

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: $\sigma = 0.89$ mho/m $\epsilon_r = 42.6$ $\rho = 1.00$ g/cm³Cubes (2): SAR (1g): 10.3 mW/g ± 0.05 dB, SAR (10g): 6.58 mW/g ± 0.04 dB

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

Powerdrift: -0.01 dB

Comment:

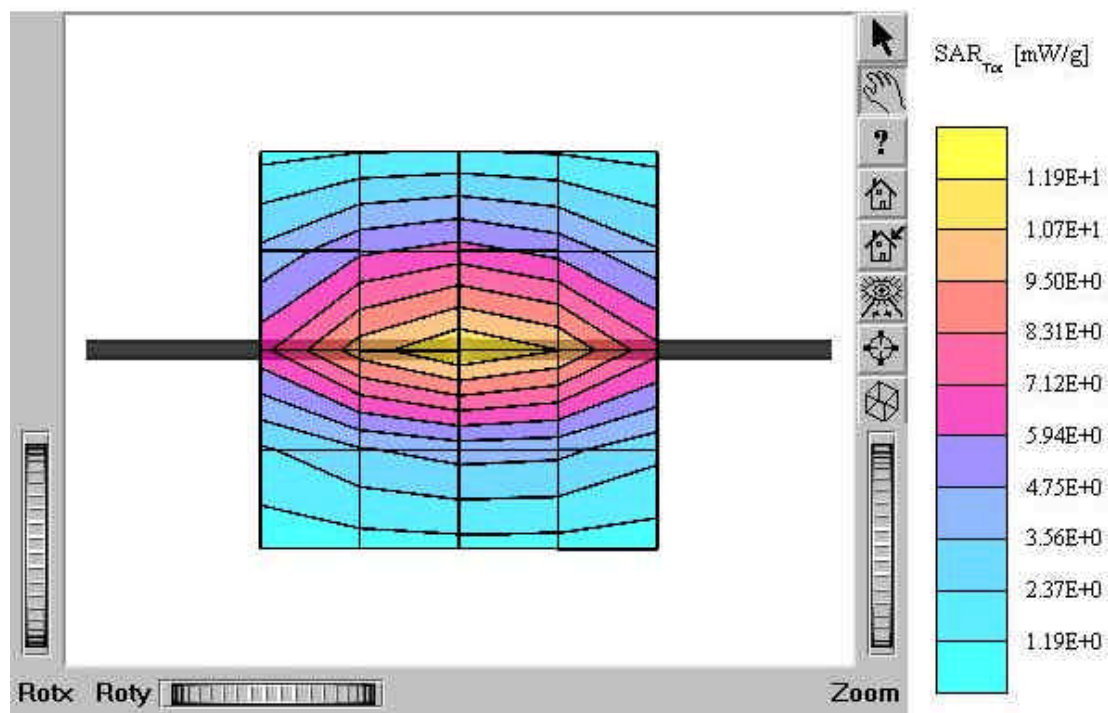
835MHz Brain Dipole Validation (D835V2/ S.N: 441)

Antenna Input Power: 30 dBm (1 W)

HCT Co., Ltd. Brain Tissue Simulating Liquid

Liquid Temperature: 21.2°C

Date Tested : June 10, 2004



Dipole 835 MHz

SAM 1 Phantom: Section: Position: ; Frequency: 835 MHz

Probe: ET3DV6 - SN1609; ConvF(6.62,6.62,6.62); Crest factor: 1.0; Brain 835 MHz: $\sigma = 0.89$ mho/m $\epsilon_s = 42.6$ $\rho = 1.00$ g/cm³

:

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

Comment:

