	Date of Evaluation:	March 27, 2006	Document Issue No.:	SV835B-032706-R0	
	Evaluation Type:	System Validation	Validation Dipole:	835 MHz	Body

## 835 MHz SYSTEM VALIDATION DIPOLE

Type:

**835 MHz Validation Dipole**

Asset Number:

**00022**

Serial Number:

**411**

Place of Calibration:

**Celltech Labs Inc.**

Date of Calibration:

**March 27, 2006**


**Celltech Labs Inc. hereby certifies that this device has been calibrated on the date indicated above.**

Calibrated by:



Approved by:



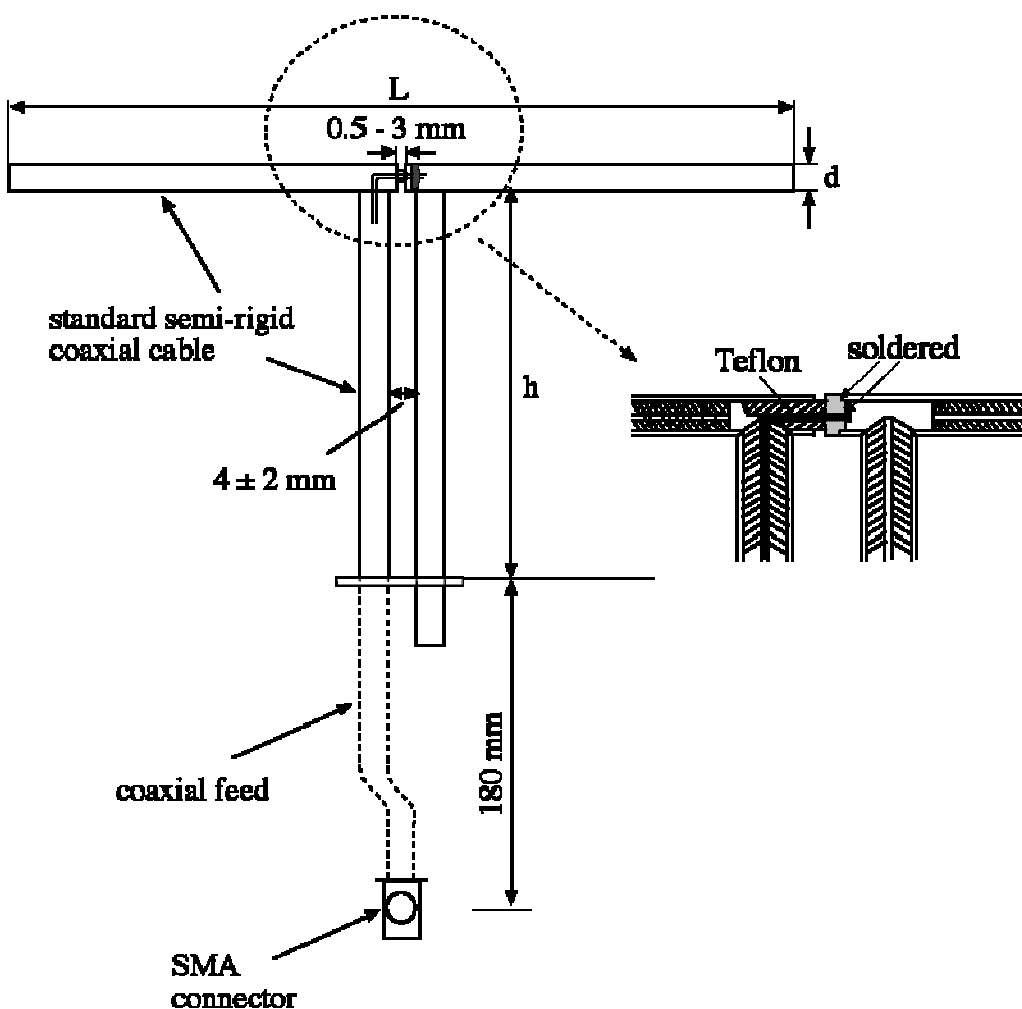
	Date of Evaluation:	March 27, 2006	Document Issue No.:	SV835B-032706-R0	
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## 1. Validation Dipole Construction & Electrical Characteristics

