SAR Test Report

On

Dual-band CDMA 800/1900 PCMCIA Card

FCC Part 22 & 24 Certification	
FCC ID:	**OVFKWC-KPC650**
Model:	**KPC 650**
Date:	**September 21, 2004**

STATEMENT OF COMPLIANCE

Kyocera Wireless Corp declares under its sole responsibility that the product, FCC ID: OVFKWC-KPC650 to which this declaration relates, is in conformity with the appropriate General Population/Uncontrolled RF exposure standards, recommendations and guidelines. It also declares that the product was tested in accordance with the appropriate measurement standards, guidelines and recommended practices.

Any deviations from these standards, guidelines and recommended practices are noted: NONE.

Date of Test:	August 31, 2004 to September 1, 2004
Test performed by:	Kyocera Wireless Corp 10300 Campus Point Drive CA 92121
Report Prepared by:	Fernando Calimbahin, Engineer
Report Reviewed by:	C. K. Li, Engineer, Senior Staff/Manager

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1 INTRODUCTION

This test report describes an environmental evaluation measurement of specific absorption rate (SAR) distribution in simulated human body tissues exposed to radio frequency (RF) radiation from a wireless portable device manufactured by Kyocera Wireless Corp. (KWC). These measurements were performed for compliance with the rules and regulations of the U.S. Federal Communications Commission (FCC). The testing was performed in accordance with FCC OET Bulletin 65 Supplement C (01/01) and IEEE P1528-2003.

2 EQUIPMENT UNDER TEST (EUT)

The wireless device is described as follows:

FCC ID:	OVFKWC-KPC650		
Product:	Dual-Band CDMA 800/1900 PCMCIA Card		
Trade Name:	Kyocera Wireless Corp		
Model Number:	KPC 650		
EUT S/N:	7Y-X----102FZJ		
Type:	[ ] Identical Prototype, [X] Pre-production		
Device Category:	Portable		
RF Exposure Environment:	General Population / Uncontrolled		
Antenna Type:	Integrated Dipole	**Antenna Location:**	Left/Top
Detachable Antenna:	No	**Antenna Dimensions:**	5.3cm (L) x .85cm (W)
Installation	PCMCIA		
External Input:	None		
Quantity:	Quantity production is planned		
FCC Rule Parts:	§22H	§22.901(d)	§24H
Modes:	800 CDMA	800 CDMA1X	1900 CDMA
Multiple Access Scheme:	CDMA	CDMA	CDMA
Duty Cycle:	1:1	1:1	1:1
TX Frequency (MHz):	824 – 849	824 – 849	1850 - 1910
Emission Designators:	1M25F9W		
Max. Output Power (dBm)	25.3 dBm ERP		28.4 dBm EIRP

2.1 Accessories

KWC Antenna Model: Antenna
There are two antenna options available to operate the PC Card.
1. Integrated antenna
2. External antenna for receiving only.

Figure 2.1 External Antenna for Receiving Only

2.2 Host Devices

The SAR evaluation was performed on the following hosts:

Host #	Description	Manufacturer	Model	Overall Dimension
1	Laptop Computer	Dell	Latitude PP01L	31.5cm x 25cm x 4.1cm
2	Laptop Computer	Toshiba	Portege R100	28.5cm x 22.5cm x 3cm
3	Laptop Computer	Hewlett-Packard	Compaq nx5000	32.5cm x 27cm x 3.8cm

3 SAR TEST RESULT SUMMARY

This device has been tested for localised specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE Std. C95.1 ~ 1992 and has been tested in accordance with the measurement procedures specified in IEEE P1528-2003. Normal antenna operating positions were incorporated, with the device transmitting at frequencies consistent with normal usage of the device. The device has been shown to be capable of compliance for localised specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE std. C95.1-1992

3.1 Maximum Results Found during SAR Evaluation

The equipment is deemed to fulfil the requirements if the measured values are less than or equal to the limit (1.6 mW/g).

