

SAR EVALUATION REPORT

For

GTRAN Wireless, Inc.

9605 Scranton Road, Suite 300
San Diego, CA 92121

FCC ID: PL5GPC-6210

August 1, 2002

This Report Concerns: ☒ Original Report	Equipment Type: Wireless Data Terminal
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Report No.: R0207165S	
Test Date: July 26, 2002	
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TABLE OF CONTENTS

SUMMARY.....	4
1 - REFERENCE.....	5
2 - TESTING EQUIPMENT.....	6
2.1 EQUIPMENTS LIST & CALIBRATION INFO.....	6
2.2 IEEE SCC-34/SC-2 P1528 RECOMMENDED TISSUE DIELECTRIC PARAMETERS	7
2.3 EQUIPMENT CALIBRATION CERTIFICATE	7
3 - EUT DESCRIPTION.....	14
4 - DOSIMETRIC ASSESSMENT SETUP.....	15
4.1 MEASUREMENT SYSTEM DIAGRAM	16
4.2. SYSTEM COMPONENTS	17
4.3 MEASUREMENT UNCERTAINTY	21
5 - EVALUATION PROCEDURE.....	22
5.1 SIMULATED TISSUE LIQUID PARAMETER CONFIRMATION	22
5.2 SYSTEM ACCURACY VERIFICATION	22
5.3 SAR EVALUATION PROCEDURE.....	23
5.4 EXPOSURE LIMITS.....	24
6 - TEST RESULTS	25
6.1 SAR BODY-WORN WORST-CASE TEST DATA	25
6.2 PLOTS OF TEST RESULT	26
EXHIBIT A - SAR SETUP PHOTOGRAPHS	27
W/ IPAQ FRONT VIEW	27
W/ IPAQ LEFT VIEW.....	27
W/ IPAQ RIGHT VIEW.....	28
W/ LAPTOP FRONT VIEW	28
W/ LAPTOP LEFT VIEW	29
W/ LAPTOP SIDE VIEW.....	29
EXHIBIT B - EUT PHOTOGRAPHS.....	30
CHASSIS - FRONT VIEW	30
CHASSIS - BACK VIEW	30
MAIN BOARD - COMPONENT VIEW	31
MAIN BOARD - SOLDER VIEW	31
EXHIBIT C - SUPPORT EQUIPMENT PHOTOGRAPHS.....	32
APPENDIX A - PLOTS OF SAR TEST DATA FOR COMPAQ IPAQ 3650 AT 835MHZ AND 1900MHZ	33
APPENDIX B - PLOTS OF SAR TEST DATA FOR COMPAQ IPAQ 3850 AT 835MHZ AND 1900MHZ.....	39
APPENDIX C - PLOTS OF SAR TEST DATA FOR COMPAQ IPAQ 3870 AT 835MHZ AND 1900MHZ	45
APPENDIX D - PLOTS OF SAR TEST DATA FOR DELL PPO1L AT 835MHZ AND 1900MHZ.....	51
APPENDIX E - PLOTS OF SAR TEST DATA FOR HP T18.033.C.00 AT 835MHZ AND 1900MHZ.....	57
APPENDIX F - PLOTS OF SAR TEST DATA FOR HOST OF IBM 1161 AT 835MHZ AND 1900MHZ	63
APPENDIX G - PLOTS OF SAR TEST DATA FOR DIPOLE VALIDATION AT 835MHZ AND 1900MHZ	69
APPENDIX H - PLOTS OF SAR TEST DATA FOR Z-AXIS AT 835MHZ AND 1900MHZ	71
APPENDIX I - PLOTS OF OUTPUT POWER FOR COMPAQ IPAQ 3650	73
APPENDIX J - PLOTS OF OUTPUT POWER FOR COMPAQ IPAQ 3850.....	74
APPENDIX K - PLOTS OF OUTPUT POWER FOR COMPAQ IPAQ 3870.....	75

APPENDIX L - PLOTS OF OUTPUT POWER FOR DELL PPO1L.....	76
APPENDIX M - PLOTS OF OUTPUT POWER FOR HP T18.033.C.00	77
APPENDIX N - PLOTS OF OUTPUT POWER FOR IBM 1161	78

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.

The investigation was limited to the worst-case scenario from the device usage point of view. For the clarity of data analysis, and clarity of presentation, only one tissue simulation was used for the head and body simulation. This means that if SAR was found at the headset position, the magnitude of SAR would be overestimated comparing to SAR to a headset placed in the ear region.

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, Office of Engineering & Technology, Washington, DC, 1997.
- [3] Thomas Schmid, Oliver Egger, and Niels Kuster, "Automated E-field scanning system for dosimetric assessments", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp. 105-113, Jan. 1996.
- [4] Niels Kuster, Ralph Kastle, and Thomas Schmid, "Dosimetric evaluation of mobile communications equipment with known precision", IEEE 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.
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- [9] Volker Hombach, Klaus Meier, Michael Burkhardt, Eberhard Kuhn, and Niels Kuster, "The dependence 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.
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- [12] W. H. Press, S. A. Teukolsky, W. T. Vetterling, and B. P. Flannery, Numerical Recipes 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 uncertainty 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	6/01	456
SPEAG E-Field Probe ET3DV6	9/7/01	1604
SPEAG Dummy Probe	N/A	N/A
SPEAG Generic Twin Phantom	N/A	N/A
SPEAG Light Alignment Sensor	N/A	278
SPEAG Validation Dipole D-1800-S-2	11/6/01	BCL-049
SPEAG Validation Dipole D900V2	9/3/01	122
Brain Equivalent Matter (800MHz)	Daily	N/A
Brain Equivalent Matter (1900MHz)	Daily	N/A
Muscle Equivalent Matter (800MHz)	Daily	N/A
Muscle Equivalent Matter (1900MHz)	Daily	N/A
Robot Table	N/A	N/A
Phone Holder	N/A	N/A
Phantom Cover	N/A	N/A
HP Spectrum Analyzer HP8593GM	6/20/01	3009A00791
Microwave Amp. 8349B	N/A	2644A02662
Power Meter HP436A	4/2/01	2709A29209
Power Sensor HP8482A	4/2/01	2349A08568
Signal Generator RS SMIQ O3	2/10/01	1084800403
Network Analyzer HP-8753ES	7/30/01	820079
Dielectric Probe Kit HP85070A	N/A	N/A

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

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

2.3 Equipment Calibration Certificate

Following is evaluated numbers for body tissue provided by the manufacturer.

PROBE: ET3DV6 - SN:1604

measured ConvF in head tissue at 900 MHz -> ConvF=6.52

measured ConvF in head tissue at 1800 MHz -> ConvF=5.52

tissue	f(MHz)	eps	sigma	ConvF $\pm$ st.dev.
BODY	835	55.2 $\pm$ 5%	0.97 $\pm$ 5%	6.4 $\pm$ 8%
BODY	1900	53.3 $\pm$ 5%	1.52 $\pm$ 5%	4.9 $\pm$ 8%

Please see the attached file for more 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:

Marie Kaya

ET3DV6 SN:1604

August 26, 2002

DASY3 - Parameters of Probe: ET3DV6 SN:1604**Sensitivity in Free Space****Diode Compression**

NormX	1.73 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	93	mV
NormY	1.68 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	93	mV
NormZ	1.72 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	93	mV

Sensitivity in Tissue Simulating Liquid

Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\% \text{ mho/m}$
Head	835 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\% \text{ mho/m}$
ConvF X	6.5 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	6.5 $\pm 9.5\%$ (k=2)	Alpha	0.36
ConvF Z	6.5 $\pm 9.5\%$ (k=2)	Depth	2.82
Head	1800 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\% \text{ mho/m}$
Head	1900 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\% \text{ mho/m}$
ConvF X	5.5 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	5.5 $\pm 9.5\%$ (k=2)	Alpha	0.50
ConvF Z	5.5 $\pm 9.5\%$ (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 $\pm$ 0.2	mm

Frequency	ϵ'	ϵ''
700000000.0000	55.8228	22.1070
704000000.0000	55.8069	22.0670
708000000.0000	55.6674	22.1232
712000000.0000	55.6457	22.0764
716000000.0000	55.5904	22.1045
720000000.0000	55.5744	22.0556
724000000.0000	55.5436	22.0676
728000000.0000	55.5359	21.9813
732000000.0000	55.5128	21.9026
736000000.0000	55.4842	21.8320
740000000.0000	55.5522	21.8217
744000000.0000	55.4789	21.8160
748000000.0000	55.4323	21.7739
752000000.0000	55.3610	21.6491
756000000.0000	55.3940	21.6504
760000000.0000	55.3905	21.5273
764000000.0000	55.3407	21.5405
768000000.0000	55.2757	21.4252
772000000.0000	55.2600	21.3802
776000000.0000	55.3027	21.3390
780000000.0000	55.2339	21.3254
784000000.0000	55.2012	21.2524
788000000.0000	55.1419	21.2812
792000000.0000	55.0503	21.2436
796000000.0000	55.0239	21.2148
800000000.0000	54.9258	21.2321
804000000.0000	54.8471	21.2490
808000000.0000	54.7803	21.2511
812000000.0000	54.6930	21.2550
816000000.0000	54.7361	21.2460
820000000.0000	54.6441	21.2800
824000000.0000	54.6044	21.3681
828000000.0000	54.5172	21.3371
832000000.0000	54.4828	21.3192
836000000.0000	54.4473	21.3737
840000000.0000	54.3851	21.3085
844000000.0000	54.3766	21.3175
848000000.0000	54.3316	21.3150
852000000.0000	54.2955	21.2859
856000000.0000	54.2950	21.2643

860000000.0000	54.2752	21.2223
864000000.0000	54.2943	21.1462
868000000.0000	54.2708	21.1199
872000000.0000	54.2147	21.0333
876000000.0000	54.2216	20.9734
880000000.0000	54.1765	20.9600
884000000.0000	54.2683	20.9265
888000000.0000	54.2298	20.8535
892000000.0000	54.2140	20.7895
896000000.0000	54.2961	20.6703
900000000.0000	54.3061	20.6436

Frequency	ϵ	
1700000000.0000	54.4221	13.5196
1706000000.0000	54.3133	13.4895
1712000000.0000	54.2990	13.4789
1718000000.0000	54.2501	13.4249
1724000000.0000	54.1843	13.4103
1730000000.0000	54.1357	13.3730
1736000000.0000	54.0602	13.3733
1742000000.0000	54.0277	13.4101
1748000000.0000	53.9734	13.4302
1754000000.0000	53.9618	13.5147
1760000000.0000	53.9242	13.5368
1766000000.0000	53.9035	13.5557
1772000000.0000	53.9154	13.6453
1778000000.0000	53.9367	13.6981
1784000000.0000	53.9566	13.7374
1790000000.0000	53.9393	13.7496
1796000000.0000	53.9036	13.7481
1802000000.0000	53.9056	13.7496
1808000000.0000	53.8591	13.7003
1814000000.0000	53.8790	13.6683
1820000000.0000	53.8525	13.6597
1826000000.0000	53.8360	13.6489
1832000000.0000	53.8236	13.5633
1838000000.0000	53.7536	13.5677
1844000000.0000	53.7145	13.4938
1850000000.0000	53.6494	13.4842
1856000000.0000	53.5798	13.4983
1862000000.0000	53.5523	13.5561
1868000000.0000	53.4641	13.6163
1874000000.0000	53.4500	13.7085
1880000000.0000	53.4281	13.7191
1886000000.0000	53.4681	13.7801
1892000000.0000	53.5001	13.8082
1898000000.0000	53.5092	13.8473
1904000000.0000	53.5673	13.8688
1910000000.0000	53.5665	13.8572
1916000000.0000	53.5687	13.9000
1922000000.0000	53.5960	13.8781
1928000000.0000	53.6163	13.8380
1934000000.0000	53.6226	13.7992

1940000000.0000	53.5950	13.7812
1946000000.0000	53.5853	13.7474
1952000000.0000	53.5821	13.6989
1958000000.0000	53.5386	13.6569
1964000000.0000	53.4976	13.6628
1970000000.0000	53.4798	13.6564
1976000000.0000	53.4929	13.6682
1982000000.0000	53.4806	13.6796
1988000000.0000	53.4594	13.7108
1994000000.0000	53.4865	13.7521
2000000000.0000	53.5345	13.8023

3 - EUT DESCRIPTION

Applicant:	GTRAN Wireless, Inc.
Product Description:	Wireless Data Terminal
Product Name:	GPC6210
FCC ID:	PL5GPC-6210
Serial Number:	None
Transmitter Frequency:	CDMA: 824~848MHz PCS: 1850~1910MHz
Maximum Output Power:	CDMA: 22.67dBm (184.93mW) PCS: 21.33dBm (135.83mW)
Dimension:	3.8" L x 2.5" W x 0.2" H approximately
RF Exposure environment:	General Population/Uncontrolled
Power Supply:	Fed by IBM Laptop Power Adapter, M/N: 02K6549
Applicable Standard	CDMA: FCC CFR 47, Part 22 PCS: FCC CFR 47, Part 24
Application Type:	Certification

¹Specific Absorption Rate (SAR) is a measure of the rate of energy absorption due to exposure to an RF transmitting source (wireless portable device).

