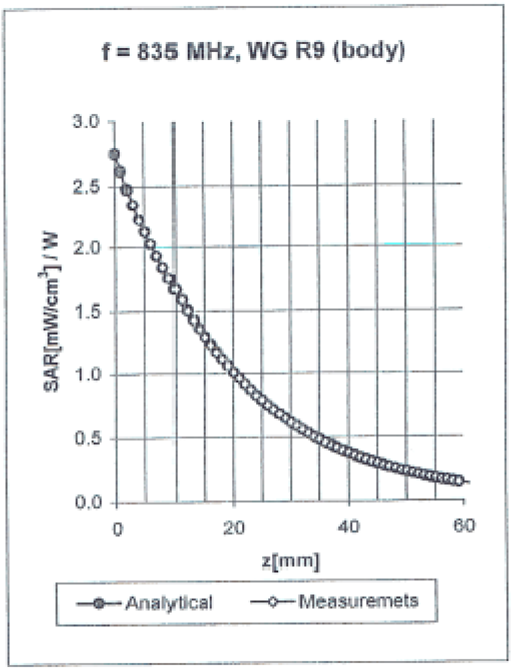
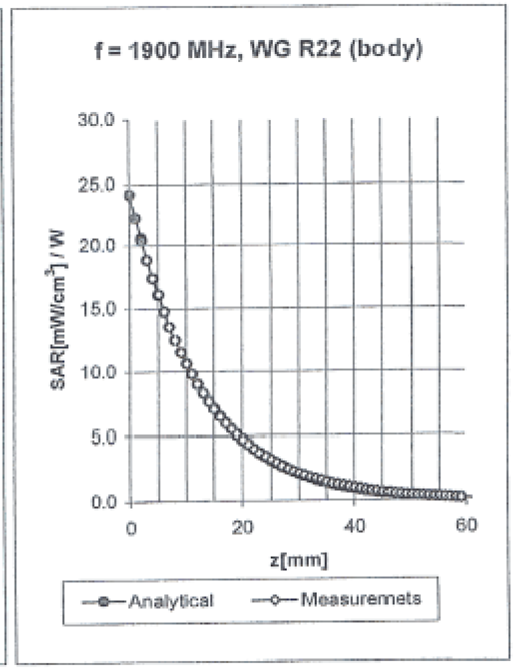
Convers ion Factor Assessment





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**

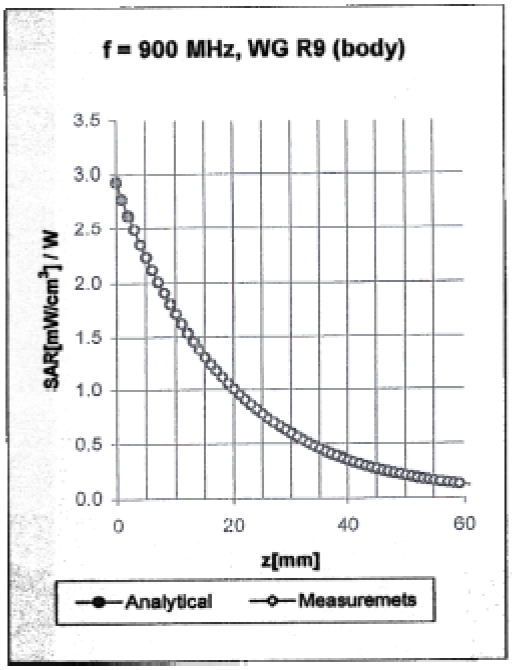
Body **1900 MHz** **ε_r = 53.3 ± 5%** **σ = 1.52 ± 5% mho/m**

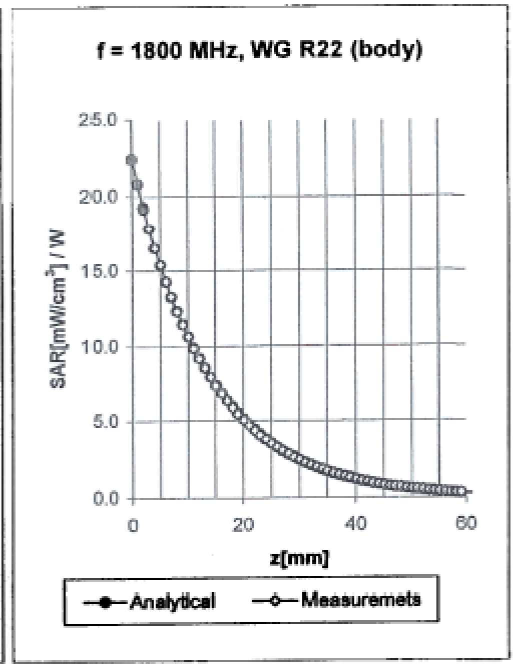
Valid for f=1805-1995 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

