835MHz Brain Dipole Validaiton

DUT: Dipole 835 MHz; Serial: 451

Program Name: 835MHz Dipole Validation
Procedure Name: 835MHz @ 250mW
Procedure Notes: Meas.Tissue Temp(celsius)-21.6;Test Date-03/Sep/2004

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1

Medium parameters used: f = 835 MHz; σ = 0.89 mho/m; ε_r = 41.1; ρ = 1000 kg/m^3

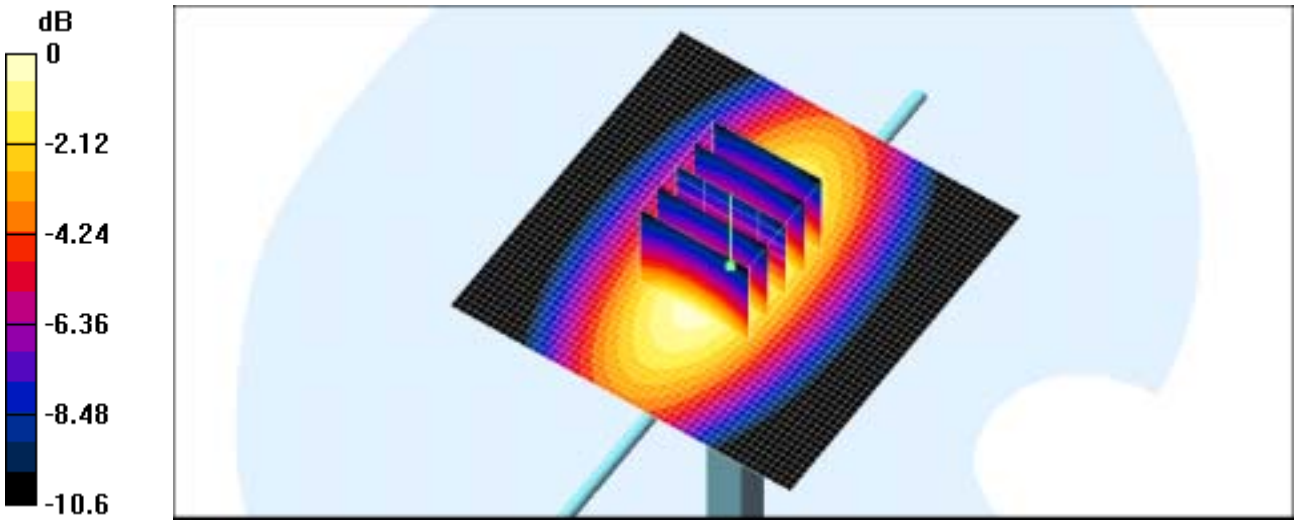
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1735; ConvF(7, 7, 7); Calibrated: 2003-11-20
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn468; Calibrated: 2003-11-21
- Phantom: SAM 835/900 MHz; Type: SAM; Serial: TP-1141
- Measurement SW: DASY4, V4.3 Build 16; Postprocessing SW: SEMCAD, V1.8 Build 123

835MHz @ 250mW/Area Scan (51x51x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 2.62 mW/g

835MHz @ 250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 55.8 V/m; Power Drift = -0.004 dB
Peak SAR (extrapolated) = 3.55 W/kg
SAR(1 g) = 2.41 mW/g
Maximum value of SAR (measured) = 2.61 mW/g



0 dB = 2.61mW/g

835MHz Brain Dipole Validation

DUT: Dipole 835 MHz; Serial: 451

Program Name: 835MHz Dipole Validation
Procedure Name: 835MHz @ 250mW
Procedure Notes: Meas.Tissue Temp(celsius)-21.3;Test Date-06/Sep/2004

