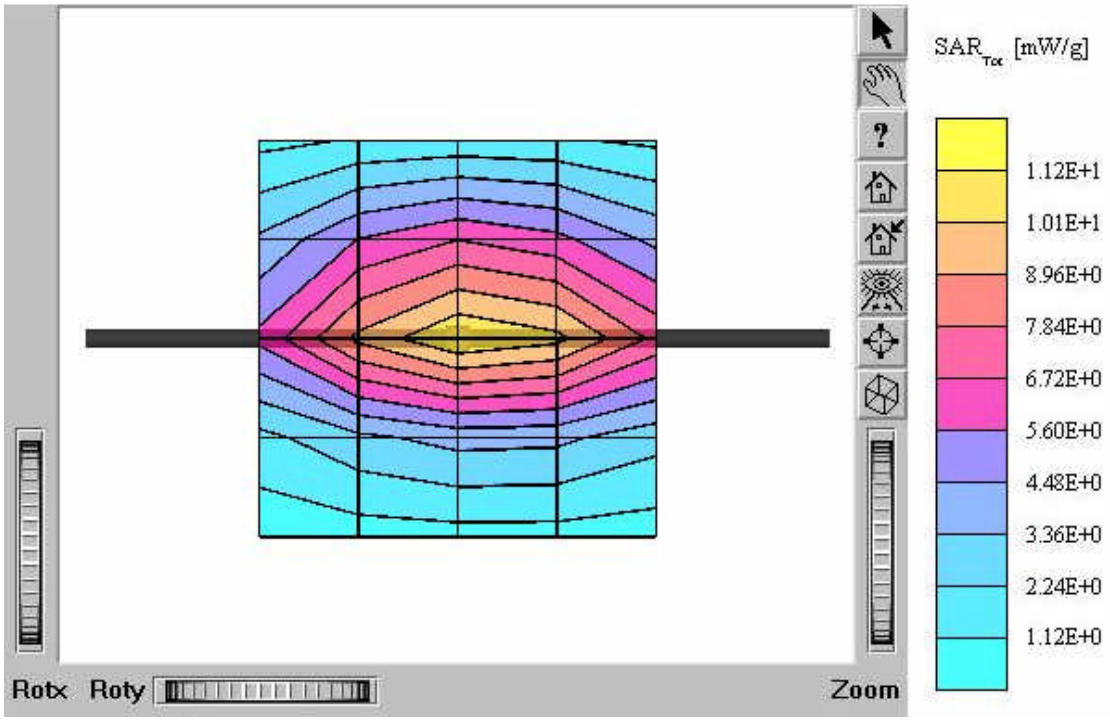
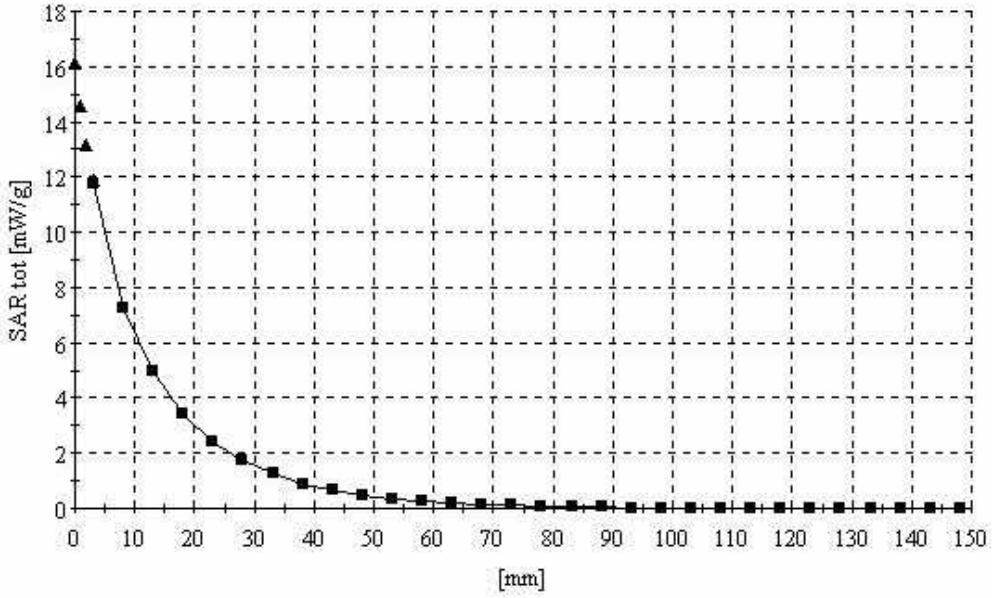
¦ Validation Data (835MHz Brain)

