SAR EVALUATION REPORT

For

Sharp Corporation

Information and Communication Systems Group
492 Minosho-cho, Yamatokoriyama-shi, Nara,
639-1186 Japan

FCC ID: APYNAR0054

2004-02-14

This Report Concerns: ☒ Original Report	**Equipment Type:** 802.11b/g mini PCI module
Test Engineer:	Eric Hong / HONG
Report No.:	R0401191S
Test Date:	2003-02-09
Reviewed By:	Ling Zhang
Prepared By:	Bay Area Compliance Laboratory Corporation 230 Commercial Street Sunnyvale, CA 94085 Tel: (408) 732-9162 Fax: (408) 732 9164

Note: This test report is specially limited to the above client company and the product model only. It may not be duplicated without prior written consent of Bay Area Compliance Laboratory Corporation. This report **must not** be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

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SUMMARY

The US Federal Communications Commission has released the report and order “Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996 [1].

The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 mW/g as recommended by the ANSI/IEEE standard C95.1-1992 [6] for an uncontrolled environment (Paragraph 65). According to the Supplement C of OET Bulletin 65 “Evaluating Compliance with FCC Guide-lines for Human Exposure to Radio frequency Electromagnetic Fields", released on Jun 29, 2001 by the FCC, the device should be evaluated at maximum output power (radiated from the antenna) under “worst-case” conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

This report describes the methodology and results of experiments performed on wireless data terminal. The objective was to determine if there is RF radiation and if radiation is found, what is the extent of radiation with respect to safety limits. SAR (Specific Absorption Rate) is the measure of RF exposure determined by the amount of RF energy absorbed by human body (or its parts) – to determine how the RF energy couples to the body or head which is a primary health concern for body worn devices. The limit below which the exposure to RF is considered safe by regulatory bodies in North America is 1.6 mW/g average over 1 gram of tissue mass.

The test configurations were laid out on a specially designed test fixture to ensure the reproducibility of measurements. Each configuration was scanned for SAR. Analysis of each scan was carried out to characterize the above effects in the device.

The investigation was limited to the worst-case scenario from the device usage point of view. For the clarity of data analysis, and clarity of presentation, only one tissue simulation was used for the head and body simulation. This means that if SAR was found at the headset position, the magnitude of SAR would be overestimated comparing to SAR to a headset placed in the ear region.

There was no SAR of any concern measured on the device for any of the investigated configurations.

1 - REFERENCE

[1] Federal Communications Commission, \Report and order: Guidelines for evaluating the environmental effects of radiofrequency radiation", Tech. Rep. FCC 96-326, FCC, Washington, D.C. 20554, 1996.

[2] David L. Means Kwok Chan, Robert F. Cleveland, \Evaluating compliance with FCC guidelines for human exposure to radiofrequency electromagnetic fields", Tech. Rep., Federal Communication Commission, O_ce of Engineering & Technology, Washington, DC, 1997.

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

[4] Niels Kuster, Ralph K.astle, and Thomas Schmid, \Dosimetric evaluation of mobile communications equipment with known precision", IEICE Transactions on Communications, vol. E80-B, no. 5, pp. 645{652, May 1997.

[5] CENELEC, \Considerations for evaluating of human exposure to electromagnetic fields (EMFs) from mobile telecommunication equipment (MTE) in the frequency range 30MHz - 6GHz", Tech. Rep., CENELEC, European Committee for Electrotechnical Standardization, Brussels, 1997.

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

[7] Katja Pokovic, Thomas Schmid, and Niels Kuster, \Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies", in ICECOM _ 97, Dubrovnik, October 15{17, 1997, pp. 120-24.

[8] Katja Pokovic, Thomas Schmid, and Niels Kuster, \E-_eld probe with improved isotropy in brain simulating liquids", in Proceedings of the ELMAR, Zadar, Croatia, 23{25 June, 1996, pp. 172-175.

[9] Volker Hombach, Klaus Meier, Michael Burkhardt, Eberhard K. uhn, and Niels Kuster, \The depen-dence of EM energy absorption upon human head modeling at 900 MHz", IEEE Transactions on Microwave Theory and Techniques, vol. 44, no. 10, pp. 1865-1873, Oct. 1996.

[10] Klaus Meier, Ralf Kastle, Volker Hombach, Roger Tay, and Niels Kuster, \The dependence of EM energy absorption upon human head modeling at 1800 MHz", IEEE Transactions on Microwave Theory and Techniques, Oct. 1997, in press.

[11] W. Gander, Computermathematik, Birkhaeuser, Basel, 1992.

[12] W. H. Press, S. A. Teukolsky,W. T. Vetterling, and B. P. Flannery, Numerical Recepies in C, The Art of Scientific Computing, Second Edition, Cambridge University Press, 1992.Dosimetric Evaluation of Sample device, month 1998 9

[13] NIS81 NAMAS, \The treatment of uncertainity in EMC measurement", Tech. Rep., NAMAS Executive, National Physical Laboratory, Teddington, Middlesex, England, 1994.

[14] Barry N. Taylor and Christ E. Kuyatt, \Guidelines for evaluating and expressing the uncertainty of NIST measurement results", Tech. Rep., National Institute of Standards and Technology, 1994. Dosimetric Evaluation of Sample device, month 1998 10

2 - TESTING EQUIPMENT

2.1 Equipments List & Calibration Info

Type / Model	Cal. Date	S/N:
DASY3 Professional Dosimetric System	N/A	N/A
Robot RX60L	N/A	F00/5H31A1/A/01
Robot Controller	N/A	F01/5J72A1/A/01
Dell Computer Optiplex GX110	N/A	N/A
Pentium III, Windows NT	N/A	N/A
SPEAG EDC3	N/A	N/A
SPEAG DAE3	2003-06	456
SPEAG E-Field Probe ET3DV6	2004-09-07	1604
SPEAG Dummy Probe	N/A	N/A
SPEAG Generic Twin Phantom	N/A	N/A
SPEAG Light Alignment Sensor	N/A	278
Apprel Validation Dipole D-1800-S-2	2003-11-06	BCL-049
SPEAG Validation Dipole D900V2	2004-09-03	122
Brain Equivalent Matter (800MHz)	Daily	N/A
Brain Equivalent Matter (1900MHz)	Daily	N/A
Brain Equivalent Matter (2450MHz)	Daily	N/A
Muscle Equivalent Matter (800MHz)	Daily	N/A
Muscle Equivalent Matter (1900MHz)	Daily	N/A
Muscle Equivalent Matter (2450MHz)	Daily	N/A
Robot Table	N/A	N/A
Phone Holder	N/A	N/A
Phantom Cover	N/A	N/A
HP Spectrum Analyzer HP8593GM	2004-06-20	3009A00791
Microwave Amp. 8349B	N/A	2644A02662
Power Meter HP436A	2004-04-02	2709A29209
Power Sensor HP8482A	2004-04-02	2349A08568
Signal Generator RS SMIQ O3	2004-02-10	1084800403
Network Analyzer HP-8753ES	2004-07-30	820079
Dielectric Probe Kit HP85070A	N/A	N/A
Apprel Validation Dipole D-2450-S-1	2003-10-01	BCL-141

2.2 Equipment Calibration Certificate

Please see the attached file.

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

Client Bay Area Comp. Lab (BACL)

CALIBRATION CERTIFICATE

Object(s)	ES3DV2 - SN:3019
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	October 9, 2003
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM E4419B	GB41293874	2-Apr-03 (METAS, No 252-0250)	Apr-04
Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04
Reference 20 dB Attenuator	SN: 5086 (20b)	3-Apr-03 (METAS No. 251-0340	Apr-04
Fluke Process Calibrator Type 702	SN: 6295803	8-Sep-03 (Sintrel SCS No. E-030020)	Sep-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (Agilent, No. 20020918)	In house check: Oct 03
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (Agilent, No. 24BR1033101)	In house check: Oct 03

	Name	Function	Signature
Calibrated by:	[redacted]		
Approved by:	[redacted]		

Date issued: October 9, 2003

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

880-KP0301061-A Page 1 (1)

Schmid & Partner Engineering AG s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Probe ES3DV2

SN: 3019

Manufactured: December 5, 2002
Last calibration: July 12, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

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ES3DV2 SN: 3019 July 12, 2003

DASY - Parameters of Probe: ES3DV2 SN: 3019

Sensitivity in Free Space

NormX	**1.03** $\mu V/(V/m)^2$	
NormY	**1.12** $\mu V/(V/m)^2$	
NormZ	**0.98** $\mu V/(V/m)^2$	

Diode Compression

DCP X	99
DCP Y	99
DCP Z	99

Sensitivity in Tissue Simulating Liquid

Head 900 MHz ε_r = 41.5 ± 5% σ = 0.97 ± 5% mho/m

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**6.4** ± 9.5% (k=2)		Boundary effect:	
ConvF Y	**6.4** ± 9.5% (k=2)		Alpha	**0.68**
ConvF Z	**6.4** ± 9.5% (k=2)		Depth	**1.11**

Head 1800 MHz ε_r = 40.0 ± 5% σ = 1.40 ± 5% mho/m

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**5.0** ± 9.5% (k=2)		Boundary effect:	
ConvF Y	**5.0** ± 9.5% (k=2)		Alpha	**0.21**
ConvF Z	**5.0** ± 9.5% (k=2)		Depth	**2.78**

Boundary Effect

Head 900 MHz Typical SAR gradient: 5 % per mm

Probe Tip to Boundary	**1 mm**	**2 mm**
SAR_{be} [%] Without Correction Algorithm	4.3	1.8
SAR_{be} [%] With Correction Algorithm	0.0	0.1

Head 1800 MHz Typical SAR gradient: 10 % per mm

Probe Tip to Boundary	**1 mm**	**2 mm**
SAR_{be} [%] Without Correction Algorithm	7.4	5.0
SAR_{be} [%] With Correction Algorithm	0.0	0.1

Sensor Offset

Probe Tip to Sensor Center **2.1** mm

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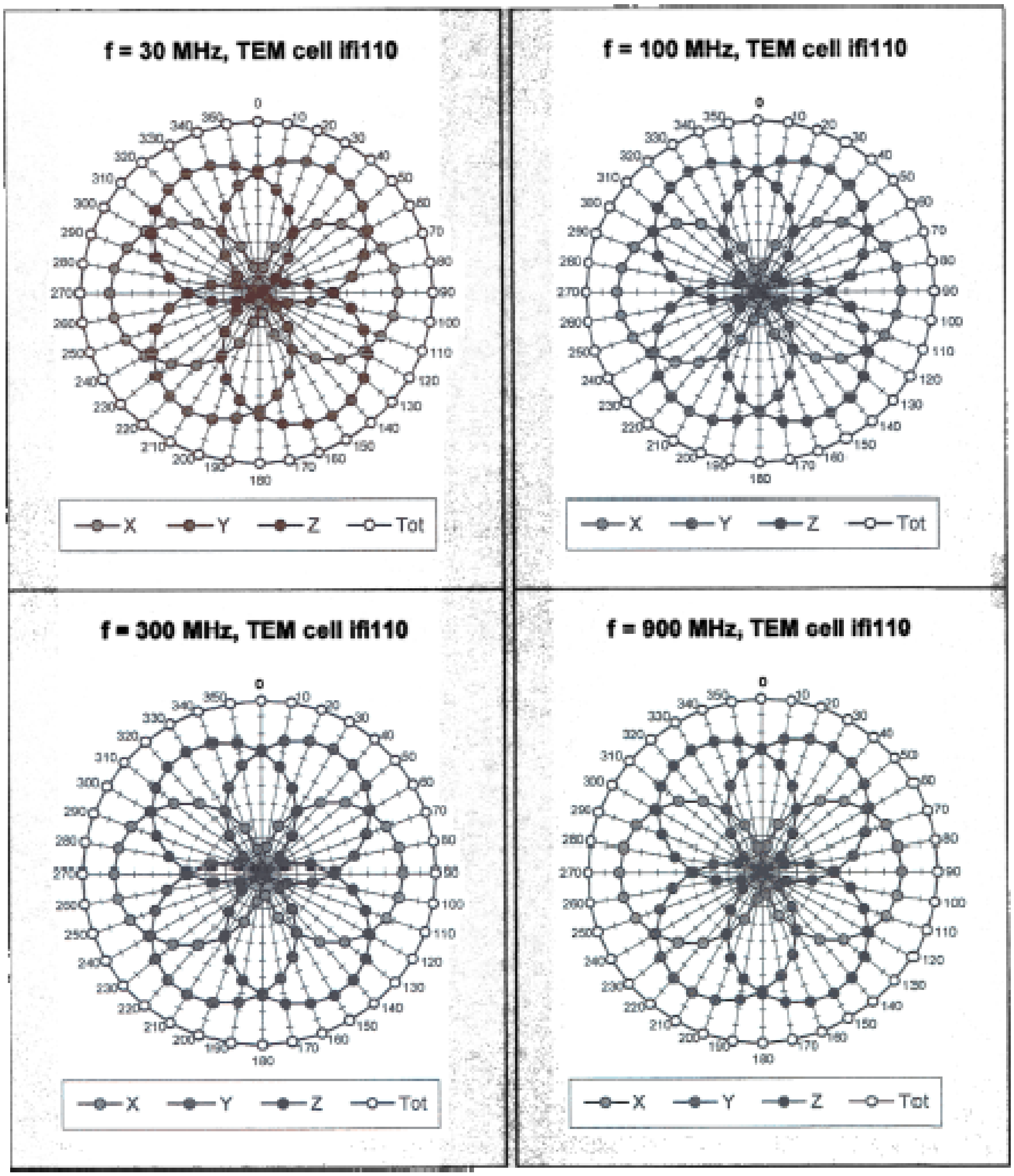
Receiving Pattern (ϕ, θ = 0°)



