Portable Cellular Phone SAR Test Report

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FCC ID #: **IHDT56JT2**

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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 (2001) CENELEC EN 50361 (2001) ARIB Std. T-56 (2002)

TESTING CERT #2518-02

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

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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The results and statements contained herein relate only to the items tested. The names of individuals involved may be mentioned only in connection with the statements or results from this report.

Motorola encourages all feedback, both positive and negative, on this test report.

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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].

2. Description of the Device Under Test

2.1 Antenna description

Type	Internal	
Location	Bottom of Transceiver	
Dimensions	Length	36.0 mm
	Width	0.8 mm
Configuration	FJA	

2.2 Device description

Serial Number	***20000554&* TXP8510053**				
Mode(s) of Operation	GSM 850	GSM 900	GSM 1800	GSM 1900	Bluetooth
Modulation Mode(s)	GSMK	GSMK	GSMK	GSMK	GFSK
Maximum Output Power Setting	33.0 dBm	33.0 dBm	30.5 dBm	30.5 dBm	4.0 dBm
Duty Cycle	1:8	1:8	1:8	1:8	1:1
Transmitting Frequency Rang(s)	824-849 MHz	880-915 MHz	1710-1785 MHz	1850– 1910 MHz	2400.0 - 2483.5 MHz
Production Unit or Identical Prototype (47 CFR §2..908)	Identical Prototype				
Device Category	Portable				
RF Exposure Limits	General Population / Uncontrolled				

Serial Number	***20000554&* TXP8510053**							
Mode(s) of Operation	GPRS Class 10 850	GPRS Class 10 900	GPRS Class 10 1800	GPRS Class 10 1900	EDGE Class 10 850	EDGE Class 10 900	EDGE Class 10 1800	EDGE Class 10 1900
Modulation Mode(s)	GSMK	GSMK	GSMK	GSMK	8PSK	8PSK	8PSK	8PSK
Maximum Output Power Setting	31.1 dBm	31.1 dBm	28.7 dBm	28.7 dBm	25.8 dBm	25.8 dBm	24.8 dBm	24.8 dBm
Duty Cycle	2:8	2:8	2:8	2:8	2:8	2:8	2:8	2:8
Transmitting Frequency Rang(s)	824-849 MHz	880-915 MHz	1710-1785 MHz	1850–1910 MHz	824-849 MHz	880-915 MHz	1710-1785 MHz	1850–1910 MHz
Production Unit or Identical Prototype (47 CFR §2..908)	Identical Prototype							
Device Category	Portable							
RF Exposure Limits	General Population / Uncontrolled							

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 6. 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™ DAE3	SN 378	4/13/2008
DASY4™ DAE3	SN 376	4/18/2009
E-Field Probe ET3DV6	SN 1514	7/11/2008
S.A.M. Phantom used for 800/900MHz	TP-1005	
S.A.M. Phantom used for 1800/1900MHz	TP-1139	
Dipole Validation Kit, DV900V2	91	5/1/2008
Dipole Validation Kit, DV900V2	91	4/22/2009
Dipole Validation Kit, DV1800V2	259tr	5/1/2008
Dipole Validation Kit, DV1800V2	259tr	4/22/2009
Dipole Validation Kit, DV2450V2	766	5/1/2008

3.2 Additional Equipment

Description	Serial Number	Cal Due Date
Signal Generator HP8648C	3847A04810	6/13/2009
Power Meter E4419B	GB39510961	1/24/2010
Power Sensor #1 – E9301A	US39210917	9/10/2008
Power Sensor #2 - E9301A	US39210918	9/10/2008
Network Analyzer HP8753ES	US39171846	7/19/2008
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 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)
900	Head	**Measured,** 6/9/2008	41.7	0.92	20.0
		Measured, 6/11/2008	41.2	0.92	20.0
		Recommended Limits	41.5 ±5%	0.97 ±5%	18-25
		Measured, 6/10/2008	53.2	1.00	20.1
		Recommended Limits	55.0 ±5%	1.05 ±5%	18-25
1880	Head	**Measured,** 6/10/2008	38.3	1.45	19.5
		Recommended Limits	40.0 ±5%	1.40 ±5%	18-25
	Body	**Measured,** 6/10/2008	51.1	1.58	19.2
		Recommended Limits	53.3 ±5%	1.52 ±5%	18-25
2450	Body	**Measured,** 3/12/2008	47.9	1.96	19.4
		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 Appendix 7. These frequencies are within ±10% of the compliance test mid-band frequency as required in [1] and [5]. The test was conducted on the same days as the measurement of the DUT. Recommended limits for permittivity and conductivity, specified in [5], are shown in the table below. The obtained results from the system accuracy verification are also displayed in the table below. SAR values are normalized to 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)		
900	**Measured,** 6/9/2008	11.57	40.9	0.98	20.5	20.2
	Measured, 6/11/2008	11.55	40.4	0.97	20.5	19.1
	Recommended Limits	11.24	41.5 ±5%	0.97 ±5%	18-25	18-25
1800	**Measured,** 6/10/2008	38.48	38.7	1.37	20.7	19.9
	Recommended Limits	37.5	40.0 ±5%	1.4 ±5%	18-25	18-25
2450	**Measured,** 3/12/2008	59.5	36.6	1.87	20.8	19.8
	Recommended Limits	58.0	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 ET3DV6	SN 1514	900	5.98	8 of 9
		1810	4.92	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 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 15cm 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:

SNN5807A - 920 mAH Battery
SNN5805A - 740 mAH Battery

The battery with the highest capacity is the SNN5807A. 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. The configuration that resulted in the highest SAR values were tested using the other batteries listed above.

6.1 Head Adjacent Test Results

The SAR results shown in tables 1 through 5 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 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 ET3DV6	SN 1514	900	5.98	8 of 9
		1810	4.92	8 of 9
		2450	4.44	8 of 9

Left Head Cheek Position								
f (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	*10g SAR value*		*1g SAR value*	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
GSM 850MHz	Channel 128	32.97	19.8	-0.04	0.679	0.69	0.956	0.97
	Channel 190	32.94	20.2	-0.04	0.599	0.60	0.81	0.82
	Channel 251	32.90	19.8	0.01	0.683	0.68	0.957	0.96
GSM 1900MHz	Channel 512	30.44	20.0	0.07	0.469	0.47	0.887	0.89
	Channel 661	30.46	20	-0.08	0.598	0.61	1.12	1.14
	Channel 810	30.42	20	0.07	0.772	0.77	1.44	1.44

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 (°C)	Drift (dB)	*10g SAR value*		*1g SAR value*	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
GSM 850MHz	Channel 128	32.97						
	Channel 190	32.94	20.2	0.07	0.59	0.59	0.794	0.79
	Channel 251	32.90						
GSM 1900MHz	Channel 512	30.44						
	Channel 661	30.46	20	-0.02	0.30	0.30	0.523	0.53
	Channel 810	30.42						

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 (°C)	Drift (dB)	*10g SAR value*		*1g SAR value*	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
GSM 850MHz	Channel 128	32.97						
	Channel 190	32.94	**20.2**	**-0.25**	**0.402**	**0.43**	**0.547**	**0.58**
	Channel 251	32.90						
GSM 1900MHz	Channel 512	30.44						
	Channel 661	30.46	20	0.1	0.141	0.14	0.239	0.24
	Channel 810	30.42						

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 (°C)	Drift (dB)	*10g SAR value*		*1g SAR value*	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
GSM 850MHz	Channel 128	32.97						
	Channel 190	32.94	20.2	-0.02	0.392	0.39	0.527	0.53
	Channel 251	32.90						
GSM 1900MHz	Channel 512	30.44						
	Channel 661	30.46	**20**	**-0.07**	**0.168**	**0.17**	**0.303**	**0.31**
	Channel 810	30.42						

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 SNN5805A battery								
f (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	*10g SAR value*		*1g SAR value*	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
GSM 850MHz *LH Cheek*	Channel 128	32.97	**19.8**	**-0.04**	**0.674**	**0.68**	**0.98**	**0.99**
	Channel 190	32.94						
	Channel 251	32.90						
	Channel 885	30.45						
GSM 1900MHz *LH Cheek*	Channel 512	30.44						
	Channel 661	30.46						
	Channel 810	30.42	**20**	**-0.37**	**0.757**	**0.82**	**1.41**	**1.54**

Table 5: 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 6 through 10 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. In addition to accessory testing, the cellular phone was tested with the front and back of the phone facing the phantom. For voice mode operation, the phone was placed as a distance of 15mm from the phantom. For data mode operation, the phone was placed as a distance of 25mm from the phantom. The cellular phone was tested with a headset connected to the device for all body-worn SAR measurements.

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 ET3DV6	SN 1514	900	5.75	8 of 9
		1810	4.59	8 of 9
		2450	4.07	8 of 9

Body-Worn; Front of Phone 15mm from Phantom								
f (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	*10g SAR value*		*1g SAR value*	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
GSM 850MHz	Channel 128	32.97						
	Channel 190	32.94	20	0.01	0.44	0.44	0.605	0.61
	Channel 251	32.90						
GSM 1900MHz	Channel 512	30.44						
	Channel 661	30.46	19.9	0.03	0.171	0.17	0.292	0.29
	Channel 810	30.42						
Bluetooth 2450MHz	**N/A**	**N/A**	**19.4**	**1.16**	**0.00017**	**0.00**	**0.000859**	**0.00**

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; Back of Phone 15mm from Phantom								
f (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	*10g SAR value*		*1g SAR value*	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
GSM 850MHz	Channel 128	32.97						
	Channel 190	32.94	**20**	**-0.02**	**0.619**	**0.62**	**0.853**	**0.86**
	Channel 251	32.90						
	Channel 885	30.45						
GSM 1900MHz	Channel 512	30.44						
	Channel 661	30.46	**19.9**	**0.05**	**0.598**	**0.60**	**1.12**	**1.12**
	Channel 810	30.42						
Bluetooth 2450MHz	N/A	N/A	19.4	-0.40	0.000115	0.00	0.000771	0.00

Table 7: 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 25mm from Phantom								
f (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	*10g SAR value*		*1g SAR value*	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
GPRS Class 10 850MHz	Channel 128	30.42						
	Channel 190	30.41	20.1	-0.01	0.464	0.46	0.627	0.63
	Channel 251	30.38						
GPRS Class 10 1900MHz	Channel 512	28.58						
	Channel 661	28.67	18.8	-0.05	0.258	0.26	0.44	0.45
	Channel 810	28.66						

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

Body-Worn; EDGE Class 10, Back of Phone 25mm from Phantom								
f (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	*10g SAR value*		*1g SAR value*	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
EDGE Class 10 850MHz	Channel 128	25.71						
	Channel 190	25.65	20.1	-0.03	0.115	0.12	0.156	0.16
	Channel 251	25.63						
EDGE Class 10 1900MHz	Channel 512	25.11						
	Channel 661	25.07	18.8	0.08	0.11	0.11	0.184	0.18
	Channel 810	24.96						

