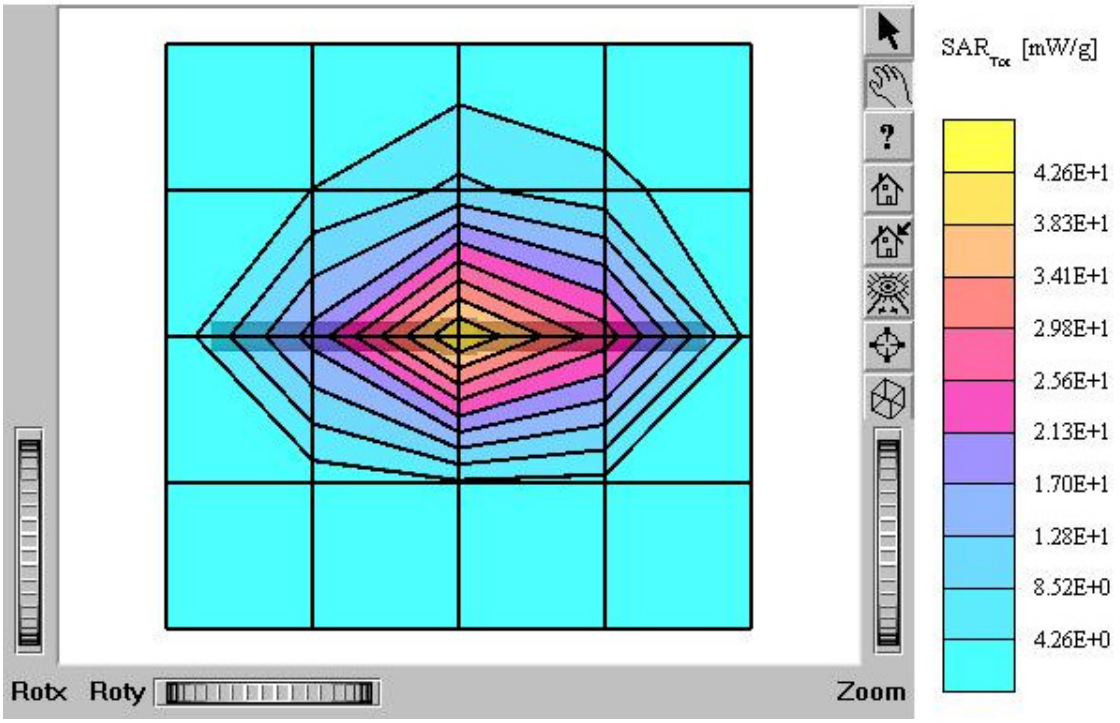
Validation Data (1900MHz Brain)

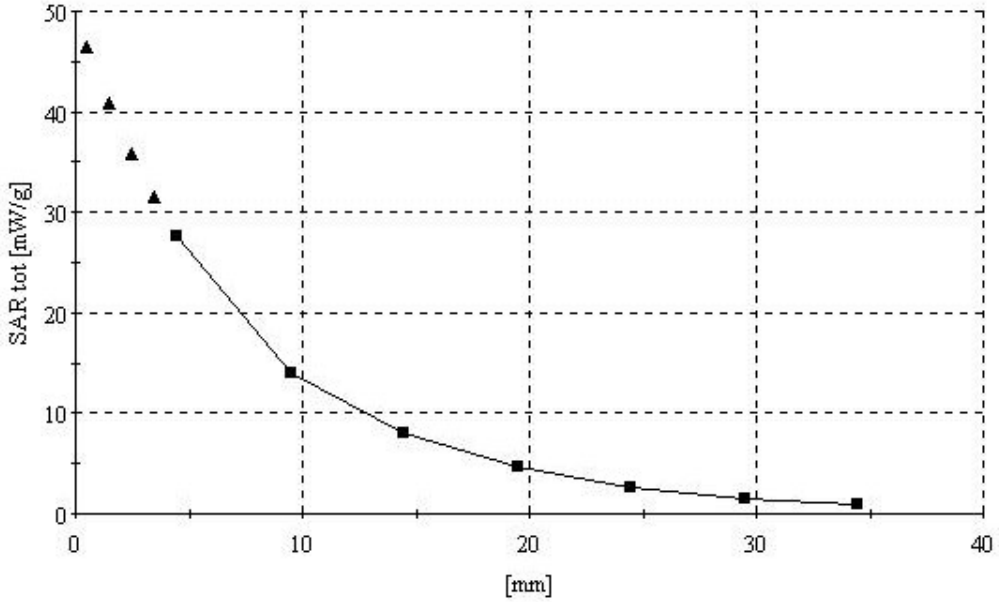
Dipole 1900 MHz
SAM II Phantom; Flat Section; Position: (90°,90°); Frequency: 1900 MHz
Probe: ET3DV6 - SN1798; ConvF(5.20,5.20,5.20); Crest factor: 1.0; Brain 1900 MHz: σ = 1.40 mho/m ε_r = 40.3 ρ = 1.00 g/cm^3
Cubes (2): SAR (1g): 40.6 mW/g ± 0.08 dB, SAR (10g): 20.8 mW/g ± 0.05 dB
Coarse: Dx = 20.0, 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℃
Date Tested : January 14, 2004



