ITS Intertek Testing Services

Specific Absorption Rate (SAR) Evaluation

Performed on the

Handheld cellular phone
Model: ISIS TCA620-1B
for
Philips Consumer Communications

FCC rule part 2.1093

Date of Test: May 15, 1998

Job #: J98014902

Total No. of Pages Contained in this Report: 15 + data pages

FCC SAR and ANSI C63.4-1992, Rev. 6/97

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ITS Intertek Testing Services

VERIFICATION OF COMPLIANCE
Report No. J98014902

Verification is hereby issued to the named APPLICANT and is VALID ONLY for the equipment tested hereon for use under the rules and regulations listed below

Equipment Under Test (EUT):	Handheld AMPS/NAMPS cellular phone
Trade Name:	ISIS
Model No.:	TCA620-1B
Serial No.:	Not labeled
FCC ID:	NRMTCA620-1B
Applicant:	Philips Consumer Communications
Contact:	Yaron Oren-Pines
Address:	5 Wood Hollow Road, Parsippany, NJ 07054
Tel. number:	(973) 581-4900
Fax. number:	(973) 581-5431
Applicable Regulation:	FCC rule part 2.1093, FCC Docket 96-326 & Supplement C to OET Bulletion 65
Exposure Class:	General Population/Uncontrolled Exposure
Test Site Location:	Intertek Testing Services 1365 Adams Court Menlo Park, CA 94025, USA
Date of Test:	May 15, 1998

Based on the test results, the tested sample was found to be in compliance with the FCC requirements for Human Exposure to Radiofrequency Emissions.

We attest to the accuracy of this report:

C. K. Li
Engineering Manager

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1.0 INTRODUCTION

This measurement report is designed to show compliance with the FCC part 2.1093, ET Docket 96-326 Rules for mobile and portable devices. The test procedures, as described in American National Standards Institute C95.1-1992[1] and FCC OET Bulletin 65-1997[2], were employed. A description of the product and operating configuration, the various provisions of the rules, the methods for determining compliance, and a detailed summary of the results are included within this test report.

2.0 DESCRIPTION OF EQUIPMENT

Equipment	Handheld AMPS/NAMP cellular phone		
Trade Name	ISIS	**Model No.**	TCA620-1B
FCC ID	NRMTCA620-1B	**S/N No.**	Not labeled
Category	Portable	**RF Exposure**	Uncontrolled Environment
Frequency Band (uplink)	825-850 MHz	**System**	AMPS NAMPS

EUT Antenna Description			
Type	Monopole	**Configuration**	Retractable
Dimensions	92 (L), 1(ϕ) mm	**Gain**	0 dBi
Location	Right, Top		

A Pre-Production version of the sample was provided by Philips Consumer Communications and received on May 15, 1998 in good working condition.

3.0 TEST SUMMARY

The maximum spatial peak SAR value averaged over 1g of tissue found in all tested configurations was:

Measurement Summary					
SAR_{1g} (mW/g)	Measured Antenna Output Power (dbm)	Antenna	Usage	FCC Limits (mW/g)	Results
1.45	26.5	Extended	Right-hand	1.6	Pass*

* *worst case uncertainty not included*

4.0 SYSTEM TEST CONFIGURATION

4.1 Support Equipment

None, the device was tested as a standalone unit

4.2 Block Diagram of Test Setup

Not applicable.

* = EUT ** = No ferrites on video cable	S = Shielded; U = Unshielded	F = With Ferrite

4.3 Test Position

The EUT was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in C95.1 (1992) and OET 65 (1997). The EUT was placed in the intended use position, i.e. CENELEC 80° position. This position is defined by a reference plane and a line. The reference plane of the head is given by three points, the auditory canal opening of both ears and center of the closed mouth. The reference line of the EUT is defined by the line which connects the center of the ear piece with the center of the bottom of the case and lies on the surface of the case facing the phantom. The reference line of the EUT lies in the reference plane of the head. The center of the ear piece of the EUT is place at the entry of the auditory canal. The angle between the reference line of the phone and the line connecting both auditory canal openings is 80°. Please refer to figure 1 below for the position details:

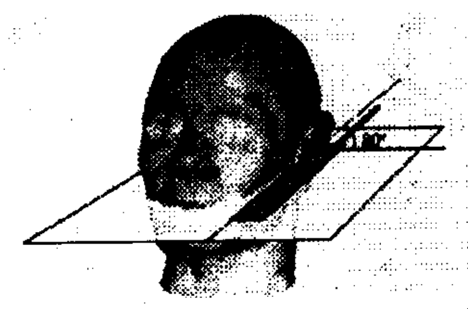


Figure 1: Intended use position

4.4 Test Condition

During tests, the worst case data (max. RF coupling) was determined with following conditions:

EUT Antenna	Extended and Retracted	Orientation	N/A
Usage	Right-Hand	Distance between antenna axis at the joint and the liquid surface:	16.8 mm
Simulating human hand	Not Used	EUT Battery	Fully Charged
Power output	Maximum (26.5 dBm)		

The spatial peak SAR values were accessed for lowest, middle and highest operating channels defined by the manufacturer.

Antenna conducted power measurement was performed, using Spectrum analyzer, before and after the SAR tests to ensure that the EUT operated at the highest power level.

4.5 Modifications Required for Compliance

The following modifications were installed during compliance testing in order to bring the product into compliance (Please note that this list does not include changes made specifically by Philips Consumer Communications prior to compliance testing):

No modifications were made to the EUT by Intertek Testing Services.

4.6 Additions, deviations and exclusions from standards

No additions, deviations or exclusions have been made from standard.

5.0 SAR EVALUATION

5.1 SAR Limits

The following FCC limits for SAR apply to devices operate in General Population/Uncontrolled Exposure environment:

EXPOSURE (General Population/Uncontrolled Exposure environment)	SAR (W/kg)
Average over the whole body	0.08
Spatial Peak (1g)	1.60
Spatial Peak for hands, wrists, feet and ankles (10g)	4.00

5.3 System Verification

Prior to the assessment, the system was verified to the ±5% of the specifications by using the system validation kit. The validation was performed at 900 MHz.

Validation kit	Targeted SAR_{1g} (mW/g)	Measured SAR_{1g} (mW/g)
D900V2, S/N #: 013	3.92	3.80

5.4 Evaluation Procedures

The SAR evaluation was performed with the following procedures:

a. SAR was measured at a fixed location above the ear point and used as a reference value for the assessing the power drop.

b. The SAR distribution at the exposed side of the head was measured at a distance of 4.3 mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 20 mm x 20 mm. Based on this data, the area of the maximum absorption was determined by spline interpolation.

c. Around this point, a volume of 32 mm x 32 mm x 34 mm was assessed by measuring 5 x 5 x 7 points. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure:

   I) The data at the surface were extrapolated, since the center of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measurement point is 1.6 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in Z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.

   ii) The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3-D spline interpolation algorithm. The 3-D spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y and z directions). The volume was integrated with the trapezoidal algorithm. 1000 points (10 x 10 x 10) were interpolated to calculate the average.

   iii) All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

d. Re-measurement of the SAR value at the same location as in step a. above. If the value changed by more than 5 %, the evaluation was repeated.

5.5 Test Results

The results on the following page(s) were obtained when the device was tested in the condition described in this report. Detail measurement data and plots which reveal information about the location of the maximum SAR with respect to the device, are reported in Appendix A.

Trade Name:	ISIS	Model No.:	TCA620-1B
Serial No.:	Not labeled	Test Engineer:	C. K. Li

TEST CONDITIONS			
Ambient Temperature	22.7 °C	Relative Humidity	38 %
Test Signal Source	Test Mode	Signal Modulation	CW
Output Power Before SAR Test	26.5	Output Power After SAR Test	26.5
Total Test Duration	60 Min.	Number of Battery Change	3

Left-Hand Usage

Channel	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{1g} (mW/g)
824 MHz	AMPS	1	Fully Retracted	1.43
		1	Fully Extended	1.41
837 MHz	AMPS	1	Fully Retracted	0.74
		1	Fully Extended	0.68
849 MHz	AMPS	1	Fully Retracted	0.83
		1	Fully Extended	0.76

Right-Hand Usage

Channel	Operating Mode	Duty Cycle ratio	Antenna Position	Measured SAR_{1g} (mW/g)
824 MHz	AMPS	1	Fully Retracted	1.43
		1	Fully Extended	1.45

Note: a) Both left and right hand usage positions were tested and the worst case data of right hand side were reported
b) Duty cycle factor included in the measured SAR data

6.0 TEST EQUIPMENT

6.1 Equipment List

The Specific Absorption Rate (SAR) tests were performed with the SPEAG model DASY 3 automated near-field scanning system which is package optimized for dosimetric evaluation of mobile radios [3]. The following major equipment/components were used for the SAR evaluations:

SAR Measurement System			
EQUIPMENT	**SPECIFICATIONS**	**S/N #**	**CAL. DATE**
Robot	**Stäubi RX60L** Repeatability: ± 0.025mm Resolution: 0.806×10^{-3} degree Number of Axes: 6	597412-01	N/A
E-Field Probe	**ET3DV5** Frequency Range: 10 MHz to 6 GHz Linearity: ± 0.2 dB Directivity: ± 0.1 dB in brain tissue	1333	01/14/98
Data Acquisition	**DAE3** Measurement Range: 1μV to >200mV Input offset Voltage: < 1μV (with auto zero) Input Resistance: 200 MΩ	317	N/A
Phantom	**Generic Twin V3.0** Type: Generic Twin, Homogenous Shell Material: Fiberglass Thickness: 2 ± 0.1 mm Capacity: 20 liter Ear spacer: ≈ 4 mm (between EUT ear piece and tissue simulating liquid)	N/A	N/A
Simulated Tissue	**Mixture** Please see section 6.2 for details	N/A	01/29/98
Power Meter	**HP 435A w/ 8481H sensor** Frequency Range: 100kHz to 18 GHz Power Range: 300μW to 3W	1312A01255	01/26/98

