

## **ATTACHMENT S – DIPOLE CALIBRATION DATA**

## Schmid & Partner Engineering AG

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### Calibration Certificate

#### 835 MHz System Validation Dipole

Type:

**D835V2**

Serial Number:

**441**

Place of Calibration:

**Zurich**

Date of Calibration:

**August 3, 2001**

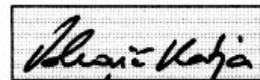
Calibration Interval:

**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  
Engineering AG**

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

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**DASY**

**Dipole Validation Kit**

**Type: D835V2**

**Serial: 441**

**Manufactured: March 9, 2001**

**Calibrated: August 3, 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 835 MHz:

Relative Dielectricity	<b>41.0</b>	± 5%
Conductivity	<b>0.89 mho/m</b>	± 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.

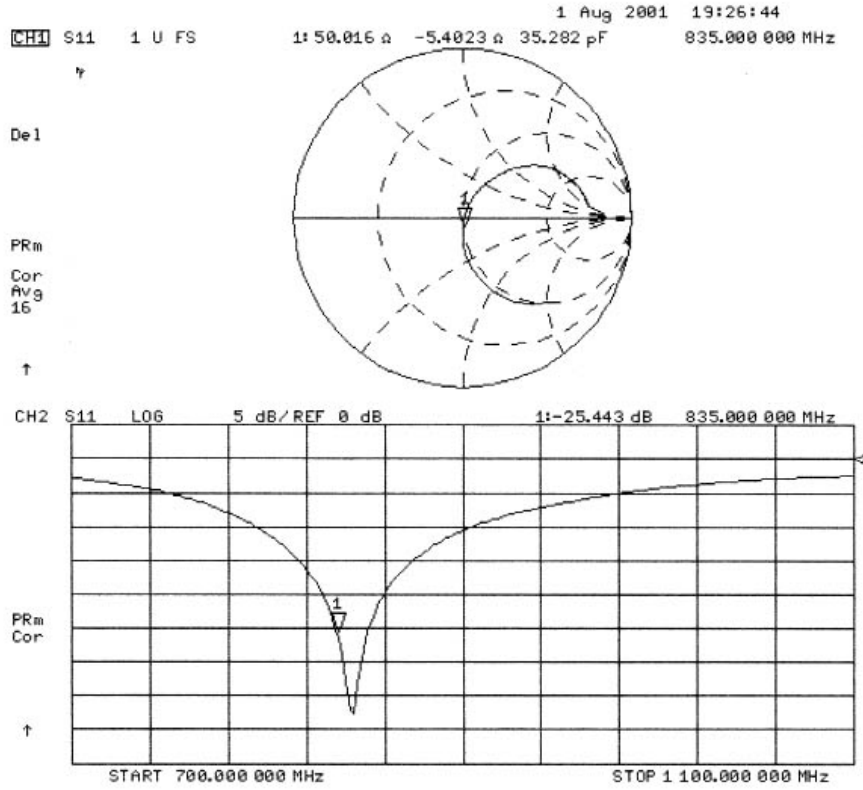
## 2. SAR Measurement

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 <sup>3</sup> (1 g) of tissue:	<b>10.64 mW/g</b>
averaged over 10 cm <sup>3</sup> (10 g) of tissue:	<b>6.80 mW/g</b>

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.

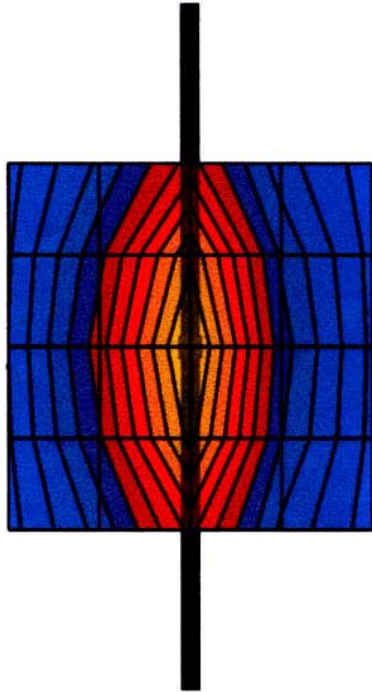




08/01/01

**Validation Dipole D835V2 SN:441, d = 15 mm**

Frequency: 835 MHz; Antenna Input Power: 250 [mW]  
 SAM Phantom: Flat - SAM 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 835 MHz;  $\sigma = 0.89$  mho/m;  $\epsilon_r = 41.0$ ;  $\rho = 1.00$  g/cm<sup>3</sup>  
 Cubes (2): Peak: 4.25 mW/g  $\pm$  0.03 dB, SAR (1g): 2.66 mW/g  $\pm$  0.03 dB, SAR (10g): 1.70 mW/g  $\pm$  0.03 dB, (Worst-case extrapolation)  
 Penetration depth: 12.0 (10.6, 13.8) [mm]  
 Powerdrift: -0.00 dB



