APPENDIX C – 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**
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 **MET Laboratories**

Certificate No: EX3-3722_May10

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3722
Calibration procedure(s)	QA CAL-01.v6, QA CAL-14.v3, QA CAL-23.v3 and QA CAL-25.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	May 19, 2010

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 (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10
DAE4	SN: 660	20-Apr-10 (No. DAE4-660_Apr10)	Apr-11

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

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

Issued: May 19, 2010

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

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ 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:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,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 *NORMx,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 ± 50 MHz to ± 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.

Probe EX3DV4

SN:3722

Manufactured:	August 14, 2009
Calibrated:	May 19, 2010

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 SN:3722

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.54	0.52	0.58	± 10.1%
DCP (mV)[B]	90.5	90.8	88.9	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	300	± 1.5%
			Y	0.00	0.00	1.00	300	
			Z	0.00	0.00	1.00	300	

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%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).

[B] Numerical linearization parameter: uncertainty not required.

[E] Uncertainty is determined using the maximum deviation from linear response applying recatangular distribution and is expressed for the square of the field value.

DASY - Parameters of Probe: EX3DV4 SN:3722

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth	Unc (k=2)
2000	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	7.10	7.10	7.10	0.64	0.68	± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	6.65	6.65	6.65	0.41	0.89	± 11.0%
2600	± 50 / ± 100	39.0 ± 5%	1.96 ± 5%	6.58	6.58	6.58	0.34	1.06	± 11.0%
5200	± 50 / ± 100	36.0 ± 5%	4.66 ± 5%	4.65	4.65	4.65	0.40	1.95	± 13.1%
5500	± 50 / ± 100	35.6 ± 5%	4.96 ± 5%	4.30	4.30	4.30	0.40	1.95	± 13.1%
5800	± 50 / ± 100	35.3 ± 5%	5.27 ± 5%	4.09	4.09	4.09	0.45	1.95	± 13.1%

[C] 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.

DASY - Parameters of Probe: EX3DV4 SN:3722

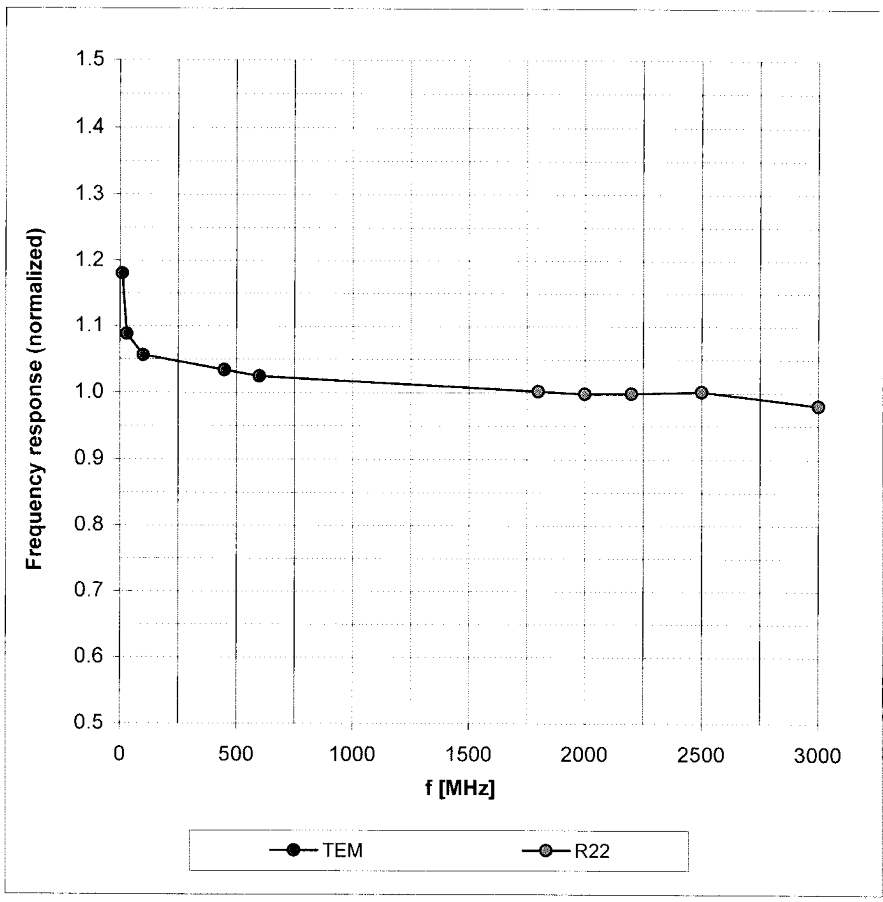
Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
2000	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	7.04	7.04	7.04	0.53	0.78 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	6.82	6.82	6.82	0.41	0.86 ± 11.0%
2600	± 50 / ± 100	52.5 ± 5%	2.16 ± 5%	6.73	6.73	6.73	0.45	0.80 ± 11.0%
5200	± 50 / ± 100	49.0 ± 5%	5.30 ± 5%	4.07	4.07	4.07	0.50	1.95 ± 13.1%
5500	± 50 / ± 100	48.6 ± 5%	5.65 ± 5%	3.63	3.63	3.63	0.55	1.95 ± 13.1%
5800	± 50 / ± 100	48.2 ± 5%	6.00 ± 5%	3.68	3.68	3.68	0.60	1.95 ± 13.1%

[C] 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.

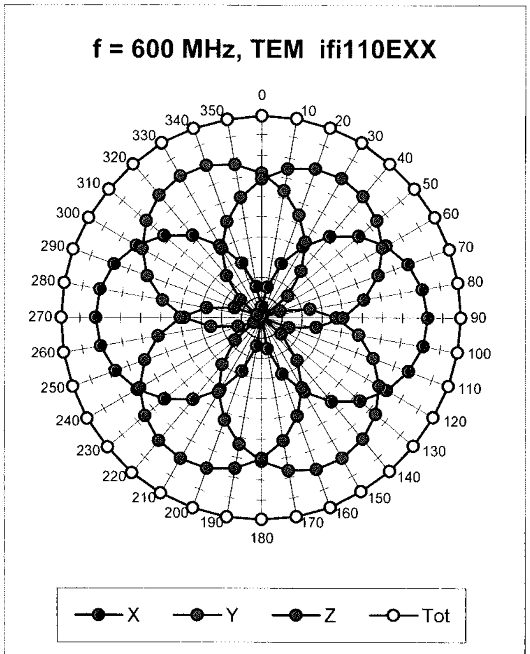
Frequency Response of E-Field

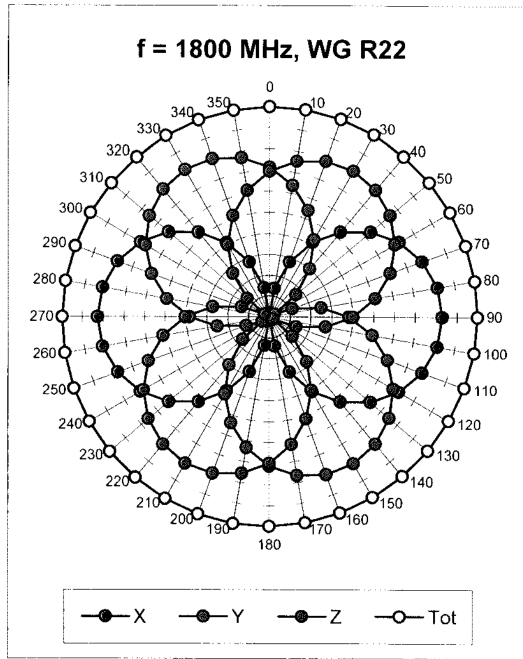
(TEM-Cell:ifi110 EXX, Waveguide: R22)

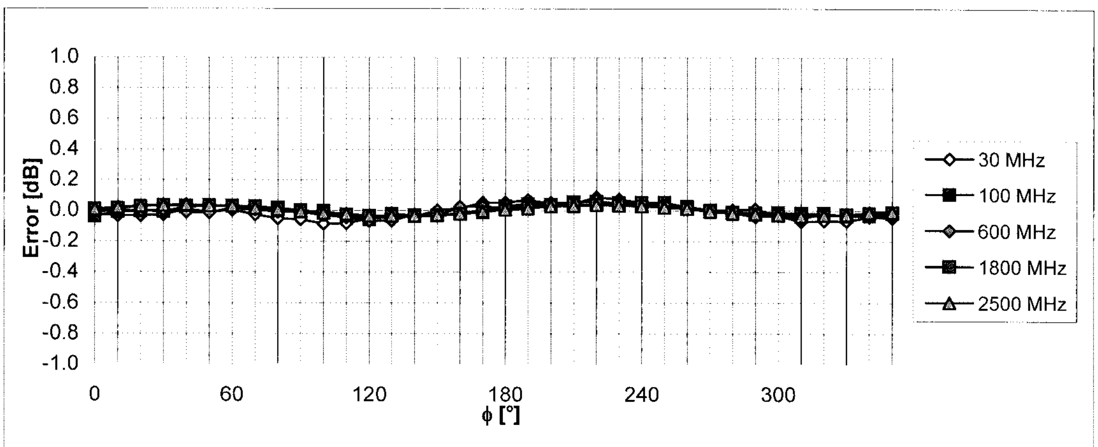


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



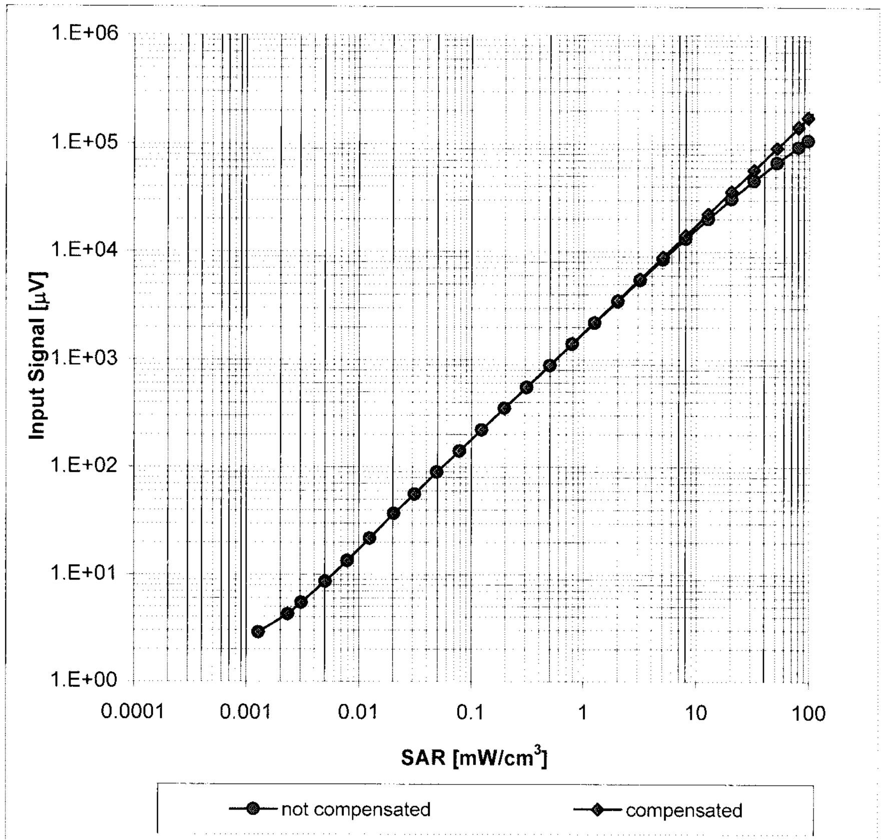


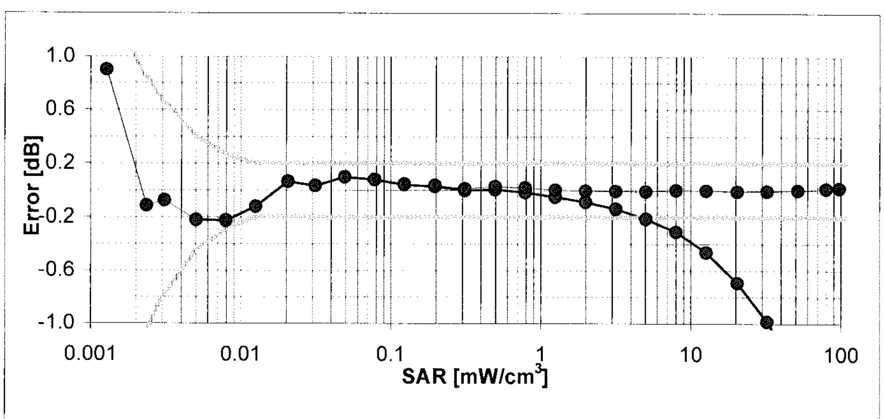


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

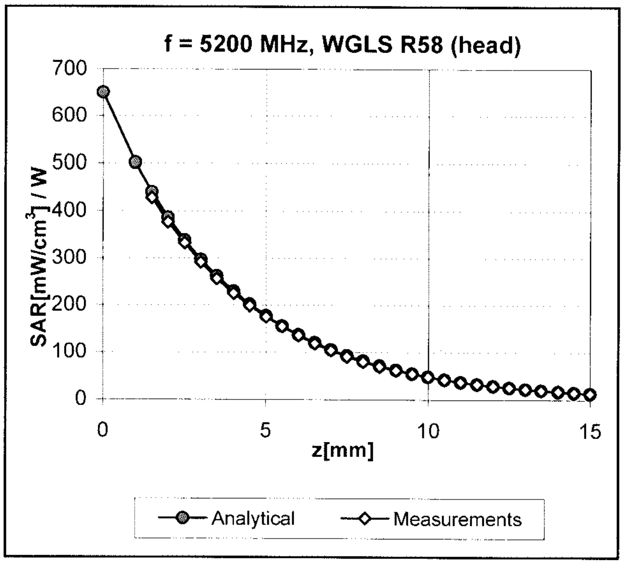
(Waveguide R22, f = 1800 MHz)

