SAR EVALUATION REPORT

For

Novatel Wireless Technologies Ltd.

Suite 200, 6715 – 8th Street N.E.
Calgary, Alberta
Canada, T2E 7H7

FCC ID: NBZNRM-U630

2004-11-15

This Report Concerns:	**Equipment Type:**
☒ Original Report	Transmitter, Portable

Test Engineer: Eric Honge / Hong

Report No.: R0411083S

Test Date: 2004-11-10

Reviewed By: Daniel Deng / 

Prepared By: Bay Area Compliance Laboratory Corporation (BACL)
230 Commercial Street
Sunnyvale, CA 94085
Tel: (408) 732-9162
Fax: (408) 732 9164

TABLE OF CONTENTS

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	2004-06-01	456
SPEAG E-Field Probe ES3DV2	2004-10-09	3019
SPEAG Generic Twin Phantom	N/A	N/A
SPEAG Light Alignment Sensor	N/A	278
Aprel Validation Dipole D-1800-S-2	2004-04-09	BCL-049
Brain Equivalent Matter (1900MHz)	Each Use	N/A
Muscle Equivalent Matter (1900MHz)	Each Use	N/A
Robot Table	Each Use	N/A
Phone Holder	Each Use	N/A
Phantom Cover	Each Use	N/A
HP Spectrum Analyzer HP8566A	N/A	2240A01930
Microwave Amp. 8349A	N/A	2644A02662
Power Meter Agilent E4919B	2004-04-29	18485-66
Power Sensor Agilent E4412A	2004-05-07	US38488542
Network Analyzer HP-8752C	2002-08-11	820079
Dielectric Probe Kit HP85070A	Each Use	US99360201
Signal Generator HP-83650B	2004-02-29	3614A002716
Amplifier, ST181-20	N/R	E012-0101
Antenna, Horn DRG-118A	2004-02-06	A052704
Analyzer, Communication, Agilent E5515C	2003-12-12	6100210612

2.2 Equipment Calibration Certificate

Please see the attached file.

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

Client Bay Area Comp. Lab (BACL)

CALIBRATION CERTIFICATE

Object(s)	ES3DV2 - SN:3019
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	October 9, 2003
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM E4419B	GB41293874	2-Apr-03 (METAS, No 252-0250)	Apr-04
Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04
Reference 20 dB Attenuator	SN: 5086 (20b)	3-Apr-03 (METAS No. 251-0340	Apr-04
Fluke Process Calibrator Type 702	SN: 6295803	8-Sep-03 (Sintrel SCS No. E-030020)	Sep-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (Agilent, No. 20020918)	In house check: Oct 03
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, In house check Aug-02)	In house check: Aug-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (Agilent, No. 24BR1033101)	In house check: Oct 03

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

Date issued: October 9, 2003

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 international Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

880-KP0301061-A Page 1 (1)

Schmid & Partner Engineering AG s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Probe ES3DV2

SN: 3019

Manufactured: December 5, 2002
Last calibration: July 12, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ES3DV2 SN: 3019 July 12, 2003

DASY - Parameters of Probe: ES3DV2 SN: 3019

Sensitivity in Free Space

Diode Compression

NormX	1.03 $\mu V/(V/m)^2$	DCP X	99
NormY	1.12 $\mu V/(V/m)^2$	DCP Y	99
NormZ	0.98 $\mu V/(V/m)^2$	DCP Z	99

Sensitivity in Tissue Simulating Liquid

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

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	6.4 ± 9.5% (k=2)	Boundary effect:	
ConvF Y	6.4 ± 9.5% (k=2)	Alpha	0.68
ConvF Z	6.4 ± 9.5% (k=2)	Depth	1.11

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

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	5.0 ± 9.5% (k=2)	Boundary effect:	
ConvF Y	5.0 ± 9.5% (k=2)	Alpha	0.21
ConvF Z	5.0 ± 9.5% (k=2)	Depth	2.78

Boundary Effect

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

Probe Tip to Boundary		1 mm	2 mm
SAR_{be} [%]	Without Correction Algorithm	4.3	1.8
SAR_{be} [%]	With Correction Algorithm	0.0	0.1

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

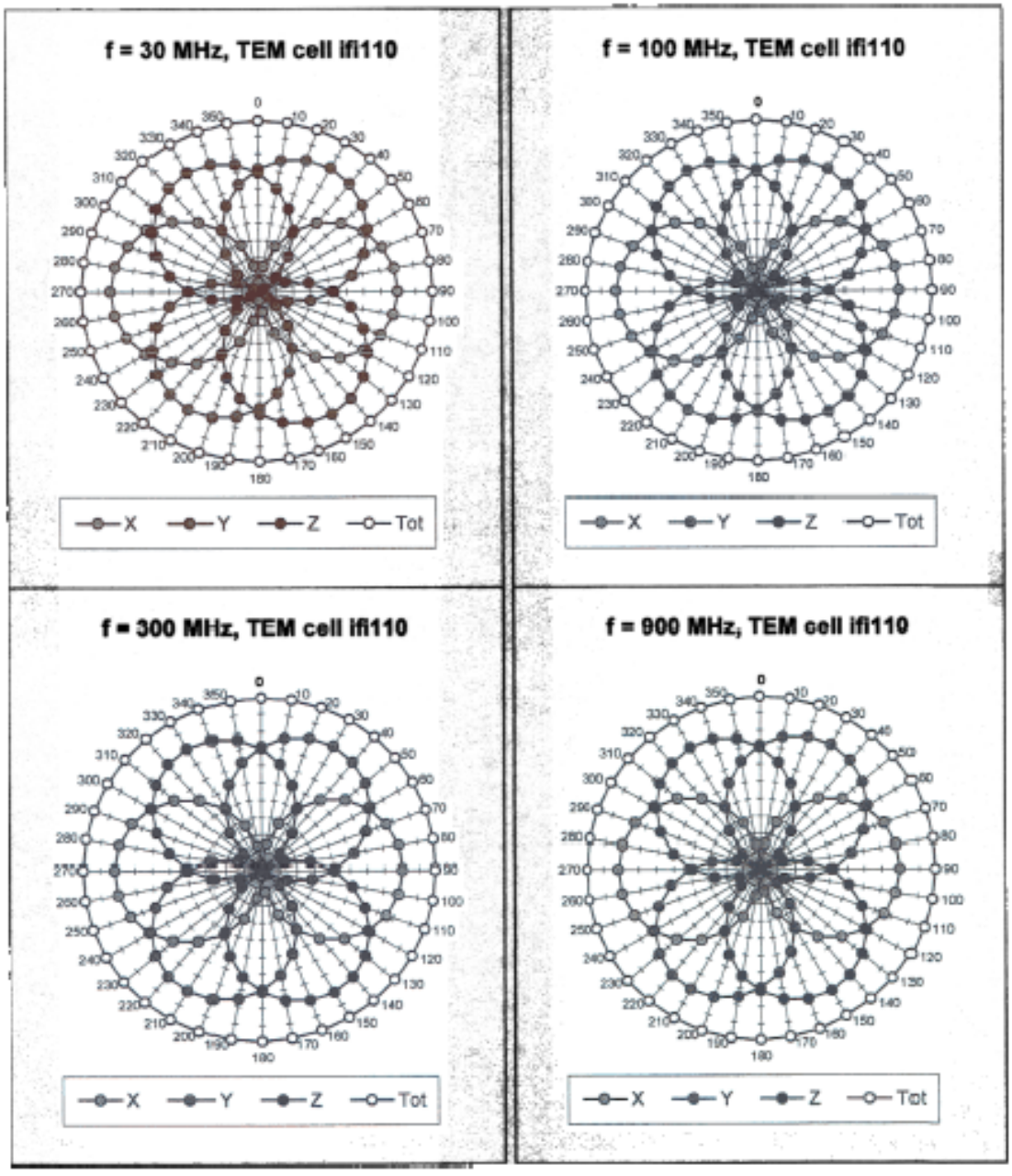
Probe Tip to Boundary		1 mm	2 mm
SAR_{be} [%]	Without Correction Algorithm	7.4	5.0
SAR_{be} [%]	With Correction Algorithm	0.0	0.1

