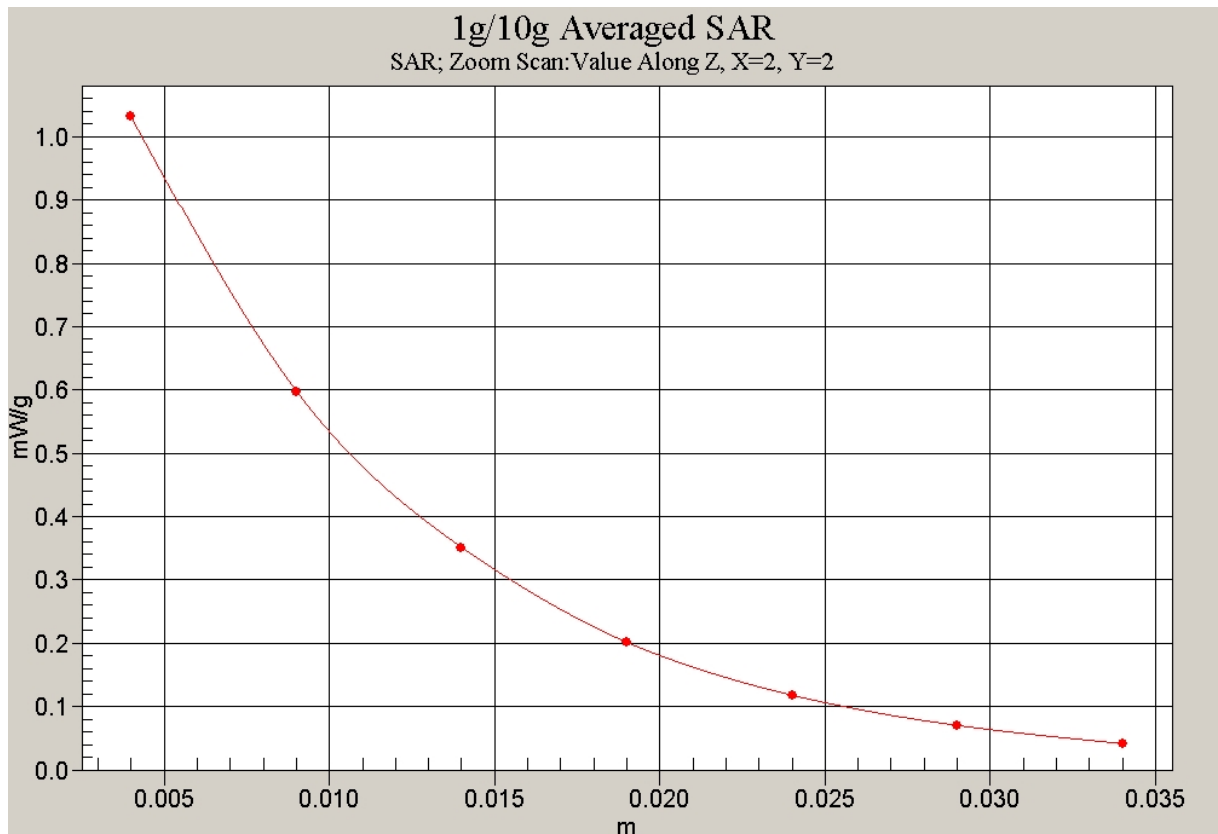


**Fig. 19 1900 MHz CH661 Test Position 3-EGPRS**



**Fig. 20 Z-Scan at power reference point (1900 MHz CH661 Test Position 3-EGPRS)**

### **WCDMA 850 Test Position 1 Middle**

Date/Time: 2008-12-2 9:04:06

Electronics: DAE4 Sn771

Medium: 850 Body

Medium parameters used (interpolated):  $f = 835$  MHz;  $\sigma = 1.00$  mho/m;  $\epsilon_r = 53.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 23.3°C      Liquid Temperature: 22.5°C

Communication System: WCDMA 850 Frequency: 835 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(5.97, 5.97, 5.97)

**Test Position 1/Area Scan (61x81x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.412 mW/g

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

Reference Value = 20.4 V/m; Power Drift = 0.052 dB

Peak SAR (extrapolated) = 0.664 W/kg

**SAR(1 g) = 0.397 mW/g; SAR(10 g) = 0.250 mW/g**

Maximum value of SAR (measured) = 0.429 mW/g

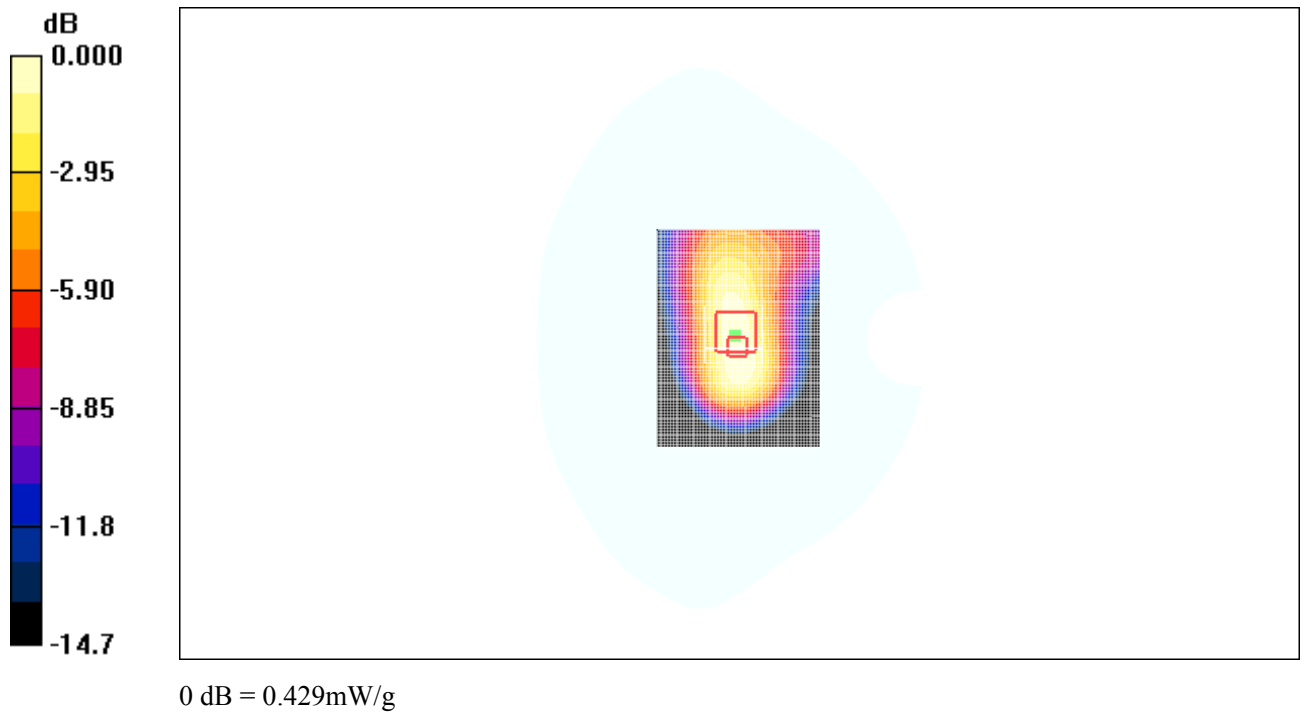
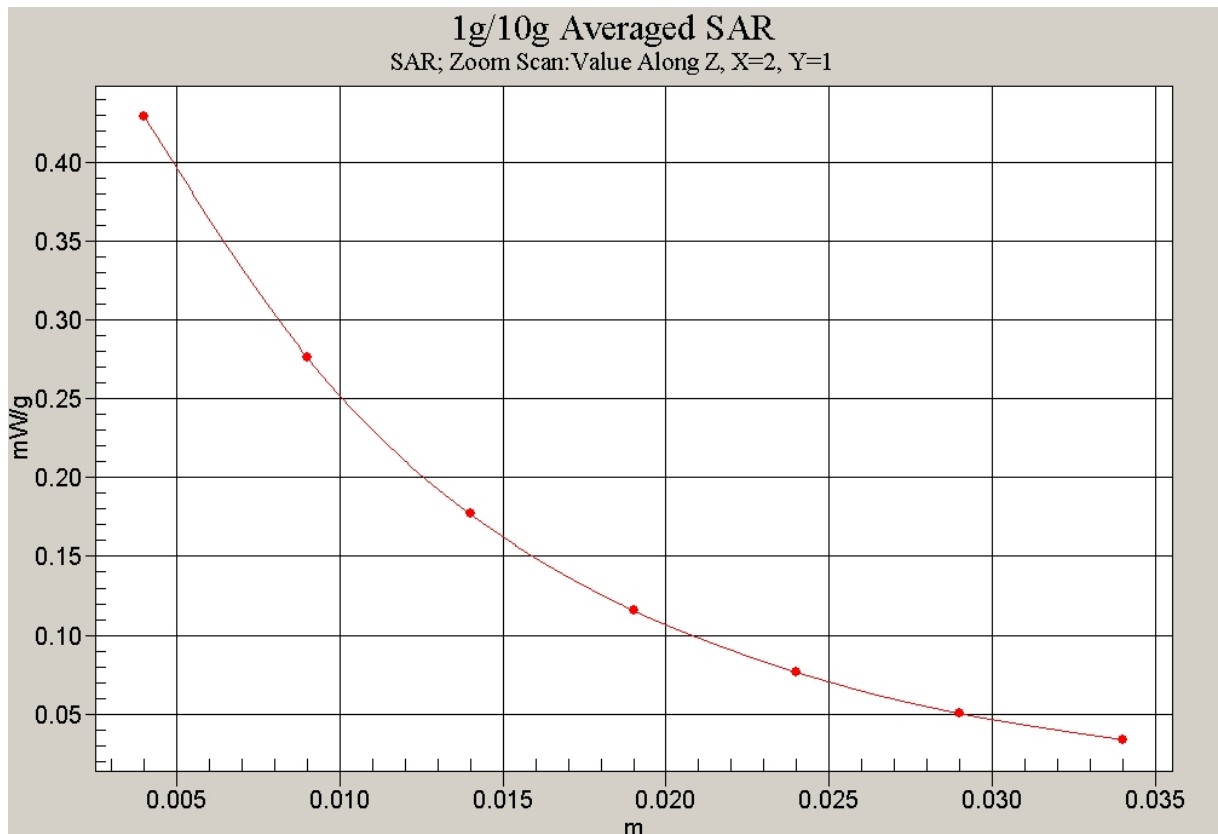


Fig. 21 WCDMA 850 CH4175 Test Position1



**Fig. 22 Z-Scan at power reference point (WCDMA 850 CH4175 Test Position1)****WCDMA 850 Test Position 2 Middle**

Date/Time: 2008-12-2 9:35:58

Electronics: DAE4 Sn771

Medium: 850 Body

Medium parameters used (interpolated):  $f = 835$  MHz;  $\sigma = 1.00$  mho/m;  $\epsilon_r = 53.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 23.3°C      Liquid Temperature: 22.5°C

Communication System: WCDMA 850 Frequency: 835 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(5.97, 5.97, 5.97)

