ITS Intertek Testing Services
ETL SEMKO

Specific Absorption Rate (SAR) Test Report

for

Matsushita Electric Works, Ltd.

on the

Emergency Portable Cellular Telephone
Model Number: PSD

Test Report: 30171762
Date of Report: January 14, 2001

Job #: 3017176
Date of Test: January 7 & 11, 2002

Total No of Pages Contained in this Report: 38 .

Warnock Hersey

Tested by:	Suresh Kondapalli
Reviewed by: David Chernomordik	David Chernomordik, Ph.D., EMC Technical Manager

Review Date: 01/21/02

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1.0 JOB DESCRIPTION

1.1 Client Information

The PSD has been tested at the request of:

Company: Matsushita Electric Works, Ltd
1048, Kadoma
Osaka, 571-8686
Japan
Name of contact: Mr. Akira Ohya
Telephone: +81-6-6906-0473
Fax: +81-6-6906-0520

1.2 Equipment under test (EUT)

Product Descriptions:

Equipment	Emergency Portable Cellular Telephone		
Trade Name	Matsushita Electric Works, Ltd.	P/N.	PSD
FCC ID	HHV20011107	S/N No.	17407801777
Category	Portable	RF Exposure	Uncontrolled Environment
Frequency Band	824-849 MHz	System	AMPS

EUT Antenna Description			
Type	Monopole	Configuration	Fixed
Dimensions	17.4mm (L),	Gain	2.14 dBi
Location	Right side top		

Use of Product : Emergency calls.
Manufacturer: Shintom Co., Ltd.

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

EUT receive date: January 3, 2002

EUT received condition: Good working condition prototype

Test start date: January 3, 2002

Test end date: January 11, 2002

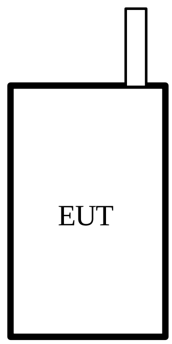
1.3 Test Plan Reference

FCC rule part 2.1093, FCC Docket 96-326 & Supplement C (Edition 01 - 01) to OET Bulletin 65

1.4 System Test Configuration

1.4.1 System Block Diagram & Support equipment

The diagram shown below details test configuration of the equipment under test.



No Support Equipment was used. The test sample was operated in a test mode that allows control of the transmitter without the need to place actual phone calls. For the purposes of this test the device is commanded to test mode and manually set to the proper channel, transmitter power level and transmit mode of operation. The device was then placed in the SAR measurement system with a fully charged battery.

1.4.2 Test Position

Three test configurations were used to show compliance with the FCC RF human exposure requirements. In all configurations, the PSD was configured for testing in a typical fashion (as a customer would normally use it). Due to the application and usage of the product, SAR measurements with the human head region are not necessary.

The intended use position is as follows:
1. Hands-free operation by using belt clip. The phone is attached to user's body.
2. Holding the phone with the hand away from user's head.
3. Hands-free operation with the phone placed away from the user, i.e. on a desk, etc.

The phone does not contain an ear piece that allows the user to position the phone against the head as with a typical phone. The phone uses a loud speaker positioned below the area of where a typical ear piece would be located. The intended use position is to hold the unit by the hand with the entire front side of the phone (speaker and microphone) towards the user or to attach the unit to the body with a belt clip.

Table 1 below describes the setup and condition:

Table 1, Equipment Setup

Configuration	Description
A	• Antenna in horizontal position The Phone Touching the Phantom • Simulating close proximity of human hand holding the Phone • Distance of Antenna axis from Phantom 12.0 mm
B	• Antenna in horizontal position, The Belt Clip touching Phantom • Simulating close proximity of human body • Distance of Antenna axis from Phantom 24.4 mm

Figure 1a: Configuration A

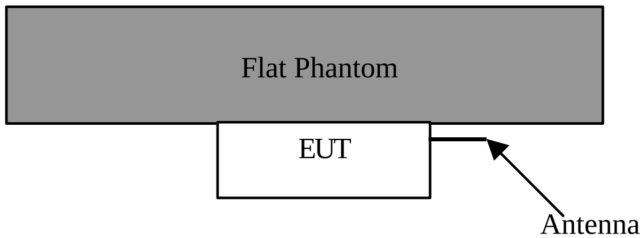
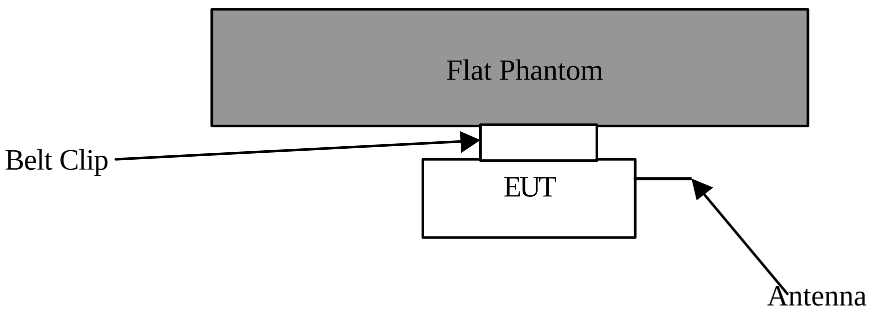


Figure 1b Configuration B



1.4.3 Test Condition

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

EUT Antenna	Fixed length		
Usage	Body Configuration	Distance between antenna axis at the joint and the liquid surface: In Configuration A In Configuration B	 12.0 mm 24.4 mm
Simulating human Body/Head	Body	EUT Battery	Unit is powered by two CR123A Lithium Batteries .
Power output (conducted)	Frequency (MHz)	Power output dBm	
	824	26.87	
	836	26.52	
	849	25.79	

The spatial peak SAR values were accessed for lowest, middle and highest operating channels defined by the manufacturer. The antenna port power level was furnished by the manufacturer.

1.5 Modifications required for compliance

No modifications were implemented by Intertek Testing Services.

