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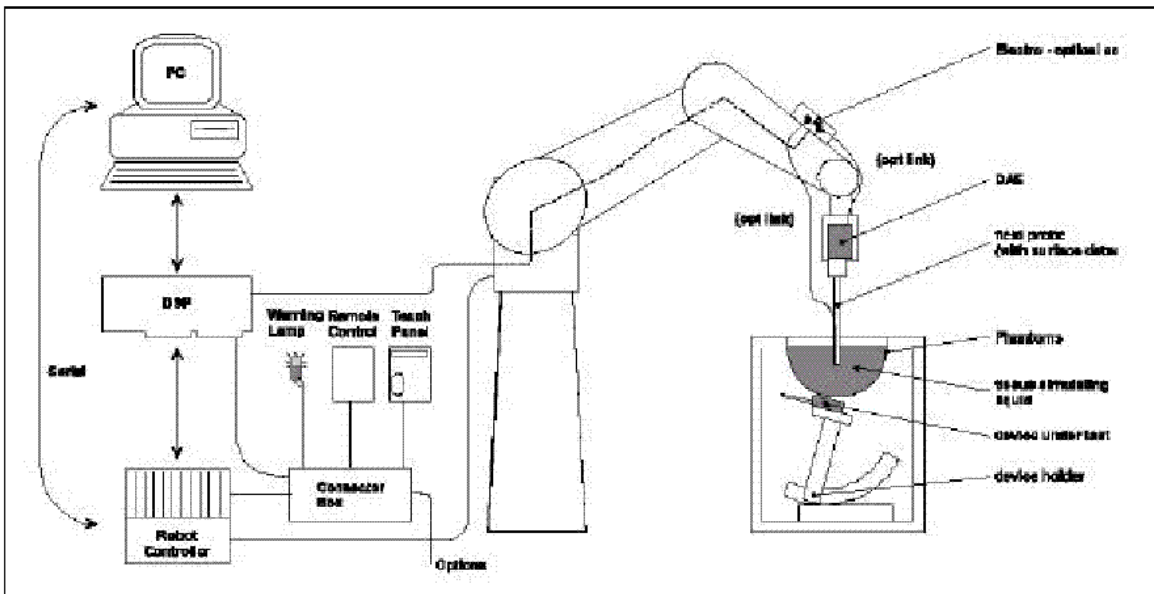
The DASY3 system for performing compliance tests consist of the following items:

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)

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

Photograph of the probe

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:

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

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)
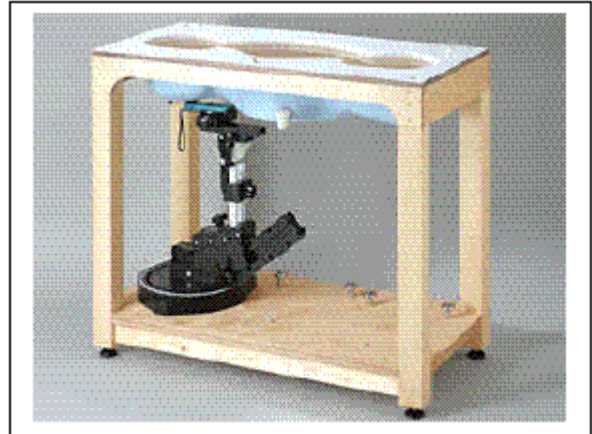
Generic Twin Phantom

Device Holder

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.
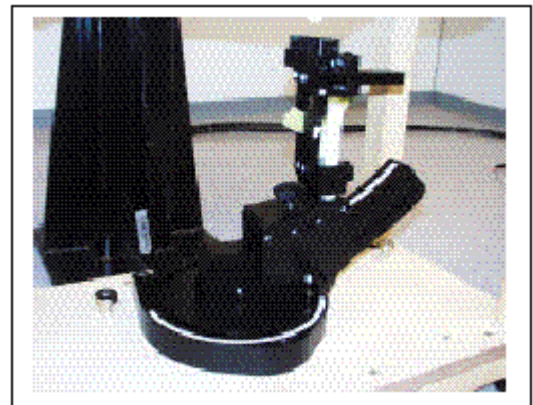
Device Holder

