Schmid & Partner
Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

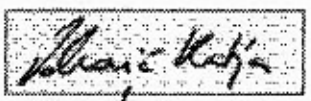
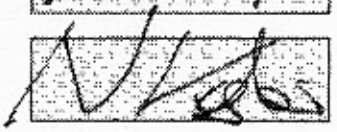
Calibration Certificate

900 MHz System Validation Dipole

Type:	D900V2
Serial Number:	078
Place of Calibration:	Zurich
Date of Calibration:	August 23, 2001
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:	
Approved by:	

Schmid & Partner
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Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

DASY

Dipole Validation Kit

Type: D900V2

Serial: 078

Manufactured: August 21, 2000
Calibrated: August 23, 2001

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 900 MHz:

Relative Dielectricity	**40.3**	± 5%
Conductivity	**0.95 mho/m**	± 5%

The DASY3 System (Software version 3.1c) with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.27 at 900 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 holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm 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. 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:	**11.3 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**7.12 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.

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 900 MHz:

Relative Dielectricity	**40.3**	± 5%
Conductivity	**0.95 mho/m**	± 5%

The DASY3 System (Software version 3.1c) with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.27 at 900 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 holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm 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. 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:	**11.3 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**7.12 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:	**1.410 ns**	(one direction)
Transmission factor:	**0.988**	(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 900 MHz:	Re{Z} = **50.5 Ω**
	Im {Z} = **-4.6 Ω**
Return Loss at 900 MHz	**-26.7 dB**

4. Handling

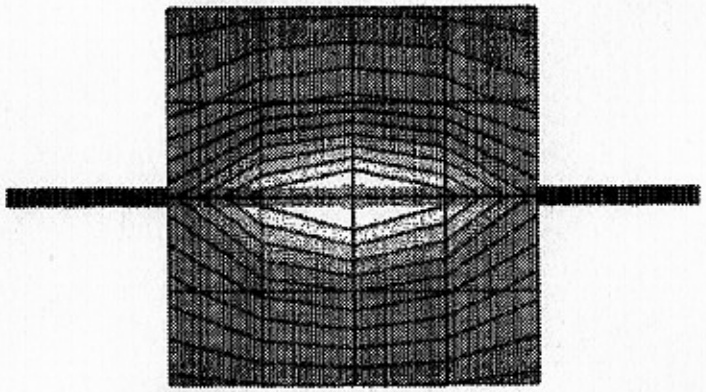
The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

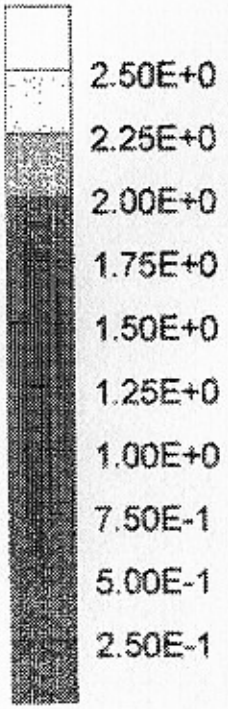
Do not apply excessive force to the dipole arms, because they might bend. If the dipole arms have to be bent back, take care to release stress to the soldered connections near the feedpoint; they might come off.

