# 4 - SYSTEM TEST CONFIGURATION

## 4.1 Justification

The system was configured for testing in a typical fashion (as normally used by a typical user).

## 4.2 EUT Exercise Procedure

The EUT exercising program used during SAR testing was designed to exercise the various system components in a manner similar to a typical use. The EUT was tested by pushing the PTT bottom during the testing.

## 4.3 Equipment Modifications

No modification(s) were made to ensure that the EUT complies with the applicable limits.

# 5 – CONDUCTED OUTPUT POWER MEASUREMENTS

## 5.1 Provision Applicable

According to §15.247(b) (3), for systems using digital modulation, the maximum peak output power of the intentional radiator shall not exceed 1 Watt.

According to FCC §22.913 (a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.  According to FCC § 24.232(b), EIRP peak power for mobile/portable stations are limited to 2 watts.

## 5.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

## 5.3 Test equipment

Hewlett Packard HP8564E Spectrum Analyzer, Calibration Due Date: 2003-08-01.
Hewlett Packard HP 7470A Plotter, Calibration not required.
A.H. Systems SAS200 Horn Antenna, Calibration Due Date: 2003-05-31
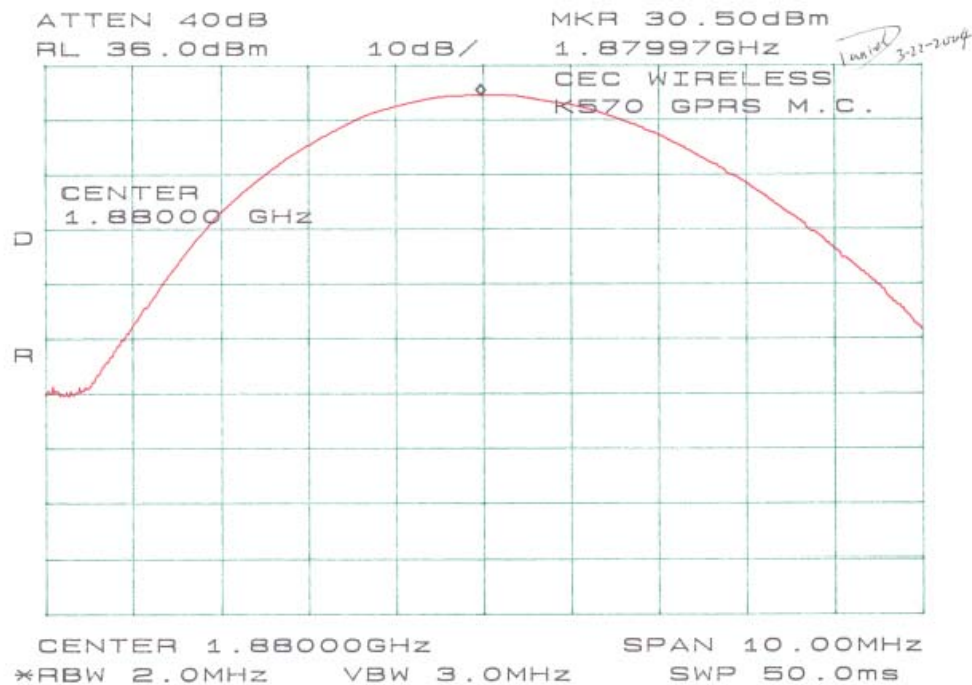Com-Power AB-100 Dipole Antenna, Calibration Due Date: 2003-09-05

## 5.4 Test Results

K570 GMS

| Channel | Frequency (MHz) | Output Power in dBm | Output Power in W | Limit (W) |
|---|---|---|---|---|
| Middle | 1880.00 | 30.50 | 1.122 | 2 |

K570 GPRS

| Channel | Frequency (MHz) | Output Power in dBm | Output Power in W | Limit (W) |
|---|---|---|---|---|
| Middle | 1880.00 | 30.50 | 1.122 | 2 |

Please refer to the following plots.
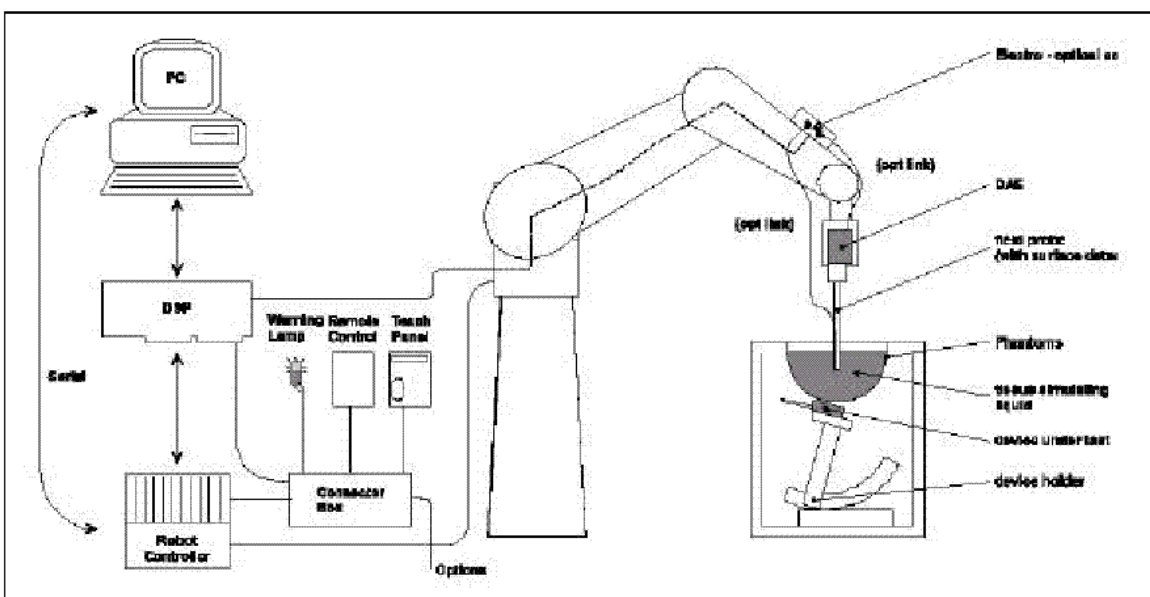
# 6 - DOSIMETRIC ASSESSMENT SETUP

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 ±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 | Frequency (MHz) | | | | | | | | | |
| (% by weight) | 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 |

## 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

### ES3DV2 Probe Specification

Construction    Symmetrical design with triangular core
                Interleafed sensors
                Built-in shielding against static charges
                PEEK enclosure material (resistant to organic solvents, e.g.,
                glycol)

Calibration     In air from 10 MHz to 3 GHz
                In brain and muscle simulating tissue at frequencies of 450
                MHz, 900 MHz and 1.8 GHz (accuracy ± 8%)
                Calibratin for other liquids and frequencies upon request

