

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

Cubes (2): SAR (1g): 41.6 mW/g ± 0.03 dB, SAR (10g): 21.1 mW/g ± 0.03 dB

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

Powerdrift: 0.03 dB

Comment:

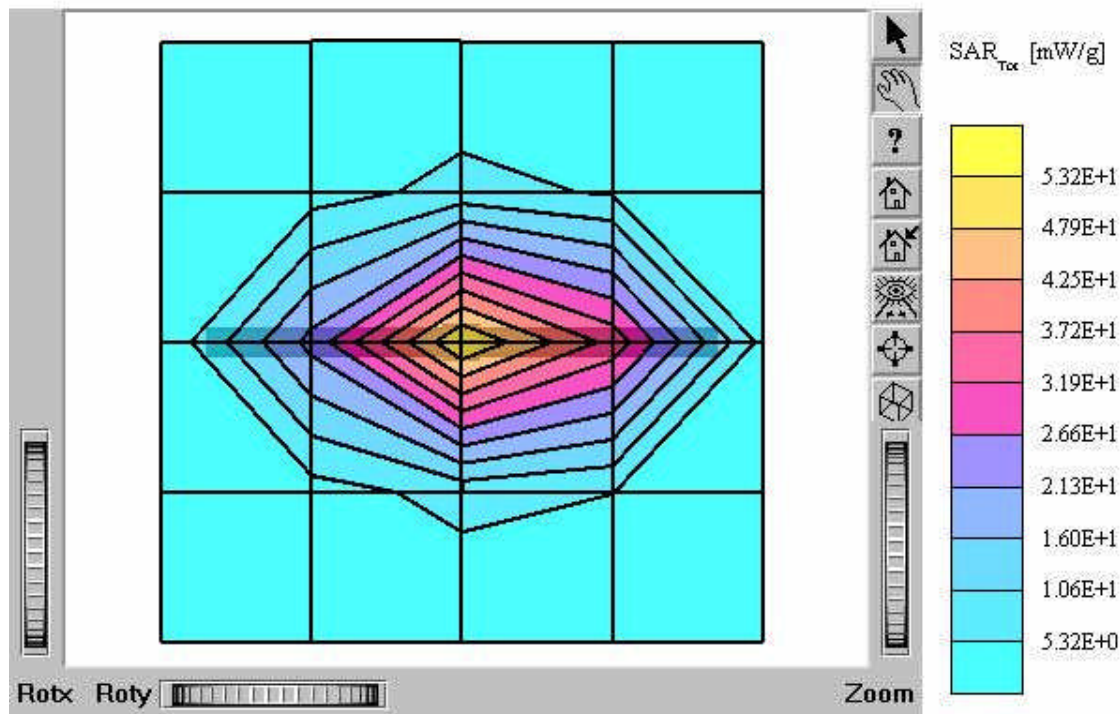
1900 MHz Brain Dipole Validation (D1900V2/ S.N: 5d032)

Antenna Input Power: 30 dBm (1 W)

HCT Co., Ltd. Brain Tissue Simulating Liquid

Liquid Temperature: 21.5°C

Date Tested : March 23, 2004



Dipole 1900 MHz

SAM II Phantom: Section: Position: ; 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 $\epsilon_r = 40.2$ $\rho = 1.00$ g/cm³

:

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

Comment:

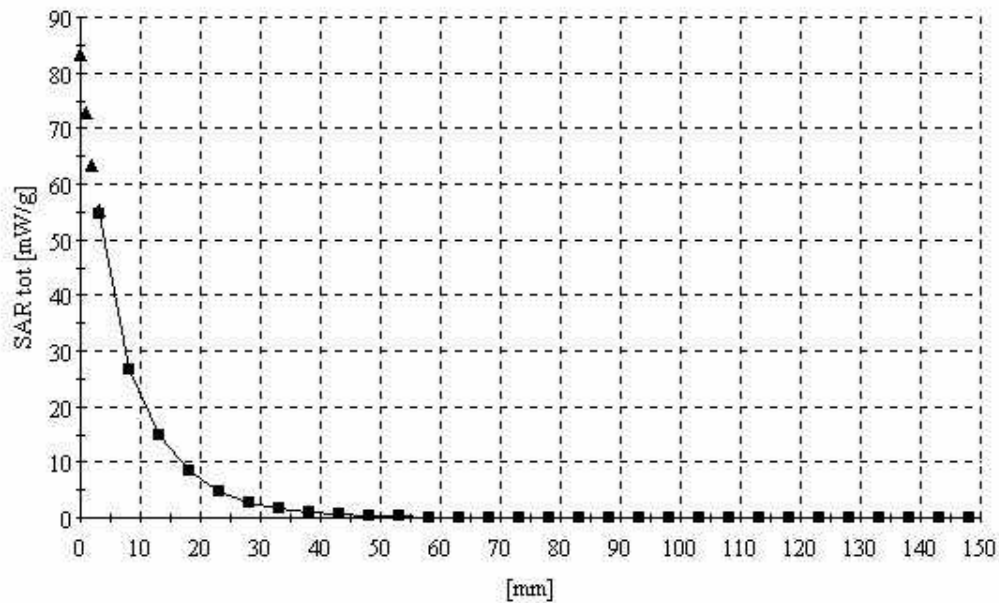
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! Dielectric Parameter (1900MHz Brain)

Title : NHC-8000
SubTitle : 1900 MHz Brain
March 23, 2004 08:43 AM

Frequency	ϵ'	ϵ''
1.800000000 GHz	40.6417	12.8723
1.810000000 GHz	40.5376	12.9267
1.820000000 GHz	40.5549	12.9872
1.830000000 GHz	40.4699	13.0665
1.840000000 GHz	40.4456	13.0952
1.850000000 GHz	40.4180	13.1260
1.860000000 GHz	40.4168	13.1489
1.870000000 GHz	40.3901	13.1820
1.880000000 GHz	40.3515	13.1716
1.890000000 GHz	40.3076	13.2160
1.900000000 GHz	40.2206	13.2018
1.910000000 GHz	40.1284	13.2186
1.920000000 GHz	40.0712	13.2367
1.930000000 GHz	39.9648	13.2729
1.940000000 GHz	39.9242	13.2986
1.950000000 GHz	39.8640	13.3641
1.960000000 GHz	39.8560	13.4303
1.970000000 GHz	39.8522	13.4700
1.980000000 GHz	39.8283	13.5259
1.990000000 GHz	39.8338	13.5324
2.000000000 GHz	39.8390	13.5713

! Dielectric Parameter (1900MHz Muscle)

Title : NHC-8000

SubTitle : 1900 MHz Body

March 23, 2004 09:17 AM

Frequency	e'	e''
1.850000000 GHz	53.6837	14.8215
1.855000000 GHz	53.6635	14.8135
1.860000000 GHz	53.6501	14.8288
1.865000000 GHz	53.5548	14.8671
1.870000000 GHz	53.5049	14.8532
1.875000000 GHz	53.3975	14.8849
1.880000000 GHz	53.3985	14.8694
1.885000000 GHz	53.3552	14.8653
1.890000000 GHz	53.3261	14.8483
1.895000000 GHz	53.2562	14.8544
1.900000000 GHz	53.2379	14.8682
1.905000000 GHz	53.2253	14.8916
1.910000000 GHz	53.1523	14.8612
1.915000000 GHz	53.1538	14.8790
1.920000000 GHz	53.1596	14.8930
1.925000000 GHz	53.1800	14.9261
1.930000000 GHz	53.1842	14.9452
1.935000000 GHz	53.1861	14.9847
1.940000000 GHz	53.1714	15.0215
1.945000000 GHz	53.1711	15.0264
1.950000000 GHz	53.1652	15.0404

**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**

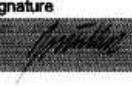
Condition of the calibrated item **In Tolerance (according to the specific calibration document)**

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 Mueller	Technician	

Approved by:	Katja Pelonzo	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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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