The validation dipole was constructed in accordance with the IEEE Standard “Annex G (informative) Reference dipoles for use in system validation”. The electrical properties were measured using an HP 8753ET Network Analyzer. The network analyzer was calibrated to the validation dipole N-type connector feed point using an HP85032E Type N calibration kit. The dipole was placed parallel to a planar phantom at a separation distance of 15.0mm from the simulating fluid using a loss-less dielectric spacer. The measured input impedance is:

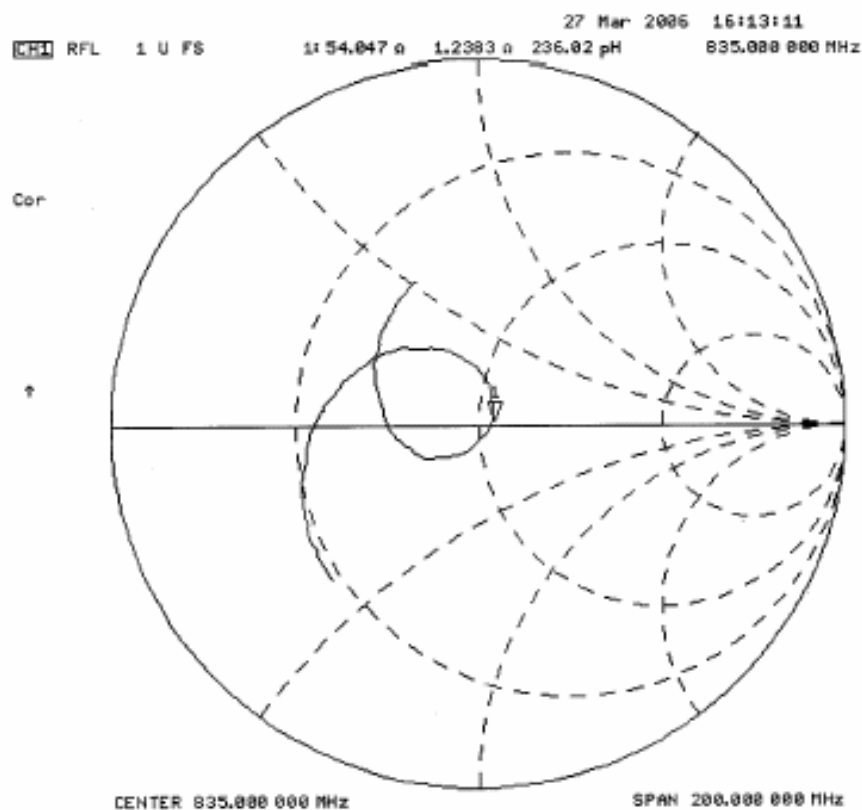
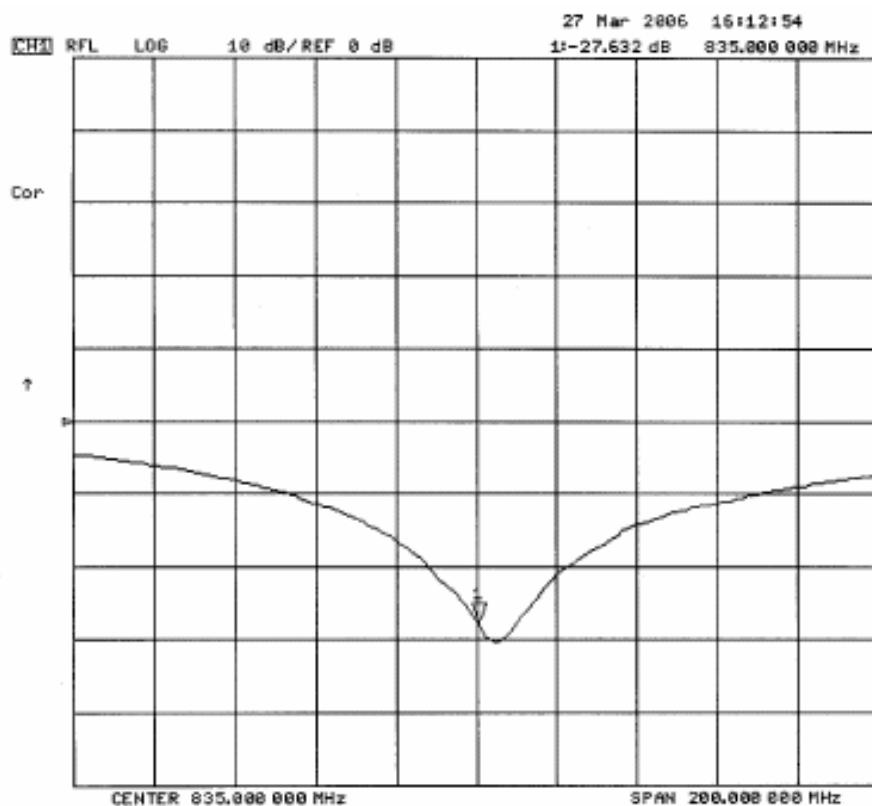
Feed point impedance at 835MHz       $\text{Re}\{Z\} = 47.627\Omega$   
 $\text{Im}\{Z\} = -0.67188\Omega$

