



## **APPLICATION FOR FCC PART 90 & 101 CERTIFICATION**

**Teledesign Systems Inc.**

**Radio Modem with 3492 Transceiver  
Model No.: TS4000-05Dff**

**FCC ID: JWFTS4000D**

**Report # J98033454E**

**Date of Report: December 21, 1998**

**Total No. of Pages Contained in this Report: 73**

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FCC Part 90 & 101 Certification

# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

Date of Test: December 11, 1998

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## 1.0 Introduction

### 1.1 Test Summary

| FCC RULE                                   | DESCRIPTION OF TEST                                         | RESULT | PAGE |
|--------------------------------------------|-------------------------------------------------------------|--------|------|
| 2.985(a)                                   | RF Power Output                                             | Pass   | 3    |
| 90.205                                     | Effective Radiated Power                                    | Pass   | 7    |
| 2.989(i), 90.209(b)(5),<br>90.210, 101.115 | Occupied Bandwidth, Bandwidth Limitation,<br>Emission Masks | Pass   | 9    |
| 2.991, 90.210                              | Spurious Emissions at Antenna Terminals                     | Pass   | 30   |
| 2.993, 15.109, 90.210                      | Field Strength of Spurious Radiation                        | Pass   | 44   |
| 15.107                                     | Line Conducted Emissions                                    | Pass   | 50   |
| 2.995(a)                                   | Frequency Stability vs. Temperature                         | Pass   | 54   |
| 2.995(d)(3)                                | Frequency Stability vs. Voltage                             | Pass   | 55   |
| 90.214                                     | Transient Frequency Behavior                                | Pass   | 56   |

*Xi-Ming Yang*

Xi-Ming Yang  
Test Engineer

February 2, 1999  
Date

# **INTERTEK TESTING SERVICES - Menlo Park**

**Teledesign Radio Modem with 3492 Transceiver**

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## **1.2 Product Description**

The unit under test is a radio modem with 3492 transceiver.

## **1.3 Related Submittal(s) Grants**

[X] Type acceptance granted for the radio transceiver used in this radio modem .

Applicant: Johnson Data Telemetry Corporation

FCC ID: NP42423492-001

Date of Grant: February 26, 1998

File No.: 31010/EQU 17.9

[X] DOC for computer section, a separate DOC is prepared.

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## 2.0 RF Power Output, FCC §2.985(a)

### 2.1 Test Procedure

The transmitter output was connected to a calibrated coaxial attenuator, the other end of which was connected to a spectrum analyzer. The resolution bandwidth and the video bandwidth of the spectrum analyzer were set up to 300 kHz and 300 kHz respectively. The attenuator was included in spectrum analyzer OFFSET function.

Transmitter output was read off the spectrum analyzer in dBm.

### 2.2 Test Equipment

Hewlett Packard 8481A Power Sensor, 435B Power Meter

Hewlett Packard HP8566B Spectrum Analyzer, 100 Hz - 22 GHz

Tektronix 2782 Spectrum Analyzer, 100 Hz - 40 GHz

### 2.3 Test Results

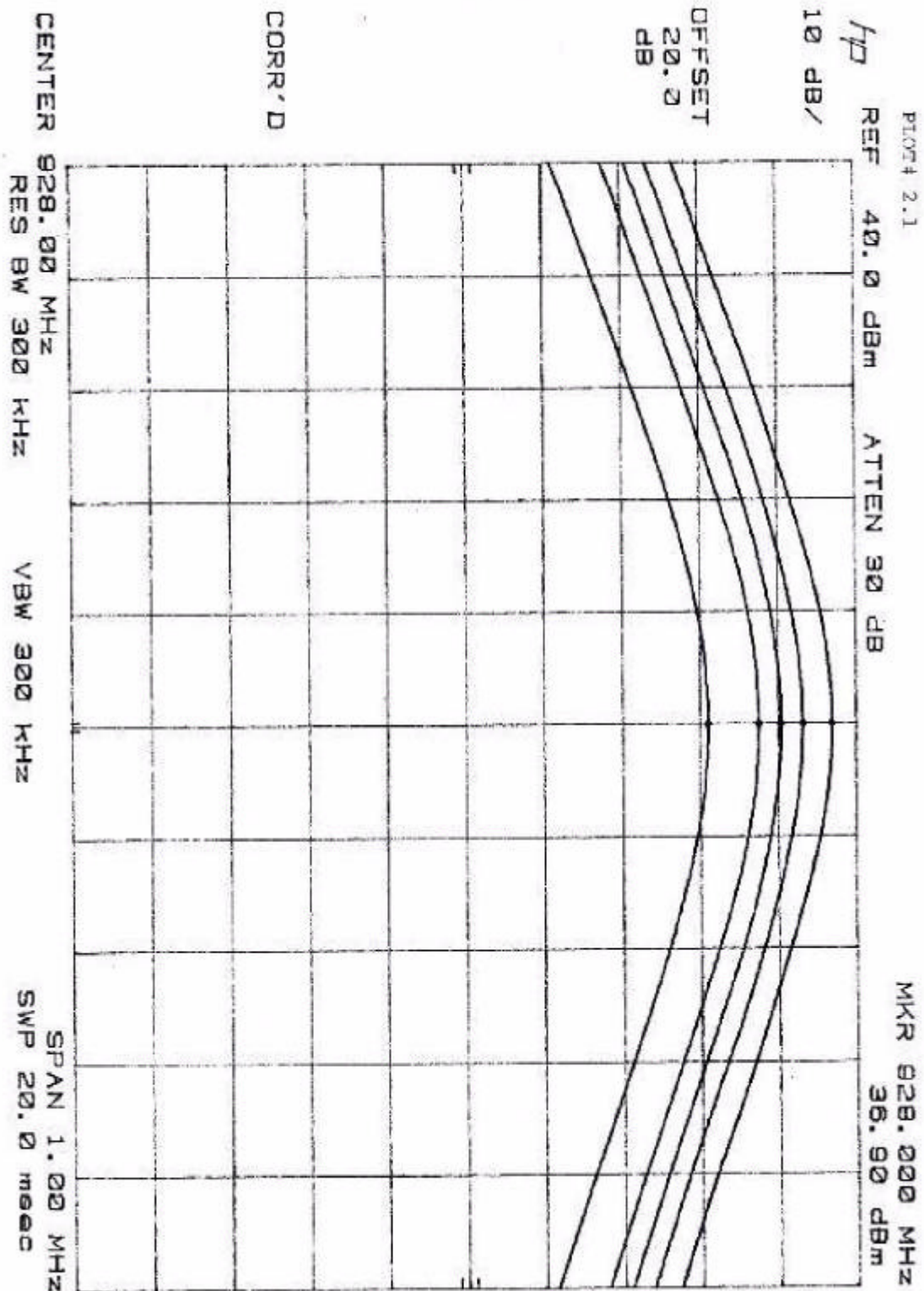
Refer to the attached plot #2.1-2.3 and table below:

| Power Level<br>(Watt) | Reading, dBm |         |         |
|-----------------------|--------------|---------|---------|
|                       | 960 MHz      | 944 MHz | 928 MHz |
| 5                     | 36.9         | 37.0    | 36.9    |
| 2                     | 33.4         | 33.4    | 33.2    |
| 1                     | 30.5         | 30.5    | 30.3    |
| 0.5                   | 27.4         | 27.6    | 27.5    |
| 0.1                   | 21.1         | 21.2    | 21.0    |

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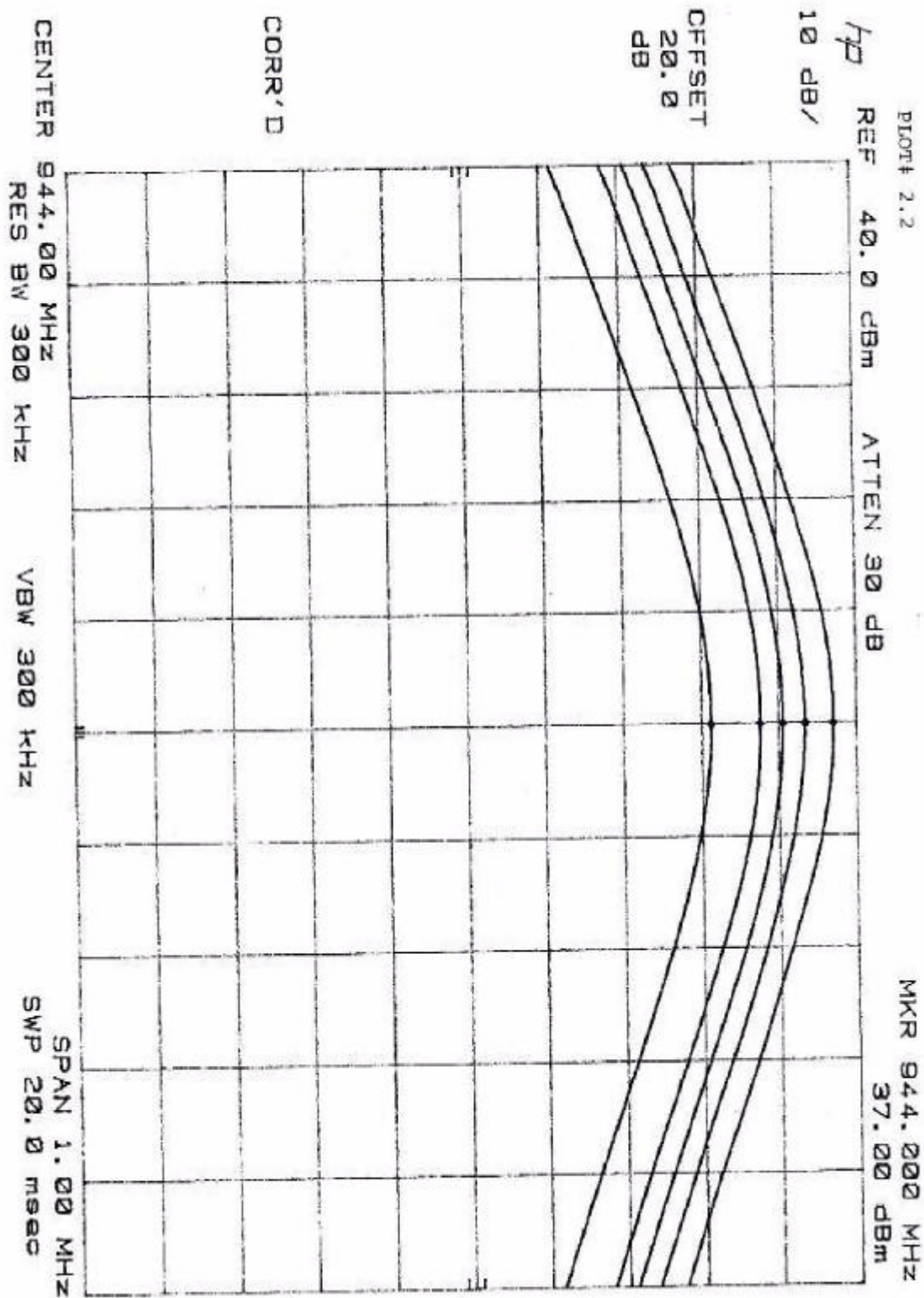
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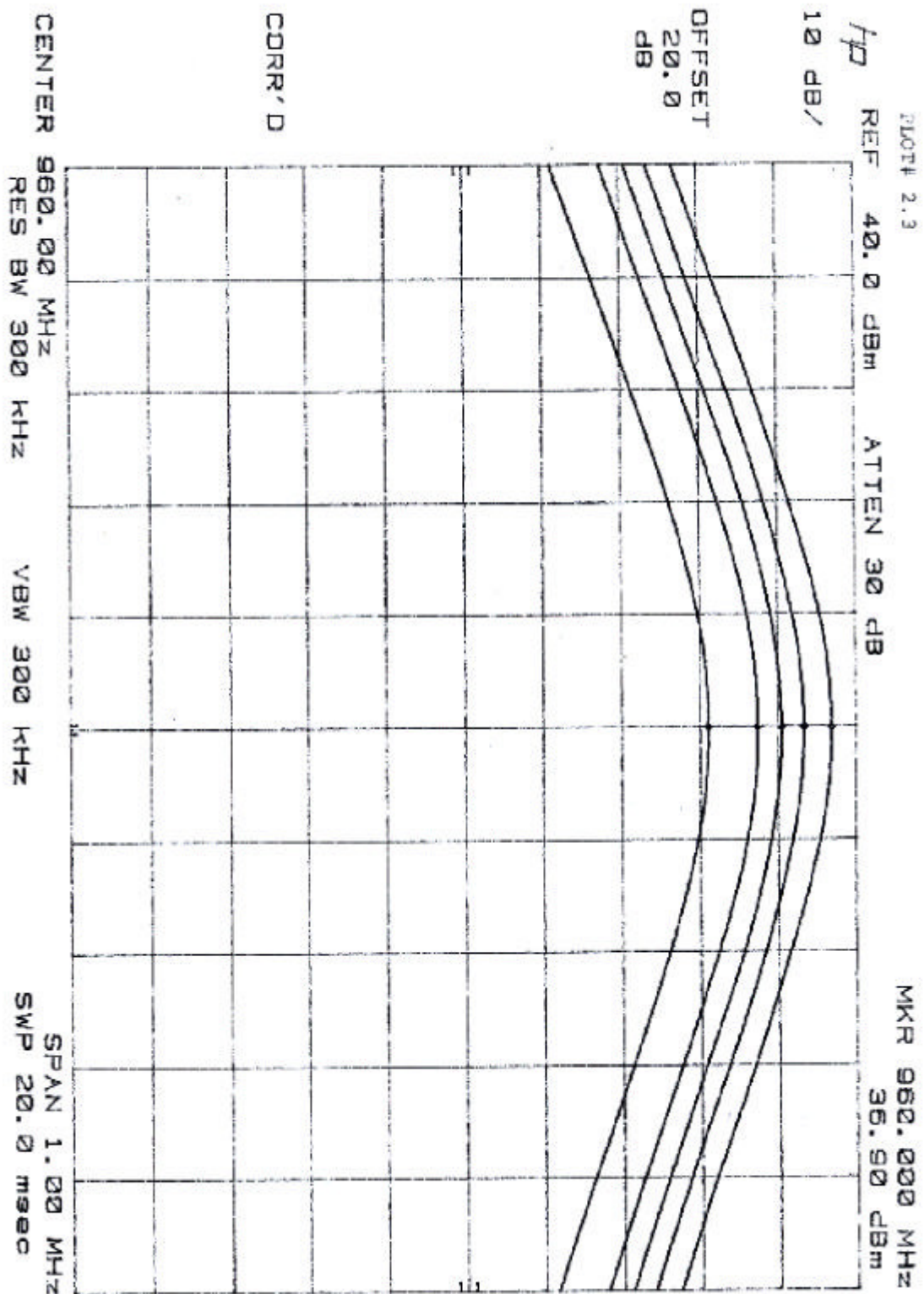
Date of Test: December 11, 1998



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## 3.0 Effective Radiated Power, FCC § 90.205

### 3.1 Test Procedure

The EUT was positioned on a non-conductive turntable, 0.8m above the ground plane on an open test site.

The radiated emission at the fundamental frequency was measured at 3m distance with a test antenna and spectrum analyzer. During the measurement, the resolution and video bandwidth of the spectrum analyzer were set to 100 kHz. The maximum emission was recorded with the rotation of the turntable and the raising and lowering of the test antenna. The spectrum analyzer reading was recorded.

The ERP was calculated as follows:

$$ERP_{(dBm)} = E_{(dBuV/m)} + 20 \log D - 10 \log 30 - 10 \log G - 90$$

where D = 3m, distance

G = 1.64, gain of half-wave dipole

### 3.2 Test Equipment

Hewlett Packard HP8566B Spectrum Analyzer

CDI Biconical Antenna

### 3.3 Test Results

The maximum ERP is 4.7W.

Refer to the attached data.

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Teledesign Radio Modem with 3492 Transceiver

Date of Test: December 11, 1998



Company: Teledesign System Inc.  
Project #: J98033454  
Model: JWFTS4000D  
Engineer: Xi-Ming Yang  
Date of test: Dec. 11, 1998

## FCC 90 Radiated Emissions

| Frequency | Antenna  | Reading | Antenna | Pre-amp | Cable | Corrected | EIRP <sup>1</sup> | ERP  |
|-----------|----------|---------|---------|---------|-------|-----------|-------------------|------|
| MHz       | Polarity | dB(uV)  | Factor  | dB      | Loss  | Reading   | dB(pW)            | dBm  |
|           | H/V      |         | dB(1/m) |         | dB    | dB(uV/m)  |                   |      |
| 960.0     | V        | 110.2   | 23.0    | 0.0     | 0.9   | 134.1     | 128.9             | 36.7 |
| 944.0     | V        | 109.9   | 23.0    | 0.0     | 0.9   | 133.8     | 128.6             | 36.4 |
| 928.0     | V        | 109.8   | 23.0    | 0.0     | 0.9   | 133.7     | 128.5             | 36.3 |

Note: 1. All measurement were made at 3 meters

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## 4.0 Occupied Bandwidth, Bandwidth Limitation, Emission masks. FCC §2.989(i), 90.209(b)(5), 90.210, 101.111

### 4.1 Test Procedure

The antenna was disconnected from the transmitter and the short cable was connected to the transmitter RF output.

The RF output was connected to the input of the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set up at least 10 times higher than the authorized bandwidth of the transmitter. The spectrum analyzer reading was recorded and plotted. This reading is used as a reference for emission mask measurements.

The resolution bandwidth of the spectrum analyzer was set up to 100 Hz and the spectrum of the transmitting signal (random pattern) was recorded. This spectrum was compared to the required emission mask.

### 4.2 Test Equipment

HP 8566B Spectrum Analyzer, 100 Hz - 22 GHz

HP 7470A Plotter

### 4.3 Test Results

The EUT meets the requirements for the emission masks C and D for the Emission Designators:

25K0F1D

20K0F1D

12K5F1D

11K2F1D

Refer to the attached plots 4.1 - 4.18.

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Teledesign Radio Modem with 3492 Transceiver

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Occupied Bandwidth Plots:

| Transmitting at 153 MHz |                     |                    |                     |                                                      |
|-------------------------|---------------------|--------------------|---------------------|------------------------------------------------------|
| Plot #                  | Emission Mask       | Type of Modulation | Emission Designator | Description                                          |
| 4.1                     | C, G<br>101.111a(6) | 4LFSK              | 25K0F1D<br>20K0F1D  | B=32 kbps, M=4 kHz, D=6 kHz, Span 100 kHz            |
| 4.2                     | C, G<br>101.111a(6) | 4LFSK              | 20K0F1D             | B=32 kbps, M=4 kHz, D=6 kHz, Span 200 kHz            |
| 4.3                     | J<br>101.111a(5)    | 4LFSK              | 12K5F1D             | B=16 kbps, M=2 kHz, D=4250 kHz, Span 100 kHz         |
| 4.4                     | C, G<br>101.111a(6) | GMSK,<br>BT=0.3    | 20K0F1D             | B=19.2 kbps, M=6.4 Hz, D=3.6 kHz, Span 100 kHz       |
| 4.5                     | C, G<br>101.111a(6) | GMSK,<br>BT=0.3    | 20K0F1D             | B=19.2 kbps, M=6.4 kHz, D=3.6 kHz, Span 200 kHz      |
| 4.6                     | D, J<br>101.111a(5) | GMSK,<br>BT=0.3    | 11K2F1D             | B=9.6 kbps, M=3.2 kHz, D=2.4 kHz, Span 100 kHz       |
| 4.7                     | C, G<br>101.111a(6) | GMSK,<br>BT=0.5    | 20K0F1D             | B=14 kbps, M=7.0 kHz, D=3.0 kHz, Span 100 kHz        |
| 4.8                     | C, G<br>101.111a(6) | GMSK,<br>BT=0.5    | 20K0F1D             | B=14 kbps, M=7.0 kHz, D=3.0 kHz, Span 200 kHz        |
| 4.9                     | D, J<br>101.111a(5) | GMSK,<br>BT=0.5    | 11K2F1D             | B=7.2 kbps, M=3.6 kHz, D=2.0 kHz, Span 100 kHz       |
| 4.10                    | C, G<br>101.111a(6) | 4LFSK              | 20K0F1D             | B=32 kbps, M=4 kHz, D=6 kHz, Span 200 kHz, Low Power |
| 4.11                    | C, G<br>101.111a(6) | GMSK,<br>BT=0.5    | 20K0F1D             | B=14 kbps, M=7 kHz, D=3 kHz, Span 100 kHz, Low Power |
| 4.18                    | D                   | 4LFSK              | 11K2F1D             | B=15 kbps, M=1875 Hz, D=3750 kHz, Span 100 kHz       |

\* = These are for special subparts of the Rules (See General Information Sheet With Bandwidths)

B = Channel Baud Rate, M = Modulation Frequency, D = Peak Deviation

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| Transmitting at 960 MHz |                     |                    |                     |                                                 |
|-------------------------|---------------------|--------------------|---------------------|-------------------------------------------------|
| Freq. MHz               | Emission Mask       | Type of Modulation | Emission Designator | Description                                     |
| 4.12                    | C, G<br>101.111a(6) | 4LFSK              | 20K0F1D             | B=32 kbps, M=4 kHz, D=6 kHz, Span 200 kHz       |
| 4.13                    | C, G<br>101.111a(6) | GMSK,<br>BT=0.3    | 20K0F1D             | B=19.2 kbps, M=6.4 kHz, D=3.6 kHz, Span 200 kHz |
| 4.14                    | C, G<br>101.111a(6) | GMSK,<br>BT=0.5    | 20K0F1D             | B=14 kbps, M=7 kHz, D=3 kHz, Span 200 kHz       |

| Transmitting at 928 MHz |                     |                    |                     |                                                 |
|-------------------------|---------------------|--------------------|---------------------|-------------------------------------------------|
| Freq. MHz               | Emission Mask       | Type of Modulation | Emission Designator | Description                                     |
| 4.15                    | C, G<br>101.111a(6) | 4LFSK              | 20K0F1D             | B=32 kbps, M=4 kHz, D=6 kHz, Span 200 kHz       |
| 4.16                    | C, G<br>101.111a(6) | GMSK,<br>BT=0.3    | 20K0F1D             | B=19.2 kbps, M=6.4 kHz, D=3.6 kHz, Span 200 kHz |
| 4.17                    | C, G<br>101.111a(6) | GMSK,<br>BT=0.5    | 20K0F1D             | B=14 kbps, M=7 kHz, D=3 kHz, Span 200 kHz       |

