SAR EVALUATION REPORT

For

VTech Telecommunications Ltd.

23/F Tai Ping Industrial Center Block 1
57 Ting Kok Road, Tai Po NT, Hong Kong

Model: VT 5831

April 1, 2002

This Report Concerns:	**Equipment Type:**
☒ Original Report	Cordless Phone

Test Engineer: John Chan

Report No.: R0203182

Test Date: March 31, 2002

Certified By:

John Y. Chan – Engineering Manager

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CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

Applicant:	VTech Telecommunications Ltd. 23/F Tai Ping Industrial Center Block 1 57 Ting Kok Road, Tai Po NT, Hong Kong
Trade Name:	N/A
Model:	2.4GHz Cordless Phone Handset
Serial Number:	N/A
FCC ID:	EW780-5198-01
Dates of Tests:	March 31, 2002
Report No:	R0203182
Tx Frequency:	2401.056 ~ 2482.272 MHz
Max. RF Output Power:	22.2dBm (0.166Watt)
RF Exposure environment:	General Population/Uncontrolled
Application Type:	Certification
FCC Rule Part(s):	FCC 15.247

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE Std. C95.1-1992 and had been tested in accordance with the measurement procedures specified in FCC OET 65 Supplement C (released on 6/29/2001 see Test Report).

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

John Chan
Engineering Manager

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1 - EUT Description

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1 Specific Absorption Rate (SAR) is a measure of the rate of energy absorption due to exposure to an RF transmitting source (wireless portable device).
2 IEEE/ANSI Std. C95.1-1992 limits are used to determine compliance with FCC ET Docket 93-62.

Note: The test data was good for test sample only. It may have deviation for other test samples.

2 - Requirements For Compliance Testing Defined By The FCC

The US Federal Communications Commission has released the report and order "Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996 [1].

The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 mW/g as recommended by the ANSI/IEEE standard C95.1-1992 [6] for an uncontrolled environment (Paragraph 65). According to the Supplement C of OET Bulletin 65 "Evaluating Compliance with FCC Guide-lines for Human Exposure to Radio frequency Electromagnetic Fields", released on Jun 29, 2001 by the FCC, the device should be evaluated at maximum output power (radiated from the antenna) under "worst-case" conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

3 - Dosimetric Assessment Setup

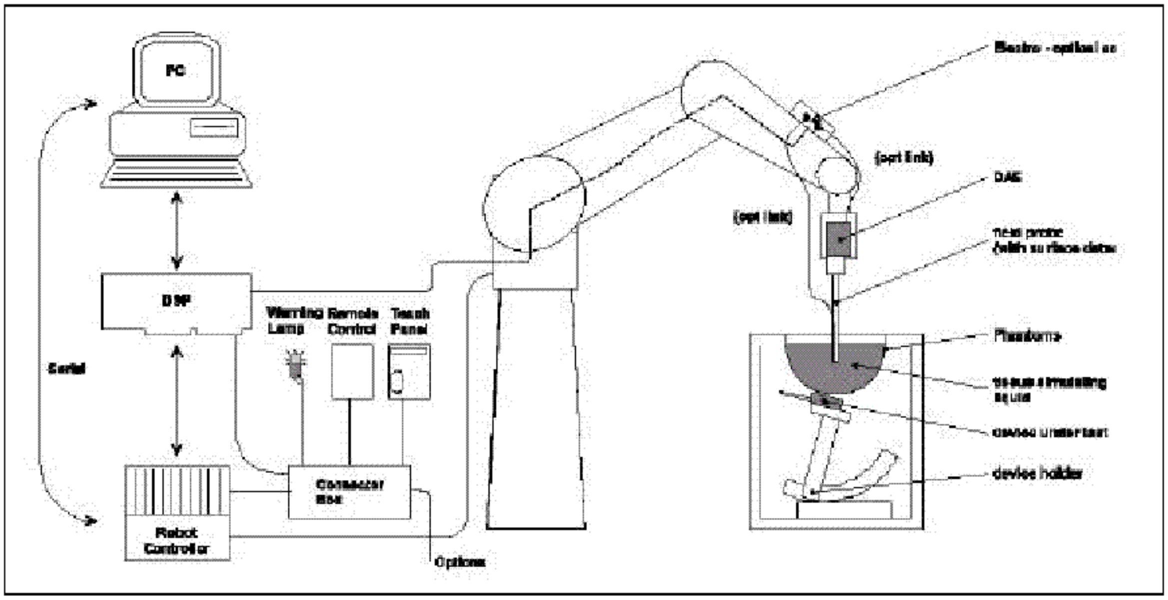
These measurements were performed with the automated near-field scanning system DASY3 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9m) which positions the probes with a positional repeatability of better than ±0.02mm. Special 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: 1577 (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 ±10%. The spherical isotropy was evaluated with the procedure described in [8] and found to be better than ±0.25dB.

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	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (s/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

3.1 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.

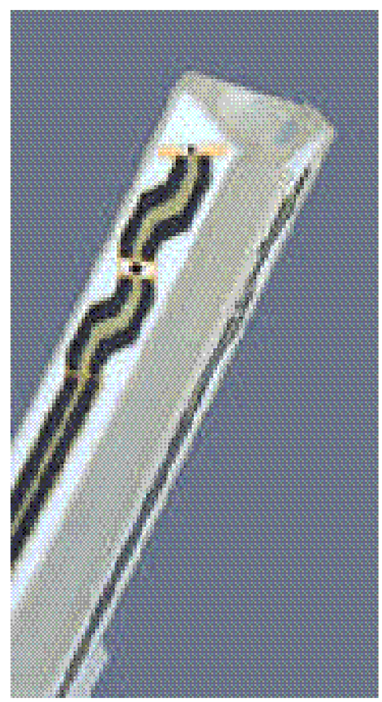
3.2. System Components

Photograph of the probe

ET3DV5 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 ± 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

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 2 nd order fitting. The approach is stopped when reaching the maximum.



Inside view of ET3DV6 E-field Probe

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 bellow 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	σ
	-Density	ρ

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:

$$Vi = Ui + (Ui)^2\ cf / dcp_i$$

With Vi = compensated signal of channel i (i =x, y, z)
Ui = 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:

E-field probes: $E_i = \sqrt{\dfrac{V_i}{Norm_i \cdot ConvF}}$

H-field probes: $H_i = \sqrt{Vi} \cdot \dfrac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$

With Vi = compensated signal of channel i (i =x, y, z)
$Norm_i$ = sensor sensitivity of channel i (i =x, y, z)
μV/ $(V/m)^2$ for E-field probes
ConF = sensitivity enhancement in solution
a_{ij} = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
Ei = 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):

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

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

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

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]
ρ = equivalent tissue density in g/cm^3

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.

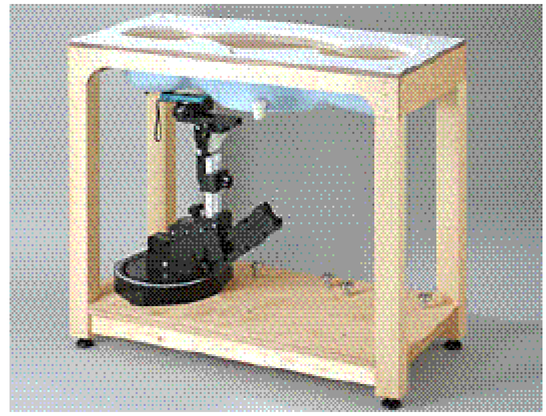
The power flow density is calculated assuming the excitation field as a free space field.

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

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)

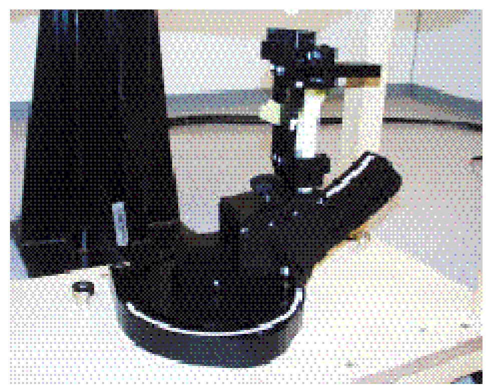


Generic Twin Phantom

Device Holder for Transmitters

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.



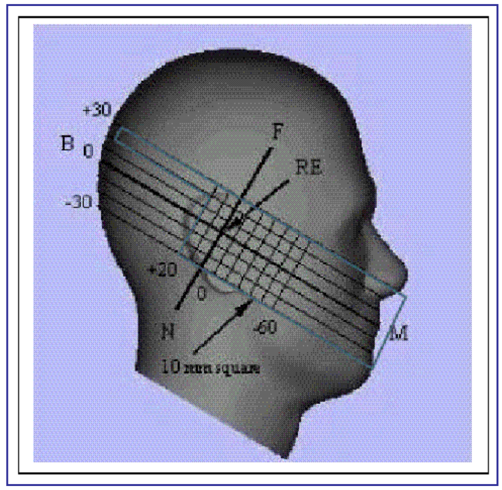
Device Holder

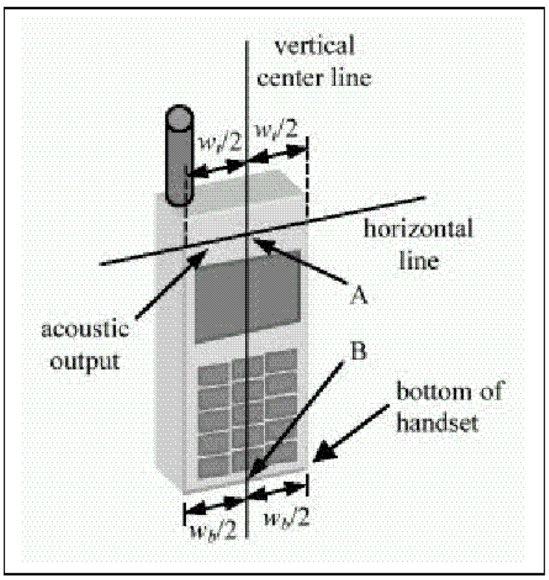
3.3. EUT Arrangement

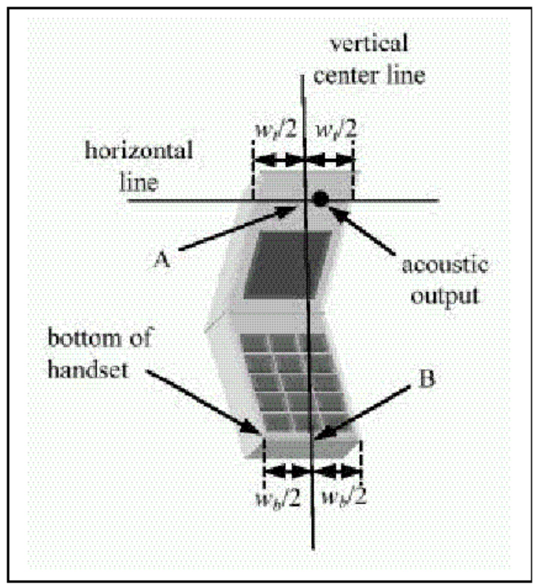
Handset Test Position

----HEAD POSTION----

The device was placed in a normal operating position with the Point A on the device, as illustrated in following drawing, aligned with the location of the RE(ERP) on the phantom. With the ear-piece pressed against the head, the vertical center line of the body of the handset was aligned with an imaginary plane consisting of the RE, LE and M. While maintaining these alignments, the body of the handset was gradually moved towards the cheek until any point on the mouth-piece or keypad contacted the cheek. This is a cheek/touch position. For ear/tilt position, while maintain the device aligned with the BM and FN lines, the device was pivot against ERP back for 15º or until the device antenna touch the phantom. Please refer to IEEE SC-2 P1528 illustration Below.







