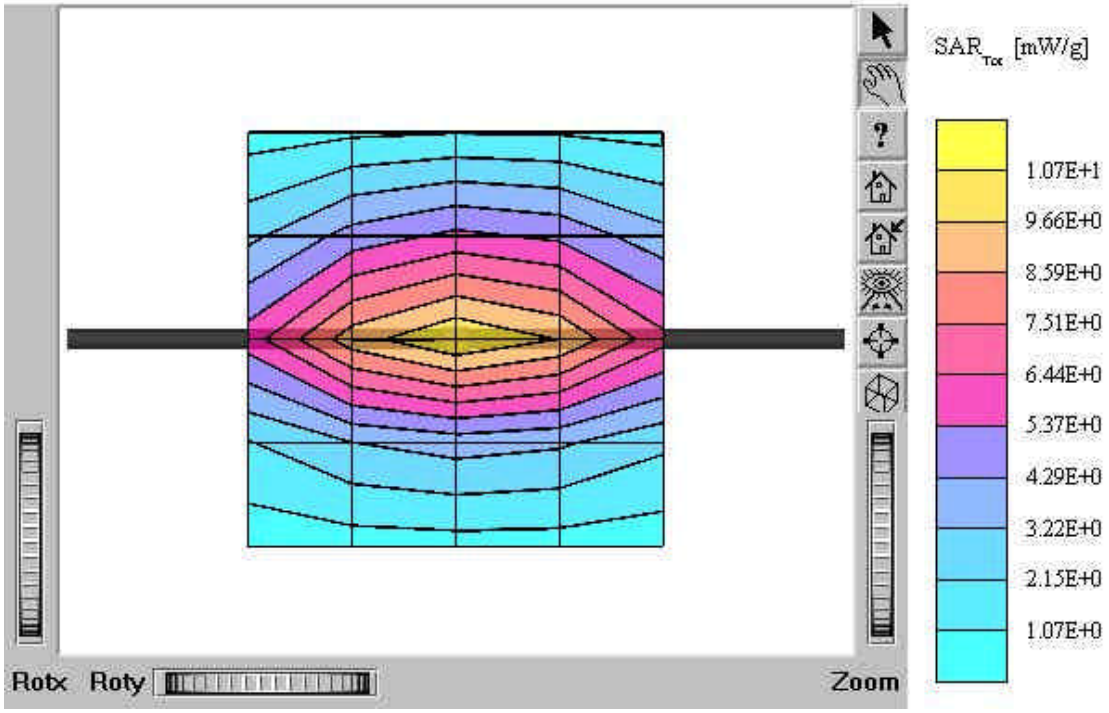
¦ Validation Data (835MHz Brain)

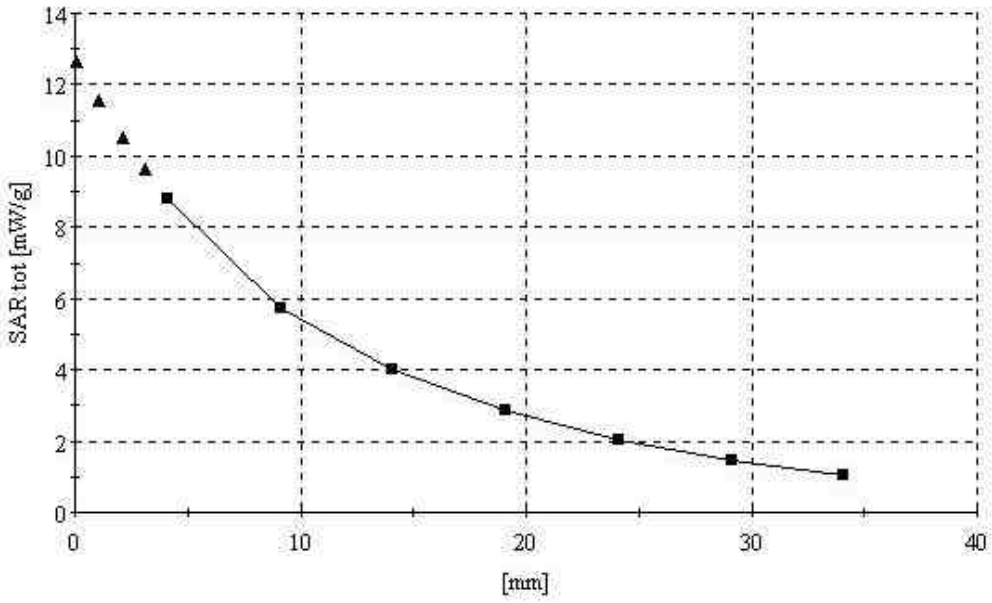
Dipole 835 MHz
SAM 1 Phantom; Flat Section; Position: (90°,90°); Frequency: 835 MHz
Probe: ET3DV6 - SN1798; ConvF(6.60,6.60,6.60); Crest factor: 1.0; Brain 835 MHz: σ = 0.88 mho/m ε_r = 42.2 ρ = 1.00 g/cm^3
Cubes (2): SAR (1g): 10.2 mW/g ± 0.01 dB, SAR (10g): 6.46 mW/g ± 0.01 dB
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.02 dB
Comment:
835MHz Brain Dipole Validation (D835V2/ S.N: 441)
Antenna Input Power : 30 dBm (1W)
HCT Co., Ltd. Brain Tissue Simulating Liquid
Liquid Temperature : 21.5 ℃
Date Tested : October 16, 2003



