Appendix 3

SAR distribution plots for Body Worn Configuration

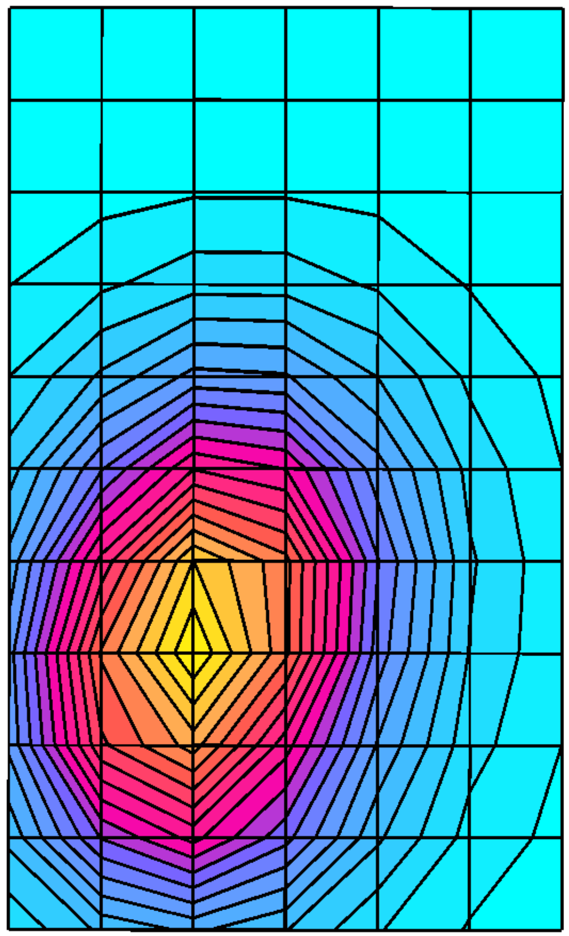
LRZ0430019

Ch# 189 Pwr Step: 5 ota
Antenna Position: INTERNAL
Type of Modulation: 850 GSM
Battery Model #: SNN5696A
Accessory Model # = pouch (SYN1066A)
wishbone (SYN8631A)

R4 - Amy Twin Phantom Rev.4 (22Aug02) Phantom; section 1 Section; Position: (0°,0°); Frequency: 836 MHz

Probe: ET3DV6 - SN1514 - FCC Body.2; ConvF(6.10,6.10,6.10); Crest factor: 8.0; 835 MHz Head & Body: σ = 0.97 mho/m ε_r = 53.9 ρ = 1.00 g/cm^3

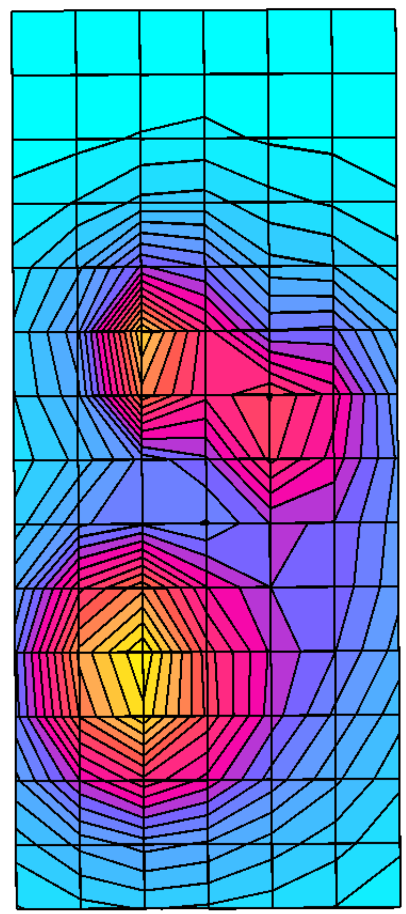
Cube 7x7x7: SAR (1g): 0.557 mW/g, SAR (10g): 0.379 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Penetration depth: 14.4 (13.4, 15.5) [mm]
Powerdrift: -0.15 dB



LRZ0430041

Ch# 661 / Pwr Step: 0 Antenna Position: Internal
Type of Modulation: GSM 1900 Battery Model #: SNN5696A
Accessory Model # = SYN1066A with SYN8763A

Simulate Temp when Measured: 19.5C Simulate Temp after Test: 18.6C
R4 - Amy Twin Phantom Rev.4 (22Aug02) Phantom; section 2 Section; Position: (0°,0°); Frequency: 1880 MHz
Probe: ET3DV6 - SN1514 - FCC Body.2; ConvF(4.70,4.70,4.70); Crest factor: 8.0; 1880 MHz Head & Body: σ = 1.59 mho/m ε_r = 52.4 ρ = 1.00 g/cm^3
Cube 7x7x7: SAR (1g): 0.0483 mW/g, SAR (10g): 0.0293 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Penetration depth: 9.8 (8.7, 11.5) [mm]
Powerdrift: -0.69 dB



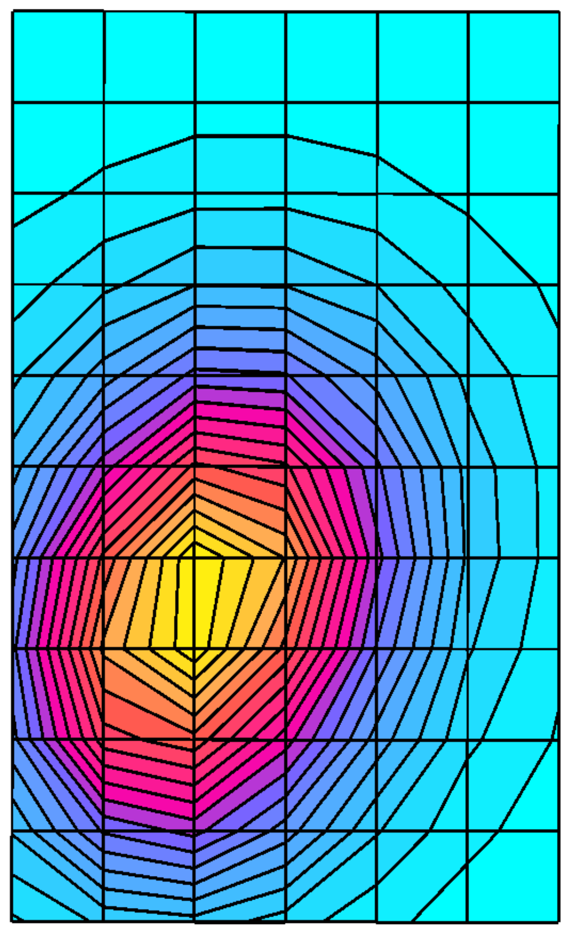
LRZ0430019

Ch# 128 Pwr Step: burst 1 and 2=5 ota Antenna Position: INTERNAL
Type of Modulation: 850 GSM gprs Battery Model #: SNN5696A
Accessory Model # = pouch (SYN1066A)
wishbone (SYN8631A)

R4 - Amy Twin Phantom Rev.4 (22Aug02) Phantom; section 1 Section; Position: (0°,0°); Frequency: 824 MHz

Probe: ET3DV6 - SN1514 - FCC Body.2; ConvF(6.10,6.10,6.10); Crest factor: 4.0; 835 MHz Head & Body: σ = 0.97 mho/m ε_r = 53.9 ρ = 1.00 g/cm^3

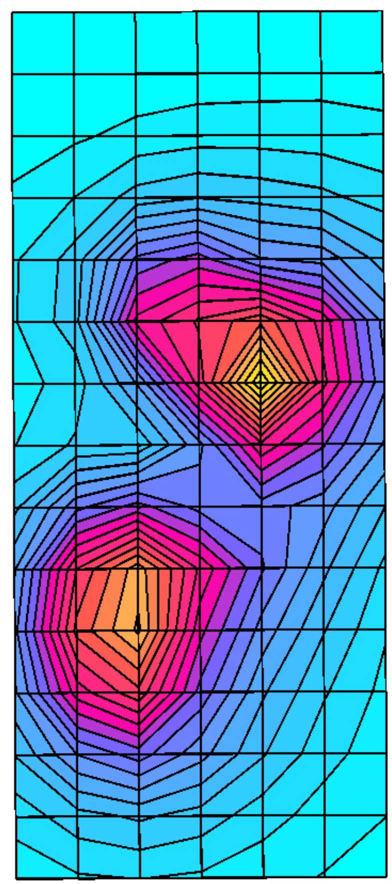
Cube 7x7x7: SAR (1g): 1.18 mW/g, SAR (10g): 0.807 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Penetration depth: 14.6 (12.6, 16.8) [mm]
Powerdrift: -0.21 dB



LRZ0430041

Ch# 661 / Pwr Step: 0 Antenna Position: Internal
Type of Modulation: GSM 1900 Battery Model #: SNN5696A
Accessory Model # = SYN1066A with SYN8763A

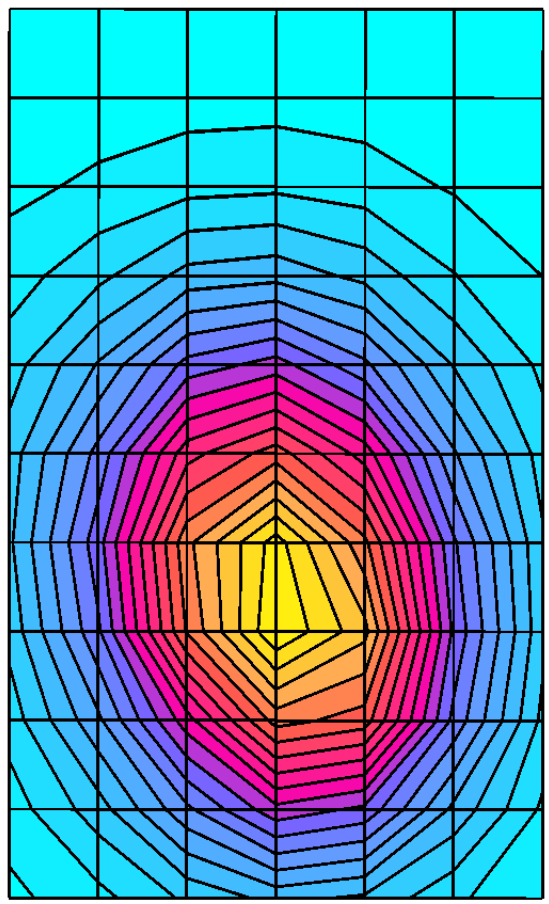
GPRS PC10 Mode
Simulate Temp when Measured: 19.5C Simulate Temp after Test: 18.4C
R4 - Amy Twin Phantom Rev.4 (22Aug02) Phantom; section 2 Section; Position: (0°,0°); Frequency: 1880 MHz
Probe: ET3DV6 - SN1514 - FCC Body.2; ConvF(4.70,4.70,4.70); Crest factor: 4.0; 1880 MHz Head & Body: σ = 1.59 mho/m ε_r = 52.4 ρ = 1.00 g/cm^3
Cube 7x7x7: SAR (1g): 0.107 mW/g, SAR (10g): 0.0615 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Penetration depth: 10.0 (9.6, 10.6) [mm]
Powerdrift: -0.07 dB



LRZ0430019

Ch# 251 Pwr Step: burst 1 and 2=5 ota Antenna Position: INTERNAL
Type of Modulation: 850 GSM gprs Battery Model #: SNN5696A
Accessory Model # = pouch (SYN1066A)
wishbone (SYN8631A)

R4 - Amy Twin Phantom Rev.4 (22Aug02) Phantom; section 1 Section; Position: (0°,0°); Frequency: 849 MHz
Probe: ET3DV6 - SN1514 - FCC Body.2; ConvF(6.10,6.10,6.10); Crest factor: 4.0; 835 MHz Head & Body: σ = 0.97 mho/m ε_r = 53.9 ρ = 1.00 g/cm^3
Cube 7x7x7: SAR (1g): 0.764 mW/g, SAR (10g): 0.538 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Penetration depth: 15.9 (14.9, 17.0) [mm]
Powerdrift: -0.10 dB



