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June 13, 2002

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

Attention: Equipment Authorization Branch

We hereby certify that the transceiver FCC ID: LJPNC-1X 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.

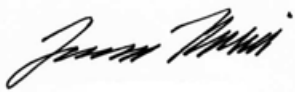

Compliance was determined by testing appropriate parameters according to
standard.

NOKIA CORPORATION

A handwritten signature in dark ink, appearing to read 'Esa Posio', is positioned above the printed name.

Esa Posio
Product Program Manager
Nokia Mobile Phones, MP Oulu

SAR Compliance Test Report

| | | | |
|--|--|---|--|
| Test report no.: | Not numbered | Date of report: | 2002-09-25 |
| Number of pages: | 71 | Contact person: | Pärnänen Pentti |
| | | Responsible test engineer: | Mäkikyrö Pertti |
| Testing laboratory: | Nokia Corporation Elektroniikkatie 10 P.O. Box 50 FIN-90571 OULU Finland Tel. +358-7180-08000 Fax. +358-7180-47222 | Client: | Nokia Corporation Elektroniikkatie 10 P.O. Box 50 FIN-90571 OULU Finland Tel. +358-7180-08000 Fax. +358-7180-47222 |
| Tested devices: | LJPNKC-1X CSM-6 | | |
| Supplement reports: | - | | |
| Testing has been carried out in accordance with: | 47CFR §2.1093 Radiofrequency Radiation Exposure Evaluation: Portable Devices IEEE P1528-200X Draft 6.4 Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01) Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields | | |
| Documentation: | The documentation of the testing performed on the tested devices is archived for 15 years at PC Site Oulu | | |
| Test results: | <p>The tested device complies with the requirements in respect of all parameters subject to the test.</p> <p>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.</p> | | |
| Date and signatures: | 2002-09-26 | | |
| For the contents: | | | |
| |  |  | |
| | Jorma Hanni Process Development Manager | Sini Mattila Test Engineer | |

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1. SUMMARY FOR SAR TEST REPORT

| | |
|--|--|
| Date of test | 2002-07-15, 2002-07-16, 2002-07-18, 2002-09-19, 2002-09-24 |
| Contact person | Pentti Pärnänen |
| Test plan referred to | - |
| FCC ID | LJPNKC-1X |
| SN, HW and SW numbers of tested device | SN:235/14026312 HW 05.01, SW 3.0 |
| Accessories used in testing | Batteries BMC-3, BLC-2 Headset HDC-5 |
| Notes | - |
| Document code | DTX 05041-EN |
| Responsible test engineer | Pertti Mäkiyry |
| Measurement performed by | Sini Mattila |

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.

1.1.1 Head Configuration

| Ch / f (MHz) | Power | Position | Limit | Measured | Result |
|--------------|----------|----------|----------|-----------|---------------|
| 991/824.04 | 24.7 dBm | cheek | 1.6 mW/g | 1.20 mW/g | PASSED |

1.1.2 Body Worn Configuration

| Ch / f (MHz) | Power | Accessory | Limit | Measured | Result |
|--------------|----------|-----------|----------|-----------|---------------|
| 991/824.04 | 24.7 dBm | CSM-6 | 1.6 mW/g | 0.87 mW/g | PASSED |

1.1.3 Measurement Uncertainty

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

2. DESCRIPTION OF TESTED DEVICE

| | | |
|-----------------------------------|-----------------------|---------------------------------------|
| Device category | Portable device | |
| Exposure environment | Uncontrolled exposure | |
| Unit type | Prototype unit | |
| Case type | Fixed case | |
| Modes of Operation | AMPS | IS136-800 |
| Modulation Mode | | $\pi/4$ Quadrature Phase Shift Keying |
| Duty Cycle | 1 | 1/3 |
| Transmitter Frequency Range (MHz) | 824.04 - 848.97 | 824.04 - 848.97 |

2.1 Picture of Phone



Original cover



Painted cover

LJPNKC-1X has painted cover as option.

2.2 Description of the Antenna

| | | |
|-----------------|---|---------|
| Type | Internal integrated antenna | |
| Dimensions (mm) | Maximum width | 41 mm |
| | Maximum length | 25.5 mm |
| Location | Inside the back cover, near the top of the device | |

2.3 Battery Options

There are two battery options available for tested device. Ni-MH battery BMC-3 and Li-ion battery BLC-2. First all measurements were done with BMC-3 and the measurements giving the highest SAR values were repeated with battery BLC-2.

In body worn configuration they do not affect the separation distance between flat-phantom and tested device.

2.4 Body Worn Accessories

Following body worn accessory is available for LJPNKC-1X:



- CSM-6

3. TEST CONDITIONS

3.1 Ambient Conditions

| | |
|---|------|
| Ambient temperature (°C) | 22±1 |
| Tissue simulating liquid temperature (°C) | 22±1 |
| Humidity | 60 |

3.2 RF characteristics of the test site

Tests were performed in a fully enclosed RF shielded environment.

3.3 Test Signal, Frequencies, and Output Power

The device was controlled by using a special test mode.

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

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

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

4. DESCRIPTION OF THE TEST EQUIPMENT

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

| Test Equipment | Serial Number | Due Date |
|-------------------------------|---------------|----------|
| DASY3 DAE V1 | 371 | 10/02 |
| E-field Probe ET3DV6 | 1381 | 10/02 |
| Dipole Validation Kit, D835V2 | 448 | 11/03 |

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 | 11/02 |
| 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. A specific distance holder is used in the positioning of antenna to ensure correct spacing between the phantom and the dipole. Manufacturer's reference dipole data is presented in Appendix C.

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

| Tissue | f (MHz) | Description | SAR (W/kg), 1g | Dielectric Parameters | | Temp (°C) |
|--------|--------------|-------------------|-------------------|-----------------------|----------------|--------------|
| | | | | ϵ_r | σ (S/m) | |
| Head | 835 | Measured 07/15/02 | 2.71 | 40.8 | 0.90 | 22 |
| | | Measured 07/16/02 | 2.69 | 40.3 | 0.89 | 22 |
| | | Measured 08/19/02 | 2.83 | 42.4 | 0.87 | 22 |
| | | Measured 09/19/02 | 2.79 | 40.2 | 0.90 | 22 |
| | | Reference Result | 2.59 | 42.3 | 0.91 | N/A |
| Muscle | 835 | Measured 07/18/02 | 2.77 | 56.7 | 0.96 | 22 |
| | | Measured 09/24/02 | 2.77 | 56.4 | 0.95 | 22 |
| | | Reference Result | 2.73 | 56.0 | 0.98 | 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 Head Tissue Simulant

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

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

| f (MHz) | Description | Dielectric Parameters | | Temp (°C) |
|--------------|--------------------|-----------------------|----------------|--------------|
| | | ϵ_r | σ (S/m) | |
| 835 | Measured 07/15/02 | 40.8 | 0.90 | 22 |
| | Measured 07/16/02 | 40.3 | 0.89 | 22 |
| | Measured 08/19/02 | 42.4 | 0.87 | 22 |
| | Measured 09/19/02 | 40.2 | 0.90 | 22 |
| | Recommended Values | 41.5 | 0.90 | 20-26 |

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

4.2.2 Muscle Tissue Simulant

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

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

| f (MHz) | Description | Dielectric Parameters | | Temp (°C) |
|--------------|--------------------|-----------------------|----------------|--------------|
| | | ϵ_r | σ (S/m) | |
| 835 | Measured 07/18/02 | 56.7 | 0.96 | 22 |
| | Measured 09/24/02 | 56.4 | 0.95 | 22 |
| | Recommended Values | 55.2 | 0.97 | 20-26 |

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

4.3 Phantoms

"SAM v4.0" phantom", manufactured by SPEAG, was used during the measurement. It has fiberglass shell integrated in a wooden table. The shape of the shell corresponds to the phantom defined by SCC34-SC2. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. Reference



markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

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

4.4 Isotropic E-Field Probe ET3DV6

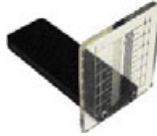
| | |
|----------------------------------|---|
| Construction | Symmetrical design with triangular core Built-in optical fiber for surface detection system Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., glycolether) |
| Calibration | Calibration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



5. DESCRIPTION OF THE TEST PROCEDURE

5.1 Test Positions

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



Device holder was provided by SPEAG together with DASY3.

5.1.1 Against Phantom Head

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

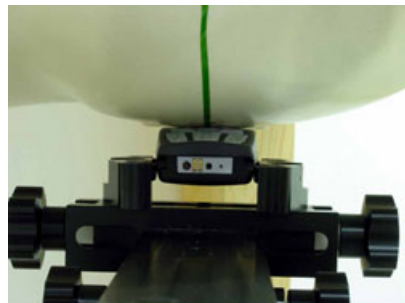
The device was positioned against phantom according to OET Bulletin 65 (97-01) Supplement C (01-01) . Definitions of terms used in aligning the device to a head phantom are available in IEEE Draft Standard P1528-2001 "Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR)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

5.1.1.1 Initial Ear Position

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

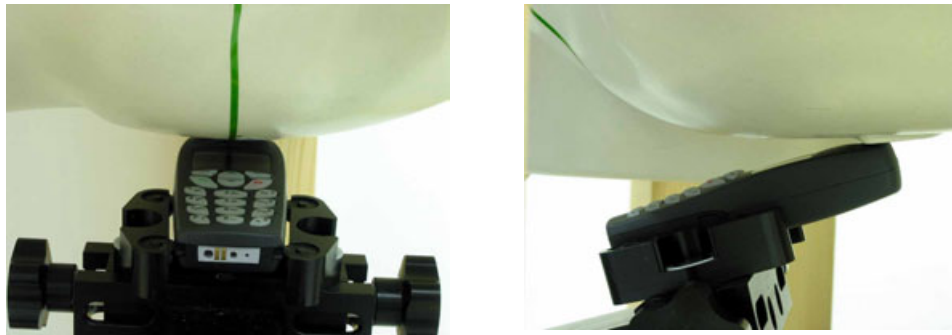
5.1.1.2 Cheek Position

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



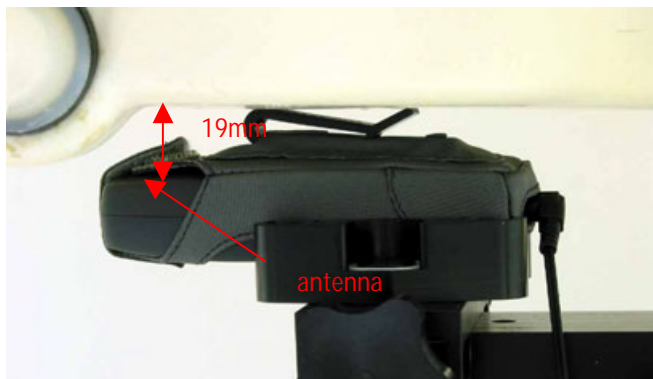
5.1.1.3 Tilt Position

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



5.1.2 Body Worn Configuration

Body worn accessory CSM-6 was tested for the FCC RF exposure compliance. The phone was positioned into carrying case and placed below of the flat phantom. Headset HDC-5 was connected during measurements.



- Body worn setup, CSM-6

5.2 Scan Procedures

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

5.3 SAR Averaging Methods

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

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

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

6. MEASUREMENT UNCERTAINTY

6.1 Description of Individual Measurement Uncertainty

6.1.1 Assessment Uncertainty

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

7. RESULTS

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

7.1 Head Configuration

| Mode | Channel/ <i>f</i> (MHz) | Power (dBm) | SAR, averaged over 1g (mW/g) | | | |
|-------------|----------------------------|----------------|------------------------------|-------------|------------|--------|
| | | | Left-hand | | Right-hand | |
| | | | Cheek | Tilted | Cheek | Tilted |
| AMPS 800 | 991/824.04 | 24.7 | 1.20 | 0.88 | 1.18 | 0.80 |
| | 380/836.40 | 24.9 | 1.17 | 0.87 | 1.15 | 0.81 |
| | 799/848.97 | 24.6 | 1.17 | 0.83 | 1.04 | 0.74 |
| TDMA 800 | 991/824.04 | 27.2 | 0.72 | 0.54 | 0.74 | 0.52 |
| | 380/836.40 | 27.5 | 0.79 | 0.58 | 0.76 | 0.54 |
| | 799/848.97 | 27.1 | 0.73 | 0.56 | 0.71 | 0.51 |

7.2 Body Worn Configuration

| Mode | Channel/ <i>f</i> (MHz) | Power (dBm) | SAR, averaged over 1g (mW/g) |
|-------------|----------------------------|----------------|------------------------------|
| | | | CSM-6 |
| AMPS 800 | 991/824.04 | 24.7 | 0.87 |
| | 380/836.40 | 24.9 | 0.70 |
| | 799/848.97 | 24.6 | 0.52 |
| TDMA 800 | 991/824.04 | 27.2 | 0.57 |
| | 380/836.40 | 27.5 | 0.46 |
| | 799/848.97 | 27.1 | 0.37 |

7.3 Optional cover check

| Painted cover | | | | | | |
|---------------|----------------------------|----------------|------------------------------|--------|------------|--------|
| Mode | Channel/ <i>f</i> (MHz) | Power (dBm) | SAR, averaged over 1g (mW/g) | | | |
| | | | Left-hand | | Right-hand | |
| | | | Cheek | Tilted | Cheek | Tilted |
| AMPS 800 | 991/824.04 | 24.7 | 1.18 | 0.88 | 1.10 | 0.76 |
| TDMA 800 | 380/836.40 | 27.5 | 0.82 | 0.59 | 0.78 | 0.55 |

| Painted cover | | | |
|---------------|----------------------------|----------------|----------------------------------|
| Mode | Channel/ <i>f</i> (MHz) | Power (dBm) | SAR, averaged over 1g (mW/g) |
| | | | Body worn configuration CSM-6 |
| AMPS 800 | 991/824.04 | 24.7 | 0.66 |
| TDMA 800 | 991/824.04 | 27.2 | 0.36 |

7.4

Battery Check

Battery BLC-2

| Mode | Channel/ <i>f</i> (MHz) | Power (dBm) | SAR, averaged over 1g (mW/g) | |
|-------------|----------------------------|----------------|------------------------------|--------|
| | | | Left-hand | |
| | | | Cheek | Tilted |
| AMPS 800 | 991/824.04 | 24.7 | 1.07 | 0.80 |
| TDMA 800 | 380/836.40 | 27.5 | 0.70 | 0.54 |

| Mode | Channel/ <i>f</i> (MHz) | Power (dBm) | SAR, averaged over 1g (mW/g) |
|-------------|----------------------------|----------------|----------------------------------|
| | | | Body worn configuration CSM-6 |
| AMPS 800 | 991/824.04 | 24.7 | 0.73 |
| TDMA 800 | 991/824.04 | 27.2 | 0.45 |

APPENDIX A.

Validation Test Printouts

Dipole 835 MHz

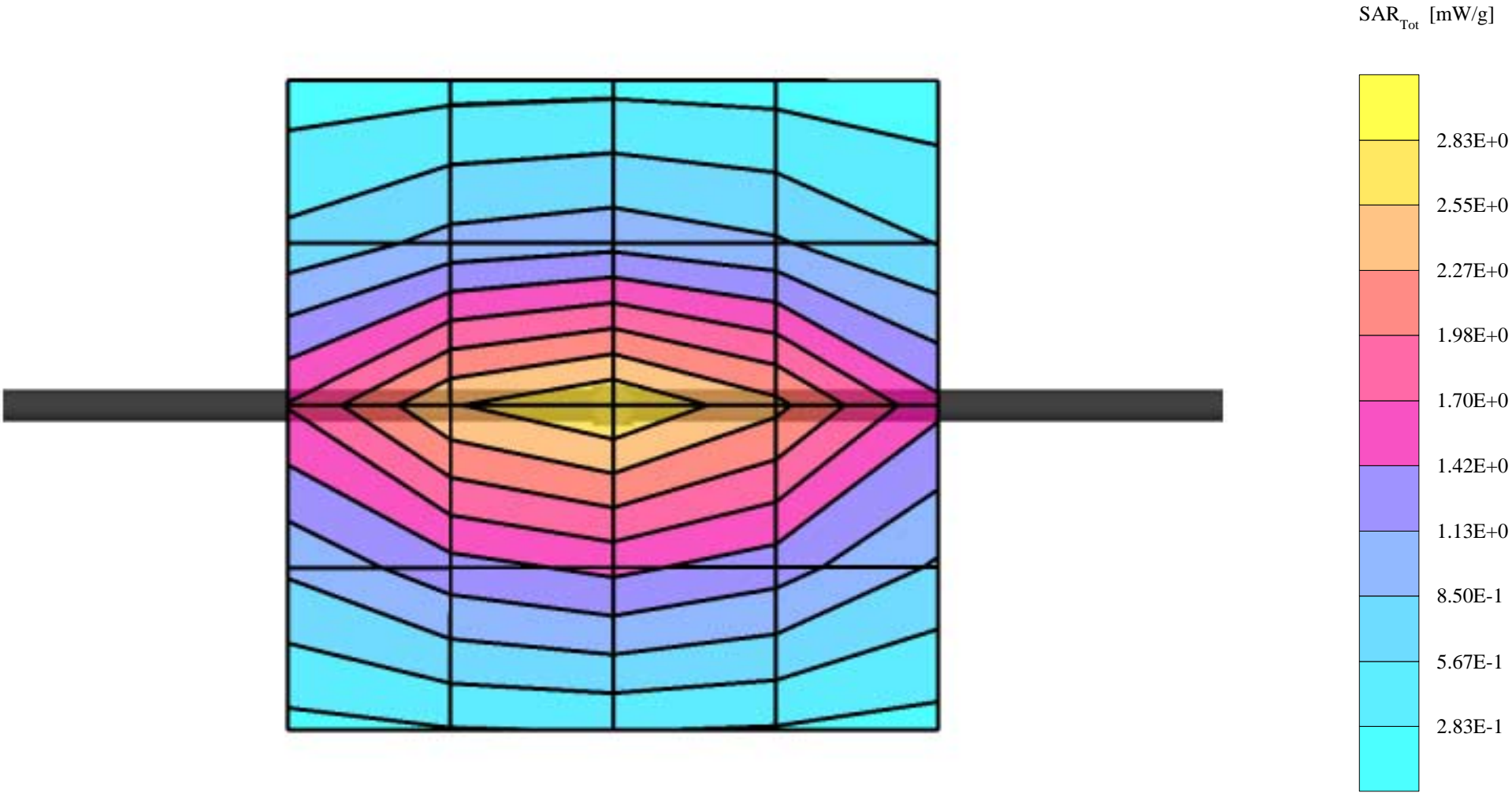
SAM 3; Flat

Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Brain 836 MHz SCC34: $\sigma = 0.90$ mho/m $\epsilon = 40.8$ $\rho = 1.00$ g/cm³, liquid temperature: 21.3 C

Cubes (2): Peak: 4.34 mW/g ± 0.04 dB, SAR (1g): 2.71 mW/g ± 0.03 dB, SAR (10g): 1.72 mW/g ± 0.03 dB

Penetration depth: 11.7 (10.5, 13.4) [mm]

Powerdrift: -0.04 dB



Dipole 835 MHz

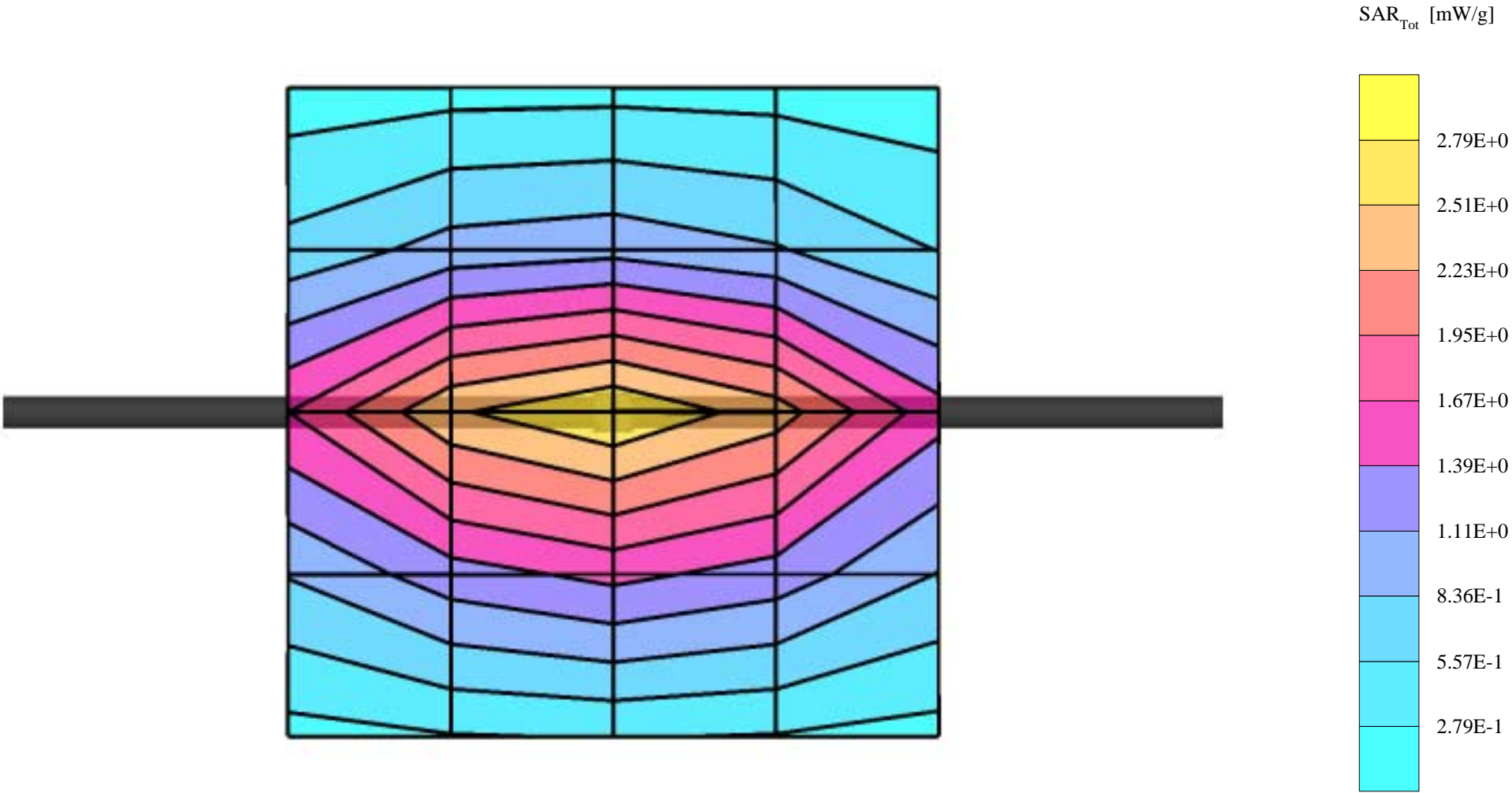
SAM 3; Flat

Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Brain 836 MHz SCC34: $\sigma = 0.89$ mho/m $\epsilon = 40.3$ $\rho = 1.00$ g/cm³, liquid temperature: 21.8 C

Cubes (2): Peak: 4.31 mW/g ± 0.02 dB, SAR (1g): 2.69 mW/g ± 0.03 dB, SAR (10g): 1.70 mW/g ± 0.03 dB

Penetration depth: 11.7 (10.5, 13.4) [mm]

Powerdrift: -0.03 dB



Dipole 835 MHz

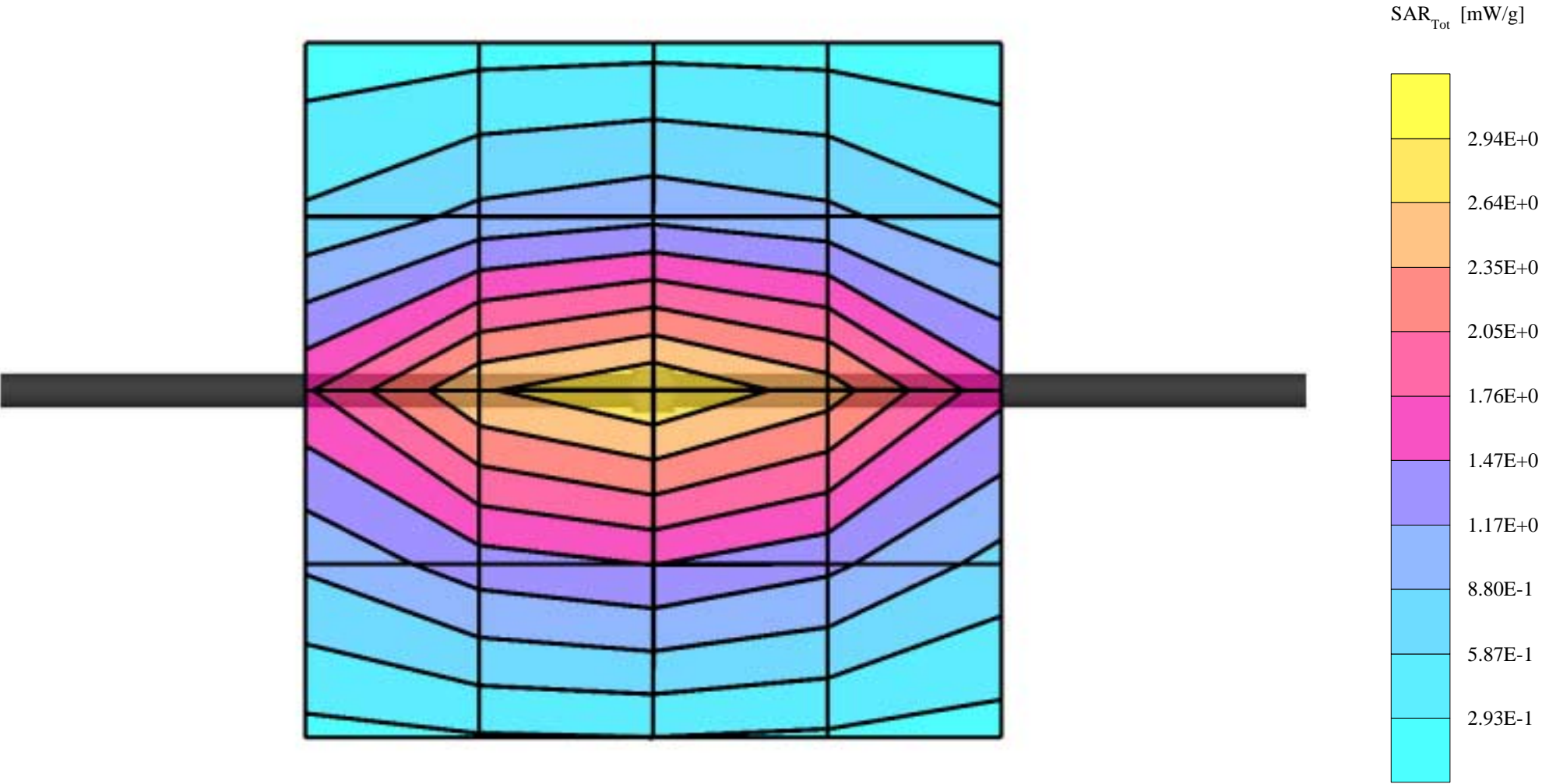
SAM 3; Flat

Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Brain 836 MHz SCC34: $\sigma = 0.87$ mho/m $\epsilon = 42.4$ $\rho = 1.00$ g/cm³, liquid temperature 21.9 C