Sensor Offset

Probe Tip to Sensor Center	2.1	mm

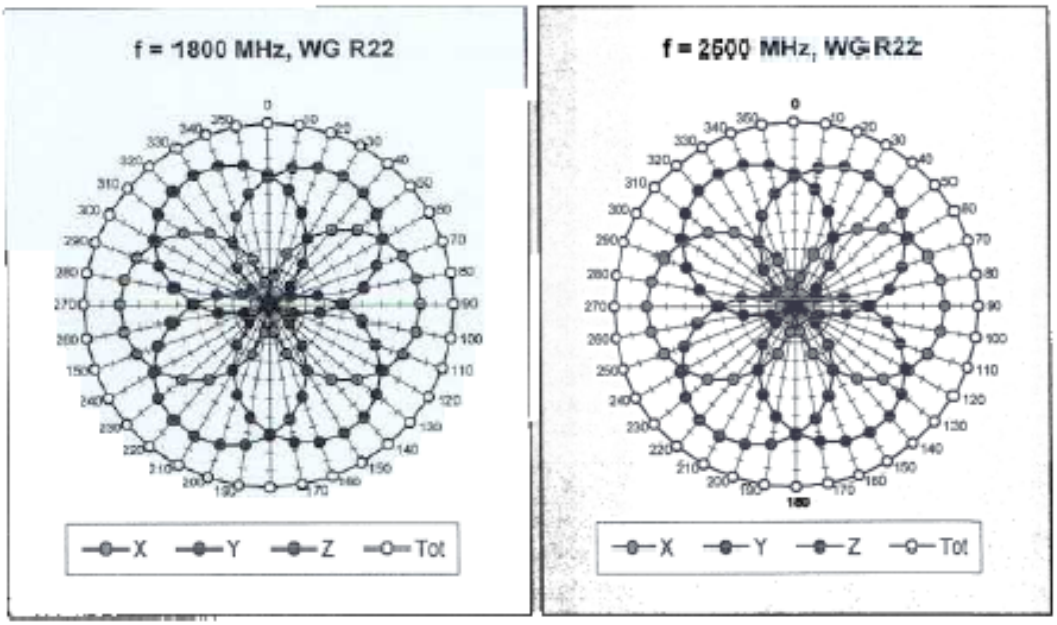
ES3DV2 SN: 3019 **July 12, 2003**

Receiving Pattern (ϕ , θ = 0°

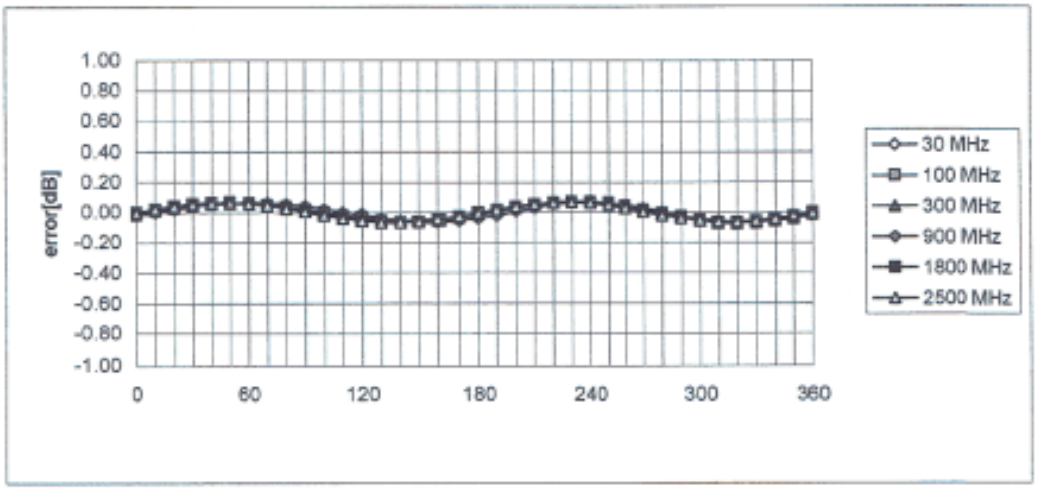


Page 3 of 10

ES3DV2 SN: 3019 July 2003



Isotropy Error (ϕ), θ = 0°

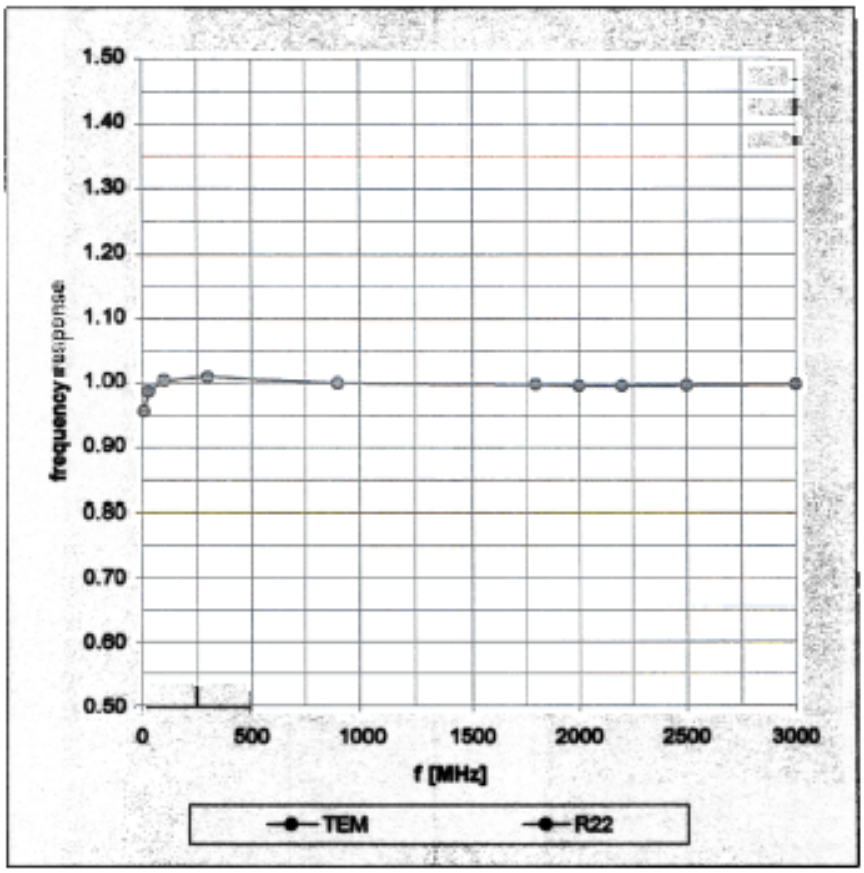


Page

ES3DV2 SN: 3019 **July 12, 2003**

Frequency Response of E-Field

(TEM-Cell:ifi110, Waveguide R22)