6.2 Brain Tissue Simulating Liquid

Ingredient	Frequency (900 MHz)
Water	40.3 %
Sugar	56.0 %
Salt	2.5 %
HEC	1.0 %
Bactericide	0.2 %

The dielectric parameters were verified prior to assessment using the HP 85070A dielectric probe kit and the HP 8753C network Analyzer. The dielectric parameters were:

Frequency (MHz)	ε_r *	σ *(mho/m)	ρ **(kg/m^3)
900	40.2 ± 5%	0.85 ± 10%	1000

* *worst case uncertainty of the HP 85070A dielectric probe kit*

** *worst case assumption*

6.3 E-Field Probe Calibration

Probes were calibrated by the manufacturer in the TEM cell ifi 110. To ensure consistency, a strict protocol was followed. The conversion factor (ConF) between this calibration and the measurement in the tissue simulation solution was performed by comparison with temperature measurement and computer simulations. Probe calibration factors are included in Appendix C.

6.4 Measurement Uncertainty

The total uncertainty for the evaluation of the spatial peak SAR values averaged over a cube of 1 g tissue mass has been assessed for this system to be less than ±20% [4]. This uncertainty includes probe, calibration, positioning and evaluation errors as well as errors in assessing the correct dielectric parameters for the brain simulating liquid, etc.

UNCERTAINTY BUDGET	
Source of Uncertainty	**Uncertainty (±%)**
Field Measurement Isotropy error in tissue-simulating liquid: < ±0.2dB Frequency response: < ±0.1dB Linearity: < ±0.2dB Data acquisition and evaluation: < ±0.05dB Probe calibration: < ±10% ELF and RF disturbance: < ±10μW/g	***13***
Spatial Peak Evaluation Extrapolation and interpolation error, and position error: < ±0.1dB Integration and maximum search routine: < ±0.1dB Inaccuracies in cube's shape: < ±0.2dB	***7***
Tissue Calibration HP85070 dielectric probe	***10***
Total (rss)	**17.8**

6.5 Measurement Traceability

All measurements described in this report are traceable to National Institute of Standards and Technology (NIST) standards or appropriate national standards..

7.0 WARNING LABEL INFORMATION - USA

Not Applicable

8.0 REFERENCES

[1] ANSI, *ANSI/IEEE C95.1-1991: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300 Ghz*, The Institute of Ecetrical and Electronics Engineers, Inc., New York, NY 10017, 1992

[2] Federal Communications Commission, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", OET Bulletin 65, FCC, Washington, D.C. 20554, 1997

[3] Thomas Schmid, Oliver Egger, and Niels Kuster, "Automated E-field scanning system for dosimetric assessments", *IEEE Transaction on Microwave Theory and Techniques*, vol. 44, pp. 105-113, Jan. 1996.

[4] Niels Kuster, Ralph Kastle, and Thomas Schmid, "Dosimetic evaluation of mobile communications equipment with know precision", IEICE Transactions on Communications, vol. E80-B, no. 5, pp.645-652, May 1997.

APPENDIX A - SAR Evaluation Data

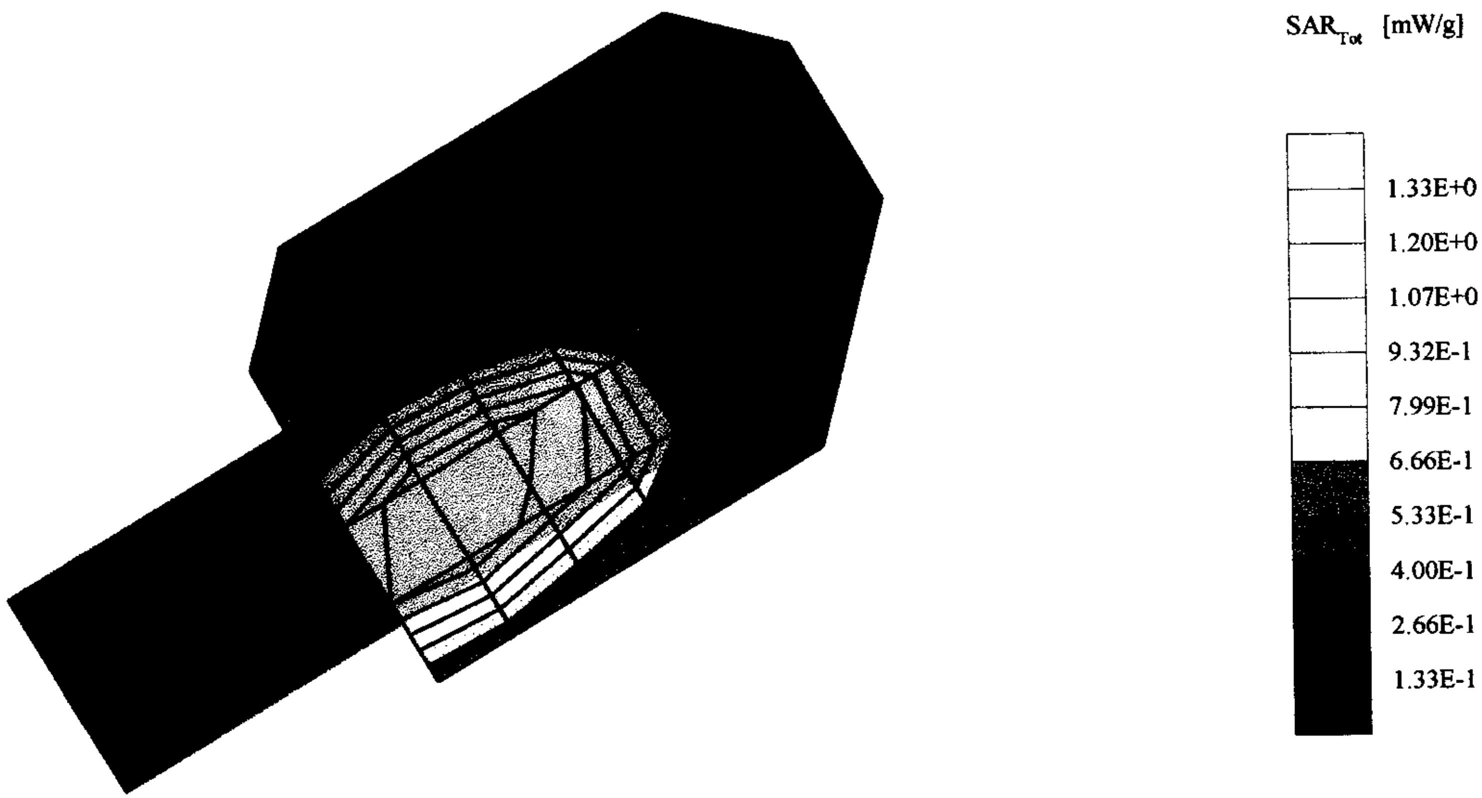
Please note that the graphical visualization of the phone position onto the SAR distribution gives only limited information on the current distribution of the device, since the curvature of the head results in graphical distortion. Full information can only be obtained either by H-field scans in free space or SAR evaluation with a flat phantom.

Powerdrift is the measurement of power drift of the device over one complete SAR scan.

APPENDIX C - E-Field Probe Calibration Data

Philips_ISIS

Generic Twin Phantom; Right Hand Section; Position: (80°,65°); Frequency: 824 [MHz]
Probe: ET3DV5 - SN1333; ConvF(5.94,5.94,5.94); Crest factor: 1.0; Brain 900 MHz: σ = 0.85 [mho/m] ε_r = 40.2 ρ = 1.00 [g/cm^3]
Cube 5x5x7: SAR (1g): 1.43 [mW/g], SAR (10g): 1.05 [mW/g], (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
O/P=26.5 dBm, Powerdrift: -0.20 dB



