SAR EVALUATION REPORT

For

MIDLAND RADIO CORPORATION

1120 Clay Street
North Kansas City, MO 64116

FCC ID: MMASP200V2

2003-11-18

This Report Concerns:	Equipment Type:
☒ Original Report	Portable Radio

Test Engineer:	Eric Hong
Report No.:	R0309222S
Test Date:	2003-10-11
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 C95.1-1992 [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, please see following table for testing result summary:

Ambient Temperature (ºC): 23.0
Relative Humidity (%): 51.1

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% duty cycle	**50% duty cycle**		
2.5 cm head separation to phantom	160	5.623	Face-held	Built-in	head	flat	none	0.0665	0.0333	8	1
back in touch with phantom	160	5.623	Body worn	Built-in	body	flat	Nylon Case: ACC-301 Speaker Microphone with PTT:ACC-714	0.439	0.220	8	7

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

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	6/04	456
SPEAG E-Field Probe ET3DV6	9/7/02	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	11/6/04	BCL-049
SPEAG Validation Dipole D900V2	9/3/04	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	6/20/04	3009A00791
Microwave Amp. 8349B	N/A	2644A02662
Power Meter HP436A	4/2/04	2709A29209
Power Sensor HP8482A	4/2/04	2349A08568
Signal Generator RS SMIQ O3	2/10/04	1084800403
Network Analyzer HP-8753ES	7/30/04	820079
Dielectric Probe Kit HP85070A	N/A	N/A
Apprel Validation Dipole D-2450-S-1	10/1/04	BCL-141
Dipole Antenna AD-100 (450MHz)	5/7/04	02220

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)

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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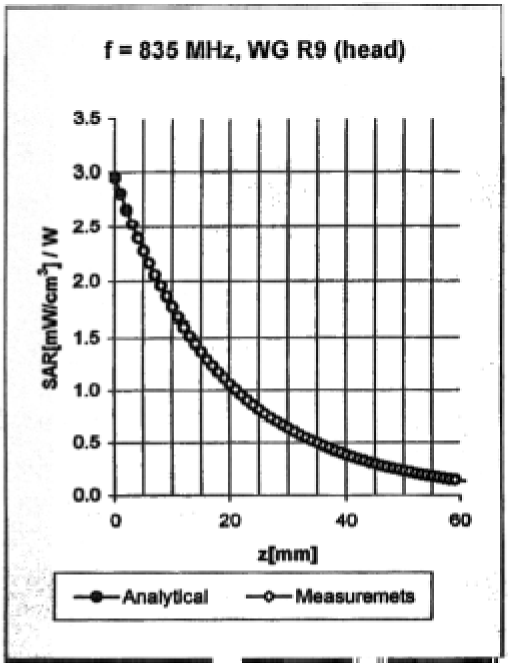
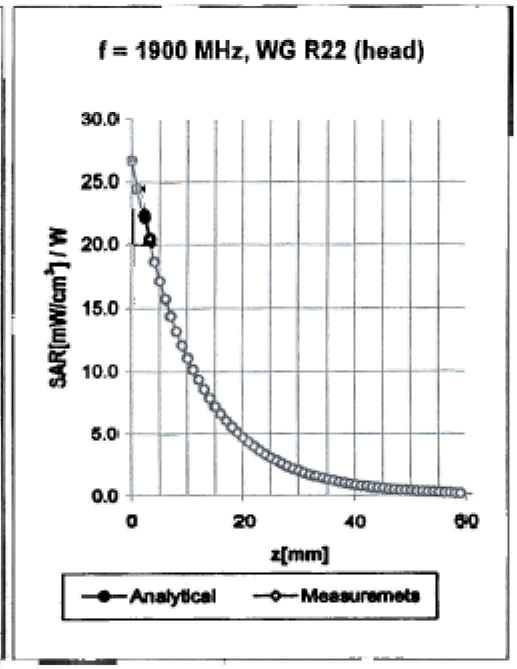
Conversion Factor Assessment