Cubes (2): Peak: 4.64 mW/g ± 0.02 dB, SAR (1g): 2.83 mW/g ± 0.00 dB, SAR (10g): 1.78 mW/g ± 0.01 dB

Penetration depth: 11.5 (10.1, 13.4) [mm]

Powerdrift: -0.00 dB



Dipole 835 MHz

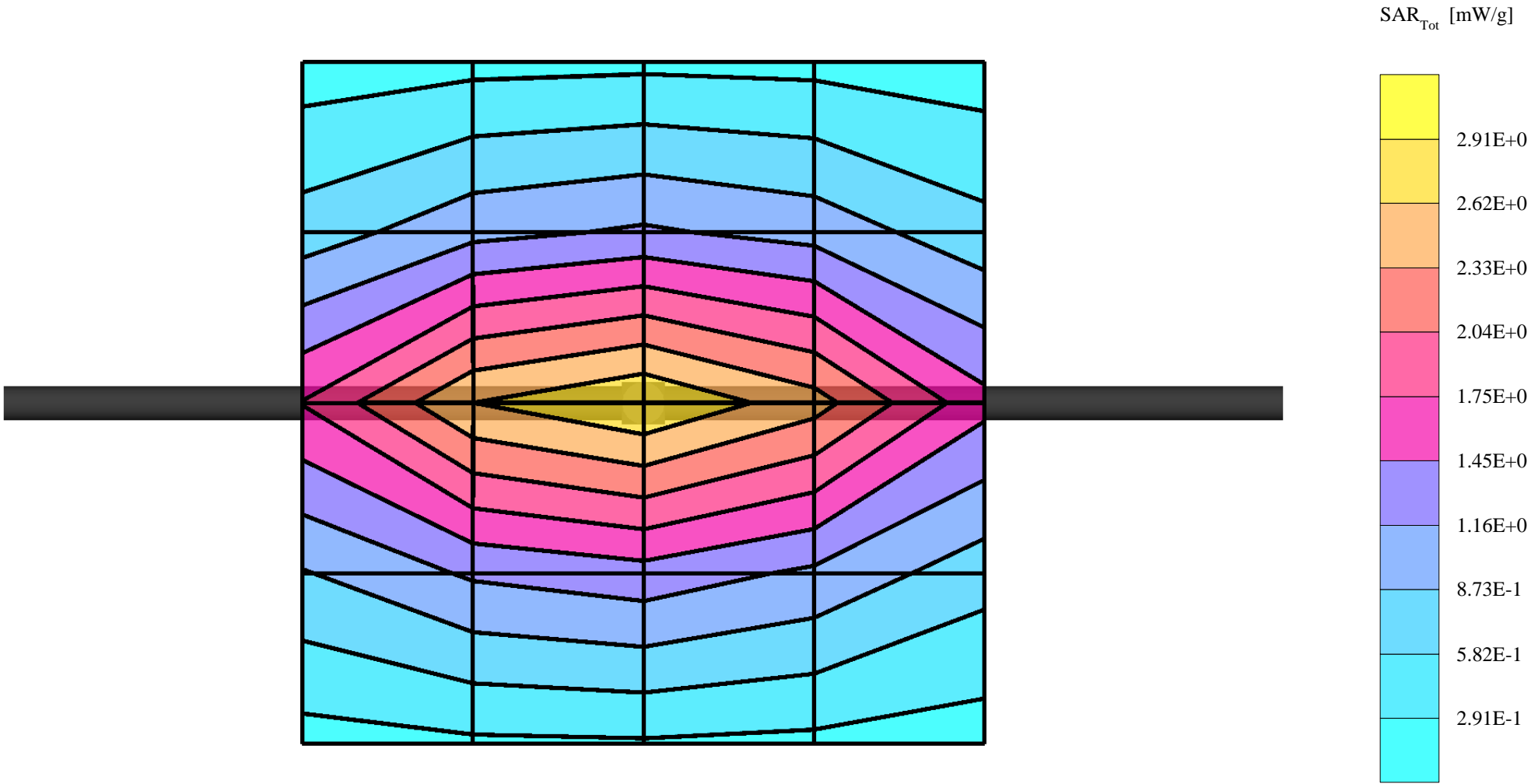
SAM 3; Flat

Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Brain 836 MHz SCC34: $\sigma = 0.90$ mho/m $\epsilon_r = 40.2$ $\rho = 1.00$ g/cm³, liquid temperature: 21.1 C

Cubes (2): Peak: 4.48 mW/g ± 0.01 dB, SAR (1g): 2.79 mW/g ± 0.01 dB, SAR (10g): 1.77 mW/g ± 0.02 dB

Penetration depth: 11.8 (10.5, 13.5) [mm]

Powerdrift: -0.07 dB



Dipole 835 MHz

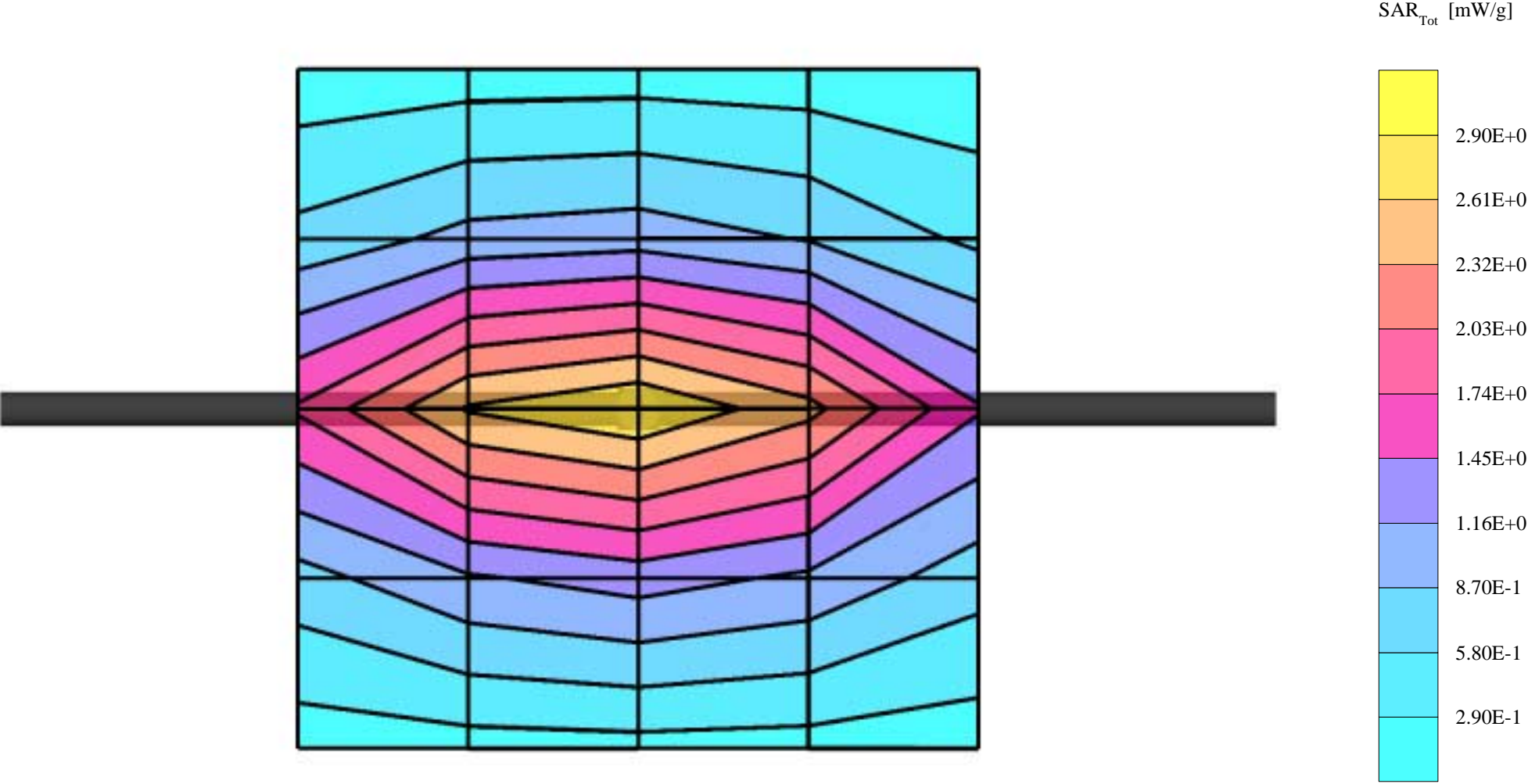
SAM 3; Flat

Probe: ET3DV6 - SN1381; ConvF(6.04,6.04,6.04); Crest factor: 1.0; Muscle 836 MHz: $\sigma = 0.96 \text{ mho/m}$ $\epsilon = 56.7$ $\rho = 1.00 \text{ g/cm}^3$, liquid temperature: 21,8 C

Cubes (2): Peak: $4.34 \text{ mW/g} \pm 0.04 \text{ dB}$, SAR (1g): $2.77 \text{ mW/g} \pm 0.04 \text{ dB}$, SAR (10g): $1.80 \text{ mW/g} \pm 0.04 \text{ dB}$

Penetration depth: 12.7 (11.2, 14.7) [mm]

Powerdrift: 0.00 dB



Dipole 835 MHz

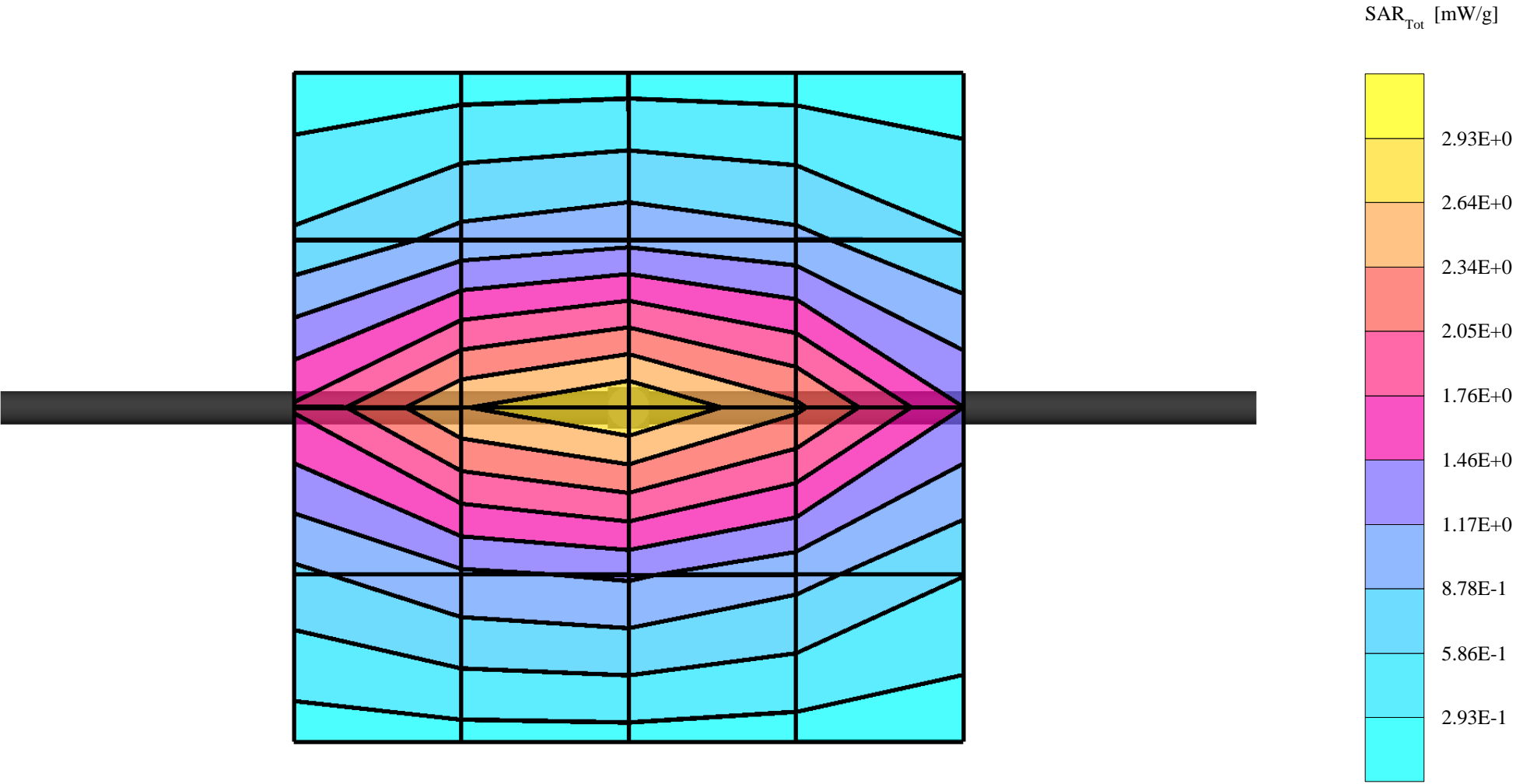
SAM 3; Flat

Probe: ET3DV6 - SN1381; ConvF(6.04,6.04,6.04); Crest factor: 1.0; Muscle 836 MHz: $\sigma = 0.95$ mho/m $\epsilon_r = 56.4$ $\rho = 1.00$ g/cm³, liquid temperature: 21.2 C

Cubes (2): Peak: 4.33 mW/g ± 0.01 dB, SAR (1g): 2.77 mW/g ± 0.01 dB, SAR (10g): 1.80 mW/g ± 0.00 dB

Penetration depth: 12.8 (11.3, 14.7) [mm]

Powerdrift: 0.03 dB



APPENDIX B.

SAR Distribution Printouts

LJPNKC-1X

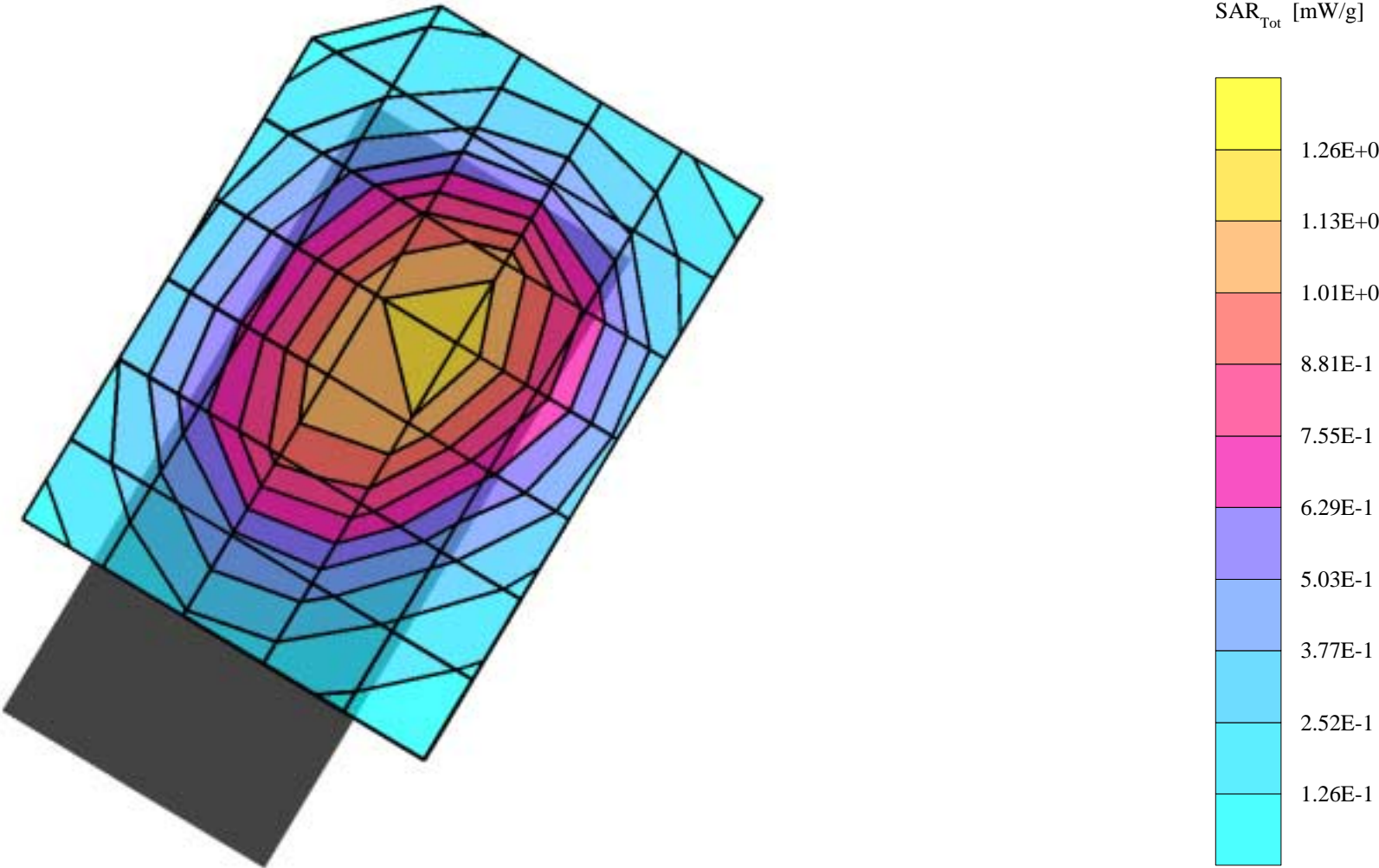
SAM 3 Phantom; Left Hand Section; Position: cheek; Frequency: 824 MHz, AMPS

Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Brain 836 MHz SCC34: $\sigma = 0.90$ mho/m $\epsilon = 40.8$ $\rho = 1.00$ g/cm³, liquid temperature: 21.7 C

Cube 5x5x7: SAR (1g): 1.20 mW/g, SAR (10g): 0.817 mW/g

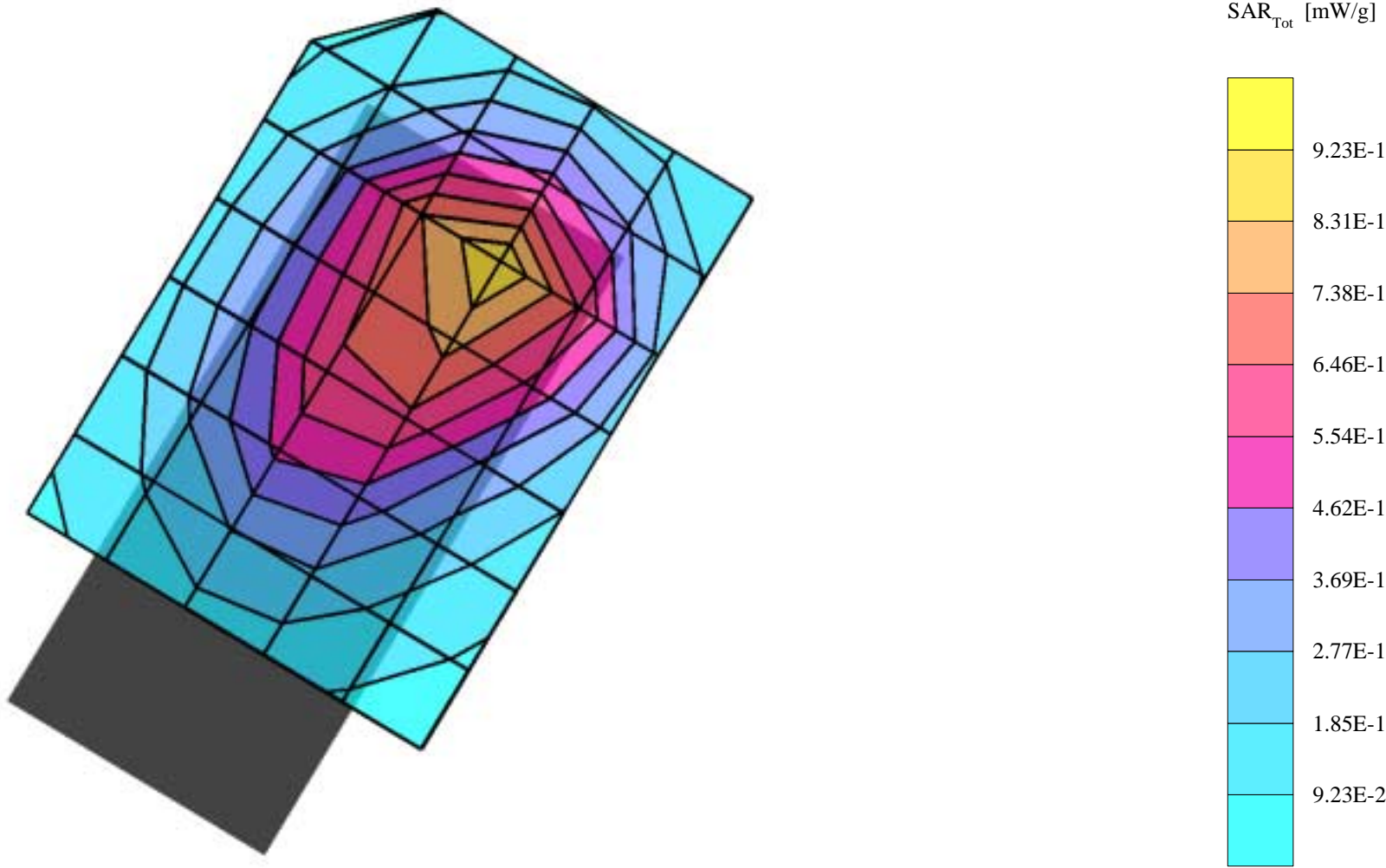
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0

Powerdrift: 0.02 dB



LJPNKC-1X

SAM 3 Phantom; Left Hand Section; Position: tilted; Frequency: 824 MHz, AMPS
Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Brain 836 MHz SCC34: $\sigma = 0.90$ mho/m $\epsilon = 40.8$ $\rho = 1.00$ g/cm³, liquid temperature: 21.8 C
Cube 5x5x7: SAR (1g): 0.878 mW/g, SAR (10g): 0.563 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.00 dB



LJPNKC-1X

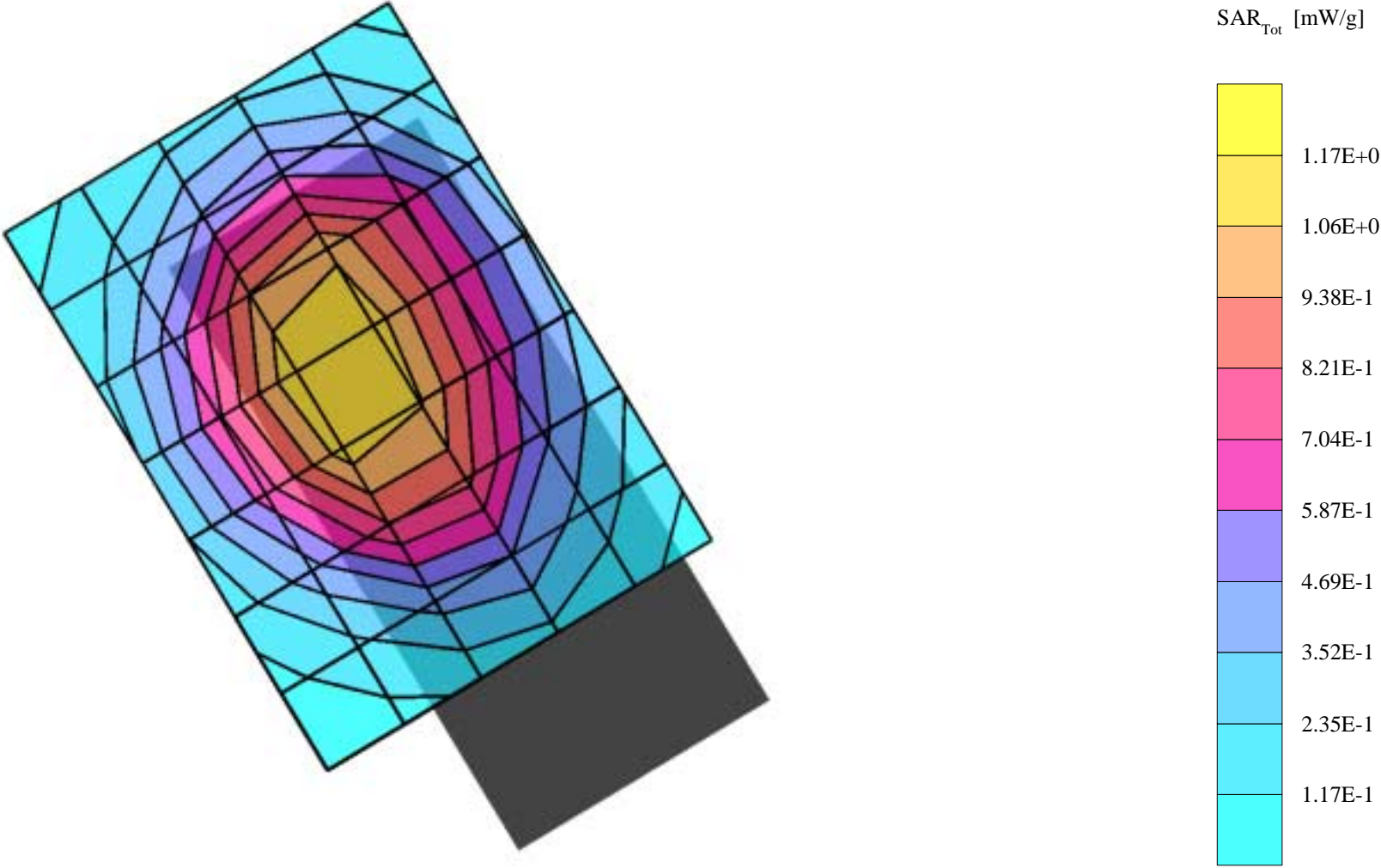
SAM 3 Phantom; Righ Hand Section; Position: cheek; Frequency: 824 MHz, AMPS

Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Brain 836 MHz SCC34: $\sigma = 0.90$ mho/m $\epsilon = 40.8$ $\rho = 1.00$ g/cm³, liquid temperature: 22,4 C

Cube 5x5x7: SAR (1g): 1.18 mW/g, SAR (10g): 0.825 mW/g

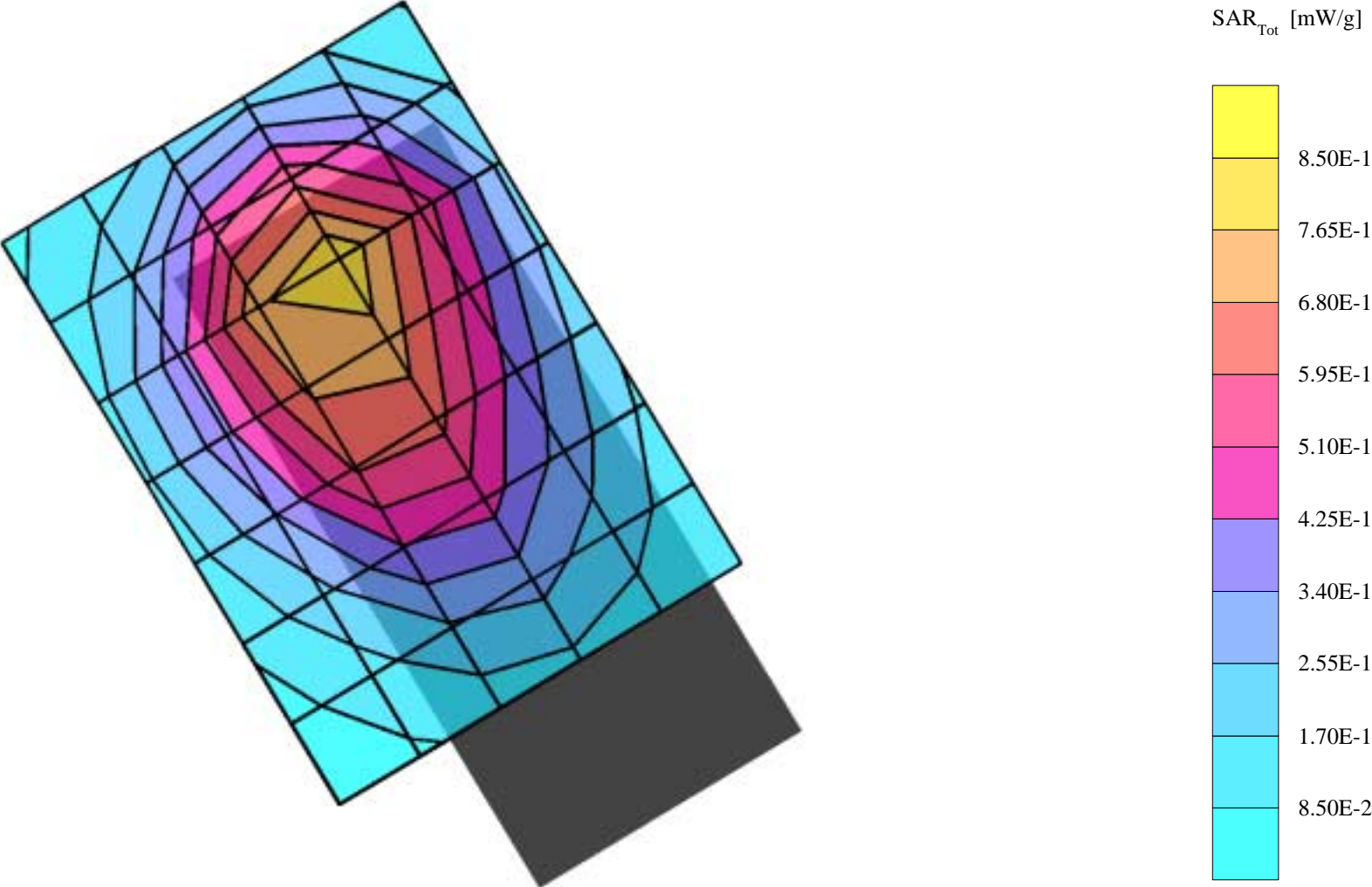
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0

Powerdrift: 0.04 dB



LJPNKC-1X

SAM 3 Phantom; Righ Hand Section; Position: tilted; Frequency: 836 MHz, AMPS
Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Brain 836 MHz SCC34: $\sigma = 0.90$ mho/m $\epsilon = 40.8$ $\rho = 1.00$ g/cm³, liquid temperature: 22.6 C
Cube 5x5x7: SAR (1g): 0.806 mW/g, SAR (10g): 0.536 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.18 dB



LJPNKC-1X

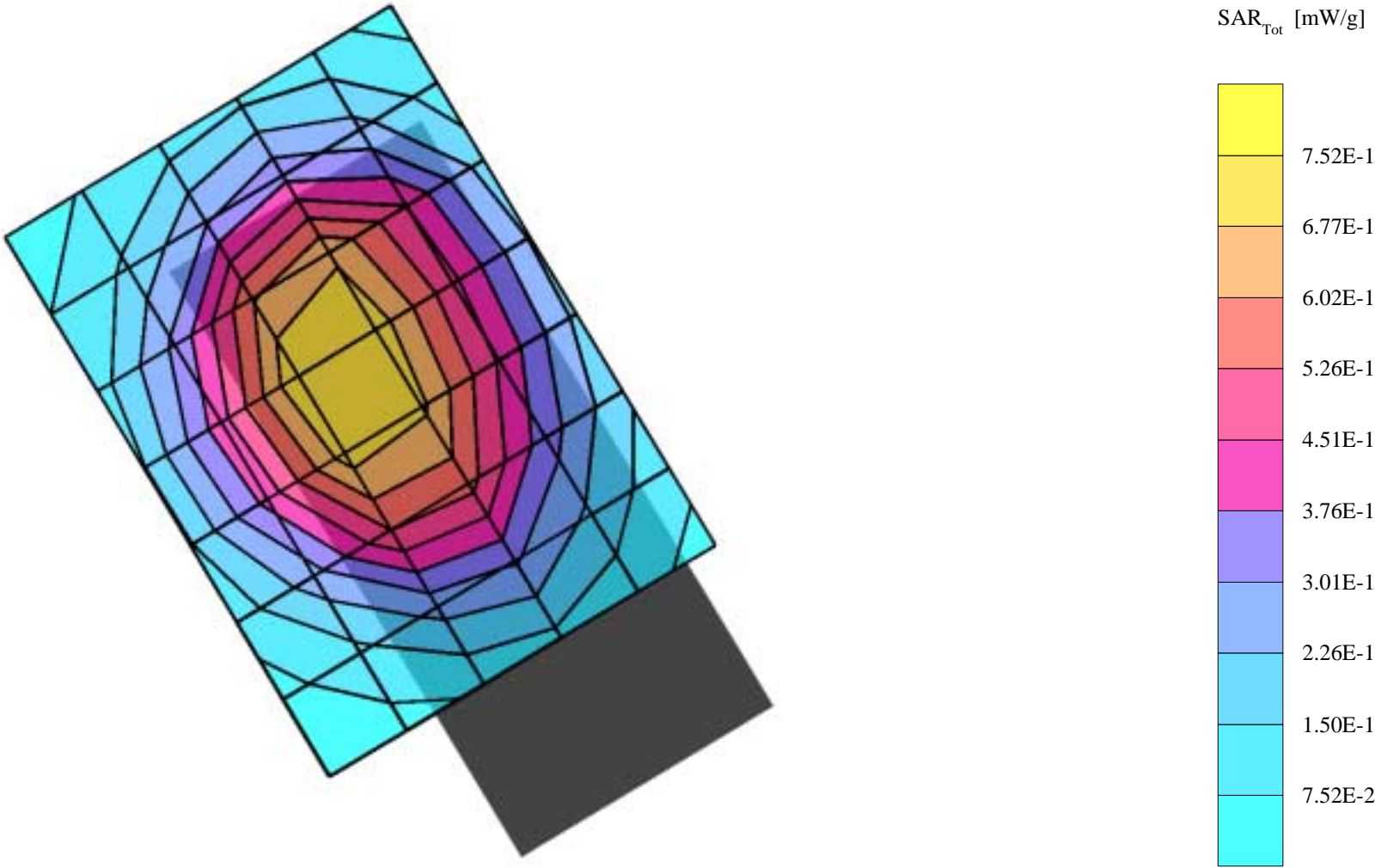
SAM 3 Phantom; Righ Hand Section; Position: cheek; Frequency: 836 MHz, TDMA

Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 3.0; Brain 836 MHz SCC34: $\sigma = 0.89$ mho/m $\epsilon = 40.3$ $\rho = 1.00$ g/cm³, liquid temperature 22.0 C

Cube 5x5x7: SAR (1g): 0.757 mW/g, SAR (10g): 0.528 mW/g

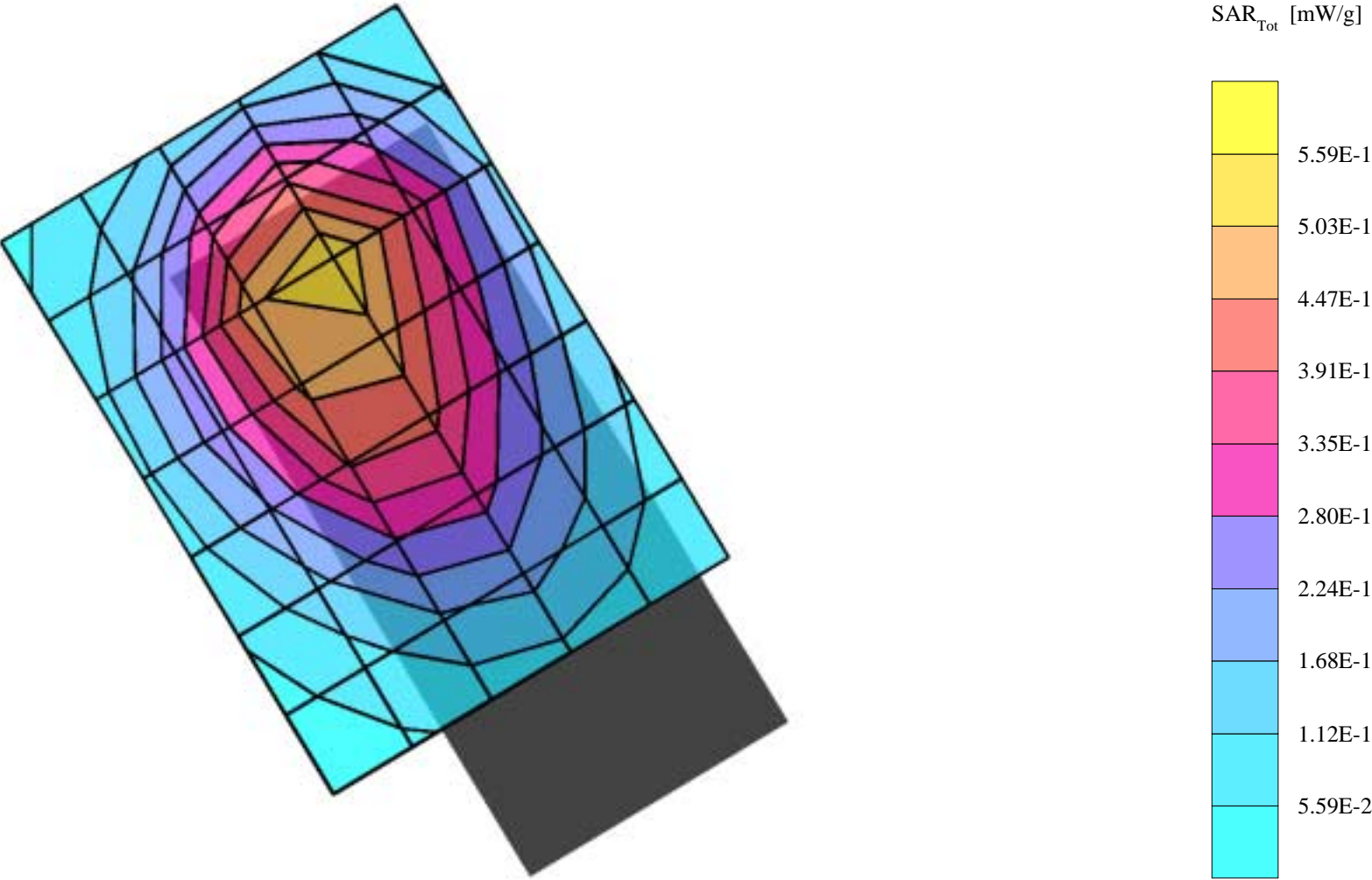
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0

Powerdrift: 0.00 dB



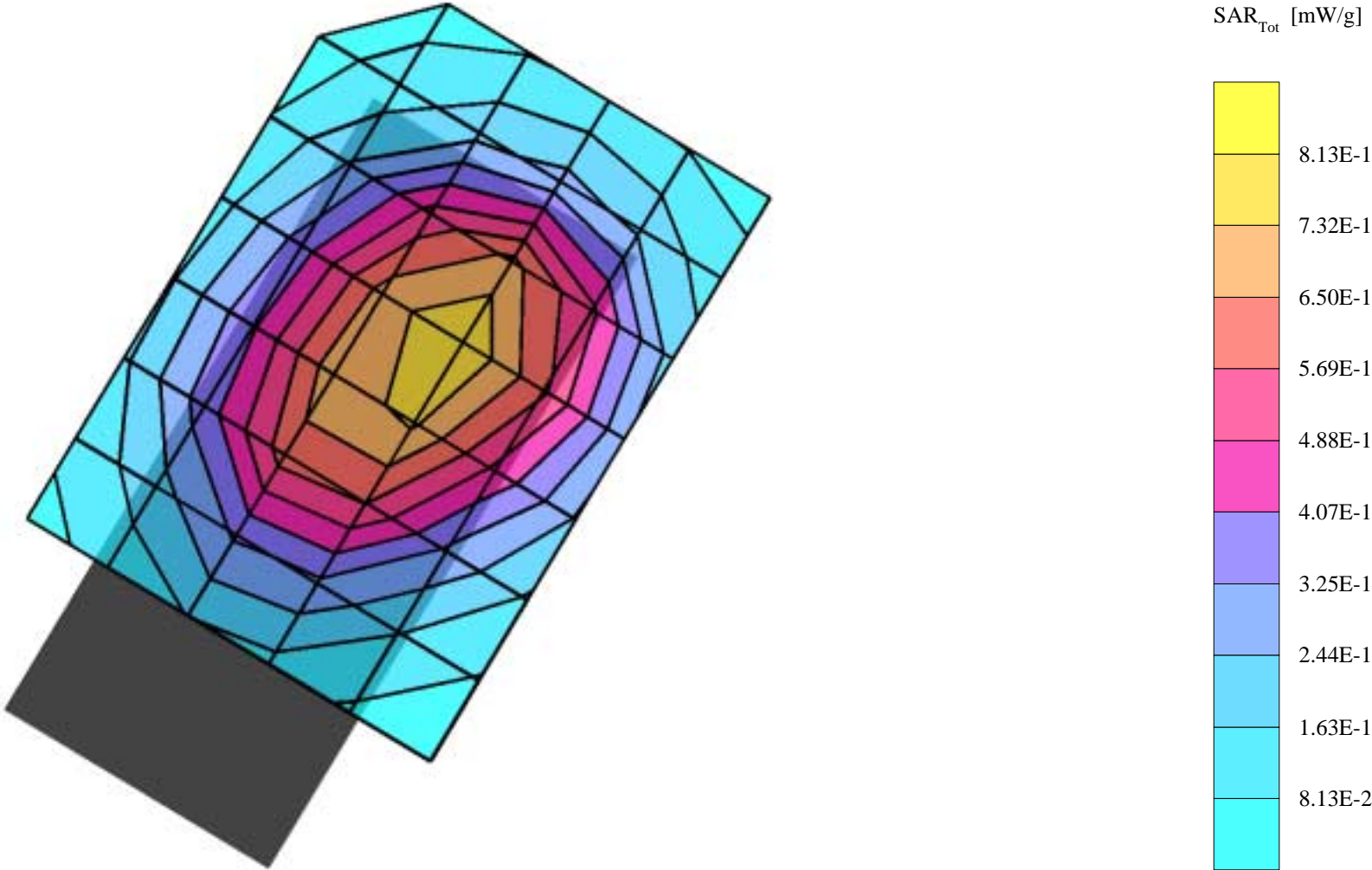
LJPNKC-1X

SAM 3 Phantom; Righ Hand Section; Position: tilted; Frequency: 836 MHz, TDMA
Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 3.0; Brain 836 MHz SCC34: $\sigma = 0.89$ mho/m $\epsilon = 40.3$ $\rho = 1.00$ g/cm³, liquid temperature: 22.0 C
Cube 5x5x7: SAR (1g): 0.542 mW/g, SAR (10g): 0.360 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: 0.00 dB



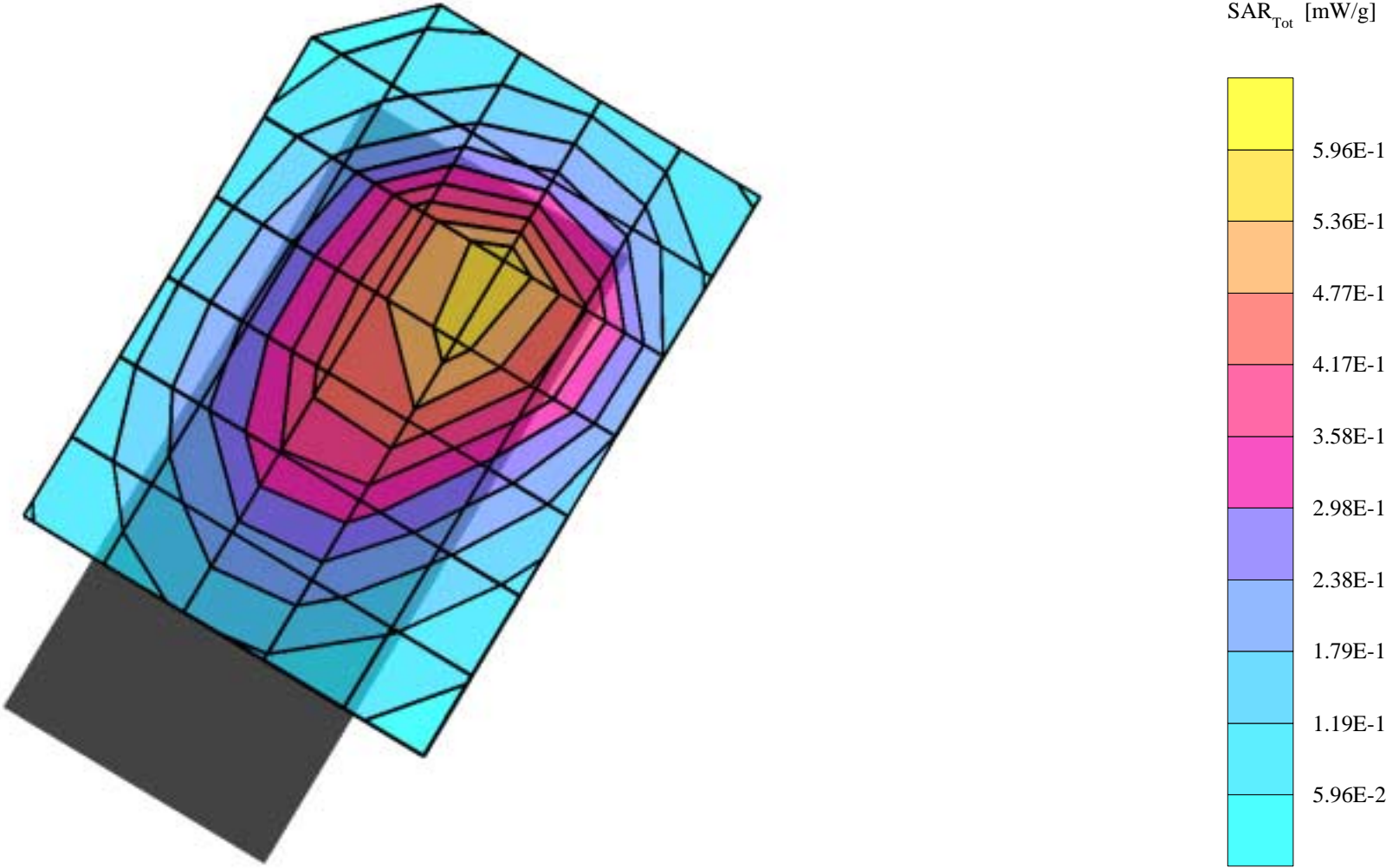
LJPNKC-1X

SAM 3 Phantom; Left Hand Section; Position: cheek; Frequency: 836 MHz, TDMA
Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 3.0; Brain 836 MHz SCC34: $\sigma = 0.87$ mho/m $\epsilon = 42.4$ $\rho = 1.00$ g/cm³, liquid temperature 22.1 C
Cube 5x5x7: SAR (1g): 0.789 mW/g, SAR (10g): 0.533 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.07 dB



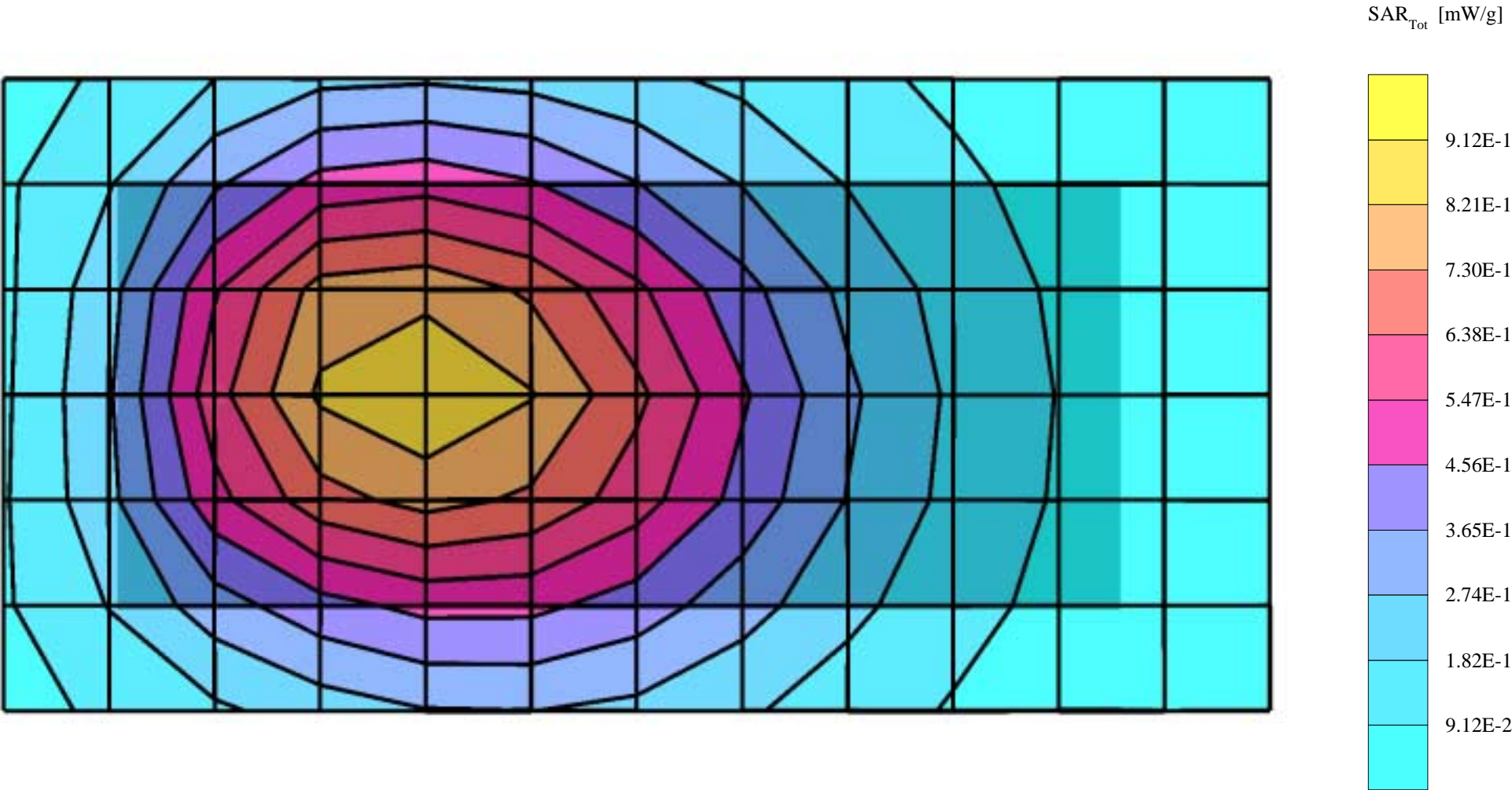
LJPNKC-1X

SAM 3 Phantom; Left Hand Section; Position: tilted; Frequency: 836 MHz, TDMA
Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 3.0; Brain 836 MHz SCC34: $\sigma = 0.87$ mho/m $\epsilon = 42.4$ $\rho = 1.00$ g/cm³, liquid temperature 22.2 C
Cube 5x5x7: SAR (1g): 0.575 mW/g, SAR (10g): 0.380 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.02 dB