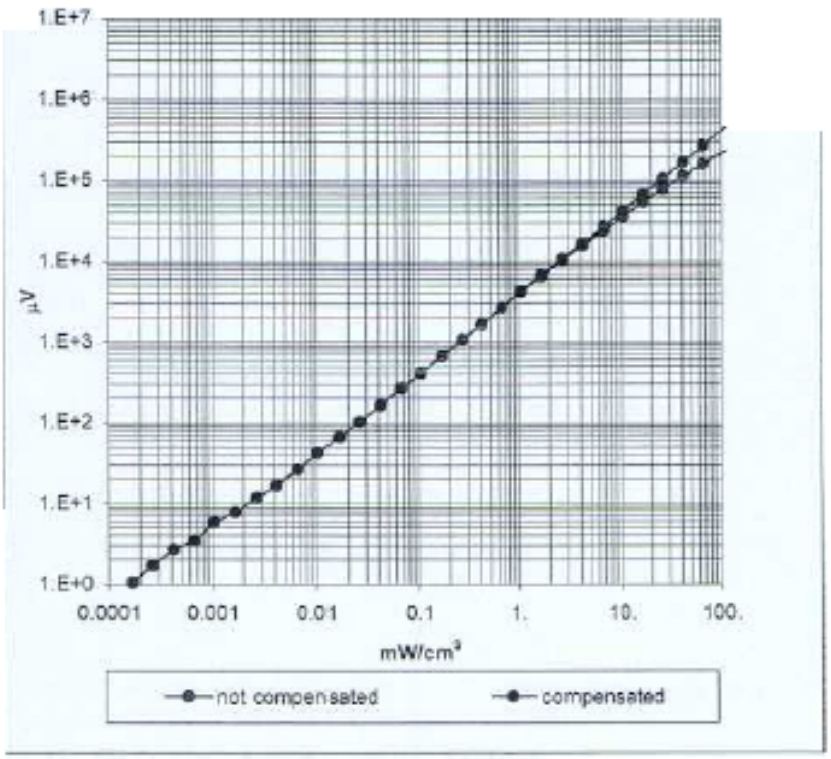


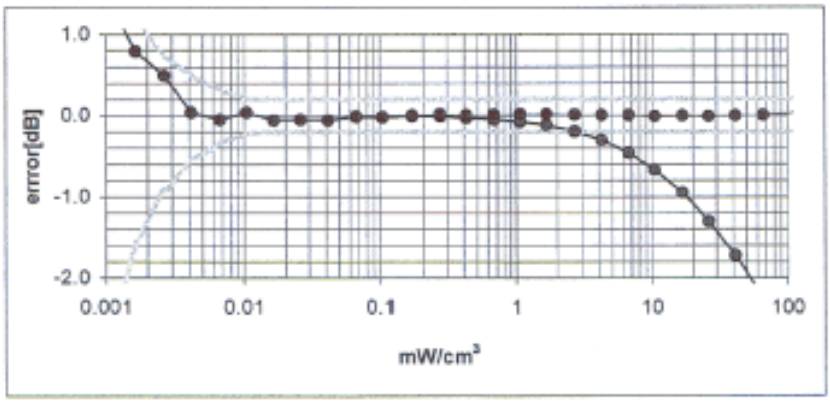
Page 5 of 10

ES3DV2 SN: 3019 **July 12, 2003**

Dynamic Range f(SAR_{brain})

(Waveguide R22)

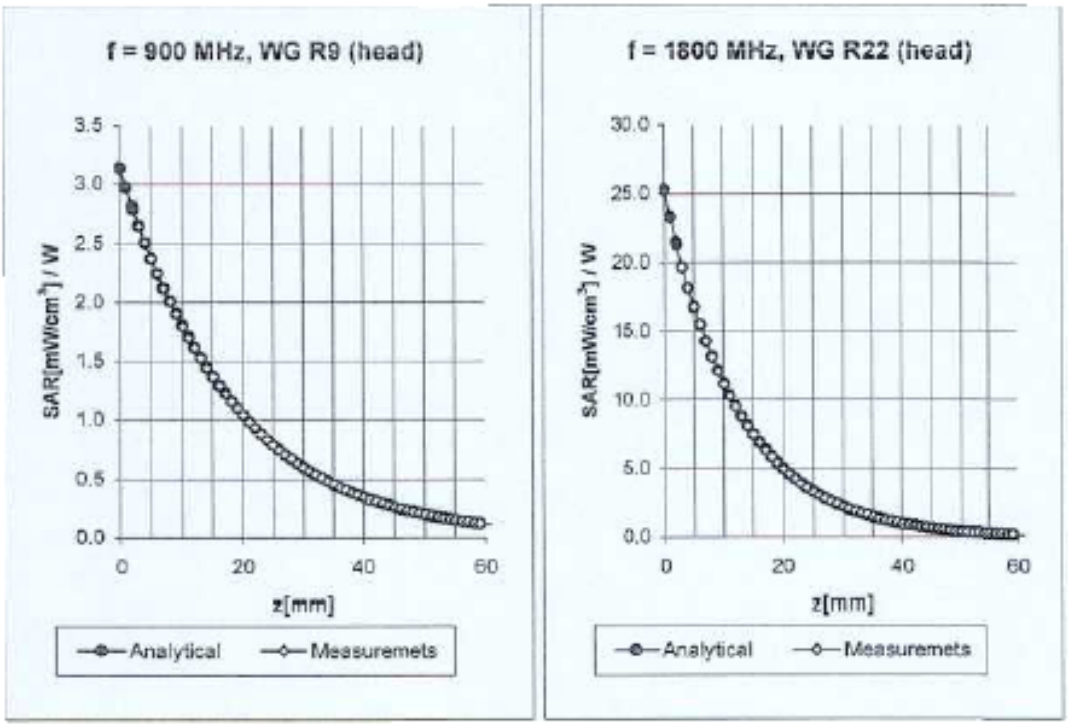




Page 6 of 10

ES3DV2 SN: 3019 **July 12, 2003**

Conversion Factor Assessment



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

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**6.4** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**6.4** ± 9.5% (k=2)	Alpha	**0.68**
ConvF Z	**6.4** ± 9.5% (k=2)	Depth	**1.11**