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**

Page 4 of 6

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

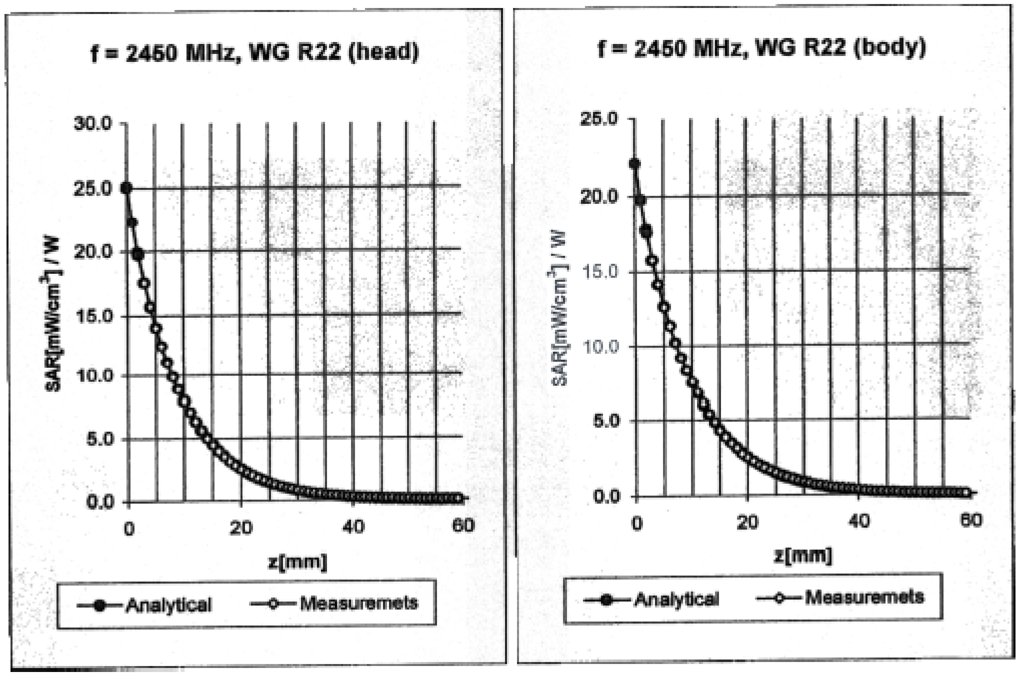
ConvF X	**6.1** ± 9.5% (k=2)		Boundary effect:	
ConvF Y	**6.1** ± 9.5% (k=2)		Alpha	**0.27**
ConvF Z	**6.1** ± 9.5% (k=2)		Depth	**1.82**

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**

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

Additional Conversion Factors

for Dosimetric E-Field Probe

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

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

Assessed by:

ES3DV2-SN:3019 October 13, 2003

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

Dosimetric E-Field Probe ES3DV2 SN:3019

Conversion factor (± standard deviation)

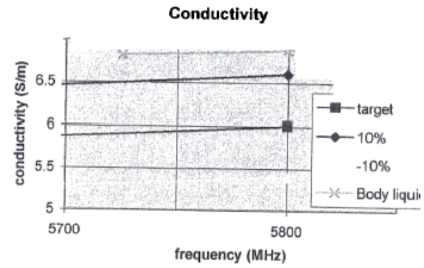
150 MHz	ConvF	8.7 ± 8%	ε_r = 52.3 ± 5% σ = 0.76 ± 5% mho/m (head tissue)
150 MHz	ConvF	8.3 ± 8%	ε_r = 61.9 ± 5% σ = 0.80 ± 5% mho/m (body tissue)
450 MHz	ConvF	7.4 ± 8%	ε_r = 43.5 ± 5% σ = 0.87 ± 5% mho/m (head tissue)
450 MHz	ConvF	7.3 ± 8%	ε_r = 56.7 ± 5% σ = 0.94 ± 5% mho/m (body tissue)

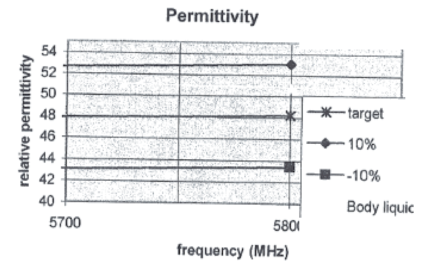
ES3DV2-SN:3019 October 13, 2003

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

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

0

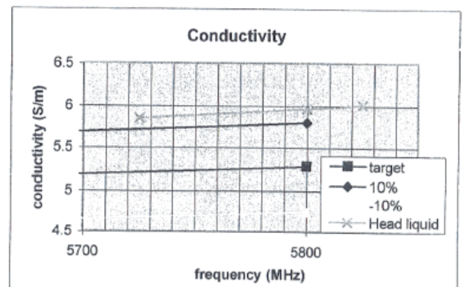


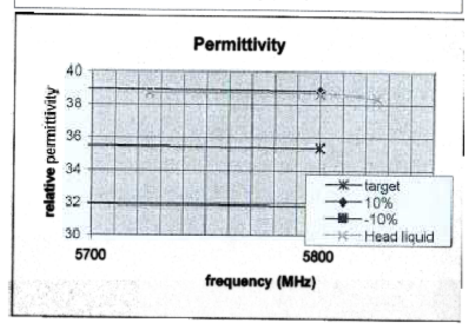


Freq. (MHz)	Amplitude (dB)	Phase (deg)	Rel. Perm.	Condy (S/m)
5725	-51.65	-20.5	38.7	5.849
5800	-52.5	-35	38.68	5.959
5825	-53	-35.6	38.39	6.008

