

ATTACHMENT Q – DIPOLE VALIDATION

Validation Data (835MHz Brain)

Dipole 1900 MHz

SAM II Phantom; Flat Section; Position: (90°,90°); Frequency: 1900 MHz

Probe: ET3DV6 - SN1608; ConvF(5.20,5.20,5.20); Crest factor: 1.0; Brain 1900 MHz: $\sigma = 1.43$

mho/m $\epsilon_r = 38.6$ $\rho = 1.00$ g/cm³

Cubes (2): SAR (1g): 41.1 mW/g ± 0.02 dB, SAR (10g): 21.1 mW/g ± 0.01 dB

Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0

Powerdrift: 0.05 dB

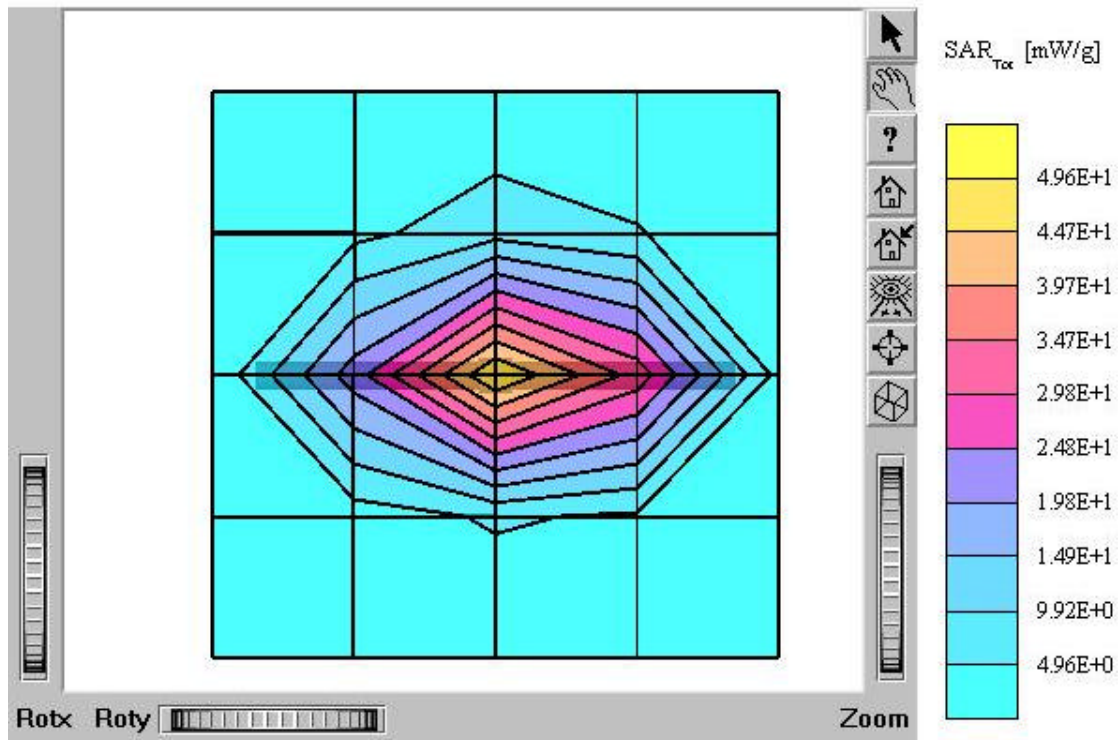
Comment:

1900 MHz Brain Dipole Validation (D1900V2/ S.N: 5d032)

Antenna Input Power : 30 dBm (1W)

HCT Co., Ltd. Brain Tissue Simulating Liquid

Liquid Temperature : 21.5 °C



Dipole 1900 MHz

SAM II Phantom; Flat Section; Position: (90°, 90°); Frequency: 1900 MHz

Probe: ET3DV6 - SN1608; ConvF(5.20,5.20,5.20); Crest factor: 1.0; Brain 1900 MHz: $\sigma = 1.43$ mho/m $\epsilon_r = 38.6$ $\rho = 1.00$ g/cm³Cubes (2): SAR (1g): 41.1 mW/g ± 0.02 dB, SAR (10g): 21.1 mW/g ± 0.01 dB

Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0

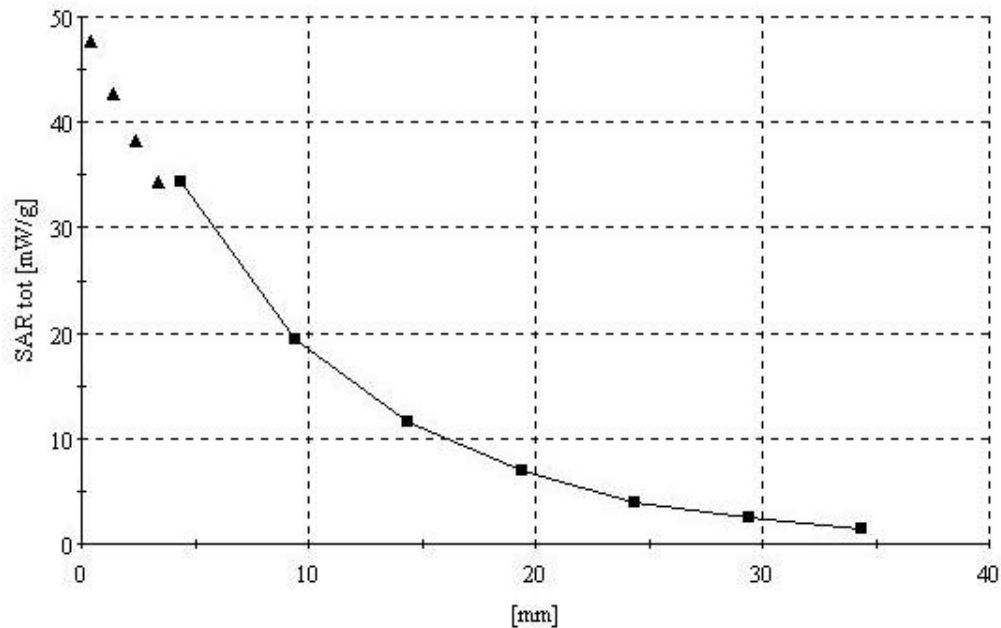
Comment:

1900 MHz Brain Dipole Validation (D1900V2/ S.N: 5d032)

Antenna Input Power : 30 dBm (1W)

HCT Co., Ltd. Brain Tissue Simulating Liquid

Liquid Temperature : 21.5 °C



Dielectric Parameter (835MHz Brain)**Title : HTP-1900****SubTitle : 1900 MHz Brain**

August 11, 2003 09:19 AM

Frequency	e'	e''
1.700000000 GHz	39.2996	13.0127
1.710000000 GHz	39.3659	13.0687
1.720000000 GHz	39.4146	13.1460
1.730000000 GHz	39.4830	13.1801
1.740000000 GHz	39.4881	13.1884
1.750000000 GHz	39.4671	13.1502
1.760000000 GHz	39.3715	13.1347
1.770000000 GHz	39.2313	13.1035
1.780000000 GHz	39.0975	13.1061
1.790000000 GHz	38.9572	13.1255
1.800000000 GHz	38.8507	13.1890
1.810000000 GHz	38.8192	13.2744
1.820000000 GHz	38.8144	13.3467
1.830000000 GHz	38.8832	13.4492
1.840000000 GHz	38.9222	13.4998
1.850000000 GHz	38.9893	13.5357
1.860000000 GHz	38.9888	13.5523
1.870000000 GHz	38.9515	13.5706
1.880000000 GHz	38.8458	13.5482
1.890000000 GHz	38.7200	13.5155
1.900000000 GHz	38.5787	13.5171
1.910000000 GHz	38.4328	13.5373
1.920000000 GHz	38.3322	13.5710
1.930000000 GHz	38.2657	13.6336
1.940000000 GHz	38.2873	13.7227
1.950000000 GHz	38.3141	13.7992
1.960000000 GHz	38.3703	13.8420
1.970000000 GHz	38.4408	13.9098
1.980000000 GHz	38.4603	13.9194
1.990000000 GHz	38.4095	13.9133
2.000000000 GHz	38.3080	13.8769

Dielectric Parameter (835MHz Body)