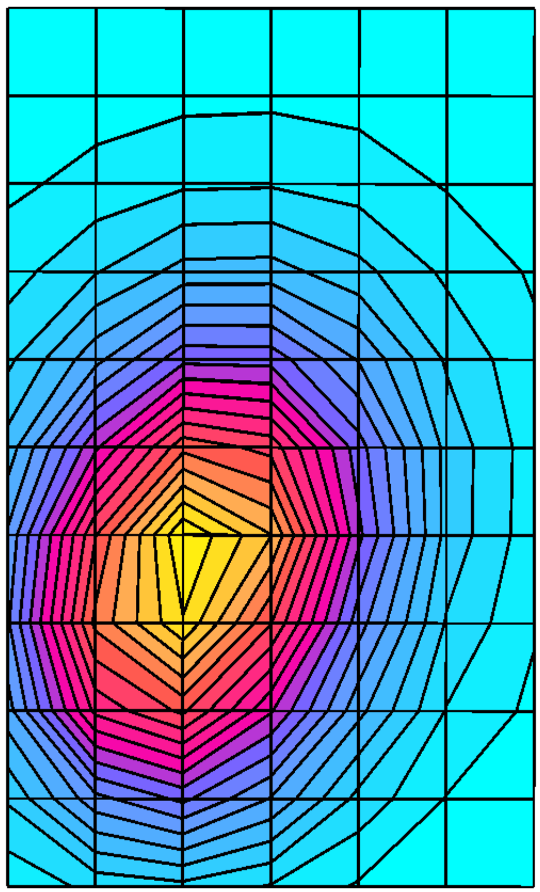
LRZ0430019

Ch# 189 Pwr Step: burst 1 and 2=5 ota Antenna Position: INTERNAL
Type of Modulation: 850 GSM gprs Battery Model #: SNN5696A
Accessory Model # = pouch (SYN1066A)
wishbone (SYN8631A)

R4 - Amy Twin Phantom Rev.4 (22Aug02) Phantom; section 1 Section; Position: (0°,0°); Frequency: 836 MHz

Probe: ET3DV6 - SN1514 - FCC Body.2; ConvF(6.10,6.10,6.10); Crest factor: 4.0; 835 MHz Head & Body: σ = 0.97 mho/m ε_r = 53.9 ρ = 1.00 g/cm^3

Cube 7x7x7: SAR (1g): 1.14 mW/g, SAR (10g): 0.777 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Penetration depth: 14.3 (13.0, 15.8) [mm]
Powerdrift: -0.19 dB

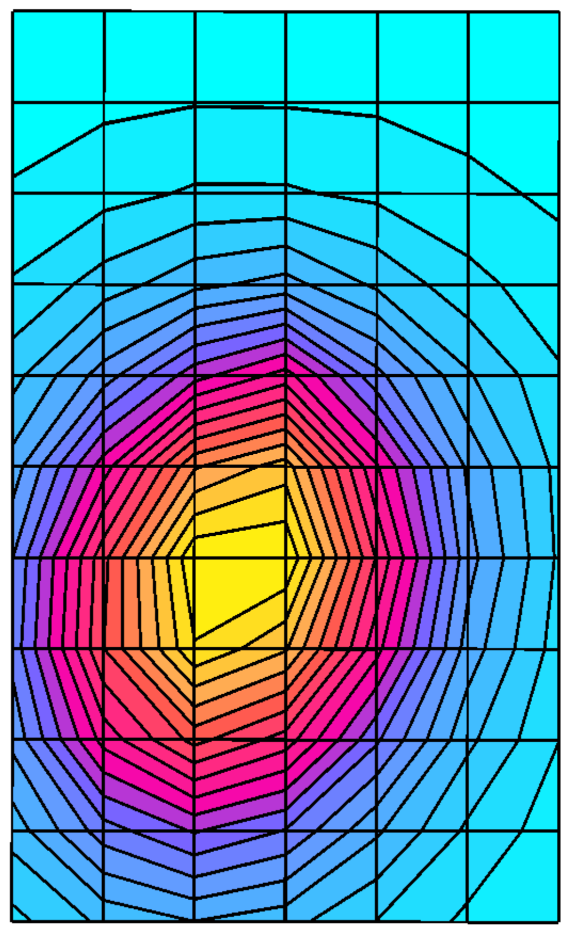


04/22/04 13:20

LRZ0430019

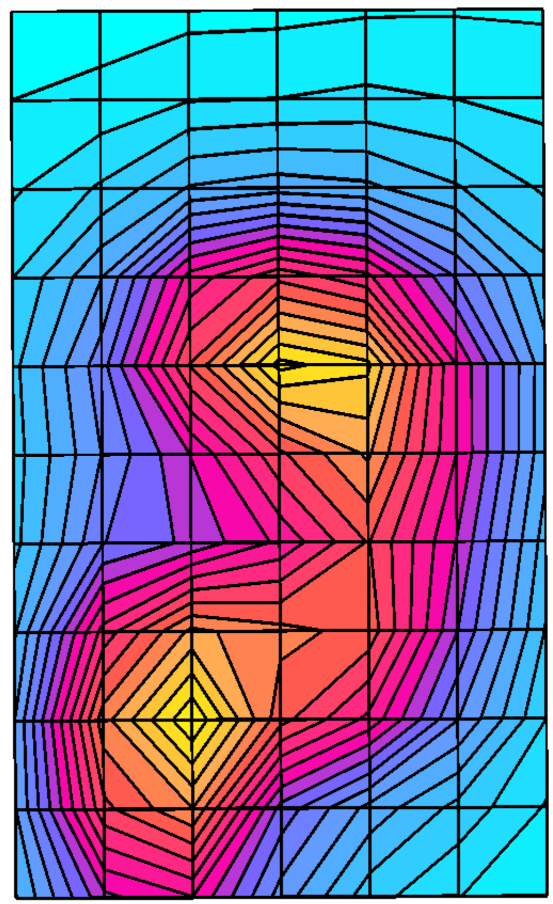
Ch# 189 Pwr Step: burst 1 and 2=5 ota Antenna Position: INTERNAL
Type of Modulation: 850 GSM gprs Battery Model #: SNN5696A
Accessory Model # = pouch (SYN1066A)
universal (SYN8763B)

R4 - Amy Twin Phantom Rev.4 (22Aug02) Phantom; section 1 Section; Position: (0°,0°); Frequency: 836 MHz
Probe: ET3DV6 - SN1514 - FCC Body.2; ConvF(6.10,6.10,6.10); Crest factor: 4.0; 835 MHz Head & Body: σ = 0.98 mho/m ε_r = 53.8 ρ = 1.00 g/cm^3
Cube 7x7x7: SAR (1g): 0.623 mW/g, SAR (10g): 0.442 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Penetration depth: 16.2 (14.6, 17.8) [mm]
Powerdrift: -0.27 dB



LRZ0430041

Ch# 661 Pwr Step: burst 1 and 2=0 ota Antenna Position: INTERNAL
Type of Modulation: 1900 GSM gprs Battery Model #: SNN5696A
Accessory Model # = pouch (SYN1066A)
wishbone (SYN8631BA)
R4 - Amy Twin Phantom Rev.4 (22Aug02) Phantom; section 2 Section; Position: (0°,0°); Frequency: 1880 MHz
Probe: ET3DV6 - SN1514 - FCC Body.2; ConvF(4.70,4.70,4.70); Crest factor: 4.0; 1880 MHz Head & Body: σ = 1.58 mho/m ε_r = 52.6 ρ = 1.00 g/cm^3
Cube 7x7x7: SAR (1g): 0.124 mW/g, SAR (10g): 0.0736 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Penetration depth: 9.5 (8.5, 11.1) [mm]
Powerdrift: -0.65 dB