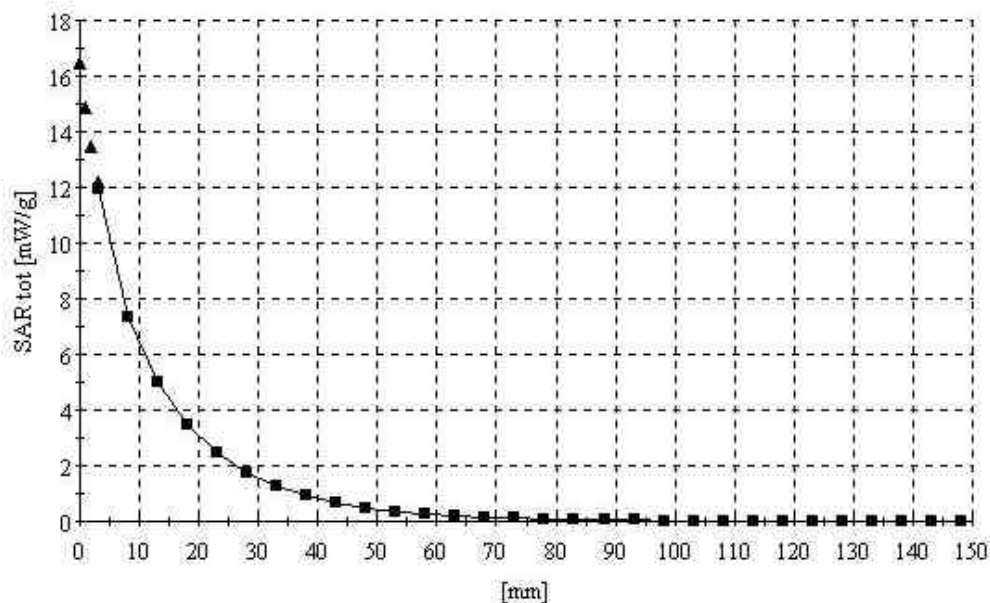
835MHz Brain Dipole Validation (D835V2/ S.N: 441)

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HCT Co., Ltd. Brain Tissue Simulating Liquid

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Dielectric Parameter (835MHz Brain)

Title : HTT-800
SubTitle : 835 MHz Brain
June 10, 2004 10:28 AM

Frequency	e'	e''
800.000000 MHz	43.1638	19.3448
805.000000 MHz	43.0527	19.3212
810.000000 MHz	42.9760	19.2994
815.000000 MHz	42.9317	19.3119
820.000000 MHz	42.8361	19.2158
825.000000 MHz	42.7255	19.2317
830.000000 MHz	42.6333	19.1950
835.000000 MHz	42.6293	19.1863
840.000000 MHz	42.4971	19.2041
845.000000 MHz	42.4586	19.1429
850.000000 MHz	42.3869	19.1439
855.000000 MHz	42.3190	19.1543
860.000000 MHz	42.2818	19.1250
865.000000 MHz	42.2686	19.1401
870.000000 MHz	42.2129	19.1472
875.000000 MHz	42.1562	19.2157
880.000000 MHz	42.1386	19.1910
885.000000 MHz	42.0892	19.1761
890.000000 MHz	42.0168	19.1984
895.000000 MHz	41.9784	19.1806
900.000000 MHz	41.9295	19.1264

Dielectric Parameter (835MHz Body)**Title : HTT-800****SubTitle : 835 MHz Body**

June 10, 2004 11:36 AM

Frequency	e'	e''
800.000000 MHz	54.4486	21.6795
805.000000 MHz	54.3925	21.6370
810.000000 MHz	54.3754	21.6376
815.000000 MHz	54.3248	21.6050
820.000000 MHz	54.2993	21.5300
825.000000 MHz	54.2846	21.5299
830.000000 MHz	54.2586	21.5115
835.000000 MHz	54.1716	21.4602
840.000000 MHz	54.1548	21.4168
845.000000 MHz	54.0522	21.3178
850.000000 MHz	54.0093	21.3179
855.000000 MHz	53.9651	21.2533
860.000000 MHz	53.8589	21.2235
865.000000 MHz	53.8097	21.2267
870.000000 MHz	53.7624	21.1756
875.000000 MHz	53.7081	21.1597
880.000000 MHz	53.6344	21.2153
885.000000 MHz	53.5368	21.2323
890.000000 MHz	53.4954	21.1856
895.000000 MHz	53.3836	21.1720
900.000000 MHz	53.3908	21.1648

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	US37292763	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

Calibrated by:	Name Justin Mueller	Function Technician	Signature 
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Approved by:	Name Katja Pokovic	Function Laboratory Director	Signature 
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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	$\pm 5\%$
Conductivity	0.90 mho/m	$\pm 5\%$

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 $\pm 3\%$. 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:	9.24 mW/g $\pm 16.8\%$ (k=2) ¹
averaged over 10 cm ³ (10 g) of tissue:	6.08 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:	1.377 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:	$\text{Re}\{Z\} = 52.0 \Omega$
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	$\text{Im}\{Z\} = -6.1 \Omega$
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Return Loss at 835 MHz	-24.1 dB
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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.

