

Specific Absorption Rate (SAR) Test Report

for
Accton Technology Corporation
on the
OfficeConnect Wireless 11g PC Card
Model Number: 3CRWE154G72

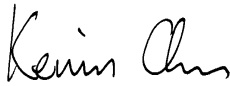
Test Report: EME-030506
Date of Report: June 16, 2003
Date of test: June 13, 2003

Total No. of Pages Contained in this Report: 100



0597
ILAC MRA

Accredited for testing to FCC Part 15

Tested by: Kevin Chen	
Reviewed by: Elton Chen	

Review Date: June 16, 2003

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STATEMENT OF COMPLIANCE

The Accton sample device, model # 3CRWE154G72 was evaluated in accordance with the requirements for compliance testing defined in FCC OET Bulletin 65, Supplement C (Edition 01-01). Testing was performed at the Intertek Testing Services facility in Hsinchu, Taiwan.

For the evaluation, the dosimetric assessment system INDEXSAR SARA2 was used. The phantom employed was the box phantom of 2mm thick in one wall. The total uncertainty for the evaluation of the spatial peak SAR values averaged over a cube of 1g tissue mass had been assessed for this system to be $\pm 27.5\%$.

The device was tested at their maximum output power declared by the Accton

In summary, the maximum spatial peak SAR value for the sample device averaged over 1g was found to be:

Phantom	Position	SAR _{1g} , mW/g
2mm thick box phantom wall	The EUT inserted into the left side of notebook PC, with EUT perpendicular to the phantom, 0 mm separation with 802.11b (DSSS Modulation).	1.282 mW/g.

In conclusion, the tested Sample device was found to be in compliance with the requirements defined in OET Bulletin 65, Supplement C (Edition 01-01) for body configurations.



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1.0 JOB DESCRIPTION

1.1 Client Information

The 3CRWE154G72 has been tested at the request of:

Company: Accton, Inc.
No. 1 Creation Rd. III, Science-based Industrial Park
Hsinchu 30077, Taiwan

1.2 Equipment under test (EUT)

Product Descriptions:

Equipment	OfficeConnect Wireless 11g PC Card		
Trade Name	Accton	Model No:	3CRWE154G72
FCC ID	HED2835WACC	S/N No.	Not Labeled
Category	Portable	RF Exposure	Uncontrolled Environment
Frequency Band	2412 – 2462 MHz	System	DSSS, OFDM

EUT Antenna Description			
Type	PCB Printed	Configuration	permanently connected
Dimensions	62.5 x 39mm	Gain	1.5 dBi

Use of Product : Wireless Data Communication

Manufacturer: Accton

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

EUT receive date: April 18, 2003

EUT received condition: Good operating condition prototype.

Test start date: April 29, 2003

Test end date: June 13, 2003



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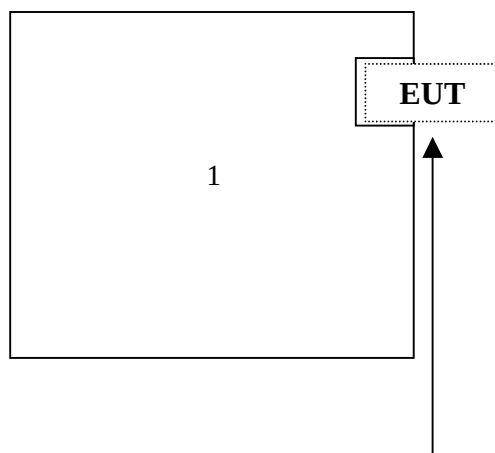
1.3 Test plan reference

FCC Rule: Part 2.1093, FCC's OET Bulletin 65, Supplement C (Edition 01-01)

1.4 System test configuration

1.4.1 System block diagram & Support equipment

Support Equipment			
Item #	Equipment	Model No.	S/N
1	HP Laptop Computer	XE ₃	TW20705468
2	Dell Laptop Computer	PP01L	CN-06P83-48643-33V-0112
3	ASUS Laptop Computer	M2400	33NP024328



Installed inside laptop with a PCMCIA Slot



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1.4.3 Test Condition

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

Usage	Operates with a portable computer	Distance between antenna axis at the joint and the liquid surface:	Laptop is touching the Phantom in all position	
Simulating human Head/ Body/Hand	Body	EUT Battery	Device is powered from host computer through battery.	
802.11b Conducted output Power	Channel	Frequency MHz	Before SAR Test (dBm)	After SAR Test (dBm)
	Low Channel - 1	2412	17.98	17.98
	Mid Channel - 6	2437	19.41	19.40
	High Channel- 11	2462	18.43	18.44
802.11g Conducted output Power	Channel	Frequency MHz	Before SAR Test (dBm)	After SAR Test (dBm)
	Low Channel - 1	2412	19.94	19.92
	Mid Channel - 6	2437	20.33	20.31
	High Channel- 11	2462	20.02	20.00

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

The conducted output power was measured before and after the test using an average power meter.

Plug the EUT into Notebook and turn on the power, then run the test program “cTxRx 1.4.1” under Windows OS.

The EUT was transmitted continuously during the test.

After verifying the maximum output power, we found the maximum output power of 802.11b was occurred at 11Mbps data rate, and 802.11g was occurred at 12Mbps.

Three typical hosts as listed in Section 1.4.1 above were subjected to the SAR testing. 802.11g (OFDM Modulation) was found the power exceeding 100 mW in one host and repeated on the other two hosts.

All the test data were performed under the above transmission rate.



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1.5 Modifications required for compliance

Intertek Testing Services implemented no modifications.

1.6 Additions, deviations and exclusions from standards

The phantom employed was the box phantom of 2mm thick in vertical wall.



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

Test System





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Test Equipment: Notebook (HP)

**SAR Measurement Test Setup
Bottom side of Laptop facing phantom touching**



Bottom side of Laptop facing phantom touching – Zoom In





SAR Measurement Test Setup
EUT perpendicular to phantom, 0 mm separation



EUT perpendicular to phantom, 0 mm separation – Zoom In





SAR Measurement Test Setup
EUT perpendicular to phantom, 15 mm separation



EUT perpendicular to phantom, 15 mm separation – Zoom In





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Test Equipment: Notebook (DELL)

**SAR Measurement Test Setup
Bottom side of Laptop facing phantom touching**





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SAR Measurement Test Setup

EUT perpendicular to phantom, 0 mm separation





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SAR Measurement Test Setup

EUT perpendicular to phantom, 15 mm separation





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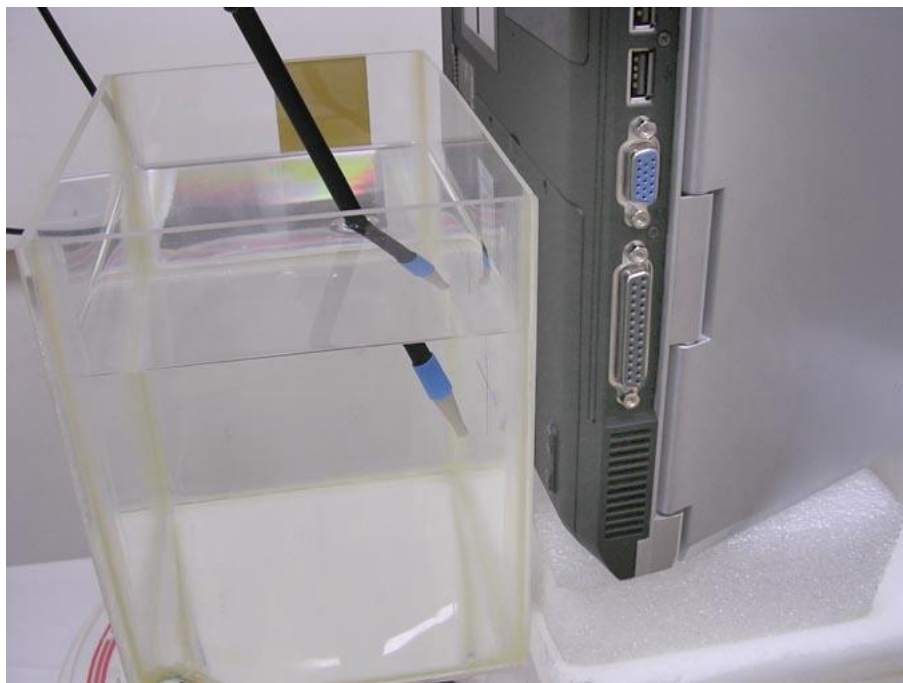
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Test Equipment: Notebook (ASUS)

SAR Measurement Test Setup

Bottom side of Laptop facing phantom touching



Bottom side of Laptop facing phantom touching – Zoom In





SAR Measurement Test Setup
EUT perpendicular to phantom, 0 mm separation



EUT perpendicular to phantom, 15 mm separation



2.3 SAR measurement system

Robot system specification

The SAR measurement system being used is the IndexSAR SARA2 system, which consists of a Mitsubishi RV-E2 6-axis robot arm and controller, IndexSAR probe and amplifier and SAM phantom Head Shape. The robot is used to articulate the probe to programmed positions inside the phantom head to obtain the SAR readings from the DUT.

The system is controlled remotely from a PC, which contains the software to control the robot and data acquisition equipment. The software also displays the data obtained from test scans.

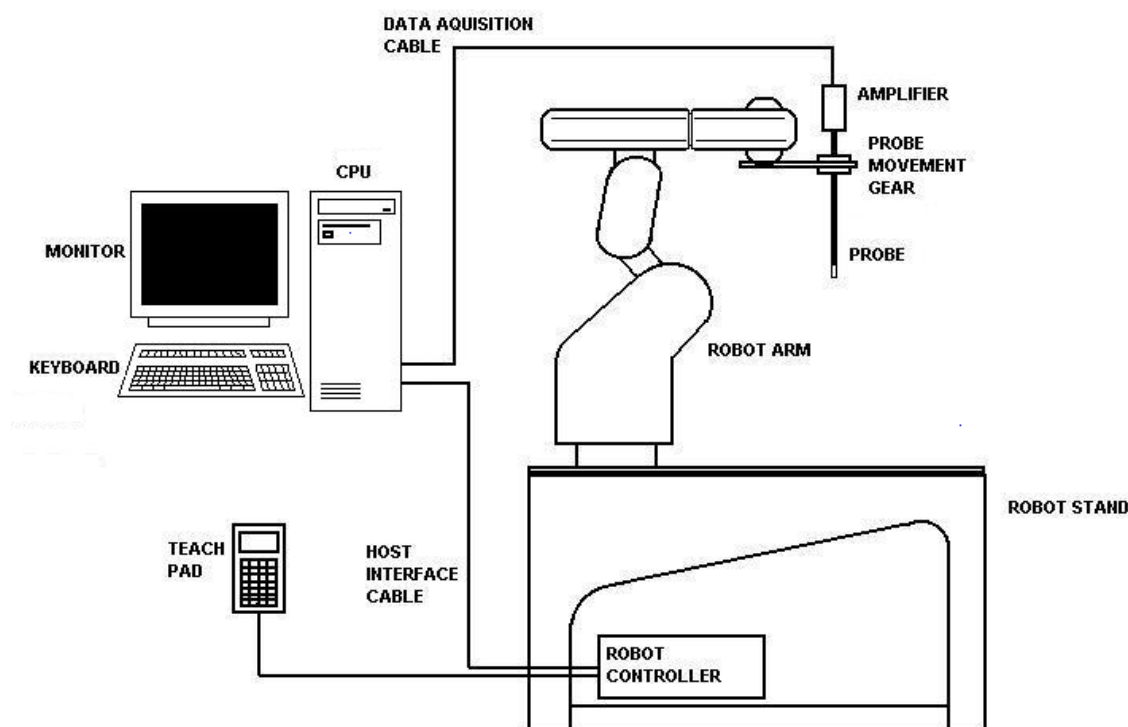


Figure 1: Schematic diagram of the SAR measurement system

The position and digitised shape of the phantom heads are made available to the software for accurate positioning of the probe and reduction of set-up time.

The SAM phantom heads are individually digitised using a Mitutoyo CMM machine to a precision of 0.02mm. The data is then converted into a shape format for the software, providing an accurate description of the phantom shell.

In operation, the system first does an area (2D) scan at a fixed depth within the liquid from the inside wall of the phantom. When the maximum SAR point has been found, the system will then carry out a 3D scan centred at that point to determine volume averaged SAR level.



2.4 SAR measurement system validation

Prior to the assessment, the system was verified to the $\pm 10\%$ of the specifications by using the system validation equipments. The validation was performed at 2450 MHz on the bottom side of box phantom.

Procedures were accordance with IEEE 1528.

The SAR evaluation was performed with the following procedures in accordance with IEEE 1528:

- a. The SAR distribution was measured at the exposed side of the bottom of the box phantom and was measured at a distance of 8 mm from the inner surface of the shell. The feed power to the validation dipole was 1/4W.
- b. The dimension for this cube is 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 3 mm away from the tip of the probe and the distance between the surface and the lowest measurement point is 5 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.

System Validation (2450 MHz Head)					
Frequency MHz	Operating Mode	Target SAR _{1g} (mW/g)	Measured SAR _{1g} (mW/g)	Deviation ($\pm 10\%$)	Plot Number
2450	CW	52.4	50.16	-5.92%	9

Test Results

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



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Measurement Results

Trade Name:	Accton	Model No.:	3CRWE154G72
Serial No.:	Not Labeled	Test Engineer:	Kevin Chen
TEST CONDITIONS			
Ambient Temperature	23 °C	Relative Humidity	60 %
Test Signal Source	Test Mode	Signal Modulation	802.11b DSSS/ 802.11g OFDM
Output Power Before SAR Test	See page 5	Output Power After SAR Test	See page 5
Test Duration	22 min. each scan	Number of Battery Change	2



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Host: Notebook (HP)

EUT Position						
Channel (MHz)	Operating Mode	Crest Factor	Description	Distance (mm)	Measured SAR _{1g} (mW/g)	Plot Number
2437	11b/DSSS	1	Bottom of Note Book	0	0.180	1
2412	11b/DSSS	1	Bottom of Note Book	0	Note	-
2462	11b/DSSS	1	Bottom of Note Book	0	Note	-
2437	11b/DSSS	1	Perpendicular to phantom	0	1.282	2
2412	11b/DSSS	1	Perpendicular to phantom	0	1.060	3
2462	11b/DSSS	1	Perpendicular to phantom	0	0.795	4
2437	11g/OFDM	1	Bottom of Note Book	0	0.137	5
2412	11g/OFDM	1	Bottom of Note Book	0	Note	-
2462	11g/OFDM	1	Bottom of Note Book	0	Note	-
2437	11g/OFDM	1	Perpendicular to phantom	0	0.762	6
2412	11g/OFDM	1	Perpendicular to phantom	0	0.851	7
2462	11g/OFDM	1	Perpendicular to phantom	0	0.600	8
2437	11b/DSSS	1	Perpendicular to phantom	15	0.145	13
2412	11b/DSSS	1	Perpendicular to phantom	15	0.125	14
2462	11b/DSSS	1	Perpendicular to phantom	15	0.087	15
2437	11g/OFDM	1	Perpendicular to phantom	15	0.078	16
2412	11g/OFDM	1	Perpendicular to phantom	15	0.091	17
2462	11g/OFDM	1	Perpendicular to phantom	15	0.054	18

Note: Configuration at middle channel with more than -3dB of applicable limit.



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Host: Notebook (DELL)

EUT Position						
Channel (MHz)	Operating Mode	Crest Factor	Description	Distance (mm)	Measured SAR _{1g} (mW/g)	Plot Number
2437	11g/OFDM	1	Bottom of Note Book	0	0.219	19
2412	11g/OFDM	1	Bottom of Note Book	0	0.227	20
2462	11g/OFDM	1	Bottom of Note Book	0	0.161	21
2437	11g/OFDM	1	Perpendicular to phantom	0	0.594	22
2412	11g/OFDM	1	Perpendicular to phantom	0	0.621	23
2462	11g/OFDM	1	Perpendicular to phantom	0	0.431	24
2437	11g/OFDM	1	Perpendicular to phantom	15	0.059	25
2412	11g/OFDM	1	Perpendicular to phantom	15	0.065	26
2462	11g/OFDM	1	Perpendicular to phantom	15	0.042	27



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Host: Notebook (ASUS)

EUT Position						
Channel (MHz)	Operating Mode	Crest Factor	Description	Distance (mm)	Measured SAR _{1g} (mW/g)	Plot Number
2437	11g/OFDM	1	Bottom of Note Book	0	0.161	28
2412	11g/OFDM	1	Bottom of Note Book	0	0.176	29
2462	11g/OFDM	1	Bottom of Note Book	0	0.120	30
2437	11g/OFDM	1	Perpendicular to phantom	0	0.679	31
2412	11g/OFDM	1	Perpendicular to phantom	0	0.740	32
2462	11g/OFDM	1	Perpendicular to phantom	0	0.471	33
2437	11g/OFDM	1	Perpendicular to phantom	15	0.092	34
2412	11g/OFDM	1	Perpendicular to phantom	15	0.086	35
2462	11g/OFDM	1	Perpendicular to phantom	15	0.059	36



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Date: 29Apr.2003		System performance check (2450 MHz Head)			
Frequency MHz	Operating Mode	Target SAR _{1g} (mW/g)	Measured SAR _{1g} (mW/g)	Deviation (±10%)	Plot Number
2450	CW	52.4	52.116	-0.54	10

Date: 2Jun.2003		System performance check (2450 MHz Head)			
Frequency MHz	Operating Mode	Target SAR _{1g} (mW/g)	Measured SAR _{1g} (mW/g)	Deviation (±10%)	Plot Number
2450	CW	52.4	52.856	0.87	11

Date: 13Jun.2003		System performance check (2450 MHz Head)			
Frequency MHz	Operating Mode	Target SAR _{1g} (mW/g)	Measured SAR _{1g} (mW/g)	Deviation (±10%)	Plot Number
2450	CW	52.4	52.796	0.75	12

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



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3.0 TEST EQUIPMENT

3.1 Equipment List

The Specific Absorption Rate (SAR) tests were performed with the INDEXSAR SARA2 SYSTEM.

The following major equipment/components were used for the SAR evaluations:

SAR Measurement System			
EQUIPMENT	SPECIFICATIONS	S/N #	LAST CAL. DATE
Balanced Validation dipole	2450MHz	0041	11/11/2002
Robot	Mitsubishi RV-E2	EA009002	N/A
	Repeatability: ± 0.04 mm; Number of Axes: 6		
E-Field Probe	IXP-050	0114	09/06/2002
	Frequency Range: Probe outer diameter: 5 mm; Length: 350 mm; Distance between the probe tip and the dipole center: 3 mm		
Data Acquisition	SARA2	N/A	N/A
	Processor: Pentium 4; Clock speed: 1.5GHz; OS: Windows XP; I/O: two RS232; Software: SARA2 ver. 0.421N;		
Phantom	2mm wall thickness box phantom	N/A	N/A
	Shell Material: clear Perspex; Thickness: 2 ± 0.1 mm; Capacity: 154 x 200 x 200 (W x L x D) mm ³ ; Dielectric constant: less than 2.85 above 500MHz;		
Device holder	Material: clear Perspex; Dielectric constant: less than 2.85 above 500MHz	N/A	N/A
Simulated Tissue	Mixture	N/A	N/A
	Please see section 3.2 for details		
RF Power Meter	Boonton 4231A with 51011-EMC power sensor	79401-32482	03/21/2003
	Frequency Range: 0.03 to 8 GHz, <24dBm		
RF Power Amplifier	HP 8348A	311A00567	01/13/2003
	2 to 26.5GHz, Gain >30dB		
Directional Coupler	HP 778D	-	08/06/2002
	0.1 to 2 GHz, Max. Power<500W		
Vector Network Analyzer	HP 8753C	US39173345	12/13/2002
	30k to 3GHz		
Signal Generator	Rohde & Schwarz SMR27	1104.0002.27	08/16/2002
	10M to 27GHz, <120dBuV		



3.2 Body Tissue Simulating Liquid

Body Ingredients Frequency (2.45 GHz)	
DGBE Dilethylene Glycol Butyl Ether	26.7%
Salt	0.04%
Water	73.2%

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:

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Frequency (MHz)	Temp. (°C)	e _r			s (mho/m)			ρ *(kg/m ³)
2450	23.1	measured	target	Δ(±5%)	measured	target	Δ(±5%)	1000
		51.149	52.7	-2.94%	1.907	1.95	-2.21%	

* Worst-case assumption

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Frequency (MHz)	Temp. (°C)	e _r			s (mho/m)			ρ *(kg/m ³)
2450	21.5	measured	target	Δ(±5%)	measured	target	Δ(±5%)	1000
		54.626	52.7	3.65%	1.949	1.95	-0.05%	

* Worst-case assumption

6/13

Frequency (MHz)	Temp. (°C)	e _r			s (mho/m)			ρ *(kg/m ³)
2450	23.3	measured	target	Δ(±5%)	measured	target	Δ(±5%)	1000
		50.434	52.7	-4.30%	1.904	1.95	-2.36%	

* Worst-case assumption

Test data is included in Appendix B.



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Head Ingredients Frequency (2.45 GHz)	
DGBE Dilethylene Glycol	53.3%
Water	46.7%

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)	Temp. (°C)	ϵ_r			s (mho/m)			ρ *(kg/m ³)
		measured	target	$\Delta(\pm 5\%)$	measured	target	$\Delta(\pm 5\%)$	
2450	23	38.050	39.2	-2.9%	1.79	1.80	-0.6%	1000

* Worst-case assumption



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3.3 E-Field Probe Calibration

Probe calibration factors are included in Appendix C.