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

Highest Body Position with SNN5805A battery								
f **(MHz)**	**Description**	**Conducted Output Power (dBm)**	**Temp (°C)**	**Drift (dB)**	***10g SAR value***		***1g SAR value***	
					Measured (W/kg)	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**
GSM 850MHz, *15mm from phantom*	**Channel 128**	32.97						
	Channel 190	32.94	20.1	-0.03	0.36	0.36	0.495	0.50
	Channel 251	32.90						
GSM 1900MHz *15mm from phantom*	**Channel 512**	30.44						
	Channel 661	30.46	18.8	-0.05	0.542	0.54	0.98	0.98
	Channel 810	30.42						
Bluetooth 2450MHz	**N/A**	**N/A**	19.2	-1.68	0.000129	0.00	0.000544	0.00

Table 10: 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: 6/9/2008 5:00:42 PM

Test Laboratory: Motorola

900 MHz Validation

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:91; FCC ID: IHDT56JT2
Procedure Notes: 900 MHz System Performance Check / PM1 Power = 200 mW PM2 Power = 200 mW Refl.Pwr PM3 = -27.46 dB Val Rack Info = r1b

Sim.Temp@meas = 20.2 Sim.Temp@SPC = 20.2 Room Temp @ SPC = 20.5

Communication System: CW - Dipole; Frequency: 900 MHz; Communication System Channel Number: 4; Duty Cycle: 1:1
Medium: VALIDATION Only; Medium parameters used: f = 900 MHz; σ = 0.98 mho/m; ε_r = 40.9; ρ = 1000 kg/m^3

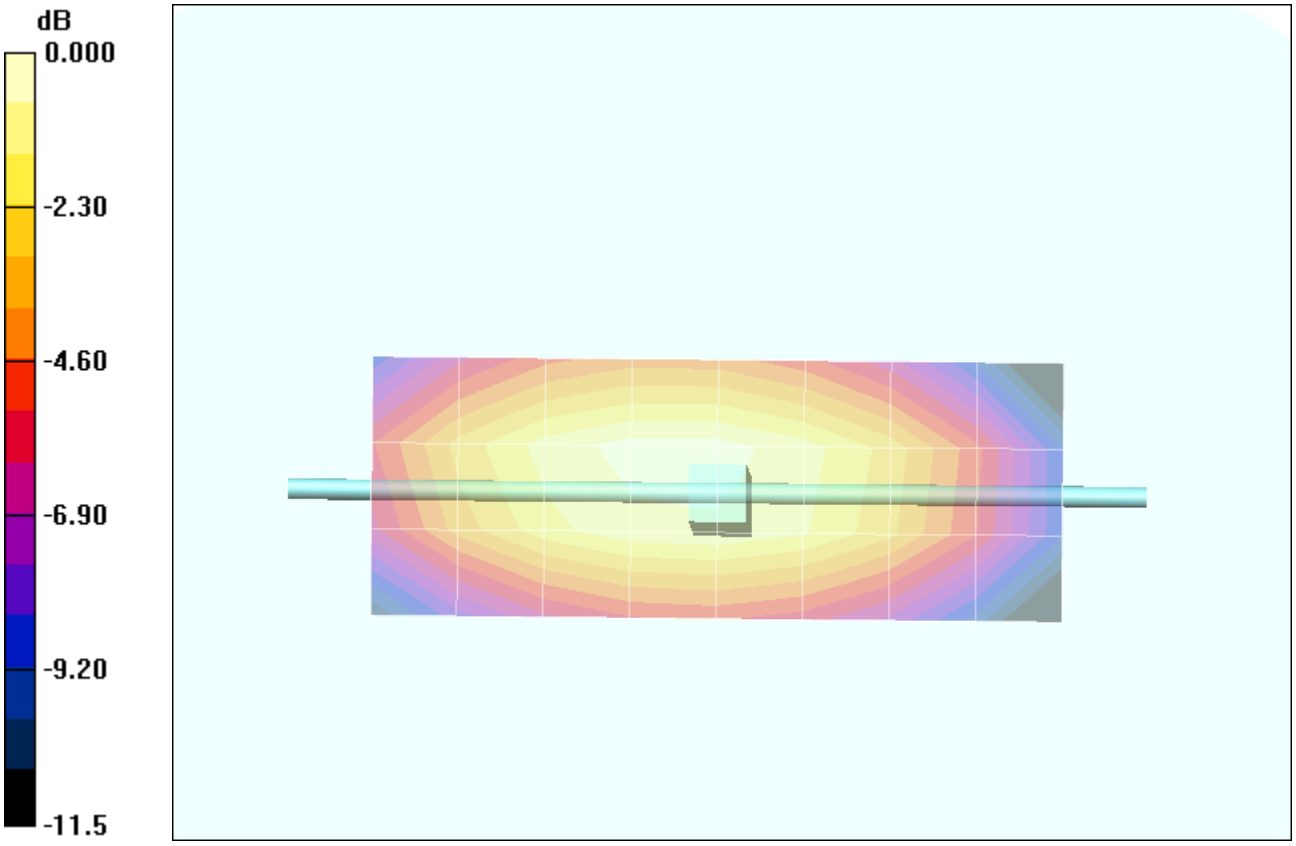
DASY4 Configuration:

- Probe: ET3DV6 - SN1514; ConvF(5.98, 5.98, 5.98); Calibrated: 7/11/2007
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 3/18/2008
- Phantom: R1_ Sugar SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1005;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Daily SPC Check/Dipole Area Scan (4x9x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 2.23 mW/g

Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 52.0 V/m; Power Drift = -0.002 dB
Peak SAR (extrapolated) = 3.55 W/kg
SAR(1 g) = 2.33 mW/g; SAR(10 g) = 1.49 mW/g
Maximum value of SAR (measured) = 2.53 mW/g

Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 52.0 V/m; Power Drift = -0.002 dB
Peak SAR (extrapolated) = 3.51 W/kg
SAR(1 g) = 2.3 mW/g; SAR(10 g) = 1.47 mW/g
Maximum value of SAR (measured) = 2.48 mW/g



0 dB = 2.48mW/g

Date/Time: 6/11/2008 9:47:38 AM

Test Laboratory: Motorola

900 MHz Validation

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:91; FCC ID: IHDT56JT2
Procedure Notes: 900 MHz System Performance Check / PM1 Power = 200mW PM2 Power = 205mW Refl.Pwr PM3 = -24.50 dB Val Rack Info = r1b

Sim.Temp@meas = 19.1 Sim.Temp@SPC = 19.1 Room Temp @ SPC = 20.5

Communication System: CW - Dipole; Frequency: 900 MHz; Communication System Channel Number: 4; Duty Cycle: 1:1
Medium: VALIDATION Only; Medium parameters used: f = 900 MHz; σ = 0.97 mho/m; ε_r = 40.4; ρ = 1000 kg/m^3

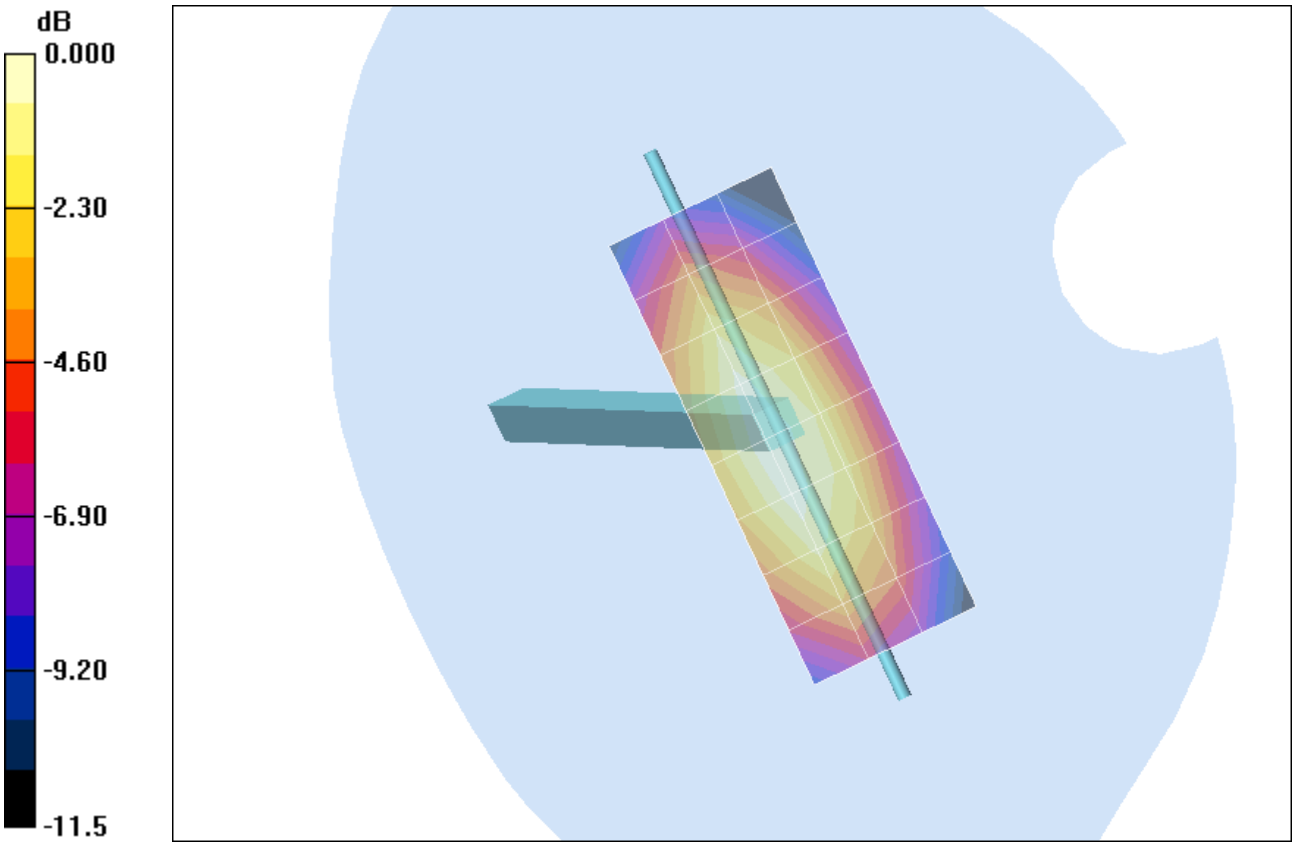
DASY4 Configuration:

- Probe: ET3DV6 - SN1514; ConvF(5.98, 5.98, 5.98); Calibrated: 7/11/2007
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 3/18/2008
- Phantom: R1_ Sugar SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1005;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Daily SPC Check/Dipole Area Scan (4x9x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 2.48 mW/g

Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 50.5 V/m; Power Drift = 0.053 dB
Peak SAR (extrapolated) = 3.54 W/kg
SAR(1 g) = 2.33 mW/g; SAR(10 g) = 1.49 mW/g
Maximum value of SAR (measured) = 2.52 mW/g

Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 50.5 V/m; Power Drift = 0.053 dB
Peak SAR (extrapolated) = 3.51 W/kg
SAR(1 g) = 2.29 mW/g; SAR(10 g) = 1.46 mW/g
Maximum value of SAR (measured) = 2.46 mW/g



0 dB = 2.46mW/g

Date/Time: 6/10/2008 8:24:06 AM

Test Laboratory: Motorola

1800 MHz Validation

DUT: Type: D1800V2; Serial: D1800V2 - SN:259tr; FCC ID: IHDT56JT2

Procedure Notes: 1800 MHz System Performance Check / PM1 Power = 200 mW PM2 Power = 209 mW Refl.Pwr PM3 = -24.75 dB Val Rack Info = r1b