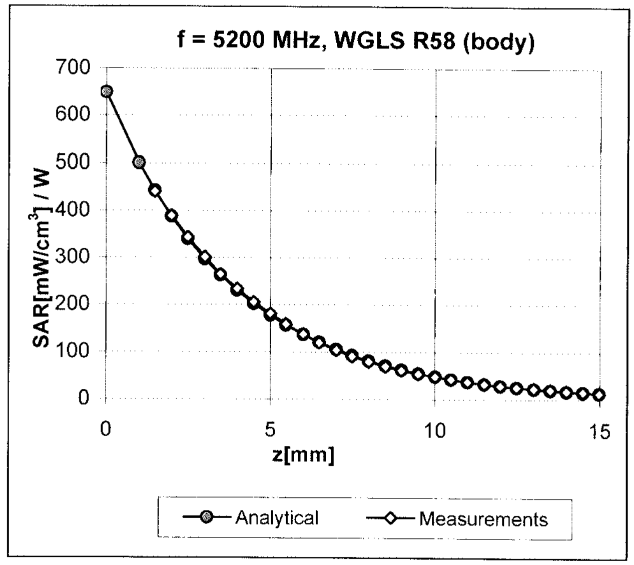




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

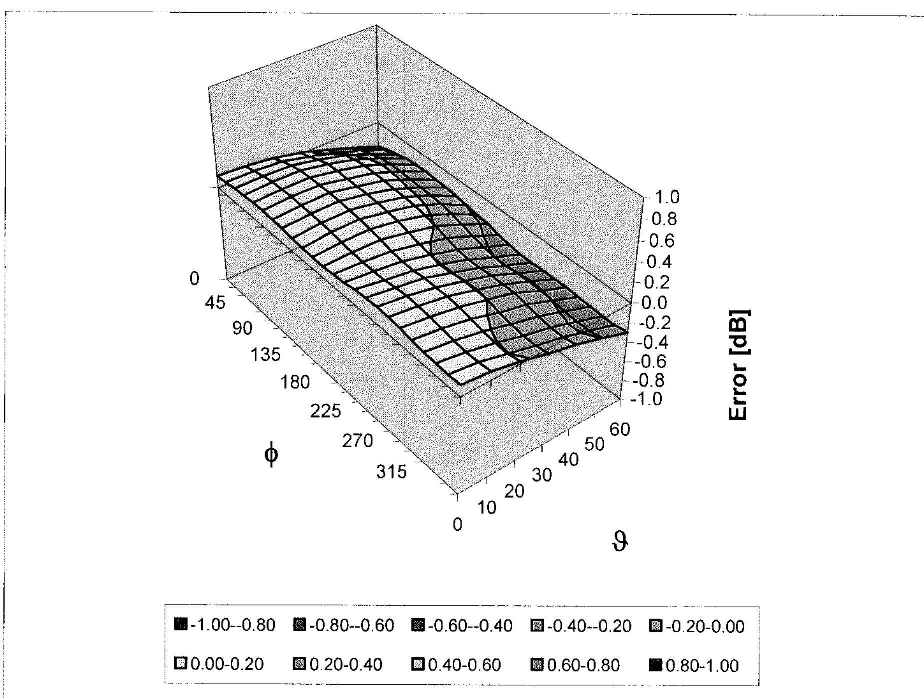
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

APPENDIX D – DIPOLE 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 **MET Laboratories**

Certificate No: D2450V2-857_Nov10

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 857
Calibration procedure(s)	QA CAL-05.v7 Calibration procedure for dipole validation kits
Calibration date:	November 25, 2010

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 (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	D. Iliev
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 25, 2010

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
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
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.

DASY Version	DASY5	V52.2
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	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.8 ± 6 %	1.72 mho/m ± 6 %
Head TSL temperature during test	(21.5 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.1 mW / g
SAR normalized	normalized to 1W	52.4 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**53.4 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.13 mW / g
SAR normalized	normalized to 1W	24.5 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**24.7 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.3 ± 6 %	1.92 mho/m ± 6 %
Body TSL temperature during test	(21.8 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.6 mW / g
SAR normalized	normalized to 1W	50.4 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**50.7 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.82 mW / g
SAR normalized	normalized to 1W	23.3 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**23.3 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.3 Ω + 3.7 jΩ
Return Loss	- 25.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.1 Ω + 5.0 jΩ
Return Loss	- 25.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.160 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	April 23, 2010

DASY5 Validation Report for Head TSL

Date/Time: 25.11.2010 15:09:32

Test Laboratory: SPEAG, Zurich, Switzerland

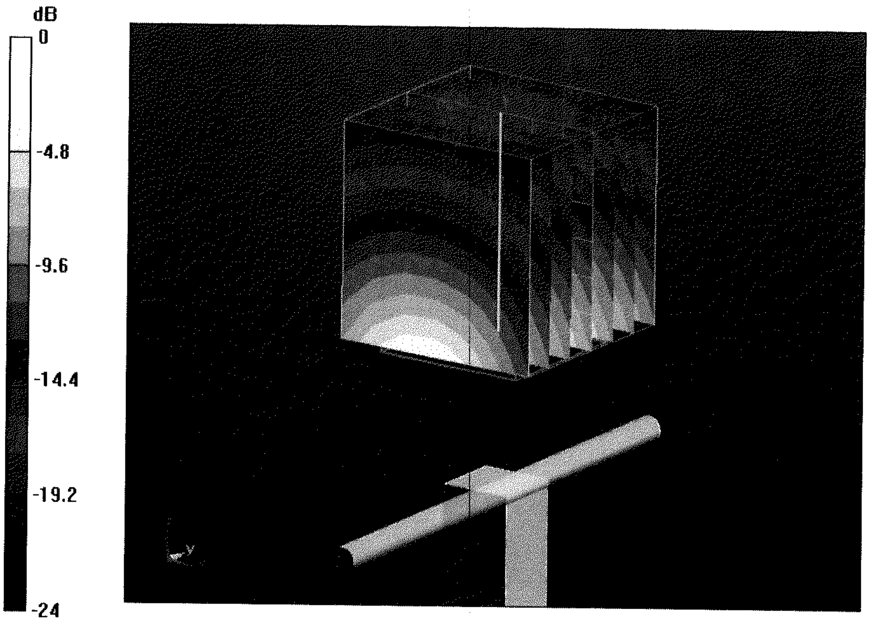
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:857

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL U12 BB
Medium parameters used: f = 2450 MHz; σ = 1.72 mho/m; ε_r = 38.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

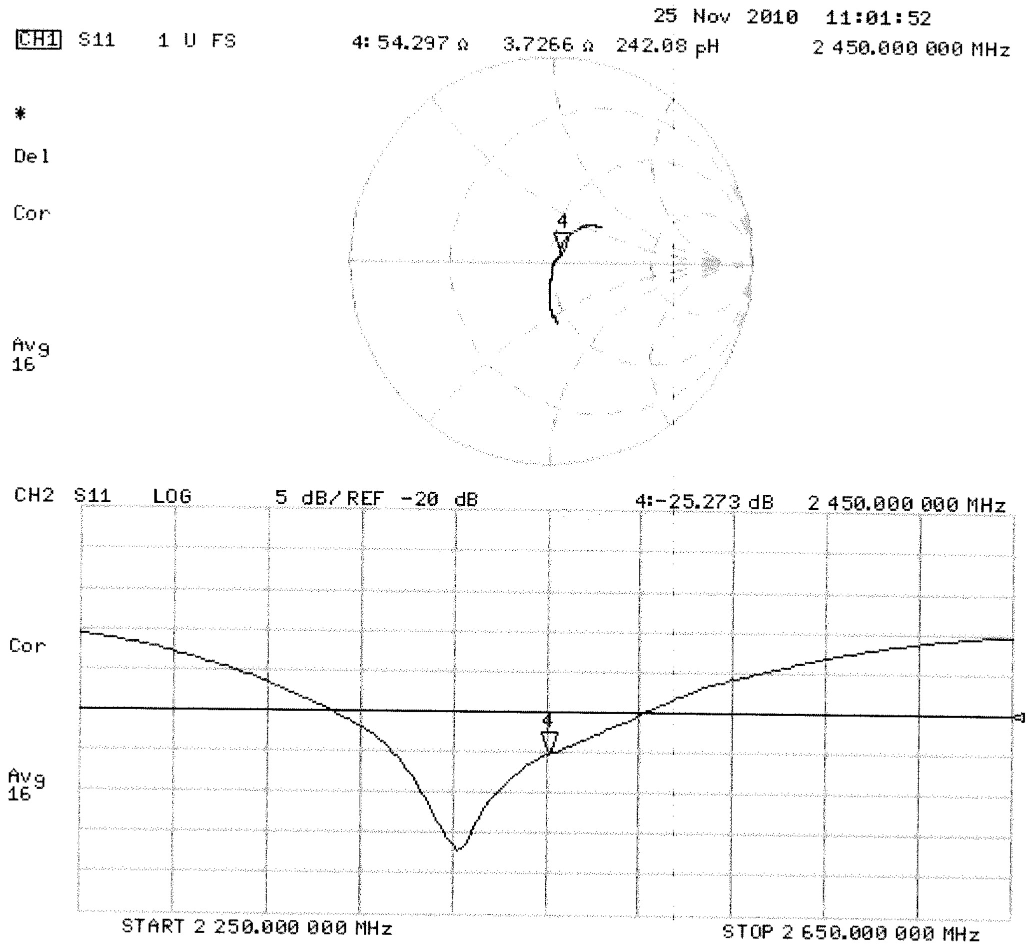
- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

Pin=250 mW/d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.0 V/m; Power Drift = 0.076 dB
Peak SAR (extrapolated) = 26.8 W/kg
SAR(1 g) = 13.1 mW/g; SAR(10 g) = 6.13 mW/g
Maximum value of SAR (measured) = 16.6 mW/g



0 dB = 16.6mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body

Date/Time: 24.11.2010 14:16:43

Test Laboratory: SPEAG, Zurich, Switzerland

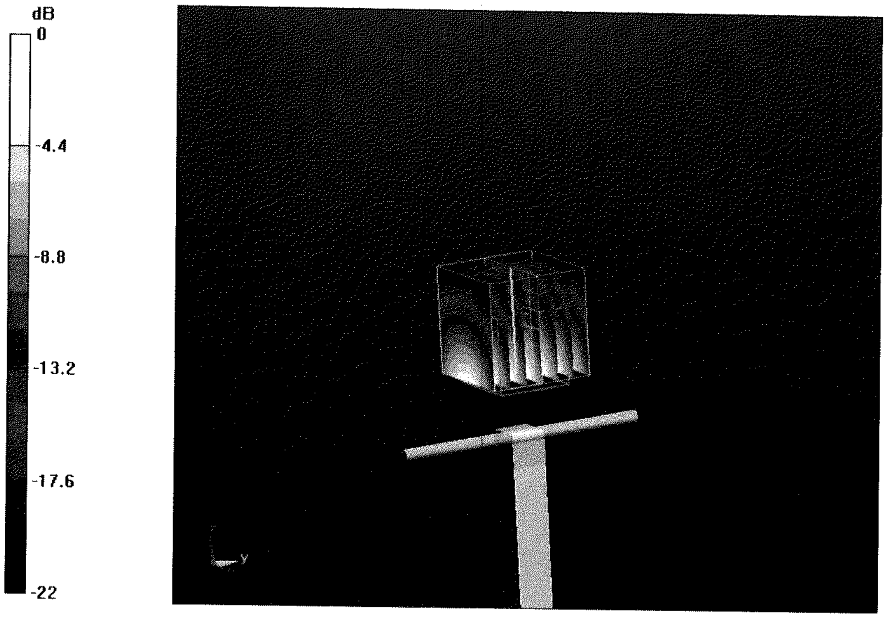
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:857

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL U12 BB
Medium parameters used: f = 2450 MHz; σ = 1.92 mho/m; ε_r = 52.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.31, 4.31, 4.31); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.6 V/m; Power Drift = 0.047 dB
Peak SAR (extrapolated) = 26.7 W/kg
SAR(1 g) = 12.6 mW/g; SAR(10 g) = 5.82 mW/g
Maximum value of SAR (measured) = 16.3 mW/g



0 dB = 16.3mW/g

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
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 **MET Laboratories**

Certificate No: IndexSAR-1S2571_Nov10

CALIBRATION CERTIFICATE

Object	IndexSAR - SN: 1S2571
Calibration procedure(s)	QA CAL-22.v1 Calibration procedure for dipole validation kits between 3-6 GHz
Calibration date:	November 26, 2010

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 (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe EX3DV4	SN: 3503	05-Mar-10 (No. EX3-3503_Mar10)	Mar-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 26, 2010

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) IEC Std 62209 Part 2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", Draft Version 0.9, December 2004

b) 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:

c) 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.

DASY Version	DASY5	V52.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Area Scan resolution	dx, dy = 10 mm	
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 2.0 mm	
Frequency	5200 MHz ± 1 MHz 5500 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.2 ± 6 %	4.59 mho/m ± 6 %
Head TSL temperature during test	(21.4 ± 0.2) °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	condition	
SAR measured	100 mW input power	7.18 mW / g
SAR normalized	normalized to 1W	71.8 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**72.2 mW / g ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.04 mW / g
SAR normalized	normalized to 1W	20.4 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**20.5 mW / g ± 19.5 % (k=2)**

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.7 ± 6 %	4.90 mho/m ± 6 %
Head TSL temperature during test	(21.4 ± 0.2) °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	condition	
SAR measured	100 mW input power	8.21 mW / g
SAR normalized	normalized to 1W	82.1 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**82.5 mW / g ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.35 mW / g
SAR normalized	normalized to 1W	23.5 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**23.6 mW / g ± 19.5 % (k=2)**

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.3 ± 6 %	5.21 mho/m ± 6 %
Head TSL temperature during test	(21.4 ± 0.2) °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	condition	
SAR measured	100 mW input power	7.26 mW / g
SAR normalized	normalized to 1W	72.6 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**72.9 mW / g ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.03 mW / g
SAR normalized	normalized to 1W	20.3 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**20.4 mW / g ± 19.5 % (k=2)**

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.4 ± 6 %	5.32 mho/m ± 6 %
Body TSL temperature during test	(21.0 ± 0.2) °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	condition	
SAR measured	100 mW input power	5.85 mW / g
SAR normalized	normalized to 1W	58.5 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**58.1 mW / g ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	1.63 mW / g
SAR normalized	normalized to 1W	16.3 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**16.2 mW / g ± 19.5 % (k=2)**

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.9 ± 6 %	5.70 mho/m ± 6 %
Body TSL temperature during test	(21.0 ± 0.2) °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	condition	
SAR measured	100 mW input power	6.16 mW / g
SAR normalized	normalized to 1W	61.6 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**61.2 mW / g ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	1.72 mW / g
SAR normalized	normalized to 1W	17.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**17.1 mW / g ± 19.5 % (k=2)**

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.5 ± 6 %	6.10 mho/m ± 6 %
Body TSL temperature during test	(21.0 ± 0.2) °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	condition	
SAR measured	100 mW input power	5.87 mW / g
SAR normalized	normalized to 1W	58.7 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**58.3 mW / g ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	1.62 mW / g
SAR normalized	normalized to 1W	16.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**16.1 mW / g ± 19.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	54.6 Ω - 14.6 jΩ
Return Loss	-16.8 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	35.9 Ω - 3.5 jΩ
Return Loss	-15.5 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	48.7 Ω + 8.8 jΩ
Return Loss	-20.9 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	39.8 Ω - 27.5 jΩ
Return Loss	-10.1 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	41.9 Ω - 27.1 jΩ
Return Loss	-10.6 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	48.5 Ω - 27.3 jΩ
Return Loss	-11.5 dB

Antenna Parameters - Remark

For all tested configurations return loss of the dipole did not comply with standard requirements.

