

# Intertek Testing Services

## APPLICATION FOR FCC CERTIFICATION

**Glenayre Western Multiplex**

**Spread Spectrum Radio**

**Model: 31850**

**FCC ID: HZB-LYNX96**

**Job # J98027347**

**Number of Pages:** 14 pp. + Supporting Data and Documents

**Date of Report: October 16, 1998**

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1.0 Summary of Tests

**Glenayre Western Multiplex - MODEL: 31850**  
**FCC ID: HZB-LYNX96**

TEST	REFERENCE	RESULTS
Max. Output power	15.247(b)	Pass
6 dB Bandwidth	15.247(a)(2)	Pass
Max. Power Density	15.247(d)	Pass
Out of Band Antenna Conducted Emission	15.247(c)	Pass
Out of Band Radiated Emission	15.247(c)	N/A
Radiated Emission in Restricted Bands	15.35(b)(c)	Pass
AC Conducted Emission	15.207	Pass
Radiated Emission from Digital Part	15.109	Pass
Radiated Emission from Receiver L.O.	15.109	Not Applicable
Processing Gain Measurements	15.247(e)	Provided by applicant
Antenna Requirement	15.203	Pass

Test Engineer: \_\_\_\_\_  
Xi-Ming Yang

Date: \_\_\_\_\_

EMC Site Manager: \_\_\_\_\_  
David Chernomordik

Date: \_\_\_\_\_

## 2.0 General Description

### 2.1 Product Description

The LYNX.SC6 (4XE1) Model No.: 31850 is a 5.8 GHz direct sequence spread spectrum radio.

A pre-production version of the sample was received on September 21, 1998 in good condition.

### Overview of Spread Spectrum Radio

Applicant	<b>Glenayre Western Multiplex</b>
Trade Name & Model No.	<b>LYNX.SC6 (4XE1), 31850</b>
FCC Identifier	<b>HZB-LYNX96</b>
Use of Product	Point-to-point fixed wireless interconnect
Manufacturer & Model of Spread Spectrum Module	Glenayre Western Multiplex
Type of Transmission	Direct Sequence
Rated RF Output (mW)	269
Frequency Range (MHz)	5735 - 5840
Number of Channel(s)	6
Antenna(s) & Gain, dBi	29
Processing Gain Measurements	<input checked="" type="checkbox"/> Will be provided to ITS for submission with the application <input type="checkbox"/> Will be provided directly to the FCC reviewing engineer by the client or manufacturer of the spread spectrum module
Antenna Requirement	<input type="checkbox"/> The EUT uses a permanently connected antenna. <input type="checkbox"/> The antenna is affixed to the EUT using a unique connector which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector. <input checked="" type="checkbox"/> The EUT requires professional installation (attach supporting documentation if using this option).
Manufacturer name & address	Glenayre Western Multiplex 1196 Borregas Avenue Sunnyvale, California 94089

### 2.2 Related Submittal(s) Grants

None.



## 2.3 Test Methodology

Both AC mains line-conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4 (1992). Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Data Sheet**" of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

## 2.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is site . This test facility and site measurement data have been fully placed on file with the FCC and NVLAP accredited.

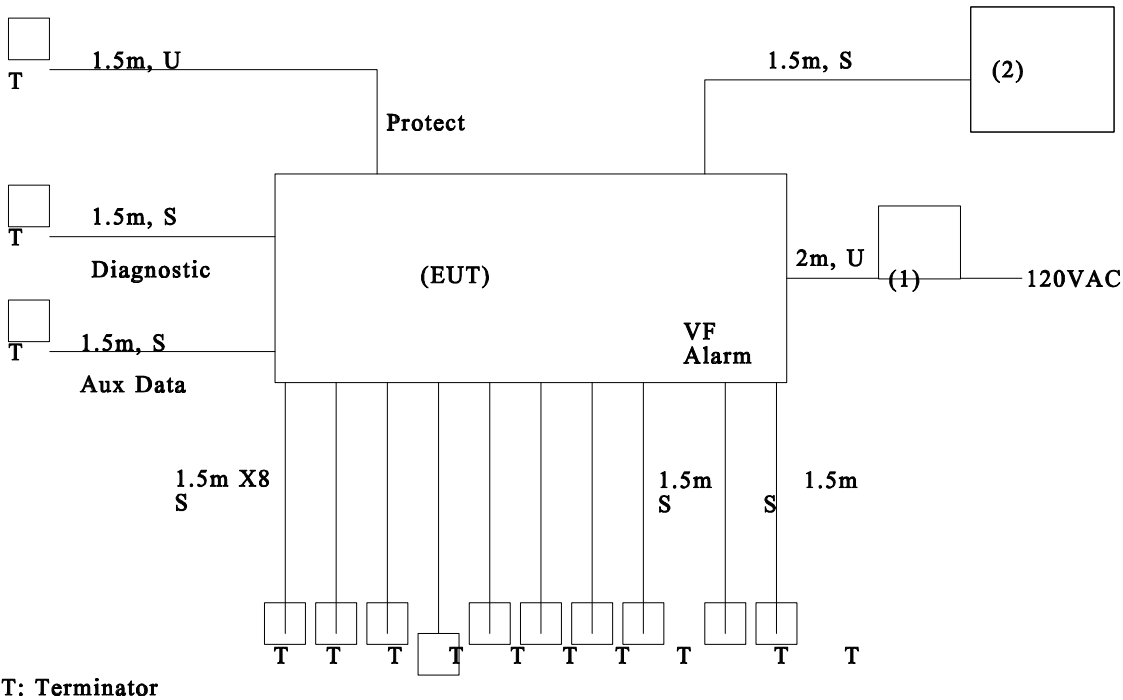
### 3.0 System Test Configuration

#### 3.1 Support Equipment and description

The FCC ID's for all equipment used in the tested system (included inserted cards, which have grants) are:

Item #	Description	Model No.	Serial No.	FCC ID
1	HP Power Supply	6296A	2234A-04750	N/A
2	Comsat Antenna	P-57C24N-1	129415	N/A

#### 3.2 Block Diagram of Test Setup



* = EUT	S = Shielded;	F = With Ferrite
** = No ferrites on video cable	U = Unshielded	

### 3.3 Justification

For emission testing, the equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). During testing, all cables were manipulated to produce worst case emissions.

For radiated emission measurements, the EUT is attached to a cardboard box (if necessary) and placed on the wooden turntable. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). The EUT is wired to transmit full power without modulation.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Detector function is in peak mode. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

### 3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. For emissions testing, the units were setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing.

### 3.5 Mode of Operation During Test

Transmitting signal on low, middle, and high frequencies.

### 3.6 Modifications Required for Compliance

The following modifications were installed during compliance testing in order to bring the product into compliance (Please note that this list does not include changes made specifically by Glenayre Western Multiplex prior to compliance testing):

No modifications were made to the EUT by Intertek Testing Services.

### 3.7 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

## 4.0 Measurement Results

### 4.1 Maximum Conducted Output Power at Antenna Terminals, FCC Rules 15.247(b):

The antenna port of the EUT was connected to the input of a power meter. Power was read directly and cable loss correction was added to the reading to obtain power at the EUT antenna terminals.

The antenna port of the EUT was connected to the input of a spectrum analyzer. The analyzer was set for maximum RES BW and power was read directly in dBm. External attenuation and cable loss were compensated for using the OFFSET function of the analyzer.

For antennas with gains of 6 dBi or less, maximum allowed transmitter output is 1 watt (+30 dBm).

For antennas with gains greater than 6 dBi, transmitter output level must be decreased by an amount equal to (GAIN - 6) dBm.

Max. antenna gain = 29		
Frequency (MHz)	Output in dBm	Output in mWatt
Low Channel: 5735	24.3	269.0
Mid Channel: 5800	23.8	240.0
High Channel: 5840	23.2	209.0

Cable loss: 0 dB

External Attenuation: 0 dB

Cable loss, external attenuation:

included in OFFSET function

added to SA raw reading

4.2 Minimum 6 dB RF Bandwidth, FCC Rule 15.247(a)(2):

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RES BW was set to 100 kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 6 dB lower than PEAK level. The 6 dB bandwidth was determined from where the channel output spectrum intersected the display line.

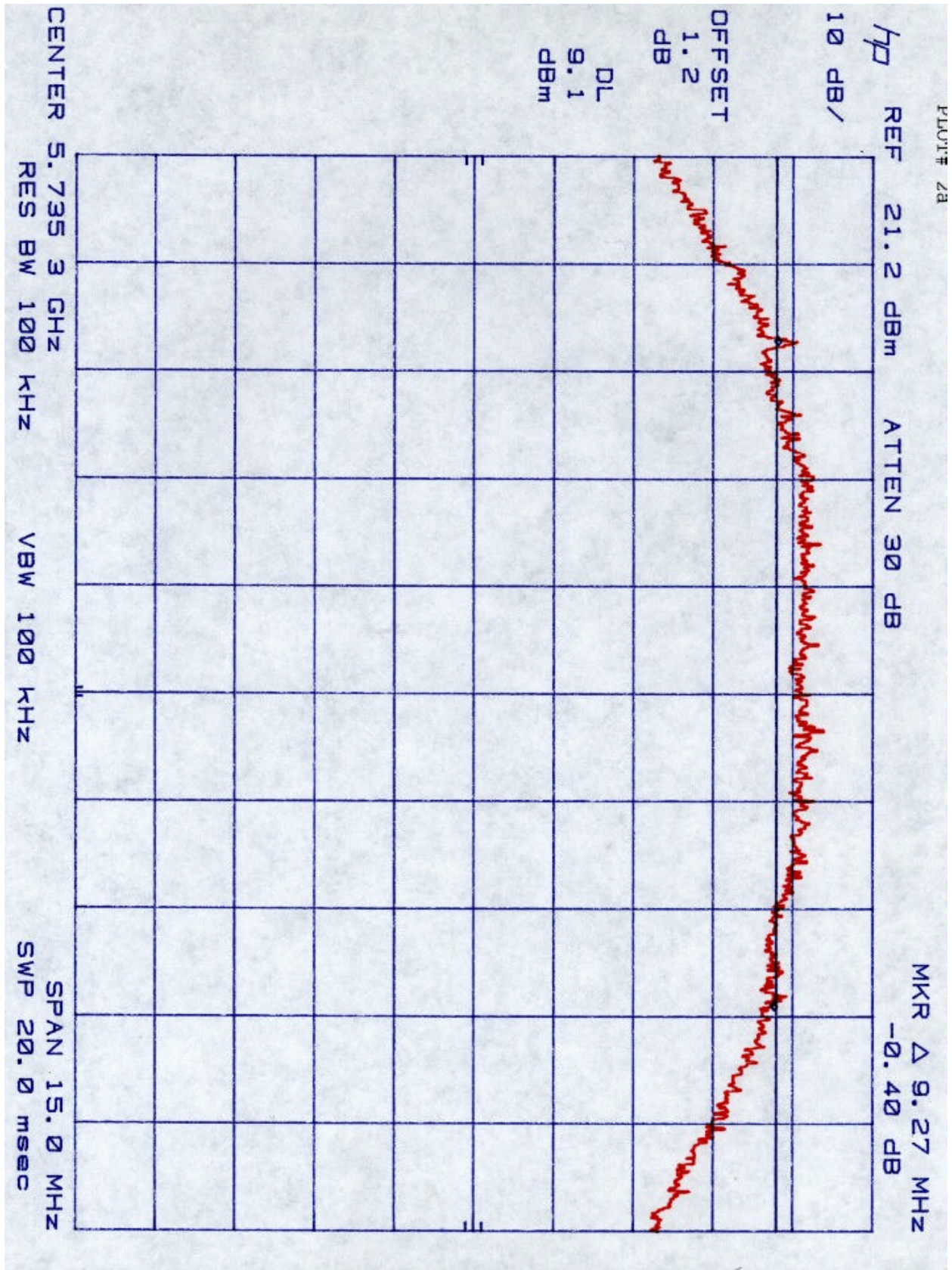
Frequency (MHz)	Min. 6 dB Bandwidth (kHz)
5800	9170

Refer to the following plots for 6 dB bandwidth sharp:

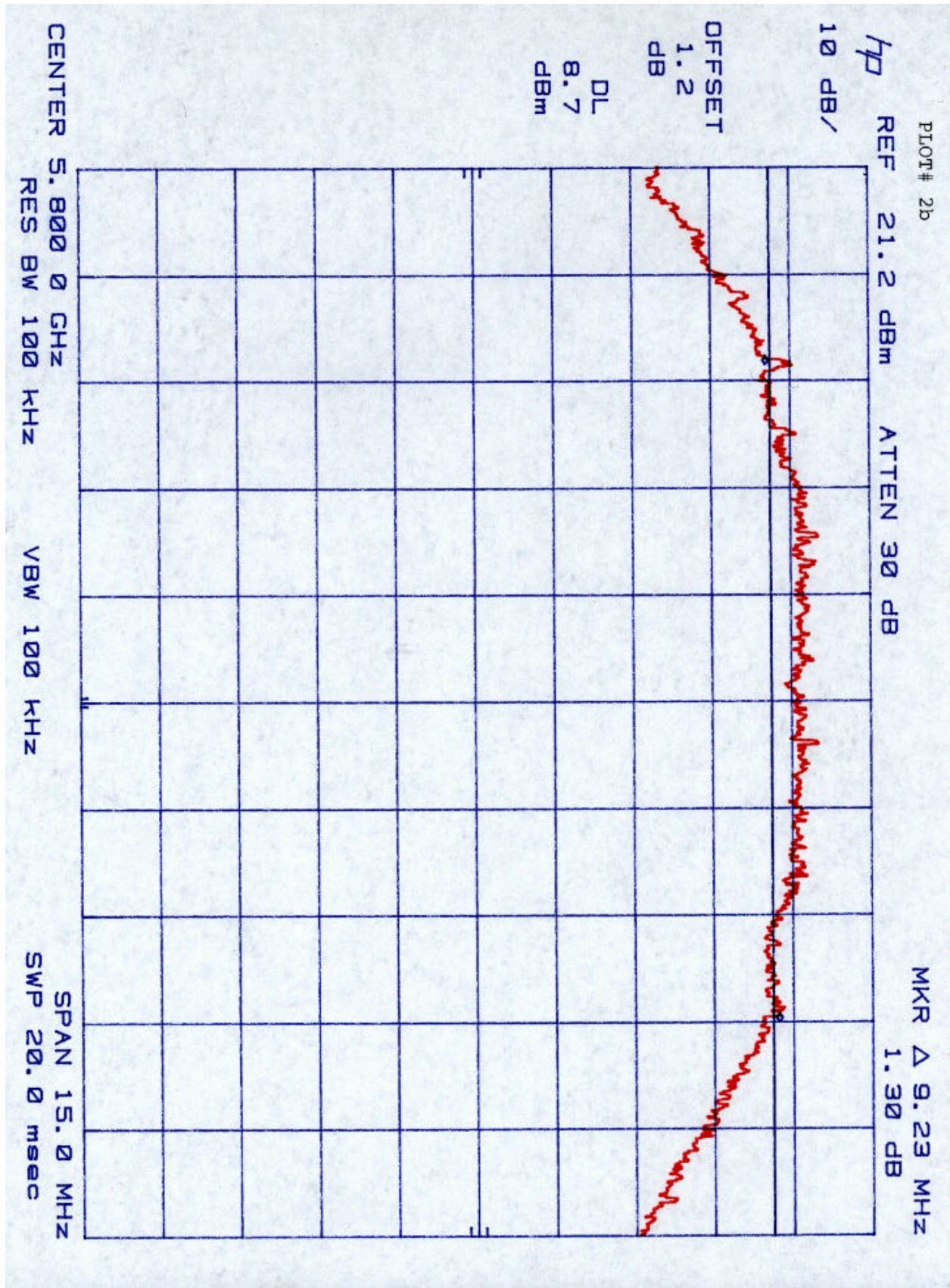
Plot 2a: Low Channel 6 dB RF Bandwidth

Plot 2b: Middle Channel 6 dB RF Bandwidth

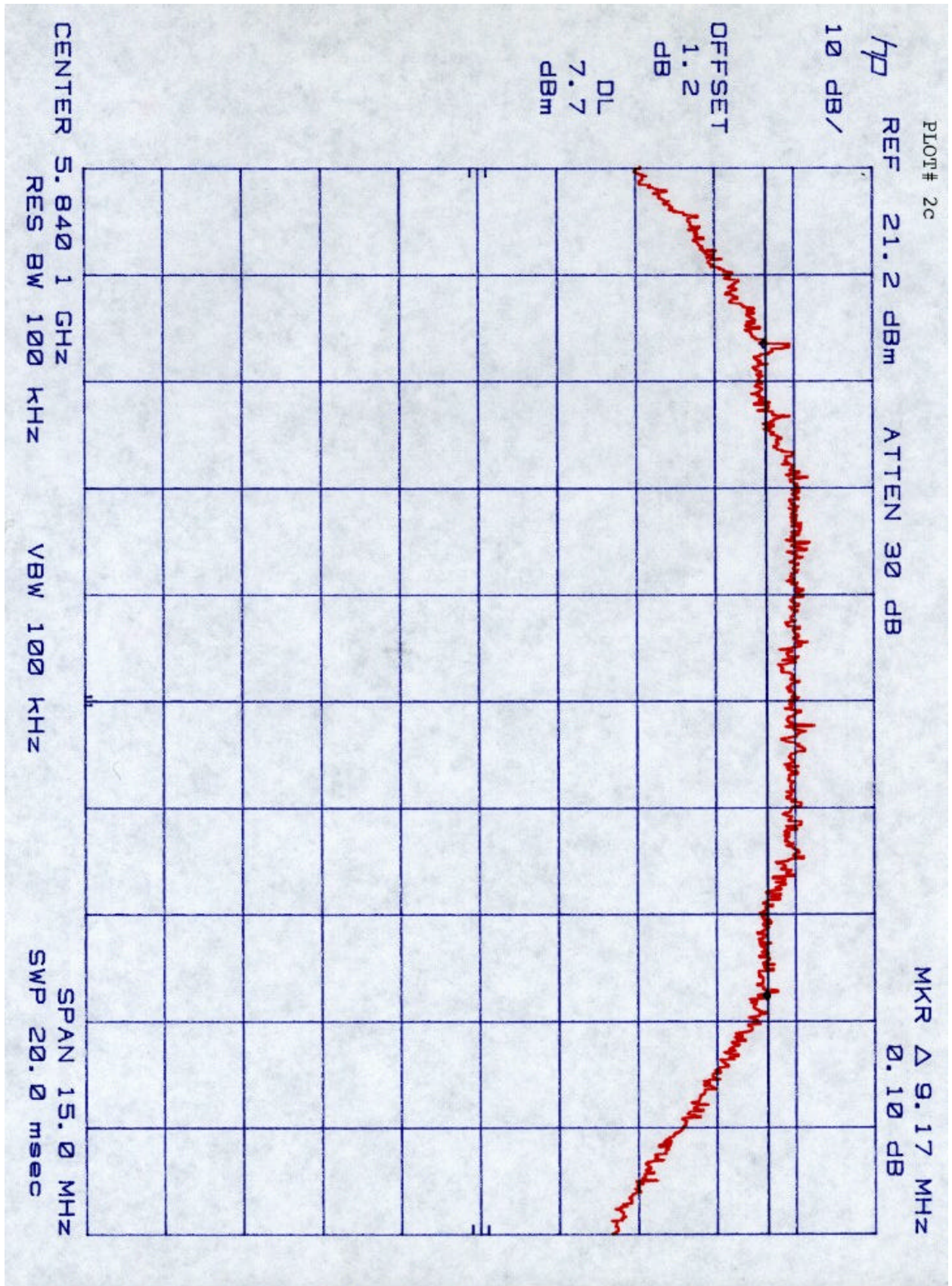
Plot 2c: High Channel 6 dB RF Bandwidth













### 4.3 Maximum Power Density Reading, FCC Rule 15.247(d):

The spectrum analyzer RES BW was set to 3 kHz. The START and STOP frequencies were set to the band edges of the maximum output passband. If there is no clear maximum amplitude in any given portion of the band, it may be necessary to make measurements at a number of bands defined by several START and STOP frequency pairs. The specification calls for a 1 second interval at each 3 kHz bandwidth; total SWEEP TIME is calculated as follows:

$$\text{SWEEP TIME (SEC)} = (\text{Fstop, kHz} - \text{Fstart, kHz}) / 3 \text{ kHz}$$

Antenna output of the EUT was coupled directly to spectrum analyzer; if an external attenuator and/or cable was used, these losses are compensated for with the analyzer OFFSET function.

Frequency (MHz)	Power Density (dBm)
5735.87	0.5

Frequency Span = 600 kHz

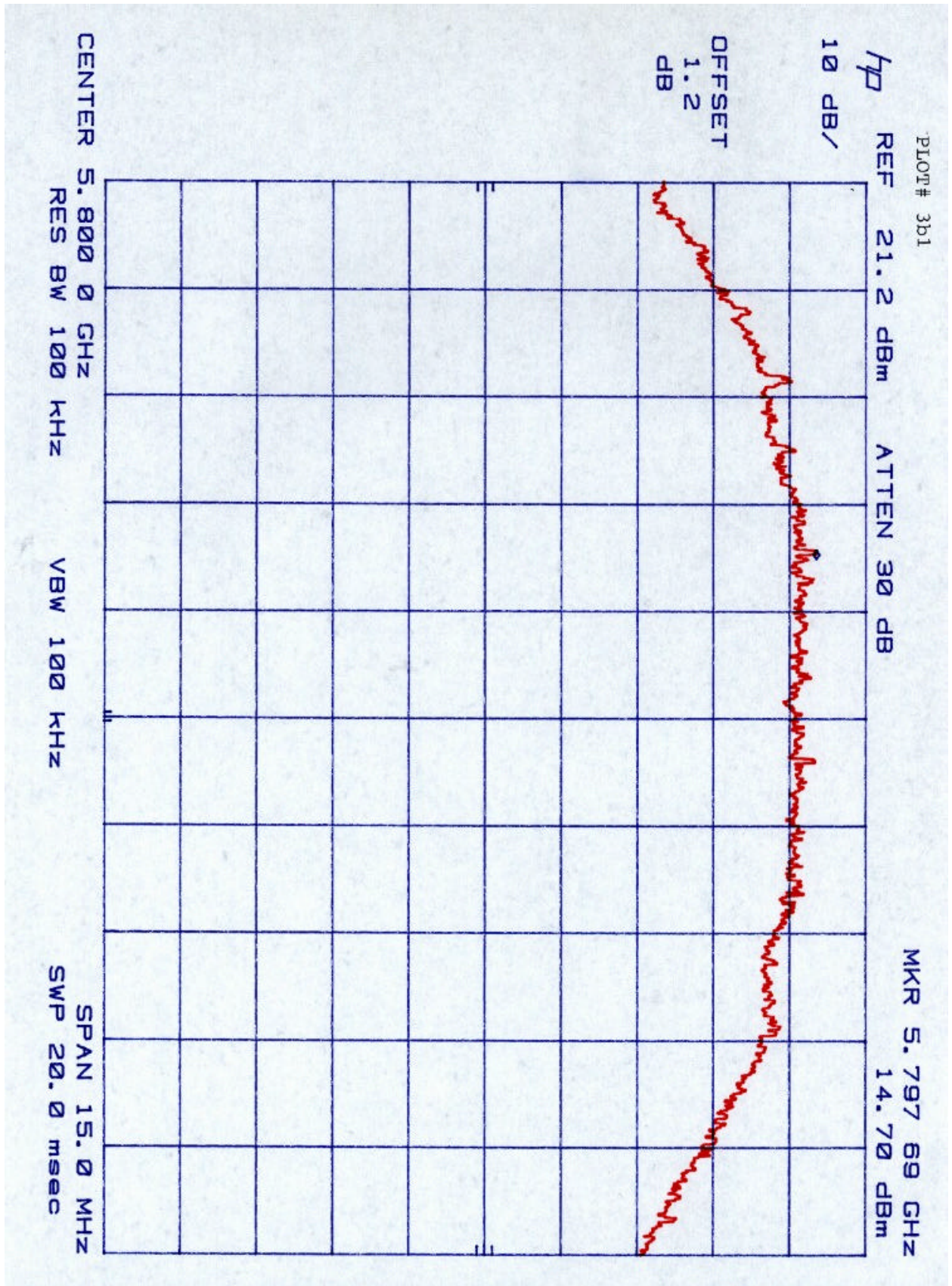
Sweep Time = Frequency Span / 3 kHz  
= 200 seconds

Refer to the following plots for power density data:

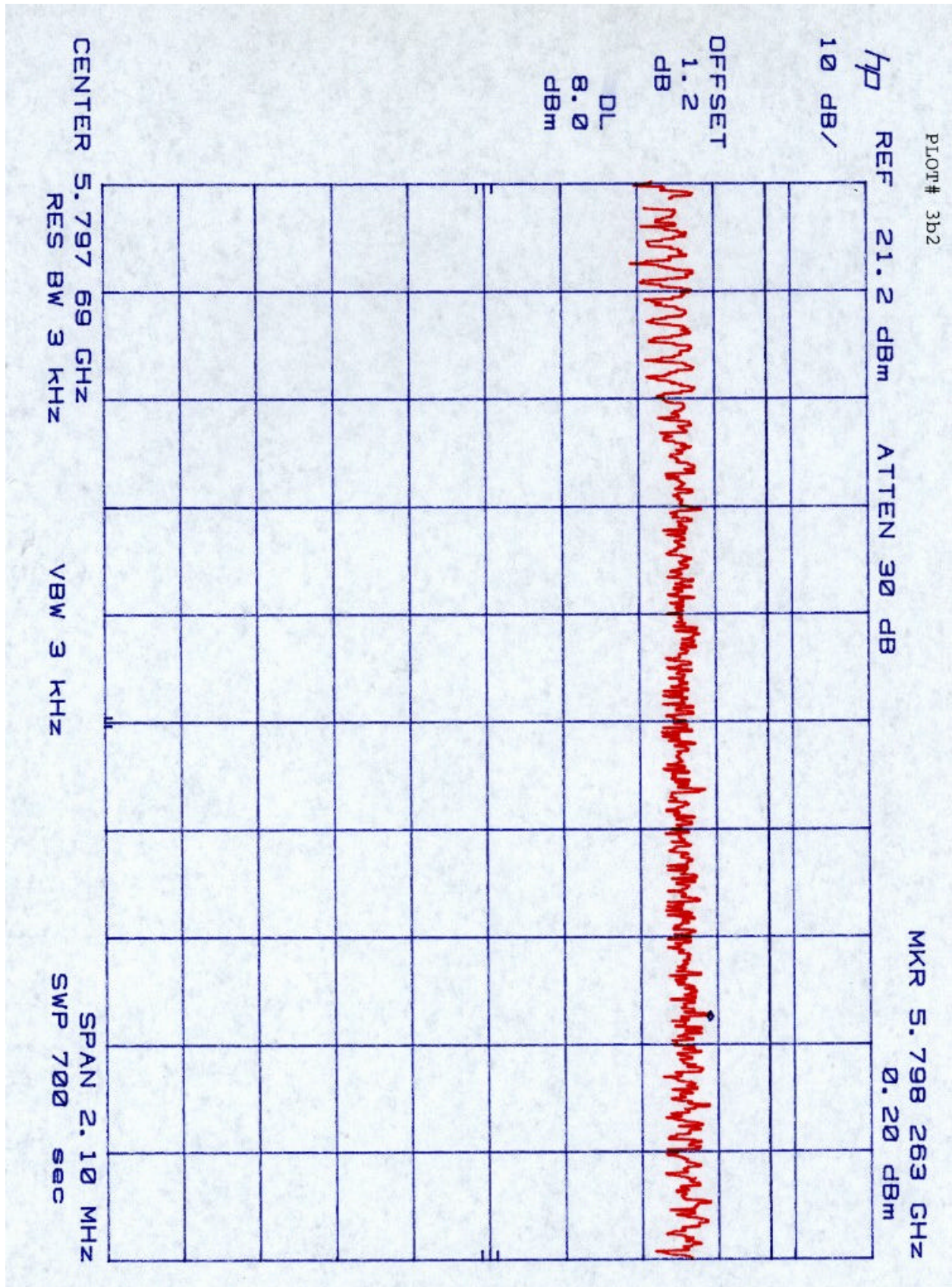
Plot 3a1-3a2: Low Channel Power Density

Plot 3b1-3b2: Middle Channel Power Density

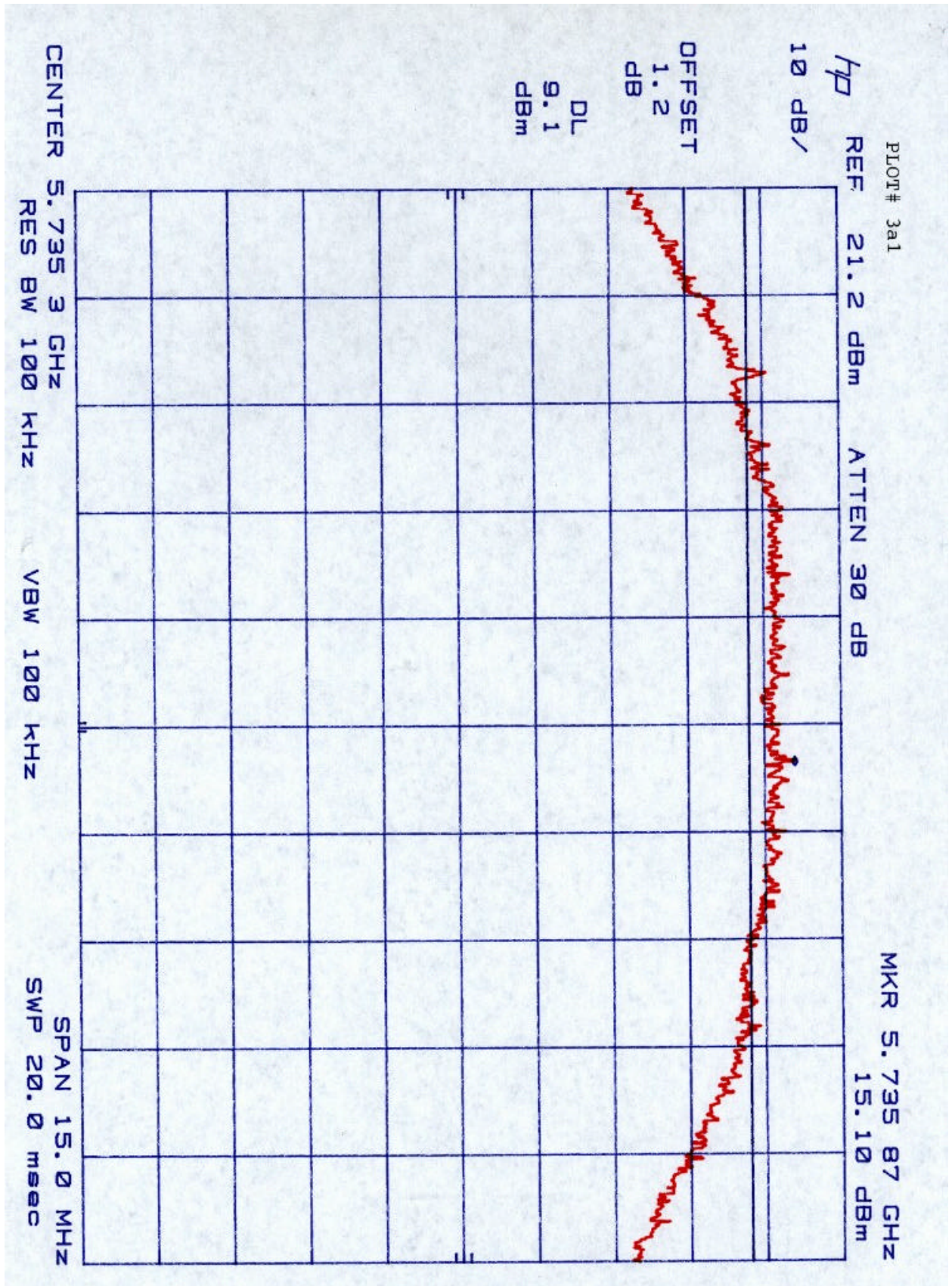
Plot 3c1-3c2: High Channel Power Density



