

## APPENDIX B PLOTS OF THE SAR MEASUREMENTS

Plots of the measured SAR distributions inside the phantom are given in this Appendix for all tested configurations. The spatial peak SAR values were assessed with the procedure described in this report.

**Table: 2450 MHz DSSS Band SAR Measurement Plot Numbers**

Test Position	Plot No.	Ant	Bit rate Mode (Mbps)	Channel Bandwidth (MHz)	Test Channel	Test Freq (MHz)
Primary Portrait	1	A	1	-	06	2437

**Table: 2450 MHz OFDM Band SAR Measurement Plot Numbers**

Test Position	Plot No.	Ant A or B	Bit rate Mode (Mbps)	Channel Bandwidth (MHz)	Test Channel	Test Freq (MHz)
Primary Portrait	2	A	HT0	20	06	2437
	3	A	HT0	40	06	2437
Primary Portrait	4	A	6	-	06	2437
Secondary Portrait	5	B	6	-	01	2412
	6				06	2437
	7				11	2462
Secondary Landscape	8	A	6	-	06	2437
	9	B	6	-	06	2437
Tablet	10	A	6	-	06	2437

**Table: 2450MHz Validation Plot**

Plot 11	Validation 2450 MHz 24 <sup>th</sup> Feb 2010
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**Test Date: 24 February 2010**

File Name: M100214 Primary Portrait DSSS 2.4 GHz Antenna A (1) 24-02-10.da4

**DUT: Fujitsu Tablet Curlin with PP 11abgn; Type: 622ANHMW; Serial: MAC: 0015005BE890**

\* Communication System: DSSS 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

\* Medium parameters used:  $f = 2438$  MHz;  $\sigma = 2$  mho/m;  $\epsilon_r = 50.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1380; ConvF(4.11, 4.11, 4.11)

- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

**Channel 6 Test/Area Scan (51x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.234 mW/g

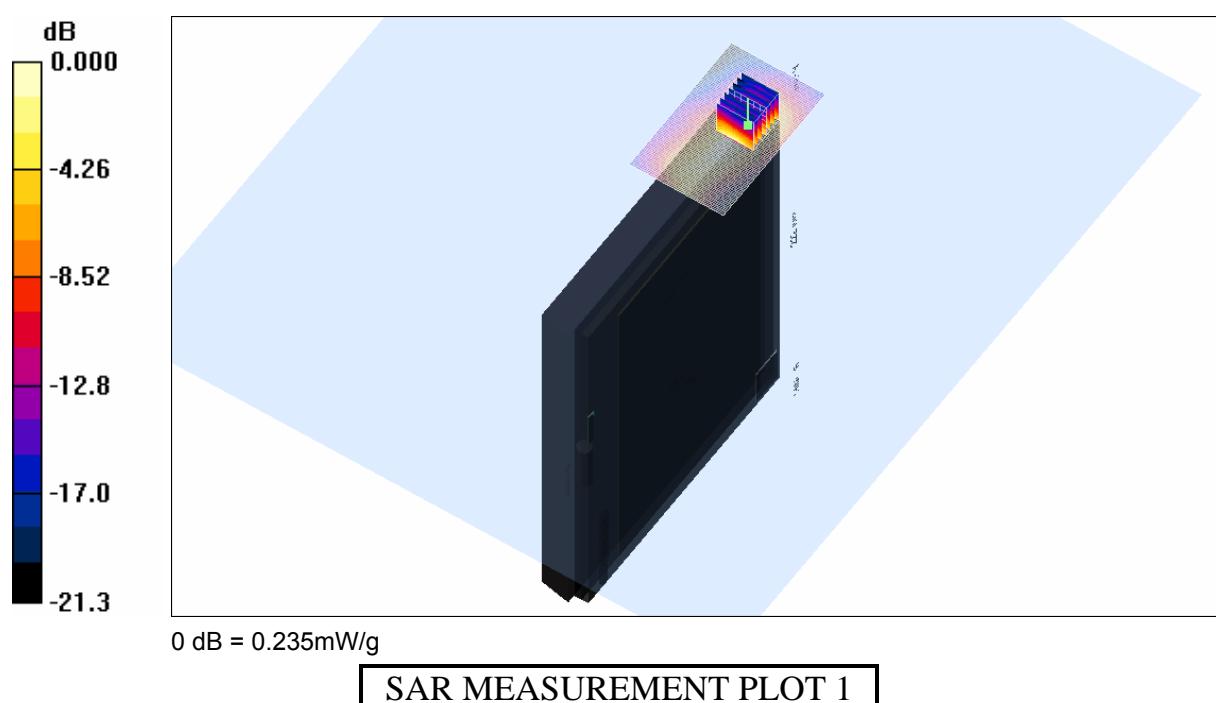
**Channel 6 Test/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.74 V/m; Power Drift = 0.055 dB

Peak SAR (extrapolated) = 0.528 W/kg

**SAR(1 g) = 0.204 mW/g; SAR(10 g) = 0.096 mW/g**

Maximum value of SAR (measured) = 0.235 mW/g



**Ambient Temperature**

**20.3 Degrees Celsius**

**Liquid Temperature**

**20.0 Degrees Celsius**

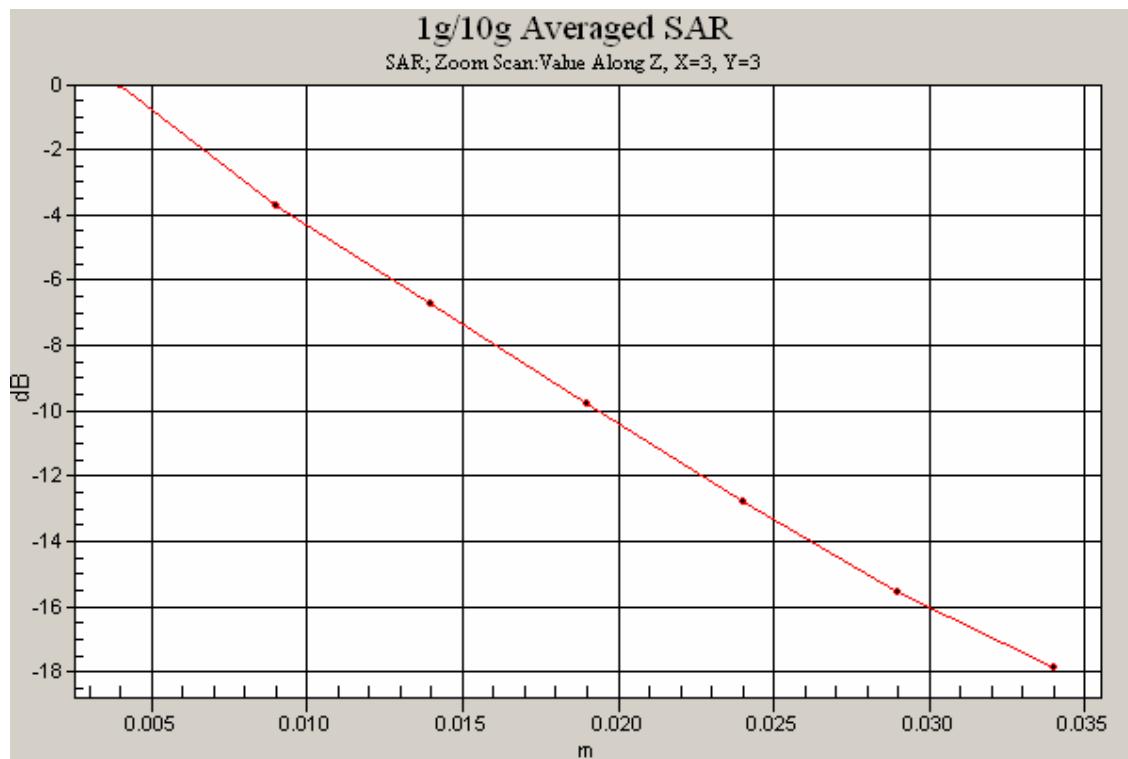
**Humidity**

**53.0 %**



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**Test Date: 24 February 2010**

File Name: M100214 Primary Portrait MCS0-20MHz 2.4 GHz Antenna A (1) 24-02-10.da4

**DUT: Fujitsu Tablet Curlin with PP 11abgn; Type: 622ANHMW; Serial: MAC: 0015005BE890**

\* Communication System: OFDM 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

\* Medium parameters used:  $f = 2438$  MHz;  $\sigma = 2$  mho/m;  $\epsilon_r = 50.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1380; ConvF(4.11, 4.11, 4.11)

- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

**Channel 6 Test/Area Scan (51x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.256 mW/g

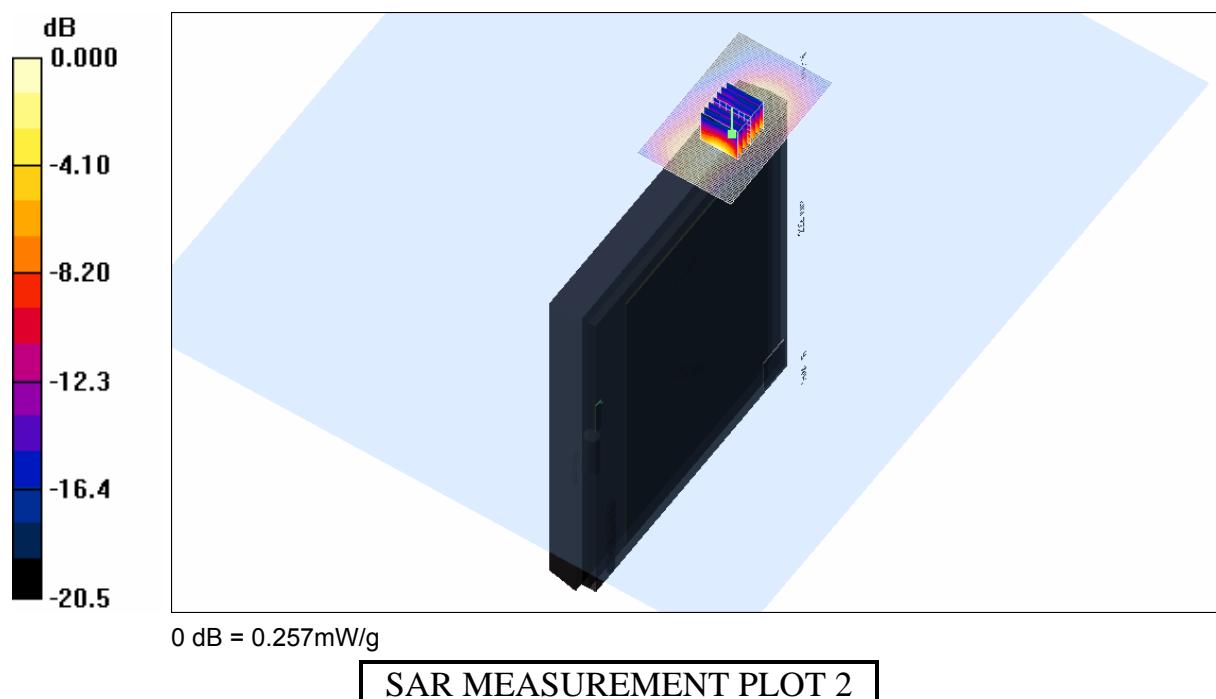
**Channel 6 Test/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.28 V/m; Power Drift = -0.048 dB