²IEEE/ANSI Std. C95.1-1992 limits are used to determine compliance with FCC ET Docket 93-62.

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

4 - DOSIMETRIC ASSESSMENT SETUP

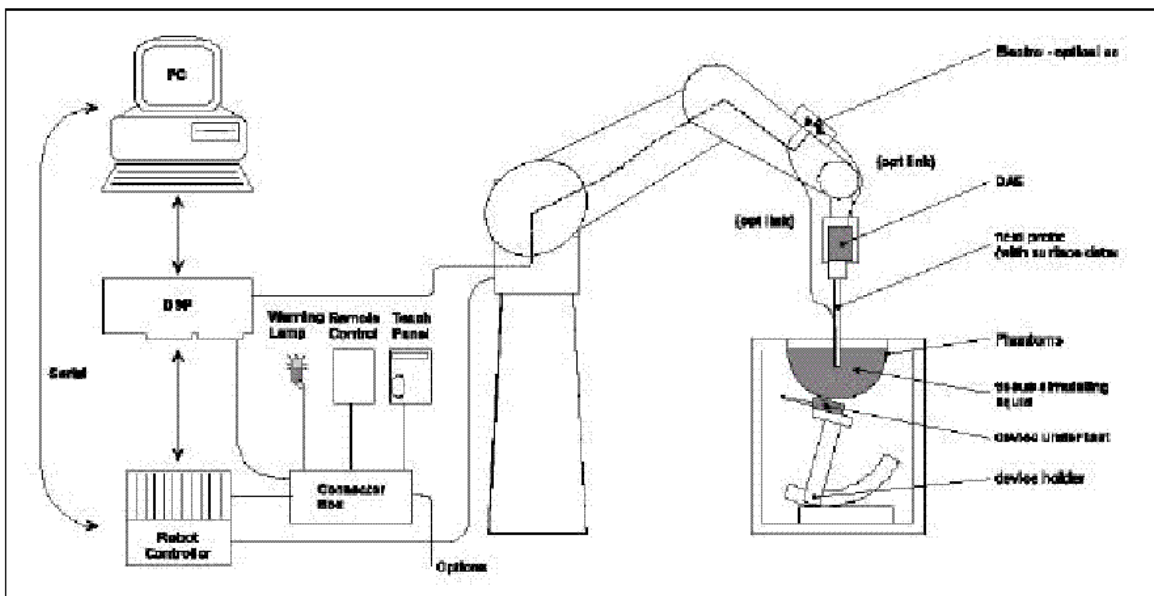
These measurements were performed with the automated near-field scanning system DASY3 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9m) which positions the probes with a positional repeatability of better than $\pm 0.02\text{mm}$.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

The phantom used was the "Generic Twin Phantom" described in [4]. The ear was simulated as a spacer of 4 mm thickness between the earpiece of the phone and the tissue simulating liquid. The Tissue simulation liquid used for each test is in according with the FCC OET65 supplement C as listed below.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton x-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	55.9	39.9	54.3	39.8	53.6
Conductivity (s/m)	0.85	0.83	0.91	0.95	1.0	0.98	1.42	1.45	1.88	1.81

4.1 Measurement System Diagram



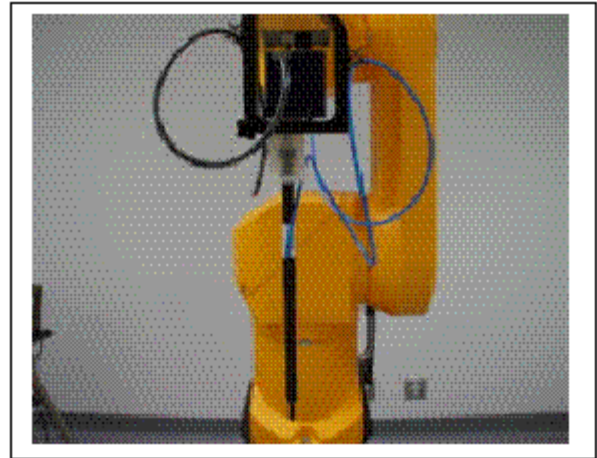
The DAS3 system for performing compliance tests consist of the following items:

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. DAS3 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.

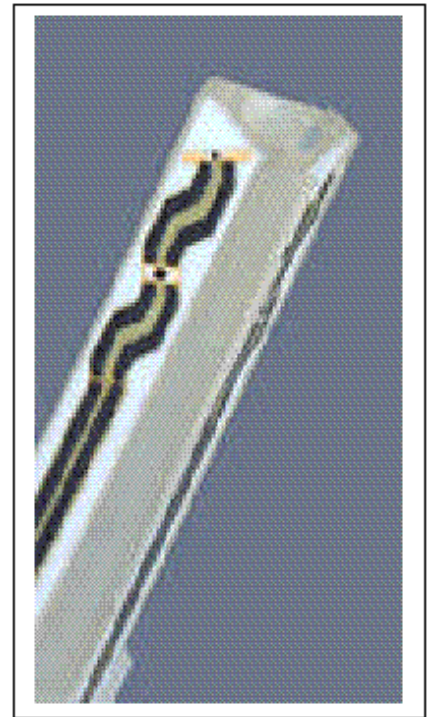
4.2. System Components

ET3DV5 Probe Specification

Construction Symmetrical design with triangular core
 Built-in optical fiber for surface detection System
 Built-in shielding against static charges
 Calibration In air from 10 MHz to 2.5 GHz
 In brain and muscle simulating tissue at
 Frequencies of 450 MHz, 900 MHz and
 1.8 GHz (accuracy $\pm 8\%$)
 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



Inside view of
ET3DV6 E-field 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 2nd order fitting. The approach is stopped when reaching the maximum.

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 below 1 GHz, and in a waveguide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

Data Evaluation

The DASY3 software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe Parameter:	-Sensitivity	Norm _i , a _{i0} , a _{i1} , a _{i2}
	-Conversion Factor	ConvFi
	-Diode compression point	Dcp _i
Device parameter:	-Frequency	f
	-Crest Factor	cf
Media parameter:	-Conductivity	σ
	-Density	ρ

These parameters must be set correctly in the software. They can either be found in the component documents or be imported into the software from the configuration files issued for the DASY3 components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + (U_i)^2 \text{ cf} / \text{dcp}_i$$

With V_i = compensated signal of channel i ($i=x, y, z$)
 U_i = input signal of channel i ($i=x, y, z$)
 cf = crest factor of exciting field (DASY parameter)
 dcp_i = diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

$$\begin{aligned} \text{E-field probes:} \quad E_i &= \sqrt{\frac{V_i}{\text{Norm}_i \cdot \text{ConvF}}} \\ \text{H-field probes:} \quad H_i &= \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f} \end{aligned}$$

With V_i = compensated signal of channel i (i=x, y, z)
 Norm_i = sensor sensitivity of channel i (i=x, y, z)
 $\mu\text{V}/(\text{V/m})^2$ for E-field probes
 ConvF = sensitivity enhancement in solution
 a_{ij} = sensor sensitivity factors for H-field probes
 f = carrier frequency [GHz]
 E_i = electric field strength 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):

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

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

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

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.

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

With P_{pwe} = equivalent power density of a plane wave in mW/cm³
 E_{tot} = total electric field strength in V/m
 H_{tot} = total magnetic field strength in V/m

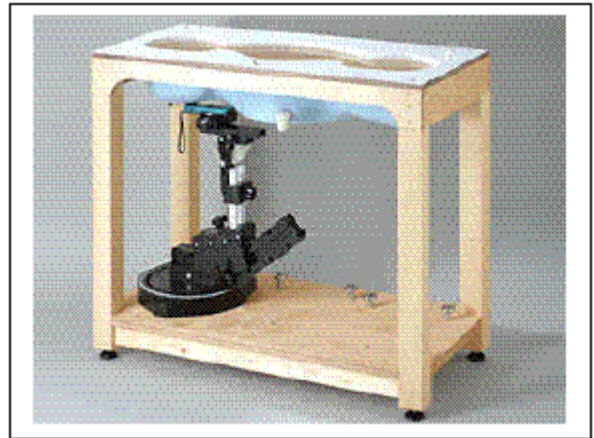
Generic Twin Phantom

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)

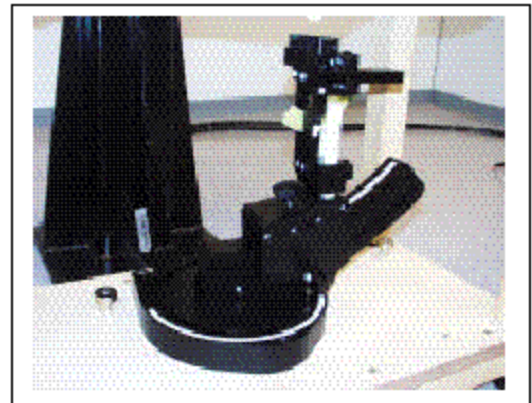


Generic Twin Phantom

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	Distrib.	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 Simulated Tissue Liquid Parameter Confirmation

The dielectric parameters were checked prior to assessment using the HP85070A dielectric probe kit. The dielectric parameters measured are reported in each correspondent section:

5.2 System Accuracy Verification

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of $\pm 10\%$. The validation results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

IEEE P1528 recommended reference value

Frequency (MHz)	1 g SAR	10 g SAR	Local SAR at surface (above feed point)	Local SAR at surface (v=2cm offset from feed point)
300	3.0	2.0	4.4	2.1
450	4.9	3.3	7.2	3.2
835	9.5	6.2	14.1	4.9
900	10.8	6.9	16.4	5.4
1450	29.0	16.0	50.2	6.5
1800	38.1	19.8	69.5	6.8
1900	39.7	20.5	72.1	6.6
2000	41.1	21.1	74.6	6.5
2450	52.4	24.0	104.2	7.7
3000	63.8	25.7	140.2	9.5

System validation result

Simulant	Freq [MHz]	Parameters	Liquid Temp [°C]	Target Value	Measured Value	Deviation	Limits [%]
Body	835	ϵ_r	23.4	56.1	54.9	-2.1	± 5
		σ	23.4	0.95	0.98	3.2	± 5
		1g SAR	23.4	9.5	8.92	-6.1	± 10
Body	1900	ϵ_r	23.4	54.3	53.6	-1.3	± 5
		σ	23.4	1.45	1.47	1.4	± 5
		1g SAR	23.4	39.7	44.81	6.5	± 10

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

Note: Input power = 19.95mW for CDMA, Input power = 82mW for PCS

5.3 SAR Evaluation Procedure

The evaluation was performed with the following procedure:

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

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

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

1. The data at the surface were extrapolated, since the center of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2 mm. The extrapolation was based on a least square algorithm [11]. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.
2. The maximum interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed by the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three 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.

5.4 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, wrists, 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.

6 - TEST RESULTS

This page summarizes the results of the performed dosimetric evaluation. The plots with the corresponding SAR distributions, which reveal information about the location of the maximum SAR with respect to the device could be found in the following pages.

