FCC APPLICATION INQUIRY RESPONSE
MIVWG9701A: SPIDER II WIRELESS MODEM
Correspondence Number: 4036
November 11, 1998

1.0 Overview

This package was compiled to reply to inquiries made by Mr. Kwok Chan of the FCC regarding the Type Certification Application for the Inet Spider II Wireless Modem. Each Inquiry item is listed below followed by the response.

2.0 Inquiry Responses

(1) Please provide the original manufacturer's data for the 900 MHz dipole used for the SAR test to support or compare to the results obtained during the SAR validation testing.

Answer:

The requested data is included in Appendix A of this submission. The first section of the Appendix is the original manufacturer's data for the probe (including description of operation) . The second section of Appendix A is the data from the July 1997 calibration of the probe (last calibration prior to that in effect for the lastInet SAR test).

(2) There is still some confusion regarding the results for the ERP testing versus similar figures for the SAR and conducted power tests. Please provide data to support the data presented or retest to verify the figures.

Answer:

Based on this request, the ERP and conducted power from the antenna port were retested for this device. Tests were performed for the low, mid & high channels (367, 799 and 991) of the device for both the AMPS and CDPD operating modes. All tests were done using a 3 MHz/3 MHz bandwidth setting. No harmonics above the fundimental were detected. The EUT was transmitting a test pattern which maximized the spectral density for all tests.

Data for these tests is included in Appendix B. Minimal difference was seen between the two operating modes (CDPD versus AMPS) for the ERP. Little difference was seen between the operating modes for the conducted power as well. The only difference that was seen during these tests was that the transmitted power level decreases at the upper channel (991). The transmitted power level drops approximately 2 dB from the low channel to the highest channel.

The highest conducted power occured for channel setting 991 with a level of 24.2 dBm in the CDPD mode. The highest AMPS conducted power was 23.9 dBm (a difference of 0.3 dB), also for Channel 991. The highest ERP occured for channel setting 991 in the CDPD operating mode with a level of 0.450 watts. The highest ERP for the AMPS mode also occurred for Channel 991 at a level of 0.390 watts (less than 2 dB difference). The revised test data for the ERP is in agreement with the data obtained for the conducted emission tests based on the nominal antenna gain for the EUT.

(3) Indicate the power level requested for the Grant based on Item (2).

Answer: A power level of 0.450 watts is requested based on the highest ERP measured from the EUT which occured for Channel Setting 991 in the CDPD mode of operation.

APPENDIX A

SAR DIPOLE PROBE
VENDOR DATA

Schmid & Partner
Engineering AG

Staffelstrasse 8, 8045 Zurich, Switzerland, Telefon +41 1 280 08 60, Fax +41 1 280 08 64

Probe ET3DV4

SN:1123

Manufactured: April 96
Recalibrated: 20 September 97

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Introduction

The performance of all probes is measured before delivery. This includes an assessment of the characteristic parameters, receiving patterns as a function of frequency, frequency response and relative accuracy. Furthermore, each probe is tested in use according to a dosimetric assessment protocol. The sensitivity parameters (NormX, NormY, NormZ), the diode compresion parameter (DCP) and the conversion factor (ConvF) of the probe and some of the measurement diagrams are given in the following.

The performance of the individual probes varies slightly due to tolerances arising from the manufacturing process. Since the lines are highly resistive (several MOhms), the offset and noise problem is greatly increased if signals in the low µV range are measured. Accurate measurement below 10 µW/g are possible if the following precautions are taken. 1) check the current grounding with the *multimeter*[1], i.e., low noise levels, 2) compensate the current *offset*[1], 3) use long integration time (approx. 10 seconds), 4) *calibrate*[1] before each measurement, 5) persons should avoid moving around the lab while measuring.

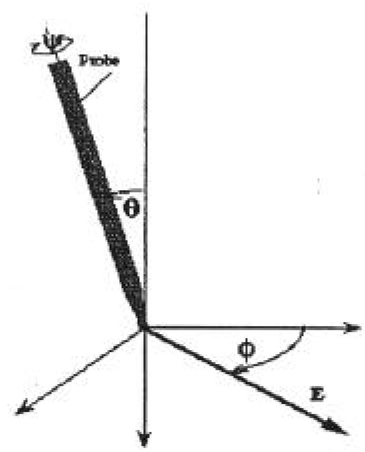


Fig 1: Due to the field distortion caused by the supporting material, the probe has two characteristic directions, referred to as angle ψ and θ.

Since the field distortion caused by the supporting material and the sheath is quite high in the θ direction, the receiving pattern is poor in air. However, the distortion in tissue equivalent material is much less because of its high dielectricity. In addition, the fields induced in the phantoms by dipole structures close to the body are dominently parallel to the surface. Thus, the error due to non-isotropy is much better than 1 dB for dosimetric assessments.

The probes are calibrated in the TEM cell ifi 110 although the field distribution in the cell is not very uniform and the frequency response is not very flat. To ensure consistency, a strict protocol is followed. The conversion factor (ConF) between this calibration and the measurement in the tissue simulation solution is performed by comparison with temperature measurements and computer simulations. This conversion factor is only valid for the specified tissue simulating liquids at the specified frequencies. If measurements have to be performed in solutions with other electrical properties or at other frequencies, the conversion factor has to be assessed by the same procedure.

As the probes have been constructed with printed resistive lines on ceramic substrates (thick film technique), the probe is very delicate with respect to mechanical shocks.

Attention:

Do not drop the probe or let the probe collide with any solid object. Never let the robot move without first activating the emergency stop feature (i.e., without first turning the data acquisition electronics on).

[1] Feature of the DASY2 Software Tool.