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

5 0





Body 2450 MHz Liquid Measurement, 2004-02-10

Hong
2/10/2004

2450 MHz Body Liquid

frequency	e'	e''
2400000000.0000	52.6735	13.9488
2402000000.0000	52.5854	14.0026
2404000000.0000	52.7475	13.9783
2406000000.0000	52.8836	14.0266
2408000000.0000	52.9645	14.0183
2410000000.0000	52.8734	14.0039
2412000000.0000	52.7795	14.0342
2414000000.0000	52.7748	14.0026
2416000000.0000	52.8348	14.0219
2418000000.0000	52.8524	14.0258
2420000000.0000	52.8201	14.0268
2422000000.0000	52.7181	14.0445
2424000000.0000	52.5875	14.0311
2426000000.0000	52.4679	14.0684
2428000000.0000	52.4572	14.1060
2430000000.0000	52.4977	14.1055
2432000000.0000	52.4841	14.0912
2434000000.0000	52.5003	14.0501
2436000000.0000	52.6003	14.1069
2438000000.0000	52.6164	14.0984
2440000000.0000	52.6844	14.0881
2442000000.0000	52.7092	14.1037
2444000000.0000	52.6703	14.1109
2446000000.0000	52.5996	14.0723
2448000000.0000	52.5549	14.1160
2450000000.0000	52.5417	14.1503
2452000000.0000	52.5663	14.1605
2454000000.0000	52.6005	14.1704
2456000000.0000	52.6193	14.1507
2458000000.0000	52.5963	14.1875
2460000000.0000	52.5909	14.2037
2462000000.0000	52.6125	14.2219
2464000000.0000	52.6138	14.2225
2466000000.0000	52.6254	14.2317
2468000000.0000	52.6151	14.2436
2470000000.0000	52.5709	14.2483
2472000000.0000	52.5904	14.2328
2474000000.0000	52.6791	14.2458
2476000000.0000	52.7674	14.2655
2478000000.0000	52.8528	14.2699
2480000000.0000	52.7638	14.2545
2482000000.0000	52.7294	14.2813
2484000000.0000	52.6734	14.3042
2486000000.0000	52.6331	14.2941
2488000000.0000	52.6112	14.2960
2490000000.0000	52.6158	14.2949
2492000000.0000	52.6292	14.3181
2494000000.0000	52.6620	14.3215
2496000000.0000	52.7338	14.3311
2498000000.0000	52.7413	14.3290
2500000000.0000	52.7454	14.3182

~~1.93~~
1.9286

$\sigma = \omega \varepsilon_o \varepsilon'' = 2 \pi f \varepsilon_o \varepsilon''=1.9286$

where $f = 2450 x 10^6$

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

$\varepsilon'' = 14.1503$

Head 2450 MHz Liquid Measurement, 2004-02-10

Hong
2/10/2004

2450 MHz head Liquid

frequency	e'	e''	
2300000000.0000	39.5703	13.1568	
2304166666.6667	39.5415	13.1731	
2308333333.3333	39.4667	13.1753	
2312500000.0000	39.4315	13.2026	
2316666666.6667	39.4022	13.2276	
2320833333.3333	39.3488	13.2427	
2325000000.0000	39.3614	13.2583	
2329166666.6667	39.3418	13.2726	
2333333333.3333	39.3485	13.3395	
2337500000.0000	39.3775	13.3799	
2341666666.6667	39.3961	13.4183	
2345833333.3333	39.3991	13.4666	
2350000000.0000	39.4172	13.4830	
2354166666.6667	39.4612	13.5303	
2358333333.3333	39.4690	13.5563	
2362500000.0000	39.4958	13.5823	
2366666666.6667	39.4769	13.6115	
2370833333.3333	39.4918	13.6205	
2375000000.0000	39.5275	13.6372	
2379166666.6667	39.5328	13.6540	
2383333333.3333	39.5053	13.6462	
2387500000.0000	39.5291	13.6646	
2391666666.6667	39.5017	13.6824	
2395833333.3333	39.4912	13.6617	
2400000000.0000	39.4149	13.6865	
2404166666.6667	39.3328	13.6458	
2408333333.3333	39.2857	13.6250	
2412500000.0000	39.2926	13.6664	
2416666666.6667	39.1856	13.5818	
2420833333.3333	39.1275	13.6054	
2425000000.0000	39.1302	13.6842	
2429166666.6667	39.0423	13.6252	
2433333333.3333	38.9632	13.5945	
2437500000.0000	39.0356	13.7377	
2441666666.6667	39.0281	13.7639	
2445833333.3333	39.0185	13.7910	
2450000000.0000	39.0062	13.8263	1.8845
2454166666.6667	39.0048	13.8700	
2458333333.3333	38.9243	13.8131	
2462500000.0000	38.9485	13.8584	
2466666666.6667	39.0303	13.9177	
2470833333.3333	39.0456	13.9368	
2475000000.0000	39.1292	14.0190	
2479166666.6667	39.0972	14.0417	
2483333333.3333	39.0786	14.1126	
2487500000.0000	39.1383	14.1530	
2491666666.6667	39.2013	14.1851	
2495833333.3333	39.1794	14.2151	
2500000000.0000	39.1380	14.2148	

