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:

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Report prepared by:

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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:

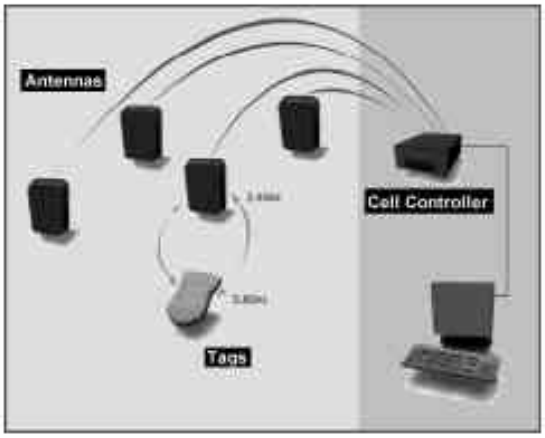
Part 2	Part 15	Comments
	15.15(b)	The product contains no user accessible controls that increase transmission power above allowable levels.
2.925	15.19	The label is shown in the label exhibit.
	15.21	Information to the user is shown in the instruction manual exhibit.
	15.27	No special accessories are 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-*i*D 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 9 kHz-26.5 GHz		HP	S/N:3829A03618	Calibration Due:31-AUG-99

ANTENNA(S)

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

PREAMPLIFIER(S)

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

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:** 3D*i* D **Work Order:** 990390

Frequency Range: 2435.7-24420.0MHz **Measurement Distance:** 3 m

Notes: First ten harmonics of TX fundamental (2442MHz) **EUT Max Freq:** 2442.0MHz
RF Antenna Conducted test. 100kHz RBW.

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)	--- Limit (dBµV/m)	--- Margin (dB)	--- Result (Pass/Fail)	FCC Class B Limit (dBµV/m)	FCC Class B Margin (dB)	FCC Class B 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)	--- Limit (dBµV/m)	--- Margin (dB)	--- Result (Pass/Fail)	FCC Class B Limit (dBµV/m)	FCC Class B Margin (dB)	FCC Class B 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:** 3D*i* D **Work Order:** 990390

Frequency Range: 30-18000MHz **Measurement Distance:** 3 m

Notes: Final Spurious Scan **EUT Max Freq:** 6246MHz
Tag and Cell Controller

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)	--- Limit (dBµV/m)	--- Margin (dB)	--- Result (Pass/Fail)	FCC Class B Limit (dBµV/m)	FCC Class B Margin (dB)	FCC Class B 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:

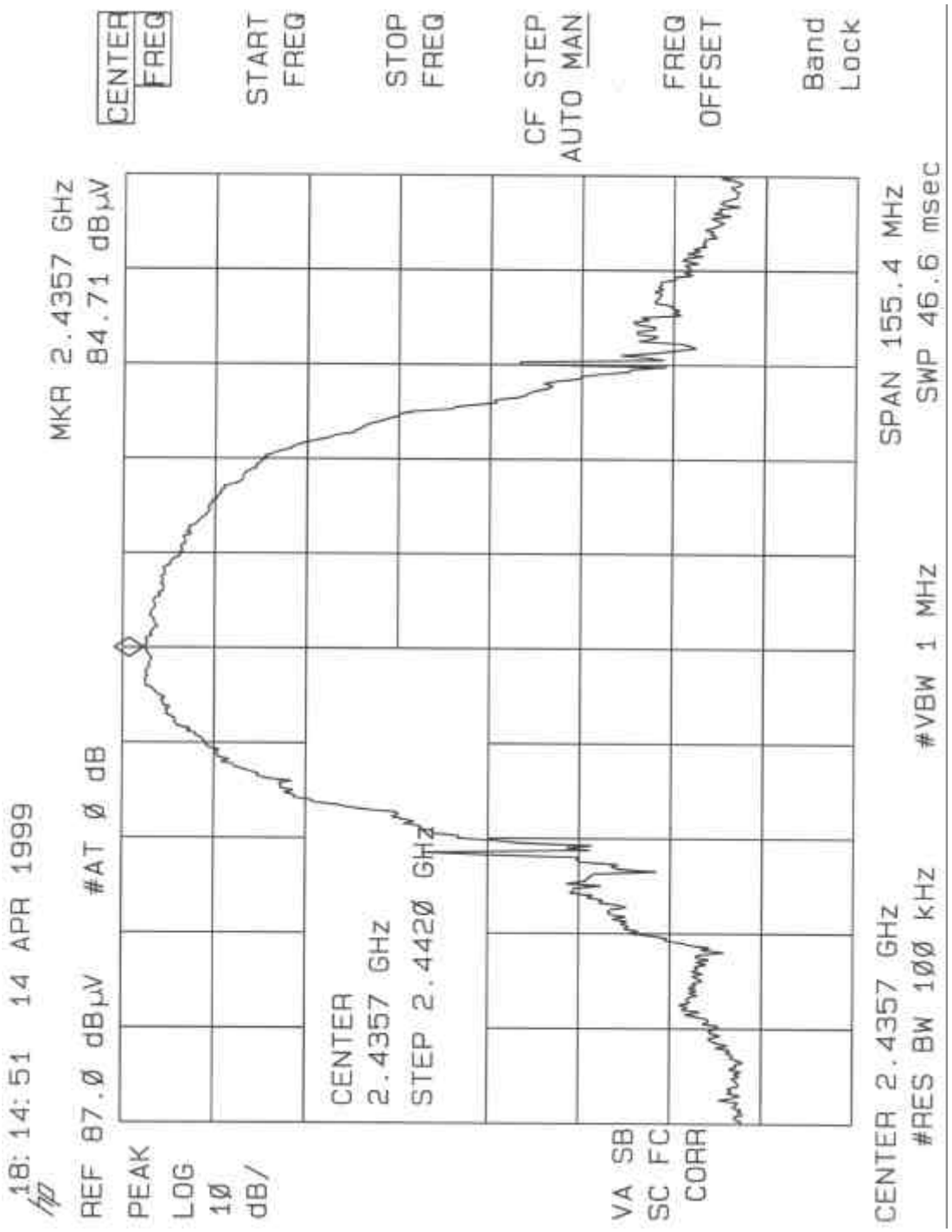
Range: 0.45 - 30.0 MHz **LISN(s):** Blue **Spectrum Analyzer:** Green

Frequency (MHz)	Quasi-Peak L1 (dBµV)	Quasi-Peak L2 (dBµV)	Quasi-Peak Reading (dBµV)	FCC Class B Limit (dBµV)	FCC Class B Result (Pass/Fail)	Average L1 (dBµV)	Average L2 (dBµV)	Average Reading (dBµV)	FCC Class B Limit (dBµV)	FCC Class B 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

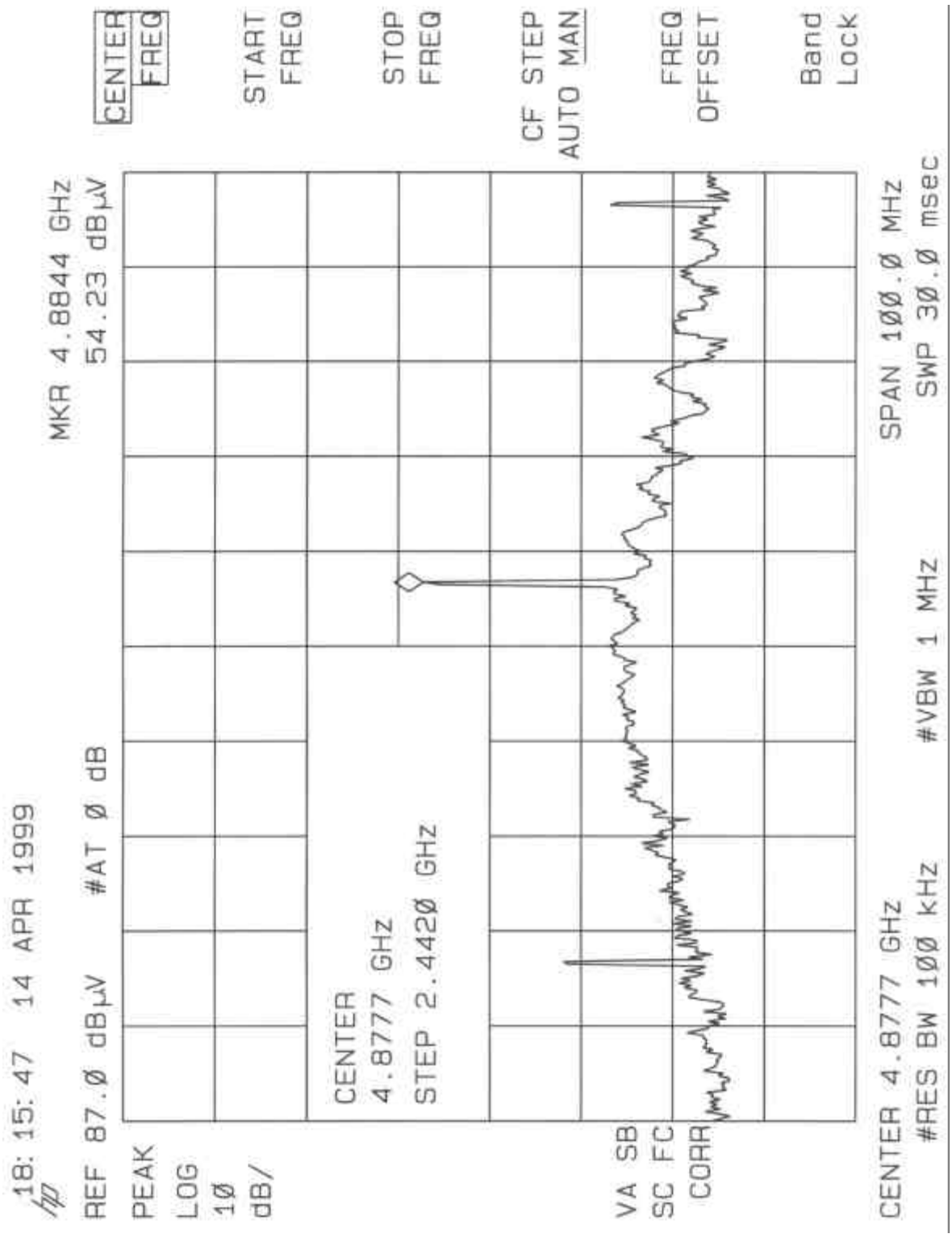
Emissions Plots:

RF Antenna Conducted Emissions

Fundamental



2nd Harmonic



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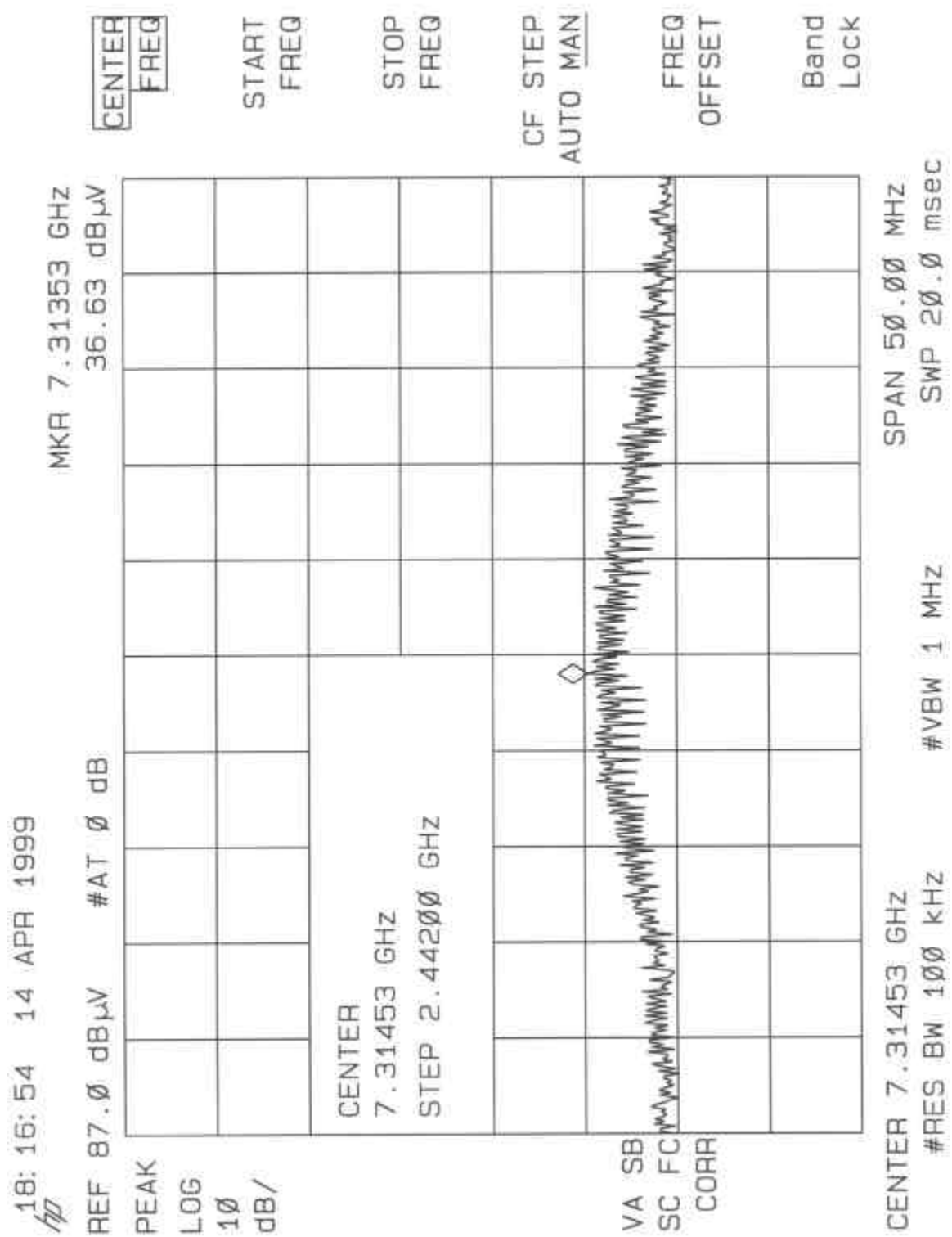