6.1 SAR Body-Worn Worst-Case Test Data

Ambient Temperature (°C): 23.4

Relative Humidity(%): 49.3

Host	Position	Ch	Conducted Power (dBm)	Worst case SAR, averaged over 1g [mW/g]			
				Setup condition (applicable checked)		Measured	Limit
Antenna		Phantom					
CDMA							
Compaq ipaq 3650	Body	825	21.83	Built-in	EUT Back Side direct touch phantom	0.238	1.6
	Body	835	22.50			0.191	1.6
	Body	845	22.83			0.259	1.6
Compaq ipaq 3850	Body	825	23.33	Built-in	EUT Back Side direct touch phantom	0.271	1.6
	Body	835	23.17			0.289	1.6
	Body	845	21.50			0.385	1.6
Compaq ipaq 3870	Body	825	22.50	Built-in	EUT Back Side direct touch phantom	0.235	1.6
	Body	835	22.33			0.208	1.6
	Body	845	22.83			0.300	1.6
Dell Ppo1L	Body	825	22.33	Built-in	EUT Back Side direct touch phantom	0.327	1.6
	Body	835	23.00			0.217	1.6
	Body	845	22.17			0.215	1.6
HP T18. 033.C.00	Body	825	22.67	Built-in	EUT Back Side direct touch phantom	0.282	1.6
	Body	835	23.17			0.282	1.6
	Body	845	23.33			0.281	1.6
IBM 1161	Body	825	22.50	Built-in	EUT Back Side direct touch phantom	0.704	1.6
	Body	835	21.17			0.700	1.6
	Body	845	22.67			0.701	1.6
PCS							
Compaq ipaq 3650	Body	1850	17.7 *	Built-in	EUT Back Side direct touch phantom	0.465	1.6
	Body	1880	19.6 *			0.457	1.6
	Body	1905	21.2 *			0.441	1.6
Compaq ipaq 3850	Body	1850	17.1 *	Built-in	EUT Back Side direct touch phantom	0.107	1.6
	Body	1880	19.2 *			0.332	1.6
	Body	1905	20.6 *			0.329	1.6
Compaq ipaq 3870	Body	1850	17.1 *	Built-in	EUT Back Side direct touch phantom	0.160	1.6
	Body	1880	20.1 *			0.386	1.6
	Body	1905	21.2 *			0.349	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	19.2 *	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	21.00 *	Built-in	EUT Back Side direct touch phantom	0.476	1.6
	Body	1880	21.33 *			0.475	1.6
	Body	1905	21.17 *			0.478	1.6

*: EIRP

6.2 Plots of Test Result

Appendix A - Plots of SAR test data for Compaq ipaq 3650 at 835MHz and 1900MHz.

Appendix B - Plots of SAR test data for Compaq ipaq 3850 at 835MHz and 1900MHz.

Appendix C - Plots of SAR test data for Compaq ipaq 3870 at 835MHz and 1900MHz.

Appendix D - Plots of SAR test data for Dell PPo1L at 835MHz and 1900MHz.

Appendix E - Plots of SAR test data for HP T18.033.C.00 at 835MHz and 1900MHz.

Appendix F - Plots of SAR test data for IBM 1161 at 835MHz and 1900MHz.

Appendix G - Plots of SAR test data for Dipole validation at 835MHz and 1900MHz.

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

Appendix I - Plots of CDMA output power for Compaq ipaq 3650.

Appendix J - Plots of CDMA output power for Compaq ipaq 3850.

Appendix K - Plots of CDMA output power for Compaq ipaq 3870.

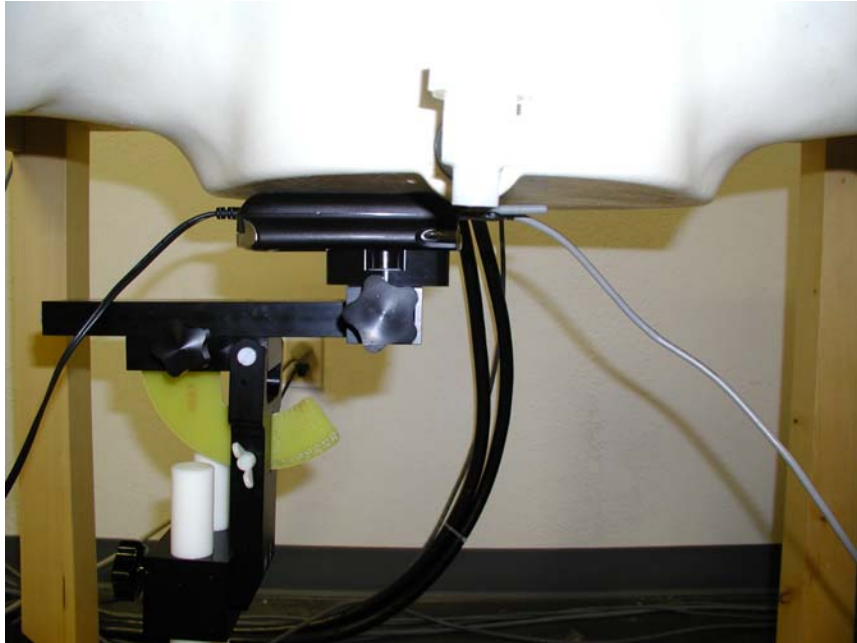
Appendix L - Plots of CDMA output power for Dell PPo1L.

Appendix M - Plots of CDMA output power for HP T18.033.C.00.

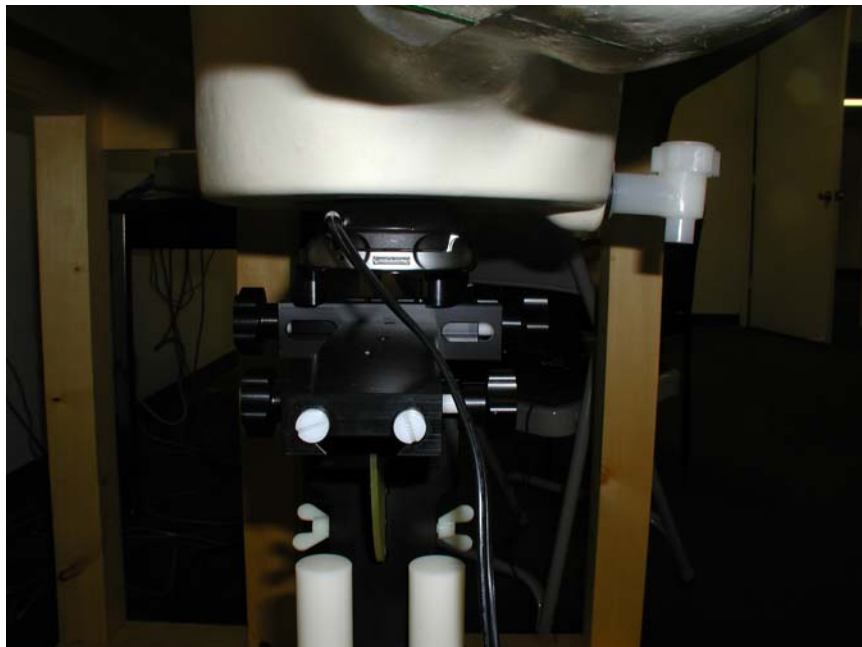
Appendix N - Plots of CDMA output power for host of IBM 1161.

EXHIBIT A - SAR SETUP PHOTOGRAPHS

W/ IPAQ Front View



W/ IPAQ Left View



W/ IPAQ Right View



W/ Laptop Front View



W/ Laptop Left View



W/ Laptop Side View



EXHIBIT B - EUT PHOTOGRAPHS

Chassis - Front View



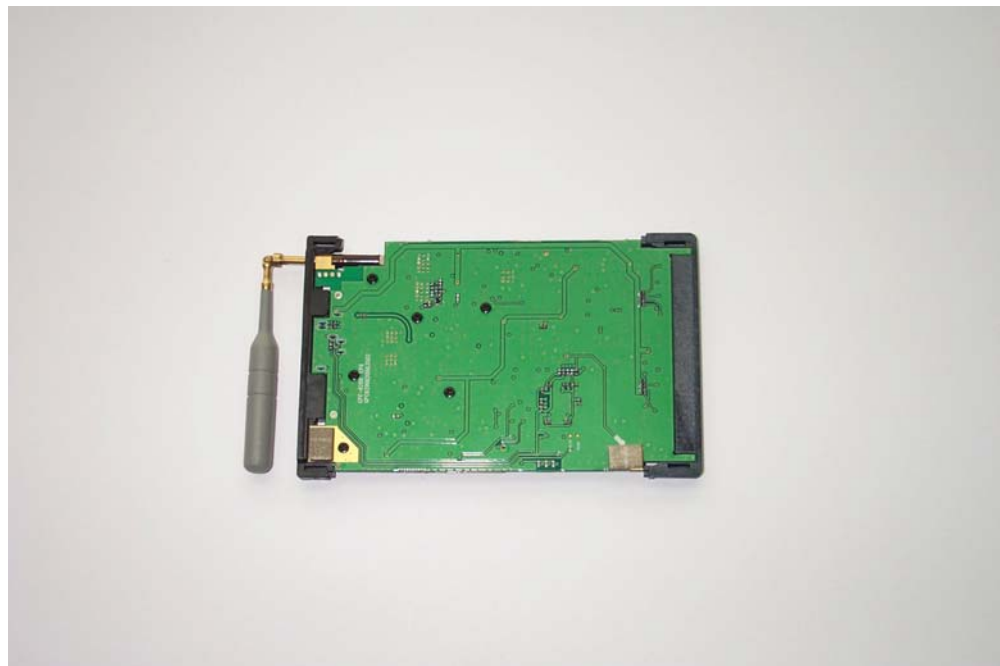
Chassis - Back View



Main Board - Component View



Main Board - Solder View



COMPAQ Quality Service Protected
 COMPAQ WITH CANADIANAL KC8-800 CLASS II
 Contains Union-Recognizable Battery
 Dispose of Properly
 R/R IT 15V-200 1A

Send to Compaq Inc.
 FCC Standards for
 Home and Office Use

N119 ROM 4+1
 CE

Product of Taiwan
 N4674-002

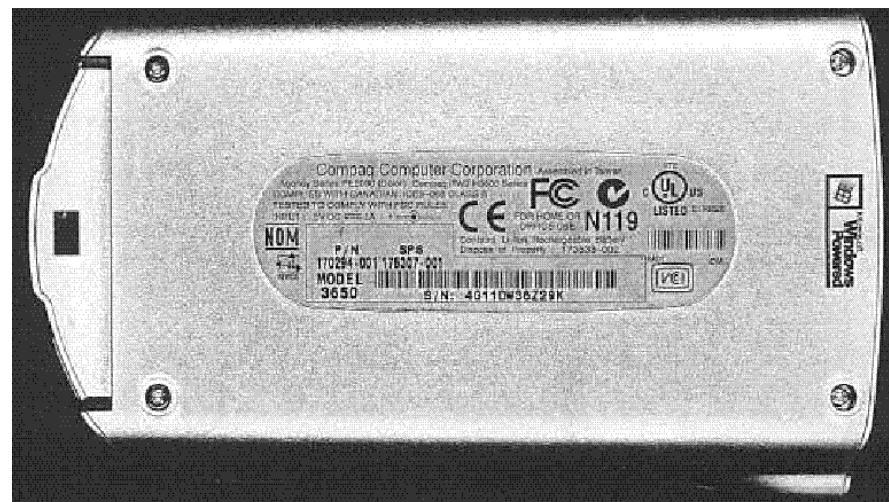
P/N 13857-01
 SPS 33294-01
 MODEL 3850
 S/N: 4623042313ED Compaq™

Windows
 Memory &
 Storage

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 N4674-002

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APPENDIX A - PLOTS OF SAR TEST DATA FOR COMPAQ IPAQ 3650 AT 835MHZ AND 1900MHZ

GTran Wireless (Compaq ipaq 3650, 22 Deg, 10/4/02)

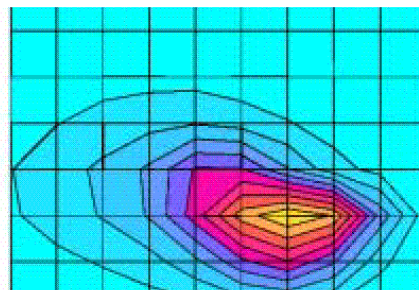
SAM Phantom; Section; Position : Frequency: 825 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98$ mho/m $\epsilon_r = 54.9$ $\rho = 1.00$ g/cm³

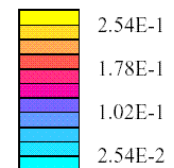
Cube 5x5x7: SAR (1g): 0.238 mW/g, SAR (10g): 0.133 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: 0.01 dB



SAR_{Tot} [mW/g]



GTran Wireless (Compaq ipaq 3650, 22 Deg., 10/4/02)

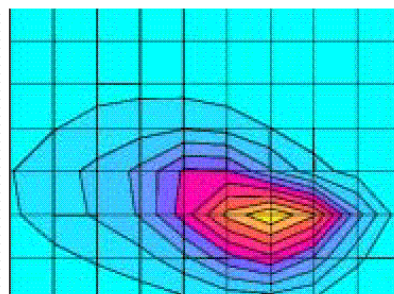
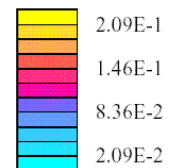
SAM Phantom; Section; Position: ; Frequency: 835 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98$ mho/m $\epsilon_r = 54.9$ $\rho = 1.00$ g/cm³