$\sigma = \omega \varepsilon_o \varepsilon'' = 2 \pi f \varepsilon_o \varepsilon'' = 1.8845$

where $f = 2450 \times 10^6$

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

$\varepsilon'' = 13.8263$

3 - EUT SUMMARY

Applicant:	AMBIT Microsystems Corporation
Product Description:	Wireless MinPCI Card
Model Name:	AIR-MPI350
FCC ID:	MCLAIRMPI350DE
Serial Number:	000000001SC/00D059C99003
Transmitter Frequency:	2412-2462 MHz
Maximum Output Power:	20.67 dBm (117 mW)
RF Exposure environment:	General Population/Uncontrolled
Power Supply:	DELL AC Adapter, M/N: AA22850
Applicable Standard	FCC CFR 47, Part 15 Subpart C
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.

** The test data gathered are from production sample, serial number:MPI350-001, provided by the manuafactuer.*

4 - SYSTEM TEST CONFIGURATION

4.1 Justification

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

4.2 EUT Exercise Software and Procedure

The EUT exercising program used during SAR testing was designed to exercise the various system components in a manner similar to a typical use. The software, PRISM utilities, contained on the hard drive, is auto starting on power-up. Once loaded, the program sequentially exercises each system component.

The testing procedure is as follows:

1. Click PRISM test utilities on Window
2. Select wireless LAN Adapter under adapters list
3. Select low, mid and high channels under Radio Channels
4. Select Tx Rate of 11MB
5. Click on “continuous Tx” bottom

4.3 Special Accessories

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

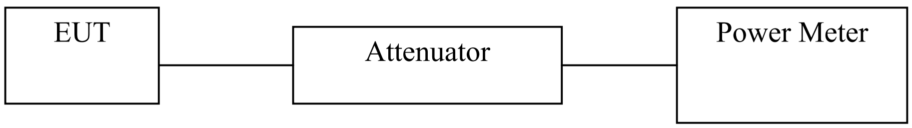
4.4 Equipment Modifications

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

5 - CONDUCTED OUTPUT POWER MEASUREMENT

5.1 Measurement Procedure

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



5.2 Test Results

HFT06

Antenna	Frequency (MHz)	Peak Output Power (dBm)	Correction Factor (dBm)	Corrected Factor (dBm)	Output Power (W)	Standard (W)	Result
Main	2462	12.50	8.0	20.50	0.112	≤ 1 W	Compliant
	2437	12.67	8.0	20.67	0.117	≤ 1 W	Compliant
	2412	12.50	8.0	20.50	0.112	≤ 1 W	Compliant
Auxiliary	2463	12.50	8.0	20.50	0.112	≤ 1 W	Compliant
	2437	12.67	8.0	20.67	0.117	≤ 1 W	Compliant
	2412	12.33	8.0	20.33	0.108	≤ 1 W	Compliant

CAQ-S

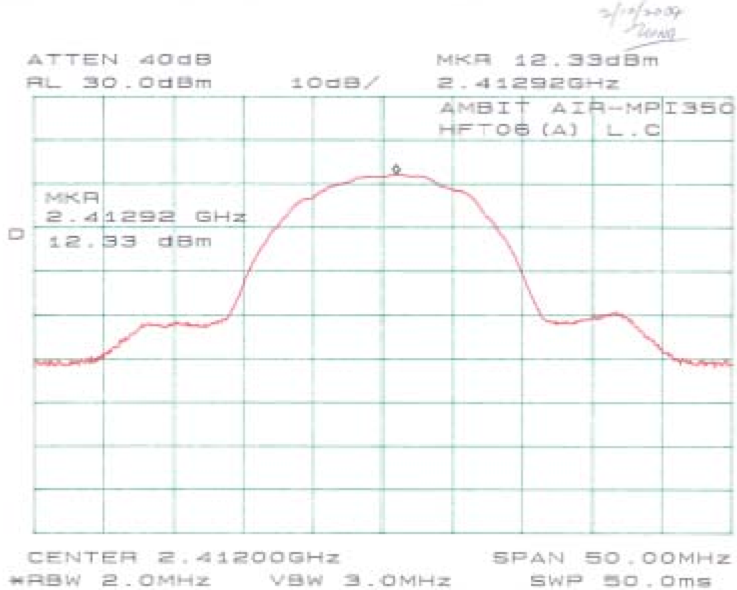
Antenna	Frequency (MHz)	Peak Output Power (dBm)	Correction Factor (dBm)	Corrected Factor (dBm)	Output Power (W)	Standard (W)	Result
Main	2437	12.67	8.0	20.67	0.117	≤ 1 W	Compliant
Auxiliary	2437	12.50	8.0	20.50	0.112	≤ 1 W	Compliant