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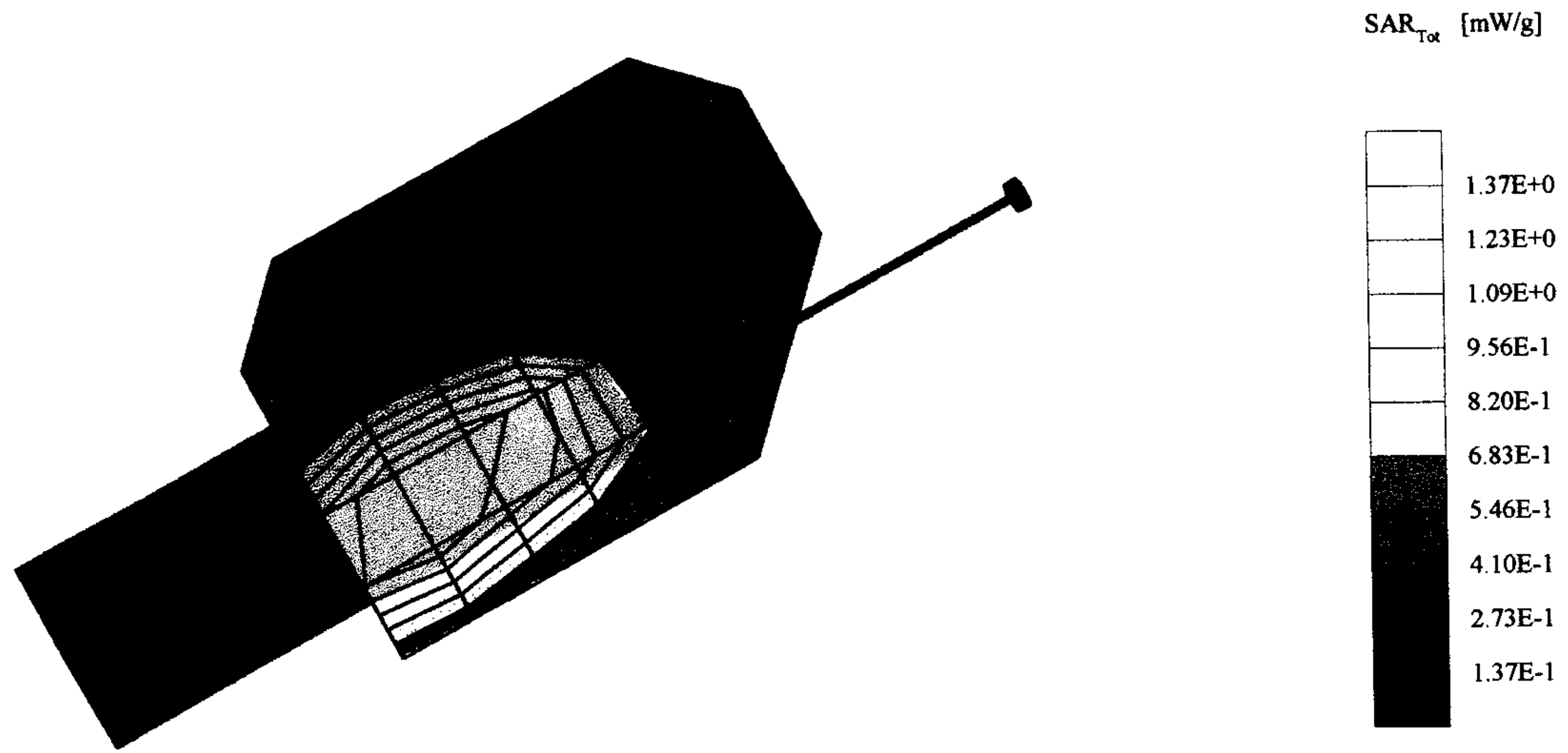
Philips_ISIS

Generic Twin Phantom; Right Hand Section; Position: (80°,65°); Frequency: 824 [MHz]
Probe: ET3DV5 - SN1333; ConvF(5.94,5.94,5.94); Crest factor: 1.0; Brain 900 MHz: $\sigma = 0.85$ [mho/m] $\varepsilon_r = 40.2$ $\rho = 1.00$ [g/cm³]
Cube 5x5x7: SAR (1g): 1.45 [mW/g], SAR (10g): 1.07 [mW/g], (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.28 dB



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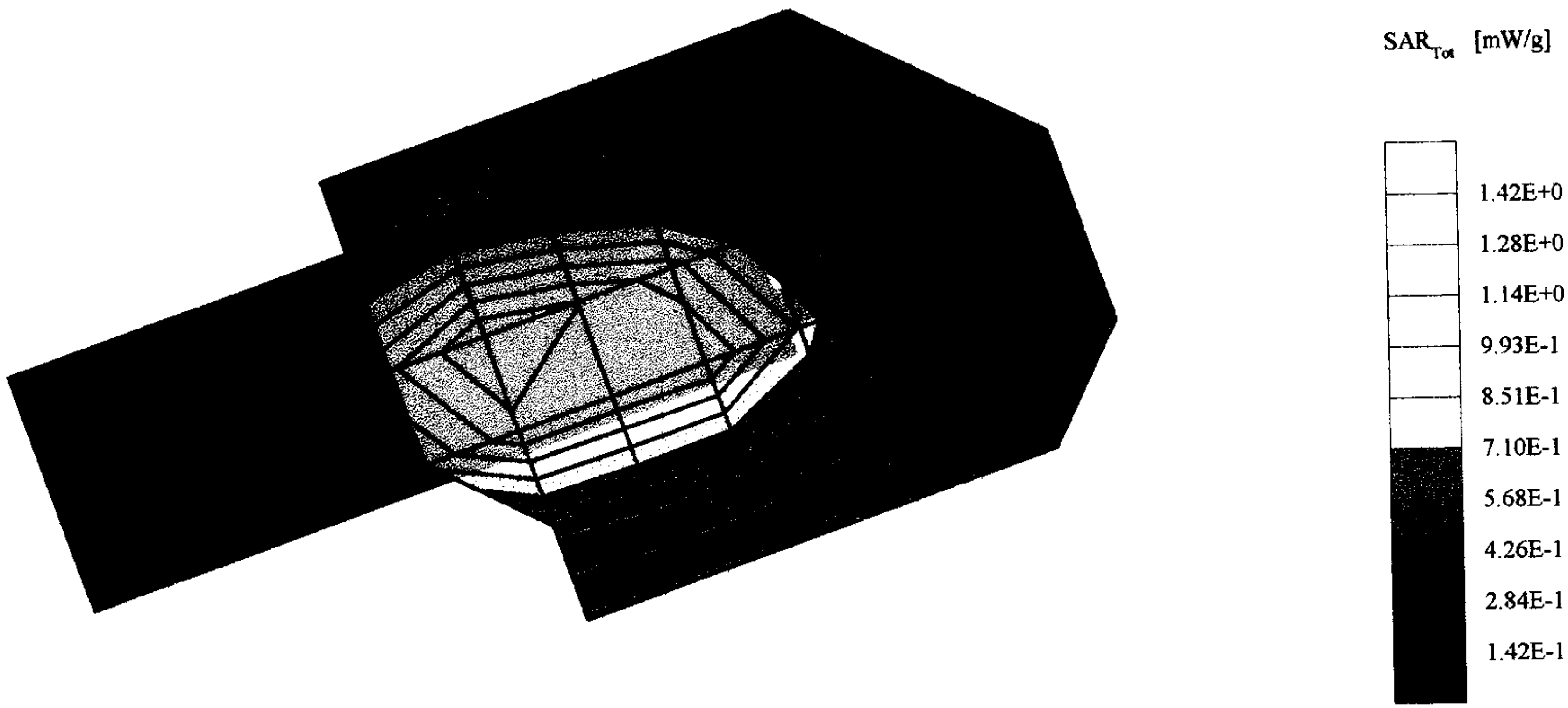
Philips_ISIS

Generic Twin Phantom; Left Hand Section; Position: (80°,65°); Frequency: 824 [MHz]
Probe: ET3DV5 - SN1333, ConvF(5.94,5.94,5.94); Crest factor: 1.0; Brain 900 MHz: $\sigma = 0.85$ [mho/m] $\varepsilon_r = 40.2$ $\rho = 1.00$ [g/cm³]
Cube 5x5x7: SAR (1g): 1.43 [mW/g], SAR (10g): 1.06 [mW/g] * Max outside, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.11 dB



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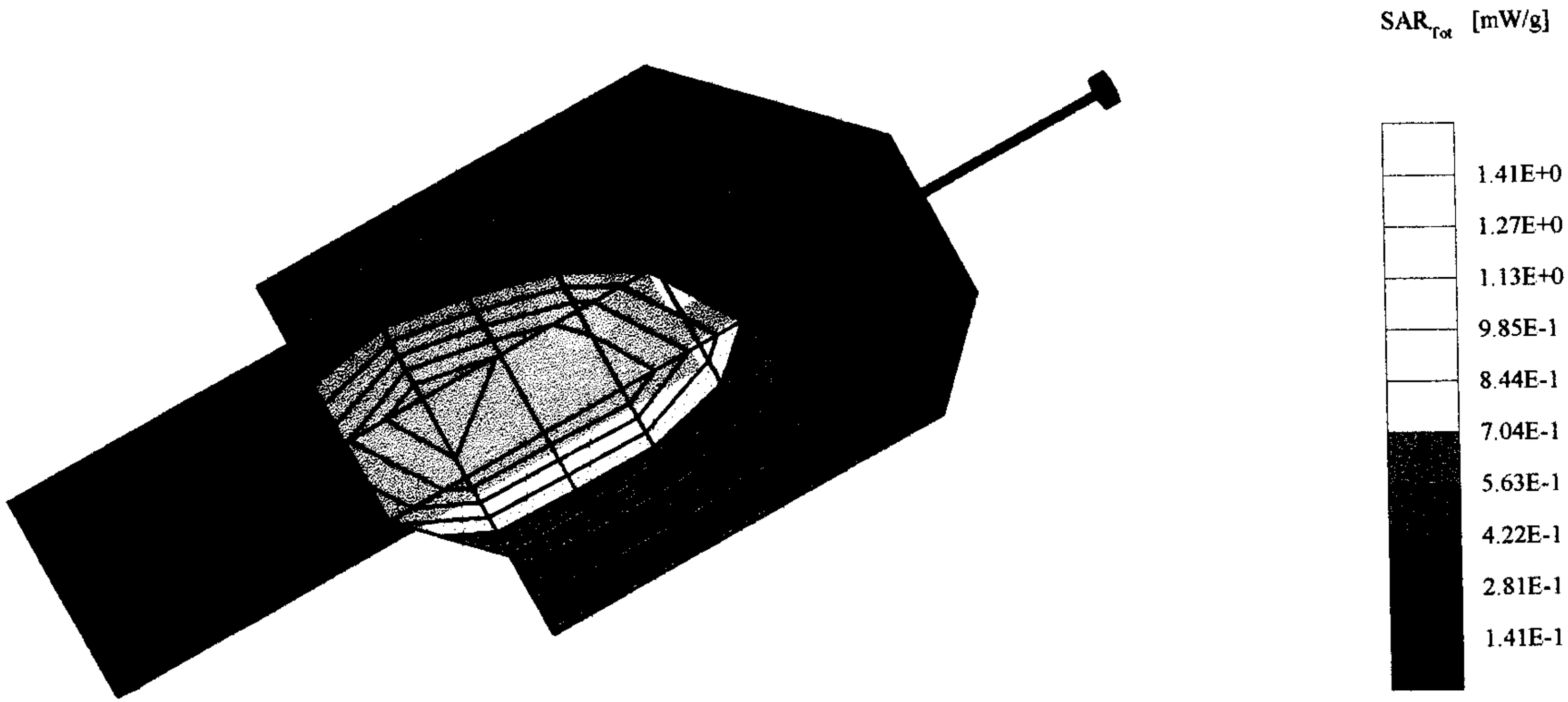
Philips_ISIS

