Schmid & Partner
Engineering AG

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Calibration Certificate

1800 MHz System Validation Dipole

Type:	D1800V2
Serial Number:	259
Place of Calibration:	Zurich
Date of Calibration:	January 25, 2002
Calibration Interval:	24 months

Schmid & Partner Engineering AG hereby certifies, that this device has been calibrated on the date indicated above. The calibration was performed in accordance with specifications and procedures of Schmid & Partner Engineering AG.

Wherever applicable, the standards used in the calibration process are traceable to international standards. In all other cases the standards of the Laboratory for EMF and Microwave Electronics at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland have been applied.

Calibrated by:	Nikolai Nikiforov
Approved by:	Niels Kuster

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DASY

Dipole Validation Kit

Type: D1800V2

Serial: 259

Manufactured: December 23, 1999
Calibrated: January 25, 2002

1. Measurement Conditions

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

Relative Dielectricity	**39.6**	± 5%
Conductivity	**1.37 mho/m**	± 5%

The DASY3 System (Software version 3.1d) with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 5.31 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 20mm was aligned with the dipole. The 5x5x7 fine cube was chosen for cube integration. Probe isotropy errors were cancelled by measuring the SAR with normal and 90° turned probe orientations and averaging.
The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

2. SAR Measurement

Standard SAR-measurements were performed with the phantom according to the measurement conditions described in section 1 (description of the modifications performed on the dipole are presented in section 4.). The results have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values are:

averaged over 1 cm^3 (1 g) of tissue:	**39.3 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**20.6 mW/g**

Note: If the liquid parameters for validation are slightly different from the ones used for initial calibration, the SAR-values will be different as well.

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:	**1.171 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:	Re{Z} = **52.8 Ω**
	Im {Z} = **5.6 Ω**
Return Loss at 1800 MHz	**-24.4 dB**

4. Modification

Small end caps (3 mm in length) made of Teflon have been added to the dipole arms by the Client. The overall dipole length has not been affected and is still according to the Standard.

5. SAR Measurement (w/o Teflon rings)

Standard SAR-measurements were performed with the phantom according to the measurement conditions described in section 1. The results have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values are:

averaged over 1 cm^3 (1 g) of tissue:	**40.4 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**21.0 mW/g**

Note: If the liquid parameters for validation are slightly different from the ones used for initial calibration, the SAR-values will be different as well.

6. Dipole Impedance and Return Loss (w/o Teflon rings)

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: Re{Z} = **47.3 Ω**

Im {Z} = **-6.2 Ω**

Return Loss at 1800 MHz **-23.2 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

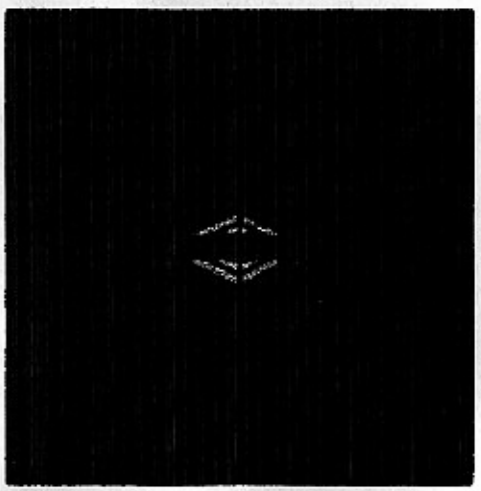
The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

