SAR EVALUATION REPORT

For

GENEX TELECOM CO., LTD.

6F FARMAX B/D 796-27 Bangbae-Dong, Seocho-Gu,
Seoul, 137-830, Korea

FCC ID: PM3GX80

This Report Concerns: ☒ Original Report	**Equipment Type:** Transceiver, VHF, PTT
Test Engineer:	Eric Hong
Report No.:	R0402182S2
Report Date:	2004-06-14
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

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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 C95.3-1992 [6] for an uncontrolled environment and 8 mW/g for occupational population (Paragraph 65). According to the Supplement C of OET Bulletin 65 (01-2001) “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 for uncontrolled environment and 8 mW/g for occupational population 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, please see following table for testing result summary:

Ambient Temperature (ºC): 23.0
Relative Humidity (%): 49.3

Worst case SAR reading

EUT position	Frequency (MHz)	Conducted Power (W)	Test Type	Antenna Type	Liquid	Phantom	Notes / Accessories	Measured (mW/g)		Limit (mW/g)	Plot #
								100%	50% duty cycle		
2.5 cm head separation to phantom	163	4.875	Face-held	Built-in	head	flat	none	0.106	0.053	8	1
back in touch with phantom	163	4.875	Body worn	Built-in	body	flat	Belt Clip and Headset	0.118	0.059	8	2

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 Equipment List & Calibration Info

Equipment Type	Model	Manufacturer	Serial No.	Cal. Date
Amplifer, Power	2HL-2-8	Mini-Circuits		N/R
Amplifier, Pre	8449B	Agilent	3008A01978	3/8/2004
Amplifier, Pre, microwave	8449B	HP	3008A00277	3/14/2001
Amplifier, RF Power	503L	ENI	285	N/R
Analyzer, Network	8752C	HP	3410A02356	8/11/2002
Analyzer, Radio Communication	MT88024	Anritsu	84442	9/10/2002
Analyzer, Spectrum , RF	8566A	HP	2240A01930	N/R
Antenna, Dipole	D-1800-S-2	Aprel	BCL-049	3/6/2003
Antenna, Dipole	D-2450-S-1	Aprel	BCL-141	N/R
Antenna, Dipole	D450V2	N/A	1010	1/24/2003
Antenna, Dipole	D900V2	N/A	122	10/3/2003
Antenna, Dipole	DS100V2	N/A	1001	8/18/2003
Antenna, Logperiodic		HTM	N/A	N/R
Calibrator, Digital	ST-089	Electronic Digital Caliper	211371	N/R
CDMA MS test set	E6393A	Agilent	JP1MJ00416	3/7/2003
Controller		STAUBLI	F01/5J72A1/A/01	N/R
DASY3 Professional Dosimetric System	DASY3	SPEAG	N/A	N/R
Generator, Signal	8657A	HP	3217A04699	8/23/2002
Generator, Signal	83650B	HP	3614A00276	1/29/2004
Meter, Power	E4419B	Agilent	MY4121511	10/25/2001
Probe, Dielectric Kit	85070A	Agilent	N/A	self
Probe, Dummy	ET3DV6	SPEAG	1604	N/R
Probe, SPEAG E-Field	ES3DV2	SPEAG	3019	10/9/2003
Robot RX60L	RX60L	SPEAG	F00/5H31A1/A/01	N/R
Scale, Weight	ACS-3D	AI	603101182	N/R
Scale, Weight	MS-7400	Measurement Specialities	N/A	N/R
Sensor, Power	E4412A	Agilent	US384885142	10/17/2002
Sensor, SPEAG Light Alignment	SPEAG Light Alignment Sensor	SPEAG	278	N/R
SPEAG Generic Twin Phantom	SPEAG Generic Twin Phantom	SPEAG	N/A	N/R

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.

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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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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

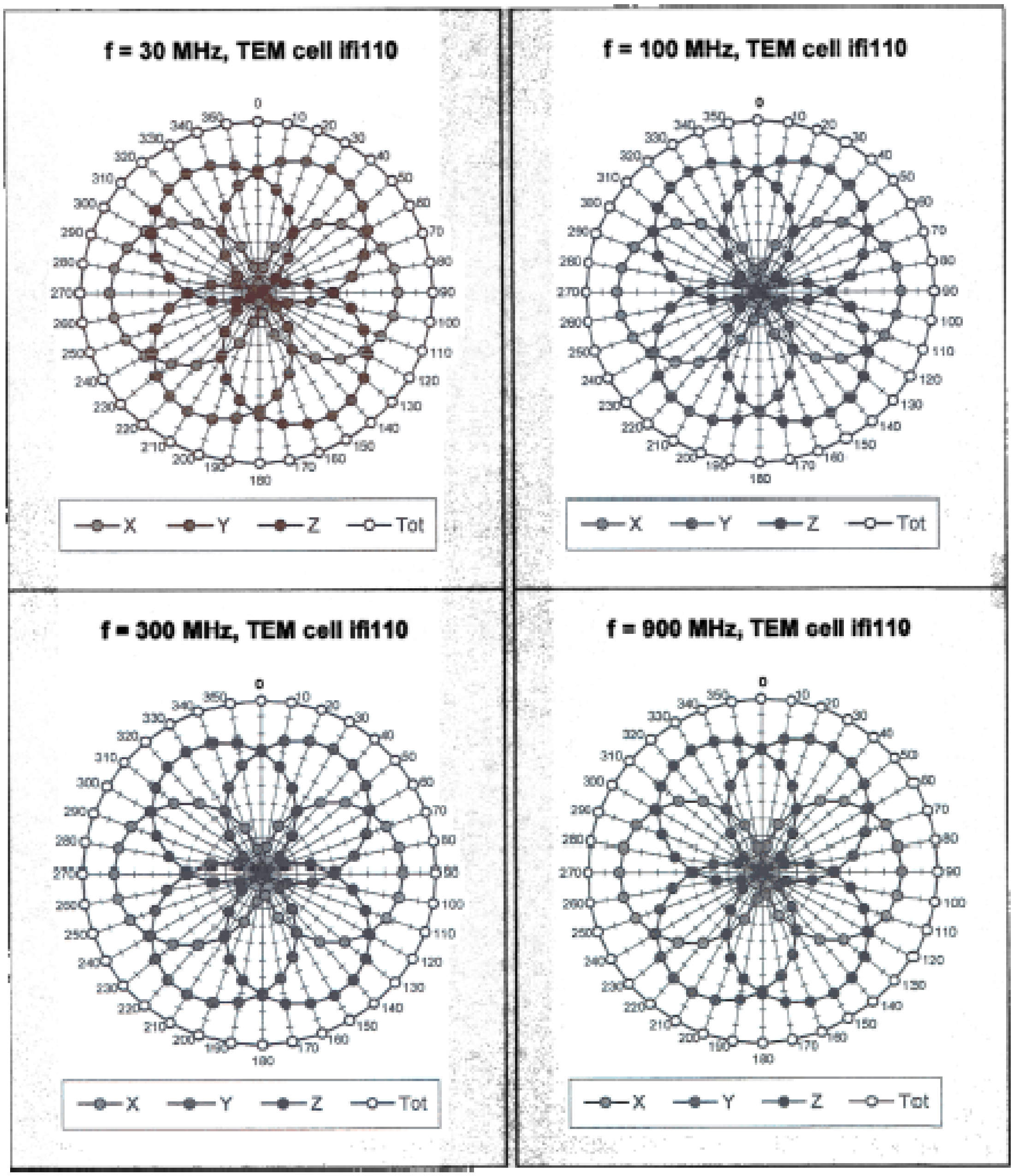
Probe Tip to Boundary	**1 mm**	**2 mm**
SAR_{be} [%] Without Correction Algorithm	7.4	5.0
SAR_{be} [%] With Correction Algorithm	0.0	0.1

Sensor Offset

Probe Tip to Sensor Center	**2.1**	mm

ES3DV2 SN: 3019 July 12, 2003

Receiving Pattern (ϕ , $\theta = 0°$)



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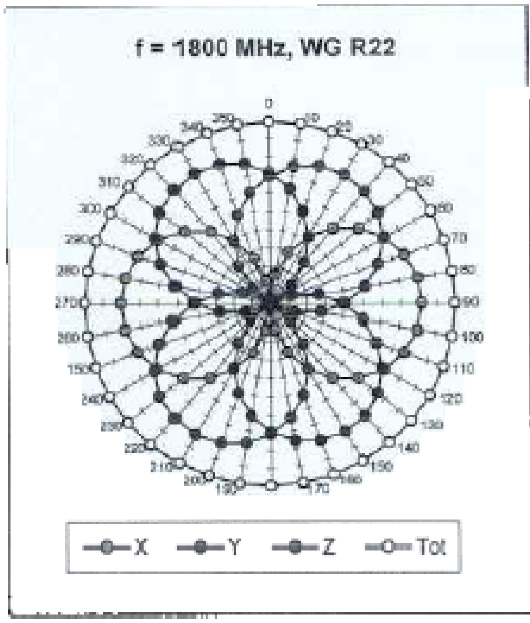
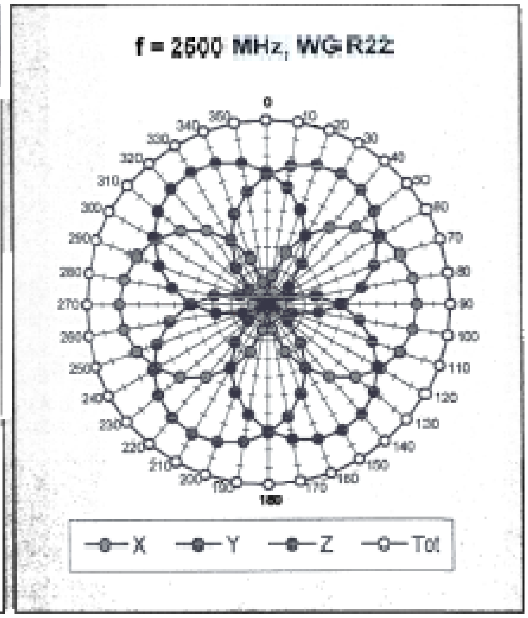
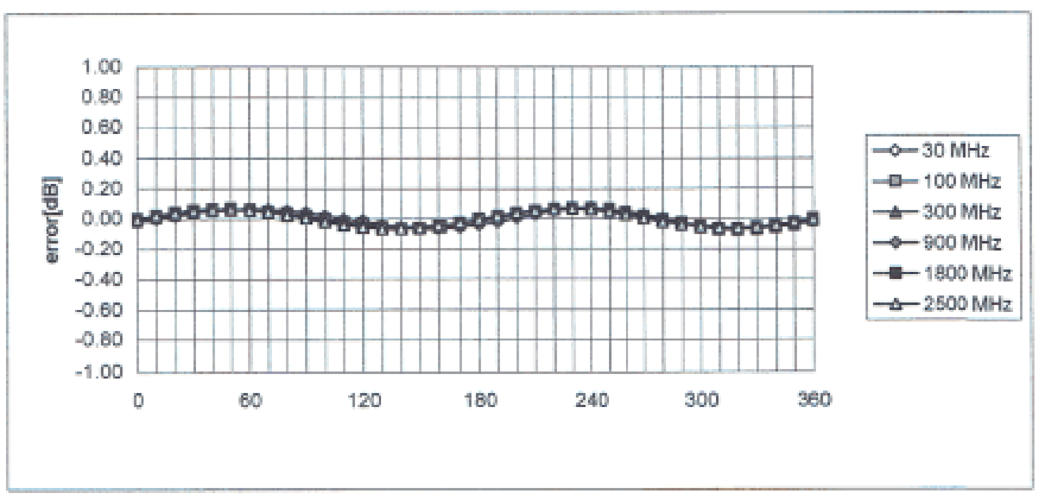