Return Loss at 835MHz      -31.954dB



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## 2. Validation Dipole VSWR Data




### 3. Validation Dipole Dimensions

Frequency (MHz)	L (mm)	h (mm)	d (mm)
300	420.0	250.0	6.2
450	288.0	167.0	6.2
835	161.0	89.8	3.6
900	149.0	83.3	3.6
1450	89.1	51.7	3.6
1800	72.0	41.7	3.6
1900	68.0	39.5	3.6
2000	64.5	37.5	3.6
2450	51.8	30.6	3.6
3000	41.5	25.0	3.6

### 4. Validation Phantom


The validation phantom is the SAM (Specific Anthropomorphic Mannequin) phantom manufactured by Schmid & Partner Engineering AG. The SAM phantom is a Fiberglass shell integrated in a wooden table. The shape of the shell corresponds to the phantom defined by SCC34-SC2. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

**Shell Thickness:** 2.0 ± 0.1 mm  
**Filling Volume:** Approx. 25 liters  
**Dimensions:** 50 cm (W) x 100 cm (L)

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## **5. 835 MHz System Validation Setup**




	Date of Evaluation:	March 27, 2006	Document Issue No.:	SV835B-032706-R0	
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## 6. 835 MHz Validation Dipole Setup





	Date of Evaluation:	March 27, 2006	Document Issue No.:	SV835B-032706-R0	
	Evaluation Type:	System Validation	Validation Dipole:	835 MHz	Body

## 7. Measurement Conditions

The SAM phantom was filled with 835 MHz body tissue simulant with the following parameters:

Relative Permittivity: 53.7  
 Conductivity: 0.94 mho/m  
 Fluid Temperature: 20.8 °C  
 Fluid Depth:  $\geq 15.0$  cm

Environmental Conditions:  
 Ambient Temperature: 22.6 °C  
 Barometric Pressure: 101.8 kPa  
 Humidity: 30 %