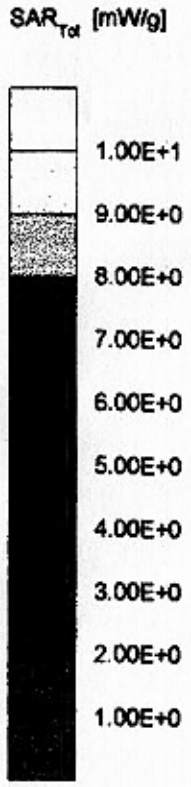
9. Power Test

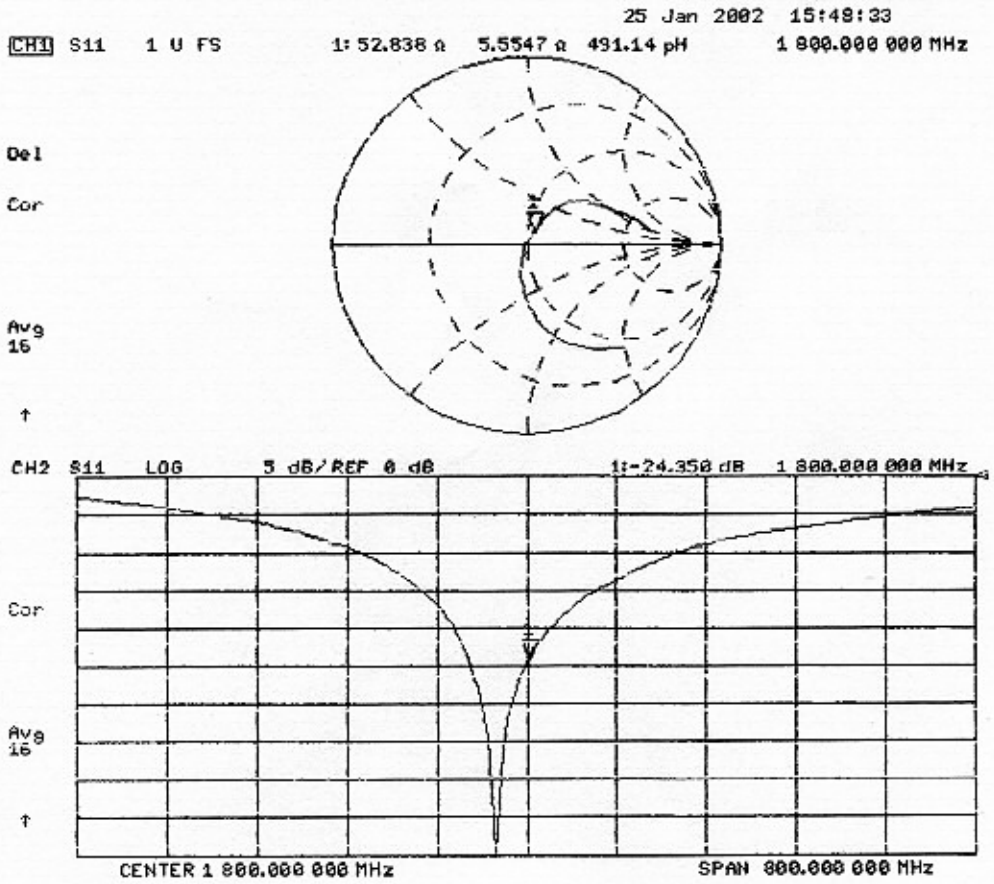
After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Validation Dipole D1800V2 SN:259, d = 10 mm (with Teflon rings)

Frequency: 1800 MHz; Antenna Input Power: 250 [mW]
SAM Phantom; Flat Section; Grid Spacing: Dx = 20.0, Dy = 20.0, Dz = 10.0
Probe: ET3DV6 - SN1507; ConvF(5.31,5.31,5.31) at 1800 MHz; IEEE1528 1800 MHz ; σ = 1.37 mho/m ε_r = 39.6 ρ = 1.00 g/cm^3
Cubes (2): Peak: 18.5 mW/g ± 0.01 dB, SAR (1g): 9.83 mW/g ± 0.02 dB, SAR (10g): 5.15 mW/g ± 0.01 dB, (Worst-case extrapolation)
Penetration depth: 8.3 (7.8, 9.3) [mm]
Powerdrift: 0.00 dB






25 Jan 2002 15:48:33
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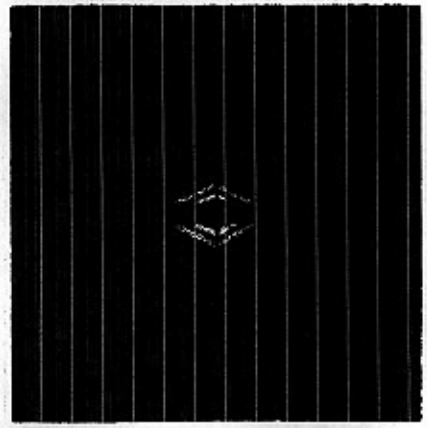
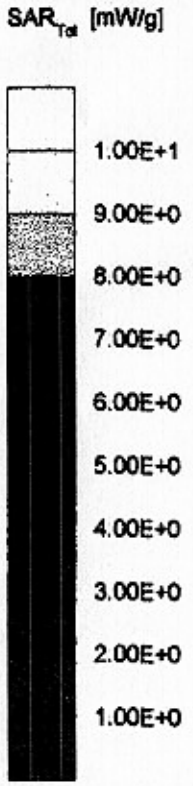
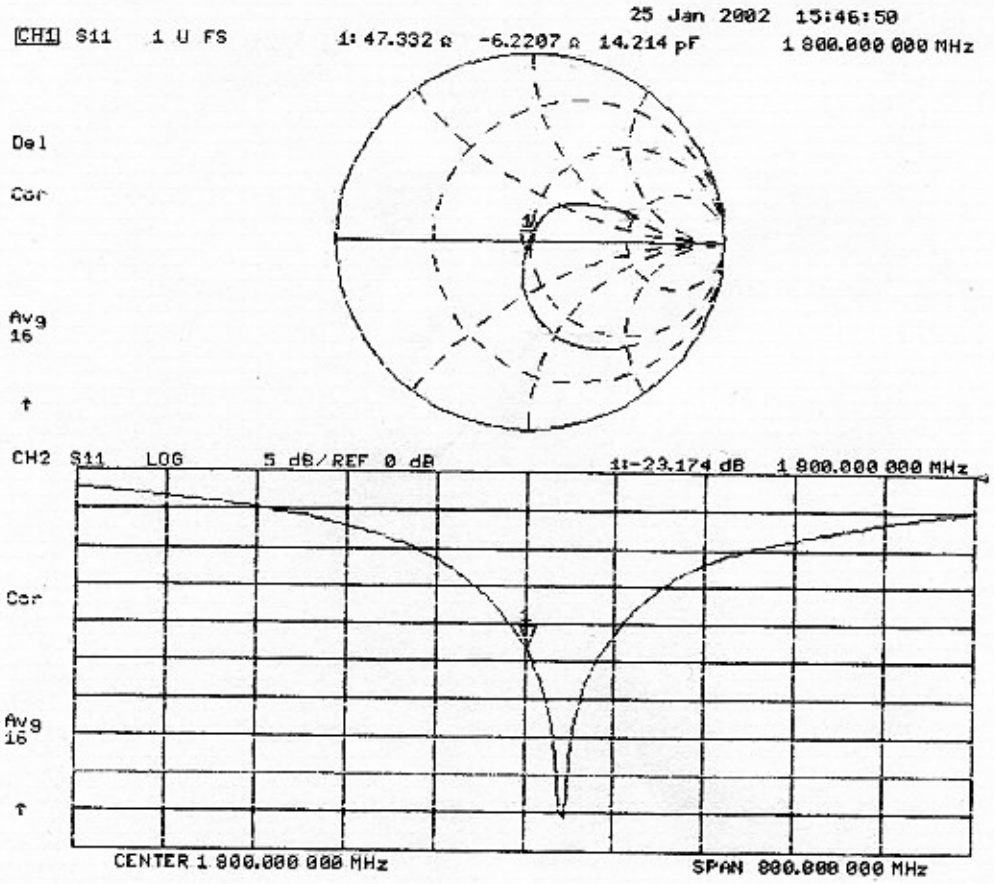
1: 52.838 Ω 5.5547 Ω 491.14 pH
1 800.000 000 MHz
Del
Cor
Avg
16
↑
CH2 S11 LOG 5 dB/ REF 0 dB
1:-24.350 dB 1 800.000 000 MHz
Cor
Avg
16
↑
CENTER 1 800.000 000 MHz
SPAN 800.000 000 MHz