Frequency       10 MHz to > 6GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)

Directivity     ± 0.2 dB in brain tissue (rotation around probe axis)
                ± 0.3 dB in brain tissue (rotation normal to probe axis)



**Photograph of the probe**

Dynamic Range 5μW/g to > 100 mW/g; Linearity: ± 0.2 dB

Dimensions      Overall length: 330 mm
                Tip length: 20 mm
                Body diameter: 12 mm
                Tip diameter: 3.9 mm
                Distance from probe tip to dipole centers: 2.7 mm

Application:    General dosimetry up to 5 GHz
                Dosimetry in strong gradient fields
                Compliance tests of mobile phones

The SAR measurements were conducted with the dosimetric probe
ET3DV2 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
ES3DV2 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 | $ConvF_i$ |
| | -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:

$$V_i = U_i + (U_i)^2\, cf\, /\, dcp_i$$

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:

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

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

With   Vi     = compensated signal of channel i (i =x, y, z)
        $Norm_i$ = sensor sensitivity of channel i (i =x, y, z)
           $\mu V/ (V/m)^2$ 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
       $\sigma$   = conductivity in [mho/m] or [Siemens/m]
       $\rho$   = 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
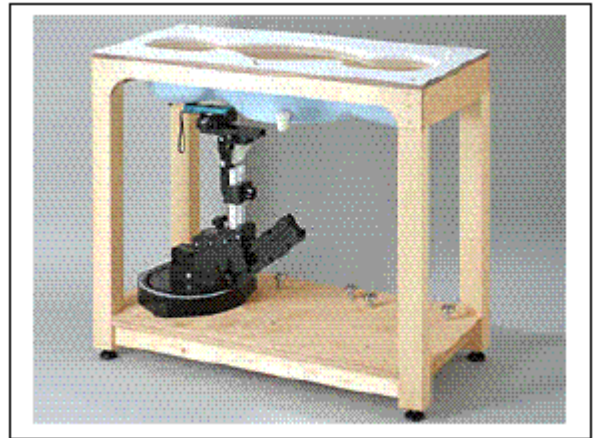       $H_{tot}$ = total magnetic filed strength in V/m

**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 $2 \pm 0.1$ 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.

| Uncertainty Description | Error | Distribution | Weight | Std. Dev. | 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 %. | / |

# 7 - EVALUATION PROCEDURE

## 7.1 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 onedimensional 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.

## 7.2 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, 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 1.6W/kg applied to the EUT.*

## 7.3 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:

## 7.4 SAR Measurement

The SAR measurement was performed with the E-field probe in mechanical detection mode only. The setup and determination of the forward power into the dipole was performed using the following procedures.

First, the power meter PM1 (including attenuator Att1) is connected to the cable to measure the forward power at the location of the dipole connector (X). The signal generator is adjusted for the desired forward power at he dipole connector (taking into account the attenuation of Att1) as read by power meter PM2. after connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2. If the signal generator does not allow adjustment in 0.01dB steps, the remaining difference at PM 2 must be taken into consideration. PM3 records the reflected power from the dipole to ensure that the value is not changed form the previous value. The reflected power should be 20dB below the forward power.

The SAR measurements were performed in order to achieve repeatability and to establish an average target value.

## 7.5 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 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 (1900 MHz)**

| Validation Measurement | SAR @ 0.126W Input averaged over 1g | SAR @ 1W Input averaged over 1g | SAR @ 0.126W Input averaged over 10g | SAR @ 1W Input averaged over 10g |
|---|---|---|---|---|
| Test 1 | 3.1 | 24.61 | 1.42 | 11.27 |
| Test 2 | 3.1 | 24.61 | 1.41 | 11.20 |
| Test 3 | 3.2 | 25.41 | 1.43 | 11.35 |
| Test 4 | 3.2 | 25.41 | 1.42 | 11.27 |
| Test 5 | 3.1 | 24.61 | 1.42 | 11.27 |
| Test 6 | 3.2 | 25.61 | 1.41 | 11.20 |
| Test 7 | 3.2 | 25.61 | 1.43 | 11.35 |
| Test 8 | 3.1 | 24.61 | 1.42 | 11.27 |
| Test 9 | 3.1 | 24.61 | 1.42 | 11.27 |
| Test 10 | 3.1 | 24.61 | 1.43 | 11.35 |
| Average | 3.14 | 24.97 | 1.421 | 11.28 |

## 7.6 Liquid Measurement Result

**2004-03-10**

| Simulant | Freq [MHz] | Parameters | Liquid Temp [ºC] | Target Value | Measured Value | Deviation | Limits [%] |
|---|---|---|---|---|---|---|---|
| Body | 1900 | $\varepsilon_r$ | 22.0 | 53.3 | 52.90 | -0.75 | ±5 |
| | | $\sigma$ | 22.0 | 1.52 | 1.50 | -1.32 | ±5 |
| | | 1g SAR | 22.0 | 24.97 | 26.00 | -4.13 | ±10 |
| Head | 1900 | $\varepsilon_r$ | 22.0 | 40.0 | 38.90 | -2.75 | ±5 |
| | | $\sigma$ | 22.0 | 1.40 | 1.46 | 4.29 | ±5 |
| | | 1g SAR | 22.0 | 39.7 | 38.41 | -3.25 | ±10 |

$\varepsilon_r$ = relative permittivity, $\sigma$ = conductivity and $\rho$=1000kg/m$^3$

Forward Power  = 20.1 dBm = 102.33 mW

**2004-03-22**

| Simulant | Freq [MHz] | Parameters | Liquid Temp [ºC] | Target Value | Measured Value | Deviation | Limits [%] |
|---|---|---|---|---|---|---|---|
| Body | 1900 | $\varepsilon_r$ | 22.0 | 53.3 | 52.40 | -1.69 | ±5 |
| | | $\sigma$ | 22.0 | 1.52 | 1.50 | -1.32 | ±5 |
| | | 1g SAR | 22.0 | 24.97 | 24.64 | -1.32 | ±10 |
| Head | 1900 | $\varepsilon_r$ | 22.0 | 40.0 | 38.4 | -4.00 | ±5 |
| | | $\sigma$ | 22.0 | 1.40 | 1.43 | 2.14 | ±5 |
| | | 1g SAR | 22.0 | 39.7 | 38.49 | -3.05 | ±10 |

$\varepsilon_r$ = relative permittivity, $\sigma$ = conductivity and $\rho$=1000kg/m$^3$

Forward Power  = 20.2 dBm = 104.71 mW

1900 MHz Body Liquid System Validation (Ambient Temp = 23 Deg C, Liquid Temp = 22 Deg C, Forwar Power = 20.1 dBm, 3/10/04)