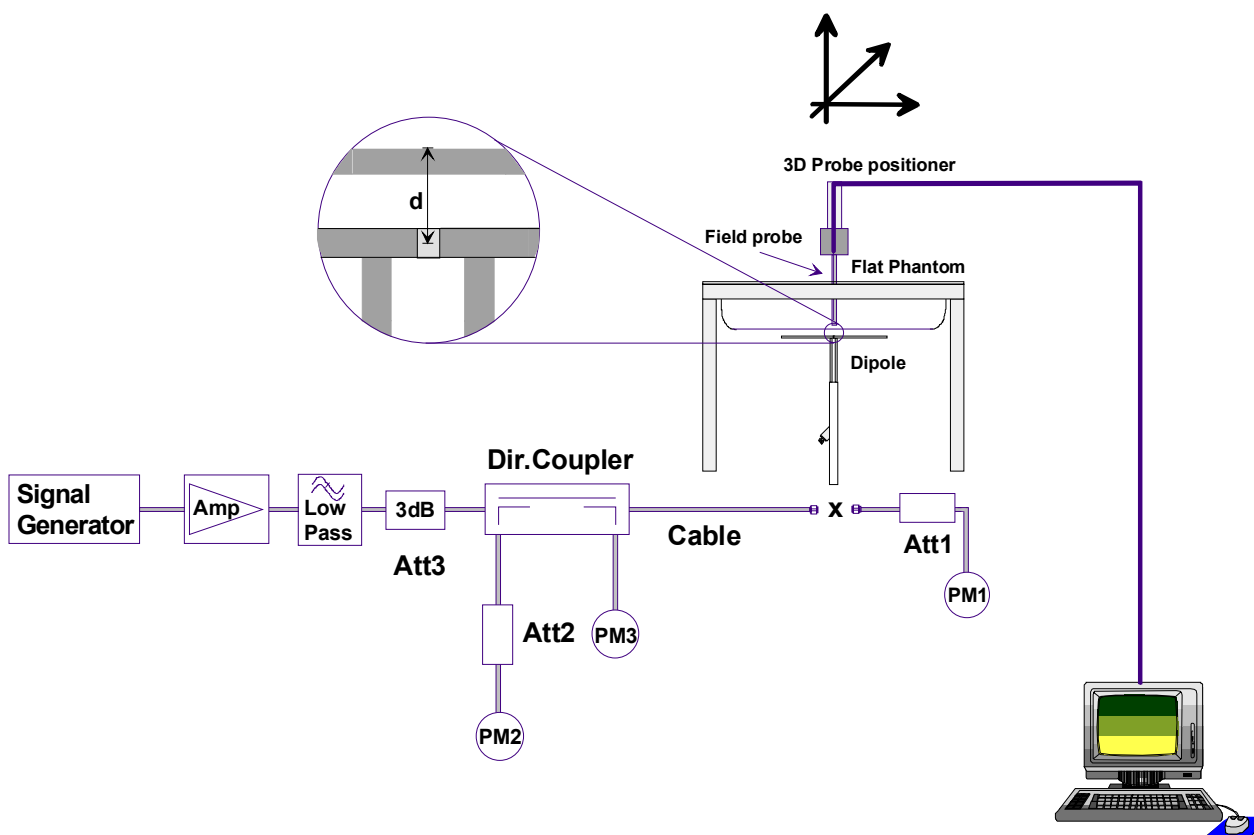
Measurements were made at the planar section of the SAM phantom using a dosimetric E-field probe ET3DV5 (S/N: 1590, conversion factor 6.47).

The 835 MHz body tissue simulant consisted of the following ingredients:

Ingredient	Percentage by weight
Water	53.79%
Sugar	45.13%
Salt	0.98%
Dowicil 75	0.10%
Target Dielectric Parameters at 22 °C	$\epsilon_r = 55.2 (+/- 5\%)$ $\sigma = 0.97 \text{ S/m } (+/- 5\%)$


## 8. SAR Measurement

The SAR measurement was performed with the E-field probe in mechanical detection mode only. The setup and determination of the forward power into the dipole was performed using the following procedures.



