

APPENDIX

Exhibit 4

System Validation Dipole - D1800V2, S/N: 2d038

Calibration Data

Client

JQA (MITC)

CALIBRATION CERTIFICATE

Object(s) D1800V2 - SN:2d038

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

Calibration date: February 5, 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.

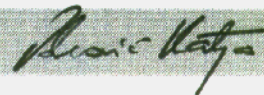
All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date	Scheduled Calibration
RF generator HP 8684C	US3642U01700	4-Aug-99 (in house check Aug-02)	In house check: Aug-05
Power sensor E4412A	MY41495277	8-Mar-02	Mar-03
Power sensor HP 8481A	MY41092180	18-Sep-02	Sep-03
Power meter EPM E4419B	GB41293874	13-Sep-02	Sep-03
Network Analyzer HP 8753E	US38432426	3-May-00	In house check: May 03
Fluke Process Calibrator Type 702	SN: 6295803	3-Sep-01	Sep-03

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Technician	

Approved by:	Katja Pokovic	Laboratory Director
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Date issued: February 7, 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.

DASY

Dipole Validation Kit

Type: D1800V2

Serial: 2d038

Manufactured: February 28, 2002

Calibrated: February 5, 2003

1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with head simulating glycol solution of the following electrical parameters at 1800 MHz:

Relative Dielectricity	39.5	$\pm 5\%$
Conductivity	1.36 mho/m	$\pm 5\%$

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 5.3 at 1800 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 $250\text{mW} \pm 3\%$. 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:	38.5 mW/g
averaged over 10 cm^3 (10 g) of tissue:	20.2 mW/g

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:	0.990	(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 1800 MHz:	$\text{Re}\{Z\} = \mathbf{49.8\ \Omega}$
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	$\text{Im}\{Z\} = \mathbf{-4.7\ \Omega}$
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Return Loss at 1800 MHz	-26.5 dB
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4. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with body simulating glycol solution of the following electrical parameters at 1800 MHz:

Relative Dielectricity	51.4	$\pm 5\%$
Conductivity	1.48 mho/m	$\pm 5\%$

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 5.0 at 1800 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 $250\text{mW} \pm 3\%$. The results are normalized to 1W input power.

5. SAR Measurement with DASY4 System

Standard SAR-measurements were performed according to the measurement conditions described in section 4. 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 cm³ (1 g) of tissue: **36.8 mW/g**

averaged over 10 cm³ (10 g) of tissue: **19.6 mW/g**

6. Dipole Impedance and Return Loss

The dipole was positioned at the flat phantom sections according to section 4 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 1800 MHz: $\text{Re}\{Z\} = 45.2 \Omega$

$\text{Im}\{Z\} = -4.7 \Omega$

Return Loss at 1800 MHz **-23.1 dB**

7. 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.

8. 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.

9. 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
File Name: SN2d038_SN1507_HSL1800_050203.da4

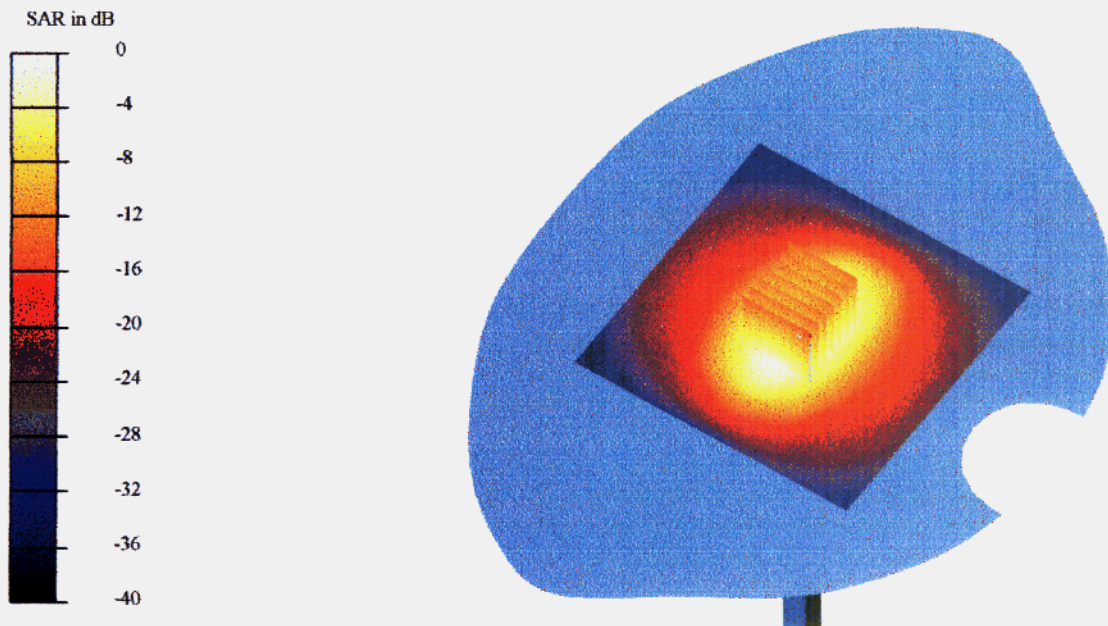
DUT: Dipole 1800 MHz Type & Serial Number: D1800V2 - SN2d038
Program: Dipole Calibration; Pin = 250 mW; d = 10 mm