Peak SAR (extrapolated) = 0.549 W/kg

**SAR(1 g) = 0.226 mW/g; SAR(10 g) = 0.108 mW/g**

Maximum value of SAR (measured) = 0.257 mW/g



**Ambient Temperature**

**20.3 Degrees Celsius**

**Liquid Temperature**

**20.0 Degrees Celsius**

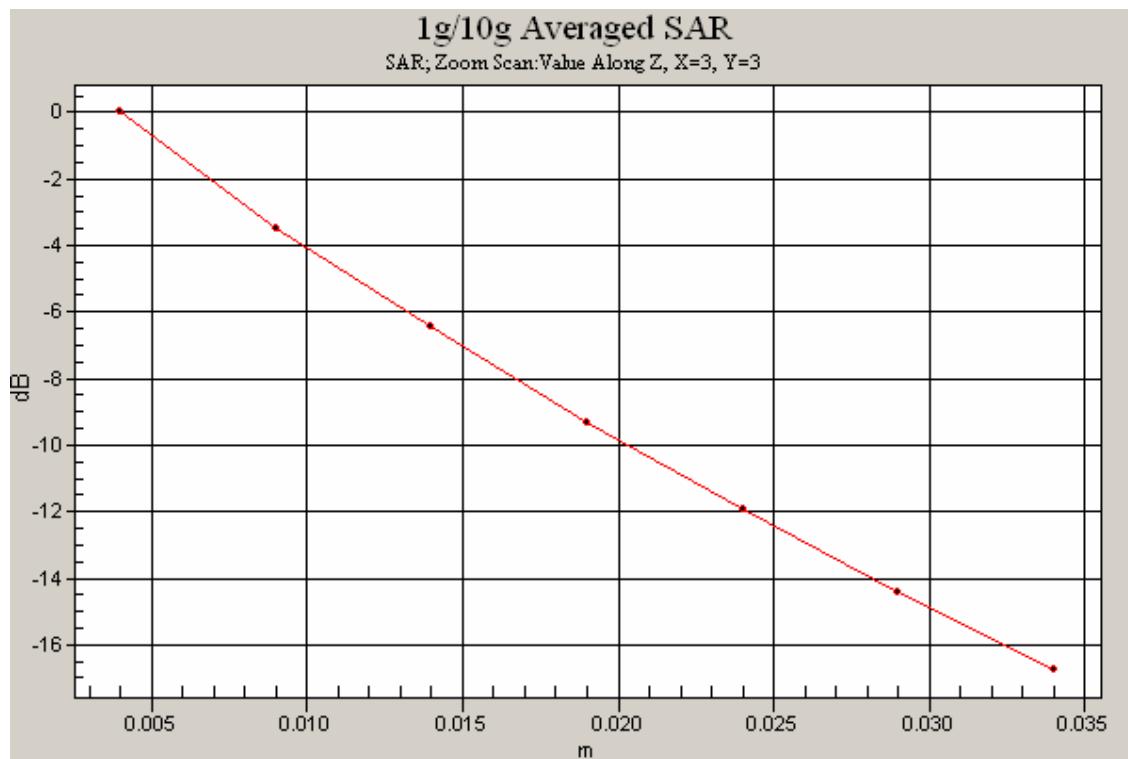
**Humidity**

**53.0 %**



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**Test Date: 24 February 2010**

File Name: M100214 Primary Portrait MCS0-40MHz 2.4 GHz Antenna A (1) 24-02-10.da4

**DUT: Fujitsu Tablet Curlin with PP 11abgn; Type: 622ANHMW; Serial: MAC: 0015005BE890**

\* Communication System: OFDM 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

\* Medium parameters used:  $f = 2438$  MHz;  $\sigma = 2$  mho/m;  $\epsilon_r = 50.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1380; ConvF(4.11, 4.11, 4.11)

- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

**Channel 6 Test/Area Scan (51x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.256 mW/g

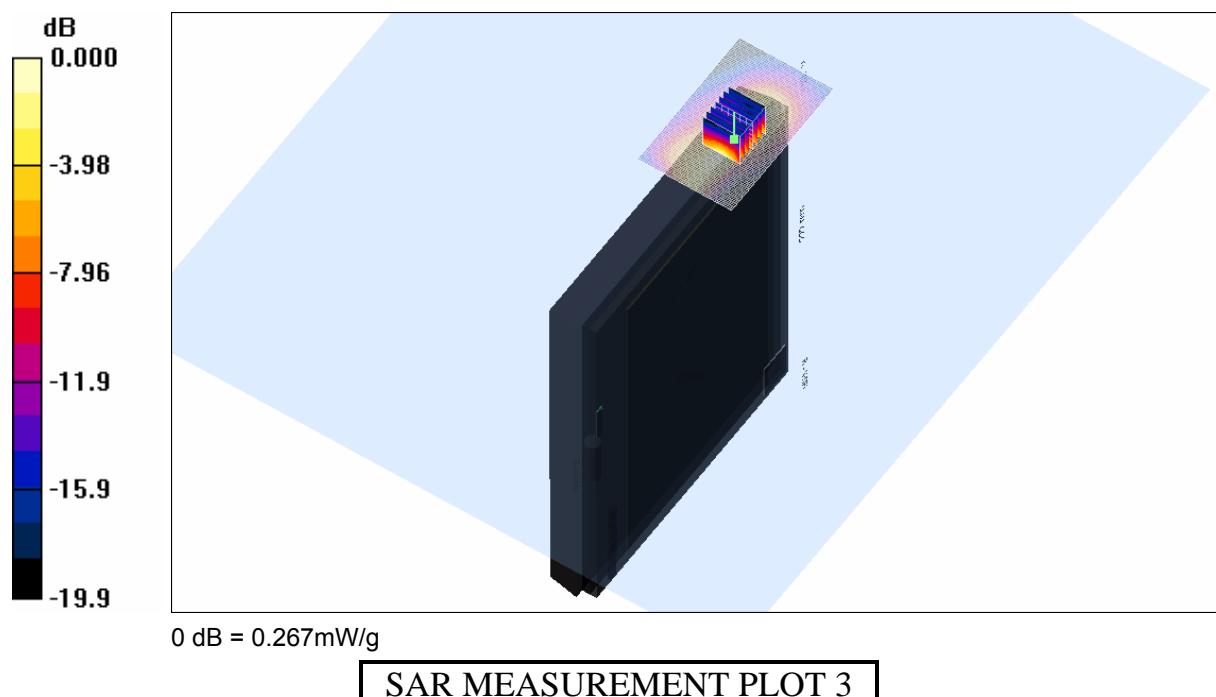
**Channel 6 Test/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.35 V/m; Power Drift = -0.093 dB

Peak SAR (extrapolated) = 0.574 W/kg

**SAR(1 g) = 0.234 mW/g; SAR(10 g) = 0.110 mW/g**

Maximum value of SAR (measured) = 0.267 mW/g



**Ambient Temperature**

**20.3 Degrees Celsius**

**Liquid Temperature**

**20.0 Degrees Celsius**

**Humidity**

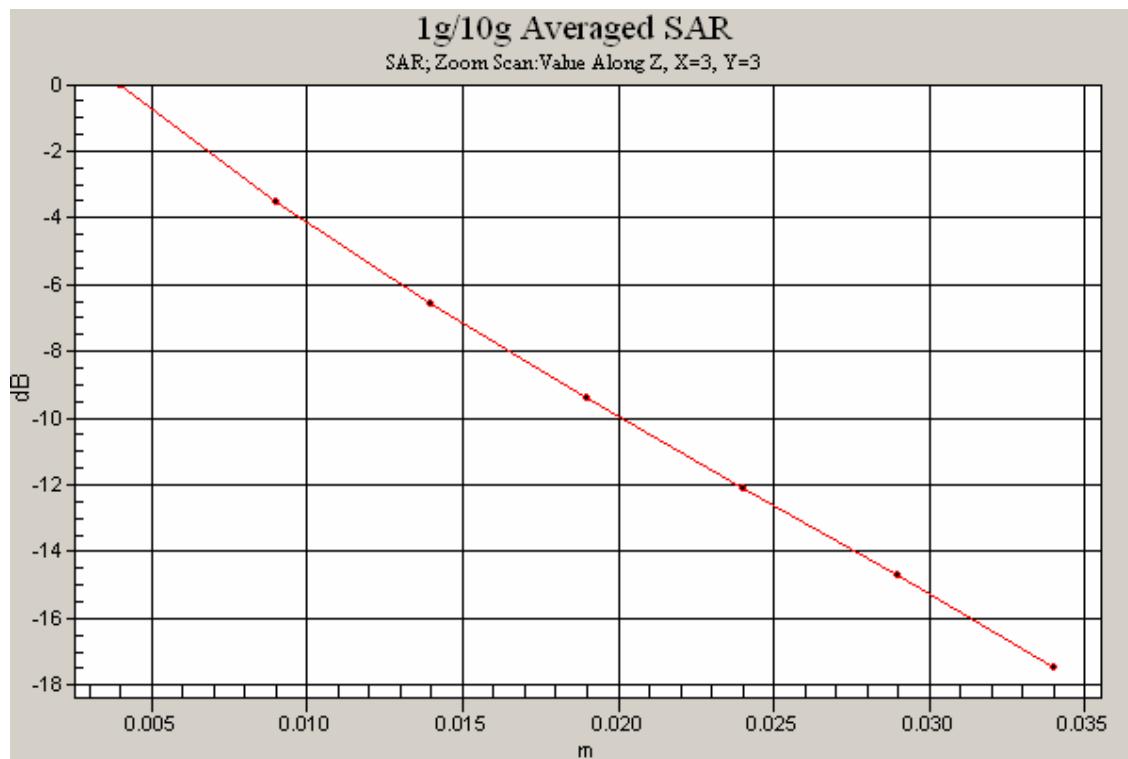
**53.0 %**



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**Test Date: 24 February 2010**

File Name: M100214 Primary Portrait OFDM 2.4 GHz Antenna A (1) 24-02-10.da4

**DUT: Fujitsu Tablet Curlin with PP 11abgn; Type: 622ANHMW; Serial: MAC: 0015005BE890**

\* Communication System: OFDM 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

\* Medium parameters used:  $f = 2438$  MHz;  $\sigma = 2$  mho/m;  $\epsilon_r = 50.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1380; ConvF(4.11, 4.11, 4.11)

- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

**Channel 6 Test/Area Scan (51x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.267 mW/g

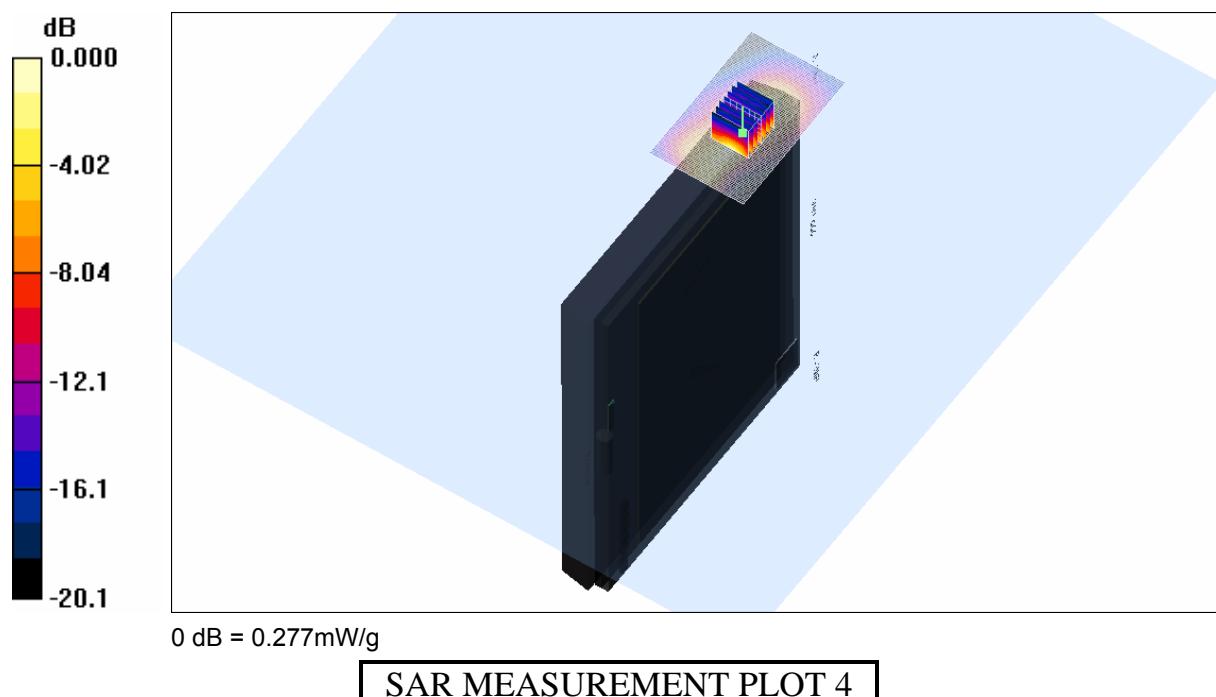
**Channel 6 Test/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.55 V/m; Power Drift = -0.148 dB

Peak SAR (extrapolated) = 0.588 W/kg

**SAR(1 g) = 0.239 mW/g; SAR(10 g) = 0.113 mW/g**

Maximum value of SAR (measured) = 0.277 mW/g



**Ambient Temperature**

**20.3 Degrees Celsius**

**Liquid Temperature**

**20.0 Degrees Celsius**

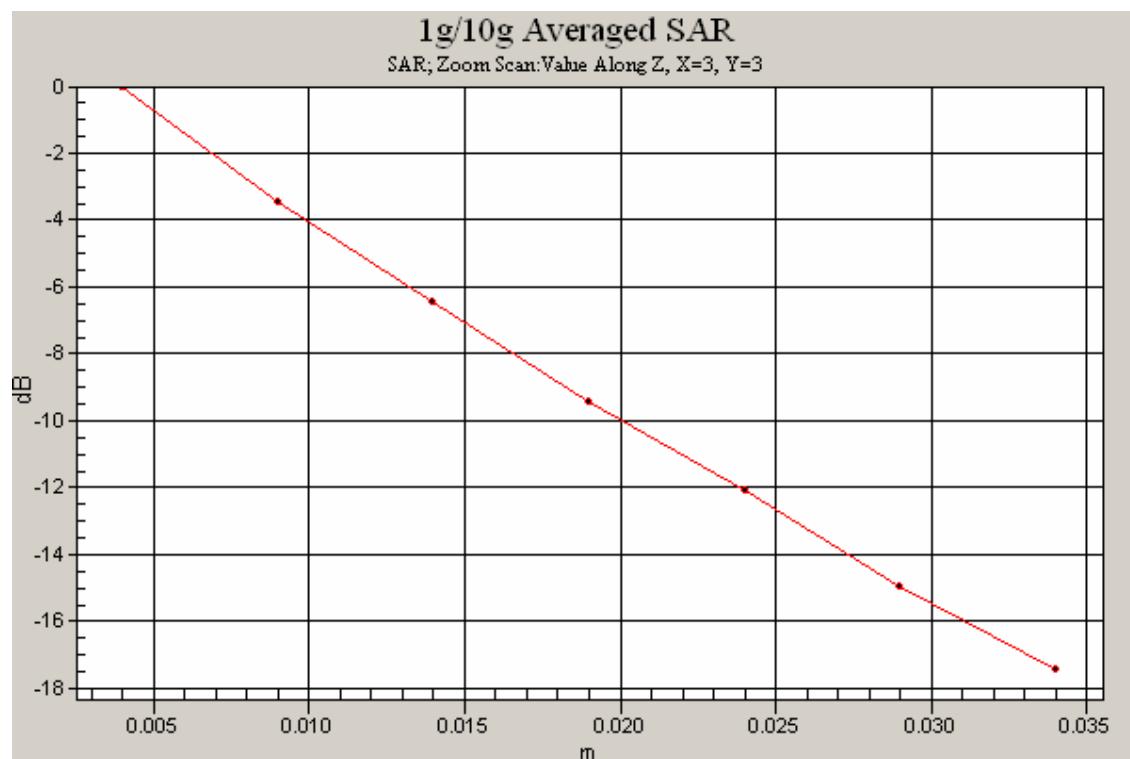
**Humidity**

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**Test Date: 24 February 2010**

File Name: M100214 Secondary Portrait OFDM 2.4 GHz Antenna B (2) 24-02-10.da4

**DUT: Fujitsu Tablet Curlin with PP 11abgn; Type: 622ANHMW; Serial: MAC: 0015005BE890**

\* Communication System: OFDM 2450 MHz; Frequency: 2412 MHz; Duty Cycle: 1:1

\* Medium parameters used:  $f = 2410$  MHz;  $\sigma = 1.96$  mho/m;  $\epsilon_r = 51$ ;  $\rho = 1000$  kg/m<sup>3</sup>

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1380; ConvF(4.11, 4.11, 4.11)

- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

**Channel 1 Test/Area Scan (51x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.903 mW/g

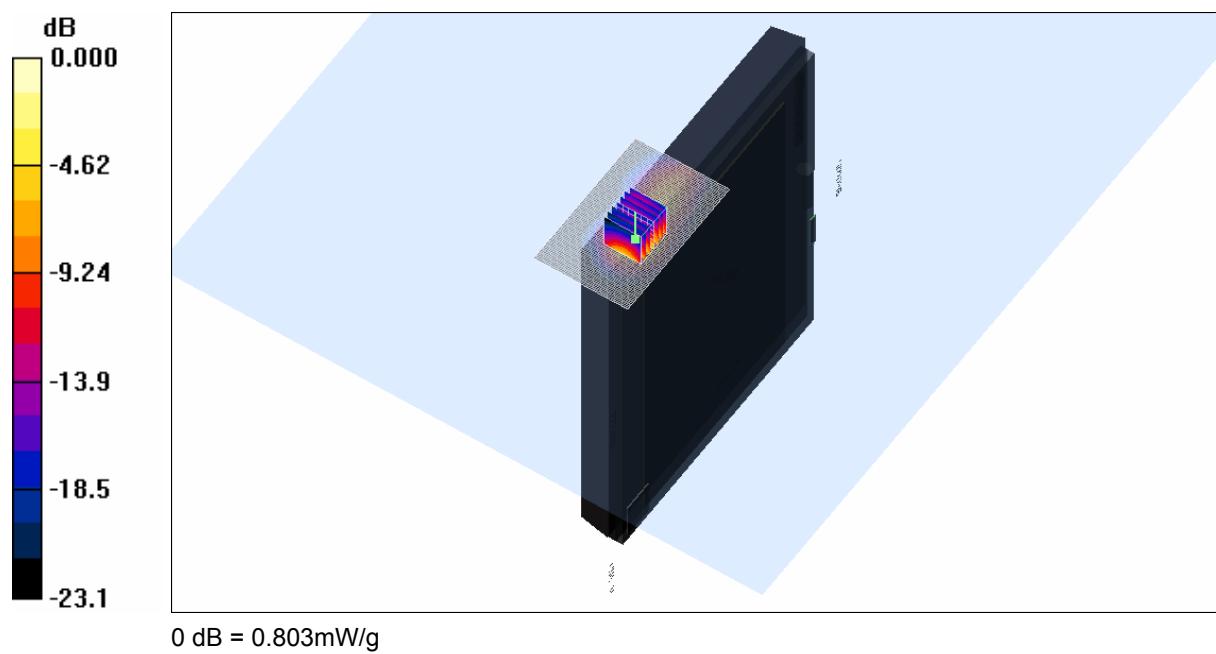
**Channel 1 Test/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.1 V/m; Power Drift = -0.095 dB

Peak SAR (extrapolated) = 2.02 W/kg

**SAR(1 g) = 0.742 mW/g; SAR(10 g) = 0.336 mW/g**

Maximum value of SAR (measured) = 0.803 mW/g



**Ambient Temperature**

**20.3 Degrees Celsius**

**Liquid Temperature**

**20.0 Degrees Celsius**

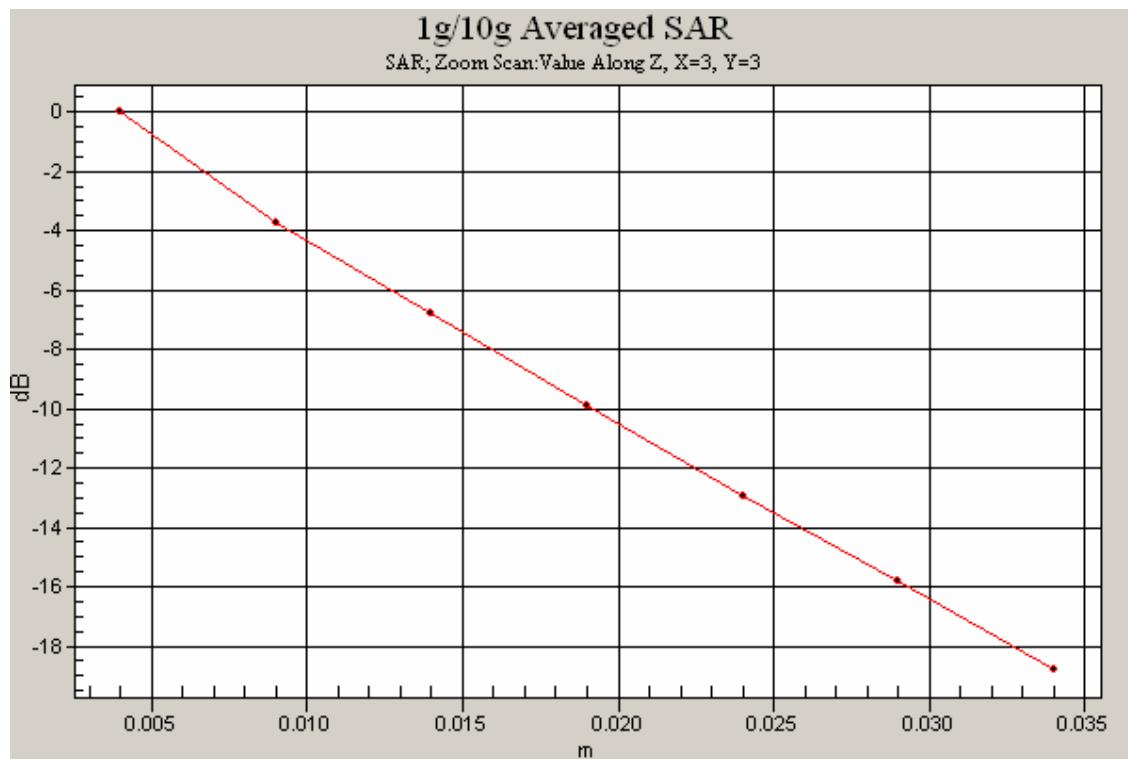
**Humidity**

**53.0 %**



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**Test Date: 24 February 2010**