Generic Twin Phantom; Left Hand Section; Position: (80°,65°); Frequency: 824 [MHz]
Probe: ET3DV5 - SN1333; ConvF(5.94,5.94,5.94); Crest factor: 1.0; Brain 900 MHz: $\sigma = 0.85$ [mho/m] $\epsilon_r = 40.2$ $\rho = 1.00$ [g/cm³]
Cube 5x5x7: SAR (1g): 1.41 [mW/g], SAR (10g): 1.04 [mW/g] * Max outside, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.34 dB



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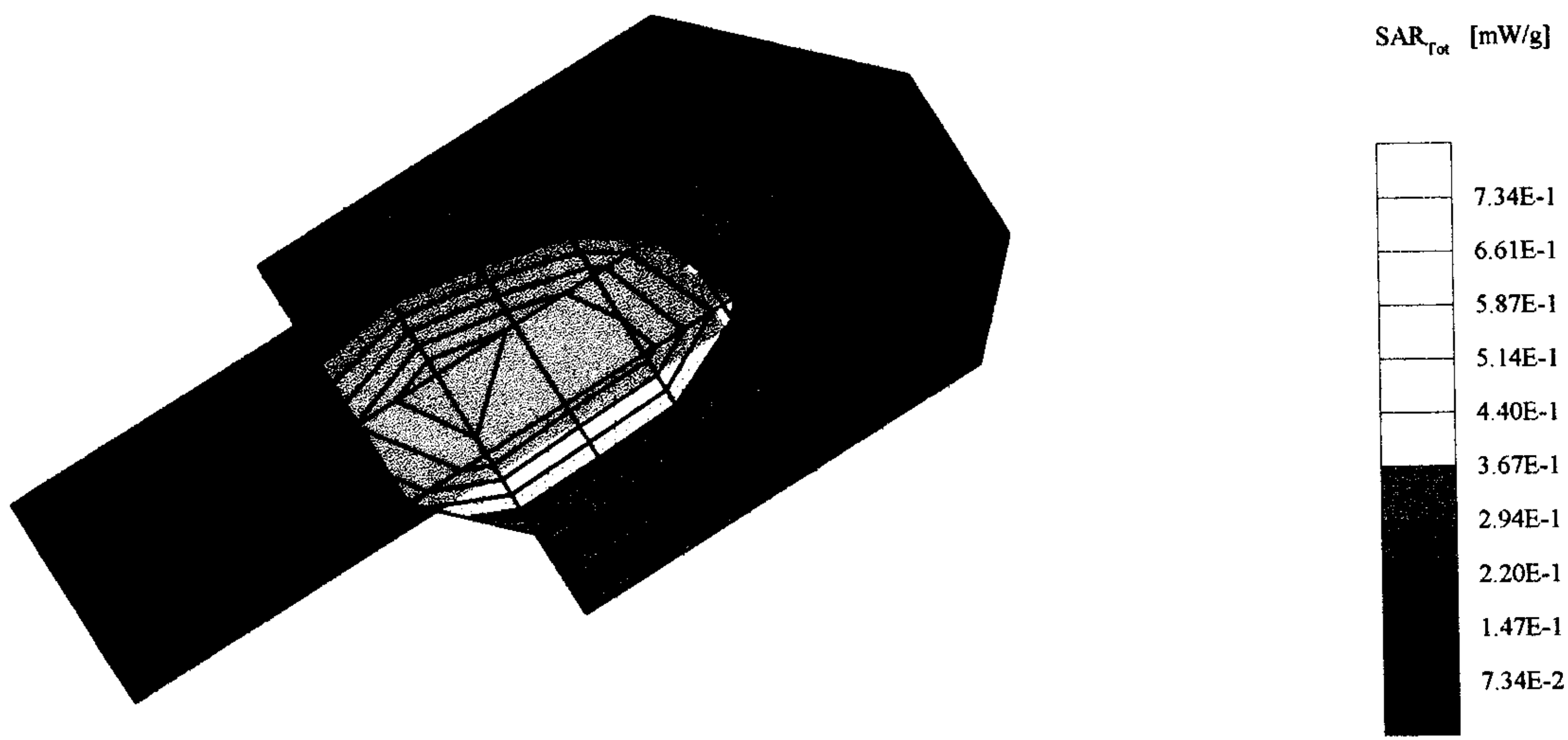
Philips_ISIS

Generic Twin Phantom; Left Hand Section; Position: (80°,65°); Frequency: 837 [MHz]
Probe: ET3DV5 - SN1333; ConvF(5.94,5.94,5.94); Crest factor: 1.0; Brain 900 MHz: σ = 0.85 [mho/m] ε_r = 40.2 ρ = 1.00 [g/cm^3]
Cube 5x5x7: SAR (1g): 0.744 [mW/g], SAR (10g): 0.548 [mW/g], (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
26.7 dBm, Powerdrift: 0.25 dB



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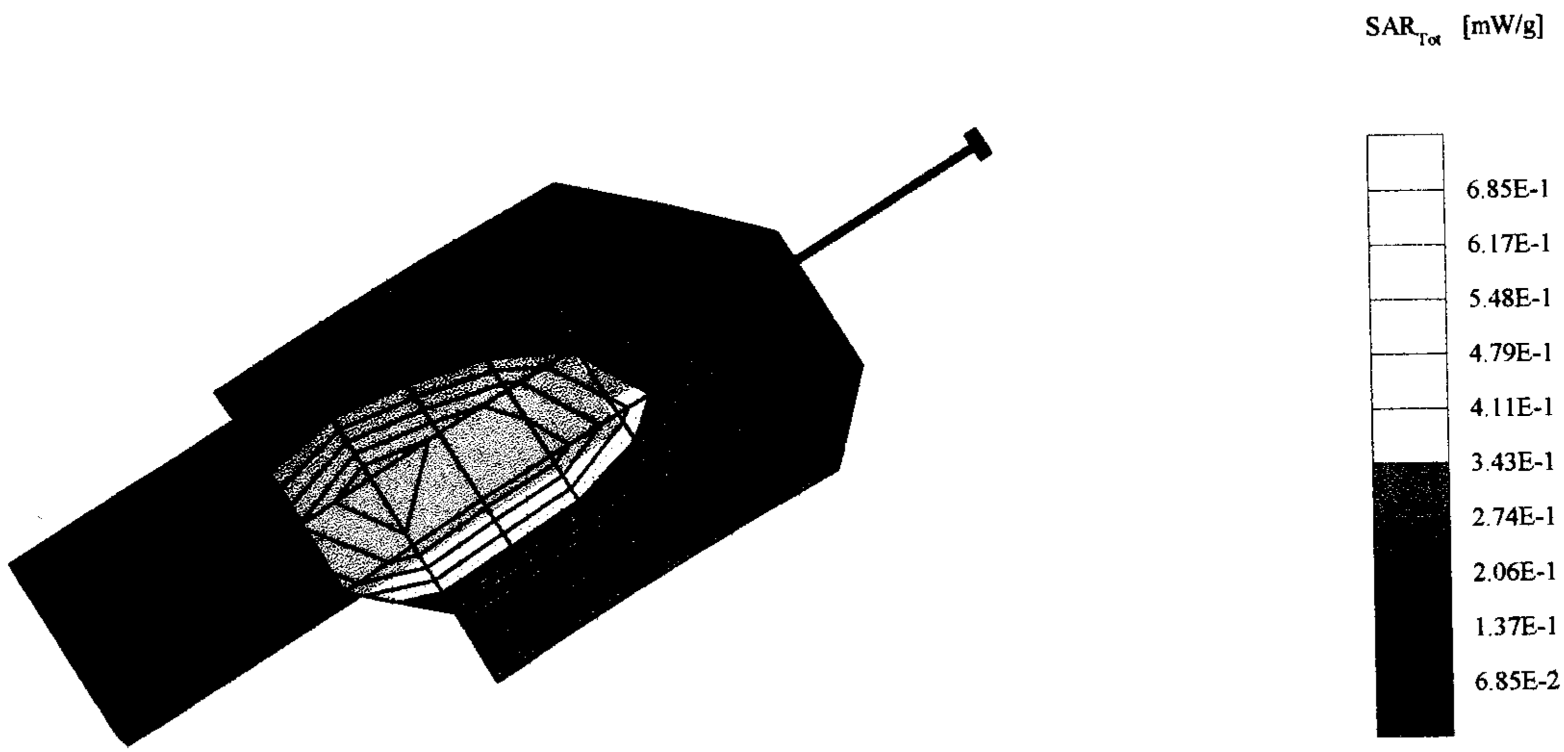
Philips_ISIS