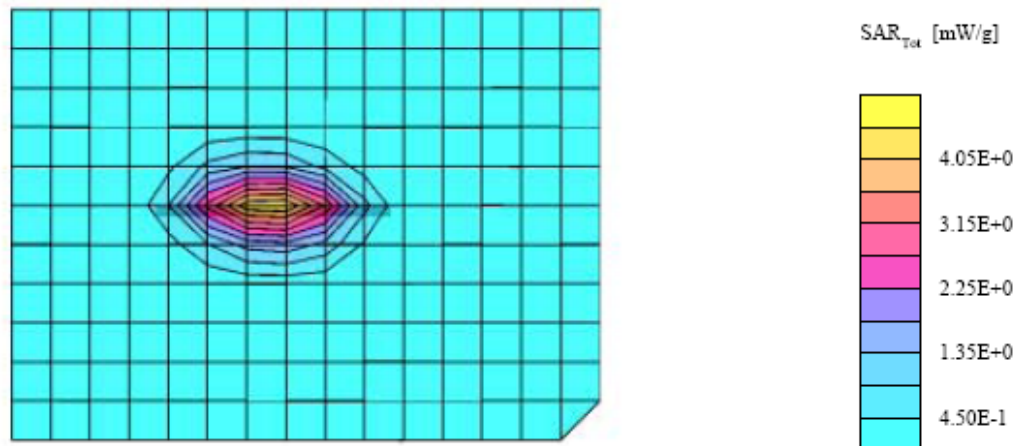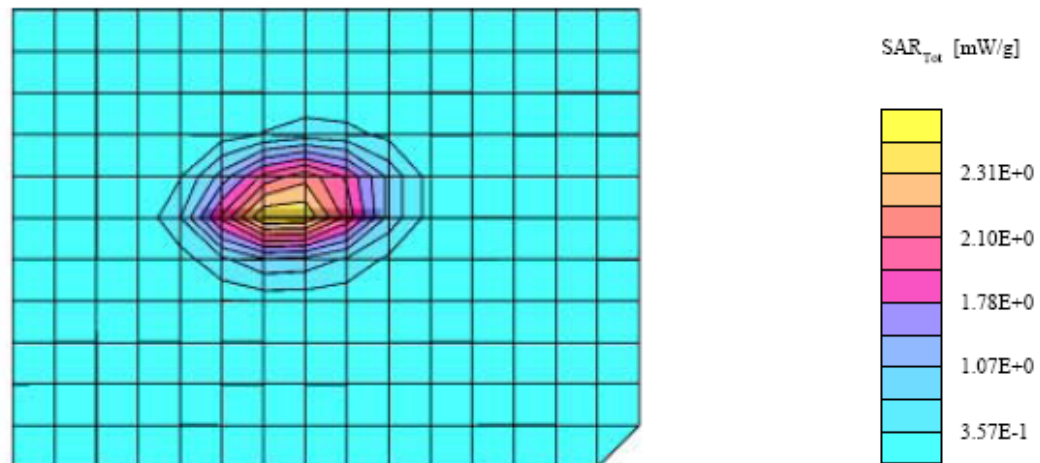SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 1900 MHz

Probe: ES3DV2 - SN3019; ConvF(4.60,4.60,4.60); Crest factor: 1.0; Body1900 MHz: $\sigma = 1.50$ mho/m $\varepsilon_r = 52.9$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 2.66 mW/g, SAR (10g): 1.33 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.01 dB



$SAR_{Tot}$ [mW/g]

1.89E+0

1.47E+0

1.05E+0

6.30E-1

2.10E-1

1900 MHz Head Liquid System Validation (Ambient Temp = 23 Deg C, Liquid Temp = 22 Deg C, Forwar Power = 20.1 dBm, 3/10/04)
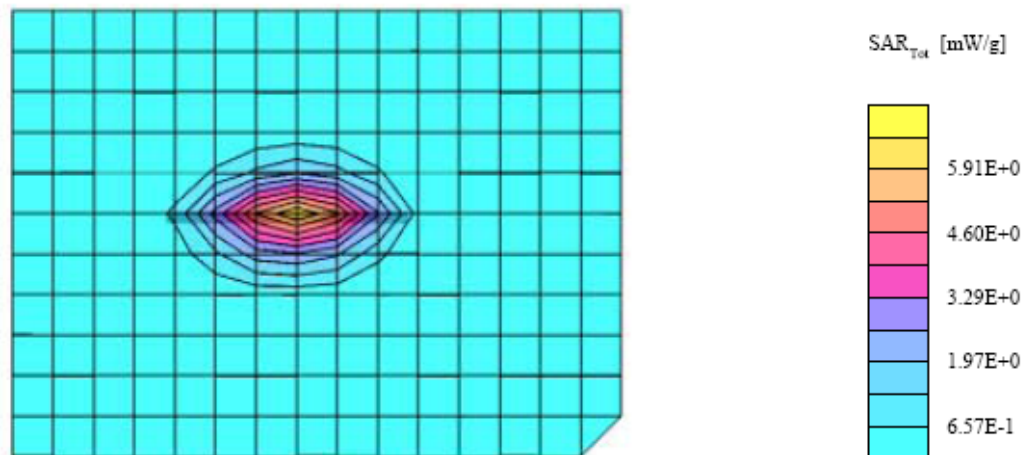SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 1900 MHz
Probe: ES3DV2 - SN3019; ConvF(4.70,4.70,4.70); Crest factor: 1.0; Head 1900 MHz: $\sigma = 1.46$ mho/m $\varepsilon_r = 38.9$ $\rho = 1.00$ g/cm³
Cube 5x5x7: SAR (1g): 3.93  mW/g, SAR (10g): 1.85  mW/g, (Worst-case extrapolation)
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0
Powerdrift: 0.00 dB

Validation Dipole SAR 1900 MHz (Ambient Temp = 23 Deg C, Liquid Temp = 22
Deg C  Forwar Power =20.2 dBm,3/22/04)
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 1900 MHz
Probe: ES3DV2 - SN3019; ConvF(4.60,4.60,4.60); Crest factor: 1.0; Body 1900 MHz: σ = 1.50 mho/m ε$_r$ = 52.4 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 2.58  mW/g, SAR (10g): 1.94  mW/g, (Worst-case extrapolation)
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0
Powerdrift: 0.00 dB



SAR$_{Tot}$ [mW/g]