File Name: M100214 Secondary Portrait OFDM 2.4 GHz Antenna B (2) 24-02-10.da4

**DUT: Fujitsu Tablet Curlin with PP 11abgn; Type: 622ANHMW; Serial: MAC: 0015005BE890**

\* Communication System: OFDM 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

\* Medium parameters used:  $f = 2438$  MHz;  $\sigma = 2$  mho/m;  $\epsilon_r = 50.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1380; ConvF(4.11, 4.11, 4.11)

- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

**Channel 6 Test/Area Scan (51x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.10 mW/g

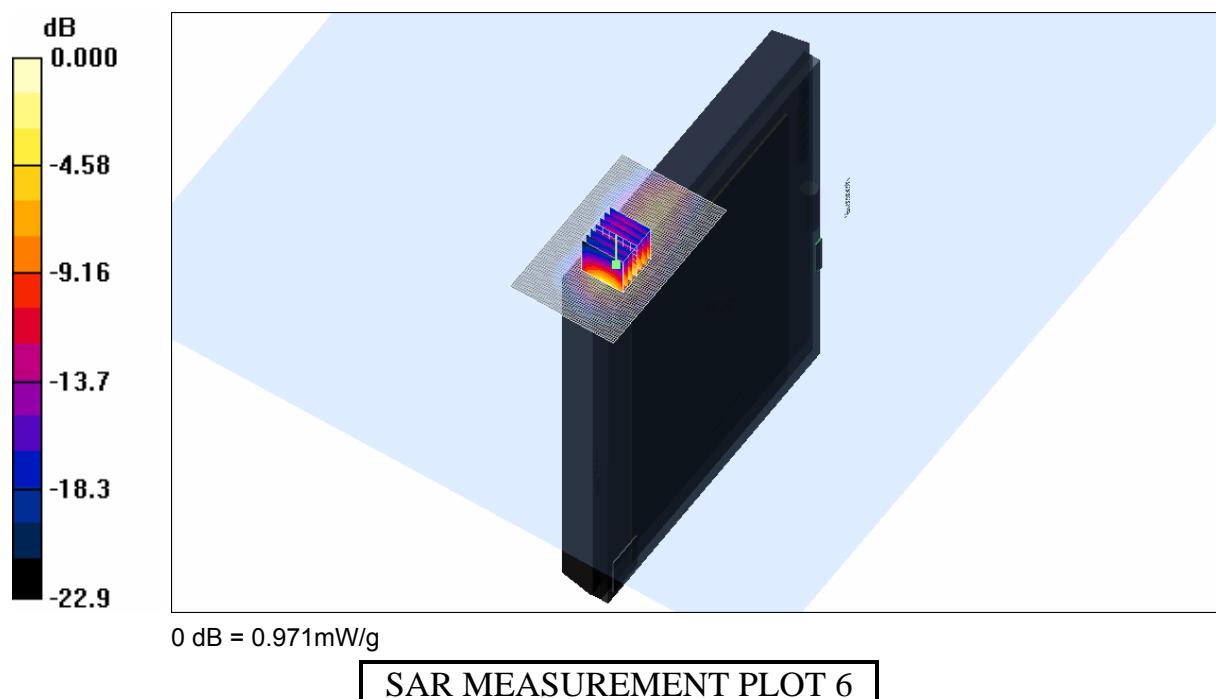
**Channel 6 Test/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 17.4 V/m; Power Drift = -0.075 dB

Peak SAR (extrapolated) = 2.47 W/kg

**SAR(1 g) = 0.912 mW/g; SAR(10 g) = 0.417 mW/g**

Maximum value of SAR (measured) = 0.971 mW/g



Ambient Temperature

**20.3 Degrees Celsius**

Liquid Temperature

**20.0 Degrees Celsius**

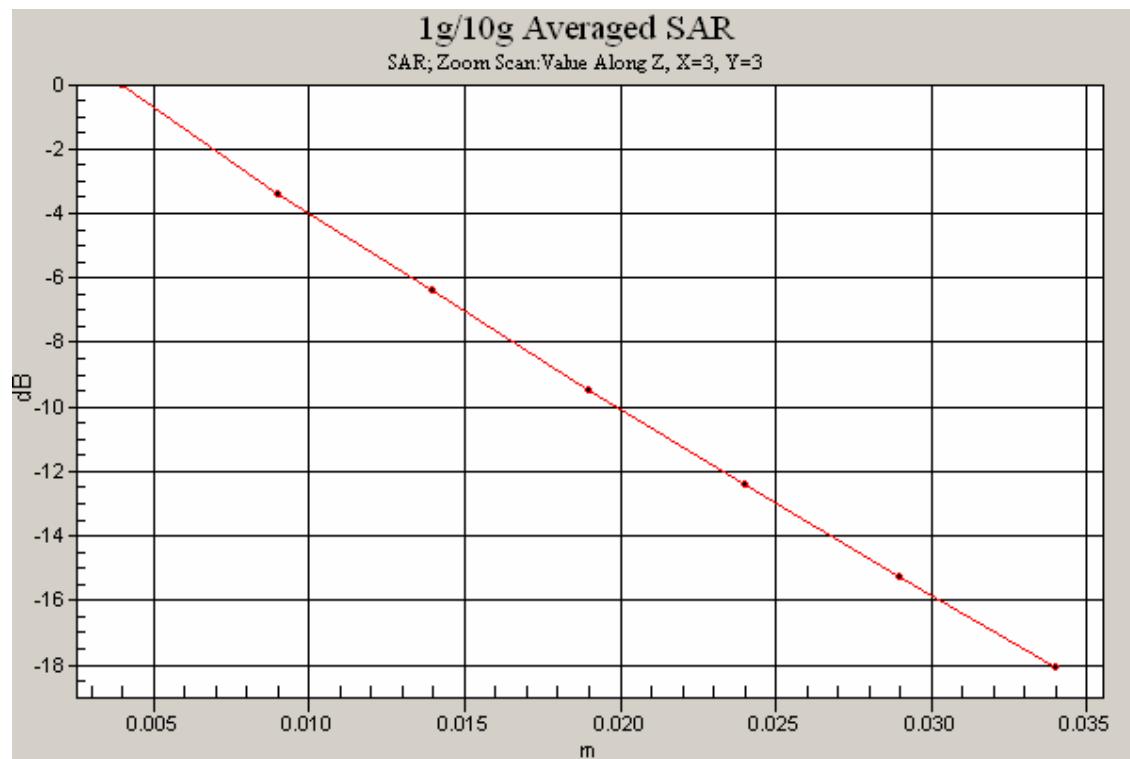
Humidity

**53.0 %**



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**Test Date: 24 February 2010**

File Name: M100214 Secondary Portrait OFDM 2.4 GHz Antenna B (2) 24-02-10.da4

**DUT: Fujitsu Tablet Curlin with PP 11abgn; Type: 622ANHMW; Serial: MAC: 0015005BE890**

\* Communication System: OFDM 2450 MHz; Frequency: 2462 MHz; Duty Cycle: 1:1

\* Medium parameters used:  $f = 2462$  MHz;  $\sigma = 2.03$  mho/m;  $\epsilon_r = 50.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1380; ConvF(4.11, 4.11, 4.11)

- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

**Channel 11 Test/Area Scan (51x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.751 mW/g

**Channel 11 Test/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm,

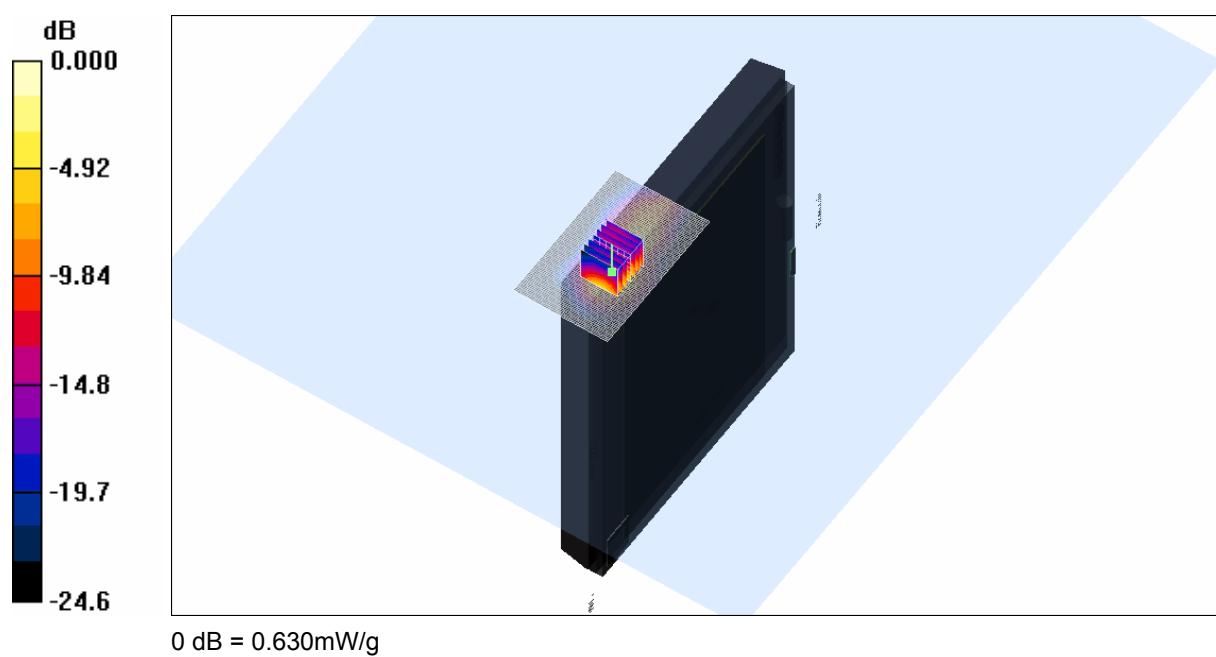
dz=5mm

Reference Value = 12.8 V/m; Power Drift = -0.376 dB

Peak SAR (extrapolated) = 1.60 W/kg

**SAR(1 g) = 0.582 mW/g; SAR(10 g) = 0.262 mW/g**

Maximum value of SAR (measured) = 0.630 mW/g



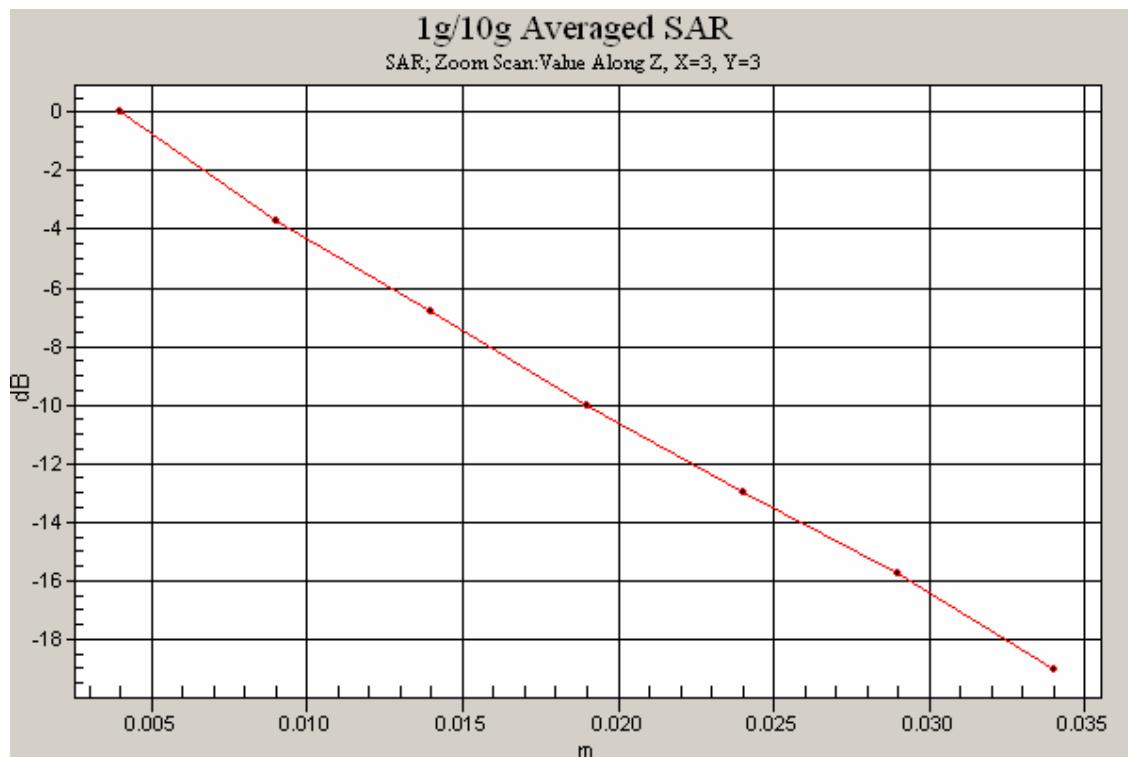
Ambient Temperature  
Liquid Temperature  
Humidity