Generic Twin Phantom; Left Hand Section; Position: (80°,65°); Frequency: 837 [MHz]
Probe: ET3DV5 - SN1333; ConvF(5.94,5.94,5.94); Crest factor: 1.0; Brain 900 MHz: $\sigma = 0.85$ [mho/m] $\varepsilon_r = 40.2$ $\rho = 1.00$ [g/cm³]
Cube 5x5x7: SAR (1g): 0.675 [mW/g], SAR (10g): 0.497 [mW/g], (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
26.7 dBm, Powerdrift: -0.50 dB



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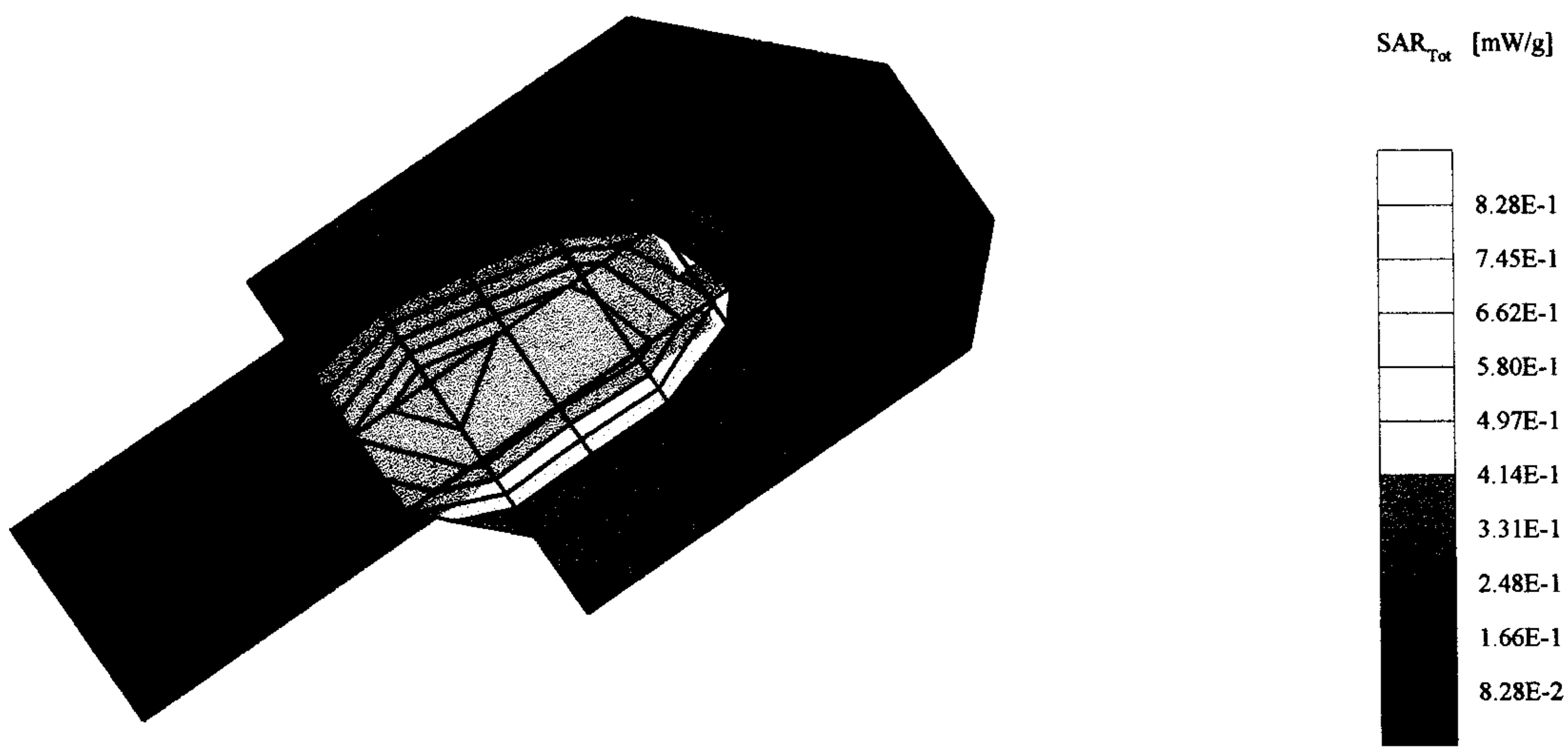
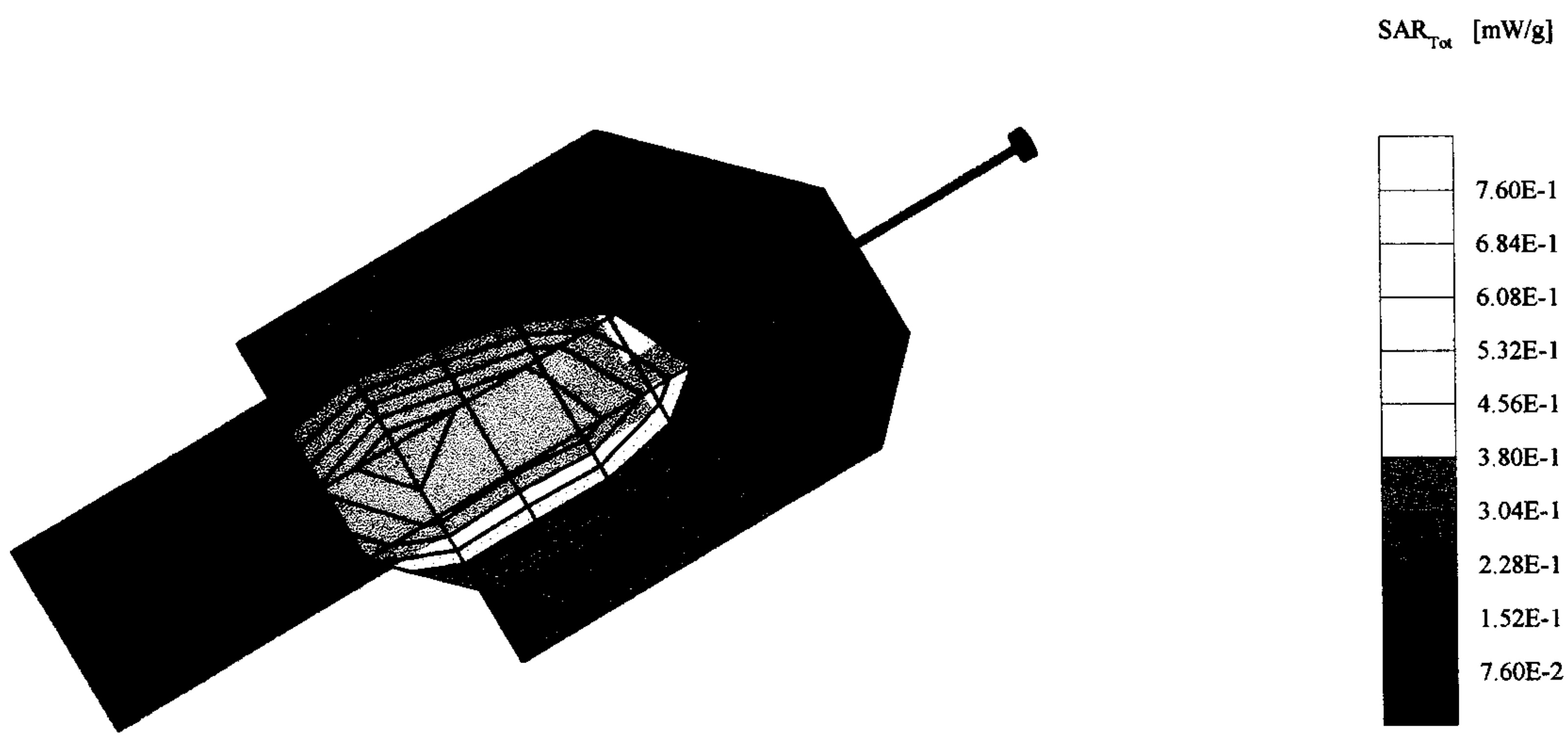
Philips_ISIS

Generic Twin Phantom; Left Hand Section; Position: (80°,65°); Frequency: 849 [MHz]
Probe: ET3DV5 - SN1333; ConvF(5.94,5.94,5.94); Crest factor: 1.0; Brain 900 MHz: $\sigma = 0.85$ [mho/m] $\varepsilon_r = 40.2$ $\rho = 1.00$ [g/cm³]
Cube 5x5x7: SAR (1g): 0.832 [mW/g], SAR (10g): 0.612 [mW/g], (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
O/P= 27.2 dBm, Powerdrift: 0.04 dB



Philips_ISIS

Generic Twin Phantom; Left Hand Section; Position: (80°,65°); Frequency: 849 [MHz]
Probe: ET3DV5 - SN1333; ConvF(5.94,5.94,5.94); Crest factor: 1.0; Brain 900 MHz: $\sigma = 0.85$ [mho/m] $\varepsilon_r = 40.2$ $\rho = 1.00$ [g/cm³]
Cube 5x5x7: SAR (1g): 0.762 [mW/g], SAR (10g): 0.561 [mW/g], (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
O/P= 27.2 dBm, Powerdrift: -0.07 dB



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Schmid & Partner
Engineering AG

Staffelstrasse 8, 8045 Zurich, Switzerland, Telefon +41 1 280 08 60, Fax +41 1 280 08 64

Probe ET3DV5

SN:1333

Manufactured: December, 20 1997
Calibrated: January, 14 1998

Calibrated for System DASY3

Introduction

The performance of all probes is measured before delivery. This includes an assessment of the characteristic parameters, receiving patterns as a function of frequency, frequency response and relative accuracy. Furthermore, each probe is tested in use according to a dosimetric assessment protocol. The sensitivity parameters (NormX, NormY, NormZ), the diode compresion parameter (DCP) and the conversion factor (ConvF) of the probe and some of the measurement diagrams are given in the following.