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3.4 Measurement Uncertainty

The uncertainty budget has been determined for the INDEXSAR SARA2 measurement system according to IEEE P1528 documents [3] and is given in the following table. The extended uncertainty (95% confidence level) was assessed to be 27.5 %

Uncertainty Component	Sec.	(dB)	Tol.(+/-)	(%)	Prob. Dist.	Divisor (descript)	Divisor (value)	c1	Standard Uncertainty (%)	
Measurement System										
Probe Calibration	E 1.1			10	N	1 or k	2	1	5.00	25.00
Axial Isotropy	E 1.2	0.25	5.93	5.93	R	$\sqrt{3}$	1.73	0	0.00	0.00
Hemispherical Isotropy	E 1.2	0.45	10.92	10.92	R	$\sqrt{3}$	1.73	1	6.30	39.73
Boundary effects	E 1.3		4	4.00	R	$\sqrt{3}$	1.73	1	2.31	5.33
Linearity	E 1.4	0.04	0.93	0.93	R	$\sqrt{3}$	1.73	1	0.53	0.29
System Detection Limits	E 1.5		1	1.00	R	$\sqrt{3}$	1.73	1	0.58	0.33
Readout Electronics	E 1.6		1	1.00	N	1 or k	1.73	1	1.00	1.00
Response time	E 1.7		0	0.00	R	$\sqrt{3}$	1.73	1	0.00	0.00
Integration time	E 1.8		1.8	1.80	R	$\sqrt{3}$	1.73	1	1.04	1.08
RF Ambient Conditions	E 5.1		3	3.00	R	$\sqrt{3}$	1.73	1	1.73	3.00
Probe Positioner Mechanical Tolerance	E 5.2		0.6	0.60	R	$\sqrt{3}$	1.73	1	0.35	0.12
Probe Position wrt. Phantom Shell	E 5.3		5	5.00	R	$\sqrt{3}$	1.73	1	2.89	8.33
SAR Evaluation Algorithms	E 4.2		8	8.00	R	$\sqrt{3}$	1.73	1	4.62	21.33
Test Sample Related										
Test Sample Positioning	E 3.2.1		10	10.00	R	$\sqrt{3}$	1.73	1	5.77	33.33
Device Holder Uncertainty	E 3.1.1		10	10.00	R	$\sqrt{3}$	1.73	1	5.77	33.33
Output Power Variation	E 5.6.2		5	4.00	R	$\sqrt{3}$	1.73	0.5	2.89	8.33
Phantom and tissue Parameters										
Phantom Uncertainty (shape and thickness)	E 2.1		4	4.00	R	$\sqrt{3}$	1.73	0.5	1.15	1.33
Liquid conductivity (Deviation from target)	E 2.2		5	5.00	R	$\sqrt{3}$	1.73	0.5	1.44	2.08
Liquid conductivity (Meas. Uncertainty)	E 2.2		10	10.00	R	$\sqrt{3}$	1.73	0.5	2.89	8.33

Combined standard uncertainty

RSS

14.0



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3.5 Measurement Traceability

All measurements described in this report are traceable to Chinese National Laboratory Accreditation (CNLA) standards or appropriate national standards.



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4.0 WARNING LABEL INFORMATION - USA

See user manual.



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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] IEEE Standards Coordinating Committee 34, ”*DRAFT* Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”, IEEE Std 1528-200X, Draft CD 1.0 – September 15, 2002



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5.0 DOCUMENT HISTORY

Revision/ Job Number	Writer Initials	Date	Change
TC0300335	J.C	April 30, 2003	Original document
TC0300335	J.C	June 3, 2003	The 1.5cm spacing test added
TC0300335	J.C	June 16, 2003	Added the 3 host testing



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APPENDIX A - SAR Evaluation Data

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

To assess the drift of the power of the device under test, a SAR measurement was made in the middle of the zoom scan volume at the start of the scan and a measurement at this point was then also made after the measurement scan. The difference between the two measurements should be less than 5%.



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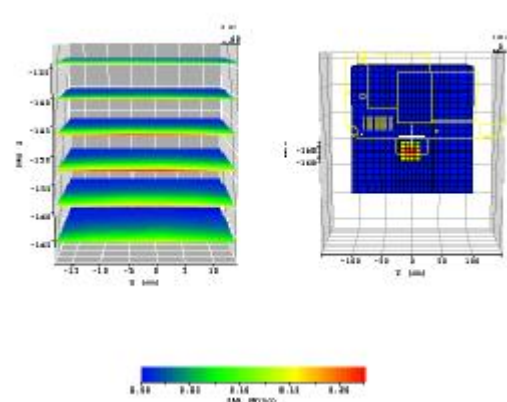
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Plot #1 (1/2)

Date / Time:	2003/4/29	Position:	bottom 0mm
Filename:	accton 11b2437bot0	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB Printed	Test Frequency:	802.11b/ 2437MHz
Shape File:	hp NB bottom.csv	Power Level:	19.41 dBm

Probe:	0114	Liquid:	15.2cm
Cal File:	SN0114_2450_CW_BODY	Type:	2450MHz body
Cal Factors:		Conductivity:	1.907
		Relative Permittivity:	51.149
		Liquid Temp (deg C):	23.3 (target 23.1)
		Ambient Temp (deg C):	22
Amp Gain:	2	Ambient RH (%):	60
Averaging:	3	Density (kg/m3):	1000
Batteries	April 29	Software Version:	0.421N
Replaced:		Crest factor =	1

	ZOOM SCAN RESULTS:		
	Spot SAR (W/kg):	Start Scan	End Scan
		0.047	0.050
	Change during Scan (%)	4.93	
Max SAR (W/kg)	Max E-field (V/m):	10.77	
		1g	10g
Location of Max (mm):		0.180	0.102
		X	Y
		75.1	-18.0
		Z	-151.1



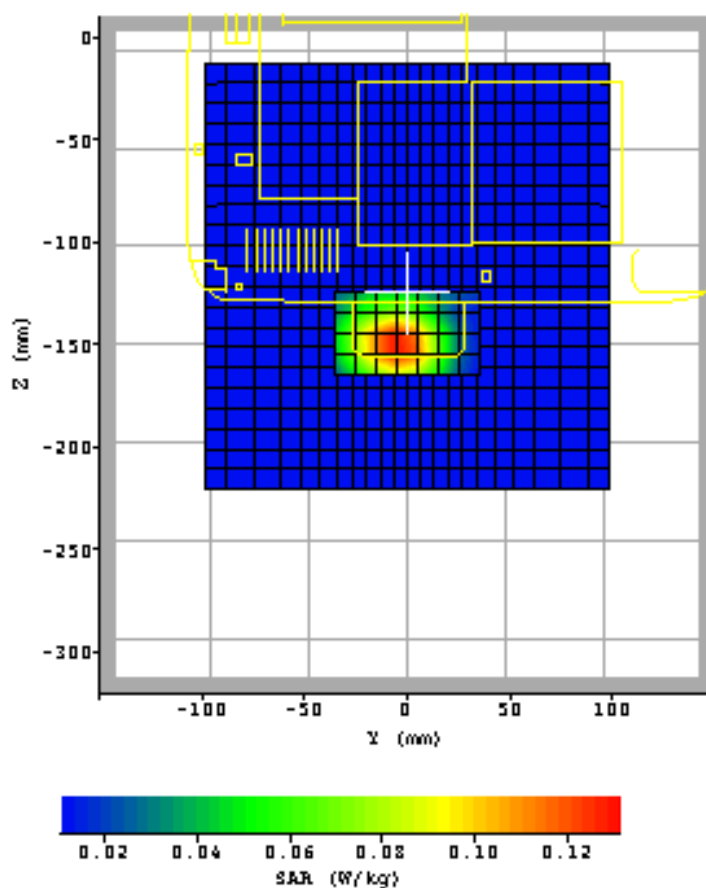
Plot #1 (2/2)

Date / Time:	2003/4/29	Position:	bottom 0mm
Filename:	accton 11b2437bot0	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB Printed	Test Frequency:	802.11b/ 2437MHz
Shape File:	hp NB bottom.csv	Power Level:	19.41 dBm

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-35.0	35.0	7.0
Z	-165.0	-125.0	4.0





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Plot #2 (1/2)

Date / Time: 2003/4/29
Filename: accton 11b2437per0
Device Tested: 3CRWE154G72
Antenna: PCB Printed
Shape File: hp NB perpendicular.csv

Position: perpendicular 0mm
Phantom: HeadBox1.csv
Head Rotation: 0
Test Frequency: 802.11b/ 2437MHz
Power Level: 19.41 dBm

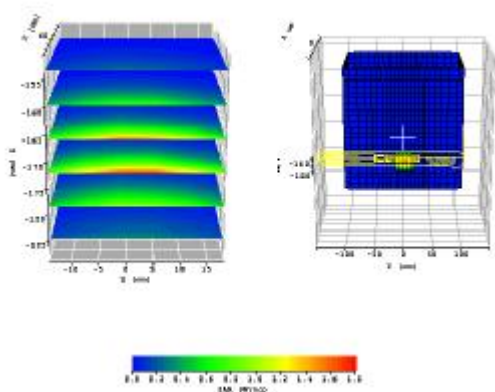
Probe: 0114
Cal File: SN0114_2450_CW_BODY

Cal Factors:

	X	Y	Z
Air	532	494	450
DCP	20	20	20
Lin	.528	.528	.528

Amp Gain: 2
Averaging: 3
Batteries Replaced: April 29

Liquid: 15.2cm
Type: 2450MHz body
Conductivity: 1.907
Relative Permittivity: 51.149
Liquid Temp (deg C): 23.4 (target 23.1)
Ambient Temp (deg C): 22.5
Ambient RH (%): 62
Density (kg/m3): 1000
Software Version: 0.421N
Crest factor = 1



ZOOM SCAN RESULTS:

Spot SAR (W/kg):	Start Scan	End Scan
	0.292	0.291
Change during Scan (%)	-0.42	
Max E-field (V/m):	30.00	
Max SAR (W/kg)	1g	10g
	1.282	0.587

Location of Max (mm):	X	Y	Z
	75.0	-14.0	-171.1



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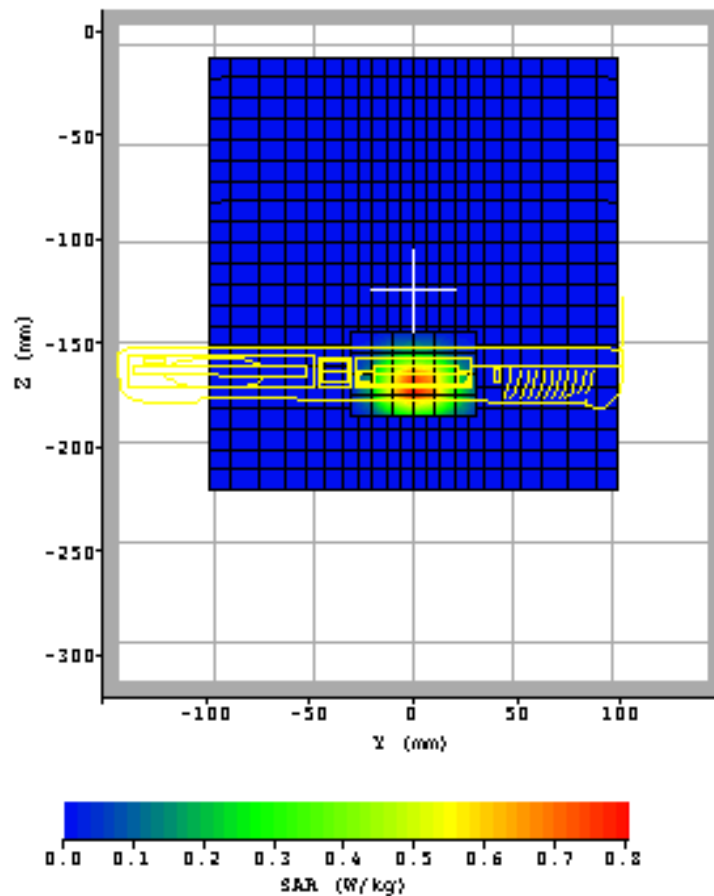
plot #2 (2/2)

Date / Time:	2003/4/29	Position:	perpendicular 0mm
Filename:	accton 11b2437per0	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB Printed	Test Frequency:	802.11b/ 2437MHz
Shape File:	hp NB perpendicular.csv	Power Level:	19.41 dBm

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-30.0	30.0	6.0
Z	-185.0	-145.0	4.0





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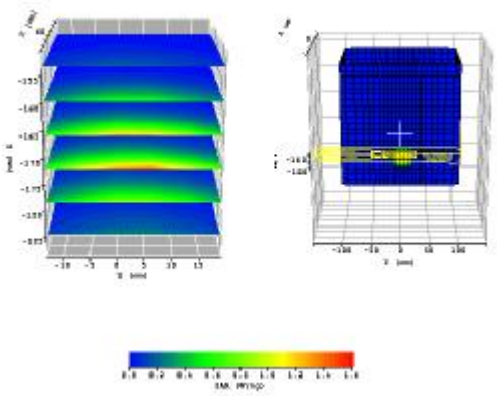
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plot #3 (1/2)

Date / Time:	2003/4/29	Position:	perpendicular 0mm
Filename:	accton 11b2412per0	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB Printed	Test Frequency:	802.11b/ 2412MHz
Shape File:	hp NB perpendicular.csv	Power Level:	17.98 dBm

Probe:	0114	Liquid:	15.2cm
Cal File:	SN0114_2450_CW_BODY	Type:	2450MHz body
Cal Factors:		Conductivity:	1.907
	Air	Relative Permittivity:	51.149
	DCP	Liquid Temp (deg C):	23.4 (target 23.1)
	Lin	Ambient Temp (deg C):	22.5
Amp Gain:	2	Ambient RH (%):	62
Averaging:	3	Density (kg/m3):	1000
Batteries Replaced:	April 29	Software Version:	0.421N
		Crest factor =	1

	ZOOM SCAN RESULTS:		
	Spot SAR (W/kg):	Start Scan	End Scan
		0.240	0.244
	Change during Scan (%)	1.78	
	Max E-field (V/m):	27.68	
	Max SAR (W/kg)	1g	10g
		1.060	0.481
	Location of Max (mm):	X	Y
		75.0	-13.0
			Z
			-171.1



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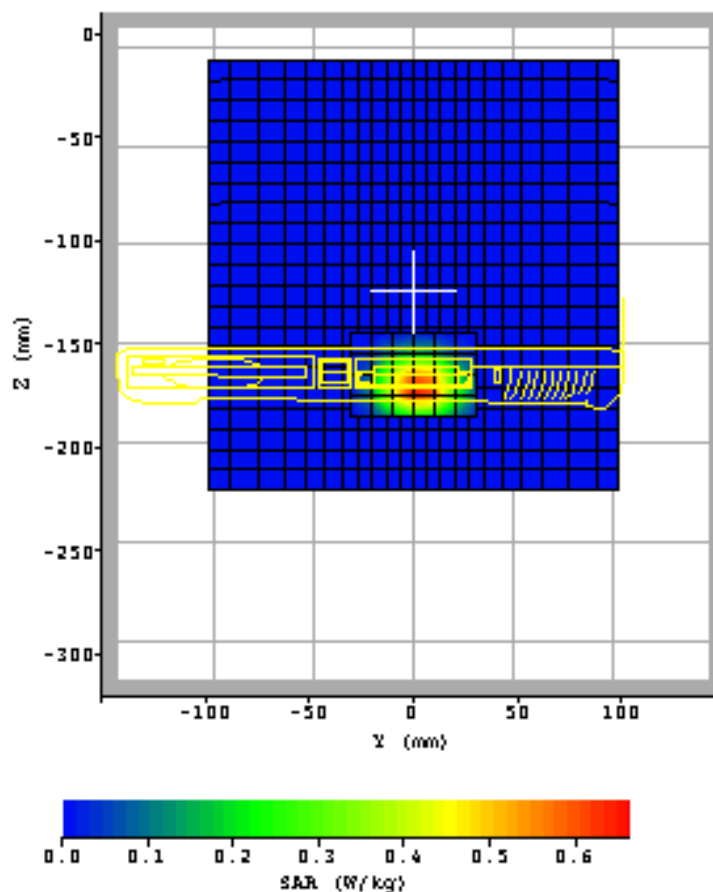
plot #3 (2/2)

Date / Time:	2003/4/29	Position:	perpendicular 0mm
Filename:	accton 11b2412per0	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB Printed	Test Frequency:	802.11b/ 2412MHz
Shape File:	hp NB perpendicular.csv	Power Level:	17.98 dBm

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-30.0	30.0	6.0
Z	-185.0	-145.0	4.0





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plot #4 (1/2)

Date / Time: 2003/4/29
Filename: accton 11b2462per0
Device Tested: 3CRWE154G72
Antenna: PCB Printed
Shape File: hp NB perpendicular.csv

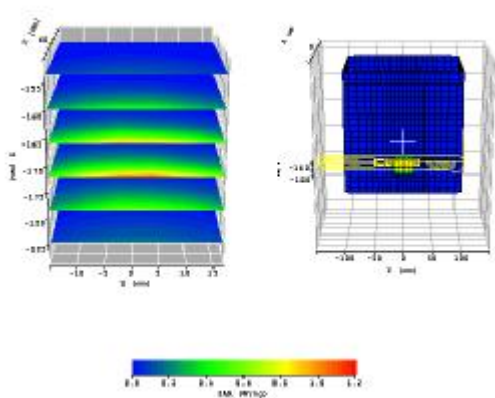
Position: perpendicular 0mm
Phantom: HeadBox1.csv
Head Rotation: 0
Test Frequency: 802.11b/ 2462MHz
Power Level: 18.43 dBm

Probe: 0114
Cal File: SN0114_2450_CW_BODY

	X	Y	Z
Cal Factors: Air	532	494	450
DCP	20	20	20
Lin	.528	.528	.528

Amp Gain: 2
Averaging: 3
Batteries Replaced: April 29

Liquid: 15.2cm
Type: 2450MHz body
Conductivity: 1.907
Relative Permittivity: 51.149
Liquid Temp (deg C): 23.3 (target 23.1)
Ambient Temp (deg C): 22.5
Ambient RH (%): 62
Density (kg/m3): 1000
Software Version: 0.421N
Crest factor = 1



ZOOM SCAN RESULTS:

Spot SAR (W/kg):	Start Scan	End Scan	
	0.170	0.166	
Change during Scan (%)	-2.13		
Max E-field (V/m):	23.71		
Max SAR (W/kg)	1g	10g	
	0.795	0.360	
Location of Max (mm):	X	Y	Z
	75.1	-15.0	-171.1



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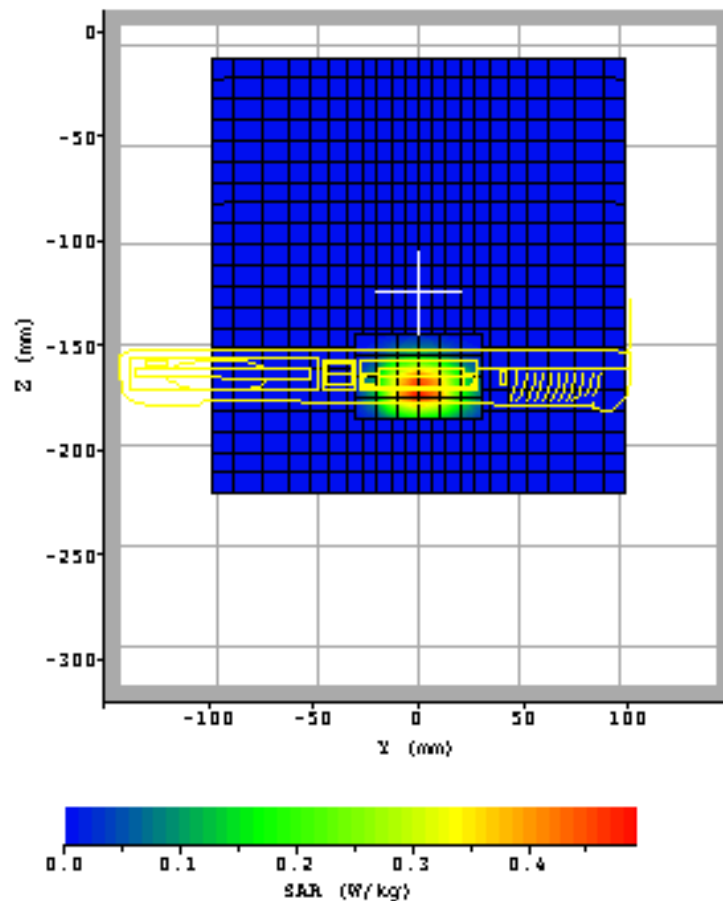
plot #4 (2/2)

Date / Time:	2003/4/29	Position:	perpendicular 0mm
Filename:	accton 11b2462per0	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB Printed	Test Frequency:	802.11b/ 2462MHz
Shape File:	hp NB perpendicular.csv	Power Level:	18.43 dBm

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-30.0	30.0	6.0
Z	-185.0	-145.0	4.0





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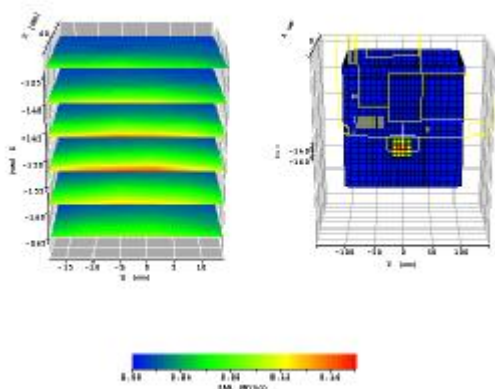
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plot #5 (1/2)

Date / Time:	2003/4/29	Position:	bottom 0mm
Filename:	accton 11g2437bot0	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB Printed	Test Frequency:	802.11g/ 2437MHz
Shape File:	hp NB bottom.csv	Power Level:	20.33 dBm

Probe:	0114			
Cal File:	SN0114_2450_CW_BODY			
Cal Factors:		X	Y	Z
	Air	532	494	450
	DCP	20	20	20
	Lin	.528	.528	.528
Amp Gain:	2			
Averaging:	3			
Batteries Replaced:	April 29			

