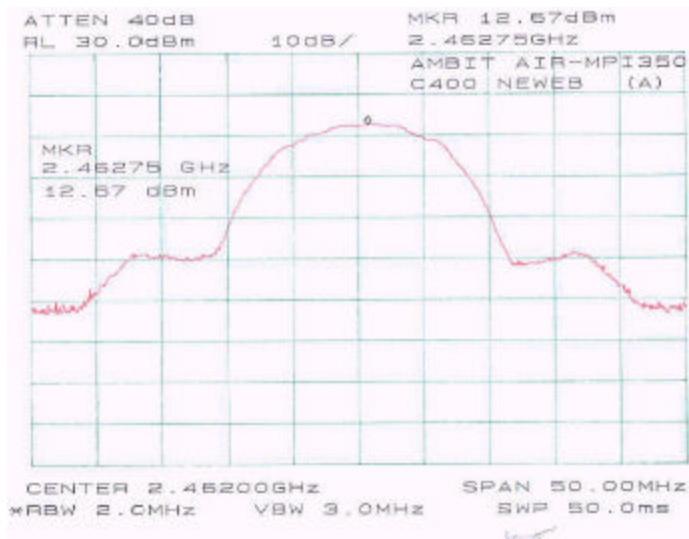
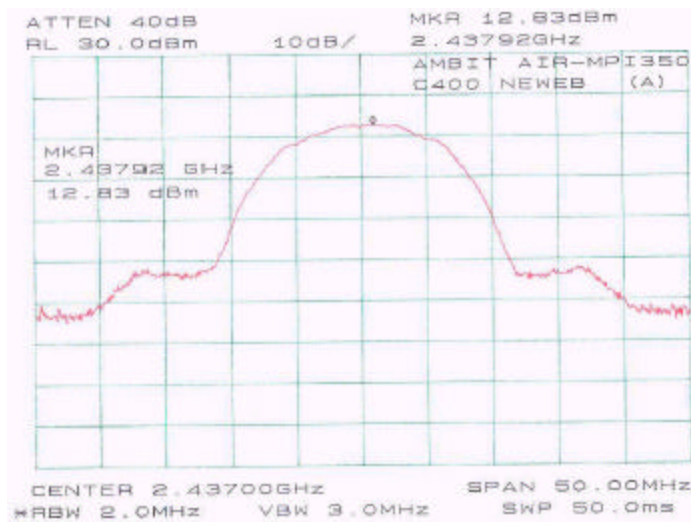
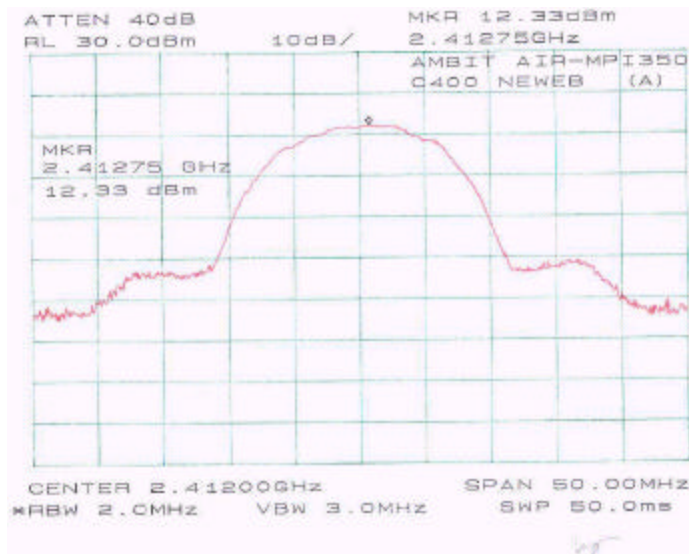
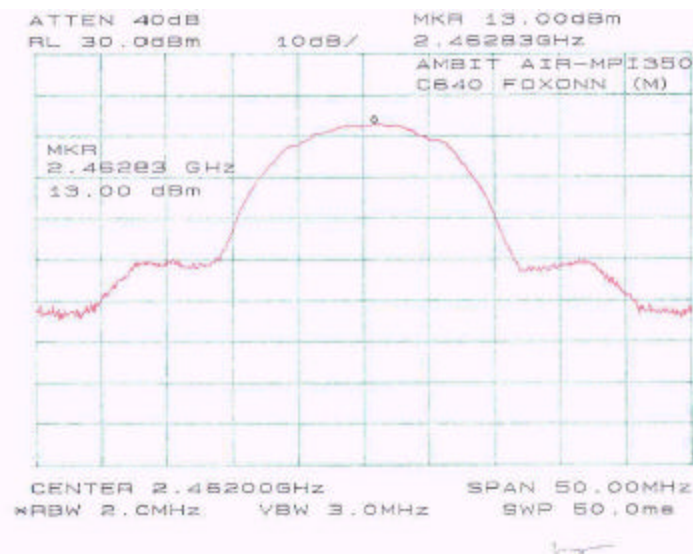
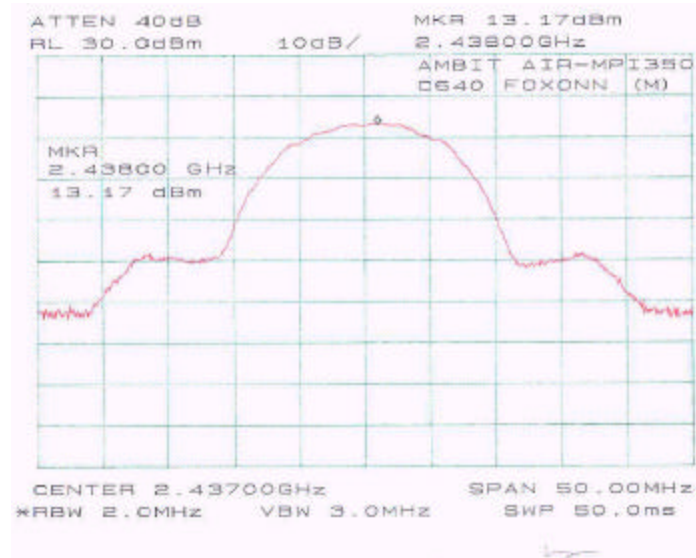
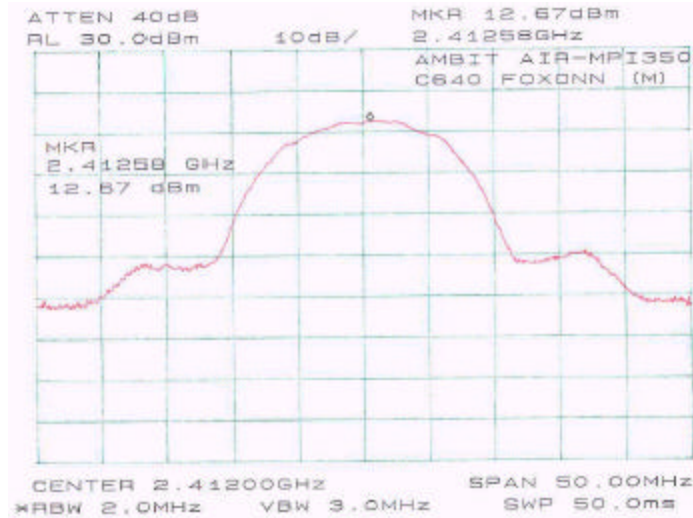
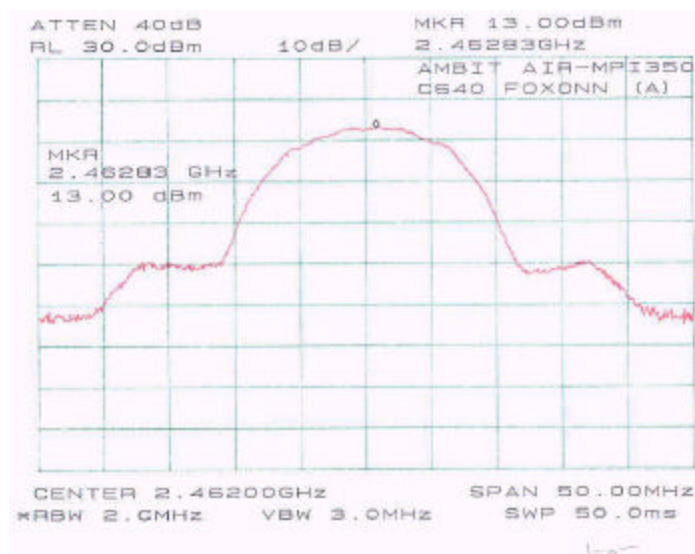
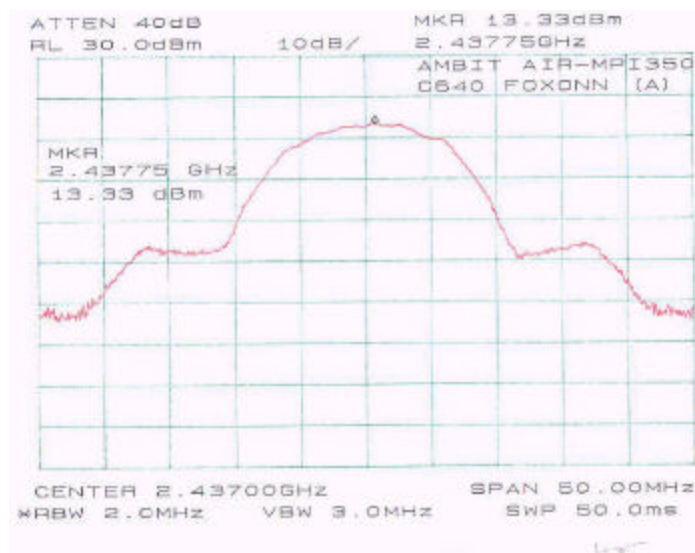
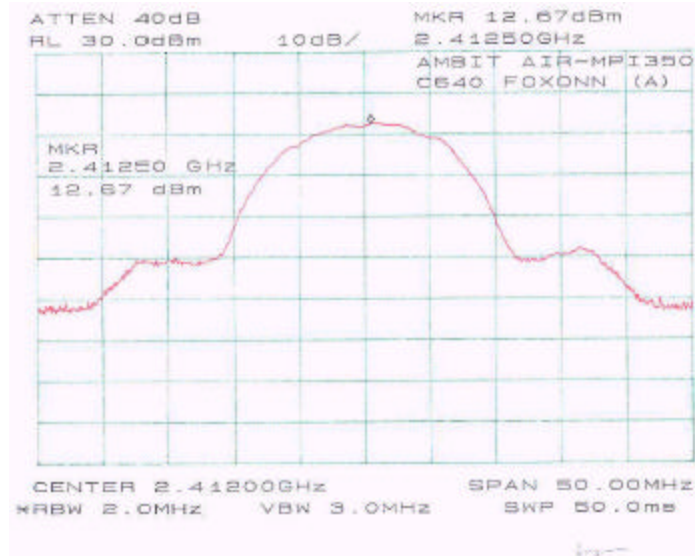








6 - DOSIMETRIC ASSESSMENT SETUP

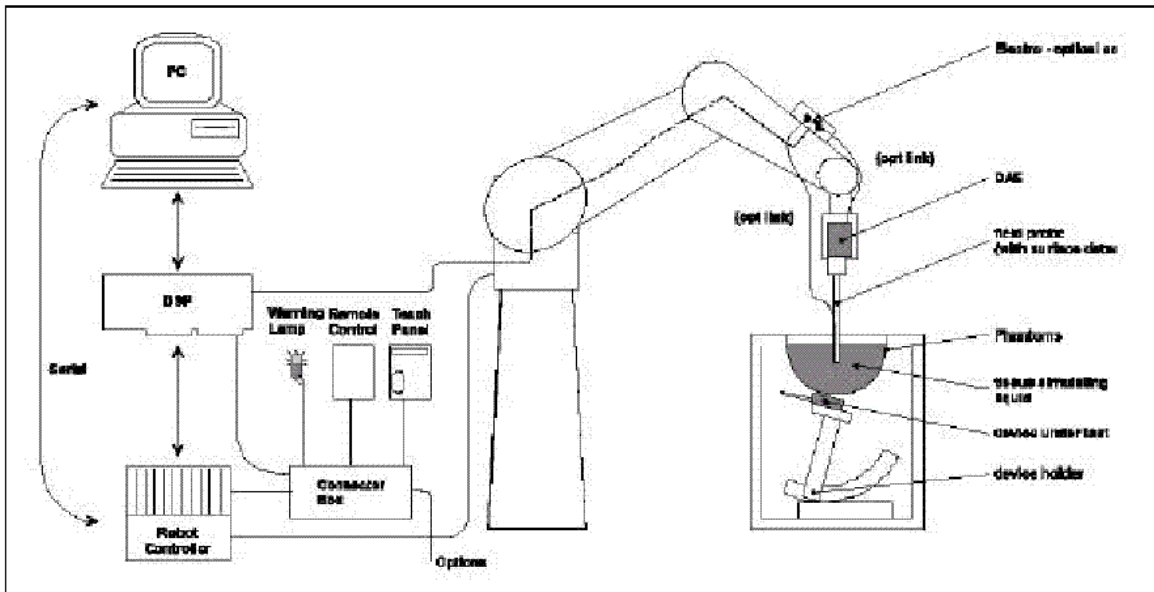
These measurements were performed with the automated near-field scanning system DASY3 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9m) which positions the probes with a positional repeatability of better than $\pm 0.02\text{mm}$. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit. The system is described in detail in [3].