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.
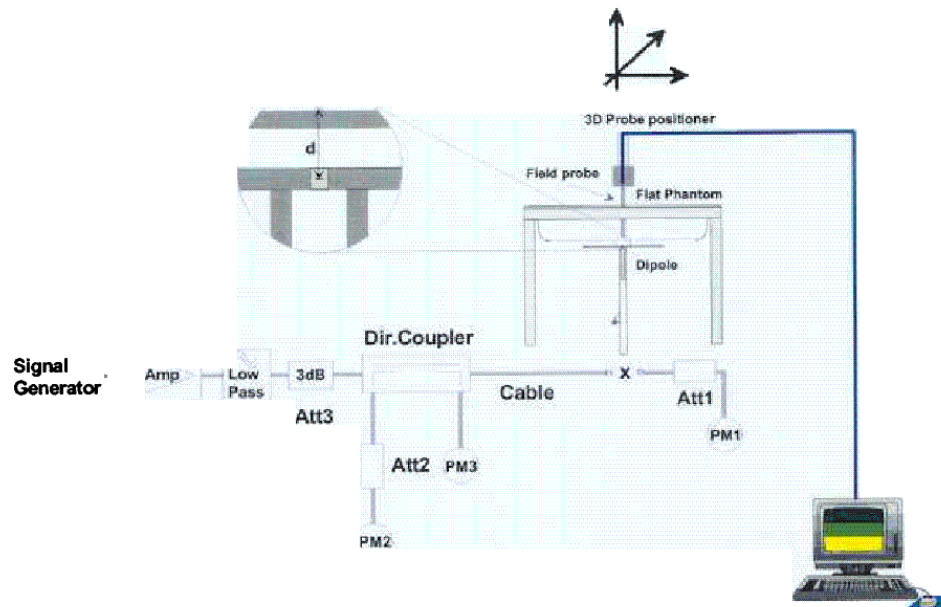
First, the power meter PM1 (including attenuator Att1) is connected to the cable to measure the forward power at the location of the dipole connector (X). The signal generator is adjusted for the desired forward power at he dipole connector (taking into account the attenuation of Att1) as read by power 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

Simulant	Freq [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation	Limits [%]
Body	1900	ε_r	22.0	53.3	53.3	0.00	±5
		σ	22.0	1.52	1.52	0.00	±5
		1g SAR	22.0	24.97	24.60	-1.48	±10
Head	1900	ε_r	22.0	40.0	38.0	-5.00	±5
		σ	22.0	1.40	1.44	2.86	±5
		1g SAR	22.0	39.7	38.99	-1.79	±10

ε_r = relative permittivity, σ = conductivity and ρ=1000kg/m^3

Body Forward Power = 20.5 dBm = 112.20 mW
Head Forward Power = 20.09 dBm = 102.09 mW

7.7 System Validation Setup Photos
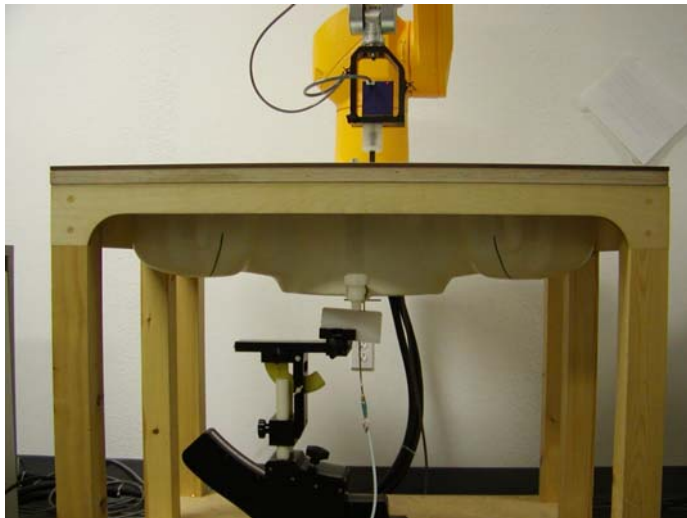
1900 MHz Body Liquid System Validation (Ambient Temp = 23 Deg C, Liquid Temp = 22 Deg C, Forwar Power = 20.5 dBm, 11/10/2004)

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 = 1.52 mho/m ε_r = 53.3 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 2.76 mW/g, SAR (10g): 1.45 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: 0.02 dB
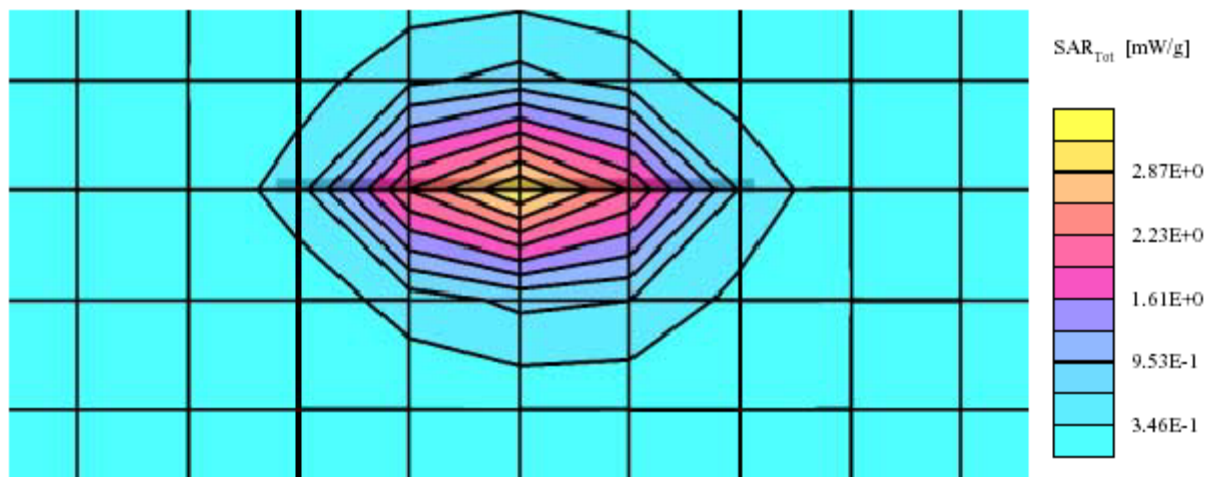
1900 MHz Head Liquid System Validation (Ambient Temp = 23 Deg C, Liquid Temp = 22 Deg C, Forwar Power = 20.09 dBm, 11/10/2004)