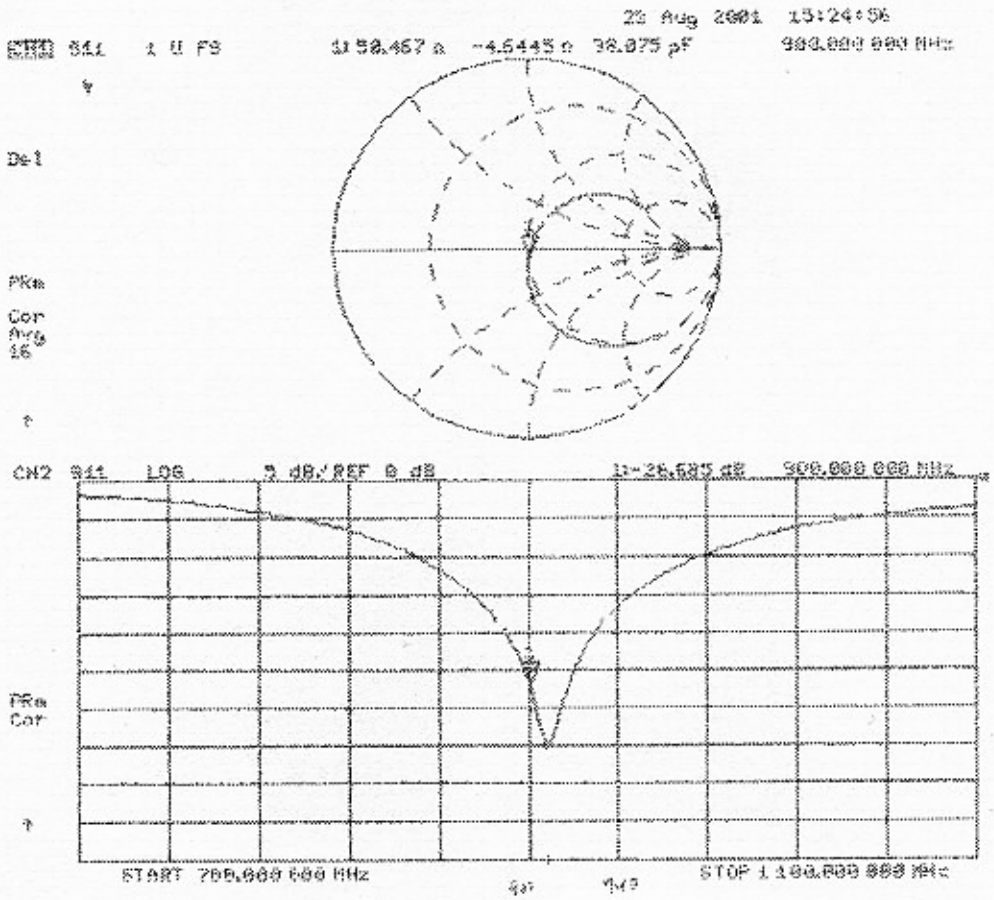
After prolonged use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Validation Dipole D900V2 SN:078, d = 15 mm

Frequency: 900 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(6.27,6.27,6.27) at 900 MHz; IEEE1528 900 MHz; σ = 0.95 mho/m ε_r = 40.3 ρ = 1.00 g/cm^3
Cubes (2): Peak: 4.57 mW/g ± 0.02 dB, SAR (1g): 2.82 mW/g ± 0.02 dB, SAR (10g): 1.78 mW/g ± 0.02 dB, (Worst-case extrapolation)
Penetration depth: 11.5 (10.2, 13.1) [mm]
Powerdrift: -0.01 dB






23 Aug 2001 13:24:56
CH1 S11 1 U FS
3158.467 Ω -4.6445 Ω 36.875 pF
900.000 000 MHz
Del
Pka
Cor
Avg
16
CH2 S11 LOG 3 dB/ REF 0 dB
1: -25.585 dB 900.000 000 MHz
PRe
Cor
START 700.000 000 MHz
STOP 1 100.000 000 MHz

Schmid & Partner
Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

Calibration Certificate

1800 MHz System Validation Dipole

Type:	D1800V2
Serial Number:	258
Place of Calibration:	Zurich
Date of Calibration:	September 24, 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:	
Approved by:	

Schmid & Partner
Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

DASY

Dipole Validation Kit

Type: D1800V2

Serial: 258

Manufactured: November 20, 1999
Calibrated: September 24, 2002

1. Measurement Conditions

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

Relative Dielectricity	**40.3**	**± 5%**
Conductivity	**1.36 mho/m**	**± 5%**

The DASY 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 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.

2.1. SAR Measurement with DASY3 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 worst-case extrapolation are:

averaged over 1 cm^3 (1 g) of tissue: **38.6 mW/g**

averaged over 10 cm^3 (10 g) of tissue: **20.4 mW/g**

2.2 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: **35.5 mW/g**

averaged over 10 cm^3 (10 g) of tissue: **19.2 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:	**1.199 ns**	(one direction)
Transmission factor:	**0.980**	(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} = **52.0 Ω**
	Im {Z} = **5.9 Ω**
Return Loss at 1800 MHz	**-24.2 dB**

4. Modification

Small end caps (3 mm in length) made of Teflon have been added to the dipole arms by the Client.

