17/2009
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (4x9x1):

Measurement grid: dx=15mm, dy=15mm; Maximum value of SAR (measured) = 6.60 mW/g

Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0:

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

Reference Value = 79.9 V/m; Power Drift = 0.012 dB; Peak SAR (extrapolated) = 12.5 W/kg

SAR(1 g) = 7.32 mW/g; SAR(10 g) = 3.93 mW/g; Maximum value of SAR (measured) = 8.26 mW/g

Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0:

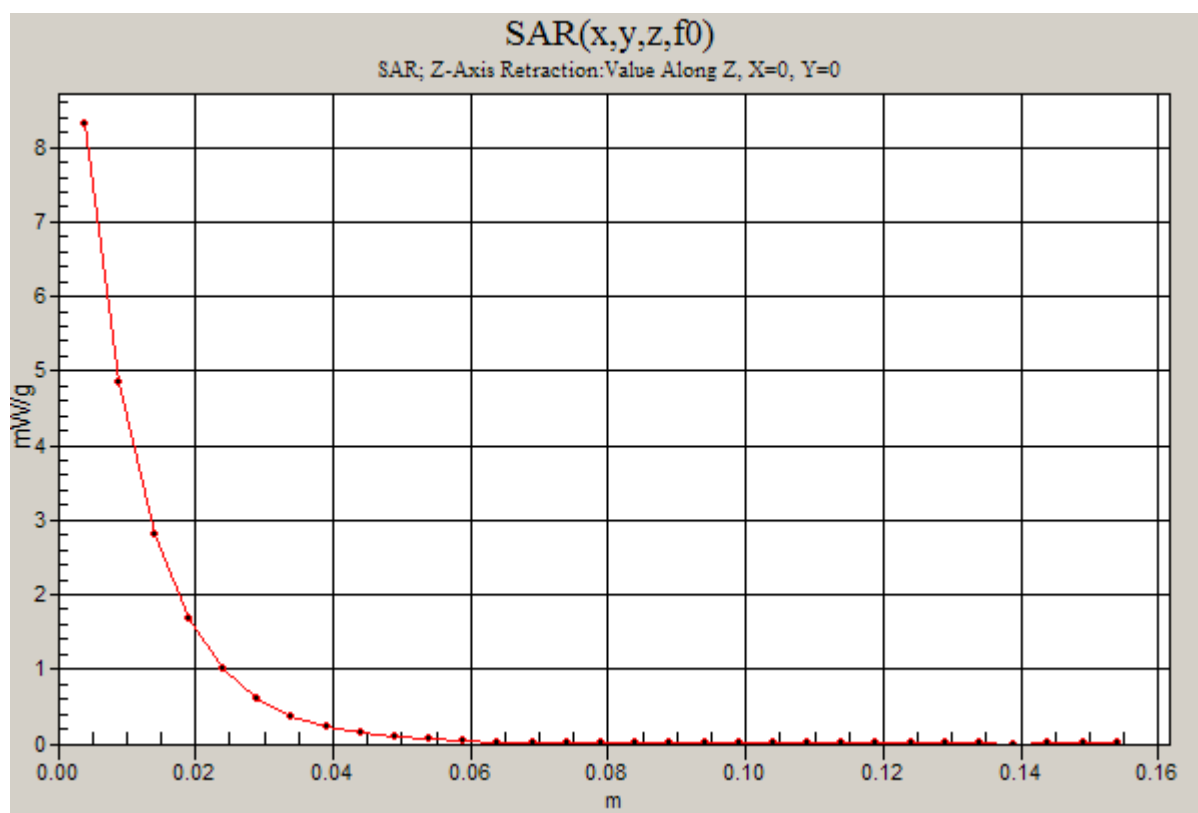
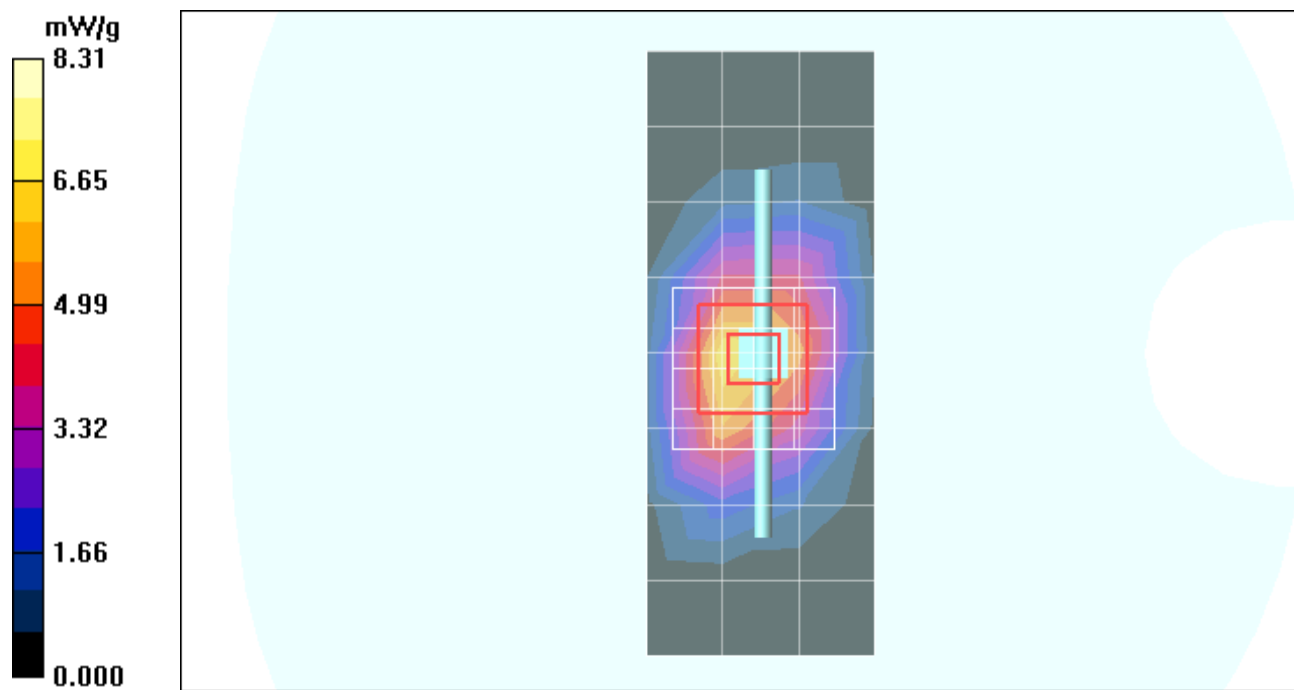
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 79.9 V/m; Power Drift = 0.012 dB; Peak SAR (extrapolated) = 12.1 W/kg

SAR(1 g) = 7.15 mW/g; SAR(10 g) = 3.84 mW/g; Maximum value of SAR (measured) = 8.04 mW/g

Daily SPC Check/Z-Axis Retraction (1x1x31):

Measurement grid: dx=20mm, dy=20mm, dz=5mm; Maximum value of SAR (measured) = 8.31 mW/g



Test Laboratory: Motorola - Dec-07-09 1800 MHz

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 272TR; FCC ID: IHDP56KC6

Procedure Notes: 1800 MHz System Performance Check; Dipole Sn# 272TR; Input Power = 200 mW

Sim.Temp@meas = 19.5 °C; Sim.Temp@SPC = 19.5 °C; Room Temp @ SPC = 20.6 °C

Communication System: CW - Dipole; Frequency: 1800 MHz; Duty Cycle: 1:1

Medium: VALIDATION Only

Medium parameters used: $f = 1800 \text{ MHz}$; $\sigma = 1.44 \text{ mho/m}$; $\epsilon_r = 39.4$; $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.14, 5.14, 5.14); Calibrated: 9/18/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn639; Calibrated: 9/17/2009
- Phantom: R4 : Sect.1, Amy Twin; Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (9x4x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$; Maximum value of SAR (measured) = 7.59 mW/g

Daily SPC Check/0-Degree 5x5x7 Cube (5x5x7)/Cube 0:

Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 80.4 V/m; Power Drift = -0.015 dB; Peak SAR (extrapolated) = 13.8 W/kg

SAR(1 g) = 7.9 mW/g; SAR(10 g) = 4.16 mW/g; Maximum value of SAR (measured) = 8.82 mW/g

Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0:

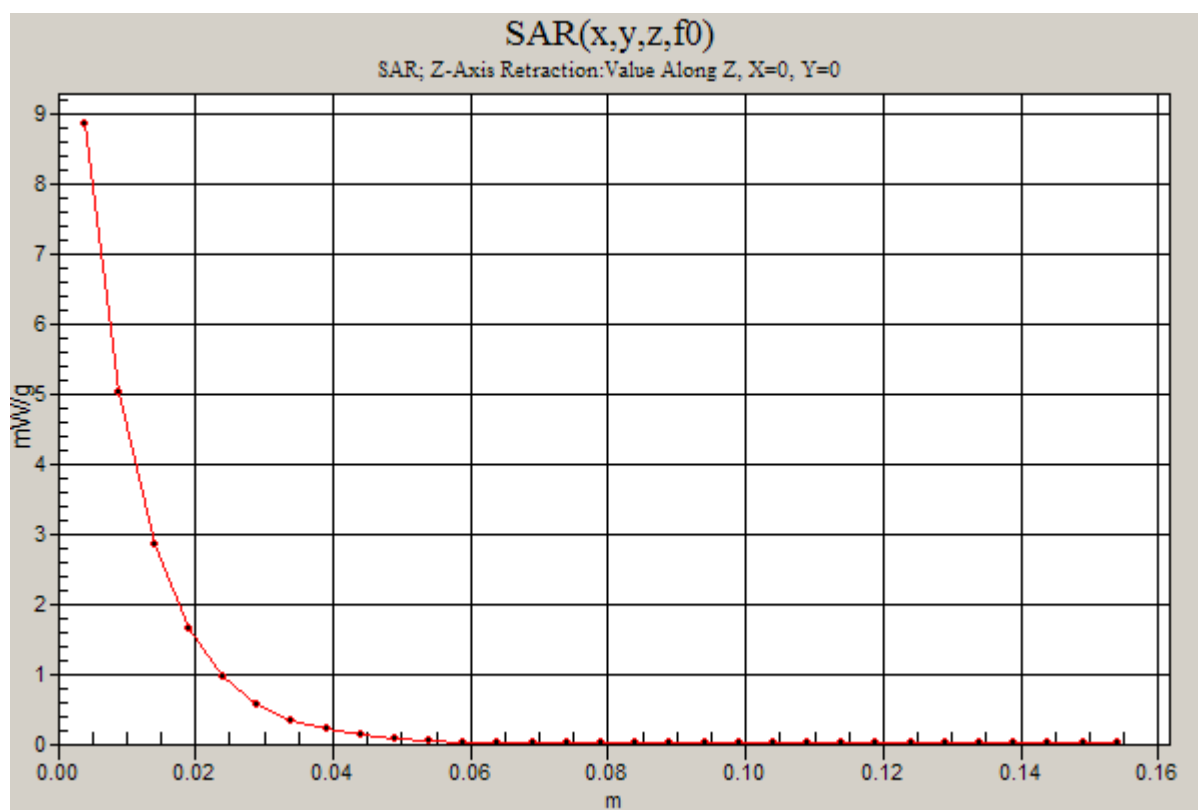
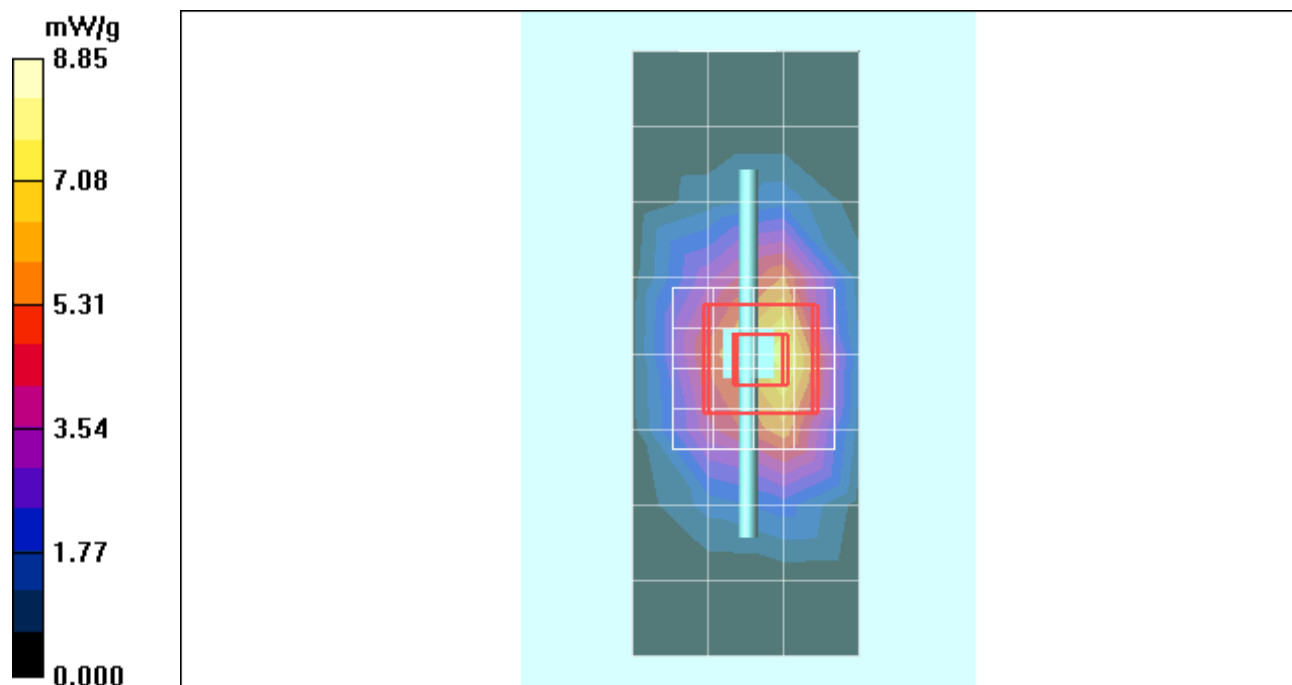
Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 80.4 V/m; Power Drift = -0.015 dB; Peak SAR (extrapolated) = 13.1 W/kg