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: $\sigma = 1.44$ mho/m $\varepsilon_r = 38.0$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 3.98 mW/g, SAR (10g): 2.11 mW/g, (Worst-case extrapolation)

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

Powerdrift: -0.03 dB
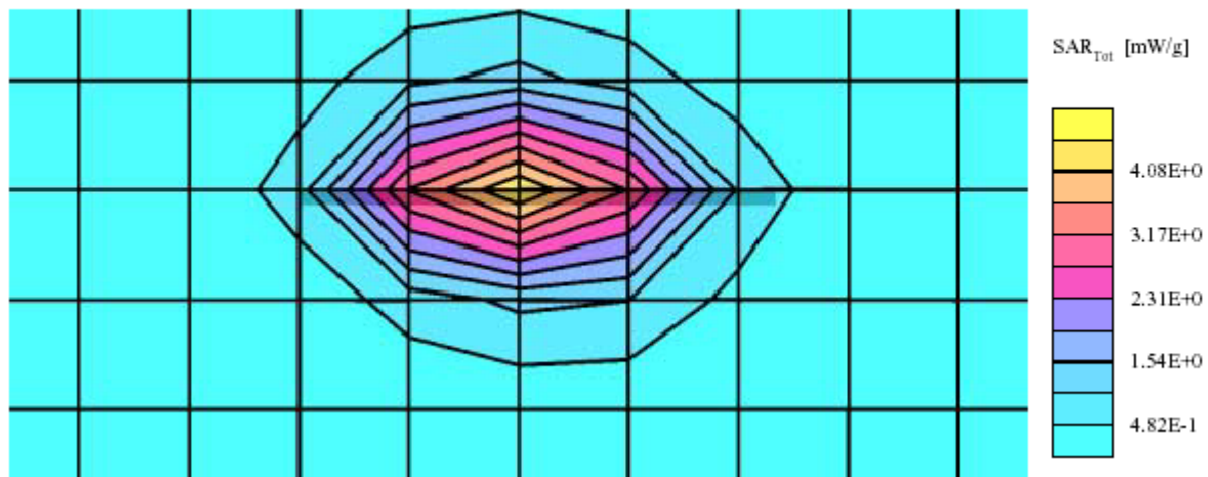
8 - SAR TEST RESULTS

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

Host PC	Operating Mode	Position	Frequency (MHz)	Output Power (dBm)	Test Type	Liquid	Phantom	Measured (mW/g)	Limit (mW/g)	Plot #
Dell (model: Latitude)	GSM	EUT bottom side facing phantom bottom and notebook bottom side in touch with flat phantom	1880	29.83	Body Worn	Body	Flat	0.367	1.6	1
Dell (model: PP01X)			1880	29.83				0.254		2
Toshiba (model: PT810C-16CF2)			1880	29.83				0.287		3
Dell (model: Latitude)	GPRS	EUT bottom side facing phantom bottom and notebook bottom side in touch with flat phantom	1880	29.83	Body Worn	Body	Flat	0.512	1.6	4
Dell (model: PP01X)			1880	29.83				0.538		5
Toshiba (model: PT810C-16CF2)			1880	29.83				0.405		6

8.2 Plots of Test Result

The plots of test result were attached as reference.

