A

APPLICATION FOR FCC PART 90 TYPE ACCEPTANCE

Teledesign Systems Inc.

Radio Modem with 3422 Transceiver
Model No.: TS4000-05Cff

FCC ID: JWFTS4000C

Report # J98033454C

Date of Report: December 21, 1998

Total No. of Pages Contained in this Report: 73

The results contained in this report were derived from measurements performed on the identified test samples. Any implied performance of other samples on this report is dependent on the representative of the samples tested.

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February 2, 1999

Xi-Ming Yang
Test Engineer

Date

1.2 Product Description

The unit under test is a radio modem with 3422 transceiver.. For more details, see attached information.

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: ATH2423422-007
Date of Grant: December 10, 1996
File No.: 31010/EQU 17.9

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

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.

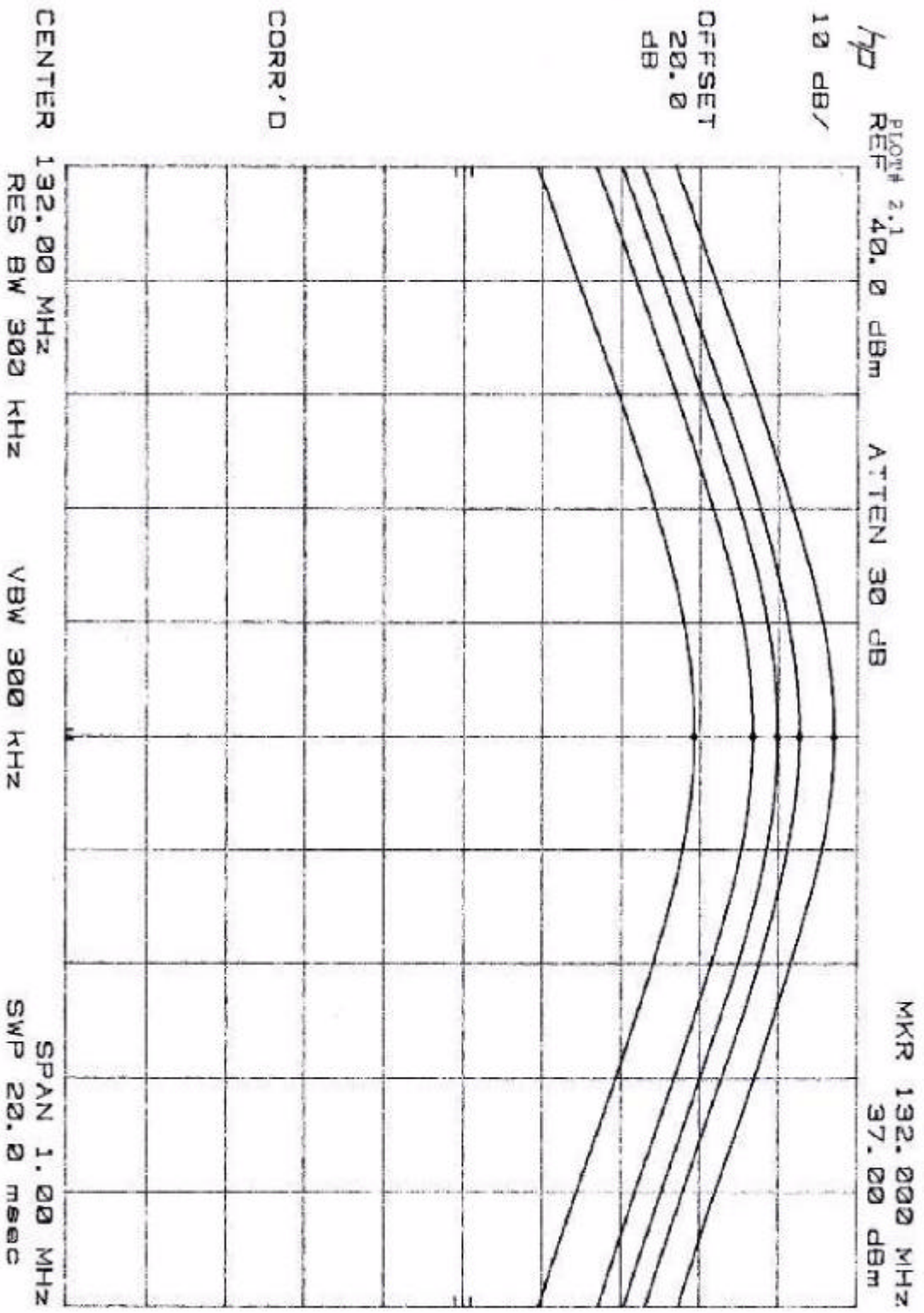
2.2 Test Equipment

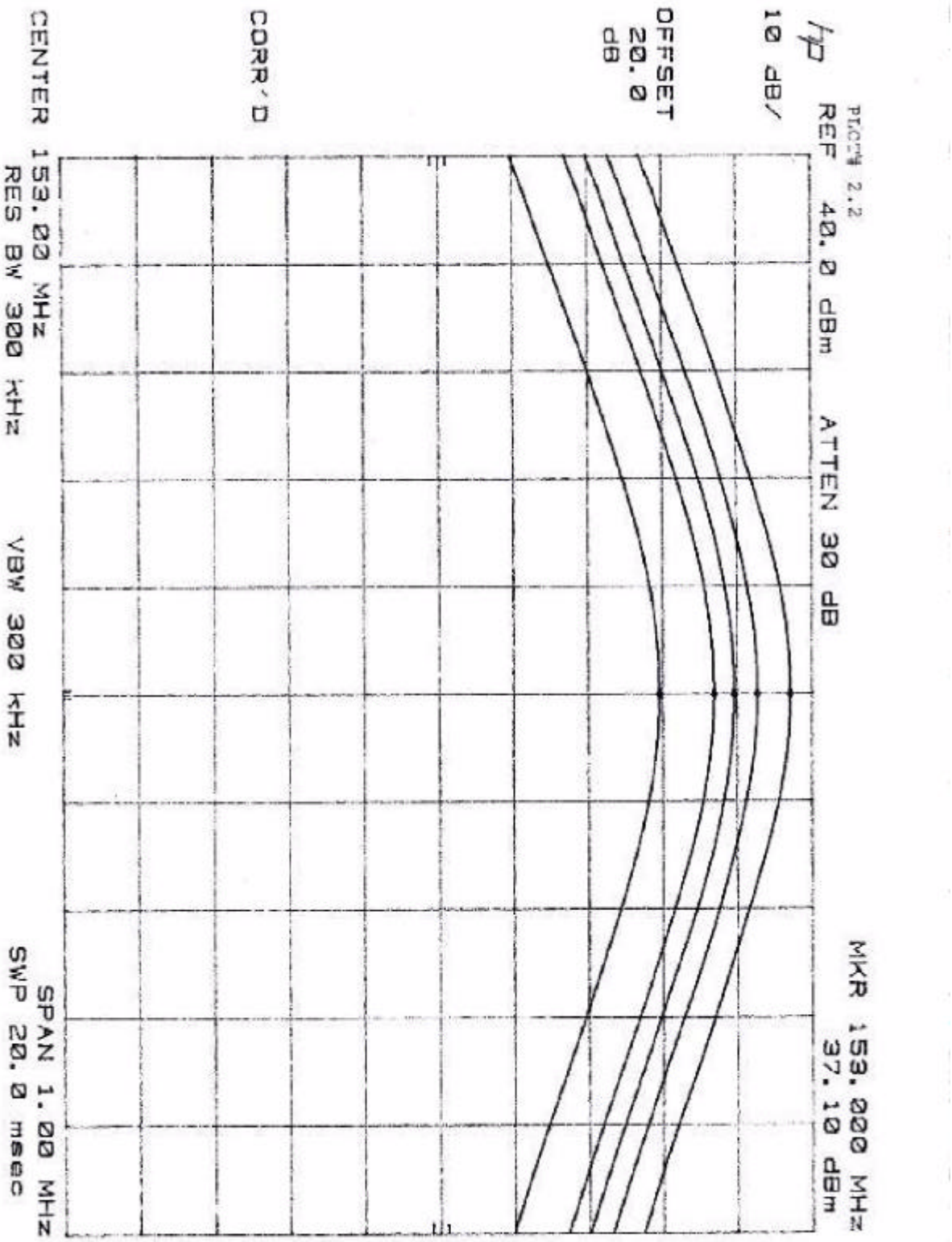
Hewlett Packard 8481A Power Sensor, 435B Power Meter
Hewlett Packard HP8566B Spectrum Analyzer, 100 Hz - 22 GHz
Tektronix 2782 Spectrum Analyzer, 100 Hz - 40 GHz