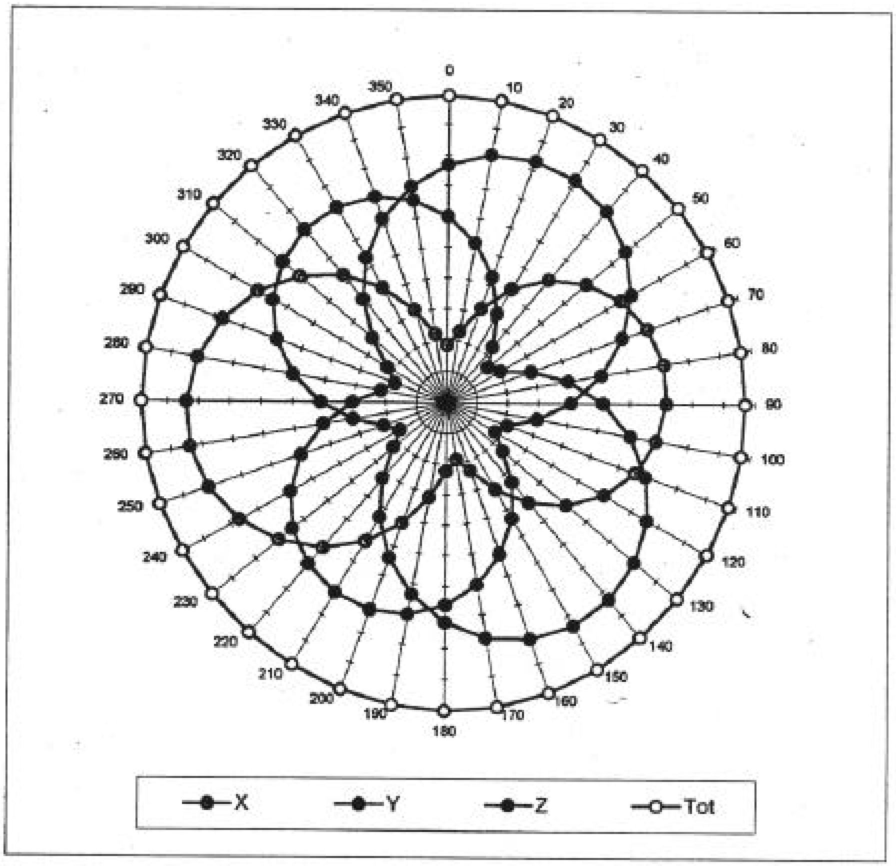
Parameters of Probe ET3DV4 SN:1123

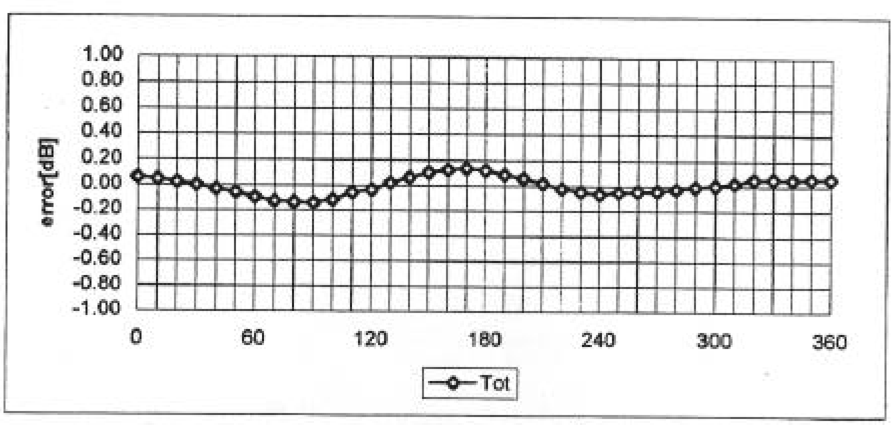
NormX	1.75	$\mu V/(V/m)^2$
NormY	1.82	$\mu V/(V/m)^2$
NormZ	1.71	$\mu V/(V/m)^2$
DCP	41000	μV
ConvF(450MHz)	6.6 ± 10%	ε_r=47.2 ± 5%; σ=0.45 ± 10% mho/m[1]
ConvF(900MHz)	5.7 ± 10%	ε_r=42.5 ± 5%; σ=0.85 ± 10% mho/m[1]
ConvF(1800MHz)	4.8 ± 10%	ε_r=41.0 ± 5%; σ=1.69 ± 10% mho/m[1]
$d_{probe\_tip - center\_dipoles}$	2.7	mm
$d_{surface - probe\_tip}$	1.3 ± 0.2	mm

[1] Brain tissue simulating liquids

ET3DV4 SN:1123

Receiving Pattern (ϕ), θ = 0°, f = 30 MHz
(TEM-Cell:ifi110)





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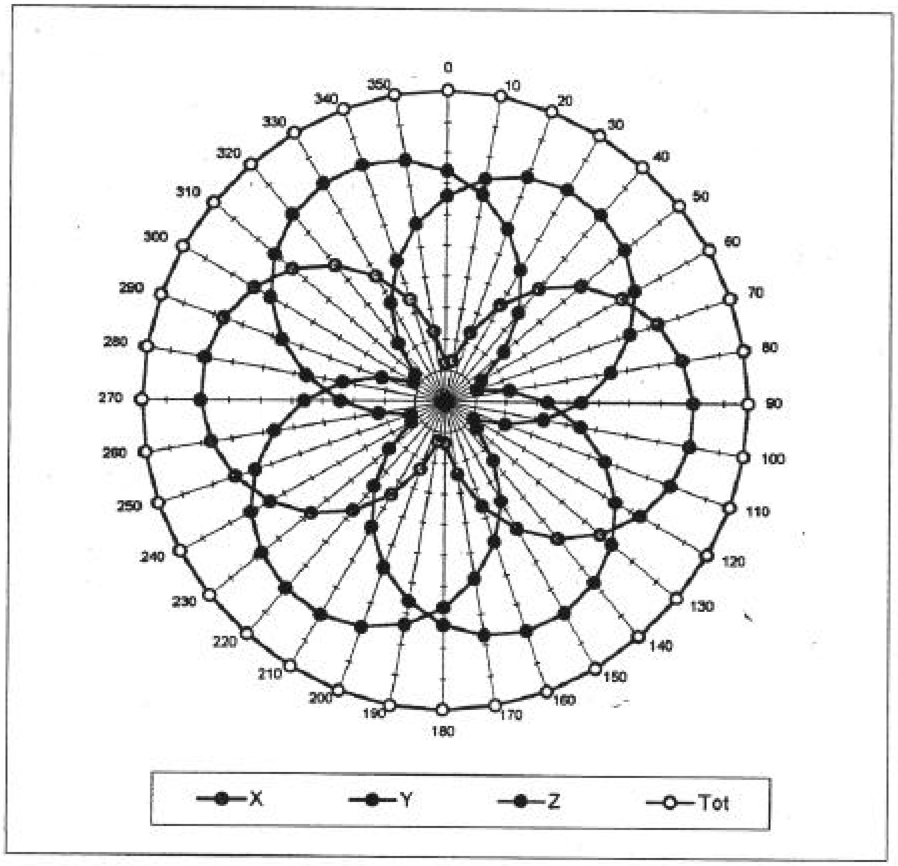
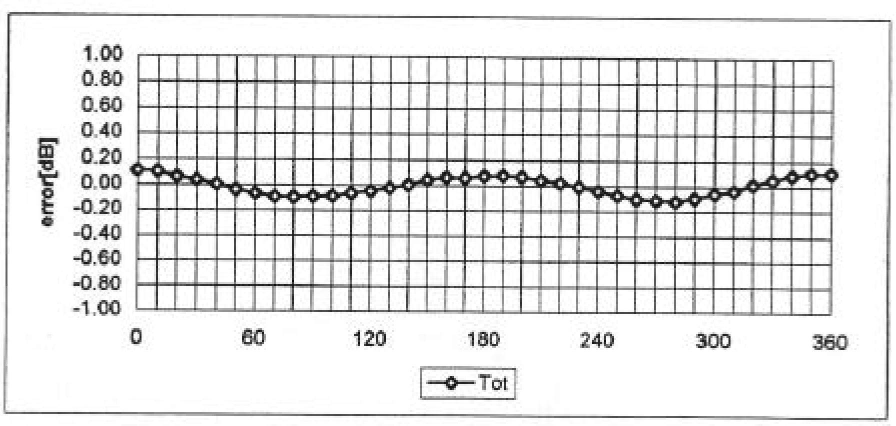
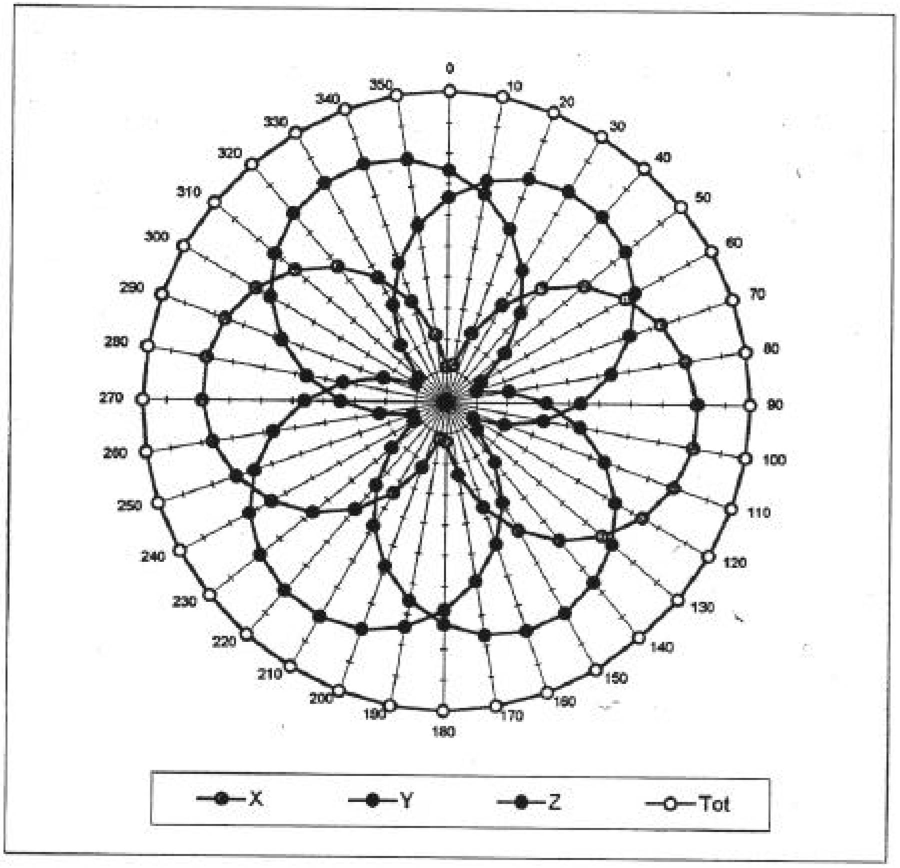
ET3DV4 SN:1123

