Specific Absorption Rate (SAR) Test Report
for
Symbol Technologies, Inc.
on the
PDT 7533 Diamond WAN CDPD radio
Model: PDT 7533

Job # J20018637
Test Report: 20018637
Date of Report: June 30, 2000

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

Tested by:	Suresh Kondapalli	
Reviewed by:	David Chernomordik	David Chernomordik

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1 JOB DESCRIPTION

1.1 Client Information

The EUT has been tested at the request of

Company: Symbol Technologies, Inc.

Address: 1 Symbol Plaza,
Holtsvillie, N.Y. 11742-1300
U.S.A

Name of contact: Mr. Sandy Mazzola
Telephone: 516-738-5373
Fax: 516-738-3318

1.2 Equipment under test (EUT)

Product Descriptions:

The PDT 7533 is based on the Symbol Technologies Inc. Diamond terminal with a Sierra Wireless CDPD radio module imbedded inside. The Symbol terminal is a handheld portable data terminal with WAN capability supplied by the Sierra Wireless SB300 CDPD module.

The PDT 7500 series family of portable data terminals put the processing power of a 486 PC in the user's hand. The terminal uses a rechargeable Lithium-Ion 1400 mAh smart battery, and incorporates a pen technology and bar code scanning capability in a key-based terminal.

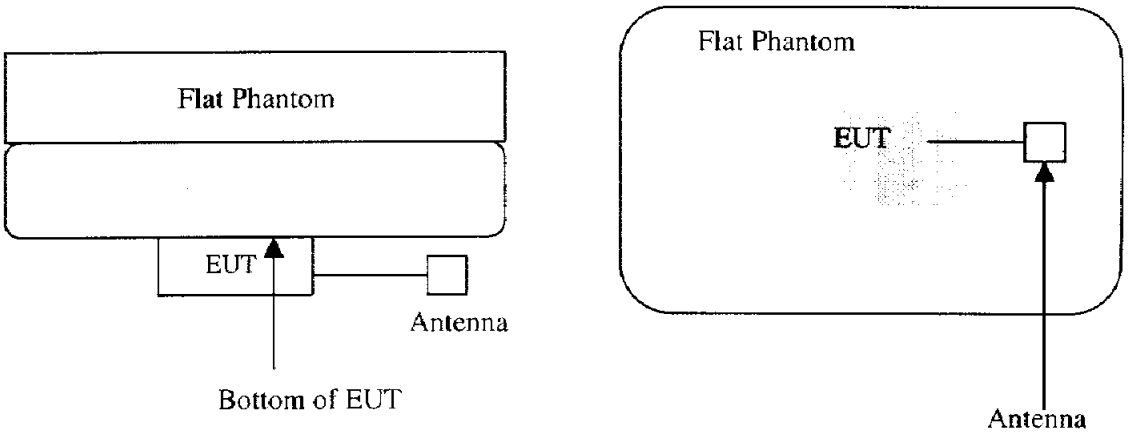
Equipment	Barcode Scanner with Data Communication		
Trade Name	Symbol Technologies	Model No.	PDT 7533
FCC ID	H9PPDY7533	S/N No.	N7NOEM2
Category	Portable	RF Exposure	Uncontrolled Environment
Frequency Band (uplink)	824 MHz – 849 MHz	System	

EUT Antenna Description			
Type	Monopole	Configuration	External, Removal
Dimensions	57.15 mm (L)	Gain	0 dBi
Location	Right side top		

Use of Product : Barcode Scanner with Data communications
Manufacturer: SAME as above.
Production is planned: [X] Yes, [ ] No
EUT receive date: 6/29/00
EUT received condition: Good working condition, prototype
Test start date: 6/30/00
Test end date: 6/30/00

1.4.2 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 Supplement C of OET 65 (1998). The EUT was placed in the intended use position, i.e. touching the human body or hand. Please refer to figure 1 below for the position details:



Side View Top View

Figure 1: Intended use position

1.4.3 Test Condition

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

EUT Antenna	Fixed	Orientation	N/A
Usage	Body-worn and hand-held	Distance between base of EUT and the liquid surface:	See data below
Simulating human hand	Not Used	EUT Battery	Fully Charged
Power output	0.600W Conducted		

The spatial peak SAR values were accessed for lowest, middle and highest operating channels defined by the manufacturer. Tests were performed at CW mode. Care was taken to ensure that performance of the EUT power amplifier would not be degrade using CW test mode. A peak radiated field strength test was performed in CW mode.

