Portable Cellular Phone SAR Test Report v2

Tests Requested By:	Motorola Mobile Devices Business Product Safety & Compliance Laboratory 19th Floor, Hibrand Living Hall, 215, Yanjae-Dong, Seocho-Gu, Seoul, 137-130, South Korea
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Test Laboratory:	Motorola Mobile Devices Business Product Safety & Compliance Laboratory 11th Floor, Hibrand Living Hall, 215, Yanjae-Dong, Seocho-Gu, Seoul, 137-130, South Korea
Report Author:	Brian Lee RF Engineer Brian Lee

Accreditation:

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

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

TESTING CERT #2518-02

Statement of Compliance:

On the following products or types of products:

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 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 1g average set in [3] and 2.0W/kg in a 10g average set in [2].

For ANSI / IEEE C95.1 (1g), the final SAR reading for this phone is 0.68 W/kg for head adjacent use and 0.23 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 Antenna	
Location	Bottom of the Transceiver	
Dimensions	Length	6.66mm
	Width	56.22mm
Configuration	FICA	

2.2 Device description

Serial number	**354636030004918**					
Mode(s) of Operation	GSM 900	GSM 1800	GSM 1900	WCDMA 2100	Bluetooth	WLAN 802.11b/g
Modulation Mode(s)	GMSK	GMSK	GMSK	QPSK	GFSK	BPSK
Maximum Output Power Setting	33.00 dBm	30.00 dBm	30.00 dBm	25.00 dBm	10.00 dBm	23.00 dBm
Duty Cycle	1:8	1:8	1:8	1:1	1:1	1:1
Transmitting Frequency Rang(s)	880.2-914.8MHz	1710.2-1784.8MHz	1850.2-1909.8MHz	1922.4-1977.6 MHz	2402.0-2483.5MHz	2412.0-2462.5MHz
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 900				GPRS 1800				GPRS 1900			
Modulation Mode(s)	GMSK				GMSK				GMSK			
Maximum Output Power Setting	33.00 dBm	**31.00 dBm**	29.00 dBm	27.00 dBm	30.00 dBm	**28.00 dBm**	26.00 dBm	24.00 dBm	30.00 dBm	**28.00 dBm**	26.00 dBm	24.00 dBm
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
Transmitting Frequency Rang(s)	880.2-914.8MHz				1710.2-1784.8MHz				1850.2-1909.8MHz			

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 10g RSS uncertainty of the measurement system is ±10.8% (K=1) with an expanded uncertainty of ±21.6% (K=2). The overall 1g RSS uncertainty of the measurement system is ±11.1% (K=1) with an expanded uncertainty of ±22.2% (K=2). The measurement uncertainty budget is given in Appendix 5. Per IEEE 1528, this uncertainty budget is applicable to the SAR range of 0.4W/kg to 10W/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	365	21-Aug-2010
E-Field Probe ES3DV3	3191	07-Nov-2009
S.A.M. Phantom used for 1800/1900/2450MHz	TP-1134	
Dipole Validation Kit, DV1800V2	277tr	01-Apr-2010
Dipole Validation Kit, DV2450V2	767	01-Apr-2010

3.2 Additional Equipment

Description	Serial Number	Cal Due Date
Signal Generator HP8648C	3847A04840	21-Jan-2010
Power Meter E4419B	GB39511085	21-Jan-2010
Power Sensor #1 - 8481A	MY41095450	21-Jan-2010
Power Sensor #2 - 8481A	2702A82671	21-Jan-2010
Network Analyzer HP8753ES	US39172714	22-Jan-2010
Dielectric Probe Kit HP85070C	US99360207	

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 ρ=1g/cm3 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)
1880	Head	**Measured, 6-Oct-2009**	38.9	1.45	21.0
		Recommended Limits	40.0 ±5%	1.40 ±5%	18-25
	Body	**Measured, 6-Oct-2009**	51.3	1.59	21.1
		Recommended Limits	53.3 ±5%	1.52 ±5%	18-25
2450	Head	**Measured, 8-Oct-2009**	37.1	1.89	21.8
		Measured, 9-Oct-2009	37.1	1.89	21.6
		Recommended Limits	39.2 ±10%	1.80 ±5%	18-25
	Body	**Measured, 8-Oct-2009**	50.2	2.04	21.9
		Measured, 9-Oct-2009	50.2	2.04	21.9
		Recommended Limits	52.7 ±10%	1.95 ±5%	18-25

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

Ingredient	835MHz / 900 MHz Head	835MHz / 900 MHz Body	1800MHz / 1900 MHz Head	1800 MHz / 1900 MHz Body	2450MHz 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 ±10% from the target SAR indicated in Appendix 6. These frequencies are within ±10% of the compliance test mid-band frequency as required in [1] and [5]. The test was conducted on the same days as the measurement of the DUT. Recommended limits for permittivity and conductivity, specified in [5], are shown in the table below. The obtained results from the system accuracy verification are also displayed in the table below. SAR values are normalized to 1W 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 15.0cm ±0.5cm. Z-axis scans showing the SAR penetration are also included in Appendix 1.

f (MHz)	Description	SAR (W/kg), 1gram	Dielectric Parameters		Ambient Temp (°C)	Tissue Temp (°C)
			ε_r	σ (S/m)		
1800	**Measured, 6-Oct-2009**	39.68	39.2	1.37	21.6	21.3
	Measured, 7-Oct-2009	38.68	39.0	1.36	22.1	21.6
	Recommended Limits	37.91	40.0 ±5%	1.40 ±5%	18-25	18-25
2450	**Measured, 8-Oct-2009**	54.75	37.1	1.89	22.2	21.9
	Measured, 9-Oct-2009	53.25	36.6	1.89	21.0	24.0
	Recommended Limits	56.68	39.2 ±10%	1.80 ±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	SN3191	1810	5.19	8 of 9
		2450	4.57	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 setup 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 (± 30%) at 850MHz. 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 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:
SNN5843A - 1390 mAH Battery

The battery with the highest capacity is the SNN5843A. This battery was used to do most of the SAR testing. The phone was placed in the SAR measurement system with a fully charged battery.

There is one accessory available for this phone
85003100001 - Retractable DMB Antenna

The phone with DMB antenna was tested at the highest head and body-worn positions. Because the DMB antenna is swivel type, eight positions of DMB antenna were tested at the highest head position and one position was tested at the highest body-worn position. Each position of the phone with DMB antenna is included in Exhibit 7D (Figure 7 through 14).

The DMB service is only available at South Korea region, and South Korea region uses the WCDMA2100 and WiFi (802.11b/g) band. Therefore, the DMB antenna is tested only with WCDMA2100 and WiFi (802.11b/g) band.

6.1 Head Adjacent Test Results

The SAR results shown in tables 1 through 12 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 New SAR = Old SAR * 10^(-drift/10). The SAR reported at the end of the measurement process by the DASY4™ measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process. This is the most conservative SAR because it corresponds to the average output power at the beginning of the SAR test. This extrapolation has been done because when the DUT is operating properly it may exhibit a slump in radiated power and SAR over time. This is verified by measuring the SAR drift after the test.

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

The guidelines provided in "SAR for Handsets with Multiple Transmitters" (KDB publication 648474 - D01 v01r03) were utilized for evaluation of the need for simultaneous transmission SAR testing. These guidelines direct that if the SAR-to-peak location separation ratio for the GSM antenna and the Wi-Fi antenna is < 0.3 then SAR evaluation for simultaneous transmission is not required. For GSM1900, the SAR-to-peak location separation ratio is 0.108. Thus, no testing was performed to determine the aggregate 1 g SAR. SAR plots with the Wi-Fi SAR overlaid upon the GSM SAR are provided in Appendix 2 to provide visual indication of the separation of the SAR hotspots for each modulation.

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 15.0cm ±0.5cm.

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

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ES3DV3	SN3191	1810	5.19	8 of 9
		2450	4.57	8 of 9

Left Head Cheek Position								
f **(MHz)**	**Description**	**Conducted Output Power (dBm)**	**Temp (℃)**	**Drift (dB)**	***10g SAR value***		***1g SAR value***	
					Measured (W/kg)	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**
GSM 1900	**Channel 512**	30.07						
	Channel 661	30.01	20.9	0.0387	0.146	0.15	0.233	0.23
	Channel 810	30.01						
WLAN 802.11b/g	**Channel 1**	21.95						
	Channel 6	22.06	21.9	-0.038	0.242	0.24	0.477	0.48
	Channel 11	22.41						

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

Right Head Cheek Position								
f **(MHz)**	**Description**	**Conducted Output Power (dBm)**	**Temp (℃)**	**Drift (dB)**	***10g SAR value***		***1g SAR value***	
					Measured (W/kg)	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**
GSM 1900	**Channel 512**	30.07						
	Channel 661	30.01	**21**	**-0.00366**	**0.154**	**0.15**	**0.251**	**0.25**
	Channel 810	30.01						
WLAN 802.11b/g	**Channel 1**	21.95						
	Channel 6	22.06	21.7	-0.0456	0.294	0.30	0.614	0.62
	Channel 11	22.41						

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

Left Head 15° Tilt Position								
f **(MHz)**	**Description**	**Conducted Output Power (dBm)**	**Temp (℃)**	**Drift (dB)**	***10g SAR value***		***1g SAR value***	
					Measured (W/kg)	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**
GSM 1900	**Channel 512**	30.07						
	Channel 661	30.01	**20.9**	**-0.00573**	**0.102**	**0.10**	**0.169**	**0.17**
	Channel 810	30.01						
WLAN 802.11b/g	**Channel 1**	21.95						
	Channel 6	22.06	**21.8**	**-0.0177**	**0.272**	**0.27**	**0.571**	**0.57**
	Channel 11	22.41						

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								
f **(MHz)**	**Description**	**Conducted Output Power (dBm)**	**Temp (℃)**	**Drift (dB)**	***10g SAR value***		***1g SAR value***	
					Measured (W/kg)	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**
GSM 1900	**Channel 512**	30.07						
	Channel 661	30.01	20.9	-0.867	0.0741	0.09	0.127	0.16
	Channel 810	30.01						
WLAN 802.11b/g	**Channel 1**	21.95						
	Channel 6	22.06	21.7	0.0273	0.251	0.25	0.501	0.50
	Channel 11	22.41						

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.