20.3 Degrees Celsius  
20.0 Degrees Celsius  
53.0 %



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**Test Date: 24 February 2010**

File Name: M100214 Secondary Landscape OFDM 2.4 GHz Antenna A (1) 24-02-10.da4

**DUT: Fujitsu Tablet Curlin with PP 11abgn; Type: 622ANHMW; Serial: MAC: 0015005BE890**

\* Communication System: OFDM 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

\* Medium parameters used:  $f = 2438$  MHz;  $\sigma = 2$  mho/m;  $\epsilon_r = 50.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1380; ConvF(4.11, 4.11, 4.11)

- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

**Channel 6 Test/Area Scan (51x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.164 mW/g

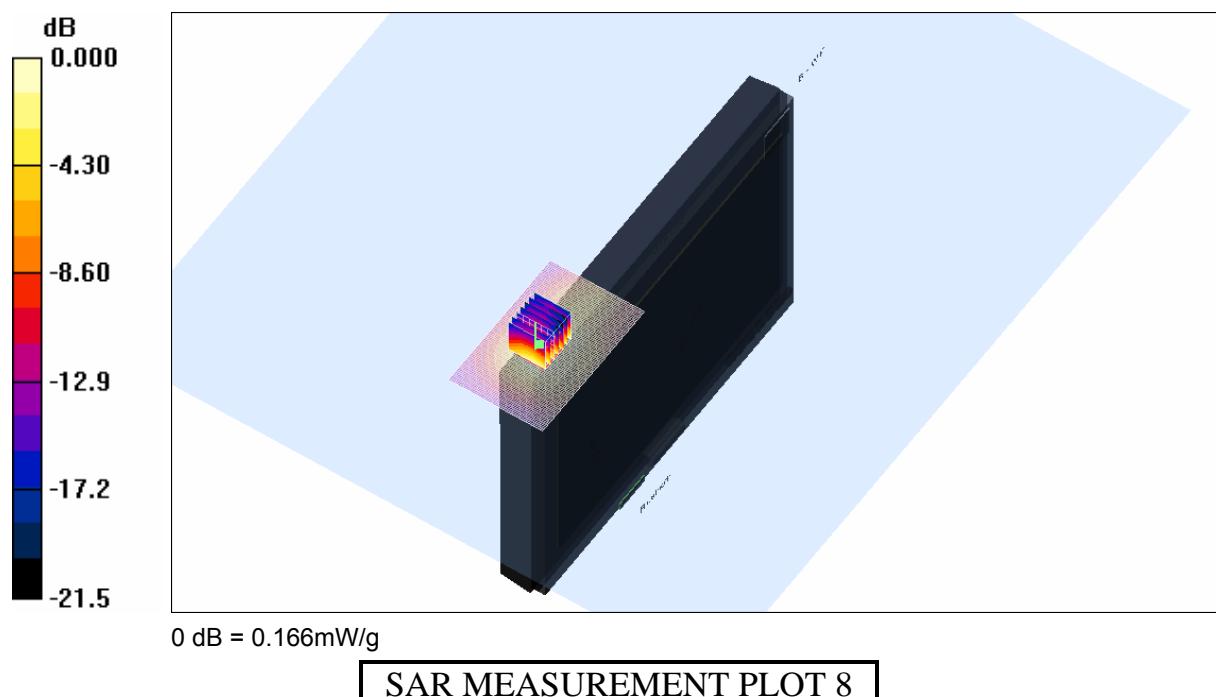
**Channel 6 Test/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.34 V/m; Power Drift = -0.267 dB

Peak SAR (extrapolated) = 0.329 W/kg

**SAR(1 g) = 0.157 mW/g; SAR(10 g) = 0.081 mW/g**

Maximum value of SAR (measured) = 0.166 mW/g



**Ambient Temperature**

**20.3 Degrees Celsius**

**Liquid Temperature**

**20.0 Degrees Celsius**

**Humidity**

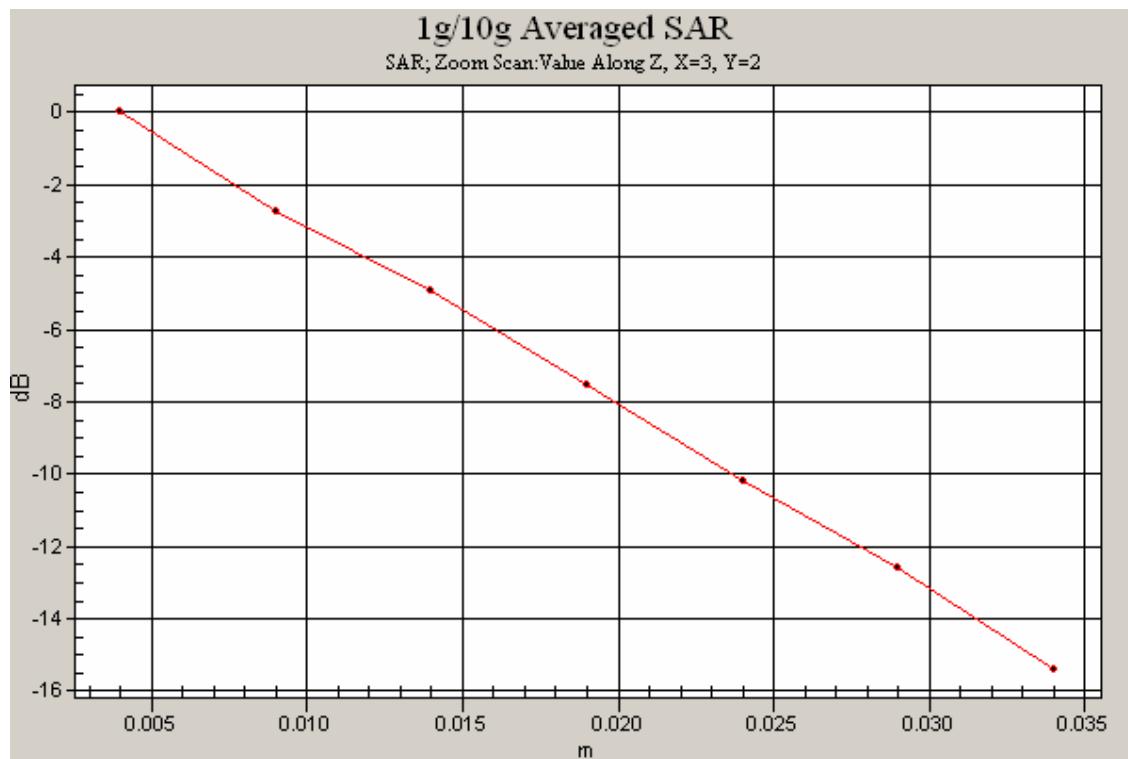
**53.0 %**



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**Test Date: 24 February 2010**

File Name: M100214 Secondary Landscape OFDM 2.4 GHz Antenna B (2) 24-02-10.da4

**DUT: Fujitsu Tablet Curlin with PP 11abgn; Type: 622ANHMW; Serial: MAC: 0015005BE890**

\* Communication System: OFDM 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

\* Medium parameters used:  $f = 2438$  MHz;  $\sigma = 2$  mho/m;  $\epsilon_r = 50.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1380; ConvF(4.11, 4.11, 4.11)

- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

**Channel 6 Test/Area Scan (51x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.126 mW/g

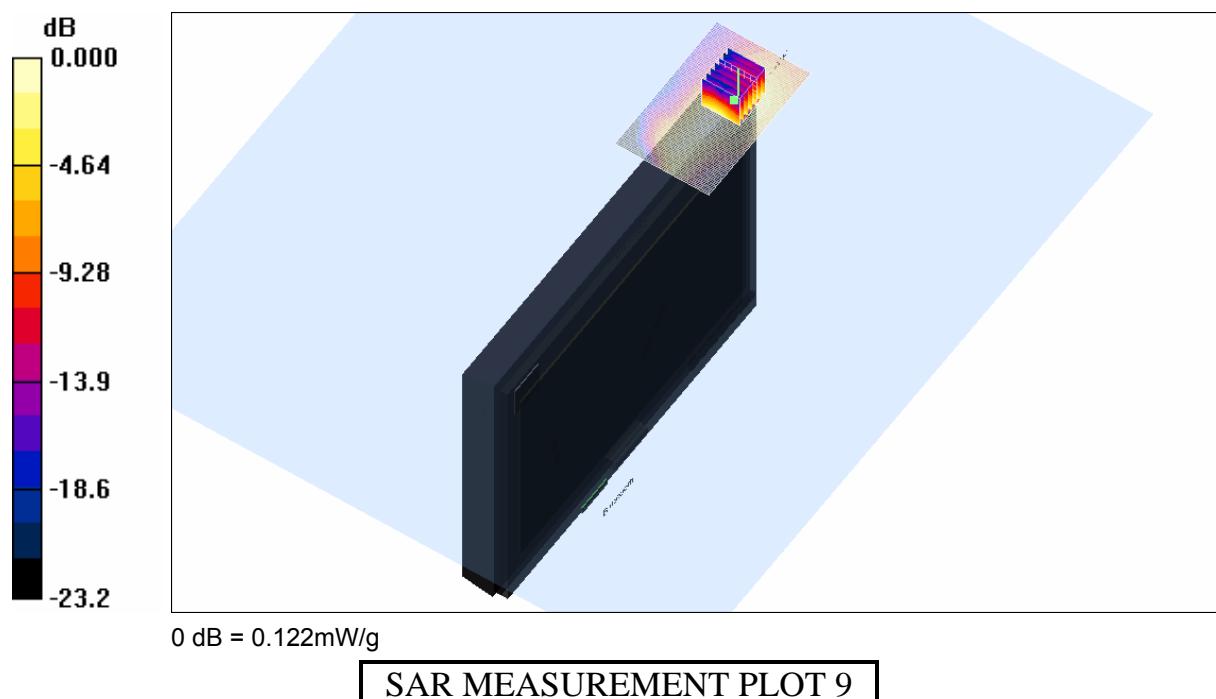
**Channel 6 Test/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.54 V/m; Power Drift = 0.049 dB

