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Jan 15, 2003

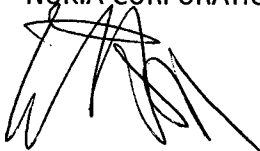
Federal Communications Commission,  
Authorization & Evaluation Division,  
7435 Oakland Mills Road  
Columbia, MD. 21046

Attention: Equipment Authorization Branch

We hereby certify that the transceiver FCC ID: P4JDTE-3 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

A handwritten signature in black ink, appearing to be 'P. Holma', written over the Nokia Corporation name.

Petteri Holma  
Product Program Manager, Nokia Corporation Oulu

## SAR Compliance Test Report

|                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                            |                                                                                                                                     |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Test report no.:                                 | Not numbered                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Date of report:            | 2002-12-17                                                                                                                          |
| Number of pages:                                 | 92                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Contact person:            | Pentti Pärnänen                                                                                                                     |
|                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Responsible test engineer: | Pertti Mäkikyrö                                                                                                                     |
| Testing laboratory:                              | Nokia Corporation<br>Elektronikkatie 10<br>P.O. Box 50<br>FIN-90571 OULU<br>Finland<br>Tel. +358-7180-08000<br>Fax. +358-7180-47222                                                                                                                                                                                                                                                                                                                                                  | Client:                    | Nokia Corporation<br>Yrtyipellontie 10<br>P.O. Box 300<br>FIN-90230 OULU<br>Finland<br>Tel. +358-7180-08000<br>Fax. +358-7180-58300 |
| Tested devices:                                  | P4JDTE-3                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                            |                                                                                                                                     |
| Supplement reports:                              | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                            |                                                                                                                                     |
| Testing has been carried out in accordance with: | 47CFR §2.1093<br>Radiofrequency Radiation Exposure Evaluation: Portable Devices<br><br>IEEE P1528-200X Draft 6.4<br>Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques<br><br>FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01)<br>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.<br><br>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.                                                                                                                                                                                                       |                            |                                                                                                                                     |

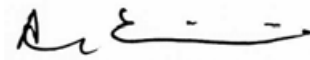
Date and signatures:

2002-12-17

For the contents:



Pertti Mäkikyrö  
Engineering Manager, EMC



Anne Kiviniemi  
Test Engineer

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# 1. SUMMARY FOR SAR TEST REPORT

|                                     |                                                                                                     |
|-------------------------------------|-----------------------------------------------------------------------------------------------------|
| Date of test                        | 2002-11-13 – 2002-11-15, 2002-11-17 – 2002-11-18<br>2002-11-23 – 2002-11-24, 2002-11-26, 2002-11-29 |
| Contact person                      | Pentti Pärnänen                                                                                     |
| Test plan referred to               | -                                                                                                   |
| FCC ID                              | P4JDTE-3                                                                                            |
| SN, HW and numbers of tested device | SN: 001004/10/07/5800/3, HW: 0701, SW: v02.30                                                       |
| Accessories used in testing         | Snap-on spacer                                                                                      |
| Notes                               | -                                                                                                   |
| Document code                       | DTX 05855-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 Body Worn Configuration

| Mode      | Ch / f (MHz) | Power    | Separation Distance | Limit    | Measured  | Result |
|-----------|--------------|----------|---------------------|----------|-----------|--------|
| GPRS 850  | 128/824.20   | 29.2 dBm | 18.9 mm             | 1.6 mW/g | 0.59 mW/g | PASSED |
| GPRS 1900 | 512/1850.20  | 29.9 dBm | 18.9 mm             | 1.6 mW/g | 0.90 mW/g | PASSED |
| WLAN      | 6/2437       | 17.1 dBm | 18.8 mm             | 1.6 mW/g | 0.15 mW/g | PASSED |

### 1.1.2 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                  |                                 |                                            |
| Modes of Operation                | GSM                             | GPRS                            | WLAN                                       |
| Modulation Mode                   | Gaussian Minimum Shift Keying   | Gaussian Minimum Shift Keying   | Differential Quadrature Phase Shift Keying |
| Duty Cycle                        | 1/8                             | 2/8                             | 4/5                                        |
| Transmitter Frequency Range (MHz) | 824.2 – 848.8<br>1850.2 -1909.8 | 824.2 - 848.8<br>1850.2 -1909.8 | 2412-2462                                  |

### 2.1 Picture of Tested Device



### 2.2 Description of the Antenna

|          |                             |
|----------|-----------------------------|
| Type     | Internal integrated antenna |
| Location | Tip of the device           |

### 2.3 Snap-on spacer

Snap-on spacer was attached to P4JDTE-3 during body worn measurements.



### 3. TEST CONDITIONS

#### 3.1 Ambient Conditions

|                                           |      |
|-------------------------------------------|------|
| Ambient temperature (°C)                  | 22±2 |
| Tissue simulating liquid temperature (°C) | 22±2 |
| Humidity                                  | 42   |

#### 3.2 RF characteristics of the test site

Tests were performed in a enclosed RF shielded environment.

#### 3.3 Test Signal, Frequencies, and Output Power

The device was controlled by using a test mode software and by using a radio tester. GSM mode was not tested since P4JDTE-3 is able to use two time slots for transmitting data in GPRS mode whereas GSM mode uses only one time slot.

P4JDTE-3 is capable of operating in several host products. Typical laptops IBM ThinkPad T23, IBM ThinkPad 560x, IBM ThinkPad 600x and pocket PCs: Casio Cassiopeia, Compaq iPAQ and Hewlett Packard Jornada were chosen for testing.

In 850 and 1900 MHz operating bands the measurements were performed on lowest, middle and highest channels and in 2450 MHz band measurements were performed at the middle channel only, because each test configuration in that channel was more than 3.0dB lower than the SAR limit. Maximum power level was used during the all tests.

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           | 11/03    |
| 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.

Due to lack of dipole and verification data for 2450 MHz, system verification for WLAN measurements were done with dipole for 1900MHz .

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 | $f$<br>(MHz) | Description         | SAR<br>(W/kg), 1g | Dielectric Parameters |                | Temp<br>(°C) |
|--------|--------------|---------------------|-------------------|-----------------------|----------------|--------------|
|        |              |                     |                   | $\epsilon_r$          | $\sigma$ (S/m) |              |
| Muscle | 835          | Measured 11/15/2002 | 2.75              | 57.9                  | 0.95           | 22           |
|        |              | Reference Result    | 2.73              | 56.0                  | 0.98           | N/A          |
| Muscle | 835          | Measured 11/17/2002 | 2.66              | 56.8                  | 0.95           | 22           |
|        |              | Reference Result    | 2.73              | 56.0                  | 0.98           | N/A          |
| Muscle | 835          | Measured 11/18/2002 | 2.66              | 56.7                  | 0.96           | 22           |
|        |              | Reference Result    | 2.73              | 56.0                  | 0.98           | N/A          |
| Muscle | 835          | Measured 11/24/2002 | 2.70              | 56.8                  | 0.94           | 22           |
|        |              | Reference Result    | 2.73              | 56.0                  | 0.98           | N/A          |

|        |      |                     |      |      |      |     |
|--------|------|---------------------|------|------|------|-----|
| Muscle | 835  | Measured 11/26/2002 | 2.73 | 56.8 | 0.96 | 22  |
|        |      | Reference Result    | 2.73 | 56.0 | 0.98 | N/A |
| Muscle | 1900 | Measured 11/13/2002 | 10.9 | 50.8 | 1.50 | 22  |
|        |      | Reference Result    | 10.6 | 53.5 | 1.46 | N/A |
| Muscle | 1900 | Measured 11/14/2002 | 11.0 | 51.0 | 1.52 | 22  |
|        |      | Reference Result    | 10.6 | 53.5 | 1.46 | N/A |
| Muscle | 1900 | Measured 11/15/2002 | 11.0 | 51.1 | 1.52 | 22  |
|        |      | Reference Result    | 10.6 | 53.5 | 1.46 | N/A |
| Muscle | 1900 | Measured 11/23/2002 | 11.1 | 51.0 | 1.49 | 22  |
|        |      | Reference Result    | 10.6 | 53.5 | 1.46 | N/A |
| Muscle | 1900 | Measured 11/24/2002 | 10.8 | 51.0 | 1.50 | 22  |
|        |      | Reference Result    | 10.6 | 53.5 | 1.46 | N/A |
| Muscle | 1900 | Measured 11/29/2002 | 10.6 | 51.0 | 1.50 | 22  |
|        |      | 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  $15\text{cm} \pm 5\text{mm}$  during all the tests. Volume for each tissue simulant was 26 liters.

### 4.2.1 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

and for 2450 MHz

70.0% De-Ionized Water  
 30.0% Diethylene Glycol Monobutyl Ether

| $f$<br>(MHz) | Description         | Dielectric Parameters |                | Temp<br>(°C) |
|--------------|---------------------|-----------------------|----------------|--------------|
|              |                     | $\epsilon_r$          | $\sigma$ (S/m) |              |
| 835          | Measured 11/15/2002 | 57.9                  | 0.95           | 22           |
|              | Recommended Values  | 55.2                  | 0.97           | 20-26        |
| 835          | Measured 11/17/2002 | 56.8                  | 0.95           | 22           |
|              | Recommended Values  | 55.2                  | 0.97           | 20-26        |

|      |                     |      |      |       |
|------|---------------------|------|------|-------|
| 835  | Measured 11/18/2002 | 56.7 | 0.96 | 22    |
|      | Recommended Values  | 55.2 | 0.97 | 20-26 |
| 835  | Measured 11/24/2002 | 56.8 | 0.94 | 22    |
|      | Recommended Values  | 55.2 | 0.97 | 20-26 |
| 835  | Measured 11/26/2002 | 56.8 | 0.96 | 22    |
|      | Recommended Values  | 55.2 | 0.97 | 20-26 |
| 1880 | Measured 11/13/2002 | 50.9 | 1.48 | 22    |
|      | Recommended Values  | 53.3 | 1.52 | 20-26 |
| 1880 | Measured 11/14/2002 | 51.2 | 1.51 | 22    |
|      | Recommended Values  | 53.3 | 1.52 | 20-26 |
| 1880 | Measured 11/15/2002 | 51.3 | 1.51 | 22    |
|      | Recommended Values  | 53.3 | 1.52 | 20-26 |
| 1880 | Measured 11/23/2002 | 51.0 | 1.47 | 22    |
|      | Recommended Values  | 53.3 | 1.52 | 20-26 |
| 1880 | Measured 11/24/2002 | 51.2 | 1.47 | 22    |
|      | Recommended Values  | 53.3 | 1.52 | 20-26 |
| 2450 | Measured 11/29/2002 | 53.7 | 2.05 | 22    |
|      | Recommended Values  | 52.7 | 1.95 | 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  $\pm 0.1\text{mm}$ .

#### 4.4 Isotropic E-Field Probe ET3DV6

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



### 5. DESCRIPTION OF THE TEST PROCEDURE

#### 5.1 Test Positions

P4JDTE-3 with Snap-On spacer attached was placed into laptops and pocket PCs and then below the flat section of the phantom using a device holder and expanded polystyrene (EPS).

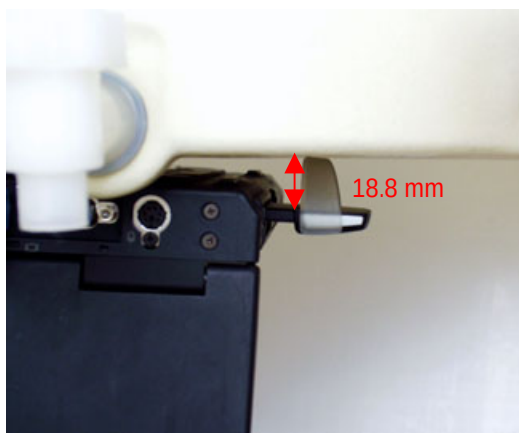
Two positions were used to test compliance. These positions correspond to applicable operating configurations.



## 5.1.1 Position for testing the lower part area of P4JDTE-3



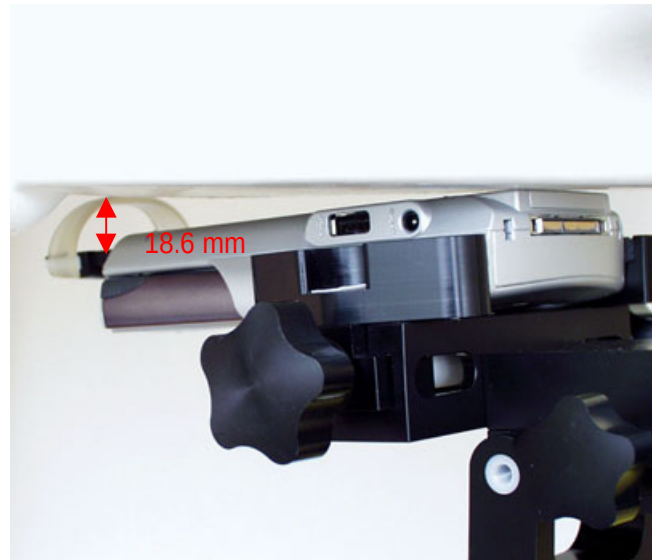
Laptop IBM 560x, all the laptops were positioned similarly for testing underneath P4JDTE-3



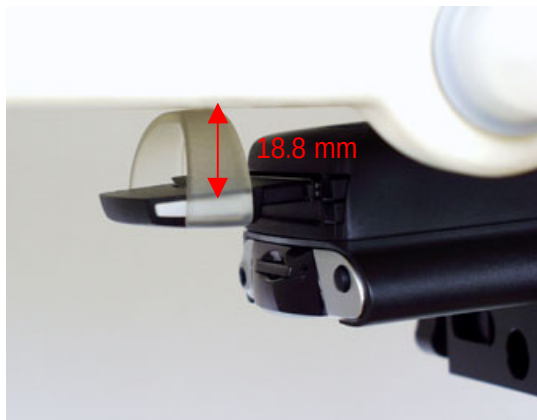
Laptop IBM 600x



Laptop IBM t23



Pocket PC Casio Cassiopeia, all the pocket PCs were positioned similarly for testing underneath P4JDTE-3

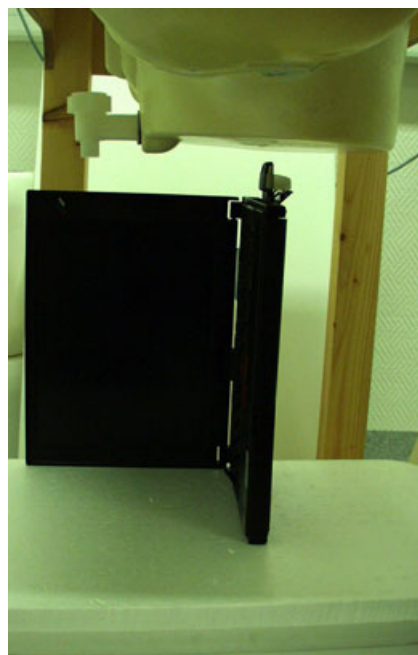
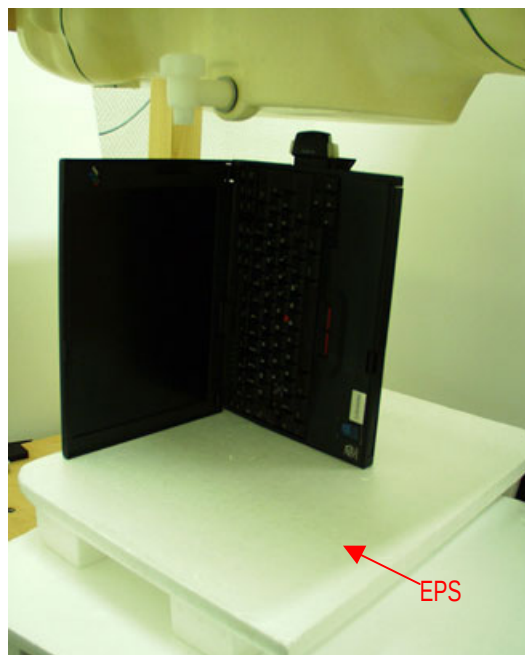


Pocket PC Compaq iPAQ



Handheld PC Hewlett Packard Jornada

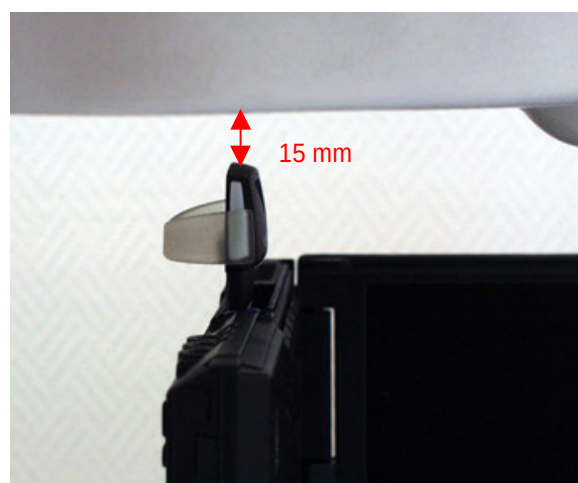
## 5.1.2 Position for testing the tip area of P4JDTE-3



Laptop IBM 560x, all the laptops were positioned similarly for testing the tip of P4JDTE-3 with separation distance 15mm.



Laptop IBM 600x



Laptop IBM T23



Pocket PC Casio Cassiopeia, all the pocket PCs were positioned similarly for testing the tip of P4JDTE-3 with separation distance 15mm.



Pocket PC Compaq iPAQ



Handheld PC Hewlett Packard Jornada

## 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 $v_{eff}$ |
|--------------------------------------------|-----------------|--------------------------|------------|-----------------|----------------------|----------------------|
| <b>Measurement System</b>                  |                 |                          |            |                 |                      |                      |
| Probe calibration                          | $\pm 4.4$       | normal                   | 1          | 1               | $\pm 4.4$            | $\infty$             |
| Axial isotropy of the probe                | $\pm 4.7$       | rectangular              | $\sqrt{3}$ | $(1-c_p)^{1/2}$ | $\pm 1.9$            | $\infty$             |
| Sph. Isotropy of the probe                 | $\pm 9.6$       | rectangular              | $\sqrt{3}$ | $(c_p)^{1/2}$   | $\pm 3.9$            | $\infty$             |
| Spatial resolution                         | $\pm 0.0$       | rectangular              | $\sqrt{3}$ | 1               | $\pm 0.0$            | $\infty$             |
| Boundary effects                           | $\pm 5.5$       | rectangular              | $\sqrt{3}$ | 1               | $\pm 3.2$            | $\infty$             |
| Probe linearity                            | $\pm 4.7$       | rectangular              | $\sqrt{3}$ | 1               | $\pm 2.7$            | $\infty$             |
| Detection limit                            | $\pm 1.0$       | rectangular              | $\sqrt{3}$ | 1               | $\pm 0.6$            | $\infty$             |
| Readout electronics                        | $\pm 1.0$       | normal                   | 1          | 1               | $\pm 1.0$            | $\infty$             |
| Response time                              | $\pm 0.8$       | rectangular              | $\sqrt{3}$ | 1               | $\pm 0.5$            | $\infty$             |
| Integration time                           | $\pm 1.4$       | rectangular              | $\sqrt{3}$ | 1               | $\pm 0.8$            | $\infty$             |
| RF ambient conditions                      | $\pm 3.0$       | rectangular              | $\sqrt{3}$ | 1               | $\pm 1.7$            | $\infty$             |
| Mech. Constrains of robot                  | $\pm 0.4$       | rectangular              | $\sqrt{3}$ | 1               | $\pm 0.2$            | $\infty$             |
| Probe positioning                          | $\pm 2.9$       | rectangular              | $\sqrt{3}$ | 1               | $\pm 1.7$            | $\infty$             |
| Extrap. And integration                    | $\pm 3.9$       | rectangular              | $\sqrt{3}$ | 1               | $\pm 2.3$            | $\infty$             |
| <b>Test Sample Related</b>                 |                 |                          |            |                 |                      |                      |
| Device positioning                         | $\pm 6.0$       | normal                   | 0.89       | 1               | $\pm 6.7$            | 12                   |
| Device holder uncertainty                  | $\pm 5.0$       | normal                   | 0.84       | 1               | $\pm 5.9$            | 8                    |
| Power drift                                | $\pm 5.0$       | rectangular              | $\sqrt{3}$ | 1               | $\pm 2.9$            | $\infty$             |
| <b>Phantom and Setup</b>                   |                 |                          |            |                 |                      |                      |
| Phantom uncertainty                        | $\pm 4.0$       | rectangular              | $\sqrt{3}$ | 1               | $\pm 2.3$            | $\infty$             |
| Liquid conductivity (target)               | $\pm 5.0$       | rectangular              | $\sqrt{3}$ | 0.6             | $\pm 1.7$            | $\infty$             |
| Liquid conductivity (meas.)                | $\pm 10.0$      | rectangular              | $\sqrt{3}$ | 0.6             | $\pm 3.5$            | $\infty$             |
| Liquid permittivity (target)               | $\pm 5.0$       | rectangular              | $\sqrt{3}$ | 0.6             | $\pm 1.7$            | $\infty$             |
| Liquid permittivity (meas.)                | $\pm 5.0$       | rectangular              | $\sqrt{3}$ | 0.6             | $\pm 1.7$            | $\infty$             |
| <b>Combined Standard Uncertainty</b>       |                 |                          |            |                 | $\pm 13.6$           |                      |
| <b>Expanded Standard Uncertainty (k=2)</b> |                 |                          |            |                 | $\pm 27.1$           |                      |

## 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 body worn configurations. The SAR distributions are substantially similar or equivalent to the plots submitted regardless of used channel in each mode and position. As all WLAN SAR results with the laptop PCs were below 0.16 W/kg, WLAN was not remeasured with the pocket PCs.

### 7.1 Body Worn Configuration

| Mode         | Channel/<br><i>f</i> (MHz) | Power (dBm) |
|--------------|----------------------------|-------------|
| GPRS<br>850  | 128/824.20                 | 29.2        |
|              | 190/836.60                 | 29.2        |
|              | 251/848.80                 | 29.0        |
| GPRS<br>1900 | 512/1850.20                | 29.9        |
|              | 661/1880.00                | 29.5        |
|              | 810/1909.80                | 29.4        |
| WLAN         | 6/2437                     | 17.1        |

| P4JDTE-3 with laptop IBM T23 |                            |                              |      |
|------------------------------|----------------------------|------------------------------|------|
| Mode                         | Channel/<br><i>f</i> (MHz) | SAR, averaged over 1g (mW/g) |      |
|                              |                            | Underneath                   | Tip  |
| GPRS<br>850                  | 128/824.20                 | 0.52                         | 0.06 |
|                              | 190/836.60                 | 0.51                         | 0.06 |
|                              | 251/848.80                 | 0.51                         | 0.06 |
| GPRS<br>1900                 | 512/1850.20                | 0.56                         | 0.30 |
|                              | 661/1880.00                | 0.53                         | 0.26 |
|                              | 810/1909.80                | 0.48                         | 0.26 |
| WLAN                         | 6/2437                     | 0.15                         | 0.04 |

| P4JDTE-3 with laptop IBM 560x |                            |                              |      |
|-------------------------------|----------------------------|------------------------------|------|
| Mode                          | Channel/<br><i>f</i> (MHz) | SAR, averaged over 1g (mW/g) |      |
|                               |                            | Underneath                   | Tip  |
| GPRS<br>850                   | 128/824.20                 | 0.42                         | 0.09 |
|                               | 190/836.60                 | 0.41                         | 0.09 |
|                               | 251/848.80                 | 0.41                         | 0.08 |
| GPRS<br>1900                  | 512/1850.20                | 0.90                         | 0.43 |
|                               | 661/1880.00                | 0.77                         | 0.36 |
|                               | 810/1909.80                | 0.69                         | 0.33 |
| WLAN                          | 6/2437                     | 0.13                         | 0.03 |

| P4JDTE-3 with laptop IBM 600x |                            |                              |      |
|-------------------------------|----------------------------|------------------------------|------|
| Mode                          | Channel/<br><i>f</i> (MHz) | SAR, averaged over 1g (mW/g) |      |
|                               |                            | Underneath                   | Tip  |
| GPRS<br>850                   | 128/824.20                 | 0.44                         | 0.04 |
|                               | 190/836.60                 | 0.43                         | 0.04 |
|                               | 251/848.80                 | 0.40                         | 0.05 |
| GPRS<br>1900                  | 512/1850.20                | 0.67                         | 0.28 |
|                               | 661/1880.00                | 0.55                         | 0.25 |
|                               | 810/1909.80                | 0.51                         | 0.26 |
| WLAN                          | 6/2437                     | 0.15                         | 0.07 |

| P4JDTE-3 with pocket PC Casio Cassiopeia |                            |                              |      |
|------------------------------------------|----------------------------|------------------------------|------|
| Mode                                     | Channel/<br><i>f</i> (MHz) | SAR, averaged over 1g (mW/g) |      |
|                                          |                            | Underneath                   | Tip  |
| GPRS<br>850                              | 128/824.20                 | 0.37                         | 0.03 |
|                                          | 190/836.60                 | 0.40                         | 0.03 |
|                                          | 251/848.80                 | 0.40                         | 0.04 |
| GPRS<br>1900                             | 512/1850.20                | 0.61                         | 0.23 |
|                                          | 661/1880.00                | 0.50                         | 0.22 |
|                                          | 810/1909.80                | 0.46                         | 0.23 |

| P4JDTE-3 with pocket PC Compaq iPAQ |                            |                              |      |
|-------------------------------------|----------------------------|------------------------------|------|
| Mode                                | Channel/<br><i>f</i> (MHz) | SAR, averaged over 1g (mW/g) |      |
|                                     |                            | Underneath                   | Tip  |
| GPRS<br>850                         | 128/824.20                 | 0.59                         | 0.03 |
|                                     | 190/836.60                 | 0.58                         | 0.04 |
|                                     | 251/848.80                 | 0.56                         | 0.04 |
| GPRS<br>1900                        | 512/1850.20                | 0.72                         | 0.24 |
|                                     | 661/1880.00                | 0.54                         | 0.23 |
|                                     | 810/1909.80                | 0.51                         | 0.26 |

| P4JDTE-3 with Handheld PC Hewlett Packard Jornada |                            |                              |      |
|---------------------------------------------------|----------------------------|------------------------------|------|
| Mode                                              | Channel/<br><i>f</i> (MHz) | SAR, averaged over 1g (mW/g) |      |
|                                                   |                            | Underneath                   | Tip  |
| GPRS<br>850                                       | 128/824.20                 | 0.35                         | 0.05 |
|                                                   | 190/836.60                 | 0.37                         | 0.05 |
|                                                   | 251/848.80                 | 0.36                         | 0.05 |
| GPRS<br>1900                                      | 512/1850.20                | 0.48                         | 0.21 |
|                                                   | 661/1880.00                | 0.41                         | 0.21 |
|                                                   | 810/1909.80                | 0.40                         | 0.20 |

## APPENDIX A.

### Validation Test Printouts

# Dipole 835 MHz

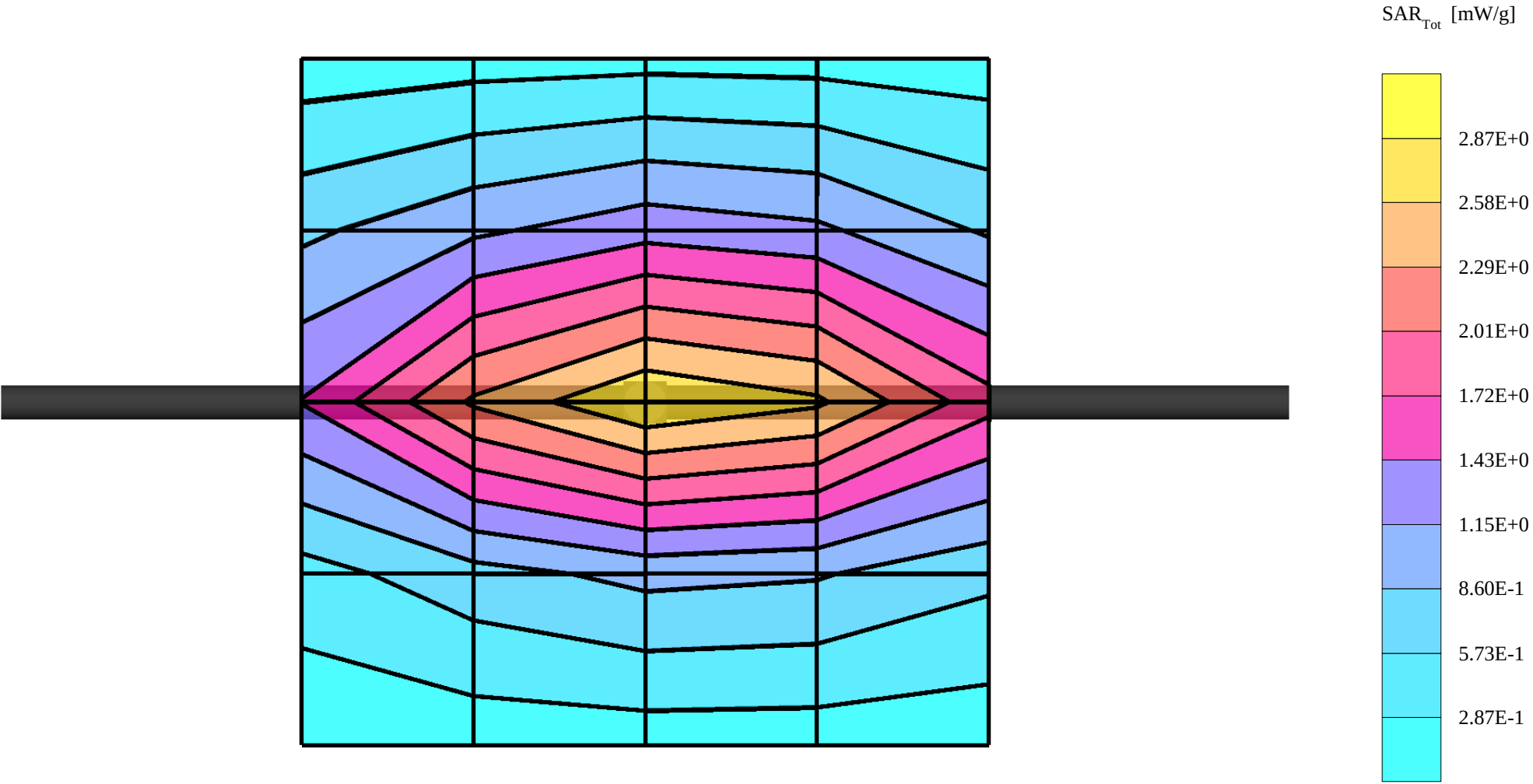
SAM 3; Flat

Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Muscle 836 MHz:  $\sigma = 0.95$  mho/m  $\epsilon_r = 57.9$   $\rho = 1.00$  g/cm<sup>3</sup>, liquid temperature: 21.0 C

Cubes (2): Peak: 4.43 mW/g  $\pm 0.09$  dB, SAR (1g): 2.75 mW/g  $\pm 0.07$  dB, SAR (10g): 1.76 mW/g  $\pm 0.05$  dB

Penetration depth: 12.5 (10.7, 14.9) [mm]

Powerdrift: -0.06 dB



# Dipole 835 MHz

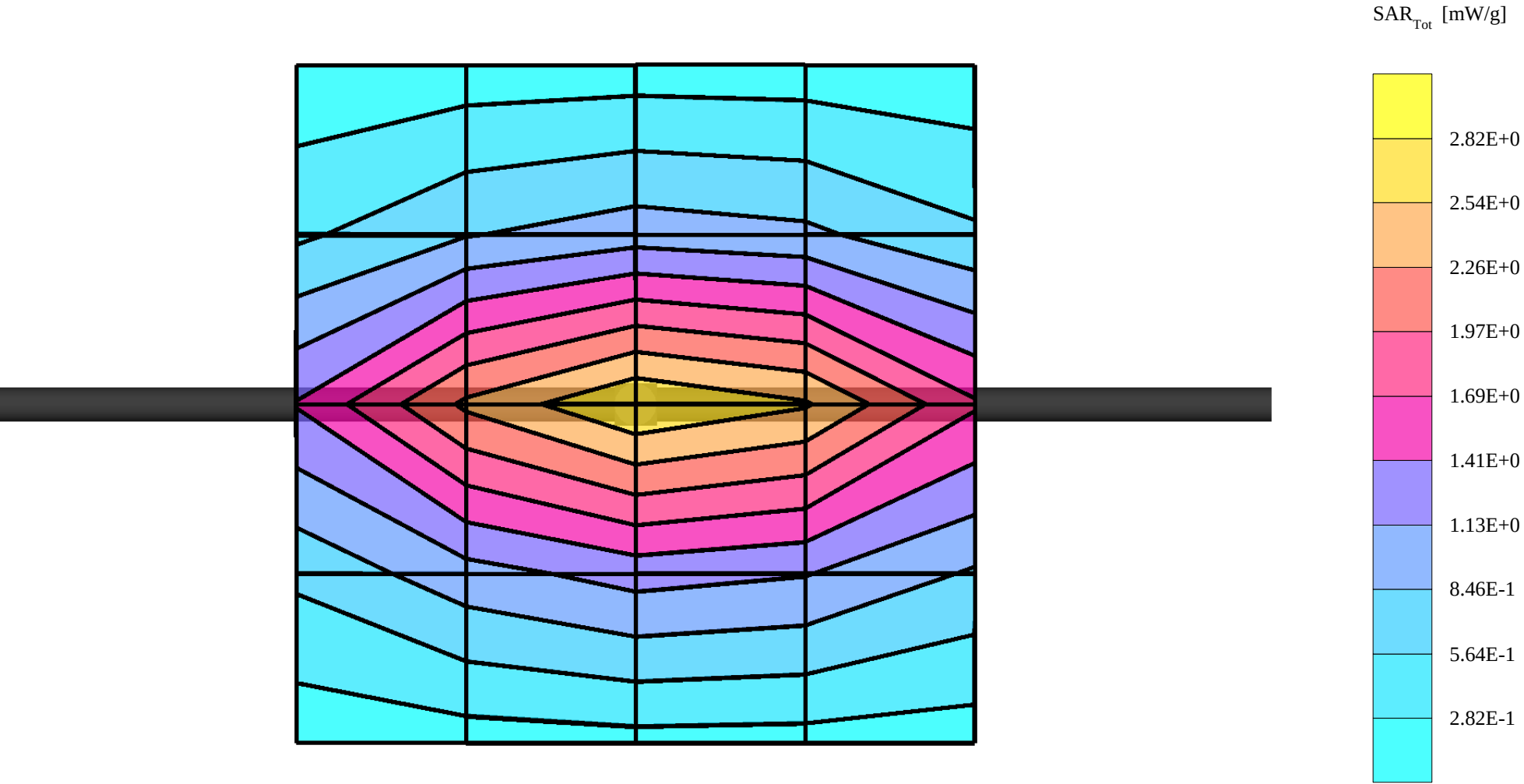
SAM 3; Flat

Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Muscle 836 MHz:  $\sigma = 0.95 \text{ mho/m}$   $\epsilon_r = 56.8$   $\rho = 1.00 \text{ g/cm}^3$ , liquid temperature: 22.3 C