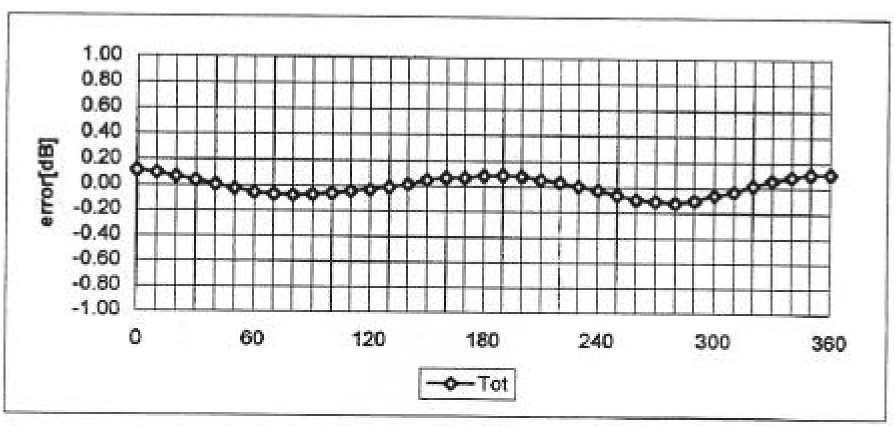
Receiving Pattern (ϕ), θ = 0°, f = 100 MHz
(TEM-Cell:ifi110)



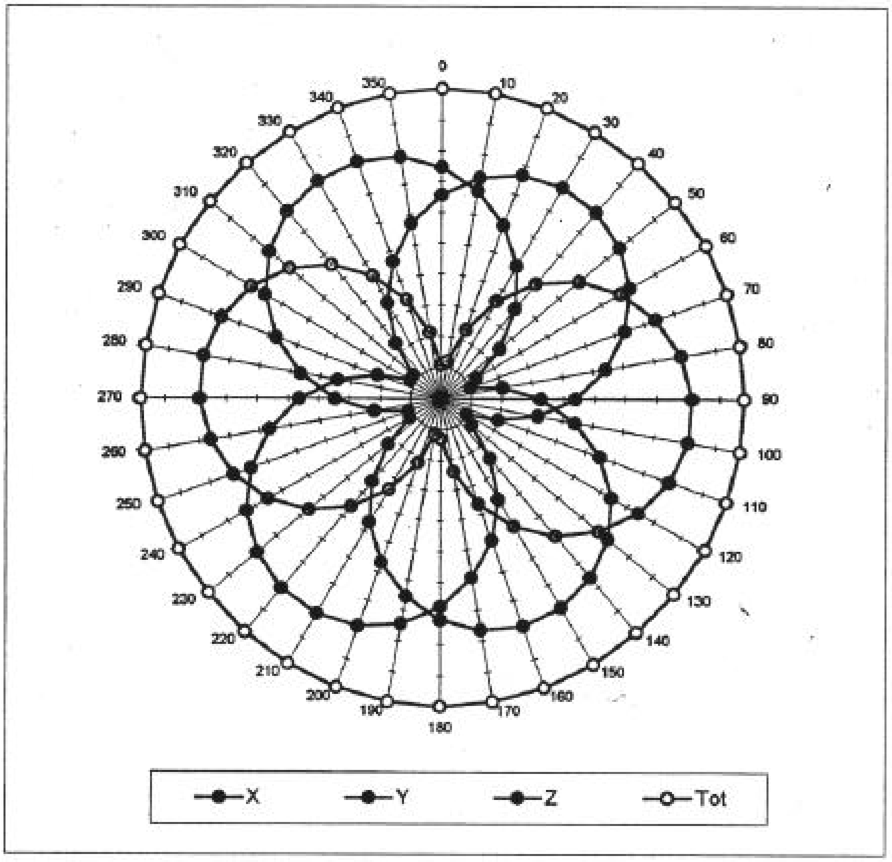


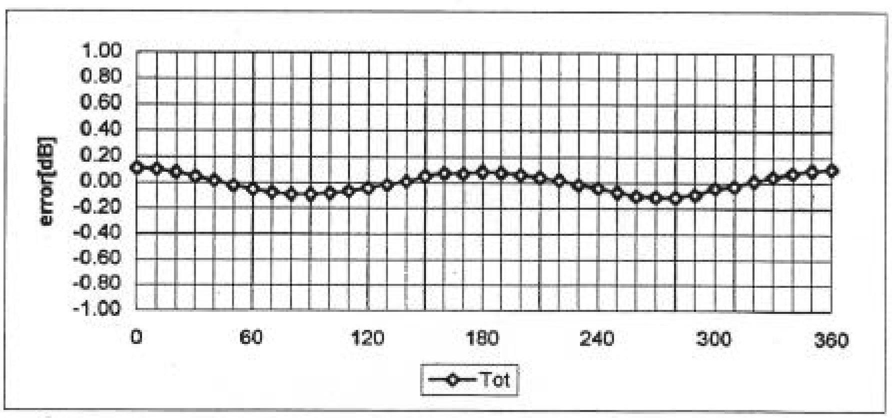
Receiving Pattern (ϕ), θ = 0°, f = 300 MHz
(TEM-Cell:ifi110)





Receiving Pattern (ϕ), θ = 0°, f = 900 MHz
(TEM-Cell:ifi110)





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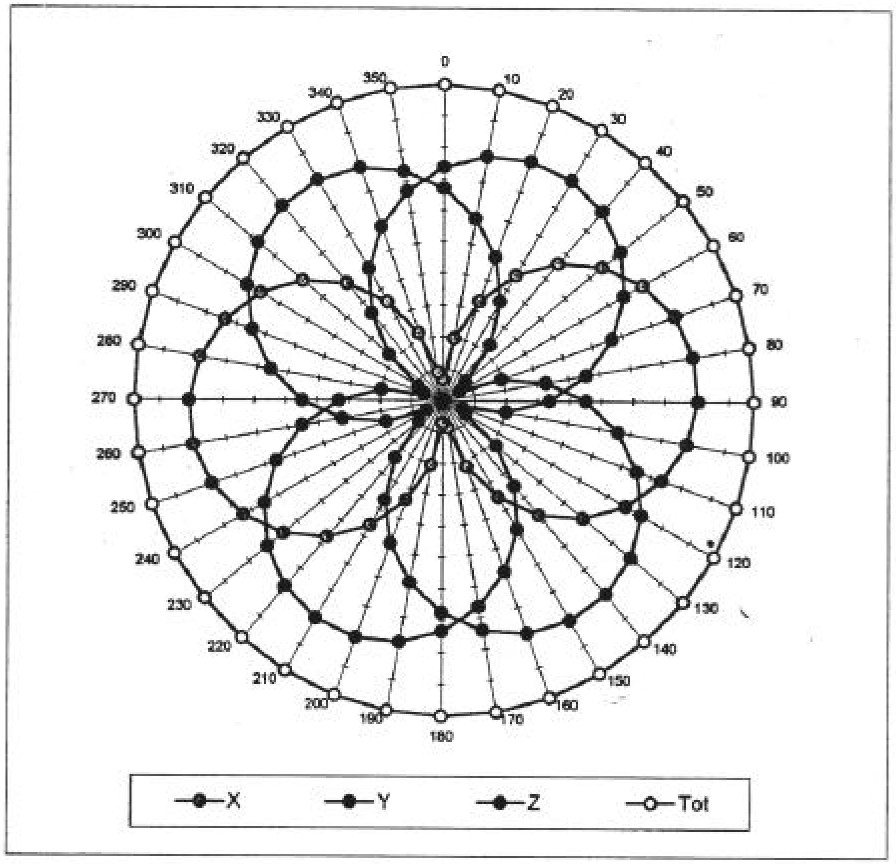
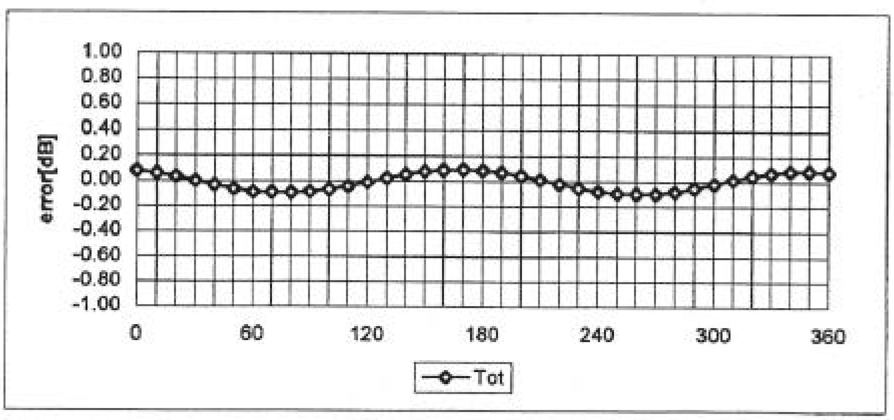
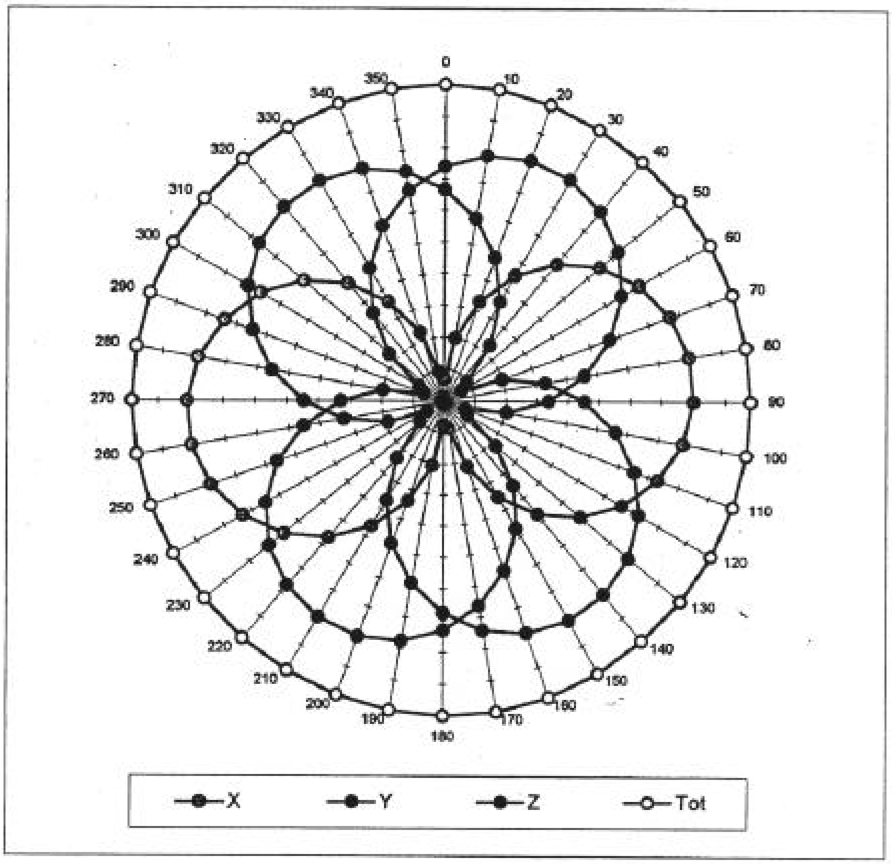
Receiving Pattern (ϕ), θ = 0°, f = 1800 MHz
(Waveguide R22)

