ITS Intertek Testing Services
ETL SEMKO

Specific Absorption Rate (SAR) Test Report
for
Hewlett Packard Company.
on the
HP Omnibook 6100 Series (with Mini PCI 802.1 lb wireless card)
Model Number: 802MIP (W)

Test Report: 20504871
Date of Report: May 28, 2001

Job #: J20050487
Date of Test: May 23 & 24, 2001

Total No of Pages Contained in this Report: 43 + Data Sheets

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NVLAP Laboratory Code 200201-0
Accredited for testing to FCC Parts 15

Tested by:	Xi Ming
Reviewed by:	David Chernomordik, Ph.D., EMC Site Manager

Review Date: 5/30/01

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Table of Contents

1.0 JOB DESCRIPTION

1.1 Client Information

The Omnibook 802MIP (W) has been tested at the request of

Company: Hewlett Packard Company
Mobile Computing Division
1000 NE Circle Blvd.
Corvallis, OR 97330

Name of contact: Ms. Kathy Warnock
Telephone: (541) 715-2171
Fax (541) 715-3607

1.2 Equipment under test (EUT)

Product Descriptions:

Equipment	**HP Omnibook 6100 Series (with Mini PCI 802.1 lb wireless card)**		
Trade Name	Hewlett Packard Company	P/N.	802MIP (W)
FCC ID	Not Labeled	S/N No.	Not Labeled
Category	Portable	RF Exposure	Uncontrolled Environment
Frequency Band	2412 – 2462 MHz	System	FHSS

EUT Antenna Description			
Type	Dipole	Configuration	Fixed
Dimensions	N/A	Gain	0 dBi
Location	Inside the laptop		

Use of Product :

Manufacturer: SAME as above.

Production is planned: [X] Yes, [ ] No

EUT receive date: May 23, 2001

EUT received condition: Good working condition prototype

Test start date: May 23, 2001

Test end date: May 24, 2001

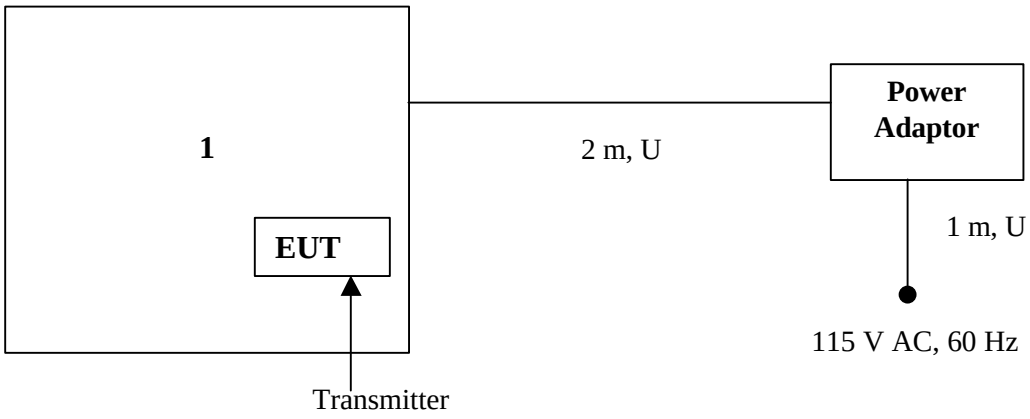
1.3 Test plan reference

FCC rule part 2.1093, FCC Docket 96-326 & Supplement C to OET Bulletin 65

1.4 System test configuration

1.4.1 System block diagram & Support equipment

Support Equipment			
Item #	**Equipment**	**Model No.**	**Serial No.**
1	Hewlett Packard Omnibook	61000	Not Labeled