Highest Head Position with DBM position 1								
f **(MHz)**	**Description**	**Conducted Output Power (dBm)**	**Temp (℃)**	**Drift (dB)**	***10g SAR value***		***1g SAR value***	
					Measured (W/kg)	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**
WLAN 802.11b/g *Right Cheek*	**Channel 1**	21.95						
	Channel 6	22.06	22.1	0.0333	0.292	0.29	0.612	0.61
	Channel 11	22.41						

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

Highest Head Position with DBM position 2								
f **(MHz)**	**Description**	**Conducted Output Power (dBm)**	**Temp (℃)**	**Drift (dB)**	***10g SAR value***		***1g SAR value***	
					Measured (W/kg)	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**
WLAN 802.11b/g *Right Cheek*	**Channel 1**	21.95						
	Channel 6	22.06	22	-0.125	0.282	0.29	0.583	0.60
	Channel 11	22.41						

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

Highest Head Position with DBM position 3								
f **(MHz)**	**Description**	**Conducted Output Power (dBm)**	**Temp (℃)**	**Drift (dB)**	***10g SAR value***		***1g SAR value***	
					Measured (W/kg)	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**
WLAN 802.11b/g *Right Cheek*	**Channel 1**	21.95						
	Channel 6	22.06	21.9	0.012	0.279	0.28	0.584	0.58
	Channel 11	22.41						

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

Highest Head Position with DBM position 4								
f **(MHz)**	**Description**	**Conducted Output Power (dBm)**	**Temp (℃)**	**Drift (dB)**	***10g SAR value***		***1g SAR value***	
					Measured (W/kg)	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**
WLAN 802.11b/g *Right Cheek*	**Channel 1**	21.95						
	Channel 6	22.06	21.8	-0.0302	0.297	0.30	0.614	0.62
	Channel 11	22.41						

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

Highest Head Position with DBM position 1 (Ant Extended)								
f **(MHz)**	**Description**	**Conducted Output Power (dBm)**	**Temp (℃)**	**Drift (dB)**	***10g SAR value***		***1g SAR value***	
					Measured (W/kg)	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**
WLAN 802.11b/g *Right Cheek*	**Channel 1**	21.95						
	Channel 6	22.06	21.7	0.0172	0.302	0.30	0.627	0.63
	Channel 11	22.41						

Table 9: SAR measurement results at the highest possible output power, measured in a head cheek position against the ICNIRP and ANSI SAR Limit.

Highest Head Position with DBM position 2 (Ant Extended)								
f **(MHz)**	**Description**	**Conducted Output Power (dBm)**	**Temp (℃)**	**Drift (dB)**	***10g SAR value***		***1g SAR value***	
					Measured (W/kg)	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**
WLAN 802.11b/g *Right Cheek*	**Channel 1**	21.95						
	Channel 6	22.06	21.6	-0.00528	0.315	0.32	0.65	0.65
	Channel 11	22.41						

Table 10: SAR measurement results at the highest possible output power, measured in a head cheek position against the ICNIRP and ANSI SAR Limit.

Highest Head Position with DBM position 3 (Ant Extended)								
f **(MHz)**	**Description**	**Conducted Output Power (dBm)**	**Temp (℃)**	**Drift (dB)**	***10g SAR value***		***1g SAR value***	
					Measured (W/kg)	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**
WLAN 802.11b/g *Right Cheek*	**Channel 1**	21.95						
	Channel 6	22.06	**21.6**	**-0.157**	**0.319**	**0.33**	**0.657**	**0.68**
	Channel 11	22.41						

Table 11: SAR measurement results at the highest possible output power, measured in a head cheek position against the ICNIRP and ANSI SAR Limit.

Highest Head Position with DBM position 4 (Ant Extended)								
f **(MHz)**	**Description**	**Conducted Output Power (dBm)**	**Temp (℃)**	**Drift (dB)**	***10g SAR value***		***1g SAR value***	
					Measured (W/kg)	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**
WLAN 802.11b/g *Right Cheek*	**Channel 1**	21.95						
	Channel 6	22.06	21.6	0.056	0.309	0.31	0.641	0.64
	Channel 11	22.41						

Table 12: SAR measurement results at the highest possible output power, measured in a head cheek position against the ICNIRP and ANSI SAR Limit.

6.2 Body Worn Test Results

The SAR results shown in tables 13 through 16 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 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 New SAR = Old SAR * 10^(-drift/10). The SAR reported at the end of the measurement process by the DASY4™ measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process. This is the most conservative SAR because it corresponds to the average output power at the beginning of the SAR test. This extrapolation has been done because when the DUT is operating properly it may exhibit a slump in radiated power and SAR over time. This is verified by measuring the SAR drift after the test.

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

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

The tissue stimulant depth was verified to be 15.0cm ±0.5cm. 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 hence the device was tested per the supplement C testing guidelines for devices that do not have body worn accessories. A separation distance of 15mm 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.

In addition to accessory testing, the cellular phone was tested in data mode operations with the front and back of the phone facing the phantom. For these tests, a separation distance of 25mm between the device and the flat phantom was used. The device was tested with the front and back of the device facing the phantom.

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	SN3191	1810	4.85	8 of 9
		2450	4.08	8 of 9

BodyWorn Front part of the phone 15mm away from the flat phantom								
f **(MHz)**	**Description**	**Conducted Output Power (dBm)**	**Temp (℃)**	**Drift (dB)**	***10g SAR value***		***1g SAR value***	
					Measured (W/kg)	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**
GSM 1900	**Channel 512**	30.07						
	Channel 661	30.01	21.2	-0.0378	0.0877	0.09	0.141	0.14
	Channel 810	30.01						
WLAN 802.11b/g	**Channel 1**	21.95						
	Channel 6	22.06	**21.9**	**-0.0665**	**0.0791**	**0.08**	**0.14**	**0.14**
	Channel 11	22.41						
Bluetooth 2450MHz	**Channel 0**	9.22						
	Channel 39	9.10	**21.9**	**2.21**	**0.00000622**	**0.00**	**0.0000419**	**0.00**
	Channel 78	9.35						
GSM 1900 + WLAN + Bluetooth						***0.17***		***0.28***

Table 13: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.

BodyWorn Back part of the phone 15mm away from the flat phantom								
f **(MHz)**	**Description**	**Conducted Output Power (dBm)**	**Temp (℃)**	**Drift (dB)**	***10g SAR value***		***1g SAR value***	
					Measured (W/kg)	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**
GSM 1900	**Channel 512**	30.07						
	Channel 661	30.01	**21.1**	**0.3**	**0.139**	**0.14**	**0.232**	**0.23**
	Channel 810	30.01						
WLAN 802.11b/g	**Channel 1**	21.95						
	Channel 6	22.06	21.8	0.0686	0.0739	0.07	0.13	0.13
	Channel 11	22.41						
Bluetooth 2450MHz	**Channel 0**	9.22						
	Channel 39	9.10	21.7	999	0.0000015	0.00	0.0000105	0.00
	Channel 78	9.35						
GSM 1900 + WLAN + Bluetooth						***0.21***		***0.36***

Table 14: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.

Highest BodyWorn Phone 25mm away from the flat phantom								
f **(MHz)**	**Description**	**Conducted Output Power (dBm)**	**Temp (℃)**	**Drift (dB)**	***10g SAR value***		***1g SAR value***	
					Measured (W/kg)	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**
GPRS1900 *Class10 Back*	**Channel 512**	28.21						
	Channel 661	28.17	21	0.0204	0.073	0.07	0.114	0.11
	Channel 810	28.21						
WLAN 802.11b/g *Front*	**Channel 1**	21.95						
	Channel 6	22.06	22.4	-0.0349	0.025	0.03	0.0429	0.04
	Channel 11	22.41						
WLAN 802.11b/g *Back*	**Channel 1**	21.95						
	Channel 6	22.06	22.2	-0.027	0.0259	0.03	0.0447	0.04
	Channel 11	22.41						
GPRS 1900 Class 10 + WLAN						***0.1***		***0.15***

Table 15: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.

Highest Back Body-Worn with DMB Position 1								
f **(MHz)**	**Description**	**Conducted Output Power (dBm)**	**Temp (℃)**	**Drift (dB)**	***10g SAR value***		***1g SAR value***	
					Measured (W/kg)	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**
WLAN 802.11b/g *Front 15mm*	**Channel 1**	21.95						
	Channel 6	22.06	21.5	0.18	0.0634	0.06	0.112	0.11
	Channel 11	22.41						

Table 16: 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 (300MHz – 3GHz)”.

[3] ANSI / IEEE, C95.1 1999 Edition “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300GHz”

[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

Date/Time: 10/6/2009 10:10:47 AM

Test Laboratory: Motorola 1006'2009_1800MHz_Good +4.7%

Procedure Notes: 1800 MHz System Performance Check / Dipole Sn# 277tr PM1 Power = 200 mW
Sim.Temp@meas = 21.5C Sim.Temp@SPC = 21.3C Room Temp @ SPC = 21.6C
Communication System: CW - Dipole; Frequency: 1800 MHz; Channel Number: 8; Duty Cycle: 1:1
Medium: VALIDATION Only; Medium parameters used: f = 1800 MHz; σ = 1.37 mho/m; ε_r = 39.2; ρ = 1000 kg/m^3

DASY4 Configuration:

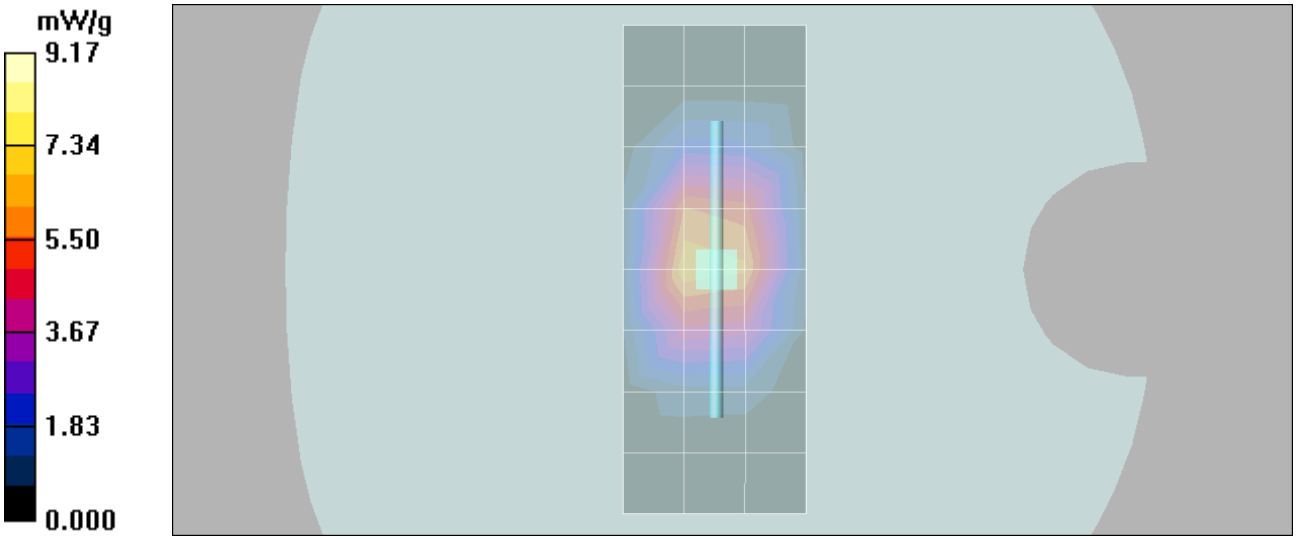
- Probe: ES3DV3 - SN3191; ConvF(5.19, 5.19, 5.19); Calibrated: 11/7/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn365; Calibrated: 8/21/2009
- Phantom: PCS-9_ Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1134;
- Measurement SW: DASY4, V4.7 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) = 6.65 mW/g