General Antenna Parameters and Design

Electrical Delay (one direction)	0.582 ns

Dipole designed and manufactured by IndexSAR. Please see details on http://www.indexsar.com/balanced.htm

Additional EUT Data

Manufactured by	IndexSAR
Manufactured on	unknown

DASY5 Validation Report for Head TSL

Date/Time: 26.11.2010 16:08:09

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: IndexSAR; Serial: IndexSAR - SN:1S2571

Communication System: CW; Frequency: 5200 MHz, Frequency: 5500 MHz, Frequency: 5800 MHz;
Duty Cycle: 1:1
Medium: HSL 5000
Medium parameters used: f = 5200 MHz; σ = 4.61 mho/m; ε_r = 37.2; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 4.92 mho/m; ε_r = 36.7; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 5.23 mho/m; ε_r = 36.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

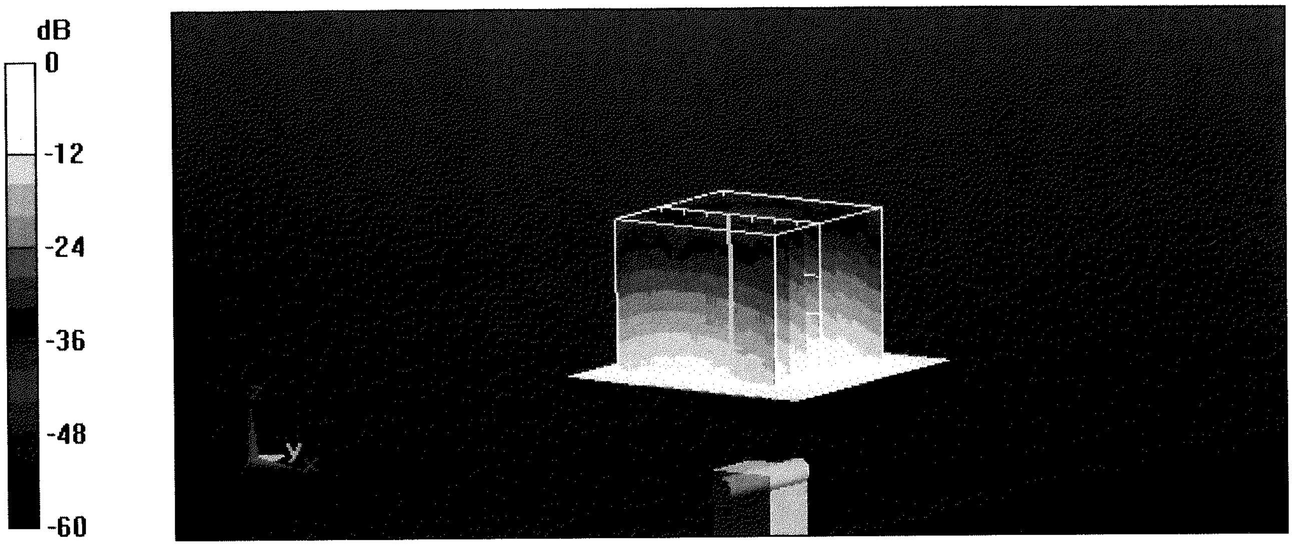
DASY5 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.36, 5.36, 5.36), ConvF(4.85, 4.85, 4.85), ConvF(4.74, 4.74, 4.74); Calibrated: 05.03.2010
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

Configuration 5GHz Dipole (Head)/d=10mm, Pin=100mW, f=5200 MHz/Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 56.7 V/m; Power Drift = 0.166 dB
Peak SAR (extrapolated) = 27.7 W/kg
SAR(1 g) = 7.18 mW/g; SAR(10 g) = 2.04 mW/g
Maximum value of SAR (measured) = 14.1 mW/g

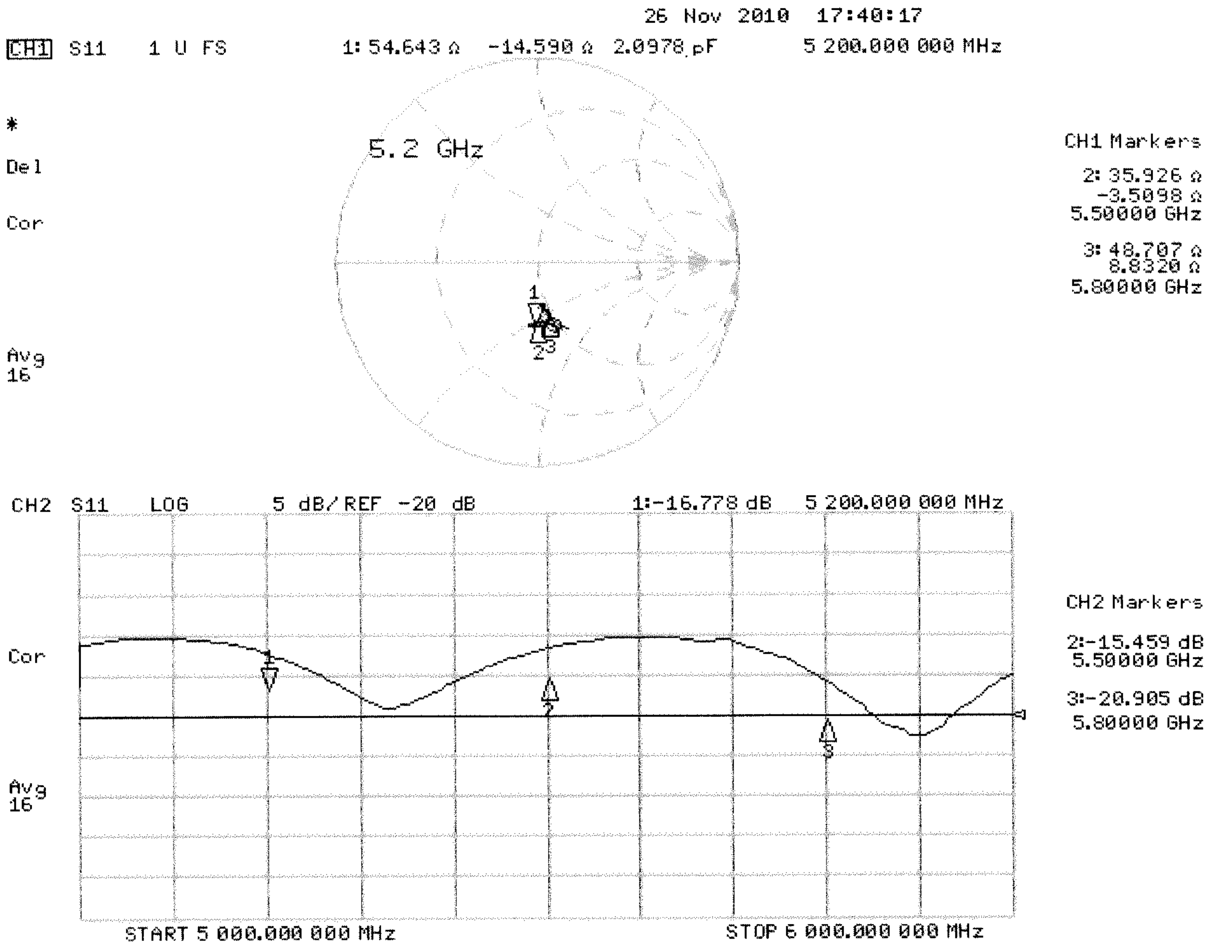
Configuration 5GHz Dipole (Head)/d=10mm, Pin=100mW, f=5500 MHz/Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 59.5 V/m; Power Drift = 0.090 dB
Peak SAR (extrapolated) = 33.3 W/kg
SAR(1 g) = 8.21 mW/g; SAR(10 g) = 2.35 mW/g
Maximum value of SAR (measured) = 16.4 mW/g

Configuration 5GHz Dipole (Head)/d=10mm, Pin=100mW, f=5800 MHz/Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 55.2 V/m; Power Drift = 0.113 dB
Peak SAR (extrapolated) = 31.3 W/kg
SAR(1 g) = 7.26 mW/g; SAR(10 g) = 2.03 mW/g
Maximum value of SAR (measured) = 14.7 mW/g



0 dB = 14.7mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 16.11.2010 15:06:09

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: IndexSAR; Serial: IndexSAR - SN:1S2571

Communication System: CW; Frequency: 5200 MHz, Frequency: 5500 MHz, Frequency: 5800 MHz;
Duty Cycle: 1:1
Medium: MSL 5000 MHz
Medium parameters used: f = 5200 MHz; σ = 5.38 mho/m; ε_r = 47.3; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 5.77 mho/m; ε_r = 46.8; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 6.17 mho/m; ε_r = 46.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

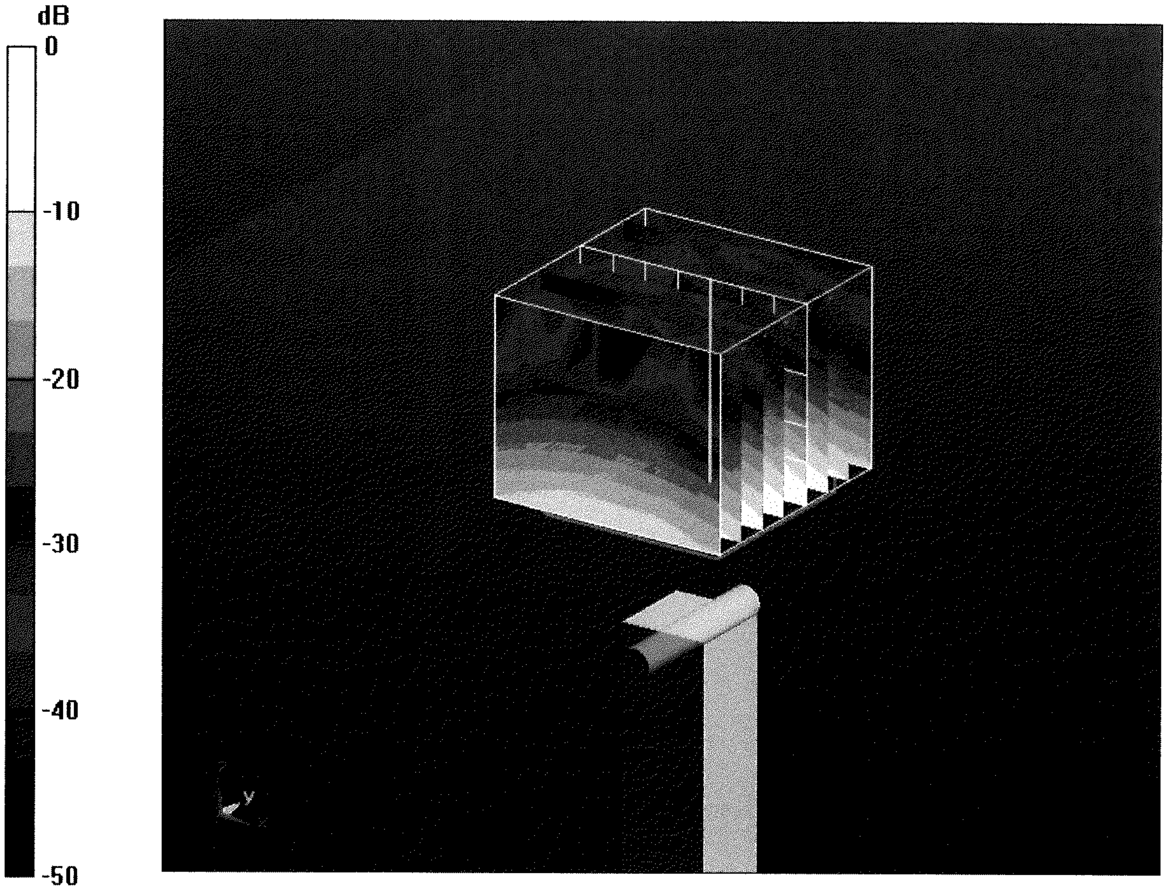
DASY5 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.88, 4.88, 4.88), ConvF(4.37, 4.37, 4.37), ConvF(4.57, 4.57, 4.57); Calibrated: 05.03.2010
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

Configuration 5GHz Dipole (Body)/d=10mm, Pin=100mW, f=5200 MHz/Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 52.4 V/m; Power Drift = -0.035 dB
Peak SAR (extrapolated) = 23.1 W/kg
SAR(1 g) = 5.85 mW/g; SAR(10 g) = 1.63 mW/g
Maximum value of SAR (measured) = 11.6 mW/g