2.31E+0

2.10E+0

1.78E+0

1.07E+0

3.57E-1

1900 MHz Head Liquid System Validation (Ambient Temp = 23 Deg C, Liquid Temp = 22 Deg C, Forwar Power = 20.2dBm, 3/22/04)
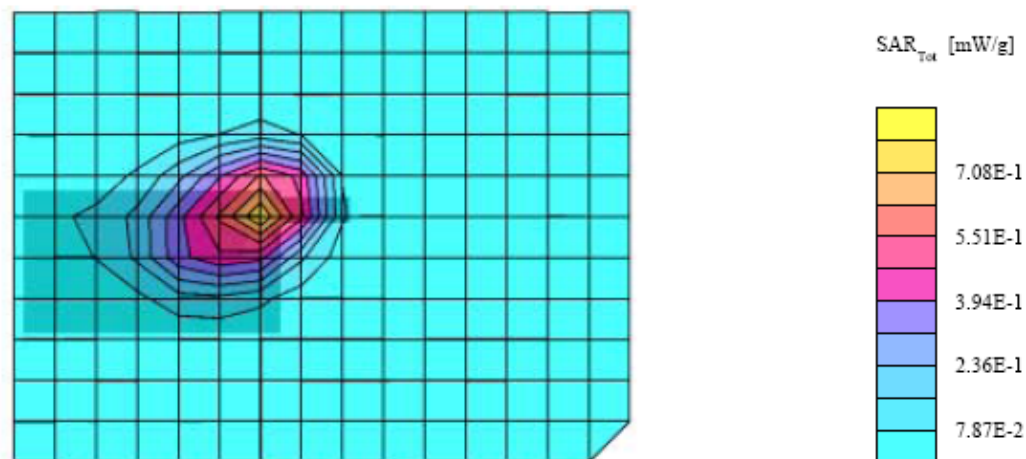
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 1900 MHz

Probe: ES3DV2 - SN3019; ConvF(4.70,4.70,4.70); Crest factor: 1.0; Head 1900 MHz: $\sigma$ = 1.43 mho/m $\varepsilon_r$ = 38.4 $\rho$ = 1.00 g/cm³

Cube 5x5x7: SAR (1g): 4.03   mW/g, SAR (10g): 2.02   mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.02 dB

## 8 - SAR 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.

### 8.1 SAR Body and Head Worst-Case Test Data

Ambient Temperature (ºC): 23
Relative Humidity (%): 49.3

| Mobile Phone | Position | Frequency (MHz) | Output Power (dBm) | Test Type | Liquid | Phantom | Measured (mW/g) | Limit (mW/g) | Plot # |
|---|---|---|---|---|---|---|---|---|---|
| K570 | GPRS Back touching flat phantom cover closed | 1880 | 30.50 | | | | 0.711 | | 1 |
| | GPRS Back touching flat phantom cover opened | 1880 | 30.50 | | | | 0.491 | | 2 |
| | GSM Back touching flat phantom | 1880 | 30.50 | | | | 0.751 | | 3 |
| | GSM Face touching flat phantom | 1880 | 30.50 | Body | Body | Flat | 0.251 | | 4 |
| | GSM Left head cheek | 1880 | 30.50 | | | | 0.507 | | 5 |
| | GSM Left head tilt | 1880 | 30.50 | | | Left | 0.416 | | 6 |
| | GSM Right head cheek | 1880 | 30.50 | | | | 0.428 | | 7 |
| | GSM Right head tilt | 1880 | 30.50 | Head | Head | Right | 0.421 | | 8 |

### 8.2 Plots of Test Result

The plots of test result were attached as reference.

CEC, Model: K570 (Body Worn, GPRS Back touching flat phantom Cover closed with accessory ( cable), Mid channel, Ambient Temp = 23 DegC, Liquid Temp = 22 Deg C, 3/22/2004)
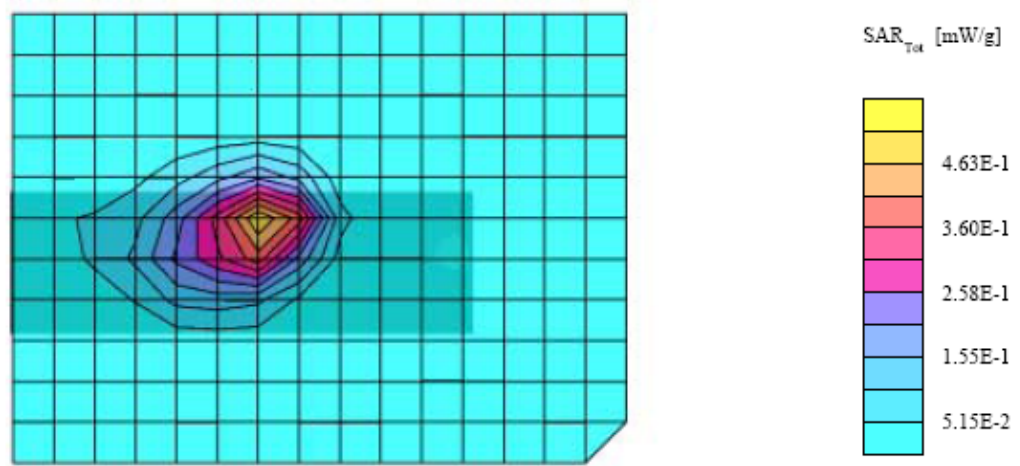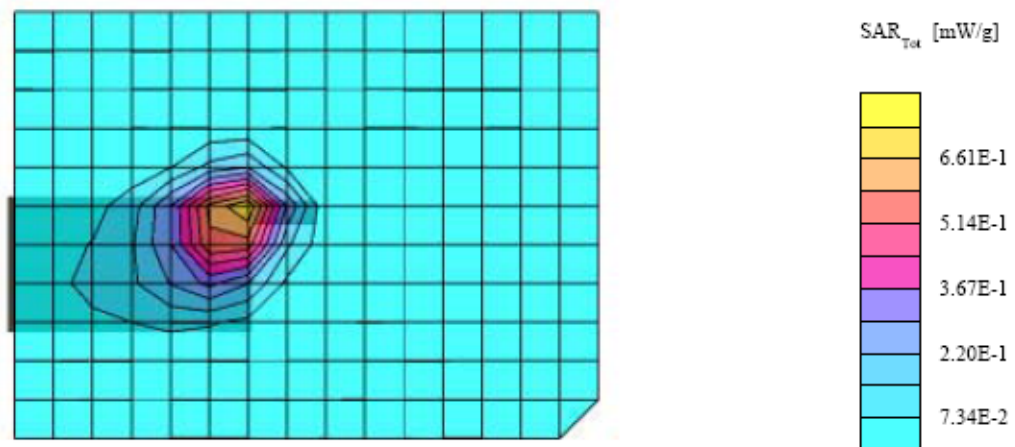
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 1880 MHz
Probe: ES3DV2 - SN3019; ConvF(4.60,4.60,4.60); Crest factor: 8.0; (Body) 1900 MHz: $\sigma = 1.50$ mho/m $\varepsilon_r = 52.4$ $\rho = 1.31$ g/cm³
Cube 5x5x7: SAR (1g): 0.711 mW/g, SAR (10g): 0.396 mW/g, (Worst-case extrapolation)
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0
Powerdrift: -0.00 dB



SAR$_{Tot}$ [mW/g]