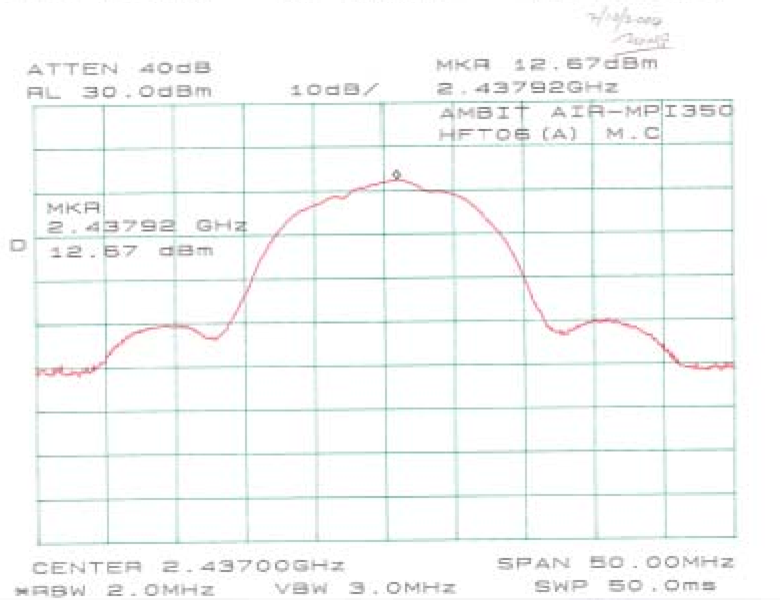
$$\text{*Correction Factor} = 10 \text{ Log} \frac{\text{6dB Bandwidth}}{\text{RBW}} = 10 \text{ Log} \frac{13}{2} \approx 8.0$$

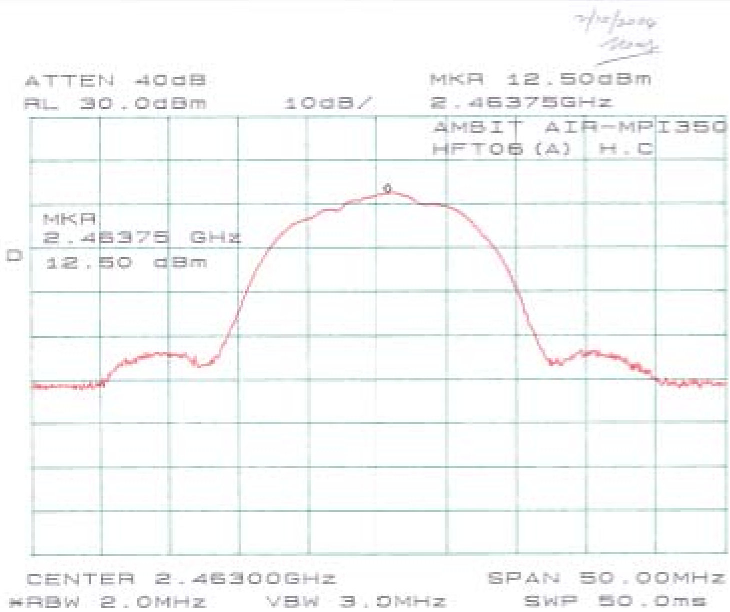
5.3 Measurement Plots

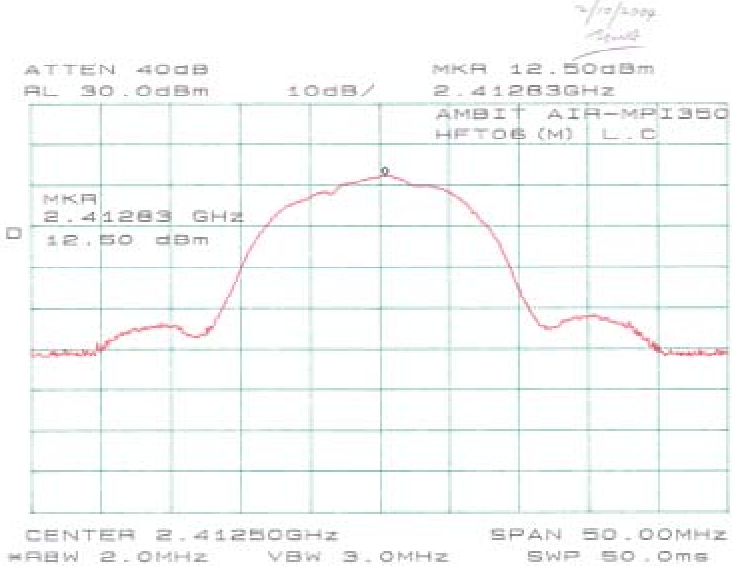
Please refer to the plots hereinafter.