5. 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.

6. Design

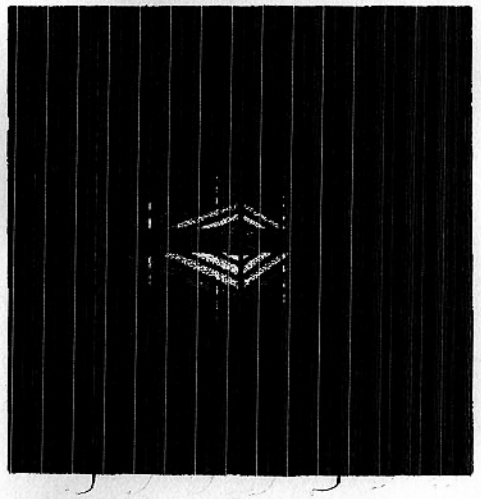
The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

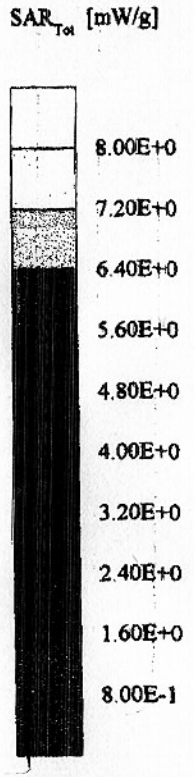
7. Power Test

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:258, d = 10 mm

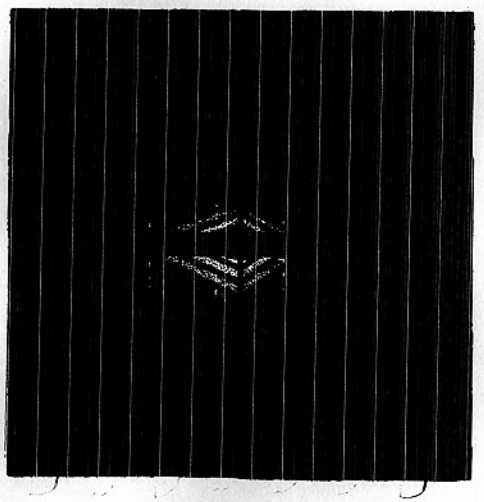
Frequency: 1800 MHz; Antenna Input Power: 250 [mW]
SAM Phantom; Flat Section; Grid Spacing: Dx = 20.0, Dy = 20.0, Dz = 10.0
Probe: ET3DV6 - SN1507; ConvF(5.30,5.30,5.30) at 1800 MHz; IEEE1528 1800 MHz: σ = 1.36 mho/m ε_r = 40.3 ρ = 1.00 g/cm³
Cubes (2): Peak: 17.7 mW/g ± 0.03 dB, SAR (1g): 9.64 mW/g ± 0.00 dB, SAR (10g): 5.11 mW/g ± 0.03 dB, (Worst-case extrapolation)
Penetration depth: 8.5 (8.1, 9.3) [mm]
Powerdrift: -0.01 dB