Validation Dipole D1800V2 SN:259, d = 10 mm (w/o Teflon rings)

Frequency: 1800 MHz; Antenna Input Power: 250 [mW]
SAM Phantom; Flat Section; Grid Spacing: Dx = 20.0, Dy = 20.0, Dz = 10.0
Probe: ET3DV6 - SN1507; ConvF(5.31,5.31,5.31) at 1800 MHz; IEEE1528 1800 MHz ; σ = 1.37 mho/m ε_r = 39.6 ρ = 1.00 g/cm^3
Cubes (2): Peak: 19.1 mW/g ± 0.03 dB, SAR (1g): 10.1 mW/g ± 0.01 dB, SAR (10g): 5.25 mW/g ± 0.01 dB, (Worst-case extrapolation)
Penetration depth: 8.3 (7.8, 9.3) [mm]
Powerdrift: -0.03 dB






25 Jan 2002 15:46:50
CH1 S11 1 U FS
1: 47.332 Ω -6.2207 Ω 14.214 pF
1 800.000 000 MHz
Del
Cor
Avg
16
↑
CH2 S11 LOG 5 dB/ REF 0 dB
1: -23.174 dB 1 800.000 000 MHz
Cor
Avg
16
↑
CENTER 1 800.000 000 MHz
SPAN 800.000 000 MHz

Interim Dipole Correlation Certificate

FCD-0359, Rev.001

Dipole Serial Number:	272(TR)	Last Calibration Date:	14-Nov-02
Dipole Type (MHz):	D1800V2 w Teflon rings	Calibration Due:	14-Nov-04
		Manufacturer:	SPEAG

-Manufacturer's Original Calibration Information-

Dipole to be correlated: [Serial Number: 272TR]

1g SAR normalized to 1W forward power (mW/g):	36.4 mW/g
Relative Dielectric:	40.2
Conductivity:	1.35
Probe Serial Number:	1507
Forward Power:	250

Primary Dipole Referenced: [Serial Number: 246TR]

1g SAR normalized to 1W forward power (mW/g):	38.8 mW/g
Relative Dielectric:	39.6
Conductivity:	1.37
Probe Serial Number:	1507
Forward Power:	250

-Correlation Method Utilized- per DOI-1265

(select one)

By Similarity: **X** By Transfer Calibration:

-Measured Data-

Probe S/N:	**1515**	Conductivity (meas.):	**1.38**
Robot Cell #:	**PCS-2**	Permittivity (meas.):	**40.7**

Primary Standard (average of 0-degree & 90-degree 1g cubes):

9.84 mW/g		
	(if required)	(if required)

Secondary Standard (average of 0-degree & 90-degree 1g cubes):

9.96 mW/g		
	(if required)	(if required)

-NEW Correlated Target-

1g SAR normalized to 1W forward power (mW/g):	38.8 mW/g
Relative Dielectric:	39.6
Conductivity:	1.37

Approved by: Antonio Fenoll **Date:** 1/10/03

Comments: Correlated to get worst case extrapolation targets. Secondary measured within 2% of the primary standard.