Sim.Temp@meas = 19.9 Sim.Temp@SPC = 20 Room Temp @ SPC = 20.7

Communication System: CW - Dipole; Frequency: 1800 MHz; Communication System Channel Number: 8; Duty Cycle: 1:1
Medium: VALIDATION Only; Medium parameters used: f = 1800 MHz; σ = 1.37 mho/m; ε_r = 38.7; ρ = 1000 kg/m^3

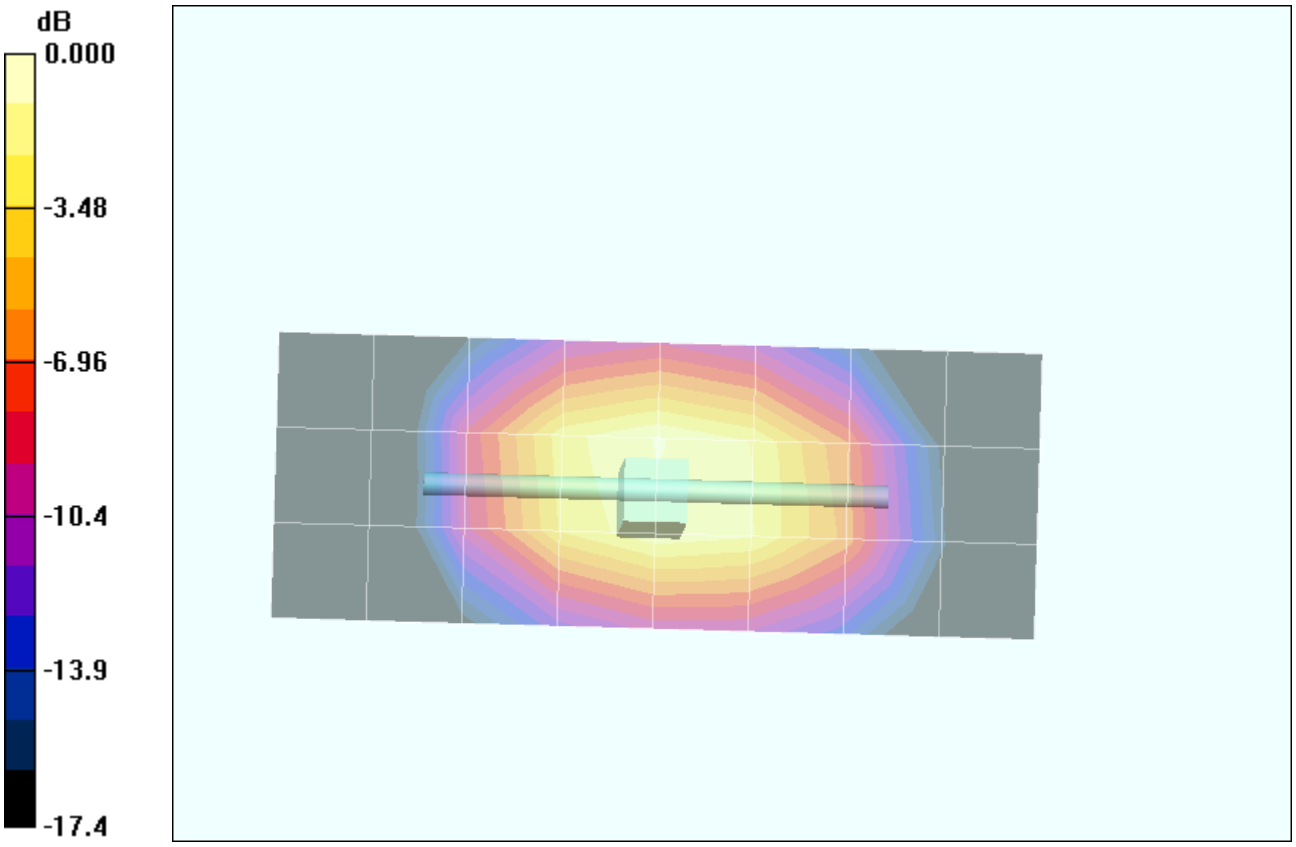
DASY4 Configuration:

- Probe: ET3DV6 - SN1514; ConvF(4.92, 4.92, 4.92); Calibrated: 7/11/2007
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 3/18/2008
- Phantom: R1_ Glycol, SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1139;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Daily SPC Check/Dipole Area Scan (4x9x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 6.61 mW/g

Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 84.3 V/m; Power Drift = 0.010 dB
Peak SAR (extrapolated) = 13.1 W/kg
SAR(1 g) = 7.74 mW/g; SAR(10 g) = 4.17 mW/g
Maximum value of SAR (measured) = 8.74 mW/g

Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 84.3 V/m; Power Drift = 0.010 dB
Peak SAR (extrapolated) = 13.0 W/kg
SAR(1 g) = 7.65 mW/g; SAR(10 g) = 4.12 mW/g
Maximum value of SAR (measured) = 8.44 mW/g



0 dB = 8.44mW/g

Date/Time: 3/12/2008 12:08:48 PM

DUT: Dipole 2450 MHz; Type: D2450V2; Procedure Notes: 2450 MHz System Performance Check / Dipole Sn# 766; PM1 Power = 200 mW;
Sim.Temp@ meas = 19.8*C; Sim.Temp@ SPC = 19.8*C; Room Temp@ SPC = 20.8*C

Communication System: CW - Dipole; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: VALIDATION Only; Medium parameters used: f = 2450 MHz; σ = 1.87 mho/m; ε_r = 36.6; ρ = 1000 kg/m^3

DASY4 Configuration:

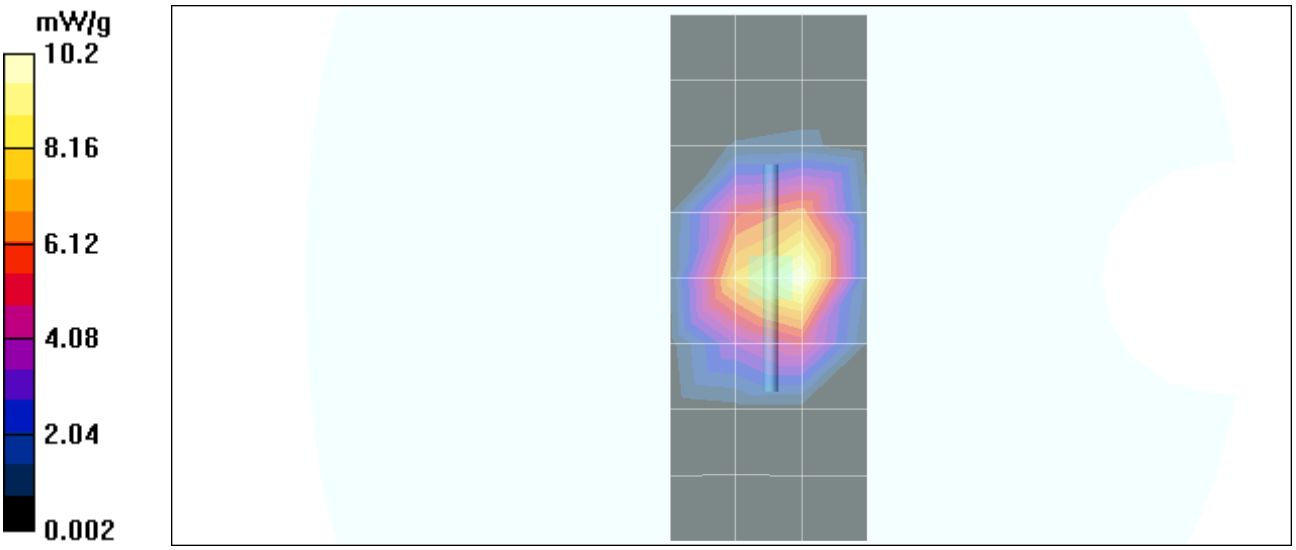
- Probe: ET3DV6 - SN1514; ConvF(4.44, 4.44, 4.44); Calibrated: 7/11/2007
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/13/2007
- Phantom: R#1 Glycol, SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1139;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

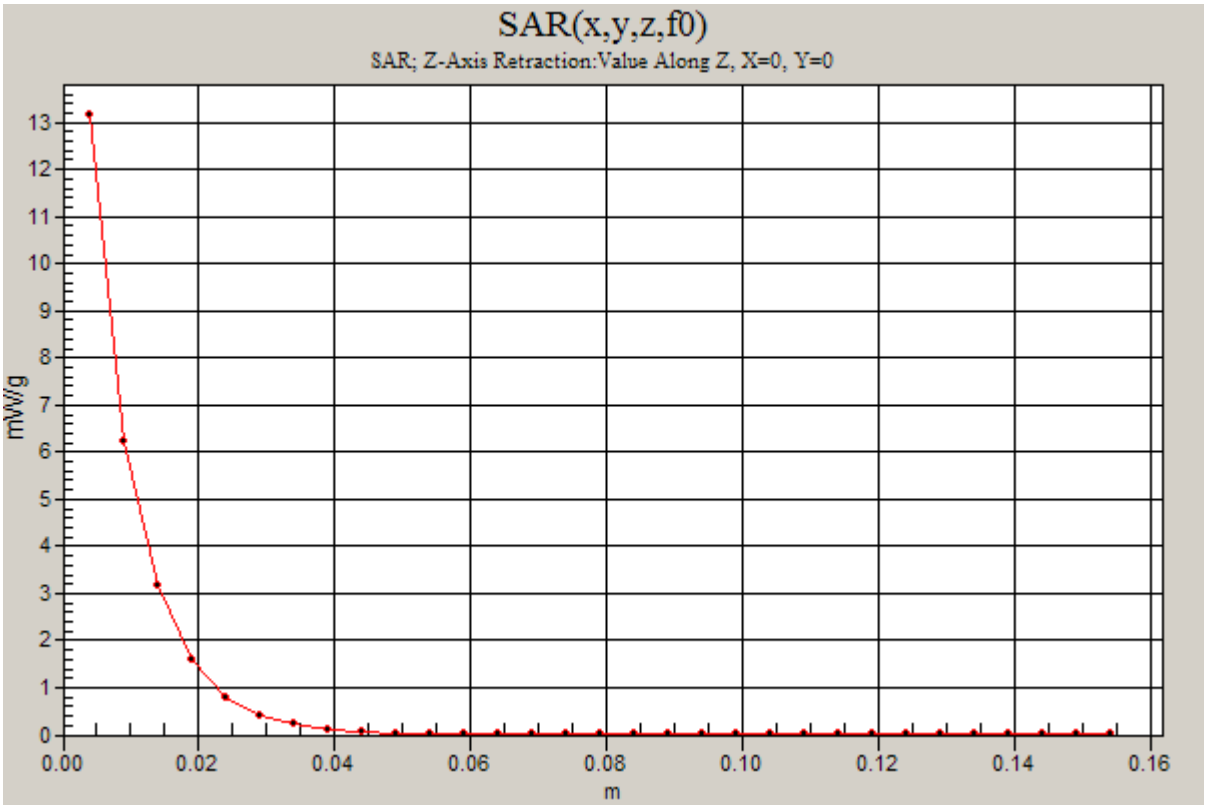
Daily SPC Check/Dipole Area Scan (4x9x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 10.2 mW/g

Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 86.8 V/m; Power Drift = -0.030 dB
Peak SAR (extrapolated) = 27.2 W/kg
SAR(1 g) = 11.9 mW/g; SAR(10 g) = 5.43 mW/g
Maximum value of SAR (measured) = 13.2 mW/g

Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 86.8 V/m; Power Drift = -0.030 dB
Peak SAR (extrapolated) = 27.4 W/kg
SAR(1 g) = 11.9 mW/g; SAR(10 g) = 5.4 mW/g
Maximum value of SAR (measured) = 12.0 mW/g

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


mW/g
10.2
8.16
6.12
4.08
2.04
0.002


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

Appendix 2

SAR distribution plots for Phantom Head Adjacent Use

Date/Time: 6/11/2008 11:47:02 AM

Test Laboratory: Motorola, Inc.

