


	<u>Date(s) of Evaluation</u> Sept. 11-14, 22, 25 & Oct. 16, 2006	<u>Test Report Serial No.</u> 072706UGL-T764-S15W	<u>Report Revision No.</u> Revision 1.0	 Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 25, 2007	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> General Population	

## APPENDIX F - SYSTEM VALIDATION

Company:	DRS Tactical Systems, Inc.	Model(s):	Hammerhead	Hammerhead X <sup>TREME</sup>	
FCC ID:	UGL0000181060001	DUT:	Rugged Tablet PC with 802.11abg WLAN and Bluetooth		
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	Date of Evaluation:	April 24, 2006	Document Serial No.:	SV2450B-042406-R1	
	Evaluation Type:	System Validation	Validation Dipole:	2450 MHz	Body

## **2450 MHz SYSTEM VALIDATION DIPOLE**

Type:

**2450 MHz Validation Dipole**

Asset Number:

**00025**

Serial Number:

**150**

Place of Validation:

**Celltech Labs Inc.**

Date of Validation:

**April 24, 2006**


**Celltech Labs Inc. hereby certifies that the 2450 MHz System Validation (Body) was performed on the date indicated above.**

Performed by:

**Sean Johnston**

Approved by:

**Spencer Watson**

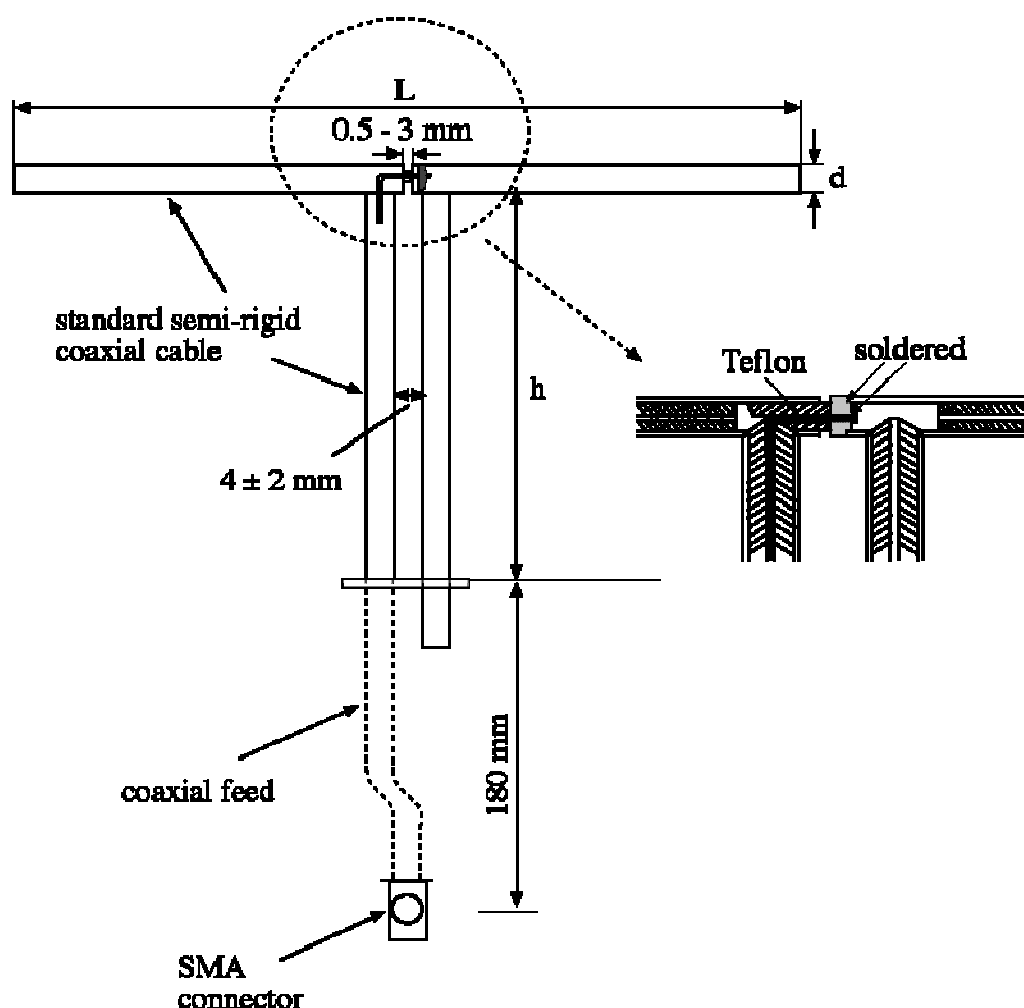
	Date of Evaluation:	April 24, 2006	Document Serial No.:	SV2450B-042406-R1	
	Evaluation Type:	System Validation	Validation Dipole:	2450 MHz	Body

## 1. Dipole Construction & Electrical Characteristics

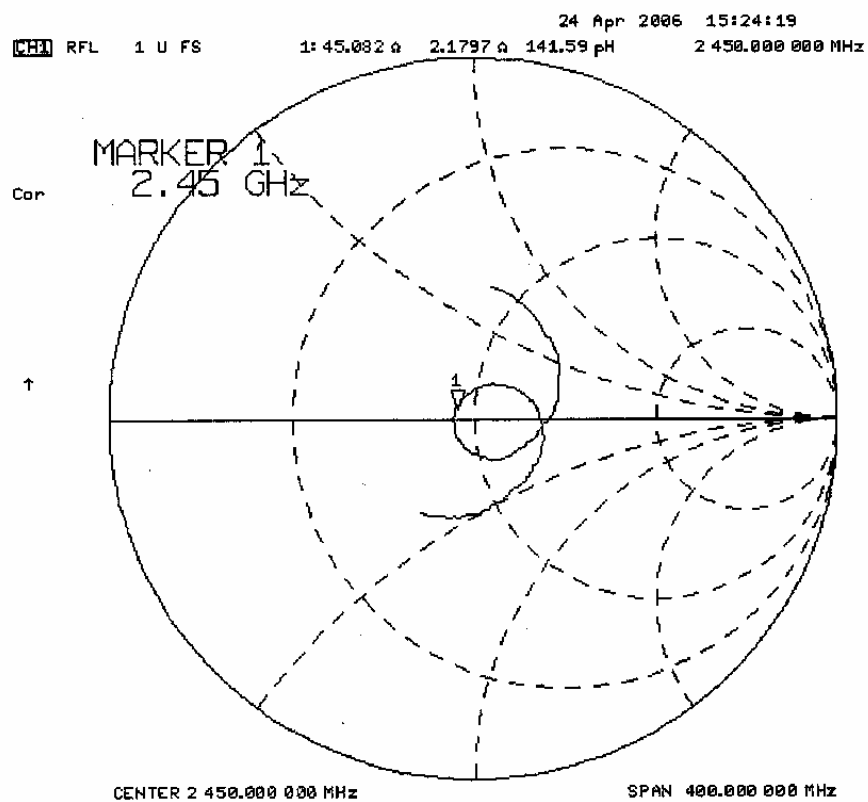
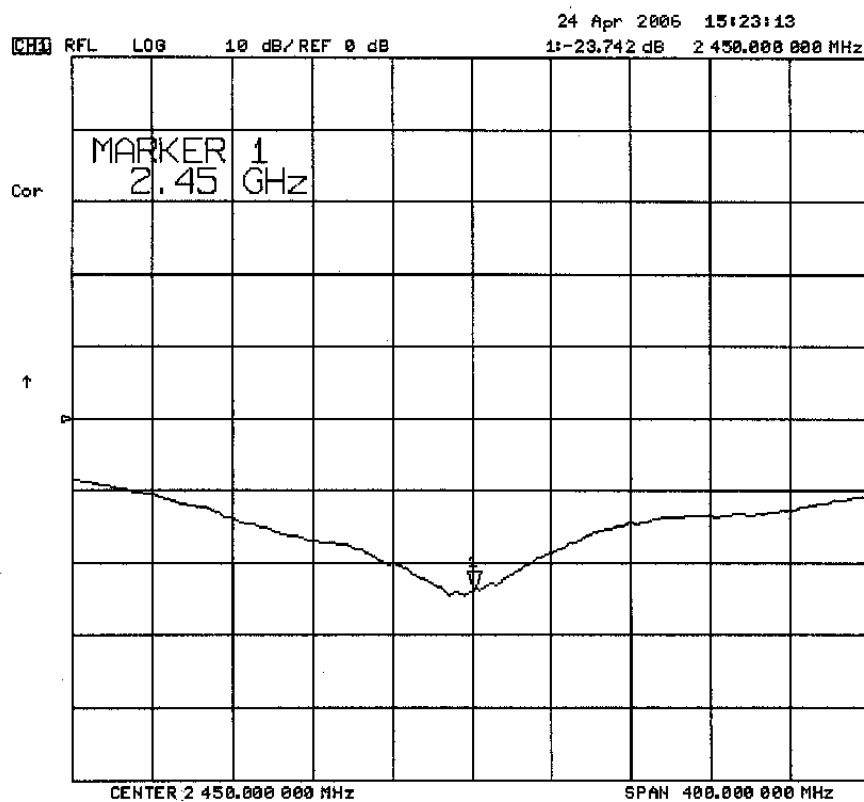
The validation dipole was constructed in accordance with the IEEE Std “Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”. The electrical properties were measured using an HP 8753E Network 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 10.0mm from the simulating fluid using a loss-less dielectric spacer. The measured input impedance is:

Feed point impedance at 2450 MHz  
 $\text{Re}\{Z\} = 45.082\Omega$   
 $\text{Im}\{Z\} = 2.1797\Omega$

Return Loss at 2450 MHz  
 -23.742dB



## 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 a Fiberglass shell planar phantom manufactured by Barski Industries Ltd. The phantom is in conformance with the requirements defined by IEEE SCC34-SC2 for the dosimetric evaluations of body-worn and lap-held operating configurations. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids.