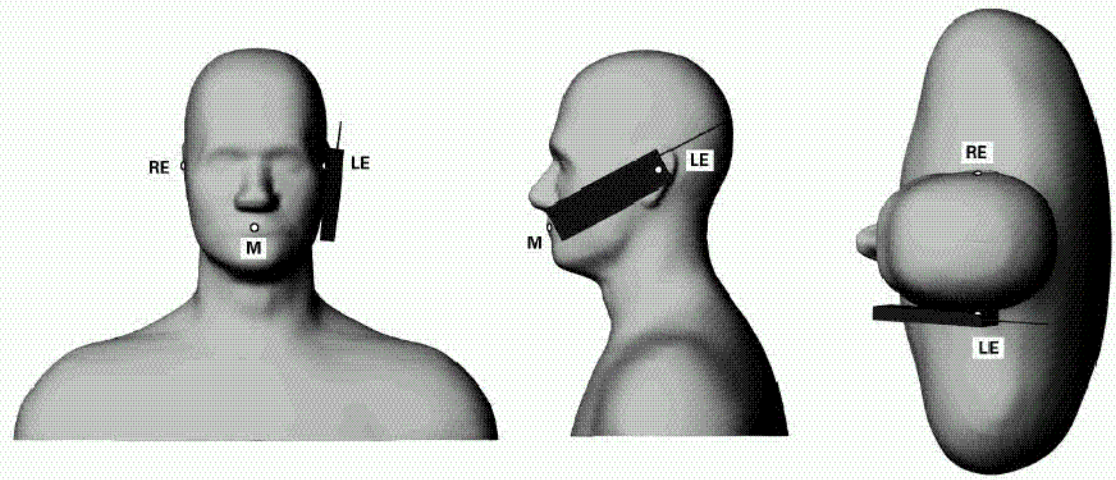


Figure – Phone position 1, "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only .

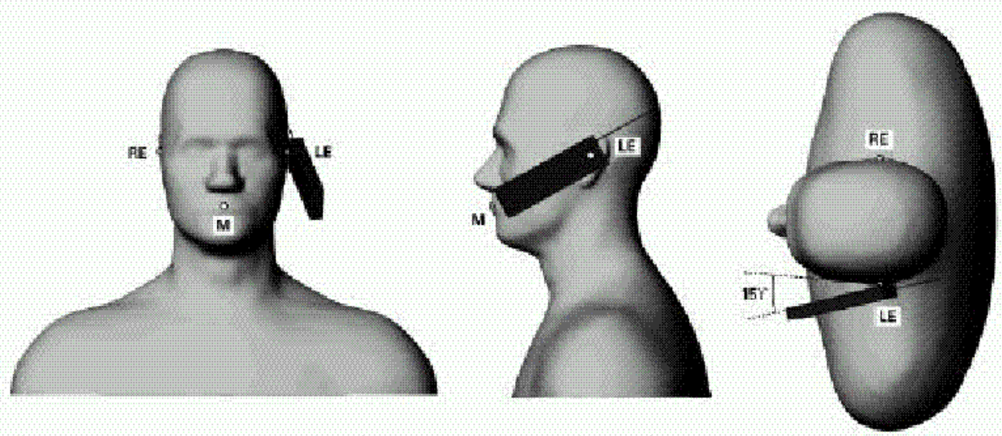
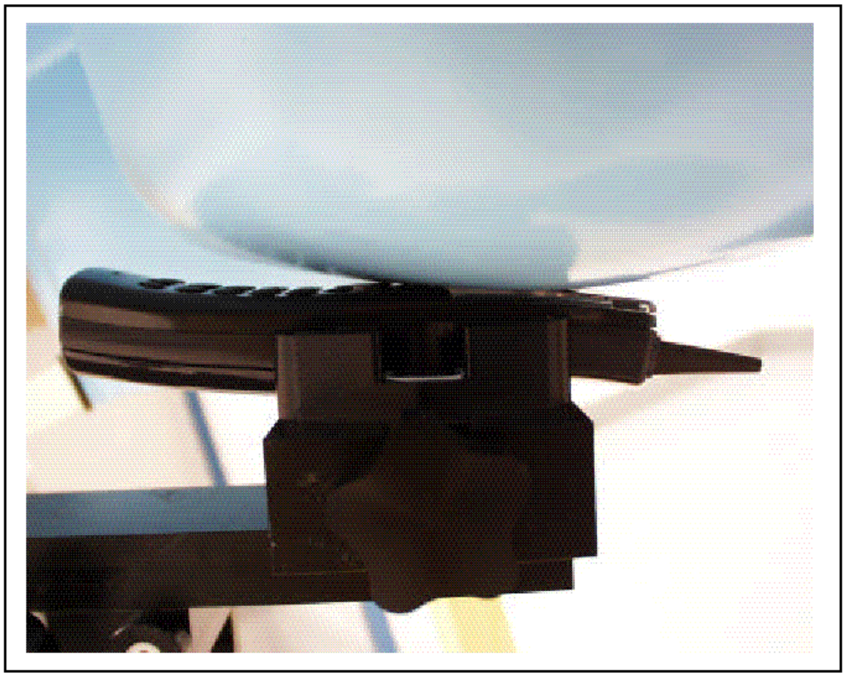
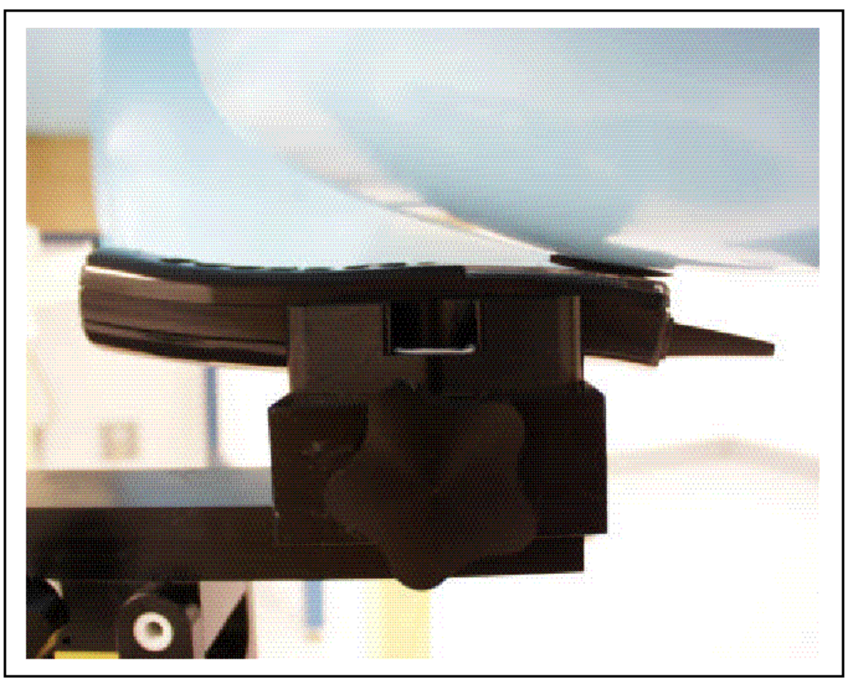


Figure – Phone position 2, "tilted position." The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only .

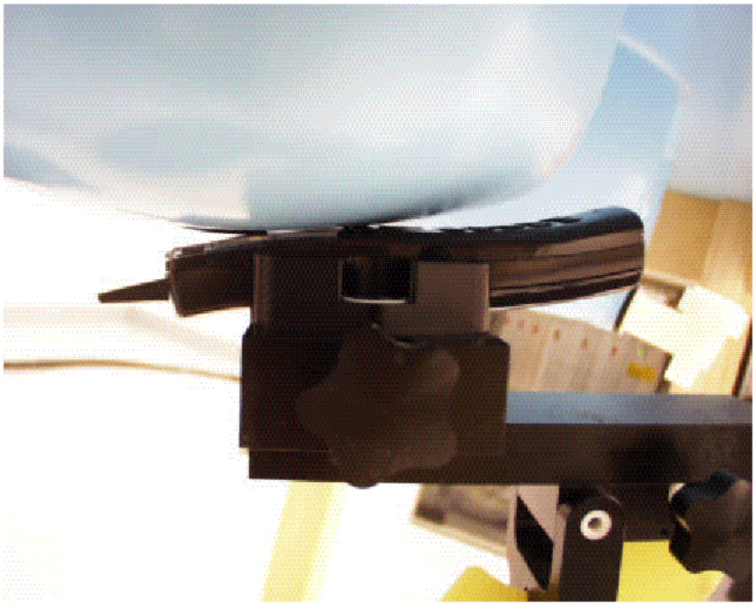
Setup Photo: Left Head Cheek Configuration



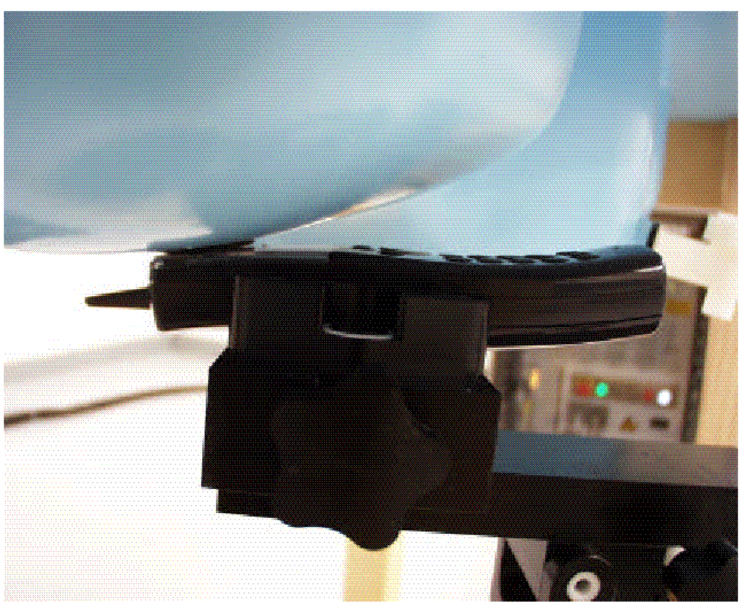
Setup Photo: Left Head Tilted Configuration