The SAR measurements were conducted with the dosimetric probe ET3DV6 SN: 1604 (manufactured by SPEAG), designed in the classical triangular configuration [3] and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure described in [7] with accuracy of better than $\pm 10\%$. The spherical isotropy was evaluated with the procedure described in [8] and found to be better than $\pm 0.25\text{dB}$.

The phantom used was the "Generic Twin Phantom" described in [4]. The ear was simulated as a spacer of 4 mm thickness between the earpiece of the phone and the tissue simulating liquid. The Tissue simulation liquid used for each test is in according with the FCC OET65 supplement C as listed below.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (Nacl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton x-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	55.2	42.0	55.9	39.9	53.3	39.8	52.7
Conductivity (s/m)	0.85	0.83	0.91	0.97	1.0	0.98	1.42	1.52	1.88	1.95

6.1 Measurement System Diagram



The DASY3 system for performing compliance tests consist of the following items:

1. A standard high precision 6-axis robot (Stäubli RX family) with controller and software.
2. An arm extension for accommodating the data acquisition electronics (DAE).
3. A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
4. A data acquisition electronic (DAE), which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
5. A unit to operate the optical surface detector, which is connected to the EOC. The Electro-optical coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the PC plug-in card. The functions of the PC plug-in card based on a DSP is to perform the time critical task such as signal filtering, surveillance of the robot operation fast movement interrupts.
6. A computer operating Windows 95 or larger
7. DASY3 software
8. Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.
9. The generic twin phantom enabling testing left-hand and right-hand usage.
10. The device holder for handheld EUT.
11. Tissue simulating liquid mixed according to the given recipes (see Application Note).
12. System validation dipoles to validate the proper functioning of the system.

6.2 System Components

ET3DV6 Probe Specification

Construction Symmetrical design with triangular core

Built-in optical fiber for surface detection System

Built-in shielding against static charges

Calibration In air from 10 MHz to 2.5 GHz

In brain and muscle simulating tissue at

Frequencies of 450 MHz, 900 MHz and

1.8 GHz (accuracy $\pm 8\%$)

Frequency 10 MHz to > 6 GHz; Linearity: ± 0.2 dB

(30 MHz to 3 GHz)

Directivity ± 0.2 dB in brain tissue (rotation around probe axis)

± 0.4 dB in brain tissue (rotation normal probe axis)

Dynamic 5 mW/g to > 100 mW/g;

Range Linearity: ± 0.2 dB

Surface ± 0.2 mm repeatability in air and clear liquids

Detection over diffuse reflecting surfaces.

Dimensions Overall length: 330 mm

Tip length: 16 mm

Body diameter: 12 mm

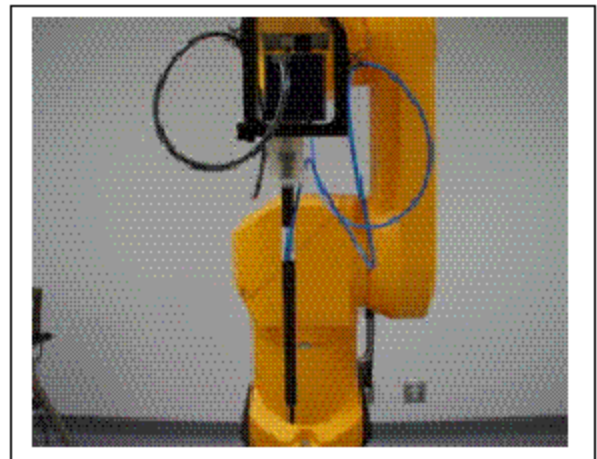
Tip diameter: 6.8 mm

Distance from probe tip to dipole centers: 2.7 mm

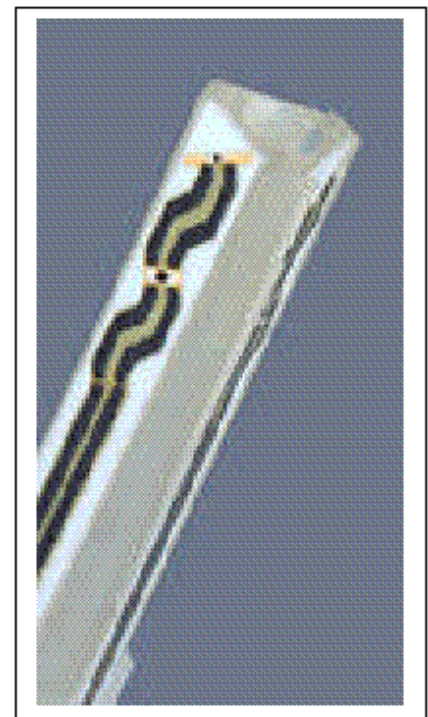
Application General dosimetric up to 3 GHz

Compliance tests of mobile phones

Fast automatic scanning in arbitrary phantoms



Photograph of the probe



Inside view of
ET3DV6 E-field Probe

The SAR measurements were conducted with the dosimetric probe ET3DV6 designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY3 software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting. The approach is stopped when reaching the maximum.

E-Field Probe Calibration Process

Each probe is calibrated according to a dosimetric assessment procedure described in [6] with accuracy better than +/- 10%. The spherical isotropy was evaluated with the procedure described in [7] and found to be better than +/-0.25dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1 GHz, and in a waveguide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

Data Evaluation

The DASY3 software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe Parameter:	-Sensitivity	Norm _i , a _{i0} , a _{i1} , a _{i2}
	-Conversion Factor	ConvFi
	-Diode compression point	Dcp _i
Device parameter:	-Frequency	f
	-Crest Factor	cf
Media parameter:	-Conductivity	ó
	-Density	ñ

These parameters must be set correctly in the software. They can either be found in the component documents or be imported into the software from the configuration files issued for the DASY3 components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + (U_i)^2 \text{ cf} / \text{dcp}_i$$

With V_i = compensated signal of channel i ($i=x, y, z$)
 U_i = input signal of channel i ($i=x, y, z$)
 cf = crest factor of exciting field (DASY parameter)
 dcp_i = diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

$$\begin{aligned} \text{E-field probes:} \quad E_i &= \sqrt{\frac{V_i}{\text{Norm}_i \cdot \text{ConvF}}} \\ \text{H-field probes:} \quad H_i &= \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f} \end{aligned}$$

With V_i = compensated signal of channel i (i =x, y, z)
 Norm_i = sensor sensitivity of channel i (i =x, y, z)
 $\hat{=}$ V/ (V/m)² for E-field probes
 ConvF = sensitivity enhancement in solution
 a_{ij} = sensor sensitivity factors for H-field probes
 f = carrier frequency [GHz]
 E_i = electric field strenggy of channel i in V/m
 H_i = diode compression point (DASY parameter)

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{\text{tot}} = \text{Square Root } [(E_x)^2 + (E_y)^2 + (E_z)^2]$$

The primary field data are used to calculate the derived field units.

$$\text{SAR} = (E_{\text{tot}})^2 \cdot \sigma / (\tilde{n} \cdot 1000)$$

With SAR = local specific absorption rate in mW/g
 E_{tot} = total field strength in V/m
 σ = conductivity in [mho/m] or [Siemens/m]
 $\tilde{n}$ = equivalent tissue density in g/cm³

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

The power flow density is calculated assuming the excitation field as a free space field.

$$P_{\text{pwe}} = (E_{\text{tot}})^2 / 3770 \text{ or } P_{\text{pwe}} = (H_{\text{tot}})^2 \cdot 37.7$$

With P_{pwe} = equivalent power density of a plane wave in mW/cm³
 E_{tot} = total electric filed strength in V/m
 H_{tot} = total magnetic filed strength in V/m

Generic Twin Phantom

The Generic Twin Phantom is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users [9][10]. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid. Reference markings on the Phantom allows the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

Shell Thickness 2 ± 0.1 mm

Filling Volume Approx. 20 liters

Dimensions 810 x 1000 x 500 mm (H x L x W)

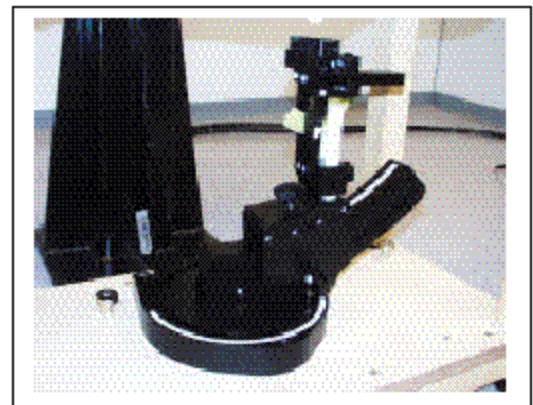


Generic Twin Phantom

Device Holder

In combination with the Generic Twin Phantom V3.0, the Mounting Device enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeatedly positioned according to the FCC and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

* Note: A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produced infinite number of configurations [10]. To produce the worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.



Device Holder

6.3 Measurement Uncertainty

The uncertainty budget has been determined for the DASY3 measurement system according to the NIS81 [13] and the NIST1297 [14] documents and is given in the following Table.