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 ($\sigma = 0.9$ mho/m, $\epsilon_r = 43$, $\rho = 1000$ kg/m³)

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

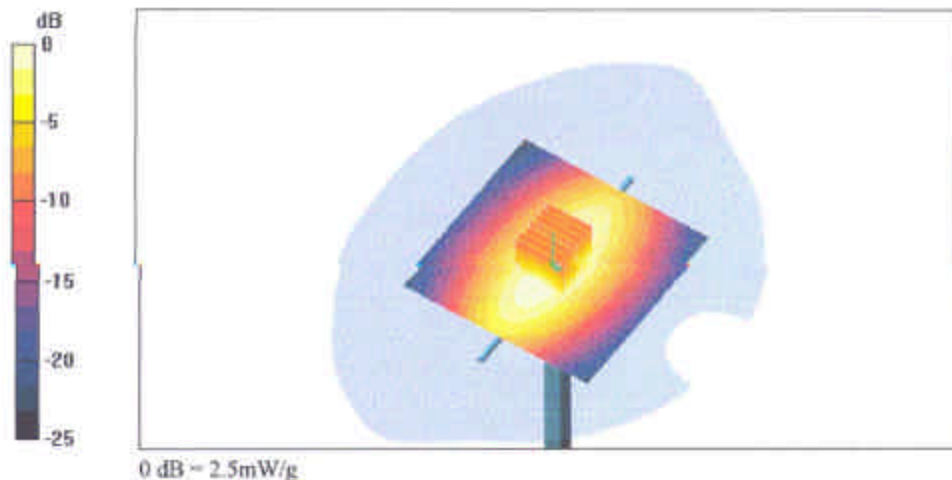
Peak SAR (extrapolated) = 3.45 W/kg

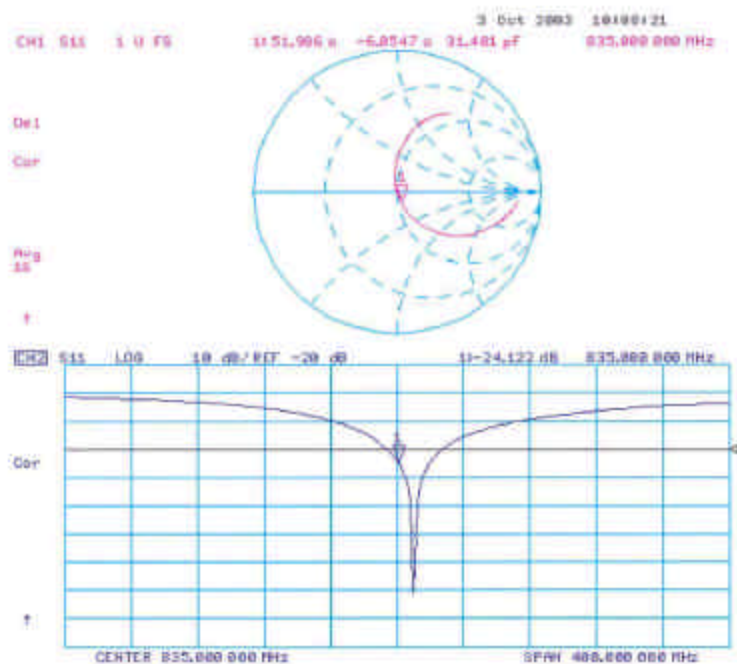
SAR(1 g) = 2.31 mW/g; SAR(10 g) = 1.52 mW/g