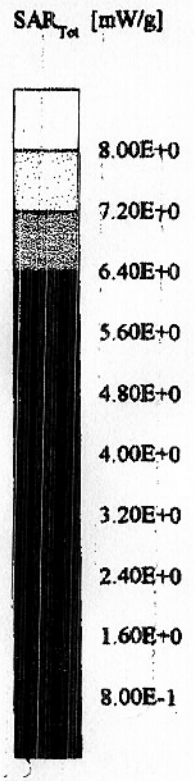




Validation Dipole D1800V2 SN:258, d = 10 mm

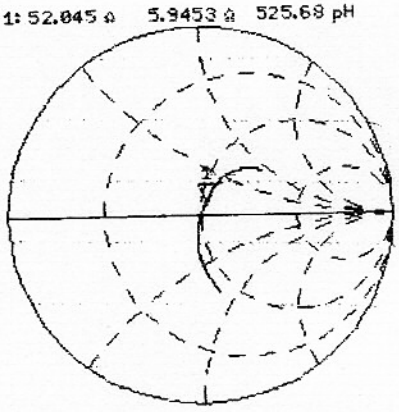
Frequency: 1800 MHz; Antenna Input Power: 250 [mW]
SAM Phantom; Flat Section; Grid Spacing: Dx = 20.0, Dy = 20.0, Dz = 10.0
Probe: ET3DV6 - SN1507; ConvF(5.30,5.30,5.30) at 1800 MHz; IEEE1528 1800 MHz: σ = 1.36 mho/m ε_r = 40.3 ρ = 1.00 g/cm^3
Cubes (2): Peak: 15.4 mW/g ± 0.03 dB, SAR (1g): 8.87 mW/g ± 0.00 dB, SAR (10g): 4.81 mW/g ± 0.03 dB, (Advanced extrapolation)
Penetration depth: 9.2 (9.1, 9.5) [mm]
Powerdrift: -0.01 dB





24 Sep 2002 09:51:39

CH1 S11 1 U FS 1: 52.045 Ω 5.9453 Ω 525.68 pH 1 800.000 000 MHz



Del

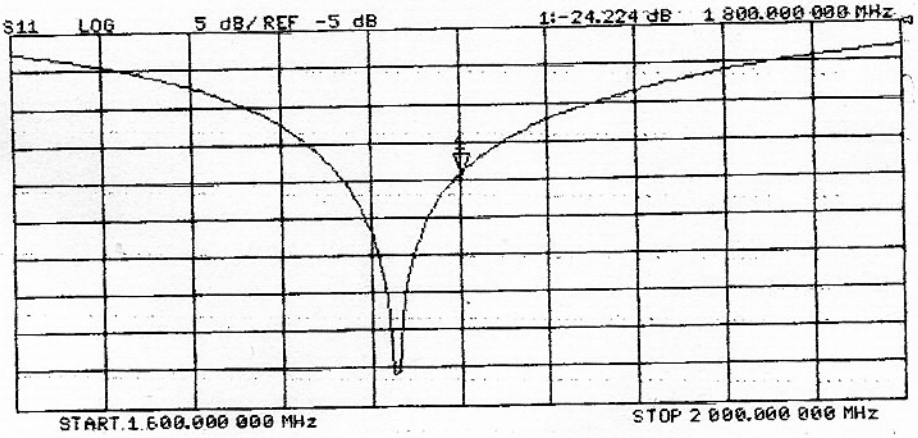
PRm

Cor

Avg

16

CH2 S11 LOG 5 dB/ REF -5 dB 1:-24.224 dB 1 800.000 000 MHz



PRm

Cor

START 1 600.000 000 MHz

STOP 2 000.000 000 MHz

Interim Dipole Correlation Certificate

FCD-0359, Rev.001

Dipole Serial Number:	079	Last Calibration Date:	15-Oct-02
Dipole Type (MHz):	900MHz dipole	Calibration Due:	15-Oct-04
		Manufacturer:	SPEAG

-Manufacturer's Original Calibration Information-

Dipole to be correlated: [Serial Number: 79]

1g SAR normalized to 1W forward power (mW/g):	10.8 mW/g
Relative Dielectric:	40.6
Conductivity:	0.95
Probe Serial Number:	1507
Forward Power:	250 mW

Primary Dipole Referenced: [Serial Number: 77]

1g SAR normalized to 1W forward power (mW/g):	11.4 mW/g
Relative Dielectric:	40.3
Conductivity:	0.95
Probe Serial Number:	1507
Forward Power:	250mW

-Correlation Method Utilized- per DOI-1265

(select one)

By Similarity: [X] By Transfer Calibration: [ ]

-Measured Data-

Probe S/N:	**1398**	Conductivity (meas.):	**0.96**
Robot Cell #:	**PCS-1**	Permittivity (meas.):	**40.0**

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

3.07 mW/g (1W)		
	(if required)	(if required)

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

3.05 mW/g (1W)		
	(if required)	(if required)

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-NEW Correlated Target-

1g SAR normalized to 1W forward power (mW/g):	11.4 mW/g
Relative Dielectric:	40.3
Conductivity:	0.95

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Approved by: Antonio Fanciulli **Date:** 12/12/2002

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