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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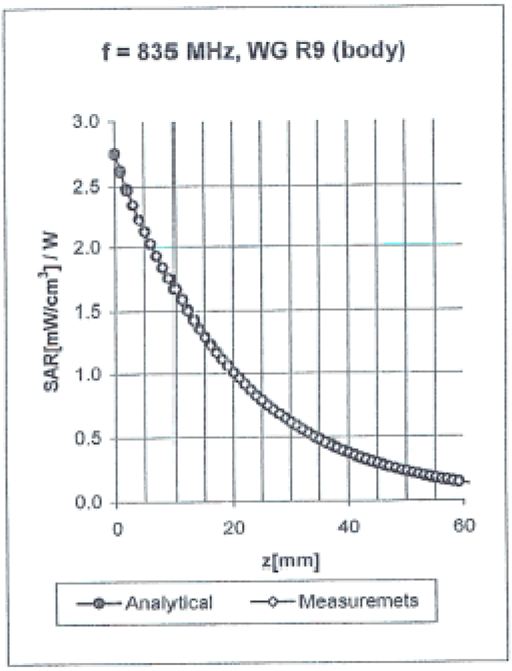
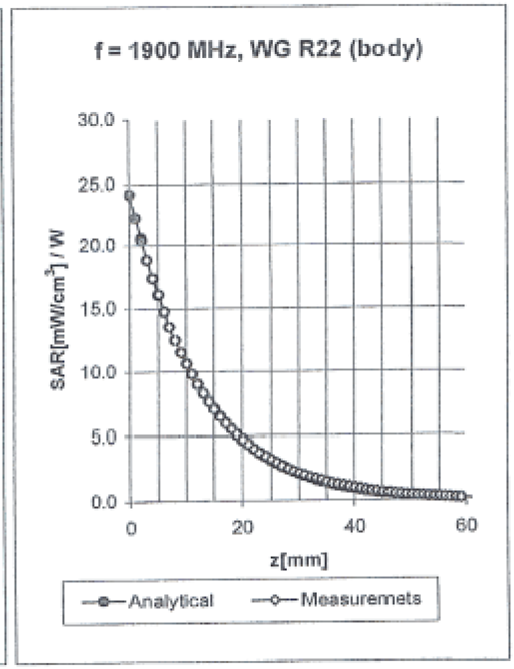
Conversion Factor Assessment





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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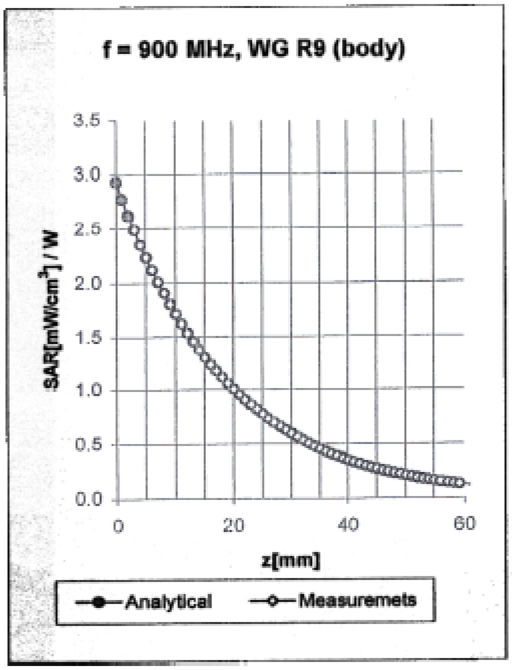
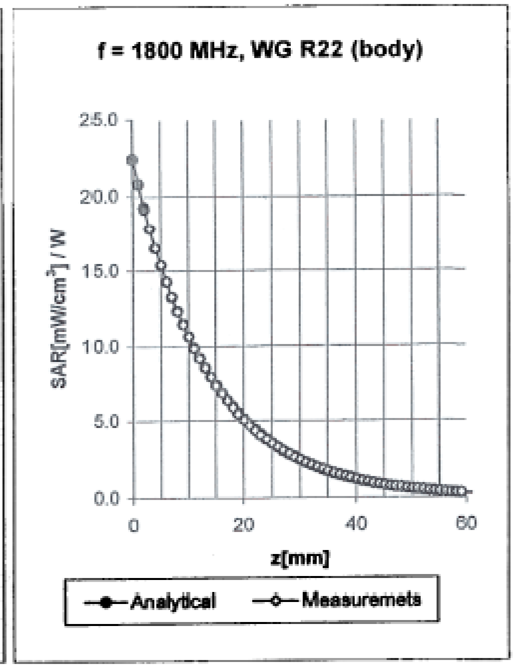
Conversion Factor Assessment





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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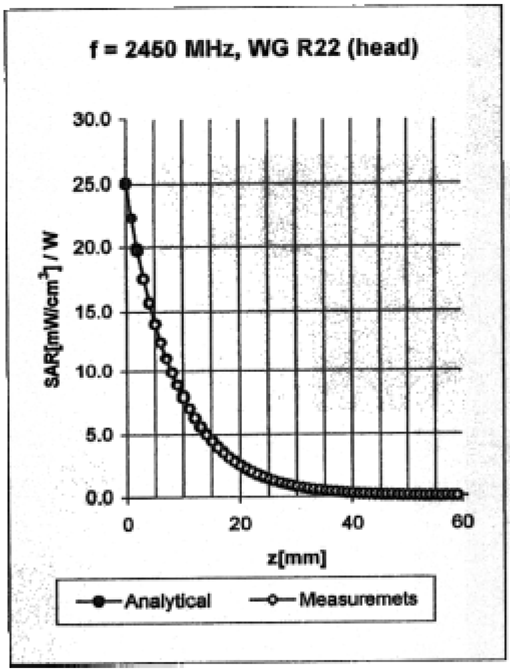
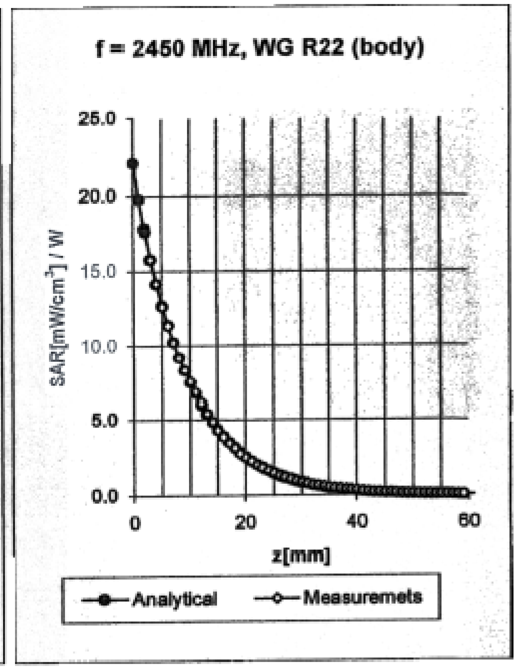
Conversion Factor Assessment