The performance of the individual probes varies slightly due to tolerances arising from the manufacturing process. Since the lines are highly resistive (several MOhms), the offset and noise problem is greatly increased if signals in the low μV range are measured. Accurate measurement below 10 μW/g are possible if the following precautions are taken. 1) check the current grounding with the *multimeter*[1], i.e., low noise levels, 2) compensate the current *offset*[1], 3) use long integration time (approx. 10 seconds), 4) *calibrate*[1] before each measurement, 5) persons should avoid moving around the lab while measuring.

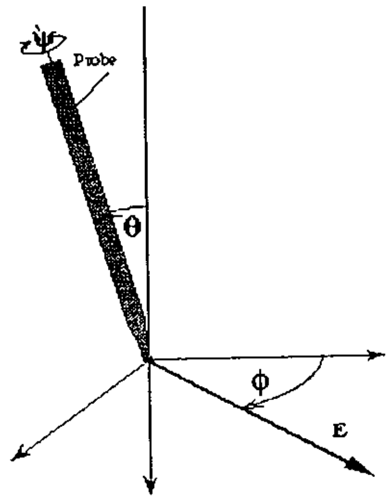


Fig 1: Due to the field distortion caused by the supporting material, the probe has two characteristic directions, referred to as angle ψ and θ.

Since the field distortion caused by the supporting material and the sheath is quite high in the θ direction, the receiving pattern is poor in air. However, the distortion in tissue equivalent material is much less because of its high dielectricity. In addition, the fields induced in the phantoms by dipole structures close to the body are dominently parallel to the surface. Thus, the error due to non-isotropy is much better than 1 dB for dosimetric assessments.

The probes are calibrated in the TEM cell ifi 110 although the field distribution in the cell is not very uniform and the frequency response is not very flat. To ensure consistency, a strict protocol is followed. The conversion factor (ConF) between this calibration and the measurement in the tissue simulation solution is performed by comparison with temperature measurements and computer simulations. This conversion factor is only valid for the specified tissue simulating liquids at the specified frequencies. If measurements have to be performed in solutions with other electrical properties or at other frequencies, the conversion factor has to be assessed by the same procedure.

As the probes have been constructed with printed resistive lines on ceramic substrates (thick film technique), the probe is very delicate with respect to mechanical shocks.

Attention:

Do not drop the probe or let the probe collide with any solid object. Never let the robot move without first activating the emergency stop feature (i.e., without first turning the data acquisition electronics on).

[1] Feature of the DASY2 Software Tool.

DASY3 - Parameters of Probe: ET3DV5 SN:1333

Sensitivity in Free Space

NormX	**2.32**	$\mu V/(V/m)^2$
NormY	**2.3**	$\mu V/(V/m)^2$
NormZ	**2.28**	$\mu V/(V/m)^2$

Diode Compression

DCP X	**102**	mV
DCP Y	**102**	mV
DCP Z	**102**	mV

Sensitivity in Tissue Simulating Liquid

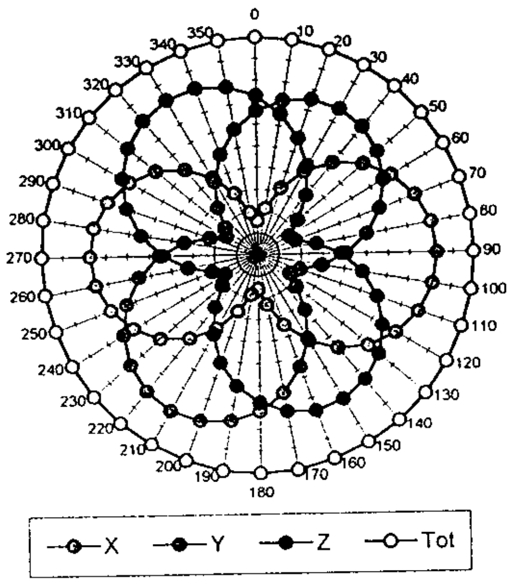
450 MHz	ConvF X	**6.33**	extrapolated	ε_r = 48 ± 5%
	ConvF Y	**6.33**	extrapolated	σ = 0.50 ± 10% mho/m
	ConvF Z	**6.33**	extrapolated	(brain tissue simulating liquid)
900 MHz	ConvF X	**5.94**	± 10%	ε_r = 42.5 ± 5%
	ConvF Y	**5.94**	± 10%	σ = 0.85 ± 10% mho/m
	ConvF Z	**5.94**	± 10%	(brain tissue simulating liquid)
1500 MHz	ConvF X	**5.43**	interpolated	ε_r = 41 ± 5%
	ConvF Y	**5.43**	interpolated	σ = 1.32 ± 10% mho/m
	ConvF Z	**5.43**	interpolated	(brain tissue simulating liquid)
1800 MHz	ConvF X	**5.17**	± 10%	ε_r = 41 ± 5%
	ConvF Y	**5.17**	± 10%	σ = 1.71 ± 10% mho/m
	ConvF Z	**5.17**	± 10%	(brain tissue simulating liquid)

Sensor Offset

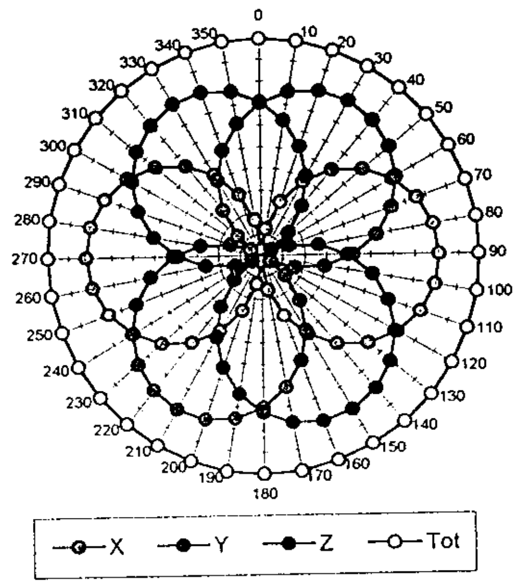
Probe Tip to Sensor Center	**2.7**	mm
Surface to Probe Tip	**1.8 ± 0.2**	mm