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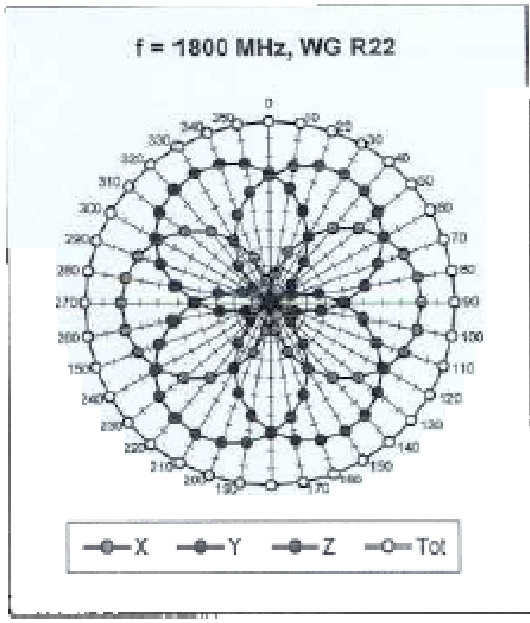
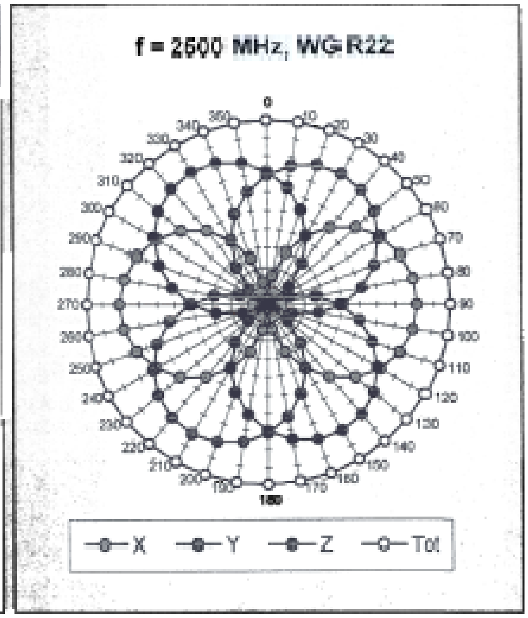
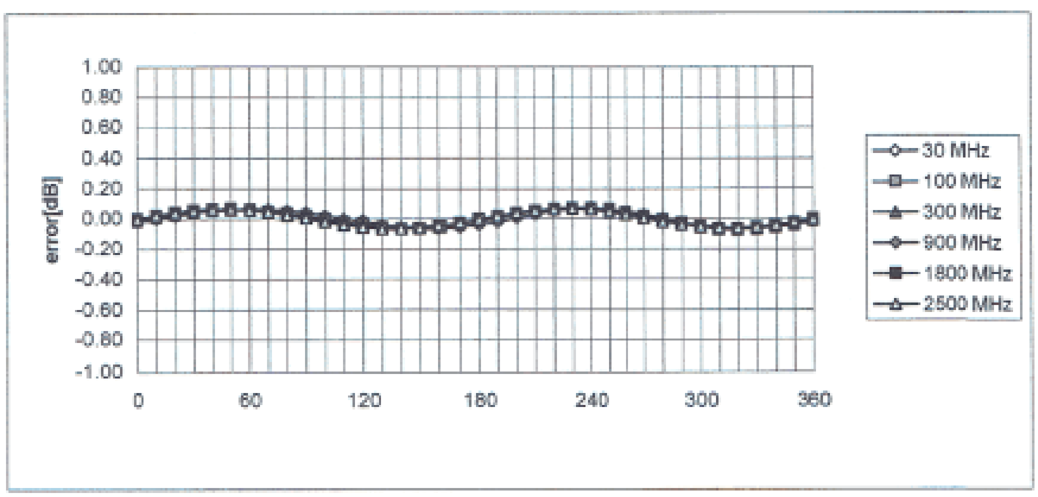




Isotropy Error (φ), θ 0°



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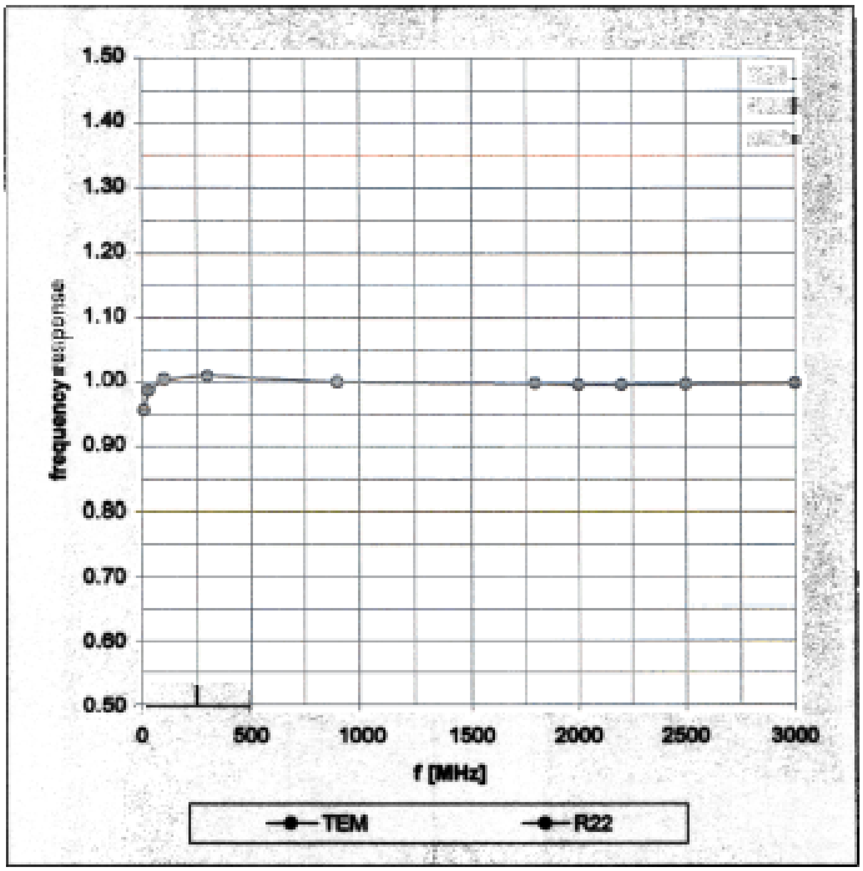
ES3DV2 SN: 3019 July 12, 2003

Frequency Response of E-Field

(TEM-Cell:ifi110, Waveguide R22)



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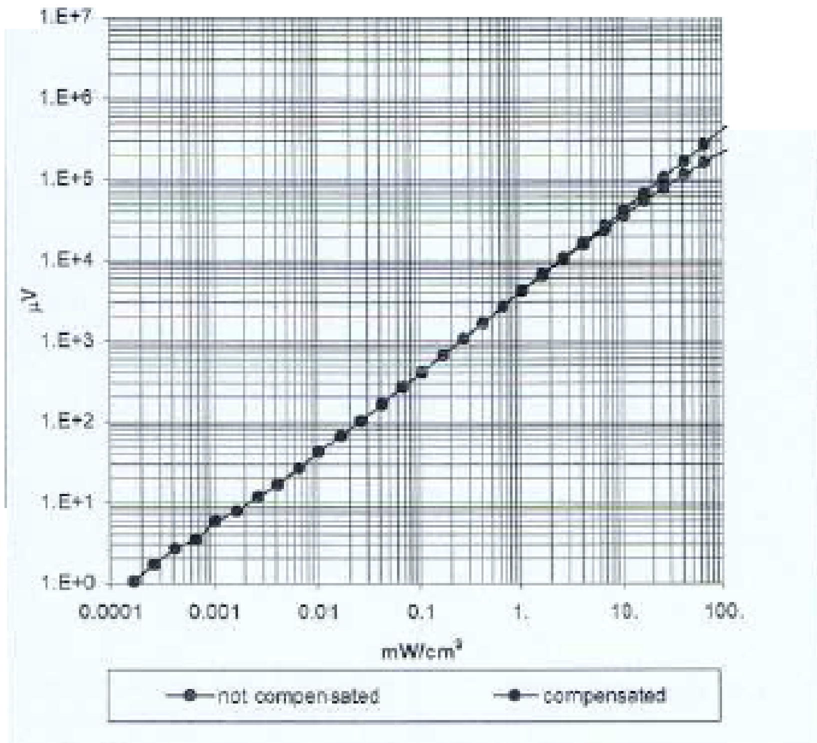
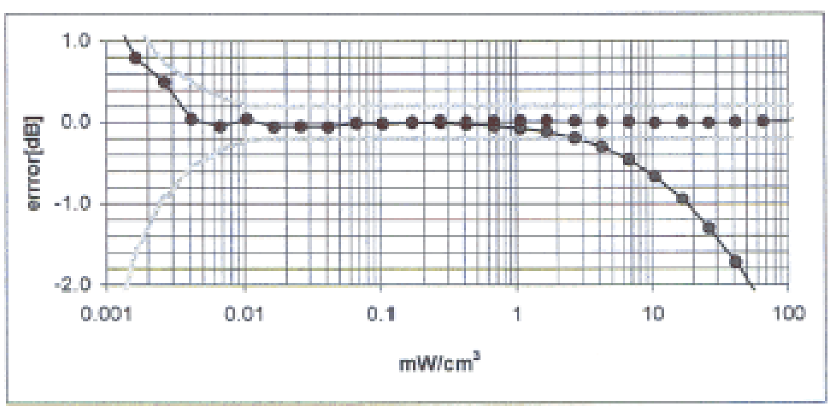
Dynamic Range f(SAR_{brain})

(Waveguide R22)





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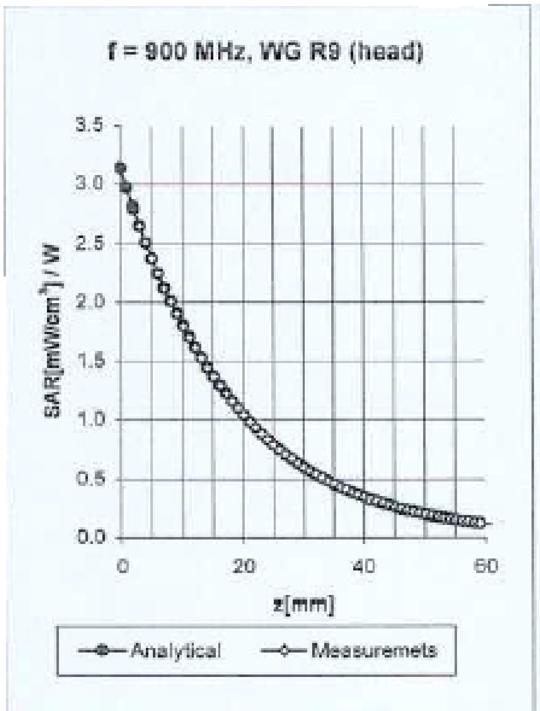
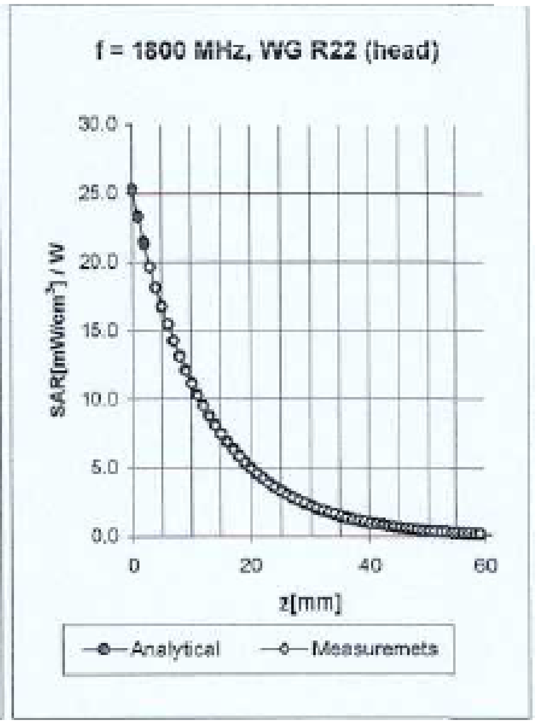
ES3DV2 SN: 3019 **July 12, 2003**

Conversion Factor Assessment





900 MHz ε_r **= 41.5 ± 5%** **σ = 0.97 ± 5% mho/m**

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**6.4** ± 9.5% (k=2)		Boundary effect:	
ConvF Y	**6.4** ± 9.5% (k=2)		Alpha	**0.68**
ConvF Z	**6.4** ± 9.5% (k=2)		Depth	**1.11**

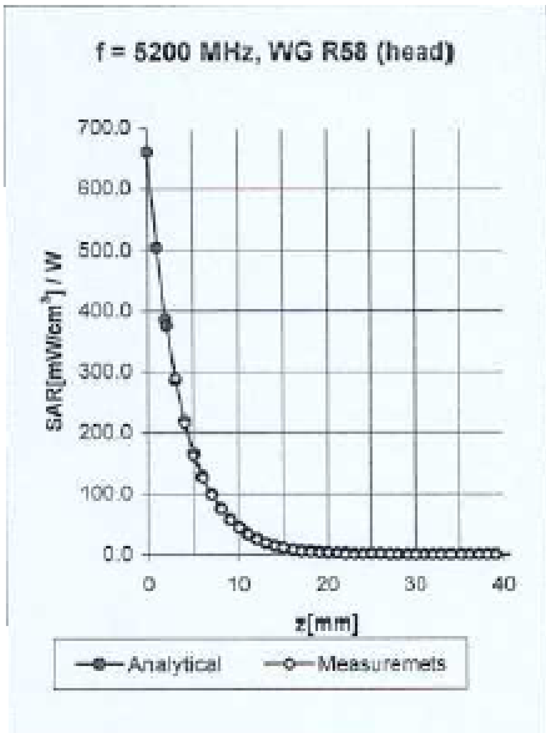
1800 MHz ε_r **= 40.0 ± 5%** **σ = 1.40 ± 5% mho/m**

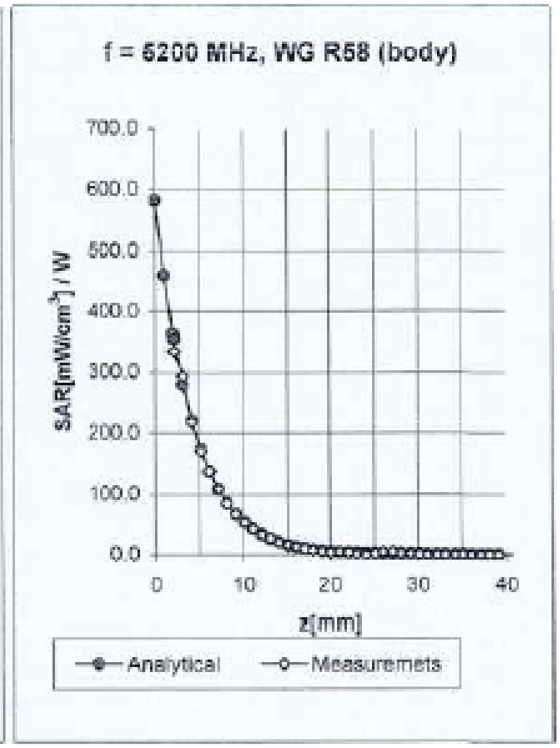
Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**5.0** ± 9.5% (k=2)		Boundary effect:	
ConvF Y	**5.0** ± 9.5% (k=2)		Alpha	**0.21**
ConvF Z	**5.0** ± 9.5% (k=2)		Depth	**2.78**