S:	Shielded	**U:**	Unshielded	**m:**	meters

1.4.2 Test Position

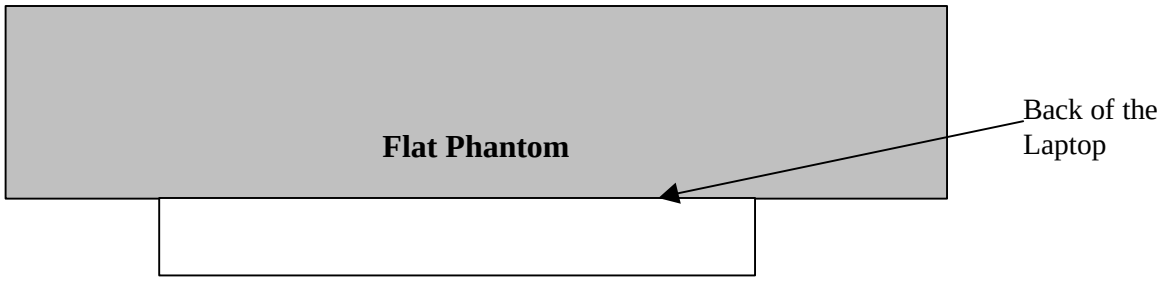


Figure 1: Laptop Upside Down

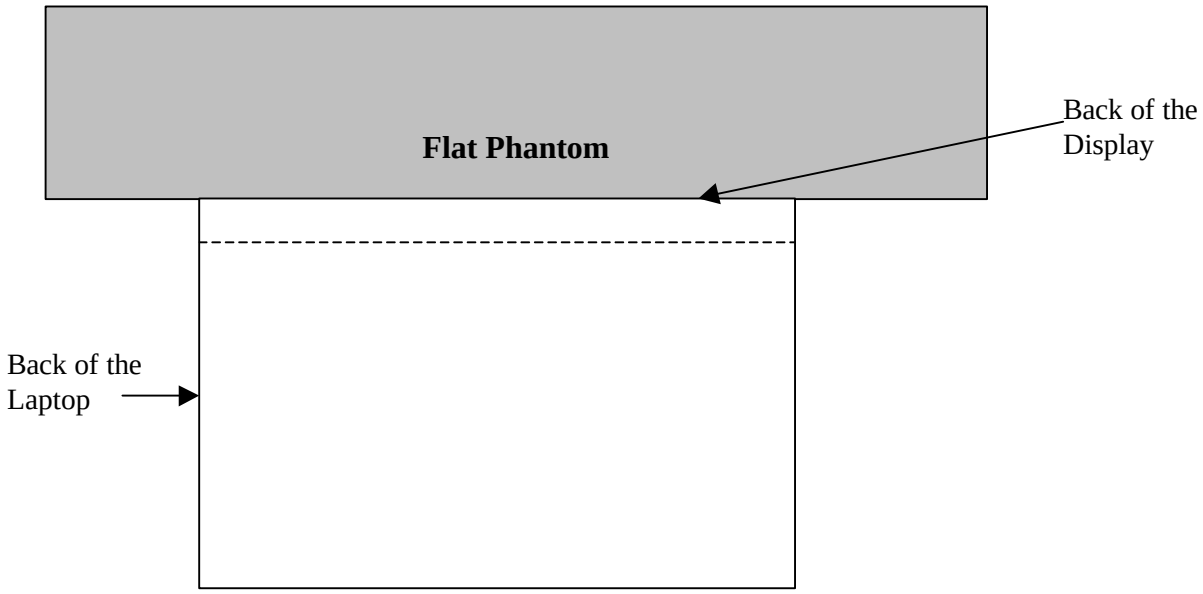


Figure 2: Laptop in Normal Open Position

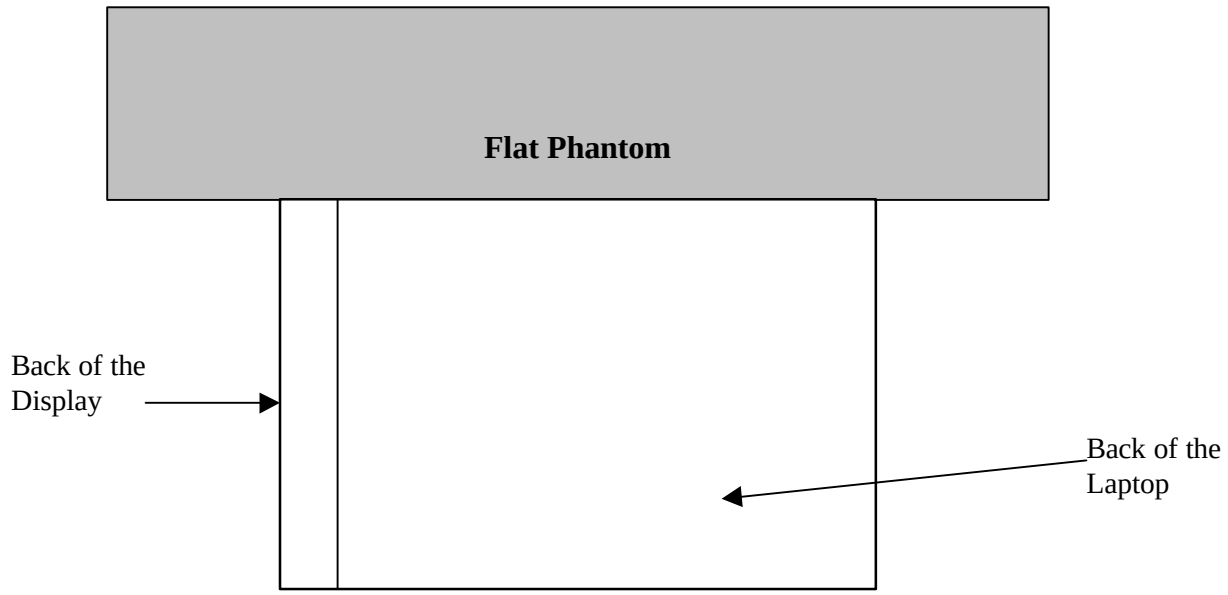


Figure 3: Laptop on Left Side

1.4.3 Test Condition

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

EUT Antenna	Fixed length	Orientation	N/A
Usage	Operates with a portable computer	Distance between antenna axis at the joint and the liquid surface:	0 mm with laptop on back side 0 mm with laptop in left side position
Simulating human Body/hand	Yes	EUT Battery	Unit powered from host computer.
Power output	14.1 dBm (2412 MHz), 12.8 dBm (2437 MHz), 12.9 dBm (2462 MHz).		

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

Radiated power measurement was performed by the customer

1.5 Modifications required for compliance

Intertek Testing Services implemented no modifications.

1.6 Additions, deviations and exclusions from standards

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

2.0 SAR EVALUATION

2.1 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

2.2 Configuration Photographs

SAR Measurement Test Setup

2.2 Configuration Photographs (Continued)

SAR measurement Test Setup

2.2 Configuration Photographs (Continued)

SAR measurement Test Setup

2.2 Configuration Photographs (Continued)

SAR measurement Test Setup

2.2 Configuration Photographs (Continued)

SAR measurement Test Setup

2.2 Configuration Photographs (Continued)

EUT Photo

2.2 Configuration Photographs (Continued)

EUT Photo

2.2 Configuration Photographs (Continued)

EUT Photo

2.3 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 1800 MHz.

Validation kit	Targeted SAR_{1g} (mW/g)	Measured SAR_{1g} (mW/g)
D900V2, S/N #: 0013	4.03	3.93

2.4 Evaluation Procedures

The SAR evaluation was performed with the following procedures:

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

b. The SAR distribution at the exposed side of the flat Phantom was measured at a distance of 30 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 straightforward 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-measurements 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.

2.5 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.

Measurement Results

Trade Name:	Hewlett Packard Company.	**Model No.:**	802MIP (W)
Serial No.:	Not Labeled	**Test Engineer:**	Xi Ming

TEST CONDITIONS			
Ambient Temperature	23.5 °C	Relative Humidity	56 %
Test Signal Source	Test Mode	Signal Modulation	CW
Output Power Before SAR Test	See page 6	Output Power After SAR Test	No change
Test Duration	23 Min. each test	Number of Battery Change	Laptop connected to AC power

EUT Position: Laptop on Back Side					
Channel MHz	Operating Mode	Crest Factor	Measured SAR_{1g} (mW/g)	Limit SAR (W/kg)	Plot Number
2412	FHSS	1	0.0558	1.6	1
2437	FHSS	1	0.0431	1.6	2
2462	FHSS	1	0.0254	1.6	3

EUT Position: Display on Back Side					
Channel MHz	Operating Mode	Crest Factor	Measured SAR_{1g} (mW/g)	Limit SAR (W/kg)	Plot Number
2412	FHSS	1	0.444	1.6	4
2437	FHSS	1	0.276	1.6	5
2462	FHSS	1	0.199	1.6	6

EUT Position: Laptop on Left Side					
Channel MHz	Operating Mode	Crest Factor	Measured SAR_{1g} (mW/g)	Limit SAR (W/kg)	Plot Number
2412	FHSS	1	0.028	1.6	7

Note: a) Worst case data were reported
b) Uncertainty of the system is not included

3.0 TEST EQUIPMENT

3.1 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**	**597412-01**	**N/A**
	Repeatability: ± 0.025mm Accuracy: $0.806x10^{-3}$ degree Number of Axes: 6		
E-Field Probe	**ET3DV5**	**1333**	**04/18/01**
	Frequency Range: 10 MHz to 6 GHz Linearity: ± 0.2 dB Directivity: ± 0.1 dB in brain tissue		
Data Acquisition	**DAE3**	**317**	**N/A**
	Measurement Range: 1µV to >200mV Input offset Voltage: < 1µV (with auto zero) Input Resistance: 200 M		
Phantom	**Generic Twin V3.0**	**N/A**	**N/A**
	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)		
Simulated Tissue	**Mixture**	**N/A**	**5/22/01**
	Please see section 6.2 for details		
Power Meter	**HP 435A w/ 8481H sensor**	**3607U00673**	**08/01/00**
	Frequency Range: 100kHz to 18 GHz Power Range: 300µW to 3W		

3.2 Muscle Tissue Simulating Liquid

Ingredient	**Frequency** (2400 MHz)
Water	55.05%
Sugar	43.5%
Salt	0%
Bactericide	1. %

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$^{3)}$
2440	52.2 ± 5%	2.15 ± 10%	1000

* *Worst case uncertainty of the HP 85070A dielectric probe kit*
** *Worst case assumption*

3.3 E-Field Probe Calibration

The manufacturer in the TEM cells ifi 110 calibrated probes. 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.

3.4 Measurement Uncertainty

The uncertainty budget has been determined for the DASY3 measurement system according to the NIS81 [5] and the NIST 1297 [6] documents and is given in the following table. The extended uncertainty (K=2) was assessed to be 23.5 %

UNCERTAINTY BUDGET				
Uncertainty Description	**Error**	**Distrib.**	**Weight**	**Std.Dev.**
Probe Uncertainty				
Axial isotropy	±0.2 dB	U-shape	0.5	±2.4 %
Spherical isotropy	±0.4 dB	U-shape	0.5	±4.8 %
Isotropy from gradient	±0.5 dB	U-shape	0	
Spatial resolution	±0.5 %	Normal	1	±0.5 %
Linearity error	±0.2 dB	Rectang.	1	±2.7 %
Calibration error	±3.3 %	Normal	1	±3.3 %
SAR Evaluation Uncertainty				
Data acquisition error	±1 %	Rectang.	1	±0.6 %
ELF and RF disturbances	±0.25 %	Normal	1	±0.25 %
Conductivity assessment	±10 %	Rectang.	1	±5.8 %
Spatial Peak SAR Evaluation Uncertainty				
Extrapol boundary effect	±3 %	Normal	1	±3 %
Probe positioning error	±0.1 mm	Normal	1	±1 %
Integrat. and cube orient	±3 %	Normal	1	±3 %
Cube shape inaccuracies	±2 %	Rectang.	1	±1.2 %
Device positioning	±6 %	Normal	1	±6 %
Combined Uncertainties				**±11.7 %**

3.5 Measurement Tractability

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

4.0 WARNING LABEL INFORMATION - USA

See attached page.

5.0 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 electrical 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.

[5] NIS81, NAMAS, "The treatment of uncertainty in EMC measurement", Tech. Rep., NAMAS Executive, National Physical Laboratory, Teddinton, Middlesex, England, 1994.

[6] Barry N. Tayor and Chris E. Kuyatt, "Guidelines for evaluating and expressing the uncertainty of NIST measurement results", Tech. Rep., National Institute of Standards and Technology, 1994.