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1

Medium parameters used: f = 835 MHz; σ = 0.89 mho/m; ε_r = 40.6; ρ = 1000 kg/m^3

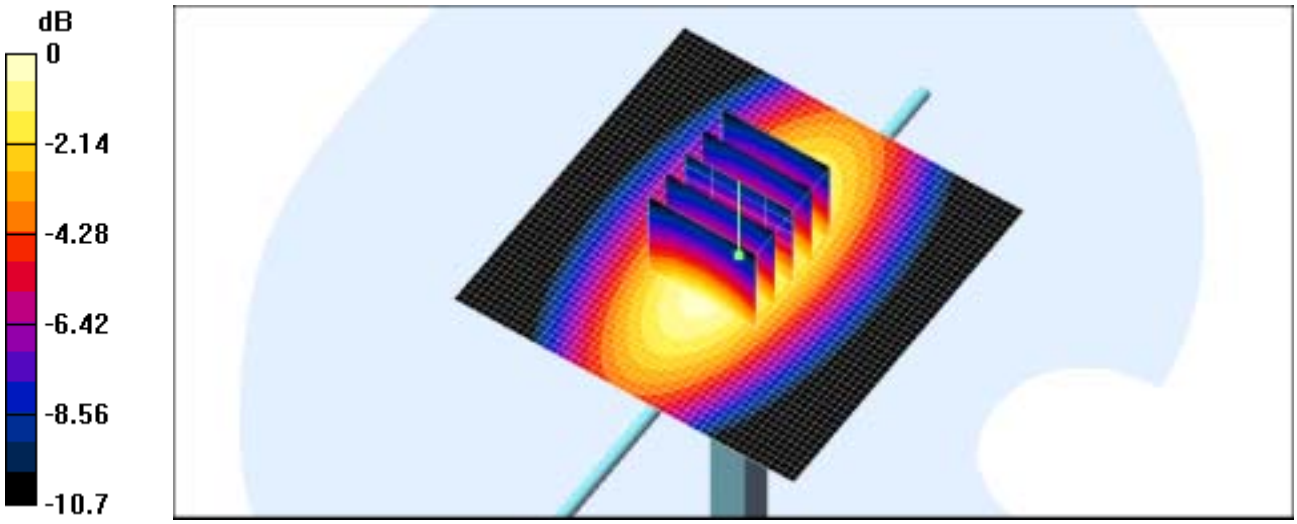
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1617; ConvF(6.23, 6.23, 6.23); Calibrated: 2004-08-27
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn486; Calibrated: 2004-08-23
- Phantom: SAM 835/900 MHz; Type: SAM; Serial: TP-1141
- Measurement SW: DASY4, V4.3 Build 16; Postprocessing SW: SEMCAD, V1.8 Build 123

835MHz @ 250mW/Area Scan (51x51x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 2.74 mW/g

835MHz @ 250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 57.5 V/m; Power Drift = 0.002 dB
Peak SAR (extrapolated) = 3.72 W/kg
SAR(1 g) = 2.5 mW/g
Maximum value of SAR (measured) = 2.71 mW/g



0 dB = 2.71mW/g

1900MHz Brain Dipole Validation

DUT: Dipole 1900 MHz; Serial: 548

Program Name: 1900MHz Dipole Validation
Procedure Name: 1900MHz @ 250mW
Procedure Notes: Meas.Tissue Temp(celsius)-21.6;Test Date-07/Sep/2004

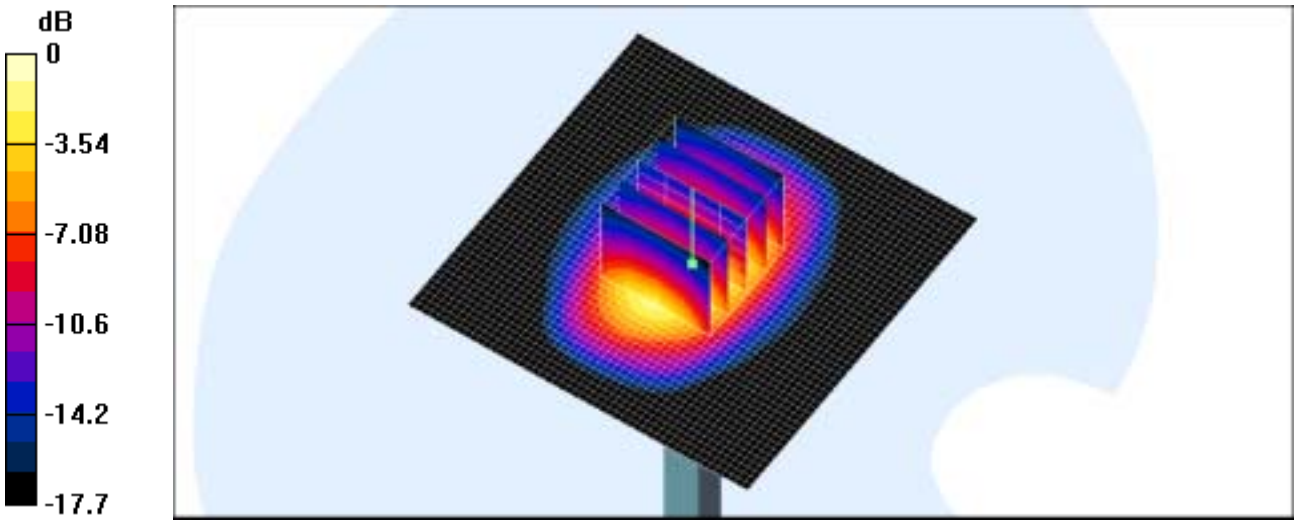
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 1.4$; mho/m, $\varepsilon_r = 38.4$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1617; ConvF(5.11, 5.11, 5.11); Calibrated: 2004-08-27
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn486; Calibrated: 2004-08-23
- Phantom: SAM 1800/1900 MHz; Type: SAM; Serial: TP-1248
- Measurement SW: DASY4, V4.3 Build 16; Postprocessing SW: SEMCAD, V1.8 Build 123

