SAR EVALUATION REPORT

For

GTRAN Wireless, Inc.

9605 Scranton Road, Suite 300
San Diego, CA 92121

FCC ID: PL5GPC-6210

October 20, 2002

This Report Concerns:	**Equipment Type:**
☒ Original Report	Wireless Data Terminal

Test Engineer:	Jeff Lee
Report No.:	R0207165S
Test Date:	October 20, 2002
Reviewed By:	John Chan
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SUMMARY

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.

This report describes the methodology and results of experiments performed on wireless data terminal. The objective was to determine if there is RF radiation and if radiation is found, what is the extent of radiation with respect to safety limits. SAR (Specific Absorption Rate) is the measure of RF exposure determined by the amount of RF energy absorbed by human body (or its parts) – to determine how the RF energy couples to the body or head which is a primary health concern for body worn devices. The limit below which the exposure to RF is considered safe by regulatory bodies in North America is 1.6 mW/g average over 1 gram of tissue mass.

The test configurations were laid out on a specially designed test fixture to ensure the reproducibility of measurements. Each configuration was scanned for SAR. Analysis of each scan was carried out to characterize the above effects in the device.

There was no SAR of any concern measured on the device for any of the investigated configurations.

1 - REFERENCE

[1] Federal Communications Commission, \Report and order: Guidelines for evaluating the environmental effects of radiofrequency radiation", Tech. Rep. FCC 96-326, FCC, Washington, D.C. 20554, 1996.

[2] David L. Means Kwok Chan, Robert F. Cleveland, \Evaluating compliance with FCC guidelines for human exposure to radiofrequency electromagnetic fields", Tech. Rep., Federal Communication Commission, O_ce of Engineering & Technology, Washington, DC, 1997.

[3] Thomas Schmid, Oliver Egger, and Niels Kuster, \Automated E-_eld scanning system for dosimetric assessments", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp. 105{113, Jan. 1996.

[4] Niels Kuster, Ralph K.astle, and Thomas Schmid, \Dosimetric evaluation of mobile communications equipment with known precision", IEICE Transactions on Communications, vol. E80-B, no. 5, pp. 645{652, May 1997.

[5] CENELEC, \Considerations for evaluating of human exposure to electromagnetic fields (EMFs) from mobile telecommunication equipment (MTE) in the frequency range 30MHz - 6GHz", Tech. Rep., CENELEC, European Committee for Electrotechnical Standardization, Brussels, 1997.

[6] ANSI, ANSI/IEEE C95.1-1992: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, The Institute of Electrical and Electronics Engineers, Inc., New York, NY 10017, 1992.

[7] Katja Pokovic, Thomas Schmid, and Niels Kuster, \Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies", in ICECOM _ 97, Dubrovnik, October 15{17, 1997, pp. 120-24.

[8] Katja Pokovic, Thomas Schmid, and Niels Kuster, \E-field probe with improved isotropy in brain simulating liquids", in Proceedings of the ELMAR, Zadar, Croatia, 23{25 June, 1996, pp. 172-175.

[9] Volker Hombach, Klaus Meier, Michael Burkhardt, Eberhard K. uhn, and Niels Kuster, \The depen-dence of EM energy absorption upon human head modeling at 900 MHz", IEEE Transactions on Microwave Theory and Techniques, vol. 44, no. 10, pp. 1865-1873, Oct. 1996.

[10] Klaus Meier, Ralf Kastle, Volker Hombach, Roger Tay, and Niels Kuster, \The dependence of EM energy absorption upon human head modeling at 1800 MHz", IEEE Transactions on Microwave Theory and Techniques, Oct. 1997, in press.

[11] W. Gander, Computermathematik, Birkhaeuser, Basel, 1992.

[12] W. H. Press, S. A. Teukolsky,W. T. Vetterling, and B. P. Flannery, Numerical Recepies in C, The Art of Scientific Computing, Second Edition, Cambridge University Press, 1992.Dosimetric Evaluation of Sample device, month 1998 9

[13] NIS81 NAMAS, \The treatment of uncertainity in EMC measurement", Tech. Rep., NAMAS Executive, National Physical Laboratory, Teddington, Middlesex, England, 1994.

[14] Barry N. Taylor and Christ E. Kuyatt, \Guidelines for evaluating and expressing the uncertainty of NIST measurement results", Tech. Rep., National Institute of Standards and Technology, 1994. Dosimetric Evaluation of Sample device, month 1998 10

2 - TESTING EQUIPMENT

2.1 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	08/26/02	456
SPEAG E-Field Probe ET3DV6	08/26/02	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	9/3/02	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	6/20/02	3009A00791
Microwave Amp. 8349B	N/A	2644A02662
Power Meter HP436A	4/2/02	2709A29209
Power Sensor HP8482A	4/2/02	2349A08568
Signal Generator RS SMIQ O3	2/10/02	1084800403
Network Analyzer HP-8753ES	7/30/02	820079
Dielectric Probe Kit HP85070A	N/A	N/A
Hewlett Packard HP8566B Spectrum Analyzer	7/23/02	None
Hewlett Packard HP 7470A Plotter	7/23/02	None
A.H. System SAS0200 Horn Antenna	7/23/02	None
Com-Power AB-100 Dipole Antenna	7/23/02	None
Agilent E4419b	4/8/02	GB40202891
Agilent E4412a	4/8/02	US38486529

2.2 Equipment Calibration Certificate

Please see the attached file for detailed information.

Schmid & Partner Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

Calibration Certificate

Dosimetric E-Field Probe

Type:	**ET3DV6**
Serial Number:	**1604**
Place of Calibration:	**Zurich**
Date of Calibration:	**August 26, 2002**
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	N. Vetter
Approved by	[signature]

ET3DV6 SN:1604

August 26, 2002

DASY3 - Parameters of Probe: ET3DV6 SN:1604

Sensitivity in Free Space

NormX	1.73 $\mu V/(V/m)^2$
NormY	1.68 $\mu V/(V/m)^2$
NormZ	1.72 $\mu V/(V/m)^2$

Diode Compression

DCP X	93	mV
DCP Y	93	mV
DCP Z	93	mV

Sensitivity in Tissue Simulating Liquid

Head	**900 MHz**	ε_r = **41.5 ± 5%**	σ = **0.97 ± 5% mho/m**
Head	**835 MHz**	ε_r = **41.5 ± 5%**	σ = **0.90 ± 5% mho/m**

ConvF X	**6.5** ± 9.5% (k=2)		Boundary effect:	
ConvF Y	**6.5** ± 9.5% (k=2)		Alpha	**0.36**
ConvF Z	**6.5** ± 9.5% (k=2)		Depth	**2.82**

Head	**1800 MHz**	ε_r = **40.0 ± 5%**	σ = **1.40 ± 5% mho/m**
Head	**1900 MHz**	ε_r = **40.0 ± 5%**	σ = **1.40 ± 5% mho/m**

ConvF X	**5.5** ± 9.5% (k=2)		Boundary effect:	
ConvF Y	**5.5** ± 9.5% (k=2)		Alpha	**0.50**
ConvF Z	**5.5** ± 9.5% (k=2)		Depth	**2.46**

Boundary Effect

Head **900 MHz** **Typical SAR gradient: 5 % per mm**

Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	11.1	6.6
SAR_{be} [%]	With Correction Algorithm	0.4	

Head **1800 MHz** **Typical SAR gradient: 10 % per mm**

Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	12.3	8.1
SAR_{be} [%]	With Correction Algorithm	0.1	0.1

Sensor Offset

Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.3 ± 0.2**	mm

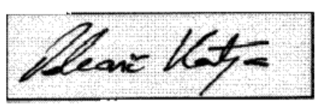
Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

Additional Conversion Factors

for Dosimetric E-Field Probe

Type	ET3DV6
Serial Number:	1604
Place of Assessment	Zurich
Date of Assessment:	October 4, 2002
Probe Calibration Date	August 26, 2002

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1800 MHz.