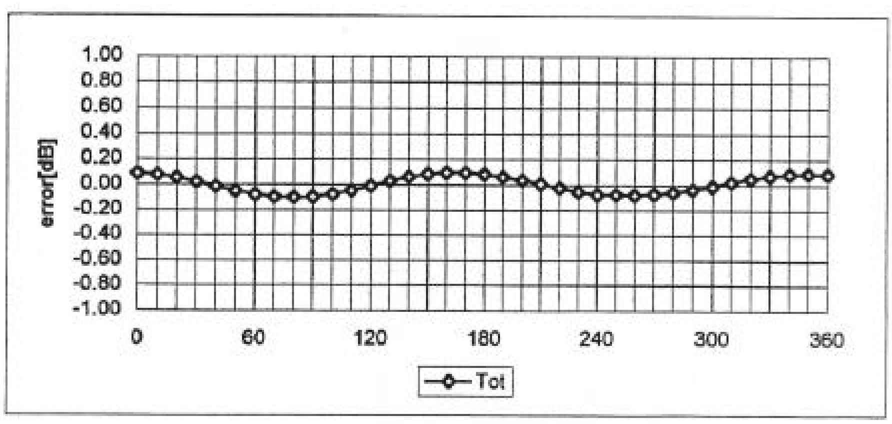




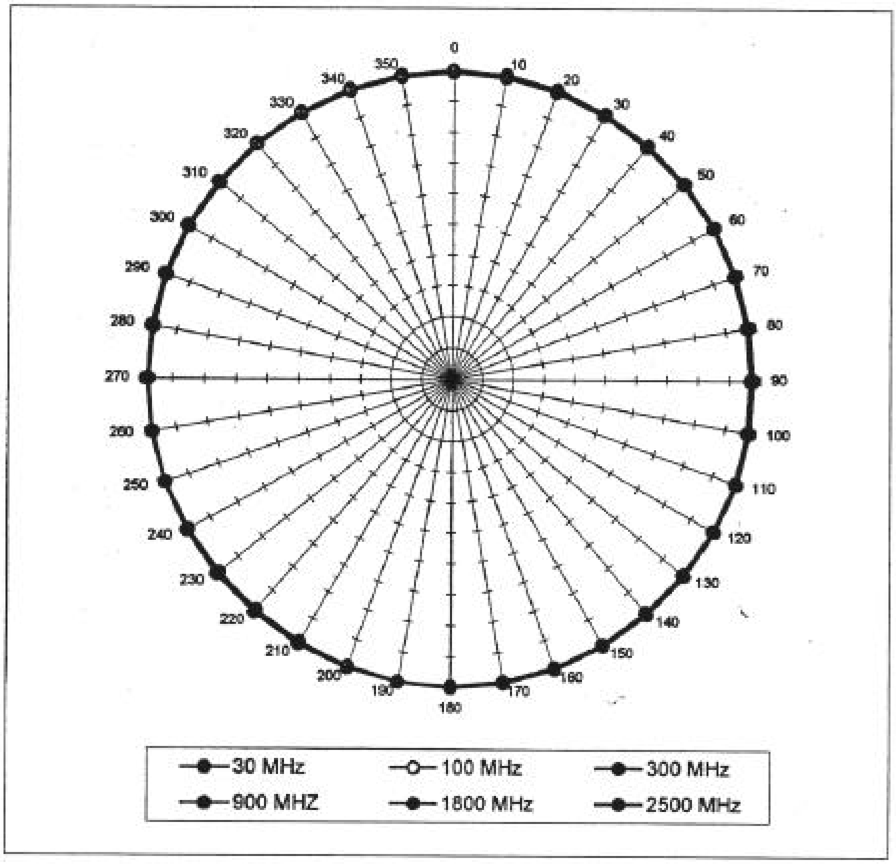
ET3DV4 SN:1123

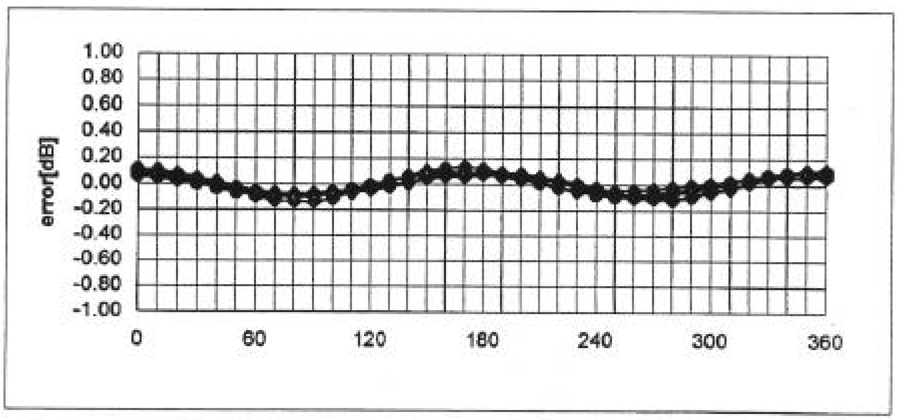
Receiving Pattern (ϕ), θ = 0°, f = 2500 MHz
(Waveguide R26)





