SAR EVALUATION REPORT

For

Axesstel, Inc.

6305 Lusk Blvd.
San Diego, CA 92121

FCC ID: PH7VZ1-3DWCB

2003-08-21

This Report Concerns:	**Equipment Type:**
☒ Original Report	Hybrid Cordless/Cellular Phone

Test Engineer:	Eric Hong /
Report No.:	R0307291S
Test Date:	2003-08-022003-07-30/2003-08-01/2003-08-04/2003-08-05/2003-08-072003-08-08
Reviewed By:	Ling Zhang /
Prepared By:	Bay Area Compliance Laboratory Corporation 230 Commercial Street Sunnyvale, CA 94085 Tel: (408) 732-9162 Fax: (408) 732 9164

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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] Katja

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

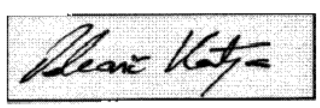
Additional Conversion Factors

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)

CDMA Mode 835MHz Body Liquid Validation

frequency	e'	e''
810000000.0000	54.6070	20.9460
811000000.0000	54.5489	20.9335
812000000.0000	54.5019	20.8969
813000000.0000	54.4421	20.8622
814000000.0000	54.4439	20.8848
815000000.0000	54.4401	20.8870
816000000.0000	54.4025	20.8136
817000000.0000	54.3731	20.8474
818000000.0000	54.3696	20.8681
819000000.0000	54.3530	20.8629
820000000.0000	54.2479	20.8474
821000000.0000	54.2093	20.8166
822000000.0000	54.2281	20.8260
823000000.0000	54.2251	20.8742
824000000.0000	54.2364	20.8596
825000000.0000	54.2723	20.9202
826000000.0000	54.2450	20.8931
827000000.0000	54.2550	20.9206
828000000.0000	54.2885	20.9222
829000000.0000	54.3128	21.0668
830000000.0000	54.2664	21.1278
831000000.0000	54.2862	21.1915
832000000.0000	54.2435	21.2230
833000000.0000	54.2152	21.2286
834000000.0000	54.3192	21.2763
835000000.0000	54.3649	21.3357
836000000.0000	54.3907	21.2856
837000000.0000	54.4988	21.3583
838000000.0000	54.5880	21.3946
839000000.0000	54.4937	21.3701
840000000.0000	54.5068	21.3309
841000000.0000	54.6159	21.3609
842000000.0000	54.6749	21.3482
843000000.0000	54.7347	21.3716
844000000.0000	54.8610	21.3643
845000000.0000	54.8065	21.3194
846000000.0000	54.6892	21.3030
847000000.0000	54.7898	21.3686
848000000.0000	54.7339	21.2605
849000000.0000	54.7798	21.3091
850000000.0000	54.8475	21.2956
851000000.0000	54.8886	21.2321
852000000.0000	54.8350	21.2741
853000000.0000	54.8886	21.2770
854000000.0000	54.8947	21.2596
855000000.0000	54.9060	21.3537
856000000.0000	54.9430	21.2237
857000000.0000	54.9490	21.2566
858000000.0000	54.9935	21.2594
859000000.0000	54.9474	21.1790
860000000.0000	54.9799	21.1427

$\sigma = \omega\, \varepsilon_o\, \varepsilon'' = 2\, \pi f\, \varepsilon_o\, \varepsilon'' = 0.991$

where $f = 835 \times 10^6$

$\varepsilon_o = 8.854 \times 10^{-12}$

$\varepsilon'' = 21.3357$

CDMA Mode 835MHz Head Liquid Validation

frequency	e'	e''
810000000.0000	42.0065	19.8224
811000000.0000	42.0175	19.7685
812000000.0000	41.9609	19.7201
813000000.0000	41.9413	19.7150
814000000.0000	41.8739	19.6914
815000000.0000	41.8530	19.6501
816000000.0000	41.8500	19.6877
817000000.0000	41.8056	19.6597
818000000.0000	41.8295	19.7032
819000000.0000	41.7664	19.6580
820000000.0000	41.7700	19.6483
821000000.0000	41.7104	19.6750
822000000.0000	41.7246	19.7140
823000000.0000	41.7355	19.7338
824000000.0000	41.7207	19.7393
825000000.0000	41.7189	19.6629
826000000.0000	41.6684	19.6175
827000000.0000	41.5719	19.6829
828000000.0000	41.5870	19.6607
829000000.0000	41.5531	19.6576
830000000.0000	41.4949	19.5915
831000000.0000	41.4708	19.5927
832000000.0000	41.3946	19.5419
833000000.0000	41.4331	19.5592
834000000.0000	41.3910	19.5755
835000000.0000	41.3461	19.4809
836000000.0000	41.2899	19.5428
837000000.0000	41.2651	19.5206
838000000.0000	41.1689	19.4783
839000000.0000	41.1799	19.4862
840000000.0000	41.1106	19.4616
841000000.0000	41.0858	19.4794
842000000.0000	41.0431	19.4407
843000000.0000	40.9958	19.4514
844000000.0000	41.0181	19.4471
845000000.0000	40.9330	19.4212
846000000.0000	40.9179	19.3918
847000000.0000	40.8571	19.4278
848000000.0000	40.7961	19.3612
849000000.0000	40.8123	19.3712
850000000.0000	40.8072	19.3974
851000000.0000	40.7709	19.4042
852000000.0000	40.8153	19.3756
853000000.0000	40.7921	19.3852
854000000.0000	40.7544	19.4279
855000000.0000	40.7142	19.4441
856000000.0000	40.6977	19.4001
857000000.0000	40.7186	19.4316
858000000.0000	40.6933	19.4852
859000000.0000	40.7384	19.4484
860000000.0000	40.6460	19.4500