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

10/11/2003

MonG

300 MHz Body Liquid.txt

frequency	e'	e''
250000000.0000	58.3344	56.0076
252000000.0000	58.2923	56.0161
254000000.0000	58.1618	56.0953
256000000.0000	58.1489	56.1543
258000000.0000	58.1162	55.9574
260000000.0000	58.0913	55.9811
262000000.0000	57.9592	55.9780
264000000.0000	57.8160	55.9226
266000000.0000	57.7613	55.9237
268000000.0000	57.6251	55.8647
270000000.0000	57.6044	55.8412
272000000.0000	57.6001	55.8121
274000000.0000	57.7135	55.8062
276000000.0000	57.6949	55.8179
278000000.0000	57.7465	55.7951
280000000.0000	57.7652	55.7846
282000000.0000	57.7861	55.7735
284000000.0000	57.7547	55.7581
286000000.0000	57.7465	55.7410
288000000.0000	57.7553	55.7250
290000000.0000	57.7474	55.7102
292000000.0000	57.7331	55.6838
294000000.0000	57.6983	55.6525
296000000.0000	57.7197	55.6247
298000000.0000	57.6762	55.5958
300000000.0000	57.7175	55.5074
302000000.0000	57.7807	55.5662
304000000.0000	57.7588	55.5453
306000000.0000	57.7722	55.6056
308000000.0000	57.6903	55.6457
310000000.0000	57.6781	55.6643
312000000.0000	57.6509	55.6594
314000000.0000	57.6013	55.7087
316000000.0000	57.7182	55.6997
318000000.0000	57.6847	55.7014
320000000.0000	57.6738	55.7440
322000000.0000	57.6991	55.7409
324000000.0000	57.6937	55.7216
326000000.0000	57.7451	55.7533
328000000.0000	57.7482	55.7470
330000000.0000	57.7369	55.7864
332000000.0000	57.7128	55.8021
334000000.0000	57.6235	55.7824
336000000.0000	57.6324	55.7729
338000000.0000	57.6817	55.7601
340000000.0000	57.6809	55.7547
342000000.0000	57.7124	55.7330
344000000.0000	57.7687	55.6923
346000000.0000	57.7563	55.6784
348000000.0000	57.7256	55.6618
350000000.0000	57.7194	55.6513

$\sigma = \omega\, \varepsilon_o\, \varepsilon'' = 2\, \pi f\, \varepsilon_o\, \varepsilon''=0.9264$

where $f = 300$

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

$\varepsilon'' = 55.5074 \times 10^{6}$

Head 300MHz Liquid Validation

10/11/2003

frequency	e'	e''
250000000.0000	45.5354	57.0086
252000000.0000	45.4933	56.8181
254000000.0000	45.2088	56.3963
256000000.0000	45.0209	56.2553
258000000.0000	44.8762	55.9584
260000000.0000	44.7943	55.6821
262000000.0000	44.4892	55.3790
264000000.0000	44.5170	55.1216
266000000.0000	44.4712	54.9227
268000000.0000	44.3258	54.4657
270000000.0000	44.4048	54.4402
272000000.0000	44.3009	54.2131
274000000.0000	44.4499	53.8572
276000000.0000	44.1442	53.5189
278000000.0000	43.8864	53.3561
280000000.0000	43.0050	53.1156
282000000.0000	43.9221	53.0125
284000000.0000	43.8148	52.7091
286000000.0000	43.8965	52.4500
288000000.0000	43.6658	52.2560
290000000.0000	43.5275	52.1802
292000000.0000	43.5330	51.9818
294000000.0000	43.3785	51.6815
296000000.0000	43.5195	51.3257
298000000.0000	43.2760	51.0458
300000000.0000	43.4173	50.7084
302000000.0000	43.2802	50.6672
304000000.0000	42.9789	50.4463
306000000.0000	43.1927	50.2096
308000000.0000	43.1601	49.9487
310000000.0000	42.9784	49.7613
312000000.0000	42.8500	49.6584
314000000.0000	42.9012	49.2077
316000000.0000	42.7481	49.0547
318000000.0000	42.7548	48.9204
320000000.0000	42.6439	48.8430
322000000.0000	42.5995	48.5459
324000000.0000	42.2937	48.2226
326000000.0000	42.2451	48.1523
328000000.0000	42.3482	47.9480
330000000.0000	42.1361	47.5844
332000000.0000	42.0128	47.5020
334000000.0000	41.8235	47.2726
336000000.0000	41.8354	47.0819
338000000.0000	41.8807	46.8701
340000000.0000	41.7809	46.5447
342000000.0000	41.7174	46.4630
344000000.0000	41.6657	46.2723
346000000.0000	41.6573	46.0684
348000000.0000	41.6246	45.9418
350000000.0000	41.3534	45.7633