**Test Position 2/Area Scan (61x81x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.679 mW/g

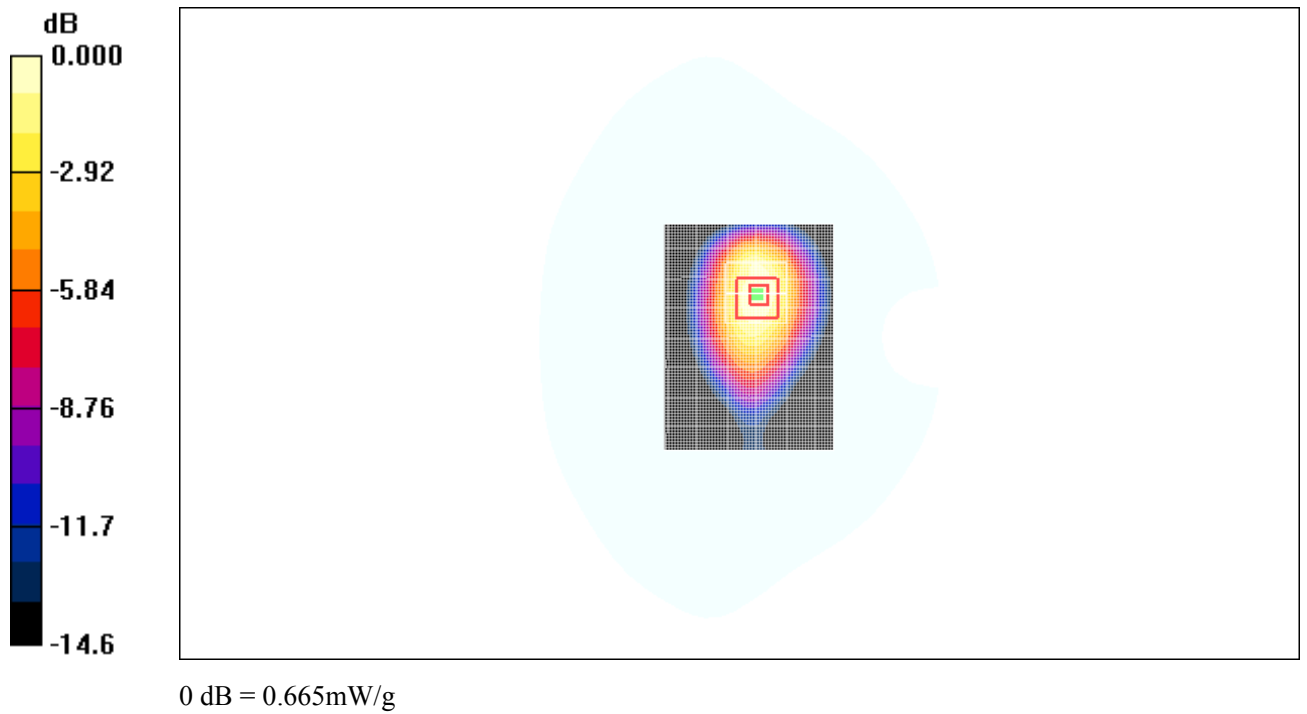
**Test Position 2/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 19.3 V/m; Power Drift = -0.119 dB

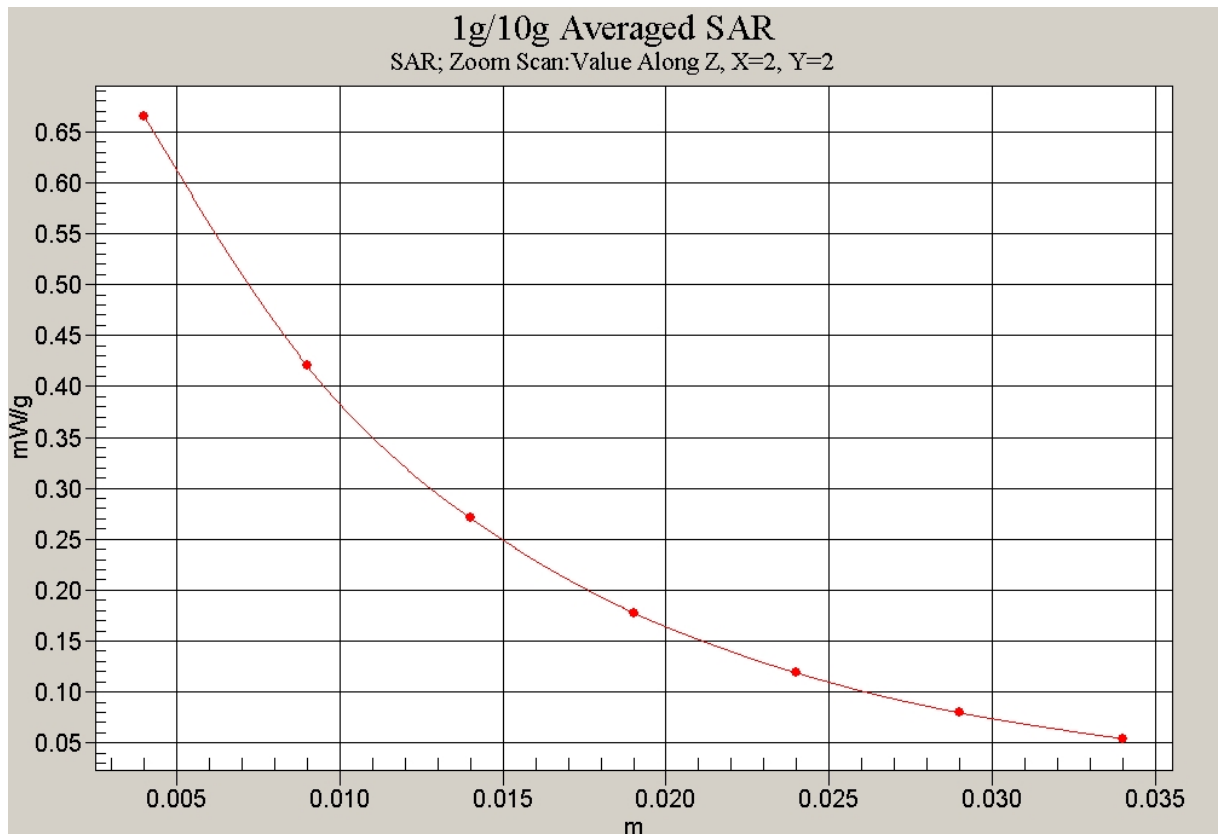
Peak SAR (extrapolated) = 0.960 W/kg

**SAR(1 g) = 0.605 mW/g; SAR(10 g) = 0.365 mW/g**

Maximum value of SAR (measured) = 0.665 mW/g



**Fig. 23 WCDMA 850 CH4175 Test Position2**



**Fig. 24 Z-Scan at power reference point (WCDMA 850 CH4175 Test Position2)**

**WCDMA 850 Test Position 3 Middle**

Date/Time: 2008-12-2 10:39:48

Electronics: DAE4 Sn771

Medium: 850 Body

Medium parameters used (interpolated):  $f = 835$  MHz;  $\sigma = 1.00$  mho/m;  $\epsilon_r = 53.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 23.3°C      Liquid Temperature: 22.5°C

Communication System: WCDMA 850 Frequency: 835 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(5.97, 5.97, 5.97)

**Test Position 3/Area Scan (61x81x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.317 mW/g

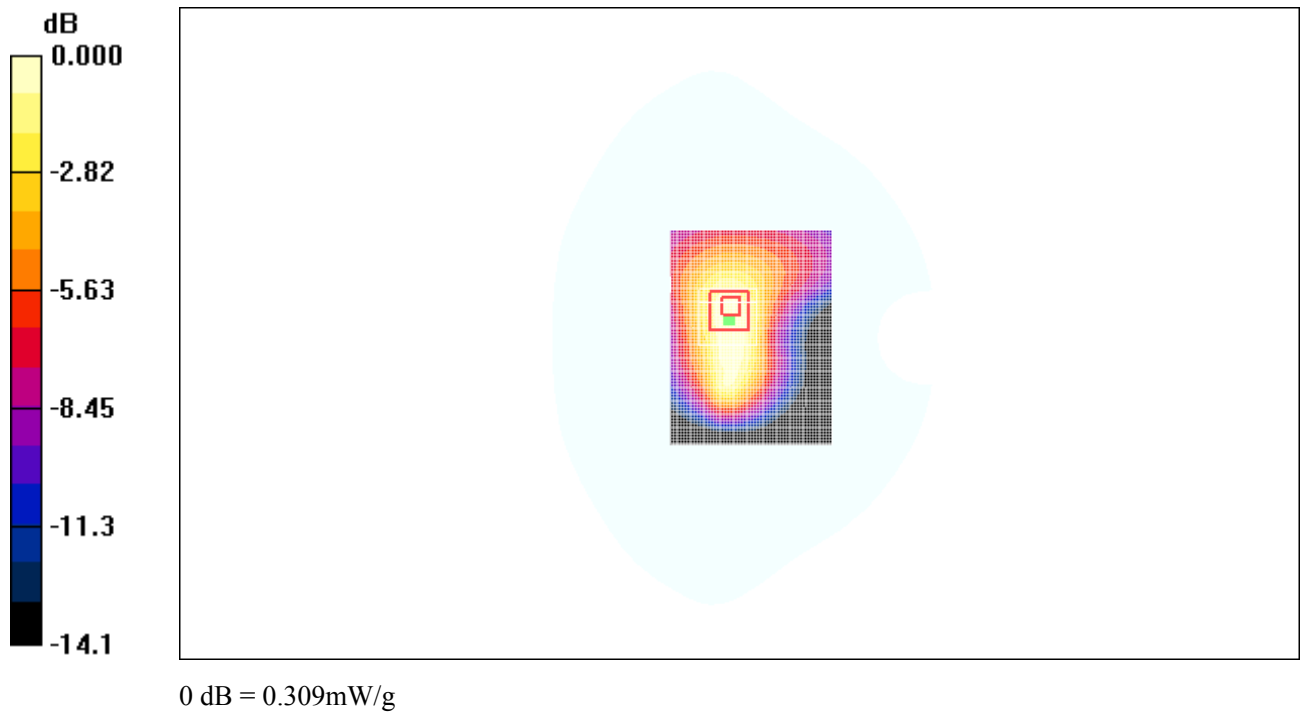
**Test Position 3/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 14.3 V/m; Power Drift = -0.061 dB

