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October 17, 2002

Federal Communications Commission,
Authorization & Evaluation Division,
7435 Oakland Mills Road
Columbia, MD. 21046

Attention: Equipment Authorization Branch

We hereby certify that the transceiver FCC ID: LJPNSB-9 complies with ANSI/IEEE C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

Compliance was determined by testing appropriate parameters according to standard.

NOKIA CORPORATION

Georg Meissner
Product Program Manager
Nokia Mobile Phones, BA Oulu

NOKIA
TCC Oulu

SAR Compliance Test Report

Test report no.:	Not numbered	**Date of report:**	2002-12-03
Number of pages:	74	**Contact person:**	Pentti Pärnänen
		Responsible test engineer:	Pertti Mäkikyrö
Testing laboratory:	Nokia Corporation Elektroniikkatie 10 P.O. Box 50 FIN-90571 OULU Finland Tel. +358-7180-08000 Fax. +358-7180-47222	**Client:**	Nokia Corporation Elektroniikkatie 10 P.O. Box 50 FIN-90571 OULU Finland Tel.+358-7180-08000 Fax. +358-7180-47222

Tested devices: **LJPNSB-9**

Supplement reports: -

Testing has been carried out in accordance with:

47CFR §2.1093
Radiofrequency Radiation Exposure Evaluation: Portable Devices

IEEE P1528-200X Draft 6.4
Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques

FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01)
Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

Documentation: The documentation of the testing performed on the tested devices is archived for 15 years at TCC Oulu

Test results: **The tested device complies with the requirements in respect of all parameters subject to the test.**

The test results and statements relate only to the items tested. The test report shall not be reproduced except in full, without written approval of the laboratory.

Date and signatures: 2002-12-03

For the contents:

Pertti Mäkikyrö	**Anne Kiviniemi**
Engineering Manager, EMC	**Test Engineer**

CONTENTS

1. SUMMARY FOR SAR TEST REPORT

Date of test	2002-11-18 – 2002-11-21
Contact person	Pentti Pärnänen
Test plan referred to	-
FCC ID	LJPNSB-9
SN, HW and SW numbers of tested device	SN: 001004/10/093147/7, HW:0401, SW:Vp3.44
Accessories used in testing	Battery BLC-2, Headset HDB-4, Headset HS-1C
Notes	-
Document code	DTX 05898-EN
Responsible test engineer	Pertti Mäkikyrö
Measurement performed by	Anne Kiviniemi

1.1 Maximum Results Found during SAR Evaluation

The equipment is deemed to fulfil the requirements if the measured values are less than or equal to the limit. Maximum found results are reported per operating band.

1.1.1 Head Configuration

Mode	Ch / *f* (MHz)	Power	Position	Limit	Measured	Result
GSM850	251/848.80	28.8 dBm	Cheek flip open	1.6 W/kg	1.20 W/kg	PASSED
GSM1900	661/1880.00	25.0 dBm	Cheek flip closed	1.6 W/kg	0.68 W/kg	PASSED

1.1.2 Body Worn Configuration

Mode	Ch / *f* (MHz)	Power	Position	Limit	Measured	Result
GSM850	128/824.20	31.7 dBm	Body worn	1.6 W/kg	0.70 W/kg	PASSED
GPRS1900	810/1909.80	25.7 dBm	Body worn	1.6 W/kg	1.02 W/kg	PASSED

1.1.3 Measurement Uncertainty

Combined Standard Uncertainty	**± 13.6%**
Expanded Standard Uncertainty (k=2)	**± 27.1%**

2. DESCRIPTION OF TESTED DEVICE

Device category	Portable device			
Exposure environment	Uncontrolled exposure			
Unit type	Prototype unit			
Case type	Fixed / Clam-shell case			
Modes of Operation	GSM850	GSM1900	GPRS850	GPRS1900
Modulation Mode	Gaussian Minimum Shift Keying	Gaussian Minimum Shift Keying	Gaussian Minimum Shift Keying	Gaussian Minimum Shift Keying
Duty Cycle	1/8	1/8	2/8	2/8
Transmitter Frequency Range (MHz)	824.2 – 848.8	1850.2 - 1909.8	824.2 – 848.8	1850.2 - 1909.8

2.1 Picture of Phone

Fip closed

Flip open

With LJPNSB-9 the call can be estamlished with flip fixed and flip open.

2.2 Description of the Antenna

Type	Internal integrated antenna	
Dimensions (mm)	Maximum width	42.18 mm
	Maximum length	38.46 mm
Location	Inside the back cover, near the top of the device	

2.3 Battery Options

There is only one battery option available for tested device, Li-ion BLC-2 battery.

3. TEST CONDITIONS

3.1 Ambient Conditions

Ambient temperature (°C)	22±2
Tissue simulating liquid temperature (°C)	22±2
Humidity	40

3.2 RF characteristics of the test site

Tests were performed in a fully enclosed RF shielded environment.

3.3 Test Signal, Frequencies, and Output Power

The device was controlled by using a special test mode.

In all operating bands the measurements were performed on lowest, middle and highest channels.

The phone was set to maximum power level during the all tests and at the beginning of the each test the battery was fully charged. Power output was measured by A2LA accredited test laboratory TCC Dallas on the same unit used in SAR testing.

DASY3 system measures power drift during SAR testing by comparing e-field in the same location at the beginning and at the end of measurement. These records were used to monitor stability of power output.

4. DESCRIPTION OF THE TEST EQUIPMENT

The measurements were performed with an automated near-field scanning system, DASY3, manufactured by Schmid & Partner Engineering AG (SPEAG) in Switzerland.

Test Equipment	Serial Number	Due Date
DASY3 DAE V1	405	02/03
E-field Probe ET3DV6	1379	02/03
Dipole Validation Kit, D835V2	448	02/03
Dipole Validation Kit, D1900V2	511	02/03

E-field probe calibration records are presented in Appendix C.

Additional equipment needed in validation

Test Equipment	Model	Serial Number	Due Date
Signal Generator	Agilent E4433B	GB40050947	09/04
Amplifier	Amplifier Research 5S1G4	27573	-
Power Meter	R&S NRT	835065/049	04/03
Power Sensor	R&S NRT-Z44	835374/021	04/03
Thermometer	DO9416	1505985462	-
Vector Network Analyzer	Hewlett Packard 8753E	US38432701	05/03
Dielectric Probe Kit	Agilent 85070C	-	-

4.1 System Accuracy Verification

The probes are calibrated annually by the manufacturer. Dielectric parameters of the simulating liquids are measured by using a dielectric probe kit and a vector network analyzer.

The SAR measurement of the DUT were done within 24 hours of system accuracy verification, which was done using the dipole validation kit.

The dipole antenna, which is manufactured by Schmid & Partner Engineering AG, is matched to be used near flat phantom filled with tissue simulating solution. Length of 835 MHz dipole is 161mm with overall height of 330mm. Dipole length for 1900 MHz is 68 mm with overall height of 300mm. A specific distance holder is used in the positioning of both antennas to ensure correct spacing between the phantom and the dipole. Manufacturer's reference dipole data is presented in Appendix C.

Power level of 250 mW was supplied to a dipole antenna placed under the flat section of SAM phantom. The validation results are in the table below and printout of the validation test is presented in Appendix A. All the measured parameters were within the specification.

Tissue	*f* (MHz)	Description	SAR (W/kg), 1g	Dielectric Parameters ε_r	Dielectric Parameters σ (S/m)	Temp (°C)
Head	835	Measured 11/20/02	2.53	40.9	0.90	21.6
		Measured 11/21/02	2.62	41.1	0.92	21.6
		Reference Result	2.59	42.3	0.91	N/A
Head	1900	Measured 11/19/02	10.5	38.0	1.43	22.5
		Reference Result	10.7	39.2	1.47	N/A
Muscle	835	Measured 11/18/02	2.66	56.7	0.96	22.0
		Reference Result	2.73	56.0	0.98	N/A
Muscle	1900	Measured 11/20/02	11.0	50.9	1.51	21.3
		Measured 12(02/02	10.9	51.1	1.51	21.3
		Reference Result	10.6	53.5	1.46	N/A

4.2 Tissue Simulants

All dielectric parameters of tissue simulants were measured within 24 hours of SAR measurements. The depth of the tissue simulant in the ear reference point of the phantom was 15cm ± 5mm during all the tests. Volume for each tissue simulant was 26 liters.

4.2.1 Head Tissue Simulant

The composition of the brain tissue simulating liquid for 835MHz is

- 58.31% Sugar
- 39.74% De-Ionized Water
- 1.55% Salt
- 0.25% HEC
- 0.15% Bactericide

and for 1900MHz

- 44.91% 2-(2-butoxyethoxy) Ethanol
- 54.88% De-Ionized Water
- 0.21% Salt

f (MHz)	Description	Dielectric Parameters		Temp (°C)
		ε_r	σ (S/m)	
835	Measured 11/20/02	40.9	0.90	22
	Measured 11/21/02	41.1	0.92	22
	Recommended Values	41.5	0.90	20-26
1880	Measured 11/19/02	38.0	1.42	22
	Recommended Values	40.0	1.40	20-26

Recommended values are adopted from OET Bulletin 65 (97-01) Supplement C (01-01).

4.2.2 Muscle Tissue Simulant

The composition of the muscle tissue simulating liquid for 835MHz is

- 55.97% De-Ionized Water
- 41.76% Sugar
- 1.21% HEC
- 0.79% Salt
- 0.27% Preservative

and for 1900MHz

- 69.02% De-Ionized Water
- 30.76% Diethylene Glycol Monobutyl Ether
- 0.22% Salt

f (MHz)	Description	Dielectric Parameters		Temp (°C)
		ε_r	σ (S/m)	
835	Measured 11/18/02	56.7	0.96	22
	Recommended Values	55.2	0.97	20-26
1880	Measured 11/20/02	51.1	1.50	22
	Recommended Values	53.3	1.52	20-26

Recommended values are adopted from OET Bulletin 65 (97-01) Supplement C (01-01).

4.3 Phantoms

"SAM v4.0" phantom", manufactured by SPEAG, was used during the measurement. It has fiberglass shell integrated in a wooden table. The shape of the shell corresponds to the phantom defined by SCC34-SC2. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

The thickness of phantom shell is 2 mm except for the ear, where an integrated ear spacer provides a 6 mm spacing from the tissue boundary. Manufacturer reports tolerance in shell thickness to be ±0.1mm.

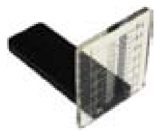
4.4 Isotropic E-Field Probe ET3DV6

Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection system Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., glycolether)
Calibration	Calibration ceritifcate in Appendix C
Frequency	10 MHz to 3 GHz (dosimetry); Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Optical Surface Detection	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.4 dB in HSL (rotation normal to probe axis)
Dynamic Range	5 µW/g to > 100 mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm Tip length: 16 mm Body diameter: 12 mm Tip diameter: 6.8 mm Distance from probe tip to dipole centers: 2.7 mm
Application	General dosimetry up to 3 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms

5. DESCRIPTION OF THE TEST PROCEDURE

5.1 Test Positions

The device was placed in holder using a special positioning tool, which aligns the bottom of the device with holder and ensures that holder contacts only to the sides of the device. After positioning is done, tool is removed. This method provides standard positioning and separation, and also ensures free space for antenna.



Device holder was provided by SPEAG together with DASY3.

5.1.1 Against Phantom Head

Measurements were made on both the "left hand" and "right hand" side of the phantom.

The device was positioned against phantom according to OET Bulletin 65 (97-01) Supplement C (01-01) . Definitions of terms used in aligning the device to a head phantom are available in IEEE Draft Standard P1528-2001 "Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques"

5.1.1.1 Initial Ear Position

The device was initially positioned with the earpiece region pressed against the ear spacer of a head phantom parallel to the "Neck-Front" line defined along the base of the ear spacer that contains the "ear reference point". The "test device reference point" is aligned to the "ear reference point" on the head phantom and the "vertical centerline" is aligned to the "phantom reference plane".

5.1.1.2 Cheek Position

"Initial ear position" alignments are maintained and the device is brought toward the mouth of the head phantom by pivoting along the "Neck-Front" line until any point on the display, keypad or mouthpiece portions of the handset is in contact with the phantom or when any portion of a foldout, sliding or similar keypad cover opened to its intended self-adjusting normal use position is in contact with the cheek or mouth of the phantom.

Cheek position: Flip closed


Cheek position: Flip open

5.1.1.3 Tilt Position

In the "Cheek Position", if the earpiece of the device is not in full contact with the phantom's ear spacer and the peak SAR location for the "cheek position" is located at the ear spacer region or corresponds to the earpiece region of the handset, the device is returned to the "initial ear position" by rotating it away from the mouth until the earpiece is in full contact with the ear spacer. Otherwise, the device is moved away from the cheek perpendicular to the line passes through both "ear reference points" for approximate 2-3 cm. While it is in this position, the device is tilted away from the mouth with respect to the "test device reference point" by 15°. After the tilt, it is then moved back toward the head perpendicular to the line passes through both "ear reference points" until the device touches the phantom or the ear spacer. If the antenna touches the head first, the positioning process is repeated with a tilt angle less than 15° so that the device and its antenna would touch the phantom simultaneously.


Tilt Position: Flip closed

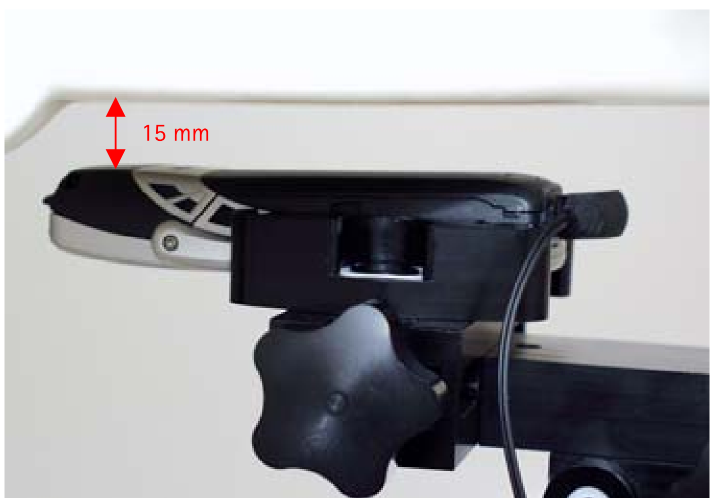
 

Tilt Position: Flip open

In tilt position, flip open, the top of the flip of LJPNSB-9 touches the phantom when the phone is tilted approximately 11° from cheek position. This is the position used for measurements.

5.1.2 Body Worn Configuration

Body SAR measurements were performed with antenna facing towards the flat part of the phantom with a separation distance of 15 mm. Headset HDB-4 was connected during measurements and the measurements giving the highest SAR were repeated with headset HC-1C.



5.2 Scan Procedures

First coarse scans are used for quick determination of the field distribution. Next a cube scan, 5x5x7 points; spacing between each point 8x8x5 mm, is performed around the highest E-field value to determine the averaged SAR-distribution over 1g.

5.3 SAR Averaging Methods

The maximum SAR value is averaged over its volume using interpolation and extrapolation.

The interpolation of the points is done with a 3d-Spline. The 3d-Spline is composed of three one-dimensional splines with the "Not a knot" -condition [W. Gander, Computermathematik, p. 141-150] (x, y and z -directions) [Numerical Recipes in C, Second Edition, p 123].

The extrapolation is based on least square algorithm [W. Gander, Computermathematik, p.168-180]. Through the points in the first 30 mm in all z-axis, polynomials of order four are calculated. This polynomial is then used to evaluate the points between the surface and the probe tip. The points, calculated from the surface, have a distance of 1mm from one another.

6. MEASUREMENT UNCERTAINTY

6.1 Description of Individual Measurement Uncertainty

6.1.1 Assessment Uncertainty

Uncertainty description	Uncert. value %	Probability distribution	Div.	c_i [1]	Stand. uncert (1g) %	v_i [2] or v_{eff}
Measurement System						
Probe calibration	± 4.4	normal	1	1	± 4.4	∞
Axial isotropy of the probe	± 4.7	rectangular	√3	$(1-c_p)^{1/2}$	± 1.9	∞
Sph. Isotropy of the probe	± 9.6	rectangular	√3	$(c_p)1^{/2}$	± 3.9	∞
Spatial resolution	± 0.0	rectangular	√3	1	± 0.0	∞
Boundary effects	± 5.5	rectangular	√3	1	± 3.2	∞
Probe linearity	± 4.7	rectangular	√3	1	± 2.7	∞
Detection limit	± 1.0	rectangular	√3	1	± 0.6	∞
Readout electronics	± 1.0	normal	1	1	± 1.0	∞
Response time	± 0.8	rectangular	√3	1	± 0.5	∞
Integration time	± 1.4	rectangular	√3	1	± 0.8	∞
RF ambient conditions	± 3.0	rectangular	√3	1	± 1.7	∞
Mech. constrains of robot	± 0.4	rectangular	√3	**1**	± 0.2	∞
Probe positioning	± 2.9	rectangular	√3	1	± 1.7	∞
Extrap. and integration	± 3.9	rectangular	√3	1	± 2.3	∞
Test Sample Related						
Device positioning	± 6.0	normal	0.89	1	± 6.7	12
Device holder uncertainty	± 5.0	normal	0.84	1	± 5.9	8
Power drift	± 5.0	rectangular	√3	1	± 2.9	∞
Phantom and Setup						
Phantom uncertainty	± 4.0	rectangular	√3	**1**	± 2.3	∞
Liquid conductivity (target)	± 5.0	rectangular	√3	**0.6**	± 1.7	∞
Liquid conductivity (meas.)	± 10.0	rectangular	√3	**0.6**	± 3.5	∞
Liquid permittivity (target)	± 5.0	rectangular	√3	**0.6**	± 1.7	∞
Liquid permittivity (meas.)	± 5.0	rectangular	√3	**0.6**	± 1.7	∞
Combined Standard Uncertainty					± 13.6	
Expanded Standard Uncertainty (k=2)					± 27.1	

7. RESULTS

Corresponding SAR distribution printouts of maximum results in every operating mode and position are shown in Appendix B. It also includes Z-plots of maximum measurement results in head and body worn configurations. The SAR distributions are substantially similar or equivalent to the plots submitted regardless of used channel in each mode and position. The coarse scans used in the head configuration measurements cover the whole head region.

7.1 Head Configuration

Mode	Channel/ *f* (MHz)	Power EIRP (dBm)	Flip	SAR, averaged over 1g (W/kg)			
				Left-hand		Right-hand	
				Cheek	Tilted	Cheek	Tilted
GSM 850	128/824.20	31.7	Closed	0.66	0.47	0.70	0.47
		27.8	Open	1.11	0.98	1.11	0.90
	190/836.60	31.8	Closed	0.77	0.56	0.83	0.53
		29.0	Open	1.19	1.04	1.15	0.97
	251/848.80	32.0	Closed	0.85	0.61	0.91	0.58
		28.8	Open	**1.20**	1.02	1.17	0.94
GSM 1900	512/1850.20	23.8	Closed	0.64	0.55	0.64	0.53
		30.1	Open	0.21	0.23	0.24	0.27
	661/1880.00	25.0	Closed	**0.68**	0.58	0.67	0.54
		31.1	Open	0.21	0.24	0.23	0.26
	810/1909.80	25.7	Closed	0.56	0.50	0.55	0.44
		30.4	Open	0.14	0.19	0.16	0.17

7.2 Body Worn Configuration

Mode	Channel/ *f* (MHz)	Power EIRP (dBm)	SAR, averaged over 1g (W/kg)
			Headset HDB-4
GSM 850	128/824.20	31.7	**0.70**
	190/836.60	31.8	0.60
	251/848.80	32.0	0.62
GPRS 1900	512/1850.20	23.8	0.44
	661/1880.00	25.0	0.48
	810/1909.80	25.7	**0.51**

There are several headsets and a loopset, which do connect similarly to LJPNSB-9, and are therefore considered to be electronically identifical. These are HDS-3, HDB-4, HS-5 and LPS-4. Camera headset HS-1C uses more pins to connect to the phone, and was checked for compliance

Mode	Channel/ *f* (MHz)	Power EIRP (dBm)	SAR, averaged over 1g (W/kg)
			Headset HS-1C
GSM 850	128/824.20	31.7	0.55
GSM 1900	810/1909.80	25.7	0.50

For dual-slot operating GPRS1900 mode the maximum result found during GSM1900 evaluation is multiplied by two. For GPRS850 the highest power levels are not available, and therefore GSM850 will give higher results.

Mode	Channel/ *f* (MHz)	Power EIRP (dBm)	SAR, averaged over 1g (W/kg)
			Multiplied GSM1900 result
GSM 1900	810/1909.80	25.7	1.02

APPENDIX A.

Validation Test Printouts

11/20/02

Dipole 835 MHz

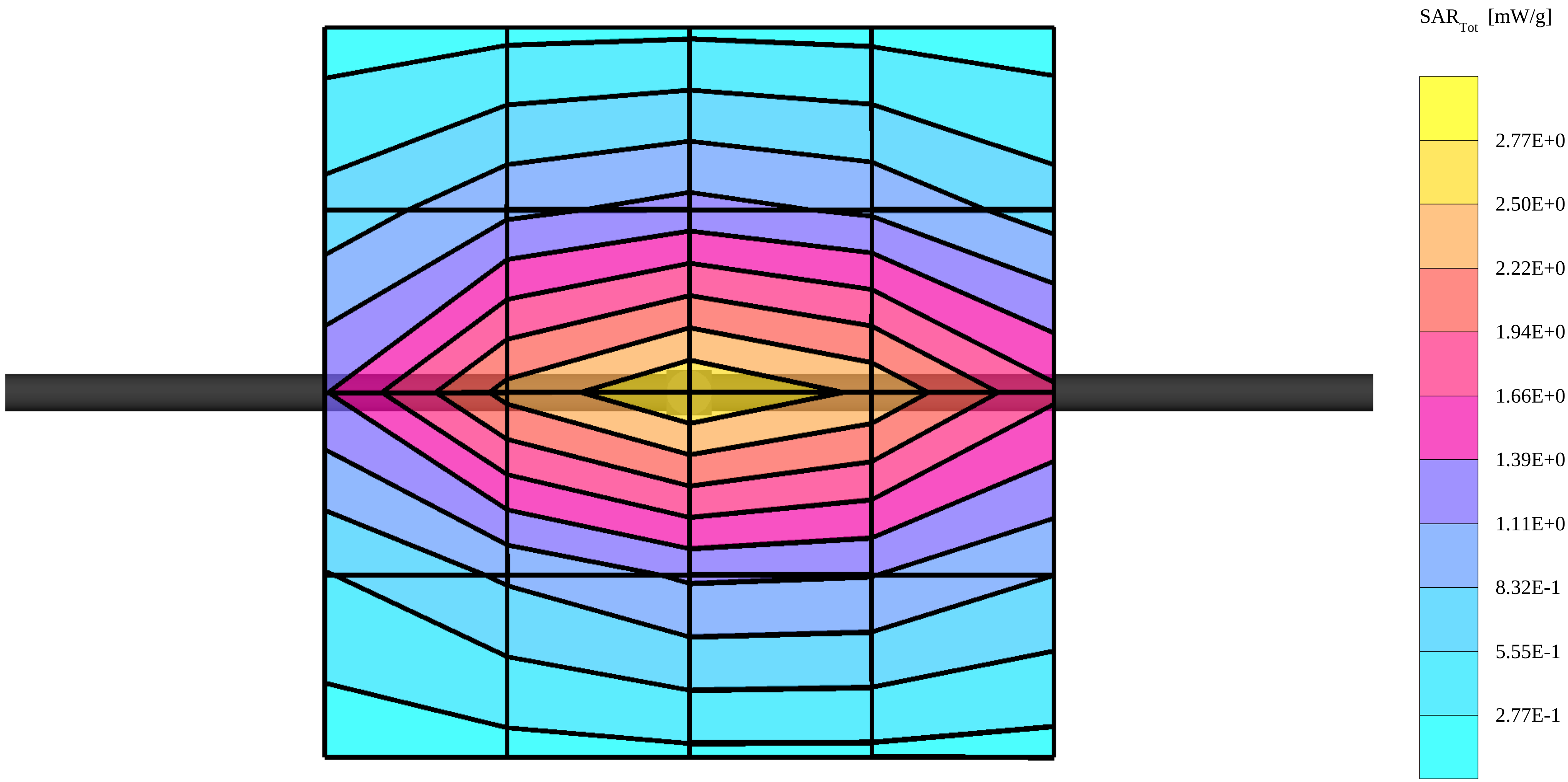
SAM 3; Flat

Probe: ET3DV6 - SN1379; ConvF(6.60,6.60,6.60); Crest factor: 1.0; Brain 836 MHz SCC34: σ = 0.90 mho/m ε_r = 40.9 ρ = 1.00 g/cm³; Liquid temperature: 21.6 °C

Cubes (2): Peak: 4.05 mW/g ± 0.06 dB, SAR (1g): 2.53 mW/g ± 0.07 dB, SAR (10g): 1.61 mW/g ± 0.08 dB

Penetration depth: 11.7 (10.4, 13.4) [mm]

