

## 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:  $\sigma = 1.39$

mho/m  $\epsilon_r = 40.3$   $\rho = 1.00$  g/cm<sup>3</sup>

Cubes (2): SAR (1g): 40.6 mW/g  $\pm 0.13$  dB, SAR (10g): 20.8 mW/g  $\pm 0.11$  dB

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

Powerdrift: -0.01 dB

Comment:

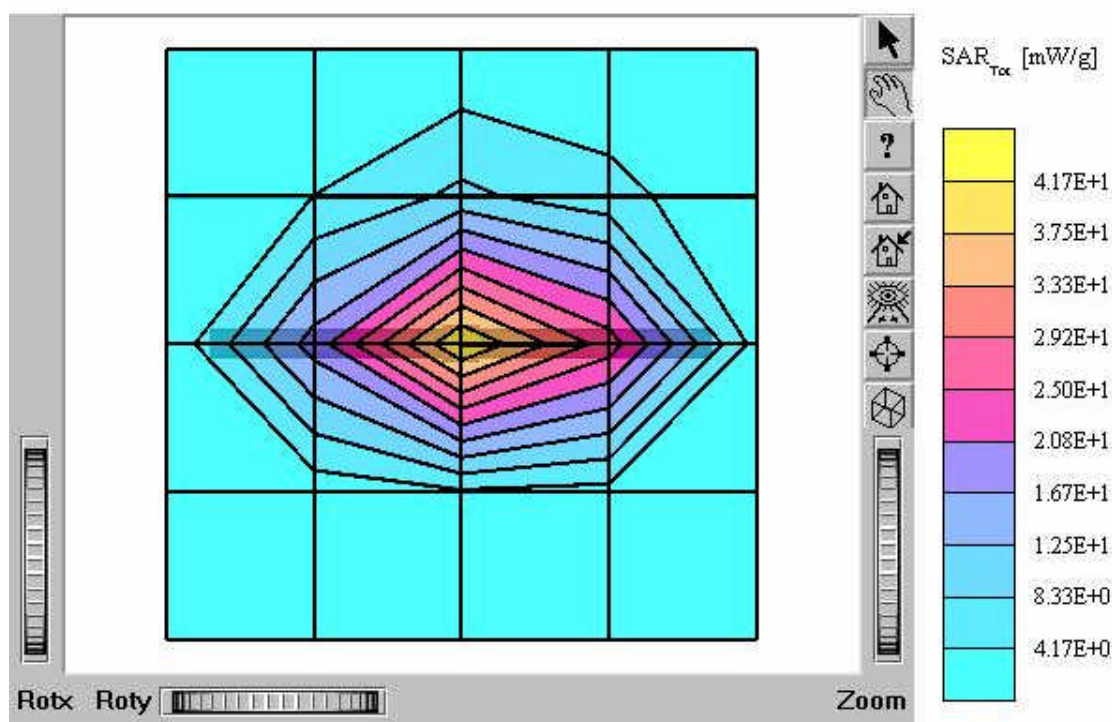
1900 MHz Brain Dipole Validation (D1900V2/ S.N: 5d032)

Antenna Input Power: 30 dBm (1 W)

HCT Co., Ltd. Brain Tissue Simulating Liquid

Liquid Temperature: 22.3 °C

Date Tested: February 19, 2004



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

### Comment:

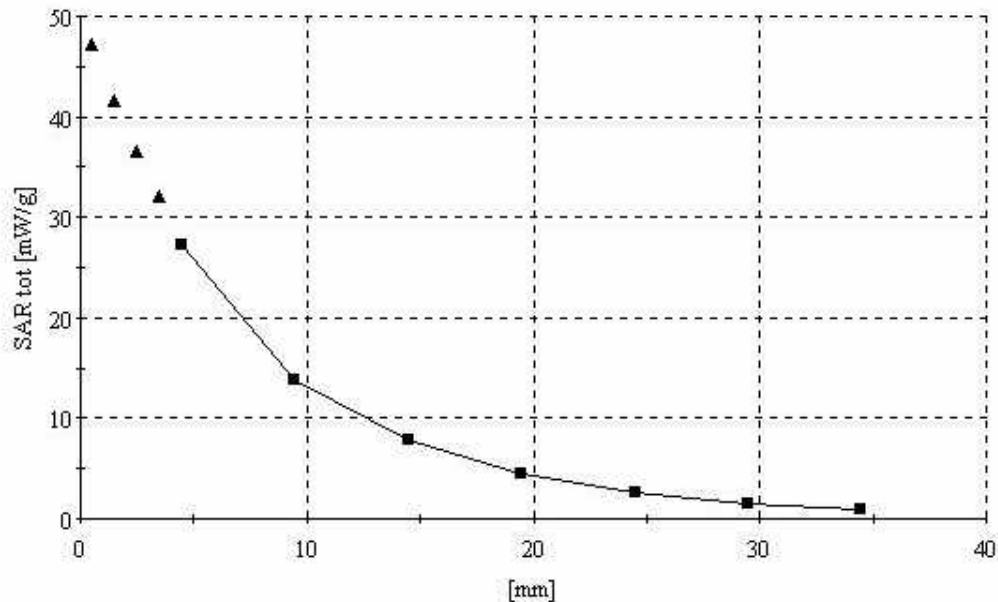
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! Dielectric Parameter (1900MHz Brain)