2.3 Test Results

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

Power Level (Watt)	**Reading, dBm**		
	174 MHz	**153 MHz**	**132 MHz**
5	37.0	37.1	37.0
2	32.9	32.7	32.6
1	29.6	29.6	29.8
0.5	26.9	26.9	26.7
0.1	20.0	19.6	19.2


PLOT# 2.1
REF 40.0 dBm
10 dB/
OFFSET 20.0 dB
ATTEN 30 dB
MKR 132.000 MHz 37.00 dBm
CORR'D
CENTER 132.00 MHz
RES BW 300 kHz
VBW 300 kHz
SPAN 1.00 MHz
SWP 20.0 msec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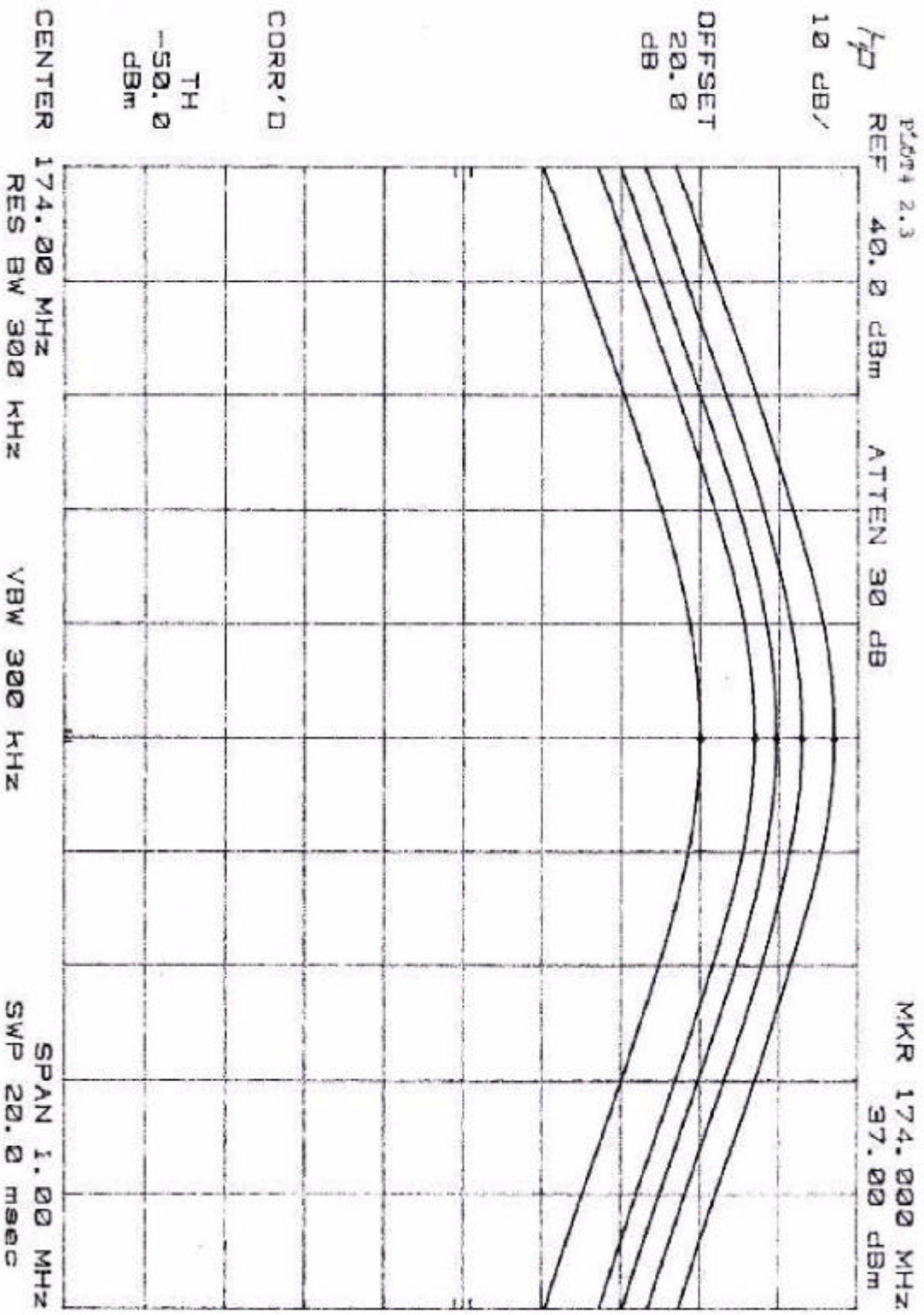
ATTEN 30 dB
10 dB/
OFFSET
20.0
dB
CORR'D
CENTER 153.00 MHz
RES BW 300 kHz
VBW 300 kHz
SPAN 1.00 MHz
SWP 20.0 msec
MKR 153.000 MHz
37.10 dBm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10 dB/
OFFSET 20.0 dB
ATTEN 30 dB
MKR 174.000 MHz 37.00 dBm
CORR'D
TH -50.0 dBm
CENTER 174.00 MHz
RES BW 300 kHz
VBW 300 kHz
SPAN 1.00 MHz
SWP 20.0 msec