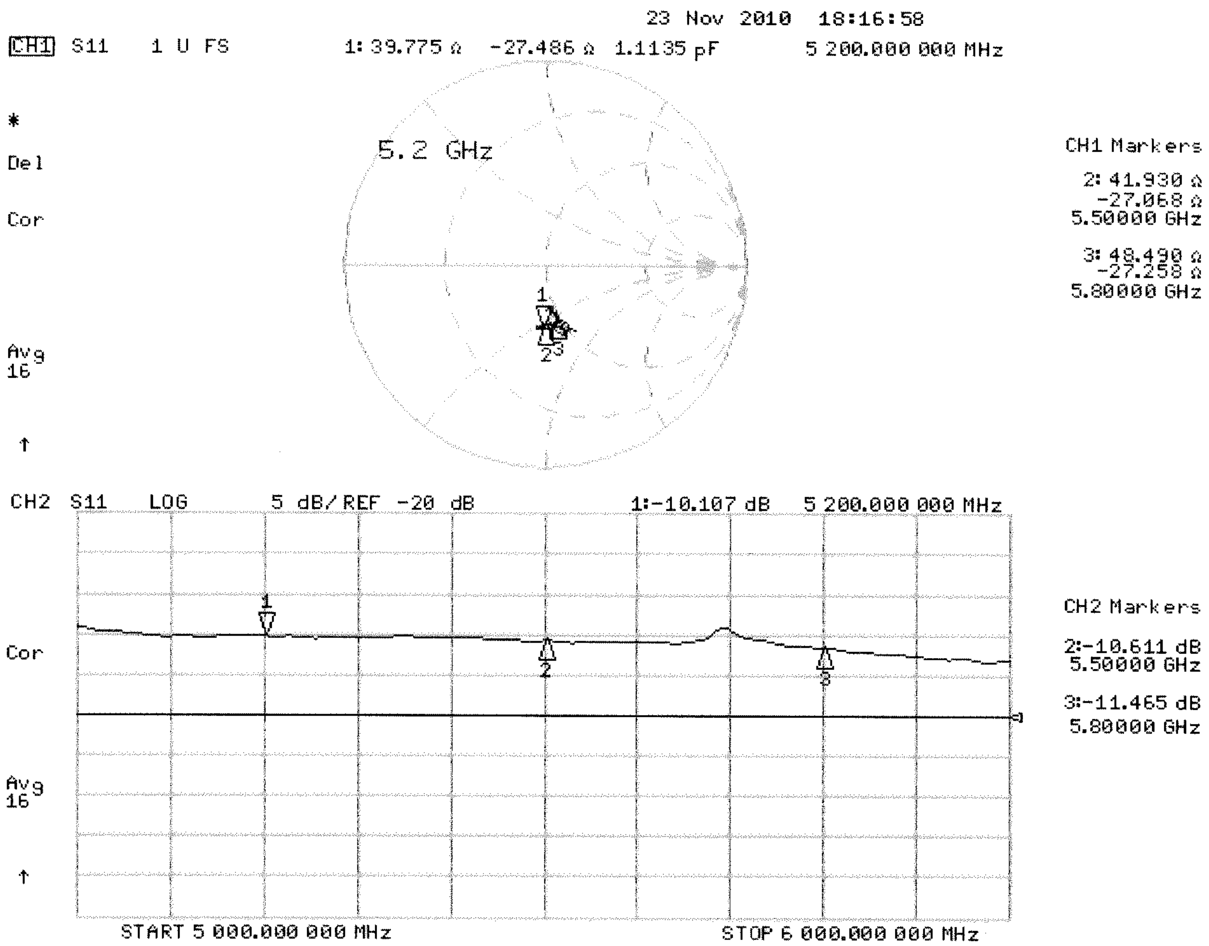
Configuration 5GHz Dipole (Body)/d=10mm, Pin=100mW, f=5500 MHz/Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 52.6 V/m; Power Drift = 0.011 dB
Peak SAR (extrapolated) = 25.8 W/kg
SAR(1 g) = 6.16 mW/g; SAR(10 g) = 1.72 mW/g
Maximum value of SAR (measured) = 12.2 mW/g

Configuration 5GHz Dipole (Body)/d=10mm, Pin=100mW, f=5800 MHz/Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 49.8 V/m; Power Drift = 0.037 dB
Peak SAR (extrapolated) = 26.3 W/kg
SAR(1 g) = 5.87 mW/g; SAR(10 g) = 1.62 mW/g
Maximum value of SAR (measured) = 11.9 mW/g



0 dB = 11.9mW/g

Impedance Measurement Plot for Body TSL



APPENDIX E - MEASURED FLUID DIELECTRIC PARAMETERS

Title

SubTitle

March 30, 2011 08:35 AM

Frequency	e'	e''
2.400000000 GI	39.404	13.5930
2.402000000 GI	39.391	13.5964
2.404000000 GI	39.389	13.6035
2.406000000 GI	39.374	13.6150
2.408000000 GI	39.374	13.6191
2.410000000 GI	39.354	13.6261
2.412000000 GI	39.351	13.6280
2.414000000 GI	39.347	13.6446
2.416000000 GI	39.337	13.6436
2.418000000 GI	39.322	13.6447
2.420000000 GI	39.317	13.6652
2.422000000 GI	39.302	13.6557
2.424000000 GI	39.289	13.6631
2.426000000 GI	39.282	13.6733
2.428000000 GI	39.277	13.6704
2.430000000 GI	39.263	13.6843
2.432000000 GI	39.245	13.6832
2.434000000 GI	39.236	13.6872
2.436000000 GI	39.237	13.7003
2.438000000 GI	39.229	13.7028
2.440000000 GI	39.206	13.7090
2.442000000 GI	39.209	13.7126
2.444000000 GI	39.186	13.7122
2.446000000 GI	39.195	13.7176
2.448000000 GI	39.171	13.7303
2.450000000 GI	39.184	13.7117
2.452000000 GI	39.169	13.7284
2.454000000 GI	39.159	13.7338
2.456000000 GI	39.157	13.7355
2.458000000 GI	39.142	13.7431
2.460000000 GI	39.147	13.7682
2.462000000 GI	39.142	13.7627
2.464000000 GI	39.139	13.7749
2.466000000 GI	39.116	13.7875
2.468000000 GI	39.114	13.7852

2.470000000 GI	39.108!	13.8017
2.472000000 GI	39.104!	13.8062
2.474000000 GI	39.089:	13.8177
2.476000000 GI	39.074(	13.8277
2.478000000 GI	39.067(	13.8365
2.480000000 GI	39.049'	13.8419
2.482000000 GI	39.039!	13.8485
2.484000000 GI	39.027:	13.8621
2.486000000 GI	39.016(	13.8677
2.488000000 GI	39.005!	13.8719
2.490000000 GI	39.002'	13.8788
2.492000000 GI	38.994!	13.8801
2.494000000 GI	38.981:	13.8860
2.496000000 GI	38.971!	13.8862
2.498000000 GI	38.977'	13.8840
2.500000000 GI	38.959:	13.8907

Title

SubTitle

April 01, 2011 08:07 AM

Frequency	e'	e''
2.400000000 GH	52.384	14.5231
2.402000000 GH	52.374	14.5477
2.404000000 GH	52.373	14.5397
2.406000000 GH	52.353	14.5555
2.408000000 GH	52.351	14.5607
2.410000000 GH	52.346	14.5737
2.412000000 GH	52.350	14.5861
2.414000000 GH	52.316	14.6007
2.416000000 GH	52.324	14.5958
2.418000000 GH	52.315	14.6185
2.420000000 GH	52.307	14.6097
2.422000000 GH	52.300	14.6123
2.424000000 GH	52.294	14.6338
2.426000000 GH	52.289	14.6419
2.428000000 GH	52.274	14.6506
2.430000000 GH	52.272	14.6623
2.432000000 GH	52.268	14.6845
2.434000000 GH	52.262	14.6803
2.436000000 GH	52.247	14.6956
2.438000000 GH	52.242	14.6989
2.440000000 GH	52.224	14.7125
2.442000000 GH	52.222	14.7079
2.444000000 GH	52.218	14.7140
2.446000000 GH	52.201	14.7350
2.448000000 GH	52.202	14.7360
2.450000000 GH	52.185	14.7409
2.452000000 GH	52.179	14.7641
2.454000000 GH	52.170	14.7429
2.456000000 GH	52.152	14.7677
2.458000000 GH	52.147	14.7661
2.460000000 GH	52.141	14.7798
2.462000000 GH	52.145	14.7776
2.464000000 GH	52.131	14.7880
2.466000000 GH	52.119	14.7925
2.468000000 GH	52.119	14.8066

2.470000000 GH	52.1129	14.8041
2.472000000 GH	52.1100	14.8080
2.474000000 GH	52.0925	14.8280
2.476000000 GH	52.0930	14.8307
2.478000000 GH	52.0845	14.8387
2.480000000 GH	52.0755	14.8533
2.482000000 GH	52.0800	14.8575
2.484000000 GH	52.0678	14.8639
2.486000000 GH	52.0603	14.8699
2.488000000 GH	52.0394	14.8863
2.490000000 GH	52.0398	14.8841
2.492000000 GH	52.0359	14.8983
2.494000000 GH	52.0260	14.9035
2.496000000 GH	52.0185	14.9227
2.498000000 GH	52.0179	14.9177
2.500000000 GH	52.0033	14.9251

Title

SubTitle

April 04, 2011 06:23 AM

Frequency	e'	e''
5.000000000 G	35.086	16.0349
5.020000000 G	35.022	16.0550
5.040000000 G	35.033	16.0161
5.060000000 G	34.935	16.0830
5.080000000 G	34.945	16.1946
5.100000000 G	34.946	16.0744
5.120000000 G	34.922	16.1035
5.140000000 G	35.048	16.0199
5.160000000 G	34.764	16.0910
5.180000000 G	34.870	16.1529
5.200000000 G	34.829	16.1430
5.220000000 G	34.771	16.0493
5.240000000 G	34.817	16.1401
5.260000000 G	34.662	16.1793
5.280000000 G	34.714	16.1746
5.300000000 G	34.622	16.0914
5.320000000 G	34.703	16.0957
5.340000000 G	34.563	16.0936
5.360000000 G	34.623	16.0876
5.380000000 G	34.555	16.0871
5.400000000 G	34.551	16.1799
5.420000000 G	34.543	15.9990
5.440000000 G	34.491	16.1665
5.460000000 G	34.485	16.0651
5.480000000 G	34.442	16.2377
5.500000000 G	34.291	16.1724
5.520000000 G	34.369	16.1571
5.540000000 G	34.259	16.1961
5.560000000 G	34.273	16.0787
5.580000000 G	34.221	16.0929
5.600000000 G	34.140	16.1120
5.620000000 G	34.209	16.1322
5.640000000 G	34.215	16.2503
5.660000000 G	34.216	16.1296
5.680000000 G	34.155	16.2399

5.700000000 GH	34.2387	16.1839
5.720000000 GH	34.0924	16.2023
5.740000000 GH	34.0794	16.1343
5.760000000 GH	34.1369	16.2017
5.780000000 GH	34.0650	16.1669
5.800000000 GH	33.9521	16.0562
5.820000000 GH	33.9412	16.1315
5.840000000 GH	34.0530	16.2882
5.860000000 GH	34.0674	16.2167
5.880000000 GH	33.9437	16.1538
5.900000000 GH	33.9632	16.1877
5.920000000 GH	33.8794	16.0571
5.940000000 GH	33.7093	16.0597
5.960000000 GH	33.7421	16.1716
5.980000000 GH	33.6739	16.2057
6.000000000 GH	33.6322	16.1961

Title

SubTitle

April 06, 2011 06:31 AM

Frequency	e'	e''
5.000000000 GH	35.851(	16.1475
5.020000000 GH	35.740	16.1799
5.040000000 GH	35.845	16.1661
5.060000000 GH	35.752(	16.2918
5.080000000 GH	35.790	16.3764
5.100000000 GH	35.701	16.1698
5.120000000 GH	35.757	16.2079
5.140000000 GH	35.767	16.2649
5.160000000 GH	35.582(	16.3650
5.180000000 GH	35.808	16.3257
5.200000000 GH	35.725	16.3816
5.220000000 GH	35.520	16.2496
5.240000000 GH	35.495(	16.3817
5.260000000 GH	35.400	16.4247
5.280000000 GH	35.595(	16.3544
5.300000000 GH	35.547	16.3647
5.320000000 GH	35.602	16.3348
5.340000000 GH	35.425	16.3272
5.360000000 GH	35.389(	16.3428
5.380000000 GH	35.440	16.2498
5.400000000 GH	35.362	16.5369
5.420000000 GH	35.442(	16.3827
5.440000000 GH	35.282(	16.4572
5.460000000 GH	35.250	16.3044
5.480000000 GH	35.206	16.4473
5.500000000 GH	35.110	16.3536
5.520000000 GH	35.183	16.5061
5.540000000 GH	35.107	16.4693
5.560000000 GH	35.196	16.3759
5.580000000 GH	35.087	16.3846
5.600000000 GH	34.934	16.4103
5.620000000 GH	35.062	16.4288
5.640000000 GH	35.081	16.4870
5.660000000 GH	35.100	16.3942
5.680000000 GH	35.084(	16.4626

5.700000000 GI	35.026	16.4281
5.720000000 GI	34.819	16.3871
5.740000000 GI	34.834	16.4482
5.760000000 GI	34.993	16.5441
5.780000000 GI	34.882	16.4886
5.800000000 GI	34.778	16.3907
5.820000000 GI	34.714	16.3450
5.840000000 GI	34.798	16.4579
5.860000000 GI	34.781	16.5223
5.880000000 GI	34.773	16.4976
5.900000000 GI	34.773	16.4741
5.920000000 GI	34.737	16.3637
5.940000000 GI	34.505	16.3839
5.960000000 GI	34.557	16.4608
5.980000000 GI	34.326	16.5433
6.000000000 GI	34.445	16.5698