Cubes (2): Peak: 4.18 mW/g  $\pm 0.06 \text{ dB}$ , SAR (1g): 2.66 mW/g  $\pm 0.07 \text{ dB}$ , SAR (10g): 1.73 mW/g  $\pm 0.07 \text{ dB}$

Penetration depth: 12.8 (11.2, 14.8) [mm]

Powerdrift: 0.01 dB



# Dipole 835 MHz

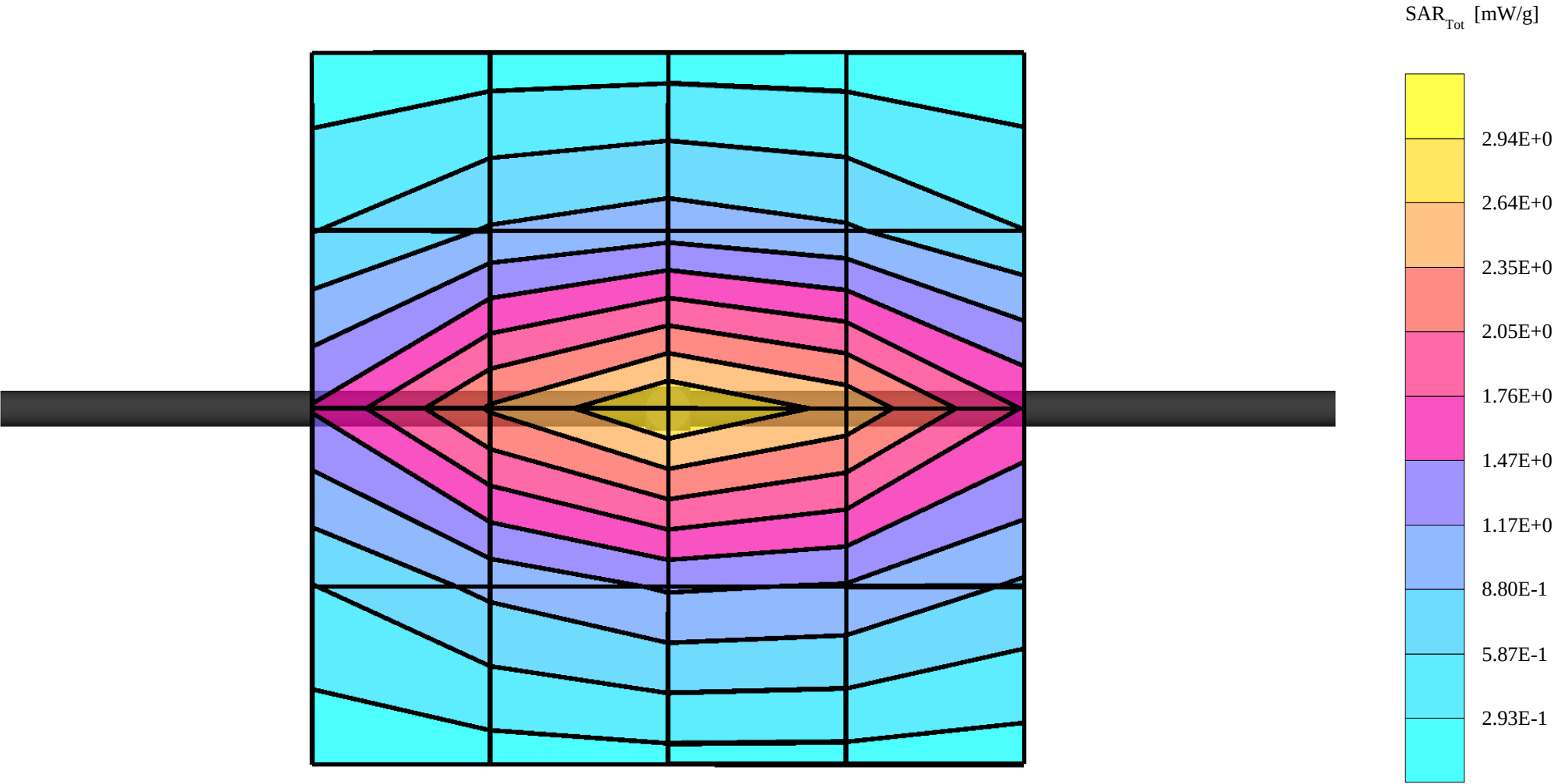
SAM 3; Flat

Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Muscle 836 MHz:  $\sigma = 0.96$  mho/m  $\epsilon_r = 56.7$   $\rho = 1.00$  g/cm<sup>3</sup>; Liquid temperature: 22.5 °C

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

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

Powerdrift: -0.02 dB



# Dipole 835 MHz

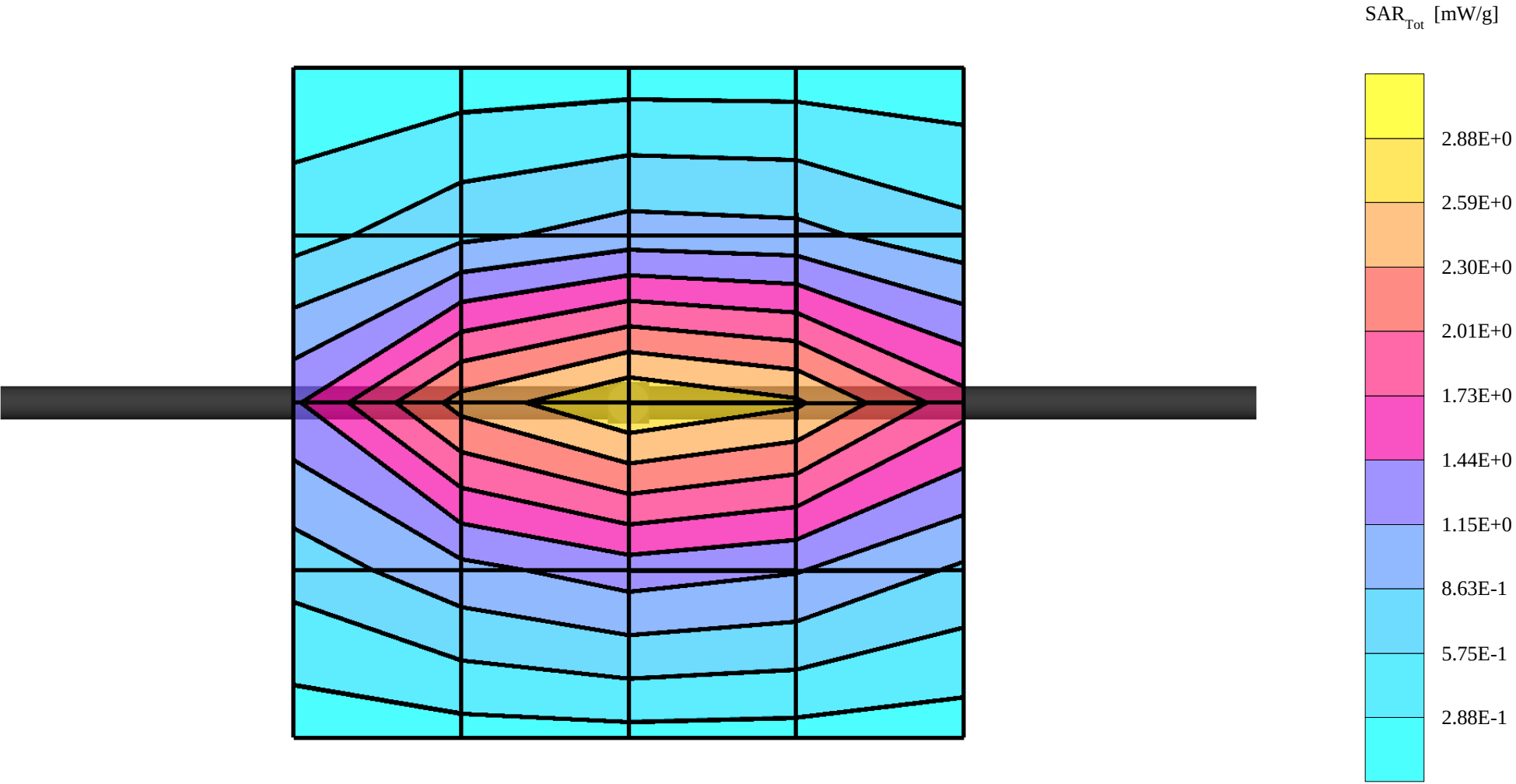
SAM 3; Flat

Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Muscle 836 MHz:  $\sigma = 0.94 \text{ mho/m}$   $\epsilon_r = 56.8$   $\rho = 1.00 \text{ g/cm}^3$ ; Liquid temperature: 21.5 °C

Cubes (2): Peak: 4.25 mW/g  $\pm 0.03 \text{ dB}$ , SAR (1g): 2.70 mW/g  $\pm 0.06 \text{ dB}$ , SAR (10g): 1.75 mW/g  $\pm 0.07 \text{ dB}$

Penetration depth: 12.8 (11.2, 14.8) [mm]

Powerdrift: 0.01 dB



# Dipole 835 MHz

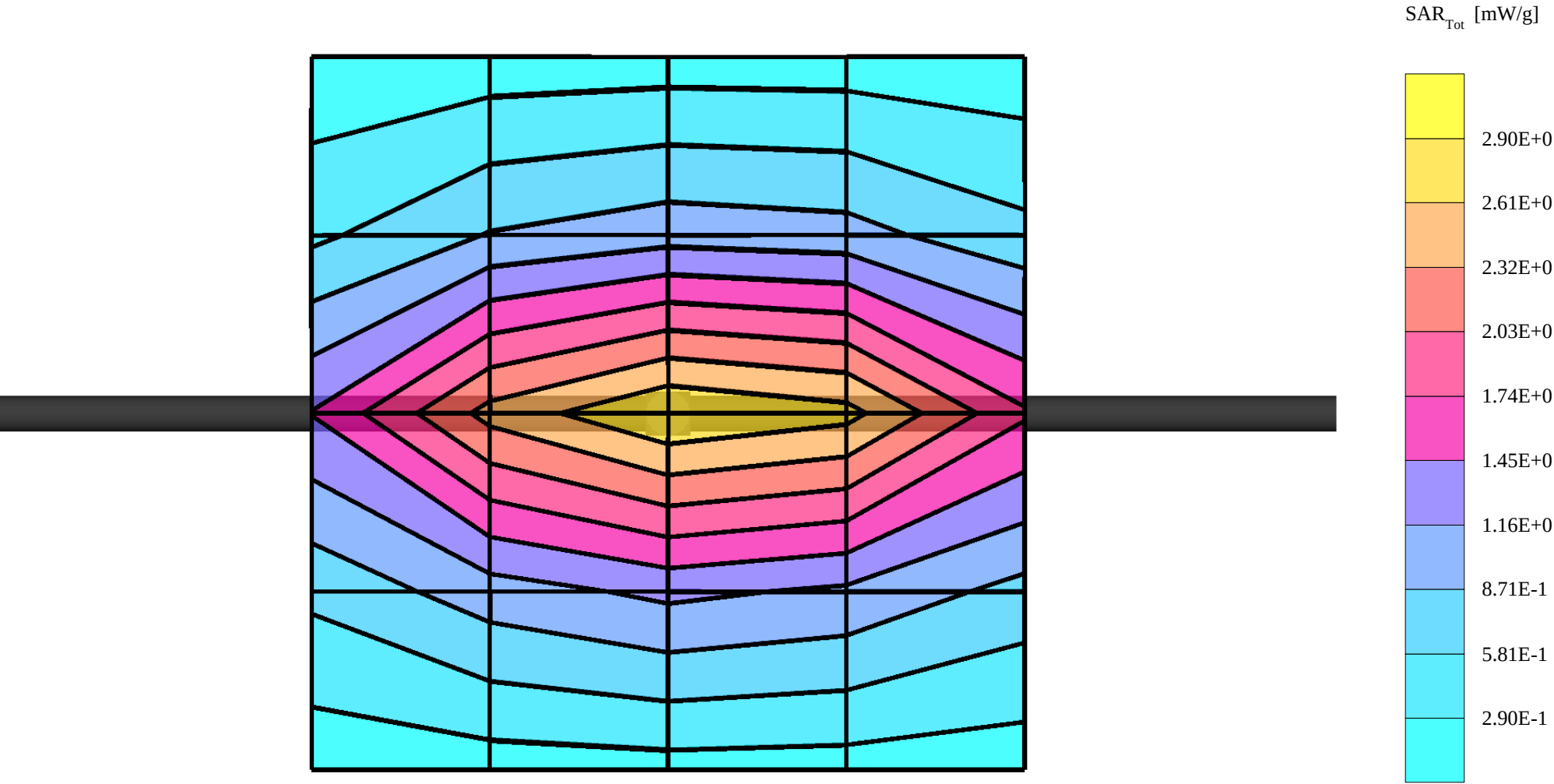
SAM 3; Flat

Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Muscle 836 MHz:  $\sigma = 0.96$  mho/m  $\epsilon_r = 56.8$   $\rho = 1.00$  g/cm<sup>3</sup>; Liquid temperature: 21.9 °C

Cubes (2): Peak: 4.35 mW/g  $\pm 0.06$  dB, SAR (1g): 2.73 mW/g  $\pm 0.01$  dB, SAR (10g): 1.76 mW/g  $\pm 0.06$  dB

Penetration depth: 12.7 (11.2, 14.8) [mm]

Powerdrift: -0.03 dB



# Dipole 1900 MHz

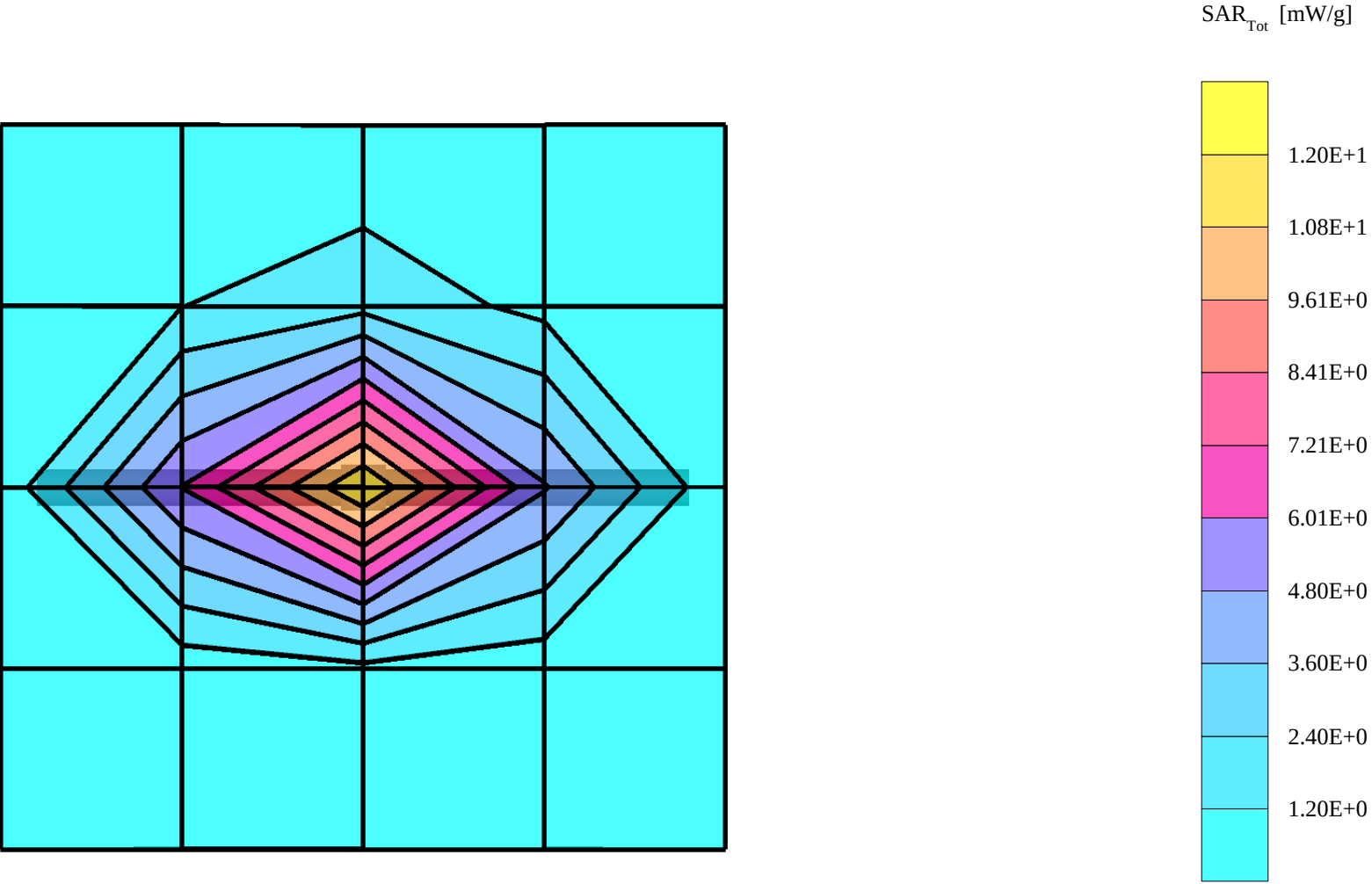
SAM 1; Flat

Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 1.0; Muscle 1900 MHz:  $\sigma = 1.50 \text{ mho/m}$   $\epsilon_r = 50.8$   $\rho = 1.00 \text{ g/cm}^3$ , liquid temperature:21.6 C

Cubes (2): Peak: 20.5 mW/g  $\pm 0.09 \text{ dB}$ , SAR (1g): 10.9 mW/g  $\pm 0.08 \text{ dB}$ , SAR (10g): 5.53 mW/g  $\pm 0.07 \text{ dB}$

Penetration depth: 8.6 (7.8, 9.9) [mm]

Powerdrift: 0.03 dB



# Dipole 1900 MHz

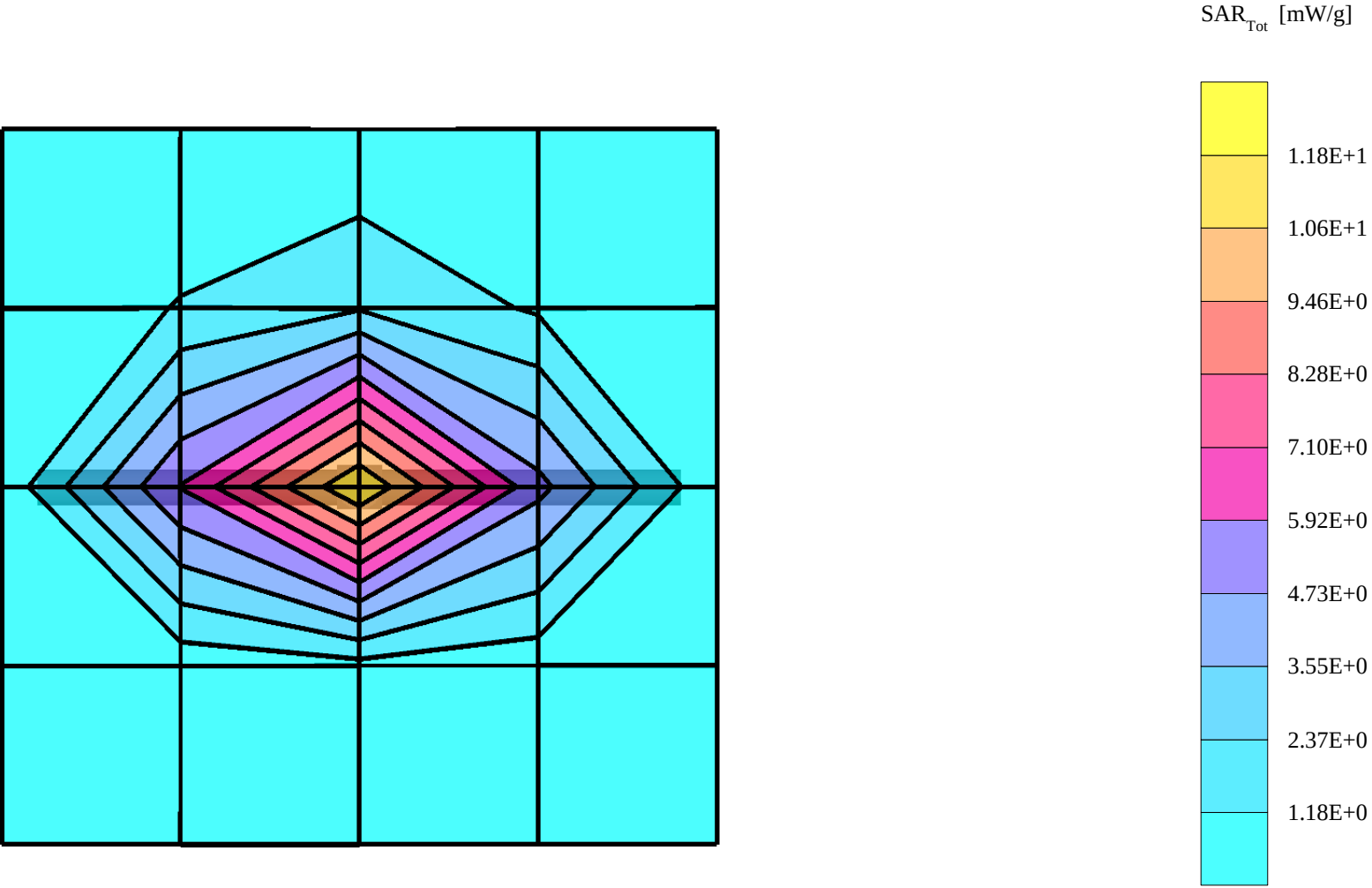
SAM 1; Flat

Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 1.0; Muscle 1900 MHz:  $\sigma = 1.52 \text{ mho/m}$   $\epsilon_r = 51.0$   $\rho = 1.00 \text{ g/cm}^3$ , liquid temperature: 21.0 C

Cubes (2): Peak: 20.6 mW/g  $\pm 0.08 \text{ dB}$ , SAR (1g): 11.0 mW/g  $\pm 0.08 \text{ dB}$ , SAR (10g): 5.62 mW/g  $\pm 0.07 \text{ dB}$

Penetration depth: 8.6 (7.9, 9.9) [mm]

Powerdrift: 0.03 dB



# Dipole 1900 MHz

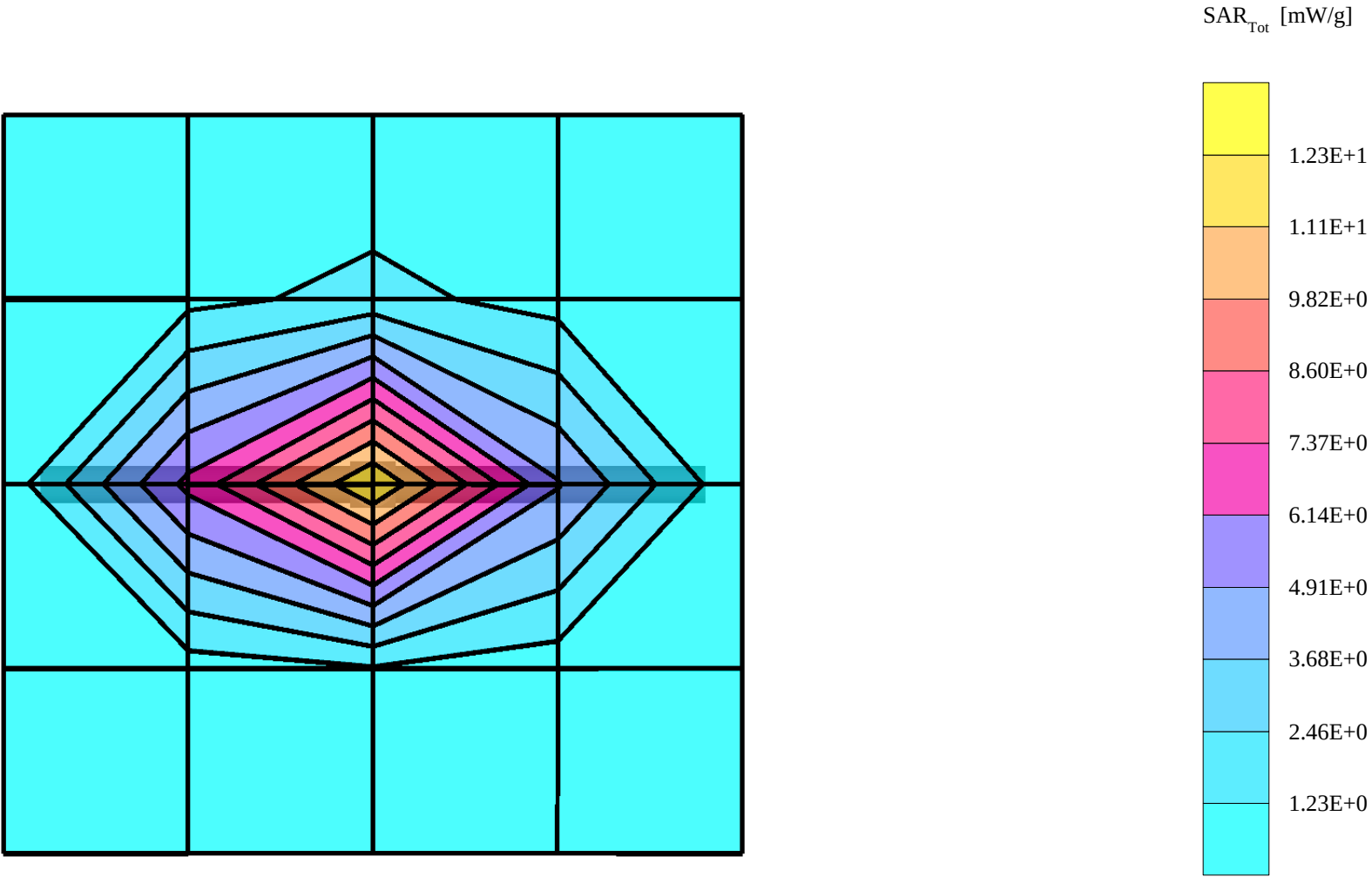
SAM 1; Flat

Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 1.0; Muscle 1900 MHz:  $\sigma = 1.52 \text{ mho/m}$   $\epsilon_r = 51.1$   $\rho = 1.00 \text{ g/cm}^3$ , liquid temperature: 21.2 C

Cubes (2): Peak: 20.8 mW/g  $\pm 0.10 \text{ dB}$ , SAR (1g): 11.0 mW/g  $\pm 0.07 \text{ dB}$ , SAR (10g): 5.58 mW/g  $\pm 0.05 \text{ dB}$

Penetration depth: 8.4 (7.7, 9.7) [mm]

Powerdrift: 0.04 dB



# Dipole 1900 MHz

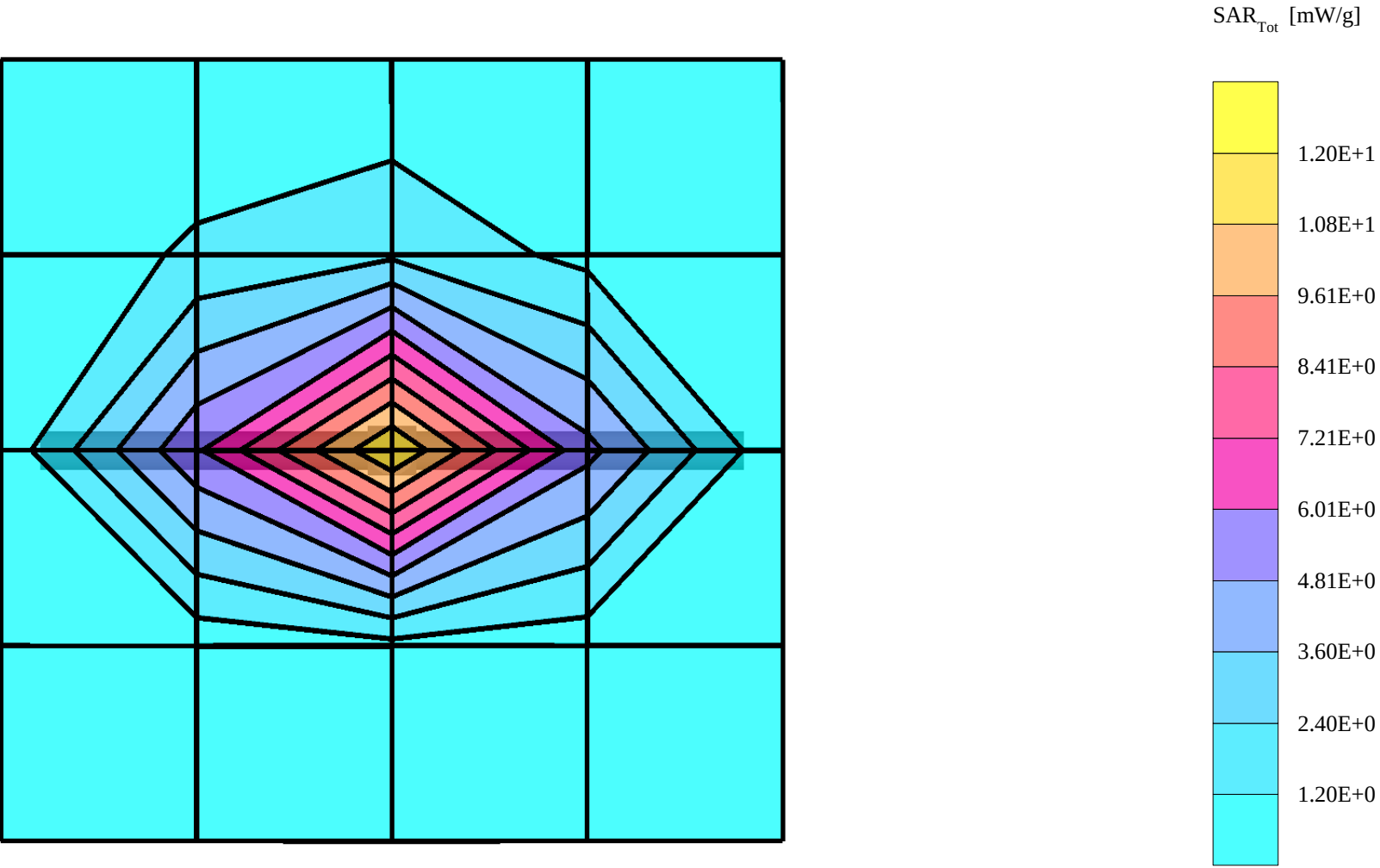
SAM 1; Flat

Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 1.0; Muscle 1900 MHz:  $\sigma = 1.49 \text{ mho/m}$   $\epsilon_r = 51.0$   $\rho = 1.00 \text{ g/cm}^3$ ; Liquid temperature: 21.8 °C

Cubes (2): Peak: 20.8 mW/g  $\pm 0.05 \text{ dB}$ , SAR (1g): 11.1 mW/g  $\pm 0.08 \text{ dB}$ , SAR (10g): 5.64 mW/g  $\pm 0.09 \text{ dB}$

Penetration depth: 8.6 (7.9, 9.9) [mm]

Powerdrift: -0.01 dB



# Dipole 1900 MHz

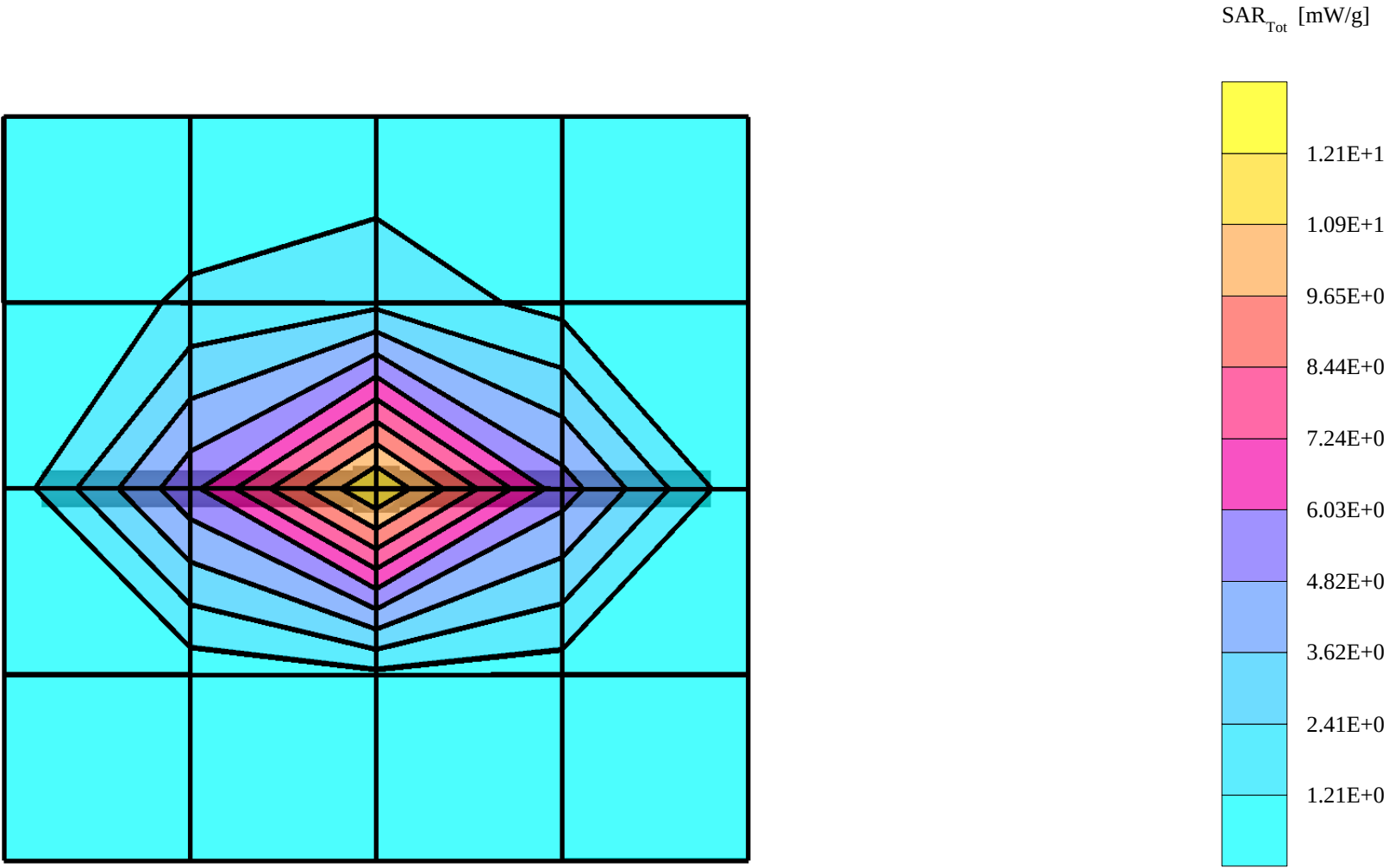
SAM 1; Flat

Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 1.0; Muscle 1900 MHz:  $\sigma = 1.50$  mho/m  $\epsilon_r = 51.0$   $\rho = 1.00$  g/cm<sup>3</sup>; Liquid temperature: 21.0 °C