Configuration	Mode	Ch/f(MHz)	Conducted Power (dBm)	Measured (mW/g)	Result
1. Dell Latitude	CDMA-800	383 / 836.49	25.15	0.67	**PASSED**
PP01L	CDMA-1900	600 / 1880	23.58	0.28	**PASSED**
2. Toshiba	CDMA-800	383 / 836.49	25.15	0.65	**PASSED**
Portege R100	CDMA-1900	600 / 1880	23.58	0.22	**PASSED**
3. HP Compaq	CDMA-800	777 / 848.31	25.01	**1.17**	**PASSED**
nx 5000	CDMA-1900	600 / 1880	23.58	**0.43**	**PASSED**

3.2 Measurement Uncertainty

Combined Uncertainty (Assessment & Source)	± **12.23 %**
Extended Uncertainty (k=2)	± **24.47%**

4 TEST CONDITIONS

4.1 Ambient Conditions

All tests were performed under the following environmental conditions:

Ambient Temperature:	22 ± 1 Degrees C
Tissue simulating liquid temperature:	22 ± 1 Degrees C
Humidity:	38 %
Pressure:	1015 mB

4.2 RF characteristics of the test site

All SAR measurements were performed inside a shielded room that provide isolation from external EM fields.

The E-field probes of the DASY 4 system are capable of detecting signals as low as 5μW/g in the liquid dielectric, and so external fields are minimised by the shielded room, leaving the EUT as the dominate radiation source. 2 two-foot square ferrite panels are placed on the floor of the room beneath the phantom area of the DASY system to minimise reflected energy that would otherwise re-enter the phantom and combine constructively or destructively with the desired fields. These ferrite panels provide roughly 12 to 13 dB of attenuation in the frequency range of 900 MHz, and 7 to 8 dB of attenuation in the frequency range of 1.9 GHz.

4.3 Test Signal, Frequencies and Output Power

The device was controlled by using Kyocera Wireless Phone Support Toolkit, Test Code Controller.

In all operating bands, the measurements were performed on low, mid and high channels.

The EUT was set to nominal maximum power level during all tests and at the beginning of the each test. Radiated power output was measured either in an Open Area Test Site (OATS) or in KWC antenna range, fully an-echoic chamber from the same unit that was used in SAR testing.

DASY4 system measures power drift during SAR testing by comparing E-field in the same location at the beginning and at the end of measurement. These records were used to monitor stability of power output.

4.4 Device Test Conditions

The EUT was installed into and powered by the host device. Conducted RF power measurements were performed before and after each SAR measurements to confirm the output power.

5 DESCRIPTION OF THE TEST EQUIPMENT

5.1 Dosimetric System

The measurements were performed with an automated near-field scanning system, DASY4, manufactured by Schmid & Partner Engineering AG (SPEAG) of Zurich, Switzerland. The system is comprised of high precision robot, robot controller, computer, near-field probe, probe alignment sensor and the SAM phantom containing brain or muscle equivalent material. The overall RSS uncertainty of the measurement system is ±12.23% with an expanded uncertainty of ±24.47% (K=2). The measurement uncertainty budget is given in section 6. Below is a list of the calibrated equipment used for the measurements:

Test Equipment	Serial Number	Cal. Due Date
DASY4 DAE3 V1	493	11-25-04
E-field Probe ET3DV6	1714	10-10-04
Dipole Validation kit, D835V2	454	04-20-06
Dipole Validation kit, D1900V2	5D016	09-05-04

The calibration records of E-field probe are attached in Appendix C.

5.2 Additional equipment needed in validation

Test Equipment	Serial Number	Cal. Due Date
Signal Generator, HP E4421B	US38440337	04-08-05
Power meter, Giga-tronics 8541C	1832573	10-14-04
Power Sensor, Giga-tronics 80601A	1831178	01-23-05
Vector Network Analyzer, Agilent 8752C	3410A03621	06-08-05
Dielectric Probe Kit, HP 85070B	3033A03145	Calibration not required
Thermometer, Digi-sense	186700	02-23-05

5.3 Tissue Stimulants

All dielectric parameters of tissue stimulants were measured within 24 hours of SAR measurements. The depth of the tissue stimulant in the ear reference point and flat reference point of the phantom were at least 15cm during all the tests.