Liquid:	15.2cm
Type:	2450MHz body
Conductivity:	1.907
Relative Permittivity:	51.149
Liquid Temp (deg C):	23.4 (target 23.1)
Ambient Temp (deg C):	22.5
Ambient RH (%):	60
Density (kg/m3):	1000
Software Version:	0.421N
Crest factor = 1	



ZOOM SCAN RESULTS:

Spot SAR (W/kg):	Start Scan	End Scan	
	0.041	0.041	
Change during Scan (%)	0.13		
Max E-field (V/m):	9.40		
Max SAR (W/kg)	1g	10g	
	0.137	0.079	
Location of Max (mm):	X	Y	Z
	75.1	-18.0	-151.1



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Report No.: EME-030506

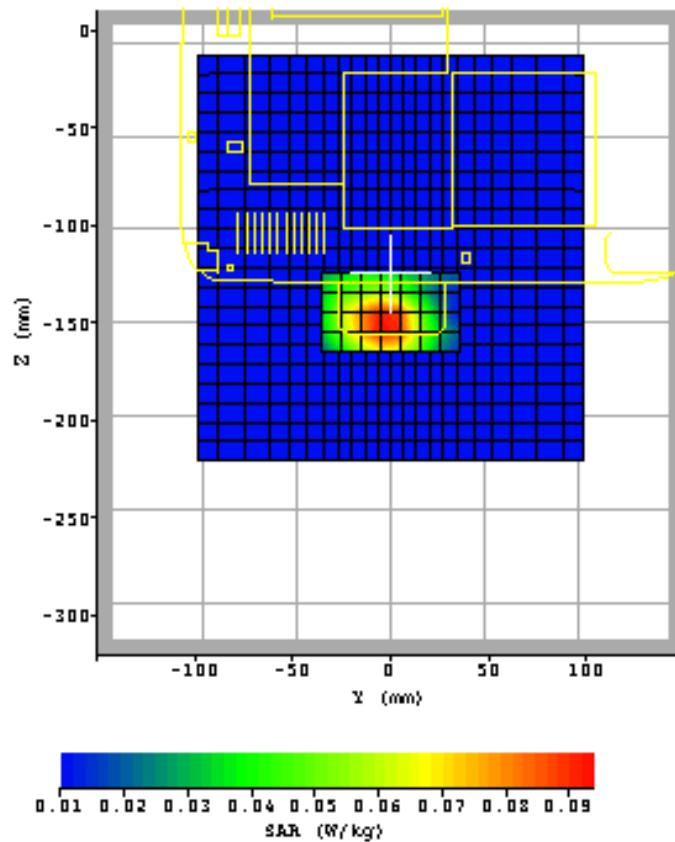
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plot #5 (2/2)

Date / Time:	2003/4/29	Position:	bottom 0mm
Filename:	accton 11g2437bot0	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB Printed	Test Frequency:	802.11g/ 2437MHz
Shape File:	hp NB bottom.csv	Power Level:	20.33 dBm

AREA SCAN:

	Min	Max	Steps
Scan Extent:			
Y	-35.0	35.0	7.0
Z	-165.0	-125.0	4.0





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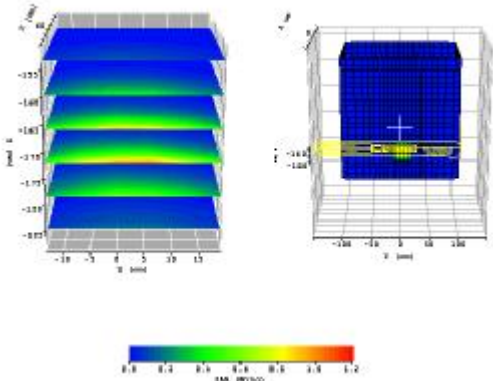
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plot #6 (1/2)

Date / Time:	2003/4/29	Position:	perpendicular 0mm
Filename:	accton 11g2437per0	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB Printed	Test Frequency:	2437
Shape File:	hp NB perpendicular.csv	Power Level:	20.33 dBm

Probe:	0114	Liquid:	15.2cm
Cal File:	SN0114_2450_CW_BODY	Type:	2450MHz body
Cal Factors:		Conductivity:	1.907
		Relative Permittivity:	51.149
		Liquid Temp (deg C):	23.5 (target 23.1)
		Ambient Temp (deg C):	22.5
Amp Gain:	2	Ambient RH (%):	62
Averaging:	3	Density (kg/m3):	1000
Batteries	April 29	Software Version:	0.421N
Replaced:		Crest factor =	1

		ZOOM SCAN RESULTS:	
Spot SAR (W/kg):		Start Scan	End Scan
		0.160	0.162
Change during Scan (%)	1.20		
Max E-field (V/m):	23.40		
Max SAR (W/kg)	1g	10g	
	0.762	0.340	
Location of Max (mm):	X	Y	Z
	75.0	-13.0	-171.1



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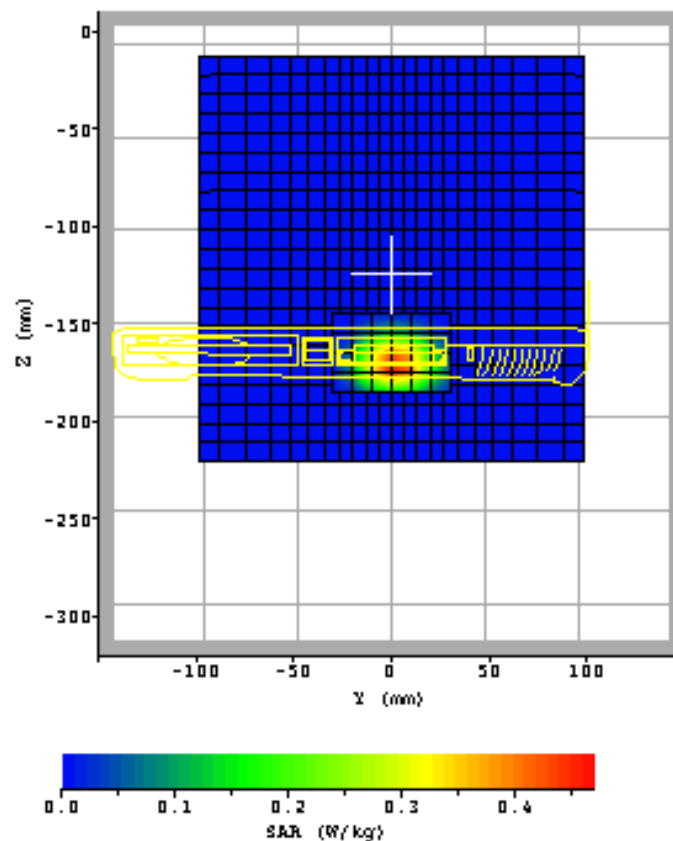
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plot #6 (2/2)

Date / Time:	2003/4/29	Position:	perpendicular 0mm
Filename:	accton 11g2437per0	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB Printed	Test Frequency:	2437
Shape File:	hp NB perpendicular.csv	Power Level:	20.33 dBm

AREA SCAN:

Scan Extent:			
	Min	Max	Steps
Y	-30.0	30.0	6.0
Z	-185.0	-145.0	4.0





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Report No.: EME-030506

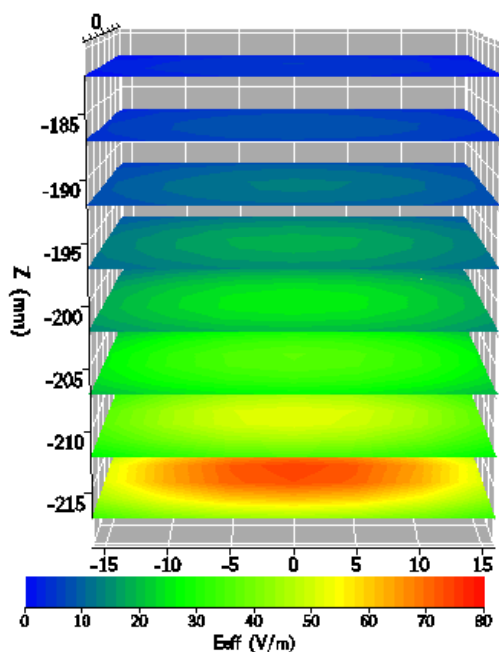
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Plot #9

Date:	2003/3/7	Position:	Bottom
Filename:	2450val3-7.txt	Phantom:	Box1.csv
Device Tested:	SARA2 system	Head Rotation:	0
Antenna:	2450dipole	Test Frequency:	2450MHz
Shape File:	none.csv	Power Level:	24dBm /CW

Probe:	0114			
Cal File:	SN0114_2450_CW_HEAD			
Cal Factors:		X	Y	Z
	Air	532	494	450
	DCP	20	20	20
	Lin	.495	.495	.495
Amp Gain:	2			
Averaging:	1			
Batteries Replaced:	N/a			

Liquid:	15.1cm
Type:	2450MHz Head
Conductivity:	1.790
Relative Permittivity:	38.050
Liquid Temp (deg C):	23
Ambient Temp (deg C):	22.1
Ambient RH (%):	63
Density (kg/m3):	1000
Software Version:	0.421N
Crest Factor = 1	



ZOOM SCAN RESULTS:

Spot SAR (W/kg):	Start Scan	End Scan

Change during Scan (%)

Max E-field (V/m): 76.33

Max SAR (W/kg)	1g	10g
	13.9475	6.54

Location of Max (mm):	X	Y	Z
	2.7	1.4	-223.0

Normalized to an input power of 1W
Averaged over 1 cm³ (1g) of tissue
55.79 W/kg



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Report No.: EME-030506

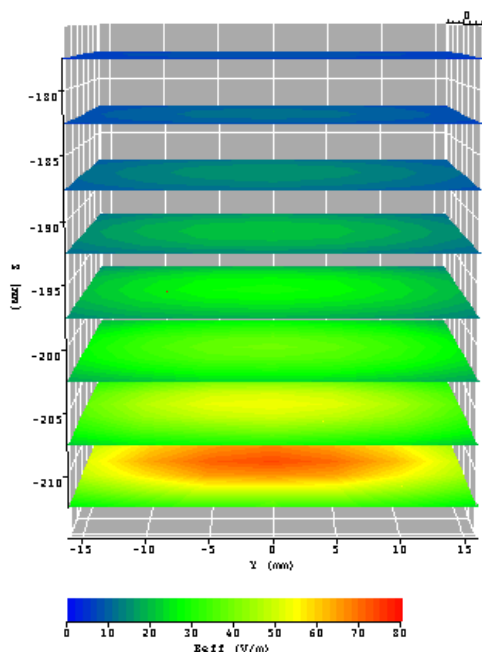
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Plot #10

Date / Time:	2003/4/29	Position:	bottom of box phantom
Filename:	2450 performance check	Phantom:	HeadBox1.csv
Device Tested:	SARA2 system	Head Rotation:	0
Antenna:	2.45GHz dipole	Test Frequency:	2450MHz
Shape File:	Dipole2450.csv	Power Level:	24 dBm /CW

Probe:	0114			
Cal File:	SN0114_2450_CW_HEAD			
Cal Factors:		X	Y	Z
	Air	532	494	450
	DCP	20	20	20
	Lin	.495	.495	.495
Amp Gain:	2			
Averaging:	3			
Batteries Replaced:	-			

Liquid:	15.2cm
Type:	2450MHz head
Conductivity:	1.881
Relative Permittivity:	38.952
Liquid Temp (deg C):	23.1
Ambient Temp (deg C):	22.5
Ambient RH (%):	61
Density (kg/m3):	1000
Software Version:	0.421N
Crest factor = 1	



ZOOM SCAN RESULTS:

Spot SAR (W/kg):	Start Scan	End Scan

Change during Scan (%)

Max E-field (V/m): 73.42

Max SAR (W/kg)	1g	10g
	13.029	6.254

Location of Max (mm):	X	Y	Z
	0.0	0.0	-220.5

Normalized to an input power of 1W
Averaged over 1 cm³ (1g) of tissue

52.116 W/kg



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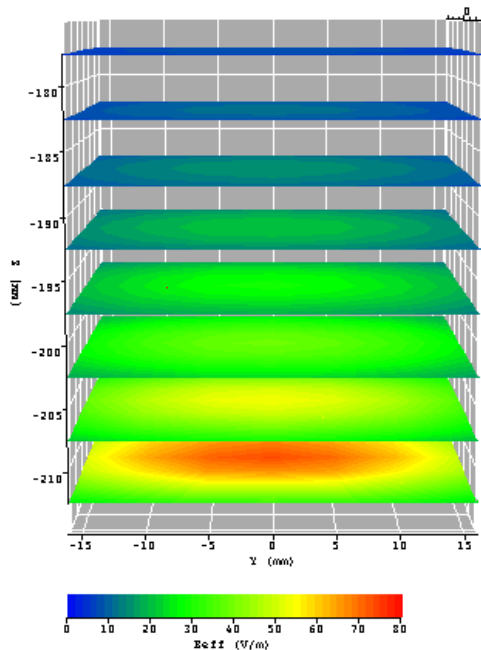
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Plot #11

Date / Time:	2003/6/2	Position:	bottom of box phantom
Filename:	2450 performance check	Phantom:	HeadBox1.csv
Device Tested:	SARA2 system	Head Rotation:	0
Antenna:	2.45GHz dipole	Test Frequency:	2450MHz
Shape File:	Dipole2450.csv	Power Level:	24 dBm /CW

Probe:	0114																
Cal File:	SN0114_2450_CW_HEAD																
Cal Factors:	<table><thead><tr><th></th><th>X</th><th>Y</th><th>Z</th></tr></thead><tbody><tr><td>Air</td><td>532</td><td>494</td><td>450</td></tr><tr><td>DCP</td><td>20</td><td>20</td><td>20</td></tr><tr><td>Lin</td><td>.495</td><td>.495</td><td>.495</td></tr></tbody></table>		X	Y	Z	Air	532	494	450	DCP	20	20	20	Lin	.495	.495	.495
	X	Y	Z														
Air	532	494	450														
DCP	20	20	20														
Lin	.495	.495	.495														
Amp Gain:	2																
Averaging:	3																
Batteries Replaced:	-																

Liquid:	15.2cm
Type:	2450MHz head
Conductivity:	1.881
Relative Permittivity:	38.952
Liquid Temp (deg C):	23.1 (target 23)
Ambient Temp (deg C):	22.4
Ambient RH (%):	62
Density (kg/m3):	1000
Software Version:	0.421N
Crest factor = 1	



ZOOM SCAN RESULTS:

Spot SAR (W/kg):	Start Scan	End Scan

Change during Scan (%)

Max E-field (V/m): 72.24

Max SAR (W/kg)	1g	10g
	13.214	6.108

Location of Max (mm):	X	Y	Z
	0.0	0.0	-220.1

Normalized to an input power of 1W

Averaged over 1 cm³ (1g) of tissue

52.856 W/kg



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Report No.: EME-030506

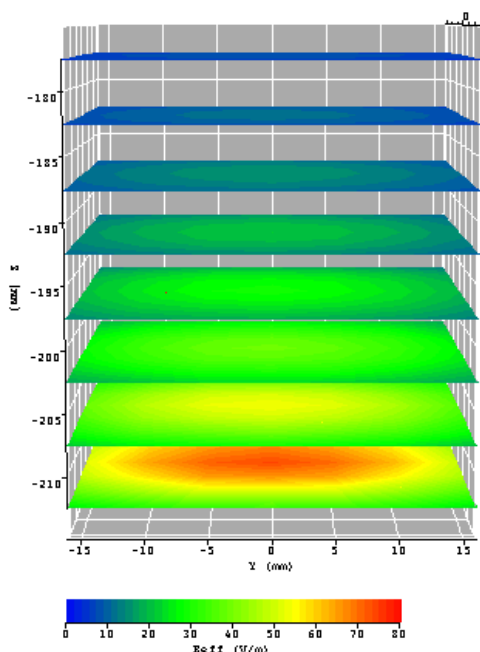
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Plot #12

Date / Time:	2003/6/13	Position:	bottom of box phantom
Filename:	2450 performance check	Phantom:	HeadBox1.csv
Device Tested:	SARA2 system	Head Rotation:	0
Antenna:	2.45GHz dipole	Test Frequency:	2450MHz
Shape File:	Dipole2450.csv	Power Level:	24 dBm /CW

Probe:	0114			
Cal File:	SN0114_2450_CW_HEAD			
Cal Factors:		X	Y	Z
	Air	532	494	450
	DCP	20	20	20
	Lin	.495	.495	.495
Amp Gain:	2			
Averaging:	3			
Batteries	-			
Replaced:	-			

Liquid:	15.2cm
Type:	2450MHz head
Conductivity:	1.881
Relative Permittivity:	38.952
Liquid Temp (deg C):	24.2
Ambient Temp (deg C):	21.2
Ambient RH (%):	63
Density (kg/m3):	1000
Software Version:	0.421N
Crest factor = 1	



ZOOM SCAN RESULTS:

Spot SAR	Start Scan	End Scan
(W/kg):		

Change during Scan (%)

Max E-field (V/m): 73.25

Max SAR (W/kg)	1g	10g
	13.119	5.987

Location of Max (mm):	X	Y	Z
	0.0	0.0	-220.9

Normalized to an input power of 1W

Averaged over 1 cm³ (1g) of tissue

52.476 W/kg



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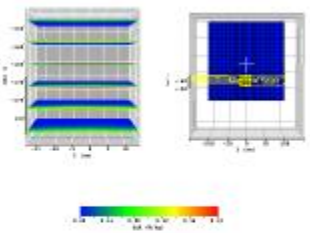
Report No.: EME-030506

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plot #13

Date / Time:	2003/6/2	Position:	perpendicular 15mm
Filename:	accton11b2437per15	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB Printed	Test Frequency:	802.11b/2437MHz
Shape File:	hp NB perpendicular.csv	Power Level:	19.41dBm

Probe:	0114	Liquid:	15.3cm
Cal File:	SN0114_2450_CW_BODY	Type:	2450MHz body
Cal Factors:		Conductivity:	1.94924
		Relative Permittivity:	54.62591
		Liquid Temp (deg C):	21.9
		Ambient Temp (deg C):	20
Amp Gain:	2	Ambient RH (%):	50
Averaging:	3	Density (kg/m3):	1000
Batteries Replaced:	June 02	Software Version:	0.421N
		Crest factor = 1	

		ZOOM SCAN RESULTS:	
Spot SAR (W/kg):	Start Scan		End Scan
	0.020		0.020
Change during Scan (%)		0.11	
Max E-field (V/m):		9.75	
Max SAR (W/kg)	1g		10g
	0.145		0.074
Location of Max (mm):	X	Y	Z
	75.1	-18.0	-170.1

Y (cm)

X (cm)

SAR (W/kg)

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-50.0	50.0	10.0
Z	-190.0	-140.0	5.0



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FCC ID. : HED2835WACC

Report No.: EME-030506

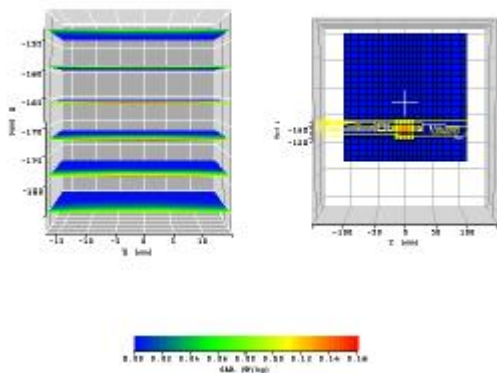
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plot #14

Date / Time:	2003/6/2	Position:	perpendicular 15mm
Filename:	accton11b2412per15	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB Printed	Test Frequency:	802.11b/2412MHz
Shape File:	hp NB perpendicular.csv	Power Level:	17.98dBm

Probe:	0114			
Cal File:	SN0114_2450_CW_BODY			
Cal Factors:		X	Y	Z
	Air	532	494	450
	DCP	20	20	20
	Lin	.528	.528	.528
Amp Gain:	2			
Averaging:	3			
Batteries Replaced:	June 02			

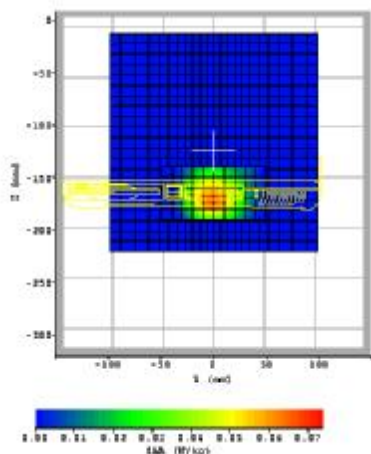
Liquid:	15.3cm
Type:	2450MHz body
Conductivity:	1.94924
Relative Permittivity:	54.62591
Liquid Temp (deg C):	21.9
Ambient Temp (deg C):	20
Ambient RH (%):	50
Density (kg/m3):	1000
Software Version:	0.421N
Crest factor = 1	



ZOOM SCAN RESULTS:

Spot SAR (W/kg):	Start Scan	End Scan
	0.017	0.018
Change during Scan (%)	3.33	
Max E-field (V/m):	9.02	
Max SAR (W/kg)	1g	10g
	0.125	0.063

Location of Max (mm):	X	Y	Z
	75.1	-17.0	-170.1



AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-50.0	50.0	10.0
Z	-190.0	-140.0	5.0



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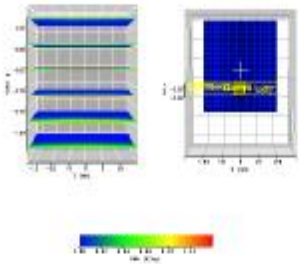
Report No.: EME-030506

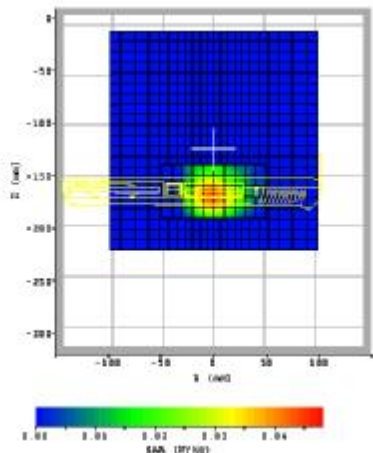
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plot #15

Date / Time:	2003/6/2	Position:	perpendicular 15mm
Filename:	accton11b2462per15	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB Printed	Test Frequency:	802.11b/2462MHz
Shape File:	hp NB perpendicular.csv	Power Level:	18.43dBm

Probe:	0114	Liquid:	15.3cm
Cal File:	SN0114_2450_CW_BODY	Type:	2450MHz body
Cal Factors:		Conductivity:	1.94924
		Relative Permittivity:	54.62591
		Liquid Temp (deg C):	21.9
		Ambient Temp (deg C):	20
Amp Gain:	2	Ambient RH (%):	50
Averaging:	3	Density (kg/m3):	1000
Batteries	June 02	Software Version:	0.421N
Replaced:		Crest factor = 1	

	ZOOM SCAN RESULTS:		
	Spot SAR (W/kg):	Start Scan	End Scan
		0.007	0.007
	Change during Scan (%)	1.23	
	Max E-field (V/m):	7.49	
	Max SAR (W/kg)	1g	10g
		0.087	0.043
	Location of Max (mm):	X	Y
		75.1	-17.0
			Z
			-170.1

	AREA SCAN:		
	Scan Extent:	Min	Max
		Steps	
		Y	Z
		-50.0	50.0
		10.0	5.0
		-190.0	-140.0
		5.0	



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plot #16

Date / Time:	2003/6/2	Position:	perpendicular 15mm
Filename:	accton11g2437per15	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB Printed	Test Frequency:	802.11g/2437MHz
Shape File:	hp NB perpendicular.csv	Power Level:	20.33dBm

Probe:	0114	Liquid:	15.3cm																
Cal File:	SN0114_2450_CW_BODY	Type:	2450MHz body																
Cal Factors:	<table border="1"> <thead> <tr> <th></th><th>X</th><th>Y</th><th>Z</th></tr> </thead> <tbody> <tr> <td>Air</td><td>532</td><td>494</td><td>450</td></tr> <tr> <td>DCP</td><td>20</td><td>20</td><td>20</td></tr> <tr> <td>Lin</td><td>.528</td><td>.528</td><td>.528</td></tr> </tbody> </table>		X	Y	Z	Air	532	494	450	DCP	20	20	20	Lin	.528	.528	.528	Conductivity:	1.94924
	X	Y	Z																
Air	532	494	450																
DCP	20	20	20																
Lin	.528	.528	.528																
Amp Gain:	2	Relative Permittivity:	54.62591																
Averaging:	3	Liquid Temp (deg C):	21.6																
Batteries Replaced:	June 02	Ambient Temp (deg C):	20																
		Ambient RH (%):	50																
		Density (kg/m3):	1000																
		Software Version:	0.421N																
		Crest factor = 1																	

The figure displays two plots related to SAR results. The left plot is a 3D surface plot showing the distribution of SAR (W/kg) over a volume, with a color scale ranging from 0.005 to 0.005 W/kg. The right plot is a 2D contour plot showing the distribution of SAR (W/kg) over a cross-section, with a color scale ranging from 0.005 to 0.005 W/kg. Below the plots is a color bar indicating the SAR values in W/kg, ranging from 0.005 to 0.005 W/kg.