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

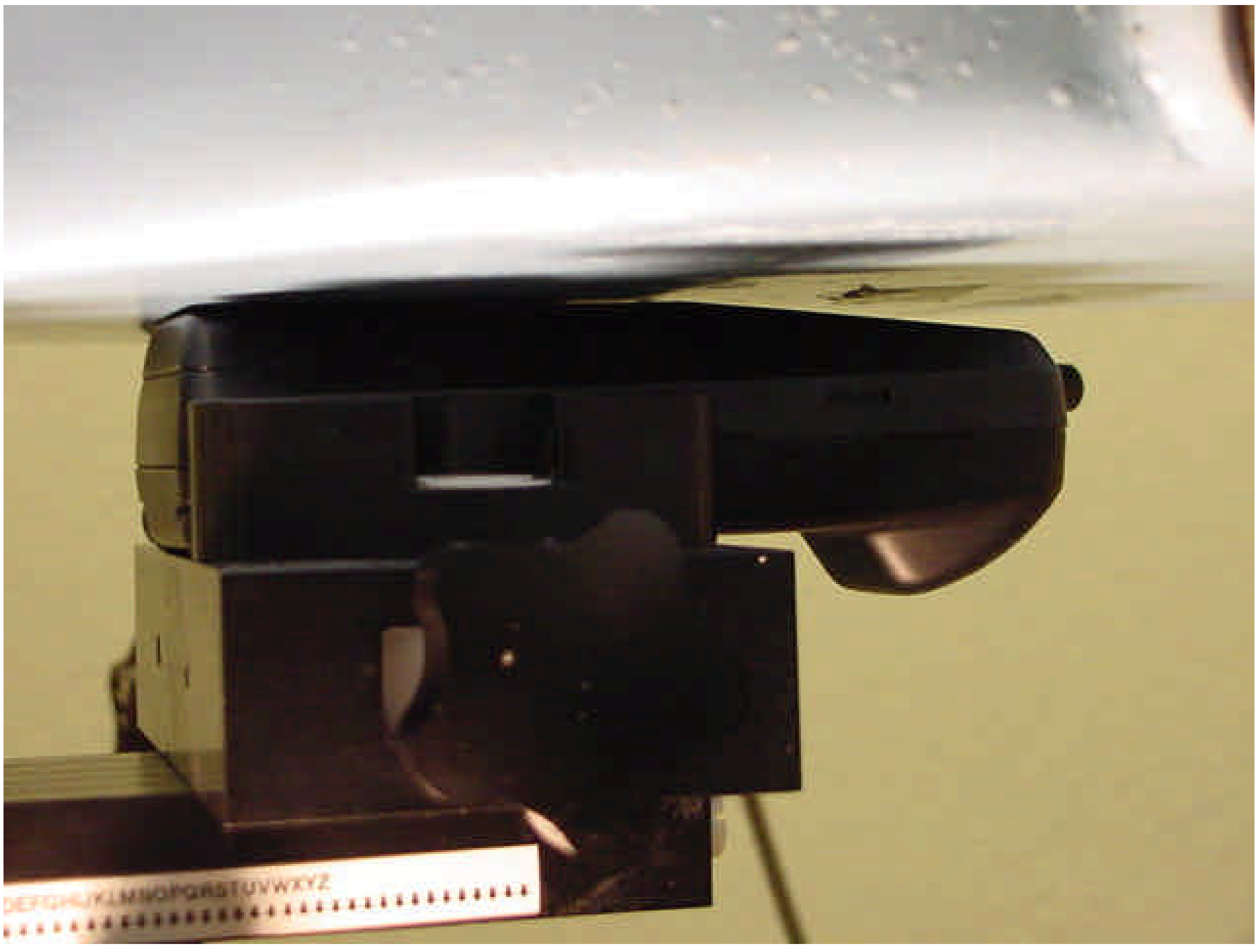
The following FCC limits for SAR apply to devices operate in General Population/Uncontrolled Exposure environment:

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

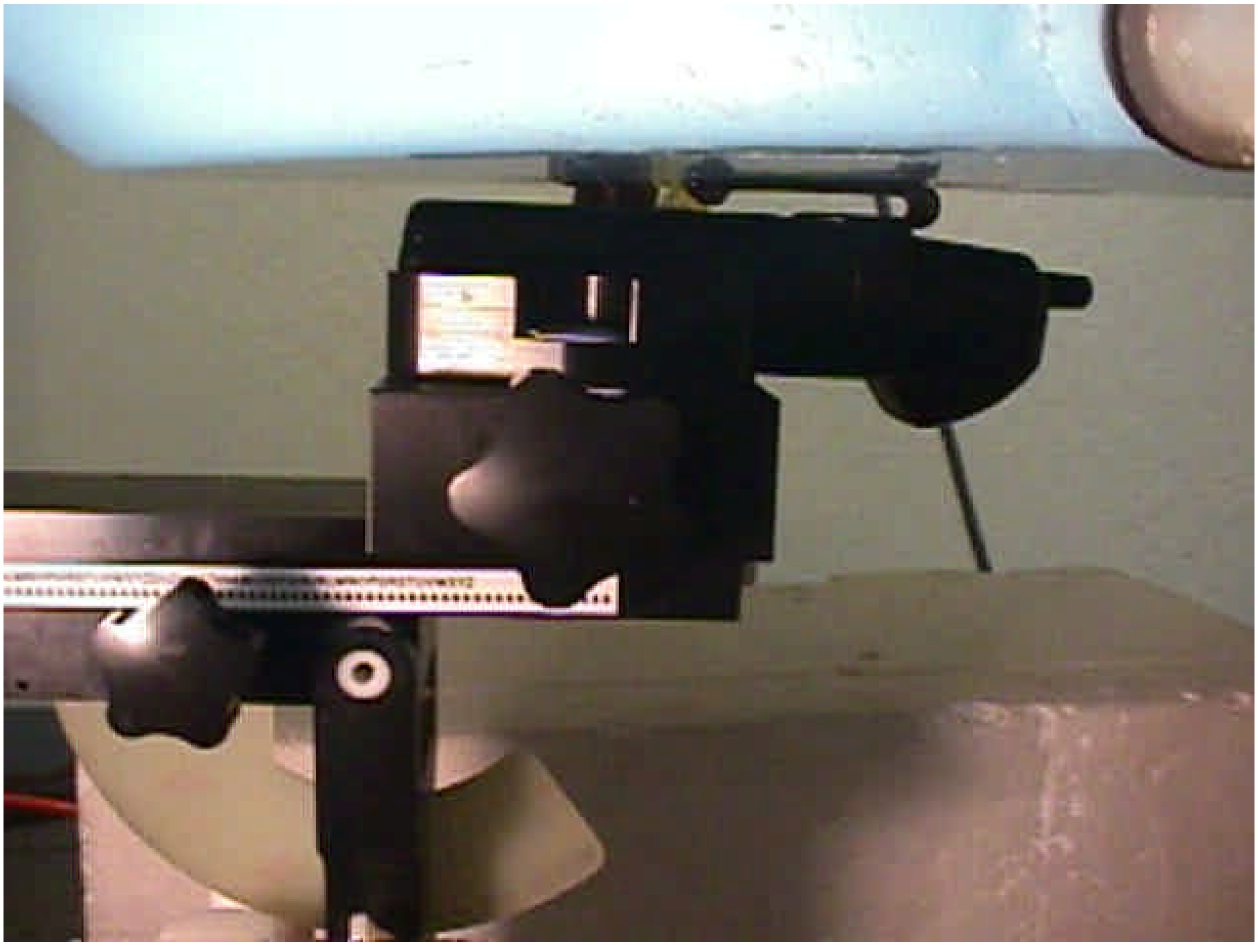
(Configuration A)



2.2 Configuration Photographs (Continued)

SAR measurement Test Setup

(Configuration B)



2.2 Configuration Photographs (Continued)

EUT Photo

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 900MHz.