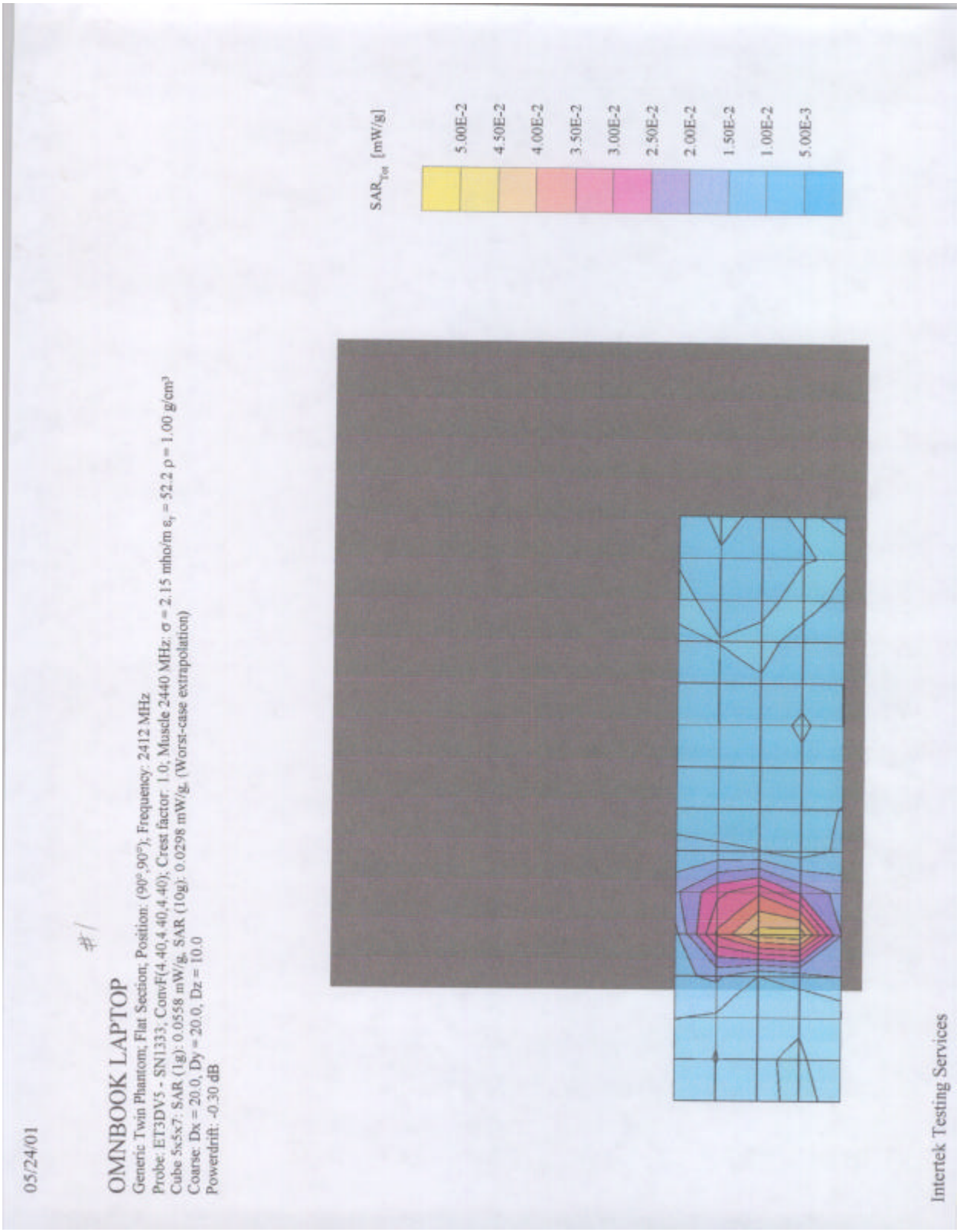
5.0 DOCUMENT HISTORY

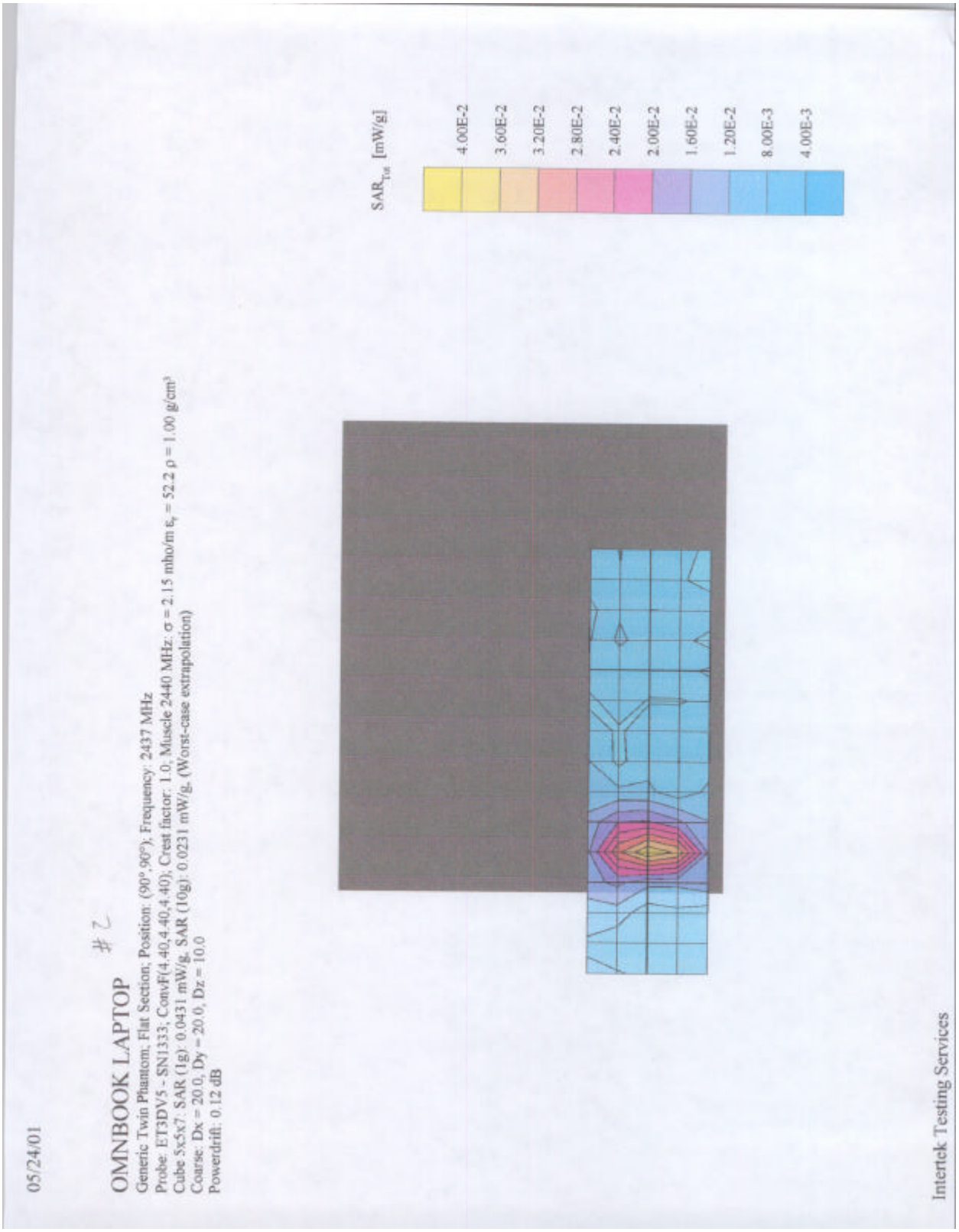
Revision/ Job Number	Writer Initials	Date	Change
1.0 /J20050487	SS	May 28, 2001	Original document

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.

