

MEASUREMENT/TECHNICAL REPORT

**Company - Model: PinPoint
ACC-CC16-01 and ACC-ANT01-01
FCC ID: OGK30011534001
May 10, 1999**

Description: This is a report to support a request for an original grant of equipment authorization.

Equipment Type: Spread Spectrum Transmitter (DSS)

Report prepared for: PinPoint Corporation
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Letter of Agency



LETTER OF AGENCY

Agent's Authorization Letter

April 19, 1999

I, an officer of PinPoint Corporation, do hereby authorize, until further notice, Curtis-Straus LLC, of 527 Great Road, Littleton, MA, 01460, to act on behalf of PinPoint Corporation in dealings before the Federal Communications Commission with respect to all matters relating to equipment authorizations under 47 CFR. This authorization includes but is not limited to the signing of Form 731.

I certify that no party (as defined in 47 CFR 1.2002) to this application, including myself, is subject to a denial of federal benefits, that include FCC benefits, pursuant to section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C., 853A.

Certified by:


Colin Lanzl
Vice President of Engineering

19 April '99
Date

Introduction

This report is an application for Certification of a Transmitter operating pursuant to Part 15.247 of the FCC Rules, Code of Federal Regulations 47. The model numbers covered by this report include:

- ACC-CC16-01 (Cell Controller Tested)
- ACC-CC12-01
- ACC-CC08-01
- ACC-CC04-01
- ACC-ANT01-01 (Antenna Tested)

The ACC-CC16-01, utilizing four transmitter boards, is the most fully configured model in the ACC-CCXX-01 family. The CC12, CC08 and CC04 models are identical to the CC16 unit except that they are equipped with fewer transmitter boards.

This report is designed to demonstrate the compliance of this device with the requirements outlined in Part 15 of CFR 47 using the methods outlined in Part 2 of CFR 47. The current revision date, October 1,1998, of each Part has been used for technical requirements.

The confidential information and descriptions included in this application are detailed descriptions of the products, block diagrams, component specifications, and schematic diagrams. We hereby respectfully request under the provision of section 0.457d of the code that the documents listed below be held confidential.

Exhibit 6.1: Technical Description & Block Diagrams

Exhibit 6.2: Schematics

Exhibit 6.3: Bill of Materials

PinPoint is requesting that the Technical Description, Block Diagrams, Schematics and Bill of Materials be kept confidential in the FCC application because of the proprietary design developed by PinPoint that is unique to the industry.

EXHIBIT 1:

1.0 Statement of Conformity

The PinPoint ACC-CC16-01 has been found to conform with the following parts of the 47 CFR as detailed below:

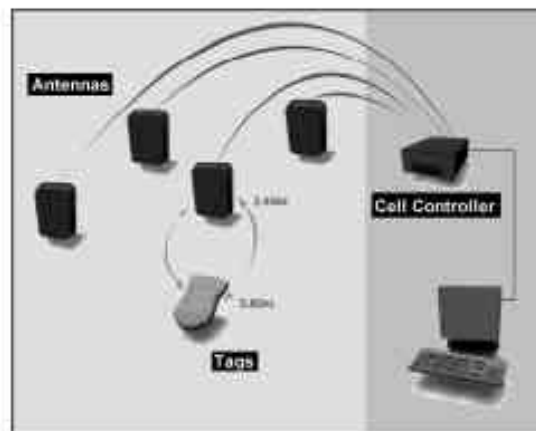
Part 2	Part 15	Comments
	15.15(b)	The product contains no user accessible controls that increase transmission power above allowable levels.
2.925	15.19	The label is shown in the label exhibit.
	15.21	Information to the user is shown in the instruction manual exhibit.
	15.27	No special accessories are required for compliance.
	15.203	The equipment is professionally installed by an authorized service agent.
	15.205 15.209	The fundamental is not in a Restricted band and the spurious and harmonic emissions in the Restricted bands comply with the general emission limits of 15.209.
	15.207	The unit complies with the general conducted emissions limits of 15.207.
	15.247(a)(2)	The unit has a 6dB bandwidth greater than 500kHz as shown in Exhibit 3.
	15.247(b)	The maximum peak output power of the unit does not exceed the limits given in 15.247 as shown in Exhibit 3.
	15.247(b)(4)	This unit does not expose the public to radio frequency levels in excess of the Commission's guidelines when installed properly.
	15.247(c)	All harmonics outside of the band in which the intentional radiator operates are at least 20dB below the highest level of in band desired power. Emissions falling in restricted bands also comply with the radiated emissions limits specified in 15.209(a).
	15.247(d)	The peak power spectral density is less than 8dBm in any 3kHz band.
	15.247(e)	The processing gain is greater than 10dB.

EXHIBIT 2

2.0 General Description

2.1 Product Description

The 3D-iD Cell Controller broadcasts spread spectrum signals at 2.44GHz to the 3D-iD tags via its attached Antennas. It then measures the total time transpired until the return signals (at 5.77GHz) are received from the Tags. Using this information it calculates the distance the Tag is from the Antenna, called Tag Antenna Distance (TAD) data. The Cell Controller sends the TAD data it generates to the ViewPoint Software via a standard ethernet link. The software can, using TAD data from several antennas, accurately determine a Tag's location (Note: The 3D-iD tags are not included in this application).



Unit Tested

Model Number: ACC-CC16-01

Serial Number: 1

2.2 Related Submittal(s) Grants

There are no other approvals required for this device.

2.3 Test Methodology

Radiated emission testing was performed according to the procedures in ANSI C63.4 (1992). Radiated testing was performed at an antenna to EUT distance of 3 meters below 1 GHz, and at a distance of 3 or 1 meter(s) above 1 GHz. The actual test distance used is noted in the test data sheets. The device's performance was investigated to 10 times the fundamental frequency.

All other performance tests were made in accordance with the procedures outlined in Part 15 of CFR 47. The applicable sections provided under Part 15 are provided in the measurement section of this report, Exhibit 3.

2.4 Test Facility

The open area test site used to collect the radiated data is located at 527 Great Road, Littleton, MA 01460. Sites "F" and "T" were used. These test facilities have been fully described in a report submitted to your office, and a letters from your office dated February 28, 1997 and August 8, 1997 verified receipt of these reports and confirmed compliance of these sites. Please reference your file # 31040/SIT 1300F2 should you have any questions regarding the test site construction.

2.5 Test Equipment Used

SPECTRUM ANALYZER(S)

GREEN 8593E	HP	S/N:3829A03618	Calibration Due:31-AUG-99
9 kHz-26.5 GHz			

ANTENNA(S)

RED 3143	EMCO	S/N:1270	Calibration Due:28-MAY-99
Biconilog 30 MHz-1.1 GHz			
YELLOW 3115	EMCO	S/N:9608-4989	Calibration Due:10-MAR-00
Horn Antenna 1-18 GHz			
HF HORN 3160-9	EMCO	S/N:9610-1068	Calibration Due:01-JUN-99
Horn Antenna 18-26.5 GHz			

PREAMPLIFIER(S)

BLACK ZFL-1000-LN	MiniCircuits		Calibration Due:01-MAR-00
RF Preamplifier 0.01 - 2000 MHz			
WHITE SMC-12A	MITEQ	S/N:426643	Calibration Due:30-OCT-99
RF Preamplifier 2000 - 18000 MHz			
YELLOW AFS4-18002650-60-8P-4	MITEQ	S/N:467559	Calibration Due:01-JUN-99
RF Preamplifier 18 - 26.5 GHz			

OPEN AREA TEST SITE(S)

SITE "F"	Calibration Due:18-OCT-99
SITE "T"	Calibration Due:28-MAY-99

Unless otherwise noted the calibration interval is one year. All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

EXHIBIT 3

3.0 *Measurement Results*

3.1 Operating Frequency

The devices operating frequency is 2442.0 MHz.

3.2 Maximum Peak Output Power Measurement

The maximum peak output power as measured with a broadband power meter at the antenna port is:

16.8dBm which is less than the 1 Watt (30dBm) limit.

3.3 Electric Field Strength Radiation Measurements

Radiated Emissions Table											Curtis-Straus LLC				
Date: 13-Apr-99			Company: PinPoint					Table 1							
Engineer: Michael Buchholz			EUT Desc: 3DiD					Work Order: 990390							
Frequency Range: 2435.7-24420.0MHz								Measurement Distance: 3 m							
Notes: First ten harmonics of TX fundamental (2442MHz) RF Antenna Conducted test. 100kHz RBW.								EUT Max Freq: 2442.0MHz							
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBμV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Duty-Cycle Factor (dB)	Adjusted Reading (dBμV/m)	---			FCC Class B				
								Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)		
n/a	2435.7	104.7	---	---	0.4	0.0	105.1	---	---	---	---	---	---		
n/a	4884.4	74.2	---	---	0.7	0.0	74.9	---	---	---	85.1	-10.1	Pass		
n/a	7313.5	56.6	---	---	1.1	0.0	57.7	---	---	---	85.1	-27.4	Pass		
n/a	9728.5	69.4	---	---	1.4	0.0	70.8	---	---	---	85.1	-14.2	Pass		
Noise Floor	12210.0	50.2	---	---	1.8	0.0	52.0	---	---	---	85.1	-33.1	Pass		
Noise Floor	14652.0	50.7	---	---	2.1	0.0	52.8	---	---	---	85.1	-32.2	Pass		
Noise Floor	17094.0	52.9	---	---	2.5	0.0	55.4	---	---	---	85.1	-29.7	Pass		
Noise Floor	19536.0	56.4	---	---	2.8	0.0	59.2	---	---	---	85.1	-25.8	Pass		
Noise Floor	21978.0	58.0	---	---	3.2	0.0	61.2	---	---	---	85.1	-23.9	Pass		
Noise Floor	24420.0	56.9	---	---	3.5	0.0	60.4	---	---	---	85.1	-24.6	Pass		
Final Result: Pass by -10.1 dB											Worst Freq: 4884.4 MHz				
Test Site: "F"		Pre-Amp: none		Cable: 1ft RG224/U			Analyzer: Green			Antenna: none					