Measurement Uncertainty Analysis per IEEE P1528-2002

Description	Section	Reported Variance (%)	Probability Distribution type	Divisor	Ci (1g)	Ui (1g)	Vi	welc/satt series term
Probe Calibration	E.2.1	4.80	N	1	1	4.80	1.00E+09	5.30842E-07
Axial isotropy	E.2.2	4.70	R	1.732	0.707107	1.92	1.00E+09	1.35563E-08
Hemispherical isotropy	E.2.2	9.60	R	1.732	0.707107	3.92	1.00E+09	2.35957E-07
Boundary effects	E.2.3	8.30	R	1.732	1	4.79	1.00E+09	5.27377E-07
Linearity	E.2.4	4.70	R	1.732	1	2.71	1.00E+09	5.4225E-08
System Detection Limit	E.2.5	1.00	R	1.732	1	0.58	1.00E+09	1.11124E-10
Readout Electronics	E.2.6	0.00	N	1	1	0.00	1.00E+09	0
Response time	E.2.7	0.00	R	1.732	1	0.00	1.00E+09	0
Integration time	E.2.8	0.00	R	1.732	1	0.00	1.00E+09	0
RF Ambient conditions	E.6.1	3.00	R	1.732	1	1.73	1.00E+09	9.00106E-09
Probe positioning mechanical tolerance	E.6.2	0.40	R	1.732	1	0.23	1.00E+09	2.84478E-12
Probe positioning wrt phantom shell	E.6.3	2.90	R	1.732	1	1.67	1.00E+09	7.8596E-09
Extra/inter-polation & integration algorithmsfor max								
SAR evaluation	E.5.2	3.90	R	1.732	1	2.25	1.00E+09	2.57079E-08
Test sample positioning	8, E.4.2	6.00	R	1.732	1	3.46	1.00E+09	1.44017E-07
Device holder distance tolerance	E.4.1	5.00	N	1	1	5.00	1.00E+09	0.000000625
Output power and SAR drift measurement	8, E.6.6.2	5.00	R	1.732	1	2.89	1.00E+09	6.94526E-08
Phantom uncertainty, shell thickness tolerance	E.3.1	4.00	R	1.732	1	2.31	1.00E+09	2.84478E-08
Liquid conductivity, deviation from target values	E.3.2	5.00	R	1.732	0.64	1.85	1.00E+09	1.16522E-08
Liquid conductivity, measurement uncertainty	E.3.3	5.00	N	1	0.64	3.20	5	20.97152
Liquid permittivity, deviation from target values	E.3.2	5.00	R	1.732	0.6	1.73	1.00E+09	9.00106E-09
Liquid permittivity, measurement uncertainty	E.3.3	5.00	N	1	0.6	3.00	5	16.2

689

Probe isotropy sensitivity coefficient 0.5

Combined Standard Uncertainty

Expanded Uncertainty, 95%

k= 2.0036

12.65 %

25.34 %

7 - SYSTEM EVALUATION

7.1 Simulated Tissue Liquid Parameter Confirmation

The dielectric parameters were checked prior to assessment using the HP85070A dielectric probe kit. The dielectric parameters measured are reported in each correspondent section:

7.2 Evaluation Procedures

Maximum Search

The maximum search is automatically performed after each coarse scan measurement. It is based on splines in two or three dimensions. The procedure can find the maximum for most SAR distributions even with relatively large grid spacings. After the coarse scan measurement, the probe is automatically moved to a position at the interpolated maximum. The following scan can directly use this position for reference, e.g., for a finer resolution grid or the cube evaluations.

Extrapolation

The extrapolation can be used in z-axis scans with automatic surface detection. The SAR values can be extrapolated to the inner phantom surface. The extrapolation distance is the sum of the probe sensor offset, the surface detection distance and the grid offset. The extrapolation is based on fourth order polynomial functions. The extrapolation is only available for SAR values.

Boundary Corrections

The correction of the probe boundary effect in the vicinity of the phantom surface can be done in two different ways. In the standard (worse case) evaluation, the boundary effect is reduced by different weights for the lowest measured points in the extrapolation routine. The result is a slight overestimation of the extrapolated SAR values (2% to 8%) depending on the SAR distribution and gradient. The advanced evaluation makes a full compensation of the boundary effect before doing the extrapolation. This is only possible of probes with specifications on the boundary effect.

Peak Search for 1g and 10g cube averaged SAR

The 1g and 10g peak evaluations are only available for the predefined cube 4x4x7 and cube 5x5x7 scans. The routine are verified and optimized for the grid dimensions used in these cube measurements. The measured volume of 32x32x35mm contains about 35g of tissue. The first procedure is an extrapolation (incl. Boundary correction) to get the points between the lowest measured plane and the surface. The next step uses 3D interpolation get all points within the measured volume in a 1mm grid (35000 points). In the last step, a 1g cube is place numerically into the volume and its averaged SAR is calculated. This cube is the moved around until the highest averaged SAR is found. This last procedure is repeated for a 10g cube. If the highest SAR is found at the edge of the measured volume, the system will issue a warning,; higher SAR values might be found outside of the measured volume. In that case the cube measurement can be repeated, using the new interpolated maximum as the center.

7.3 System Accuracy Verification

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of $\pm 10\%$. The validation results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

IEEE P1528 recommended reference value for Head

Frequency (MHz)	1 g SAR	10 g SAR	Local SAR at surface (above feed point)	Local SAR at surface (v=2cm offset from feed point)
300	3.0	2.0	4.4	2.1
450	4.9	3.3	7.2	3.2
835	9.5	6.2	14.1	4.9
900	10.8	6.9	16.4	5.4
1450	29.0	16.0	50.2	6.5
1800	38.1	19.8	69.5	6.8
1900	39.7	20.5	72.1	6.6
2000	41.1	21.1	74.6	6.5
2450	52.4	24.0	104.2	7.7
3000	63.8	25.7	140.2	9.5

Validation Dipole SAR Reference Test Result for Body (2450 MHz)

Validation Measurement	SAR @ 0.025W Input averaged over 1g	SAR @ 1W Input averaged over 1g	SAR @ 0.025W Input averaged over 10g	SAR @ 1W Input averaged over 10g
Test 1	14.2	56.80	6.33	25.32
Test 2	14.3	57.20	6.34	25.36
Test 3	14.2	56.80	6.33	25.32
Test 4	14.1	56.40	6.32	25.28
Test 5	14.3	57.20	6.33	25.32
Test 6	14.0	56.00	6.31	25.24
Test 7	14.2	56.80	6.33	25.32
Test 8	14.2	56.80	6.33	25.32
Test 9	14.4	57.60	6.34	25.36
Test 10	14.2	56.80	6.32	25.28
Average	14.21	56.84	6.32	25.31

System validation result

D800 NEWEB:

Simulant	Freq [MHz]	Parameters	Liquid Temp [°C]	Target Value	Measured Value	Deviation [%]	Limits [%]
Body	2450	ϵ	21	52.7	55.1	4.36	± 5
		σ	21	1.95	1.96	0.51	± 5
		1g SAR	21	56.84	57.22	0.67	± 10
Head	2450	ϵ	21	39.2	40.0	2.04	± 5
		σ	21	1.80	1.85	2.78	± 5
		1g SAR	21	52.4	48.82	-7.33	± 10

ϵ = relative permittivity, σ = conductivity and $\rho=1000\text{kg/m}^3$

Note: Forward power = 20.8 dBm = 120.23 mW

D800 Hitachi:

Simulant	Freq [MHz]	Parameters	Liquid Temp [°C]	Target Value	Measured Value	Deviation [%]	Limits [%]
Body	2450	ϵ	21	52.7	53.0	0.57	± 5
		σ	21	1.95	1.96	0.51	± 5
		1g SAR	21	56.84	51.57	-9.27	± 10
Head	2450	ϵ	21	39.2	40.0	2.04	± 5
		σ	21	1.80	1.85	2.78	± 5
		1g SAR	21	52.4	48.04	-8.32	± 10

ϵ = relative permittivity, σ = conductivity and $\rho=1000\text{kg/m}^3$

Note: Forward power = 20.2 dBm = 104.71 mW

D600 NEWEB:

Simulant	Freq [MHz]	Parameters	Liquid Temp [°C]	Target Value	Measured Value	Deviation [%]	Limits [%]
Body	2450	ϵ	21	52.7	55.1	4.55	± 5
		σ	21	1.95	2.01	3.08	± 5
		1g SAR	21	56.84	61.20	7.67	± 10
Head	2450	ϵ	21	39.2	38.1	-2.81	± 5
		σ	21	1.80	1.85	2.78	± 5
		1g SAR	21	52.4	47.44	-9.47	± 10

ϵ = relative permittivity, σ = conductivity and $\rho=1000\text{kg/m}^3$

Note: Forward power = 20.55 dBm = 113.40 mW

D600 Hitachi:

Simulant	Freq [MHz]	Parameters	Liquid Temp [°C]	Target Value	Measured Value	Deviation [%]	Limits [%]
Body	2450	ϵ	21	52.7	55.1	4.55	± 5
		σ	21	1.95	2.01	3.08	± 5
		1g SAR	21	56.84	61.20	7.67	± 10
Head	2450	ϵ	21	39.2	38.1	-2.81	± 5
		σ	21	1.80	1.85	2.78	± 5
		1g SAR	21	52.4	47.44	-9.47	± 10

ϵ = relative permittivity, σ = conductivity and $\rho=1000\text{kg/m}^3$

Note: Forward power = 20.55 dBm = 113.40 mW

D400 NEWEB:

Simulant	Freq [MHz]	Parameters	Liquid Temp [°C]	Target Value	Measured Value	Deviation [%]	Limits [%]
Body	2450	ϵ	21	52.7	54.7	3.80	± 5
		σ	21	1.95	1.95	0	± 5
		1g SAR	21	56.84	59.43	4.56	± 10
Head	2450	ϵ	21	39.2	39.7	1.28	± 5
		σ	21	1.80	1.85	2.78	± 5
		1g SAR	21	52.4	51.57	-1.58	± 10

ϵ = relative permittivity, σ = conductivity and $\rho=1000\text{kg/m}^3$

Note: Forward power = 20.54 dBm = 113.24 mW

C400 NEWEB:

Simulant	Freq [MHz]	Parameters	Liquid Temp [°C]	Target Value	Measured Value	Deviation [%]	Limits [%]
Body	2450	ϵ	21	52.7	53.5	1.52	± 5
		σ	21	1.95	1.96	0.51	± 5
		1g SAR	21	56.84	58.72	3.31	± 10
Head	2450	ϵ	21	39.2	39.4	0.51	± 5
		σ	21	1.80	1.83	1.67	± 5
		1g SAR	21	52.4	50.11	-4.37	± 10

ϵ = relative permittivity, σ = conductivity and $\rho=1000\text{kg/m}^3$

Note: Forward power = 20.65 dBm = 116.14 mW

C640 Foxonn:

Simulant	Freq [MHz]	Parameters	Liquid Temp [°C]	Target Value	Measured Value	Deviation [%]	Limits [%]
Body	2450	ϵ	21	52.7	54.4	3.23	± 5
		σ	21	1.95	1.97	1.03	± 5
		1g SAR	21	56.84	61.68	8.52	± 10
Head	2450	ϵ	21	39.2	38.9	-0.76	± 5
		σ	21	1.80	1.86	3.33	± 5
		1g SAR	21	52.4	53.62	2.33	± 10

ϵ = relative permittivity, σ = conductivity and $\rho=1000\text{kg/m}^3$

Note: Forward power = 20.43 dBm = 110.41 mW

System Validation for 2450 MHz Body Liquid (Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 5/17/2003)

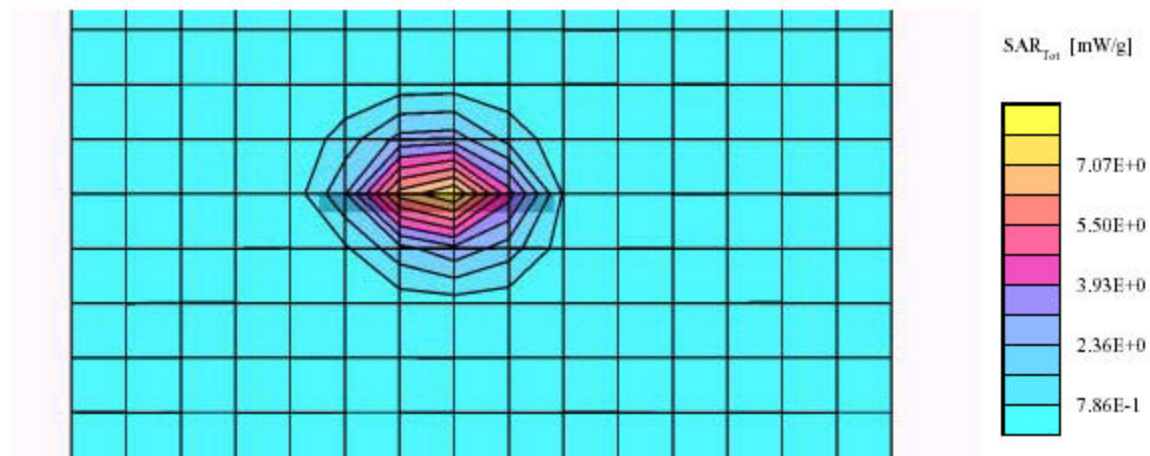
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2450 MHz