Setup Photo: Right Head Cheek Configuration



Setup Photo: Right Head Tilted Configuration

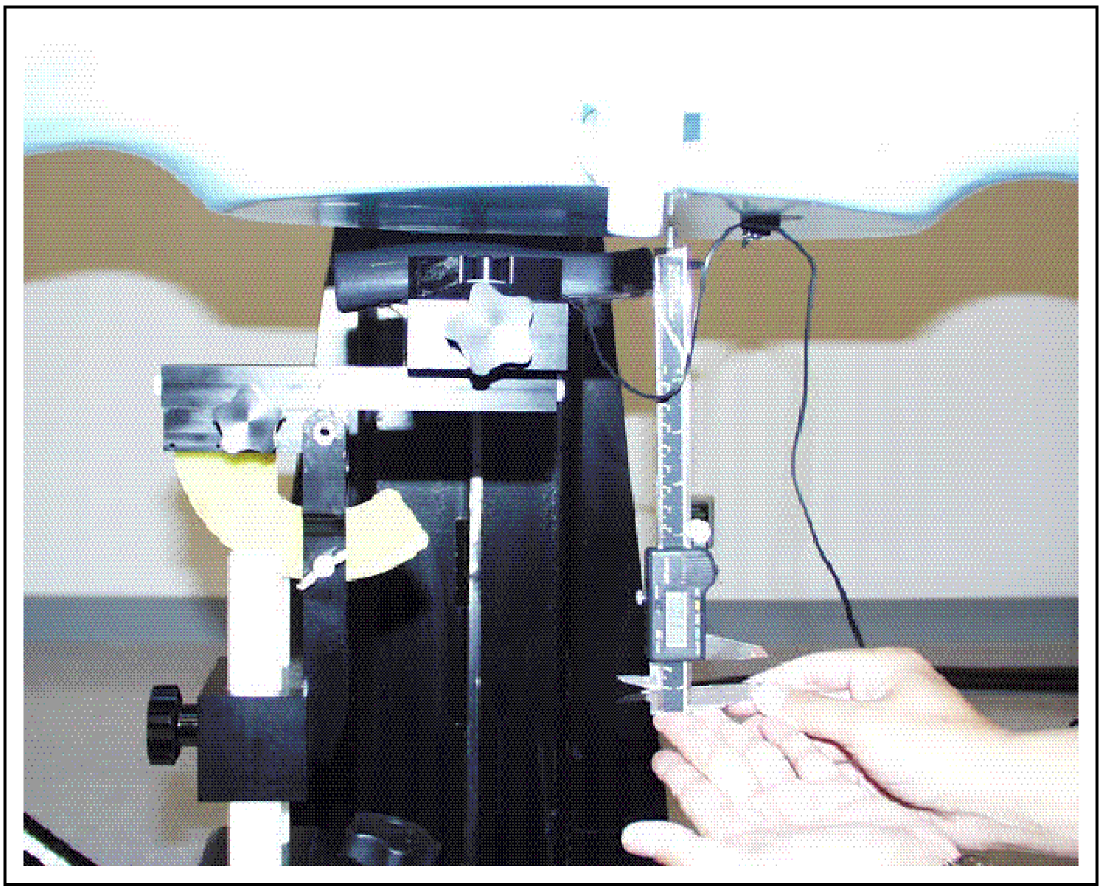


Body-Worn Test Setup

----Body Holster Configuration----

The body holster configuration is used for body-worn devices that have a body holster accessory. Typically, a holster or carrying case is provided or available as an accessory item for supporting headset and body-worn operations. SAR may vary depending on the body separation distance provided by the type of holster and batteries supplied for a phone. Generally, the design of the holster allows the phone to be positioned only with the keypad facing away from the phantom. Proper usage of the holster restricts the antenna to a specified distance away from the surface of the body. For this test the EUT is placed into the holster and the holster is positioned against the surface of the phantom in a normal operating position. The Ear-Microphone wire is then connected to the phone to simulate hands-free operation in a body holster configuration. Since this EUT does not supply any body worn accessory to the end user **a distance of 15mm from the EUT back surface to the liquid interface is configured for the generic test.**

Setup Photo: Body Holster Configuration



3.4 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.

Uncertainty Description	Error	Distribution	Weight	Standard Deviation	Offset
Probe Uncertainty					
Axial isotropy	± 0.2 dB	U-shape	0.5	±2.4 %	/
Spherical isotropy	±0.4 dB	U-shape	0.5	±4.8 %	/
Isotropy from gradient	±0.5 dB	U-shape	0	/	/
Spatial resolution	±0.5 %	Normal	1	±0.5 %	/
Linearity error	±0.2 dB	Rectangle	1	±2.7 %	/
Calibration error	±3.3 %	Normal	1	± 3.3 %	/
SAR Evaluation Uncertainty					
Data acquisition error	±1%	Rectangle	1	±0.6 %	/
ELF and RF disturbances	±0.25 %	Normal	1	±0.25 %	/
Conductivity assessment	±10 %	Rectangle	1	± 5.8 %	/
Spatial Peak SAR Evaluation Uncertainty					
Extrapol boundary effect	±3%	Normal	1	±3%	± 5%
Probe positioning error	±0.1 mm	Normal	1	± 1%	/
Integrat. and cube orient	±3%	Normal	1	±3%	/
Cube shape inaccuracies	±2%	Rectangle	1	±1.2 %	/
Device positioning	±6%	Normal	1	± 6%	/
Combined Uncertainties	/	/	1	**±11.7 %**	**± 5%**
Extended uncertainty (K = 2)	/	/	/	**± 23.5 %.**	/

4 - EUT Tune-up Procedure

Operation of the FCC Fixed Part (Base) Unit

To invoke RF Test Mode on Base:

- Power up the base; select 'MENU' (hit middle soft), then select "Base Settings" item and hit O
- At the Base Settings Menu, enter in the code **RFTEST## (**738378##) and hit OK; the base should reset
- After power up, the base will be in non-stack, FCC Test Mode; the user will be placed directly in the RF test menu, which will contain these three options:

1. 'SEL RF CHANNEL':

- Use digital keys to choose the new channel (0-94)
- Use middle softkey SAVE to start using the new channel in a single active tx slot and single-channel hopping on your selected channel. (Note: Any number greater than 94 will result in the new channel being 94)
- Use the left or right softkeys to increment or decrement the channel number

2. 'SEL # OF TX SLOT':

- Use left or right softkey to choose number of active tx slots (1, 2 or 4)
- Use middle softkey SAVE to start activating the tx slots at the current RF channel

3. 'Reset Base': (used to rest the base, exiting from RF test mode)

- Use the right softkey to reset the base
- Use the left softkey to cancel base reset, and return to the base setting menu

To exit RF Test Mode on Base:

- Select option 3 from the RF Test menu and hit OK or
- Power cycle the base

Operation of the FCC Portable Part (Handset) unit

To invoke RF Test Mode on Handset:

- Power up the handset; select 'MENU' (hit middle soft), then select REGISTER item and hit OK.
- Type **RFTEST (**738387) and hit OK; the handset should reset. Unlike base, you don't need to enter ## at the end of sequence.
- After power up, the handset will be in non-stack, FCC Test Mode; the user will be placed directly in the RF Test menu, which will contain the same options and same functionality as on the base (see above).

To exit RF Test Mode on Handset:

- Select option 3 from the RF Test menu and hit OK. Unlike base, handset power cycle will not exit RF Test Mode.

5 - Evaluation Procedure

5.1 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:

5.2 System Accuracy Verification

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of ±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

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

System validation result

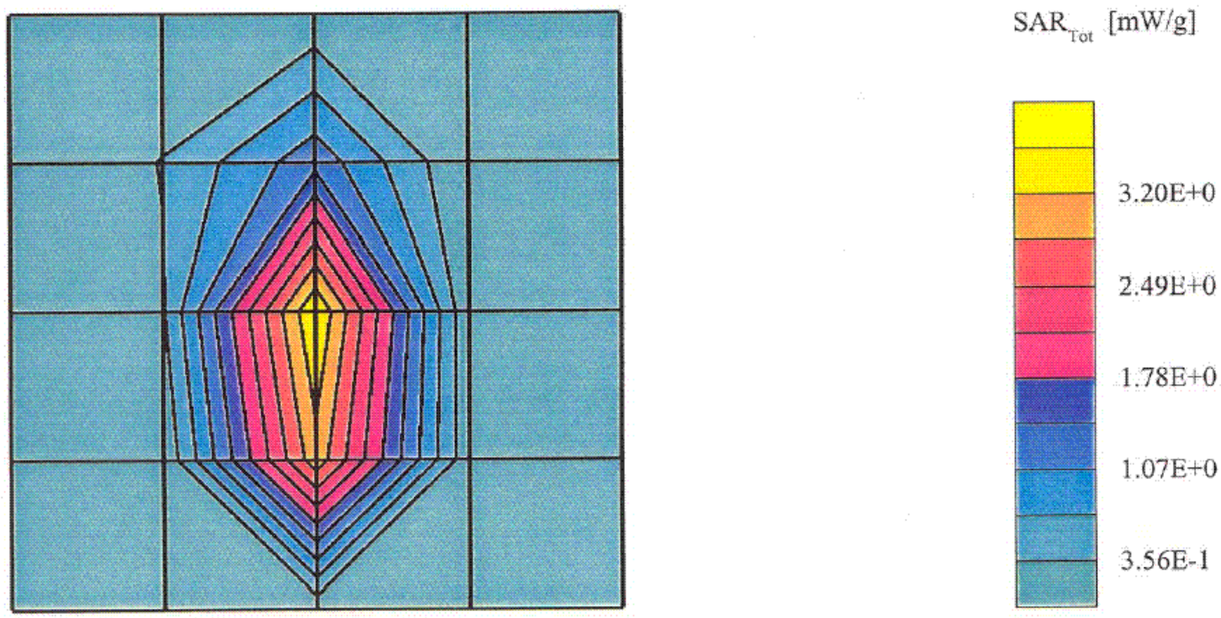
Freq [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation [%]	Limits [%]
1800	ε_r	23.4	53.3	54.6	2.4	±5
	σ	23.4	1.40	1.39	-0.7	±5
	1g SAR	23.4	38.1	41.64	9.291	±10

ε_r = relative permittivity, σ = conductivity and $\rho=1000 kg/m^3$

Note: Input power = 83.33mW.

Dipole 1800 MHz

SAM;
Probe: ET3DV6 - SN1604; ConvF(5.68,5.68,5.68); Crest factor: 1.0; Body 1800 MHz: σ = 1.39 mho/m ε_r = 54.6 ρ = 1.00 g/cm³
Cubes (2): Peak: 7.06 mW/g ± 0.00 dB, SAR (1g): 3.47 mW/g ± 0.01 dB, SAR (10g): 1.65 mW/g ± 0.02 dB, (Worst-case extrapolation)
Penetration depth: 7.7 (7.1, 9.1) [mm]
Powerdrift: -0.15 dB



5.3 SAR Evaluation Procedure

The evaluation was performed with the following procedure:

Step 1: Measurement of the SAR value at a fixed location above the ear point or central position was used as a reference value for assessing the power drop.

Step 2: The SAR distribution at the exposed side of the head was measured at a distance of 3.9 mm from the inner surface of the shell. The area covered the entire dimension of the head or EUT and the horizontal grid spacing was 20 mm x 20 mm. Based on these data, the area of the maximum absorption was determined by spline interpolation.

Step 3: Around this point, a volume of 32 mm x 32 mm x 34 mm was assessed by measuring 5 x 5 x 7 points. On the basis of this data set, the spatial peak SAR value was evaluated under the following procedure:

1. The data at the surface were extrapolated, since the center of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2 mm. The extrapolation was based on a least square algorithm [11]. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.

2. The maximum interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed by the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one dimensional splines with the “Not a knot"-condition (in x, y and z-directions) [11], [12]. The volume was integrated with the trapezoidal-algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.

3. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

Step 4: Re-measurement of the SAR value at the same location as in Step 1. If the value changed by more than 5%, the evaluation was repeated.