GSM 850 MHz Cheek Touch

DUT: Serial: 20000554; FCC ID: IHDT56JT2
Procedure Notes: Pwr Step: 05 Antenna Position: internal Battery Model #: SNN5805A DEVICE POSITION: cheek

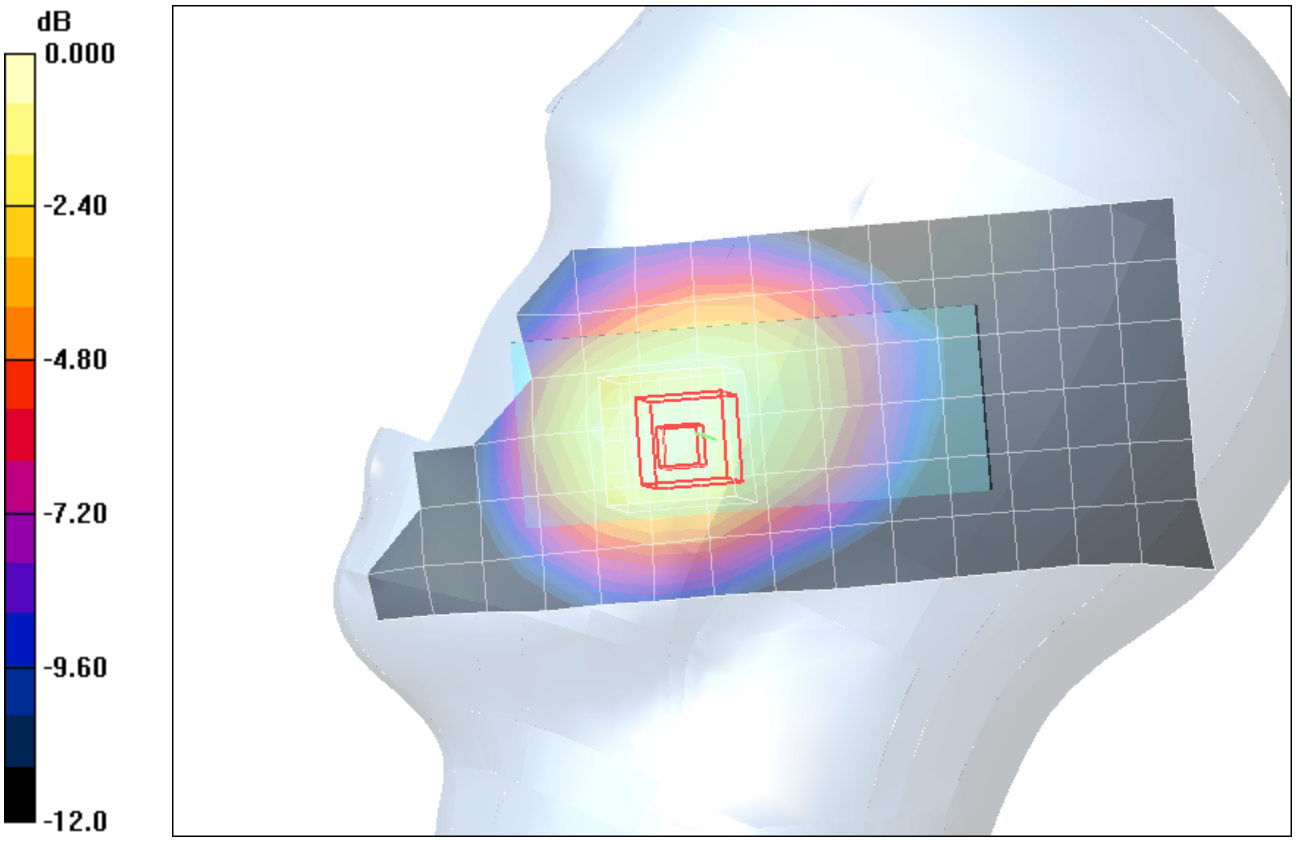
Communication System: GSM 850; Frequency: 824.2 MHz; Communication System Channel Number: 128; Duty Cycle: 1:8
Medium: Low Freq Head; Medium parameters used: f = 835 MHz; σ = 0.91 mho/m; ε_r = 41.2; ρ = 1000 kg/m^3

DASY4 Configuration:

- Probe: ET3DV6 - SN1514; ConvF(5.98, 5.98, 5.98); Calibrated: 7/11/2007
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 3/18/2008
- Phantom: R1_ Sugar SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1005;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Left Head Template/Area Scan - Normal (15mm) (7x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.962 mW/g

Left Head Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 34.9 V/m; Power Drift = -0.044 dB
Peak SAR (extrapolated) = 1.41 W/kg
SAR(1 g) = 0.980 mW/g; SAR(10 g) = 0.674 mW/g
Maximum value of SAR (measured) = 1.03 mW/g



0 dB = 1.03mW/g

Date/Time: 6/9/2008 10:46:43 PM

Test Laboratory: Motorola

GSM 850 Tilt

DUT: Serial: TXP8510053; FCC ID: IHDT56JT2
Procedure Notes: Pwr Step: 5 Antenna Position: internal Battery Model #: SNN5807A DEVICE POSITION: tilted

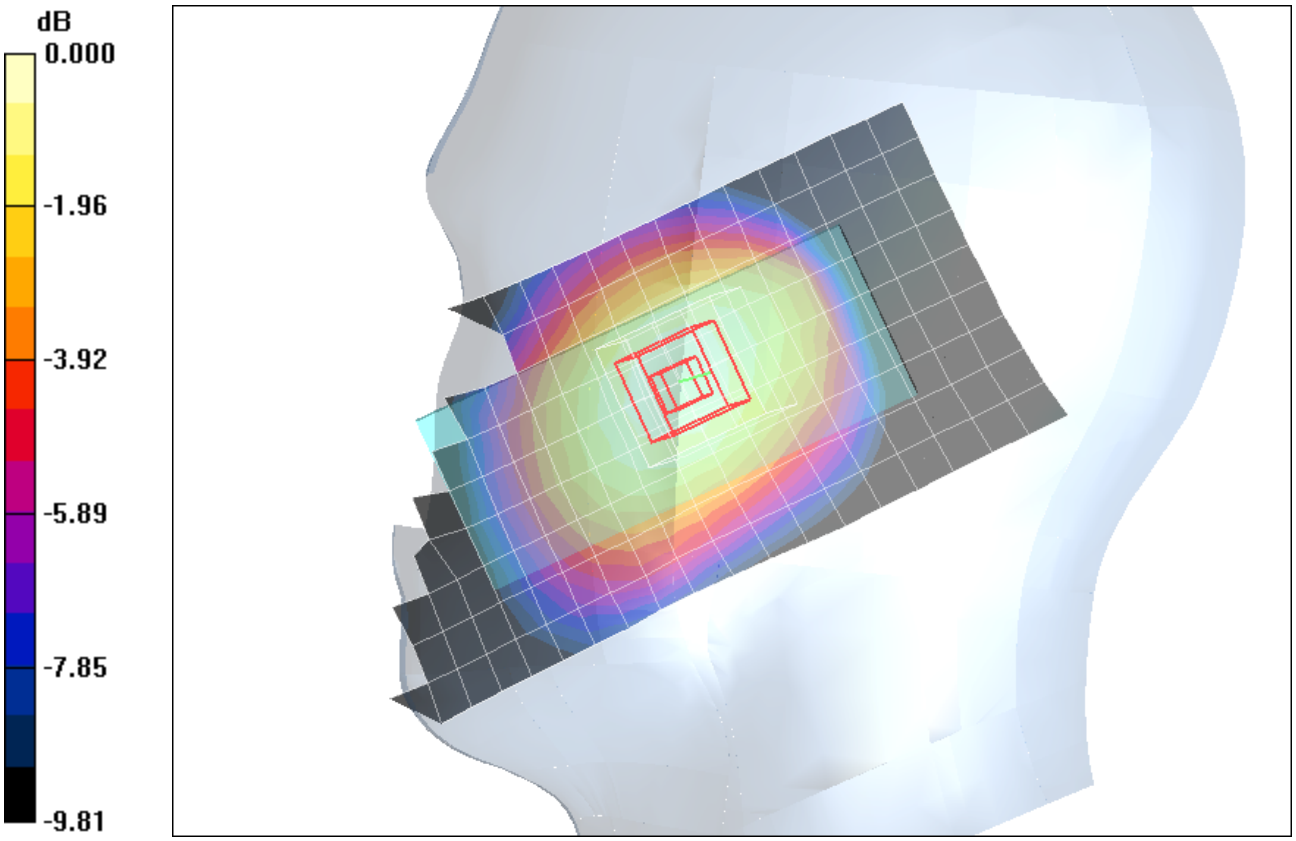
Communication System: GSM 850; Frequency: 836.6 MHz; Communication System Channel Number: 190; Duty Cycle: 1:8
Medium: Low Freq Head; Medium parameters used: f = 835 MHz; σ = 0.92 mho/m; ε_r = 41.7; ρ = 1000 kg/m^3

DASY4 Configuration:

- Probe: ET3DV6 - SN1514; ConvF(5.98, 5.98, 5.98); Calibrated: 7/11/2007
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 3/18/2008
- Phantom: R1_ Sugar SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1005;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Right Head Template/Area Scan - Normal (10mm) (10x25x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.553 mW/g

Right Head Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.8 V/m; Power Drift = -0.015 dB
Peak SAR (extrapolated) = 0.672 W/kg
SAR(1 g) = 0.527 mW/g; SAR(10 g) = 0.392 mW/g
Maximum value of SAR (measured) = 0.555 mW/g



0 dB = 0.555mW/g

Date/Time: 6/10/2008 12:17:56 PM

Test Laboratory: Motorola

GSM 1900 MHz Cheek Touch

DUT: Serial: TXP8510053; FCC ID: IHDT56JT2
Procedure Notes: Pwr Step: 05 Antenna Position: internal Battery Model #: SNN5805A DEVICE POSITION: cheek