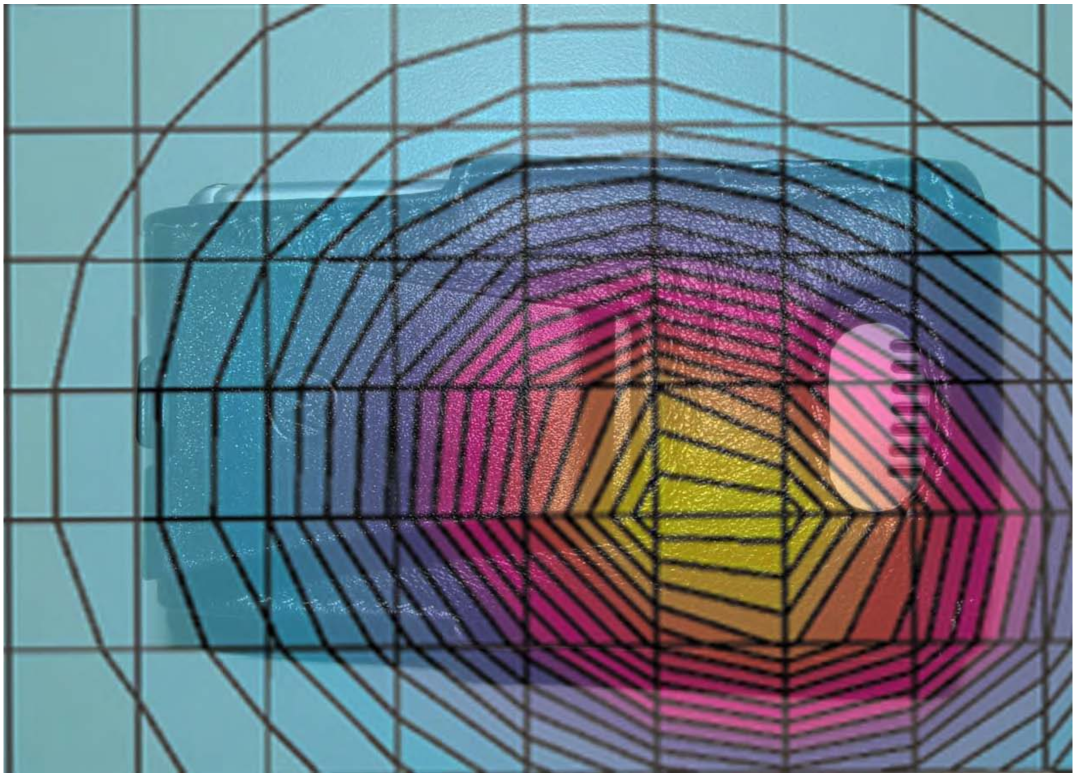


Figure 7.Typical 850MHz GSM Body Worn Contour Overlaid on Phone

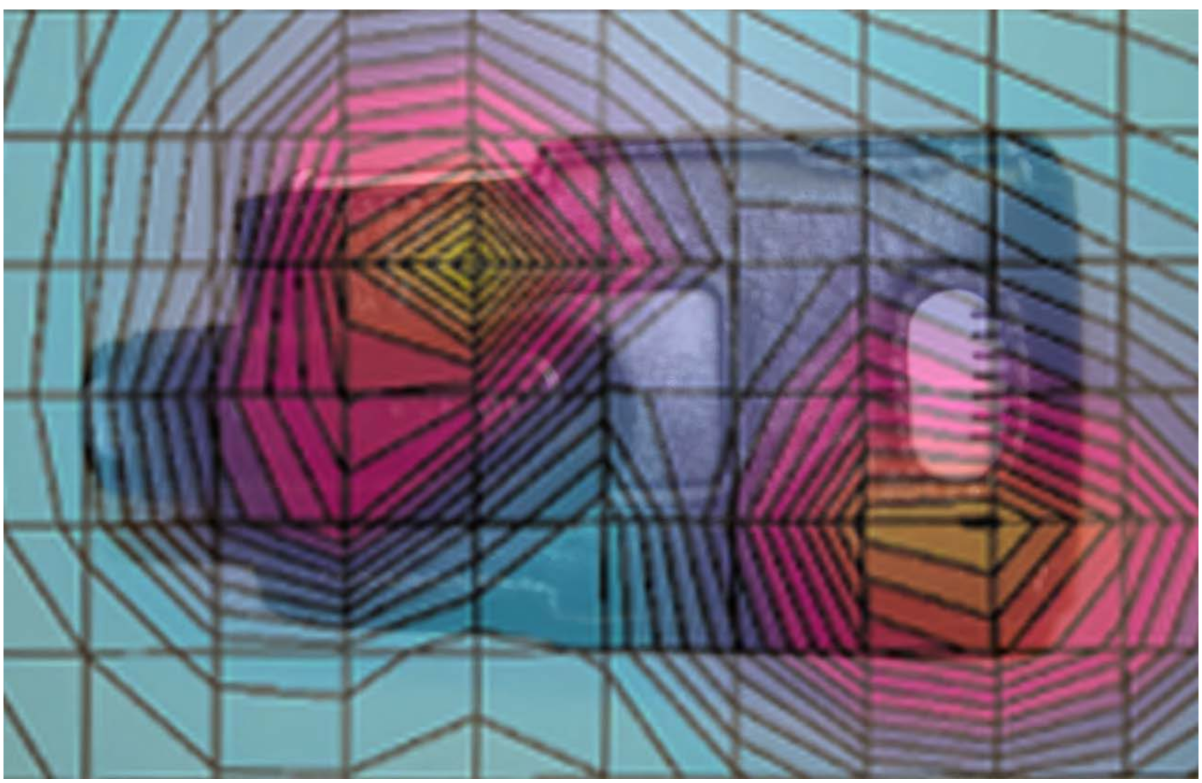
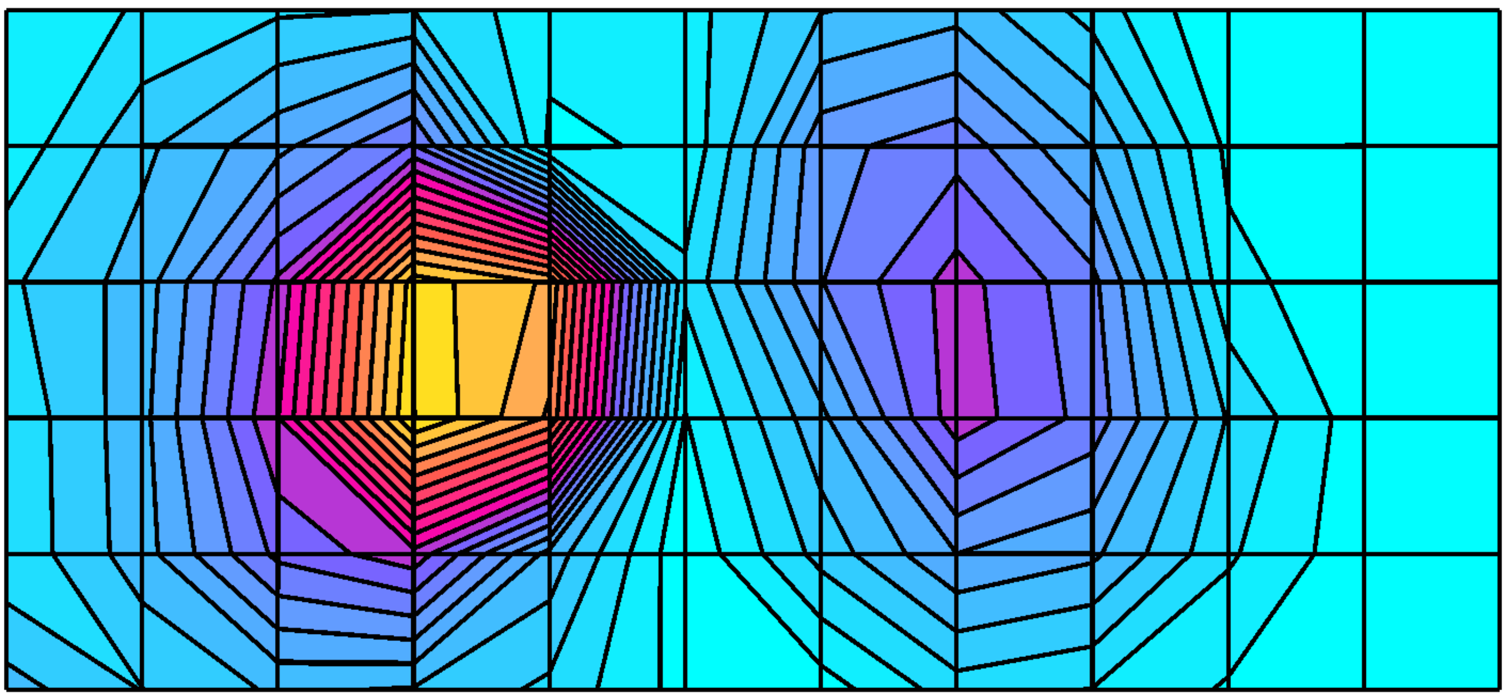


Figure 8.Typical 1900MHz GSM Body Worn Contour Overlaid on Phone

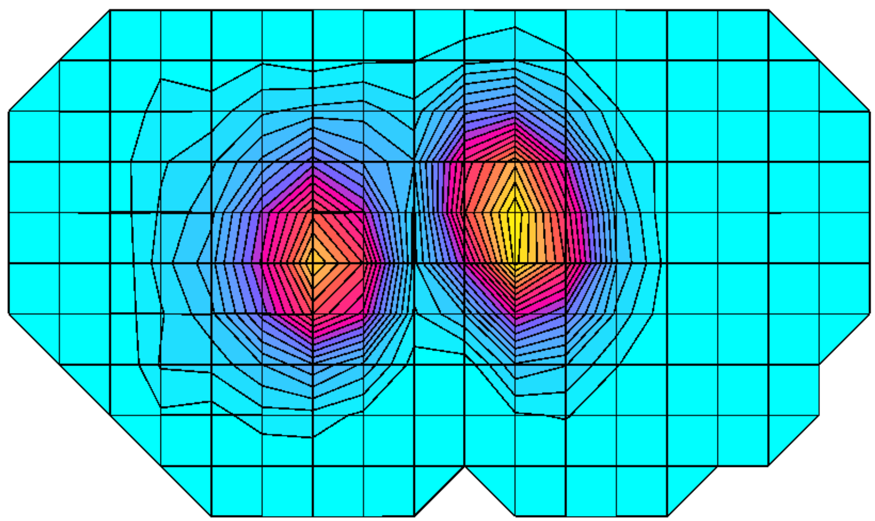
LRZ0420029

Ch# ALL Pwr Step: radio com ota using rohde/schwarz cmu200 class 1 (freq.hopping)
Type of Modulation: 2450 bluetooth Antenna Position: INTERNAL
Accessory Model # = pouch (SYN1066A)
wishbone (SYN8631A) (BLUETOOTH class 1)
R4 TP-1250 GLYCOL sam expanded (Rev. 2)-9Jan03 Phantom; Flat Section; Position: (90°,90°); Frequency: 2450 MHz
Probe: ET3DV6 - SN1514 - IEEE Head.2; ConvF(4.70,4.70,4.70); Crest factor: 1.0; 2450 MHz Head & Body: σ = 1.89 mho/m ε_r = 38.4 ρ = 1.00 g/cm^3
Cube 7x7x7: SAR (1g): 0.0138 mW/g, SAR (10g): 0.0066 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Penetration depth: 7.0 (6.9, 7.2) [mm]
Powerdrift: 0.19 dB



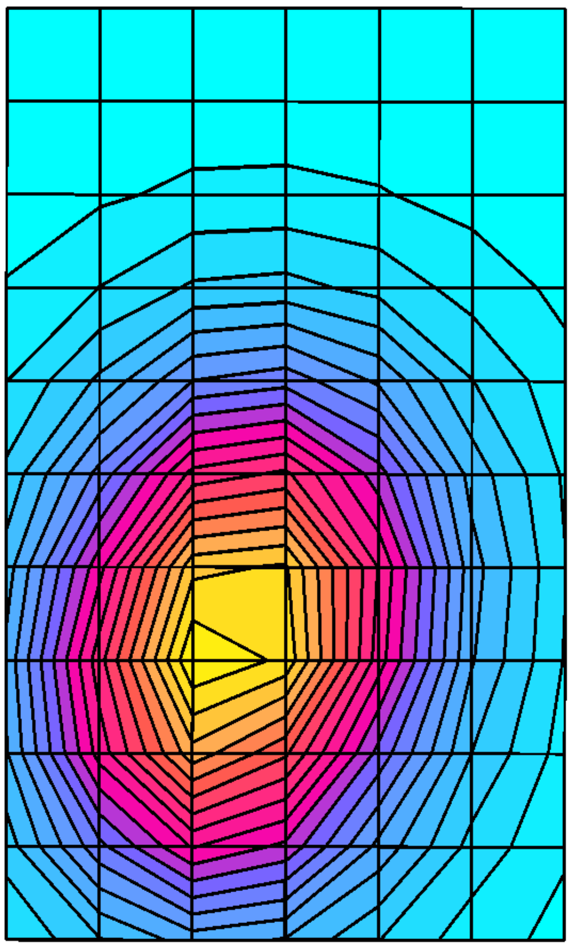
LRZ0420029

Ch# ALL Pwr Step: radio com ota using rohde/schwarz cmu200 class 1 (freq.hopping)
Type of Modulation: 2450 bluetooth   Antenna Position: INTERNAL
Accessory Model # = pouch (SYN1066A)
wishbone (SYN8631A)   (BLUETOOTH class 1)
R4 TP-1250 GLYCOL sam expanded (Rev. 2)-9Jan03 Phantom; Flat Section; Position: (90°,180°); Frequency: 2450 MHz
Probe: ET3DV6 - SN1514 - IEEE Head.2; ConvF(4.70,4.70,4.70); Crest factor: 1.0; 2450 MHz Head & Body: σ = 1.89 mho/m ε_r = 38.4 ρ = 1.00 g/cm^3
Cube 7x7x7: SAR (1g): 0.0155 mW/g, SAR (10g): 0.0083 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Penetration depth: 7.0 (6.7, 7.8) [mm]
Powerdrift: -0.06 dB



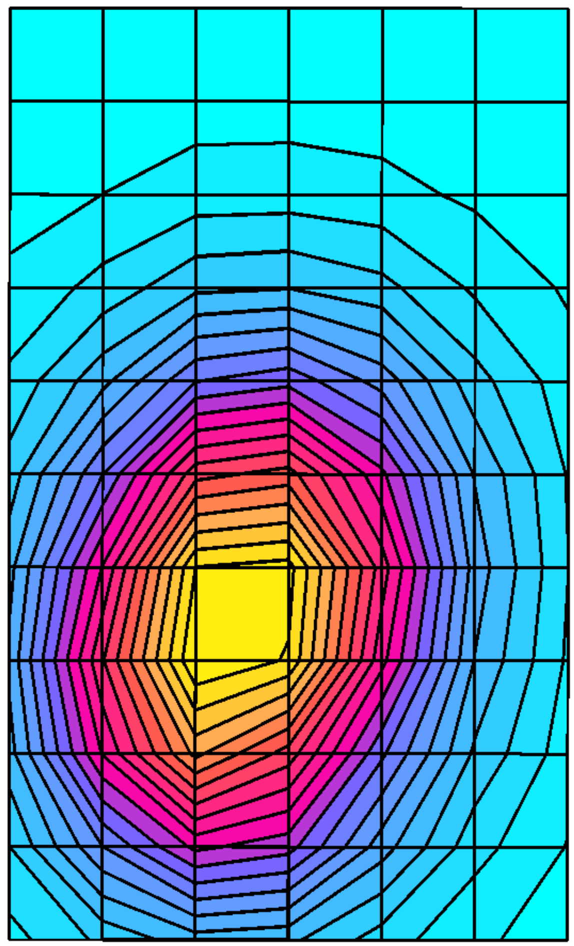
LRZ0420029

Ch# 128 Pwr Step: burst 1 and 2=5 ota Antenna Position: INTERNAL
Type of Modulation: 850 GSM Battery Model #: SNN5696A
Accessory Model # = pouch (SYN1066A)
wishbone (SYN8631A) (GPRS) (BLUETOOTH class 1)
R4 - Amy Twin Phantom Rev.4 (22Aug02) Phantom; section 1 Section; Position: (0°,0°); Frequency: 824 MHz
Probe: ET3DV6 - SN1514 - FCC Body.2; ConvF(6.10,6.10,6.10); Crest factor: 4.0; 835 MHz Head & Body: σ = 0.97 mho/m ε_r = 53.2 ρ = 1.00 g/cm^3
Cube 7x7x7: SAR (1g): 1.02 mW/g, SAR (10g): 0.712 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Penetration depth: 15.1 (14.0, 16.4) [mm]
Powerdrift: -0.22 dB



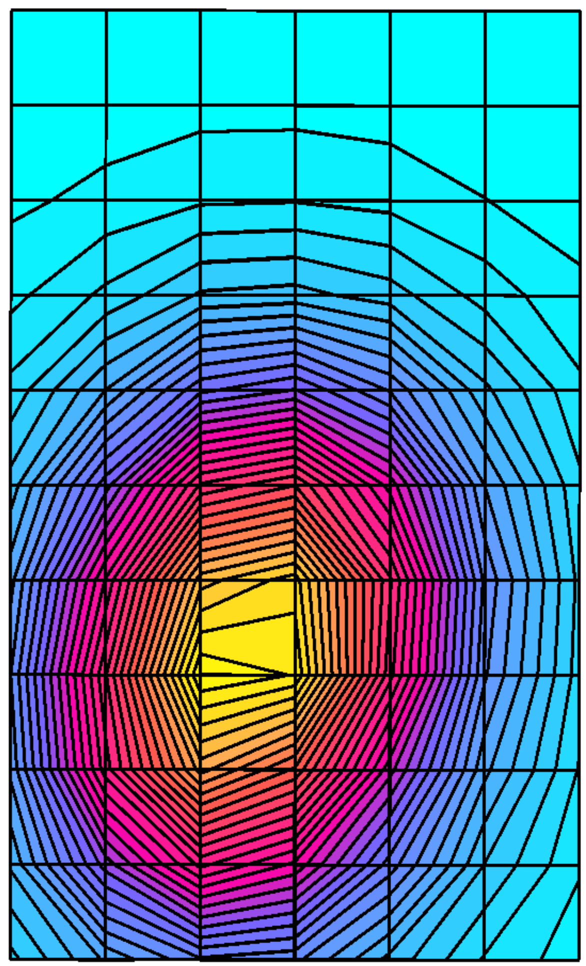
LRZ0420029

Ch# 189 Pwr Step: burst 1 and 2=5 ota Antenna Position: INTERNAL
Type of Modulation: 850 GSM Battery Model #: SNN5696A
Accessory Model # = pouch (SYN1066A)
wishbone (SYN8631A) (GPRS) (BLUETOOTH class 1)
R4 - Amy Twin Phantom Rev.4 (22Aug02) Phantom; section 1 Section; Position: (0°,0°); Frequency: 836 MHz
Probe: ET3DV6 - SN1514 - FCC Body.2; ConvF(6.10,6.10,6.10); Crest factor: 4.0; 835 MHz Head & Body: σ = 0.97 mho/m ε_r = 53.2 ρ = 1.00 g/cm^3
Cube 7x7x7: SAR (1g): 1.00 mW/g, SAR (10g): 0.690 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Penetration depth: 14.8 (13.5, 16.3) [mm]
Powerdrift: -0.38 dB