Novatec Wireless, Model: U630 (1900 GSM, Dell Notebook, Model: Latitude, EUT bottom side facing phantom bottom and notebook bottom side in touch with flat phantom, Middle Channel, Ambient Temp = 23 Deg C, Liqiud Temp = 21 Deg C, 10/11/2004)
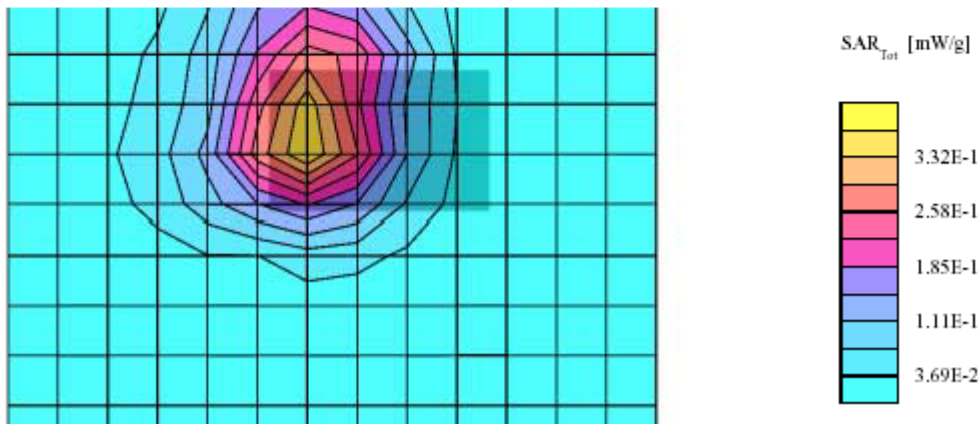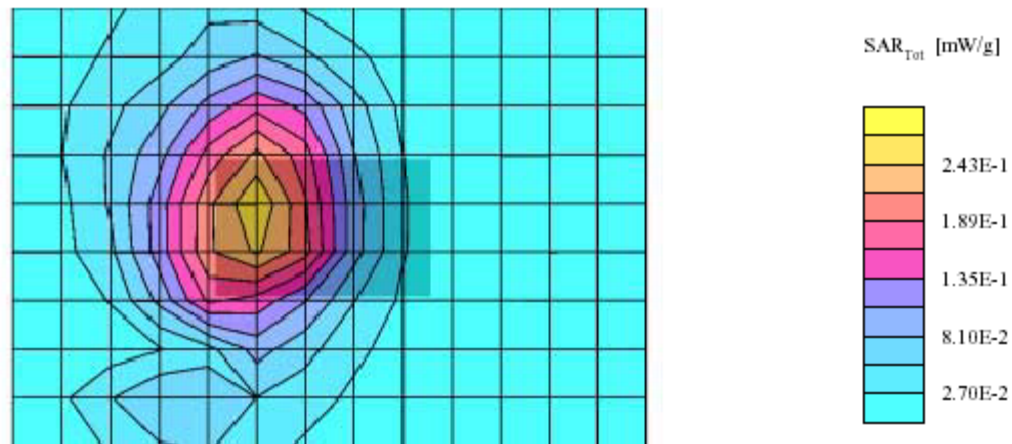
SAM Phantom; Flat Section; Position: (90°,270°); Frequency: 1880 MHz
Probe: ES3DV2 - SN3019; ConvF(4.60,4.60,4.60); Crest factor: 8.0; (Body) 1900 MHz: σ = 1.52 mho/m ε$_r$ = 53.3 ρ = 1.31 g/cm³
Cube 5x5x7: SAR (1g): 0.367 mW/g, SAR (10g): 0.229 mW/g, (Worst-case extrapolation)
Coarse: Dx = 13.0, Dy = 13.0, Dz = 10.0
Powerdrift: -0.04 dB

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

3.32E-1
2.58E-1
1.85E-1
1.11E-1
3.69E-2

Plot #1

Novatec Wireless, Model: U630 (1900 GSM, Dell Notebook, Model: PP01X, EUT bottom side facing phantom bottom and notebook bottom side in touch with flat phantom, Middle Channel, Ambient Temp = 23 Deg C, Liqiud Temp = 21 Deg C, 10/11/2004)

SAM Phantom; Flat Section; Position: (90°,270°); Frequency: 1880 MHz
Probe: ES3DV2 - SN3019; ConvF(4.60,4.60,4.60); Crest factor: 8.0; (Body) 1900 MHz: $\sigma = 1.52$ mho/m $\varepsilon_r = 53.3$ $\rho = 1.31$ g/cm³
Cube 5x5x7: SAR (1g): 0.254 mW/g, SAR (10g): 0.162 mW/g, (Worst-case extrapolation)
Coarse: Dx = 13.0, Dy = 13.0, Dz = 10.0
Powerdrift: -0.03 dB

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

| 2.43E-1 |
| 1.89E-1 |
| 1.35E-1 |
| 8.10E-2 |
| 2.70E-2 |

Plot #2

Novatec Wireless, Model: U630 (1900 GSM, Toshiba Notebook, Model: PT810C-16CF2, EUT bottom side facing phantom bottom and notebook bottom side in touch with flat phantom, Middle Channel, Ambient Temp = 23 Deg C, Liqiud Temp = 21 Deg C, 10/11/2004)