Receiving Pattern (ϕ,f), θ = 0°





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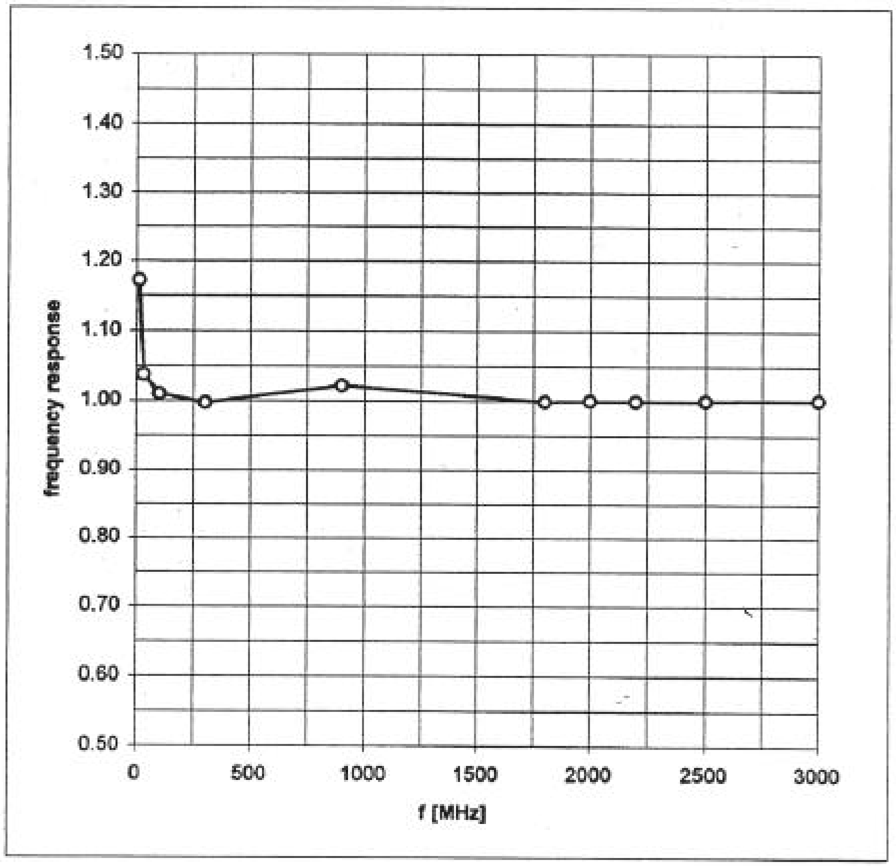
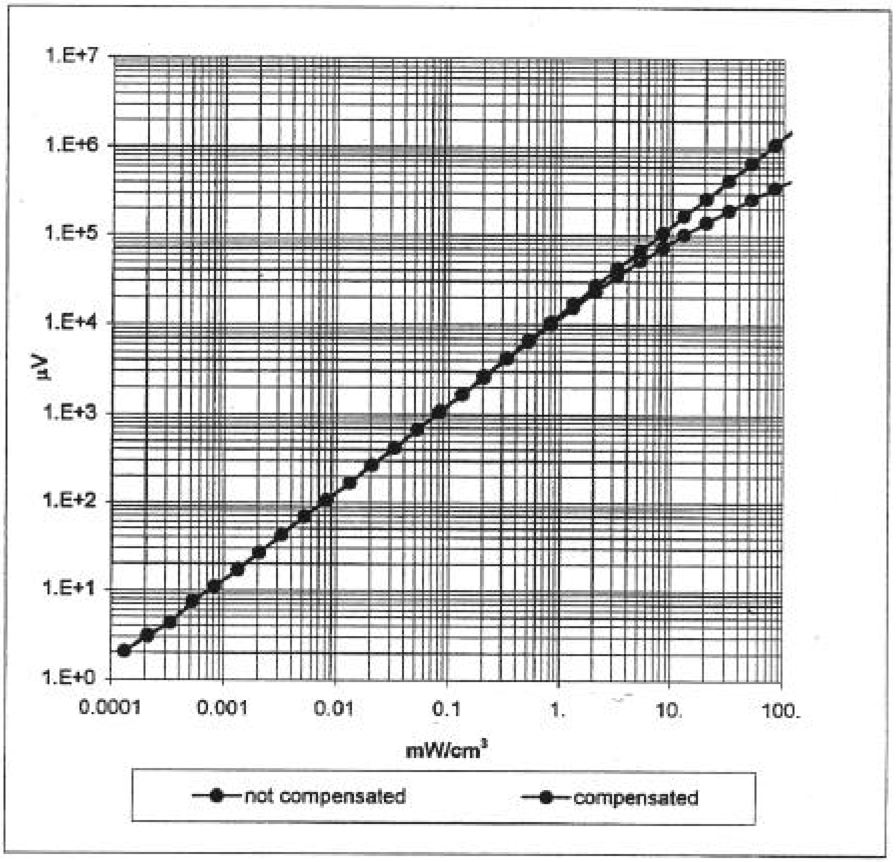
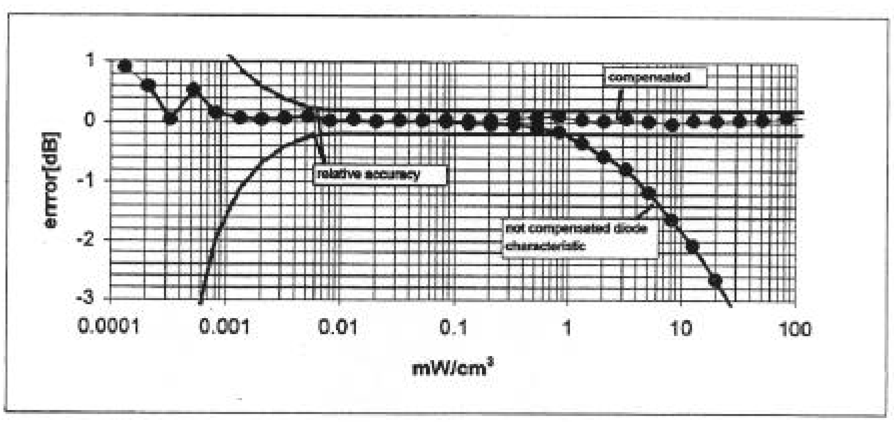
Frequency Response of E-Field
(TEM-Cell:ifi110, Waveguide R22, R26)



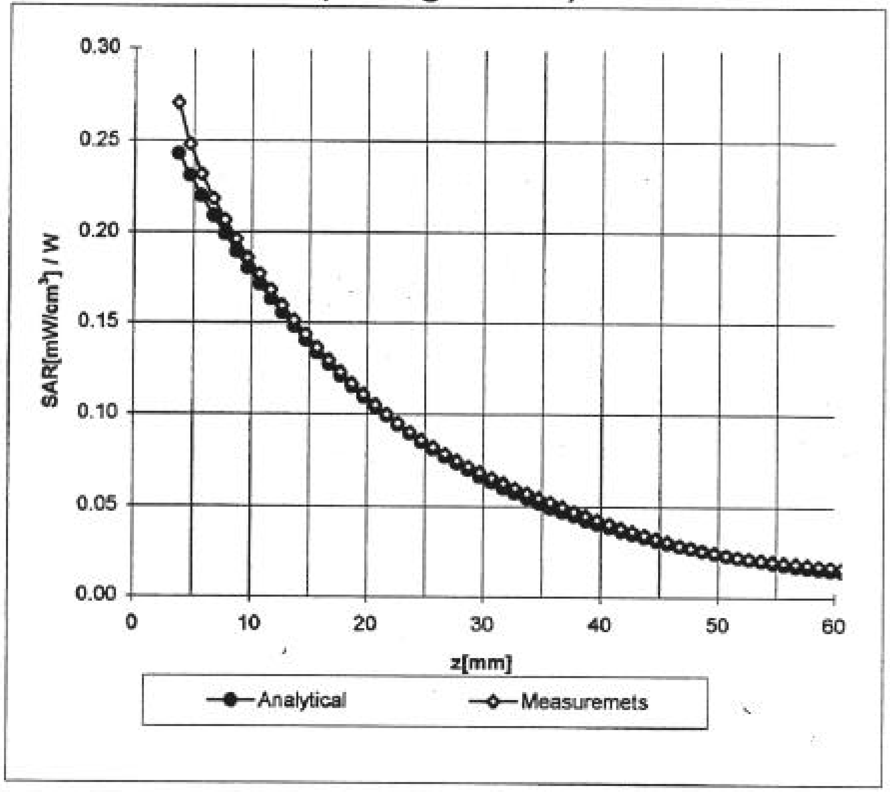
Dynamic Range f(SAR_{brain})
(TEM-Cell:ifi110)





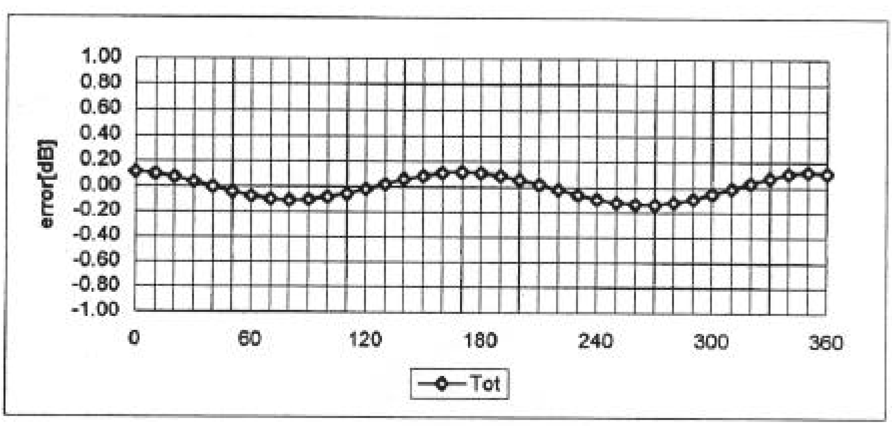
Conversion Factor Assessment, f = 900 MHz