Dipole 835 MHz

SAM I Phantom; Flat Section; Position: (90°,90°); Frequency: 835 MHz
Probe: ET3DV6 - SN1798; ConvF(6.60,6.60,6.60); Crest factor: 1.0; Brain 835 MHz: σ = 0.88 mho/m ε_r = 42.2 ρ = 1.00 g/cm^3
Cubes (2): SAR (1g): 10.2 mW/g ± 0.01 dB, SAR (10g): 6.46 mW/g ± 0.01 dB
Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0

Comment:
835MHz Brain Dipole Validation (D835V2/ S.N: 441)
Antenna Input Power : 30 dBm (1W)
HCT Co., Ltd. Brain Tissue Simulating Liquid
Liquid Temperature : 21.5 ℃
Date Tested : October 16, 2003



¦ Dielectric Parameter (835MHz Brain)

Title : AXW-P800
SubTitle : 835 MHz Brain
October 16, 2003 08:20 AM

Frequency	e'	e''
800.000000 MHz	42.8977	19.0153
805.000000 MHz	42.7431	19.0278
810.000000 MHz	42.6466	18.9707
815.000000 MHz	42.5510	18.9893
820.000000 MHz	42.4385	19.0182
825.000000 MHz	42.3761	19.0118
830.000000 MHz	42.2352	19.0226
835.000000 MHz	42.1719	19.0223
840.000000 MHz	42.0709	18.9596
845.000000 MHz	42.0097	18.8866
850.000000 MHz	42.0012	18.7786
855.000000 MHz	42.0688	18.6493
860.000000 MHz	42.0295	18.6135
865.000000 MHz	42.0261	18.6287
870.000000 MHz	42.0215	18.6033
875.000000 MHz	41.9987	18.5834
880.000000 MHz	41.9935	18.6038
885.000000 MHz	41.8788	18.5914
890.000000 MHz	41.8219	18.6171
895.000000 MHz	41.7381	18.6161
900.000000 MHz	41.6862	18.5859

¦ Dielectric Parameter (835MHz Body)

Title : AXW-P800
SubTitle : 835 MHz Body
October 16, 2003 08:42 AM

Frequency	e'	e''
800.000000 MHz	54.4727	20.7481
805.000000 MHz	54.3332	20.6718
810.000000 MHz	54.3254	20.7073
815.000000 MHz	54.2231	20.6642
820.000000 MHz	54.1680	20.6551
825.000000 MHz	54.0824	20.6349
830.000000 MHz	53.9840	20.6365
835.000000 MHz	53.9395	20.5857
840.000000 MHz	53.8863	20.5387
845.000000 MHz	53.8229	20.5503
850.000000 MHz	53.8537	20.5487
855.000000 MHz	53.7426	20.5133
860.000000 MHz	53.7203	20.5098
865.000000 MHz	53.7010	20.4837
870.000000 MHz	53.6451	20.4716
875.000000 MHz	53.6774	20.4791
880.000000 MHz	53.6377	20.4767
885.000000 MHz	53.5632	20.4772
890.000000 MHz	53.5855	20.4667
895.000000 MHz	53.5178	20.4386
900.000000 MHz	53.4386	20.4051

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.