$\sigma = \omega \, \varepsilon_o \, \varepsilon'' = 2 \, \pi f \, \varepsilon_o \, \varepsilon'' = 0.8463$

where $f = 300$

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

$\varepsilon'' = 50.7084 \times 10^{6}$

Body 150MHz Liquid Validation

10/11/2003

frequency	e'	e''
100000000.0000	62.5372	115.6646
102000000.0000	62.2910	114.5220
104000000.0000	62.7325	113.3263
106000000.0000	62.4233	111.1480
108000000.0000	62.3111	109.0908
110000000.0000	63.0351	108.7827
112000000.0000	62.5699	107.3689
114000000.0000	62.5500	106.0751
116000000.0000	62.2624	104.8434
118000000.0000	62.2689	103.9225
120000000.0000	62.1699	102.2089
122000000.0000	62.2543	101.1206
124000000.0000	60.9910	100.1873
126000000.0000	60.9599	98.9036
128000000.0000	60.7205	98.1416
130000000.0000	60.5281	97.9260
132000000.0000	60.9087	97.1988
134000000.0000	61.4194	96.6510
136000000.0000	61.1388	95.8432
138000000.0000	61.2468	95.1523
140000000.0000	61.3888	94.9260
142000000.0000	61.5592	94.3742
144000000.0000	60.7135	94.1275
146000000.0000	60.9002	94.0156
148000000.0000	60.9839	94.0085
150000000.0000	61.2320	93.6643
152000000.0000	61.2013	92.0578
154000000.0000	61.3297	91.6687
156000000.0000	61.2036	90.0945
158000000.0000	61.1534	89.7276
160000000.0000	61.1785	88.5783
162000000.0000	60.9534	88.0299
164000000.0000	60.8302	87.3978
166000000.0000	60.6652	86.8542
168000000.0000	60.5449	86.3878
170000000.0000	60.7038	86.3289
172000000.0000	60.4294	85.8105
174000000.0000	60.5686	85.3959
176000000.0000	60.5286	85.3525
178000000.0000	60.7906	84.9058
180000000.0000	60.6992	84.5199
182000000.0000	60.9779	84.3105
184000000.0000	60.3722	83.9773
186000000.0000	60.8902	83.2531
188000000.0000	60.4571	82.6901
190000000.0000	60.7261	82.3384
192000000.0000	60.6320	81.8965
194000000.0000	60.4842	81.4993
196000000.0000	60.5100	80.7800
198000000.0000	60.1256	80.4726
200000000.0000	60.2227	80.3792

$\sigma = \omega \varepsilon_o \varepsilon'' = 2 \pi f \varepsilon_o \varepsilon''=0.7816$

where $f = 150$

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

$\varepsilon'' = 93.6643 \times 10^{6}$

Head 150MHz Liquid Validation

10/11/2003

150 MHz head liquid validation.txt

frequency	e'	e''
100000000.0000	55.8676	110.7701
102000000.0000	55.6758	109.4161
104000000.0000	55.2593	108.2127
106000000.0000	55.7177	107.9158
108000000.0000	54.8084	108.1790
110000000.0000	55.1850	106.6241
112000000.0000	54.3864	103.0122
114000000.0000	55.8008	101.5057
116000000.0000	55.0305	101.6422
118000000.0000	55.2686	101.8637
120000000.0000	54.8036	99.8597
122000000.0000	55.4325	99.6513
124000000.0000	54.7872	98.9210
126000000.0000	55.4801	97.2628
128000000.0000	55.4782	95.0212
130000000.0000	54.8234	94.8225
132000000.0000	54.7670	93.9737
134000000.0000	54.9572	92.7865
136000000.0000	54.8692	91.7824
138000000.0000	54.7993	90.5071
140000000.0000	54.3590	91.7802
142000000.0000	54.0066	91.1423
144000000.0000	54.0389	90.2664
146000000.0000	54.3192	90.2833
148000000.0000	53.8614	89.2307
150000000.0000	53.7303	89.3719
152000000.0000	53.8487	88.8794
154000000.0000	53.6060	87.4281
156000000.0000	53.4000	86.3297
158000000.0000	53.5043	86.2918
160000000.0000	53.6525	85.7404
162000000.0000	52.7843	85.2187
164000000.0000	53.1137	85.0357
166000000.0000	53.2010	84.7621
168000000.0000	52.9645	84.2101
170000000.0000	52.8889	83.2419
172000000.0000	53.0655	82.7187
174000000.0000	52.9926	81.4979
176000000.0000	52.9798	80.3335
178000000.0000	52.5362	80.7595
180000000.0000	52.5539	80.2726
182000000.0000	52.3528	80.1969
184000000.0000	52.1861	80.2451
186000000.0000	52.1976	79.7736
188000000.0000	52.5639	79.8510
190000000.0000	52.5486	79.9264
192000000.0000	52.5155	89.0060
194000000.0000	52.3686	88.9862
196000000.0000	51.9964	88.2466
198000000.0000	52.2391	87.4413
200000000.0000	51.9747	87.8634