Communication System: CW-1800; Frequency: 1800 MHz; Duty Cycle: 1:1
Medium: HSL 1800 MHz ($\sigma = 1.36$ mho/m, $\epsilon = 39.52$, $\rho = 1000$ kg/m³)
Phantom section: FlatSection

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(5.3, 5.3, 5.3); Calibrated: 1/18/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN410; Calibrated: 1/14/2003
- Phantom: SAM 4.0 - TP:1006
- Software: DASY4, V4.0 Build 51

Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm
Reference Value = 93.9 V/m
Peak SAR = 16.6 mW/g
SAR(1 g) = 9.62 mW/g; SAR(10 g) = 5.06 mW/g
Power Drift = -0.02 dB



5 Feb 2003 10:27:53

CH1 S11 1 U FS

1: 49.777 Ω -4.7285 Ω 18.699 pF

1 800.000 000 MHz

γ

Del

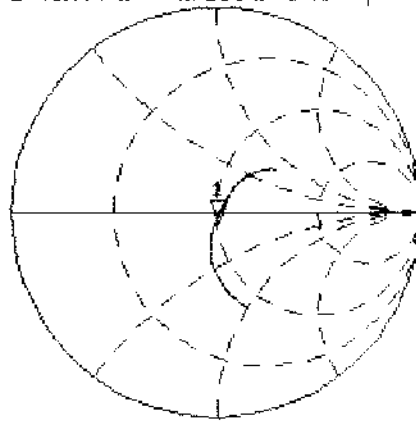
PRm

Cor

Avg

16

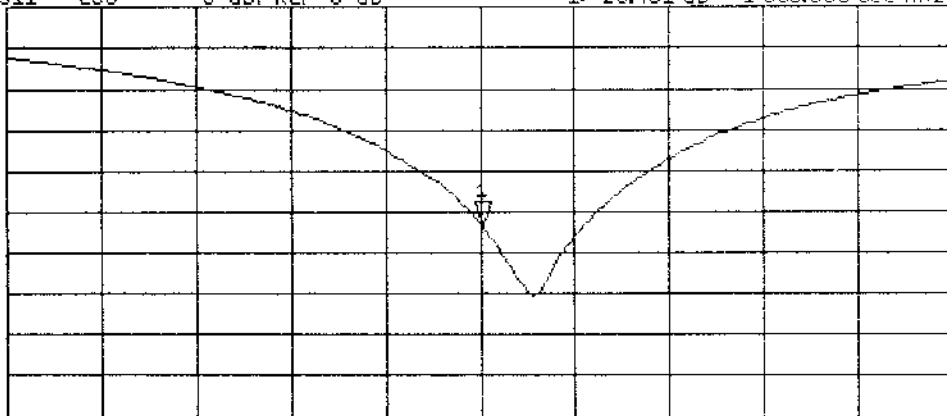
$\uparrow$



CH2 S11 LOG 5 dB/REF 0 dB 1:-26.461 dB 1 800.000 000 MHz

PRm
Cor

$\uparrow$



START 1 800.000 000 MHz

STOP 2 000.000 000 MHz

Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN2d038_SN1507_M1800_050203.da4