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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

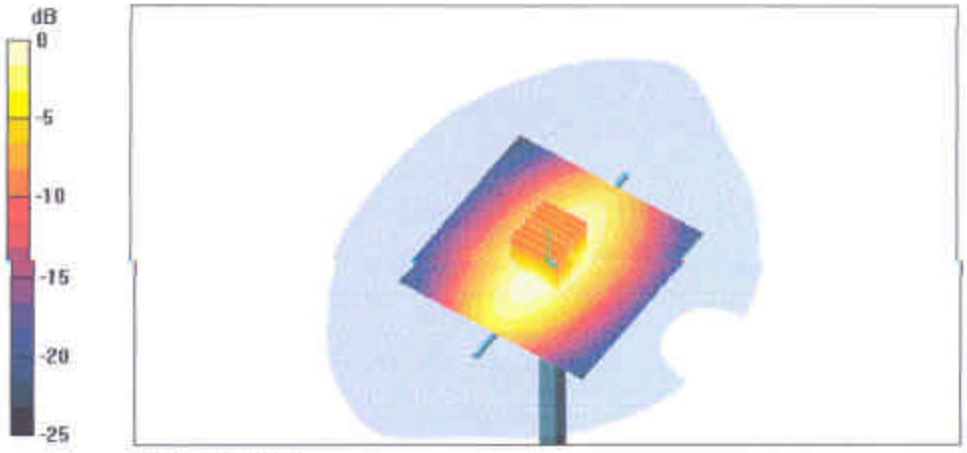
Communication System: CW-835; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: HSL 835 MHz (σ = 0.9 mho/m, ε_r = 43, ρ = 1000 kg/m^3)
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

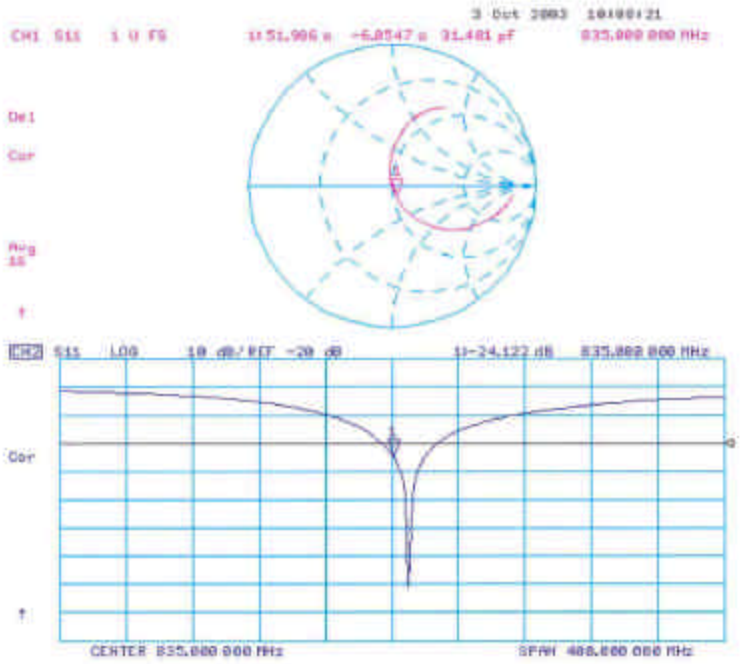
- Probe: ET3DV6 - SN1507; ConvF(6.7, 6.7, 6.7); Calibrated: 1/18/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN411; Calibrated: 1/16/2003
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, 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 10:00:21
CH1 S11 1 U FS
51.906 Ω -6.8547 Ω 31.481 pF
835.000 000 MHz
Del
Cor
Avg
16
CH2 S11 LOG 10 dB/ REF -20 dB
-24.122 dB 835.000 000 MHz
Cor
CENTER 835.000 000 MHz
SPAN 400.000 000 MHz