

Validation Data (1900MHz Brain)

Dipole 1900 MHz

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

Probe: ET3DV6 - SN1609; ConvF(5.29,5.29,5.29); Crest factor: 1.0; Brain 1900 MHz: $\sigma = 1.41$

mho/m $\epsilon_r = 40.2$ $\rho = 1.00$ g/cm³

Cubes (2): SAR (1g): 41.9 mW/g ± 0.00 dB, SAR (10g): 21.1 mW/g ± 0.01 dB

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

Powerdrift: -0.08 dB

Comment:

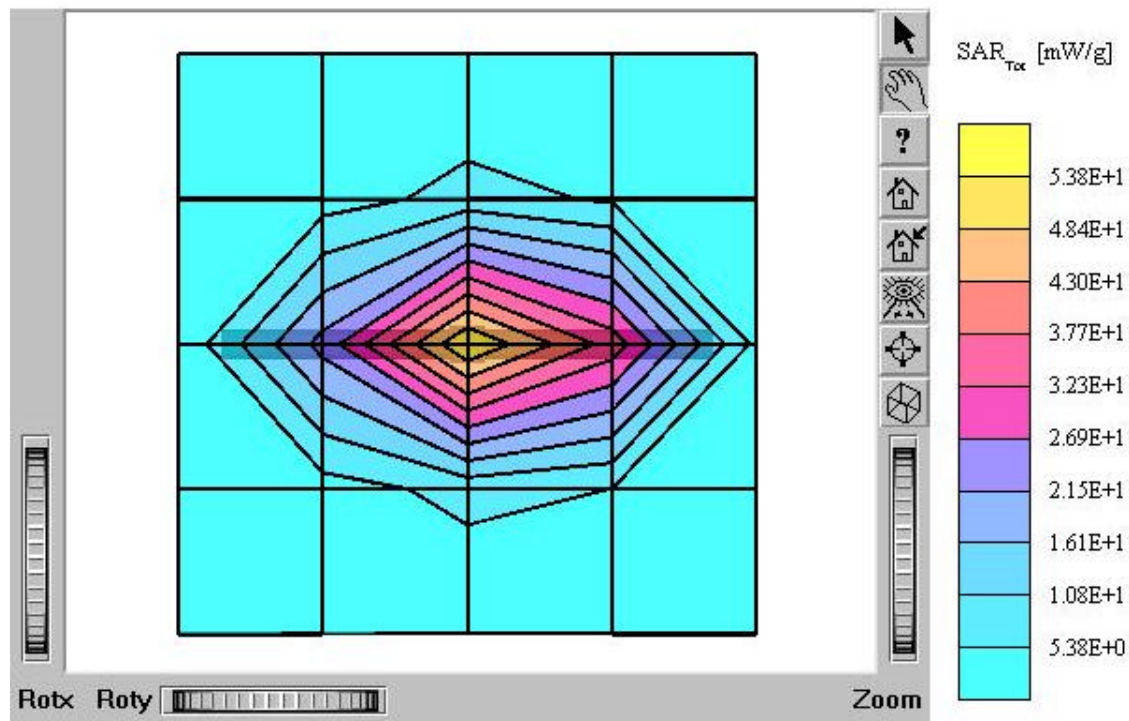
1900 MHz Brain Dipole Validation (D1900V2/ S.N: 5d032)

Antenna Input Power: 30 dBm (1 W)

HCT Co., Ltd. Brain Tissue Simulating Liquid

Liquid Temperature: 21.8 °C

Date Tested : April 6, 2004



Dipole 1900 MHz

SAM II Phantom: Section: Position: ; Frequency: 1900 MHz

Probe: ET3DV6 - SN1609; ConvP(5.29,5.29,5.29); Crest factor: 1.0; Brain 1900 MHz: $\sigma = 1.41$ mho/m $\epsilon_r = 40.2$ $\rho = 1.00$ g/cm³

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Z-Axis: Dx = 0.0, Dy = 0.0, Dz = 5.0

Comment:

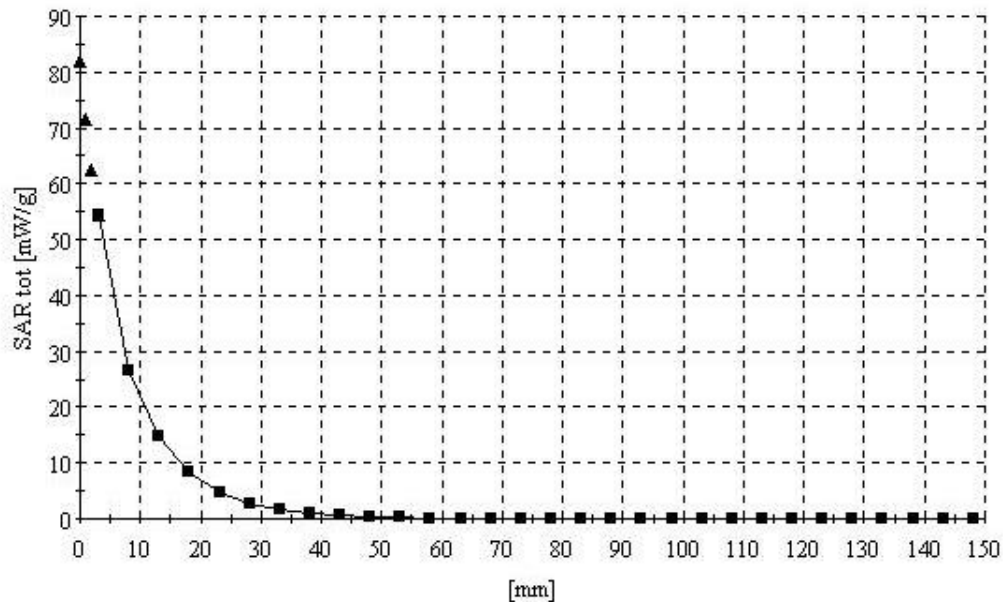
1900 MHz Brain Dipole Validation (D1900V2/ S.N: 5d032)

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! Dielectric Parameter (1900MHz Brain)

Title : ACH-770P
SubTitle : 1900 MHz Brain
April 06, 2004 01:42 AM

Frequency	e'	e''
1.800000000 GHz	40.7275	12.9902
1.810000000 GHz	40.6416	13.0294
1.820000000 GHz	40.6361	13.0824
1.830000000 GHz	40.5420	13.1182
1.840000000 GHz	40.5206	13.1416
1.850000000 GHz	40.4632	13.2062
1.860000000 GHz	40.4112	13.2250
1.870000000 GHz	40.4270	13.2486
1.880000000 GHz	40.3451	13.2871
1.890000000 GHz	40.2940	13.3059
1.900000000 GHz	40.2342	13.3187
1.910000000 GHz	40.1635	13.3449
1.920000000 GHz	40.1188	13.3723
1.930000000 GHz	40.0379	13.3970
1.940000000 GHz	39.9616	13.4221
1.950000000 GHz	39.9179	13.4674
1.960000000 GHz	39.8970	13.5182
1.970000000 GHz	39.8348	13.5584
1.980000000 GHz	39.8008	13.5946
1.990000000 GHz	39.7665	13.6457
2.000000000 GHz	39.7547	13.6934

! Dielectric Parameter (1900MHz Muscle)

Title : ACH-770P
SubTitle : 1900 MHz Body
April 06, 2004 09:14 AM

Frequency	e'	e''
1.850000000 GHz	53.8117	14.9799
1.855000000 GHz	53.7804	14.9592
1.860000000 GHz	53.7354	14.9881
1.865000000 GHz	53.6891	15.0110
1.870000000 GHz	53.6188	15.0190
1.875000000 GHz	53.5752	14.9992
1.880000000 GHz	53.5299	14.9851
1.885000000 GHz	53.4583	14.9660
1.890000000 GHz	53.4389	14.9432
1.895000000 GHz	53.3700	14.9223
1.900000000 GHz	53.3297	14.9121
1.905000000 GHz	53.2918	14.9477
1.910000000 GHz	53.2603	14.9224
1.915000000 GHz	53.2087	14.9381
1.920000000 GHz	53.1917	14.9511
1.925000000 GHz	53.2470	14.9625
1.930000000 GHz	53.2173	14.9766
1.935000000 GHz	53.2323	15.0220
1.940000000 GHz	53.2170	15.0777
1.945000000 GHz	53.2334	15.0960
1.950000000 GHz	53.2451	15.1593

**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**

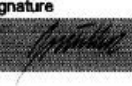
Condition of the calibrated item **In Tolerance (according to the specific calibration document)**

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)

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	US38432426	3-May-00 (Agilent, No. 8702K064602)	In house check: May 03

	Name	Function	Signature
Calibrated by:	Judith Munder	Technician	

Approved by:	Katja Polovka	Laboratory Director
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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: **$42.0 \text{ mW/g} \pm 16.8\% (k=2)^1$**

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

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