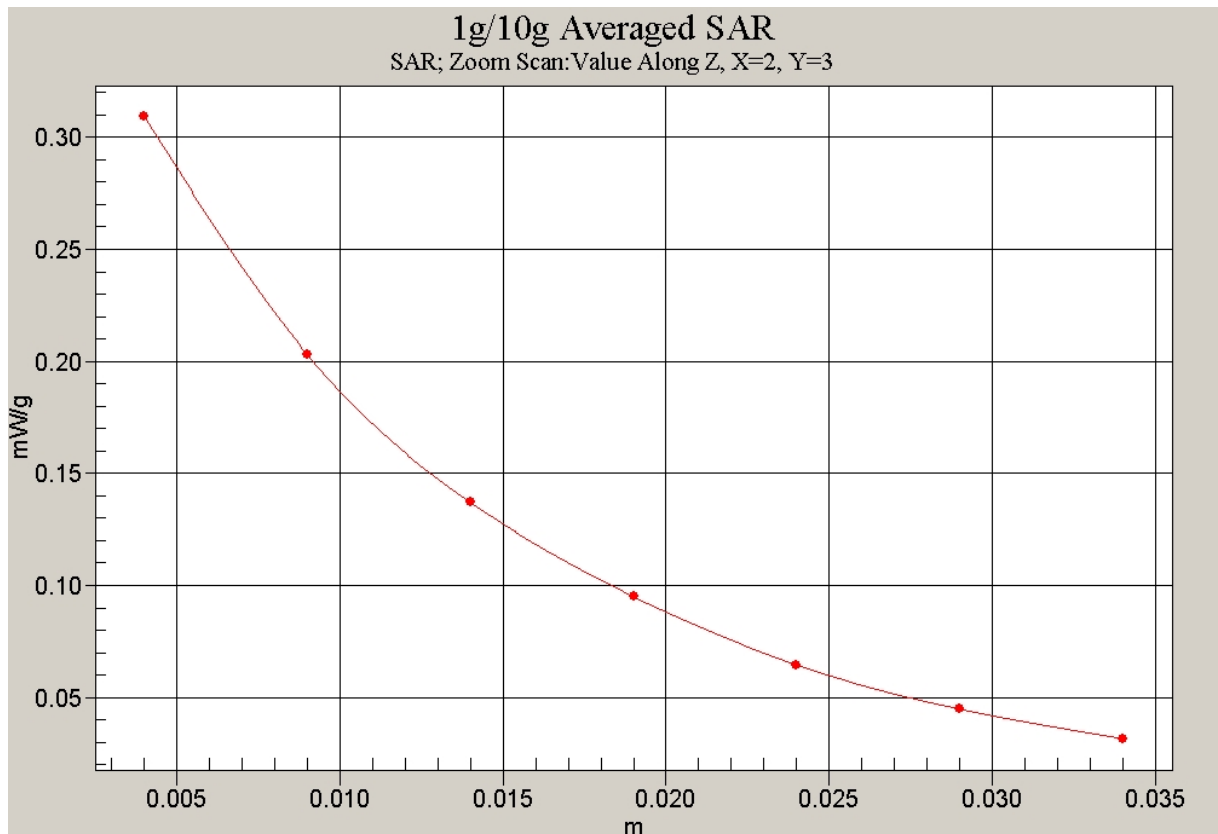
Peak SAR (extrapolated) = 0.434 W/kg

**SAR(1 g) = 0.280 mW/g; SAR(10 g) = 0.177 mW/g**

Maximum value of SAR (measured) = 0.309 mW/g



**Fig. 25 WCDMA 850 CH4175 Test Position3**



**Fig. 26 Z-Scan at power reference point (WCDMA 850 CH4175 Test Position3)**

#### **WCDMA 850 Test Position 4 Middle**

Date/Time: 2008-12-2 10:04:16

Electronics: DAE4 Sn771

Medium: 850 Body

Medium parameters used (interpolated):  $f = 835$  MHz;  $\sigma = 1.00$  mho/m;  $\epsilon_r = 53.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 23.3°C      Liquid Temperature: 22.5°C

Communication System: WCDMA 850 Frequency: 835 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(5.97, 5.97, 5.97)

**Test Position 4/Area Scan (61x81x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.196 mW/g

**Test Position 4/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

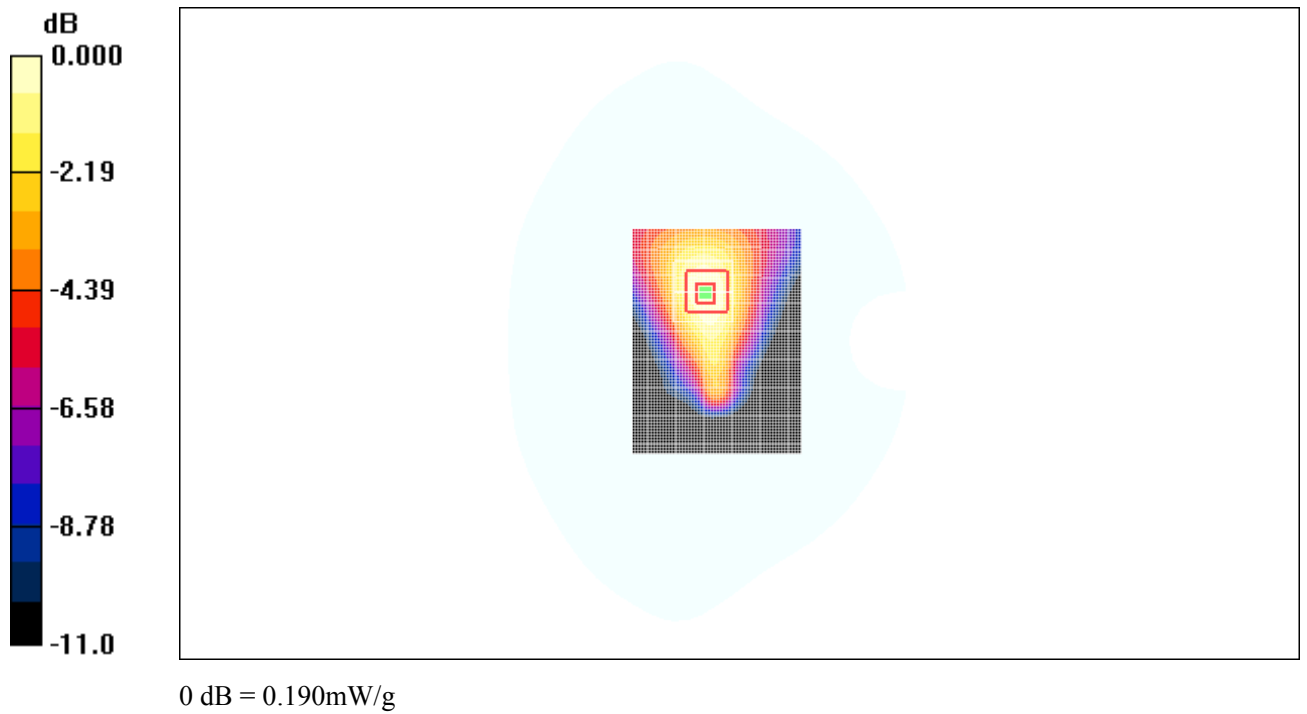
Reference Value = 11.8 V/m; Power Drift = -0.134 dB

Peak SAR (extrapolated) = 0.259 W/kg

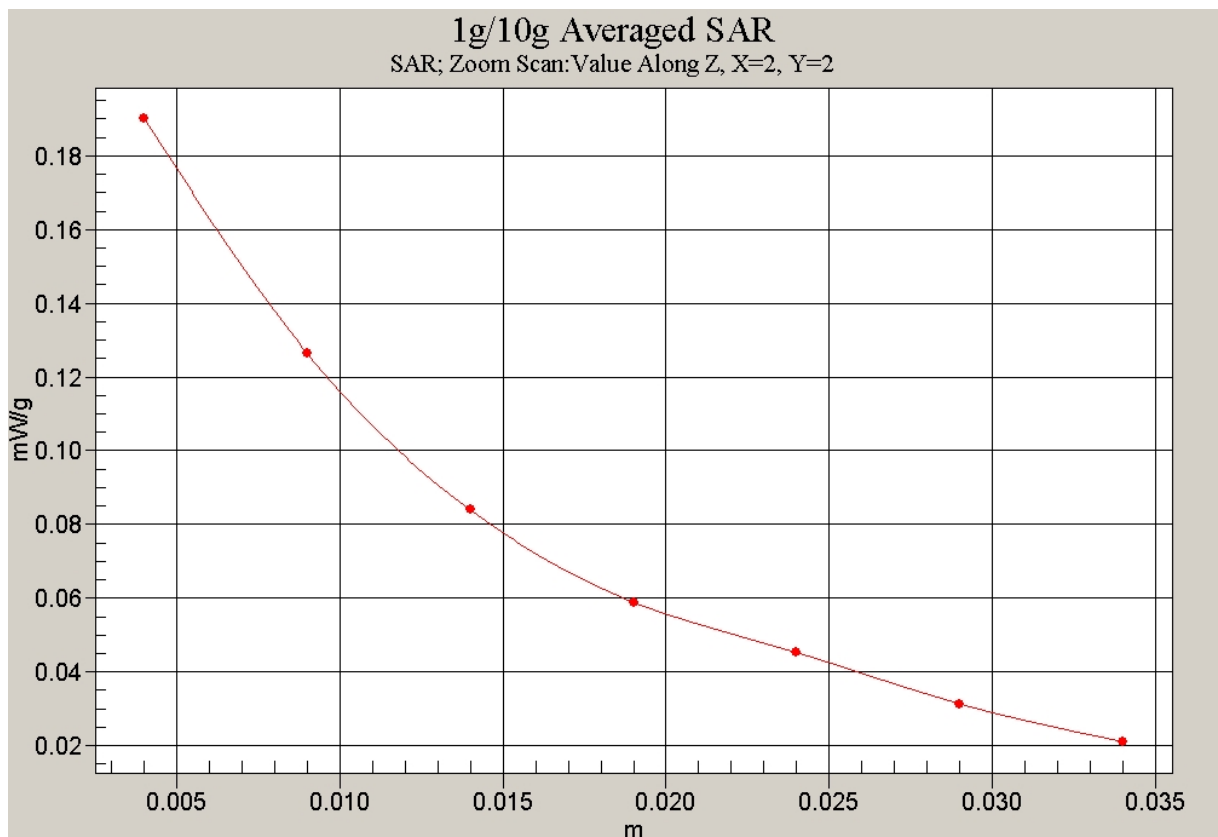
**SAR(1 g) = 0.175 mW/g; SAR(10 g) = 0.114 mW/g**

Maximum value of SAR (measured) = 0.190 mW/g





**Fig. 27 WCDMA 850 CH4175 Test Position4**



**Fig. 28 Z-Scan at power reference point (WCDMA 850 CH4175 Test Position4)**

### **WCDMA 1900 Test Position 1 Middle**

Date/Time: 2008-12-3 11:59:27

Electronics: DAE4 Sn771

Medium: Body 1900 MHz

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.44$  mho/m;  $\epsilon_r = 53$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 23.3°C      Liquid Temperature: 22.5°C

Communication System: WCDMA 1900 Frequency: 1880 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(4.85, 4.85, 4.85)

**Test Position 1/Area Scan (61x81x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.446 mW/g

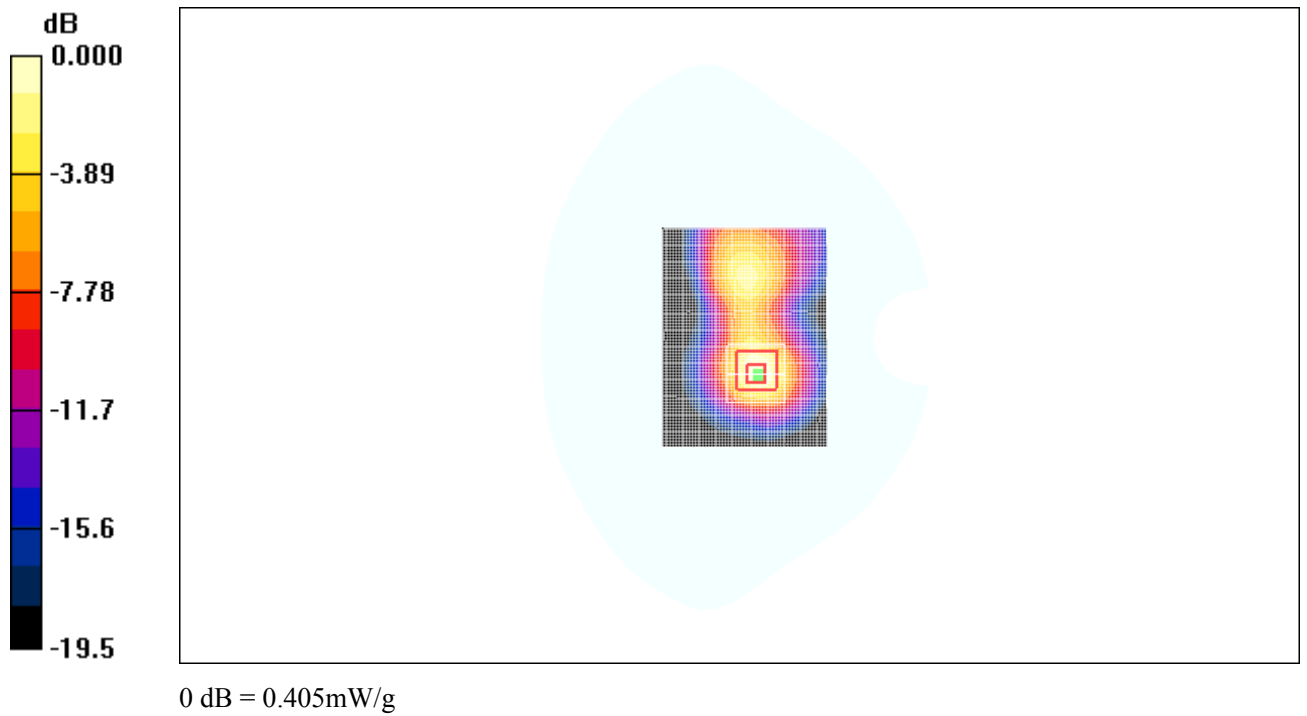
**Test Position 1/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.81 V/m; Power Drift = 0.200 dB