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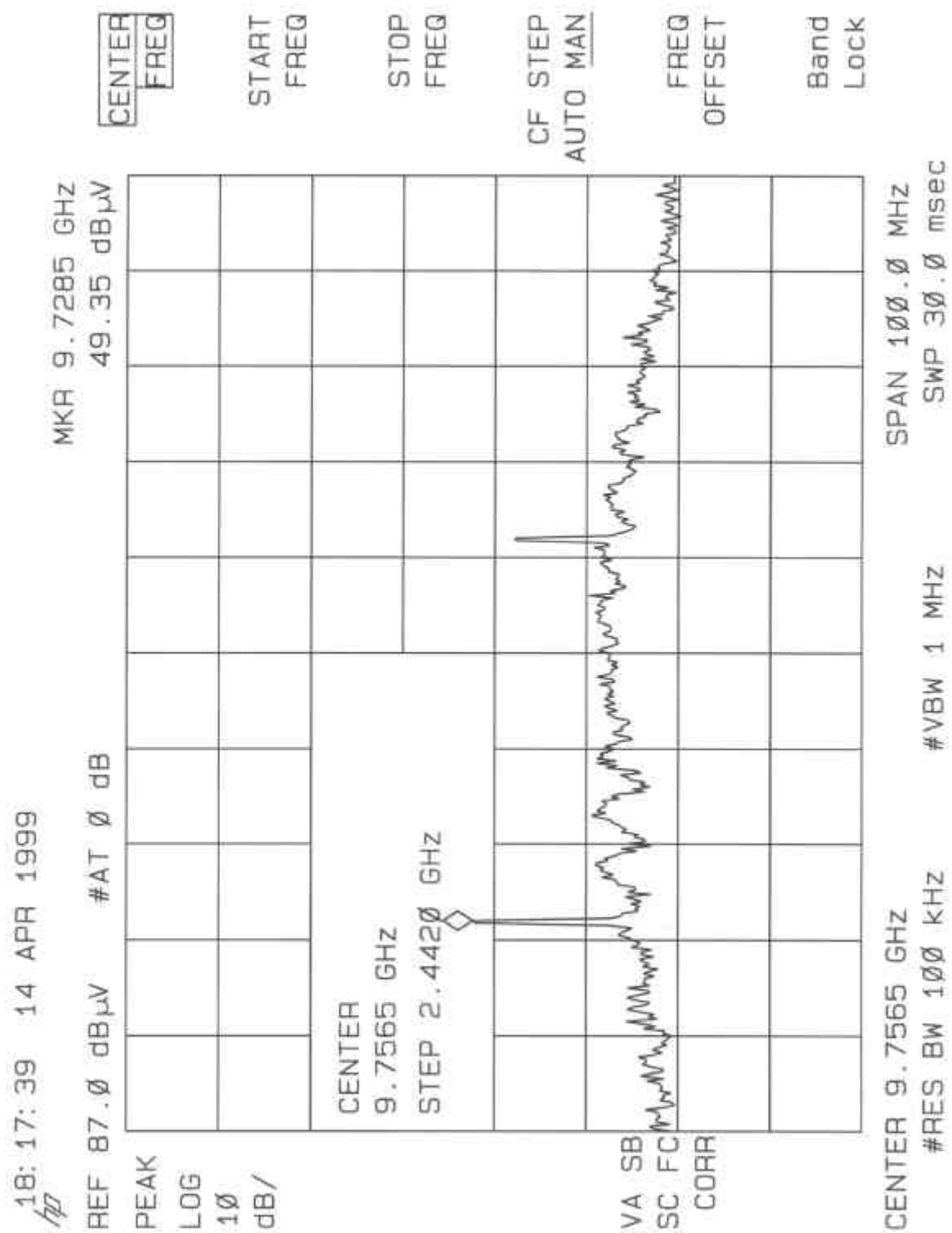

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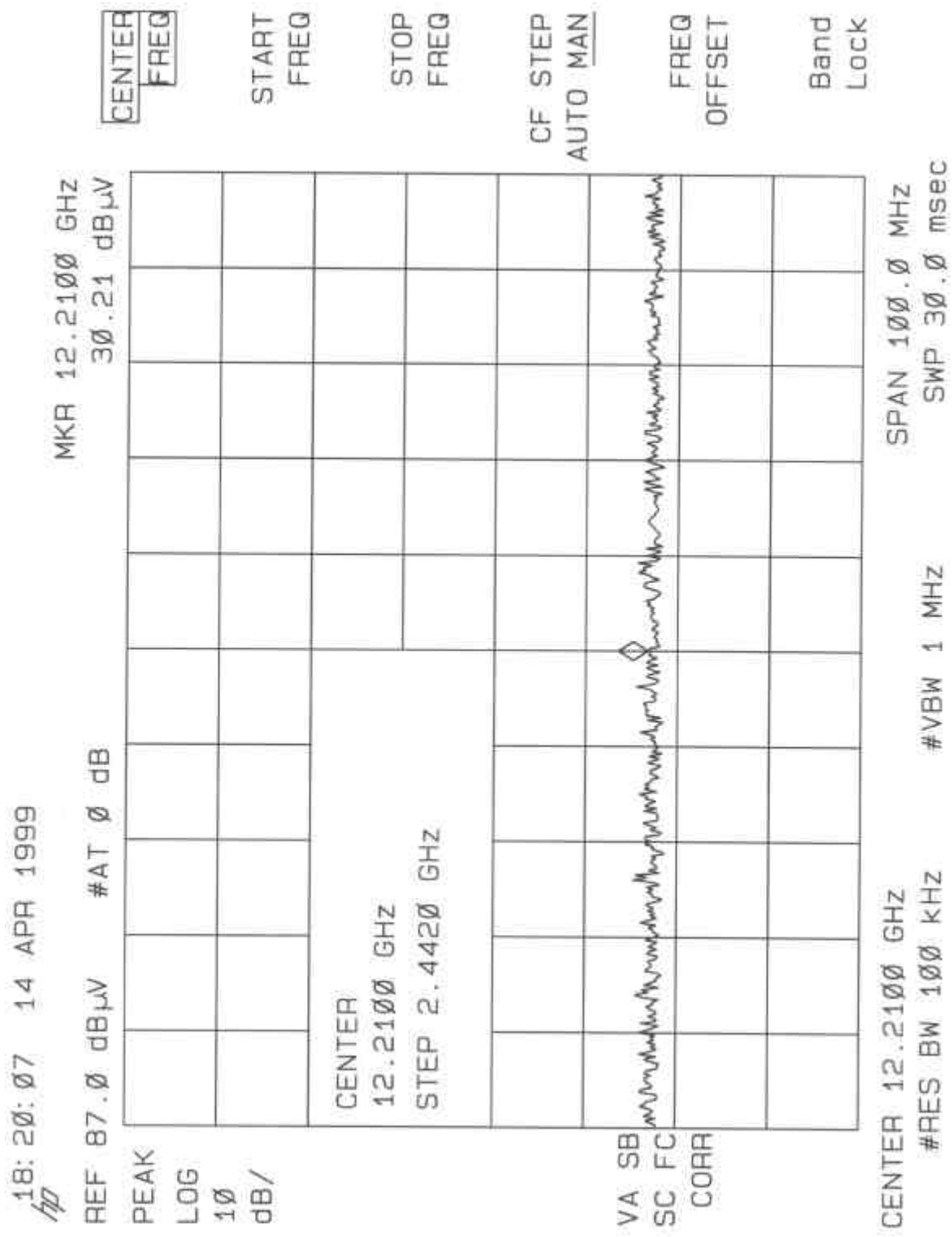

