

Validation Data (835MHz Brain)

Dipole 835 MHz

SAM I Phantom: Flat Section: Position: (90°,90°); Frequency: 835 MHz

Probe: ET3DV6 - SN1608: ConvF(6.50,6.50,6.50); Crest factor: 1.0; Brain 835 MHz: $s = 0.89 \text{ mho/m}$, $\epsilon_r = 43.2$, $\rho = 1.00 \text{ g/cm}^3$

Cubes (2): SAR (1g): $9.76 \text{ mW/g} \pm 0.03 \text{ dB}$, SAR (10g): $6.21 \text{ mW/g} \pm 0.03 \text{ dB}$

Coarse: $D_x = 20.0$, $D_y = 20.0$, $D_z = 10.0$

Comment:

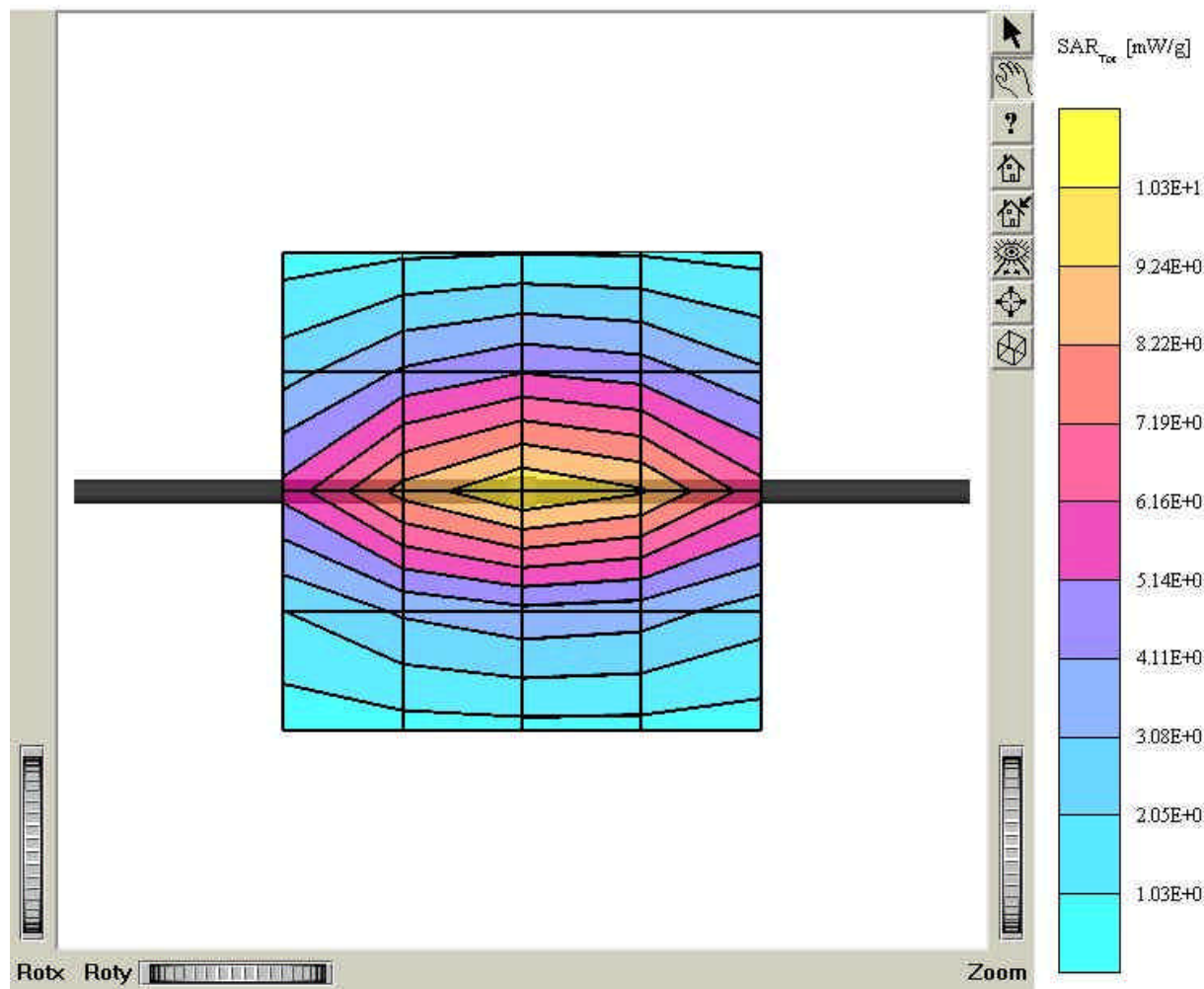
835MHz Brain Dipole Validation (D835V2/ S.N: 441)