B = Channel Baud Rate

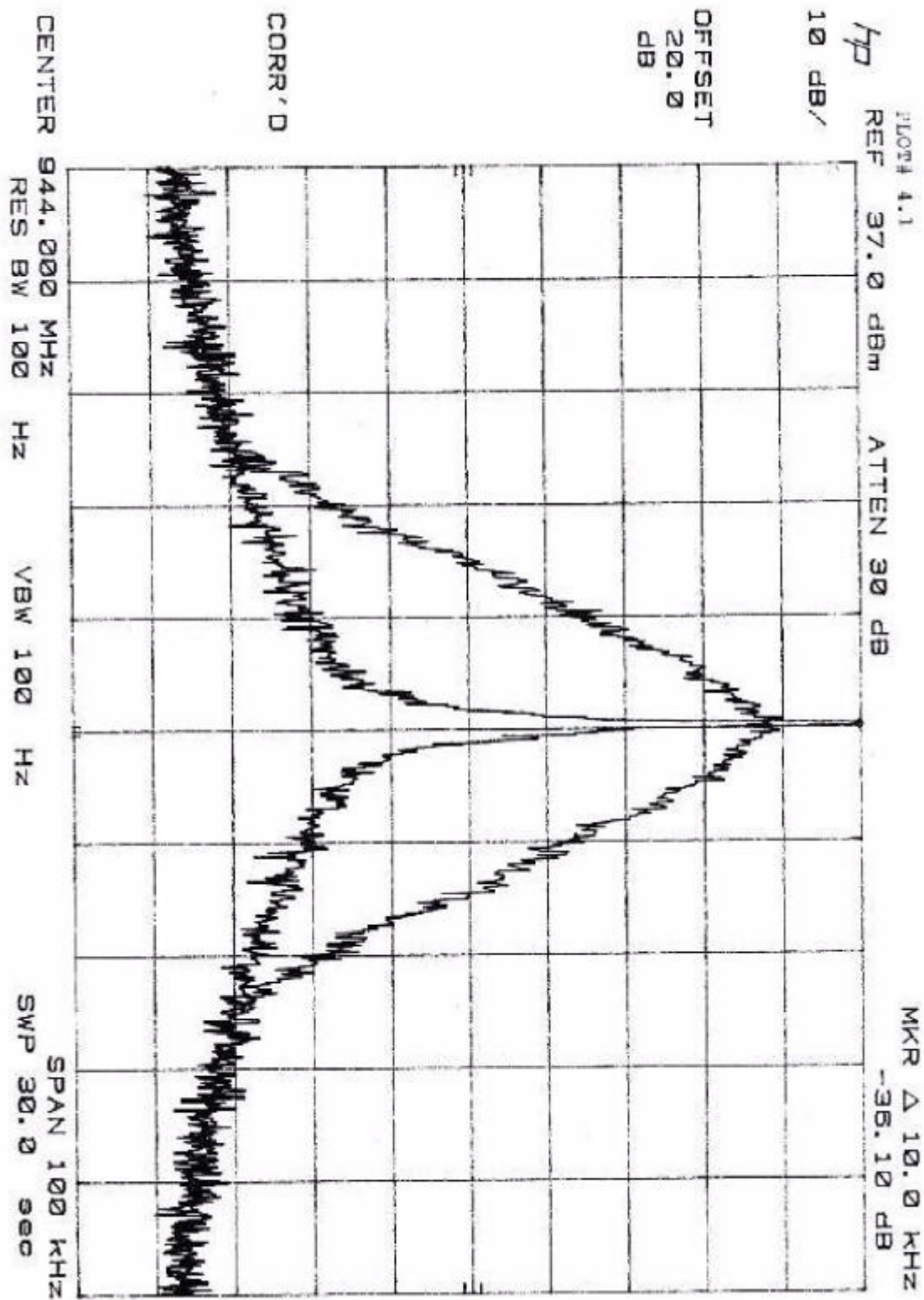
M = Modulation Frequency

D = Peak Deviation

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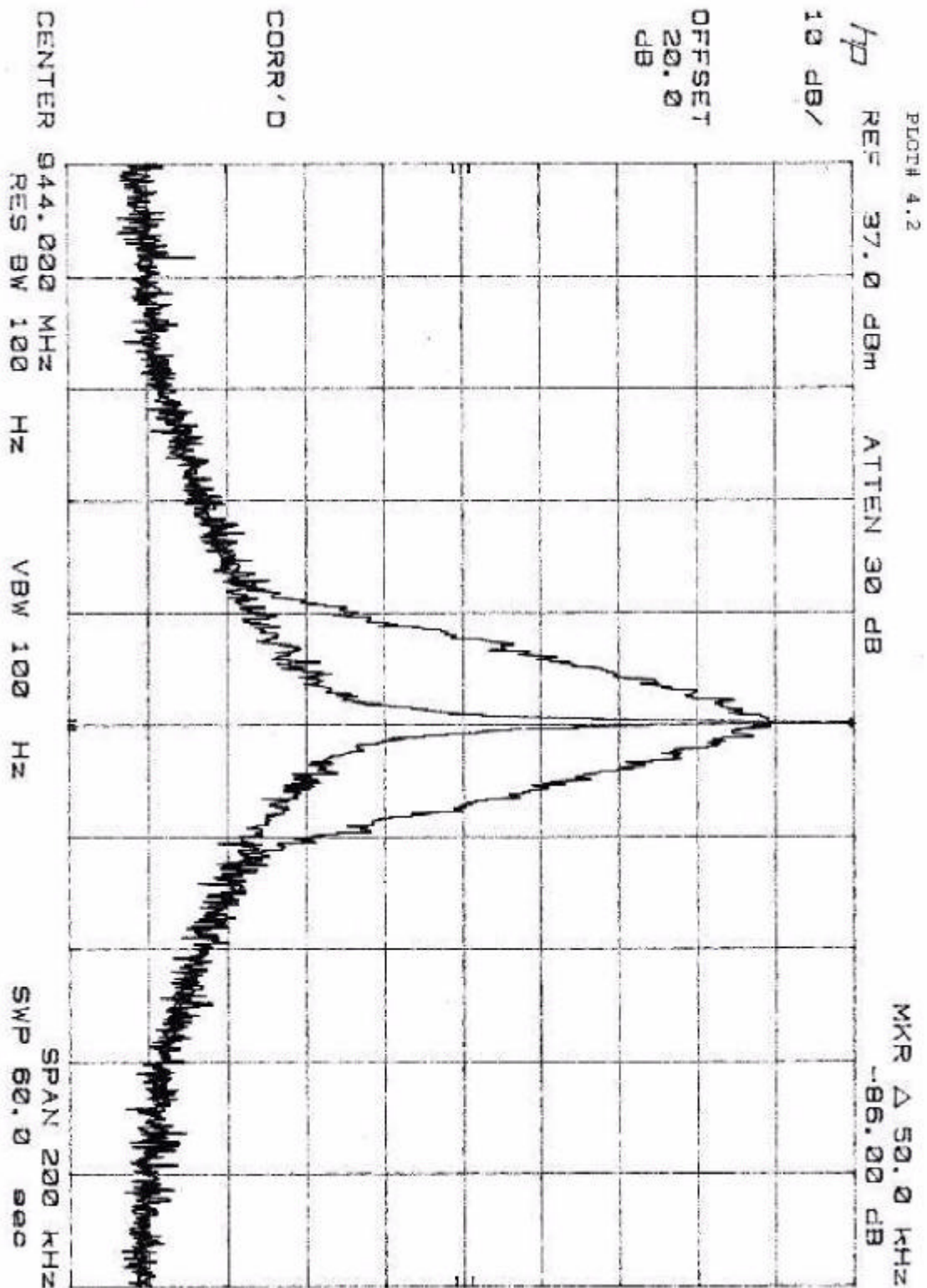
Date of Test: December 11, 1998



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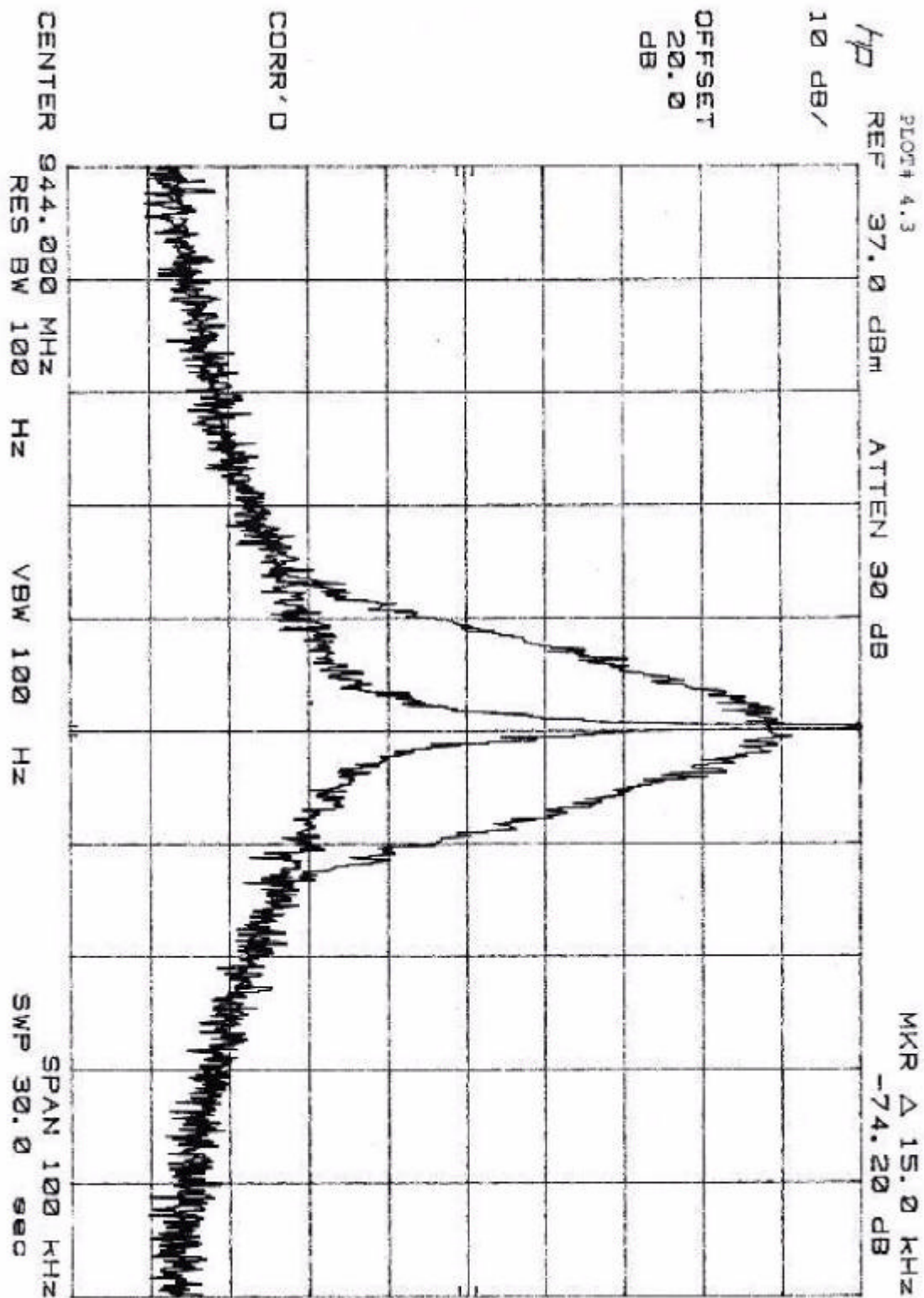
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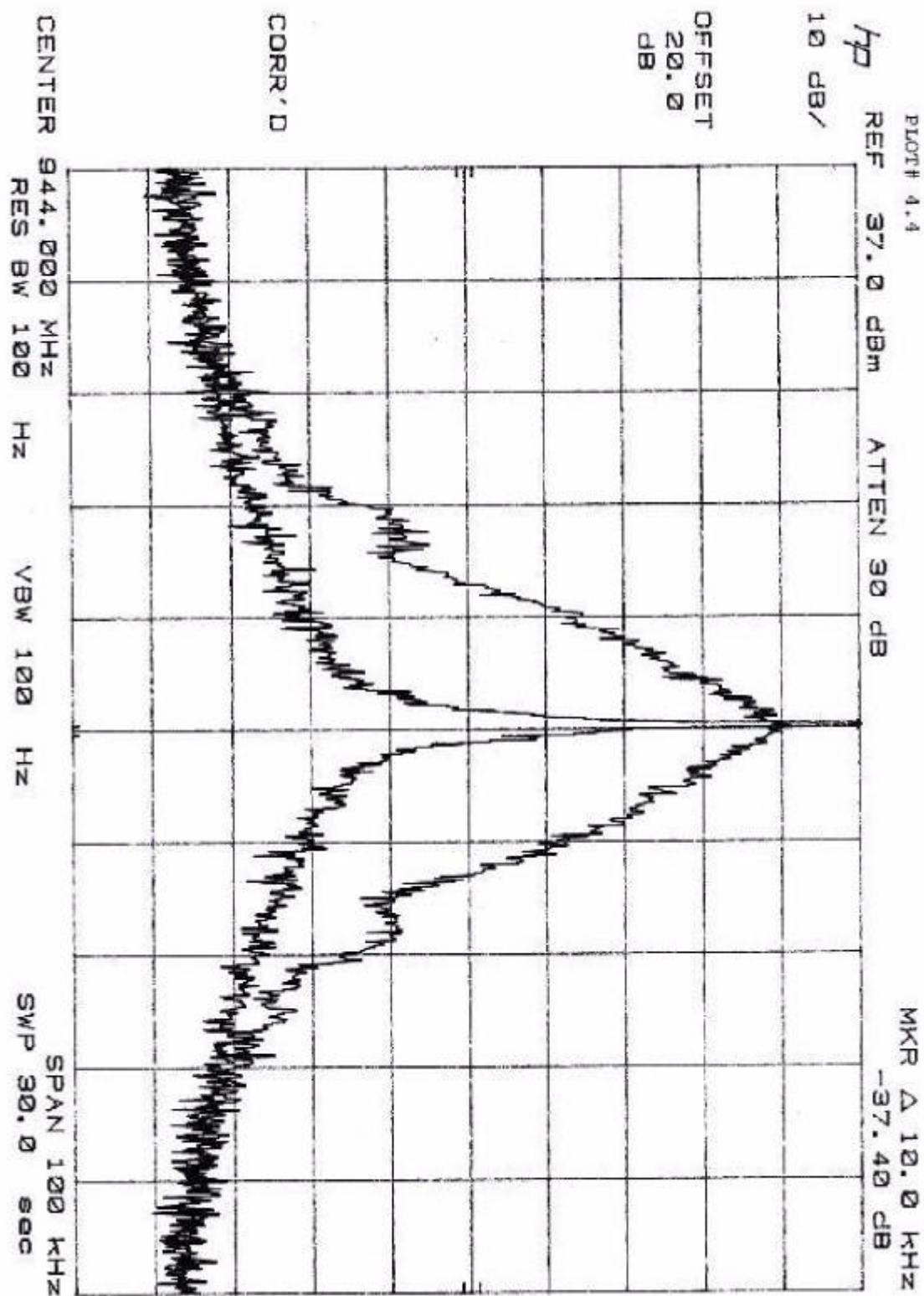
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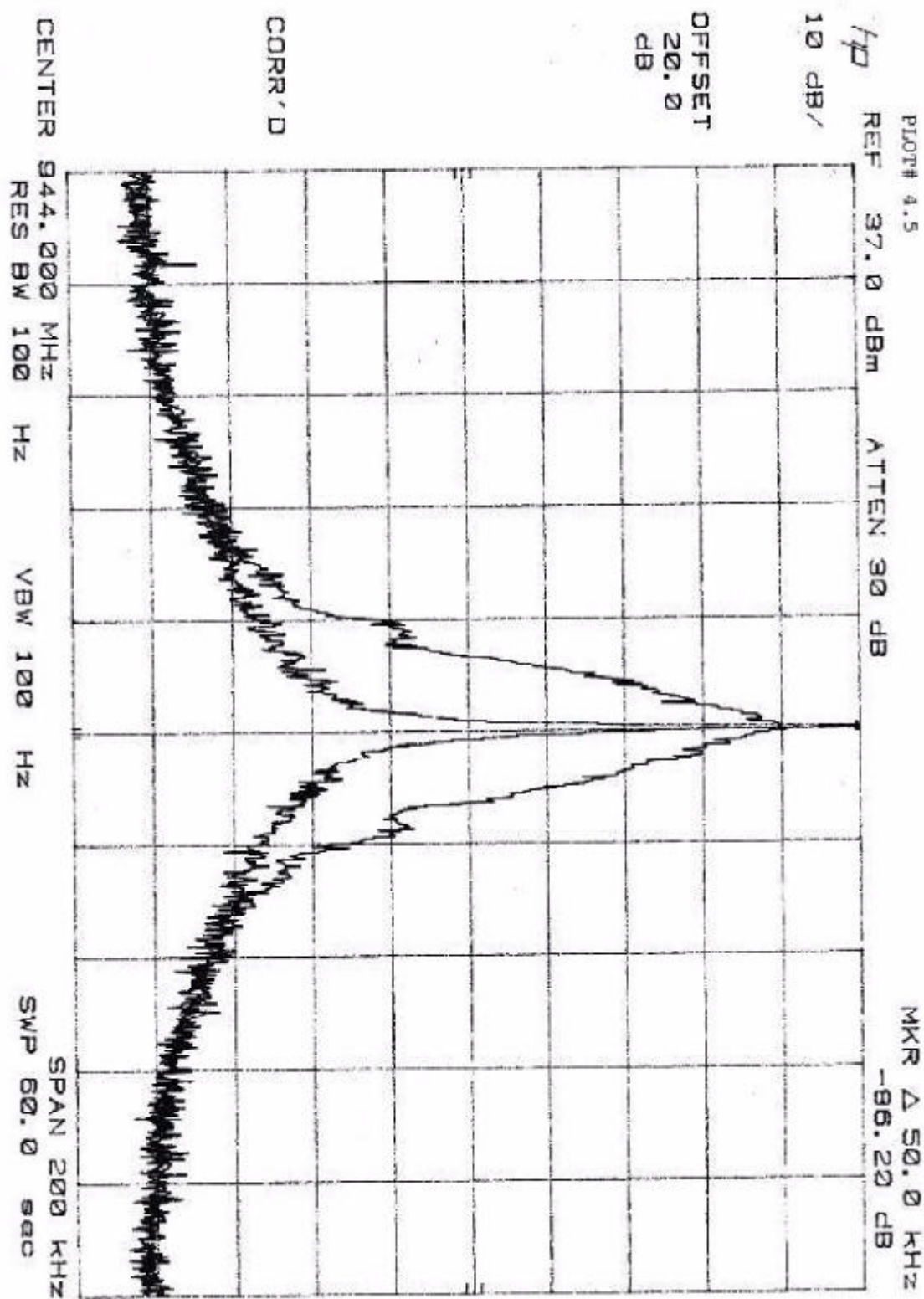
Date of Test: December 11, 1998



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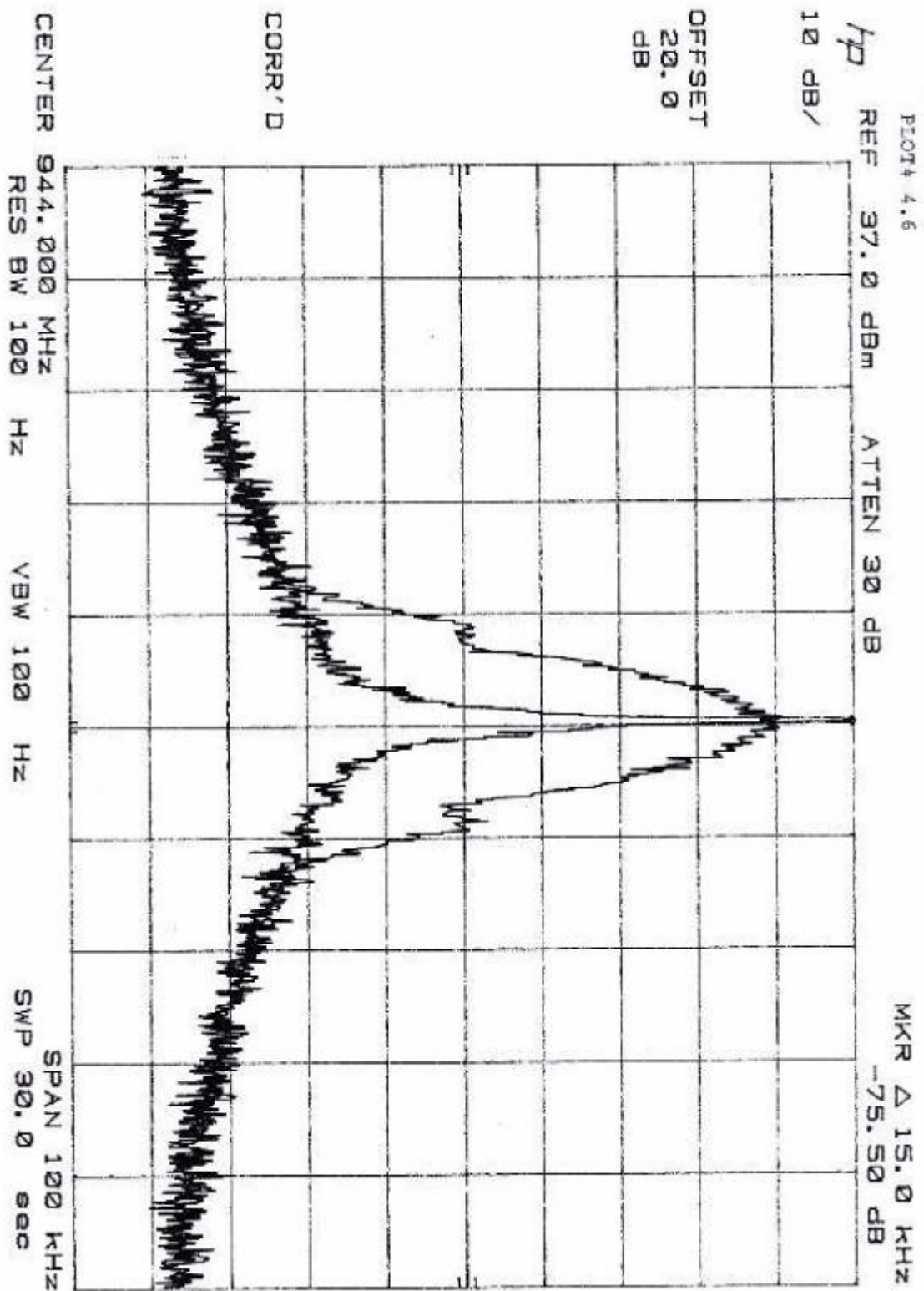
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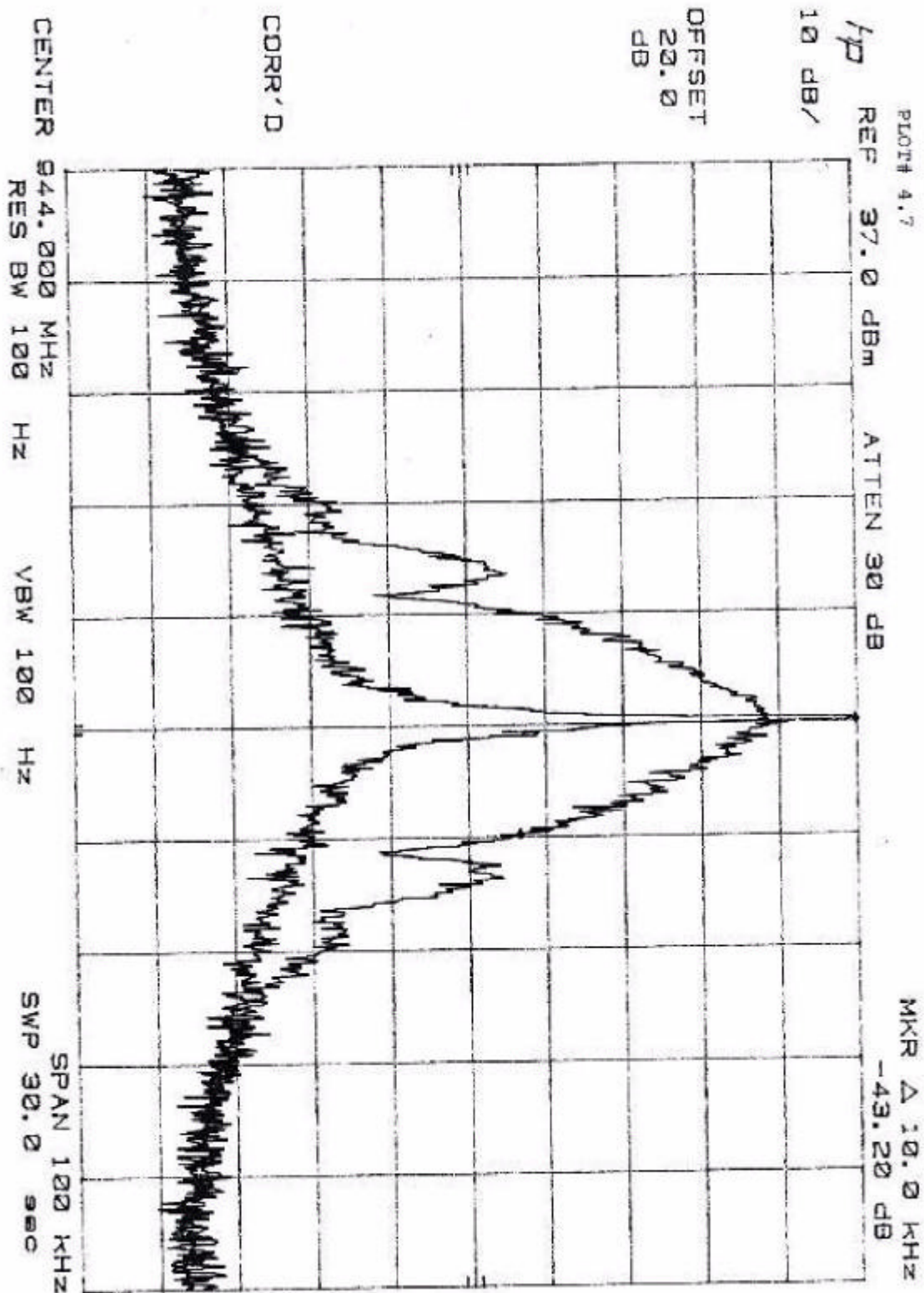
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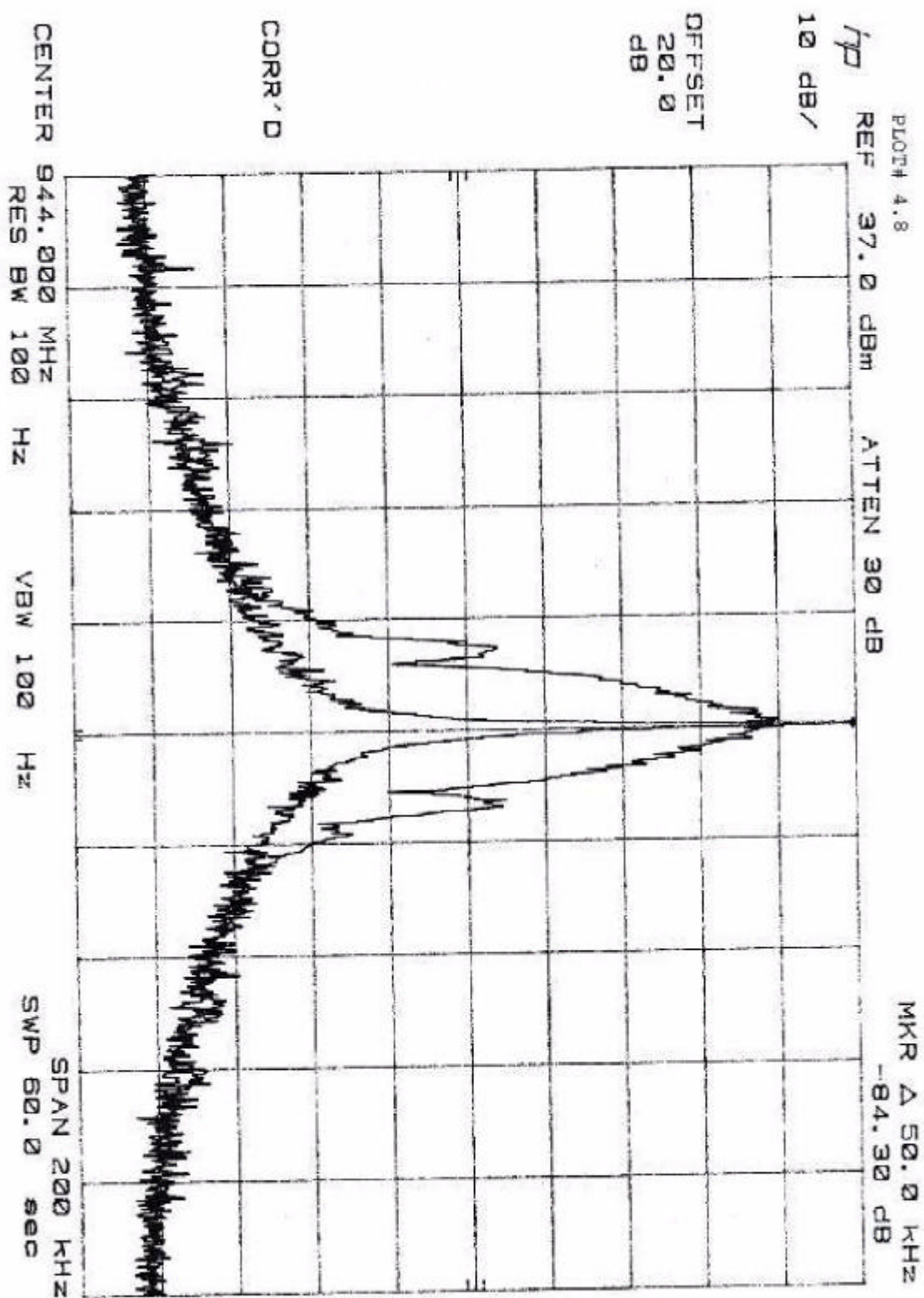
Date of Test: December 11, 1998



