

Validation Data (1900MHz Brain)

Dipole 1900 MHz

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

Probe: ET3DV6 - SN1798; ConvF(5.20,5.20,5.20); Crest factor: 1.0; Brain 1900 MHz: $\sigma = 1.43$ mho/m $\epsilon_r = 39.0$ $\rho = 1.00$ g/cm³Cubes (2): SAR (1g): 40.8 mW/g ± 0.05 dB, SAR (10g): 20.9 mW/g ± 0.04 dB

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

Powerdrift: 0.02 dB

Comment:

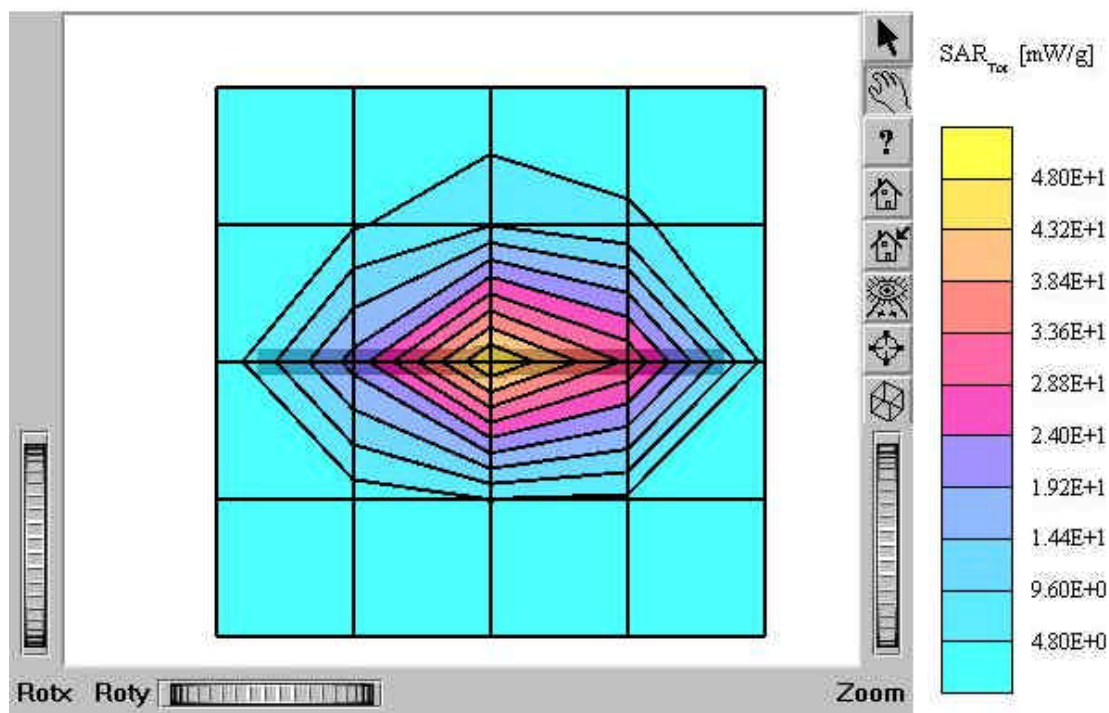
1900 MHz Brain Dipole Validation (D1900V2/ S.N: 5d032)

Antenna Input Power : 30 dBm (1W)

HCT Co., Ltd. Brain Tissue Simulating Liquid

Liquid Temperature : 21.5 °C

Date Tested : October 16, 2003



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

Comment:

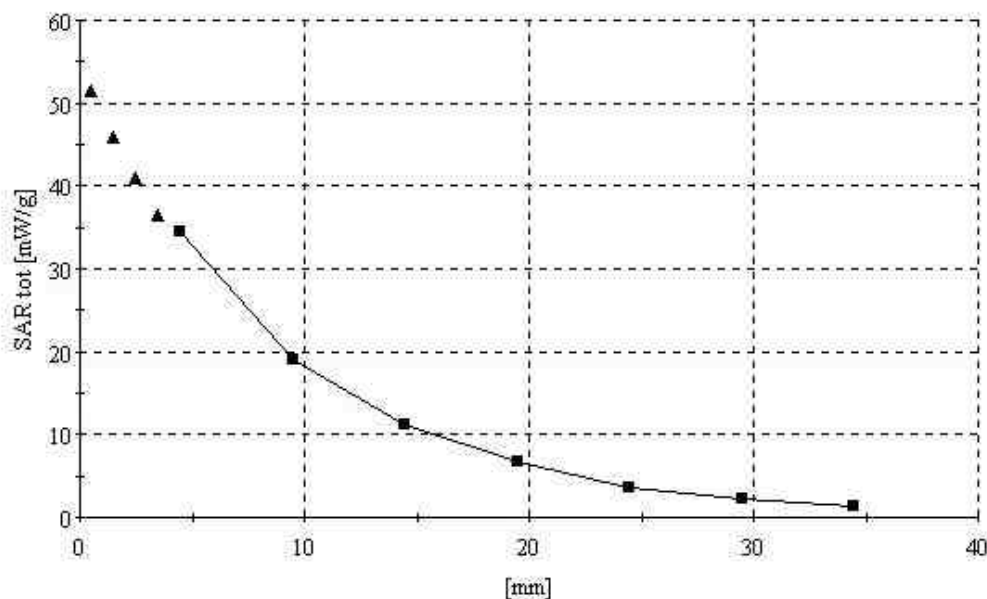
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Dielectric Parameter (1900MHz Brain)**Title : AXW-P1900****SubTitle : 1900 MHz Brain**