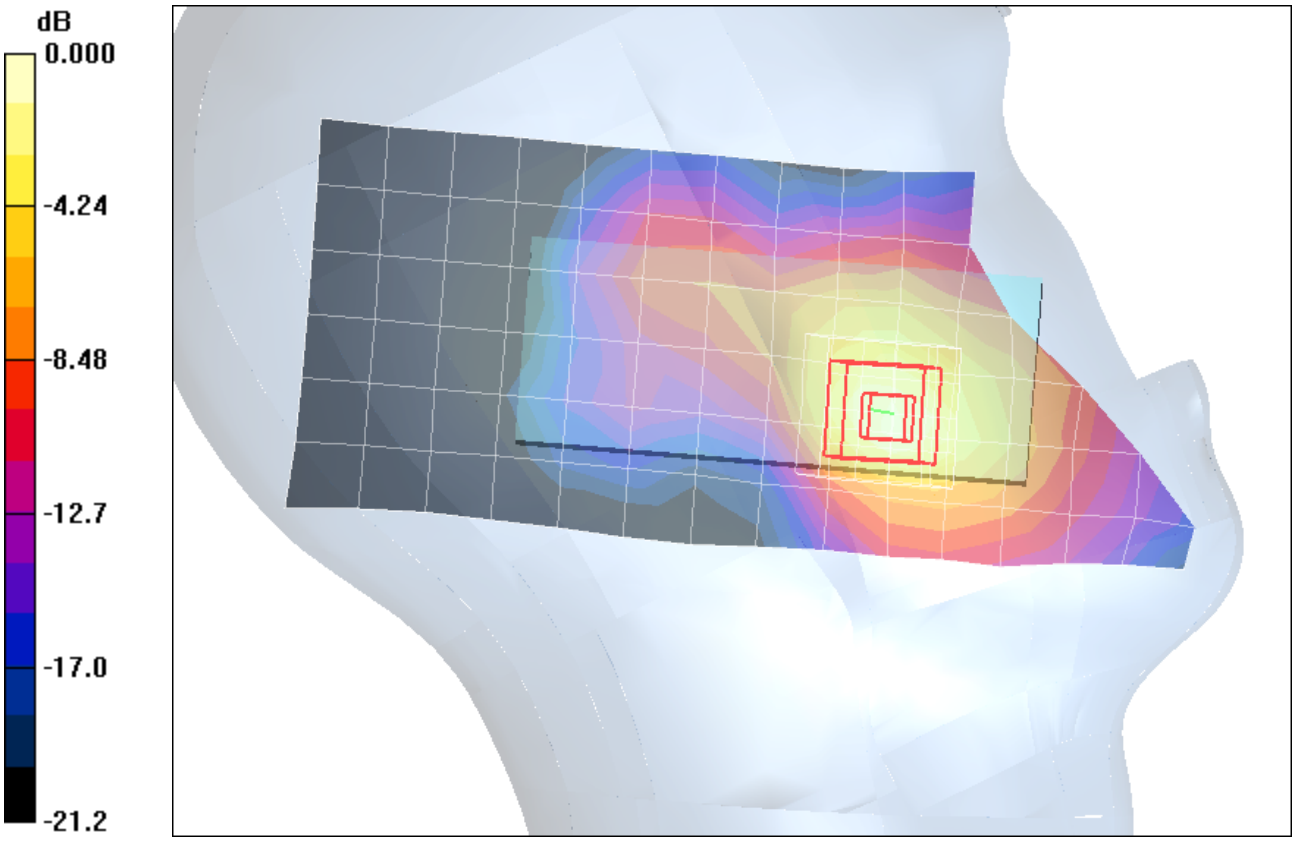
Communication System: GSM 1900; Frequency: 1909.8 MHz; Communication System Channel Number: 810; Duty Cycle: 1:8
Medium: Regular Glycol Head 1750/1880; Medium parameters used: f = 1880 MHz; σ = 1.45 mho/m; ε_r = 38.3; ρ = 1000 kg/m^3

DASY4 Configuration:

- Probe: ET3DV6 - SN1514; ConvF(4.92, 4.92, 4.92); Calibrated: 7/11/2007
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 3/18/2008
- Phantom: R1_ Glycol, SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1139;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Left Head Template/Area Scan - Normal (15mm) (7x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.28 mW/g

Left Head Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.4 V/m; Power Drift = -0.373 dB
Peak SAR (extrapolated) = 2.27 W/kg
SAR(1 g) = 1.41 mW/g; SAR(10 g) = 0.757 mW/g
Maximum value of SAR (measured) = 1.57 mW/g



0 dB = 1.57mW/g

Date/Time: 6/10/2008 11:40:27 AM

Test Laboratory: Motorola

GSM 1900 MHz Tilt

DUT: Serial: TXP8510053; FCC ID: IHDT56JT2
Procedure Notes: Pwr Step: 05 Antenna Position: internal Battery Model #: SNN5807A DEVICE POSITION: tilt

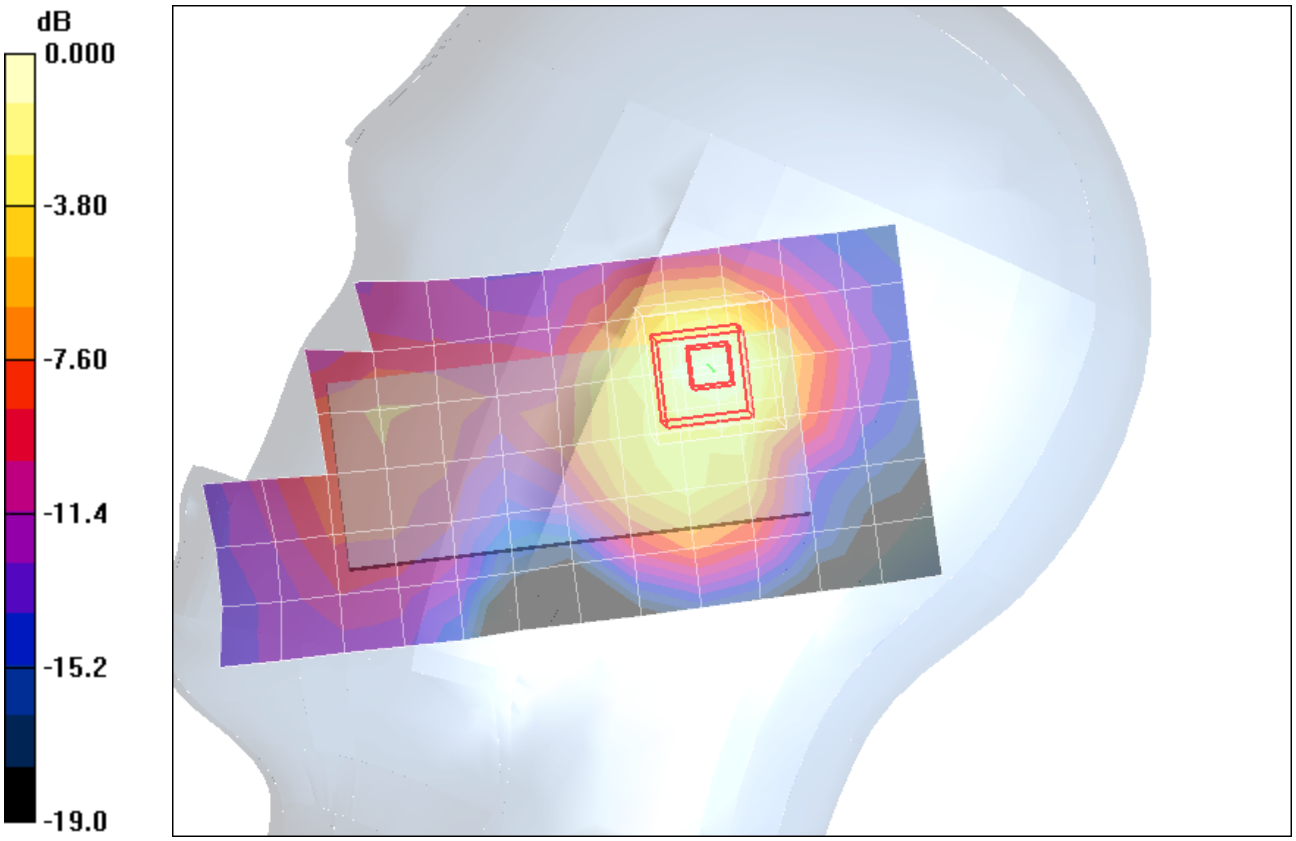
Communication System: GSM 1900; Frequency: 1880 MHz; Communication System Channel Number: 661; Duty Cycle: 1:8
Medium: Regular Glycol Head 1750/1880; Medium parameters used: f = 1880 MHz; σ = 1.45 mho/m; ε_r = 38.3; ρ = 1000 kg/m^3

DASY4 Configuration:

- Probe: ET3DV6 - SN1514; ConvF(4.92, 4.92, 4.92); Calibrated: 7/11/2007
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 3/18/2008
- Phantom: R1_ Glycol, SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1139;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Right Head Template/Area Scan - Normal (15mm) (7x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.296 mW/g

Right Head Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.8 V/m; Power Drift = -0.070 dB
Peak SAR (extrapolated) = 0.520 W/kg
SAR(1 g) = 0.303 mW/g; SAR(10 g) = 0.168 mW/g
Maximum value of SAR (measured) = 0.337 mW/g



0 dB = 0.337mW/g

Appendix 3

SAR distribution plots for Body Worn Configuration

Date/Time: 6/10/2008 3:07:59 AM

Test Laboratory: Motorola

GSM850 Body

DUT: Serial: TXP8510053; FCC ID: IHDT56JT2
Procedure Notes: Pwr Step: 5 Antenna Position: internal Battery Model #: SNN5807A