Cube 5x5x7; SAR (1g): 0.191 mW/g, SAR (10g): 0.108 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: -0.15 dB

SAR_{Tot} [mW/g]

GTran Wireless (Compaq ipaq 3650, 22 Deg, 10/4/02)

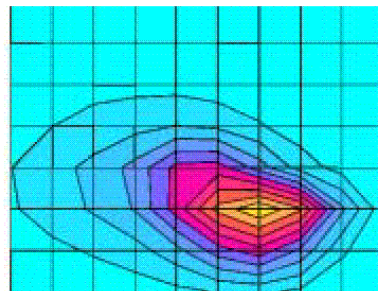
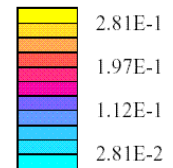
SAM Phantom; Section: Position: ; Frequency: 845 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98$ mho/m $\epsilon_r = 54.9$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.259 mW/g, SAR (10g): 0.148 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: -0.07 dB

SAR_{Tot} [mW/g]

GTran Wireless (Compaq ipaq 3650, 24 Deg, 10/4/02)

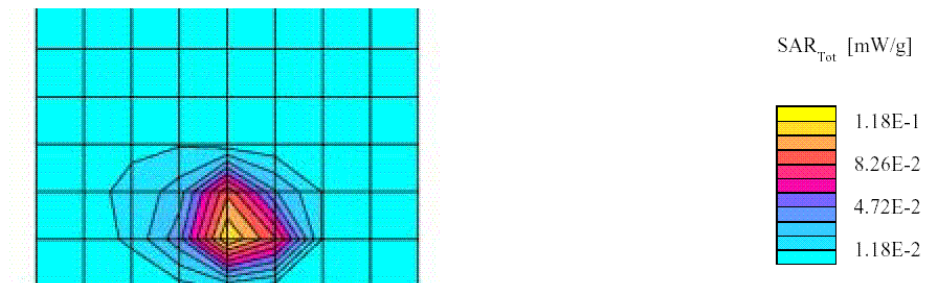
SAM Phantom; Section; Position: ; Frequency: 1850 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47$ mho/m $\epsilon_r = 53.6$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.465 mW/g, SAR (10g): 0.202 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: -0.03 dB



GTran Wireless(Compaq ipaq 3650, 24 Deg, 10/4/02)

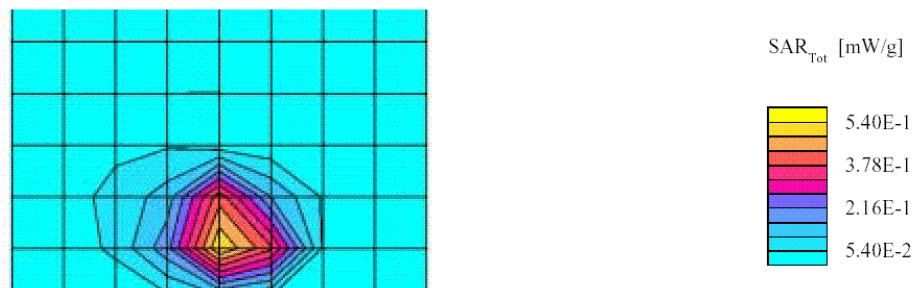
SAM Phantom; Section; Position: ; Frequency: 1880 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47$ mho/m $\epsilon_r = 53.6$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.457 mW/g, SAR (10g): 0.212 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: -0.02 dB



GTran Wireless (Compaq ipaq 3650, 24 Deg, 10/4/02)

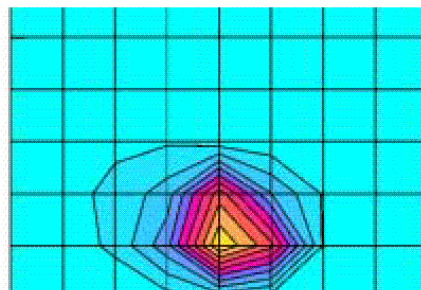
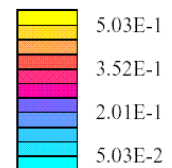
SAM Phantom; Section; Position: ; Frequency: 1905 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47$ mho/m $\epsilon_r = 53.6$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.441 mW/g, SAR (10g): 0.204 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: -0.04 dB

SAR_{Tot} [mW/g]

APPENDIX B - PLOTS OF SAR TEST DATA FOR COMPAQ IPAQ 3850 AT 835MHZ AND 1900MHZ

GTran Wireless (Compaq ipaq 3850, 22 Deg., 10/4/02)

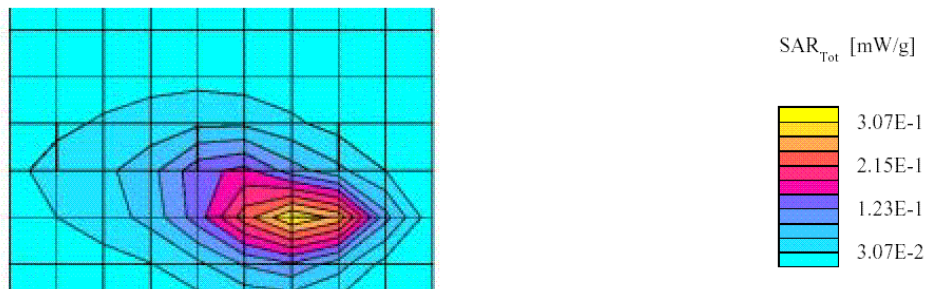
SAM Phantom; Section; Position: ; Frequency: 825 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98$ mho/m $\epsilon_r = 54.9$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.271 mW/g, SAR (10g): 0.151 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: 0.01 dB



GTran Wireless (Compaq ipaq 3850, 22 Deg., 10/4/02)

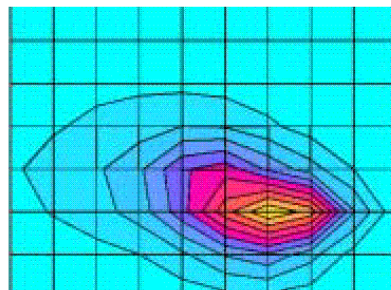
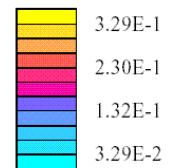
SAM Phantom; Section; Position: ; Frequency: 835 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98$ mho/m $\epsilon_r = 54.9$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.289 mW/g, SAR (10g): 0.163 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: -0.11 dB

SAR_{Tot} [mW/g]

GTran Wireless (Compaq ipaq 3850, 22 Deg., 10/4/02)

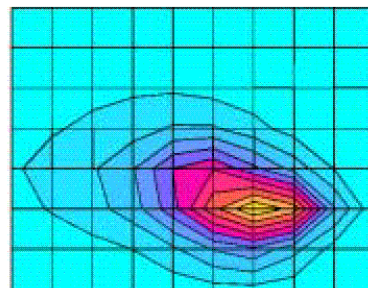
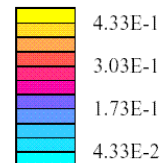
SAM Phantom; Section: Position: ; Frequency: 845 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98$ mho/m $\epsilon_r = 54.9$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.385 mW/g, SAR (10g): 0.218 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: 0.04 dB

SAR_{Tot} [mW/g]

GTran Wireless (Compaq ipaq 3850, 24 Deg, 10/4/02)

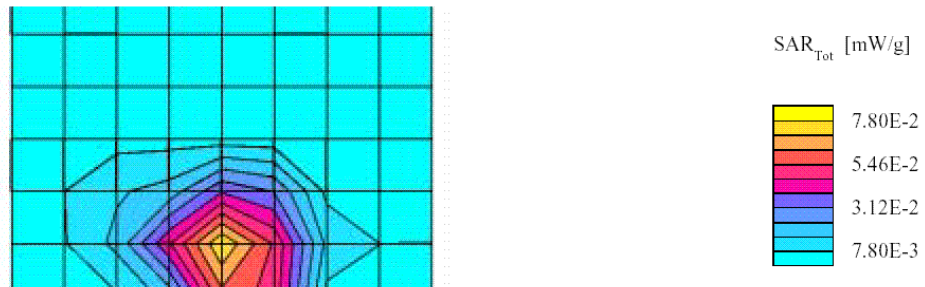
SAM Phantom; Section; Position: ; Frequency: 1850 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47$ mho/m $\epsilon_r = 53.6$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.107 mW/g, SAR (10g): 0.0504 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: -0.56 dB



GTran Wireless (Compaq ipaq 3850, 24 Deg, 10/4/02)

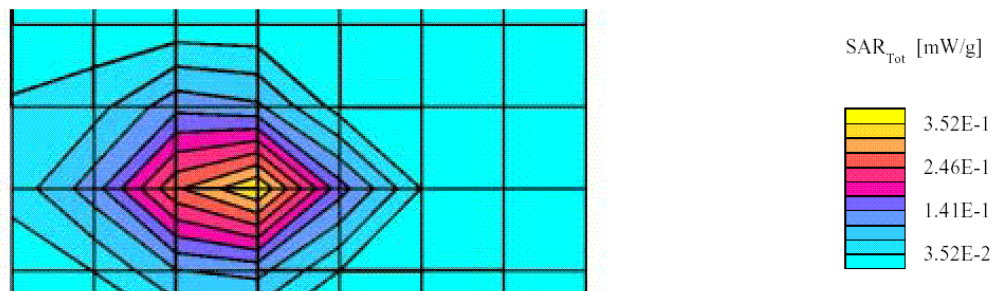
SAM Phantom; Section; Position: ; Frequency: 1880 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47$ mho/m $\epsilon_r = 53.6$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.332 mW/g, SAR (10g): 0.159 mW/g, (Worst-case extrapolation)

Coarse: Dx = 15.0, Dy = 15.0, Dz = 14.0

Powerdrift: -0.12 dB



GTran Wireless (Compaq ipaq 3850, 24 Deg, 10/4/02)

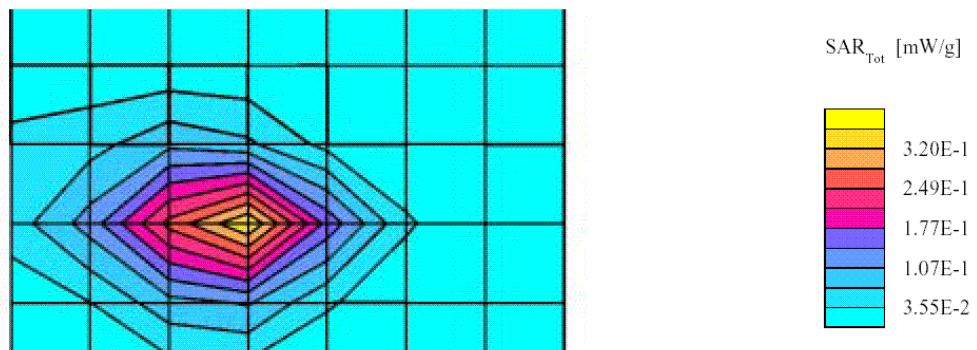
SAM Phantom; Section; Position: ; Frequency: 1905 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47$ mho/m $\epsilon_r = 53.6$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.329 mW/g, SAR (10g): 0.149 mW/g, (Worst-case extrapolation)

Coarse: Dx = 15.0, Dy = 15.0, Dz = 14.0

Powerdrift: -0.02 dB



APPENDIX C - PLOTS OF SAR TEST DATA FOR COMPAQ IPAQ 3870 AT 835MHZ AND 1900MHZ

GTran Wireless (Compaq ipaq 3870, 22 Deg., 10/4/02)

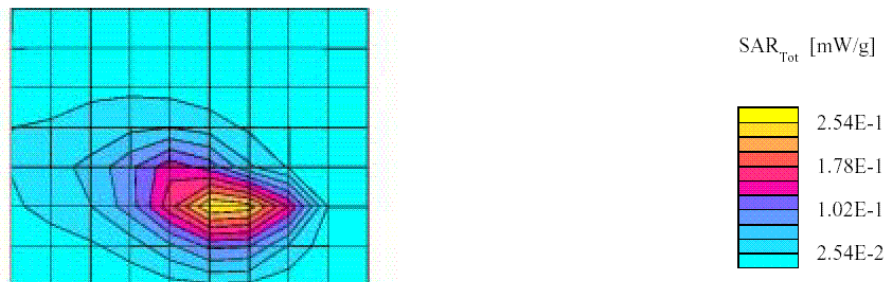
SAM Phantom; Section; Position: ; Frequency: 825 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98$ mho/m $\epsilon_r = 54.9$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.235 mW/g, SAR (10g): 0.132 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: 0.20 dB