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

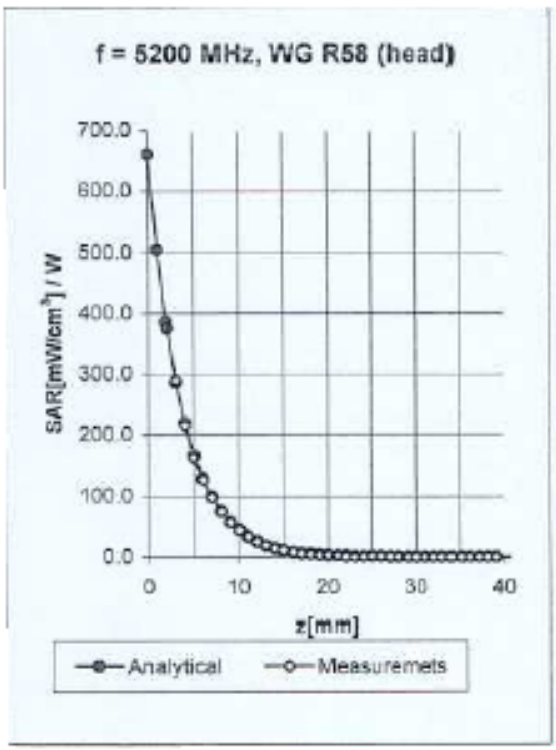
Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

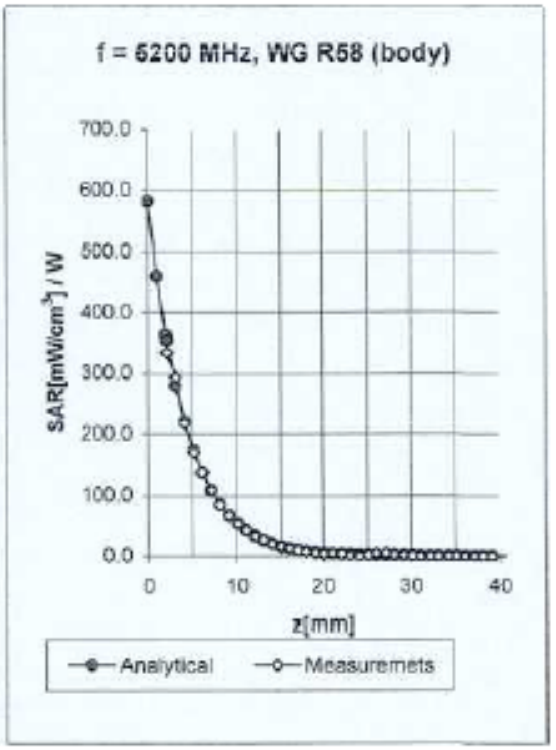
ConvF X	**5.0** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**5.0** ± 9.5% (k=2)	Alpha	**0.21**
ConvF Z	**5.0** ± 9.5% (k=2)	Depth	**2.78**

Page 7 of 10

ES3DV2 SN: 3019 **July 12, 2003**

Conversion Factor Assessment





Head **5200** **MHz** ε_r = **36.0 ± 5%** σ = **4.66 ± 5% mho/m**

Valid for f=4940-5460 MHz with Head Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**2.3** ± 14.6% (k=2)	Boundary effect:	
ConvF Y	**2.3** ± 14.6% (k=2)	Alpha	**1.05**
ConvF Z	**2.3** ± 14.6% (k=2)	Depth	**1.50**

Body **5200** **MHz** ε_r = **49.0 ± 5%** σ = **5.30 ± 5% mho/m**

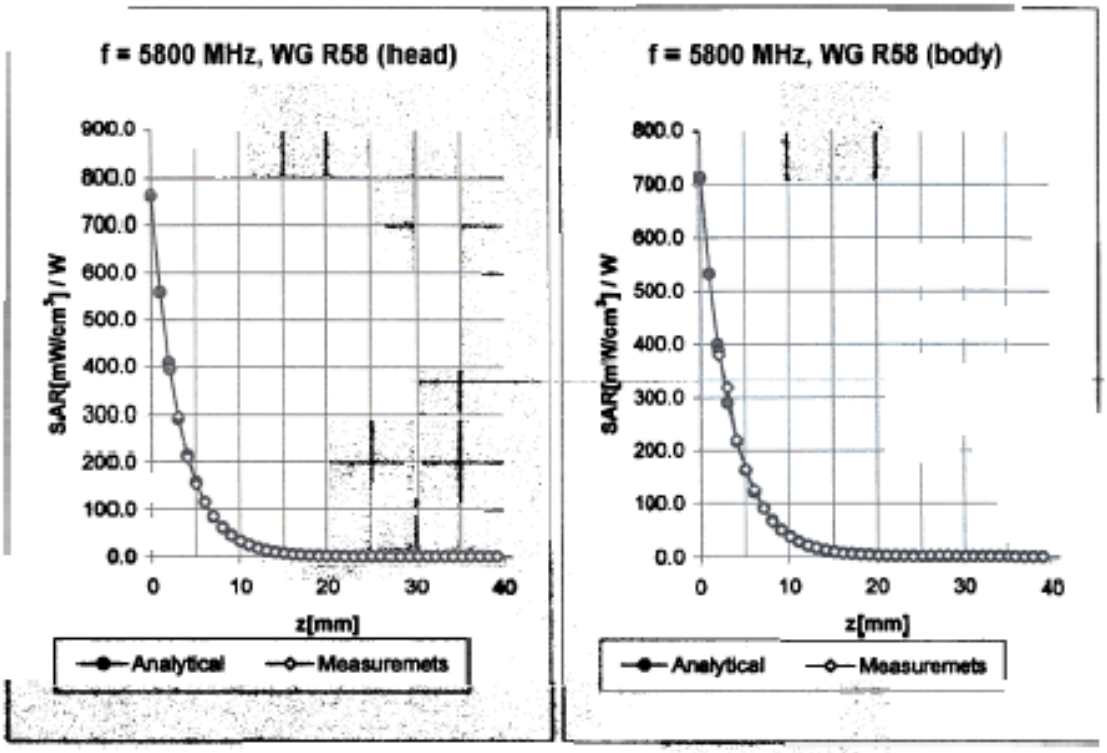
Valid for f=4940-5460 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**1.4** ± 14.6% (k=2)	Boundary effect:	
ConvF Y	**1.4** ± 14.6% (k=2)	Alpha	**1.01**
ConvF Z	**1.4** ± 14.6% (k=2)	Depth	**1.85**

Page 8 of 10

ES3DV2 SN: 3019 **July 12, 2003**

Conversion Factor Assessment



Head **5800** **MHz** ε_r = **35.3 ± 5%** σ = **5.27 ± 5% mho/m**

Valid for f=5510-6090 MHz with Head Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**1.8** ± 14.6% (k=2)	Boundary effect:	
ConvF Y	**1.8** ± 14.6% (k=2)	Alpha	**0.90**
ConvF Z	**1.8** ± 14.6% (k=2)	Depth	**1.90**

