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s p e a g

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Dosimetric E-Field Probe ET3DV6 SN:1604

Conversion factor (± standard deviation)

f = 150 MHz	ConvF	**9.0 ± 10%**	ε_r = 52.3 ± 5% σ = 0.76 ± 5% mho/m (head tissue)
f = 150 MHz	ConvF	**8.6 ± 10%**	ε_r = 61.9 ± 5% σ = 0.80 ± 5% mho/m (body tissue)
f = 300 MHz	ConvF	**7.9 ± 9%**	ε_r = 58.2 ± 5% σ = 0.92 ± 5% mho/m (body tissue)

Important Note:

For numerically assessed probe conversion factors, parameters Alpha and Delta in the DASY software must have the following entries: Alpha = 0 and Delta = 1.

Please see also Section 4.7 of the DASY4 Manual.

APPENDIX C – DIPOLE CALIBRATION CERTIFICATES

Certificate of Calibration Verification

Description of EUT	Tuned Dipole Antenna
EUT Model Number	D450V2
EUT Serial Number	1010
Center Frequency	450 MHz

Calibration Date: 1 April 2004

Testing conditions:

per P1528/D1.2:2003:	
Ambient Temperature (18-25 °C)	19 °C
Ambient Humidity	45%
Liquid Temperature at start of measurements:(±2°C)	18.5 °C
Liquid temperature at end of measurements:	18.5 °C
Date and time at beginning of test:	2004-04-01-16:20 PST
Date and time at beginning of test:	2004-04-01-19:40 PST

Equipment used for measurements

Network Analyzer	HP	8752C	1 Nov 2002
Impedance adapter	AGILENT	43961A	31 Oct 2003
Short Reference	HP	04191-85300	31 Oct 2003
Open Reference	HP	04191-85302	31 Oct 2003
Load Reference	HP	04191-85301	31 Oct 2003
Signal Generator	HP	83650B	29 Feb 2004
Calibration Cable:	SMA Utiflex, 3.05 meter cable S/N 99E1206 (Number 8)		
Phantom Model:			Flat
Liquid:			450 MHz, Head Liquid
Liquid Validation Date:			1 April 2004
Quantity of Liquid in Phantom:			19.8 Liters

Measurement Procedure

In accordance with IEEE P1528/D1.2:2003, 8.3.4, 8.2.3 through 8.2.4

Liquid Validation

Instrument	Manufacturer	Model	Calibrated
Network Analyzer	HP	4396B	1 Nov 2002
Dielectric Probe Kit,	Agilent	85070C	Each Use
H_2O, 18 M-Ohm	BACL		Each Use
Probe, SAR 10 kHz - 6 GHz	SPEAG	ES3DV2	9 Oct 2003

Attestation:

I hereby attest that the equipment are suitable for the performance requirements of IEEE P1528/D1.2:2003 and the personnel operating the test equipment and measurements are properly trained to perform the verification of this calibration procedure set forth in IEEE P1528/D1.2:2003.

The validation antenna herein meets the minimum requirements of 20 dB insertion loss

Hans T. Mellberg
Engineering Manager

1 APR 2004
Date

450MHZ Head Liquid validation Ambient Temp = 23 °C , Liquid Temp = 22 °C , Date : 4-1-2004

Frequency	e'	e''	σ ($\sigma = 2\pi f \varepsilon_o \epsilon''$)
400000000.0000	47.0741	37.0458	
402000000.0000	46.9285	36.9126	
404000000.0000	46.9148	36.7377	
406000000.0000	46.7700	36.5998	
408000000.0000	46.6560	36.4571	
410000000.0000	46.5144	36.3600	
412000000.0000	46.5640	36.1548	
414000000.0000	46.3147	36.1139	
416000000.0000	46.3675	35.8883	
418000000.0000	46.1897	35.7819	
420000000.0000	46.1260	35.7120	
422000000.0000	46.0450	35.7659	
424000000.0000	45.9349	35.5439	
426000000.0000	45.9866	35.4514	
428000000.0000	45.8519	35.2826	
430000000.0000	45.7126	35.2557	
432000000.0000	45.6660	35.1799	
434000000.0000	45.6577	35.0455	
436000000.0000	45.5362	34.9879	
438000000.0000	45.4105	35.0042	
440000000.0000	45.3932	34.7596	
442000000.0000	45.3127	34.7457	
444000000.0000	45.2511	34.6851	
446000000.0000	45.0985	34.5960	
448000000.0000	45.0891	34.4475	
450000000.0000	45.0920	34.3537	0.86
452000000.0000	45.0366	34.2809	
454000000.0000	44.9343	34.1844	
456000000.0000	44.9365	34.1765	
458000000.0000	44.8407	34.1634	
460000000.0000	44.7601	34.0021	
462000000.0000	44.7440	33.9995	
464000000.0000	44.6917	33.9572	
466000000.0000	44.7270	33.7312	
468000000.0000	44.6845	33.7290	
470000000.0000	44.5403	33.6083	
472000000.0000	44.5331	33.5784	
474000000.0000	44.5213	33.5566	
476000000.0000	44.5188	33.4589	
478000000.0000	44.4619	33.3014	
480000000.0000	44.4198	33.2614	
482000000.0000	44.4075	33.1219	
484000000.0000	44.3243	33.0731	
486000000.0000	44.3347	33.0550	
488000000.0000	44.3348	32.9936	
490000000.0000	44.1957	33.0055	
492000000.0000	44.2071	32.9878	
494000000.0000	44.1550	32.8686	
496000000.0000	44.1839	32.8149	
498000000.0000	44.1281	32.6530	
500000000.0000	44.1630	32.6245	