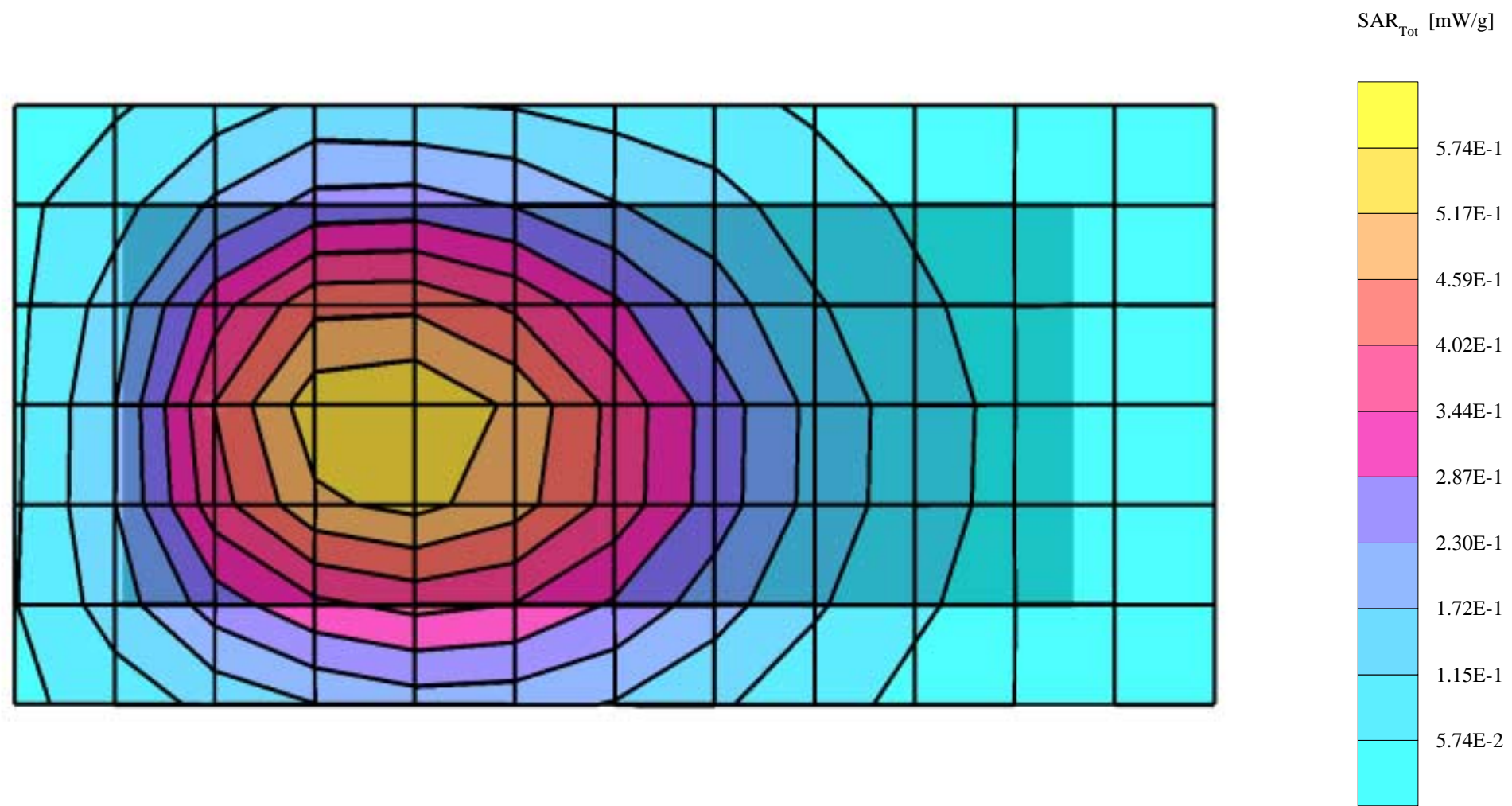
LJPNKC-1X, CSM-6

SAM 3 Phantom; Flat Section; Position: body worn; Frequency: 824 MHz, AMPS
Probe: ET3DV6 - SN1381; ConvF(6.04,6.04,6.04); Crest factor: 1.0; Muscle 836 MHz: $\sigma = 0.96$ mho/m $\epsilon = 56.7$ $\rho = 1.00$ g/cm³, liquid temperature: 21.8 C
Cube 5x5x7: SAR (1g): 0.873 mW/g, SAR (10g): 0.614 mW/g
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0
Powerdrift: -0.10 dB



LJPNKC-1X, CSM-6

SAM 3 Phantom; Flat Section; Position: body worn; Frequency: 824 MHz, TDMA
Probe: ET3DV6 - SN1381; ConvF(6.04,6.04,6.04); Crest factor: 3.0; Muscle 836 MHz: $\sigma = 0.96 \text{ mho/m}$ $\epsilon = 56.7$ $\rho = 1.00 \text{ g/cm}^3$, liquid temperature: 22.2 C
Cube 5x5x7: SAR (1g): 0.567 mW/g, SAR (10g): 0.396 mW/g
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0
Powerdrift: 0.02 dB



LJPNKC-1X, optional battery BLC-2

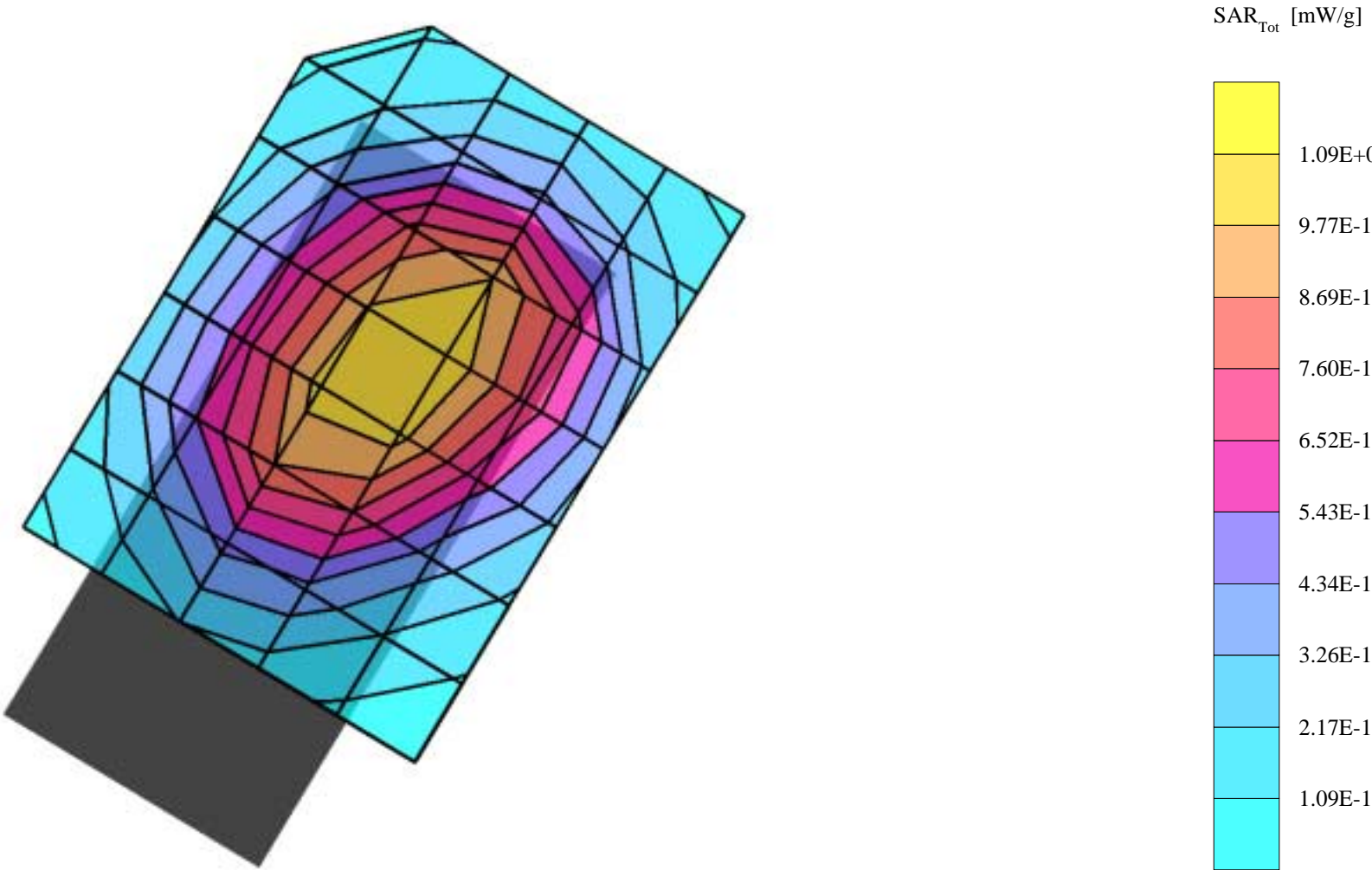
SAM 3 Phantom; Left Hand Section; Position: cheek; Frequency: 824 MHz, AMPS

Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Brain 836 MHz SCC34: $\sigma = 0.89$ mho/m $\epsilon = 40.3$ $\rho = 1.00$ g/cm³, liquid temperature: 22.8 C

Cube 5x5x7: SAR (1g): 1.07 mW/g, SAR (10g): 0.743 mW/g

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

Powerdrift: -0.02 dB



LJPNKC-1X, optional battery BLC-2

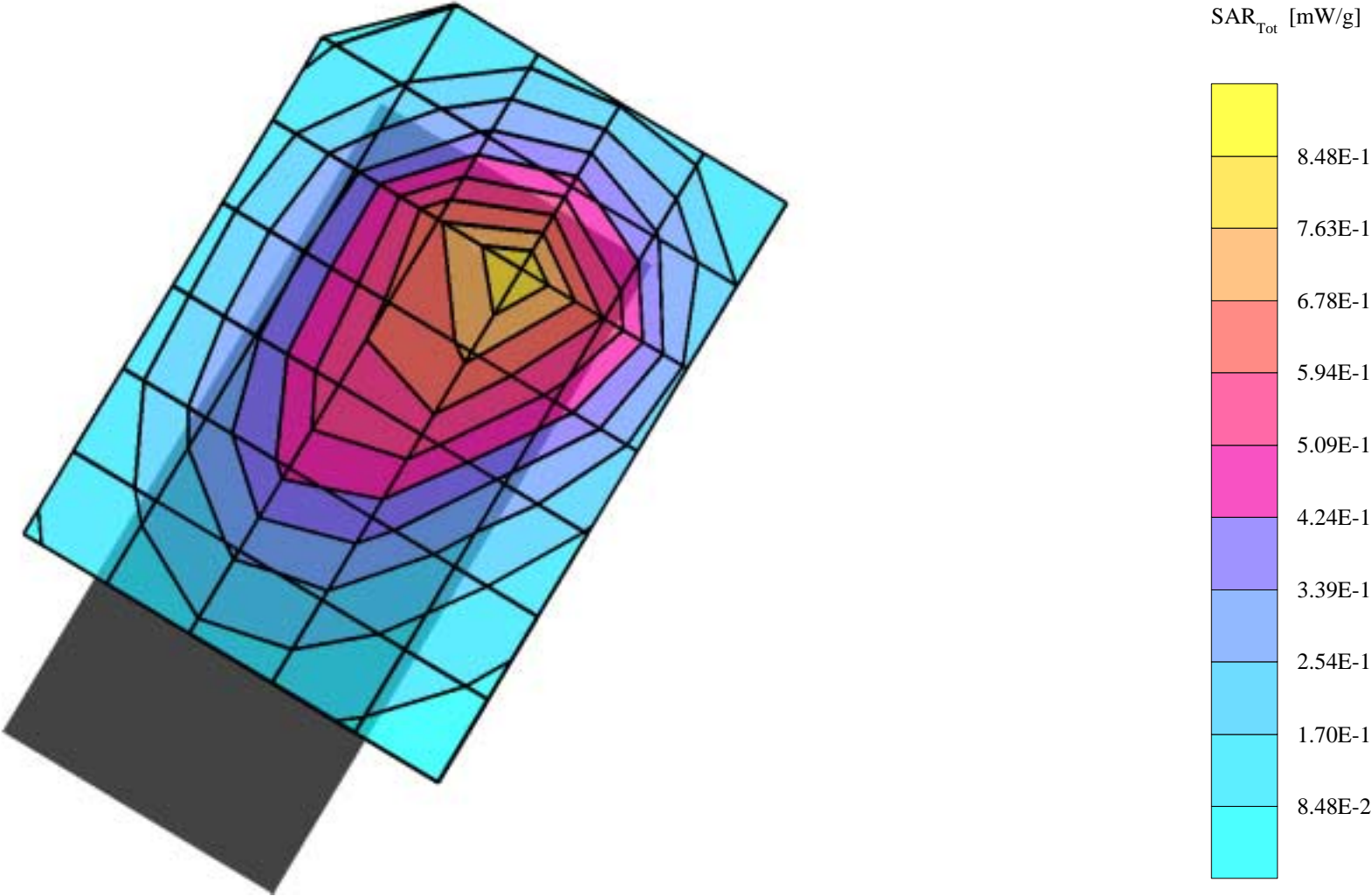
SAM 3 Phantom; Left Hand Section; Position: tilted; Frequency: 824 MHz, AMPS

Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Brain 836 MHz SCC34: $\sigma = 0.89$ mho/m $\epsilon = 40.3$ $\rho = 1.00$ g/cm³, liquid temperature: 22.8 C

Cube 5x5x7: SAR (1g): 0.794 mW/g, SAR (10g): 0.510 mW/g

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

Powerdrift: 0.02 dB



LJPNKC-1X, optional battery BLC-2

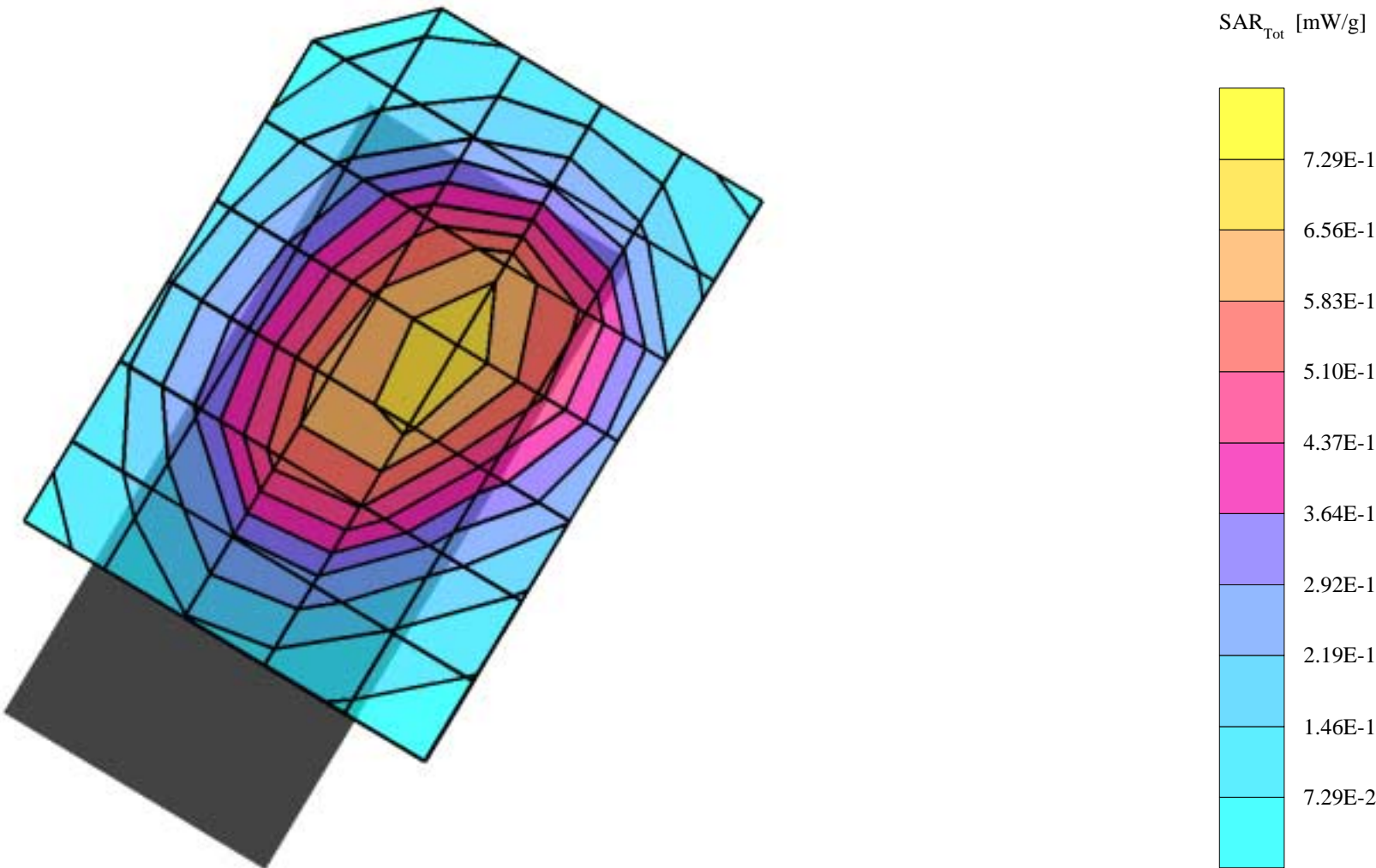
SAM 3 Phantom; Left Hand Section; Position: Cheek; Frequency: 836 MHz, TDMA

Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 3.0; Brain 836 MHz SCC34: $\sigma = 0.87 \text{ mho/m}$ $\epsilon = 42.4$ $\rho = 1.00 \text{ g/cm}^3$, liquid temperature 23.0 C

Cube 5x5x7: SAR (1g): 0.702 mW/g, SAR (10g): 0.481 mW/g

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

Powerdrift: -0.02 dB



LJPNKC-1X, optional battery BLC-2

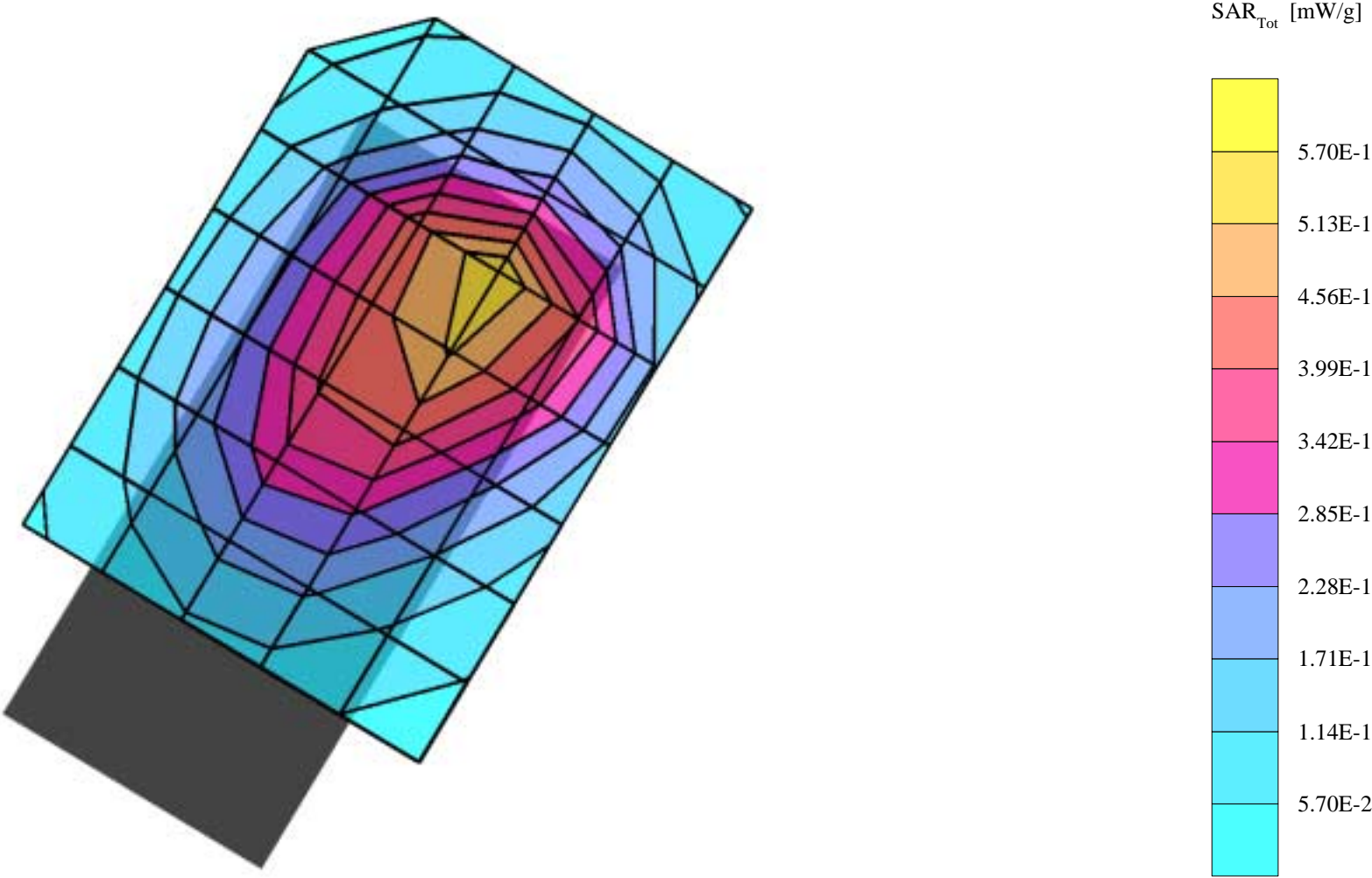
SAM 3 Phantom; Left Hand Section; Position: tilted; Frequency: 836 MHz, TDMA

Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 3.0; Brain 836 MHz SCC34: $\sigma = 0.87 \text{ mho/m}$ $\epsilon = 42.4$ $\rho = 1.00 \text{ g/cm}^3$, liquid temperature 22,8 C

Cube 5x5x7: SAR (1g): 0.536 mW/g, SAR (10g): 0.355 mW/g

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

Powerdrift: -0.03 dB



LJPNKC-1X, CSM-6, optional battery BLC-2

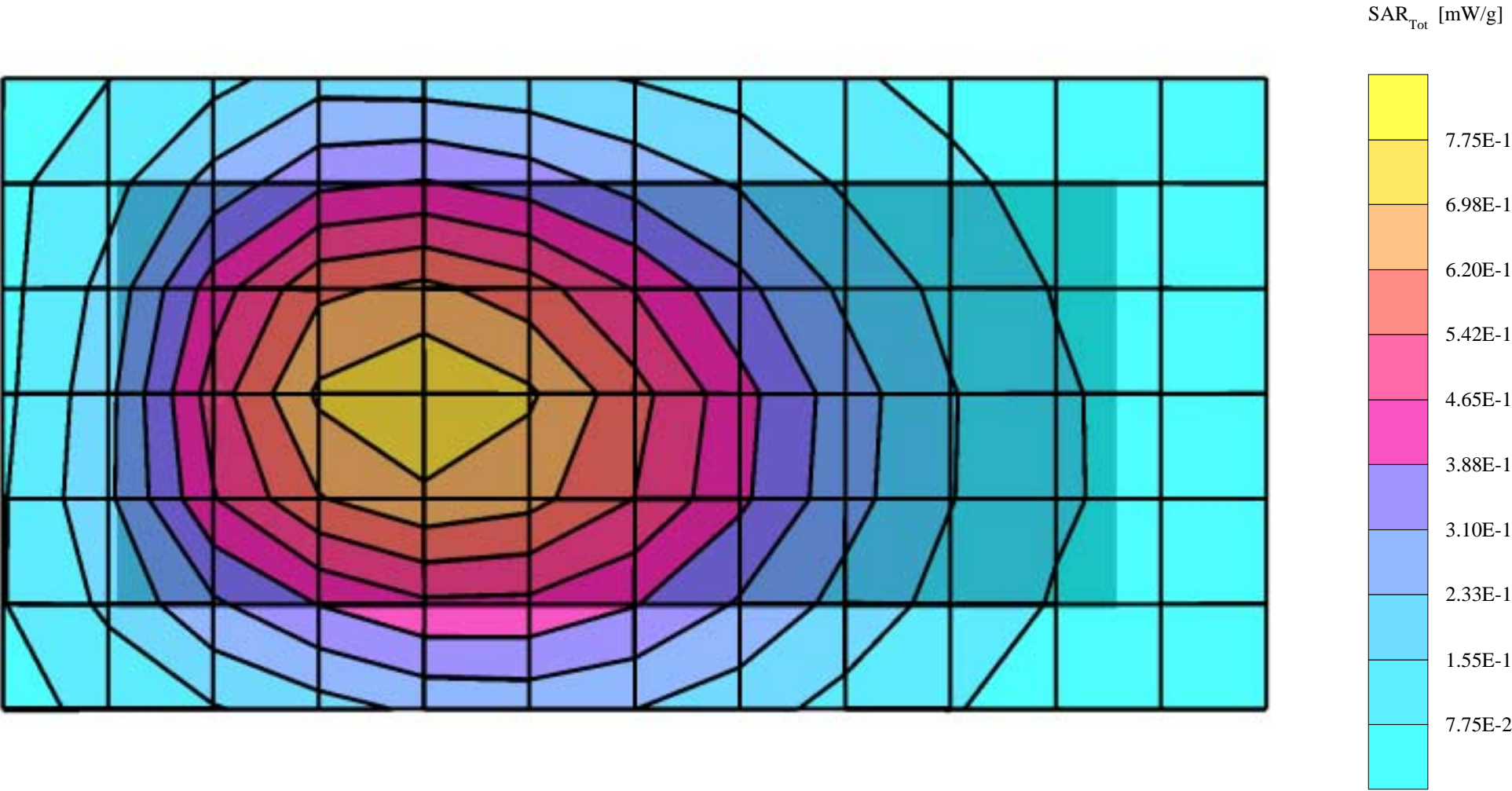
SAM 3 Phantom; Flat Section; Position: Body worn; Frequency: 824 MHz, AMPS

Probe: ET3DV6 - SN1381; ConvF(6.04,6.04,6.04); Crest factor: 1.0; Muscle 836 MHz: $\sigma = 0.96 \text{ mho/m}$ $\epsilon = 56.7$ $\rho = 1.00 \text{ g/cm}^3$, liquid temperature: 22.7 C