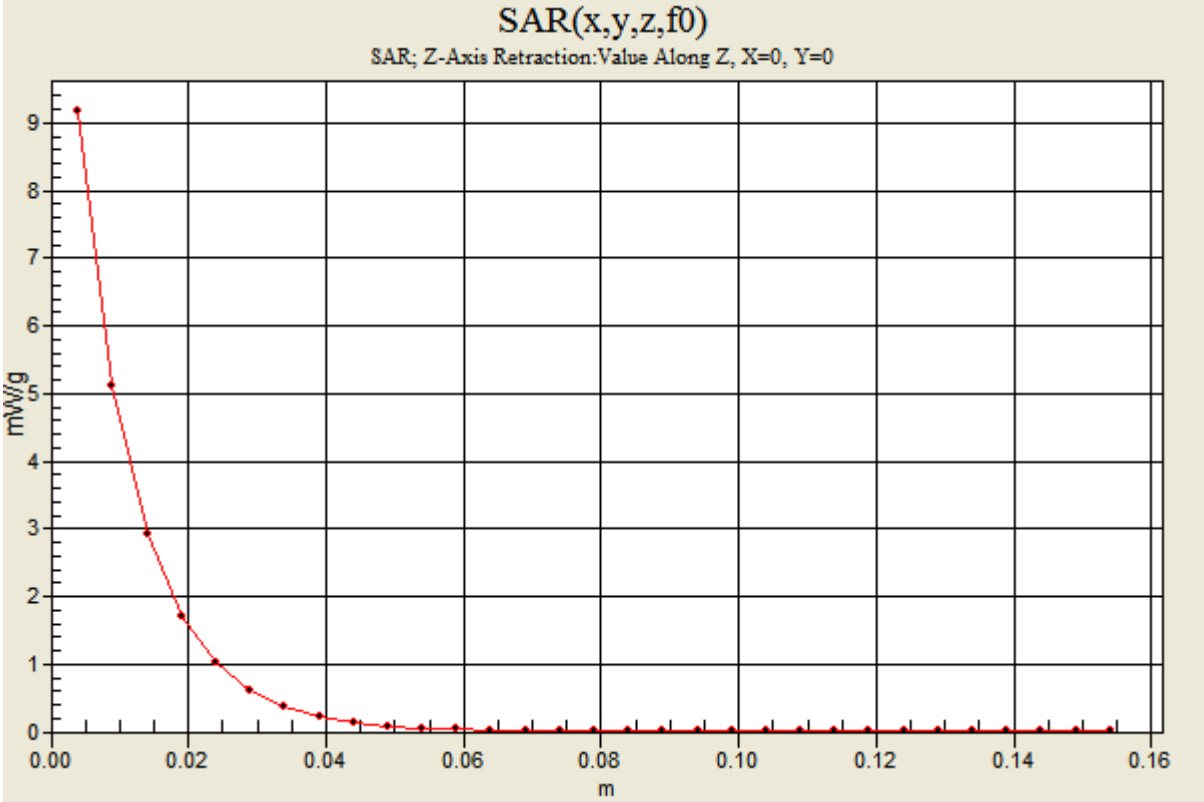
Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 81.7 V/m; Power Drift = 0.030 dB
Peak SAR (extrapolated) = 14.8 W/kg
SAR(1 g) = 8.11 mW/g; SAR(10 g) = 4.25 mW/g
Maximum value of SAR (measured) = 9.12 mW/g

Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 81.7 V/m; Power Drift = 0.030 dB
Peak SAR (extrapolated) = 14.2 W/kg
SAR(1 g) = 7.76 mW/g; SAR(10 g) = 4.07 mW/g
Maximum value of SAR (measured) = 8.66 mW/g

Daily SPC Check/Z-Axis Retraction (1x1x31):
Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 9.17 mW/g



1006'2009_1800MHz_Good +4.7%



Date/Time: 10/8/2009 1:23:18 PM

Test Laboratory: Motorola 1008'2009_2450MHz_Good -3.4%

Procedure Notes: 2450 MHz System Performance Check / Dipole Sn# 767 PM1 Power = 200 mW
Sim.Temp@meas = 23.2C Sim.Temp@SPC = 21.9C Room Temp @ SPC = 22.2C
Communication System: CW - Dipole; Frequency: 2450 MHz; Channel Number: 11; Duty Cycle: 1:1
Medium: VALIDATION Only; Medium parameters used: f = 2450 MHz; σ = 1.89 mho/m; ε_r = 37.1; ρ = 1000 kg/m^3

DASY4 Configuration:

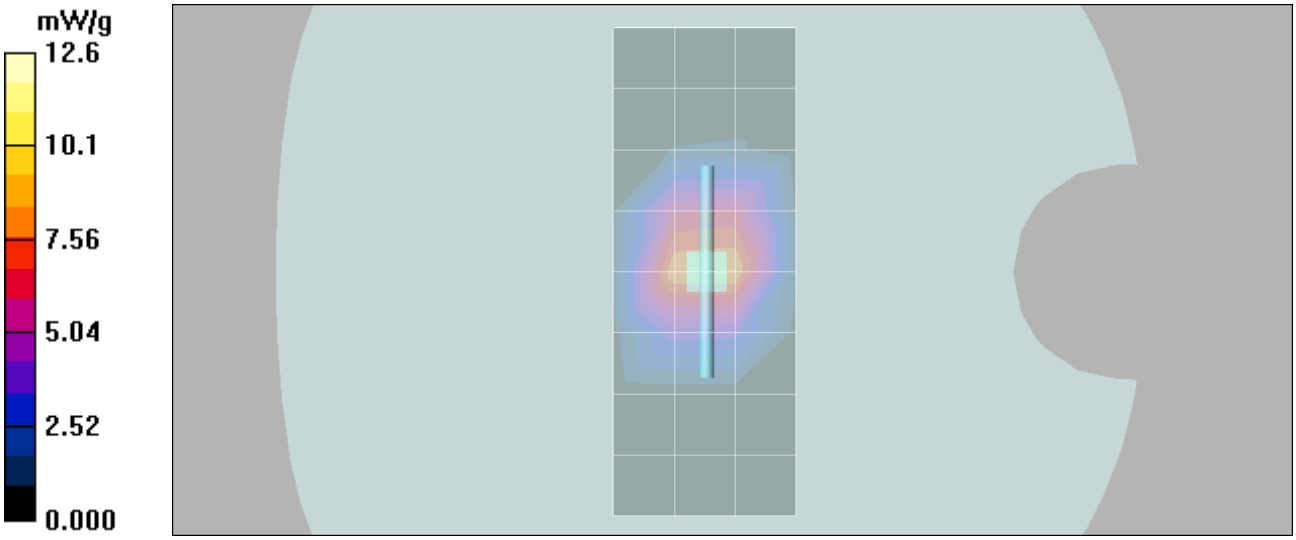
- Probe: ES3DV3 - SN3191; ConvF(4.57, 4.57, 4.57); Calibrated: 11/7/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn365; Calibrated: 8/21/2009
- Phantom: PCS-9_ Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1134;
- Measurement SW: DASY4, V4.7 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) = 8.53 mW/g

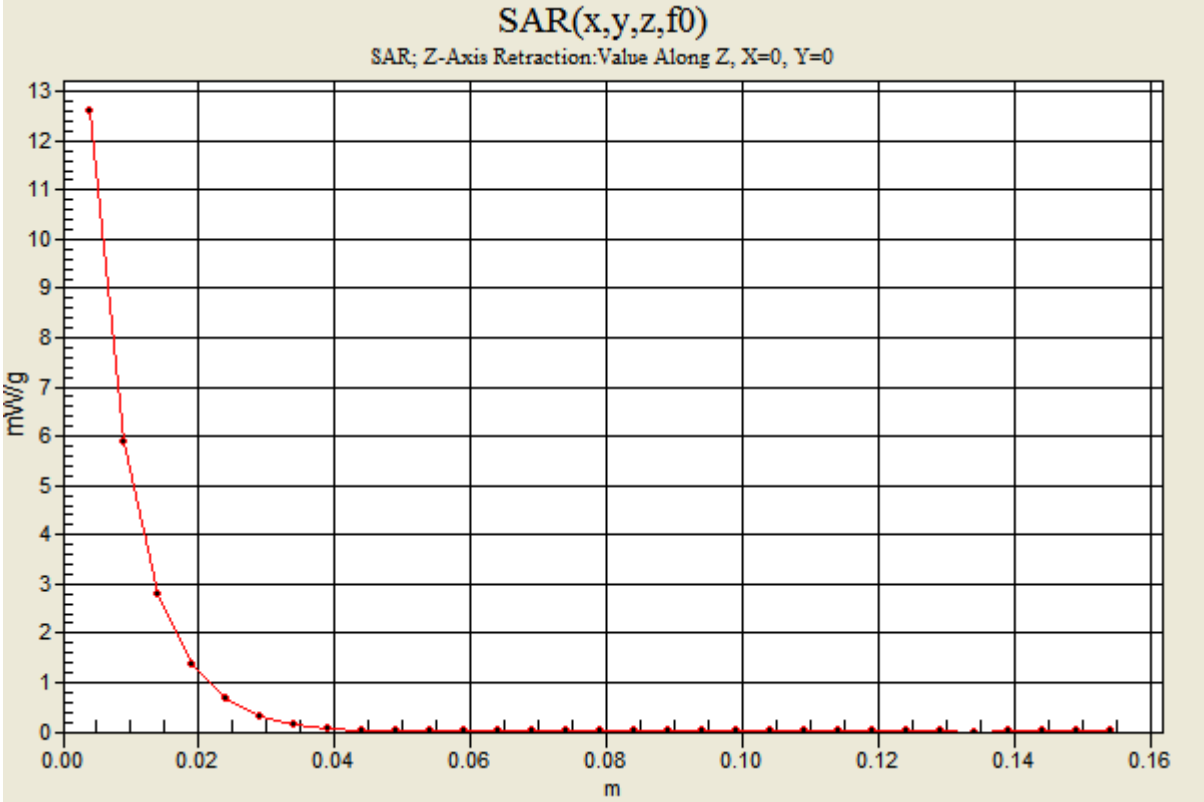
Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 82.6 V/m; Power Drift = -0.018 dB
Peak SAR (extrapolated) = 24.1 W/kg
SAR(1 g) = 11.1 mW/g; SAR(10 g) = 5.05 mW/g
Maximum value of SAR (measured) = 12.5 mW/g

Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 82.6 V/m; Power Drift = -0.018 dB
Peak SAR (extrapolated) = 23.6 W/kg
SAR(1 g) = 10.8 mW/g; SAR(10 g) = 4.88 mW/g
Maximum value of SAR (measured) = 11.9 mW/g

Daily SPC Check/Z-Axis Retraction (1x1x31):
Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 12.6 mW/g