Radiated emission measurement was performed, before and after the SAR tests to ensure that the EUT operated at the highest power level.

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 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

EUT Antenna	Fixed	Orientation	N/A
Usage	Body-worn and hand-held	Distance between base of EUT and the liquid surface:	See data below
Simulating human hand	Not Used	EUT Battery	Fully Charged
Power output	0.600W Conducted		

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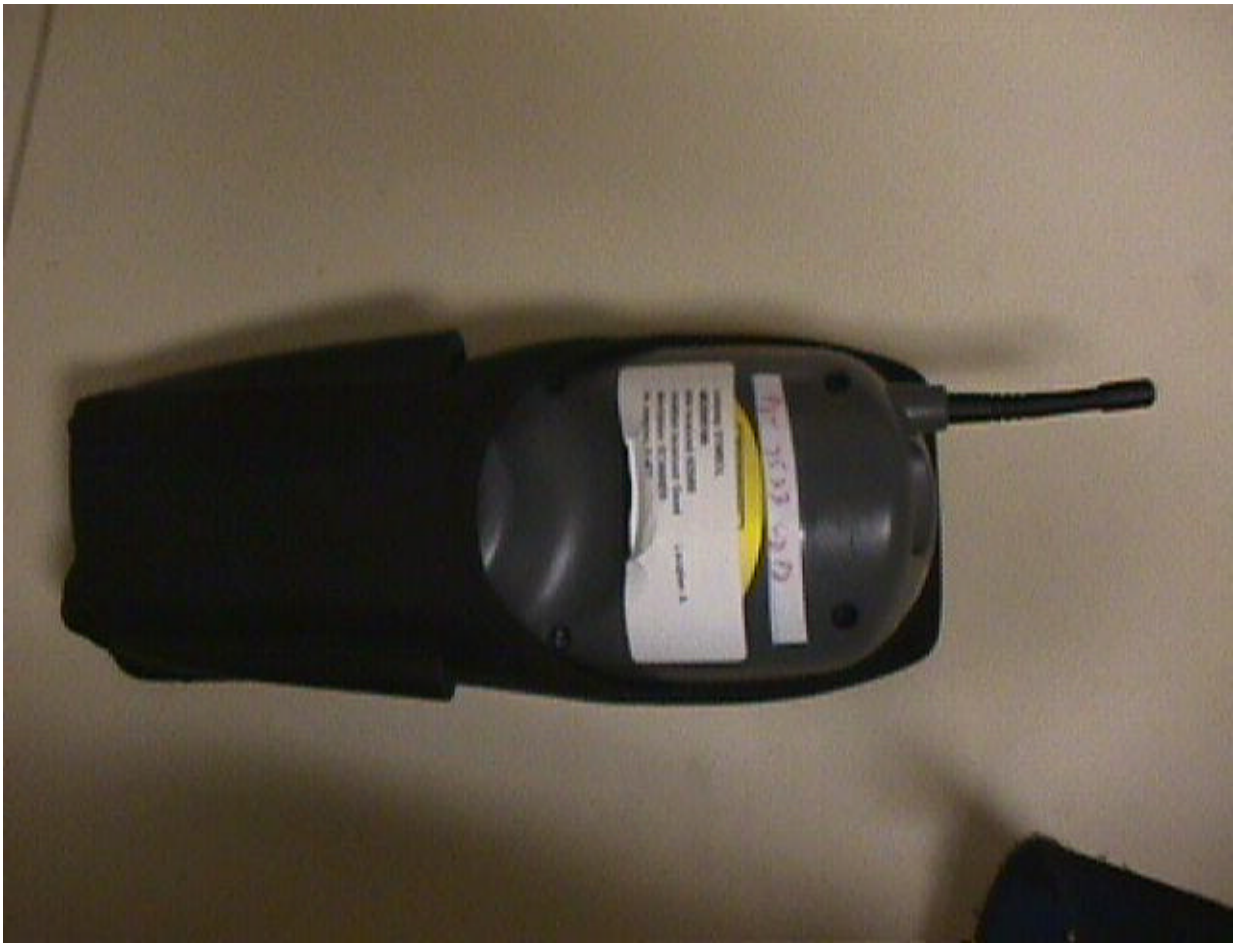
2.2 Configuration Photographs