SAR(1 g) = 7.56 mW/g; SAR(10 g) = 4.01 mW/g; Maximum value of SAR (measured) = 8.43 mW/g

Daily SPC Check/Z-Axis Retraction (1x1x31):

Measurement grid: $dx=20\text{mm}$, $dy=20\text{mm}$, $dz=5\text{mm}$; Maximum value of SAR (measured) = 8.85 mW/g



Test Laboratory: Motorola - Dec-09-09 1800 MHz

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 272TR; FCC ID: IHDP56KC6

Procedure Notes: 1800 MHz System Performance Check; Dipole Sn# 272TR; Input Power = 200 mW

Sim.Temp@meas = 18.9 °C; Sim.Temp@SPC = 19.4 °C; Room Temp @ SPC = 20.2 °C

Communication System: CW - Dipole; Frequency: 1800 MHz; Duty Cycle: 1:1

Medium: VALIDATION Only

Medium parameters used: $f = 1800 \text{ MHz}$; $\sigma = 1.39 \text{ mho/m}$; $\epsilon_r = 39.6$; $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.14, 5.14, 5.14); Calibrated: 9/18/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn639; Calibrated: 9/17/2009
- Phantom: R4 : Sect.1, Amy Twin; Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (9x4x1):

Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$; Maximum value of SAR (measured) = 7.66 mW/g

Daily SPC Check/0-Degree 5x5x7 Cube (5x5x7)/Cube 0:

Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 80.5 V/m; Power Drift = -0.005 dB; Peak SAR (extrapolated) = 13.3 W/kg

SAR(1 g) = 7.73 mW/g; SAR(10 g) = 4.13 mW/g; Maximum value of SAR (measured) = 8.62 mW/g

Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0:

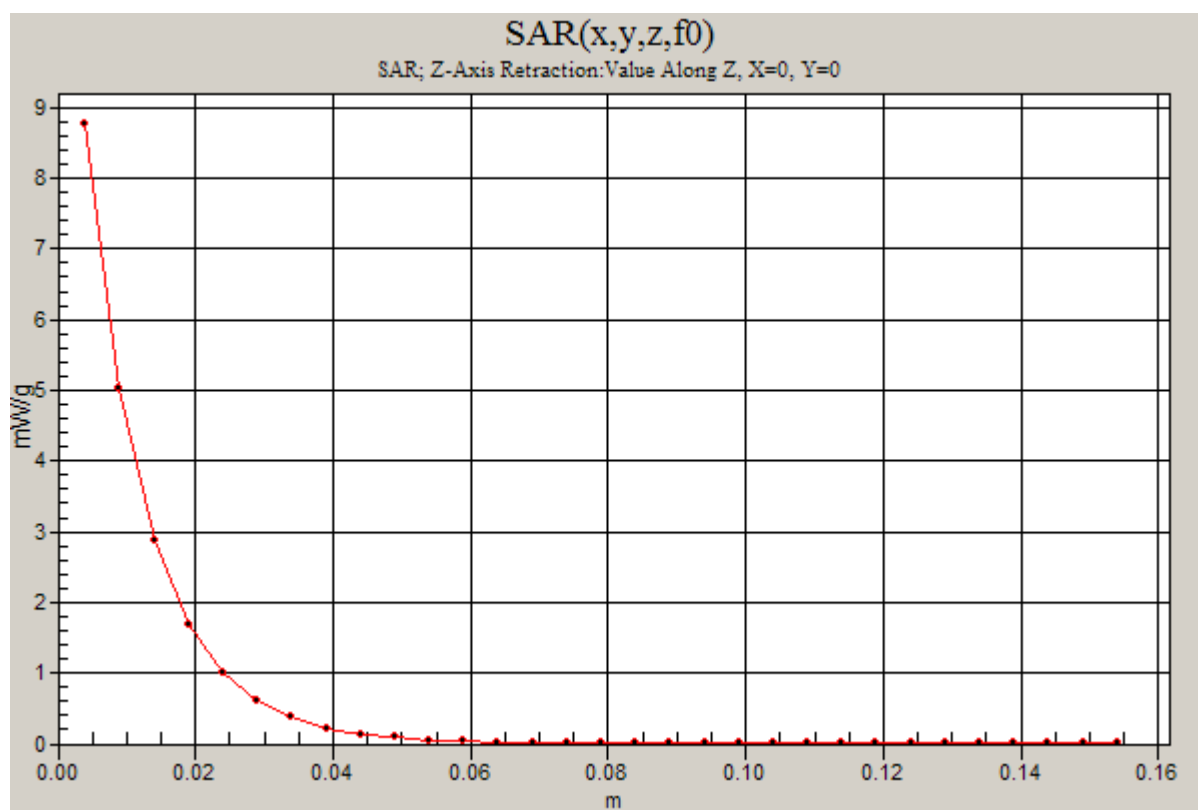
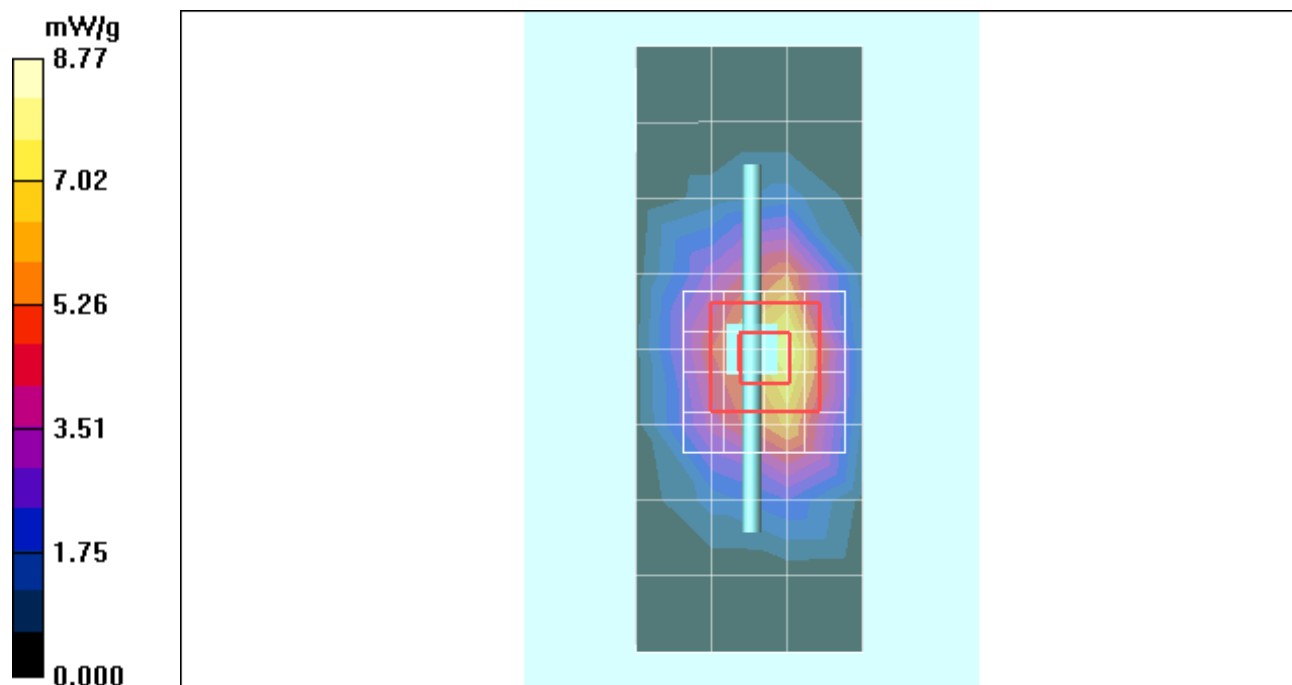
Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 80.5 V/m; Power Drift = -0.005 dB; Peak SAR (extrapolated) = 12.8 W/kg

SAR(1 g) = 7.51 mW/g; SAR(10 g) = 4.01 mW/g; Maximum value of SAR (measured) = 8.37 mW/g

Daily SPC Check/Z-Axis Retraction (1x1x31):

Measurement grid: $dx=20\text{mm}$, $dy=20\text{mm}$, $dz=5\text{mm}$; Maximum value of SAR (measured) = 8.77 mW/g



Test Laboratory: Motorola - Dec-08-09 2450 MHz

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 740; FCC ID: IHDP56KC6

Procedure Notes: 2450 MHz System Performance Check; Dipole Sn# 740; Input Power = 200 mW

Sim.Temp@meas = 19.9°C; Sim.Temp@SPC = 19.9°C; Room Temp @ SPC = 20.7°C

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

Medium: VALIDATION Only

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.82$ mho/m; $\epsilon_r = 36.2$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(4.44, 4.44, 4.44); Calibrated: 9/18/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn639; Calibrated: 9/17/2009
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (4x9x1):

Measurement grid: dx=15mm, dy=15mm; Maximum value of SAR (measured) = 9.61 mW/g

Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0:

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

Reference Value = 82.1 V/m; Power Drift = 0.019 dB; Peak SAR (extrapolated) = 22.4 W/kg

SAR(1 g) = 10.7 mW/g; SAR(10 g) = 4.87 mW/g; Maximum value of SAR (measured) = 12.2 mW/g

Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0:

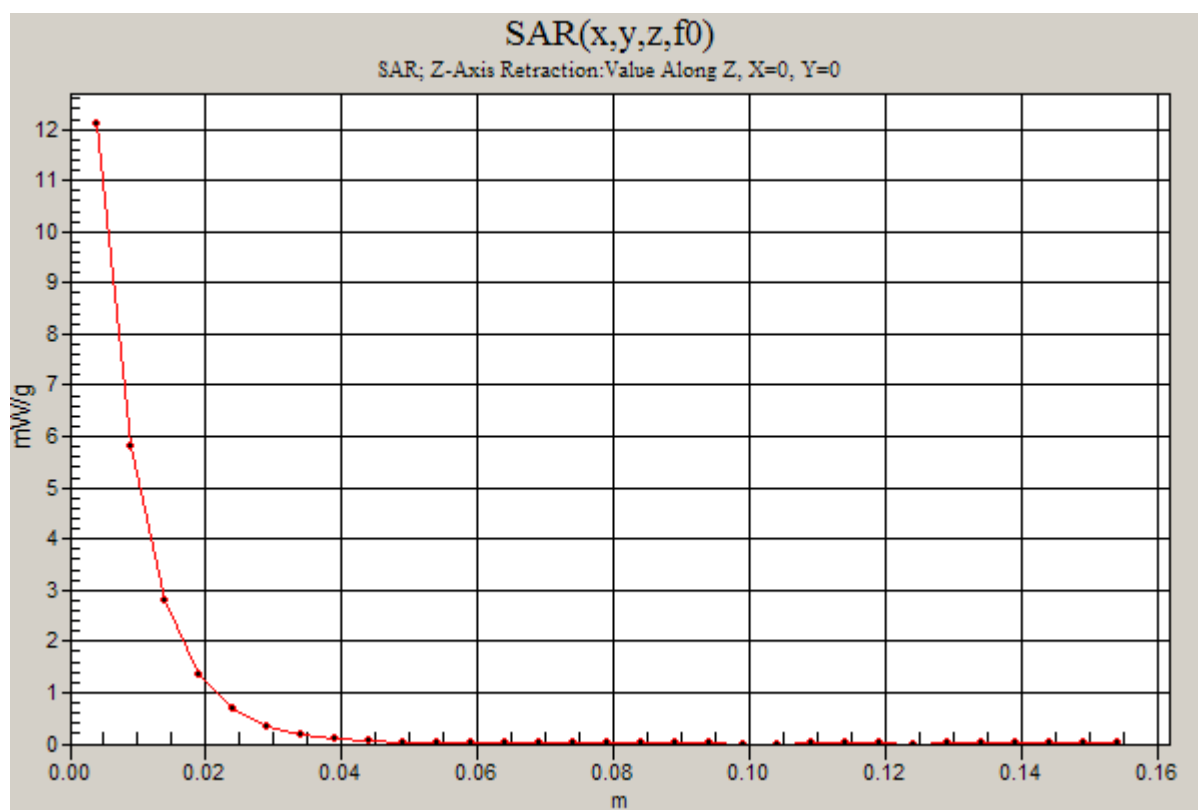
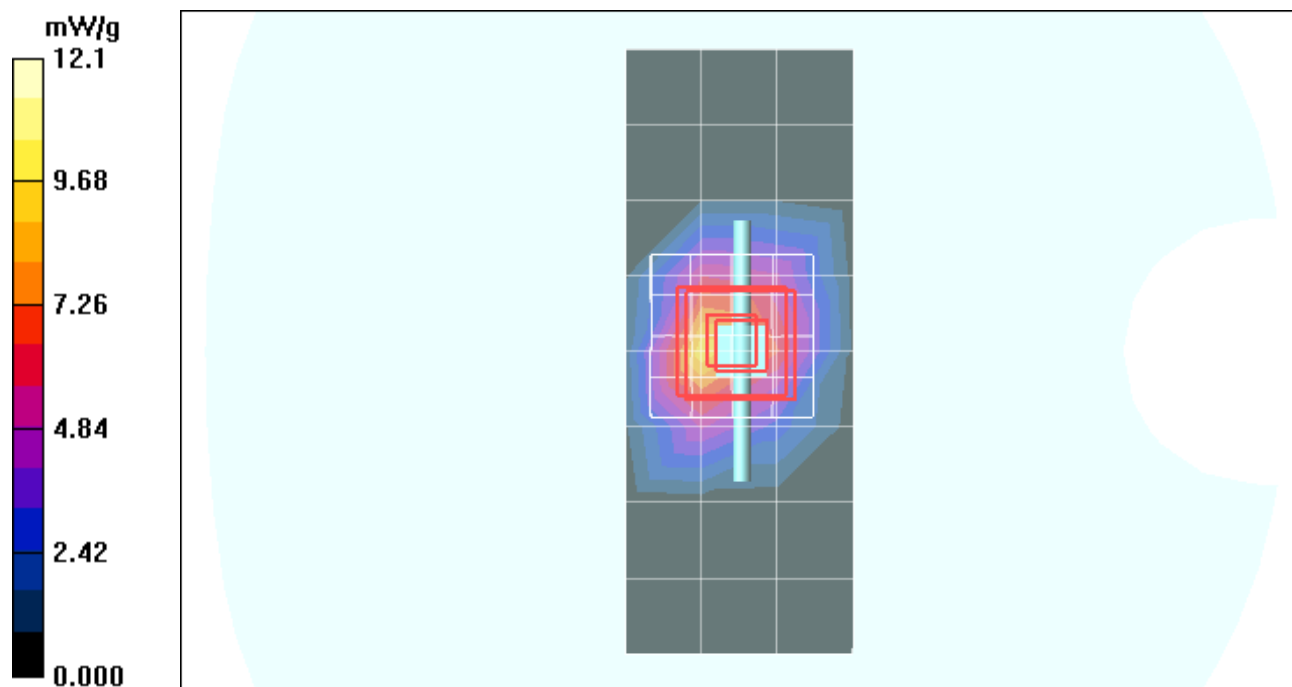
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 82.1 V/m; Power Drift = 0.019 dB; Peak SAR (extrapolated) = 21.7 W/kg