Antenna Input Power: 30 dBm (1W)

HCT Co., Ltd. Brain Tissue Simulating Liquid

Liquid Temperature : 21.5 °C

Date Tested: June 25, 2003



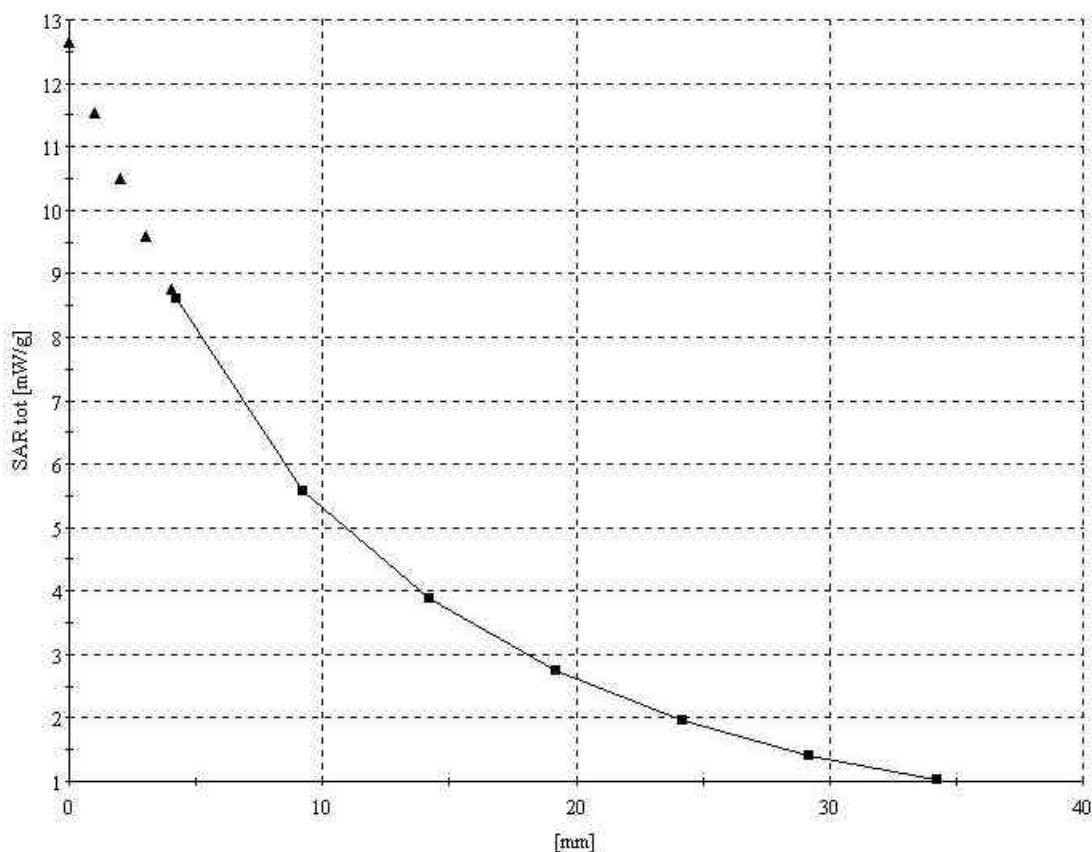
Validation Data (835MHz Brain)

Dipole 835 MHz

SAM 1 Phantom: Flat Section; Position: (90°, 90°); Frequency: 835 MHz
Probe: ET3DV6 - SN1608; ConvF(6.50, 6.50, 6.50); Crest factor: 1.0; Brain 835 MHz: $s = 0.89 \text{ mho/m}$, $\epsilon_r = 43.2$, $r = 1.00 \text{ g/cm}^3$
Cubes (2): SAR (1g): $9.76 \text{ mW/g} \pm 0.03 \text{ dB}$, SAR (10g): $6.21 \text{ mW/g} \pm 0.03 \text{ dB}$
Cube 5x5x7: $D_x = 8.0$, $D_y = 8.0$, $D_z = 5.0$

Comment:

835MHz Brain Dipole Validation (D835V2/ S.N: 441)
Antenna Input Power: 30 dBm (1W)
HCT Co., Ltd. Brain Tissue Simulating Liquid
Liquid Temperature : 21.5 °C
Date Tested: June 25, 2003