Validation kit	Targeted SAR_{1g} (mW/g)	Measured SAR_{1g} (mW/g)
D900V2, S/N #: 0013	2.77	2.97

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:	Matsushita Electric Works, Ltd.	**Model No.:**	PSD
Serial No.:	17407801777	**Test Engineer:**	Suresh Kondapalli

TEST CONDITIONS			
Ambient Temperature	23.5 ^{o}C	Relative Humidity	55 %
Test Signal Source	Test Mode	Signal Modulation	CW
Test Duration	20 Min. each test	Number of Battery Change	Every Scan

Configuration A (Phone Touching Phantom)				
Frequency MHz	Operating Mode	Duty Cycle ratio	Measured SAR_{10g} (mW/g)	Plot Number
824	CW	1	1.55	4
836	CW	1	1.54	5
849	CW	1	1.50	6

Configuration B (Phone with the belt clip)				
Frequency MHz	Operating Mode	Duty Cycle ratio	Measured SAR_{1g} (mW/g)	Plot Number
824	CW	1	1.39	1
836	CW	1	1.42	2
849	CW	1	1.36	3

Note: a) Worst case data were reported
b) Duty cycle factor included in the measured SAR data
c) 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 a 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 #	LAST CAL. DATE
Robot	**Stäubi RX60L**	597412-01	N/A
	Repeatability: ± 0.025mm Accuracy: 0.806×10^{-3} degree Number of Axes: 6		
E-Field Probe	**ET3DV5**	1333	04/13/01
	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	01/07/02
	Please see section 6.2 for details		
Power Meter	**HP 8900D** w/ 84811A sensor	3607U00673	08/08/01
	Frequency Range: 100kHz to 18 GHz Power Range: 300µW to 3W		

3.2 Muscle Tissue Simulating Liquid

Ingredient	**Frequency** (800-900 MHz)
Water	52.4 %
Sugar	45.0 %
Salt	1.4 %
Bactericide	0.1 %
HEC	1.0 %

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$^{3)}$
836	55.2	0.97	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

For body-worn operation, this phone has been tested and meets the FCC RF Exposure guidelines when used in hands or with the belt clip supplied or designated for this product. Use of other belt clip or close to the head may not ensure compliance with FCC RF Exposure guidelines.

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.

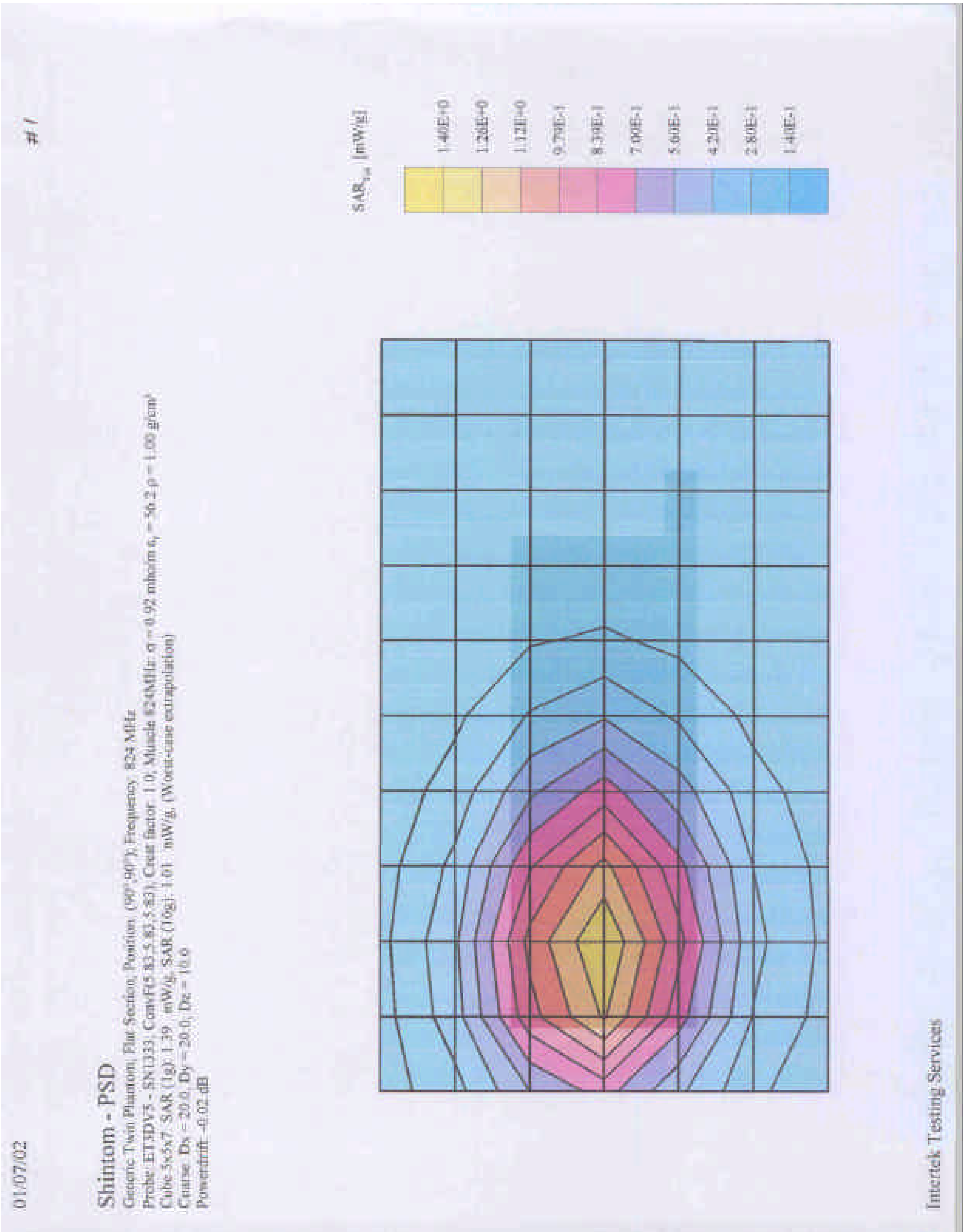
6.0 DOCUMENT HISTORY

Revision/ Job Number	Writer Initials	Date	Change
1.0 /3017176	SS	January 14, 2001	Original document