Probe: ET3DV6 - SN1604; ConvF(4.30,4.30,4.30); Crest factor: 1.0; 2450 MHz: $\sigma = 1.96 \text{ mho/m}$, $\epsilon_r = 55.1$, $\rho = 1.00 \text{ g/cm}^3$

Cube 5x5x7: SAR (1g): 6.88 mW/g, SAR (10g): 3.17 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.03 dB



System Validation for 2450 MHz Head Liquid (Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 5/17/2003)

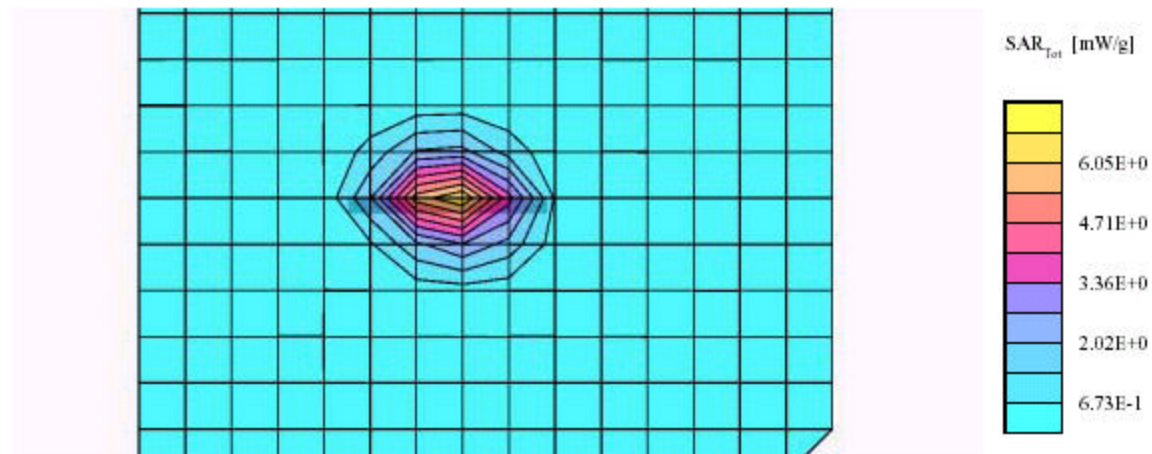
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2450 MHz

Probe: ET3DV6 - SN1604; ConvF(4.70,4.70,4.70); Crest factor: 1.0; 2450 MHz: $\sigma = 1.85 \text{ mho/m}$, $\epsilon_r = 40.0$ $\rho = 1.00 \text{ g/cm}^3$

Cube 5x5x7: SAR (1g): 5.87 mW/g, SAR (10g): 2.70 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.05 dB



System Validation for 2450 MHz Body Liquid (Ambient Temp = 22 Deg C, Liquid Temp = 21 Deg C, 5/17/2003)

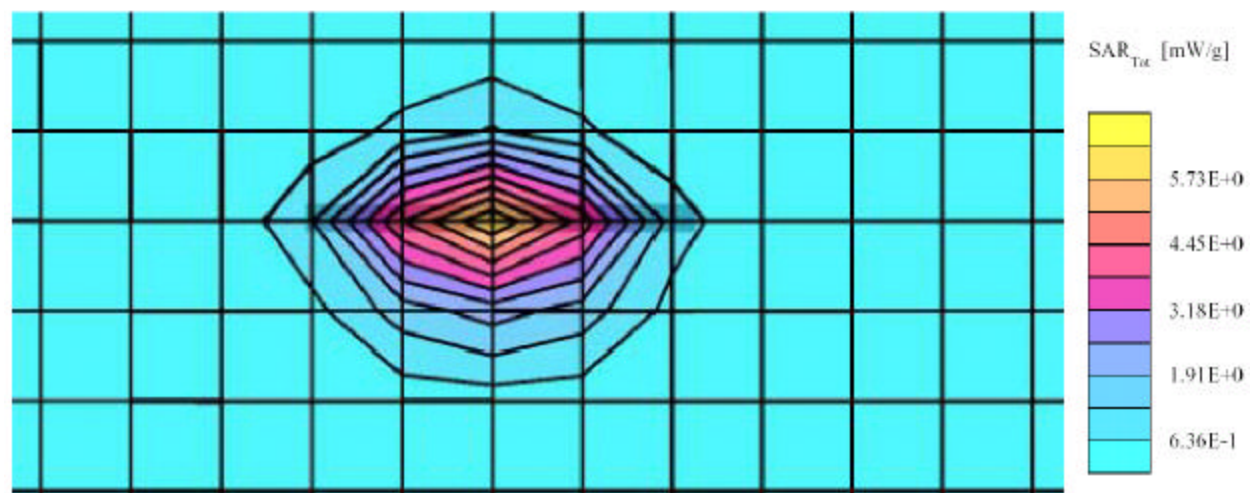
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2450 MHz

Probe: ET3DV6 - SN1604; ConvF(4.30,4.30,4.30); Crest factor: 1.0; 2450 MHz: $\sigma = 1.96 \text{ mho/m}$ $\epsilon_r = 53.0$ $\rho = 1.00 \text{ g/cm}^3$

Cube 5x5x7; SAR (1g): 5.40 mW/g, SAR (10g): 2.50 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.02 dB



System Validation for 2450 MHz Head Liquid (Ambient Temp = 22 Deg C, Liquid Temp = 21 Deg C, 5/17/2003)

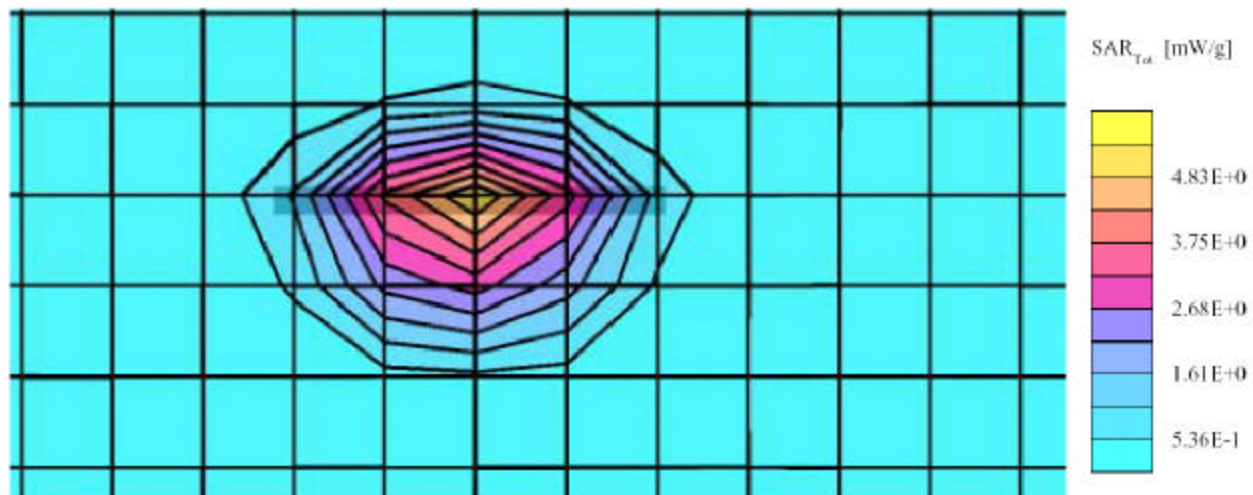
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2450 MHz

Probe: ET3DV6 - SN1604; ConvF(4.70,4.70,4.70); Crest factor: 1.0; 2450 MHz: $\sigma = 1.85 \text{ mho/m}$ $\epsilon_r = 40.0$ $\rho = 1.00 \text{ g/cm}^3$

Cube 5x5x7; SAR (1g): 5.03 mW/g, SAR (10g): 2.29 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.01 dB



System Validation for 2450 MHz Body Liquid (Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 5/16/2003)

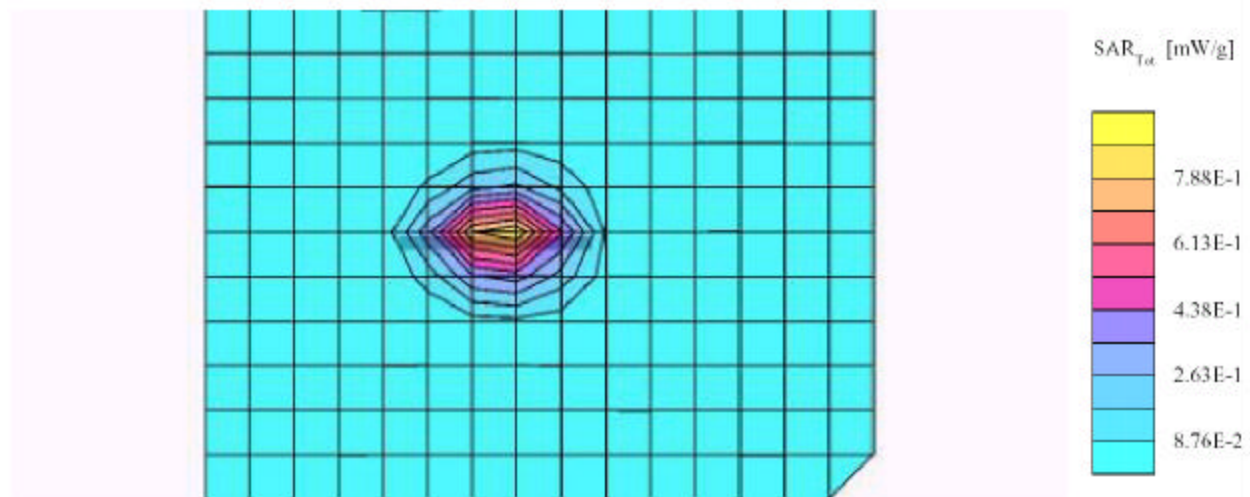
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2450 MHz

Probe: ET3DV6 - SN1604; ConvF(4.30,4.30,4.30); Crest factor: 1.0; 2450 MHz: $\sigma = 2.01 \text{ mho/m}$ $\epsilon_r = 55.0$ $\rho = 1.00 \text{ g/cm}^3$

Cube 5x5x7: SAR (1g): 0.786 mW/g, SAR (10g): 0.364 mW/g, (Worst-case extrapolation)

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

Powerdrift: 0.05 dB



System Validation for 2450 MHz Head Liquid (Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 5/16/2003)

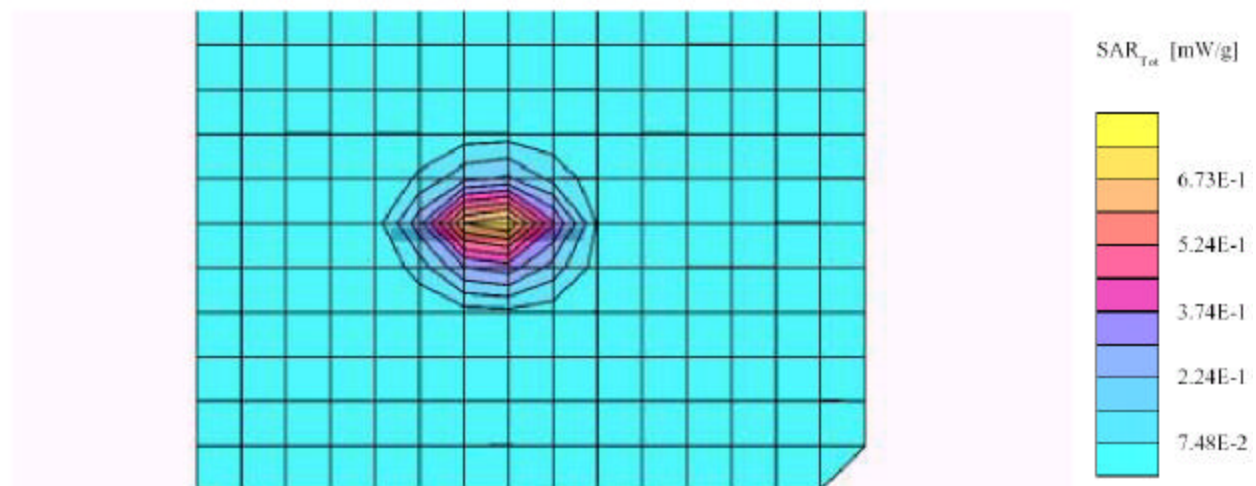
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2450 MHz