Assessed by 

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Conversion factor (± standard deviation)

835 MHz	**ConvF**	**6.4 ± 8%**	ε_r = 55.2 ± 5% σ = 0.97 ± 5% mho/m (body tissue)
1900 MHz	**ConvF**	**4.9 ± 8%**	ε_r = 53.3 ± 5% σ = 1.52 ± 5% mho/m (body tissue)

Body 1900 validation 1

frequency	e'	e''
1700000000.0000	54.7470	13.0708
1706000000.0000	54.7530	13.0654
1712000000.0000	54.7456	13.0786
1718000000.0000	54.6772	13.1045
1724000000.0000	54.6210	13.1383
1730000000.0000	54.5793	13.1127
1736000000.0000	54.6113	13.1449
1742000000.0000	54.5174	13.1496
1748000000.0000	54.5105	13.1810
1754000000.0000	54.4451	13.2355
1760000000.0000	54.4387	13.2713
1766000000.0000	54.3971	13.3097
1772000000.0000	54.3610	13.3651
1778000000.0000	54.3526	13.4136
1784000000.0000	54.3537	13.4452
1790000000.0000	54.3421	13.4672
1796000000.0000	54.3534	13.4929
1802000000.0000	54.3424	13.5109
1808000000.0000	54.2996	13.5147
1814000000.0000	54.2709	13.5025
1820000000.0000	54.2446	13.4830
1826000000.0000	54.2149	13.5103
1832000000.0000	54.2168	13.4866
1838000000.0000	54.1610	13.4679
1844000000.0000	54.1363	13.5018
1850000000.0000	54.0816	13.4991
1856000000.0000	54.0984	13.5208
1862000000.0000	54.0600	13.5277
1868000000.0000	53.9864	13.5811
1874000000.0000	54.0117	13.6035
1880000000.0000	53.9784	13.6547
1886000000.0000	53.9373	13.6893
1892000000.0000	53.9642	13.7318
1898000000.0000	53.9187	13.7622
1904000000.0000	53.9259	13.8199
1910000000.0000	53.9491	13.8148
1916000000.0000	53.9098	13.8843
1922000000.0000	53.9107	13.8559
1928000000.0000	53.9383	13.8620
1934000000.0000	53.9146	13.8358
1940000000.0000	53.8985	13.8533
1946000000.0000	53.8934	13.8532
1952000000.0000	53.8613	13.8336
1958000000.0000	53.8327	13.8260
1964000000.0000	53.8128	13.8649
1970000000.0000	53.7988	13.8340
1976000000.0000	53.7832	13.8586
1982000000.0000	53.7635	13.9166
1988000000.0000	53.7363	13.9487
1994000000.0000	53.7407	13.9806
2000000000.0000	53.7246	14.0129

Body 835 validation 1

frequency	e'	e''
700000000.0000	55.8185	22.0093
706000000.0000	55.7905	21.9246
712000000.0000	55.8705	21.7613
718000000.0000	55.7676	21.6491
724000000.0000	55.7429	21.5751
730000000.0000	55.5832	21.4687
736000000.0000	55.3859	21.4401
742000000.0000	55.1896	21.4562
748000000.0000	54.8798	21.4851
754000000.0000	54.6597	21.5916
760000000.0000	54.4263	21.6206
766000000.0000	54.2273	21.6535
772000000.0000	54.0952	21.7393
778000000.0000	54.0451	21.7949
784000000.0000	54.0178	21.8439
790000000.0000	54.0183	21.8695
796000000.0000	54.0535	21.8039
802000000.0000	54.1295	21.7268
808000000.0000	54.2676	21.7359
814000000.0000	54.3862	21.6168
820000000.0000	54.5023	21.5116
826000000.0000	54.5553	21.3125
832000000.0000	54.5793	21.1966
838000000.0000	54.5259	21.0775
844000000.0000	54.4593	21.0068
850000000.0000	54.3215	20.8916
856000000.0000	54.1329	20.9072
862000000.0000	53.8861	20.8333
868000000.0000	53.5886	20.8767
874000000.0000	53.3584	20.9722
880000000.0000	53.1394	20.9937
886000000.0000	52.9160	21.0794
892000000.0000	52.7825	21.1814
898000000.0000	52.6403	21.2927
904000000.0000	52.5533	21.3359
910000000.0000	52.5916	21.3863
916000000.0000	52.6688	21.3971
922000000.0000	52.7396	21.3346
928000000.0000	52.8785	21.2284
934000000.0000	53.0730	21.1685
940000000.0000	53.1753	21.0302
946000000.0000	53.2885	20.8973
952000000.0000	53.3868	20.7057
958000000.0000	53.3428	20.6325
964000000.0000	53.3069	20.5095
970000000.0000	53.1794	20.4185
976000000.0000	53.0437	20.3588
982000000.0000	52.8092	20.3488
988000000.0000	52.5995	20.3947
994000000.0000	52.3040	20.4742
1000000000.0000	52.0663	20.5563

3 - EUT DESCRIPTION

Applicant:	GTRAN Wireless, Inc.
Product Description:	Wireless Data Terminal
Product Name:	GPC6210
FCC ID:	PL5GPC-6210
Serial Number:	None
Transmitter Frequency:	PMS: 824~848MHz
	PCS: 1850~1910MHz
Maximum RF Output Power:	PMS (EIRP): 22.35dBm (171.79mW)
	PCS (EIRP): 23.1dBm (204.17mW)
Dimension:	3.8" L x 2.5"W x 0.2"H approximately
RF Exposure environment:	General Population/Uncontrolled
Power Supply:	Fed by Laptop Power Adapter
Applicable Standard	PMS: FCC CFR 47, Part 22
	PCS: FCC CFR 47, Part 24
Application Type:	Certification

Test Support Equipment:	Compaq IPAQ 3650
	Compaq IPAQ 3850
	Compaq IPAQ 3870
	Dell PPO1L
	HP T18.033.C.00
	IBM 1161

4 - DOSIMETRIC ASSESSMENT SETUP

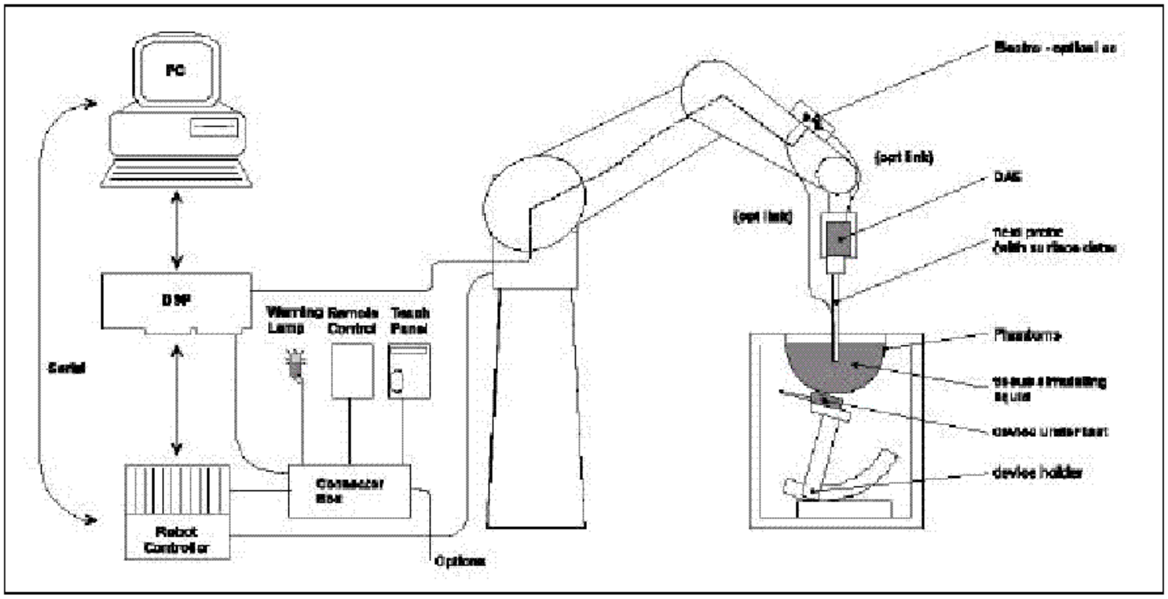
These measurements were performed with the automated near-field scanning system DASY3 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9m) which positions the probes with a positional repeatability of better than ±0.02mm. Special 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	55.2	42.0	55.9	39.9	53.3	39.8	53.6
Conductivity (s/m)	0.85	0.83	0.91	0.97	1.0	0.98	1.42	1.52	1.88	1.81

4.1 Measurement System Diagram



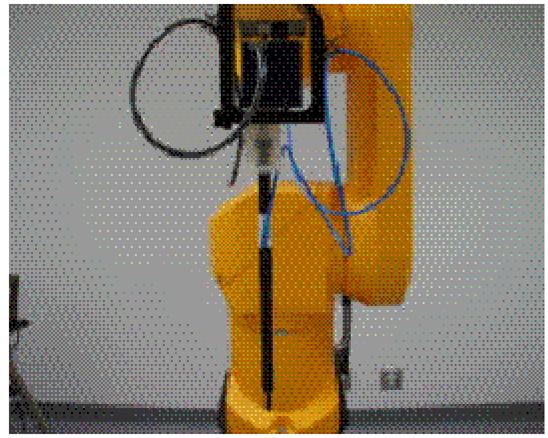
The DASY3 system for performing compliance tests consist of the following items:

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.