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: σ = 1.40 mho/m ε_r = 40.3 ρ = 1.00 g/cm^3
Cubes (2): SAR (1g): 40.6 mW/g ± 0.08 dB, SAR (10g): 20.8 mW/g ± 0.05 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 (1 W)
HCT Co., Ltd. Brain Tissue Simulating Liquid
Liquid Temperature: 21.5℃
Date Tested : January 14, 2004



¦ Dielectric Parameter (1900MHz Brain)

Title : JMS110
SubTitle : PCS CDMA Brain
January 14, 2004 08:34 AM

Frequency	e'	e''
1.800000000 GHz	40.7060	12.9362
1.810000000 GHz	40.6322	12.9559
1.820000000 GHz	40.6277	13.0206
1.830000000 GHz	40.5370	13.0910
1.840000000 GHz	40.5173	13.0982
1.850000000 GHz	40.4882	13.1599
1.860000000 GHz	40.4965	13.1883
1.870000000 GHz	40.4978	13.2180
1.880000000 GHz	40.4503	13.2219
1.890000000 GHz	40.3832	13.2538
1.900000000 GHz	40.3065	13.2324
1.910000000 GHz	40.2196	13.2483
1.920000000 GHz	40.1648	13.2883
1.930000000 GHz	40.0485	13.3186
1.940000000 GHz	39.9871	13.3398
1.950000000 GHz	39.9473	13.4004
1.960000000 GHz	39.9351	13.4602
1.970000000 GHz	39.9217	13.5118
1.980000000 GHz	39.8991	13.5784
1.990000000 GHz	39.8841	13.5718
2.000000000 GHz	39.8913	13.6091

¦ Dielectric Parameter (1900MHz Muscle)

Title : JMS110
SubTitle : PCS CDMA Body
January 14, 2004 09:12 PM

Frequency	e'	e''
1.850000000 GHz	53.0336	14.4639
1.855000000 GHz	52.9671	14.4702
1.860000000 GHz	52.9084	14.5498
1.865000000 GHz	52.8564	14.5873
1.870000000 GHz	52.8312	14.5972
1.875000000 GHz	52.7619	14.6544
1.880000000 GHz	52.8114	14.6773
1.885000000 GHz	52.7695	14.6992
1.890000000 GHz	52.7798	14.7139
1.895000000 GHz	52.7789	14.7315
1.900000000 GHz	52.7814	14.7605
1.905000000 GHz	52.8068	14.7939
1.910000000 GHz	52.7755	14.7848
1.915000000 GHz	52.7635	14.7726
1.920000000 GHz	52.7892	14.7692
1.925000000 GHz	52.7826	14.7738
1.930000000 GHz	52.7863	14.7616
1.935000000 GHz	52.7687	14.7692
1.940000000 GHz	52.7048	14.7695
1.945000000 GHz	52.6807	14.7653
1.950000000 GHz	52.6531	14.7609

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 Pokovic	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.

880-KP0301061-A

Schmid & Partner Engineering AG

s p e a g

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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**	± 5%
Conductivity	**1.44 mho/m**	± 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 mW ± 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** ± 16.8 % (k=2)[1]
averaged over 10 cm^3 (10 g) of tissue:	**21.6 mW/g** ± 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:	Re{Z} = **50.5 Ω**
	Im {Z} = **3.2 Ω**
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