Title : HTP-1900
SubTitle : 1900 MHz Body
August 11, 2003 09:29 AM

Frequency	e'	e''
1.700000000 GHz	52.8298	14.2819
1.710000000 GHz	52.7852	14.3245
1.720000000 GHz	52.7630	14.3603
1.730000000 GHz	52.7124	14.4081
1.740000000 GHz	52.7066	14.4050
1.750000000 GHz	52.6991	14.4068
1.760000000 GHz	52.6675	14.4214
1.770000000 GHz	52.5995	14.4119
1.780000000 GHz	52.5799	14.4278
1.790000000 GHz	52.5600	14.4369
1.800000000 GHz	52.4975	14.4749
1.810000000 GHz	52.4945	14.5206
1.820000000 GHz	52.4211	14.5579
1.830000000 GHz	52.3741	14.6273
1.840000000 GHz	52.3453	14.6776
1.850000000 GHz	52.2777	14.6933
1.860000000 GHz	52.2392	14.7276
1.870000000 GHz	52.2484	14.7524
1.880000000 GHz	52.2076	14.8001
1.890000000 GHz	52.1771	14.7883
1.900000000 GHz	52.1352	14.7943
1.910000000 GHz	52.0668	14.7850
1.920000000 GHz	52.0208	14.8066
1.930000000 GHz	52.0019	14.8362
1.940000000 GHz	51.9491	14.8505
1.950000000 GHz	51.8788	14.9101
1.960000000 GHz	51.8796	14.9512
1.970000000 GHz	51.8236	14.9986
1.980000000 GHz	51.7654	15.0415
1.990000000 GHz	51.7799	15.0489
2.000000000 GHz	51.7536	15.0949

ATTACHMENT R – PROBE CALIBRATION DATA

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

Client **Hyundai (Dymstec)**

CALIBRATION CERTIFICATE

Object(s) **ET3DV6 - SN:1606**

Calibration procedure(s) **QA CAL-01.v2**
Calibration procedure for dosimetric E-field probes

Calibration date: **June 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
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05
Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (Agilent, No. 20020918)	Sep-03
Power meter EPM E4419B	GB41293874	2-Apr-03 (METAS, No 252-0250)	Apr-04
Network Analyzer HP 8753E	US37390585	18-Oct-01 (Agilent, No. 24BR1033101)	In house check: Oct 03
Fluke Process Calibrator Type 702	SN: 6295803	3-Sep-01 (ELCAL, No.2360)	Sep-03

Calibrated by: **Name** **Function** **Signature**
Katja Polakovic **Laboratory Director** *Katja Polakovic*

Approved by: **Name** **Function**
F. Bensch **R&D Director** *F. Bensch*

Date issued: June 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.

Schmid & Partner Engineering AG

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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 ET3DV6

SN:1608

Manufactured: July 27, 2001
Last calibration: August 20, 2001
Recalibrated: June 9, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ET3DV6 SN:1608

June 9, 2003

DASY - Parameters of Probe: ET3DV6 SN:1608

Sensitivity in Free Space

Diode Compression

NormX	1.77 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	92	mV
NormY	1.58 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	92	mV
NormZ	1.87 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	92	mV

Sensitivity in Tissue Simulating Liquid

Head 900 MHz $\epsilon_r = 41.5 \pm 5\%$ $\sigma = 0.97 \pm 5\%$ mho/m

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

ConvF X	6.5 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	6.5 $\pm 9.5\%$ (k=2)	Alpha	0.39
ConvF Z	6.5 $\pm 9.5\%$ (k=2)	Depth	2.44

Head 1800 MHz $\epsilon_r = 40.0 \pm 5\%$ $\sigma = 1.40 \pm 5\%$ mho/m

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

ConvF X	5.2 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	5.2 $\pm 9.5\%$ (k=2)	Alpha	0.48
ConvF Z	5.2 $\pm 9.5\%$ (k=2)	Depth	2.68

Boundary Effect

Head 900 MHz Typical SAR gradient: 5 % per mm

Probe Tip to Boundary		1 mm	2 mm
SAR _{be} [%]	Without Correction Algorithm	9.7	5.5
SAR _{be} [%]	With Correction Algorithm	0.3	0.5

Head 1800 MHz Typical SAR gradient: 10 % per mm

Probe Tip to Boundary		1 mm	2 mm
SAR _{be} [%]	Without Correction Algorithm	13.4	9.1
SAR _{be} [%]	With Correction Algorithm	0.2	0.1