SAM Phantom; Flat Section; Position: (90°,270°); Frequency: 1880 MHz
Probe: ES3DV2 - SN3019; ConvF(4.60,4.60,4.60); Crest factor: 8.0; (Body) 1900 MHz: σ = 1.52 mho/m ε_r = 53.3 ρ = 1.31 g/cm³
Cube 5x5x7: SAR (1g): 0.287 mW/g, SAR (10g): 0.183 mW/g, (Worst-case extrapolation)
Coarse: Dx = 13.0, Dy = 13.0, Dz = 10.0
Powerdrift: 0.00 dB

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

2.65E-1

2.06E-1

1.47E-1

8.82E-2

2.94E-2
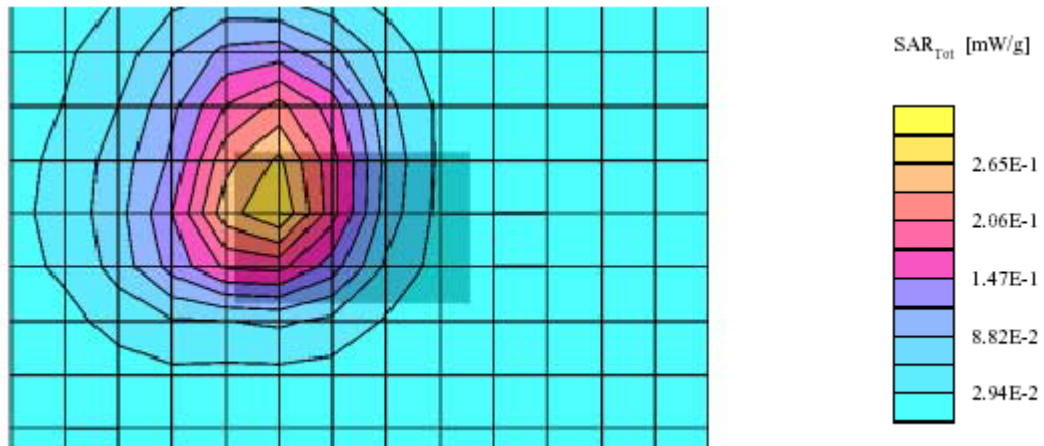
Plot #3

Novatec Wireless, Model: U630 (1900 GPRS, Dell Notebook, Model: Latitude, EUT bottom side facing phantom bottom and notebook bottom side in touch with flat phantom, Middle Channel, Ambient Temp = 23 Deg C, Liqiud Temp = 21 Deg C, 10/11/2004)
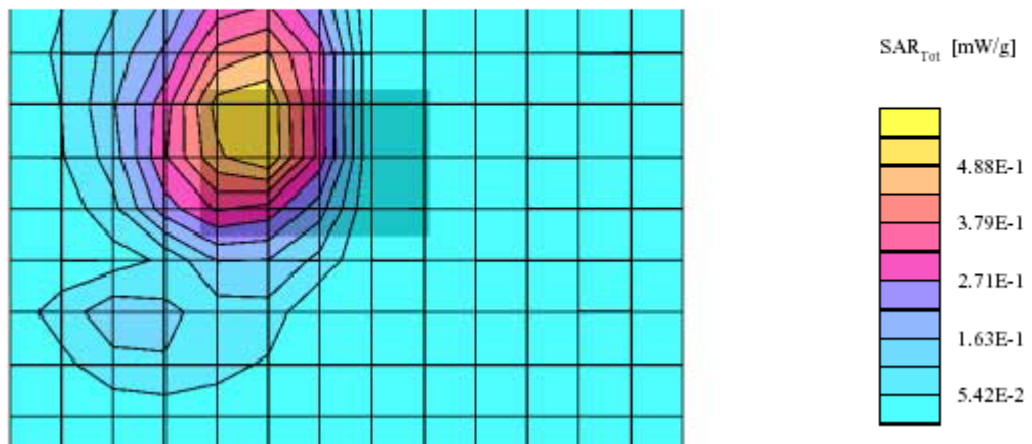
SAM Phantom; Flat Section; Position: (90°,270°); Frequency: 1880 MHz

Probe: ES3DV2 - SN3019; ConvF(4.60,4.60,4.60); Crest factor: 8.0; (Body) 1900 MHz: σ = 1.52 mho/m ε_r = 53.3 ρ = 1.31 g/cm³

Cube 5x5x7: SAR (1g): 0.512 mW/g, SAR (10g): 0.328 mW/g, (Worst-case extrapolation)