Powerdrift: -0.03 dB



Dipole 835 MHz

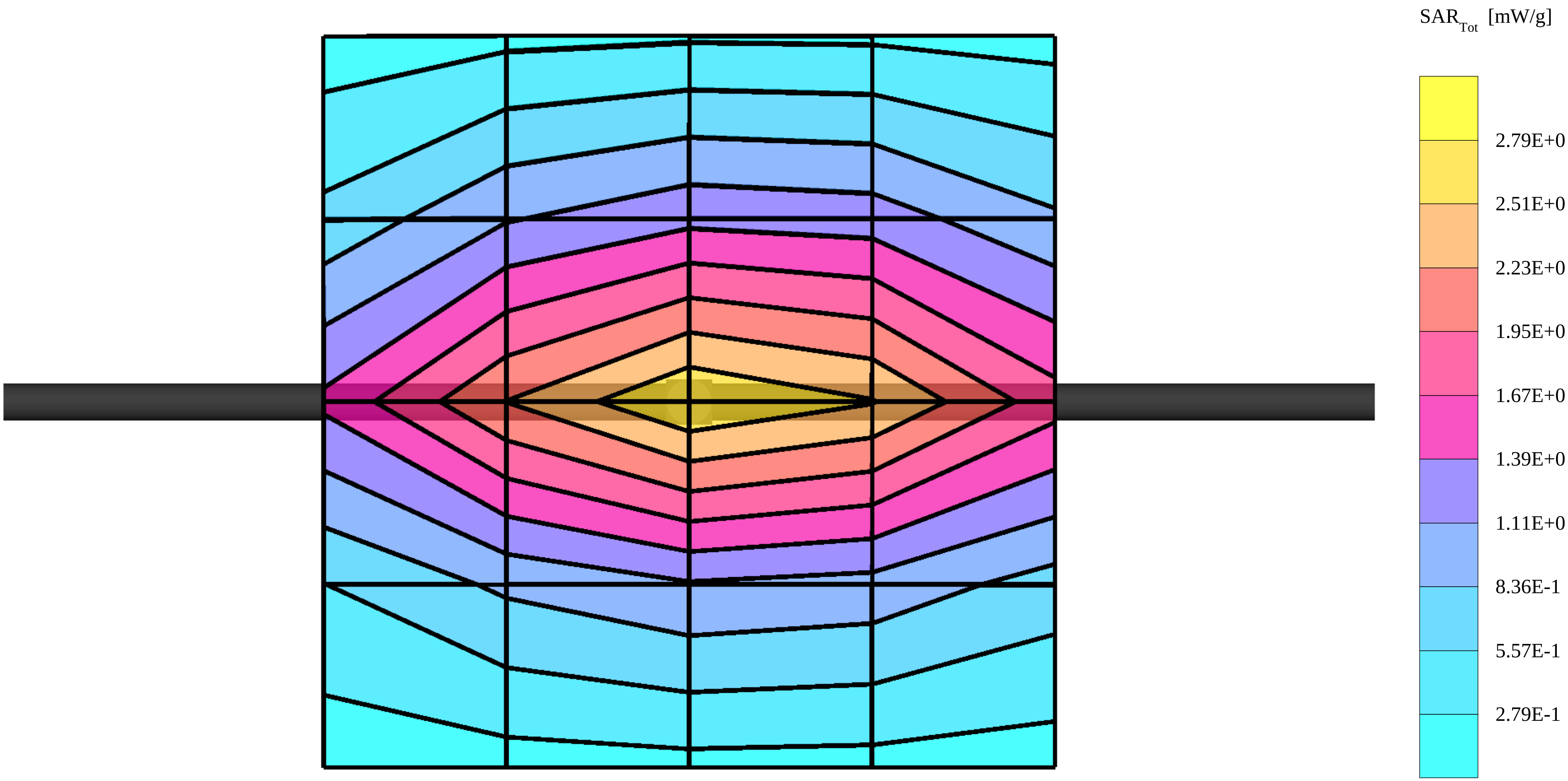
SAM 3; Flat

Probe: ET3DV6 - SN1379; ConvF(6.60,6.60,6.60); Crest factor: 1.0; Brain 836 MHz SCC34: σ = 0.92 mho/m ε_r = 41.1 ρ = 1.00 g/cm³; Liquid temperature: 21.6 °C

Cubes (2): Peak: 4.26 mW/g ± 0.17 dB, SAR (1g): 2.62 mW/g ± 0.13 dB, SAR (10g): 1.66 mW/g ± 0.07 dB

Penetration depth: 11.5 (10.1, 13.5) [mm]

Powerdrift: -0.01 dB



11/19/02

Dipole 1900 MHz

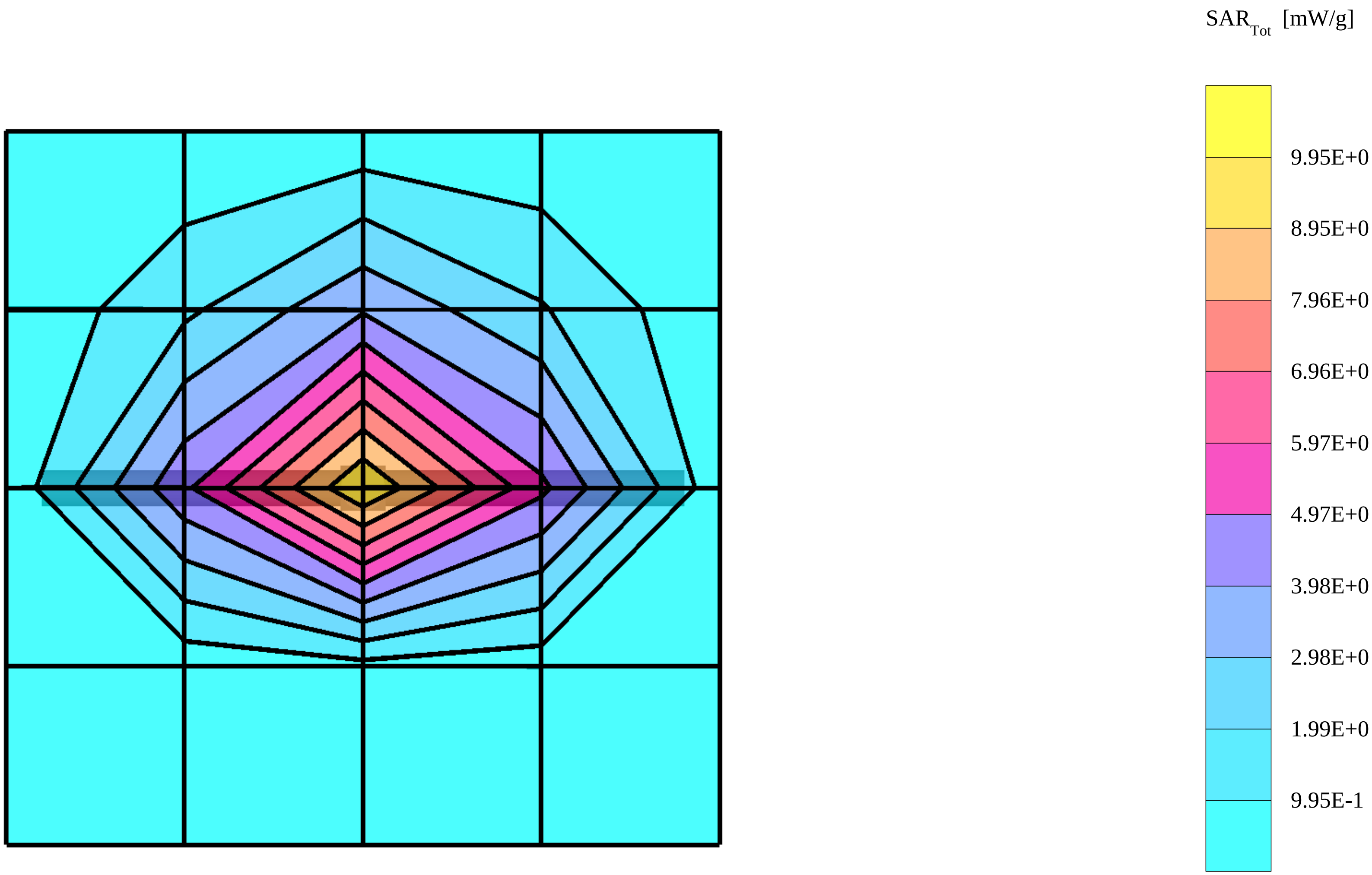
SAM 2; Flat

Probe: ET3DV6 - SN1379; ConvF(5.30,5.30,5.30); Crest factor: 1.0; Brain 1900 MHz SCC34: σ = 1.43 mho/m ε_r = 38.0 ρ = 1.00 g/cm³; Liquid temperature: 22.5 °C

Cubes (2): Peak: 19.9 mW/g ± 0.05 dB, SAR (1g): 10.5 mW/g ± 0.05 dB, SAR (10g): 5.39 mW/g ± 0.05 dB

Penetration depth: 8.2 (7.6, 9.3) [mm]

Powerdrift: 0.02 dB



Dipole 835 MHz

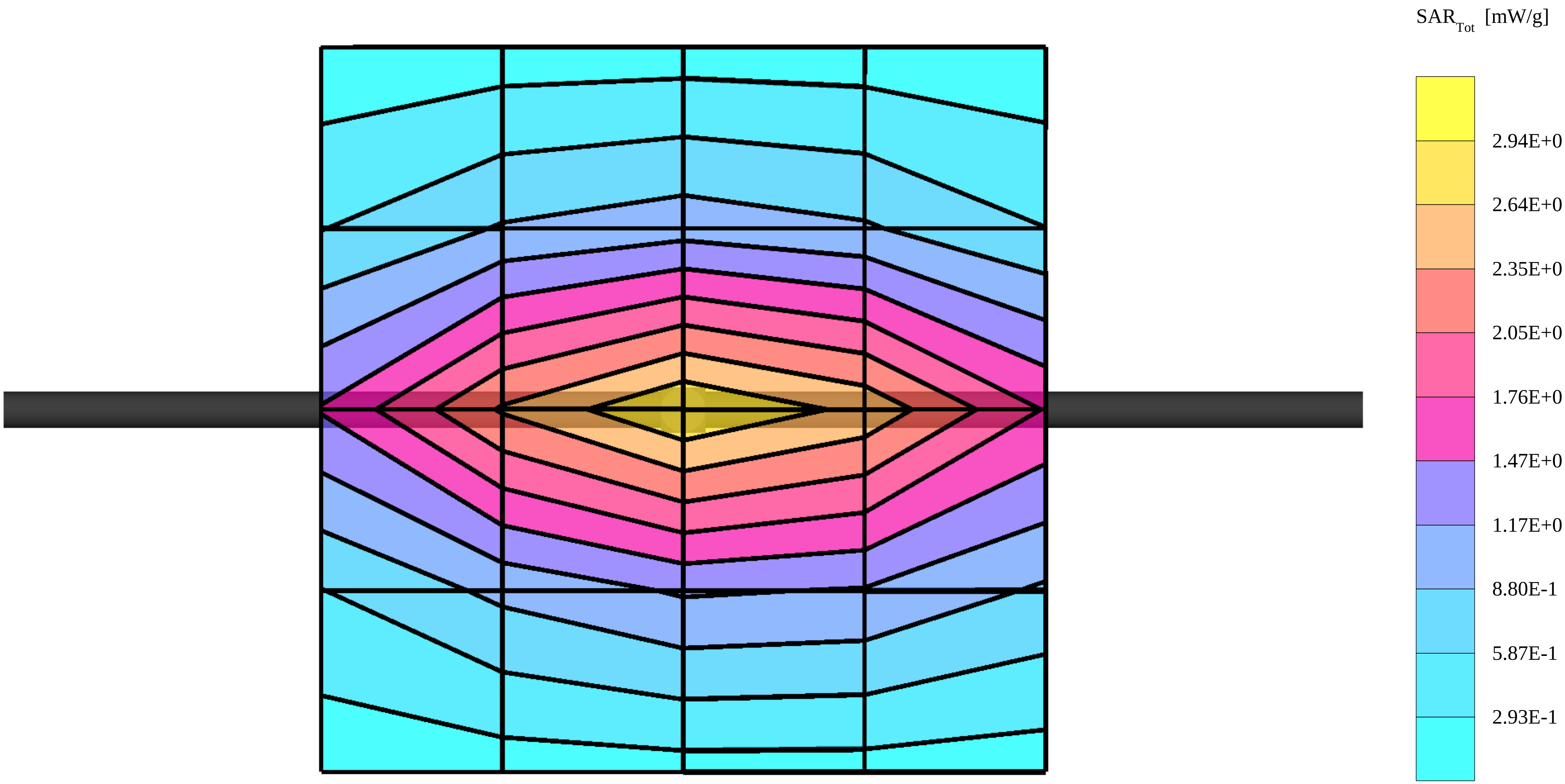
SAM 3; Flat

Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Muscle 836 MHz: σ = 0.96 mho/m ε_r = 56.7 ρ = 1.00 g/cm³; Liquid temperature: 22.0 °C

Cubes (2): Peak: 4.20 mW/g ± 0.13 dB, SAR (1g): 2.66 mW/g ± 0.10 dB, SAR (10g): 1.72 mW/g ± 0.08 dB

Penetration depth: 12.6 (11.0, 14.7) [mm]

Powerdrift: -0.02 dB



Dipole 1900 MHz

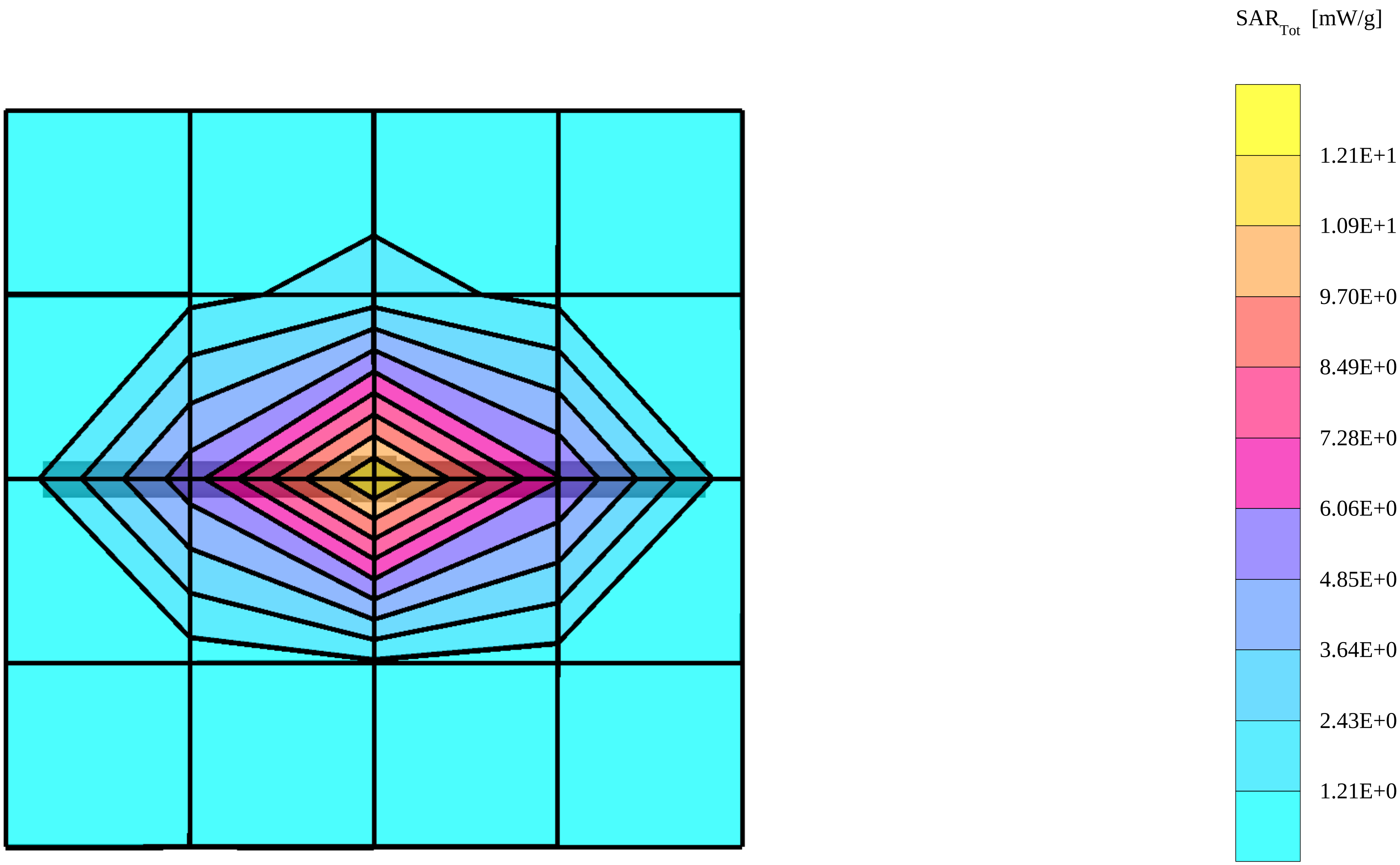
SAM 1; Flat

Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 1.0; Muscle 1900 MHz: σ = 1.51 mho/m ε_r = 50.9 ρ = 1.00 g/cm³; Liquid temperature: 21.3 °C

Cubes (2): Peak: 20.9 mW/g ± 0.11 dB, SAR (1g): 11.0 mW/g ± 0.10 dB, SAR (10g): 5.55 mW/g ± 0.07 dB

Penetration depth: 8.4 (7.7, 9.8) [mm]

Powerdrift: -0.01 dB



12/02/02

Dipole 1900 MHz

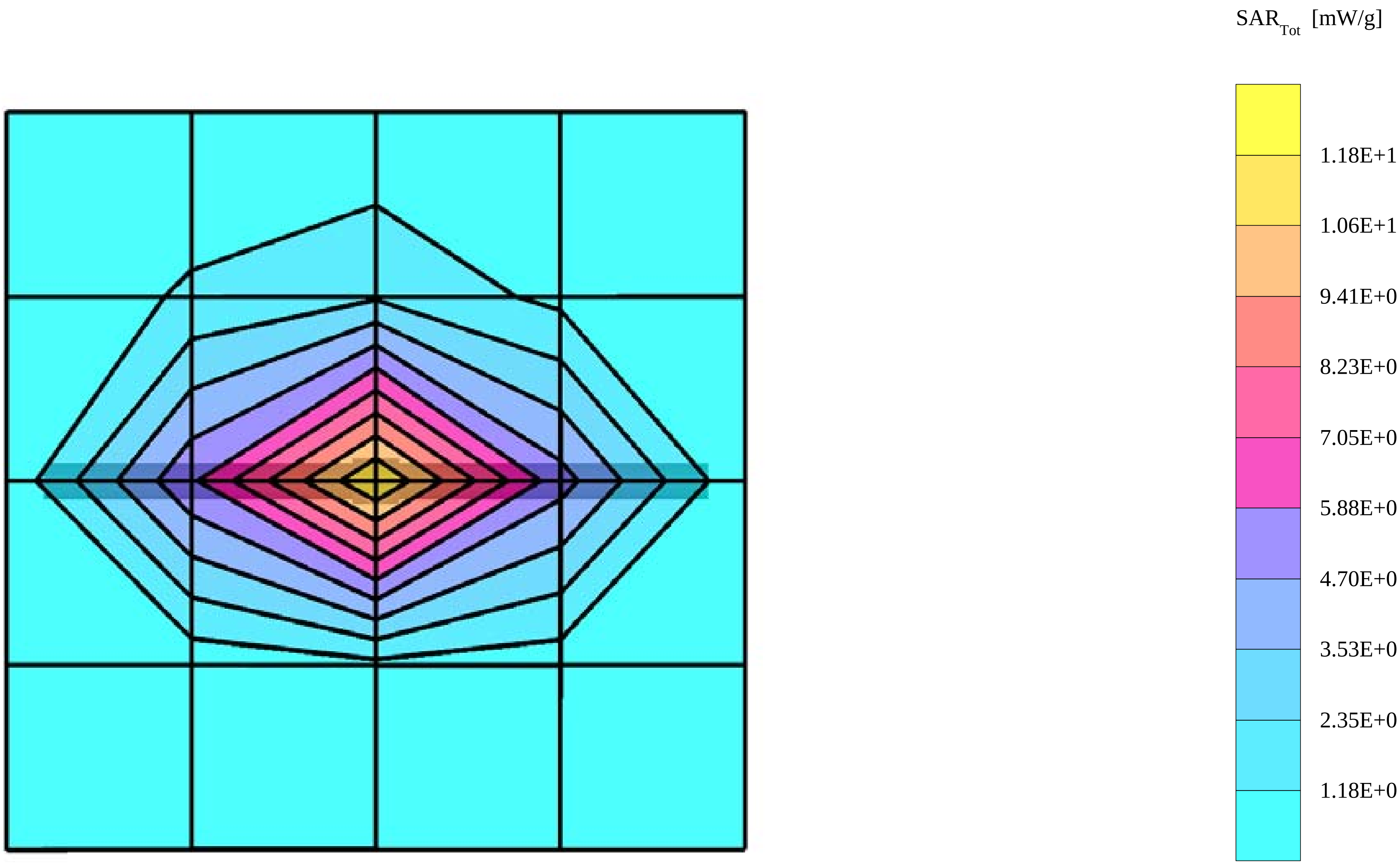
SAM 1; Flat

Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 1.0; Muscle 1900 MHz: σ = 1.51 mho/m ε_r = 51.1 ρ = 1.00 g/cm^3; Liquid temperature: 21.3 °C

Cubes (2): Peak: 20.8 mW/g ± 0.07 dB, SAR (1g): 10.9 mW/g ± 0.09 dB, SAR (10g): 5.53 mW/g ± 0.10 dB

Penetration depth: 8.5 (7.8, 9.8) [mm]

Powerdrift: 0.03 dB



APPENDIX B.

SAR Distribution Printouts

11/20/02

LJPNSB-9

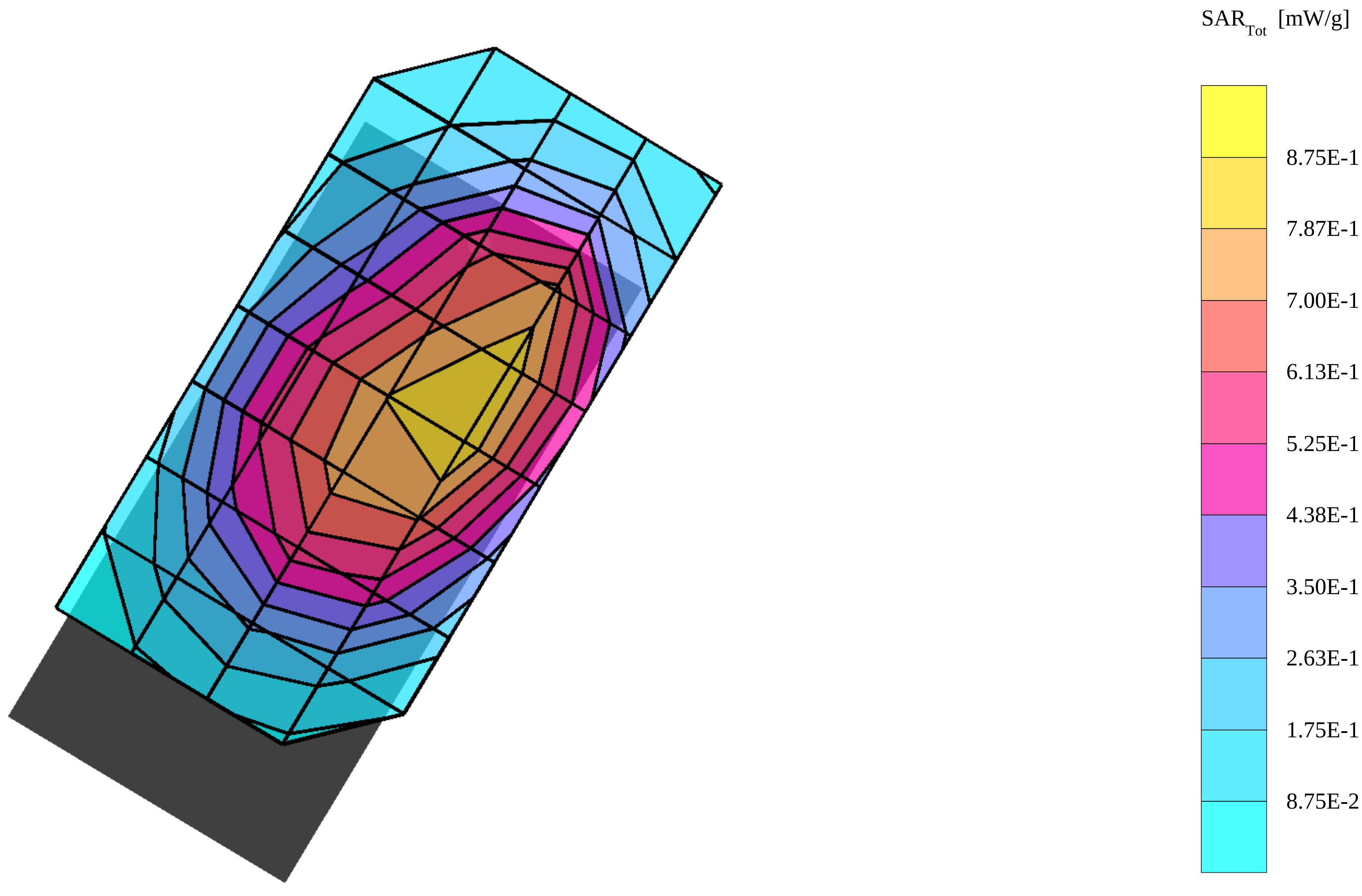
SAM 3 Phantom; Left Hand Section; Position: Cheek; Frequency: 849 MHz; GSM

Probe: ET3DV6 - SN1379; ConvF(6.60,6.60,6.60); Crest factor: 8.0; Brain 836 MHz SCC34: σ = 0.90 mho/m ε_r = 40.9 ρ = 1.00 g/cm³; Liquid temperature: 22.0 °C

Cube 5x5x7: SAR (1g): 0.851 mW/g, SAR (10g): 0.592 mW/g

Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0

Powerdrift: -0.01 dB



11/20/02

LJPNSB-9

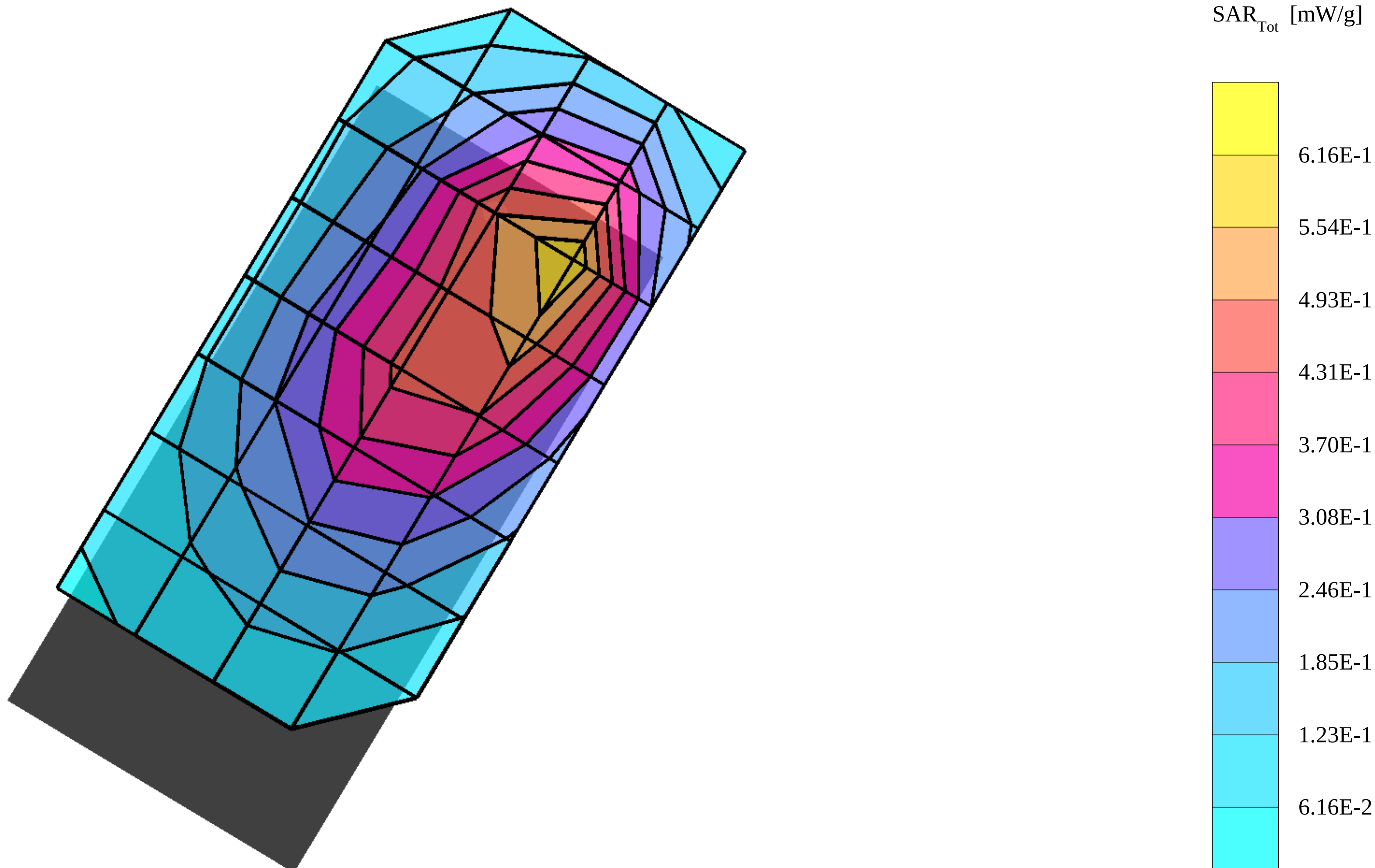
SAM 3 Phantom; Left Hand Section; Position: tilted; Frequency: 849 MHz; GSM