5.4 Exposure Limits

Table 1: Limits for Occupational/Controlled Exposure (mW/g)

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

Table 2: Limits for General Population/Uncontrolled Exposure (mW/g)

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, writs, 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 1.6mW/g applied to the EUT.

6 - 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.

6.1 Left Head Configuration

Position	Ch	Frequency [MHz]	Conducted Power (dBm)	Worst case SAR, averaged over 1g [mW/g]				
				Setup condition (applicable checked)			Measured	Limit
				Antenna	Cheek	Tilted		
Head	L	2401.056	22.2	Built-in	√		0.0166	1.6
Head	M	2442.525	22.2	Built-in	√		0.0156	1.6
Head	H	2482.952	22.2	Built-in	√		0.0133	1.6
Head	L	2401.056	22.2	Built-in		√	0.0242	1.6
Head	M	2442.525	22.2	Built-in		√	0.0268	1.6
Head	H	2482.952	22.2	Built-in		√	0.0256	1.6

6.2 Right Head Configuration

Position	Ch	Frequency [MHz]	Conducted Power (dBm)	Worst case SAR, averaged over 1g [mW/g]				
				Setup condition (applicable checked)			Measured	Limit
				Antenna	Cheek	Tilted		
Head	L	2401.056	22.2	Built-in	√		0.0161	1.6
Head	M	2442.525	22.2	Built-in	√		0.0146	1.6
Head	H	2482.952	22.2	Built-in	√		0.0215	1.6
Head	L	2401.056	22.2	Built-in		√	0.0225	1.6
Head	M	2442.525	22.2	Built-in		√	0.0237	1.6
Head	H	2482.952	22.2	Built-in		√	0.0269	1.6

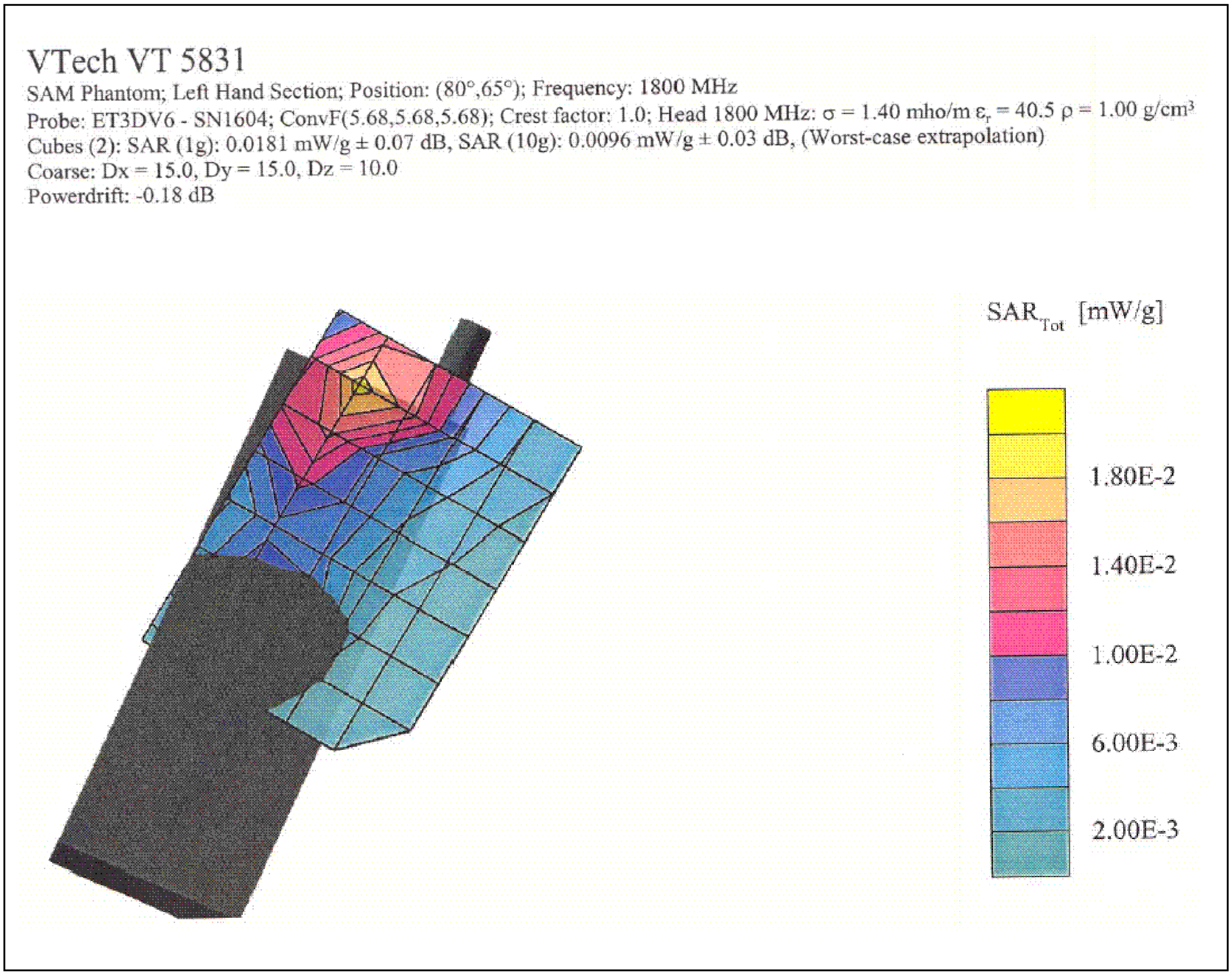
6.3 Body Worn Configuration

Position	Ch	Frequency [MHz]	Conducted Power (dBm)	Worst case SAR, averaged over 1g [mW/g]			
				Setup condition (applicable checked)		Measured	Limit
				Antenna	Sp Dist (mm)		
Body	L	2401.056	22.2	Built-in	15	0.0069	1.6
Body	M	2442.525	22.2	Built-in	15	0.0176	1.6
Body	H	2482.952	22.2	Built-in	15	0.0125	1.6

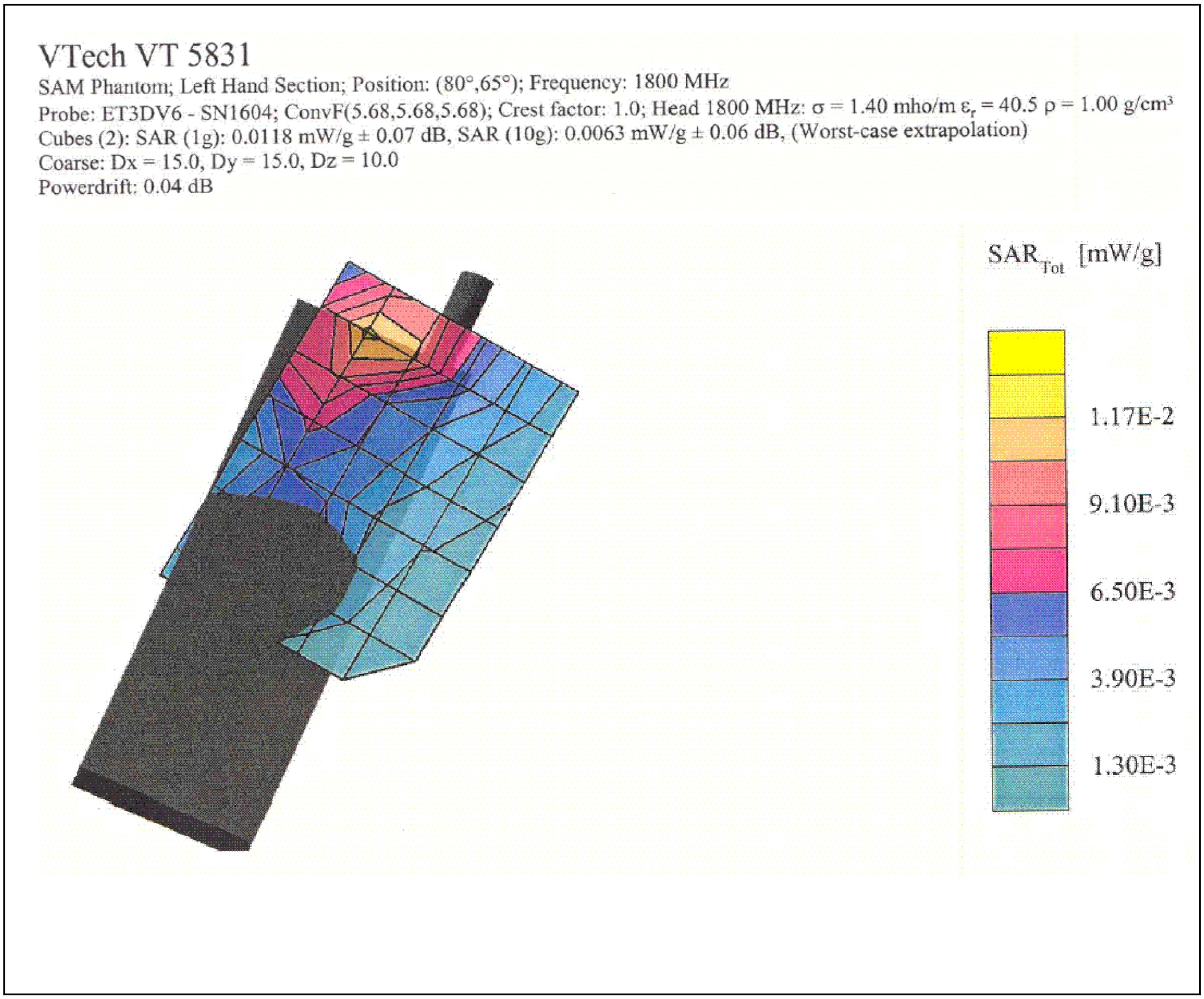
6.4 Liquid Measurement Result

Freq [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation [%]	Limits [%]
1800	ε	23.4	53.2	54.6	2.6	±5
	σ	23.4	1.40	1.39	-0.7	±5

Left Head, Cheek, Low Frequency, Worst Case



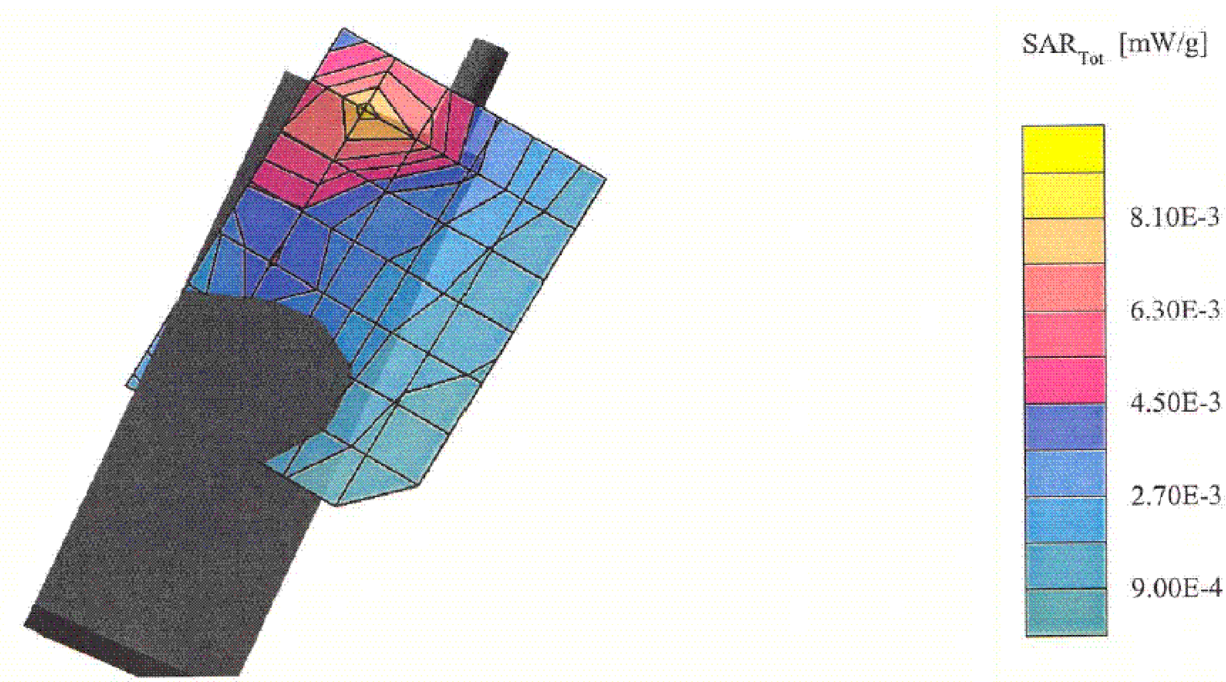
Left Head, Cheek, Middle Frequency, Worst Case