ZOOM SCAN RESULTS:

Spot SAR

(W/kg):

Start Scan

0.005

End Scan

0.005

Change during

Scan (%)

-1.85

Max E-field

(V/m):

7.15

Max SAR (W/kg)

1g

0.078

10g

0.037

Location of Max

(mm):

X

75.0

Y

-19.0

Z

-170.1

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-50.0	50.0	10.0
Z	-190.0	-140.0	5.0



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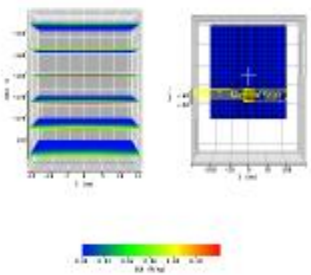
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plot #17

Date / Time:	2003/6/2	Position:	perpendicular 15mm
Filename:	accton11g2412per15	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB Printed	Test Frequency:	802.11g/2412MHz
Shape File:	hp NB perpendicular.csv	Power Level:	19.94dBm

Probe:	0114	Liquid:	15.3cm
Cal File:	SN0114_2450_CW_BODY	Type:	2450MHz body
Cal Factors:		Conductivity:	1.94924
		Relative Permittivity:	54.62591
		Liquid Temp (deg C):	21.9
		Ambient Temp (deg C):	20
Amp Gain:	2	Ambient RH (%):	50
Averaging:	3	Density (kg/m3):	1000
Batteries		Software Version:	0.421N
Replaced:	June 02	Crest factor = 1	



The figure displays two heatmaps of SAR distribution. The left heatmap shows a color scale from 0.00 to 0.04 W/kg, with a color bar at the bottom indicating the SAR scale from 0.00 to 0.04 W/kg. The right heatmap shows a color scale from 0.00 to 0.04 W/kg, with a color bar at the bottom indicating the SAR scale from 0.00 to 0.04 W/kg.

ZOOM SCAN RESULTS:

Spot SAR

(W/kg):

Start Scan	End Scan
0.011	0.011

Change during
Scan (%)

2.33

Max E-field

(V/m):

7.63

Max SAR (W/kg)

1g	10g
0.091	0.045

Location of Max
(mm):

X	Y	Z
75.1	-16.0	-170.1

The figure displays a 2D heatmap representing the Area Scan of SAR (Specific Absorption Rate) distribution. The horizontal axis is labeled 'X (cm)' and ranges from -100 to 100. The vertical axis is labeled 'Z (cm)' and ranges from -200 to 0. A color bar at the bottom indicates the SAR scale in W/kg, ranging from 0.00 (blue) to 0.05 (red). The heatmap shows a central region of high SAR (red/yellow) with a white crosshair at the center (0,0). The SAR values decrease as the distance from the center increases, transitioning through green and blue.

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-50.0	50.0	10.0
Z	-190.0	-140.0	5.0



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plot #18

Date / Time:	2003/6/2	Position:	perpendicular 15mm
Filename:	accton11g2462per15	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB Printed	Test Frequency:	802.11g/2462MHz
Shape File:	hp NB perpendicular.csv	Power Level:	20.02dBm

Probe:	0114			
Cal File:	SN0114_2450_CW_BODY			
Cal Factors:		X	Y	Z
	Air	532	494	450
	DCP	20	20	20
	Lin	.528	.528	.528
Amp Gain:	2			
Averaging:	3			
Batteries Replaced:	June 02			

Liquid:	15.3cm
Type:	2450MHz body
Conductivity:	1.94924
Relative Permittivity:	54.62591
Liquid Temp (deg C):	21.6
Ambient Temp (deg C):	20
Ambient RH (%):	50
Density (kg/m3):	1000
Software Version:	0.421N
Crest factor = 1	

The figure displays two side-by-side plots. The left plot is a 3D surface plot showing the Spot SAR (W/kg) distribution across a rectangular volume. The color scale ranges from 0.000 (blue) to 0.001 (red). The right plot is a 2D cross-section plot showing the Change during Scan (%) distribution. The color scale ranges from 0.000 (blue) to 0.001 (red). Below the plots is a color bar for the SAR distribution, ranging from 0.000 to 0.001 W/kg.

ZOOM SCAN RESULTS:

Spot SAR

(W/kg):

Change during

Scan (%)

Max E-field

(V/m):

Max SAR (W/kg)

Location of Max
(mm):

Start Scan	End Scan
0.001	0.000

6.03

1g	10g
0.054	0.025

X	Y	Z
75.1	-16.0	-169.1

0.000 0.005 0.010 0.015 0.020 0.025

SAR (W/kg)

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-50.0	50.0	10.0
Z	-190.0	-140.0	5.0



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plot #19

Date / Time: 2003/6/13
Filename: accton 802.11g 2437 dell bot
Device Tested: 3CRWE154G72
Antenna: PCB printed
Shape File: Dell-bot.csv

Position: bottom
Phantom: HeadBox1.csv
Head Rotation: 0
Test Frequency: 802.11g 2437MHz
Power Level: 20.33dBm

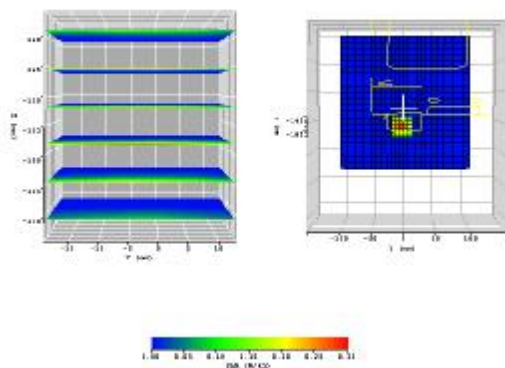
Probe: 0114
Cal File: SN0114_2450_CW_BODY

Cal Factors:

	X	Y	Z
Air	532	494	450
DCP	20	20	20
Lin	.528	.528	.528

Amp Gain: 2
Averaging: 3
Batteries Replaced: June 13

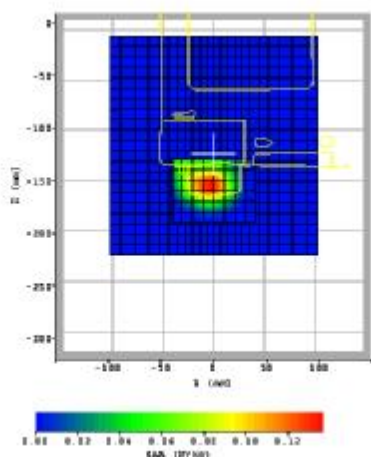
Liquid: 15.3cm
Type: 2450MHz body
Conductivity: 1.90368
Relative Permittivity: 50.43422
Liquid Temp (deg C): 22.9
Ambient Temp (deg C): 20
Ambient RH (%): 65
Density (kg/m3): 1000
Software Version: 0.421N
Crest Factor=1



ZOOM SCAN RESULTS:

Spot SAR (W/kg):	Start Scan	End Scan
	0.049	0.047
Change during Scan (%)	-3.46	
Max E-field (V/m):	12.06	
Max SAR (W/kg)	1g	10g
	0.219	0.113

Location of Max (mm):	X	Y	Z
	75.0	-19.0	-155.0



AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-40.0	40.0	8.0
Z	-190.0	-130.0	6.0



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plot #20

Date / Time:	2003/6/13	Position:	bottom
Filename:	accton 802.11g 2412 dell bot	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB printed	Test Frequency:	802.11g 2412MHz
Shape File:	Dell-bot.csv	Power Level:	19.94dBm

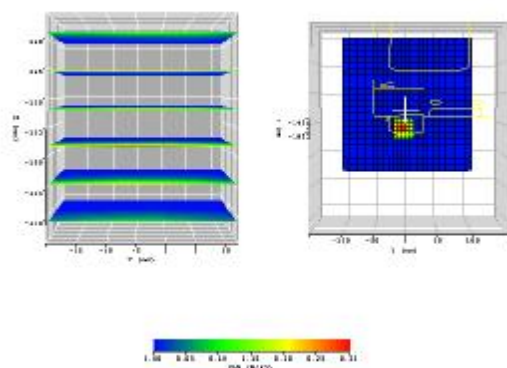
Probe: 0114
Cal File: SN0114_2450_CW_BODY

Cal Factors:

	X	Y	Z
Air	532	494	450
DCP	20	20	20
Lin	.528	.528	.528

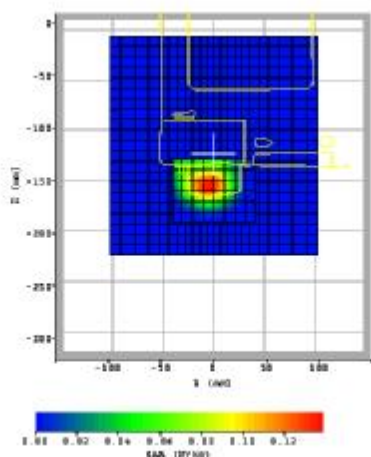
Amp Gain: 2
Averaging: 3
Batteries Replaced: June 13

Liquid: 15.3cm
Type: 2450MHz body
Conductivity: 1.90368
Relative Permittivity: 50.43422
Liquid Temp (deg C): 22.9
Ambient Temp (deg C): 20
Ambient RH (%): 65
Density (kg/m3): 1000
Software Version: 0.421N
Crest Factor=1



ZOOM SCAN RESULTS:

Spot SAR (W/kg):	Start Scan	End Scan	
	0.048	0.048	
Change during Scan (%)	0.00		
Max E-field (V/m):	12.23		
Max SAR (W/kg)	1g	10g	
	0.227	0.117	
Location of Max (mm):	X	Y	Z
	75.0	-20.0	-155.0



AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-40.0	40.0	8.0
Z	-190.0	-130.0	6.0



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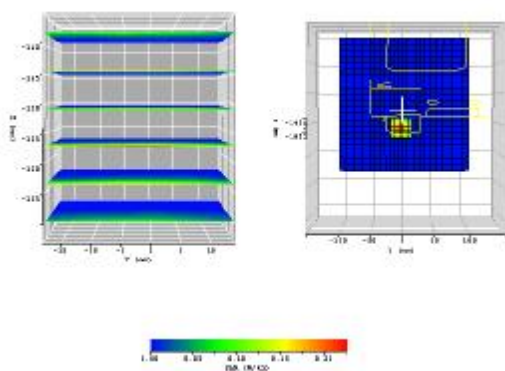
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plot #21

Date / Time:	2003/6/13	Position:	bottom
Filename:	accton 802.11g 2462 dell bot	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB printed	Test Frequency:	802.11g 2462MHz
Shape File:	Dell-bot.csv	Power Level:	20.02dBm

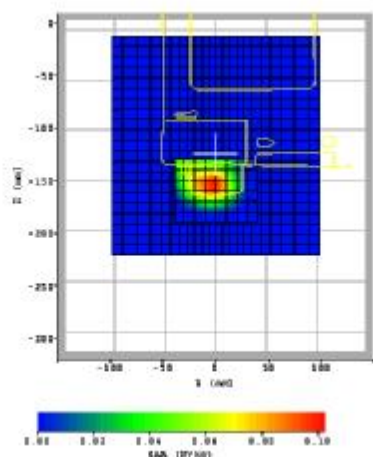
Probe:	0114			
Cal File:	SN0114_2450_CW_BODY			
Cal Factors:		X	Y	Z
	Air	532	494	450
	DCP	20	20	20
	Lin	.528	.528	.528
Amp Gain:	2			
Averaging:	3			
Batteries Replaced:	June 13			

Liquid:	15.3cm
Type:	2450MHz body
Conductivity:	1.90368
Relative Permittivity:	50.43422
Liquid Temp (deg C):	22.9
Ambient Temp (deg C):	20
Ambient RH (%):	65
Density (kg/m3):	1000
Software Version:	0.421N
Crest Factor=1	



ZOOM SCAN RESULTS:

Spot SAR (W/kg):	Start Scan	End Scan	
	0.040	0.031	
Change during Scan (%)	-21.03		
Max E-field (V/m):	10.28		
Max SAR (W/kg)	1g	10g	
	0.161	0.083	
Location of Max (mm):	X	Y	Z
	75.1	-18.0	-154.0



AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-40.0	40.0	8.0
Z	-190.0	-130.0	6.0



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plot #22

Date / Time:	2003/6/13	Position:	perpendicular 0mm
Filename:	accton 802.11g 2437 dell per0	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB printed	Test Frequency:	802.11g 2437MHz
Shape File:	Dell-per..csv	Power Level:	20.33dBm

Probe:	0114			
Cal File:	SN0114_2450_CW_BODY			
Cal Factors:		X	Y	Z
	Air	532	494	450
	DCP	20	20	20
	Lin	.528	.528	.528
Amp Gain:	2			
Averaging:	3			
Batteries Replaced:	June 13			

Liquid:	15.3cm
Type:	2450MHz body
Conductivity:	1.90368
Relative Permittivity:	50.43422
Liquid Temp (deg C):	22.9
Ambient Temp (deg C):	20
Ambient RH (%):	65
Density (kg/m3):	1000
Software Version:	0.421N
Crest Factor=1	

ZOOM SCAN RESULTS:

Spot SAR

(W/kg):

Start Scan	End Scan
0.123	0.124

Change during

Scan (%)

0.53

Max E-field

(V/m):

20.56

Max SAR (W/kg)

1g	10g
0.594	0.274

Location of Max

(mm):

X	Y	Z
75.1	-16.0	-178.1

The figure displays a 2D SAR scan plot. The horizontal axis is labeled 'X (cm)' and ranges from -100 to 100. The vertical axis is labeled 'Z (cm)' and ranges from -300 to 0. A color bar at the bottom indicates the SAR value in W/kg, ranging from 0.00 (blue) to 0.40 (red). The plot shows a high SAR region (yellow/red) on the left side of the device, with a white crosshair indicating the center of the device.

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-40.0	40.0	8.0
Z	-195.0	-150.0	5.0



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plot #23

Date / Time:	2003/6/13	Position:	perpendicular 0mm
Filename:	accton 802.11g 2412 dell per0	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB printed	Test Frequency:	802.11g 2412MHz
Shape File:	Dell-per..csv	Power Level:	19.94dBm

Probe:	0114			
Cal File:	SN0114_2450_CW_BODY			
Cal Factors:		X	Y	Z
	Air	532	494	450
	DCP	20	20	20
	Lin	.528	.528	.528
Amp Gain:	2			
Averaging:	3			
Batteries Replaced:	June 13			

Liquid:	15.3cm
Type:	2450MHz body
Conductivity:	1.90368
Relative Permittivity:	50.43422
Liquid Temp (deg C):	22.9
Ambient Temp (deg C):	20
Ambient RH (%):	65
Density (kg/m3):	1000
Software Version:	0.421N
Crest Factor=1	

ZOOM SCAN RESULTS:

Spot SAR

(W/kg):

Change during
Scan (%)

Max E-field

(V/m):

Max SAR (W/kg)

Location of Max
(mm):

Start Scan	End Scan	
0.127	0.130	
2.37		
20.98		
1g	10g	
0.621	0.285	
X	Y	Z
75.0	-14.0	-178.1

The figure displays a 2D heatmap representing the Area Scan of SAR (Specific Absorption Rate) distribution. The horizontal axis is labeled 'X (mm)' and ranges from -100 to 100. The vertical axis is labeled 'Y (mm)' and ranges from -200 to 0. A color bar at the bottom indicates the SAR values in W/kg, ranging from 0.00 (blue) to 0.40 (red). The heatmap shows a central region of high SAR (red/yellow) with a white crosshair at the center (0,0). The SAR values decrease as the distance from the center increases, transitioning through green and blue.

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-40.0	40.0	8.0
Z	-195.0	-150.0	5.0



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plot #24

Date / Time:	2003/6/13	Position:	perpendicular 0mm
Filename:	accton 802.11g 2462 dell per0	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB printed	Test Frequency:	802.11g 2462MHz
Shape File:	Dell-per..csv	Power Level:	20.02Bm

Probe:	0114	Liquid:	15.3cm
Cal File:	SN0114_2450_CW_BODY	Type:	2450MHz body
Cal Factors:		Conductivity:	1.90368
		Relative Permittivity:	50.43422
		Liquid Temp (deg C):	22.9
		Ambient Temp (deg C):	20
Amp Gain:	2	Ambient RH (%):	65
Averaging:	3	Density (kg/m3):	1000
Batteries		Software Version:	0.421N
Replaced:	June 13	Crest Factor=1	

The figure displays two 3D surface plots of SAR distribution. The left plot shows a full body scan with a color scale from 0.0 to 0.5 W/kg. The right plot is a zoomed-in view of the head area, showing a color scale from 0.0 to 0.5 W/kg. A color bar at the bottom indicates the SAR values in W/kg, ranging from 0.0 (blue) to 0.5 (red).

ZOOM SCAN RESULTS:

**Spot SAR
(W/kg):**

Start Scan	End Scan
0.084	0.085

**Change during
Scan (%)**

1.39

**Max E-field
(V/m):**

17.41

Max SAR (W/kg)

1g	10g
0.431	0.198

**Location of Max
(mm):**

X	Y	Z
75.1	-16.0	-177.0

The figure displays a 2D area scan plot of SAR (Specific Absorption Rate) distribution. The plot is a square grid with X and Y axes ranging from -100 to 100 mm. A color bar at the bottom indicates SAR values from 0.00 to 0.25 W/kg, with a color gradient from blue (low) to red (high). The plot shows a central region of high SAR (red/yellow) with a white crosshair, surrounded by a blue region (low SAR). The SAR values are highest in the center and decrease towards the edges.

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-40.0	40.0	8.0
Z	-195.0	-150.0	5.0



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plot #25

Date / Time:	2003/6/13	Position:	perpendicular 15mm
Filename:	accton 802.11g 2437 dell per15	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB printed	Test Frequency:	802.11g 2437MHz
Shape File:	Dell-per..csv	Power Level:	20.33Bm

Probe:	0114			
Cal File:	SN0114_2450_CW_BODY			
Cal Factors:		X	Y	Z
	Air	532	494	450
	DCP	20	20	20
	Lin	.528	.528	.528
Amp Gain:	2			
Averaging:	3			
Batteries Replaced:	June 13			

Liquid:	15.3cm
Type:	2450MHz body
Conductivity:	1.90368
Relative Permittivity:	50.43422
Liquid Temp (deg C):	22.9
Ambient Temp (deg C):	20
Ambient RH (%):	65
Density (kg/m3):	1000
Software Version:	0.421N
Crest Factor=1	

The figure displays two heatmaps representing SAR distribution. The left heatmap shows a color scale from 0.000 to 0.008 W/kg. The right heatmap shows a color scale from 0.000 to 0.008 W/kg. A color bar at the bottom indicates the SAR scale from 0.000 to 0.008 W/kg.