Cube 5x5x7: SAR (1g): 0.732 mW/g, SAR (10g): 0.516 mW/g

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

Powerdrift: 0.06 dB



LJPNKC-1X, CSM-6, optional battery BLC-2

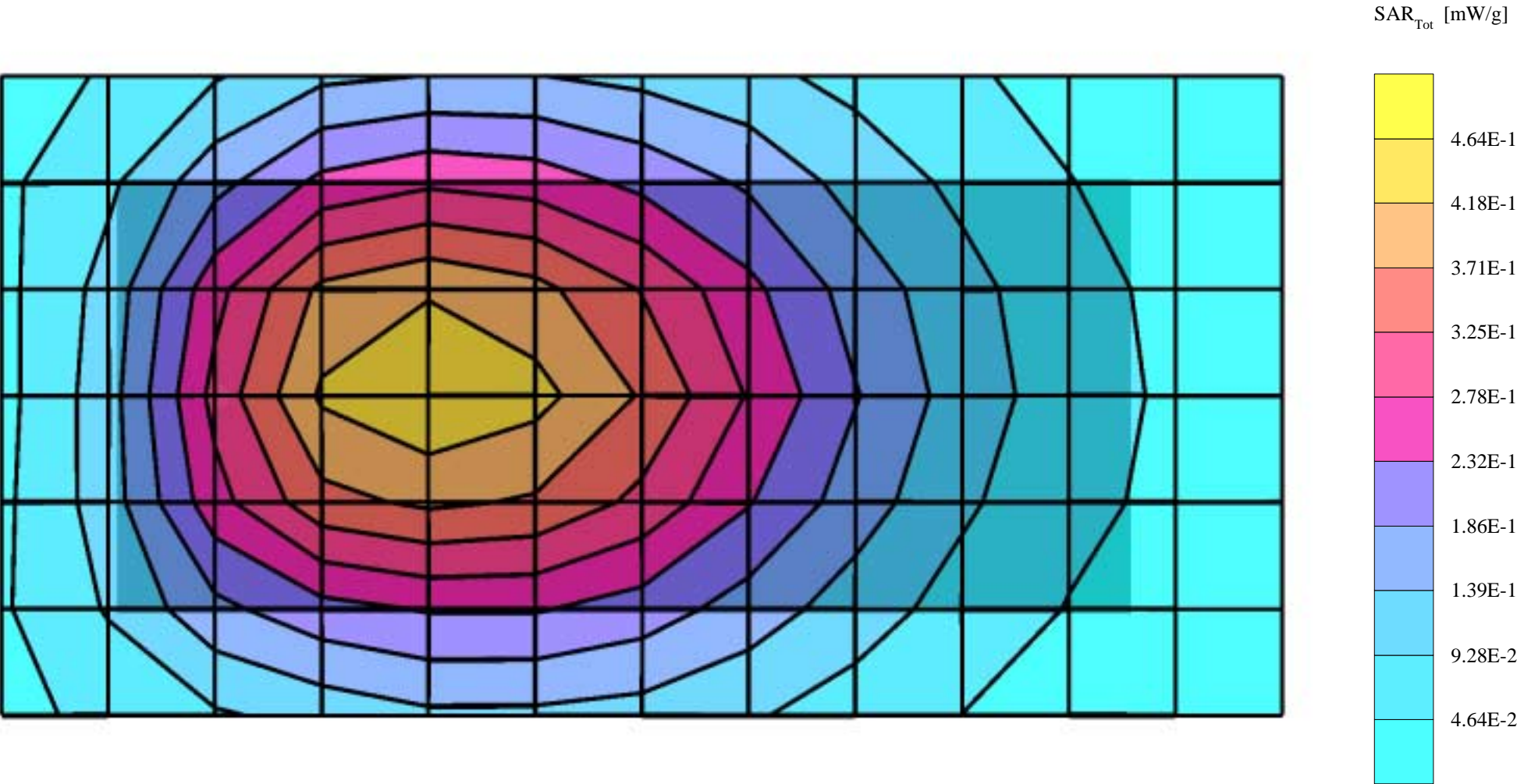
SAM 3 Phantom; Flat Section; Position: body worn; Frequency: 824 MHz, TDMA

Probe: ET3DV6 - SN1381; ConvF(6.04,6.04,6.04); Crest factor: 3.0; Muscle 836 MHz: $\sigma = 0.96 \text{ mho/m}$ $\epsilon = 56.7$ $\rho = 1.00 \text{ g/cm}^3$, liquid temperature: 22,7 C

Cube 5x5x7: SAR (1g): 0.451 mW/g, SAR (10g): 0.317 mW/g

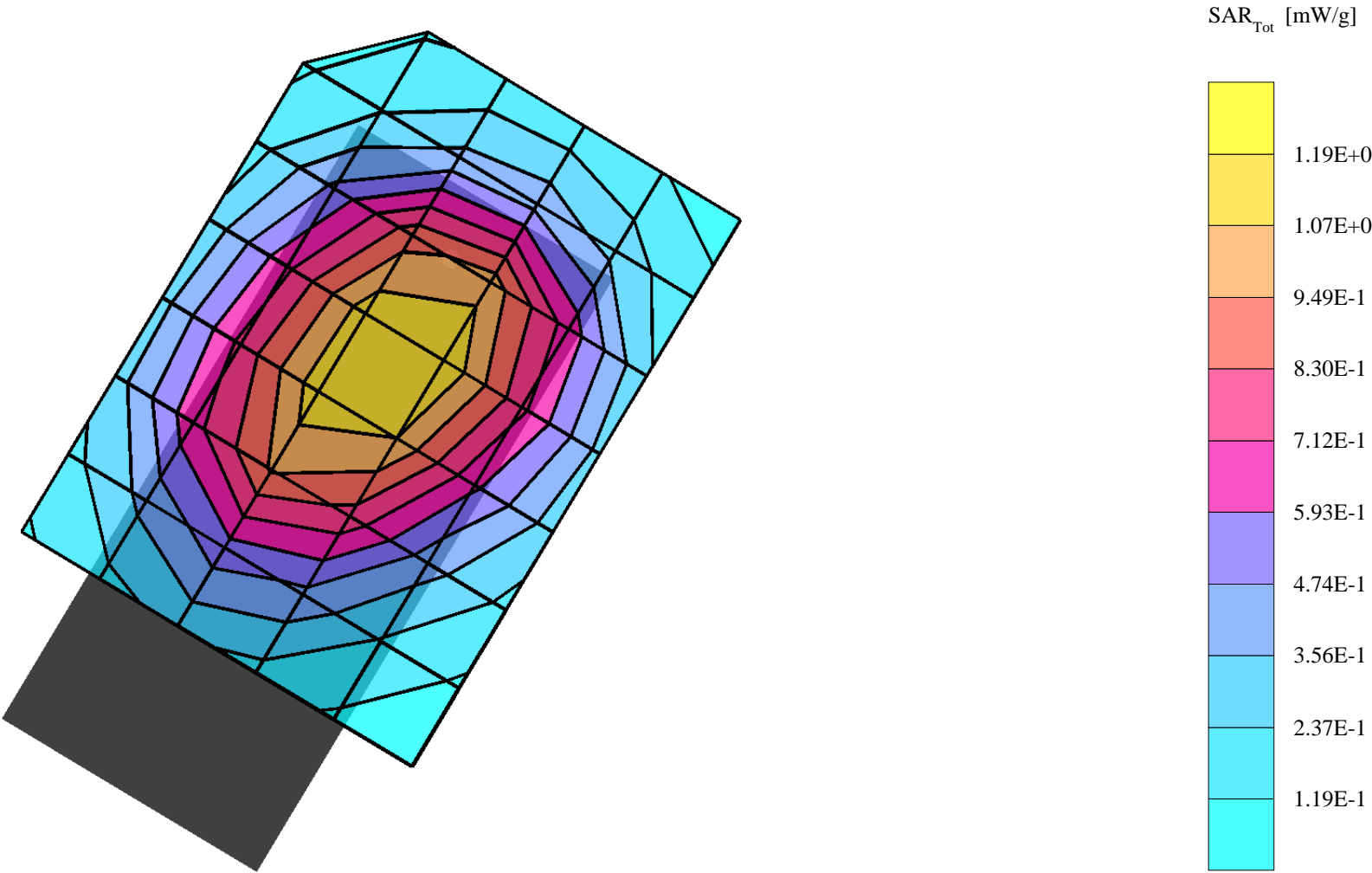
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0

Powerdrift: 0.05 dB



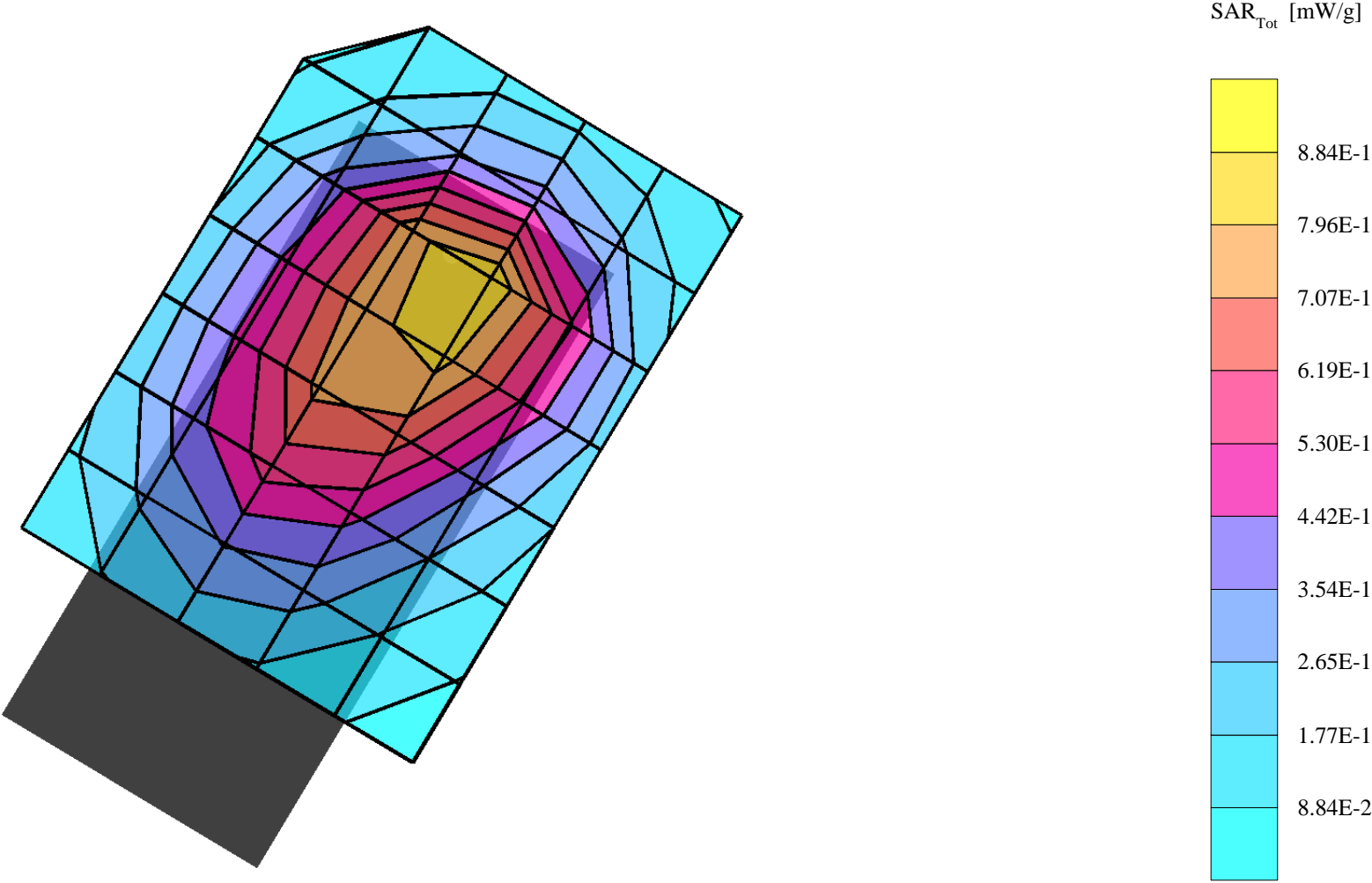
LJPNKC-1X

SAM 3 Phantom; Left Hand Section; Position: cheek; Frequency: 824 MHz, AMPS, painted cover
Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Brain 836 MHz SCC34: $\sigma = 0.90$ mho/m $\epsilon_r = 40.2$ $\rho = 1.00$ g/cm³, liquid temperature: 21.6 C
Cube 5x5x7: SAR (1g): 1.18 mW/g, SAR (10g): 0.808 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: 0.04 dB



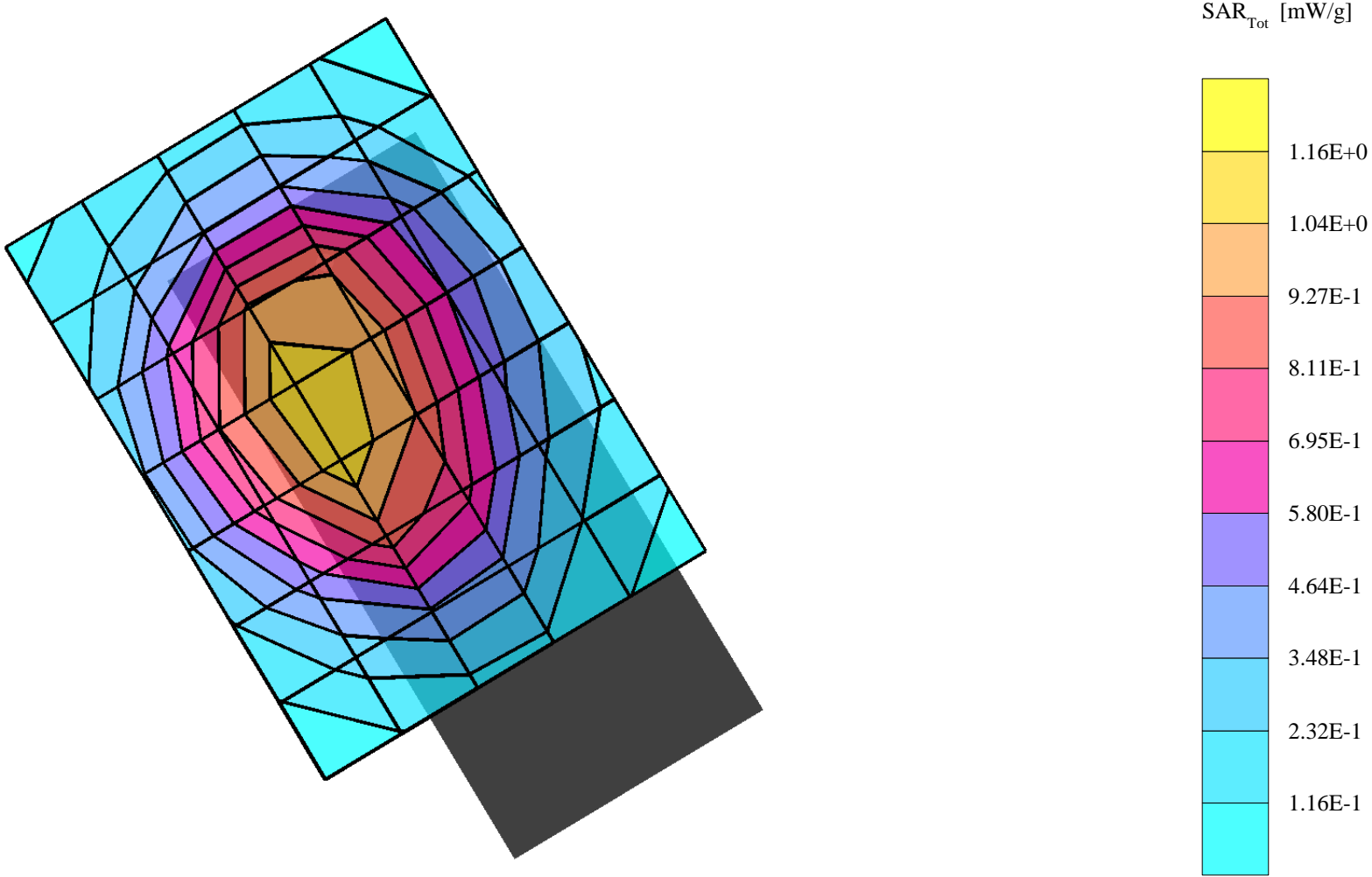
LJPNKC-1X

SAM 3 Phantom; Left Hand Section; Position: tilted Frequency: 824 MHz, AMPS, painted cover
Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Brain 836 MHz SCC34: $\sigma = 0.90$ mho/m $\epsilon_r = 40.2$ $\rho = 1.00$ g/cm³, liquid temperature: 21.6 C
Cube 5x5x7: SAR (1g): 0.879 mW/g, SAR (10g): 0.585 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: 0.02 dB



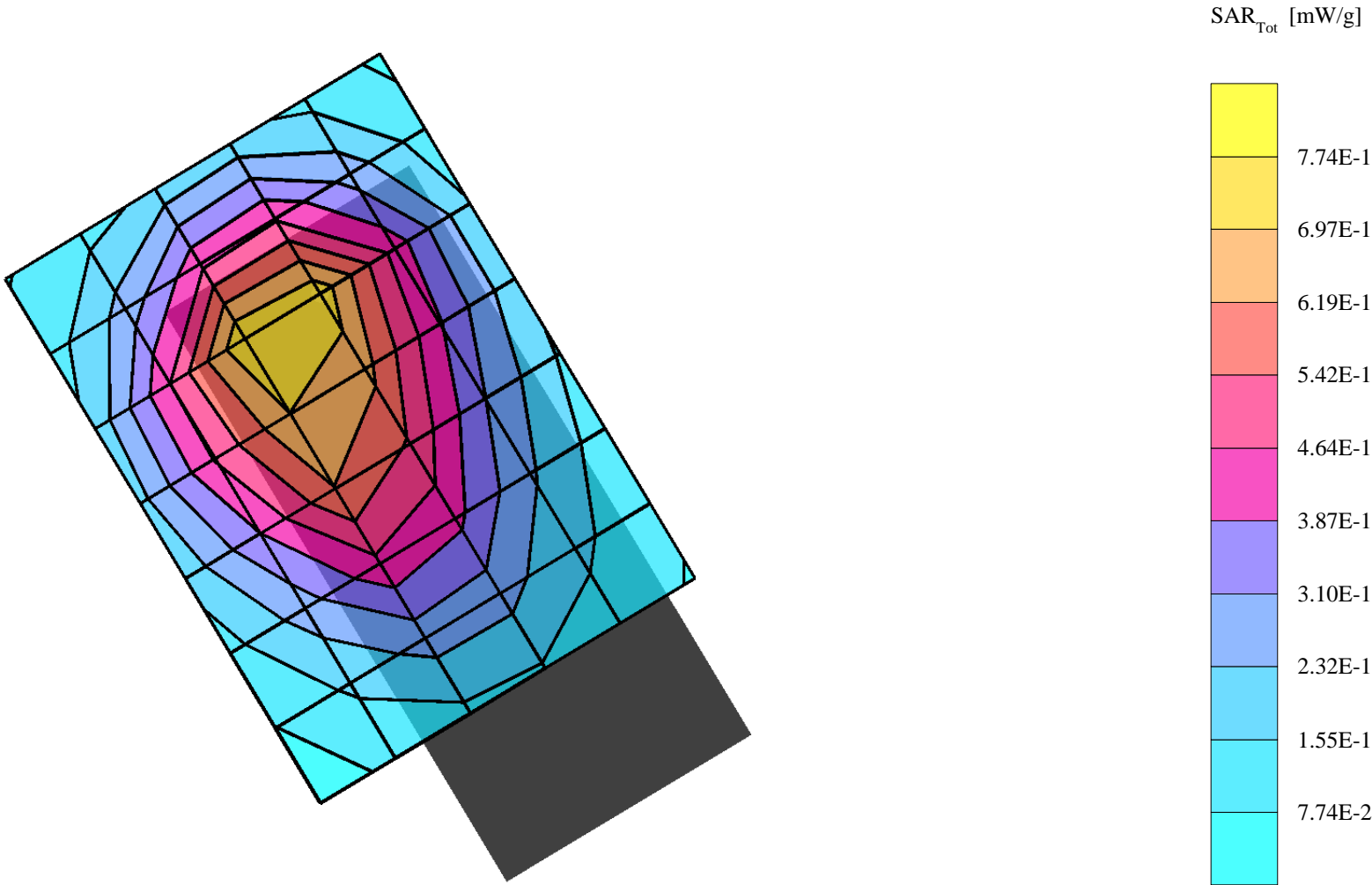
LJPNKC-1X

SAM 3 Phantom; Righ Hand Section; Position: cheek; Frequency: 824 MHz, AMPS, painted cover
Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Brain 836 MHz SCC34: $\sigma = 0.90$ mho/m $\epsilon_r = 40.2$ $\rho = 1.00$ g/cm³, liquid temperature: 22.0 C
Cube 5x5x7: SAR (1g): 1.10 mW/g, SAR (10g): 0.773 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.11 dB



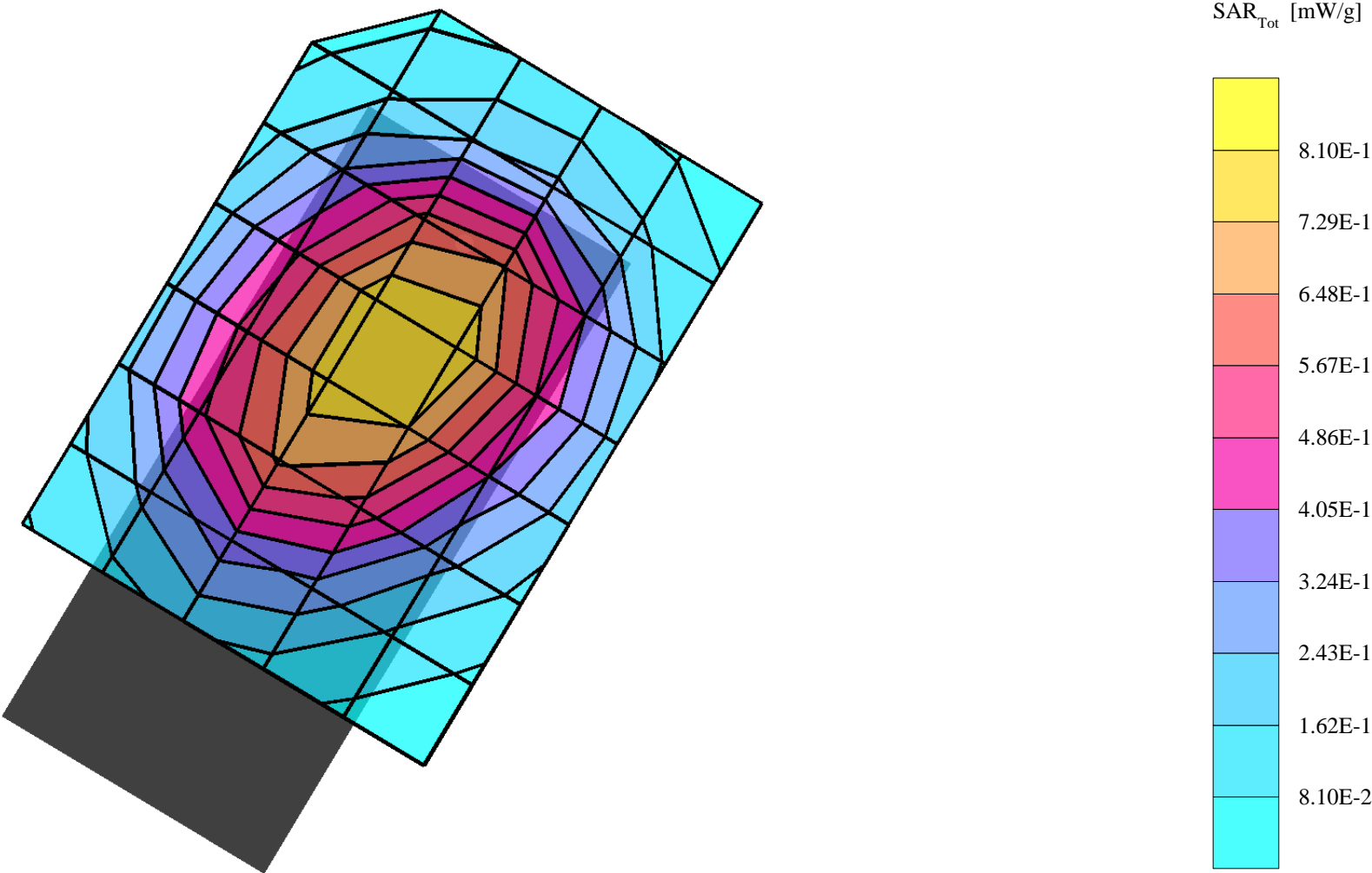
LJPNKC-1X

SAM 3 Phantom; Righ Hand Section; Position: tilted; Frequency: 824 MHz, AMPS, painted cover
Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Brain 836 MHz SCC34: $\sigma = 0.90$ mho/m $\epsilon_r = 40.2$ $\rho = 1.00$ g/cm³, liquid temperature 22.0 C
Cube 5x5x7: SAR (1g): 0.763 mW/g, SAR (10g): 0.512 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.02 dB