Isotropy Error (ϕ), θ 0°



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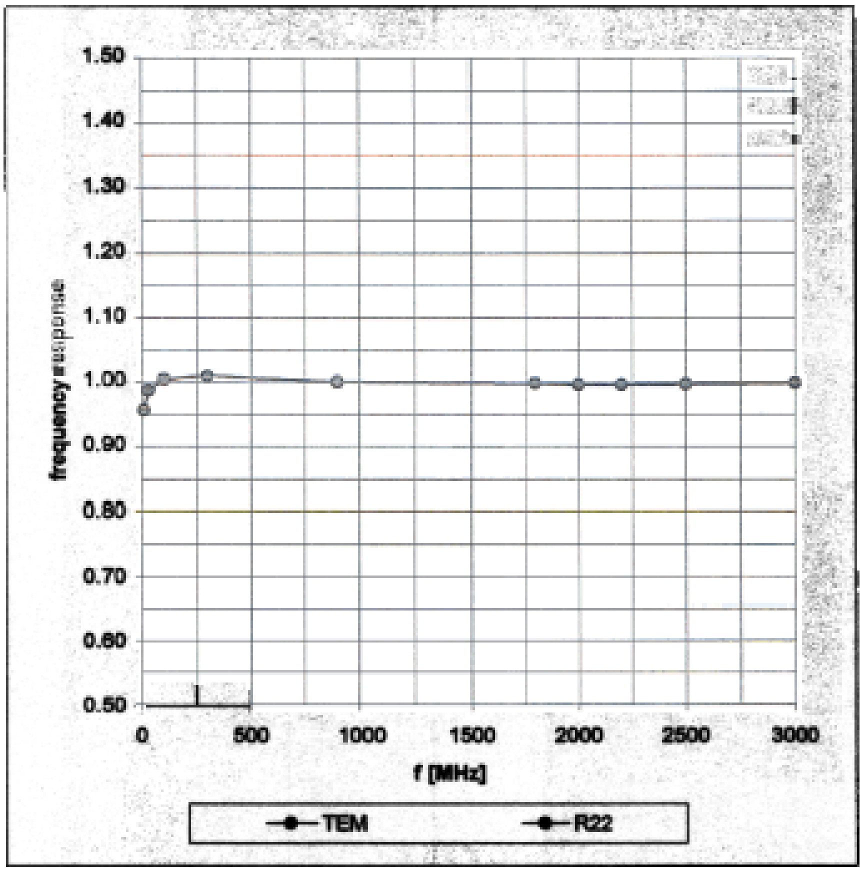
ES3DV2 SN: 3019 July 12, 2003

Frequency Response of E-Field

(TEM-Cell:ifi110, Waveguide R22)



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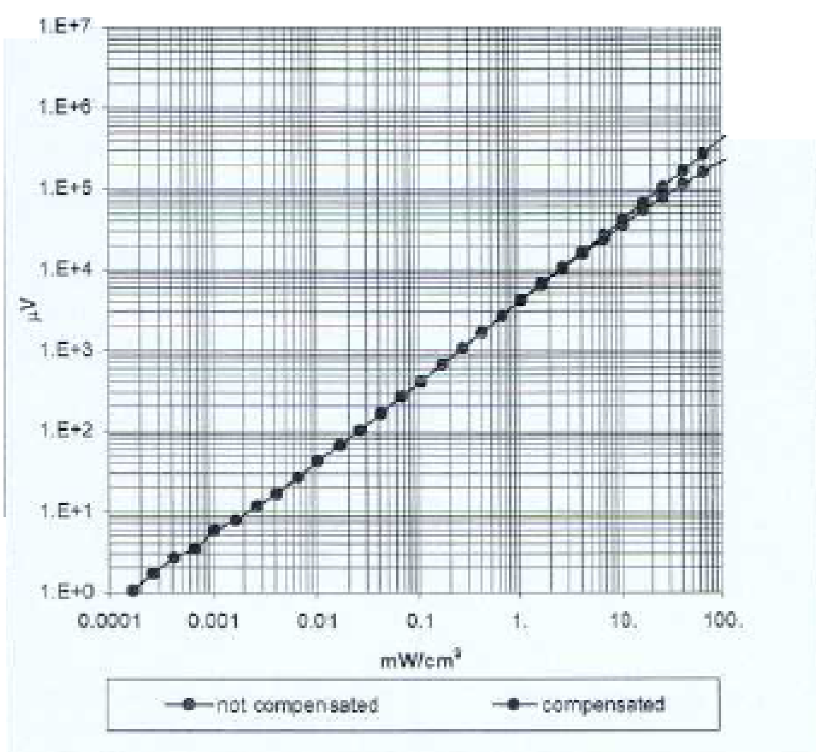
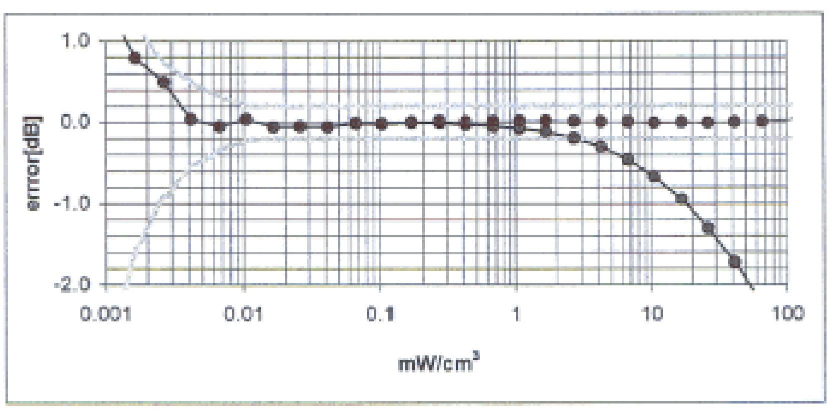
Dynamic Range f(SAR_{brain})

(Waveguide R22)





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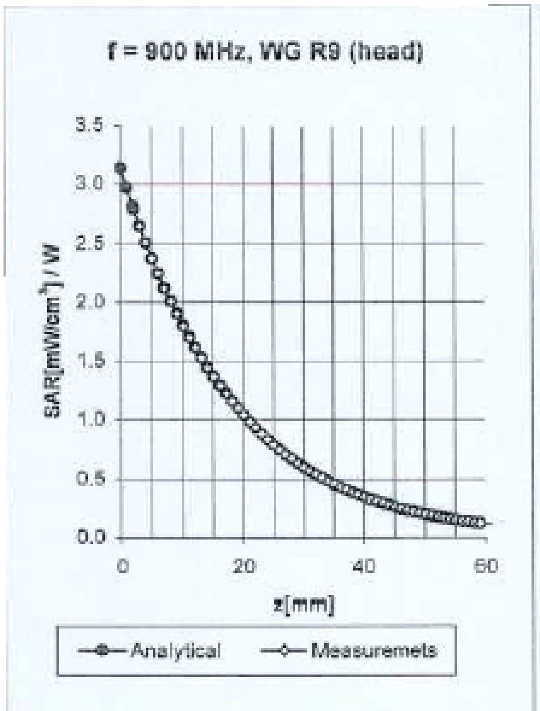
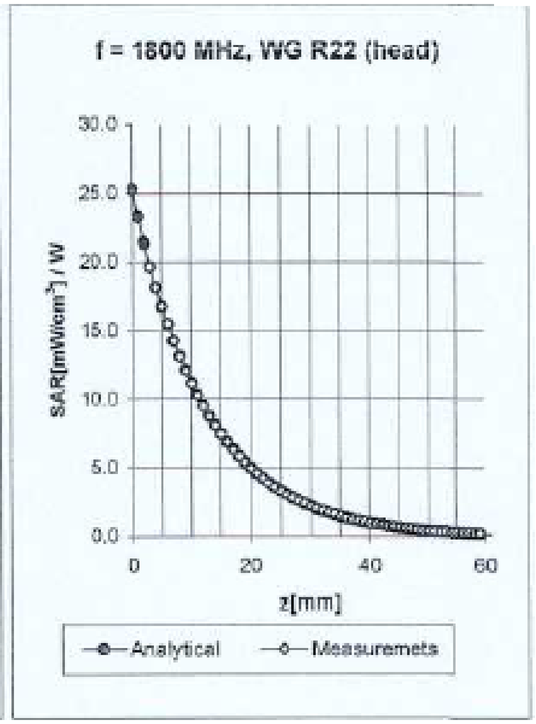
Conversion Factor Assessment





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**

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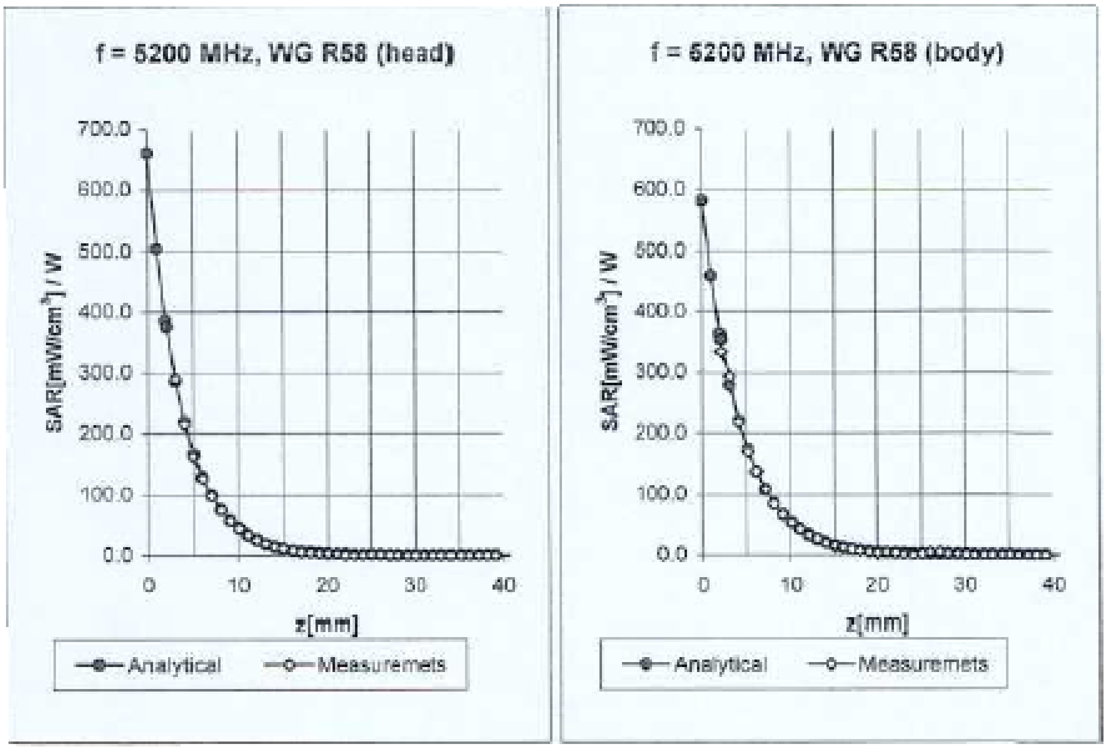
ES3DV2 SN: 3019 July 12, 2003