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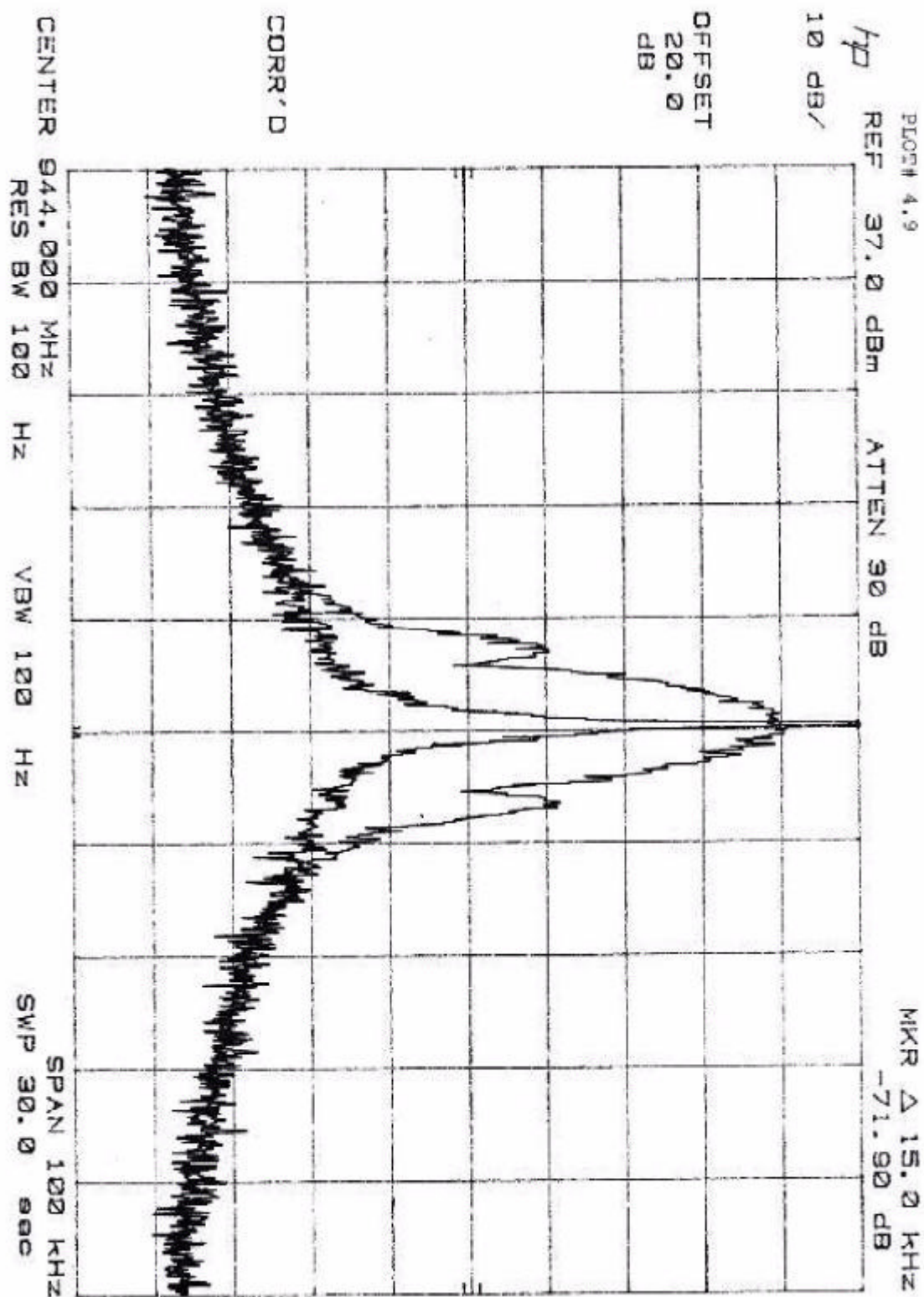
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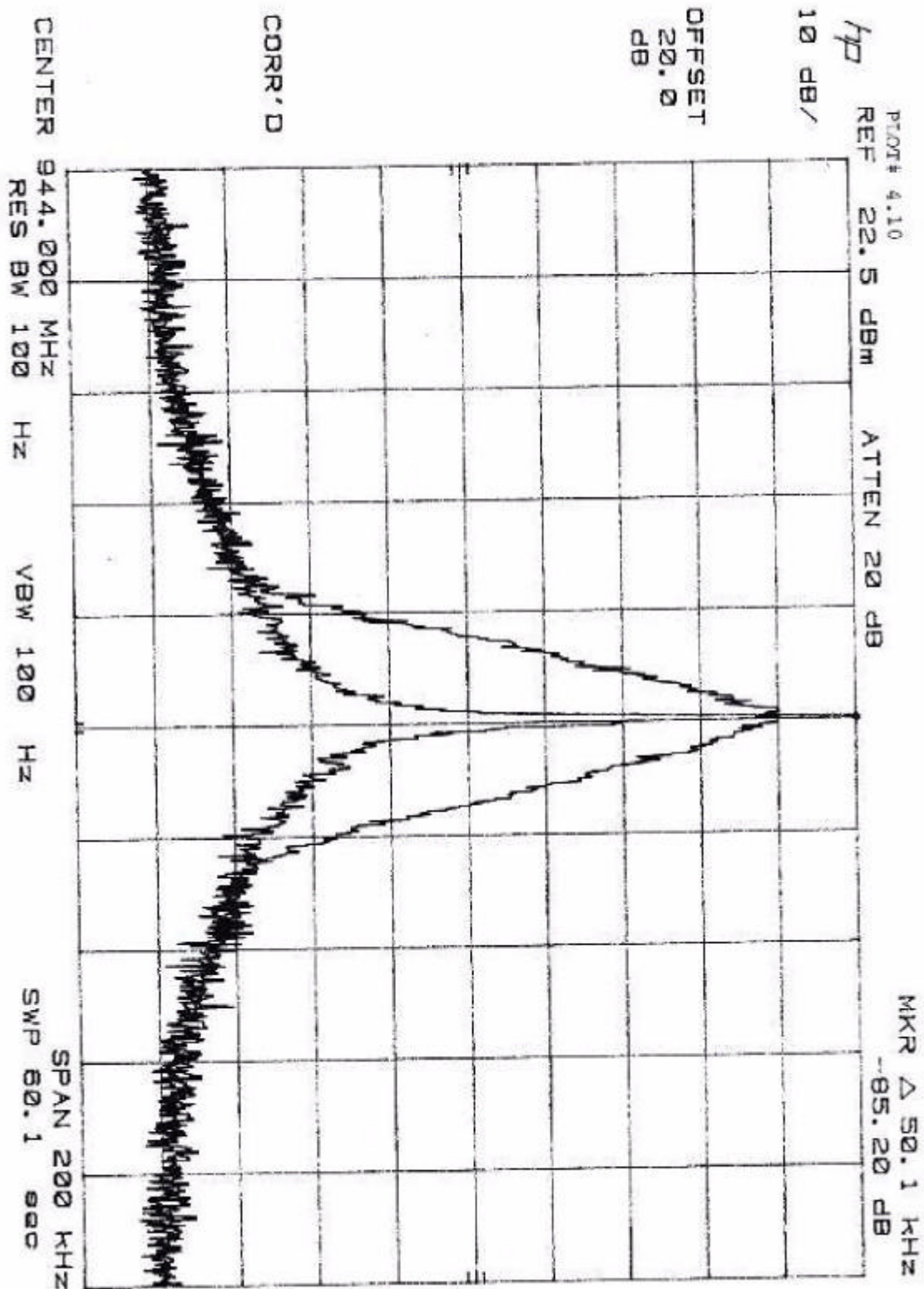
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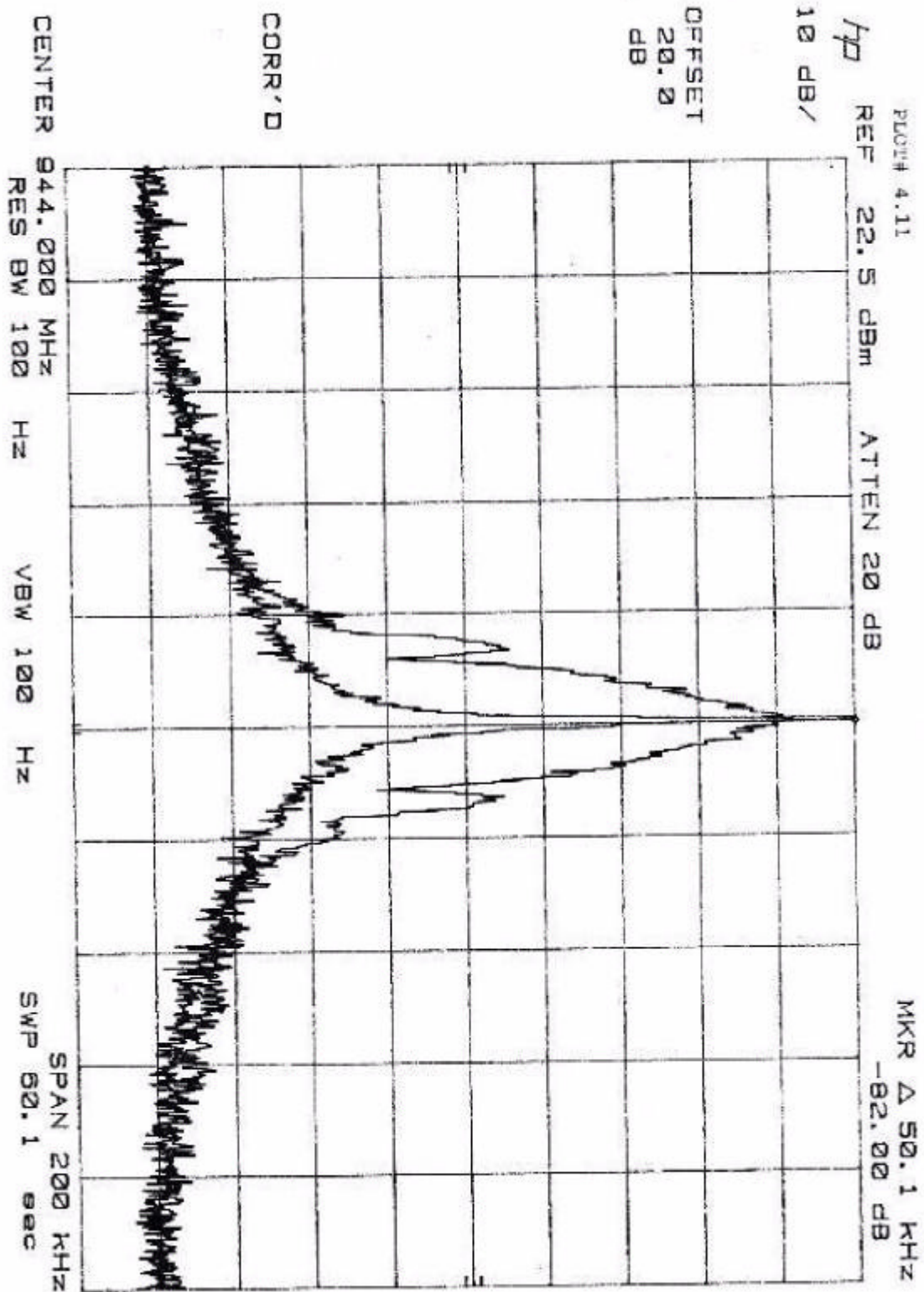
Date of Test: December 11, 1998



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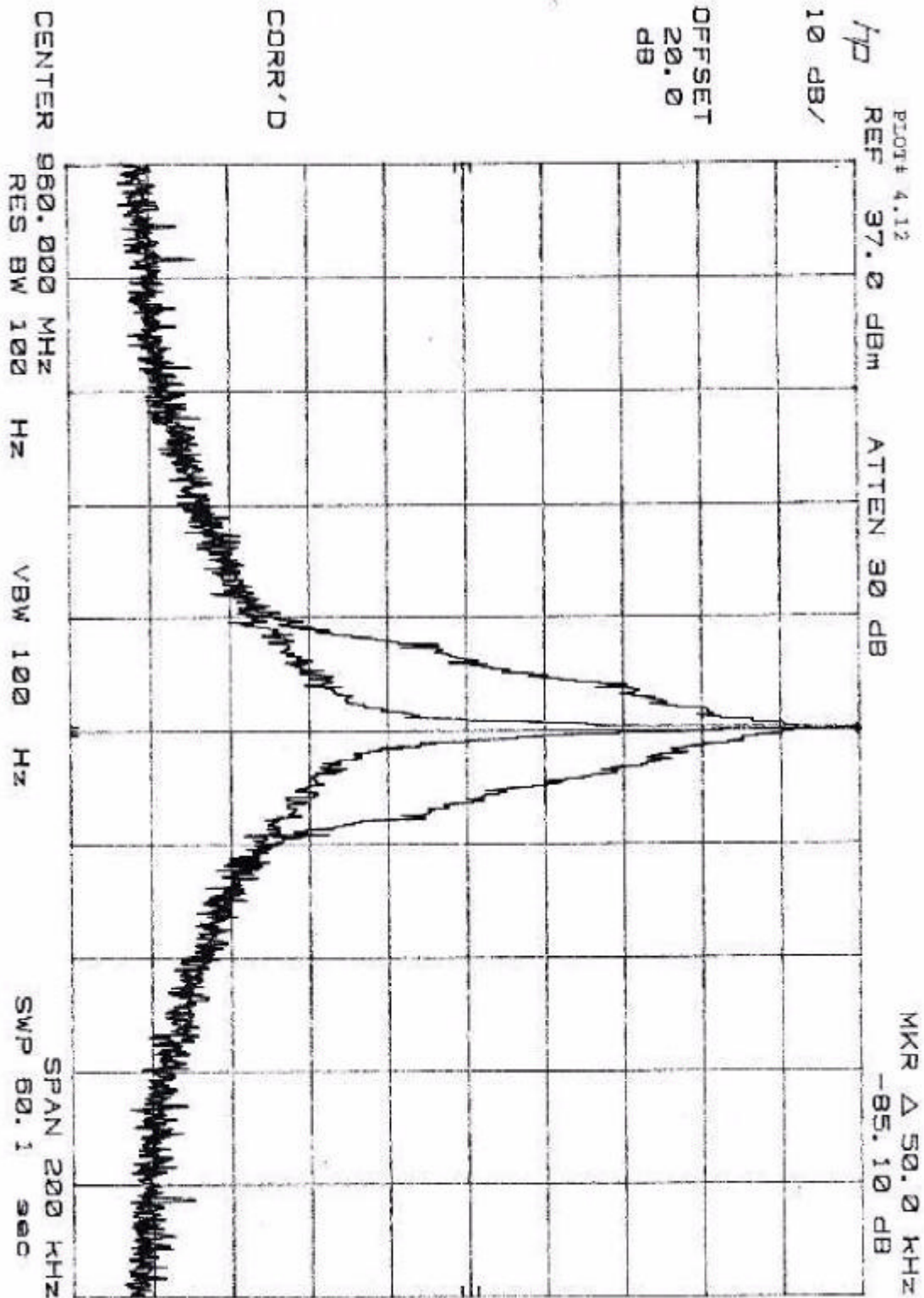
Date of Test: December 11, 1998



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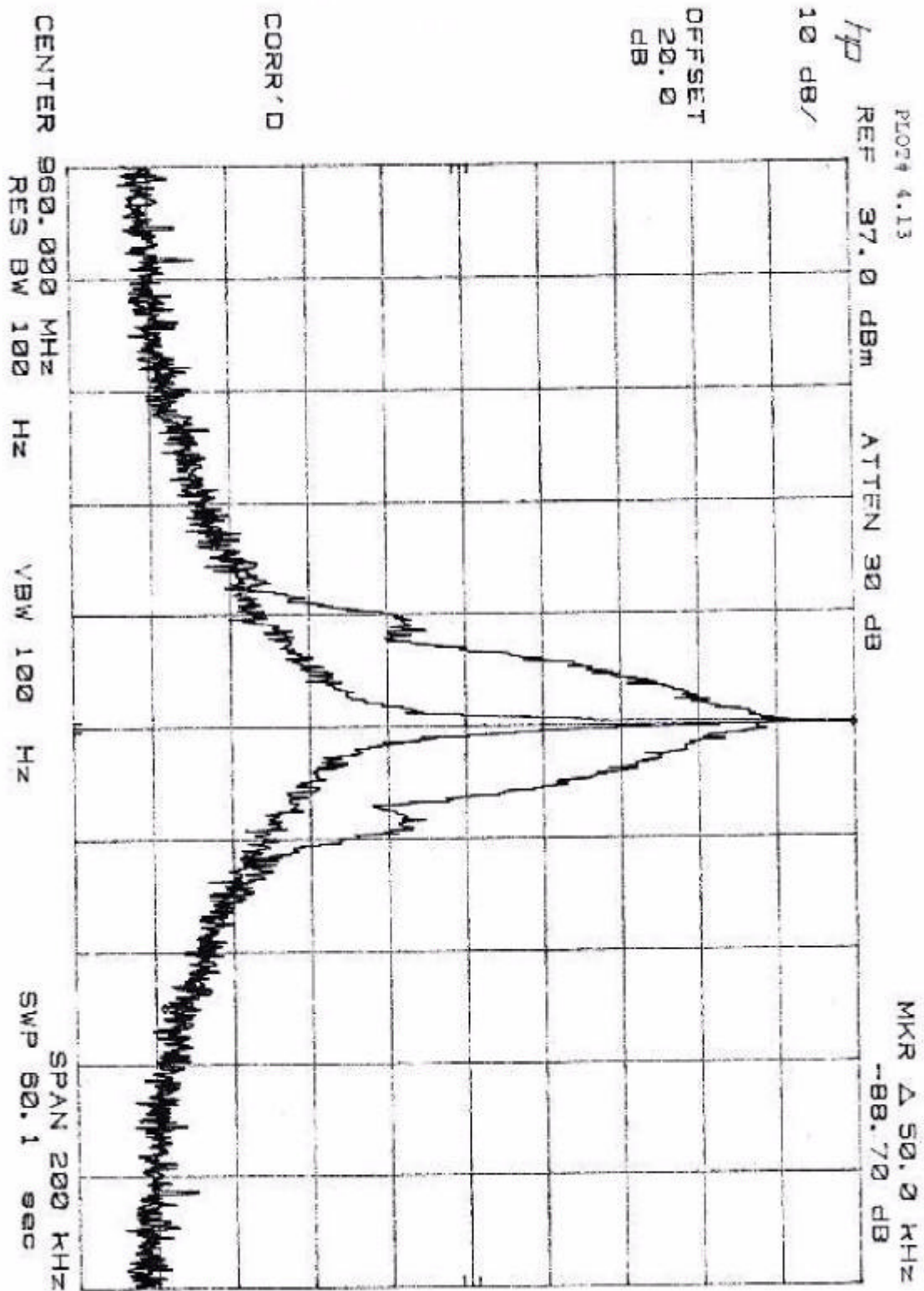
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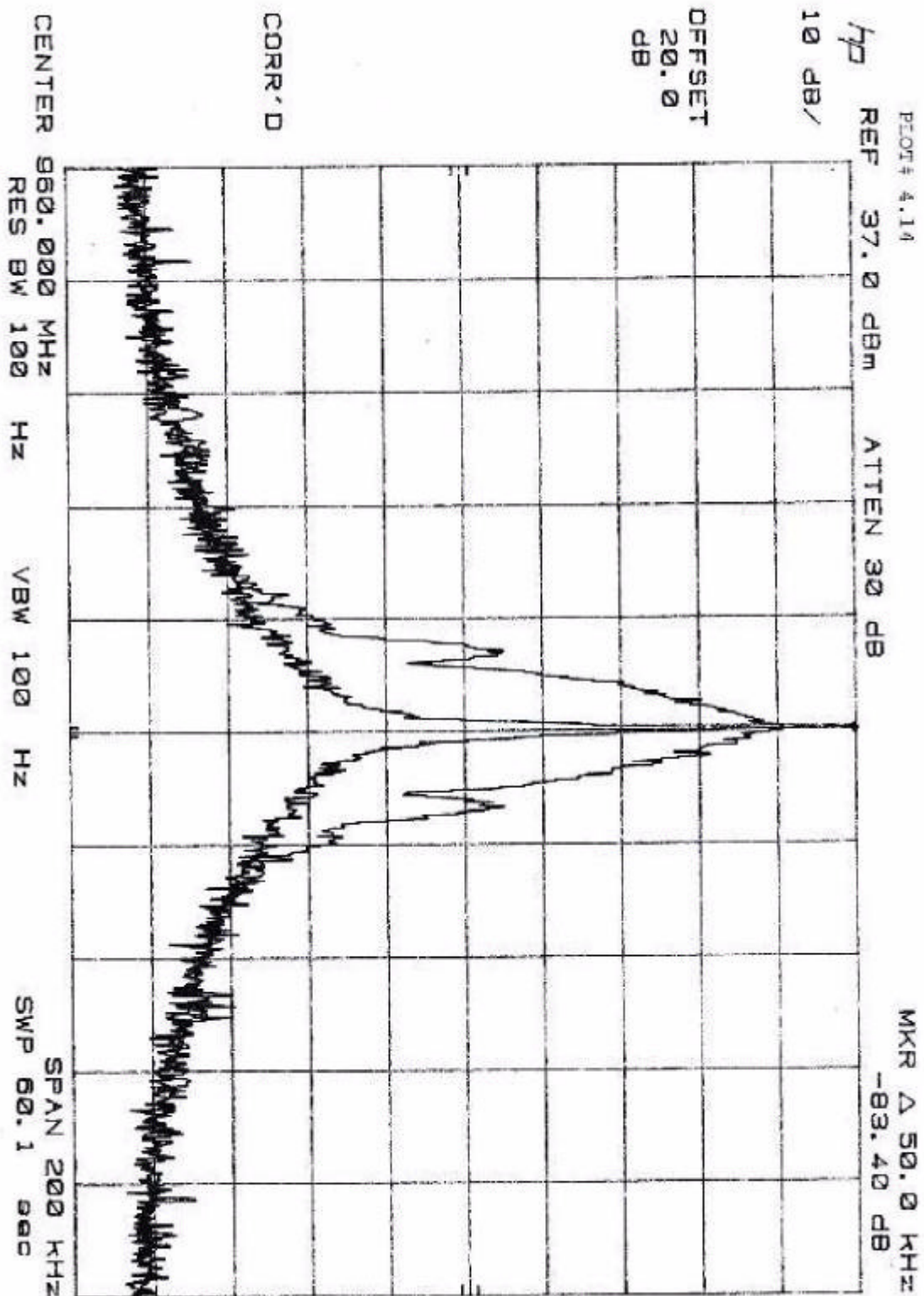
Date of Test: December 11, 1998