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 3.5W.

Refer to the attached data.

ITS Intertek Testing Services

Company: Teledesign System Inc.
Project #: J98033454
Model: JWFTS4000C
Engineer: Xi-Ming Yang
Date of test: Dec. 18, 1998

FCC 90 Radiated Emissions

Frequency	Antenna Polarity	Reading	Antenna Factor	Pre-amp	Cable Loss	Corrected Reading	EIRP	ERP
MHz	H/V	dB(uV)	dB(1/m)	dB	dB	dB(uV/m)	dB(pW)	dBm
132.0	V	125.9	7.8	0.0	0.1	132.9	127.7	35.5
153.0	V	121.9	10.5	0.0	0.1	132.5	127.3	35.1
174.0	V	123.7	8.3	0.0	0.2	132.2	127.0	34.8

Note: 1. All measurement were made at 3 meters

4.0 **Occupied Bandwidth**, **Bandwidth Limitation, Emission Masks.** FCC §2.989(i), 90.209(b)(5), 90.210, 90.63(d)(7), 90.65(c)(18), 90.67(c)(14), 90.73(d)(13), 90.75(c)(19), 90.79(d)(6)

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 then 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:

20K0F1D	
16K0F1D	
11K2F1D	
6K00F1D	(For Subparts 90.63(d)(7), 90.65(c)(18), 90.67(c)(14), 90.73(d)(13), 90.75(c)(19), 90.79(d)(6) only).

Refer to the attached plots 4.1 - 4.22.

Occupied Bandwidth Plots:

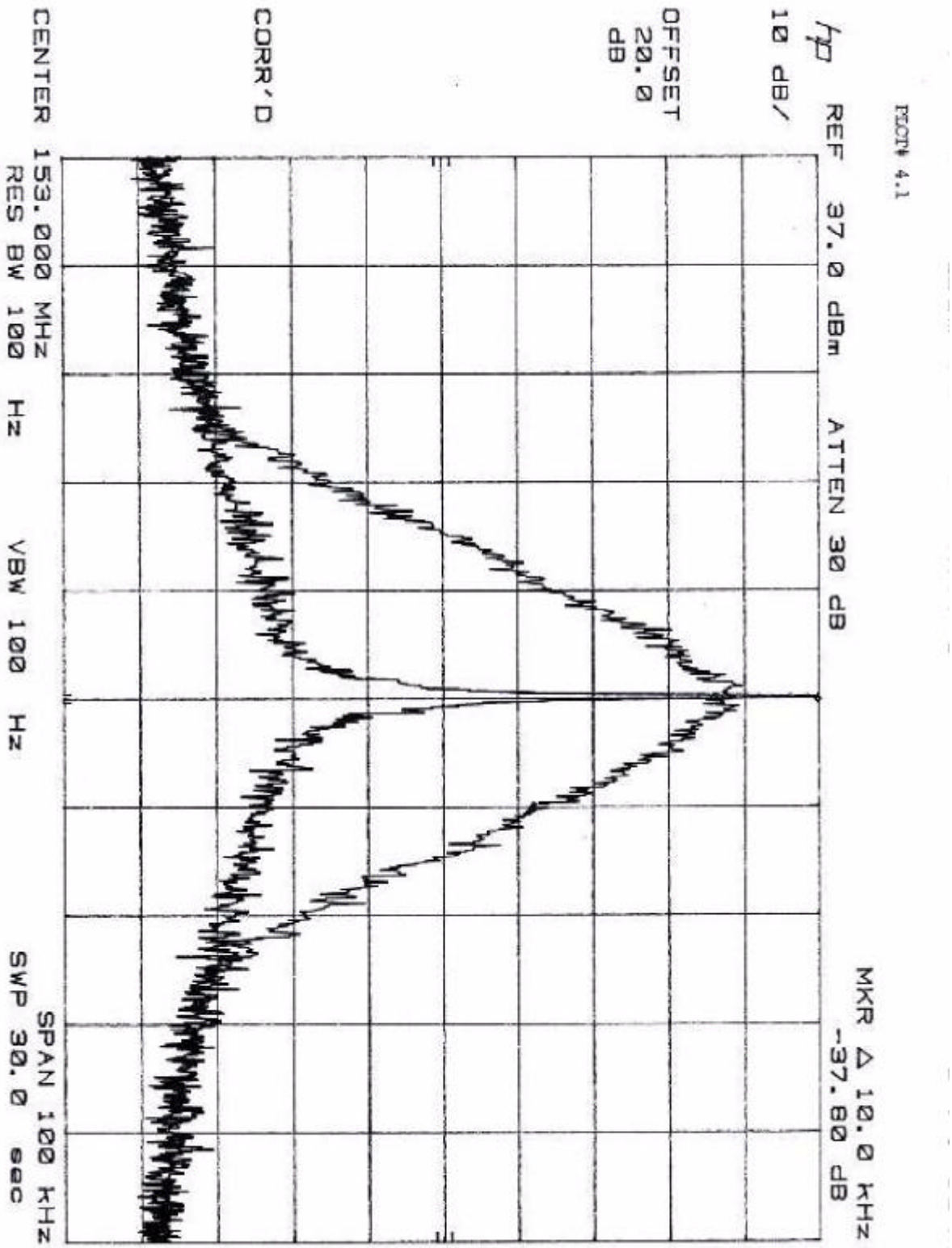
Transmitting at 153 MHz				
Plot #	**Emission Mask**	**Type of Modulation**	**Emission Designator**	**Description**
4.1	C	4LFSK	20K0F1D	B=32 kbps, M=4 kHz, D=6 kHz, Span 100 kHz
4.2	C	4LFSK	20K0F1D	B=32 kbps, M=4 kHz, D=6 kHz, Span 200 kHz
4.3	C	4LFSK	16K0F1D	B=24 kbps, M=3 kHz, D=5 kHz, Span 100 kHz
4.4	D	4LFSK	11K2F1D	B=15 kbps, M=1875 Hz, D=3750 Hz, Span 100 kHz
4.5	*	4LFSK	6K00F1D*	B=4.8 kbps, M=600 kHz, D=1.8 kHz, Span 100 kHz
4.6	C	GMSK, BT=0.3	20KOF1D	B=19.2 kbps, M=6.4 kHz, D=3.6 kHz, Span 100 kHz
4.7	C	GMSK, BT=0.3	20K0F1D	B=19.2 kbps, M=6.4 kHz, D=3.6 kHz, Span 200 kHz
4.8	C	GMSK, BT=0.3	16K0F1D	B=19.2 kbps, M=6.4 kHz, D=1.6 kHz, Span 100 kHz
4.9	D	GMSK, BT=0.3	11K2F1D	B=9.6 kbps, M=3.2 kHz, D=2.4 kHz, Span 100 kHz
4.10	*	GMSK, BT=0.3	6K00F1D*	B=2.4 kbps, M=800 Hz, D=1.5 kHz, Span 100 kHz
4.11	C	GMSK, BT=0.5	20K0F1D	B=14 kbps, M=7 kHz, D=3 kHz, Span 100 kHz
4.12	C	GMSK, BT=0.5	20K0F1D	B=14 kbps, M=7 kHz, D=3 kHz, Span 200 kHz
4.13	C	GMSK, BT=0.5	16K0F1D	B=10 kbps, M=5 kHz, D=3 kHz, Span 100 kHz
4.14	D	GMSK, BT=0.5	11K2F1D	B=7.2 kbps, M=3.6 kHz, D=2 kHz, Span 100 kHz
4.15	C	4LFSK	20K0F1D	B=32 kbps, M=4 kHz, D=6 kHz, Span 200 kHz, Low Power
4.16	C	GMSK, BT=0.5	20K0F1D	B=14 kbps, M=7 kHz, D=3 kHz, Span 200 kHz, Low Power

* = These are for special subparts of the Rules (See General Information Sheet with Bandwidths)
B = Channel Baud Rate, M = Modulation Frequency, D = Peak Deviation