1008'2009_2450MHz_Good -3.4%



Date/Time: 10/9/2009 2:39:22 PM

Test Laboratory: Motorola 1009'2009_2450MHz_Good -6.1%

Procedure Notes: 2450 MHz System Performance Check / Dipole Sn# 767 PM1 Power = 200 mW
Sim.Temp@meas = 23.8C Sim.Temp@SPC = 24C Room Temp @ SPC = 21C
Communication System: CW - Dipole; Frequency: 2450 MHz; Channel Number: 11; Duty Cycle: 1:1
Medium: VALIDATION Only; Medium parameters used: f = 2450 MHz; σ = 1.89 mho/m; ε_r = 36.6; ρ = 1000 kg/m^3

DASY4 Configuration:

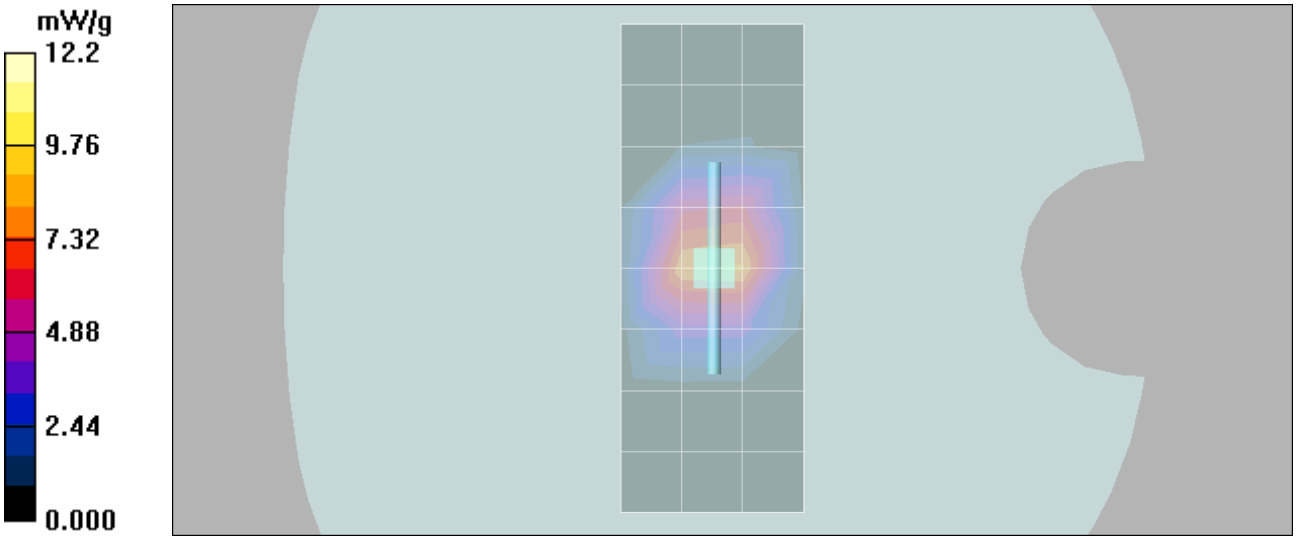
- Probe: ES3DV3 - SN3191; ConvF(4.57, 4.57, 4.57); Calibrated: 11/7/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn365; Calibrated: 8/21/2009
- Phantom: PCS-9_ Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1134;
- Measurement SW: DASY4, V4.7 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) = 8.35 mW/g

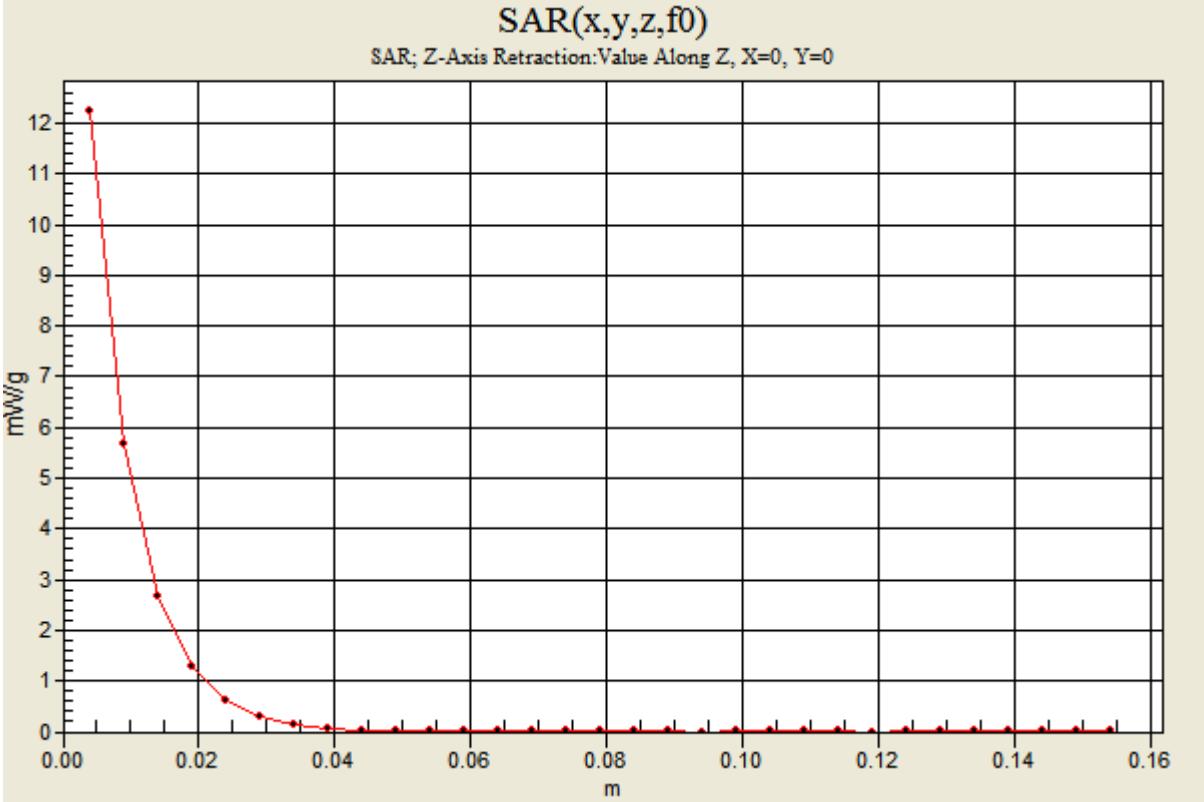
Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 81.9 V/m; Power Drift = 0.038 dB
Peak SAR (extrapolated) = 23.6 W/kg
SAR(1 g) = 10.8 mW/g; SAR(10 g) = 4.89 mW/g
Maximum value of SAR (measured) = 12.1 mW/g

Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 81.9 V/m; Power Drift = 0.038 dB
Peak SAR (extrapolated) = 23.1 W/kg
SAR(1 g) = 10.5 mW/g; SAR(10 g) = 4.72 mW/g
Maximum value of SAR (measured) = 11.6 mW/g

Daily SPC Check/Z-Axis Retraction (1x1x31):
Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 12.2 mW/g



1009'2009_2450MHz_Good -6.1%



Appendix 2

SAR distribution plots for Phantom Head Adjacent Use

Date/Time: 10/6/2009 2:11:38 PM

Test Laboratory: Motorola GSM1900 Cheek

354636030004918;

Procedure Notes: Pwr Step: 00(OTA) Antenna Position: Internal
Battery Model #: SNN5843A; DEVICE POSITION (cheek or rotated): 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; σ = 1.45 mho/m; ε_r = 38.9; ρ = 1000 kg/m^3

DASY4 Configuration:

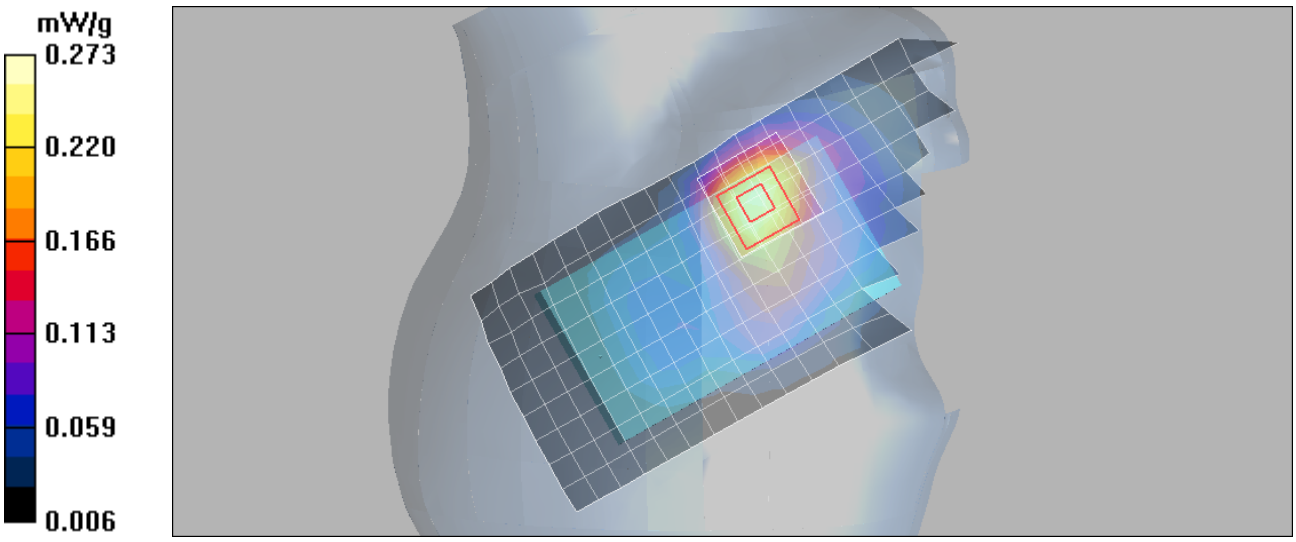
- Probe: ES3DV3 - SN3191; ConvF(5.19, 5.19, 5.19); Calibrated: 11/7/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn365; Calibrated: 8/21/2009
- Phantom: PCS-9_ Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1134;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Right Head Template/Area Scan - Normal (10mm) (10x25x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.257 mW/g

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

Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.2 V/m; Power Drift = -0.004 dB
Peak SAR (extrapolated) = 0.388 W/kg
SAR(1 g) = 0.251 mW/g; SAR(10 g) = 0.154 mW/g
Maximum value of SAR (measured) = 0.273 mW/g



Date/Time: 10/6/2009 1:16:22 PM

Test Laboratory: Motorola GSM1900 Tilted

354636030004918;

Procedure Notes: Pwr Step: 00(OTA) Antenna Position: Internal
Battery Model #: SNN5843A; DEVICE POSITION (cheek or rotated): Rotated
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; σ = 1.45 mho/m; ε_r = 38.9; ρ = 1000 kg/m^3

DASY4 Configuration:

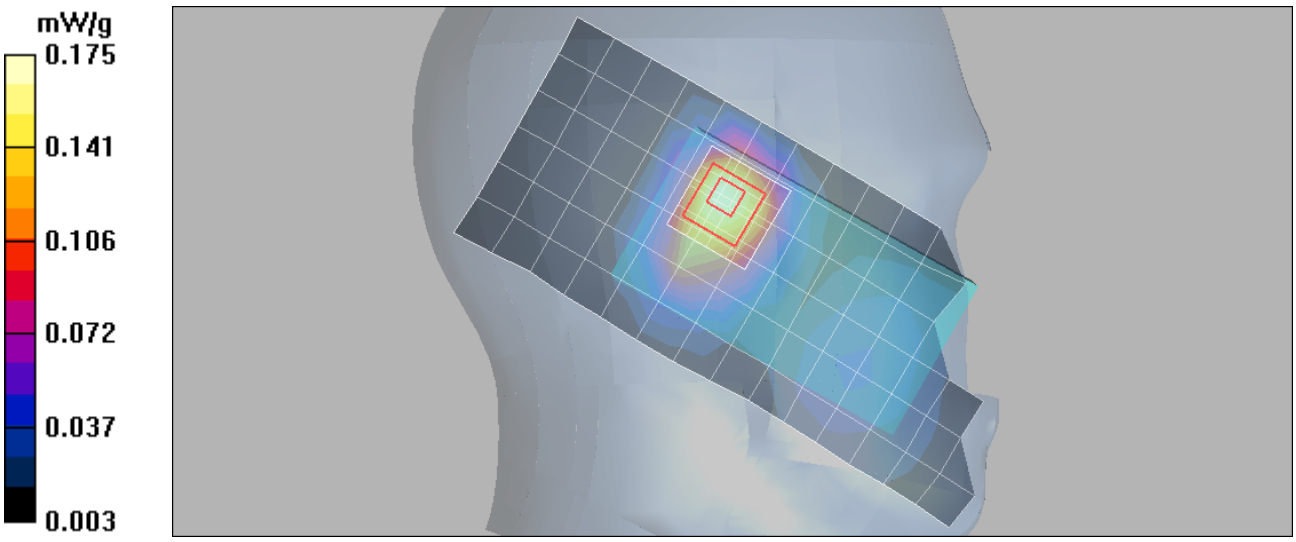
- Probe: ES3DV3 - SN3191; ConvF(5.19, 5.19, 5.19); Calibrated: 11/7/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn365; Calibrated: 8/21/2009
- Phantom: PCS-9_ Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1134;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

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

Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.181 mW/g

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

Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.5 V/m; Power Drift = -0.006 dB
Peak SAR (extrapolated) = 0.264 W/kg
SAR(1 g) = 0.169 mW/g; SAR(10 g) = 0.102 mW/g
Maximum value of SAR (measured) = 0.175 mW/g



Date/Time: 10/9/2009 8:54:46 AM

Test Laboratory: Motorola WiFi Cheek

354636030004918;

Procedure Notes: Pwr Step: Test Mode(20dBm); Antenna Position: Internal; Accessory Model #: DMB Ant(Ext)
Battery Model #: SNN5843A DEVICE POSITION (cheek or rotated): 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; σ = 1.89 mho/m; ε_r = 37.1; ρ = 1000 kg/m^3

DASY4 Configuration:

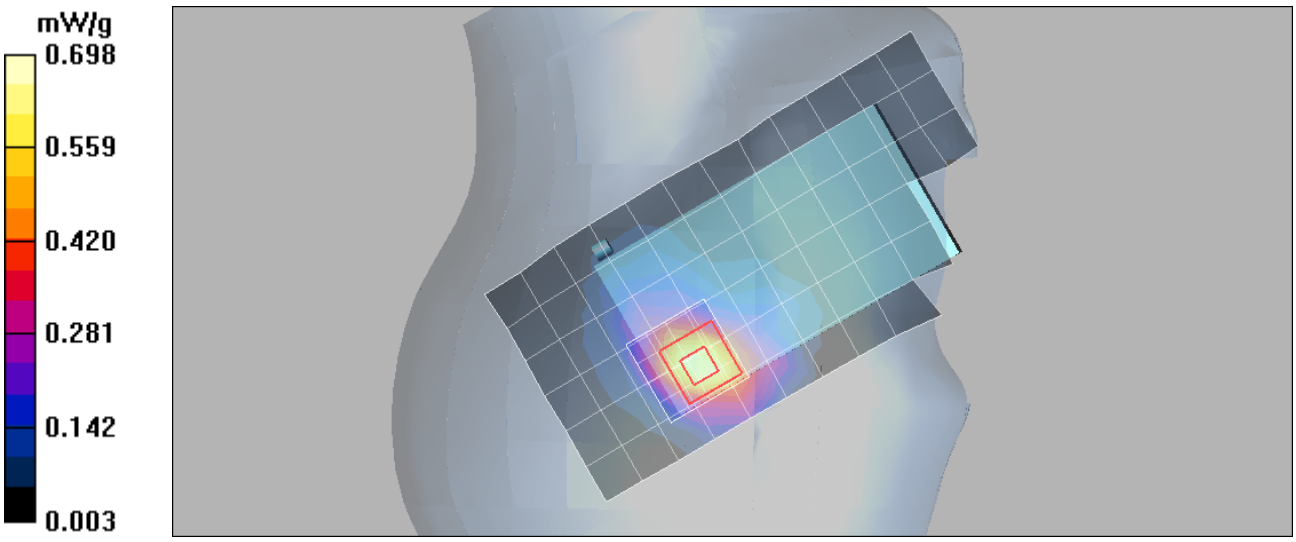
- Probe: ES3DV3 - SN3191; ConvF(4.57, 4.57, 4.57); Calibrated: 11/7/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn365; Calibrated: 8/21/2009
- Phantom: PCS-9_ Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1134;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

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

Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.587 mW/g

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

Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.8 V/m; Power Drift = -0.157 dB
Peak SAR (extrapolated) = 1.30 W/kg
SAR(1 g) = 0.657 mW/g; SAR(10 g) = 0.319 mW/g
Maximum value of SAR (measured) = 0.698 mW/g



Date/Time: 10/8/2009 2:25:27 PM

Test Laboratory: Motorola WiFi Tilted

354636030004918;

Procedure Notes: Pwr Step: Test Mode(20dBm); Antenna Position: Internal
Battery Model #: SNN5843A; DEVICE POSITION (cheek or rotated): Rotated
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; σ = 1.89 mho/m; ε_r = 37.1; ρ = 1000 kg/m^3

DASY4 Configuration:

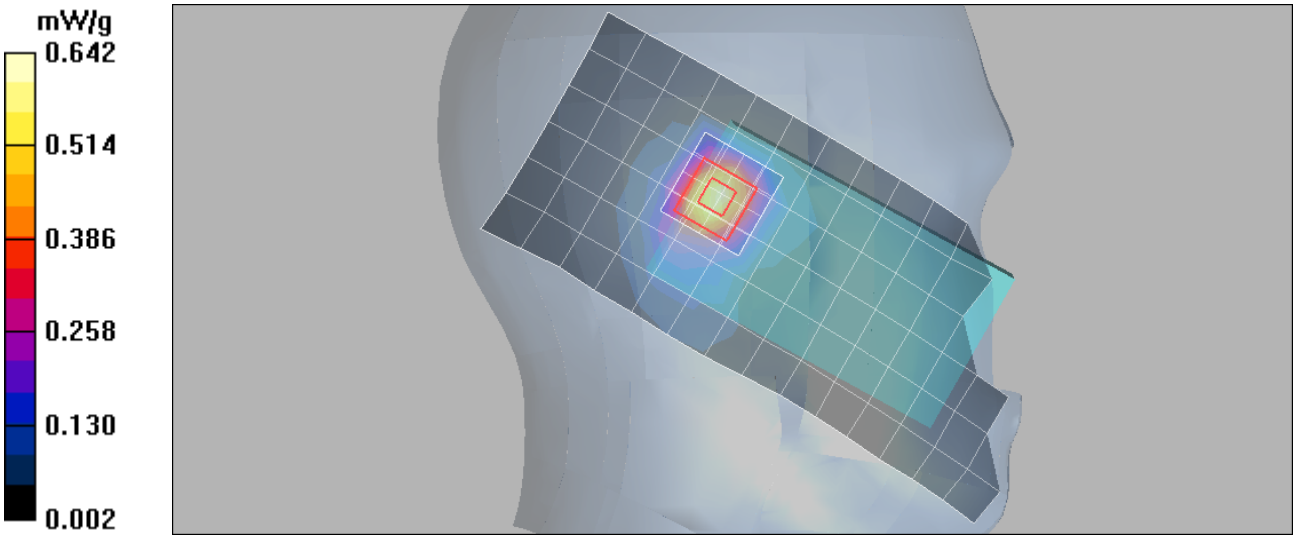
- Probe: ES3DV3 - SN3191; ConvF(4.57, 4.57, 4.57); Calibrated: 11/7/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn365; Calibrated: 8/21/2009
- Phantom: PCS-9_ Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1134;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

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

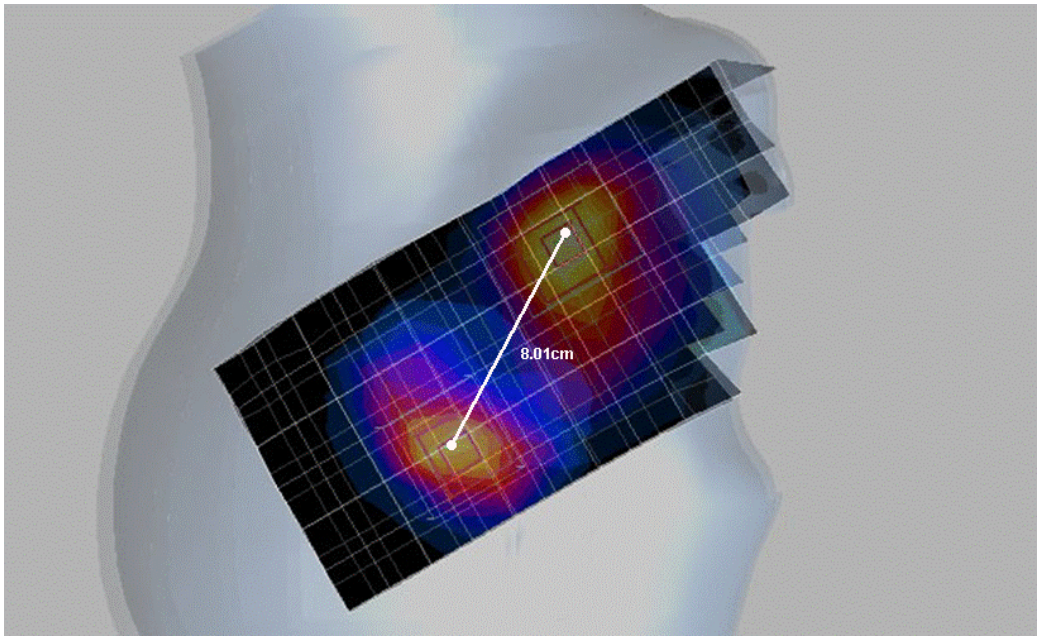
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.493 mW/g