4.2. System Components

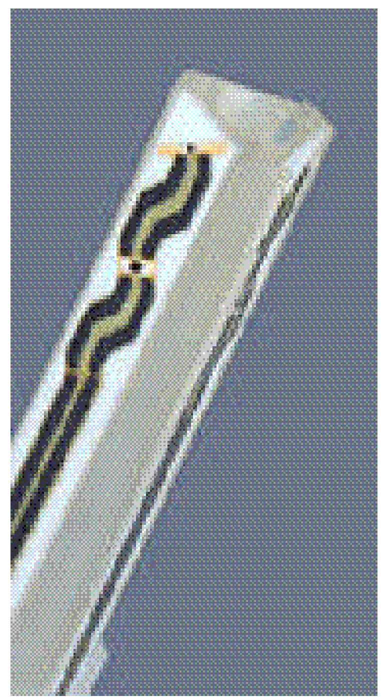
ET3DV6 Probe Specification

Construction Symmetrical design with triangular core
Built-in optical fiber for surface detection System
Built-in shielding against static charges
Calibration In air from 10 MHz to 2.5 GHz
In brain and muscle simulating tissue at
Frequencies of 450 MHz, 900 MHz and
1.8 GHz (accuracy ± 8%)
Frequency 10 MHz to > 6 GHz; Linearity: ± 0.2 dB
(30 MHz to 3 GHz)
Directivity ± 0.2 dB in brain tissue (rotation around
probe axis)
± 0.4 dB in brain tissue (rotation normal probe axis)
Dynamic 5 mW/g to > 100 mW/g;
Range Linearity: ± 0.2 dB
Surface ± 0.2 mm repeatability in air and clear liquids
Detection over diffuse reflecting surfaces.
Dimensions Overall length: 330 mm
Tip length: 16 mm
Body diameter: 12 mm
Tip diameter: 6.8 mm
Distance from probe tip to dipole centers: 2.7 mm
Application General dosimetric up to 3 GHz
Compliance tests of mobile phones
Fast automatic scanning in arbitrary phantoms



Photograph of the probe

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	s
	-Density	?

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: $$E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

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) 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.

$$SAR = (E_{tot})^2 ?s /(? ?1000)$$

With SAR = local specific absorption rate in mW/g
E_{tot} = total field strength in V/m
s = conductivity in [mho/m] or [Siemens/m]
? = 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.

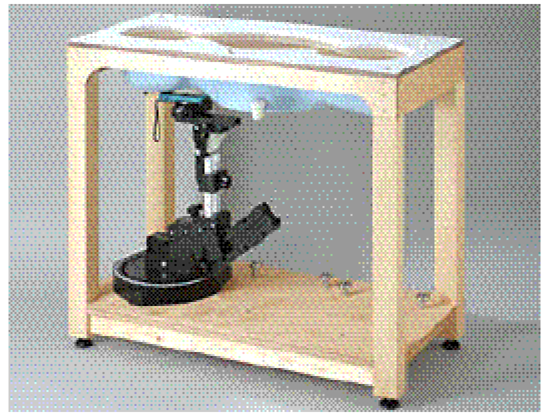
The power flow density is calculated assuming the excitation field as a free space field.

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

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)

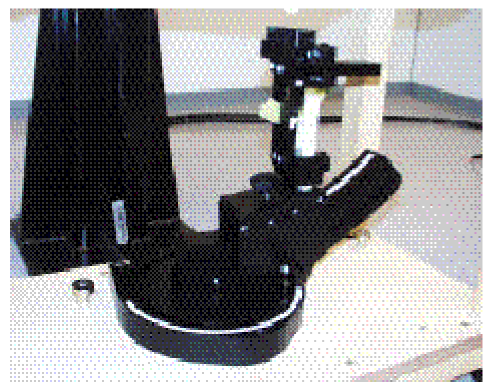


Generic Twin Phantom

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

4.3 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 %.	/

5 - EVALUATION PROCEDURE

5.1 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.

5.2 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).

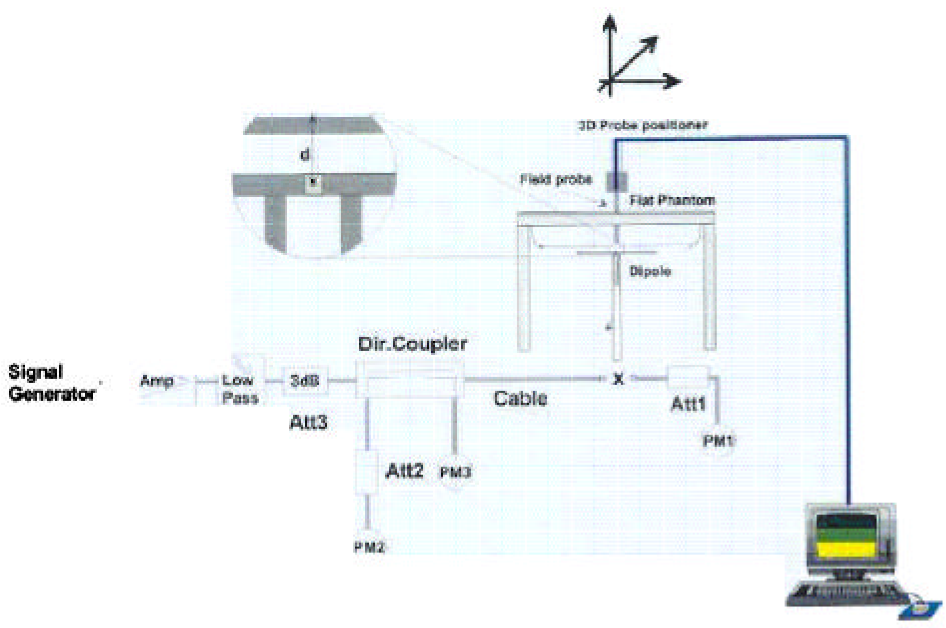
Population/uncontrolled environments Partial-body limit 1.6W/kg applied to the EUT.

5.3 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:

5.4 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.

5.5 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 recomme nded 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 (835 MHz)

Validation Measurement	SAR @ 0.025W Input averaged over 1g	SAR @ 1W Input averaged over 1g	SAR @ 0.025W Input averaged over 10g	SAR @ 1W Input averaged over 10g
Test 1	0.222	8.88	0.112	4.48
Test 2	0.221	8.84	0.111	4.44
Test 3	0.222	8.88	0.112	4.48
Test 4	0.220	8.80	0.111	4.44
Test 5	0.223	8.92	0.113	4.52
Test 6	0.222	8.88	0.115	4.60
Test 7	0.221	8.84	0.114	4.56
Test 8	0.222	8.88	0.114	4.56
Test 9	0.223	8.92	0.113	4.52
Test 10	0.222	8.88	0.112	4.48
Average	0.2218	8.872	0.1127	4.51