**Title : ACH-700P**  
**SubTitle : 1900 MHz Brain**  
February 19, 2004 09:36 AM

| Frequency       | e'      | e''     |
|-----------------|---------|---------|
| 1.800000000 GHz | 40.6747 | 12.8762 |
| 1.810000000 GHz | 40.5814 | 12.9237 |
| 1.820000000 GHz | 40.5972 | 12.9819 |
| 1.830000000 GHz | 40.5169 | 13.0399 |
| 1.840000000 GHz | 40.4751 | 13.0795 |
| 1.850000000 GHz | 40.4588 | 13.1424 |
| 1.860000000 GHz | 40.4547 | 13.1608 |
| 1.870000000 GHz | 40.4577 | 13.1745 |
| 1.880000000 GHz | 40.4046 | 13.1793 |
| 1.890000000 GHz | 40.3634 | 13.2096 |
| 1.900000000 GHz | 40.2791 | 13.1905 |
| 1.910000000 GHz | 40.1714 | 13.2203 |
| 1.920000000 GHz | 40.1168 | 13.2245 |
| 1.930000000 GHz | 40.0274 | 13.2642 |
| 1.940000000 GHz | 39.9400 | 13.2822 |
| 1.950000000 GHz | 39.9193 | 13.3628 |
| 1.960000000 GHz | 39.8833 | 13.4358 |
| 1.970000000 GHz | 39.8658 | 13.4726 |
| 1.980000000 GHz | 39.8485 | 13.5123 |
| 1.990000000 GHz | 39.8769 | 13.5178 |
| 2.000000000 GHz | 39.8659 | 13.5676 |



! Dielectric Parameter (1900MHz Muscle)

**Title : ACH-700P**  
**SubTitle : 1900 MHz Body**  
February 19, 2004 09:11 AM

| Frequency       | $e'$    | $e''$   |
|-----------------|---------|---------|
| 1.850000000 GHz | 53.6829 | 14.8370 |
| 1.855000000 GHz | 53.6696 | 14.8448 |
| 1.860000000 GHz | 53.6254 | 14.8586 |
| 1.865000000 GHz | 53.5674 | 14.8851 |
| 1.870000000 GHz | 53.4847 | 14.8716 |
| 1.875000000 GHz | 53.4220 | 14.8956 |
| 1.880000000 GHz | 53.4167 | 14.8933 |
| 1.885000000 GHz | 53.3686 | 14.8640 |
| 1.890000000 GHz | 53.3289 | 14.8714 |
| 1.895000000 GHz | 53.2849 | 14.8537 |
| 1.900000000 GHz | 53.2416 | 14.8722 |
| 1.905000000 GHz | 53.2442 | 14.8962 |
| 1.910000000 GHz | 53.1784 | 14.8736 |
| 1.915000000 GHz | 53.1656 | 14.8681 |
| 1.920000000 GHz | 53.1666 | 14.9084 |
| 1.925000000 GHz | 53.1708 | 14.9202 |
| 1.930000000 GHz | 53.1804 | 14.9451 |
| 1.935000000 GHz | 53.1993 | 14.9870 |
| 1.940000000 GHz | 53.1929 | 14.9939 |
| 1.945000000 GHz | 53.1920 | 15.0213 |
| 1.950000000 GHz | 53.2041 | 15.0658 |

**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**

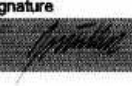
**Condition of the calibrated item**      **In Tolerance (according to the specific calibration document)**

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 |

|                       |                |                 |                                                                                       |
|-----------------------|----------------|-----------------|---------------------------------------------------------------------------------------|
|                       | <b>Name</b>    | <b>Function</b> | <b>Signature</b>                                                                      |
| <b>Calibrated by:</b> | Judith Mueller | Technician      |  |

|                     |               |                     |
|---------------------|---------------|---------------------|
| <b>Approved by:</b> | Katja Pelonzo | Laboratory Director |
|---------------------|---------------|---------------------|

**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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# 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 | <b>38.8</b>       | $\pm 5\%$ |
| Conductivity           | <b>1.44 mho/m</b> | $\pm 5\%$ |

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  $1 \text{ cm}^3$  (1 g) of tissue: **42.0 mW/g  $\pm 16.8\%$  ( $k=2$ )<sup>1</sup>**

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

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<sup>1</sup> 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