Receiving Pattern (ϕ), θ = 0°

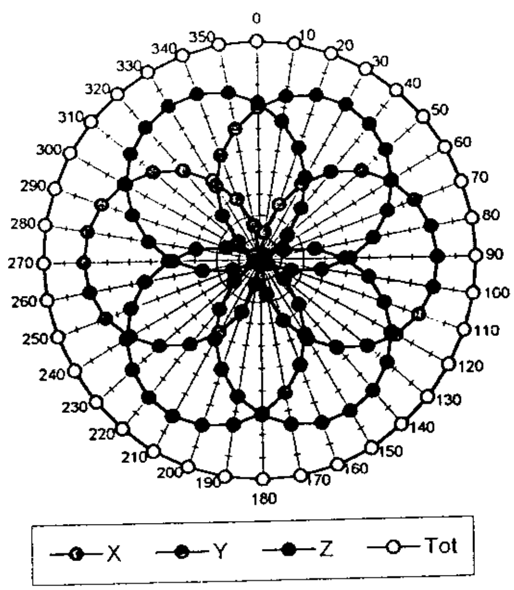
f = 30 MHz, TEM cell ifi110



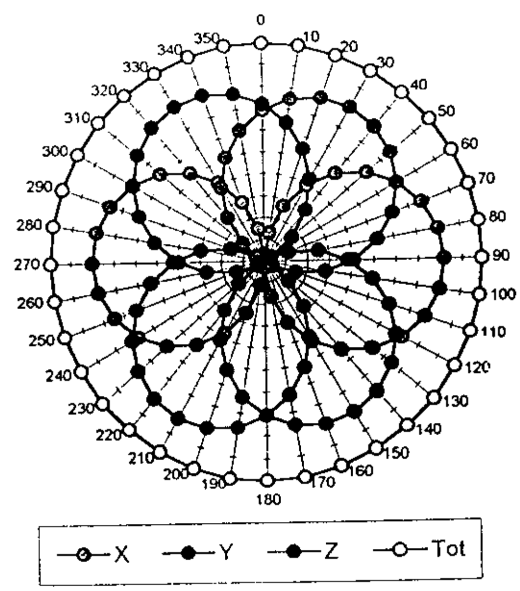
f = 100 MHz, TEM cell ifi110

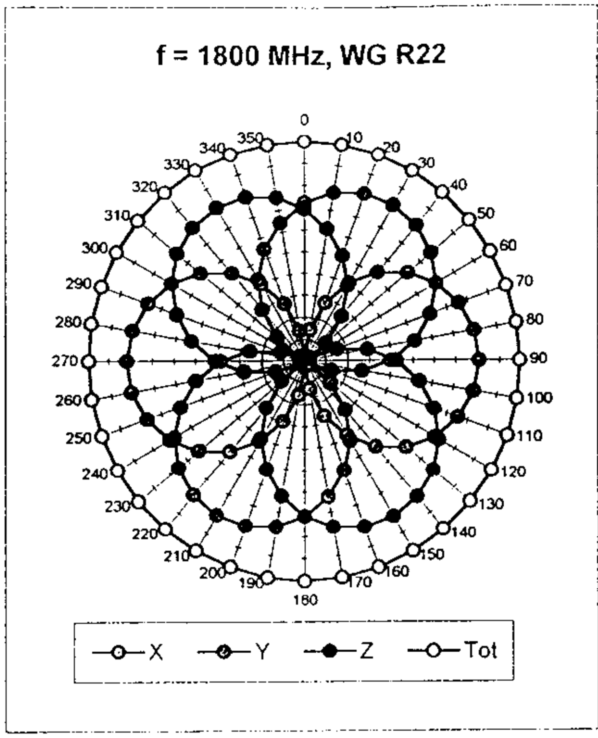


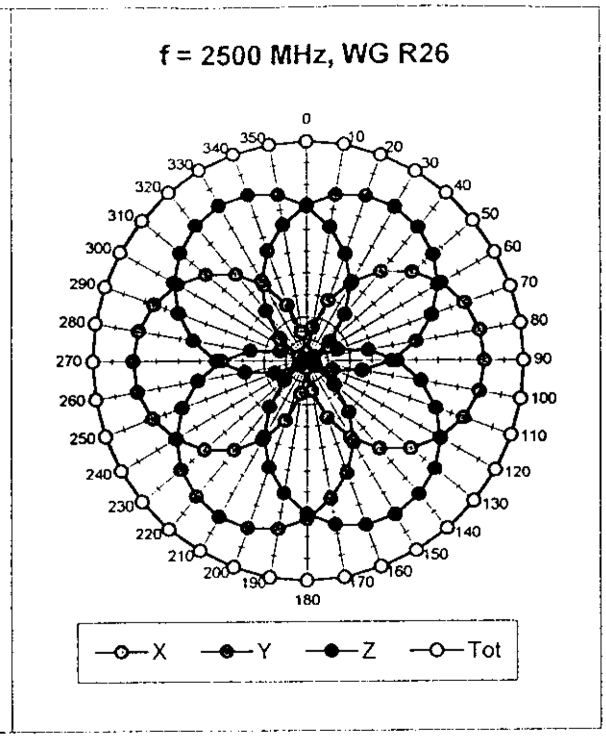
f = 300 MHz, TEM cell ifi110



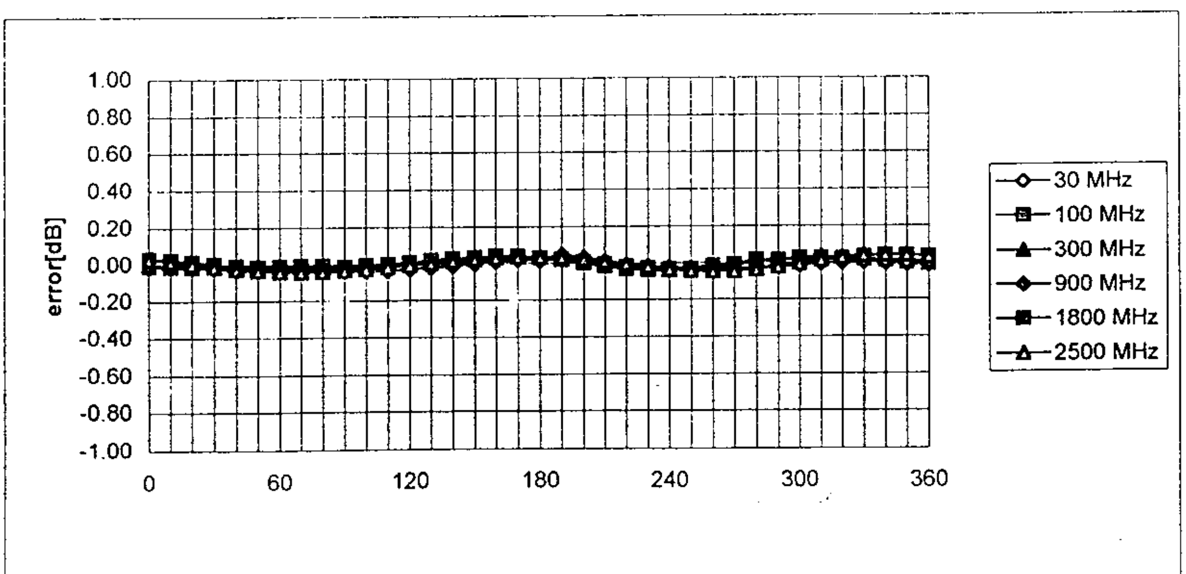
f = 900 MHz, TEM cell ifi110





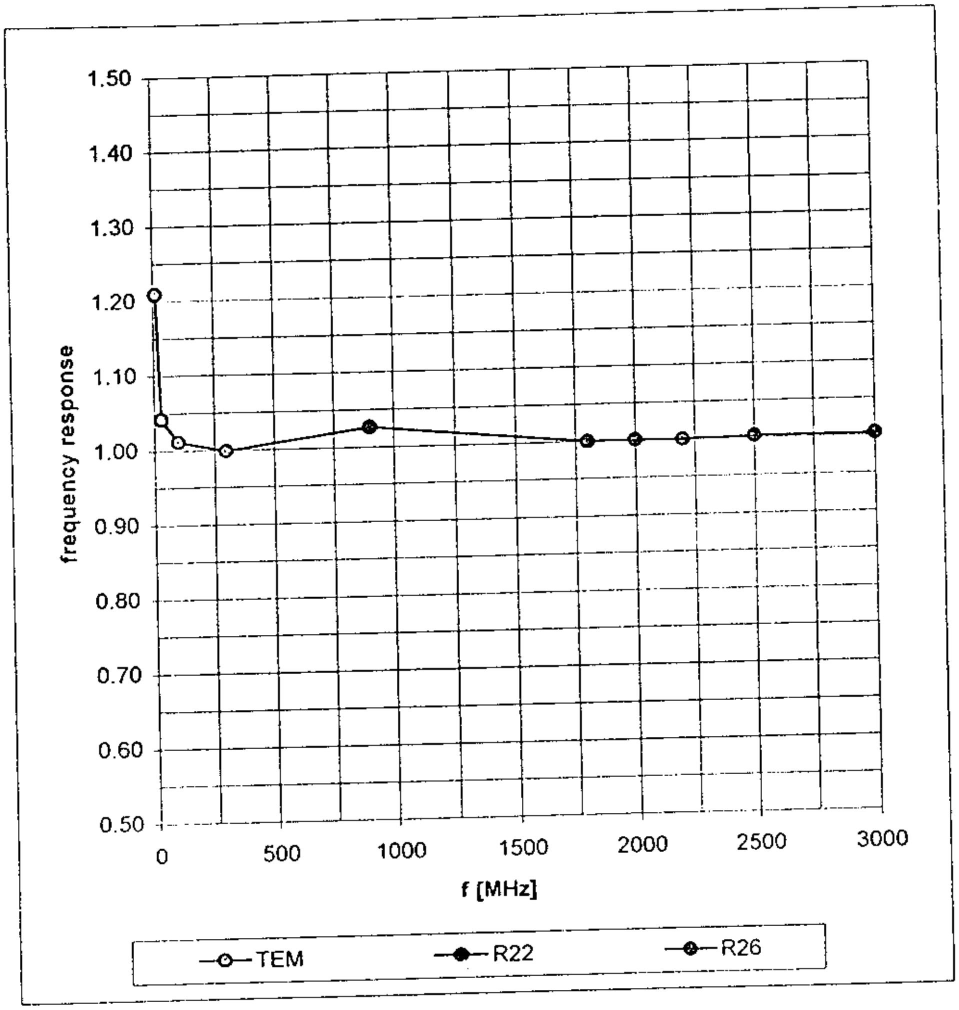


Isotropy Error (ϕ), θ = 0°



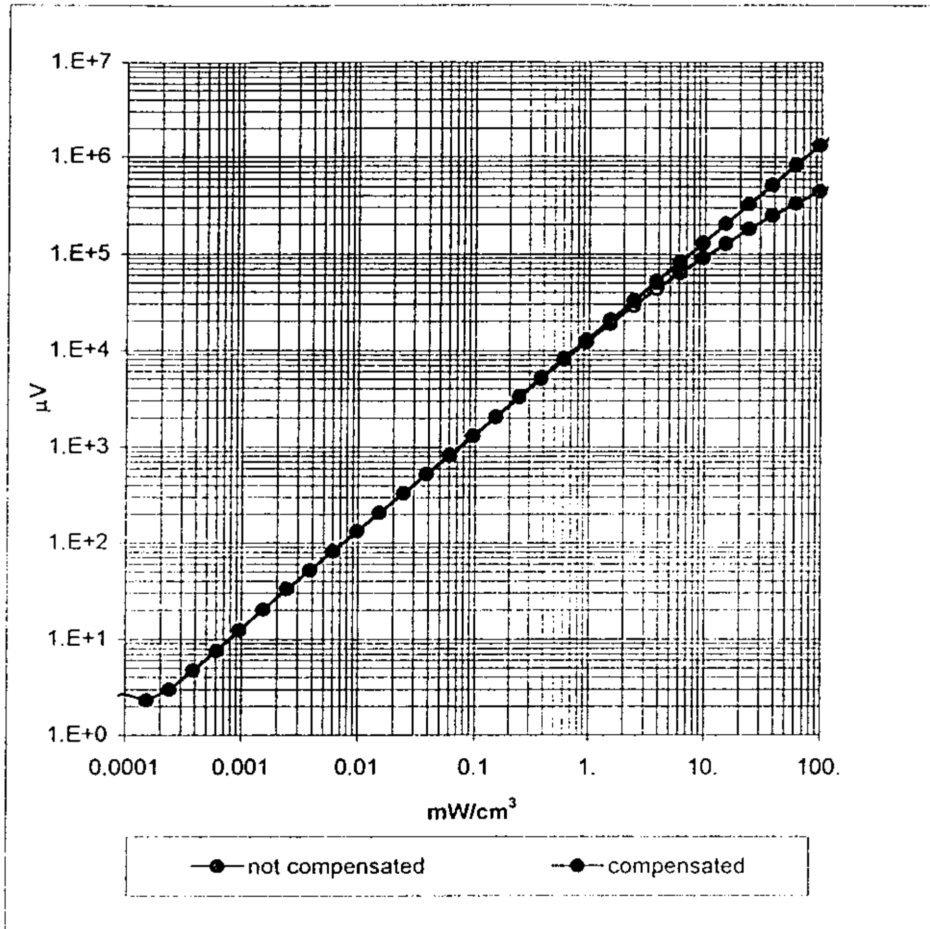