SAR(1 g) = 10.4 mW/g; SAR(10 g) = 4.77 mW/g; Maximum value of SAR (measured) = 11.5 mW/g

Daily SPC Check/Z-Axis Retraction (1x1x31):

Measurement grid: dx=20mm, dy=20mm, dz=5mm; Maximum value of SAR (measured) = 12.1 mW/g



Appendix 2

SAR distribution plots for Phantom Head Adjacent Use

Test Laboratory: Motorola - GSM 850 Cheek

Serial: 352296030006264; FCC ID: IHDP56KC6

Procedure Notes: Pwr Step: 5; Antenna Position: Internal; Accessory Model #: N/A

Battery Model #: SNN5843A; DEVICE POSITION: CHEEK

Communication System: GSM 850; Frequency: 836.6 MHz; Channel Number: 190; Duty Cycle: 1:8

Medium: Low Freq Head

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.91 \text{ mho/m}$; $\epsilon_r = 41.7$; $\rho = 1000 \text{ kg/m}^3$

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(6.26, 6.26, 6.26); Calibrated: 9/18/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn639; Calibrated: 9/17/2009
- Phantom: R#4 Sugar SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1131;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Left Head Template/Area Scan - Normal (15mm) (7x17x1):

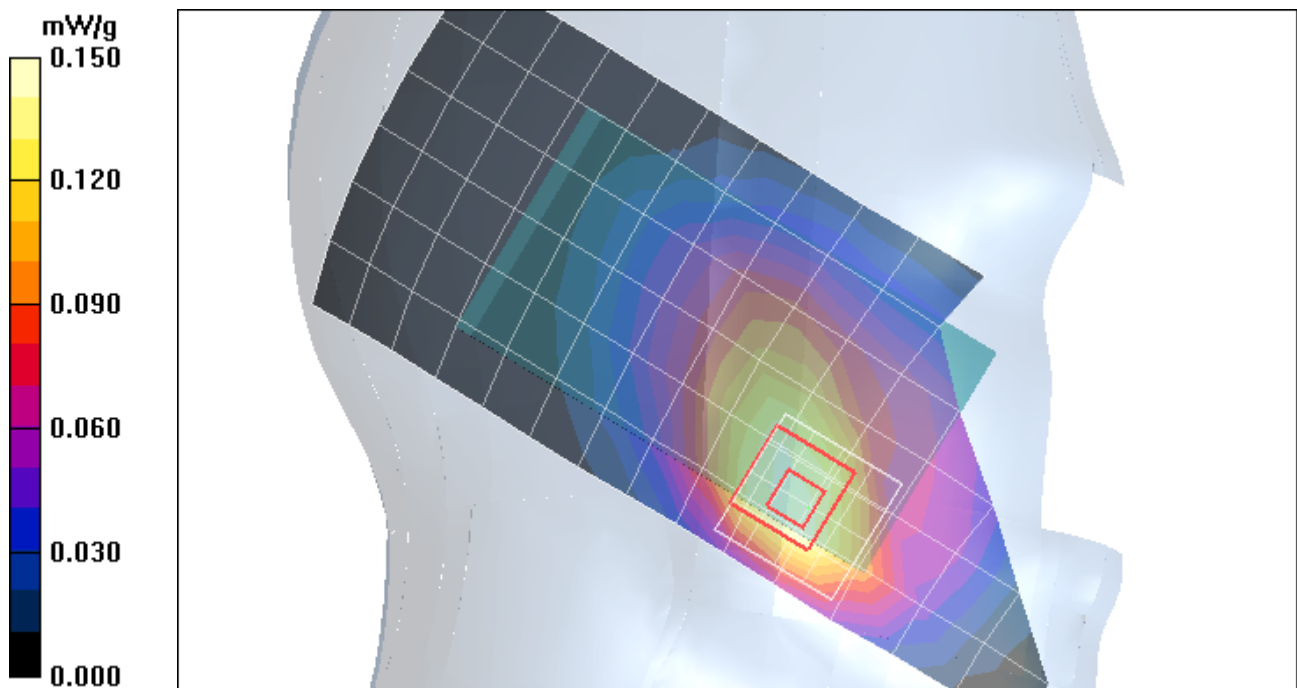
Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$; Maximum value of SAR (measured) = 0.150 mW/g

Left Head Template/5x5x7 Zoom Scan ($\leq 3\text{GHz}$) (5x5x7)/Cube 0:

Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 11.8 V/m; Power Drift = -0.112 dB; Peak SAR (extrapolated) = 0.243 W/kg

SAR(1 g) = 0.152 mW/g; SAR(10 g) = 0.094 mW/g; Maximum value of SAR (measured) = 0.164 mW/g



Test Laboratory: Motorola - GSM 1900 Cheek

Serial: 352296030006264; FCC ID: IHDP56KC6

Procedure Notes: Pwr Step: 0; Antenna Position: Internal; Accessory Model #: N/A

Battery Model #: SNN5843A; DEVICE POSITION: CHEEK

Communication System: GSM 1900; Frequency: 1880 MHz; Channel Number: 661; Duty Cycle: 1:8

Medium: Regular Glycol Head 1750/1880

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.45$ mho/m; $\epsilon_r = 38.3$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.14, 5.14, 5.14); Calibrated: 9/18/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn639; Calibrated: 9/17/2009
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Left Head Template/Area Scan - Normal (15mm) (7x17x1):

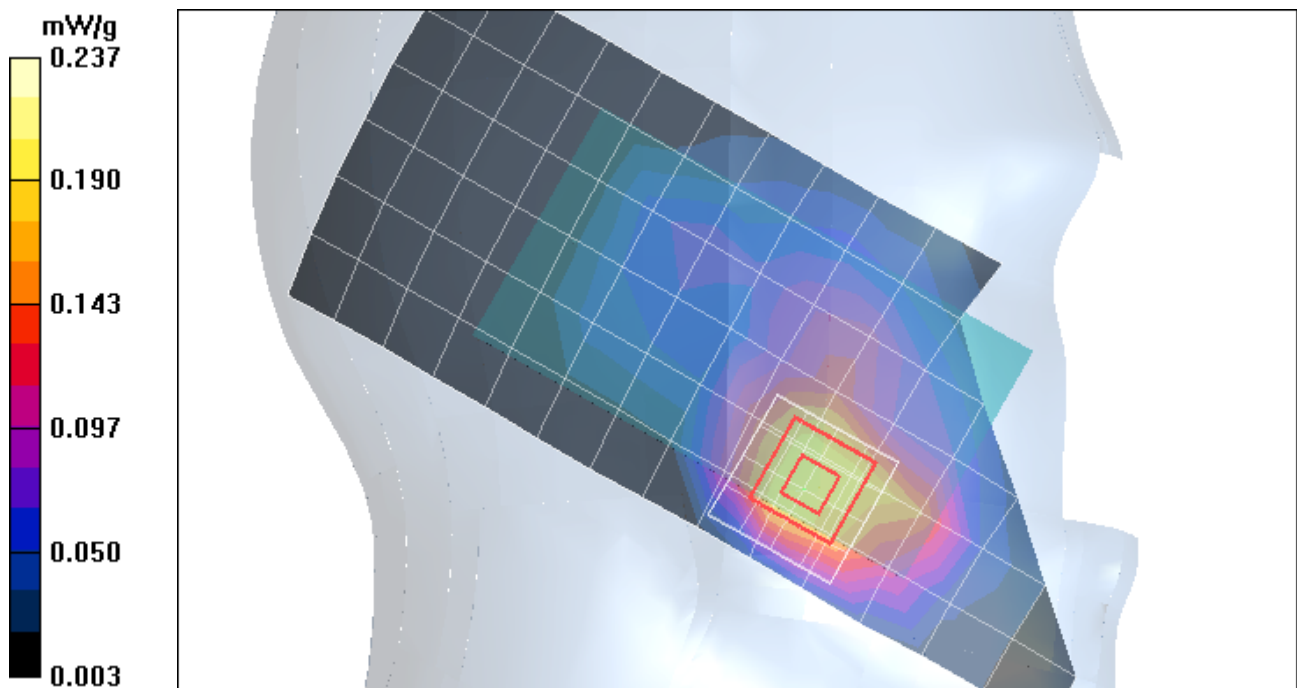
Measurement grid: $dx=15$ mm, $dy=15$ mm; Maximum value of SAR (measured) = 0.189 mW/g

Left Head Template/5x5x7 Zoom Scan (≤ 3 GHz) (5x5x7)/Cube 0:

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

Reference Value = 10.7 V/m; Power Drift = -0.046 dB; Peak SAR (extrapolated) = 0.317 W/kg

SAR(1 g) = 0.214 mW/g; SAR(10 g) = 0.129 mW/g; Maximum value of SAR (measured) = 0.237 mW/g



Test Laboratory: Motorola - WCDMA 1700 Cheek

Serial: 352296030006264; FCC ID: IHDP56KC6

Procedure Notes: Pwr Step: All up Bits; Antenna Position: Internal; Accessory Model #: N/A

Battery Model #: SNN5843A; DEVICE POSITION: CHEEK

Communication System: WCDMA 1700; Frequency: 1732.5 MHz; Channel Number: 1413; Duty Cycle: 1:1

Medium: 1730 Glycol Head

Medium parameters used: $f = 1730$ MHz; $\sigma = 1.37$ mho/m; $\epsilon_r = 39.7$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.14, 5.14, 5.14); Calibrated: 9/18/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn639; Calibrated: 9/17/2009
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Left Head Template/Area Scan - Normal (15mm) (7x17x1):