Transmit power set to 127 mW

System validation

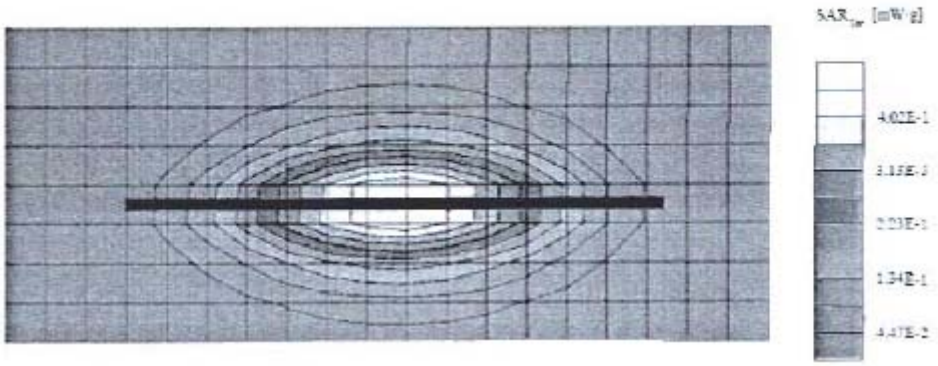
Flat Phantom v4.4 Phantom, Flat Section, Position: (90°,90°), Frequency: 450 MHz

Probe: ES3DV2 - SN3019; ConvF(7.40,7.40,7.40); Crest factor: 1.0; Head 450 MHz: σ = 0.86 mho/m, ε_r = 43.1, ρ = 1.00 g/cm³

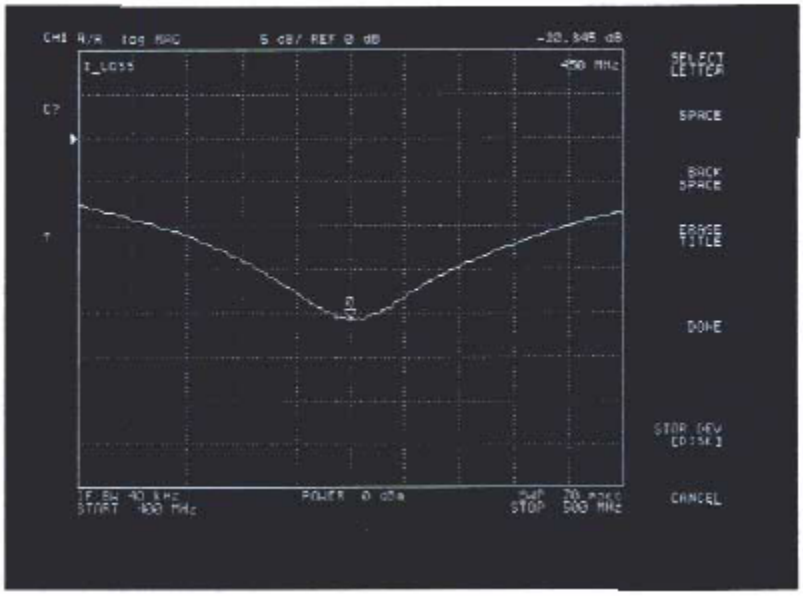
Cube 5x5x7: SAR (1g): 0.487 mW/g, SAR (10g): 0.348 mW/g (Worst-case extrapolation)

Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0

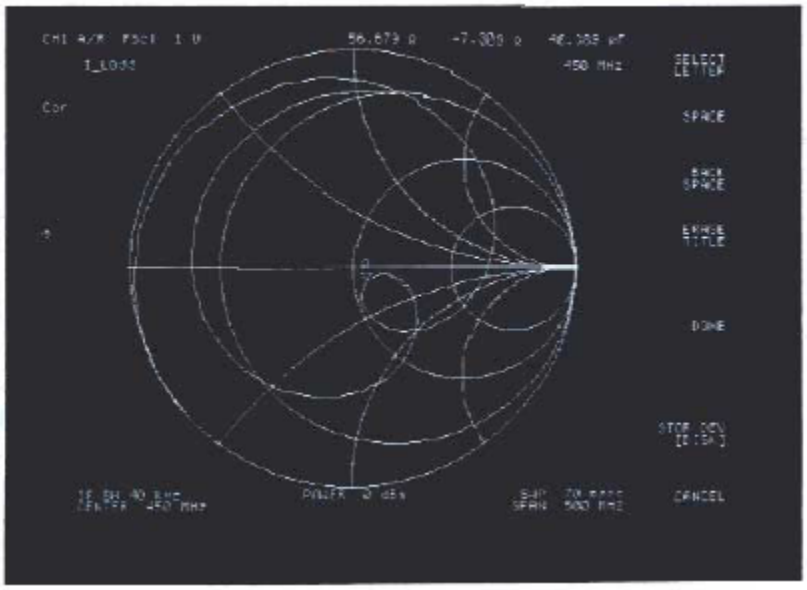
Powerdrift: -0.02 dB



Insertion Loss Plot
S11



Smith Chart



APPENDIX D - TEST SYSTEM VERIFICATIONS SCANS

Liquid Measurement Result

2005-06-10

Simulant	Freq [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation	Limits [%]
Body	450	ε_r	22.0	56.7	56.9	0.35	±5
		σ	22.0	0.94	0.94	0	±5
		1g SAR	22.0	4.874	5.02	3.00	±10
Head	450	ε_r	22.0	43.5	43.6	0.23	±5
		σ	22.0	0.87	0.88	1.15	±5
		1g SAR	22.0	4.9	4.99	1.84	±10