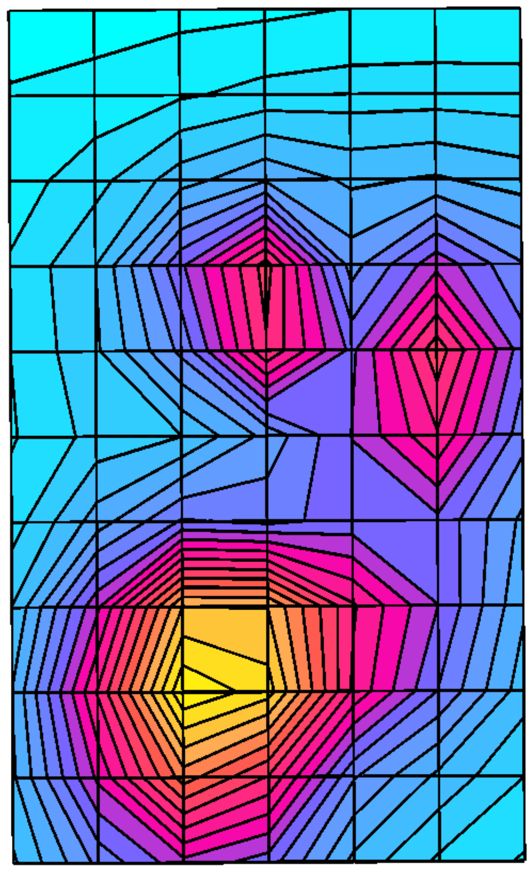
LRZ0420029

Ch# 251 Pwr Step: burst 1 and 2=5 ota Antenna Position: INTERNAL
Type of Modulation: 850 GSM Battery Model #: SNN5696A
Accessory Model # = pouch (SYN1066A)
wishbone (SYN8631A) (GPRS) (BLUETOOTH class 1)
R4 - Amy Twin Phantom Rev.4 (22Aug02) Phantom; section 1 Section; Position: (0°,0°); Frequency: 849 MHz
Probe: ET3DV6 - SN1514 - FCC Body.2; ConvF(6.10,6.10,6.10); Crest factor: 4.0; 835 MHz Head & Body: σ = 0.97 mho/m ε_r = 53.2 ρ = 1.00 g/cm^3
Cube 7x7x7: SAR (1g): 0.887 mW/g, SAR (10g): 0.620 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Penetration depth: 15.5 (14.8, 16.3) [mm]
Powerdrift: -0.28 dB



LRZ0420029

Ch# 661Pwr Step: burst 1 and 2=0 ota   Antenna Position: INTERNAL
Type of Modulation: 1900 GSM   Battery Model #: SNN5696A
Accessory Model # = pouch (SYN1066A)
universal (SYN8763B)   (GPRS) (BLUETOOTH class 1)
R4 - Amy Twin Phantom Rev.4 (22Aug02) Phantom; section 2 Section; Position: (0°,0°); Frequency: 1880 MHz
Probe: ET3DV6 - SN1514 - FCC Body.2; ConvF(4.70,4.70,4.70); Crest factor: 4.0; 1880 MHz Head & Body: σ = 1.59 mho/m ε_r = 52.3 ρ = 1.00 g/cm^3
Cube 7x7x7: SAR (1g): 0.114 mW/g, SAR (10g): 0.0682 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Penetration depth: 9.7 (8.7, 11.3) [mm]
Powerdrift: -0.68 dB



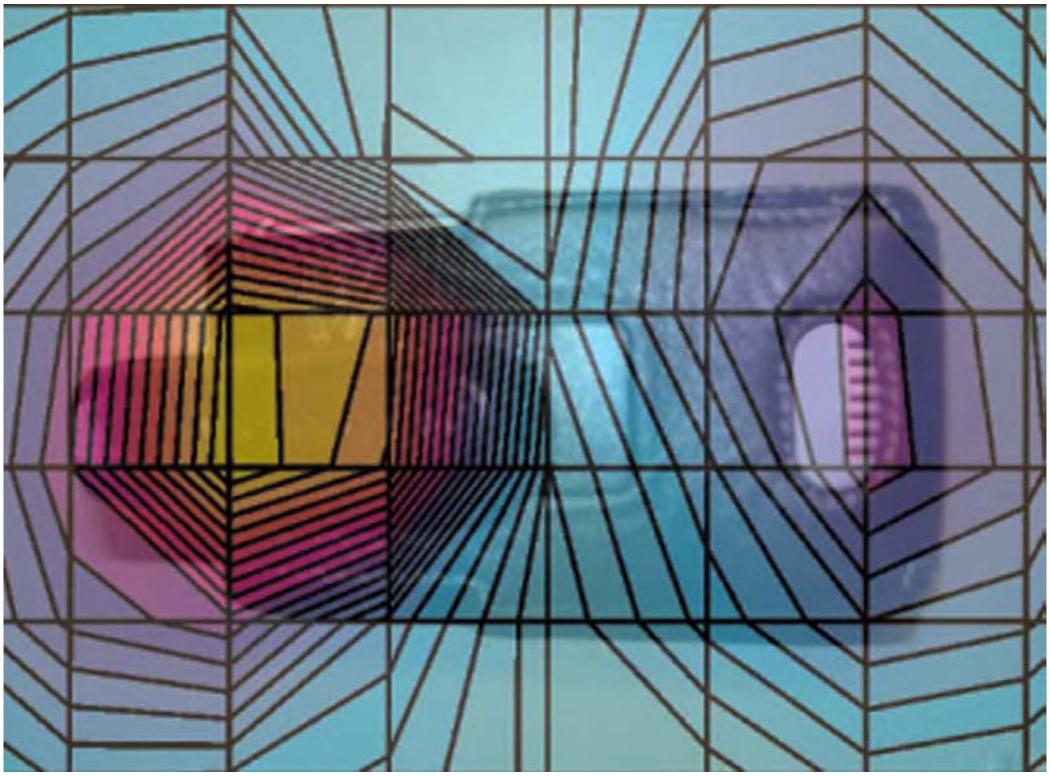


Figure 9.Typical Bluetooth Body Worn Contour Overlaid on Phone

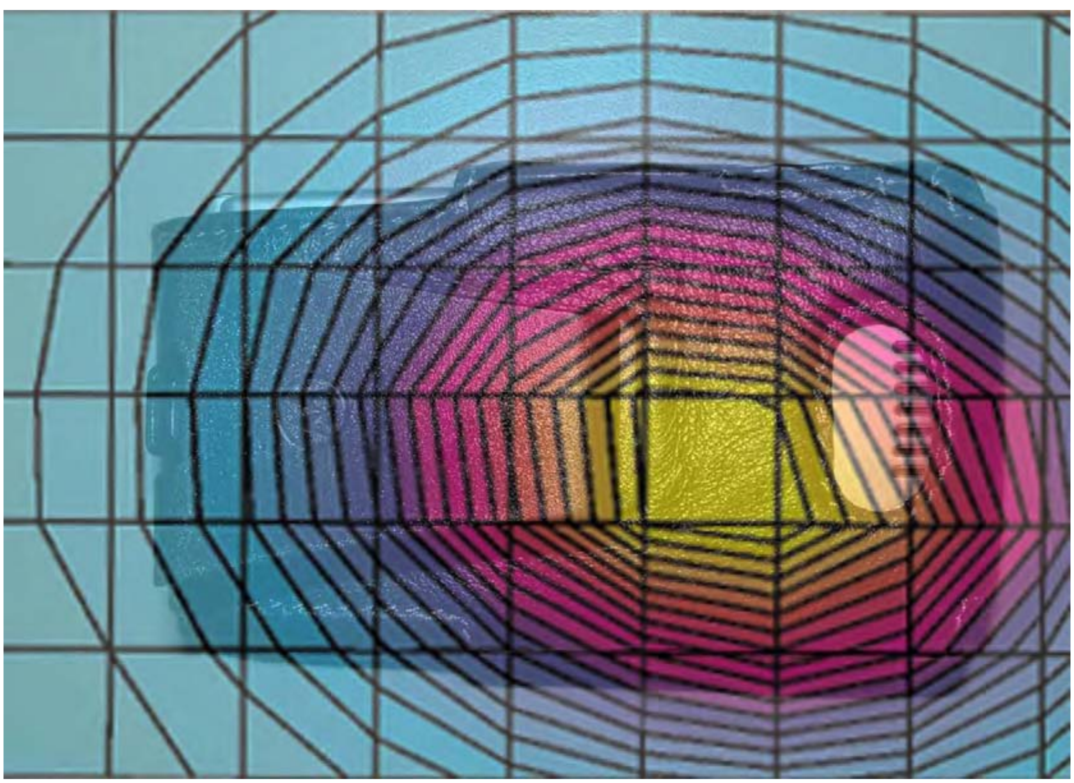


Figure 10.Typical 850 GSM with Bluetooth enabled Body Worn Contour Overlaid on Phone

Figure 11.Typical 1900 GSM with Bluetooth enabled Body Worn Contour Overlaid on Phone

Appendix 4

Probe Calibration Certificate

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

Client Motorola MRO

CALIBRATION CERTIFICATE

Object(s)	ET3DV6 - SN:1514
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	July 31, 2003
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05
Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (Agilent, No. 20020918)	Sep-03
Power meter EPM E4419B	GB41293874	2-Apr-03 (METAS, No 252-0250)	Apr-04
Network Analyzer HP 8753E	US37390585	18-Oct-01 (Agilent, No. 24BR1033101)	In house check: Oct 03
Fluke Process Calibrator Type 702	SN: 6295803	3-Sep-01 (ELCAL, No.2360)	Sep-03

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Technician	N. Vetterli
Approved by:	Katja Pokovic	Laboratory Director	

Date issued: July 31, 2003

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

Schmid & Partner Engineering AG
s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Probe ET3DV6

SN:1514

Manufactured:	November 24, 1999
Last calibration:	July 25, 2002
Recalibrated:	July 31, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1514

Sensitivity in Free Space

NormX	**1.70**	$\mu V/(V/m)^2$
NormY	**1.86**	$\mu V/(V/m)^2$
NormZ	**1.79**	$\mu V/(V/m)^2$

Diode Compression

DCP X	**93**	mV
DCP Y	**93**	mV
DCP Z	**93**	mV

Sensitivity in Tissue Simulating Liquid

Head 900 MHz ε_r = 41.5 ± 5% σ = 0.97 ± 5% mho/m

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**6.3**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**6.3**	± 9.5% (k=2)	Alpha	**0.58**
ConvF Z	**6.3**	± 9.5% (k=2)	Depth	**1.95**

Head 1800 MHz ε_r = 40.0 ± 5% σ = 1.40 ± 5% mho/m

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**5.1**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**5.1**	± 9.5% (k=2)	Alpha	**0.55**
ConvF Z	**5.1**	± 9.5% (k=2)	Depth	**2.48**

Boundary Effect

Head 900 MHz Typical SAR gradient: 5 % per mm

Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	9.7	5.1
SAR_{be} [%]	With Correction Algorithm	0.2	0.4