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

5.6 Liquid Measurement Result

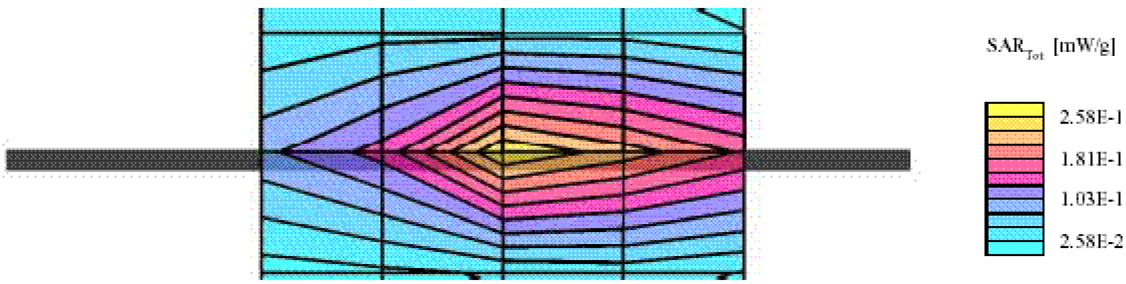
Simulant	Freq [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation	Limits [%]
Body	835	e_r	24.0	55.2	54.5	1.3	±5
		s	24.0	0.97	0.98	-1.03	±5
		SAR (1g)	24.0	8.872	8.84	0.36	±10
Body	1900	e_r	23.0	53.3	53.9	-1.13	±5
		s	23.0	1.52	1.46	3.9	±5
		SAR (1 g)	23.0	24.97	24.60	1.48	±10

e_r = relative permittivity, s = conductivity and ?=1000kg/m^3

Input power = 25.12mW for PMS, Forward power = 125.90mW for PCS

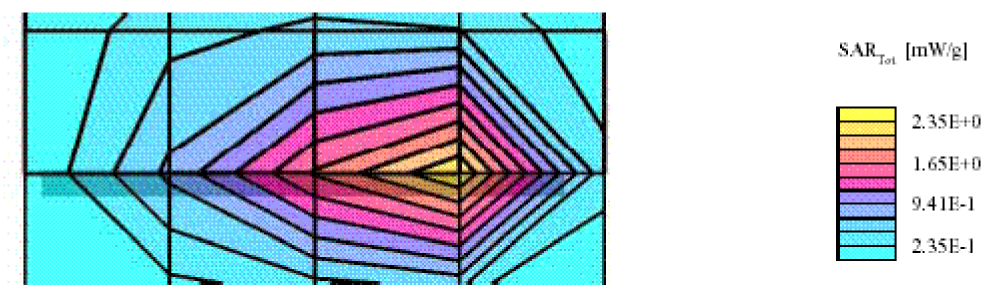
System Validation 835 MHz

SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 835 MHz
Probe: ET3DV6 - SN1604; ConvF(6.40,6.40,6.40); Crest factor: 1.0; Body 835 MHz: σ = 0.98 mho/m ε_r = 54.5 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 0.222 mW/g, SAR (10g): 0.112 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.02 dB



System Validation 1900 MHz (24 Deg, 10/19/02)

SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 1900 MHz
Probe: ET3DV6 - SN1604; ConvF(4.90,4.90,4.90); Crest factor: 1.0; Body 1900MHz: σ = 1.46 mho/m ε_r = 53.9 ρ = 1.00 g/cm³
Cubes (3): SAR (1g): 3.10 mW/g ± 0.13 dB, SAR (10g): 1.42 mW/g ± 0.01 dB, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.02 dB



6 - 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.

6.1 SAR Body-Worn Worst-Case Test Data

Ambient Temperature (ºC): 23.4
Relative Humidity%): 49.3
All output power values were EIRP for PCS and PMS, which were measured by using substitution method in accordance with ANSI C63.4-2000.

Host	Position	Ch	EIRP (dBm)	Worst case SAR, averaged over 1g [mW/g]			
				Setup condition (applicable checked)		Measured	Limit
				Antenna	Phantom		
PMS							
Compaq ipaq 3650	Body	825	20.92	Built-in	EUT Back Side direct touch phantom	0.367	1.6
	Body	835	21.33			0.436	1.6
	Body	845	21.86			0.571	1.6
Compaq ipaq 3850	Body	825	21.05	Built-in	EUT Back Side direct touch phantom	0.384	1.6
	Body	835	21.63			0.371	1.6
	Body	845	21.19			0.327	1.6
Compaq ipaq 3870	Body	825	21.04	Built-in	EUT Back Side direct touch phantom	0.255	1.6
	Body	835	21.33			0.311	1.6
	Body	845	20.95			0.317	1.6
Dell PPo1L	Body	825	21.14	Built-in	EUT Back Side direct touch phantom	0.218	1.6
	Body	835	21.86			0.162	1.6
	Body	845	20.92			0.250	1.6
HP T18. 033.C.00	Body	825	21.42	Built-in	EUT Back Side direct touch phantom	0.363	1.6
	Body	835	21.73			0.348	1.6
	Body	845	20.95			0.725	1.6
IBM 1161	Body	825	22.35	Built-in	EUT Back Side direct touch phantom	0.369	1.6
	Body	835	21.63			0.538	1.6
	Body	845	22.09			0.457	1.6
PCS							
Compaq ipaq 3650	Body	1850	20.17	Built-in	EUT Back Side direct touch phantom	1.05	1.6
	Body	1880	20.96			1.05	1.6
	Body	1905	21.2			1.05	1.6
Compaq ipaq 3850	Body	1850	20.23	Built-in	EUT Back Side direct touch phantom	1.05	1.6
	Body	1880	20.44			1.04	1.6
	Body	1905	20.6			0.997	1.6
Compaq ipaq 3870	Body	1850	20.6	Built-in	EUT Back Side direct touch phantom	1.05	1.6
	Body	1880	20.1			1.03	1.6
	Body	1905	21.2			1.00	1.6
Dell PPo1L	Body	1850	22.1	Built-in	EUT Back Side direct touch phantom	0.504	1.6
	Body	1880	21.7			0.512	1.6
	Body	1905	23.1			0.515	1.6
HP T18. 033.C.00	Body	1850	21.1	Built-in	EUT Back Side direct touch phantom	0.415	1.6
	Body	1880	22.3			0.419	1.6
	Body	1905	21.7			0.416	1.6
IBM 1161	Body	1850	20.45	Built-in	EUT Back Side direct touch phantom	0.476	1.6
	Body	1880	20.27			0.475	1.6
	Body	1905	21.06			0.478	1.6

6.2 Plots of Test Result

Appendix A - Plots of SAR test data
Appendix B - Plots of SAR test data for Z-Axis at 835MHz and 1900MHz.

7 - OUTPUT POWER MEASUREMENT

7.1 Test Equipment

Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter
A.H. System SAS0200 Horn Antenna
Com-Power AB-100 Dipole Antenna

7.2 Substitution Measurement

1. On a test site, the EUT shall be placed on a wooden turn-table.
2. The test antenna shall be oriented initially for vertical polarization located 3m from EUT.
3. The output of the test antenna shall be connected to the measuring receiver.
4. The transmitter (EUT) shall be switched on.
5. The test antenna shall be raised and lowered until a maximum signal level is detected by the measuring receiver.
6. The transmitter shall then rotated through 360 in the horizontal plane, until the maximum Signal level is detected by the measuring receiver.
7. The test antenna shall be raised and lowered again until a maximum signal level is detected and noted.
8. The EUT shall be replaced by a substitution antenna (dipole for EIRP, or horn for EIRP)The substitution antenna shall be orientated for vertical polarization.
9. The substitution antenna shall be connected to a signal generator.
10. The test antenna shall be raised and lowered to ensure that the maximum signal is received.
11. Then the input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, which is equal to the level noted while the transmitter radiated power was measured.
12. The input level to the substitution antenna shall be recorded as power level in dBm.
13. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.
14. The measure of the radiated power is the large of the two levels recorded, at the input to the substitution antenna, corrected for both substitution antenna gain and cable loss.

7.3 Test Result

021015B1.Gtran R0207165 EUT : GPC6210 Support Equipment : IBM Notebook

825MHz (PMS, Low CH.)

Indicated		Table	Test Antenna		Substituted	Substitution Antenna			Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wavel.	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
825	121.3	90	1.2	v	825	20.55	18	v	1.5	v	2.1	0.3	22.35			
825	115.4	120	1	h	825		18	h	1.5	h	2.1	0.3				

835MHz (PMS, Mid CH.)

Indicated		Table	Test Antenna		Substituted	Substitution Antenna			Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wavel.	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
835	120.8	0	1.2	v	835	19.83	18	v	1.5	v	2.1	0.3	21.63			
835	112.6	30	1	h	835		18	h	1.5	h	2.1	0.3				

845MHz (PMS, High CH.)

Indicated		Table	Test Antenna		Substituted	Substitution Antenna			Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wavel.	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
845	121	90	1.2	v	845	20.29	18	v	1.5	v	2.1	0.3	22.09			
845	107.4	110	1	h	845		18	h	1.8	h	2.1	0.3				

1855MHz (PCS, Low CH.)

Indicated		Table	Test Antenna		Substituted	Substitution Antenna			Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wavel.	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
1855	118.8	0	1.2	v	1855	14.15	8	v	1.5	v	6.8	0.5	20.45			
1855	108.9	90	1.2	h	1855		8	h	1.5	h	6.8	0.5				

1880MHz (PCS, Mid CH.)

Indicated		Table	Test Antenna		Substituted	Substitution Antenna			Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wavel.	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
1880	118.4	0	1.2	v	1880	15.23	8	v	1.5	v	6.8	0.5	20.27			
1880	110.2	130	1.2	h	1880		8	h	1.5	h	6.8	0.5				

1905MHz (PCS, High CH.)