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

Date/Time: 6/10/2005 4:08:23 PM

Test Laboratory: Bay Area Compliance Lab Corp.
File Name: 050610_ET_1604_SystemValidationCheck-D450_Body.da4

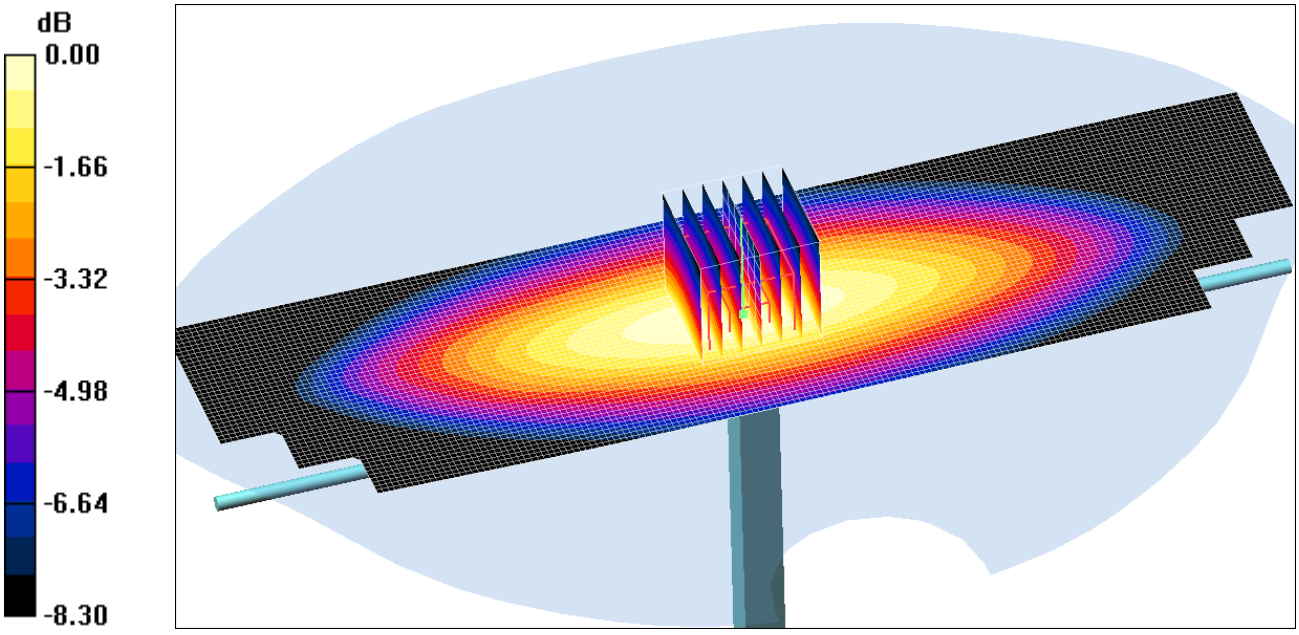
DUT: Dipole 450 MHz; Type: D450V2; Serial: D450V2 - SN:1010
Program Name: System Validation Check at 450 MHz

Communication System: CW; Frequency: 450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 450 MHz; σ = 0.94 mho/m; ε_r = 56.9; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1604; ConvF(7.54, 7.54, 7.54); Calibrated: 3/18/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 6/1/2004
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

d=15mm, Pin=1W Run 4/Area Scan (51x181x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 5.30 mW/g

d=15mm, Pin=1W Run 4/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 74.7 V/m; Power Drift = 0.039 dB
Peak SAR (extrapolated) = 8.05 W/kg
SAR(1 g) = 5.02 mW/g; SAR(10 g) = 3.44 mW/g
Maximum value of SAR (measured) = 5.27 mW/g



0 dB = 5.27mW/g

Date/Time: 6/10/2005 5:03:22 PM

Test Laboratory: Bay Area Compliance Lab Corp.
File Name: 050610_ET_1604_SystemValidationCheck-D450_Head.da4