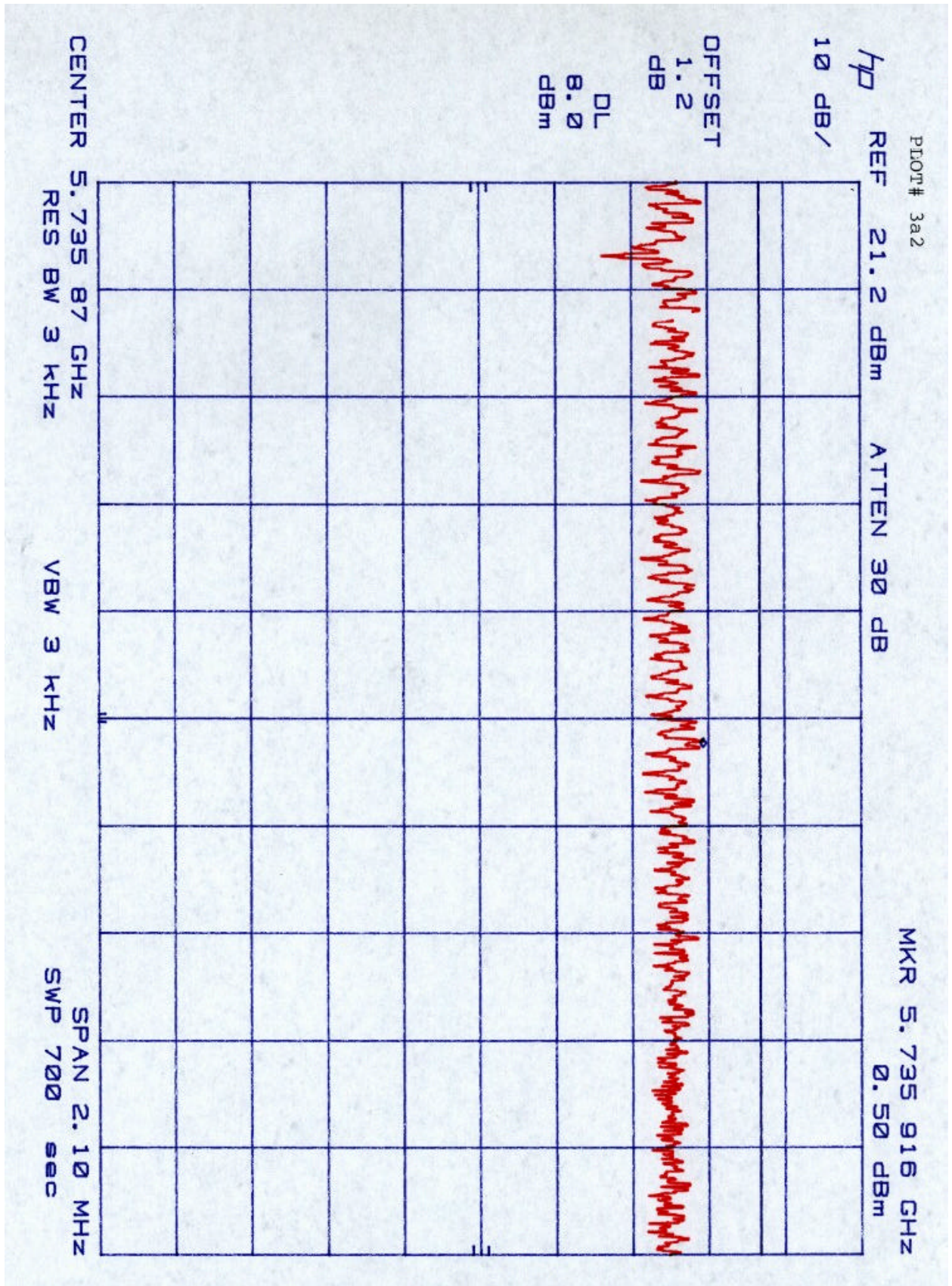




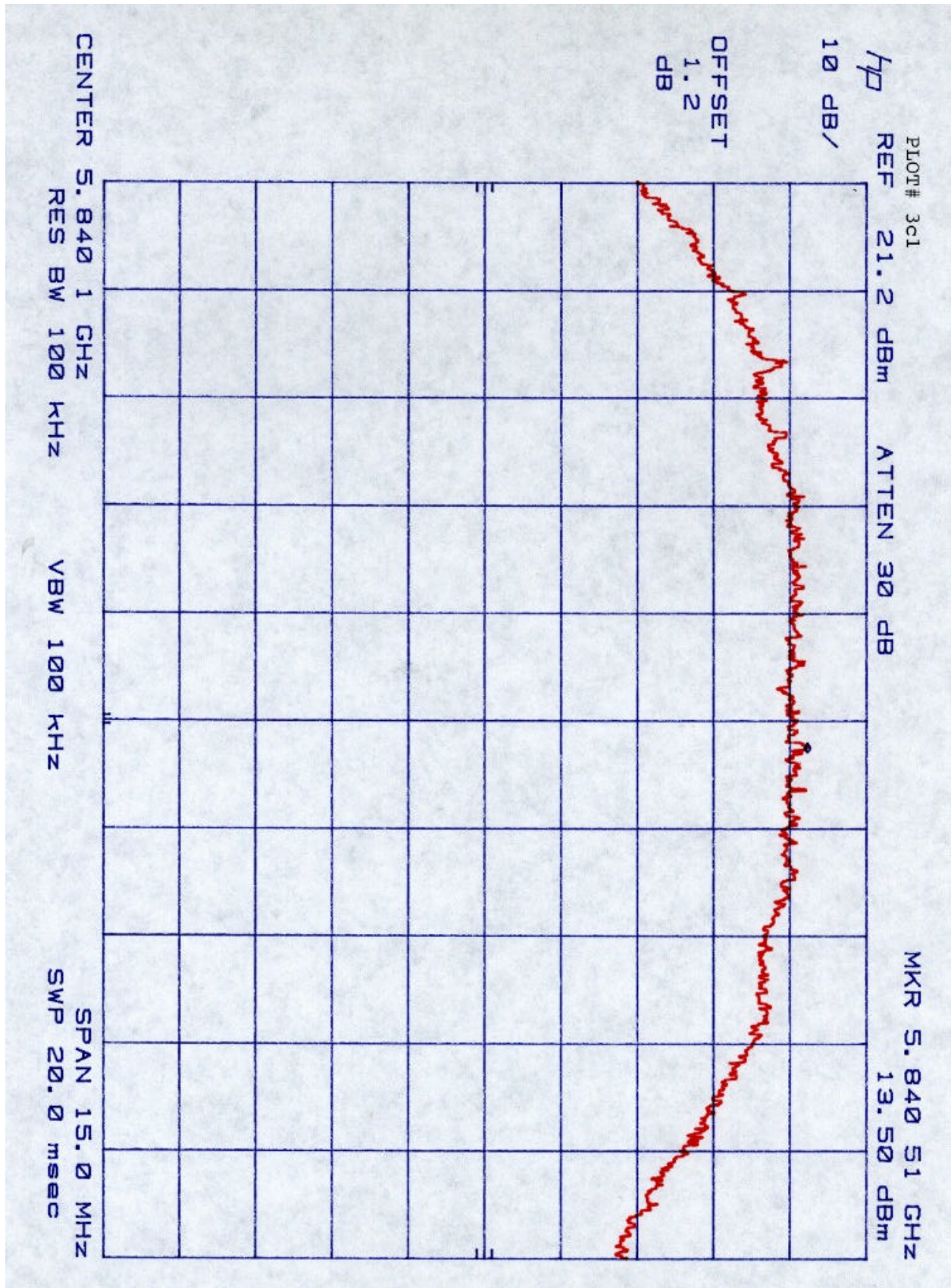




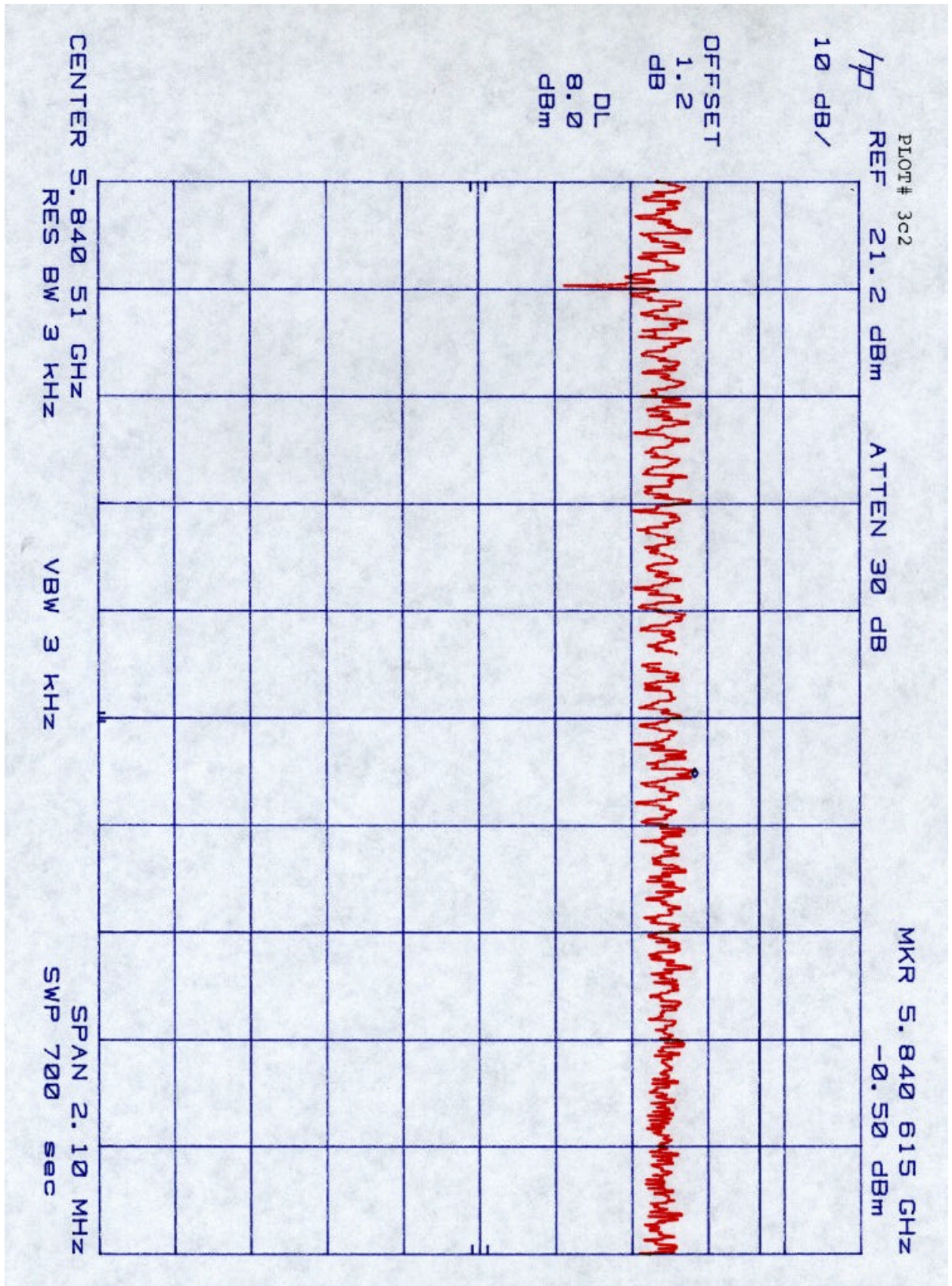












#### 4.4 Out of Band Conducted Emissions, FCC Rule 15.247(c):

In any 100 kHz bandwidth outside the EUT passband, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20 dB below that of the maximum in-band 100 kHz emission, or else shall meet the general limits for radiated emissions at frequencies outside the passband, whichever results in lower attenuation.

All other types of emissions from the EUT shall meet the general limits for radiated frequencies outside the passband.

Refer to the following plots for out of band conducted emissions data:

Plot 4a1 - 4a6: Low Channel Emissions  
Plot 4b1 - 4b5: Middle Channel Emissions  
Plot 4c1 - 4c6: High Channel Emissions

#### 4.5 Out of Band Radiated Emissions ( for emissions in 4. above that are less than 26 dB below carrier), FCC Rule 15.247(c):

For out of band emissions that are close to or that exceed the 20 dB attenuation requirement described in the specification, radiated measurements were performed at a 3 m separation distance to determine whether these emissions complied with the general radiated emission requirement.