Probe: ET3DV6 - SN1604; ConvF(4.70,4.70,4.70); Crest factor: 1.0; 2450 MHz: $\sigma = 1.85 \text{ mho/m}$ $\epsilon_r = 38.1$ $\rho = 1.00 \text{ g/cm}^3$

Cube 5x5x7: SAR (1g): 0.669 mW/g, SAR (10g): 0.311 mW/g, (Worst-case extrapolation)

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

Powerdrift: 0.01 dB



System Validation for 2450 MHz Body Liquid (Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 5/16/2003)

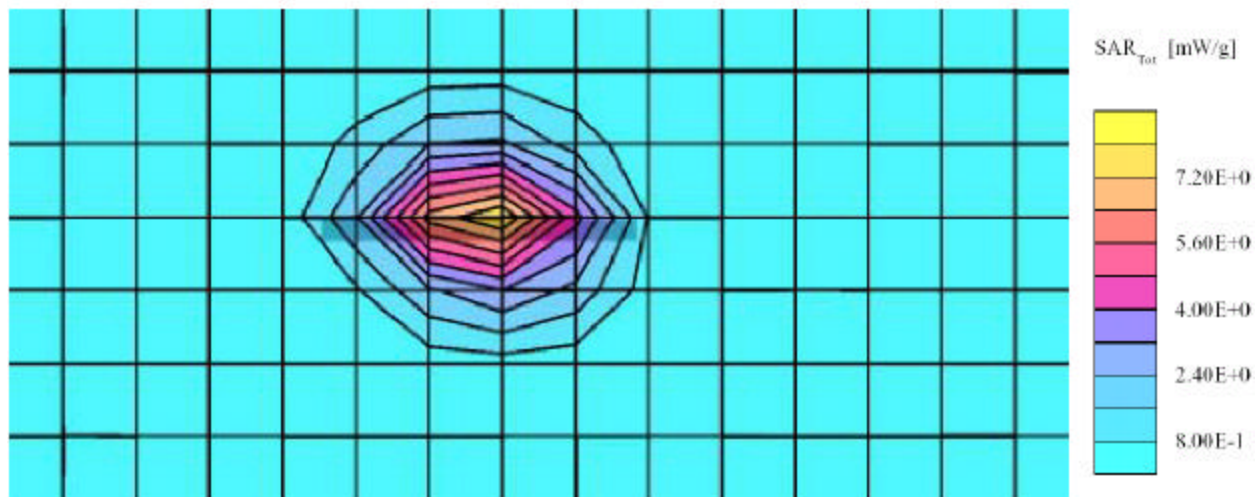
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2450 MHz

Probe: ET3DV6 - SN1604; ConvF(4.30,4.30,4.30); Crest factor: 1.0; 2450 MHz: $\sigma = 2.01 \text{ mho/m}$, $\epsilon_r = 55.0$, $\rho = 1.00 \text{ g/cm}^3$

Cube 5x5x7: SAR (1g): 6.94 mW/g, SAR (10g): 3.19 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.02 dB



System Validation for 2450 MHz Head Liquid (Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 5/16/2003)

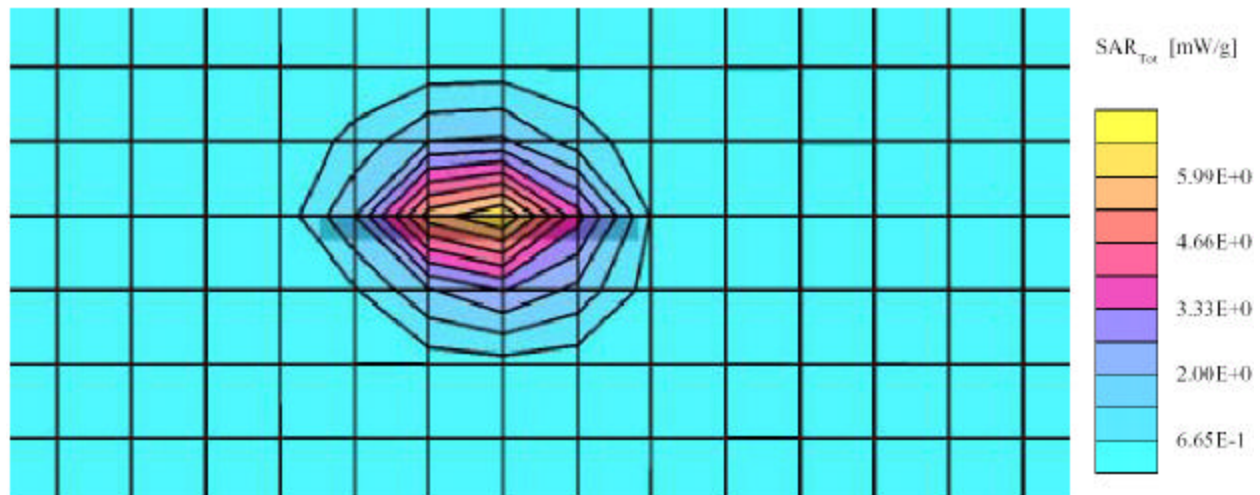
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2450 MHz

Probe: ET3DV6 - SN1604; ConvF(4.70,4.70,4.70); Crest factor: 1.0; 2450 MHz: $\sigma = 1.85 \text{ mho/m}$, $\epsilon_r = 38.1$, $\rho = 1.00 \text{ g/cm}^3$

Cube 4x4x7: SAR (1g): 5.38 mW/g, SAR (10g): 2.71 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.01 dB



System Validation for 2450 MHz Body Liquid (Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 5/21/2003)

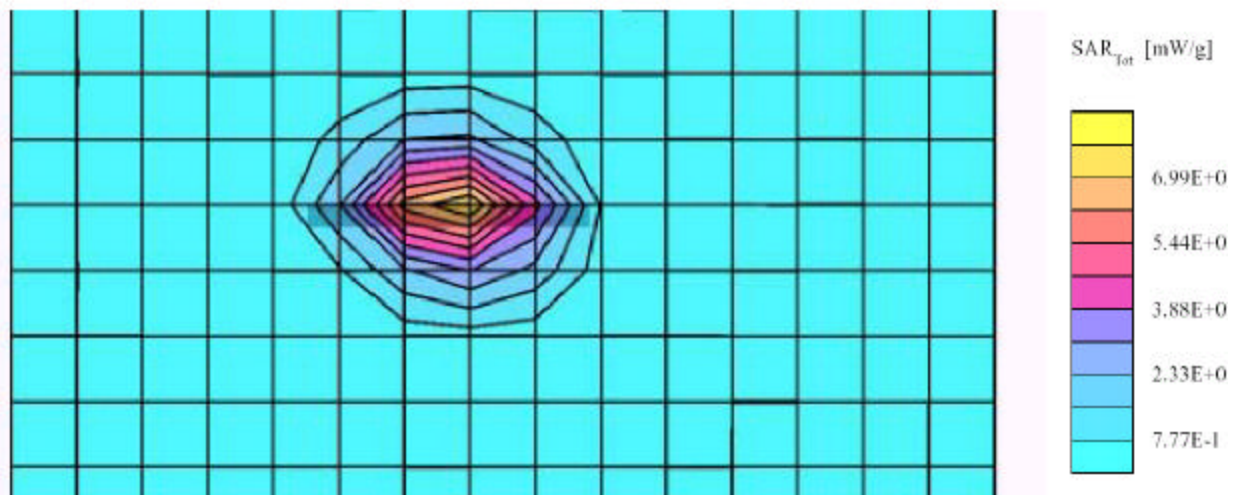
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2450 MHz

Probe: ET3DV6 - SN1604; ConvF(4.30,4.30,4.30); Crest factor: 1.0; 2450 MHz: $\sigma = 1.95 \text{ mho/m}$ $\epsilon_r = 54.7$ $\rho = 1.00 \text{ g/cm}^3$

Cube 5x5x7; SAR (1g): 6.73 mW/g, SAR (10g): 3.10 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.02 dB



System Validation for 2450 MHz Head Liquid (Ambient Temp = 23 Deg C, Liquid Temp = 22 Deg C, 5/21/2003)

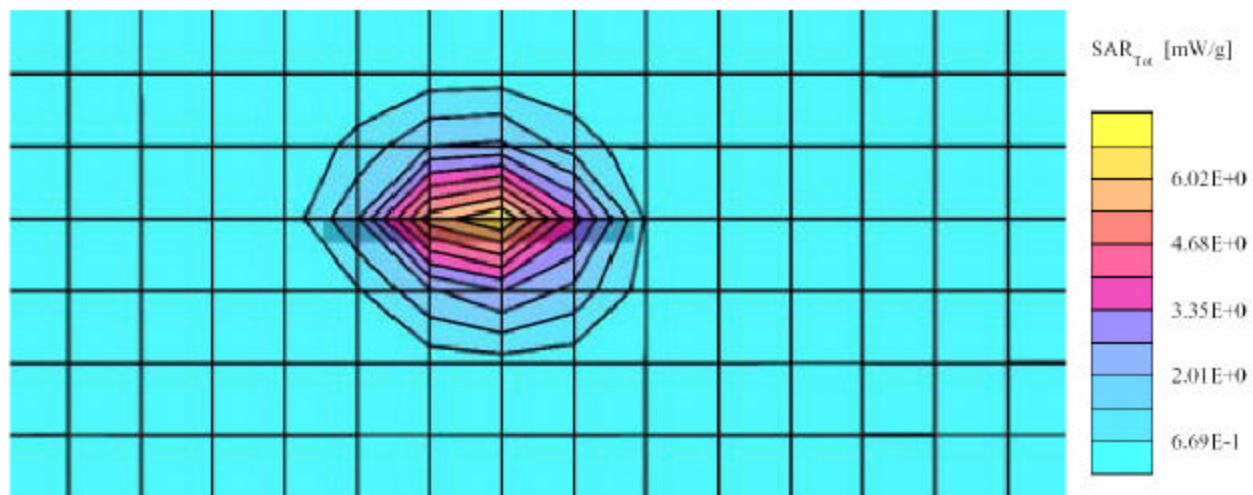
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2450 MHz

Probe: ET3DV6 - SN1604; ConvF(4.70,4.70,4.70); Crest factor: 1.0; 2450 MHz: $\sigma = 1.85 \text{ mho/m}$ $\epsilon_r = 39.7$ $\rho = 1.00 \text{ g/cm}^3$

Cube 5x5x7; SAR (1g): 5.84 mW/g, SAR (10g): 2.69 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.02 dB



System Validation for 2450 MHz Body Liquid (Ambient Temp = 23 Deg C, Liquid Temp = 22 Deg C, 5/30/2003)