Indicated		Table	Test Antenna		Substituted	Substitution Antenna			Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wavel.	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
1905	120.2	90	1	v	1905	14.76	8	v	1.5	v	6.8	0.5	21.06			
1905	113.3	90	1.2	h	1905		8	h	1.8	h	6.8	0.5				

021015B2.Gtran R0207165 R0207165 GPC6210 Support Equipment : Dell Notebook PC

825MHz (PMS, Low CH.)

Indicated		Table	Test Antenna		Substituted	Substitution Antenna			Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wavel.	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
825	120.3	180	1.2	v	825	19.34	18	v	1.5	v	2.1	0.3	21.14			
825	114.5	150	1	h	825		18	h	1.5	h	2.1	0.3				

835MHz (PMS, Mid CH.)

Indicated		Table	Test Antenna		Substituted	Substitution Antenna			Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wavel.	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
835	120.9	0	1.2	v	835	20.06	18	v	1.5	v	2.1	0.3	21.86			
835	118.7	30	1	h	835		18	h	1.5	h	2.1	0.3				

845MHz (PMS, High CH.)

Indicated		Table	Test Antenna		Substituted	Substitution Antenna			Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wavel.	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
845	119.1	90	1.2	v	845	19.12	18	v	1.5	v	2.1	0.3	20.92			
845	109.6	110	1	h	845		18	h	1.8	h	2.1	0.3				

1855MHz (PCS, Low CH.)

Indicated		Table	Test Antenna		Substituted	Substitution Antenna			Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wavel.	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
1855	121.5	270	1.2	v	1855	15.8	8	v	1.5	v	6.8	0.5	22.1			
1855	117.2	310	1	h	1855		8	h	1.5	h	6.8	0.5				

1880MHz (PCS, Mid CH.)

Indicated		Table	Test Antenna		Substituted	Substitution Antenna			Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wavel.	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
1880	121.2	230	1.2	v	1880	15.4	8	v	1.5	v	6.8	0.5	21.7			
1880	115.8	210	1	h	1880		8	h	1.5	h	6.8	0.5				

1905MHz (PCS, High CH.)

Indicated		Table	Test Antenna		Substituted	Substitution Antenna			Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wavel.	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
1905	123.9	30	1.2	v	1905	16.8	8	v	1.5	v	6.8	0.5	23.1			
1905	117.5	90	1	h	1905		8	h	1.8	h	6.8	0.5				

02101583/Gtran R0207165 EUT : GPC6210 Support Equipment : HP Notebook PC

825MHz (PMS, Low CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wavel.	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
825	120.5	90	1.5	v	825	19.62	18	v	1.5	v	2.1	0.3	21.42			
825	112.6	30	1.5	h	825		18	h	1.5	h	2.1	0.3				

835MHz (PMS, Mid CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wavel.	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
835	120.8	180	1.5	v	835	19.93	18	v	1.5	v	2.1	0.3	21.73			
835	114.5	150	1.2	h	835		18	h	1.5	h	2.1	0.3				

845MHz (PMS, High CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wavel.	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
845	119.4	290	1.2	v	845	19.15	18	v	1.5	v	2.1	0.3	20.95			
845	108.3	330	1.2	h	845		18	h	1.8	h	2.1	0.3				

1855MHz (PCS, Low CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wavel.	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
1855	120.8	330	1.2	v	1855	14.8	8	v	1.5	v	6.8	0.5	21.1			
1855	114.3	0	1.2	h	1855		8	h	1.5	h	6.8	0.5				

1880MHz (PCS, Mid CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wavel.	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
1880	121.9	270	1.2	v	1880	16	8	v	1.5	v	6.8	0.5	22.3			
1880	114.6	0	1.2	h	1880		8	h	1.5	h	6.8	0.5				

1905MHz (PCS, High CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wavel.	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
1905	121.2	90	1	v	1905	15.4	8	v	1.5	v	6.8	0.5	21.7			
1905	114.3	30	1.2	h	1905		8	h	1.8	h	6.8	0.5				

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825MHz (PMS, Low CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wave	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
825	119.1	160	1.2	v	825	19.12	18	v	1.5	v	2.1	0.3	20.92			
825	108.4	130	1	h	825		18	h	1.5	h	2.1	0.3				

835MHz (PMS, Mid CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wave	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
835	120.6	0	1.2	v	835	19.53	18	v	1.5	v	2.1	0.3	21.33			
835	113.5	30	1	h	835		18	h	1.5	h	2.1	0.3				

845MHz (PMS, High CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wave	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
845	120.9	90	1.2	v	845	20.06	18	v	1.5	v	2.1	0.3	21.86			
845	114.7	110	1	h	845		18	h	1.8	h	2.1	0.3				

1855MHz (PCS, Low CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wave	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
1855	118.2	90	1.2	v	1855	13.87	8	v	1.5	v	6.8	0.5	20.17			
1855	110.7	270	1.5	h	1855		8	h	1.5	h	6.8	0.5				

1880MHz (PCS, Mid CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wave	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
1880	119.3	0	1.2	v	1880	14.66	8	v	1.5	v	6.8	0.5	20.96			
1880	115.4	90	1.2	h	1880		8	h	1.5	h	6.8	0.5				

1905MHz (PCS, High CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Half-wave	Polar	Height	Polar	Gain	Loss	Level	Emissions		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	cm	H/V	Meter	H/V	Correction	dB	dBm	dB	dBm	dB
1905	120.5	0	1	v	1905	14.9	8	v	1.5	v	6.8	0.5	21.2			
1905	116.9	30	1.2	h	1905		8	h	1.8	h	6.8	0.5				

021015B5.Gtran R0207165 EUT : GPC6210 Support Equipment : IPAQ 3850

825MHz (PMS, Low CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Half-wavel. cm	Polar H/V	Height Meter	Polar H/V	Gain Correction	Loss dB	Level dBm	Emissions dB	dBm	dB
825	119.7	90	1.2	v	825	19.25	18	v	1.5	v	2.1	0.3	21.05			
825	115.4	120	1	h	825		18	h	1.5	h	2.1	0.3				

835MHz (PMS, Mid CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Half-wavel. cm	Polar H/V	Height Meter	Polar H/V	Gain Correction	Loss dB	Level dBm	Emissions dB	dBm	dB
835	120.8	0	1.2	v	835	19.83	18	v	1.5	v	2.1	0.3	21.63			
835	112.6	30	1	h	835		18	h	1.5	h	2.1	0.3				

845MHz (PMS, High CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Half-wavel. cm	Polar H/V	Height Meter	Polar H/V	Gain Correction	Loss dB	Level dBm	Emissions dB	dBm	dB
845	120.4	90	1.2	v	845	19.39	18	v	1.5	v	2.1	0.3	21.19			
845	107.4	110	1	h	845		18	h	1.8	h	2.1	0.3				

1855MHz (PCS, Low CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Half-wavel. cm	Polar H/V	Height Meter	Polar H/V	Gain Correction	Loss dB	Level dBm	Emissions dB	dBm	dB
1855	118.7	0	1.2	v	1855	13.93	8	v	1.5	v	6.8	0.5	20.23			
1855	108.9	90	1.2	h	1855		8	h	1.5	h	6.8	0.5				

1880MHz (PCS, Mid CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Half-wavel. cm	Polar H/V	Height Meter	Polar H/V	Gain Correction	Loss dB	Level dBm	Emissions dB	dBm	dB
1880	118.9	0	1.2	v	1880	14.14	8	v	1.5	v	6.8	0.5	20.44			
1880	110.2	130	1.2	h	1880		8	h	1.5	h	6.8	0.5				

1905MHz (PCS, High CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Half-wavel. cm	Polar H/V	Height Meter	Polar H/V	Gain Correction	Loss dB	Level dBm	Emissions dB	dBm	dB
1905	119.2	90	1	v	1905	14.3	8	v	1.5	v	6.8	0.5	20.6			
1905	113.3	90	1.2	h	1905		8	h	1.8	h	6.8	0.5				

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825MHz (PMS, Low CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Half-wavd. cm	Polar H/V	Height Meter	Polar H/V	Gain Correction	Loss dB	Level dBm	Emissions dB	dBm	dB
825	120.2	310	1.2	v	825	19.24	18	v	1.5	v	2.1	0.3	21.04			
825	113.5	0	1	h	825		18	h	1.5	h	2.1	0.3				

835MHz (PMS, Mid CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Half-wavd. cm	Polar H/V	Height Meter	Polar H/V	Gain Correction	Loss dB	Level dBm	Emissions dB	dBm	dB
835	120.6	270	1.2	v	835	19.53	18	v	1.5	v	2.1	0.3	21.33			
835	109.8	240	1	h	835		18	h	1.5	h	2.1	0.3				

845MHz (PMS, High CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Half-wavd. cm	Polar H/V	Height Meter	Polar H/V	Gain Correction	Loss dB	Level dBm	Emissions dB	dBm	dB
845	119.4	0	1.2	v	845	19.15	18	v	1.5	v	2.1	0.3	20.95			
845	116.2	30	1	h	845		18	h	1.8	h	2.1	0.3				

1855MHz (PCS, Low CH.)

Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Half-wavd. cm	Polar H/V	Height Meter	Polar H/V	Gain Correction	Loss dB	Level dBm	Emissions dB	dBm	dB
1855	119.2	150	1.2	v	1855	14.3	8	v	1.5	v	6.8	0.5	20.6			
1855	106.9	150	1.2	h	1855		8	h	1.5	h	6.8	0.5				

1880MHz (PCS, Mid CH.)

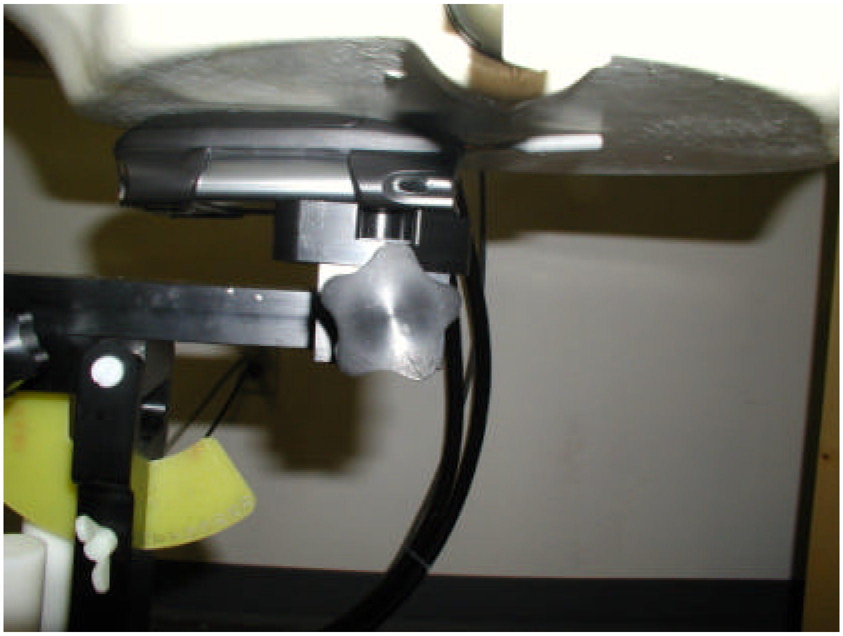
Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Half-wavd. cm	Polar H/V	Height Meter	Polar H/V	Gain Correction	Loss dB	Level dBm	Emissions dB	dBm	dB
1880	118.7	180	1.2	v	1880	13.8	8	v	1.5	v	6.8	0.5	20.1			
1880	112.5	270	1.2	h	1880		8	h	1.5	h	6.8	0.5				

1905MHz (PCS, High CH.)

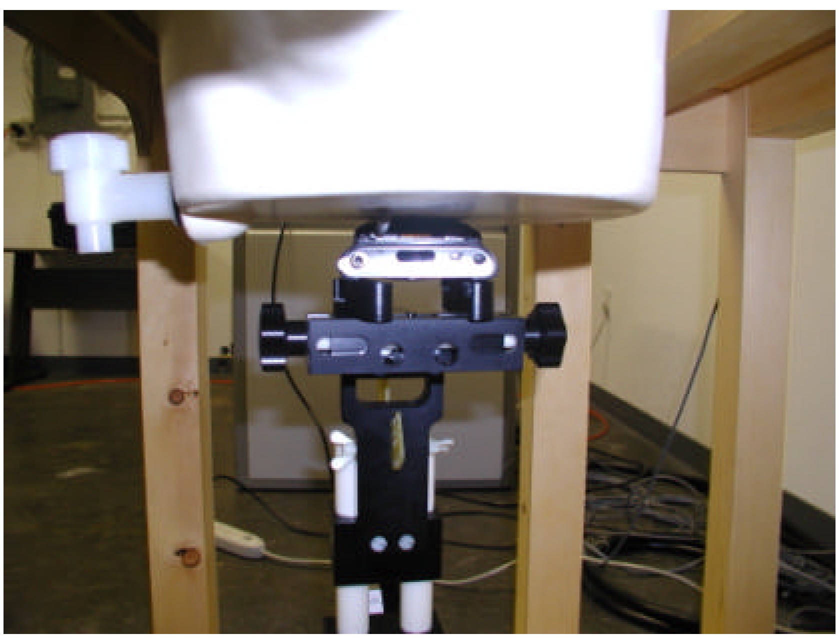
Indicated		Table	Test Antenna		Substituted		Substitution Antenna		Test Antenna		Antenna	Cable	Absolute	Spurious	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Half-wavd. cm	Polar H/V	Height Meter	Polar H/V	Gain Correction	Loss dB	Level dBm	Emissions dB	dBm	dB
1905	120.5	180	1.2	v	1905	14.9	8	v	1.5	v	6.8	0.5	21.2			
1905	115.3	210	1.2	h	1905		8	h	1.8	h	6.8	0.5				