Peak SAR (extrapolated) = 0.233 W/kg

**SAR(1 g) = 0.110 mW/g; SAR(10 g) = 0.055 mW/g**

Maximum value of SAR (measured) = 0.122 mW/g



**Ambient Temperature**

**20.3 Degrees Celsius**

**Liquid Temperature**

**20.0 Degrees Celsius**

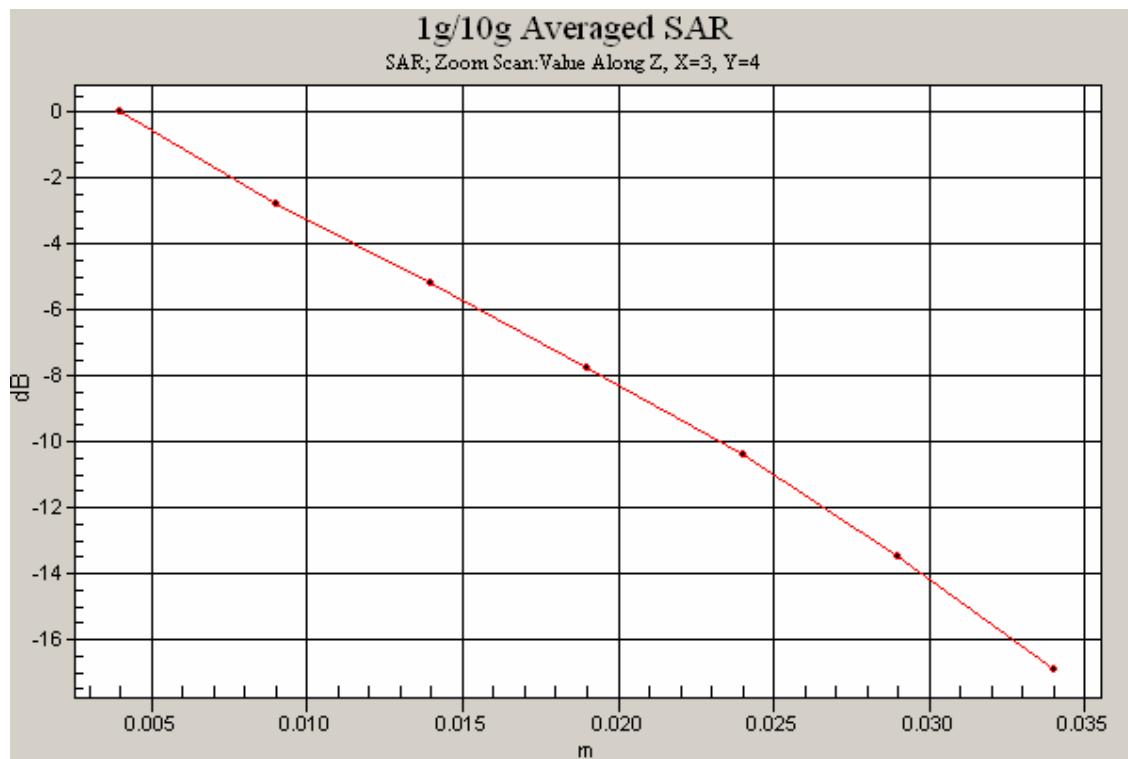
**Humidity**

**53.0 %**



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**Test Date: 24 February 2010**

File Name: M100214 Tablet OFDM 2.4 GHz Antenna A (1) 24-02-10.da4

**DUT: Fujitsu Tablet Curlin with PP 11abgn; Type: 622ANHMW; Serial: MAC: 0015005BE890**

\* Communication System: OFDM 2450 MHz; Frequency: 2437 MHz; Duty Cycle: 1:1

\* Medium parameters used:  $f = 2438$  MHz;  $\sigma = 2$  mho/m;  $\epsilon_r = 50.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1380; ConvF(4.11, 4.11, 4.11)

- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

**Channel 6 Test/Area Scan (51x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.091 mW/g

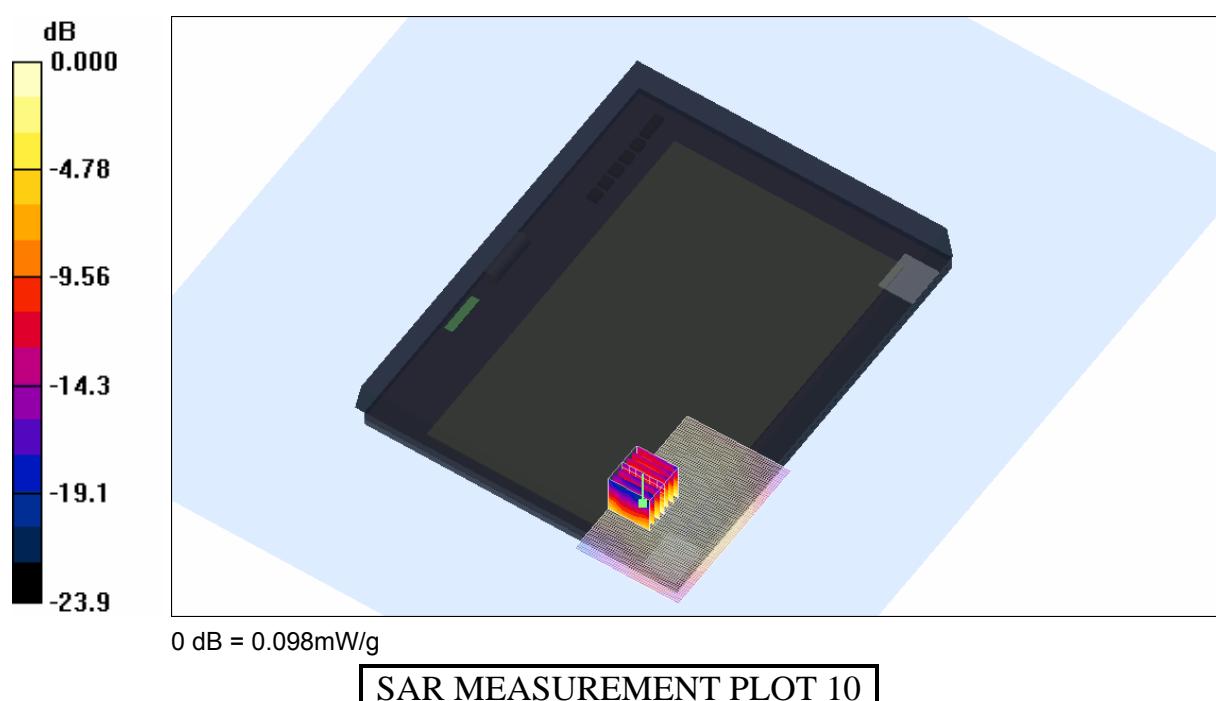
**Channel 6 Test/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.81 V/m; Power Drift = -0.031 dB

Peak SAR (extrapolated) = 0.178 W/kg

**SAR(1 g) = 0.090 mW/g; SAR(10 g) = 0.050 mW/g**

Maximum value of SAR (measured) = 0.098 mW/g



**Ambient Temperature**

**20.3 Degrees Celsius**

**Liquid Temperature**

**20.0 Degrees Celsius**

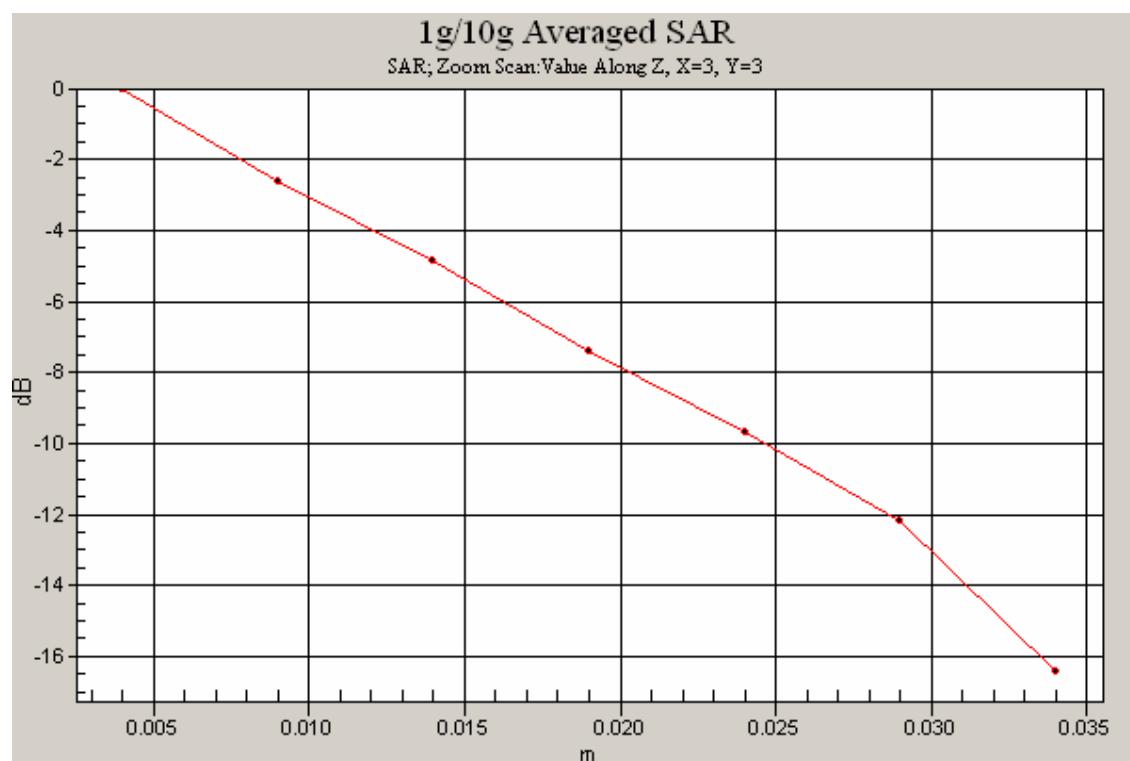
**Humidity**

**53.0 %**



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**Test Date: 24 February 2010**

File Name: Validation 2450 MHz (DAE442 Probe1380) 24-02-10.da4

**DUT: Dipole 2450 MHz; Type: DV2450V2; Serial: 724**

\* Communication System: CW 2450 MHz; Frequency: 2450 MHz; Duty Cycle: 1:1

\* Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.82$  mho/m;  $\epsilon_r = 38.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1380; ConvF(4.44, 4.44, 4.44)