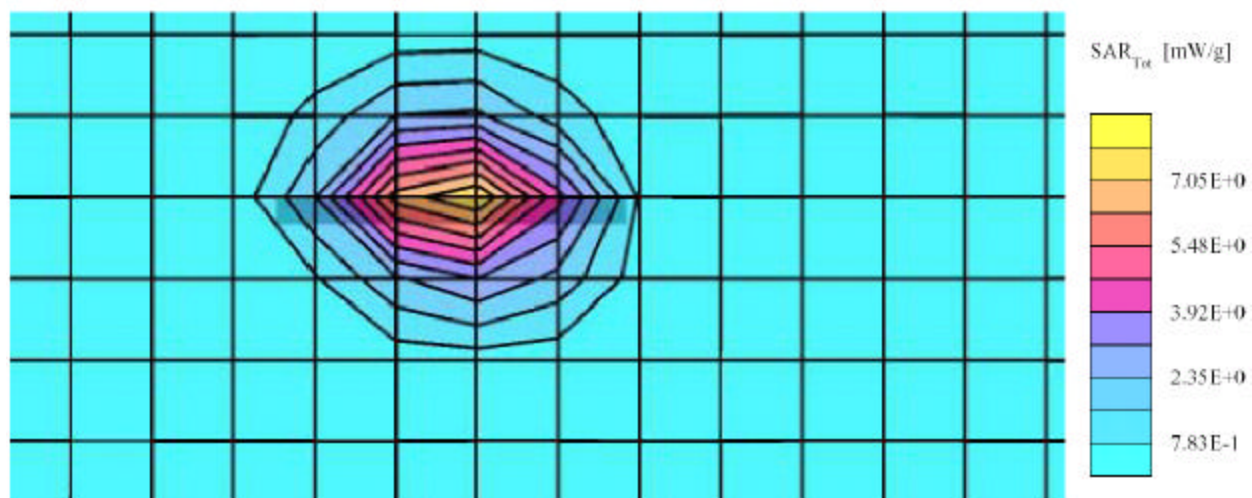
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2450 MHz

Probe: ET3DV6 - SN1604; ConvF(4.30,4.30,4.30); Crest factor: 1.0; 2450 MHz: $\sigma = 1.96 \text{ mho/m}$ $\epsilon_r = 53.5$ $\rho = 1.00 \text{ g/cm}^3$

Cube 5x5x7: SAR (1g): 6.82 mW/g, SAR (10g): 3.13 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.02 dB



System Validation for 2450 MHz Head Liquid (Ambient Temp = 23 Deg C, Liquid Temp = 22 Deg C, 5/30/2003)

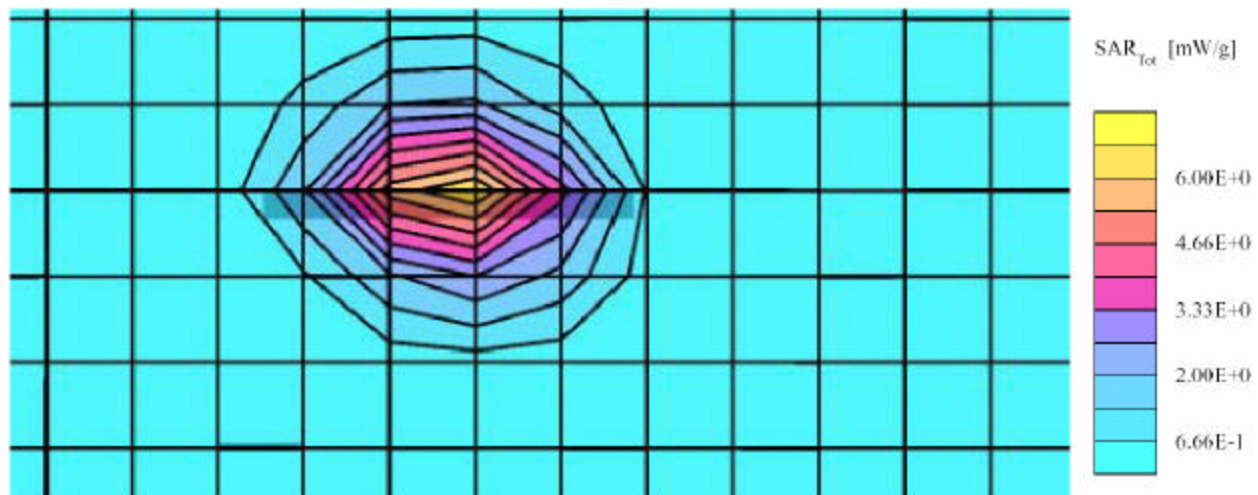
SAM Phantom; Flat Section; Position: (90°, 90°); Frequency: 2450 MHz

Probe: ET3DV6 - SN1604; ConvF(4.70,4.70,4.70); Crest factor: 1.0; 2450 MHz: $\sigma = 1.83 \text{ mho/m}$ $\epsilon_r = 39.4$ $\rho = 1.00 \text{ g/cm}^3$

Cube 5x5x7; SAR (1g): 5.82 mW/g, SAR (10g): 2.68 mW/g, (Worst-case extrapolation)

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

Powerdrift: 0.01 dB



System Validation for 2450 MHz Body Liquid (Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 5/17/2003)

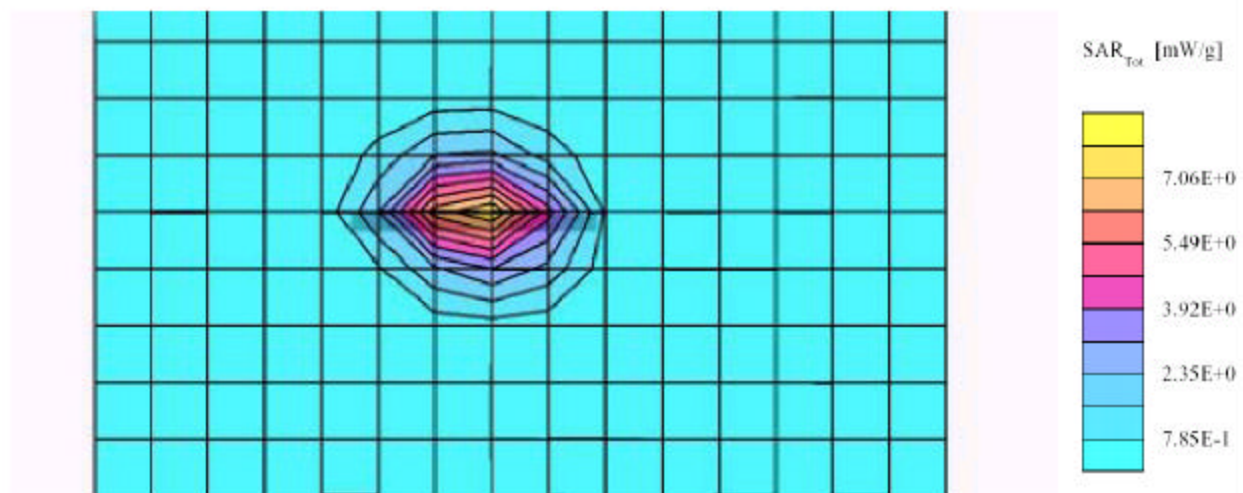
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2450 MHz

Probe: ET3DV6 - SN1604; ConvF(4.30,4.30,4.30); Crest factor: 1.0; 2450 MHz: $\sigma = 1.97 \text{ mho/m}$ $\epsilon_r = 54.4$ $\rho = 1.00 \text{ g/cm}^3$

Cube 5x5x7: SAR (1g): 6.81 mW/g, SAR (10g): 3.14 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.01 dB



System Validation for 2450 MHz Head Liquid (Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 5/17/2003)

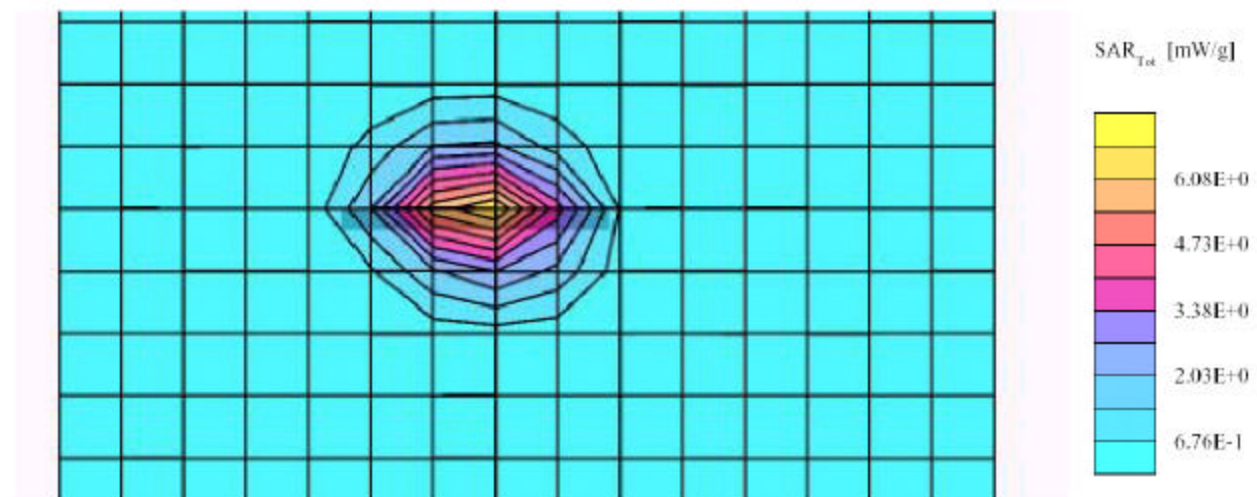
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2450 MHz

Probe: ET3DV6 - SN1604; ConvF(4.70,4.70,4.70); Crest factor: 1.0; 2450 MHz: $\sigma = 1.86 \text{ mho/m}$ $\epsilon_r = 38.9$ $\rho = 1.00 \text{ g/cm}^3$

Cube 5x5x7; SAR (1g): 5.92 mW/g, SAR (10g): 2.72 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.01 dB



7.4 SAR Evaluation Procedure

- a. The evaluation was performed in the applicable area of the phantom depending on the type of device being tested. For device held to the head during normal operation, both the left and right ear positions were evaluated in accordance with FCC OET Bulletin 65, Supplement C (Edition 01-01) using the SAM phantom. For body-worn and face-held devices a planar phantom was used. The EUT in the test setup for body-worn and face-held devices was placed in three different positions (relative to the phantom): parallel, bystand (perpendicular) and 1.5cm separation.
- b. The SAR was determined by a pre-defined procedure within the DASY3 software. Upon completion of a reference and optical surface check, the exposed region of the phantom was scanned near the inner surface with a grid spacing of 20mm x 20mm.
- c. A 5x5x7 matrix was performed around the greatest SAR distribution found during the area scan of the applicable exposed region. SAR values were then calculated using a 3-D spline interpolation algorithm and averaged over spatial volumes of 1 and 10 grams.
- d. The depth of the simulating tissue in the planar used for the SAR evaluation and system validation was no less than 15.0cm.
- e. For this particular evaluation, a stack of low-density, low-loss dielectric foamed polystyrene was used in place of the device holder.
- f. Re-measurement of the SAR value at the same location as in a. If the value changed by more than 5%, the evaluation was repeated.

7.5 Exposure Limits

Table 1: Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands. Wrists. Feet and Ankles
0.4	8.0	20.0

Table 2: Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands. Wrists. Feet and Ankles
0.08	1.6	4.0

Note: Whole-body SAR is averaged over the entire body, partial-body SAR is averaged over any 1 gram of tissue defined as a tissue volume in the shape of a cube SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

Population/Uncontrolled Environments are defined as locations where there is the exposure of individual who have no knowledge or control of their exposure.

Occupational/Controlled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).

Population/uncontrolled environments Partial-body limit 1.6W/kg applied to the EUT.

8 - TEST RESULTS

This page summarizes the results of the performed dosimetric evaluation. The plots with the corresponding SAR distributions, which reveal information about the location of the maximum SAR with respect to the device could be found in the following pages.

According to the data in section 6.1, the EUT complied with the FCC 2.1093 RF Exposure standards, with worst case of **1.53**.