Reference Value = 54.7 V/m

Power Drift = 0.003 dB

Maximum value of SAR = 2.5 mW/g





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Zughausstrasse 43, 8004 Zurich, Switzerland

Client **H-CT (Dymstec)**

CALIBRATION CERTIFICATE

Object(s) D1900V2 - SN:5d032

Calibration procedure(s) QA CAL-05.v2
Calibration procedure for dipole validation kits

Calibration date April 26, 2004

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

This calibration statement documents traceability of M&E 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&E critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM E442	GB37460704	6-Nov-03 (METAS, No. 252-0254)	Nov-04
Power sensor HP 8481A	US37292783	6-Nov-03 (METAS, No. 252-0254)	Nov-04
Power sensor HP 8481A	MY41092317	18-Oct-02 (Agilent, No. 20021018)	Oct-04
RF generator R&S SML-03	100898	27-Mar-2002 (R&S, No. 20-92389)	In house check: Mar-05
Network Analyzer HP 8753E	US37390665	18-Oct-01 (SPEAG, in house check Nov-03)	In house check: Oct-05

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

Date issued: April 27, 2004

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: D1900V2

Serial: 5d032

Manufactured: March 17, 2003
Calibrated: April 26, 2004

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	40.1	$\pm 5\%$
Conductivity	1.45 mho/m	$\pm 5\%$

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 4.96 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 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 $\pm 3\%$. The results are normalized to 1 W 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 1 W (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:	40.0 mW/g $\pm 16.8\%$ (k=2)¹
averaged over 10 cm ³ (10 g) of tissue:	21.0 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: **1.192 ns** (one direction)
Transmission factor: **0.999** (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 1900 MHz: $\text{Re}\{Z\} = 49.8 \Omega$

$\text{Im}\{Z\} = 3.4 \Omega$

Return Loss at 1900 MHz: **-29.5 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.

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN5d032

Communication System: CW-1900; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: HSL 1900 MHz;

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.45$ mho/m; $\epsilon_r = 40.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(4.96, 4.96, 4.96); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn411; Calibrated: 11/6/2003
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006;
- Measurement SW: DASY4, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm

Reference Value = 92 V/m; Power Drift = 0.0 dB

Maximum value of SAR (interpolated) = 11.4 mW/g

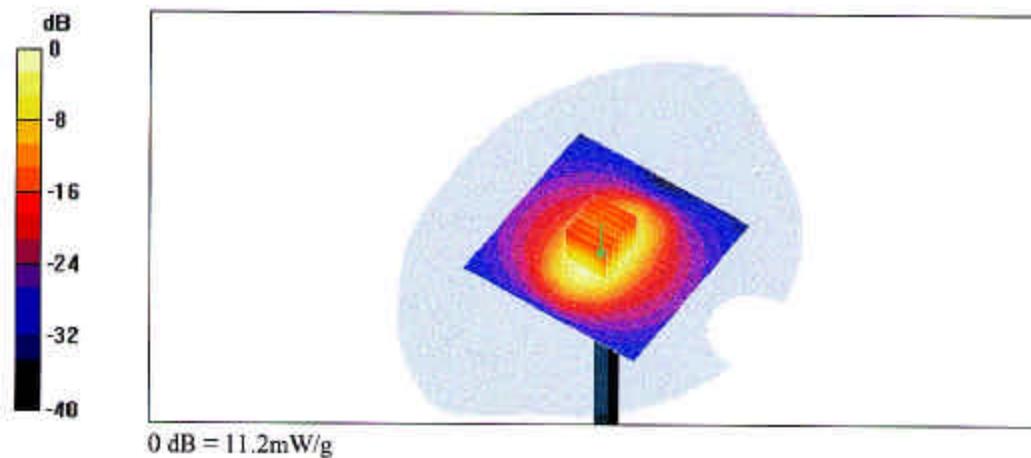
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 92 V/m; Power Drift = 0.0 dB

Maximum value of SAR (measured) = 11.2 mW/g

Peak SAR (extrapolated) = 17.8 W/kg

SAR(1 g) = 10 mW/g; SAR(10 g) = 5.25 mW/g



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