Title

SubTitle

April 07, 2011 06:16 AM

Frequency	e'	e''
5.000000000 GI	36.050!	16.9991
5.020000000 GI	35.867!	17.0407
5.040000000 GI	35.789(	16.9063
5.060000000 GI	35.958!	16.9791
5.080000000 GI	35.835!	17.0320
5.100000000 GI	35.802	17.0795
5.120000000 GI	35.783!	17.0921
5.140000000 GI	35.637	16.9978
5.160000000 GI	35.700(	17.0726
5.180000000 GI	35.602	17.1396
5.200000000 GI	35.592(	16.9954
5.220000000 GI	35.515	17.1136
5.240000000 GI	35.541	17.0963
5.260000000 GI	35.510(	17.1494
5.280000000 GI	35.383	17.1446
5.300000000 GI	35.284!	17.1071
5.320000000 GI	35.373	17.0364
5.340000000 GI	35.294	17.1910
5.360000000 GI	35.248(	17.2803
5.380000000 GI	35.289(	17.2536
5.400000000 GI	35.243	17.2159
5.420000000 GI	35.039	17.2294
5.440000000 GI	35.076	17.2633
5.460000000 GI	35.036!	17.2031
5.480000000 GI	35.081!	17.2149
5.500000000 GI	34.978(	17.3068
5.520000000 GI	34.908!	17.3256
5.540000000 GI	34.827	17.2824
5.560000000 GI	34.866	17.2944
5.580000000 GI	34.763(	17.4727
5.600000000 GI	34.761(	17.3390
5.620000000 GI	34.646(	17.3197
5.640000000 GI	34.716(	17.4593
5.660000000 GI	34.554	17.4878
5.680000000 GI	34.551	17.3559

5.700000000 G	34.564	17.4564
5.720000000 G	34.542	17.3159
5.740000000 G	34.492	17.4729
5.760000000 G	34.479	17.5204
5.780000000 G	34.435	17.5519
5.800000000 G	34.332	17.4884
5.820000000 G	34.329	17.5600
5.840000000 G	34.159	17.4616
5.860000000 G	34.146	17.6672
5.880000000 G	34.244	17.6545
5.900000000 G	34.306	17.6675
5.920000000 G	34.210	17.5246
5.940000000 G	34.139	17.5483
5.960000000 G	34.017	17.7276
5.980000000 G	34.048	17.6969
6.000000000 G	33.988	17.5603

Title

SubTitle

April 08, 2011 06:28 AM

Frequency	e'	e''
5.000000000 GI	35.682	16.1881
5.020000000 GI	35.630	16.1893
5.040000000 GI	35.575	16.2024
5.060000000 GI	35.538	16.2226
5.080000000 GI	35.498	16.2723
5.100000000 GI	35.496	16.2803
5.120000000 GI	35.438	16.2749
5.140000000 GI	35.398	16.2817
5.160000000 GI	35.342	16.3028
5.180000000 GI	35.302	16.3429
5.200000000 GI	35.266	16.3767
5.220000000 GI	35.245	16.3956
5.240000000 GI	35.209	16.3957
5.260000000 GI	35.177	16.3804
5.280000000 GI	35.119	16.3866
5.300000000 GI	35.064	16.4337
5.320000000 GI	35.038	16.4706
5.340000000 GI	35.019	16.4980
5.360000000 GI	34.996	16.4840
5.380000000 GI	34.959	16.4849
5.400000000 GI	34.882	16.4837
5.420000000 GI	34.828	16.5289
5.440000000 GI	34.807	16.5518
5.460000000 GI	34.800	16.5809
5.480000000 GI	34.779	16.5950
5.500000000 GI	34.745	16.5747
5.520000000 GI	34.653	16.5760
5.540000000 GI	34.586	16.5956
5.560000000 GI	34.515	16.6270
5.580000000 GI	34.503	16.6741
5.600000000 GI	34.517	16.7172
5.620000000 GI	34.520	16.7368
5.640000000 GI	34.470	16.7135
5.660000000 GI	34.402	16.7136
5.680000000 GI	34.338	16.7142

5.700000000 GI	34.318	16.7599
5.720000000 GI	34.299	16.7753
5.740000000 GI	34.335	16.8196
5.760000000 GI	34.295	16.8083
5.780000000 GI	34.240	16.8088
5.800000000 GI	34.168	16.8190
5.820000000 GI	34.105	16.8466
5.840000000 GI	34.114	16.9021
5.860000000 GI	34.148	16.9114
5.880000000 GI	34.151	16.9211
5.900000000 GI	34.109	16.9075
5.920000000 GI	34.031	16.8937
5.940000000 GI	33.942	16.8998
5.960000000 GI	33.876	16.9236
5.980000000 GI	33.833	16.9384
6.000000000 GI	33.814	16.9482

Title

SubTitle

April 13, 2011 06:24 AM

Frequency	e'	e''
5.000000000 GI	51.191	17.6007
5.020000000 GI	50.964	17.6435
5.040000000 GI	51.092	17.6408
5.060000000 GI	50.961	17.7965
5.080000000 GI	50.996	17.7485
5.100000000 GI	50.937	17.7725
5.120000000 GI	50.910	17.7463
5.140000000 GI	50.919	17.8392
5.160000000 GI	50.798	17.8594
5.180000000 GI	50.813	17.9745
5.200000000 GI	50.702	17.9077
5.220000000 GI	50.740	17.9443
5.240000000 GI	50.599	17.9846
5.260000000 GI	50.632	18.0219
5.280000000 GI	50.631	18.0397
5.300000000 GI	50.513	17.9267
5.320000000 GI	50.433	18.1132
5.340000000 GI	50.332	18.1920
5.360000000 GI	50.191	18.0851
5.380000000 GI	50.257	18.1919
5.400000000 GI	50.275	18.1024
5.420000000 GI	50.237	18.2370
5.440000000 GI	50.194	18.2705
5.460000000 GI	50.017	18.2639
5.480000000 GI	49.874	18.3011
5.500000000 GI	50.081	18.3247
5.520000000 GI	49.946	18.4413
5.540000000 GI	49.945	18.3470
5.560000000 GI	49.933	18.4260
5.580000000 GI	49.849	18.5376
5.600000000 GI	49.775	18.6583
5.620000000 GI	49.792	18.6118
5.640000000 GI	49.766	18.5469
5.660000000 GI	49.657	18.6339
5.680000000 GI	49.548	18.6884

5.700000000 G	49.626	18.7708
5.720000000 G	49.574	18.6069
5.740000000 G	49.755	18.6643
5.760000000 G	49.574	18.6866
5.780000000 G	49.343	18.7754
5.800000000 G	49.551	18.6963
5.820000000 G	49.384	18.9455
5.840000000 G	49.260	18.8908
5.860000000 G	49.319	18.8640
5.880000000 G	49.292	18.7773
5.900000000 G	49.163	18.8636
5.920000000 G	49.134	18.9634
5.940000000 G	48.887	19.0268
5.960000000 G	49.055	19.0683
5.980000000 G	49.012	18.8603
6.000000000 G	48.965	19.0709

Title

SubTitle

April 14, 2011 06:25 AM

Frequency	e'	e''
5.000000000 GI	50.587	16.5197
5.020000000 GI	50.478	16.4748
5.040000000 GI	50.662	16.7008
5.060000000 GI	50.588	16.7006
5.080000000 GI	50.498	16.7006
5.100000000 GI	50.498	16.7020
5.120000000 GI	50.504	16.6782
5.140000000 GI	50.570	16.7432
5.160000000 GI	50.463	16.7127
5.180000000 GI	50.322	16.7367
5.200000000 GI	50.341	16.7672
5.220000000 GI	50.242	16.8250
5.240000000 GI	50.239	16.9486
5.260000000 GI	50.163	16.9063
5.280000000 GI	50.345	16.9660
5.300000000 GI	50.077	16.9447
5.320000000 GI	50.194	16.9497
5.340000000 GI	50.080	16.9806
5.360000000 GI	49.997	16.8581
5.380000000 GI	50.019	16.9708
5.400000000 GI	49.962	17.0044
5.420000000 GI	49.985	17.1227
5.440000000 GI	49.905	17.0449
5.460000000 GI	49.766	17.0698
5.480000000 GI	49.811	17.1493
5.500000000 GI	49.877	17.1091
5.520000000 GI	49.679	17.2785
5.540000000 GI	49.803	17.1628
5.560000000 GI	49.654	17.2489
5.580000000 GI	49.600	17.3870
5.600000000 GI	49.482	17.4226
5.620000000 GI	49.640	17.3736
5.640000000 GI	49.627	17.2419
5.660000000 GI	49.502	17.3670
5.680000000 GI	49.364	17.5343

5.700000000 GI	49.393	17.4060
5.720000000 GI	49.322	17.3824
5.740000000 GI	49.511	17.3706
5.760000000 GI	49.199	17.4140
5.780000000 GI	49.294	17.4858
5.800000000 GI	49.290	17.3283
5.820000000 GI	49.089	17.4527
5.840000000 GI	48.999	17.6939
5.860000000 GI	48.950	17.7337
5.880000000 GI	49.186	17.4795
5.900000000 GI	48.905	17.5091
5.920000000 GI	48.923	17.6205
5.940000000 GI	48.741	17.6375
5.960000000 GI	48.681	17.6610
5.980000000 GI	48.697	17.7171
6.000000000 GI	48.748	17.7718

APPENDIX F – PHANTOM CERTIFICATE OF CONFORMITY

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Certificate of conformity / First Article Inspection

Item	SAM Twin Phantom V4.0
Type No	QD 000 P40 C
Series No	TP-1150 and higher
Manufacturer / Origin	Untersee Composites Hauptstr. 69 CH-8559 Fruthwilen Switzerland

Tests

The series production process used allows the limitation to test of first articles.
Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been retested using further series units (called samples).

Test	Requirement	Details	Units tested
Shape	Compliance with the geometry according to the CAD model.	IT'IS CAD File (*)	First article, Samples
Material thickness	Compliant with the requirements according to the standards	2mm +/- 0.2mm in specific areas; 6mm +/- 0.2mm at ERP	First article, Samples
Material parameters	Dielectric parameters for required frequencies	200 MHz – 3 GHz Relative permittivity < 5 Loss tangent < 0.05.	Material sample TP 104-5
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards if handled and cleaned according to the instructions	DEGMBE based simulating liquids	Pre-series, First article, Samples

Standards

[1] CENELEC EN 50361
[2] IEEE Std 1528-200x Draft CD 1.1 (Dec 02)
[3] IEC 62209/CD (Nov 02)
(*) The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of [1] and [3].

Conformity

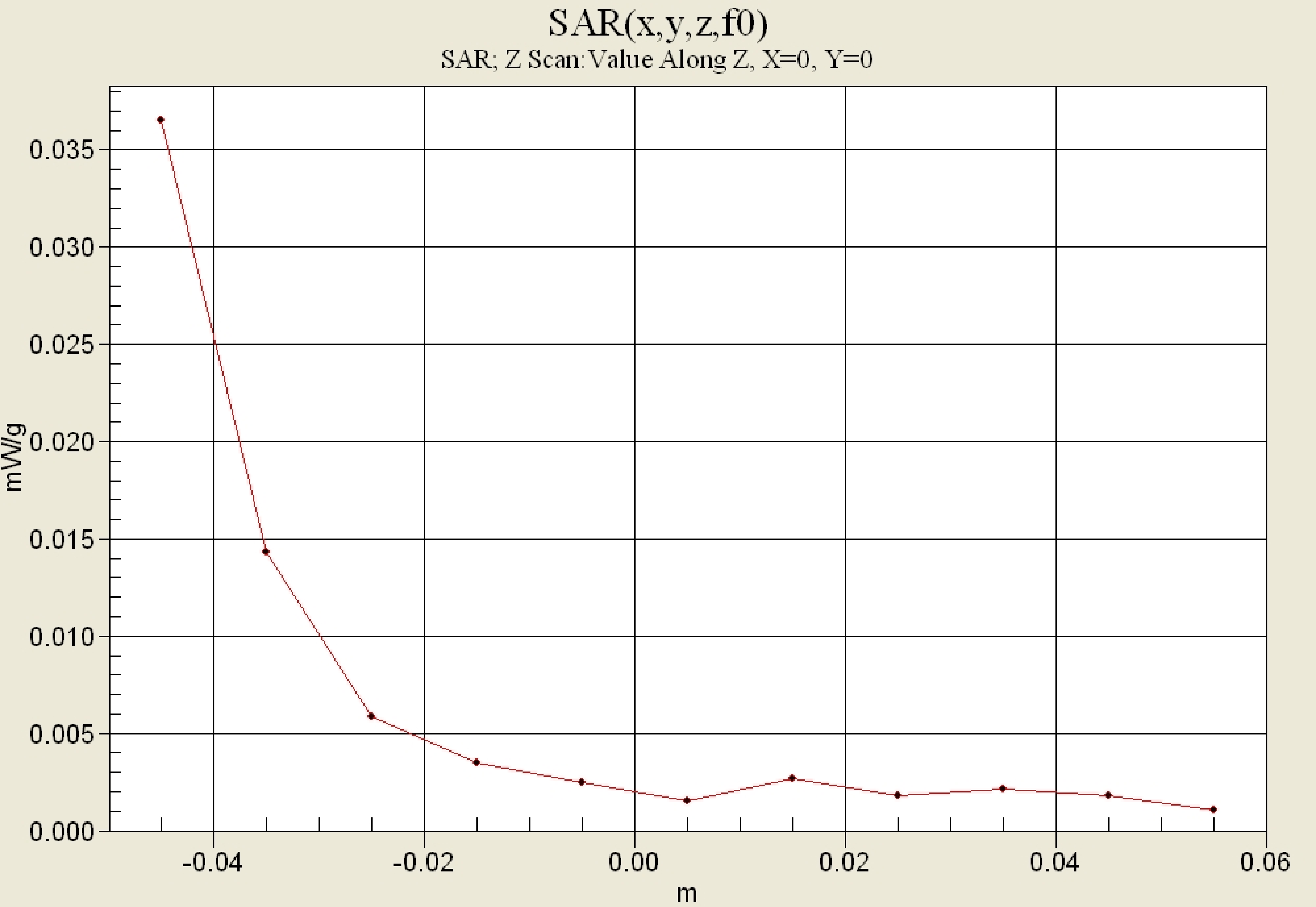
Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standard [1] and draft standards [2] and [3].