Probe: ET3DV6 - SN1379; ConvF(6.60,6.60,6.60); Crest factor: 8.0; Brain 836 MHz SCC34: σ = 0.90 mho/m ε_r = 40.9 ρ = 1.00 g/cm^3; Liquid temperature: 22.1 °C

Cube 5x5x7: SAR (1g): 0.607 mW/g, SAR (10g): 0.350 mW/g

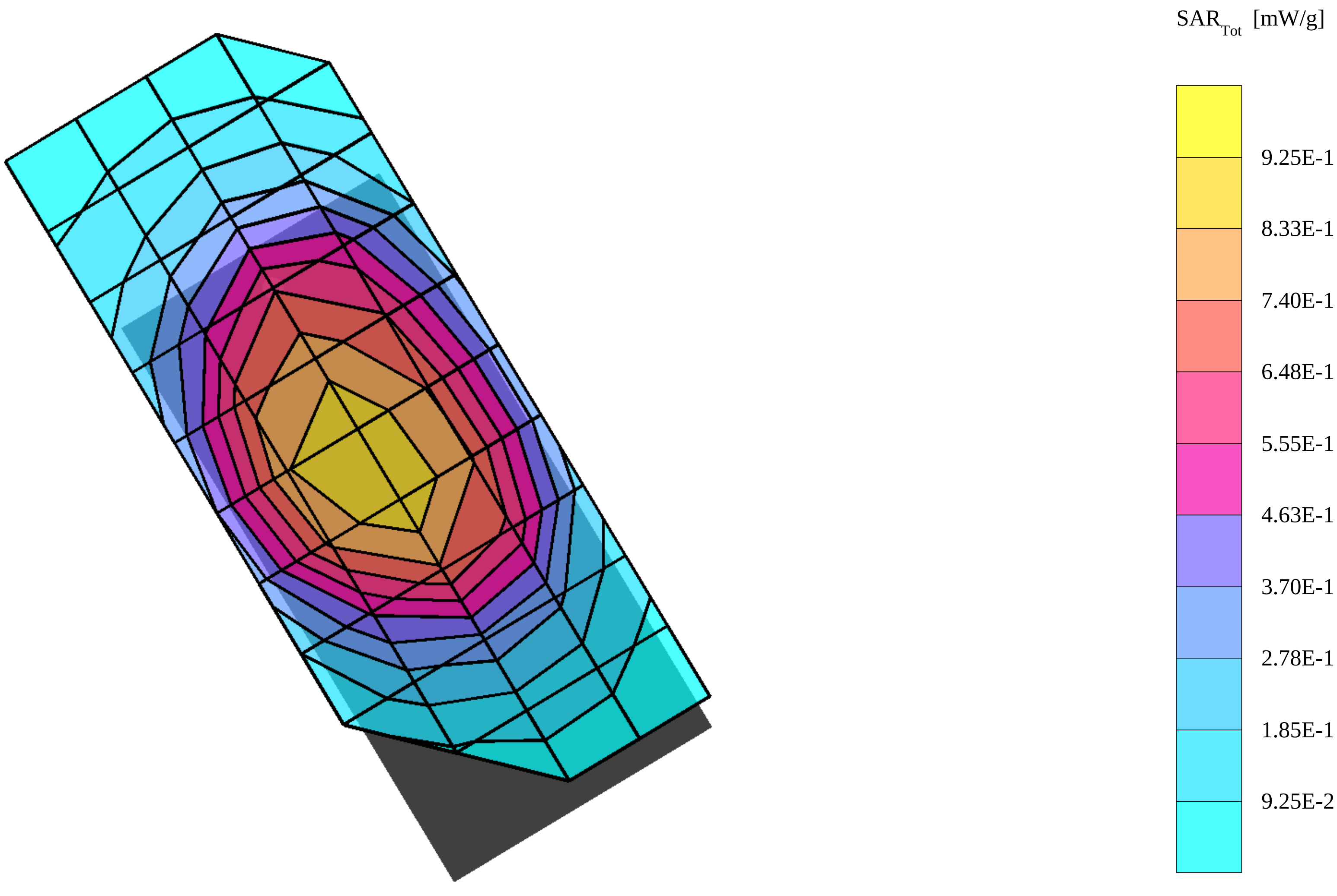
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0

Powerdrift: -0.01 dB



LJPNSB-9

SAM 3 Phantom; Righ Hand Section; Position: Cheek; Frequency: 849 MHz; GSM
Probe: ET3DV6 - SN1379; ConvF(6.60,6.60,6.60); Crest factor: 8.0; Brain 836 MHz SCC34: σ = 0.92 mho/m ε_r = 41.1 ρ = 1.00 g/cm³; Liquid temperature: 22.2 °C
Cube 5x5x7: SAR (1g): 0.910 mW/g, SAR (10g): 0.677 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: 0.03 dB



LJPNSB-9

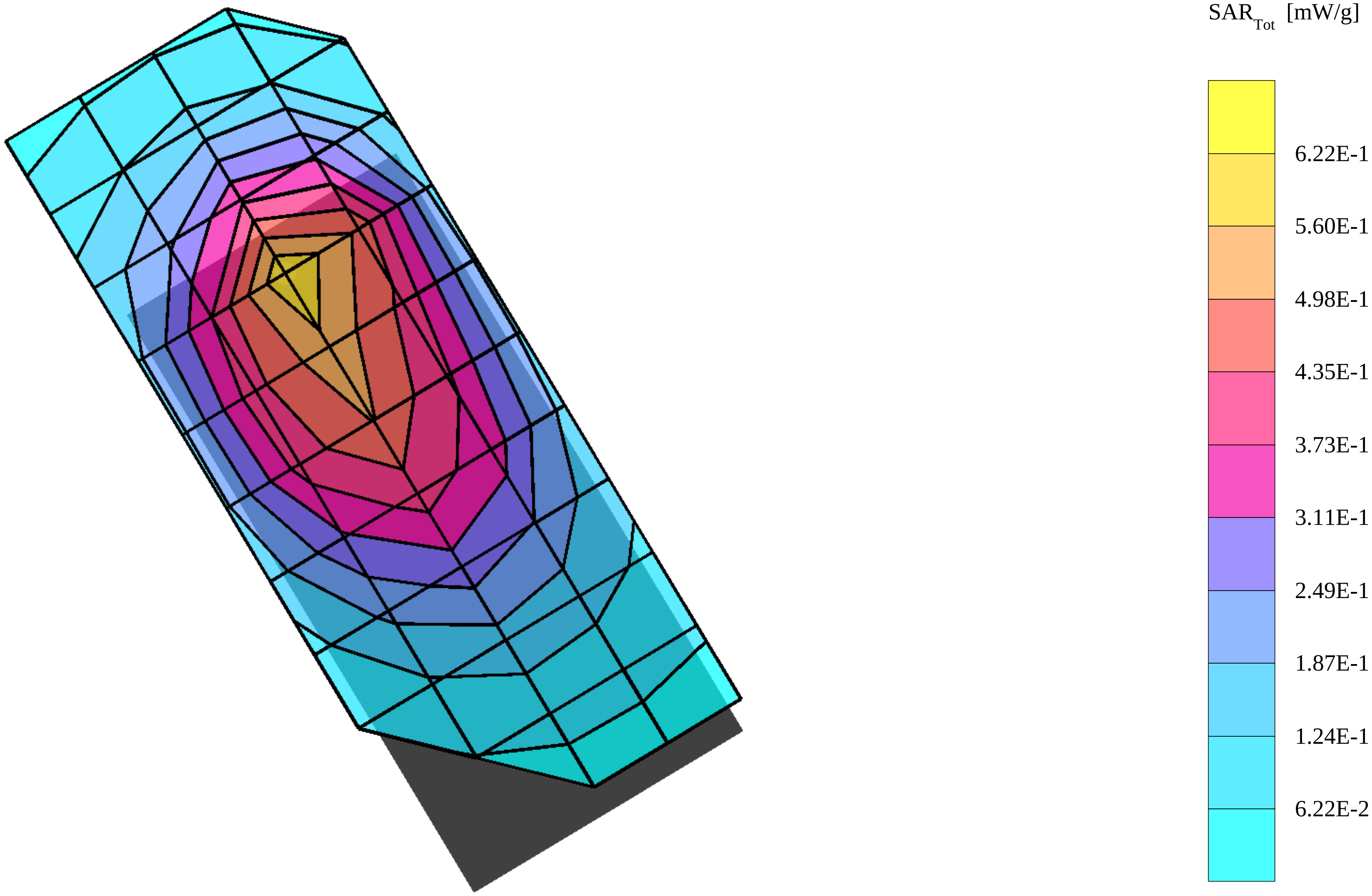
SAM 3 Phantom; Righ Hand Section; Position: tilted; Frequency: 849 MHz; GSM

Probe: ET3DV6 - SN1379; ConvF(6.60,6.60,6.60); Crest factor: 8.0; Brain 836 MHz SCC34: σ = 0.92 mho/m ε_r = 41.1 ρ = 1.00 g/cm^3; Liquid temperature: 22.2 °C

Cube 5x5x7: SAR (1g): 0.579 mW/g, SAR (10g): 0.358 mW/g

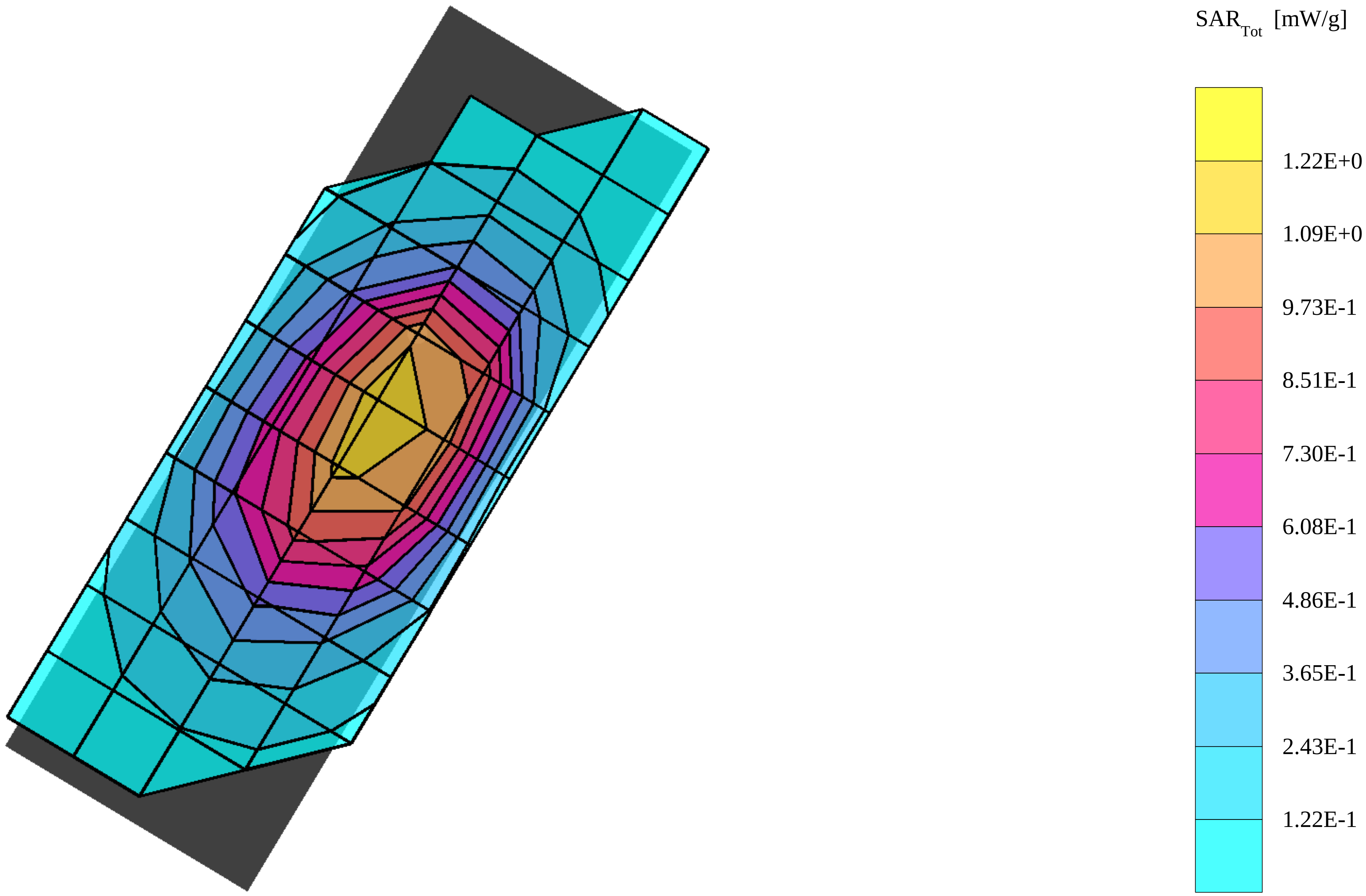
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0

Powerdrift: -0.00 dB



LJPNSB-9

SAM 3 Phantom; Left Hand Section; Position: Cheek, flip open; Frequency: 849 MHz; GSM
Probe: ET3DV6 - SN1379; ConvF(6.60,6.60,6.60); Crest factor: 8.0; Brain 836 MHz SCC34: σ = 0.92 mho/m ε_r = 41.1 ρ = 1.00 g/cm³; Liquid temperature: 21.5 °C
Cube 5x5x7: SAR (1g): 1.20 mW/g, SAR (10g): 0.796 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: 0.01 dB



LJPNSB-9

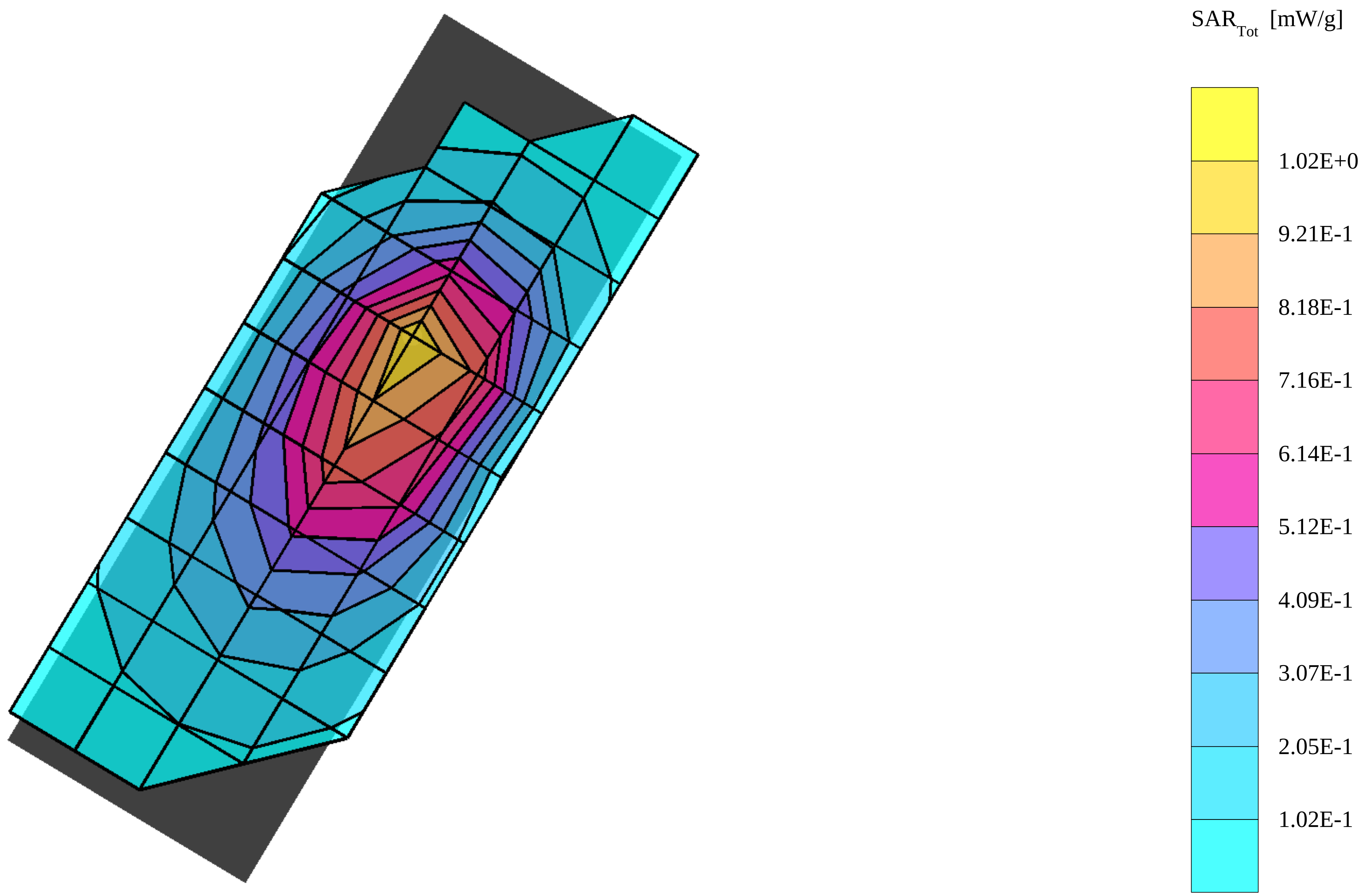
SAM 3 Phantom; Left Hand Section; Position: tilted, flip open; Frequency: 836 MHz; GSM

Probe: ET3DV6 - SN1379; ConvF(6.60,6.60,6.60); Crest factor: 8.0; Brain 836 MHz SCC34: σ = 0.92 mho/m ε_r = 41.1 ρ = 1.00 g/cm³; Liquid temperature: 21.5 °C

Cube 5x5x7: SAR (1g): 1.04 mW/g, SAR (10g): 0.618 mW/g

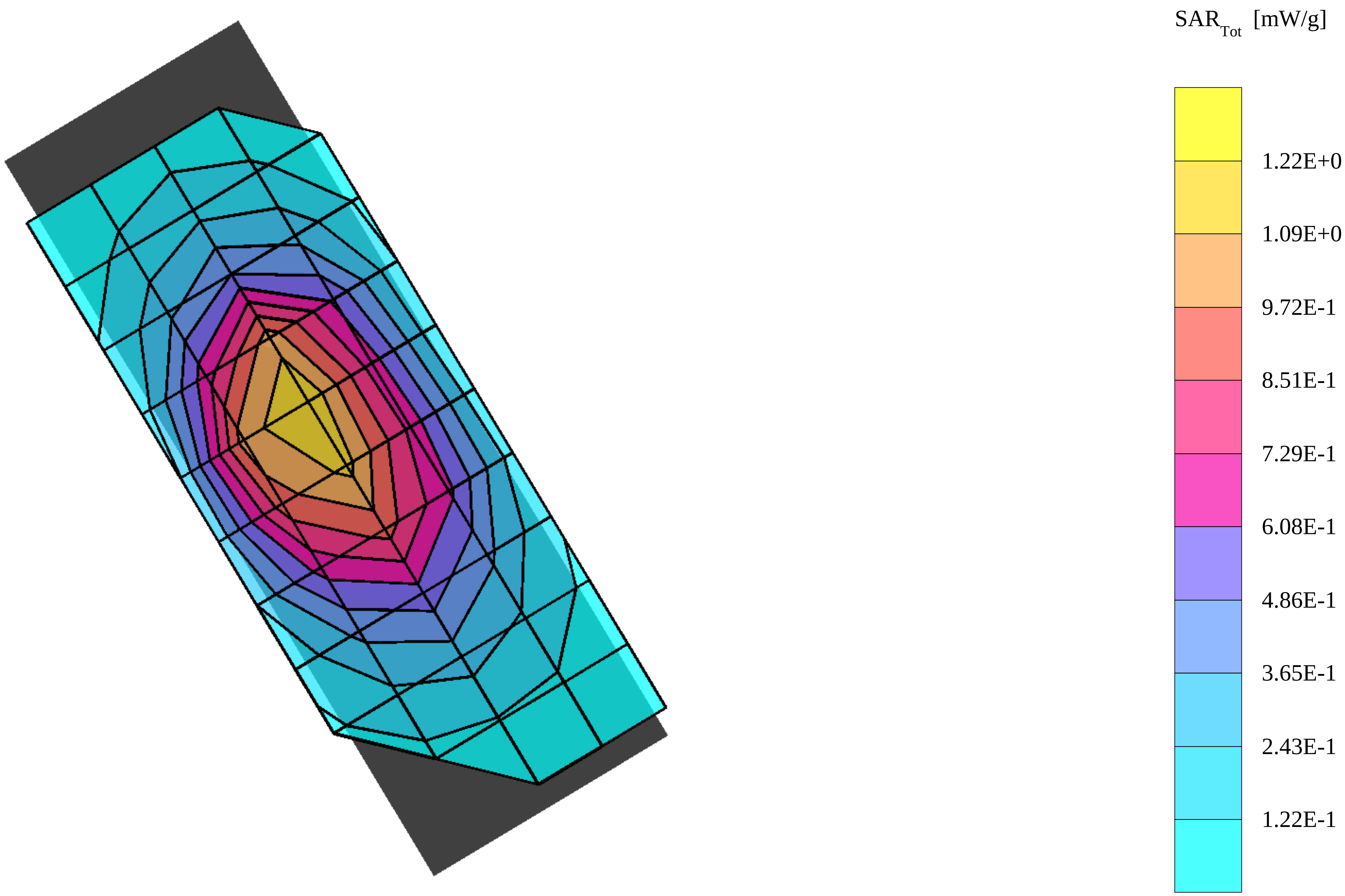
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0

Powerdrift: 0.02 dB



LJPNSB-9

SAM 3 Phantom; Righ Hand Section; Position: Cheek, flip open; Frequency: 849 MHz; GSM
Probe: ET3DV6 - SN1379; ConvF(6.60,6.60,6.60); Crest factor: 8.0; Brain 836 MHz SCC34: σ = 0.92 mho/m ε_r = 41.1 ρ = 1.00 g/cm³; Liquid temperature: 21.9 °C
Cube 5x5x7: SAR (1g): 1.17 mW/g, SAR (10g): 0.794 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: 0.07 dB



LJPNSB-9

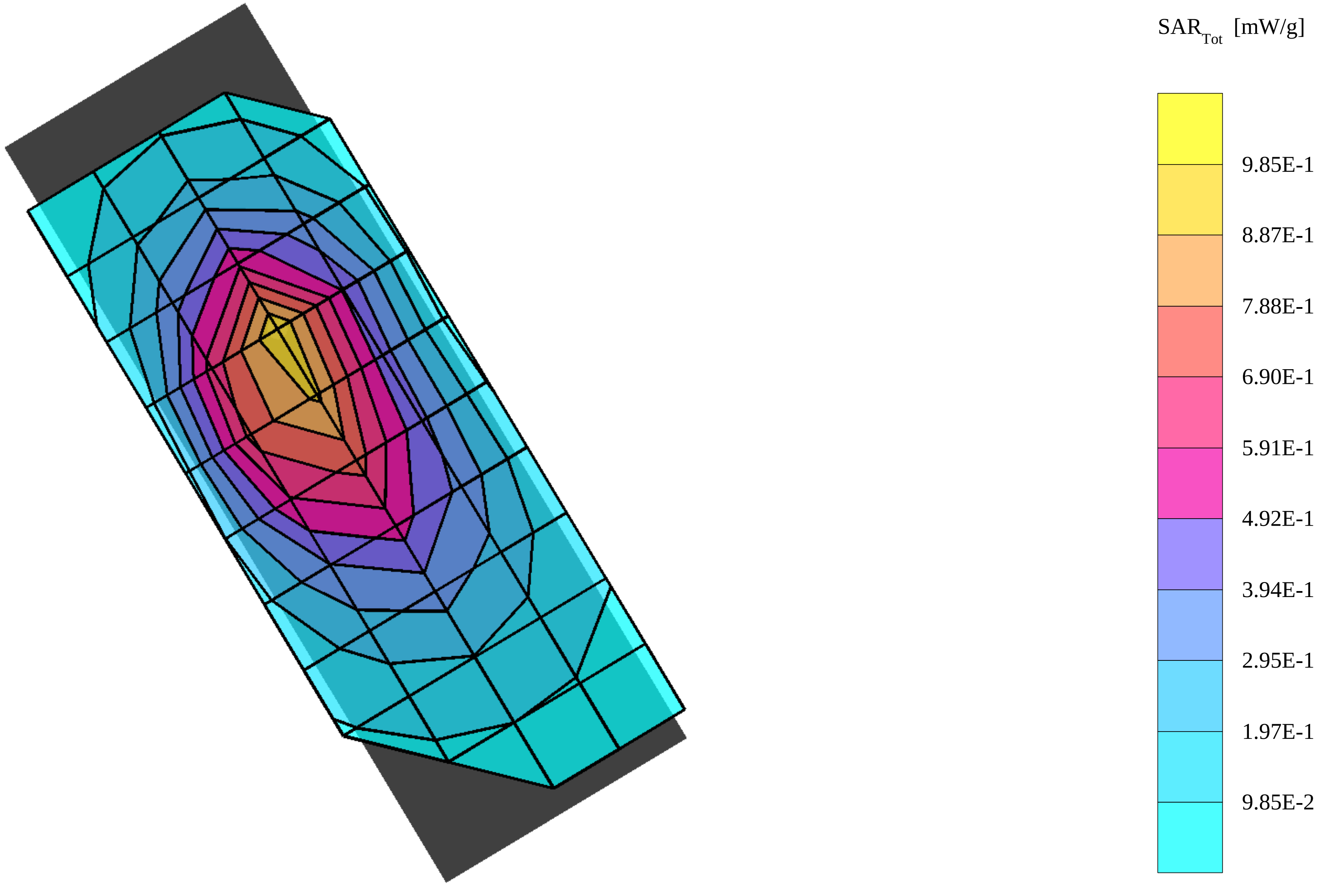
SAM 3 Phantom; Righ Hand Section; Position: tilted, flip open; Frequency: 836 MHz; GSM