8.1 SAR Body-Worn Test Data

Ambient Temperature (°C): 23.0

Relative Humidity (%): 49.3

Worst case SAR reading

Host PC	EUT position	Frequency (MHz)	Output Power (W)	Test Type	Antenna Type	Liquid	Phantom	Measured (mW/g)	Limit (mW/g)	Plot #
D800 NEWEB	Back touching phantom at left	2437	0.131	Body worn	Built-in	body	flat	0.643	1.6	1
	Back touching phantom at right	2412	0.117	Body worn	Built-in	body	flat	0.800	1.6	2
	Back touching phantom at right	2437	0.131	Body worn	Built-in	body	flat	0.838	1.6	3
	Back touching phantom at right	2462	0.117	Body worn	Built-in	body	flat	0.713	1.6	4
D800 Hitachi	Back touching phantom at left	2437	0.131	Body worn	Built-in	body	flat	0.357	1.6	5
	Back touching phantom at right	2437	0.131	Body worn	Built-in	body	flat	0.592	1.6	6
D600 NEWEB	Back touching phantom at left	2412	0.117	Body worn	Built-in	body	flat	1.18	1.6	7
	Back touching phantom at left	2437	0.131	Body worn	Built-in	body	flat	0.983	1.6	8
	Back touching phantom at left	2462	0.117	Body worn	Built-in	body	flat	0.753	1.6	9
	Back touching phantom at right	2437	0.131	Body worn	Built-in	body	flat	0.615	1.6	10
D600 Hitachi	Back touching phantom at left	2412	0.117	Body worn	Built-in	body	flat	1.53	1.6	11
	Back touching phantom at left	2437	0.131	Body worn	Built-in	body	flat	1.09	1.6	12
	Back touching phantom at left	2462	0.117	Body worn	Built-in	body	flat	1.39	1.6	13
	Back touching phantom at right	2412	0.117	Body worn	Built-in	body	flat	1.50	1.6	14
	Back touching phantom at right	2437	0.131	Body worn	Built-in	body	flat	1.02	1.6	15
	Back touching phantom at right	2462	0.117	Body worn	Built-in	body	flat	1.45	1.6	16

Host PC	EUT position	Frequency (MHz)	Output Power (W)	Test Type	Antenna Type	Liquid	Phantom	Measured (mW/g)	Limit (mW/g)	Plot #
D400 NEWEB	Back touching phantom at left	2437	0.131	Body worn	Built-in	body	flat	0.0771	1.6	17
	Back touching phantom at right	2437	0.131	Body worn	Built-in	body	flat	0.203	1.6	18
C400 NEWEB	Back touching phantom at left	2437	0.131	Body worn	Built-in	body	flat	0.176	1.6	19
	Back touching phantom at right	2437	0.131	Body worn	Built-in	body	flat	0.0974	1.6	20
C640 Foxonn	Back touching phantom at left	2437	0.131	Body worn	Built-in	body	flat	0.622	1.6	21
	Back touching phantom at right	2412	0.117	Body worn	Built-in	body	flat	0.729	1.6	22
	Back touching phantom at right	2437	0.131	Body worn	Built-in	body	flat	0.981	1.6	23
	Back touching phantom at right	2462	0.117	Body worn	Built-in	body	flat	0.798	1.6	24

8.2 Plots of Test Result

The plots of test result were attached as reference.

Ambit. Dell notebook model name: D800 Neweb, Antenna model name: CA0-C (Back touching flat phantom, Antenna position: Left side, Middle channel, Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 5/17/2003)

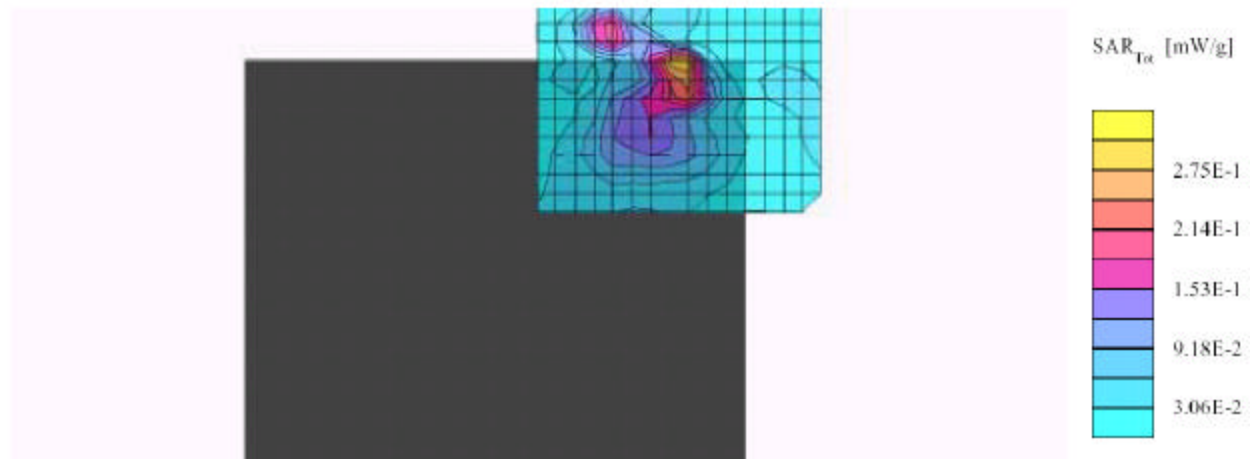
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2437 MHz

Probe: ET3DV6 - SN1604; ConvF(4.30,4.30,4.30); Crest factor: 1.0; 2450; $\sigma = 1.96 \text{ mho/m}$ $\epsilon_r = 55.1$ $\rho = 1.00 \text{ g/cm}^3$

Cube 5x5x7; SAR (1g): 0.643 mW/g, SAR (10g): 0.308 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.01 dB



Plot # 1

Ambit. Dell notebook model name: D800 Neweb, Antenna model name: CA0-C (Back touching flat phantom, Antenna position: Right side, Low channel, Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 5/17/2003)

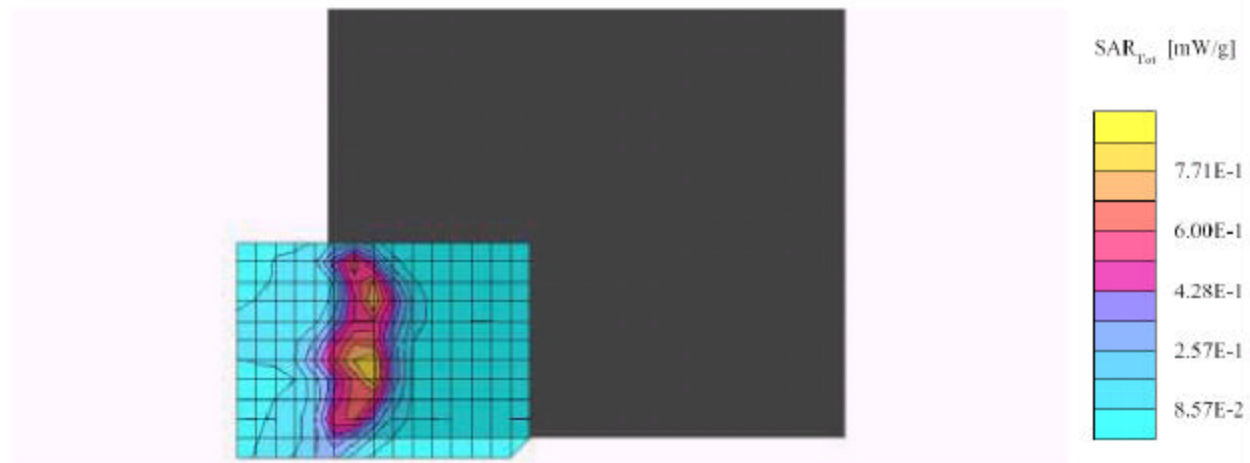
SAM Phantom; Flat Section; Position: (90°, 90°); Frequency: 2412 MHz

Probe: ET3DV6 - SN1604; ConvF(4.30,4.30,4.30); Crest factor: 1.0; 2450: $\sigma = 1.96 \text{ mho/m}$ $\epsilon_r = 55.1$ $\rho = 1.00 \text{ g/cm}^3$

Cube 5x5x7: SAR (1g): 0.800 mW/g, SAR (10g): 0.440 mW/g, (Worst-case extrapolation)

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

Powerdrift: 0.00 dB



Plot # 2

Ambit, Dell notebook model name: D800 Neweb, Antenna model name: CA0-C (Back touching flat phantom, Antenna position: Right side, Middle channel, Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 5/17/2003)

SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2437 MHz

Probe: ET3DV6 - SN1604; ConvF(4.30,4.30,4.30); Crest factor: 1.0; 2450: $\sigma = 1.96 \text{ mho/m}$, $\epsilon_r = 55.1$, $\rho = 1.00 \text{ g/cm}^3$

Cube 5x5x7; SAR (1g): 0.838 mW/g, SAR (10g): 0.449 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.01 dB



Plot # 3

Ambit. Dell notebook model name: D800 Neweb, Antenna model name: CA0-C (Back touching flat phantom, Antenna position: Right side, High channel, Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 5/17/2003)

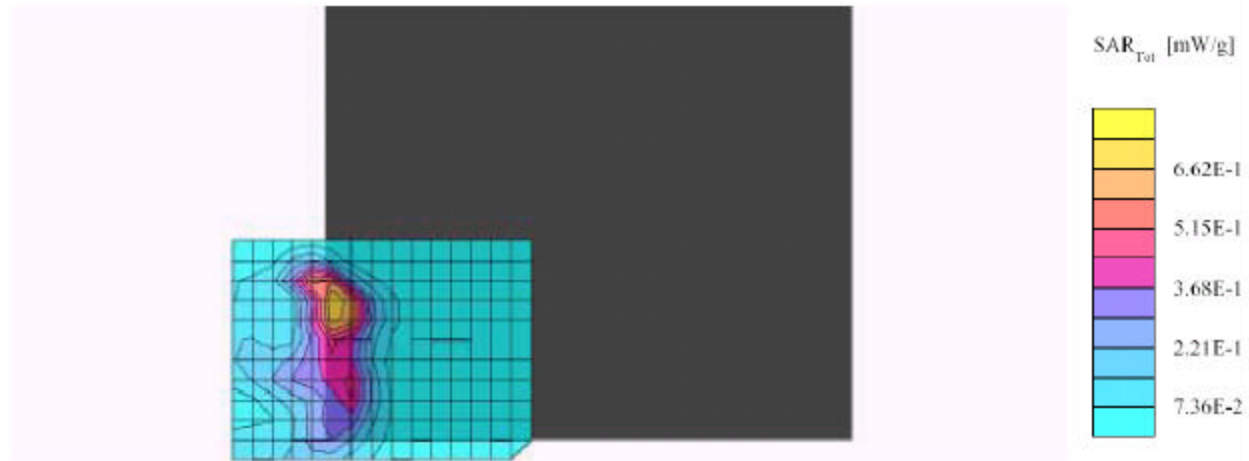
SAM Phantom: Flat Section; Position: (90°, 90°); Frequency: 2462 MHz

Probe: ET3DV6 - SN1604; ConvF(4.30,4.30,4.30); Crest factor: 1.0; 2450: $\sigma = 1.96$ mho/m $\epsilon_r = 55.1$ $\rho = 1.00$ g/cm³

Cube 5x5x7; SAR (1g): 0.713 mW/g, SAR (10g): 0.385 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.01 dB



Plot # 4

**Ambit Dell notebook model name: D800 Hitachi (Body back touch with flat phantom,
Antenna position: left side, Middle channel, Ambient Temp = 23 Deg C, Liquid Temp = 21
Deg C, 5/17/2003)**