$\sigma = \omega \varepsilon_o \varepsilon'' = 2 \pi f \varepsilon_o \varepsilon''=0.905$

where $f = 835 \times 10^{6}$

$\varepsilon_o = 8.854 \times 10^{-12}$

$\varepsilon'' = 19.4809$

1900MHz Body Liquid Validation

frequency	e'	e''
1850000000.0000	52.1861	13.9311
1852000000.0000	52.1850	13.9218
1854000000.0000	52.1751	13.9172
1856000000.0000	52.1706	13.9247
1858000000.0000	52.1537	13.8986
1860000000.0000	52.1215	13.9222
1862000000.0000	52.1296	13.8998
1864000000.0000	52.1149	13.9300
1866000000.0000	52.0820	13.9310
1868000000.0000	52.0716	13.9393
1870000000.0000	52.0384	13.9098
1872000000.0000	52.0523	13.9541
1874000000.0000	52.0525	13.9944
1876000000.0000	52.0440	14.0120
1878000000.0000	52.0469	14.0211
1880000000.0000	52.0595	14.0204
1882000000.0000	52.0254	14.0555
1884000000.0000	52.0508	14.0716
1886000000.0000	52.0342	14.0777
1888000000.0000	52.0241	14.0665
1890000000.0000	52.0420	14.1016
1892000000.0000	52.0142	14.0727
1894000000.0000	52.0041	14.1209
1896000000.0000	52.0497	14.0879
1898000000.0000	52.0163	14.0875
1900000000.0000	52.0286	14.0993
1902000000.0000	52.0091	14.1219
1904000000.0000	52.0118	14.1161
1906000000.0000	51.9726	14.1521
1908000000.0000	52.0364	14.1796
1910000000.0000	52.0075	14.1847
1912000000.0000	52.0059	14.1893
1914000000.0000	51.9967	14.1374
1916000000.0000	52.0276	14.1501
1918000000.0000	51.9749	14.1390
1920000000.0000	51.9857	14.2052
1922000000.0000	52.0059	14.2296
1924000000.0000	51.9985	14.1950
1926000000.0000	51.9888	14.2203
1928000000.0000	51.9869	14.2697
1930000000.0000	51.9766	14.2839
1932000000.0000	52.0034	14.2905
1934000000.0000	51.9685	14.3096
1936000000.0000	52.0103	14.3260
1938000000.0000	52.0213	14.3165
1940000000.0000	51.9755	14.3442
1942000000.0000	51.9717	14.3407
1944000000.0000	51.9459	14.3707
1946000000.0000	51.9644	14.3659
1948000000.0000	51.9561	14.3859
1950000000.0000	51.9068	14.3789

$\sigma = \omega \varepsilon_o \varepsilon'' = 2 \pi f \varepsilon_o \varepsilon''=1.4903$

where $f = 1900x\,10^6$

$\varepsilon_o = 8.854 \times 10^{-12}$

$\varepsilon'' = 14.0993$

1900MHz Head Liquid Validation

frequency	e'	e''
1875000000.0000	40.5551	13.8392
1876000000.0000	40.5467	13.8010
1877000000.0000	40.5700	13.8041
1878000000.0000	40.5538	13.8170
1879000000.0000	40.5595	13.8199
1880000000.0000	40.5449	13.8197
1881000000.0000	40.5553	13.8007
1882000000.0000	40.5365	13.7902
1883000000.0000	40.5174	13.8030
1884000000.0000	40.5508	13.8105
1885000000.0000	40.5522	13.8207
1886000000.0000	40.5332	13.8276
1887000000.0000	40.5491	13.8466
1888000000.0000	40.5564	13.8392
1889000000.0000	40.5230	13.8432
1890000000.0000	40.5331	13.8591
1891000000.0000	40.5564	13.8620
1892000000.0000	40.5533	13.8910
1893000000.0000	40.6101	13.8984
1894000000.0000	40.5233	13.8454
1895000000.0000	40.5249	13.8524
1896000000.0000	40.4842	13.8664
1897000000.0000	40.4614	13.8254
1898000000.0000	40.4716	13.8441
1899000000.0000	40.4586	13.8598
1900000000.0000	40.4413	13.8566
1901000000.0000	40.4503	13.8477
1902000000.0000	40.4272	13.8532
1903000000.0000	40.4621	13.8764
1904000000.0000	40.4594	13.8733
1905000000.0000	40.4278	13.8527
1906000000.0000	40.4178	13.8712
1907000000.0000	40.4078	13.8839
1908000000.0000	40.4081	13.8779
1909000000.0000	40.4069	13.8762
1910000000.0000	40.4072	13.8702
1911000000.0000	40.3829	13.8829
1912000000.0000	40.3701	13.8811
1913000000.0000	40.3934	13.9244
1914000000.0000	40.4083	13.8750
1915000000.0000	40.3436	13.8789
1916000000.0000	40.3771	13.9032
1917000000.0000	40.3861	13.9031
1918000000.0000	40.3446	13.8811
1919000000.0000	40.3406	13.9197
1920000000.0000	40.3452	13.9036
1921000000.0000	40.3384	13.9076
1922000000.0000	40.3373	13.9116
1923000000.0000	40.3262	13.8940
1924000000.0000	40.3295	13.9341
1925000000.0000	40.3298	13.9396

$\sigma = \omega\, \varepsilon_o\, \varepsilon'' = 2\,\pi f\, \varepsilon_o\, \varepsilon'' = 1.4646$

where $f = 1900 \times 10^6$

$\varepsilon_o = 8.854 \times 10^{-12}$

$\varepsilon'' = 13.8566$

AMPS Mode 835 MHz Body Liquid Validation

frequency	e'	e''
810000000.0000	54.3159	20.6362
811000000.0000	54.2134	20.6001
812000000.0000	54.1150	20.5715
813000000.0000	54.1297	20.5648
814000000.0000	54.0575	20.5418
815000000.0000	54.0650	20.5573
816000000.0000	54.0095	20.5122
817000000.0000	54.0191	20.5590
818000000.0000	53.9659	20.5729
819000000.0000	53.9587	20.5406
820000000.0000	53.8781	20.5362
821000000.0000	53.8564	20.5205
822000000.0000	53.8512	20.4919
823000000.0000	53.7875	20.4656
824000000.0000	53.7661	20.4774
825000000.0000	53.8130	20.5511
826000000.0000	53.7365	20.5085
827000000.0000	53.8305	20.5122
828000000.0000	53.8021	20.5277
829000000.0000	53.8110	20.6250
830000000.0000	53.7687	20.7116
831000000.0000	53.7371	20.7470
832000000.0000	53.7497	20.8147
833000000.0000	53.7325	20.8062
834000000.0000	53.7742	20.8589
835000000.0000	53.8483	20.8675
836000000.0000	53.8750	20.8729
837000000.0000	53.9236	20.8852
838000000.0000	54.0304	20.9038
839000000.0000	53.9875	20.8718
840000000.0000	53.9136	20.8149
841000000.0000	54.0427	20.8764
842000000.0000	54.0835	20.8649
843000000.0000	54.1593	20.8853
844000000.0000	54.2155	20.9203
845000000.0000	54.1542	20.8616
846000000.0000	54.1317	20.8420
847000000.0000	54.1625	20.8719
848000000.0000	54.0873	20.8299
849000000.0000	54.1632	20.8587
850000000.0000	54.2711	20.8706
851000000.0000	54.2846	20.8502
852000000.0000	54.2267	20.8494
853000000.0000	54.3002	20.8563
854000000.0000	54.2647	20.8120
855000000.0000	54.2589	20.8744
856000000.0000	54.3024	20.8335
857000000.0000	54.2680	20.8250
858000000.0000	54.3893	20.8195
859000000.0000	54.2828	20.7862
860000000.0000	54.3589	20.7051