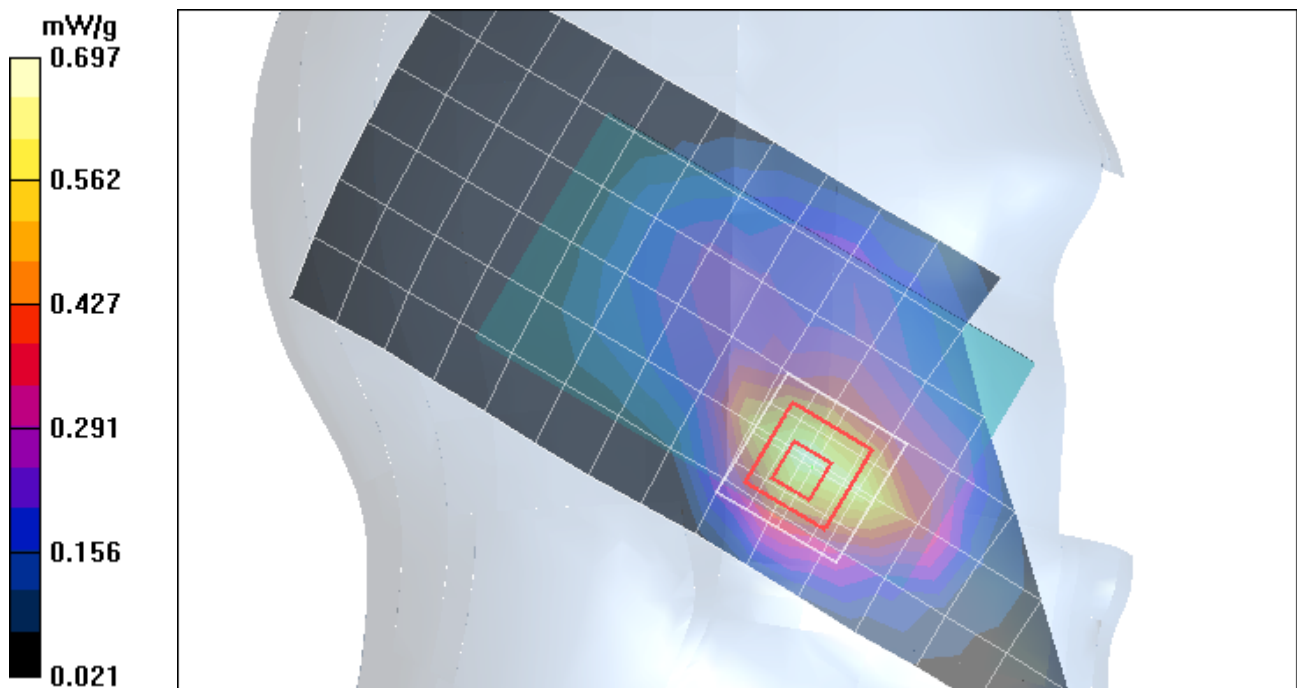
Measurement grid: $dx=15$ mm, $dy=15$ mm; Maximum value of SAR (measured) = 0.679 mW/g

Left Head Template/5x5x7 Zoom Scan (≤ 3 GHz) (5x5x7)/Cube 0:

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

Reference Value = 21.7 V/m; Power Drift = -0.047 dB; Peak SAR (extrapolated) = 0.899 W/kg

SAR(1 g) = 0.643 mW/g; SAR(10 g) = 0.406 mW/g; Maximum value of SAR (measured) = 0.697 mW/g



Test Laboratory: Motorola - Wi-Fi Cheek

Serial: 352296030006264; FCC ID: IHDP56KC6

Procedure Notes: Pwr Step: N/A; Antenna Position: Internal; Accessory Model #: N/A

Battery Model #: SNN5843A; DEVICE POSITION: Cheek

Communication System: Wi-Fi 2450; Frequency: 2437 MHz; Channel Number: 6; Duty Cycle: 1:1

Medium: 2450 Glycol Head

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.82$ mho/m; $\epsilon_r = 36.2$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(4.44, 4.44, 4.44); Calibrated: 9/18/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn639; Calibrated: 9/17/2009
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Right Head Template/Area Scan - Normal (15mm) (7x17x1):

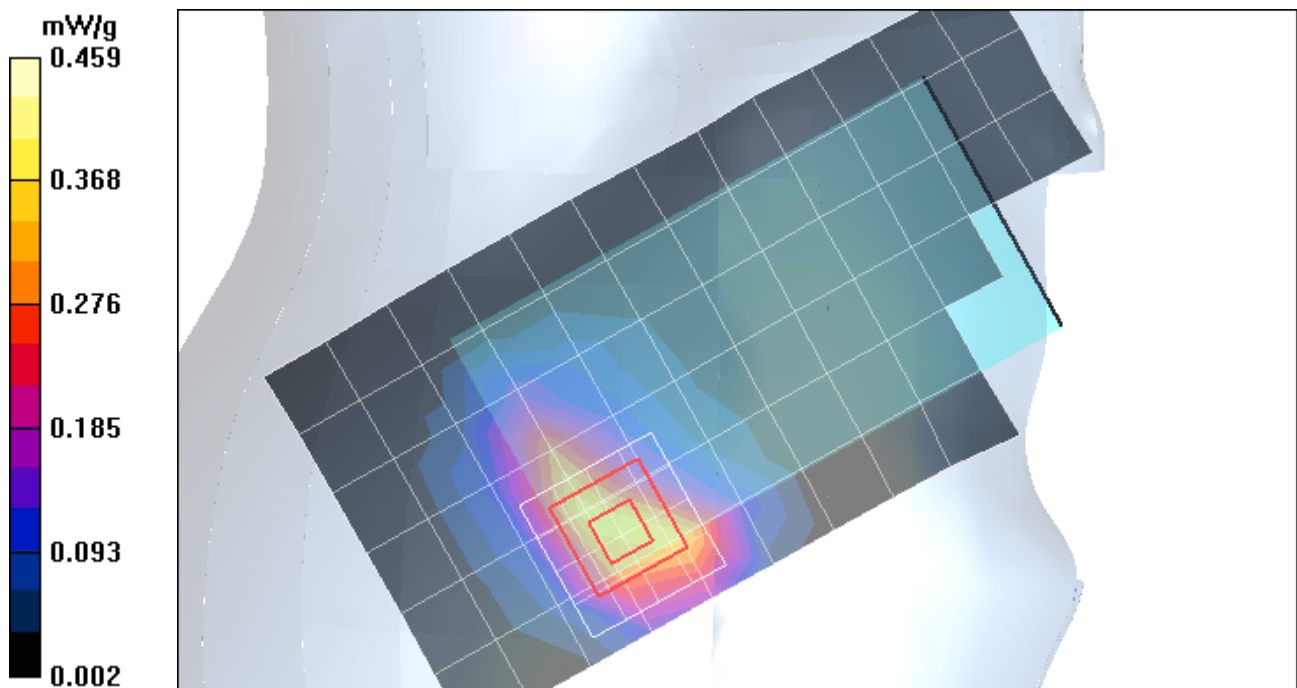
Measurement grid: $dx=15$ mm, $dy=15$ mm; Maximum value of SAR (measured) = 0.362 mW/g

Right Head Template/5x5x7 Zoom Scan (≤ 3 GHz) (5x5x7)/Cube 0:

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

Reference Value = 10.9 V/m; Power Drift = -0.037 dB; Peak SAR (extrapolated) = 0.764 W/kg

SAR(1 g) = 0.397 mW/g; SAR(10 g) = 0.194 mW/g; Maximum value of SAR (measured) = 0.459 mW/g



Test Laboratory: Motorola - GSM 850 Tilt

Serial: 352296030006264; FCC ID: IHDP56KC6

Procedure Notes: Pwr Step: 5; Antenna Position: Internal; Accessory Model #: N/A

Battery Model #: SNN5843A; DEVICE POSITION: TILT

Communication System: GSM 850; Frequency: 836.6 MHz; Channel Number: 190; Duty Cycle: 1:8

Medium: Low Freq Head

Medium parameters used: $f = 835$ MHz; $\sigma = 0.91$ mho/m; $\epsilon_r = 41.7$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(6.26, 6.26, 6.26); Calibrated: 9/18/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn639; Calibrated: 9/17/2009
- Phantom: R#4 Sugar SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1131;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Left Head Template/Area Scan - Normal (15mm) (7x17x1):

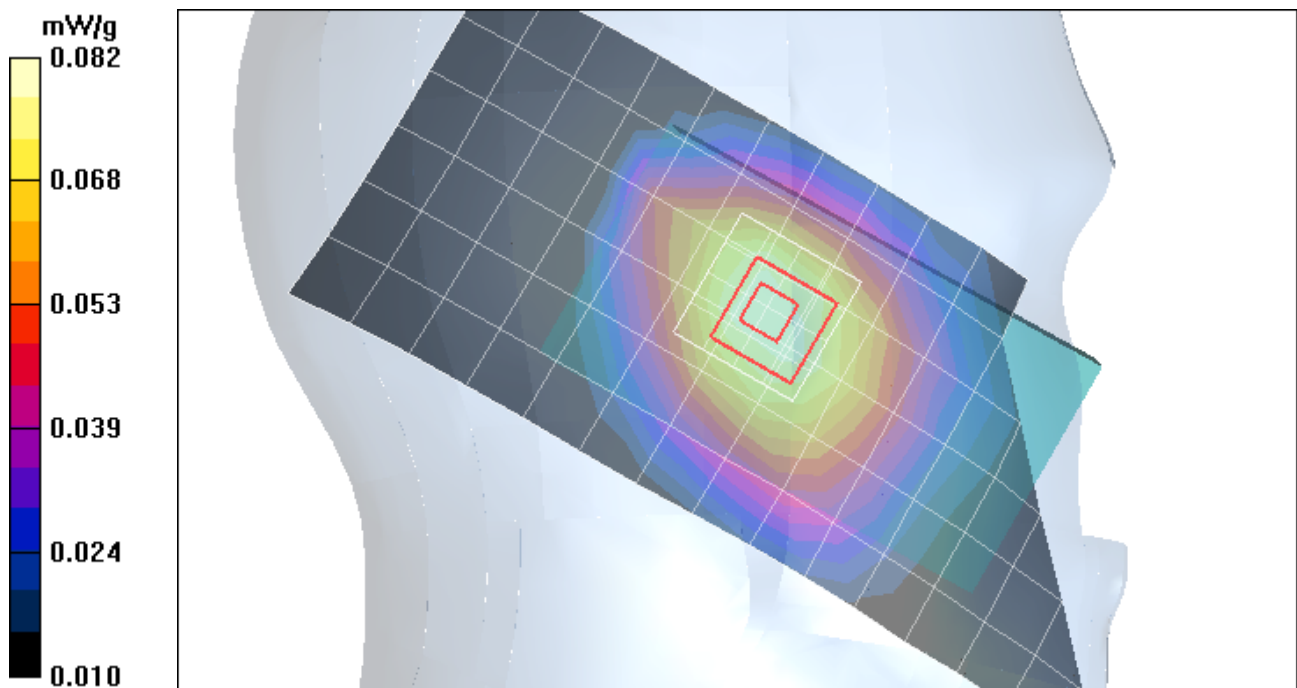
Measurement grid: $dx=15$ mm, $dy=15$ mm; Maximum value of SAR (measured) = 0.081 mW/g

Left Head Template/5x5x7 Zoom Scan (≤ 3 GHz) (5x5x7)/Cube 0:

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

Reference Value = 9.53 V/m; Power Drift = -0.128 dB; Peak SAR (extrapolated) = 0.095 W/kg

SAR(1 g) = 0.078 mW/g; SAR(10 g) = 0.059 mW/g; Maximum value of SAR (measured) = 0.082 mW/g



Test Laboratory: Motorola - GSM 1900 Tilt

Serial: 352296030006264; FCC ID: IHDP56KC6

Procedure Notes: Pwr Step: 0; Antenna Position: Internal; Accessory Model #: N/A

Battery Model #: SNN5843A; DEVICE POSITION: TILT

Communication System: GSM 1900; Frequency: 1880 MHz; Channel Number: 661; Duty Cycle: 1:8

Medium: Regular Glycol Head 1750/1880

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.45$ mho/m; $\epsilon_r = 38.3$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.14, 5.14, 5.14); Calibrated: 9/18/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn639; Calibrated: 9/17/2009
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Left Head Template/Area Scan - Normal (15mm) (7x17x1):

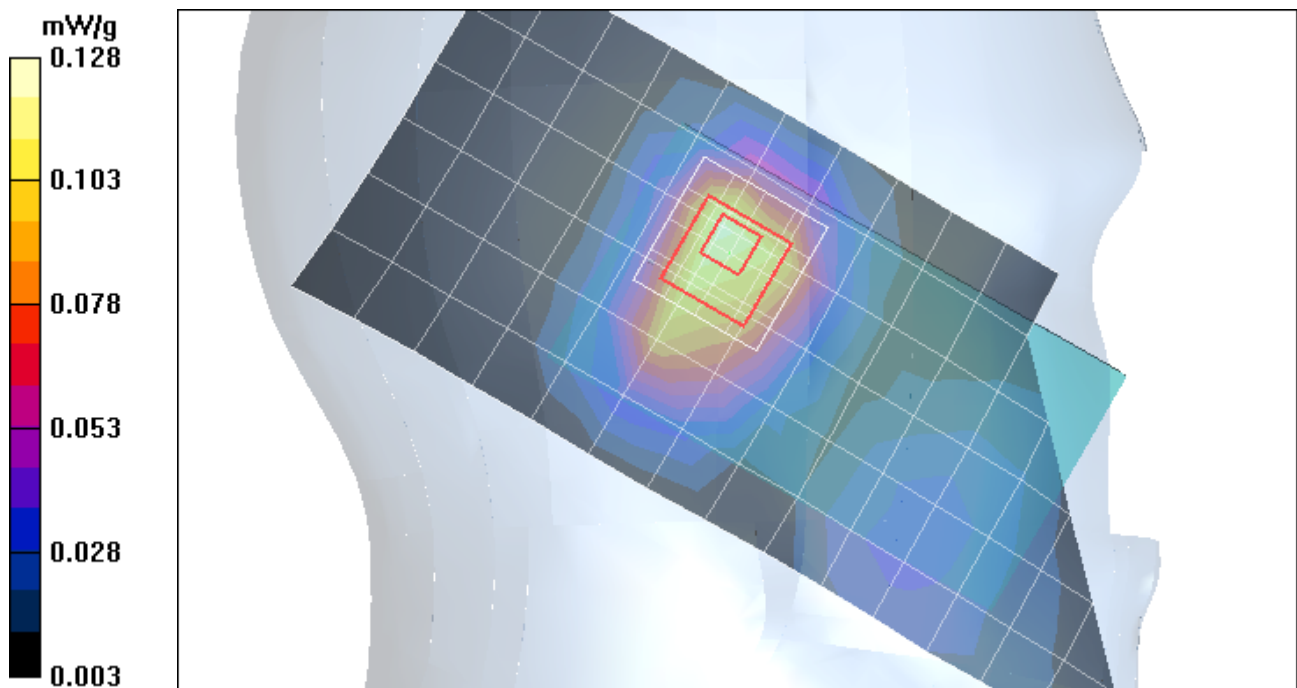
Measurement grid: $dx=15$ mm, $dy=15$ mm; Maximum value of SAR (measured) = 0.124 mW/g