Accessory Model # = BACK OF PHONE 15MM AWAY FROM PHANTOM

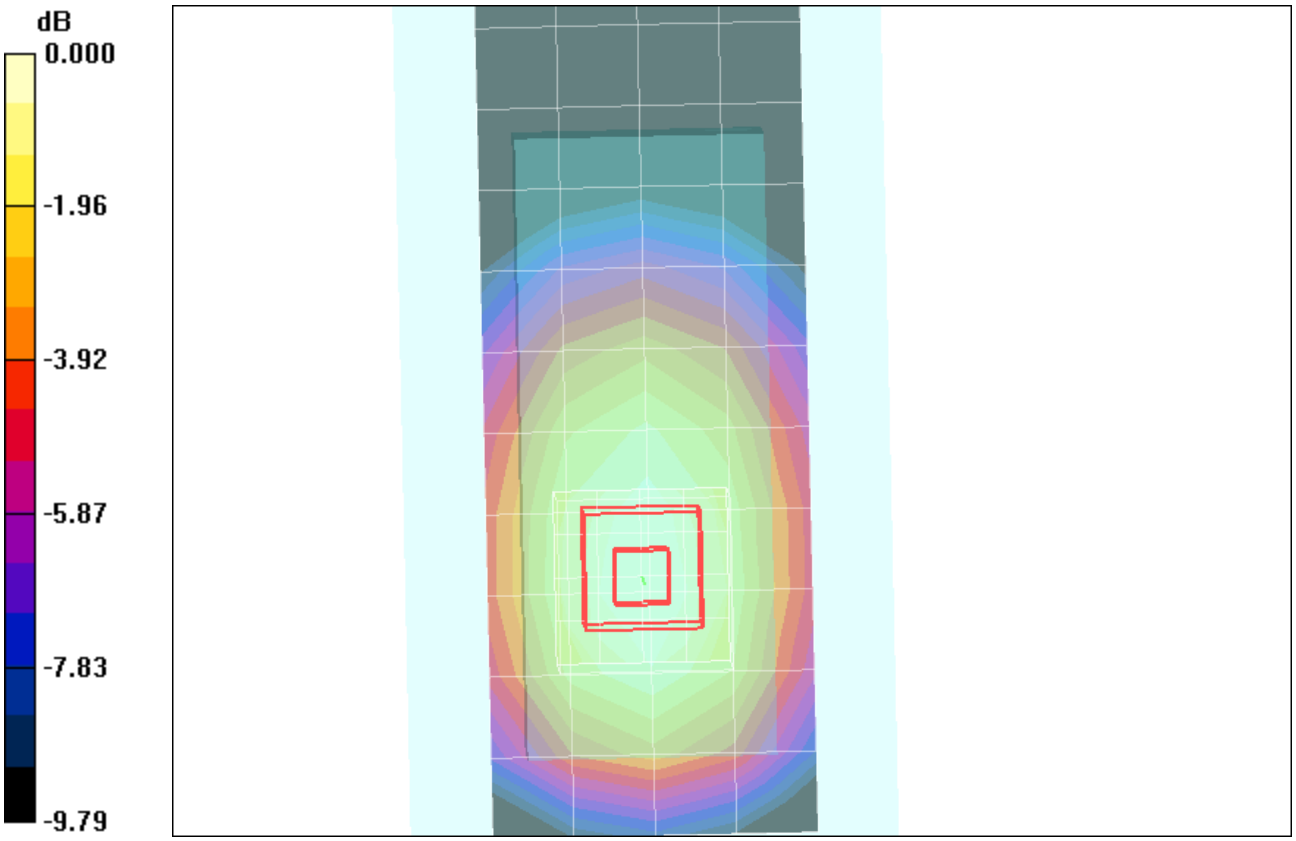
Communication System: GSM 850; Frequency: 836.6 MHz; Communication System Channel Number: 190; Duty Cycle: 1:8
Medium: Low Freq Body; Medium parameters used: f = 835 MHz; σ = 1 mho/m; ε_r = 53.2; ρ = 1000 kg/m^3

DASY4 Configuration:

- Probe: ET3DV6 - SN1514; ConvF(5.75, 5.75, 5.75); Calibrated: 7/11/2007
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 3/18/2008
- Phantom: R1_ Section 1, Amy Twin, Rev2 (23-June-04); Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Amy Twin Phone Template/Area Scan - Normal Body (15mm) (13x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.900 mW/g

Amy Twin Phone Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 30.0 V/m; Power Drift = -0.017 dB
Peak SAR (extrapolated) = 1.10 W/kg
SAR(1 g) = 0.853 mW/g; SAR(10 g) = 0.619 mW/g
Maximum value of SAR (measured) = 0.905 mW/g



0 dB = 0.905mW/g

Date/Time: 6/10/2008 2:19:58 PM

Test Laboratory: Motorola

GSM 1900MHz Body

DUT: Serial: TXP8510053; FCC ID: IHDT56JT2
Procedure Notes: Pwr Step: 0 Antenna Position: internal Battery Model #: SNN5807A Tester Initials: bde
Accessory Model # = "BACK OF PHONE 15MM AWAY FROM PHANTOM "

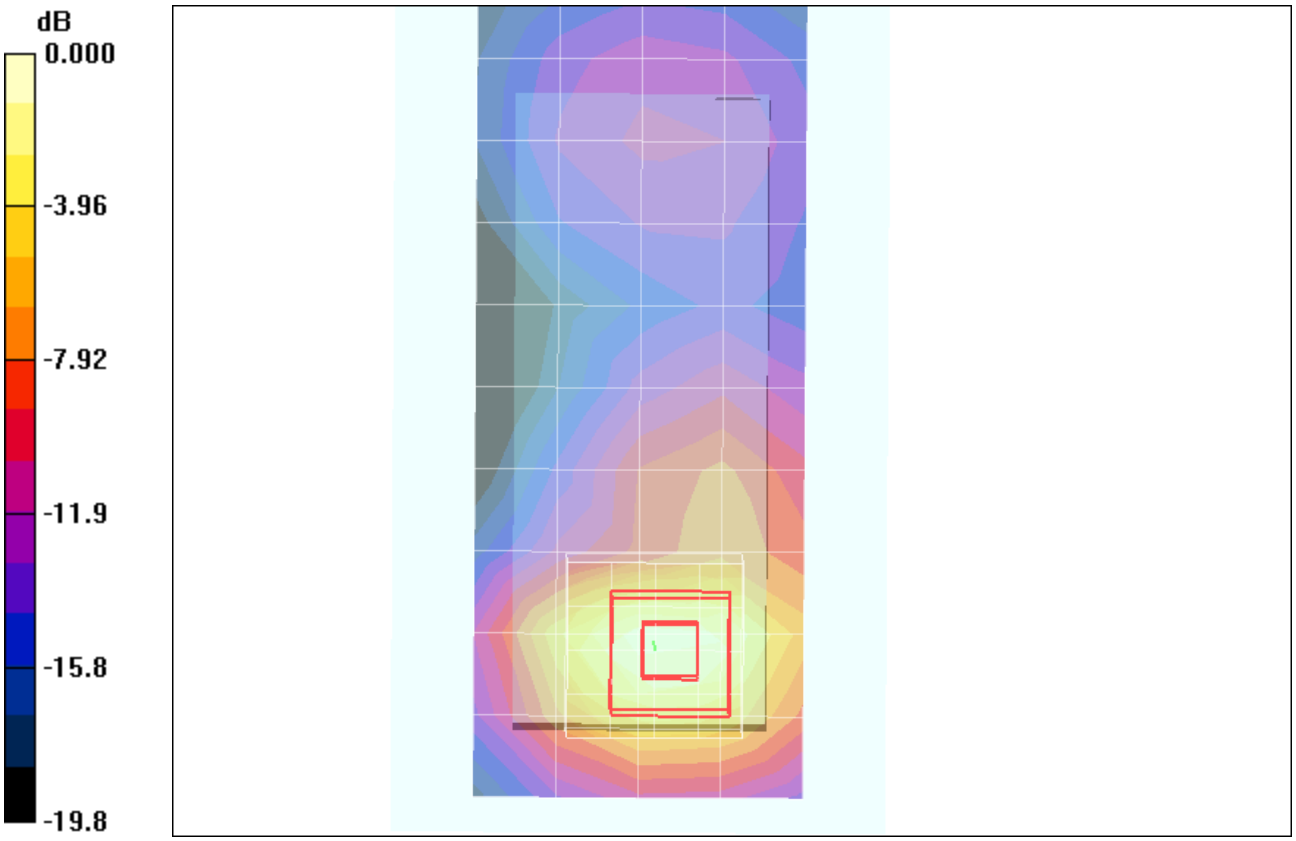
Communication System: GSM 1900; Frequency: 1880 MHz; Communication System Channel Number: 661; Duty Cycle: 1:8
Medium: Regular Glycol Body 1750/1880; Medium parameters used: f = 1880 MHz; σ = 1.58 mho/m; ε_r = 51.1; ρ = 1000 kg/m^3

DASY4 Configuration:

- Probe: ET3DV6 - SN1514; ConvF(4.59, 4.59, 4.59); Calibrated: 7/11/2007
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 3/18/2008
- Phantom: R1_ Section 2, Amy Twin, Rev2 (23-June-04); Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Amy Twin Phone Template/Area Scan - Normal Body (15mm) (13x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.08 mW/g

Amy Twin Phone Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.4 V/m; Power Drift = 0.049 dB
Peak SAR (extrapolated) = 1.93 W/kg
SAR(1 g) = 1.12 mW/g; SAR(10 g) = 0.598 mW/g
Maximum value of SAR (measured) = 1.24 mW/g



0 dB = 1.24mW/g

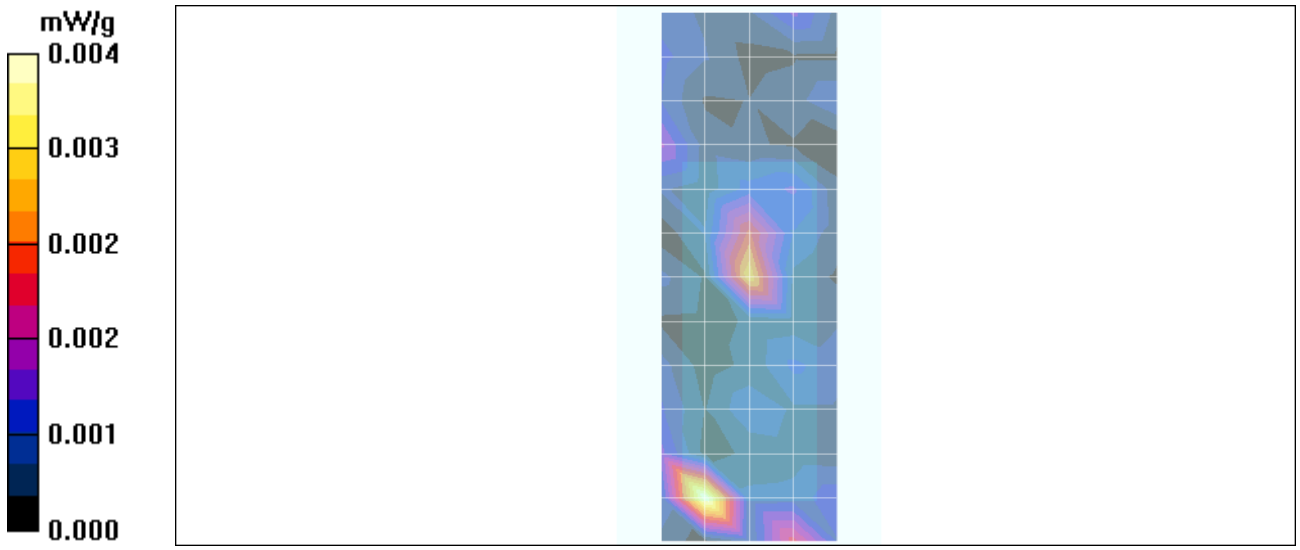
Date/Time: 3/12/2008 6:27:38 PM

Serial: 20000554; Procedure Notes: Pwr Step: n/a; Antenna Position: internal; Battery Model #: SNN5807A; DEVICE POSITION: FRONT OF PHONE 15MM AWAY FROM PHANTOM; Communication System: Bluetooth; Frequency: 2441 MHz; Communication System Channel Number: 39; Duty Cycle: 1:1; Medium: 2450 Glycol Body; Medium parameters used: f = 2450 MHz; σ = 1.96 mho/m; ε_r = 47.9; ρ = 1000 kg/m^3 ; DASY4 Configuration: FCC ID: IHDT56JT2

- Probe: ET3DV6 - SN1514; ConvF(4.07, 4.07, 4.07); Calibrated: 7/11/2007
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/13/2007
- Phantom: R1: Sect.2, Amy Twin; Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Amy Twin Phone Template/Area Scan - Normal Body (15mm) (13x7x1): Measurement grid: dx=15mm, dy=15mm; Maximum value of SAR (measured) = 0.004 mW/g