Coarse: Dx = 13.0, Dy = 13.0, Dz = 10.0

Powerdrift: 0.01 dB
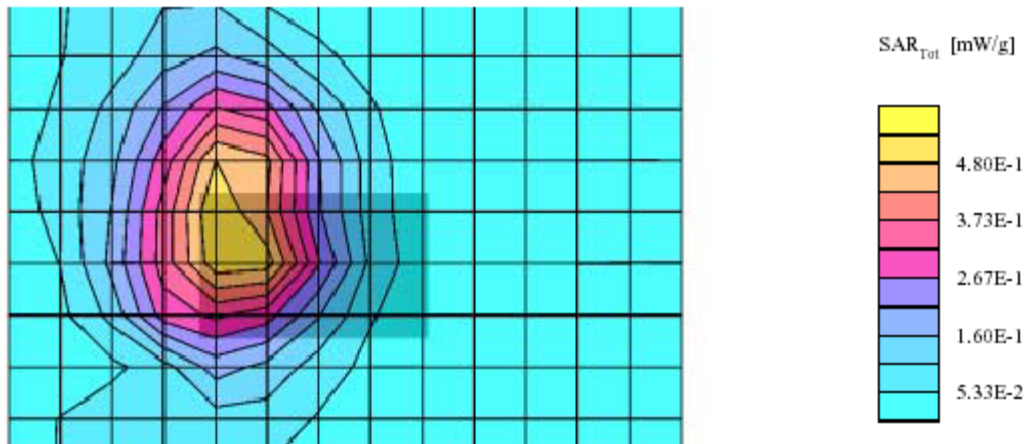
Plot #4

Novatec Wireless, Model: U630 (1900 GPRS, Dell Notebook, Model: PP01X, EUT bottom side facing phantom bottom and notebook bottom side in touch with flat phantom, Middle Channel, Ambient Temp = 23 Deg C, Liqiud Temp = 21 Deg C, 10/11/2004)

SAM Phantom; Flat Section; Position: (90°,270°); Frequency: 1880 MHz
Probe: ES3DV2 - SN3019; ConvF(4.60,4.60,4.60); Crest factor: 8.0; (Body) 1900 MHz: $\sigma = 1.52$ mho/m $\varepsilon_r = 53.3$ $\rho = 1.31$ g/cm³
Cube 5x5x7: SAR (1g): 0.538 mW/g, SAR (10g): 0.342 mW/g, (Worst-case extrapolation)
Coarse: Dx = 13.0, Dy = 13.0, Dz = 10.0
Powerdrift: -0.05 dB

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

4.88E-1

3.79E-1

2.71E-1

1.63E-1

5.42E-2

Plot #5

Novatec Wireless, Model: U630 (1900 GPRS, Toshiba Notebook, Model: PT810C-16CF2, EUT bottom side facing phantom bottom and notebook bottom side in touch with flat phantom, Middle Channel, Ambient Temp = 23 Deg C, Liqiud Temp = 21 Deg C, 10/11/2004)

SAM Phantom; Flat Section; Position: (90°,270°); Frequency: 1880 MHz

Probe: ES3DV2 - SN3019; ConvF(4.60,4.60,4.60); Crest factor: 8.0; (Body) 1900 MHz: $\sigma = 1.52$ mho/m $\varepsilon_r = 53.3$ $\rho = 1.31$ g/cm³

Cube 5x5x7: SAR (1g): 0.405 mW/g, SAR (10g): 0.266 mW/g, (Worst-case extrapolation)

Coarse: Dx = 13.0, Dy = 13.0, Dz = 10.0

Powerdrift: -0.01 dB
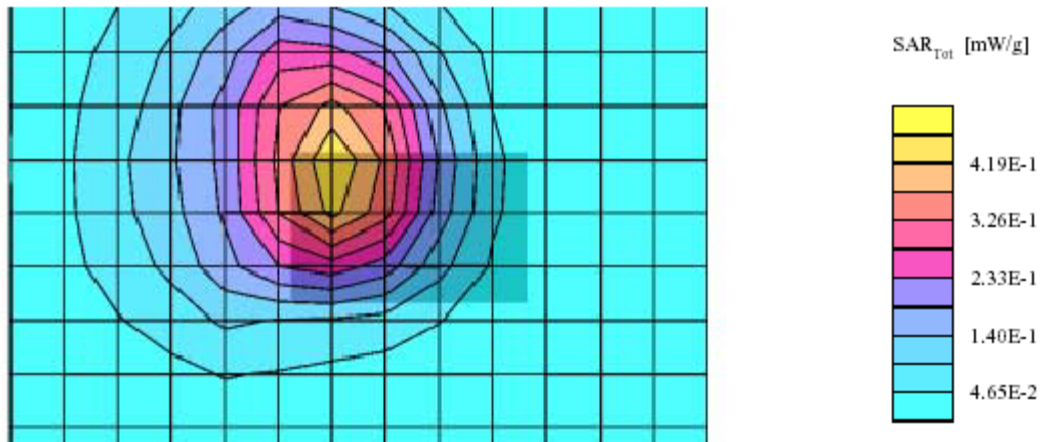
Plot #6

EXHIBIT A - SAR SETUP PHOTOGRAPHS

Body Worn, DELL (model: Latitude) Host PC, EUT Bottom Side Facing Phantom Bottom and Notebook Bottom Side in Touch with Flat Phantom