Date 7.8.2003

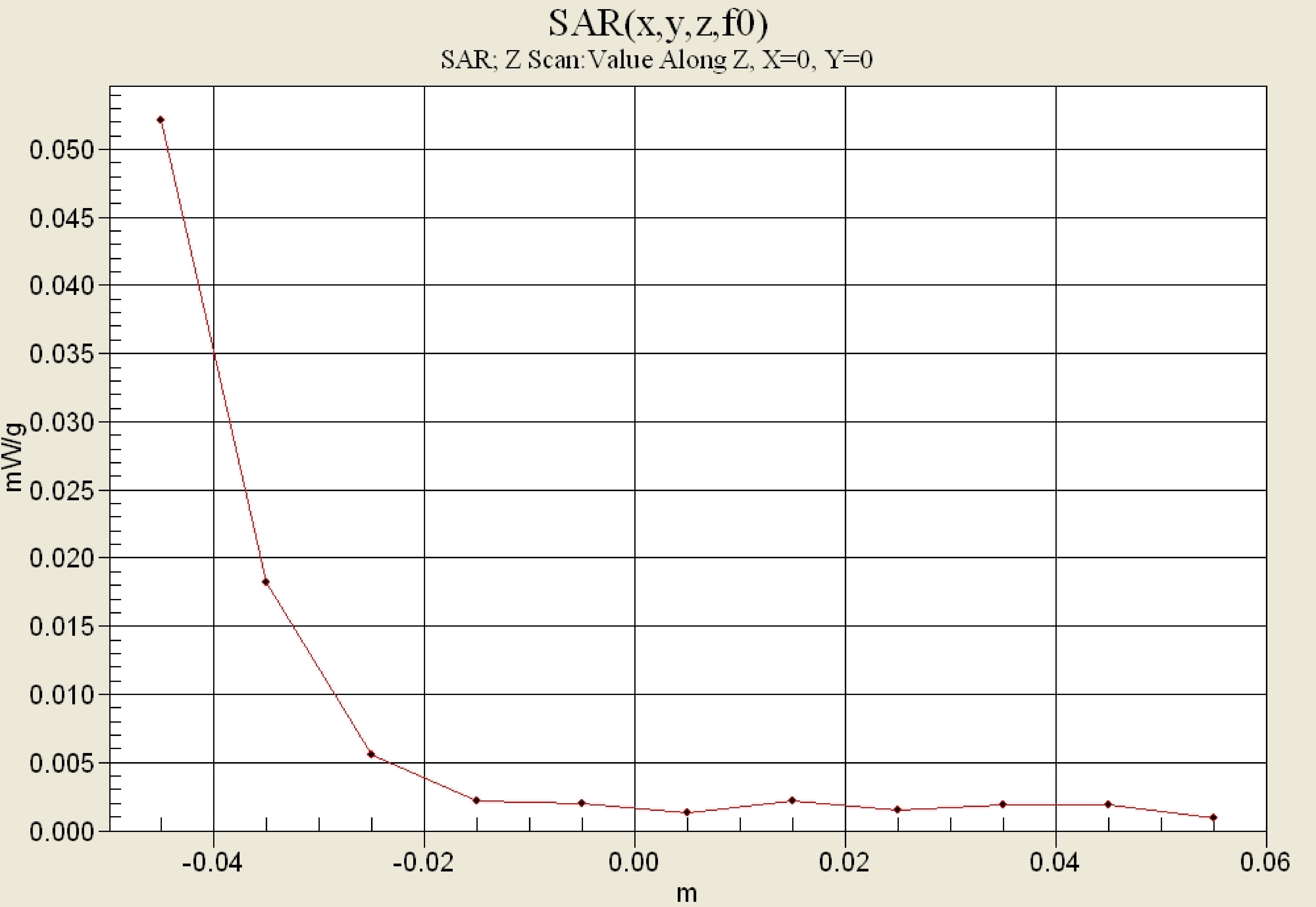
Signature / Stamp

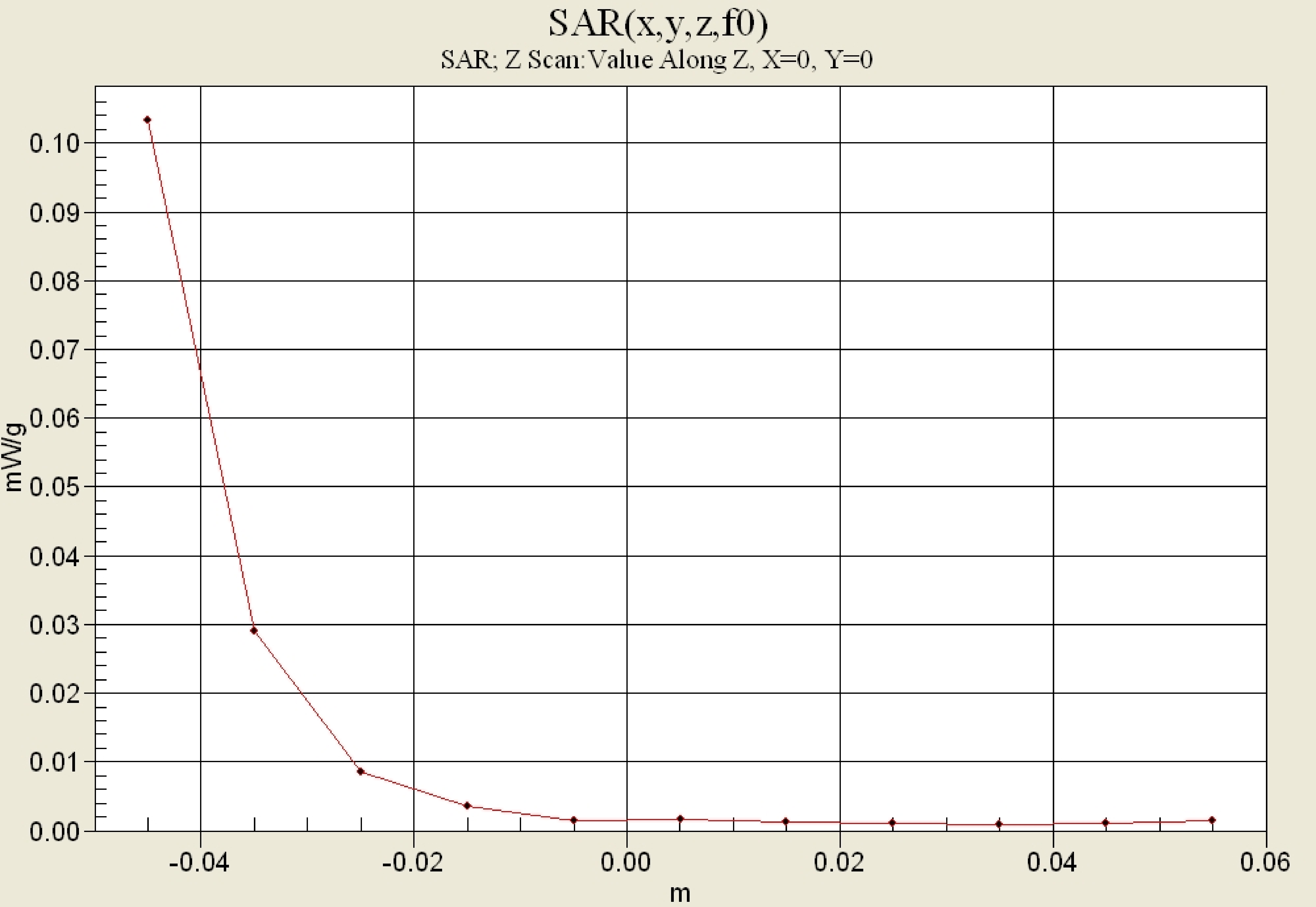
speag
Schmid & Partner Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

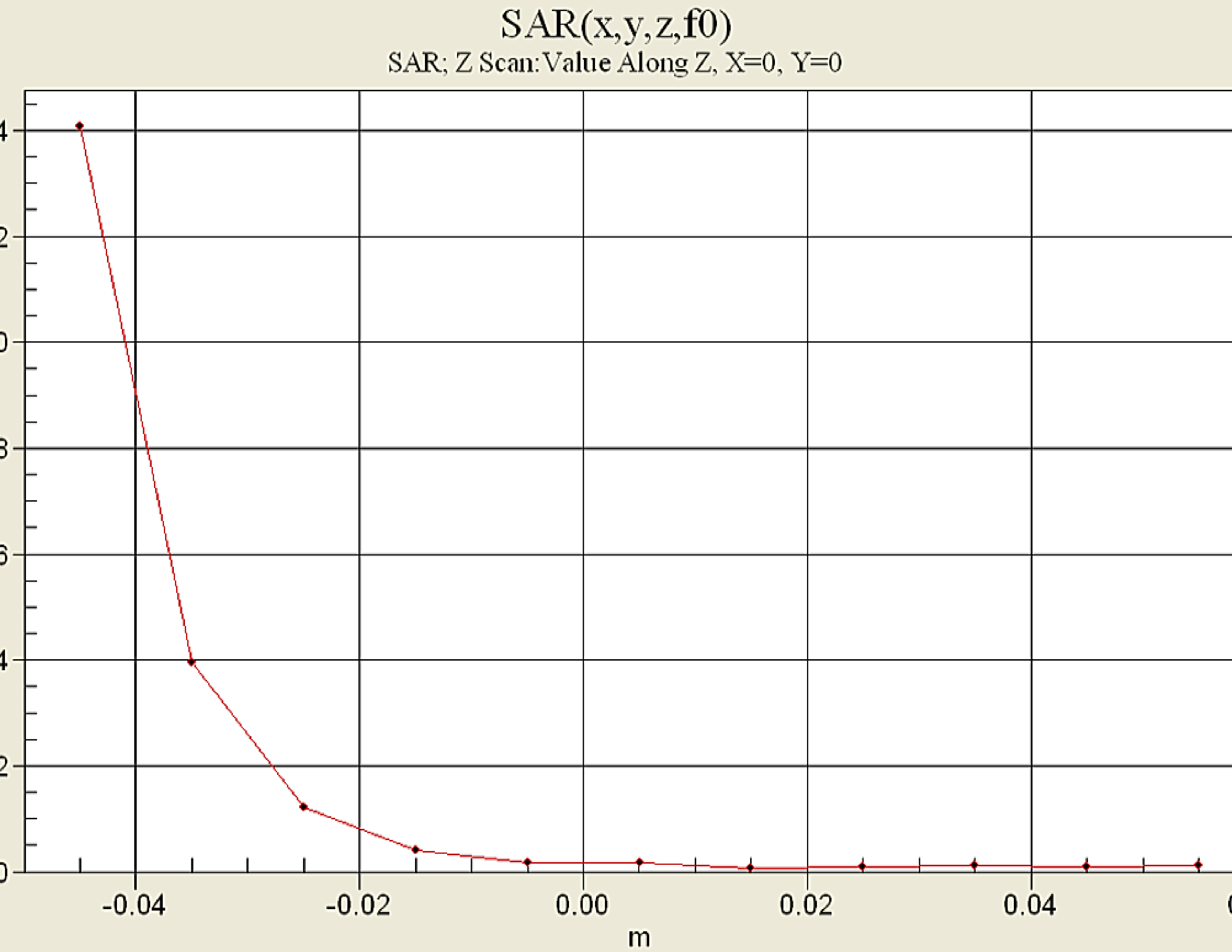
APPENDIX G – Z-Scans

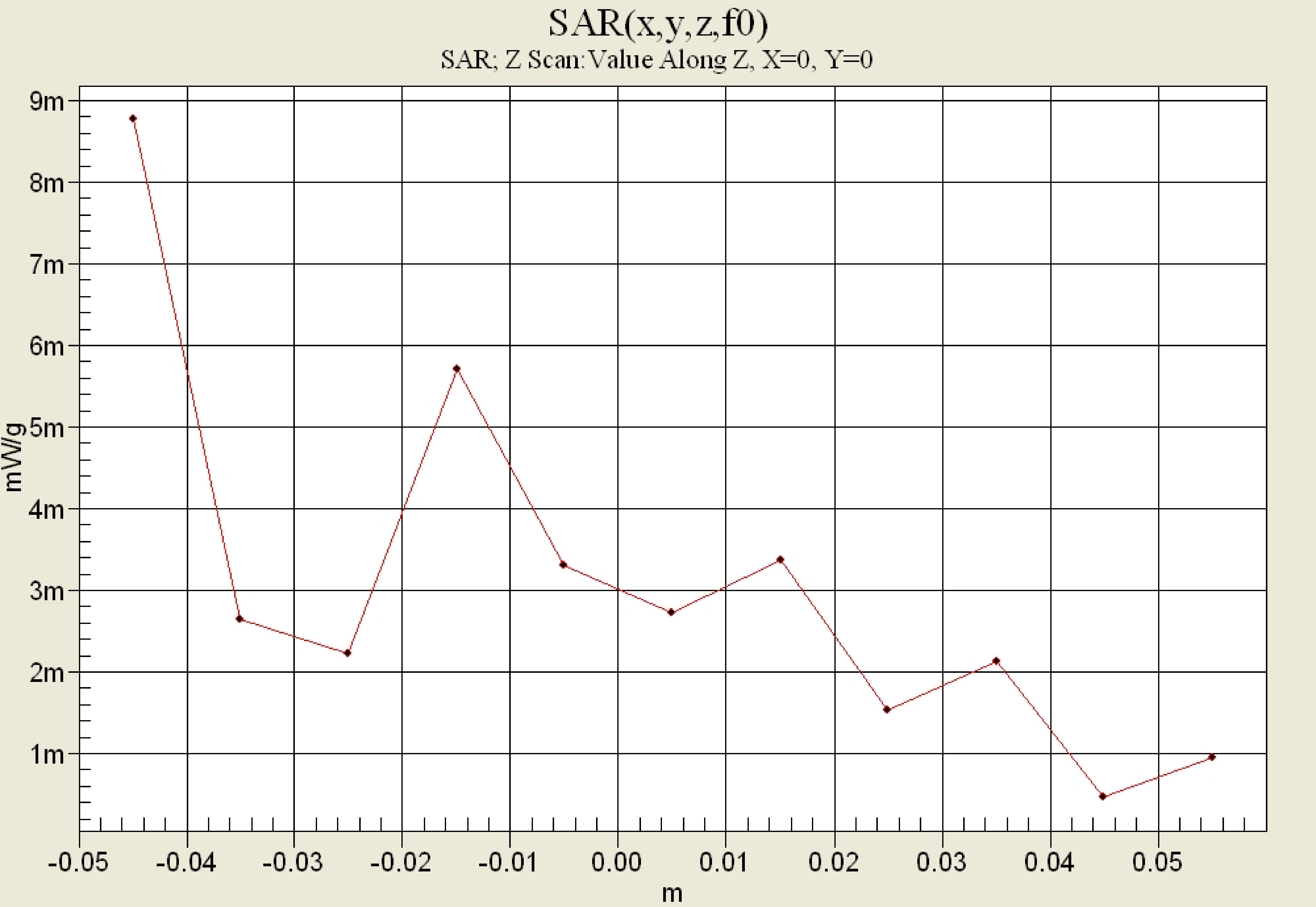


SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
mW/g
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
-0.04
-0.02
0.00
0.02
0.04
0.06
m


SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
mW/g
0.000
0.005
0.010
0.015
0.020
0.025
0.030
0.035
0.040
0.045
0.050
-0.04
-0.02
0.00
0.02
0.04
0.06
m

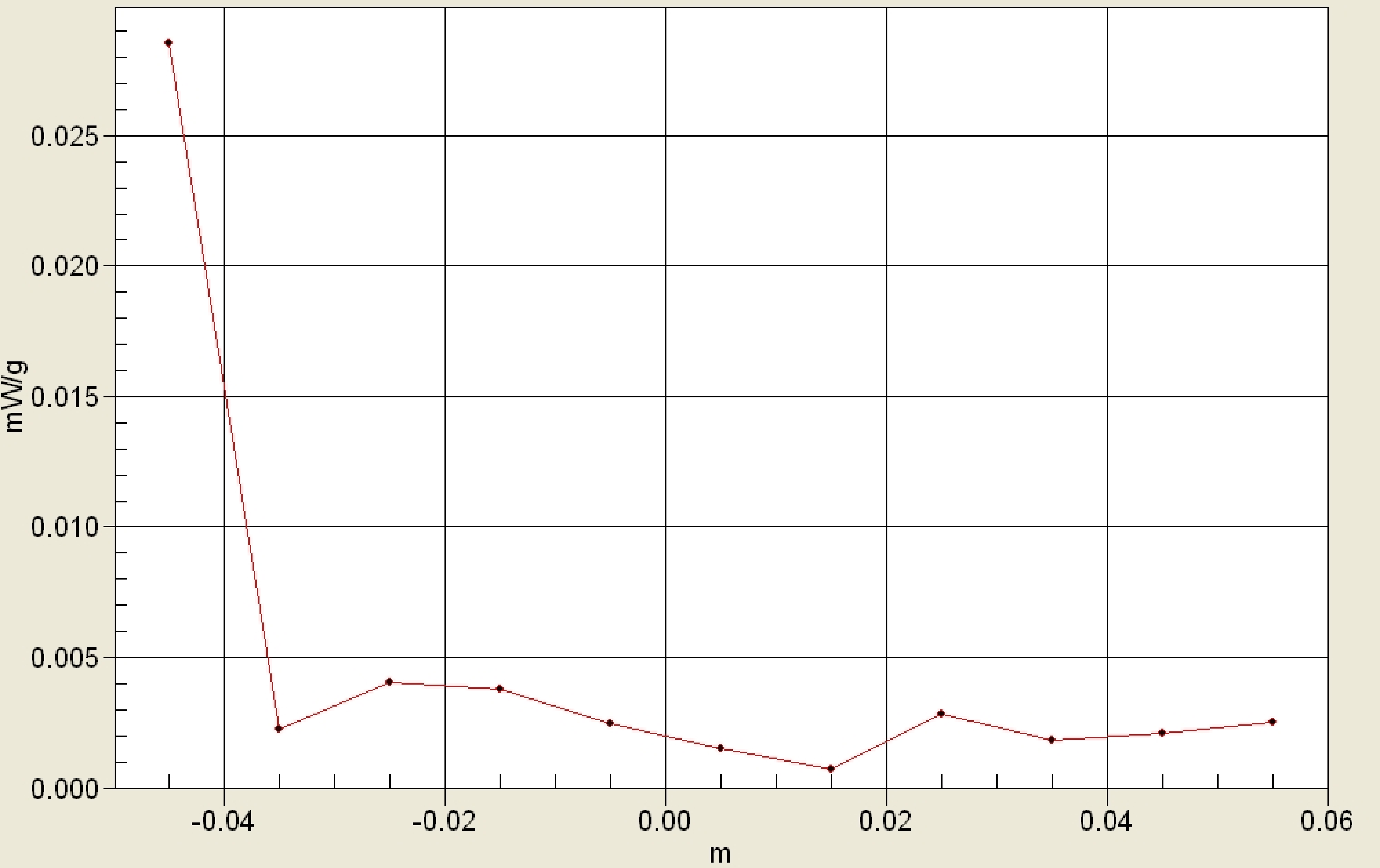

SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
mW/g
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
-0.04
-0.02
0.00
0.02
0.04
0.06
m

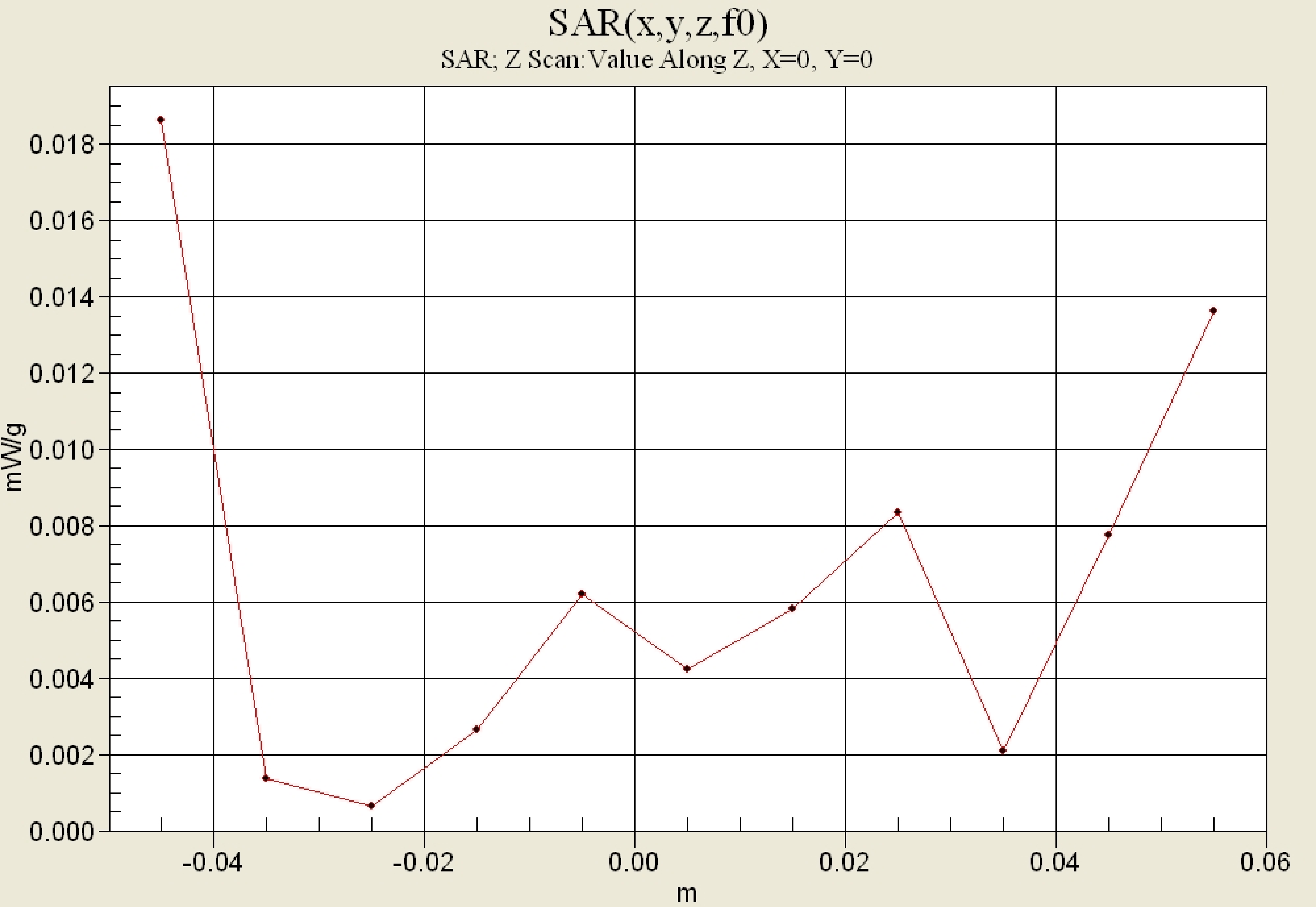

SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
-0.04
-0.02
0.00
0.02
0.04
m

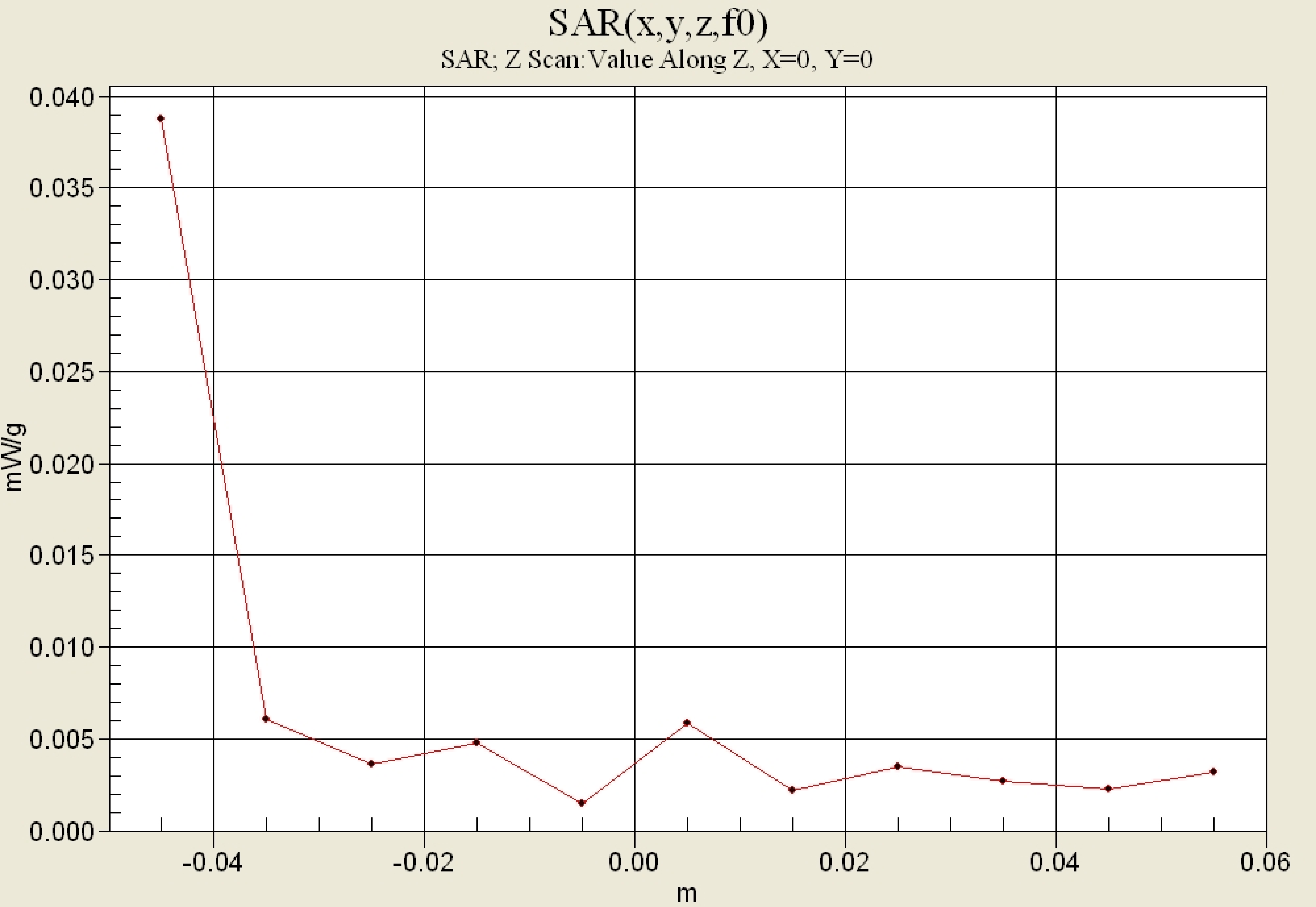

SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
9m
8m
7m
6m
5m
4m
3m
2m
1m
mW/g
-0.05
-0.04
-0.03
-0.02
-0.01
0.00
0.01
0.02
0.03
0.04
0.05
m

SAR(x,y,z,f0)