Left Head, Cheek, High Frequency, Worst Case

VTech VT 5831

SAM Phantom; Left Hand Section; Position: (80°,65°); Frequency: 1800 MHz
Probe: ET3DV6 - SN1604; ConvF(5.68,5.68,5.68); Crest factor: 1.0; Head 1800 MHz: σ = 1.40 mho/m ε_r = 40.5 ρ = 1.00 g/cm^3
Cubes (2): SAR (1g): 0.0084 mW/g ± 0.09 dB, SAR (10g): 0.0048 mW/g ± 0.00 dB, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: 0.18 dB



Z Axis

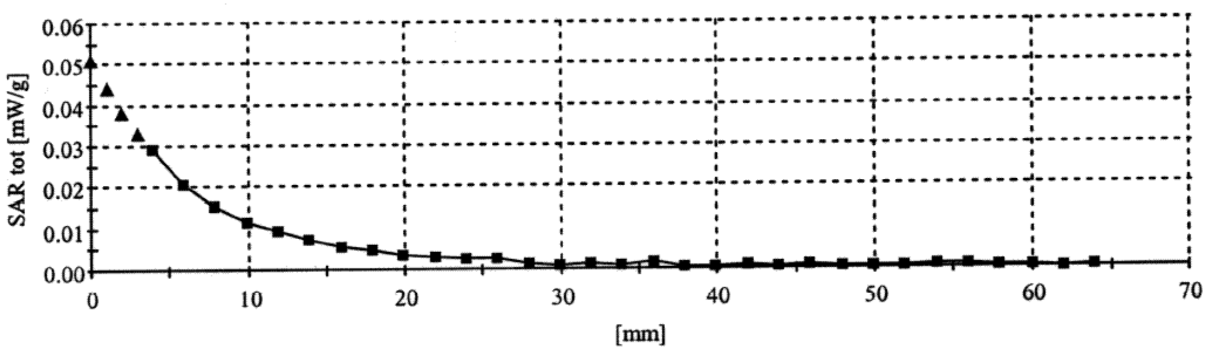
VTech VT 5831

SAM Phantom; Section; Position: ; Frequency: 1800 MHz

Probe: ET3DV6 - SN1604; ConvF(5.68,5.68,5.68); Crest factor: 1.0; Head 1800 MHz: σ = 1.40 mho/m ε_r = 40.5 ρ = 1.00 g/cm³

: , ()

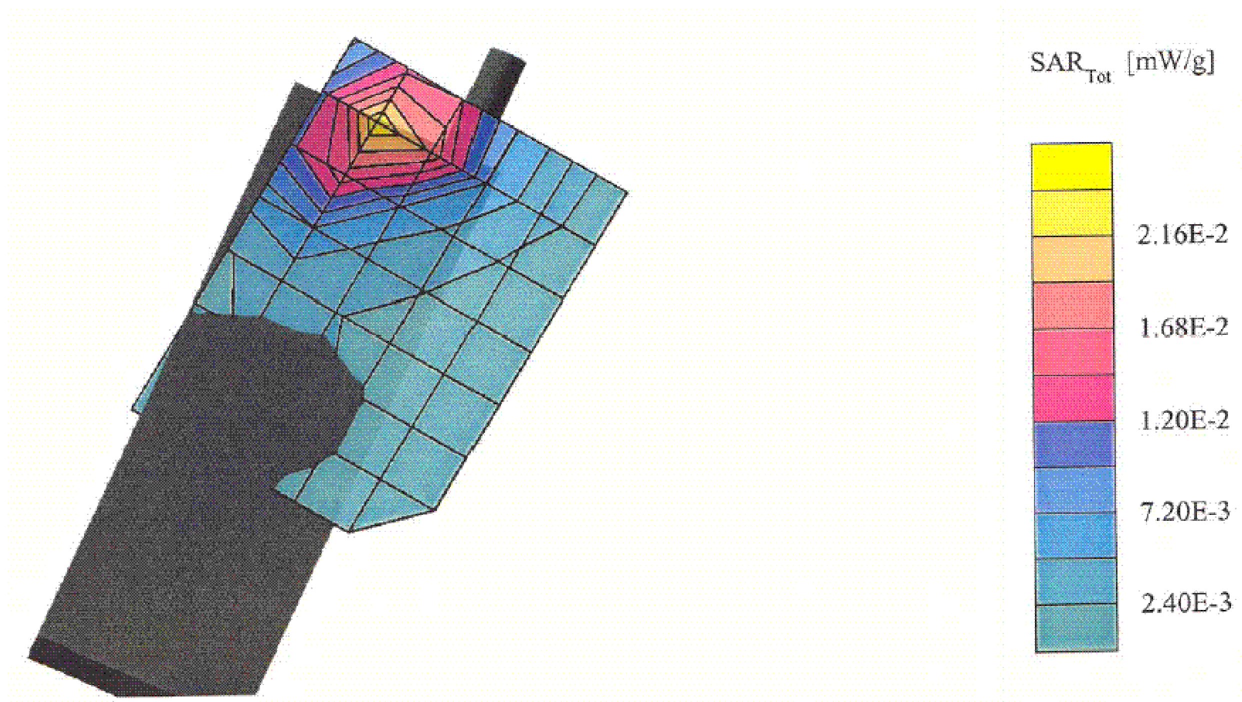
Z-Axis: Dx = 0.0, Dy = 0.0, Dz = 2.0



Left Head, Touch, Low Frequency, Worst Case

VTech VT 5831

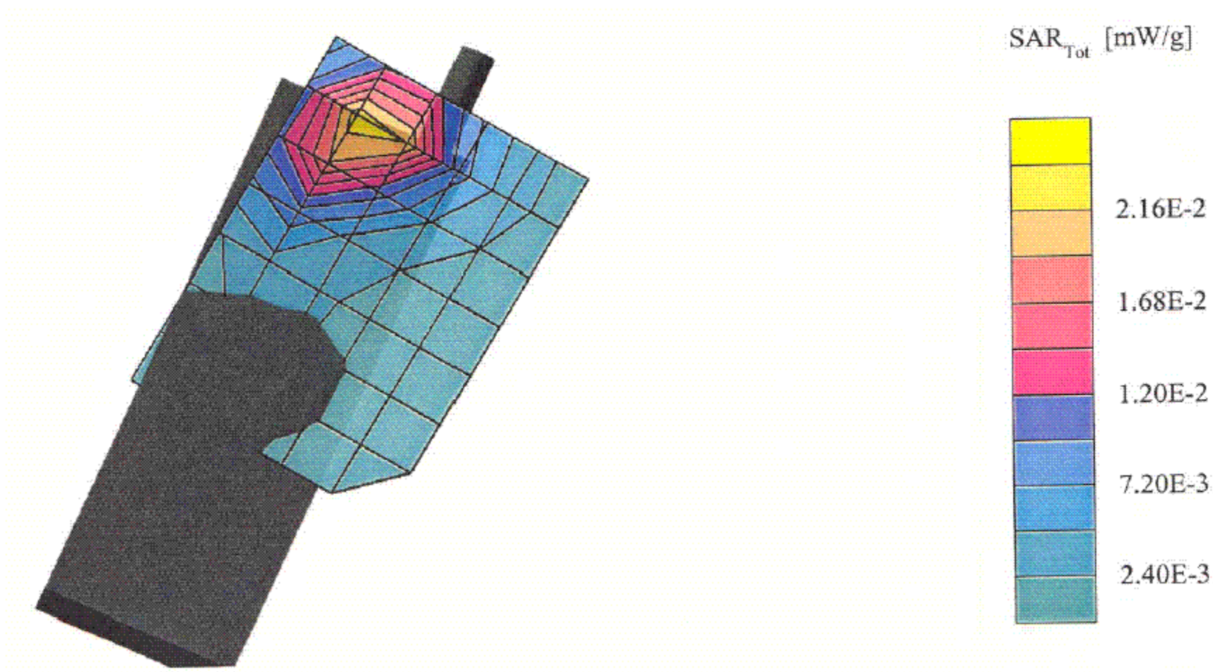
SAM Phantom; Left Hand Section; Position: (80°,65°); Frequency: 1800 MHz
Probe: ET3DV6 - SN1604; ConvF(5.68,5.68,5.68); Crest factor: 1.0; Head 1800 MHz: σ = 1.40 mho/m ε_r = 40.5 ρ = 1.00 g/cm^3
Cubes (2): SAR (1g): 0.0227 mW/g ± 0.00 dB, SAR (10g): 0.0115 mW/g ± 0.01 dB, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.11 dB