(Waveguide R9)



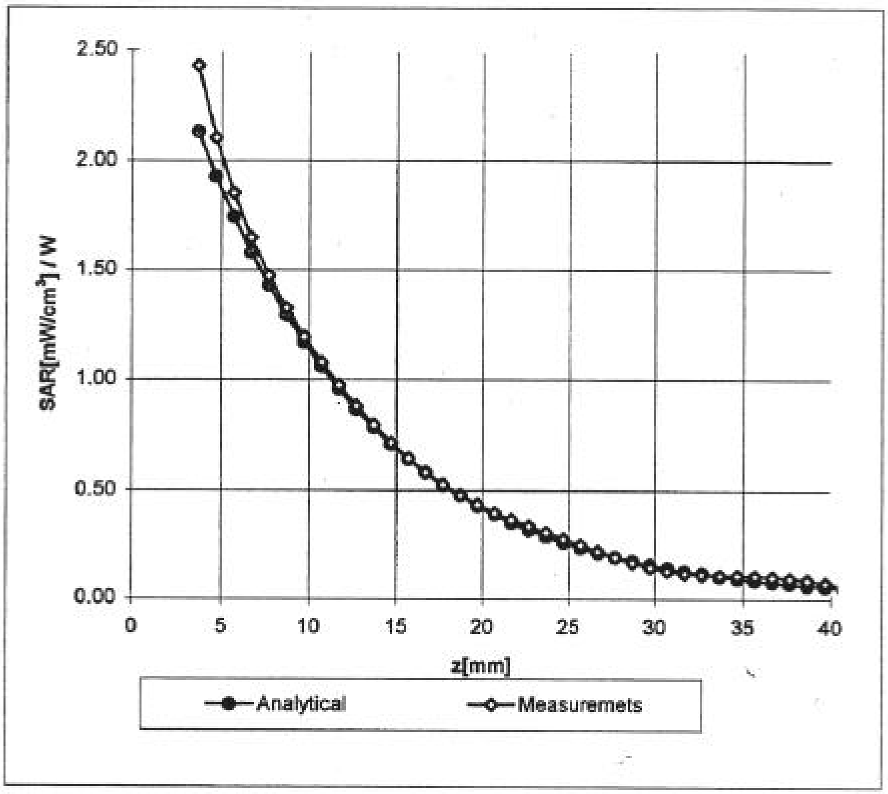
Receiving Pattern (ϕ)

(in brain tissue, z = 5 mm)



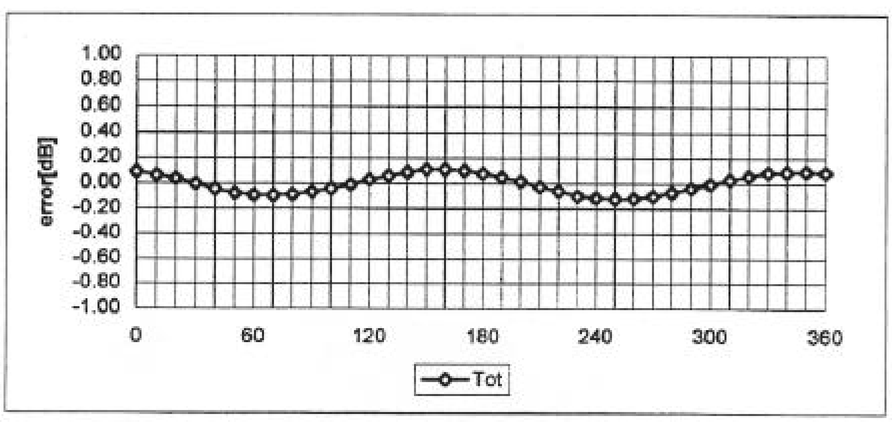
Conversion Factor Assessment, f = 1800 MHz

(Waveguide R22)



Receiving Pattern (ϕ)

(in brain tissue, z = 5 mm)



Schmid & Partner
Engineering AG

Staffelstrasse 8, 8045 Zurich, Switzerland, Telefon +41 1 280 08 60, Fax +41 1 280 08 64

DASY

Dipole Validation Kit

Type : D900V2

Ser.: 011

Manufactured:	June 1996
Calibrated:	June 1996
Recalibrated:	July 1997

3. Dipole Impedanc and return loss

The impedance was measured at the SMA-connector with a network analyser and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.419 ns**	(one direction)
Transmission factor:	**0.985**	(voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 900 MHz:	Re{Z} = **43.9 Ω**
	Im {Z} = **1.7Ω**
Return Loss at 900 MHz	**- 23.2 dB**

4. Handling

The dipole is made of standard semirigid coaxial cable. The centre conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

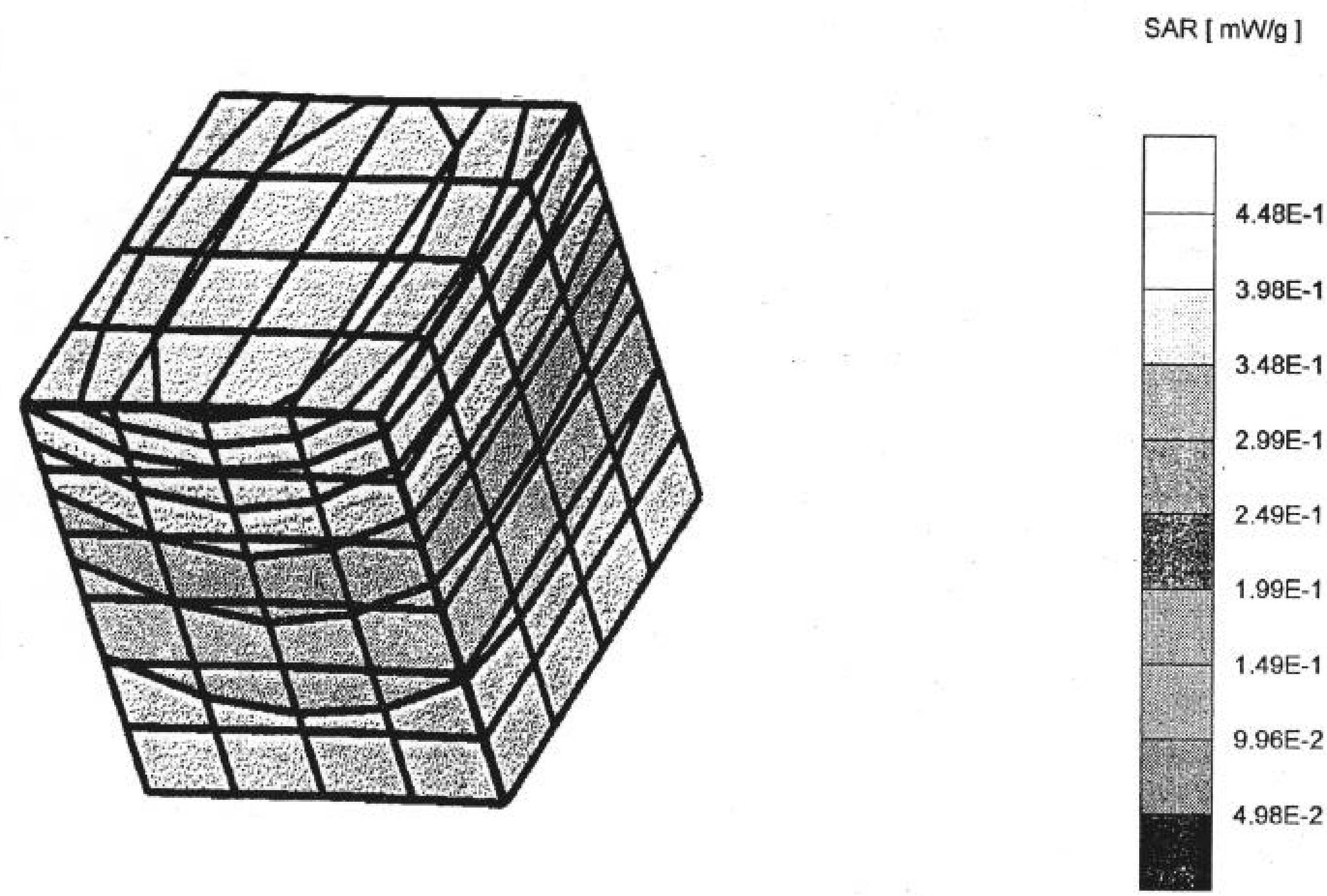
Do not apply excessive force to the dipole arms, because they might bend. If the dipole arms have to be bent back, take care to release stress to the soldered connections near the feedpoint; they might come off.