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**

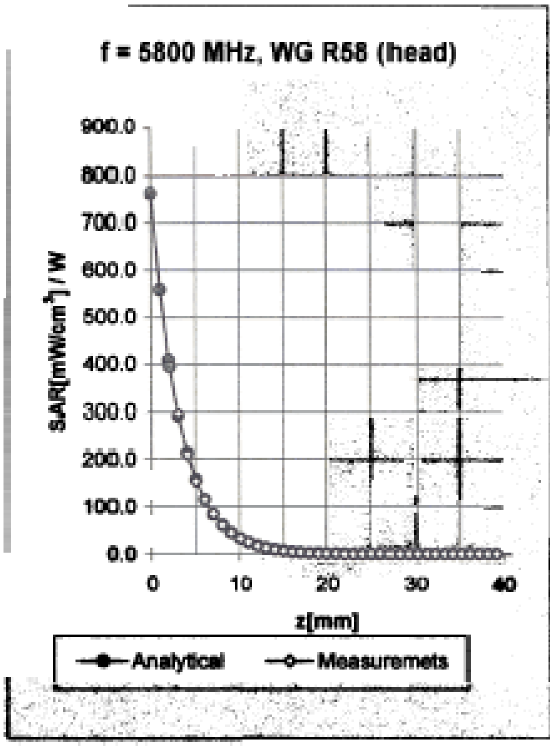
Body	5200	MHz	ε_r = 49.0 ± 5%	σ = 5.30 ± 5% mho/m

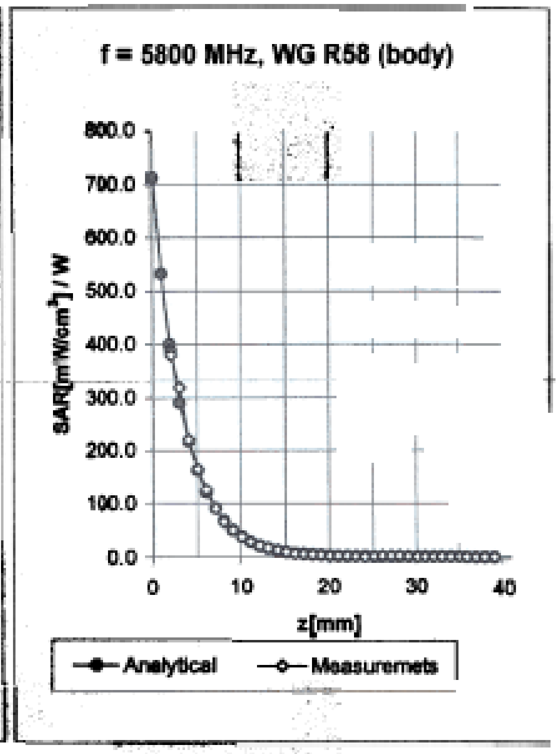
Valid for f=4940-5460 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

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

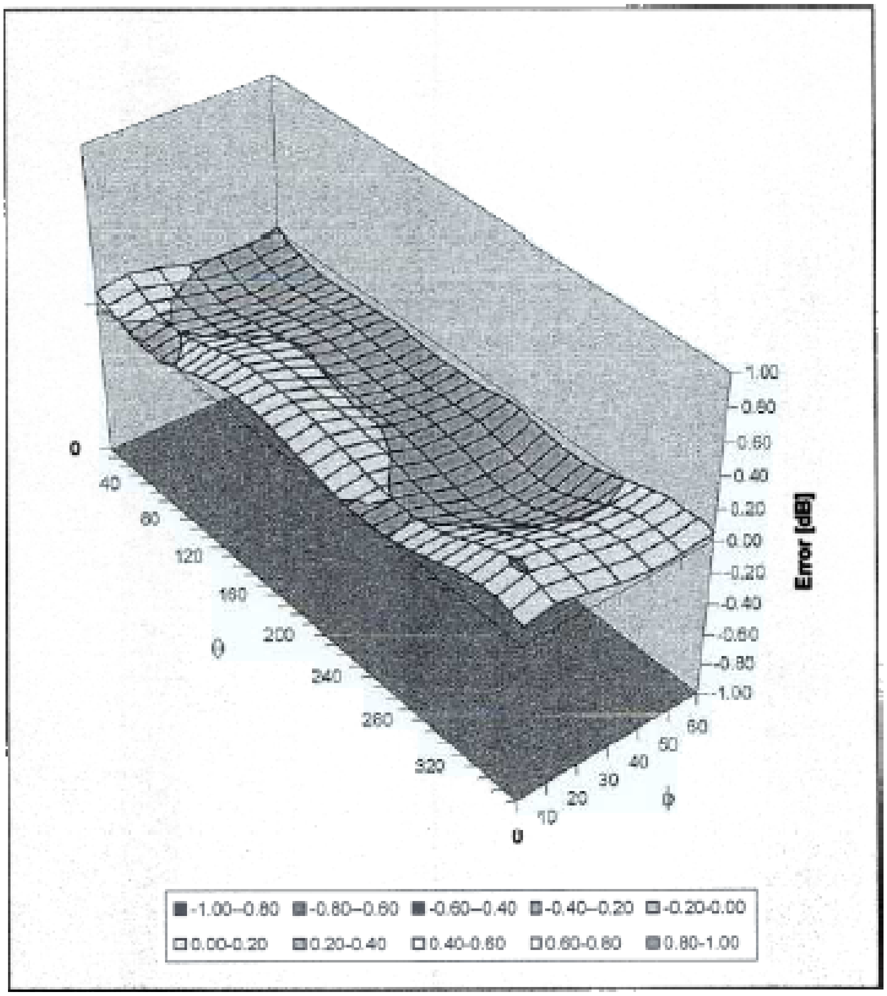
Valid for f=5510-6090 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

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



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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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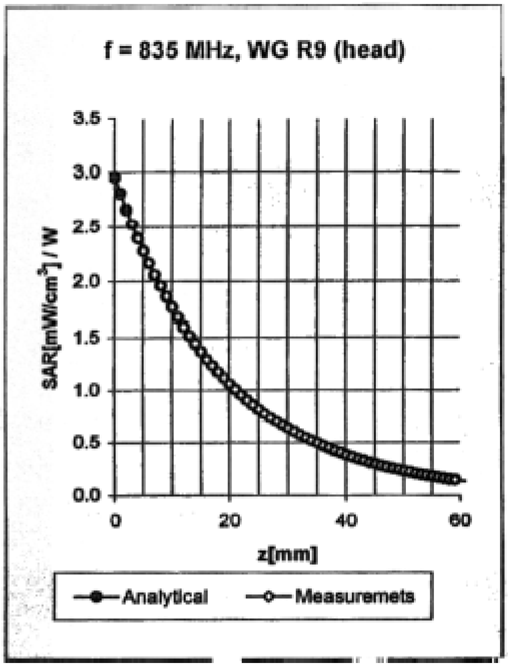
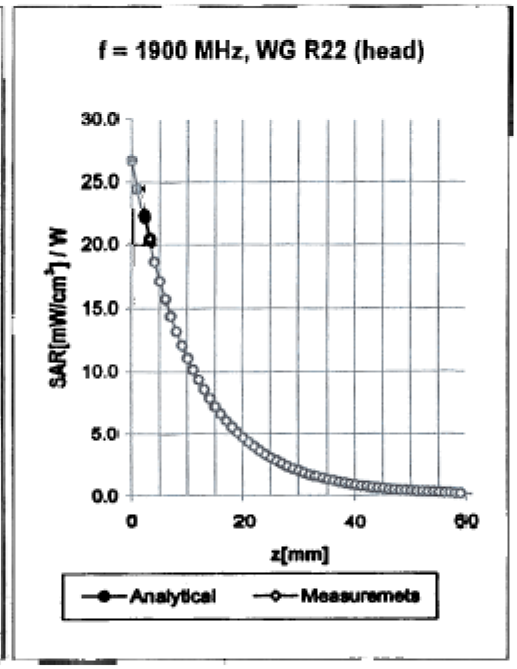
Conversion Factor Assessment





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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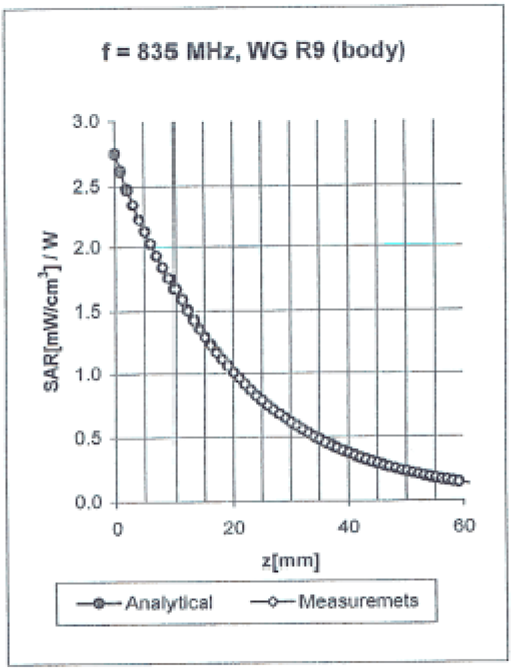
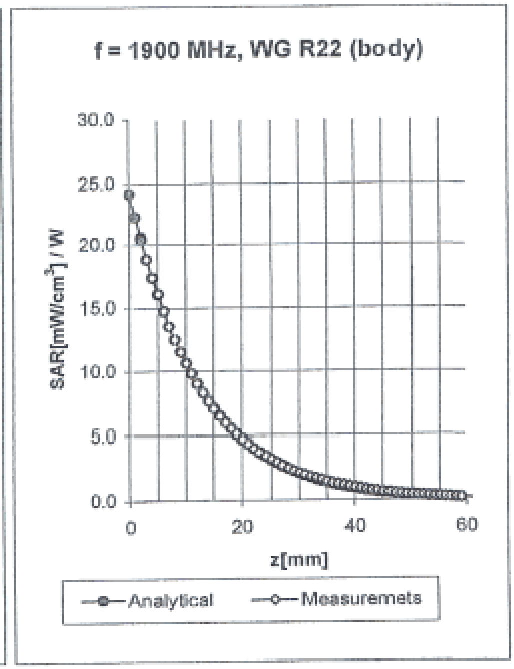
Conversion Factor Assessment