Left Head Template/5x5x7 Zoom Scan (≤ 3 GHz) (5x5x7)/Cube 0:

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

Reference Value = 9.41 V/m; Power Drift = -0.031 dB; Peak SAR (extrapolated) = 0.172 W/kg

SAR(1 g) = 0.119 mW/g; SAR(10 g) = 0.074 mW/g; Maximum value of SAR (measured) = 0.128 mW/g



Test Laboratory: Motorola - WCDMA 1700 Tilt

Serial: 352296030006264; FCC ID: IHDP56KC6

Procedure Notes: Pwr Step: All up Bits; Antenna Position: Internal; Accessory Model #: N/A

Battery Model #: SNN5843A; DEVICE POSITION: TILTED

Communication System: WCDMA 1700; Frequency: 1732.5 MHz; Channel Number: 1413; Duty Cycle: 1:1

Medium: 1730 Glycol Head

Medium parameters used: $f = 1730$ MHz; $\sigma = 1.37$ mho/m; $\epsilon_r = 39.7$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.14, 5.14, 5.14); Calibrated: 9/18/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn639; Calibrated: 9/17/2009
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Right Head Template/Area Scan - Normal (15mm) (7x17x1):

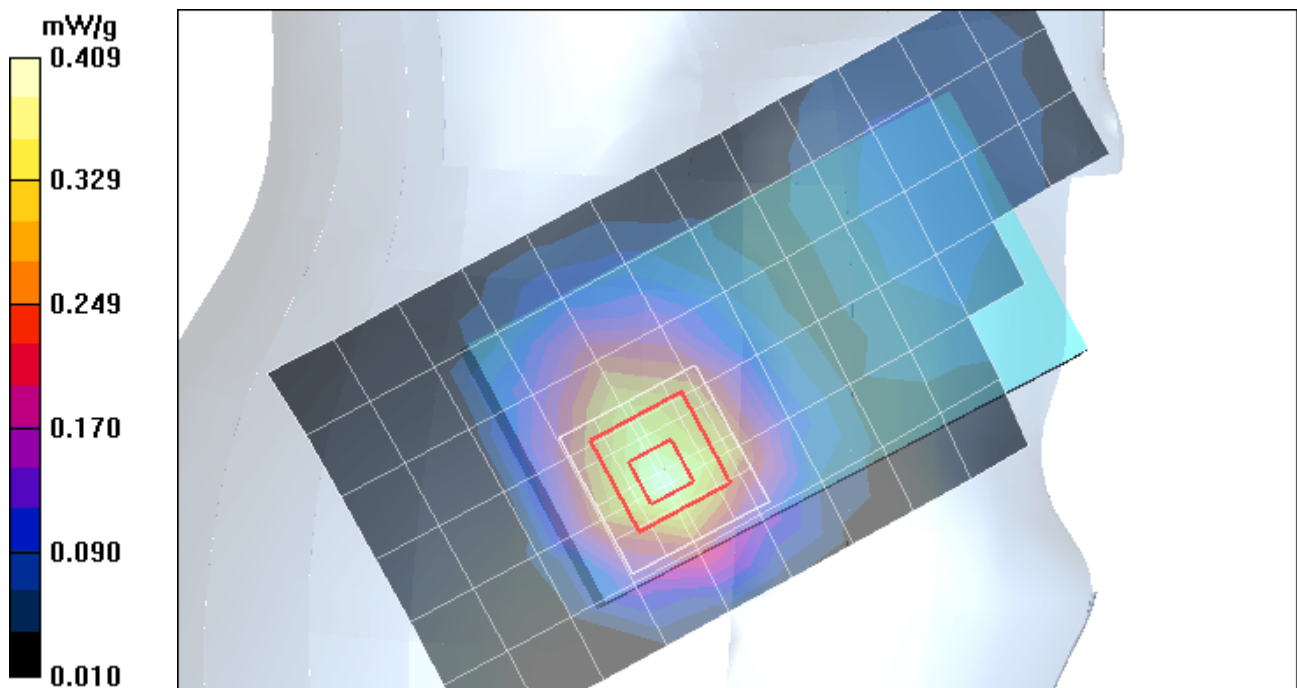
Measurement grid: $dx=15$ mm, $dy=15$ mm; Maximum value of SAR (measured) = 0.407 mW/g

Right Head Template/5x5x7 Zoom Scan (≤ 3 GHz) (5x5x7)/Cube 0:

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

Reference Value = 17.4 V/m; Power Drift = -0.067 dB; Peak SAR (extrapolated) = 0.519 W/kg

SAR(1 g) = 0.378 mW/g; SAR(10 g) = 0.245 mW/g; Maximum value of SAR (measured) = 0.409 mW/g



Test Laboratory: Motorola - Wi-Fi Tilt

Serial: 352296030006264; FCC ID: IHDP56KC6

Procedure Notes: Pwr Step: N/A; Antenna Position: Internal; Accessory Model #: N/A

Battery Model #: SNN5843A; DEVICE POSITION: TILT

Communication System: Wi-Fi 2450; Frequency: 2437 MHz; Channel Number: 6; Duty Cycle: 1:1

Medium: 2450 Glycol Head

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.82$ mho/m; $\epsilon_r = 36.2$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(4.44, 4.44, 4.44); Calibrated: 9/18/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn639; Calibrated: 9/17/2009
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Left Head Template/Area Scan - Normal (15mm) (7x17x1):

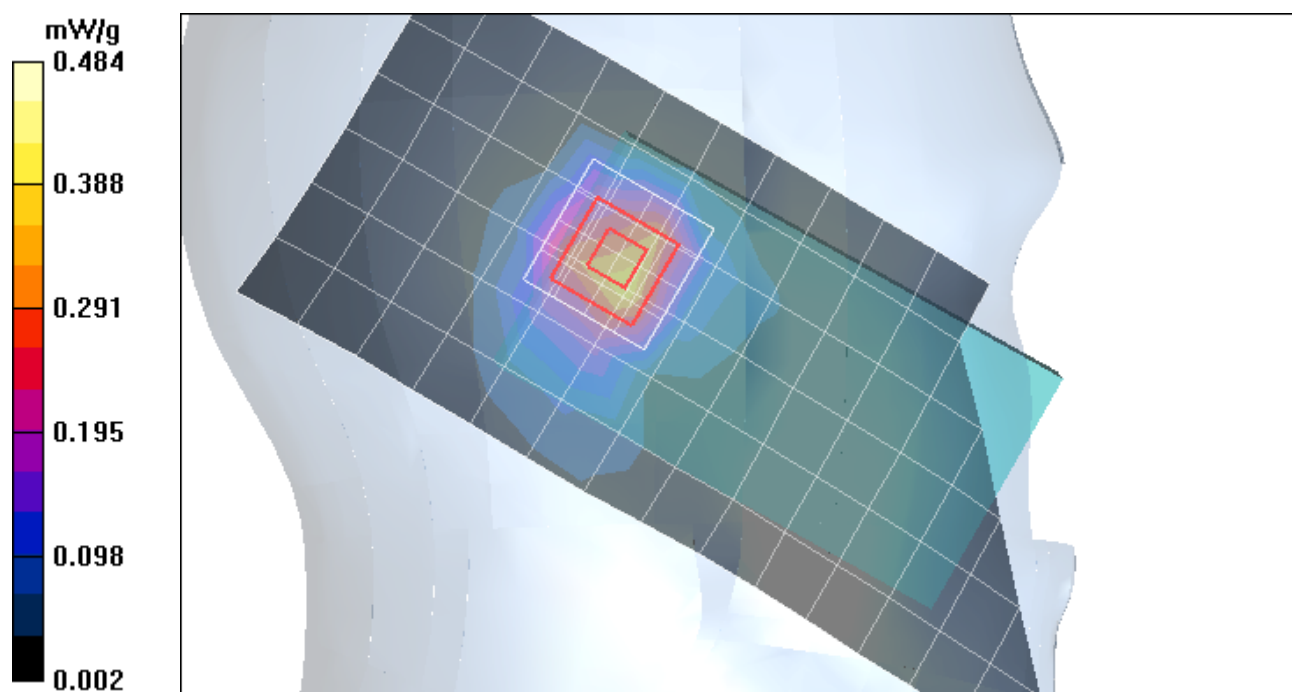
Measurement grid: $dx=15$ mm, $dy=15$ mm; Maximum value of SAR (measured) = 0.357 mW/g

Left Head Template/5x5x7 Zoom Scan (≤ 3 GHz) (5x5x7)/Cube 0:

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

Reference Value = 15.4 V/m; Power Drift = -0.065 dB; Peak SAR (extrapolated) = 0.804 W/kg

SAR(1 g) = 0.421 mW/g; SAR(10 g) = 0.203 mW/g; Maximum value of SAR (measured) = 0.484 mW/g



Appendix 3

SAR distribution plots for Body Worn Configuration

Test Laboratory: Motorola - GSM 850 Body-Worn

Serial: 352296030006264; FCC ID: IHDP56KC6

Procedure Notes: Pwr Step: 5; Antenna Position: Internal; Battery Model #: SNN5843A

Device Position: Body Worn, Front of Phone 15 mm from Phantom

Communication System: GSM 850; Frequency: 836.6 MHz; Channel Number: 190; Duty Cycle: 1:8

Medium: Low Freq Body

Medium parameters used: $f = 835$ MHz; $\sigma = 0.98$ mho/m; $\epsilon_r = 54$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(6.08, 6.08, 6.08); Calibrated: 9/18/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn639; Calibrated: 9/17/2009
- Phantom: R4 : Sect.2, Amy Twin; Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

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

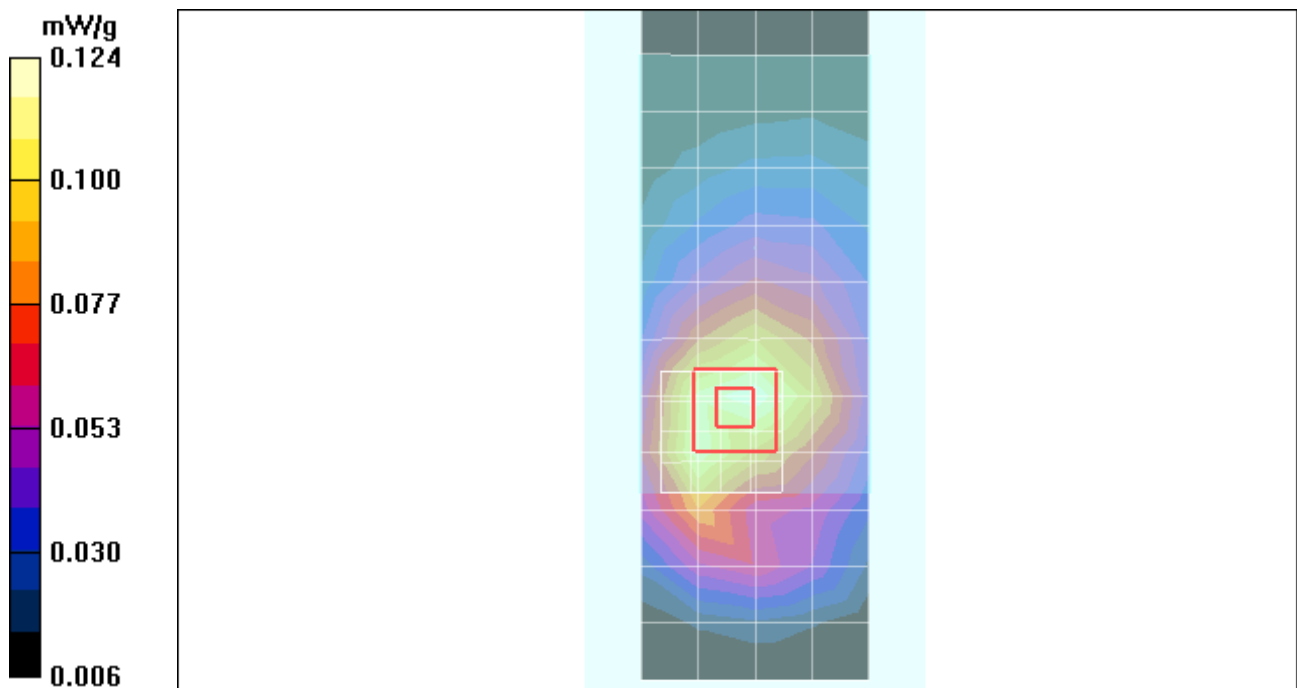
Measurement grid: $dx=15$ mm, $dy=15$ mm; Maximum value of SAR (measured) = 0.123 mW/g