7.08E-1

5.51E-1

3.94E-1

2.36E-1

7.87E-2

Plot #1

CEC, Model: K570 (Body Worn, GPRS Back touching flat phantom Cover opened with accessory ( cable), Mid channel, Ambient Temp = 23 DegC, Liquid Temp = 22 Deg C, 3/22/2004)
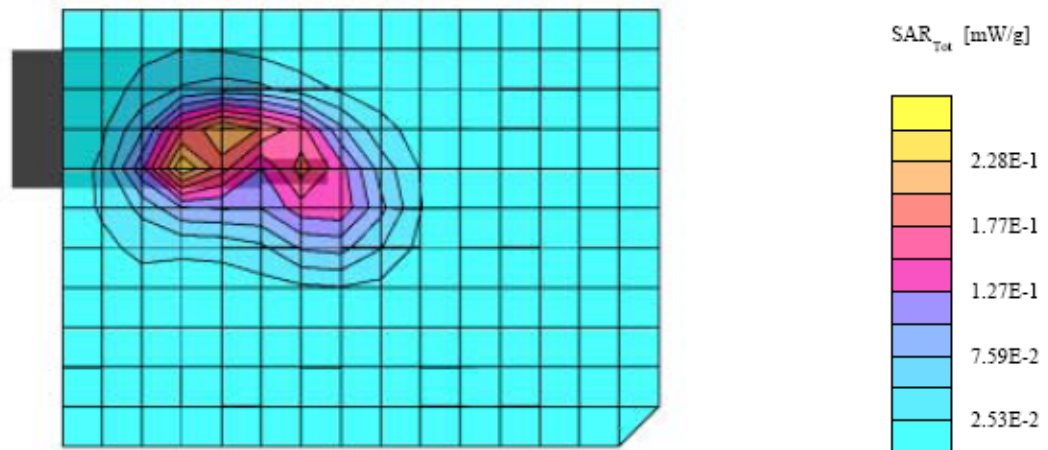
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 1880 MHz

Probe: ES3DV2 - SN3019; ConvF(4.60,4.60,4.60); Crest factor: 8.0; (Body) 1900 MHz: $\sigma$ = 1.50 mho/m $\epsilon_r$ = 52.4 $\rho$ = 1.31 g/cm³

Cube 5x5x7: SAR (1g): 0.491 mW/g, SAR (10g): 0.262 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.03 dB



SAR$_{Tot}$ [mW/g]

4.63E-1

3.60E-1

2.58E-1

1.55E-1

5.15E-2

Plot #2

CEC, Model: K570 (Body Worn, Back touching flat phantom with accessory ( headset), Mid channel, Ambient Temp = 23 DegC, Liquid Temp = 22 Deg C, 3/10/2004)

SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 1880 MHz
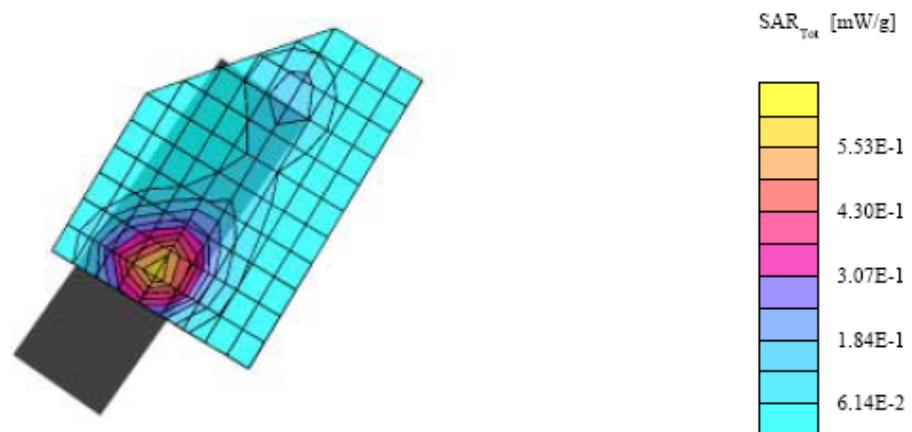
Probe: ES3DV2 - SN3019; ConvF(4.60,4.60,4.60); Crest factor: 8.0; (Body) 1900 MHz: $\sigma = 1.50$ mho/m $\epsilon_r = 52.9$ $\rho = 1.31$ g/cm³

Cube 5x5x7: SAR (1g): 0.751 mW/g, SAR (10g): 0.404 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.01 dB



Plot #3

CEC, Model: K570 (Body Worn, Face touching flat phantom with accessory ( headset), Mid channel, Ambient Temp = 23 DegC, Liquid Temp = 22 Deg C, 3/10/2004)
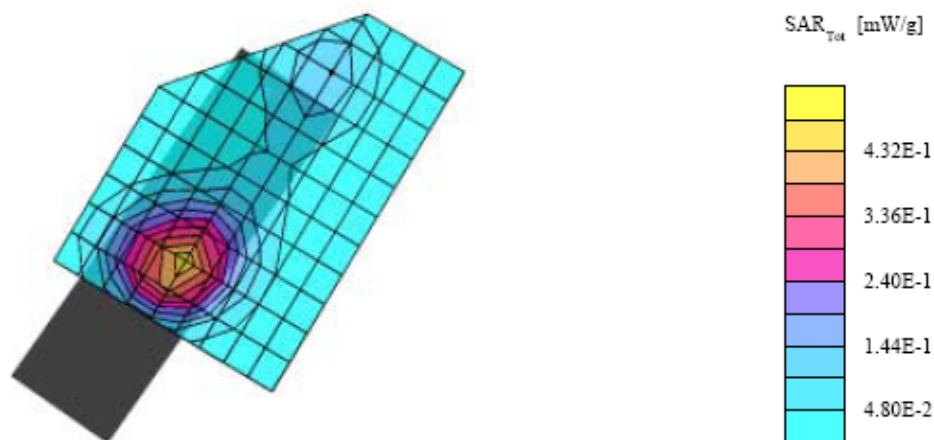
SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 1880 MHz

Probe: ES3DV2 - SN3019; ConvF(4.60,4.60,4.60); Crest factor: 8.0; (Body) 1900 MHz: $\sigma$ = 1.50 mho/m $\varepsilon_r$ = 52.9 $\rho$ = 1.31 g/cm³

Cube 5x5x7: SAR (1g): 0.251 mW/g, SAR (10g): 0.155 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.01 dB



Plot #4

CEC, Model: K570 (Left Head, Cheek,  Mid channel, Ambient Temp = 23 Deg C, Liquid Temp = 22 Deg C, 3/10/2004)

SAM; Left Hand

Probe: ES3DV2 - SN3019; ConvF(4.70,4.70,4.70); Crest factor: 8.0; (Head) 1880MHz: $\sigma = 1.46$ mho/m $\varepsilon_r = 38.9$ $\rho = 1.31$ g/cm³