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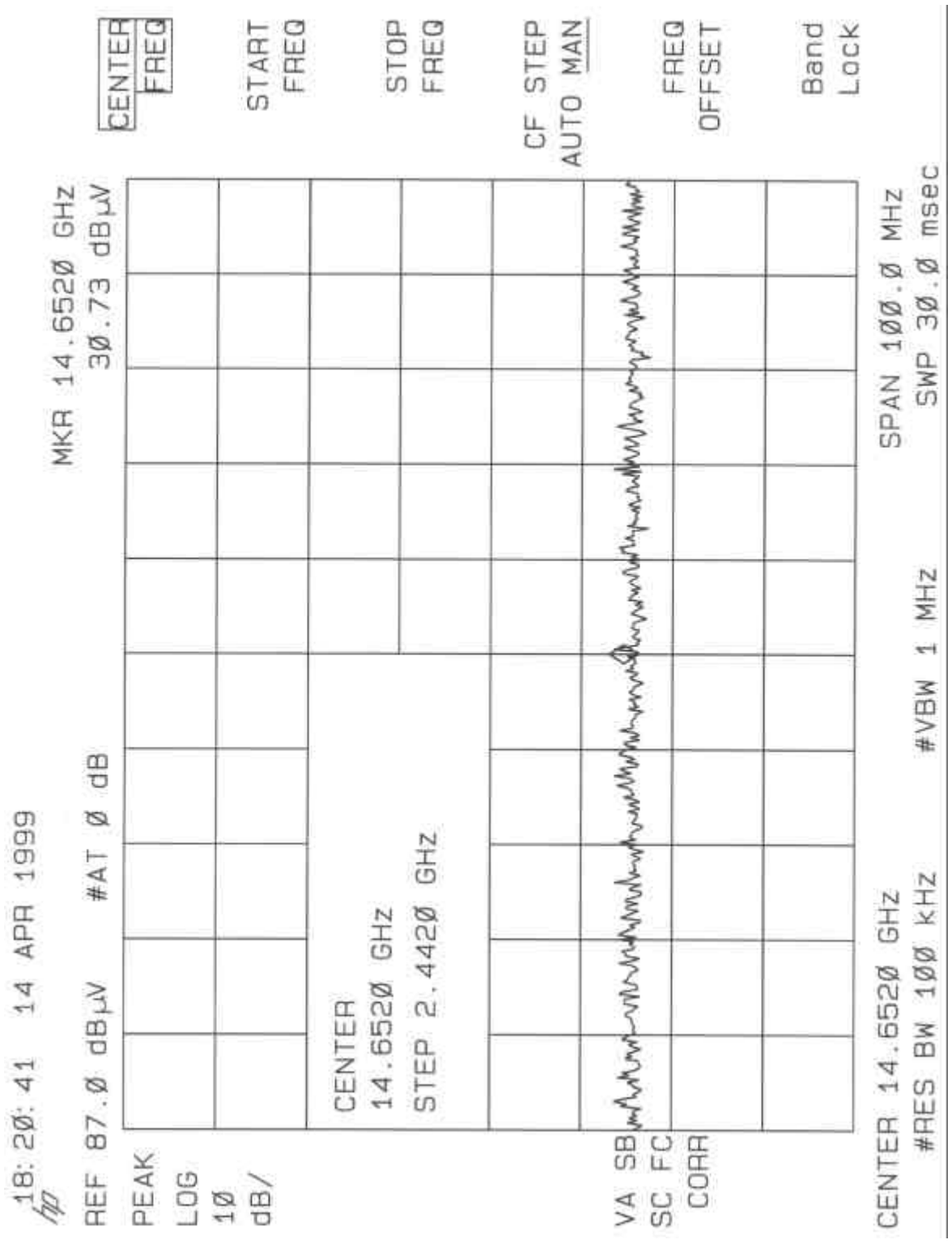
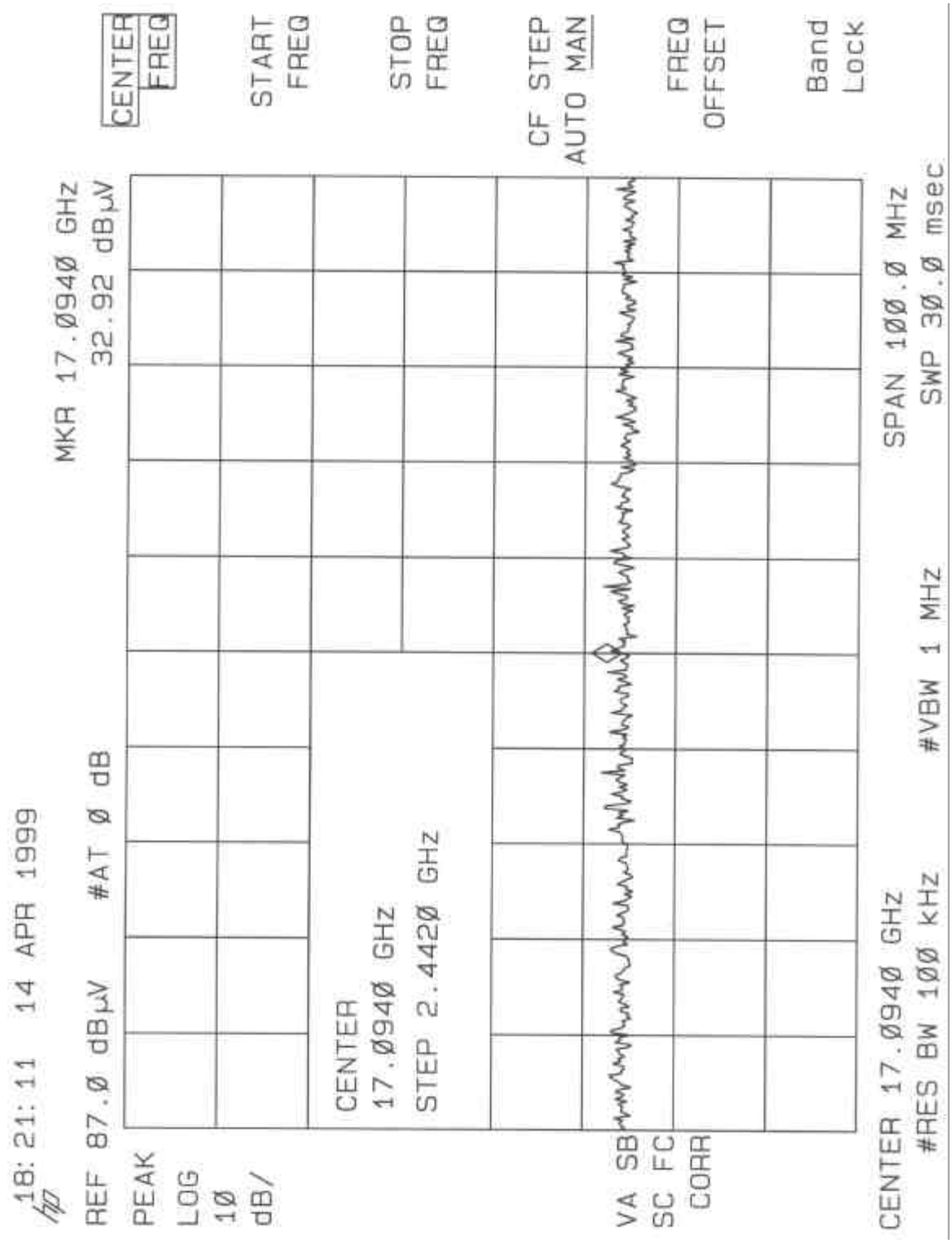
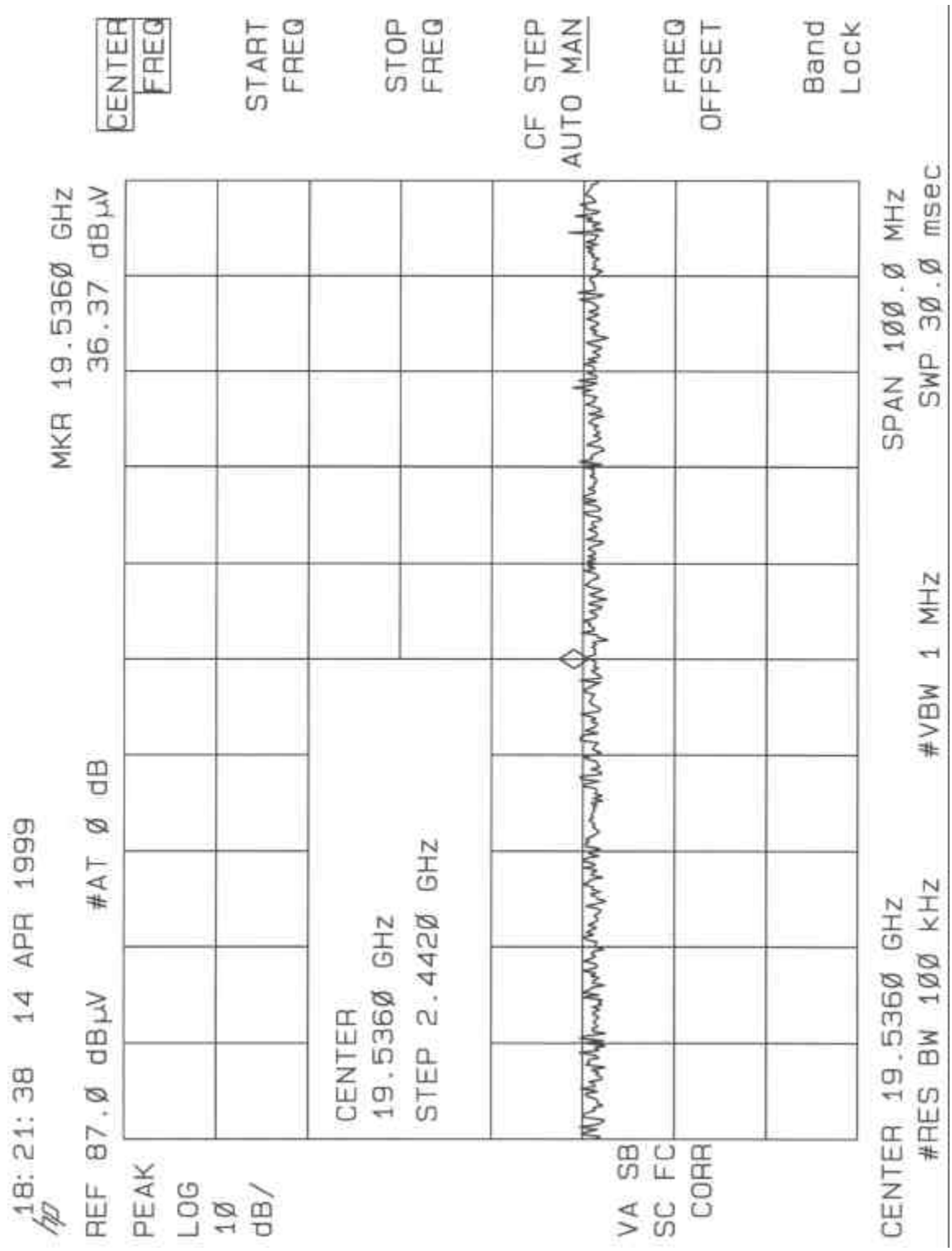