The list of ingredients and the percent composition used for the Head and Muscle tissue simulates are listed in the table below:

	835 MHz	1900 MHz
Ingredient	***MUSCLE***	***MUSCLE***
Water	65.45%	69.91%
Cellulose	--	--
Glycol monobutyl	--	29.96%
Sugar	34.31%	--
Preventol	0.1%	--
Salt	0.62%	0.13%

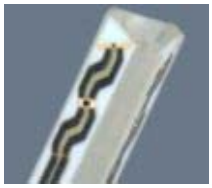
The ingredients above are adopted from Application Note: Recipes for Head/Muscle Tissue Simulating Liquid by SPEAG.

5.4 Phantoms Description

SAM v4.0 phantom, manufactured by SPEAG, was used during the measurement. It has fiberglass shell integrated in a wooden table. The shape of the shell corresponds to the phantom defined in IEEE 1528-2003. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. Reference markings on the phantom allow the complete set-up of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

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

5.5 Isotropic E-Field Probe

Model	• ET3DV6 
Construction	• Symmetrical design with triangular core • Built-in optical fiber for surface detection system • Built-in shielding against static charges • PEEK enclosure material (resistant to organic solvents, e.g., glycol)
Calibration	• Calibration certificate in Appendix C
Frequency	• 10MHz to 3GHz (dosimetry); Linearity: ± 0.2dB (30MHz to 3GHz)
Optical Surface	• ± 0.2mm repeatability in air and clear liquid over diffuse reflecting
Detection	• Surface
Directivity	• ± 0.2dB in HSL (rotation around probe axis) • ± 0.4dB in HSL (rotation normal to probe axis)
Dynamic Range	• 5 uW/g to > 100 mW/g; Linearity: ± 0.2dB
Dimensions	• Overall length: 330mm • Tip length: 16mm • Body diameter: 12mm • Tip diameter: 6.8mm • Distance from probe tip to dipole centers: 2.7mm
Application	• General dosimetry up to 3GHz • Compliance tests of mobile phones • Fast automatic scanning in arbitrary phantoms.

6 SYSTEM VALIDATION

The probes are calibrated annually by the manufacturer. Dielectric parameters of the stimulating liquids are measured with an automated Hewlett Packard 85070B dielectric probe in conjunction with an Agilent 8753C-network analyser.

The SAR measurements of the device were done within 24 hours of system accuracy verification, which was done using the dipole validation kit. Power level of 20dBm was supplied to a dipole antenna placed under the flat section of SAM phantom. The validation results are in the table below and printouts of the validation test are attached in Appendix A. All the measured parameters were within the specification.

Note since the validation reference in muscle liquid is not available, the system validation with head tissues was done for the device testing in muscle. Based on OET 65 Supplement C EAB Part 22/24 SAR review Reminder Sheet 01/2002, this is a valid test.

Tissue	Freq. (MHz)	Description	Validation SAR (mW/g), 1g	Dielectric Parameters		Temp. (°C)	Test date	Comments
				ε_r	σ (S/m)			Validation testing -
Head	835	Measured	1.04	**41.1**	**0.916**	22±1	8-31-04	for device testing in muscle
		SPEAG Reference	1.02	42.8	.94	--	4-20-04	
		FCC Reference*	--	41.5	0.90	20-26	--	
	1900	Measured	4.00	**41.9**	**1.45**	22±1	9-01-04	for device testing in muscle
		SPEAG Reference	4.04	39.8	1.46	--	9-05-02	
		FCC Reference*	--	40.0	1.40	20-26	--	
Muscle	835	Measured	--	**55.2**	**.99**	22±1	8-31-04	for device testing in muscle
		FCC Reference*	--	55.2	0.97	--	--	
	1900	Measured	--	**55.3**	**1.52**	22±1	9-01-04	for device testing in muscle
		FCC Reference*	--	53.3	1.52	20-26	--	

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

7 DESCRIPTION OF THE TEST PROCEDURE

Measurements were performed with 3 typical host laptop computers, using the same test sample and same SAR system.

For laptop computers having multiple card slots (e.g., two stacked), RF exposure was evaluated with the transmitter installed in the slot(s) producing the highest SAR.