EXHIBIT A - SAR SETUP PHOTOGRAPHS

IPAQ 3650 - Front View

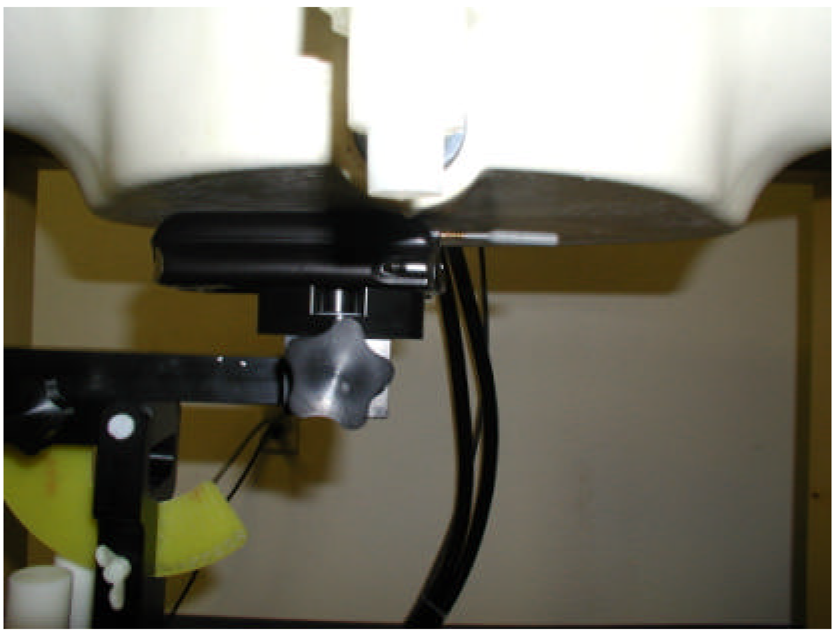


IPAQ 3650 - Left View

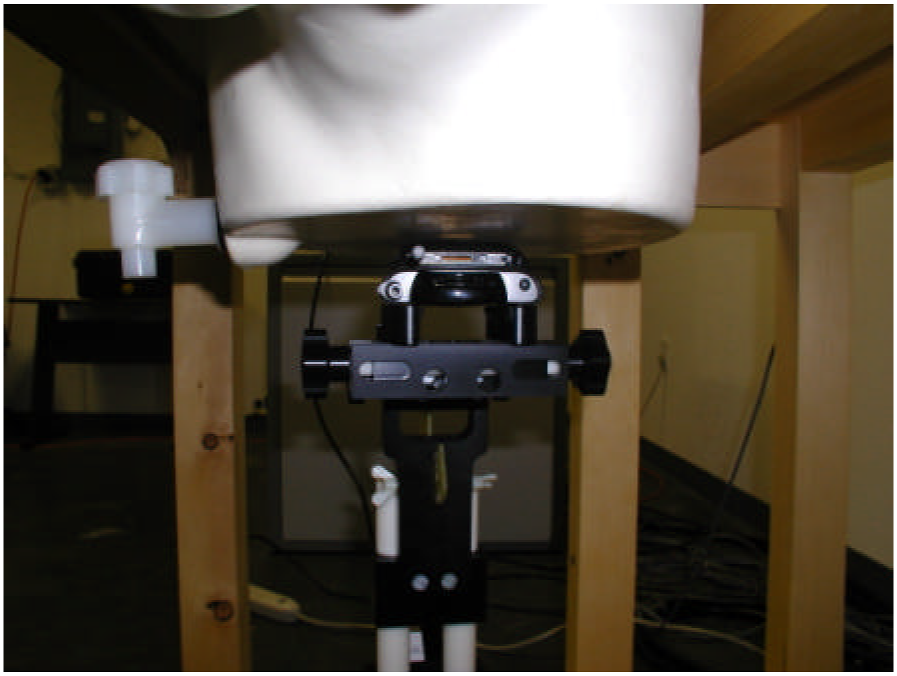


IPAQ 3650 - Rear View

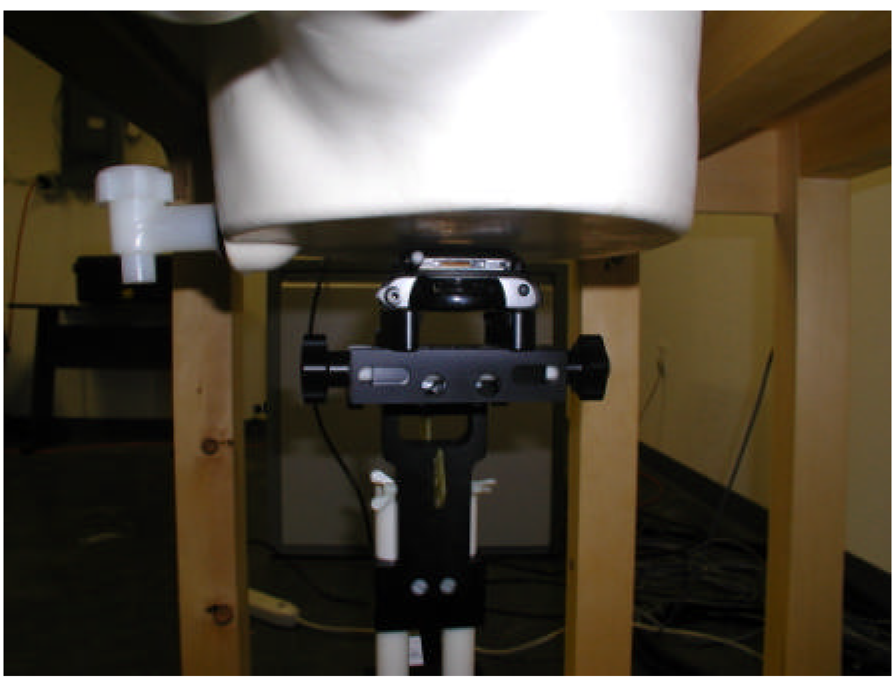
IPAQ 3850 - Front View



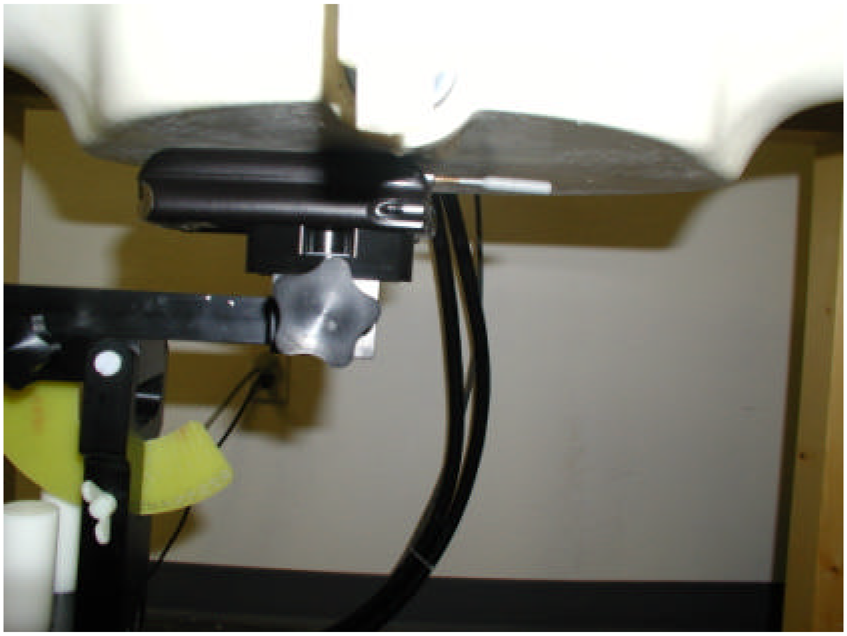
IPAQ 3850 - Left View



IPAQ 3850 - Right View



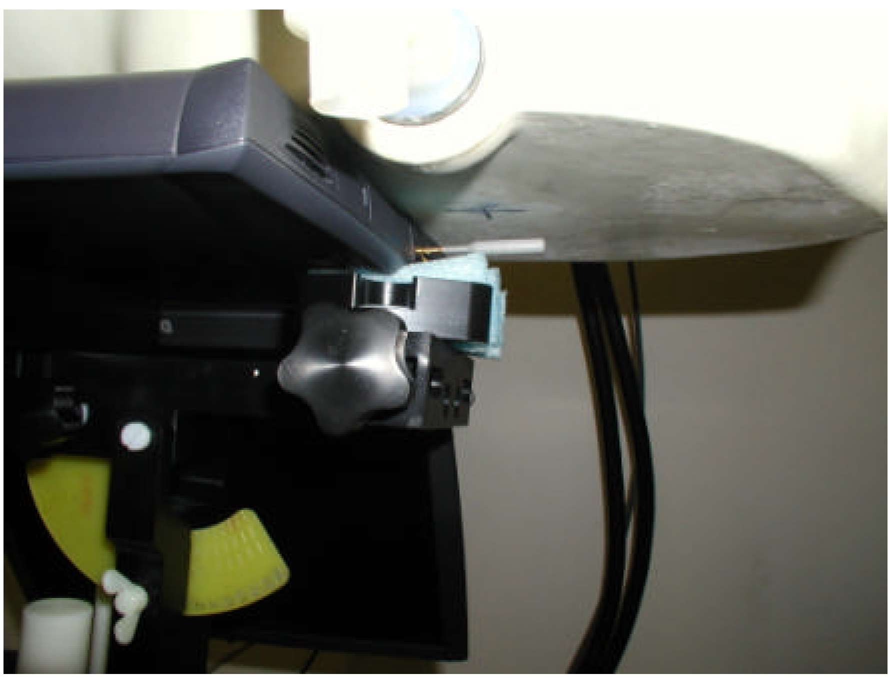
IPAQ 3870 - Front View



IPAQ 3870 - Left View

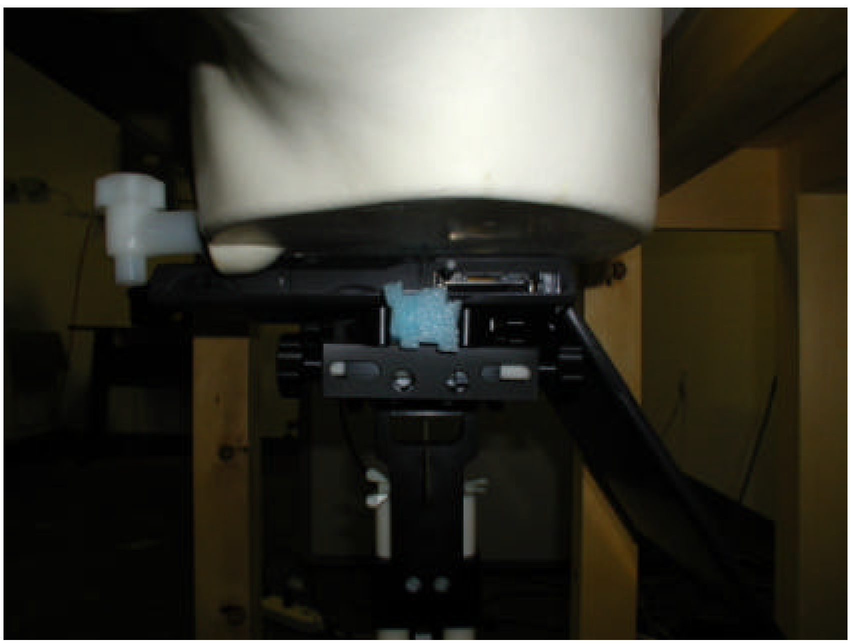