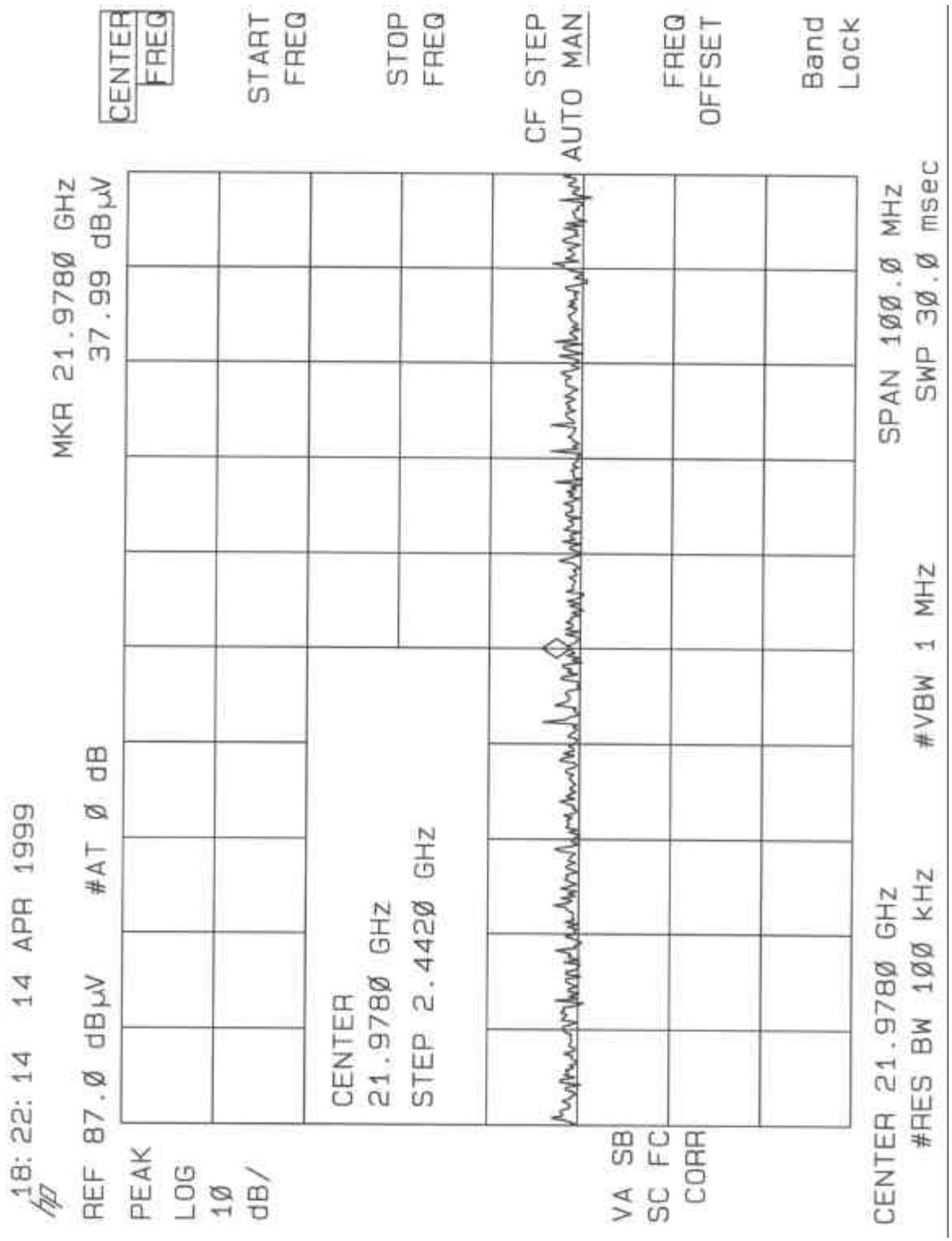
7th Harmonic



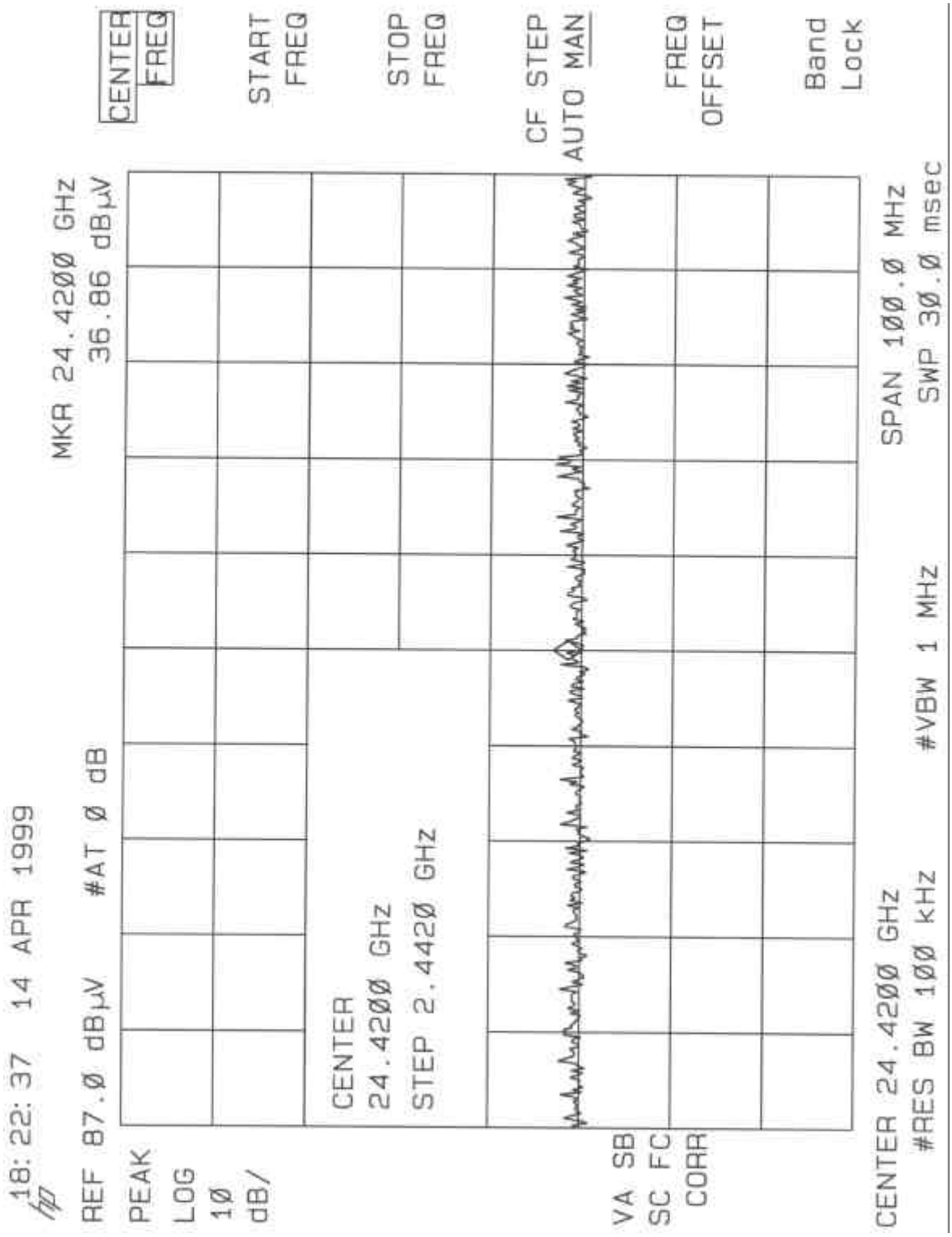
8th Harmonic



9th Harmonic



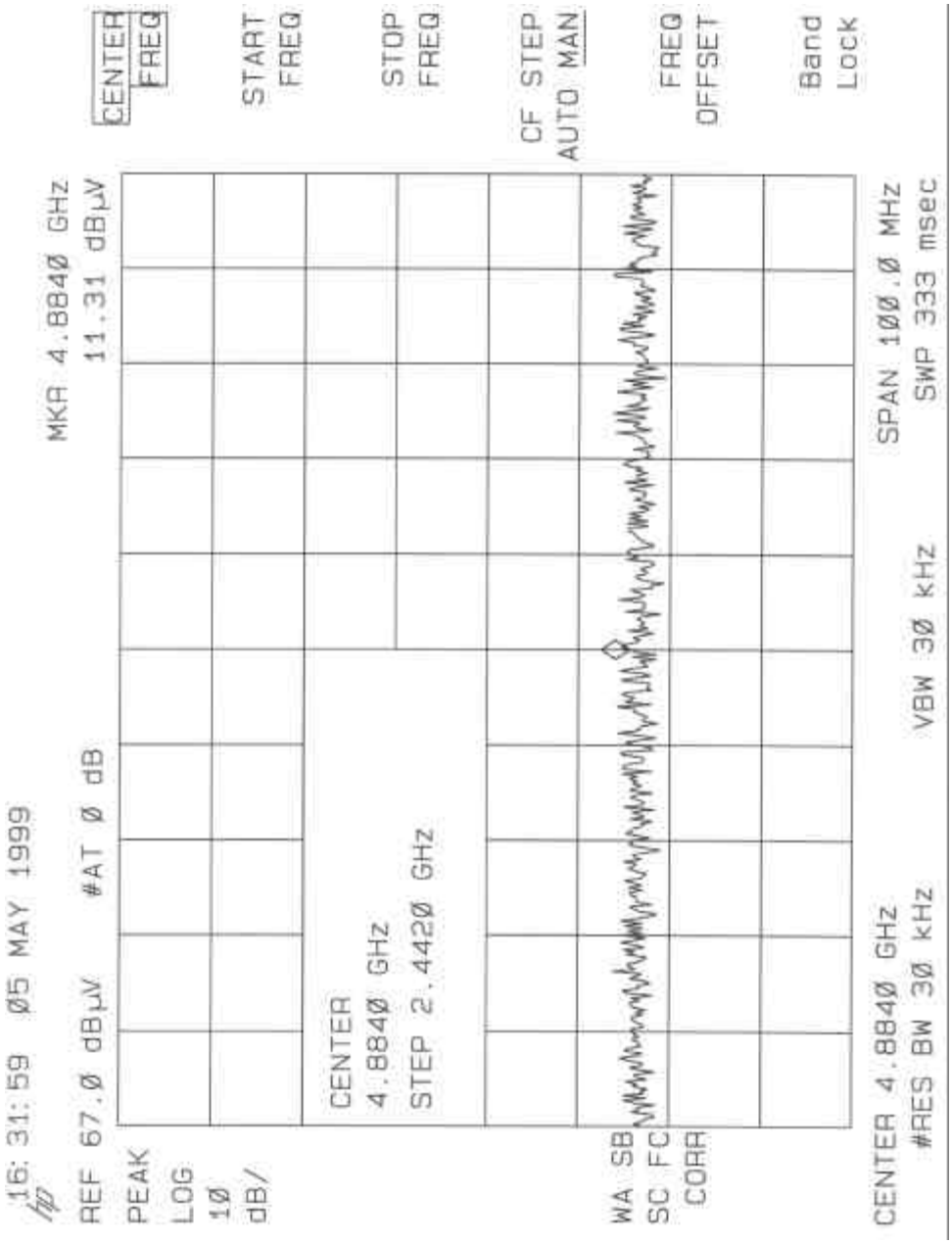
10th Harmonic



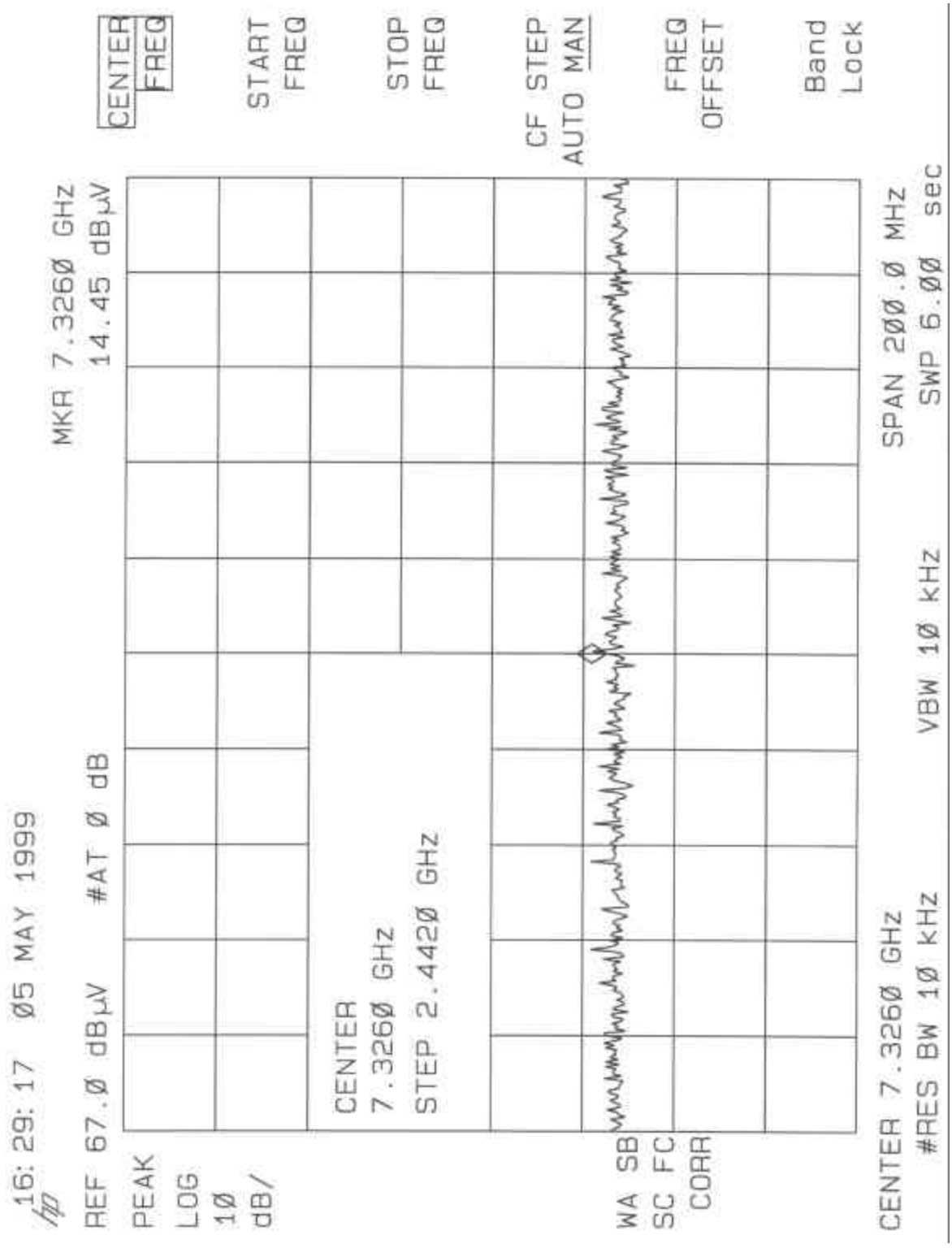
Radiated Emissions Plots:

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 in shown in section 3.7.