ZOOM SCAN RESULTS:

**Spot SAR
(W/kg):**

Start Scan	End Scan
0.007	0.008

**Change during
Scan (%)**

2.55

**Max E-field
(V/m):**

6.25

Max SAR (W/kg)

1g	10g
0.059	0.029

**Location of Max
(mm):**

X	Y	Z
75.0	-21.0	-176.3

Area Scan heatmap showing SAR distribution. The plot displays SAR (W/kg) on a color scale from 0.00 (blue) to 0.03 (red). The X-axis represents X (cm) from -100 to 100, and the Z-axis represents Z (cm) from -200 to 0. A white crosshair is centered at (0,0). A yellow and orange region of high SAR is visible near the center, with a white line tracing a path through it.

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-40.0	40.0	8.0
Z	-195.0	-150.0	5.0



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plot #26

Date / Time:	2003/6/13	Position:	perpendicular 15mm
Filename:	accton 802.11g 2412 dell per15	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB printed	Test Frequency:	802.11g 2412MHz
Shape File:	Dell-per..csv	Power Level:	19.94dBm

Probe:	0114			
Cal File:	SN0114_2450_CW_BODY			
Cal Factors:		X	Y	Z
	Air	532	494	450
	DCP	20	20	20
	Lin	.528	.528	.528
Amp Gain:	2			
Averaging:	3			
Batteries Replaced:	June 13			

Liquid:	15.3cm
Type:	2450MHz body
Conductivity:	1.90368
Relative Permittivity:	50.43422
Liquid Temp (deg C):	22.9
Ambient Temp (deg C):	20
Ambient RH (%):	65
Density (kg/m3):	1000
Software Version:	0.421N
Crest Factor=1	

ZOOM SCAN RESULTS:

**Spot SAR
(W/kg):**

Start Scan	End Scan
0.009	0.008

**Change during
Scan (%)**

-4.44

**Max E-field
(V/m):**

6.57

Max SAR (W/kg)

1g	10g
0.065	0.033

**Location of Max
(mm):**

X	Y	Z
75.0	-19.0	-176.1

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-40.0	40.0	8.0
Z	-195.0	-150.0	5.0



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plot #27

Date / Time:	2003/6/13	Position:	perpendicular 15mm
Filename:	accton 802.11g 2462 dell per15	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB printed	Test Frequency:	802.11g 2462MHz
Shape File:	Dell-per..csv	Power Level:	20.02Bm

Probe:	0114			
Cal File:	SN0114_2450_CW_BODY			
Cal Factors:		X	Y	Z
	Air	532	494	450
	DCP	20	20	20
	Lin	.528	.528	.528
Amp Gain:	2			
Averaging:	3			
Batteries Replaced:	June 13			

Liquid:	15.3cm
Type:	2450MHz body
Conductivity:	1.90368
Relative Permittivity:	50.43422
Liquid Temp (deg C):	22.9
Ambient Temp (deg C):	20
Ambient RH (%):	65
Density (kg/m3):	1000
Software Version:	0.421N
Crest Factor=1	

The figure consists of two 3D surface plots and a color bar. The left plot shows a rectangular object with a color-coded SAR distribution, with a color bar below it ranging from 0.000 to 0.020 W/kg. The right plot shows a similar distribution on a different object. The color bar is labeled 'Max (W/kg)' and has a scale from 0.000 to 0.020.

ZOOM SCAN RESULTS:

**Spot SAR
(W/kg):**

Start Scan	End Scan
0.003	0.003

**Change during
Scan (%)**

-3.25

**Max E-field
(V/m):**

5.29

Max SAR (W/kg)

1g	10g
0.042	0.019

**Location of Max
(mm):**

X	Y	Z
75.1	-22.0	-176.3

A 2D area scan plot showing SAR distribution on a rectangular object. The plot is color-coded, with a color bar at the bottom indicating SAR values from 0.0000 to 0.0200 W/kg. The X-axis is labeled 'X (cm)' and ranges from -100 to 100. The Y-axis is labeled 'Y (cm)' and ranges from -200 to 0. The plot shows a rectangular object with a crosshair in the center. The SAR distribution is concentrated on the object, with a color bar at the bottom indicating values from 0.0000 to 0.0200 W/kg.

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-40.0	40.0	8.0
Z	-195.0	-150.0	5.0



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plot #28

Date / Time: 2003/6/13
Filename: accton 11g 2437asus-bot
Device Tested: 3CRWE154G72
Antenna: PCB printed
Shape File: ASUSbot.csv

Position: bottom
Phantom: HeadBox1.csv
Head Rotation: 0
Test Frequency: 802.11g 2437MHz
Power Level: 20.33dBm

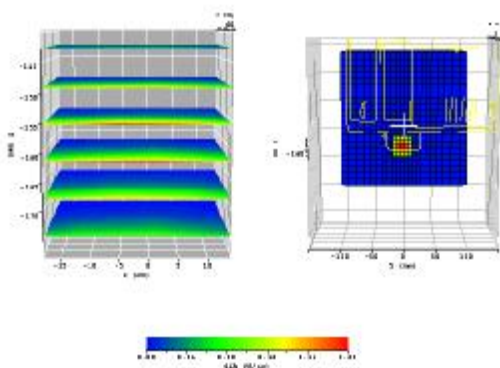
Probe: 0114
Cal File: SN0114_2450_CW_BODY

Cal Factors:

	X	Y	Z
Air	532	494	450
DCP	20	20	20
Lin	.528	.528	.528

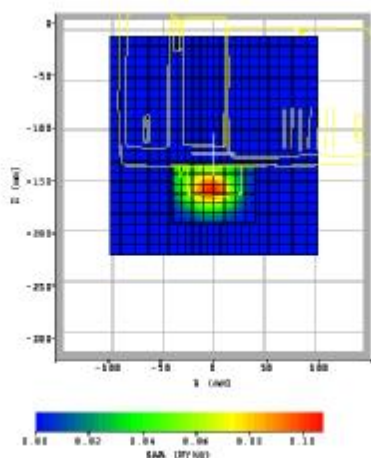
Amp Gain: 2
Averaging: 3
Batteries Replaced: June 13

Liquid: 15.3cm
Type: 2450MHz body
Conductivity: 1.90368
Relative Permittivity: 50.43422
Liquid Temp (deg C): 23.6
Ambient Temp (deg C): 20
Ambient RH (%): 60
Density (kg/m3): 1000
Software Version: 0.421N
Crest Factor=1



ZOOM SCAN RESULTS:

Spot SAR (W/kg):	Start Scan	End Scan
	0.047	0.047
Change during Scan (%)	-1.13	
Max E-field (V/m):	10.19	
Max SAR (W/kg)	1g	10g
	0.161	0.087
Location of Max (mm):	X	Y
	75.1	-18.0



AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-40.0	40.0	8.0
Z	-190.0	-135.0	6.0



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plot #29

Date / Time:	2003/6/13	Position:	bottom
Filename:	accton 11g 2412asus-bot	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB printed	Test Frequency:	802.11g 2412MHz
Shape File:	ASUSbot.csv	Power Level:	19.94dBm

Probe:	0114			
Cal File:	SN0114_2450_CW_BODY			
Cal Factors:		X	Y	Z
	Air	532	494	450
	DCP	20	20	20
	Lin	.528	.528	.528
Amp Gain:	2			
Averaging:	3			
Batteries Replaced:	June 13			

Liquid:	15.3cm
Type:	2450MHz body
Conductivity:	1.90368
Relative Permittivity:	50.43422
Liquid Temp (deg C):	23.6
Ambient Temp (deg C):	20
Ambient RH (%):	60
Density (kg/m3):	1000
Software Version:	0.421N
Crest Factor=1	

ZOOM SCAN RESULTS:

**Spot SAR
(W/kg):**

Start Scan	End Scan
0.045	0.044

**Change during
Scan (%)**

-1.24

**Max E-field
(V/m):**

10.62

Max SAR (W/kg)

1g	10g
0.176	0.095

**Location of Max
(mm):**

X	Y	Z
75.0	-20.0	-158.8

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-40.0	40.0	8.0
Z	-190.0	-135.0	6.0



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plot #30

Date / Time:	2003/6/13	Position:	bottom
Filename:	accton 11g 2462asus-bot	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB printed	Test Frequency:	802.11g 2462MHz
Shape File:	ASUSbot.csv	Power Level:	20.02dBm

Probe:	0114			
Cal File:	SN0114_2450_CW_BODY			
Cal Factors:		X	Y	Z
	Air	532	494	450
	DCP	20	20	20
	Lin	.528	.528	.528
Amp Gain:	2			
Averaging:	3			
Batteries Replaced:	June 13			

Liquid:	15.3cm
Type:	2450MHz body
Conductivity:	1.90368
Relative Permittivity:	50.43422
Liquid Temp (deg C):	23.6
Ambient Temp (deg C):	20
Ambient RH (%):	60
Density (kg/m3):	1000
Software Version:	0.421N
Crest Factor=1	

Two 3D SAR plots are shown. The left plot displays a color-coded SAR distribution over a rectangular area with axes X (mm) from -35 to 35, Y (mm) from -15 to 15, and Z (mm) from -15 to 15. The right plot shows a similar distribution with axes X (mm) from -110 to 110, Y (mm) from -110 to 110, and Z (mm) from -110 to 110. A color scale at the bottom indicates SAR values from 0.000 to 0.120 W/kg.

ZOOM SCAN RESULTS:

**Spot SAR
(W/kg):**

Start Scan	End Scan
0.028	0.028

**Change during
Scan (%)**

-2.29

**Max E-field
(V/m):**

8.84

Max SAR (W/kg)

1g	10g
0.120	0.066

**Location of Max
(mm):**

X	Y	Z
75.1	-17.0	-157.9

Area Scan plot showing a color-coded field distribution. The plot is a square with axes ranging from -100 to 100 on both the X and Y axes. The color scale ranges from 0.00 (blue) to 0.07 (red). A bright red/orange region is visible in the center, indicating a high field strength. The plot is overlaid with a grid of blue lines. A color bar at the bottom indicates the field strength scale.

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-40.0	40.0	8.0
Z	-190.0	-135.0	6.0



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plot #31

Date / Time:	2003/6/13	Position:	perpendicular0mm
Filename:	accton 11g 2437asus-per0	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB printed	Test Frequency:	802.11g 2437MHz
Shape File:	ASUSper.csv	Power Level:	20.33dBm

Probe:	0114			
Cal File:	SN0114_2450_CW_BODY			
Cal Factors:		X	Y	Z
	Air	532	494	450
	DCP	20	20	20
	Lin	.528	.528	.528
Amp Gain:	2			
Averaging:	3			
Batteries Replaced:	June 13			

Liquid:	15.3cm
Type:	2450MHz body
Conductivity:	1.90368
Relative Permittivity:	50.43422
Liquid Temp (deg C):	23.8
Ambient Temp (deg C):	20
Ambient RH (%):	50
Density (kg/m3):	1000
Software Version:	0.421N

ZOOM SCAN RESULTS:

**Spot SAR
(W/kg):**

Start Scan	End Scan
0.152	0.151

**Change during
Scan (%)**

-0.86

**Max E-field
(V/m):**

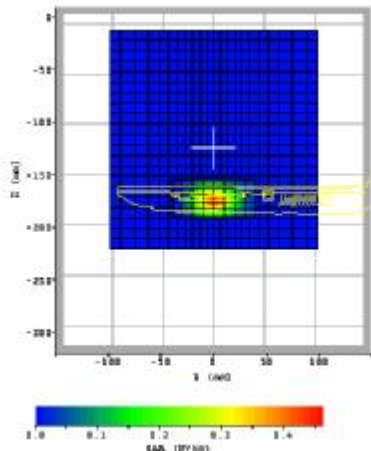
21.76

Max SAR (W/kg)

1g	10g
0.679	0.316

**Location of Max
(mm):**

X	Y	Z
75.1	-15.0	-174.6

	AREA SCAN:			
	Scan Extent:	Min	Max	Steps
	Y	-40.0	40.0	8.0
	Z	-190.0	-155.0	5.0



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plot #32

Date / Time:	2003/6/13	Position:	perpendicular0mm
Filename:	accton 11g 2412asus-per0	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB printed	Test Frequency:	802.11g 2412MHz
Shape File:	ASUSper.csv	Power Level:	19.94dBm

Probe:	0114			
Cal File:	SN0114_2450_CW_BODY			
Cal Factors:		X	Y	Z
	Air	532	494	450
	DCP	20	20	20
	Lin	.528	.528	.528
Amp Gain:	2			
Averaging:	3			
Batteries Replaced:	June 13			

Liquid:	15.3cm
Type:	2450MHz body
Conductivity:	1.90368
Relative Permittivity:	50.43422
Liquid Temp (deg C):	23.8
Ambient Temp (deg C):	20
Ambient RH (%):	50
Density (kg/m3):	1000
Software Version:	0.421N
Crest Factor=1	

The figure displays two plots related to SAR distribution. The left plot is a 3D surface plot showing the SAR distribution over a volume defined by X (mm) from -10 to 10, Y (mm) from -10 to 10, and Z (mm) from -10 to 10. The color scale ranges from 0.0 to 1.8 W/kg. The right plot is a 2D zoomed-in SAR plot showing the SAR distribution over a volume defined by X (mm) from -10 to 10 and Y (mm) from -10 to 10. The color scale ranges from 0.0 to 1.8 W/kg. A color bar at the bottom indicates the SAR scale in W/kg, ranging from 0.0 to 1.8.

ZOOM SCAN RESULTS:

**Spot SAR
(W/kg):**

Start Scan	End Scan
0.167	0.168

**Change during
Scan (%)**

0.34

**Max E-field
(V/m):**

22.85

Max SAR (W/kg)

1g	10g
0.740	0.342

**Location of Max
(mm):**

X	Y	Z
75.1	-15.0	-174.6

A 2D area scan plot showing SAR distribution. The plot is a square grid with X (cm) on the horizontal axis and Y (cm) on the vertical axis, both ranging from -100 to 100. A color bar at the bottom indicates SAR (W/kg) values from 0.0 (blue) to 0.5 (red). A bright yellow/orange region is visible, centered around X=20, Y=0, with a peak value of approximately 0.5 W/kg. A white crosshair is centered at (0,0). The text 'Amplitude' is visible in the lower right quadrant of the plot area.

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-40.0	40.0	8.0
Z	-190.0	-155.0	5.0



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plot #33

Date / Time:	2003/6/13	Position:	perpendicular0mm
Filename:	accton 11g 2462asus-per0	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB printed	Test Frequency:	802.11g 2462MHz
Shape File:	ASUSper.csv	Power Level:	20.02dBm

Probe:	0114	Liquid:	15.3cm
Cal File:	SN0114_2450_CW_BODY	Type:	2450MHz body
Cal Factors:		Conductivity:	1.90368
		Relative Permittivity:	50.43422
		Liquid Temp (deg C):	23.8
		Ambient Temp (deg C):	20
Amp Gain:	2	Ambient RH (%):	50
Averaging:	3	Density (kg/m3):	1000
Batteries		Software Version:	0.421N
Replaced:	June 13	Crest Factor=1	

Two 3D plots showing SAR distribution. The left plot shows SAR (W/kg) on a color scale from 0.0 to 0.7. The right plot shows SAR (W/kg) on a color scale from 0.0 to 0.7. A color bar at the bottom indicates SAR (W/kg) values from 0.0 to 0.7.

ZOOM SCAN RESULTS:

**Spot SAR
(W/kg):**

Start Scan	End Scan
0.107	0.105

**Change during
Scan (%)**

-1.76

**Max E-field
(V/m):**

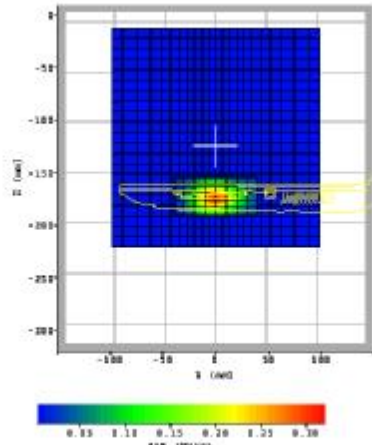
17.96

Max SAR (W/kg)

1g	10g
0.471	0.226

**Location of Max
(mm):**

X	Y	Z
75.1	-16.0	-174.6



The figure is a 2D area scan plot showing SAR distribution. The horizontal axis is labeled 'X (cm)' and ranges from -100 to 100. The vertical axis is labeled 'Y (cm)' and ranges from -200 to 0. A color bar at the bottom indicates SAR values in dBm/kg, ranging from 0.05 (blue) to 0.30 (red). The plot shows a blue background with a yellow beam on the right side. A white crosshair is centered at (0,0).

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-40.0	40.0	8.0
Z	-190.0	-155.0	5.0



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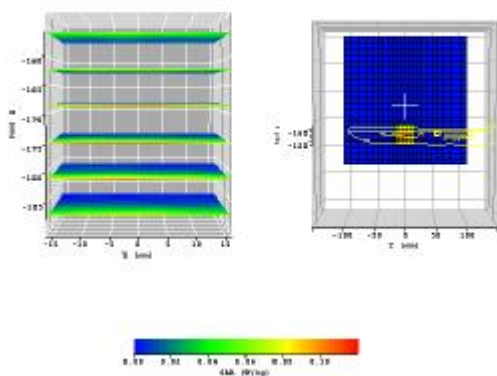
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plot #34

Date / Time:	2003/6/13	Position:	perpendicular15mm
Filename:	accton 11g 2437asus-per15	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB printed	Test Frequency:	802.11g 2437MHz
Shape File:	ASUSper.csv	Power Level:	20.33dBm

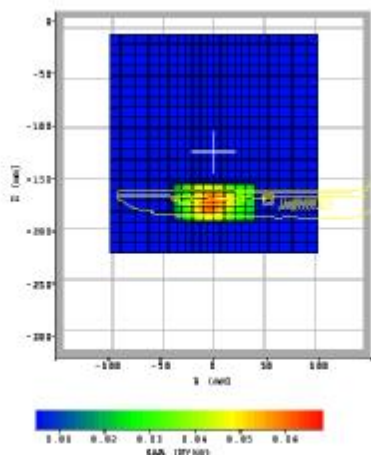
Probe:	0114			
Cal File:	SN0114_2450_CW_BODY			
Cal Factors:		X	Y	Z
	Air	532	494	450
	DCP	20	20	20
	Lin	.528	.528	.528
Amp Gain:	2			
Averaging:	3			
Batteries Replaced:	June 13			

Liquid:	15.3cm
Type:	2450MHz body
Conductivity:	1.90368
Relative Permittivity:	50.43422
Liquid Temp (deg C):	23.8
Ambient Temp (deg C):	20
Ambient RH (%):	50
Density (kg/m3):	1000
Software Version:	0.421N
Crest Factor=1	



ZOOM SCAN RESULTS:

Spot SAR (W/kg):	Start Scan	End Scan	
	0.034	0.034	
Change during Scan (%)	-1.16		
Max E-field (V/m):	7.58		
Max SAR (W/kg)	1g	10g	
	0.092	0.054	
Location of Max (mm):	X	Y	Z
	75.1	-16.0	-173.9



AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-40.0	40.0	8.0
Z	-190.0	-155.0	5.0



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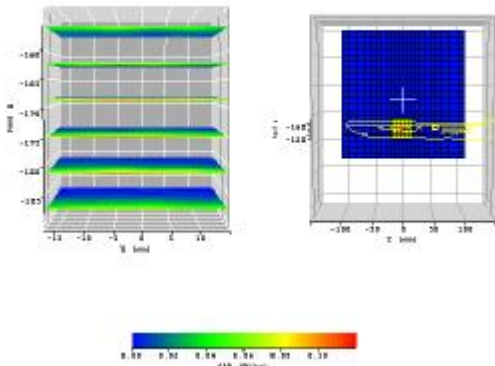
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plot #35

Date / Time:	2003/6/13	Position:	perpendicular15mm
Filename:	accton 11g 2412asus-per15	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB printed	Test Frequency:	802.11g 2412MHz
Shape File:	ASUSper.csv	Power Level:	19.94dBm

Probe:	0114	Liquid:	15.3cm
Cal File:	SN0114_2450_CW_BODY	Type:	2450MHz body
Cal Factors:		Conductivity:	1.90368
		Relative Permittivity:	50.43422
		Liquid Temp (deg C):	23.8
		Ambient Temp (deg C):	20
Amp Gain:	2	Ambient RH (%):	50
Averaging:	3	Density (kg/m3):	1000
Batteries Replaced:	June 13	Software Version:	0.421N
		Crest Factor=	1



The figure displays two 3D plots of SAR distribution. The left plot shows a color-coded volume with a crosshair indicating the maximum point. The right plot shows a color-coded volume with a crosshair indicating the maximum point. A color bar at the bottom indicates SAR values from 0.00 to 0.10 W/kg.

ZOOM SCAN RESULTS:

Spot SAR
(W/kg):

Start Scan	End Scan
0.025	0.025

Change during
Scan (%)

0.00

Max E-field
(V/m):

7.32

Max SAR (W/kg)

1g	10g
0.086	0.052

Location of Max
(mm):

X	Y	Z
75.1	-17.0	-173.9

The figure displays a 2D area scan plot of SAR (Specific Absorption Rate) distribution. The plot is a square grid with X and Y axes ranging from -100 to 100 cm. A color bar at the bottom indicates SAR values from 0.01 to 0.06 W/kg. A yellow beam is shown entering from the right, and a crosshair marks the center of the scan area.