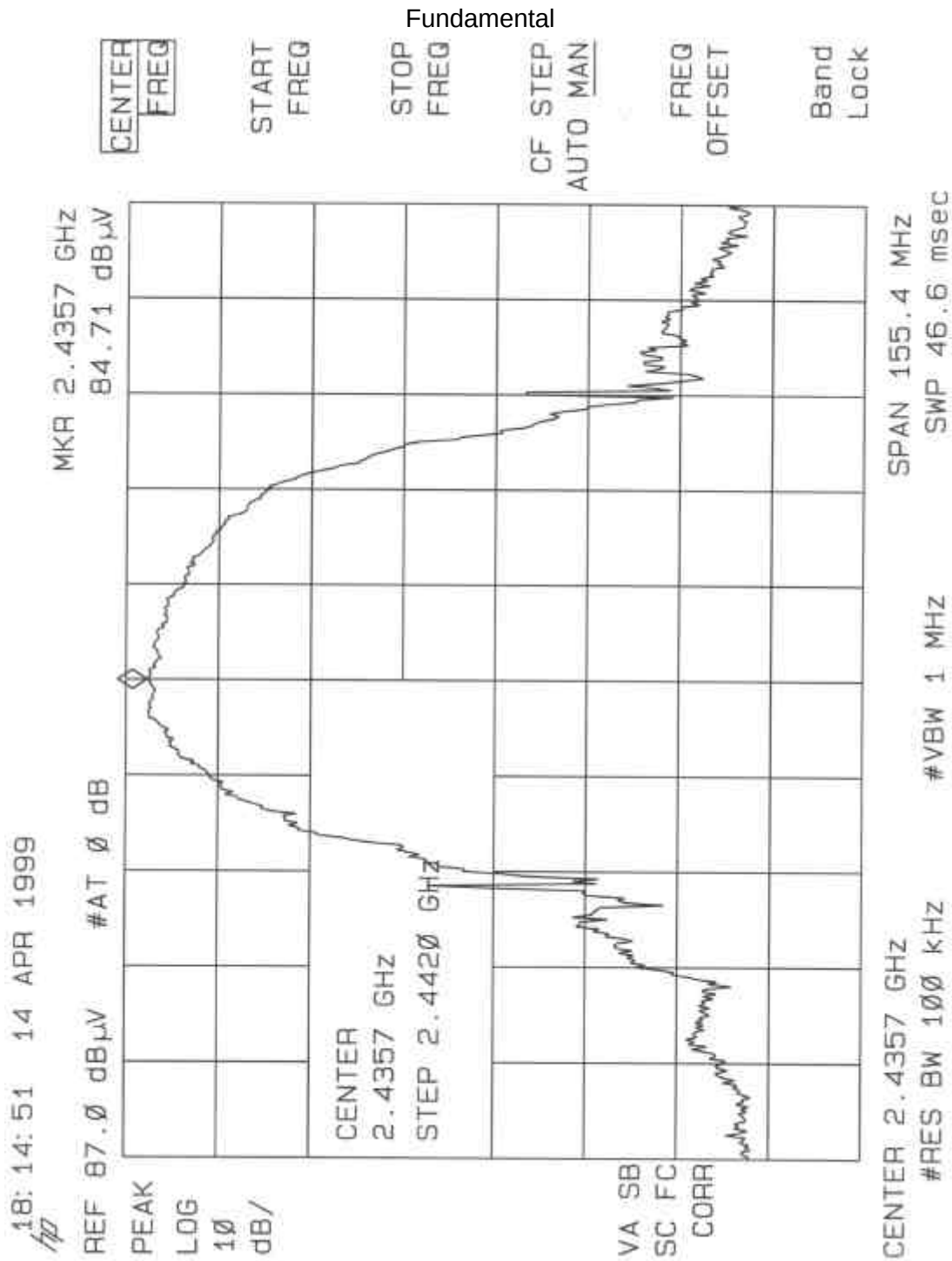
Radiated Emissions Table									Curtis-Straus LLC					
Date: 05-May-99			Company: PinPoint						Table 2					
Engineer: Michael Buchholz			EUT Desc: 3DiD Cell Controller						Work Order: 990390					
Frequency Range: 2442.0-24420.0MHz									Measurement Distance: 1 m, 0.3m					
Notes: Radiated TX harmonics (2442.0MHz) scan for restricted band intrusion.														
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBμV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Distance Factor (dB)	Adjusted Reading (dBμV/m)	---			FCC Class B			
								Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)	
Scanned at 1m														
H / V	2441.8	82.0	0.0	30.5	1.5	0.0	114.0	---	---	---	---	---	---	---
Noise Floor	4884.0	11.3	0.0	36.0	2.4	0.0	49.7	---	---	---	63.5	-13.8	Pass	
Noise Floor	7326.0	14.5	0.0	38.7	3.1	0.0	56.3	---	---	---	63.5	-7.2	Pass	
Noise Floor	9768.0	8.6	0.0	40.7	3.7	0.0	53.0	---	---	---	63.5	-10.5	Pass	
Scanned at 0.3m														
Noise Floor	12210.0	15.9	0.0	40.9	4.3	10.5	50.6	---	---	---	63.5	-12.9	Pass	
Noise Floor	14652.0	16.2	0.0	42.4	4.9	10.5	53.0	---	---	---	63.5	-10.5	Pass	
Noise Floor	17094.0	16.3	0.0	43.0	5.5	10.5	54.3	---	---	---	63.5	-9.2	Pass	
Scanned at 1m														
Noise Floor	19536.0	16.7	21.4	40.3	0.0	0.0	35.6	---	---	---	63.5	-27.9	Pass	
Noise Floor	21978.0	20.5	21.9	40.3	0.0	0.0	38.9	---	---	---	63.5	-24.6	Pass	
Noise Floor	24420.0	18.7	22.2	40.4	0.0	0.0	36.9	---	---	---	63.5	-26.6	Pass	
Final Result: Pass by -7.2 dB Worst Freq: 7326.0 MHz														
Test Site: "F"		Pre-Amp: none, HF		Cable: 12 ft RG8A/U, HF		Analyzer: Green		Antenna: Yellow Horn, HF Horn						

Radiated Emissions Table								Curtis-Straus LLC					
Date: 27-Apr-99			Company: PinPoint					Table 3					
Engineer: Michael Buchholz			EUT Desc: 3Di/D					Work Order: 990390					
Frequency Range: 30-18000MHz								Measurement Distance: 3 m					
Notes: Final Spurious Scan Tag and Cell Controller								EUT Max Freq: 6246MHz					
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Duty-Cycle Factor (dB)	Adjusted Reading (dBµV/m)	---			FCC Class B		
								Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
V	128.9	45.9	22.3	8.0	1.1	0.0	32.7	---	---	---	43.5	-10.8	Pass
V	167.1	47.2	22.3	9.4	1.3	0.0	35.6	---	---	---	43.5	-7.9	Pass
H	200.0	44.4	22.4	10.1	1.5	0.0	33.6	---	---	---	43.5	-9.9	Pass
V	250.0	36.6	22.5	12.7	1.7	0.0	28.5	---	---	---	46.0	-17.5	Pass
H	280.0	42.6	22.5	13.4	1.9	0.0	35.4	---	---	---	46.0	-10.6	Pass
H	300.8	40.7	22.5	13.9	2.0	0.0	34.1	---	---	---	46.0	-11.9	Pass
H	320.0	47.7	22.5	14.4	2.0	0.0	41.6	---	---	---	46.0	-4.4	Pass
H	350.0	33.4	22.4	15.1	2.2	0.0	28.3	---	---	---	46.0	-17.7	Pass
V	360.0	48.6	22.4	15.3	2.2	0.0	43.7	---	---	---	46.0	-2.3	Pass
H	400.0	42.5	22.3	16.3	2.4	0.0	38.9	---	---	---	46.0	-7.1	Pass
H	450.0	41.6	22.5	17.4	2.6	0.0	39.1	---	---	---	46.0	-6.9	Pass
V	500.0	36.3	22.6	18.4	2.8	0.0	34.9	---	---	---	46.0	-11.1	Pass
H	560.0	37.2	22.4	19.1	3.0	0.0	36.9	---	---	---	46.0	-9.1	Pass
H	600.0	42.3	22.3	19.5	3.1	0.0	42.6	---	---	---	46.0	-3.4	Pass
H	650.0	36.1	22.2	20.3	3.3	0.0	37.5	---	---	---	46.0	-8.5	Pass
H	720.0	35.6	22.0	21.4	3.5	0.0	38.5	---	---	---	46.0	-7.5	Pass
V	1000.0	32.0	21.5	23.4	4.4	0.0	38.3	---	---	---	54.0	-15.7	Pass
V	1440.0	34.4	20.5	26.8	5.6	0.0	46.3	---	---	---	54.0	-7.7	Pass
V	1679.0	51.2	20.3	27.8	6.2	20.0	44.9	---	---	---	54.0	-9.1	Pass
V	2082.0	39.1	20.3	29.6	1.3	0.0	49.7	---	---	---	54.0	-4.3	Pass
V	2160.0	28.2	20.3	29.8	1.4	0.0	39.1	---	---	---	54.0	-14.9	Pass
NF	3694.0	26.8	19.9	33.3	2.0	0.0	42.2	---	---	---	54.0	-11.8	Pass
V	4164.0	31.5	19.8	33.9	2.1	0.0	47.7	---	---	---	54.0	-6.3	Pass
V	5037.0	44.1	20.5	36.3	2.4	20.0	42.3	---	---	---	54.0	-11.7	Pass
V	6246.0	31.2	18.6	36.9	2.8	0.0	52.3	---	---	---	54.0	-1.7	Pass
Final Result: Pass by 1.7 dB								Worst Freq: 6246.0 MHz					
Test Site: "F","T"		Pre-Amp: Black, White		Cable: 65&12 ft RG8A/U		Analyzer: Green		Antenna: Red, Yellow					