Cube 5x5x7: Peak: 0.728  mW/g, SAR (1g): 0.507  mW/g, SAR (10g): 0.322  mW/g, (Worst-case extrapolation)

Penetration depth: 12.5 (12.2, 12.8) [mm]

Powerdrift: -0.03 dB



SAR$_{Tot}$  [mW/g]

| 5.53E-1 |
| 4.30E-1 |
| 3.07E-1 |
| 1.84E-1 |
| 6.14E-2 |

Plot #5

CEC, Model: K570 (Left Head, Tilted, Mid channel, Ambient Temp = 23 Deg C, Liquid Temp = 22 Deg C, 3/10/2004)

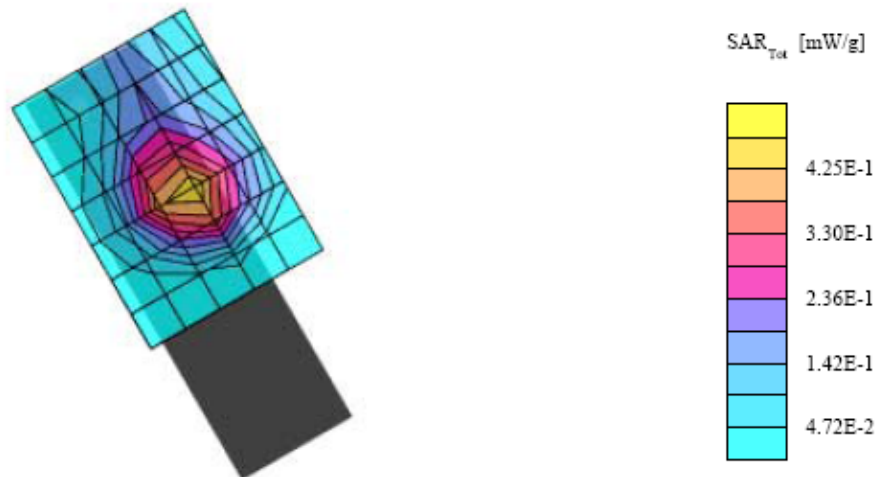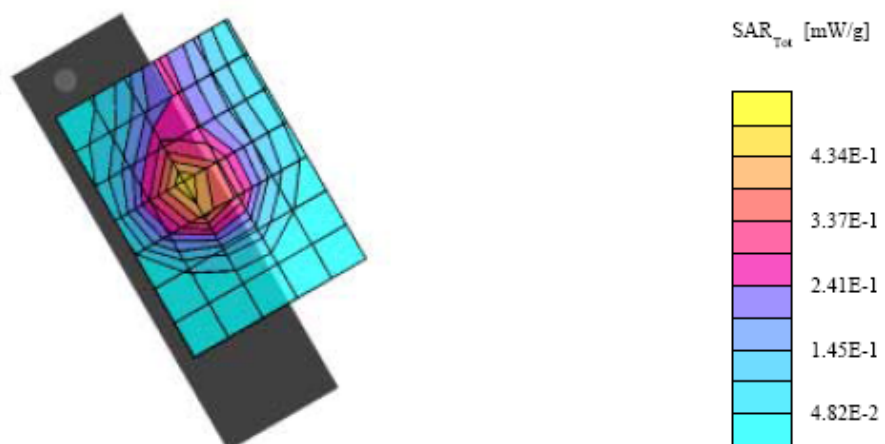SAM Phantom; Left Hand Section; Position: (90°,55°); Frequency: 1880 MHz

Probe: ES3DV2 - SN3019; ConvF(4.70,4.70,4.70); Crest factor: 8.0; (Head) 1880MHz: $\sigma$ = 1.46 mho/m $\varepsilon_r$ = 38.9 $\rho$ = 1.31 g/cm³

Cube 5x5x7: SAR (1g): 0.416 mW/g, SAR (10g): 0.259 mW/g, (Worst-case extrapolation)

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

Powerdrift: 0.03 dB



SAR$_{Tot}$ [mW/g]

| |
|---|
| 4.32E-1 |
| 3.36E-1 |
| 2.40E-1 |
| 1.44E-1 |
| 4.80E-2 |

Plot #6

CEC Model: K570 (Right Head, Cheek, Mid channel, Ambient Temp = 23 Deg C, Liquid Temp = 22 Deg C, 3/10/2004)
SAM Phantom; Righ Hand Section; Position: (90°,300°); Frequency: 1880 MHz
Probe: ES3DV2 - SN3019; ConvF(4.70,4.70,4.70); Crest factor: 8.0; (Head) 835 MHz: σ = 1.46 mho/m ε_r = 38.9 ρ = 1.31 g/cm³
Cube 5x5x7: SAR (1g): 0.428 mW/g, SAR (10g): 0.267 mW/g, (Worst-case extrapolation)
Coarse: Dx = 13.0, Dy = 13.0, Dz = 10.0
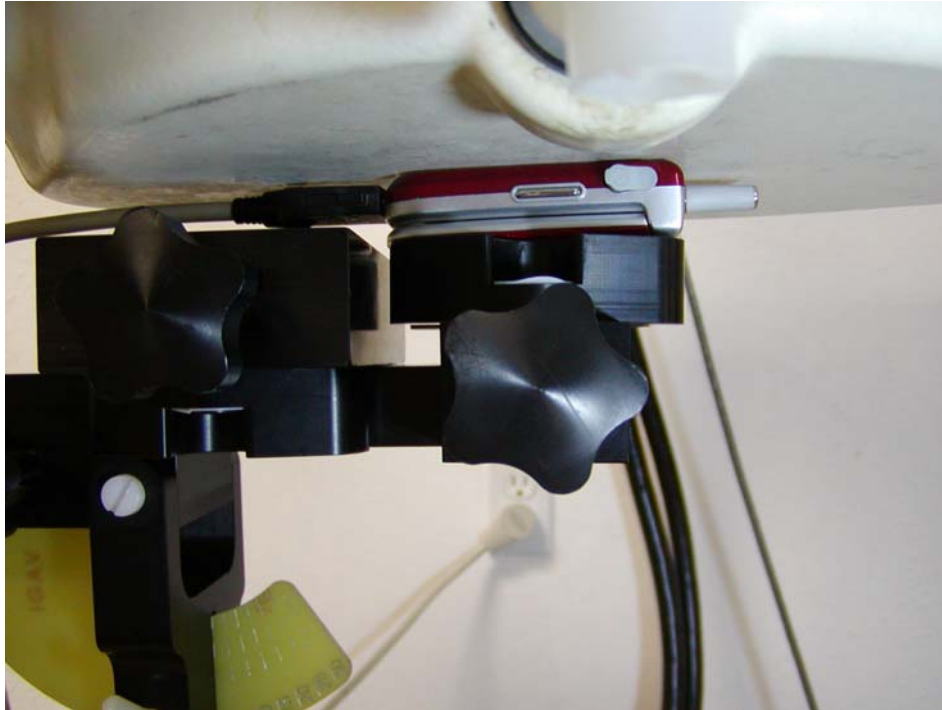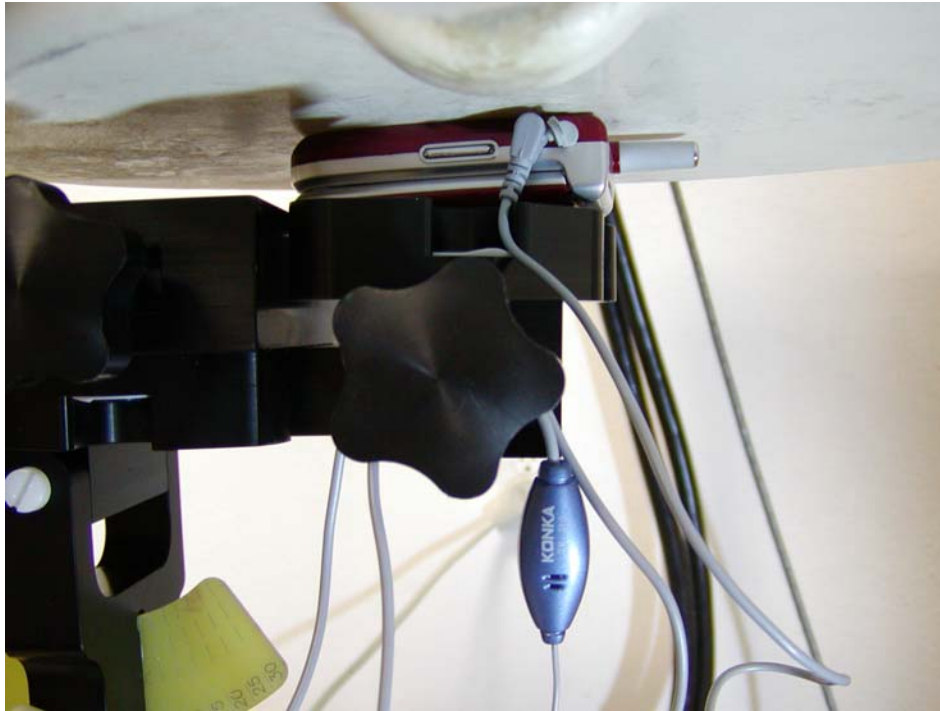Powerdrift: 0.02 dB