Cubes (2): Peak: 20.5 mW/g  $\pm 0.05$  dB, SAR (1g): 10.8 mW/g  $\pm 0.07$  dB, SAR (10g): 5.53 mW/g  $\pm 0.08$  dB

Penetration depth: 8.5 (7.8, 9.7) [mm]

Powerdrift: 0.03 dB



# Dipole 1900 MHz

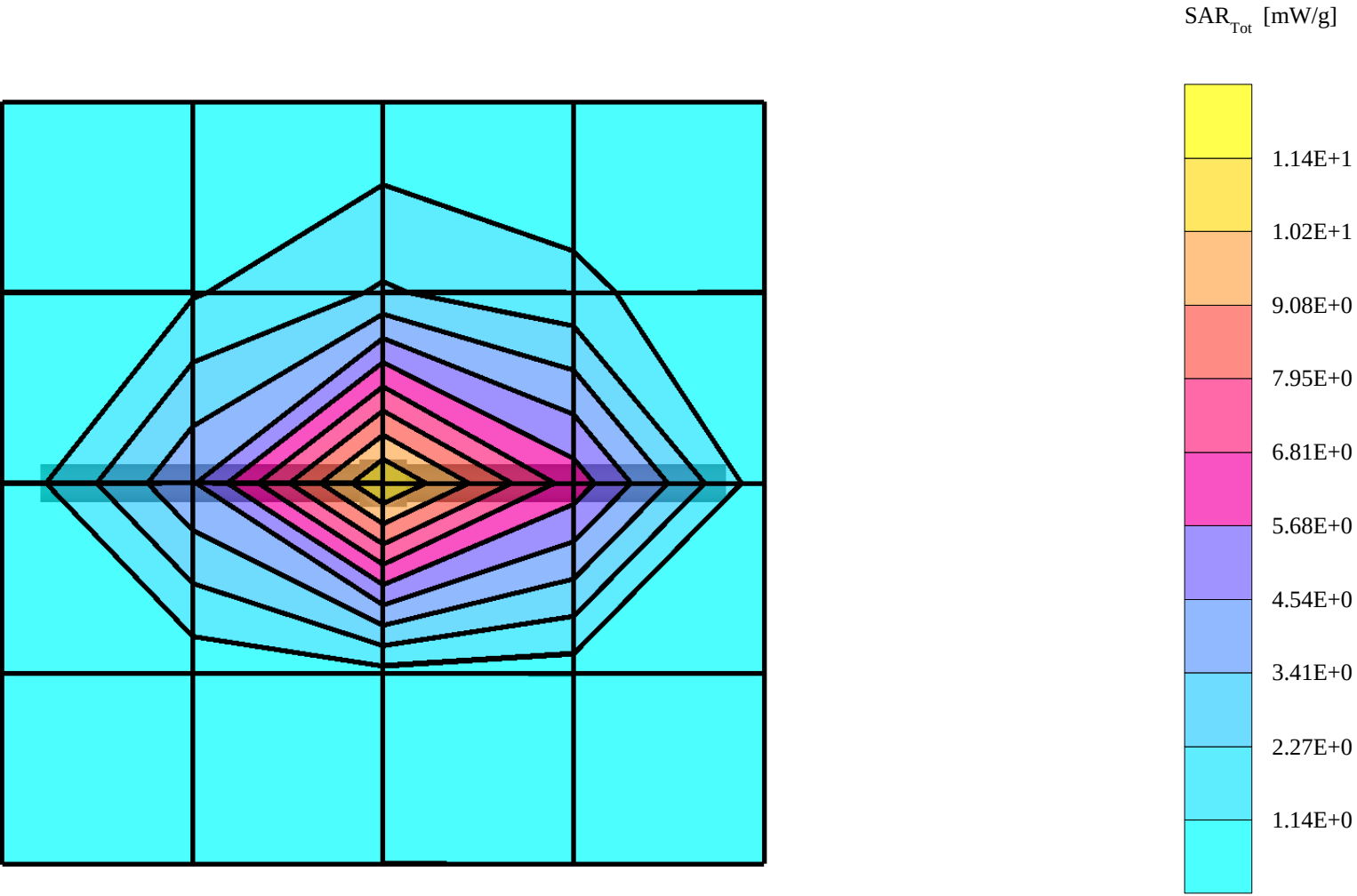
SAM 2; Flat

Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 1.0; Muscle 1900 MHz:  $\sigma = 1.50$  mho/m  $\epsilon_r = 51.0$   $\rho = 1.00$  g/cm<sup>3</sup>; Liquid temperature: 21.9 °C

Cubes (2): Peak: 19.9 mW/g  $\pm 0.01$  dB, SAR (1g): 10.6 mW/g  $\pm 0.03$  dB, SAR (10g): 5.44 mW/g  $\pm 0.08$  dB

Penetration depth: 8.7 (7.9, 10.2) [mm]

Powerdrift: -0.00 dB

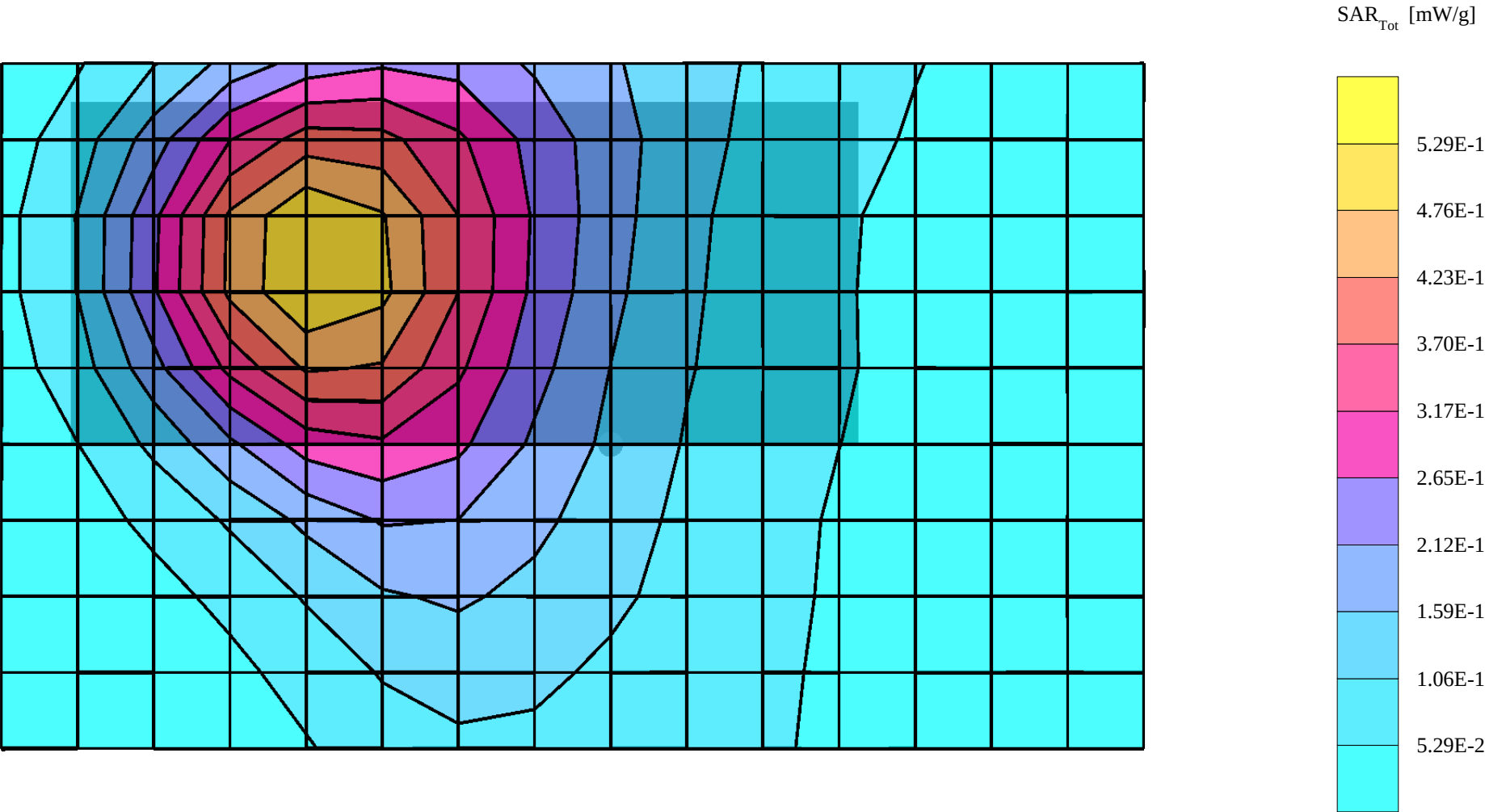


## APPENDIX B.

### SAR Distribution Printouts

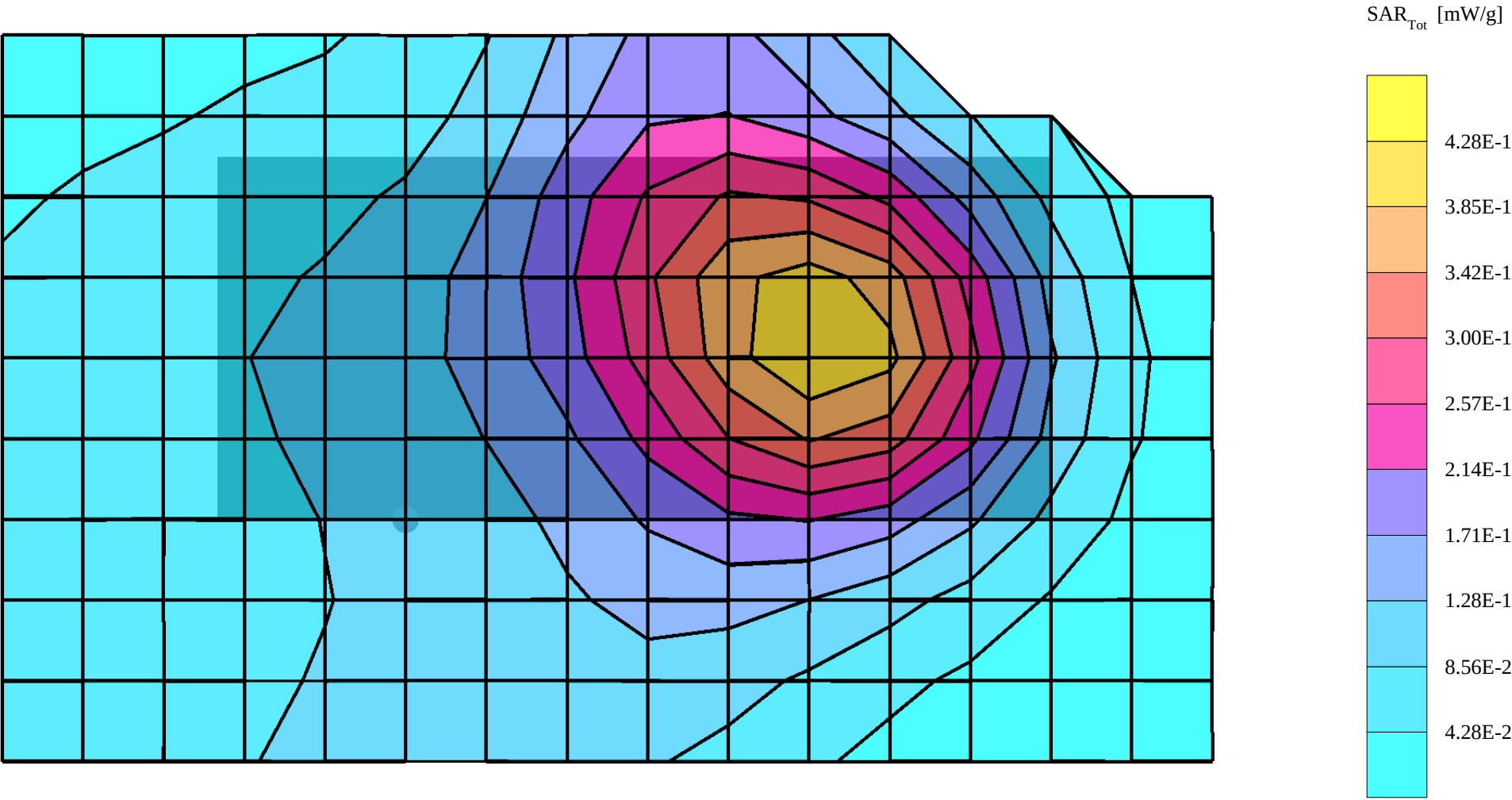
P4JDTE-3

SAM 3 Phantom; Flat Section; Position: body worn, IBM T23; Frequency: 824 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 4.0; Muscle 836 MHz:  $\sigma = 0.96$  mho/m  $\epsilon_r = 56.7$   $\rho = 1.00$  g/cm<sup>3</sup>; Liquid temperature: 22.5 °C  
Cube 5x5x7: SAR (1g): 0.522 mW/g, SAR (10g): 0.359 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: -0.01 dB



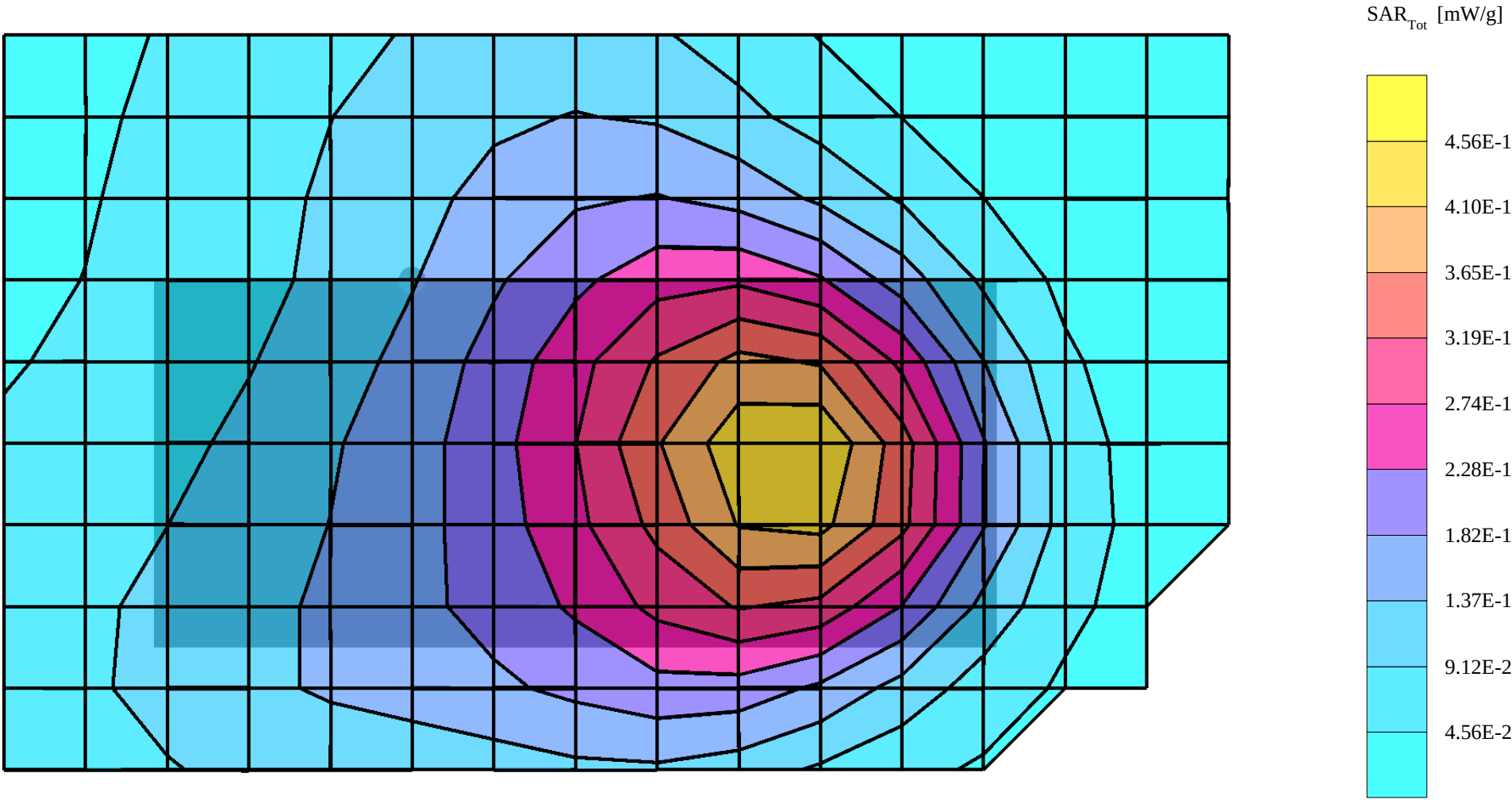
P4JDTE-3

SAM 3 Phantom; Flat Section; Position: body worn, IBM 560X; Frequency: 824 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 4.0; Muscle 836 MHz:  $\sigma = 0.95 \text{ mho/m}$   $\epsilon_r = 56.8$   $\rho = 1.00 \text{ g/cm}^3$ ; Liquid temperature: 21.6 °C  
Cube 5x5x7: SAR (1g): 0.419 mW/g, SAR (10g): 0.290 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: 0.01 dB



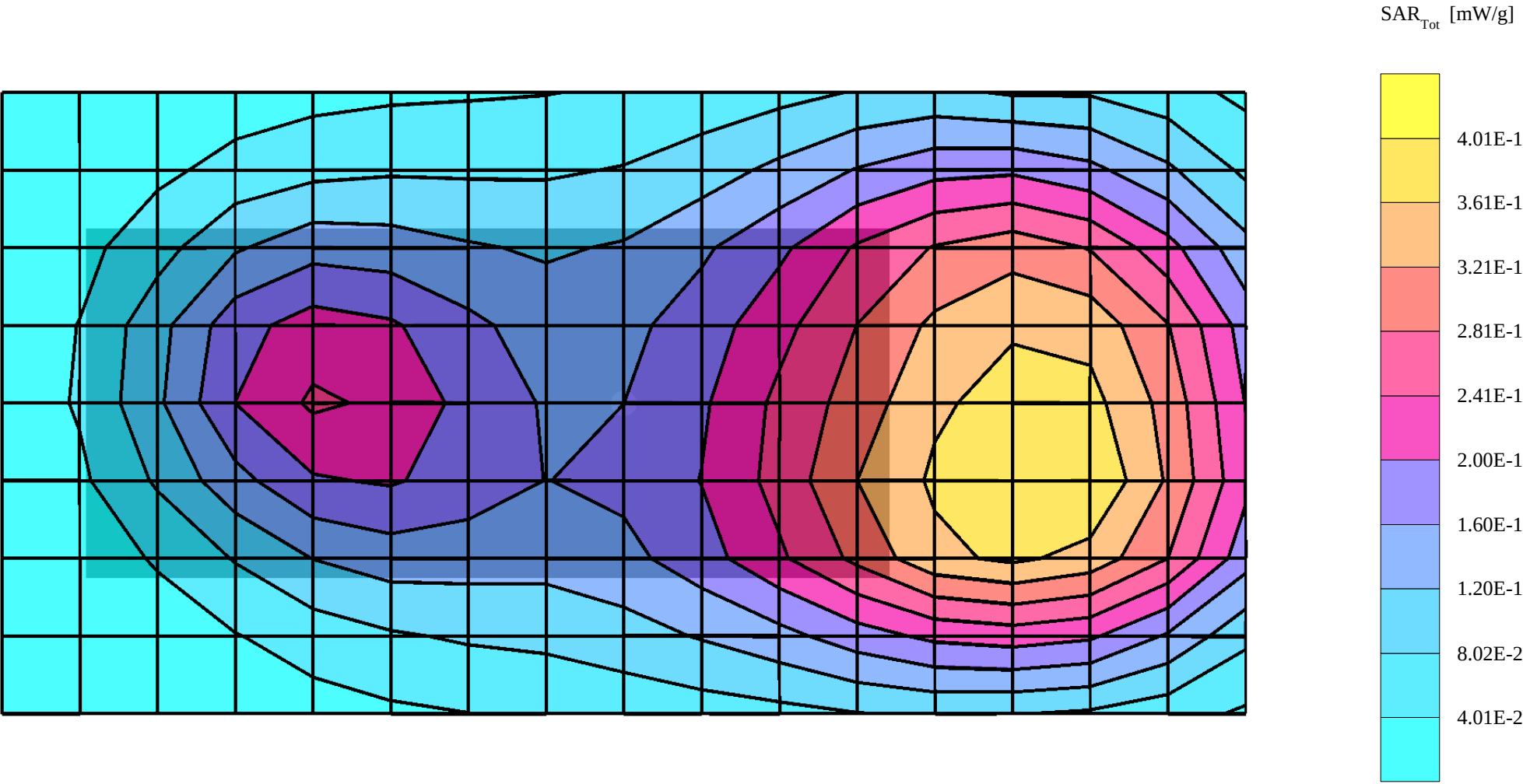
P4JDTE-3

SAM 3 Phantom; Flat Section; Position: body worn, IBM 600X; Frequency: 824 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 4.0; Muscle 836 MHz:  $\sigma = 0.95 \text{ mho/m}$   $\epsilon_r = 56.8$   $\rho = 1.00 \text{ g/cm}^3$ ; Liquid temperature: 21.5 °C  
Cube 5x5x7: SAR (1g): 0.443 mW/g, SAR (10g): 0.306 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: -0.03 dB



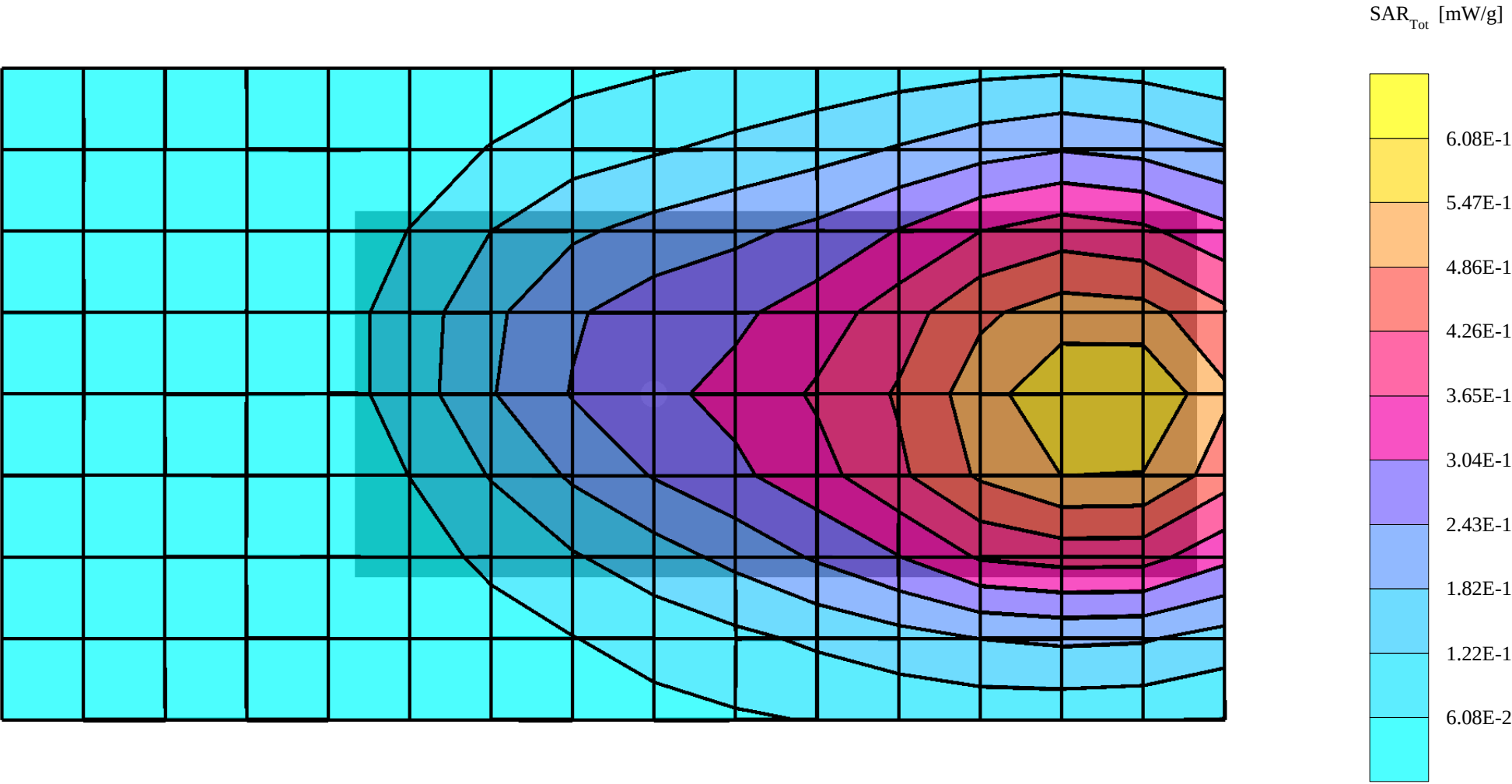
P4JDTE-3

SAM 3 Phantom; Flat Section; Position: body worn, Casio; Frequency: 836 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 4.0; Muscle 836 MHz:  $\sigma = 0.94 \text{ mho/m}$   $\epsilon_r = 56.8$   $\rho = 1.00 \text{ g/cm}^3$ ; Liquid temperature: 21.7 °C  
Cube 5x5x7: SAR (1g): 0.403 mW/g, SAR (10g): 0.308 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: 0.03 dB



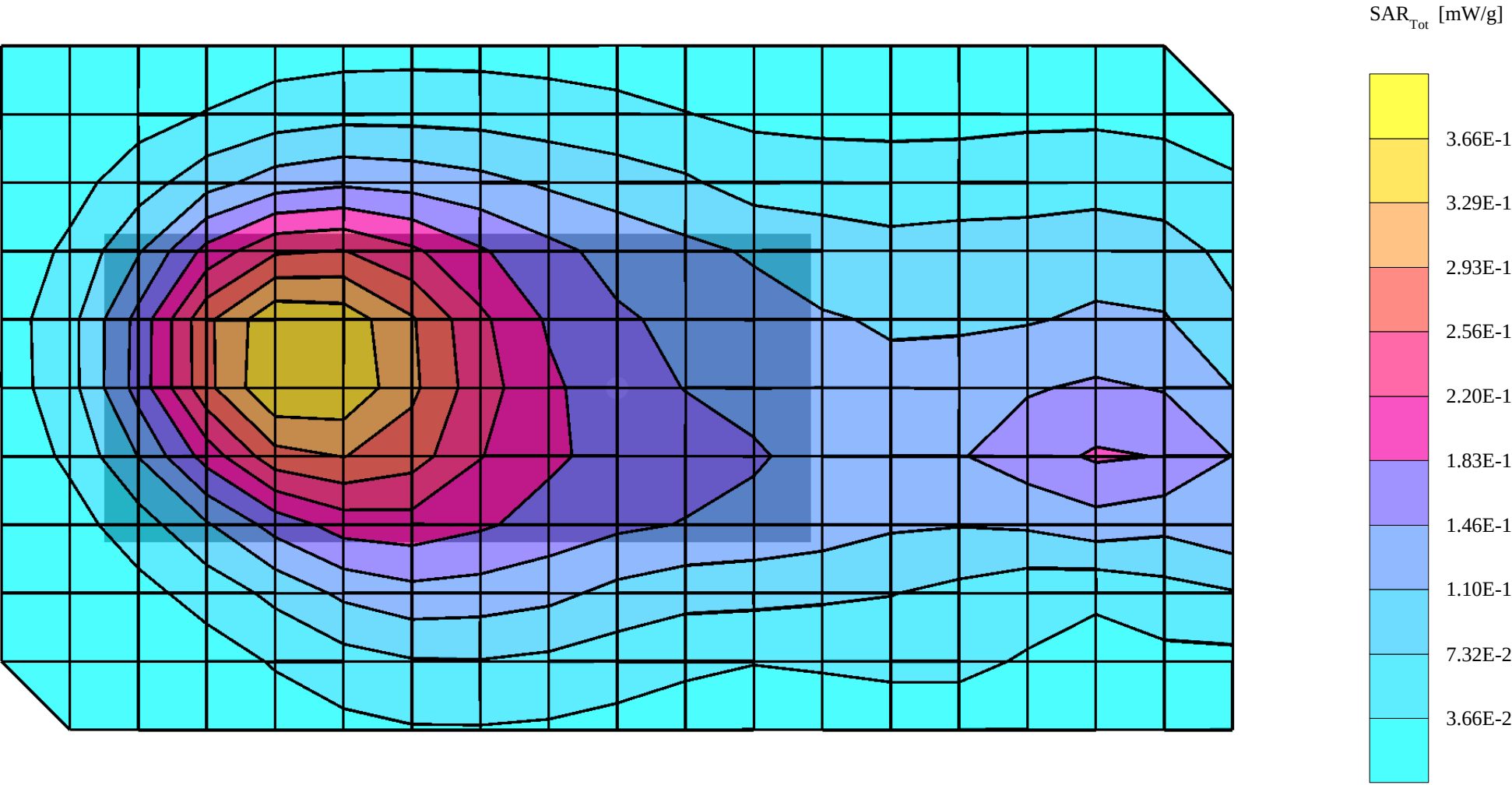
P4JDTE-3

SAM 3 Phantom; Flat Section; Position: body worn, Compaq; Frequency: 824 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 4.0; Muscle 836 MHz:  $\sigma = 0.94$  mho/m  $\epsilon_r = 56.8$   $\rho = 1.00$  g/cm<sup>3</sup>; Liquid temperature, 21.6 °C  
Cube 5x5x7: SAR (1g): 0.590 mW/g, SAR (10g): 0.436 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: -0.06 dB



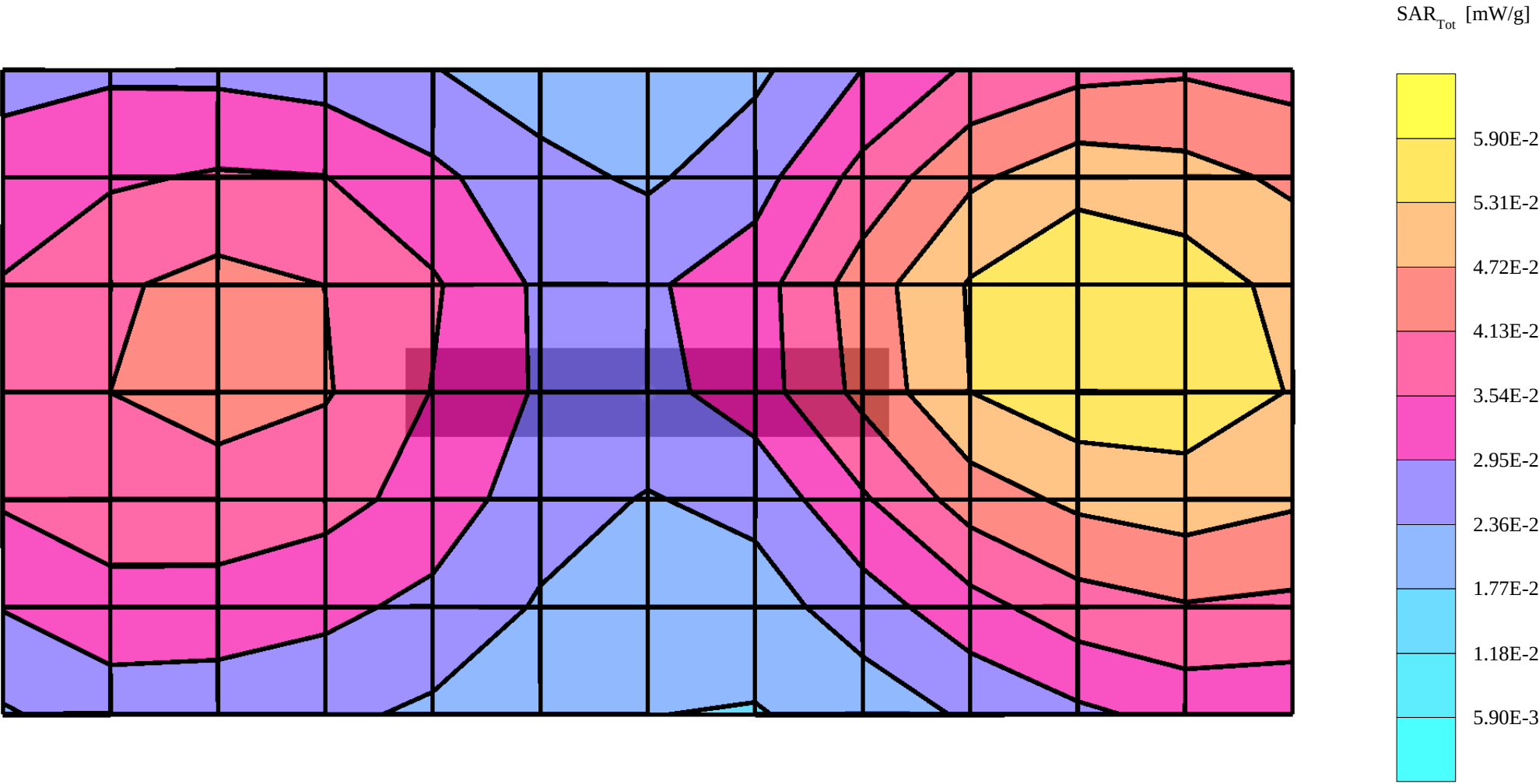
P4JDTE-3

SAM 3 Phantom; Flat Section; Position: body worn, HP; Frequency: 836 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 4.0; Muscle 836 MHz:  $\sigma = 0.96 \text{ mho/m}$   $\epsilon_r = 56.8$   $\rho = 1.00 \text{ g/cm}^3$ ; Liquid temperature: 22.0 °C  
Cube 5x5x7: SAR (1g): 0.368 mW/g, SAR (10g): 0.249 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: 0.03 dB