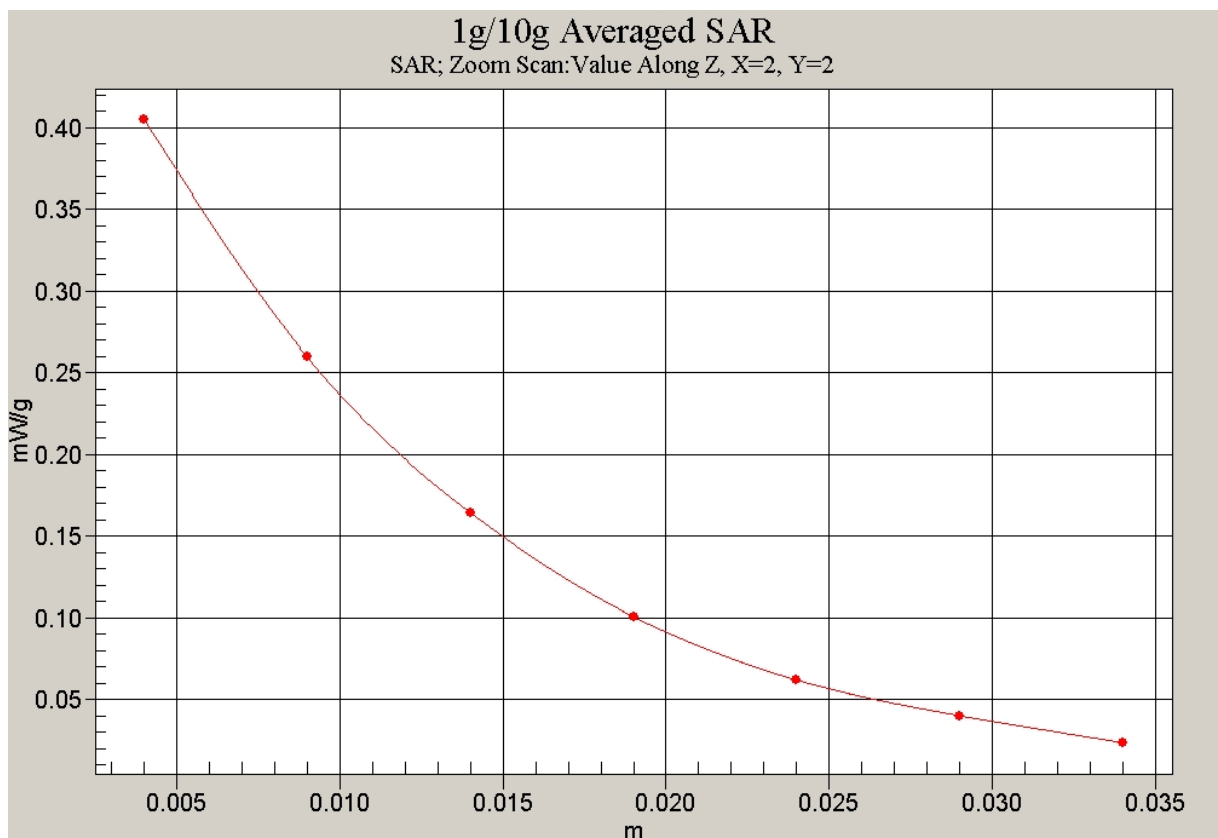
Peak SAR (extrapolated) = 0.616 W/kg

**SAR(1 g) = 0.358 mW/g; SAR(10 g) = 0.187 mW/g**

Maximum value of SAR (measured) = 0.405 mW/g



**Fig. 29 WCDMA 1900 CH9400 Test Position 1**



**Fig. 30 Z-Scan at power reference point (WCDMA 1900 CH9400 Test Position 1)**

**WCDMA 1900 Test Position 2 Middle**

Date/Time: 2008-12-3 13:15:14

Electronics: DAE4 Sn771

Medium: Body 1900 MHz

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.44$  mho/m;  $\epsilon_r = 53$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 23.3°C      Liquid Temperature: 22.5°C

Communication System: WCDMA 1900 Frequency: 1880 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(4.85, 4.85, 4.85)

**Test Position 2/Area Scan (61x81x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.414 mW/g

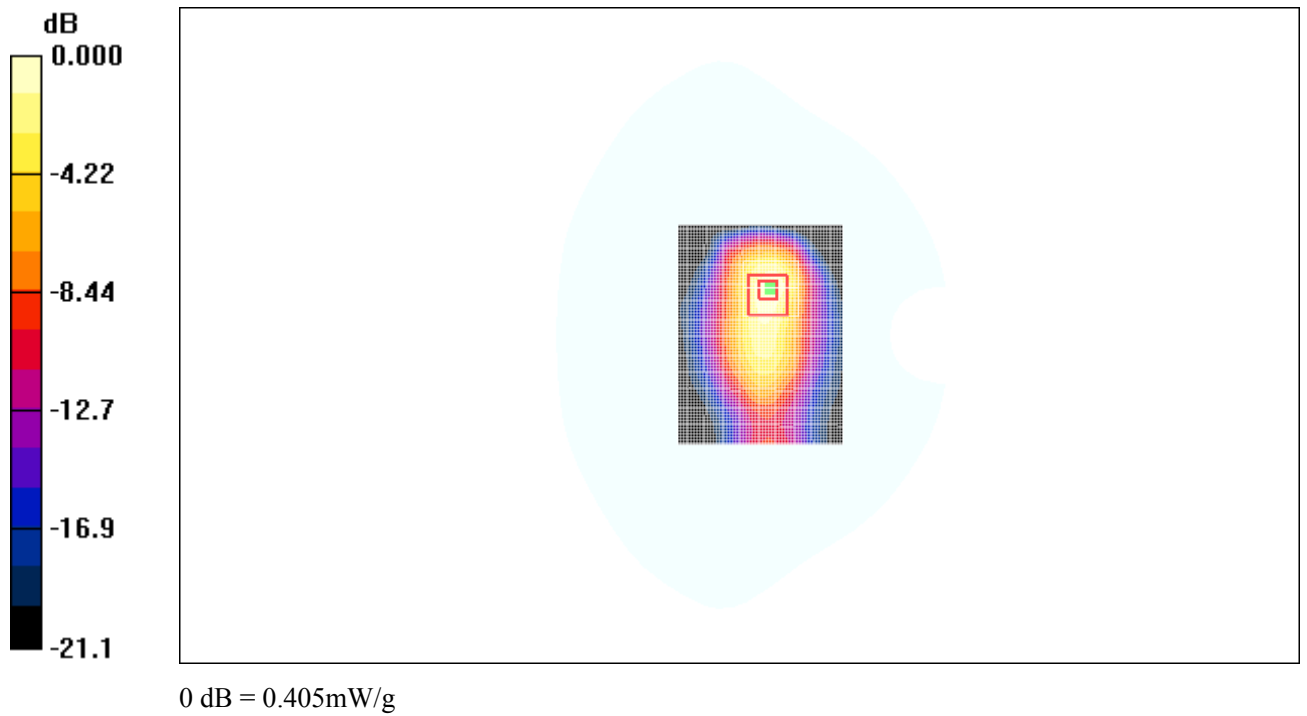
**Test Position 2/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.9 V/m; Power Drift = -0.179 dB

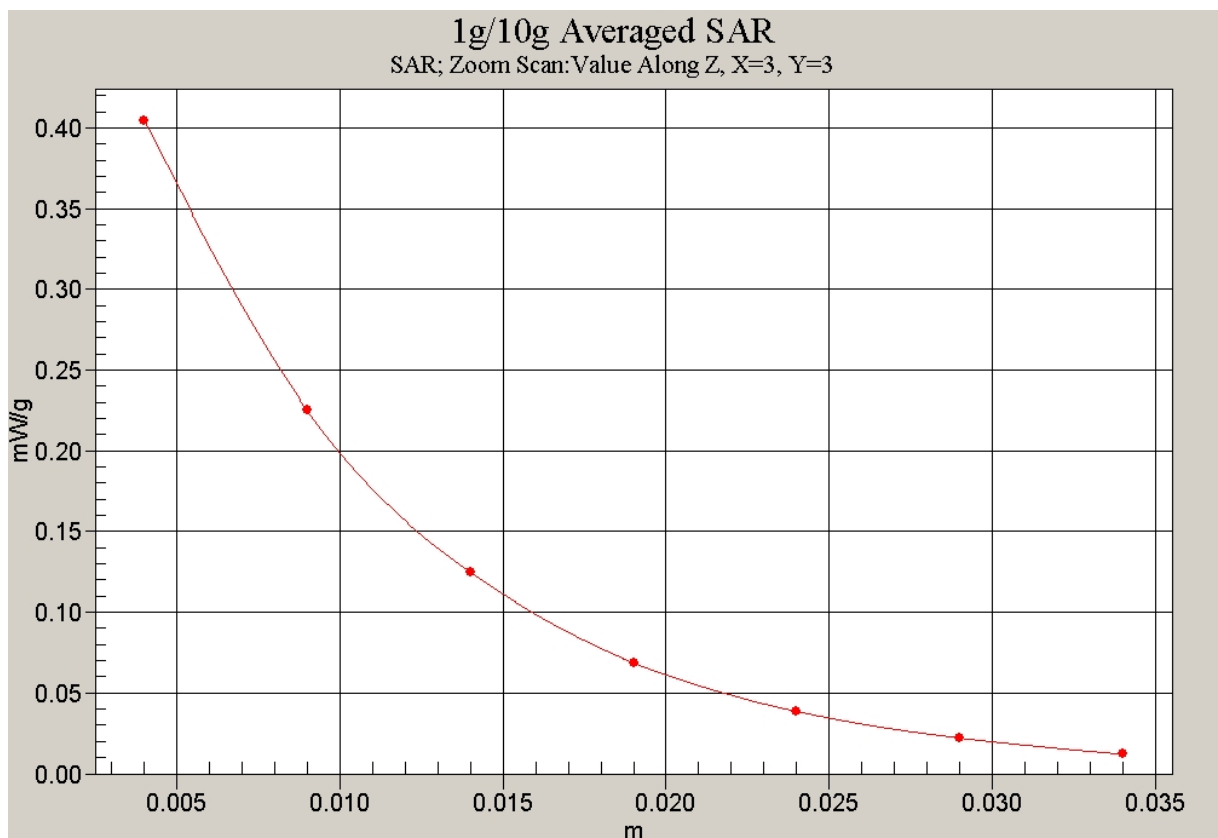
Peak SAR (extrapolated) = 0.701 W/kg

**SAR(1 g) = 0.360 mW/g; SAR(10 g) = 0.190 mW/g**

Maximum value of SAR (measured) = 0.405 mW/g



**Fig. 31 WCDMA 1900 CH9400 Test Position 2**



**Fig. 32 Z-Scan at power reference point (WCDMA 1900 CH9400 Test Position 2)**

**WCDMA 1900 Test Position 3 Middle**

Date/Time: 2008-12-3 13:46:45

Electronics: DAE4 Sn771

Medium: Body 1900 MHz

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.44$  mho/m;  $\epsilon_r = 53$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 23.3°C      Liquid Temperature: 22.5°C

Communication System: WCDMA 1900 Frequency: 1880 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(4.85, 4.85, 4.85)