APPENDIX A - SAR Evaluation Data

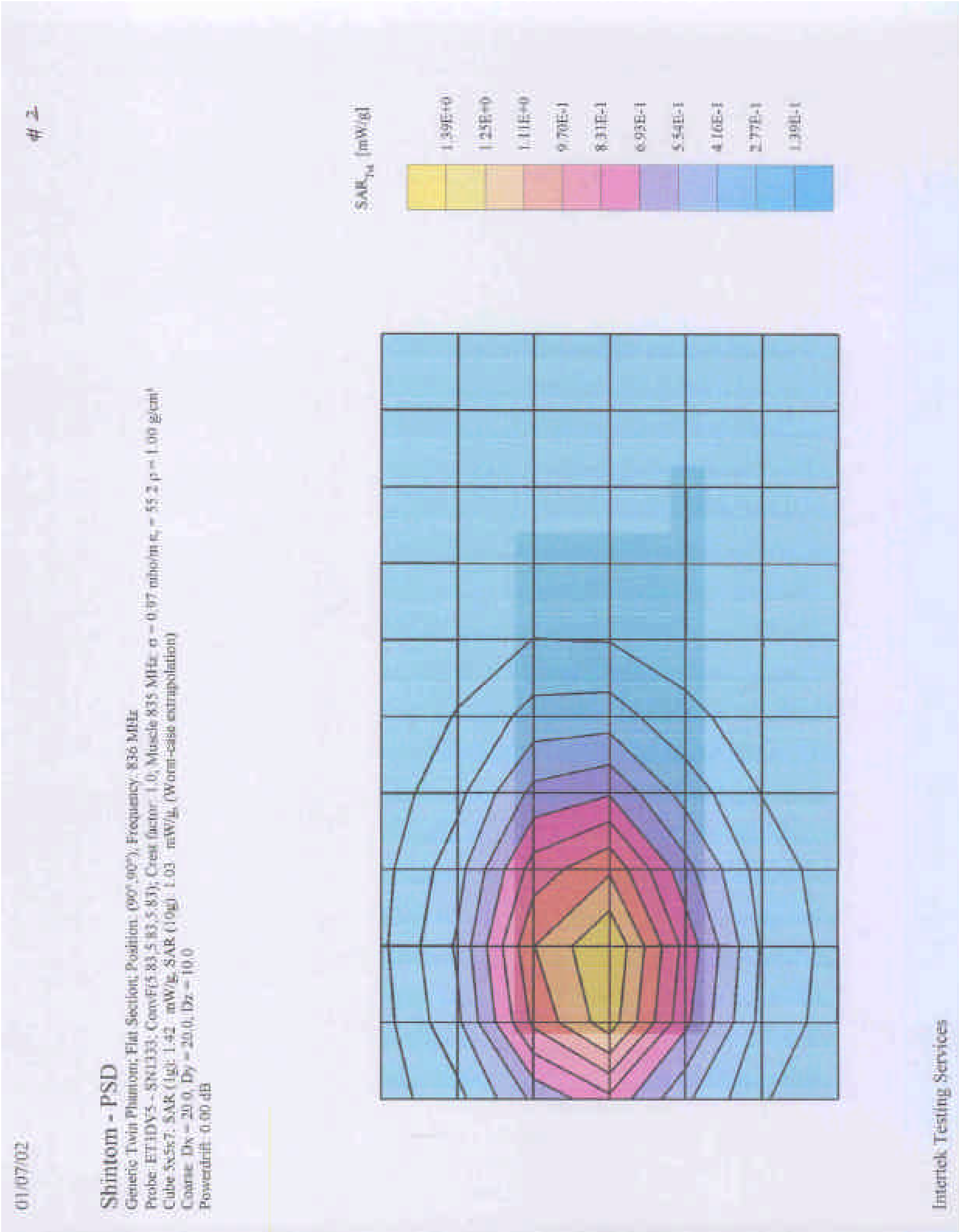
Please note that the graphical visualization of the phone position onto the SAR distribution gives only limited information on the current distribution of the device, since the curvature of the head results in graphical distortion. Full information can only be obtained either by H-field scans in free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

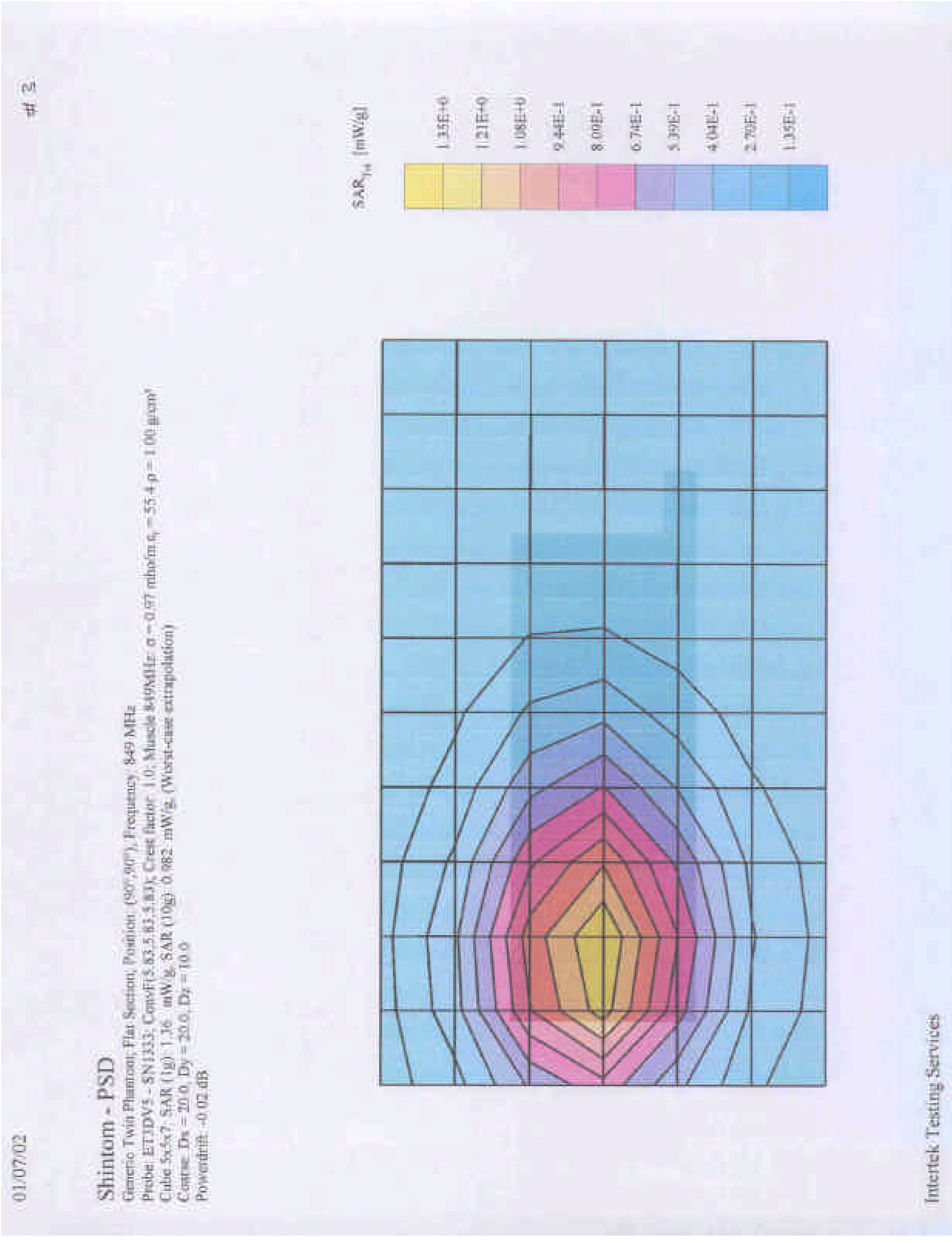
Power drift is the measurement of power drift of the device over one complete SAR scan.