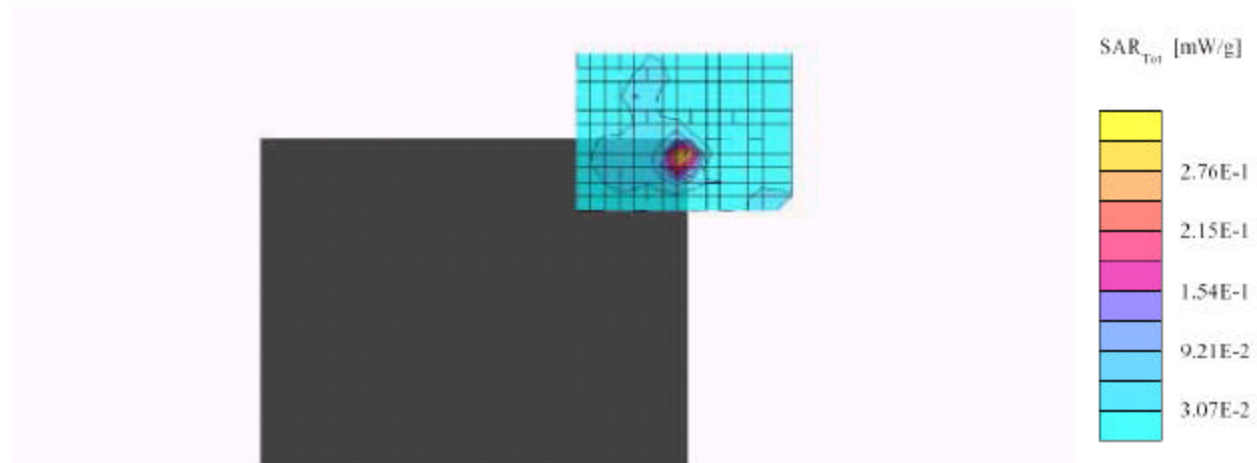
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2437 MHz

Probe: ET3DV6 - SN1604; ConvF(4.30,4.30,4.30); Crest factor: 1.0; 2450 MHz: $\sigma = 1.96 \text{ mho/m}$, $\epsilon_r = 55.1$, $\rho = 1.00 \text{ g/cm}^3$

Cube 5x5x7: SAR (1g): 0.357 mW/g, SAR (10g): 0.150 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.01 dB



Plot # 5

Ambit Dell notebook model name: D800 Hitachi (Body back touch with flat phantom,
Antenna position: right side, Middle channel, Ambient Temp = 23 Deg C, Liquid Temp = 21
Deg C, 5/17/2003)

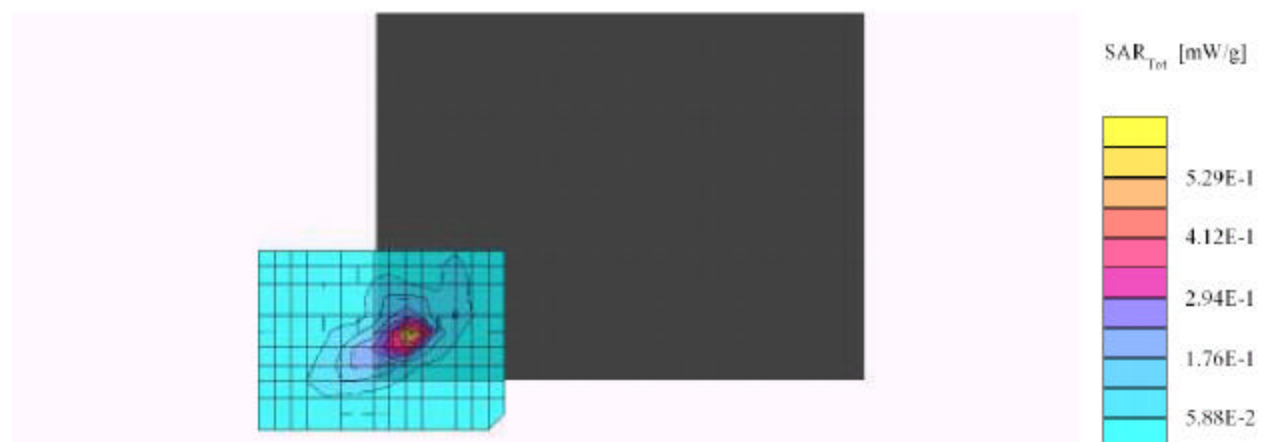
SAM Phantom: Flat Section; Position: (90°,90°); Frequency: 2437 MHz

Probe: ET3DV6 - SN1604; ConvF(4.30,4.30,4.30); Crest factor: 1.0; 2450 MHz: $\sigma = 1.96$ mho/m $\epsilon_r = 55.1$ $\rho = 1.00$ g/cm³

Cube 5x5x7; SAR (1g): 0.592 mW/g, SAR (10g): 0.289 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.05 dB



Plot # 6

Ambit. Dell notebook model name: D600 Neweb, Antenna model name: CA5-Q (Back touching flat phantom, Antenna position: Left side, Low channel, Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 5/16/2003)

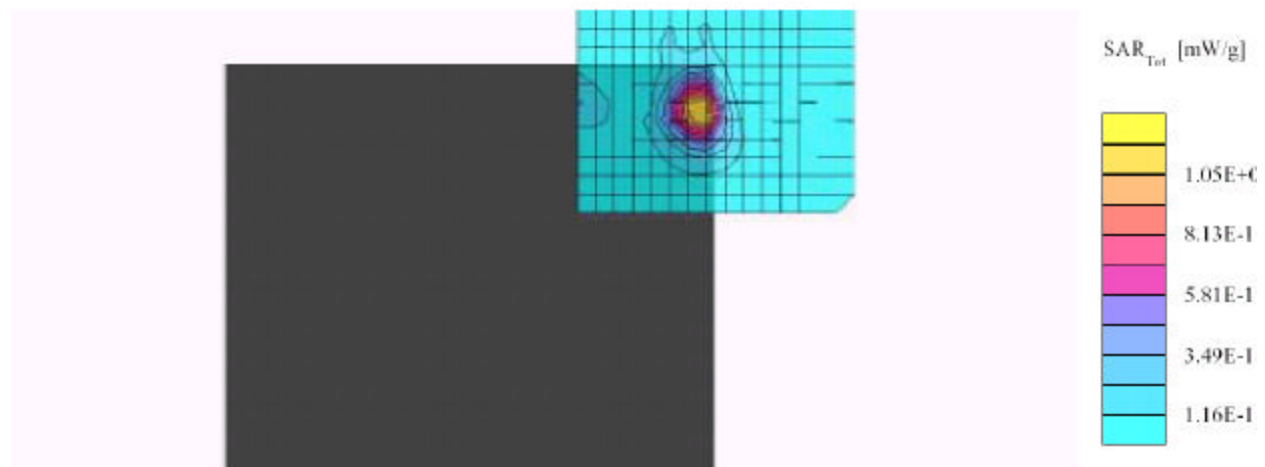
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2412 MHz

Probe: ET3DV6 - SN1604; ConvF(4.30,4.30,4.30); Crest factor: 1.0; 2450: $\sigma = 2.01$ mho/m $\epsilon_r = 55.0$ $\rho = 1.00$ g/cm³

Cube 5x5x7; SAR (1g): 1.18 mW/g, SAR (10g): 0.614 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.01 dB



Plot # 7

Ambit. Dell notebook model name: D600 Neweb, Antenna model name: CA5-Q (Back touching flat phantom, Antenna position: Left side, Middle channel, Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 5/16/2003)

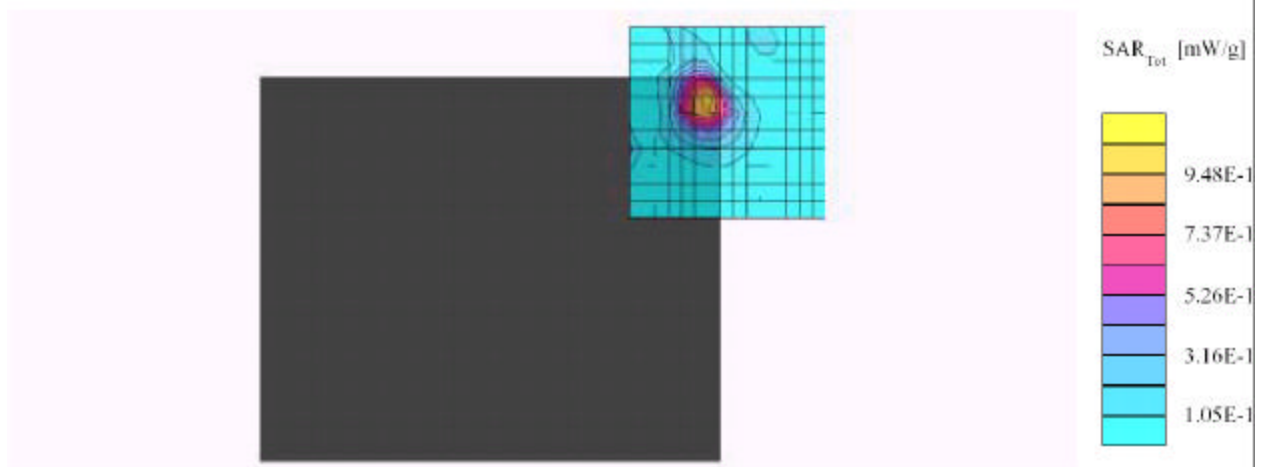
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 2437 MHz

Probe: ET3DV6 - SN1604; ConvF(4.30,4.30,4.30); Crest factor: 1.0; 2450: $\sigma = 2.01$ mho/m $\epsilon_r = 55.0$ $\rho = 1.00$ g/cm³

Cube 5x5x7; SAR (1g): 0.983 mW/g, SAR (10g): 0.516 mW/g, (Worst-case extrapolation)

Coarse: Dx = 12.0, Dy = 9.0, Dz = 10.0

Powerdrift: -0.01 dB



Plot # 8

Ambit. Dell notebook model name: D600 Neweb, Antenna model name: CA5-Q (Back touching flat phantom, Antenna position: Left side, High channel, Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 5/16/2003)

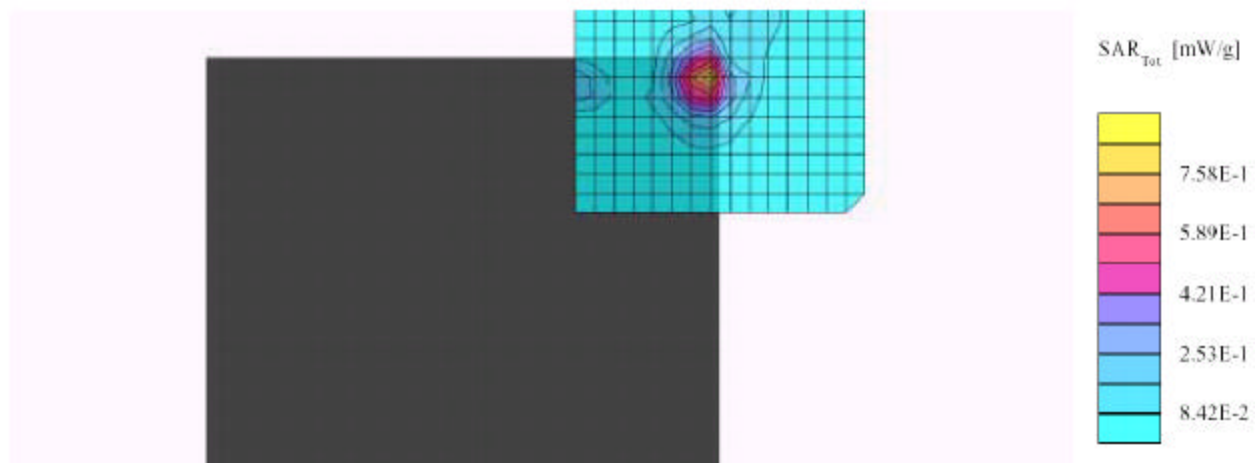
SAM Phantom: Flat Section; Position: (90°,90°); Frequency: 2462 MHz

Probe: ET3DV6 - SN1604; ConvF(4.30,4.30,4.30); Crest factor: 1.0; 2450: $\sigma = 2.01$ mho/m $\epsilon_r = 55.0$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.753 mW/g, SAR (10g): 0.383 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.05 dB



Plot # 9