**Shell Thickness:** 2.0 ± 0.2 mm  
**Filling Volume:** Approx. 72 liters  
**Dimensions:** L) 94 cm x (W) 44 cm x (H) 22 cm

	Date of Evaluation:	April 24, 2006	Document Serial No.:	SV2450B-042406-R1	
	Evaluation Type:	System Validation	Validation Dipole:	2450 MHz	Body


## 5. 2450 MHz System Validation Setup



	Date of Evaluation:	April 24, 2006	Document Serial No.:	SV2450B-042406-R1	
	Evaluation Type:	System Validation	Validation Dipole:	2450 MHz	Body

## 6. 2450 MHz Dipole Setup



	Date of Evaluation:	April 24, 2006	Document Serial No.:	SV2450B-042406-R1	
	Evaluation Type:	System Validation	Validation Dipole:	2450 MHz	Body

## 7. Measurement Conditions

The planar phantom was filled with 2450 MHz Body tissue simulant:

Relative Permittivity: 51.2 (-2.8% deviation from target)  
 Conductivity: 1.89 mho/m (-3% deviation from target)  
 Fluid Temperature: 23.9 °C  
 Fluid Depth:  $\geq 15.0$  cm

Environmental Conditions:  
 Ambient Temperature: 24.9 °C  
 Humidity: 30 %  
 Barometric Pressure: 101.1 kPa

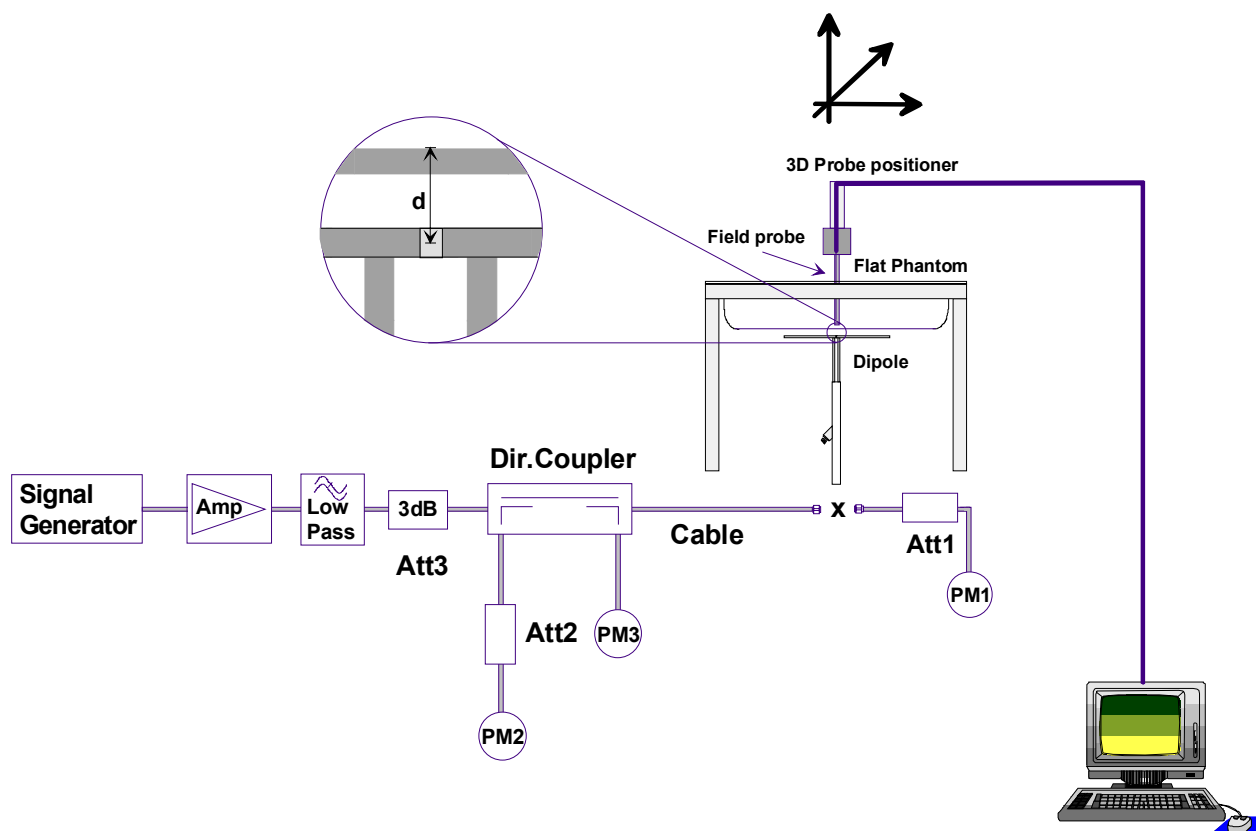
The 2450 MHz Body tissue simulant consisted of the following ingredients:

Ingredient	Percentage by weight
Water	69.98%
Glycol Monobutyl	30.00%
Salt	0.02%
Target Dielectric Parameters at 22°C	$\epsilon_r = 52.7 (+/-5\%)$ $\sigma = 1.95 \text{ S/m } (+/-5\%)$



## 8. SAR Measurement

Measurements were made at the planar section of the SAM phantom using a dosimetric E-field probe ET3DV6 (S/N: 1590, conversion factor 4.22). 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.

## 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	Peak SAR @ 0.25W Input
Test 1	12.7	50.80	5.87	23.48	14.40
Test 2	12.8	51.20	5.88	23.52	14.40
Test 3	12.6	50.40	5.81	23.24	14.10
Test 4	13.1	52.40	6.05	24.20	14.70
Test 5	12.7	50.80	5.84	23.36	14.20
Test 6	12.6	50.40	5.79	23.16	14.10
Test 7	12.9	51.60	6.00	24.00	14.50
Test 8	12.9	51.60	5.99	23.96	14.50
Test 9	13.1	52.40	6.09	24.36	14.80
Test10	13.2	52.80	6.09	24.36	14.90
<b>Average Value</b>	<b>12.86</b>	<b>51.44</b>	<b>5.94</b>	<b>23.76</b>	<b>14.46</b>

The results have been normalized to 1W (forward power) into the dipole.

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 (%)	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 (%)
51.2	+/- 10%	51.44	+0.47%	23.7	+/- 10%	23.76	+0.27%

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.

	Date of Evaluation:	April 24, 2006	Document Serial No.:	SV2450B-042406-R1	
	Evaluation Type:	System Validation	Validation Dipole:	2450 MHz	Body

## 2450 MHz Dipole - System Validation (Body) - April 24, 2006

DUT: Dipole 2450 MHz; Model: D2450V2; Serial: 150; Validated: 04/24/2006  
Ambient Temp: 24.9 °C; Fluid Temp: 23.9 °C; Barometric Pressure: 101.1 kPa; Humidity: 30%  
Communication System: CW  
Frequency: 2450 MHz; Duty Cycle: 1:1  
Medium: M2450 ( $\sigma = 1.89$  mho/m;  $\epsilon_r = 51.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>)  
- Probe: ET3DV6 - SN1590; ConvF(4.22, 4.22, 4.22); Calibrated: 20/05/2005  
- Sensor-Surface: 4mm (Mechanical Surface Detection)  
- Electronics: DAE4 Sn353; Calibrated: 15/06/2005  
- Phantom: Barski Industries; Type: Fiberglass Planar; Serial: 03-01  
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 161

**2450 MHz System Validation/Area Scan (6x10x1):** Measurement grid: dx=10mm, dy=10mm

**2450 MHz System Validation/Zoom Scan 1 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 84.0 V/m; Power Drift = -0.104 dB  
**SAR(1 g) = 12.7 mW/g; SAR(10 g) = 5.87 mW/g**  
Maximum value of SAR (measured) = 14.4 mW/g

**2450 MHz System Validation/Zoom Scan 2 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 83.9 V/m; Power Drift = -0.070 dB  
**SAR(1 g) = 12.8 mW/g; SAR(10 g) = 5.88 mW/g**  
Maximum value of SAR (measured) = 14.4 mW/g

**2450 MHz System Validation/Zoom Scan 3 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 84.1 V/m; Power Drift = -0.039 dB  
**SAR(1 g) = 12.6 mW/g; SAR(10 g) = 5.81 mW/g**  
Maximum value of SAR (measured) = 14.1 mW/g

**2450 MHz System Validation/Zoom Scan 4 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 86.2 V/m; Power Drift = -0.026 dB  
**SAR(1 g) = 13.1 mW/g; SAR(10 g) = 6.05 mW/g**  
Maximum value of SAR (measured) = 14.7 mW/g

**2450 MHz System Validation/Zoom Scan 5 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 83.3 V/m; Power Drift = 0.014 dB  
**SAR(1 g) = 12.7 mW/g; SAR(10 g) = 5.84 mW/g**  
Maximum value of SAR (measured) = 14.2 mW/g