Probe: ET3DV6 - SN1379; ConvF(6.60,6.60,6.60); Crest factor: 8.0; Brain 836 MHz SCC34: σ = 0.92 mho/m ε_r = 41.1 ρ = 1.00 g/cm³; Liquid temperature: 22.0 °C

Cube 5x5x7: SAR (1g): 0.965 mW/g, SAR (10g): 0.594 mW/g

Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0

Powerdrift: 0.06 dB



LJPNSB-9

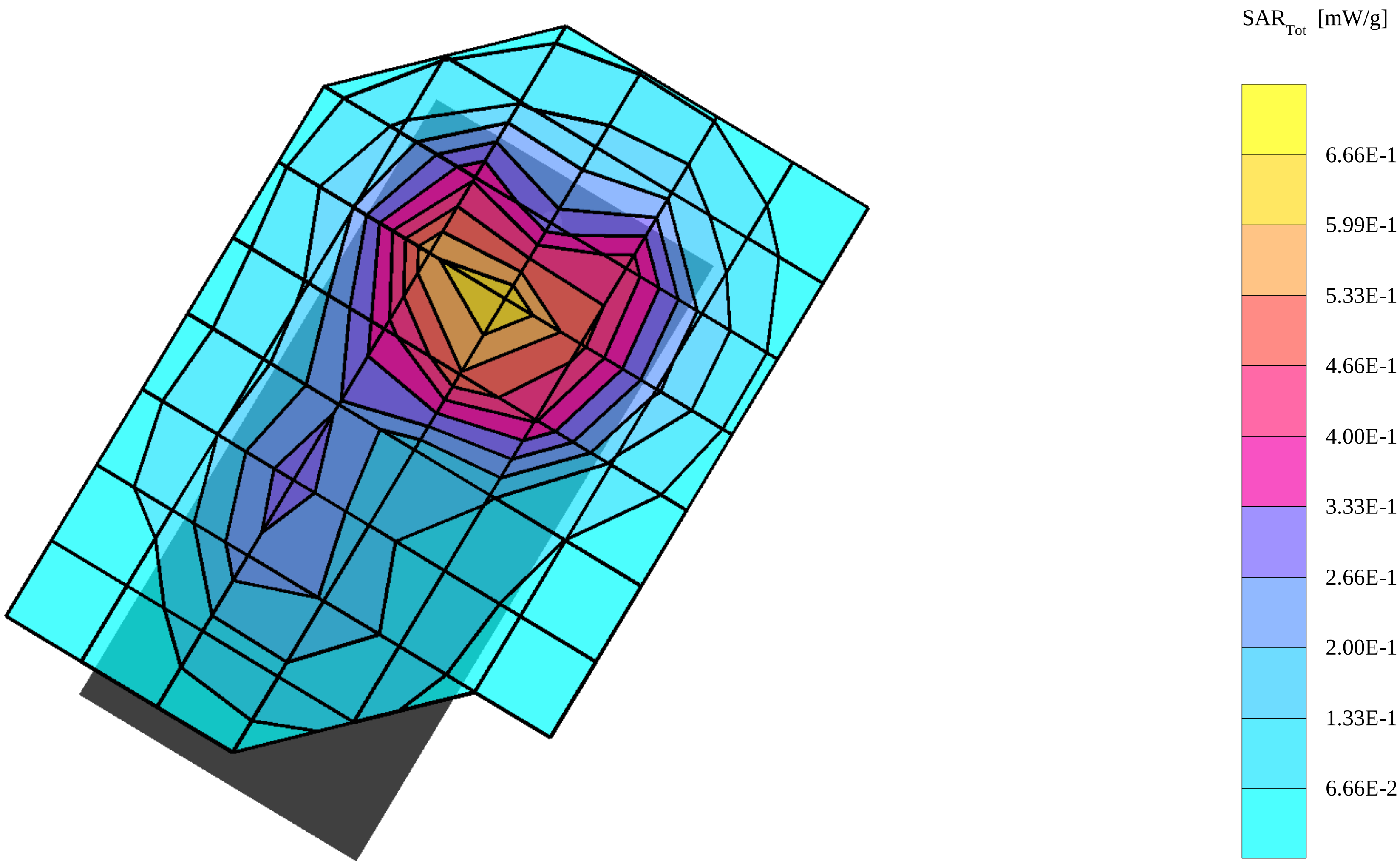
SAM 2 Phantom; Left Hand Section; Position: cheek; Frequency: 1880 MHz; GSM

Probe: ET3DV6 - SN1379; ConvF(5.30,5.30,5.30); Crest factor: 8.0; Brain 1880 MHz SCC34: σ = 1.42 mho/m ε_r = 38.0 ρ = 1.00 g/cm³; Liquid temperature: 22.1 °C

Cube 5x5x7: SAR (1g): 0.676 mW/g, SAR (10g): 0.397 mW/g

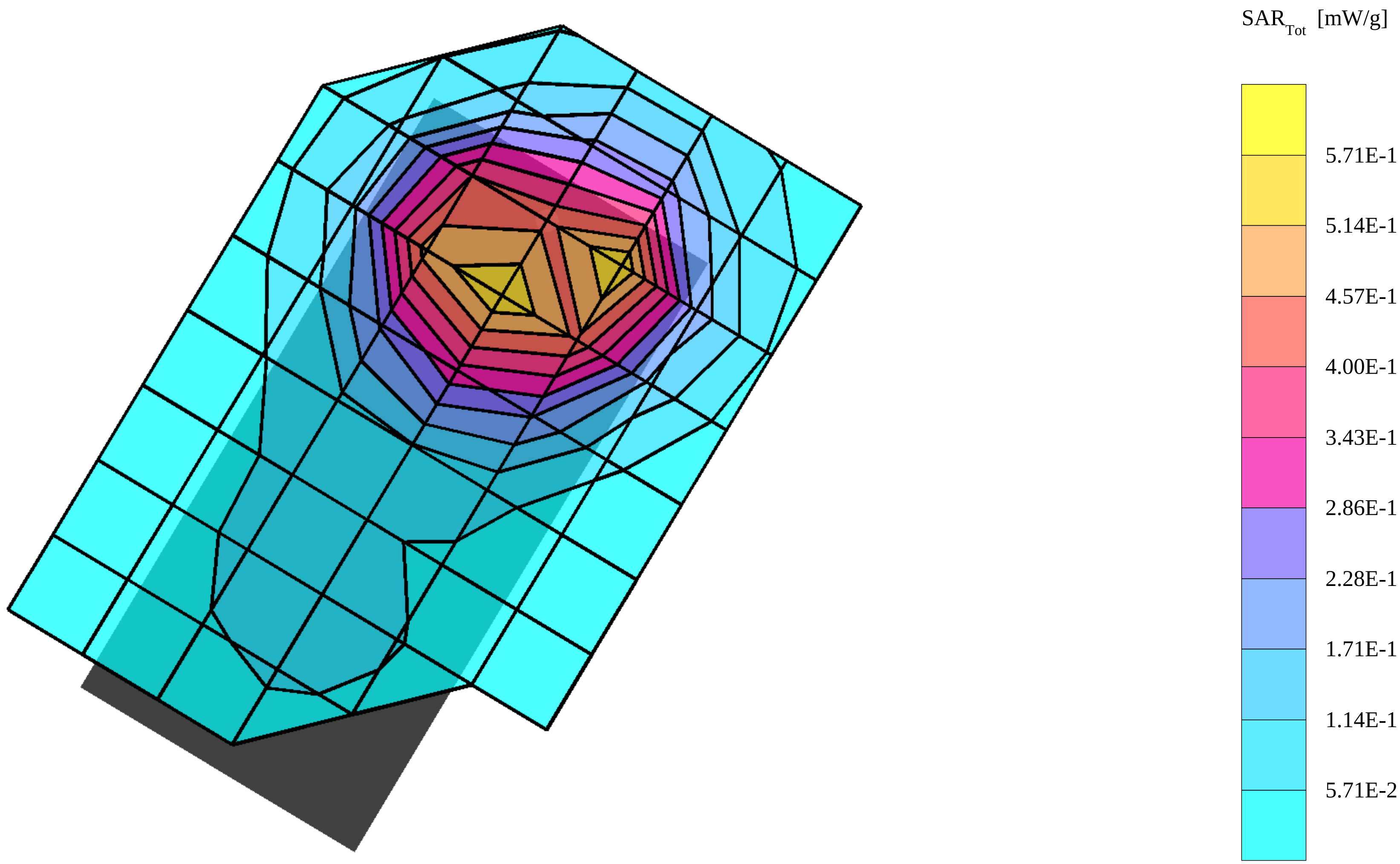
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0

Powerdrift: -0.01 dB



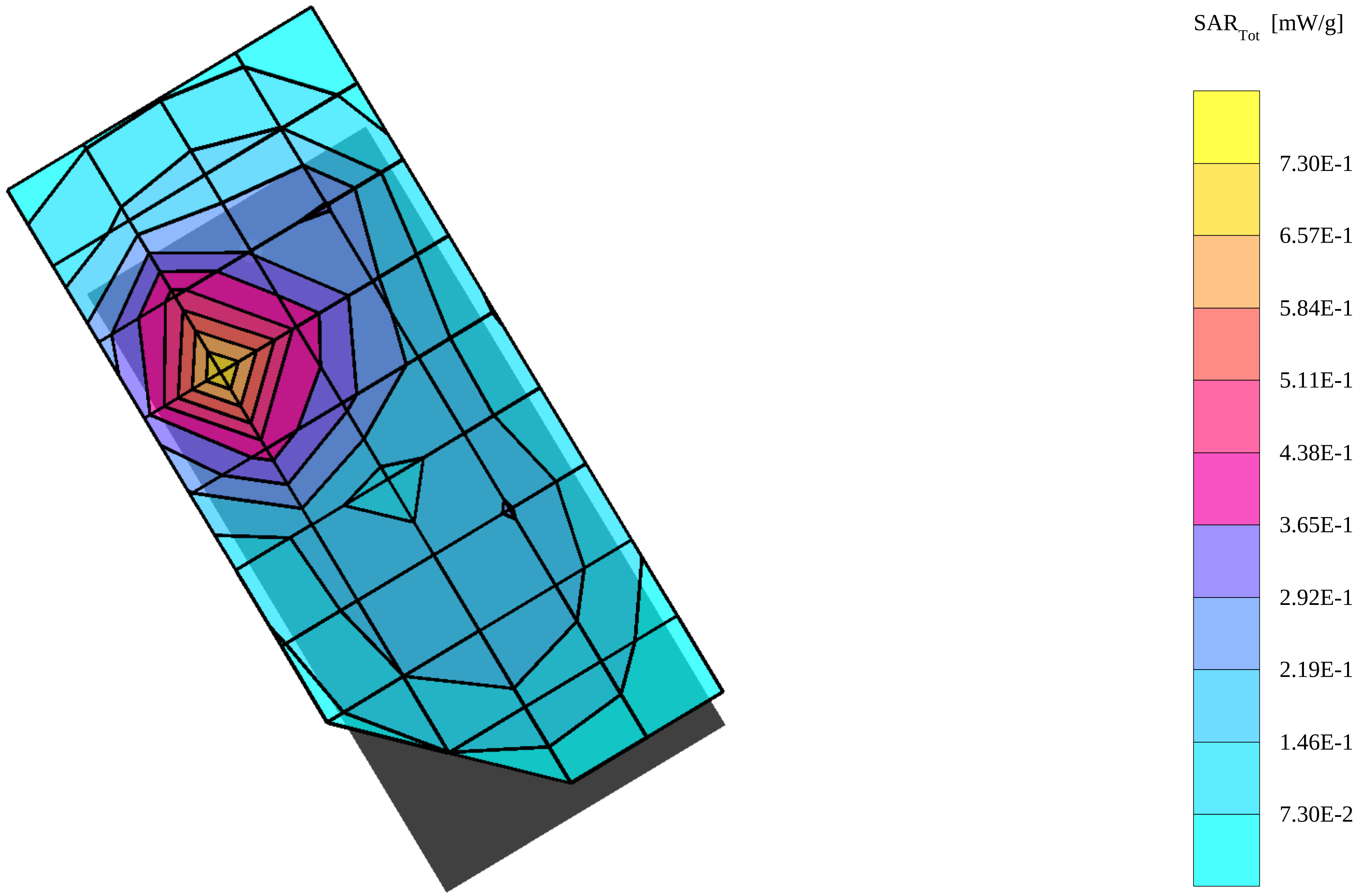
LJPNSB-9

SAM 2 Phantom; Left Hand Section; Position: tilted; Frequency: 1880 MHz; GSM
Probe: ET3DV6 - SN1379; ConvF(5.30,5.30,5.30); Crest factor: 8.0; Brain 1880 MHz SCC34: σ = 1.42 mho/m ε_r = 38.0 ρ = 1.00 g/cm³; Liquid temperature: 22.0 °C
Cube 5x5x7: SAR (1g): 0.584 mW/g, SAR (10g): 0.326 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: 0.06 dB



LJPNSB-9

SAM 2 Phantom; Righ Hand Section; Position: cheek; Frequency: 1880 MHz; GSM
Probe: ET3DV6 - SN1379; ConvF(5.30,5.30,5.30); Crest factor: 8.0; Brain 1880 MHz SCC34: σ = 1.42 mho/m ε_r = 38.0 ρ = 1.00 g/cm³; Liquid temperature: 22.5 °C
Cube 5x5x7: SAR (1g): 0.670 mW/g, SAR (10g): 0.376 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.01 dB



LJPNSB-9

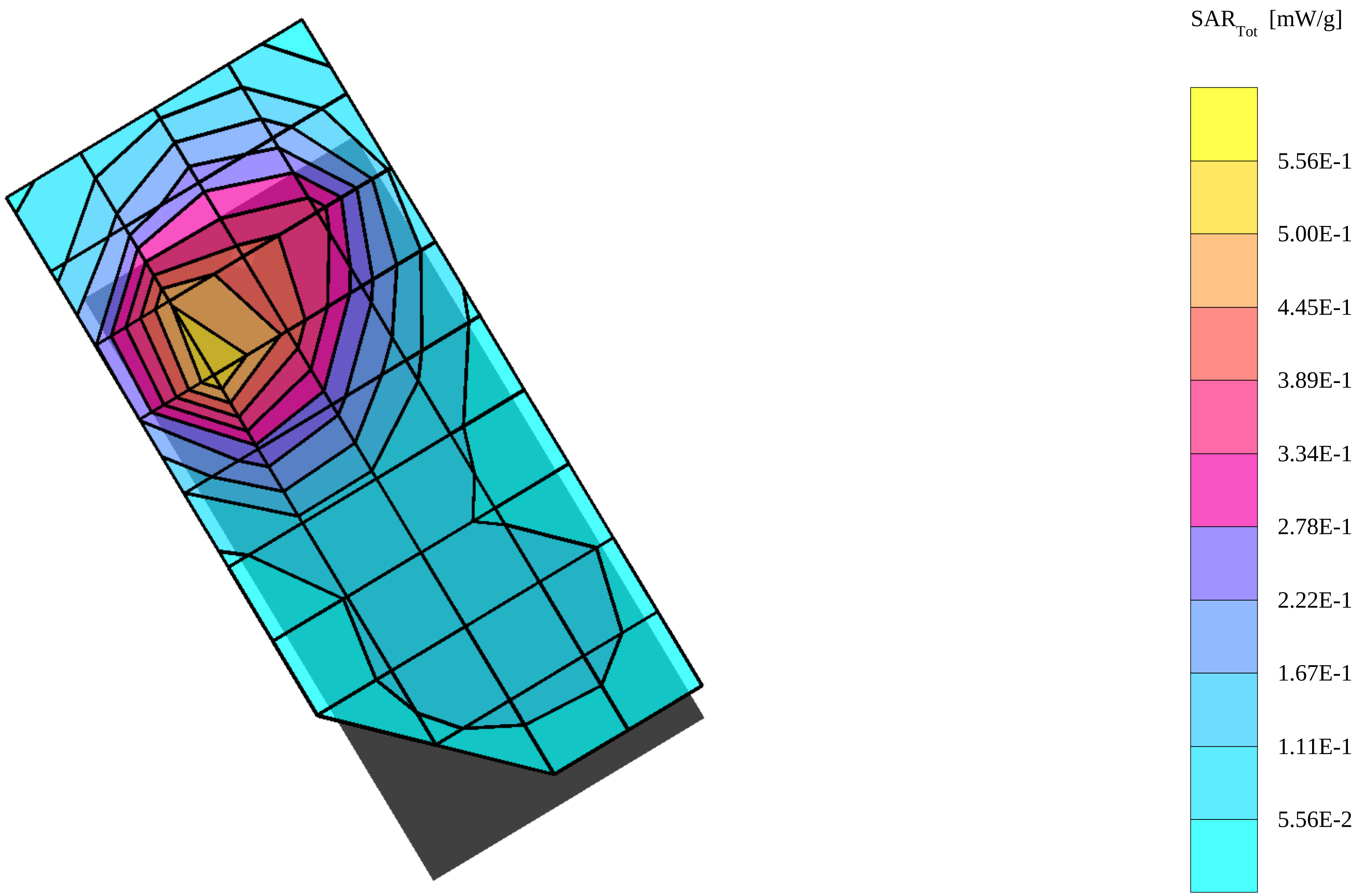
SAM 2 Phantom; Righ Hand Section; Position: tilted; Frequency: 1880 MHz; GSM

Probe: ET3DV6 - SN1379; ConvF(5.30,5.30,5.30); Crest factor: 8.0; Brain 1880 MHz SCC34: σ = 1.42 mho/m ε_r = 38.0 ρ = 1.00 g/cm³; Liquid temperature: 22.5 °C

Cube 5x5x7: SAR (1g): 0.542 mW/g, SAR (10g): 0.316 mW/g

Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0

Powerdrift: -0.00 dB



LJPNSB-9

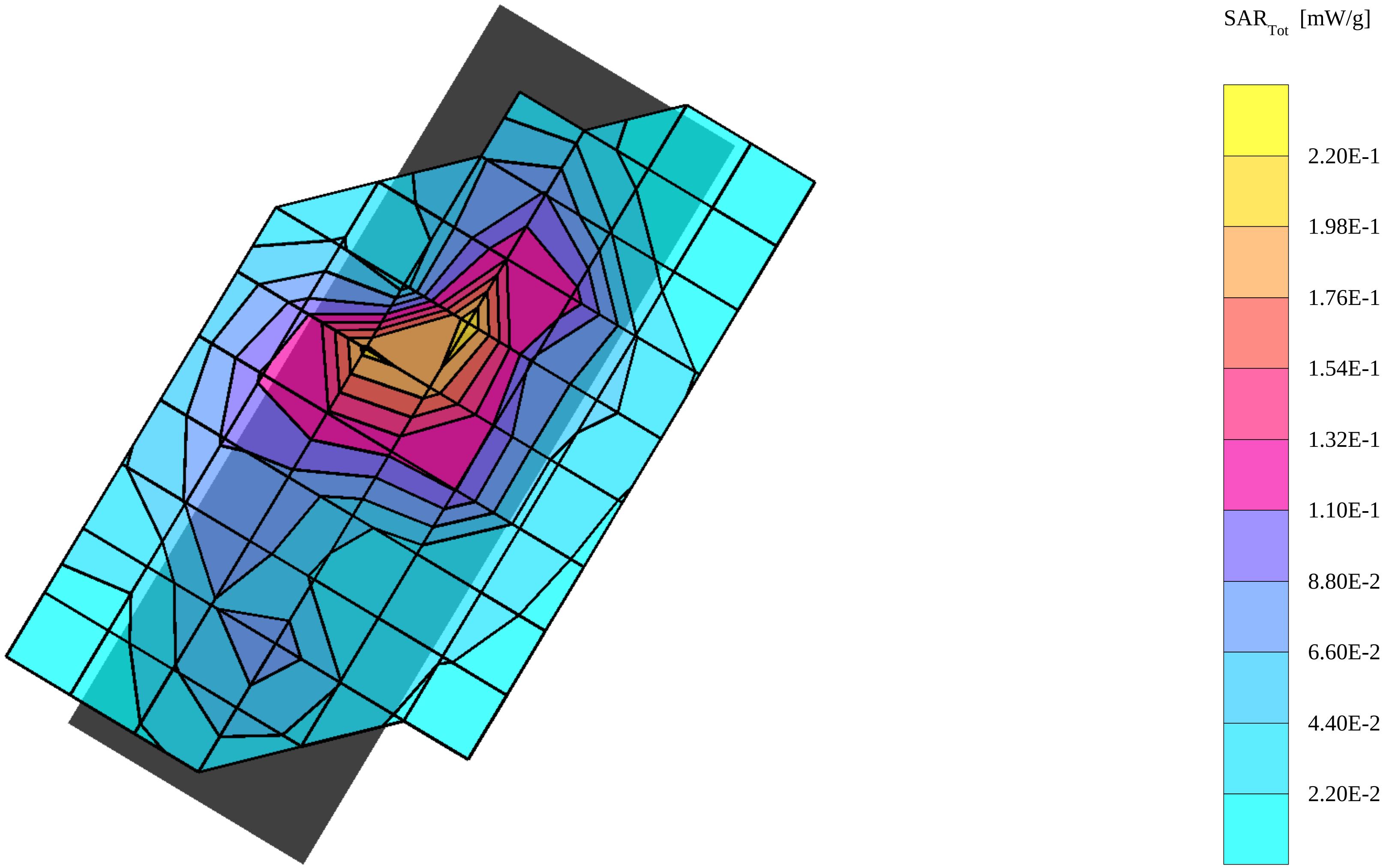
SAM 2 Phantom; Left Hand Section; Position: cheek, flip open; Frequency: 1850 MHz; GSM

Probe: ET3DV6 - SN1379; ConvF(5.30,5.30,5.30); Crest factor: 8.0; Brain 1880 MHz SCC34: σ = 1.42 mho/m ε_r = 38.0 ρ = 1.00 g/cm³; Liquid temperature: 22.1 °C

Cube 5x5x7: SAR (1g): 0.207 mW/g, SAR (10g): 0.110 mW/g

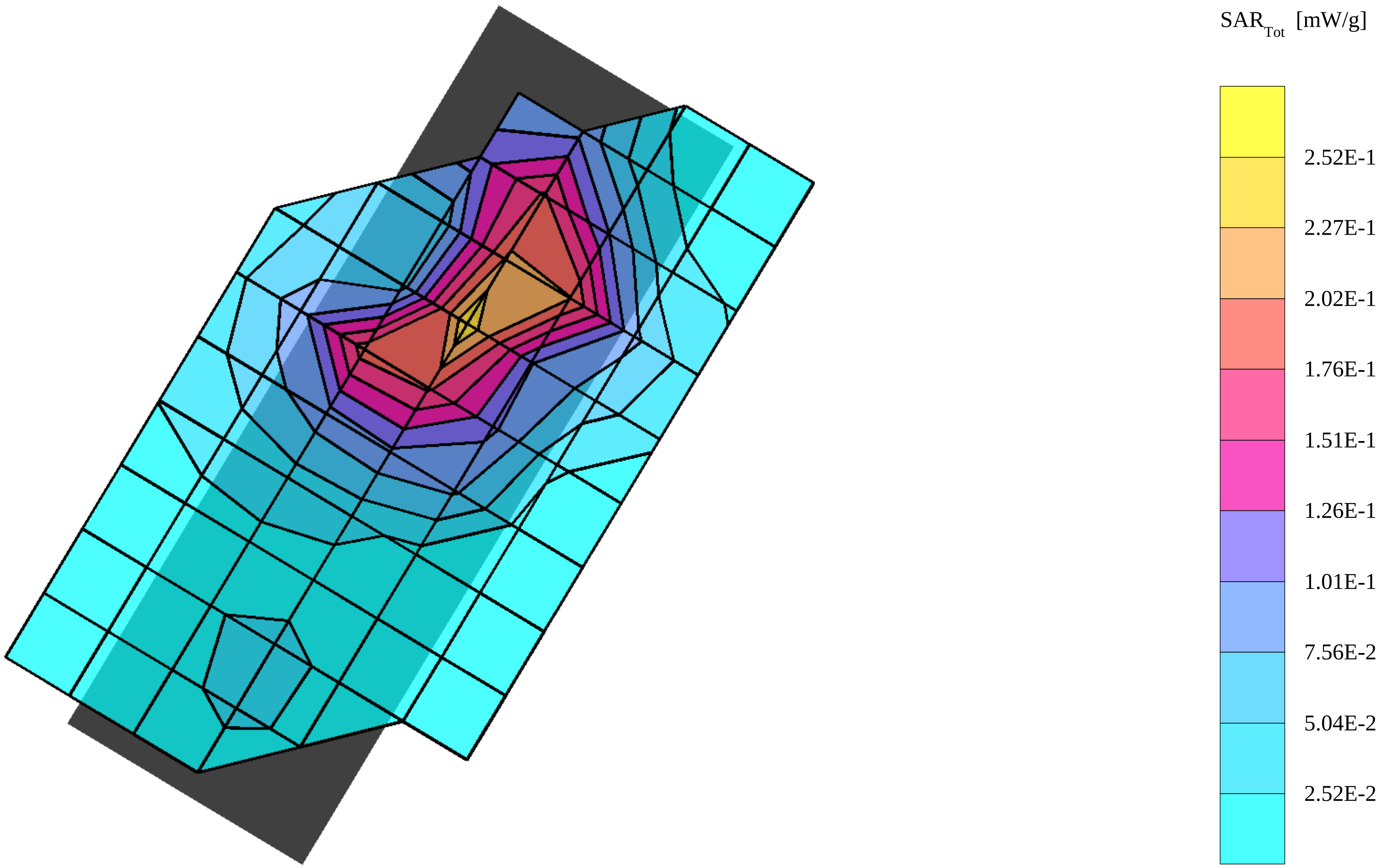
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0

Powerdrift: 0.00 dB



LJPNSB-9

SAM 2 Phantom; Left Hand Section; Position: tilted, flip open; Frequency: 1880 MHz; GSM
Probe: ET3DV6 - SN1379; ConvF(5.30,5.30,5.30); Crest factor: 8.0; Brain 1880 MHz SCC34: σ = 1.42 mho/m ε_r = 38.0 ρ = 1.00 g/cm^3; Liquid temperature: 22.3 °C
Cube 5x5x7: SAR (1g): 0.235 mW/g, SAR (10g): 0.124 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: 0.02 dB