Amy Twin Phone Template/5x5x7 Zoom Scan (≤ 3 GHz) (5x5x7)/Cube 0:

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

Reference Value = 10.8 V/m; Power Drift = -0.187 dB; Peak SAR (extrapolated) = 0.168 W/kg

SAR(1 g) = 0.118 mW/g; SAR(10 g) = 0.078 mW/g; Maximum value of SAR (measured) = 0.124 mW/g



Test Laboratory: Motorola - GSM 1900 Body-Worn

Serial: 352296030006264; FCC ID: IHDP56KC6

Procedure Notes: Pwr Step: 0; Antenna Position: Internal; Battery Model #: SNN5843A

Device Position: Body Worn, Back of Phone 15 mm from Phantom

Communication System: GSM 1900; Frequency: 1880 MHz; Channel Number: 661; Duty Cycle: 1:8

Medium: Regular Glycol Body 1750/1880

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.58$ mho/m; $\epsilon_r = 50.8$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(4.84, 4.84, 4.84); Calibrated: 9/18/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn639; Calibrated: 9/17/2009
- Phantom: R4 : Sect.1, Amy Twin; Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

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

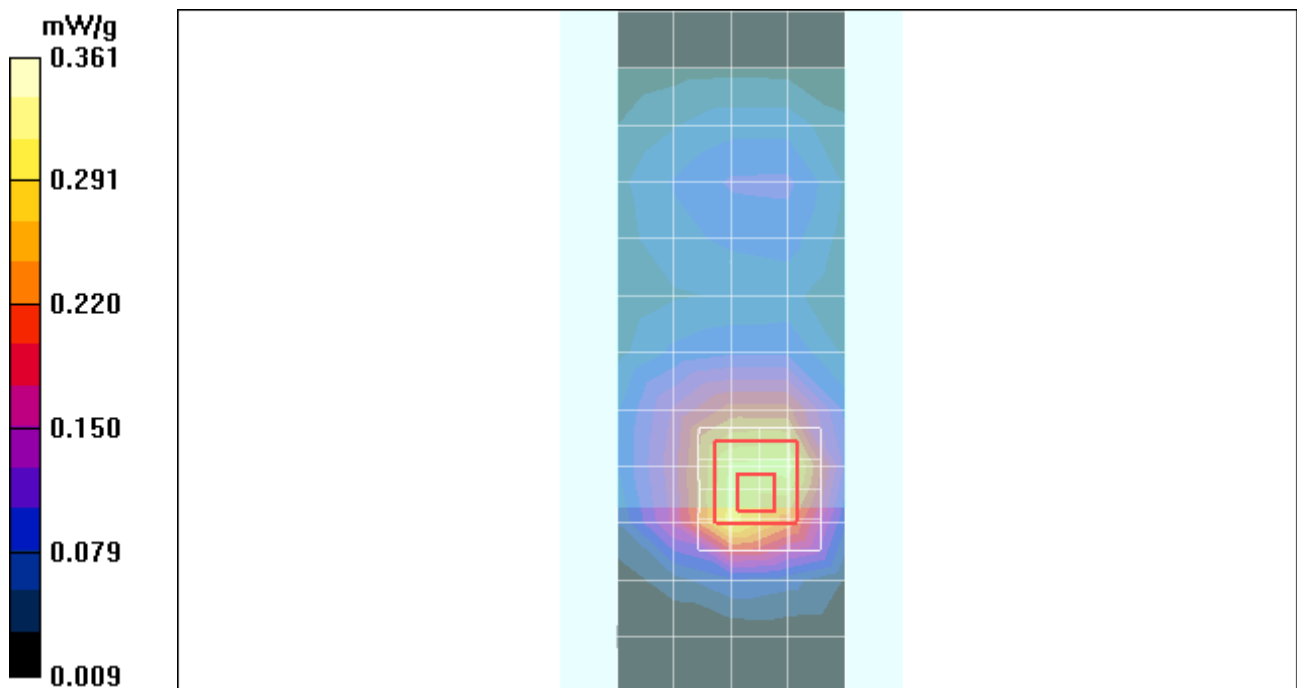
Measurement grid: $dx=15$ mm, $dy=15$ mm; Maximum value of SAR (measured) = 0.304 mW/g

Amy Twin Phone Template/5x5x7 Zoom Scan (≤ 3 GHz) (5x5x7)/Cube 0:

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

Reference Value = 13.7 V/m; Power Drift = 0.009 dB; Peak SAR (extrapolated) = 0.520 W/kg

SAR(1 g) = 0.332 mW/g; SAR(10 g) = 0.200 mW/g; Maximum value of SAR (measured) = 0.361 mW/g



Test Laboratory: Motorola - WCDMA 1700 Body-Worn

Serial: 352296030006264; FCC ID: IHDP56KC6

Procedure Notes: Pwr Step: All up Bits; Antenna Position: Internal; Battery Model #: SNN5843A

Device Position: Body Worn, Back of Phone 15 mm from Phantom

Communication System: WCDMA 1700; Frequency: 1712.4 MHz; Channel Number: 1312; Duty Cycle: 1:1

Medium: 1730 Glycol Body

Medium parameters used: $f = 1730$ MHz; $\sigma = 1.52$ mho/m; $\epsilon_r = 51.2$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(4.84, 4.84, 4.84); Calibrated: 9/18/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn639; Calibrated: 9/17/2009
- Phantom: R4 : Sect.1, Amy Twin; Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

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

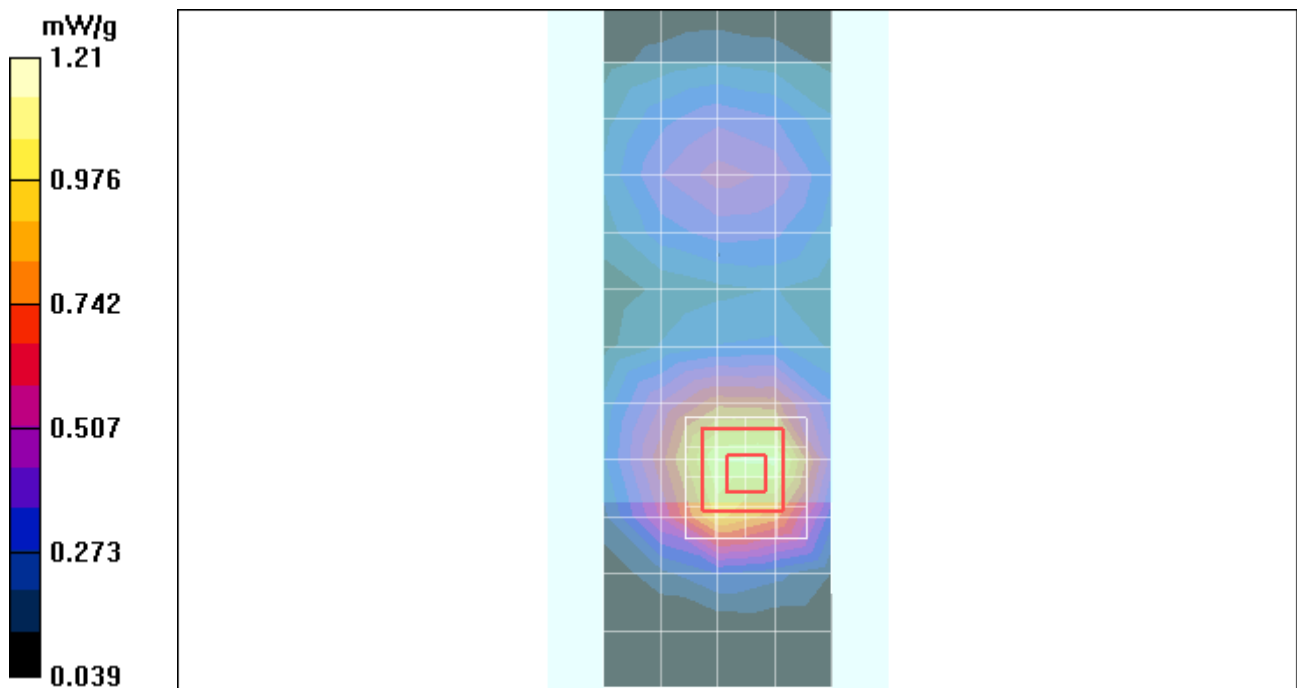
Measurement grid: $dx=15$ mm, $dy=15$ mm; Maximum value of SAR (measured) = 1.08 mW/g

Amy Twin Phone Template/5x5x7 Zoom Scan (≤ 3 GHz) (5x5x7)/Cube 0:

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

Reference Value = 26.5 V/m; Power Drift = -0.024 dB; Peak SAR (extrapolated) = 1.66 W/kg

SAR(1 g) = 1.11 mW/g; SAR(10 g) = 0.695 mW/g; Maximum value of SAR (measured) = 1.21 mW/g



Test Laboratory: Motorola - Wi-Fi Body-Worn

Serial: 352296030006264; FCC ID: IHDP56KC6

Procedure Notes: Pwr Step: N/A; Antenna Position: Internal; Battery Model #: SNN5843A

Device Position: Body Worn, Back of Phone 15 mm from Phantom

Communication System: Wi-Fi 2450; Frequency: 2437 MHz; Channel Number: 6; Duty Cycle: 1:1

Medium: 2450 Glycol Body

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.99$ mho/m; $\epsilon_r = 48.4$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(4.28, 4.28, 4.28); Calibrated: 9/18/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn639; Calibrated: 9/17/2009
- Phantom: R4 : Sect.1, Amy Twin; Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

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

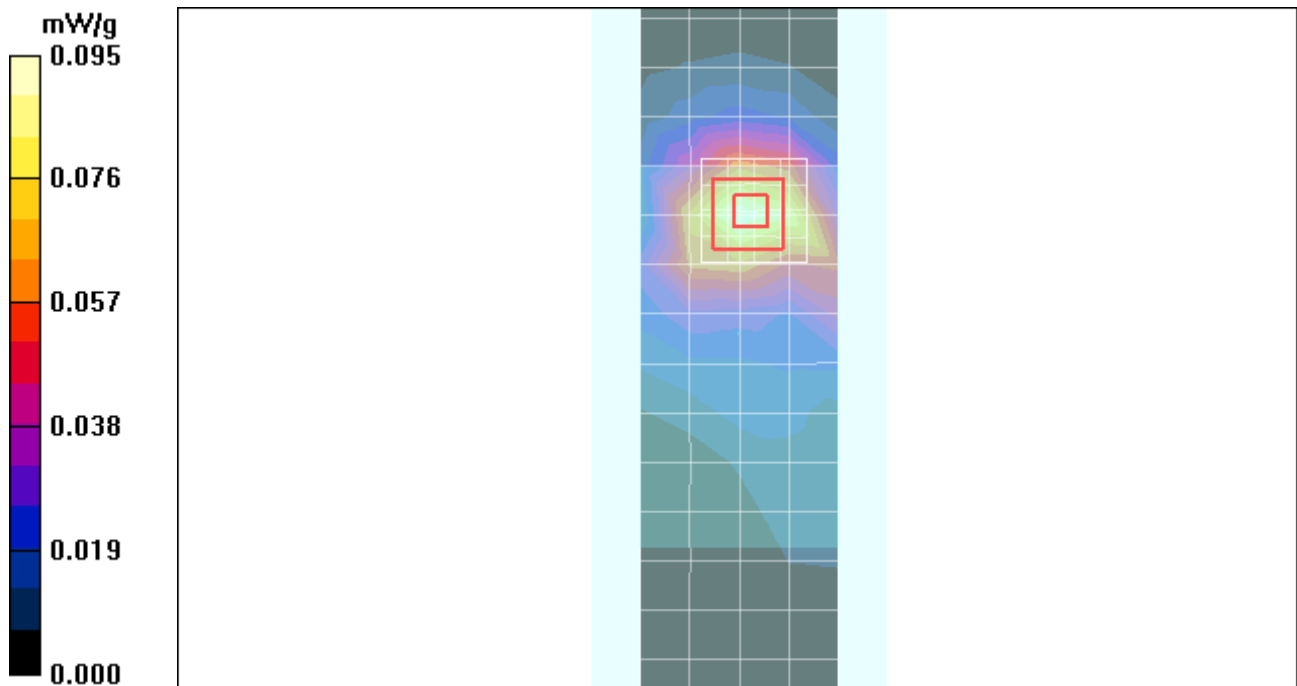
Measurement grid: $dx=15$ mm, $dy=15$ mm; Maximum value of SAR (measured) = 0.096 mW/g

Amy Twin Phone Template/5x5x7 Zoom Scan (≤ 3 GHz) (5x5x7)/Cube 0:

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

Reference Value = 6.92 V/m; Power Drift = 0.086 dB; Peak SAR (extrapolated) = 0.172 W/kg

SAR(1 g) = 0.089 mW/g; SAR(10 g) = 0.048 mW/g; Maximum value of SAR (measured) = 0.095 mW/g



Test Laboratory: Motorola - Bluetooth Body-Worn

Serial: 352296030006264; FCC ID: IHDP56KC6

Procedure Notes: Pwr Step: N/A; Antenna Position: Internal; Battery Model #: SNN5843A

Device Position: Body Worn, Back of Phone 15 mm from Phantom

Communication System: Bluetooth; Frequency: 2441 MHz; Channel Number: 39; Duty Cycle: 1:1

Medium: 2450 Glycol Body

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.99$ mho/m; $\epsilon_r = 48.4$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(4.28, 4.28, 4.28); Calibrated: 9/18/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn639; Calibrated: 9/17/2009
- Phantom: R4 : Sect.1, Amy Twin; Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

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

Measurement grid: $dx=15$ mm, $dy=15$ mm; Maximum value of SAR (measured) = 0.001 mW/g

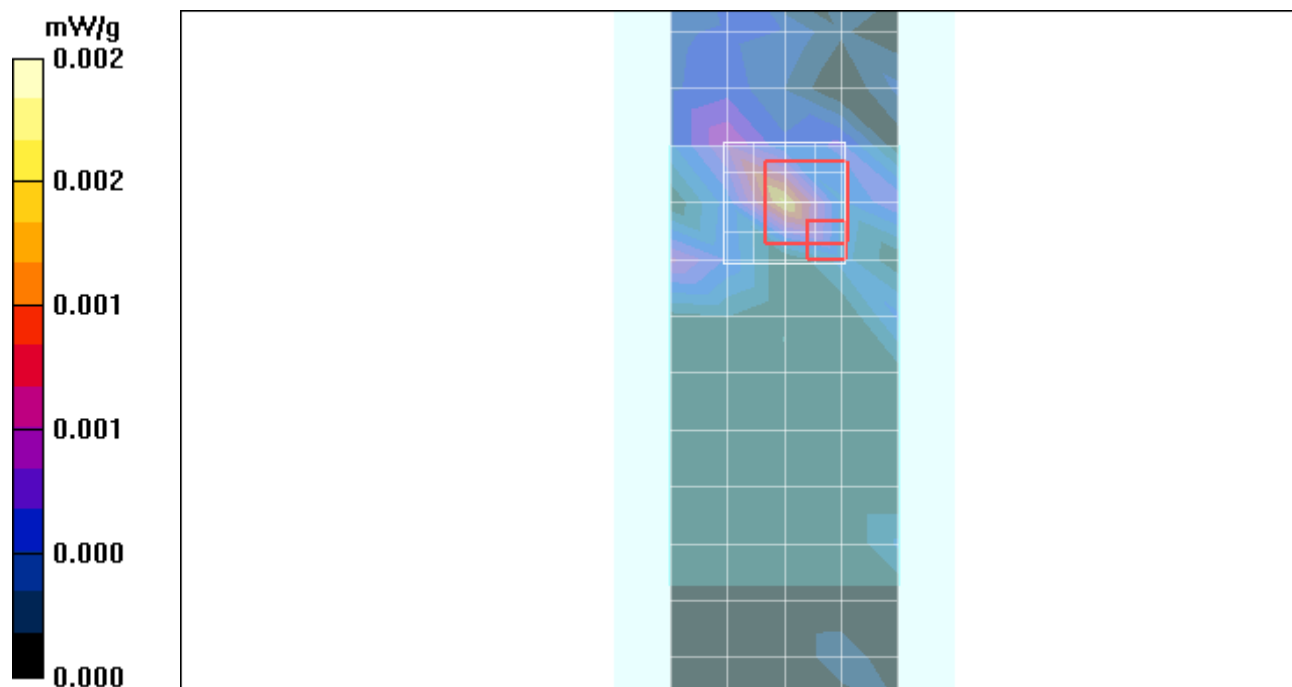
Amy Twin Phone Template to Shift Cube/5x5x7 Zoom Scan (≤ 3 GHz) (5x5x7)/Cube 0:

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

Reference Value = 0.444 V/m; Power Drift = 3.37 dB; Peak SAR (extrapolated) = 0.002 W/kg

SAR(1 g) = 0.000606 mW/g; SAR(10 g) = 0.000258 mW/g;

Maximum value of SAR (measured) = 0.002 mW/g



Appendix 4

Probe Calibration Certificate



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

Client **Motorola MDB**

Certificate No: **ES3-3184_Sep09**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3184**

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

Calibration date: **September 18, 2009**

Condition of the calibrated item **In Tolerance**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

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

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

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

Issued: September 21, 2009

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



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

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
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 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 (no uncertainty required). DCP does not depend on frequency nor media.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to 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:3184

Manufactured:	August 19, 2008
Last calibrated:	September 22, 2008
Recalibrated:	September 18, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ES3DV3 SN:3184

Sensitivity in Free Space^A

NormX	1.28 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.36 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.27 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression^B

DCP X	91 mV
DCP Y	92 mV
DCP Z	95 mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

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

Sensor Center to Phantom Surface Distance		3.0 mm	4.0 mm
SAR _{be} [%]	Without Correction Algorithm	11.1	7.3
SAR _{be} [%]	With Correction Algorithm	0.8	0.5

TSL **1810 MHz** **Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance		3.0 mm	4.0 mm
SAR _{be} [%]	Without Correction Algorithm	12.1	8.3
SAR _{be} [%]	With Correction Algorithm	0.8	0.4

Sensor Offset

Probe Tip to Sensor Center **2.0 mm**

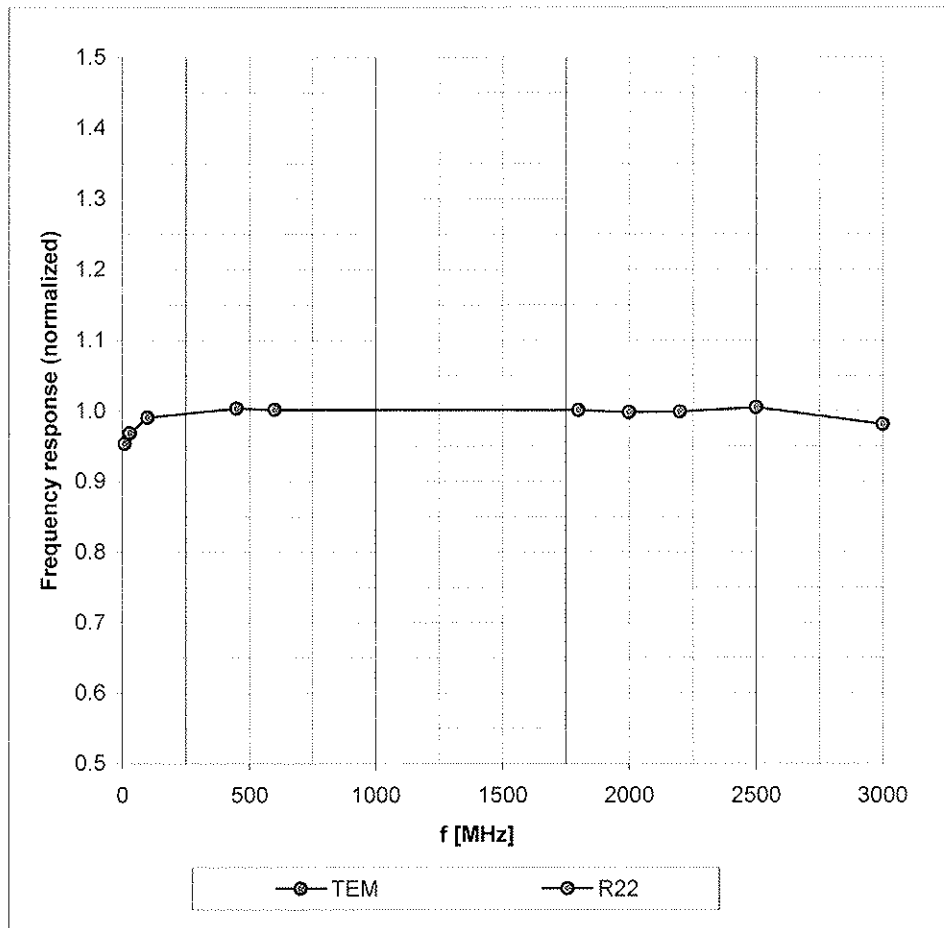
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Page 8).

^B Numerical linearization parameter: uncertainty not required.

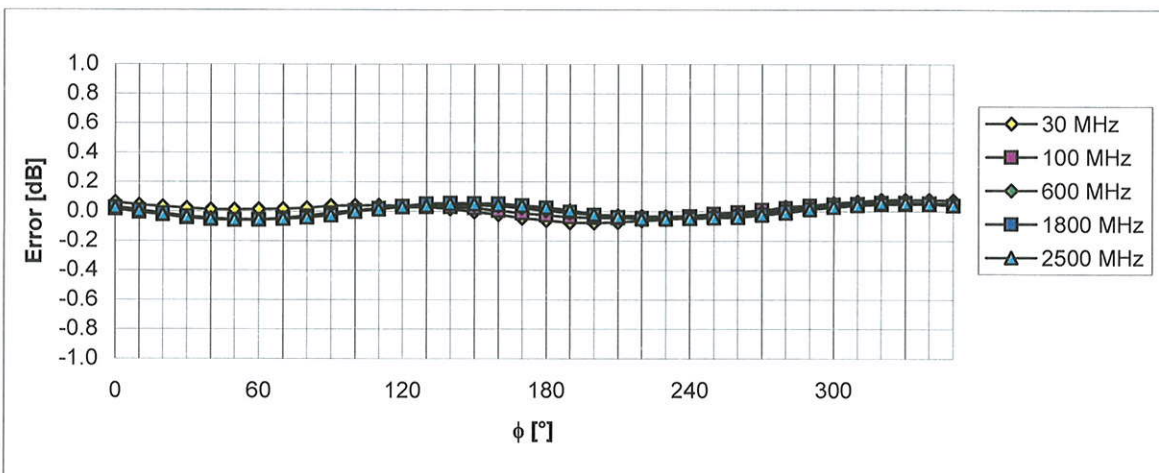
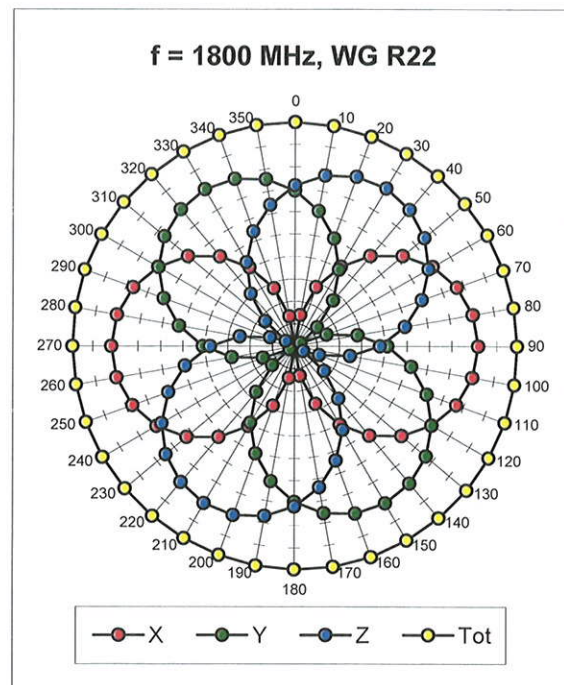
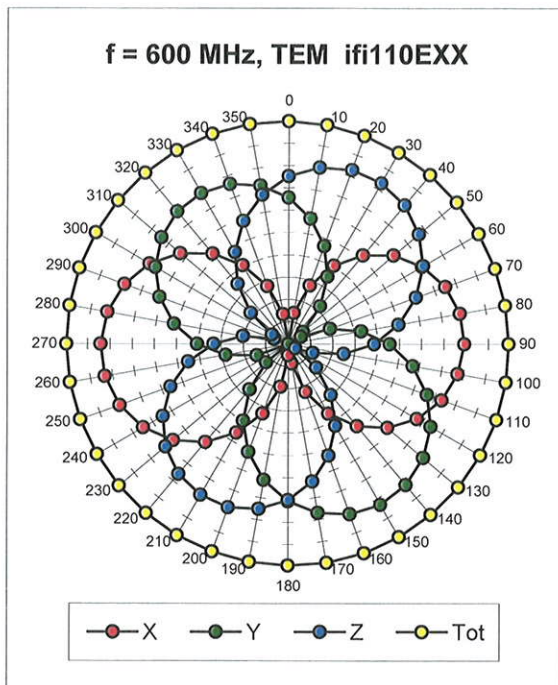
Frequency Response of E-Field