Head 1800 MHz Typical SAR gradient: 10 % per mm

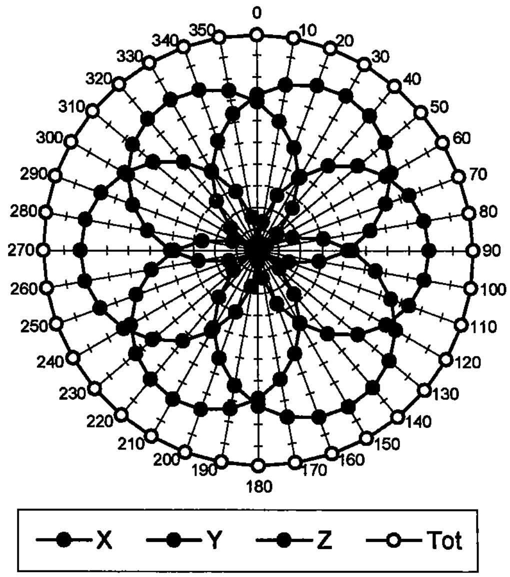
Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	13.9	9.0
SAR_{be} [%]	With Correction Algorithm	0.1	0.0

Sensor Offset

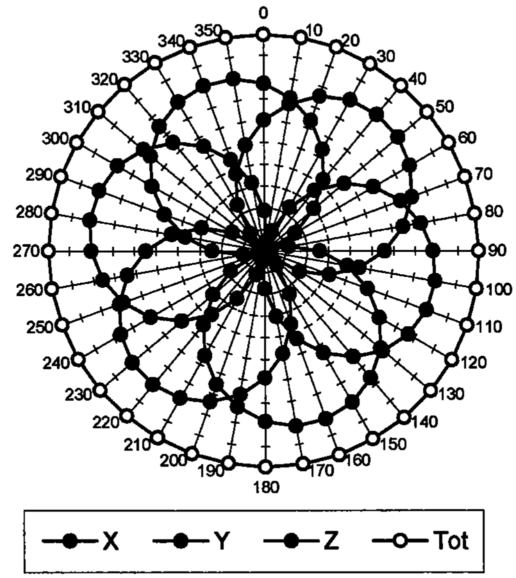
Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**0.8 ± 0.2**	mm