$\sigma = \omega \varepsilon_o \varepsilon'' = 2 \pi f \varepsilon_o \varepsilon''=0.7458$

where $f = 150$

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

$\varepsilon'' = 89.3719 \times 10^{6}$

3 - EUT DESCRIPTION

Applicant:	MIDLAND RADIO CORPORATION
Product Description:	Portable Radio
FCC ID:	MMASP200V2
Serial Number:	B003
Transmitter Frequency:	146.00 – 174.00 MHz
Maximum Output Power:	5.62 W
Dimension:	9.8"L x 2.5"W x 2.0"H approximately
RF Exposure environment:	Occupational Population
Applicable Standard	FCC CFR 47, Part 80 & 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. C95.1-1992 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 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.

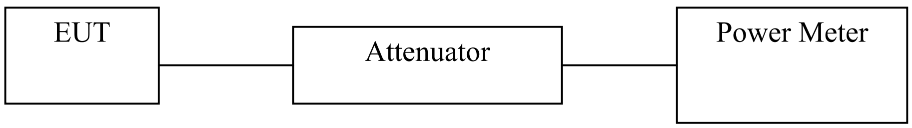
4.4 Equipment Modifications

No modifications were made to the EUT.

5 - CONDUCTED OUTPUT POWER MEASUREMENT

5.1 Measurement Procedure

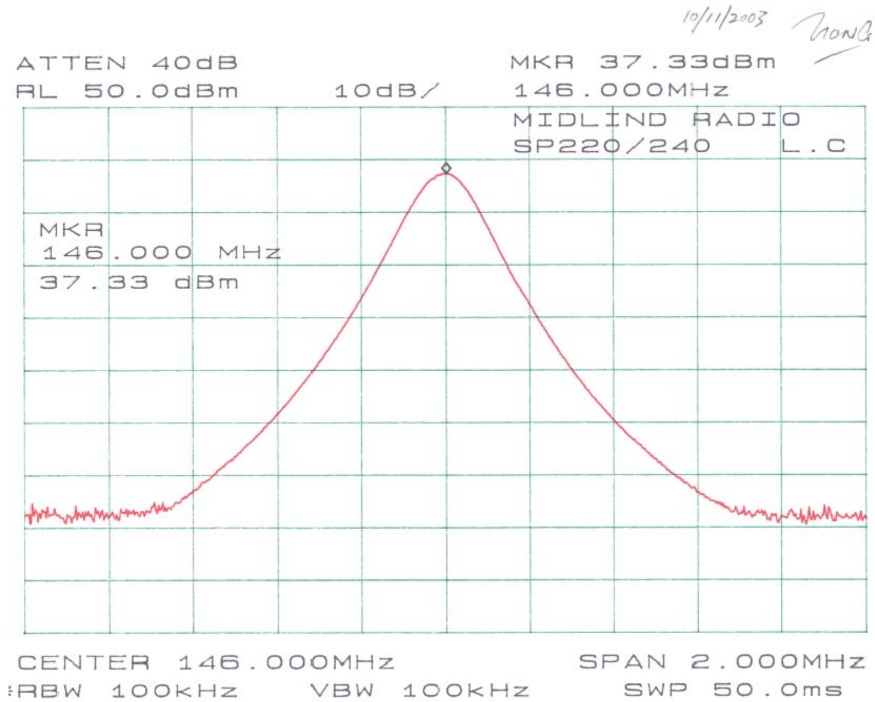
1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
3. Add a correction factor to the display.