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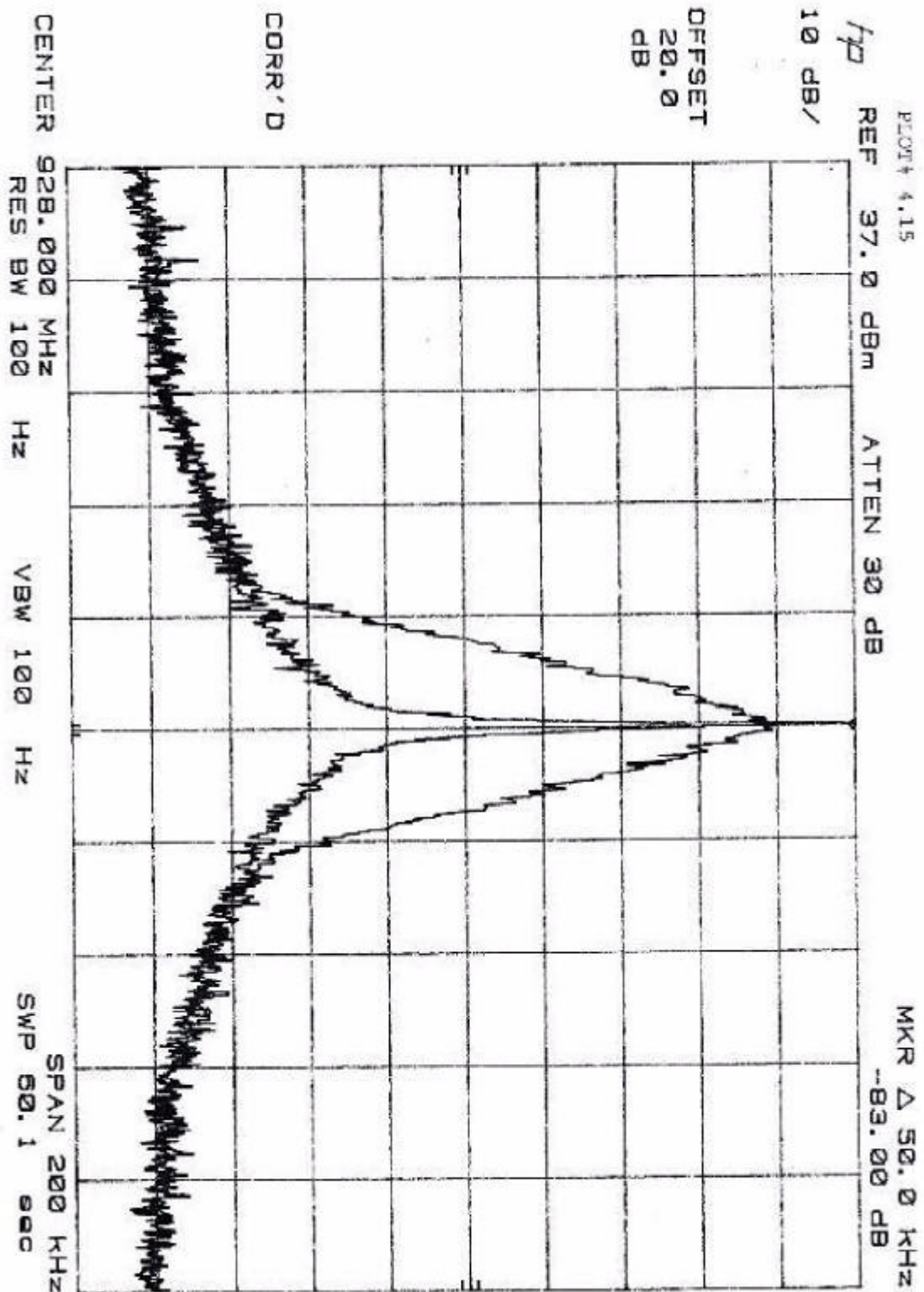
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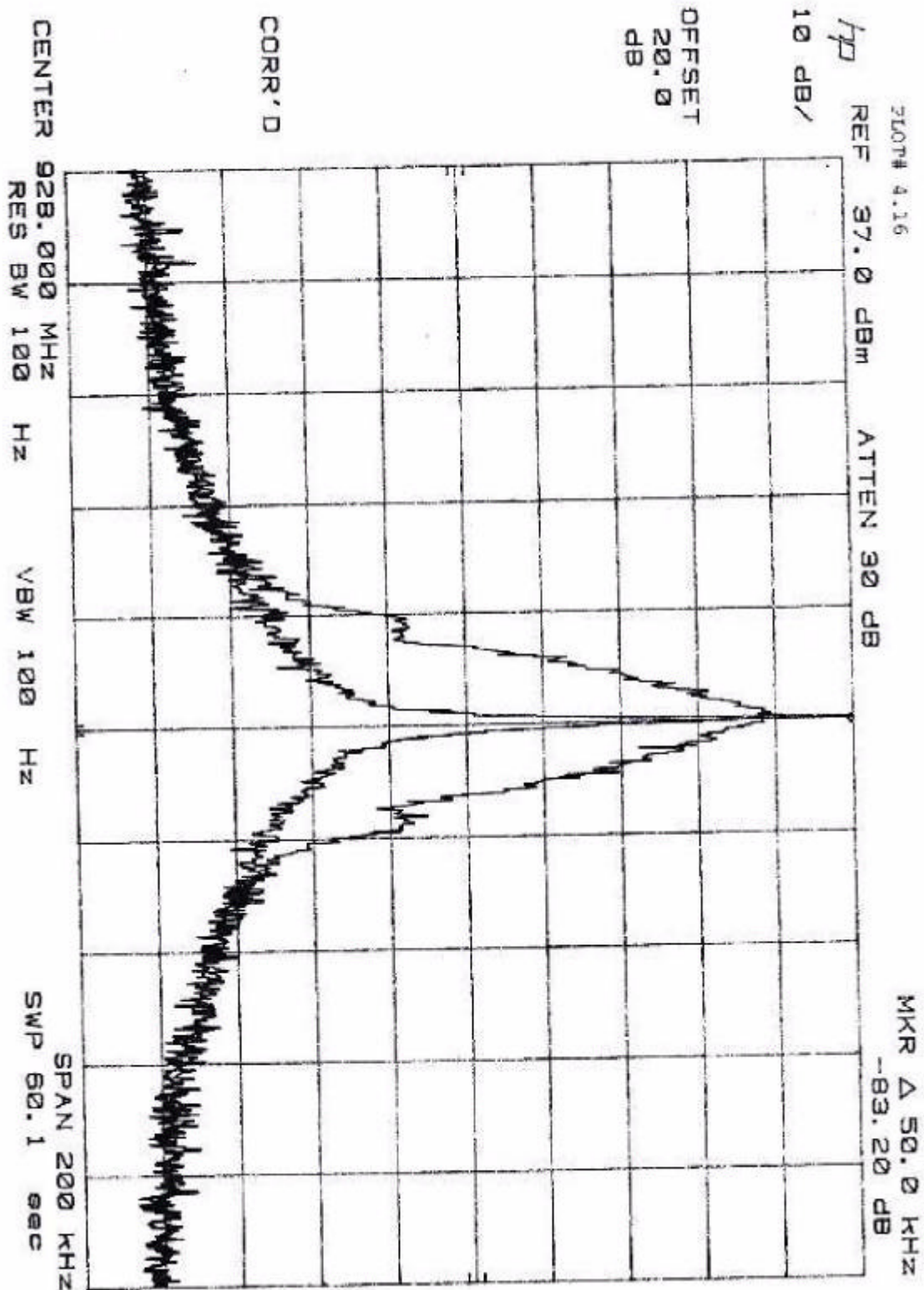
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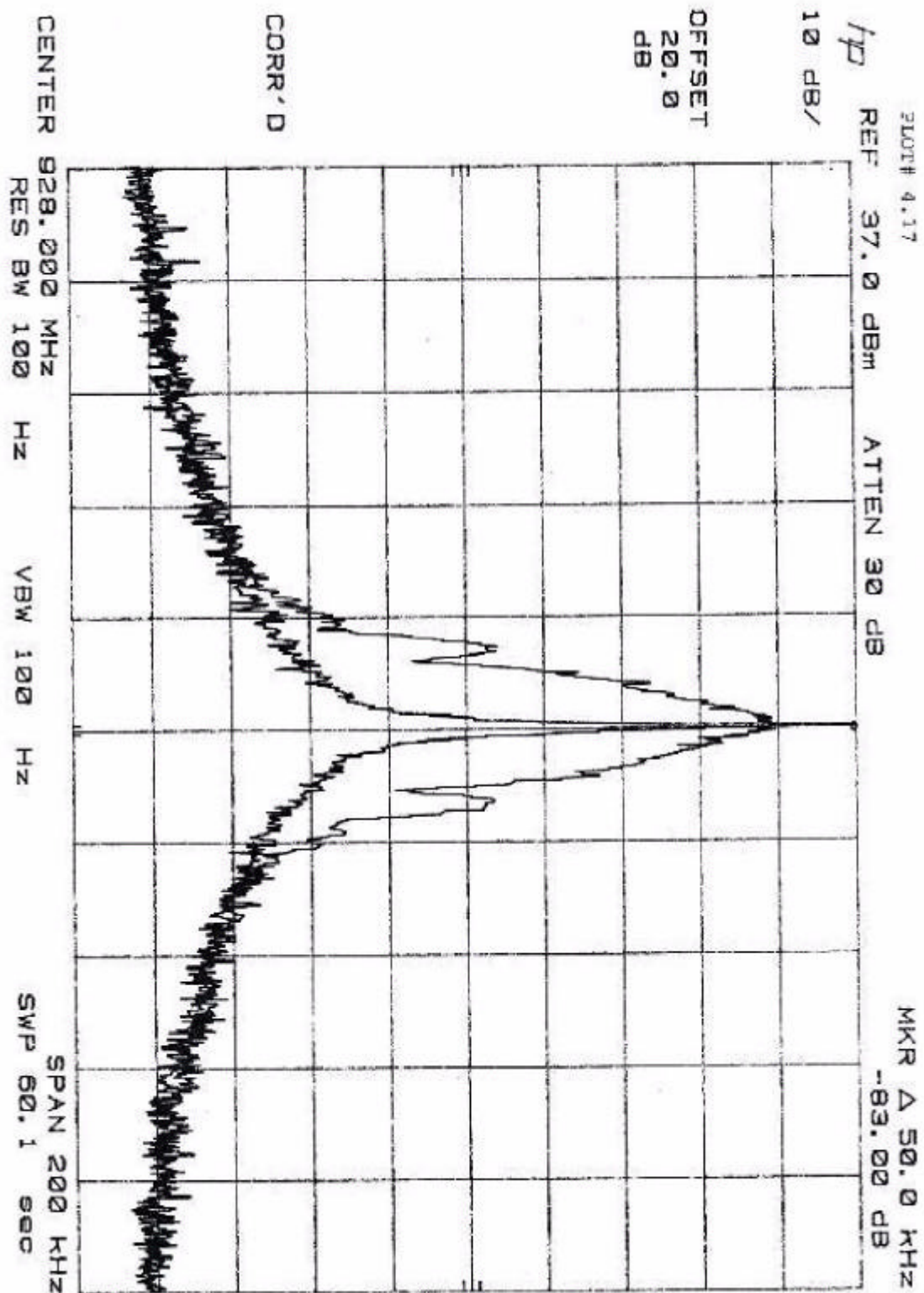
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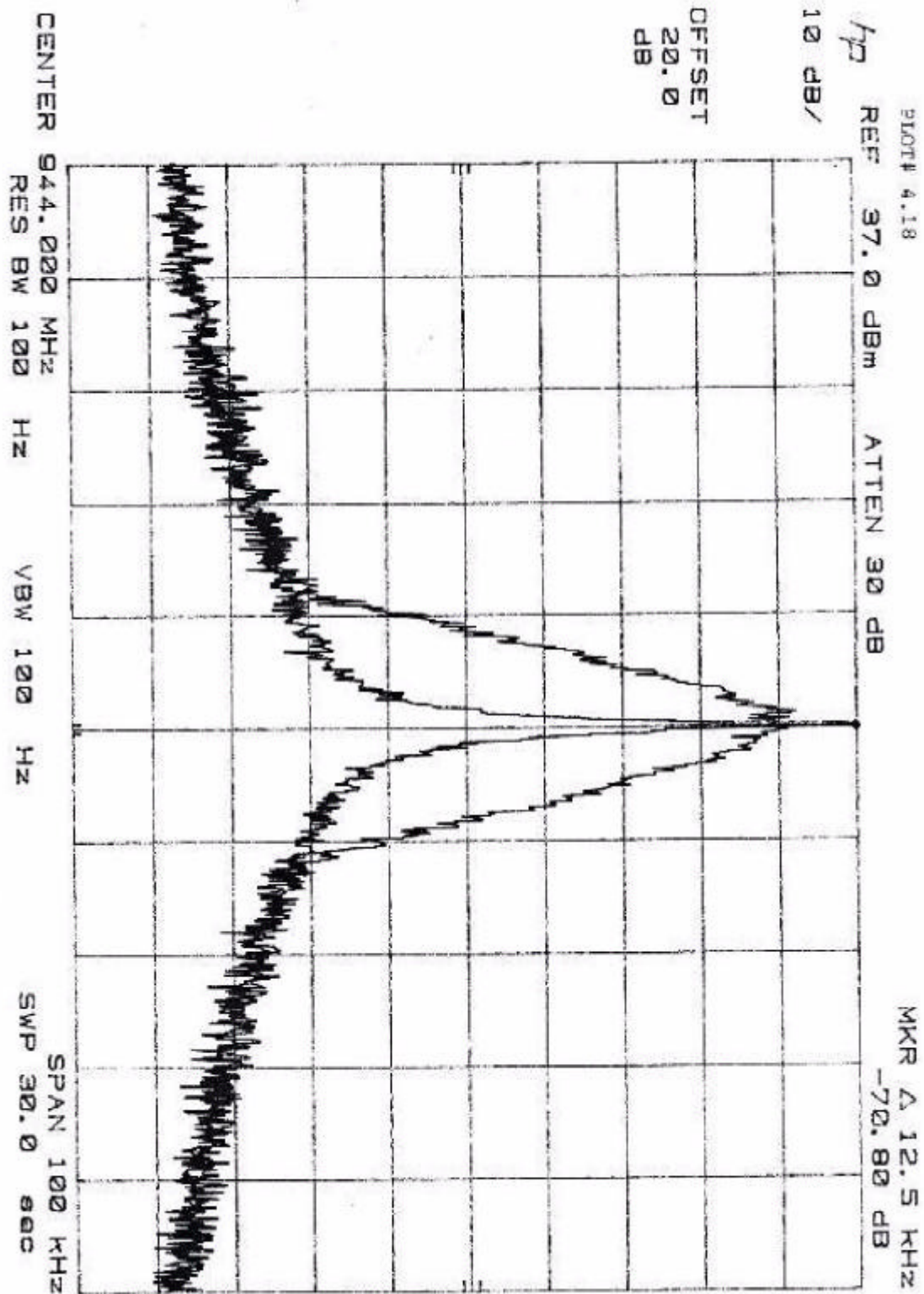
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## 5.0 Spurious Emissions at Antenna Terminals , FCC §2.991, §90.210

### Out of Band Emissions:

The power of emissions must be attenuated below the power of the unmodulated carrier (P) on any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth - at least  $50 + 10 \log P \text{ dB} = 50 + \text{LOG}(5) = 57$ .

### 5.1 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. Sufficient scans were taken to show the out-of- band emissions if any up to 10th harmonic.

### 5.2 Test Equipment

HP 8566B Spectrum Analyzer, 100 Hz - 22 GHz  
HP 7470A Plotter

### 5.3 Test Results

The EUT passed the test. Refer to the attached plots.

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Teledesign Radio Modem with 3492 Transceiver

Date of Test: December 11, 1998

| Transmitting at 928 MHz |                    |                     |                   |
|-------------------------|--------------------|---------------------|-------------------|
| Plot Number             | Type of Modulation | Emission Designator | Description       |
| 5.1                     | GMSK, BT=0.5       | 20K0F1D             | Scan 1-100 MHz    |
| 5.2                     | GMSK, BT=0.5       | 20K0F1D             | Scan 100-1000 MHz |
| 5.3                     | GMSK, BT=0.5       | 20K0F1D             | Scan 1-2.5 GHz    |
| 5.4                     | GMSK, BT=0.5       | 20K0F1D             | Scan 2.5 - 10 GHz |

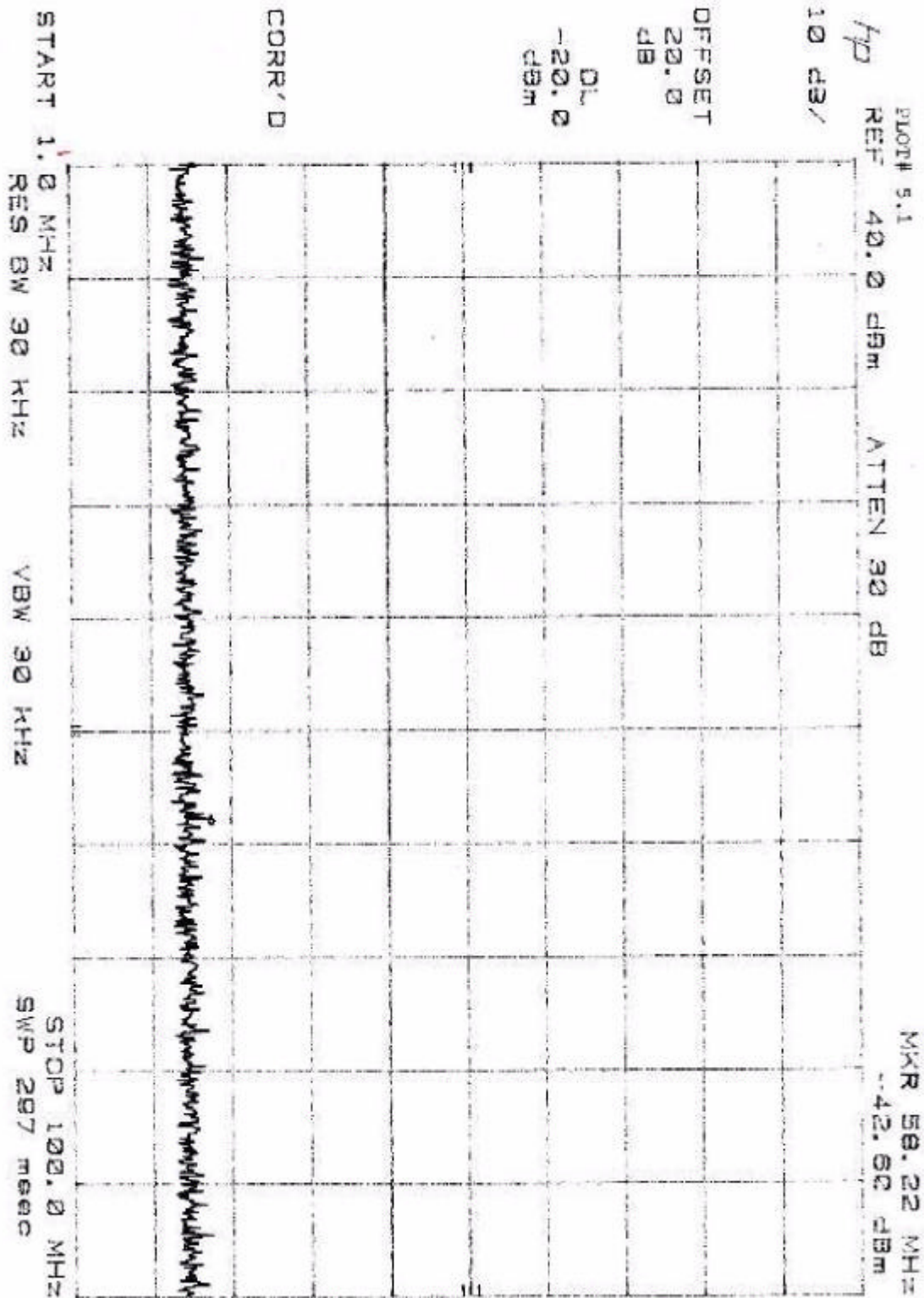
| Transmitting at 944 MHz |                    |                     |                   |
|-------------------------|--------------------|---------------------|-------------------|
| Plot Number             | Type of Modulation | Emission Designator | Description       |
| 5.5                     | GMSK, BT=0.5       | 20K0F1D             | Scan 1-100 MHz    |
| 5.6                     | GMSK, BT=0.5       | 20K0F1D             | Scan 100-1000 MHz |
| 5.7                     | GMSK, BT=0.5       | 20K0F1D             | Scan 1-2.5 GHz    |
| 5.8                     | GMSK, BT=0.5       | 20K0F1D             | Scan 2.5 - 10 GHz |

| Transmitting at 960 MHz |                    |                     |                   |
|-------------------------|--------------------|---------------------|-------------------|
| Plot Number             | Type of Modulation | Emission Designator | Description       |
| 5.9                     | GMSK, BT=0.5       | 20K0F1D             | Scan 1-100 MHz    |
| 5.10                    | GMSK, BT=0.5       | 20K0F1D             | Scan 100-1000 MHz |
| 5.11                    | GMSK, BT=0.5       | 20K0F1D             | Scan 1-2.5 GHz    |
| 5.12                    | GMSK, BT=0.5       | 20K0F1D             | Scan 2.5 - 10 GHz |

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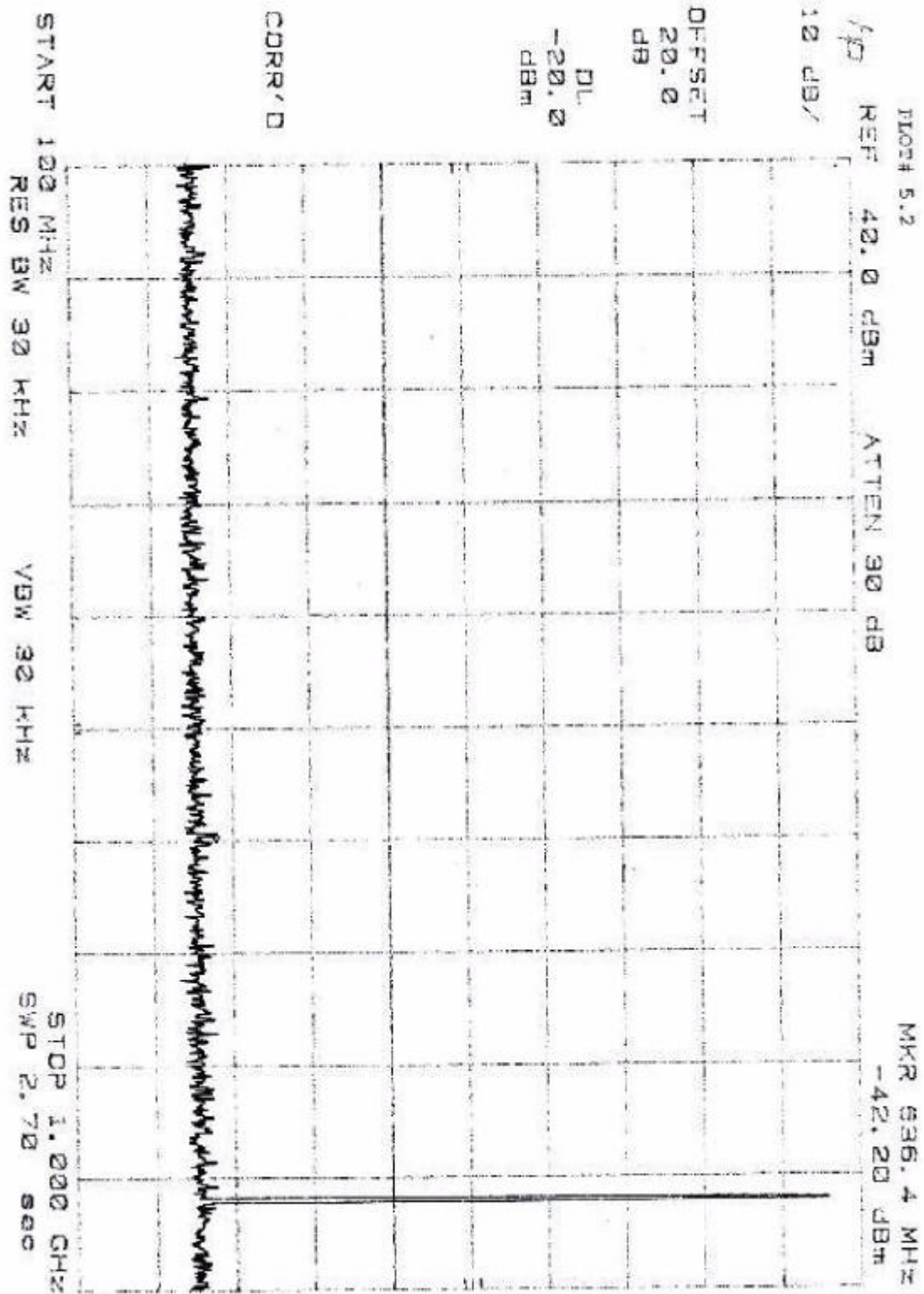
Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

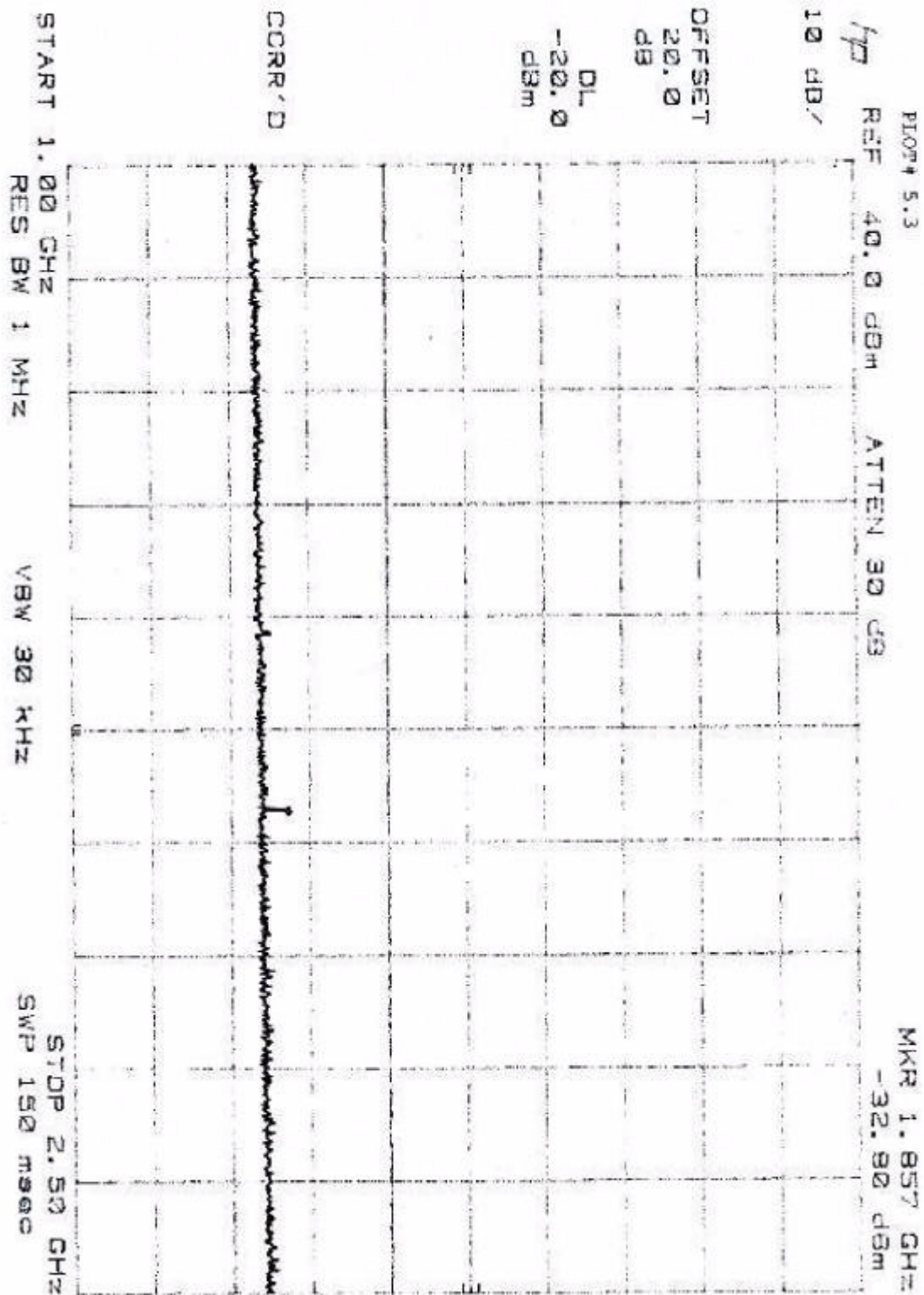
Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