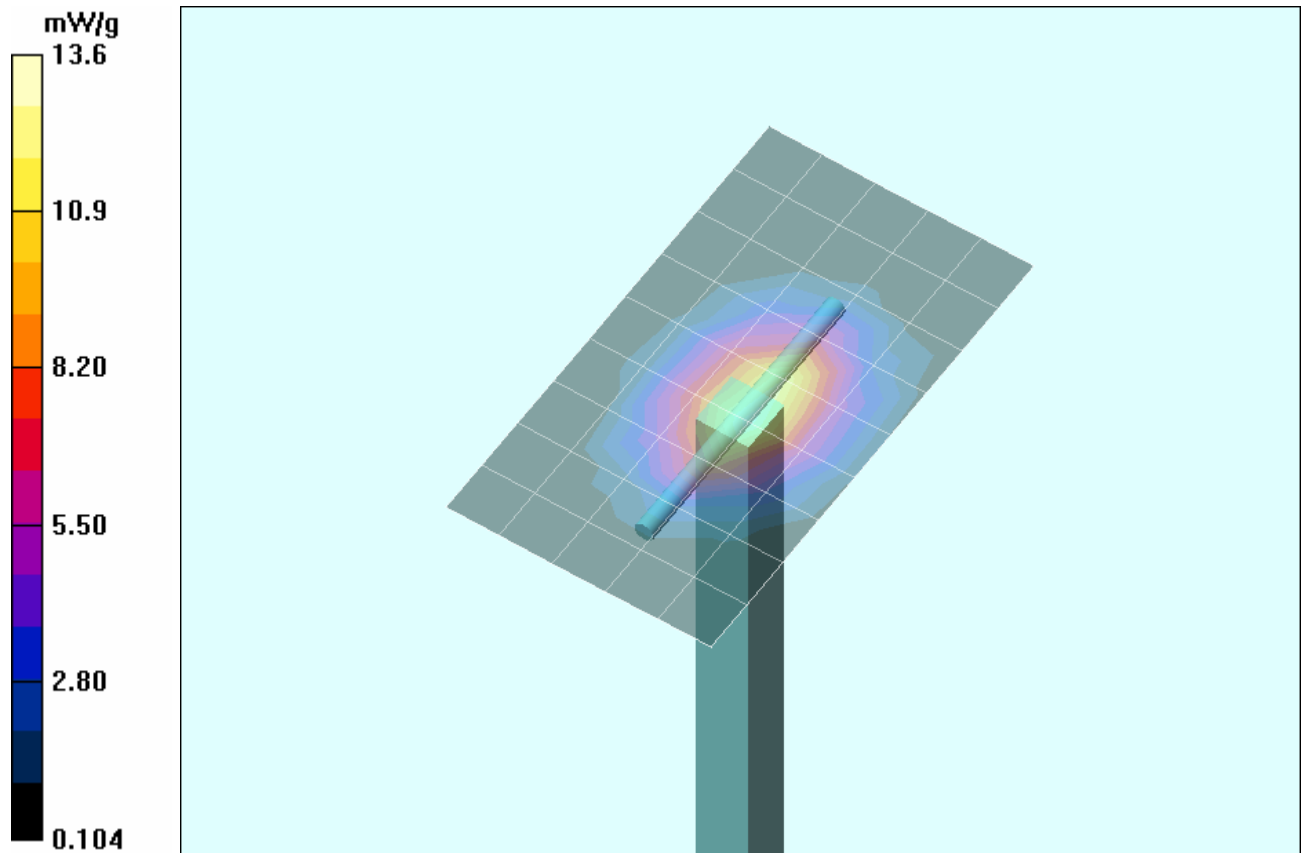
**2450 MHz System Validation/Zoom Scan 6 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 84.5 V/m; Power Drift = -0.037 dB  
**SAR(1 g) = 12.6 mW/g; SAR(10 g) = 5.79 mW/g**  
Maximum value of SAR (measured) = 14.1 mW/g

**2450 MHz System Validation/Zoom Scan 7 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 89.0 V/m; Power Drift = -0.078 dB  
**SAR(1 g) = 12.9 mW/g; SAR(10 g) = 6 mW/g**  
Maximum value of SAR (measured) = 14.5 mW/g

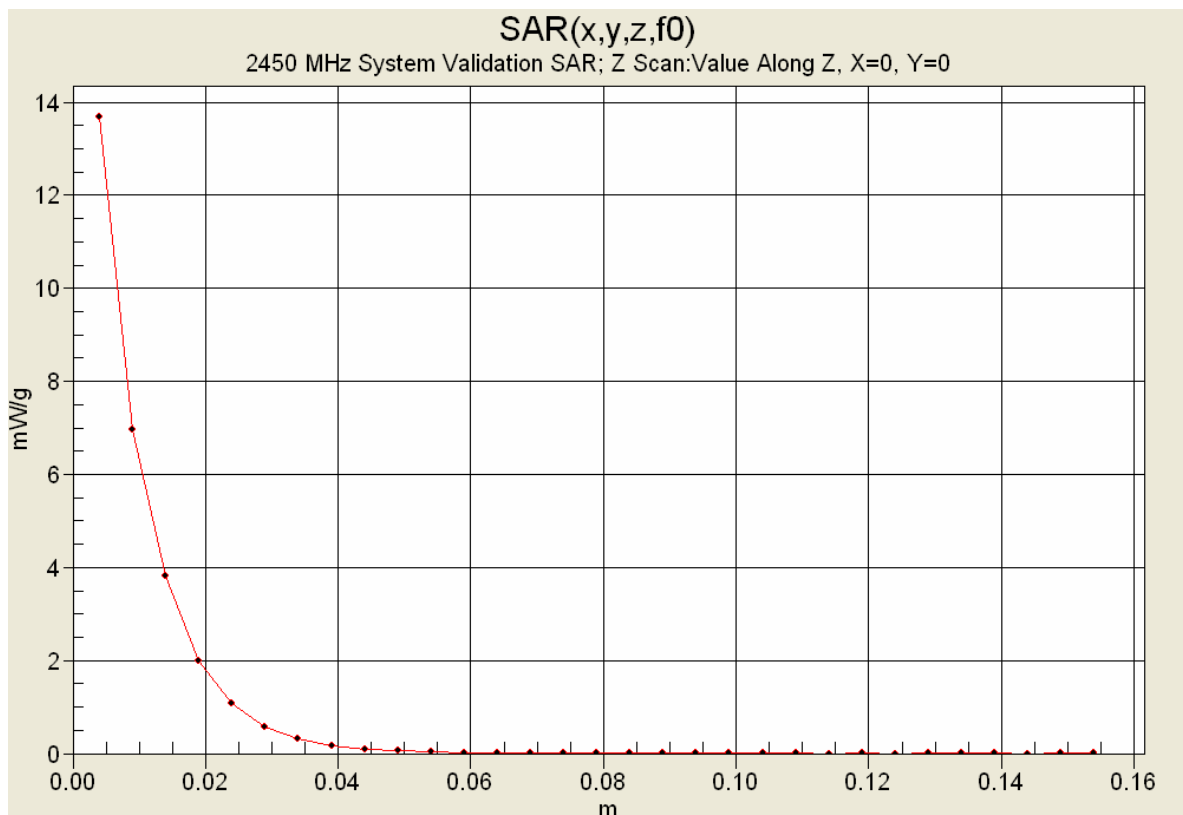
**2450 MHz System Validation/Zoom Scan 8 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 89.1 V/m; Power Drift = -0.069 dB  
**SAR(1 g) = 12.9 mW/g; SAR(10 g) = 5.99 mW/g**  
Maximum value of SAR (measured) = 14.5 mW/g


**2450 MHz System Validation/Zoom Scan 9 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 89.8 V/m; Power Drift = -0.076 dB  
**SAR(1 g) = 13.1 mW/g; SAR(10 g) = 6.09 mW/g**  
Maximum value of SAR (measured) = 14.8 mW/g

**2450 MHz System Validation/Zoom Scan 10 (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 89.8 V/m; Power Drift = -0.013 dB  
**SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.09 mW/g**  
Maximum value of SAR (measured) = 14.9 mW/g



1 g average of 10 measurements: 12.86 mW/g  
10 g average of 10 measurements: 5.94 mW/g



	Date of Evaluation:	April 24, 2006	Document Serial No.:	SV2450B-042406-R1	
	Evaluation Type:	System Validation	Validation Dipole:	2450 MHz	Body

## 10. Measured Fluid Dielectric Parameters

### 2450 MHz System Validation (Body)

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Celltech Labs Inc.

Test Result for UIM Dielectric Parameter

Mon 24/Apr/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
2.3500	52.83	1.85	51.24	1.76
2.3600	52.82	1.86	51.30	1.78
2.3700	52.81	1.87	51.30	1.79
2.3800	52.79	1.88	51.28	1.81
2.3900	52.78	1.89	51.28	1.82
2.4000	52.77	1.90	51.22	1.81
2.4100	52.75	1.91	51.26	1.85
2.4200	52.74	1.92	51.13	1.85
2.4300	52.73	1.93	51.03	1.86
2.4400	52.71	1.94	51.10	1.86
2.4500	52.70	1.95	51.17	1.89
2.4600	52.69	1.96	51.07	1.92
2.4700	52.67	1.98	51.03	1.92
2.4800	52.66	1.99	51.04	1.92
2.4900	52.65	2.01	51.04	1.93
2.5000	52.64	2.02	51.04	1.93
2.5100	52.62	2.04	50.96	1.95
2.5200	52.61	2.05	50.94	1.97
2.5300	52.60	2.06	51.02	1.97
2.5400	52.59	2.08	50.97	1.99
2.5500	52.57	2.09	50.85	1.98

	Date of Evaluation:	July 18, 2006	Document Issue No.:		SV5200M-071806-R1.0	
	Evaluation Type:	System Validation	Validation Dipole:	5200 MHz	Fluid Type:	Body

## 5200 MHz SYSTEM VALIDATION

Type:

**5200 MHz Validation Dipole**

Asset Number:

**00126**

Serial Number:

**1031**

Place of Validation:

**Celltech Labs Inc.**

Date of Validation:

**July 18, 2006**


**Celltech Labs Inc. hereby certifies that the 5200 MHz System Validation was performed on the date indicated above.**

Performed by:

**Sean Johnston**

Approved by:

**Spencer Watson**

	Date of Evaluation:	July 18, 2006	Document Issue No.:		SV5200M-071806-R1.0	
	Evaluation Type:	System Validation	Validation Dipole:	5200 MHz	Fluid Type:	Body

## 1. Dipole Construction & Electrical Characteristics

The validation dipole was constructed in accordance with the IEEE Std “Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”. 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 10.0mm from the simulating fluid using a loss-less dielectric spacer. The measured input impedance is:

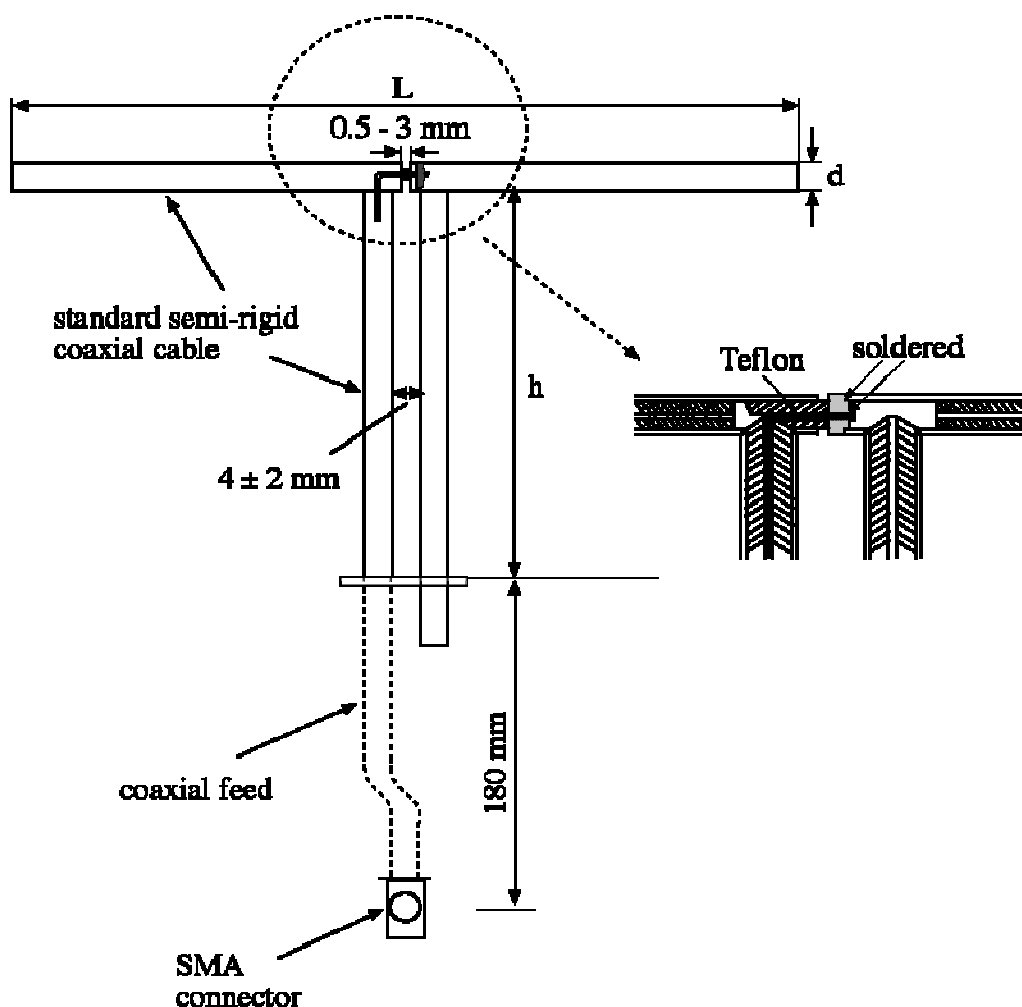
Feed point impedance at 5200 MHz

$$\text{Re}\{Z\} = 54.721\Omega$$

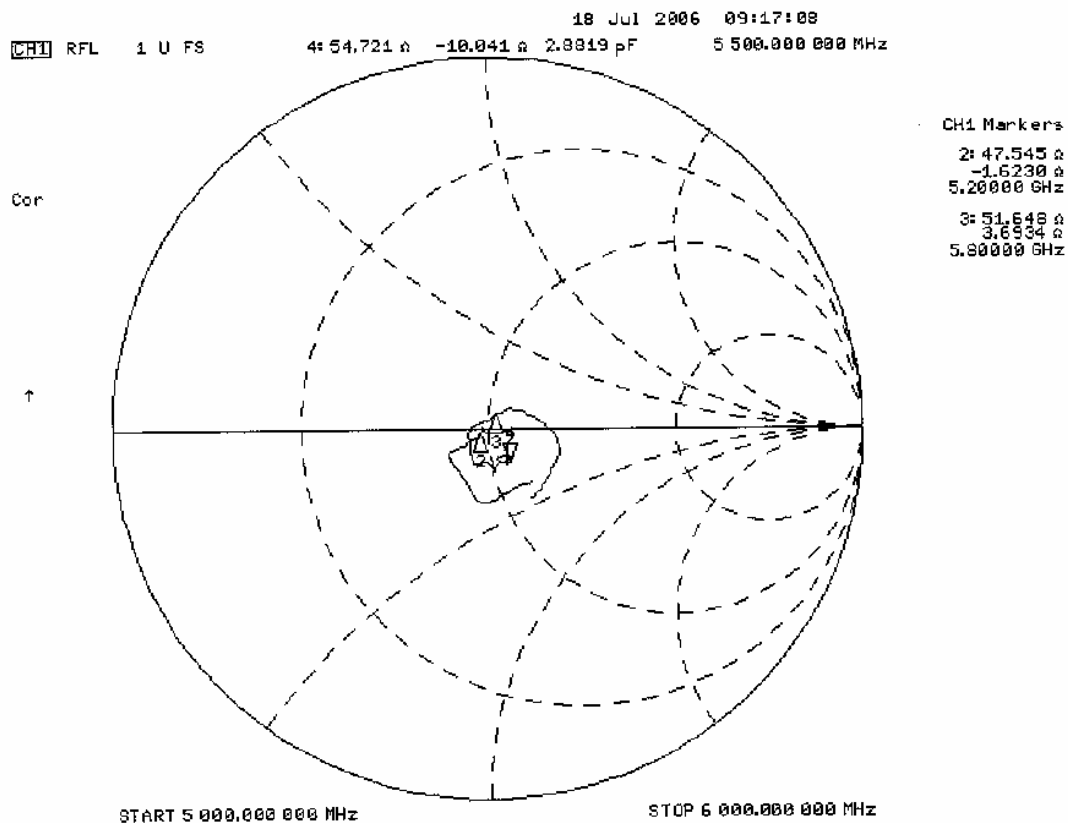
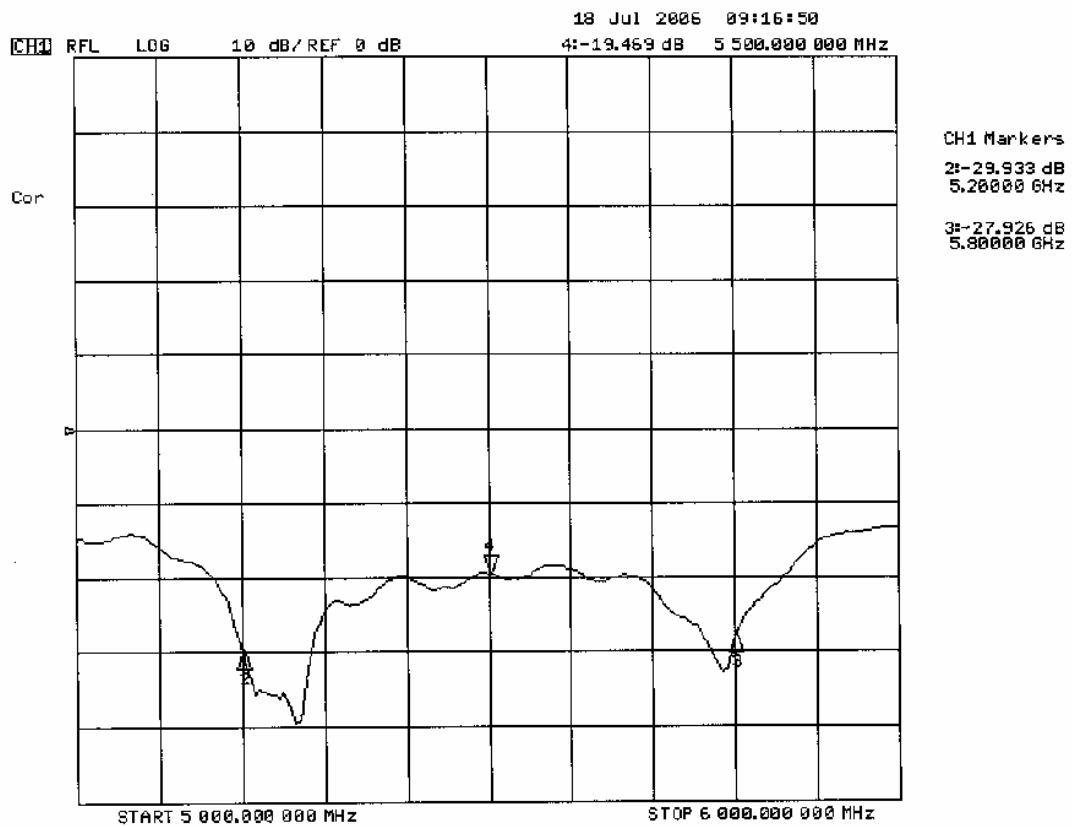
$$\text{Im}\{Z\} = -10.041\Omega$$

Return Loss at 5200 MHz

-19.469 dB



## 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
5200 - 5800	20.6	40.65	3.6

### 4. Validation Phantom

The validation phantom is a Fiberglass shell planar phantom manufactured by Barski Industries Ltd. The phantom is in conformance with the requirements defined by IEEE SCC34-SC2 for the dosimetric evaluations of body-worn and lap-held operating configurations. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids.

**Shell Thickness:** 2.0 ± 0.1 mm  
**Filling Volume:** Approx. 55 liters  
**Dimensions:** 44 cm (W) x 94 cm (L) x 22 cm (H)

	Date of Evaluation:	July 18, 2006	Document Issue No.:		SV5200M-071806-R1.0	
	Evaluation Type:	System Validation	Validation Dipole:	5200 MHz	Fluid Type:	Body