Schmid & Partner Engineering AG, Zurich, Switzerland

## Schmid & Partner Engineering AG

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### Calibration Certificate

#### 1900 MHz System Validation Dipole

Type:

D1900V2

Serial Number:

5d017

Place of Calibration:

Zurich

Date of Calibration:

September 5, 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:

D. Vetter

Approved by:

Alain Kofler



**Schmid & Partner  
Engineering AG**

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# DASY3

## Dipole Validation Kit

Type: D1900V2

Serial: 5d017

Manufactured: June 4, 2002

Calibrated: September 5, 2002

## 1. Measurement Conditions

The measurements were performed in the flat section of the new SAM twin phantom filled with head simulating solution of the following electrical parameters at 1900 MHz:

Relative permittivity	<b>39.8</b>	$\pm 5\%$
Conductivity	<b>1.46 mho/m</b>	$\pm 10\%$

The DASY System with a dosimetric E-field probe ET3DV6 (SN:1507, conversion factor 5.2 at 1900 MHz) was used for the measurements.

The dipole feedpoint was positioned below the center marking and 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  $\pm 3\%$ . 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 <sup>3</sup> (1 g) of tissue:	<b>44.4 mW/g</b>
averaged over 10 cm <sup>3</sup> (10 g) of tissue:	<b>22.9 mW/g</b>

### 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 <sup>3</sup> (1 g) of tissue:	<b>40.4 mW/g</b>
averaged over 10 cm <sup>3</sup> (10 g) of tissue:	<b>21.5 mW/g</b>

### **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:   **0.991**     (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 1900 MHz:        $\text{Re}\{Z\} = 51.1 \Omega$

$\text{Im}\{Z\} = 2.9 \Omega$

Return Loss at 1900 MHz                **- 30.1 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.

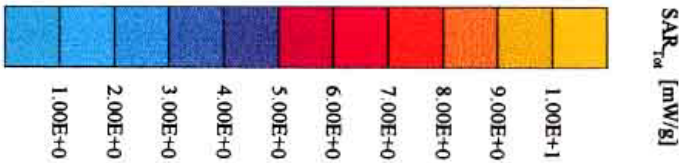
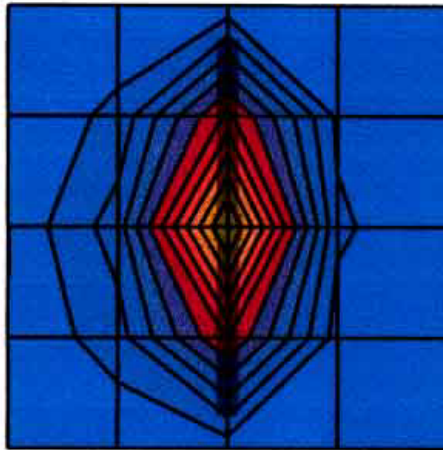
### **6. Power Test**

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

09/04/02

**Validation Dipole D1900V2 SN5d017, d = 10 mm**

Frequency: 1900 MHz; Antenna Input Power: 250 [mW]  
 SAM Phantom; Flat Section; Grid Spacing: Dx = 20.0, Dy = 20.0, Dz = 10.0  
 Probe: ET3DV6 ± SNI507; ConvF(5.20,5.20,5.20) at 1900 MHz; IEEE1528 1900 MHz:  $\sigma = 1.46$  mho/m  $\epsilon_r = 39.8$   $\rho = 1.00$  g/cm<sup>3</sup>  
 Cubes (2): Peak: 20.7 mW/g ± 0.01 dB, SAR (1g): 11.1 mW/g ± 0.02 dB, SAR (10g): 5.73 mW/g ± 0.03 dB, (Worst-case extrapolation)  
 Penetration depth: 8.1 (7.8, 8.8) [mm]  
 Powerdrift: -0.02 dB



09/04/02

**Validation Dipole D1900V2 SN5d017, d = 10 mm**

Frequency: 1900 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(5.20,5.20,5.20) at 1900 MHz, IEEE1528 1900 MHz:  $\sigma = 1.46$  mho/cm,  $\epsilon_r = 39.8$ ,  $\rho = 1.00$  g/cm<sup>3</sup>  
 Cubes (2): Peak: 17.9 mW/g  $\pm$  0.01 dB, SAR (1g): 10.1 mW/g  $\pm$  0.02 dB, SAR (10g): 5.37 mW/g  $\pm$  0.03 dB, (Advanced extrapolation)  
 Penetration depth: 8.8 (8.7, 8.9) [mm]  
 Powerdrift: -0.02 dB