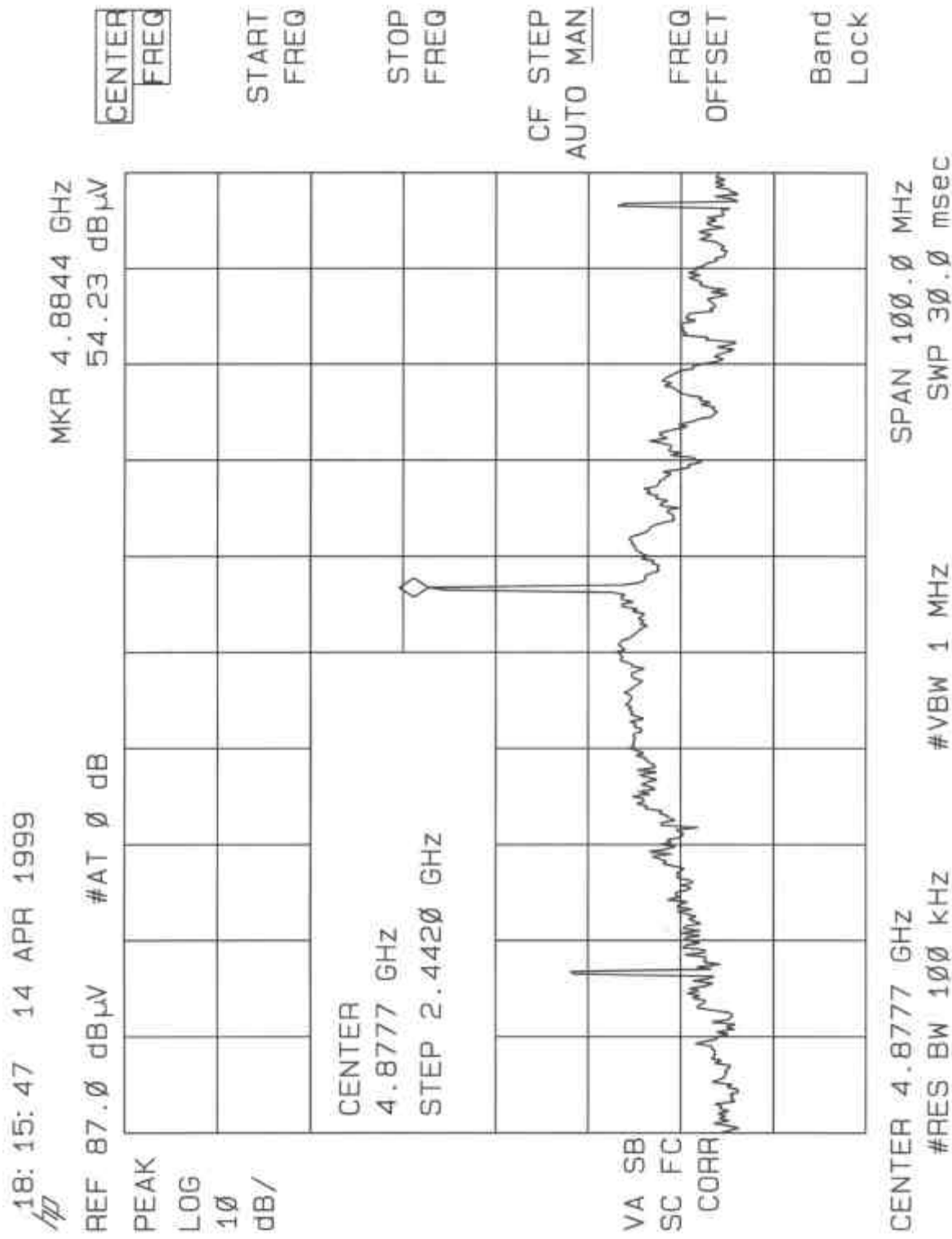
Conducted Emissions Chart								Curtis-Straus LLC			
Date: 14-Apr-99			Company: PinPoint					Table No: 4			
Engineer: Michael Buchholz			EUT Desc: 3DiD Cell Controller					Work Order: 990390			
Notes:											
Range: 0.45 - 30.0 MHz			LISN(s): Blue			Spectrum Analyzer: Green					
Frequency (MHz)	Quasi-Peak			FCC Class B		Average			FCC Class B		
	L1 (dBμV)	L2 (dBμV)	Reading (dBμV)	Limit (dBμV)	Result (Pass/Fail)	L1 (dBμV)	L2 (dBμV)	Reading (dBμV)	Limit (dBμV)	Result (Pass/Fail)	
0.45	41.8	40.9	41.8	48.0	Pass			---	48.0	Pass	
1.00	28.9	29.3	29.3	48.0	Pass			---	48.0	Pass	
5.00	30.4	29.3	30.4	48.0	Pass			---	48.0	Pass	
10.00	29.2	29.5	29.5	48.0	Pass			---	48.0	Pass	
20.00	27.6	28.0	28.0	48.0	Pass			---	48.0	Pass	
30.00	28.6	28.6	28.6	48.0	Pass			---	48.0	Pass	

Emissions Plots:

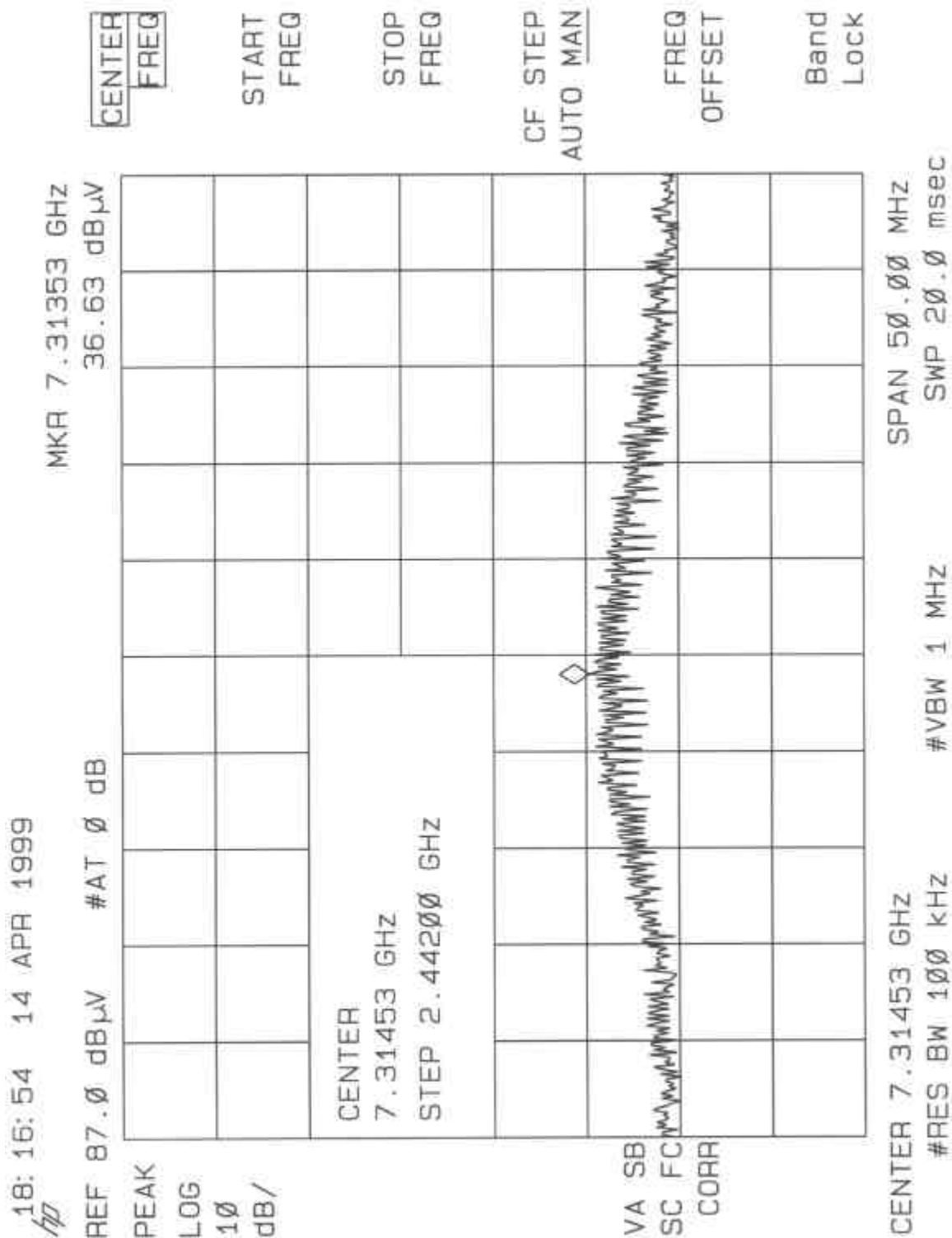
RF Antenna Conducted Emissions



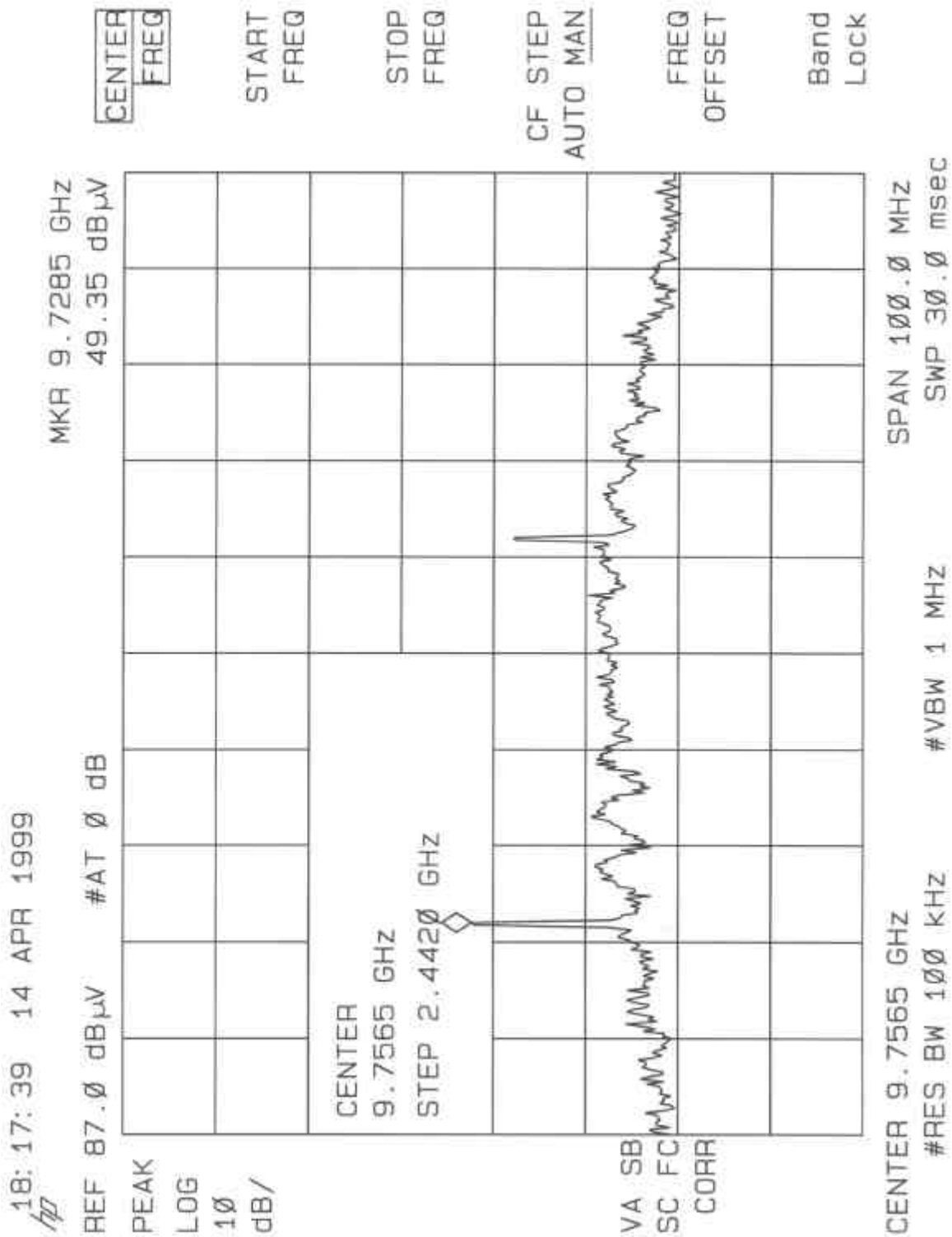
2nd Harmonic



3rd Harmonic



4th Harmonic



5th Harmonic

18: 20:07 14 APR 1999

REF 87.0 dBμV #AT 0 dB

MARKER 12.2100 GHz 30.21 dBμV

CENTER 12.2100 GHz
STEP 2.4420 GHz

PEAK
LOG
10
dB/

VA SB
SC FC
CORR

CF STEP
AUTO MAN

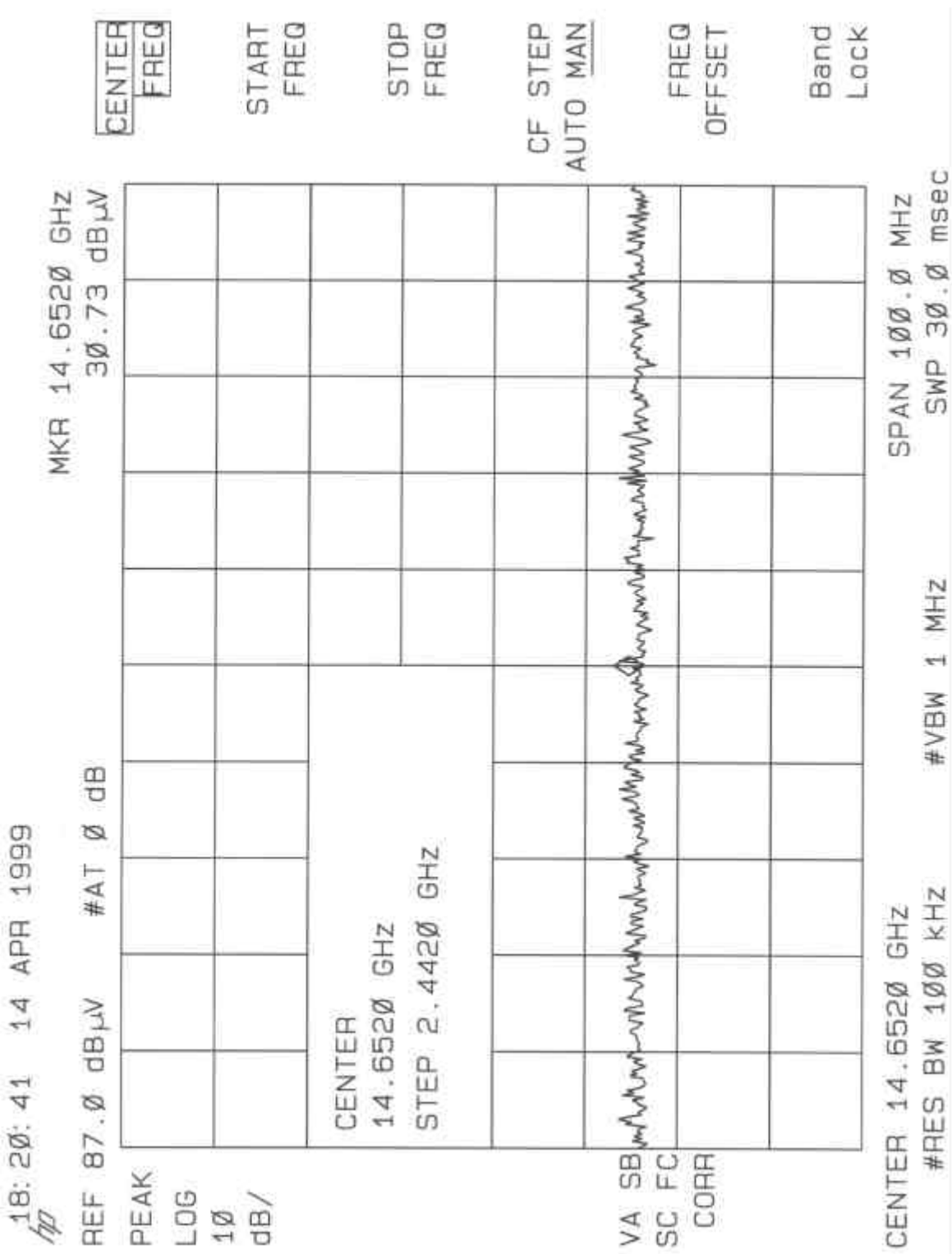
START FREQ
STOP FREQ

FREQ
OFFSET

Band
Lock

CENTER 12.2100 GHz
#RES BW 100 kHz
#VBW 1 MHz
SPAN 100.0 MHz
SWP 30.0 msec

6th Harmonic



7th Harmonic

18:21:11 14 APR 1999

REF 87.0 dB μ V #AT 0 dB MKR 17.0940 GHz
32.92 dB μ V

PEAK
LOG
10
dB/

CENTER FREQ	START FREQ	STOP FREQ	CF STEP AUTO MAN	FREQ OFFSET	Band Lock
CENTER 17.0940 GHz STEP 2.4420 GHz					
VA SB					
SC FC					
CORR					

CENTER 17.0940 GHz SPAN 100.0 MHz
#RES BW 100 kHz SWP 30.0 msec
#VBW 1 MHz

8th Harmonic

18:21:38 14 APR 1999

hp

REF 87.0 dBμV #AT 0 dB

PEAK

LOG

10

dB/

CENTER 19.5360 GHz

STEP 2.4420 GHz

CF STEP

AUTO MAN

FREQ

OFFSET

Band

Lock

MARKER 19.5360 GHz 36.37 dBμV

CENTER FREQ

START FREQ

STOP FREQ

SPAN 100.0 MHz

SWP 30.0 msec

#RES BW 100 kHz

#VBW 1 MHz

CENTER 19.5360 GHz

VA SB

SC FC

CORR

9th Harmonic

18:22:14 14 APR 1999

REF 87.0 dBμV #AT 0 dB MKR 21.9780 GHz
37.99 dBμV

										CENTER FREQ	START FREQ	STOP FREQ	CF STEP AUTO MAN	FREQ OFFSET	Band Lock
PEAK															
LOG															
10															
dB/															
										CENTER 21.9780 GHZ STEP 2.4420 GHZ					
VA SB															
SC FC															
CORR															