Body **5800** **MHz** ε_r = **48.2 ± 5%** σ = **6.00 ± 5% mho/m**

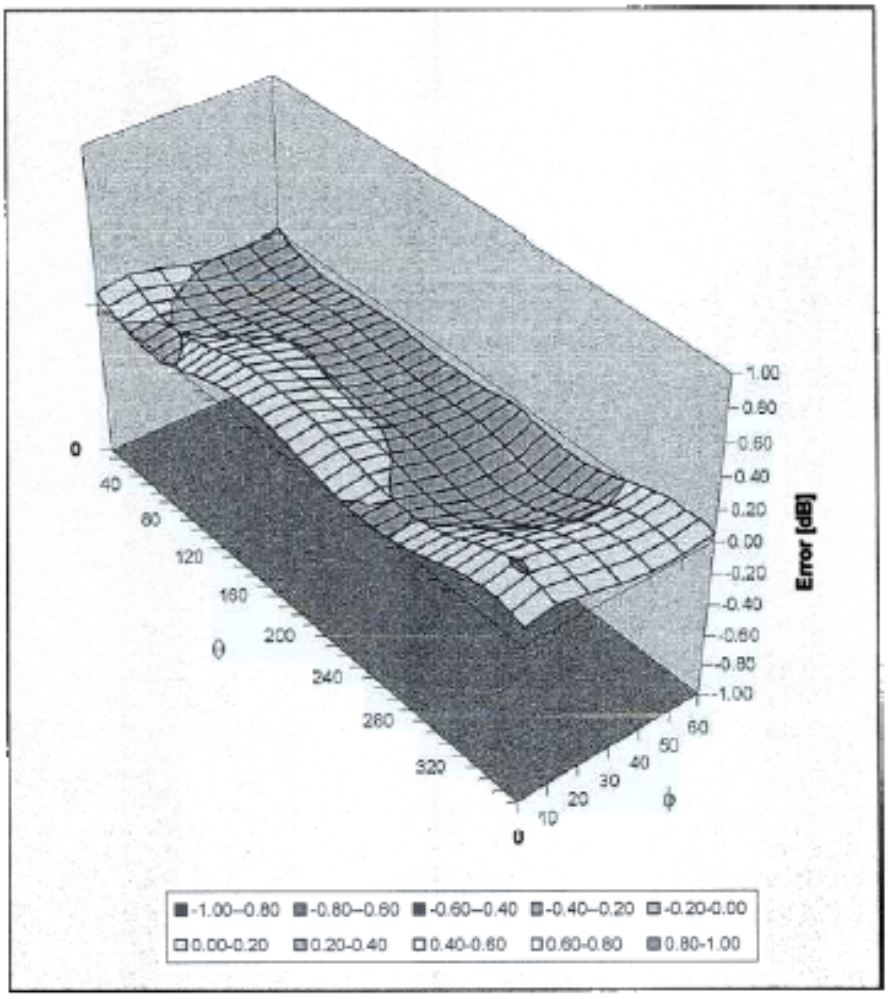
Valid for f=5510-6090 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**1.2** ± 14.6% (k=2)	Boundary effect:	
ConvF Y	**1.2** ± 14.6% (k=2)	Alpha	**1.18**
ConvF Z	**1.2** ± 14.6% (k=2)	Depth	**1.65**

ES3DV2 SN: 3019 **July 12, 2003**

Deviation from Isotropy in HSL

Error ($\theta\phi$), f = 900 MHz



Page 10 of 10

Zeughausstrasse 43, 8004 Zürich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Probe ES3DV2

SN:3019

Additional Conversion Factors

Manufactured:	December 5, 2002
Last calibration:	July 12, 2003
Add. calibration:	October 9, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ES3DV2 SN:3019

Sensitivity in Free Space

NormX	**1.05** $\mu V/(V/m)^2$
NormY	**1.14** $\mu V/(V/m)^2$
NormZ	**0.98** $\mu V/(V/m)^2$

Diode Compression

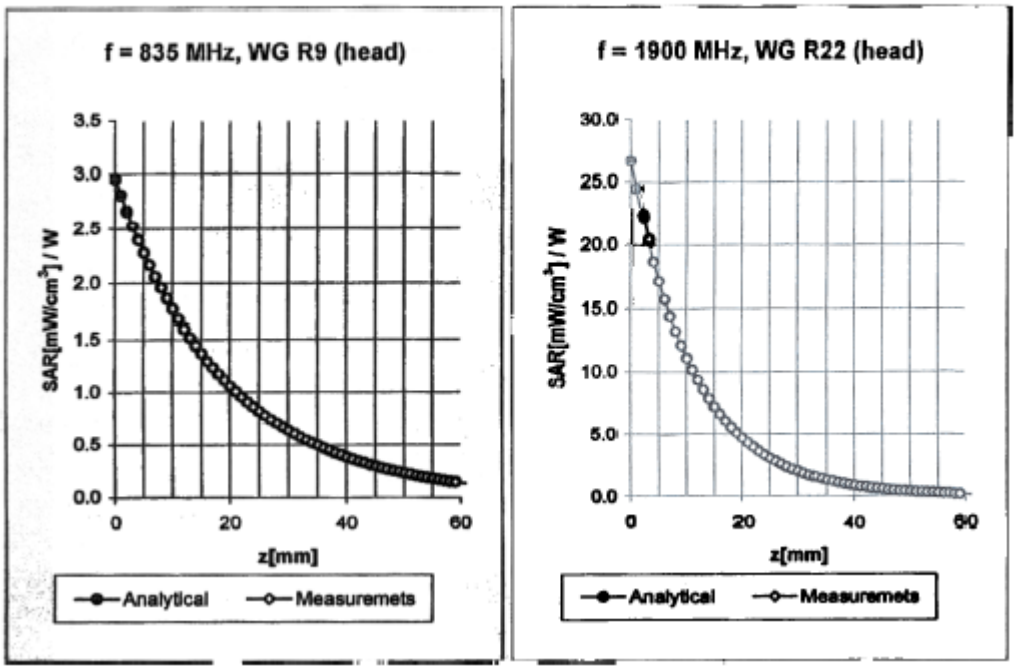
DCP X	**99**
DCP Y	**99**
DCP Z	**99**

Sensor Offset

Probe Tip to Sensor Center	**2.1**	mm

Page 2 of 6

Conversion Factor Assessment



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

Valid for f=793-877 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**6.5** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**6.5** ± 9.5% (k=2)	Alpha	**0.35**
ConvF Z	**6.5** ± 9.5% (k=2)	Depth	**1.46**