Worst-Case SAR measurement

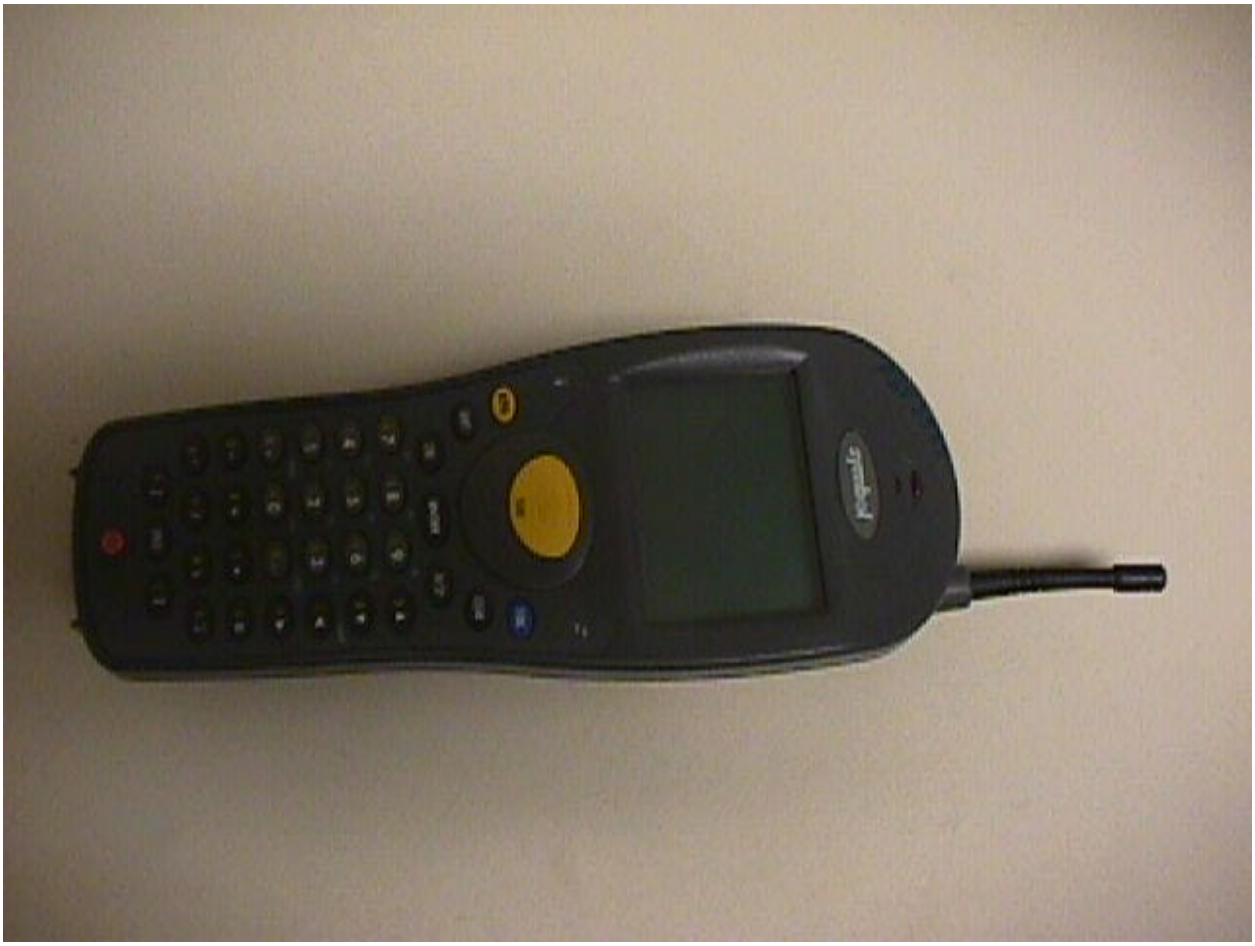
2.2 Configuration Photographs - Continued

Worst-Case SAR measurement



2.2 Configuration Photographs - Continued

Worst-Case SAR measurement



2.3 Configuration Photographs – Continued

2.2 Configuration Photographs - Continued

Worst-Case SAR measurement

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.

The maximum spatial peak SAR values average over 1g assessed in "normal" position was 0.195 mW/g for the CW mode. The measured SAR data, the unit is in compliance with the requirements of the FCC for body requirements.