LJPNSB-9

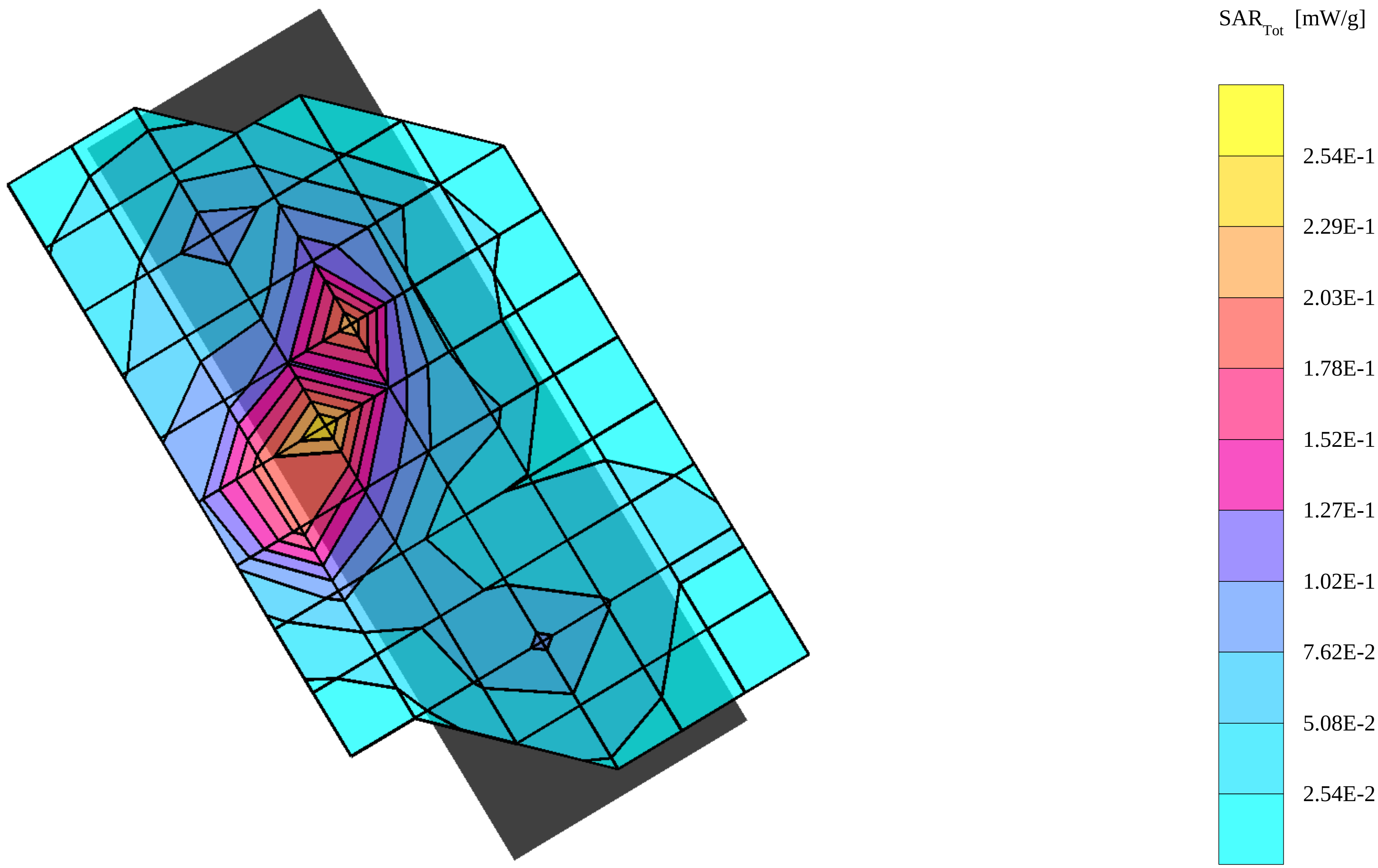
SAM 2 Phantom; Righ Hand Section; Position: cheek, flip open; Frequency: 1850 MHz; GSM

Probe: ET3DV6 - SN1379; ConvF(5.30,5.30,5.30); Crest factor: 8.0; Brain 1880 MHz SCC34: σ = 1.42 mho/m ε_r = 38.0 ρ = 1.00 g/cm^3; Liquid temperature: 22.4 °C

Cube 5x5x7: SAR (1g): 0.242 mW/g, SAR (10g): 0.140 mW/g

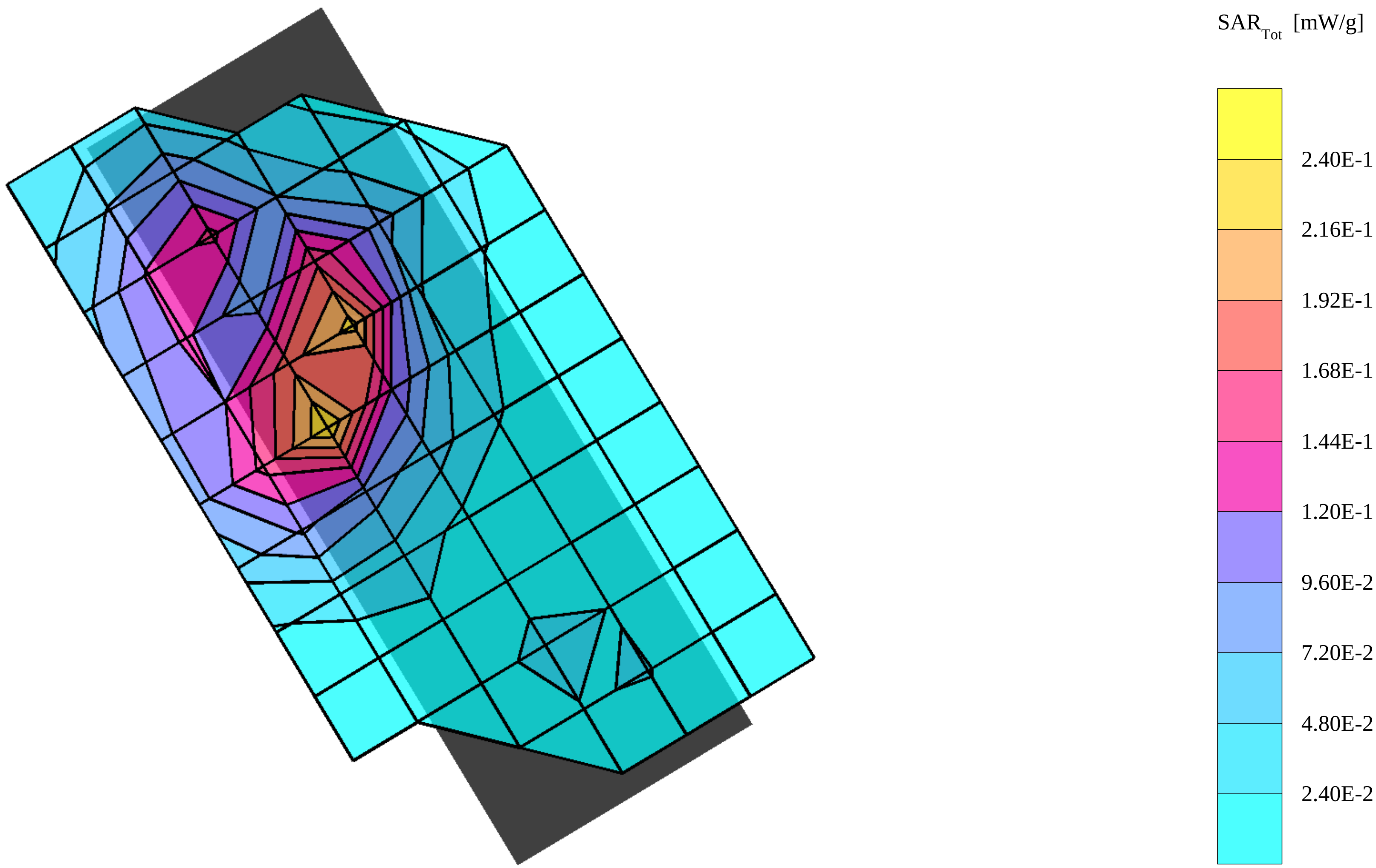
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0

Powerdrift: -0.01 dB



LJPNSB-9

SAM 2 Phantom; Righ Hand Section; Position: tilted, flip open; Frequency: 1850 MHz; GSM
Probe: ET3DV6 - SN1379; ConvF(5.30,5.30,5.30); Crest factor: 8.0; Brain 1880 MHz SCC34: σ = 1.42 mho/m ε_r = 38.0 ρ = 1.00 g/cm³; Liquid temperature: 22.3 °C
Cube 5x5x7: SAR (1g): 0.268 mW/g, SAR (10g): 0.143 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.01 dB



11/18/02

LJPNSB-9

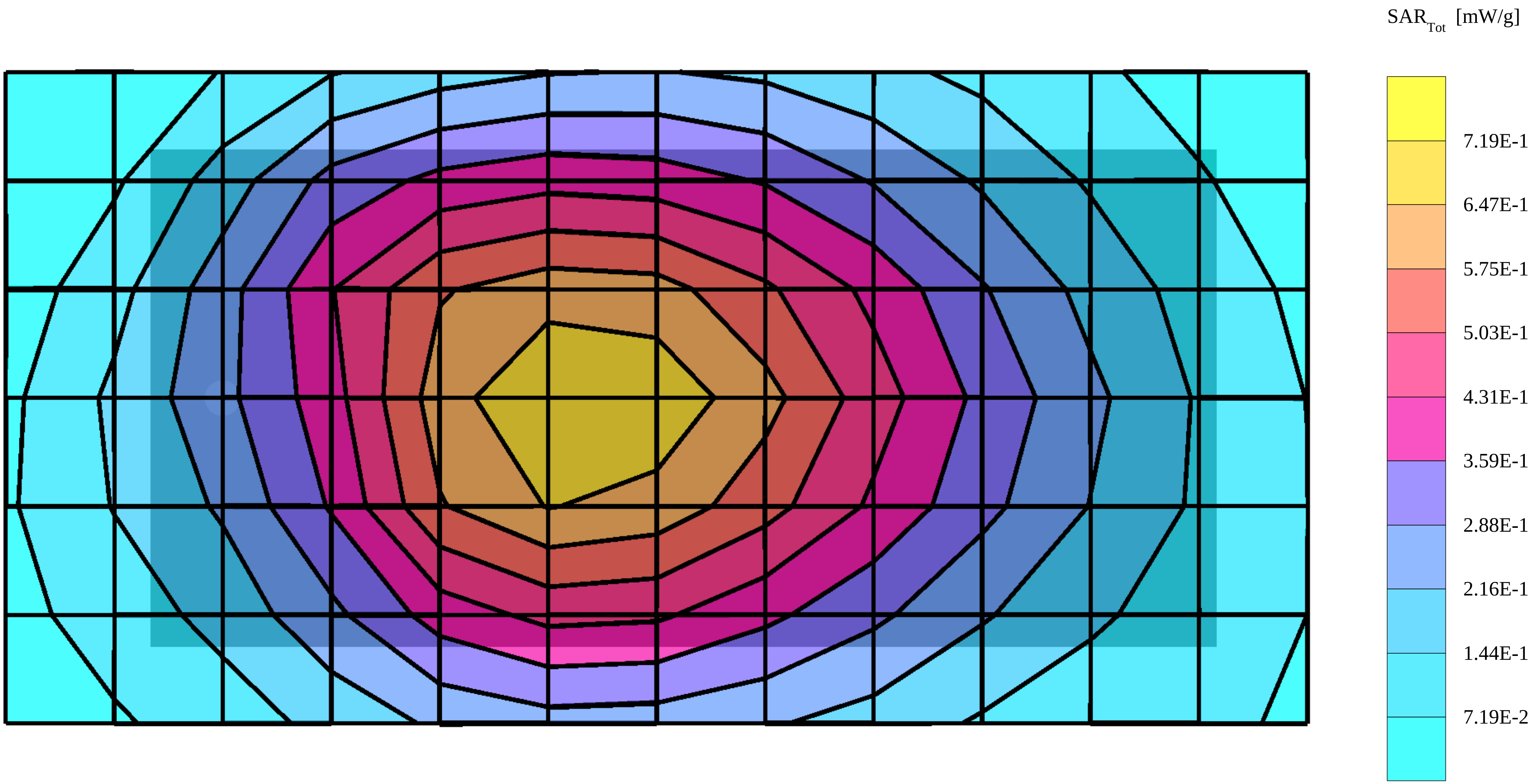
SAM 3 Phantom; Flat Section; Position: body worn; Frequency: 824 MHz; GSM

Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 8.0; Muscle 836 MHz: σ = 0.96 mho/m ε_r = 56.7 ρ = 1.00 g/cm³; Liquid temperature: 22.3 °C

Cube 5x5x7: SAR (1g): 0.700 mW/g, SAR (10g): 0.496 mW/g

Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0

Powerdrift: 0.12 dB



11/20/02

LJPNSB-9

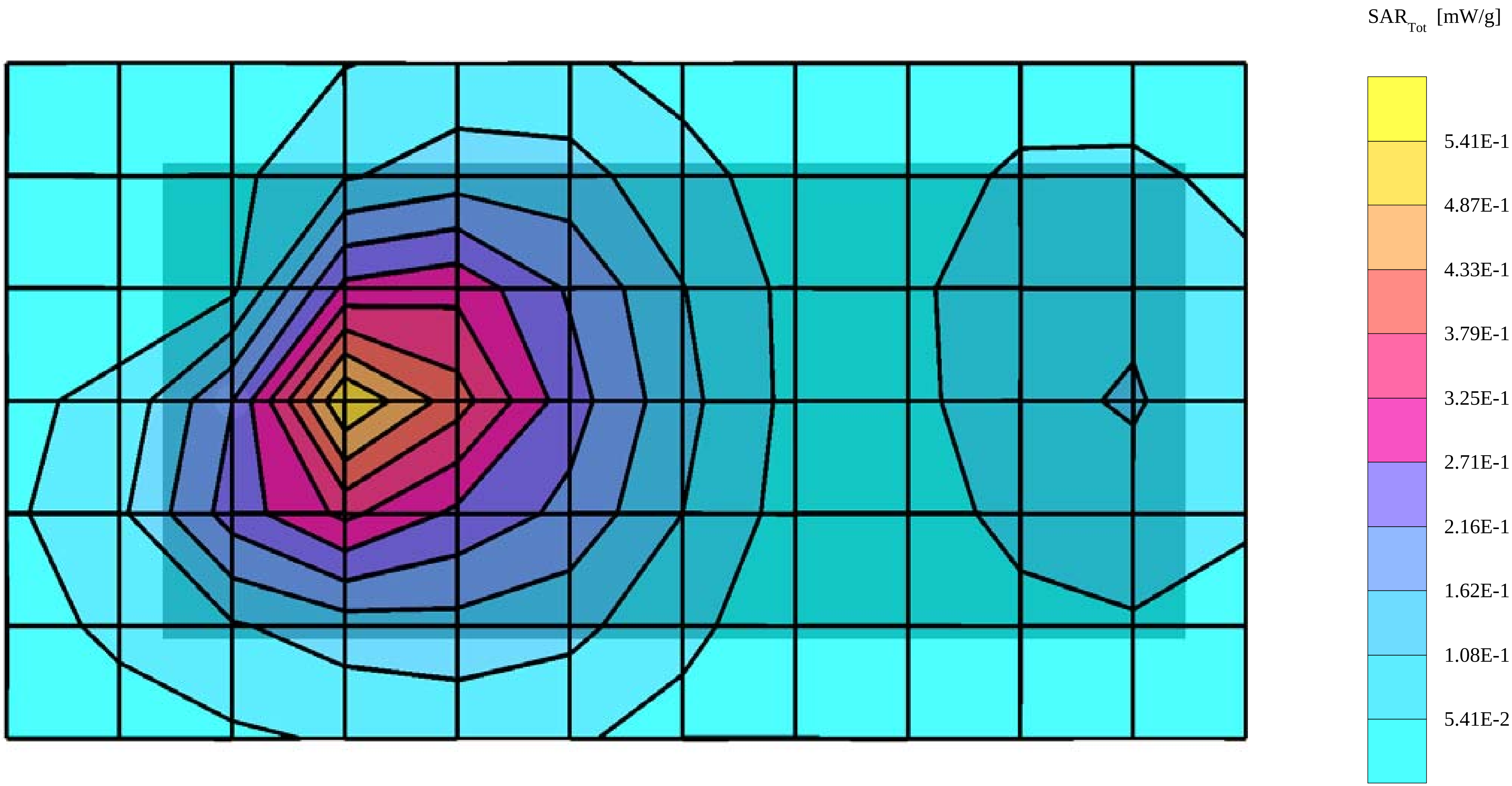
SAM 1 Phantom; Flat Section; Position: body worn; Frequency: 1910 MHz; GSM

Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 8.0; Muscle 1880 MHz: σ = 1.50 mho/m ε_r = 51.1 ρ = 1.00 g/cm³; Liquid temperature: 21.4 °C

Cube 5x5x7: SAR (1g): 0.506 mW/g, SAR (10g): 0.276 mW/g

Coarse: Dx = 13.0, Dy = 13.0, Dz = 10.0

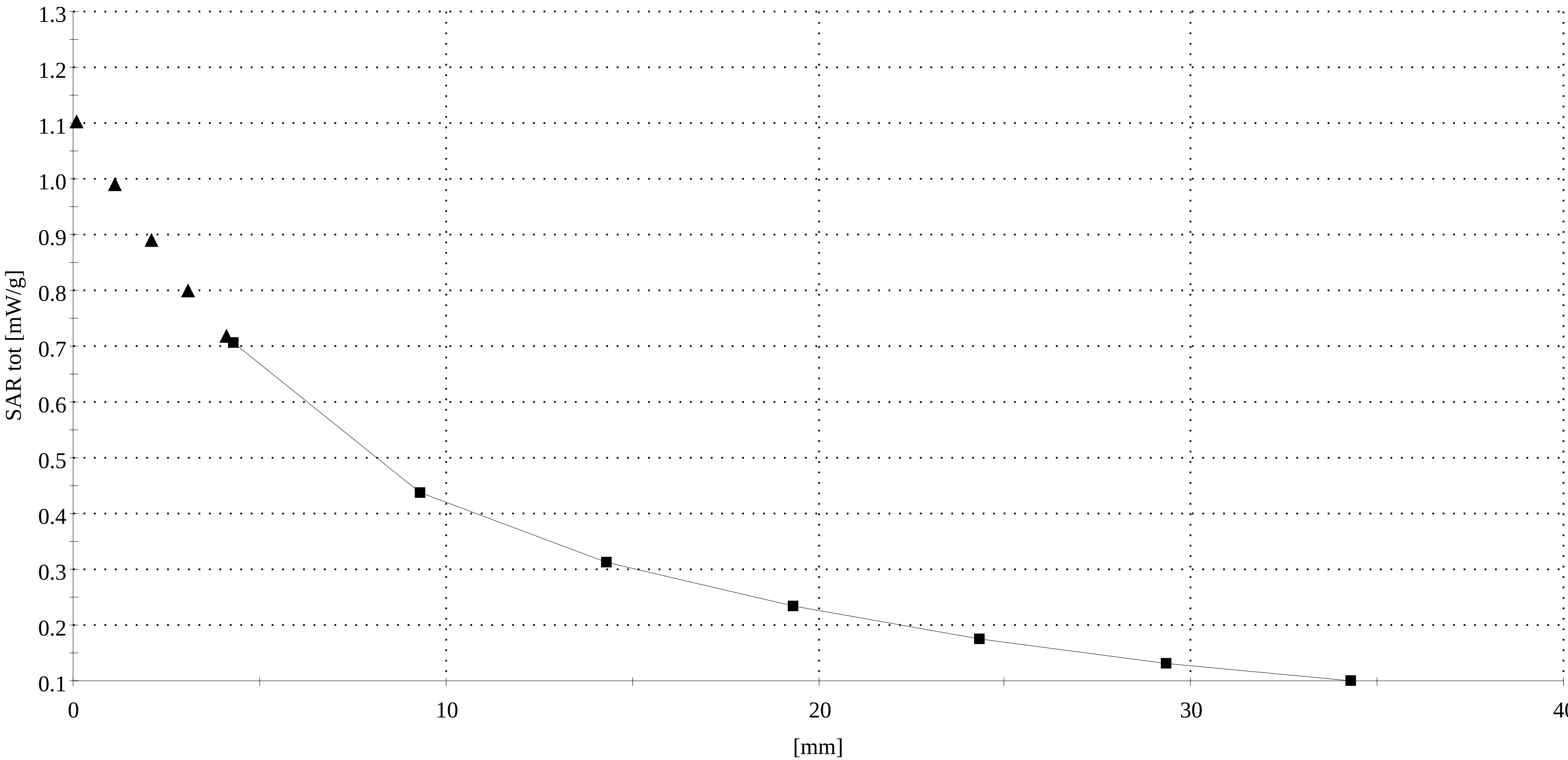
Powerdrift: 0.06 dB



DTX05898-EN

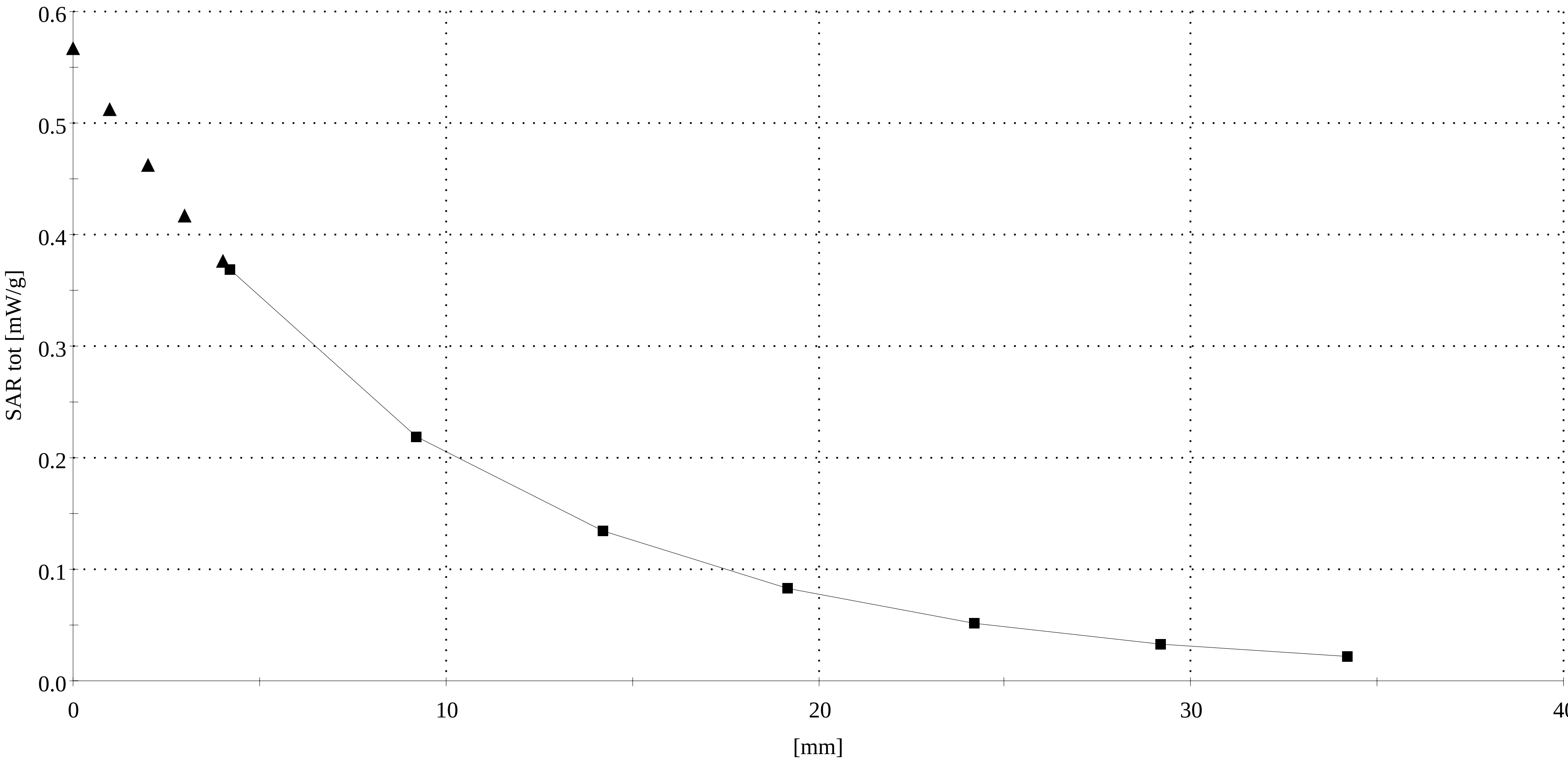
LJPNSB-9

SAM 3 Phantom; Left Hand Section; Position: Cheek, flip open; Frequency: 849 MHz; GSM
Probe: ET3DV6 - SN1379; ConvF(6.60,6.60,6.60); Crest factor: 8.0; Brain 836 MHz SCC34: σ = 0.92 mho/m ε_r = 41.1 ρ = 1.00 g/cm³; Liquid temperature: 21.5 °C
Cube 5x5x7: SAR (1g): 1.20 mW/g, SAR (10g): 0.796 mW/g
Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0