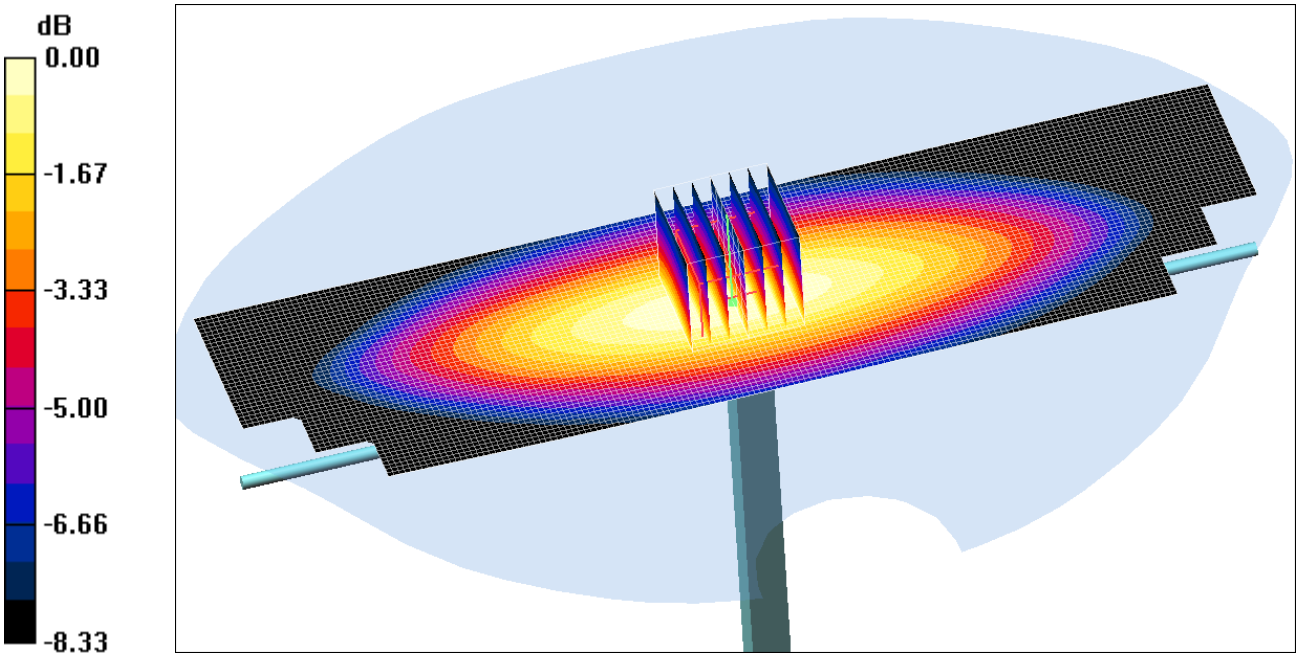
DUT: Dipole 450 MHz; Type: D450V2; Serial: D450V2 - SN:1010
Program Name: System Validation Check at 450 MHz

Communication System: CW; Frequency: 450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 450 MHz; σ = 0.88 mho/m; ε_r = 43.6; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1604; ConvF(8.1, 8.1, 8.1); Calibrated: 3/18/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 6/1/2004
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

d=15mm, Pin=1W Run 2/Area Scan (51x181x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 5.26 mW/g

d=15mm, Pin=1W Run 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 74.9 V/m; Power Drift = 0.026 dB
Peak SAR (extrapolated) = 8.04 W/kg
SAR(1 g) = 4.99 mW/g; SAR(10 g) = 3.43 mW/g
Maximum value of SAR (measured) = 5.26 mW/g



0 dB = 5.26mW/g

APPENDIX E - EUT SCANS

Date/Time: 6/10/2005 10:39:31 AM

Test Laboratory: Bay Area Compliance Lab Corp.
File Name: 050610_HYT_Body worn with belt clip.da4

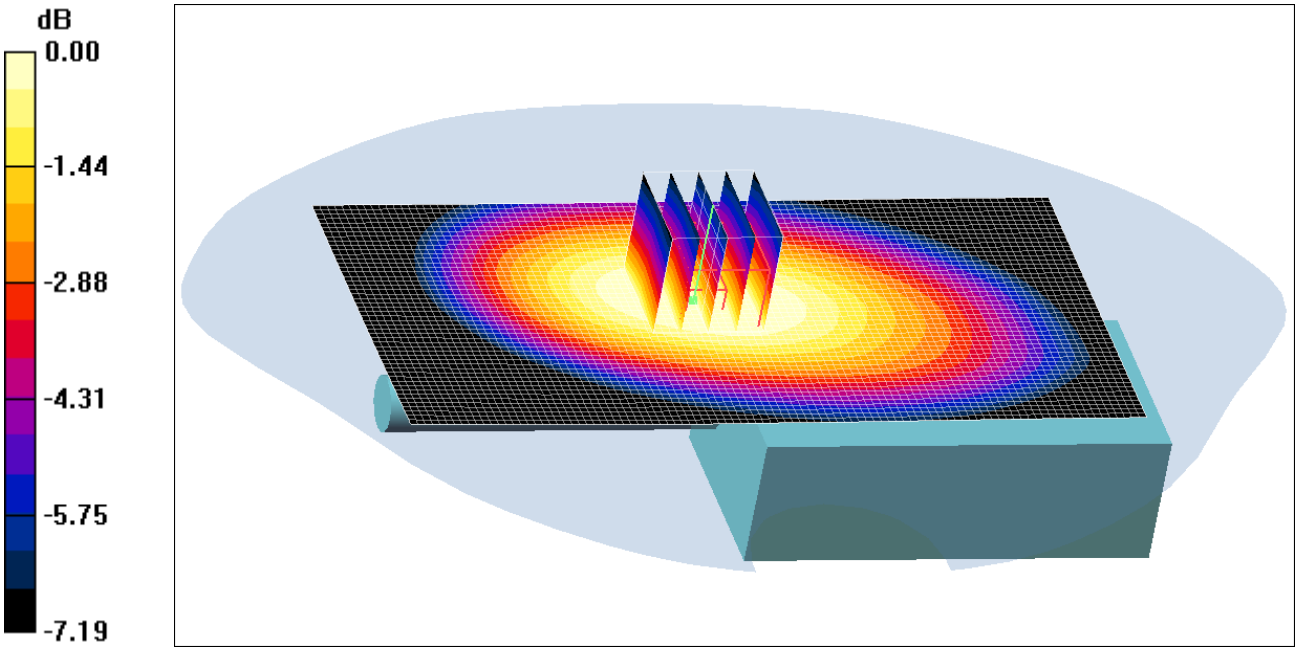
DUT: HYT TC600 U(2); Serial: 05509F0001
Program Name: Body Worn