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


05/24/01
#1
OMNBOOK LAPTOP
Generic Twin Phantom; Flat Section; Position: (90°,90°); Frequency: 2412 MHz
Probe: ET3DV5 - SN1333; ConvF(4.40,4.40,4.40); Crest factor: 1.0; Muscle 2440 MHz: σ = 2.15 mho/m εr = 52.2 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 0.0558 mW/g, SAR (10g): 0.0298 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.30 dB
SAR_Tot [mW/g]
5.00E-2
4.50E-2
4.00E-2
3.50E-2
3.00E-2
2.50E-2
2.00E-2
1.50E-2
1.00E-2
5.00E-3
Intertek Testing Services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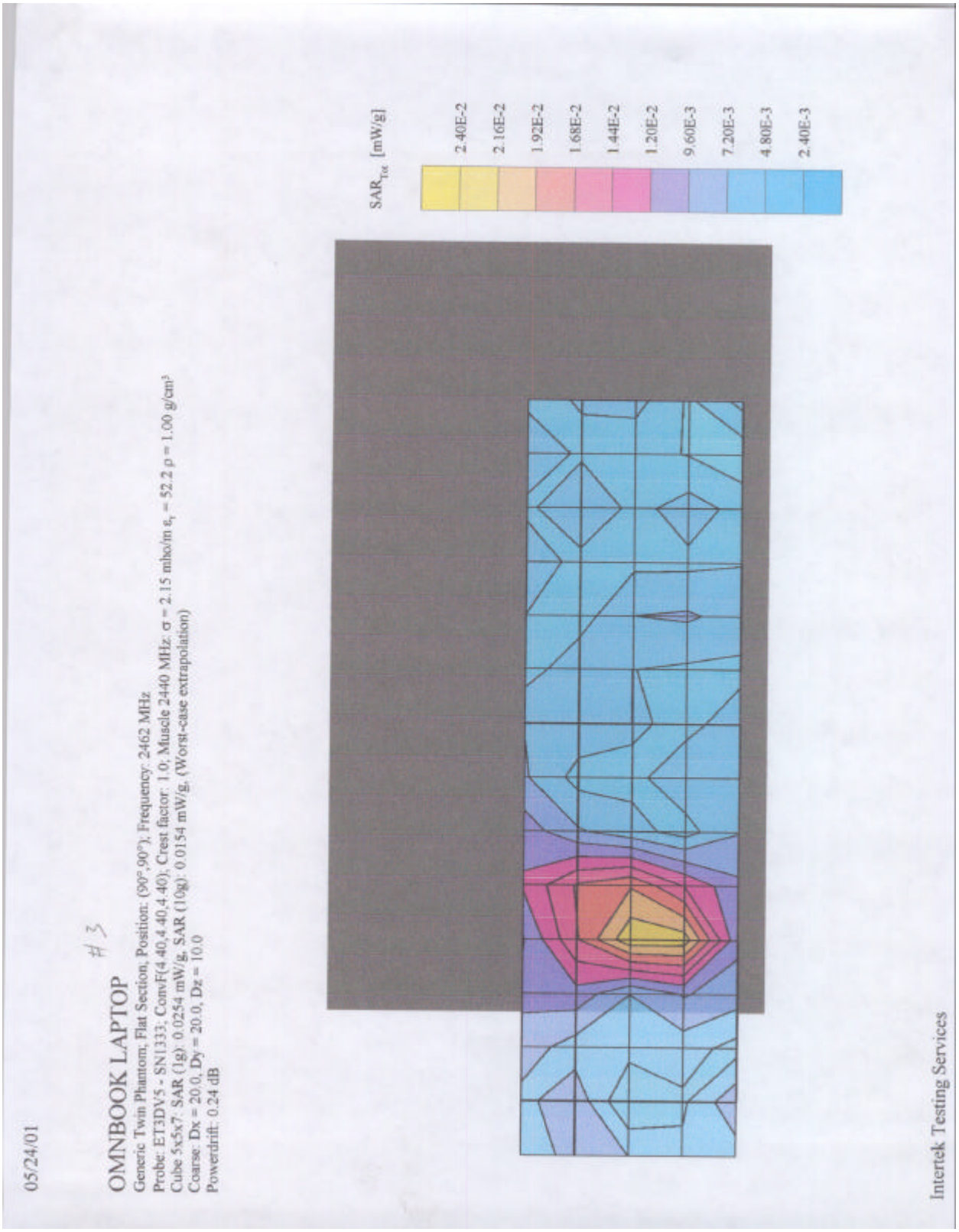
Generic Twin Phantom; Flat Section; Position: (90°,90°); Frequency: 2437 MHz
Probe: ET3DV5 - SN1333; ConvF(4.40,4.40,4.40); Crest factor: 1.0; Muscle 2440 MHz: σ = 2.15 mho/m εr = 52.2 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 0.0431 mW/g, SAR (10g): 0.0231 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.12 dB
SAR [mW/g]
4.00E-2
3.60E-2
3.20E-2
2.80E-2
2.40E-2
2.00E-2
1.60E-2
1.20E-2
8.00E-3
4.00E-3
Intertek Testing Services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Generic Twin Phantom; Flat Section; Position: (90°,90°); Frequency: 2462 MHz