IPAQ 3870 - Rear View

Dell - Front View



Dell - Rear View

Dell - Right View

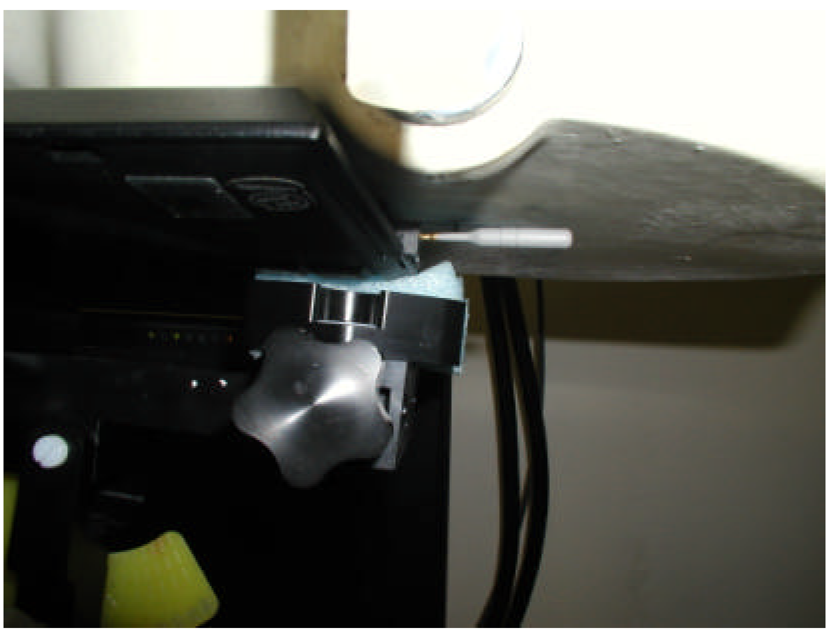


HP - Front View

HP - Rear View

HP - Right View

IBM 1161 - Front View



IBM 1161 - Rear View

IBM 1161 - Right View

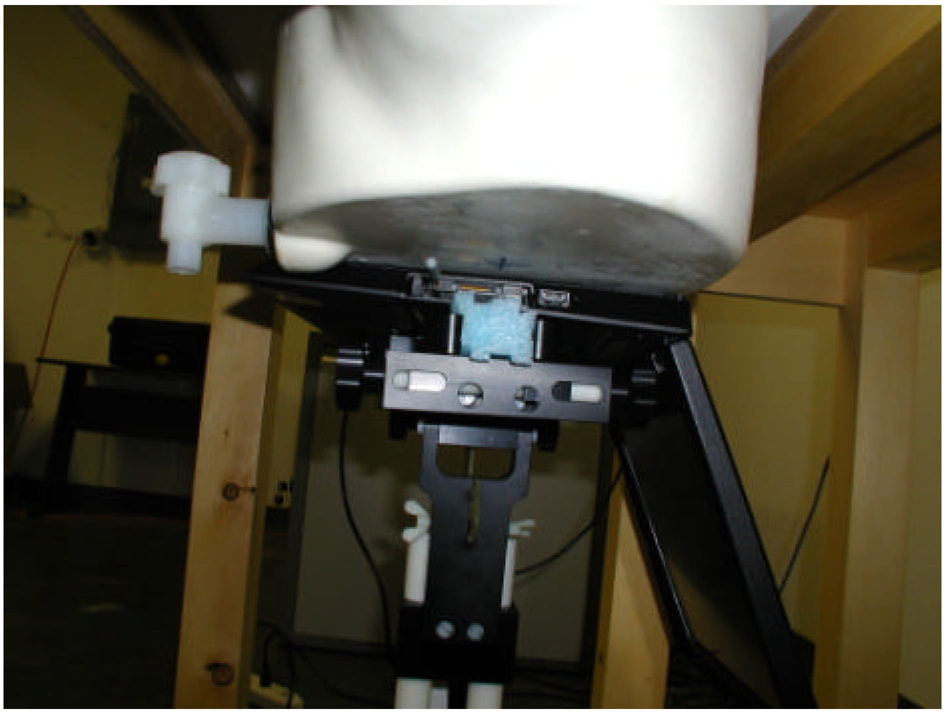


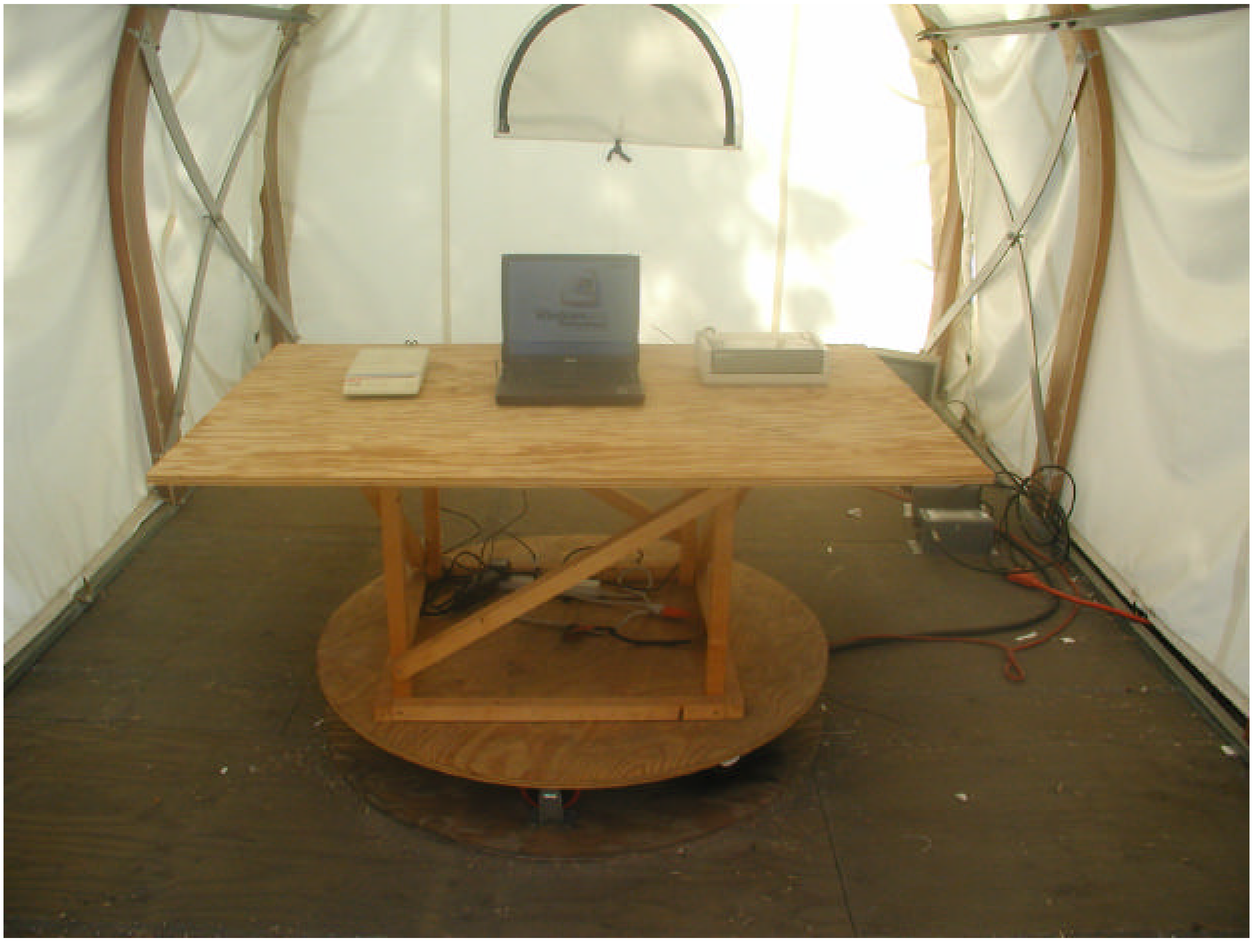
EXHIBIT B - OUTPUT POWER TEST SETUP PHOTOGRAPHS

IPAQ 3650 Setup

IPAQ 3850 Setup

IPAQ 3870 Setup

Dell Setup



HP Setup

IBM Setup

Substitution Antenna

Test Antenna