1900MHz @ 250mW/Area Scan (51x51x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 16.6 mW/g

1900MHz @ 250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 96.8 V/m; Power Drift = 0.0 dB
Peak SAR (extrapolated) = 17.8 W/kg
SAR(1 g) = 10.3 mW/g
Maximum value of SAR (measured) = 11.6 mW/g



0 dB = 11.6mW/g

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

Client Samsung (Dymstec)

CALIBRATION CERTIFICATE

Object(s)	D835V2 - SN:451
Calibration procedure(s)	QA CAL-05.v2 Calibration procedure for dipole validation kits
Calibration date:	November 18, 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 meter EPM E442	GB37480704	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	100698	27-Mar-2002 (R&S, No. 20-92389)	In house check: Mar-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-03)	In house check: Oct 05

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

Date issued: November 20, 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.

checked by

Schmid & Partner Engineering AG

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Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

DASY

Dipole Validation Kit

Type: D835V2

Serial: 451

Manufactured:	December 24, 2001
Repaired:	November 11, 2003
Calibrated:	November 18, 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	**41.2**	± 5%
Conductivity	**0.88 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:	**9.32 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:	**1.393 ns**	(one direction)
Transmission factor:	**0.986**	(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 835 MHz:	Re{Z} = **51.6 Ω**
	Im {Z} = **-0.9 Ω**
Return Loss at 835 MHz	**-35.0 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: 11/18/03 16:59:17

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN451

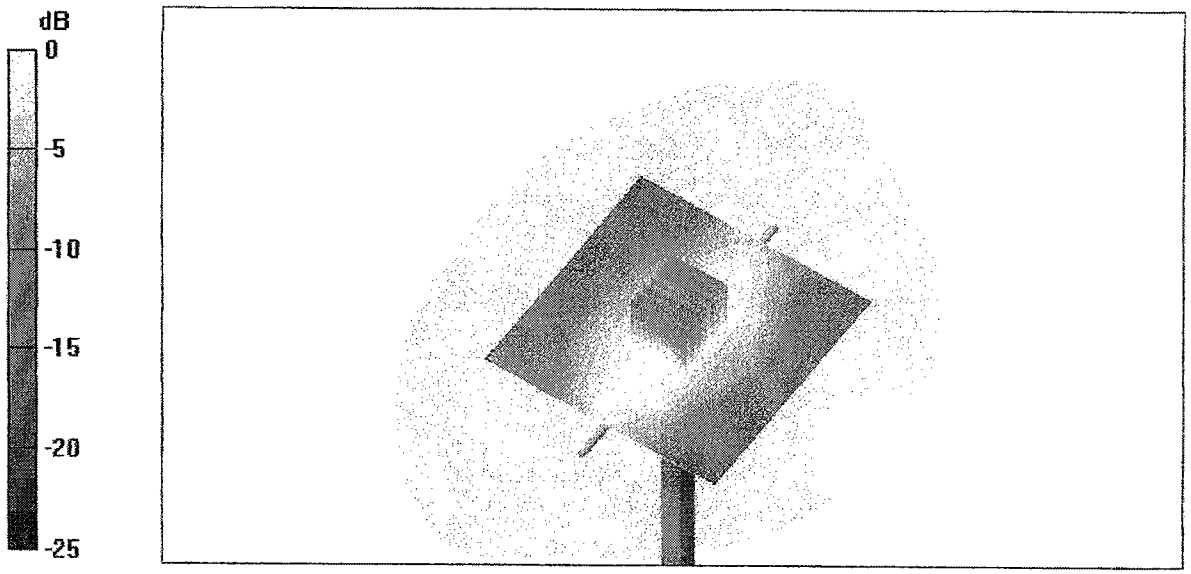
Communication System: CW-835; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: HSL 835 MHz (σ = 0.88 mho/m, ε_r = 41.22, ρ = 1000 kg/m^3)
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