2nd Harmonic



3rd Harmonic



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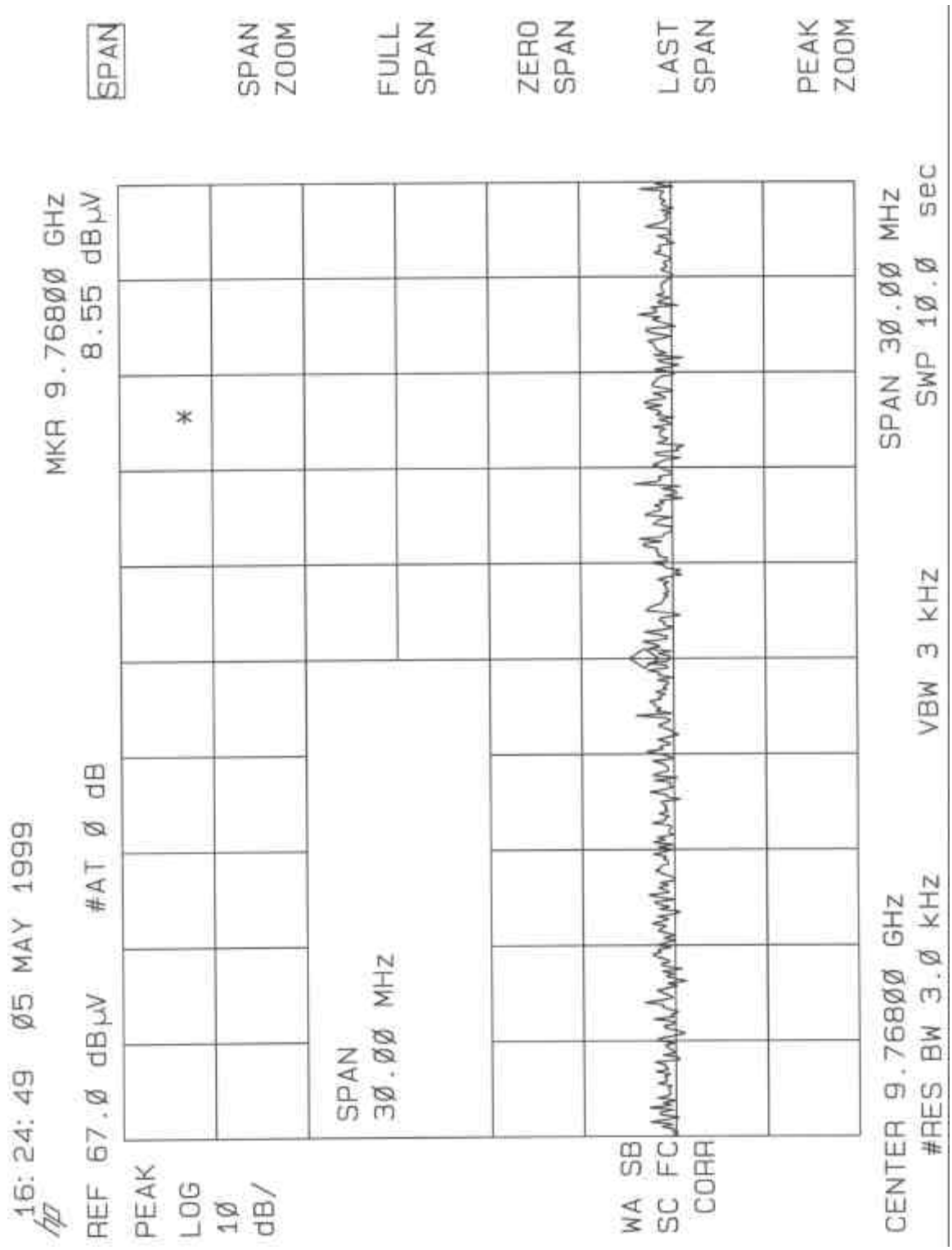

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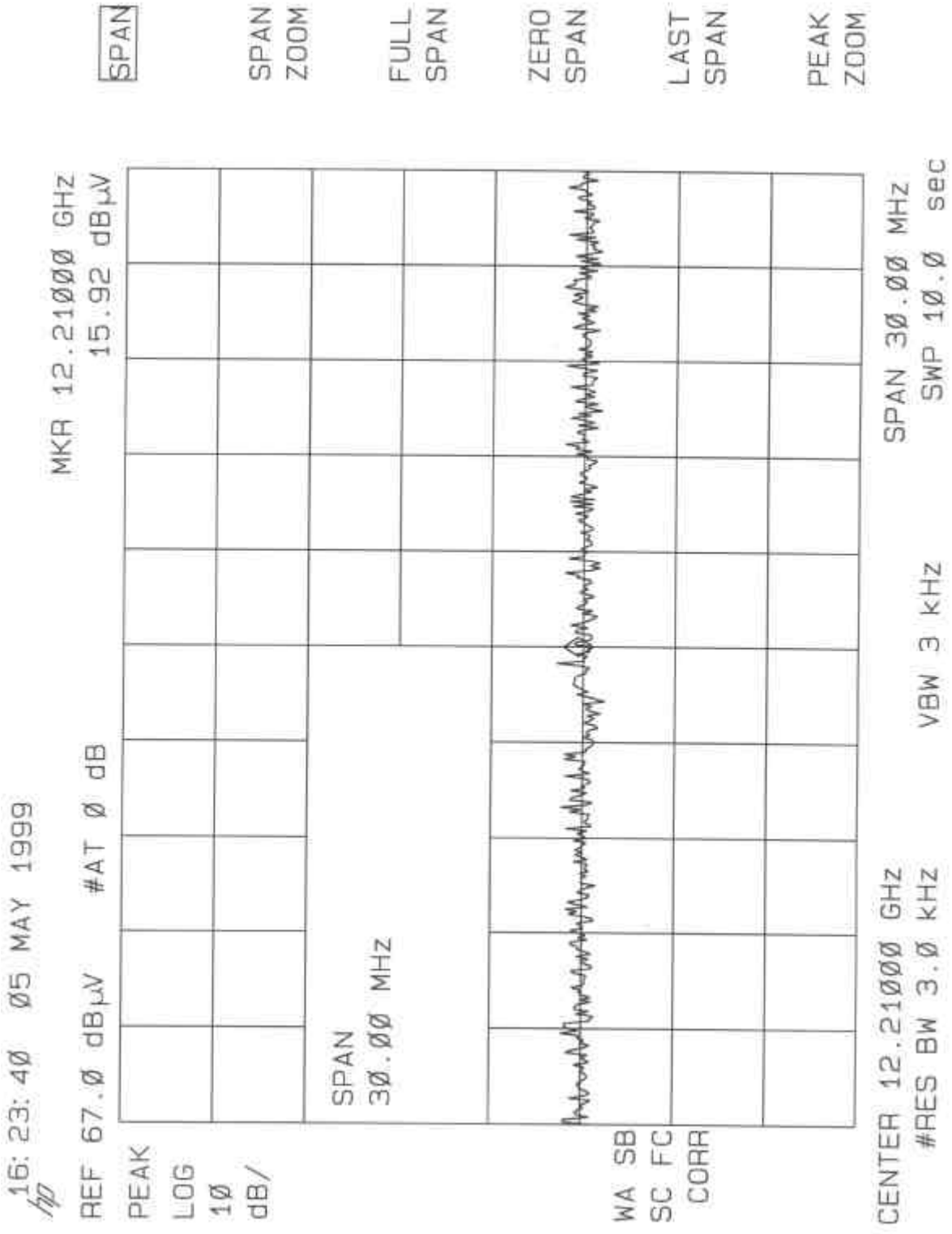
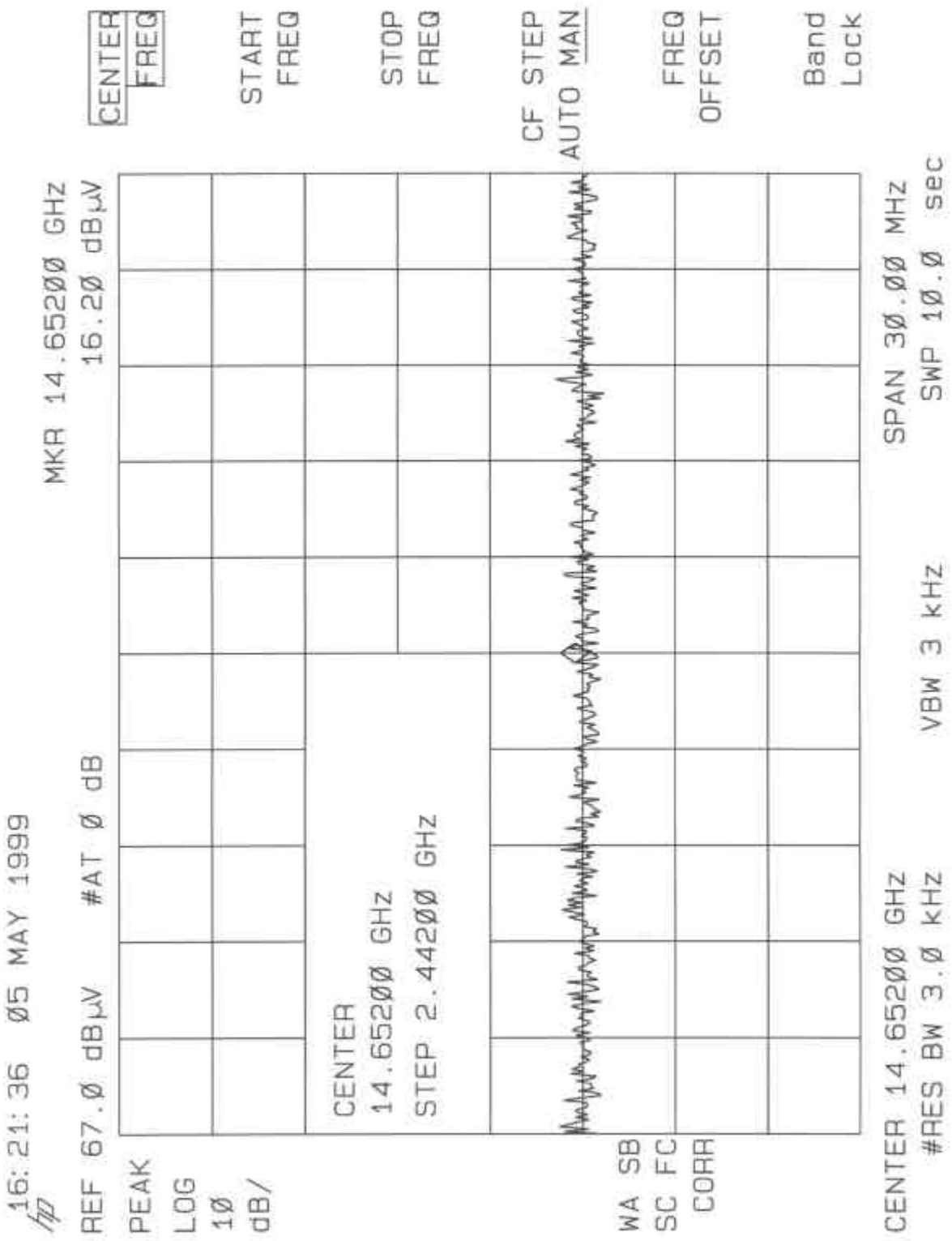
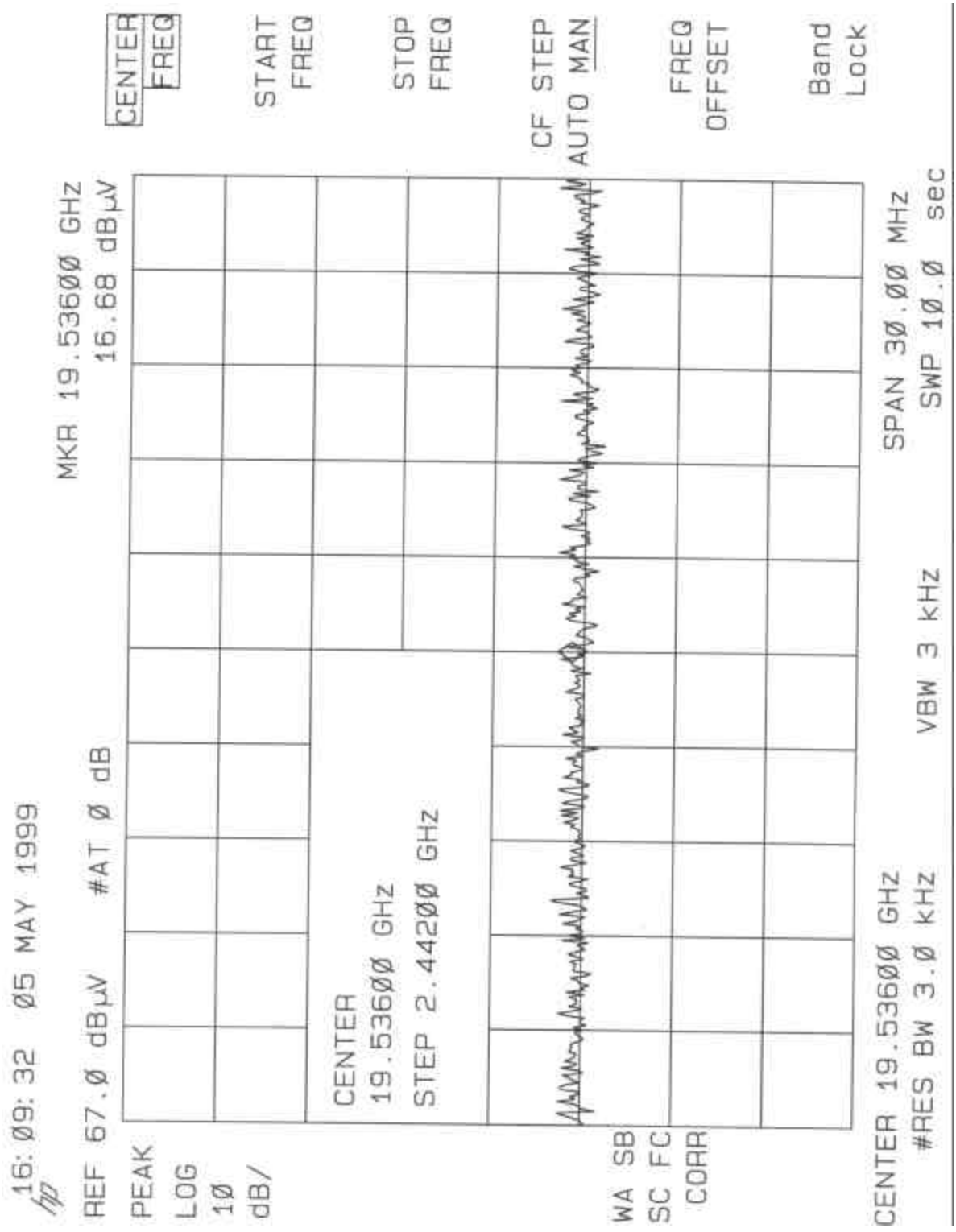