Amy Twin Phone Template/5x5x7 Zoom Scan (<=3GHz), - to correct max out (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm; Reference Value = 0.457 V/m; Power Drift = 1.16 dB; Peak SAR (extrapolated) = 0.008 W/kg; **SAR(1 g) = 0.000859 mW/g; SAR(10 g) = 0.00017 mW/g;** Maximum value of SAR (measured) = 0.008 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 Federal Office of Metrology and Accreditation
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **Motorola MDb**

Certificate No: ET3-1514_Jul07

CALIBRATION CERTIFICATE

Object	ET3DV6 - SN:1514
Calibration procedure(s)	QA CAL-01.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	July 11, 2007
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 (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Power sensor E4412A	MY41495277	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Power sensor E4412A	MY41498087	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-06 (METAS, No. 217-00592)	Aug-07
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-07 (METAS, No. 217-00671)	Mar-08
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-06 (METAS, No. 217-00593)	Aug-07
Reference Probe ES3DV2	SN: 3013	4-Jan-07 (SPEAG, No. ES3-3013_Jan07)	Jan-08
DAE4	SN: 654	20-Apr-07 (SPEAG, No. DAE4-654_Apr07)	Apr-08

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-06)	In house check: Oct-07

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

Issued: July 12, 2007

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
ConF	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., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not 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 $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ET3DV6

SN:1514

Manufactured:	November 24, 1999
Last calibrated:	July 17, 2006
Recalibrated:	July 11, 2007

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1514

Sensitivity in Free Space[A]

NormX	**1.70** ± 10.1%	$\mu V/(V/m)^2$	DCP X	**91** mV
NormY	**1.94** ± 10.1%	$\mu V/(V/m)^2$	DCP Y	**91** mV
NormZ	**1.85** ± 10.1%	$\mu V/(V/m)^2$	DCP Z	**89** 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		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	10.2	5.3
SAR_{be} [%]	With Correction Algorithm	0.1	0.3

TSL 1810 MHz Typical SAR gradient: 10 % per mm

Sensor Center to Phantom Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	14.0	9.1
SAR_{be} [%]	With Correction Algorithm	0.1	0.0

Sensor Offset

Probe Tip to Sensor Center **2.7** mm

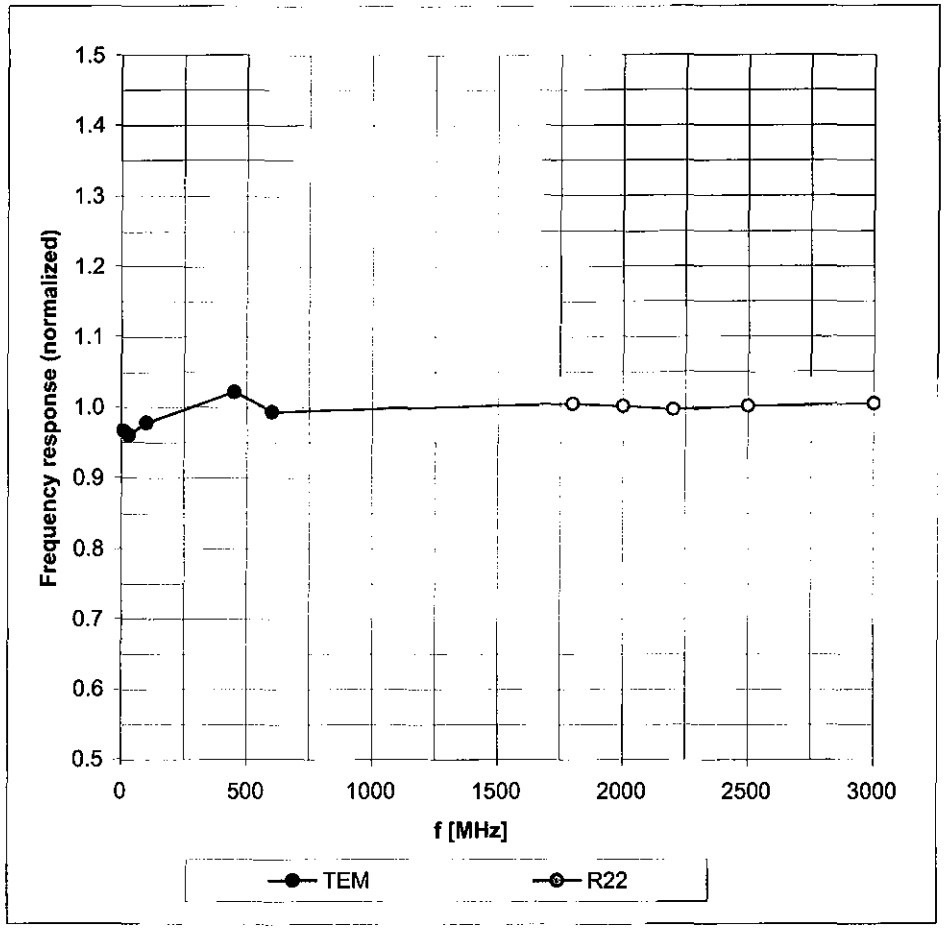
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[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.

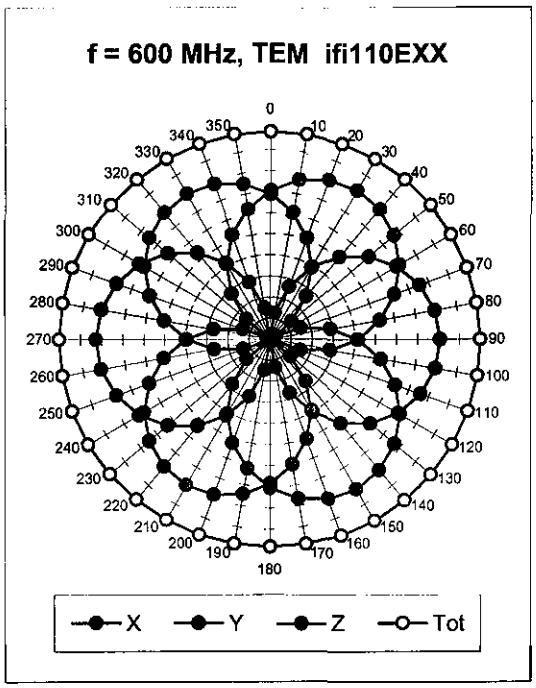
Frequency Response of E-Field

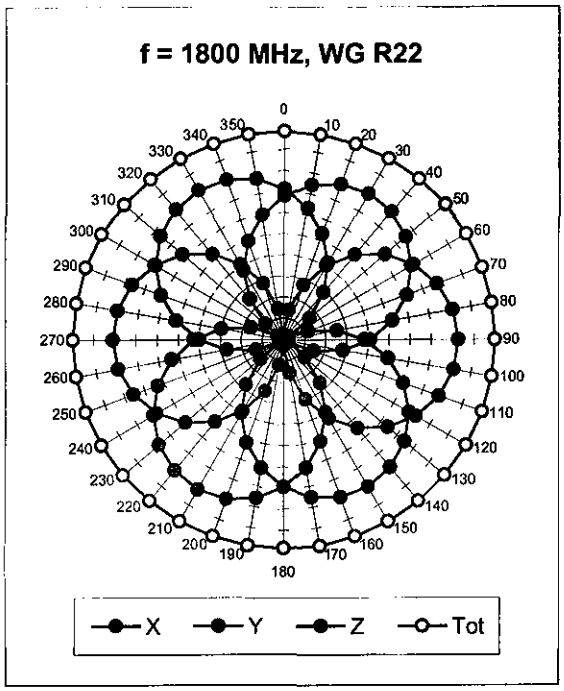
(TEM-Cell:ifi110 EXX, Waveguide: R22)