First the power meter PM1 (including attenuator Att1) is connected to the cable to measure the forward power at the location of the dipole connector (X). The signal generator is adjusted for the desired forward power at the dipole connector (taking into account the attenuation of Att1) as read by power meter PM2. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2. If the signal generator does not allow adjustment in 0.01dB steps, the remaining difference at PM2 must be taken into consideration. PM3 records the reflected power from the dipole to ensure that the value is not changed from the previous value. The reflected power should be 20dB below the forward power.



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## 9. Validation Dipole SAR Test Results


Ten SAR measurements were performed in order to achieve repeatability and to establish an average target value.

Validation Measurement	SAR @ 0.25W Input averaged over 1g	SAR @ 1W Input averaged over 1g	SAR @ 0.25W Input averaged over 10g	SAR @ 1W Input averaged over 10g	Max SAR @ 0.25W Input
Test 1	2.46	9.84	1.62	6.48	2.65
Test 2	2.46	9.84	1.62	6.48	2.66
Test 3	2.46	9.84	1.62	6.48	2.67
Test 4	2.47	9.88	1.62	6.48	2.68
Test 5	2.43	9.72	1.60	6.40	2.64
Test 6	2.43	9.72	1.59	6.36	2.63
Test 7	2.42	9.68	1.59	6.36	2.59
Test 8	2.46	9.84	1.62	6.48	2.64
Test 9	2.47	9.88	1.62	6.48	2.65
Test10	2.45	9.80	1.62	6.48	2.61
Average SAR	2.451	9.804	1.612	6.448	2.642

IEEE Target SAR @ 1 Watt Input averaged over 1 gram (W/kg)		Measured SAR @ 1 Watt Input averaged over 1 gram (W/kg)	Deviation from Target (%)	IEEE Target SAR @ 1 Watt Input averaged over 10 grams (W/kg)		Measured SAR @ 1 Watt Input averaged over 10 grams (W/kg)	Deviation from Target (%)
9.71	+/- 10%	9.804	+1.0%	6.38	+/- 10%	6.448	+1.1%

Dipole Type	Distance [mm]	Frequency [MHz]	SAR (1g) [W/kg]	SAR (10g) [W/kg]	SAR (peak) [W/kg]
D300V2	15	300	3.02	2.06	4.36
D450V2	15	450	5.01	3.36	7.22
D835V2	15	835	9.71	6.38	14.1
D900V2	15	900	11.1	7.17	16.3
D1450V2	10	1450	29.6	16.6	49.8
D1500V2	10	1500	30.8	17.1	52.1
D1640V2	10	1640	34.4	18.7	59.4
D1800V2	10	1800	38.5	20.3	67.5
D1900V2	10	1900	39.8	20.8	69.6
D2000V2	10	2000	40.9	21.2	71.5
D2450V2	10	2450	51.2	23.7	97.6
D3000V2	10	3000	61.9	24.8	136.7

Table 32.1: Numerical reference SAR values for SPEAG dipoles and flat phantom filled with body-tissue simulating liquid. Note: All SAR values normalized to 1 W forward power.

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	Evaluation Type:	System Validation	Validation Dipole:	835 MHz	Body

### 835 MHz Dipole System Validation (Body) - March 27, 2006

DUT: Dipole 835 MHz; Model: D835V2; Serial: 411; Calibrated: 03/27/2006  
Ambient Temp: 22.6 °C; Fluid Temp: 20.8 °C; Barometric Pressure: 101.8 kPa; Humidity: 30%  
Communication System: CW  
Frequency: 835 MHz; Duty Cycle: 1:1  
Medium: M835 ( $\sigma = 0.94$  mho/m;  $\epsilon_r = 53.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>)  
- Probe: ET3DV6 - SN1590; ConvF(6.47, 6.47, 6.47); Calibrated: 20/05/2005  
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)  
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005  
- Phantom: SAM 4.0; Type: Fiberglass; Serial: 1033  
- Measurement SW: DASY4, V4.6 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 159