6th Harmonic

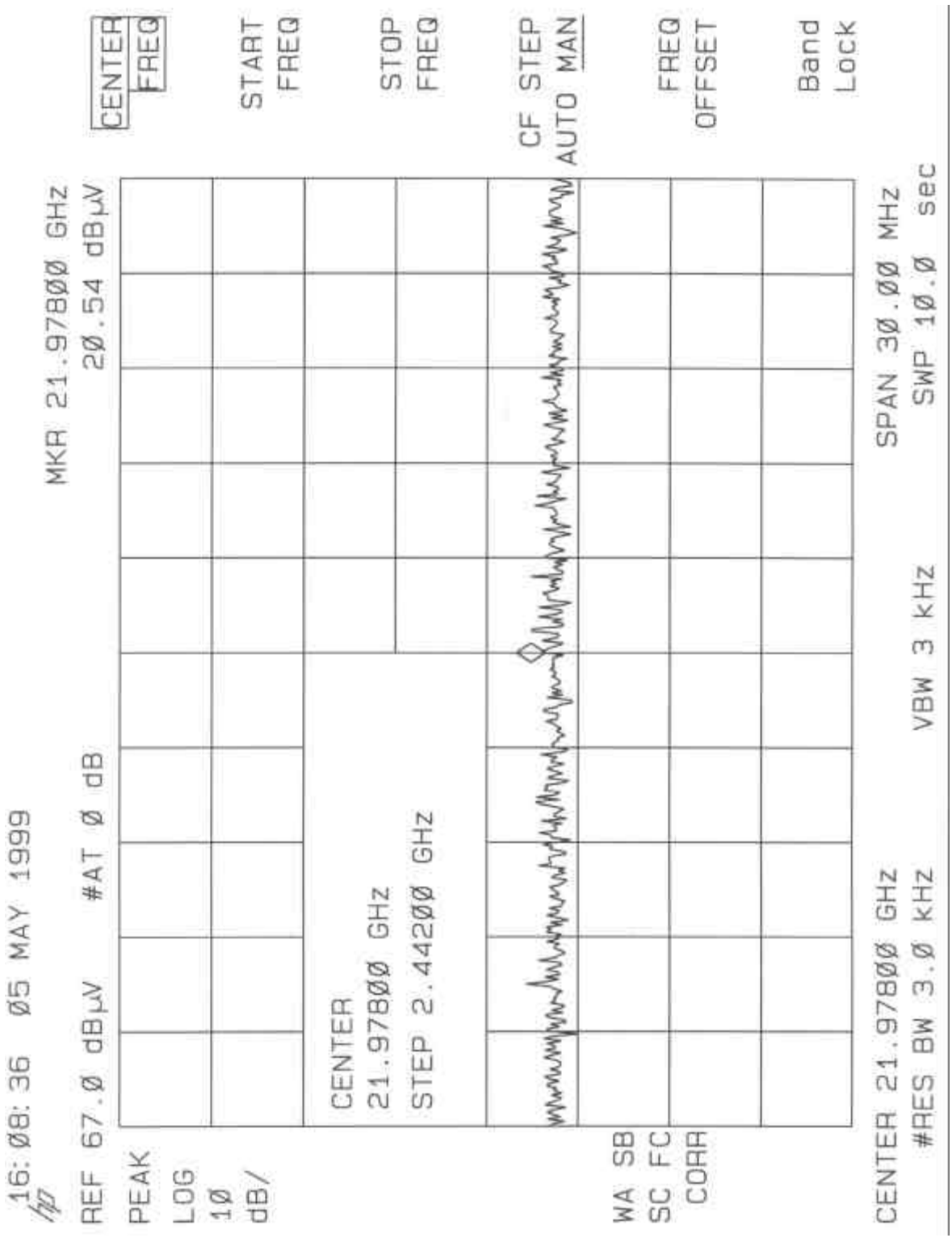


7th Harmonic

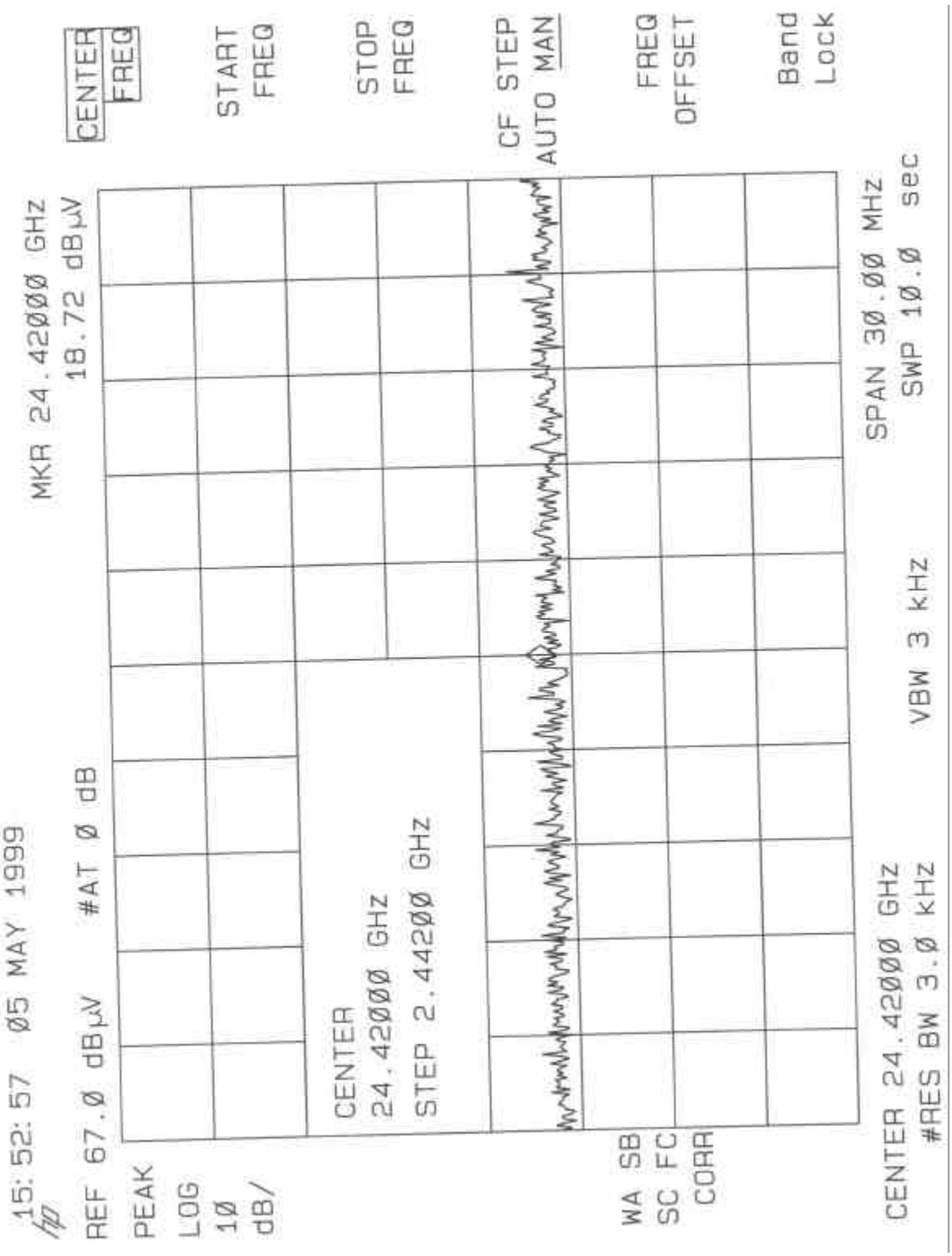
8th Harmonic



9th Harmonic

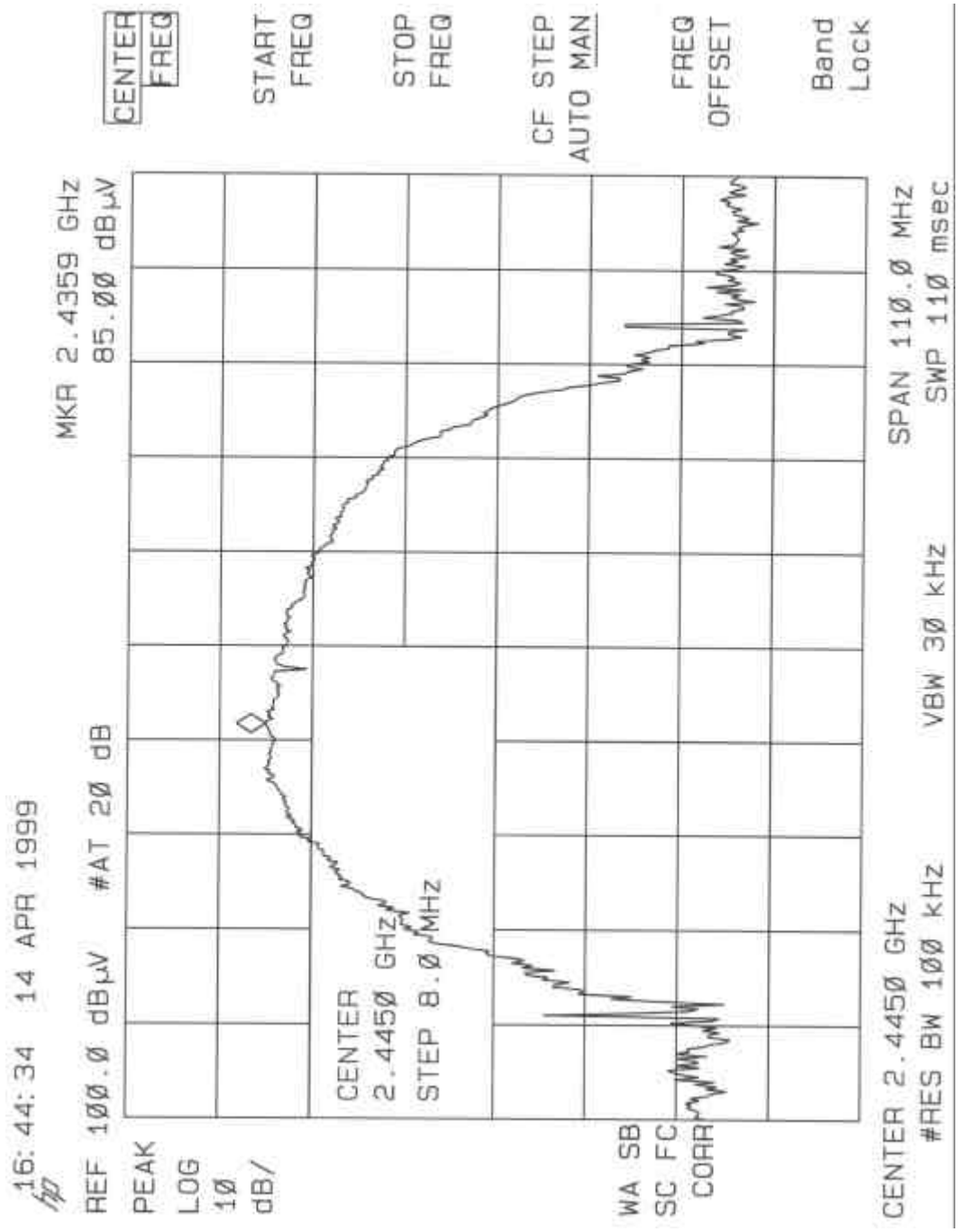


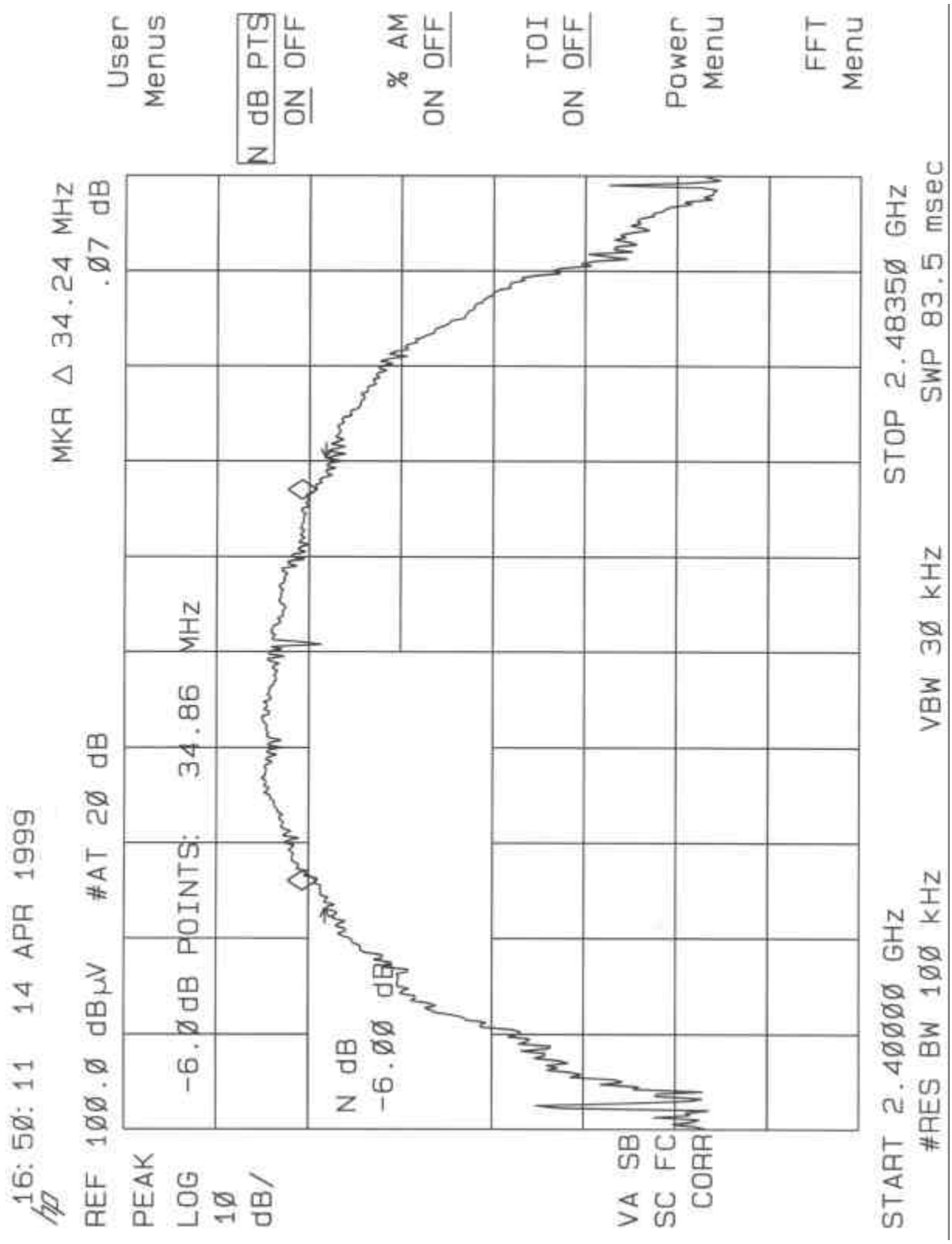
10th Harmonic



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.




16: 50: 11 14 APR 1999
REF 100.0 dBµV #AT 20 dB
PEAK
LOG
10
dB/
-6.0 dB POINTS: 34.86 MHz
N dB
-6.00 dB
MKR Δ 34.24 MHz
.07 dB
User Menus
N dB PTS ON OFF
% AM ON OFF
TOI ON OFF
Power Menu
FFT Menu
VA SB
SC FC
CORR
START 2.400000 GHz
#RES BW 100 kHz
VBW 30 kHz
STOP 2.48350 GHz
SWP 83.5 msec

3.5 Processing Gain Measurement

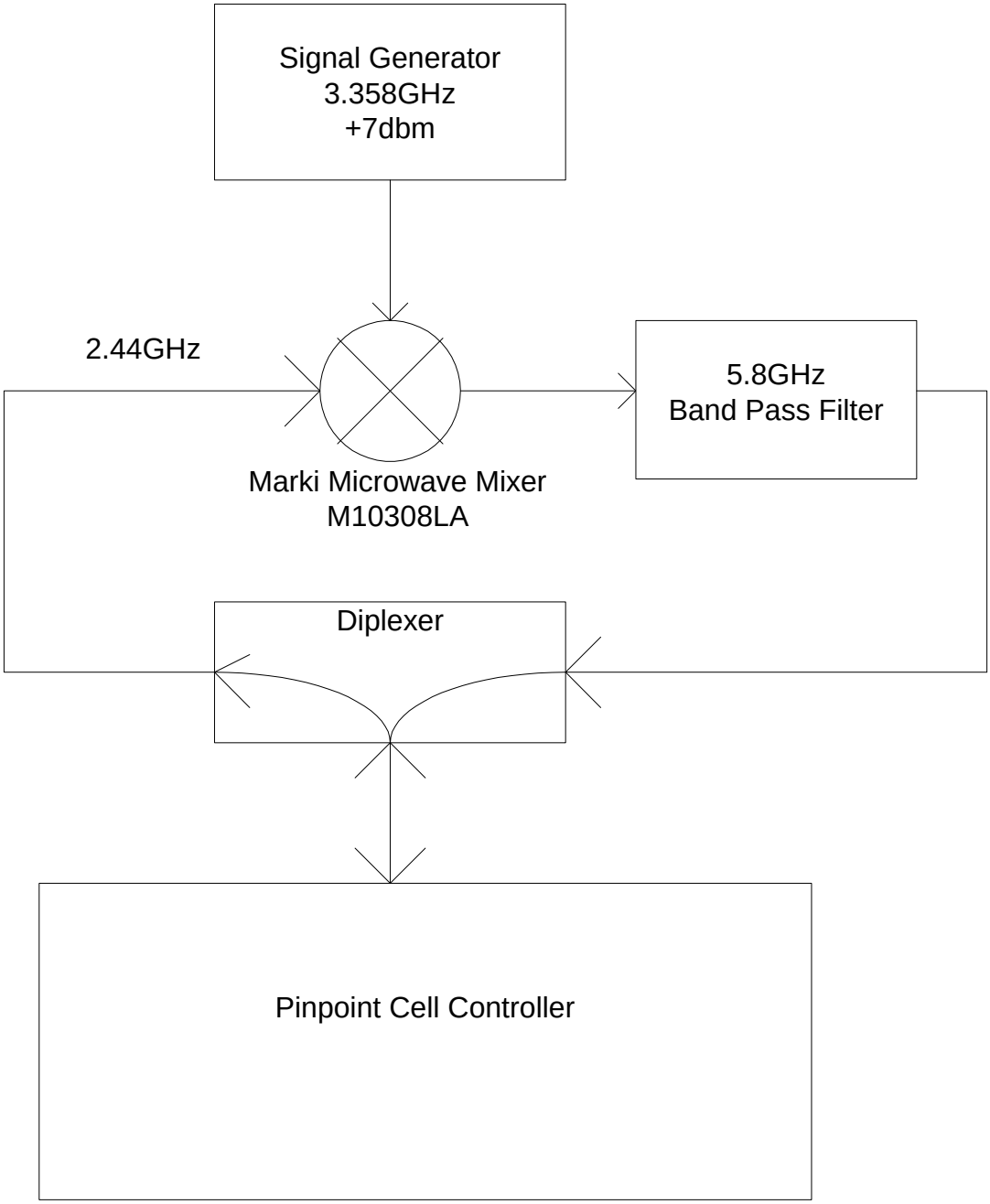