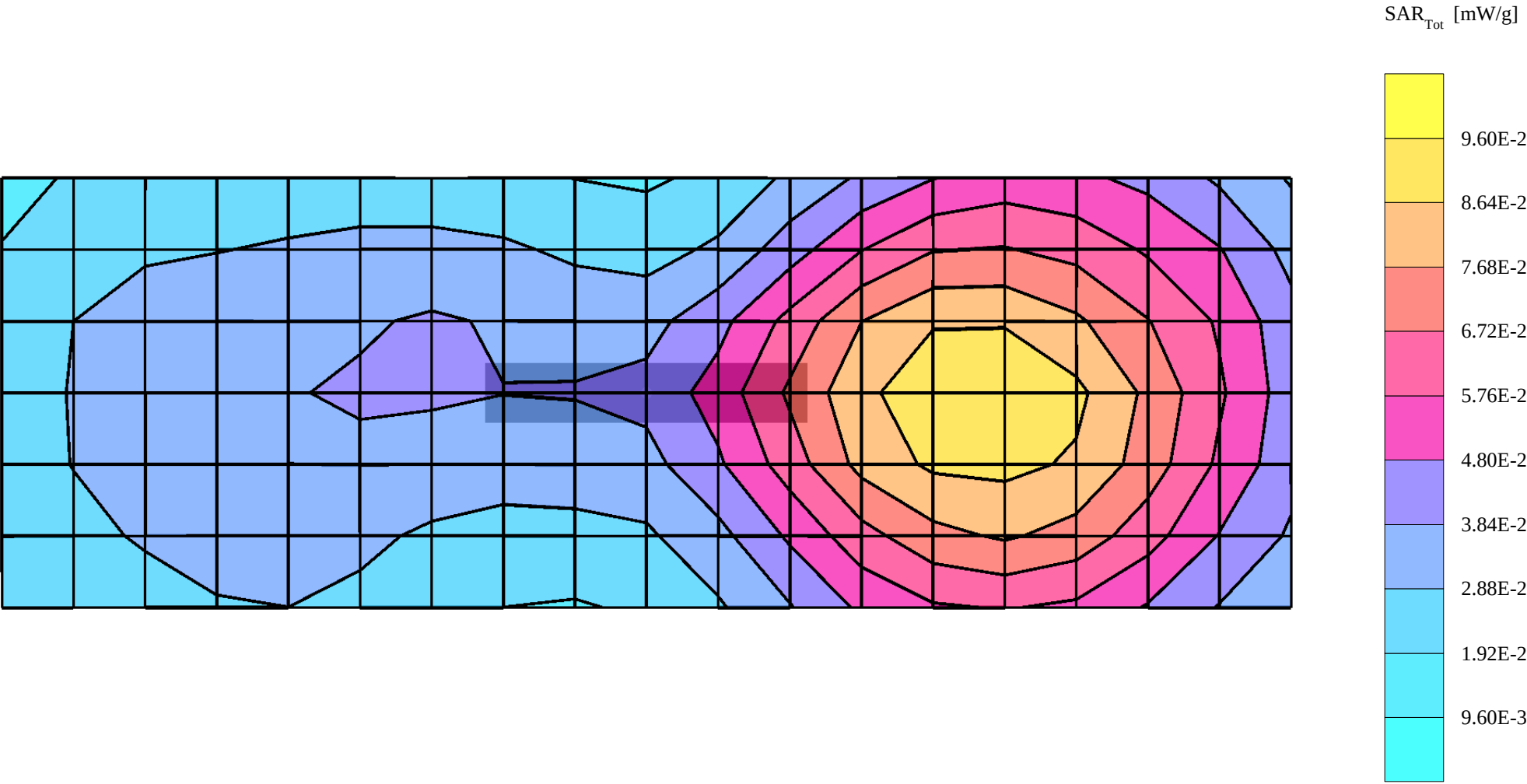
P4JDTE-3

SAM 3 Phantom; Flat Section; Position: body worn, IBM T23; Frequency: 836 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 4.0; Muscle 836 MHz:  $\sigma = 0.95$  mho/m  $\epsilon_r = 57.9$   $\rho = 1.00$  g/cm<sup>3</sup>; Liquid temperature: 21.1 °C  
Cube 5x5x7: SAR (1g): 0.0570 mW/g, SAR (10g): 0.0418 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: 0.07 dB



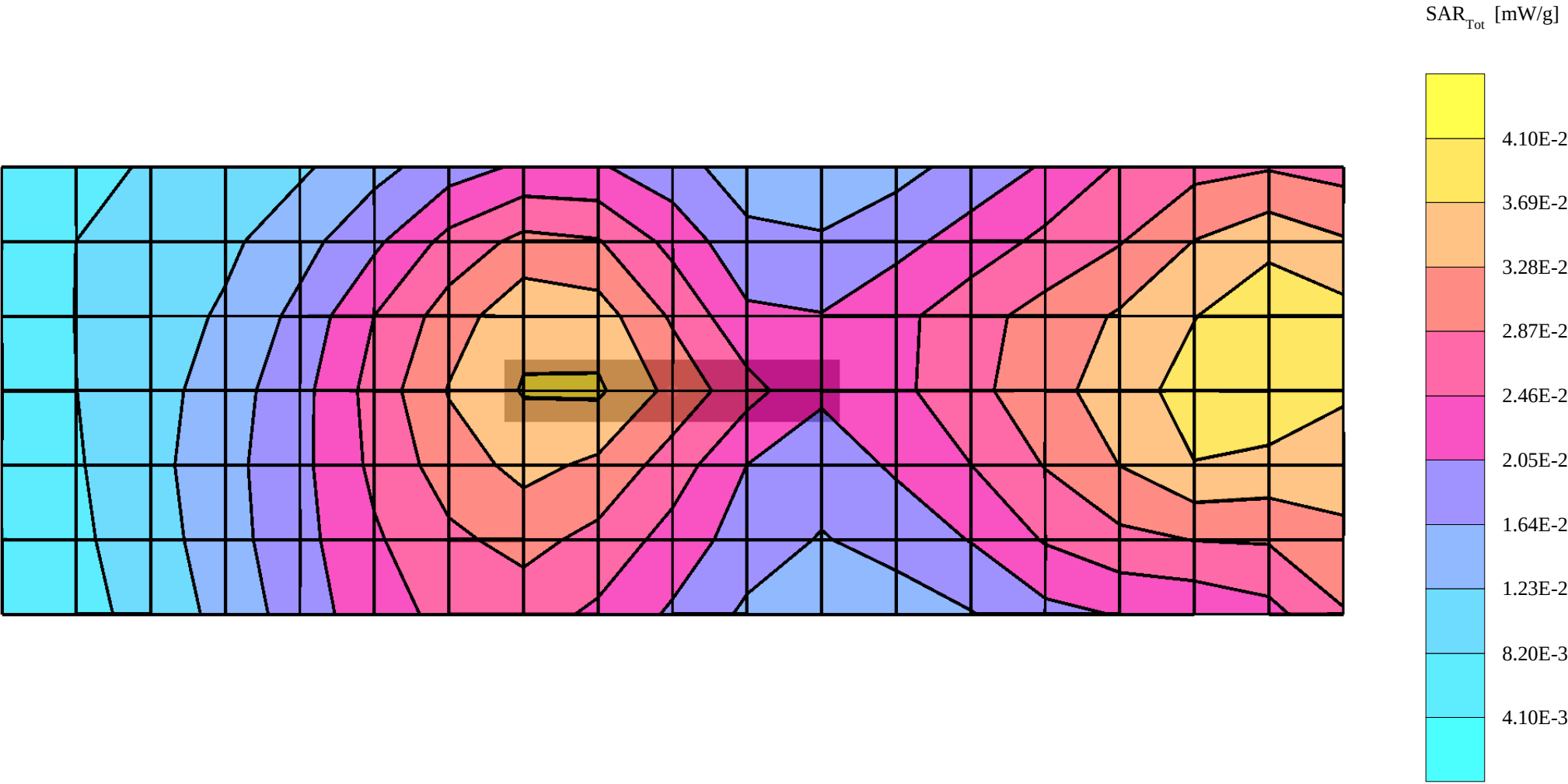
P4JDTE-3

SAM 3 Phantom; Flat Section; Position: body worn, IBM 560X; Frequency: 824 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 4.0; Muscle 836 MHz:  $\sigma = 0.96 \text{ mho/m}$   $\epsilon_r = 56.7$   $\rho = 1.00 \text{ g/cm}^3$ ; Liquid temperature: 22.5 °C  
Cube 5x5x7: SAR (1g): 0.0920 mW/g, SAR (10g): 0.0674 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: -0.02 dB



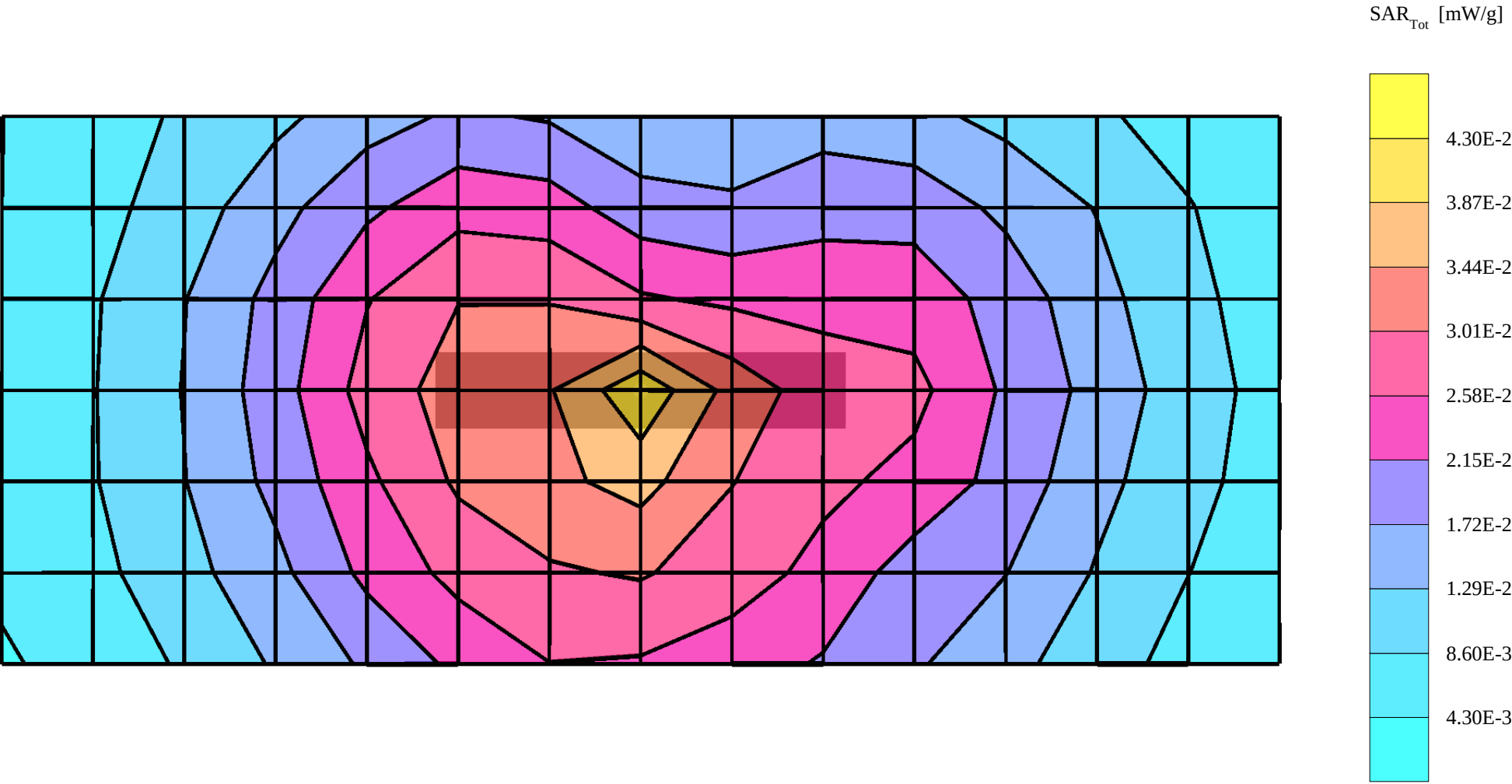
P4JDTE-3

SAM 3 Phantom; Flat Section; Position: body worn, IBM 600X; Frequency: 849 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 4.0; Muscle 836 MHz:  $\sigma = 0.96$  mho/m  $\epsilon_r = 56.7$   $\rho = 1.00$  g/cm<sup>3</sup>; Liquid temperature: 22.7 °C  
Cube 5x5x7: left peak SAR (1g): 0.0499 mW/g, SAR (10g): 0.0288 mW/g, right peak SAR (1g): 0.0388mW/g, SAR (10g): 0.0285mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: -0.01 dB



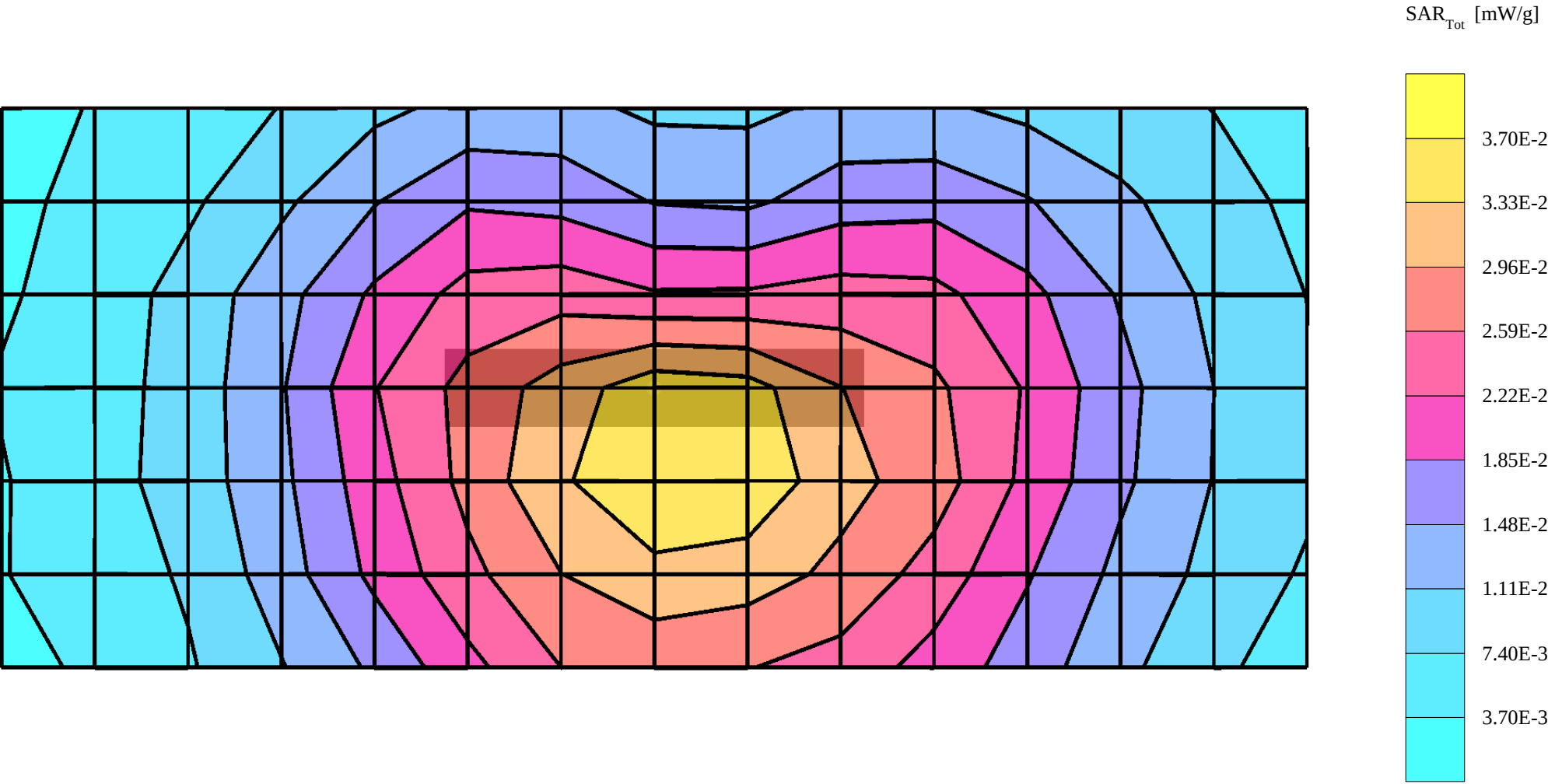
# P4JDTE-3

SAM 3 Phantom; Flat Section; Position: body worn, Casio; Frequency: 849 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 4.0; Muscle 836 MHz:  $\sigma = 0.96 \text{ mho/m}$   $\epsilon_r = 56.8$   $\rho = 1.00 \text{ g/cm}^3$ ; Liquid temperature: 22.4 °C  
Cube 5x5x7: SAR (1g): 0.0358 mW/g, SAR (10g): 0.0230 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: -0.02 dB



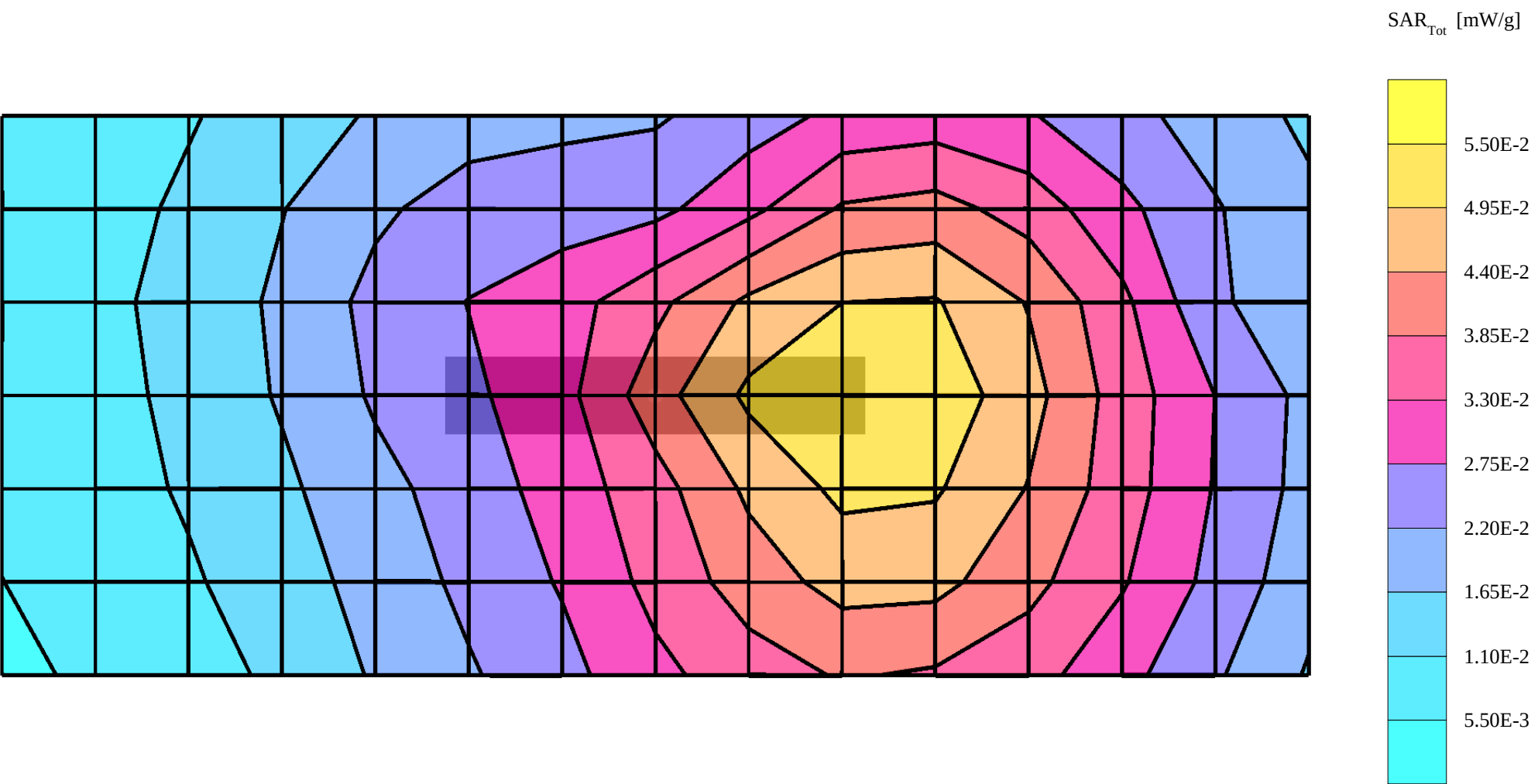
P4JDTE-3

SAM 3 Phantom; Flat Section; Position: body worn, Compaq; Frequency: 849 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 4.0; Muscle 836 MHz:  $\sigma = 0.96 \text{ mho/m}$   $\epsilon_r = 56.8$   $\rho = 1.00 \text{ g/cm}^3$ ; Liquid temperature: 22.1 °C  
Cube 5x5x7: SAR (1g): 0.0381 mW/g, SAR (10g): 0.0235 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: 0.01 dB



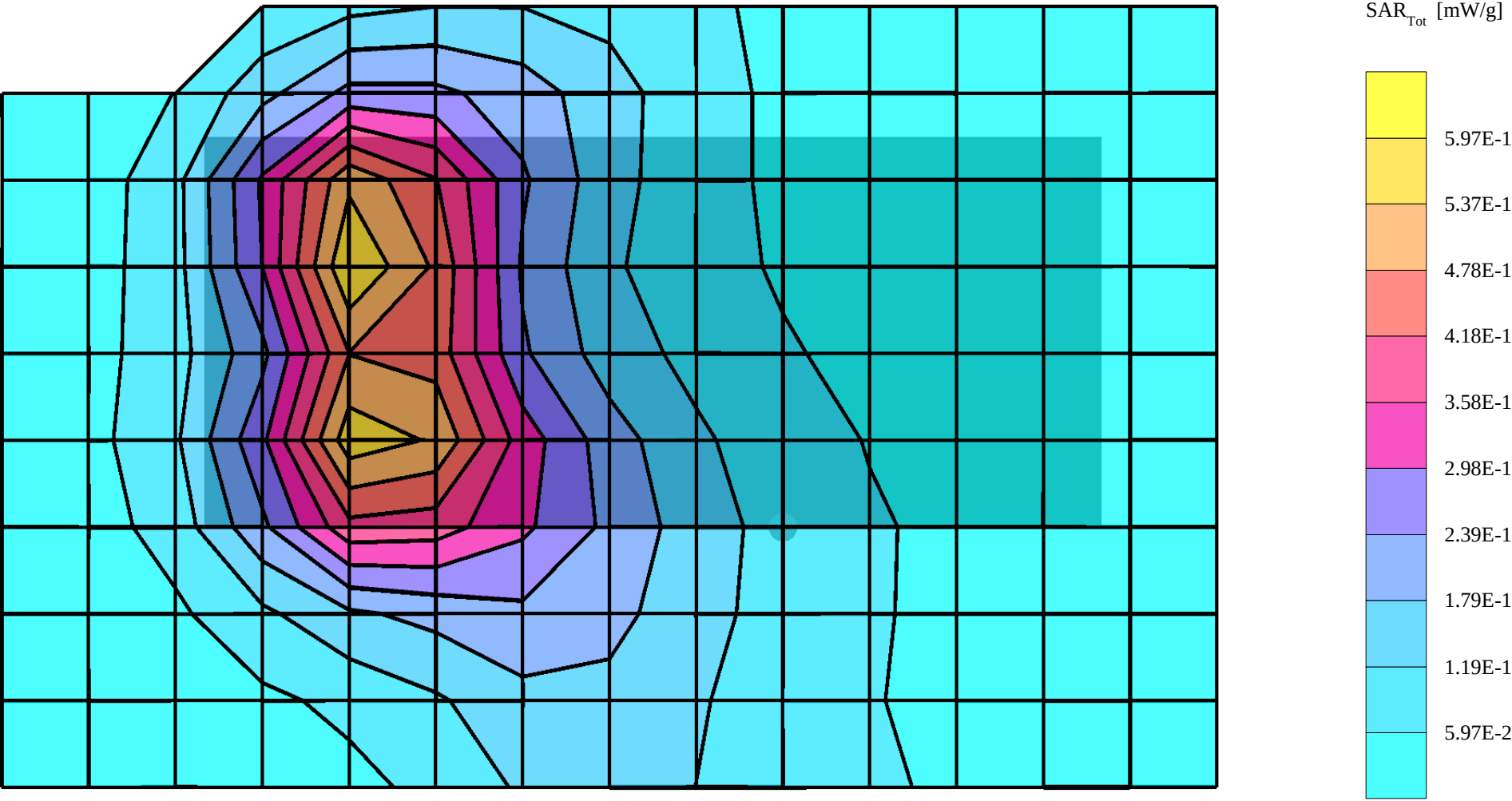
P4JDTE-3

SAM 3 Phantom; Flat Section; Position: body worn, HP; Frequency: 836 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 4.0; Muscle 836 MHz:  $\sigma = 0.96 \text{ mho/m}$   $\epsilon_r = 56.8$   $\rho = 1.00 \text{ g/cm}^3$ ; Liquid temperature: 21.9 °C  
Cube 5x5x7: SAR (1g): 0.0530 mW/g, SAR (10g): 0.0377 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: 0.04 dB



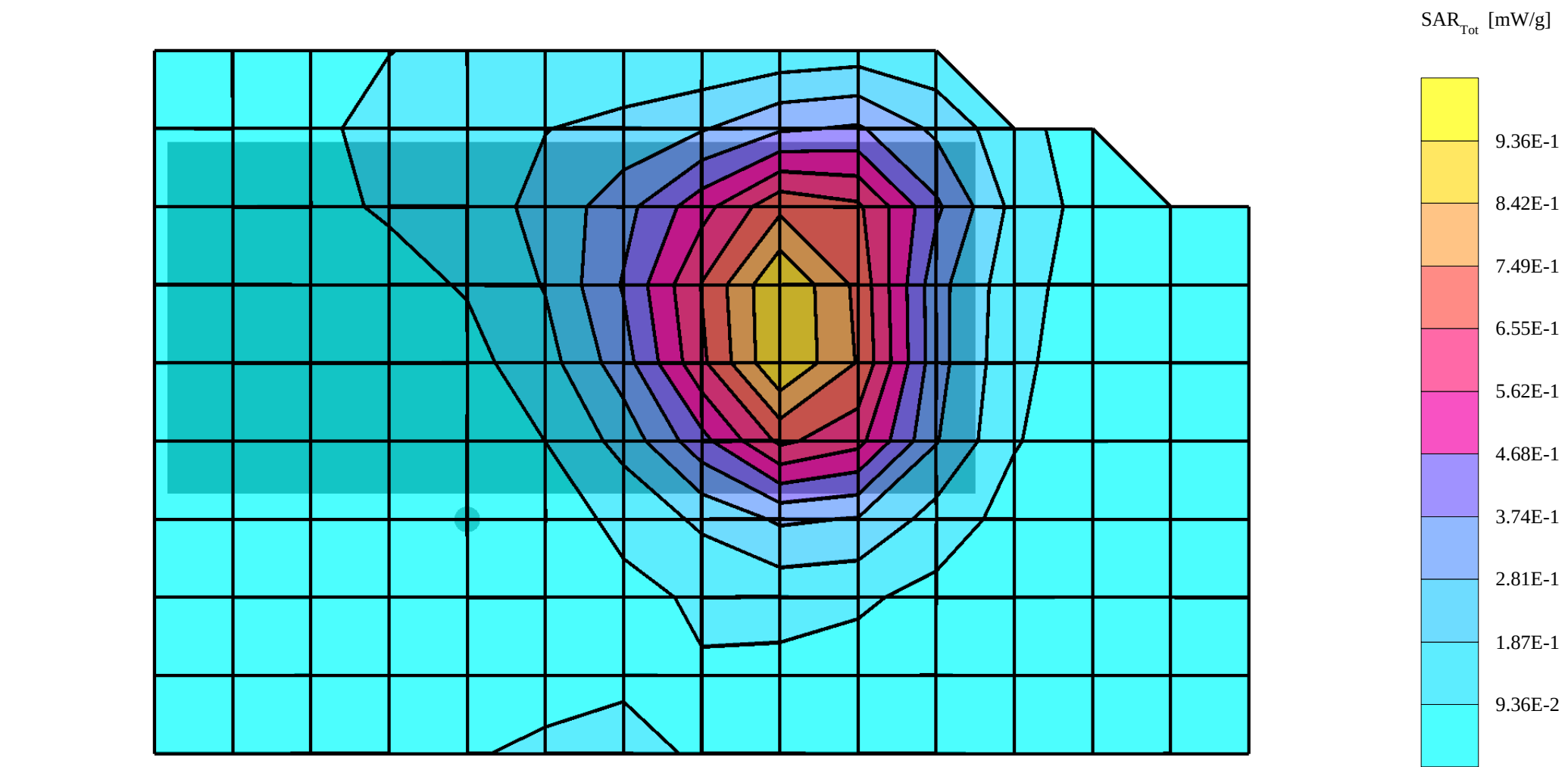
P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn, IBM T23; Frequency: 1850 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 4.0; Muscle 1880 MHz:  $\sigma = 1.48$  mho/m  $\epsilon_r = 50.9$   $\rho = 1.00$  g/cm<sup>3</sup>; Liquid temperature: 21.6 °C  
Cube 5x5x7: Upper peak SAR (1g): 0.560 mW/g, SAR (10g): 0.315 mW/g, lower peak SAR (1g): 0.549 mW/g, SAR (10g): 0.317 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: -0.11 dB



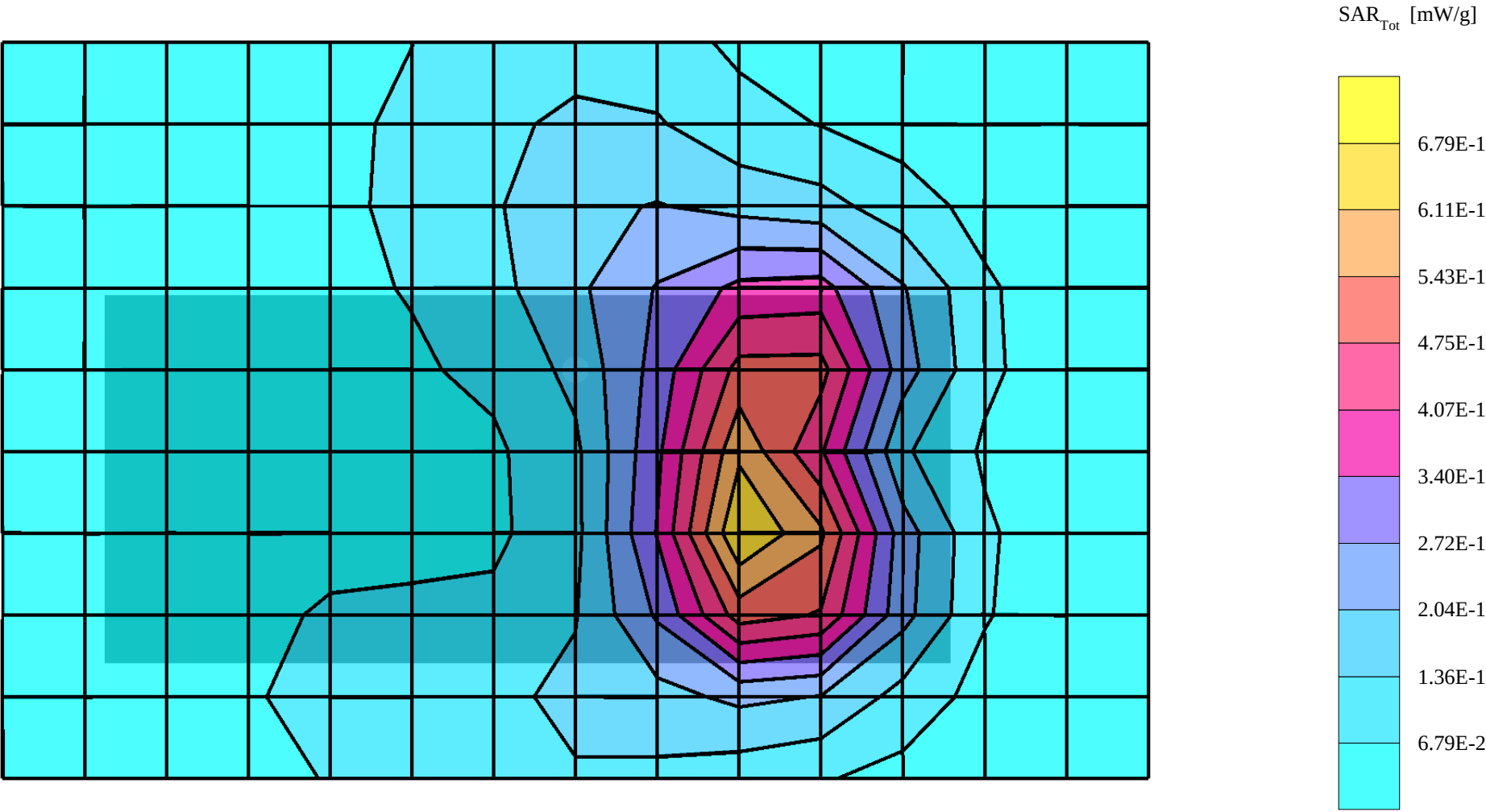
P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn, IBM 560X; Frequency: 1850 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 4.0; Muscle 1880 MHz:  $\sigma = 1.51 \text{ mho/m}$   $\epsilon_r = 51.2$   $\rho = 1.00 \text{ g/cm}^3$ ; Liquid temperature: 21.1 °C  
Cube 5x5x7: SAR (1g): 0.902 mW/g, SAR (10g): 0.542 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: 0.06 dB