Receiving Pattern (ϕ, θ = 0°

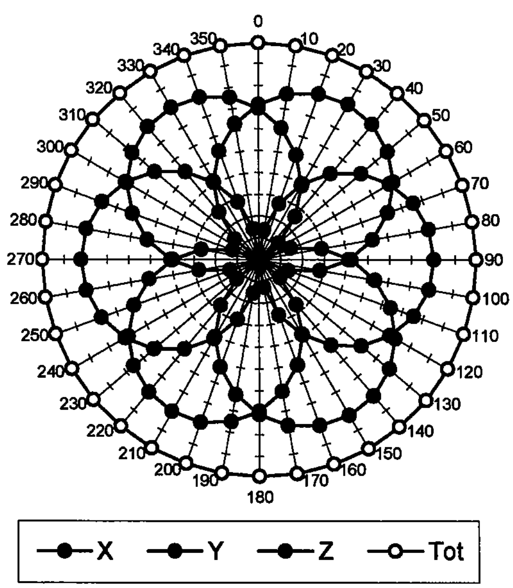
f = 30 MHz, TEM cell ifi110



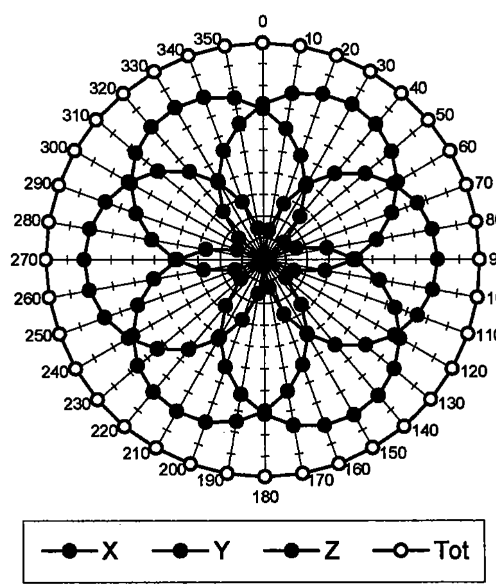
f = 100 MHz, TEM cell ifi110

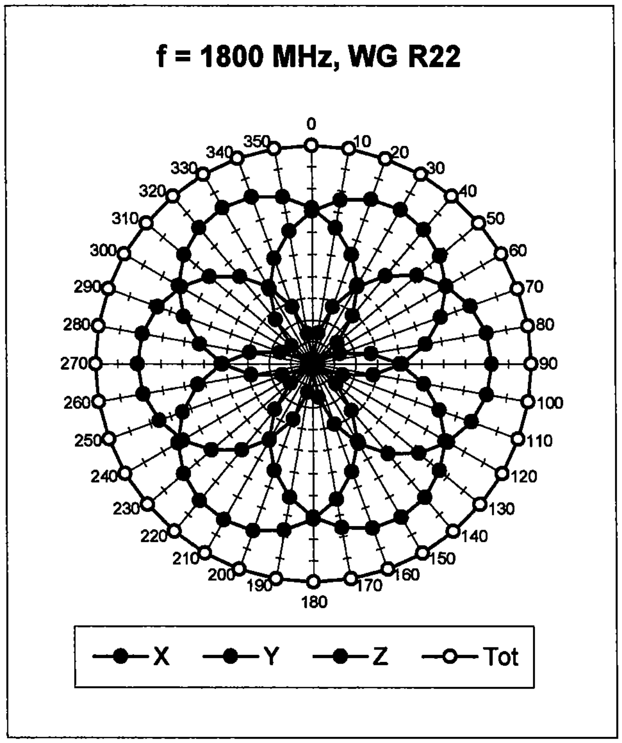


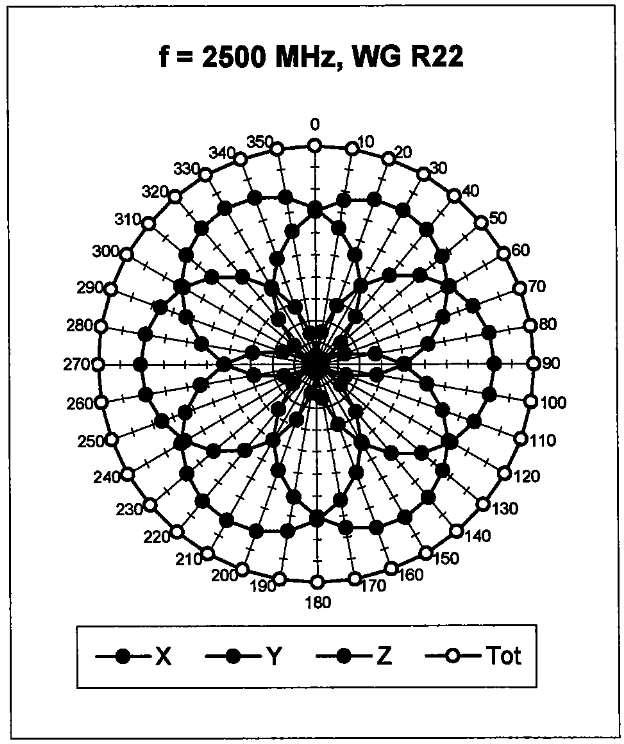
f = 300 MHz, TEM cell ifi110



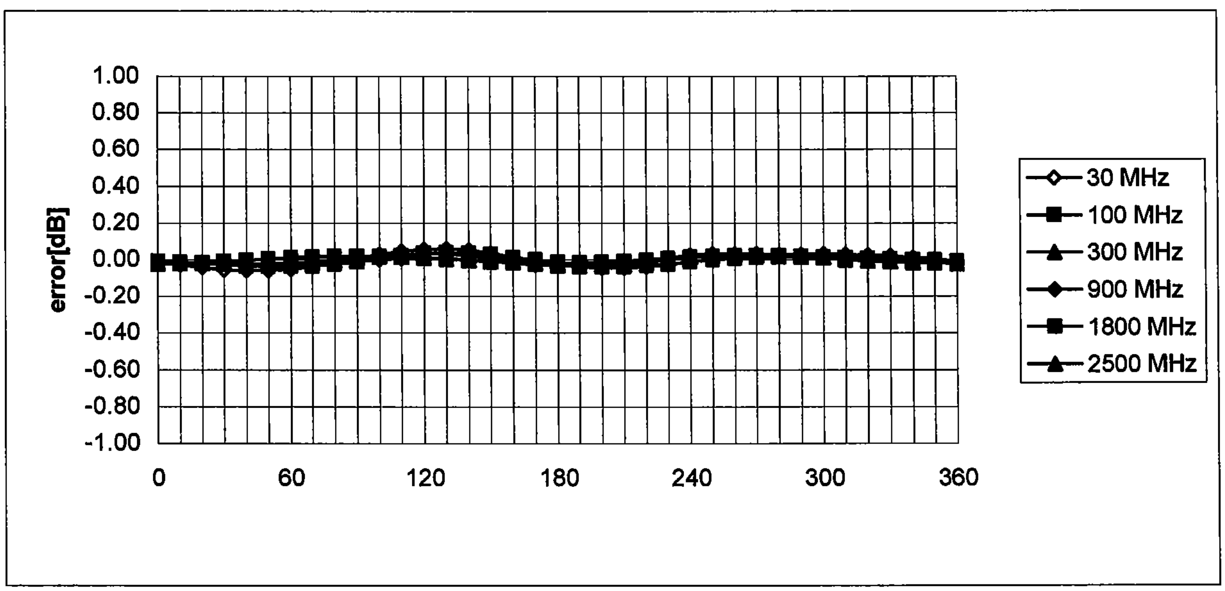
f = 900 MHz, TEM cell ifi110





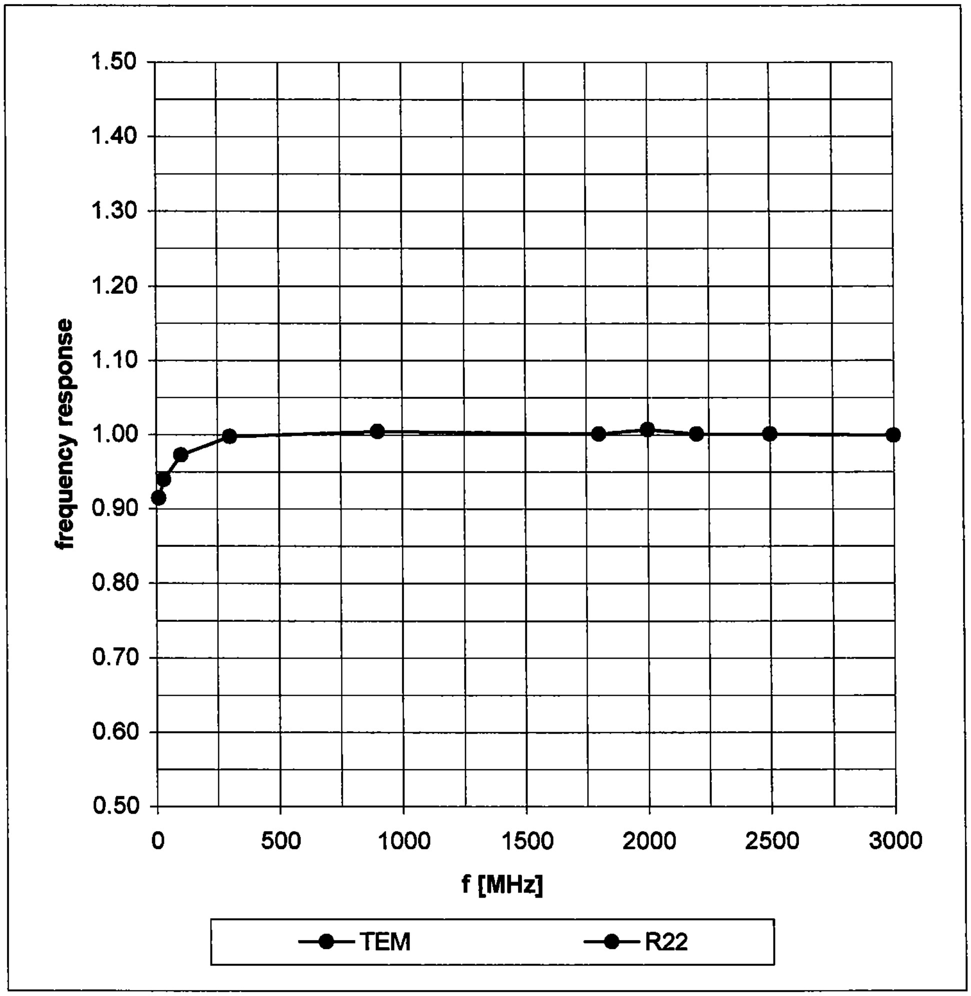


Isotropy Error (ϕ), θ = 0°



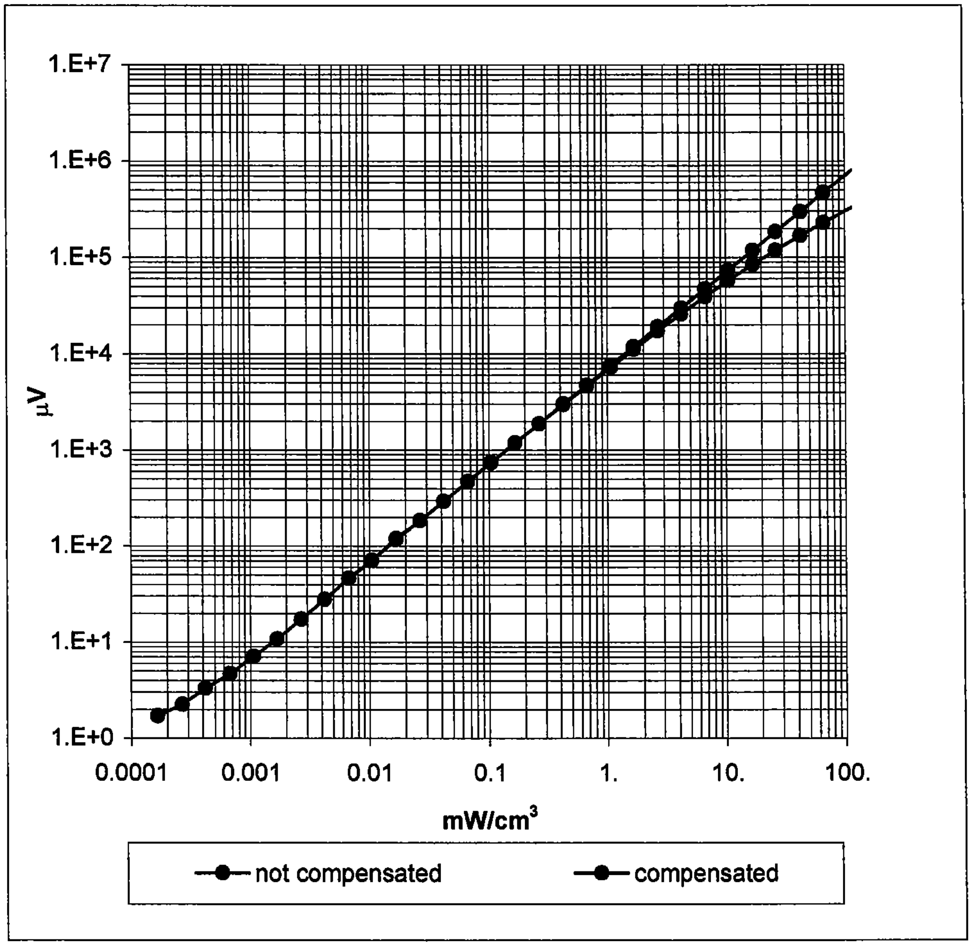
Frequency Response of E-Field

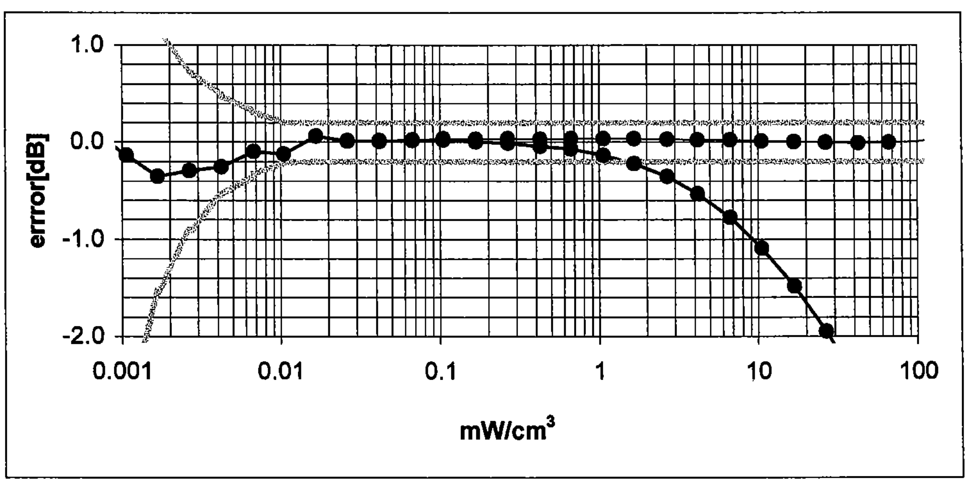
(TEM-Cell:ifi110, Waveguide R22)



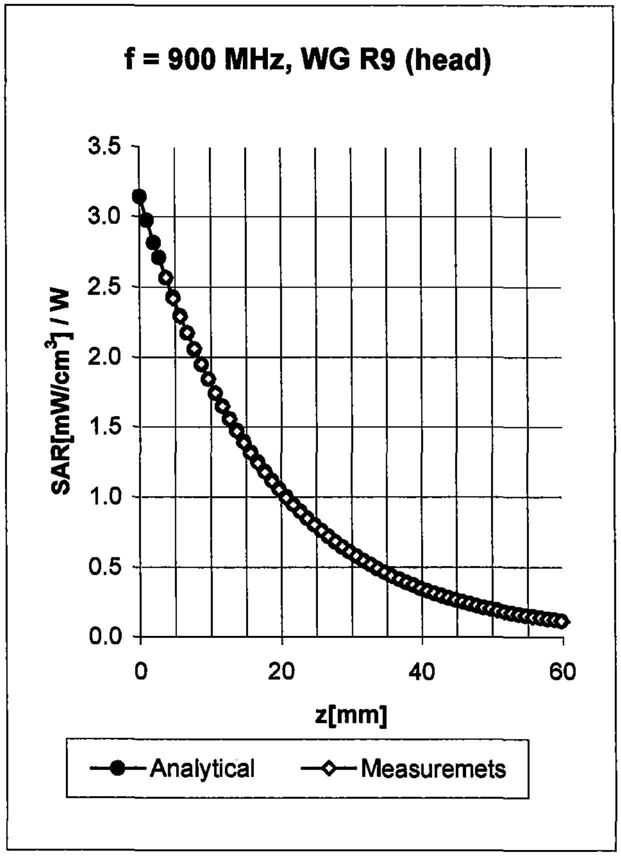
Dynamic Range f(SAR_{brain})

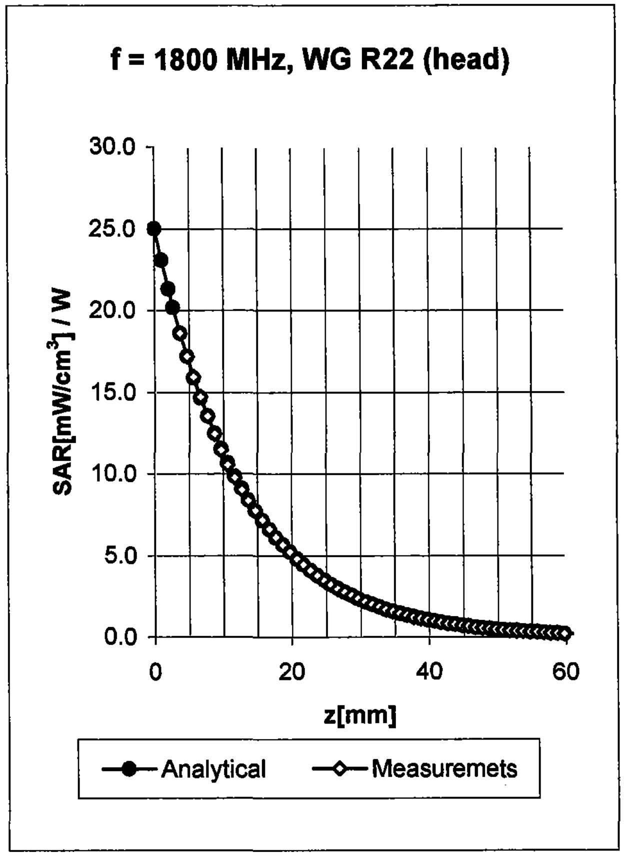
(Waveguide R22)





Conversion Factor Assessment





Head	900 MHz	ε_r = 41.5 ± 5%	σ = 0.97 ± 5% mho/m

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

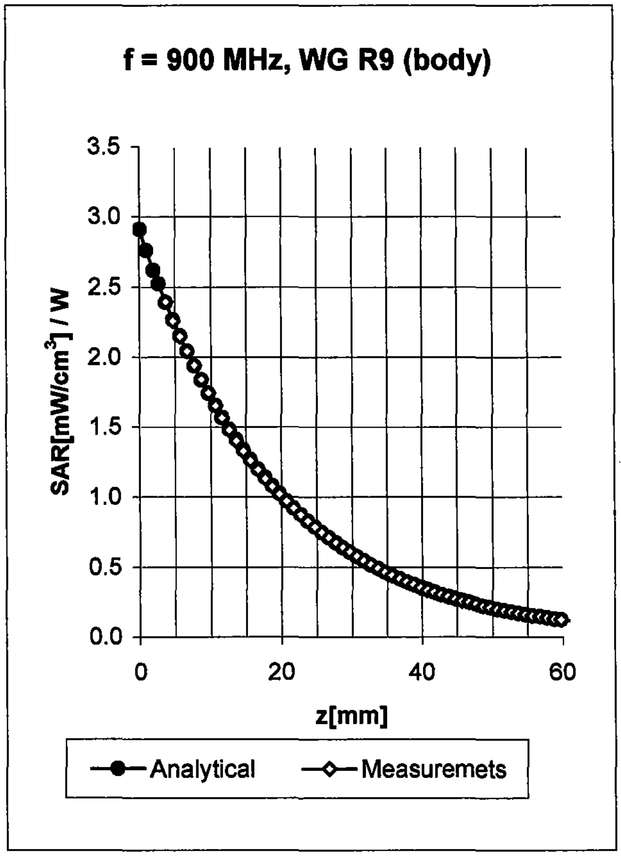
ConvF X	**6.3** ± 9.5% (k=2)		Boundary effect:	
ConvF Y	**6.3** ± 9.5% (k=2)		Alpha	**0.58**
ConvF Z	**6.3** ± 9.5% (k=2)		Depth	**1.95**

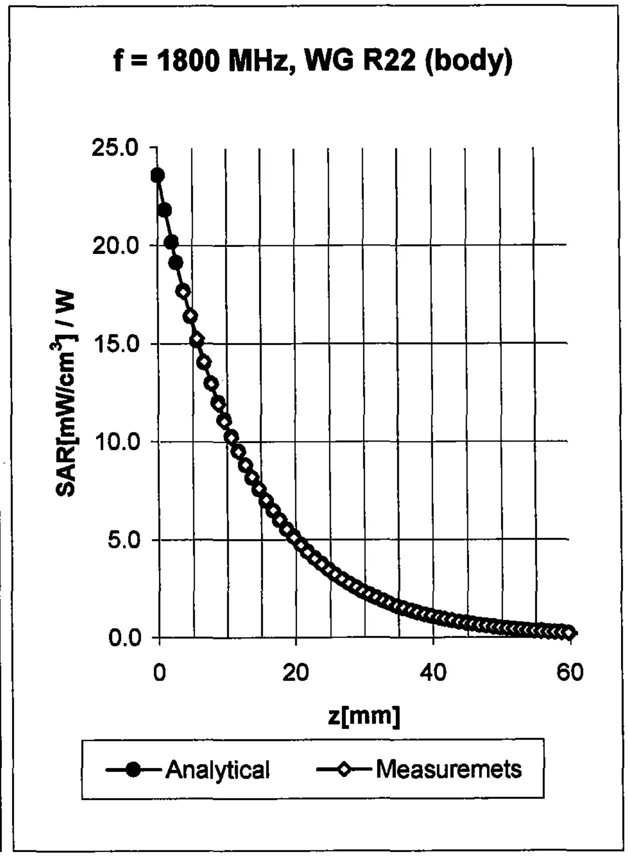
Head	1800 MHz	ε_r = 40.0 ± 5%	σ = 1.40 ± 5% mho/m

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**5.1** ± 9.5% (k=2)		Boundary effect:	
ConvF Y	**5.1** ± 9.5% (k=2)		Alpha	**0.55**
ConvF Z	**5.1** ± 9.5% (k=2)		Depth	**2.48**