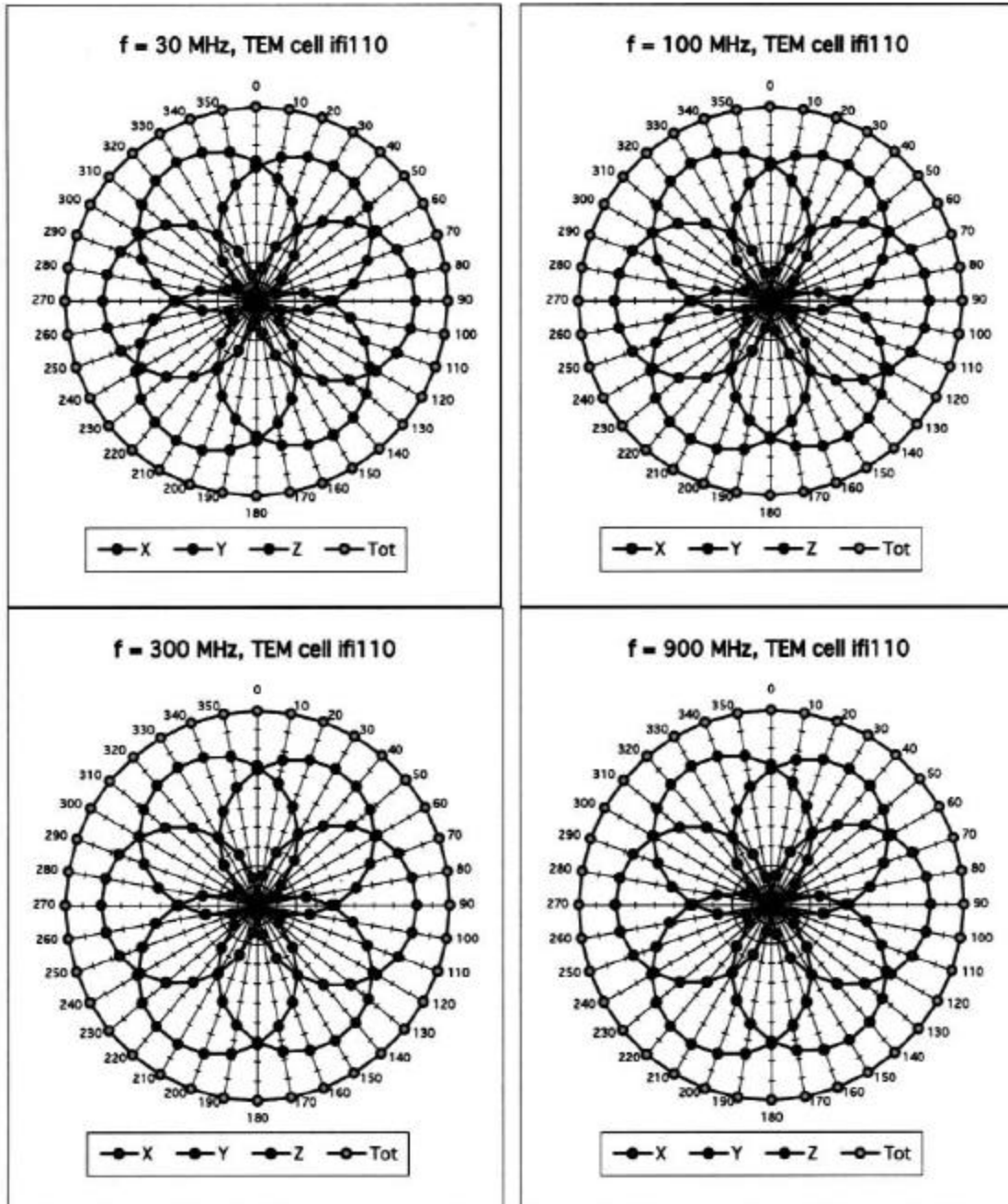
Sensor Offset

Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.5 ± 0.2	mm

ET3DV6 SN:1608

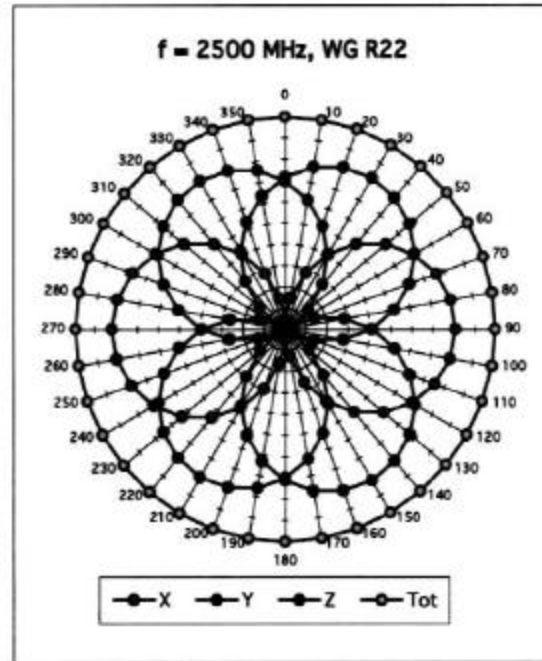
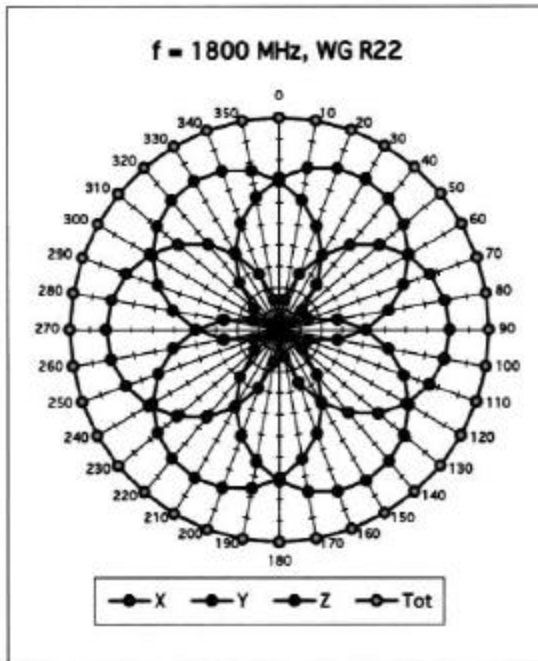
June 9, 2003