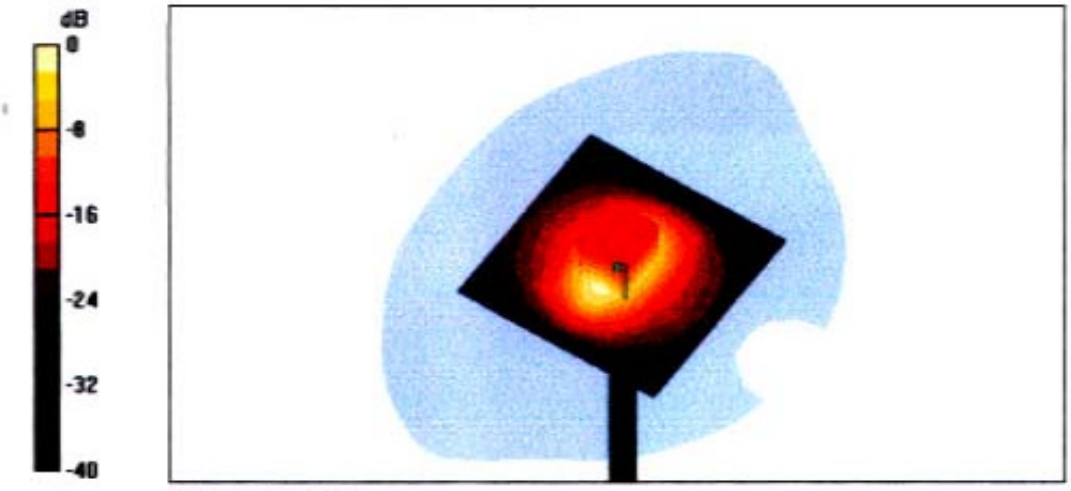
Communication System: CW-1900; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL 1900 MHz (σ = 1.44 mho/m, ε_r = 38.8, ρ = 1000 kg/m^3)
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

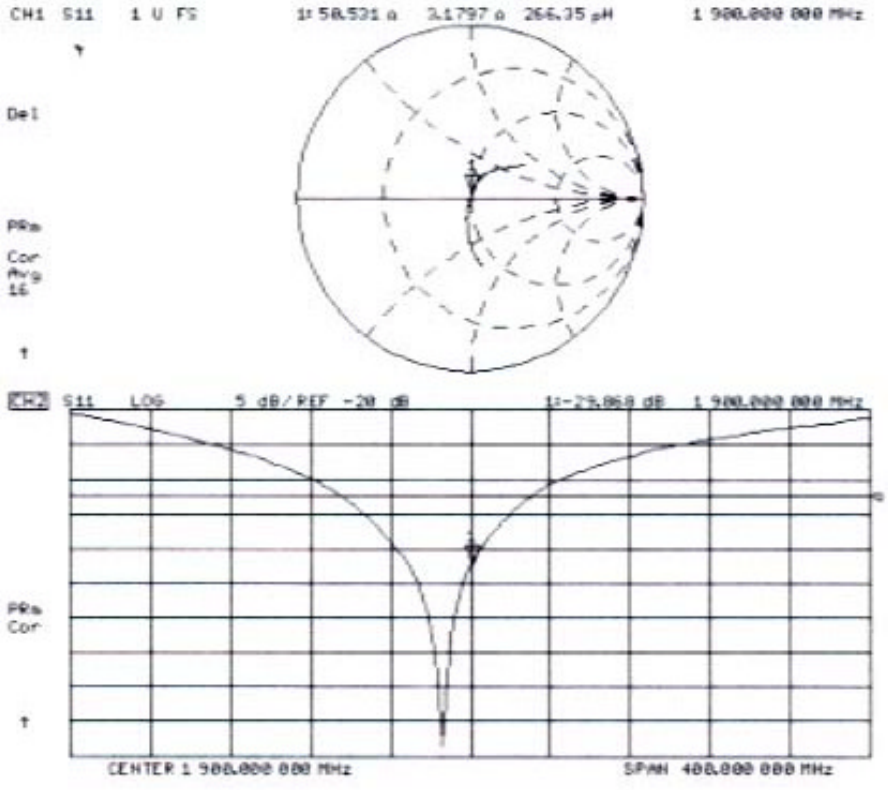
- Probe: ET3DV6 - SN1507; ConvF(5.2, 5.2, 5.2); Calibrated: 1/18/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN411; Calibrated: 1/16/2003
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD,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



0 dB = 11.8mW/g


CH1 S11 1 U FS
1: 58.521 Ω 3.1797 Ω 266.35 pH
1 900.000 000 MHz
Del
PRm
Cor
Avg
16
CH2 S11 LOG 5 dB/ REF -20 dB
1: -23.869 dB 1 900.000 000 MHz
PRm
Cor
CENTER 1 900.000 000 MHz
SPAN 400.000 000 MHz