Communication System: CW; Frequency: 450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 450 MHz; σ = 0.94 mho/m; ε_r = 56.9; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1604; ConvF(7.54, 7.54, 7.54); Calibrated: 3/18/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 6/1/2004
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Body worn position with Belt Clip/Area Scan (51x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 2.63 mW/g

Body worn position with Belt Clip/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.6 V/m; Power Drift = -0.056dB
Peak SAR (extrapolated) = 3.48 W/kg
SAR(1 g) = 2.38 mW/g; SAR(10 g) = 1.76 mW/g
Maximum value of SAR (measured) = 2.47 mW/g



0 dB = 2.47mW/g

Plot #1

Date/Time: 6/10/2005 1:14:14 PM

Test Laboratory: Bay Area Compliance Lab Corp.
File Name: 050610_HYT_Face_2.5cm.da4

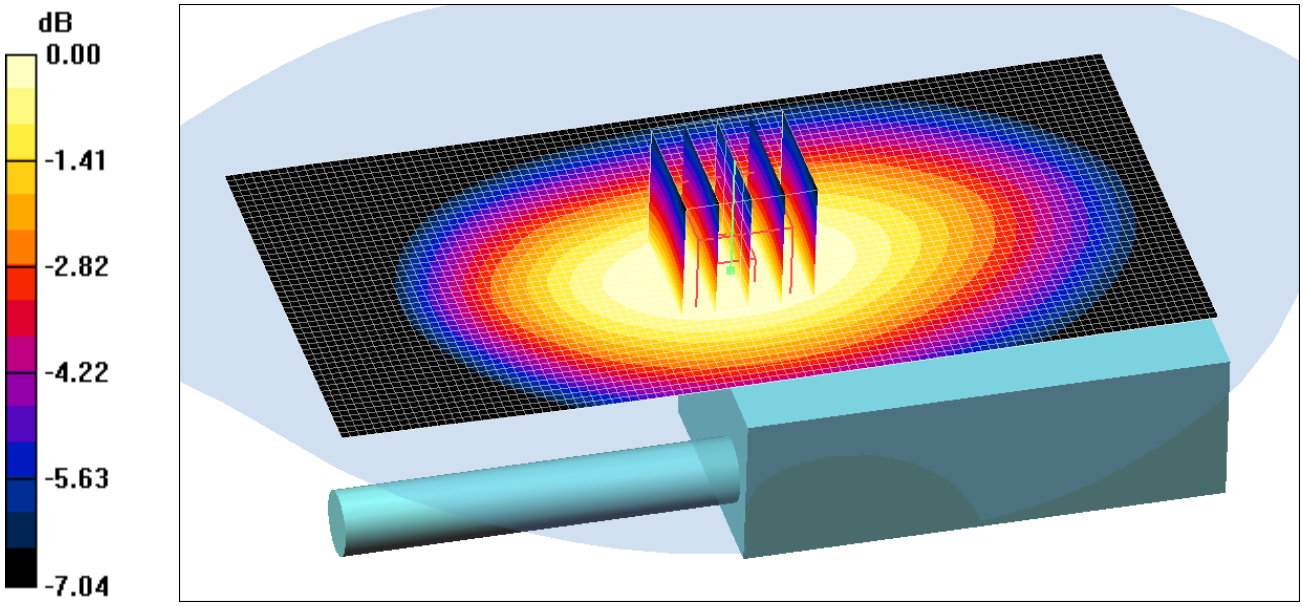
DUT: HYT TC600 U(2); Serial: 05509F0001
Program Name: Face position_2.5cm

Communication System: CW; Frequency: 450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 450 MHz; σ = 0.88 mho/m; ε_r = 43.6; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1604; ConvF(8.1, 8.1, 8.1); Calibrated: 3/18/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 6/1/2004
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Face position_2.5cm 2/Area Scan (51x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 2.18 mW/g

Face position_2.5cm 2/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 49.7 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 2.83 W/kg
SAR(1 g) = 1.95 mW/g; SAR(10 g) = 1.45 mW/g
Maximum value of SAR (measured) = 2.02 mW/g



0 dB = 2.02mW/g

Plot #2

APPENDIX F – CONDUCTED OUTPUT POWER MEASUREMENT

Provision Applicable

The measured peak output power should be greater and within 5% than EMI measurement.