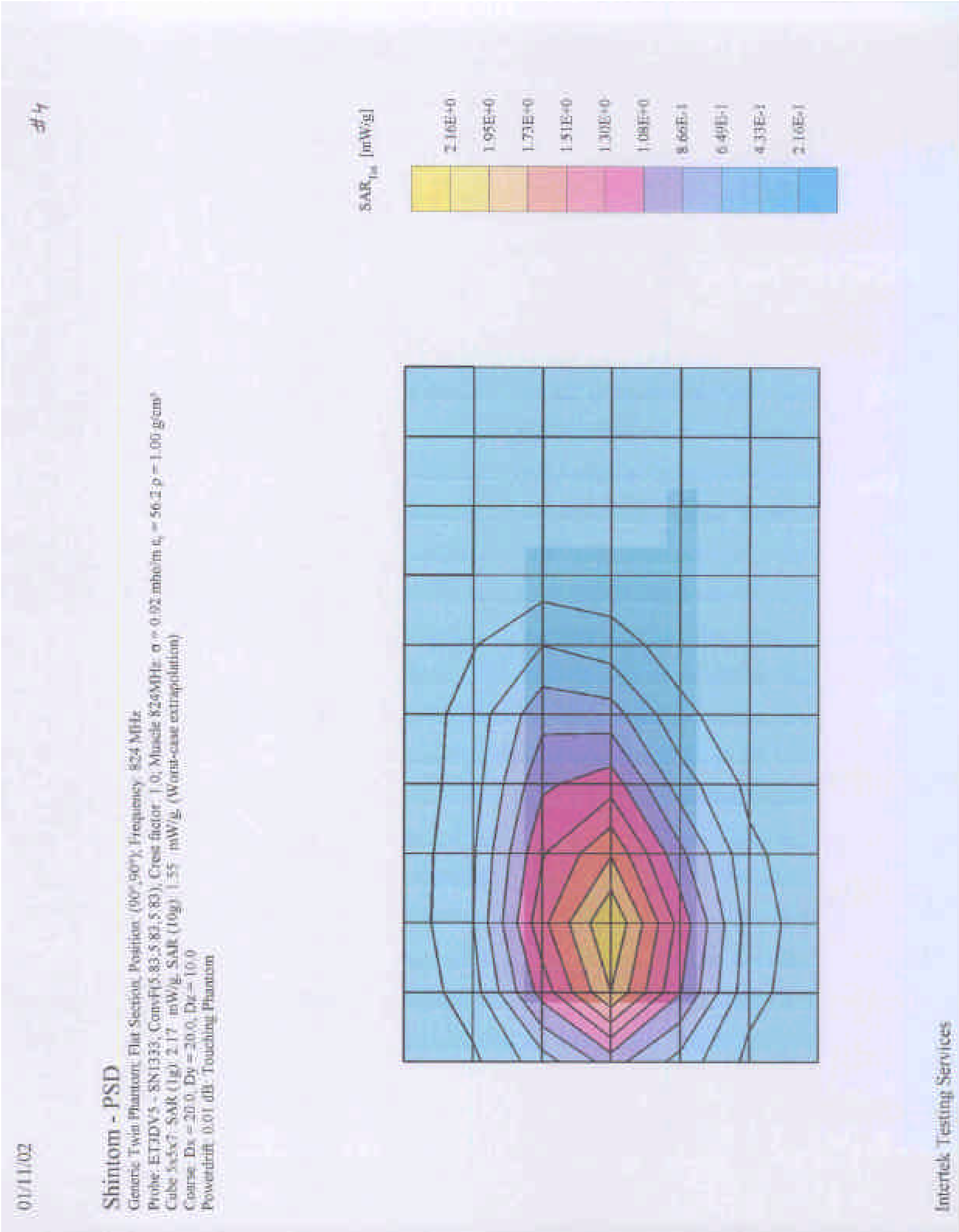

#1
01/07/02
Shintom - PSD
Generic Twin Phantom; Flat Section; Position: (90°,90°); Frequency: 824 MHz
Probe: ET3DV5 - SN1333; ConvF(5.83,5.83,5.83); Crest factor: 1.0; Muscle 824MHz: σ = 0.92 mho/m εr = 56.2 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 1.39 mW/g, SAR (10g): 1.01 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.02 dB
SAR Tot [mW/g]
1.40E+0
1.26E+0
1.12E+0
9.79E-1
8.39E-1
7.00E-1
5.60E-1
4.20E-1
2.80E-1
1.40E-1
Intertek Testing Services