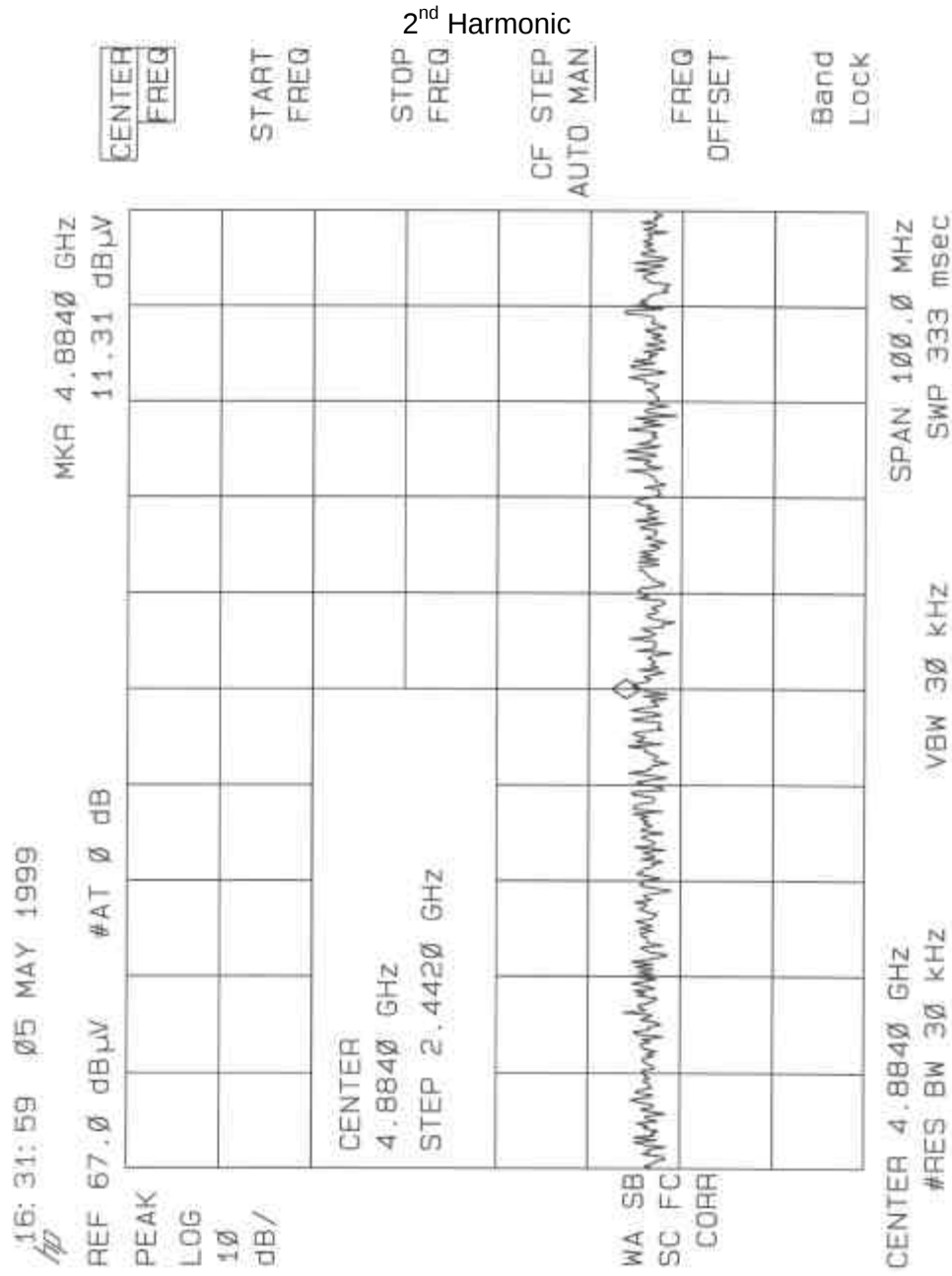
CENTER 21.9780 GHz SPAN 100.0 MHz
#RES BW 100 kHz SWP 30.0 msec
#VBW 1 MHz

10th Harmonic

[illegible]

Radiated Emissions Plots:

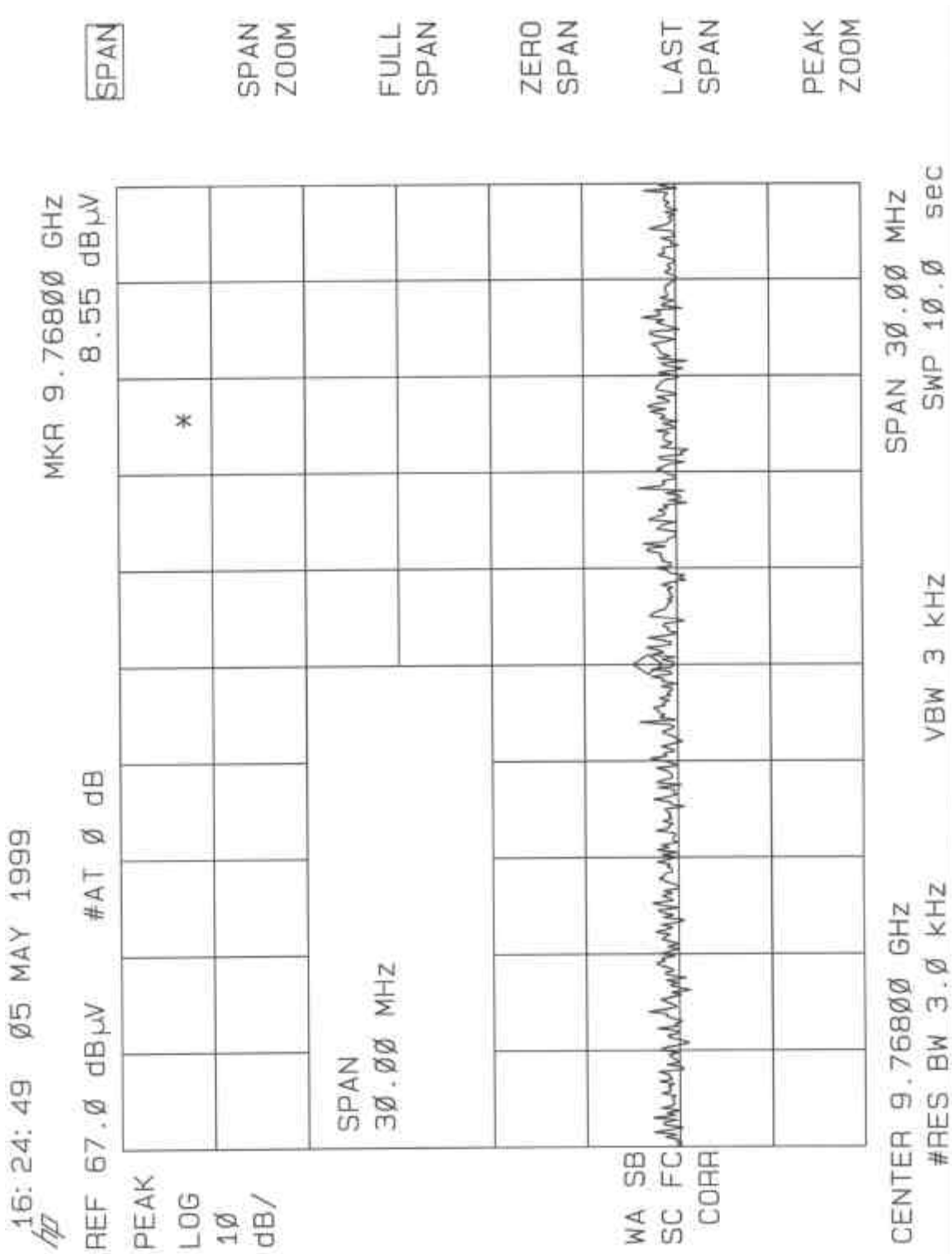
These radiated emissions plots were taken for TX harmonic emissions appearing in or near a restricted band. At higher frequencies, it was necessary to reduce the RBW and the measurement distance in order to lower the noise floor to 6dB or more below the FCC class B limit. The data for all of the first ten TX harmonics appears in section 3.3 table 2 (all readings are noise floor). A photograph of the test setup is shown in section 3.7.



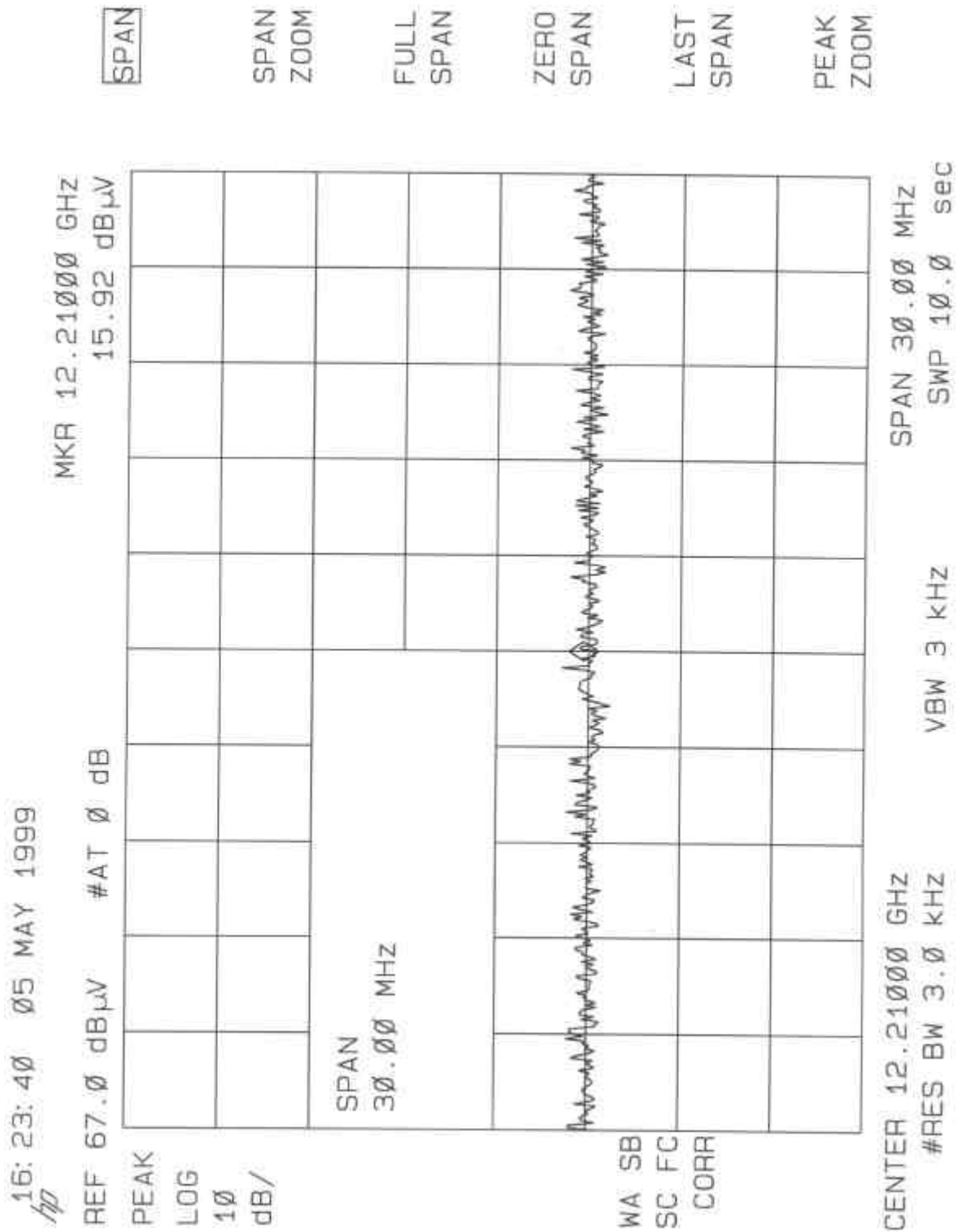
3rd Harmonic

[illegible]