Receiving Pattern (ϕ), $\theta = 0^\circ$

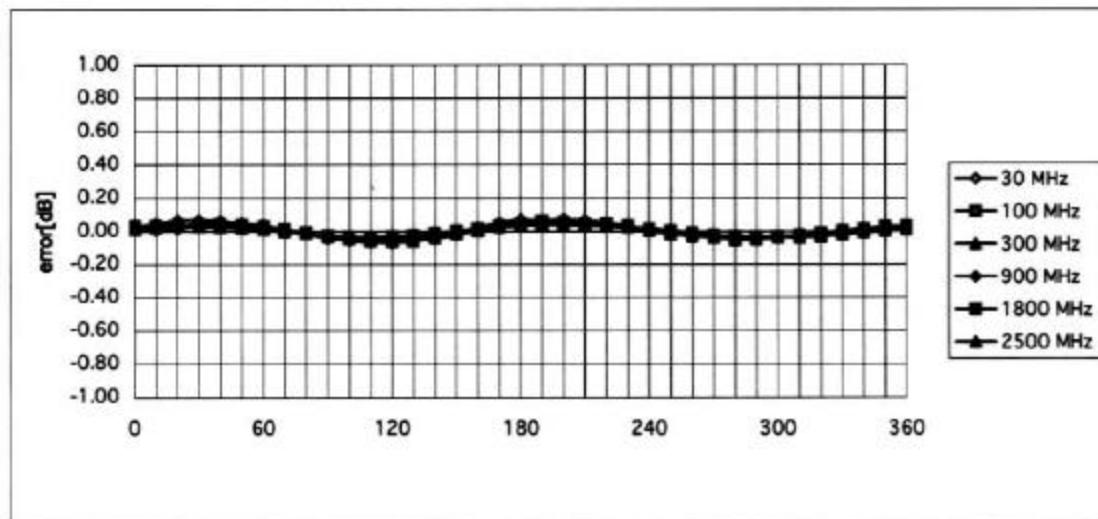


ET3DV6 SN:1608

June 9, 2003



Isotropy Error (ϕ), $\theta = 0^\circ$

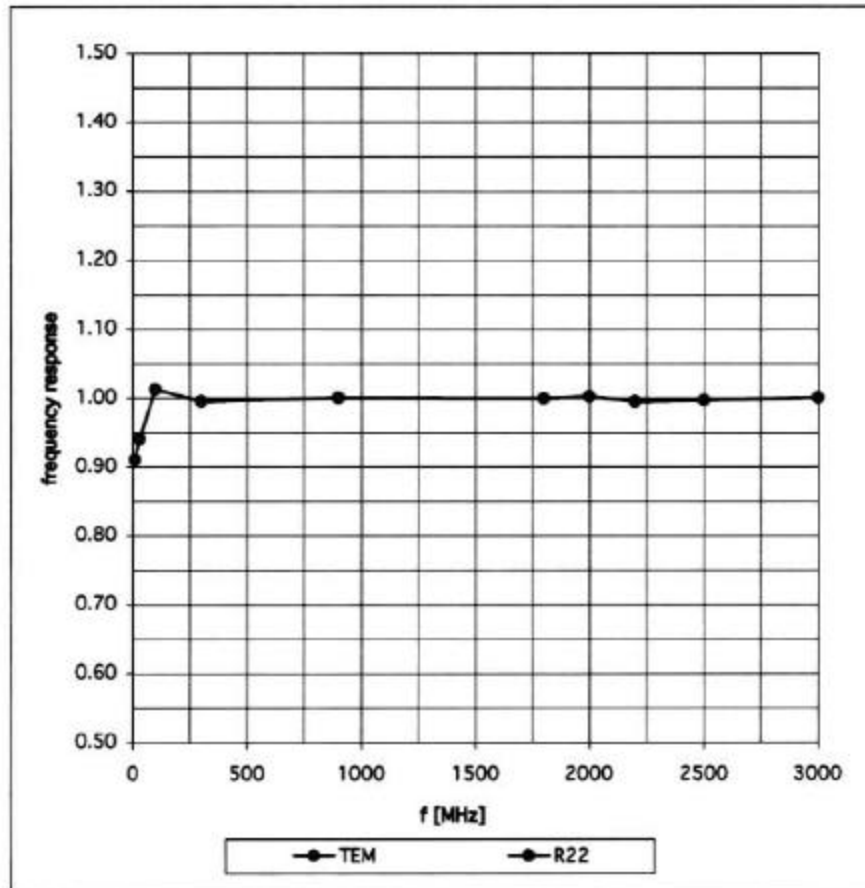