[x] Not required  
[ ] See attached data sheet

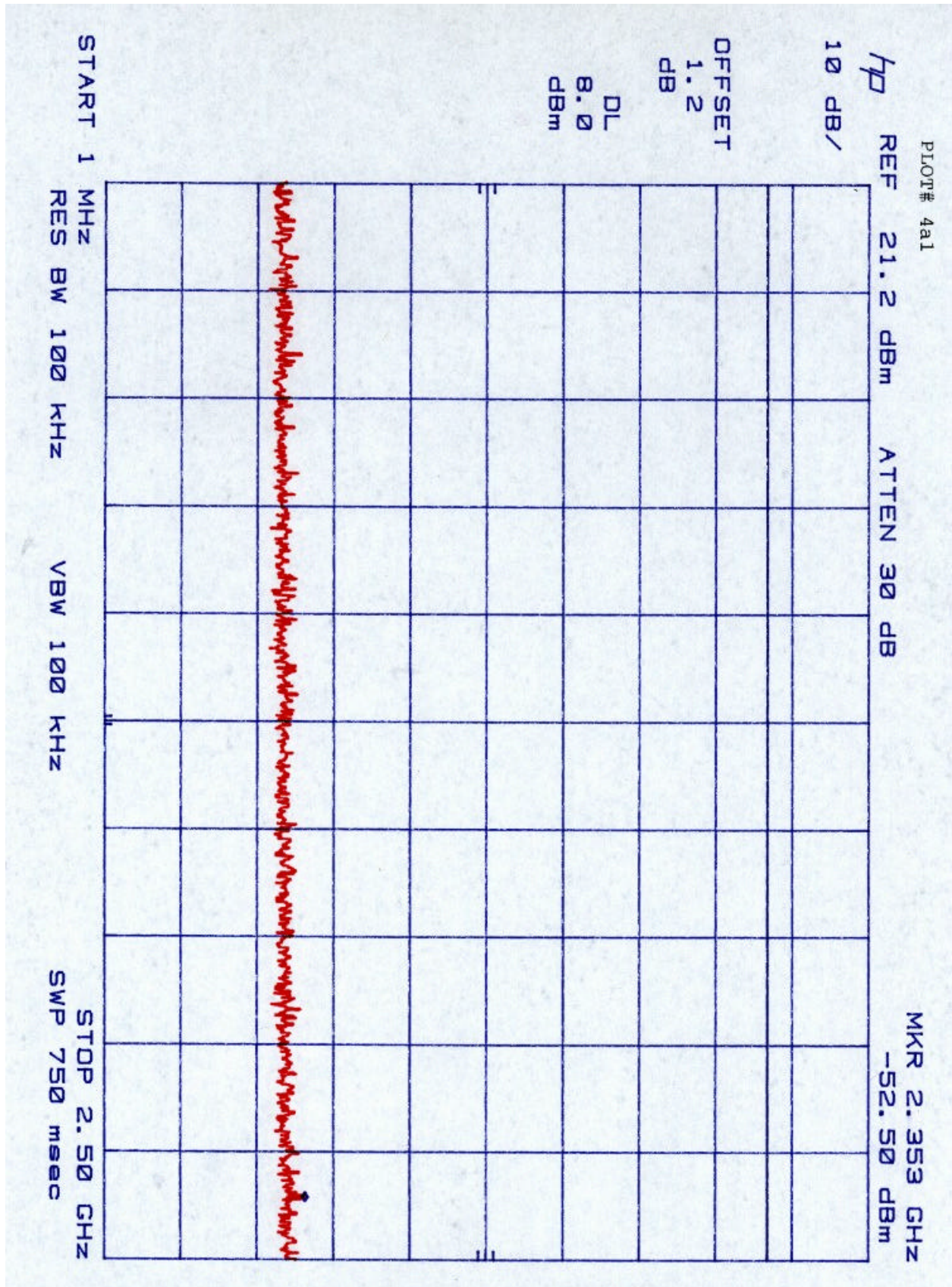
#### 4.6 Transmitter Radiated Emissions in Restricted Bands, FCC Rule 15.35(b), (c):

Radiated emission measurements were performed from 30 MHz to <40,000> MHz. Analyzer resolution is 100 kHz or greater for 30 MHz to 1000 MHz, 1 MHz for >1000 MHz.

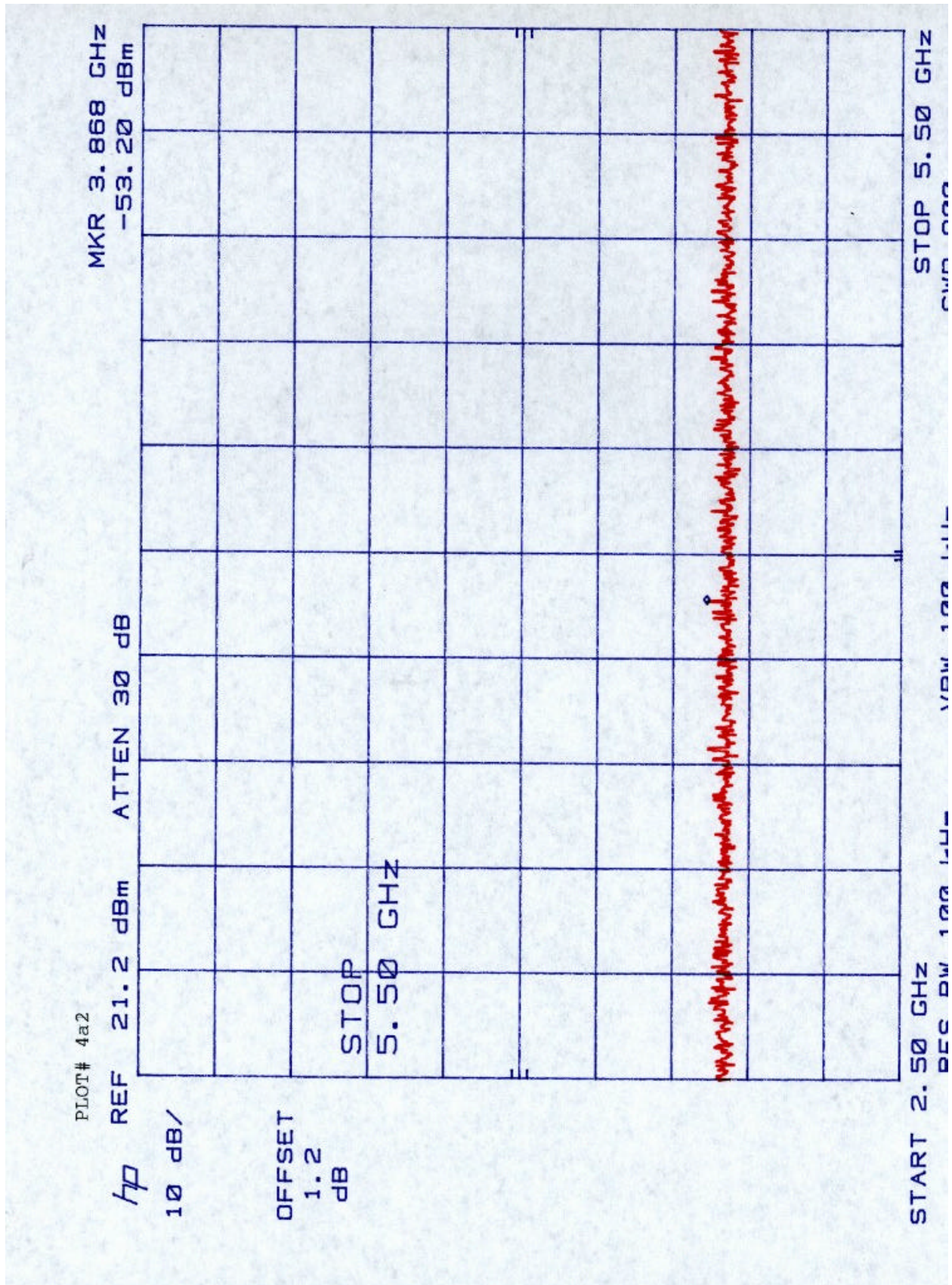
Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included. All measurements were performed with peak detection unless otherwise specified.