4th Harmonic



5th Harmonic



6th Harmonic

16:21:36 05 MAY 1999

REF 67.0 dBμV #AT 0 dB

MKR 14.65200 GHz 16.20 dBμV

CENTER FREQ

START FREQ

STOP FREQ

CF STEP

AUTO MAN

FREQ

OFFSET

Band Lock

PEAK	LOG	10	dB/
CENTER	14.65200 GHz	STEP 2.44200 GHz	

WA SB

SC FC

CORR

CENTER 14.65200 GHz

#RES BW 3.0 kHz

SPAN 30.00 MHz

SWP 10.0 sec

7th Harmonic

8th Harmonic

[illegible]

9th Harmonic

16:08:36 05 MAY 1999

REF 67.0 dBμV #AT 0 dB MKR 21.97800 GHz 20.54 dBμV

PEAK
LOG
10
dB/

CENTER FREQ	START FREQ	STOP FREQ	CF STEP AUTO MAN	FREQ OFFSET	Band Lock
CENTER 21.97800 GHz STEP 2.44200 GHz					
WA SB					
SC FC					
CORR					

CENTER 21.97800 GHz SPAN 30.00 MHz
#RES BW 3.0 kHz VBW 3 kHz SWP 10.0 sec

15:52:57 05 MAY 1999

REF 67.0 dBμV #AT 0 dB

CENTER 24.42000 GHz
STEP 2.44200 GHz

SPAN 30.00 MHz
SWP 10.0 sec

VBW 3 kHz

RBW 3.0 kHz

PEAK
LOG
10
dB/

WA SB
SC FC
CORR

CENTER 24.42000 GHz
FREQ 18.72 dBμV

START FREQ
STOP FREQ

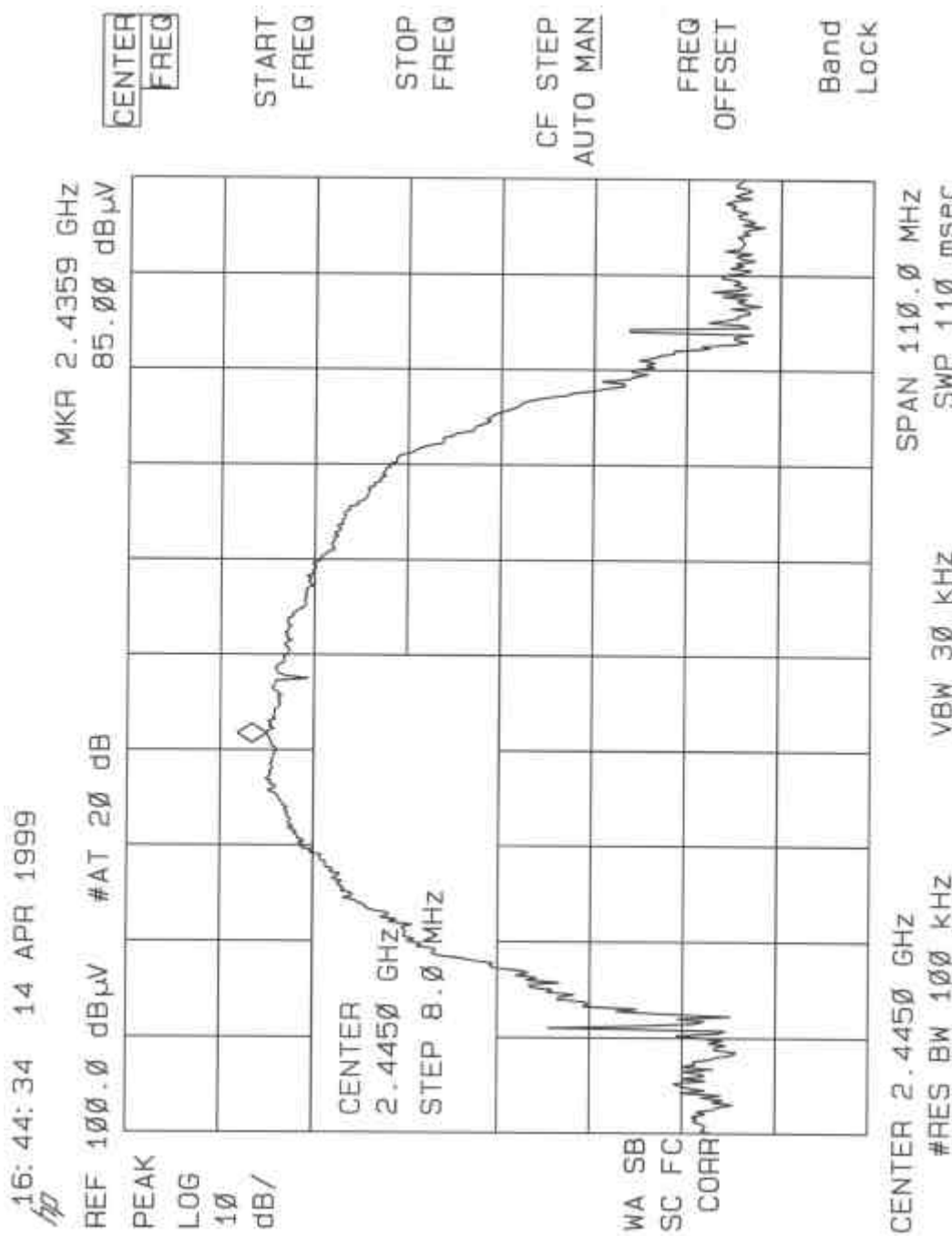
CF STEP
AUTO MAN

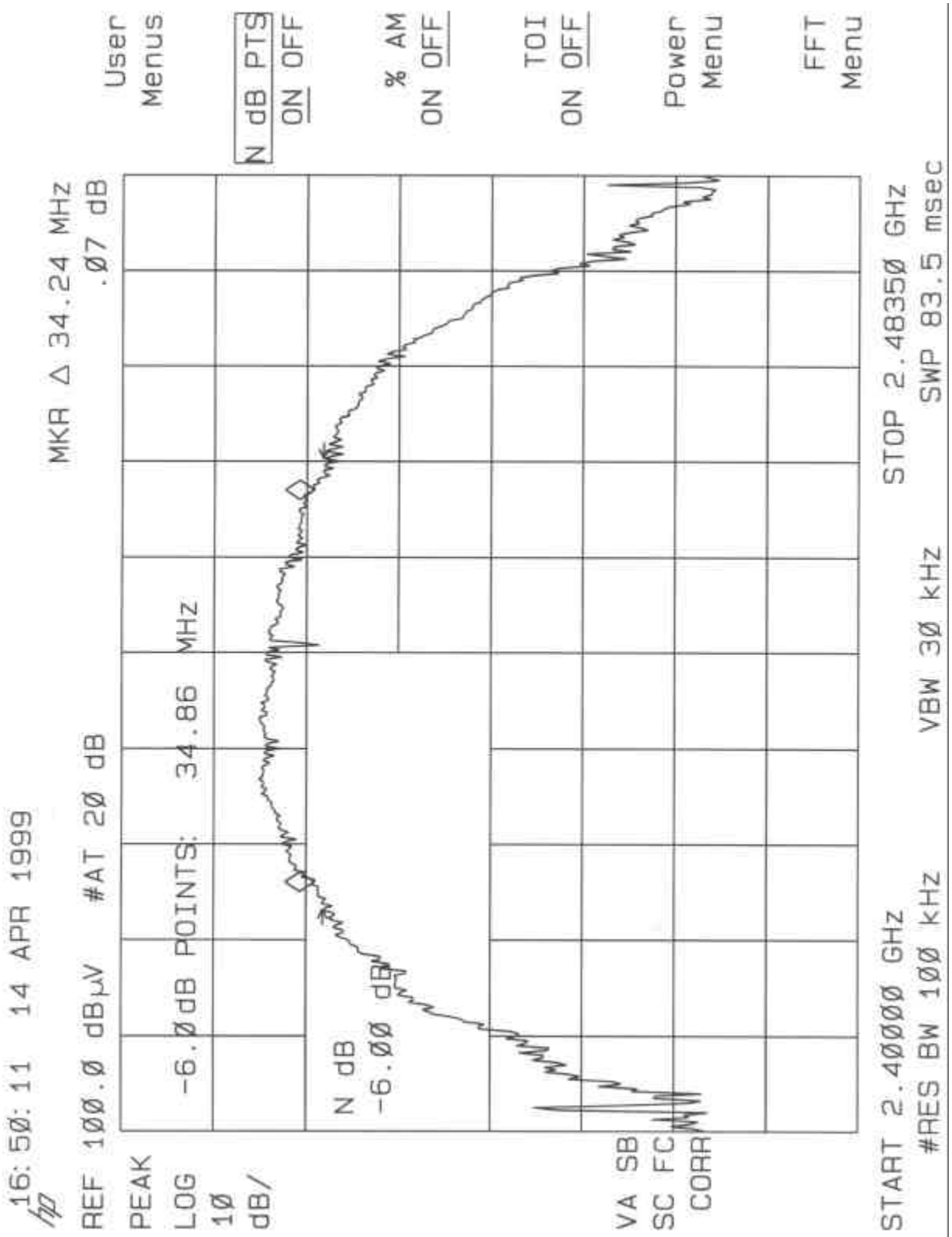
FREQ
OFFSET

Band
Lock

3.4 Occupied Bandwidth Measurements

Plots were obtained with the unit operating with spreading. The bandwidth observed does not extend outside of the operating band 2400-2483.5MHz and the 6dB bandwidth is greater than 500kHz.