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Frequency Response of E-Field

(TEM-Cell:iff110, Waveguide R22)

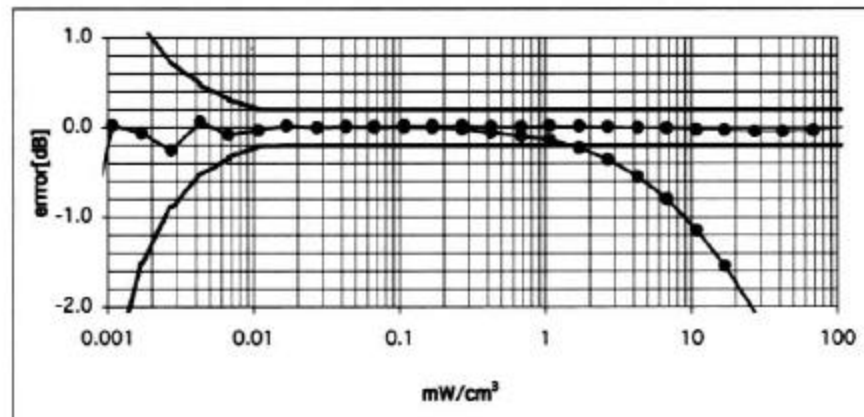
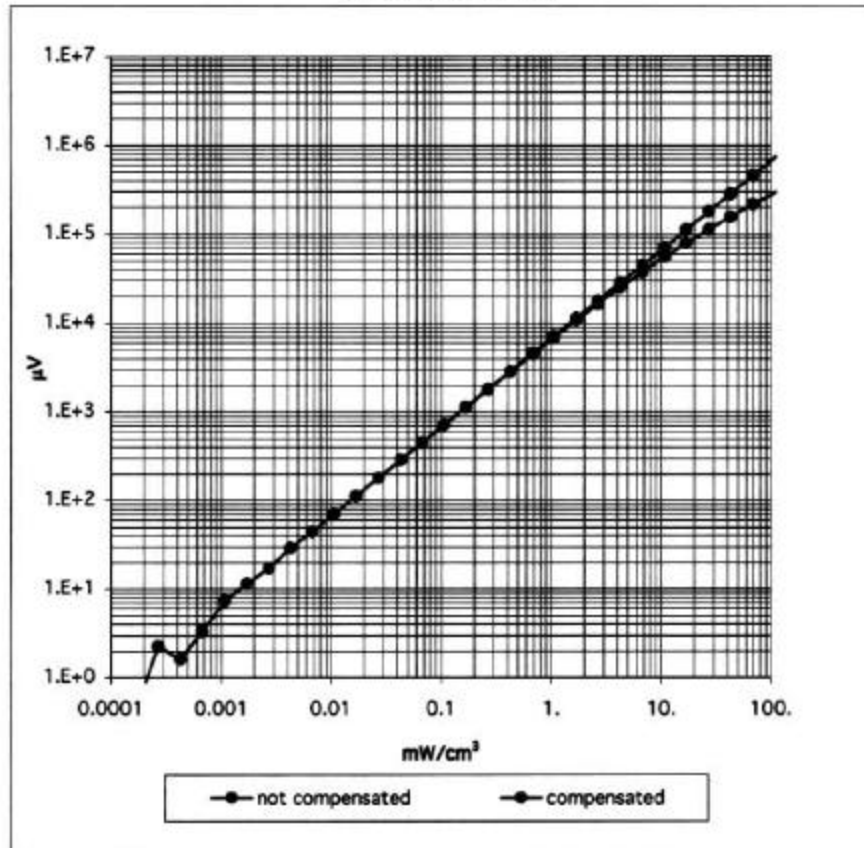