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



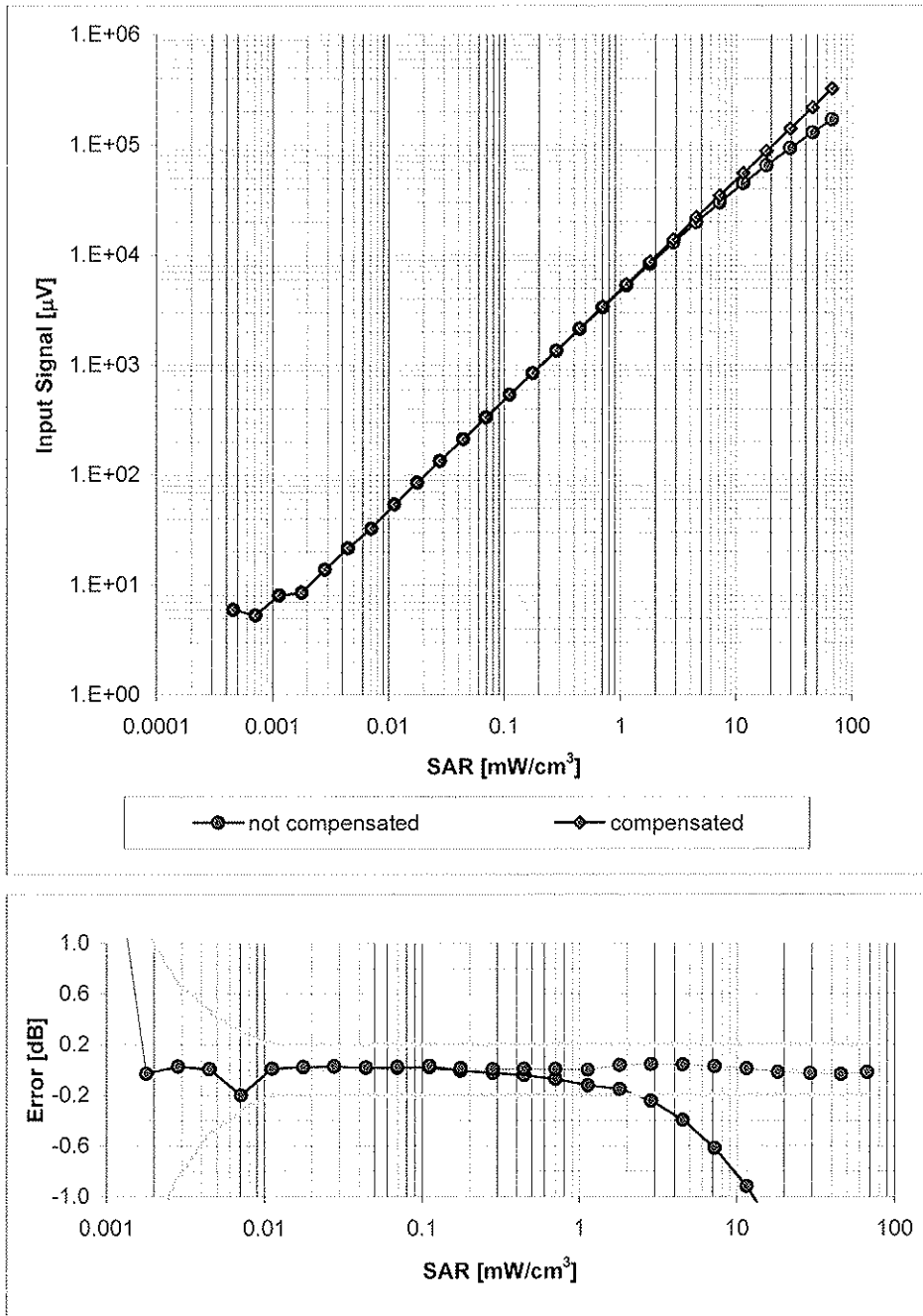
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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



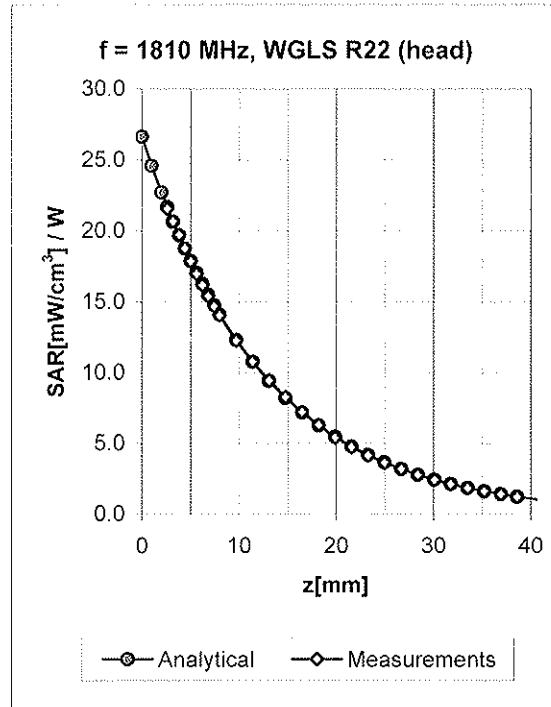
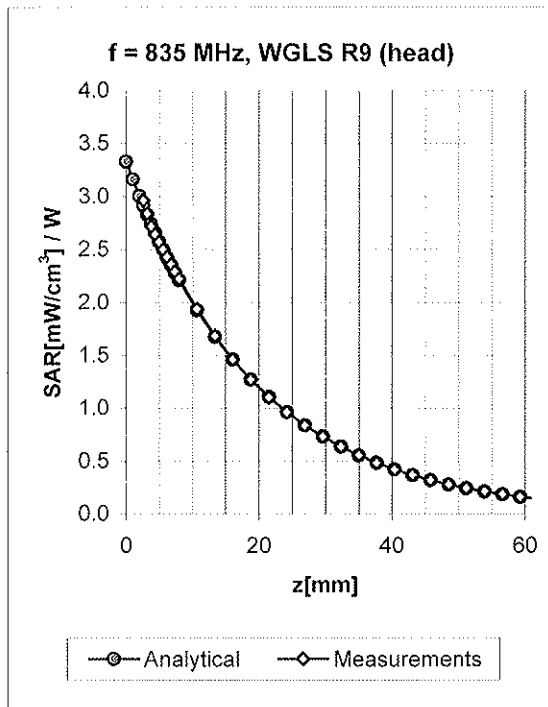
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (Waveguide R22, $f = 1800 \text{ MHz}$)



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

Conversion Factor Assessment

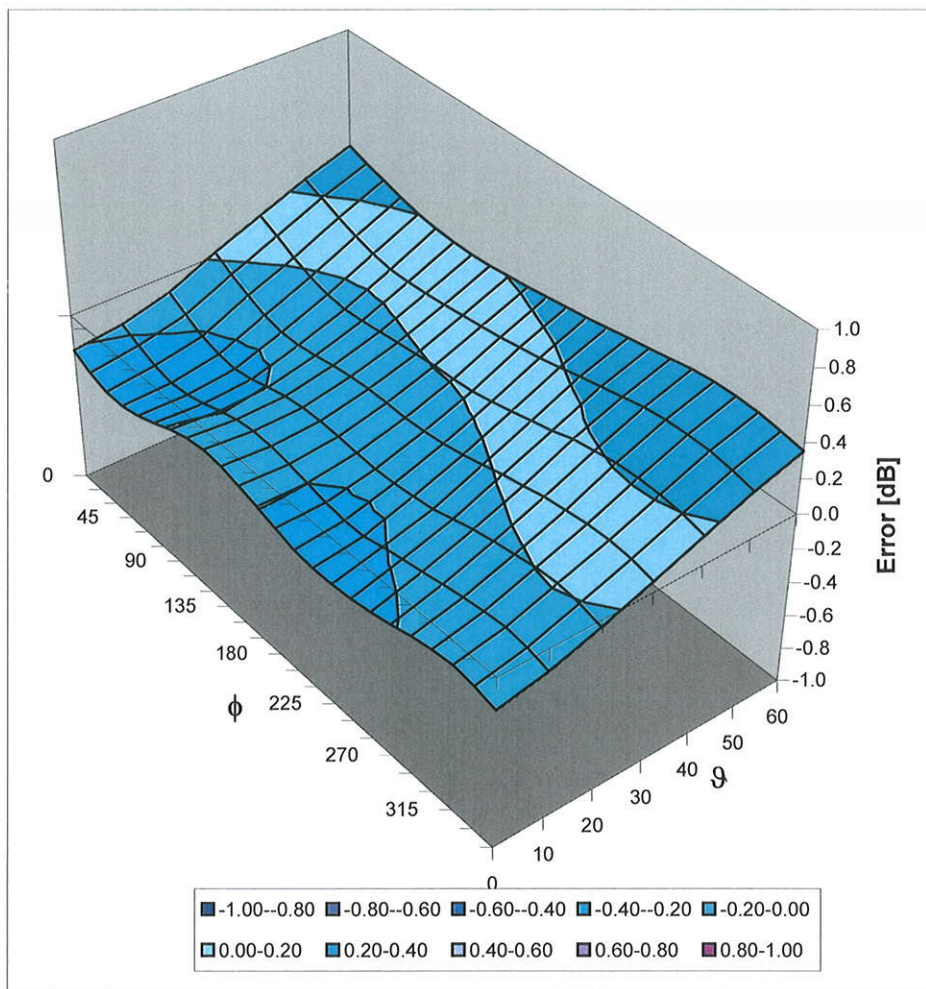


f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	0.27	2.21	6.26 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.26	2.94	5.14 ± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.23	3.55	4.94 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.34	2.33	4.44 ± 11.0% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	0.32	1.92	6.08 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.37	2.02	4.84 ± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.30	2.95	4.81 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.99	1.20	4.28 ± 11.0% (k=2)

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

Deviation from Isotropy in HSL

Error (ϕ , ϑ), $f = 900$ MHz



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

Appendix 5

Measurement Uncertainty Budget

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

Appendix 6

Dipole Characterization Certificate

Certification of System Performance Check Targets

FCD-1806, rev-1

-Historical Data-

	835 MHz	
Reference Target:	9.56	(W/kg)
Measurement Uncertainty (k=1):	9.0%	
Measurement Period:	26-Aug-09 to 8-Oct-09	
# of tests performed:	48	
Grand Average:	9.69	(W/kg)
% Delta (Average - Reference Target)	1.4%	
Is % Delta <= Expanded Measurement Uncertainty (k=2)?	Yes	
Accept/Reject <u>Average</u> as new system performance check target?	ACCEPT	
	Applies to Dipole SN's: 432tr, 417tr, 420tr, 422tr, 423tr, 424tr, 425tr, 431tr, 434tr, 421tr, 436tr	

-New System Performance Check Targets- per WI-0396
(based on analysis of historical data)

Frequency	SAR Target (W/kg)	Permittivity Target +/- %	Conductivity (S/m) Target +/- %
835 MHz	9.69	41.5 +/- 5%	0.90 +/- 5%

-Approvals-

Submitted by: Marge Kaunas

Date: 12-Oct-09

Signed: Marge Kaunas

Comments:

Approved by: Steve Hauswirth

Date: 13-Oct-09

Signed: Steve Hauswirth

Comments:

Certification of System Performance Check Targets

FCD-1806, rev-1

-Historical Data-

	1800 MHz	
Reference Target:	38.4	(W/kg)
Measurement Uncertainty (k=1):	9.0%	
Measurement Period:	15April08 - 26March09	
# of tests performed:	929	
Grand Average:	37.91	(W/kg)
% Delta (Average - Reference Target)	-1.3%	
Is % Delta <= Expanded Measurement Uncertainty (k=2)?	Yes	
Accept/Reject <u>Average</u> as new system performance check target?	ACCEPT	
	Applies to Dipole SN's: 246tr, 250tr, 251tr, 259tr, 263tr, 271tr, 272tr, 276tr, 277tr, 279tr, 280tr, 281tr, 283tr, 284tr, 2d128, 2d129	

-New System Performance Check Targets- per WI-0396

(based on analysis of historical data)

Frequency	SAR Target (W/kg)	Permittivity Target +/- %	Conductivity (S/m) Target +/- %
1800 MHz	37.91	40.0 +/- 5%	1.40 +/- 5%

-Approvals-

Submitted by:

Marge Kaunas

Date:

1-Apr-09

Signed:

Marge Kaunas

Comments:

Data file available upon request.

Approved by:

Steve Hauswirth

Date:

1-Apr-09

Signed:

Steve Hauswirth

Comments:

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Certification of System Performance Check Targets

FCD-1806, rev-1

-Historical Data-

	2450 MHz	
Reference Target:	52.4	(W/kg)
Measurement Uncertainty (k=1):	9.0%	
Measurement Period:	15April08 - 26March09	
# of tests performed:	150	
Grand Average:	56.68	(W/kg)
% Delta (Average - Reference Target)	8.2%	
Is % Delta <= Expanded Measurement Uncertainty (k=2)?	Yes	
Accept/Reject <u>Average</u> as new system performance check target?	ACCEPT	
	Applies to Dipole SN's:	
	740, 766, 767, 788, 789	

-New System Performance Check Targets- per WI-0396

(based on analysis of historical data)

Frequency	SAR Target (W/kg)	Permittivity Target +/- %	Conductivity (S/m) Target +/- %
2450 MHz	56.68	39.2 +/- 10%	1.80 +/- 5%

-Approvals-

Submitted by: Marge Kaunas Date: 1-Apr-09

Signed: Marge Kaunas

Comments: Data file available upon request.

Approved by: Steve Hauswirth Date: 1-Apr-09

Signed: Steve Hauswirth

Comments:

END OF REPORT