7.1 Test Positions

One test position was evaluated for the laptop computers. The laptop bottom is placed in parallel and in contact (0 cm) with the flat phantom.

7.1.1 Test Configuration

The PC was initially positioned such that PC bottom is placed against the flat phantom. The antenna is pointing downward, the position suggested by the manufacturer. The distance between antenna and flat phantom is determined by the PCMCIA slot in the PC.

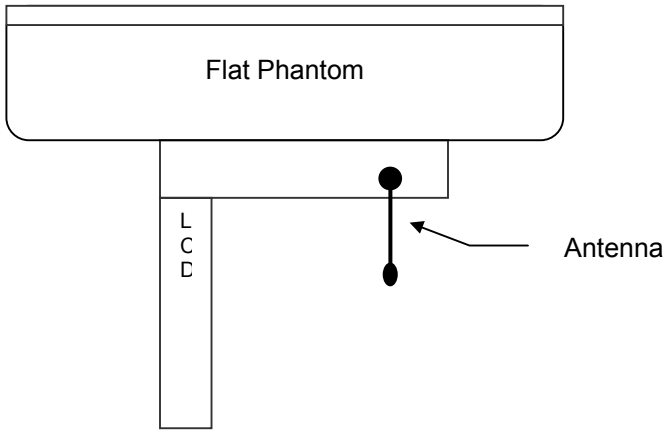


Figure 7-1 – Antenna in Vertical Position

7.2 Scan Procedures

First coarse scans are used for quick determination of the field distribution. Next a cube scans, 7x7x7 points; spacing between each point 5x5x5mm, is performed around the highest E-field value to determine the averaged SAR-distribution over 1g.

7.3 SAR Averaging Methods

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

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

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

8 MEASUREMENT UNCERTAINTY

Description of individual measurement uncertainty

Uncertainty Description	Uncert. Value (± %)	Prob. Dist.	Div	C_i^1 1g	Stand. Uncert (1g) (±%)	V_i^2 or V_{eff}
Measurement system						
Probe calibration	4.8	N	1	1	4.8	∞
Axial isotropy	4.7	R	√3	0.7	1.9	∞
Hemispherical Isotropy	9.6	R	√3	0.7	3.9	∞
Boundary effects	1.0	R	√3	1	0.6	∞
Linearity	4.7	R	√3	1	1.0	∞
System Detection limit	1.0	R	√3	1	0.5	∞
Readout Electronics	1.0	N	1	1	1.0	∞
Response Time	0.8	R	√3	1	0.5	∞
Integration Time	2.6	R	√3	1	1.5	∞
RF ambient conditions	3.0	R	√3	1	1.7	∞
Mech. Constrains of robot	0.4	R	√3	1	0.2	∞
Probe positioning	2.9	R	√3	1	1.7	∞
Extrapolation, integration and Integration Algorithms for Max. SAR Evaluation	1.0	R	√3	1	0.6	∞
Test Sample Related						
Device positioning	3.0	N	1	1	3.0	∞
Device Holder	5.0	N	1	1	5.0	∞
Power drift	10.0	N	√3	1	5.8	∞
Phantom and setup						
Phantom uncertainty	4.0	R	√3	1	2.3	∞
Liquid conductivity (target)	5.0	R	√3	0.6	1.7	∞
Liquid conductivity (meas.)	5.0	N	1	0.6	3.0	∞
Liquid permittivity (target)	5.0	R	√3	0.6	1.7	∞
Liquid permittivity (meas.)	2.5	N	1	0.6	1.5	∞
Combined Standard Uncertainty:					**12.23**	
Extended Standard Uncertainty (k=2):					**24.47**	

N: Normal
R: Rectangular

9 TEST DATA

9.1 BODY SAR Test Results

The following tables list the SAR results in each configuration and operating mode. The channels tested for each configuration have similar SAR distributions. SAR plots for each configuration is provided in Appendix B. Highest SAR in bold and blue color.