This system utilizes direct-sequence spread spectrum signals to locate items at a distance. The cell controller modulates a 127 chip pseudorandom sequence onto an RF carrier at 2442MHz and emits this signal sequentially through an array of antennas. The tag shifts this signal to 5800MHz, phase modulates 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).

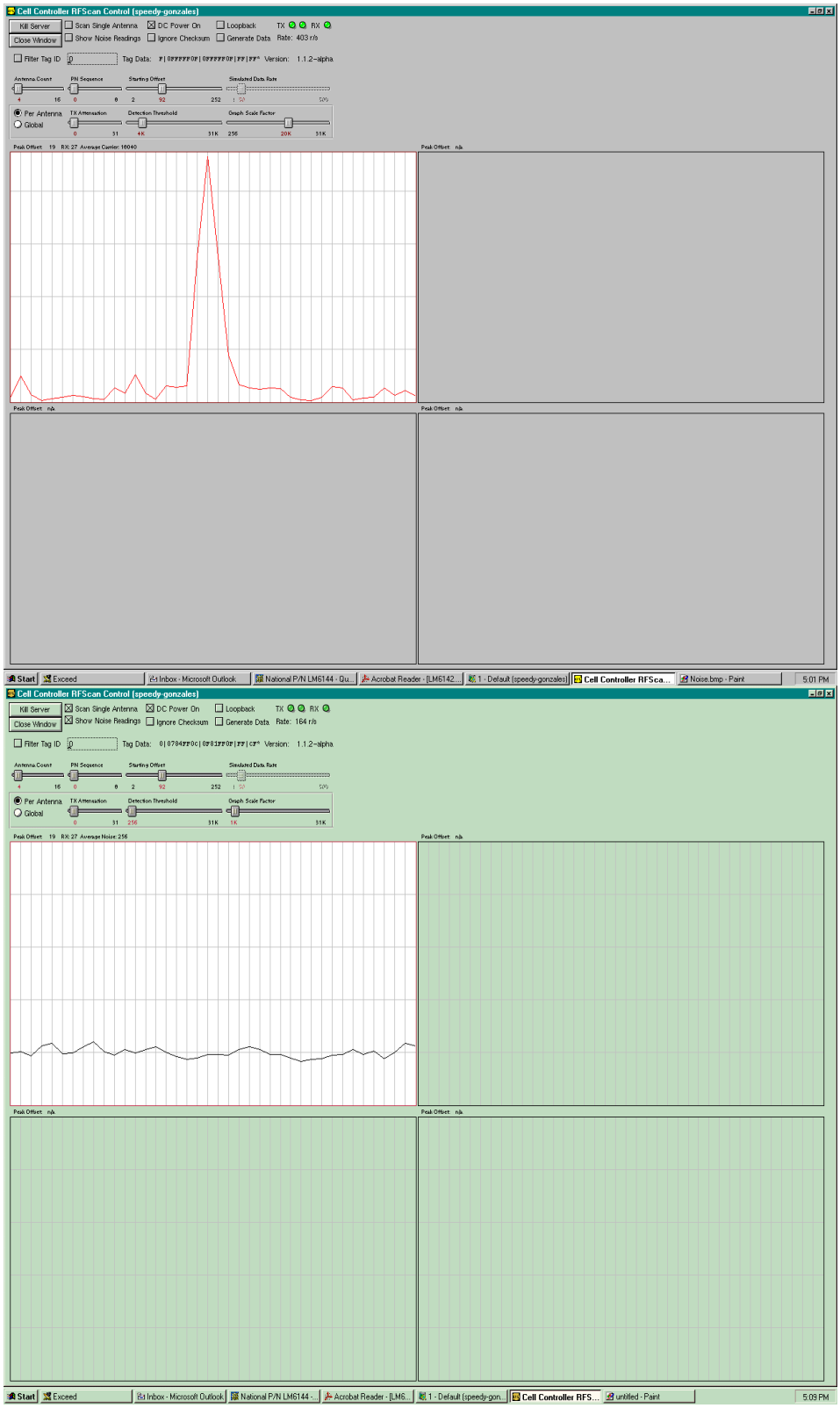
Accordingly, the software installation tool used to set up the cell controller (Cell Controller RFScan Control) has been equipped with features to enable the measurement of the processing gain with the system set up in RF loopback. This mode of operation simply translates the 2.442GHz low-level transmitter 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) = 21dB) minus some implementation loss (about 3dB in our system).