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

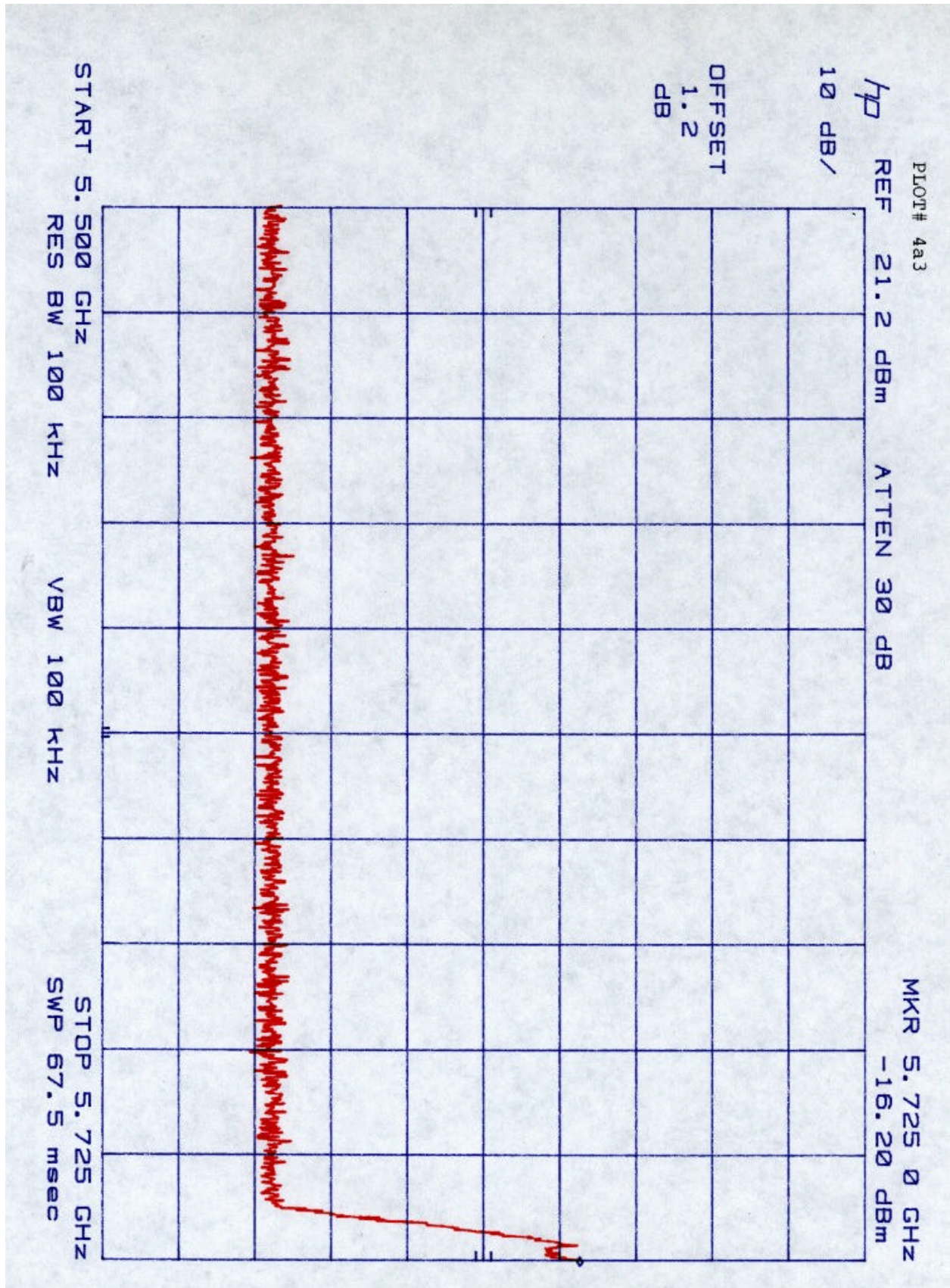




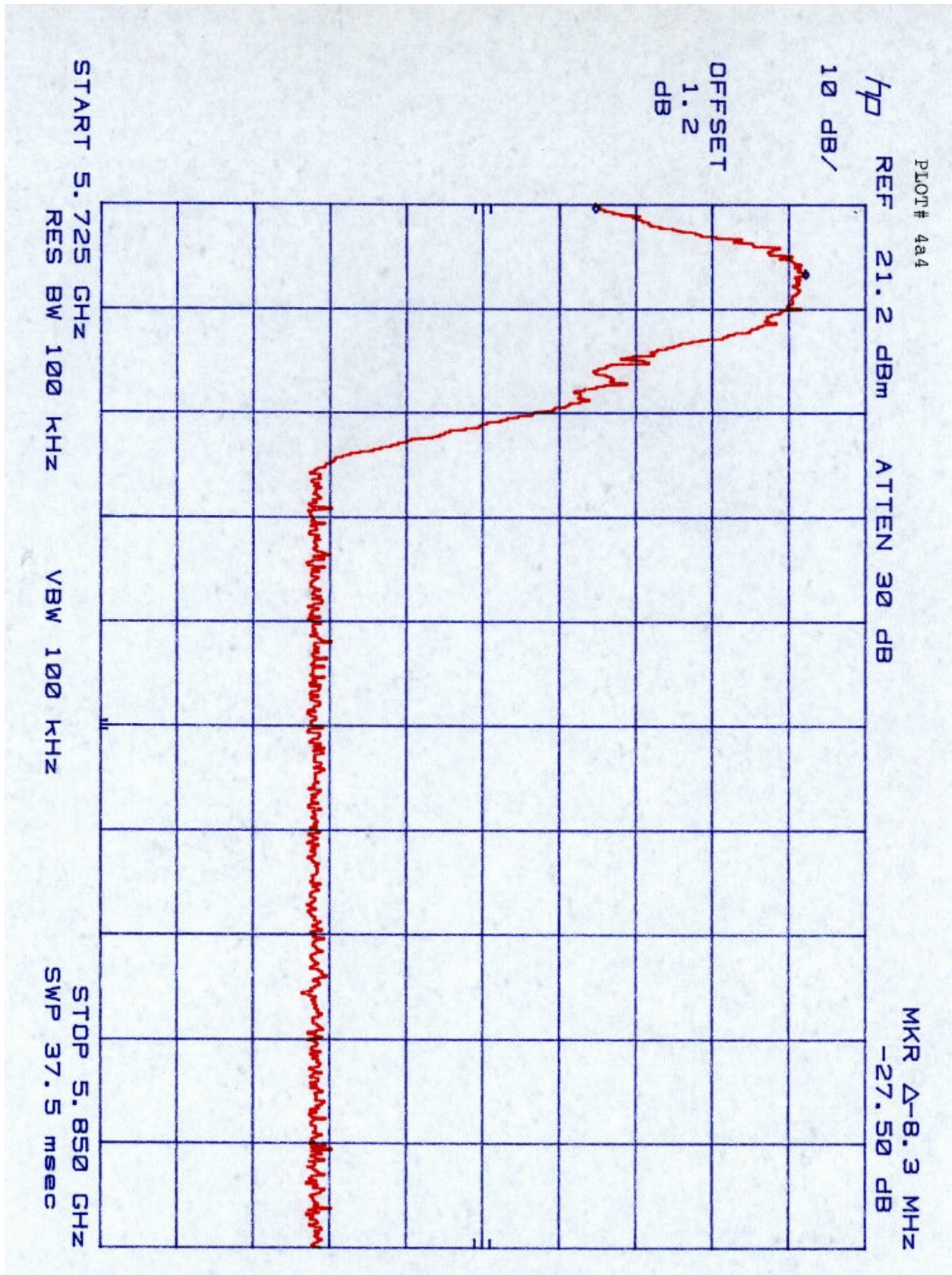




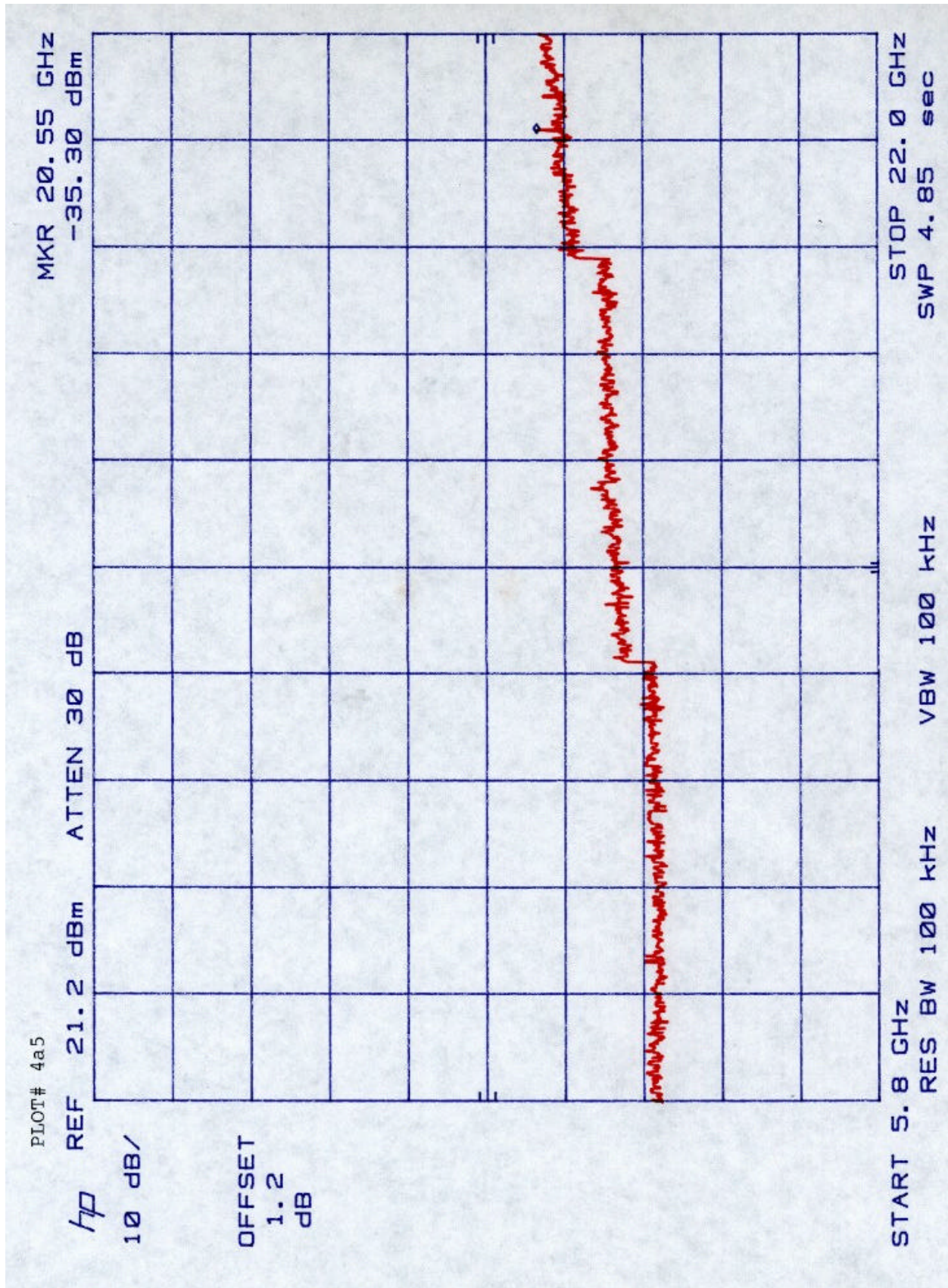




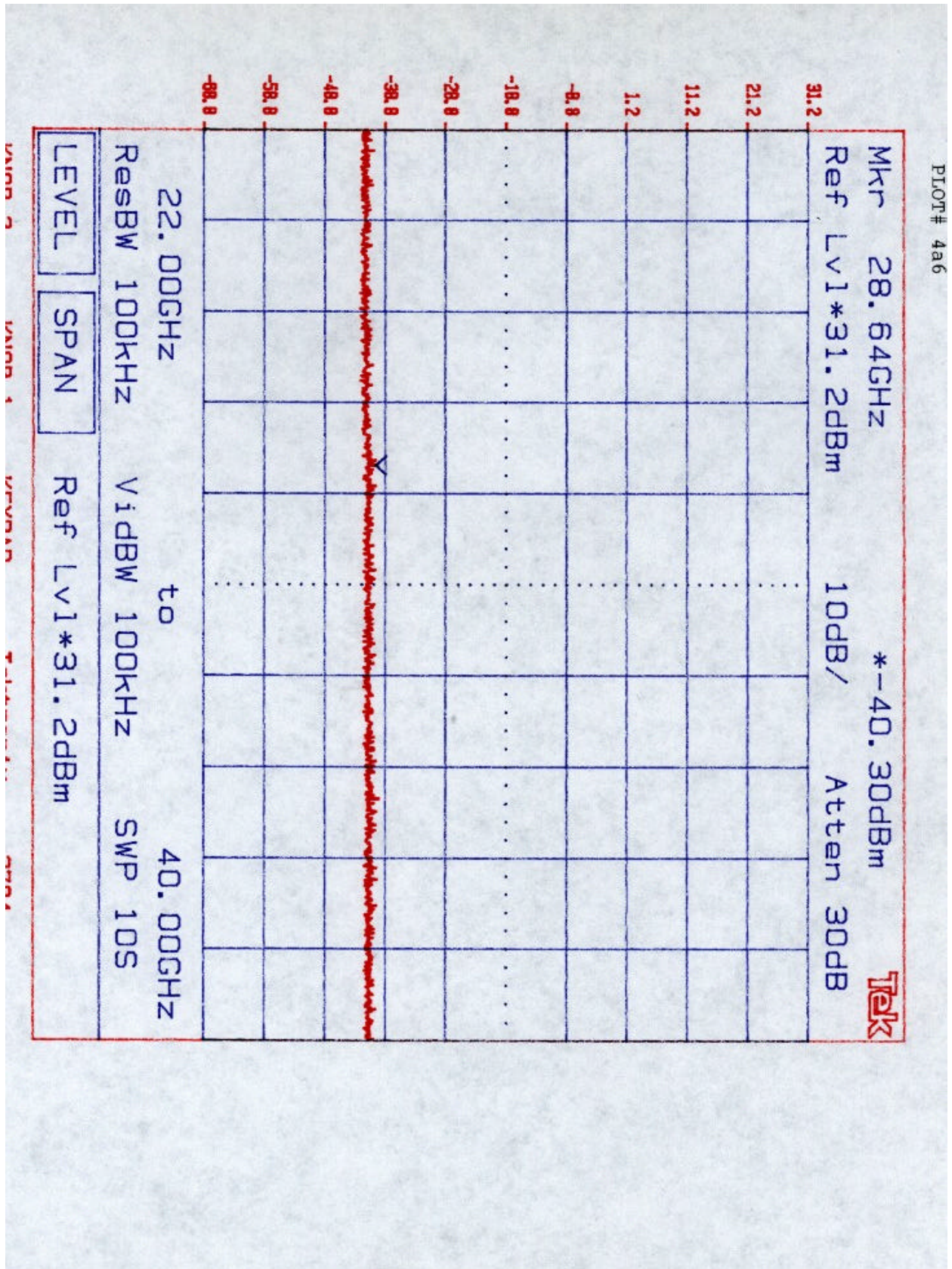




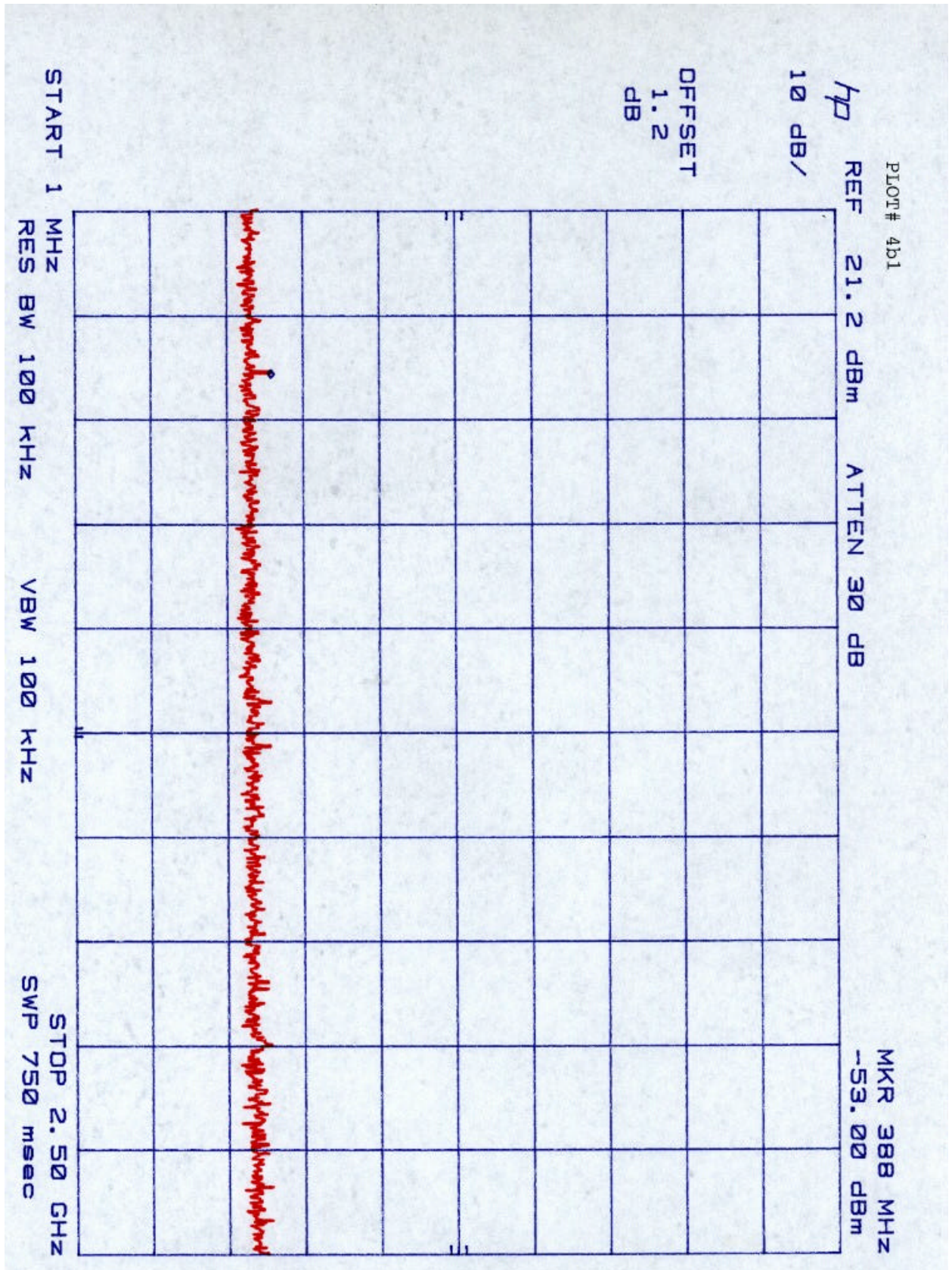




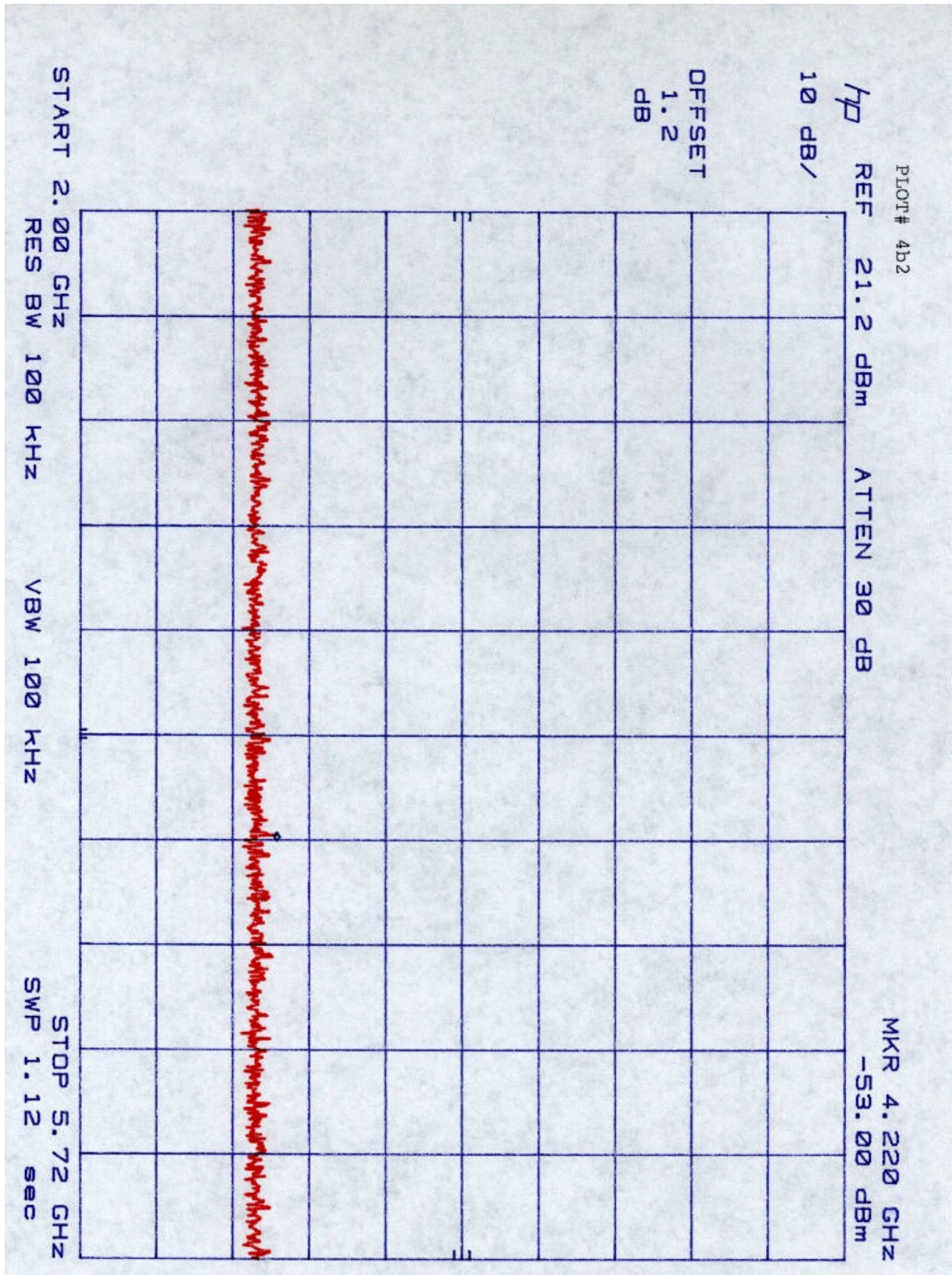




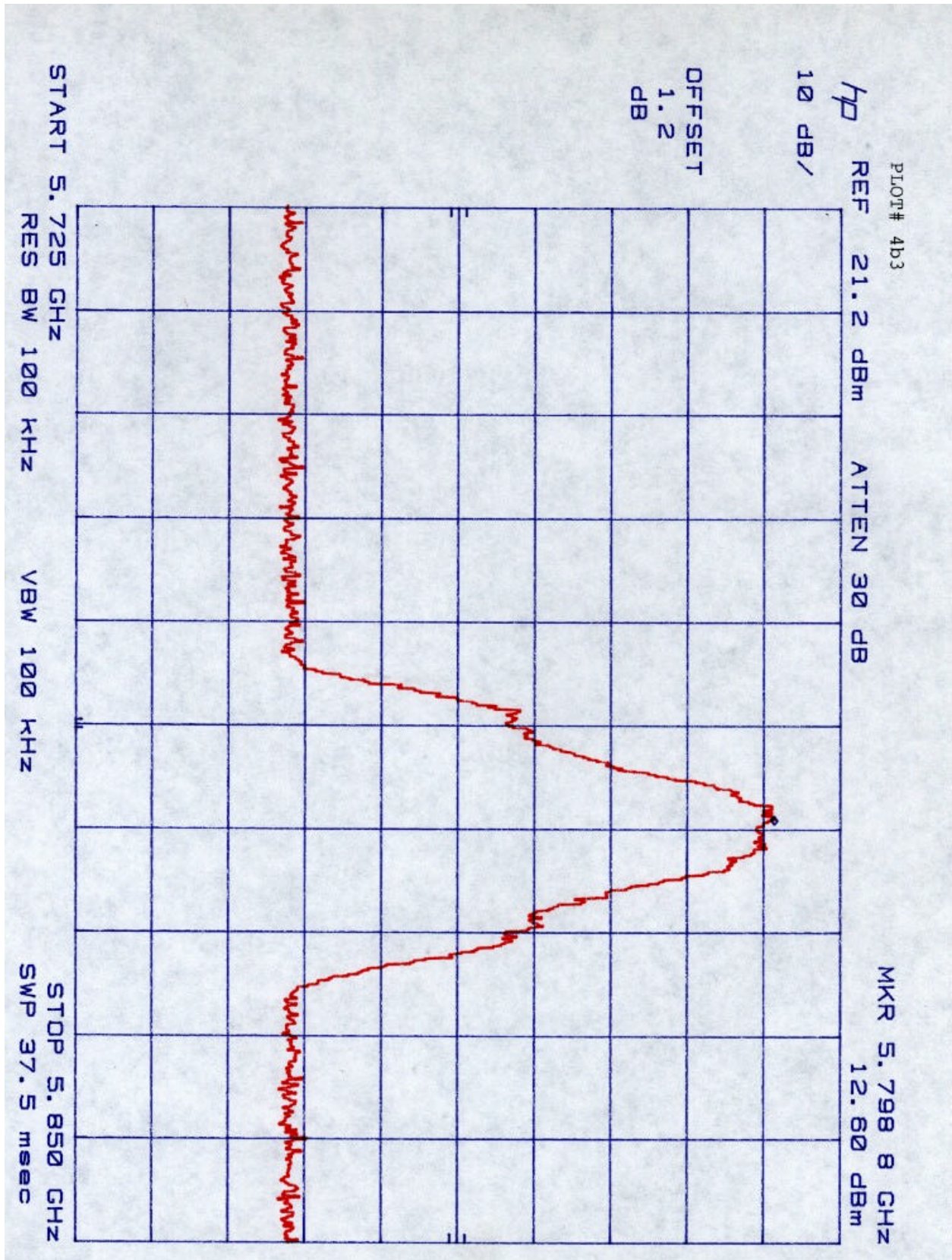




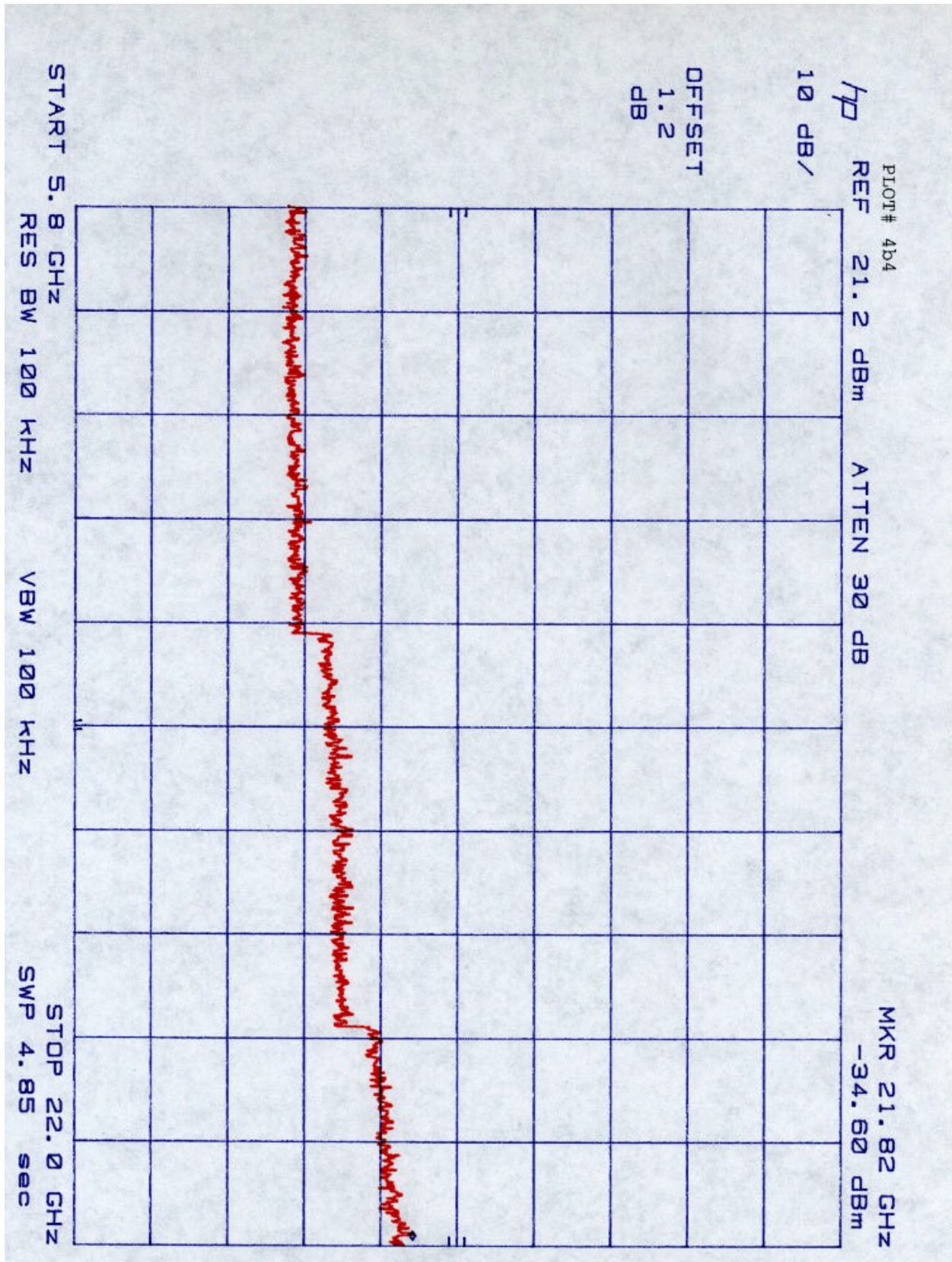




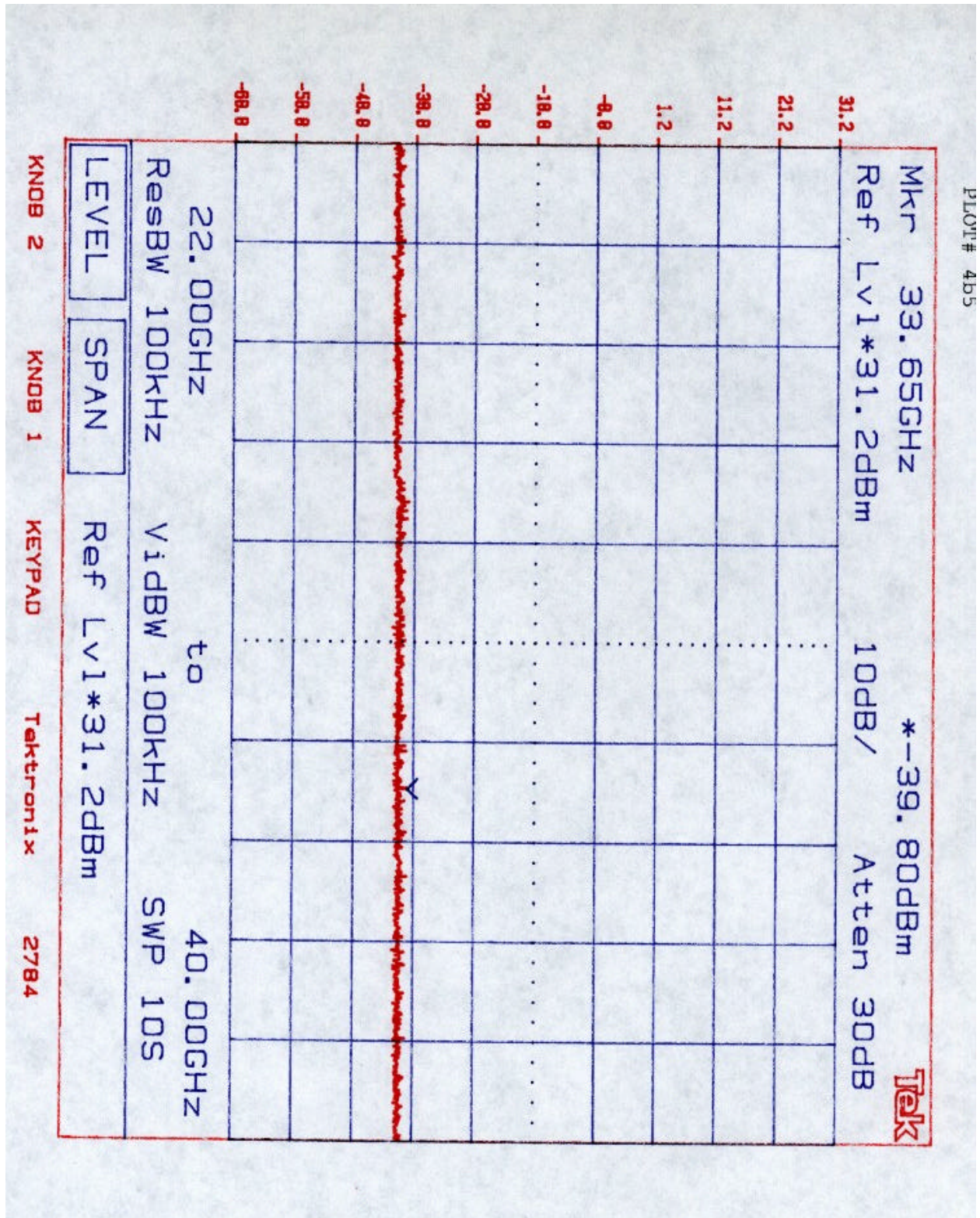




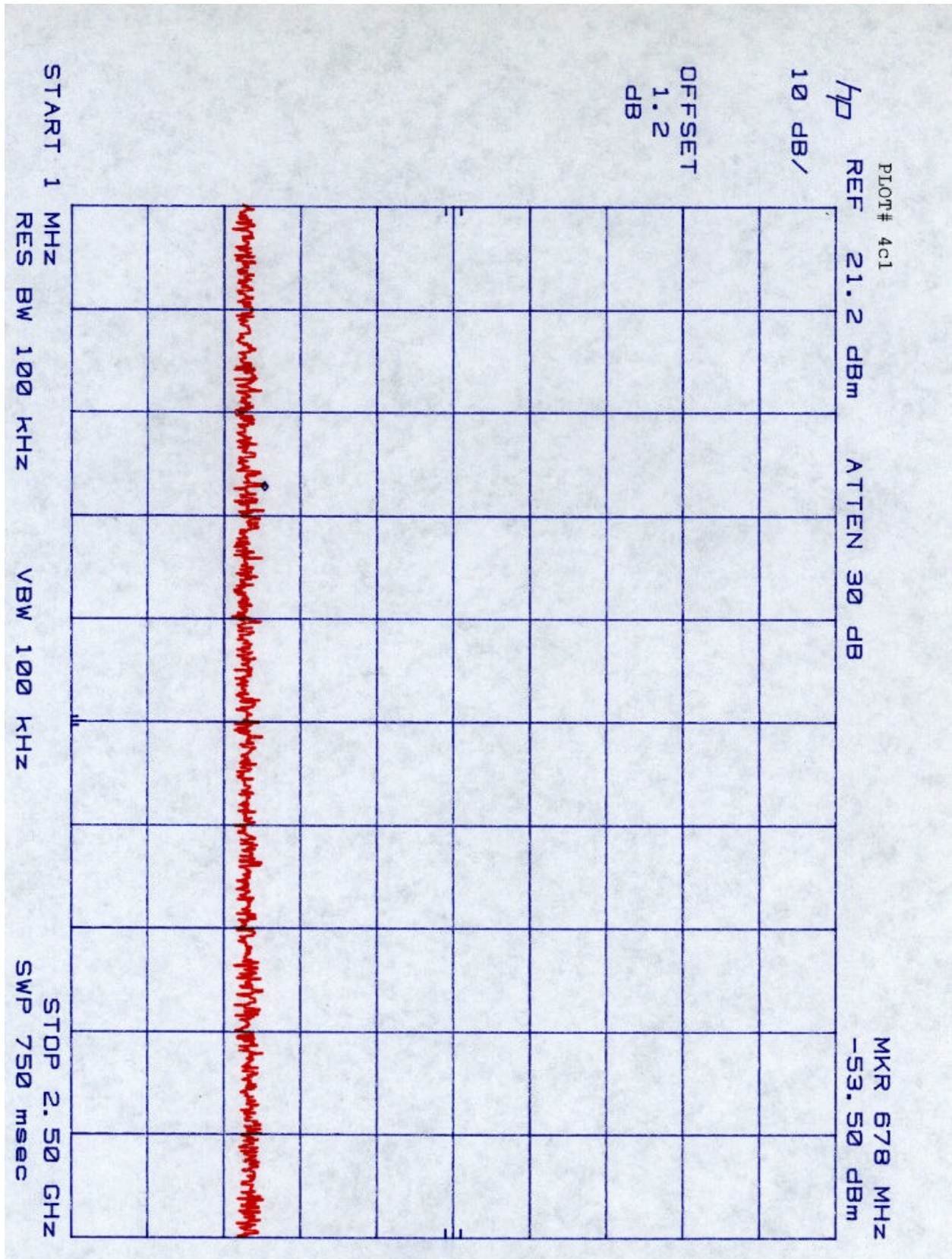




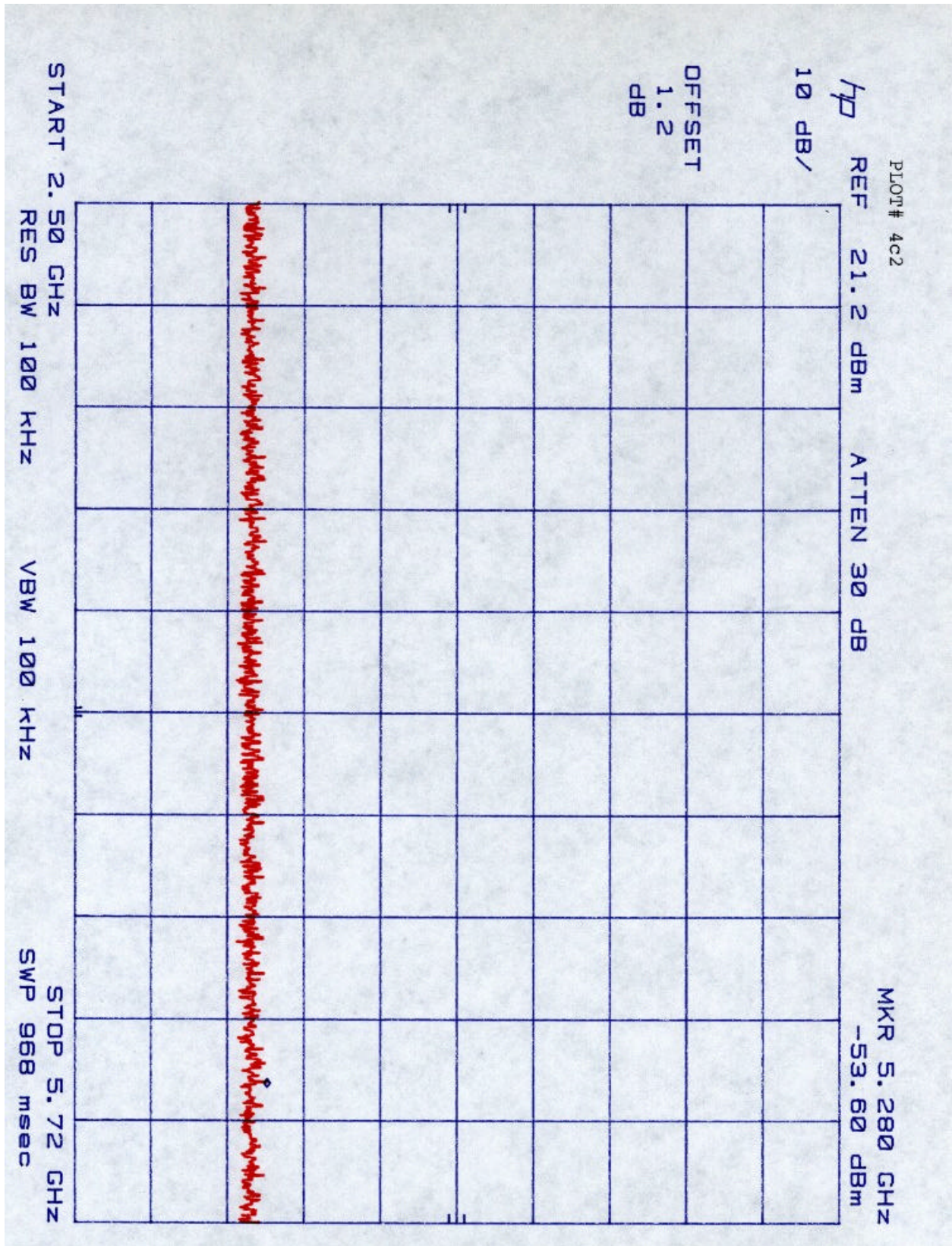




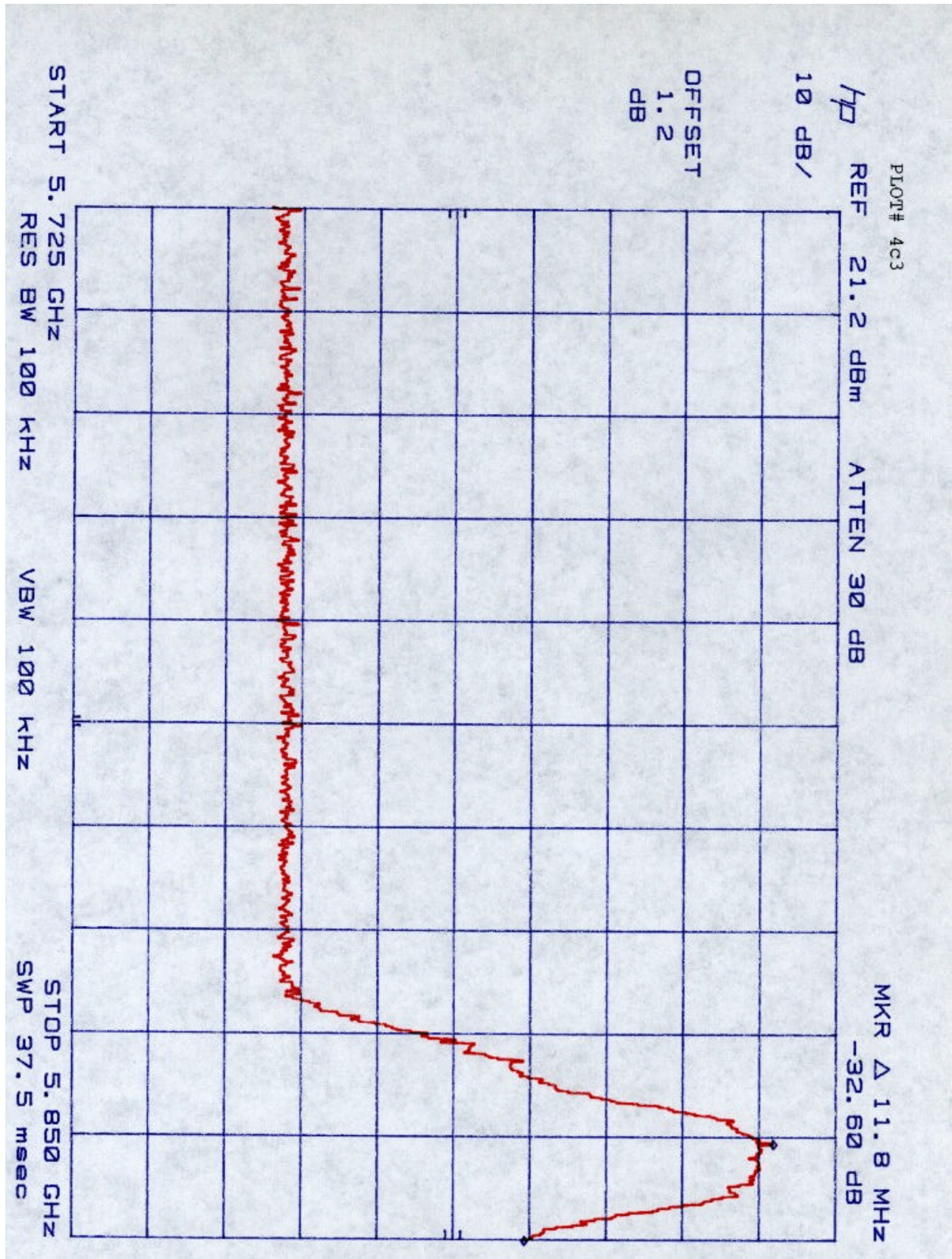




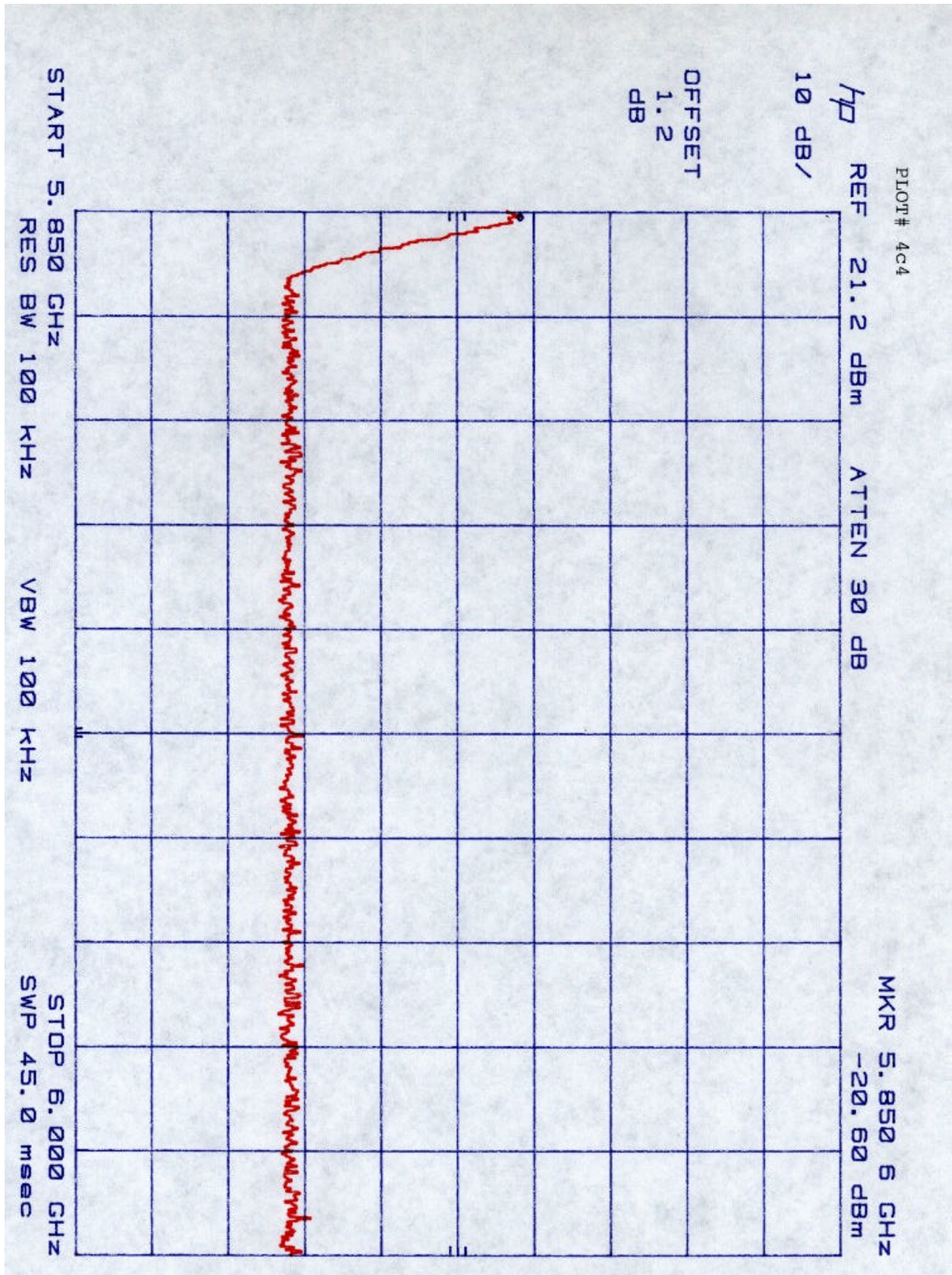




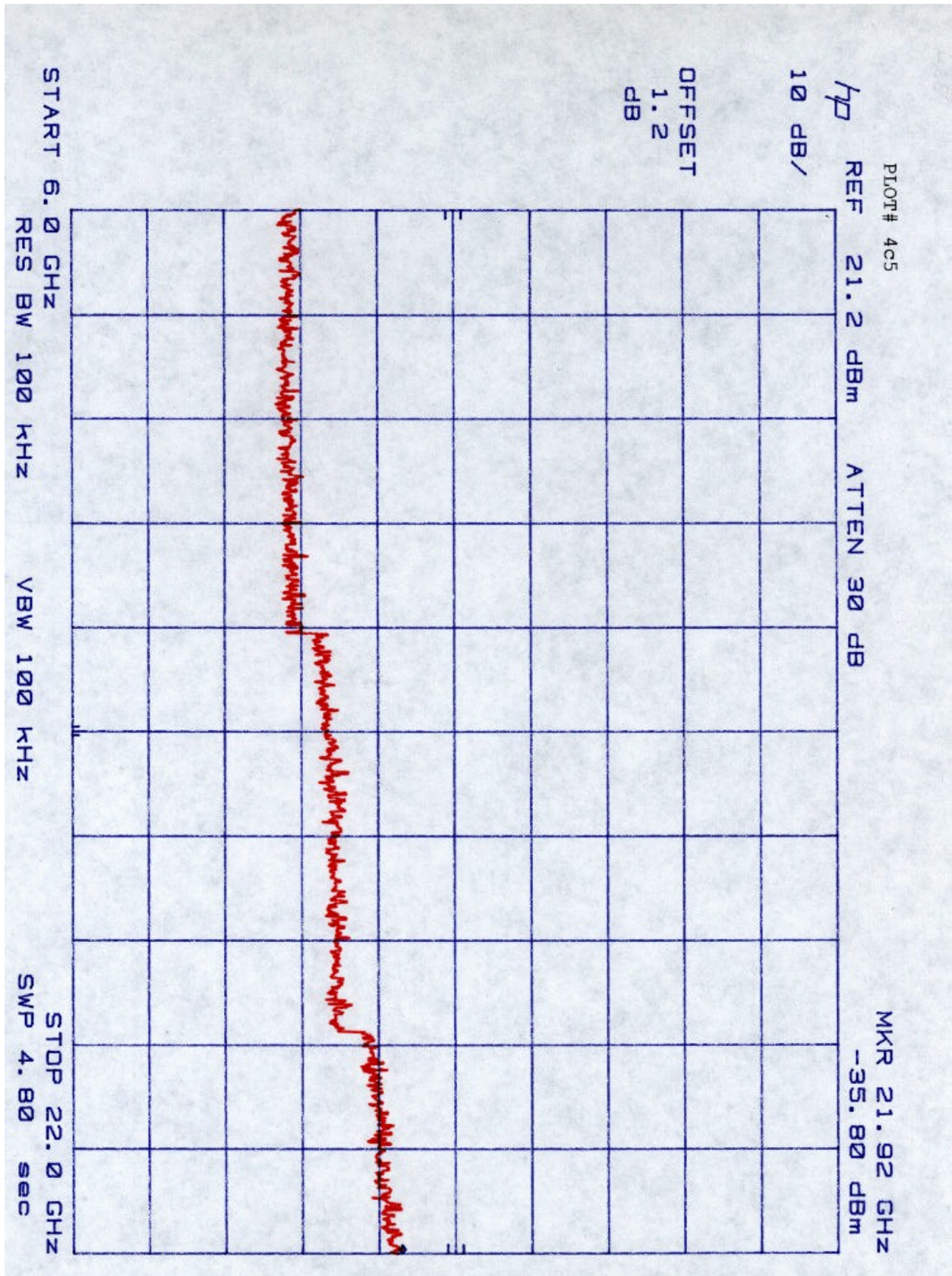




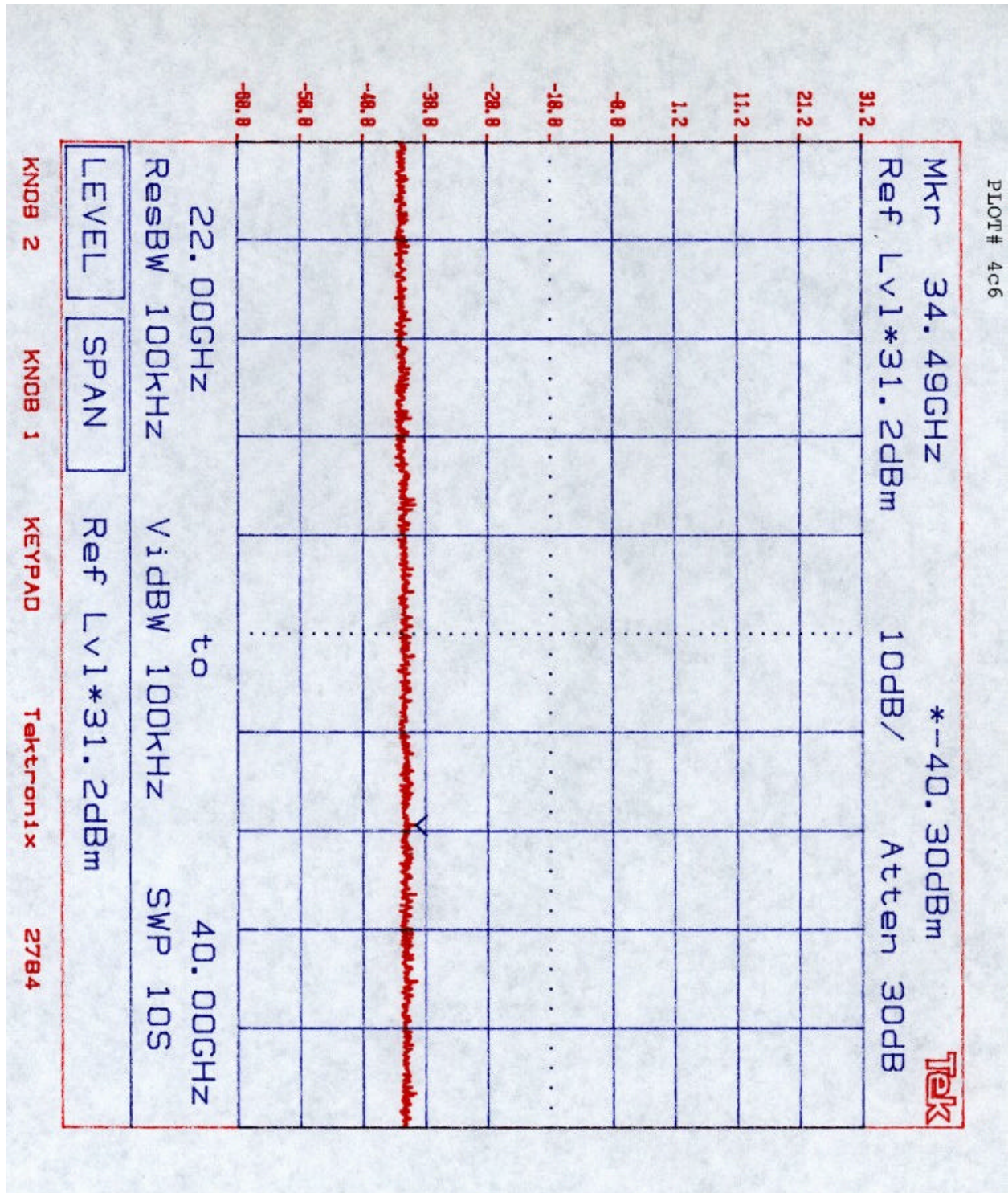












4.7 AC Line Conducted Emission, FCC Rule 15.207:

Not required; battery operation only

Test data attached

4.10 Radiated Emissions from Digital Section of Transceiver (Transmitter), FCC Ref: 15.109

- Not required - No digital part
- Test results are attached
- Included in the separate DOC report.

4.11 Radiated Emissions from Receiver Section of Transceiver (L.O. Radiation), FCC Ref: 15.109, 15.111

- Not required - EUT operation above 960 MHz only
- Not required - EUT is transmitter only
- Not performed; exempt until June 1999
- Test results are attached



#### 4.12 Processing Gain Measurements, FCC Rule 15.247(e)

The processing gain shall be determined from the ratio in dB of the signal to noise ratio with the system spreading code turned OFF, to the signal to noise ratio with the system spreading code turned ON, as measured at the demodulated output of the receiver. The processing gain shall be at least 10 dB for a direct sequence spread spectrum system.