3.5 Processing Gain Measurement

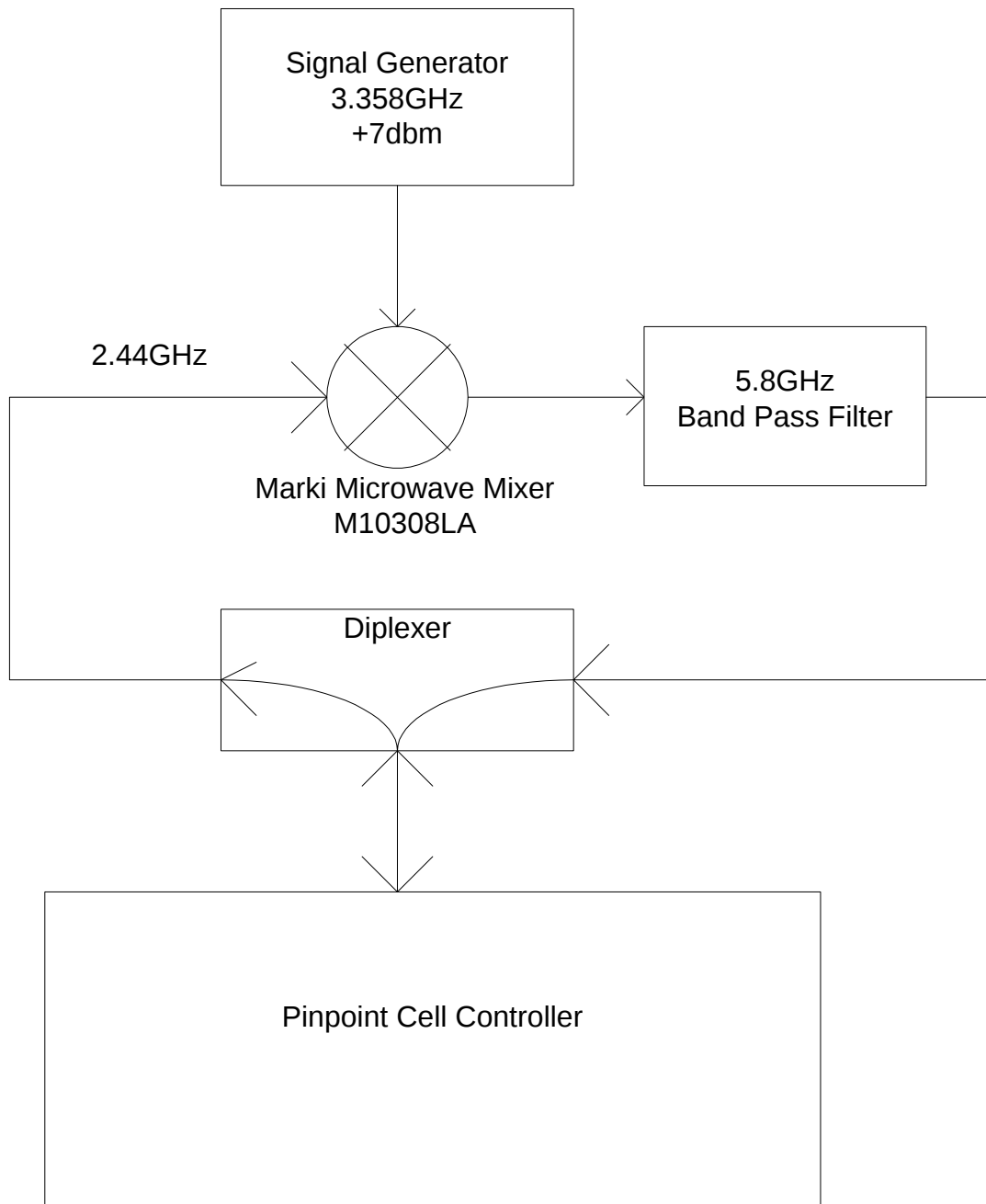
This system utilizes direct-sequence spread spectrum signals to locate items at a distance. The cell controller modulates a 127 chip pseudorandom sequence onto an RF carrier at 2442MHz and emits this signal sequentially through an array of antennas. The tag shifts this signal to 5800MHz, phase modulates the tag data onto the this signal and radiates the result back to the cell controller. The cell controller then demodulates the resulting signal back to baseband and correlates that baseband signal. The signal-processing algorithms then use the correlated echoes to determine the location of the tag.

So, the system basically looks at the peaks of correlated baseband signals in its normal mode of operation. The simplest and most accurate way to determine the correlation gain or processing gain of this system is to use the baseband signal-processing algorithms to measure averaged peaks of the correlated signal with the baseband spreading turned on and compare that to the averaged noise. This process is then repeated for the signal with the baseband spreading turned off. The two signal to noise ratios are then compared. This procedure mirrors the requirements stated in Part 15.247 (e)(1).

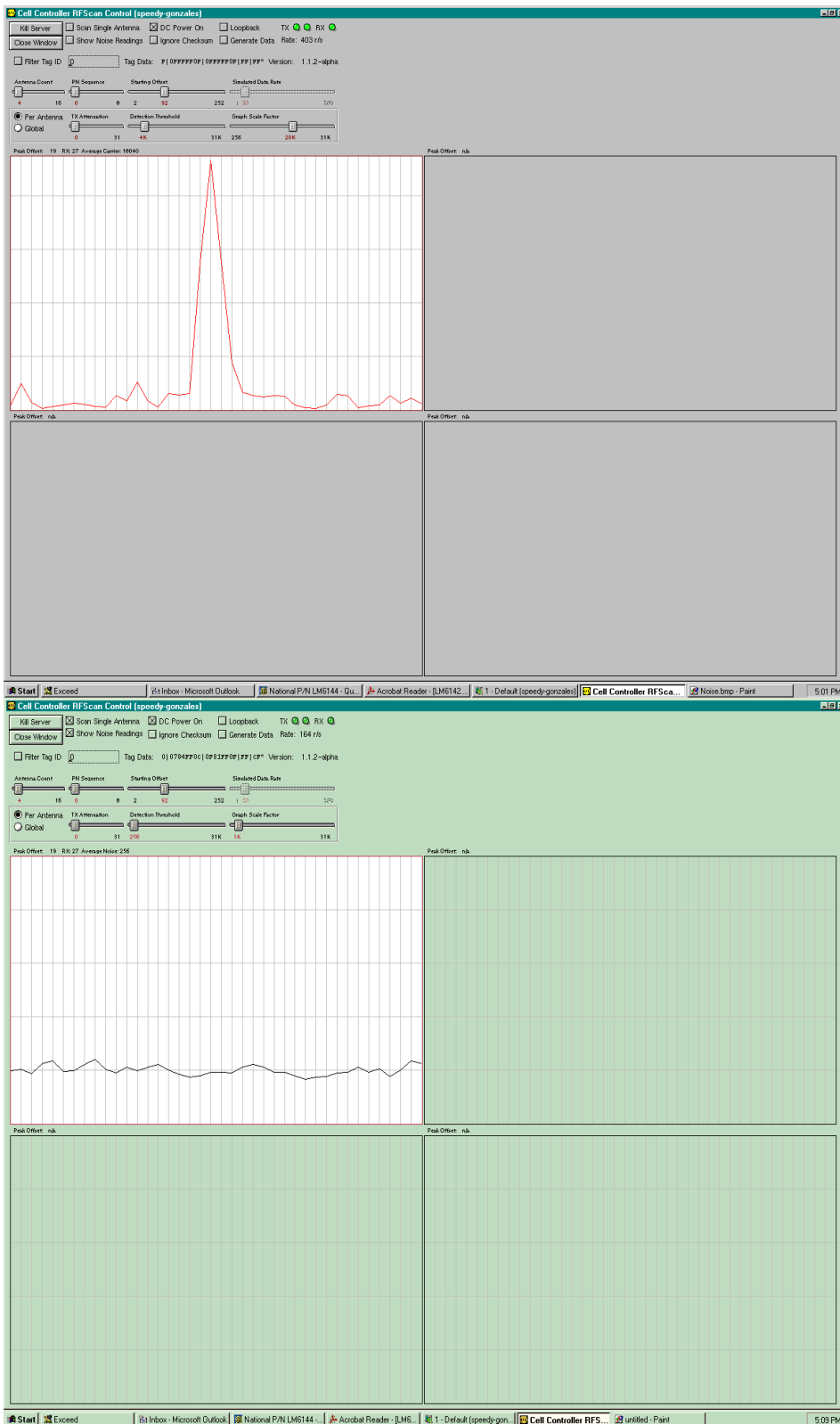
Accordingly, the software installation tool used to set up the cell controller (Cell Controller RFScan Control) has been equipped with features to enable the measurement of the processing gain with the system set up in RF loopback. This mode of operation simply translates the 2.442GHz low-level transmitter signal from the cell controller to the 5.800GHz receiver signal using an external generator and a mixer. The first plot set shows the average signal and noise measurements (antenna port turned on and antenna port turned off) in normal operation. The second plot set shows the same plots taken with the spreading sequence removed from the input to the modulator. The second set typically illustrates a S/N ratio of 0dB and the first set typically demonstrates a signal to noise ratio of about 18dB. This is consistent with the theoretical processing gain of our system ($10 * \log(127) = 21\text{dB}$) minus some implementation loss (about 3dB in our system).