- Phantom: SAM 22; Serial: 1260; Phantom section: Flat Section

**Channel 1 Test/Area Scan (51x51x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 17.3 mW/g

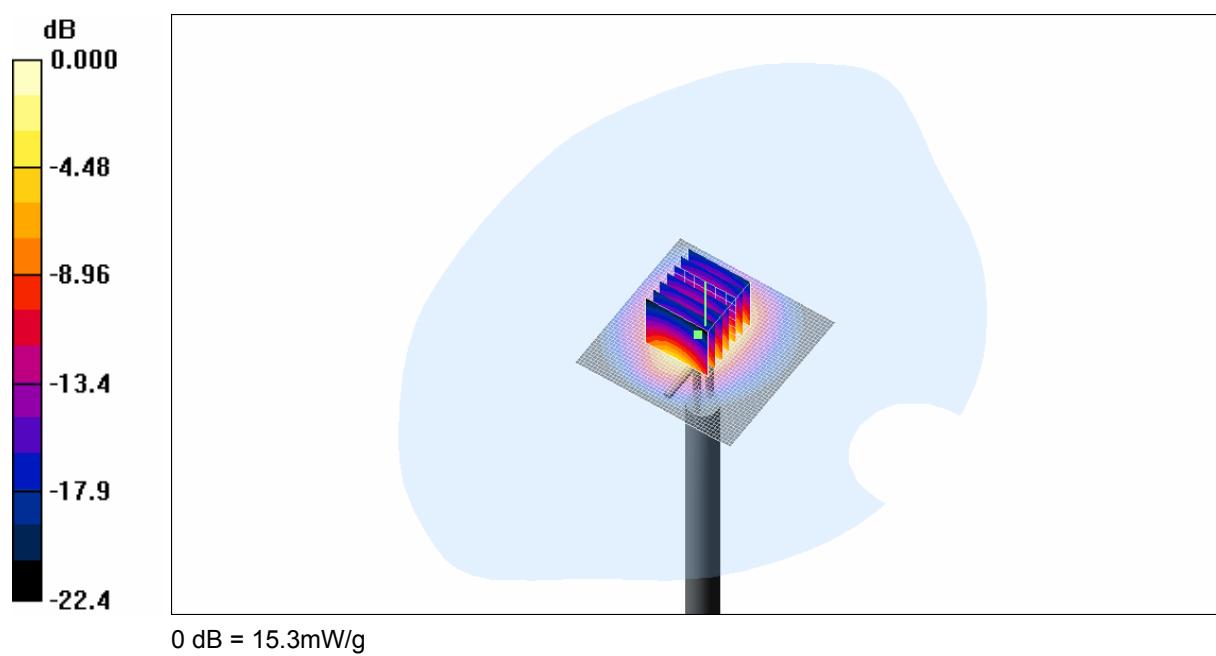
**Channel 1 Test/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.4 V/m; Power Drift = -0.056 dB

Peak SAR (extrapolated) = 29.6 W/kg

**SAR(1 g) = 13.6 mW/g; SAR(10 g) = 6.38 mW/g**

Maximum value of SAR (measured) = 15.3 mW/g



**Ambient Temperature**

**20.3 Degrees Celsius**

**Liquid Temperature**

**20.0 Degrees Celsius**

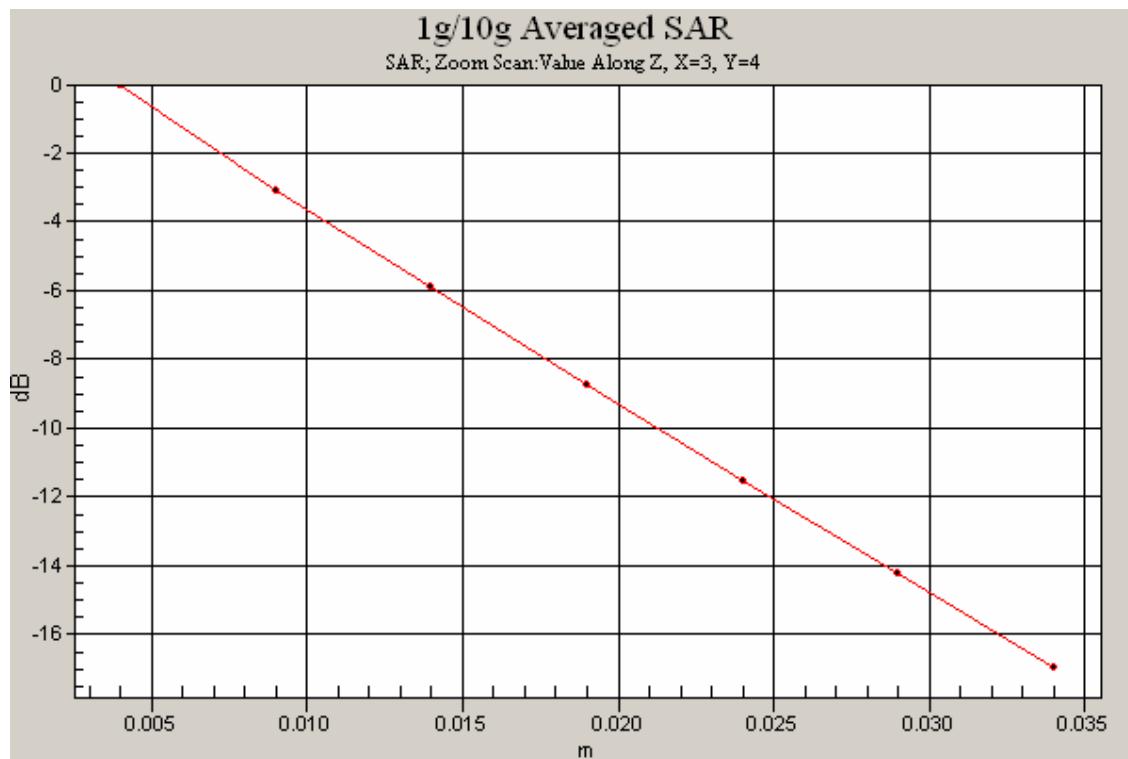
**Humidity**

**53.0 %**



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## APPENDIX C CALIBRATION DOCUMENTS

1. SN1380: ET3DV6 Probe Calibration Certificate
2. SN724: DV2450V2 Dipole Calibration Certificate

**Calibration Laboratory of**  
**Schmid & Partner**  
**Engineering AG**  
**Zeughausstrasse 43, 8004 Zurich, Switzerland**



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**C** Servizio svizzero di taratura  
**S** Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)  
 The Swiss Accreditation Service is one of the signatories to the EA  
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**Client **EMC Technologies**Certificate No: **ET3-1380\_Dec09**

## CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1380** *S-038-01*

Calibration procedure(s) **QA CAL-01.v6, QA CAL-12.v6, QA CAL-23.v3 and QA CAL-25.v2**  
 Calibration procedure for dosimetric E-field probes

Calibration date: **December 11, 2009** *11.12.09*

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe ES3DV2	SN: 3013	2-Jan-09 (No. ES3-3013_Jan09)	Jan-10
DAE4	SN: 660	29-Sep-09 (No. DAE4-660_Sep09)	Sep-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10

Calibrated by:	Name	Function	Signature
	Jeton Kastrati	Laboratory Technician	<i>J. Kastrati</i>

Approved by:	Name	Function	Signature
	Katja Pokovic	Technical Manager	<i>K. Pokovic</i>

Issued: December 11, 2009

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Certificate No: **ET3-1380\_Dec09**

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**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

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Accreditation No.: **SCS 108**

#### **Glossary:**

TS	tissue simulating liquid
NORM <sub>x,y,z</sub>	sensitivity in free space
ConvF	sensitivity in TSL / NORM <sub>x,y,z</sub>
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization $\varphi$	$\varphi$ rotation around probe axis
Polarization $\theta$	$\theta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\theta = 0$ is normal to probe axis

#### **Calibration is Performed According to the Following Standards:**

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

#### **Methods Applied and Interpretation of Parameters:**

- $NORM_{x,y,z}$ : Assessed for E-field polarization  $\theta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide).  $NORM_{x,y,z}$  are only intermediate values, i.e., the uncertainties of  $NORM_{x,y,z}$  does not effect the E<sup>2</sup>-field uncertainty inside TSL (see below *ConvF*).
- $NORM(f)x,y,z = NORM_{x,y,z} * frequency\_response$  (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- $DCPx,y,z$ : DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- $Ax,y,z; Bx,y,z; Cx,y,z$ ;  $VRx,y,z$ : A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters*: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to  $NORM_{x,y,z} * ConvF$  whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.



ET3DV6 SN:1380

December 11, 2009

# Probe ET3DV6

## SN:1380

Manufactured:	August 16, 1999
Last calibrated:	December 18, 2008
Recalibrated:	December 11, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

Certificate No: ET3-1380\_Dec09

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ET3DV6 SN:1380

December 11, 2009

**DASY - Parameters of Probe: ET3DV6 SN:1380****Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	1.68	1.63	1.73	$\pm 10.1\%$
DCP (mV) <sup>B</sup>	88.6	88.4	89.0	

**Modulation Calibration Parameters**

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc <sup>E</sup> (k=2)
10000	CW	0.00	X Y Z	0.00 0.00 0.00	0.00 0.00 0.00	1.00 1.00 1.00	300 300 300	$\pm 1.5\%$

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the E-field uncertainty inside TSL (see Pages 5 and 6).

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

<sup>E</sup> Uncertainty is determined using the maximum deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

ET3DV6 SN:1380

December 11, 2009

**DASY - Parameters of Probe: ET3DV6 SN:1380****Calibration Parameter Determined in Head Tissue Simulating Media**

f [MHz]	Validity [MHz] <sup>c</sup>	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
450	± 50 / ± 100	43.5 ± 5%	0.87 ± 5%	6.80	6.80	6.80	0.31	1.99 ± 13.3%
900	± 50 / ± 100	41.5 ± 5%	0.97 ± 5%	6.08	6.08	6.08	0.59	2.01 ± 11.0%
1640	± 50 / ± 100	40.3 ± 5%	1.29 ± 5%	5.33	5.33	5.33	0.54	2.66 ± 11.0%
1810	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	5.03	5.03	5.03	0.65	2.38 ± 11.0%
1950	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	4.79	4.79	4.79	0.85	2.02 ± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	4.44	4.44	4.44	0.99	1.70 ± 11.0%

<sup>c</sup> The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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ET3DV6 SN:1380

December 11, 2009

**DASY - Parameters of Probe: ET3DV6 SN:1380****Calibration Parameter Determined in Body Tissue Simulating Media**

f [MHz]	Validity [MHz] <sup>c</sup>	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
450	± 50 / ± 100	56.7 ± 5%	0.94 ± 5%	7.35	7.35	7.35	0.21	2.02 ± 13.3%
900	± 50 / ± 100	55.0 ± 5%	1.05 ± 5%	5.78	5.78	5.78	0.39	2.76 ± 11.0%
1810	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.64	4.64	4.64	0.80	2.47 ± 11.0%
1950	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.61	4.61	4.61	0.99	2.11 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	4.11	4.11	4.11	0.99	1.65 ± 11.0%

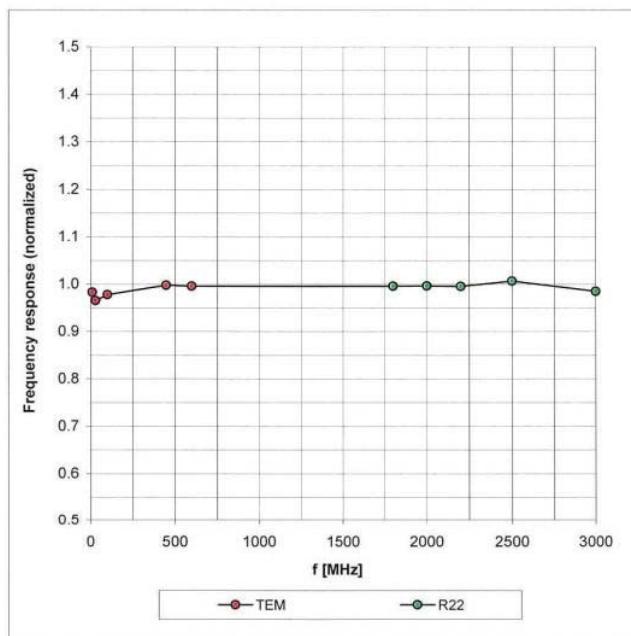
<sup>c</sup> The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