## 5. 5200 MHz System Validation Setup



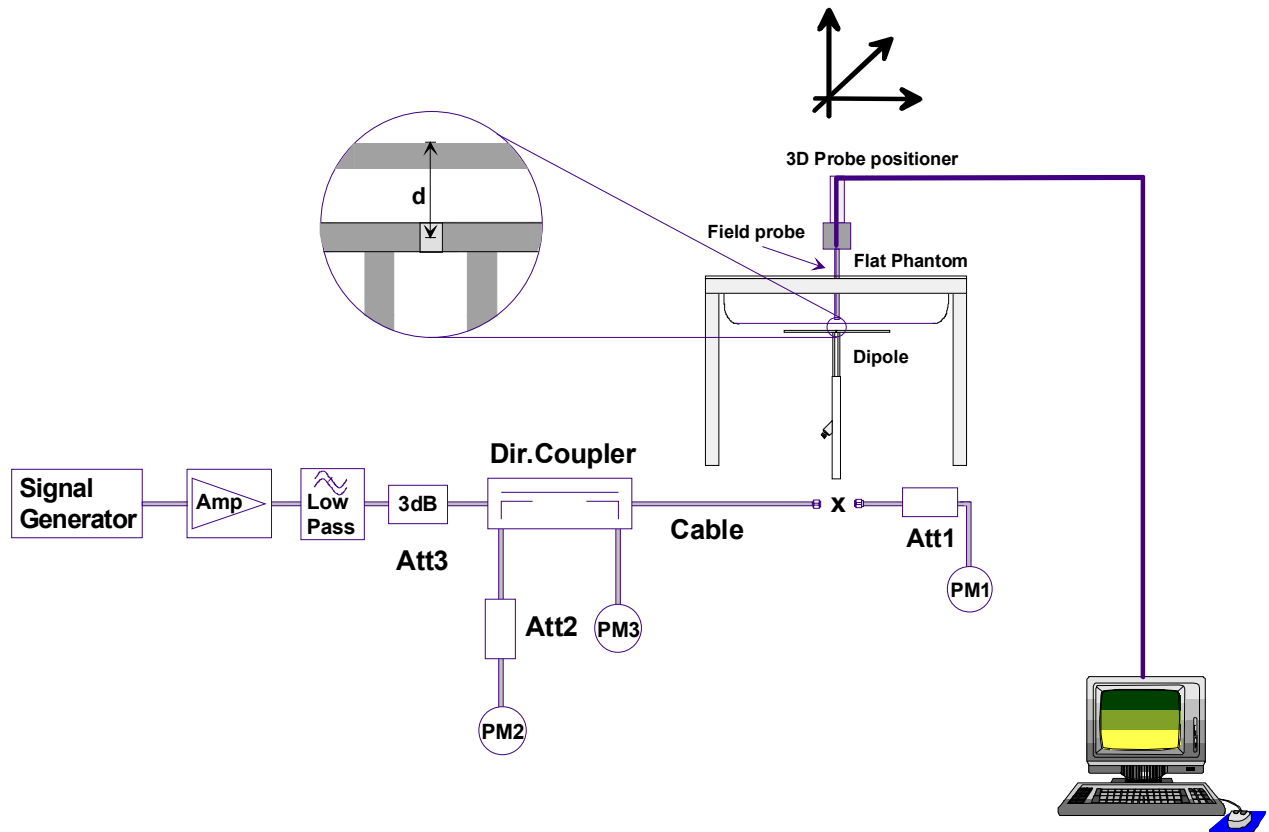
	Date of Evaluation:	July 18, 2006	Document Issue No.:		SV5200M-071806-R1.0	
	Evaluation Type:	System Validation	Validation Dipole:	5200 MHz	Fluid Type:	Body

## 6. 5200 MHz Dipole Setup



## 7. 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.

	Date of Evaluation:	July 18, 2006	Document Issue No.:		SV5200M-071806-R1.0	
	Evaluation Type:	System Validation	Validation Dipole:	5200 MHz	Fluid Type:	Body

## 8. Measurement Conditions

The planar phantom was filled with 5200 MHz body tissue simulant.

Relative Permittivity: 47.5 (-3.2% deviation from target)  
 Conductivity: 5.24 mho/m (-1.1% deviation from target)  
 Fluid Temperature: 22.3 °C  
 Fluid Depth:  $\geq 15.0$  cm

Environmental Conditions:

Ambient Temperature: 21.8°C  
 Humidity: 32%  
 Barometric Pressure: 101.8kPa

The 5200 MHz body tissue simulant consisted of the following ingredients:

Ingredient	Percentage by weight
Water	64 - 78%
Mineral Oil	11 - 18%
Emulsifiers	9 - 15%
Additives and Salt	2 - 3%
Target Dielectric Parameters at 22°C	$\epsilon_r = 49.0$ (+/-5%) $\sigma = 5.30$ S/m (+/-5%)

## 9. 5200 MHz System Validation SAR Results

SAR @ 0.25W Input averaged over 1g				SAR @ 1W Input averaged over 1g			
Manufacturer's Target	Measured	Deviation		Manufacturer's Target	Measured	Deviation	
18.0	+/- 10%	19.2	+6.7%	71.8	+/- 10%	76.8	+7.0%
SAR @ 0.25W Input averaged over 10g				SAR @ 1W Input averaged over 10g			
Manufacturer's Target	Measured	Deviation		Manufacturer's Target	Measured	Deviation	
5.03	+/- 10%	5.33	+6.0%	20.1	+/- 10%	21.3	+6.1%

The results have been normalized to 1W (forward power) into the dipole.

	Date of Evaluation:	July 18, 2006	Document Issue No.:	SV5200M-071806-R1.0		
	Evaluation Type:	System Validation	Validation Dipole:	5200 MHz	Fluid Type:	Body

## System Validation - 5200 MHz Dipole - Body Fluid - July 18, 2006

**DUT: Dipole 5GHz; Model: D5GHzV2; Serial: 1031; Asset: 00126; Manufacturer: SPEAG**

Ambient Temp: 21.8°C; Fluid Temp: 22.3°C; Barometric Pressure: 101.8 kPa; Humidity: 32%

Communication System: CW

Forward Conducted Power: 250 mW

Frequency: 5200 MHz; Duty Cycle: 1:1

Medium: M5200-5800 Medium parameters used:  $f = 5200$  MHz;  $\sigma = 5.24$  mho/m;  $\epsilon_r = 47.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

- Probe: EX3DV4 - SN3547; ConvF(4.87, 4.87, 4.87); Calibrated: 14/02/2006
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 21/06/2006
- Phantom: Barski Industries; Type: Fiberglass Planar; Serial: 03-01
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

### 5200 MHz Dipole - System Validation/Area Scan (9x13x1):

Measurement grid: dx=5mm, dy=5mm

Maximum value of SAR (measured) = 38.3 mW/g

### 5200 MHz Dipole - System Validation/Zoom Scan (8x8x8)/Cube 0:

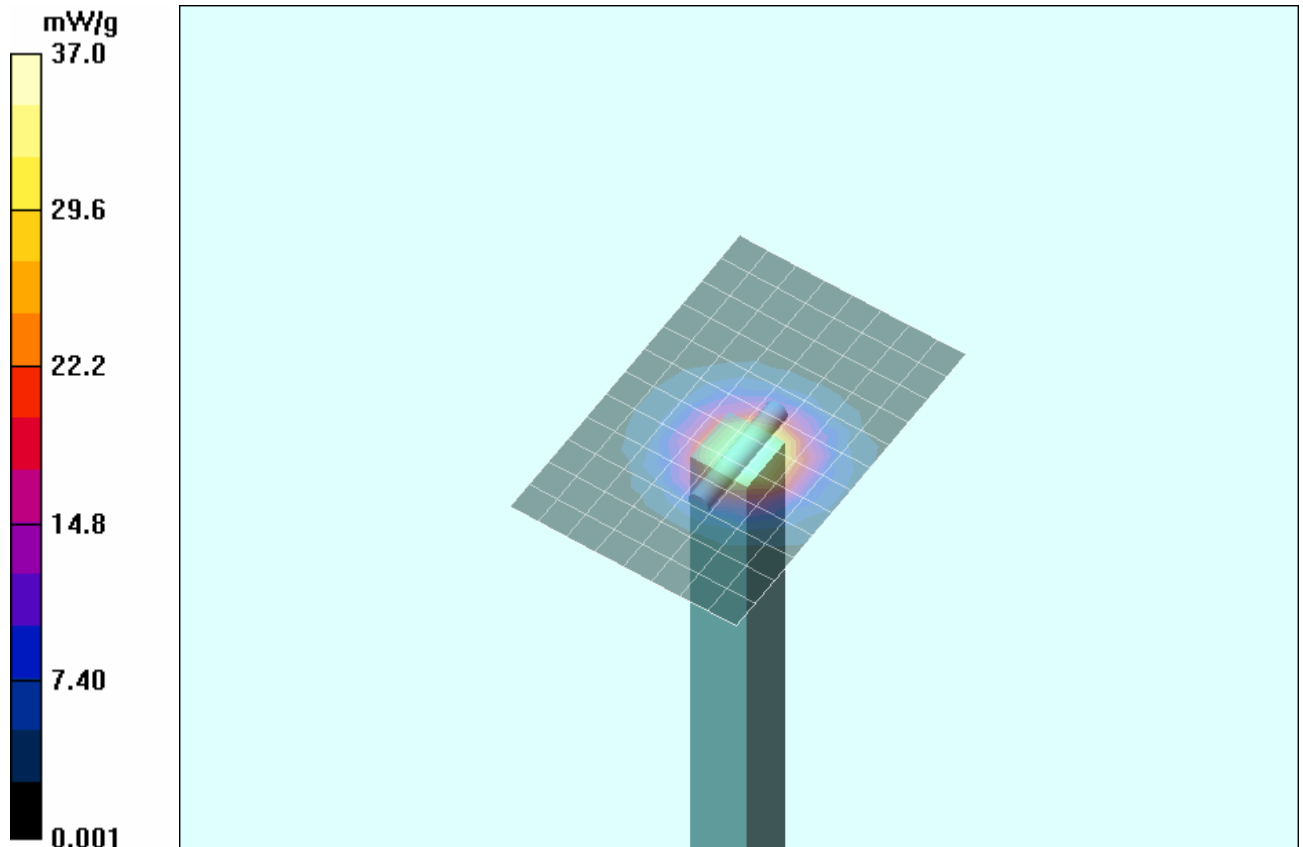
Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