Dipole 835 MHz
SAM I Phantom: Flat Section: Position: (90°,90°); Frequency: 835 MHz
Probe: ET3DV6 - SN1609; ConvF(6.62,6.62,6.62); Crest factor: 1.0; Brain 835 MHz: σ = 0.90 mho/m ε_r = 41.9 ρ = 1.00 g/cm³
Cubes (2): SAR (1g): 9.96 mW/g ± 0.01 dB, SAR (10g): 6.39 mW/g ± 0.00 dB
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.04 dB
Comment:
835MHz Brain Dipole Validation (D835V2/ S.N: 441)
Antenna Input Power: 30 dBm (1 W)
HCT Co., Ltd. Brain Tissue Simulating Liquid
Liquid Temperature: 21.6 ℃
Date Tested: April 2, 2004



Dipole 835 MHz
SAM I Phantom; Section: Position: ; Frequency: 835 MHz
Probe: ET3DV6 - SN1609; ConvF(6.62,6.62,6.62); Crest factor: 1.0; Brain 835 MHz: σ = 0.90 mho/m ε_r = 41.9 ρ = 1.00 g/cm^3
:
Z-Axis: Dx = 0.0, Dy = 0.0, Dz = 5.0

Comment:
835MHz Brain Dipole Validation (D835V2/ S.N: 441)
Antenna Input Power: 30 dBm (1 W)
HCT Co., Ltd. Brain Tissue Simulating Liquid
Liquid Temperature: 21.6 ℃
Date Tested: April 2, 2004



¦ Dielectric Parameter (835MHz Brain)

Title : ACH-770

SubTitle : 835 MHz Brain

April 02, 2004 09:46 AM

Frequency	e'	e''
800.000000 MHz	42.3560	19.6223
805.000000 MHz	42.2551	19.6182
810.000000 MHz	42.1776	19.5755
815.000000 MHz	42.1604	19.5921
820.000000 MHz	42.1055	19.5280
825.000000 MHz	42.0371	19.5269
830.000000 MHz	41.9901	19.5042
835.000000 MHz	41.8911	19.4807
840.000000 MHz	41.8294	19.4367
845.000000 MHz	41.7163	19.4288
850.000000 MHz	41.6911	19.3962
855.000000 MHz	41.6024	19.3926
860.000000 MHz	41.5244	19.3862
865.000000 MHz	41.4489	19.3487
870.000000 MHz	41.3771	19.3208
875.000000 MHz	41.3183	19.2998
880.000000 MHz	41.2671	19.2669
885.000000 MHz	41.1375	19.2725
890.000000 MHz	41.0950	19.2629
895.000000 MHz	41.0465	19.2303
900.000000 MHz	40.9404	19.2351

¦ Dielectric Parameter (835MHz Muscle)

Title : ACH-770

SubTitle : 835 MHz Body

April 02, 2004 09:44 AM

Frequency	e'	e''
800.000000 MHz	56.5184	20.7620
805.000000 MHz	56.4695	20.7136
810.000000 MHz	56.4253	20.6753
815.000000 MHz	56.3685	20.7210
820.000000 MHz	56.2267	20.6860
825.000000 MHz	56.1017	20.6903
830.000000 MHz	55.9639	20.6555
835.000000 MHz	55.9030	20.6145
840.000000 MHz	55.7699	20.6127
845.000000 MHz	55.6778	20.5409
850.000000 MHz	55.6052	20.5172
855.000000 MHz	55.5601	20.5050
860.000000 MHz	55.4711	20.4884
865.000000 MHz	55.5159	20.4522
870.000000 MHz	55.4549	20.4467
875.000000 MHz	55.4067	20.5112
880.000000 MHz	55.3791	20.5297
885.000000 MHz	55.2418	20.3902
890.000000 MHz	55.2362	20.3529
895.000000 MHz	55.1897	20.4479
900.000000 MHz	55.1209	20.5094

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

Client Hyundai (Dymstec)

CALIBRATION CERTIFICATE

Object(s)	D835V2 - SN:441
Calibration procedure(s)	QA CAL-05.v2 Calibration procedure for dipole validation kits
Calibration date:	October 3, 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
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
RF generator R&S SML-03	100698	27-Mar-2002 (R&S, No. 20-92389)	In house check: Mar-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (Agilent, No. 24BR1033101)	In house check: Oct 03

	Name	Function	Signature
Calibrated by:	Judith Mueller	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

Date issued: October 10, 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

s p e a g

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DASY

Dipole Validation Kit

Type: D835V2

Serial: 441

Manufactured: March 9, 2001
Calibrated: October 3, 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 835 MHz:

Relative Dielectricity	**43.0**	± 5%
Conductivity	**0.90 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.7 at 835 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 15mm from dipole center to the solution surface. The included distance spacer 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:	**9.24 mW/g** ± 16.8 % (k=2)[1]
averaged over 10 cm^3 (10 g) of tissue:	**6.08 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:	**1.377 ns**	(one direction)
Transmission factor:	**0.983**	(voltage transmission, one direction)

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

Feedpoint impedance at 835 MHz:	Re{Z} = **52.0 Ω**
	Im {Z} = **-6.1 Ω**
Return Loss at 835 MHz	**-24.1 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.