Body Worn, DELL (model: PP01X) Host PC, EUT Bottom Side Facing Phantom Bottom and Notebook Bottom Side in Touch with Flat Phantom

Body Worn, Toshiba (model: PT810C-16CF2) Host PC, EUT Bottom Side Facing Phantom Bottom and Notebook Bottom Side in Touch with Flat Phantom
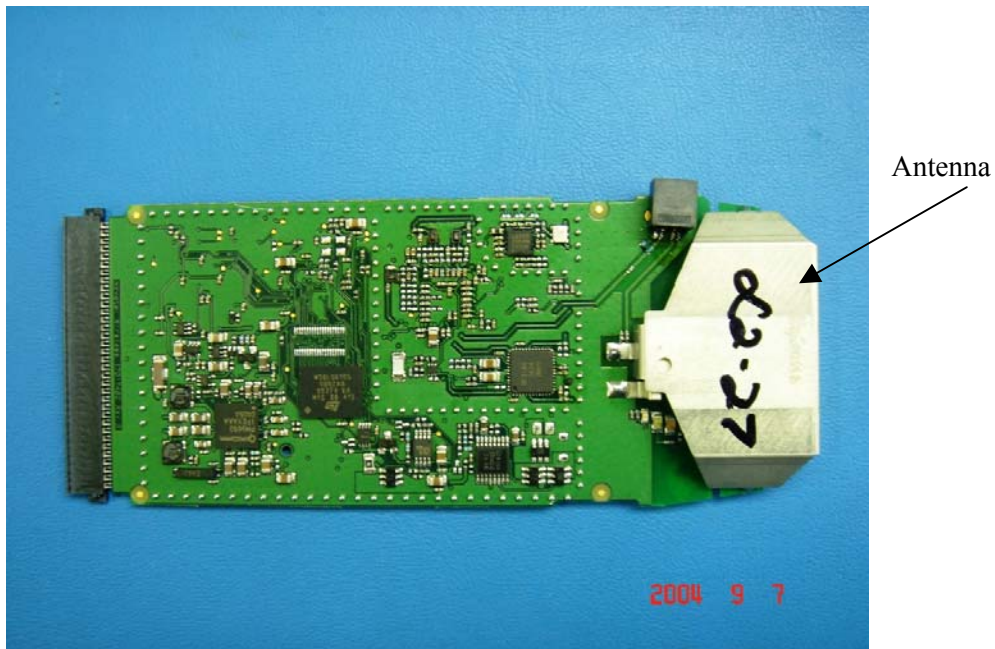
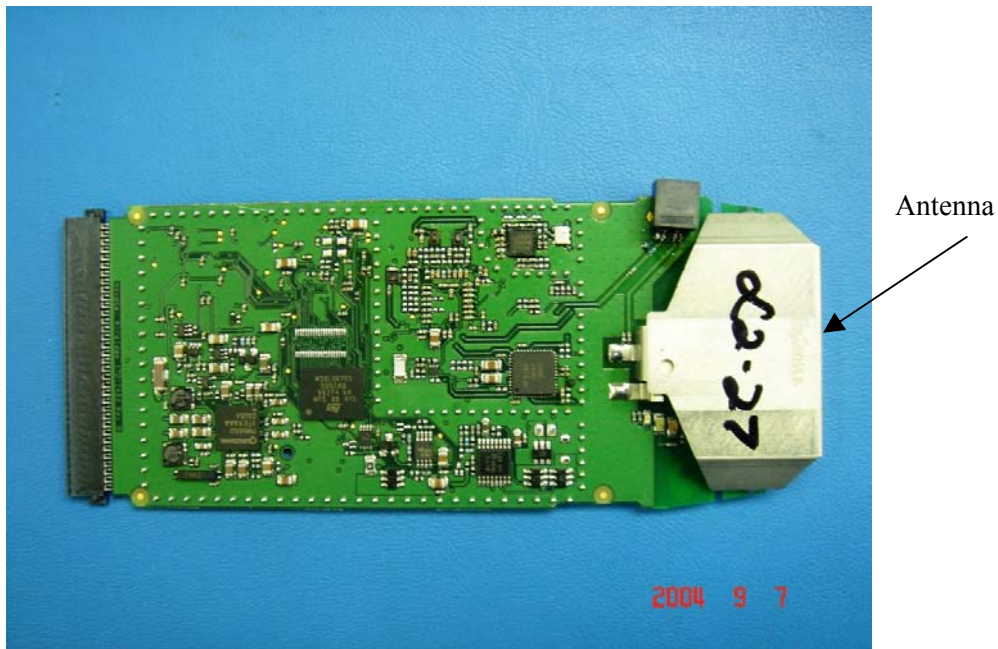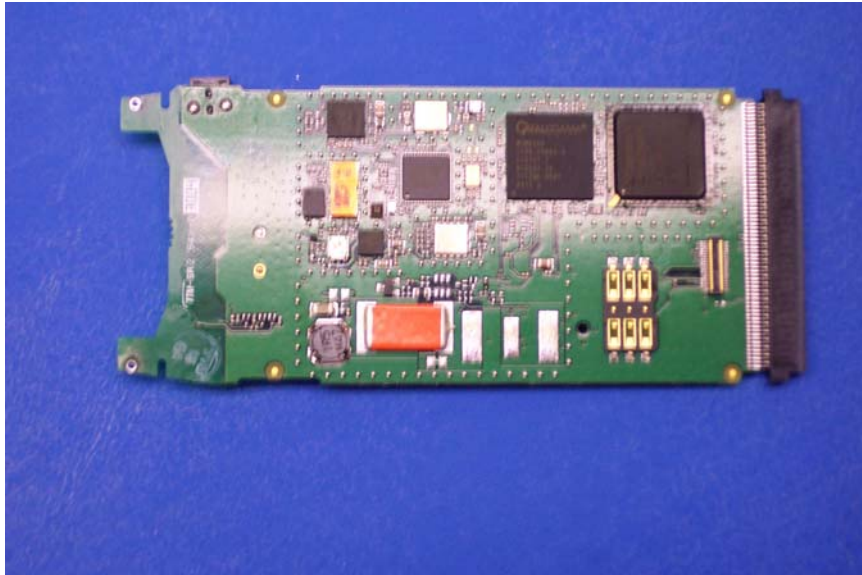## EXHIBIT B – EUT PHOTOGRAPHS