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-40.0	40.0	8.0
Z	-190.0	-155.0	5.0



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plot #36

Date / Time:	2003/6/13	Position:	perpendicular15mm
Filename:	accton 11g 2462asus-per15	Phantom:	HeadBox1.csv
Device Tested:	3CRWE154G72	Head Rotation:	0
Antenna:	PCB printed	Test Frequency:	802.11g 2462MHz
Shape File:	ASUSper.csv	Power Level:	20.02dBm

Probe:	0114			
Cal File:	SN0114_2450_CW_BODY			
Cal Factors:		X	Y	Z
	Air	532	494	450
	DCP	20	20	20
	Lin	.528	.528	.528
Amp Gain:	2			
Averaging:	3			
Batteries Replaced:	June 13			

Liquid:	15.3cm
Type:	2450MHz body
Conductivity:	1.90368
Relative Permittivity:	50.43422
Liquid Temp (deg C):	23.8
Ambient Temp (deg C):	20
Ambient RH (%):	50
Density (kg/m3):	1000
Software Version:	0.421N
Crest Factor=1	

ZOOM SCAN RESULTS:

**Spot SAR
(W/kg):**

Start Scan	End Scan
0.014	0.013

**Change during
Scan (%)**

-3.98

**Max E-field
(V/m):**

6.21

Max SAR (W/kg)

1g	10g
0.059	0.032

**Location of Max
(mm):**

X	Y	Z
75.0	-19.0	-173.9

The figure displays a 2D Area Scan SAR plot. The horizontal axis is labeled 'X (m)' and ranges from -100 to 100. The vertical axis is labeled 'Y (m)' and ranges from -200 to 0. A color bar at the bottom indicates the SAR intensity in W/kg, ranging from 0.00 (blue) to 0.04 (red). The plot shows a high-intensity region (yellow/red) centered around X=0 and Y=-150, with a white crosshair marking the center. A yellow beam-like shape is visible on the right side of the plot.

AREA SCAN:

Scan Extent:

	Min	Max	Steps
Y	-40.0	40.0	8.0
Z	-190.0	-155.0	5.0



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APPENDIX B – 2450MHz body liquid Calibration Data



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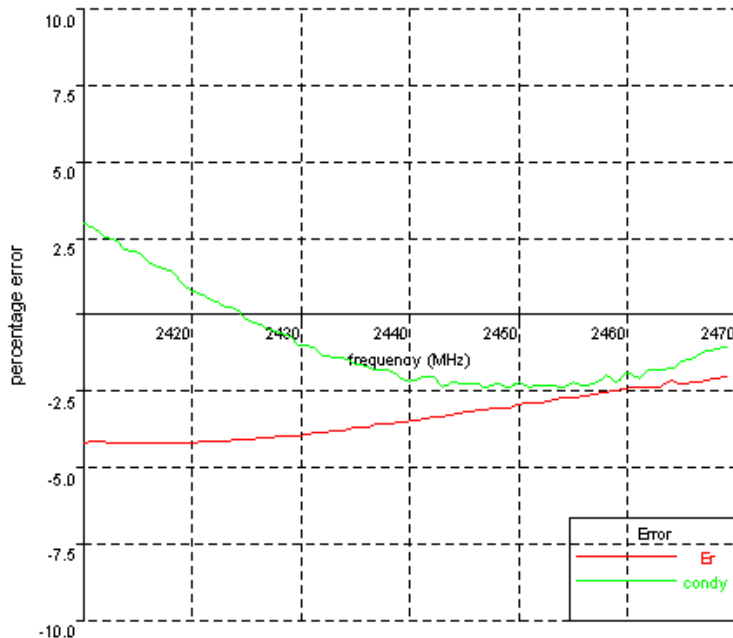
ETL SEMKO

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Date	29Apr2003	Temperature	23.1°C	Tested by	Bruce
2410, 50.5398829427, -1.9693698876 2411, 50.5646515293, -1.9665870778 2412, 50.5521565213, -1.9625567589 2413, 50.521029101, -1.9613757208 2414, 50.5316028824, -1.9560884292 2415, 50.5346108607, -1.9556961182 2416, 50.5314177661, -1.9507914319 2417, 50.5252781989, -1.9481038787 2418, 50.5209808002, -1.9468092368 2419, 50.5358536158, -1.9405161939 2420, 50.5122563689, -1.936353882 2421, 50.5542067605, -1.9345388703 2422, 50.5536539502, -1.9317570321 2423, 50.5579533146, -1.9292999761 2424, 50.5728370145, -1.9291293394 2425, 50.5779122884, -1.9231587859 2426, 50.5952609729, -1.9212120946 2427, 50.5958142321, -1.9189559942 2428, 50.6303570408, -1.9175499659 2429, 50.6334943105, -1.9161037476 2430, 50.6460003006, -1.9113564958 2431, 50.67901777, -1.9117402314 2432, 50.6827735738, -1.9066526932 2433, 50.7132178595, -1.9070426807 2434, 50.7262982266, -1.9067317735 2435, 50.7822268546, -1.904588172 2436, 50.7722925248, -1.9037791926 2437, 50.832805035, -1.9024177207 2438, 50.832805035, -1.9032885437 2439, 50.8564194543, -1.9000688871 2440, 50.8809536961, -1.8981265479 2441, 50.8985296341, -1.9011676612 2442, 50.9391111389, -1.9031864384 2443, 50.9499952672, -1.897542368 2444, 50.9837684203, -1.901372116 2445, 51.0233019944, -1.9007440204 2446, 51.0507265072, -1.902291537 2447, 51.0587901956, -1.9005001088 2448, 51.1026659581, -1.9040054113 2449, 51.0879523744, -1.9026815621 2450, 51.1488411009, -1.9067074069 2451, 51.1781984671, -1.9050517214 2452, 51.1875882198, -1.9081699746 2453, 51.2101857363, -1.9089481842 2454, 51.2645550408, -1.9093823024 2455, 51.2691391107, -1.9136260394 2456, 51.2885944297, -1.9129253494 2457, 51.3213012567, -1.9157590306 2458, 51.3553205369, -1.9221101335 2459, 51.3799269075, -1.9196607453 2460, 51.4206673189, -1.9270806874 2461, 51.4263525767, -1.925048568 2462, 51.4239157595, -1.932028629 2463, 51.4478047798, -1.9331468457 2464, 51.5394387809, -1.9352795667 2465, 51.4857633165, -1.9410137743 2466, 51.5193282496, -1.944588 2467, 51.5377513661, -1.9503728907 2468, 51.5742343564, -1.9530276144 2469, 51.5970025636, -1.9560524868 2470, 51.59261401, -1.9606349122					





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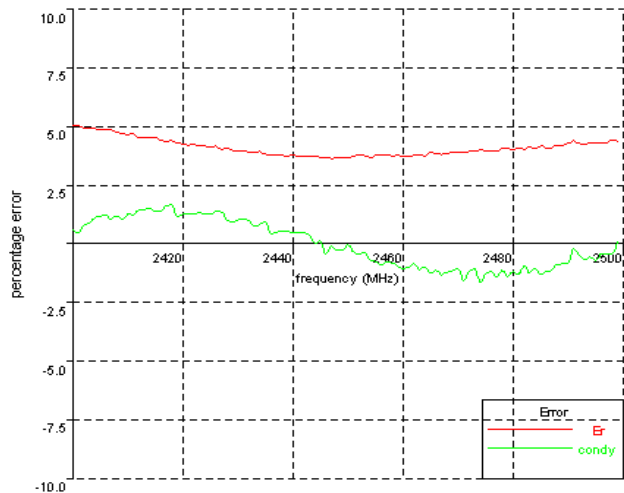
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Date	02June2003	Temperature	21.5°C	Tested by	kevin
2400,	55.4418689299,	-1.9139374404	2450, 54.6259052515,	-1.9492424091	
2401,	55.4227139064,	-1.9118480065	2451, 54.6694586008,	-1.9446920899	
2402,	55.3778238462,	-1.9190744382	2452, 54.6849547021,	-1.9440238324	
2403,	55.3778238462,	-1.9220602103	2453, 54.6835593937,	-1.9468686819	
2404,	55.350687606,	-1.9274034713	2454, 54.634442284,	-1.9425164436	
2405,	55.3343878742,	-1.9295279752	2455, 54.6772251732,	-1.9421201174	
2406,	55.3188793254,	-1.9317101065	2456, 54.6896932145,	-1.9407526519	
2407,	55.3202907645,	-1.929471683	2457, 54.6987503802,	-1.9448135493	
2408,	55.2643294122,	-1.9322543218	2458, 54.6701933022,	-1.9451819306	
2409,	55.2364635634,	-1.9308363791	2459, 54.6727838711,	-1.9442041533	
2410,	55.1961377636,	-1.9357842594	2460, 54.6626861701,	-1.9435928331	
2411,	55.2382651892,	-1.936658078	2461, 54.6548293775,	-1.946470655	
2412,	55.1482931232,	-1.9412486497	2462, 54.6709191522,	-1.9502268084	
2413,	55.1318721321,	-1.9428336373	2463, 54.6868342628,	-1.9466834749	
2414,	55.1261581315,	-1.9448063011	2464, 54.6632913037,	-1.9502474569	
2415,	55.1397737667,	-1.9436305695	2465, 54.7298377136,	-1.9467034444	
2416,	55.0815456951,	-1.9446928993	2466, 54.7133418453,	-1.95042393	
2417,	55.0454423927,	-1.9494223039	2467, 54.688591422,	-1.9480281976	
2418,	55.0646847577,	-1.9515731159	2468, 54.7093443352,	-1.9516360391	
2419,	55.024123353,	-1.9427861067	2469, 54.7281101385,	-1.9547751734	
2420,	54.9906578624,	-1.9456676238	2470, 54.71704489,	-1.9571132378	
2421,	54.963110313,	-1.9470730252	2471, 54.7184409736,	-1.9488368904	
2422,	54.9663158055,	-1.9478062683	2472, 54.7480910432,	-1.9576706699	
2423,	54.9450958261,	-1.9501925485	2473, 54.7506853033,	-1.961922234	
2424,	54.9295161877,	-1.9495031681	2474, 54.7790949215,	-1.951884774	
2425,	54.8979970574,	-1.9506942767	2475, 54.7609674029,	-1.9598942088	
2426,	54.930307056,	-1.953579117	2476, 54.7502547276,	-1.9638895198	
2427,	54.8571908539,	-1.9541967861	2477, 54.7466156653,	-1.95988626	
2428,	54.8774076618,	-1.9485950605	2478, 54.8191248289,	-1.9675880826	
2429,	54.84161807,	-1.9480350735	2479, 54.8179059267,	-1.9634990334	
2430,	54.8168096189,	-1.9505567743	2480, 54.7688676593,	-1.9690858069	
2431,	54.8188076916,	-1.9519623892	2481, 54.8098699544,	-1.9680387	
2432,	54.7972052754,	-1.9524569048	2482, 54.7872525829,	-1.9768820757	
2433,	54.7720374708,	-1.9484621068	2483, 54.8349318955,	-1.9717698196	
2434,	54.7956181986,	-1.9506712522	2484, 54.7987505431,	-1.9775168238	
2435,	54.7336955616,	-1.953891108	2485, 54.8693286239,	-1.9733473166	
2436,	54.7222302024,	-1.9443149333	2486, 54.7917927215,	-1.9771643509	
2437,	54.718174171,	-1.9474313581	2487, 54.7958533216,	-1.9800683099	
2438,	54.7095316777,	-1.9488537288	2488, 54.869227722,	-1.9863091144	
2439,	54.6815071173,	-1.9502704124	2489, 54.8702477096,	-1.9883345049	
2440,	54.7056470758,	-1.9497276439	2490, 54.9078888877,	-1.9906975256	
2441,	54.6794381288,	-1.9509586907	2491, 54.9597468218,	-2.0038440144	
2442,	54.6747874004,	-1.9515207978	2492, 54.8985070494,	-1.9994904468	
2443,	54.677378187,	-1.9508744586	2493, 54.8837808163,	-1.997519603	
2444,	54.6797897187,	-1.9446843413	2494, 54.9087906184,	-2.0010915247	
2445,	54.6562497923,	-1.947409728	2495, 54.9168631825,	-1.9993176265	
2446,	54.6562497923,	-1.9379561998	2496, 54.9018918951,	-2.0068271105	
2447,	54.6146333882,	-1.9451786238	2497, 54.9079620499,	-2.0079701989	
2448,	54.6427931547,	-1.9434385696	2498, 54.9699036264,	-2.0095146561	
2449,	54.6514242258,	-1.9437755894	2499, 54.9383613214,	-2.0209534868	
			2500, 54.9269676508,	-2.0148546961	





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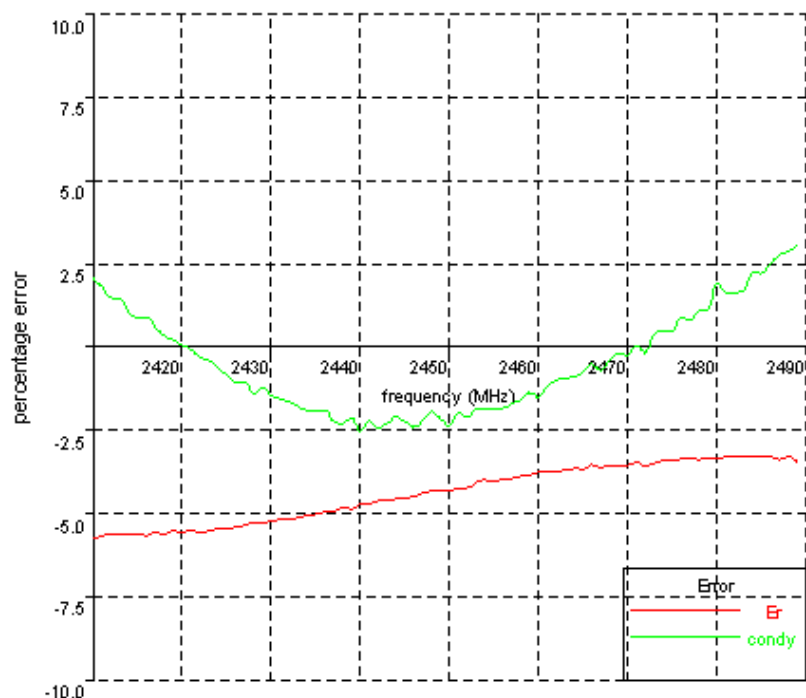
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Date: 13 June2003	Temperature:23.3℃	Type: 2450MHz/body	Tested by: Kevin
2410, 49.7362752482, -1.9509979202		2450, 50.4342176763, -1.9036817091	
2411, 49.7489404323, -1.9475689196		2451, 50.4479616408, -1.913191481	
2412, 49.7931670273, -1.9420127363		2452, 50.4683930652, -1.911839383	
2413, 49.7719122592, -1.9426030723		2453, 50.553577066, -1.917671082	
2414, 49.770642309, -1.9359734478		2454, 50.5919768272, -1.9190246121	
2415, 49.7755826582, -1.933319656		2455, 50.568475882, -1.9202597863	
2416, 49.7596550257, -1.934738949		2456, 50.6038853871, -1.9224738363	
2417, 49.8005991855, -1.9302828188		2457, 50.6150299731, -1.9264901666	
2418, 49.7817000707, -1.925909146		2458, 50.6465411942, -1.9304442032	
2419, 49.8329542708, -1.9241747155		2459, 50.655094947, -1.9360871542	
2420, 49.8026460321, -1.9224709488		2460, 50.7114995936, -1.9344453742	
2421, 49.8360583092, -1.920993334		2461, 50.7084800623, -1.9427456195	
2422, 49.8019331675, -1.9171584967		2462, 50.707925565, -1.9477353403	
2423, 49.8195787163, -1.9163267455		2463, 50.7351805662, -1.9499399148	
2424, 49.8660856877, -1.9132809213		2464, 50.7593046749, -1.9524506067	
2425, 49.8660856877, -1.9099282548		2465, 50.7531374194, -1.9569810718	
2426, 49.8760033055, -1.9068919517		2466, 50.8154793239, -1.9626492534	
2427, 49.917589044, -1.9078402143		2467, 50.766468638, -1.9603228168	
2428, 49.952051173, -1.9019729265		2468, 50.8095375948, -1.9681969438	
2429, 49.950612763, -1.9061598778		2469, 50.7842511733, -1.9733215365	
2430, 49.9677462781, -1.9031074629		2470, 50.8057076798, -1.9736264771	
2431, 49.9949861162, -1.9016692209		2471, 50.8480685896, -1.9803417845	
2432, 49.9889117254, -1.9010637011		2472, 50.7956685995, -1.9776673946	
2433, 50.0228213799, -1.8994754258		2473, 50.8336963894, -1.9904699831	
2434, 50.0504378413, -1.898061989		2474, 50.8766369596, -1.9937426197	
2435, 50.07220482, -1.8988625647		2475, 50.8695097882, -1.9954976189	
2436, 50.1165113951, -1.8998039412		2476, 50.895348948, -2.0041205181	
2437, 50.1163469879, -1.8943490362		2477, 50.8983785788, -2.0044564179	
2438, 50.1679457335, -1.8939675417		2478, 50.88635754, -2.0118144559	
2439, 50.1524409601, -1.8982528867		2479, 50.9075231825, -2.0138845336	
2440, 50.2219772797, -1.8914120271		2480, 50.8925318787, -2.0307420626	
2441, 50.220695846, -1.8983459554		2481, 50.9362647724, -2.0262154923	
2442, 50.2742345228, -1.8949932956		2482, 50.9344081455, -2.027532843	
2443, 50.2724020269, -1.8984900291		2483, 50.9175529122, -2.03086344	
2444, 50.3007063143, -1.9039031444		2484, 50.9129994507, -2.0430152083	
2445, 50.3205278394, -1.9016408048		2485, 50.9250176048, -2.0440114975	
2446, 50.3432930771, -1.899214681		2486, 50.929348552, -2.0508839876	
2447, 50.3908399639, -1.9040487568		2487, 50.8750104071, -2.0578343029	
2448, 50.4197622681, -1.9102249536		2488, 50.9254724855, -2.0618116372	
2449, 50.4304802915, -1.9072730613		2489, 50.844155916, -2.0663367164	
		2490, 50.9127955265, -2.0621916184	





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APPENDIX C - E-Field Probe Calibration Data



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FCC ID. : HED2835WACC



Report No.: EME-030506

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Indexsar Limited

Oakfield House

Cudworth Lane

Newdigate

Surrey RH5 5DR

Tel: +44 (0) 1306 631 233

Fax: +44 (0) 1306 631 834

e-mail: enquiries@indexsar.com

Calibration Certificate
Dosimetric E-field Probe

Type: **IXP-050**

Manufacturer: **IndexSAR, UK**

Serial Number: **0114**

Place of Calibration: **IndexSAR, UK**

IndexSAR Limited hereby declares that the IXP-050 Probe named above has been calibrated for conformity to the IEEE 1528 and CENELEC En 50361 standards on the date shown below.

Date of Initial Calibration: **6th September 2002**

The probe named above will require a calibration check on the date shown below.

Next Calibration Date: **September 2003**

The calibration was carried out using the methods described in the calibration document.
Where applicable, the standards used in the calibration process are traceable to the UK's National Physical Laboratory.

Calibrated By:

Approved By:

Please keep this certificate with the calibration document. When the probe is sent for a calibration check, please include the calibration document.



Intertek Testing Services
ETL SEMKO

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Report No.: EME-030506

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IMMERSIBLE SAR PROBE

CALIBRATION REPORT

Part Number: IXP – 050

S/N 0114

6th September 2002



Indexsar Limited
Oakfield House
Cudworth Lane
Newdigate
Surrey RH5 5DR

Tel: +44 (0) 1306 631 233

Fax: +44 (0) 1306 631 834

e-mail: enquiries@indexsar.com



INTRODUCTION

This Report presents measured calibration data for a particular Indexsar SAR probe (S/N 0114) and describes the procedures used for characterisation and calibration.

Indexsar probes are characterised using procedures that, where applicable, follow the recommendations of CENELEC [1] and IEEE [2] standards. The procedures incorporate techniques for probe linearisation, isotropy assessment and determination of liquid factors (conversion factors). Calibrations are determined by comparing probe readings with analytical computations in canonical test geometries (waveguides, boxes and spheres) using normalised power inputs.

Each step of the calibration procedure and the equipment used is described in the sections below.

CALIBRATION PROCEDURE

1. Equipment Used

For the first part of the calibration procedure, the probe is placed in a calibration jig as pictured in Figure 1. In this position the probe can be rotated about its axis by a non-metallic belt driven by a stepper motor.

The probe is attached via its amplifier and an optical cable to a PC. A schematic representation of the test geometry is illustrated in Figure 2.

A balanced dipole (900 MHz) is inserted horizontally into the bracket attached to a second belt (Figure 1). The dipole can also be rotated about its axis. A cable connects the dipole to a signal generator, via a directional coupler and power meter. The signal generator feeds an RF amplifier at constant power, the output of which is monitored using the power meter. The probe is positioned so that its sensors line up with the rotation center of the source dipole. By recording output voltage measurements of each channel as both the probe and the dipole are rotated, data are obtained from which the spherical isotropy of the probe can be optimised and its magnitude determined.

The calibration process requires E-field measurements to be taken in air, in 900 MHz simulated brain liquid and at other frequencies/liquids as appropriate. When it is necessary to place the probe in liquid, a rectangular box made from PMMA (200mm internal width, 200mm internal height and 100mm internal depth; wall thickness 4mm) is filled with the appropriate liquid and positioned on the stand so that the probe tip is positioned within the liquid (Figure 1). The box is positioned so that its outer surface is 2mm from the dipole. The procedure follows that described in Ref [2]. Section A.5.2.1.

2. Linearising probe output

The probe channel output signals are linearised in the manner set out in Refs [1] and [2]. The following equation is utilized for each channel:

$$U_{lin} = U_{o/p} + U_{o/p}^2 / DCP \quad (1)$$



where U_{lin} is the linearised signal, $U_{o/p}$ is the raw output signal in voltage units and DCP is the diode compression potential in similar voltage units.

DCP is determined from fitting equation (1) to measurements of U_{lin} versus source feed power over the full dynamic range of the probe. The DCP is a characteristic of the schottky diodes used as the sensors. For the IXP-050 probes with CW signals the DCP values are typically 0.10V (or 20 in the voltage units used by Indexsar software, which are V*200).