October 16, 2003 08:54 AM

Frequency	e'	e''
1.700000000 GHz	39.7909	13.0635
1.710000000 GHz	39.7401	13.1220
1.720000000 GHz	39.7406	13.1538
1.730000000 GHz	39.7072	13.2050
1.740000000 GHz	39.6800	13.2432
1.750000000 GHz	39.6532	13.2533
1.760000000 GHz	39.6226	13.2810
1.770000000 GHz	39.5622	13.2926
1.780000000 GHz	39.4905	13.2778
1.790000000 GHz	39.4351	13.2781
1.800000000 GHz	39.3575	13.2800
1.810000000 GHz	39.2846	13.2976
1.820000000 GHz	39.2474	13.3272
1.830000000 GHz	39.1532	13.3945
1.840000000 GHz	39.1607	13.4240
1.850000000 GHz	39.1146	13.4472
1.860000000 GHz	39.0749	13.5174
1.870000000 GHz	39.0341	13.5643
1.880000000 GHz	39.0512	13.5872
1.890000000 GHz	39.0200	13.5835
1.900000000 GHz	38.9611	13.5766
1.910000000 GHz	38.9119	13.5788
1.920000000 GHz	38.8521	13.5674
1.930000000 GHz	38.7887	13.5764
1.940000000 GHz	38.7259	13.6030
1.950000000 GHz	38.6803	13.6453
1.960000000 GHz	38.6256	13.6759
1.970000000 GHz	38.5997	13.7493
1.980000000 GHz	38.5603	13.7907
1.990000000 GHz	38.5400	13.8460
2.000000000 GHz	38.5114	13.8514

Dielectric Parameter (1900MHz Body)**Title : AXW-P1900****SubTitle : 1900 MHz Body**

October 16, 2003 09:06 AM

Frequency	e'	e''
1.700000000 GHz	52.8218	14.2627
1.710000000 GHz	52.8101	14.3009
1.720000000 GHz	52.7820	14.3522
1.730000000 GHz	52.7476	14.3795
1.740000000 GHz	52.7479	14.3931
1.750000000 GHz	52.7461	14.3754
1.760000000 GHz	52.7071	14.3813
1.770000000 GHz	52.6674	14.3626
1.780000000 GHz	52.6193	14.3622
1.790000000 GHz	52.5852	14.3721
1.800000000 GHz	52.5160	14.3941
1.810000000 GHz	52.5016	14.4313
1.820000000 GHz	52.4456	14.5188
1.830000000 GHz	52.3810	14.5599
1.840000000 GHz	52.3659	14.6345
1.850000000 GHz	52.3372	14.6703
1.860000000 GHz	52.3046	14.7280
1.870000000 GHz	52.2759	14.7427
1.880000000 GHz	52.2636	14.7576
1.890000000 GHz	52.2205	14.7279
1.900000000 GHz	52.1995	14.6934
1.910000000 GHz	52.1161	14.7119
1.920000000 GHz	52.0375	14.6981
1.930000000 GHz	52.0089	14.7257
1.940000000 GHz	51.9898	14.7773
1.950000000 GHz	51.8924	14.8546
1.960000000 GHz	51.8851	14.9067
1.970000000 GHz	51.8660	14.9592
1.980000000 GHz	51.8267	14.9842
1.990000000 GHz	51.8179	15.0168
2.000000000 GHz	51.8165	15.0174