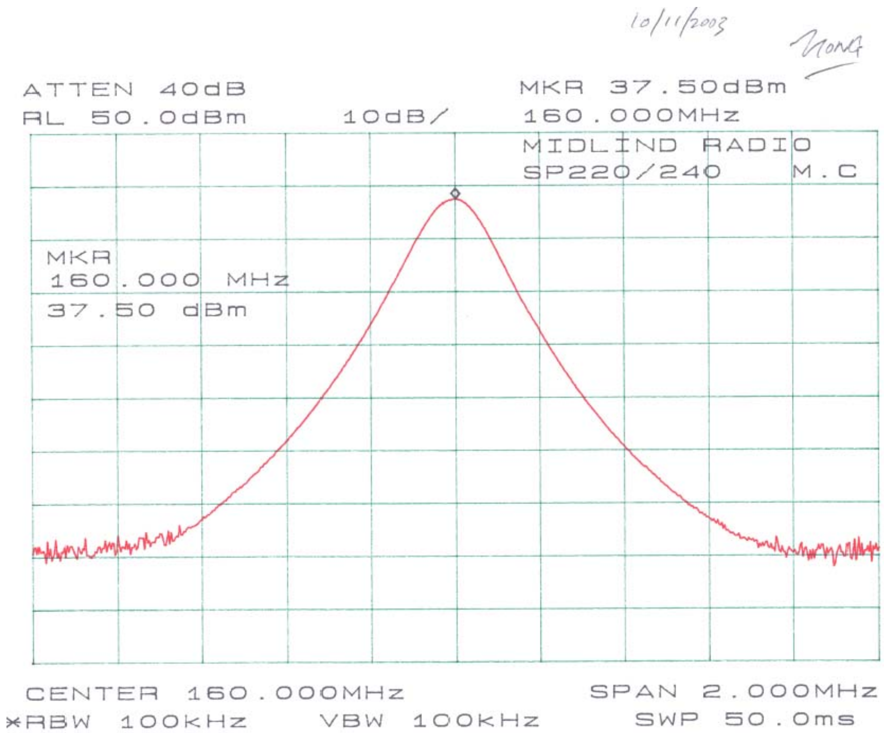


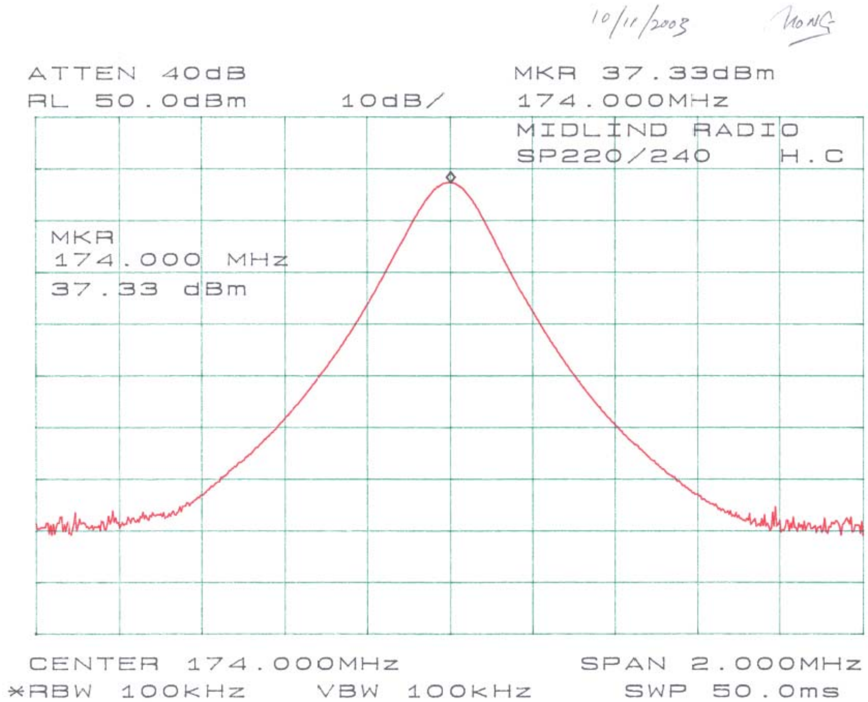
5.2 Test Results

Channel	Frequency in MHz	Output Power in dBm	Output Power in W
Low	146.00	37.33	5.408
Middle	160.00	37.50	5.623
High	174.00	37.33	5.408

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


10/11/2003
ATTEN 40dB
RL 50.0dBm
10dB/
MKR 37.33dBm
146.000MHz
MIDLIND RADIO
SP220/240 L.C
MKR
146.000 MHz
37.33 dBm
CENTER 146.000MHz
SPAN 2.000MHz
RBW 100kHz
VBW 100kHz
SWP 50.0ms


10/11/2003
ATTEN 40dB
RL 50.0dBm
10dB/
MKR 37.50dBm
160.000MHz
MIDLIND RADIO
SP220/240 M.C
MKR
160.000 MHz
37.50 dBm
CENTER 160.000MHz
SPAN 2.000MHz
*RBW 100kHz
VBW 100kHz
SWP 50.0ms


10/11/2003
ATTEN 40dB
RL 50.0dBm
10dB/
MKR 37.33dBm
174.000MHz
MIDLIND RADIO
SP220/240 H.C
MKR
174.000 MHz
37.33 dBm
CENTER 174.000MHz
SPAN 2.000MHz
*RBW 100kHz
VBW 100kHz
SWP 50.0ms