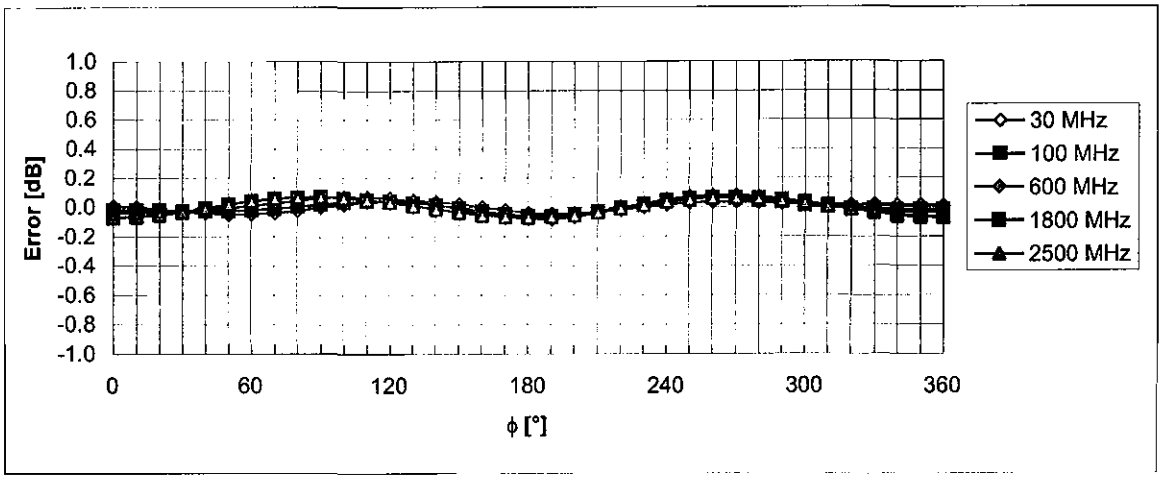


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



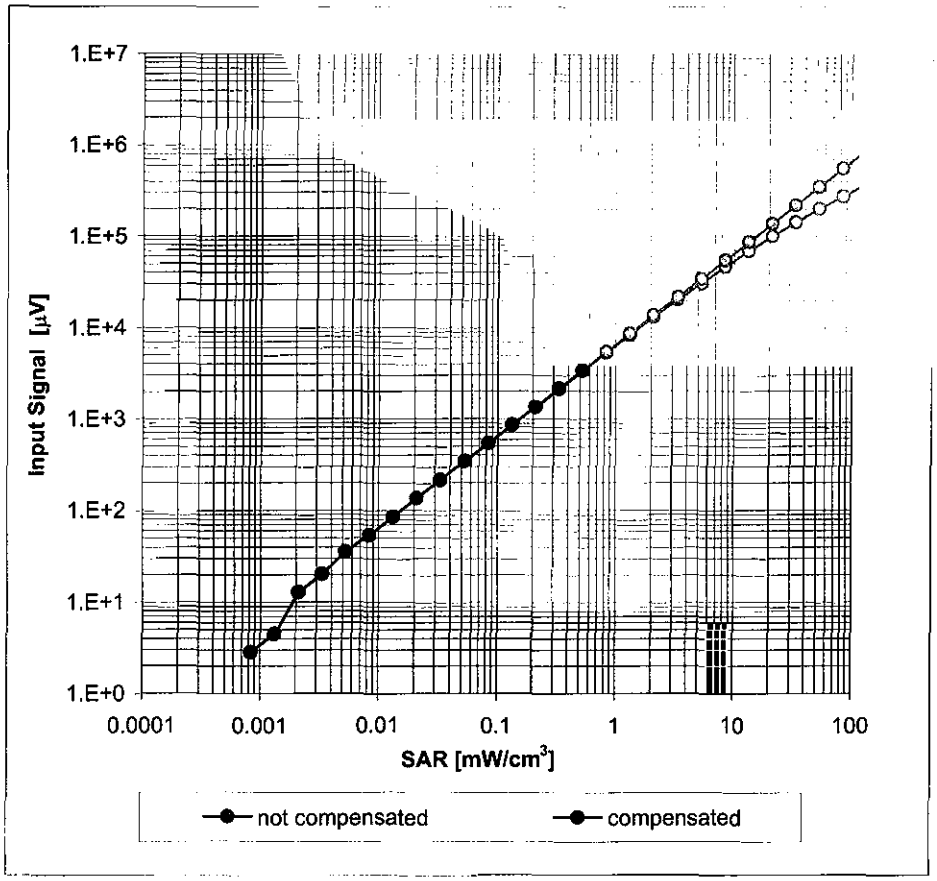


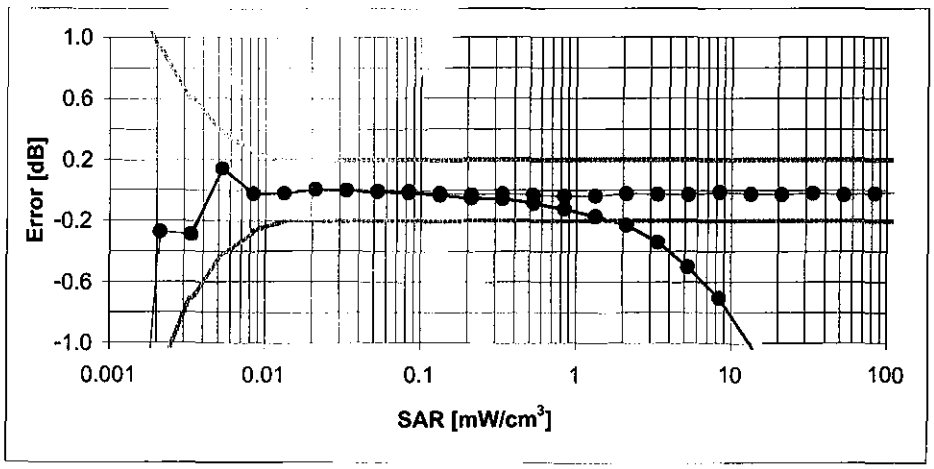


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

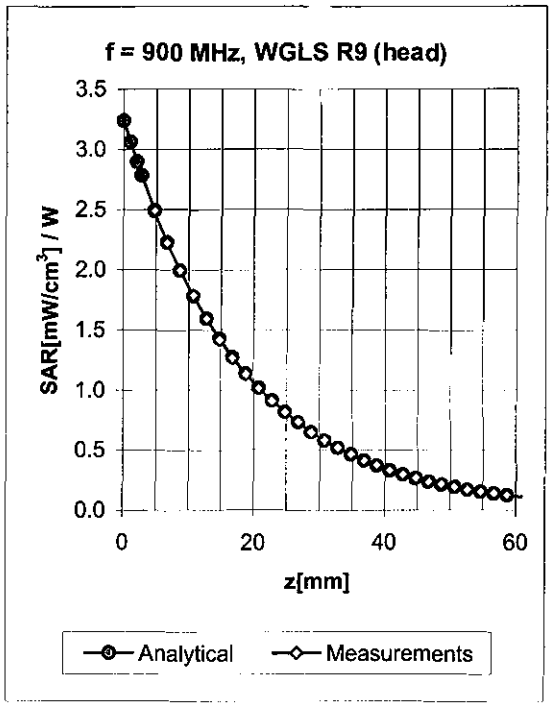
(Waveguide R22, f = 1800 MHz)

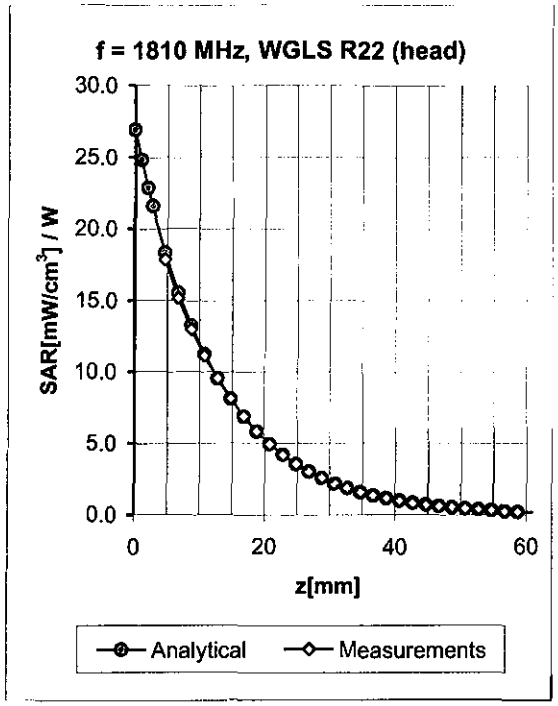




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



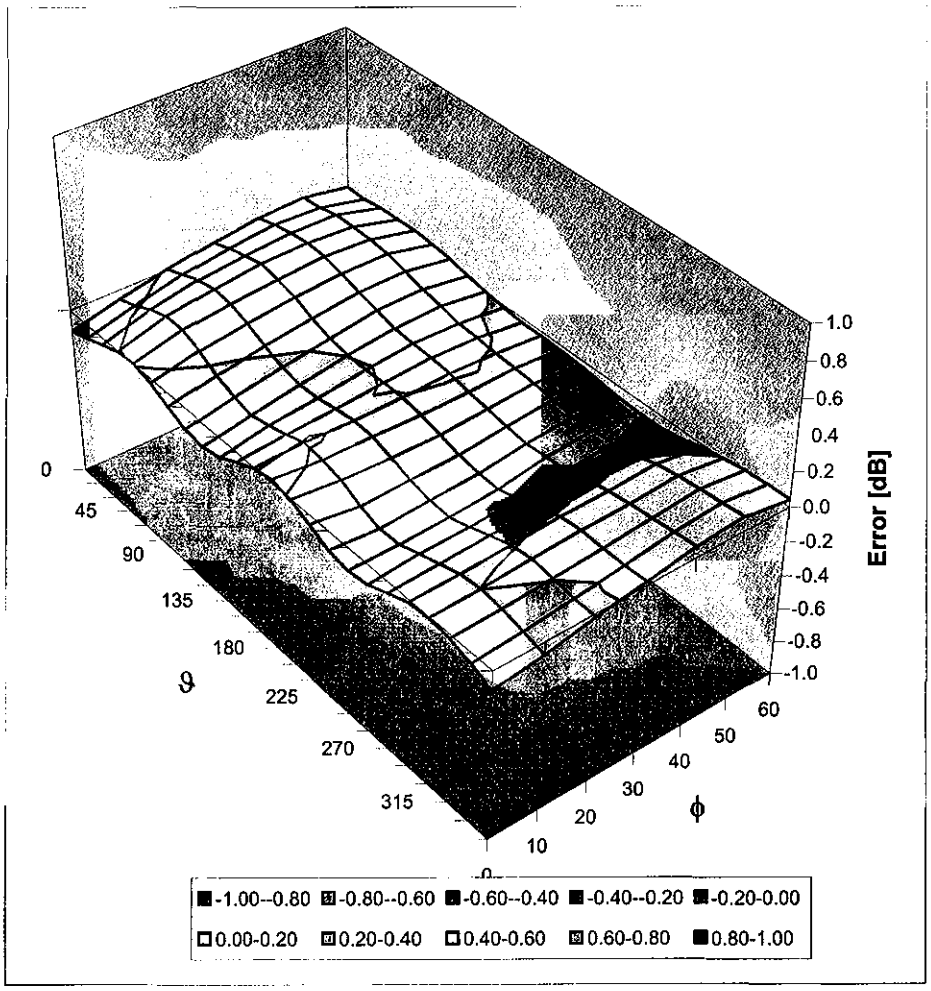


f [MHz]	Validity [MHz][C]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.33	2.62	5.98 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.54	2.61	4.92 ± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.62	2.50	4.72 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.94	1.62	4.44 ± 11.8% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.33	2.79	5.75 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.74	2.31	4.59 ± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.97	1.96	4.34 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.79	1.94	4.07 ± 11.8% (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
Based on WI-0396

-Historical Data-

	900MHz	
Reference Target:	10.9	(W/kg)
Measurement Uncertainty (k=1):	9.0%	
Measurement Period:	*18-April-07 to 14-April-08*	
# of tests performed:	1,125	
Grand Average:	11.29	(W/kg)
% Delta (Average - Reference Target)	3.6%	
Is % Delta <= Expanded Measurement Uncertainty (k=2)?	**Yes**	
Accept/Reject Average as new system performance check target?	**ACCEPT**	
	Applies to Dipole SN's: 55, 69, 77, 78, 79, 80, 91, 92, 93, 94, 95, 96, 97, 1d034, 1d035	

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

Frequency	SAR Target (W/kg)	Permittivity	Conductivity (S/m)
900MHz	**11.29**	41.5 ± 5%	0.97 ± 5%

-Approvals-

Submitted by:	Marge Kaunas	Date:	16-Apr-08
Signed:			
Comments:	Spreadsheet detailing referenced historical measurements is available upon request.		
Approved by:	Mark Douglas	**Date:**	22-Apr-08
Signed:			
Comments:			

Certification of System Performance Check Targets

Based on WI-0396

-Historical Data-

	1800MHz	
Reference Target:	38.4	**(W/kg)**
Measurement Uncertainty (k=1):	9.0%	
Measurement Period:	*18-April-07 to 14-April-08*	
# of tests performed:	1,028	
Grand Average:	37.7	**(W/kg)**
% Delta (Average - Reference Target)	-1.7%	
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	Conductivity (S/m)
1800MHz	**37.7**	40.0 ± 5%	1.40 ± 5%

-Approvals-

Submitted by: Marge Kaunas Date: 16-Apr-08

Signed: Marge Kaunas

Comments: Spreadsheet detailing referenced historical measurements is available upon request.

Approved by: Mark Douglas **Date:** 22-Apr-08

Signed: Mark Douglas

Comments:

Certification of System Performance Check Targets

Based on WI-0396

-Historical Data-

	2450MHz	
Reference Target:	52.4	**(W/kg)**
Measurement Uncertainty (k=1):	9.0%	
Measurement Period:	*18-April-07 to 14-April-08*	
# of tests performed:	77	
Grand Average:	56.5	**(W/kg)**
% Delta (Average - IEEE1528 Target)	7.8%	
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	Conductivity (S/m)
2450MHz	**56.5**	39.2 ± 5%	1.80 ± 5%

-Approvals-

Submitted by:	Marge Kaunas	Date:	16-Apr-08
Signed:			
Comments:	Spreadsheet detailing referenced historical measurements is available upon request.		
Approved by:	Mark Douglas	**Date:**	22-Apr-08
Signed:			
Comments:			