Probe: ET3DV5 - SN1333; ConvF(4.40,4.40,4.40); Crest factor: 1.0; Muscle 2440 MHz: σ = 2.15 mho/m εr = 52.2 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 0.0254 mW/g, SAR (10g): 0.0154 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.24 dB
SAR_Tot [mW/g]
2.40E-2
2.16E-2
1.92E-2
1.68E-2
1.44E-2
1.20E-2
9.60E-3
7.20E-3
4.80E-3
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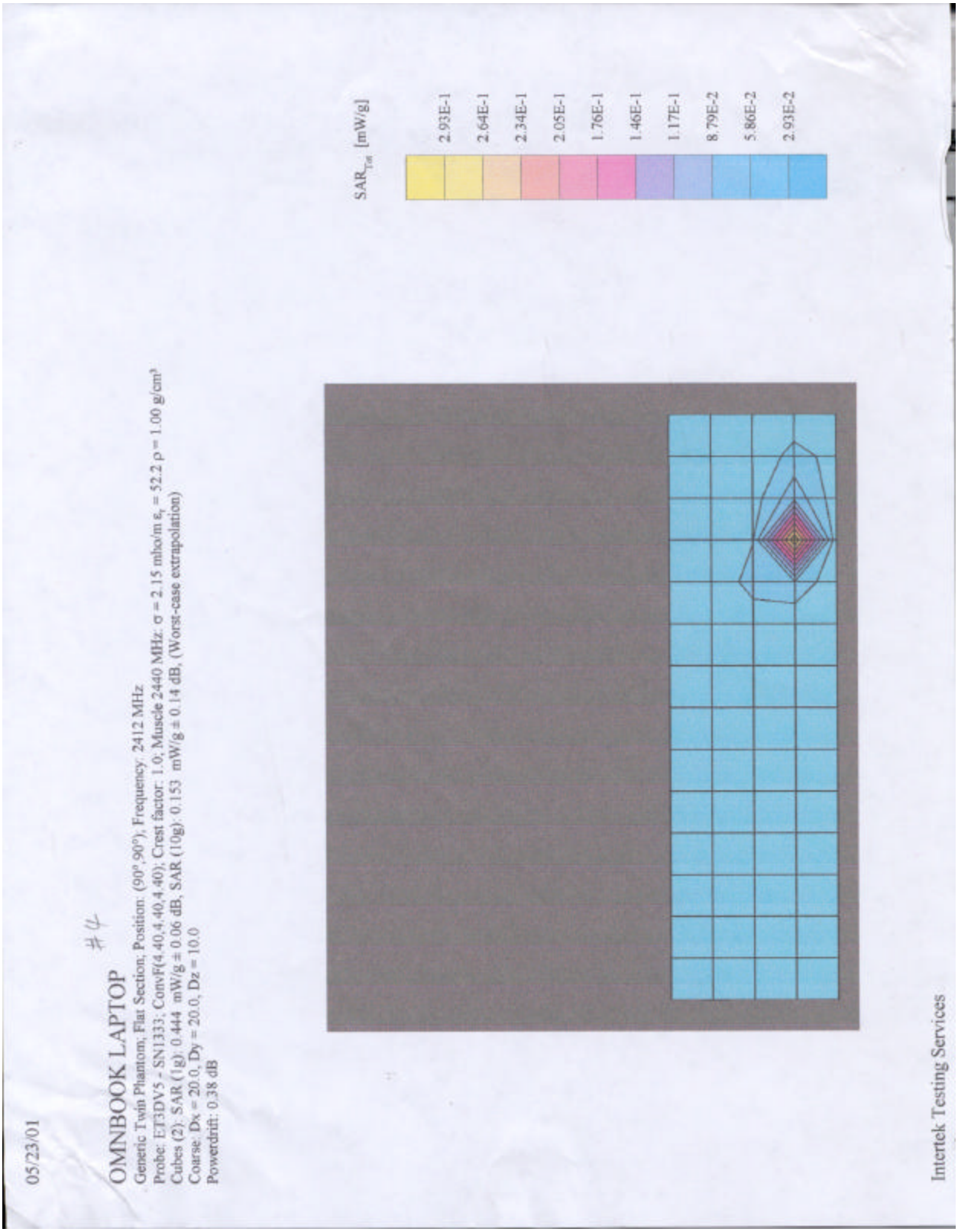
Intertek Testing Services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Generic Twin Phantom; Flat Section; Position: (90°,90°); Frequency: 2412 MHz
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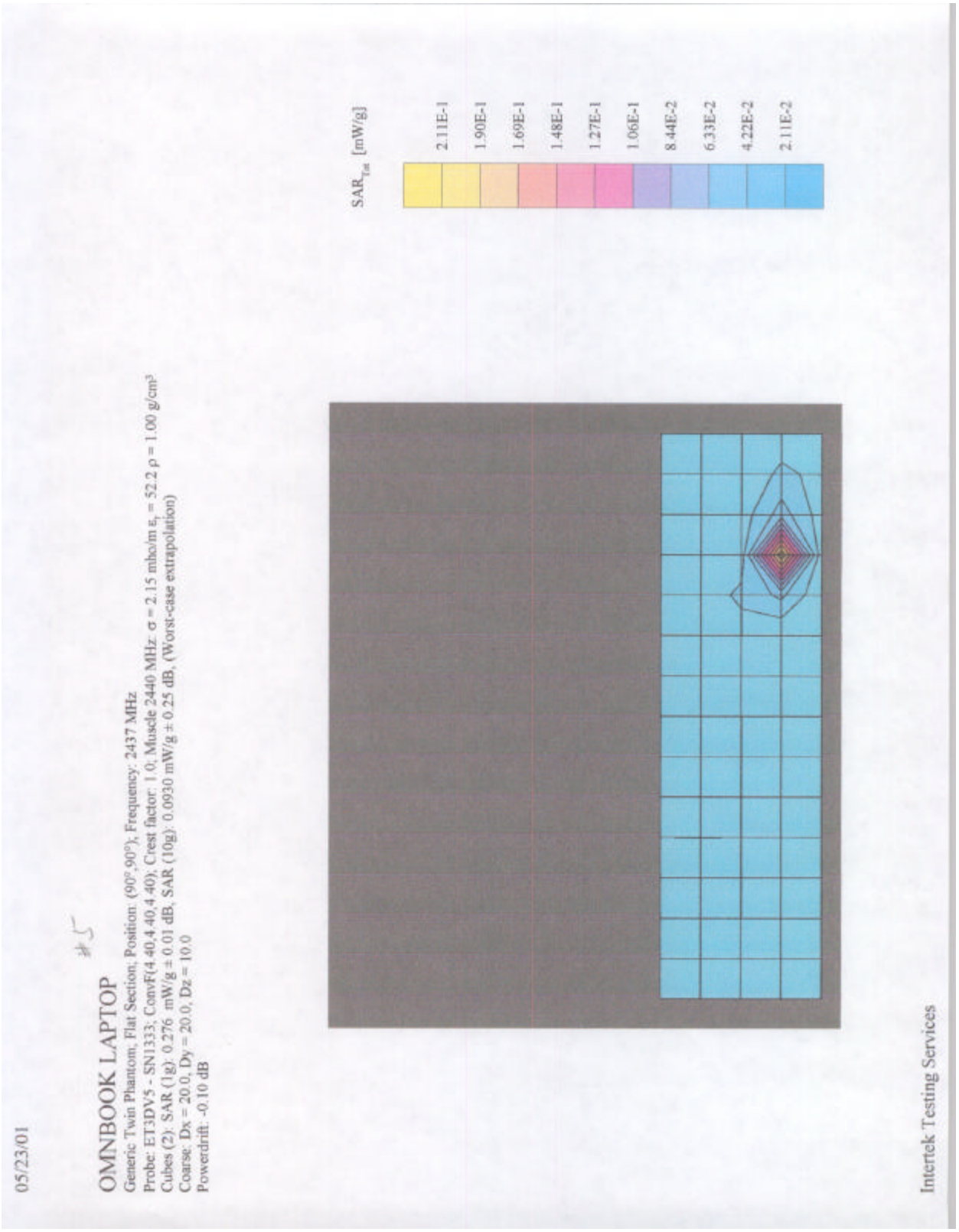
Cubes (2): SAR (1g): 0.444 mW/g ± 0.06 dB, SAR (10g): 0.153 mW/g ± 0.14 dB, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.38 dB
SAR_Tot [mW/g]
2.93E-1
2.64E-1
2.34E-1
2.05E-1
1.76E-1
1.46E-1
1.17E-1
8.79E-2
5.86E-2
2.93E-2
Intertek Testing Services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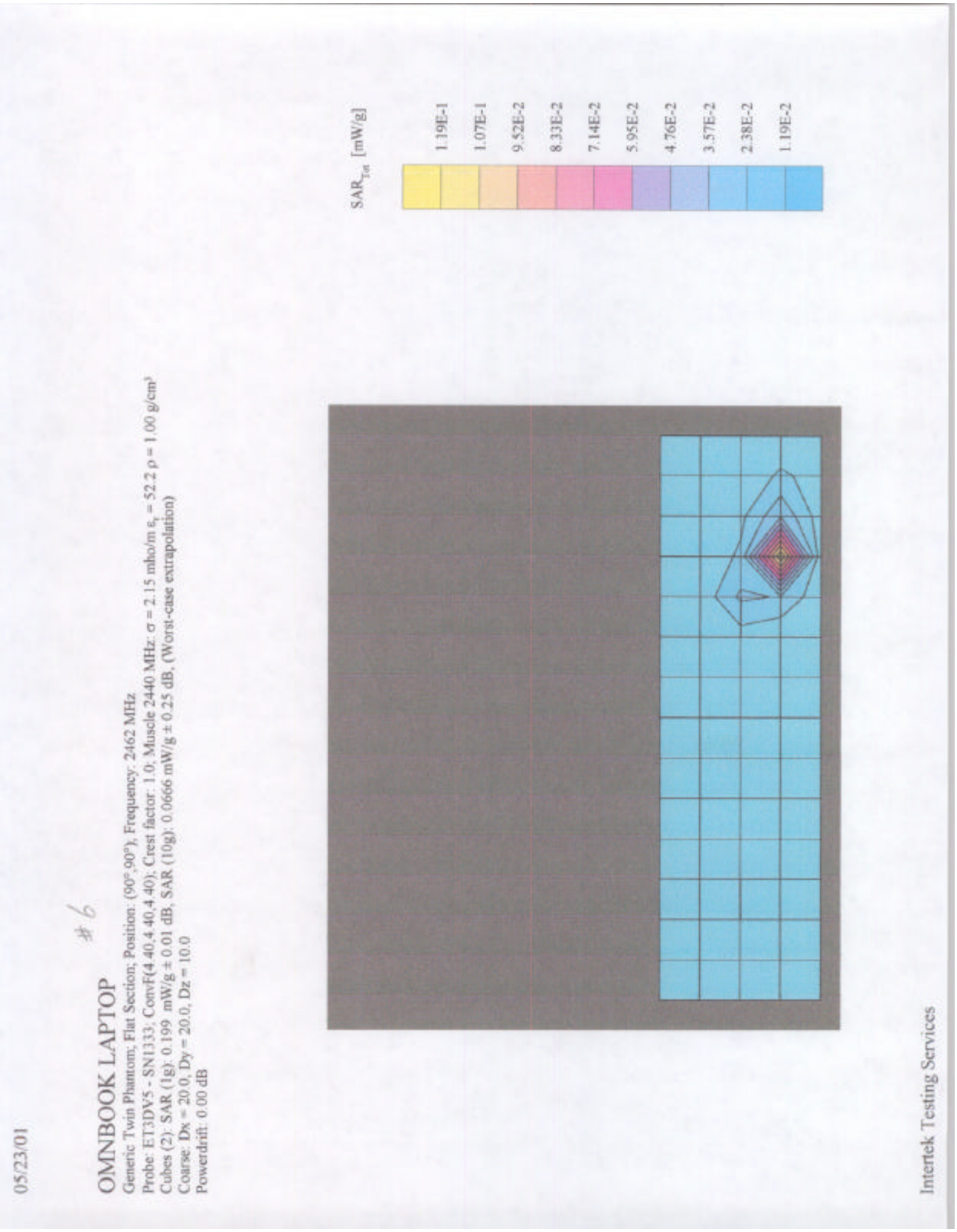
Generic Twin Phantom; Flat Section; Position: (90°,90°); Frequency: 2437 MHz
Probe: ET3DV5 - SN1333; ConvF(4.40,4.40,4.40); Crest factor: 1.0; Muscle 2440 MHz: σ = 2.15 mho/m ε_r = 52.2 ρ = 1.00 g/cm³