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Dynamic Range f(SAR_{brain})

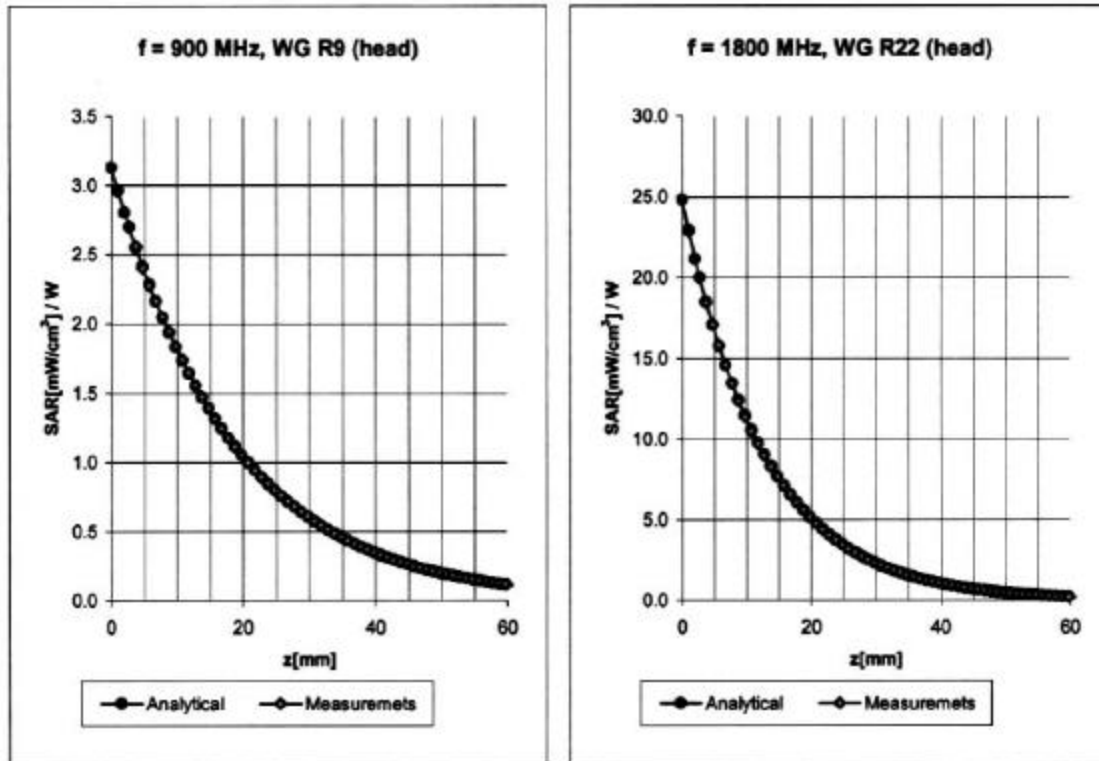
(Waveguide R22)



ET3DV6 SN:1608

June 9, 2003

Conversion Factor Assessment



Head 900 MHz $\epsilon_r = 41.5 \pm 5\%$ $\sigma = 0.97 \pm 5\%$ mho/m

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

ConvF X	6.5 $\pm$ 9.5% (k=2)	Boundary effect:	
ConvF Y	6.5 $\pm$ 9.5% (k=2)	Alpha	0.39
ConvF Z	6.5 $\pm$ 9.5% (k=2)	Depth	2.44