ES3DV2 SN: 3019 **July 12, 2003**

Conversion Factor Assessment





Head **5200** **MHz** ε_r **= 36.0 ± 5%** σ **= 4.66 ± 5% mho/m**

Valid for f=4940-5460 MHz with Head Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**2.3** ± 14.6% (k=2)	Boundary effect:	
ConvF Y	**2.3** ± 14.6% (k=2)	Alpha	**1.05**
ConvF Z	**2.3** ± 14.6% (k=2)	Depth	**1.50**

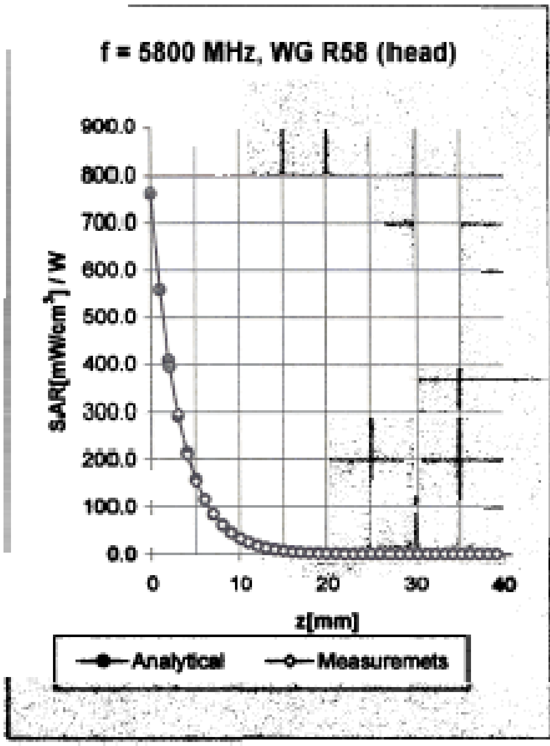
Body **5200** **MHz** ε_r **= 49.0 ± 5%** σ **= 5.30 ± 5% mho/m**

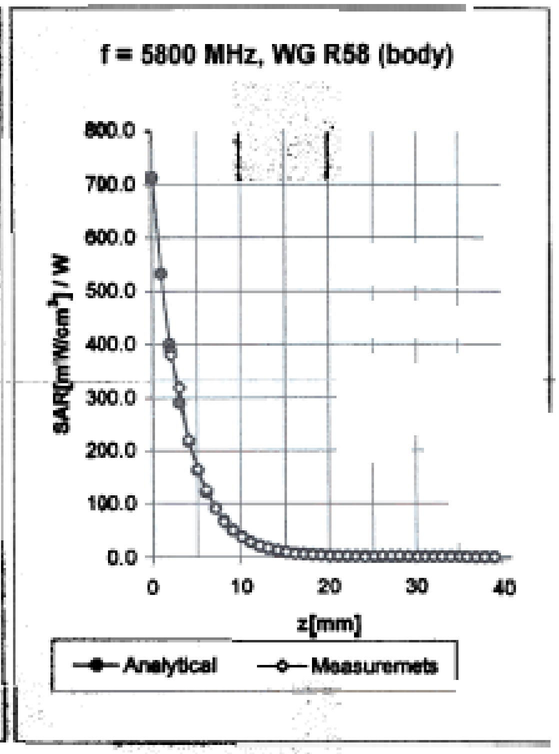
Valid for f=4940-5460 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**1.4** ± 14.6% (k=2)	Boundary effect:	
ConvF Y	**1.4** ± 14.6% (k=2)	Alpha	**1.01**
ConvF Z	**1.4** ± 14.6% (k=2)	Depth	**1.85**

ES3DV2 SN: 3019 **July 12, 2003**

Conversion Factor Assessment





Head 5800 MHz ε_r = 35.3 ± 5% σ = 5.27 ± 5% mho/m

Valid for f=5510-6090 MHz with Head Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**1.8** ± 14.6% (k=2)		Boundary effect:	
ConvF Y	**1.8** ± 14.6% (k=2)		Alpha	**0.90**
ConvF Z	**1.8** ± 14.6% (k=2)		Depth	**1.90**

Body 5800 MHz ε_r = 48.2 ± 5% σ = 6.00 ± 5% mho/m

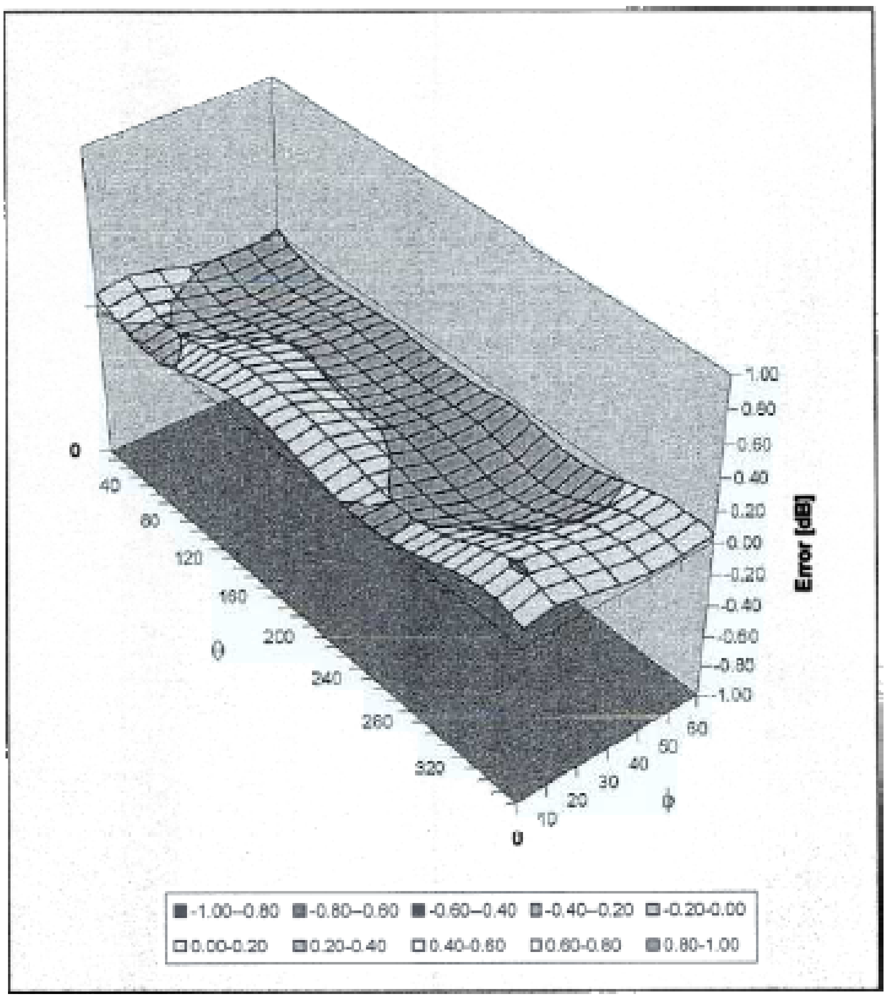
Valid for f=5510-6090 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**1.2** ± 14.6% (k=2)		Boundary effect:	
ConvF Y	**1.2** ± 14.6% (k=2)		Alpha	**1.18**
ConvF Z	**1.2** ± 14.6% (k=2)		Depth	**1.65**

ES3DV2 SN: 3019 **July 12, 2003**

Deviation from Isotropy in HSL

Error (θϕ), f = 900 MHz



Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Probe ES3DV2

SN:3019

Additional Conversion Factors

Manufactured:	December 5, 2002
Last calibration:	July 12, 2003
Add. calibration:	October 9, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

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DASY - Parameters of Probe: ES3DV2 SN:3019

Sensitivity in Free Space

NormX	**1.05** $\mu V/(V/m)^2$
NormY	**1.14** $\mu V/(V/m)^2$
NormZ	**0.98** $\mu V/(V/m)^2$

Diode Compression

DCP X	**99**
DCP Y	**99**
DCP Z	**99**

Sensor Offset

Probe Tip to Sensor Center	**2.1**	mm

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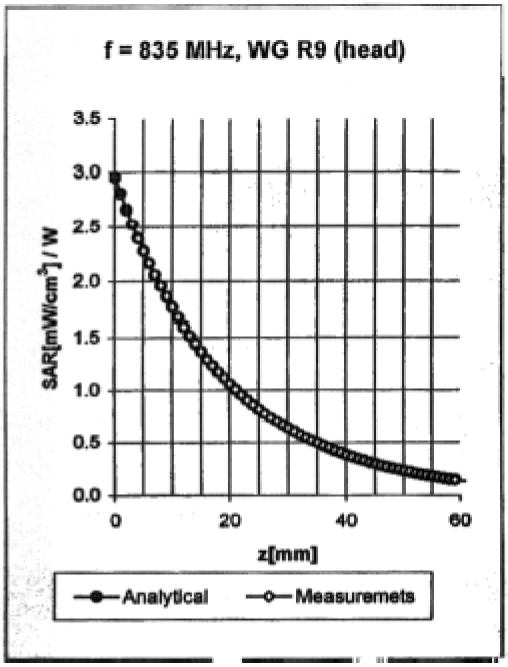
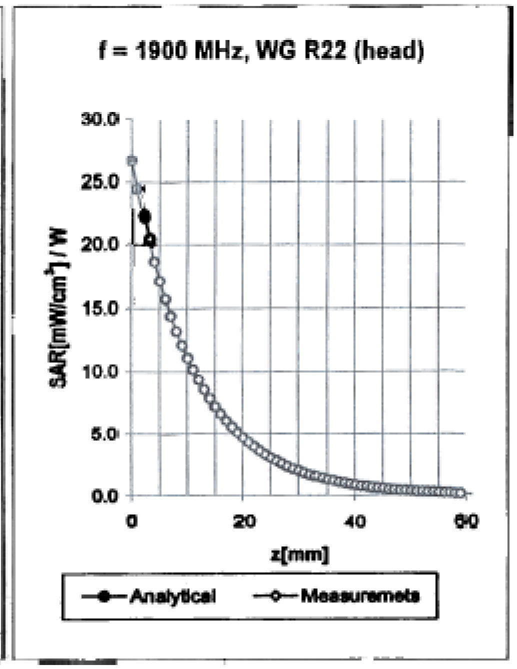
Conversion Factor Assessment





Head **835 MHz** ε_r **= 41.5 ± 5%** **σ = 0.90 ± 5% mho/m**

Valid for f=793-877 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**6.5** ± 9.5% (k=2)	Boundary effect:		
ConvF Y	**6.5** ± 9.5% (k=2)	Alpha	**0.35**	
ConvF Z	**6.5** ± 9.5% (k=2)	Depth	**1.46**	

Head **1900 MHz** ε_r **= 40.0 ± 5%** **σ = 1.40 ± 5% mho/m**

Valid for f=1805-1995 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**4.7** ± 9.5% (k=2)	Boundary effect:		
ConvF Y	**4.7** ± 9.5% (k=2)	Alpha	**0.22**	
ConvF Z	**4.7** ± 9.5% (k=2)	Depth	**3.48**	

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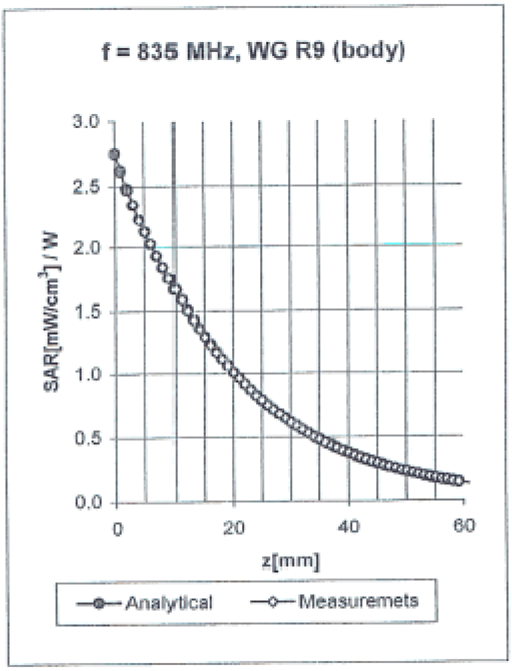
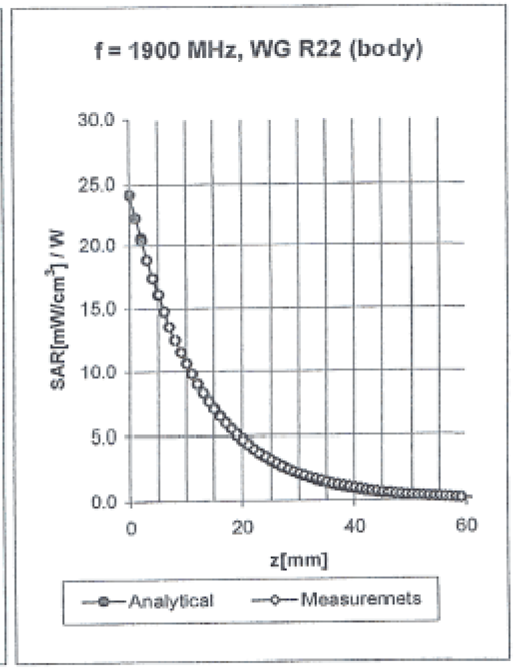
Conversion Factor Assessment





Body **835 MHz** ε_r **= 55.2 ± 5%** **σ = 0.97 ± 5% mho/m**

Valid for f=793-877 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	6.1	± 9.5% (k=2)	Boundary effect:	
ConvF Y	6.1	± 9.5% (k=2)	Alpha	0.24
ConvF Z	6.1	± 9.5% (k=2)	Depth	2.00

Body **1900 MHz** ε_r **= 53.3 ± 5%** **σ = 1.52 ± 5% mho/m**

Valid for f=1805-1995 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	4.6	± 9.5% (k=2)	Boundary effect:	
ConvF Y	4.6	± 9.5% (k=2)	Alpha	0.24
ConvF Z	4.6	± 9.5% (k=2)	Depth	2.64