**Test Position 3 /Area Scan (61x81x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.674 mW/g

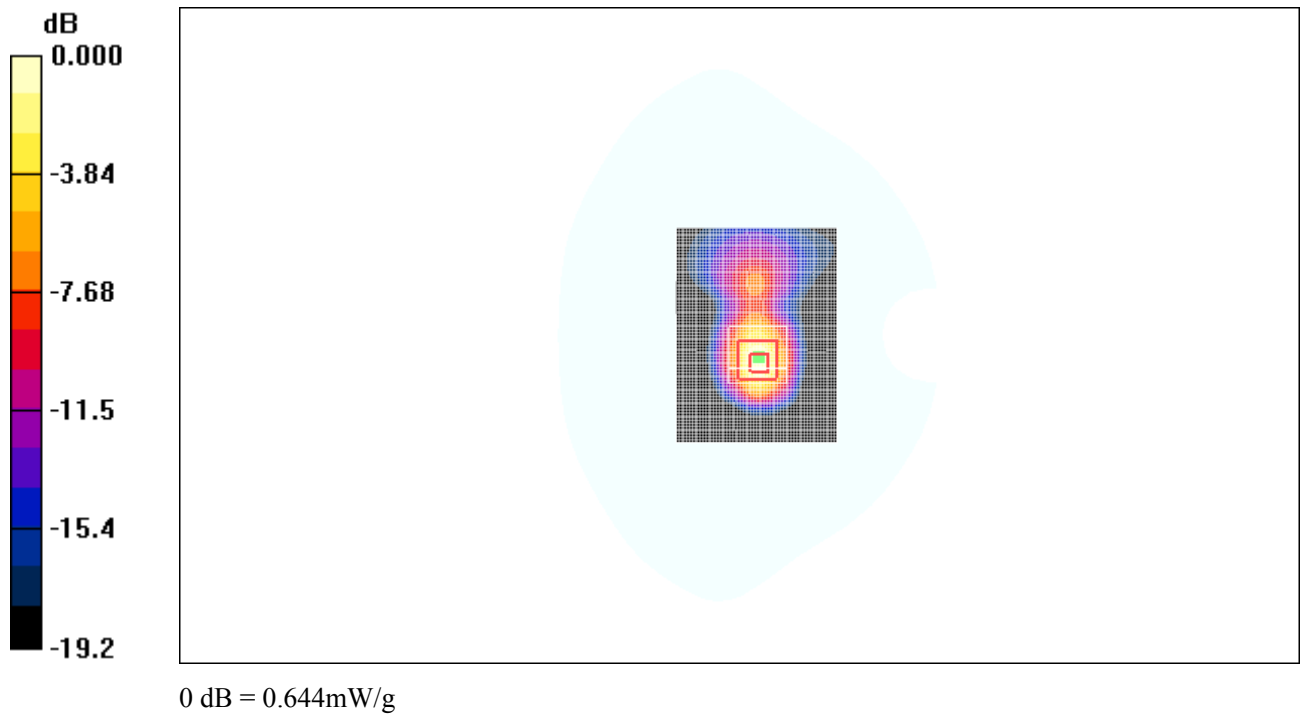
**Test Position 3/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.8 V/m; Power Drift = -0.005 dB

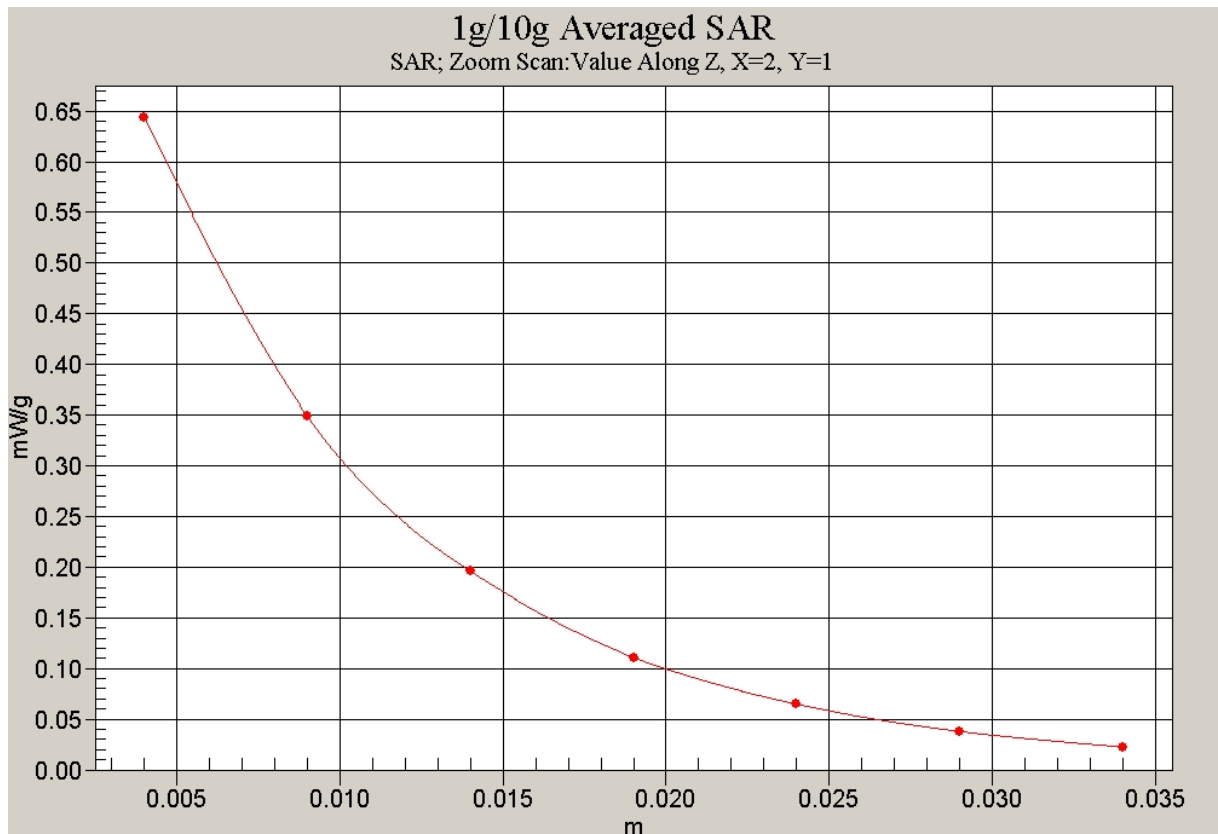
Peak SAR (extrapolated) = 1.17 W/kg

**SAR(1 g) = 0.587 mW/g; SAR(10 g) = 0.276 mW/g**

Maximum value of SAR (measured) = 0.644 mW/g



**Fig. 33 WCDMA 1900 CH9400 Test Position 3**



**Fig.34 Z-Scan at power reference point (WCDMA 1900 CH9400 Test Position 3)**

#### **WCDMA 1900 Test Position 4 Middle**

Date/Time: 2008-12-3 14:06:56

Electronics: DAE4 Sn771

Medium: Body 1900 MHz

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.44$  mho/m;  $\epsilon_r = 53$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 23.3°C      Liquid Temperature: 22.5°C

Communication System: WCDMA 1900 Frequency: 1880 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(4.85, 4.85, 4.85)

**Test Position 4/Area Scan (61x81x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.186 mW/g

**Test Position 4/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

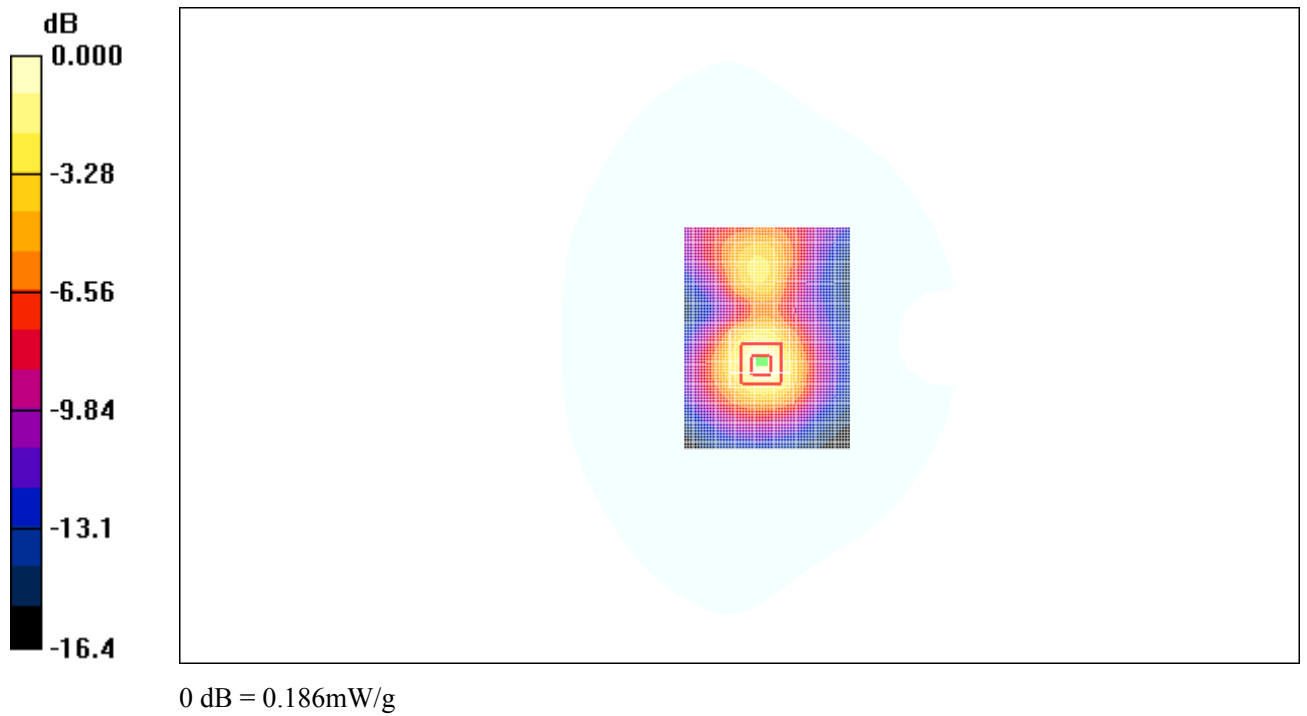
Reference Value = 9.70 V/m; Power Drift = -0.200 dB