Matsushita Electric Works, Ltd, Model No: PSD
FCC ID: HHV20011107

Date of Test: January 7 & 11, 2002



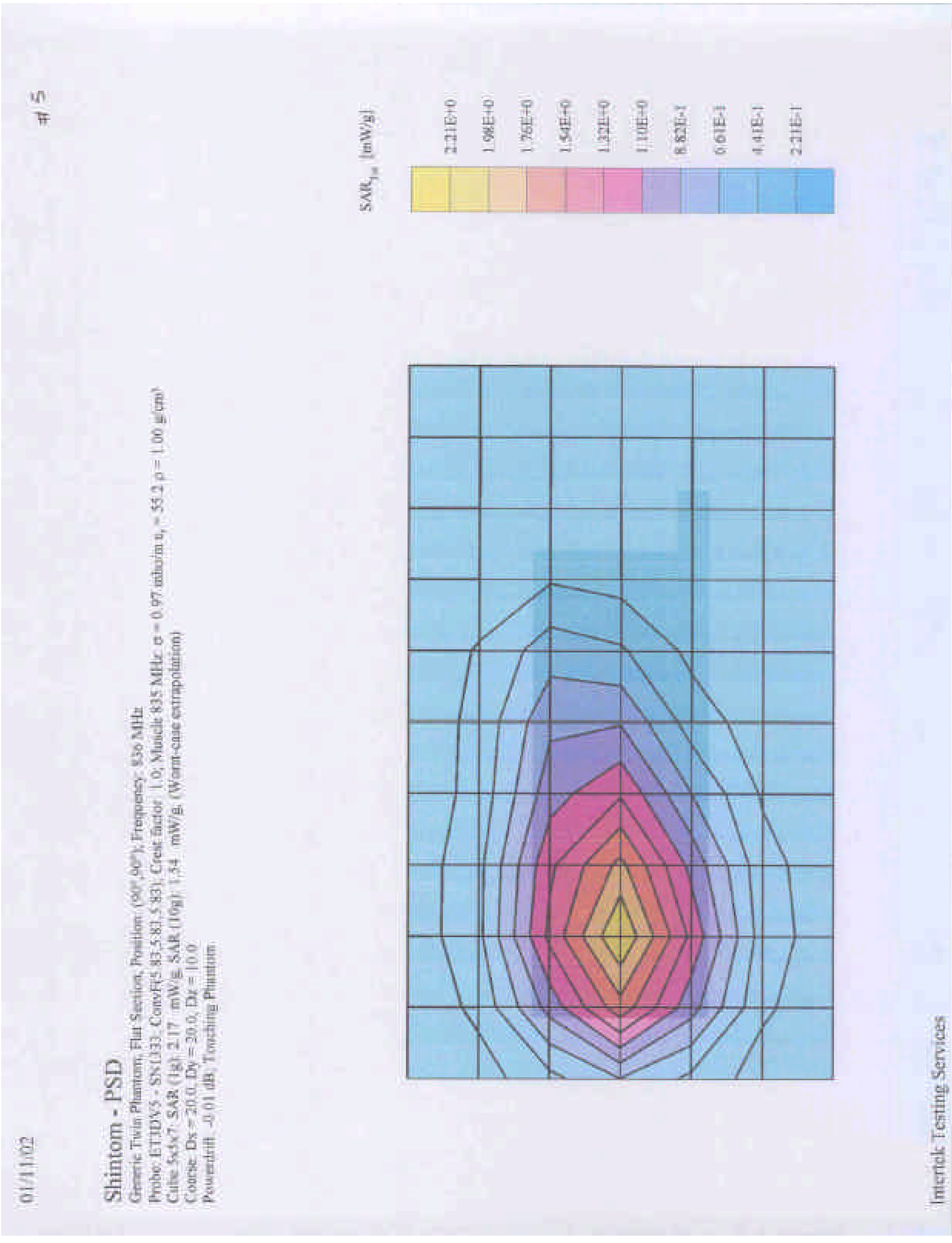

01/07/02
Shintom - PSD
Intertek Testing Services



01/11/02
Shintom - PSD
SAR1g [mW/g]
2.16E+0
1.95E+0
1.73E+0
1.51E+0
1.30E+0
1.08E+0
8.66E-1
6.49E-1
4.33E-1
2.16E-1
Intertek Testing Services

Matsushita Electric Works, Ltd, Model No: PSD
FCC ID: HHV20011107

Date of Test: January 7 & 11, 2002



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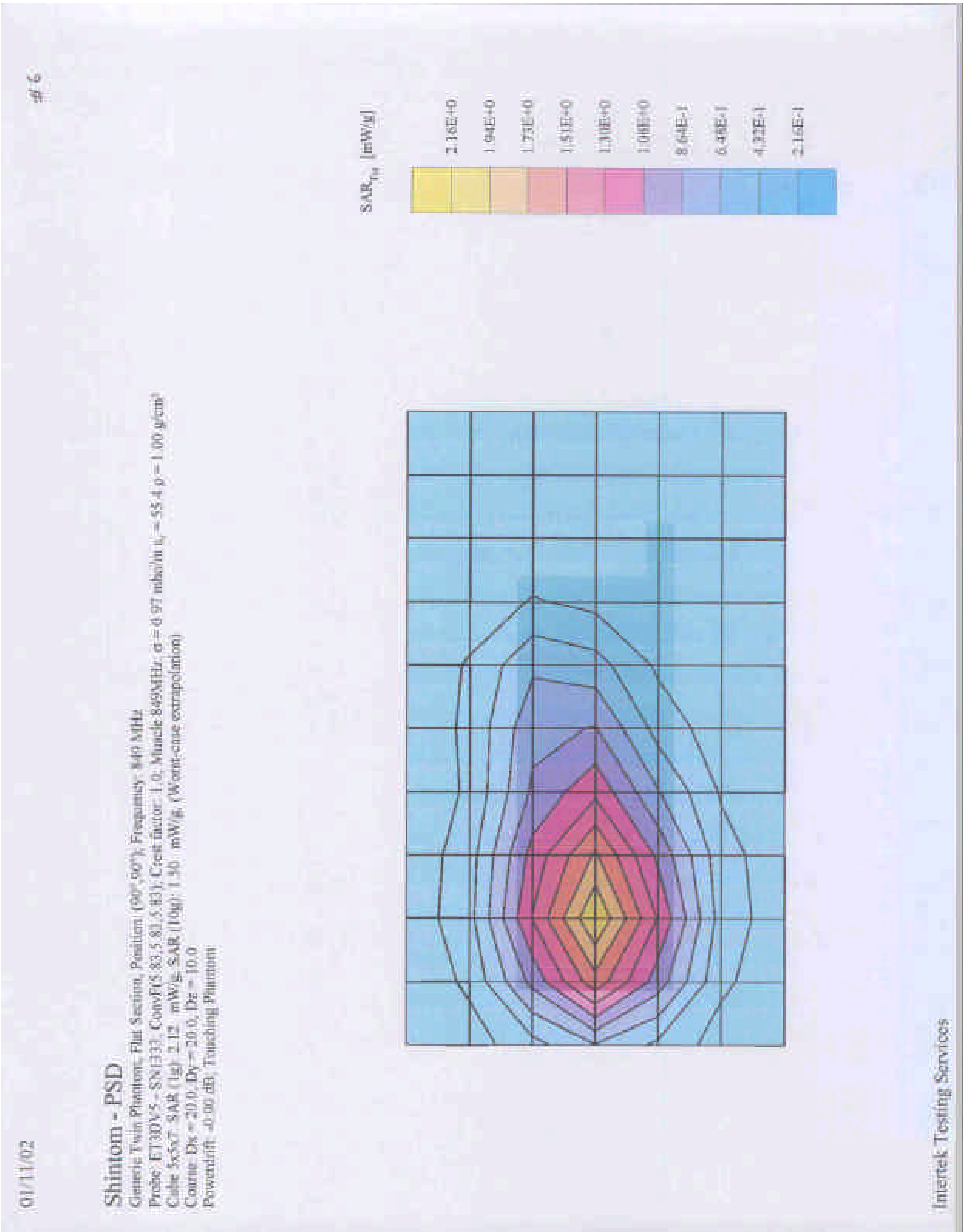
FCC ID: HHV20011107

Date of Test: January 7 & 11, 2002



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:

Approved by:

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

NormX	**2.37**	$\mu V/(V/m)^2$
NormY	**2.38**	$\mu V/(V/m)^2$
NormZ	**2.33**	$\mu V/(V/m)^2$

Diode Compression

DCP X	**100**	mV
DCP Y	**100**	mV
DCP Z	**100**	mV

Sensitivity in Tissue Simulating Liquid

Head 450 MHz $\varepsilon_r = 43.5 \pm 5\%$ $\sigma = 0.87 \pm 10\%$ **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 $\varepsilon_r = 42 \pm 5\%$ $\sigma = 0.97 \pm 10\%$ **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 $\varepsilon_r = 41 \pm 5\%$ $\sigma = 1.32 \pm 10\%$ **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 $\varepsilon_r = 41 \pm 5\%$ $\sigma = 1.69 \pm 10\%$ **mho/m**