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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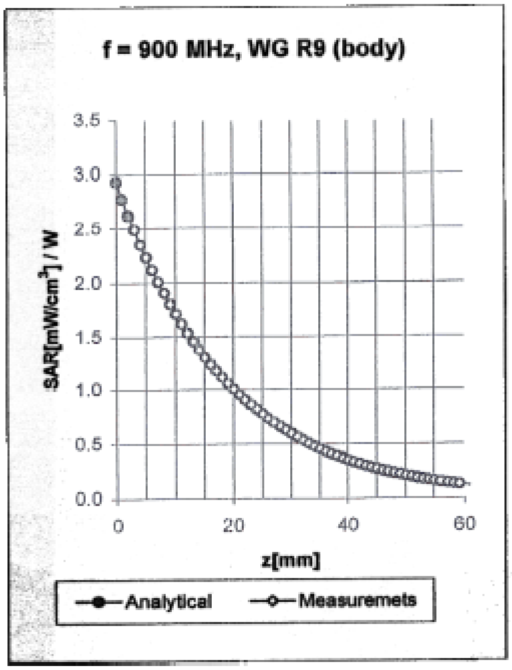
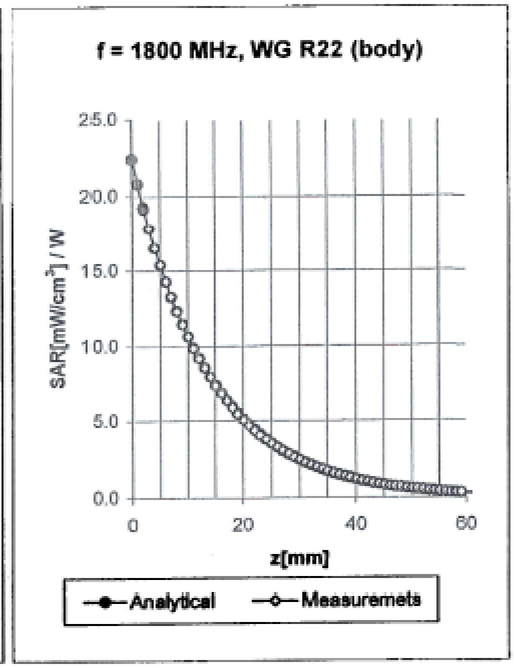
Conversion Factor Assessment





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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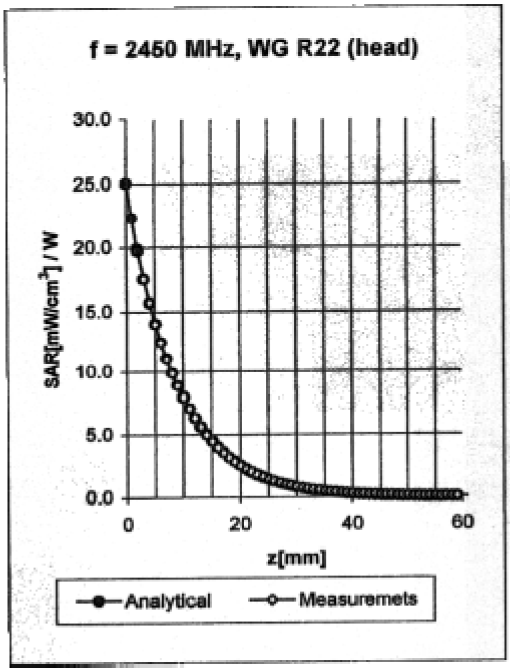
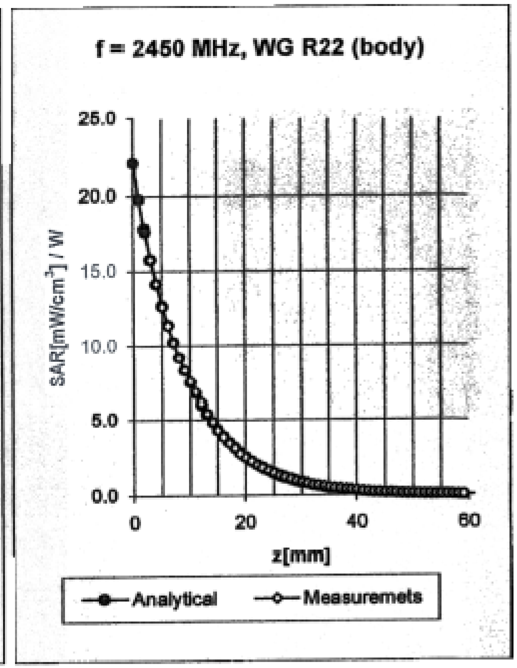
Conversion Factor Assessment





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**

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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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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

Body 300MHz Liquid Validation, Ambient Temp = 23 Deg C, Liquid Temp = 22 Deg C, 06/13/04

Frequency	e'	e''
250000000.0000	61.8593	58.0974
252000000.0000	61.7428	58.9587
254000000.0000	61.6894	58.3857
256000000.0000	61.4112	58.4215
258000000.0000	61.3354	58.0215
260000000.0000	61.0145	58.0102
262000000.0000	61.0107	57.9026
264000000.0000	61.0512	57.8931
266000000.0000	60.9218	57.7257
268000000.0000	60.8413	57.8963
270000000.0000	60.7445	57.7403
272000000.0000	60.6517	57.6775
274000000.0000	60.5795	56.7007
276000000.0000	60.4240	56.3212
278000000.0000	59.9018	55.9661
280000000.0000	59.8695	55.8134
282000000.0000	58.6717	55.5648
284000000.0000	58.7034	55.5159
286000000.0000	58.6225	55.4542
288000000.0000	58.5456	55.3457
290000000.0000	58.3842	55.3212
292000000.0000	58.2725	54.2392
294000000.0000	58.1457	54.1244
296000000.0000	58.1210	54.5734
298000000.0000	58.2251	54.3245
300000000.0000	58.2667	54.2613
302000000.0000	58.3396	54.3147
304000000.0000	58.4829	54.1335
306000000.0000	58.5805	54.2429
308000000.0000	58.6268	54.4671
310000000.0000	58.5441	54.3242
312000000.0000	58.4621	54.2559
314000000.0000	57.8683	54.1247
316000000.0000	57.9805	53.9214
318000000.0000	57.8210	53.5673
320000000.0000	57.7826	53.5260
322000000.0000	57.6101	53.4927
324000000.0000	57.0145	53.3019
326000000.0000	57.0253	53.0880
328000000.0000	57.1473	53.8910
330000000.0000	57.2461	53.7798
332000000.0000	57.3526	53.6110
334000000.0000	57.5497	53.4789
336000000.0000	57.3924	53.5145
338000000.0000	57.6983	53.2848
340000000.0000	57.5748	53.3541
342000000.0000	57.6371	53.1816
344000000.0000	57.6761	53.6871
346000000.0000	57.7199	53.5744
348000000.0000	57.7214	53.7487
350000000.0000	57.7417	53.8547

$\sigma = \omega \varepsilon_o \varepsilon'' = 2 \pi f \varepsilon_o \varepsilon''=0.91$

where $f = 300$

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

$\varepsilon'' = 54.2613x10^6$

Head 300MHz Liquid Validation, Ambient Temp = 23 Deg C, Liquid Temp = 22 Deg C, 06/13/04

Frequency	e'	e''
250000000.0000	45.7084	52.9484
252000000.0000	45.6435	52.8541
254000000.0000	45.5174	52.8254
256000000.0000	45.4863	52.7459
258000000.0000	45.4841	52.7587
260000000.0000	45.4364	52.6541
262000000.0000	45.4372	51.5410
264000000.0000	45.4145	51.4218
266000000.0000	45.3562	51.3247
268000000.0000	45.2847	51.2719
270000000.0000	45.4658	51.1741
272000000.0000	45.4514	51.1457
274000000.0000	45.4711	51.1172
276000000.0000	45.3354	51.0278
278000000.0000	45.5237	50.9221
280000000.0000	45.6538	50.8149
282000000.0000	45.7511	50.7622
284000000.0000	45.7127	50.6121
286000000.0000	45.8315	50.4542
288000000.0000	45.8205	50.3117
290000000.0000	45.7654	50.2127
292000000.0000	45.8592	50.3382
294000000.0000	45.7891	50.3245
296000000.0000	45.7145	50.4734
298000000.0000	45.6431	50.4045
300000000.0000	45.7743	50.5110
302000000.0000	45.6541	50.5147
304000000.0000	45.5225	50.6515
306000000.0000	45.4874	50.5042
308000000.0000	45.3167	50.4142
310000000.0000	45.3214	50.3129
312000000.0000	45.4052	50.2559
314000000.0000	45.5126	50.1217
316000000.0000	45.6431	50.0134
318000000.0000	45.7458	50.0021
320000000.0000	45.6521	50.0260
322000000.0000	45.5421	50.1927
324000000.0000	45.4515	50.0121
326000000.0000	45.3571	50.0089
328000000.0000	45.2450	50.0120
330000000.0000	44.9452	49.9562
332000000.0000	44.8140	49.8747
334000000.0000	44.7414	49.8220
336000000.0000	44.6574	49.7558
338000000.0000	44.5527	49.6574
340000000.0000	44.4741	49.5212
342000000.0000	44.5214	49.4816
344000000.0000	44.3689	49.4897
346000000.0000	44.2138	49.4744
348000000.0000	44.1240	49.3487
350000000.0000	44.0437	49.2812

$\sigma = \omega\, \varepsilon_o\, \varepsilon'' = 2\, \pi f\, \varepsilon_o\, \varepsilon''=0.84$

where $f = 300$

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

$\varepsilon'' = 50.5110 \times 10^{6}$

150 MHz body liquid validation
Ambient Temp=23 Deg C, Liquid Temp=22 Deg C, 6/13/2004

Frequency	e'	e''
100000000.0000	64.8527	110.2359
102000000.0000	64.3579	109.6810
104000000.0000	64.1250	108.6975
106000000.0000	64.0328	107.9813
108000000.0000	63.5794	106.5568
110000000.0000	63.9857	105.3698
112000000.0000	63.5231	104.5621
114000000.0000	62.9827	103.3687
116000000.0000	63.6542	101.3579
118000000.0000	62.6921	100.0357
120000000.0000	62.4592	99.8920
122000000.0000	62.0567	99.5037
124000000.0000	62.3359	99.3468
126000000.0000	61.9230	98.6422
128000000.0000	61.8627	98.3259
130000000.0000	61.5033	97.6891
132000000.0000	61.4620	97.2657
134000000.0000	61.3687	96.8921
136000000.0000	61.1320	96.5940
138000000.0000	60.9037	96.2468
140000000.0000	60.8609	95.3579
142000000.0000	60.7932	94.8903
144000000.0000	60.6893	94.5371
146000000.0000	60.3891	94.8927
148000000.0000	60.5328	94.6891
150000000.0000	60.5986	94.5627
152000000.0000	60.4681	93.6235
154000000.0000	60.5307	92.3549
156000000.0000	60.3479	92.5621
158000000.0000	60.4637	91.2468
160000000.0000	60.2034	91.6940
162000000.0000	60.0127	90.8834
164000000.0000	59.9824	90.5130
166000000.0000	59.8136	89.6792
168000000.0000	59.7933	89.1037
170000000.0000	59.9176	88.6654
172000000.0000	59.8934	88.3014
174000000.0000	59.9937	87.0358
176000000.0000	58.7315	86.2567
178000000.0000	58.5389	87.2365
180000000.0000	58.3168	87.0346
182000000.0000	58.1687	86.7923
184000000.0000	58.0357	85.6491
186000000.0000	58.2379	84.6231
188000000.0000	58.0327	83.6470
190000000.0000	57.9816	82.6548
192000000.0000	57.6719	81.0365
194000000.0000	57.9136	80.6941
196000000.0000	57.8216	80.0238
198000000.0000	57.7138	80.9824
200000000.0000	57.5307	80.3567