X	Refer to attached test procedure and data sheets.
	Refer to circuit analysis and processing gain calculations provided by manufacturer.

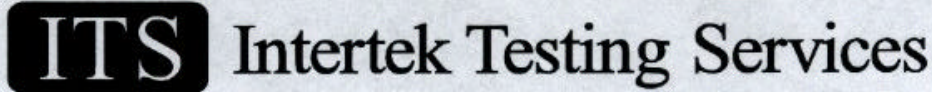
#### 4.13 Transmitter Duty Cycle Calculation and Measurements, FCC Rule 15.35(b), (c)

The EUT antenna output port was connected to the input of the spectrum analyzer. The analyzer center frequency was set to EUT RF channel carrier. The SWEEP function on the analyzer was set to ZERO SPAN. The transmitter ON time was determined from the resultant time-amplitude display:

$$\text{Duty cycle} = \text{Maximum ON time in } 100 \text{ msec}/100$$

$$\text{Duty cycle correction, dB} = 20 * \log(\text{DC})$$

	See attached spectrum analyzer chart(s) for transmitter timing
	See transmitter timing diagram provided by manufacturer
X	Not applicable.



**Company:** Glenayer Western Multiplex  
**Project #:** J98027347  
**Model:** Lynx sc6 5.8 GHz Radio Modem  
**Engineer:** Xi-Ming Yang  
**Date of test:** September 24, 1998

### FCC Part 15 Class B Radiated Emissions

F = 5735 MHz

Frequency	Antenna Polarity	Reading	Antenna Factor	Cable Loss	Pre-amp	Distance Factor	Corrected Reading	Limit	Margin
MHz	H/V	dB(uV)	dB(1/m)	dB	dB	dB	dB(uV/m)	dB(uV/m)	dB
11470.0	V	40.0*	40.1	5.5	-39.7	0.0	45.9	74.0	-28.1
11470.0	V	31.0	40.1	5.5	-39.7	0.0	36.9	54.0	-17.1