$\sigma = \omega \varepsilon_o \varepsilon'' = 2 \pi f \varepsilon_o \varepsilon''=0.969$
where $f = 835x 10^6$
$\varepsilon_o = 8.854 \times 10^{-12}$
$\varepsilon'' = 20.8675$

AMPS 835MHz Head Liquid Validation

frequency	e'	e''
810000000.0000	42.1587	19.5280
811000000.0000	42.0862	19.4766
812000000.0000	42.0453	19.4217
813000000.0000	42.0476	19.4165
814000000.0000	42.0202	19.4634
815000000.0000	41.9669	19.4298
816000000.0000	41.9501	19.4277
817000000.0000	41.9015	19.3845
818000000.0000	41.9152	19.4200
819000000.0000	41.8542	19.3978
820000000.0000	41.8015	19.3645
821000000.0000	41.7814	19.3964
822000000.0000	41.7653	19.4064
823000000.0000	41.7214	19.3416
824000000.0000	41.6975	19.3627
825000000.0000	41.6559	19.3257
826000000.0000	41.6654	19.3707
827000000.0000	41.6023	19.3621
828000000.0000	41.6003	19.3225
829000000.0000	41.5467	19.2742
830000000.0000	41.6128	19.2978
831000000.0000	41.5236	19.3154
832000000.0000	41.5884	19.3047
833000000.0000	41.5166	19.3344
834000000.0000	41.5506	19.3272
835000000.0000	41.5735	19.2787
836000000.0000	41.5587	19.3005
837000000.0000	41.5439	19.2582
838000000.0000	41.5275	19.2966
839000000.0000	41.5259	19.2894
840000000.0000	41.4807	19.2828
841000000.0000	41.4801	19.2992
842000000.0000	41.4936	19.3102
843000000.0000	41.4353	19.2688
844000000.0000	41.4516	19.3185
845000000.0000	41.4462	19.3009
846000000.0000	41.4636	19.2905
847000000.0000	41.4340	19.2822
848000000.0000	41.4917	19.2841
849000000.0000	41.4696	19.2849
850000000.0000	41.4524	19.2877
851000000.0000	41.4550	19.3423
852000000.0000	41.4313	19.2764
853000000.0000	41.4652	19.3504
854000000.0000	41.4492	19.3251
855000000.0000	41.4094	19.3406
856000000.0000	41.4255	19.3267
857000000.0000	41.4104	19.3444
858000000.0000	41.3977	19.3377
859000000.0000	41.3965	19.4012
860000000.0000	41.3788	19.3610

$\sigma = \omega \varepsilon_o \varepsilon'' = 2 \pi f \varepsilon_o \varepsilon''=0.8955$

where $f = 835x\ 10^6$

$\varepsilon_o = 8.854 \times 10^{-12}$

$\varepsilon'' = 19.2787$

3 - EUT DESCRIPTION

Applicant:	Axesstel, Inc.
Product Description:	Hybrid Cordless/Cellular Phone
Product Model Number:	VZ1-3DWCB
FCC ID:	PH7VZ1-3DWCB
Serial Number:	None
Maximum RF Output Power:	26.50 dBm
RF Exposure environment:	General Population/Uncontrolled
Applicable Standard	FCC CFR 47, Part 15C, 22, & 24
Application Type:	Certification

4 - SYSTEM TEST CONFIGURATION

4.1 Justification

The system was configured for testing in a typical fashion (as normally used by a typical user).

4.2 EUT Exercise Procedure

The EUT exercising program used during SAR testing was designed to exercise the various system components in a manner similar to a typical use. The EUT was tested by pushing the PTT bottom during the testing.

4.3 Equipment Modifications

No modification(s) were made by BACL to ensure that the EUT complies with the applicable limits.

5 – CONDUCTED OUTPUT POWER MEASUREMENTS

5.1 Provision Applicable

According to §15.247(b) (3), for systems using digital modulation, the maximum peak output power of the intentional radiator shall not exceed 1 Watt.

According to FCC §22.913 (a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts. According to FCC § 24.232(b), EIRP peak power for mobile/portable stations are limited to 2 watts.