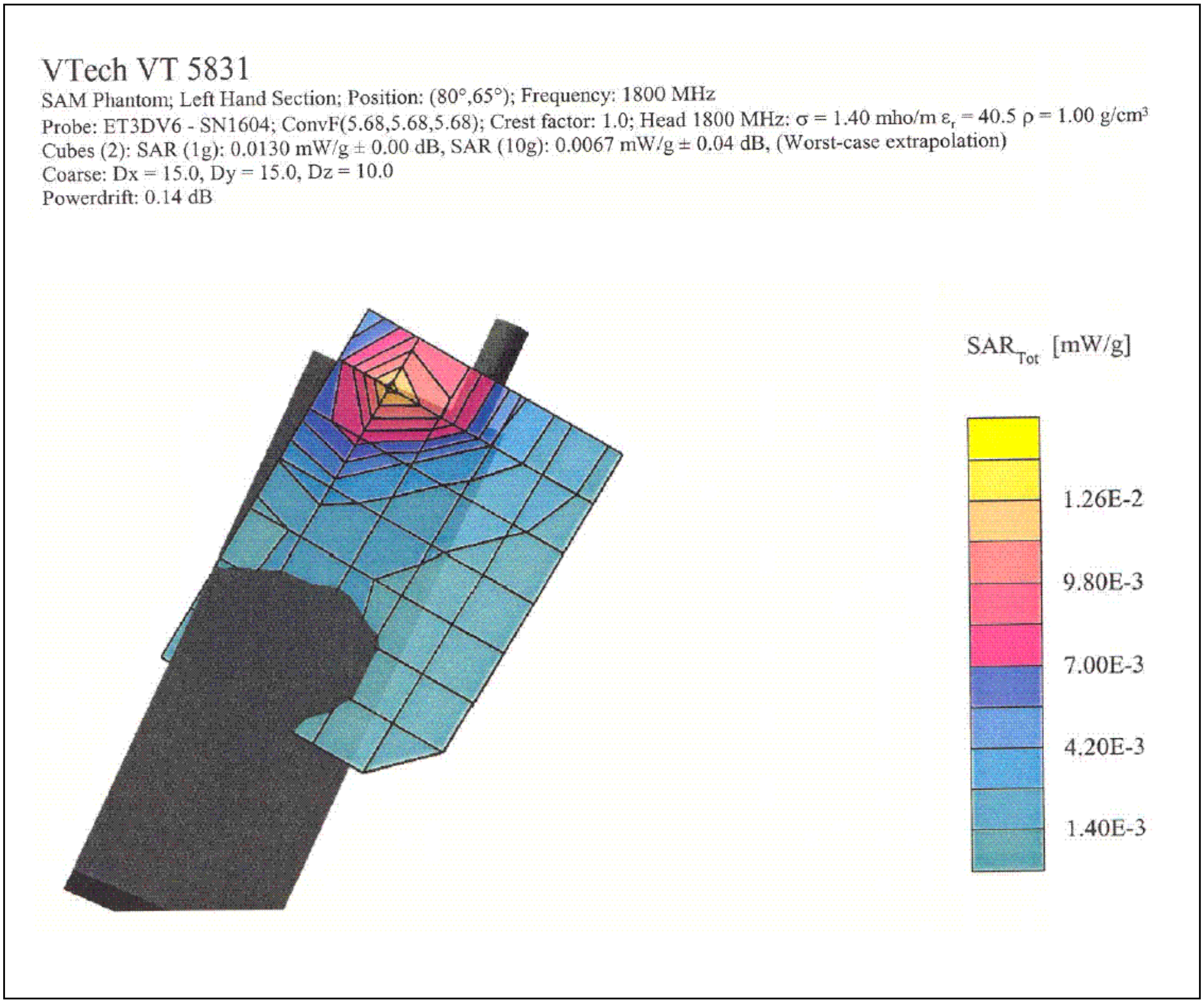
Left Head, Touch, Middle Frequency, Worst Case

VTech VT 5831

SAM Phantom; Left Hand Section; Position: (80°,65°); Frequency: 1800 MHz
Probe: ET3DV6 - SN1604; ConvF(5.68,5.68,5.68); Crest factor: 1.0; Head 1800 MHz: $\sigma = 1.40$ mho/m $\varepsilon_r = 40.5$ $\rho = 1.00$ g/cm^3
Cubes (2): SAR (1g): 0.0237 mW/g ± 0.03 dB, SAR (10g): 0.0120 mW/g ± 0.01 dB, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: 0.07 dB



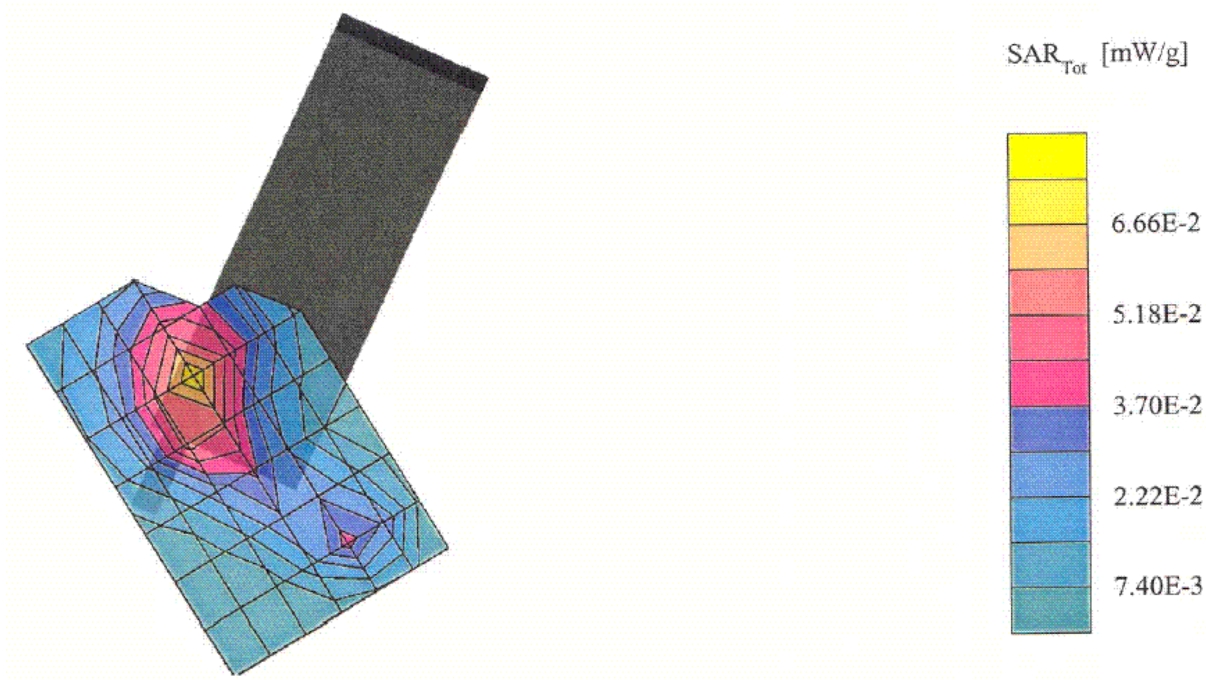
Left Head, Touch, High Frequency, Worst Case



Right Head, Cheek, Low Frequency, Worst Case

VTech VT 5831

SAM Phantom; Righ Hand Section; Position: (80°,65°); Frequency: 1800 MHz
Probe: ET3DV6 - SN1604; ConvF(5.68,5.68,5.68); Crest factor: 1.0; Head 1800 MHz: σ = 1.40 mho/m ε_r = 40.5 ρ = 1.00 g/cm^3
Cubes (2): SAR (1g): 0.0657 mW/g ± 0.00 dB, SAR (10g): 0.0348 mW/g ± 0.00 dB, (Worst-case extrapolation)
Coarse: Dx = 19.0, Dy = 14.0, Dz = 10.0
Powerdrift: 0.16 dB



Right Head, Cheek, Middle Frequency, Worst Case

VTech VT 5831

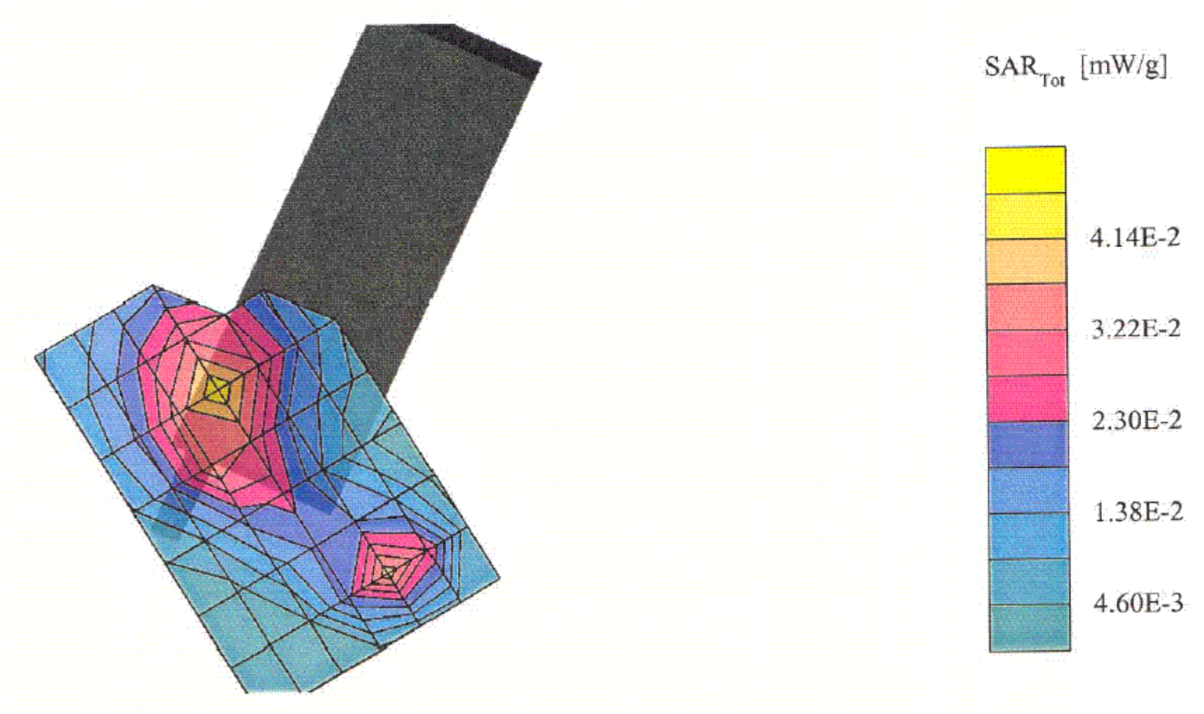
SAM Phantom; Righ Hand Section; Position: (80°,65°); Frequency: 1800 MHz

Probe: ET3DV6 - SN1604; ConvF(5.68,5.68,5.68); Crest factor: 1.0; Head 1800 MHz: $\sigma = 1.40$ mho/m $\varepsilon_r = 40.5$ $\rho = 1.00$ g/cm³

Cubes (2): SAR (1g): 0.0404 mW/g ± 0.00 dB, SAR (10g): 0.0217 mW/g ± 0.00 dB, (Worst-case extrapolation)

Coarse: Dx = 19.0, Dy = 14.0, Dz = 10.0

Powerdrift: -0.01 dB



Right Head, Cheek, High Frequency, Worst Case

VTech VT 5831

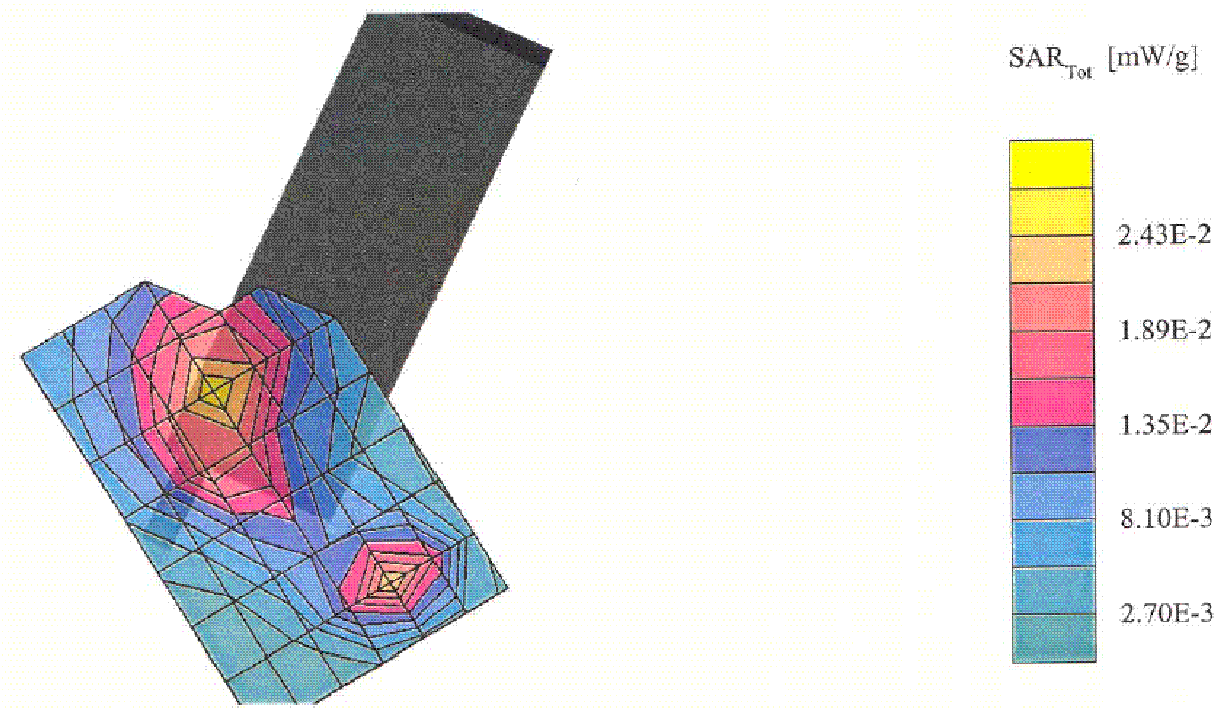
SAM Phantom; Righ Hand Section; Position: (80°,65°); Frequency: 1800 MHz