The maximum spatial peak SAR values average over 10g assessed in "normal" position was 0.143 mW/g for CW. The unit is in compliance with the requirements of the FCC for hands and feet requirements.

Trade Name:	Wireless	**Model No.:**	PDT7533
Serial No.:	Unit # 1	**Test Engineer:**	Suresh Kondapalli

TEST CONDITIONS			
Ambient Temperature	24.8 °C	Relative Humidity	48 %
Test Signal Source	Test Mode	Signal Modulation	CW Unmodulated
Output Power Before SAR Test	0.600W	Output Power After SAR Test	0.600 W
Test Duration	25 Min.	Number of Battery Change	Every Scan

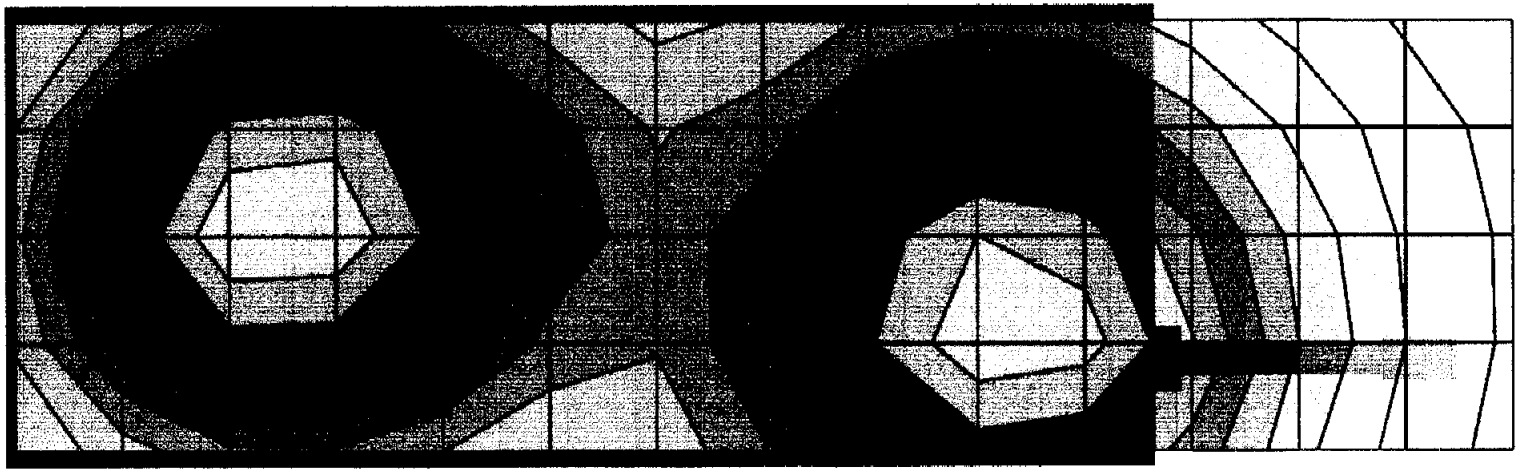
Usage (Touch position)

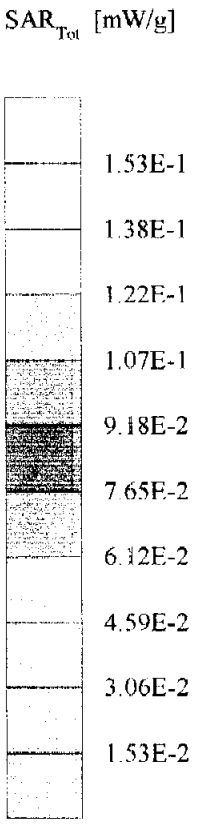
Plots #	Channel (MHz)	Operating Mode	Position	Antenna	Distance From Phantom	Measured SAR_{1g} (mW/g)	Measured SAR_{10g} (mW/g)
1	828	CW	Face Up	Extended	*Normal position	0.151	0.101
2	836	CW	Face Up	Extended	*Normal position	0.153	0.112
3	847	CW	Face Up	Extended	*Normal position	0.195	0.143

Note: *PDT 7355 is normally inserted screen to long side of the holster supplied with the product
a) Worst case data were reported
b) Duty cycle factor included in the measured SAR data
c) Uncertainty of the system is not included
d) Transmission duty cycle not included.