6 - DOSIMETRIC ASSESSMENT SETUP

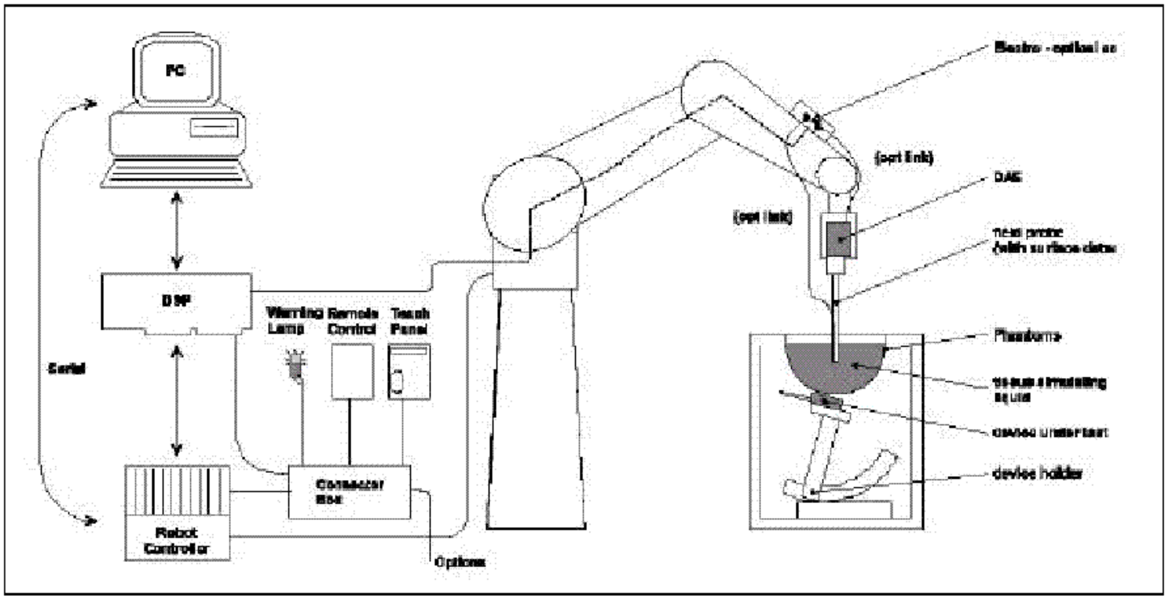
These measurements were performed with the automated near-field scanning system DASY3 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9m) which positions the probes with a positional repeatability of better than ±0.02mm. Special 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 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

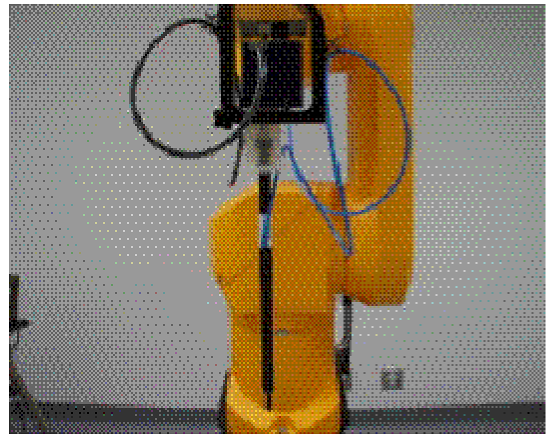
6.1 Measurement System Diagram



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.

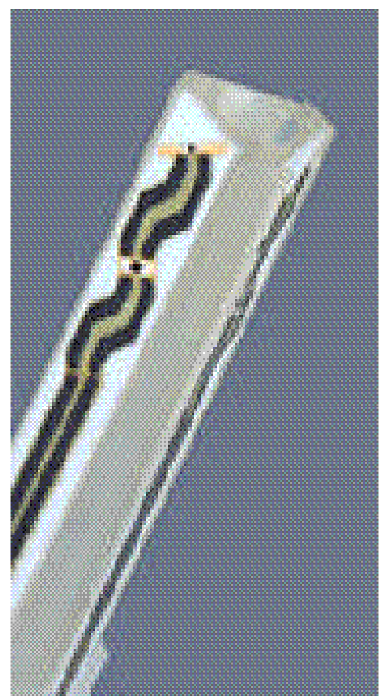
6.2 System Components



Photograph of the probe

ET3DV6 Probe Specification

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)
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.

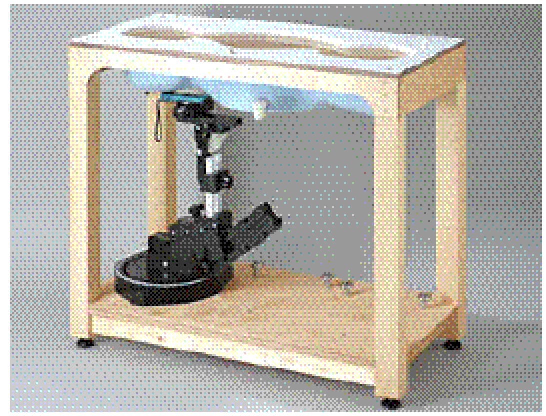
The power flow density is calculated assuming the excitation field as a free space field.

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

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

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)

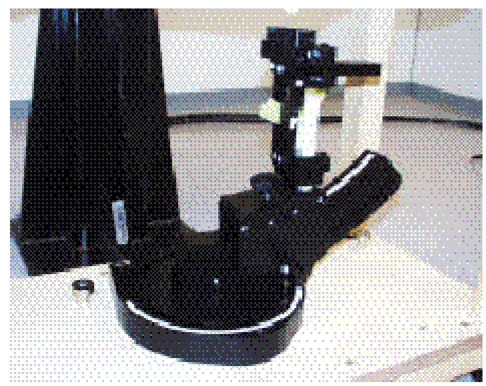


Generic Twin Phantom

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% 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