Peak SAR (extrapolated) = 0.281 W/kg

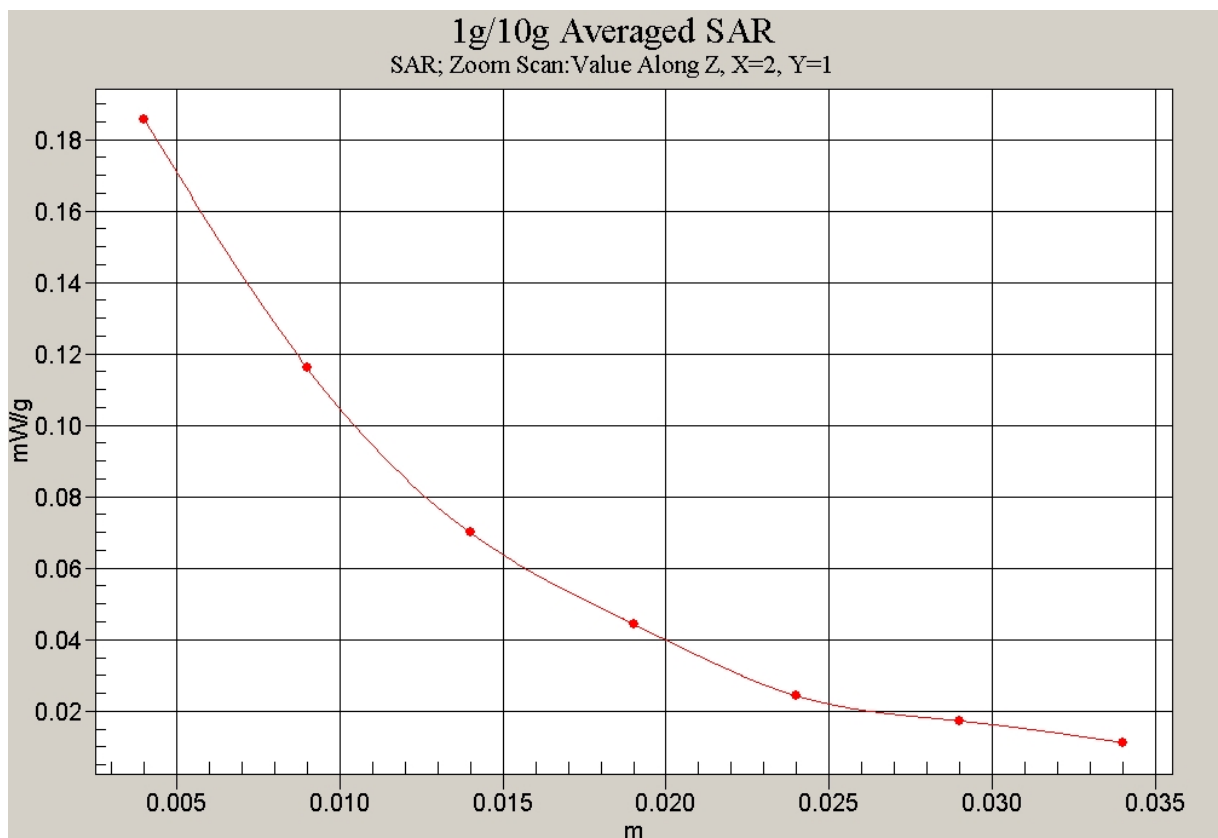
**SAR(1 g) = 0.169 mW/g; SAR(10 g) = 0.096 mW/g**

Maximum value of SAR (measured) = 0.186 mW/g





**Fig. 35 WCDMA 1900 CH9400 Test Position 4**



**Fig. 36 Z-Scan at power reference point (WCDMA 1900 CH9400 Test Position 4)**

## **ANNEX D SYSTEM VALIDATION RESULTS**

### **835MHz**

Date/Time: 2008-12-2 7:41:02

Electronics: DAE4 Sn771

Medium: Head 835

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.91 \text{ mho/m}$ ;  $\epsilon_r = 43.5$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature:  $23.3^\circ\text{C}$       Liquid Temperature:  $22.5^\circ\text{C}$

Communication System: CW Frequency: 835 MHz Duty Cycle: 1:1

Probe: ES3DV3 – SN3149 ConvF(6.28, 6.28, 6.28)

**835MHz/Area Scan (101x101x1):** Measurement grid:  $dx=10\text{mm}$ ,  $dy=10\text{mm}$

Maximum value of SAR (interpolated) = 2.68 mW/g

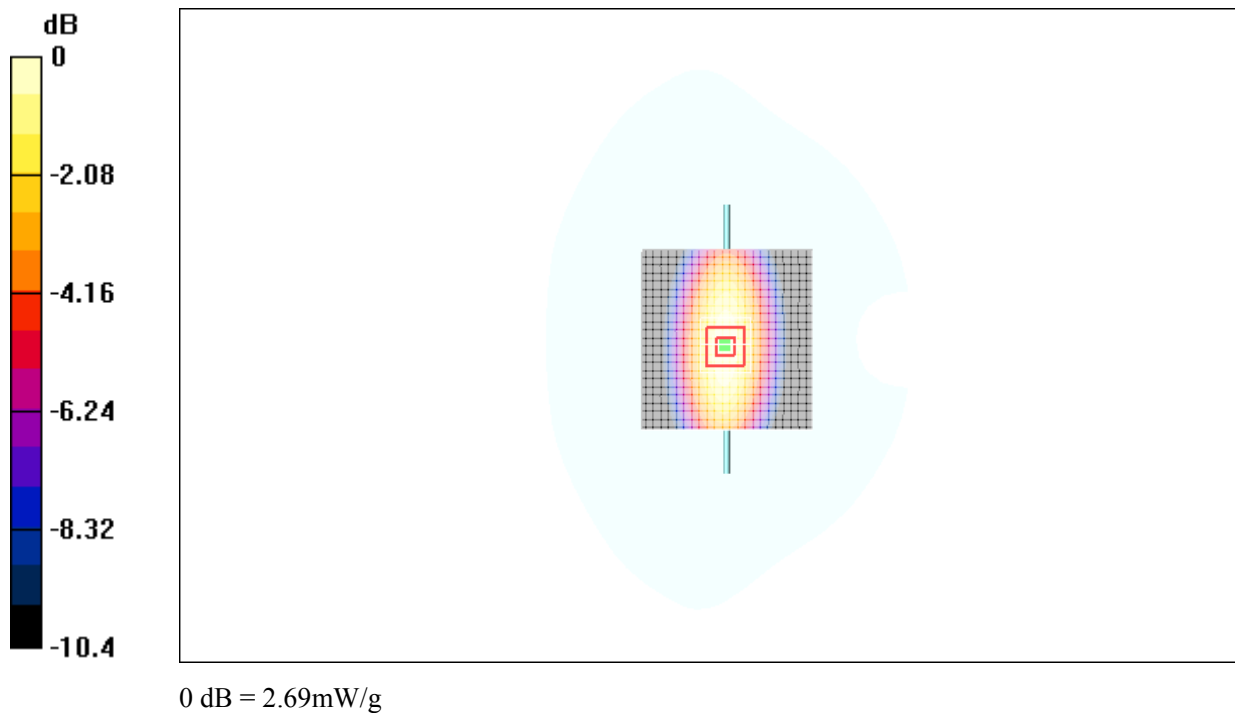
**835MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 56.8 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.67 W/kg

**SAR(1 g) = 2.50 mW/g; SAR(10 g) = 1.62 mW/g**

Maximum value of SAR (measured) = 2.69 mW/g



**Fig.37 validation 835MHz 250mW**

## 1900MHz

Date/Time: 2008-12-3 7:48:53

Electronics: DAE4 Sn771

Medium: Head 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.38$  mho/m;  $\epsilon_r = 40.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 23.3°C      Liquid Temperature: 22.5°C

Communication System: CW Frequency: 1900 MHz Duty Cycle: 1:1

Probe: ES3DV3 - SN3149 ConvF(5.08, 5.08, 5.08)

**System Validation/Area Scan (101x101x1):** Measurement grid: dx=10mm, dy=10mm  
Maximum value of SAR (interpolated) = 11.2 mW/g

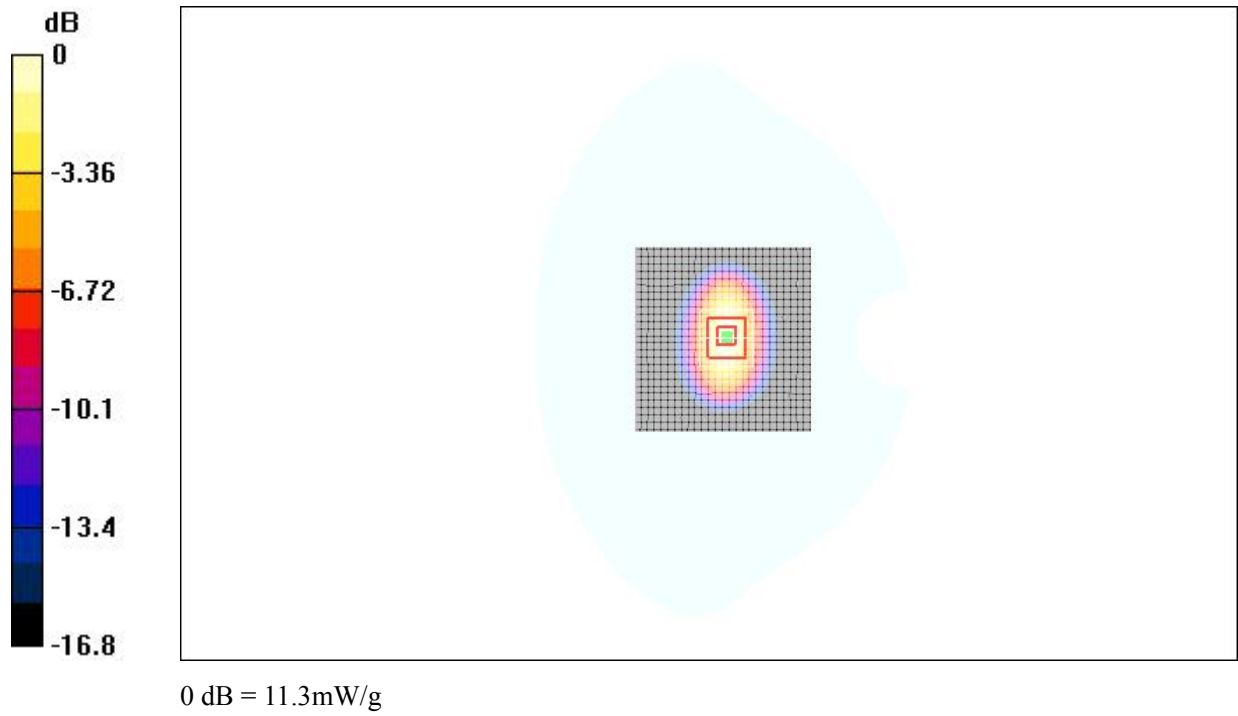
**System Validation/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 92.1 V/m; Power Drift = 0.1 dB

Peak SAR (extrapolated) = 16.9 W/kg

**SAR(1 g) = 9.91 mW/g; SAR(10 g) = 5.27 mW/g**

Maximum value of SAR (measured) = 11.3 mW/g



**Fig.38 validation 1900MHz 250mW**

## ANNEX E PROBE CALIBRATION CERTIFICATE

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



S Schweizerischer Kalibrierdienst  
C Service suisse d'étalonnage  
S 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 **TMC**

Certificate No: ES3-3149\_Dec07

### CALIBRATION CERTIFICATE

Object: **ES3DV3 - SN:3149**

Calibration procedure(s): **QA CAL-01.v6  
Calibration procedure for dosimetric E-field probes**

Calibration date: **December 14, 2007**

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 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Power sensor E4412A	MY41495277	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Power sensor E4412A	MY41498087	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Reference 3 dB Attenuator	SN: S5054 (3c)	8-Aug-07 (METAS, No. 217-00719)	Aug-08
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-07 (METAS, No. 217-00671)	Mar-08
Reference 30 dB Attenuator	SN: S5129 (30b)	8-Aug-07 (METAS, No. 217-00720)	Aug-08
Reference Probe ES3DV2	SN: 3013	4-Jan-07 (SPEAG, No. ES3-3013_Jan07)	Jan-08
DAE4	SN: 654	20-Apr-07 (SPEAG, No. DAE4-654_Apr07)	Apr-08

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-07)	In house check: Oct-08

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: December 14, 2007

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

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



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** 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**

**Glossary:**

TSL	tissue simulating liquid
NORM <sub>x,y,z</sub>	sensitivity in free space
ConF	sensitivity in TSL / NORM <sub>x,y,z</sub>
DCP	diode compression point
Polarization $\phi$	$\phi$ rotation around probe axis
Polarization $\vartheta$	$\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

**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

**Methods Applied and Interpretation of Parameters:**

- **NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not effect the E<sup>2</sup>-field uncertainty inside TSL (see below *ConvF*).
- **NORM(f)<sub>x,y,z</sub>** = NORM<sub>x,y,z</sub> \* *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*.
- **DCP<sub>x,y,z</sub>**: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- **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<sub>x,y,z</sub> \* *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.