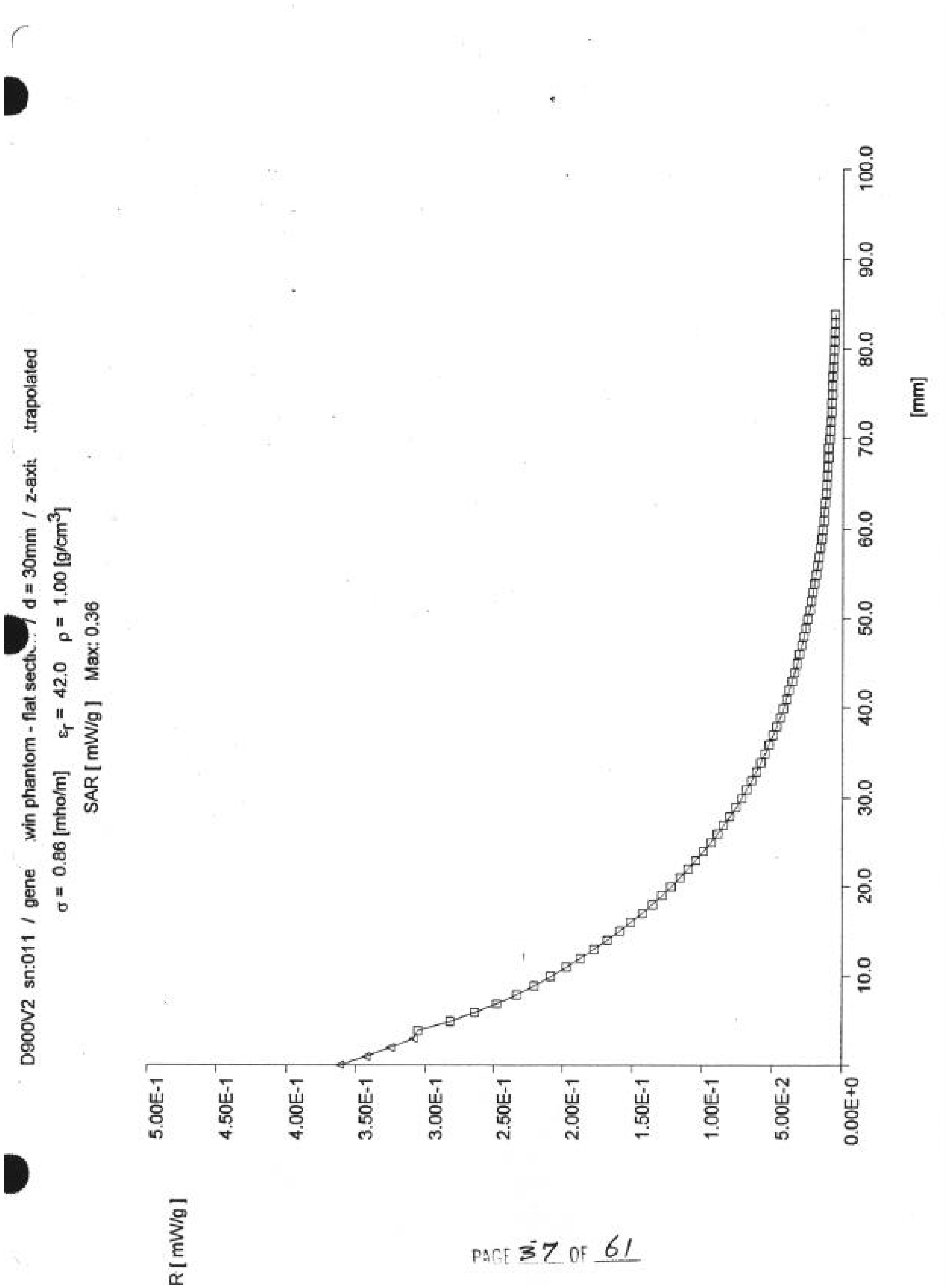
After prolonged use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

D900V2 sn:011 / generic twin phantom - flat section / Pin = 0.1W / d = 30mm

σ = 0.86 [mho/m] ε_r = 42.0 ρ = 1.00 [g/cm^3]

SAR (1g): 0.420 [mW/g] SAR (10g): 0.294 [mW/g]




D900V2 sn:011 / gene .win phantom - flat sectio.. / d = 30mm / z-axi: .trapolated
σ = 0.86 [mho/m] ε_r = 42.0 ρ = 1.00 [g/cm³]
SAR [mW/g] Max: 0.36
R [mW/g]
5.00E-1
4.50E-1
4.00E-1
3.50E-1
3.00E-1
2.50E-1
2.00E-1
1.50E-1
1.00E-1
5.00E-2
0.00E+0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
[mm]
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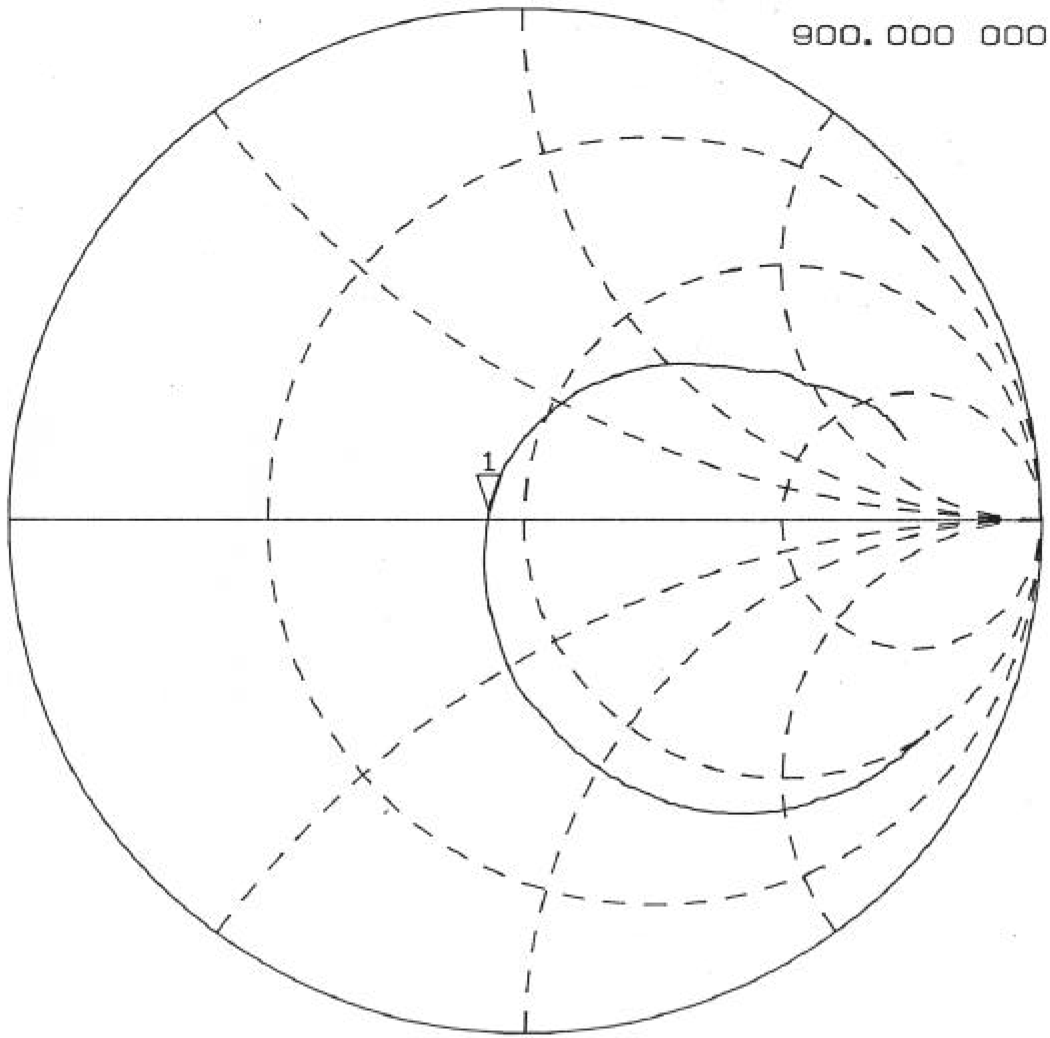
CH1 1→1 1 U FS 1: 43.861 Ω 1.6641 Ω 294.27 pH

900.000 000 MHz

Cor
E
Del



CENTER 900.000 000 MHz SPAN 400.000 000 MHz

D900V2 SN:011

S11

Flat phantom with brain simulating solution

d = 30mm

(distance from dipole center to solution)