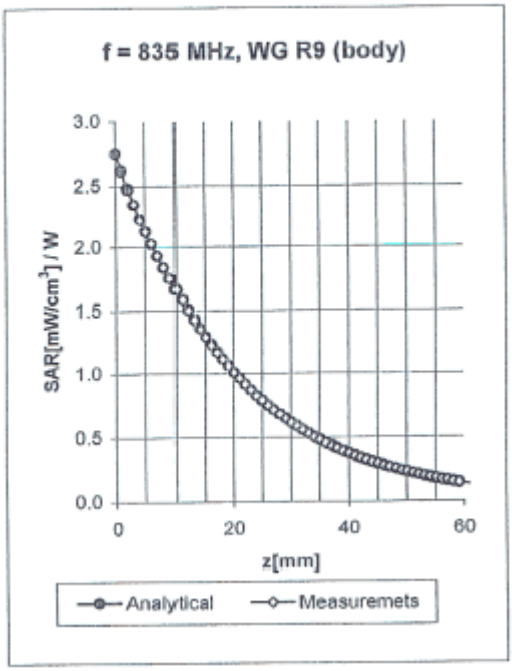
Head **1900 MHz** ε_r = 40.0 ± 5% σ = 1.40 ± 5% mho/m

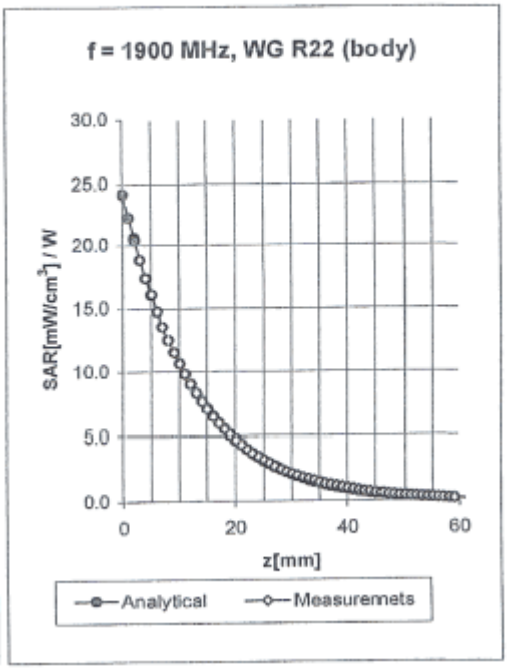
Valid for f=1805-1995 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**4.7** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**4.7** ± 9.5% (k=2)	Alpha	**0.22**
ConvF Z	**4.7** ± 9.5% (k=2)	Depth	**3.48**

Page 3 of 6

Conversion Factor Assessment





Body **835 MHz** ε_r = 55.2 ± 5% σ = 0.97 ± 5% mho/m

Valid for f=793-877 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	6.1 ± 9.5% (k=2)	Boundary effect:	
ConvF Y	6.1 ± 9.5% (k=2)	Alpha	0.24
ConvF Z	6.1 ± 9.5% (k=2)	Depth	2.00

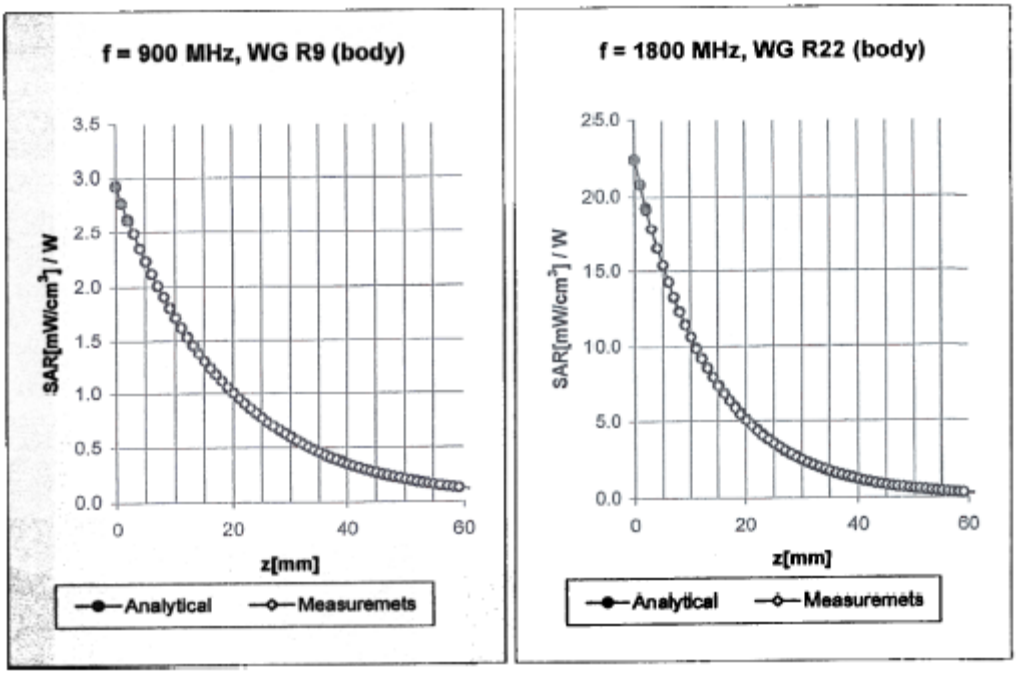
Body **1900 MHz** ε_r = 53.3 ± 5% σ = 1.52 ± 5% mho/m

Valid for f=1805-1995 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	4.6 ± 9.5% (k=2)	Boundary effect:	
ConvF Y	4.6 ± 9.5% (k=2)	Alpha	0.24
ConvF Z	4.6 ± 9.5% (k=2)	Depth	2.64

Page 4 of 6

Conversion Factor Assessment



Body 900 MHz ε_r = 55.0 ± 5% σ = 1.05 ± 5% mho/m

Valid for f=855-945 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	6.1 ± 9.5% (k=2)	Boundary effect:	
ConvF Y	6.1 ± 9.5% (k=2)	Alpha	0.27
ConvF Z	6.1 ± 9.5% (k=2)	Depth	1.82

Body 1800 MHz ε_r = 53.3 ± 5% σ = 1.52 ± 5% mho/m

Valid for f=1710-1890 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**4.7** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**4.7** ± 9.5% (k=2)	Alpha	**0.23**
ConvF Z	**4.7** ± 9.5% (k=2)	Depth	**2.99**

Certificate of Calibration Verification

Description of EUT	Tuned Dipole Antenna
EUT Model Number	D-1800-S-1
EUT Serial Number	BCL-049
Center Frequency	1800 MHz

Calibration Date: 12 April 2004

Testing conditions:

per P1528/D1.2:2003:	
Ambient Temperature (18-25 °C)	23 °C
Ambient Humidity	43%
Liquid Temperature at start of measurements:(≤2°C)	21 °C
Liquid temperature at end of measurements:	21 °C
Date and time at beginning of test:	2004-04-09-16:20 PST
Date and time at beginning of test:	2004-04-09-19:40 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:			SAM
Liquid:			1800 MHz, Head Liquid
Liquid Validation Date:			12 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.