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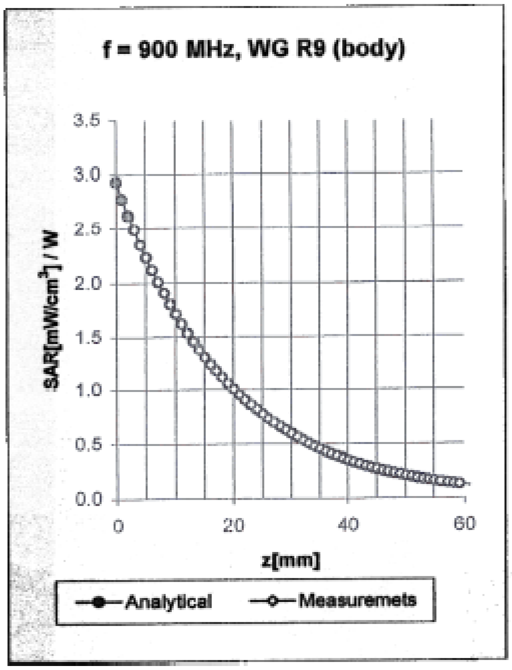
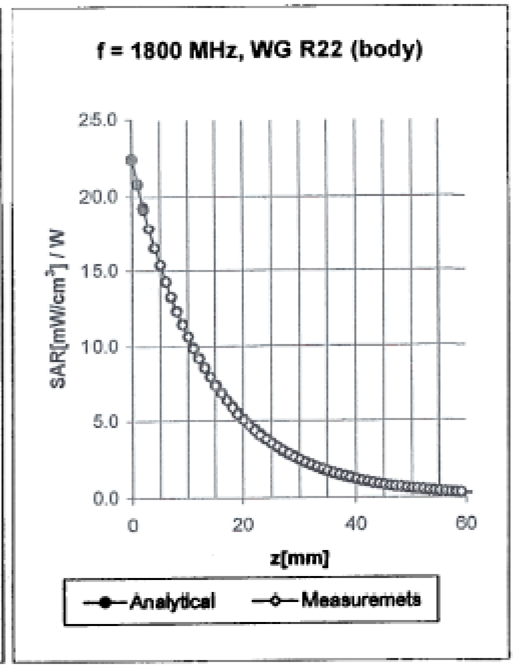
Conversion Factor Assessment





Body 900 MHz ε_r = 55.0 ± 5% σ = 1.05 ± 5% mho/m

Valid for f=855-945 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**6.1** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**6.1** ± 9.5% (k=2)	Alpha	**0.27**
ConvF Z	**6.1** ± 9.5% (k=2)	Depth	**1.82**

Body 1800 MHz ε_r = 53.3 ± 5% σ = 1.52 ± 5% mho/m

Valid for f=1710-1890 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**4.7** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**4.7** ± 9.5% (k=2)	Alpha	**0.23**
ConvF Z	**4.7** ± 9.5% (k=2)	Depth	**2.99**

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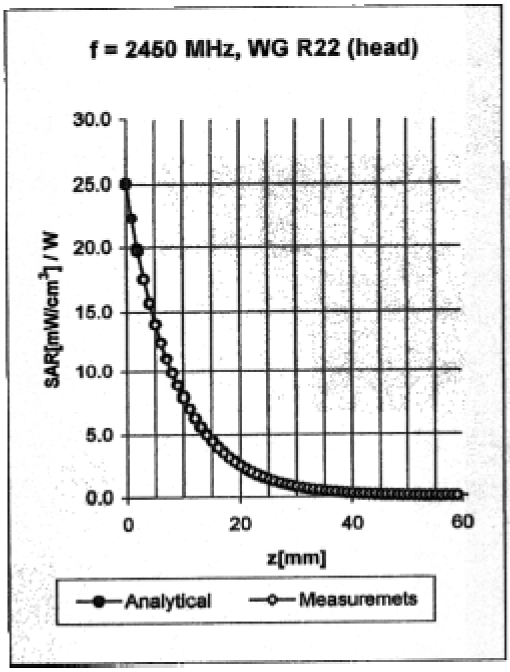
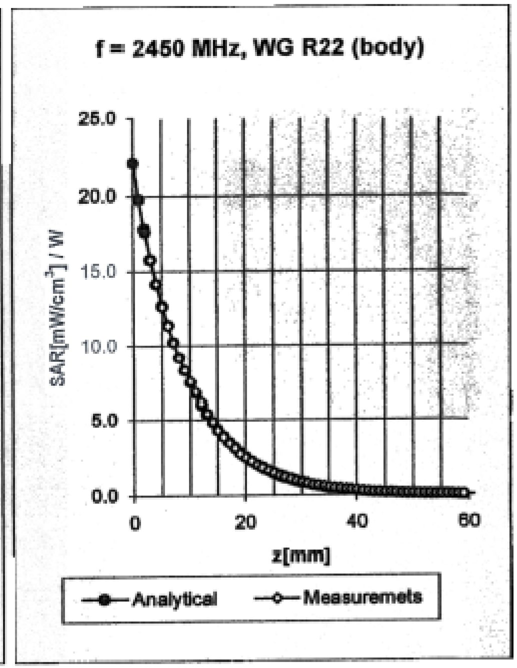
Conversion Factor Assessment





Head **2450 MHz** ε_r **= 39.2 ± 5%** **σ = 1.80 ± 5% mho/m**

Valid for f=2400-2500 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**4.5** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**4.5** ± 9.5% (k=2)	Alpha	**0.40**
ConvF Z	**4.5** ± 9.5% (k=2)	Depth	**1.62**

Body **2450 MHz** ε_r **= 52.7 ± 5%** **σ = 1.95 ± 5% mho/m**

Valid for f=2400-2500 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**4.2** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**4.2** ± 9.5% (k=2)	Alpha	**0.32**
ConvF Z	**4.2** ± 9.5% (k=2)	Depth	**1.98**

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Additional Conversion Factors

for Dosimetric E-Field Probe

'ype:	ES3DV2
Serial Number:	**3019**
Place of Assessment:	Zurich
Date of Assessment:	October 13, 2003
Probe Calibration Date:	**October 9, 2003**

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1800 MHz.

Assessed by:

ES3DV2-SN:3019 **October 13, 2003**

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Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Dosimetric E-Field Probe ES3DV2 SN:3019

Conversion factor (± standard deviation)

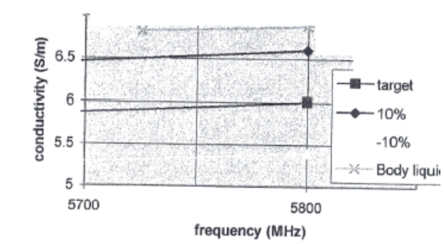
150 MHz	ConvF	8.7 ± 8%	ε_r = 52.3 ± 5% σ = 0.76 ± 5% mho/m (head tissue)
150 MHz	ConvF	8.3 ± 8%	ε_r = 61.9 ± 5% σ = 0.80 ± 5% mho/m (body tissue)
450 MHz	ConvF	7.4 ± 8%	ε_r = 43.5 ± 5% σ = 0.87 ± 5% mho/m (head tissue)
450 MHz	ConvF	7.3 ± 8%	ε_r = 56.7 ± 5% σ = 0.94 ± 5% mho/m (body tissue)

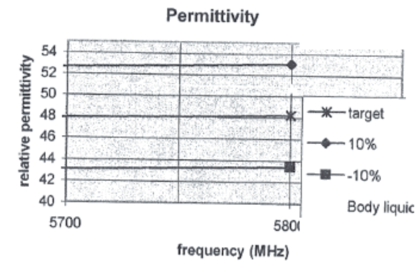
ES3DV2-SN:3019 October 13, 2003

Freq. (MHz)	Amplitude (dB)	Phase (deg)	Rel. Perm	Condy (S/m)
5725	-53.5	152	51	6.829
5800	-54	138	50.81	6.891
5825	-54.75	134	50.65	6.996

Freq. (MHz)	Rel. Perm.	Condy (S/m)	
400	45.3	0.87	
835	41.5	0.9	
900	41.5	0.97	
1450	40.5	1.2	
1800	40	1.4	
2000	40	1.4	
2450	39.2	1.8	
3000	38.5	2.4	
5800	48.2	6	
400	49.83	0.96	10
835	45.65	0.99	High %
900	45.65	1.07	
1450	44.55	1.32	
1800	44.00	1.54	
2000	44.00	1.54	
2450	43.12	1.98	
3000	42.35	2.64	
5800	53.02	6.60	
400	40.77	0.78	10
835	37.35	0.81	Low %
900	37.35	0.87	
1450	36.45	1.08	
1800	36.00	1.26	
2000	36.00	1.26	
2450	35.28	1.62	
3000	34.65	2.16	
5800	43.38	5.4	

0

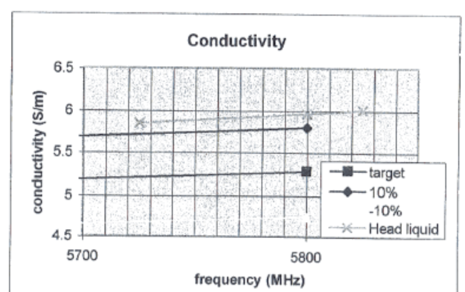


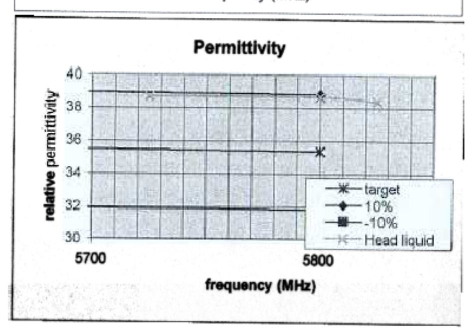


Freq. (MHz)	Amplitude (dB)	Phase (deg)	Rel. Perm.	Condy (S/m)
5725	-51.65	-20.5	38.7	5.849
5800	-52.5	-35	38.68	5.959
5825	-53	-35.6	38.39	6.008

Freq. (MHz)	Rel. Perm.	Condy (S/m)	
400	45.3	0.87	
835	41.5	0.9	
900	41.5	0.97	
1450	40.5	1.2	
1800	40	1.4	
2000	40	1.4	
2450	39.2	1.8	
3000	38.5	2.4	
5800	35.33	5.27	
400	49.83	0.96	10
835	45.65	0.99	High %
900	45.65	1.07	
1450	44.55	1.32	
1800	44.00	1.54	
2000	44.00	1.54	
2450	43.12	1.98	
3000	42.35	2.64	
5800	38.86	5.80	
400	40.77	0.78	10
835	37.35	0.81	Low %
900	37.35	0.87	
1450	36.45	1.08	
1800	36.00	1.26	
2000	36.00	1.26	
2450	35.28	1.62	
3000	34.65	2.16	
5800	31.797	4.743	

5 0





Body 2450 Mhz Liquid Measurement, 2004-02-09

frequency	e'	e''
2400000000.0000	52.0190	14.5220
2402000000.0000	52.2186	14.6198
2404000000.0000	52.3094	14.6571
2406000000.0000	52.4675	14.7388
2408000000.0000	52.7489	14.8234
2410000000.0000	53.0701	14.9608
2412000000.0000	52.9411	14.9332
2414000000.0000	52.7491	14.8789
2416000000.0000	52.7649	14.8950
2418000000.0000	52.6675	14.8986
2420000000.0000	52.4430	14.7979
2422000000.0000	52.5968	14.8747
2424000000.0000	52.5679	14.8784
2426000000.0000	52.6173	14.9413
2428000000.0000	52.6955	14.9219
2430000000.0000	52.5737	14.9090
2432000000.0000	52.1590	14.7705
2434000000.0000	51.8131	14.6466
2436000000.0000	51.7813	14.6269
2438000000.0000	51.7200	14.6165
2440000000.0000	51.5324	14.5320
2442000000.0000	51.5260	14.5378
2444000000.0000	51.4419	14.5187
2446000000.0000	51.3878	14.4792
2448000000.0000	51.3142	14.4650
2450000000.0000	51.1855	14.4312
2452000000.0000	51.1443	14.4375
2454000000.0000	51.0610	14.4234
2456000000.0000	51.0125	14.3840
2458000000.0000	50.8301	14.3259
2460000000.0000	50.6842	14.3097
2462000000.0000	50.6155	14.2429
2464000000.0000	50.5818	14.2355
2466000000.0000	50.5746	14.2538
2468000000.0000	50.5130	14.2378
2470000000.0000	50.4803	14.2285
2472000000.0000	50.4101	14.2106
2474000000.0000	50.3284	14.2014
2476000000.0000	50.3057	14.2068
2478000000.0000	50.2859	14.1918
2480000000.0000	50.2772	14.2337
2482000000.0000	50.2732	14.2658
2484000000.0000	50.3264	14.2966
2486000000.0000	50.3028	14.3043
2488000000.0000	50.3355	14.3224
2490000000.0000	50.3337	14.3309
2492000000.0000	50.2464	14.3388
2494000000.0000	50.3068	14.3456
2496000000.0000	50.2245	14.3684
2498000000.0000	50.2278	14.3618
2500000000.0000	50.2106	14.3821

$\sigma = \omega \varepsilon_o \varepsilon'' = 2 \pi f \varepsilon_o \varepsilon'' = 1.97$

where $f = 2450 x 10^6$

$\varepsilon_o = 8.854 x 10^{-12}$

$\varepsilon'' = 14.4312$

Head 2450 Mhz Liquid Measurement, 2003-09-04

frequency	e'	e''
2400000000.0000	39.3680	13.2332
2402000000.0000	39.3587	13.2645
2404000000.0000	39.3064	13.2793
2406000000.0000	39.3815	13.2287
2408000000.0000	39.3513	13.2435
2410000000.0000	39.3662	13.2728
2412000000.0000	39.3463	13.2859
2414000000.0000	39.3541	13.2883
2416000000.0000	39.3274	13.2176
2418000000.0000	39.2990	13.2362
2420000000.0000	39.2982	13.2713
2422000000.0000	39.3008	13.2821
2424000000.0000	39.3621	13.2872
2426000000.0000	39.3490	13.2028
2428000000.0000	39.3855	13.2543
2430000000.0000	39.3030	13.2647
2432000000.0000	39.2953	13.3026
2434000000.0000	39.2996	13.2928
2436000000.0000	39.2961	13.3151
2438000000.0000	39.2913	13.3442
2440000000.0000	39.3167	13.3414
2442000000.0000	39.3138	13.2513
2444000000.0000	39.3123	13.2248
2446000000.0000	39.3254	13.2322
2448000000.0000	39.3140	13.2676
2450000000.0000	39.3019	13.3492
2452000000.0000	39.2892	13.3436
2454000000.0000	39.3593	13.3759
2456000000.0000	39.3501	13.2968
2458000000.0000	39.3464	13.2952
2460000000.0000	39.3502	13.1983
2462000000.0000	39.3547	13.3395
2464000000.0000	39.3819	13.3853
2466000000.0000	39.3146	13.3741
2468000000.0000	39.3375	13.2426
2470000000.0000	39.3243	13.2849
2472000000.0000	39.3507	13.2894
2474000000.0000	39.3421	13.2083
2476000000.0000	39.3405	13.2139
2478000000.0000	39.3482	13.3228
2480000000.0000	39.3421	13.3635
2482000000.0000	39.3318	13.3427
2484000000.0000	39.3072	13.3693
2486000000.0000	39.3117	13.3470
2488000000.0000	39.3271	13.3433
2490000000.0000	39.3173	13.3073
2492000000.0000	39.3608	13.3126
2494000000.0000	39.3287	13.3112
2496000000.0000	39.3579	13.3347
2498000000.0000	39.3062	13.3018
2500000000.0000	39.2894	13.3179

$\sigma = \omega\, \varepsilon_o\, \varepsilon'' = 2\, \pi f\, \varepsilon_o\, \varepsilon''=1.82$

where $f = 2450x\ 10^6$

$\varepsilon_o = 8.854\ x\ 10^{-12}$

$\varepsilon'' = 13.3492$

3 - EUT SUMMARY

The *Aztech Systems Ltd.'s*, model: *T60H713,* or the "EUT" as referred to in this report is an 802.11b/g mini PCI module which is measured approximately 2.4"L x 1.7"W x 0.1"H.