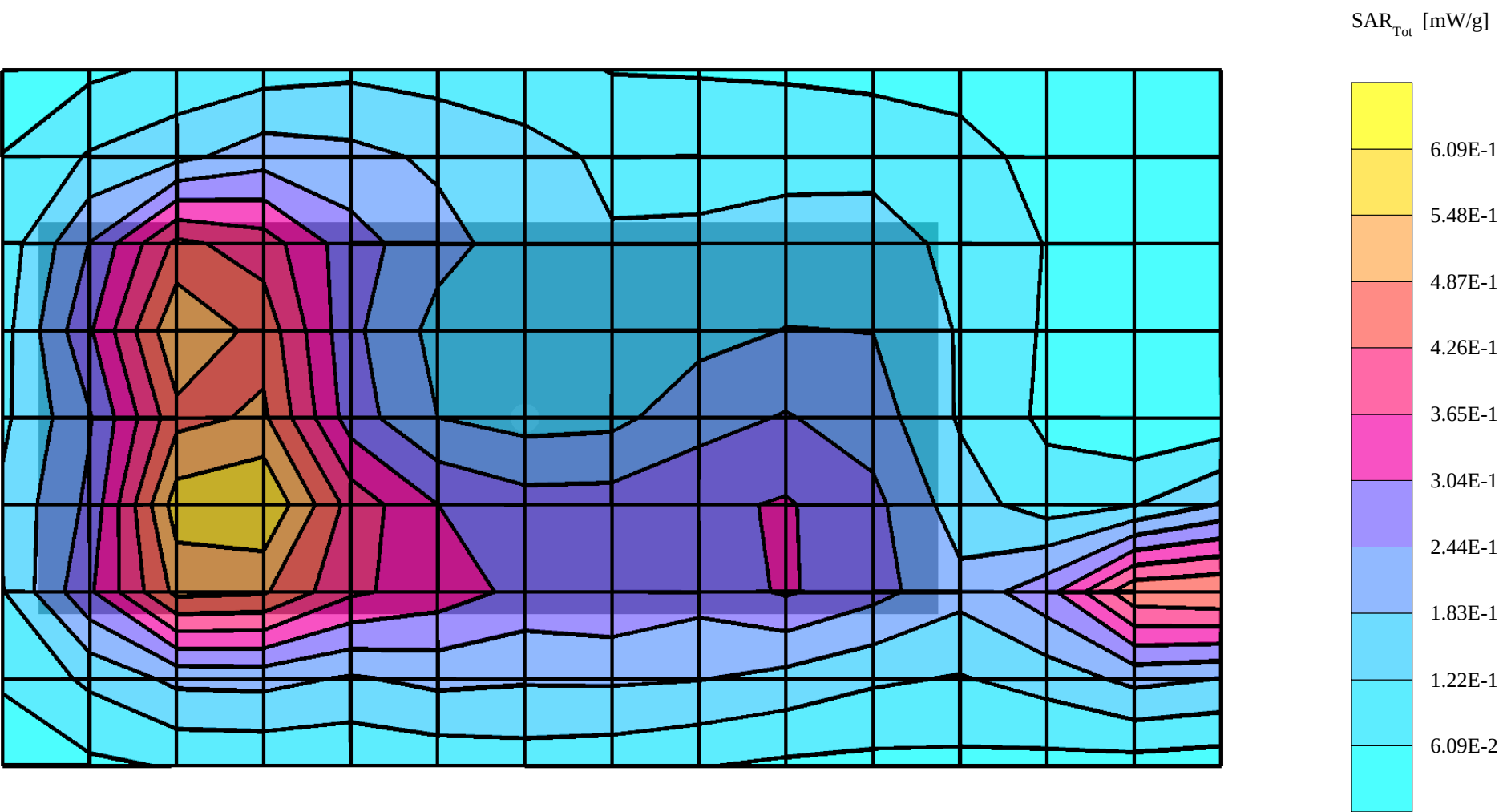
P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn, IBM 600X; Frequency: 1850 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 4.0; Muscle 1880 MHz:  $\sigma = 1.51 \text{ mho/m}$   $\epsilon_r = 51.2$   $\rho = 1.00 \text{ g/cm}^3$ ; Liquid temperature: 21.6 °C  
Cube 5x5x7: SAR (1g): 0.668 mW/g, SAR (10g): 0.366 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: -0.00 dB



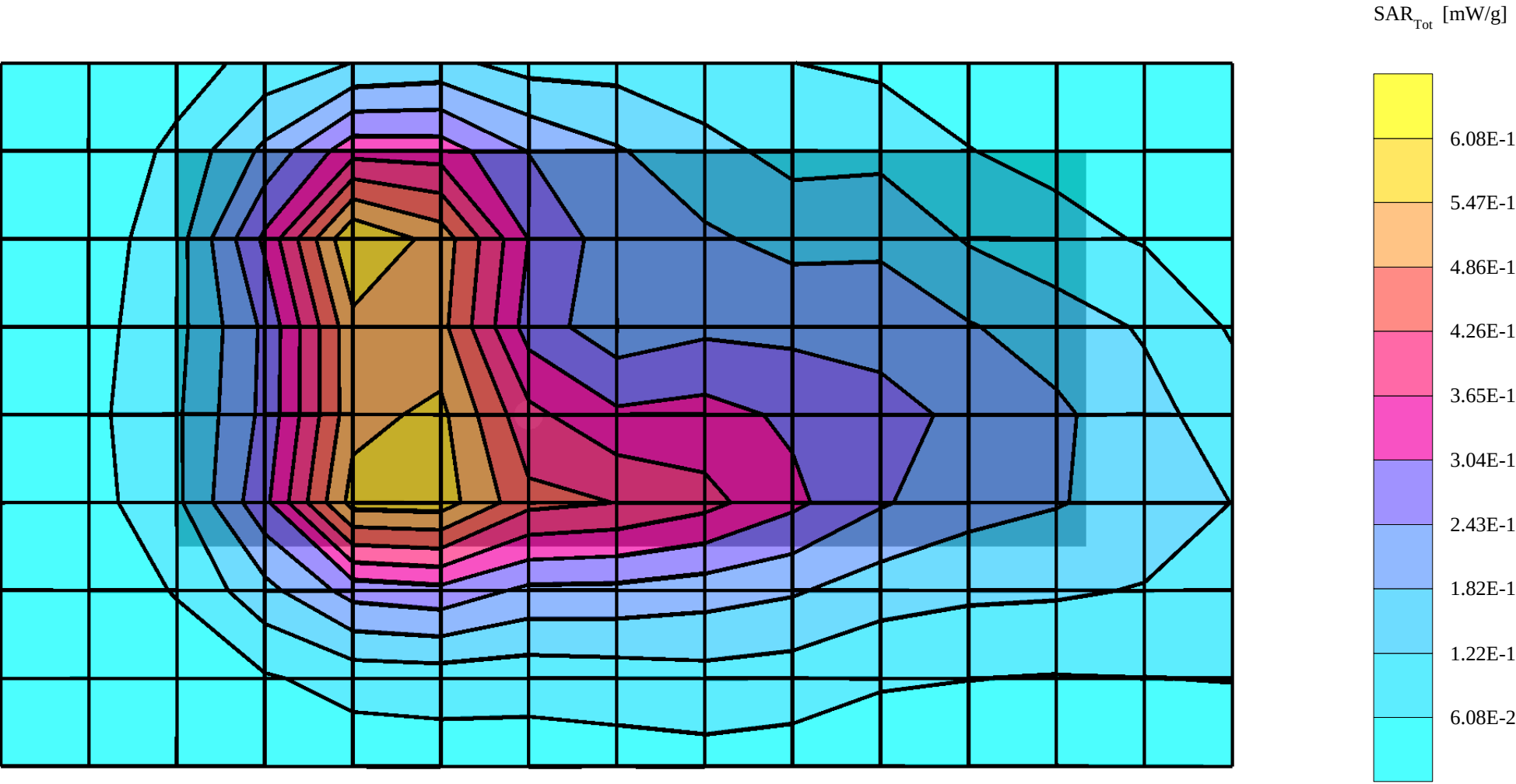
P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn, Casio; Frequency: 1850 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 4.0; Muscle 1880 MHz:  $\sigma = 1.47 \text{ mho/m}$   $\epsilon_r = 51.0$   $\rho = 1.00 \text{ g/cm}^3$ ; Liquid temperature: 22.3 °C  
Cube 5x5x7: SAR (1g): 0.611 mW/g, SAR (10g): 0.358 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: -0.06 dB



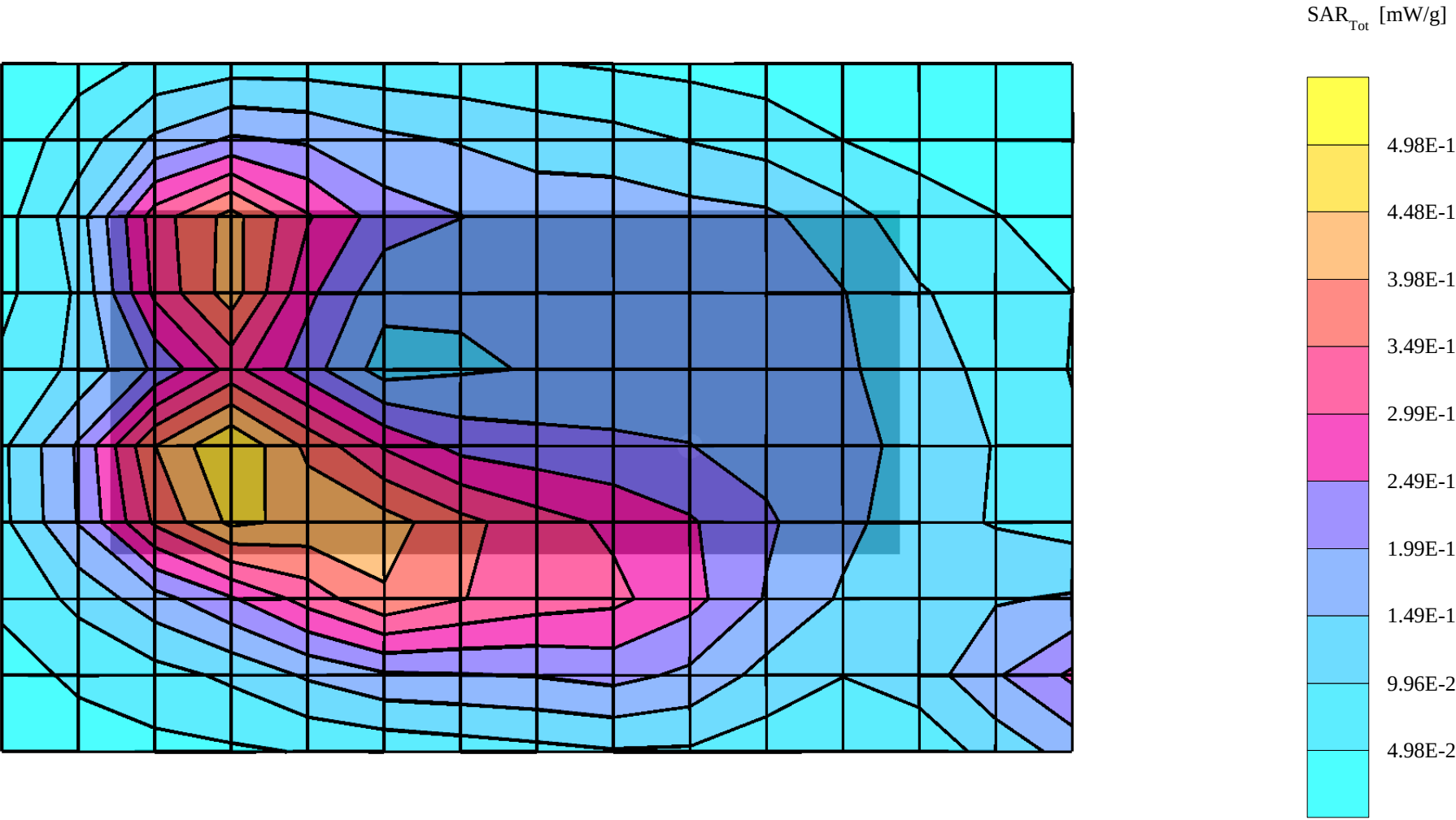
# P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn, Compaq; Frequency: 1850 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 4.0; Muscle 1880 MHz:  $\sigma = 1.47$  mho/m  $\epsilon_r = 51.0$   $\rho = 1.00$  g/cm<sup>3</sup>; Liquid temperature: 22.3 °C  
Cube 5x5x7: Upper peak SAR (1g): 0.715 mW/g, SAR (10g): 0.352 mW/g, lower peak SAR (1g): 0.622mW/g, SAR (10g): 0.363 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: 0.09 dB



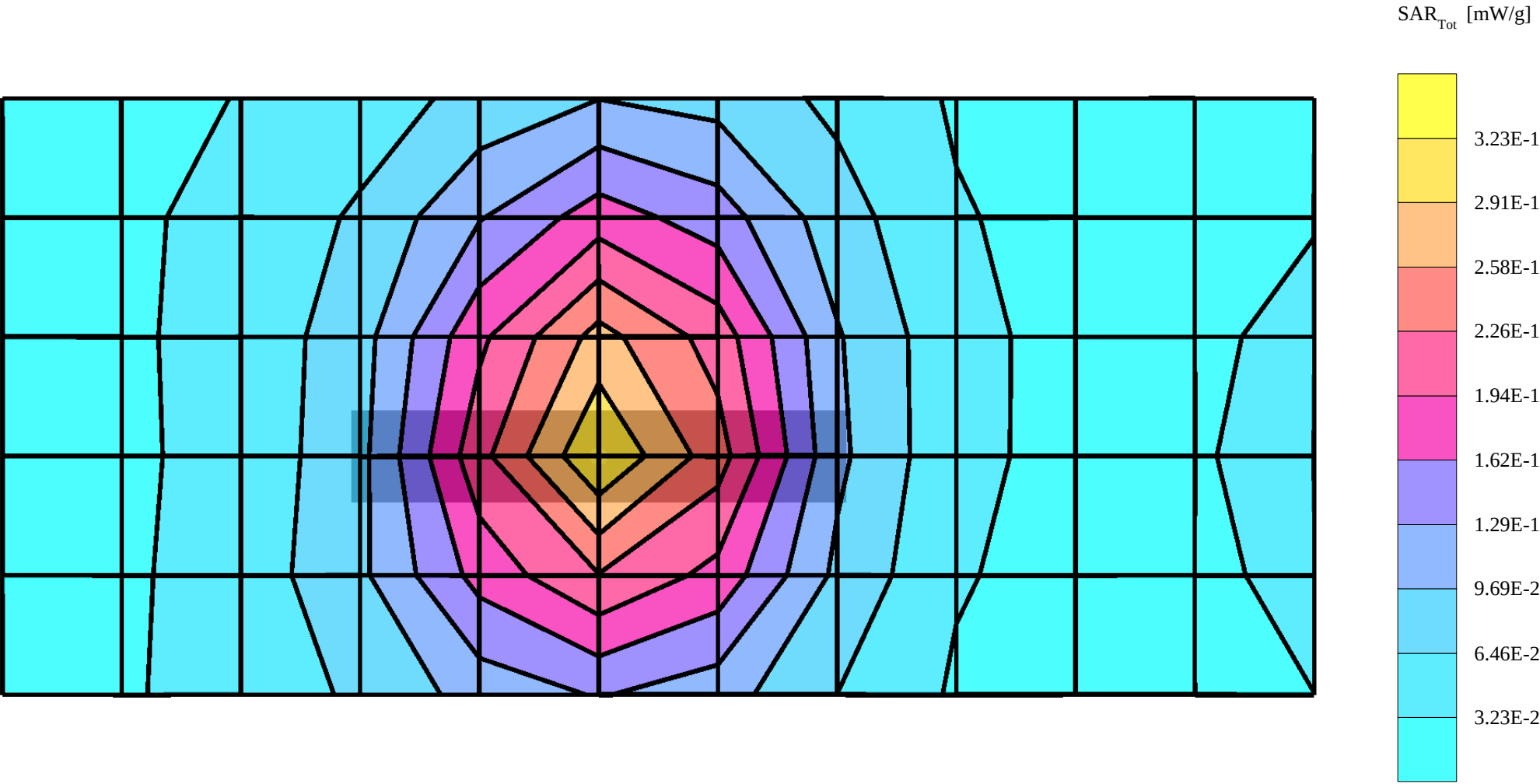
P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn, HP; Frequency: 1850 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 4.0; Muscle 1880 MHz:  $\sigma = 1.47 \text{ mho/m}$   $\epsilon_r = 51.0$   $\rho = 1.00 \text{ g/cm}^3$ ; Liquid temperature: 21.5 °C  
Cube 5x5x7: SAR (1g): 0.483 mW/g, SAR (10g): 0.290 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: 0.03 dB



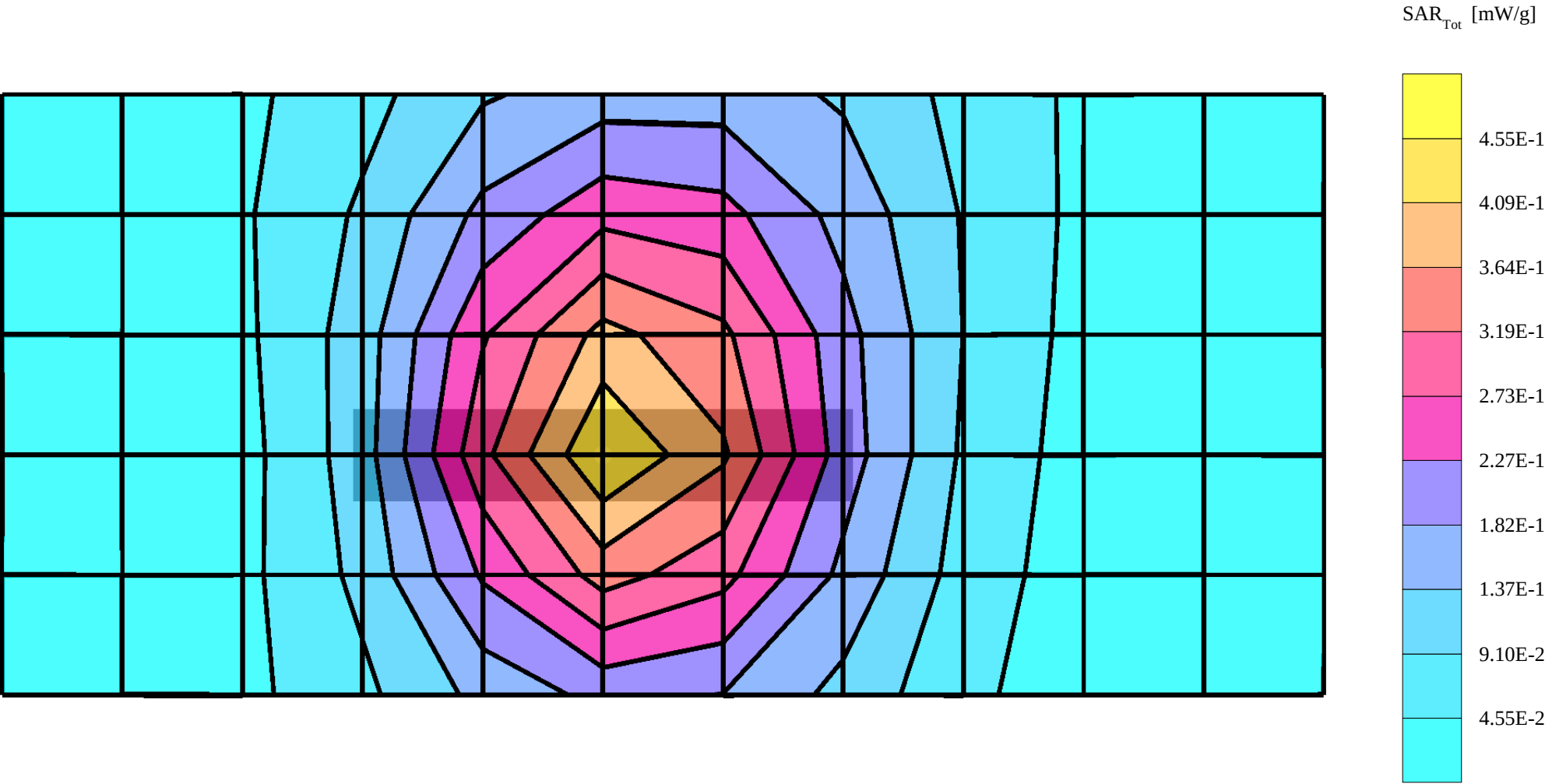
P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn, IBM T23; Frequency: 1850 MHz, GPRS  
Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 4.0; Muscle 1880 MHz:  $\sigma = 1.51$  mho/m  $\epsilon_r = 51.2$   $\rho = 1.00$  g/cm<sup>3</sup>, liquid temperature: 21.8 C  
Cube 5x5x7: SAR (1g): 0.302 mW/g, SAR (10g): 0.181 mW/g  
Coarse: Dx = 13.0, Dy = 13.0, Dz = 10.0  
Powerdrift: -0.14 dB



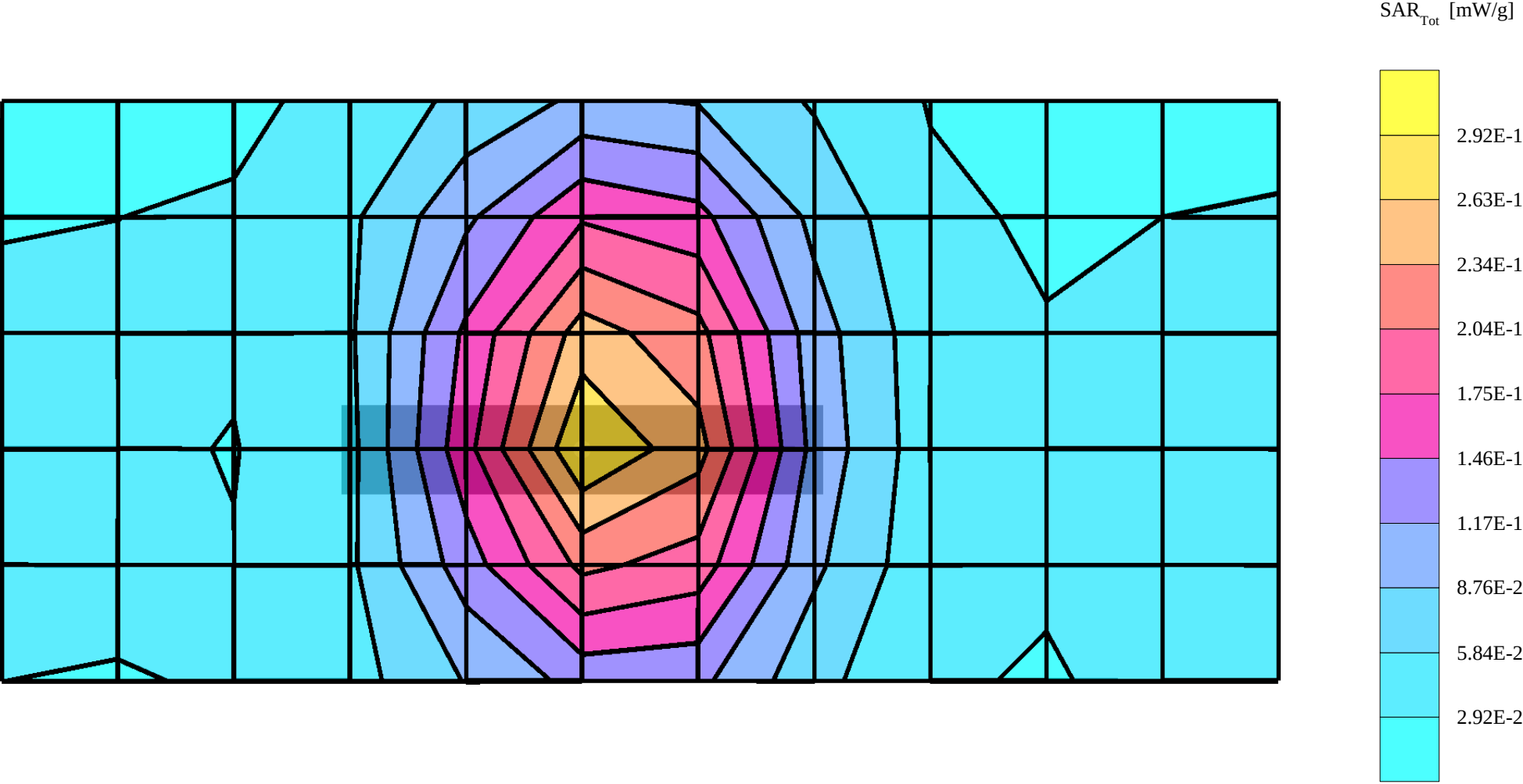
P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn, IBM 560X; Frequency: 1850 MHz, GPRS  
Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 4.0; Muscle 1880 MHz:  $\sigma = 1.51$  mho/m  $\epsilon_r = 51.3$   $\rho = 1.00$  g/cm<sup>3</sup>, liquid temperature: 21.2 C  
Cube 5x5x7: SAR (1g): 0.429 mW/g, SAR (10g): 0.259 mW/g  
Coarse: Dx = 13.0, Dy = 13.0, Dz = 10.0  
Powerdrift: -0.07 dB



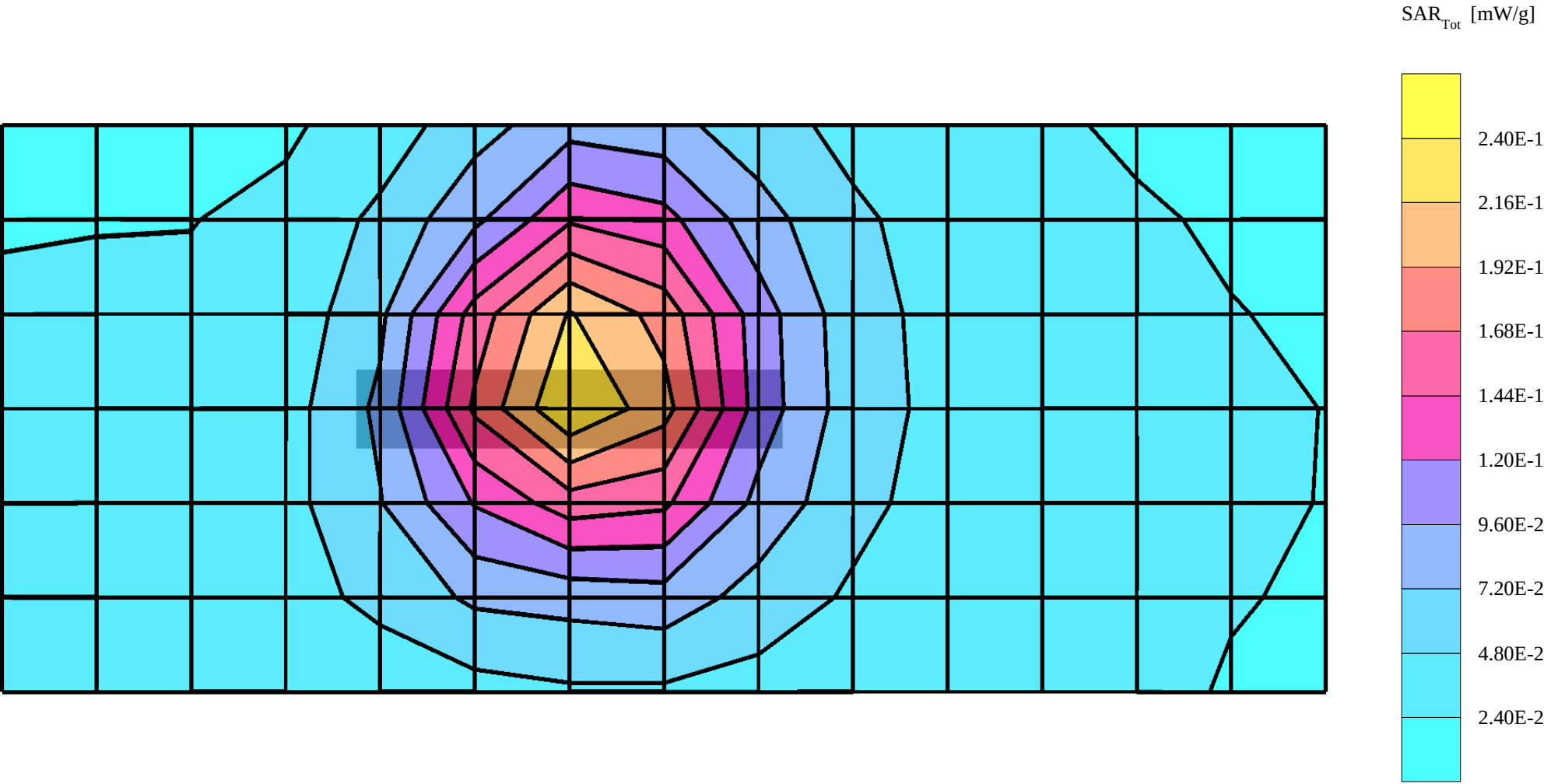
P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn, IBM 600X ; Frequency: 1850 MHz, GPRS  
Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 4.0; Muscle 1880 MHz:  $\sigma = 1.51$  mho/m  $\epsilon_r = 51.3$   $\rho = 1.00$  g/cm<sup>3</sup>, liquid temperature: 21.4 C  
Cube 5x5x7: SAR (1g): 0.279 mW/g, SAR (10g): 0.167 mW/g  
Coarse: Dx = 13.0, Dy = 13.0, Dz = 10.0  
Powerdrift: -0.02 dB



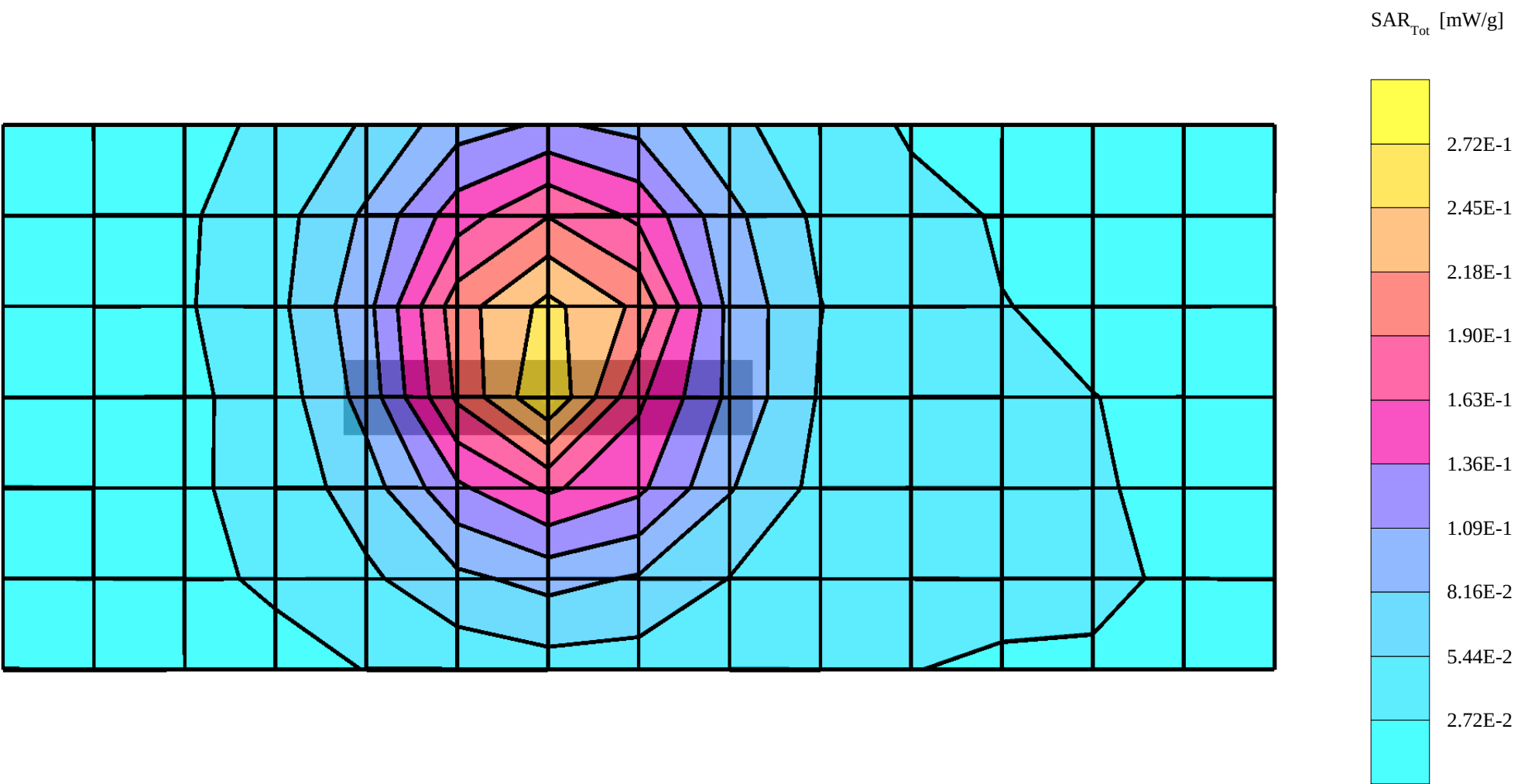
P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn, Casio; Frequency: 1910 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 4.0; Muscle 1880 MHz:  $\sigma = 1.47$  mho/m  $\epsilon_r = 51.2$   $\rho = 1.00$  g/cm<sup>3</sup>; Liquid temperature: 21.7 °C  
Cube 5x5x7: SAR (1g): 0.233 mW/g, SAR (10g): 0.136 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: -0.00 dB