ET3DV6 SN:1380

December 11, 2009

## Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)

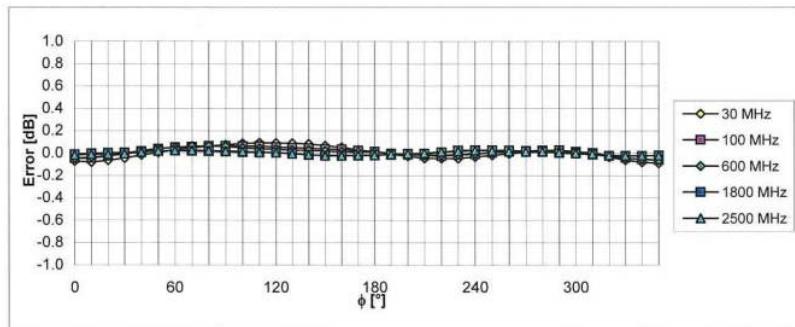
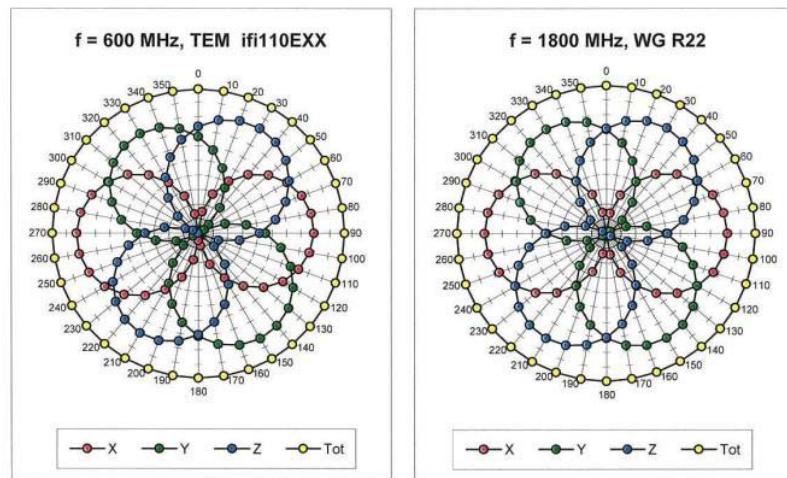
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

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December 11, 2009

**Receiving Pattern ( $\phi$ ),  $\theta = 0^\circ$** Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

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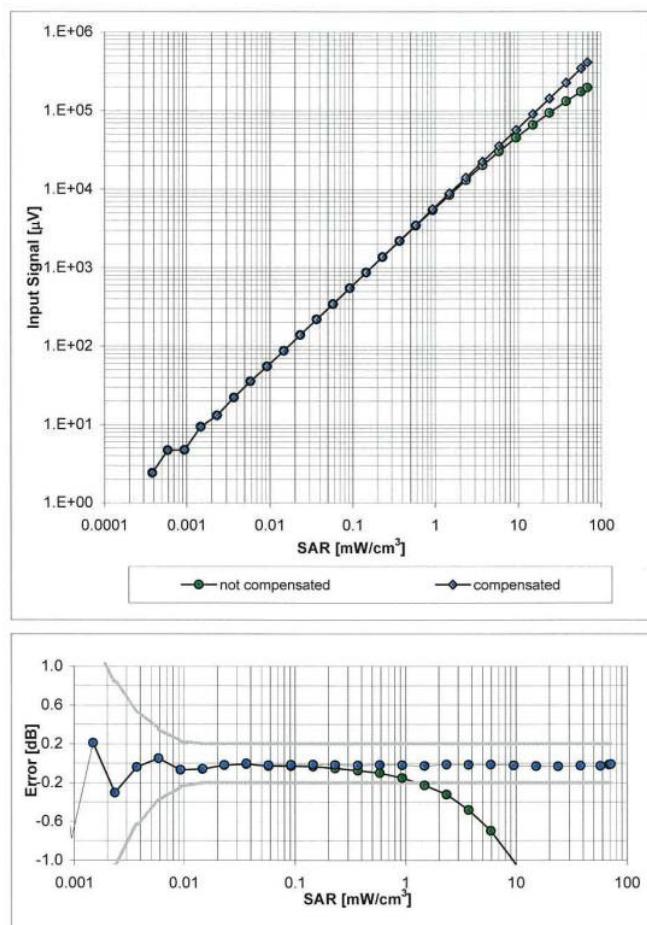
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ET3DV6 SN:1380

December 11, 2009

### Dynamic Range f(SAR<sub>head</sub>) (Waveguide R22, f = 1800 MHz)

Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

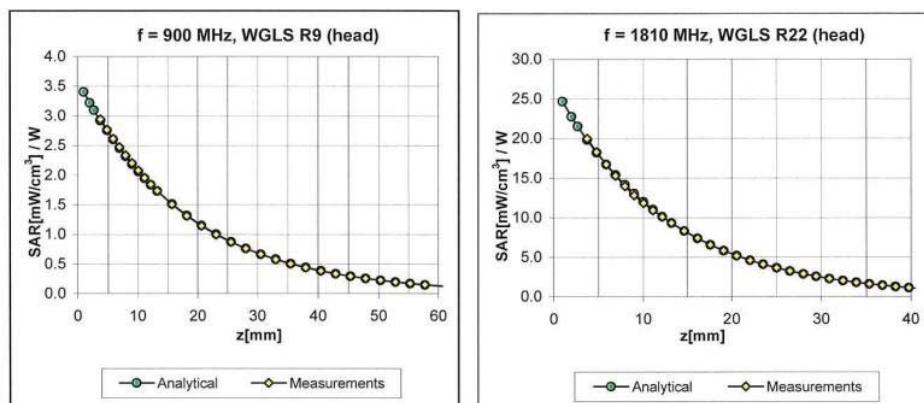
Certificate No: ET3-1380\_Dec09

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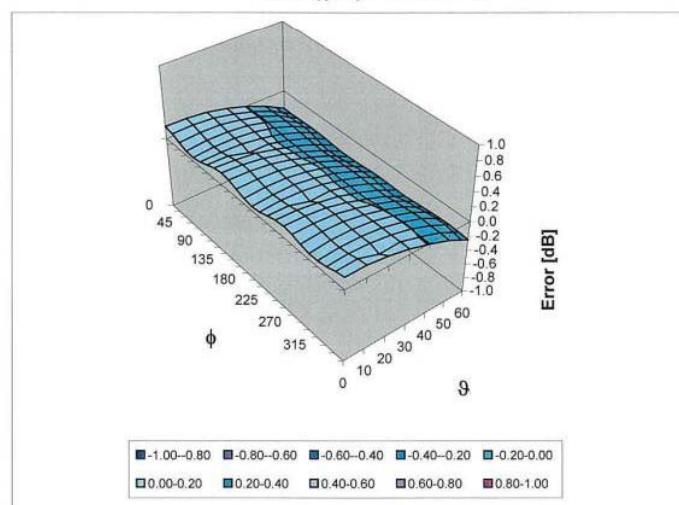
ET3DV6 SN:1380

December 11, 2009

### Conversion Factor Assessment



### Deviation from Isotropy in HSL

Error ( $\phi, \theta$ ),  $f = 900$  MHzUncertainty of Spherical Isotropy Assessment:  $\pm 2.6\%$  ( $k=2$ )

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ET3DV6 SN:1380

December 11, 2009

## Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	enabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	6.8 mm
Probe Tip to Sensor X Calibration Point	2.7 mm
Probe Tip to Sensor Y Calibration Point	2.7 mm
Probe Tip to Sensor Z Calibration Point	2.7 mm
Recommended Measurement Distance from Surface	4 mm

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Accreditation No.: **SCS 108**Client **EMC Technologies**Certificate No: **D2450V2-724\_Dec08**

## CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 724**
 Calibration procedure(s) **QA CAL-05.v7**  
 Calibration procedure for dipole validation kits
Calibration date: **December 10, 2008**Condition of the calibrated item **In Tolerance**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&amp;TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: S5086 (20g)	01-Jul-08 (No. 217-00864)	Jul-09
Type-N mismatch combination	SN: 5047.2 / 06327	01-Jul-08 (No. 217-00867)	Jul-09
Reference Probe ES3DV2	SN: 3025	28-Apr-08 (No. ES3-3025_Apr08)	Apr-09
DAE4	SN: 601	14-Mar-08 (No. DAE4-601_Mar08)	Mar-09

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

Calibrated by:	Name	Function	Signature
	Jeton Kastrati	Laboratory Technician	

Approved by:	Name	Function	Signature
	Katja Pokovic	Technical Manager	

Issued: December 10, 2008

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Certificate No: **D2450V2-724\_Dec08**

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#### **Glossary:**

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

#### **Calibration is Performed According to the Following Standards:**

- a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

#### **Additional Documentation:**

- d) DASY4/5 System Handbook

#### **Methods Applied and Interpretation of Parameters:**

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.



## Measurement Conditions

DASY system configuration, as far as not given on page 1.

<b>DASY Version</b>	DASY5	V5.0
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Modular Flat Phantom V5.0	
<b>Distance Dipole Center - TSL</b>	10 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	2450 MHz ± 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	39.2	1.80 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	37.9 ± 6 %	1.79 mho/m ± 6 %
<b>Head TSL temperature during test</b>	(22.0 ± 0.2) °C	----	----

## SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.2 mW / g
SAR normalized	normalized to 1W	52.8 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	52.0 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.17 mW / g
SAR normalized	normalized to 1W	24.7 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	24.4 mW / g ± 16.5 % (k=2)

<sup>1</sup> Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"



## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.8 $\Omega$ + 3.4 $j\Omega$
Return Loss	- 27.3 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.151 ns
----------------------------------	----------

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

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.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 16, 2002

**DASY5 Validation Report for Head TSL**

Date/Time: 10.12.2008 11:10:54

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN724**

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: HSL U10 BB

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.79$  mho/m;  $\epsilon_r = 37.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.4, 4.4, 4.4); Calibrated: 28.04.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 14.03.2008
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

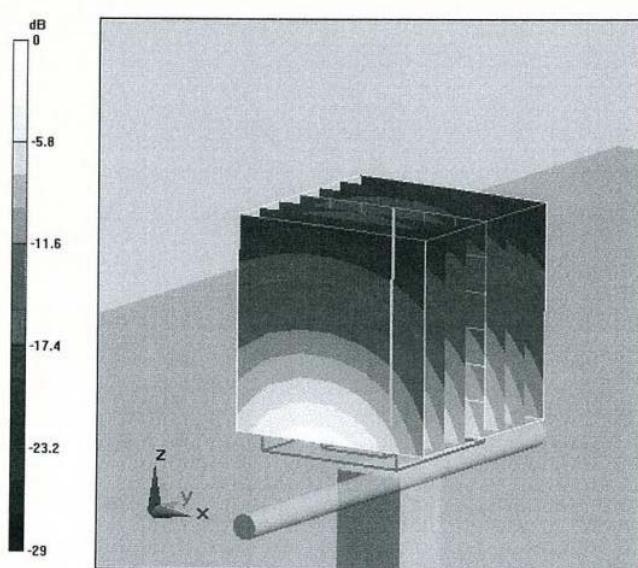
**Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.4 V/m; Power Drift = 0.040 dB

Peak SAR (extrapolated) = 27.6 W/kg

**SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.17 mW/g**

Maximum value of SAR (measured) = 15.7 mW/g



**Impedance Measurement Plot for Head TSL**