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

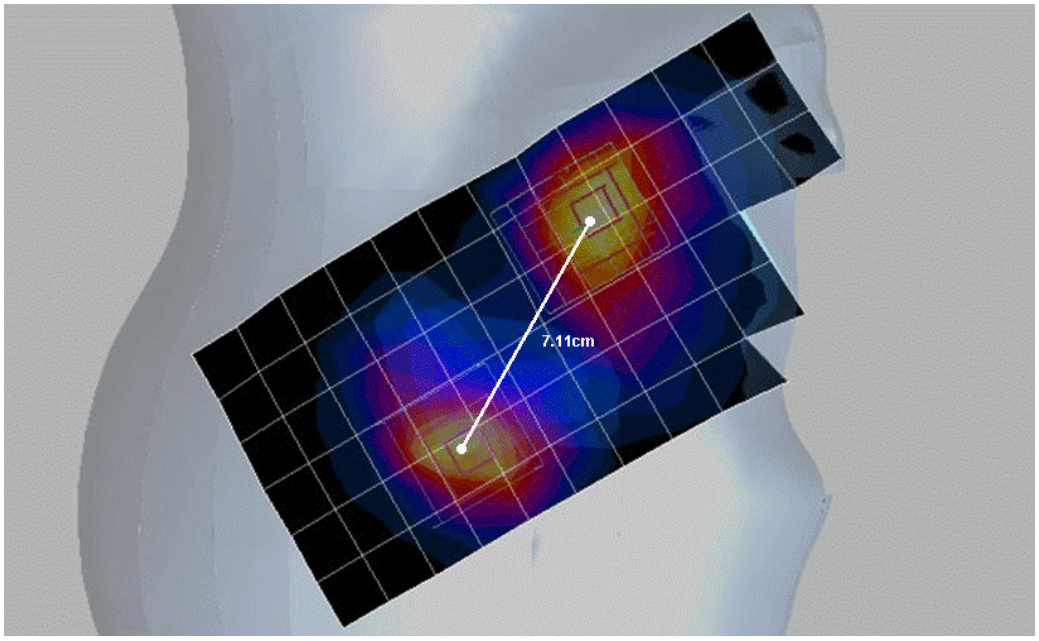
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.5 V/m; Power Drift = -0.018 dB
Peak SAR (extrapolated) = 1.14 W/kg
SAR(1 g) = 0.571 mW/g; SAR(10 g) = 0.272 mW/g
Maximum value of SAR (measured) = 0.642 mW/g



The guidelines provided in "SAR for Handsets with Multiple Transmitters" (KDB publication 648474 - D01 v01r03) were utilized for evaluation of the need for simultaneous transmission SAR testing. These guidelines direct that if the SAR-to-peak location separation ratio for the GSM/WCDMA antenna and the Wi-Fi antenna is < 0.3 then SAR evaluation for simultaneous transmission is not required. For GSM1900, the SAR-to-peak location separation ratio is 0.108. And for WCDMA2100, the SAR-to-peak location separation ratio is 0.269. Thus, no testing was performed to determine the aggregate 1 g SAR. SAR plots with the Wi-Fi SAR overlaid upon the GSM/WCDMA SAR are provided below. These summation plots provide visual indication of the separation of the SAR hotspots for each modulation.



GSM 1900 Right Head Cheek SAR overlaid with Wi-Fi Right Head Cheek SAR



WCDMA 2100 Right Head Cheek with DMB Antenna SAR overlaid with Wi-Fi Right Head Cheek with DMB Antenna SAR

Appendix 3

SAR distribution plots for Body Worn Configuration

Date/Time: 10/6/2009 4:16:32 PM

Test Laboratory: Motorola GSM1900 BodyWorn

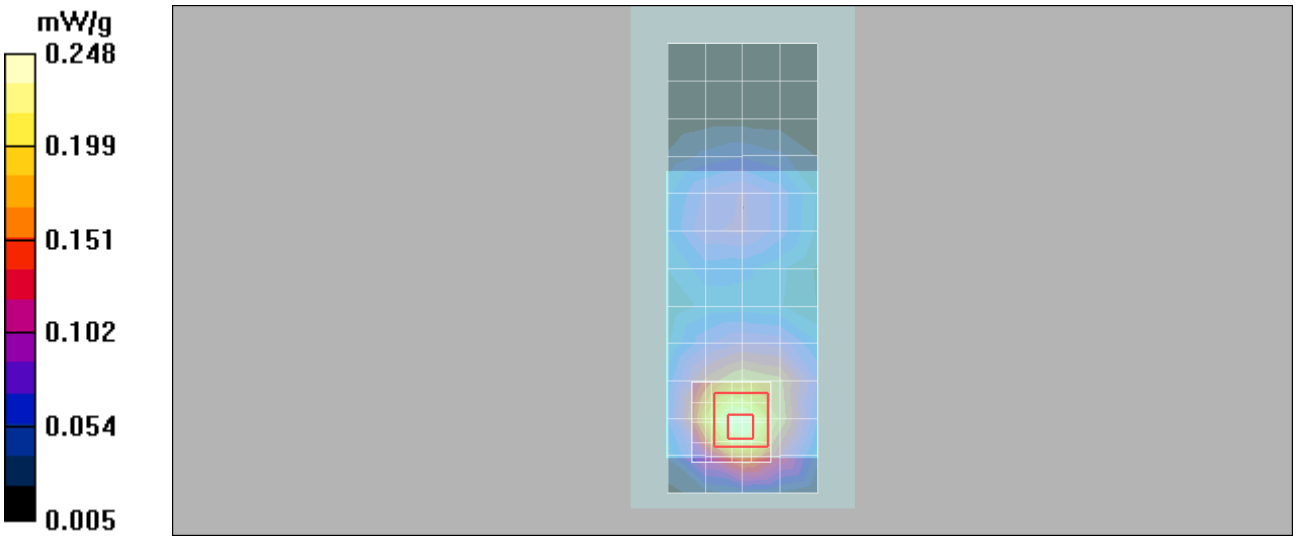
354636030004918;
Procedure Notes: Pwr Step: 00(OTA) Antenna Position: Internal
Battery Model #: SNN5843A; Device Position: Back of phone 15mm away from the flat phantom
Communication System: GSM 1900; Frequency: 1880 MHz; Channel Number: 661; Duty Cycle: 1:8
Medium: Regular Glycol Body 1750/1880; Medium parameters used: f = 1880 MHz; σ = 1.59 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3191; ConvF(4.85, 4.85, 4.85); Calibrated: 11/7/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn365; Calibrated: 8/21/2009
- Phantom: R#9_ Section 2, Amy Twin, Rev2 (23-June-04); Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Amy Twin Phone Template/Area Scan - Normal Body (15mm) (13x7x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.237 mW/g

Amy Twin Phone Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.8 V/m; Power Drift = 0.300 dB
Peak SAR (extrapolated) = 0.360 W/kg
SAR(1 g) = 0.232 mW/g; SAR(10 g) = 0.139 mW/g
Maximum value of SAR (measured) = 0.248 mW/g



Date/Time: 10/8/2009 4:23:18 PM

Test Laboratory: Motorola WiFi BodyWorn

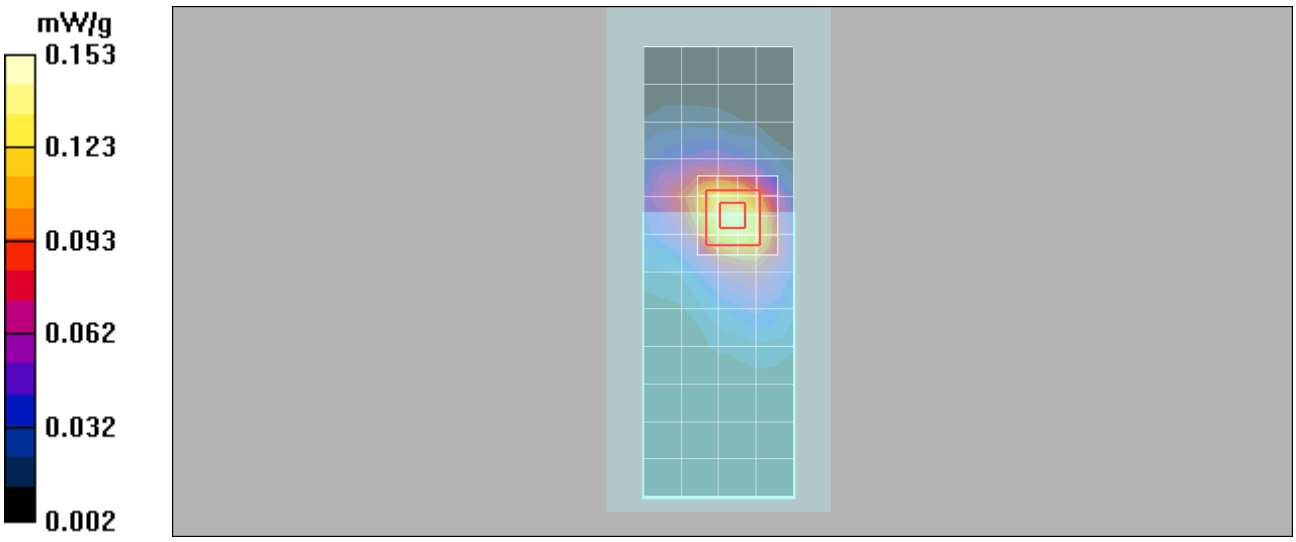
354636030004918;
Procedure Notes: Pwr Step: 20dBm; Antenna Position: Internal
Battery Model #: SNN5843A; Device Position: Front of phone 15mm away from the flat phantom
Communication System: Wi-Fi 2450; Frequency: 2437 MHz; Channel Number: 6; Duty Cycle: 1:1
Medium: 2450 Glycol Body; Medium parameters used: f = 2450 MHz; σ = 2.04 mho/m; ε_r = 50.2; ρ = 1000 kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3191; ConvF(4.08, 4.08, 4.08); Calibrated: 11/7/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn365; Calibrated: 8/21/2009
- Phantom: R#9_ Section 2, Amy Twin, Rev2 (23-June-04); Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Amy Twin Phone Template/Area Scan - Normal Body (15mm) (13x7x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.133 mW/g

Amy Twin Phone Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.58 V/m; Power Drift = -0.067 dB
Peak SAR (extrapolated) = 0.244 W/kg
SAR(1 g) = 0.140 mW/g; SAR(10 g) = 0.079 mW/g
Maximum value of SAR (measured) = 0.153 mW/g