$\sigma = \omega \varepsilon_o \varepsilon'' = 2 \pi f \varepsilon_o \varepsilon''=0.7891$
where $f = 150$
$\varepsilon_o = 8.854 \times 10^{-12}$
$\varepsilon'' = 94.5627 \times 10^{6}$

150 MHz head liquid validation
Ambient Temp = 23 Deg C, Liquid Temp = 22 Deg C, 6/13/2004

Frequency	e'	e''
100000000.0000	53.9821	107.8923
102000000.0000	53.6984	106.8532
104000000.0000	53.3821	105.3252
106000000.0000	53.1368	103.6871
108000000.0000	53.0225	102.6891
110000000.0000	52.9866	101.9822
112000000.0000	52.8952	101.5986
114000000.0000	52.6145	100.3986
116000000.0000	52.5987	99.3622
118000000.0000	52.4689	98.6387
120000000.0000	52.3527	97.3321
122000000.0000	52.1359	96.2571
124000000.0000	52.0368	94.6589
126000000.0000	51.9022	93.2654
128000000.0000	51.8920	92.5973
130000000.0000	51.6821	92.3651
132000000.0000	51.4261	91.8920
134000000.0000	51.3988	91.6524
136000000.0000	51.2981	91.1285
138000000.0000	51.2530	90.8913
140000000.0000	51.2015	90.6892
142000000.0000	51.1598	89.6891
144000000.0000	51.0367	89.3641
146000000.0000	51.0237	89.2368
148000000.0000	50.9826	89.0568
150000000.0000	50.9756	89.1359
152000000.0000	50.6271	89.0365
154000000.0000	50.5321	88.5638
156000000.0000	50.3258	88.2364
158000000.0000	50.1657	87.6981
160000000.0000	50.0126	87.2368
162000000.0000	49.9813	86.7561
164000000.0000	49.7625	85.9654
166000000.0000	49.6248	84.2687
168000000.0000	49.8956	83.6523
170000000.0000	49.6782	82.3647
172000000.0000	49.5368	82.1259
174000000.0000	49.3872	81.9813
176000000.0000	49.2689	81.3579
178000000.0000	49.1328	80.6128
180000000.0000	49.1598	80.3492
182000000.0000	49.1137	79.7689
184000000.0000	49.1033	79.2678
186000000.0000	49.0989	78.3921
188000000.0000	48.9963	77.3891
190000000.0000	48.8517	76.4598
192000000.0000	48.6981	75.3479
194000000.0000	48.8942	74.2689
196000000.0000	48.7795	74.6981
198000000.0000	48.5268	73.6529
200000000.0000	48.3568	72.3365

$\sigma = \omega \varepsilon_o \varepsilon'' = 2 \pi f \varepsilon_o \varepsilon''=0.7438$
where $f = 150$
$\varepsilon_o = 8.854 \times 10^{-12}$
$\varepsilon'' = 89.1359x10^{6}$

3 - EUT DESCRIPTION

Serial Number:	00000001
Applicant:	GENEX TELECOM CO., LTD.
Product Description:	Transceiver, PTT Portable 2-Way Radio
FCC ID:	PM3GX80
Transmitter Frequency:	430.9875 – 469.9875 MHz
Maximum Output Power:	4.875 W
Dimension:	9.9"L x 2.5"W x 1.75"H
RF Exposure environment:	Occupational Population
Applicable Standard	FCC CFR 47, Part 90
Application Type:	Certification

1 Specific Absorption Rate (SAR) is a measure of the rate of energy absorption due to exposure to an RF transmitting source (wireless portable device).
2 IEEE/ANSI Std. C95.3-2002 limits are used to determine compliance with FCC ET Docket 93-62.
Note: The test data was good for test sample only. It may have deviation for other test samples.

4 - SYSTEM TEST CONFIGURATION

4.1 Justification

The system was configured for testing according to ANSI C63.4-2001.

4.2 EUT Exercise 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 EUT was tested by pushing the PTT bottom during the testing.

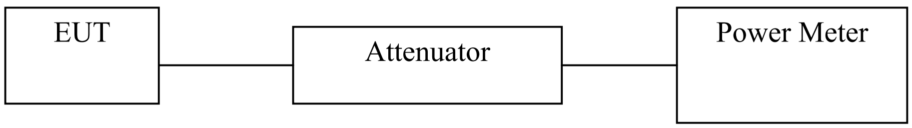
4.3 Equipment Modifications

No modifications were made to the EUT.

5 - CONDUCTED OUTPUT POWER MEASUREMENT

5.1 Measurement Procedure

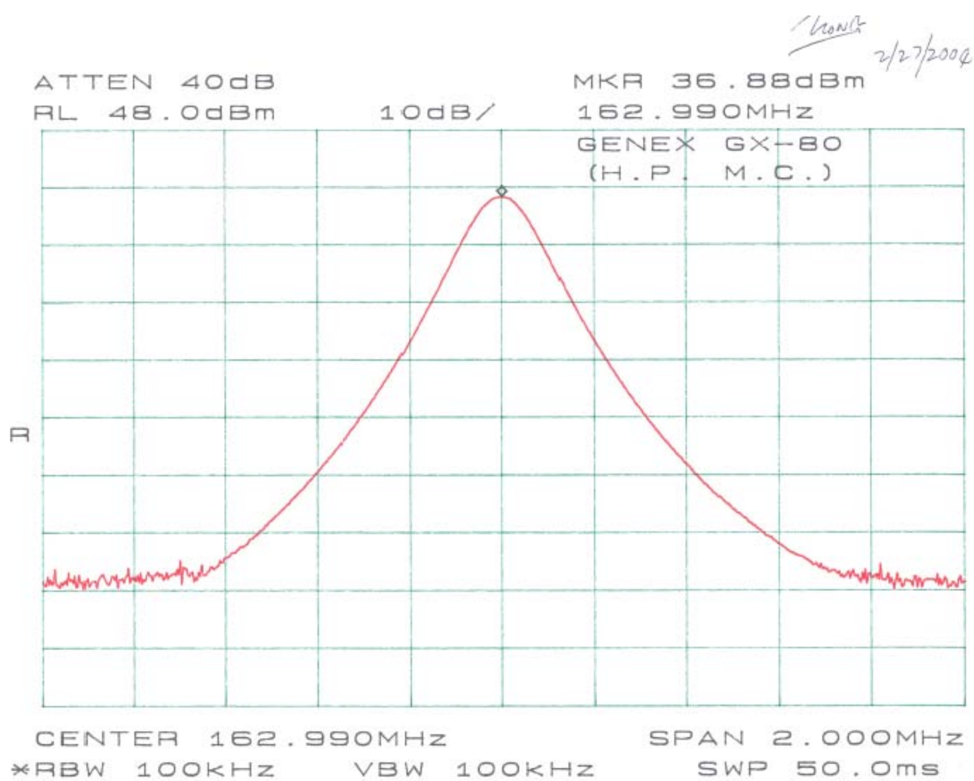
1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
3. Add a correction factor to the display.



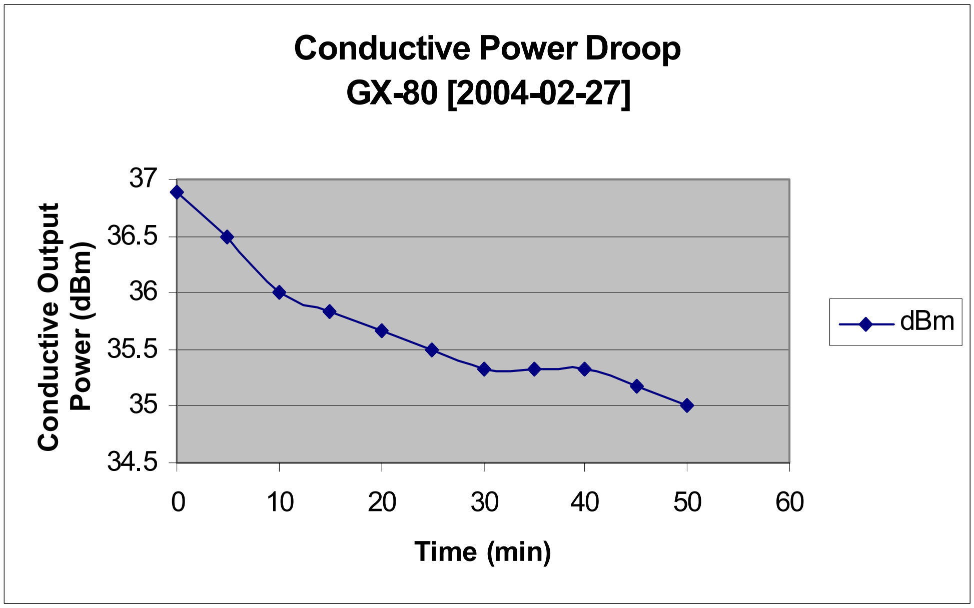
5.2 Test Results

Channel	Frequency in MHz	Output Power in dBm	Output Power in W
Middle	162.990	36.388	4.875

Note: The power output may depend on the intended use of the EUT. For all tests, the EUT was set to maximum conditions.



5.3 Test Results of Power Droop



6 - DOSIMETRIC ASSESSMENT SETUP

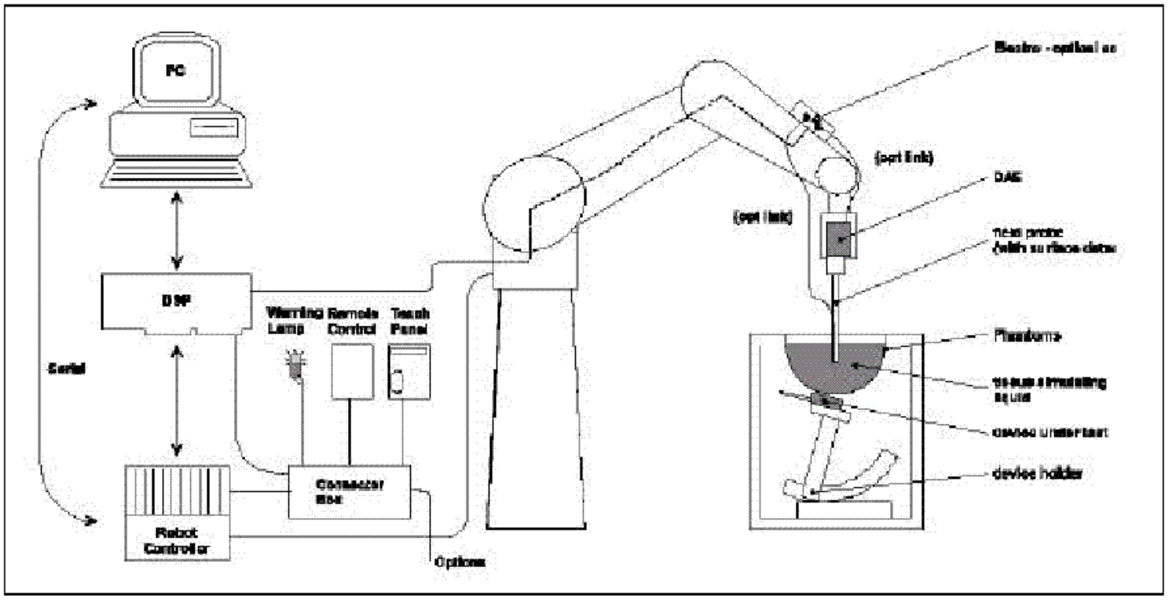
These measurements were performed with the automated near-field scanning system DASY3 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9m) which positions the probes with a positional repeatability of better than ±0.02mm. Special 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 ET3DV2 SN: 3019 (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	55.2	42.0	55.9	39.9	53.3	39.8	53.6
Conductivity (s/m)	0.85	0.83	0.91	0.97	1.0	0.98	1.42	1.52	1.88	1.81