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

Client **Hyundai CT (Dymstec)**

CALIBRATION CERTIFICATE																											
Object(s)	D1900V2 - SN.5d032																										
Calibration procedure(s)	QA CAL-05 v2 Calibration procedure for dipole validation kits																										
Calibration date:	May 12, 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) <table border="1"><thead><tr><th>Model Type</th><th>ID #</th><th>Cal Date (Calibrated by, Certificate No.)</th><th>Scheduled Calibration</th></tr></thead><tbody><tr><td>RF generator R&S SML-03</td><td>100698</td><td>27-Mar-2002 (R&S, No. 20-92389)</td><td>In house check: Mar-05</td></tr><tr><td>Power sensor HP 8481A</td><td>MY41092317</td><td>18-Oct-02 (Agilent, No. 20021018)</td><td>Oct-04</td></tr><tr><td>Power sensor HP 8481A</td><td>US37292783</td><td>30-Oct-02 (METAS, No. 252-0236)</td><td>Oct-03</td></tr><tr><td>Power meter EPM E442</td><td>GB37480704</td><td>30-Oct-02 (METAS, No. 252-0236)</td><td>Oct-03</td></tr><tr><td>Network Analyzer HP 8753E</td><td>US38432428</td><td>3-May-00 (Agilent, No. 8702K064802)</td><td>In house check: May 03</td></tr></tbody></table>				Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration	RF generator R&S SML-03	100698	27-Mar-2002 (R&S, No. 20-92389)	In house check: Mar-05	Power sensor HP 8481A	MY41092317	18-Oct-02 (Agilent, No. 20021018)	Oct-04	Power sensor HP 8481A	US37292783	30-Oct-02 (METAS, No. 252-0236)	Oct-03	Power meter EPM E442	GB37480704	30-Oct-02 (METAS, No. 252-0236)	Oct-03	Network Analyzer HP 8753E	US38432428	3-May-00 (Agilent, No. 8702K064802)	In house check: May 03
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Calibrated by:	Name Juergen Mueller	Function Technician	Signature 																								
Approved by:	Name Karlja Pakovic	Function Laboratory Director	Signature 																								
Date issued: May 13, 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>

DASY

Dipole Validation Kit

Type: D1900V2

Serial: 5d032

Manufactured: March 17, 2003

Calibrated: May 12, 2003

1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with head simulating solution of the following electrical parameters at 1900 MHz:

Relative Dielectricity	38.8	$\pm 5\%$
Conductivity	1.44 mho/m	$\pm 5\%$

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 5.2 at 1900 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 7x7x7 fine cube was chosen for cube integration.

The dipole input power (forward power) was $250 \text{ mW} \pm 3\%$. The results are normalized to 1W input power.

2. SAR Measurement with DASY4 System

Standard SAR-measurements were performed according to the measurement conditions described in section 1. The results (see figure supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured with the dosimetric probe ET3DV6 SN:1507 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	42.0 mW/g $\pm 16.8\%$ (k=2)¹
averaged over 10 cm^3 (10 g) of tissue:	21.6 mW/g $\pm 16.2\%$ (k=2)¹

¹ validation uncertainty

3. Dipole Impedance and Return Loss

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay: **1.195 ns** (one direction)
Transmission factor: **0.980** (voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 1900 MHz: $\text{Re}\{Z\} = 50.5 \Omega$

$\text{Im}\{Z\} = 3.2 \Omega$

Return Loss at 1900 MHz **-29.9 dB**

4. Handling

Do not apply excessive force to the dipole arms, because they might bend. Bending of the dipole arms stresses the soldered connections near the feedpoint leading to a damage of the dipole.

5. Design

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

Small end caps have been added to the dipole arms in order to improve matching when loaded according to the position as explained in Section 1. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

6. Power Test

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Date/Time: 05/12/03 20:36:30

Test Laboratory: SPEAG, Zurich, Switzerland

File Name: SN5d032_SN1507_HSL1900_120503.da4**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN5d032****Program: Dipole Calibration**

Communication System: CW-1900; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: HSL 1900 MHz ($\sigma = 1.44 \text{ mho/m}$, $\epsilon_r = 38.8$, $\rho = 1000 \text{ kg/m}^3$)

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(5.2, 5.2, 5.2); Calibrated: 1/18/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN411; Calibrated: 1/16/2003
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm

Reference Value = 94.9 V/m

Power Drift = 0.06 dB

Maximum value of SAR = 11.6 mW/g

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Peak SAR (extrapolated) = 18.4 W/kg

SAR(1 g) = 10.5 mW/g; SAR(10 g) = 5.39 mW/g

Reference Value = 94.9 V/m

Power Drift = 0.06 dB

Maximum value of SAR = 11.8 mW/g