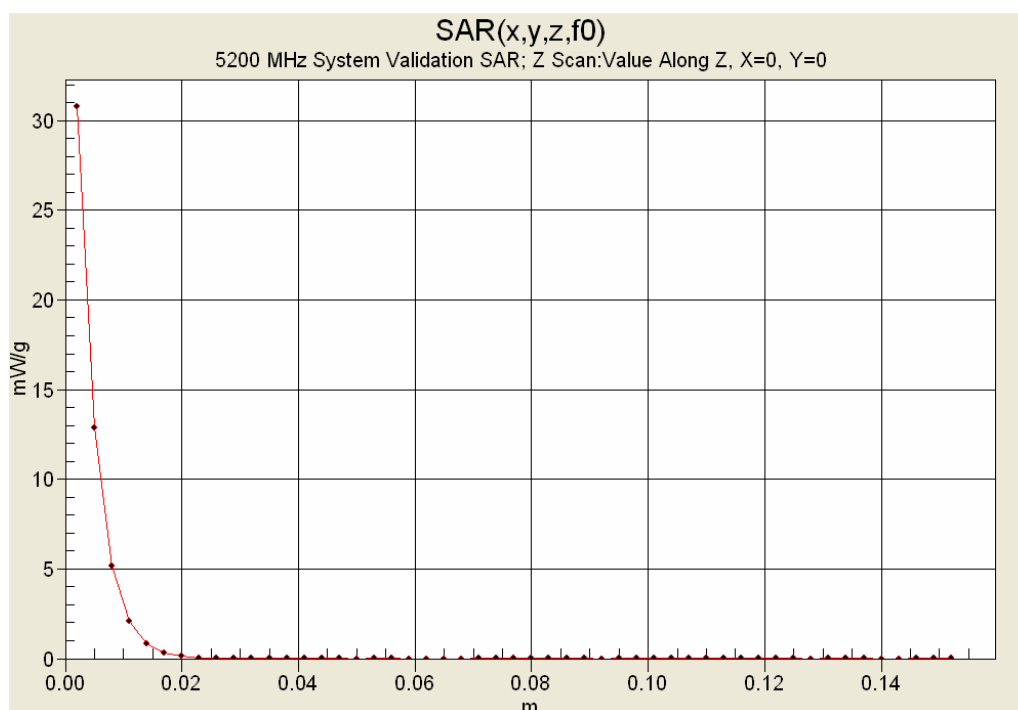
Reference Value = 80.9 V/m; Power Drift = -0.0291 dB

Peak SAR (extrapolated) = 76.1 W/kg

**SAR(1 g) = 19.2 mW/g; SAR(10 g) = 5.33 mW/g**

Maximum value of SAR (measured) = 37.0 mW/g





## 10. Measured Fluid Dielectric Parameters

### System Validation (Body) - 5200 MHz Dipole

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Celltech Labs Inc.

Test Result for UIM Dielectric Parameter

Tue 18/Jul/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
5.1600	49.07	5.25	47.40	5.20
5.1700	49.06	5.26	47.54	5.21
5.1800	49.04	5.28	47.44	5.22
5.1900	49.03	5.29	47.49	5.22
5.2000	49.01	5.30	47.50	5.24
5.2100	49.00	5.31	47.34	5.24
5.2200	48.99	5.32	47.45	5.22
5.2300	48.97	5.33	47.38	5.24
5.2400	48.96	5.35	47.36	5.28
5.2500	48.95	5.36	47.38	5.31
5.2600	48.93	5.37	47.37	5.28
5.2700	48.92	5.38	47.50	5.26
5.2800	48.91	5.39	47.31	5.30
5.2900	48.89	5.40	47.30	5.31
5.3000	48.88	5.42	47.19	5.29
5.3100	48.87	5.43	47.47	5.29
5.3200	48.85	5.44	47.19	5.42
5.3300	48.84	5.45	47.20	5.39
5.3400	48.82	5.46	47.34	5.33
5.3500	48.81	5.47	47.34	5.39
5.3600	48.80	5.49	47.49	5.45

	Date of Evaluation:	July 18, 2006	Document Issue No.:		SV5800M-071806-R1.0	
	Evaluation Type:	System Validation	Validation Dipole:	5800 MHz	Fluid Type:	Body

## 5800 MHz SYSTEM VALIDATION

Type:

**5800 MHz Validation Dipole**

Asset Number:

**00126**

Serial Number:

**1031**

Place of Validation:

**Celltech Labs Inc.**

Date of Validation:

**July 18, 2006**

**Celltech Labs Inc. hereby certifies that the 5800 MHz System Validation was performed on the date indicated above.**


Performed by:

**Sean Johnston**

Approved by:

**Spencer Watson**



	Date of Evaluation:	July 18, 2006	Document Issue No.:		SV5800M-071806-R1.0	
	Evaluation Type:	System Validation	Validation Dipole:	5800 MHz	Fluid Type:	Body

## 1. Dipole Construction & Electrical Characteristics

The validation dipole was constructed in accordance with the IEEE Std “Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”. The electrical properties were measured using an HP 8753E Network Analyzer. The network analyzer was calibrated to the validation dipole N-type connector feed point using an HP85032ET Type N calibration kit. The dipole was placed parallel to a planar phantom at a separation distance of 10.0mm from the simulating fluid using a loss-less dielectric spacer. The measured input impedance is:

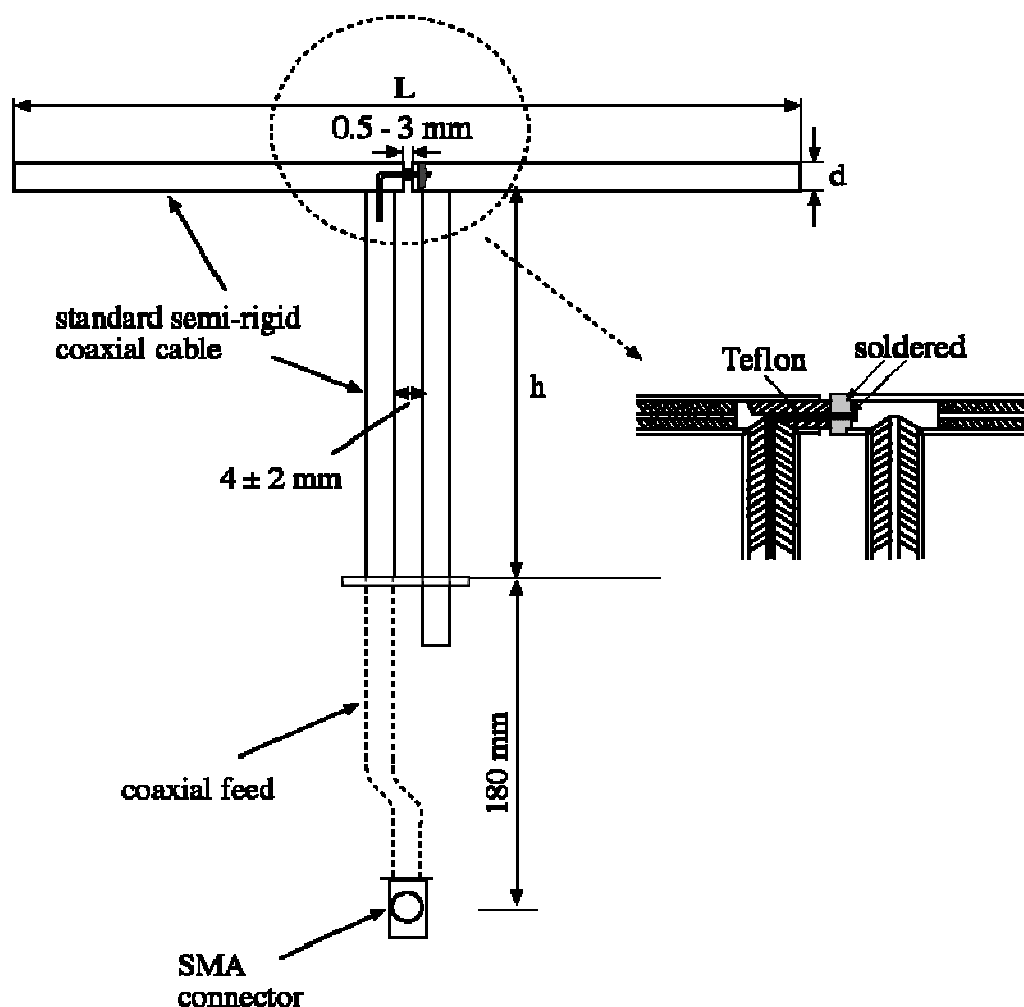
Feed point impedance at 5800 MHz

$$\text{Re}\{Z\} = 54.721\Omega$$

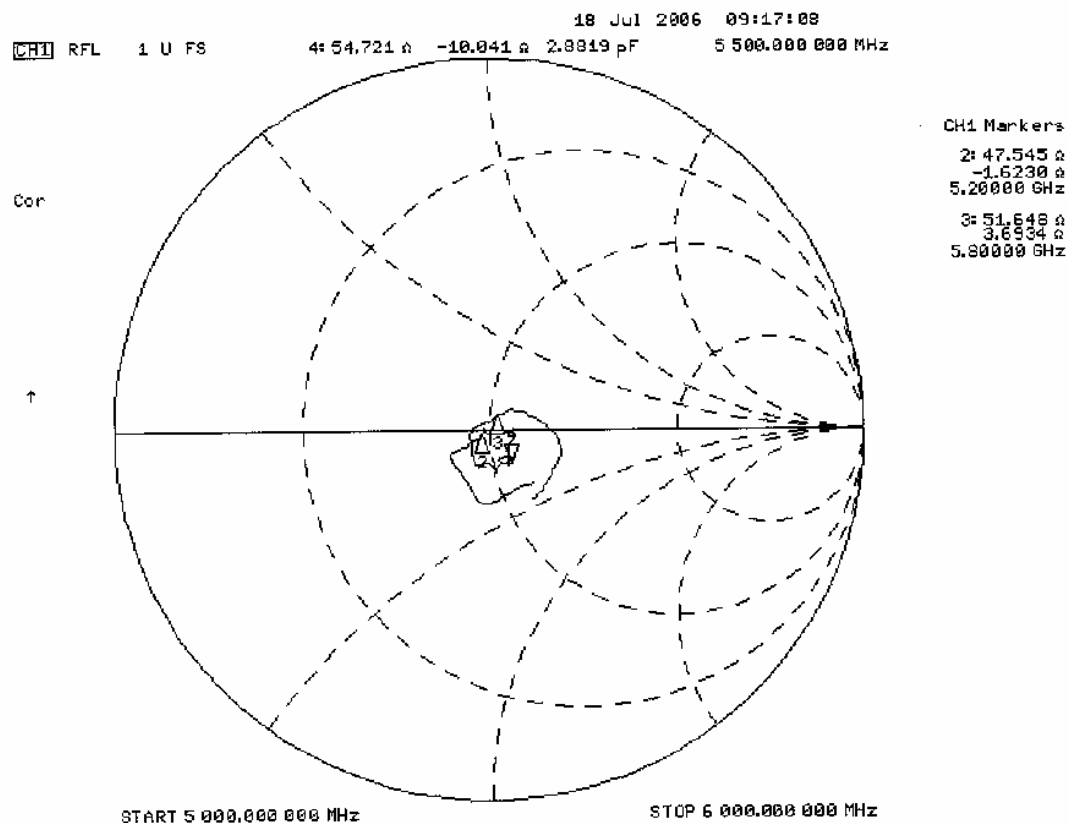
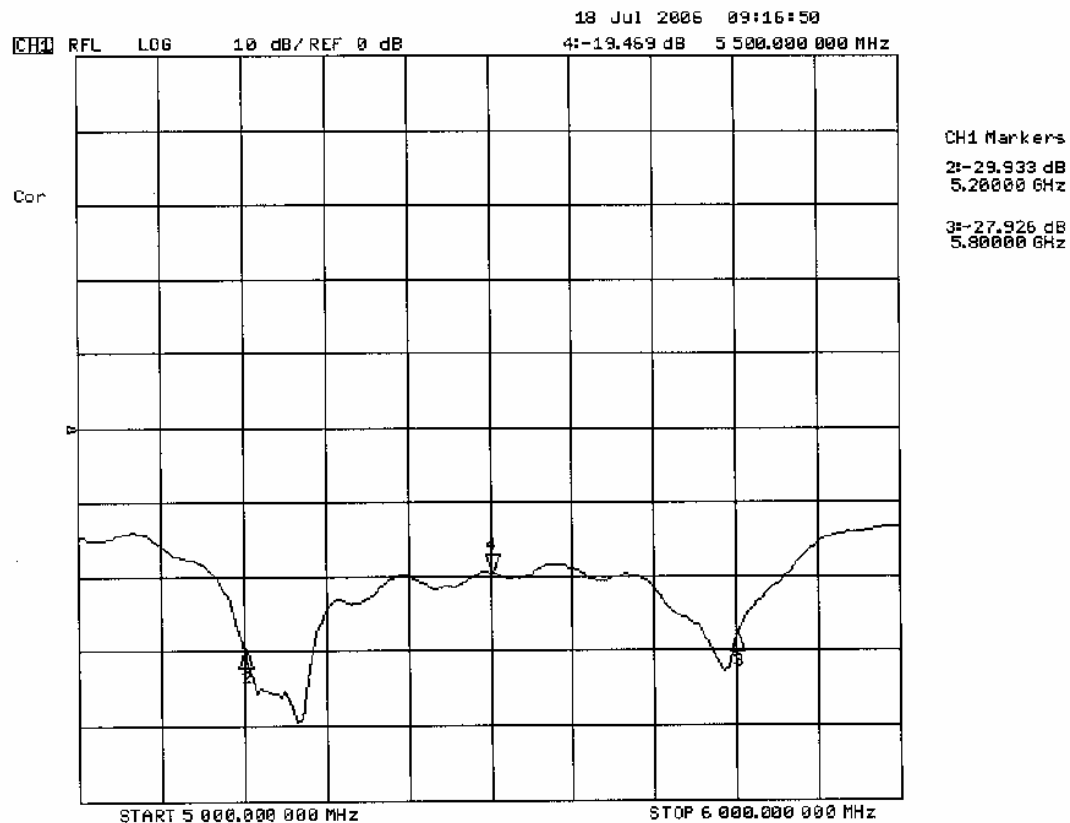
$$\text{Im}\{Z\} = -10.041\Omega$$

Return Loss at 5800 MHz

-19.469 dB



## 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
5200 - 5800	20.6	40.65	3.6

### 4. Validation Phantom


The validation phantom is a Fiberglass shell planar phantom manufactured by Barski Industries Ltd. The phantom is in conformance with the requirements defined by IEEE SCC34-SC2 for the dosimetric evaluations of body-worn and lap-held operating configurations. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids.

**Shell Thickness:** 2.0 ± 0.1 mm  
**Filling Volume:** Approx. 55 liters  
**Dimensions:** 44 cm (W) x 94 cm (L) x 22 cm (H)

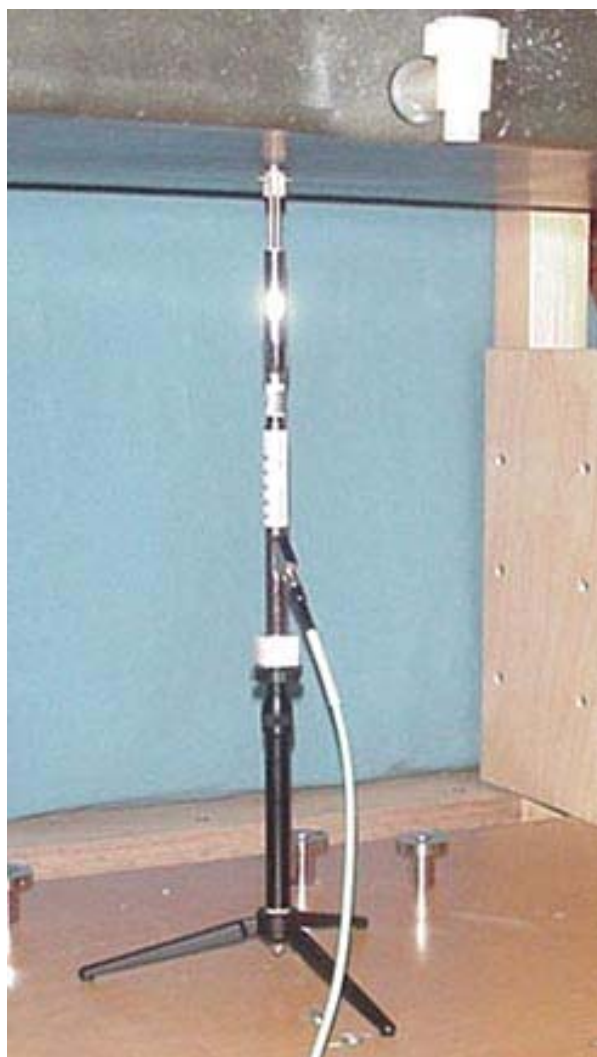
	Date of Evaluation:	July 18, 2006	Document Issue No.:		SV5800M-071806-R1.0	
	Evaluation Type:	System Validation	Validation Dipole:	5800 MHz	Fluid Type:	Body

## 5. 5800 MHz System Validation Setup



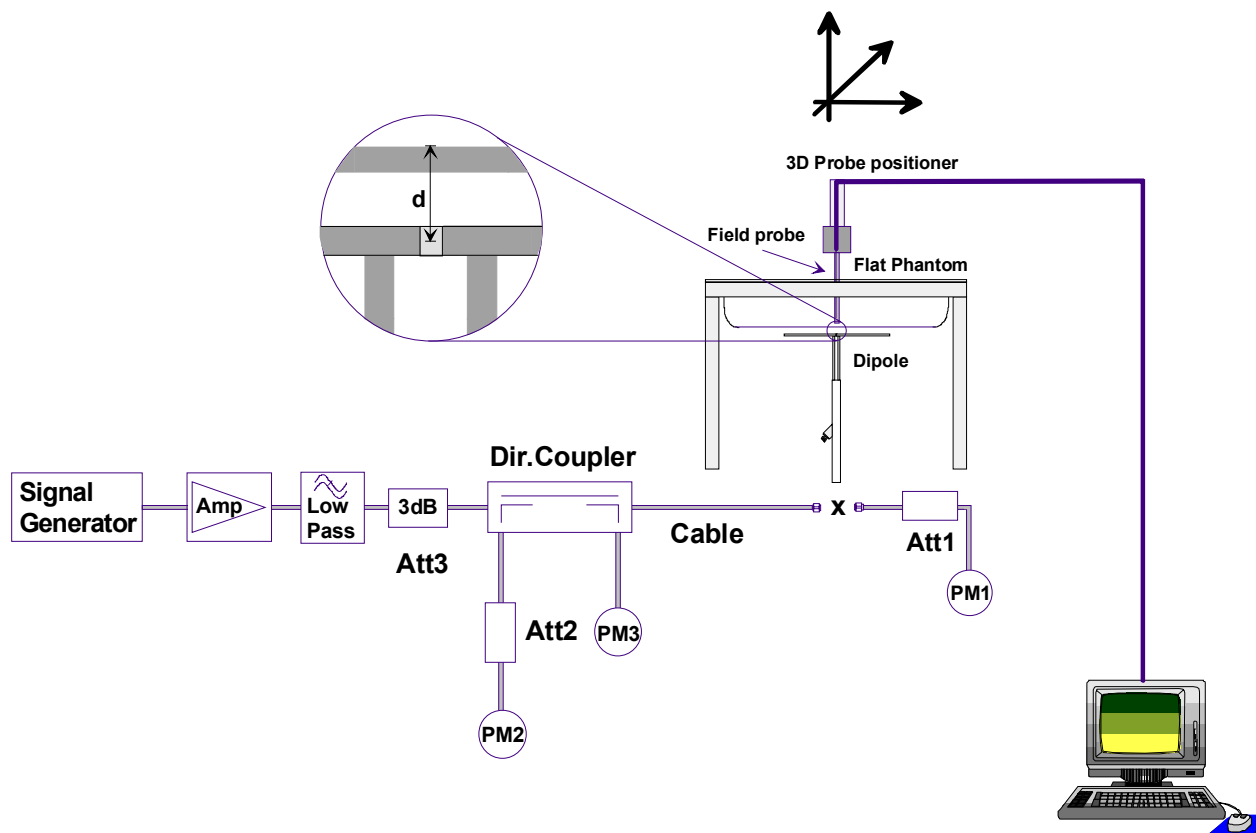
	Date of Evaluation:	July 18, 2006	Document Issue No.:		SV5800M-071806-R1.0	
	Evaluation Type:	System Validation	Validation Dipole:	5800 MHz	Fluid Type:	Body

## 6. 5800 MHz Dipole Setup



## 7. 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.

	Date of Evaluation:	July 18, 2006	Document Issue No.:		SV5800M-071806-R1.0	
	Evaluation Type:	System Validation	Validation Dipole:	5800 MHz	Fluid Type:	Body

## 8. Measurement Conditions

The planar phantom was filled with 5800 MHz body tissue simulant.