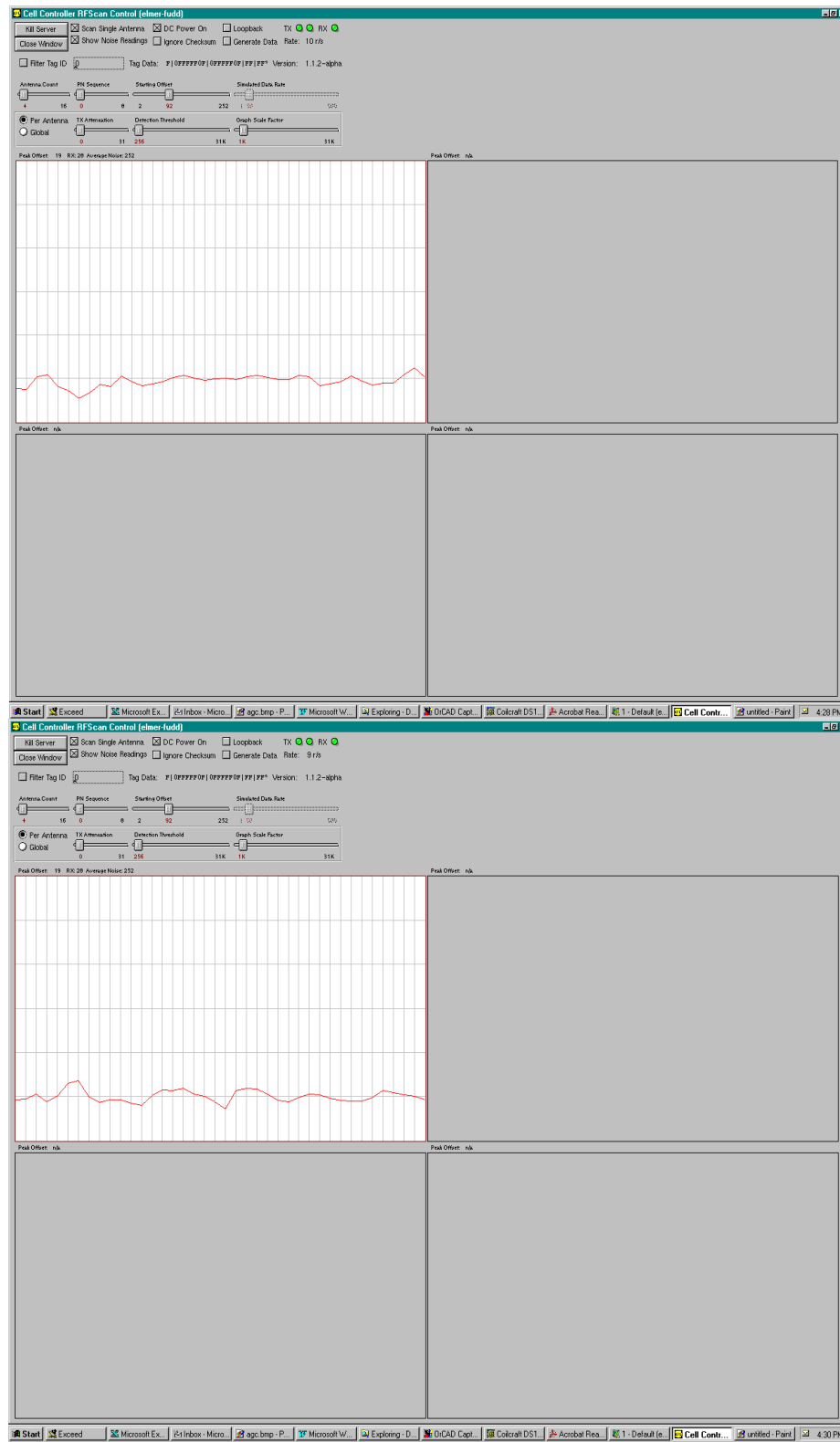
A block diagram of the setup and data plots are shown below. The top line directly above the plot area reports either the averaged signal or the averaged noise, depending on the plot. To determine the signal to noise ratio (in dB) for a particular condition, take the logarithm (base 10) of the ratio of the averaged carrier to the average noise and multiply by 10. For the data plots presented below, the S/N ratio for the system operating normally is $10 * \log(18010/256) = 18.5\text{dB}$. The S/N ratio for the system with the baseband spreading removed is $10 * \log(256/256) = 0$. Thus, the processing gain, G_p , is

$$G_p = 18.5 - 0 = \mathbf{18.5dB}.$$



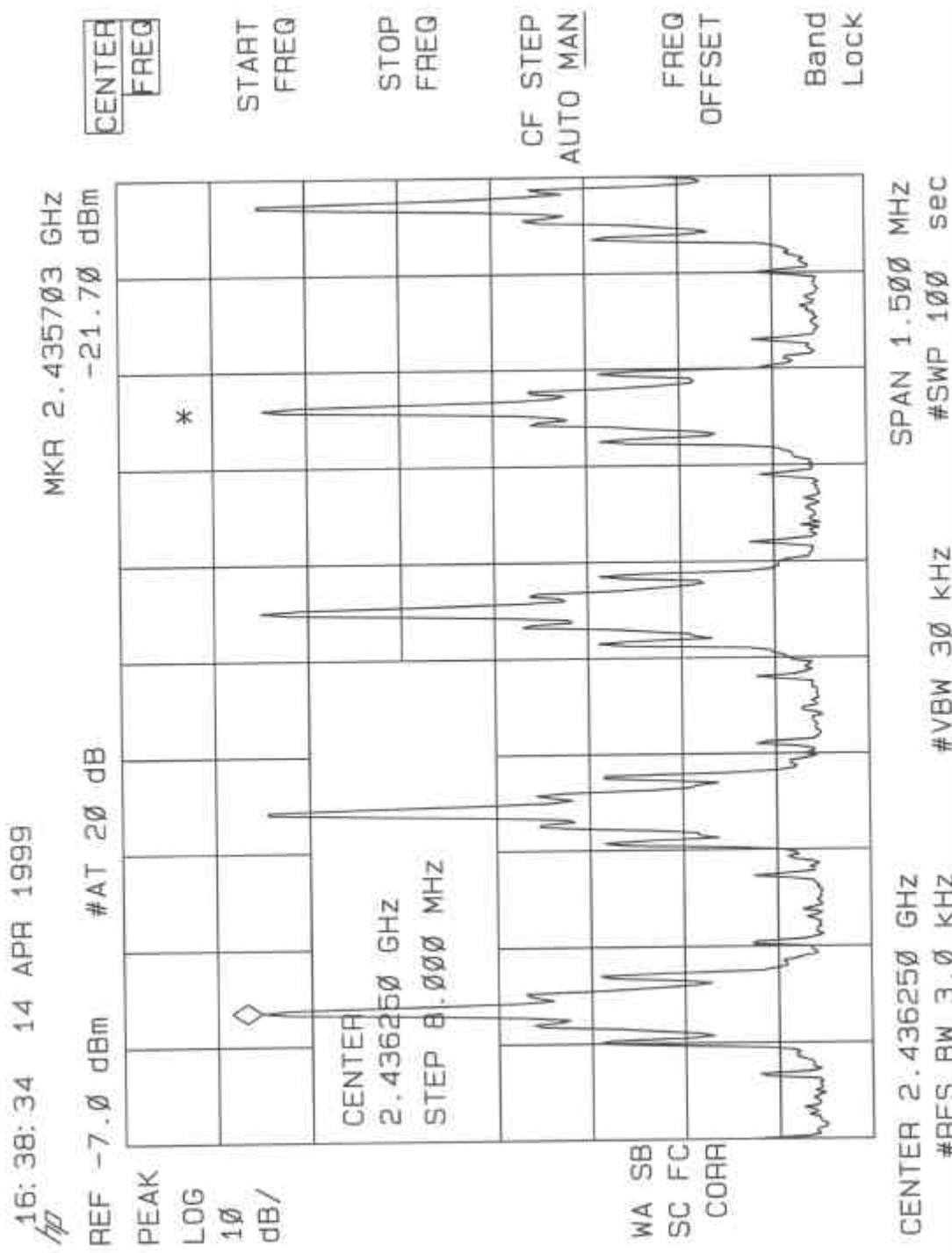
Processing Gain Setup





3.6 Power Spectral Density Measurement

The peak power spectral density as measured through a 20dB attenuator is:
 $-21.7\text{dBm} + 20\text{dBm (attenuator)} = \mathbf{-1.7\text{dBm}}$



3.7 Radiofrequency Radiation Exposure Evaluation

Radiofrequency radiation exposure evaluation for 3D/D Cell Controller

The cell controller antenna radiates with an effective isotropic power of about 31.5dBm or 1.41 watts. The limits of 1.1310 are 1 milliwatt per square centimeter for uncontrolled exposure. So, to determine the power density for radiation at some distance from the cell controller antenna, we need to calculate the area of a sphere at that distance and divide that into the effective radiated power. The surface area of a sphere is given by:

$$A = 4 * \pi * (r^2)$$

Let's start by assuming a distance of 11cm (the radius). The output power is 1.41 watts, so the power density at any distance r is:

$$D_p = 1.41 / A \text{ (watts/cm}^2\text{)}$$

$$D_p = 1.41 / (4 * \pi * ((11\text{cm})^2)) = 1.41 / (1.5205 * 10^3) = 927.3 * 10^{-6} \text{ (watts/cm}^2\text{)}$$

$$D_p = 0.927 \text{ mW/ cm}^2$$

So, a power density of less than 1mW/ cm² is achieved when the measurement is made further than 11cm (4.33 inches) from the antenna.

If the EIRP were 1 watt, the distance necessary would be about 9cm (3.54 inches).

To ensure compliance, we must require the installation of antennas in such a manner that people can come no closer to an antenna than 6 inches (leaving some margin for safety).

3.8 Test Setup Photographs

See file "990390 Exhibit 3.8 - Test Setup Photos.doc"

EXHIBIT 4

4.0 *Equipment Photographs*

External

See file "990390 Exhibit 4 - External Photos.doc"

Internal

See file "990390 Exhibit 4 - Internal Photos.doc"

EXHIBIT 5

5.0 *Product Labeling*

See file "990390 Exhibit 5 - Label Info.doc"

EXHIBIT 6

6.0 *Technical Specifications*

6.1 Technical Description and Block Diagram

See file "990390 Exhibit 6.1 - Technical Description & Block Diagram.doc"

6.2 Schematics

Transmit Module Schematic

See file "990390 Exhibit 6.2 – Transmit Schematic.pdf"

Antenna Module Schematic

See file "990390 Exhibit 6.2 – Antenna Schematic.pdf"

6.3 Bill of Materials

Transmitter Board Bill of Materials

See file "990390 Exhibit 6.3 – Transmitter BoM.pdf"

Antenna Bill of Materials

See file "990390 Exhibit 6.3 – Antenna BoM.pdf"

EXHIBIT 7

7.0 *Instruction Manuals*

Please note the required user warnings that appear on the second page of each of these manuals.

7.1 System Hardware Introduction

Please note that the required FCC user warning that appears on page 2 of this manual.

See file "990390 Exhibit 7.1 – System Hardware Introduction.pdf"

7.2 Cell Controller Installation Guide

Please note that the required FCC user warning that appears on page 2 of this manual.

See file "990390 Exhibit 7.2 – Cell Controller Guide.pdf"

7.3 Antenna Installation Guide

Please note that the required minimum installation distance from humans, as calculated in section 3.7 *Radiofrequency Radiation Exposure Evaluation*, appears on page 2 of this manual.

See file "990390 Exhibit 7.3 – Antenna Guide.pdf"

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