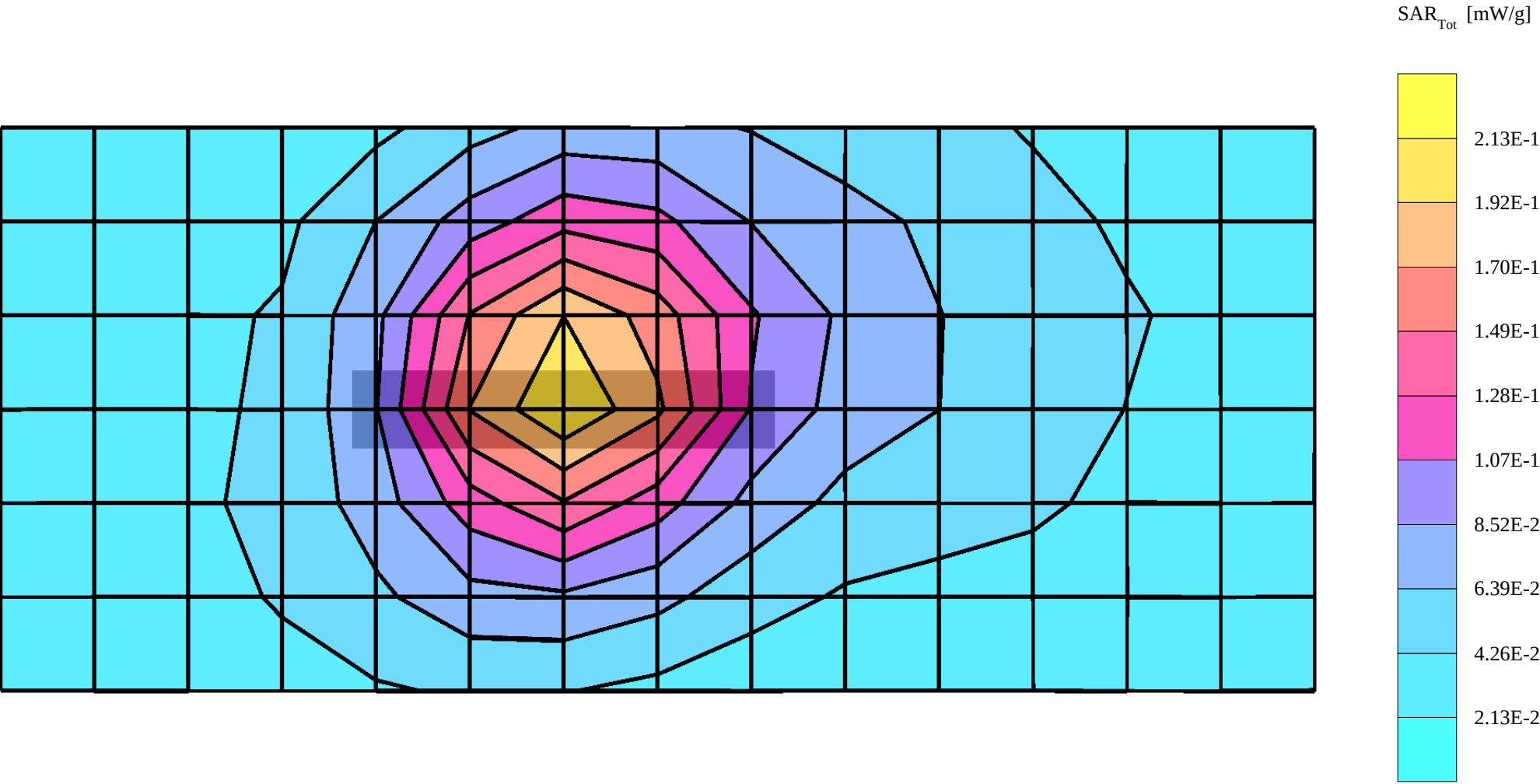
P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn, Compaq; Frequency: 1910 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 4.0; Muscle 1880 MHz:  $\sigma = 1.47$  mho/m  $\epsilon_r = 51.2$   $\rho = 1.00$  g/cm<sup>3</sup>; Liquid temperature: 21.6 °C  
Cube 5x5x7: SAR (1g): 0.260 mW/g, SAR (10g): 0.151 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: -0.04 dB



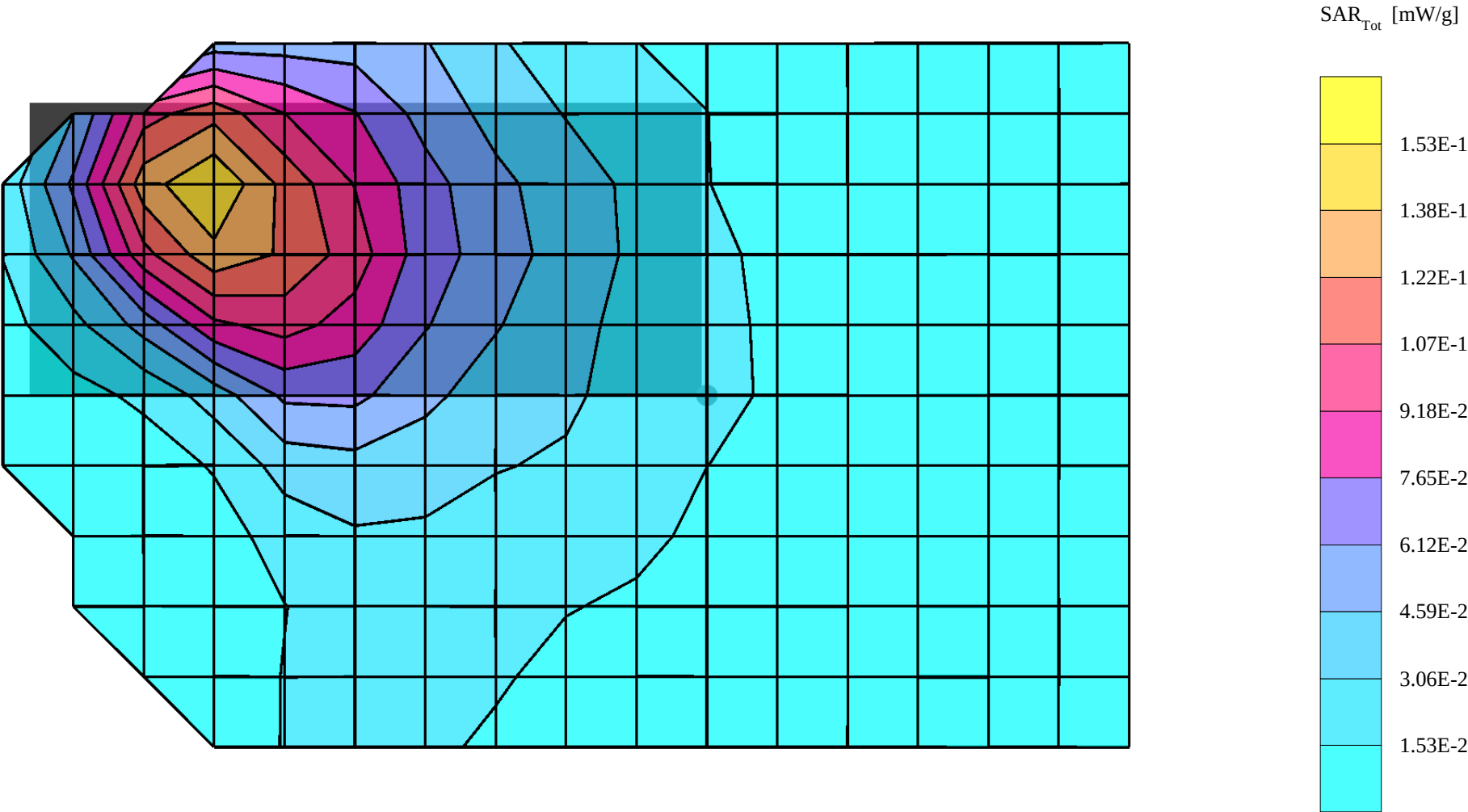
# P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn, HP; Frequency: 1880 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 4.0; Muscle 1880 MHz:  $\sigma = 1.47$  mho/m  $\epsilon_r = 51.2$   $\rho = 1.00$  g/cm<sup>3</sup>; Liquid temperature: 21.2 °C  
Cube 5x5x7: SAR (1g): 0.214 mW/g, SAR (10g): 0.124 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: 0.04 dB



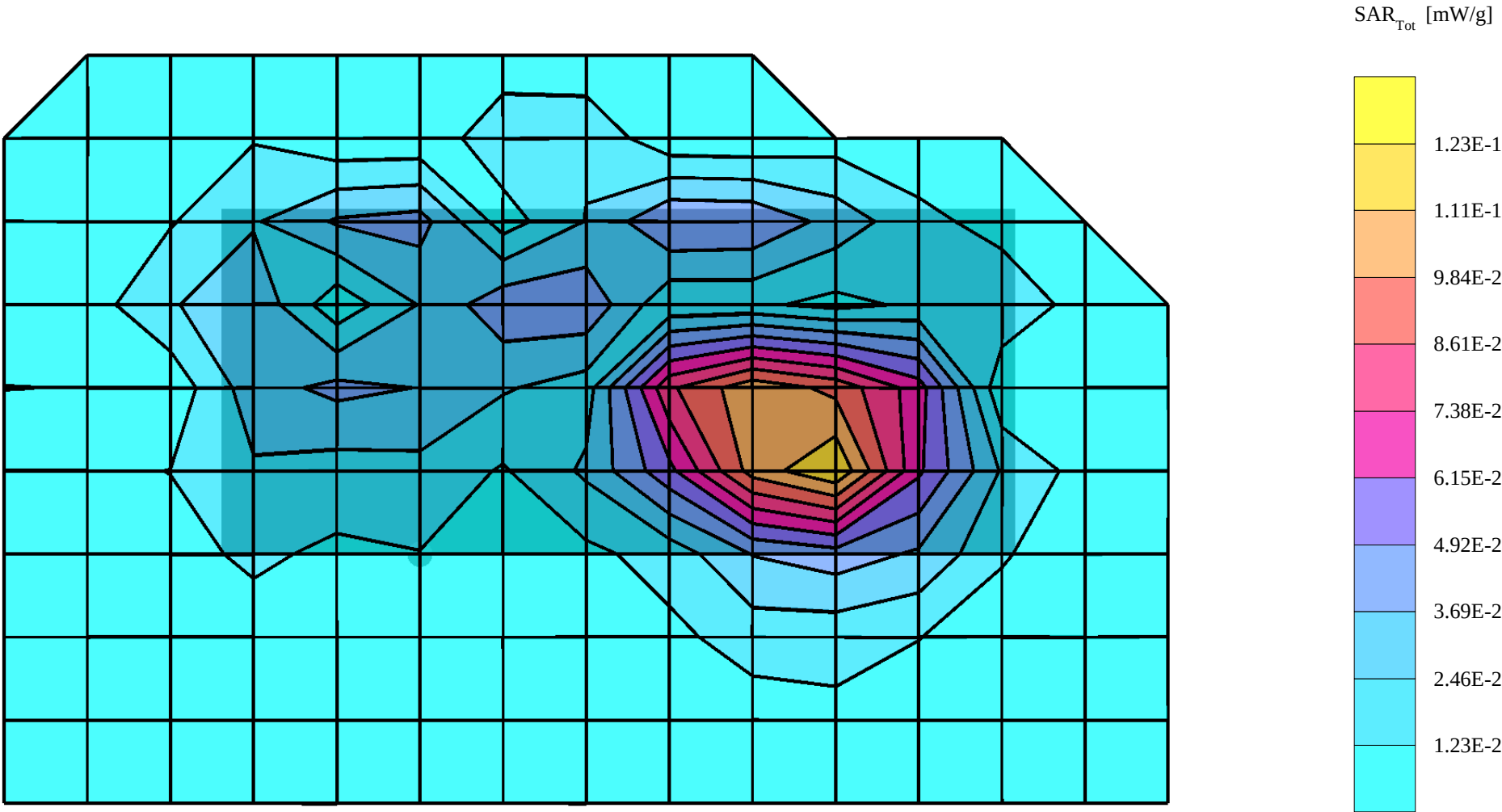
P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn, IBM T23; Frequency: 2437 MHz; WLAN  
Probe: ET3DV6 - SN1379; ConvF(4.00,4.00,4.00); Crest factor: 1.3; Muscle 2437 MHz:  $\sigma = 2.00$  mho/m  $\epsilon_r = 53.7$   $\rho = 1.00$  g/cm<sup>3</sup>; Liquid temperature: 21.5 °C  
Cube 5x5x7: SAR (1g): 0.147 mW/g, SAR (10g): 0.0827 mW/g  
Coarse: Dx = 13.0, Dy = 13.0, Dz = 10.0  
Powerdrift: 0.06 dB



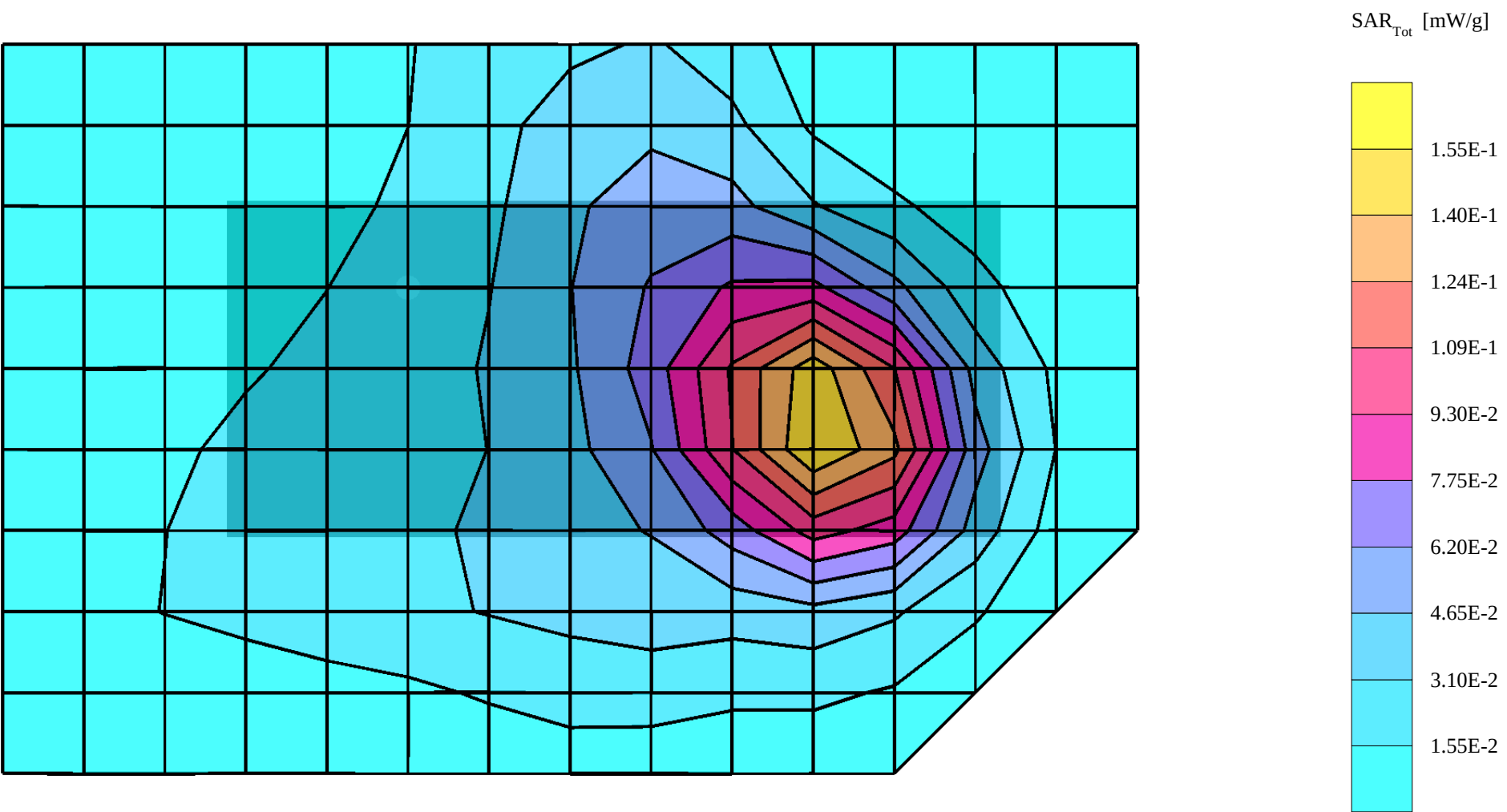
P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn IBM 560X; Frequency: 2437 MHz, WLAN  
Probe: ET3DV6 - SN1379; ConvF(4.00,4.00,4.00); Crest factor: 1.3; Muscle 2437 MHz:  $\sigma = 2.00 \text{ mho/m}$   $\epsilon_r = 53.7$   $\rho = 1.00 \text{ g/cm}^3$ , liquid temperature: 21.6 C  
Cube 5x5x7: SAR (1g): 0.125 mW/g, SAR (10g): 0.0568 mW/g  
Coarse: Dx = 13.0, Dy = 13.0, Dz = 10.0  
Powerdrift: -0.03 dB



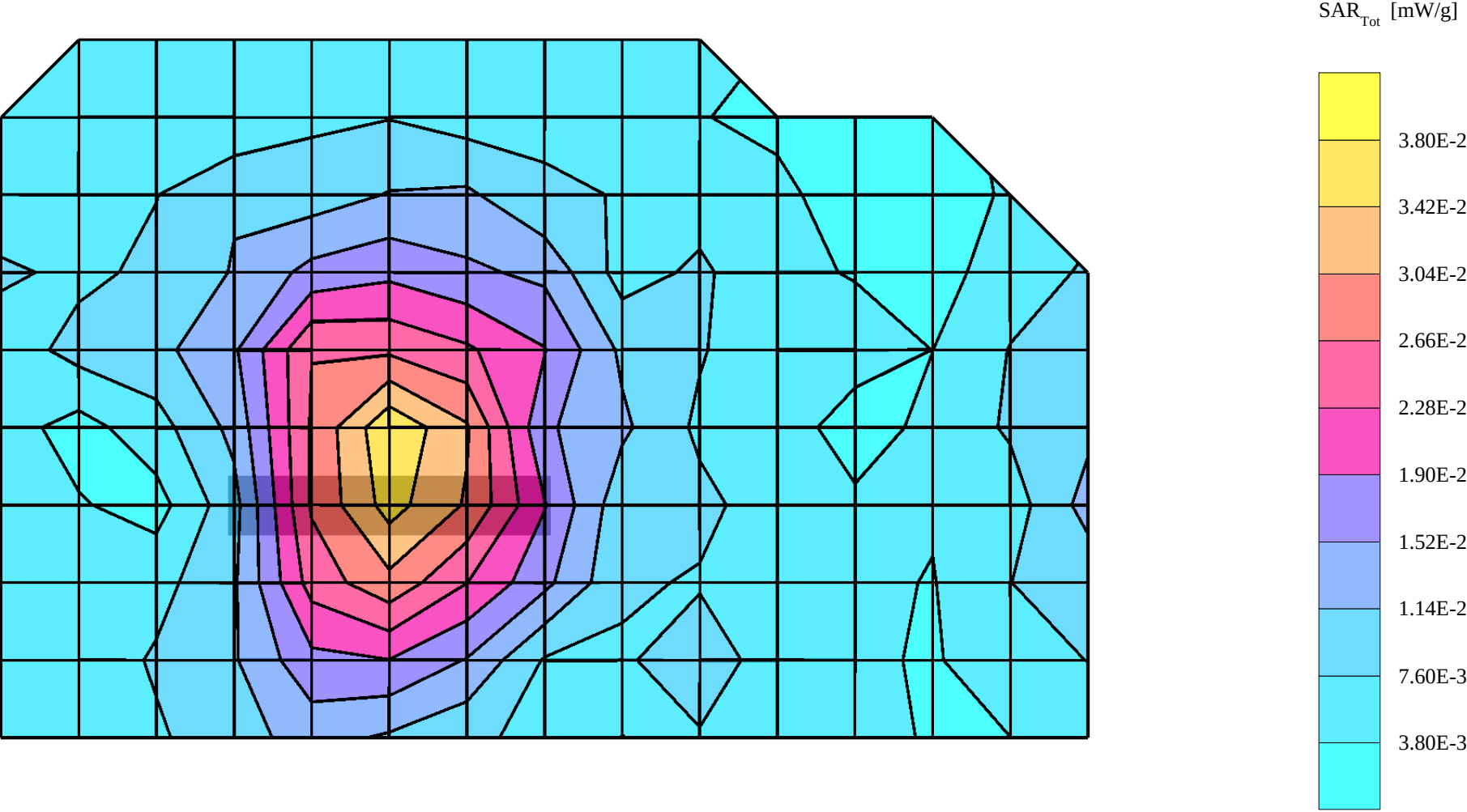
P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn, IBM 600X; Frequency: 2437 MHz, WLAN  
Probe: ET3DV6 - SN1379; ConvF(4.00,4.00,4.00); Crest factor: 1.3; Muscle 2437 MHz:  $\sigma = 2.00$  mho/m  $\epsilon_r = 53.7$   $\rho = 1.00$  g/cm<sup>3</sup>, liquid temperature: 21.5 C  
Cube 5x5x7: SAR (1g): 0.153 mW/g, SAR (10g): 0.0833 mW/g  
Coarse: Dx = 13.0, Dy = 13.0, Dz = 10.0  
Powerdrift: -0.25 dB



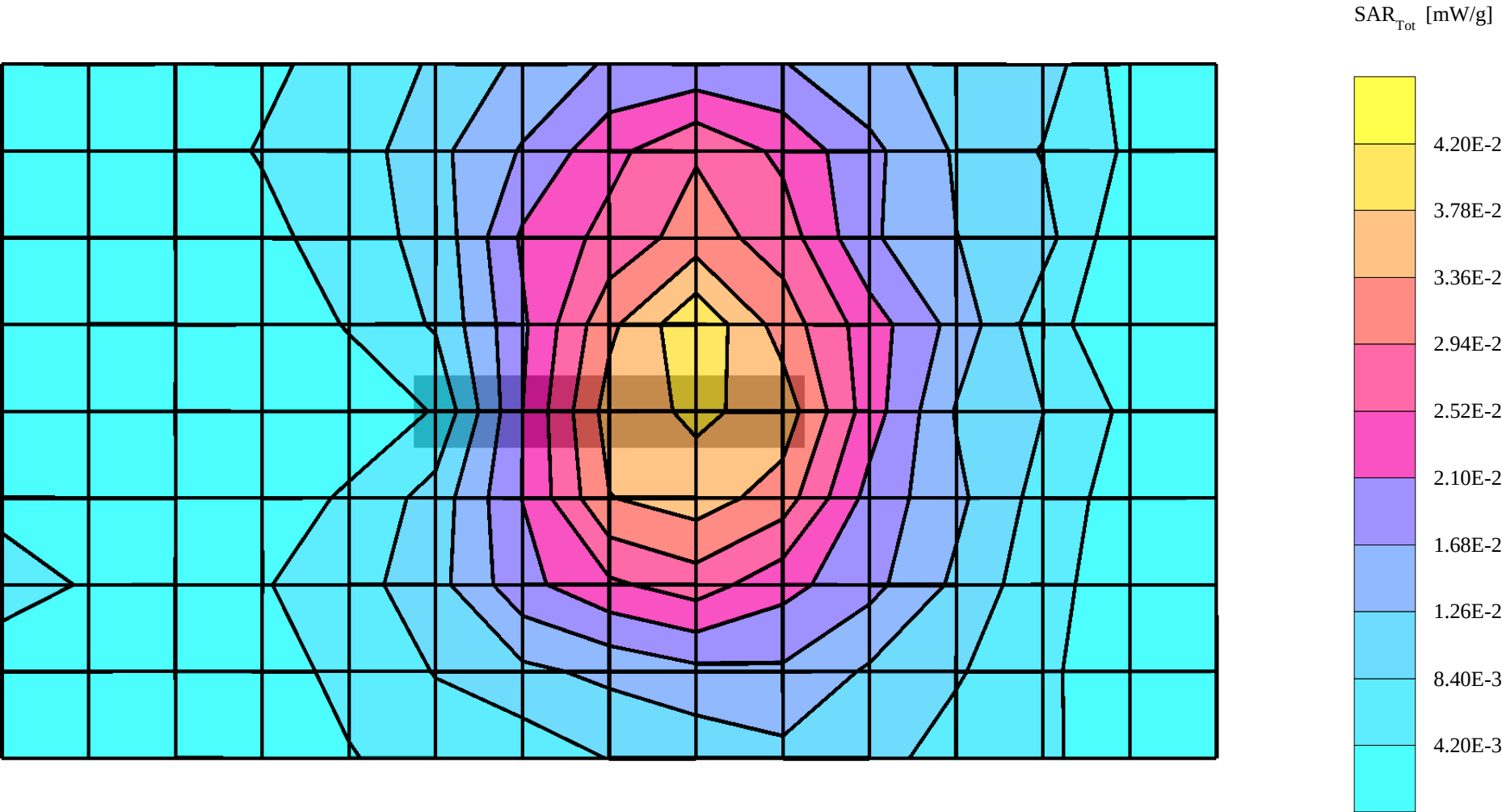
P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn, IBM T23; Frequency: 2437 MHz; WLAN  
Probe: ET3DV6 - SN1379; ConvF(4.00,4.00,4.00); Crest factor: 1.3; Muscle 2437 MHz:  $\sigma = 2.00 \text{ mho/m}$   $\epsilon_r = 53.7$   $\rho = 1.00 \text{ g/cm}^3$ ; Liquid temperature: 22.1°C  
Cube 5x5x7: SAR (1g): 0.0360 mW/g, SAR (10g): 0.0192 mW/g  
Coarse: Dx = 13.0, Dy = 13.0, Dz = 10.0  
Powerdrift: -0.15 dB



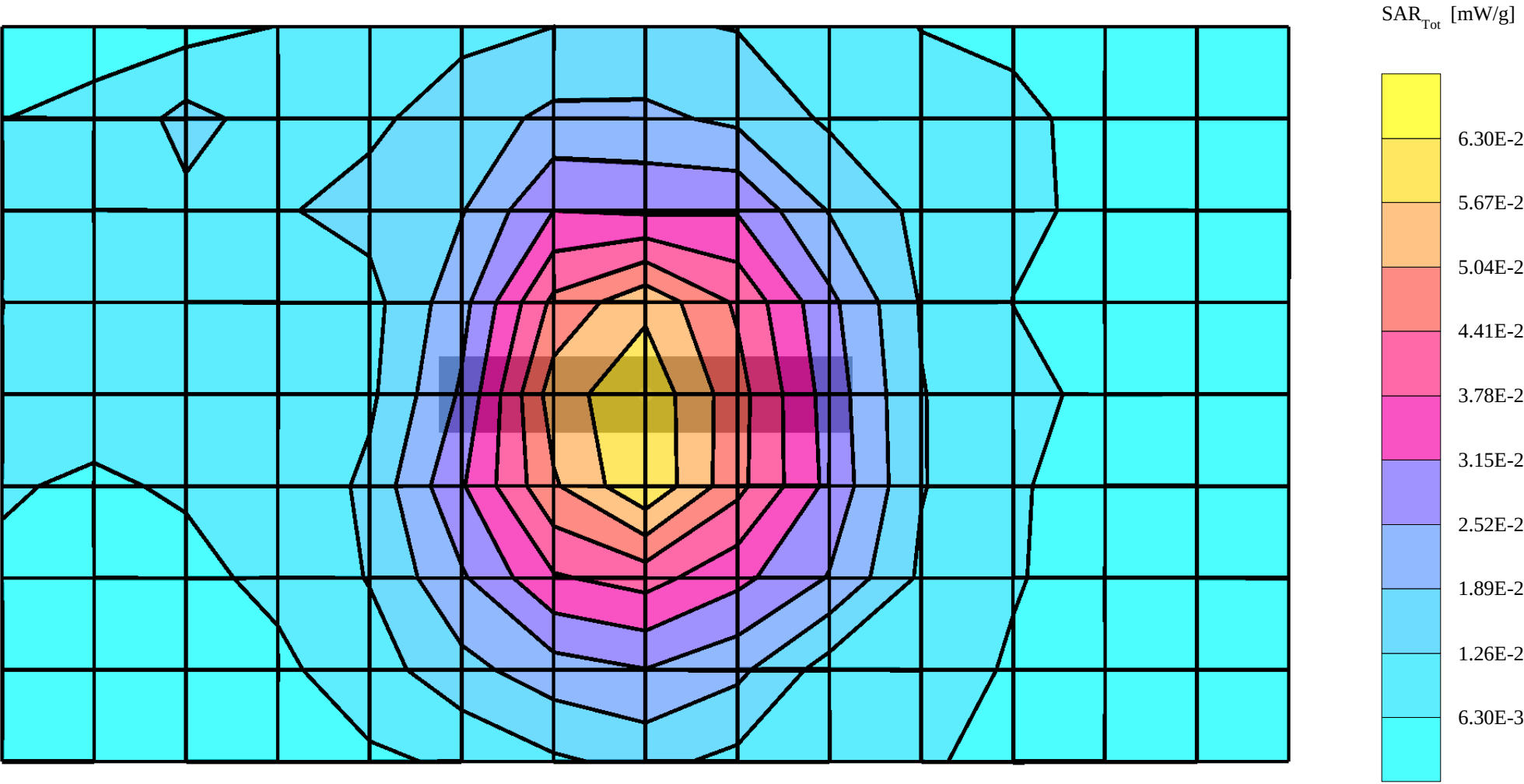
P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn, IBM 560X; Frequency: 2437 MHz; WLAN  
Probe: ET3DV6 - SN1379; ConvF(4.00,4.00,4.00); Crest factor: 1.3; Muscle 2437 MHz:  $\sigma = 2.00$  mho/m  $\epsilon_r = 53.7$   $\rho = 1.00$  g/cm<sup>3</sup>; Liquid temperature: 22.3 °C  
Cube 5x5x7: SAR (1g): 0.0335 mW/g, SAR (10g): 0.0134 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: -0.24 dB



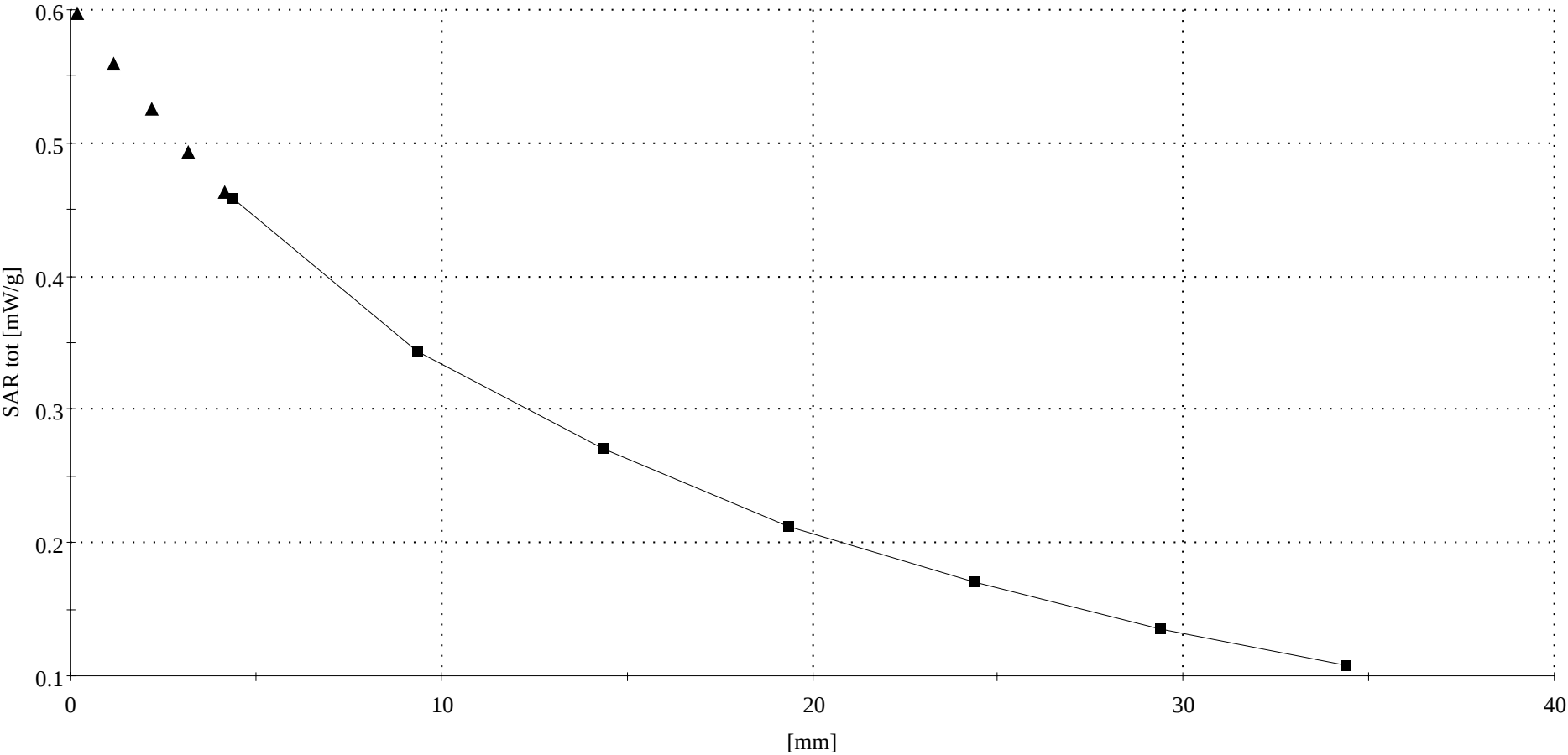
P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn, IBM 600X; Frequency: 2437 MHz; WLAN  
Probe: ET3DV6 - SN1379; ConvF(4.00,4.00,4.00); Crest factor: 1.3; Muscle 2437 MHz:  $\sigma = 2.00$  mho/m  $\epsilon_r = 53.7$   $\rho = 1.00$  g/cm<sup>3</sup>; Liquid temperature: 22.3 °C  
Cube 5x5x7: SAR (1g): 0.0654 mW/g, SAR (10g): 0.0362 mW/g  
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0  
Powerdrift: 0.26 dB