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

ES3DV2 Probe Specification

Photograph of the probe

Construction	Symmetrical design with triangular core Interleafed sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., glycol)
Calibration	In air from 10 MHz to 3 GHz In brain and muscle simulating tissue at frequencies of 450 MHz, 900 MHz and 1.8 GHz (accuracy ± 8%) Calibratin for other liquids and frequencies upon request
Frequency	10 MHz to > 6GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity	± 0.2 dB in brain tissue (rotation around probe axis) ± 0.3 dB in brain tissue (rotation normal to probe axis)
Dynamic Range	5μW/g to > 100 mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm Tip length: 20 mm Body diameter: 12 mm Tip diameter: 3.9 mm Distance from probe tip to dipole centers: 2.7 mm
Application:	General dosimetry up to 5 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones

The SAR measurements were conducted with the dosimetric probe ET3DV2 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.

Inside view of ES3DV2 E-field Probe

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)
μV/ $(V/m)^2$ 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

Flatphantom V4.4

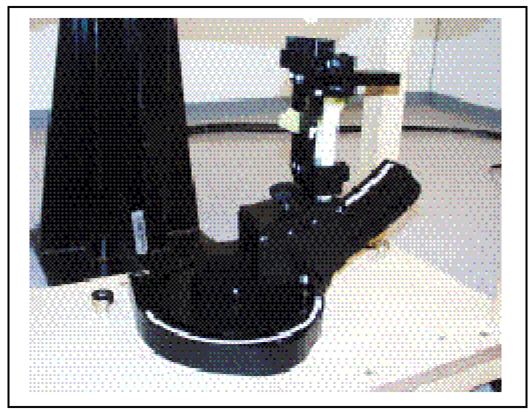
FLATPHANTOM V4.4

Construction :
Flat phantom for system performance check prior to dosimetric evaluations of body mounted usage for the frequency range 300MHz - 3 GHz. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.
Shell Thickness: 6.0 ± 0.2 mm

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% confidence		**k=**	**2.004**			**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

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 (300 MHz)

Validation Measurement	SAR @ 100 mW Input averaged over 1g	SAR @ 1W Input averaged over 1g	SAR @ 100 mW Input averaged over 10g	SAR @ 1W Input averaged over 10g
Test 1	0.376	3.76	0.255	2.55
Test 2	0.378	3.78	0.256	2.56
Test 3	0.380	3.80	0.258	2.58
Test 4	0.385	3.85	0.261	2.61
Test 5	0.384	3.84	0.261	2.61
Test 6	0.383	3.83	0.261	2.61
Test 7	0.382	3.82	0.260	2.60
Test 8	0.381	3.81	0.259	2.59
Test 9	0.379	3.79	0.258	2.58
Test 10	0.379	3.79	0.257	2.57
Average	0.381	3.81	0.259	2.59

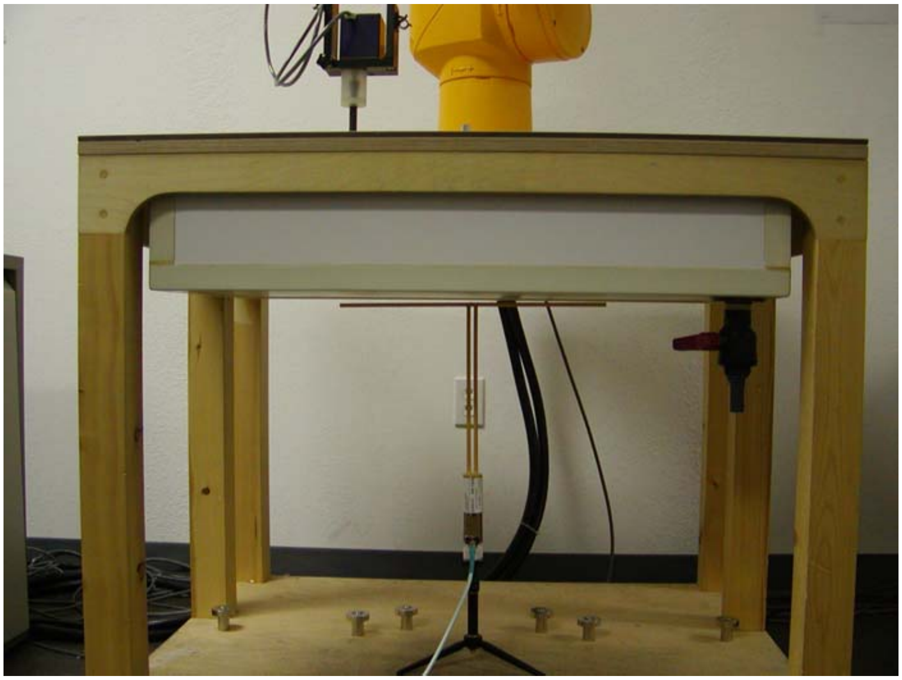
System validation result

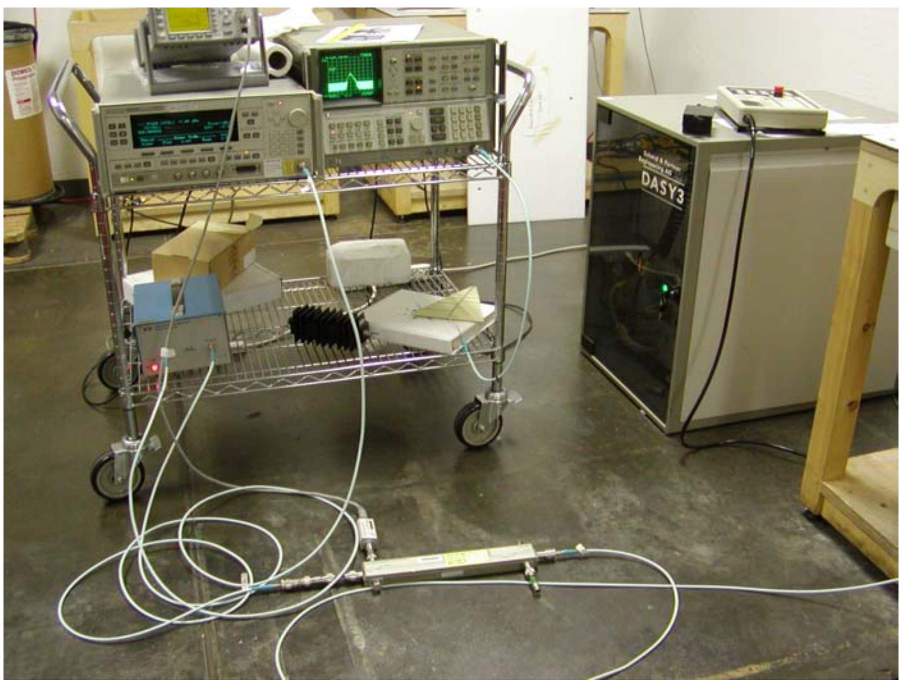
2004-06-13
Ambient Temperature (ºC): 23.0
Relative Humidity (%): 49.3

Simulant	Freq [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation [%]	Limits [%]
Body	300	ε	22	58.2	58.3	0.17	±5
		σ	22	0.92	0.92	0.00	±5
		1g SAR	22	3.81	3.66	-3.94	±10
Head	300	ε	22	45.3	45.8	1.10	±5
		σ	22	0.87	0.84	-3.45	±5
		1g SAR	22	3.00	3.18	6.00	±10

ε = relative permittivity, σ = conductivity and ρ=1000kg/m^3
Note: Forward power for Body = 20.51 dBm = 112.46 mW
Forward power for Head = 20.55 dBm = 113.50 mW

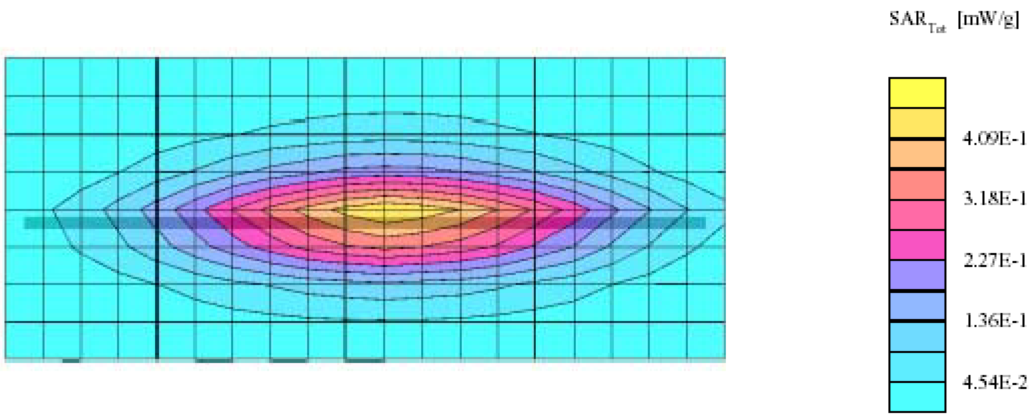
System Validation Setup Photo





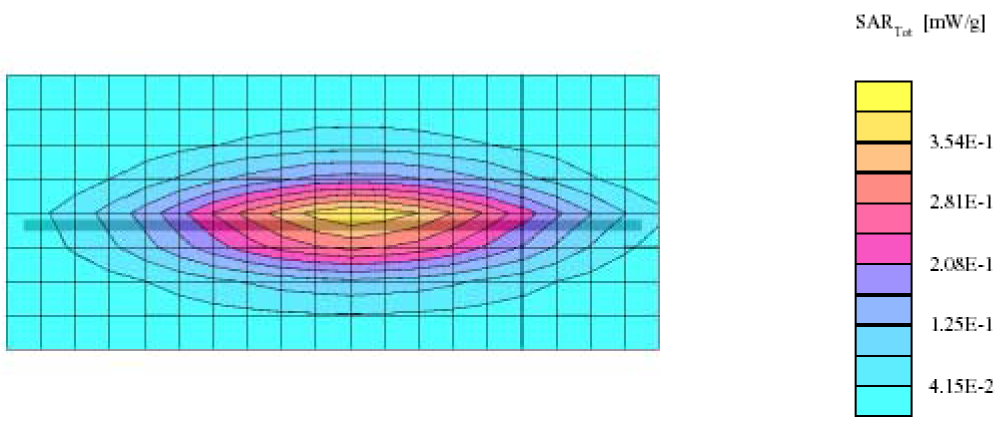
300 MHz Body Liquid System Validation (Ambient Temp = 23 Deg C, Liquid Temp = 22 Deg C, Forward Power = 20.51 dBm, 6/13/2004)

Flat Phantom v4.4 Phantom; Flat Section; Position: (90°,90°); Frequency: 300 MHz
Probe: ES3DV2 - SN3019; ConvF(7.54,7.54,7.54); Crest factor: 1.0; Body liquid 300 MHz: σ = 0.92 mho/m ε_r = 58.3 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 0.412 mW/g, SAR (10g): 0.281 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.00 dB



300 MHz Head Liquid System Validation (Ambient Temp = 23 Deg C, Liquid Temp = 22 Deg C, Forward Power = 20.55 dBm, 6/13/2004)

Flat Phantom v4.4 Phantom; Flat Section; Position: (90°,90°); Frequency: 300 MHz
Probe: ES3DV2 - SN3019; ConvF(7.54,7.54,7.54); Crest factor: 1.0; Body liquid 300 MHz: σ = 0.84 mho/m ε_r = 45.8 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 0.361 mW/g, SAR (10g): 0.233 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.00 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): with belt clip, without belt clip and 2.5cm facing left head side and 2.5cm facing right head side.
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).