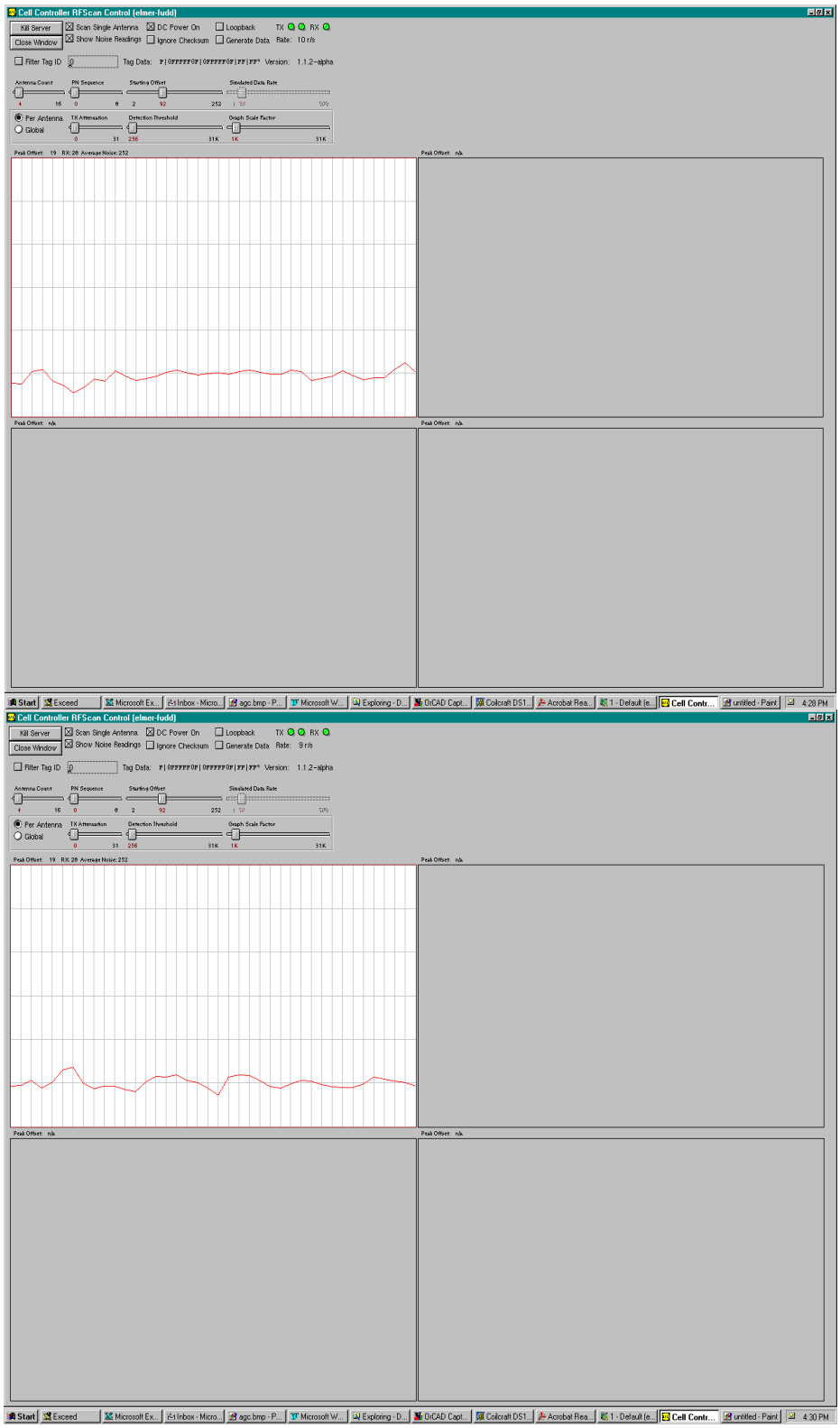
A block diagram of the setup and data plots are shown below. The top line directly above the plot area reports either the averaged signal or the averaged noise, depending on the plot. To determine the signal to noise ratio (in dB) for a particular condition, take the logarithm (base 10) of the ratio 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) = 18.5dB. 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

$G_p = 18.5 – 0 =$ ***18.5dB***.



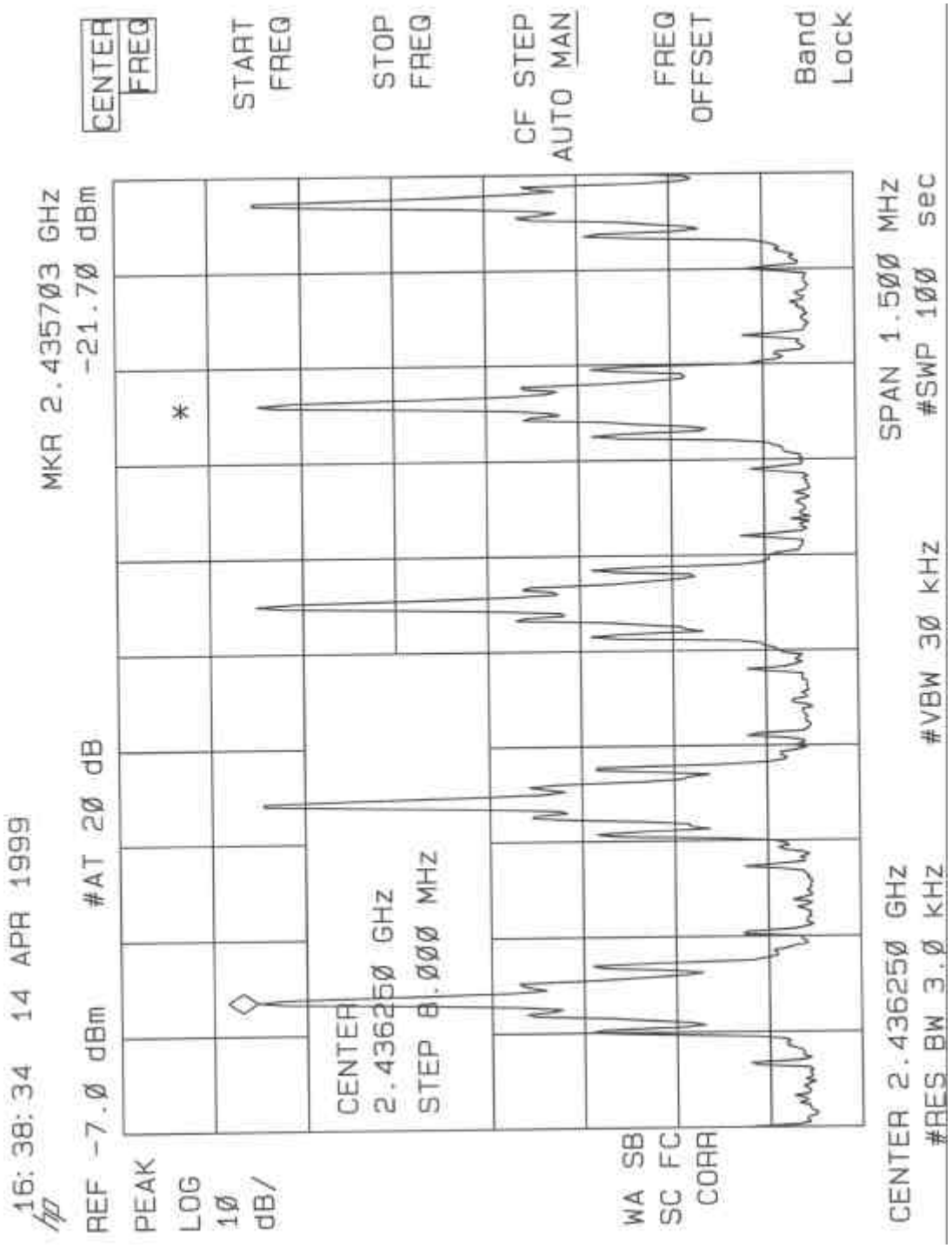
Processing Gain Setup


Cell Controller RFScan Control (speedy-gonzales)
Kill Server
Close Window
Scan Single Antenna
Show Noise Readings
DC Power On
Ignore Checksum
Loopback
Generate Data
TX
RX
Rate: 403 r/s
Filter Tag ID
Tag Data:
Version: 1.1.2-alpha
Antenna Count
PN Sequence
Starting Offset
Simulated Data Rate
Per Antenna
Global
TX Attenuation
Detection Threshold
Graph Scale Factor
Peak Offset: 19 RX: 27 Average Carrier: 18040
Peak Offset: n/a
Start
Exceed
Inbox - Microsoft Outlook
National P/N LM6144 - Qu...
Acrobat Reader - [LM6142...
1 - Default (speedy-gonzales)
Cell Controller RFSca...
Noise.bmp - Paint
5:01 PM
Cell Controller RFScan Control (speedy-gonzales)
Kill Server
Close Window
Scan Single Antenna
Show Noise Readings
DC Power On
Ignore Checksum
Loopback
Generate Data
TX
RX
Rate: 164 r/s
Filter Tag ID
Tag Data:
Version: 1.1.2-alpha
Antenna Count
PN Sequence
Starting Offset
Simulated Data Rate
Per Antenna
Global
TX Attenuation
Detection Threshold
Graph Scale Factor
Peak Offset: 19 RX: 27 Average Noise: 256
Peak Offset: n/a
Start
Exceed
Inbox - Microsoft Outlook
National P/N LM6144 -...
Acrobat Reader - [LM6...
1 - Default (speedy-gon...
Cell Controller RFS...
untitled - Paint
5:09 PM


Cell Controller RFScan Control (elmer-fudd)
Kill Server
Close Window
Scan Single Antenna
Show Noise Readings
DC Power On
Ignore Checksum
Loopback
Generate Data
TX
RX
Rate: 10 r/s
Filter Tag ID
Tag Data:
Version: 1.1.2-alpha
Antenna Count
PN Sequence
Starting Offset
Simulated Data Rate
Per Antenna
Global
TX Attenuation
Detection Threshold
Graph Scale Factor
Peak Offset: 19 RX: 28 Average Noise: 252
Peak Offset: n/a
Start
Exceed
Microsoft Ex...
Inbox - Micro...
agc.bmp - P...
Microsoft W...
Exploring - D...
OrCAD Capt...
Coilcraft DS1...
Acrobat Rea...
1 - Default [e...
Cell Contr...
untitled - Paint
4:29 PM
Cell Controller RFScan Control (elmer-fudd)
Kill Server
Close Window
Scan Single Antenna
Show Noise Readings
DC Power On
Ignore Checksum
Loopback
Generate Data
TX
RX
Rate: 9 r/s
Filter Tag ID
Tag Data:
Version: 1.1.2-alpha
Antenna Count
PN Sequence
Starting Offset
Simulated Data Rate
Per Antenna
Global
TX Attenuation
Detection Threshold
Graph Scale Factor
Peak Offset: 19 RX: 28 Average Noise: 252
Peak Offset: n/a
Start
Exceed
Microsoft Ex...
Inbox - Micro...
agc.bmp - P...
Microsoft W...
Exploring - D...
OrCAD Capt...
Coilcraft DS1...
Acrobat Rea...
1 - Default [e...
Cell Contr...
untitled - Paint
4:30 PM

3.6 Power Spectral Density Measurement

The peak power spectral density as measured through a 20dB attenuator is:
-21.7dBm + 20dBm (attenuator) = ***-1.7dBm***



3.7 Radiofrequency Radiation Exposure Evaluation

Radiofrequency radiation exposure evaluation for 3D*i*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:

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

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

$$D_p = 0.927 \ mW/ cm^2$$

So, a power density of less than $1mW/ cm^2$ 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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