GTran Wireless (Compaq ipaq 3870, 22 Deg., 10/4/02)

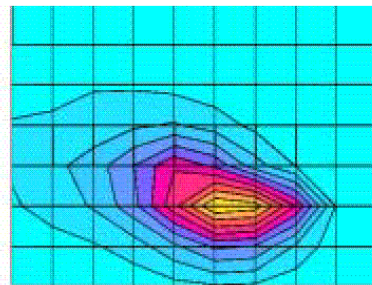
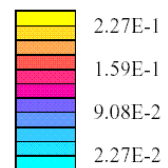
SAM Phantom; Section; Position: ; Frequency: 835 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98$ mho/m $\epsilon_r = 54.9$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.208 mW/g, SAR (10g): 0.116 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: -0.13 dB

SAR_{Tot} [mW/g]

GTran Wireless (Compaq ipaq 3870, 22 Deg., 10/4/02)

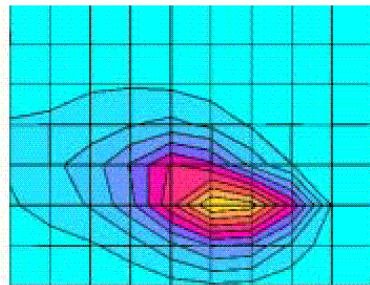
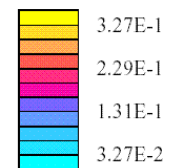
SAM Phantom; Section; Position: ; Frequency: 845 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98$ mho/m $\epsilon_r = 54.9$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.300 mW/g, SAR (10g): 0.170 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: -0.05 dB

SAR_{Tot} [mW/g]

GTran Wireless (Compaq ipaq 3870, 24 Deg, 10/4/02)

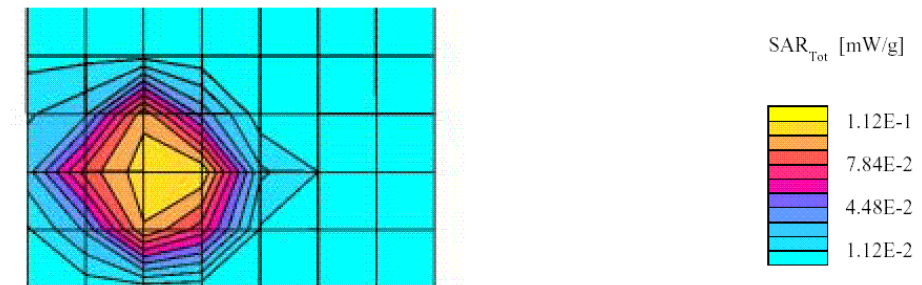
SAM Phantom; Section; Position: ; Frequency: 1850 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47$ mho/m $\epsilon_r = 53.6$ $\rho = 1.00$ g/cm³

Cube 5x5x7; SAR (1g): 0.160 mW/g, SAR (10g): 0.0770 mW/g, (Worst-case extrapolation)

Coarse: Dx = 15.0, Dy = 15.0, Dz = 14.0

Powerdrift: -0.01 dB



GTran Wireless (Compaq ipaq 3870, 24 Deg, 10/4/02)

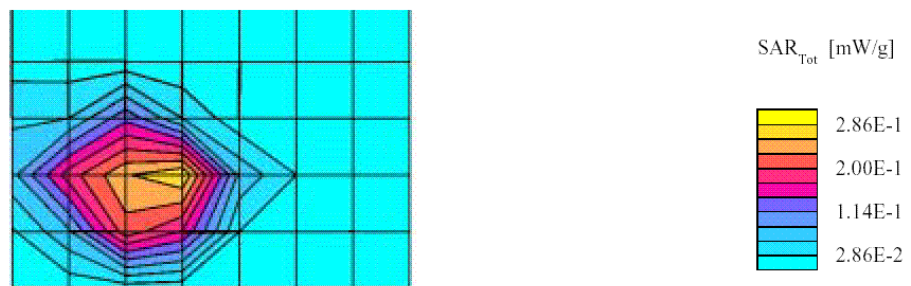
SAM Phantom; Section; Position: ; Frequency: 1880 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47$ mho/m $\epsilon_r = 53.6$ $\rho = 1.00$ g/cm³

Cube 5x5x7; SAR (1g): 0.386 mW/g, SAR (10g): 0.182 mW/g, (Worst-case extrapolation)

Coarse: Dx = 15.0, Dy = 15.0, Dz = 14.0

Powerdrift: -0.17 dB



GTran Wireless (Compaq ipaq 3870, 24 Deg, 10/4/02)

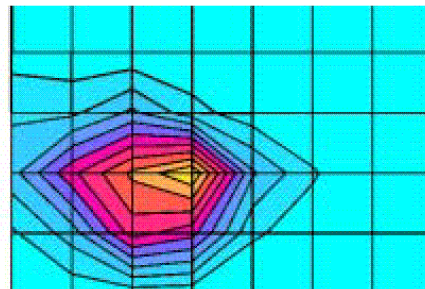
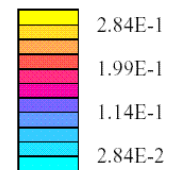
SAM Phantom; Section; Position: ; Frequency: 1905 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47 \text{ mho/m}$, $\epsilon_r = 53.6$, $\rho = 1.00 \text{ g/cm}^3$

Cube 5x5x7: SAR (1g): 0.349 mW/g, SAR (10g): 0.163 mW/g, (Worst-case extrapolation)

Coarse: Dx = 15.0, Dy = 15.0, Dz = 14.0

Powerdrift: -0.18 dB

SAR_{Tot} [mW/g]

APPENDIX D - PLOTS OF SAR TEST DATA FOR DELL PPO1L AT 835MHZ AND 1900MHZ

GTran Wireless (Dell PPO1L, 22 Deg, 10/4/02)

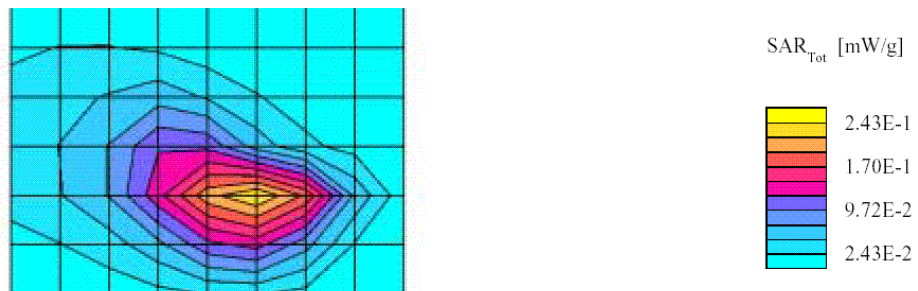
SAM Phantom; Section; Position: ; Frequency: 825 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98$ mho/m $\epsilon_r = 54.9$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.327 mW/g, SAR (10g): 0.185 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: -0.01 dB



GTran Wireless (Dell PPO1L, 22 Deg, 10/4/02)

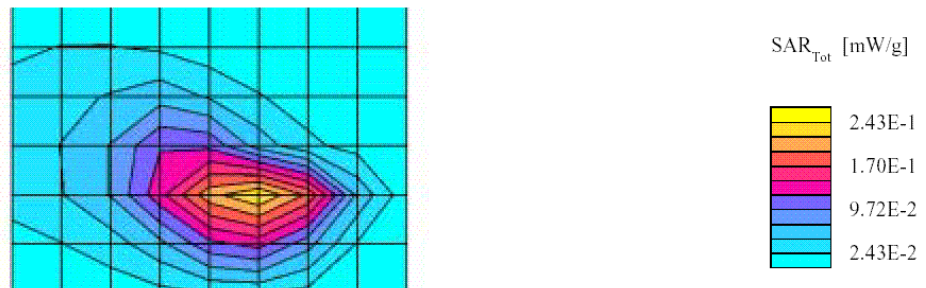
SAM Phantom; Section; Position: ; Frequency: 835 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98$ mho/m $\epsilon_r = 54.9$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.217 mW/g, SAR (10g): 0.122 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: 0.20 dB



GTran Wireless (Dell PPolL, 22 Deg, 10/4/02)

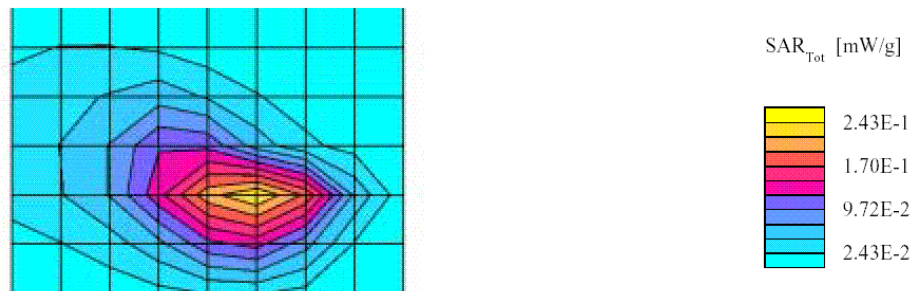
SAM Phantom; Section; Position: ; Frequency: 845 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98$ mho/m $\epsilon_r = 54.9$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.215 mW/g, SAR (10g): 0.122 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: 0.19 dB



GTran Wireless (Dell PPO1L, 24 Deg, 10/4/02)

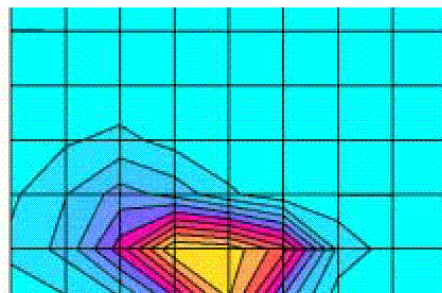
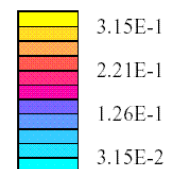
SAM Phantom; Section; Position: ; Frequency: 1850 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47$ mho/m $\epsilon_r = 53.6$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.504 mW/g, SAR (10g): 0.225 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: 0.07 dB

SAR_{Tot} [mW/g]

GTran Wireless (Dell PPO1L, 24 Deg, 10/4/02)

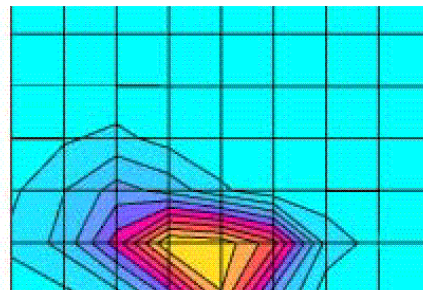
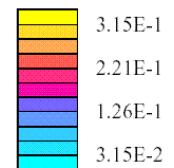
SAM Phantom; Section; Position: ; Frequency: 1880 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47$ mho/m $\epsilon_r = 53.6$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.512 mW/g, SAR (10g): 0.227 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: 0.06 dB

SAR_{Tot} [mW/g]

GTran Wireless (Dell PPO1L, 24 Deg, 10/4/02)

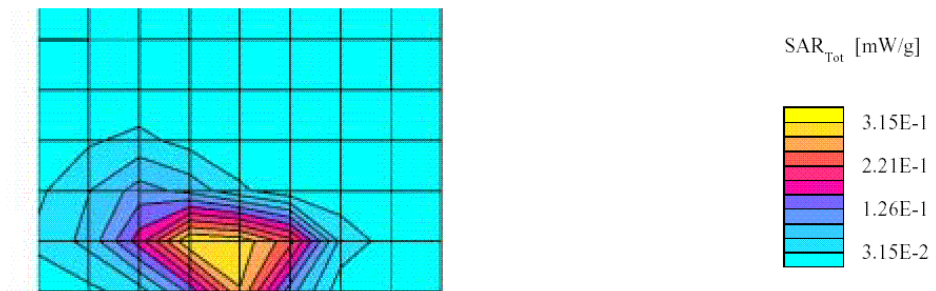
SAM Phantom; Section; Position: ; Frequency: 1905 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47$ mho/m $\epsilon_r = 53.6$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.515 mW/g, SAR (10g): 0.229 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: 0.05 dB



APPENDIX E - PLOTS OF SAR TEST DATA FOR HP T18.033.C.00 AT 835MHZ AND 1900MHZ

GTran Wireless (HP T18.033.C.00, 22 Deg, 10/4/02)