EUT – Front View

EUT – Back View

EUT – Component View

Antenna

EUT – Solder View

Antenna

EUT – Component View with Shielding

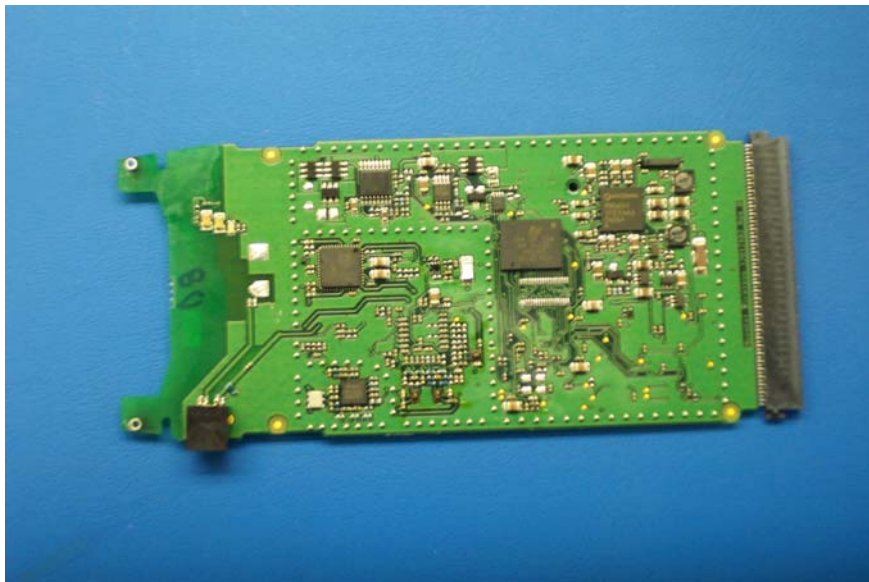**EUT – Solder View without Shielding**

EXHIBIT C – Z-Axis

Novatec Wireless, Model: U630 (1900 GPRS, Dell Notebook, Model: PP01X, EUT bottom side facing phantom bottom and notebook bottom side in touch with flat phantom, Middle Channel, Ambient Temp = 23 Deg C, Liqiud Temp = 21 Deg C, 10/11/2004)

SAM Phantom; Section; Position: ; Frequency: 1880 MHz
Probe: ES3DV2 - SN3019; ConvF(4.60,4.60,4.60); Crest factor: 1.0; (Body) 1900 MHz: σ = 1.52 mho/m ε_r = 53.3 ρ = 1.31 g/cm³
: , 0
Z-Axis: Dx = 0.0, Dy = 0.0, Dz = 2.0