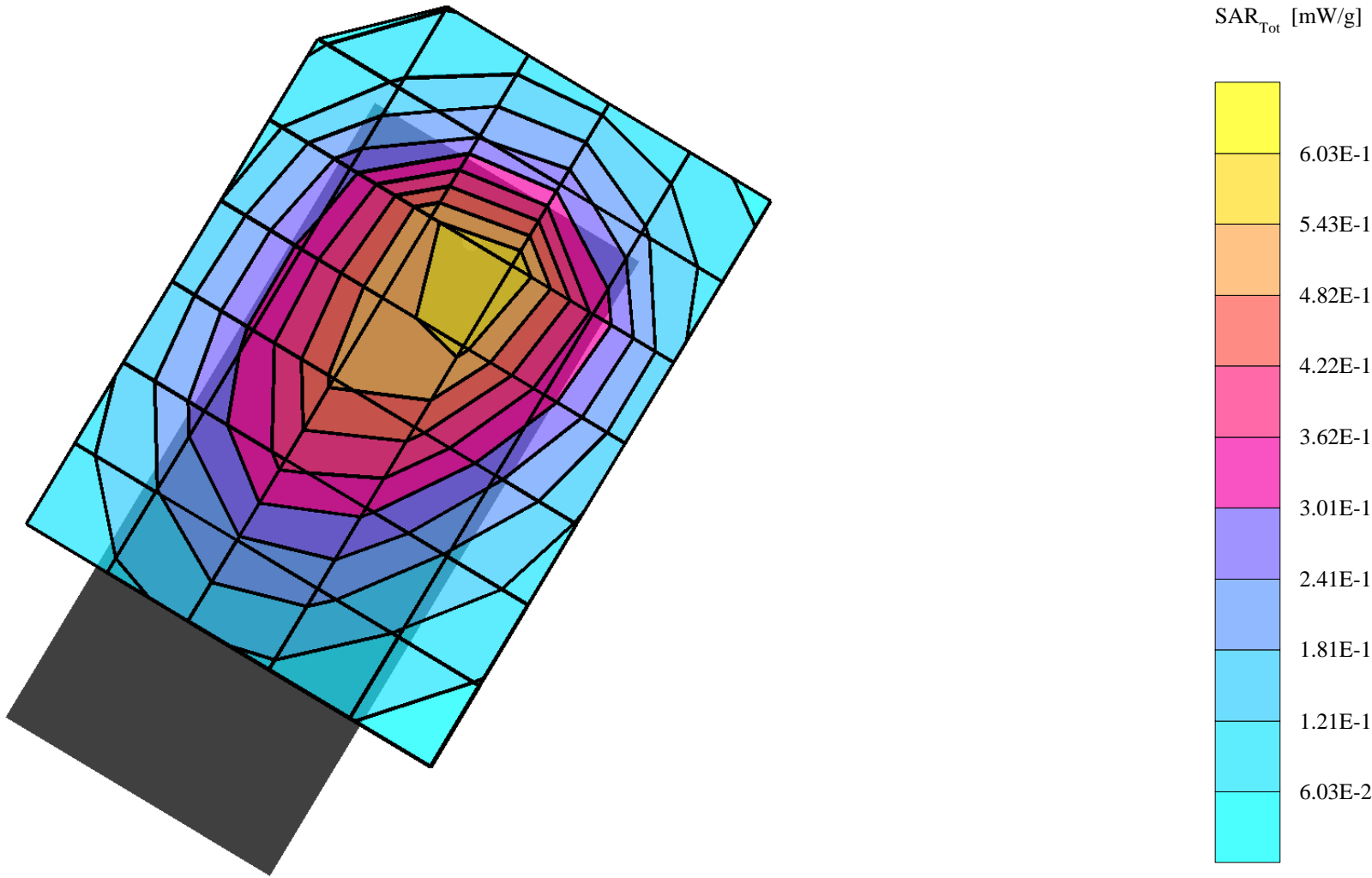
LJPNKC-1X

SAM 3 Phantom; Left Hand Section; Position: cheek; Frequency: 836 MHz, TDMA, painted cover
Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 3.0; Brain 836 MHz SCC34: $\sigma = 0.90$ mho/m $\epsilon_r = 40.2$ $\rho = 1.00$ g/cm³, liquid temperature: 21.8 C
Cube 5x5x7: SAR (1g): 0.818 mW/g, SAR (10g): 0.555 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: 0.04 dB



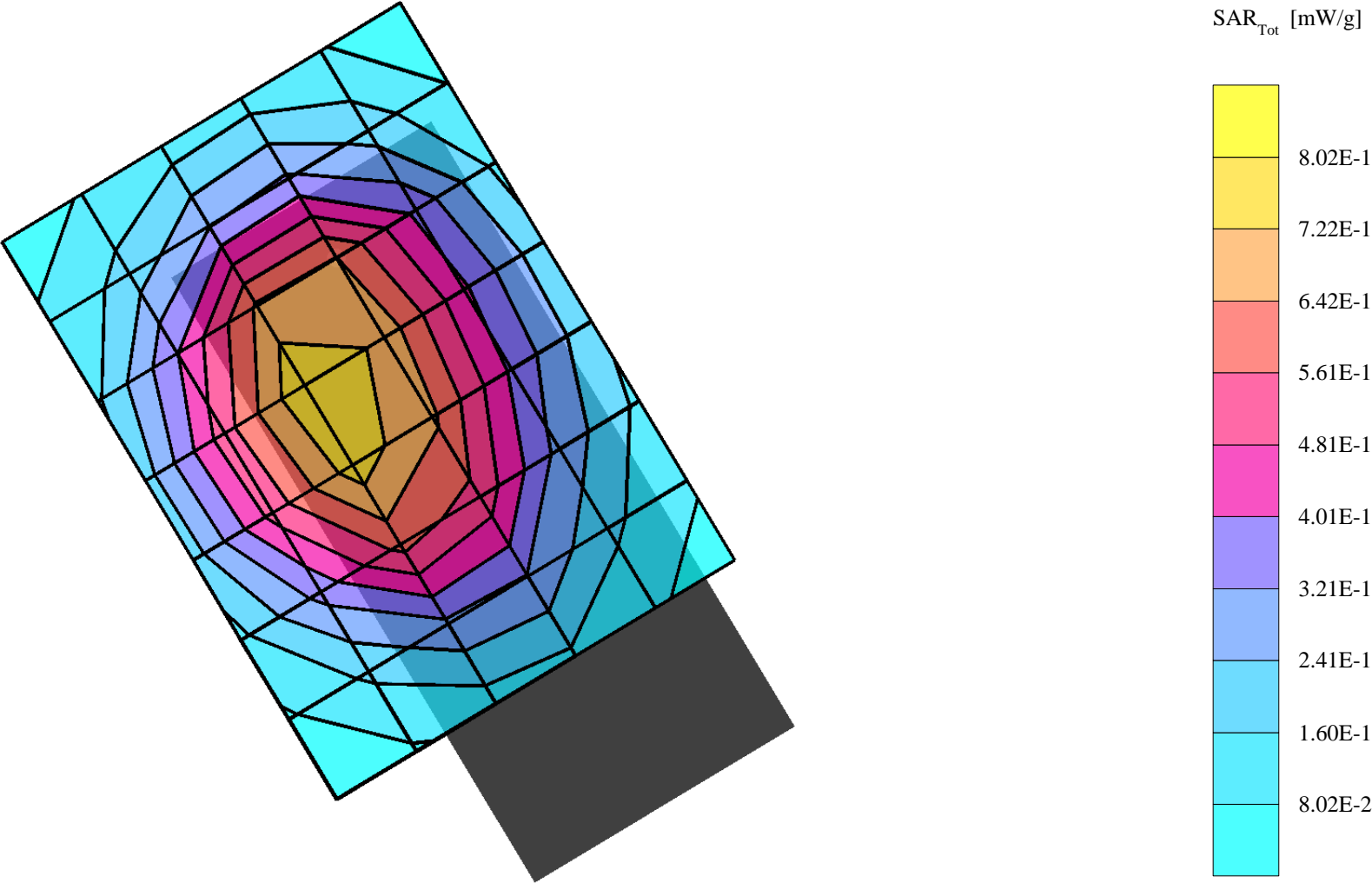
LJPNKC-1X

SAM 3 Phantom; Left Hand Section; Position: tilted; Frequency: 836 MHz, TDMA, painted cover
Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 3.0; Brain 836 MHz SCC34: $\sigma = 0.90$ mho/m $\epsilon_r = 40.2$ $\rho = 1.00$ g/cm³, liquid temperature: 21.8 C
Cube 5x5x7: SAR (1g): 0.591 mW/g, SAR (10g): 0.392 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.01 dB



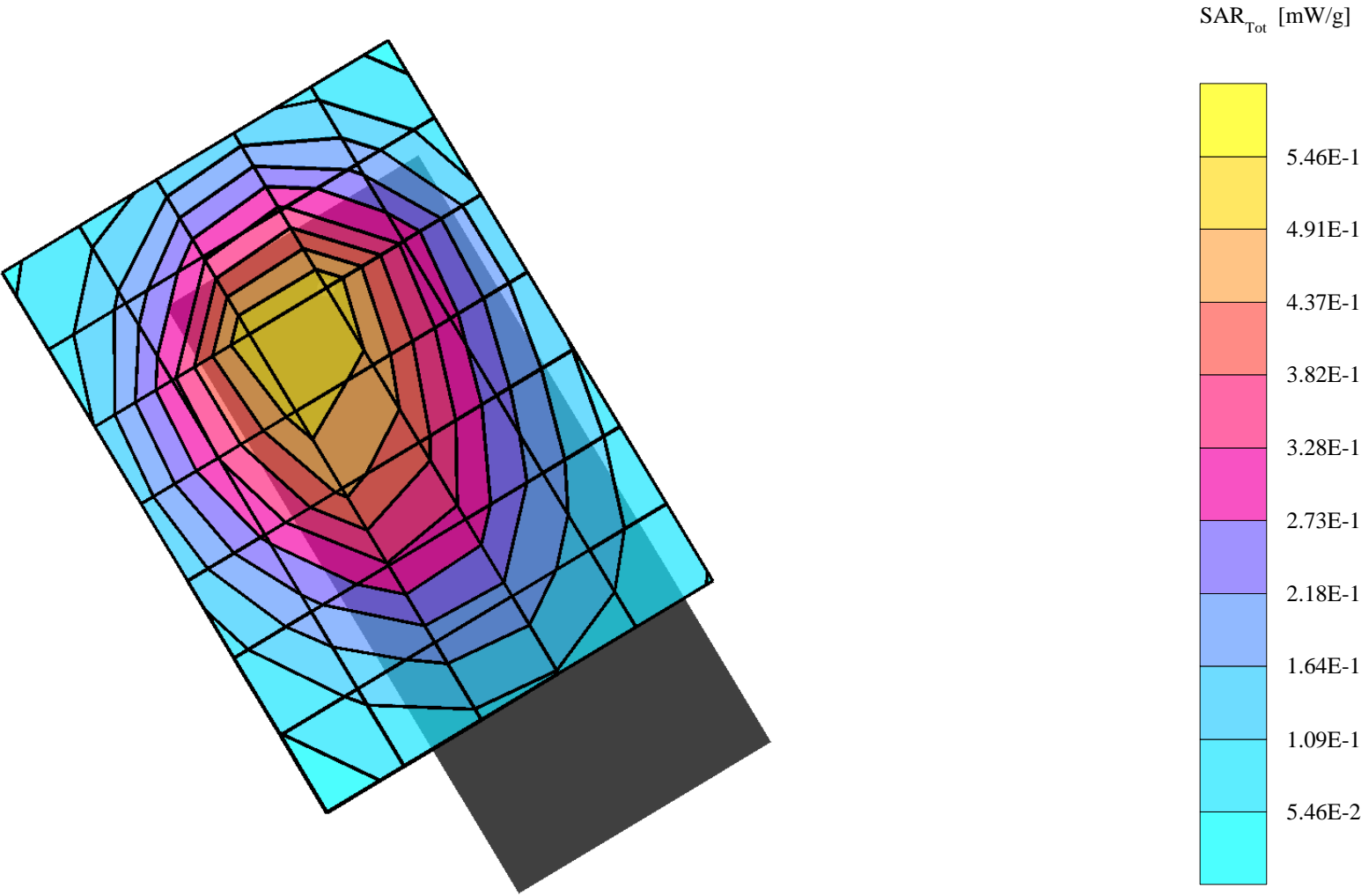
LJPNKC-1X

SAM 3 Phantom; Righ Hand Section; Position: cheek; Frequency: 836 MHz, TDMA, painted cover
Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 3.0; Brain 836 MHz SCC34: $\sigma = 0.90$ mho/m $\epsilon_r = 40.2$ $\rho = 1.00$ g/cm³, liquid temperature: 21.9 C
Cube 5x5x7: SAR (1g): 0.777 mW/g, SAR (10g): 0.544 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: 0.06 dB



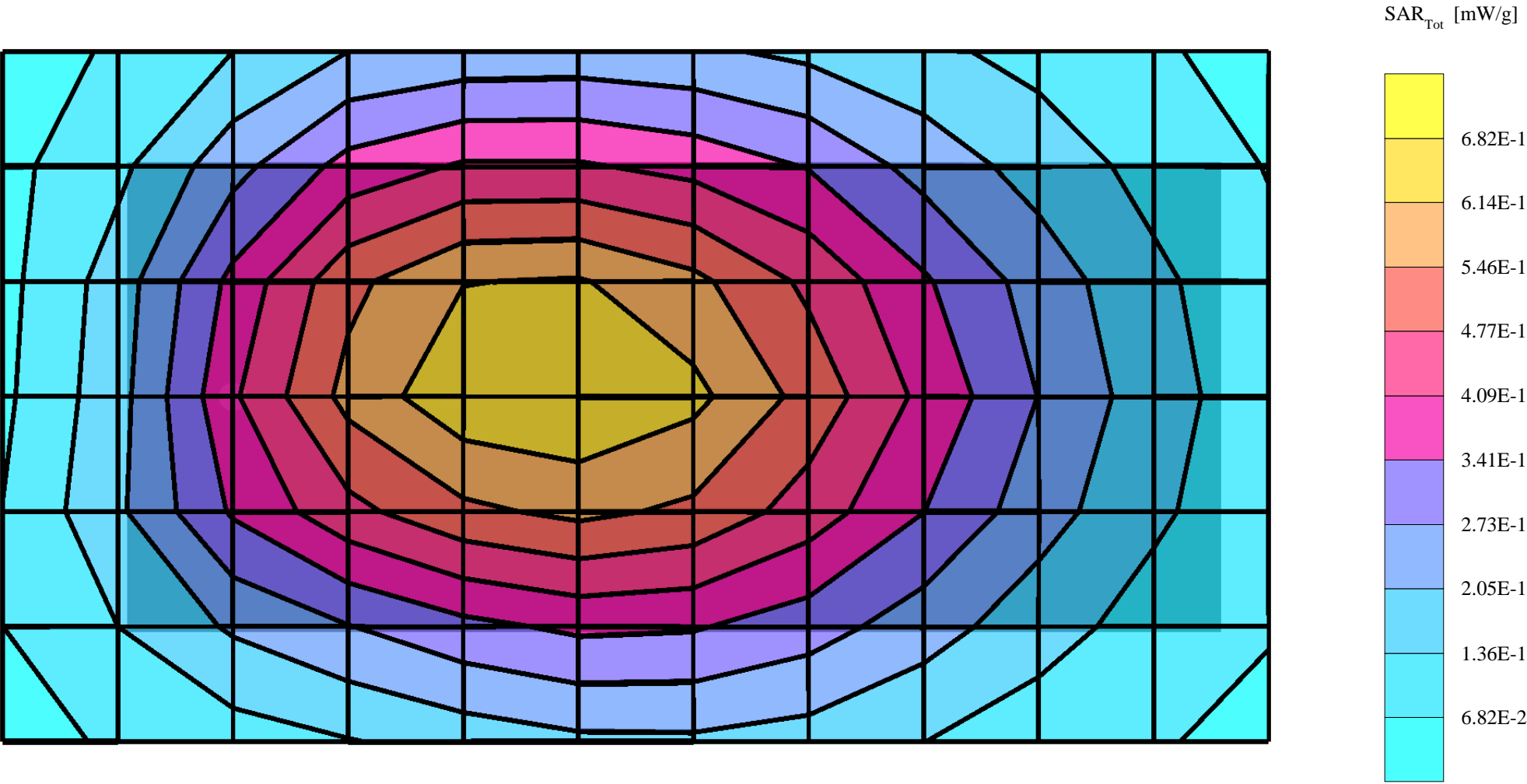
LJPNKC-1X

SAM 3 Phantom; Righ Hand Section; Position: tilted; Frequency: 836 MHz, TDMA, painted cover
Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 3.0; Brain 836 MHz SCC34: $\sigma = 0.90$ mho/m $\epsilon_r = 40.2$ $\rho = 1.00$ g/cm³, liquid temperature: 21.9 C
Cube 5x5x7: SAR (1g): 0.548 mW/g, SAR (10g): 0.372 mW/g
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: 0.03 dB



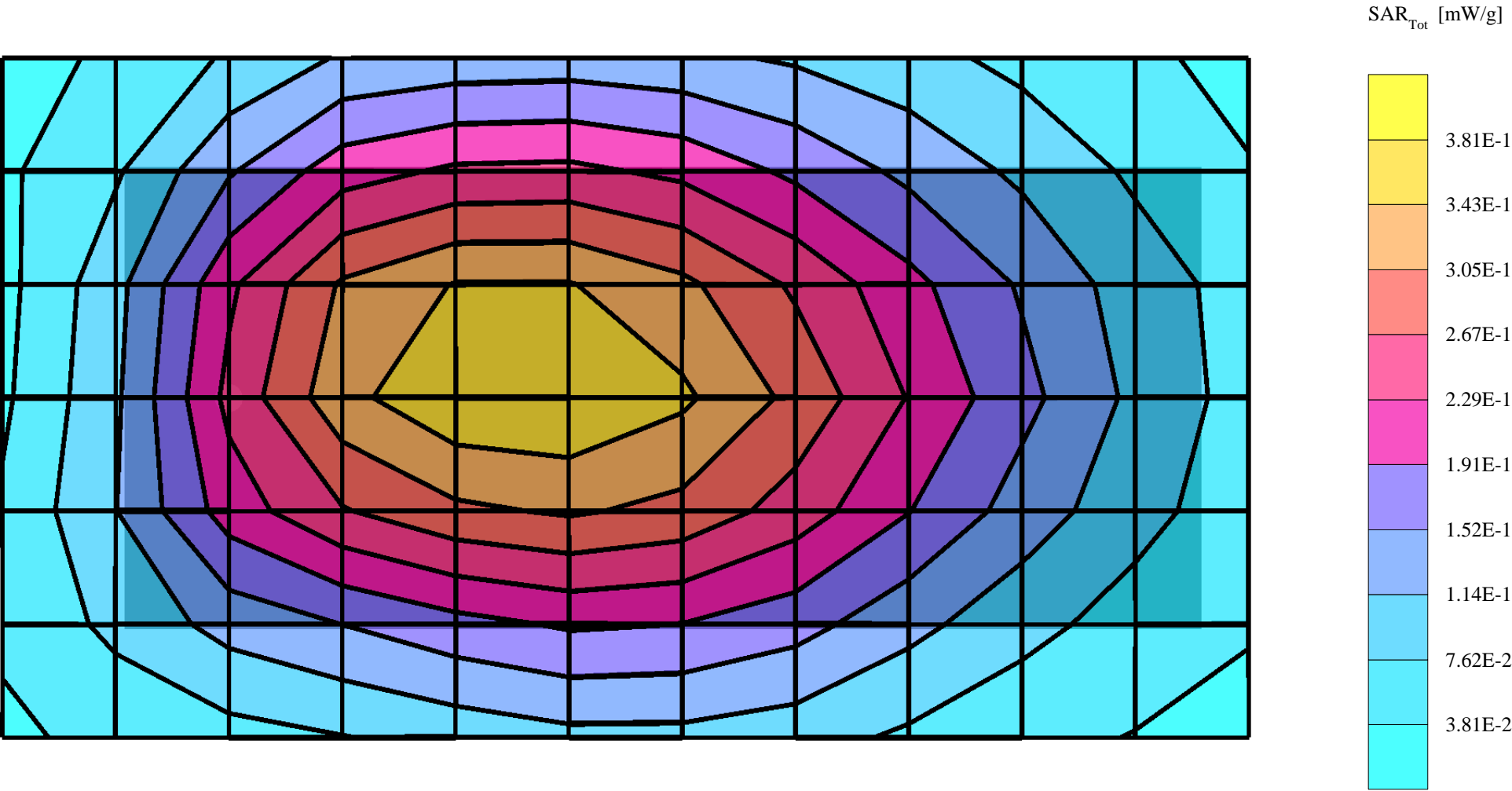
LJPNKC-1X, CSM-6

SAM 3 Phantom; Flat Section; Position: body worn; Frequency: 824 MHz, AMPS, painted cover
Probe: ET3DV6 - SN1381; ConvF(6.04,6.04,6.04); Crest factor: 1.0; Muscle 836 MHz: $\sigma = 0.95 \text{ mho/m}$ $\epsilon_r = 56.4$ $\rho = 1.00 \text{ g/cm}^3$, liquid temperature: 21.2
Cube 5x5x7: SAR (1g): 0.662 mW/g, SAR (10g): 0.475 mW/g
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0
Powerdrift: -0.15 dB



LJPNKC-1X, CSM-6

SAM 3 Phantom; Flat Section; Position: body worn; Frequency: 824 MHz, TDMA, painted cover
Probe: ET3DV6 - SN1381; ConvF(6.04,6.04,6.04); Crest factor: 3.0; Muscle 836 MHz: $\sigma = 0.95$ mho/m $\epsilon_r = 56.4$ $\rho = 1.00$ g/cm³, liquid temperature: 21.2 C
Cube 5x5x7: SAR (1g): 0.363 mW/g, SAR (10g): 0.261 mW/g
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0
Powerdrift: -0.02 dB



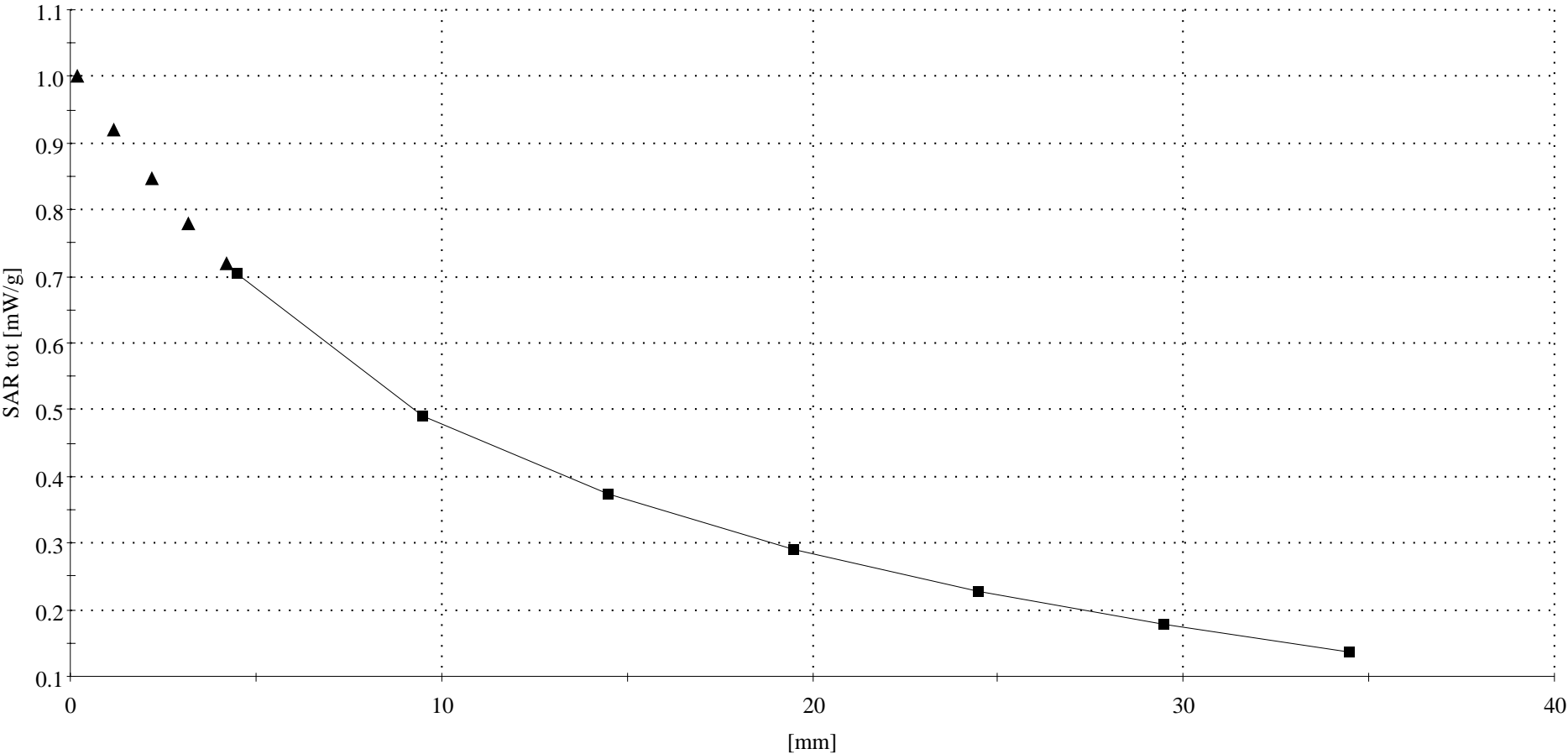
LJPNKC-1X

SAM 3 Phantom; Left Hand Section; Position: cheek; Frequency: 824 MHz

Probe: ET3DV6 - SN1381; ConvF(6.20,6.20,6.20); Crest factor: 1.0; Brain 836 MHz SCC34: $\sigma = 0.90$ mho/m $\epsilon = 40.8$ $\rho = 1.00$ g/cm³, liquiud temperature: 21.7 C

Cube 5x5x7: SAR (1g): 1.20 mW/g, SAR (10g): 0.817 mW/g

Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0



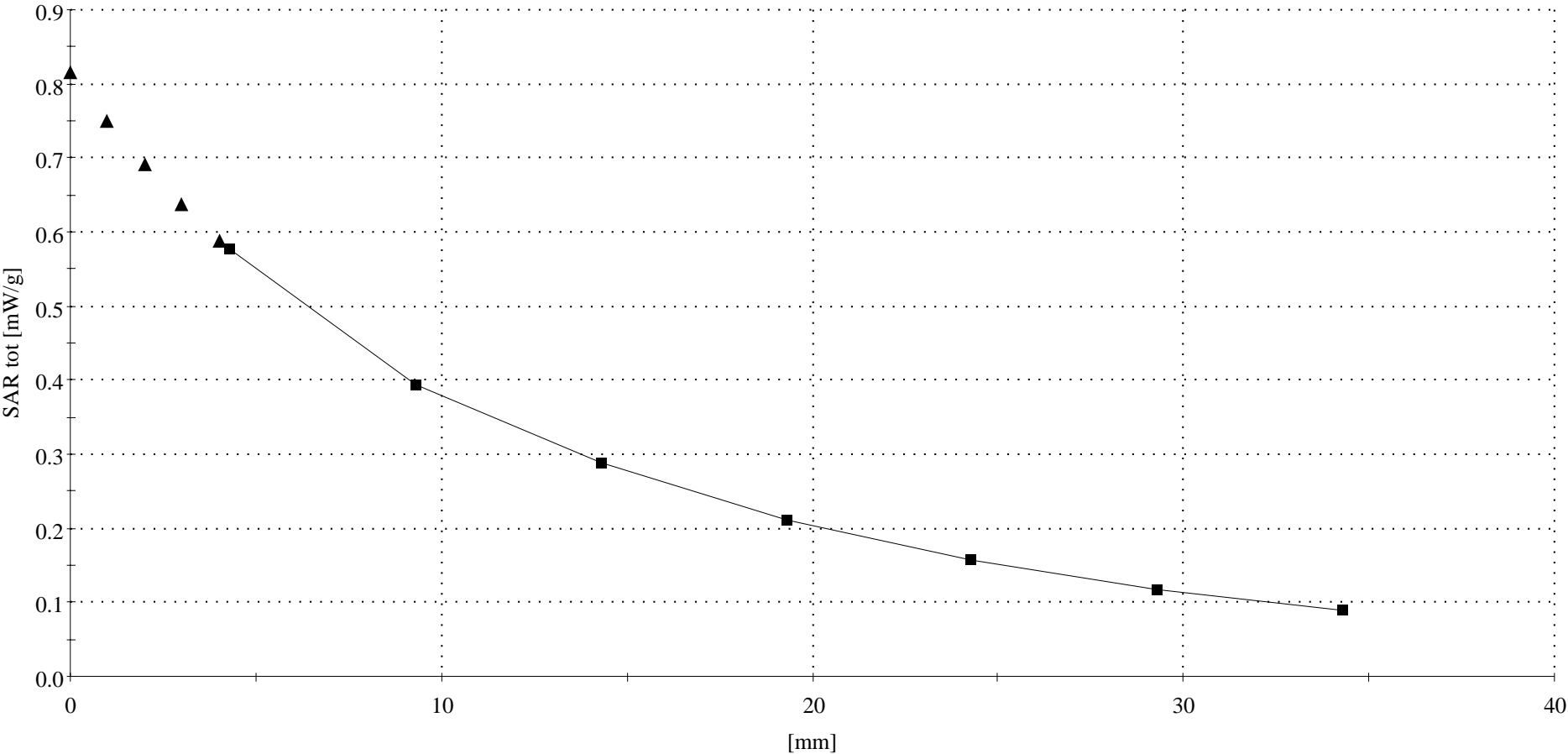
LJPNKC-1X, CSM-6

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

Probe: ET3DV6 - SN1381; ConvF(6.04,6.04,6.04); Crest factor: 1.0; Muscle 836 MHz: $\sigma = 0.96 \text{ mho/m}$ $\epsilon = 56.7$ $\rho = 1.00 \text{ g/cm}^3$, liquid temperature: 21.8 C

Cube 5x5x7: SAR (1g): 0.873 mW/g, SAR (10g): 0.614 mW/g

Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0



APPENDIX C.