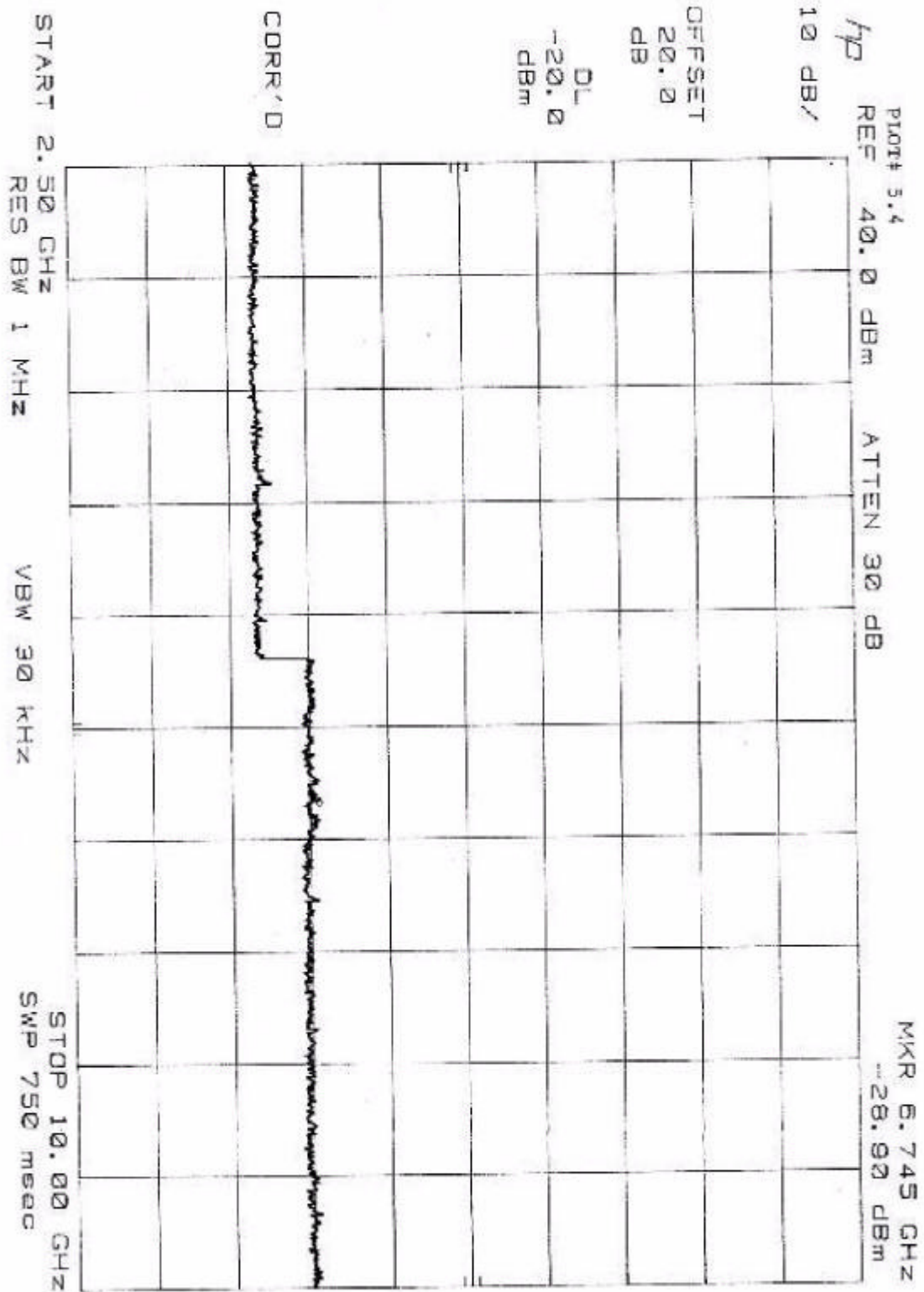
Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

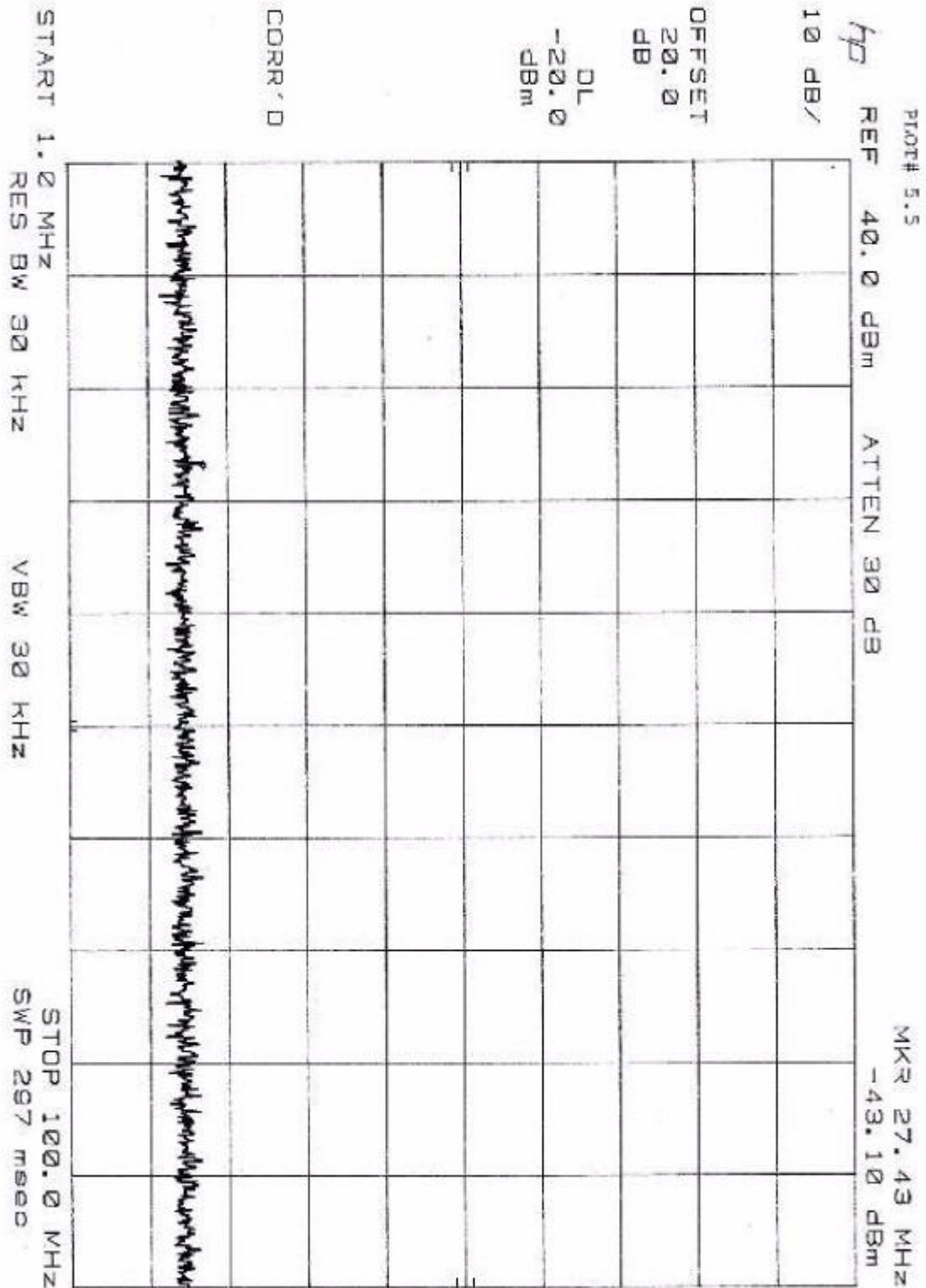
Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

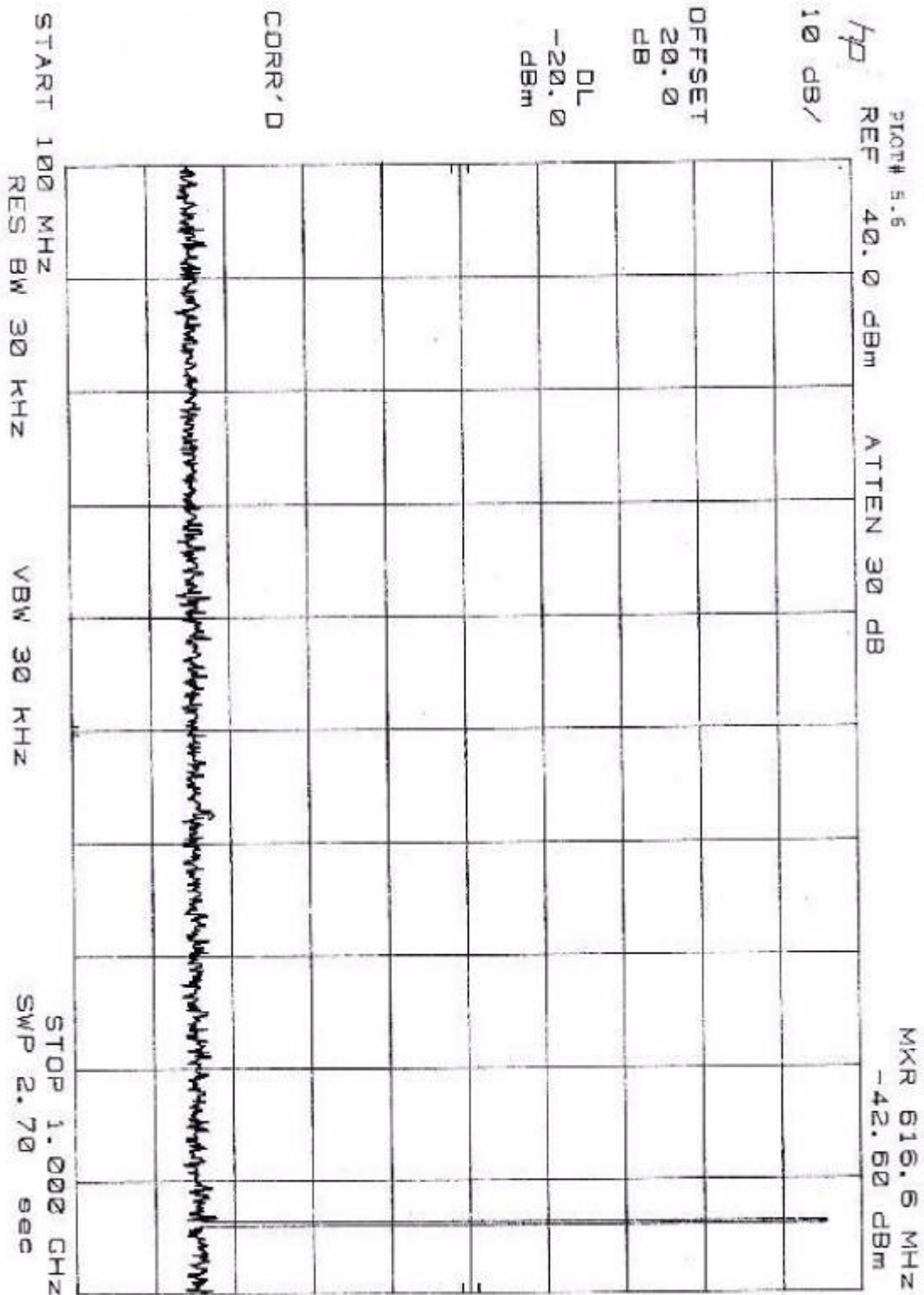
Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

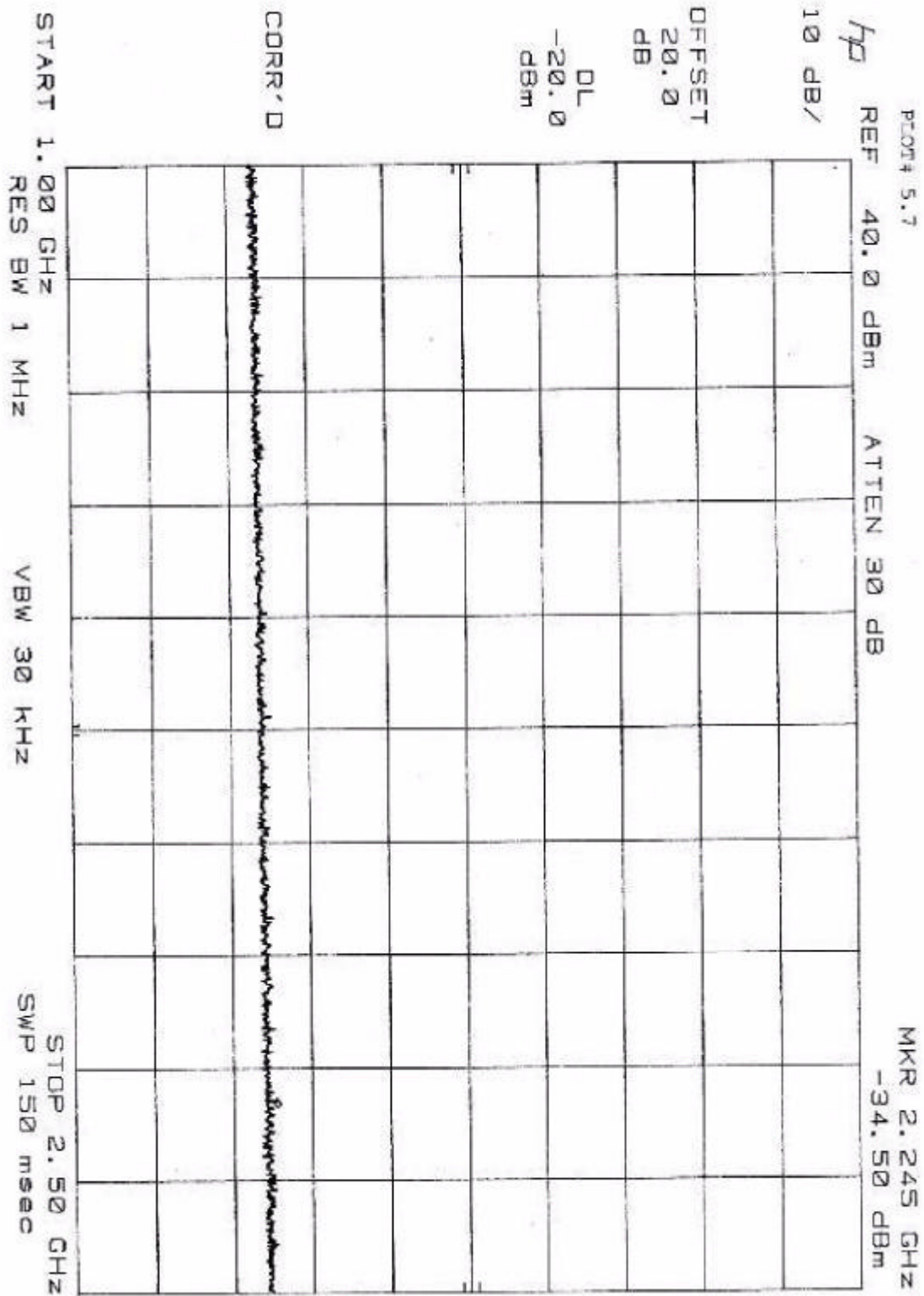
Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

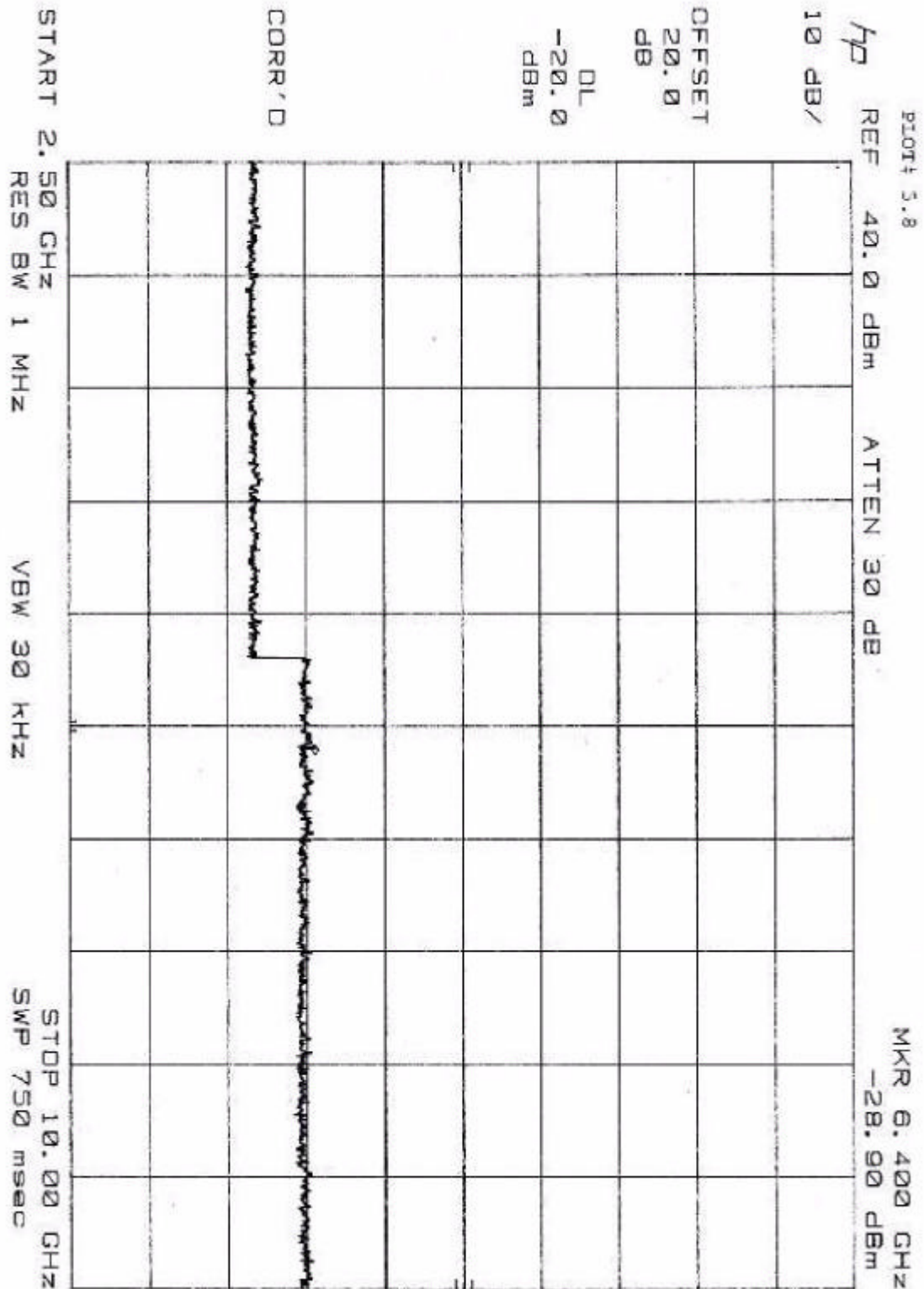
Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

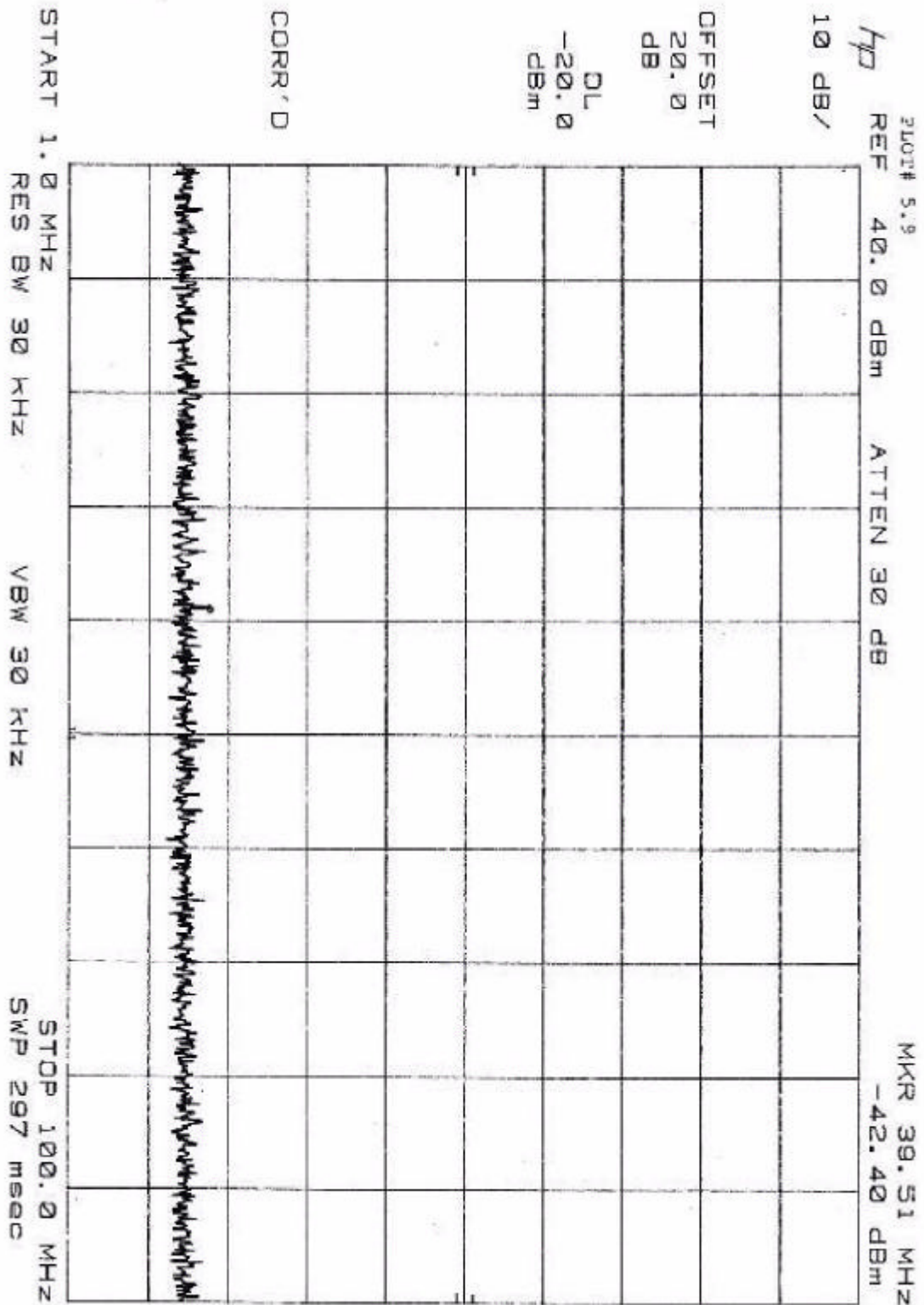
Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

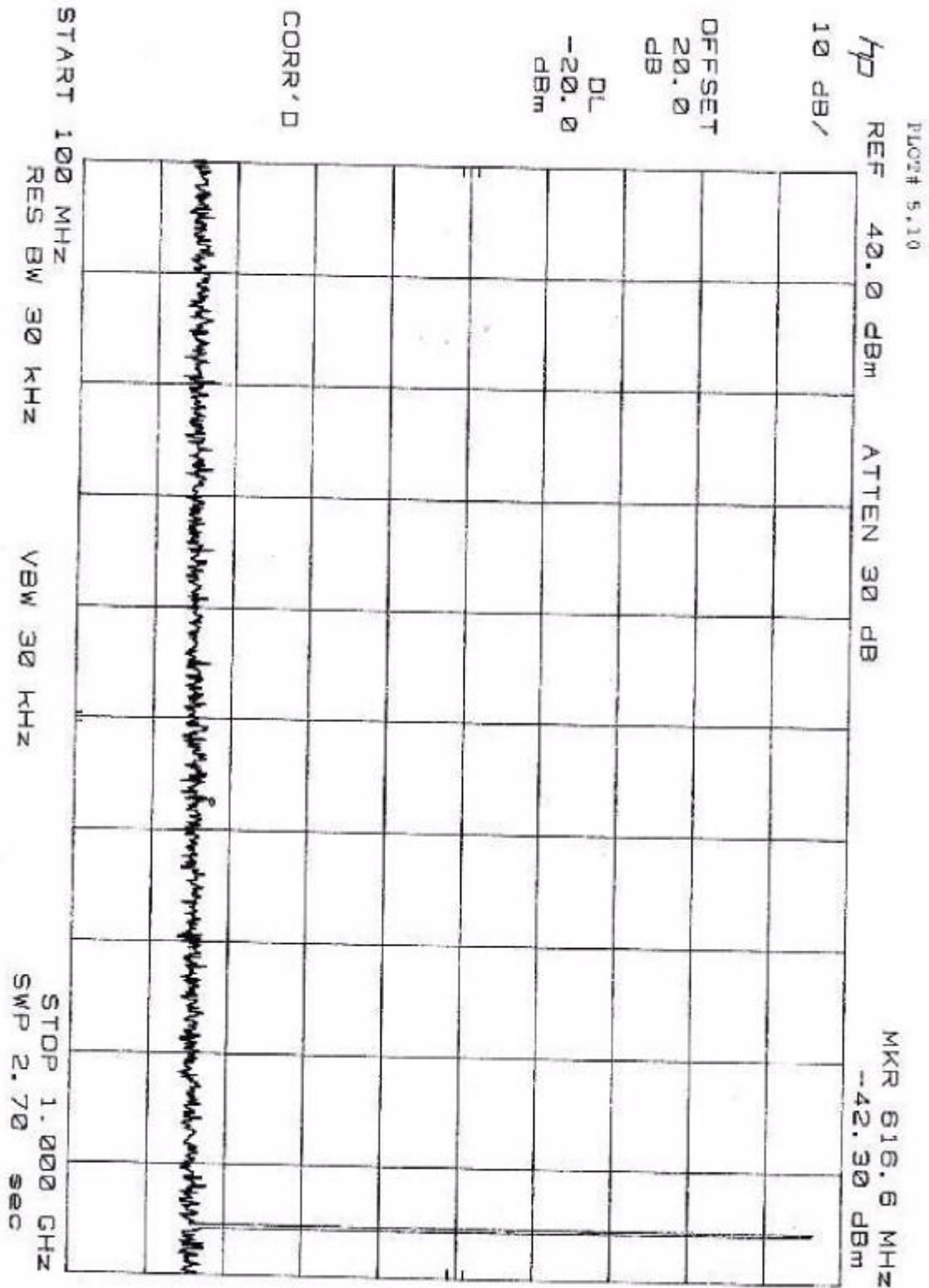
Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