The EUT utilized the Sharp power adapter, M/N: EA-MU01V.

** The test data gathered are from a production sample, S/N: PC-MM2, provided by the manufacturer.*

4 - SYSTEM TEST CONFIGURATION

4.1 Justification

The system was configured for testing in a typical fashion (as normally used by a typical user).

4.2 EUT Exercise Software and Procedure

The EUT exercising program used during SAR testing was designed to exercise the various system components in a manner similar to a typical use. The test software, provided by the customer, is started the Windows terminal program under the Windows 98/2000/ME/XP operating system.

Once loaded, set the Tx channel to low, mid and high for testing.

4.3 Special Accessories

All interface cables used for compliance testing are shielded as normally supplied by INMAC, Monster Cable and their respective support equipment manufacturer. The EUT is featured shielded metal connectors.

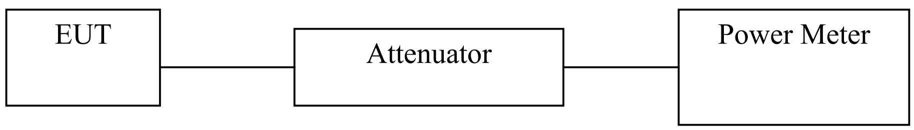
4.4 Equipment Modifications

No modification(s) were made to ensure that the EUT complies with the applicable limits.

5 - CONDUCTED OUTPUT POWER MEASUREMENT

5.1 Measurement Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
3. Add a correction factor to the display.

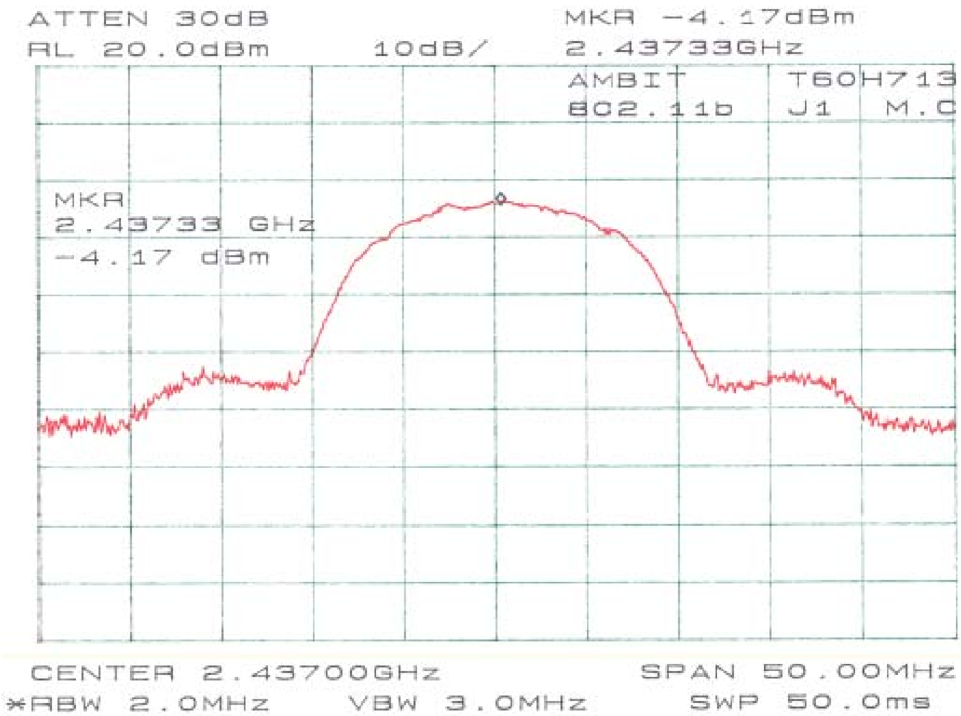


5.2 Test Results

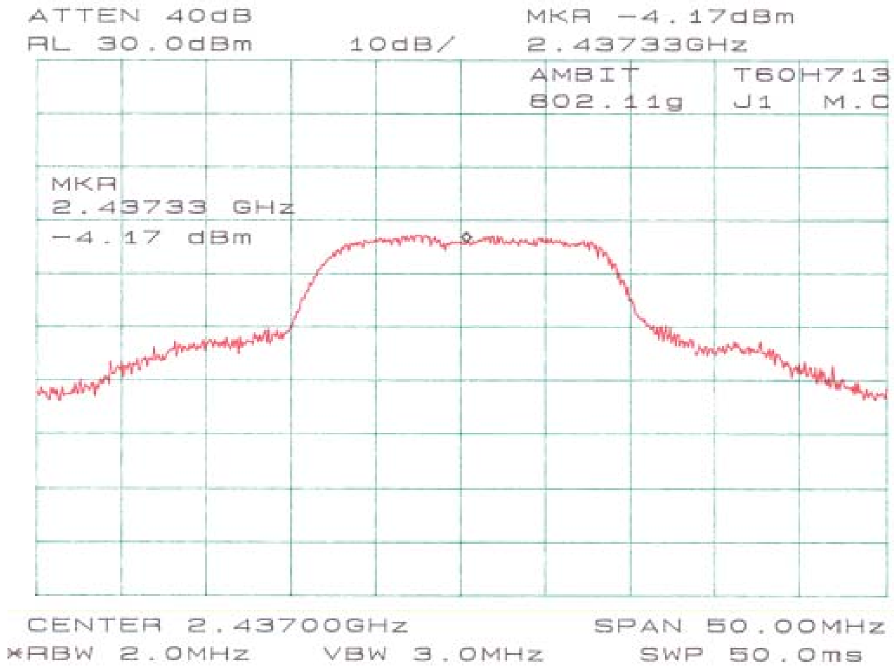
Port	Mode	Frequency (MHz)	Peak Output Power (dBm)	Output Power (W)	Standard (W)	Result
J1	802.11b	2437	-4.17	0.0004	≤ 1W	Compliant
J2		2437	17.50	0.0562	≤ 1W	Compliant
J1	802.11g	2437	-4.17	0.0004	≤ 1W	Compliant
J2		2437	17.50	0.0562	≤ 1W	Compliant

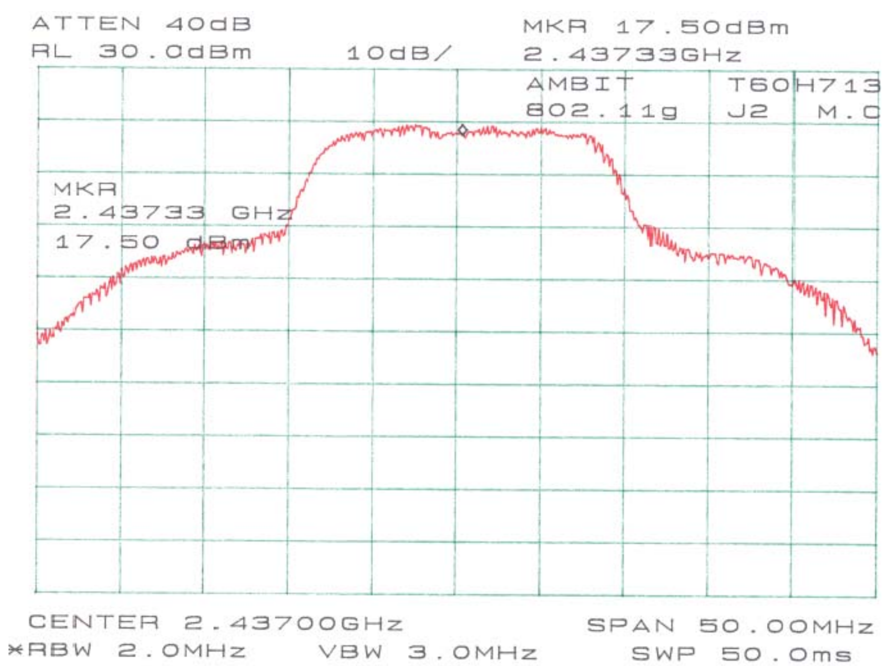
5.3 Measurement Plots

Please refer to the plots hereinafter.


ATTEN 30dB
RL 20.0dBm
10dB/
MKR -4.17dBm
2.43733GHz
AMBIT
802.11b
T60H713
J1
M.C
MKR
2.43733 GHz
-4.17 dBm
CENTER 2.43700GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms


ATTEN 30dB
RL 20.0dBm
10dB/
MKR 17.50dBm
2.43733GHz
AMBIT
802.11b
T60H713
J2
M.C
MKR
2.43733 GHz
17.50 dBm
CENTER 2.43700GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR -4.17dBm
2.43733GHz
AMBIT
802.11g
T60H713
J1
M.C
MKR
2.43733 GHz
-4.17 dBm
CENTER 2.43700GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 17.50dBm
2.43733GHz
AMBIT
802.11g
T60H713
J2
M.C
MKR
2.43733 GHz
17.50 dBm
CENTER 2.43700GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms

6 - DOSIMETRIC ASSESSMENT SETUP

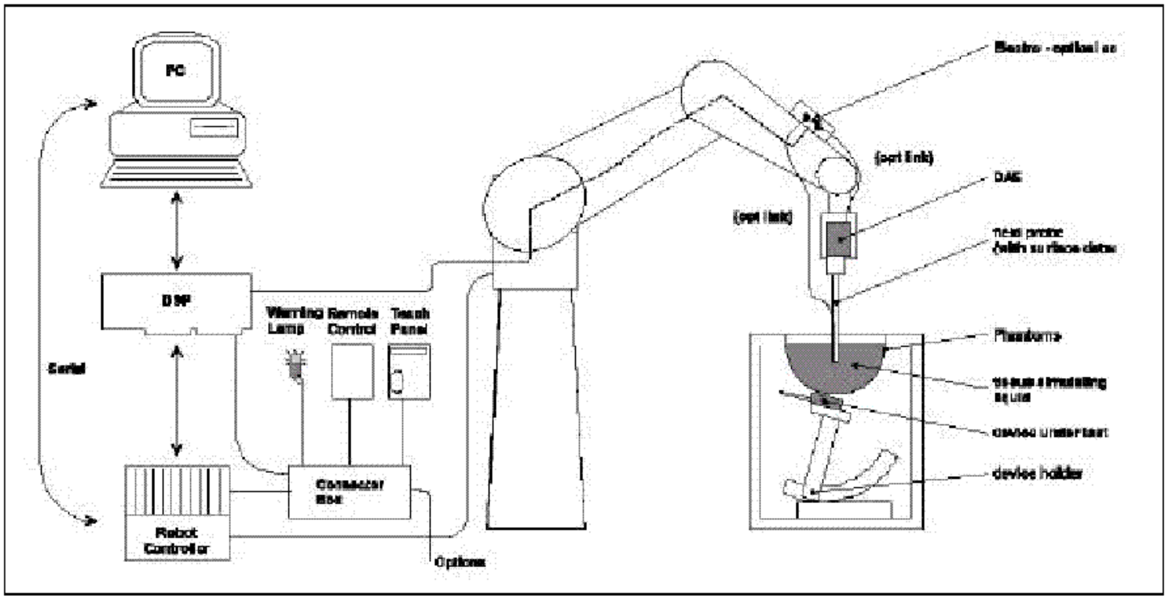
These measurements were performed with the automated near-field scanning system DASY3 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9m) which positions the probes with a positional repeatability of better than ±0.02mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit. The system is described in detail in [3].

The SAR measurements were conducted with the dosimetric probe ET3DV6 SN: 1604 (manufactured by SPEAG), designed in the classical triangular configuration [3] and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure described in [7] with accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure described in [8] and found to be better than ±0.25dB.

The phantom used was the \Generic Twin Phantom" described in [4]. The ear was simulated as a spacer of 4 mm thickness between the earpiece of the phone and the tissue simulating liquid. The Tissue simulation liquid used for each test is in according with the FCC OET65 supplement C as listed below.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (Nacl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton x-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (s/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

6.1 Measurement System Diagram

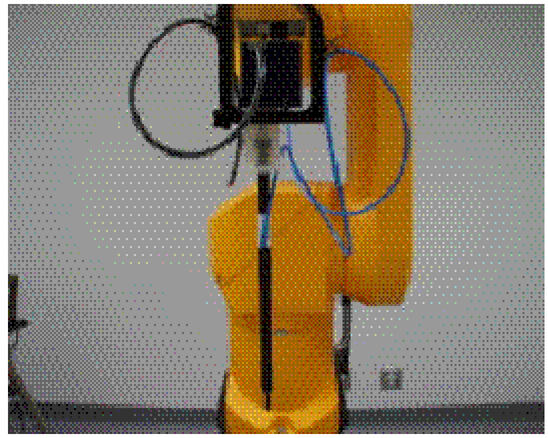


The DASY3 system for performing compliance tests consist of the following items:

1. A standard high precision 6-axis robot (Stäubli RX family) with controller and software.
2. An arm extension for accommodating the data acquisition electronics (DAE).
3. A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
4. A data acquisition electronic (DAE), which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
5. A unit to operate the optical surface detector, which is connected to the EOC. The Electro-optical coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the PC plug-in card. The functions of the PC plug-in card based on a DSP is to perform the time critical task such as signal filtering, surveillance of the robot operation fast movement interrupts.
6. A computer operating Windows 95 or larger
7. DASY3 software
8. Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.
9. The generic twin phantom enabling testing left-hand and right-hand usage.
10. The device holder for handheld EUT.
11. Tissue simulating liquid mixed according to the given recipes (see Application Note).
12. System validation dipoles to validate the proper functioning of the system.