**835 MHz Dipole System Validation/Area Scan (6x10x1):** Measurement grid: dx=10mm, dy=10mm

**835 MHz Dipole System Validation/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 55.0 V/m; Power Drift = 0.027 dB  
**SAR(1 g) = 2.46 mW/g; SAR(10 g) = 1.62 mW/g**  
Maximum value of SAR (measured) = 2.65 mW/g

**835 MHz Dipole System Validation/Zoom Scan 3 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 54.8 V/m; Power Drift = 0.029 dB  
**SAR(1 g) = 2.46 mW/g; SAR(10 g) = 1.62 mW/g**  
Maximum value of SAR (measured) = 2.66 mW/g

**835 MHz Dipole System Validation/Zoom Scan 4 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 54.5 V/m; Power Drift = 0.075 dB  
**SAR(1 g) = 2.46 mW/g; SAR(10 g) = 1.62 mW/g**  
Maximum value of SAR (measured) = 2.67 mW/g

**835 MHz Dipole System Validation/Zoom Scan 5 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 54.9 V/m; Power Drift = 0.010 dB  
**SAR(1 g) = 2.47 mW/g; SAR(10 g) = 1.62 mW/g**  
Maximum value of SAR (measured) = 2.68 mW/g

**835 MHz Dipole System Validation/Zoom Scan 6 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 55.0 V/m; Power Drift = -0.087 dB  
**SAR(1 g) = 2.43 mW/g; SAR(10 g) = 1.6 mW/g**  
Maximum value of SAR (measured) = 2.64 mW/g

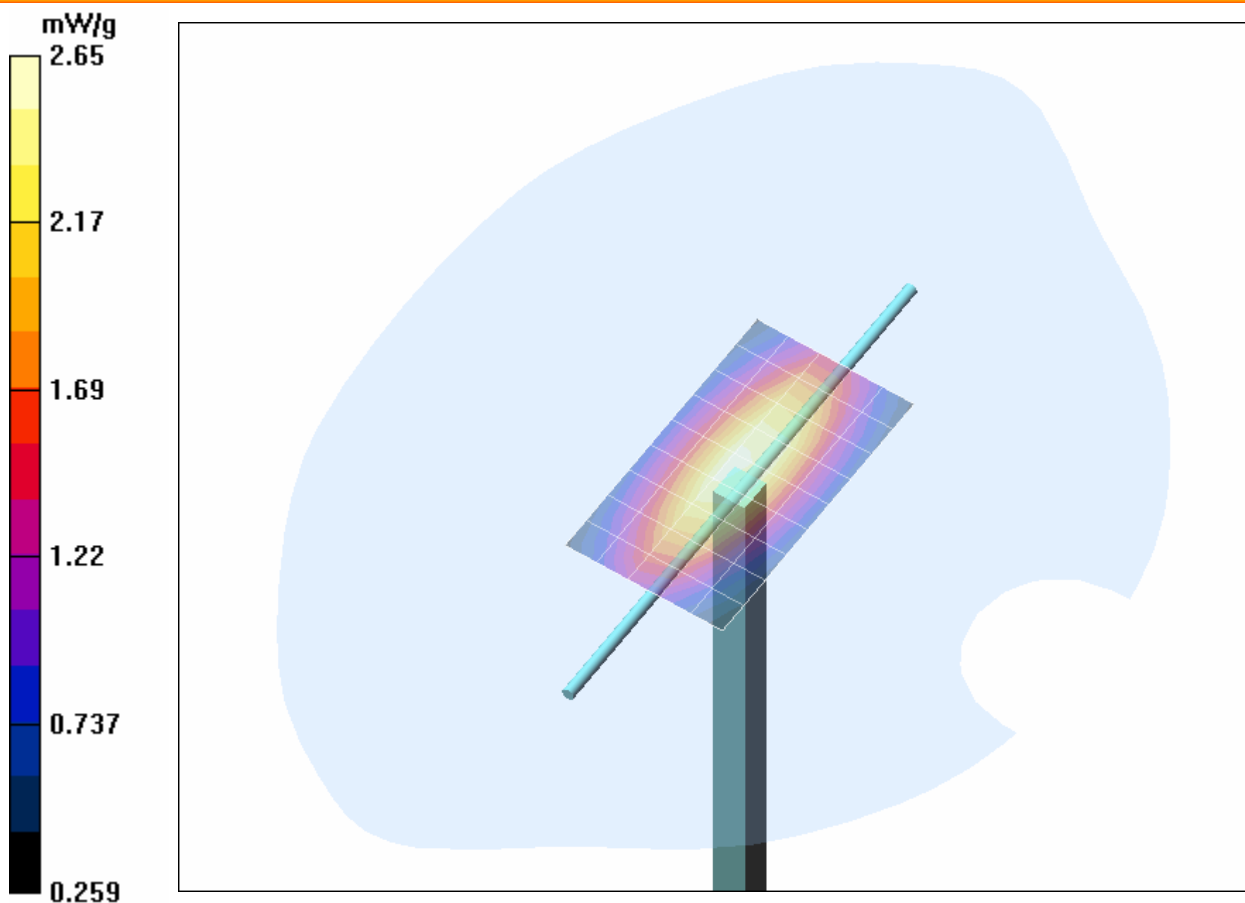
**835 MHz Dipole System Validation/Zoom Scan 7 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 54.6 V/m; Power Drift = -0.017 dB  
**SAR(1 g) = 2.43 mW/g; SAR(10 g) = 1.59 mW/g**  
Maximum value of SAR (measured) = 2.63 mW/g