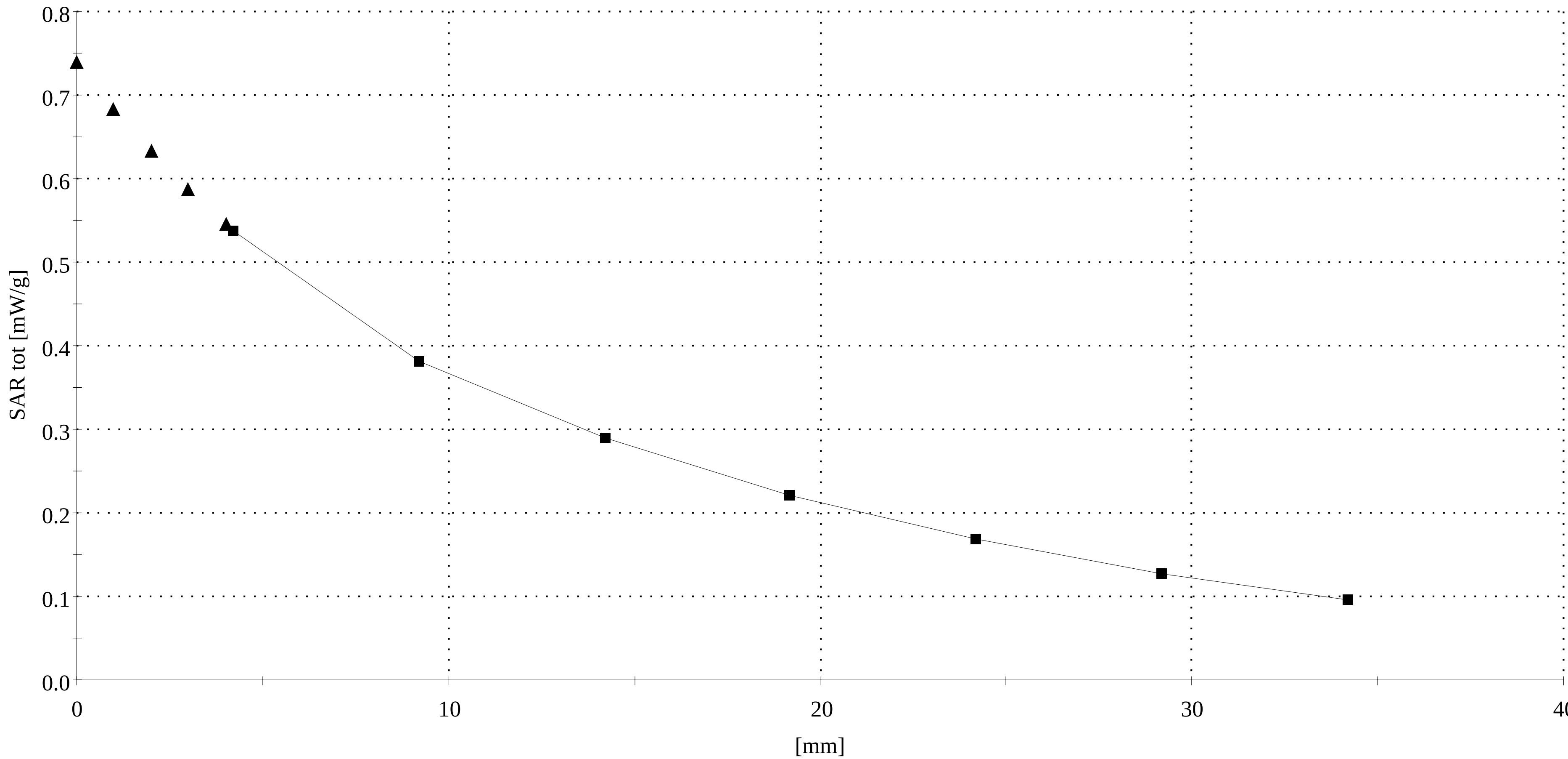
LJPNSB-9

SAM 2 Phantom; Left Hand Section; Position: cheek; Frequency: 1880 MHz; GSM
Probe: ET3DV6 - SN1379; ConvF(5.30,5.30,5.30); Crest factor: 8.0; Brain 1880 MHz SCC34: σ = 1.42 mho/m ε_r = 38.0 ρ = 1.00 g/cm³; Liquid temperature: 22.1 °C
Cube 5x5x7: SAR (1g): 0.676 mW/g, SAR (10g): 0.397 mW/g
Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0



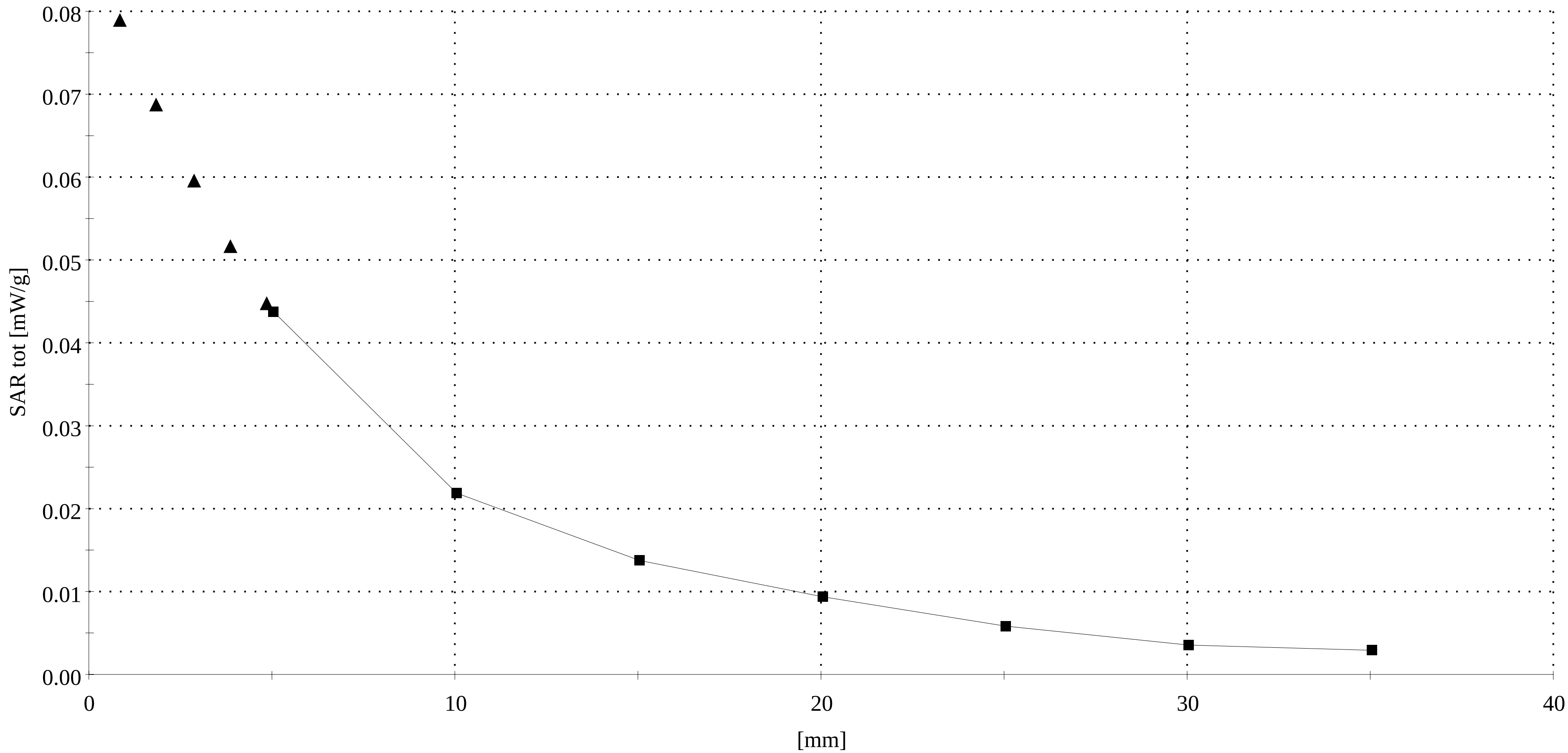
LJPNSB-9

SAM 3 Phantom; Flat Section; Position: body worn; Frequency: 824 MHz; GSM
Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 8.0; Muscle 836 MHz: σ = 0.96 mho/m ϵ_r = 56.7 ρ = 1.00 g/cm^3; Liquid temperature: 22.3 °C
Cube 5x5x7: SAR (1g): 0.700 mW/g, SAR (10g): 0.496 mW/g
Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0



LJPNSB-9

SAM 1 Phantom; Flat Section; Position: body worn; Frequency: 1910 MHz; GSM
Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 8.0; Muscle 1880 MHz: $\sigma = 1.50$ mho/m $\varepsilon_r = 51.1$ $\rho = 1.00$ g/cm³; Liquid temperature: 21.4 °C
Cube 5x5x7: SAR (1g): 0.506 mW/g, SAR (10g): 0.276 mW/g
Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0



APPENDIX C.

Calibration Certificate(s)

550065

Schmid & Partner
Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

Calibration Certificate

Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1379**
Place of Calibration:	**Zurich**
Date of Calibration:	**February 22, 2002**
Calibration Interval:	**12 months**

Schmid & Partner Engineering AG hereby certifies, that this device has been calibrated on the date indicated above. The calibration was performed in accordance with specifications and procedures of Schmid & Partner Engineering AG.

Wherever applicable, the standards used in the calibration process are traceable to international standards. In all other cases the standards of the Laboratory for EMF and Microwave Electronics at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland have been applied.

Calibrated by:	
Approved by:	

Probe ET3DV6

SN:1379

Manufactured:	September 21, 1999
Last calibration:	February 20, 2001
Recalibrated:	February 22, 2002

Calibrated for System DASY3

DASY3 - Parameters of Probe: ET3DV6 SN:1379

Sensitivity in Free Space

NormX	**1.74**	$\mu V/(V/m)^2$
NormY	**1.72**	$\mu V/(V/m)^2$
NormZ	**1.75**	$\mu V/(V/m)^2$

Diode Compression

DCP X	**95**	mV
DCP Y	**95**	mV
DCP Z	**95**	mV

Sensitivity in Tissue Simulating Liquid

Head **900 MHz** e_r **= 41.5 ± 5%** s **= 0.97 ± 5% mho/m**

ConvF X	**6.5**	± 8.9% (k=2)	Boundary effect:	
ConvF Y	**6.5**	± 8.9% (k=2)	Alpha	**0.45**
ConvF Z	**6.5**	± 8.9% (k=2)	Depth	**2.34**

Head **1800 MHz** e_r **= 40.0 ± 5%** s **= 1.40 ± 5% mho/m**

ConvF X	**5.4**	± 8.9% (k=2)	Boundary effect:	
ConvF Y	**5.4**	± 8.9% (k=2)	Alpha	**0.62**
ConvF Z	**5.4**	± 8.9% (k=2)	Depth	**2.15**

Boundary Effect

Head **900 MHz** **Typical SAR gradient: 5 % per mm**

Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	10.6	5.8
SAR_{be} [%]	With Correction Algorithm	0.3	0.6

Head **1800 MHz** **Typical SAR gradient: 10 % per mm**

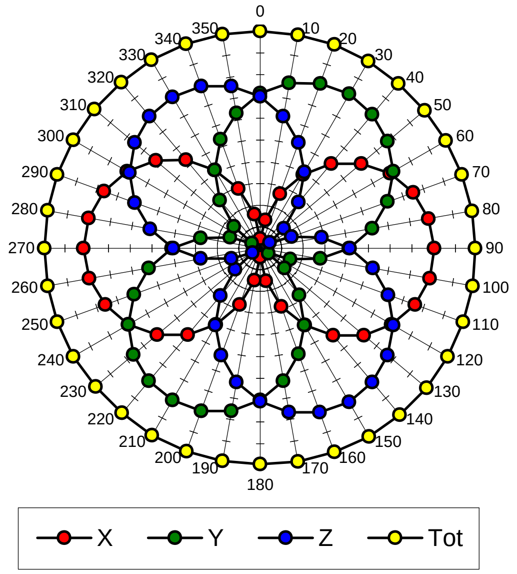
Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	12.3	7.6
SAR_{be} [%]	With Correction Algorithm	0.1	0.2

Sensor Offset

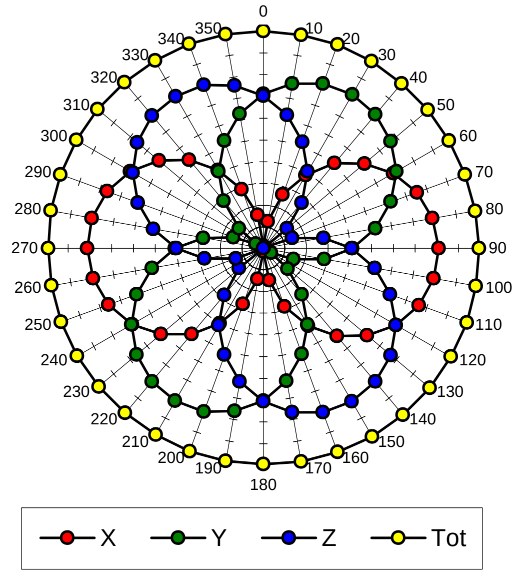
Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.5 ± 0.2**	mm

Receiving Pattern (f), q = 0°

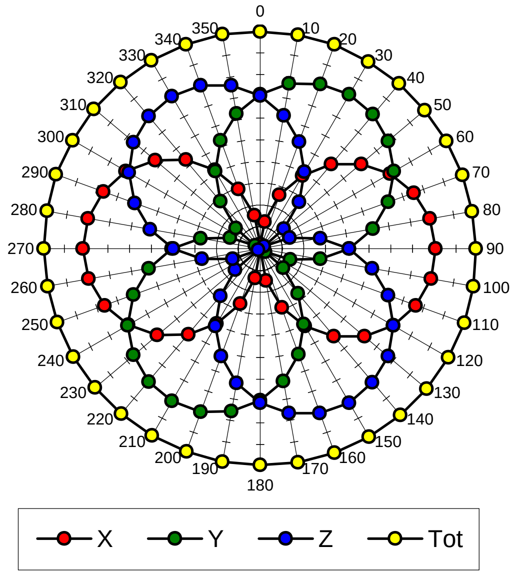
f = 30 MHz, TEM cell ifi110



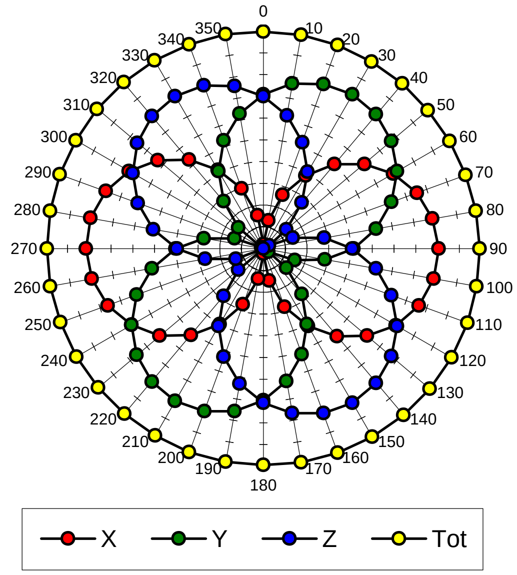
f = 100 MHz, TEM cell ifi110

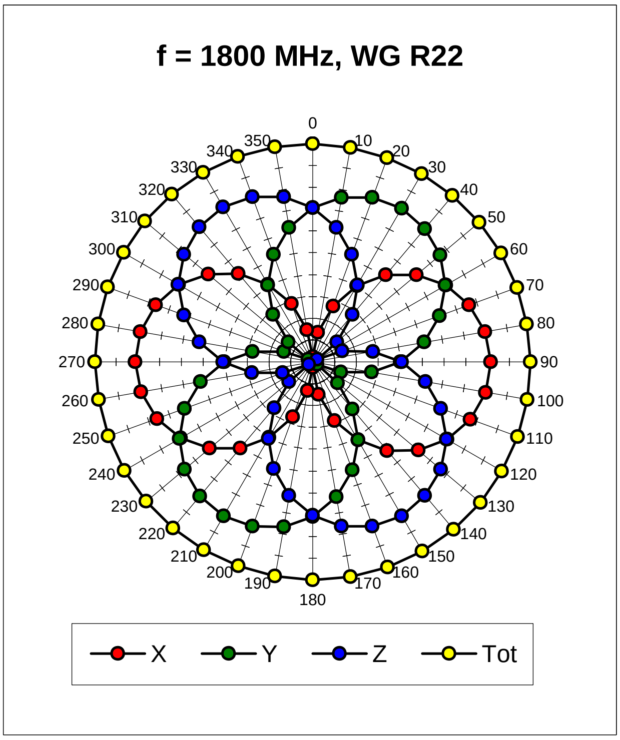


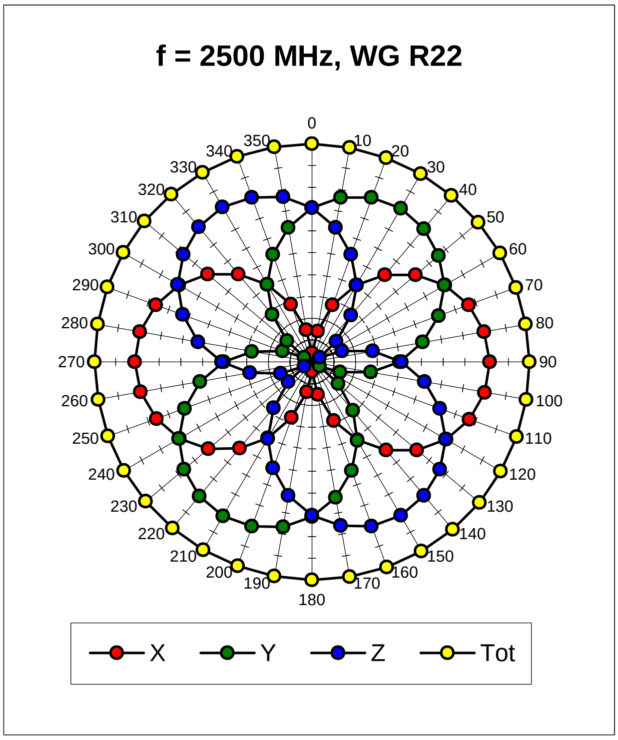
f = 300 MHz, TEM cell ifi110



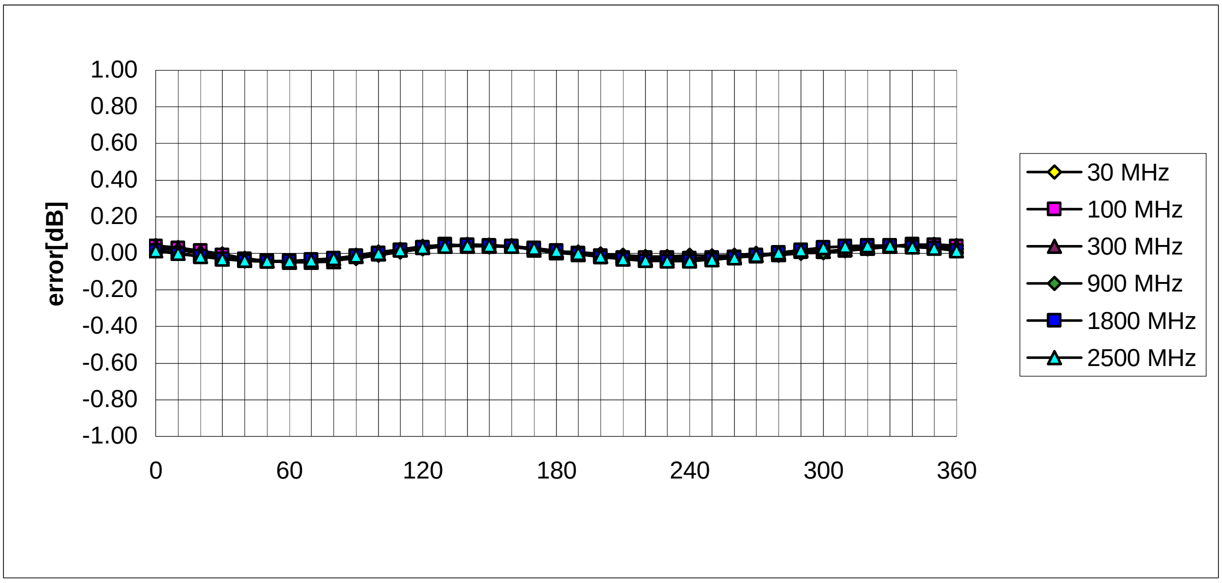
f = 900 MHz, TEM cell ifi110





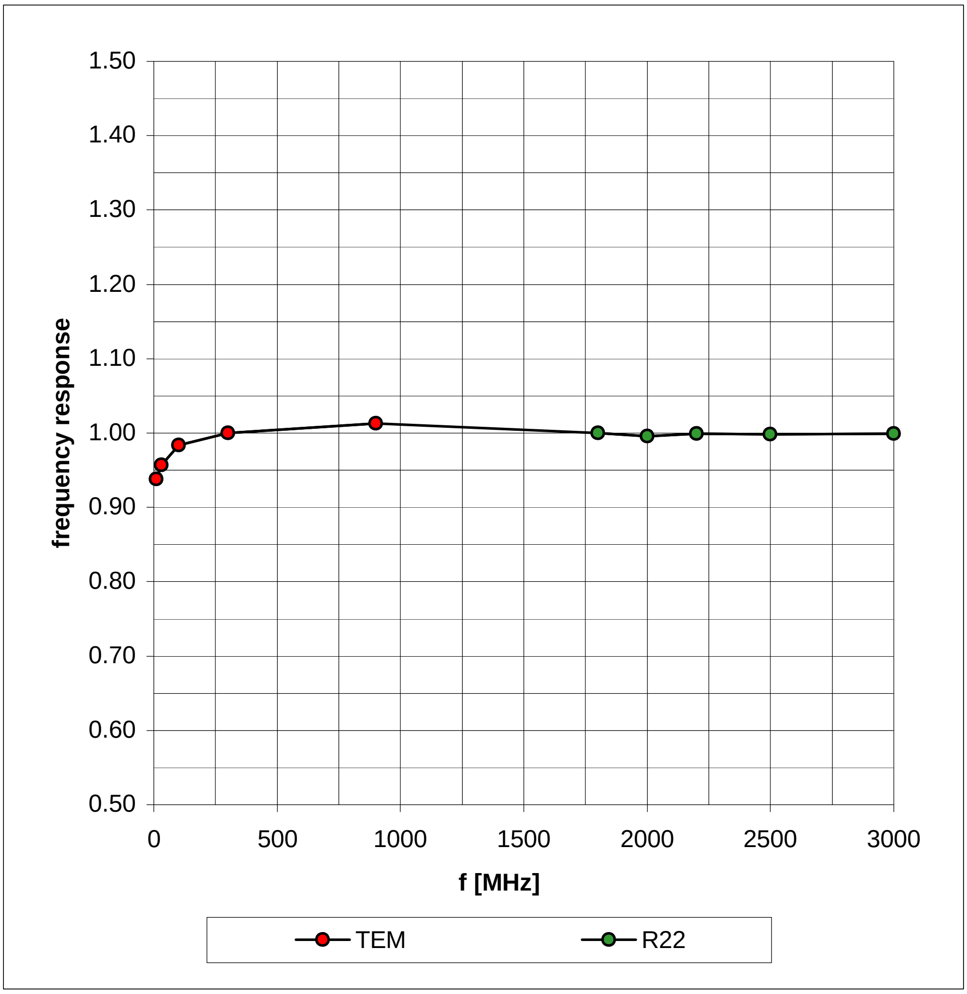


Isotropy Error (f), q = 0°



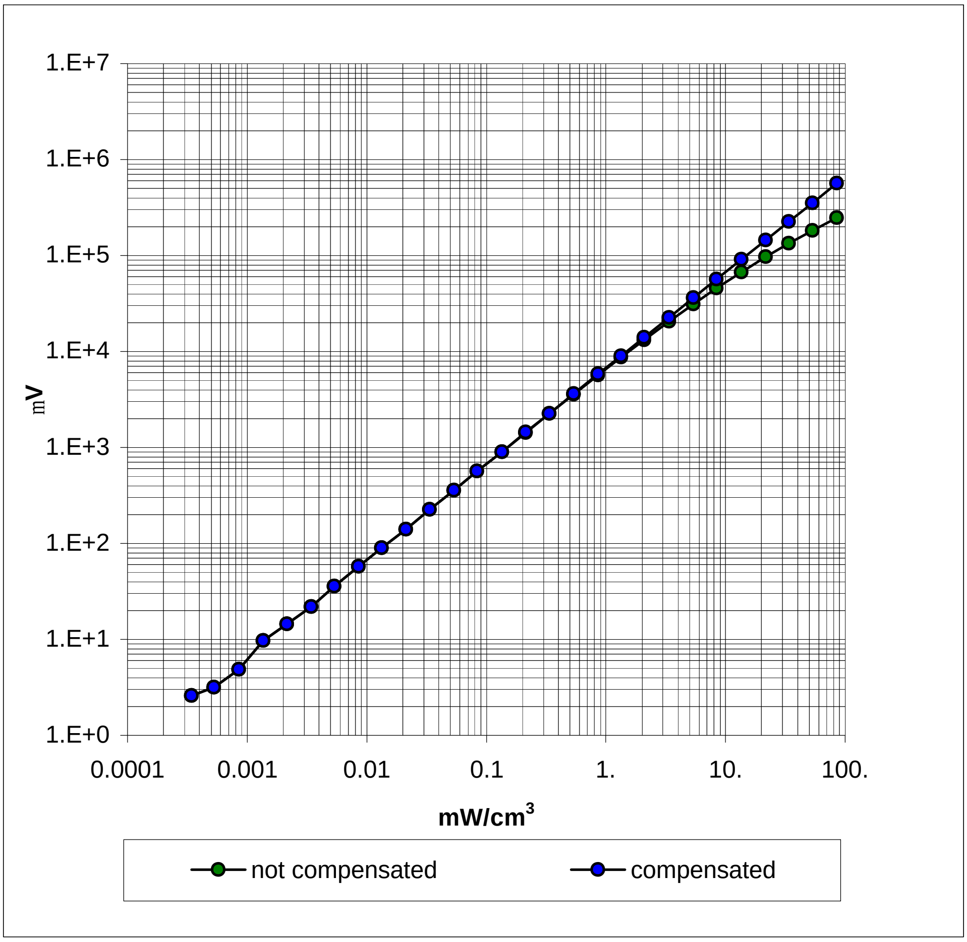
Frequency Response of E-Field

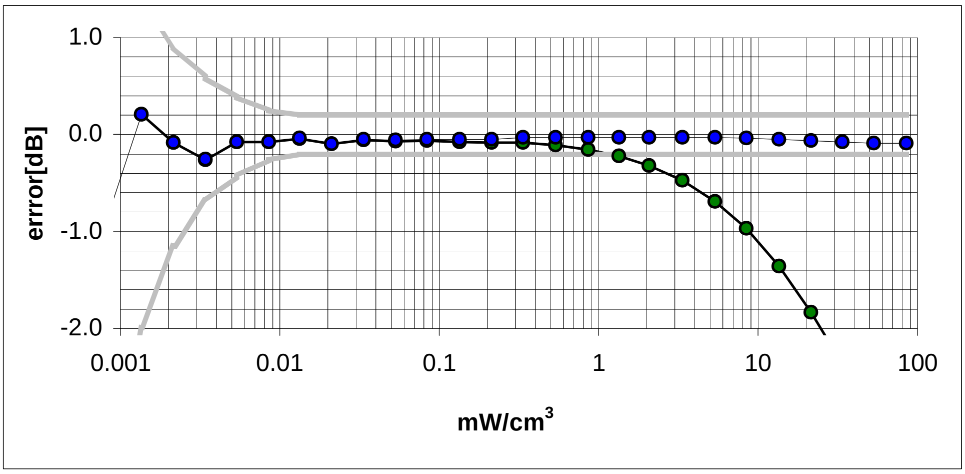
(TEM-Cell:ifi110, Waveguide R22)



Dynamic Range f(SAR_{brain})