SAR_Tot [mW/g]

4.25E-1

3.30E-1

2.36E-1

1.42E-1

4.72E-2

Plot #7

CEC Model: C570 (Right Head, Tilted, Antenna position retracted, Mid channel, Ambient Temp = 23 DegC, Liquid Temp = 22 Deg C, 3/10/2004)

SAM Phantom; Righ Hand Section; Position: (90°,300°); Frequency: 1880 MHz
Probe: ES3DV2 - SN3019; ConvF(4.70,4.70,4.70); Crest factor: 8.0; (Head) 1900MHz: $\sigma = 1.46$ mho/m $\varepsilon_r = 38.9$ $\rho = 1.31$ g/cm³
Cube 5x5x7: SAR (1g): 0.421 mW/g, SAR (10g): 0.268 mW/g, (Worst-case extrapolation)
Coarse: Dx = 13.0, Dy = 13.0, Dz = 10.0
Powerdrift: 0.02 dB



Plot #8

## EXHIBIT A - SAR SETUP PHOTOGRAPHS

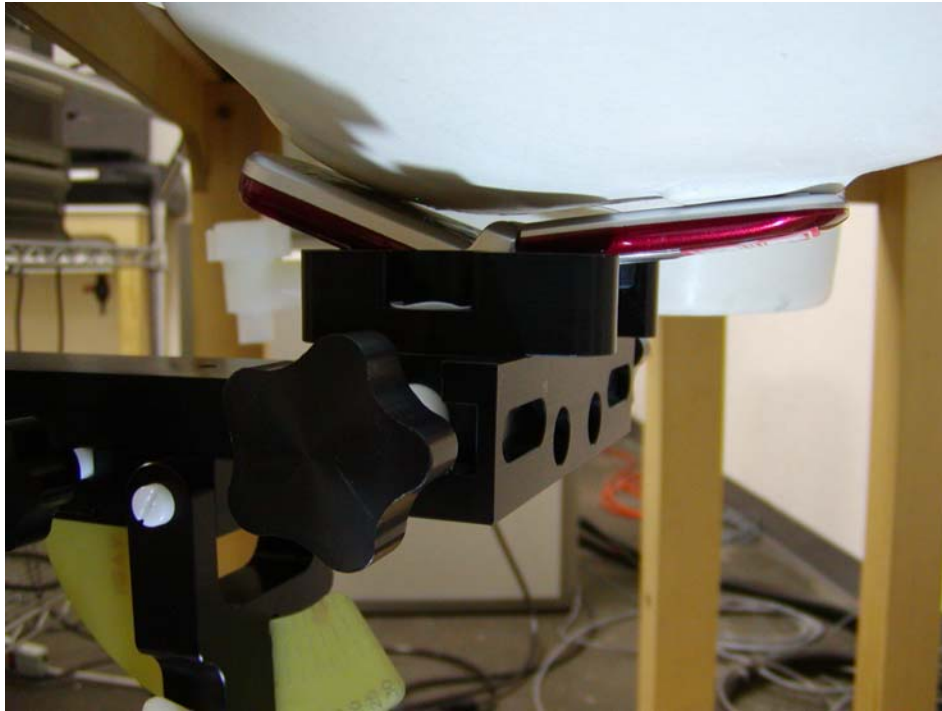**K570 Body Worn GPRS Back Touching Flat Phantom Cover Closed With Accessory**