Head 1800 MHz $\epsilon_r = 40.0 \pm 5\%$ $\sigma = 1.40 \pm 5\%$ mho/m

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

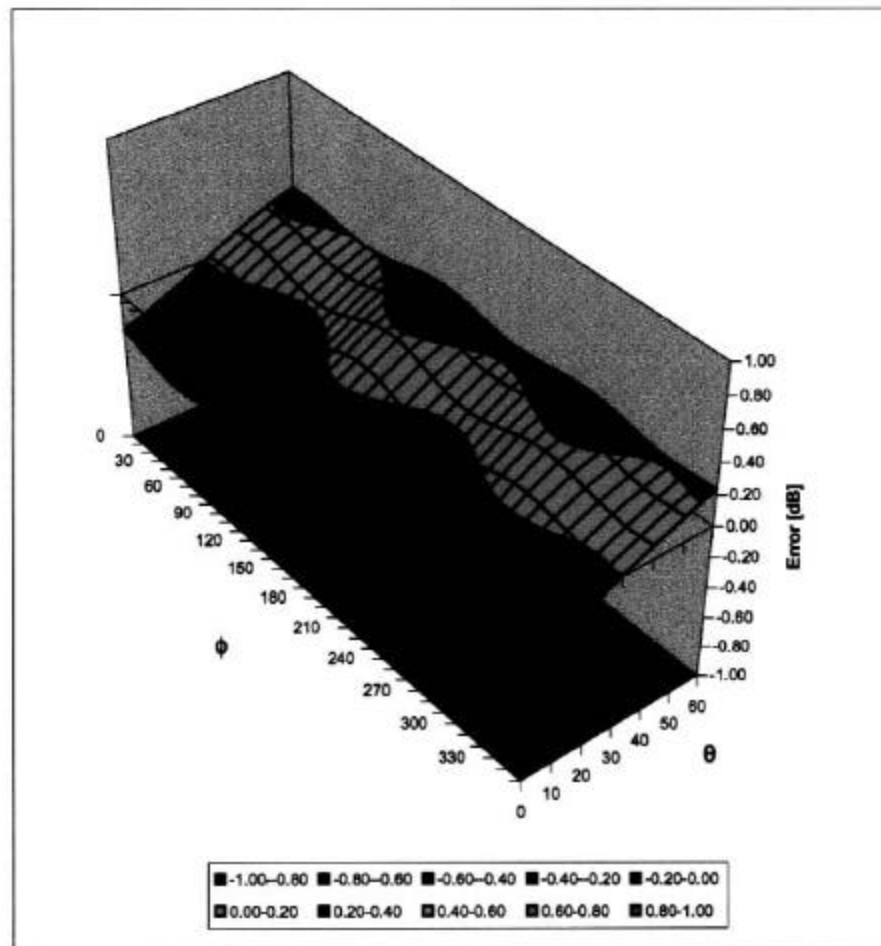
ConvF X	5.2 $\pm$ 9.5% (k=2)	Boundary effect:	
ConvF Y	5.2 $\pm$ 9.5% (k=2)	Alpha	0.48
ConvF Z	5.2 $\pm$ 9.5% (k=2)	Depth	2.68

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Deviation from Isotropy in HSL

Error (θ, ϕ), $f = 900$ MHz



Schmid & Partner Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9778
info@speag.com, <http://www.speag.com>

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Additional Conversion Factors for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1608

Place of Assessment:

Zurich

Date of Assessment:

June 23, 2003

Probe Calibration Date:

June 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:



ET3DV6-SN:1608

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June 23, 2003

Schmid & Partner Engineering AG

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

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Dosimetric E-Field Probe ET3DV6 SN:1608

Conversion factor ($\pm$ standard deviation)

835 MHz	ConvF	$6.3 \pm 8\%$	$\epsilon_r = 55.2 \pm 5\%$ $\sigma = 0.97 \pm 5\% \text{ mho/m}$ (body tissue)
1900 MHz	ConvF	$4.7 \pm 8\%$	$\epsilon_r = 53.3 \pm 5\%$ $\sigma = 1.52 \pm 5\% \text{ mho/m}$ (body tissue)
450 MHz	ConvF	$7.4 \pm 8\%$	$\epsilon_r = 43.5 \pm 5\%$ $\sigma = 0.87 \pm 5\% \text{ mho/m}$ (head tissue)
450 MHz	ConvF	$7.5 \pm 8\%$	$\epsilon_r = 56.7 \pm 5\%$ $\sigma = 0.94 \pm 5\% \text{ mho/m}$ (body tissue)