Occupational/Controlled environments Partial-body limit 8mW/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 8.1, the EUT complied with the FCC 2.1093 RF Exposure standards, with worst case of **0.053 mW/g**.

8.1 SAR Test Data

Ambient Temperature (ºC): 23.0
Relative Humidity (%): 49.3
Flat Phantom Dimension: 1000mm x 500mm

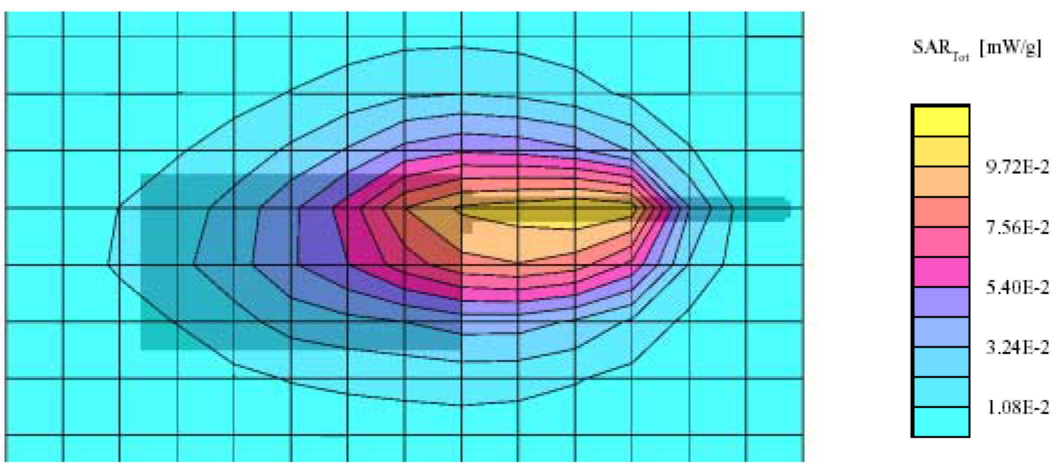
Worst case SAR reading

EUT position	Frequency (MHz)	Conducted Power (W)	Test Type	Antenna Type	Liquid	Phantom	Notes / Accessories	Measured (mW/g)		Limit (mW/g)	Plot #
								100%	50% duty cycle		
2.5 cm head separation to phantom	163	4.875	Face-held	Built-in	head	flat	none	0.106	0.053	8	1
back in touch with phantom	163	4.875	Body worn	Built-in	body	flat	Belt Clip and Headset	0.118	0.059	8	2

8.2 Plots of Test Result

The plots of test result were attached as reference.

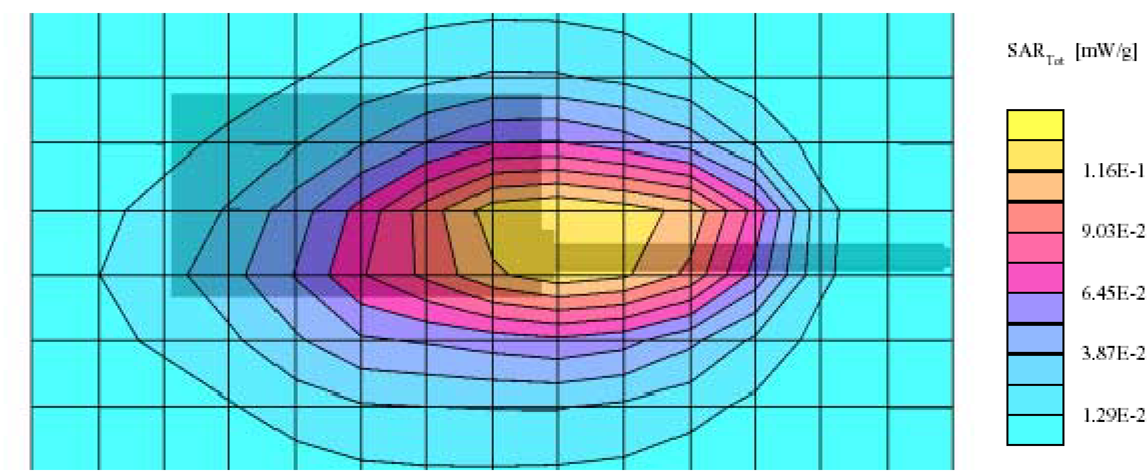
Genex, Model number: GX-80 (Face-held 2.5 cm separation to flat phantom, Mid Channel, Ambient Temp = 23 Deg C, Liquid Temp = 22 Deg C, 6/13/2004)
Flat Phantom v4.4 Phantom; Flat Section; Position: (90°,270°); Frequency: 163 MHz
Probe: ES3DV2 - SN3019; ConvF(8.70,8.70,8.70); Crest factor: 1.0; Head 150 MHz: σ = 0.74 mho/m ε_r = 51.0 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 0.106 mW/g, SAR (10g): 0.0661 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.01 dB



Plot #1

Genex, Model number: GX-80 (Back touch flat phantom with headset, Mid Channel, Ambient Temp = 23 Deg C, Liquid Temp = 22 Deg C, 6/13/2004)

Flat Phantom v4.4 Phantom; Flat Section; Position: (270°,90°); Frequency: 163 MHz
Probe: ES3DV2 - SN3019; ConvF(8.30,8.30,8.30); Crest factor: 1.0; Body 150 MHz: σ = 0.79 mho/m ε_r = 60.6 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 0.118 mW/g, SAR (10g): 0.0821 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.00 dB



Plot #2

EXHIBIT A - SAR SETUP PHOTOGRAPHS

2.5cm Head Separation to Flat Phantom

Back Touching with Flat Phantom with Belt Clip and Headset

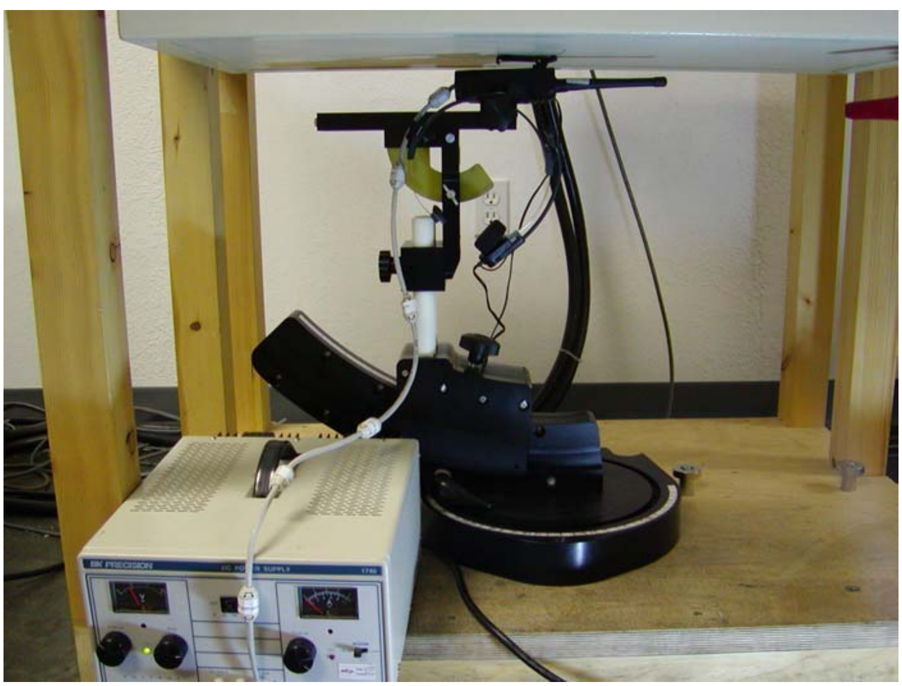
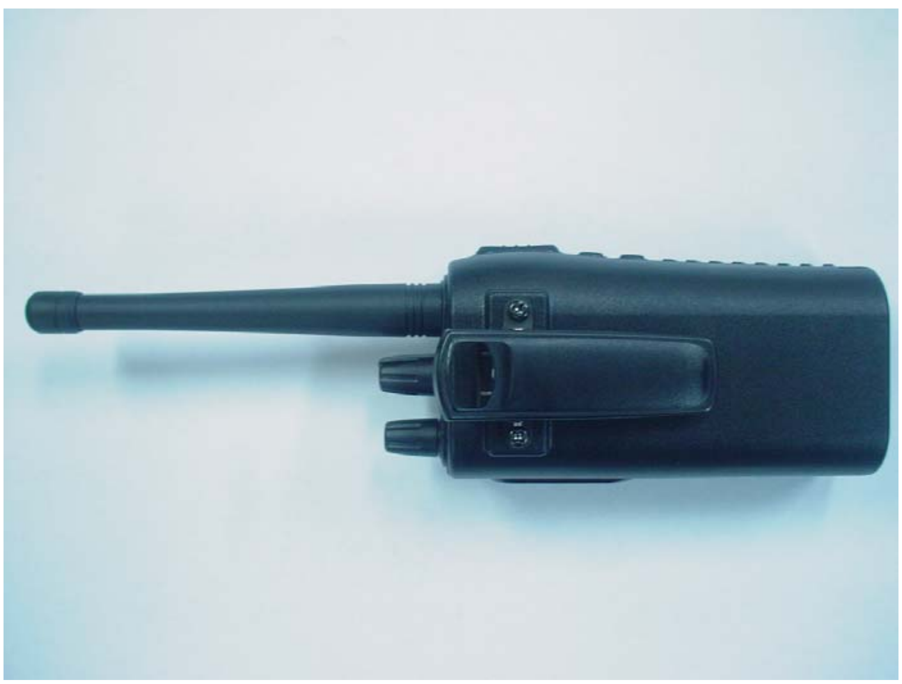