5.2 Test Procedure

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

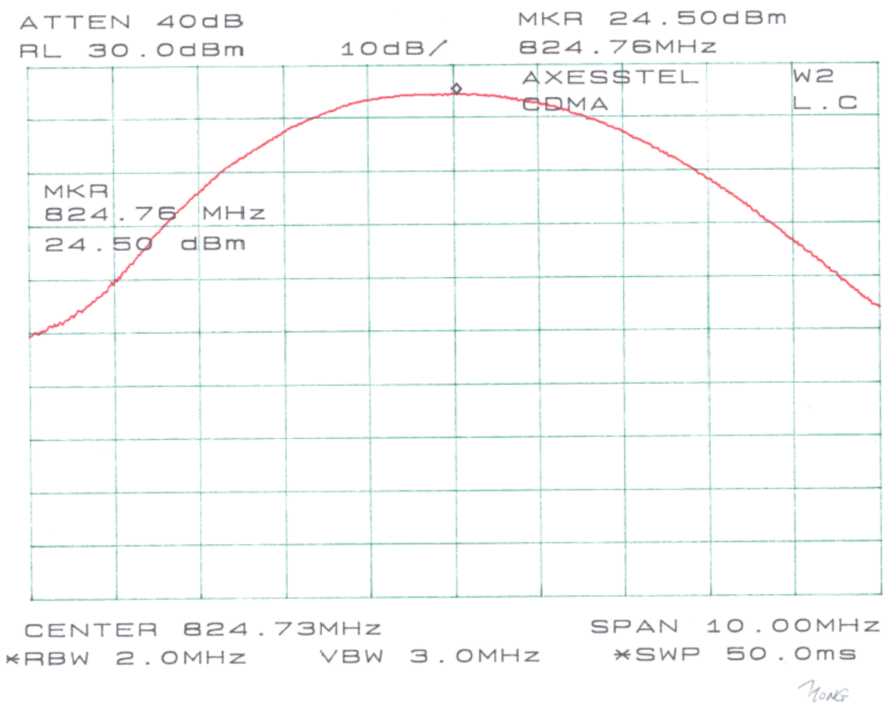
5.3 Test equipment

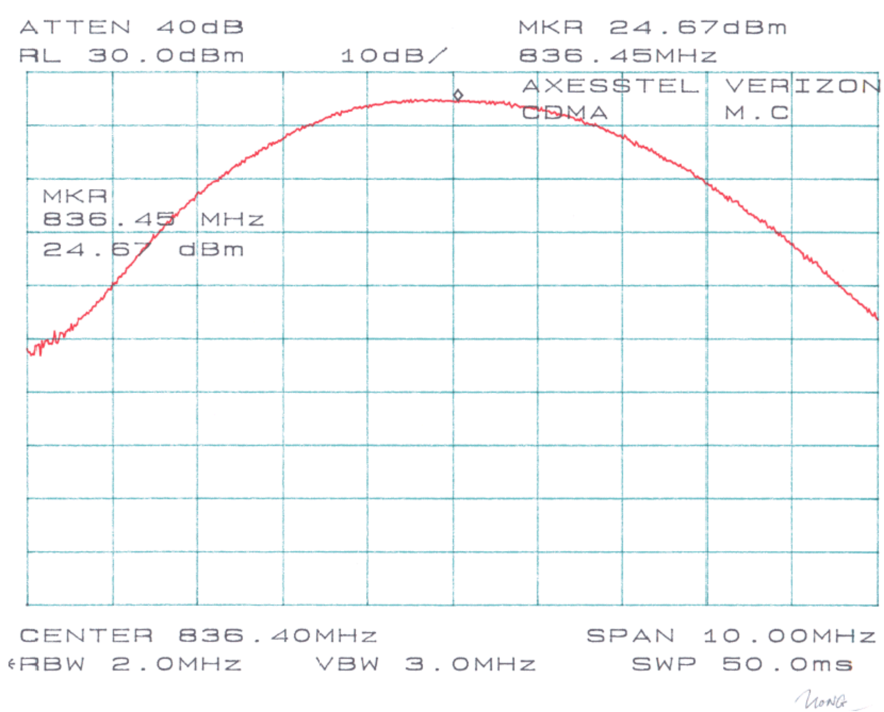
Hewlett Packard HP8564E Spectrum Analyzer, Calibration Due Date: 2004-08-01.
Hewlett Packard HP 7470A Plotter, Calibration not required.
A.H. Systems SAS200 Horn Antenna, Calibration Due Date: 2004-05-31
Com-Power AB-100 Dipole Antenna, Calibration Due Date: 2003-09-05

5.4 Test Results

Modulation Type		Channel	Output Power in dBm	Output Power in W	Limit (W)
PMS	CDMA	Low	24.50	0.28	7
		Middle	24.67	0.29	7
		High	24.50	0.28	7
	AMPS	Low	26.50	0.45	7
		Middle	26.50	0.45	7
		High	26.50	0.45	7
PCS-CDMA		Low	24.50	0.28	2
		Middle	24.50	0.28	2
		High	24.50	0.28	2

Please refer to the following plots.