Test Procedure

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

Test equipment

Hewlett Packard HP8564E Spectrum Analyzer, Calibration Due Date: 2005-10-04.
Hewlett Packard HP 7470A Plotter, Calibration not required.
A.H. Systems SAS200 Horn Antenna, Calibration Due Date: 2005-05-31
Com-Power AB-100 Dipole Antenna, Calibration Due Date: 2005-09-05

Test Results

Frequency (MHz)	Output Power in dBm	Output Power in W
460.125	36.99	5.0

APPENDIX G – Z-AXIS PLOT

Date/Time: 6/10/2005 10:39:31 AM

Test Laboratory: Bay Area Compliance Lab Corp.
File Name: 050610_HYT_Body worn with belt clip.da4

DUT: HYT TC600 U(2); Serial: 05509F0001
Program Name: Body Worn

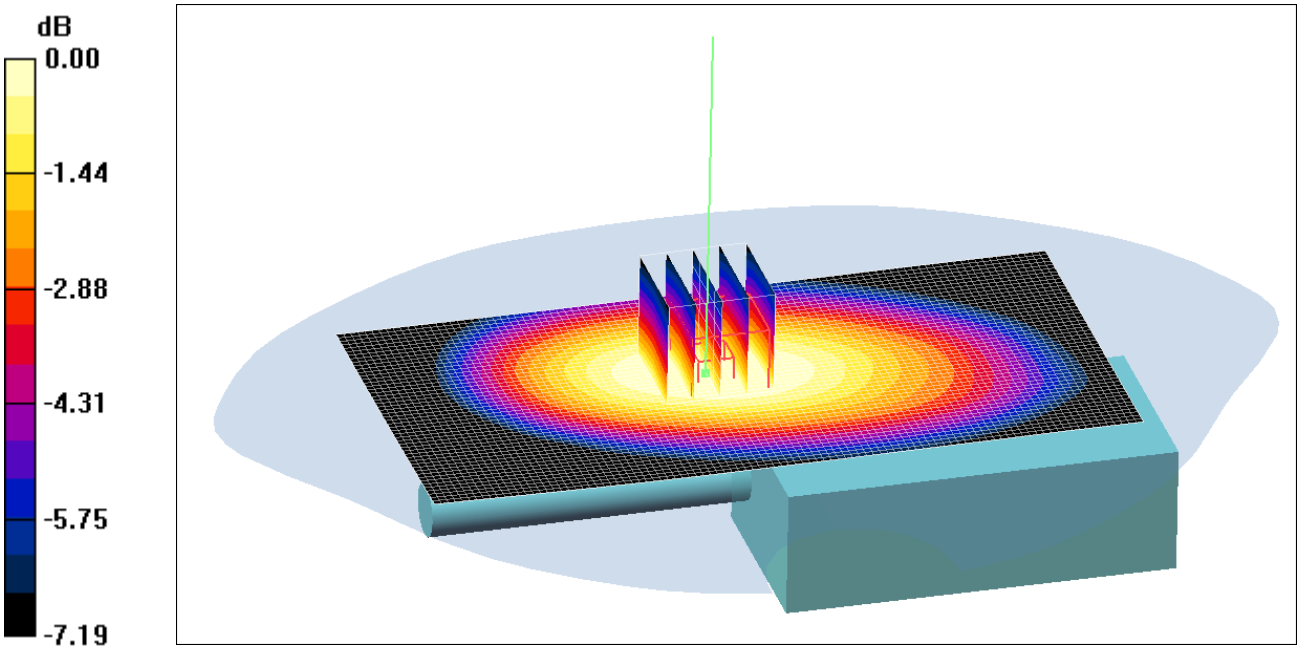
Communication System: CW; Frequency: 450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 450 MHz; σ = 0.94 mho/m; ε_r = 56.9; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1604; ConvF(7.54, 7.54, 7.54); Calibrated: 3/18/2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn456; Calibrated: 6/1/2004
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

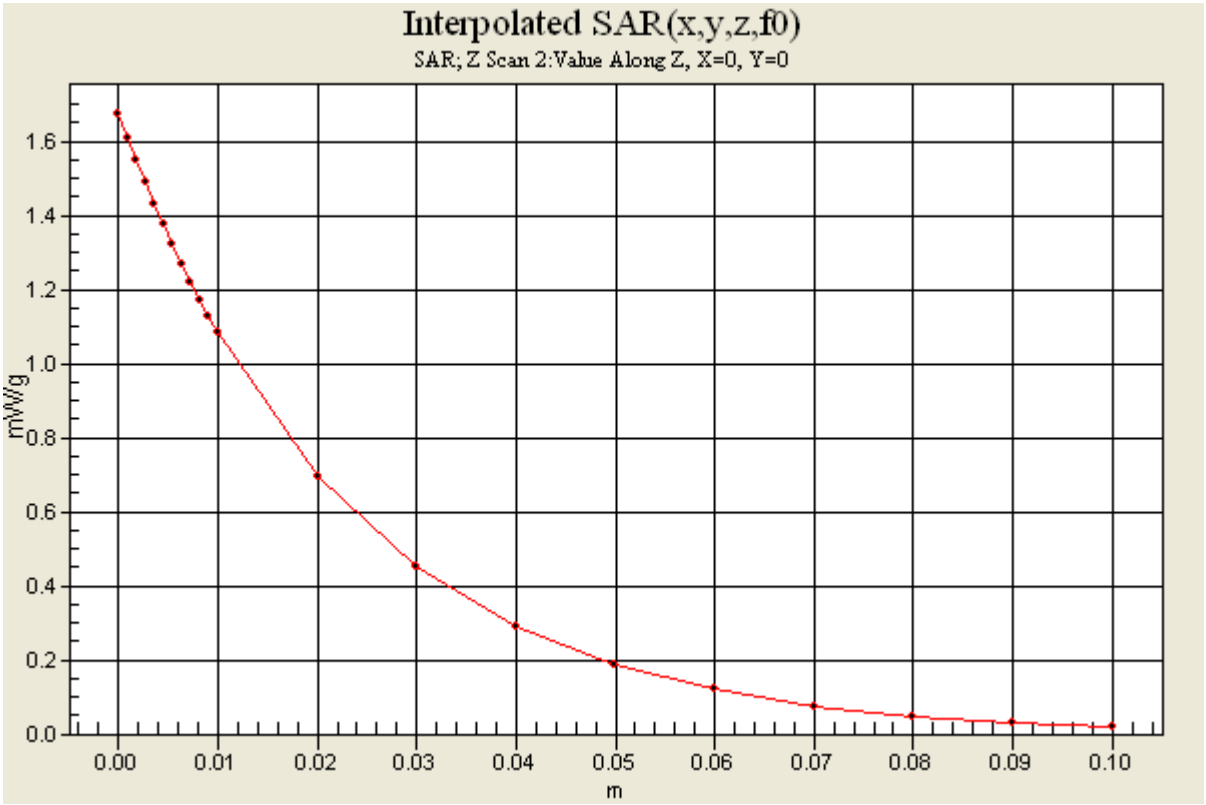
Body worn position with Belt Clip/Area Scan (51x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (interpolated) = 2.63 mW/g