Probe: ET3DV6 - SN1604; ConvF(5.68,5.68,5.68); Crest factor: 1.0; Head 1800 MHz: σ = 1.40 mho/m ε_r = 40.5 ρ = 1.00 g/cm^3

Cubes (2): SAR (1g): 0.0242 mW/g ± 0.02 dB, SAR (10g): 0.0131 mW/g ± 0.01 dB, (Worst-case extrapolation)

Coarse: Dx = 19.0, Dy = 14.0, Dz = 10.0

Powerdrift: -0.27 dB



Right Head, Touch, Low Frequency, Worst Case

VTech VT 5831

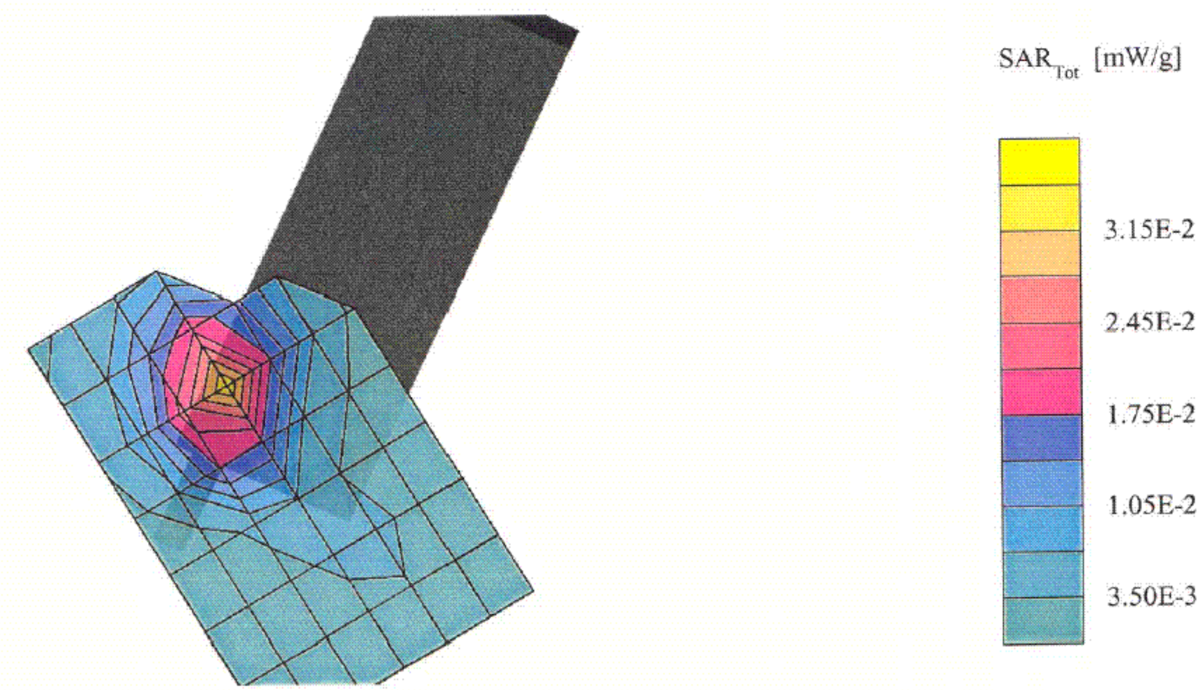
SAM Phantom; Righ Hand Section; Position: (80°,65°); Frequency: 1800 MHz

Probe: ET3DV6 - SN1604; ConvF(5.68,5.68,5.68); Crest factor: 1.0; Head 1800 MHz: σ = 1.40 mho/m ε_r = 40.5 ρ = 1.00 g/cm³

Cubes (2): SAR (1g): 0.0306 mW/g ± 0.00 dB, SAR (10g): 0.0154 mW/g ± 0.02 dB, (Worst-case extrapolation)

Coarse: Dx = 19.0, Dy = 14.0, Dz = 10.0

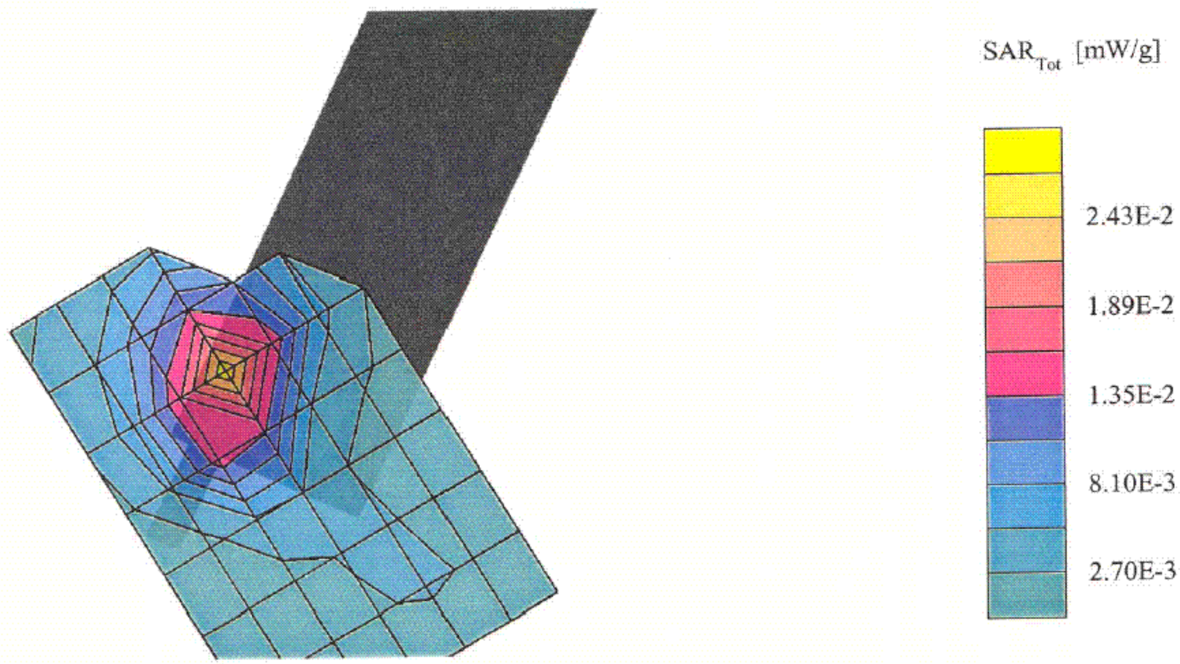
Powerdrift: -0.05 dB



Right Head, Touch, Middle Frequency, Worst Case

VTech VT 5831

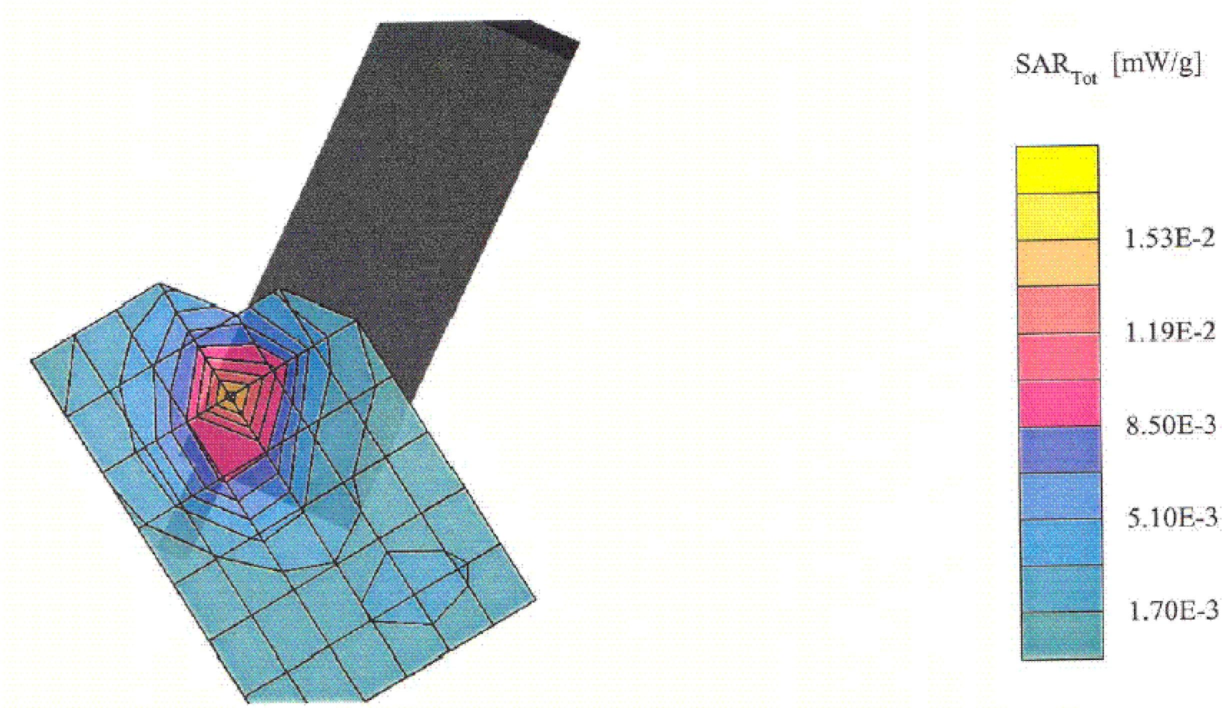
SAM Phantom; Righ Hand Section; Position: (80°,65°); Frequency: 1800 MHz
Probe: ET3DV6 - SN1604; ConvF(5.68,5.68,5.68); Crest factor: 1.0; Head 1800 MHz: σ = 1.40 mho/m ε_r = 40.5 ρ = 1.00 g/cm^3
Cubes (2): SAR (1g): 0.0230 mW/g ± 0.00 dB, SAR (10g): 0.0116 mW/g ± 0.00 dB, (Worst-case extrapolation)
Coarse: Dx = 19.0, Dy = 14.0, Dz = 10.0
Powerdrift: 0.22 dB