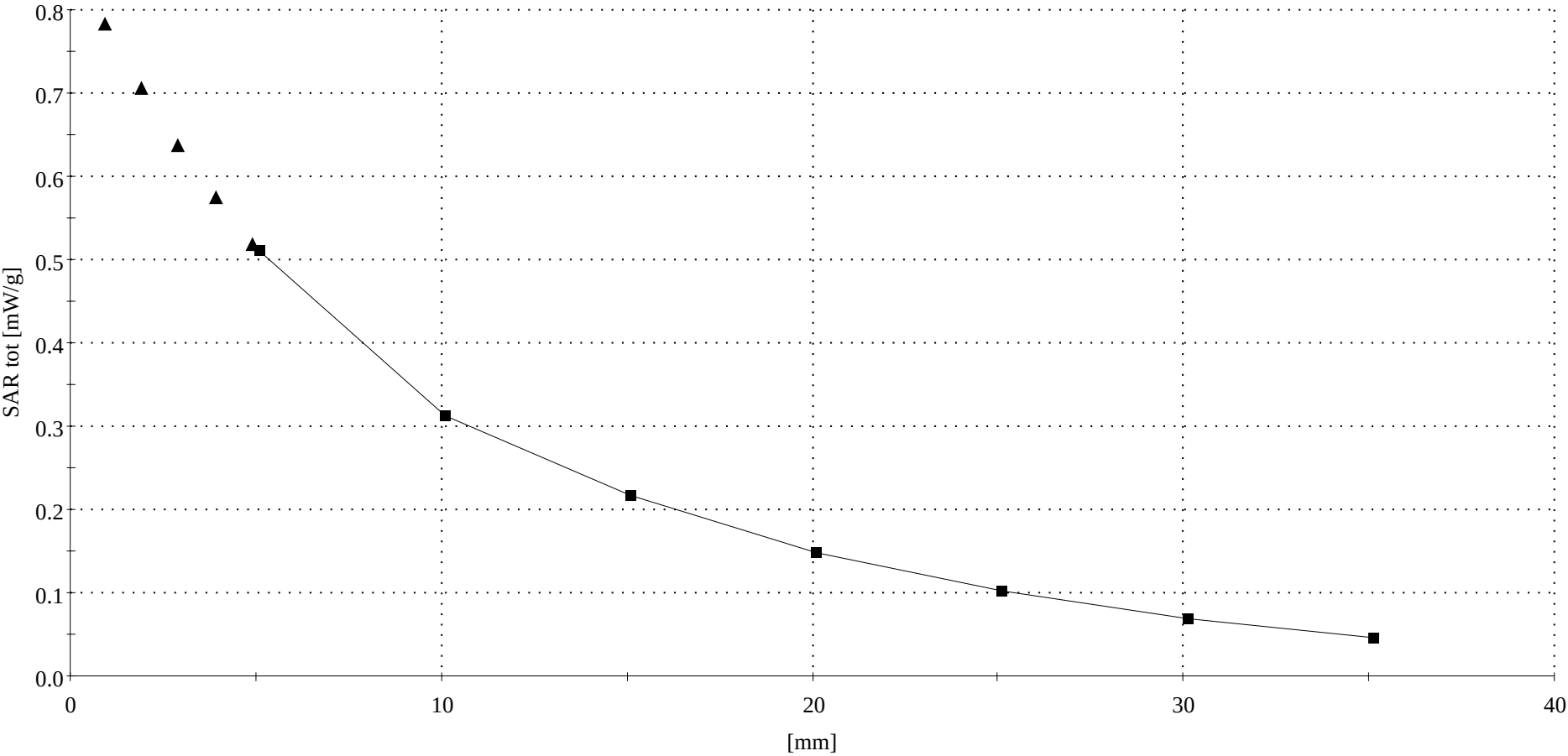
P4JDTE-3

SAM 3 Phantom; Flat Section; Position: body worn, Compaq; Frequency: 824 MHz, GPRS  
Probe: ET3DV6 - SN1379; ConvF(6.20,6.20,6.20); Crest factor: 4.0; Muscle 836 MHz:  $\sigma = 0.94$  mho/m  $\epsilon_r = 56.8$   $\rho = 1.00$  g/cm<sup>3</sup>, liquid temperature: 21.6 C  
Cube 5x5x7: SAR (1g): 0.590 mW/g, SAR (10g): 0.436 mW/g  
Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0



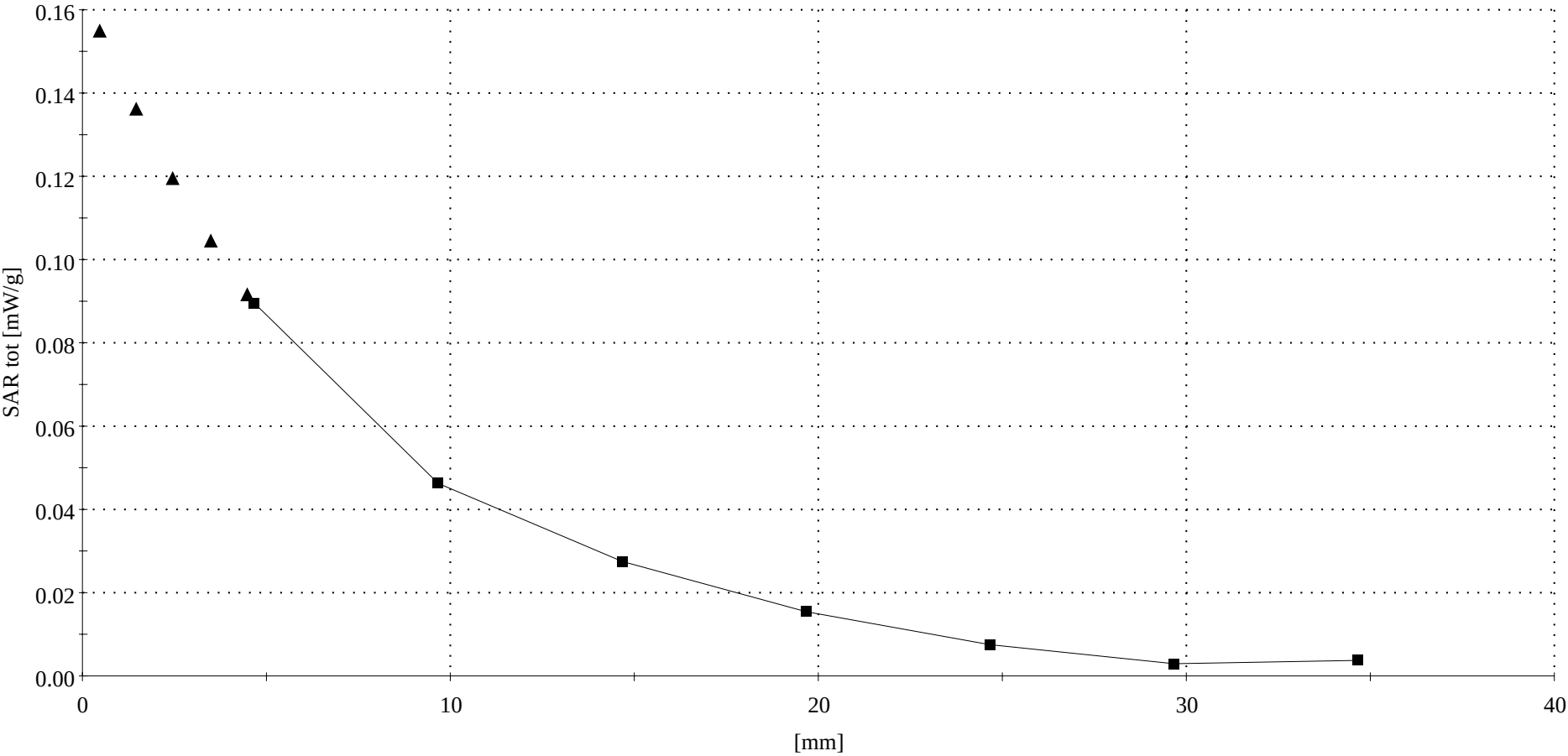
P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn, IBM560X; Frequency: 1850 MHz; GPRS  
Probe: ET3DV6 - SN1379; ConvF(4.80,4.80,4.80); Crest factor: 4.0; Muscle 1880 MHz:  $\sigma = 1.51 \text{ mho/m}$   $\epsilon_r = 51.2$   $\rho = 1.00 \text{ g/cm}^3$ ; Liquid temperature: 21.1 °C  
Cube 5x5x7: SAR (1g): 0.902 mW/g, SAR (10g): 0.542 mW/g  
Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0



P4JDTE-3

SAM 1 Phantom; Flat Section; Position: body worn, IBM 600X; Frequency: 2437 MHz, WLAN  
Probe: ET3DV6 - SN1379; ConvF(4.00,4.00,4.00); Crest factor: 1.3; Muscle 2437 MHz:  $\sigma = 2.00 \text{ mho/m}$   $\epsilon_r = 53.7$   $\rho = 1.00 \text{ g/cm}^3$ , liquid temperature: 21.5 C  
Cube 5x5x7: SAR (1g): 0.153 mW/g, SAR (10g): 0.0833 mW/g  
Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0



APPENDIX C.

Calibration Certificate(s)

530065

# 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**

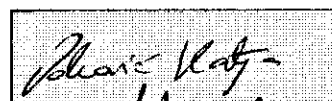
Calibration Interval:

**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 | <b>1.74</b> $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormY | <b>1.72</b> $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormZ | <b>1.75</b> $\mu\text{V}/(\text{V}/\text{m})^2$ |

### Diode Compression

|       |           |    |
|-------|-----------|----|
| DCP X | <b>95</b> | mV |
| DCP Y | <b>95</b> | mV |
| DCP Z | <b>95</b> | mV |

### Sensitivity in Tissue Simulating Liquid

**Head**                      **900 MHz**                       $\epsilon_r = 41.5 \pm 5\%$                        $s = 0.97 \pm 5\% \text{ mho/m}$

|         |                              |                   |
|---------|------------------------------|-------------------|
| ConvF X | <b>6.5</b> $\pm 8.9\%$ (k=2) | Boundary effect:  |
| ConvF Y | <b>6.5</b> $\pm 8.9\%$ (k=2) | Alpha <b>0.45</b> |
| ConvF Z | <b>6.5</b> $\pm 8.9\%$ (k=2) | Depth <b>2.34</b> |

**Head**                      **1800 MHz**                       $\epsilon_r = 40.0 \pm 5\%$                        $s = 1.40 \pm 5\% \text{ mho/m}$

|         |                              |                   |
|---------|------------------------------|-------------------|
| ConvF X | <b>5.4</b> $\pm 8.9\%$ (k=2) | Boundary effect:  |
| ConvF Y | <b>5.4</b> $\pm 8.9\%$ (k=2) | Alpha <b>0.62</b> |
| ConvF Z | <b>5.4</b> $\pm 8.9\%$ (k=2) | Depth <b>2.15</b> |

### Boundary Effect

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

|                                                    |             |             |
|----------------------------------------------------|-------------|-------------|
| Probe Tip to Boundary                              | <b>1 mm</b> | <b>2 mm</b> |
| SAR <sub>be</sub> [%] Without Correction Algorithm | 10.6        | 5.8         |
| SAR <sub>be</sub> [%] With Correction Algorithm    | 0.3         | 0.6         |

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

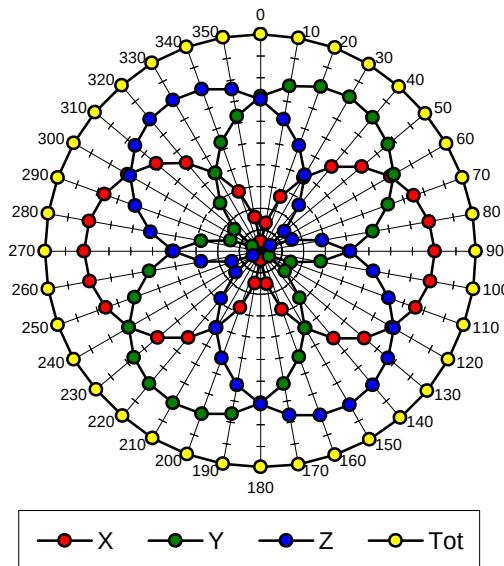
|                                                    |             |             |
|----------------------------------------------------|-------------|-------------|
| Probe Tip to Boundary                              | <b>1 mm</b> | <b>2 mm</b> |
| SAR <sub>be</sub> [%] Without Correction Algorithm | 12.3        | 7.6         |
| SAR <sub>be</sub> [%] With Correction Algorithm    | 0.1         | 0.2         |

### Sensor Offset

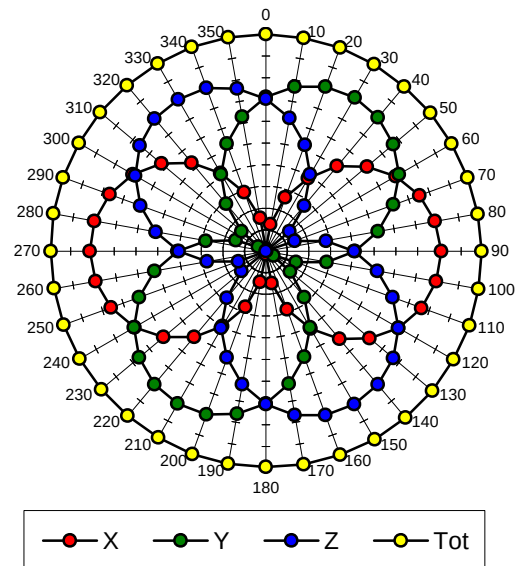
|                            |                                 |    |
|----------------------------|---------------------------------|----|
| Probe Tip to Sensor Center | <b>2.7</b>                      | mm |
| Optical Surface Detection  | <b>1.5 <math>\pm</math> 0.2</b> | mm |

## Receiving Pattern ( f ), $q = 0^\circ$

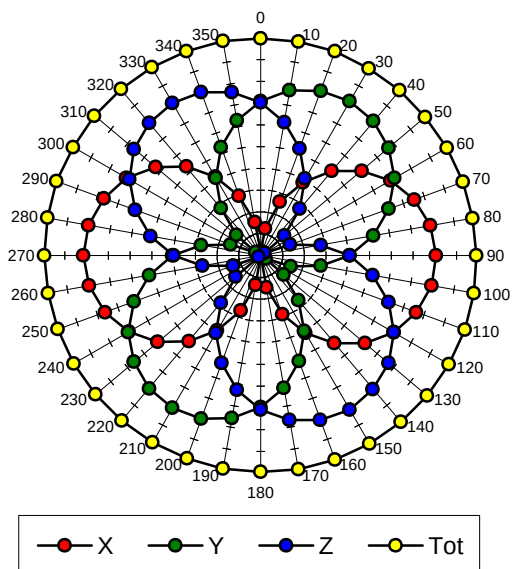
**f = 30 MHz, TEM cell ifi110**



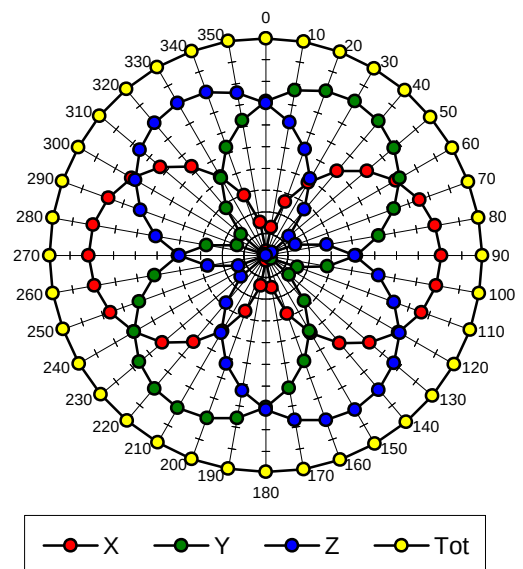
**f = 100 MHz, TEM cell ifi110**

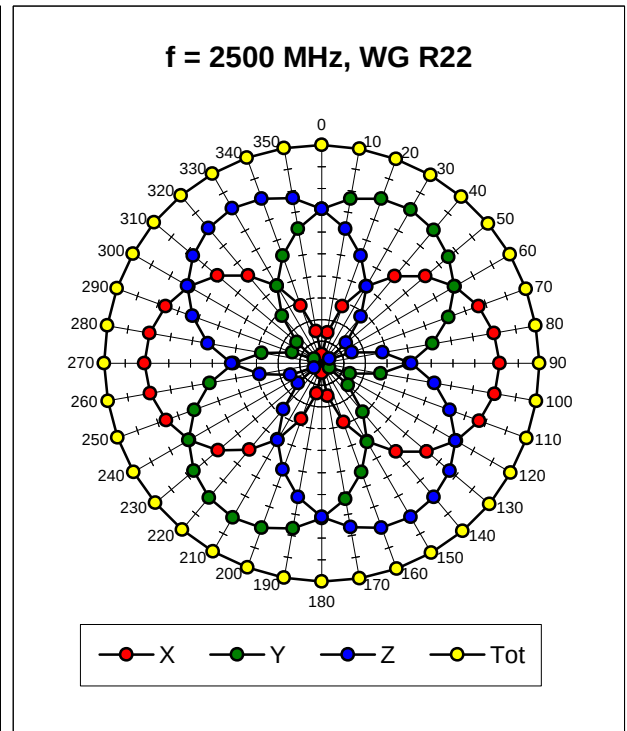
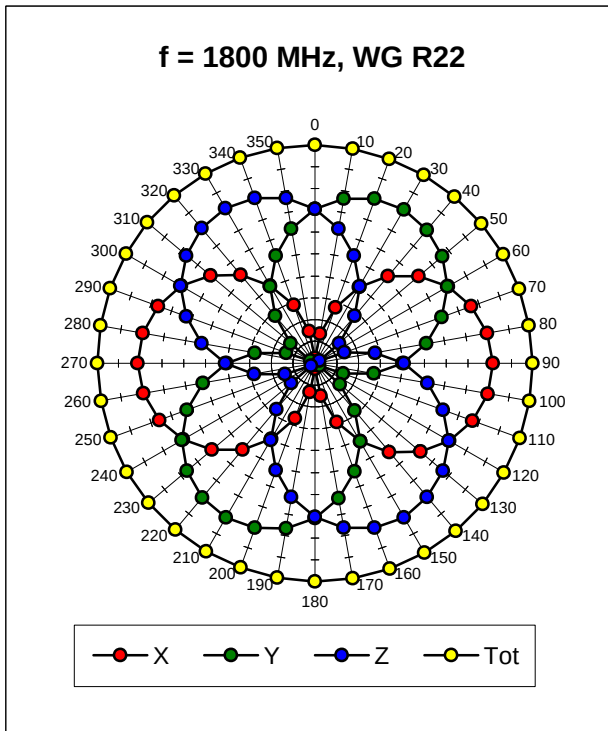


**f = 300 MHz, TEM cell ifi110**

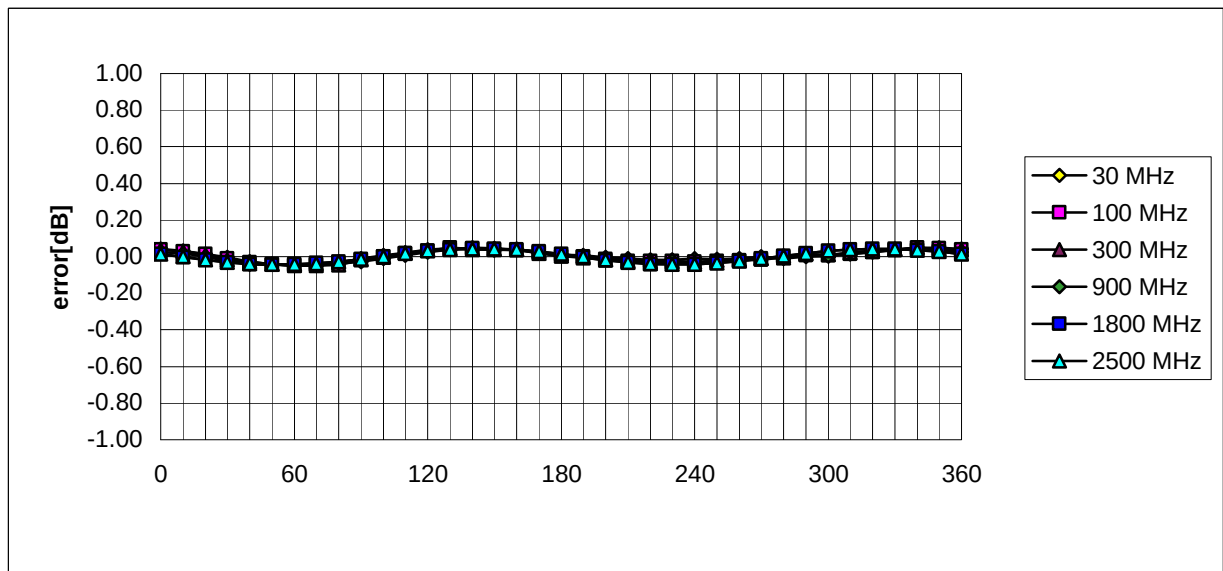


**f = 900 MHz, TEM cell ifi110**



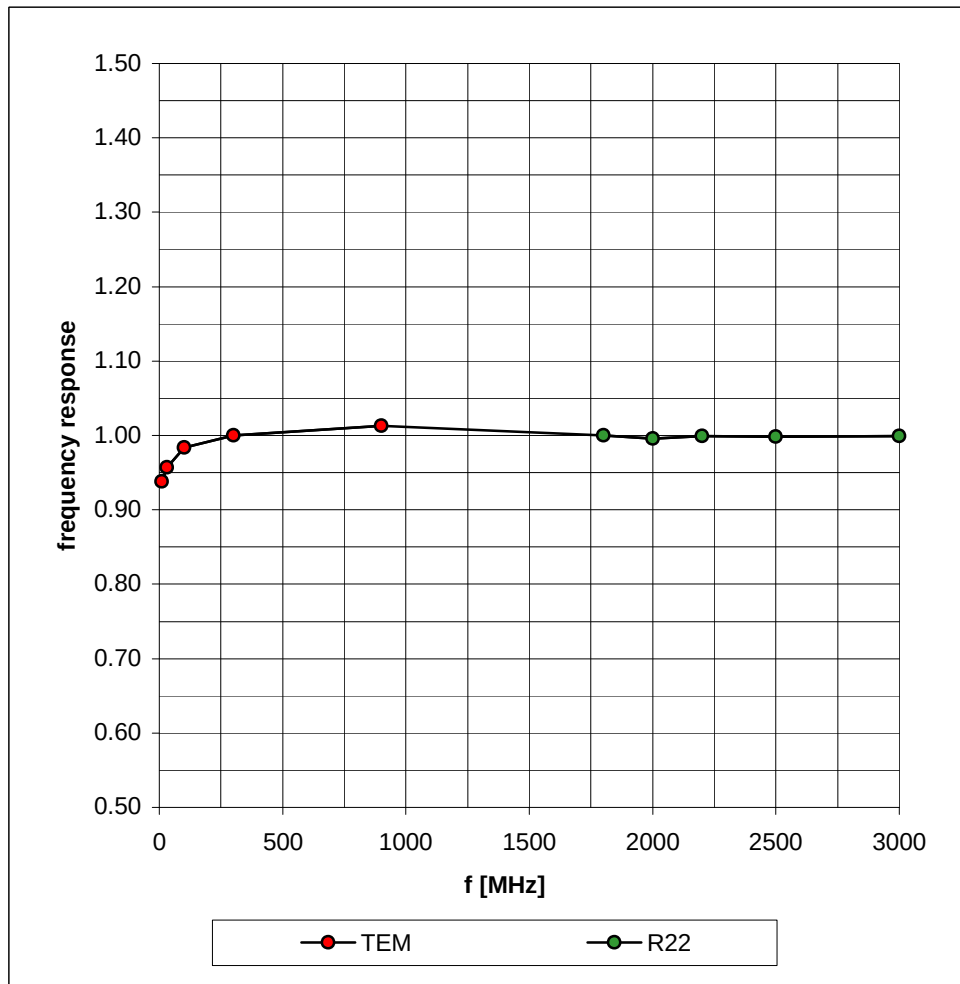


### Isotropy Error ( f), $q = 0^\circ$

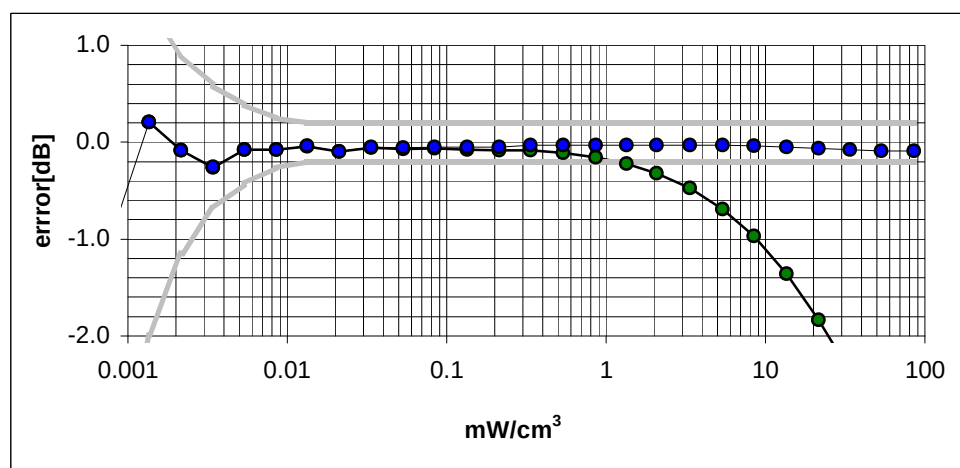
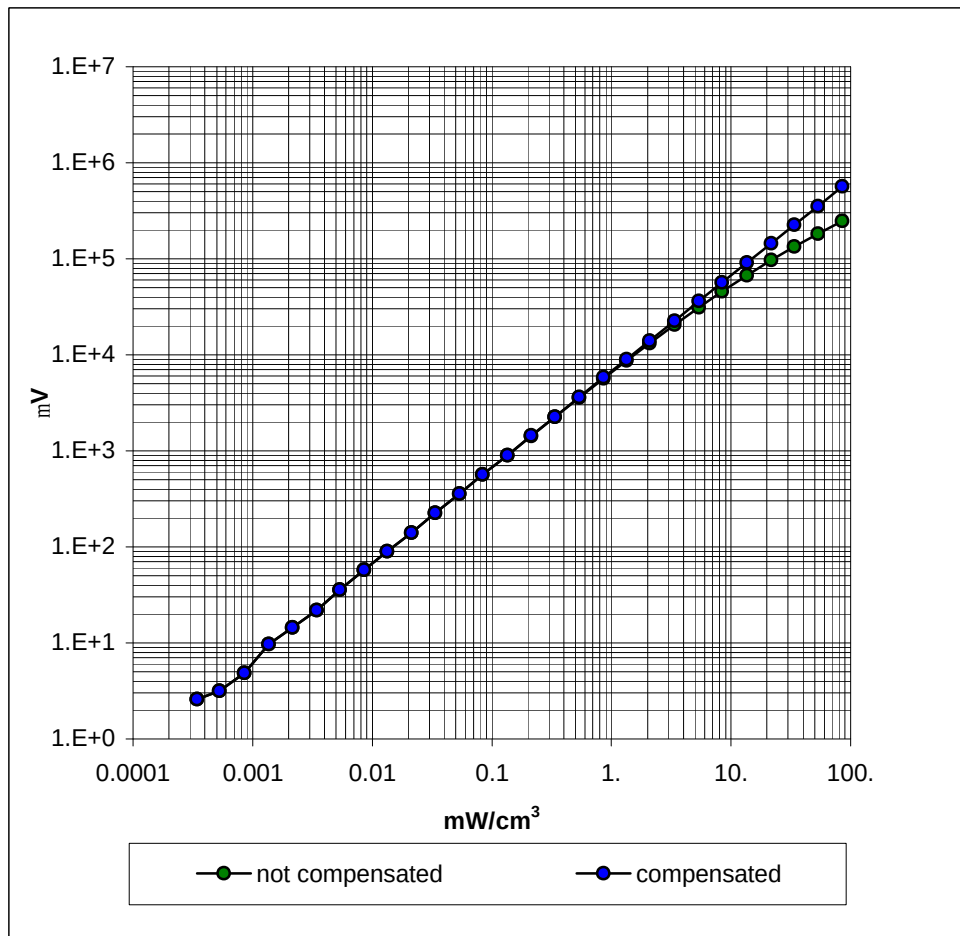


## Frequency Response of E-Field

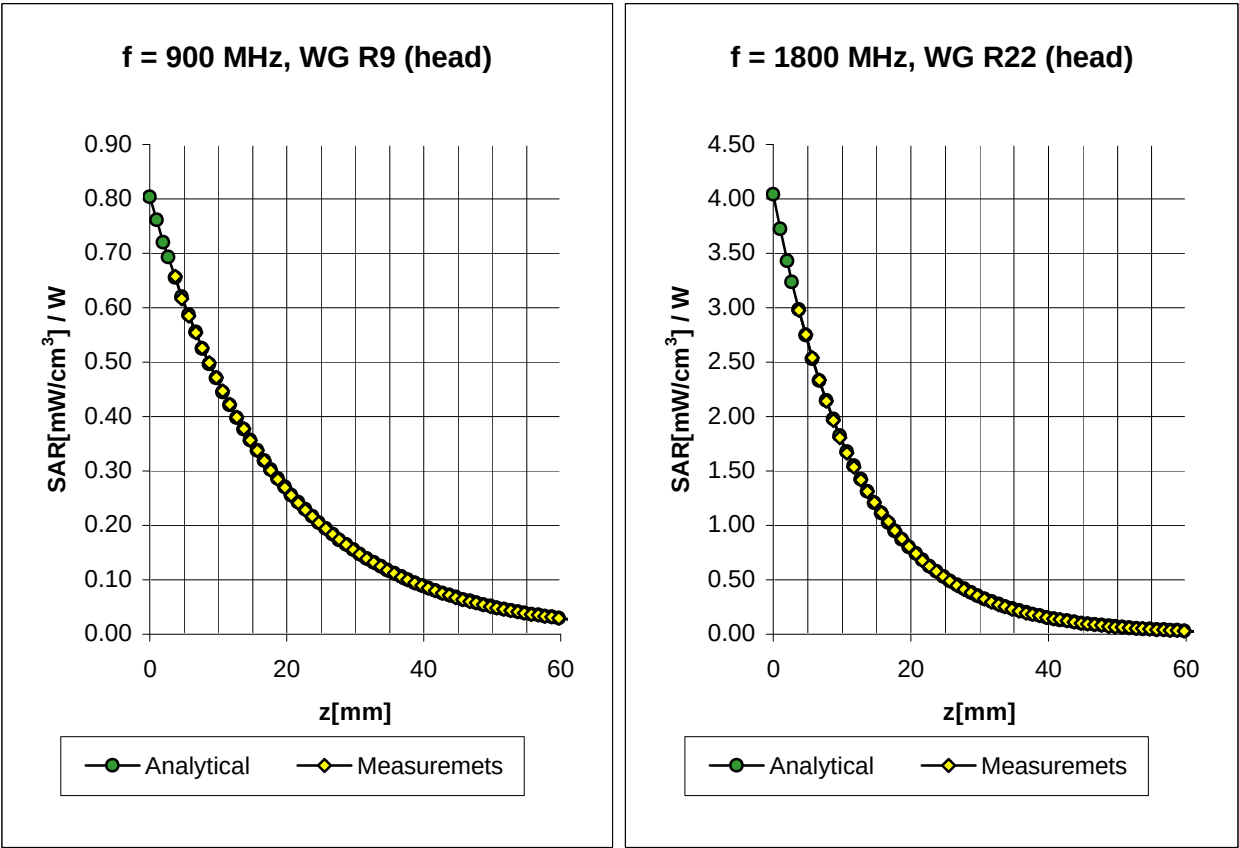
( TEM-Cell:ifi110, Waveguide R22)



## Dynamic Range f(SAR<sub>brain</sub>) ( Waveguide R22 )



# Conversion Factor Assessment



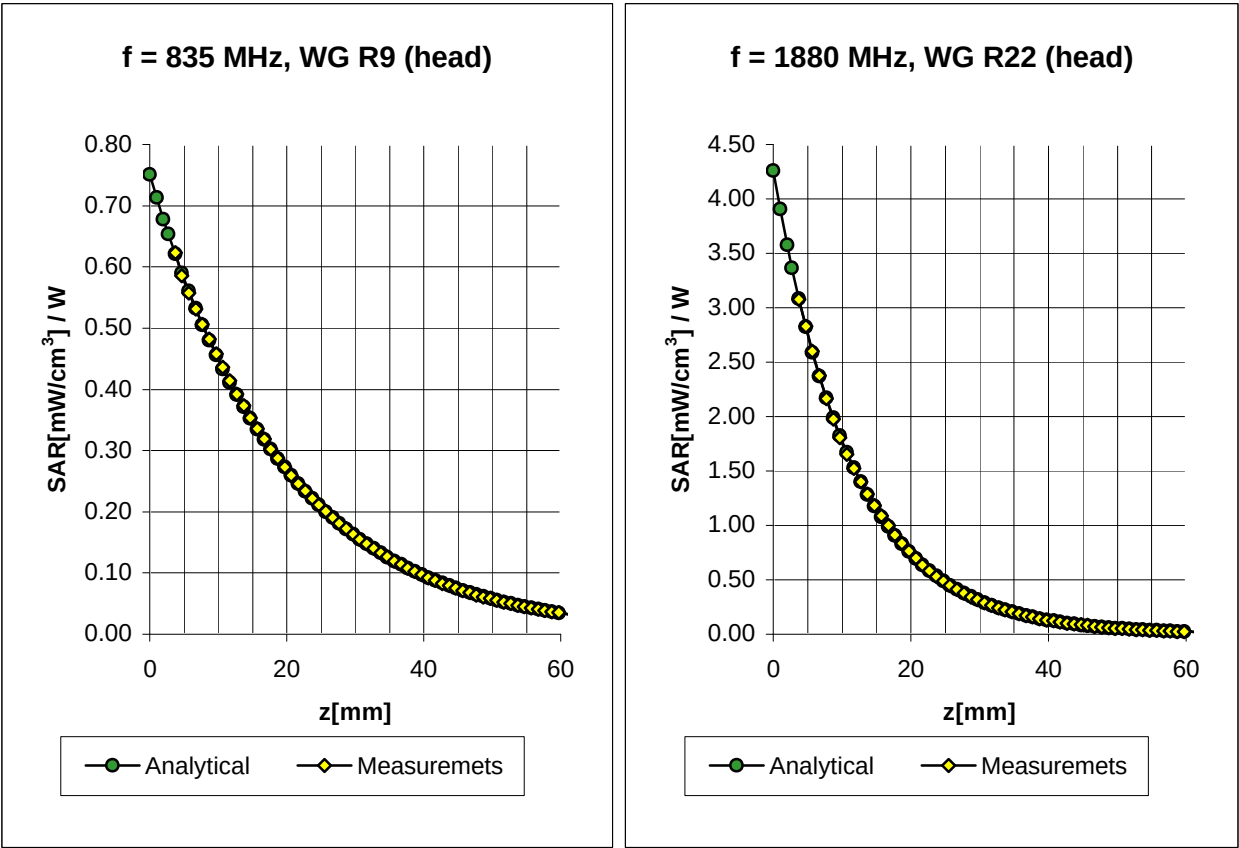
|         |                       |                             |                                  |
|---------|-----------------------|-----------------------------|----------------------------------|
| Head    | 900 MHz               | $\epsilon_r = 41.5 \pm 5\%$ | $s = 0.97 \pm 5\% \text{ mho/m}$ |
| ConvF X | 6.5 $\pm 8.9\%$ (k=2) | Boundary effect:            |                                  |
| ConvF Y | 6.5 $\pm 8.9\%$ (k=2) | Alpha                       | 0.45                             |
| ConvF Z | 6.5 $\pm 8.9\%$ (k=2) | Depth                       | 2.34                             |

|         |                       |                             |                                  |
|---------|-----------------------|-----------------------------|----------------------------------|
| Head    | 1800 MHz              | $\epsilon_r = 40.0 \pm 5\%$ | $s = 1.40 \pm 5\% \text{ mho/m}$ |
| ConvF X | 5.4 $\pm 8.9\%$ (k=2) | Boundary effect:            |                                  |
| ConvF Y | 5.4 $\pm 8.9\%$ (k=2) | Alpha                       | 0.62                             |
| ConvF Z | 5.4 $\pm 8.9\%$ (k=2) | Depth                       | 2.15                             |