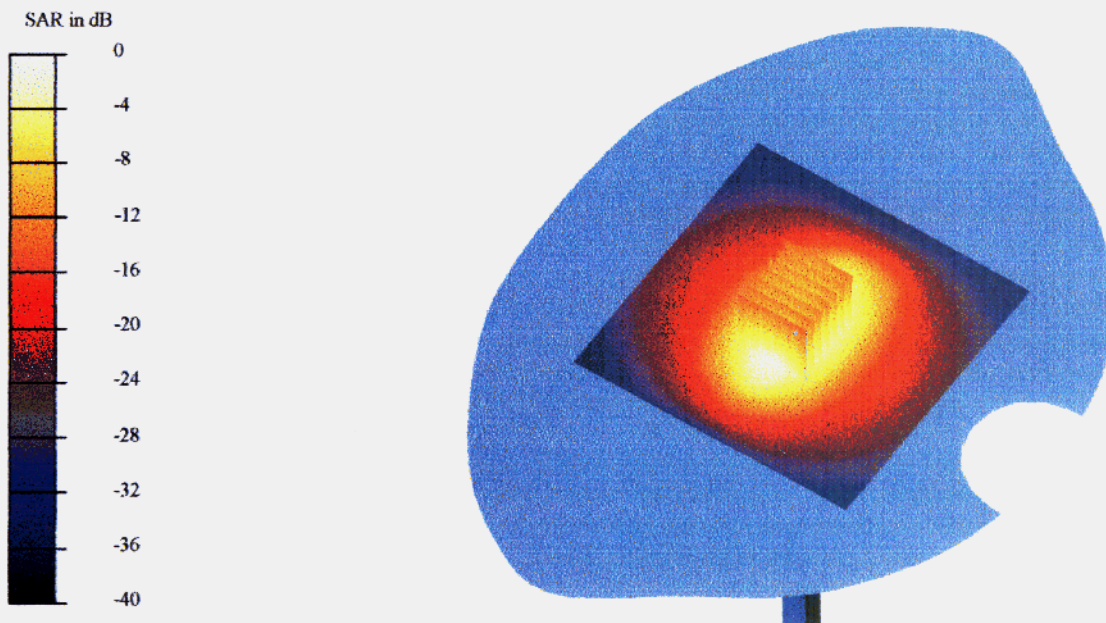
DUT: Dipole 1800 MHz Type & Serial Number: D1800V2 - SN2d038
Program: Dipole Calibration; Pin = 250 mW; d = 10 mm

Communication System: CW-1800; Frequency: 1800 MHz; Duty Cycle: 1:1
Medium: Muscle 1800 MHz ($\sigma = 1.48$ mho/m, $\epsilon = 51.39$, $\rho = 1000$ kg/m³)
Phantom section: FlatSection

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(5, 5, 5); Calibrated: 1/18/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN410; Calibrated: 1/14/2003
- Phantom: SAM 4.0 - TP:1006
- Software: DASY4, V4.0 Build 51

Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm
Reference Value = 89.8 V/m
Peak SAR = 15.4 mW/g
SAR(1 g) = 9.21 mW/g; SAR(10 g) = 4.89 mW/g
Power Drift = -0.01 dB



5 Feb 2003 19:30:07

CH1 S11 1 U FS

1: 45.234 Ω -4.7129 Ω 18.761 pF

1 800.000 000 MHz

↑

Del

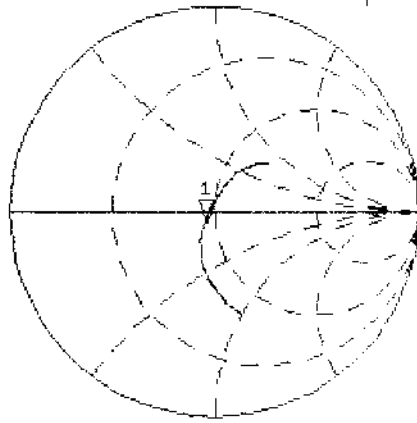
PRM

Cor

Avg

16

↑



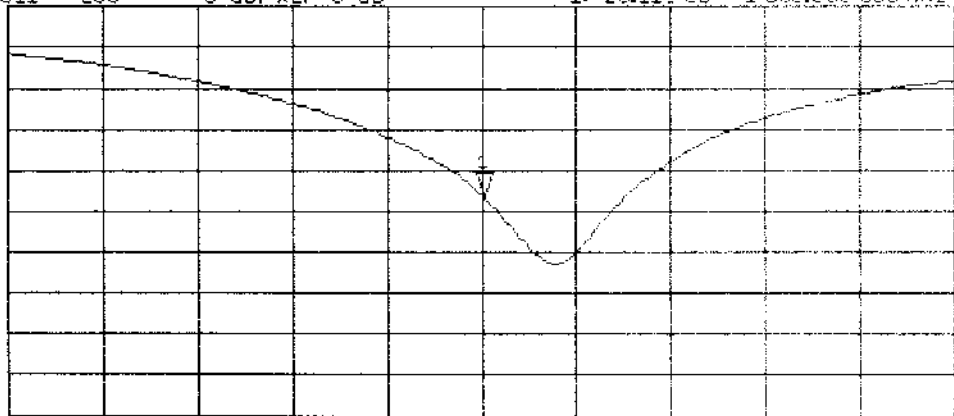
1800 Hz

CH2 S11 LOG 5 dB/REF 0 dB 1: -23.113 dB 1 800.000 000 MHz

PRM

Cor

↑



START 1 600.000 000 MHz

STOP 2 000.000 000 MHz