Conversion Factor Assessment





Body **900 MHz** ε_r **= 55.0 ± 5%** σ **= 1.05 ± 5% mho/m**

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to OET 65 Suppl. C

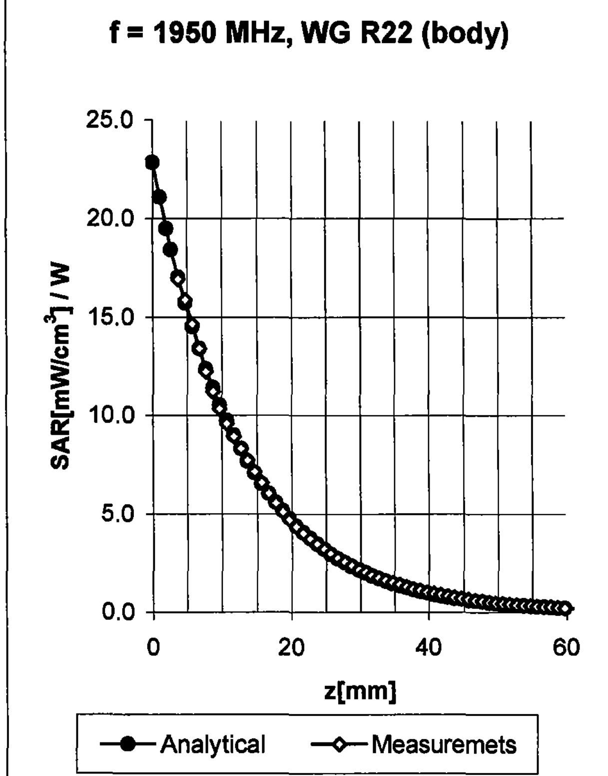
ConvF X	**6.1**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**6.1**	± 9.5% (k=2)	Alpha	**0.51**
ConvF Z	**6.1**	± 9.5% (k=2)	Depth	**2.18**

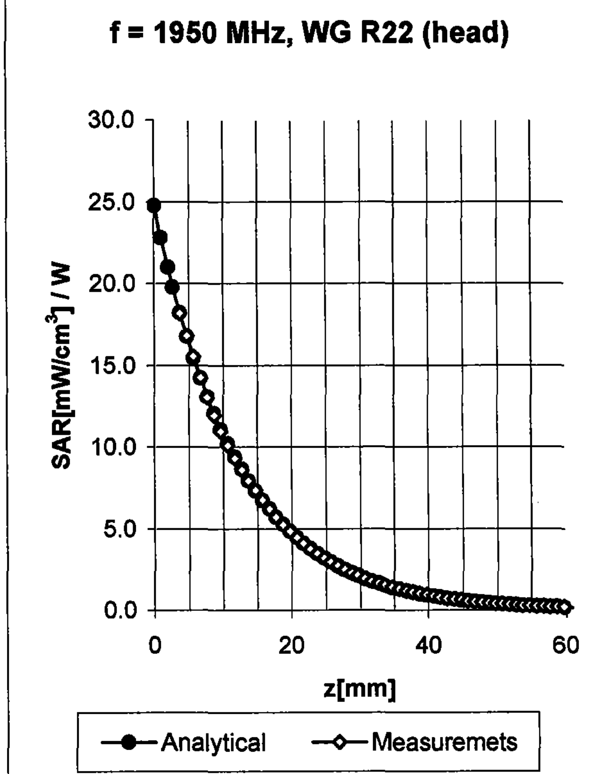
Body **1800 MHz** ε_r **= 53.3 ± 5%** σ **= 1.52 ± 5% mho/m**

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**4.7**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**4.7**	± 9.5% (k=2)	Alpha	**0.57**
ConvF Z	**4.7**	± 9.5% (k=2)	Depth	**2.85**

Conversion Factor Assessment

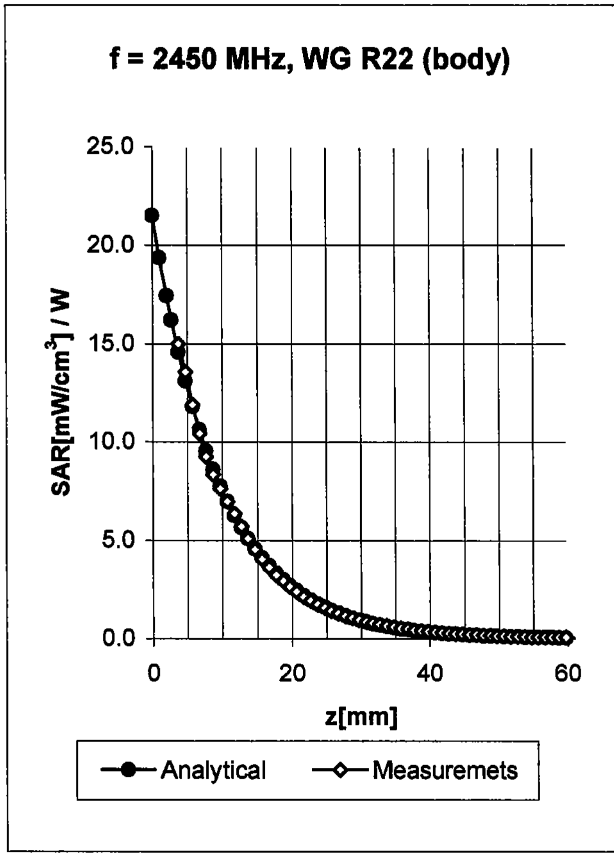


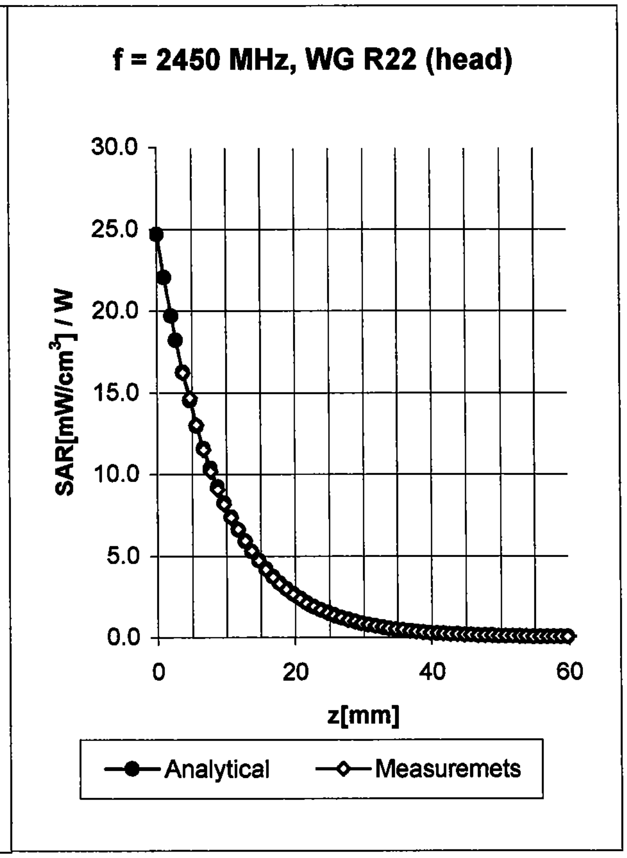


Body	**1950 MHz**	ε_r **= 53.3 ± 5%**	σ **= 1.52 ± 5% mho/m**	
	ConvF X	**4.5** ± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**4.5** ± 9.5% (k=2)	Alpha	**0.80**
	ConvF Z	**4.5** ± 9.5% (k=2)	Depth	**2.23**

Head	**1950 MHz**	ε_r **= 40.0 ± 5%**	σ **= 1.40 ± 5% mho/m**	
	ConvF X	**5.0** ± 8.9% (k=2)	Boundary effect:	
	ConvF Y	**5.0** ± 8.9% (k=2)	Alpha	**0.60**
	ConvF Z	**5.0** ± 8.9% (k=2)	Depth	**2.44**

Conversion Factor Assessment





Body **2450 MHz** ε_r **= 52.7 ± 5%** σ **= 1.95 ± 5% mho/m**

Valid for f=2400-2500 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**4.4** ± 8.9% (k=2)		Boundary effect:	
ConvF Y	**4.4** ± 8.9% (k=2)		Alpha	**1.55**
ConvF Z	**4.4** ± 8.9% (k=2)		Depth	**1.45**

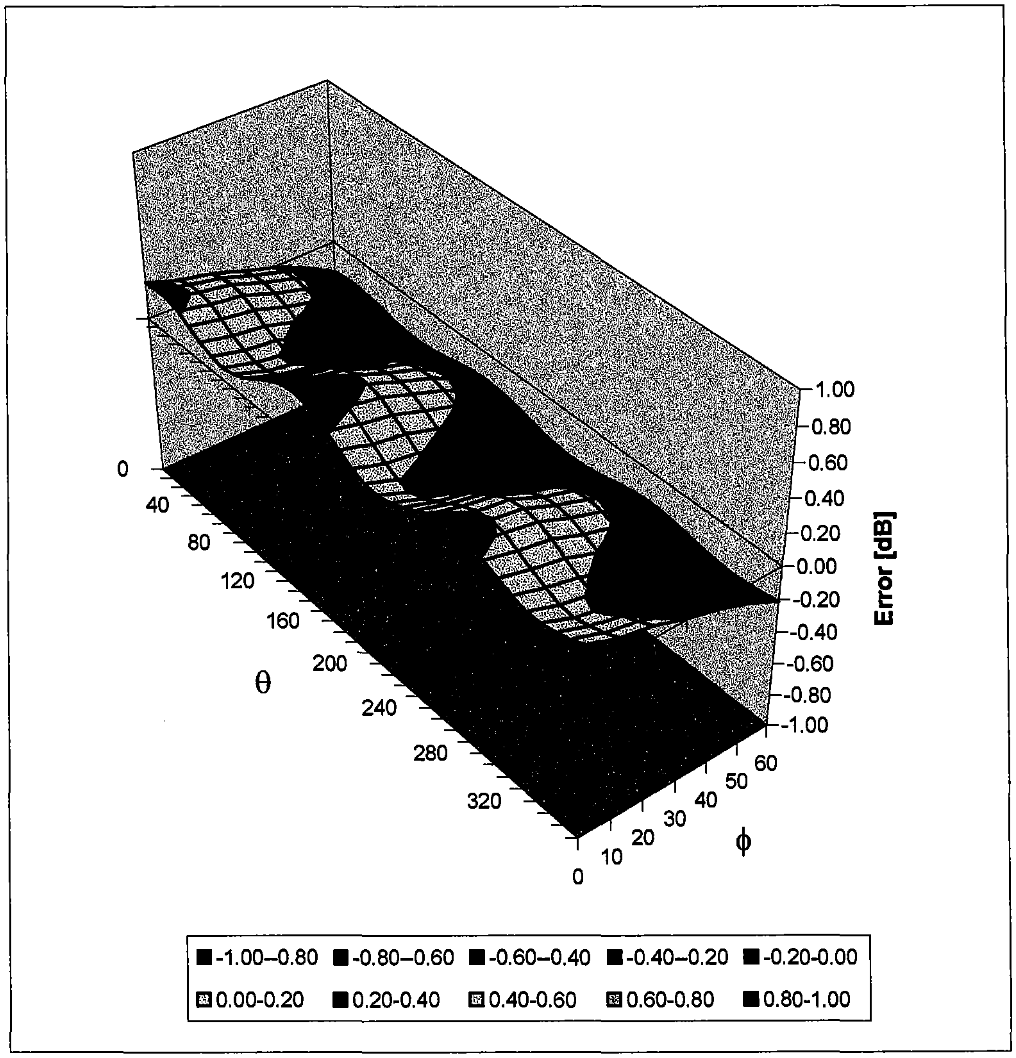
Head **2450 MHz** ε_r **= 39.2 ± 5%** σ **= 1.80 ± 5% mho/m**

Valid for f=2400-2500 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**4.7** ± 8.9% (k=2)		Boundary effect:	
ConvF Y	**4.7** ± 8.9% (k=2)		Alpha	**1.24**
ConvF Z	**4.7** ± 8.9% (k=2)		Depth	**1.67**

Deviation from Isotropy in HSL

Error (θϕ), f = 900 MHz



Appendix 5

Dipole Characterization Certificate

Certification of System Performance Check Targets
Based on APP-0396

-Historical Data-

	835MHz	900MHz	1800MHz	1900MHz	
IEEE1528 Target: Advanced Extrapolation	9.5	10.8	38.1	39.7	**(W/kg)**
Measurement Uncertainty (k=1):	9.0%	9.0%	9.0%	9.0%	
Measurement Period:	*1-July-03 to 1-Apr-04*	*1-July-03 to 1-Apr-04*	*1-July-03 to 1-Apr-04*	*1-July-03 to 1-Apr-04*	
# of tests performed:	214	1148	1135	62	
Grand Average: Worst Case Extrapolation	10.0	11.4	40.7	42.0	**(W/kg)**
% Delta (Average - IEEE1528 Target)	5.3%	5.6%	6.8%	5.8%	
Is % Delta <= Measurement Uncertainty?	**Yes**	**Yes**	**Yes**	**Yes**	
Accept/Reject Average as new system performance check target?	**ACCEPT**	**ACCEPT**	**ACCEPT**	**ACCEPT**	
	Applicable 835MHz Dipole Serial Numbers:	**Applicable 900MHz Dipole Serial Numbers:**	**Applicable 1800MHz Dipole Serial Numbers:**	**Applicable 1900Mhz Dipole Serial Numbers:**	
	420(TR), 421(TR)	77, 78	246(TR), 250(TR)	514(TR), 518(TR)	
	422(TR), 423(TR)	79, 80	251(TR), 258(TR)	519(TR), 520(TR)	
	424(TR), 425(TR)	91, 92	259(TR), 262(TR)	523(TR), 524(TR)	
	431(TR), 432(TR)	93, 94	263(TR), 271(TR)	526(TR), 527(TR)	
	433(TR), 434(TR)	95, 96	272(TR), 273(TR)	528(TR), 529(TR)	
	436(TR)	97, 55	276(TR), 277(TR)	530(TR), 533(TR)	
			279(TR), 280(TR)		
			281(TR), 282(TR)		
			283(TR), 284(TR)		

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

Frequency	SAR Target (W/kg)	Permittivity	Conductivity (S/m)
835MHz	**10.0**	41.5 ± 5%	0.90 ± 5%
900MHz	**11.4**	41.5 ± 5%	0.97 ± 5%
1800MHz	**40.7**	40.0 ± 5%	1.40 ± 5%
1900MHz	**42.0**	40.0 ± 5%	1.40 ± 5%

-Approvals-

Submitted by: Marge Kaunas Date: 2-Apr-04

Signed:

Comments: Spreadsheet detailing all historical measurements available upon request.