ET3DV6 SN:1379

February 22, 2002

# Conversion Factor Assessment



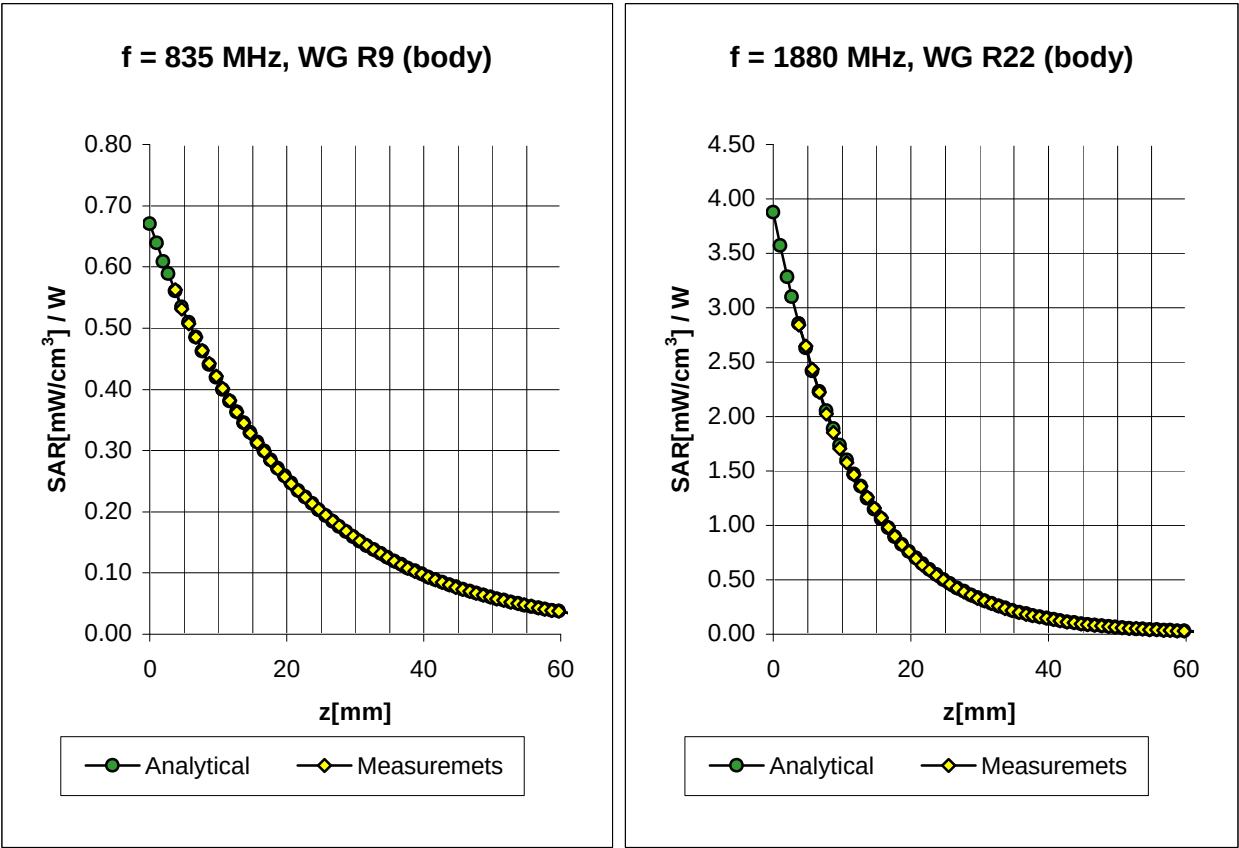
|         |                              |                             |                                  |
|---------|------------------------------|-----------------------------|----------------------------------|
| Head    | 835 MHz                      | $\epsilon_r = 41.5 \pm 5\%$ | $s = 0.90 \pm 5\% \text{ mho/m}$ |
| ConvF X | <b>6.6</b> $\pm 8.9\%$ (k=2) | Boundary effect:            |                                  |
| ConvF Y | <b>6.6</b> $\pm 8.9\%$ (k=2) | Alpha                       | <b>0.42</b>                      |
| ConvF Z | <b>6.6</b> $\pm 8.9\%$ (k=2) | Depth                       | <b>2.44</b>                      |

|         |                              |                             |                                  |
|---------|------------------------------|-----------------------------|----------------------------------|
| Head    | 1880 MHz                     | $\epsilon_r = 40.0 \pm 5\%$ | $s = 1.40 \pm 5\% \text{ mho/m}$ |
| ConvF X | <b>5.3</b> $\pm 8.9\%$ (k=2) | Boundary effect:            |                                  |
| ConvF Y | <b>5.3</b> $\pm 8.9\%$ (k=2) | Alpha                       | <b>0.64</b>                      |
| ConvF Z | <b>5.3</b> $\pm 8.9\%$ (k=2) | Depth                       | <b>2.15</b>                      |

ET3DV6 SN:1379

February 22, 2002

# Conversion Factor Assessment



|         |                              |                             |                                  |
|---------|------------------------------|-----------------------------|----------------------------------|
| Body    | 835 MHz                      | $\epsilon_r = 55.2 \pm 5\%$ | $s = 0.97 \pm 5\% \text{ mho/m}$ |
| ConvF X | <b>6.2</b> $\pm 8.9\%$ (k=2) | Boundary effect:            |                                  |
| ConvF Y | <b>6.2</b> $\pm 8.9\%$ (k=2) | Alpha                       | <b>0.42</b>                      |
| ConvF Z | <b>6.2</b> $\pm 8.9\%$ (k=2) | Depth                       | <b>2.56</b>                      |

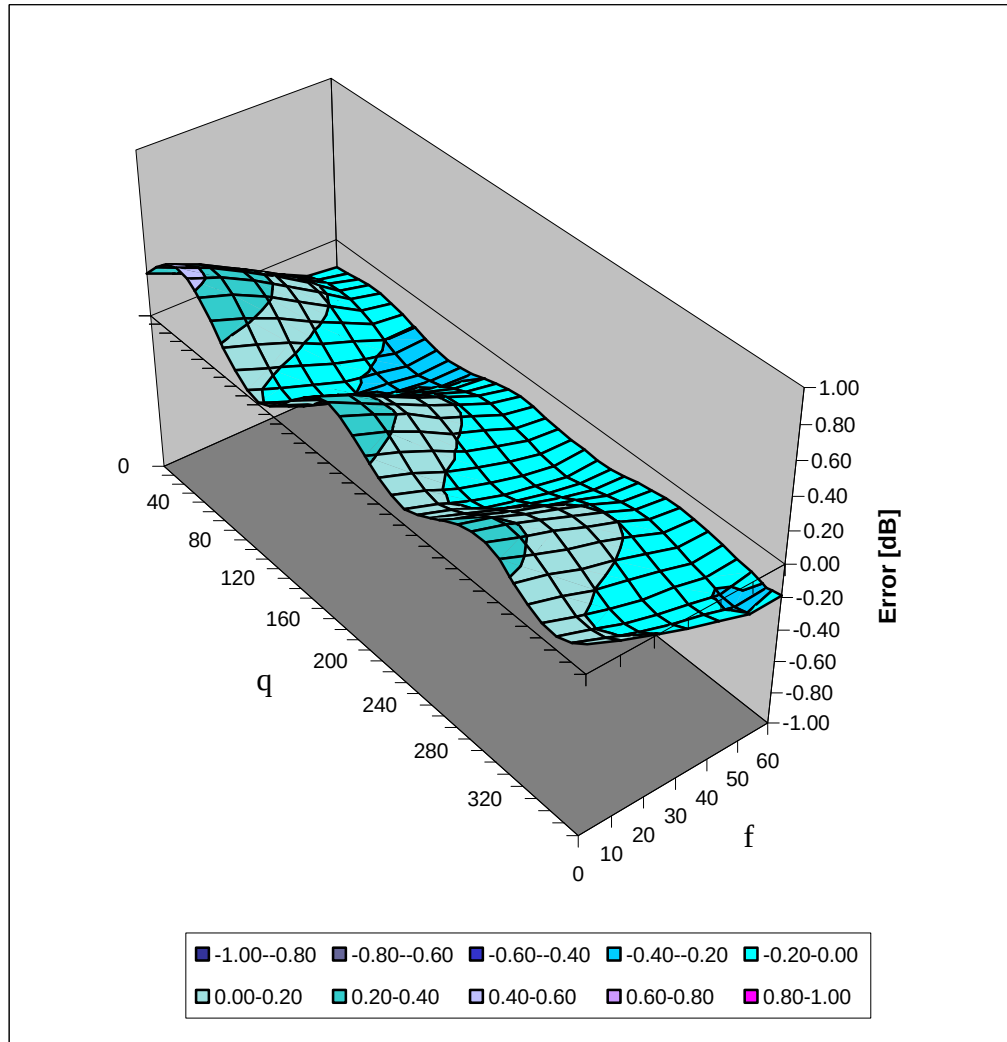
|         |                              |                             |                                  |
|---------|------------------------------|-----------------------------|----------------------------------|
| Body    | 1880 MHz                     | $\epsilon_r = 53.3 \pm 5\%$ | $s = 1.52 \pm 5\% \text{ mho/m}$ |
| ConvF X | <b>4.8</b> $\pm 8.9\%$ (k=2) | Boundary effect:            |                                  |
| ConvF Y | <b>4.8</b> $\pm 8.9\%$ (k=2) | Alpha                       | <b>0.92</b>                      |
| ConvF Z | <b>4.8</b> $\pm 8.9\%$ (k=2) | Depth                       | <b>1.86</b>                      |

ET3DV6 SN:1379

February 22, 2002

# 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 | <b>42.3</b>       | $\pm 5\%$ |
| Conductivity           | <b>0.91 mho/m</b> | $\pm 5\%$ |

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  $\pm 3\%$ . 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 <sup>3</sup> (1 g) of tissue:   | <b>10.36 mW/g</b> |
| averaged over 10 cm <sup>3</sup> (10 g) of tissue: | <b>6.64 mW/g</b>  |

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:    | <b>1.404 ns</b> | (one direction)                       |
| Transmission factor: | <b>0.995</b>    | (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: | $\text{Re}\{Z\} = 49.1 \Omega$ |
|---------------------------------|--------------------------------|

|  |                                |
|--|--------------------------------|
|  | $\text{Im}\{Z\} = -5.3 \Omega$ |
|--|--------------------------------|

|                        |                 |
|------------------------|-----------------|
| Return Loss at 835 MHz | <b>-25.3 dB</b> |
|------------------------|-----------------|

### 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 | <b>56.0</b>       | $\pm 5\%$ |
| Conductivity           | <b>0.98 mho/m</b> | $\pm 5\%$ |

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  $\pm 3\%$ . 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<sup>3</sup> (1 g) of tissue:      **10.92 mW/g**

averaged over 10 cm<sup>3</sup> (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  $\Omega$**

**Im {Z} = -6.5  $\Omega$**

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**

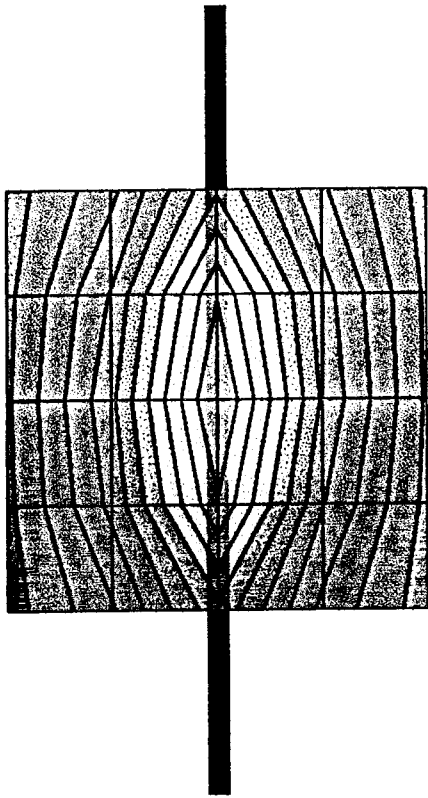
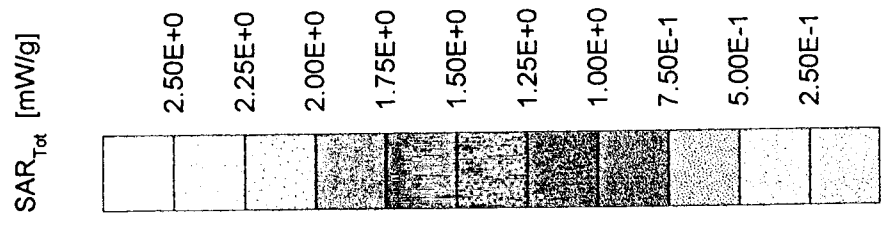
The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

## **9. Power Test**

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

# 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;  $\sigma = 0.91$  mho/m  $\epsilon_r = 42.3$   $\rho = 1.00$  g/cm<sup>3</sup>  
Cubes (2): Peak: 4.15 mW/g  $\pm 0.02$  dB, SAR (1g): 2.59 mW/g  $\pm 0.00$  dB, SAR (10g): 1.66 mW/g  $\pm 0.01$  dB, (Worst-case extrapolation)  
Penetration depth: 12.0 (10.6, 13.7) [mm]  
Powerdrift: -0.01 dB



CH1 S11 1 U FS

1: 49.117  $\Omega$  -5.3047  $\Omega$  35.931 pF

835.000 000 MHz

De1

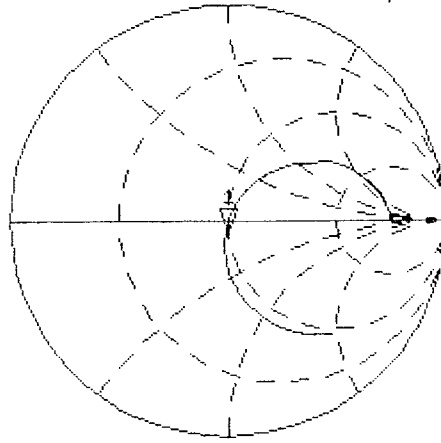
PRM

Cor

Avg

16

↑



CH2

S11

LOG

5 dB/REF 0 dB

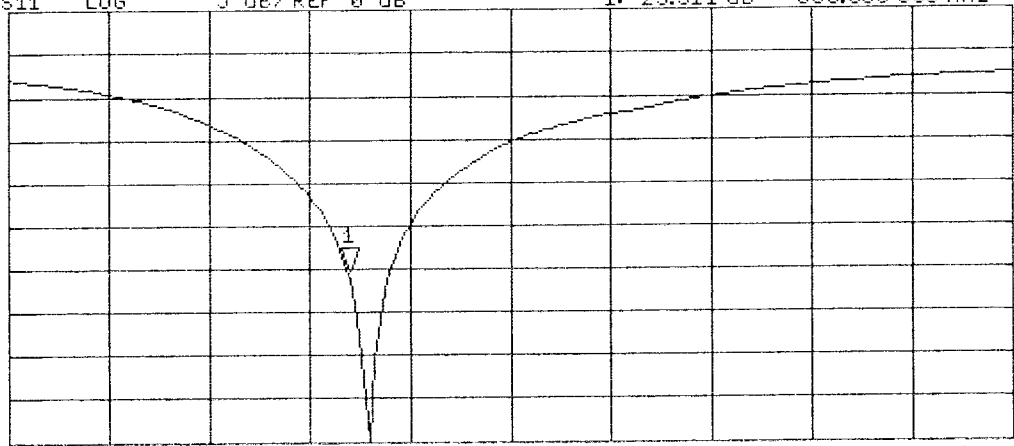
1:-25.311 dB

835.000 000 MHz

PRM

Cor

↑

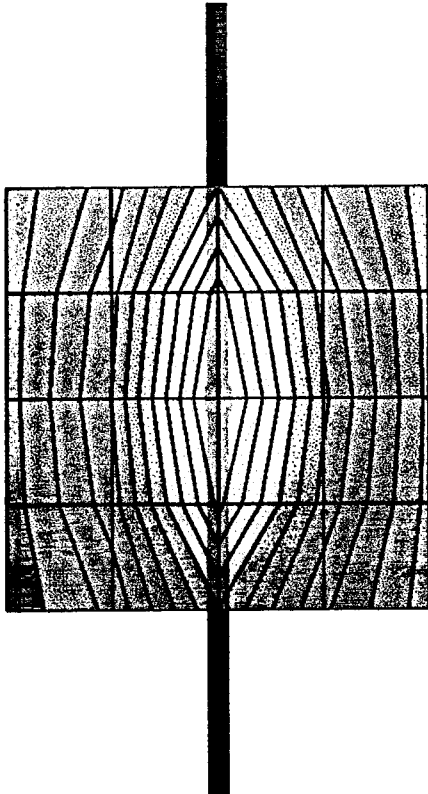
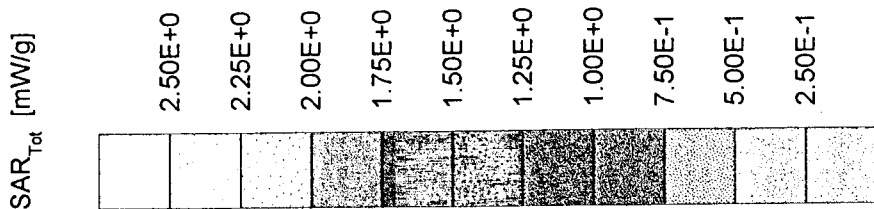


START 700.000 000 MHz

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;  $\sigma = 0.98$  mho/m  $\epsilon_r = 56.0$   $\rho = 1.00$  g/cm<sup>3</sup>  
Cubes (2): Peak: 4.32 mW/g  $\pm 0.00$  dB, SAR (1g): 2.73 mW/g  $\pm 0.01$  dB, SAR (10g): 1.76 mW/g  $\pm 0.02$  dB, (Worst-case extrapolation)  
Penetration depth: 12.4 (11.0, 14.3) [mm]  
Powerdrift: 0.02 dB



29 Nov 2001 19:28:38

CHI S11 1 U FS

1: 45.607  $\Omega$  -6.4648  $\Omega$  29.483 pF

835.000 000 MHz

Del

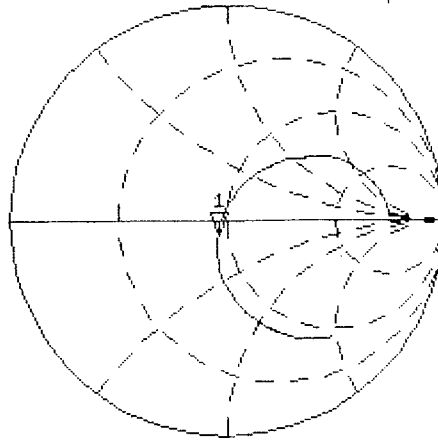
PRM

Cor

Avg

16

↑



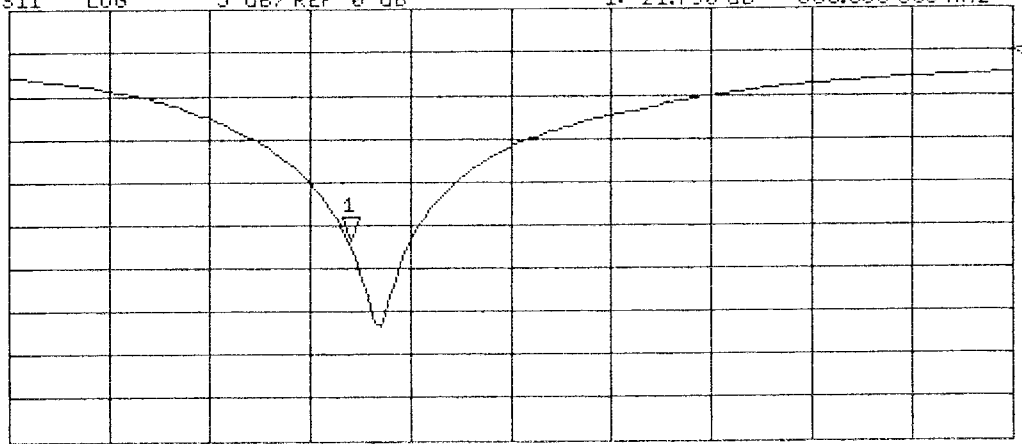
CH2 S11 LOG 5 dB/REF 0 dB

1: -21.790 dB 835.000 000 MHz

PRM

Cor

↑



START 700.000 000 MHz

STOP 1 1100.000 000 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 permittivity | 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<sup>3</sup> (1 g) of tissue: 42.8 mW/g

averaged over 10 cm<sup>3</sup> (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: | $\text{Re}\{Z\} = 50.1 \Omega$ |
|                                  | $\text{Im}\{Z\} = -1.5 \Omega$ |
| 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 permittivity | 53.5       | $\pm 5\%$  |
| Conductivity          | 1.46 mho/m | $\pm 10\%$ |

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  $\pm 3\%$ . 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  $1 \text{ cm}^3$  (1 g) of tissue:      **42.4 mW/g**

averaged over  $10 \text{ cm}^3$  (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:    | <b>1.205 ns</b> | (one direction)                       |
| Transmission factor: | <b>0.983</b>    | (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:       **$\text{Re}\{Z\} = 45.3 \Omega$**

**$\text{Im}\{Z\} = -1.0 \Omega$**

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]

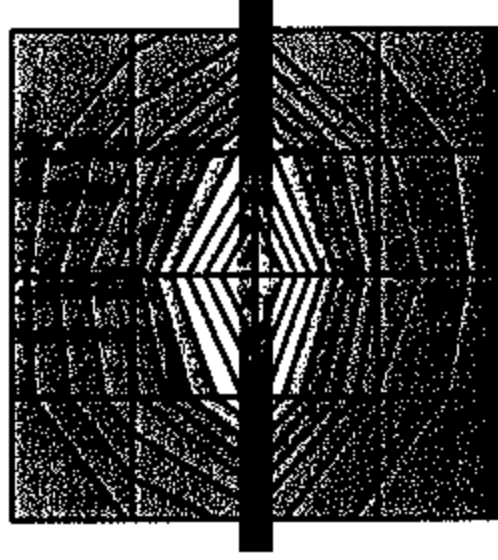
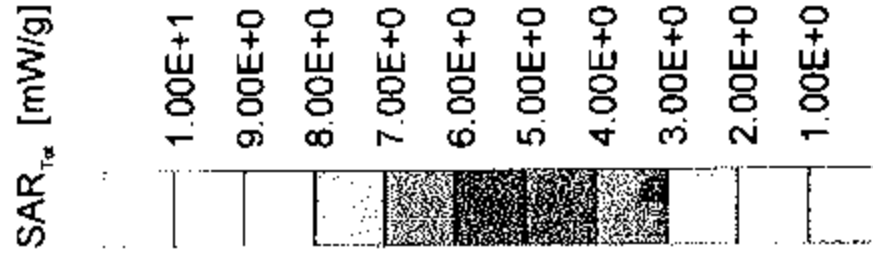
Generic Twin Phantom; Flat Section; Grid Spacing: Dx = 15.0, Dy = 15.0, Dz = 10.0

Probe: ET3DV6 - SN1507; ConvF(5.57,5.57,5.57) at 1800 MHz;  $\sigma = 1.47 \text{ mW/m}^2$ ,  $\epsilon_r = 39.2$ ,  $\rho = 1.00 \text{ g/cm}^3$

Cubes (2); Peak: 20.6 mW/g  $\pm 0.02 \text{ dB}$ , SAR (1g): 10.7 mW/g  $\pm 0.03 \text{ dB}$ , SAR (10g): 5.47 mW/g  $\pm 0.03 \text{ dB}$ , (Worst-case extrapolation)

Penetration depth: 7.9 (7.4, 9.1) [mm]

Powerdrift: 0.00 dB



13 Feb 2001 10:46:52

CH1 511 1 U F8

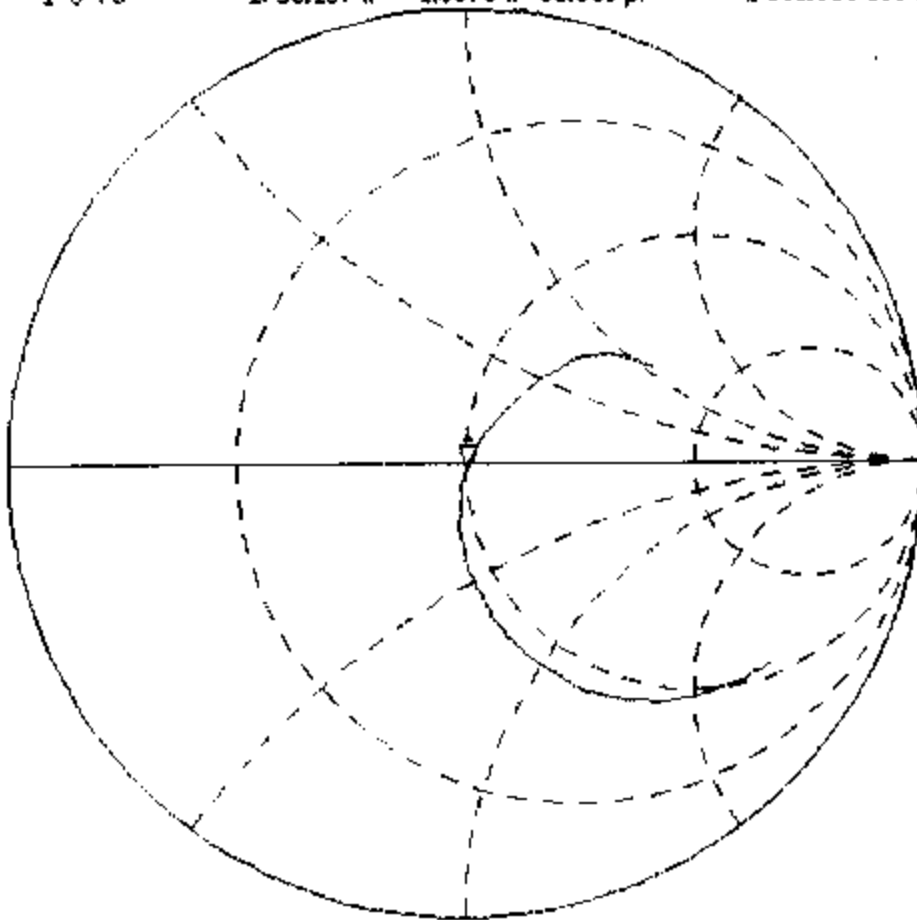
11 50.137  $\Omega$  -1.5078  $\Omega$  55.555 pF

1 900.000 000 MHz

PRM  
De-I

Cor  
rv9  
16

↑



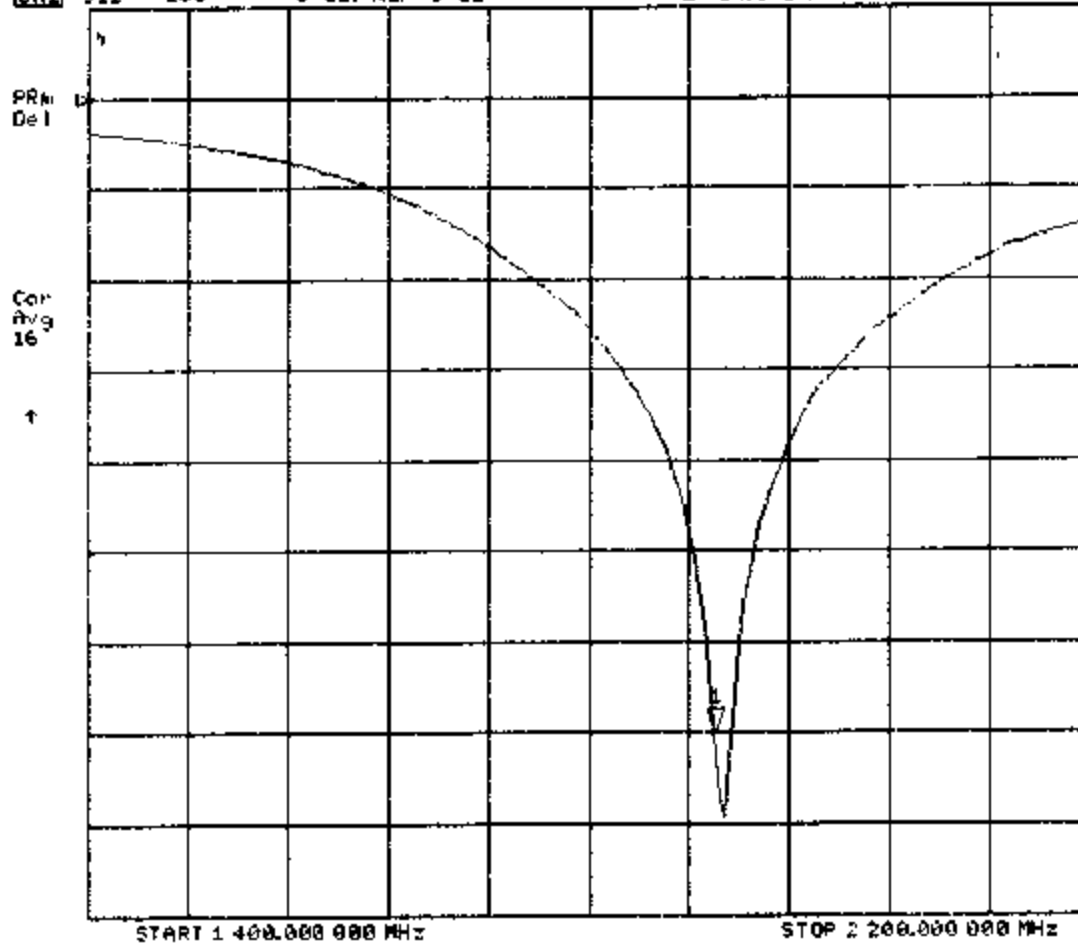
START 1 400.000 000 MHz

STOP 2 200.000 000 MHz

13 Feb 2001 10:46:40

CH1 S11 LOG 5 dB/REF 0 dB

11-34.942 dB 1 900.000 000 MHz



# Validation Dipole D1900V2 SN:511, d = 10 mm

Frequency: 1900 MHz; Antenna Input Power: 250 [mW]

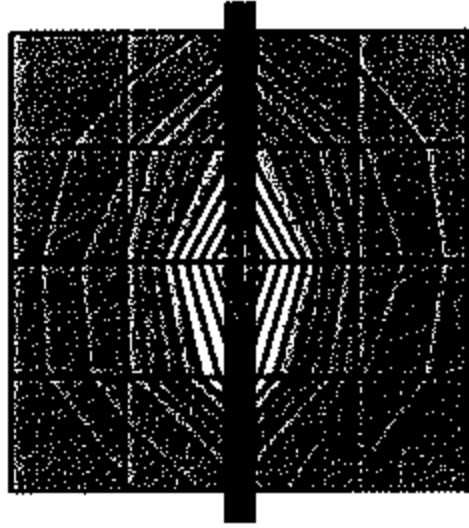
Generic: Twin Phantom; Flat Section; Grid Spacing: Dx = 15.0, Dy = 15.0, Dz = 10.0

Probe: ET3DV6 - SN1507; ConvF(4.85,4.85,4.85) at 1800 MHz; Muscle: 1900 MHz;  $\sigma = 1.46$  mho/m  $\epsilon_r = 53.5$   $\rho = 1.00$  g/cm<sup>3</sup>

Cubes (2): Peak: 20.0 mW/g  $\pm 0.06$  dB; SAR (1g) 10.6 mW/g  $\pm 0.05$  dB; SAR (10g): 5.49 mW/g  $\pm 0.04$  dB; (Worst-case extrapolation)

Penetration depth: 8.7 (7.9, 10.3) [mm]

Powerdrift: 0.01 dB



13 Feb 2001 18:09:51

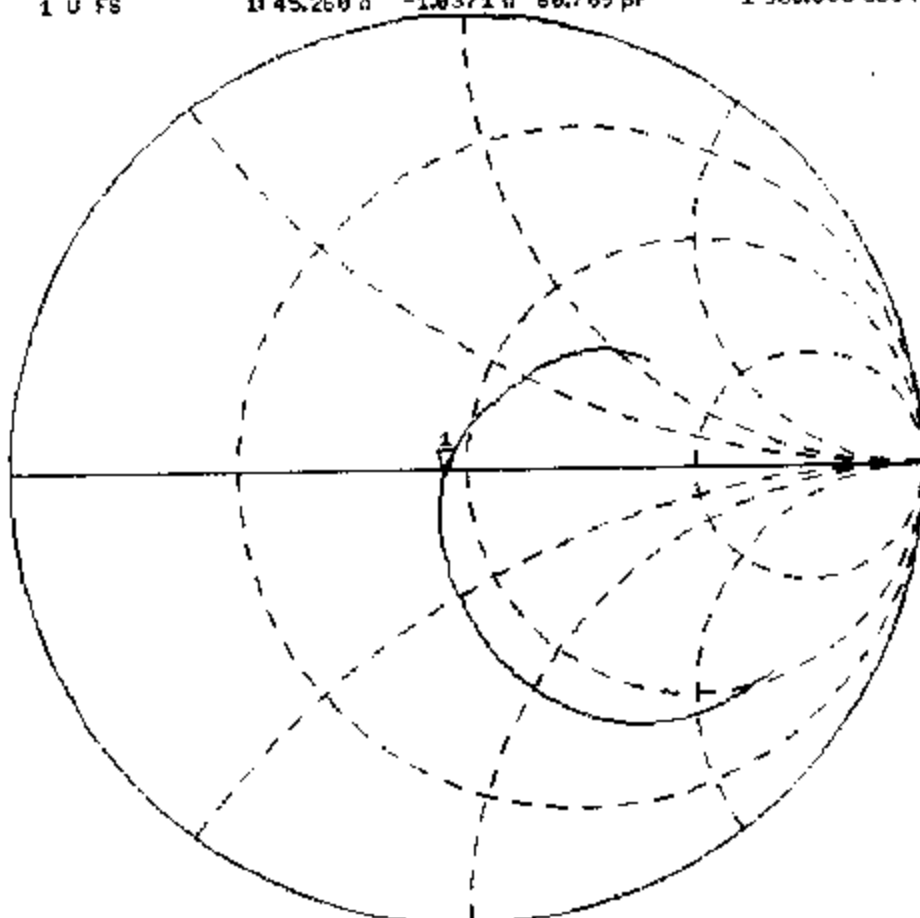
CH1 S11 1 U FS

1145.260 n -1.0371 n 80.769 pF

1 900.000 000 MHz

PRn  
DeJ

Cor  
Avg  
16



START 1 400.000 000 MHz

STOP 2 200.000 000 MHz