CDMA 800 BODY	**Channel:**	1013	383	777
	Frequency (MHz):	824.70	836.49	848.31
	Power before Test (dBm):	25.06	25.15	25.01
	Power after Test (dBm):	24.90	25.17	24.95
Configuration		**SAR, 1g (W/kg)**		
1. Dell Latitude PP01L with battery and cord		--	0.67	--
2. Toshiba Portege R100 with battery and cord		--	0.65	--
3. HP Compaq nx 5000 with battery and cord		0.96	0.84	**1.17**

Note: -- SAR measured at the middle channel is at least 3dB lower than the SAR limit, testing at the low and high channels are optional for this test configuration.

CDMA 1900 BODY	**Channel:**	25	600	1175
	Frequency (MHz):	1851.25	1880	1908.75
	Power before Test (dBm):	23.56	23.58	23.47
	Power after Test (dBm):	--	23.40	--
Configuration		**SAR, 1g (W/kg)**		
1. Dell Latitude PP01L with battery and cord		--	0.28	**--**
2. Toshiba Portege R100 with battery and cord		--	0.22	**--**
3. HP Compaq nx 5000 with battery and cord		--	**0.43**	**--**

Note: -- SAR measured at the middle channel is at least 3dB lower than the SAR limit, testing at the low and high channels are optional for this test configuration.