Approved by: Mark Douglas **Date:** 2-Apr-04

Signed:

Comments: Targets and associated simulant properties are derived from the IEEE 1528 standard.

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

Client Motorola MRO

CALIBRATION CERTIFICATE

Object(s)	D2450V2 - SN:740
Calibration procedure(s)	QA CAL-05 v2 Calibration procedure for dipole validation kits
Calibration date:	January 16, 2004
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM E442	GB37480704	6-Nov-03 (METAS, No. 252-0254)	Nov-04
Power sensor HP 8481A	US37292783	6-Nov-03 (METAS, No. 252-0254)	Nov-04
Power sensor HP 8481A	MY41092317	18-Oct-02 (Agilent, No. 20021018)	Oct-04
RF generator R&S SML-03	100698	27-Mar-2002 (R&S, No. 20-92389)	In house check: Mar-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-03)	In house check: Oct 05

	Name	Function	Signature
Calibrated by:	Judith Mueller	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

Date issued: January 19, 2004

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

Schmid & Partner Engineering AG

s p e a g

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info@speag.com, http://www.speag.com

DASY

Dipole Validation Kit

Type: D2450V2

Serial: 740

Manufactured: September 18, 2003
Calibrated: January 16, 2004

1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with **head simulating solution** of the following electrical parameters at 2450 MHz:

Relative Dielectricity	**38.4**	± 5%
Conductivity	**1.86 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ES3DV2 (SN:3013, Conversion factor 4.8 at 2450 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. The included distance spacer was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 7x7x7 fine cube was chosen for cube integration.
The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

2. SAR Measurement with DASY4 System

Standard SAR-measurements were performed according to the measurement conditions described in section 1. The results (see figure supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured with the dosimetric probe ES3DV2 SN:3013 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**57.6 mW/g** ± 16.8 % (k=2)[1]
averaged over 10 cm^3 (10 g) of tissue:	**26.0 mW/g** ± 16.2 % (k=2)[1]

[1] validation uncertainty

3. Dipole Impedance and Return Loss

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.161 ns**	(one direction)
Transmission factor:	**0.992**	(voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance spacer was in place during impedance measurements.

Feedpoint impedance at 2450 MHz:	Re{Z} = **52.5 Ω**
	Im {Z} = **4.8 Ω**
Return Loss at 2450 MHz	**-26.6 dB**

4. Handling

Do not apply excessive force to the dipole arms, because they might bend. Bending of the dipole arms stresses the soldered connections near the feedpoint leading to a damage of the dipole.

5. Design

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

Small end caps have been added to the dipole arms in order to improve matching when loaded according to the position as explained in Section 1. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

6. Power Test

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN740

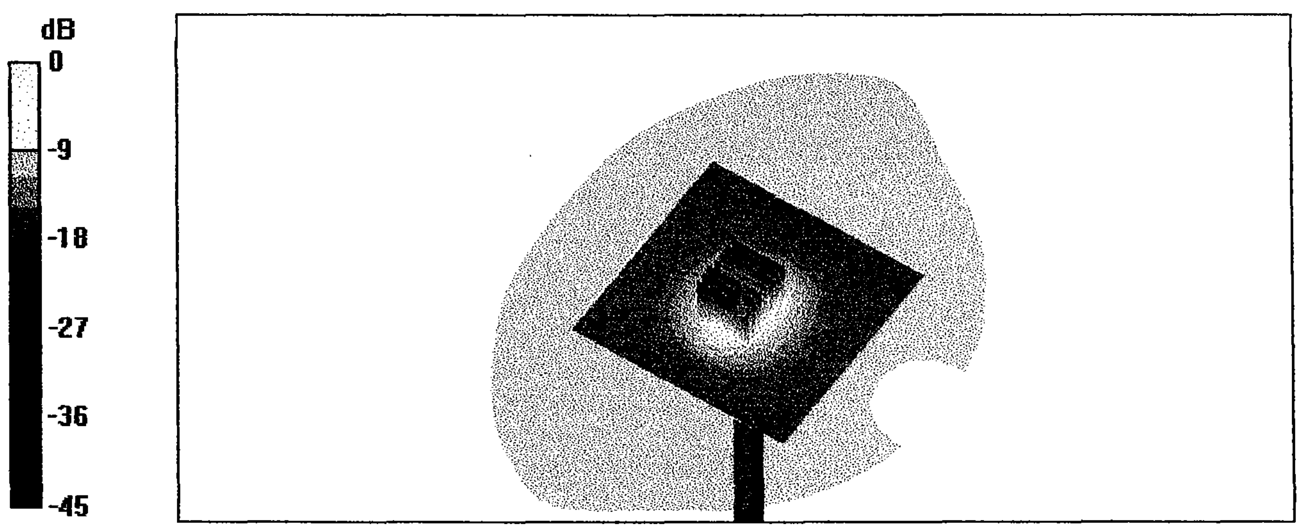
Communication System: CW-2450; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: HSL 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.86 mho/m; ε_r = 38.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

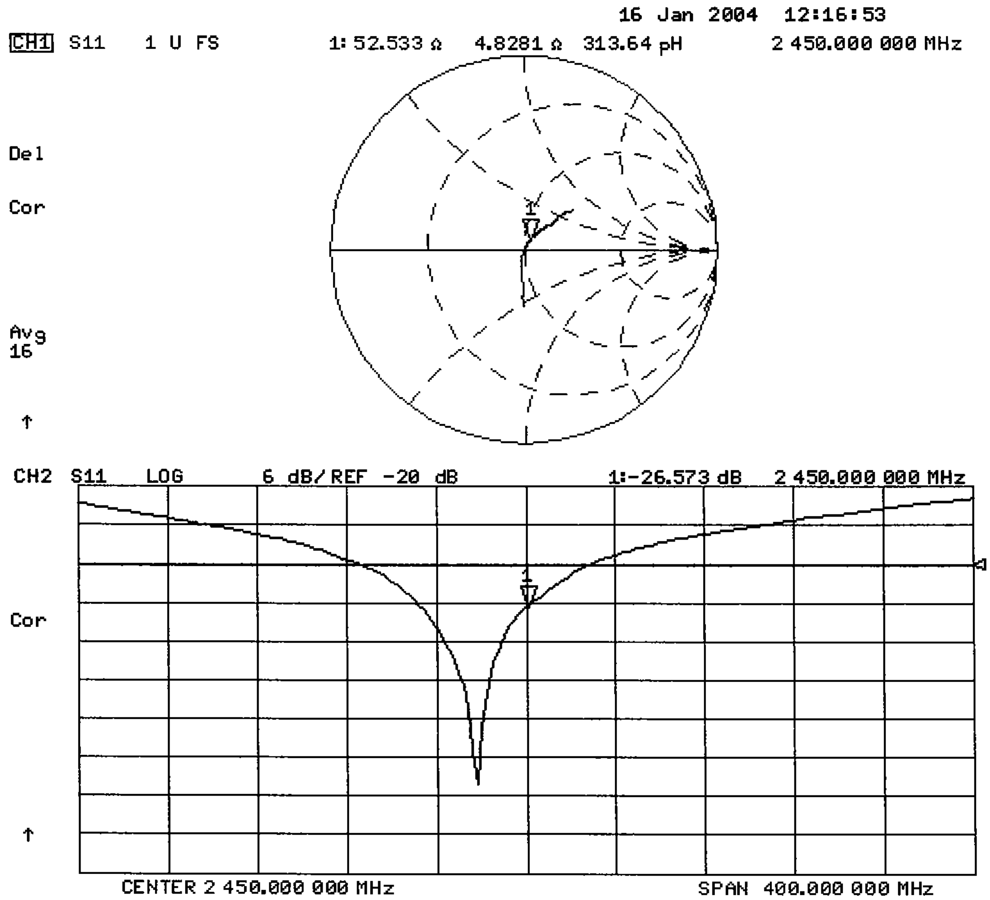
- Probe: ES3DV2 - SN3013; ConvF(4.8, 4.8, 4.8); Calibrated: 1/19/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN411; Calibrated: 1/16/2003
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006
- Measurement SW: DASY4, V4.2 Build 12; Postprocessing SW: SEMCAD, V1.8 Build 93

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 93.1 V/m
Power Drift = -0.005 dB
Maximum value of SAR = 16.6 mW/g

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 32.2 W/kg
SAR(1 g) = 14.4 mW/g; SAR(10 g) = 6.5 mW/g
Reference Value = 93.1 V/m
Power Drift = -0.005 dB
Maximum value of SAR = 16 mW/g



0 dB = 16mW/g


16 Jan 2004 12:16:53
CH1 S11 1 U FS
1: 52.533 Ω 4.8281 Ω 313.64 pH
2 450.000 000 MHz
Del
Cor
Avg
16
CH2 S11 LOG
6 dB/ REF -20 dB
1:-26.573 dB 2 450.000 000 MHz
Cor
CENTER 2 450.000 000 MHz
SPAN 400.000 000 MHz

Appendix 6

Measurement Uncertainty Budget

Uncertainty Budget for Device Under Test

a	b	c	d	e = f(d,k)	f	g	h = c x f / e	i = c x g / e	k
Uncertainty Component	Sec.	**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	9.5	N	2.00	1	1	4.8	4.8	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	5.8	R	1.73	1	1	3.3	3.3	∞
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	1.0	N	1.00	1	1	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1	1	0.5	0.5	∞
Integration Time	E.2.8	1.3	R	1.73	1	1	0.8	0.8	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.3	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	1.1	R	1.73	1	1	0.6	0.6	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	3.9	R	1.73	1	1	2.3	2.3	∞
Test sample Related									
Test Sample Positioning	E.4.2	3.6	N	1.00	1	1	3.6	3.6	29
Device Holder Uncertainty	E.4.1	2.8	N	1.00	1	1	2.8	2.8	8
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	10.0	R	1.73	0.64	0.43	3.7	2.5	∞
Liquid Permittivity - deviation from target values	E.3.2	10.0	R	1.73	0.6	0.49	3.5	2.8	∞
Liquid Permittivity - measurement uncertainty	E.3.3	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Combined Standard Uncertainty			RSS				11.72	11.09	1363
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k =2				22.98	21.75	

Uncertainty Budget for System Performance Check (dipole & flat phantom)

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	Sec.	**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	9.5	N	2.00	1	1	4.8	4.8	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0	0	0.0	0.0	∞
Boundary Effect	E.2.3	5.8	R	1.73	1	1	3.3	3.3	∞
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	1.0	N	1.00	1	1	1.0	1.0	∞
Response Time	E.2.7	0.0	R	1.73	1	1	0.0	0.0	∞
Integration Time	E.2.8	0.0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.3	R	1.73	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	E.6.3	1.1	R	1.73	1	1	0.6	0.6	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5	3.9	R	1.73	1	1	2.3	2.3	∞
Dipole									
Dipole Axis to Liquid Distance	8, E.4.2	1.0	R	1.73	1	1	0.6	0.6	∞
Input Power and SAR Drift Measurement	8, 6.6.2	4.7	R	1.73	1	1	2.7	2.7	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	10.0	R	1.73	0.64	0.43	3.7	2.5	∞
Liquid Permittivity - deviation from target values	E.3.2	10.0	R	1.73	0.6	0.49	3.5	2.8	∞
Liquid Permittivity - measurement uncertainty	E.3.3	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Combined Standard Uncertainty			RSS				10.16	9.43	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				19.92	18.48	