Symbol PDT7533

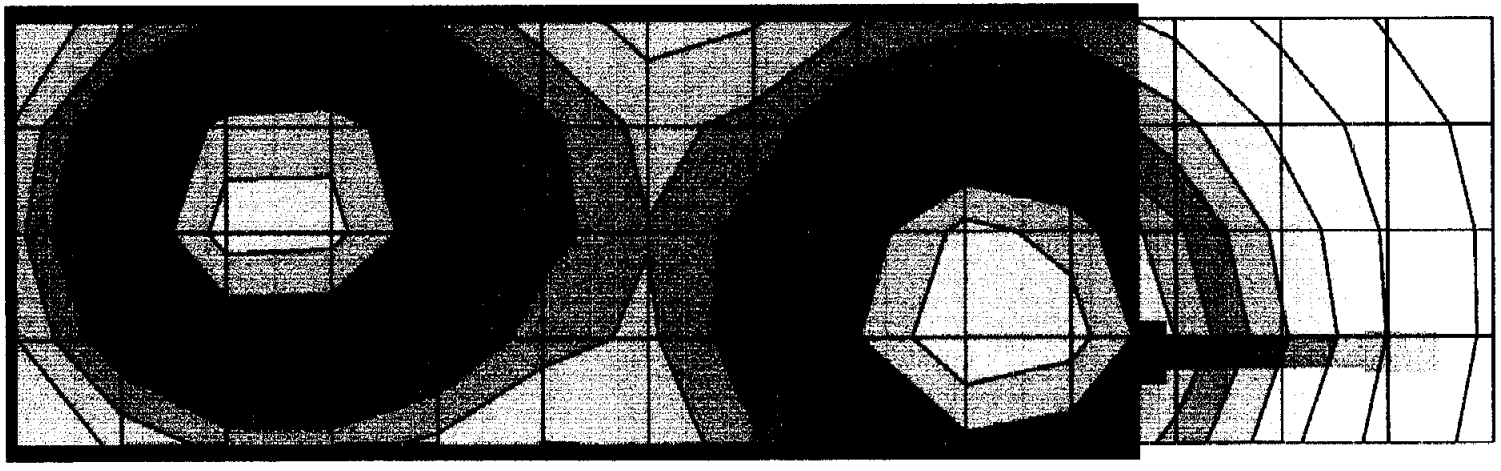
Generic Twin Phantom; Flat Section; Position: (90°,90°); Frequency: 828 MHz
Probe: ET3DV5 - SN1333; ConvF(5.70,5.70,5.70); Crest factor: 1.0; Muscle 835 MHz: σ = 0.95 mho/m ε_r = 56.1 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.151 mW/g * , SAR (10g): 0.101 mW/g Max outside, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.10 dB
Face up