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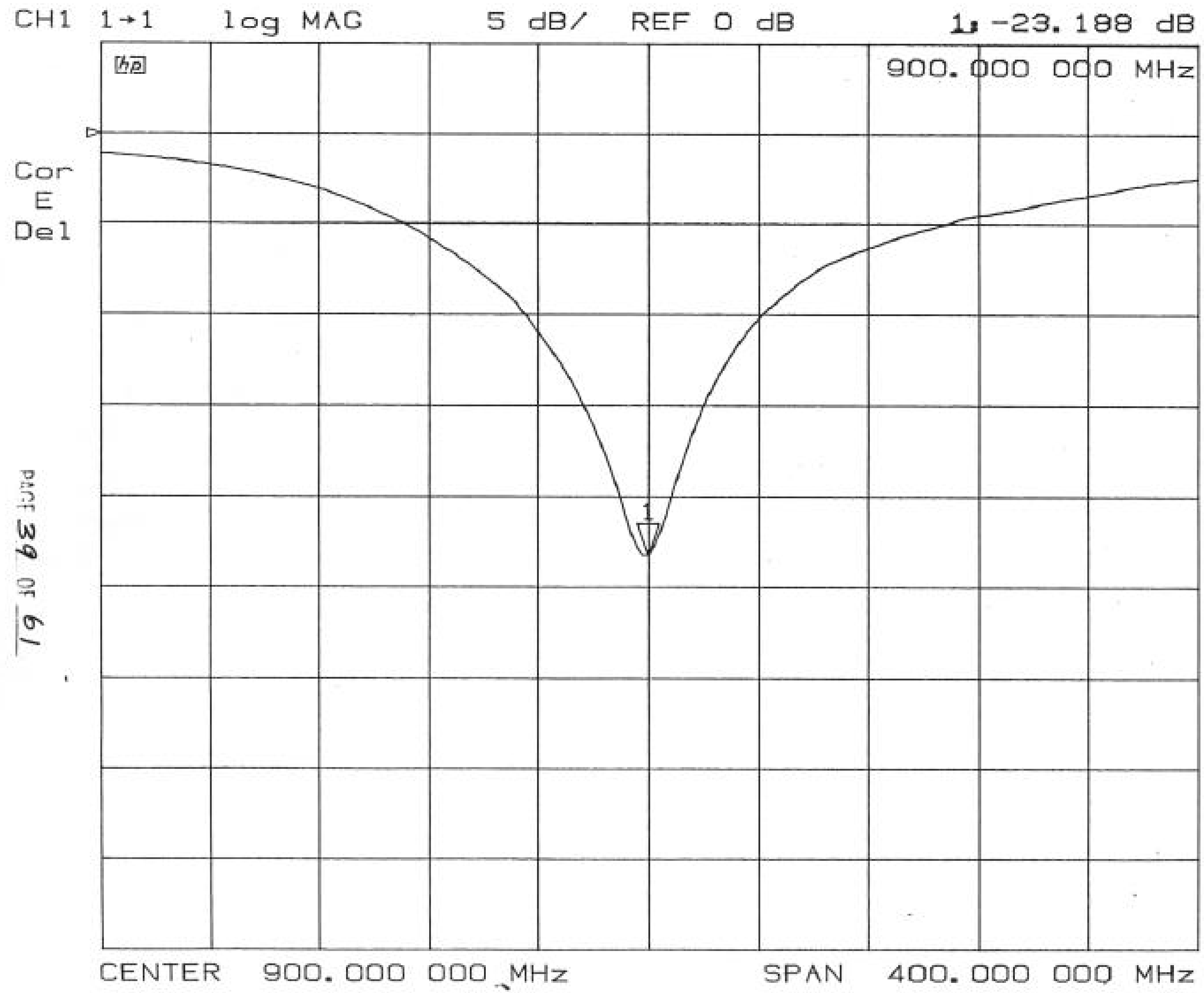

D900V2 SN:011

S11

Flat phantom with brain simulating solution

d = 30mm

(distance from dipole center to solution)

APPENDIX B

TEST DATA

Effective Radiated Power Data Sheet

Inet Incorporated
Spider II Wireless Modem

SERIAL #: 8
DATE: November 10, 1998
PROJECT #: 98-284
Mode: AMPS

MEASUREMENT DISTANCE (m): 10
MEASUREMENT HEIGHT: 1.8 meter
EUT Orientation: 265

EIRP

Channel Setting	EUT Ant. Polar.	Meas. Ant. Polar.	Freq. (MHz)	Recorded Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	EIRP (Watts)
991	V	V	824.1	87.1	21.9	4.4	113.4	0.3921
991	V	H	824.1	78.3	21.9	4.4	104.6	0.0517
991	H	H	824.1	82.5	21.9	4.4	108.8	0.1359
991	H	V	824.1	72.3	21.9	4.4	98.6	0.0130
367	V	V	836.0	86.9	21.9	4.4	113.2	0.3744
367	V	H	836.0	76.8	21.9	4.4	103.1	0.0366
367	H	H	836.0	82.5	21.9	4.4	108.8	0.1359
367	H	V	836.0	71.8	21.9	4.4	98.1	0.0116
799	V	V	848.9	85.0	22.1	4.4	111.5	0.2531
799	V	H	848.9	73.6	22.1	4.4	100.1	0.0183
799	H	H	848.9	80.4	22.1	4.4	106.9	0.0878
799	H	V	848.9	70.4	22.1	4.4	96.9	0.0088

Corrected Level = Recorded Level + Antenna Factor + Cable Loss

COMMENT #1: All measurements for this test based on peak measurement methods

COMMENT #2:

TEST ENGINEER:______________________ **APPROVED BY**: ______________________
John O'Brien Jeffery Lenk

Effective Radiated Power Data Sheet

Inet Incorporated
Spider II Wireless Modem

SERIAL #: 8
DATE: November 10, 1998
PROJECT #: 98-284
Mode: CDPD

MEASUREMENT DISTANCE (m): 10
MEASUREMENT HEIGHT: 1.8 meter
EUT Orientation: 262

EIRP

Channel Setting	EUT Ant. Polar.	Meas. Ant. Polar.	Freq. (MHz)	Recorded Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	EIRP (Watts)
991	V	V	824.1	87.7	21.9	4.4	114.0	0.4502
991	V	H	824.1	79.4	21.9	4.4	105.7	0.0666
991	H	H	824.1	82.2	21.9	4.4	108.5	0.1269
991	H	V	824.1	73.2	21.9	4.4	99.5	0.0160
367	V	V	836.0	86.6	21.9	4.4	112.9	0.3494
367	V	H	836.0	77.8	21.9	4.4	104.1	0.0461
367	H	H	836.0	83.0	21.9	4.4	109.3	0.1525
367	H	V	836.0	74.0	21.9	4.4	100.3	0.0192
799	V	V	848.9	84.2	22.1	4.4	110.7	0.2106
799	V	H	848.9	74.1	22.1	4.4	100.6	0.0206
799	H	H	848.9	79.8	22.1	4.4	106.3	0.0764
799	H	V	848.9	71.3	22.1	4.4	97.8	0.0108

Corrected Level = Recorded Level + Antenna Factor + Cable Loss

COMMENT #1: All measurements for this test based on peak measurement methods

COMMENT #2:

TEST ENGINEER:______________________ **APPROVED BY**: ______________________
John O'Brien Jeffery Lenk

Conducted Output Power Data Sheet

Inet Incorporated
Spider II Wireless Modem

SERIAL #: 8
DATE: November 10, 1998
PROJECT #: 98-284

PORT UNDER TEST: Antenna I/O
MEASUREMENT METHOD: Peak

TX Mode	Channel Setting	Freq. (MHz)	Recorded Level (dBm)	Cable Loss (dB)	Corrected Level (dBm)	Corrected Level (watts)	Margin (watts)
AMPS	991	824.1	23.9	1.0	24.9	0.309	-6.691
AMPS	367	836.0	23.7	1.0	24.7	0.295	-6.705
AMPS	799	848.9	22.6	1.0	23.6	0.229	-6.771
CDPD	991	824.1	24.2	1.0	25.2	0.331	-6.669
CDPD	367	836.0	23.2	1.0	24.2	0.263	-6.737
CDPD	799	848.9	21.8	1.0	22.8	0.191	-6.809

Corrected Level = Recorded Level + Cable Loss

COMMENT #1: All measurements are Peak Measurements

COMMENT #2: Bandwidth 3 MHz/ 3 MHz

TEST ENGINEER:______________________ **APPROVED BY**: ______________________
John O'Brien Jeffery Lenk