Dielectric Parameter (835MHz Brain)**Title: TDC-6610****SubTitle: 835 Brain**

June 25, 2003 08:21 AM

Frequency	e'	e''
800.000000 MHz	44.1598	19.2716
805.000000 MHz	44.0072	19.2360
810.000000 MHz	43.8494	19.2137
815.000000 MHz	43.6980	19.1688
820.000000 MHz	43.5176	19.2030
825.000000 MHz	43.3851	19.1918
830.000000 MHz	43.2838	19.2092
835.000000 MHz	43.1513	19.2042
840.000000 MHz	43.0665	19.2489
845.000000 MHz	43.0408	19.2762
850.000000 MHz	42.9843	19.3018
855.000000 MHz	43.0440	19.3655
860.000000 MHz	43.0317	19.3257
865.000000 MHz	43.0520	19.3585
870.000000 MHz	43.1241	19.3240
875.000000 MHz	43.1747	19.3874
880.000000 MHz	43.1991	19.3969
885.000000 MHz	43.2016	19.3672
890.000000 MHz	43.2497	19.3536
895.000000 MHz	43.2067	19.2730
900.000000 MHz	43.1603	19.2441

Dielectric Parameter (835MHz Muscle)**Title: TDC-6610****SubTitle: 835MHz Body**

June 25, 2003 09:57 AM

Frequency	e'	e''
800.000000 MHz	54.5899	20.8544
805.000000 MHz	54.4857	20.8778
810.000000 MHz	54.3889	20.8536
815.000000 MHz	54.2588	20.7635
820.000000 MHz	54.2466	20.8107
825.000000 MHz	54.1402	20.7639
830.000000 MHz	54.0737	20.7917
835.000000 MHz	54.0264	20.7630
840.000000 MHz	53.9958	20.7174
845.000000 MHz	53.9010	20.7614
850.000000 MHz	53.9258	20.7717
855.000000 MHz	53.9356	20.7114
860.000000 MHz	53.8773	20.6984
865.000000 MHz	53.8495	20.7063
870.000000 MHz	53.7883	20.6520
875.000000 MHz	53.8315	20.6595
880.000000 MHz	53.7782	20.6770
885.000000 MHz	53.6909	20.6442
890.000000 MHz	53.7112	20.6280
895.000000 MHz	53.6345	20.5501
900.000000 MHz	53.5997	20.5504

Schmid & Partner Engineering AG

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

Calibration Certificate

835 MHz System Validation Dipole

Type:

D835V2

Serial Number:

441

Place of Calibration:

Zurich

Date of Calibration:

August 3, 2001

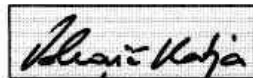
Calibration Interval:

24 months

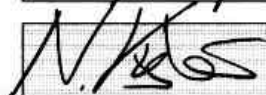
Schmid & Partner Engineering AG hereby certifies, that this device has been calibrated on the date indicated above. The calibration was performed in accordance with specifications and procedures of Schmid & Partner Engineering AG.

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

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	41.0	$\pm 5\%$
Conductivity	0.89 mho/m	$\pm 5\%$

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 $\pm 3\%$. 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:	10.64 mW/g
averaged over 10 cm ³ (10 g) of tissue:	6.80 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: **1.390 ns** (one direction)
Transmission factor: **0.996** (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: $\text{Re}\{Z\} = 50.0 \, \Omega$