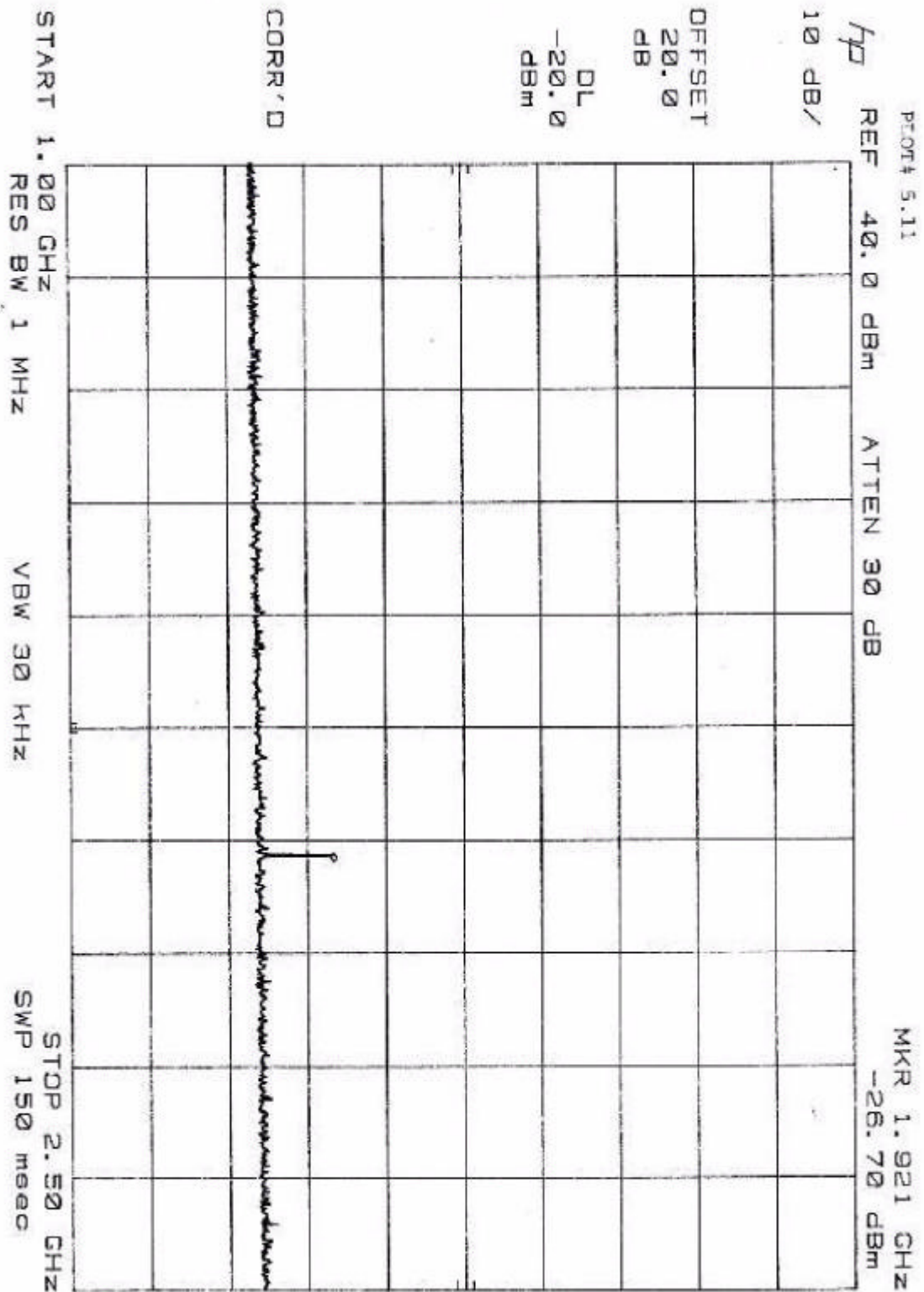
Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

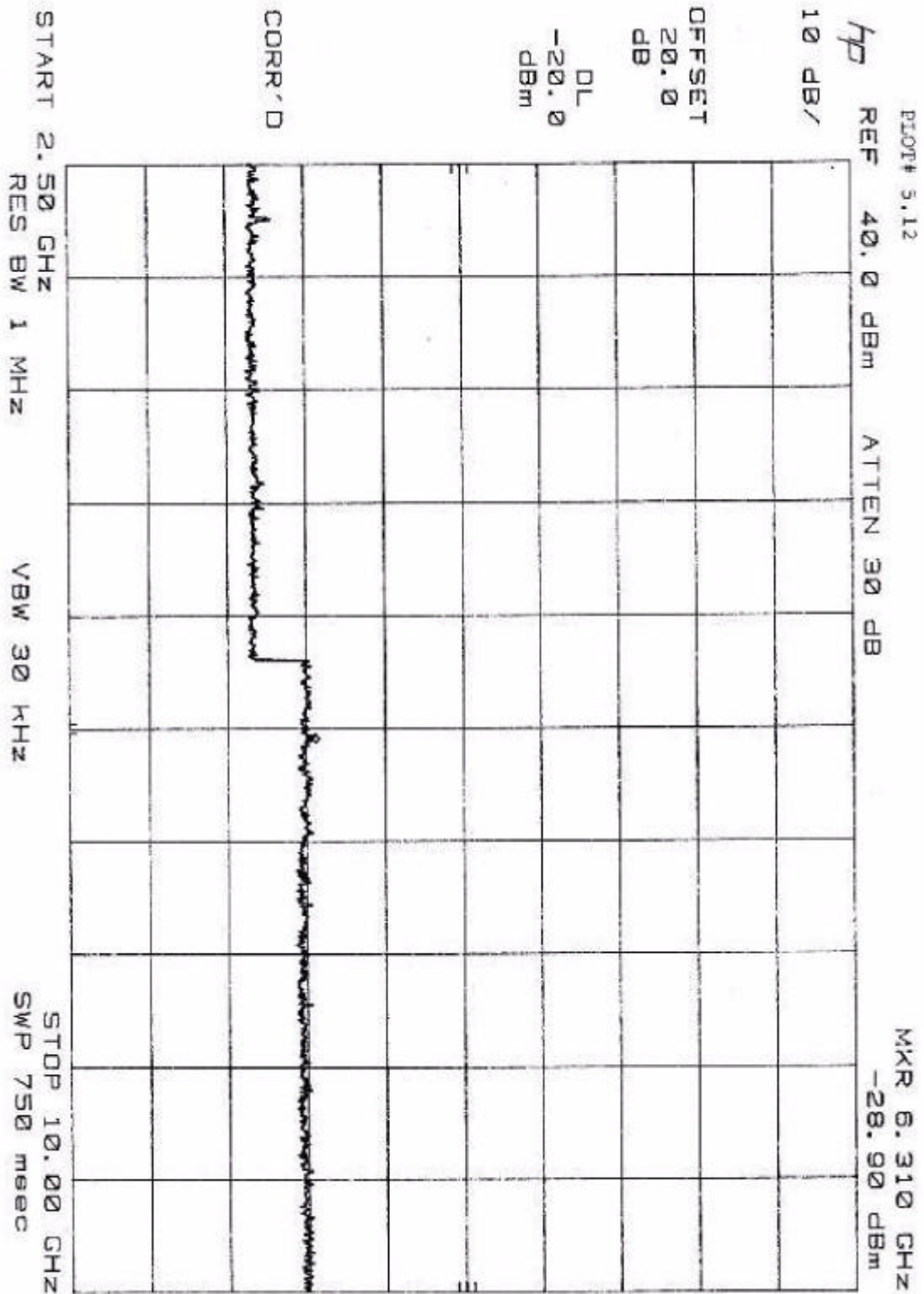
Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

Date of Test: December 11, 1998



# **INTERTEK TESTING SERVICES - Menlo Park**

**Teledesign Radio Modem with 3492 Transceiver**

**Date of Test: December 11, 1998**

## **6.0 Field Strength of Spurious Radiation, FCC § 2.993, §15.109, §90.210**

### **6.1 Test Procedure**

The transmitter was placed on a wooden turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3 orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

The spurious harmonic attenuation was calculated as the difference between E in dB(uV/m) at the fundamental frequency and at the spurious emission frequency.

### **6.2 Test Equipment**

EMCO 3143 Bilog antenna

EMCO 3115 Horn Antenna

HP 8566B Spectrum Analyzer

Preamplifiers: CDI P950, 10 - 1000 MHz

CDI P1000+, 1 - 10 GHz

# **INTERTEK TESTING SERVICES - Menlo Park**

**Teledesign Radio Modem with 3492 Transceiver**

**Date of Test: December 11, 1998**

## **6.3 Test Results**

Refer to the attached data sheets.

# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

Date of Test: December 11, 1998



Company: Teledesign System Inc.  
Project #: J98033454  
Model: JWFTS4000D (Tx @ 928.0 MHz)  
Engineer: Xi-Ming Yang  
Date of test: Dec. 11, 1998

## FCC 90 Radiated Emissions

| Frequency | Antenna  | Reading | Antenna | Pre-amp | Cable | Field    | Spurious    | Margin |
|-----------|----------|---------|---------|---------|-------|----------|-------------|--------|
| MHz       | Polarity |         | Factor  |         | Loss  | Strength | Attenuation |        |
|           | H/V      | dB(uV)  | dB(1/m) | dB      | dB    | dB(uV/m) | dB          | dB     |
| 1856.0    | V        | 34.0    | 27.5    | 0.0     | 2.0   | 63.5     | 70.2        | -13.2  |
| 2784.0    | V        | 35.4    | 29.0    | 0.0     | 2.2   | 66.6     | 67.1        | -10.1  |
| 3712.0    | V        | 23.0    | 32.0    | 0.0     | 2.9   | 57.9     | 75.8        | -18.8  |
| 4640.0    | V        | 31.0    | 32.5    | 0.0     | 3.5   | 67.0     | 66.7        | -9.7   |
| 5568.0    | V        | 28.7    | 34.4    | 0.0     | 4.2   | 67.3     | 66.4        | -9.4   |
| 6496.0    | V        | 26.2    | 34.2    | 0.0     | 4.4   | 64.8     | 68.9        | -11.9  |
| 7424.0    | H        | 18.0    | 37.5    | 0.0     | 4.7   | 60.2     | 73.5        | -16.5  |
| 8352.0    | H        | 18.0    | 37.3    | 0.0     | 4.9   | 60.2     | 73.5        | -16.5  |
| 9280.0    | V        | 18.0    | 37.4    | 0.0     | 5.4   | 60.8     | 72.9        | -15.9  |

- Note:
1. All measurement were made at 3 meters
  2. Field Strength at the fundamental frequency equals 133.7 dBuV/m
  3. Spurious emissions attenuation limit equals  $50 + 10 \log P = 57.0$  dB

# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

Date of Test: December 11, 1998



Company: Teledesign System Inc.  
Project #: J98033454  
Model: JWFTS4000D (Tx @ 944.0 MHz)  
Engineer: Xi-Ming Yang  
Date of test: Dec. 11, 1998

## FCC 90 Radiated Emissions

| Frequency | Antenna  | Reading | Antenna | Pre-amp | Cable | Field    | Spurious    | Margin |
|-----------|----------|---------|---------|---------|-------|----------|-------------|--------|
| MHz       | Polarity | dB(uV)  | Factor  | dB      | Loss  | Strength | Attenuation | dB     |
| 1888.0    | V        | 30.7    | 27.5    | 0.0     | 2.0   | 60.2     | 73.6        | -16.6  |
| 2832.0    | V        | 33.2    | 29.0    | 0.0     | 2.2   | 64.4     | 69.4        | -12.4  |
| 3776.0    | V        | 26.0    | 32.0    | 0.0     | 2.9   | 60.9     | 72.9        | -15.9  |
| 4720.0    | V        | 31.0    | 32.5    | 0.0     | 3.5   | 67.0     | 66.8        | -9.8   |
| 5664.0    | H        | 22.5    | 34.4    | 0.0     | 4.2   | 61.1     | 72.7        | -15.7  |
| 6608.0    | H        | 22.0    | 34.2    | 0.0     | 4.4   | 60.6     | 73.2        | -16.2  |
| 7552.0    | H        | 18.0    | 37.5    | 0.0     | 4.7   | 60.2     | 73.6        | -16.6  |
| 8496.0    | H        | 18.0    | 37.3    | 0.0     | 4.9   | 60.2     | 73.6        | -16.6  |
| 9440.0    | V        | 18.0    | 37.4    | 0.0     | 5.4   | 60.8     | 73.0        | -16.0  |

- Note:
1. All measurement were made at 3 meters
  2. Field Strength at the fundamental frequency equals 133.8 dBuV/m
  3. Spurious emissions attenuation limit equals  $50 + 10\log P = 57.0$  dB

# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

Date of Test: December 11, 1998



Company: Teledesign System Inc.  
Project #: J98033454  
Model: JWFTS4000D (Tx @ 960.0 MHz)  
Engineer: Xi-Ming Yang  
Date of test: Dec. 11, 1998

## FCC 90 Radiated Emissions

| Frequency | Antenna  | Reading | Antenna | Pre-amp | Cable | Field    | Spurious    | Margin |
|-----------|----------|---------|---------|---------|-------|----------|-------------|--------|
| MHz       | Polarity | dB(uV)  | Factor  | dB      | Loss  | Strength | Attenuation | dB     |
| 1920.0    | H        | 38.6    | 27.5    | 0.0     | 2.0   | 68.1     | 66.0        | -9.0   |
| 2880.0    | V        | 30.0    | 29.0    | 0.0     | 2.2   | 61.2     | 72.9        | -15.9  |
| 3840.0    | V        | 29.2    | 32.0    | 0.0     | 2.9   | 64.1     | 70.0        | -13.0  |
| 4800.0    | H        | 31.2    | 32.5    | 0.0     | 3.5   | 67.2     | 66.9        | -9.9   |
| 5760.0    | V        | 25.0    | 34.4    | 0.0     | 4.2   | 63.6     | 70.5        | -13.5  |
| 6720.0    | V        | 31.0    | 34.2    | 0.0     | 4.4   | 69.6     | 64.5        | -7.5   |
| 7680.0    | H        | 18.0    | 37.5    | 0.0     | 4.7   | 60.2     | 73.9        | -16.9  |
| 8640.0    | V        | 18.0    | 37.3    | 0.0     | 4.9   | 60.2     | 73.9        | -16.9  |
| 9600.0    | H        | 18.0    | 37.4    | 0.0     | 5.4   | 60.8     | 73.3        | -16.3  |

- Note:
1. All measurement were made at 3 meters
  2. Field Strength at the fundamental frequency equals 134.1 dBuV/m
  3. Spurious emissions attenuation limit equals  $50 + 10 \log P = 57.0$  dB

# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

Date of Test: December 11, 1998



Company: Teledesign System Inc.  
Project #: J98033454  
Model: JWFTS4000D (Rx @ High Mid. and Low Channal)  
Engineer: Xi-Ming Yang  
Date of test: Dec. 11, 1998

## FCC 15.209 Radiated Emissions

| Low Ch.<br>Frequency | Antenna<br>Polarity | Reading | Antenna<br>Factor | Pre-amp | Cable<br>Loss | Corrected<br>Reading | Limit    | Margin |
|----------------------|---------------------|---------|-------------------|---------|---------------|----------------------|----------|--------|
| MHz                  | H/V                 | dB(uV)  | dB(1/m)           | dB      | dB            | dB(uV/m)             | dB(uV/m) | dB     |
| 840.2                | V                   | 23.9    | 22.3              | -14.6   | 0.8           | 32.4                 | 46.0     | -13.6  |
| 1680.3               | V                   | 40.8    | 24.9              | -29.6   | 1.6           | 37.7                 | 54.0     | -16.3  |
| 2520.5               | V                   | 30.0    | 27.9              | -28.4   | 2.2           | 31.7                 | 54.0     | -22.3  |
| Mid. Ch              |                     |         |                   |         |               |                      |          |        |
| 856.2                | H                   | 23.1    | 22.3              | -14.6   | 0.8           | 31.6                 | 46.0     | -14.4  |
| 1712.3               | H                   | 34.0    | 24.9              | -29.6   | 1.6           | 30.9                 | 54.0     | -23.1  |
| 2568.4               | V                   | 36.0    | 27.9              | -28.4   | 2.2           | 37.7                 | 54.0     | -16.3  |
| High Ch              |                     |         |                   |         |               |                      |          |        |
| 872.2                | H                   | 22.0    | 22.3              | -14.6   | 0.8           | 30.5                 | 46.0     | -15.5  |
| 1744.3               | H                   | 33.5    | 24.9              | -29.6   | 1.6           | 30.4                 | 54.0     | -23.6  |
| 2616.4               | V                   | 34.7    | 27.9              | -28.4   | 2.2           | 36.4                 | 54.0     | -17.6  |

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

# **INTERTEK TESTING SERVICES - Menlo Park**

**Teledesign Radio Modem with 3492 Transceiver**

**Date of Test: December 11, 1998**

## **7.0 Line Conducted Emissions, FCC § 15.107**

### **7.1 Test Procedure**

Test procedure described in the ANSI C63.4 Standard was employed.

The EUT was connected to the DC power supply, that was connected to the AC line through the LISNs.

Both HOT and NEUTRAL leads were tested.

# **INTERTEK TESTING SERVICES - Menlo Park**

**Teledesign Radio Modem with 3492 Transceiver**

**Date of Test: December 11, 1998**

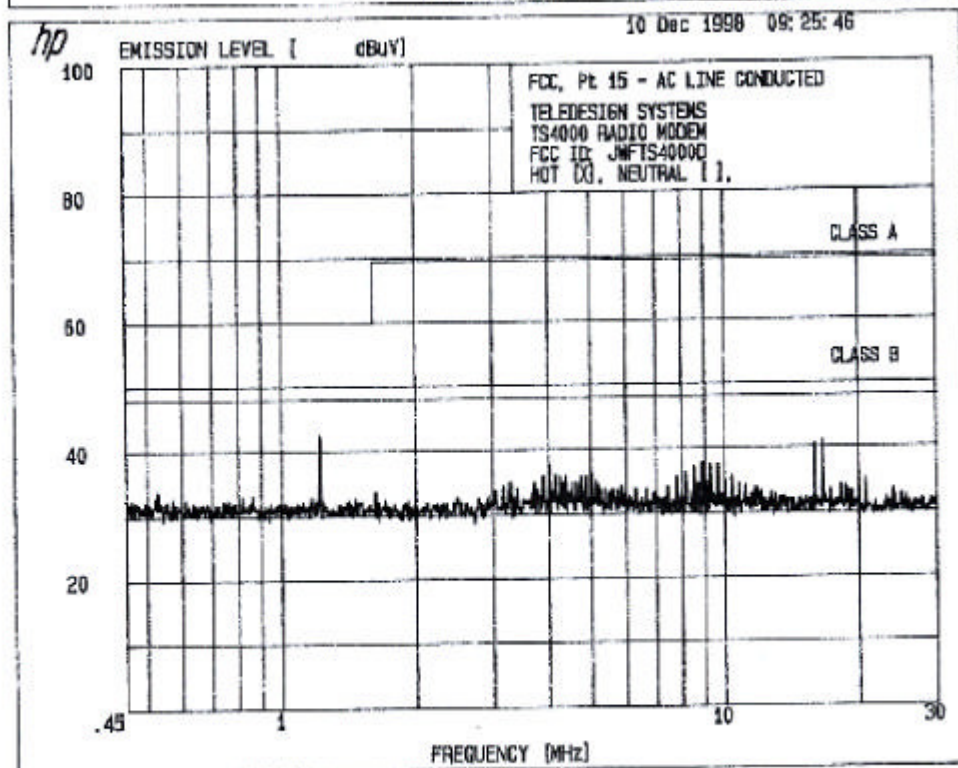
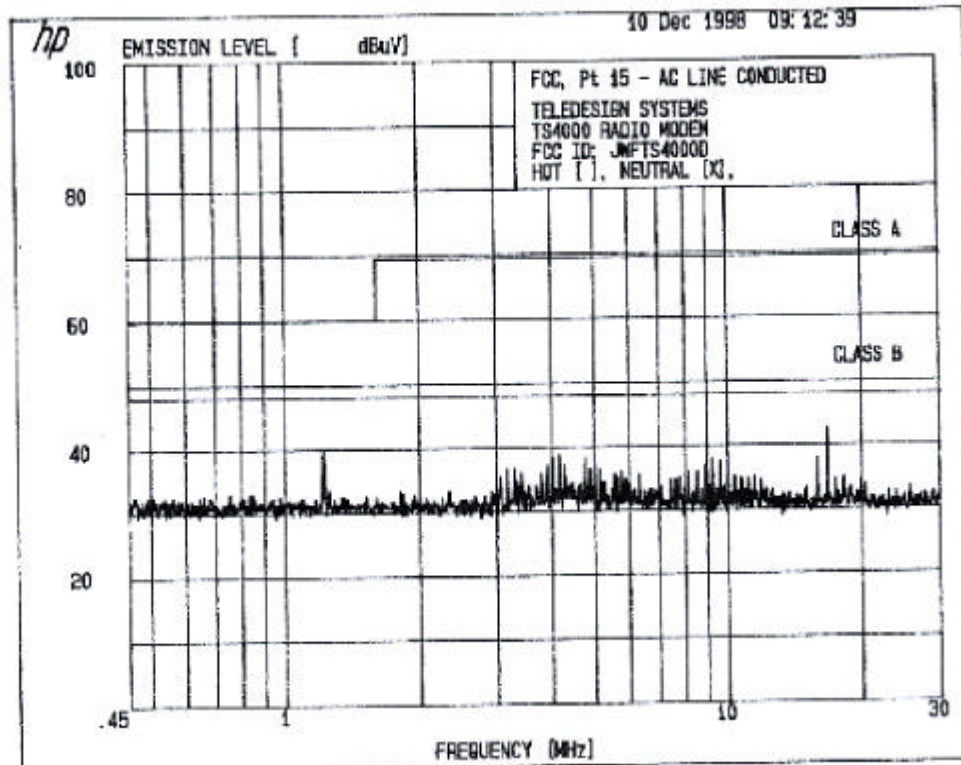
## **7.2 Test Results**

See attached pages.

# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

Date of Test: December 11, 1998

| 10 Dec 1998 09:25:46                                                                                 |                 |             |
|------------------------------------------------------------------------------------------------------|-----------------|-------------|
| 3. FCC CFR 47, Pt 15<br>3.1 FCC, Pt 15 - AC LINE CONDUCTED                                           |                 |             |
| TELEDESIGNSYSTEMS, TS 4000 RADIO MODEM<br>FCC ID: JWFTS4000D<br>(Neutral), Peaks Found Above 38 dBuV |                 |             |
| PEAK #                                                                                               | FREQUENCY (MHz) | AMPL (dBuV) |
| 1                                                                                                    | 1.227           | 39.8        |
| 2                                                                                                    | 4.038           | 38.3        |
| 3                                                                                                    | 4.158           | 38.9        |
| 4                                                                                                    | 4.776           | 38.4        |
| 5                                                                                                    | 9.267           | 38.0        |
| 6                                                                                                    | 15.92           | 38.0        |
| 7                                                                                                    | 16.74           | 42.7        |

| 10 Dec 1998 09:25:46                                                                             |                 |             |
|--------------------------------------------------------------------------------------------------|-----------------|-------------|
| 3. FCC CFR 47, Pt 15<br>3.1 FCC, Pt 15 - AC LINE CONDUCTED                                       |                 |             |
| TELEDESIGNSYSTEMS, TS 4000 RADIO MODEM<br>FCC ID: JWFTS4000B<br>(Hot), Peaks Found Above 38 dBuV |                 |             |
| PEAK #                                                                                           | FREQUENCY (MHz) | AMPL (dBuV) |
| 1                                                                                                | 1.221           | 42.5        |
| 2                                                                                                | 15.92           | 40.5        |
| 3                                                                                                | 16.60           | 41.0        |

# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

Date of Test: December 11, 1998

## 8.0 Frequency Stability vs Temperature, FCC § 2.995(a)

### 8.1 Test Procedure

The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feedthrough attenuators. The EUT was placed inside the temperature chamber. The DC leads, RF output cable, exited the chamber through an opening. After the temperature stabilized for approximately 20 minutes, the frequency of the output signal was recorded from the counter.

### 8.2 Test Equipment

Temperature Chamber, -50C to +100C  
Hewlett Packard 5383A Frequency Counter  
Tektronix 2784 Spectrum Analyzer  
Goldstar DC Power Supply, GR303

### 8.3 Test Results

Refer to the test data below.

Frequency: 944 MHz, Tolerance  $\pm 1416$  Hz

| Frequency Stability vs Temperature |                 |
|------------------------------------|-----------------|
| Temperature, C                     | Difference (Hz) |
| +60                                | -138            |
| +50                                | -300            |
| +40                                | -125            |
| +30                                | - 25            |
| +20                                | -300            |
| +10                                | -788            |
| 0                                  | -850            |
| -10                                | -975            |
| -20                                | -1000           |
| -30                                | -1188           |

Justification: Passed

# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

Date of Test: December 11, 1998

## 9.0 Frequency Stability vs Voltage, FCC 2.995(d)(3)

### 9.1 Test Procedure

An external variable DC power supply was connected to the EUT. The frequency of the transmitter was measured for the nominal supply voltage and at each extreme of the supply voltage range.

### 9.2 Test Equipment

Hewlett Packard 5383A Frequency Counter

Tektronix 2784 Spectrum Analyzer

Goldstar DC Power Supply, GR303

### 9.3 Test Results.

Refer to the test data below.