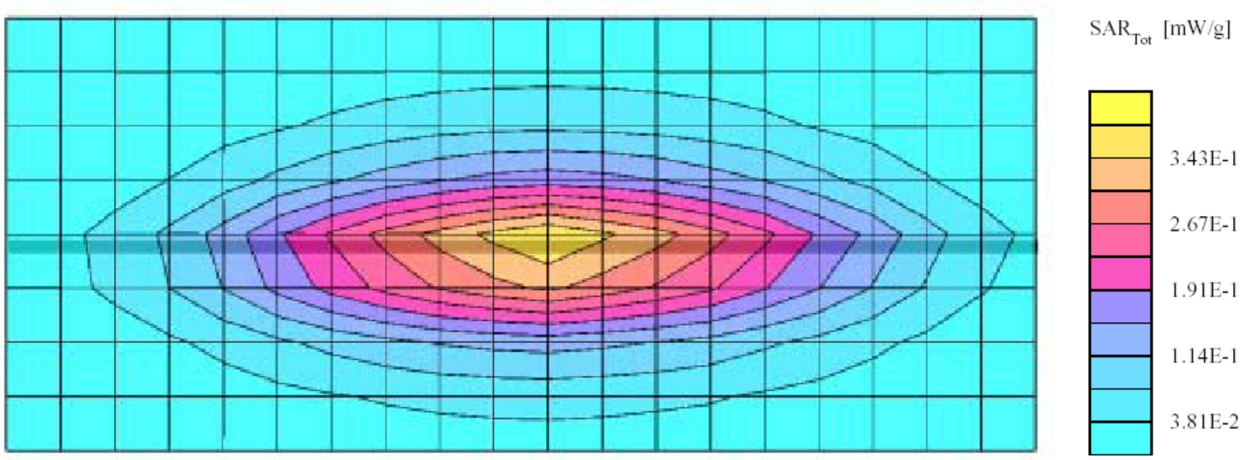
2003-10-11
Ambient Temperature (ºC): 23.0
Relative Humidity (%): 49.3

Simulant	Freq [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation [%]	Limits [%]
Body	300	ε	21	58.2	57.7	-0.86	±5
		σ	21	0.92	0.93	1.09	±5
		1g SAR	21	3.81	3.81	0.00	±10
Head	300	ε	21	45.3	43.4	-4.19	±5
		σ	21	0.87	0.85	-2.30	±5
		1g SAR	21	3.00	3.00	0.00	±10

ε = relative permittivity, σ = conductivity and $\rho=1000kg/m^3$
Note: Forward power for Body = 20.05 dBm = 101.16 mW
Forward power = 20.3 dBm = 107.15 mW

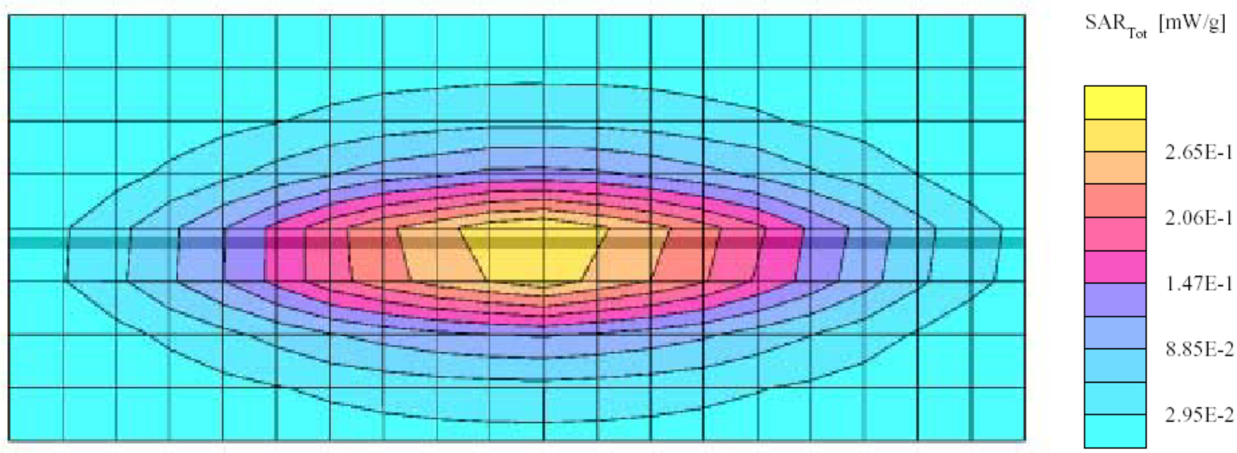
300 MHz Body Liquid System Validation (Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, Forward Power = 20.05 dBm, 10/11/2003)

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 = 0.93 mho/m ε_r = 57.7 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 0.385 mW/g, SAR (10g): 0.261 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.02 dB



300 MHz Head System Validation (Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, Forward Power = 20.3 dBm, 10/11/2003)

Flat Phantom v4.4 Phantom; Flat Section; Position: (90°,90°); Frequency: 300 MHz
Probe: ES3DV2 - SN3019; ConvF(7.81,7.81,7.81); Crest factor: 1.0; Body liquid 300 MHz: σ = 0.85 mho/m ε_r = 43.4 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 0.321 mW/g, SAR (10g): 0.218 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.01 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.