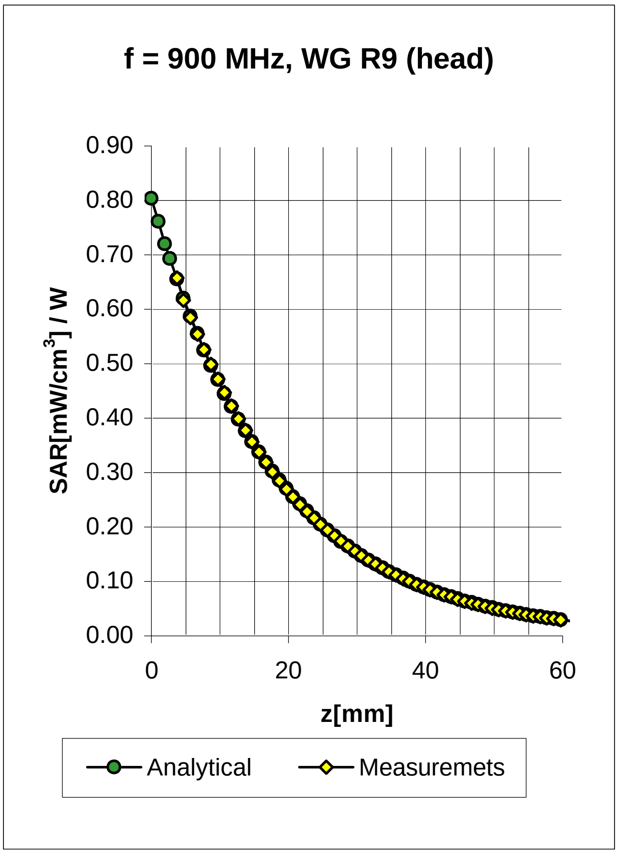
(Waveguide R22)

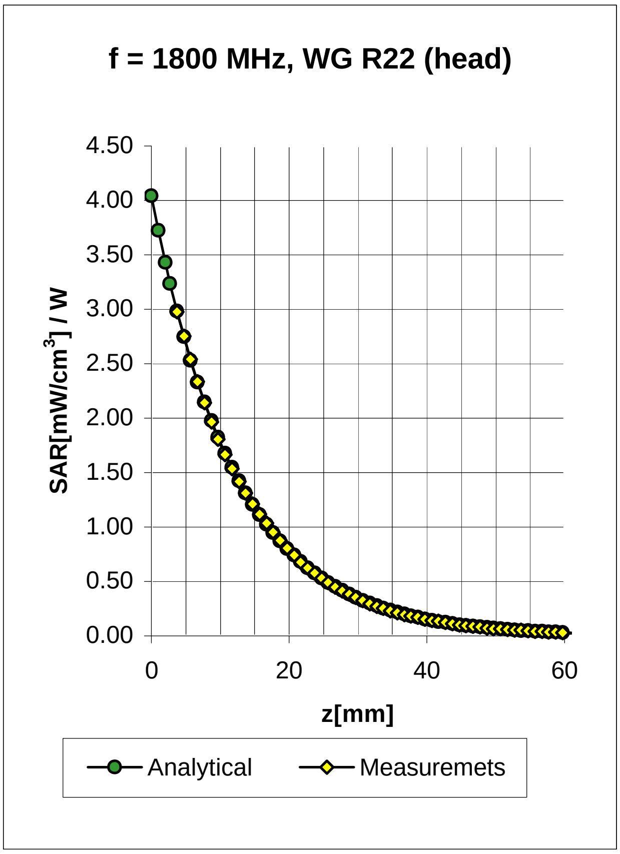




ET3DV6 SN:1379 February 22, 2002

Conversion Factor Assessment

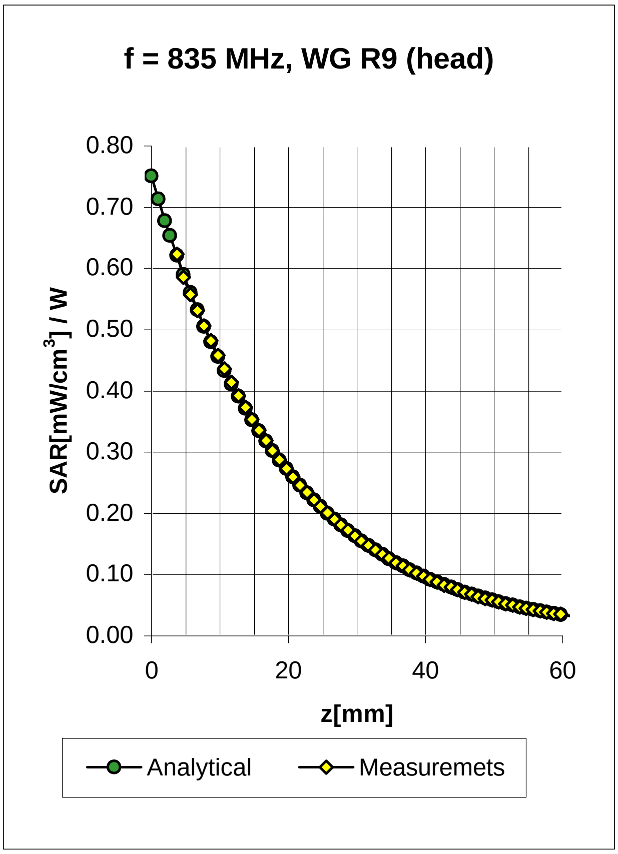


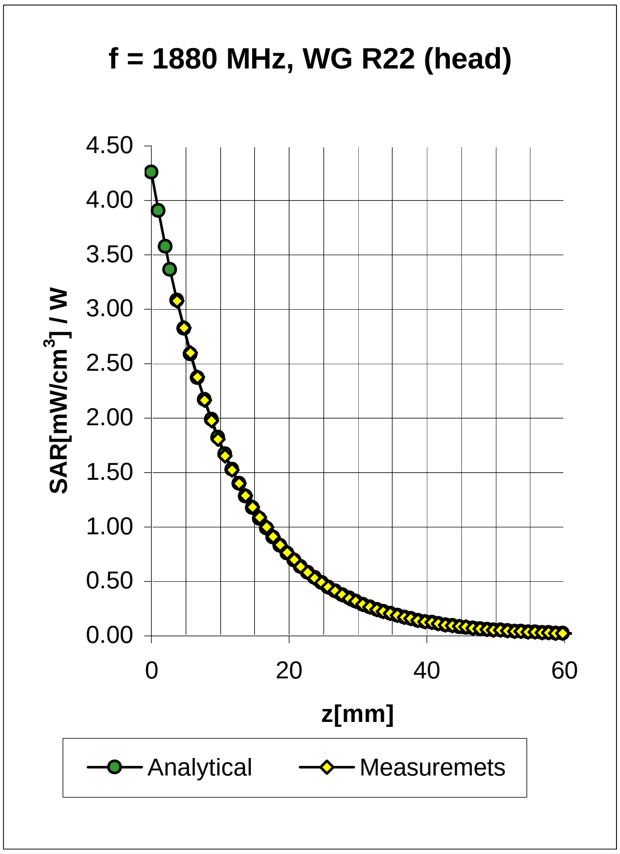


Head	**900 MHz**	e_r **= 41.5 ± 5%**	s **= 0.97 ± 5% mho/m**	
	ConvF X	**6.5** ± 8.9% (k=2)	Boundary effect:	
	ConvF Y	**6.5** ± 8.9% (k=2)	Alpha	**0.45**
	ConvF Z	**6.5** ± 8.9% (k=2)	Depth	**2.34**

Head	**1800 MHz**	e_r **= 40.0 ± 5%**	s **= 1.40 ± 5% mho/m**	
	ConvF X	**5.4** ± 8.9% (k=2)	Boundary effect:	
	ConvF Y	**5.4** ± 8.9% (k=2)	Alpha	**0.62**
	ConvF Z	**5.4** ± 8.9% (k=2)	Depth	**2.15**

Conversion Factor Assessment





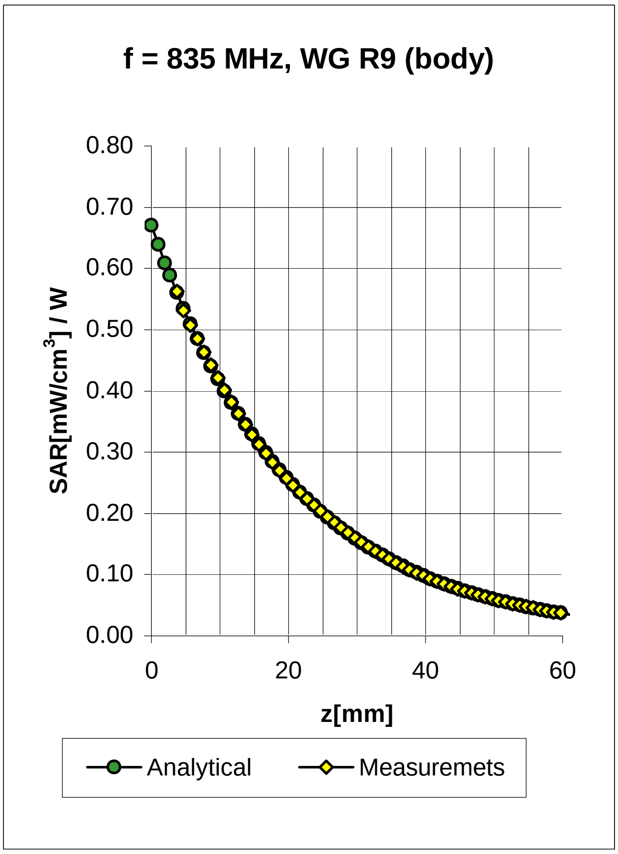
Head **835 MHz** e_r **= 41.5 ± 5%** s **= 0.90 ± 5% mho/m**

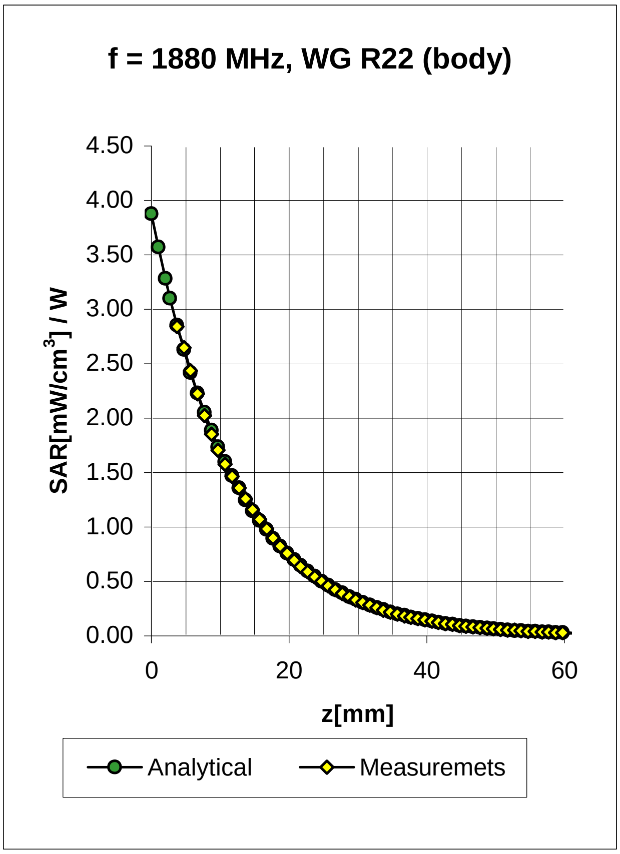
ConvF X	**6.6**	± 8.9% (k=2)	Boundary effect:	
ConvF Y	**6.6**	± 8.9% (k=2)	Alpha	**0.42**
ConvF Z	**6.6**	± 8.9% (k=2)	Depth	**2.44**

Head **1880 MHz** e_r **= 40.0 ± 5%** s **= 1.40 ± 5% mho/m**

ConvF X	**5.3**	± 8.9% (k=2)	Boundary effect:	
ConvF Y	**5.3**	± 8.9% (k=2)	Alpha	**0.64**
ConvF Z	**5.3**	± 8.9% (k=2)	Depth	**2.15**

Conversion Factor Assessment





Body	**835 MHz**	e_r **= 55.2 ± 5%**	s **= 0.97 ± 5% mho/m**

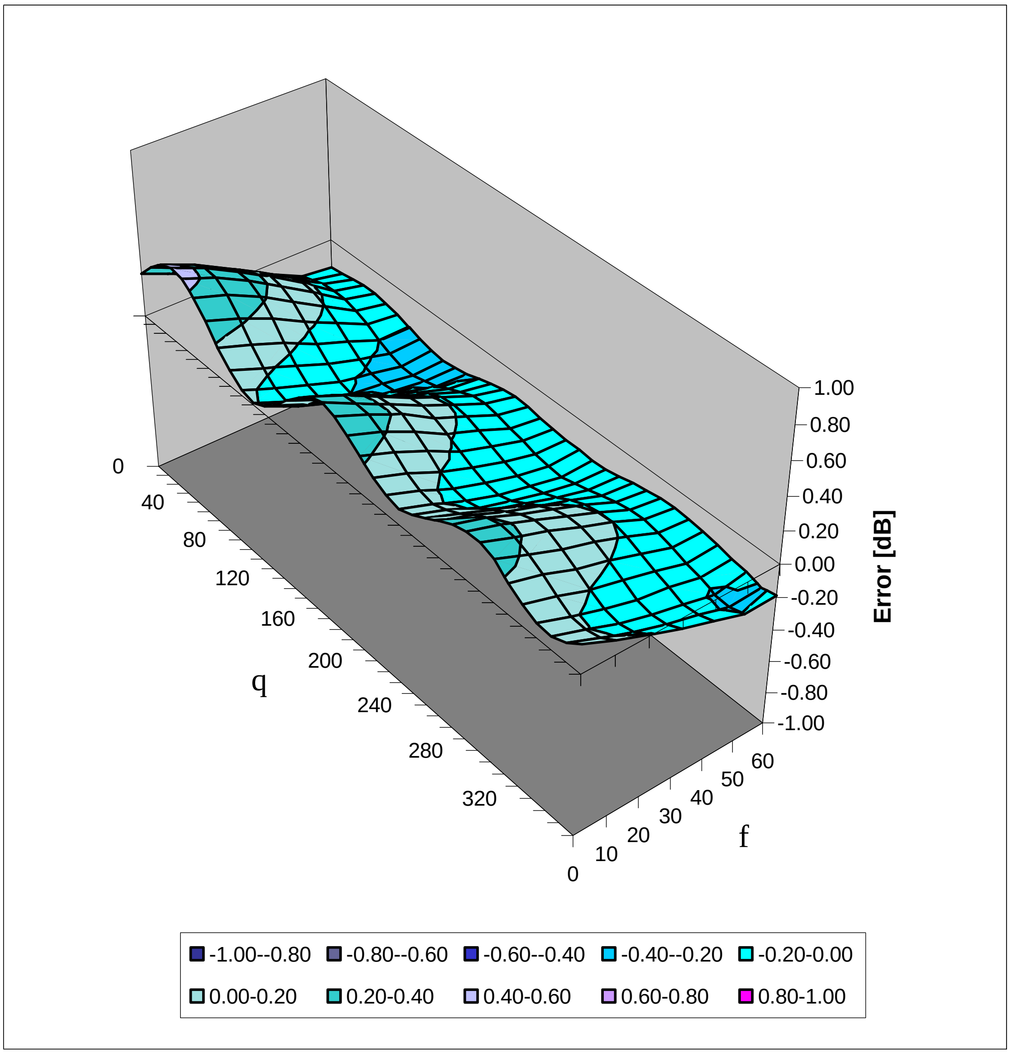
ConvF X	**6.2** ± 8.9% (k=2)	Boundary effect:	
ConvF Y	**6.2** ± 8.9% (k=2)	Alpha	**0.42**
ConvF Z	**6.2** ± 8.9% (k=2)	Depth	**2.56**

Body	**1880 MHz**	e_r **= 53.3 ± 5%**	s **= 1.52 ± 5% mho/m**

ConvF X	**4.8** ± 8.9% (k=2)	Boundary effect:	
ConvF Y	**4.8** ± 8.9% (k=2)	Alpha	**0.92**
ConvF Z	**4.8** ± 8.9% (k=2)	Depth	**1.86**

Deviation from Isotropy in HSL

Error (q , f), f = 900 MHz



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DASY

Dipole Validation Kit

Type: D835V2

Serial: 448

Manufactured: October 24, 2001
Calibrated: November 30, 2001

1. Measurement Conditions

The measurements were performed in the flat section of the new generic twin phantom filled with head simulating solution of the following electrical parameters at 835 MHz:

Relative Dielectricity	**42.3**	± 5%
Conductivity	**0.91 mho/m**	± 5%

The DASY3 System (Software version 3.1c) with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.48 at 900 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 20mm was aligned with the dipole. The 5x5x7 fine cube was chosen for cube integration. Probe isotropy errors were cancelled by measuring the SAR with normal and 90° turned probe orientations and averaging.
The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

2. SAR Measurement

Standard SAR-measurements were performed with the phantom according to the measurement conditions described in section 1. The results have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values are:

averaged over 1 cm^3 (1 g) of tissue:	**10.36 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**6.64 mW/g**

Note: If the liquid parameters for validation are slightly different from the ones used for initial calibration, the SAR-values will be different as well.

3. Dipole Impedance and Return Loss

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.404 ns**	(one direction)
Transmission factor:	**0.995**	(voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 835 MHz:	Re{Z} = **49.1 Ω**
	Im {Z} = **-5.3 Ω**
Return Loss at 835 MHz	**-25.3 dB**

4. Measurement Conditions

The measurements were performed in the flat section of the new generic twin phantom filled with muscle simulating solution of the following electrical parameters at 835 MHz:

Relative Dielectricity	**56.0**	± 5%
Conductivity	**0.98 mho/m**	± 5%

The DASY3 System (Software version 3.1c) with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.10 at 900 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 20mm was aligned with the dipole. The 5x5x7 fine cube was chosen for cube integration. Probe isotropy errors were cancelled by measuring the SAR with normal and 90° turned probe orientations and averaging.
The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

5. SAR Measurement

Standard SAR-measurements were performed with the phantom according to the measurement conditions described in section 4. The results have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values are:

averaged over 1 cm^3 (1 g) of tissue:	**10.92 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**7.04 mW/g**

6. Dipole Impedance and Return Loss

The dipole was positioned at the flat phantom sections according to section 4 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 835 MHz:	Re{Z} = **45.6 Ω**
	Im {Z} = **-6.5 Ω**
Return Loss at 835 MHz	**-21.8 dB**

7. Handling

Do not apply excessive force to the dipole arms, because they might bend. Bending of the dipole arms stresses the soldered connections near the feedpoint leading to a damage of the dipole.

8. Design

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.

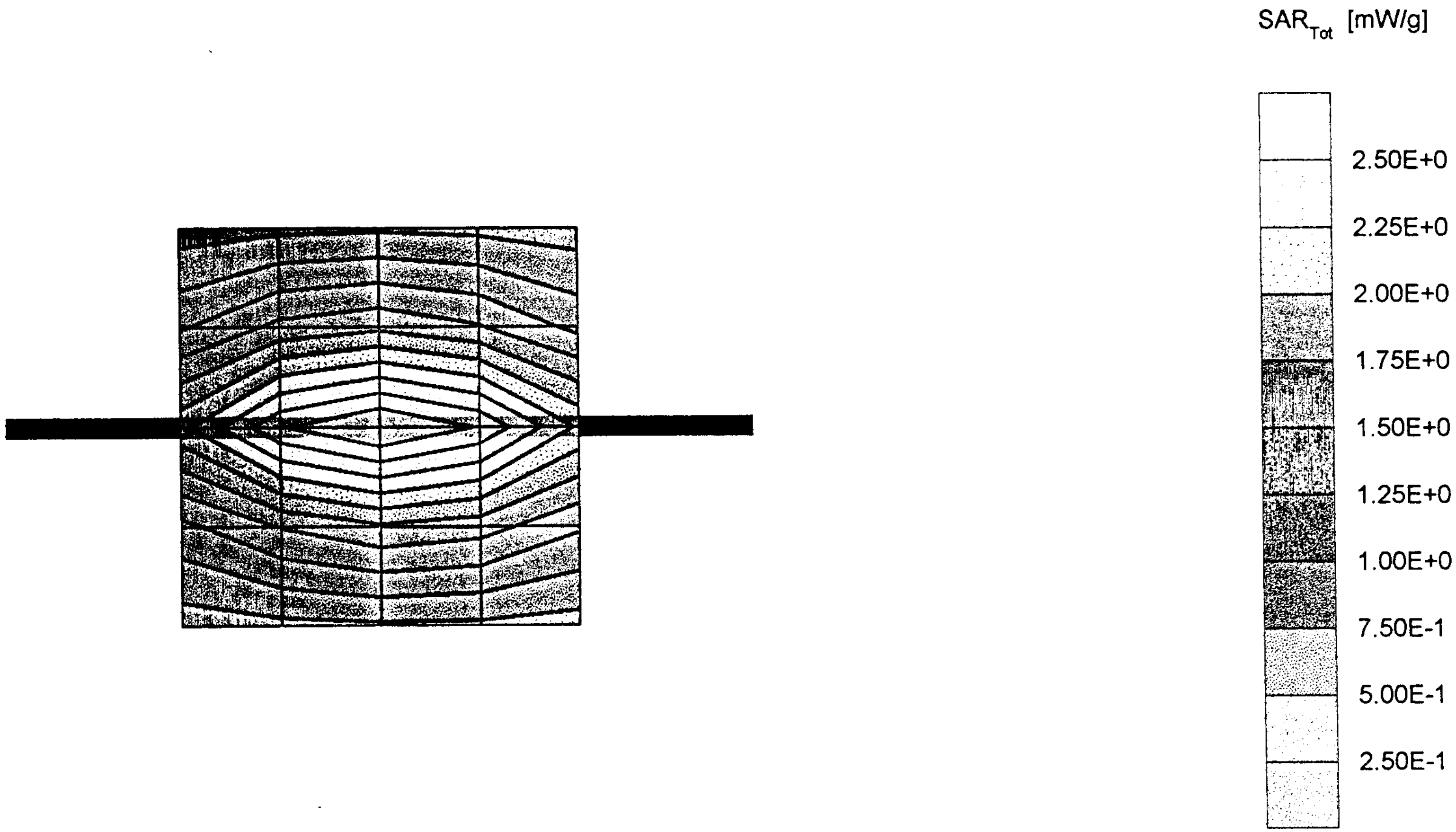
9. Power Test

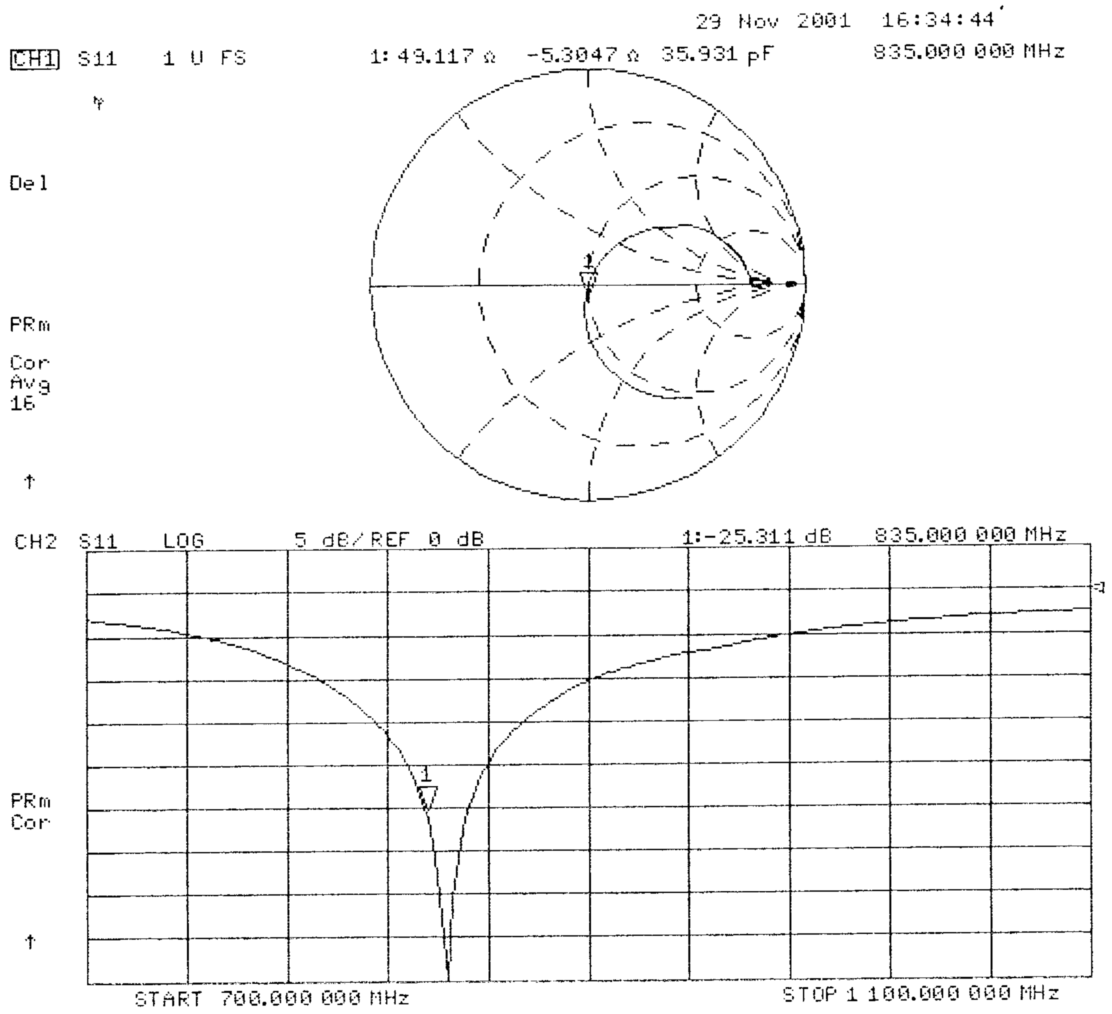
After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