10 TEST SETUP PHOTOS

Figure 10.1 DASY 4 System

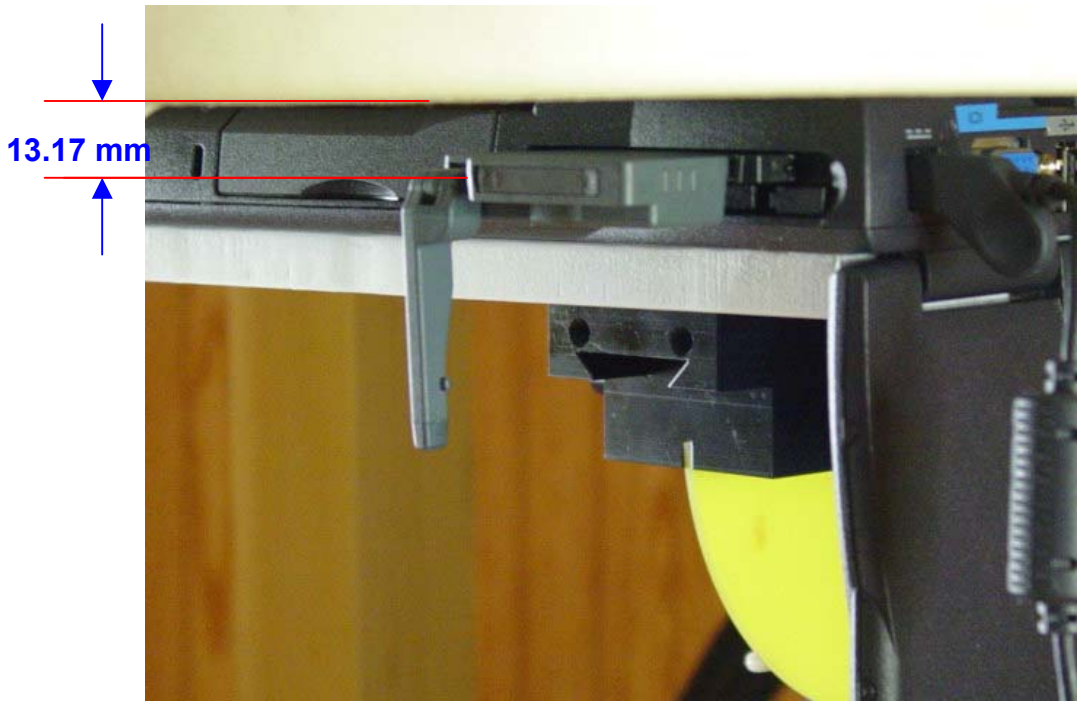


Figure 10.2 Dell Latitude PP01L

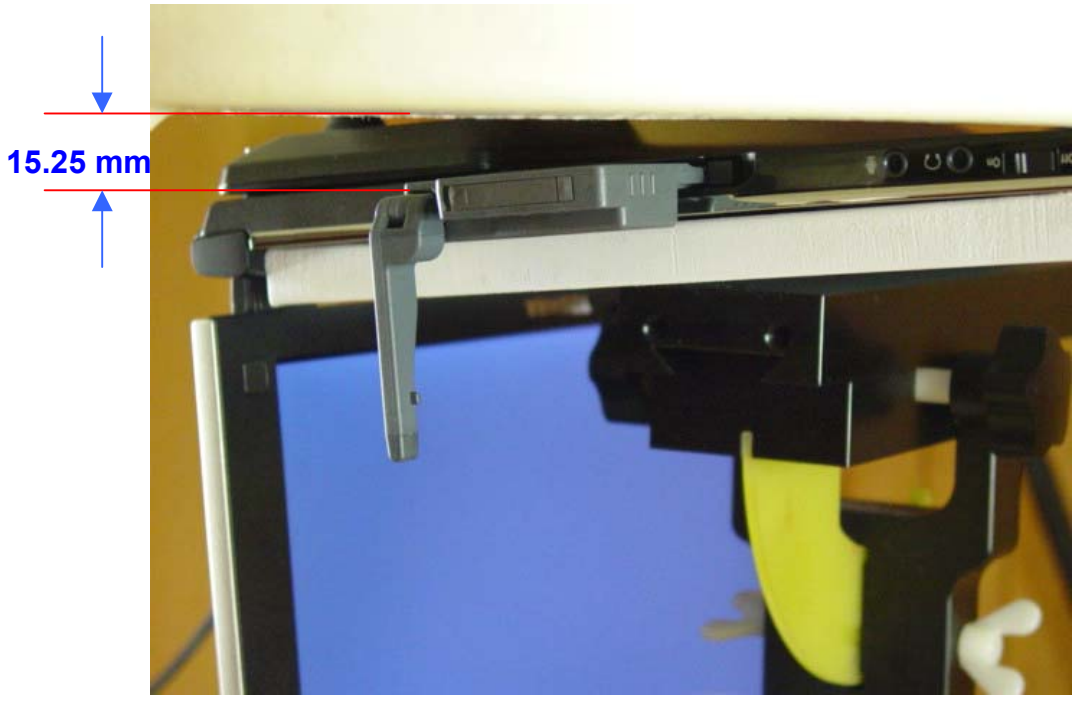


Figure 10.3 Toshiba Portege R100

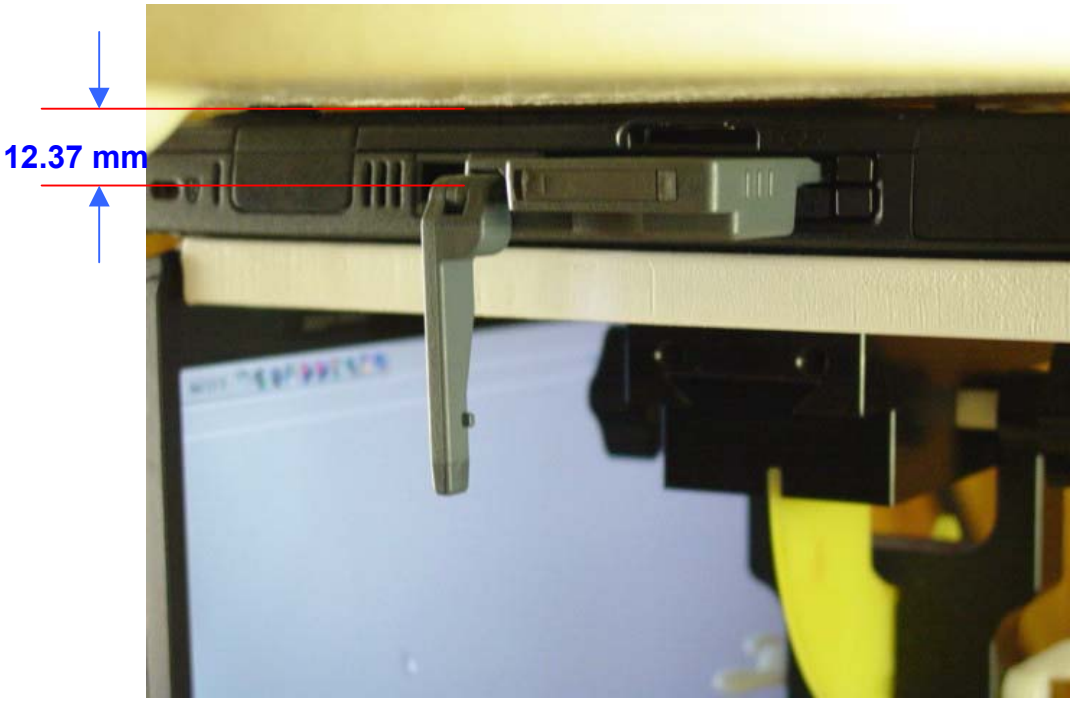


Figure 10.4 HP Compaq nx 5000

Appendix A: Validation test printout

Date/Time: 08/31/04 09:59:07

Test Laboratory: Kyocera

835Mhz Validation Probe 1714, DAE 493, Dipole 454, 08-31-04

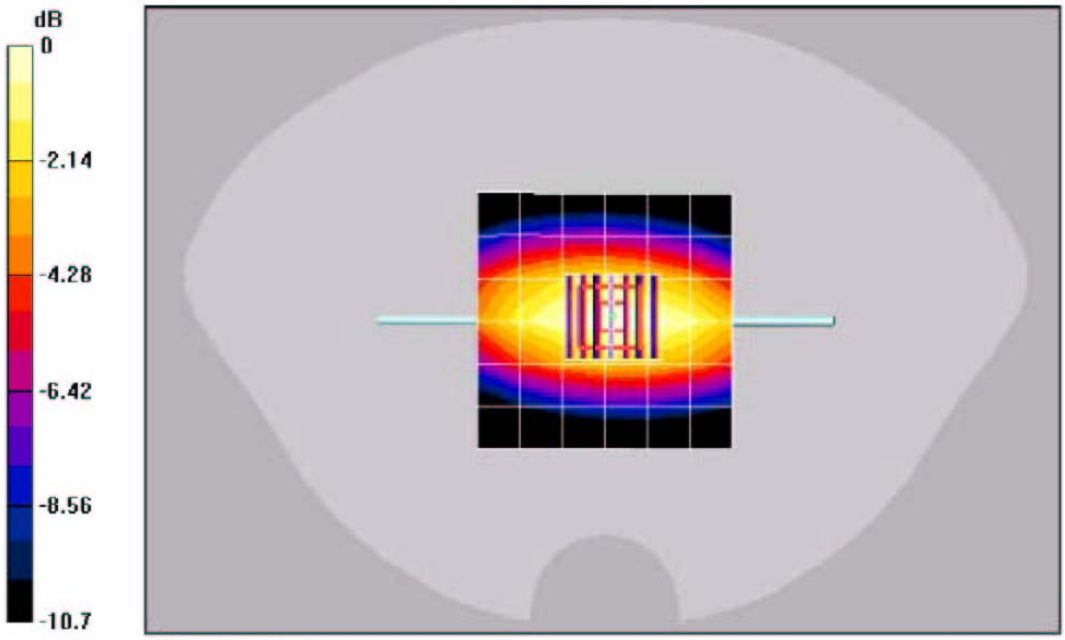
Communication System: CW, Frequency: 835 MHz, Duty Cycle: 1:1
Medium: HSL900,Medium parameters used: f = 835 MHz; σ = 0.916 mho/m; ε_r = 41.1; ρ = 1000 kg/m^3
Phantom: SAM 12,Phantom section: Flat Section

DASY4 Configuration:
Probe: ET3DV6 - SN1714, ConvF(6.6, 6.6, 6.6), Calibrated: 10/10/2003
Sensor-Surface: 4mm (Mechanical And Optical Surface Detection),
Electronics: DAE3 Sn493,Calibrated: 11/25/2003
Measurement SW: DASY4, V4.2 Build 44
Postprocessing SW: SEMCAD, V1.8 Build 112