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 = 55.5 V/m
Power Drift = -0.007 dB
Maximum value of SAR = 2.51 mW/g

Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 3.5 W/kg
SAR(1 g) = 2.33 mW/g; SAR(10 g) = 1.52 mW/g
Reference Value = 55.5 V/m
Power Drift = -0.007 dB
Maximum value of SAR = 2.51 mW/g



0 dB = 2.51mW/g

18 Nov 2003 10:33:15

CH1 S11 1 U FS 1: 51.605 Ω -857.42 mΩ 222.30 pF 835.000 000 MHz

Del

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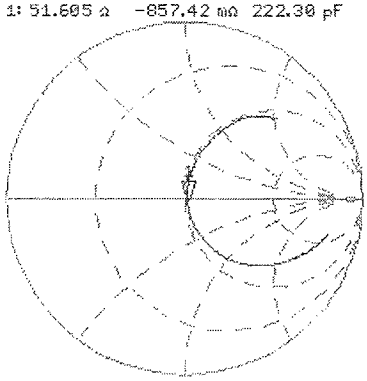
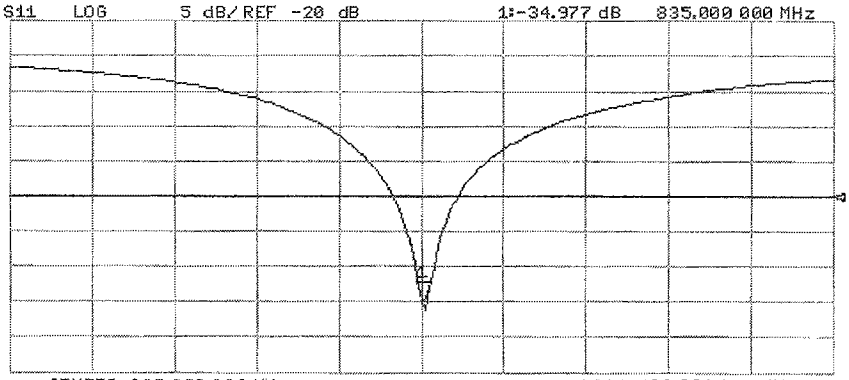
16



CH2 S11 LOG 5 dB/ REF -20 dB 1:-34.977 dB 835.000 000 MHz

Cor



CENTER 835.000 000 MHz SPAN 400.000 000 MHz

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

Client Samsung (Dymstec)

CALIBRATION CERTIFICATE

Object(s)	D1900V2 - SN:548
Calibration procedure(s)	QA CAL-05.v2 Calibration procedure for dipole validation kits
Calibration date:	November 13, 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 meter EPM E442	GB37480704	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	100698	27-Mar-2002 (R&S, No. 20-92389)	In house check: Mar-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-03)	In house check: Oct 05

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

Date issued: November 20, 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.

Checked by

Schmid & Partner Engineering AG

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Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

DASY

Dipole Validation Kit

Type: D1900V2

Serial: 548

Manufactured:	November 15, 2001
Repaired:	November 11, 2003
Calibrated:	November 13, 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	**40.5**	± 5%
Conductivity	**1.46 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 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:	**39.7 mW/g** ± 16.8 % (k=2)[1]
averaged over 10 cm^3 (10 g) of tissue:	**20.8 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:	**1.199 ns**	(one direction)
Transmission factor:	**0.982**	(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:	Re{Z} = **51.1 Ω**
	Im {Z} = **3.8 Ω**
Return Loss at 1900 MHz	**-28.2 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.