Frequency: 944.00 MHz, Tolerance  $\pm 1416$  Hz

| Frequency Stability vs. Voltage |                 |
|---------------------------------|-----------------|
| Voltage                         | Difference (Hz) |
| 11                              | -180            |
| 14                              | -135            |
| 20                              | -120            |
| 24                              | -110            |
| 28                              | -105            |

Justification: Passed

# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

Date of Test: December 11, 1998

## 10.0 Transient Frequency Behavior, FCC 90.214

### 10.1 Test Procedure

Test was performed according the TIA/EIA/IS-102.CAAA, Section 2.2.18. The transmitter was continuously transmitting an unmodulated signal. The generator was generating FM signal (1 kHz tone, 12.5 kHz deviation). Several plots were made on the FM demodulator output with the EUT turned ON and OFF.

| PLOT # | FREQ.<br>MHz | TRANSMIT<br>MODULATION | DESCRIPTION            |
|--------|--------------|------------------------|------------------------|
| 10.1   | 928          | Low                    | Transmitter On, T1     |
| 10.2   | 928          | Low                    | Transmitter On, T2     |
| 10.3   | 928          | Low                    | Transmitter Off, T3    |
| 10.4   | 928          | High                   | Transmitter On, T1, T2 |
| 10.5   | 928          | High                   | Transmitter Off, T3    |
| 10.6   | 944          | Low                    | Transmitter On, T1     |
| 10.7   | 944          | Low                    | Transmitter On, T2     |
| 10.8   | 944          | Low                    | Transmitter Off, T3    |
| 10.9   | 944          | High                   | Transmitter On, T1, T2 |
| 10.10  | 944          | High                   | Transmitter Off, T3    |
| 10.11  | 960          | Low                    | Transmitter On, T1     |
| 10.12  | 960          | Low                    | Transmitter On, T2     |
| 10.13  | 960          | Low                    | Transmitter Off, T3    |
| 10.14  | 960          | High                   | Transmitter On, T1, T2 |
| 10.15  | 960          | High                   | Transmitter Off, T3    |

# **INTERTEK TESTING SERVICES - Menlo Park**

**Teledesign Radio Modem with 3492 Transceiver**

**Date of Test: December 11, 1998**

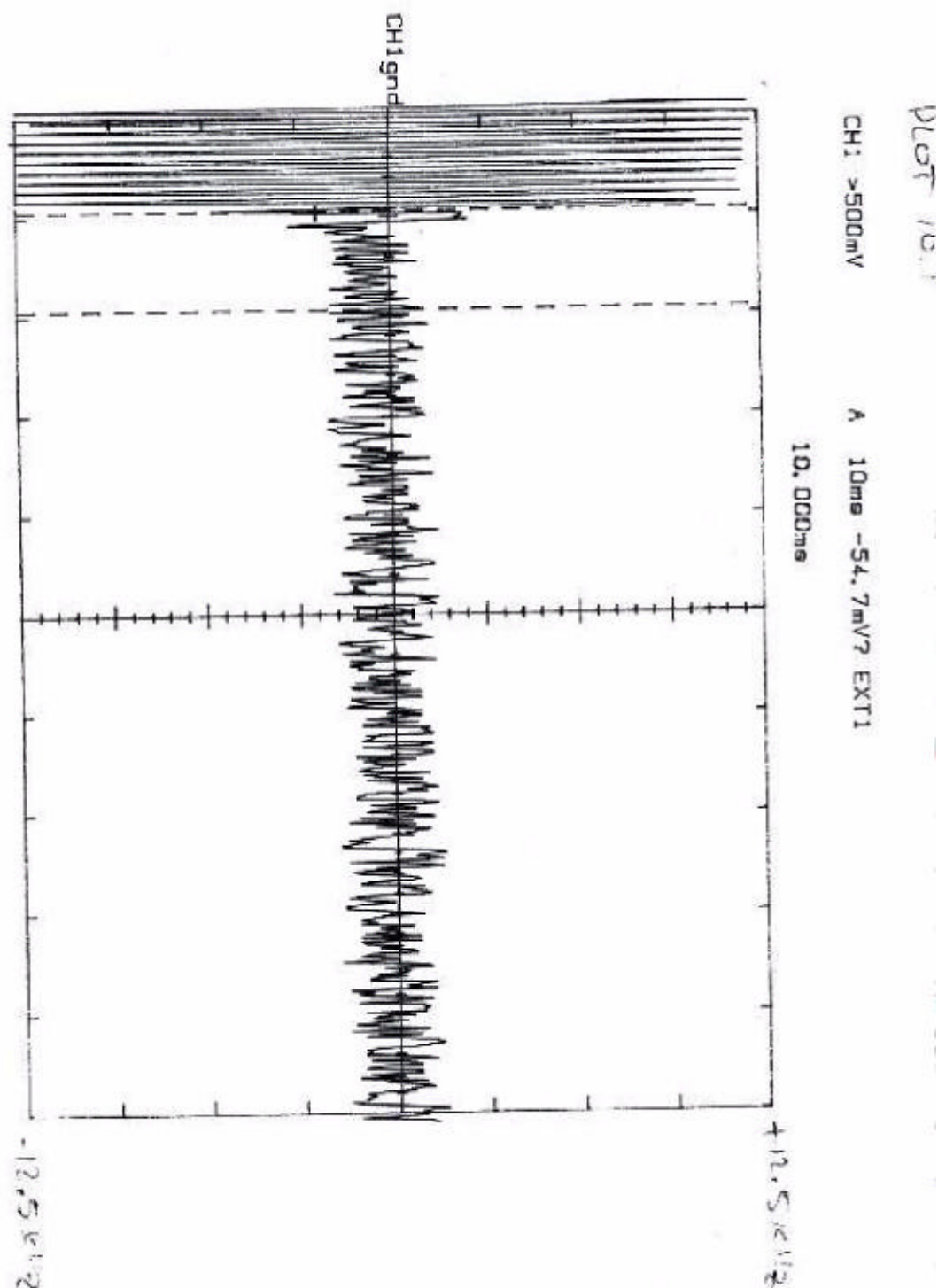
## **10.2 Test Result**

For the test result, see attached plots. The EUT passed the test.

# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

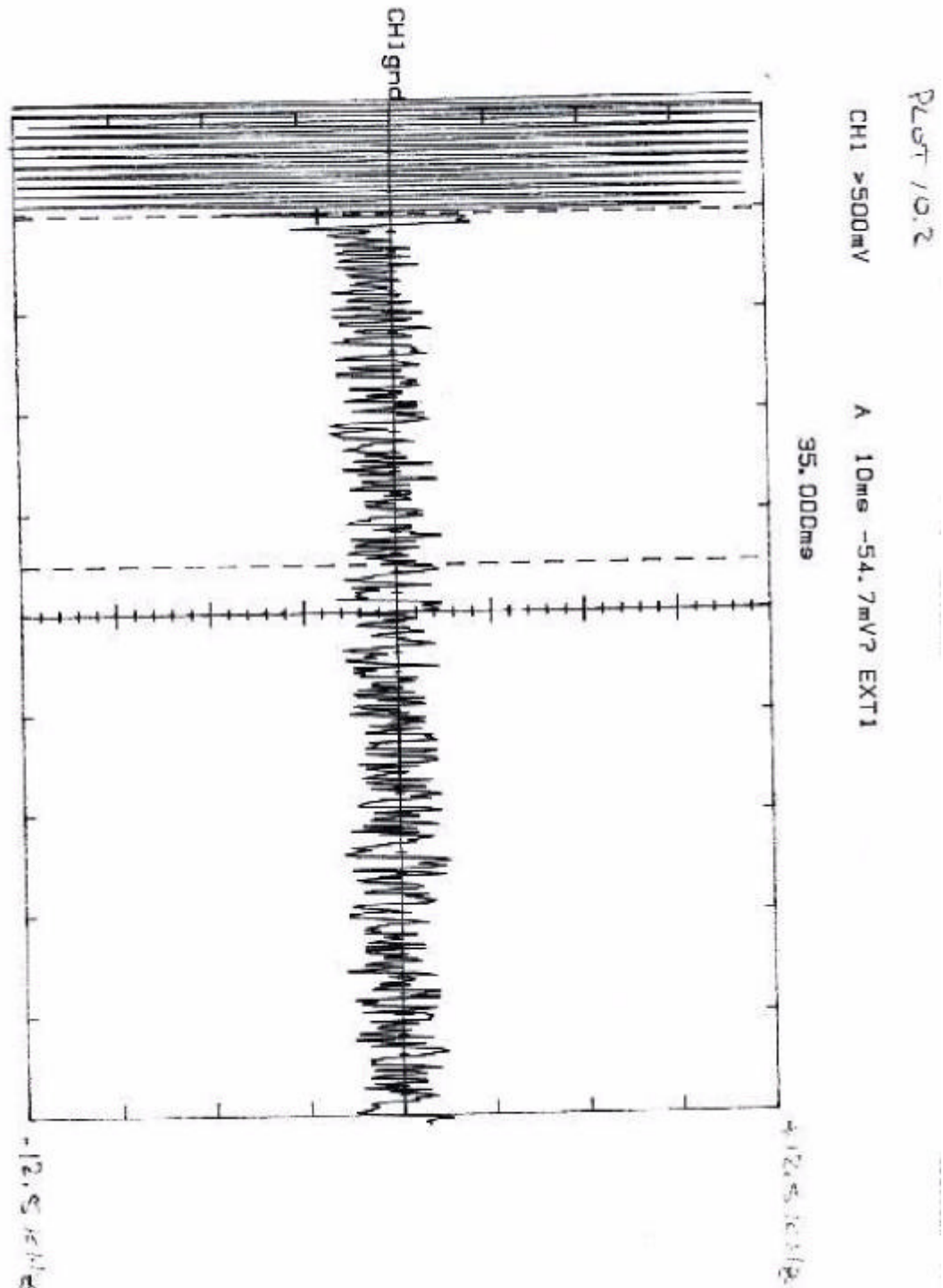
Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

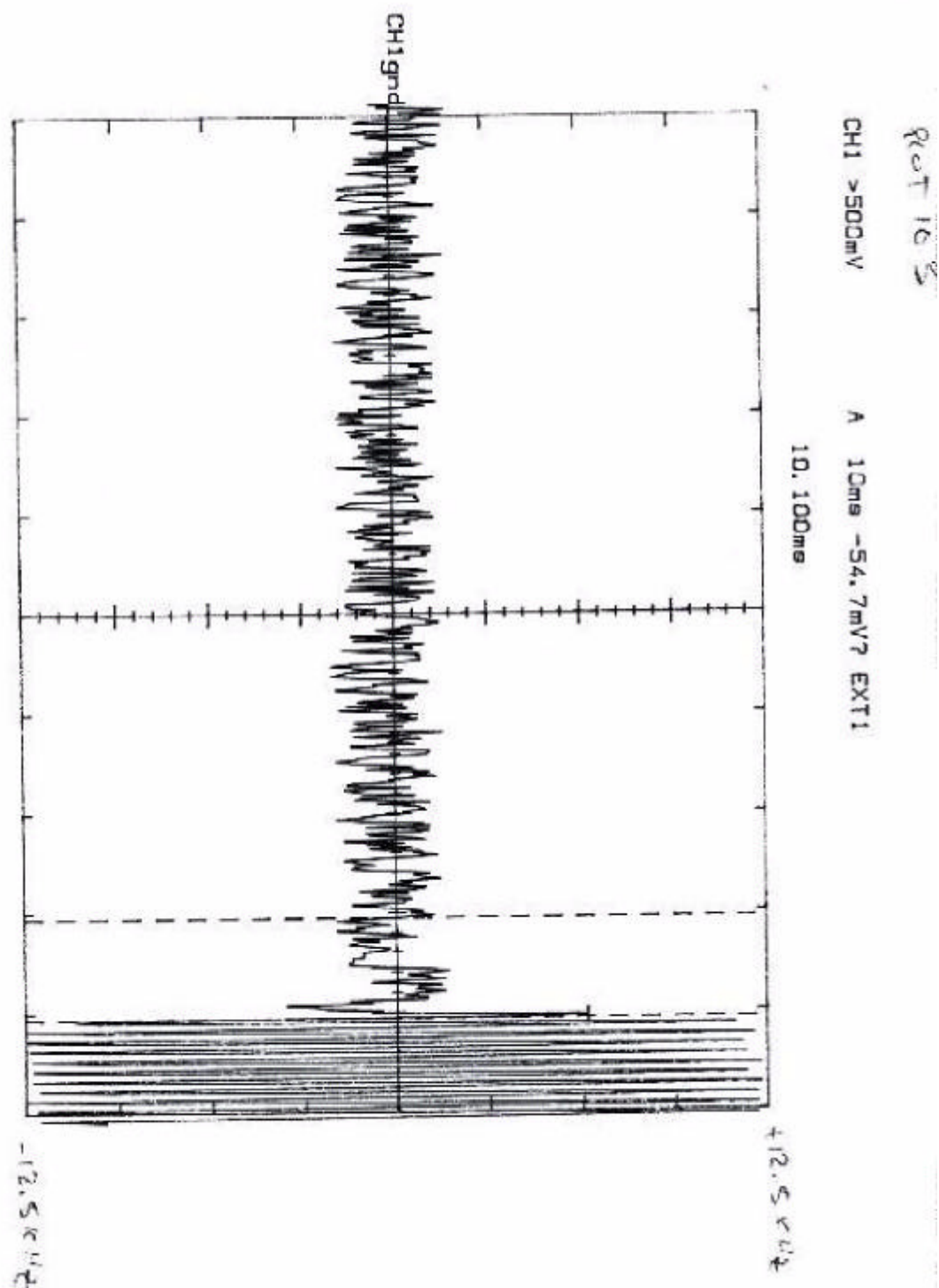
Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

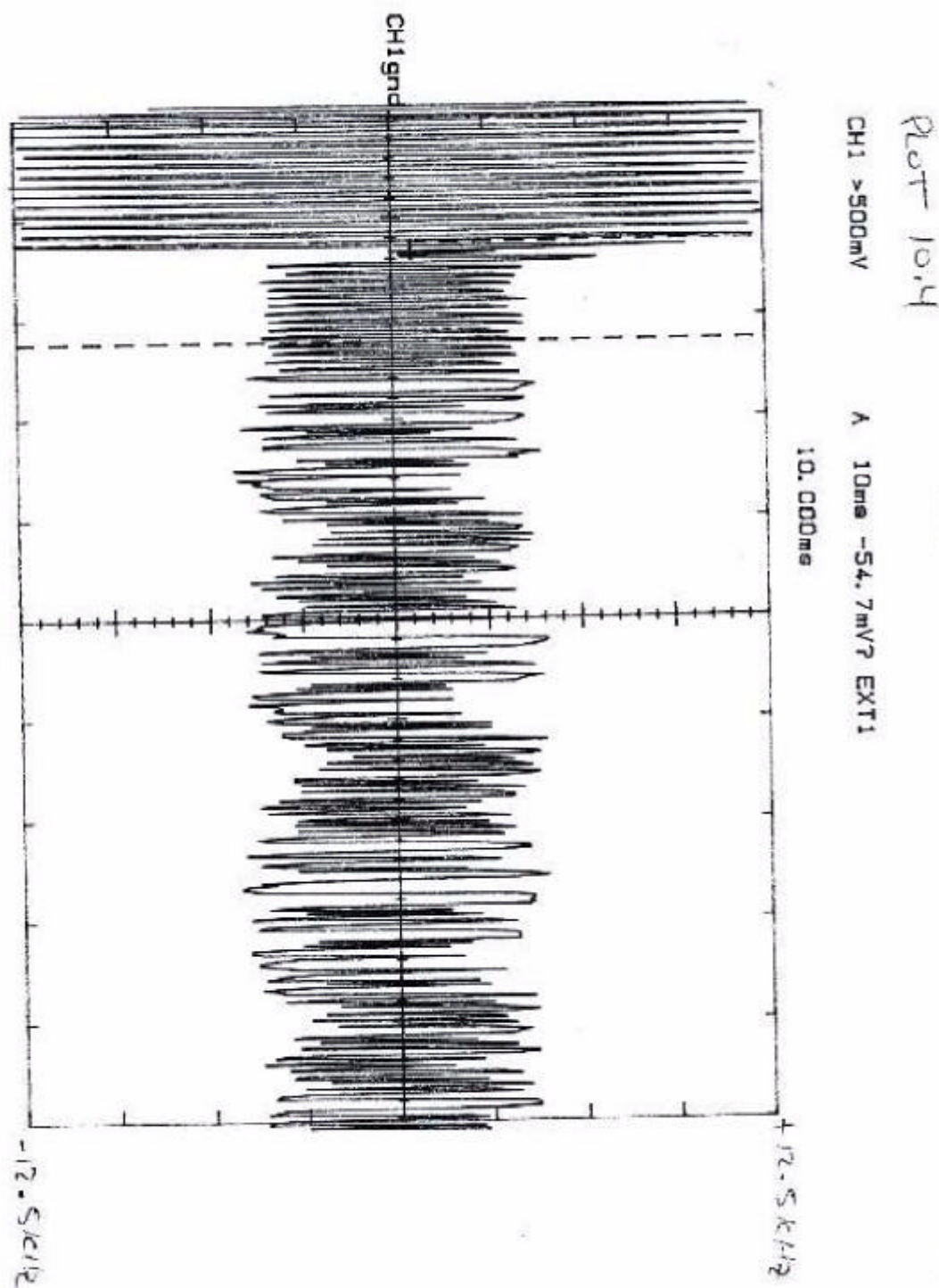
Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

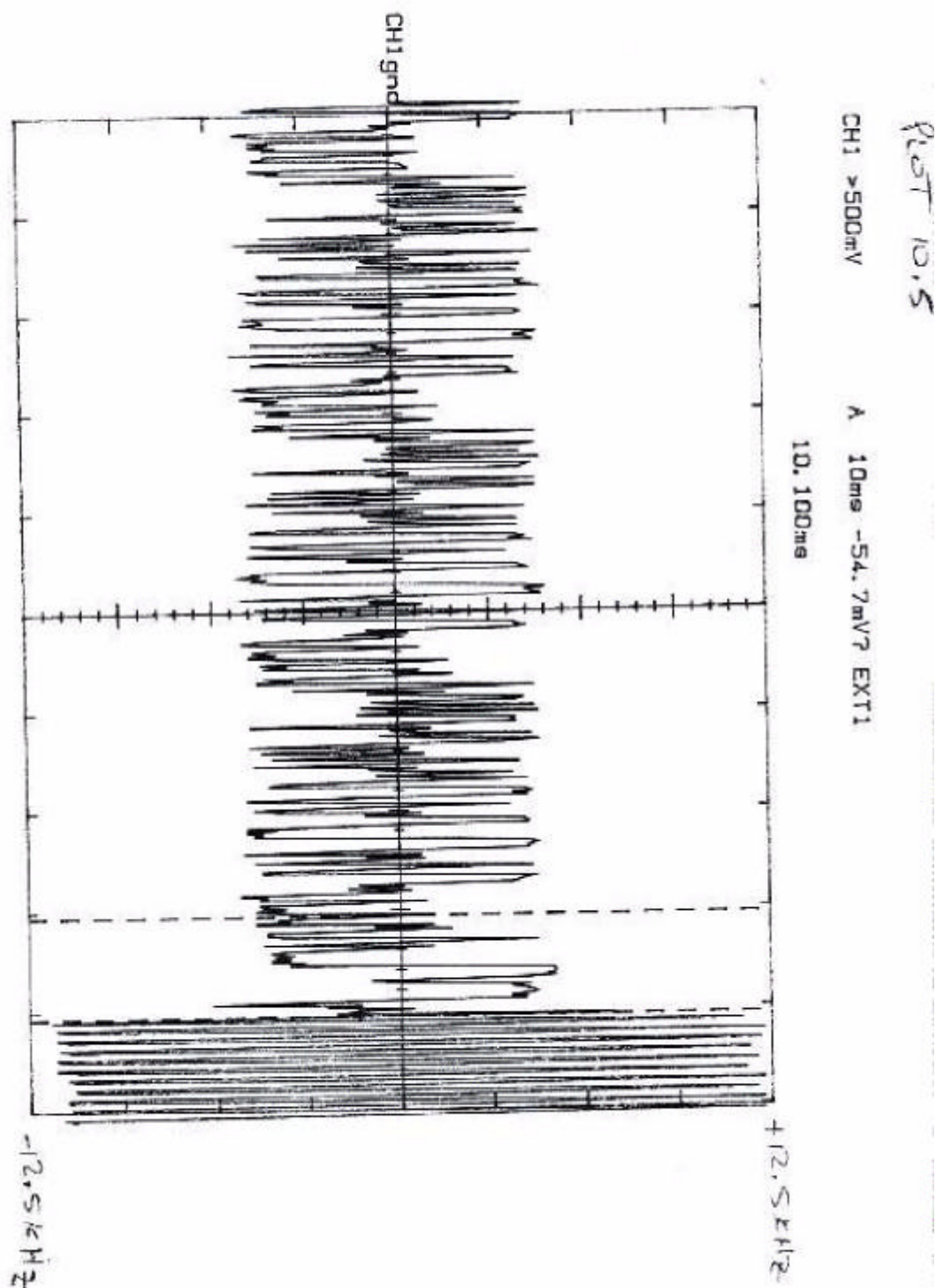
Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

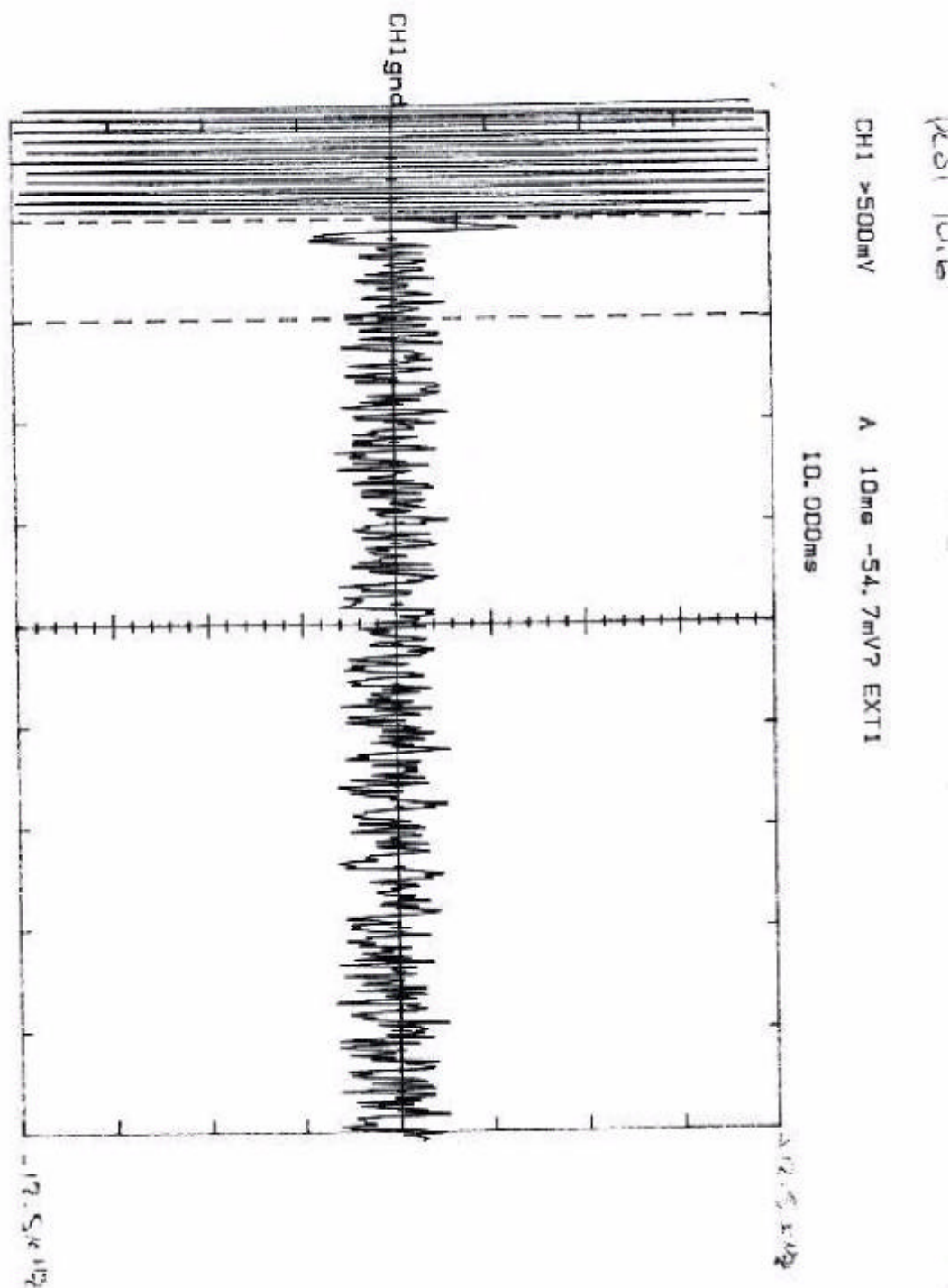
Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