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 24.50dBm
824.76MHz
AXESSTEL
CDMA
W2
L.C
MKR
824.76 MHz
24.50 dBm
CENTER 824.73MHz
SPAN 10.00MHz
*RBW 2.0MHz
VBW 3.0MHz
*SWP 50.0ms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RL 30.0dBm
10dB/
MKR 24.67dBm
836.45MHz
AXESSTEL
CDMA
VERIZON
M.C
MKR
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24.67 dBm
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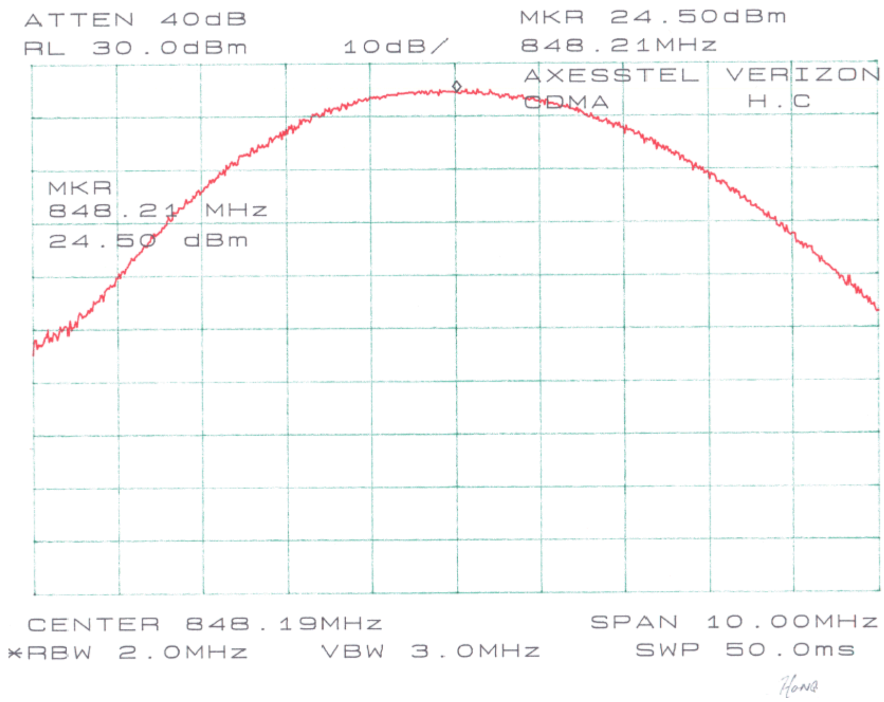
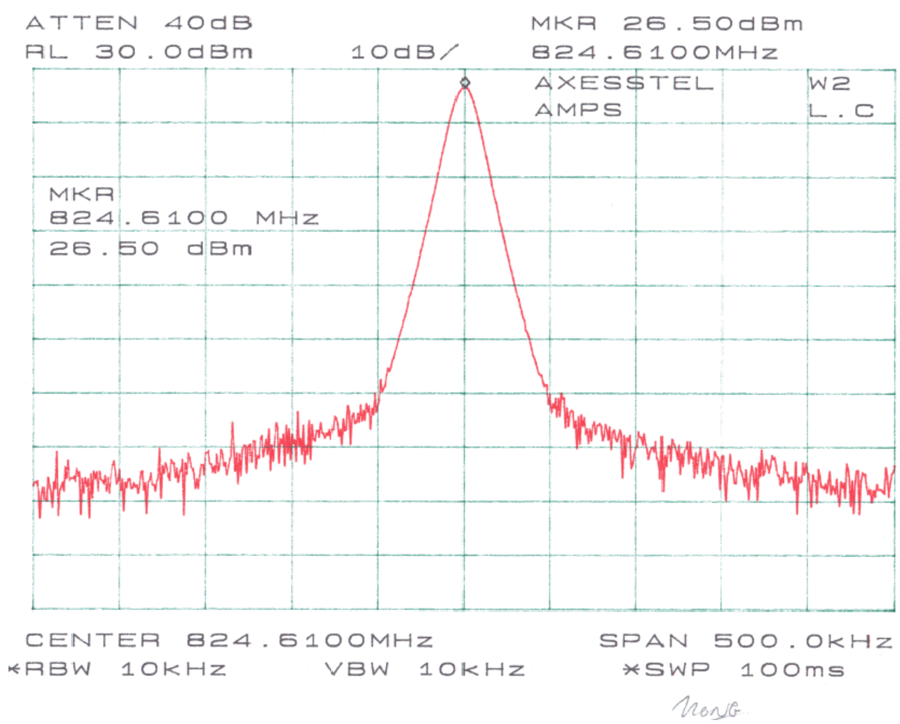
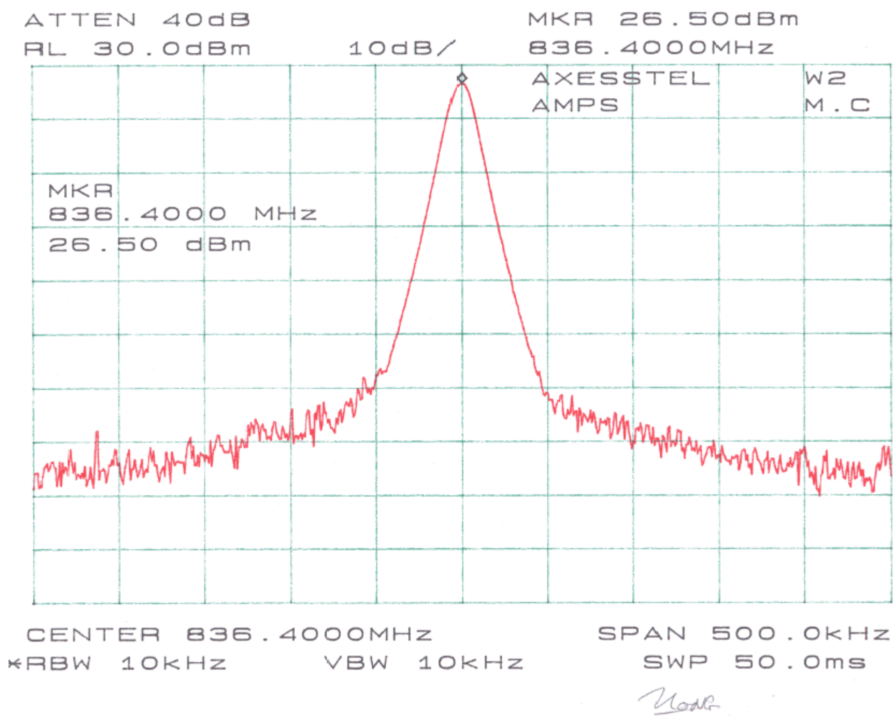
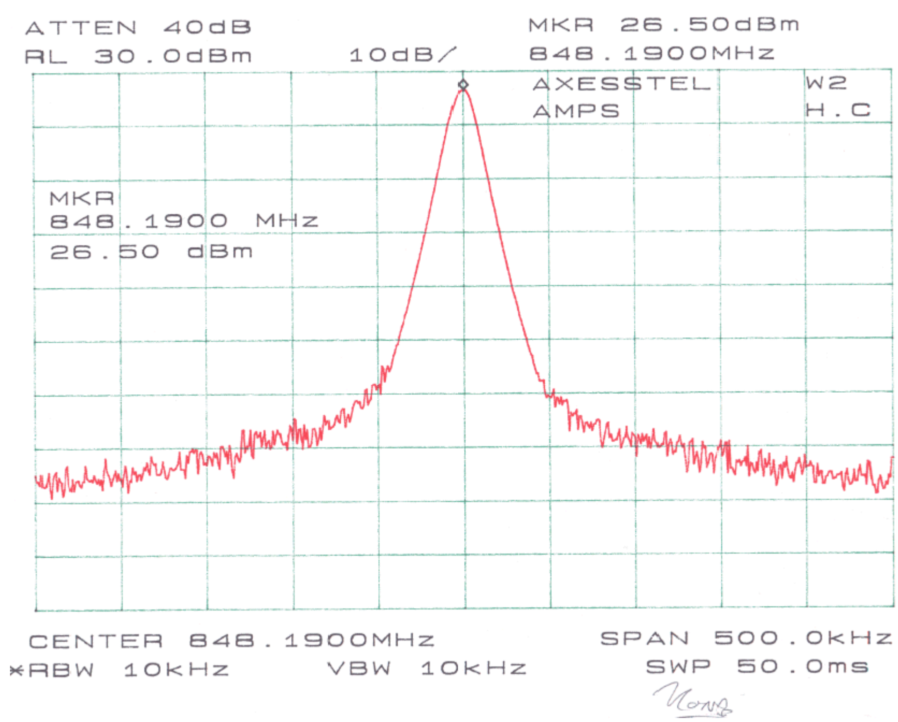
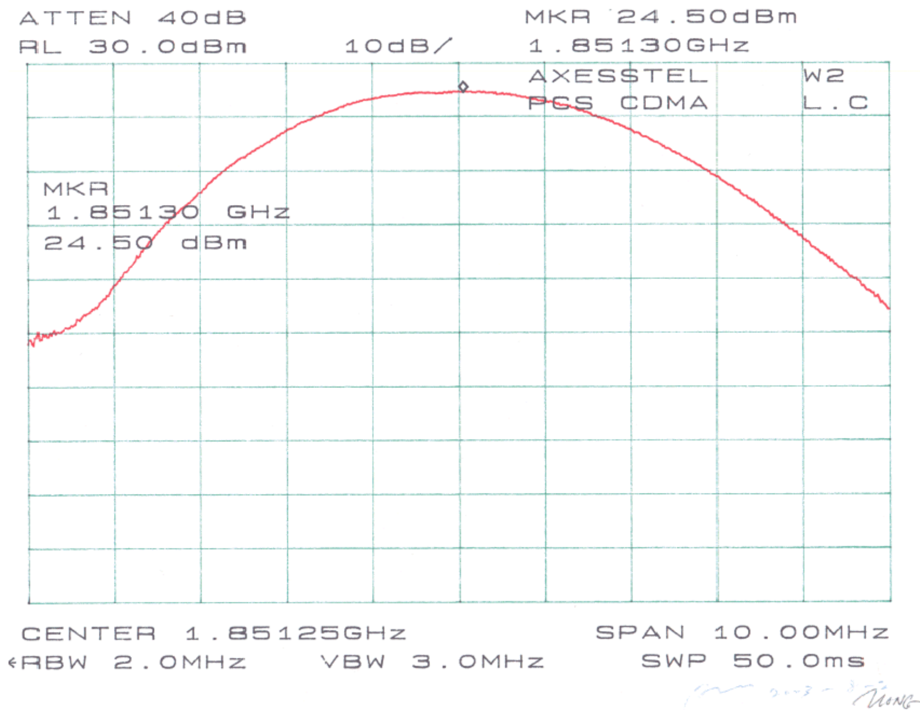
SPAN 10.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms

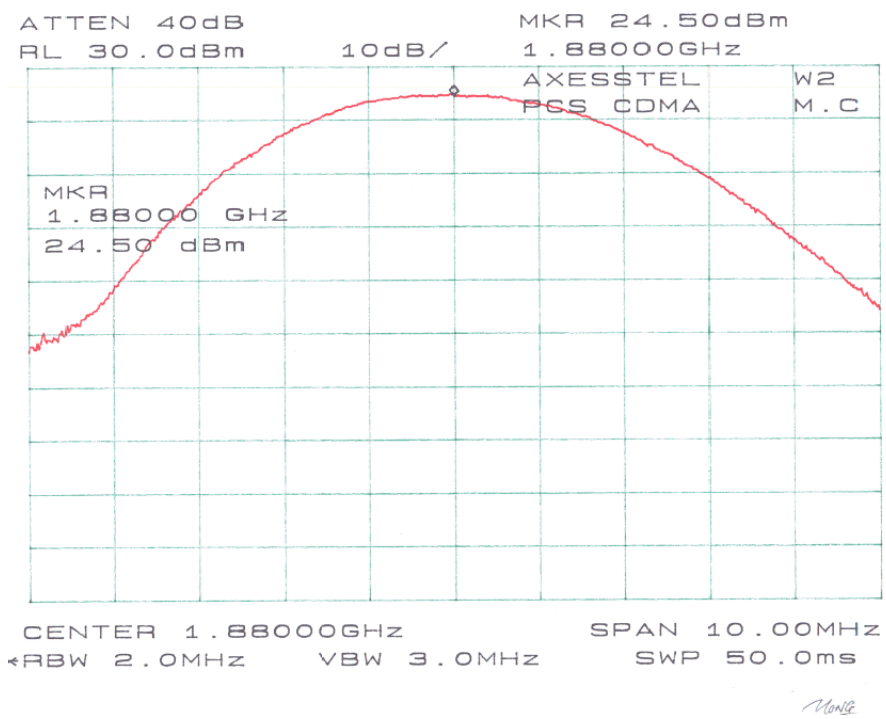

ATTEN 40dB
RL 30.0dBm
10dB/
MKR 24.50dBm
848.21MHz
AXESSTEL VERIZON
CDMA
H.C
MKR
848.21 MHz
24.50 dBm
CENTER 848.19MHz
SPAN 10.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 26.50dBm
824.6100MHz
AXESSTEL
AMPS
W2
L.C
MKR
824.6100 MHz
26.50 dBm
CENTER 824.6100MHz
SPAN 500.0kHz
*RBW 10kHz
VBW 10kHz
*SWP 100ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 26.50dBm
836.4000MHz
AXESSTEL
AMPS
W2
M.C
MKR
836.4000 MHz
26.50 dBm
CENTER 836.4000MHz
SPAN 500.0kHz
*RBW 10kHz
VBW 10kHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 26.50dBm
848.1900MHz
AXESSTEL
AMPS
W2
H.C
MKR
848.1900 MHz
26.50 dBm
CENTER 848.1900MHz
SPAN 500.0kHz
*RBW 10kHz
VBW 10kHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 24.50dBm
1.85130GHz
AXESSTEL
PCS CDMA
W2
L.C
MKR
1.85130 GHz
24.50 dBm
CENTER 1.85125GHz
SPAN 10.00MHz
RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 24.50dBm
1.88000GHz
AXESSTEL
PCS CDMA
W2
M.C
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24.50 dBm
CENTER 1.88000GHz
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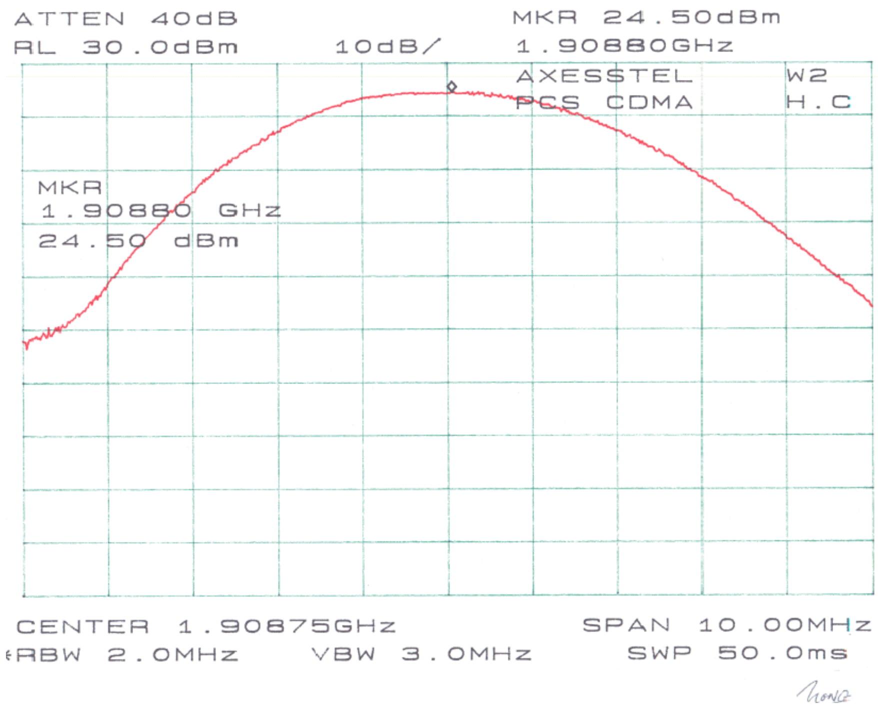
VBW 3.0MHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 24.50dBm
1.90880GHz
AXESSTEL
PCS CDMA
W2
H.C
MKR
1.90880 GHz
24.50 dBm
CENTER 1.90875GHz
SPAN 10.00MHz
RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms

6 - DOSIMETRIC ASSESSMENT SETUP

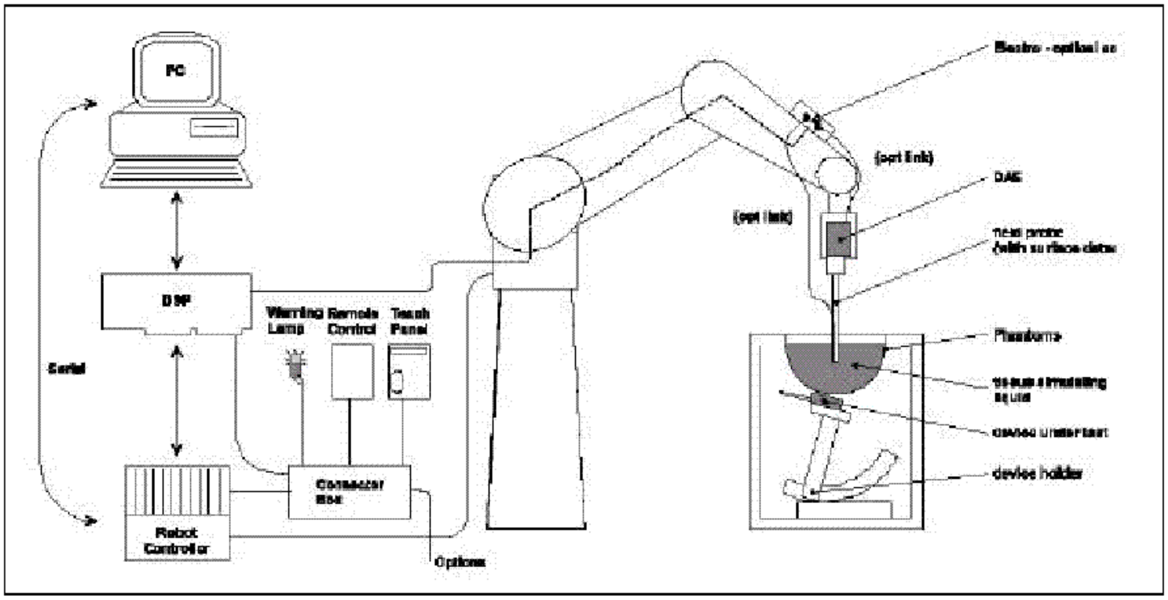
These measurements were performed with the automated near-field scanning system DASY3 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9m) which positions the probes with a positional repeatability of better than ±0.02mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit. The system is described in detail in [3].

The SAR measurements were conducted with the dosimetric probe ET3DV6 SN: 1577 (manufactured by SPEAG), designed in the classical triangular configuration [3] and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure described in [7] with accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure described in [8] and found to be better than ±0.25dB.

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

Ingredients (% 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	56.8	39.9	54.0	39.8	52.5
Conductivity (s/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

6.1 Measurement System Diagram



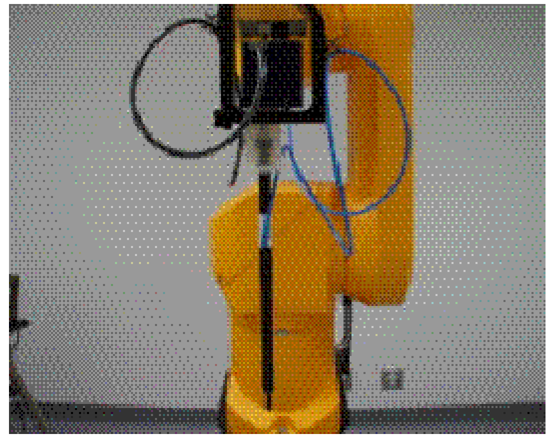
The DASY3 system for performing compliance tests consist of the following items:

1. A standard high precision 6-axis robot (Stäubli RX family) with controller and software.
2. An arm extension for accommodating the data acquisition electronics (DAE).
3. A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
4. A data acquisition electronic (DAE), which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
5. A unit to operate the optical surface detector, which is connected to the EOC. The Electro-optical coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the PC plug-in card. The functions of the PC plug-in card based on a DSP is to perform the time critical task such as signal filtering, surveillance of the robot operation fast movement interrupts.
6. A computer operating Windows 95 or larger
7. DASY3 software
8. Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.
9. The generic twin phantom enabling testing left-hand and right-hand usage.
10. The device holder for handheld EUT.
11. Tissue simulating liquid mixed according to the given recipes (see Application Note).
12. System validation dipoles to validate the proper functioning of the system.