Temperature:
Room T = 21.8 +/- 1 deg C, Liquid T = 22.0 +/- 1 deg C

835MHz Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 36.1 V/m; Power Drift = -0.008 dB
Maximum value of SAR (measured) = 1.12 mW/g
Peak SAR (extrapolated) = 1.54 W/kg
SAR(1 g) = 1.04 mW/g; SAR(10 g) = 0.676 mW/g



0 dB = 1.12mW/g

Date/Time: 09/01/04 08:09:25

Test Laboratory: Kyocera

1900Mhz Validation with Prob 1714, DAE 493, Dipole 5d016, 09-01-04

Communication System: CW, Frequency: 1900 MHz, Duty Cycle: 1:1
Medium: HSL1800,Medium parameters used (interpolated): f = 1900 MHz; σ = 1.45 mho/m; ε_r = 41.9; ρ = 1000 kg/m³
Phantom: SAM 12,Phantom section: Flat Section

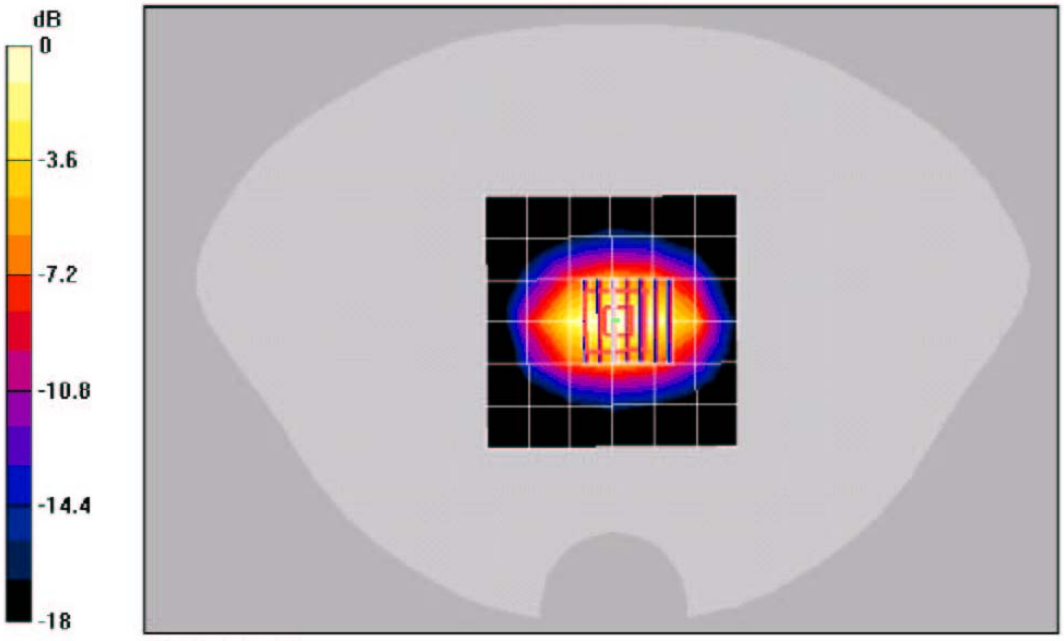
DASY4 Configuration:
Probe: ET3DV6 - SN1714, ConvF(5.4, 5.4, 5.4), Calibrated: 10/10/2003
Sensor-Surface: 4mm (Mechanical And Optical Surface Detection),
Electronics: DAE3 Sn493,Calibrated: 11/25/2003
Measurement SW: DASY4, V4.2 Build 44
Postprocessing SW: SEMCAD, V1.8 Build 112

Temperature:
Room T = 21.8 +/- 1 deg C, Liquid T = 22.0 +/- 1 deg C

1900MHz Validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 59.4 V/m; Power Drift = -0.0 dB
Maximum value of SAR (measured) = 4.52 mW/g
Peak SAR (extrapolated) = 6.86 W/kg
SAR(1 g) = 4 mW/g; SAR(10 g) = 2.12 mW/g

Info: Interpolated medium parameters used for SAR evaluation!



0 dB = 4.52mW/g

Appendix B: SAR distribution printout

Please see separate attachment

Appendix C: probe calibration parameters

Please see separate attachment