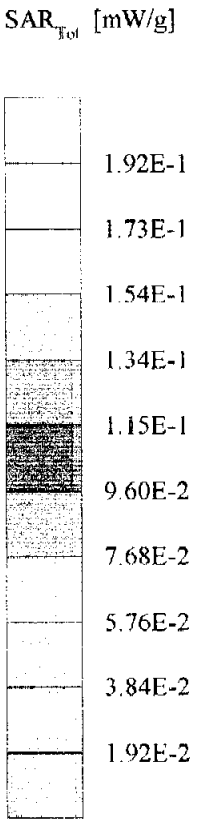




Symbol PDT7533

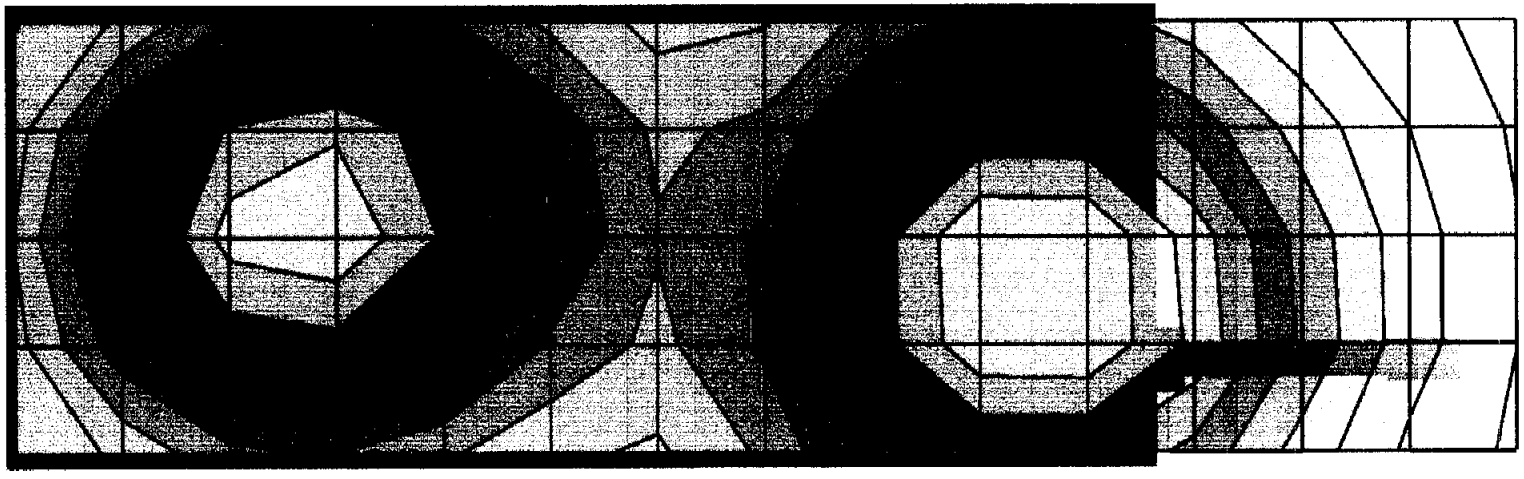
Generic Twin Phantom; Flat Section; Position: (90°,90°); Frequency: 836 MHz
Probe: ET3DV5 - SN1333; ConvF(5.70,5.70,5.70); Crest factor: 1.0; Muscle 835 MHz: σ = 0.95 mho/m ε_r = 56.1 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.153 mW/g, SAR (10g): 0.112 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.18 dB
Face up

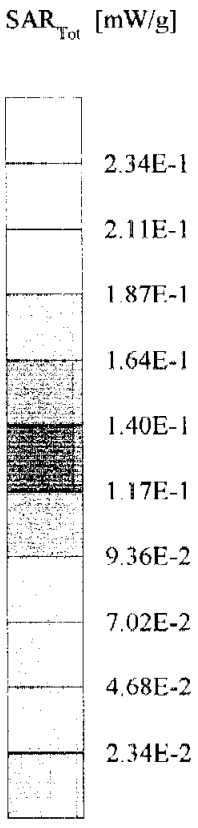




Symbol PDT7533

Generic Twin Phantom; Flat Section; Position: (90°,90°); Frequency: 847 MHz
Probe: ET3DV5 - SN1333; ConvF(5.70,5.70,5.70); Crest factor: 1.0; Muscle 835 MHz: σ = 0.95 mho/m ε_r = 56.1 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.195 mW/g, SAR (10g): 0.143 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.04 dB
Face up





3 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	**Stäubli RX60L** Repeatability: ± 0.025mm Accuracy: 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	04/10/2000
Data Acquisition	**DAE3** Measurement Range: 1µV to >200mV Input offset Voltage: < 1µV (with auto zero) Input Resistance: 200 M	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 3.2 for details	N/A	04/15/2000
Power Meter	**HP** 435A w/ 8481H sensor Frequency Range: 100kHz to 18 GHz Power Range: 300µW to 3W	1312A01255	02/16/2000

3.2 Muscle Tissue Simulating Liquid

Ingredient	**Frequency** (800 - 850 MHz)
Water	54.05 %
Sugar	45.05 %
Salt	0.1 %
Bactericide	0.8 %

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*	σ*(mho/m)	ρ**(kg/m^3)
835	56.1 ± 5%	0.95 ± 10%	1000

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

** worst case assumption

3.3 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.

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 WARNING LABEL INFORMATION - USA

Not Applicable

5 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 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.