22940.0	H	33.0*	44.0	7.5	-24.2	-9.5	50.8	74.0	-23.2
22940.0	H	25.0	44.0	7.5	-24.2	-9.5	42.8	54.0	-11.2

F = 5775 MHz

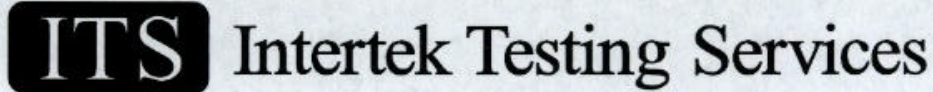
Frequency	Antenna Polarity	Reading	Antenna Factor	Cable Loss	Pre-amp	Distance Factor	Corrected Reading	Limit	Margin
MHz	H/V	dB(uV)	dB(1/m)	dB	dB	dB	dB(uV/m)	dB(uV/m)	dB
11550.0	V	40.5*	40.1	5.5	-39.7	0.0	46.4	74.0	-27.6
11550.0	V	30.5	40.1	5.5	-39.7	0.0	36.4	54.0	-17.6
23100.0	H	33.5*	44.0	7.5	-24.2	-9.5	51.3	74.0	-22.7
23100.0	H	25.5	44.0	7.5	-24.2	-9.5	43.3	54.0	-10.7

F = 5840 MHz

Frequency	Antenna Polarity	Reading	Antenna Factor	Cable Loss	Pre-amp	Distance Factor	Corrected Reading	Limit	Margin
MHz	H/V	dB(uV)	dB(1/m)	dB	dB	dB	dB(uV/m)	dB(uV/m)	dB
11680.0	V	41.0*	40.1	5.5	-39.7	0.0	46.9	74.0	-27.1
11680.0	V	32.0	40.1	5.5	-39.7	0.0	37.9	54.0	-16.1

- Note:**
1. All measurement were made at 3 meters
  2. Negative signs (-) in the margin column signify levels below the limit.
  3. Readings with \* are peak readings. Otherwise the readings are average.
  4. The readings above 20 GHz are noise floor





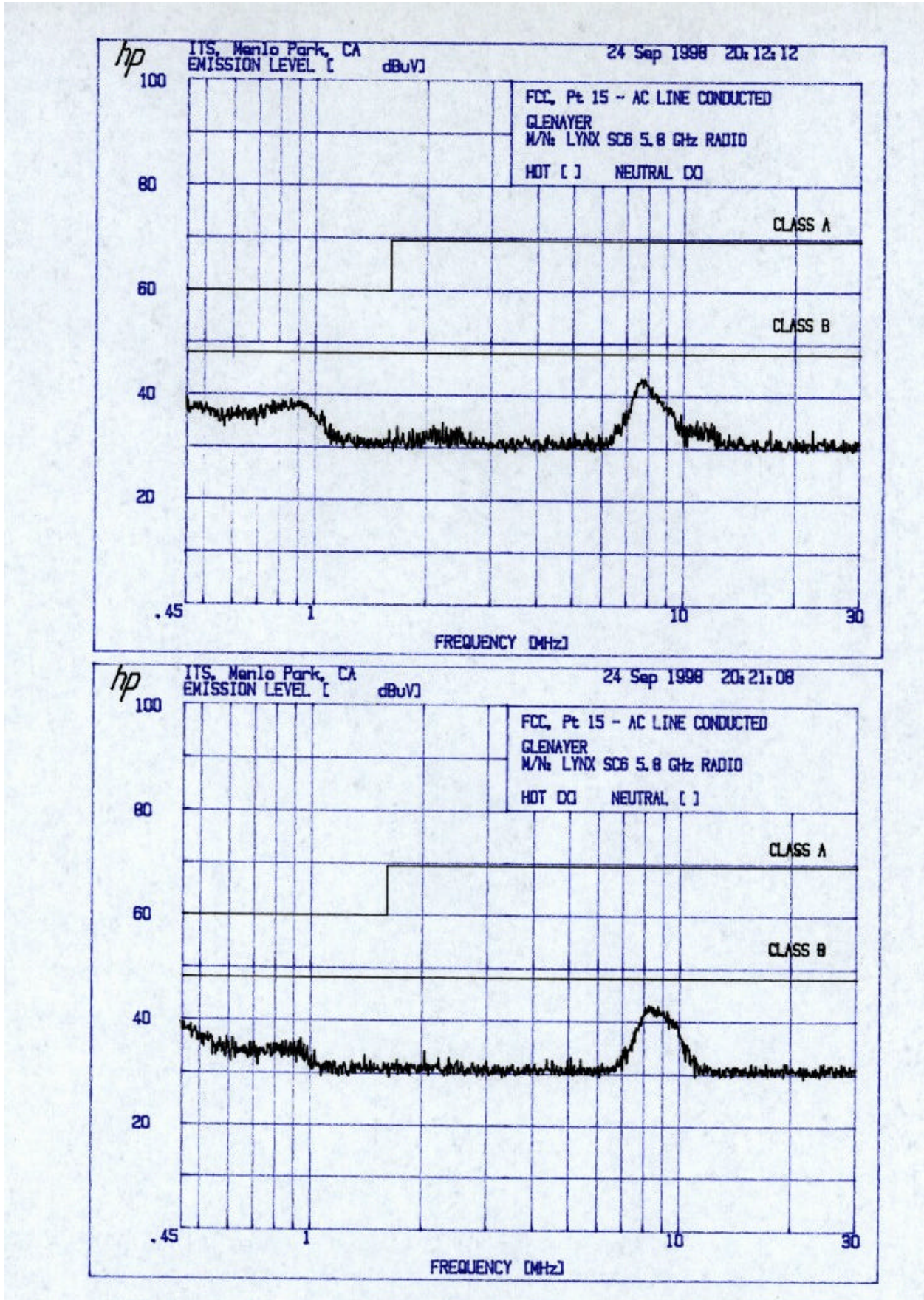
**Company:** Glenayer Western Multiplex  
**Project #:** J98027347  
**Model:** Lynx sc6 5.8 GHz Radio Modem  
**Engineer:** Xi-Ming Yang  
**Date of test:** September 24, 1998

### FCC Part 15 Class B Radiated Emissions

Frequency MHz	Antenna Polarity H/V	Reading dB(uV)	Antenna Factor dB(1/m)	Pre-amp dB	Distance Factor dB	Corrected Reading dB(uV/m)	Limit dB(uV/m)	Margin dB
39.1	V	14.0	10.9	0.0	0.0	24.9	40.0	-15.1