6.2. System Components

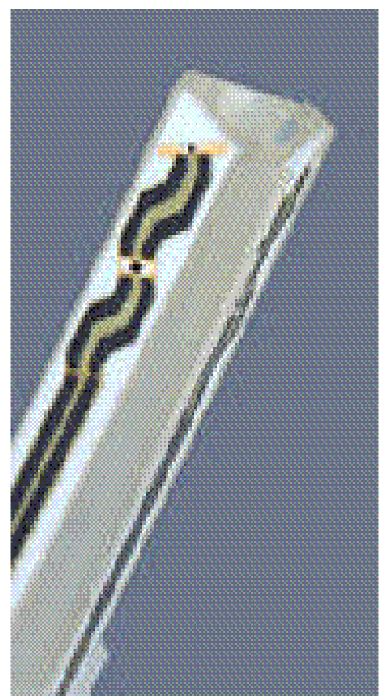
ET3DV6 Probe Specification

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	σ
	-Density	ρ

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

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

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

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

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

E-field probes: $$E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

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)
$\mu V/ (V/m)^2$ for E-field probes
ConF = sensitivity enhancement in solution
a_{ij} = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
Ei = electric field strenggy of channel i in V/m
H_i = diode compression point (DASY parameter)

The RSS value of the field components gives the total field strength (Hermitian magnitude):

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

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

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

With SAR = local specific absorption rate in mW/g
E_{tot} = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm^3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

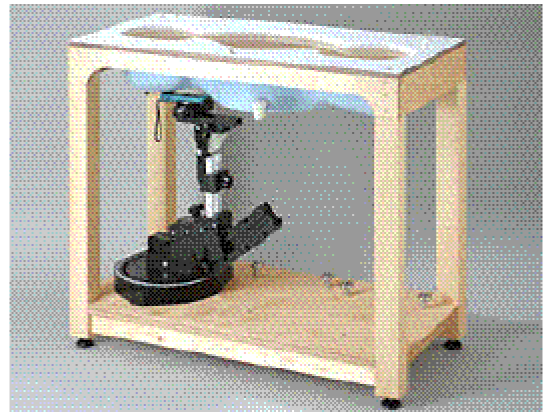
The power flow density is calculated assuming the excitation field as a free space field.

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

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

Generic Twin Phantom

The Generic Twin Phantom is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users [9][10]. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid. Reference markings on the Phantom allows the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.
Shell Thickness 2 ± 0.1 mm
Filling Volume Approx. 20 liters
Dimensions 810 x 1000 x 500 mm (H x L x W)

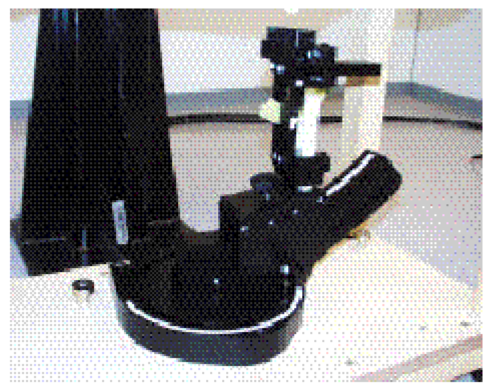


Generic Twin Phantom

Device Holder

In combination with the Generic Twin Phantom V3.0, the Mounting Device enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeatedly positioned according to the FCC and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

* Note: A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produced infinite number of configurations [10]. To produce the worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.



Device Holder

6.3 Measurement Uncertainty

The uncertainty budget has been determined for the DASY3 measurement system according to the NIS81 [13] and the NIST1297 [14] documents and is given in the following Table.

Measurement Uncertainty Analysis per IEEE P1528-2002

Description	Section	Reported Variance (%)	Probability Distribution type	Divisor	Ci (1g)	Ui (1g)	Vi	welc/satt series term
Probe Calibration	E.2.1	4.80	N	1	1	4.80	1.00E+09	5.30842E-07
Axial isotropy	E.2.2	4.70	R	1.732	0.707107	1.92	1.00E+09	1.35563E-08
Hemispherical isotropy	E.2.2	9.60	R	1.732	0.707107	3.92	1.00E+09	2.35957E-07
Boundary effects	E.2.3	8.30	R	1.732	1	4.79	1.00E+09	5.27377E-07
Linearity	E.2.4	4.70	R	1.732	1	2.71	1.00E+09	5.4225E-08
System Detection Limit	E.2.5	1.00	R	1.732	1	0.58	1.00E+09	1.11124E-10
Readout Electronics	E.2.6	0.00	N	1	1	0.00	1.00E+09	0
Response time	E.2.7	0.00	R	1.732	1	0.00	1.00E+09	0
Integration time	E.2.8	0.00	R	1.732	1	0.00	1.00E+09	0
RF Ambient conditions	E.6.1	3.00	R	1.732	1	1.73	1.00E+09	9.00106E-09
Probe positioning mechanical tolerance	E.6.2	0.40	R	1.732	1	0.23	1.00E+09	2.84478E-12
Probe positioning wrt phantom shell	E.6.3	2.90	R	1.732	1	1.67	1.00E+09	7.8596E-09
Extra/inter-polation & integration algorithmsfor max SAR evaluation	E.5.2	3.90	R	1.732	1	2.25	1.00E+09	2.57079E-08
Test sample positioning	8, E.4.2	6.00	R	1.732	1	3.46	1.00E+09	1.44017E-07
Device holder distance tolerance	E.4.1	5.00	N	1	1	5.00	1.00E+09	0.000000625
Output power and SAR drift measurement	8, E.6.6.2	5.00	R	1.732	1	2.89	1.00E+09	6.94526E-08
Phantom uncertainty, shell thickness tolerance	E.3.1	4.00	R	1.732	1	2.31	1.00E+09	2.84478E-08
Liquid conductivity, deviation from target values	E.3.2	5.00	R	1.732	0.64	1.85	1.00E+09	1.16522E-08
Liquid conductivity, measurement uncertainty	E.3.3	5.00	N	1	0.64	3.20	5	20.97152
Liquid permitivity, deviation from target values	E.3.2	5.00	R	1.732	0.6	1.73	1.00E+09	9.00106E-09
Liquid permitivity, measurement uncertainty	E.3.3	5.00	N	1	0.6	3.00	5	16.2
								689
Probe isotropy sensitivity coefficient	**0.5**							
Combined Standard Uncertainty						**12.65 %**		
Expanded Uncertainty, 95%		**k=**	**2.0036**			**25.34 %**		