7 APPENDIX B - E-FIELD PROBE CALIBRATION DATA

[X] See Separate Attachment
[ ] See Below

Schmid & Partner
Engineering AG

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

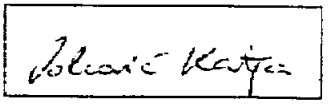
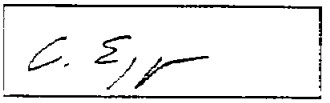
Calibration Certificate

Dosimetric E-Field Probe

Type:	**ET3DV5**
Serial Number:	**1333**
Place of Calibration:	**Zurich**
Date of Calibration:	**April 10, 2000**
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

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
Last calibration:	March 18, 1999
Recalibrated:	April 10, 2000

Calibrated for System DASY3

DASY3 - Parameters of Probe: ET3DV5 SN:1333

Sensitivity in Free Space

Diode Compression

NormX	**2.39** $\mu V/(V/m)^2$	DCP X	**100** mV
NormY	**2.36** $\mu V/(V/m)^2$	DCP Y	**100** mV
NormZ	**2.34** $\mu V/(V/m)^2$	DCP Z	**100** mV

Sensitivity in Tissue Simulating Liquid

Brain **450 MHz** ε_r **= 48 ± 5%** σ **= 0.50 ± 10% mho/m**

ConvF X	**6.03** extrapolated	Boundary effect:	
ConvF Y	**6.03** extrapolated	Alpha	**0.13**
ConvF Z	**6.03** extrapolated	Depth	**3.57**

Brain **900 MHz** ε_r **= 42.5 ± 5%** σ **= 0.86 ± 10% mho/m**

ConvF X	**5.70** ± 7% (k=2)	Boundary effect:	
ConvF Y	**5.70** ± 7% (k=2)	Alpha	**0.34**
ConvF Z	**5.70** ± 7% (k=2)	Depth	**3.00**

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

ConvF X	**5.25** interpolated	Boundary effect:	
ConvF Y	**5.25** interpolated	Alpha	**0.61**
ConvF Z	**5.25** interpolated	Depth	**2.23**

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

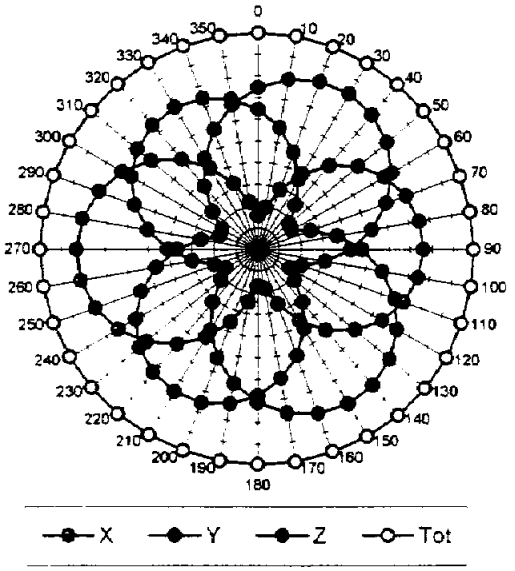
ConvF X	**5.03** ± 7% (k=2)	Boundary effect:	
ConvF Y	**5.03** ± 7% (k=2)	Alpha	**0.74**
ConvF Z	**5.03** ± 7% (k=2)	Depth	**1.85**

Sensor Offset

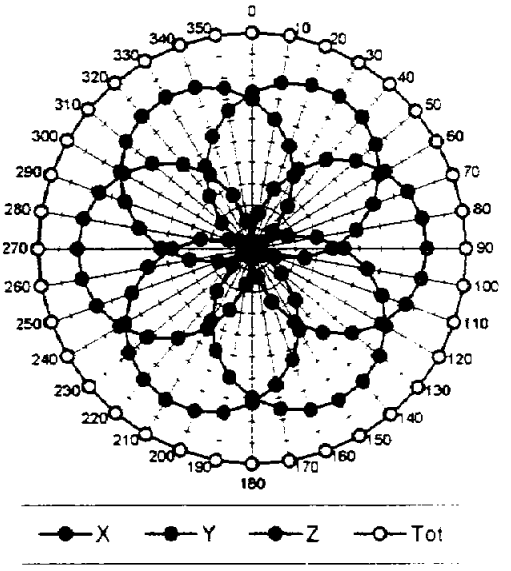
Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.9 ± 0.2**	mm