60.0	V	24.0	6.6	0.0	0.0	30.6	40.0	-9.4
125.6	V	16.0	11.5	0.0	0.0	27.5	43.5	-16.0
193.9	V	29.0	9.7	0.0	0.0	38.7	43.5	-4.8
215.3	H	11.8	11.5	0.0	0.0	23.3	43.5	-20.2
251.2	H	16.0	12.4	0.0	0.0	28.4	46.0	-17.6
258.7	H	23.0	12.5	0.0	0.0	35.5	46.0	-10.5
269.1	H	26.0	13.1	0.0	0.0	39.1	46.0	-6.9
305.1	H	19.0	14.1	0.0	0.0	33.1	46.0	-12.9
412.7	H	19.0	16.5	0.0	0.0	35.5	46.0	-10.5
502.5	H	16.0	18.1	0.0	0.0	34.1	46.0	-11.9

- Note:**
1. All measurement were made at 3 meters
  2. Negative signs (-) in the margin column signify levels below the limit.







```
=====
ITS, Menlo Park, CA          24 Sep 1998  20:12:12
=====
3. FCC CFR 47, Pt 15
3.1 FCC, Pt 15 - AC LINE CONDUCTED
=====
GLENAYER
M/N: LYNX SC6 5.8 GHz RADIO

HOT [ ]   NEUTRAL [X]

PEAKS FOUND ABOVE 39 dBuV

PEAK#  FREQ (MHz)  AMPL (dBuV)
  1      .8659      39.2
  2      7.705      43.4
```

```
=====
ITS, Menlo Park, CA          24 Sep 1998  20:21:00
=====
3. FCC CFR 47, Pt 15
3.1 FCC, Pt 15 - AC LINE CONDUCTED
=====
GLENAYER
M/N: LYNX SC6 5.8 GHz RADIO

HOT [X]   NEUTRAL [ ]

PEAKS FOUND ABOVE 38 dBuV

PEAK#  FREQ (MHz)  AMPL (dBuV)
  1      8.274      43.2
```



## 5.0 List of Exhibits

- Exhibit 1*      **ID Label Format**
- Exhibit 2*      **ID Label Location**
- Exhibit 3*      **Equipment Photographs**
- Exhibit 4*      **Block Diagram**
- Exhibit 5*      **Circuit Diagram**
- Exhibit 6*      **This Test Report**
- Exhibit 7*      **Test Setup Photos**
- Exhibit 8*      **Instruction Manual**
- Exhibit 9*      **Antenna Information**