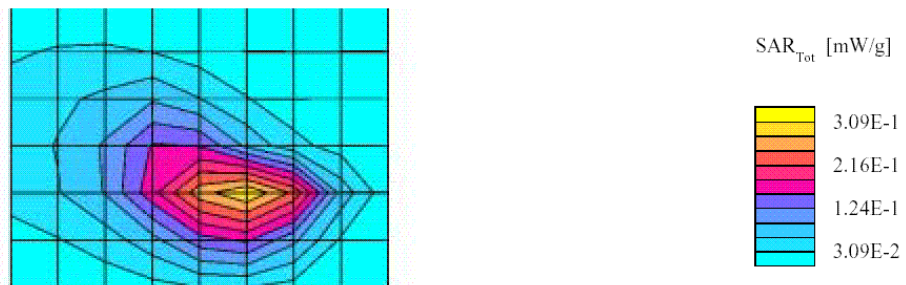
SAM Phantom; Section; Position: ; Frequency: 825 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98$ mho/m $\epsilon_r = 54.9$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.282 mW/g, SAR (10g): 0.160 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: 0.05 dB



GTran Wireless (HP T18.033.C.00, 22 Deg, 10/4/02)

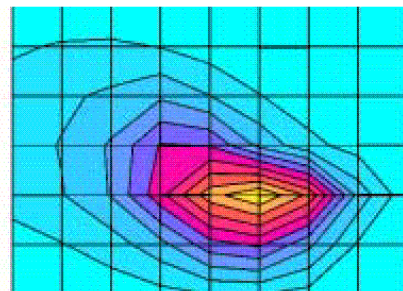
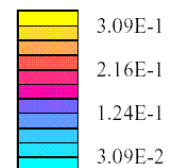
SAM Phantom; Section; Position: ; Frequency: 835 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98$ mho/m $\epsilon_r = 54.9$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.282 mW/g, SAR (10g): 0.160 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: 0.05 dB

SAR_{Tot} [mW/g]

GTran Wireless (HP T18.033.C.00, 22 Deg, 10/4/02)

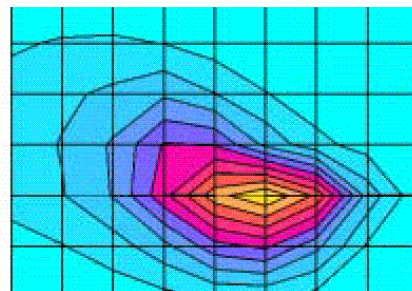
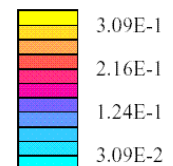
SAM Phantom; Section; Position: ; Frequency: 845 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98$ mho/m $\epsilon_r = 54.9$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.281 mW/g, SAR (10g): 0.159 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: 0.00 dB

SAR_{Tot} [mW/g]

GTran Wireless (HP T18.033.C.00, 24 Deg, 10/4/02)

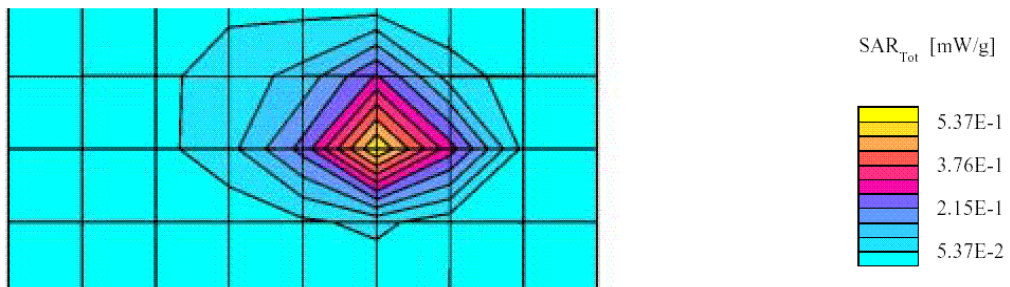
SAM Phantom; Section; Position: ; Frequency: 1850 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47$ mho/m $\epsilon_r = 53.6$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.415 mW/g, SAR (10g): 0.186 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: -0.01 dB



GTran Wireless (HP T18.033.C.00, 24 Deg, 10/4/02)

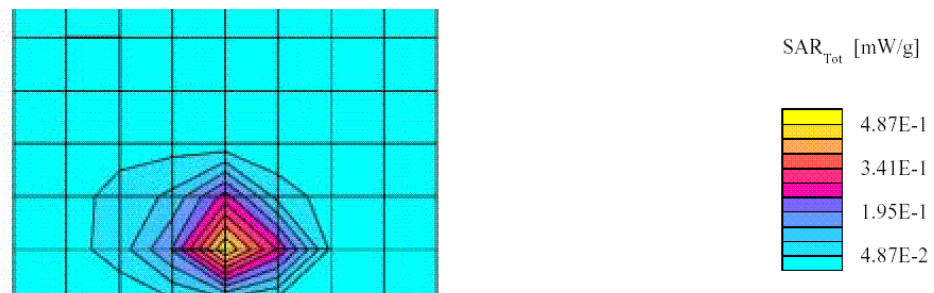
SAM Phantom; Section; Position: ; Frequency: 1880 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47$ mho/m $\epsilon_r = 53.6$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.419 mW/g, SAR (10g): 0.181 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: -0.05 dB



GTran Wireless (HP T18.033.C.00, 24 Deg, 10/4/02)

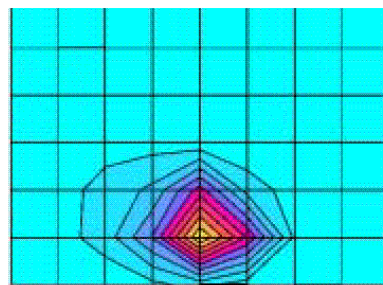
SAM Phantom; Section; Position: ; Frequency: 1905 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47$ mho/m $\epsilon_r = 53.6$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.416 mW/g, SAR (10g): 0.179 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: 0.02 dB

SAR_{Tot} [mW/g]

APPENDIX F - PLOTS OF SAR TEST DATA FOR HOST OF IBM 1161 AT 835MHZ AND 1900MHZ

GTran Wireless (IBM 1161, 22 Deg, 10/4/02)

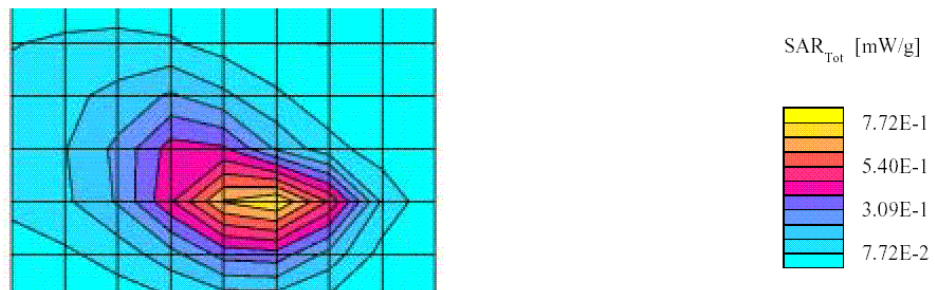
SAM Phantom; Section: Position: ; Frequency: 825 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98$ mho/m $\epsilon_r = 54.9$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.704 mW/g, SAR (10g): 0.395 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: -0.01 dB



GTran Wireless (IBM 1161, 22 Deg, 10/4/02)

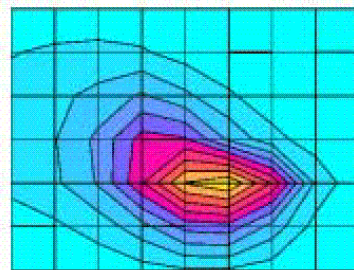
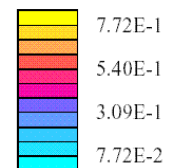
SAM Phantom; Section; Position: ; Frequency: 835 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98$ mho/m $\epsilon_r = 54.9$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.700 mW/g, SAR (10g): 0.393 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: -0.00 dB

SAR_{Tot} [mW/g]

GTran Wireless (IBM 1161, 22 Deg, 10/4/02)

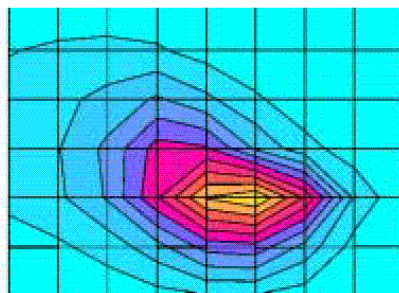
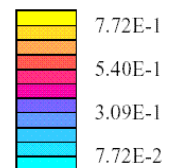
SAM Phantom; Section; Position: ; Frequency: 845 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98$ mho/m $\epsilon_r = 54.9$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.701 mW/g, SAR (10g): 0.393 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: -0.01 dB

SAR_{Tot} [mW/g]

GTran Wireless (IBM 1161, 24 Deg, 10/4/02)

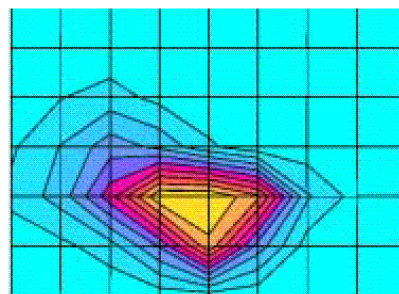
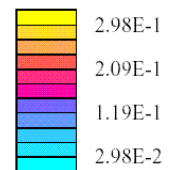
SAM Phantom; Section; Position: ; Frequency: 1850 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47$ mho/m $\epsilon_r = 53.6$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.476 mW/g, SAR (10g): 0.212 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: 0.01 dB

SAR_{Tot} [mW/g]

GTran Wireless (IBM 1161, 24 Deg, 10/4/02)

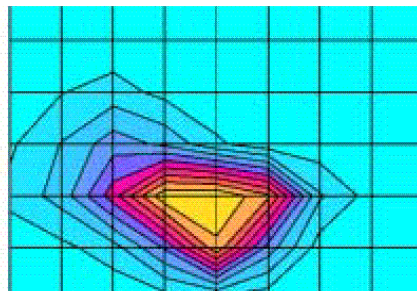
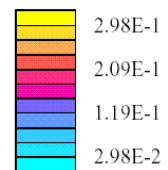
SAM Phantom; Section; Position: ; Frequency: 1880 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47$ mho/m $\epsilon_r = 53.6$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.475 mW/g, SAR (10g): 0.211 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

Powerdrift: 0.03 dB

SAR_{Tot} [mW/g]

GTran Wireless (IBM 1161, 24 Deg, 10/4/02)

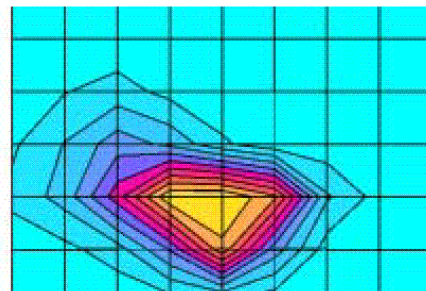
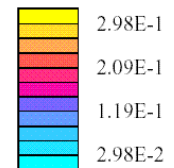
SAM Phantom; Section; Position: ; Frequency: 1905 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47$ mho/m $\epsilon_r = 53.6$ $\rho = 1.00$ g/cm³

Cube 5x5x7: SAR (1g): 0.478 mW/g, SAR (10g): 0.212 mW/g, (Worst-case extrapolation)

Coarse: Dx = 16.0, Dy = 16.0, Dz = 14.0

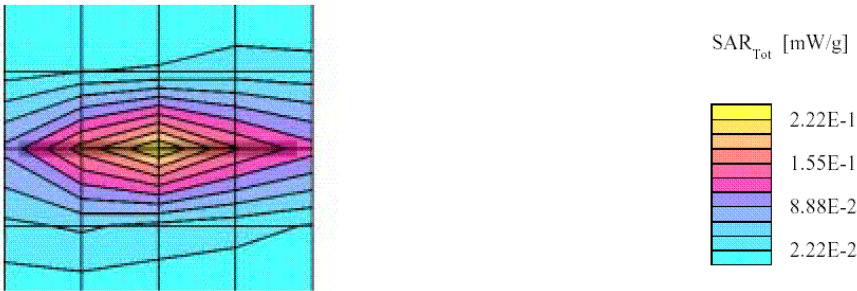
Powerdrift: 0.05 dB

SAR_{Tot} [mW/g]

**APPENDIX G - PLOTS OF SAR TEST DATA FOR DIPOLE VALIDATION
AT 835MHZ AND 1900MHZ**

Validation 835MHz

SAM Phantom; Flat Section; Position: (90°,90°); Frequency: 835 MHz
Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98 \text{ mho/m}$ $\epsilon_r = 54.9$ $\rho = 1.00 \text{ g/cm}^3$
Cube 5x5x7: SAR (1g): 0.178 mW/g, SAR (10g): 0.0840 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.05 dB