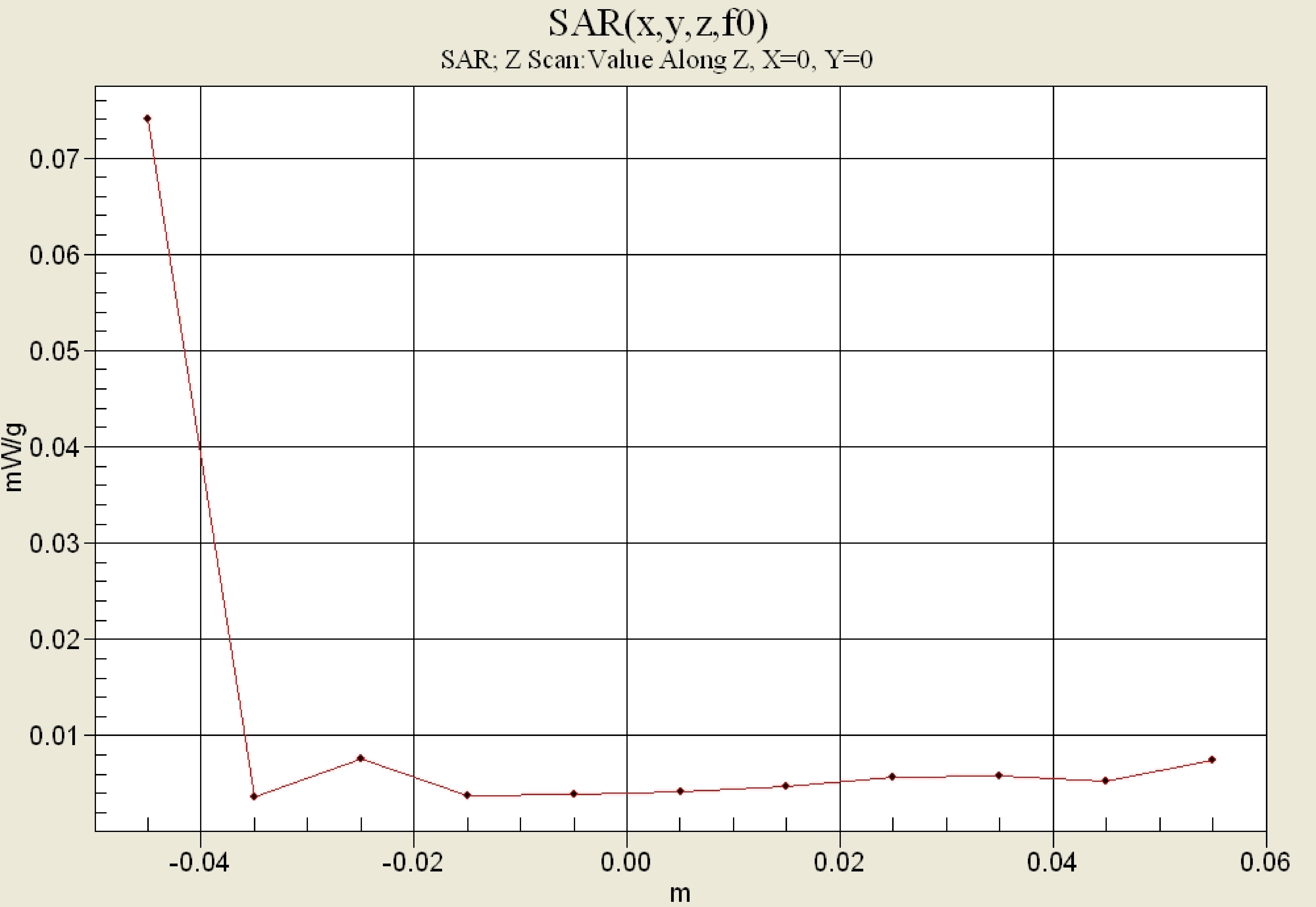
SAR; Z Scan:Value Along Z, X=0, Y=0

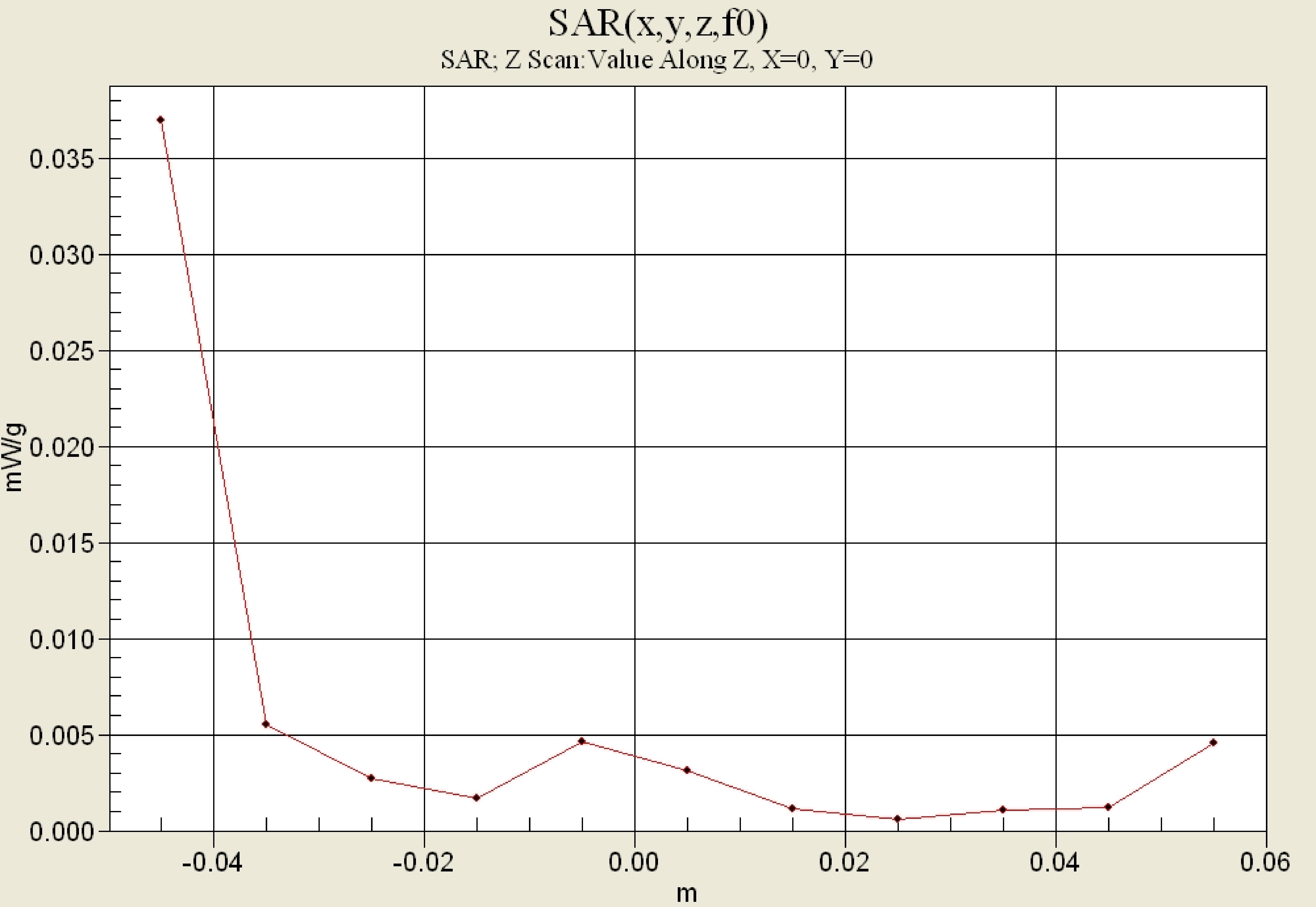


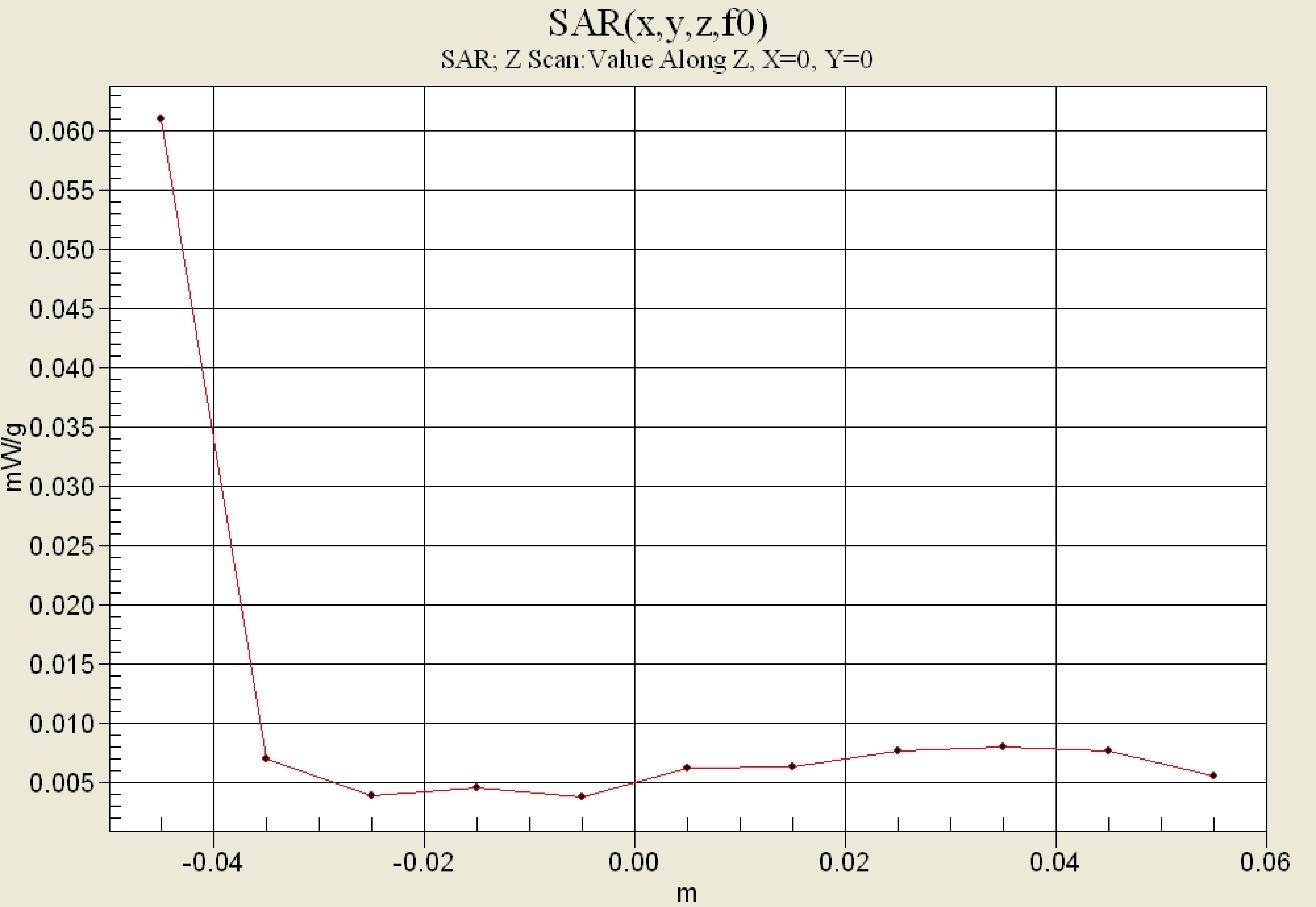

SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
0.018
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
mW/g
-0.04
-0.02
0.00
0.02
0.04
0.06
m

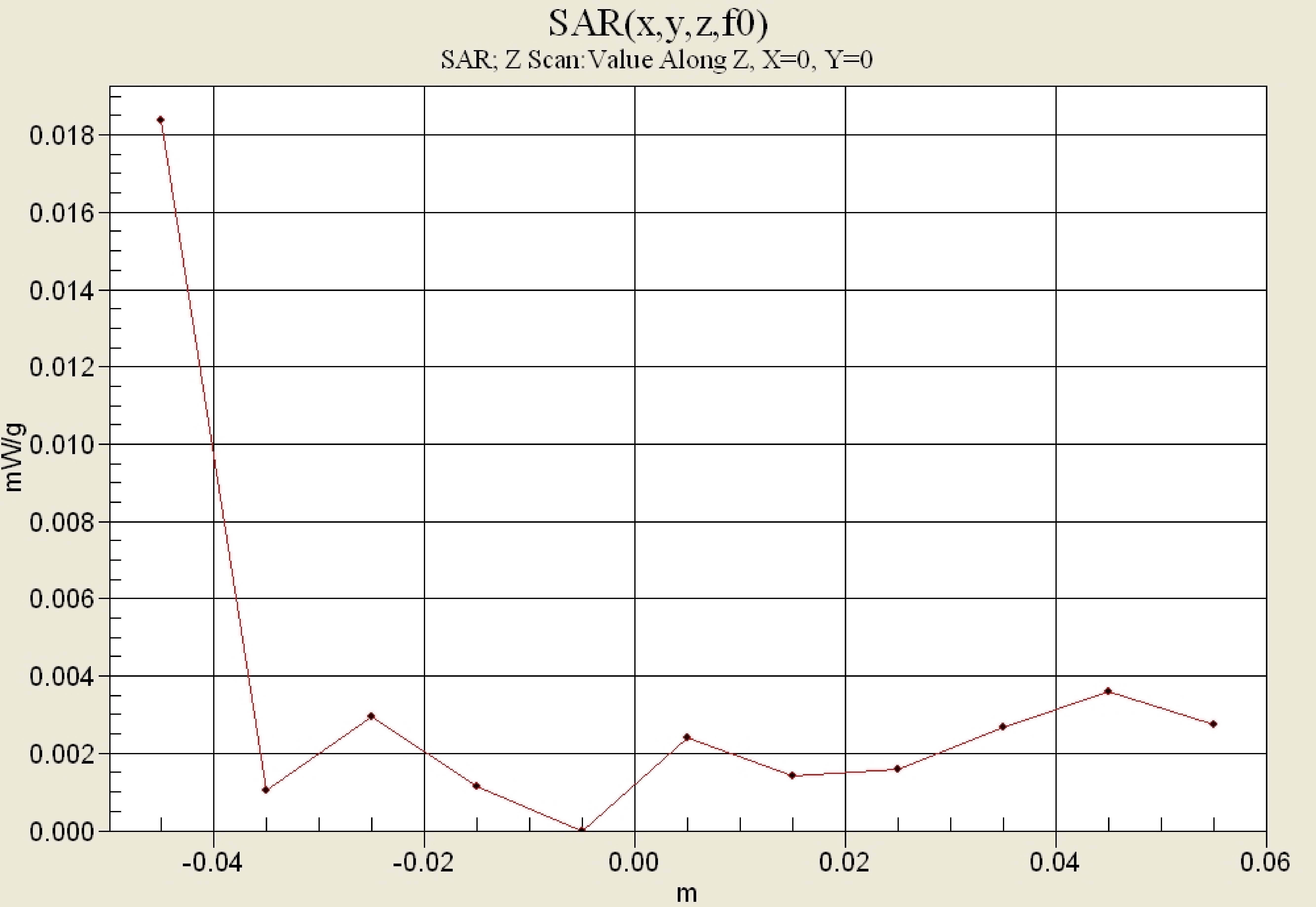


SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
mW/g
-0.04
-0.02
0.00
0.02
0.04
0.06
m


SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
mW/g
0.07
0.06
0.05
0.04
0.03
0.02
0.01
-0.04
-0.02
0.00
0.02
0.04
0.06
m


SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
mW/g
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
-0.04
-0.02
0.00
0.02
0.04
0.06
m


SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
0.060
0.055
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
mW/g
-0.04
-0.02
0.00
0.02
0.04
0.06
m


SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
0.018
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
mW/g
-0.04
-0.02
0.00
0.02
0.04
0.06
m