EXHIBIT B - EUT PHOTOGRAPHS

Chassis - Front View

Chassis – Back View I



Chassis – Back View II

Chassis – Back Frame

Chassis – Top View

Chassis – Left Side View

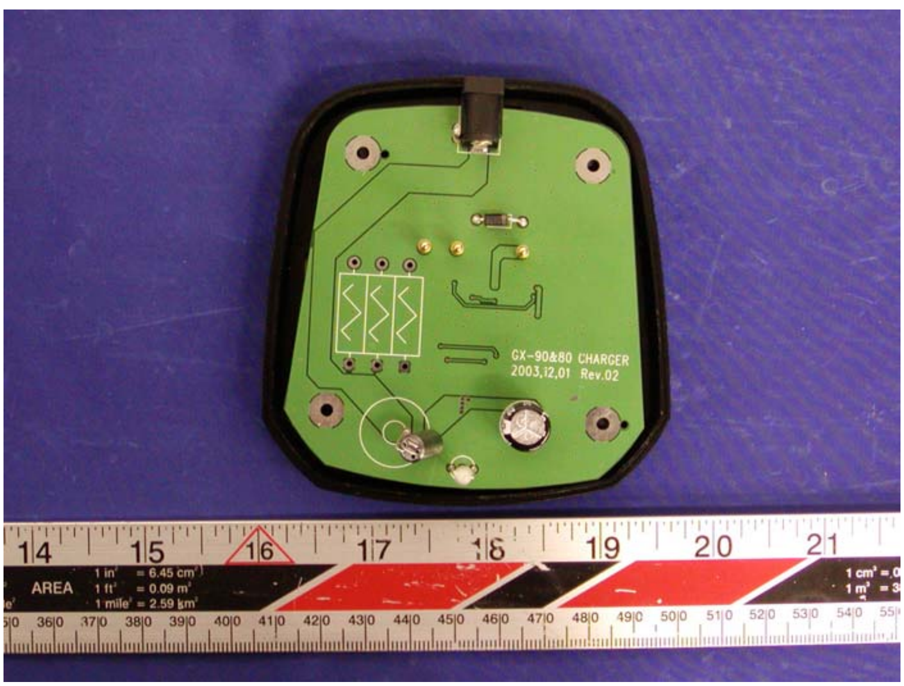
Chassis – Right Side View

Adapter View

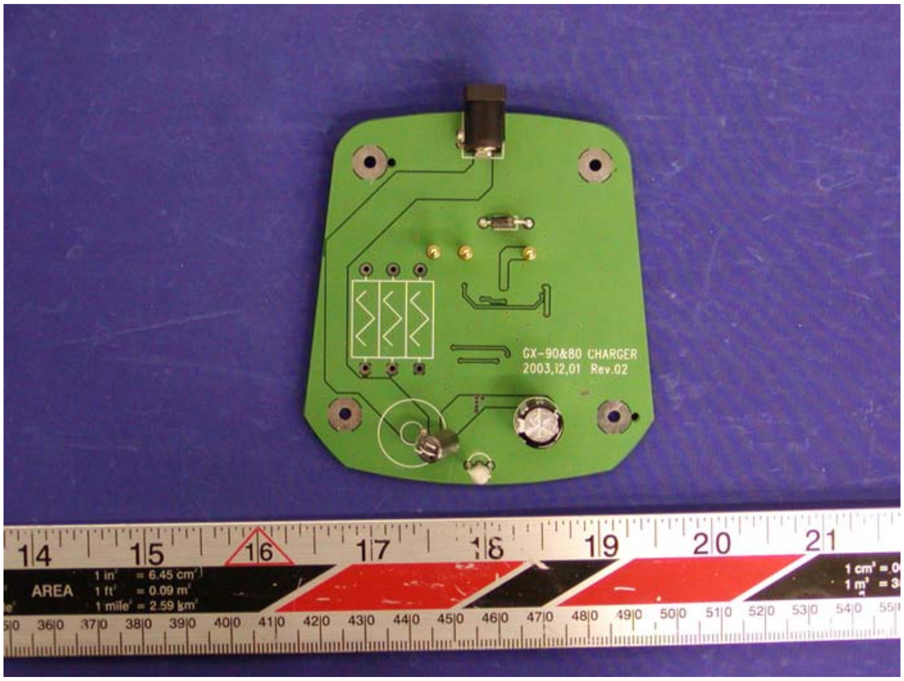
Battery Charger – Front View

Battery Charger – Rear View

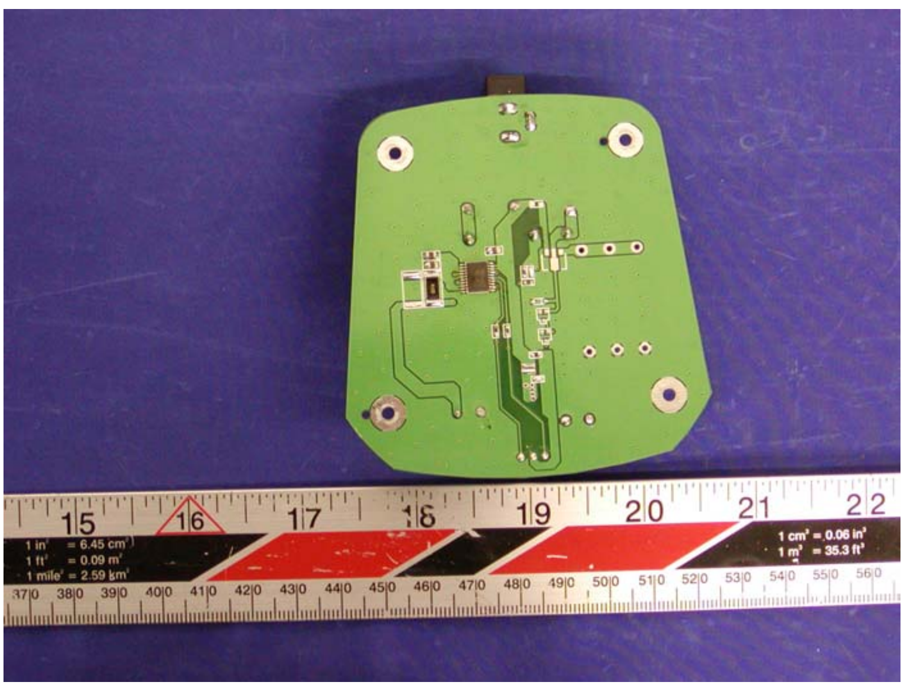
Battery Charger – Cover off View



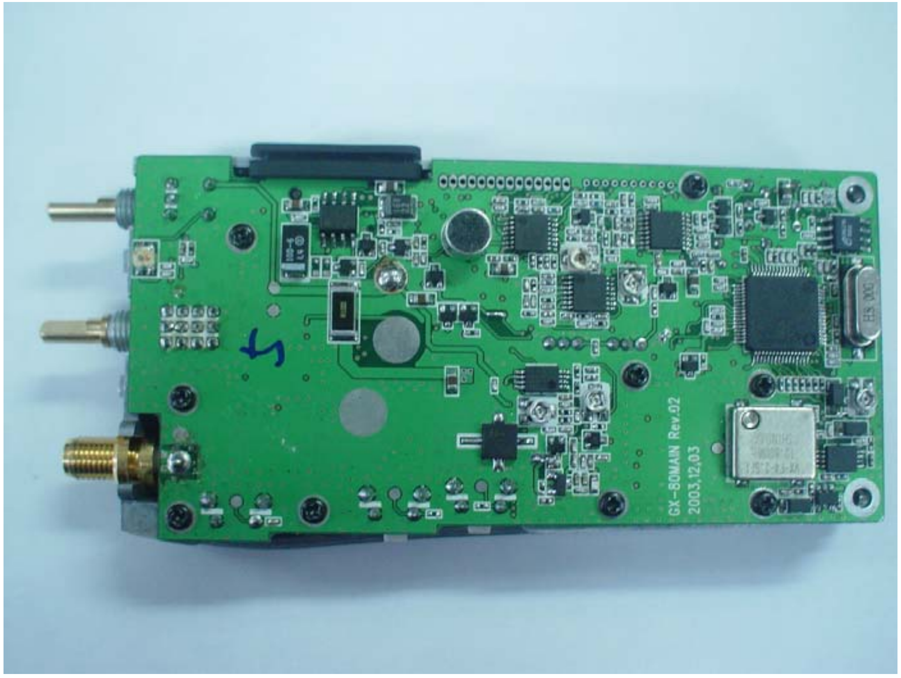
Battery Charger – Component View



Battery Charger – Solder View



PCB – Top View I



PCB – Top View II

PCB – Bottom View

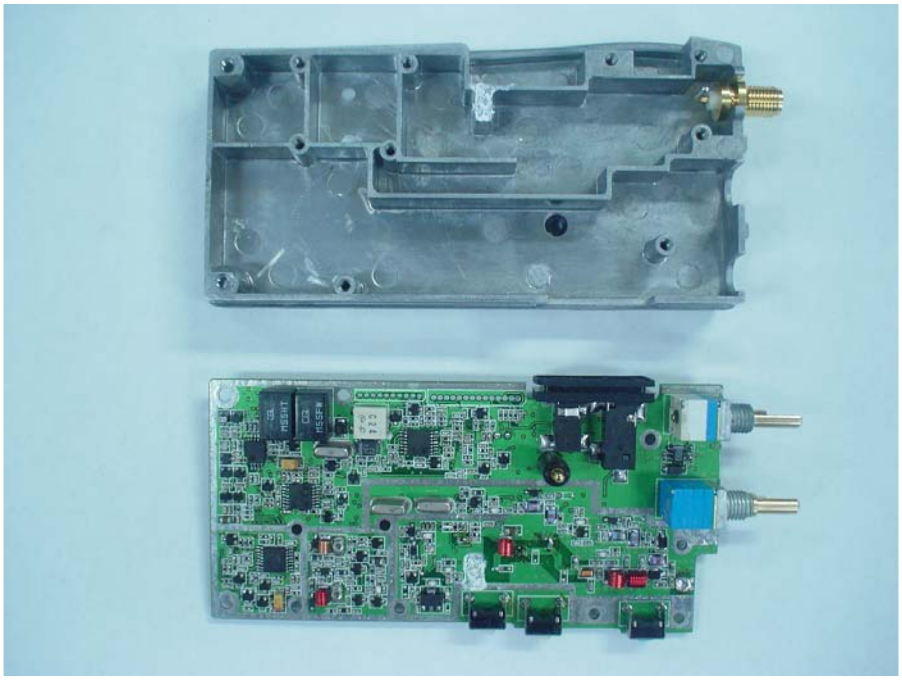


EXHIBIT C – Z-Axis

Genex, Model number: GX-80 (Face-held 2.5 cm separation to flat phantom, Mid Channel, Ambient Temp = 23 Deg C, Liquid Temp = 22 Deg C, 2/27/2004)

SAM Phantom; Section; Position: ; Frequency: 163 MHz

Probe: ES3DV2 - SN3019; ConvF(8.70,8.70,8.70); Crest factor: 1.0; 150 MHz Head liquid: $\sigma = 0.74$ mho/m $\varepsilon_r = 52.8$ $\rho = 1.00$ g/cm³

: , 0

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