11/29/01

Validation Dipole D835V2 SN:448, d = 15 mm

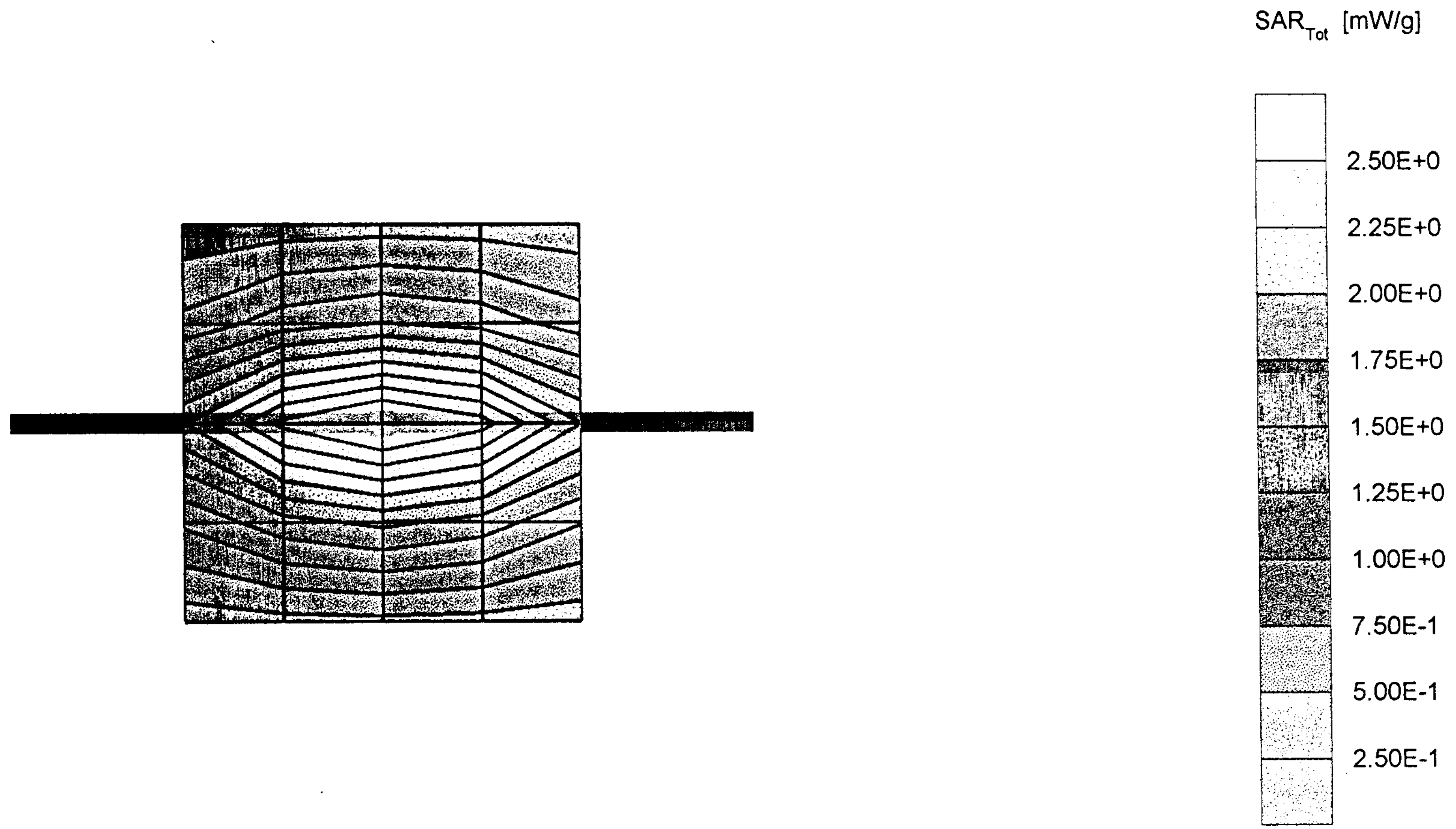
Frequency: 835 MHz; Antenna Input Power: 250 [mW]
SAM Phantom; Flat Section; Grid Spacing: Dx = 20.0, Dy = 20.0, Dz = 10.0
Probe: ET3DV6 - SN1507; ConvF(6.48,6.48,6.48) at 900 MHz; IEEE1528 835 MHz; σ = 0.91 mho/m ε_r = 42.3 ρ = 1.00 g/cm^3
Cubes (2): Peak: 4.15 mW/g ± 0.02 dB, SAR (1g): 2.59 mW/g ± 0.00 dB, SAR (10g): 1.66 mW/g ± 0.01 dB, (Worst-case extrapolation)
Penetration depth: 12.0 (10.6, 13.7) [mm]
Powerdrift: -0.01 dB

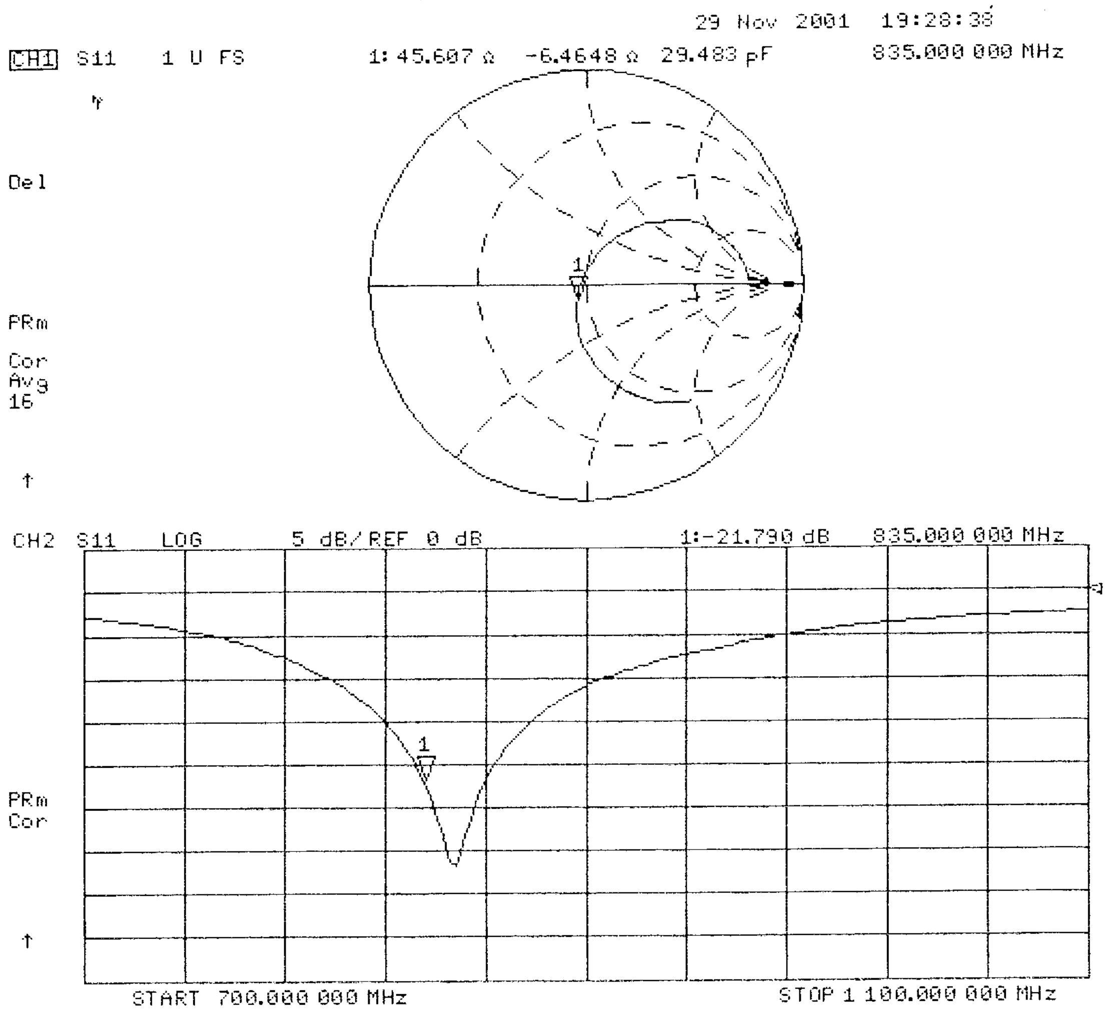



29 Nov 2001 16:34:44
CH1 S11 1 U FS
1: 49.117 Ω -5.3047 Ω 35.931 pF
835.000 000 MHz
Del
PRm
Cor
Avg
16
CH2 S11 LOG 5 dB/ REF 0 dB
1:-25.311 dB 835.000 000 MHz
PRm
Cor
START 700.000 000 MHz
STOP 1 100.000 000 MHz

Validation Dipole D835V2 SN:448, d = 15 mm

Frequency: 835 MHz; Antenna Input Power: 250 [mW]
SAM Phantom; Flat Section; Grid Spacing: Dx = 20.0, Dy = 20.0, Dz = 10.0
Probe: ET3DV6 - SN1507; ConvF(6.10,6.10,6.10) at 900 MHz; Muscle 835 MHz; σ = 0.98 mho/m ε_r = 56.0 ρ = 1.00 g/cm^3
Cubes (2): Peak: 4.32 mW/g ± 0.00 dB, SAR (1g): 2.73 mW/g ± 0.01 dB, SAR (10g): 1.76 mW/g ± 0.02 dB, (Worst-case extrapolation)
Penetration depth: 12.4 (11.0, 14.3) [mm]
Powerdrift: 0.02 dB




29 Nov 2001 19:28:38
CH1 S11 1 U FS
1: 45.607 Ω -6.4648 Ω 29.483 pF
835.000 000 MHz
Del
PRm
Cor
Avg
16
1
CH2 S11 LOG 5 dB/ REF 0 dB
1:-21.790 dB 835.000 000 MHz
PRm
Cor
START 700.000 000 MHz
STOP 1 100.000 000 MHz

Schmid & Partner
Engineering AG

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DASY3

Dipole Validation Kit

Type: D1900V2

Serial: 511

Manufactured: October 20, 1999
Calibrated: February 13, 2001

1. Measurement Conditions

The measurements were performed in the flat section of the new generic twin phantom filled with head simulating solution of the following electrical parameters at 1900 MHz:

Relative permitivity	**39.2**	± 5%
Conductivity	**1.47 mho/m**	± 10%

The DASY3 System (Software version 3.1c) with a dosimetric E-field probe ET3DV6 (SN:1507, conversion factor 5.57 at 1800 MHz) was used for the measurements.

The dipole feedpoint was positioned below the center marking and oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 5x5x7 fine cube was chosen for cube integration. Probe isotropy errors were cancelled by measuring the SAR with normal and 90° turned probe orientations and averaging.
The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

2. SAR Measurement

Standard SAR-measurements were performed with the head phantom according to the measurement conditions described in section 1. The results (see figure) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values are:

averaged over 1 cm^3 (1 g) of tissue:	**42.8 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**21.9 mW/g**

Note: If the liquid parameters for validation are slightly different from the ones used for initial calibration, the SAR-values will be different as well. The estimated sensitivities of SAR-values and penetration depths to the liquid parameters are listed in the DASY Application Note 4: 'SAR Sensitivities'.

3. Dipole impedance and return loss

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.205 ns**	(one direction)
Transmission factor:	**0.983**	(voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 1900 MHz:	Re{Z} = **50.1 Ω**
	Im {Z} = **-1.5 Ω**
Return Loss at 1900 MHz	**- 34.9 dB**

4. Measurement Conditions

The measurements were performed in the flat section of the new generic twin phantom filled with muscle simulating solution of the following electrical parameters at 1900 MHz:

Relative permitivity	**53.5**	± 5%
Conductivity	**1.46 mho/m**	± 10%

The DASY3 System (Software version 3.1c) with a dosimetric E-field probe ET3DV6 (SN:1507, conversion factor 4.85 at 1800 MHz) was used for the measurements.

The dipole feedpoint was positioned below the center marking and oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 5x5x7 fine cube was chosen for cube integration. Probe isotropy errors were cancelled by measuring the SAR with normal and 90° turned probe orientations and averaging.
The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

6. SAR Measurement

Standard SAR-measurements were performed with the head phantom according to the measurement conditions described in section 1. The results (see figure) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values are:

averaged over 1 cm^3 (1 g) of tissue:	**42.4 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**22.0 mW/g**

Note: If the liquid parameters for validation are slightly different from the ones used for initial calibration, the SAR-values will be different as well.

7. Dipole impedance and return loss

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.205 ns**	(one direction)
Transmission factor:	**0.983**	(voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 1900 MHz:	Re{Z} = **45.3 Ω**
	Im {Z} = **-1.0 Ω**
Return Loss at 1900 MHz	**- 25.6 dB**

8. Handling

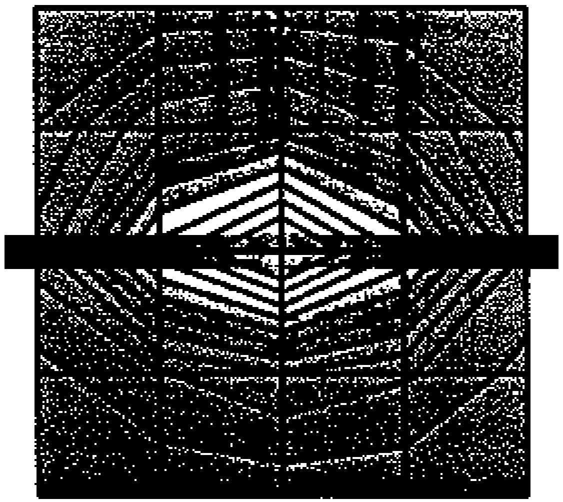
The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

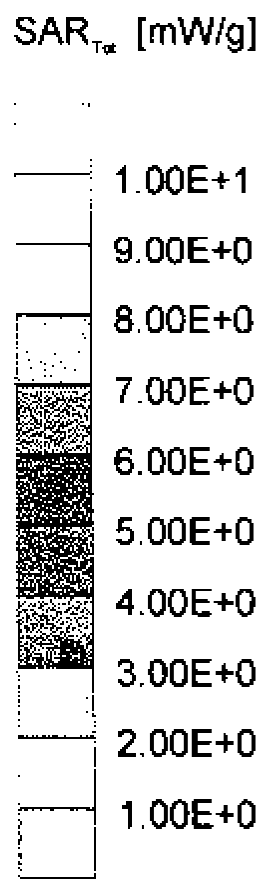
Do not apply excessive force to the dipole arms, because they might bend. If the dipole arms have to be bent back, take care to release stress to the soldered connections near the feedpoint; they might come off.

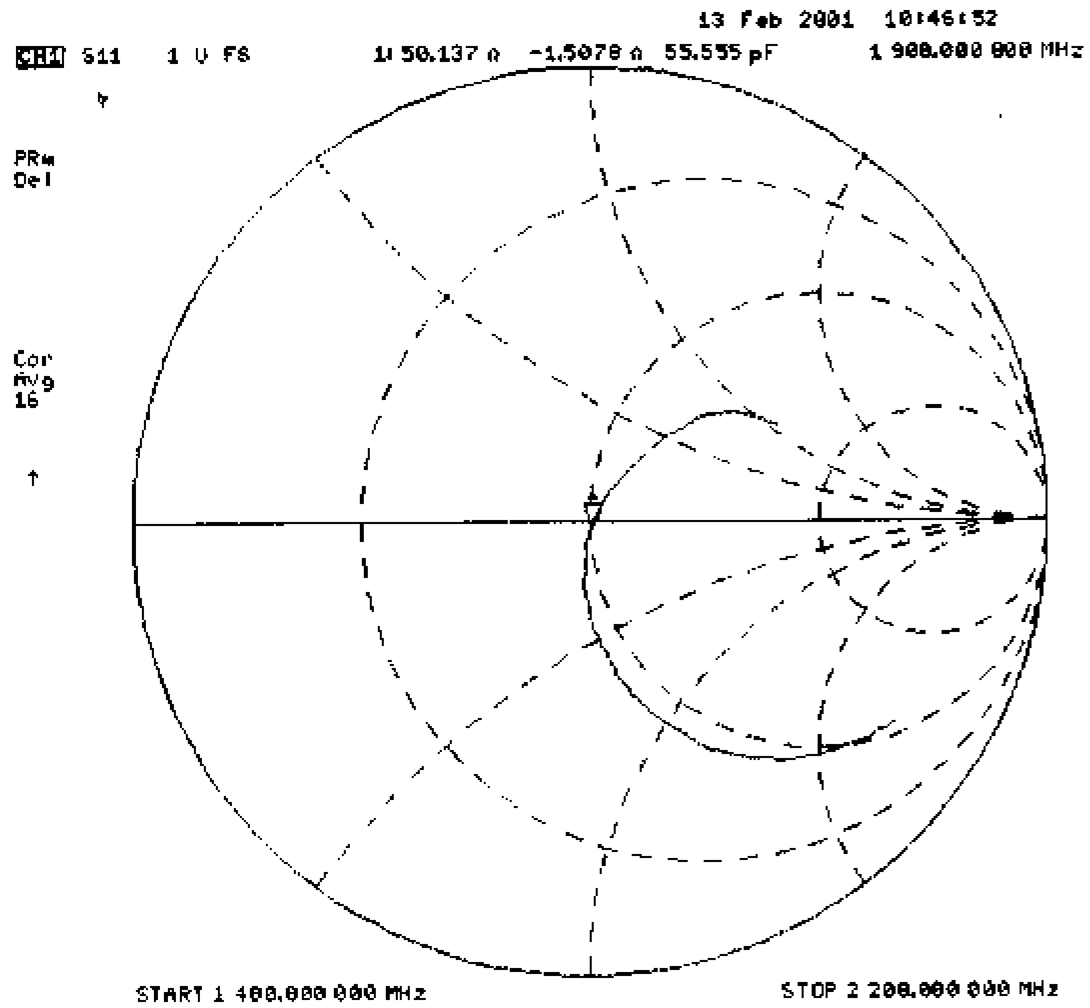
After prolonged use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

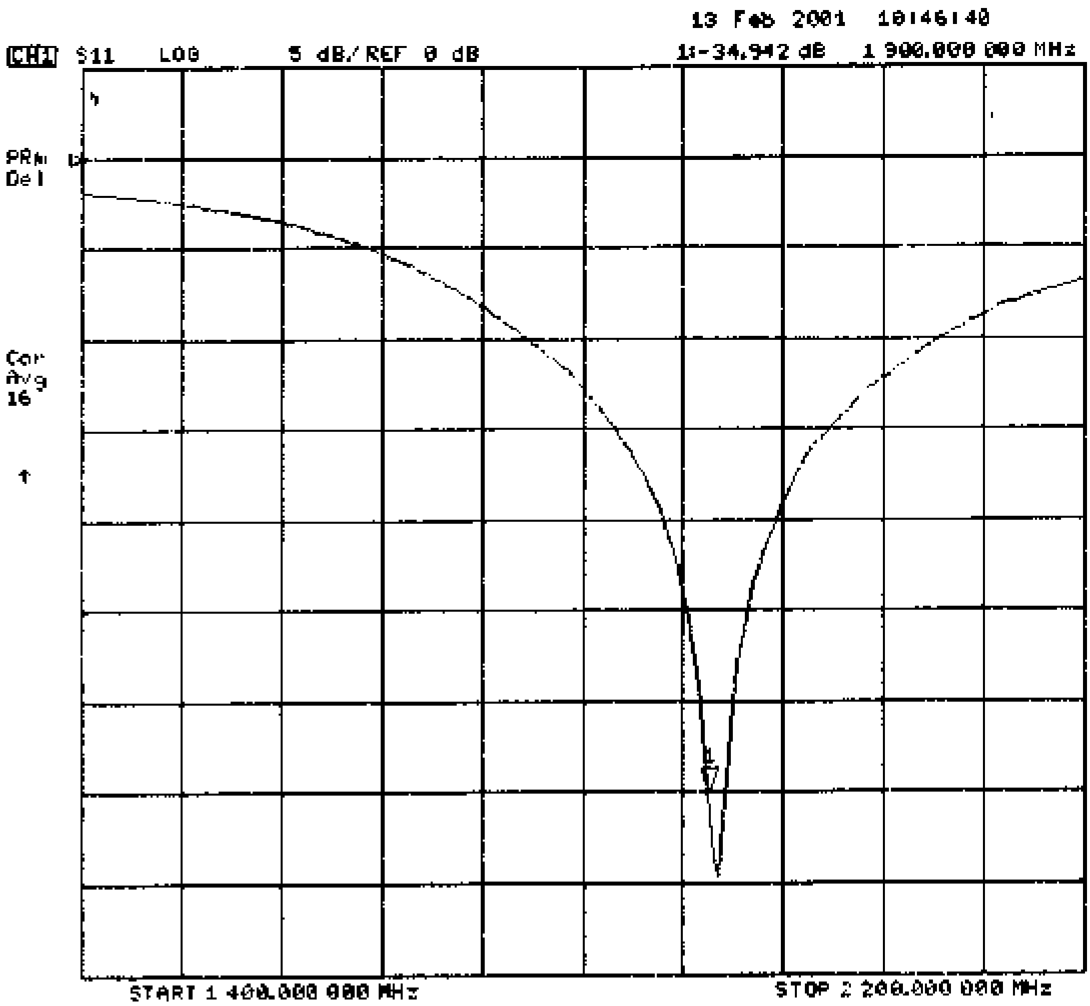
Validation Dipole D1900V2 SN:511, d = 10 mm

Frequency: 1900 MHz; Antenna Input Power: 250 [mW]
Generic Twin Phantom; Flat Section; Grid Spacing: Dx = 15.0, Dy = 15.0, Dz = 10.0
Probe: ET3DV6 - SN1507; ConvF(5.57,5.57,5.57) at 1800 MHz; IEEE1528 1900 MHz ; σ = **1.47** mho/m ϵ_r = **39.2** ρ = 1.00 g/cm³
Cubes (2): Peak: 20.6 mW/g ± 0.02 dB, SAR (1g): **10.7** mW/g ± 0.03 dB, SAR (10g): 5.47 mW/g ± 0.03 dB, (Worst-case extrapolation)
Penetration depth: 7.9 (7.4, 9.1) [mm]
Powerdrift: 0.00 dB



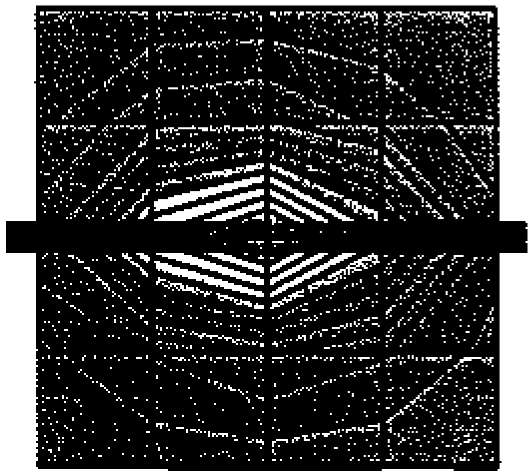


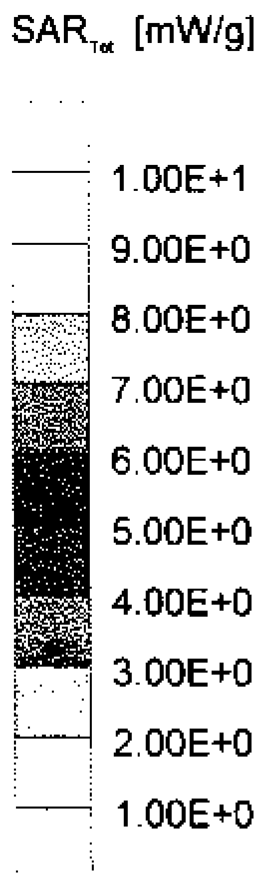

13 Feb 2001 10:46:52
CH1 S11 1 U FS 1: 50.137 Ω -1.5078 Ω 55.555 pF 1 900.000 000 MHz
PRm
Del
Cor
Avg
16
START 1 400.000 000 MHz
STOP 2 200.000 000 MHz


13 Feb 2001 10:46:40
CH1 S11 LOG 5 dB/ REF 0 dB
1:-34.942 dB 1 900.000 000 MHz
PRm
Del
Cor
Avg
16
START 1 400.000 000 MHz
STOP 2 200.000 000 MHz

Validation Dipole D1900V2 SN:511, d = 10 mm

Frequency: 1900 MHz; Antenna Input Power: 250 [mW]
Generic Twin Phantom; Flat Section; Grid Spacing: Dx = 15.0, Dy = 15.0, Dz = 10.0
Probe: ET3DV6 - SN1507; ConvF(4.85,4.85,4.85) at 1800 MHz; **Muscle 1900 MHz**: σ = **1.46 mho/m** ε_r = **53.5** ρ = **1.00 g/cm³**
Cubes (2): Peak: 20.0 mW/g ± 0.06 dB, SAR (1g): 10.6 mW/g ± 0.05 dB, SAR (10g): 5.49 mW/g ± 0.04 dB, (Worst-case extrapolation)
Penetration depth: 8.7 (7.9, 10.3) [mm]
Powerdrift: 0.01 dB



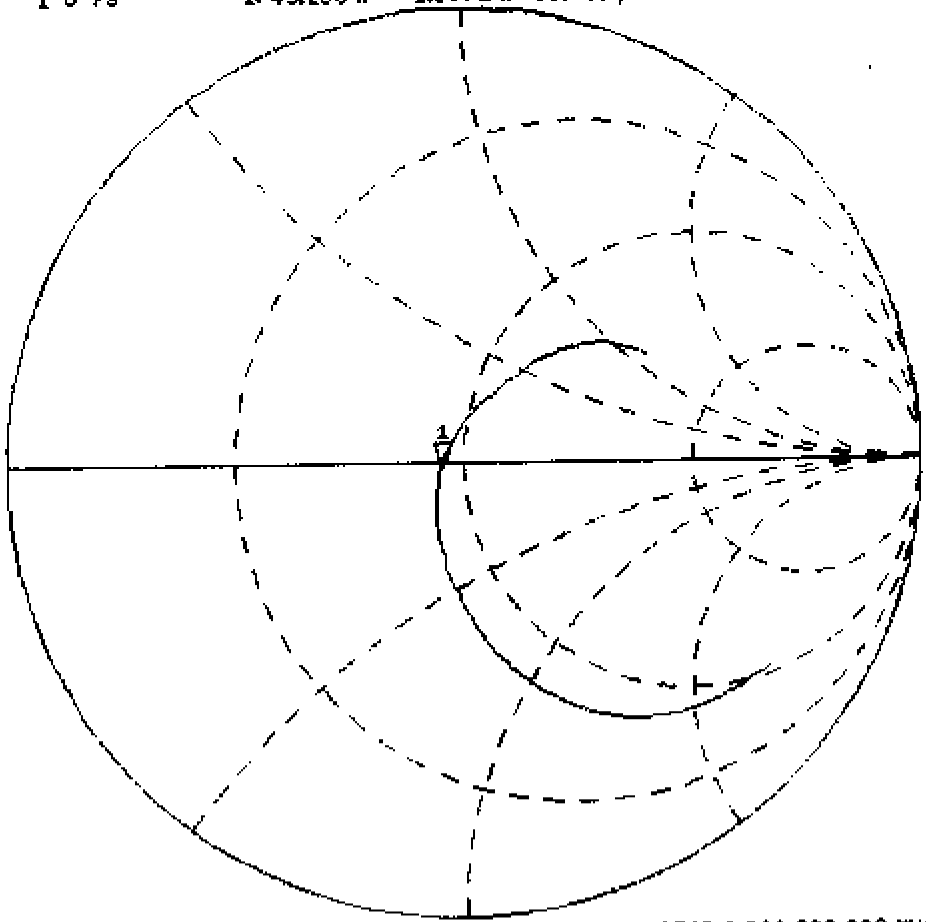


13 feb 2001 18:09:51

CH1 S11 1 U FS 1: 45.260 Ω -1.0371 Ω 80.769 pF 1 900.000 000 MHz

PRm
Del

Cor
Avg
16



START 1 400.000 000 MHz STOP 2 200.000 000 MHz