ES3DV3 SN:3149

December 14, 2007

# Probe ES3DV3

## SN:3149

Manufactured:	June 12, 2007
Calibrated:	December 14, 2007

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ES3DV3 SN:3149

December 14, 2007

**DASY - Parameters of Probe: ES3DV3 SN:3149**

Sensitivity in Free Space<sup>A</sup>

NormX	1.14 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.23 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.29 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression<sup>B</sup>

DCP X	94 mV
DCP Y	95 mV
DCP Z	91 mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL                    900 MHz    Typical SAR gradient: 5 % per mm

Sensor Center to Phantom Surface Distance		3.0 mm	4.0 mm
SAR <sub>be</sub> [%]	Without Correction Algorithm	3.7	1.7
SAR <sub>be</sub> [%]	With Correction Algorithm	0.9	0.7

TSL                    1810 MHz    Typical SAR gradient: 10 % per mm

Sensor Center to Phantom Surface Distance		3.0 mm	4.0 mm
SAR <sub>be</sub> [%]	Without Correction Algorithm	6.9	3.4
SAR <sub>be</sub> [%]	With Correction Algorithm	0.4	0.2

Sensor Offset

Probe Tip to Sensor Center                    2.0 mm

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<sup>2</sup>-field uncertainty inside TSL (see Page 8).

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

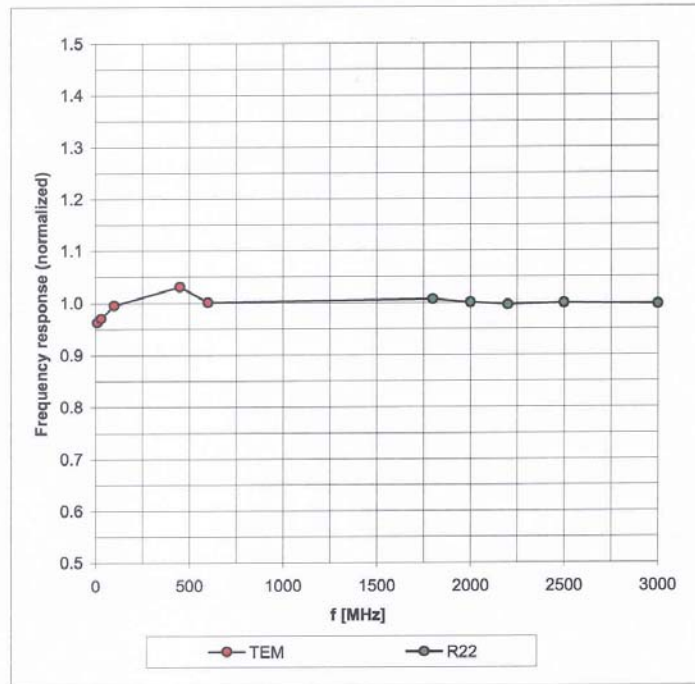


ES3DV3 SN:3149

December 14, 2007

### Frequency Response of E-Field

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

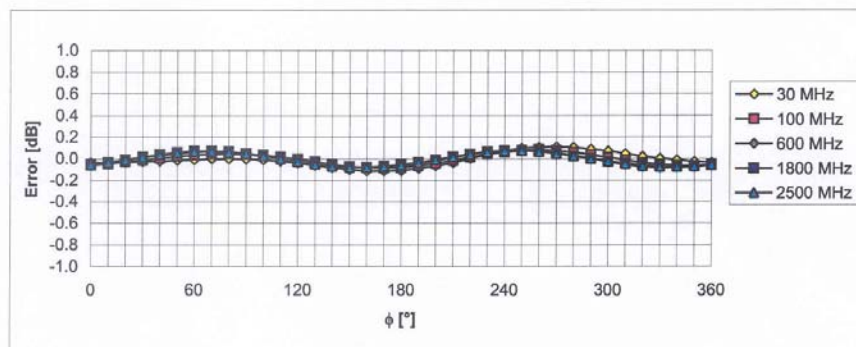
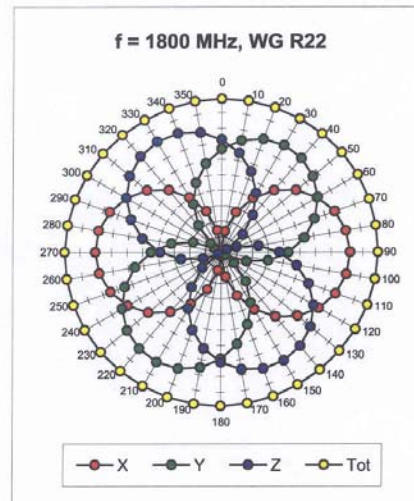
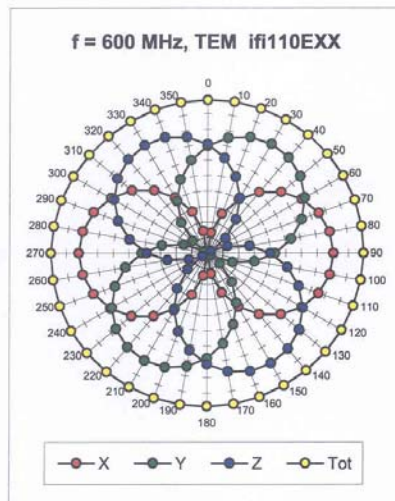


Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

ES3DV3 SN:3149

December 14, 2007

### Receiving Pattern ( $\phi$ ), $\vartheta = 0^\circ$

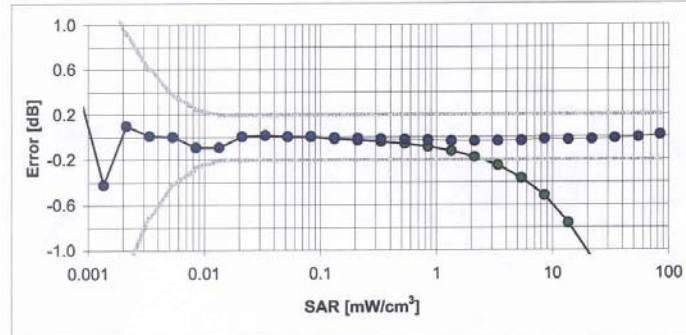
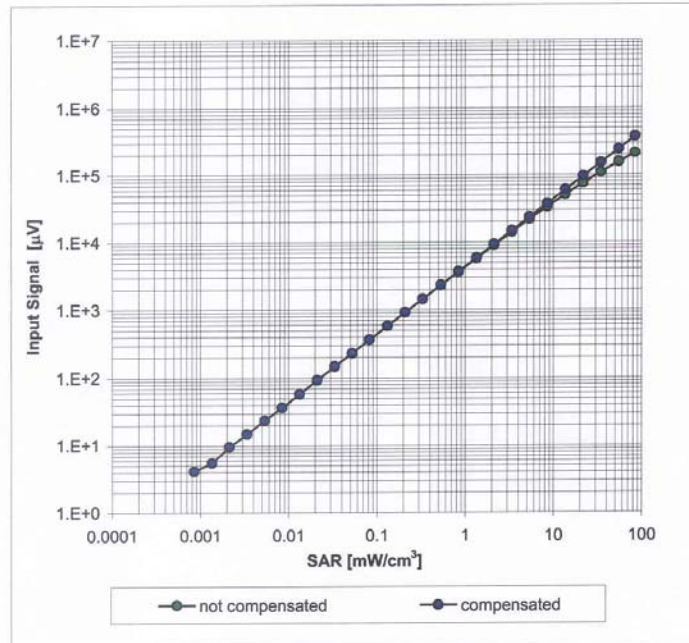


Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

ES3DV3 SN:3149

December 14, 2007

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

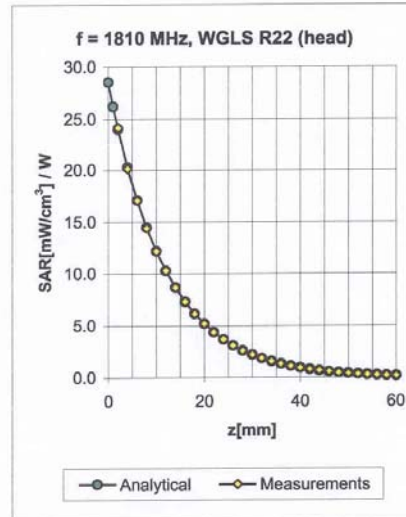
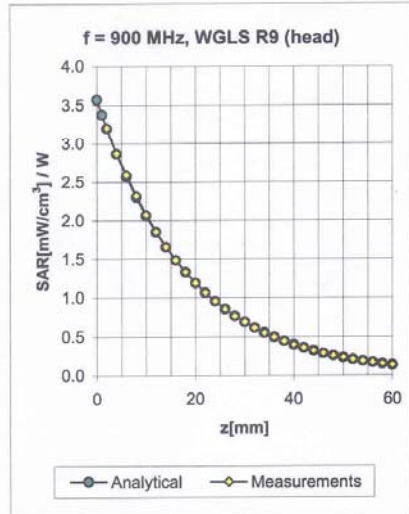


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

ES3DV3 SN:3149

December 14, 2007

### Conversion Factor Assessment



f [MHz]	Validity [MHz] <sup>c</sup>	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.89	1.24	6.28 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.66	1.44	5.08 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.94	1.16	5.97 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.73	1.33	4.85 ± 11.0% (k=2)

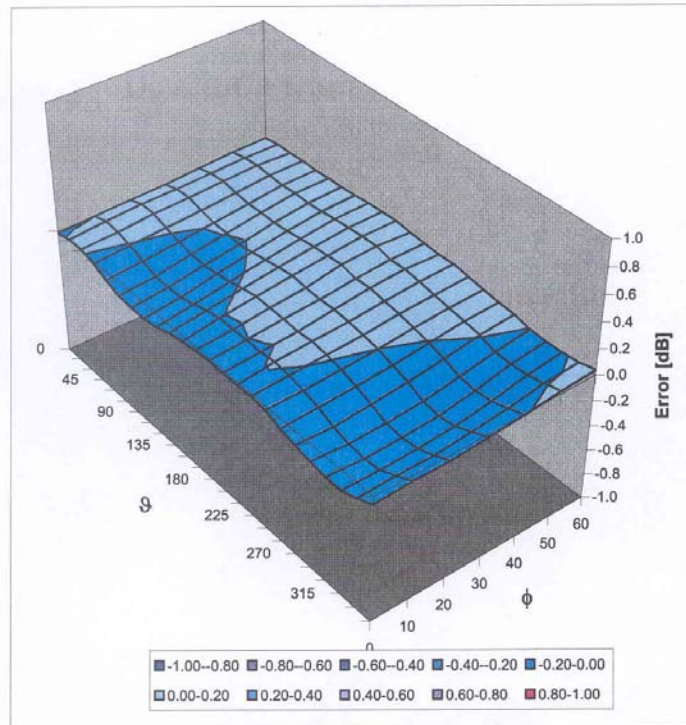
<sup>c</sup> The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

ES3DV3 SN:3149

December 14, 2007

### Deviation from Isotropy in HSL

Error ( $\phi, \vartheta$ ),  $f = 900$  MHz



Uncertainty of Spherical Isotropy Assessment:  $\pm 2.6\%$  ( $k=2$ )

## ANNEX F DIPOLE CALIBRATION CERTIFICATE

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



S Schweizerischer Kalibrierdienst  
C Service suisse d'étalonnage  
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S Swiss Calibration Service

Accredited by the Swiss Federal Office of metrology and Accreditation  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates  
Client: TMC China

Accreditation No.: SCS 108

Certificate No: D835V2-443\_Feb07

### CALIBRATION CERTIFICATE


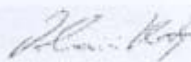
Object	D835V2-SN: 443
Calibration procedure(s)	QA CAL-05.v6 Calibration procedure for dipole validation kits
Calibration date:	February 19, 2007
Condition of the calibrated item	In Tolerance

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 at an environment temperature  $(22\pm 3)^{\circ}\text{C}$  and humidity <70%

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Data (Calibrated by, Certification NO.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	03-Oct-06 (METAS, NO. 217-00608)	Oct-07
Power sensor 8481A	US37292783	03-Oct-06 (METAS, NO. 217-00608)	Oct-07
Reference 20 dB Attenuator	SN:5086 (20g )	10-Aug-06 (METAS, NO. 217-00591)	Aug-07
Reference 10 dB Attenuator	SN:5047_2 (10r)	10-Aug-06 (METAS, NO. 217-00591)	Aug-07
DAE4	SN:601	30-Jan-07 (SPEAG, NO.DAE4-601_Jan07)	Jan-08
Reference Probe ET3DV6 (HF)	SN: 1507	19-Oct-06 (SPEAG, NO. ET3-1507_Oct06)	Oct-07
Secondary Standards	ID#	Check Data (in house)	Scheduled Calibration
Power sensor HP 8481A	MY41092317	18-Oct-02(SPEAG, in house check Oct-05)	In house check: Oct-07
RF generator Agilent E4421B	MY41000675	11-May-05(SPEAG, in house check Nov-05)	In house check: Nov -07
Network Analyzer HP 8753E	US37390585S4206	18-Oct-01(SPEAG, in house check Oct-06)	In house check: Oct -07

	Name	Function	Signature
Calibrated by:	Marcel Fehr	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Director	

Issued: February 21, 2007

This calibration certificate shall not be reported except in full without written approval of the laboratory.