Frequency Response of E-Field

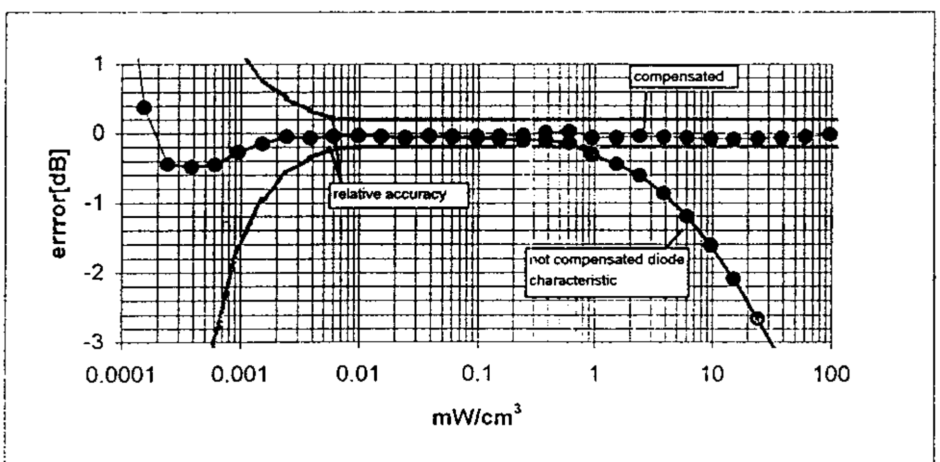
(TEM-Cell:ifi110, Waveguide R22, R26)



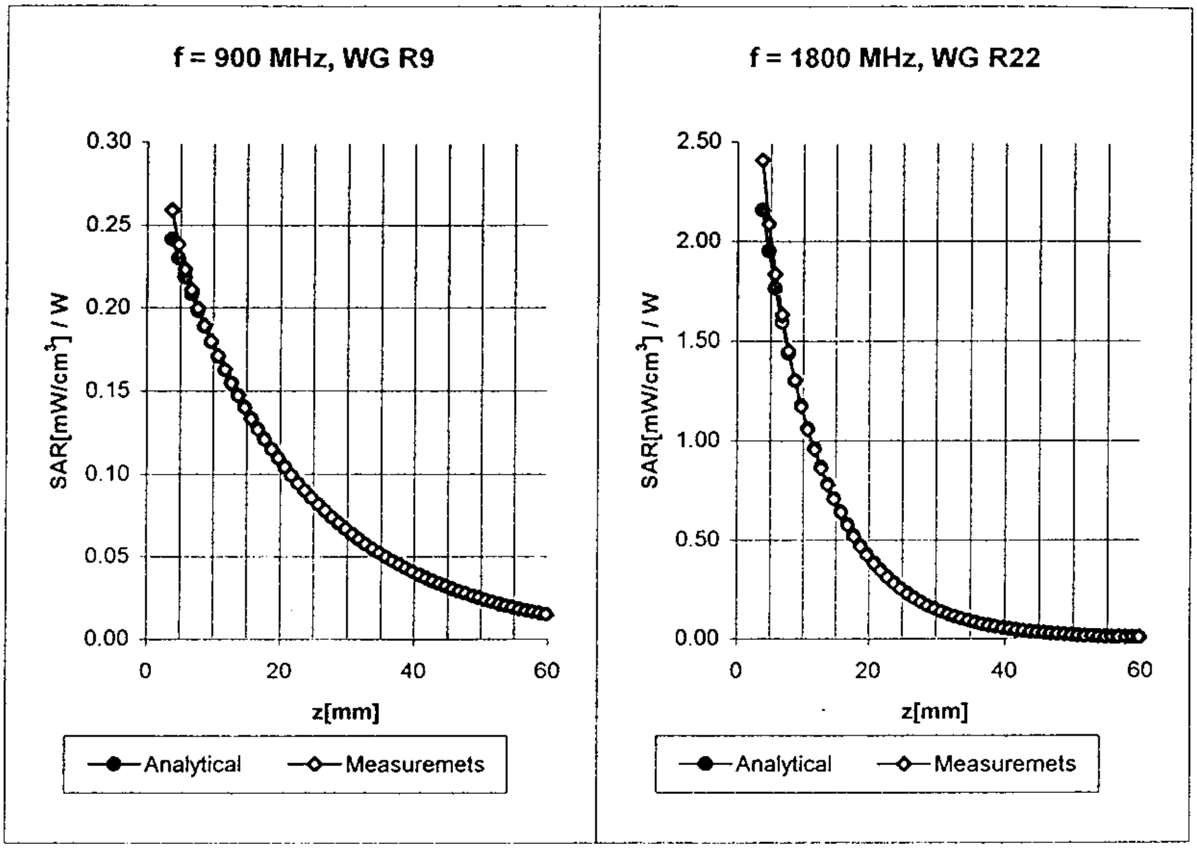
Dynamic Range f(SAR_{brain})

(TEM-Cell:ifi110)



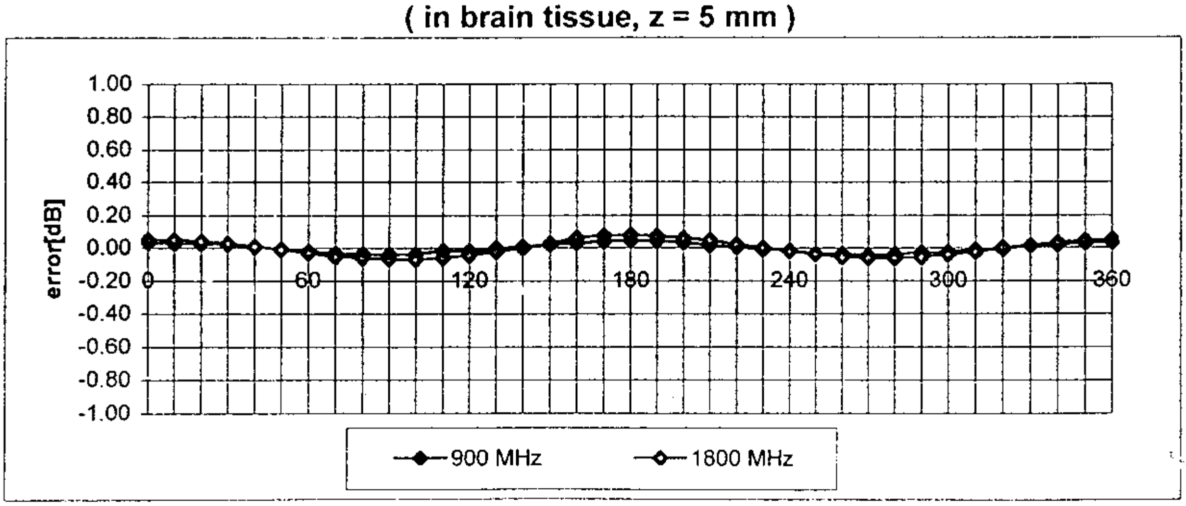


Conversion Factor Assessment



Receiving Pattern (ϕ)

(in brain tissue, z = 5 mm)



Appendix H - Users Manual - See attached pages.

This manual will be provided to the end-user with each unit sold/leased in the United States.