Calibration Certificate(s)

Calibration Certificate

Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1381

Place of Calibration:

Zurich

Date of Calibration:

October 25, 2001

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:

Nikolaus Meriana

Approved by:

Julian Kofja

Probe ET3DV6

SN:1381

| | |
|-------------------|--------------------|
| Manufactured: | September 18, 1999 |
| Last calibration: | October 6, 2000 |
| Recalibrated: | October 25, 2001 |

Calibrated for System DASY3

DASY3 - Parameters of Probe: ET3DV6 SN:1381

Sensitivity in Free Space

| | |
|-------|---|
| NormX | 1.57 $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormY | 1.70 $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormZ | 1.78 $\mu\text{V}/(\text{V}/\text{m})^2$ |

Diode Compression

| | |
|-------|--------------|
| DCP X | 95 mV |
| DCP Y | 95 mV |
| DCP Z | 95 mV |

Sensitivity in Tissue Simulating Liquid

Head **450 MHz** $\epsilon_r = 43.5 \pm 5\%$ $S = 0.87 \pm 10\%$ mho/m

| | | | |
|---------|--------------------------|------------------|-------------|
| ConvF X | 6.66 extrapolated | Boundary effect: | |
| ConvF Y | 6.66 extrapolated | Alpha | 0.29 |
| ConvF Z | 6.66 extrapolated | Depth | 2.78 |

Head **800 - 1000 MHz** $\epsilon_r = 39.0 - 43.5$ $S = 0.80 - 1.10$ mho/m

| | | | |
|---------|-------------------------------|------------------|-------------|
| ConvF X | 6.21 $\pm 9.5\%$ (k=2) | Boundary effect: | |
| ConvF Y | 6.21 $\pm 9.5\%$ (k=2) | Alpha | 0.40 |
| ConvF Z | 6.21 $\pm 9.5\%$ (k=2) | Depth | 2.61 |

Head **1500 MHz** $\epsilon_r = 40.4 \pm 5\%$ $S = 1.23 \pm 10\%$ mho/m

| | | | |
|---------|--------------------------|------------------|-------------|
| ConvF X | 5.61 interpolated | Boundary effect: | |
| ConvF Y | 5.61 interpolated | Alpha | 0.55 |
| ConvF Z | 5.61 interpolated | Depth | 2.38 |

Head **1700 - 1910 MHz** $\epsilon_r = 39.5 - 41.0$ $S = 1.20 - 1.55$ mho/m

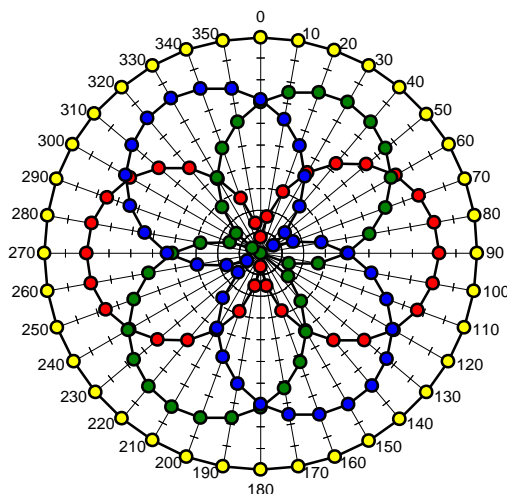
| | | | |
|---------|-------------------------------|------------------|-------------|
| ConvF X | 5.31 $\pm 9.5\%$ (k=2) | Boundary effect: | |
| ConvF Y | 5.31 $\pm 9.5\%$ (k=2) | Alpha | 0.62 |
| ConvF Z | 5.31 $\pm 9.5\%$ (k=2) | Depth | 2.27 |

Sensor Offset

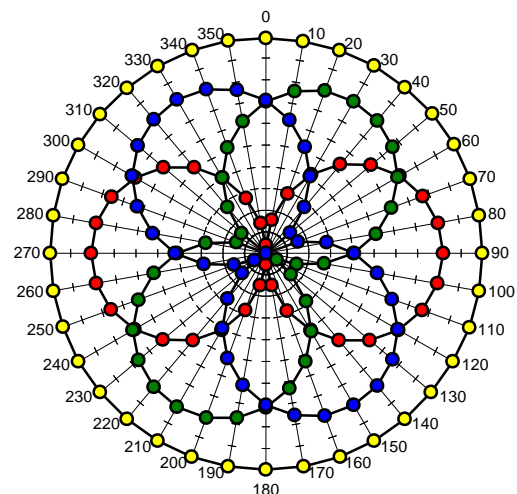
| | | |
|----------------------------|---------------------------------|----|
| Probe Tip to Sensor Center | 2.7 | mm |
| Optical Surface Detection | 1.6 \pm 0.2 | mm |

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

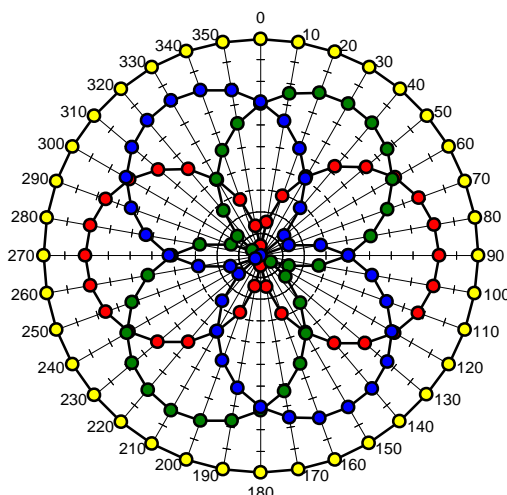
f = 30 MHz, TEM cell ifi110



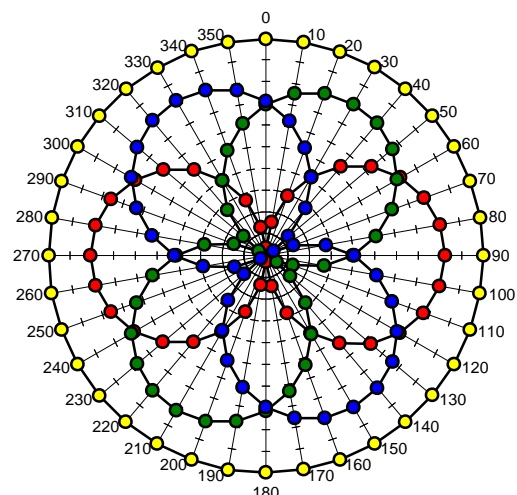
f = 100 MHz, TEM cell ifi110

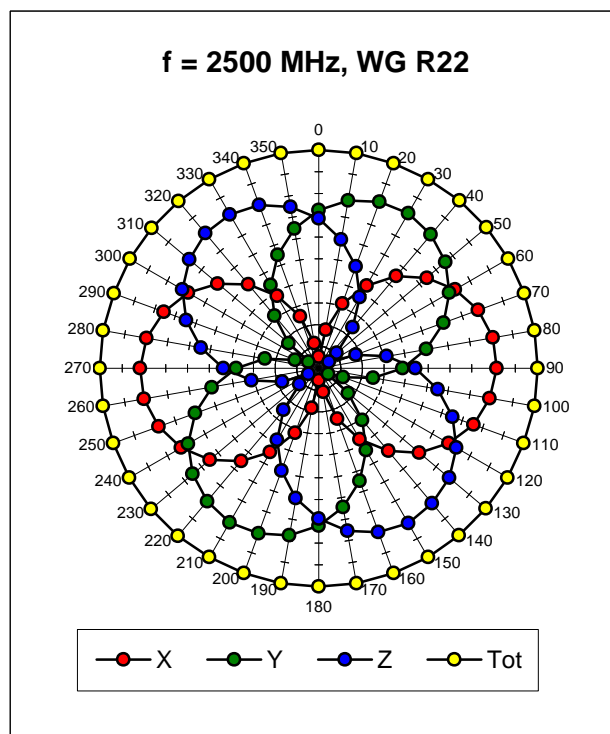
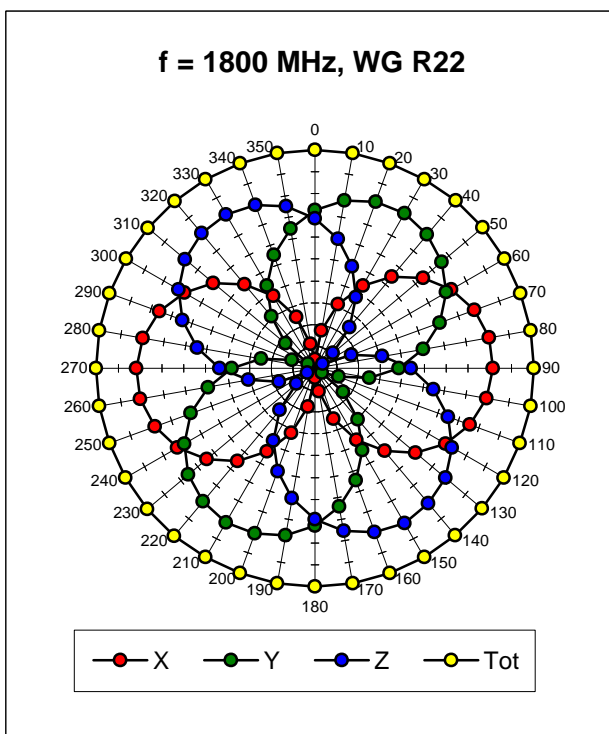


f = 300 MHz, TEM cell ifi110

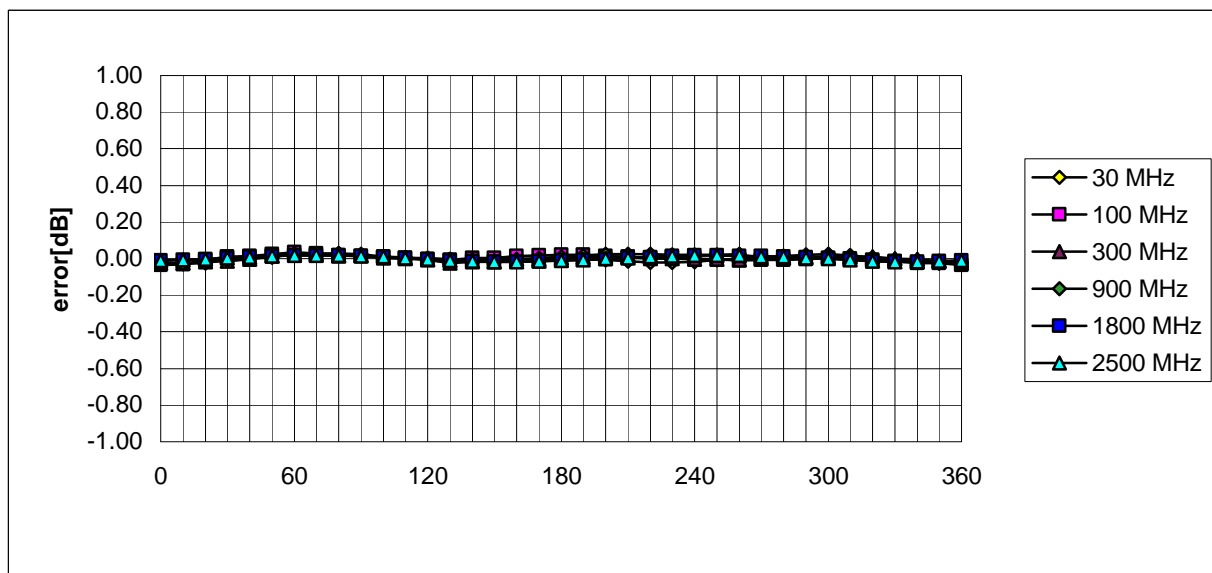


f = 900 MHz, TEM cell ifi110



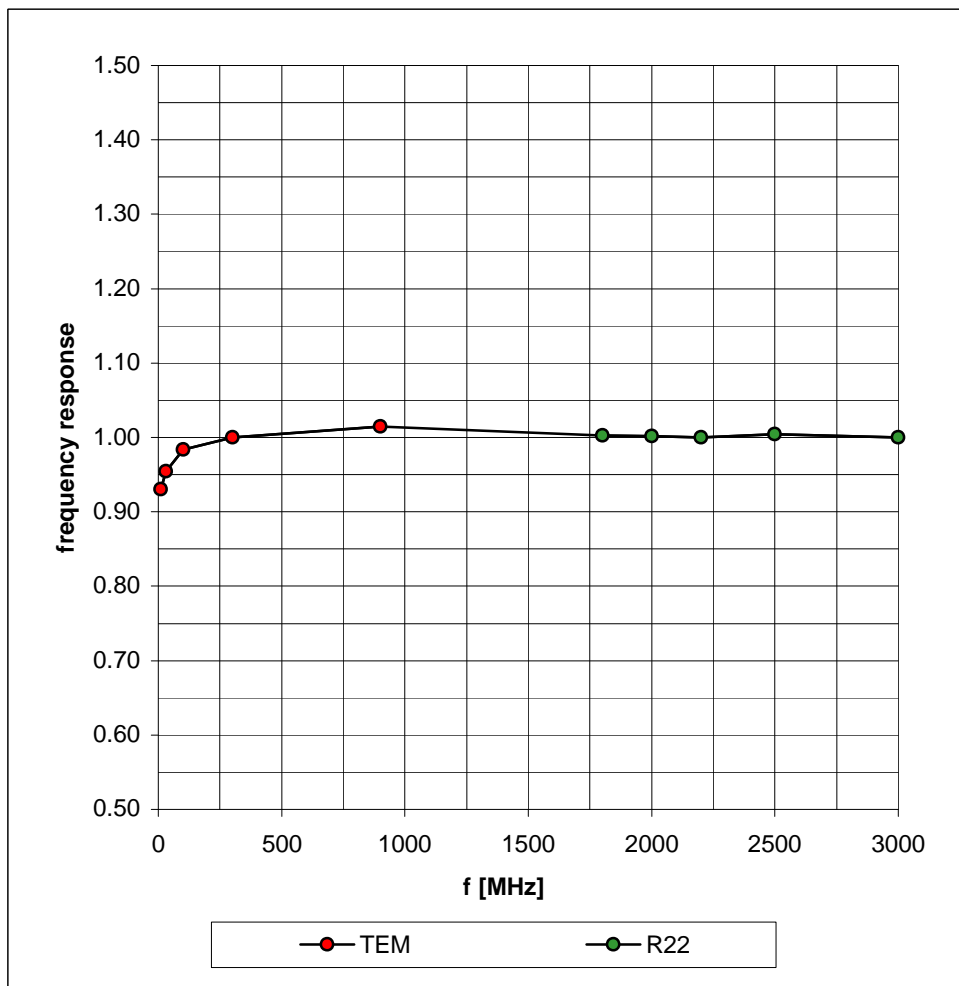


Isotropy Error (f), $q = 0^\circ$

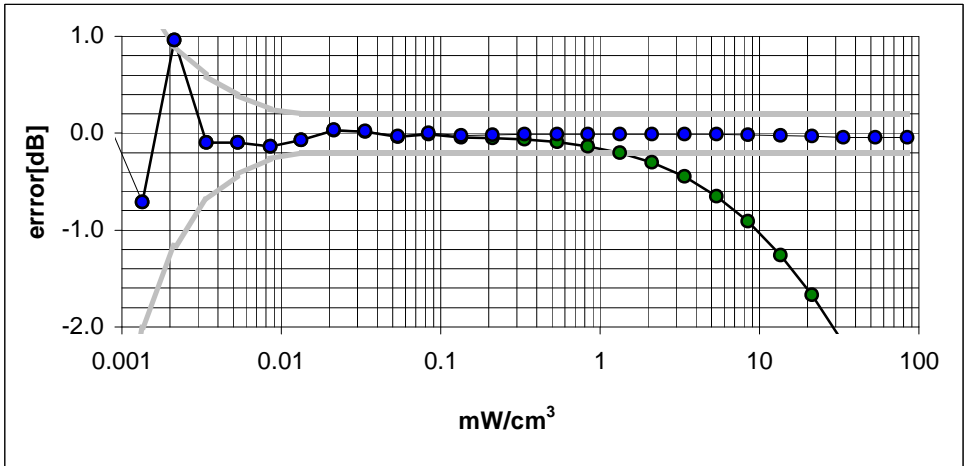
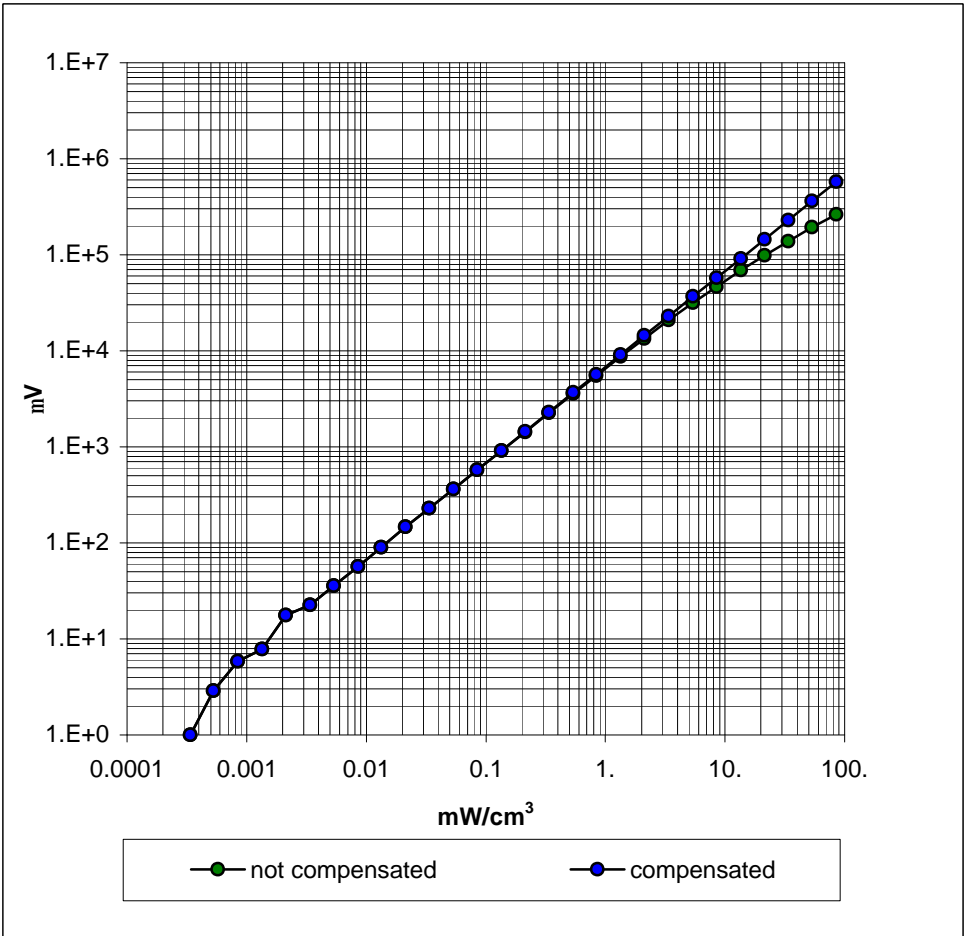


Frequency Response of E-Field

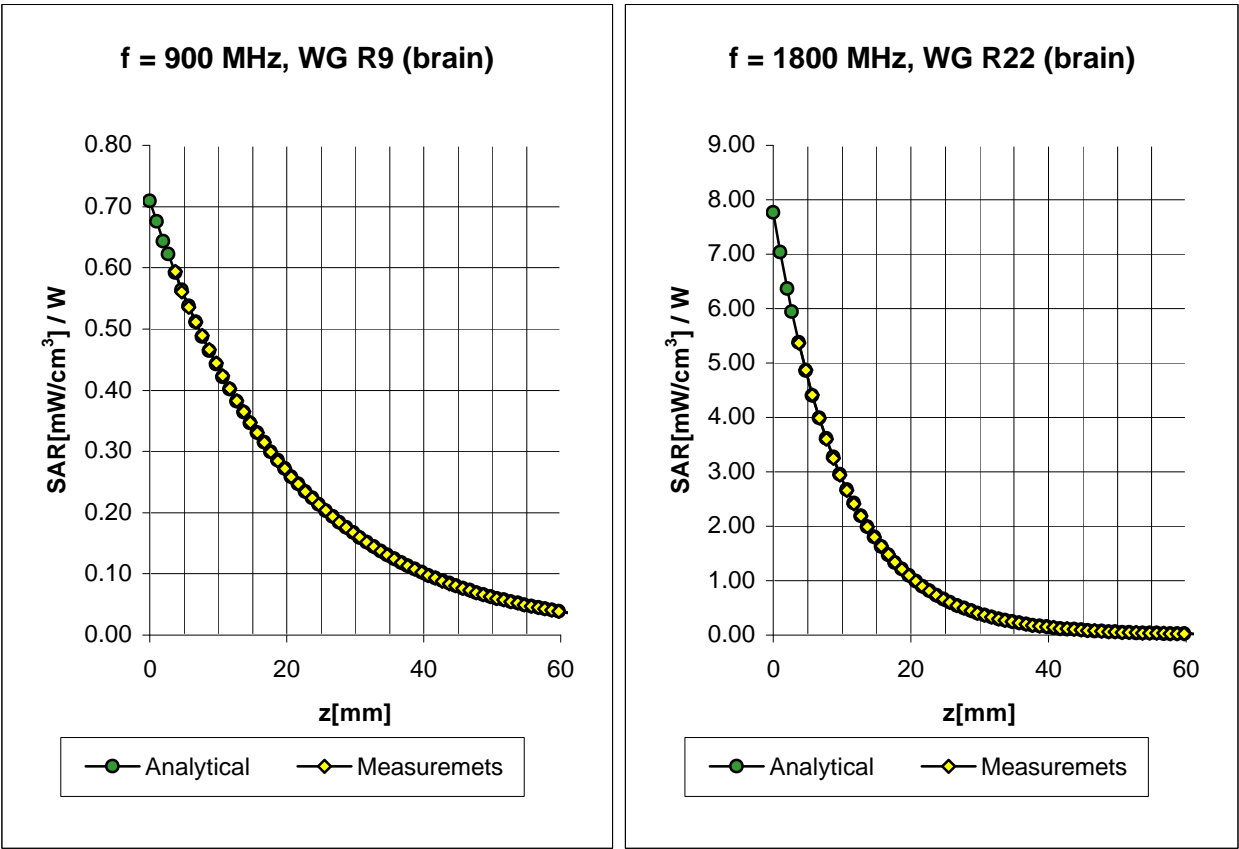
(TEM-Cell:ifi110, Waveguide R22)



Dynamic Range f(SAR_{brain})
(Waveguide R22)