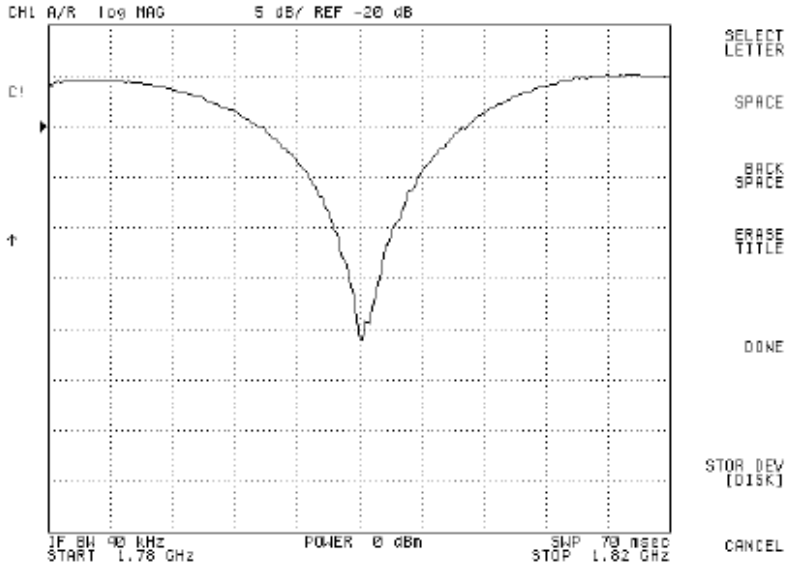
The validation antenna herein meets the minimum requirements of 20 dB insertion loss

2004-05-06

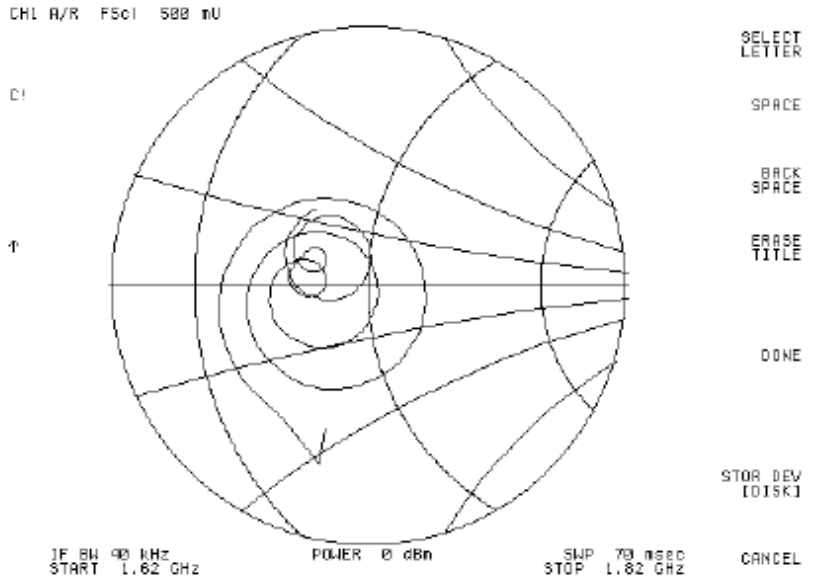
Hans T. Mellberg
Engineering Manager

Date

Insertion Loss Plot
S11



Smith Chart


CH1 A/R FSc1 500 mU
C1
1
SELECT LETTER
SPACE
BACK SPACE
ERASE TITLE
DONE
STOR DEV [DISK]
CANCEL
IF BW 90 kHz
START 1.62 GHz
POWER 0 dBm
SWP 70 msec
STOP 1.82 GHz

1900MHz Body, Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 11/10/2004

Frequency	e'	e"
1850000000.0000	53.6424	14.0145
1852000000.0000	53.6389	14.0523
1854000000.0000	53.6731	14.1312
1856000000.0000	53.6584	14.0954
1858000000.0000	53.6147	14.1329
1860000000.0000	53.6032	14.2505
1862000000.0000	53.5754	14.4756
1864000000.0000	53.5656	14.1018
1866000000.0000	53.6043	14.2953
1868000000.0000	53.6179	14.1667
1870000000.0000	53.5958	14.0948
1872000000.0000	53.5841	14.1420
1874000000.0000	53.5780	14.2440
1876000000.0000	53.5301	14.3968
1878000000.0000	53.5009	14.2376
1880000000.0000	53.4932	14.2412
1882000000.0000	53.4664	14.2421
1884000000.0000	53.4560	14.2569
1886000000.0000	53.4413	14.1848
1888000000.0000	53.4364	14.0952
1890000000.0000	53.4178	14.0288
1892000000.0000	53.3840	14.2503
1894000000.0000	53.3535	14.2735
1896000000.0000	53.2906	14.3146
1898000000.0000	53.2841	14.3561
1900000000.0000	53.2660	14.3639
1902000000.0000	53.2438	14.3727
1904000000.0000	53.2386	14.3883
1906000000.0000	53.2064	14.3007
1908000000.0000	53.1939	14.4501
1910000000.0000	53.1727	14.4220
1912000000.0000	53.1606	14.4268
1914000000.0000	53.1553	14.4321
1916000000.0000	53.1445	14.4458
1918000000.0000	53.1312	14.4500
1920000000.0000	53.1205	14.4839
1922000000.0000	53.1496	14.4713
1924000000.0000	53.1562	14.4828
1926000000.0000	53.1625	14.5113
1928000000.0000	53.1791	14.5470
1930000000.0000	53.1075	14.5395
1932000000.0000	53.1216	14.5331
1934000000.0000	53.1339	14.5179
1936000000.0000	53.1840	14.5592
1938000000.0000	53.1949	14.5637
1940000000.0000	53.2064	14.5621
1942000000.0000	53.2267	14.5525
1944000000.0000	53.2640	14.5971
1946000000.0000	53.2915	14.6381
1948000000.0000	53.3001	14.6765
1950000000.0000	53.3131	14.5892

$\sigma = \omega \varepsilon_o \varepsilon" = 2 \pi f \varepsilon_o \varepsilon" = 1.5183$

where $f = 1900 \times 10^6$

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

$\varepsilon" = 14.3639$

1900MHz Head, Ambient Temp = 23 Deg C, Liquid Temp = 21 Deg C, 11/10/2004

frequency	e'	e''
1850000000.0000	38.2458	13.4292
1852000000.0000	38.2209	13.4700
1854000000.0000	38.1992	13.4590
1856000000.0000	38.1329	13.4713
1858000000.0000	37.9577	13.3849
1860000000.0000	37.8340	13.3130
1862000000.0000	37.7891	13.2692
1864000000.0000	37.7788	13.3135
1866000000.0000	37.8102	13.3318
1868000000.0000	37.8546	13.3465
1870000000.0000	37.8851	13.3574
1872000000.0000	37.8891	13.4053
1874000000.0000	37.9632	13.4286
1876000000.0000	37.9959	13.5052
1878000000.0000	38.0341	13.4790
1880000000.0000	37.9972	13.4987
1882000000.0000	37.9890	13.5141
1884000000.0000	37.9804	13.5110
1886000000.0000	38.0144	13.5129
1888000000.0000	38.0184	13.5175
1890000000.0000	38.0350	13.5541
1892000000.0000	38.0546	13.5880
1894000000.0000	38.0538	13.5751
1896000000.0000	38.0363	13.5557
1898000000.0000	38.0244	13.5963
1900000000.0000	38.0398	13.6041
1902000000.0000	38.0330	13.5696
1904000000.0000	38.0316	13.5736
1906000000.0000	38.0467	13.5870
1908000000.0000	38.0296	13.5946
1910000000.0000	38.0237	13.6026
1912000000.0000	38.0040	13.5746
1914000000.0000	37.9866	13.5580
1916000000.0000	37.9913	13.5566
1918000000.0000	37.9710	13.5428
1920000000.0000	37.9667	13.5522
1922000000.0000	37.9777	13.5694
1924000000.0000	37.9726	13.6014
1926000000.0000	37.9694	13.5883
1928000000.0000	37.9431	13.5883
1930000000.0000	37.9468	13.6149
1932000000.0000	37.9143	13.6316
1934000000.0000	37.9468	13.6098
1936000000.0000	37.9556	13.6563
1938000000.0000	37.9320	13.6648
1940000000.0000	37.9150	13.6482
1942000000.0000	37.9067	13.6671
1944000000.0000	37.8976	13.6677
1946000000.0000	37.8772	13.7114
1948000000.0000	37.8699	13.7021
1950000000.0000	37.8666	13.7028