Transmitting at 174 MHz				
Freq. MHz	**Emission Mask**	**Type of Modulation**	**Emission Designator**	**Description**
4.17	C	4LFSK	20K0F1D	B=32 kbps, M=4 kHz, D=6 kHz, Span 200 kHz
4.18	C	GMSK, BT=0.3	20K0F1D	B=19.2 kbps, M=6.4 kHz, D=3.6 kHz, Span 200 kHz
4.19	C	GMSK, BT=0.5	20K0F1D	B=14 kbps, M=7 kHz, D=3 kHz, Span 200 kHz

Transmitting at 132 MHz				
Freq. MHz	**Emission Mask**	**Type of Modulation**	**Emission Designator**	**Description**
4.20	C	4LFSK	20K0F1D	B=32 kbps, M=4 kHz, D=6 kHz, Span 200 kHz
4.21	C	GMSK, BT=0.3	20K0F1D	B=19.2 kbps, M=6.4 kHz, D=3.6 kHz, Span 200 kHz
4.22	C	GMSK, 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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10 dB/
ATTEN 30 dB
OFFSET
20.0
dB
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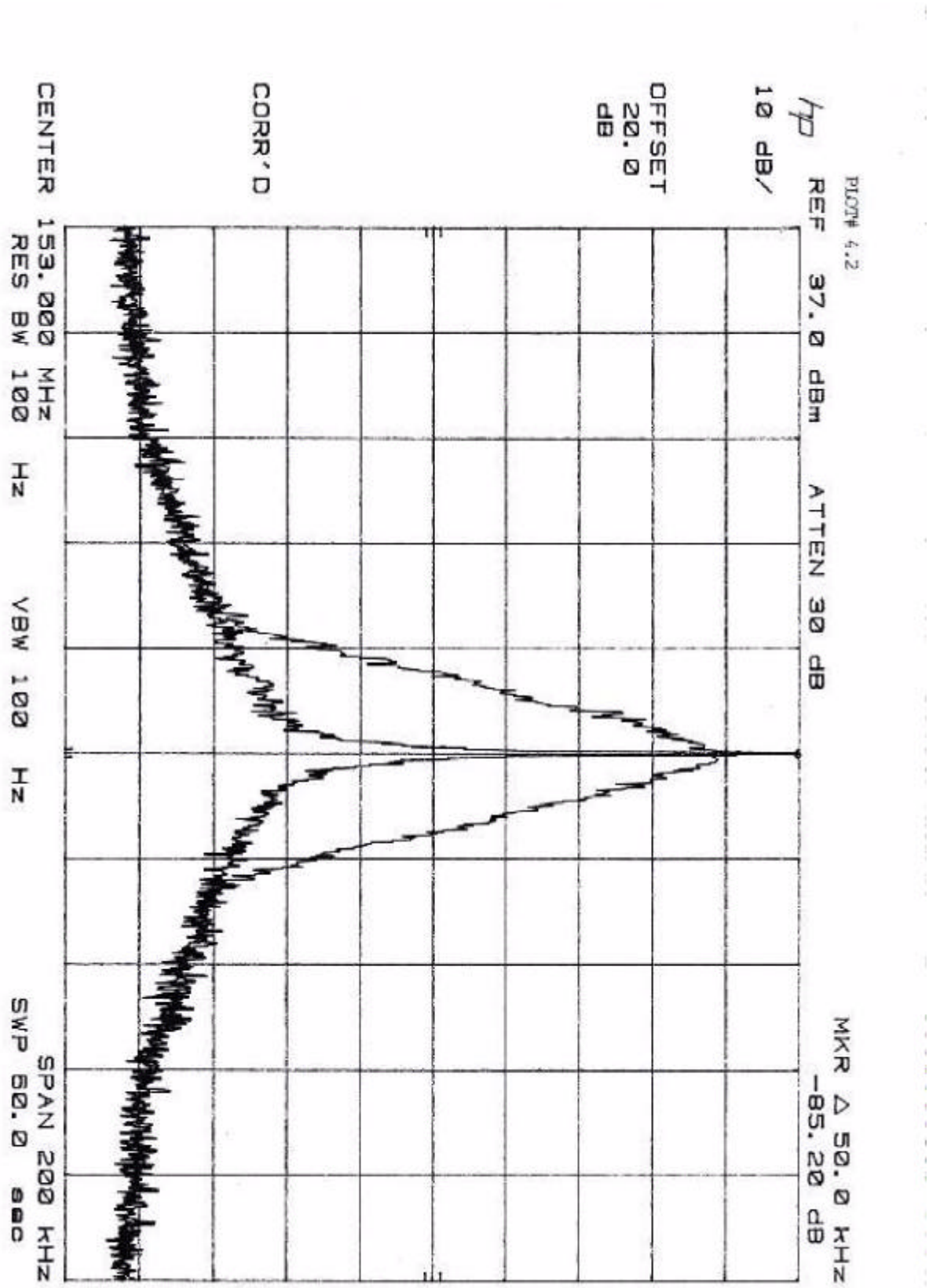
CENTER 153.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 100 kHz