$\text{Im}\{Z\} = -5.4 \, \Omega$

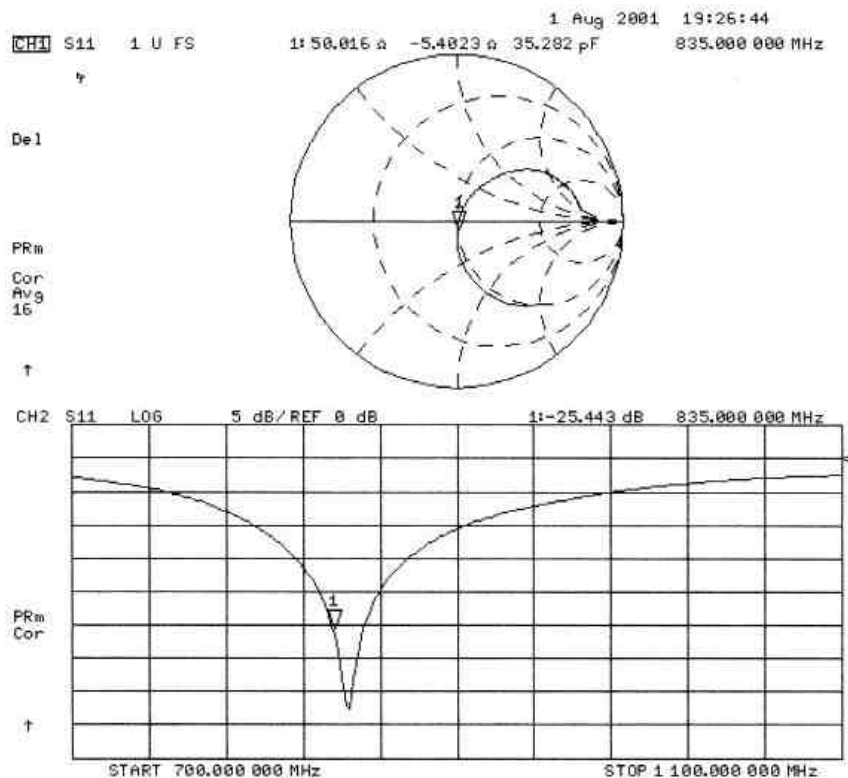
Return Loss at 835 MHz **-25.4 dB**

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.

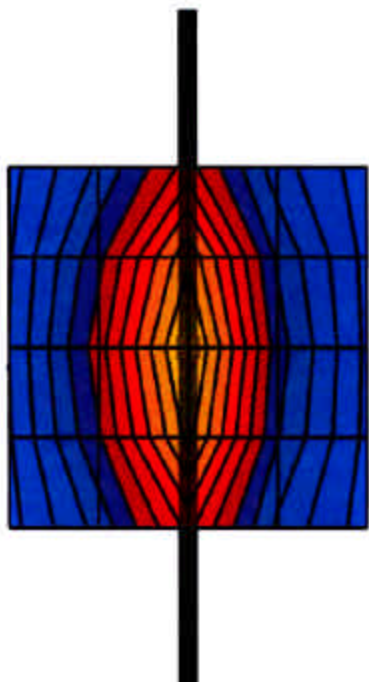
After prolonged use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.



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: ET3DVG - SN1507; ConvF(6.27,6.27,6.27) at 800 MHz; IEEE1528 835 MHz; $\sigma = 0.89$ mho/m; $\epsilon_r = 41.0$; $\rho = 1.00$ g/cm³
 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

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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:

Heinrich Kutz

**Schmid & Partner
Engineering AG**

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

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	39.8	± 5%
Conductivity	1.46 mho/m	± 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 ± 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:	44.4 mW/g
averaged over 10 cm ³ (10 g) of tissue:	22.9 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:	40.4 mW/g
averaged over 10 cm ³ (10 g) of tissue:	21.5 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: **0.991** (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.

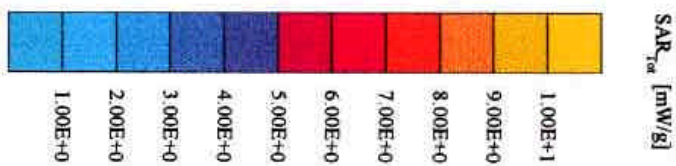
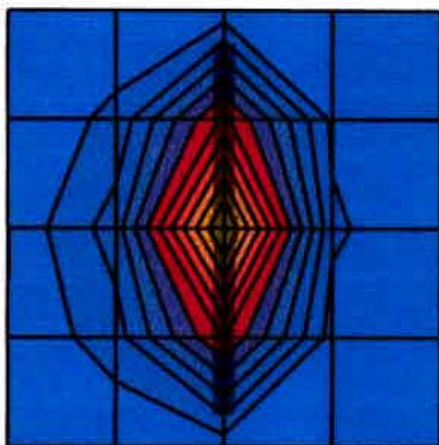
6. Power Test

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: $D_x = 20.0$, $D_y = 20.0$, $D_z = 10.0$
 Probe: ET3DV6 - SN1507; 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/cm³
 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]
 Powerdnt: -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: $D_x = 20.0$, $D_y = 20.0$, $D_z = 10.0$
 Probe: ET3DV6 - SN1507, 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/cm³
 Cubes (2): Peak: 17.9 mW/g ± 0.01 dB, SAR (1g): 10.1 mW/g ± 0.02 dB, SAR (10g): 5.37 mW/g ± 0.03 dB, (Advanced extrapolation)
 Penetration depth: 8.8 (8.7, 8.9) [mm]
 Powerdrift: -0.02 dB