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



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

Accredited by the Swiss Federal Office of Metrology and Accreditation  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

**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) CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001
- 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 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.

DASY Version	DASY4	V4.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.9 $\pm$ 6 %	0.88 mho/m $\pm$ 6 %
Head TSL temperature during test	(21.2 $\pm$ 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	2.48 mW / g
SAR normalized	normalized to 1W	9.90 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	<b>9.70 mW / g <math>\pm</math> 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.60 mW / g
SAR normalized	normalized to 1W	6.40 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	<b>6.31 mW / g <math>\pm</math> 16.5 % (k=2)</b>



**Appendix**

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	50.5Ω - 6.8 jΩ
Return Loss	- 25.8 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.402 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	September 3, 2001

**DASY4 Validation Report for Head TSL**

Date/Time: 19.02.2007 10:04:15

Test laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; serial: D835V2-SN: 443

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: HSL 835 MHz;

Medium parameters used:  $f=835$  MHz;  $\sigma=0.88$  mho/m;  $\epsilon_r=39.9$ ;  $\rho=1000$ kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6-SN1507(HF); ConvF(6.01,6.01,6.01); Calibrated: 19.10.2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.1\_2007
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA;
- Measurement SW: DASY, V4.7 Build 53; Post processing SW: SEMCAD, V1.8 Build 172

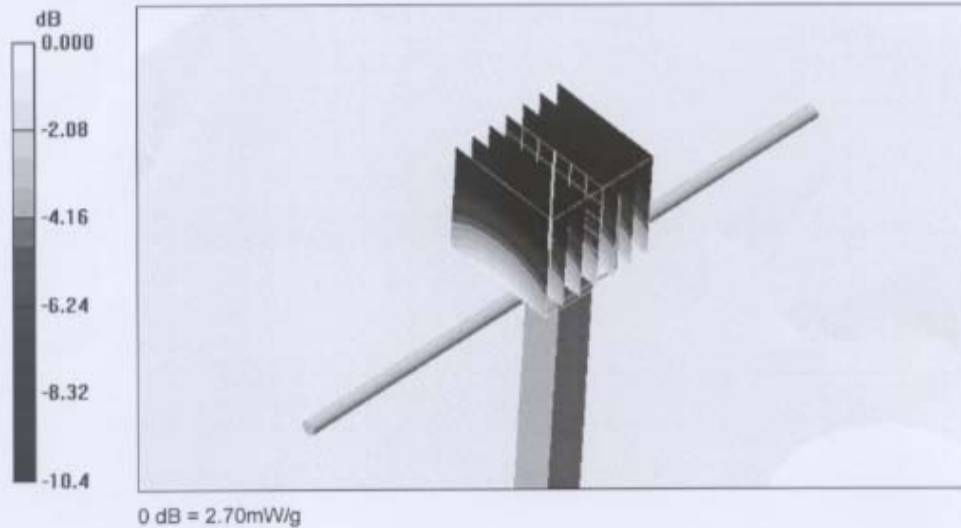
$P_{in} = 250$  mW;  $d = 15$  mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 56.6 V/m; Power Drift = 0.010 dB

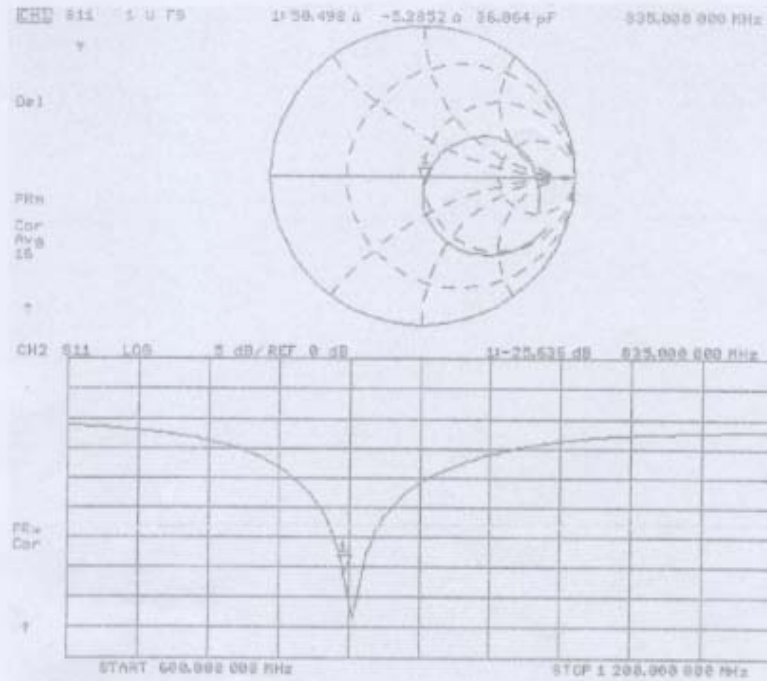
Peak SAR (extrapolated) = 3.72 W/kg

**SAR(1 g) = 2.48 mW/g; SAR(10 g) = 1.60 mW/g**

Maximum value of SAR (measured) = 2.70 mW/g



**Impedance measurement Plot for Head TSL**



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client TMC China

Certificate No: D1900V2-541\_Feb07

**CALIBRATION CERTIFICATE**

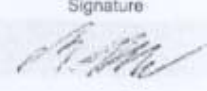
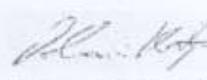
Object	D1900V2-SN: 541
Calibration procedure(s)	QA CAL-05.v6 Calibration procedure for dipole validation kits
Calibration date:	February 20, 2007
Condition of the calibrated item	In Tolerance

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 at an environment temperature (22±3)°C and humidity<70%

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Data (Calibrated by, Certification NO.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	03-Oct-06 (METAS, NO. 217-00608)	Oct-07
Power sensor B481A	US37292783	03-Oct-06 (METAS, NO. 217-00608)	Oct-07
Reference 20 dB Attenuator	SN:5086 (20g )	10-Aug-05 (METAS, NO. 217-00591)	Aug-07
Reference 10 dB Attenuator	SN:5047_2 (10r)	10-Aug-05 (METAS, NO. 217-00591)	Aug-07
DAE4	SN:901	30-Jan-07 (SPEAG, NO DAE4-601_Jan07)	Jan-08
Reference Probe ET3DV6 (HF)	SN: 1507	19-Oct-06 (SPEAG, NO. ET3-1507_Oct06)	Oct-07
Secondary Standards	ID#	Check Data (in house)	Scheduled Calibration
Power sensor HP 8481A	MY41092317	18-Oct-02(SPEAG, in house check Oct-05)	In house check: Oct-07
RF generator Agilent E4421B	MY41000676	11-May-05(SPEAG, in house check Nov-05)	In house check: Nov -07
Network Analyzer HP 8753E	US37390585S4206	18-Oct-01(SPEAG, in house check Oct-06)	In house check: Oct-07

	Name	Function	Signature
Calibrated by:	Marcel Fehr	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Director	

Issued: February 21, 2007

This calibration certificate shall not be reported except in full without written approval of the laboratory.

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



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

Accredited by the Swiss Federal Office of Metrology and Accreditation  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

**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) CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001
- 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 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.

DASY Version	DASY4	V4.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.9 ± 6 %	1.38 mho/m ± 6 %
Head TSL temperature during test	(22.1 ± 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	9.73 mW /g
SAR normalized	normalized to 1W	38.9 mW /g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	38.6 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	5.09 mW /g
SAR normalized	normalized to 1W	20.4 mW /g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	20.2 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	48.4 $\Omega$ - 8.9 j $\Omega$
Return Loss	- 26.4 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.214 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 4 , 2001

**DASY4 Validation Report for Head TSL**

Date/Time: 20.02.2007 09:25:37

Test laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; serial: D1900V2-SN: 541

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: HSL 1900 MHz;

Medium parameters used:  $f=1900$  MHz;  $\sigma=1.38$  mho/m;  $\epsilon_r=38.9$ ;  $\rho= 1000$ kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6-SN1507(HF); ConvF(5.03, 5.03, 5.03); Calibrated: 19.10.2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.1\_2007
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA;
- Measurement SW: DASY, V4.7 Build 53; Post processing SW: SEMCAD, V1.8 Build 172

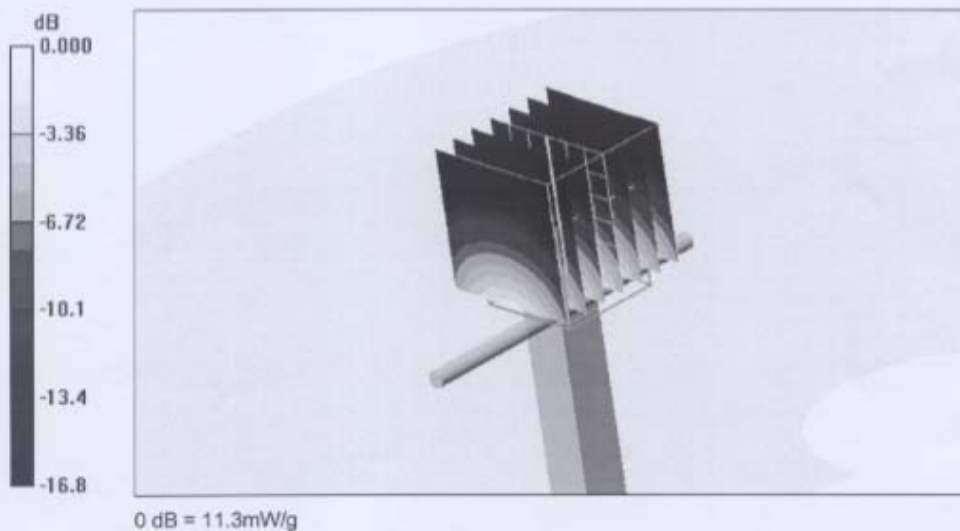
$P_{in} = 250$  mW;  $d = 15$  mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 92.1 V/m; Power Drift = 0.059 dB

Peak SAR (extrapolated) = 16.9 W/kg

**SAR(1 g) = 9.73 mW/g; SAR(10 g) = 5.09 mW/g**

Maximum value of SAR (measured) = 11.3 mW/g





Impedance measurement Plot for Head TSL