$\sigma = \omega \varepsilon_o \varepsilon'' = 2 \pi f \varepsilon_o \varepsilon'' = 1.4380$
where $f = 1900 \times 10^6$
$\varepsilon_o = 8.854 \times 10^{-12}$
$\varepsilon'' = 13.6041$

3 - EUT DESCRIPTION

The *Novatel Wireless Technologies Ltd.* product, FCC ID:NBZNRM-U630 or the "EUT" as referred to in this report is a 3G Wireless PC card modem , which measures approximately 120mm(L) x 53mm(W) x 8mm(H). The EUT operates at the frequency of 1850.2 – 1909.8 MHz, maximum output power (ERP) 29.83dBm (0.962W), frequency tolerance 0.054ppm and emission designator 253KGXW.

** The test data gathered are from typical production sample, serial number: Novatel0804, provided by the manufacturer.*

4 - SYSTEM TEST CONFIGURATION

4.1 Justification

The system was configured for testing as required by the standard.

4.2 EUT Exercise Procedure

The EUT exercising program used during SAR testing as required by the standard.

4.3 Equipment Modifications

No modification(s) were made to the EUT.

5 – CONDUCTED OUTPUT POWER MEASUREMENTS

5.1 Provision Applicable

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.

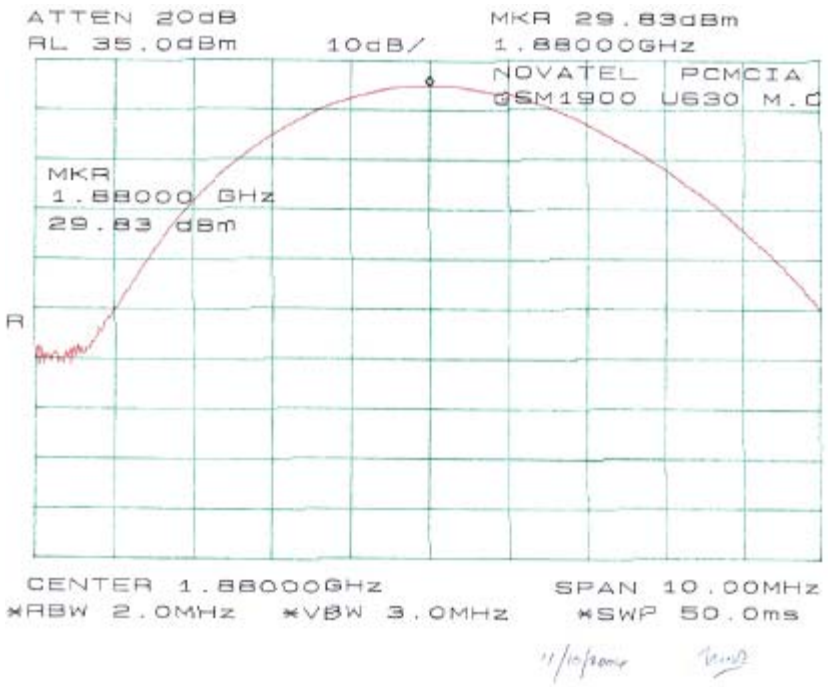
5.3 Test equipment

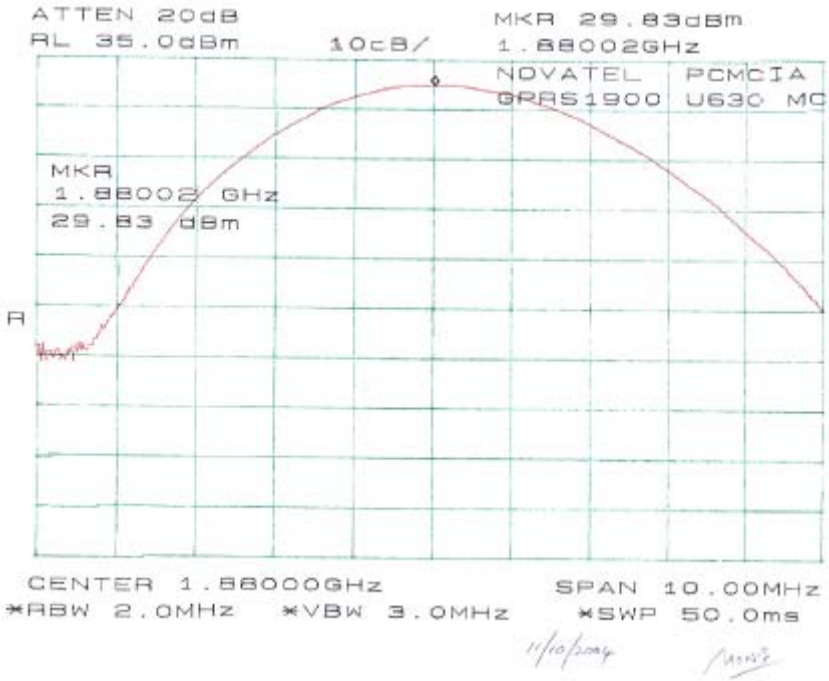
Hewlett Packard HP8564E Spectrum Analyzer, Calibration Date: 2004-08-01
Hewlett Packard HP 7470A Plotter, Calibration not required.
A.H. Systems SAS200 Horn Antenna, Calibration Date: 2004-05-31
Com-Power AB-100 Dipole Antenna, Calibration Date: 2004-09-05

5.4 Test Results, Conducted Power Measurements

MODE	Channel	Frequency (MHz)	Output Power in dBm	Output Power in W	Limit (W)
GSM1900	Middle	1880.00	29.83	0.962	2
GPRS1900	Middle	1880.02	29.83	0.962	2

Please refer to the following plots.




ATTEN 20dB
RL 35.0dBm
10dB/
MKR 29.83dBm
1.88002GHz
NOVATEL PCMCIA
GPRS1900 U630 MC
MKR
1.88002 GHz
29.83 dBm
A
CENTER 1.88000GHz
SPAN 10.00MHz
*RBW 2.0MHz
*VBW 3.0MHz
*SWP 50.0ms