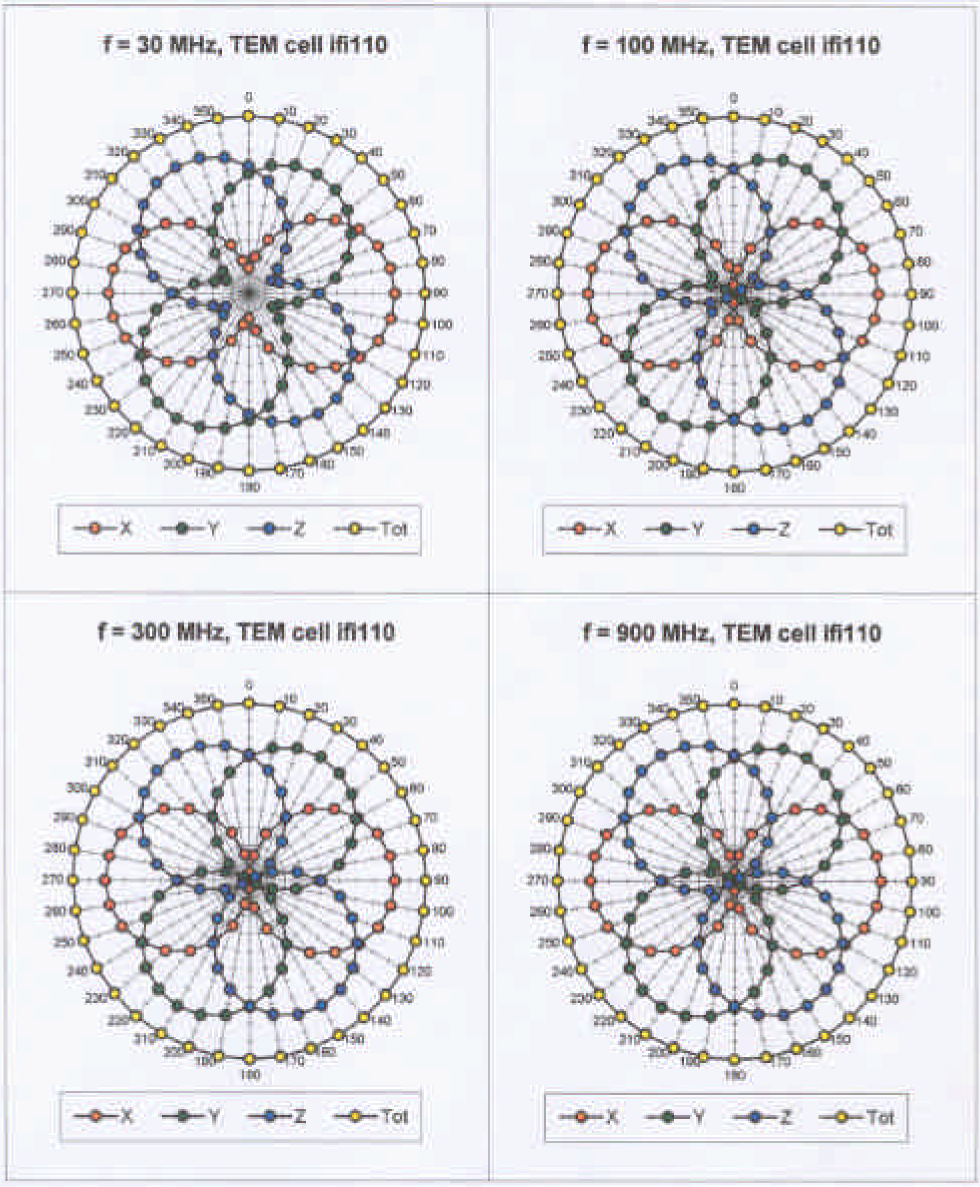
ConvF X	**4.99**	± 7% (k=2)	Boundary effect:	
ConvF Y	**4.99**	± 7% (k=2)	Alpha	**0.75**
ConvF Z	**4.99**	± 7% (k=2)	Depth	**1.99**

Sensor Offset

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

ET3DV5 SN:1333

Receiving Pattern (ϕ), θ = 0°



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Matsushita Electric Works, Ltd, Model No: PSD
FCC ID: HHV20011107

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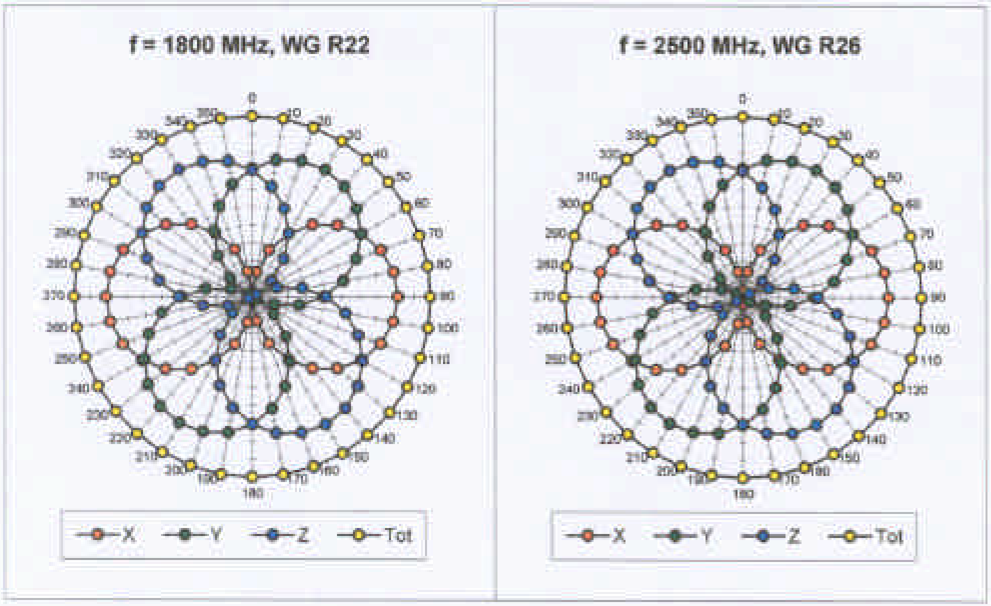
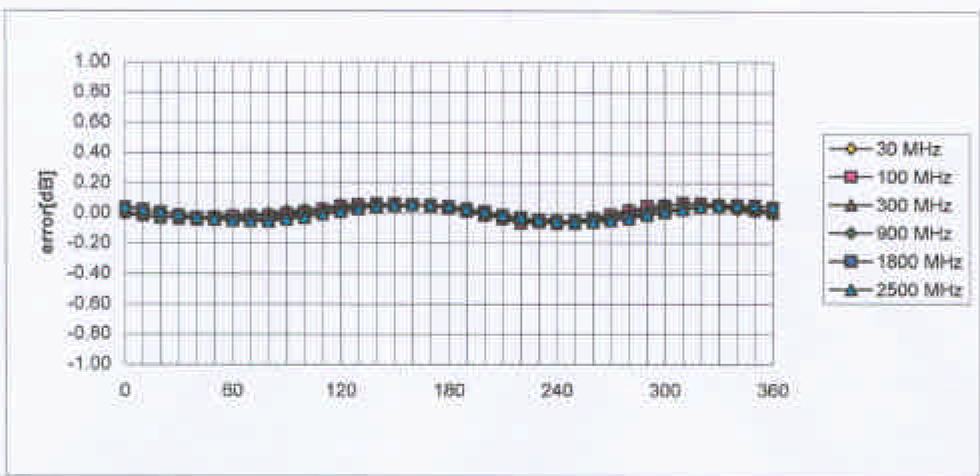
ET3DV5 SN:1333