Dipole 1900 MHz

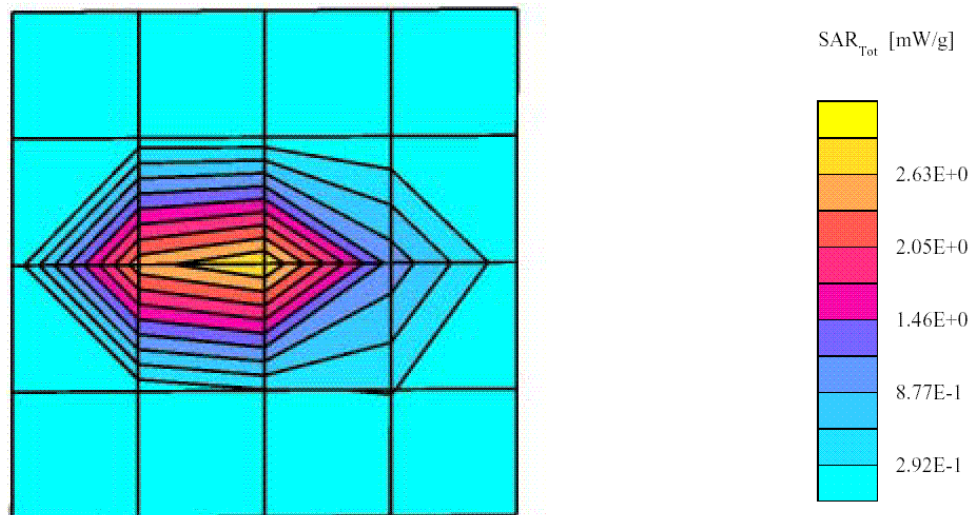
SAM:

Probe: ET3DV6 - SN1604; ConvF(7.31,7.31,7.31); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47$ mho/m $\epsilon_r = 53.6$ $\rho = 1.00$ g/cm³

Cubes (2): Peak: 7.06 mW/g ± 0.00 dB, SAR (1g): 3.47 mW/g ± 0.01 dB, SAR (10g): 1.65 mW/g ± 0.02 dB, (Worst-case extrapolation)

Penetration depth: 7.7 (7.1, 9.1) [mm]

Powerdrift: -0.15 dB



APPENDIX H - PLOTS OF SAR TEST DATA FOR Z-AXIS AT 835MHZ AND 1900MHZ

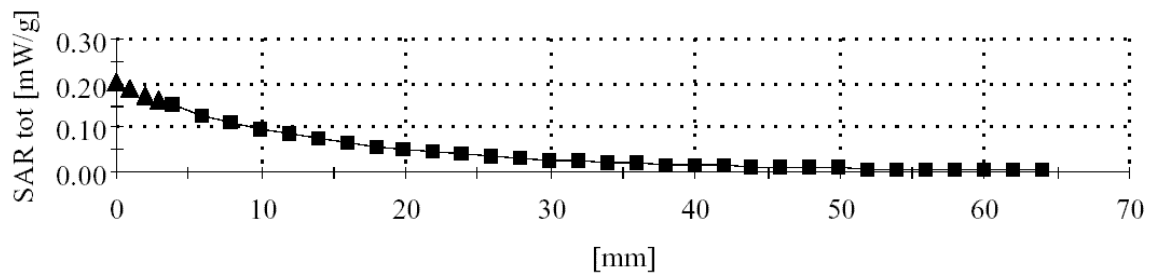
GTran Wireless (HP T18.033.C.00, 22 Deg, 10/4/02)

SAM Phantom; Section; Position: ; Frequency: 825 MHz

Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 835 MHz: $\sigma = 0.98$ mho/m $\epsilon_r = 54.9$ $\rho = 1.00$ g/cm³

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



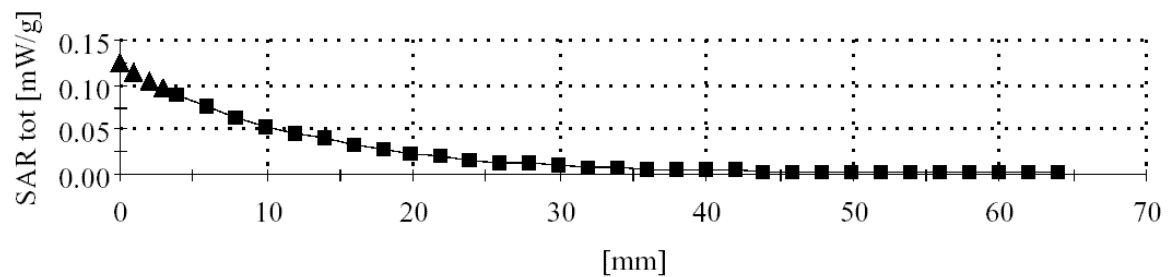
GTran Wireless (Compaq ipaq 3870, 24 Deg, 10/4/02)

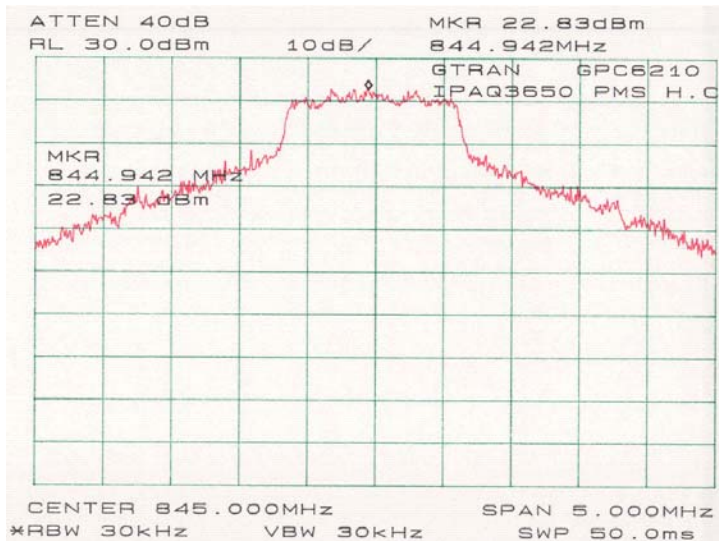
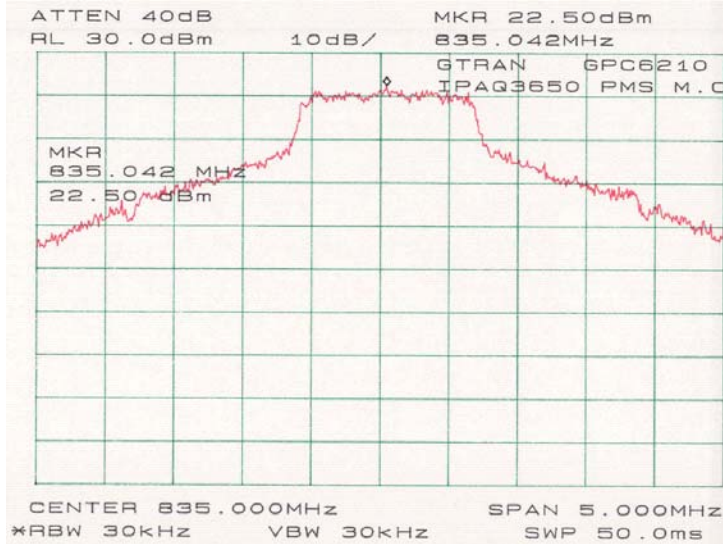
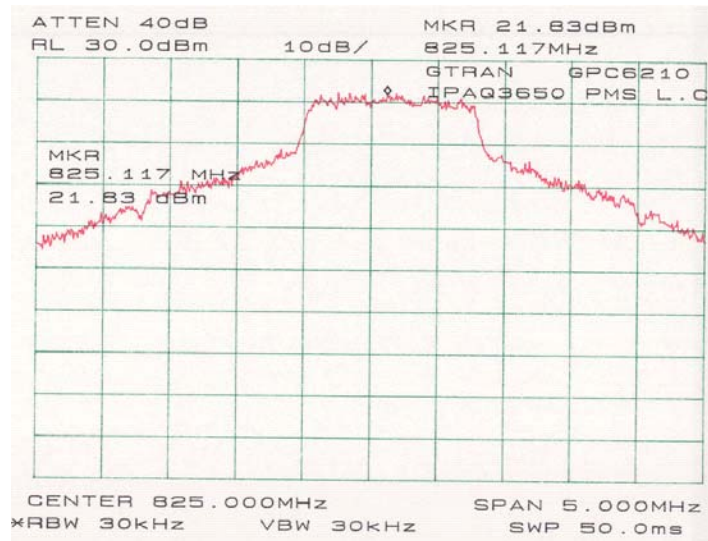
SAM Phantom; Section; Position: ; Frequency: 1850 MHz

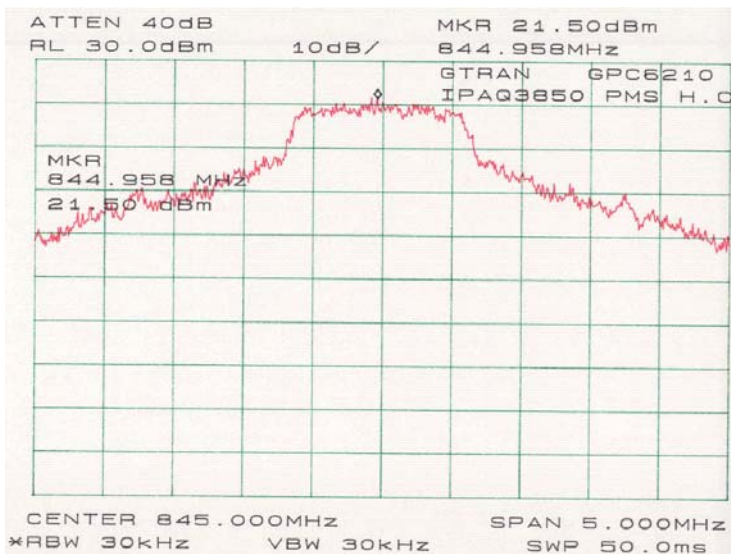
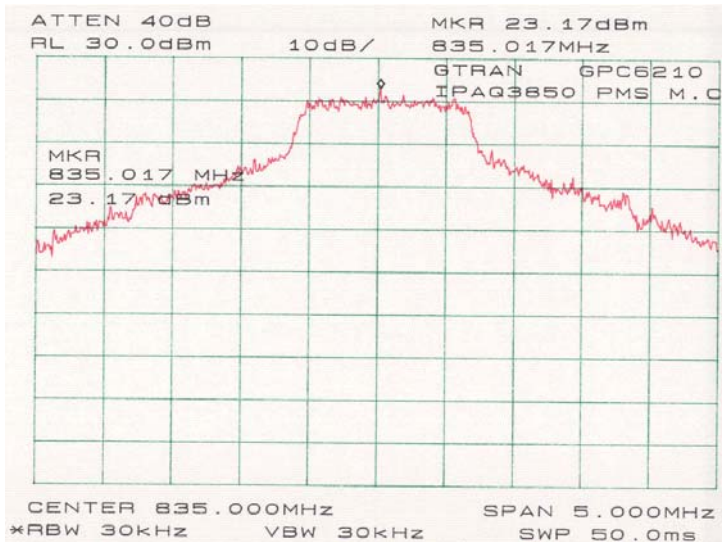
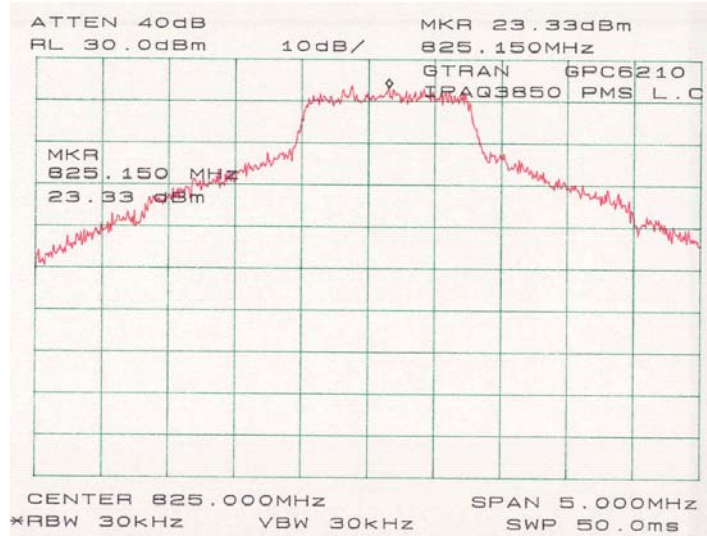
Probe: ET3DV6 - SN1604; ConvF(6.77,6.77,6.77); Crest factor: 1.0; Body 1900 MHz: $\sigma = 1.47$ mho/m $\epsilon_r = 53.6$ $\rho = 1.00$ g/cm³