ConvF(5.2, 5.2, 5.2)Date/Time: 11/13/03 11:51:21

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN548

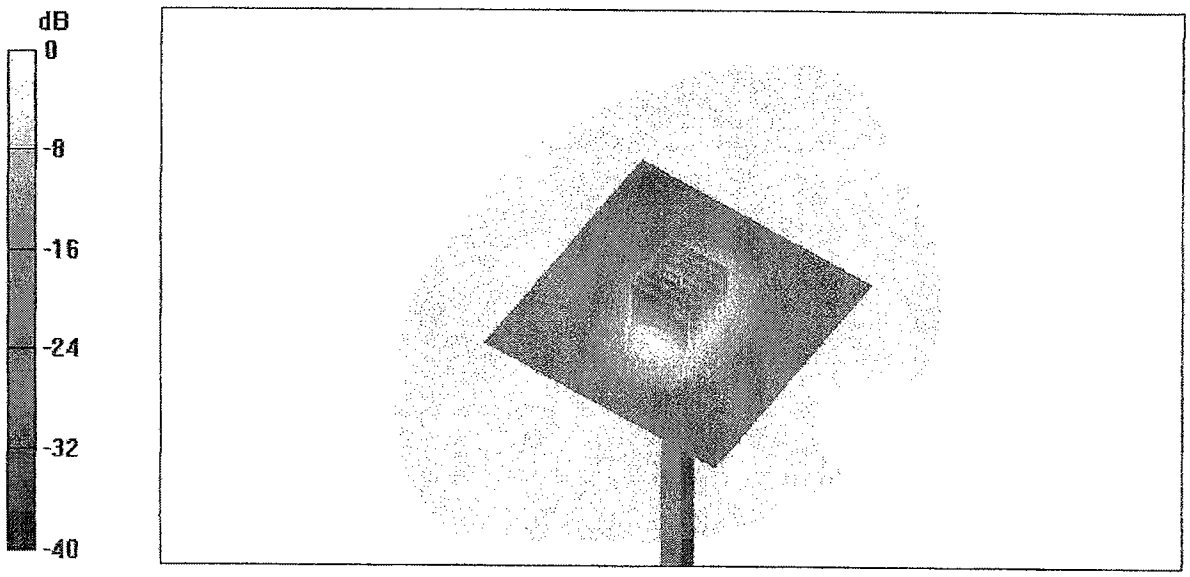
Communication System: CW-1900; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL 1900 MHz (σ = 1.46 mho/m, ε_r = 40.45, ρ = 1000 kg/m^3)
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

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, V1.8 Build 60

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 92.4 V/m
Power Drift = -0.0 dB
Maximum value of SAR = 11.2 mW/g

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 17.6 W/kg
SAR(1 g) = 9.92 mW/g; SAR(10 g) = 5.19 mW/g
Reference Value = 92.4 V/m
Power Drift = -0.0 dB
Maximum value of SAR = 11.2 mW/g



0 dB = 11.2mW/g

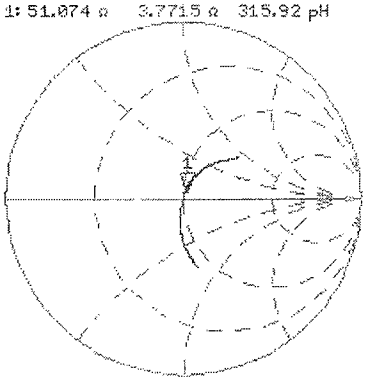
13 Nov 2003 10:34:34

CH1 S11 1 U FS 1: 51.074 Ω 3.7715 Ω 315.92 pH 1 900.000 000 MHz

Del

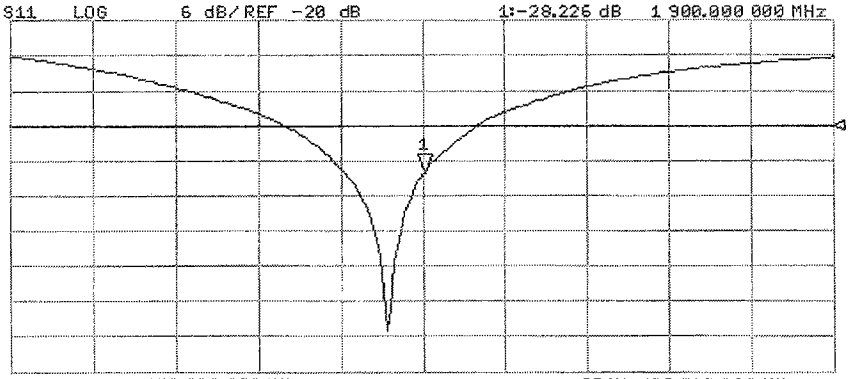
Cor

Avg
16



CH2 S11 LOG 6 dB/ REF -20 dB 1:-28.226 dB 1 900.000 000 MHz

Cor



CENTER 1 900.000 000 MHz SPAN 400.000 000 MHz