Relative Permittivity: 46.4 (-3.7% deviation from target)  
 Conductivity: 6.25 mho/m (+4.2% deviation from target)  
 Fluid Temperature: 22.3 °C  
 Fluid Depth:  $\geq 15.0$  cm

Environmental Conditions:


Ambient Temperature: 21.8°C  
 Humidity: 32%  
 Barometric Pressure: 101.8kPa

The 5800 MHz body tissue simulant consisted of the following ingredients:

Ingredient	Percentage by weight
Water	64 - 78%
Mineral Oil	11 - 18%
Emulsifiers	9 - 15%
Additives and Salt	2 - 3%
Target Dielectric Parameters at 22°C	$\epsilon_r = 48.2$ (+/-5%) $\sigma = 6.00$ S/m (+/-5%)

## 9. 5800 MHz System Validation SAR Results

SAR @ 0.25W Input averaged over 1g				SAR @ 1W Input averaged over 1g			
Manufacturer's Target	Measured	Deviation		Manufacturer's Target	Measured	Deviation	
18.5	+/- 10%	17.0	-8.1%	74.1	+/- 10%	68.0	-8.2%
SAR @ 0.25W Input averaged over 10g				SAR @ 1W Input averaged over 10g			
Manufacturer's Target	Measured	Deviation		Manufacturer's Target	Measured	Deviation	
5.13	+/- 10%	4.65	-9.4%	20.5	+/- 10%	18.6	-9.3%
The results have been normalized to 1W (forward power) into the dipole.							

	Date of Evaluation:	July 18, 2006	Document Issue No.:	SV5800M-071806-R1.0		
	Evaluation Type:	System Validation	Validation Dipole:	5800 MHz	Fluid Type:	Body

## System Validation - 5800 MHz Dipole - Body Fluid - July 18, 2006

**DUT: Dipole 5GHz; Model: D5GHzV2; Serial: 1031; Asset: 00126; Manufacturer: SPEAG**

Ambient Temp: 21.8°C; Fluid Temp: 22.3°C; Barometric Pressure: 101.8 kPa; Humidity: 32%

Communication System: CW

Forward Conducted Power: 250 mW

Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: M5200-5800 Medium parameters used:  $f = 5800$  MHz;  $\sigma = 6.25$  mho/m;  $\epsilon_r = 46.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

- Probe: EX3DV4 - SN3547; ConvF(4.69, 4.69, 4.69); Calibrated: 14/02/2006
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 21/06/2006
- Phantom: Barski Industries; Type: Fiberglass Planar; Serial: 03-01
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

### 5800 MHz Dipole - System Validation/Area Scan (9x13x1):

Measurement grid:  $dx=5$ mm,  $dy=5$ mm

Maximum value of SAR (measured) = 35.2 mW/g

### 5800 MHz Dipole - System Validation/Zoom Scan (8x8x8)/Cube 0:

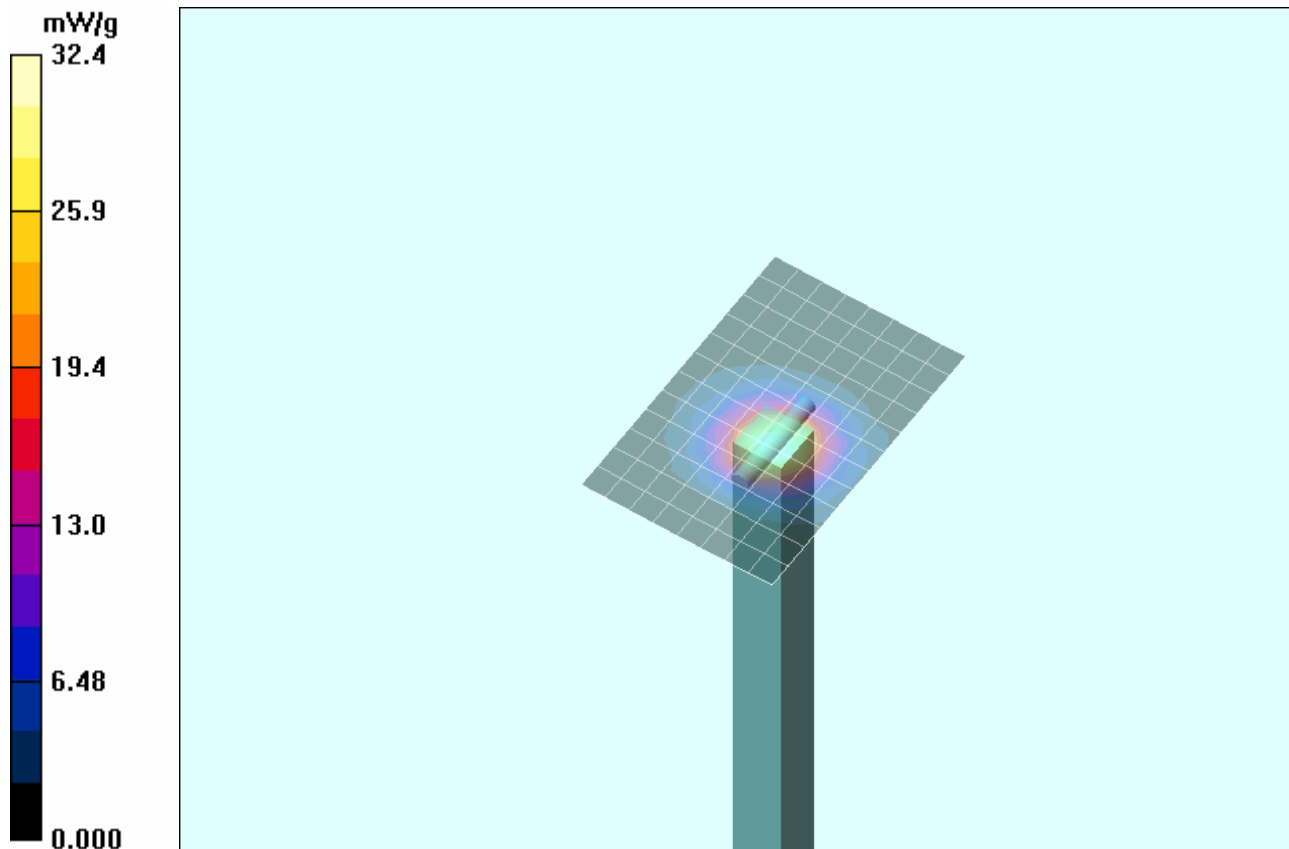
Measurement grid:  $dx=4.3$ mm,  $dy=4.3$ mm,  $dz=3$ mm

Reference Value = 66.8 V/m; Power Drift = -0.036 dB

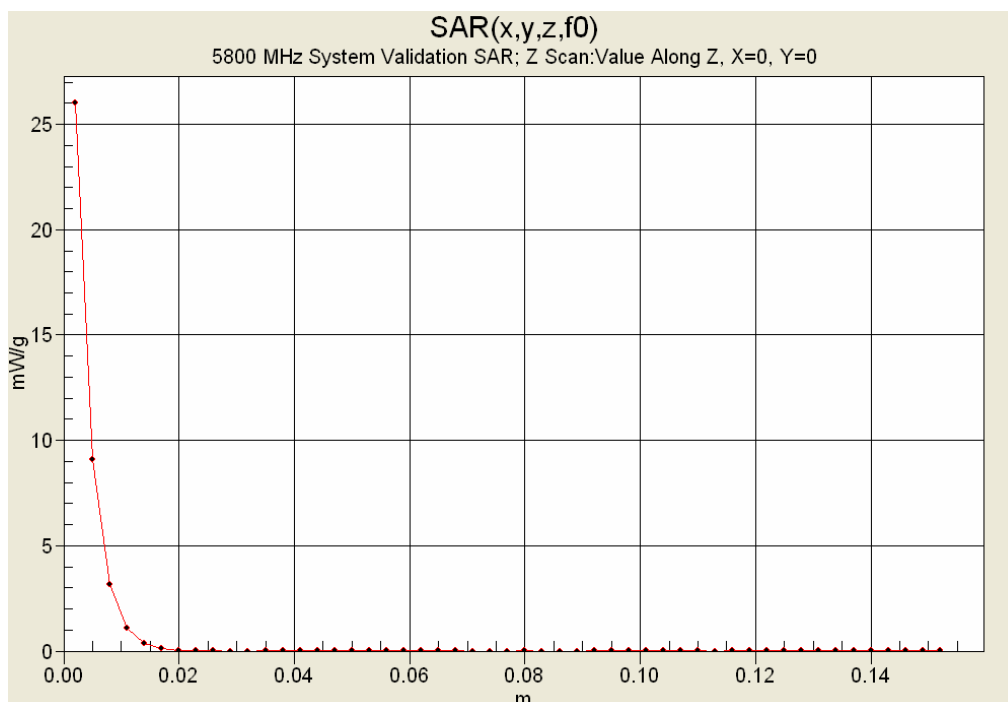
Peak SAR (extrapolated) = 82.4 W/kg

**SAR(1 g) = 17.0 mW/g; SAR(10 g) = 4.65 mW/g**

Maximum value of SAR (measured) = 32.4 mW/g







## 10. Measured Fluid Dielectric Parameters

### System Validation (Body) - 5800 MHz Dipole

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Celltech Labs Inc.

Test Result for UIM Dielectric Parameter

Tue 18/Jul/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
5.7000	48.34	5.88	46.39	6.00
5.7100	48.32	5.89	46.90	6.10
5.7200	48.31	5.91	46.87	6.09
5.7300	48.30	5.92	46.53	6.07
5.7400	48.28	5.93	46.63	6.11
5.7500	48.27	5.94	46.66	6.14
5.7600	48.25	5.95	46.47	6.20
5.7700	48.24	5.96	46.44	6.14
5.7800	48.23	5.98	46.15	6.13
5.7900	48.21	5.99	46.27	6.24
5.8000	48.20	6.00	46.35	6.25
5.8100	48.19	6.01	46.33	6.19
5.8200	48.17	6.02	46.13	6.27
5.8300	48.16	6.04	46.28	6.23
5.8400	48.15	6.05	46.02	6.23
5.8500	48.13	6.06	46.29	6.32
5.8600	48.12	6.07	46.02	6.31
5.8700	48.10	6.08	46.14	6.28
5.8800	48.09	6.09	46.42	6.30
5.8900	48.08	6.11	46.10	6.48
5.9000	48.06	6.12	46.32	6.39