Cubes (2): SAR (1g): 0.276 mW/g ± 0.01 dB, SAR (10g): 0.0930 mW/g ± 0.25 dB, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.10 dB
SAR_Tot [mW/g]
2.11E-1
1.90E-1
1.69E-1
1.48E-1
1.27E-1
1.06E-1
8.44E-2
6.33E-2
4.22E-2
2.11E-2
Intertek Testing Services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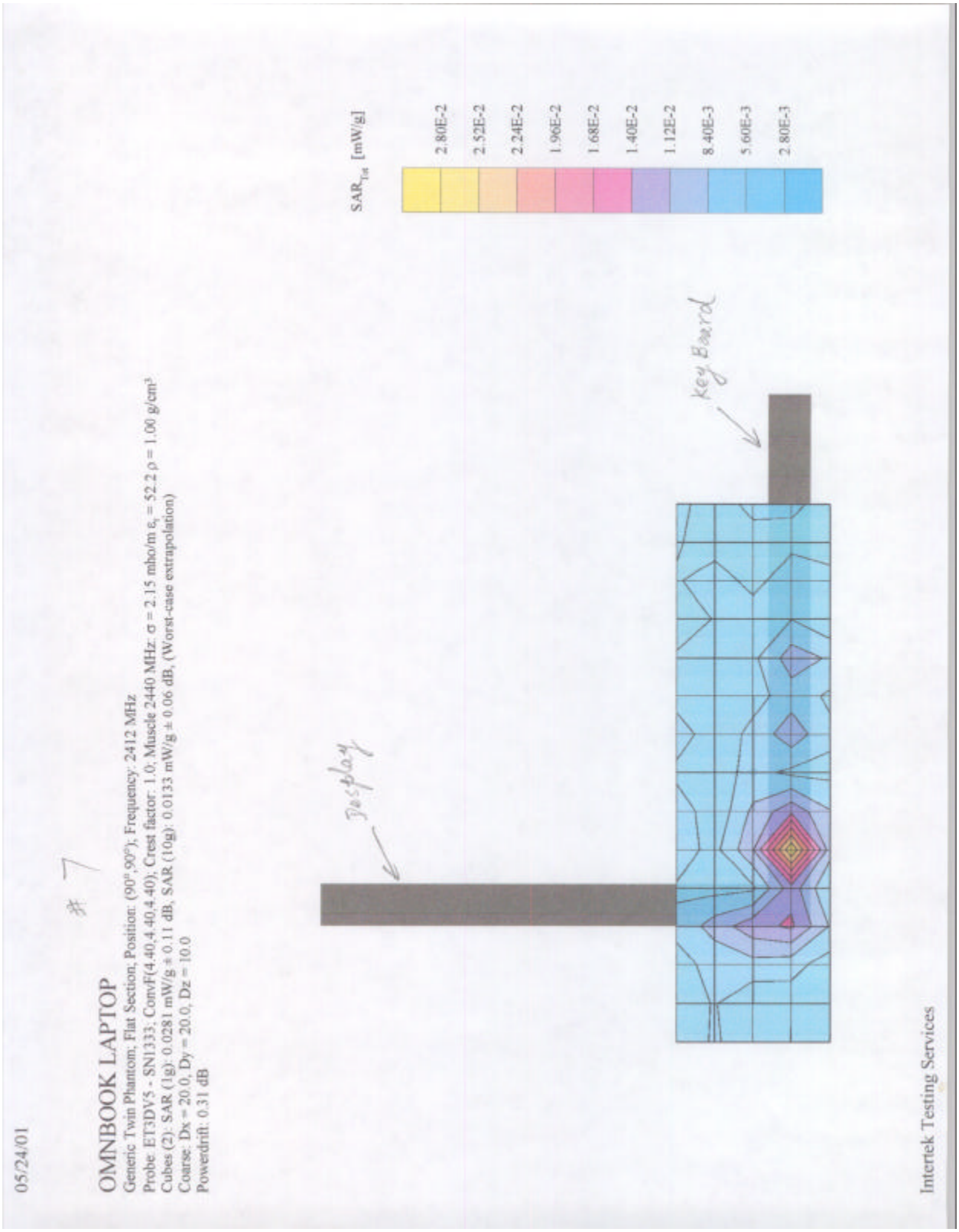
OMNBOOK LAPTOP
Generic Twin Phantom; Flat Section; Position: (90°,90°); Frequency: 2462 MHz
Probe: ET3DV5 - SN1333; ConvF(4.40,4.40,4.40); Crest factor: 1.0; Muscle 2440 MHz: σ = 2.15 mho/m ε_r = 52.2 ρ = 1.00 g/cm³
Cubes (2): SAR (1g): 0.199 mW/g ± 0.01 dB, SAR (10g): 0.0666 mW/g ± 0.25 dB, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.00 dB
SAR_Tot [mW/g]
1.19E-1
1.07E-1
9.52E-2
8.33E-2
7.14E-2
5.95E-2
4.76E-2
3.57E-2
2.38E-2
1.19E-2
Intertek Testing Services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Probe: ET3DV5 - SN1333; ConvF(4.40,4.40,4.40); Crest factor: 1.0; Muscle 2440 MHz: σ = 2.15 mho/m εr = 52.2 ρ = 1.00 g/cm³
Cubes (2): SAR (1g): 0.0281 mW/g ± 0.11 dB, SAR (10g): 0.0133 mW/g ± 0.06 dB, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.31 dB
SAR1st [mW/g]
2.80E-2
2.52E-2
2.24E-2
1.96E-2
1.68E-2
1.40E-2
1.12E-2
8.40E-3
5.60E-3
2.80E-3
Key Board
Display
Intertek Testing Services