Date/Time: 10/9/2009 10:22:22 AM

Test Laboratory: Motorola Bluetooth2450 BodyWorn

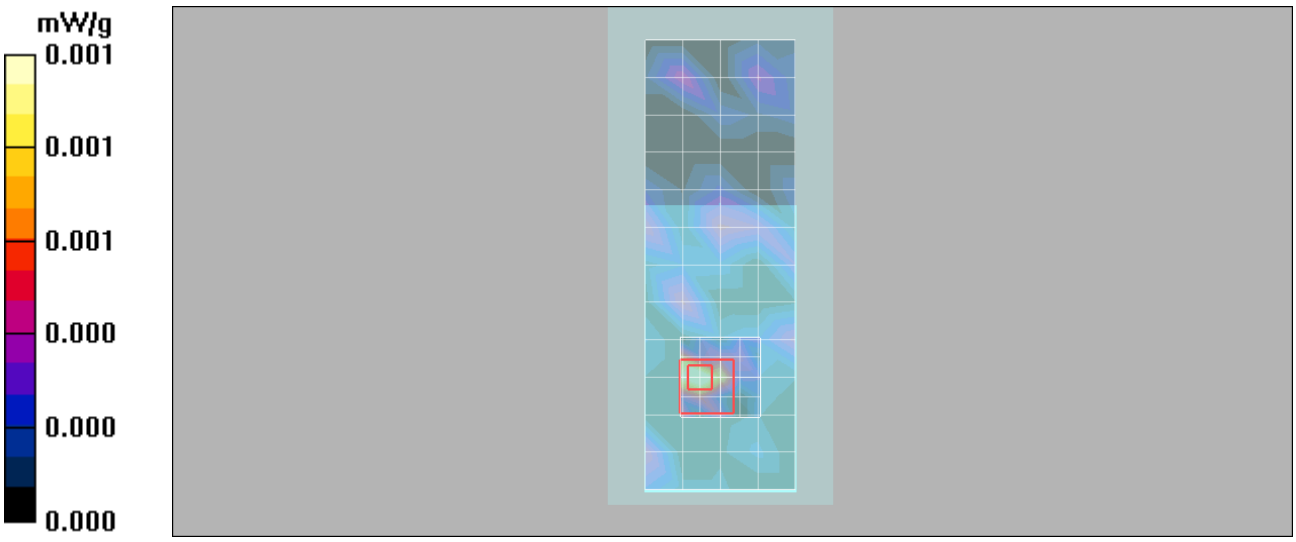
354636030004918;
Procedure Notes: Pwr Step: Test Mode(OTA) Antenna Position: Internal
Battery Model #: SNN5843A; Device Position: Front part of phone 15mm away from the flat phantom
Communication System: Bluetooth; Frequency: 2441 MHz; Channel Number: 39; Duty Cycle: 1:1
Medium: 2450 Glycol Body; Medium parameters used: f = 2450 MHz; σ = 2.04 mho/m; ε_r = 50.2; ρ = 1000 kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3191; ConvF(4.08, 4.08, 4.08); Calibrated: 11/7/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn365; Calibrated: 8/21/2009
- Phantom: R#9_ Section 2, Amy Twin, Rev2 (23-June-04); Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Amy Twin Phone Template/Area Scan - Normal Body (15mm) (13x7x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.000 mW/g

Amy Twin Phone Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.342 V/m; Power Drift = 2.21 dB
Peak SAR (extrapolated) = 0.001 W/kg
SAR(1 g) = 4.19e-005 mW/g; SAR(10 g) = 6.22e-006 mW/g
Maximum value of SAR (measured) = 0.001 mW/g



Appendix 4

Probe Calibration Certificate

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

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

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

Accreditation No.: SCS 108

Client Motorola Korea

Certificate No: ES3-3191_Nov08

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3191
Calibration procedure(s)	QA CAL-01.v6 and QA CAL-23.v3 Calibration procedure for dosimetric E-field probes
Calibration date:	November 7, 2008
Condition of the calibrated item	In Tolerance

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41495277	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41498087	1-Apr-08 (No. 217-00788)	Apr-09
Reference 3 dB Attenuator	SN: S5054 (3c)	1-Jul-08 (No. 217-00865)	Jul-09
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	1-Jul-08 (No. 217-00866)	Jul-09
Reference Probe ES3DV2	SN: 3013	2-Jan-08 (No. ES3-3013_Jan08)	Jan-09
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:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: November 11, 2008

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

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3191

Manufactured: June 16, 2008
Calibrated: November 7, 2008

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ES3DV3 SN:3191

Sensitivity in Free Space[A]

NormX	**1.25** ± 10.1%	$\mu V/(V/m)^2$	DCP X	**83** mV
NormY	**1.34** ± 10.1%	$\mu V/(V/m)^2$	DCP Y	**84** mV
NormZ	**1.32** ± 10.1%	$\mu V/(V/m)^2$	DCP Z	**81** mV

Diode Compression[B]

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL **900 MHz** **Typical SAR gradient: 5 % per mm**

Sensor Center to Phantom Surface Distance		**3.0 mm**	**4.0 mm**
SAR_{be} [%]	Without Correction Algorithm	12.0	7.5
SAR_{be} [%]	With Correction Algorithm	0.7	0.3

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	9.4	6.0
SAR_{be} [%]	With Correction Algorithm	0.8	0.3

Sensor Offset

Probe Tip to Sensor Center **2.0** mm

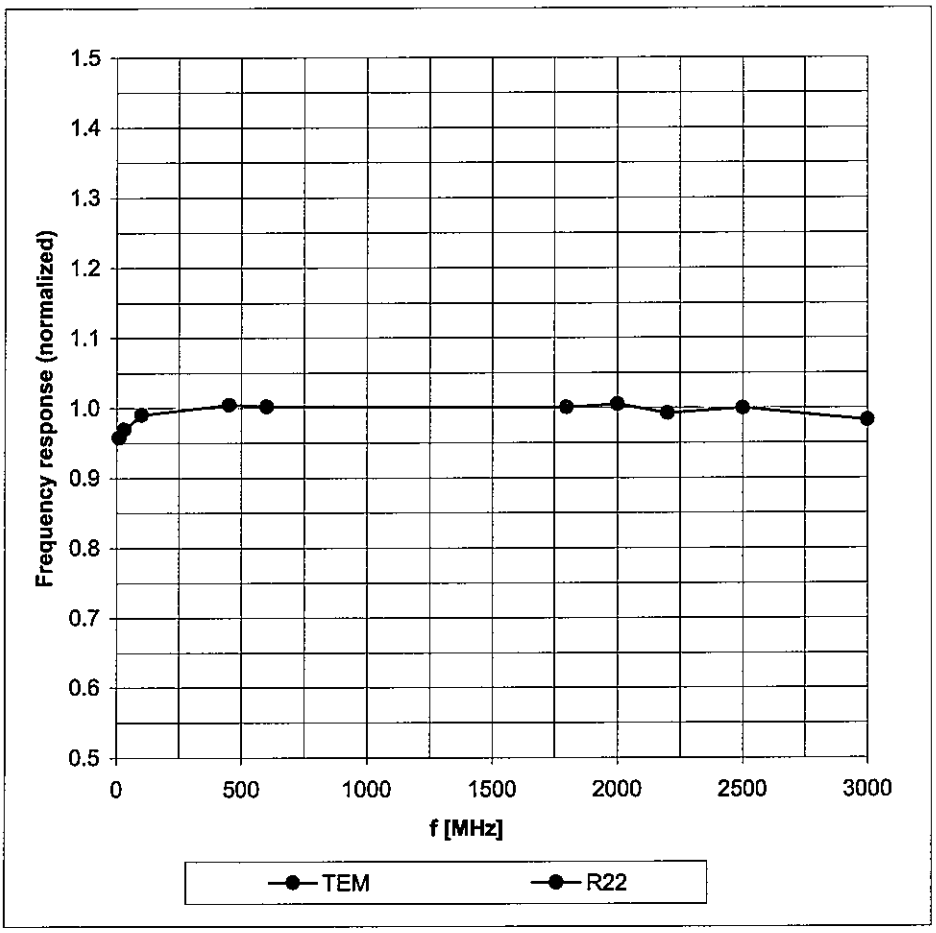
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Page 8).

[B] Numerical linearization parameter: uncertainty not required.

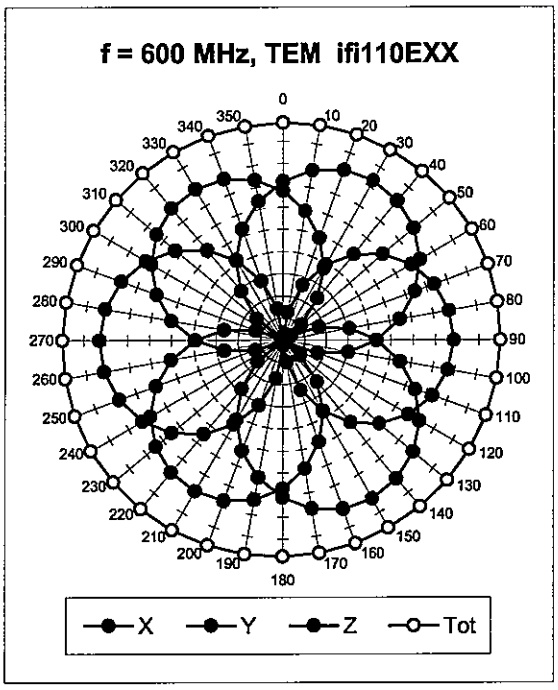
Frequency Response of E-Field

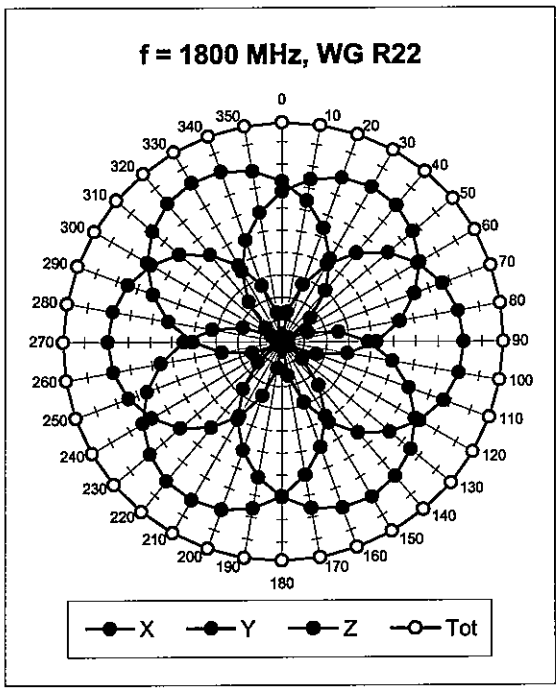
(TEM-Cell:ifi110 EXX, Waveguide: R22)