Conversion Factor Assessment



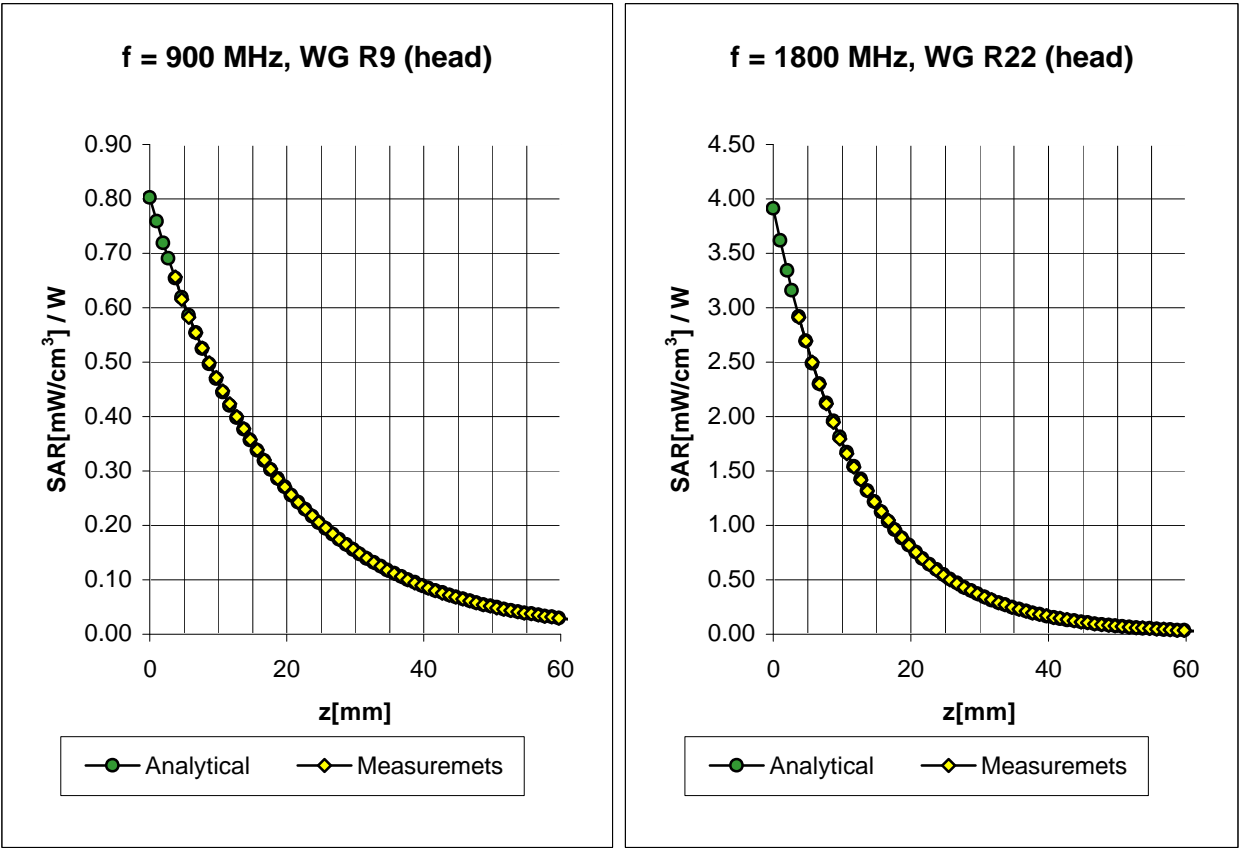
Brain 800 - 1000 MHz $\epsilon_r = 39.3 - 43.0$ $s = 0.75 - 1.00$ mho/m

| | | |
|---------|--------------------------|-------------------|
| ConvF X | 6.13 ± 9.5% (k=2) | Boundary effect: |
| ConvF Y | 6.13 ± 9.5% (k=2) | Alpha 0.45 |
| ConvF Z | 6.13 ± 9.5% (k=2) | Depth 2.36 |

Brain 1700 - 1910 MHz $\epsilon_r = 39.3 - 41.6$ $s = 1.53 - 1.90$ mho/m

| | | |
|---------|--------------------------|-------------------|
| ConvF X | 5.53 ± 9.5% (k=2) | Boundary effect: |
| ConvF Y | 5.53 ± 9.5% (k=2) | Alpha 0.66 |
| ConvF Z | 5.53 ± 9.5% (k=2) | Depth 2.07 |

Conversion Factor Assessment



Head 800 - 1000 MHz $\epsilon_r = 39.0 - 43.5$ $s = 0.80 - 1.10$ mho/m

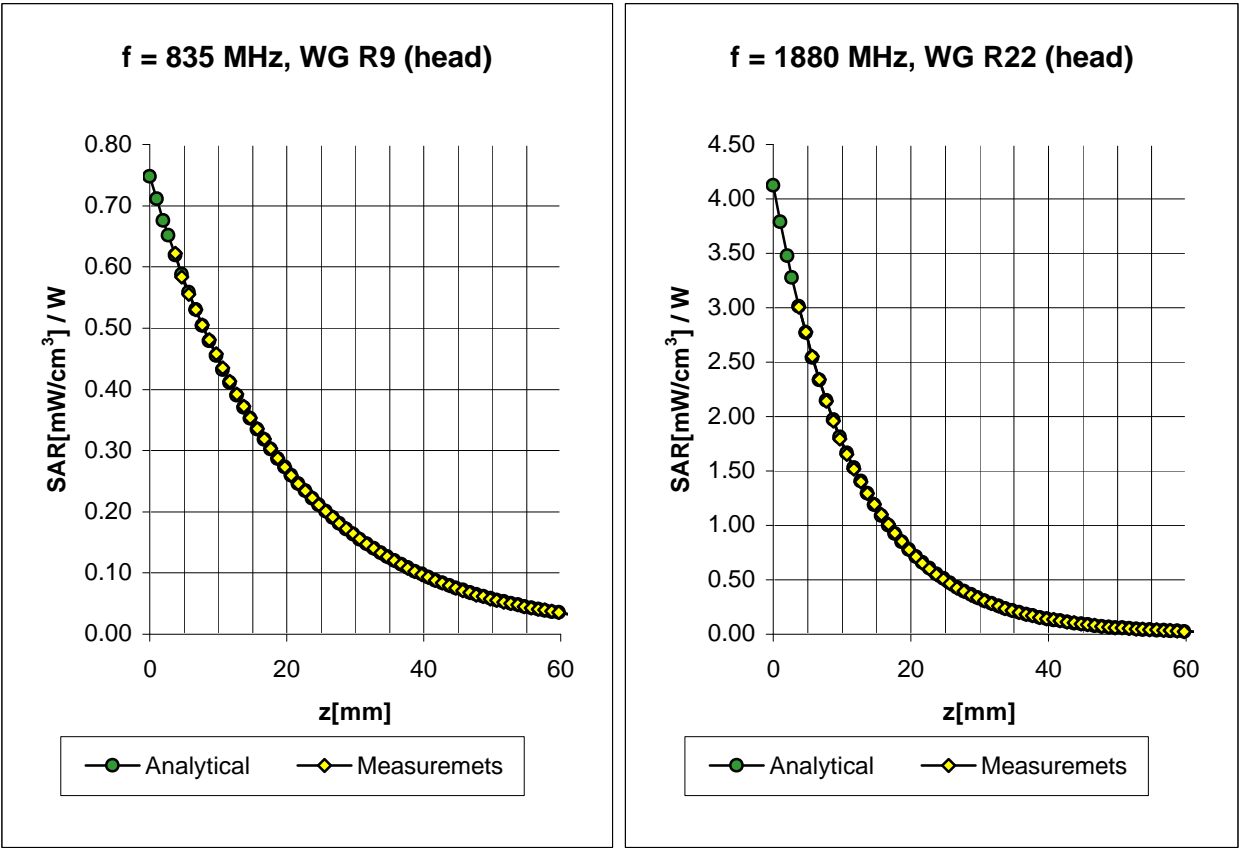
| | | |
|---------|-------------------------------|-------------------|
| ConvF X | 6.21 $\pm 9.5\%$ (k=2) | Boundary effect: |
| ConvF Y | 6.21 $\pm 9.5\%$ (k=2) | Alpha 0.40 |
| ConvF Z | 6.21 $\pm 9.5\%$ (k=2) | Depth 2.61 |

Head 1700 - 1910 MHz $\epsilon_r = 39.5 - 41.0$ $s = 1.20 - 1.55$ mho/m

| | | |
|---------|-------------------------------|-------------------|
| ConvF X | 5.31 $\pm 9.5\%$ (k=2) | Boundary effect: |
| ConvF Y | 5.31 $\pm 9.5\%$ (k=2) | Alpha 0.62 |
| ConvF Z | 5.31 $\pm 9.5\%$ (k=2) | Depth 2.27 |

ET3DV6 SN:1381

Conversion Factor Assessment

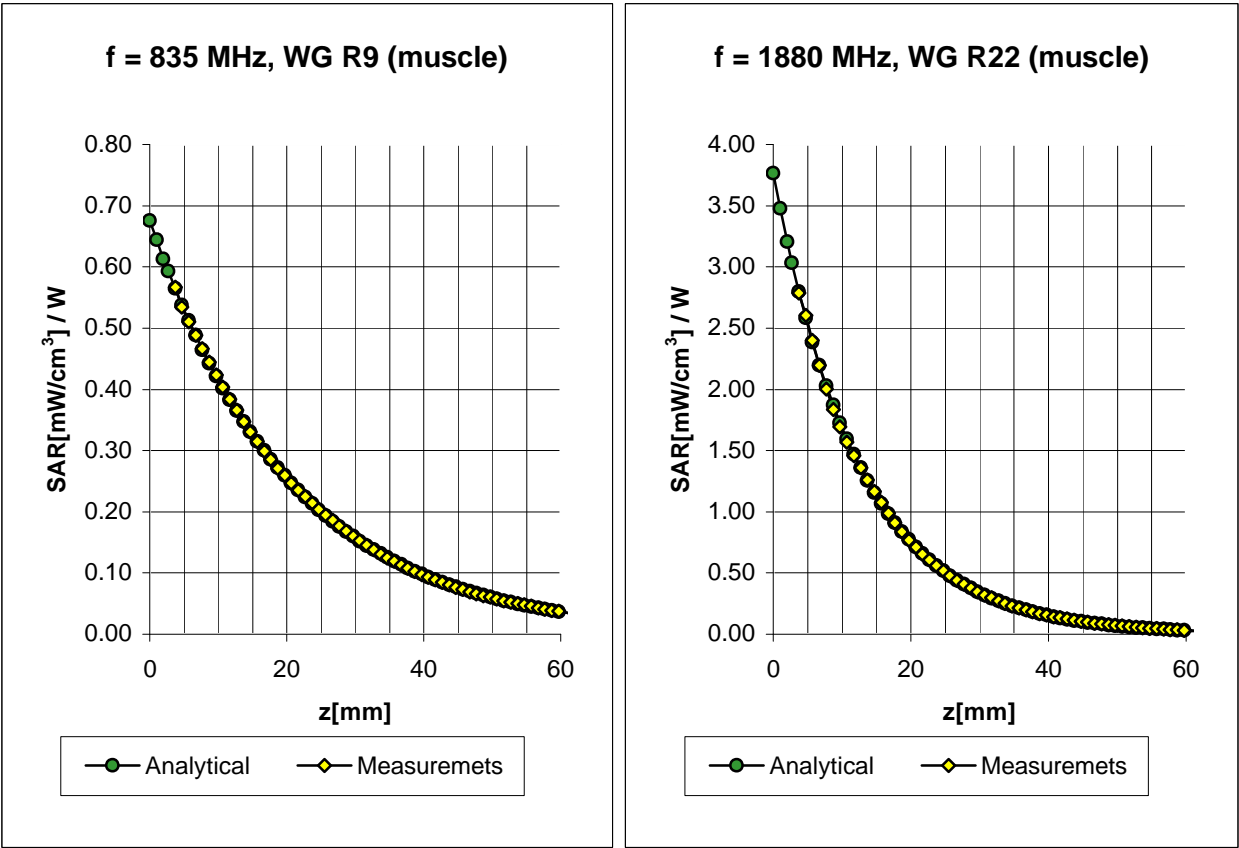


| | | | |
|---------|-------------------------------|-----------------------------|----------------------------------|
| Head | 835 MHz | $\epsilon_r = 41.5 \pm 5\%$ | $S = 0.90 \pm 5\% \text{ mho/m}$ |
| ConvF X | 6.20 $\pm 8.9\%$ (k=2) | Boundary effect: | |
| ConvF Y | 6.20 $\pm 8.9\%$ (k=2) | Alpha | 0.41 |
| ConvF Z | 6.20 $\pm 8.9\%$ (k=2) | Depth | 2.58 |

| | | | |
|---------|-------------------------------|-----------------------------|-----------------------------------|
| Head | 1880 MHz | $\epsilon_r = 40.0 \pm 5\%$ | $S = 1.540 \pm 5\% \text{ mho/m}$ |
| ConvF X | 5.22 $\pm 8.9\%$ (k=2) | Boundary effect: | |
| ConvF Y | 5.22 $\pm 8.9\%$ (k=2) | Alpha | 0.64 |
| ConvF Z | 5.22 $\pm 8.9\%$ (k=2) | Depth | 2.23 |

ET3DV6 SN:1381

Conversion Factor Assessment



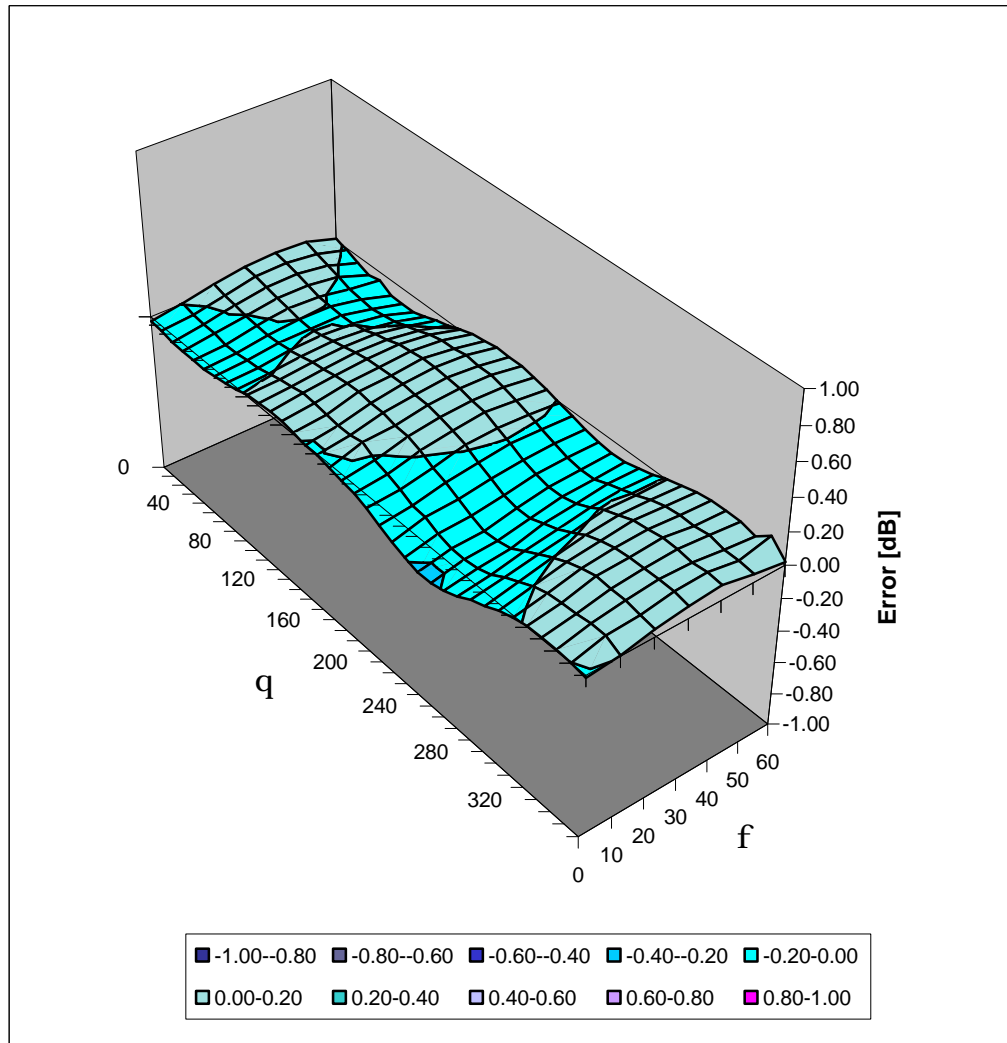
| | | | |
|---------|-------------------------------|-----------------------------|----------------------------------|
| Muscle | 835 MHz | $\epsilon_r = 55.2 \pm 5\%$ | $s = 0.97 \pm 5\% \text{ mho/m}$ |
| ConvF X | 6.04 $\pm 8.9\%$ (k=2) | Boundary effect: | |
| ConvF Y | 6.04 $\pm 8.9\%$ (k=2) | Alpha | 0.42 |
| ConvF Z | 6.04 $\pm 8.9\%$ (k=2) | Depth | 2.73 |

| | | | |
|---------|-------------------------------|-----------------------------|----------------------------------|
| Muscle | 1880 MHz | $\epsilon_r = 53.3 \pm 5\%$ | $s = 1.52 \pm 5\% \text{ mho/m}$ |
| ConvF X | 4.96 $\pm 8.9\%$ (k=2) | Boundary effect: | |
| ConvF Y | 4.96 $\pm 8.9\%$ (k=2) | Alpha | 0.91 |
| ConvF Z | 4.96 $\pm 8.9\%$ (k=2) | Depth | 1.88 |

ET3DV6 SN:1381

Deviation from Isotropy in HSL

Error (q,f), f = 900 MHz



Schmid & Partner Engineering AG

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DASY

Dipole Validation Kit

Type: D835V2

Serial: 448

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

1. Measurement Conditions

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

| | | |
|------------------------|-------------------|-----------|
| Relative Dielectricity | 42.3 | $\pm 5\%$ |
| Conductivity | 0.91 mho/m | $\pm 5\%$ |

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

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

3. Dipole Impedance and Return Loss

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

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

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

| | |
|---------------------------------|--------------------------------|
| Feedpoint impedance at 835 MHz: | $\text{Re}\{Z\} = 49.1 \Omega$ |
|---------------------------------|--------------------------------|

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

| | |
|------------------------|-----------------|
| Return Loss at 835 MHz | -25.3 dB |
|------------------------|-----------------|

4. Measurement Conditions

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

| | | |
|------------------------|-------------------|-----------|
| Relative Dielectricity | 56.0 | $\pm 5\%$ |
| Conductivity | 0.98 mho/m | $\pm 5\%$ |

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 cm³ (1 g) of tissue: **10.92 mW/g**

averaged over 10 cm³ (10 g) of tissue: **7.04 mW/g**

6. Dipole Impedance and Return Loss

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

Feedpoint impedance at 835 MHz: **Re{Z} = 45.6 Ω**

Im {Z} = -6.5 Ω

Return Loss at 835 MHz **-21.8 dB**

7. Handling

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

8. Design

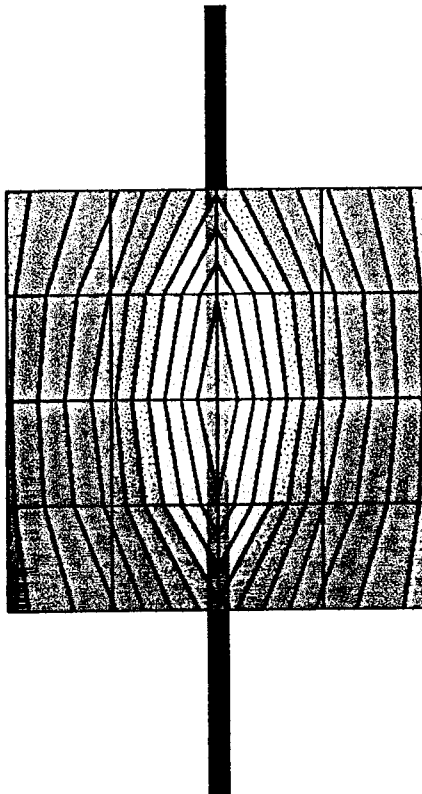
The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

9. Power Test

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

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/cm³
Cubes (2): Peak: 4.15 mW/g ± 0.02 dB, SAR (1g): 2.59 mW/g ± 0.00 dB, SAR (10g): 1.66 mW/g ± 0.01 dB, (Worst-case extrapolation)
Penetration depth: 12.0 (10.6, 13.7) [mm]
Powerdrift: -0.01 dB



CH1 S11 1 U FS

1: 49.117 Ω -5.3047 Ω 35.931 pF

835.000 000 MHz

De1

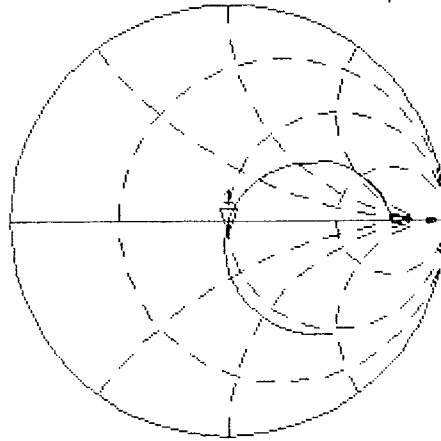
PRM

Cor

Avg

16

↑



CH2

S11

LOG

5 dB/REF 0 dB

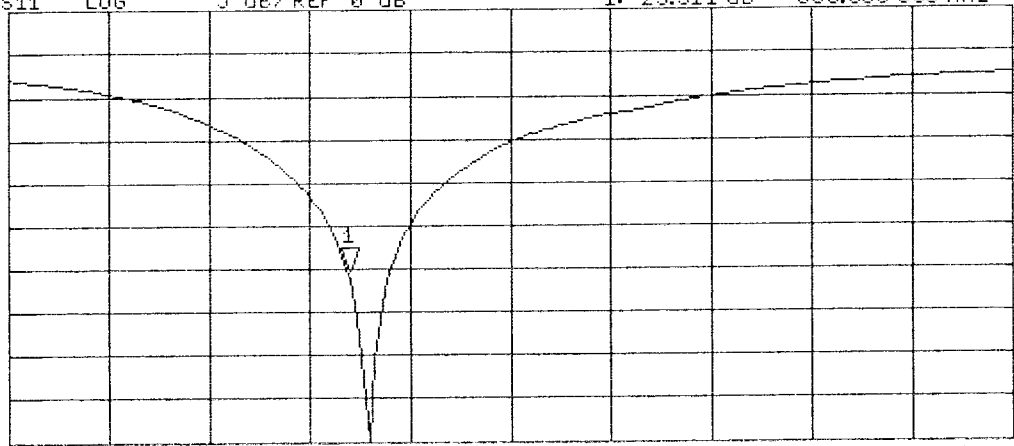
1:-25.311 dB

835.000 000 MHz

PRM

Cor

↑

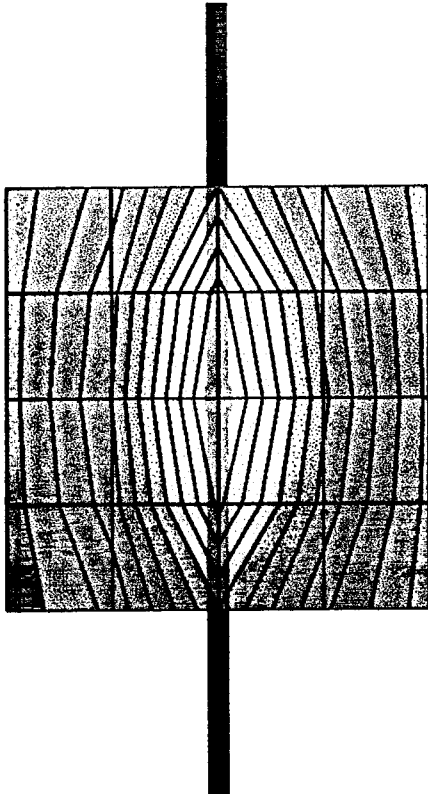
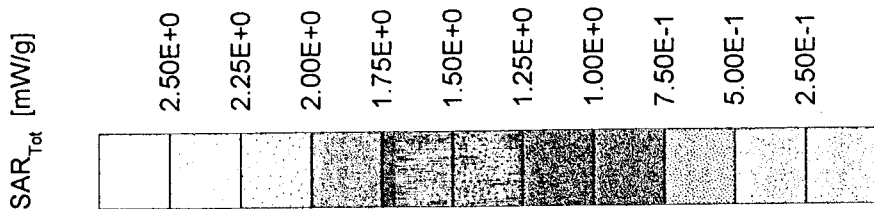


START 700.000 000 MHz

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/cm³
Cubes (2): Peak: 4.32 mW/g ± 0.00 dB, SAR (1g): 2.73 mW/g ± 0.01 dB, SAR (10g): 1.76 mW/g ± 0.02 dB, (Worst-case extrapolation)
Penetration depth: 12.4 (11.0, 14.3) [mm]
Powerdrift: 0.02 dB



29 Nov 2001 19:28:38

CHI S11 1 U FS

1: 45.607 Ω -6.4648 Ω 29.483 pF

835.000 000 MHz

Del

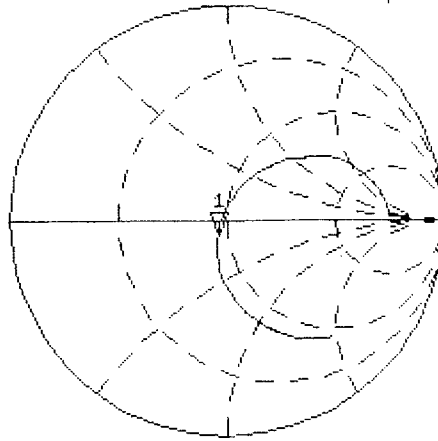
PRM

Cor

Avg

16

↑



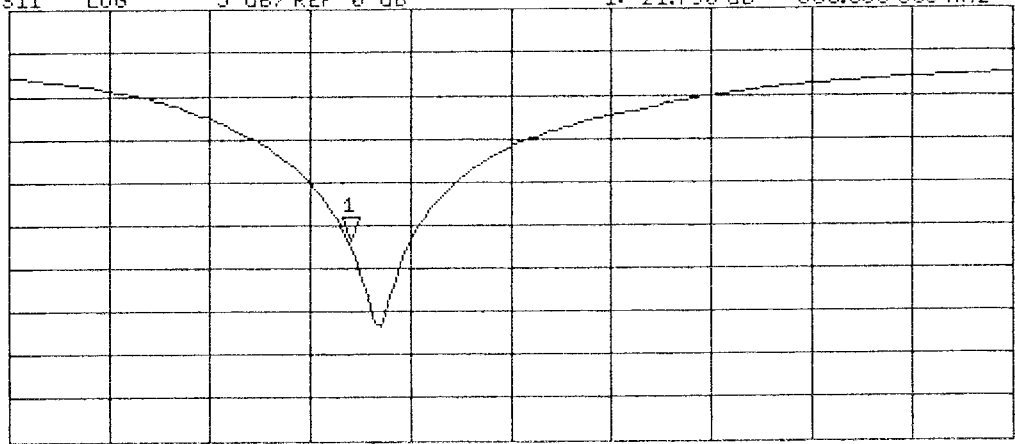
CH2 S11 LOG 5 dB/REF 0 dB

1: -21.790 dB 835.000 000 MHz

PRM

Cor

↑



START 700.000 000 MHz

STOP 1 1100.000 000 MHz