3. Selecting channel sensitivity factors to optimise isotropic response

The basic measurements obtained using the calibration jig (Fig 1) represent the output from each diode sensor as a function of the presentation angle of the source (probe and dipole rotation angles). The directionality of the orthogonally-arranged sensors can be checked by analysing the data using dedicated Indexsar software, which displays the data in 3D format as in Figure 3. The left-hand side of this diagram shows the individual channel outputs after linearisation (see above). The program uses these data to balance the channel outputs and then applies an optimisation process, which makes fine adjustments to the channel factors for optimum isotropic response.

The next stage of the process is to calibrate the Indexsar probe to a W&G EMR300 E-field meter in air. The principal reasons for this are to obtain conversion factors applicable should the probe be used in air and to provide an overall measure of the probe sensitivity.

A multiplier is applied to factors to bring the magnitudes of the average E-field measurements as close as possible to those of the W&G probe.

The following equation is used (where linearised output voltages are in units of V*200):

$$E_{air}^2 \text{ (V/m)} = U_{linx} * \text{Air Factor}_x + U_{liny} * \text{Air Factor}_y + U_{linz} * \text{Air Factor}_z \quad (2)$$

It should be noted that the air factors are not separately used for normal SAR testing. The IXP-050 probes are optimised for use in tissue-simulating liquids and do not behave isotropically in air.

4. 900 MHz Liquid Calibration

Conversion factors for use when the probes are immersed in tissue-simulant liquids at 900 MHz are determined either using a waveguide or by comparison to a reference probe that has been calibrated by NPL. Waveguide procedures are described later. The summary sheet indicates the method used for the probe S/N 0114.

The conversion factor, referred to as the 'liquid factor' is also applied to the measurements of each channel. The following equation is used (where output voltages are in units of V*200):



$$E_{liq}^2 (V/m) = U_{linx} * Air Factor_x * Liq Factor_x + U_{liny} * Air Factor_y * Liq Factor_y + U_{linz} * Air Factor_z * Liq Factor_z \quad (3)$$

A 3D representation of the spherical isotropy for probe S/N 0114 using these factors is shown in Figure 3.

The rotational isotropy can also be determined from the calibration jig measurements and is reported as the 900MHz isotropy in the summary table. Note that waveguide measurements can also be used to determine rotational isotropy (Fig. 5).

For other frequencies, probe conversion factors are determined using waveguide cells as shown in Figure 4. The cells consist of a coax to waveguide transition and an open-ended section of waveguide containing a dielectric separator. Each waveguide cell stands in the upright position and is filled with liquid within 10 mm of the open end. The separator provides a liquid seal and is designed for a good electrical transition from air filled guide to liquid filled guide. The choice of cell depends on the portion of the frequency band to be examined and the choice of liquid used. The depth of liquid ensures there is negligible radiation from the waveguide open top and that the probe calibration is not influenced by reflections from nearby objects. The return loss at the coaxial connector of the filled waveguide cell is measured initially using a network analyser and this information is used subsequently in the calibration procedure. The probe is positioned in the centre of the waveguide and is adjusted vertically or rotated using stepper motor arrangements. The signal generator is connected to the waveguide cell and the power is monitored with a coupler and a power meter. A fuller description of the waveguide method is given below.

The liquid dielectric parameters used for the probe calibrations are listed in the Tables below. The final calibration factors for the probe are listed in the summary chart.

WAVEGUIDE MEASUREMENT PROCEDURE

The calibration method is based on setting up a calculable specific absorption rate (SAR) in a vertically-mounted WG8 (R22) waveguide section [1]. The waveguide has an air-filled, launcher section and a liquid-filled section separated by a matching window that is designed to minimise reflections at the liquid interface. A TE_{01} mode is launched into the waveguide by means of a N-type-to-waveguide adapter. The power delivered to the liquid section is calculated from the forward power and reflection coefficient measured at the input to the waveguide. At the centre of the cross-section of the waveguide, the local spot SAR in the liquid as a function of distance from the window is given by functions set out in IEEE1528 as below:

Because of the low cutoff frequency, the field inside the liquid nearly propagates as a TEM wave. The depth of the medium (greater than three penetration depths) ensures that reflections at the upper surface of the liquid are negligible. The power absorbed in the liquid is determined by measuring the waveguide forward and reflected power. Equation (4) shows the relationship between the SAR at the cross-sectional center of the lossy waveguide and the longitudinal distance (z) from the dielectric separator



$$SAR(z) = \frac{4(P_f - P_b)}{r abd} e^{-2z/d} \quad (4)$$

where the density r is conventionally assumed to be 1000 kg/m^3 , ab is the cross-sectional area of the waveguide, P_f and P_b are the forward and reflected power inside the lossless section of the waveguide, respectively. The penetration depth d , which is the reciprocal of the waveguide-mode attenuation coefficient, is determined from a scan along the z -axis and compared with the theoretical value determined from Equation (5) using the measured dielectric properties of the lossy liquid.

$$d = \left[\text{Re} \left\{ \sqrt{(p/a)^2 + j\omega\mu_0(s + j\omega\epsilon_0\epsilon_r)} \right\} \right]^{-1} \quad (5)$$

Table A.1 of [1] can be used for designing calibration waveguides with a return loss greater than 30 dB at the most important frequencies used for personal wireless communications. Values for the penetration depth for these specific fixtures and tissue-simulating mixtures are also listed in Table A.1.

According to [1], this calibration technique provides excellent accuracy, with standard uncertainty less than 3.6% depending on the frequency and medium. The calibration itself is reduced to power measurements traceable to a standard calibration procedure. The practical limitation to the frequency band of 800 to 2500 MHz because of the waveguide size is not severe in the context of compliance testing.

CALIBRATION FACTORS MEASURED FOR PROBE S/N 0114

The probe was calibrated at 1800, 1900 and 2450MHz MHz in liquid samples representing both brain liquid and body fluid at these frequencies. The calibration was for CW signals only, and the axis of the probe was parallel to the direction of propagation of the incident field i.e. end-on to the incident radiation. The axial isotropy of the probe was measured by rotating the probe about its axis in 10 degree steps through 360 degrees in this orientation.

The reference point for the calibration is in the centre of the probe's cross-section at a distance of 2.5 mm from the probe tip in the direction of the AD converter. A value of 2.5 mm should be used for the tip to sensor offset distance in the software.

It is important that the diode compression point and air factors used in the software are the same as those quoted in the results tables, as these are used to convert the diode output voltages to a SAR value.

DIELECTRIC PROPERTIES OF LIQUIDS

The dielectric properties of the brain and body tissue-simulant liquids employed for calibration are listed in the tables below. The measurements were performed using an Indexsar DiLine measurement kit, which uses the TEM method as recommended in [2].



AMBIENT CONDITIONS

Measurements were made in the open laboratory at $23 \pm 0.5^{\circ}\text{C}$. The temperature of the liquids in the waveguide used was measured using a mercury thermometer.

GSM RESPONSE

SAR probes are required to measure the effective value (RMS value) of the electric field strength. The averaging time is defined in the standards as being over 6 minutes but with most of the signals that occur in the real world, such a long averaging time is unnecessary since the fluctuations are eliminated with significantly shorter averaging times. With most signals, a much shorter averaging time is sufficient. For example the GSM frame rate is 120mS and averaging over this time period will remove the fluctuations.

In diode probes, a single Schottky diode is used as the detector for each of the three channels (X, Y and Z). For small field strengths, these offer a very good approximation to a true RMS rectifier. For higher field strengths, higher or lower values than the RMS value can be displayed - depending on the modulation frequency.

The theoretical maximum deviation from the RMS value can be derived based on the behavior of the two extremes [4]:

An average-value rectifier

- displays a value proportional to the average value of the magnitude of a measured quantity.

A peak-value rectifier

- displays a value proportional to the peak value of the magnitude of a measured quantity

The proportionality factor for a practical probe is chosen so that the probe reads the true RMS value for a continuous (CW) signal.

For pulsed signals, a diode rectifier must deliver a value lying somewhere between the two extremes of an average value rectifier and a peak value rectifier. By way of example, for a GSM signal with a 1 in 8 duty cycle (ratio of 'on' time to total time), the power measurement at higher powers can vary between being a factor of 8 too low (average value extreme) and a factor of 8 too high (peak-value extreme).

The actual behaviour is complex as it depends on the period of the modulation in relation to various time constants in the measuring system. These include the holding time of the diode (typically 50 uS), the time constant of the high-resistance leads and the time constant and integration periods of the measurement electronics. Also, the modulation periods are complex – GSM has a basic burst rate of 4.615mS, but the full modulation scheme only repeats every 120mS.



To correct for the errors due to the diode response to pulsed signals, a multiplier can be added to the second term of Equation 1 (see earlier). In principle, this multiplier can have a range for a GSM signal of between 8 and 1/8. The correction scheme will

$$U_{lin} = U_{o/p} + U_{o/p}^2 * PCF / DCP \quad (4)$$

Where PCF is a pulse correction factor ranging between the duty cycle and the reciprocal of the duty cycle.

Indexsar SAR probes show a qualitatively similar behaviour in response to GSM signals, but with a much lesser degree of over or underestimation than indicated by the possible ranges above. Indeed, for many Indexsar probes, the PCF has been established by measurement to be close to unity. A probe with a unity PCF reads true RMS for a pulsed signal without correction.

The PCF has the effect of altering the effective diode compression potential and a modification to the DCP value is how the GSM correction is implemented in the Indexsar probe calibration scheme.

The modified DCP values for GSM are included in the summary page. The value has been determined by finding the modified DCP required to linearise the probe response as indicated in Figure 7.

Non-amplitude modulated carriers can be considered as CW as far as the probe calibration is concerned.

The effects of amplitude modulation of the CDMA signal on SAR measurements has been considered in a draft paper [see ref. 4] submitted to IEEE SCC-34.



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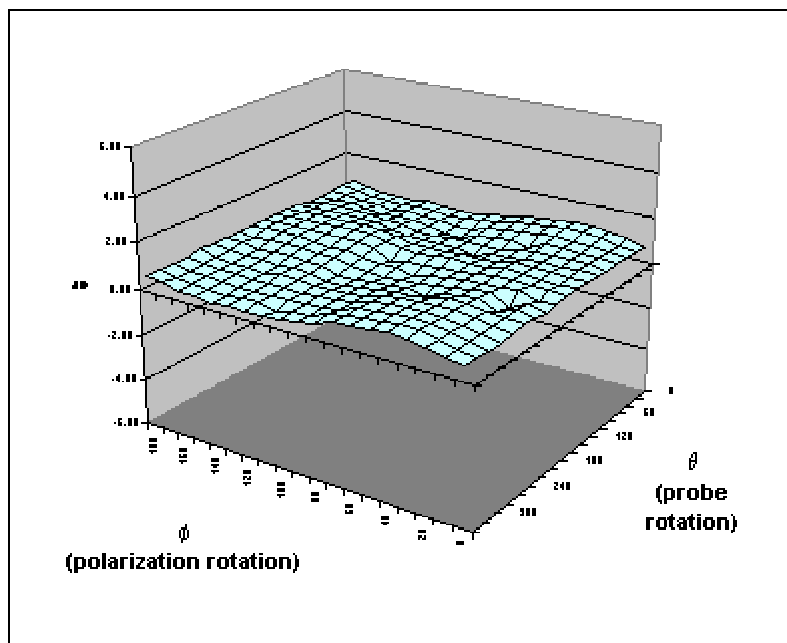
SUMMARY OF CALIBRATION FACTORS FOR PROBE IXP-050 S/N 0114

IXP-050

S/N0114

06/08/2002

Spherical isotropy measured at 900 MHz 0.50 (+/-) dB



	X	Y	Z	
Air factors	532	494	450	(V*200)
DCPs CW	20	20	20	(V*200)
DCPs GSM	7	7	7	(V*200)

f (MHz)	Axial isotropy (+/- dB)		SAR conversion factors (liq/air)		Notes
	BRAIN	BODY	BRAIN	BODY	
900	0.10	<i>0.10</i>	0.340	<i>0.374</i>	3, 1
1800	0.08	0.08	0.381	0.417	
1900	0.09	0.08	0.387	0.417	
2450	0.08	0.08	0.495	0.528	

Notes

- 1) Extrapolated values in italics
- 2) Calibrations done at 22C +/- 2C
- 3) Probe calibration by substitution against NPL-calibrated probe
(Probe IXP-050 S/N0071; NPL Cal Rept. No: EF07/2002/03/IndexSAR)
- 4) Waveguide calibration
- 5) Checked using box-phantom validation test

(the graph shows a simple, spreadsheet representation of surface shown in 3D in Figure 3 below)



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PROBE SPECIFICATIONS

Indexsar probe 0106, along with its calibration, is compared with CENELEC and IEEE standards recommendations (Refs [1] and [2]) in the Tables below. A listing of relevant specifications is contained in the tables below:

Dimensions	S/N 0114	CENELEC [1]	IEEE [2]
Overall length (mm)	350		
Tip length (mm)	10		
Body diameter (mm)	12		
Tip diameter (mm)	5.2	8	8
Distance from probe tip to dipole centers (mm)	3.0		

Dynamic range	S/N 0114	CENELEC [1]	IEEE [2]
Minimum (W/kg)	0.01	<0.02	0.01
Maximum (W/kg) N.B. only measured to 35 W/kg	>35	>100	100

Linearity of response	S/N 0114	CENELEC [1]	IEEE [2]
Over range 0.01 – 100 W/kg (+/- dB)	0.125	0.50	0.25

Isotropy (measured at 900MHz)	S/N 0114	CENELEC [1]	IEEE [2]
Axial rotation with probe normal to source (+/- dB) at 900, 1800, 1900 and 2450 MHz	Max. 0.10 (see summary table)	0.5	0.25
Spherical isotropy covering all orientations to source (+/- dB)	0.50	1.0	0.50

Construction	Each probe contains three orthogonal dipole sensors arranged on a triangular prism core, protected against static charges by built-in shielding, and covered at the tip by PEEK cylindrical enclosure material. No adhesives are used in the immersed section. Outer case materials are PEEK and heat-shrink sleeving.
Chemical resistance	Tested to be resistant to glycol and alcohol containing simulant liquids but probes should be removed, cleaned and dried when not in use.



REFERENCES

- [1] CENELEC, EN 50361, July 2001. Basic Standard for the measurement of specific absorption rate related to human exposure to electromagnetic fields from mobile phones.
- [2] IEEE 1528, Recommended practice for determining the spatial-peak specific absorption rate (SAR) in the human body due to wireless communications devices: Experimental techniques.
- [3] Calibration report on SAR probe IXP-050 S/N 0071 from National Physical Laboratory. Test Report EF07/2002/03/IndexSAR. Dated 20 February 2002.
- [4] The response of Indexsar SAR probes to amplitude modulated (pulsed) RF signals, Indexsar Support document IXS211.

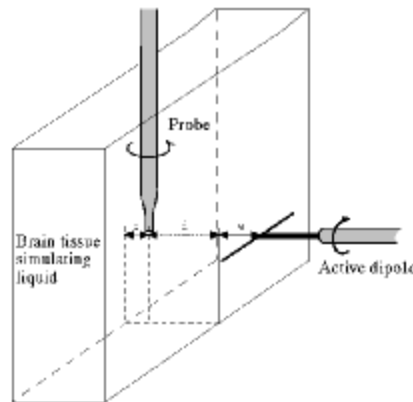
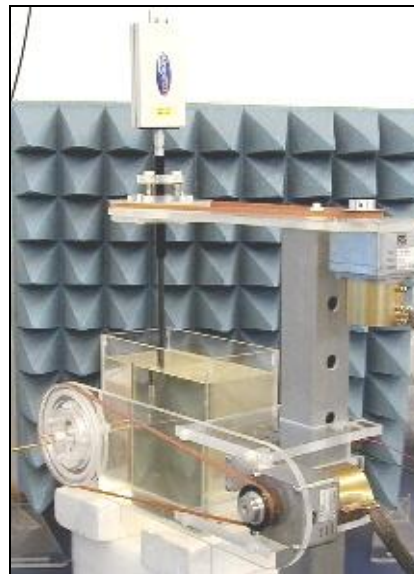


Figure 1. Calibration jig showing probe, dipole and box filled with simulated brain liquid (see Ref [2], Section A.5.2.1)

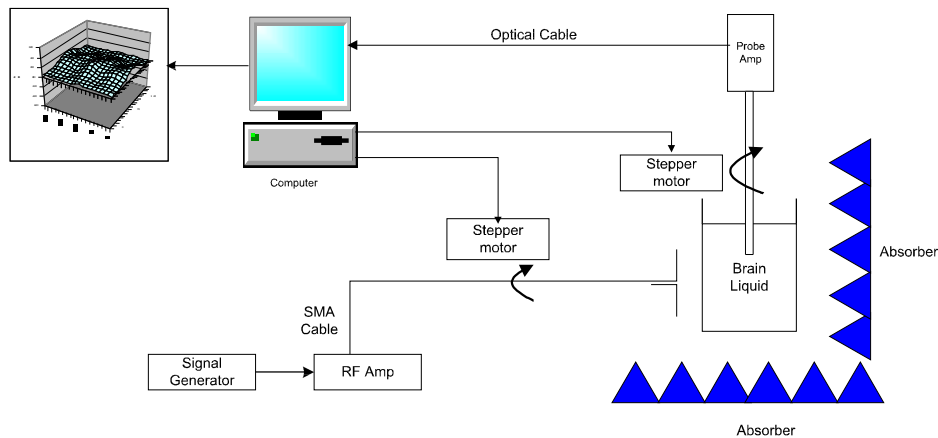


Figure 2. Schematic diagram of the test geometry used for isotropy determination

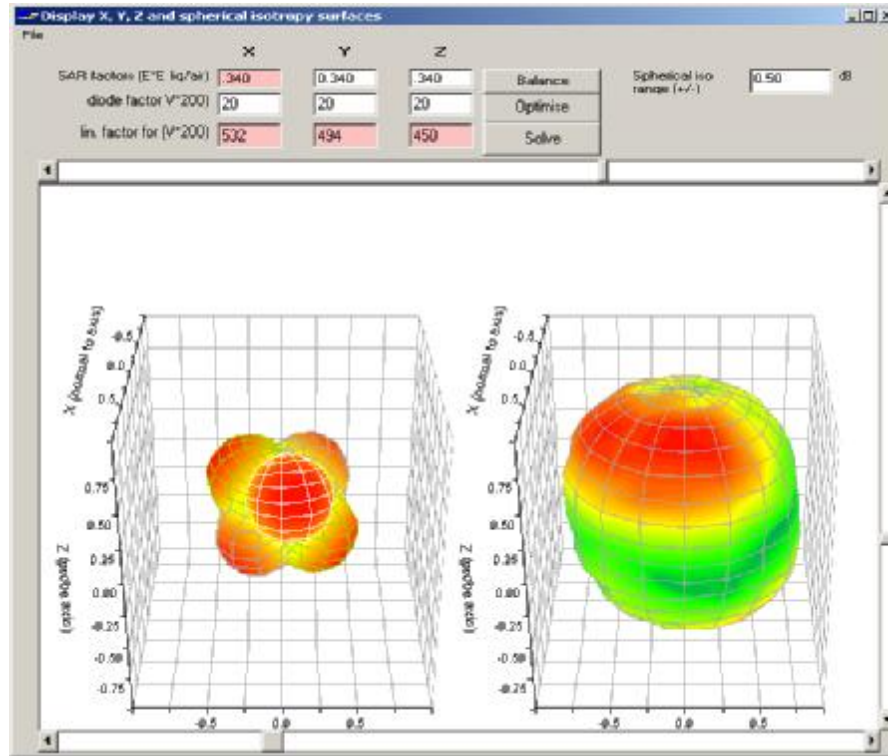


Figure 3. Graphical representation of the probe response to fields applied from each direction. The diagram on the left shows the individual response characteristics of each of the three channels and the diagram on the right shows the resulting probe sensitivity in each direction. The colour range in the figure images the lowest values as blue and the maximum values as red. For the probe S/N 0114, this range is (+/-) 0.50 dB. The probe is more sensitive to fields parallel to the axis and less sensitive to fields normal to the probe axis.