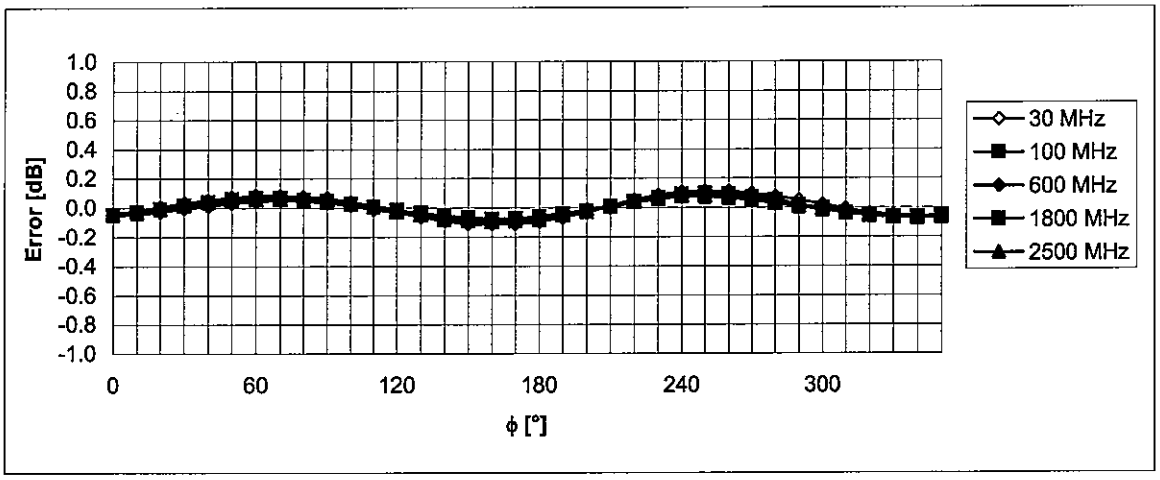


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



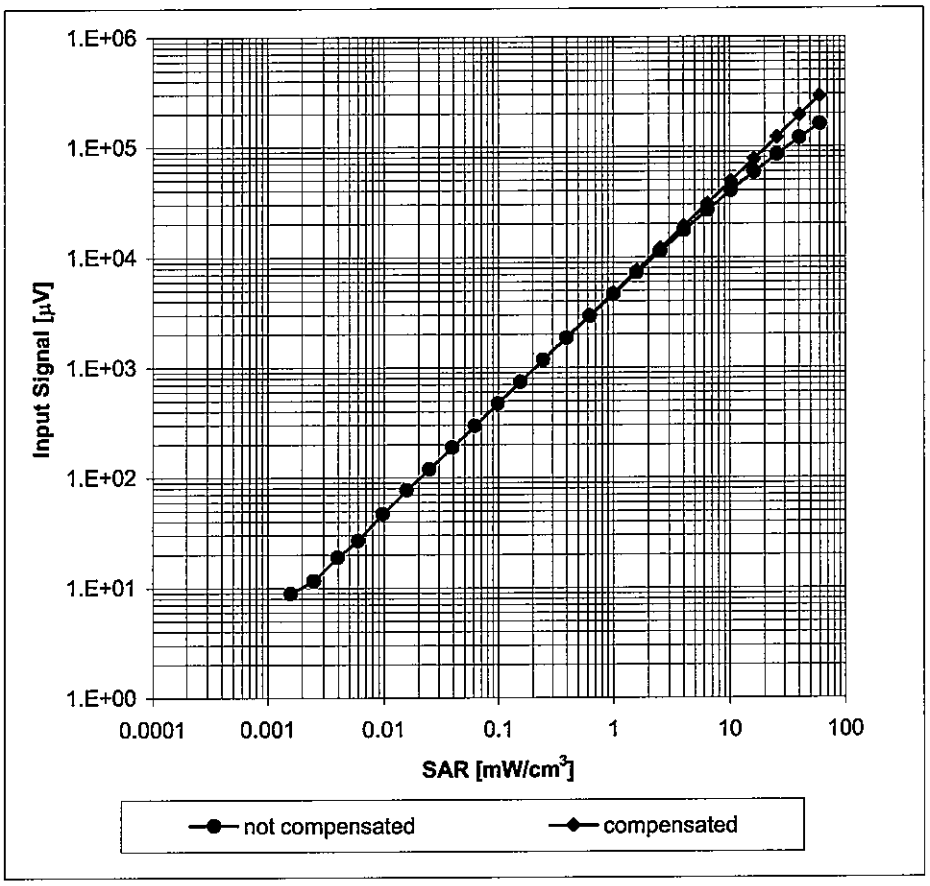


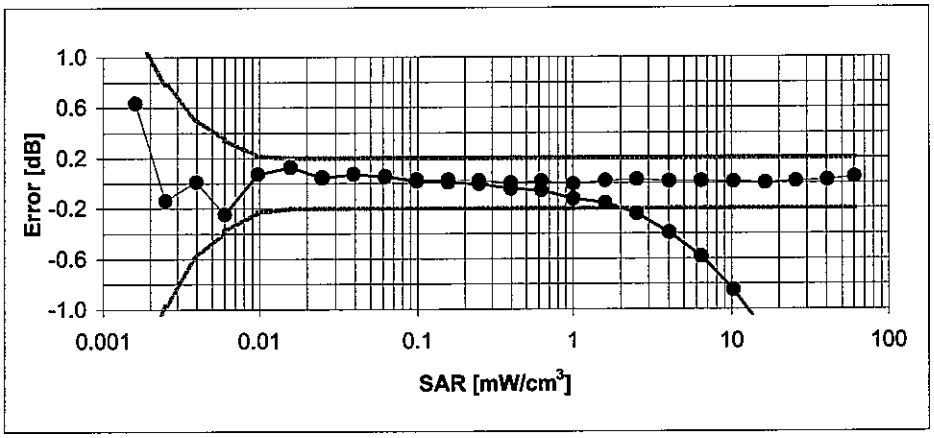


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

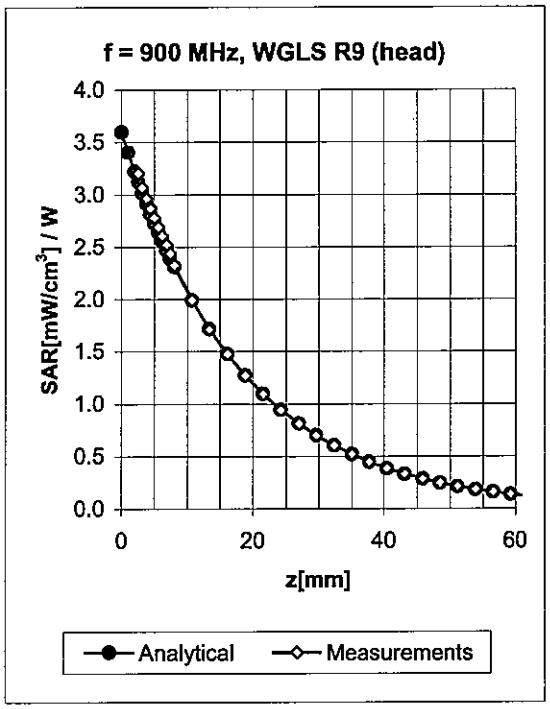
(Waveguide R22, f = 1800 MHz)

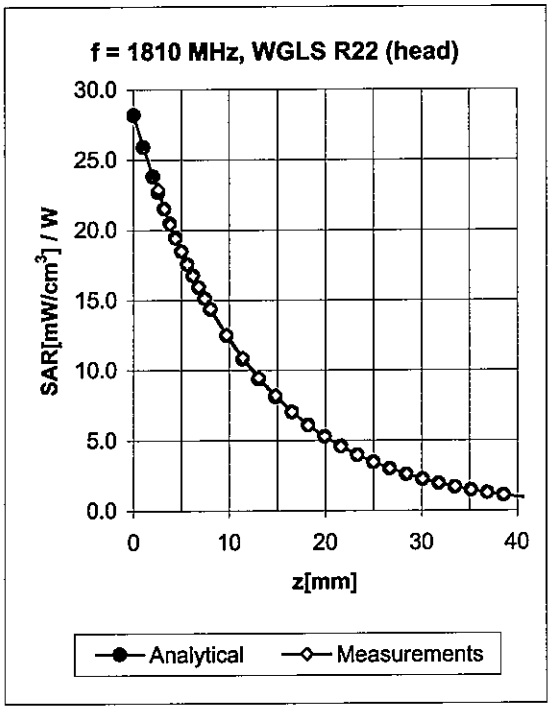




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



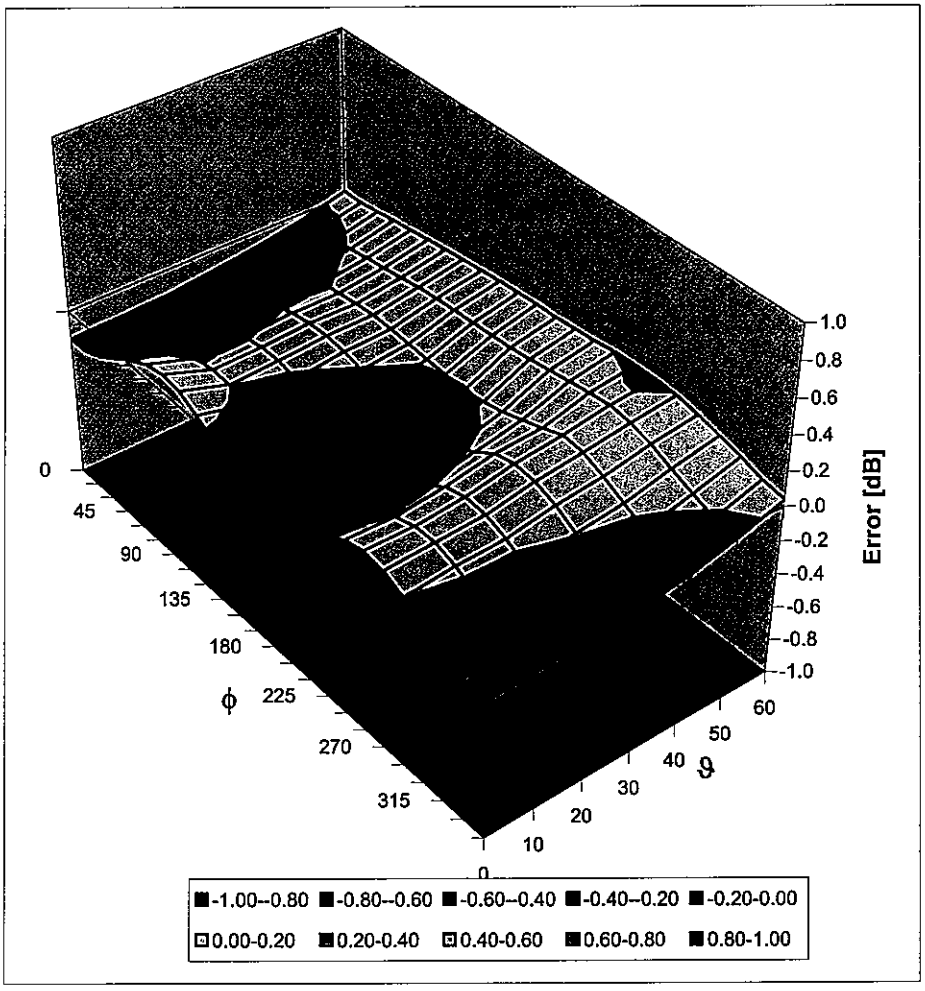


f [MHz]	Validity [MHz][c]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.46	1.50	6.03 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.70	1.33	5.19 ± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.63	1.43	4.97 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.61	1.55	4.57 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.88	1.25	6.01 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.32	2.12	4.85 ± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.30	2.41	4.77 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.49	1.66	4.08 ± 11.0% (k=2)

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

Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

Appendix 5

Measurement Uncertainty Budget

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

Appendix 6

Dipole Characterization Certificate

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 Average 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: Steven Hauswirth

Comments:

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 Average 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: Steven Hauswirth

Comments:

END OF REPORT