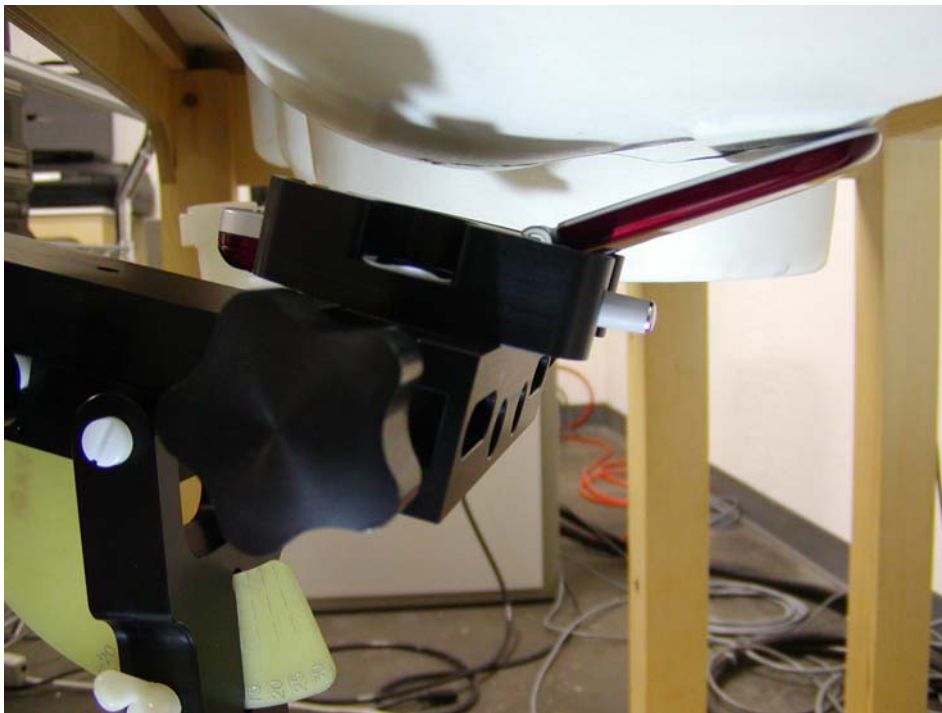**K570 Body Worn GPRS Back Touching Flat Phantom Cover Opened With Accessory**

**K570 GSM Body Worn Back Touching Flat Phantom With Accessory**



**K570 GSM Body Worn Face Touching Flat Phantom With Accessory**

**K570 GMS Left Head Cheek**



**K570 GMS Left Head Tilt**

**K570 GMS Right Head Cheek**



**K570 GMS Right Head Tilt**

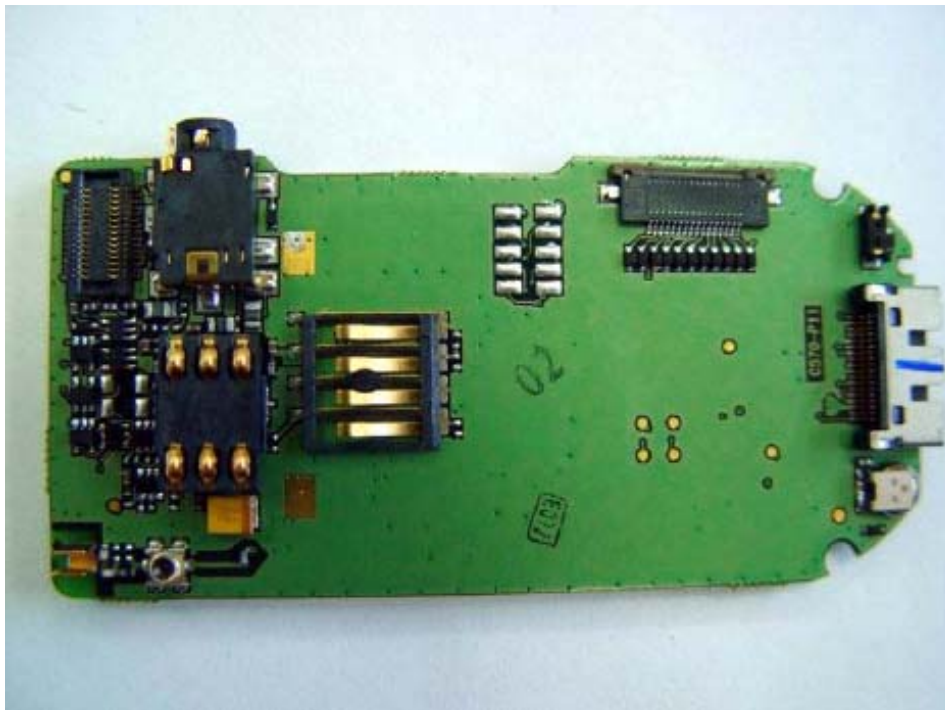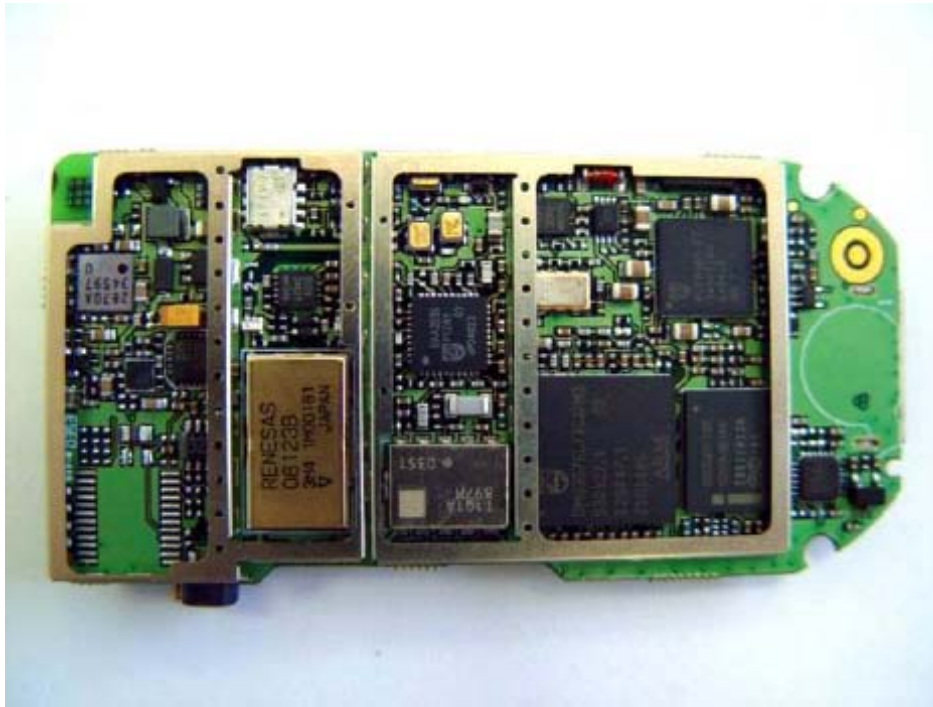## EXHIBIT B – EUT PHOTOGRAPHS

**K570 – Front, Rear, Side and Open View**



**K570 – Solder View**

**K570 – Component View**



**K570 Earpiece – Top View**

**K570 Power Adapter – Top View**

## EXHIBIT C – Z-Axis

CEC, Model: K570 (Body Worn, Back touching flat phantom with accessory ( headset), Mid channel, Ambient Temp = 23 DegC, Liquid Temp = 22 Deg C, 3/10/2004)

SAM Phantom; Section; Position: ; Frequency: 1880 MHz

Probe: ES3DV2 - SN3019; ConvF(4.60,4.60,4.60); Crest factor: 8.0; (Body) 1900 MHz: $\sigma$ = 1.50 mho/m $\varepsilon_r$ = 52.9 $\rho$ = 1.31 g/cm³ : , ()

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