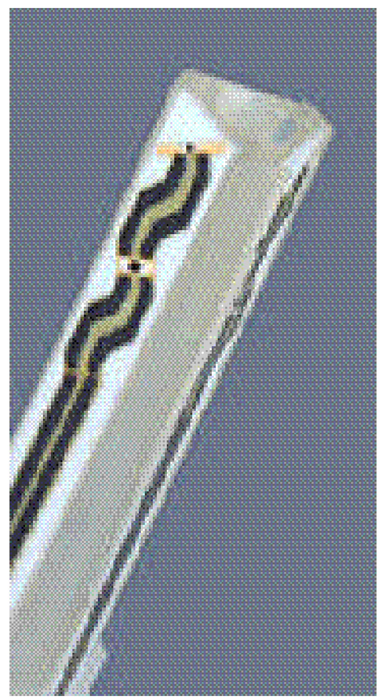
6.2 System Components

ET3DV6 Probe Specification



Photograph of the probe

Construction Symmetrical design with triangular core
Built-in optical fiber for surface detection System
Built-in shielding against static charges
Calibration In air from 10 MHz to 2.5 GHz
In brain and muscle simulating tissue at
Frequencies of 450 MHz, 900 MHz and
1.8 GHz (accuracy ± 8%)
Frequency 10 MHz to > 6 GHz; Linearity: ± 0.2 dB
(30 MHz to 3 GHz)
Directivity ± 0.2 dB in brain tissue (rotation around
probe axis)
± 0.4 dB in brain tissue (rotation normal probe axis)
Dynamic 5 mW/g to > 100 mW/g;
Range Linearity: ± 0.2 dB
Surface ± 0.2 mm repeatability in air and clear liquids
Detection over diffuse reflecting surfaces.
Dimensions Overall length: 330 mm
Tip length: 16 mm
Body diameter: 12 mm
Tip diameter: 6.8 mm
Distance from probe tip to dipole centers: 2.7 mm
Application General dosimetric up to 3 GHz
Compliance tests of mobile phones
Fast automatic scanning in arbitrary phantoms



Inside view of ET3DV6 E-field Probe

The SAR measurements were conducted with the dosimetric probe ET3DV6 designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY3 software reads the reflection during a software approach and looks for the maximum using a 2 nd order fitting. The approach is stopped when reaching the maximum.

E-Field Probe Calibration Process

Each probe is calibrated according to a dosimetric assessment procedure described in [6] with accuracy better than +/- 10%. The spherical isotropy was evaluated with the procedure described in [7] and found to be better than +/-0.25dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies bellow 1 GHz, and in a waveguide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

Data Evaluation

The DASY3 software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe Parameter:	-Sensitivity	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	-Conversion Factor	ConvFi
	-Diode compression point	Dcp_i
Device parameter:	-Frequency	f
	-Crest Factor	cf
Media parameter:	-Conductivity	σ
	-Density	ρ

These parameters must be set correctly in the software. They can either be found in the component documents or be imported into the software from the configuration files issued for the DASY3 components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$Vi = Ui + (Ui)^2 \, cf / dcp_i$$

With Vi = compensated signal of channel i (i =x, y, z)
Ui = input signal of channel i (i =x, y, z)
cf = crest factor of exciting field (DASY parameter)
dcp_i = diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes: $$E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

H-field probes: $$H_i = \sqrt{Vi} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$$

With Vi = compensated signal of channel i (i =x, y, z)
$Norm_i$ = sensor sensitivity of channel i (i =x, y, z)
$\mu V/ (V/m)^2$ for E-field probes
ConF = sensitivity enhancement in solution
a_{ij} = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
Ei = electric field strenggy of channel i in V/m
H_i = diode compression point (DASY parameter)

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \text{Square Root } [(E_x)^2 + (E_y)^2 + (E_z)^2]$$

The primary field data are used to calculate the derived field units.

$$SAR = (E_{tot})^2 \cdot \sigma / (\rho \cdot 1000)$$

With SAR = local specific absorption rate in mW/g
E_{tot} = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm^3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

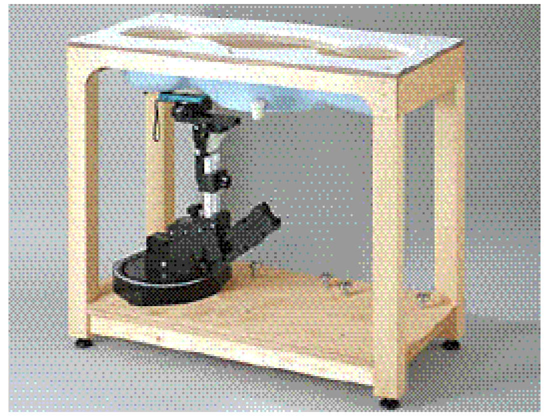
The power flow density is calculated assuming the excitation field as a free space field.

$$P_{pwe} = (E_{tot})^2 / 3770 \text{ or } P_{pwe} = (H_{tot})2 \cdot 37.7$$

With P_{pwe} = equivalent power density of a plane wave in mW/cm3
E_{tot} = total electric filed strength in V/m
H_{tot} = total magnetic filed strength in V/m

Generic Twin Phantom

The Generic Twin Phantom is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users [9][10]. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid. Reference markings on the Phantom allows the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.
Shell Thickness 2 ± 0.1 mm
Filling Volume Approx. 20 liters
Dimensions 810 x 1000 x 500 mm (H x L x W)

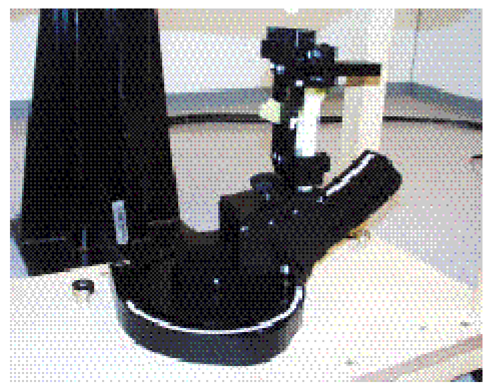


Generic Twin Phantom

Device Holder

In combination with the Generic Twin Phantom V3.0, the Mounting Device enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeatedly positioned according to the FCC and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

* Note: A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produced infinite number of configurations [10]. To produce the worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.



Device Holder

6.3 Measurement Uncertainty

The uncertainty budget has been determined for the DASY3 measurement system according to the NIS81 [13] and the NIST1297 [14] documents and is given in the following Table.

Measurement Uncertainty Analysis per IEEE P1528-2002

Description	Section	Reported Variance (%)	Probability Distribution type	Divisor	Ci (1g)	Ui (1g)	Vi	welc/satt series term
Probe Calibration	E.2.1	4.80	N	1	1	4.80	1.00E+09	5.30842E-07
Axial isotropy	E.2.2	4.70	R	1.732	0.707107	1.92	1.00E+09	1.35563E-08
Hemispherical isotropy	E.2.2	9.60	R	1.732	0.707107	3.92	1.00E+09	2.35957E-07
Boundary effects	E.2.3	8.30	R	1.732	1	4.79	1.00E+09	5.27377E-07
Linearity	E.2.4	4.70	R	1.732	1	2.71	1.00E+09	5.4225E-08
System Detection Limit	E.2.5	1.00	R	1.732	1	0.58	1.00E+09	1.11124E-10
Readout Electronics	E.2.6	0.00	N	1	1	0.00	1.00E+09	0
Response time	E.2.7	0.00	R	1.732	1	0.00	1.00E+09	0
Integration time	E.2.8	0.00	R	1.732	1	0.00	1.00E+09	0
RF Ambient conditions	E.6.1	3.00	R	1.732	1	1.73	1.00E+09	9.00106E-09
Probe positioning mechanical tolerance	E.6.2	0.40	R	1.732	1	0.23	1.00E+09	2.84478E-12
Probe positioning wrt phantom shell	E.6.3	2.90	R	1.732	1	1.67	1.00E+09	7.8596E-09
Extra/inter-polation & integration algorithmsfor max SAR evaluation	E.5.2	3.90	R	1.732	1	2.25	1.00E+09	2.57079E-08
Test sample positioning	8, E.4.2	6.00	R	1.732	1	3.46	1.00E+09	1.44017E-07
Device holder distance tolerance	E.4.1	5.00	N	1	1	5.00	1.00E+09	0.000000625
Output power and SAR drift measurement	8, E.6.6.2	5.00	R	1.732	1	2.89	1.00E+09	6.94526E-08
Phantom uncertainty, shell thickness tolerance	E.3.1	4.00	R	1.732	1	2.31	1.00E+09	2.84478E-08
Liquid conductivity, deviation from target values	E.3.2	5.00	R	1.732	0.64	1.85	1.00E+09	1.16522E-08
Liquid conductivity, measurement uncertainty	E.3.3	5.00	N	1	0.64	3.20	5	20.97152
Liquid permitivity, deviation from target values	E.3.2	5.00	R	1.732	0.6	1.73	1.00E+09	9.00106E-09
Liquid permitivity, measurement uncertainty	E.3.3	5.00	N	1	0.6	3.00	5	16.2
								689

Probe isotropy sensitivity coefficient **0.5**

Combined Standard Uncertainty **12.65 %**

Expanded Uncertainty, 95% **k= 2.0036** **25.34 %**

7 - SYSTEM EVALUATION

7.1 Simulated Tissue Liquid Parameter Confirmation

The dielectric parameters were checked prior to assessment using the HP85070A dielectric probe kit. The dielectric parameters measured are reported in each correspondent section:

7.2 Evaluation Procedures

Maximum Search

The maximum search is automatically performed after each coarse scan measurement. It is based on splines in two or three dimensions. The procedure can find the maximum for most SAR distributions even with relatively large grid spacings. After the coarse scan measurement, the probe is automatically moved to a position at the interpolated maximum. The following scan can directly use this position for reference, e.g., for a finer resolution grid or the cube evaluations.

Extrapolation

The extrapolation can be used in z-axis scans with automatic surface detection. The SAR values can be extrapolated to the inner phantom surface. The extrapolation distance is the sum of the probe sensor offset, the surface detection distance and the grid offset. The extrapolation is based on fourth order polynomal functions. The extrapolation is only available for SAR values.

Boundary Corrections

The correction of the probe boundary effect in the vicinity of the phantom surface can be done in two different ways. In the standard (worse case) evaluation, the boundary effect is reduced by different weights for the lowest measured points in the extrapolation routine. The result is a slight overestimation of the extrapolated SAR values (2% to 8%) depending on the SAR distribution and gradient. The advanced evaluation makes a full compensation of the boundary effect before doing the extrapolation. This is only possible of probes with specifications on the boundary effect.

Peak Search for 1g and 10g cube averaged SAR

The 1g and 10g peak evaluations are only available for the predefined cube 4x4x7 and cube 5x5x7 scans. The routine are verified and optimized for the grid dimensions used in these cube measurements. The measured volume of 32x32x35mm contains about 35g of tissue. The first procedure is an extrapolation (incl. Boundary correction) to get the points between the lowest measured plane and the surface. The next step uses 3D interpolation get all points within the measured volume in a 1mm grid (35000 points). In the last step, a 1g cube is place numerically into the volume and its averaged SAR is calculated. This cube is the moved around until the highest averaged SAR is found. This last procedure is repeated for a 10g cube. If the highest SAR is found at the edge of the measured volume, the system will issue a warning,: higher SAR values might be found outside of the measured volume. In that case the cube measurement can be repeated, using the new interpolated maximum as the center.

7.3 System Accuracy Verification

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of ±10%. The validation results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

IEEE P1528 recommended reference value for Head

Frequency (MHz)	1 g SAR	10 g SAR	Local SAR at surface (above feed point)	Local SAR at surface (v=2cm offset from feed point)
300	3.0	2.0	4.4	2.1
450	4.9	3.3	7.2	3.2
835	9.5	6.2	14.1	4.9
900	10.8	6.9	16.4	5.4
1450	29.0	16.0	50.2	6.5
1800	38.1	19.8	69.5	6.8
1900	39.7	20.5	72.1	6.6
2000	41.1	21.1	74.6	6.5
2450	52.4	24.0	104.2	7.7
3000	63.8	25.7	140.2	9.5

Validation Dipole SAR Reference Test Result for Body (2450 MHz)

Validation Measurement	SAR @ 0.025W Input averaged over 1g	SAR @ 1W Input averaged over 1g	SAR @ 0.025W Input averaged over 10g	SAR @ 1W Input averaged over 10g
Test 1	14.2	56.80	6.33	25.32
Test 2	14.3	57.20	6.34	25.36
Test 3	14.2	56.80	6.33	25.32
Test 4	14.1	56.40	6.32	25.28
Test 5	14.3	57.20	6.33	25.32
Test 6	14.0	56.00	6.31	25.24
Test 7	14.2	56.80	6.33	25.32
Test 8	14.2	56.80	6.33	25.32
Test 9	14.4	57.60	6.34	25.36
Test 10	14.2	56.80	6.32	25.28
Average	14.21	56.84	6.32	25.31

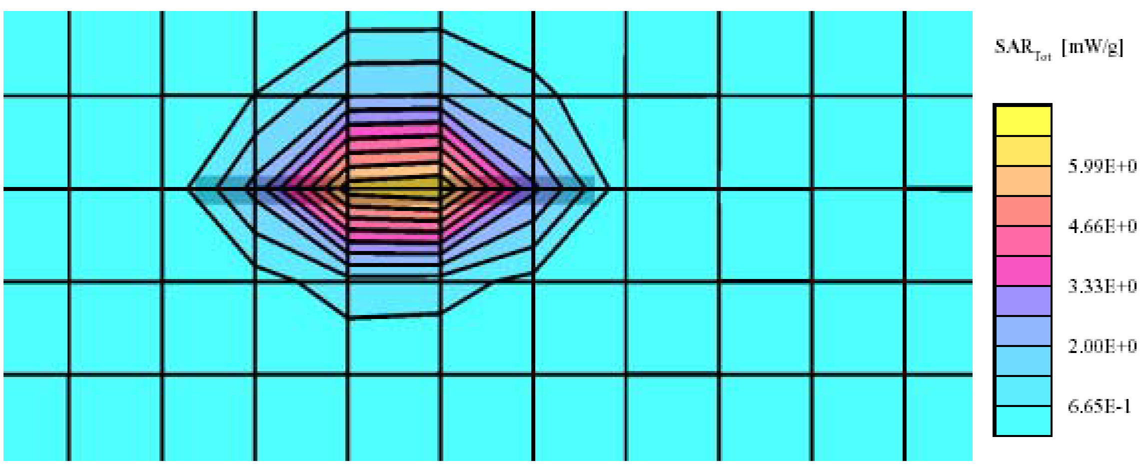
System validation result

Simulant	Freq [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation [%]	Limits [%]
Body	2450	ε	22	52.7	51.2	-2.85	±5
		σ	22	1.95	1.97	1.03	±5
		1g SAR	22	56.84	55.20	-2.89	±10
Head	2450	ε	21	39.2	39.3	0.26	±5
		σ	21	1.80	1.82	1.11	±5
		1g SAR	21	52.4	54.00	3.05	±10