Isotropy Error (ϕ), θ = 0°



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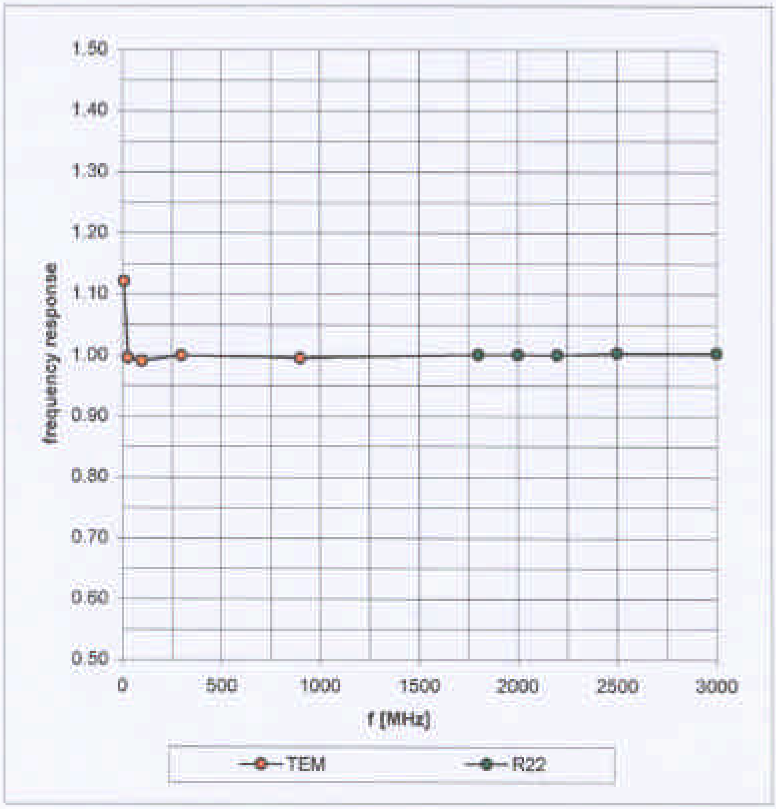
ET3DV5 SN:1333

Frequency Response of E-Field

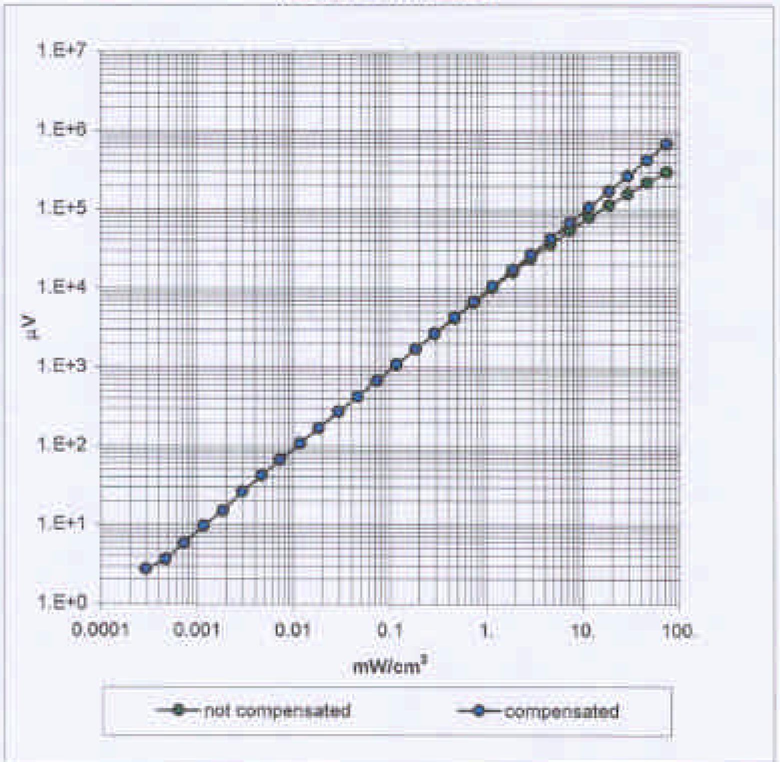
(TEM-Cell:ifi110, Waveguide R22)

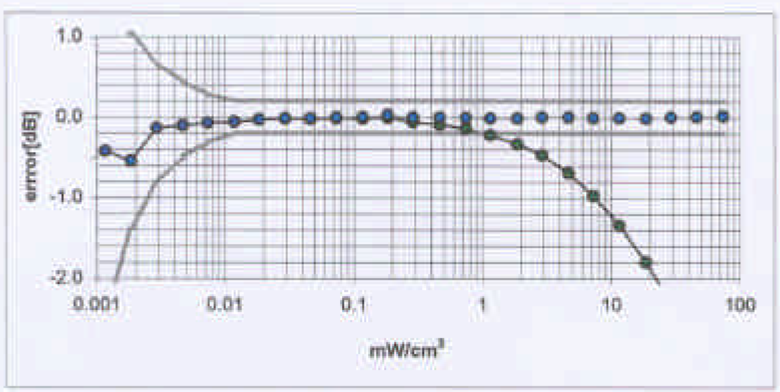


ET3DV5 SN:1333

Dynamic Range f(SAR_{brain})

(TEM-Cell:ifi110)





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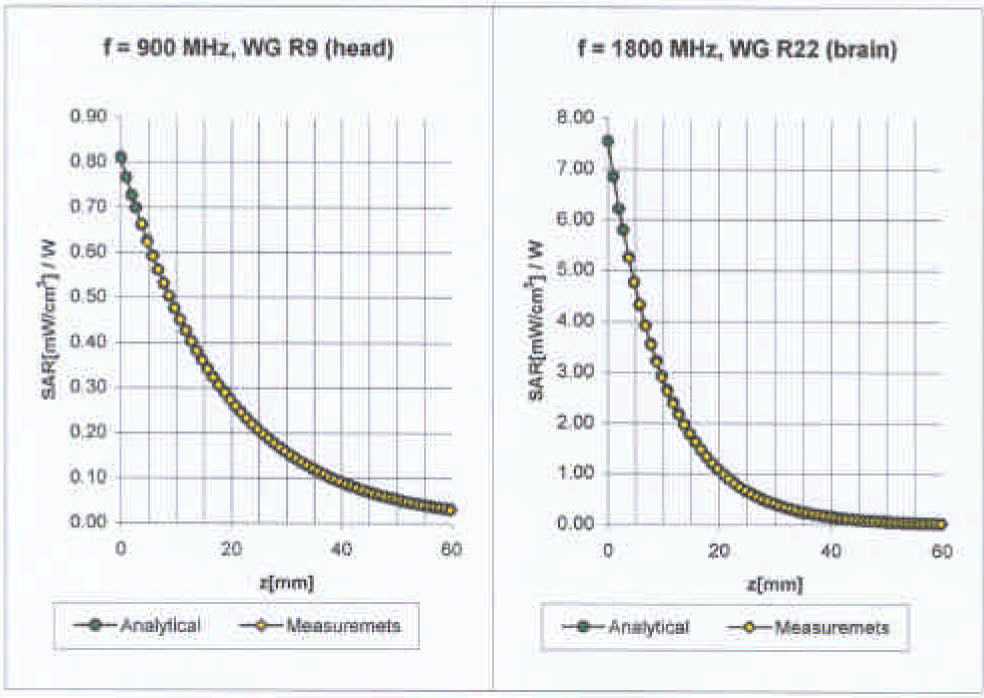
Matsushita Electric Works, Ltd, Model No: PSD
FCC ID: HHV20011107

Date of Test: January 7 & 11, 2002

ET3DV5 SN:1333

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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