Date of Test: December 11, 1998



## Teledesign Radio Modem with 3492 Transceiver

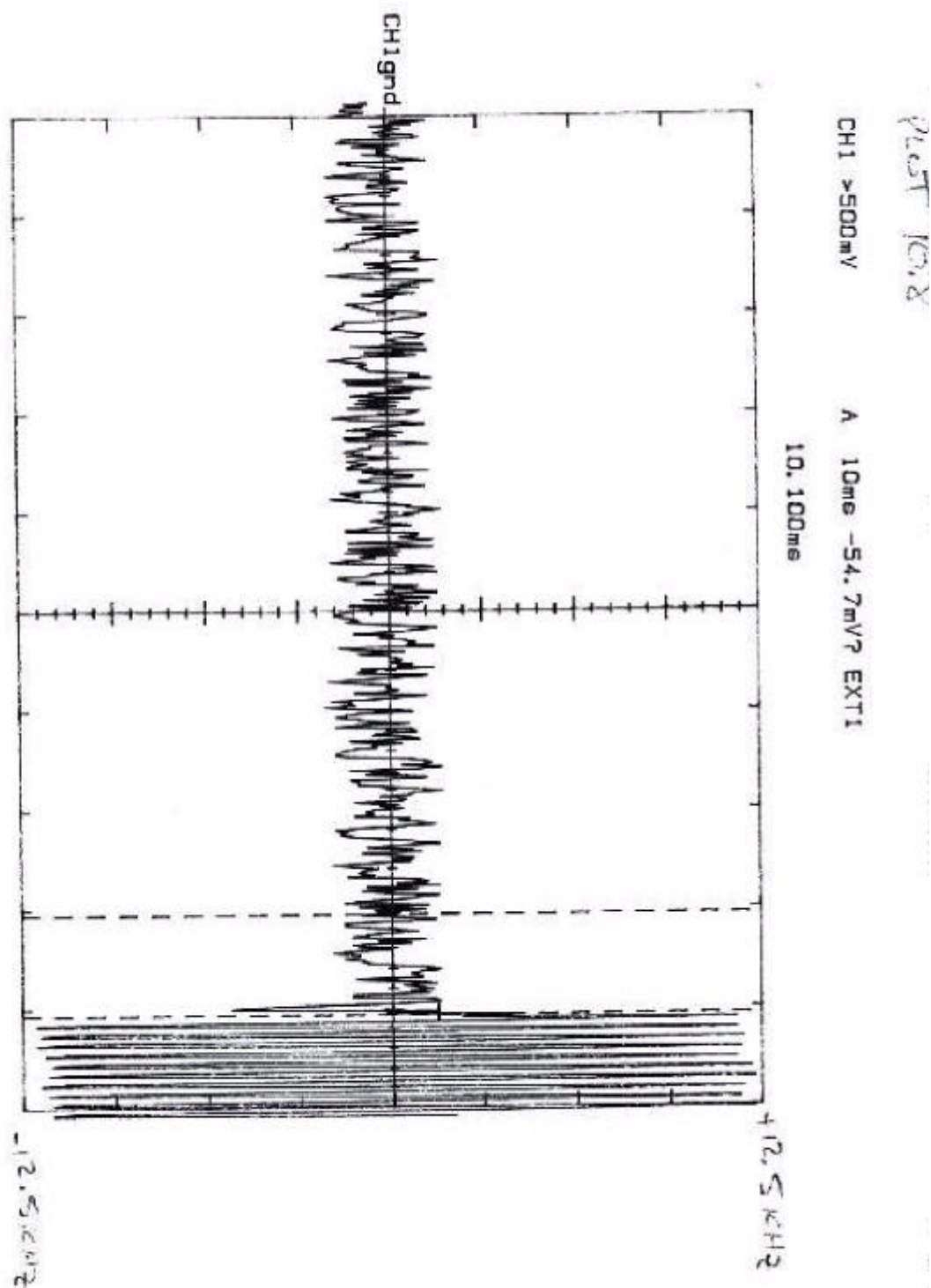
**Date of Test: December 11, 1998**



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

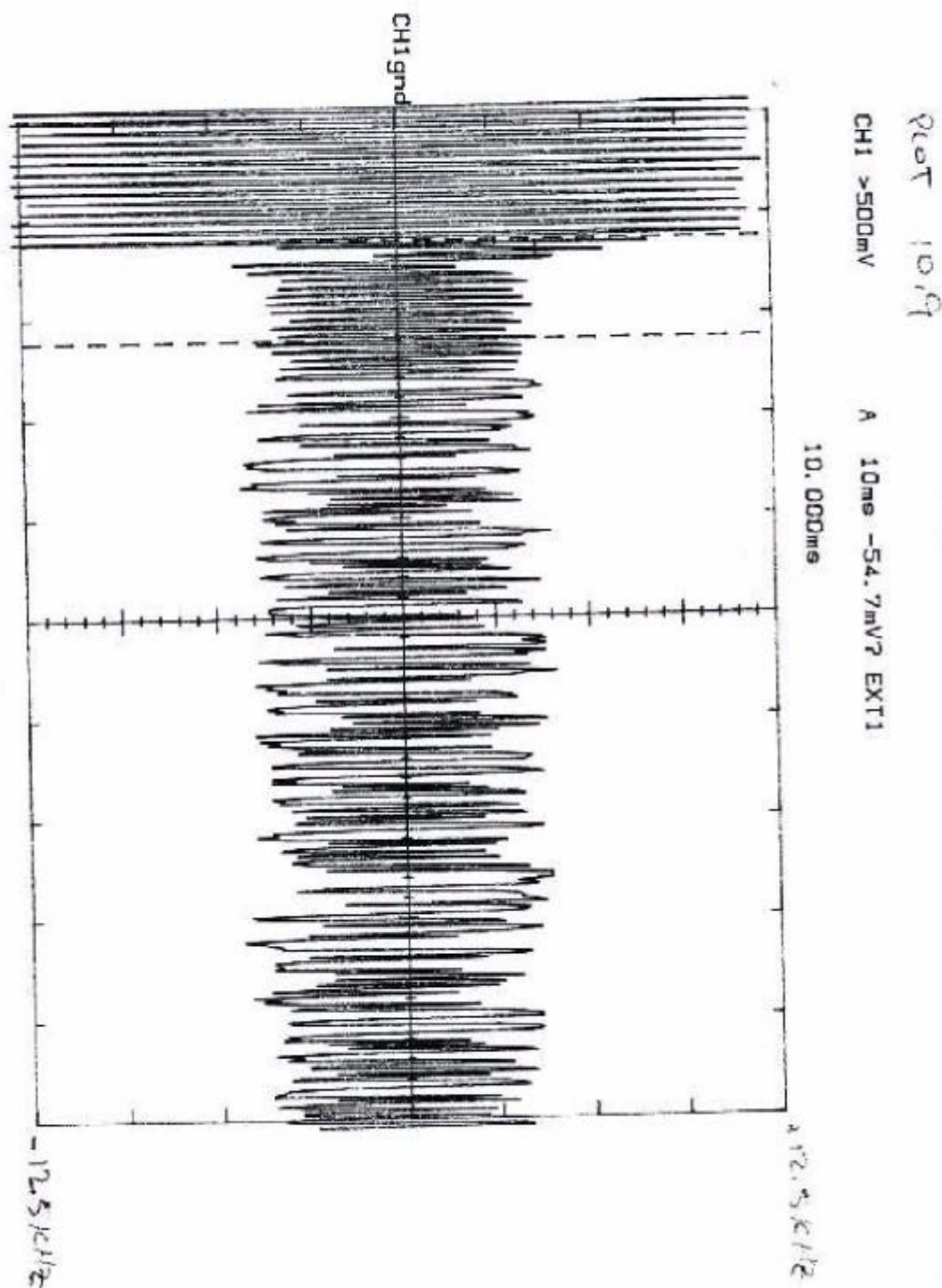
Date of Test: December 11, 1998



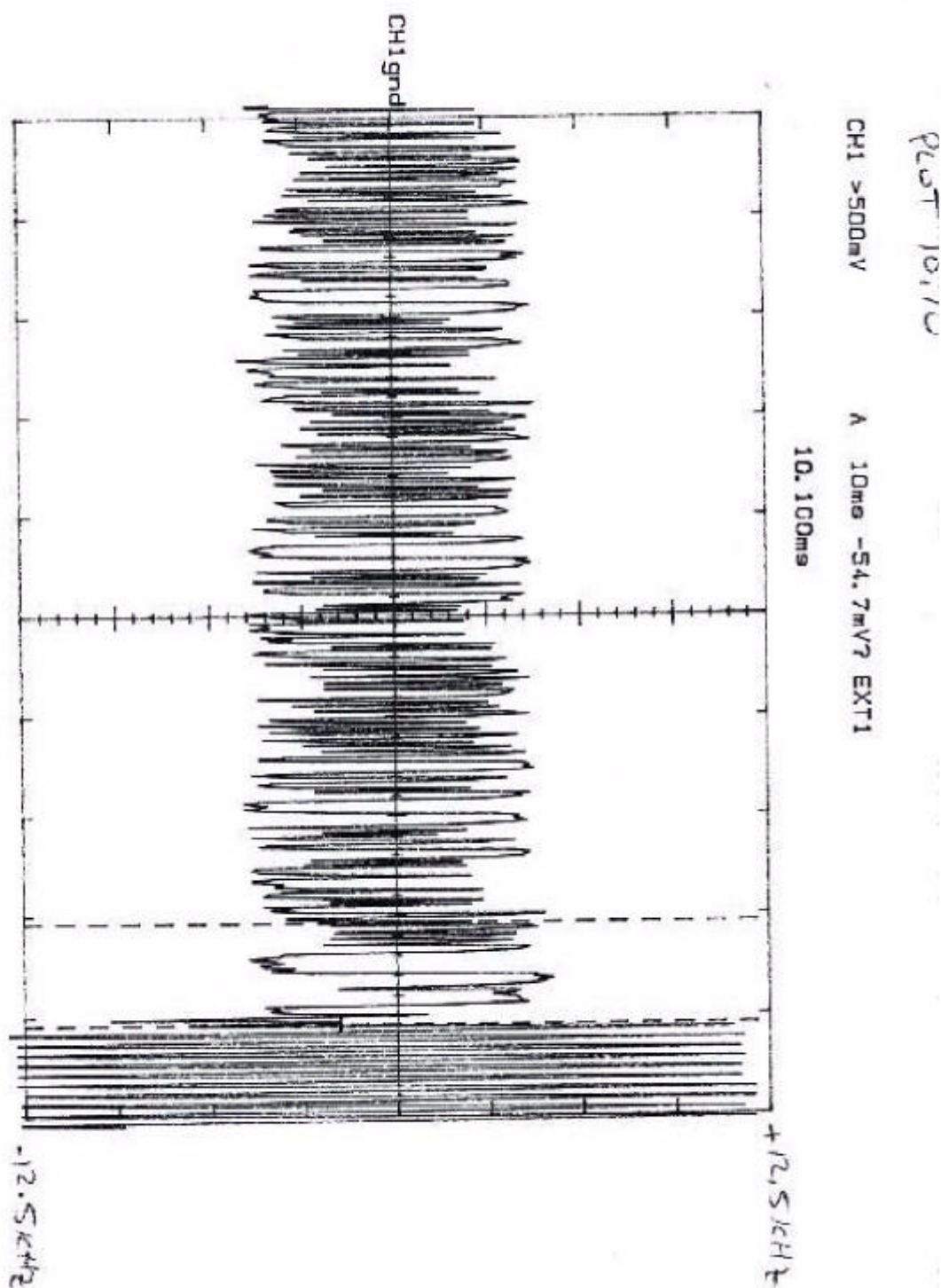
# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

Date of Test: December 11, 1998



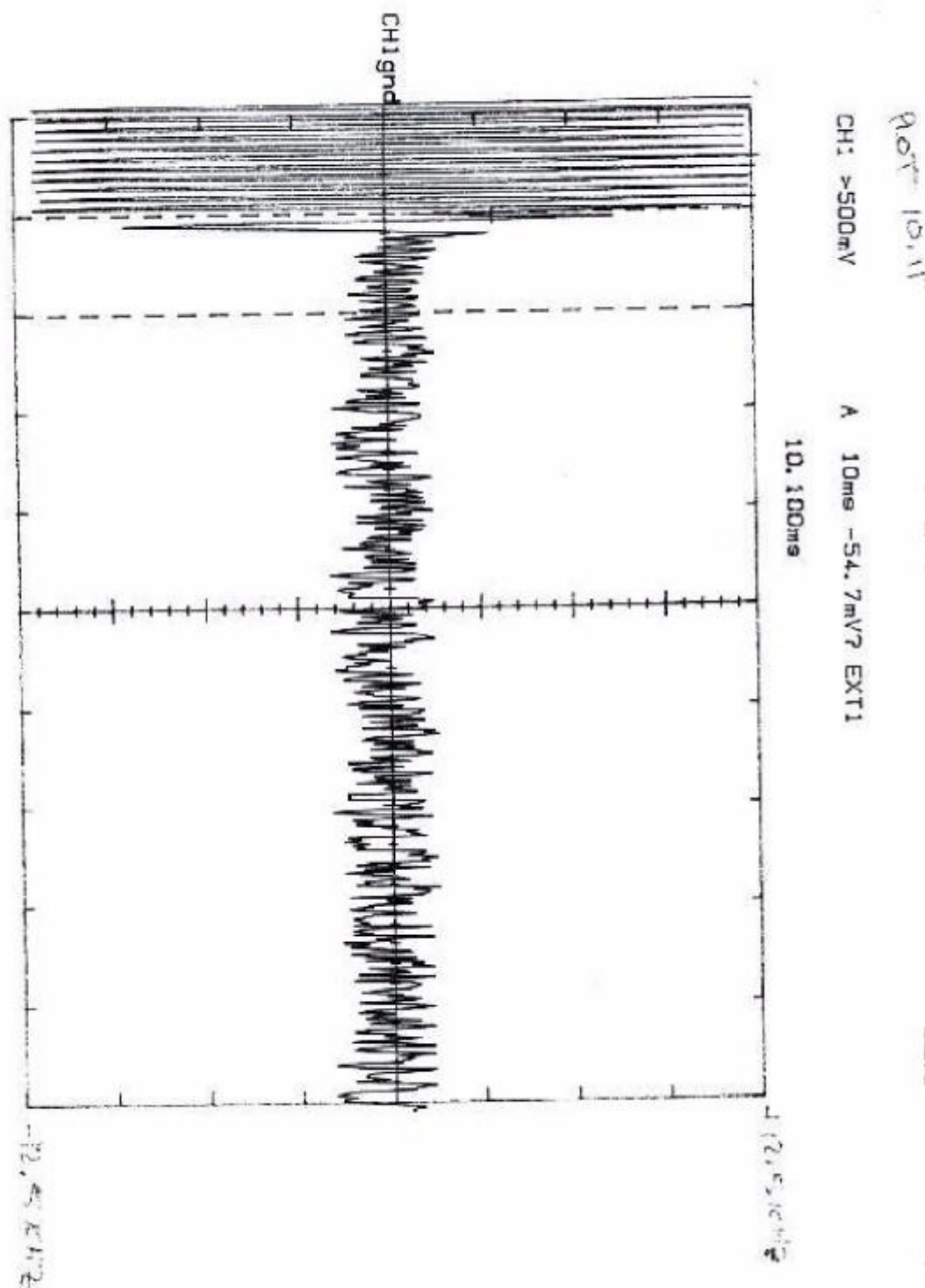
**Date of Test: December 11, 1998**



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

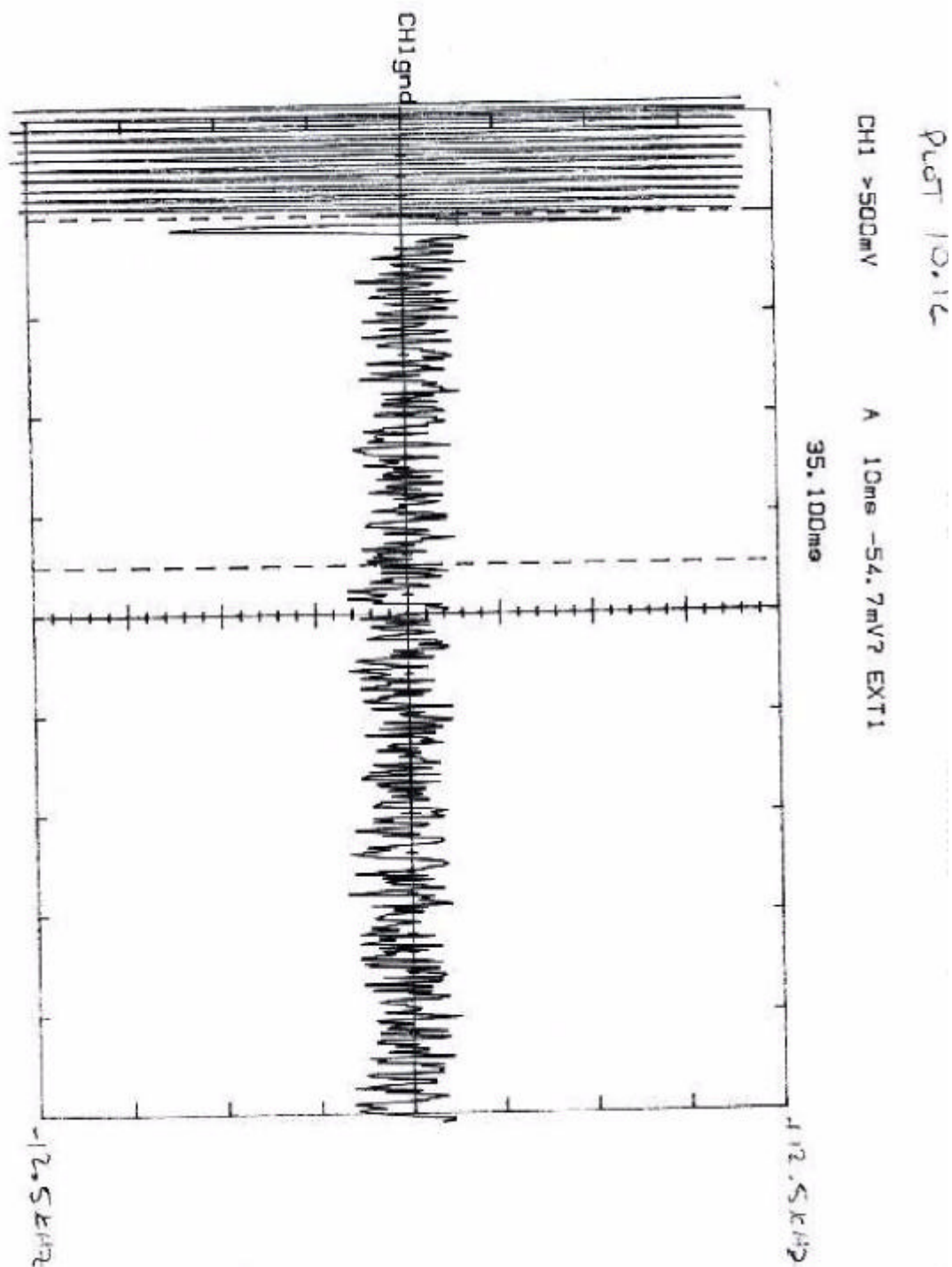
Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

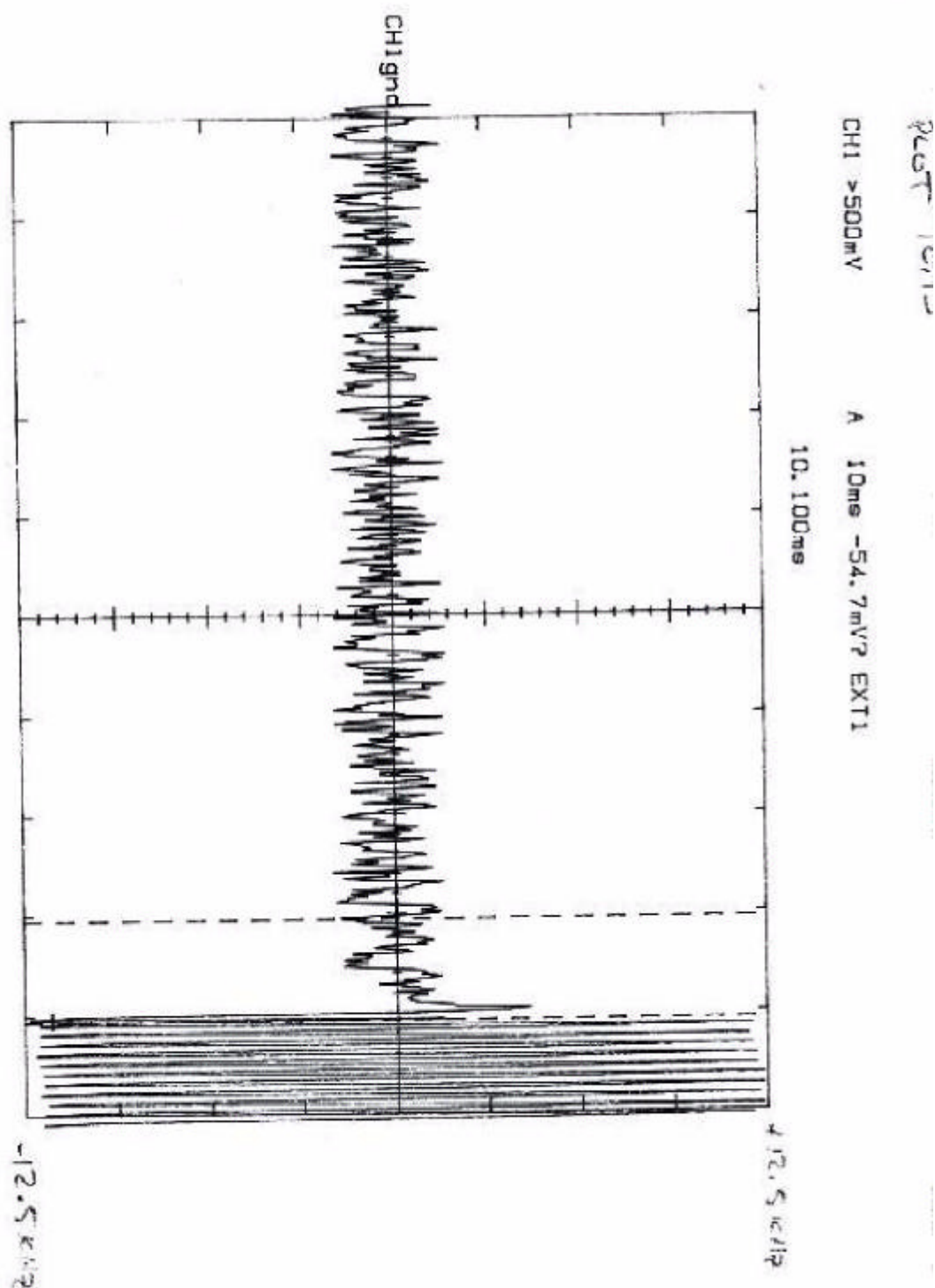
Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

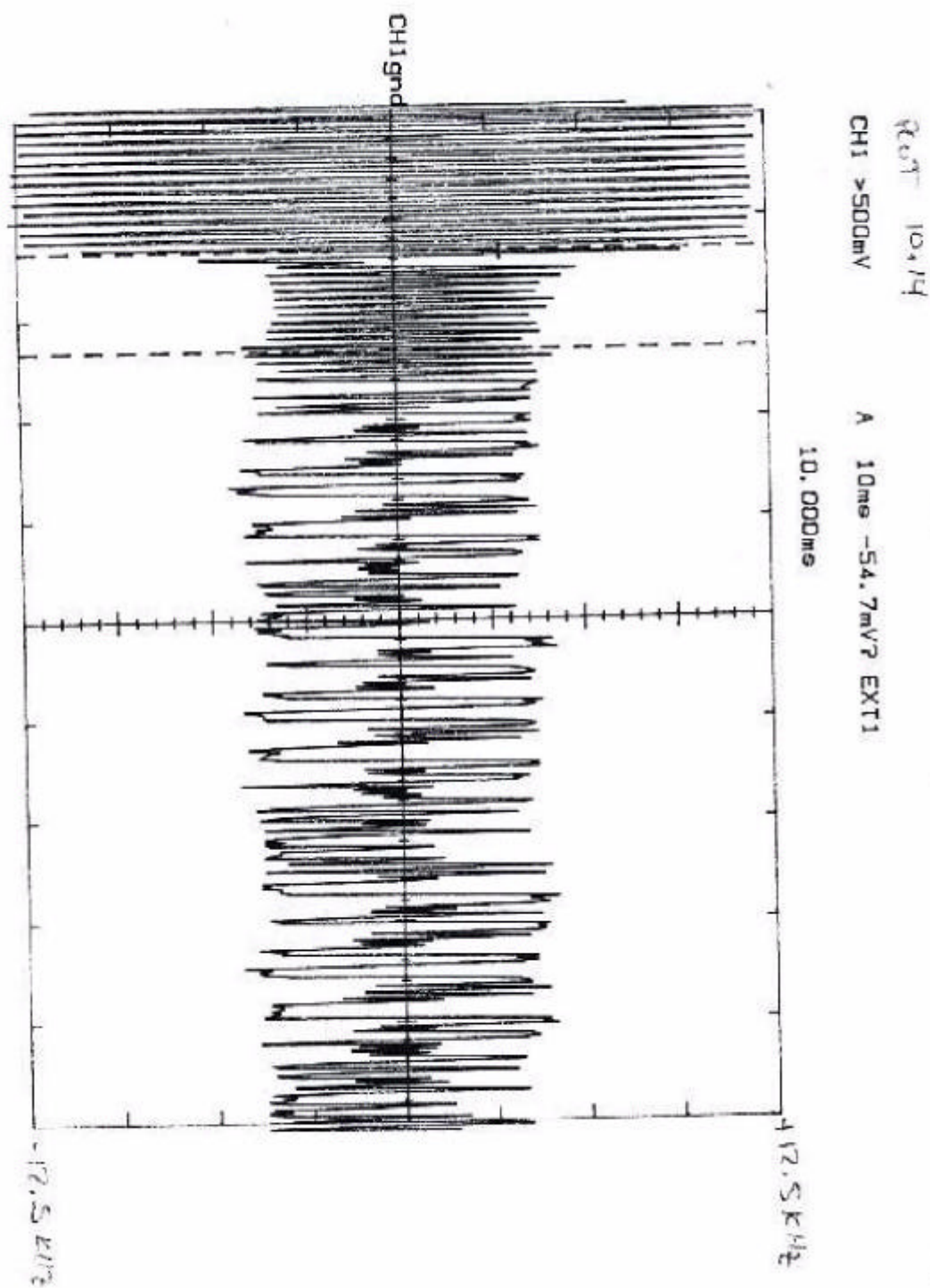
Date of Test: December 11, 1998



# INTERTEK TESTING SERVICES - Menlo Park

Teledesign Radio Modem with 3492 Transceiver

Date of Test: December 11, 1998



## Teledesign Radio Modem with 3492 Transceiver

**Date of Test: December 11, 1998**