ε = relative permittivity, σ = conductivity and ρ=1000kg/m^3
Note: Forward power = 107.6 mW

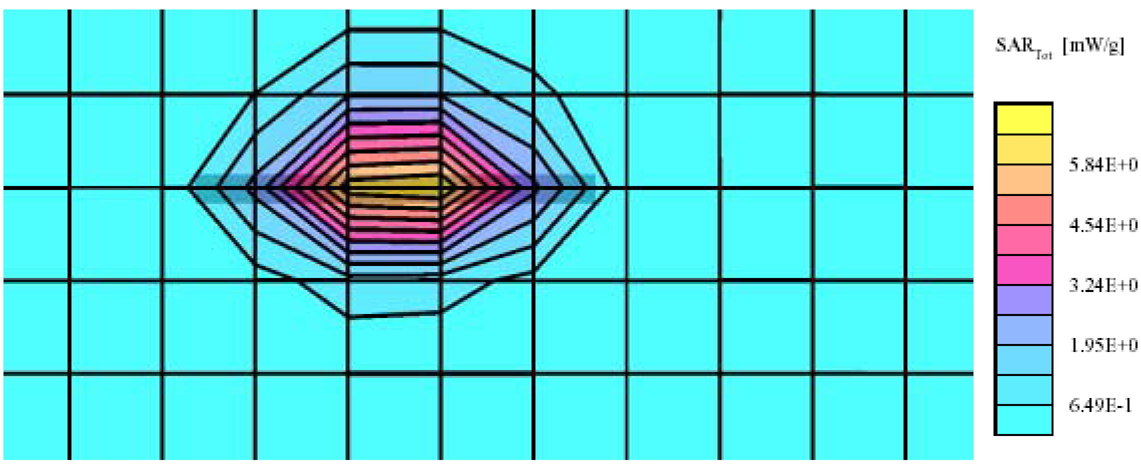
2450 MHz Body Liquid System Validation (Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, Forward Power = 20.2 dBm, 2/9/2004)

SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2450 MHz
Probe: ES3DV2 - SN3019; ConvF(4.20,4.20,4.20); Crest factor: 1.0; 2450 MHz: σ = 1.97 mho/m ε_r = 51.2 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 5.94 mW/g, SAR (10g): 2.41 mW/g, (Worst-case extrapolation)
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0
Powerdrift: -0.01 dB



2450 MHz Head Liquid System Validation (Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, Forward Power = 20.3 dBm, 2/9/2004)

SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2450 MHz
Probe: ES3DV2 - SN3019; ConvF(4.50,4.50,4.50); Crest factor: 1.0; 2450 MHz Head Liquid: σ = 1.82 mho/m ε_r = 39.3 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 5.81 mW/g, SAR (10g): 2.36 mW/g, (Worst-case extrapolation)
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0
Powerdrift: -0.02 dB



7.4 SAR Evaluation Procedure

a. The evaluation was performed in the applicable area of the phantom depending on the type of device being tested. For device held to the dear during normal operation, both the left and right ear positions were evaluated in accordance with FCC OET Bulletin 65, Supplement C (Edition 01-01) using the SAM phantom. For body-worn and face-held devices a planar phantom was used. The EUT in the test setup for body-worn and face-held devices was placed in three different positions (relative to the phantom): parallel, bystand (perpendicular) and 1.5cm separation.
b. The SAR was determined by a pre-defined procedure within the DASY3 software. Upon completion of a reference and optical surface check, the exposed region of the phantom was scanned near the inner surface with a grid spacing of 20mm x 20mm.
c. A 5x5x7 matrix was performed around the greatest special SAR distribution found during the area scan of the applicable exposed region. SAR values were then calculated using a 3-D spline interpolation algorithm and averaged over spatial volumes of 1 and 10 grams.
d. The depth of the simulating tissue in the planar used for the SAR evaluation and system validation was no less than 15.0cm.
e. For this particular evaluation, a stack of low-density, low-loss dielectric foamed polystyrene was used in place of the device holder.
f. Re-measurement of the SAR value at the same location as in a. If the value changed by more than 5%, the evaluation was repeated.

7.5 Exposure Limits

Table 1: Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands. Wrists. Feet and Ankles
0.4	8.0	20.0

Table 2: Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands. Wrists. Feet and Ankles
0.08	1.6	4.0

Note: Whole-body SAR is averaged over the entire body, partial-body SAR is averaged over any 1 gram of tissue defined as a tissue volume in the shape of a cube SAR for hands, writs, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

Population/Uncontrolled Environments are defined as locations where there is the exposure of individual who have no knowledge or control of their exposure.

Occupational/Controlled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).

Population/uncontrolled environments Partial-body limit 1.6W/kg applied to the EUT.

8 - TEST RESULTS

This page summarizes the results of the performed dosimetric evaluation. The plots with the corresponding SAR distributions, which reveal information about the location of the maximum SAR with respect to the device could be found in the following pages.

According to the data in section 6.1, the EUT complied with the FCC 2.1093 RF Exposure standards, with worst case of **0.689mW/g**.

8.1 SAR Body-Worn Test Data

Ambient Temperature (ºC): 23.0
Relative Humidity (%): 53.5

Worst case SAR reading

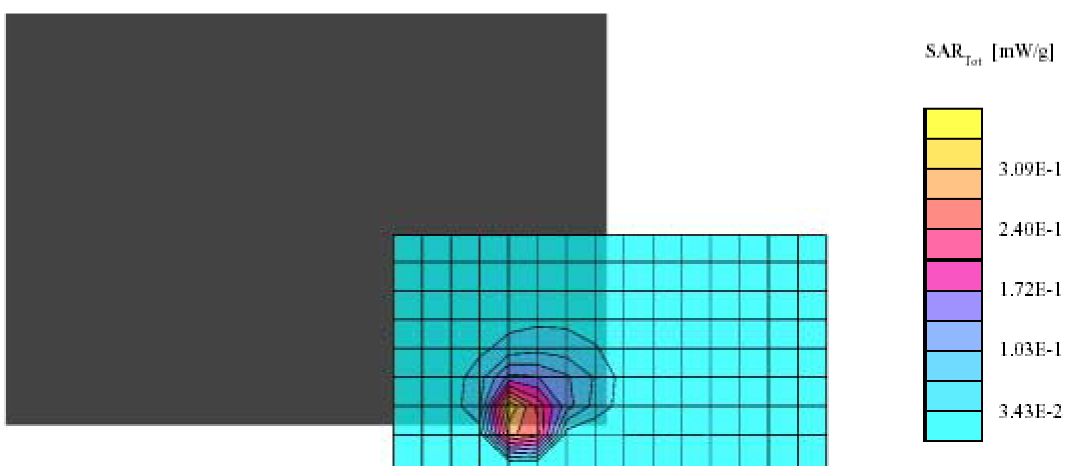
Mode	Port	EUT position	Frequency (MHz)	Output Power (W)	Test Type	Notebook Postion	Liquid	Phantom	Measured (mW/g)	Limit (mW/g)	Plot #
802.11b	J2	Top touching, antenna at right	2437	0.0562	Body worn	Cover Closed	body	flat	0.407	1.6	1
802.11g	J1	Top touching, antenna at left	2437	0.0004	Body worn	Cover Closed	body	flat	0.0123	1.6	2
	J2	Top touching, antenna at right	2437	0.0562	Body worn	Cover Closed	body	flat	0.689	1.6	3
	J1	Perpendicular touching, antenna at left	2437	0.0004	Body worn	Cover Closed	body	flat	0.0265	1.6	4
	J2	Perpendicular touching, antenna at right	2437	0.0562	Body worn	Cover Closed	body	flat	0.287	1.6	5
	J1	Bottom touching, antenna at left	2437	0.0004	Body worn	Cover Closed	body	flat	0.0017	1.6	6
	J2	Bottom touching, antenna at right	2437	0.0562	Body worn	Cover Closed	body	flat	0.0025	1.6	7

8.2 Plots of Test Result

The plots of test result were attached as reference.

Ambit, T60H713 (Notebook cover closed top side touching flat phantom, Antenna Position: Right side (J2), Middle Channel, Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 2/9/2004)

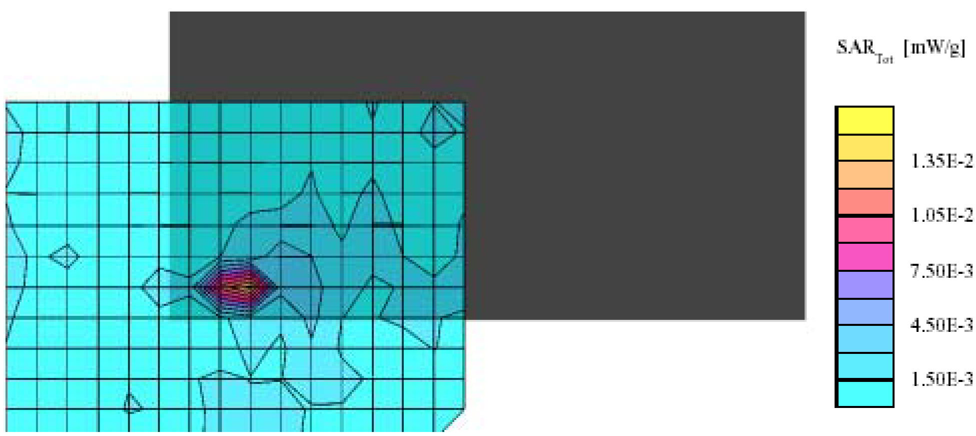
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2437 MHz
Probe: ES3DV2 - SN3019; ConvF(4.20,4.20,4.20); Crest factor: 1.0; 2450 MHz : σ = 1.97 mho/m ε_r = 51.2 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 0.407 mW/g, SAR (10g): 0.161 mW/g, (Worst-case extrapolation)
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0
Powerdrift: 0.02 dB



Plot # 1

Ambit, T60H713 (Notebook cover closed top side touching flat phantom, Antenna Position: Left side (J1), Middle Channel, Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 2/9/2004)

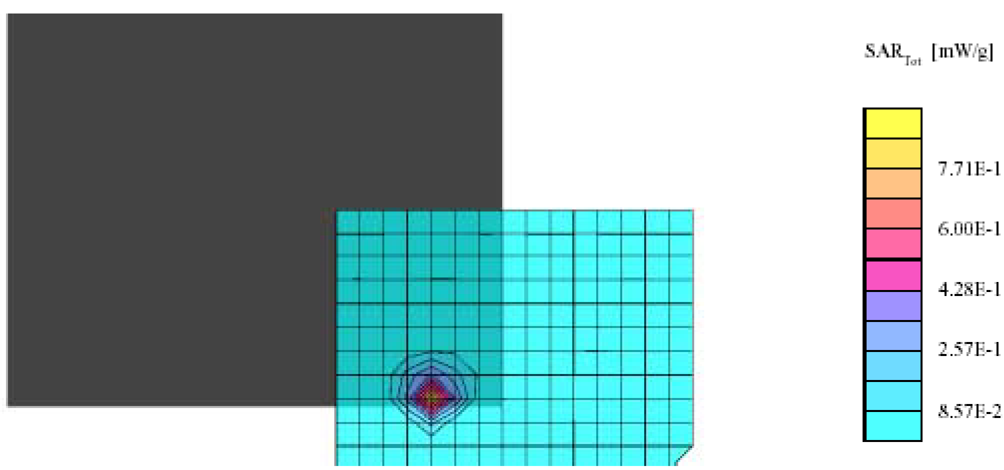
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2437 MHz
Probe: ES3DV2 - SN3019; ConvF(4.20,4.20,4.20); Crest factor: 1.0; 2450 MHz : σ = 1.97 mho/m ε_r = 51.2 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 0.0123 mW/g, SAR (10g): 0.0050 mW/g, (Worst-case extrapolation)
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0
Powerdrift: 0.04 dB



Plot # 2

Ambit, T60H713 (Notebook cover closed top side touching flat phantom, Antenna Position: Right side (J2), Middle Channel, Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 2/9/2004)

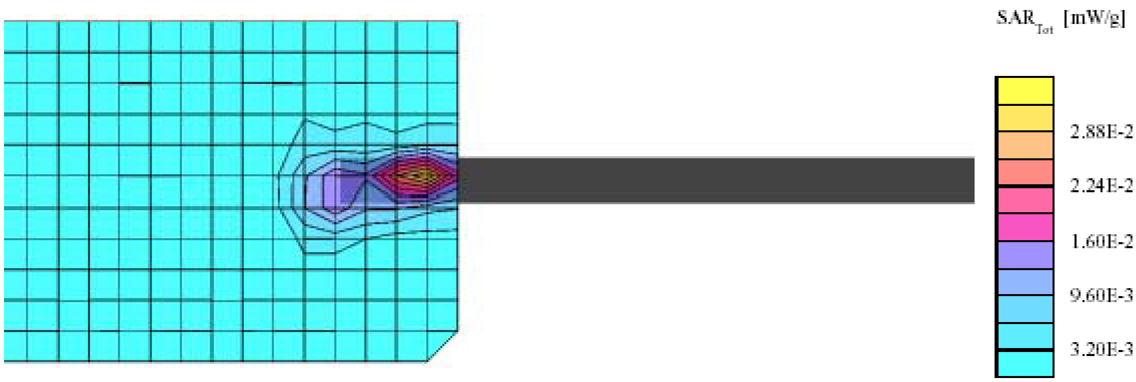
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2437 MHz
Probe: ES3DV2 - SN3019; ConvF(4.20,4.20,4.20); Crest factor: 1.0; 2450 MHz : σ = 1.97 mho/m ε_r = 51.2 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 0.689 mW/g, SAR (10g): 0.261 mW/g, (Worst-case extrapolation)
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0
Powerdrift: -0.05 dB



Plot # 3

Ambit, T60H713 (Notebook cover closed perpendicular touching flat phantom, Antenna Position: Left side (J1), Middle Channel, Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 2/9/2004)