**835 MHz Dipole System Validation/Zoom Scan 8 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 54.1 V/m; Power Drift = -0.023 dB  
**SAR(1 g) = 2.42 mW/g; SAR(10 g) = 1.59 mW/g**  
Maximum value of SAR (measured) = 2.59 mW/g

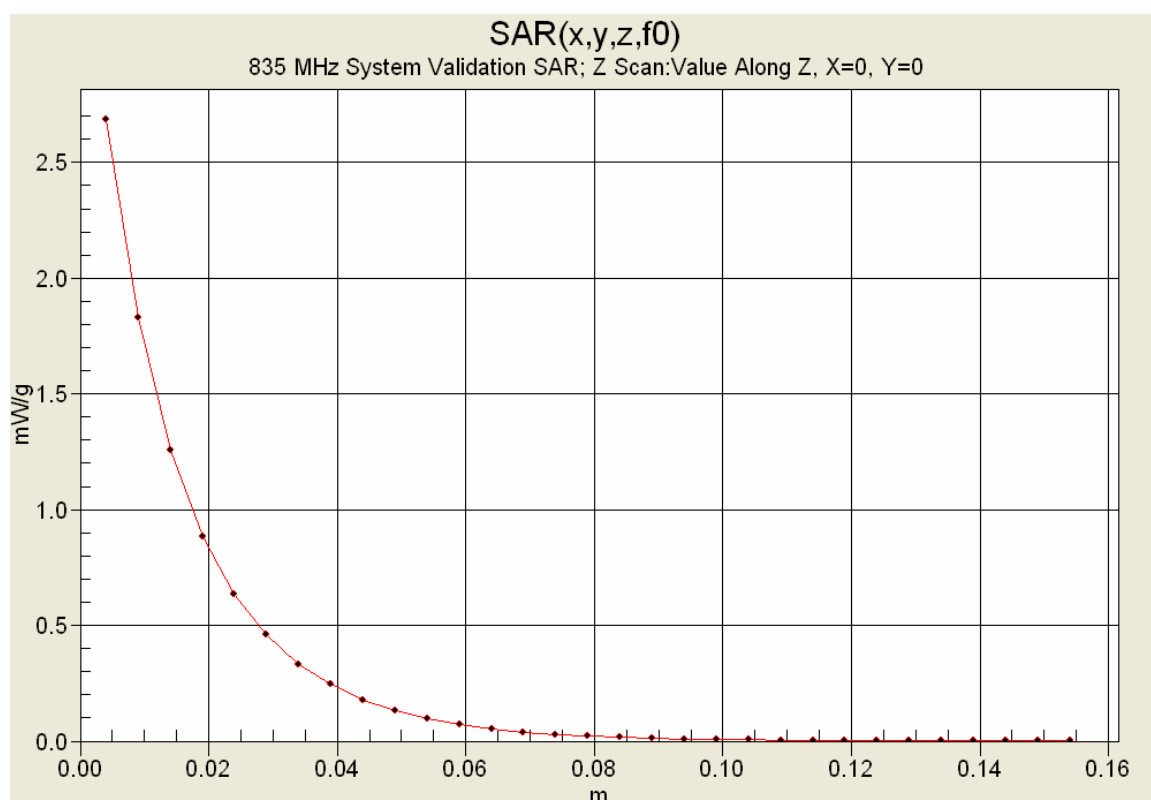
**835 MHz Dipole System Validation/Zoom Scan 9 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 54.6 V/m; Power Drift = -0.004 dB  
**SAR(1 g) = 2.46 mW/g; SAR(10 g) = 1.62 mW/g**  
Maximum value of SAR (measured) = 2.64 mW/g