APPENDIX B - E-Field Probe Calibration Data

See attached.

Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

Calibration Certificate

Dosimetric E-Field Probe

Type:	**ET3DV5**
Serial Number:	**1333**
Place of Calibration:	**Zurich**
Date of Calibration:	**April 23, 2001**
Calibration Interval:	**12 months**

Schmid & Partner Engineering AG hereby certifies, that this device has been calibrated on the date indicated above. The calibration was performed in accordance with specifications and procedures of Schmid & Partner Engineering AG.

Wherever applicable, the standards used in the calibration process are traceable to international standards. In all other cases the standards of the Laboratory for EMF and Microwave Electronics at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland have been applied.

Calibrated by:	Nikolova Neviana
Approved by:	Jlusic Katja

Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland, Telephone +41 1 245 97 00, Fax +41 1 245 97 79

Probe ET3DV5

SN:1333

Manufactured:	December 20, 1997
Last calibration:	April 10, 2000
Recalibrated:	April 23, 2001

Calibrated for System DASY3

ET3DV5 SN:1333

DASY3 - Parameters of Probe: ET3DV5 SN:1333

Sensitivity in Free Space

Diode Compression

NormX	2.37 $\mu V/(V/m)^2$	DCP X	100 mV
NormY	2.38 $\mu V/(V/m)^2$	DCP Y	100 mV
NormZ	2.33 $\mu V/(V/m)^2$	DCP Z	100 mV

Sensitivity in Tissue Simulating Liquid

Head **450 MHz** ε_r = 43.5 ± 5% σ = 0.87 ± 10% mho/m

ConvF X	6.25 extrapolated	Boundary effect:	
ConvF Y	6.25 extrapolated	Alpha	0.19
ConvF Z	6.25 extrapolated	Depth	3.06

Head **900 MHz** ε_r = 42 ± 5% σ = 0.97 ± 10% mho/m

ConvF X	5.83 ± 7% (k=2)	Boundary effect:	
ConvF Y	5.83 ± 7% (k=2)	Alpha	0.38
ConvF Z	5.83 ± 7% (k=2)	Depth	2.70

Brain **1500 MHz** ε_r = 41 ± 5% σ = 1.32 ± 10% mho/m

ConvF X	5.27 interpolated	Boundary effect:	
ConvF Y	5.27 interpolated	Alpha	0.63
ConvF Z	5.27 interpolated	Depth	2.23

Brain **1800 MHz** ε_r = 41 ± 5% σ = 1.69 ± 10% mho/m

ConvF X	4.99 ± 7% (k=2)	Boundary effect:	
ConvF Y	4.99 ± 7% (k=2)	Alpha	0.75
ConvF Z	4.99 ± 7% (k=2)	Depth	1.99

Sensor Offset

Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.6 ± 0.2	mm

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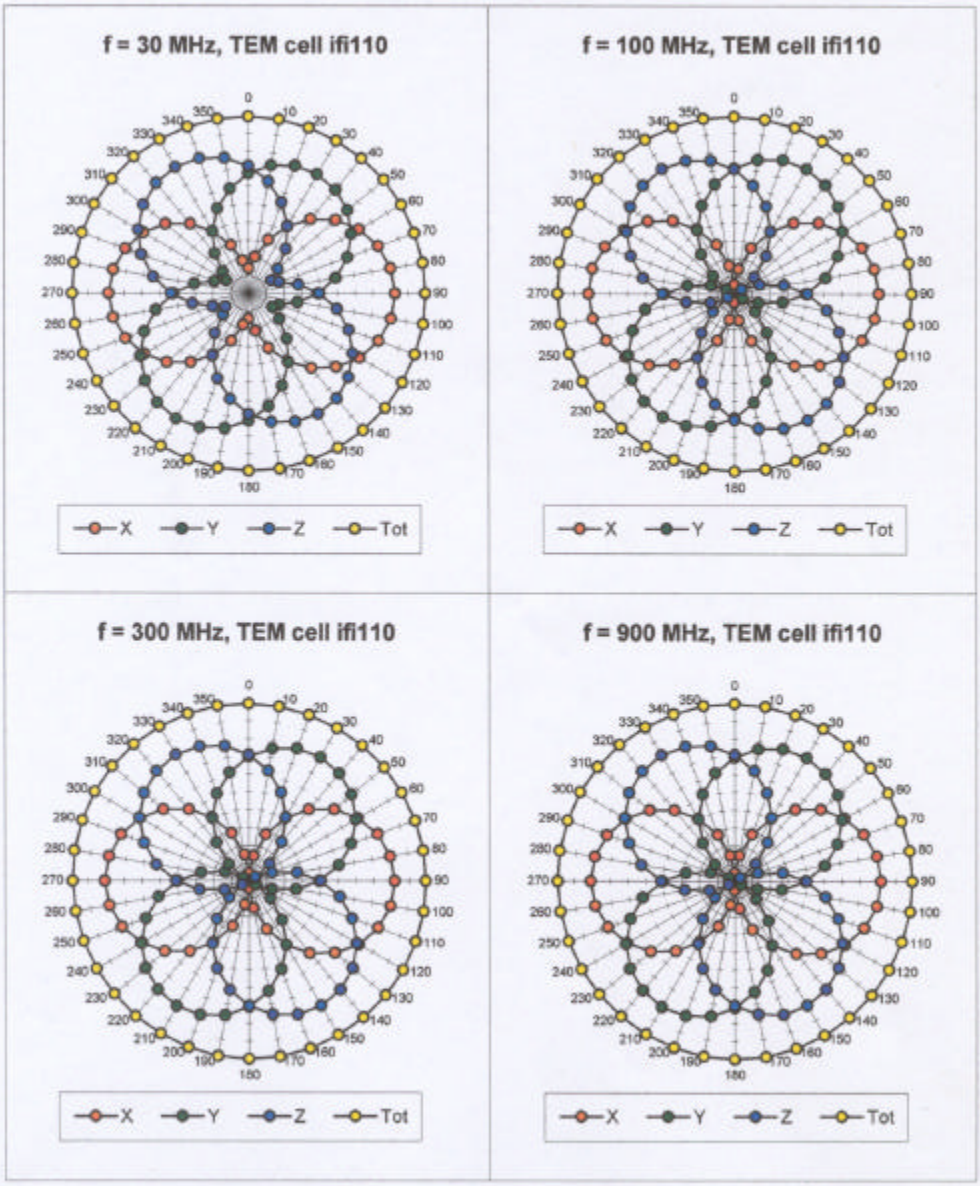
Receiving Pattern (ϕ), θ = 0°



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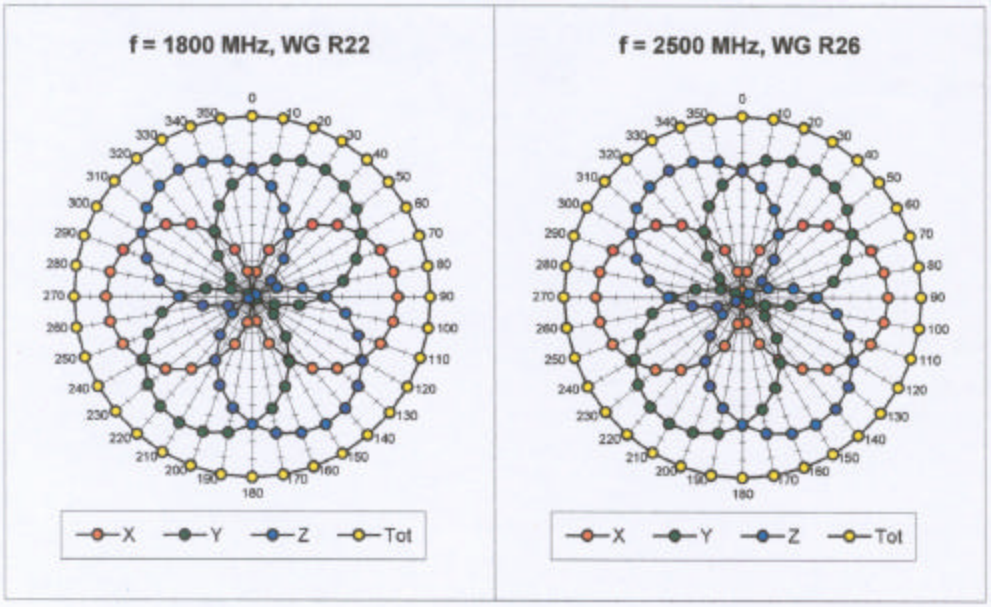
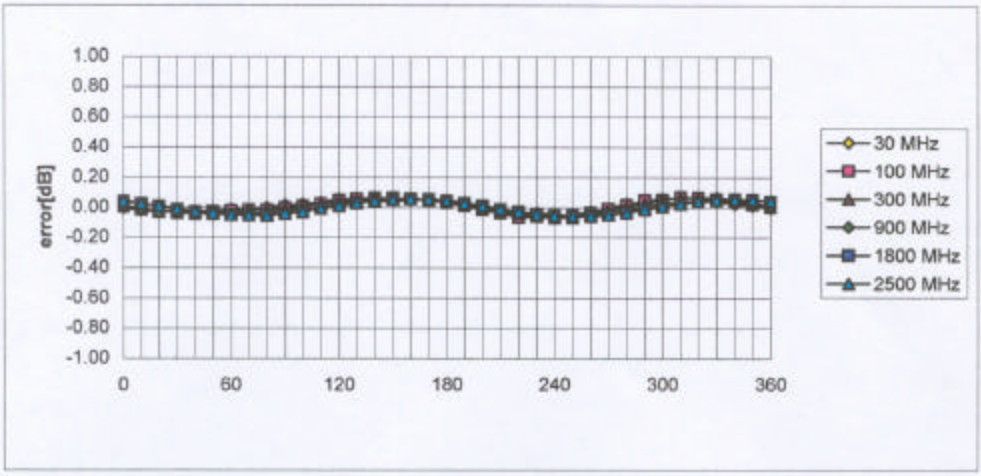