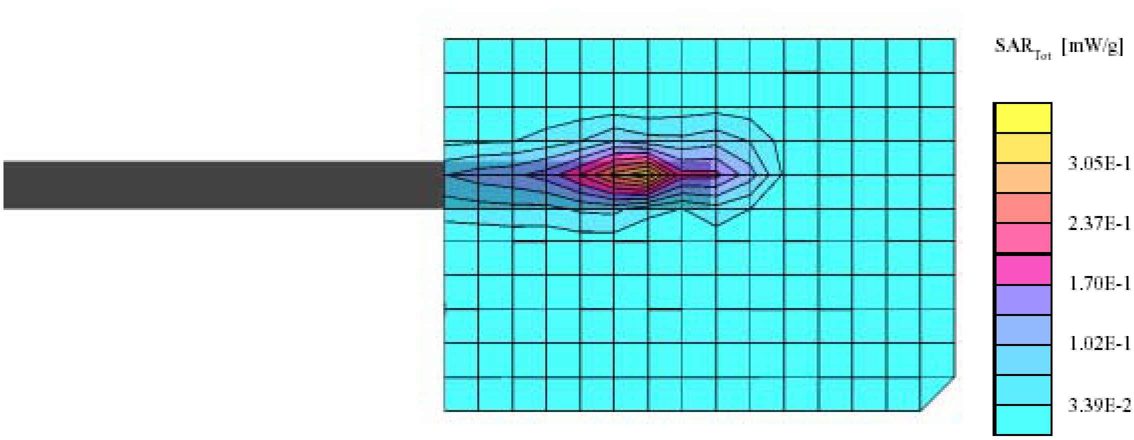
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2437 MHz
Probe: ES3DV2 - SN3019; ConvF(4.20,4.20,4.20); Crest factor: 1.0; 2450 MHz : σ = 1.97 mho/m ε_r = 51.2 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 0.0265 mW/g, SAR (10g): 0.0113 mW/g, (Worst-case extrapolation)
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0
Powerdrift: 0.05 dB



Plot # 4

Ambit, T60H713 (Notebook cover closed perpendicular touching flat phantom, Antenna Position: Right side (J2), Middle Channel, Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 2/9/2004)

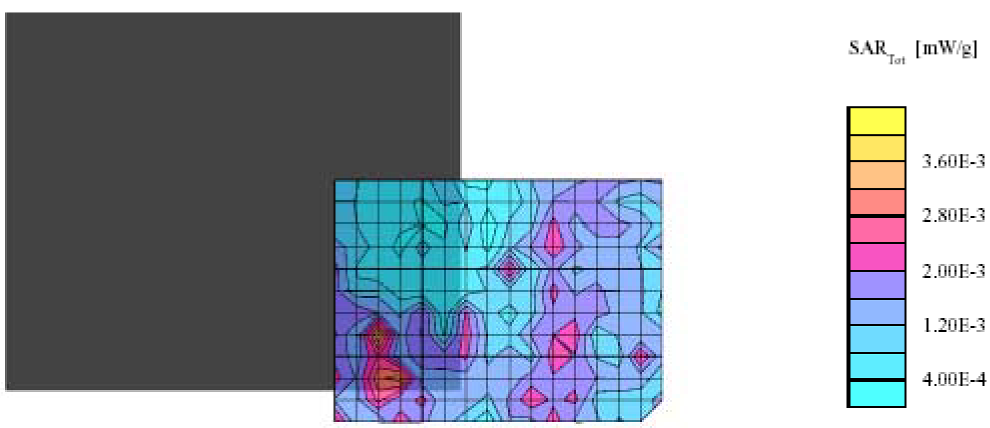
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2437 MHz
Probe: ES3DV2 - SN3019; ConvF(4.20,4.20,4.20); Crest factor: 1.0; 2450 MHz : σ = 1.97 mho/m ε_r = 51.2 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 0.287 mW/g, SAR (10g): 0.117 mW/g, (Worst-case extrapolation)
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0
Powerdrift: 0.03 dB



Plot # 5

Ambit, T60H713 (Notebook cover closed bottom side touching flat phantom, Antenna Position: Left side (J1), Middle Channel, Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 2/9/2004)

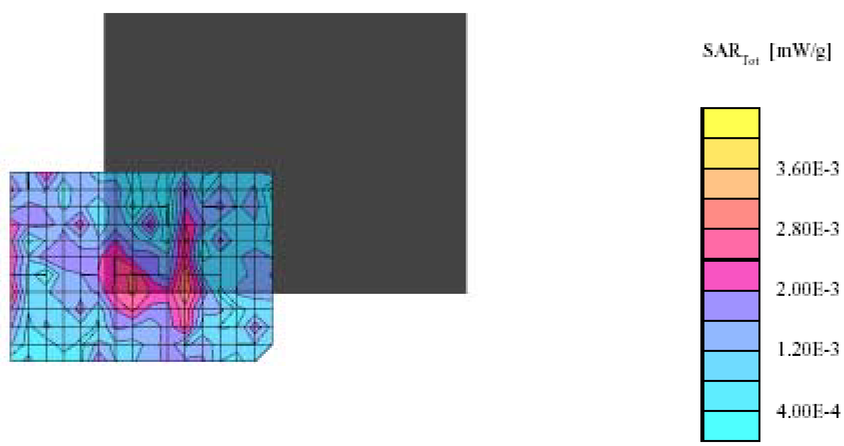
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2437 MHz
Probe: ES3DV2 - SN3019; ConvF(4.20,4.20,4.20); Crest factor: 1.0; 2450 MHz : σ = 1.97 mho/m ε_r = 51.2 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 0.0017 mW/g, SAR (10g): 0.0020 mW/g, (Worst-case extrapolation)
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0
Powerdrift: -0.05 dB



Plot # 6

Ambit, T60H713 (Notebook cover closed bottom side touching flat phantom, Antenna Position: Right side (J2), Middle Channel, Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 2/9/2004)

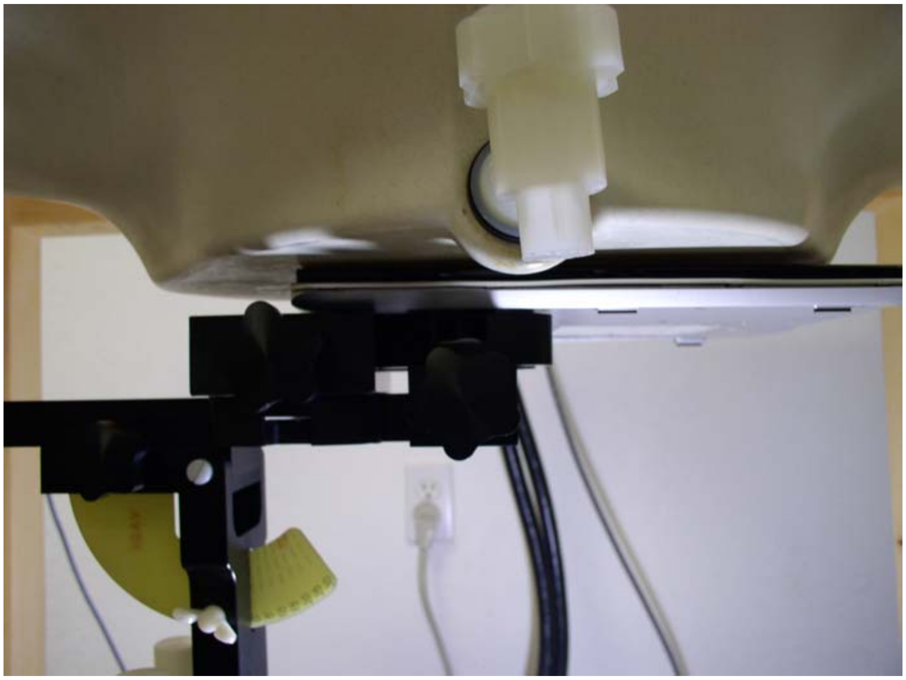
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2437 MHz
Probe: ES3DV2 - SN3019; ConvF(4.20,4.20,4.20); Crest factor: 1.0; 2450 MHz : σ = 1.97 mho/m ε_r = 51.2 ρ = 1.00 g/cm³
Cubes (2): SAR (1g): 0.0025 mW/g, SAR (10g): 0.0021 mW/g, (Worst-case extrapolation)
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0
Powerdrift: 0.04 dB



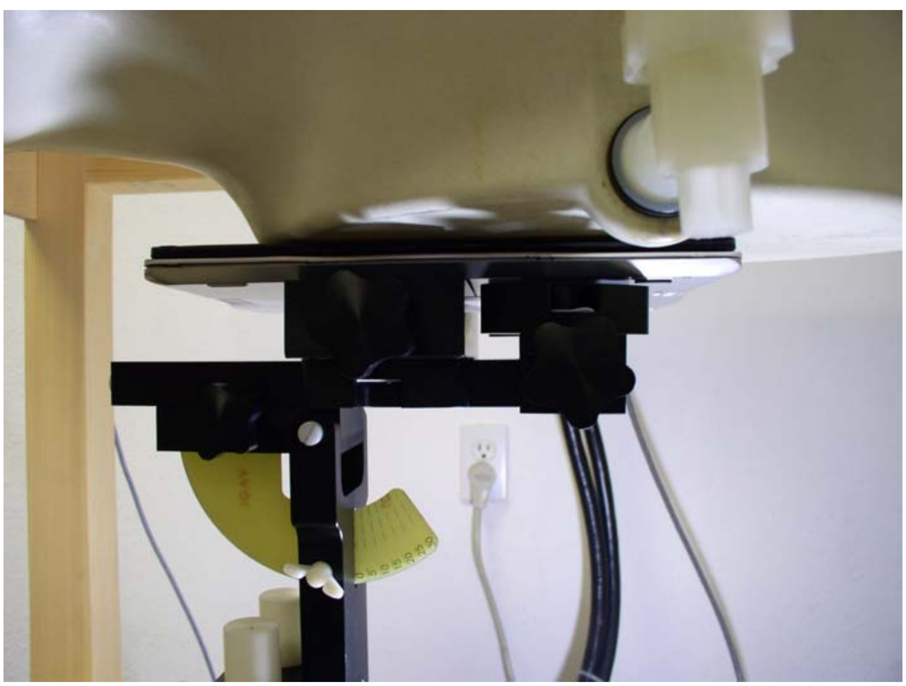
Plot # 7

EXHIBIT A - SAR SETUP PHOTOGRAPHS

Notebook Cover Closed, Top Touching, J1, Antenna at Left



Notebook Cover Closed, Top Touching, J2, Antenna at Right



Notebook Cover Closed, Perpendicular Touching, J1, Antenna at Left

Notebook Cover Closed, Perpendicular Touching, J2, Antenna at Right

Notebook Cover Closed, Bottom Touching, J1, Antenna at Left

Notebook Cover Closed, Bottom Touching, J2, Antenna at Right

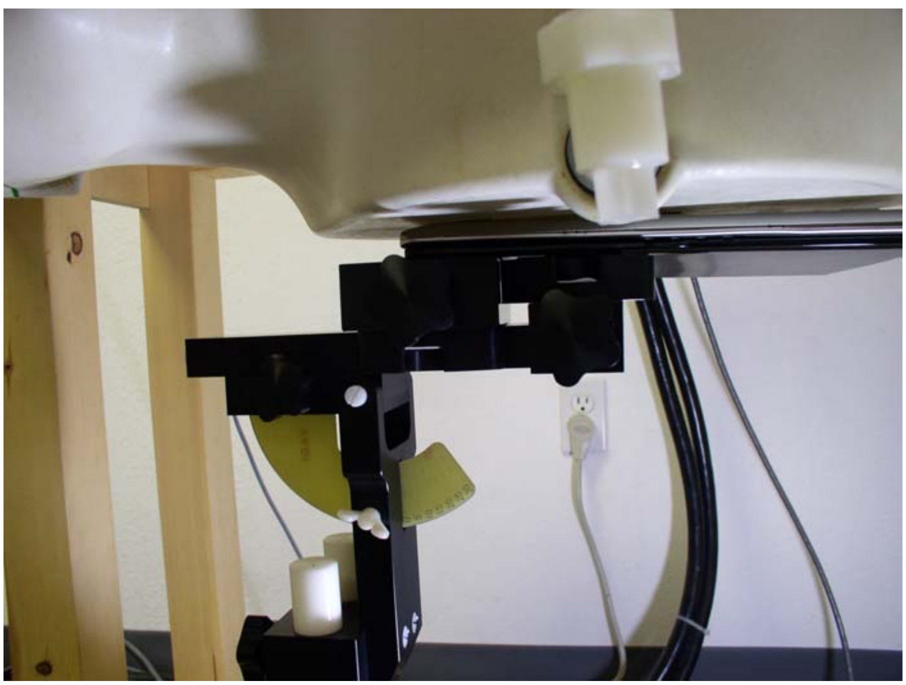


EXHIBIT B - EUT PHOTOGRAPHS

EUT – Component with Shield

EUT – Component View

EUT – Solder View

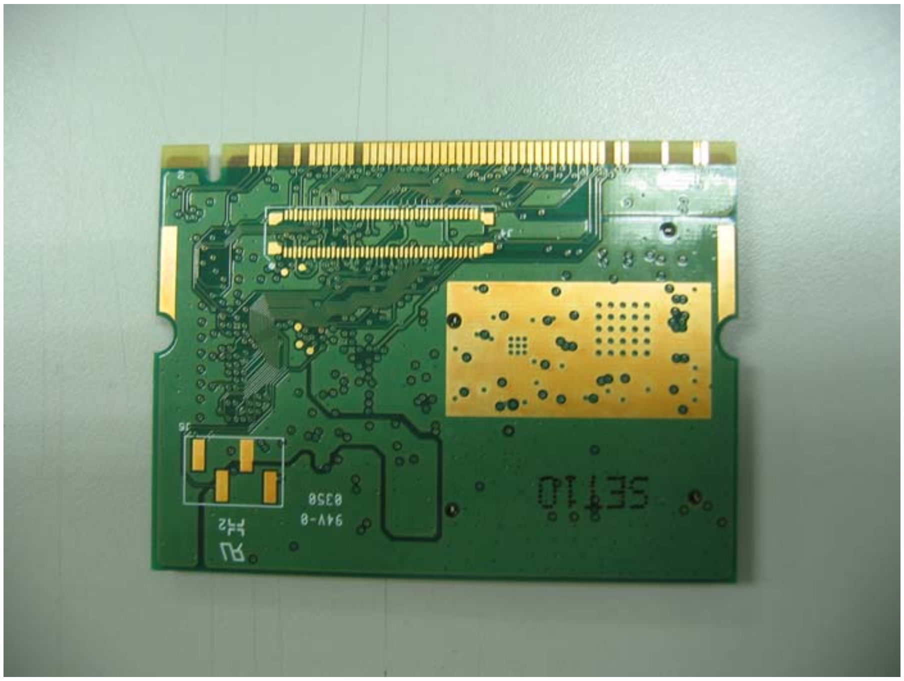


EXHIBIT C – Z-Axis

Ambit, T60H713 (Notebook cover closed top side touching flat phantom, Antenna Position: Left side (J2), Middle Channel, Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 2/9/2004)

SAM Phantom; Section; Position: ; Frequency: 2437 MHz

Probe: ES3DV2 - SN3019; ConvF(4.20,4.20,4.20); Crest factor: 1.0; 2450 MHz : σ = 1.97 mho/m ε_r = 51.2 ρ = 1.00 g/cm³

: , 0

Z-Axis: Dx = 0.0, Dy = 0.0, Dz = 2.0