6. Power Test

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

ConvF(6.7, 6.7, 6.7)Date/Time: 10/03/03 12:18:18

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN441

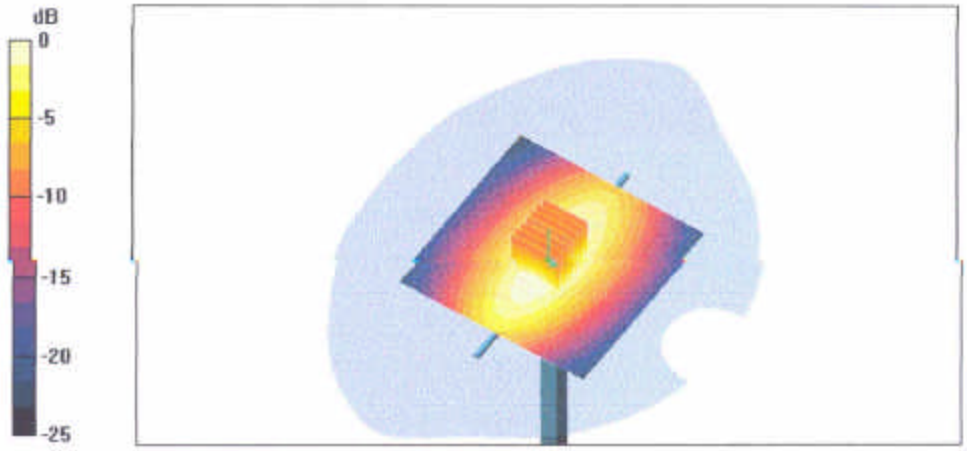
Communication System: CW-835; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: HSL 835 MHz (σ = 0.9 mho/m, ε_r = 43, ρ = 1000 kg/m^3)
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

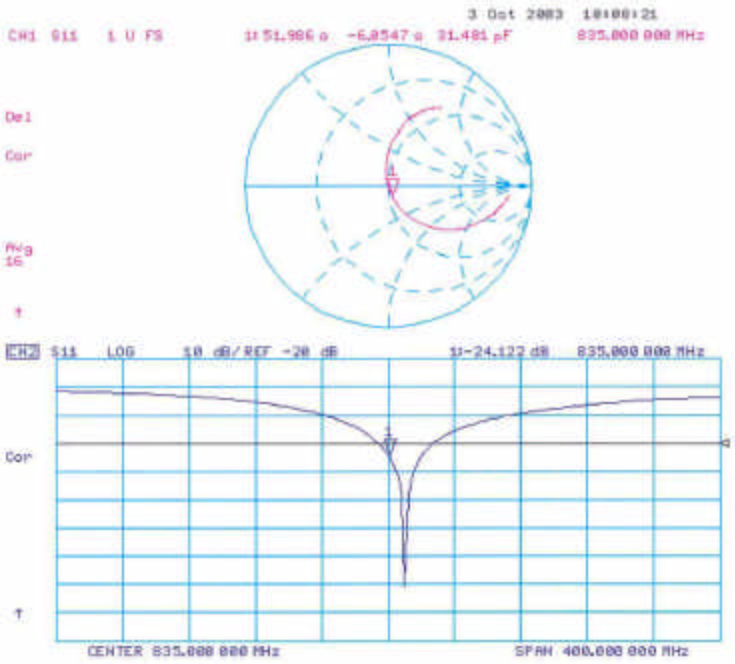
- Probe: ET3DV6 - SN1507; ConvF(6.7, 6.7, 6.7); Calibrated: 1/18/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN411; Calibrated: 1/16/2003
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.8 Build 60

Pin = 250 mW; d = 15 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 54.7 V/m
Power Drift = 0.003 dB
Maximum value of SAR = 2.48 mW/g

Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 3.45 W/kg
SAR(1 g) = 2.31 mW/g; SAR(10 g) = 1.52 mW/g
Reference Value = 54.7 V/m
Power Drift = 0.003 dB
Maximum value of SAR = 2.5 mW/g



0 dB = 2.5mW/g


3 Oct 2003 18:00:21
CH1 S11 1 U FS
1: 51.986 Ω -6.8547 Ω 31.481 pF
835.000 000 MHz
Del
Cor
Avg
16
CH2 S11 LOG 10 dB/ REF -20 dB
1: -24.122 dB 835.000 000 MHz
Cor
CENTER 835.000 000 MHz
SPAN 400.000 000 MHz