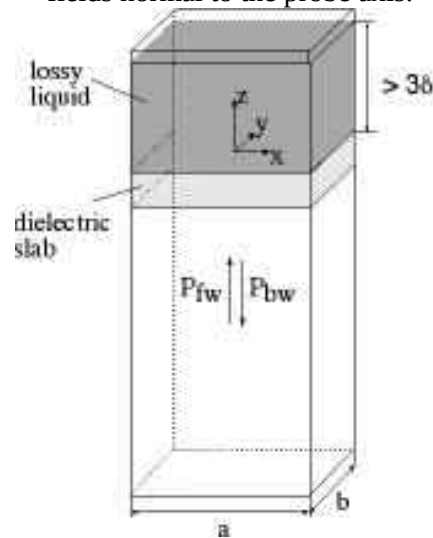


Figure 4. Geometry used for waveguide calibration (after Ref [2]. Section A.3.2.2)

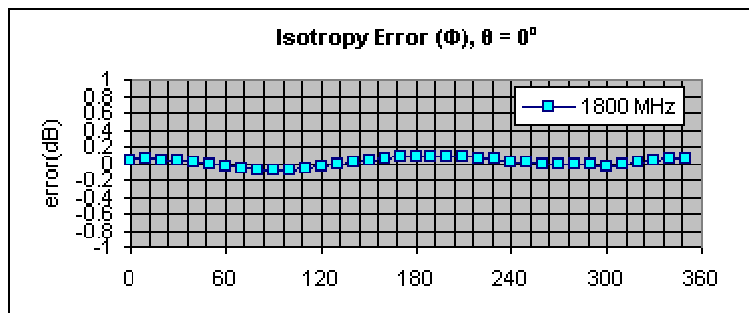
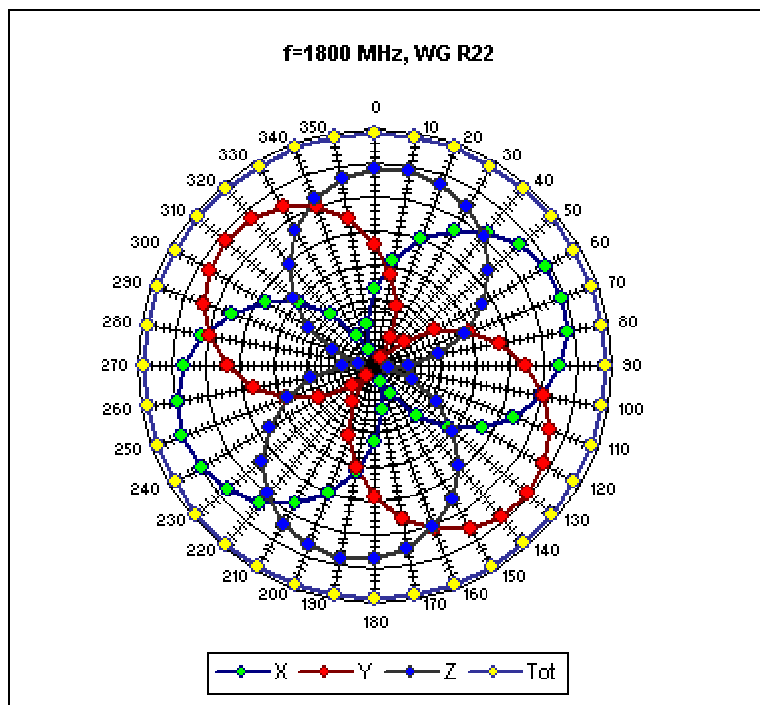


Figure 5. Example of the rotational isotropy of probe S/N 0114 obtained by rotating the probe in a liquid-filled waveguide at 1800 MHz. Similar distributions are obtained at the other test frequencies (1900 and 2450 MHz) both in brain liquids and body fluids (see summary table)

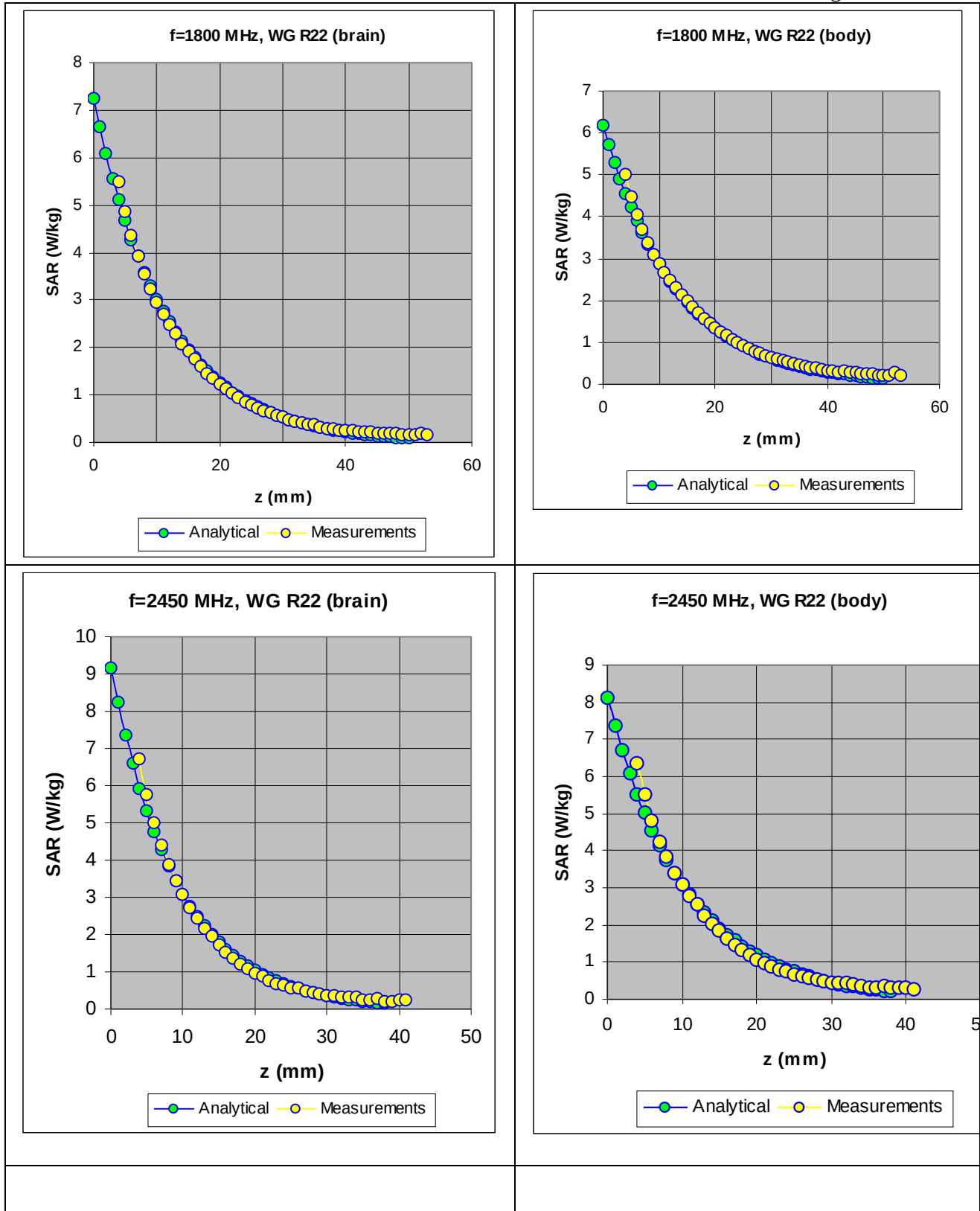


Figure 6. The measured SAR decay function along the centreline of the R22 waveguide with conversion factors adjusted to fit to the theoretical function for the particular dimension, frequency, power and liquid properties employed.

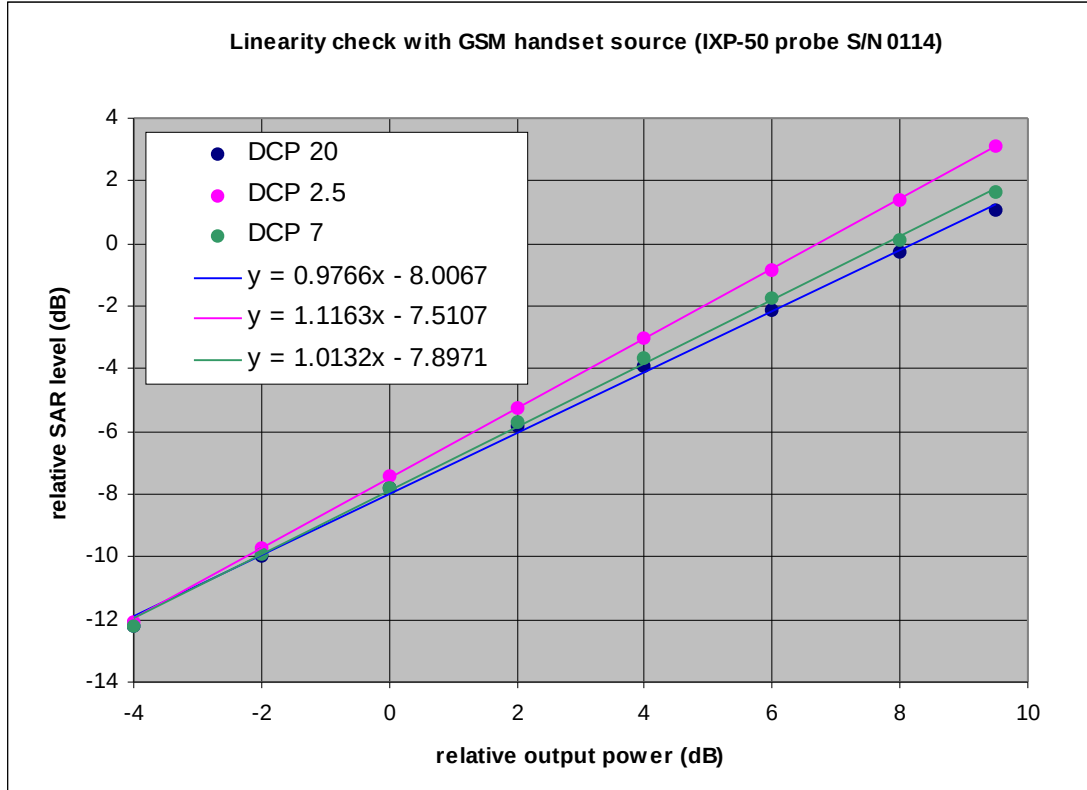


Figure 7. The GSM response of IXP-050 probe S/N 0114 at 1800MHz (max. SAR level 1.6 W/kg)

Table indicating the dielectric parameters of the liquids used for calibrations at each frequency

<i>Liquid used</i>	<i>Relative permittivity (measured)</i>	<i>Conductivity (S/m) (measured)</i>
835 MHz BRAIN	42.85	0.90
900 MHz BRAIN	42.43	1.01
1800 MHz BRAIN	39.09	1.37
1800 MHz BODY	52.53	1.49
1900 MHz BRAIN	38.6	1.48
1900 MHz BODY	52.21	1.60
2450 MHz BRAIN	38.13	1.82
2450 MHz BODY	55.28	1.92



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Indexsar Limited

Oakfield House

Cudworth Lane

Newdigate

Surrey RH5 5DR

Tel: +44 (0) 1306 631 233

Fax: +44 (0) 1306 631 834

e-mail: enquiries@indexsar.com

Calibration / Conformance statement

Balanced Validation dipole

Type:	IXD-245 2450MHz
-------	------------------------

Manufacturer:	IndexSAR, UK
---------------	---------------------

Serial Number:	0041
----------------	-------------

Place of Calibration:	IndexSAR, UK
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IndexSAR Limited hereby declares that the IXD series dipole named above has been checked for conformity to the specifications given in the draft IEEE 1528 and CENELEC En 50361 standards on the date shown below.

Date of Calibration/Check:	11th November 2002
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The dipole named above should be periodically re-checked using the procedures set out in the dipole calibration document. It is important that the cautions regarding handling of the dipoles (given in the calibration document) are adhered to.

Next Calibration Date:	November 2004
------------------------	----------------------

The calibration measurements were carried out using the methods described in the calibration document. Where applicable, the standards used in the calibration process are traceable to the UK's National Physical Laboratory.

Calibrated By:	
----------------	---

Approved By:	
--------------	---

Company Reg No. 4075046

Reg. Office: Oakfield House, Cudworth Lane, Newdigate, Surrey RH5 5DR..

Directors: D Riley and MI Manning PhD.



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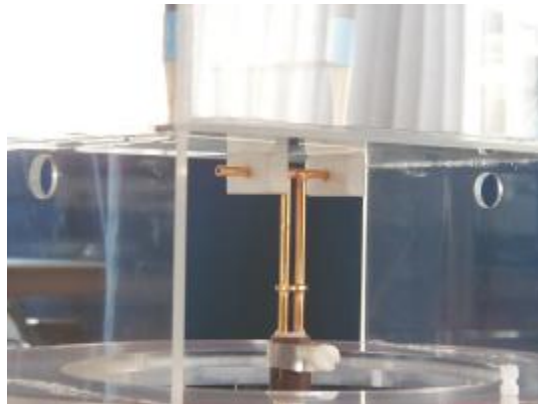
Report No. SN0041_2450

11th November 2002

INDEXSAR
2450MHz validation Dipole
Type IXD-245 S/N 0041

Performance measurements

MI Manning



Indexsar, Oakfield House, Cudworth Lane,
Newdigate, Surrey RH5 5DR. UK.
Tel: +44 (0) 1306 631233 Fax: +44 (0) 1306 631834
e-mail: enquiries@indexsar.com

Company Reg No. 4075046
Reg. Office: Oakfield House, Cudworth Lane, Newdigate, Surrey RH5 5DR..
Directors: D Riley and MI Manning PhD.



1. Measurement Conditions

Measurements were performed using a box-shaped phantom made of PMMA with dimensions designed to meet the accuracy criteria for reasonably-sized phantoms that do not have liquid capacities substantially in excess of the volume of liquid required to fill the Indexsar upright SAM phantoms used for SAR testing of handsets against the ear.

An HP 8753B vector network analyser was used for the return loss measurements. The dipole was placed in a special holder made of low-permittivity, low-loss materials. This holder enables the dipole to be positioned accurately in the centre of the base of the Indexsar box-phantom used for flat-surface testing and validation checks.

The validation dipoles are supplied with special spacers made from a low-permittivity, low-loss foam material. These spacers are fitted to the dipole arms to ensure that, when the dipole is offered up to the phantom surface, the spacing between the dipole and the liquid surface is accurately aligned according to the guidance in the relevant standards documentation. The spacers are rectangular with a central hole equal to the dipole arm diameter and dimensioned so that the longer side can be used to ensure a spacing of 15mm from the liquid in the phantom (for tests at 900MHz and below) and the shorter side can be used for tests at 1800MHz and above to ensure a spacing of 10mm from the liquid in the phantom. The spacers are made on a CNC milling machine with an accuracy of $1/40^{\text{th}}$ mm but they may suffer wear and tear and need to be replaced periodically. The material used is Rohacell, which has a relative permittivity of approx. 1.05 and a negligible loss tangent.

The apparatus supplied by Indexsar for dipole validation tests thus includes:

Balanced dipoles for each frequency required are dimensioned according to the guidelines given in IEEE 1528 [1]. The dipoles are made from semi-rigid 50 Ohm co-ax, which is joined by soldering and is gold-plated subsequently. The constructed dipoles are easily deformed, if mis-handled, and periodic checks need to be made of their symmetry.

Rohacell foam spacers designed for presenting the dipoles to 2mm thick PMMA box phantoms. These components also suffer wear and tear and should be replaced when the central hole is a loose-fit on the dipole arms or if the edges are too worn to ensure accurate alignment. The standard spacers are dimensioned for use with 2mm wall thickness (additional spacers are available for 4mm wall thickness).

2. Typical SAR Measurement

A SAR validation check is performed with the box-phantom located on the SARA2 phantom support base on the SARA2 robot system. Tests are then conducted at a feed power level of approx. 0.25W. The actual power level is recorded and used to normalise the results obtained to the standard input power conditions of 1W (forward power). The ambient temperature is $24^{\circ}\text{C} \pm 1^{\circ}\text{C}$ and the relative humidity is around 67% during the measurements.

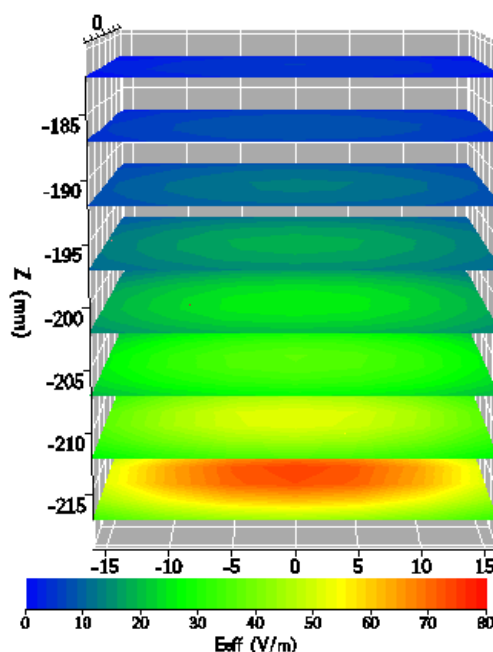


The phantom is filled with a 2450MHz brain liquid using a recipe from [1], which has the following electrical parameters (measured using an Indexsar DiLine kit) at 2450MHz:

Relative Permittivity **37.735**
Conductivity **1.788 S/m**

The SARA2 software version 0.290 is used with an Indexsar probe previously calibrated using waveguides.

The 3D measurements made using the dipole at the bottom of the phantom box is shown below:



The results, normalised to an input power of 1W (forward power) are typically:

Averaged over 1 cm³ (1g) of tissue **55.12 W/kg**
Averaged over 10cm³ (10g) of tissue **26.46 W/kg**

These results can be compared with Table 8.1 in [1]. The agreement is within 10%.

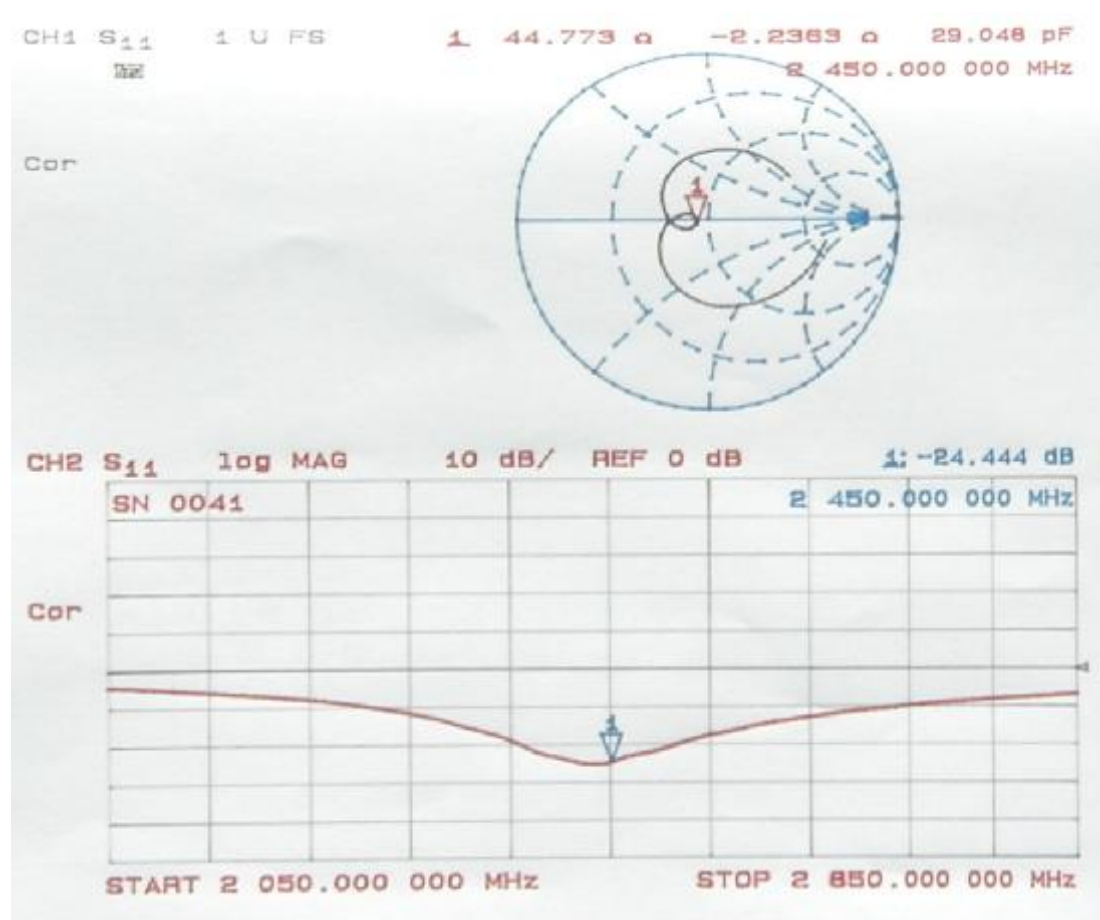
3. Dipole impedance and return loss

The dipoles are designed to have low return loss ONLY when presented against a lossy-phantom at the specified distance. A Vector Network Analyser (VNA) was used to perform a return loss measurement on the specific dipole when in the measurement-location against the box phantom. The distance was as specified in the standard i.e. 10mm from the liquid (for 2450MHz). The Indexsar foam spacers (described above) were used to ensure this condition during measurement.

The impedance was measured at the SMA-connector with the network analyser.
The following parameters were measured:

Dipole impedance at 2450 MHz $\text{Re}\{Z\} = 44.773 \Omega$
 $\text{Im}\{Z\} = -2.2363 \Omega$

Return loss at 2450MHz **-24.444 dB**



4. Dipole handling

The dipoles are made from standard, copper-sheathed coaxial cable. In assembly, the sections are joined using ordinary soft-soldering. This is necessary to avoid excessive heat input in manufacture, which would destroy the polythene dielectric used for the cable. The consequence of the construction material and the assembly technique is that the dipoles are fragile and can be deformed by rough handling. Conversely, they can be straightened quite easily as described in this report.



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If a dipole is suspected of being deformed, a normal workshop lathe can be used as an alignment jig to restore the symmetry. To do this, the dipole is first placed in the headstock of the lathe (centred on the plastic or brass spacers) and the headstock is rotated by hand (do NOT use the motor). A marker (lathe tool or similar) is brought up close to the end of one dipole arm and then the headstock is rotated by 0.5 rev. to check the opposing arm. If they are not balanced, judicious deformation of the arms can be used to restore the symmetry.

If a dipole has a failed solder joint, the dipole can be fixed down in such a way that the arms are co-linear and the joint re-soldered with a reasonably-powerful electrical soldering iron. Do not use gas soldering irons. After such a repair, electrical tests must be performed as described below.

Please note that, because of their construction, the dipoles are short-circuited for DC signals.

5. Tuning the dipole

The dipole dimensions are based on calculations that assumed specific liquid dielectric properties. If the liquid dielectric properties are somewhat different, the dipole tuning will also vary. A pragmatic way of accounting for variations in liquid properties is to 'tune' the dipole (by applying minor variations to its effective length). For this purpose, Indexsar can supply short brass tube lengths to extend the length of the dipole and thus 'tune' the dipole. It cannot be made shorter without removing a bit from the arm. An alternative way to tune the dipole is to use copper shielding tape to extend the effective length of the dipole. Do both arms equally.

It should be possible to tune a dipole as described, whilst in place in the measurement position as long as the user has access to a VNA for determining the return loss.

6. References

[1] Draft recommended practice for determining the peak spatial-average specific absorption rate (SAR) in the human body due to wireless communications devices: Experimental Techniques.

[2] Calibration report on SAR probe IXP-050 S/N 0071 from National Physical Laboratory. Test Report EF07/2002/03/IndexSAR. Dated 20 February 2002.

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