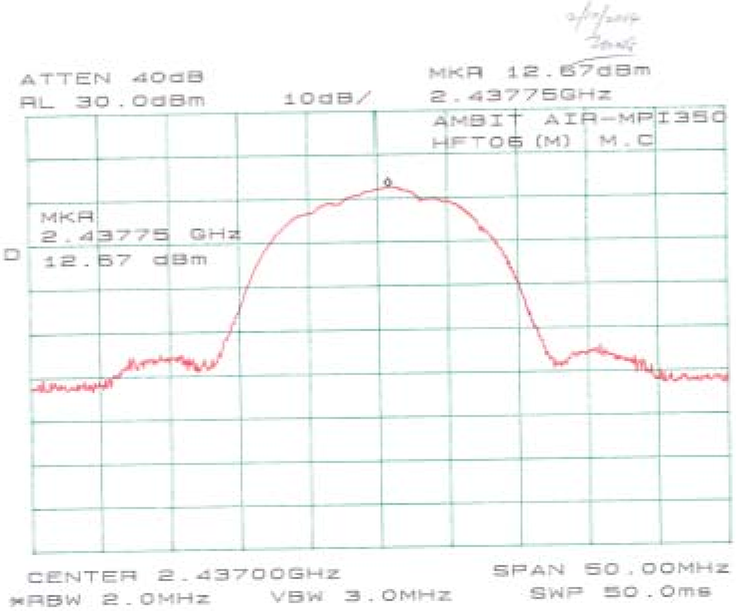
HFT06

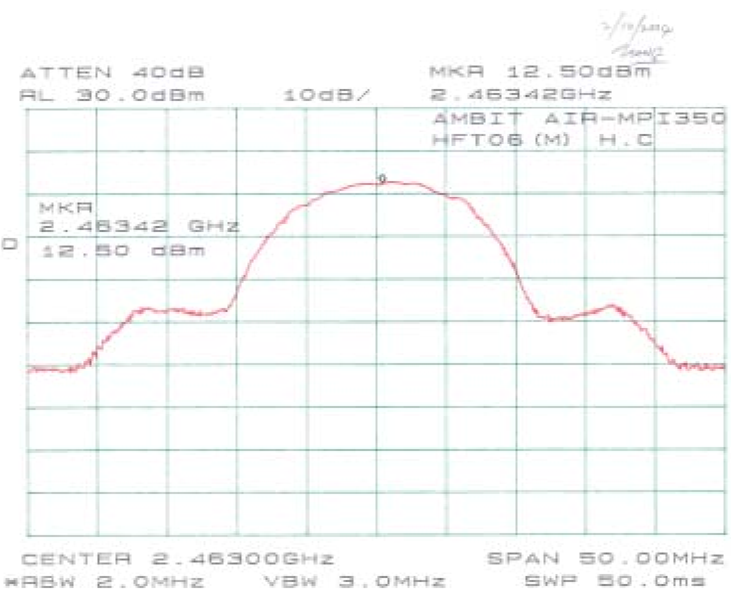

ATTEN 40dB
RL 30.0dBm 10dB/
MKR 12.33dBm
2.41292GHz
AMBIT AIR-MPI350
HFT06(A) L.C
MKR
2.41292 GHz
12.33 dBm
D
CENTER 2.41200GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm 10dB/
MKR 12.67dBm
2.43792GHz
AMBIT AIR-MPI350
HFT06(A) M.C
MKR
2.43792 GHz
12.67 dBm
D
CENTER 2.43700GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms

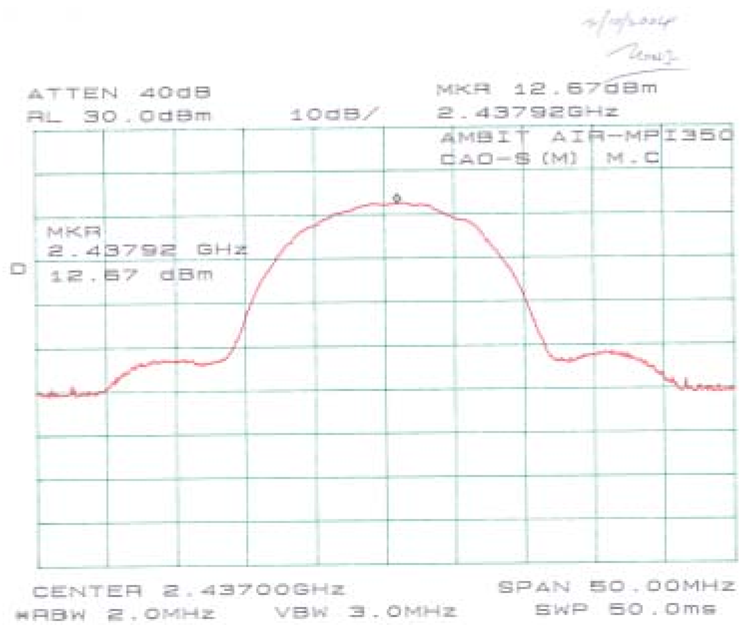

ATTEN 40dB
RL 30.0dBm 10dB/
MKR 12.50dBm
2.46375GHz
AMBIT AIR-MPI350
HFT06(A) H.C
MKR
2.46375 GHz
12.50 dBm
D
CENTER 2.46300GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 12.50dBm
2.41283GHz
AMBIT AIR-MPI350
HFT06 (M) L.C
MKR
2.41283 GHz
12.50 dBm
D
CENTER 2.41250GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms

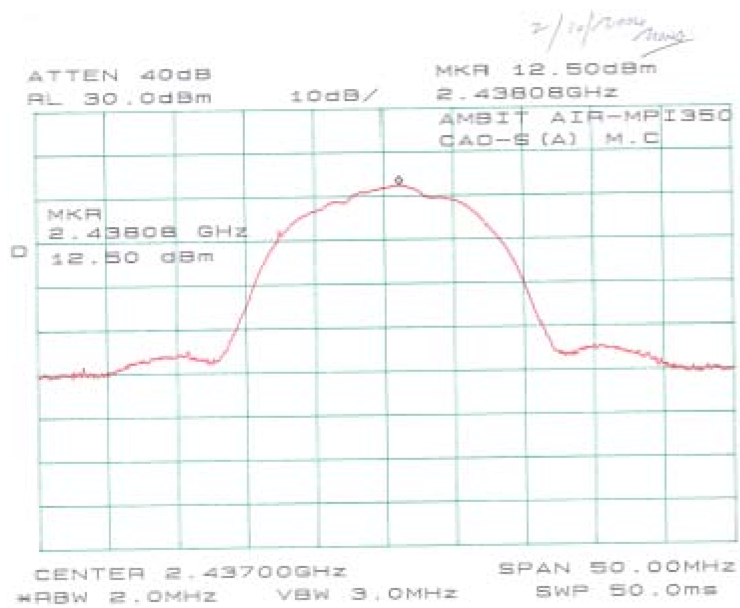

ATTEN 40dB
RL 30.0dBm
10dB/
MKR 12.67dBm
2.43775GHz
AMBIT AIR-MPI350
HFT06 (M) M.C
MKR
2.43775 GHz
12.67 dBm
D
CENTER 2.43700GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 12.50dBm
2.46342GHz
AMBIT AIR-MPI350
HFT06 (M) H.C
MKR
2.46342 GHz
12.50 dBm
D
CENTER 2.46300GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms

CAQ-S



ATTEN 40dB
RL 30.0dBm
10dB/
MKR 12.67dBm
2.43792GHz
AMBIT AIR-MPI350
CAO-S (M) M.C
MKR
2.43792 GHz
12.67 dBm
CENTER 2.43700GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms



ATTEN 40dB
RL 30.0dBm
10dB/
MKR 12.50dBm
2.43808GHz
AMBIT AIR-MPI350
CAO-S (A) M.C
MKR
2.43808 GHz
12.50 dBm
CENTER 2.43700GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms

6 - DOSIMETRIC ASSESSMENT SETUP

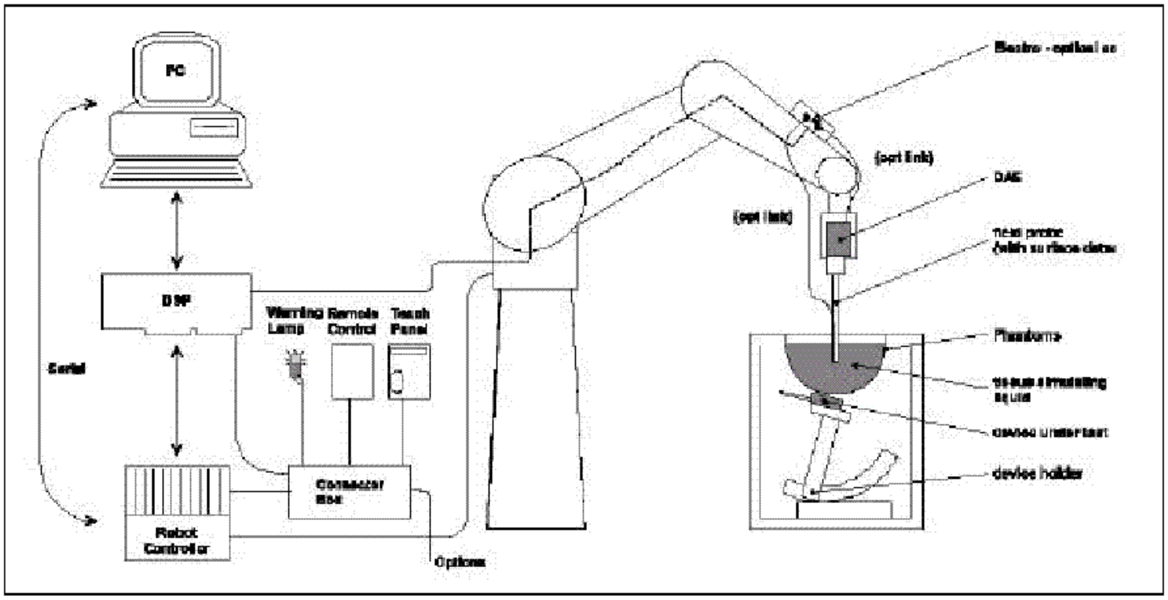
These measurements were performed with the automated near-field scanning system DASY3 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9m) which positions the probes with a positional repeatability of better than ±0.02mm. Special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

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

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

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (Nacl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton x-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.2	52.7
Conductivity (s/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.80	1.91

6.1 Measurement System Diagram

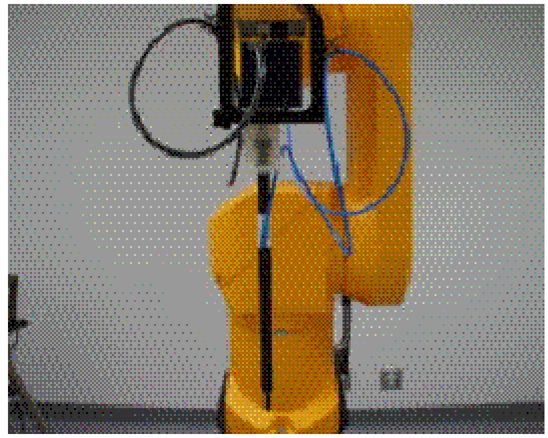


The DASY3 system for performing compliance tests consist of the following items:

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

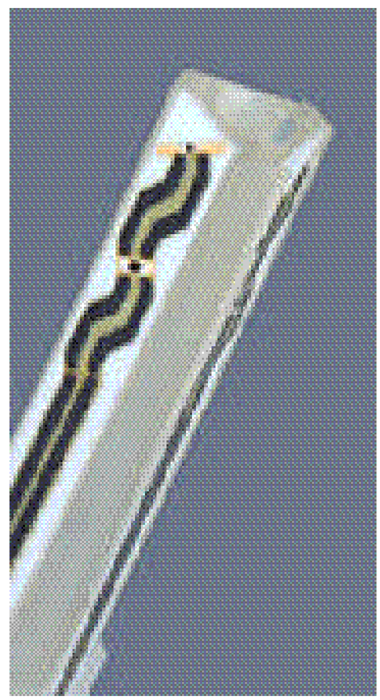
6.2 System Components

ET3DV6 Probe Specification



Photograph of the probe

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



Inside view of ET3DV6 E-field Probe

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

E-Field Probe Calibration Process

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

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

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

Data Evaluation

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

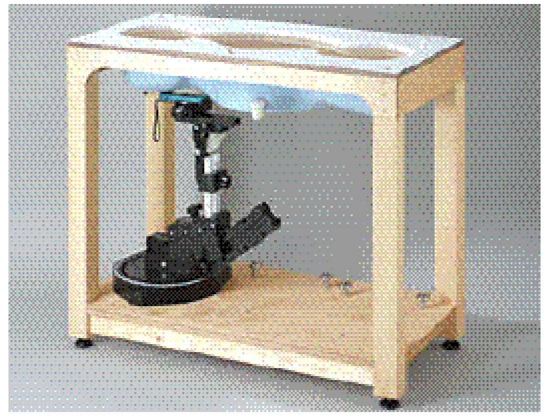
The power flow density is calculated assuming the excitation field as a free space field.

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

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

Generic Twin Phantom

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

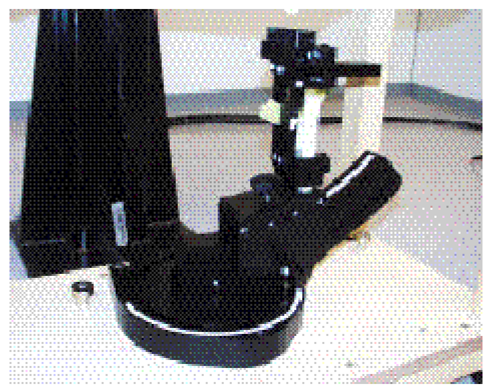


Generic Twin Phantom

Device Holder

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

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



Device Holder