Right Head, Touch, High Frequency, Worst Case

VTech VT 5831

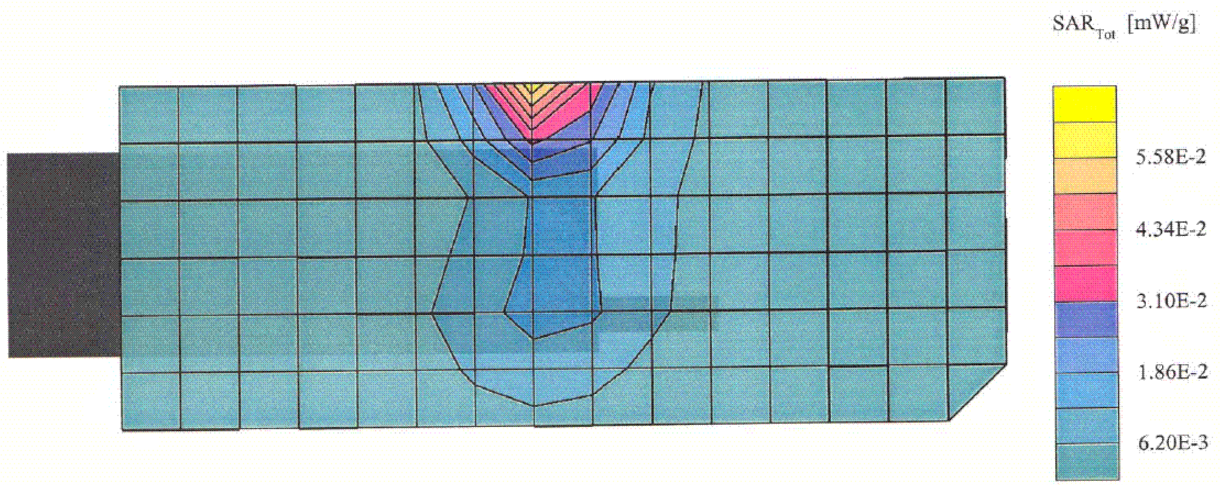
SAM Phantom; Righ Hand Section; Position: (80°,65°); Frequency: 1800 MHz
Probe: ET3DV6 - SN1604; ConvF(5.68,5.68,5.68); Crest factor: 1.0; Head 1800 MHz: $\sigma = 1.40$ mho/m $\varepsilon_r = 40.5$ $\rho = 1.00$ g/cm^3
Cubes (2): SAR (1g): 0.0140 mW/g ± 0.00 dB, SAR (10g): 0.0071 mW/g ± 0.00 dB, (Worst-case extrapolation)
Coarse: Dx = 19.0, Dy = 14.0, Dz = 10.0
Powerdrift: 0.55 dB



Flat, Low Frequency, Worst Case

VTech VT 5831

SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 1800 MHz
Probe: ET3DV6 - SN1604; ConvF(5.68,5.68,5.68); Crest factor: 1.0; Head 1800 MHz: σ = 1.40 mho/m ε_r = 40.5 ρ = 1.00 g/cm³
Cubes (2): SAR (1g): 0.0561 mW/g ± 0.13 dB, SAR (10g): 0.0272 mW/g ± 0.10 dB, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.07 dB



Flat, Middle Frequency, Worst Case

VTech VT 5831

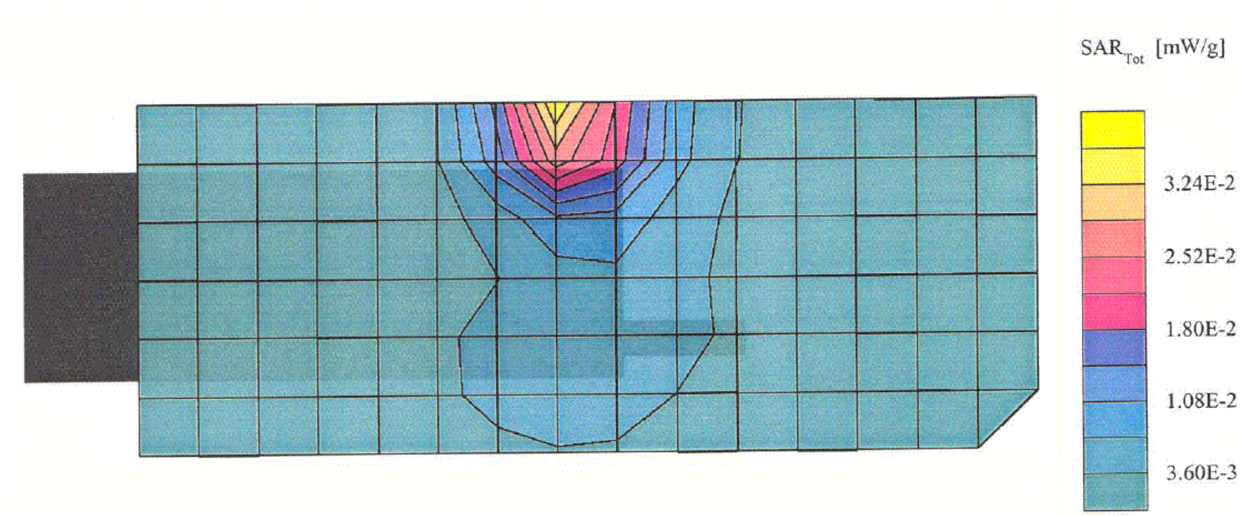
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 1800 MHz

Probe: ET3DV6 - SN1604; ConvF(5.68,5.68,5.68); Crest factor: 1.0; Head 1800 MHz: $\sigma = 1.40$ mho/m $\varepsilon_r = 40.5$ $\rho = 1.00$ g/cm³

Cubes (2): SAR (1g): 0.0338 mW/g ± 0.13 dB, SAR (10g): 0.0166 mW/g ± 0.13 dB, (Worst-case extrapolation)

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

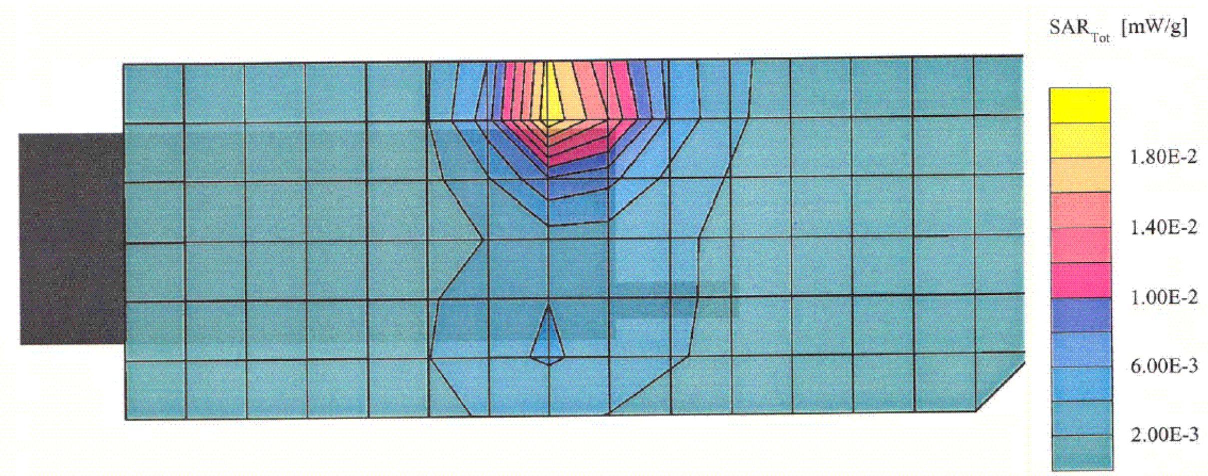
Powerdrift: 0.25 dB



Flat, High Frequency, Worst Case

VTech VT 5831

SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 1800 MHz
Probe: ET3DV6 - SN1604; ConvF(5.68,5.68,5.68); Crest factor: 1.0; Head 1800 MHz: σ = 1.40 mho/m ε_r = 40.5 ρ = 1.00 g/cm^3
Cubes (2): SAR (1g): 0.0216 mW/g ± 0.09 dB, SAR (10g): 0.0104 mW/g ± 0.09 dB, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.18 dB



7 - Reference

7.1 Reference

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Dosimetric Evaluation of Sample device, month 1998 10

7.2 Equipments List & Calibration Info

Type / Model	Cal. Date	S/N:
DASY3 Professional Dosimetric System	N/A	N/A
Robot RX60L	N/A	F00/5H31A1/A/01
Robot Controller	N/A	F01/5J72A1/A/01
Dell Computer Optiplex GX110	N/A	N/A
Pentium III, Windows NT	N/A	N/A
SPEAG EDC3	N/A	N/A
SPEAG DAE3	6/01	456
SPEAG E-Field Probe ET3DV6	9/7/01	1604
SPEAG Dummy Probe	N/A	N/A
SPEAG Generic Twin Phantom	N/A	N/A
SPEAG Light Alignment Sensor	N/A	278
SPEAG Validation Dipole D-1800-S-2	11/6/01	BCL-049
SPEAG Validation Dipole D900V2	9/3/01	122
Brain Equivalent Matter (800MHz)	Daily	N/A
Brain Equivalent Matter (1900MHz)	Daily	N/A
Muscle Equivalent Matter (800MHz)	Daily	N/A
Muscle Equivalent Matter (1900MHz)	Daily	N/A
Robot Table	N/A	N/A
Phone Holder	N/A	N/A
Phantom Cover	N/A	N/A
HP Spectrum Analyzer HP8593GM	6/20/01	3009A00791
Microwave Amp. 8349B	N/A	2644A02662
Power Meter HP436A	4/2/01	2709A29209
Power Sensor HP8482A	4/2/01	2349A08568
Signal Generator RS SMIQ O3	2/10/01	1084800403
Network Analyzer HP-8753ES	7/30/01	820079
Dielectric Probe Kit HP85070A	N/A	N/A

7.3 IEEE SCC-34/SC-2 P1528 Recommended Tissue Dielectric Parameters

Frequency	Head		Body	
(MHz)	ε_r	Ơ (S/m)	ε_r	Ơ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800-2000	40.0	1.40	53.2	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

7.4 Equipment Calibration Certificate

Please see the attached file.

Schmid & Partner
Engineering AG

DASY - DOSIMETRIC ASSESSMENT SYSTEM

CALIBRATION REPORT

DATA ACQUISITION ELECTRONICS

MODEL:	DAE3 V1
SERIAL NUMBER:	456

This Data Acquisition Unit was calibrated and tested using a FLUKE 702 Process Calibrator. Calibration and verification were performed at an ambient temperature of 23 ± 5 °C and a relative humidity of < 70%.

Measurements were performed using the standard DASY software for converting binary values, offset compensation and noise filtering. Software settings are indicated in the reports.

Results from this calibration relate only to the unit calibrated.

Calibrated by:	E. Meyer
Calibration Date:	June 21, 2001
DASY Software Version:	DASY3 V3.1c

Dae456.doc

Schmid & Partner
Engineering AG

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

Calibration Certificate

Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1604**
Place of Calibration:	**Zurich**
Date of Calibration:	**September 7, 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:

Approved by:

8 - SAR Setup Photographs

9 - EUT Photographs