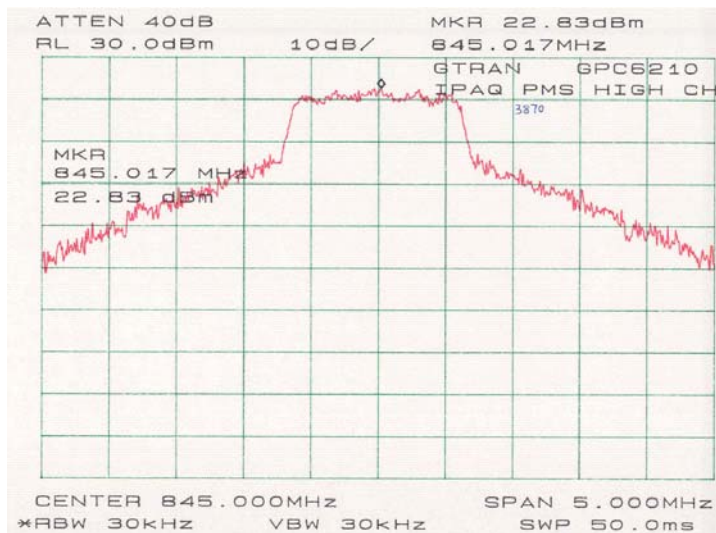
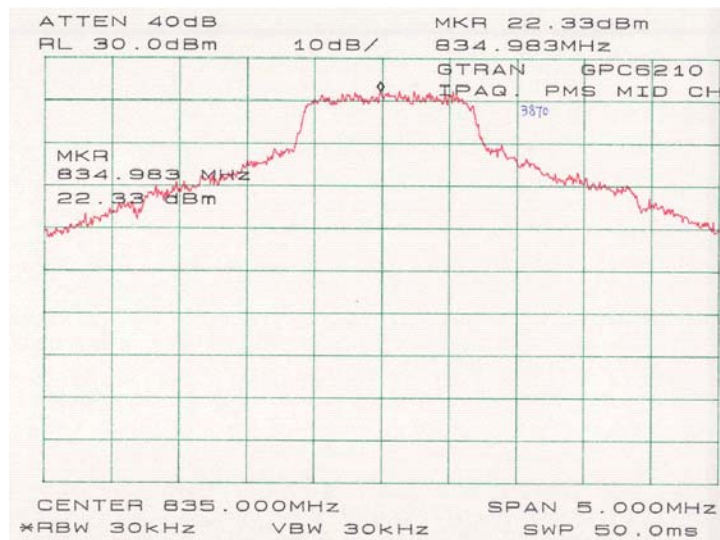
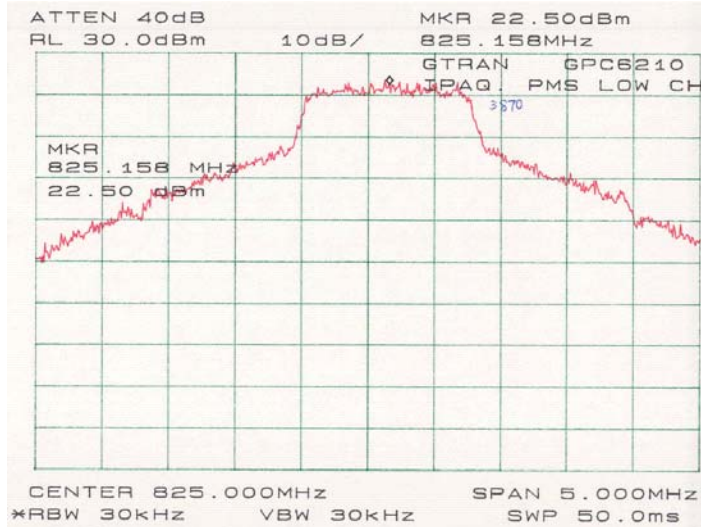
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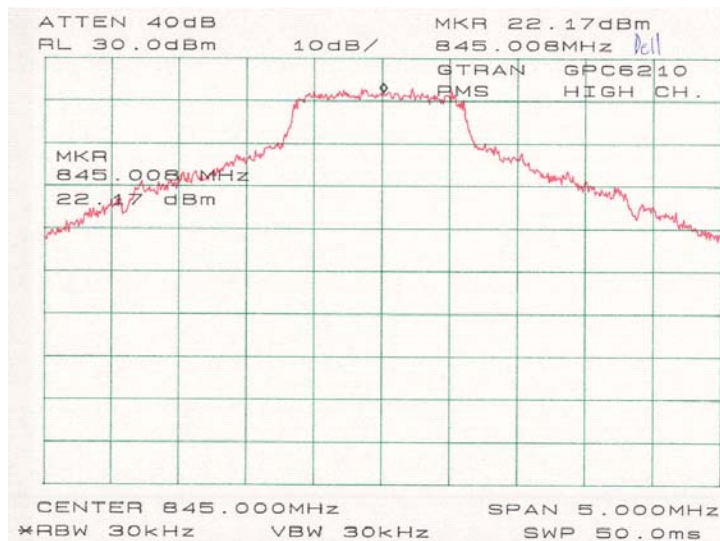
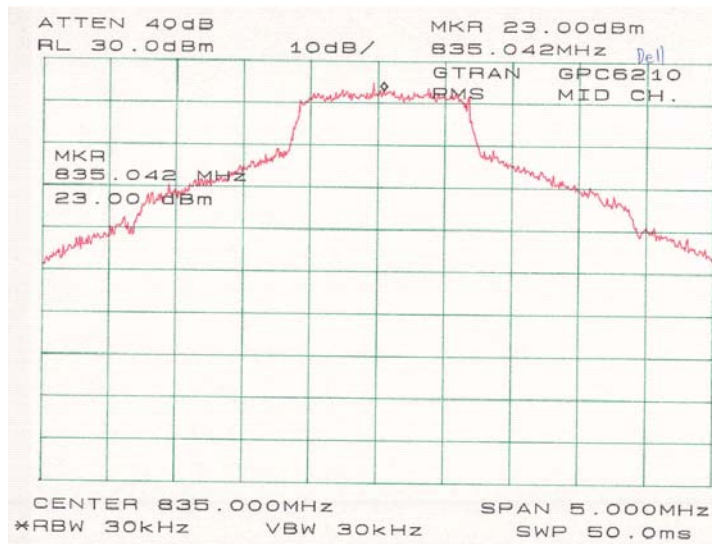
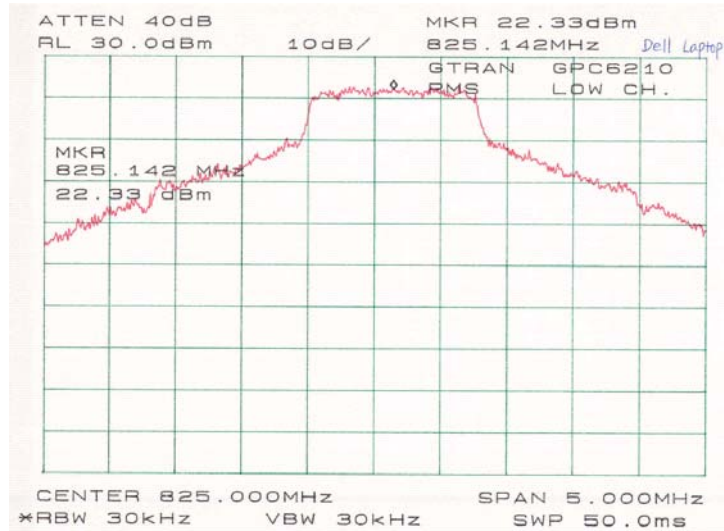
Z-Axis: Dx = 0.0, Dy = 0.0, Dz = 2.0

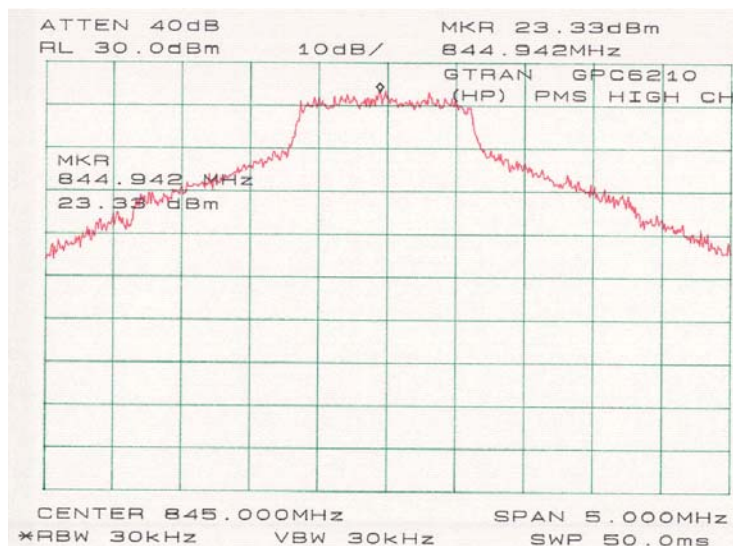
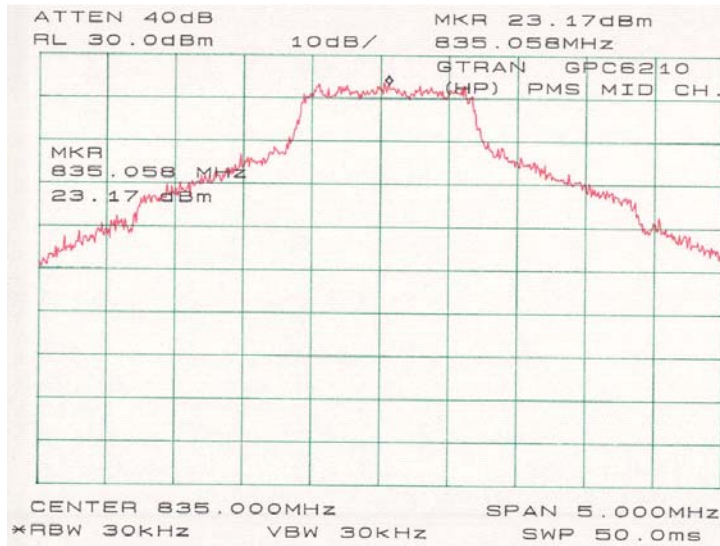
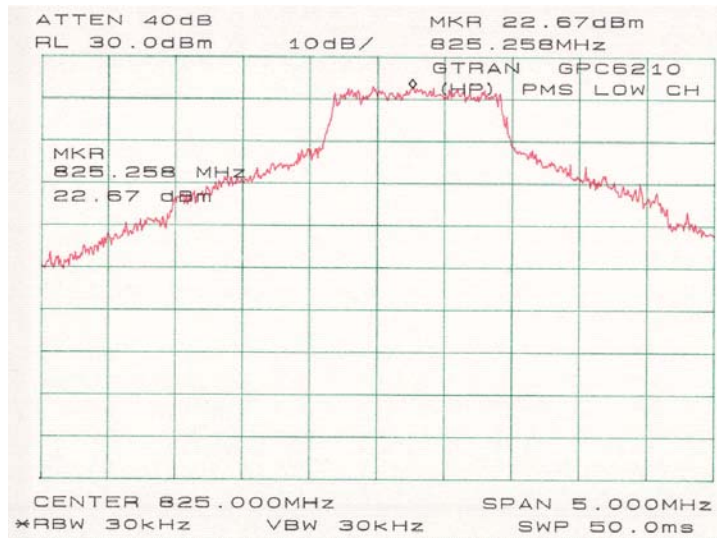


APPENDIX I - PLOTS OF OUTPUT POWER FOR COMPAQ IPAQ 3650

APPENDIX J - PLOTS OF OUTPUT POWER FOR COMPAQ IPAQ 3850

APPENDIX K - PLOTS OF OUTPUT POWER FOR COMPAQ IPAQ 3870

APPENDIX L - PLOTS OF OUTPUT POWER FOR DELL PPO1L

APPENDIX M - PLOTS OF OUTPUT POWER FOR HP T18.033.C.00

APPENDIX N - PLOTS OF OUTPUT POWER FOR IBM 1161