Receiving Pattern (ϕ), θ = 0°

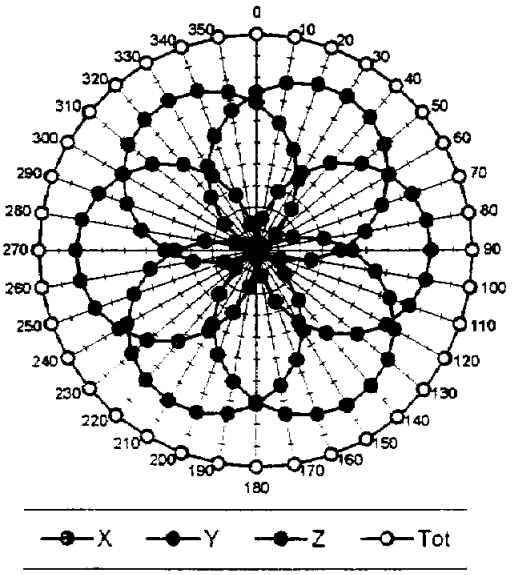
f = 30 MHz, TEM cell ifi110



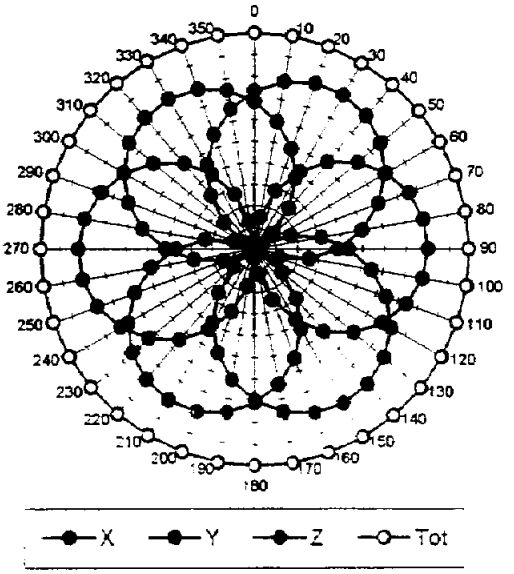
f = 100 MHz, TEM cell ifi110



f = 300 MHz, TEM cell ifi110

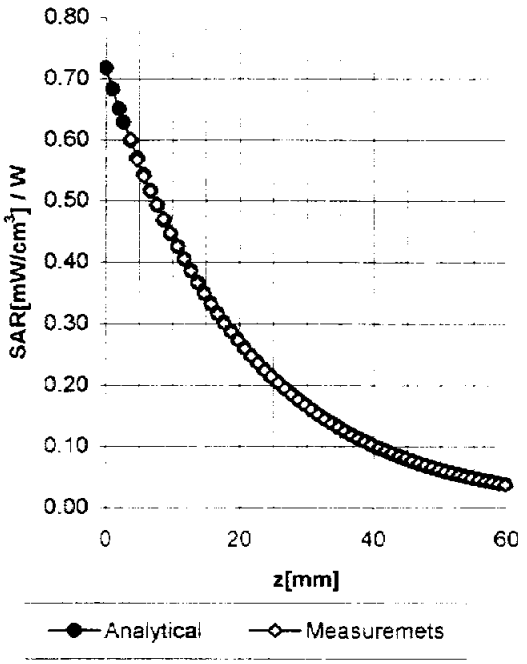


f = 900 MHz, TEM cell ifi110

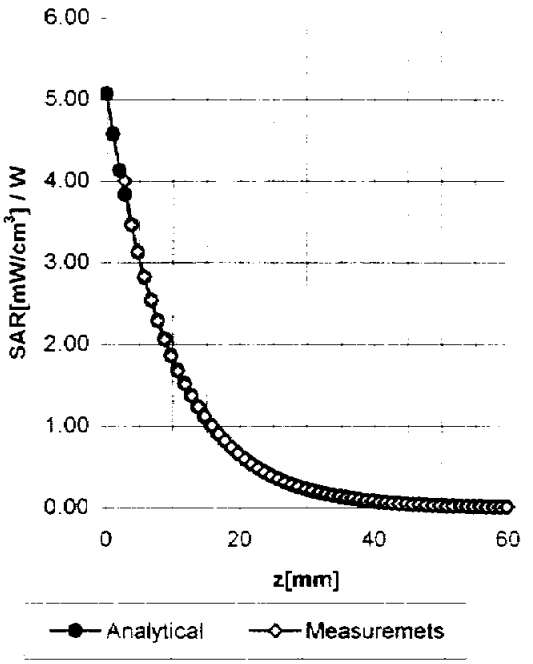


Conversion Factor Assessment

f = 900 MHz, WG R9



f = 1800 MHz, WG R22



Receiving Pattern (ϕ)

(in brain tissue, z = 5 mm)