**835 MHz Dipole System Validation/Zoom Scan 10 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 54.5 V/m; Power Drift = 0.012 dB  
**SAR(1 g) = 2.47 mW/g; SAR(10 g) = 1.62 mW/g**  
Maximum value of SAR (measured) = 2.65 mW/g

**835 MHz Dipole System Validation/Zoom Scan 11 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 54.5 V/m; Power Drift = -0.005 dB  
**SAR(1 g) = 2.45 mW/g; SAR(10 g) = 1.62 mW/g**  
Maximum value of SAR (measured) = 2.61 mW/g



1 g average of 10 measurements: 2.451 mW/g  
10 g average of 10 measurements: 1.612 mW/g



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	Evaluation Type:	System Validation	Validation Dipole:	835 MHz	Body

## 10. Measured Fluid Dielectric Parameters

### 835 MHz System Validation (Body)

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Celltech Labs Inc.

Test Result for UIM Dielectric Parameter

Mon 27/Mar/2006

Frequency(GHz)

FCC\_eH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon

FCC\_sH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma

FCC\_eB FCC Limits for Body Epsilon

FCC\_sB FCC Limits for Body Sigma

Test\_e Epsilon of UIM

Test\_s Sigma of UIM

\*\*\*\*\*

Freq	FCC_eB	FCC_sB	Test_e	Test_s
0.7350	55.59	0.96	54.23	0.86
0.7450	55.55	0.96	54.00	0.87
0.7550	55.51	0.96	54.00	0.88
0.7650	55.47	0.96	54.04	0.89
0.7750	55.43	0.97	53.97	0.90
0.7850	55.39	0.97	54.01	0.90
0.7950	55.36	0.97	53.96	0.91
0.8050	55.32	0.97	53.85	0.92
0.8150	55.28	0.97	53.79	0.93
0.8250	55.24	0.97	53.69	0.94
0.8350	55.20	0.97	53.68	0.94
0.8450	55.17	0.98	53.35	0.95
0.8550	55.14	0.99	53.18	0.96
0.8650	55.11	1.01	53.25	0.98
0.8750	55.08	1.02	53.26	0.98
0.8850	55.05	1.03	53.11	0.99
0.8950	55.02	1.04	53.11	1.00
0.9050	55.00	1.05	52.96	1.01
0.9150	55.00	1.06	52.91	1.02
0.9250	54.98	1.06	52.93	1.03
0.9350	54.96	1.07	52.58	1.03