Body worn position with Belt Clip/Z Scan 2 (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=10mm
Maximum value of SAR (interpolated) = 1.67 mW/g

Body worn position with Belt Clip/Zoom Scan 2 (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.6 V/m; Power Drift = -0.056dB
Peak SAR (extrapolated) = 3.48 W/kg
SAR(1 g) = 2.38 mW/g; SAR(10 g) = 1.76 mW/g
Maximum value of SAR (measured) = 2.47 mW/g


dB
0.00
-1.44
-2.88
-4.31
-5.75
-7.19

0 dB = 2.47mW/g


Interpolated SAR(x,y,z,f0)
SAR; Z Scan 2:Value Along Z, X=0, Y=0
mW/g
m
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10

APPENDIX H – EUT TEST POSITION PHOTOS

2.5cm Face

Body Worn

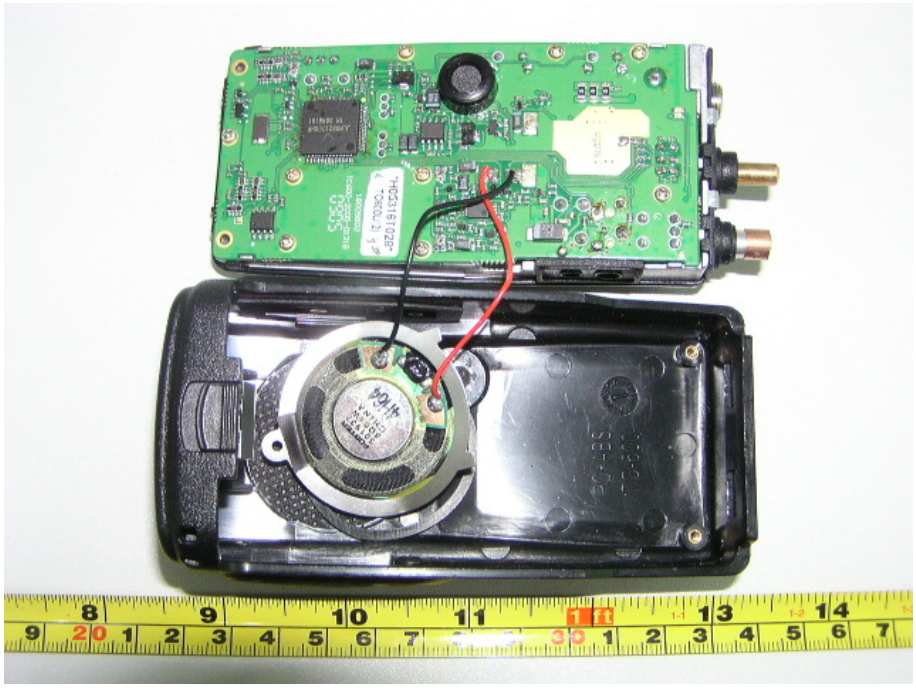
APPENDIX I – EUT & ACCESSORIES PHOTOS

EUT – Front View

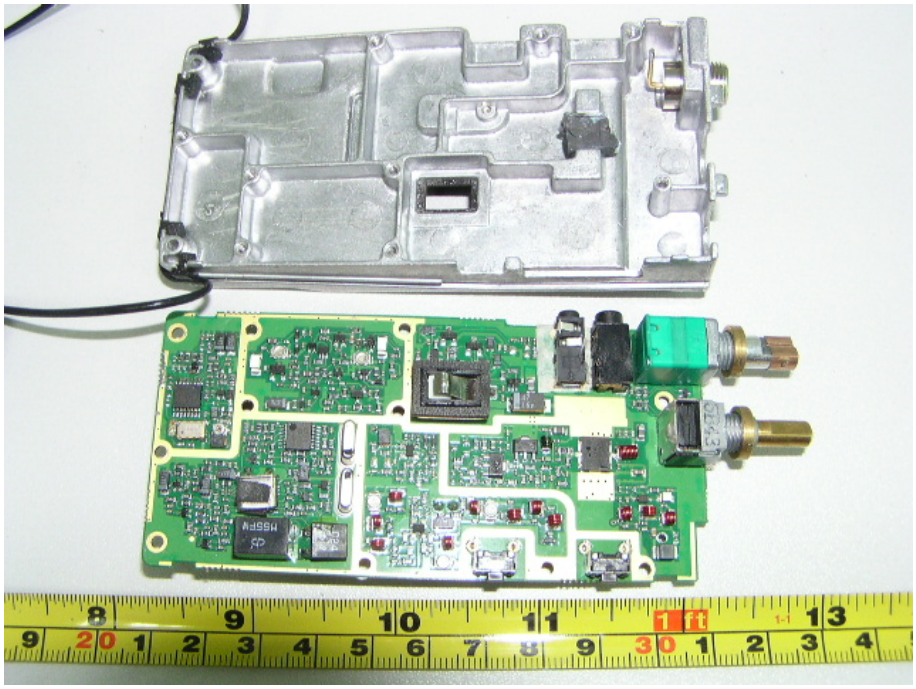
EUT – Rear View

EUT – Uncover View (1)

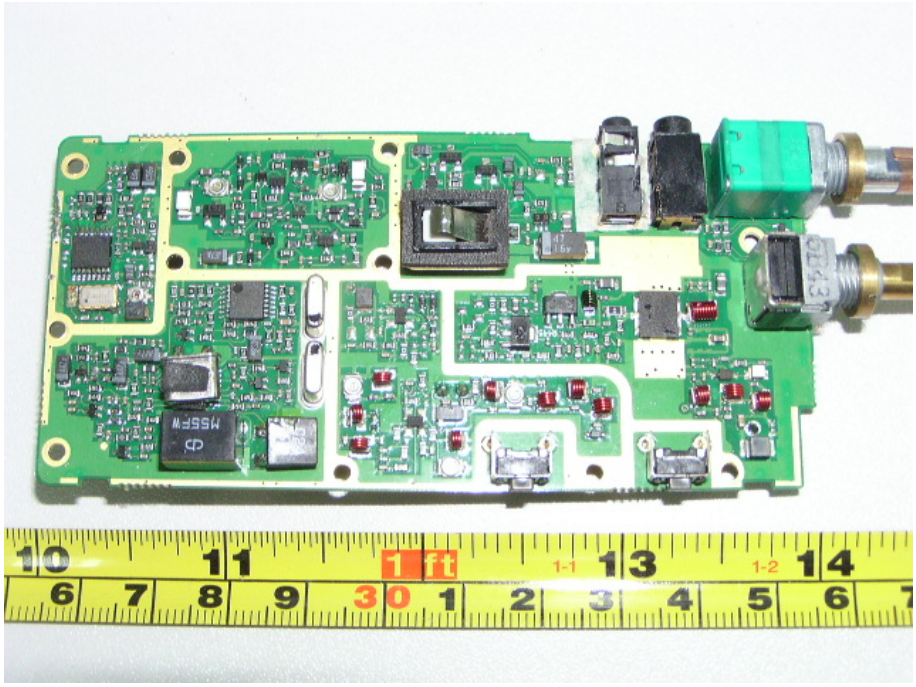
EUT – Uncover View (2)



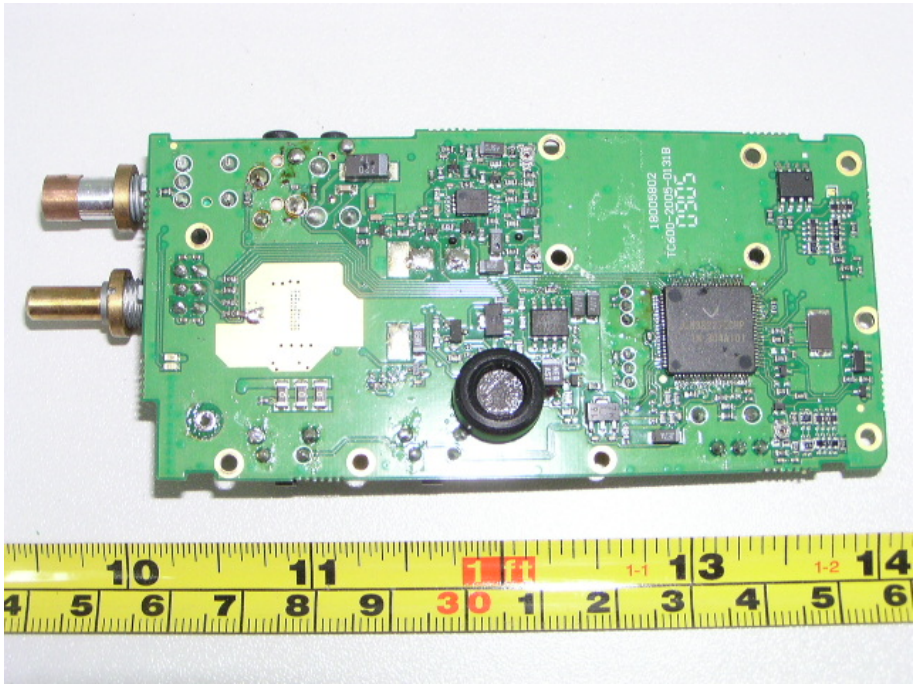
EUT – Uncover View (3)



EUT – Mainboard View (1)



EUT – Mainboard View (2)



APPENDIX J - INFORMATIVE REFERENCES

[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.