Isotropy Error (ϕ), θ = 0°



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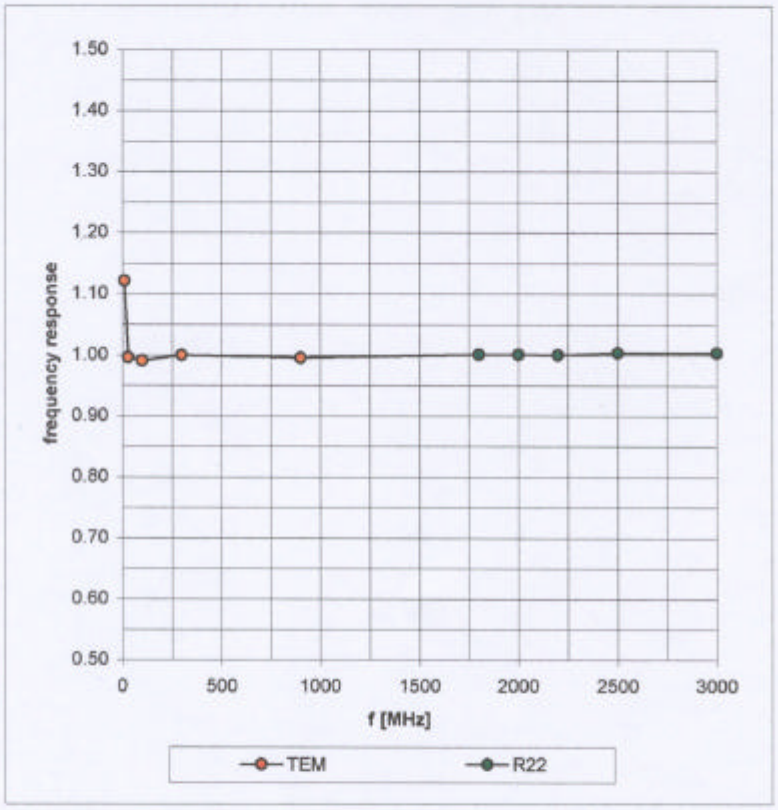
Frequency Response of E-Field

(TEM-Cell:ifi110, Waveguide R22)



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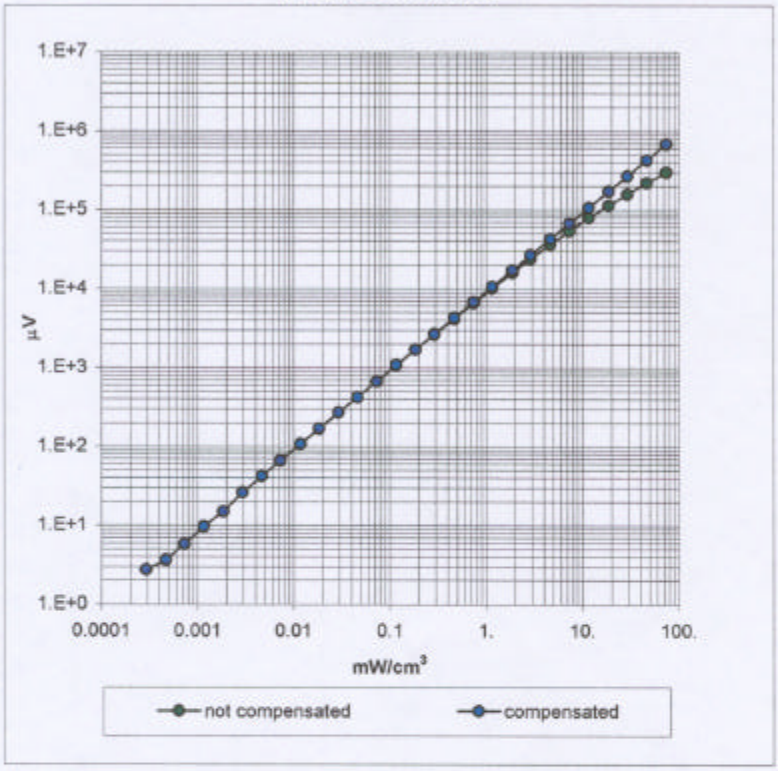
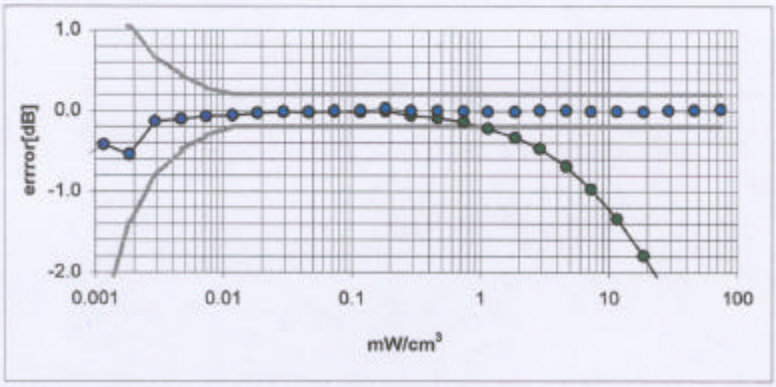
Dynamic Range f(SAR_{brain})

(TEM-Cell:ifi110)





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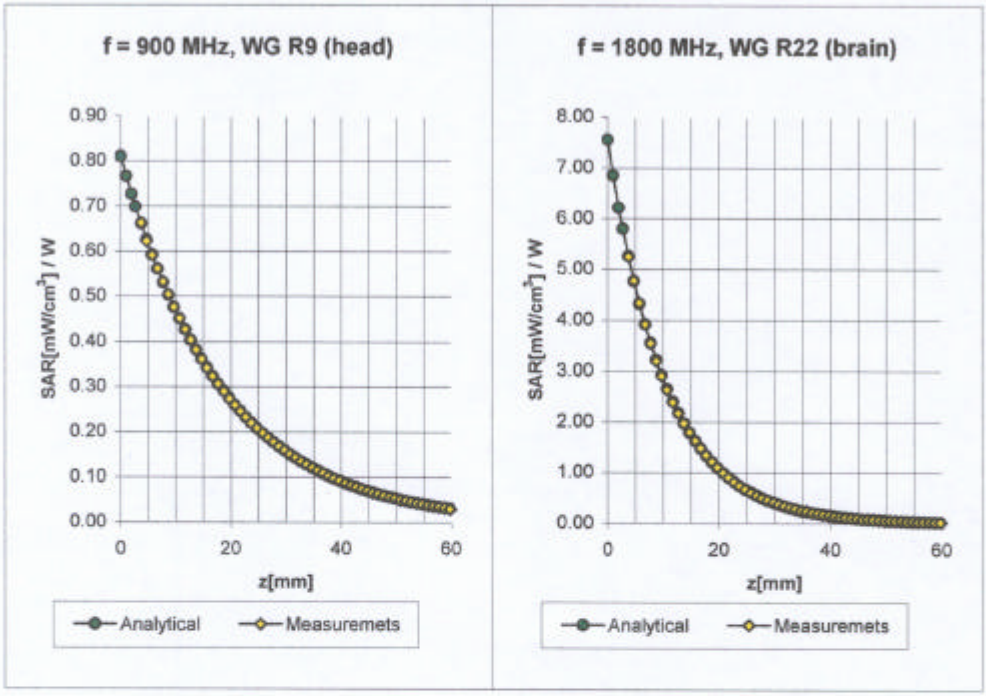
Conversion Factor Assessment



Head **900 MHz** ε_r **= 42 ± 5%** σ **= 0.97 ± 10% mho/m**

ConvF X	**5.83** ± 7% (k=2)	Boundary effect:	
ConvF Y	**5.83** ± 7% (k=2)	Alpha	**0.38**
ConvF Z	**5.83** ± 7% (k=2)	Depth	**2.70**

Brain **1800 MHz** ε_r **= 41 ± 5%** σ **= 1.69 ± 10% mho/m**

ConvF X	**4.99** ± 7% (k=2)	Boundary effect:	
ConvF Y	**4.99** ± 7% (k=2)	Alpha	**0.75**
ConvF Z	**4.99** ± 7% (k=2)	Depth	**1.99**

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