SWP 30.0 sec
MKR Δ 10.0 kHz
-37.80 dB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10 dB/
ATTEN 30 dB
OFFSET
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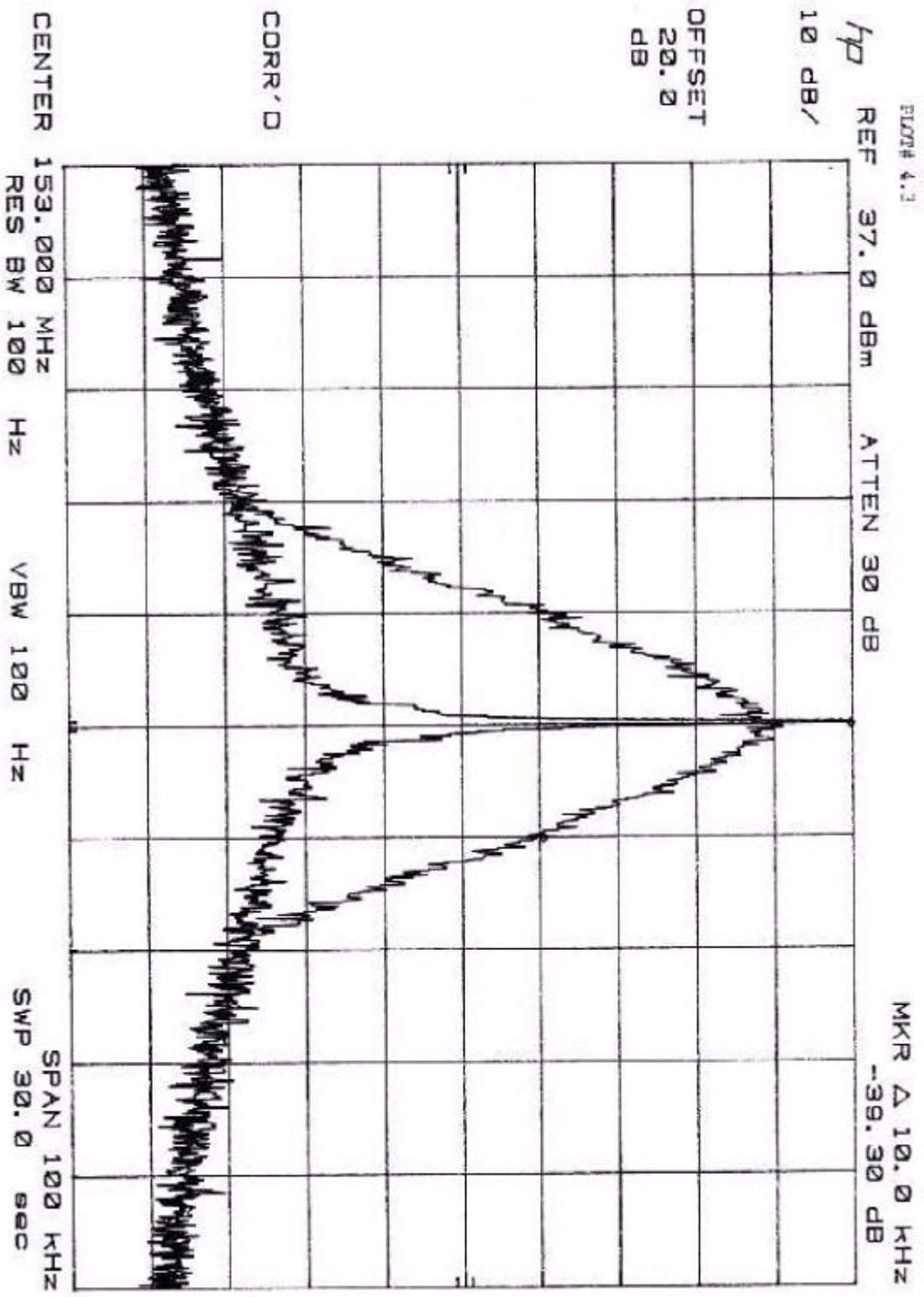
dB
CORR'D
MKR Δ 50.0 kHz
-85.20 dB
CENTER 153.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 200 kHz
SWP 60.0 sec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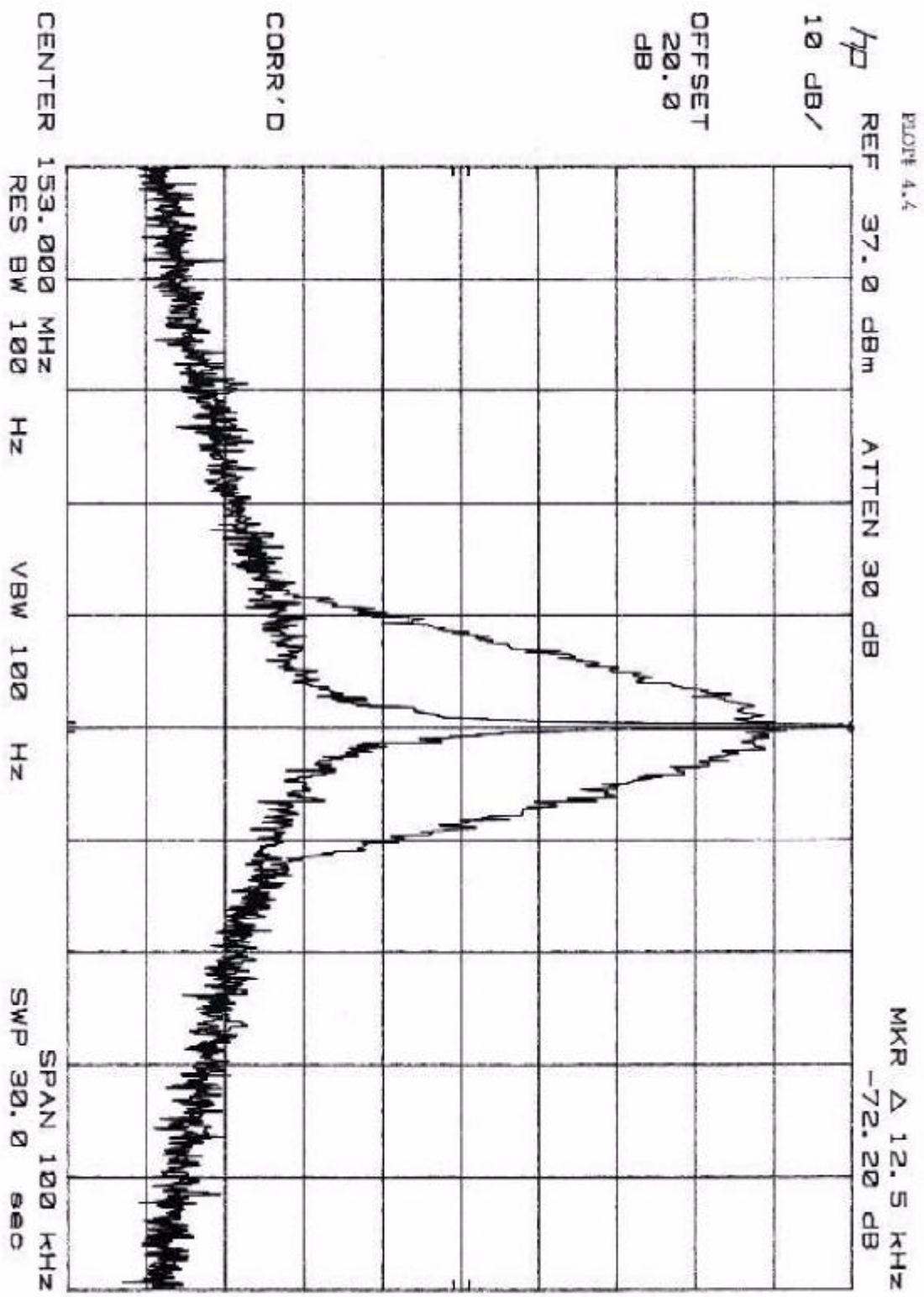
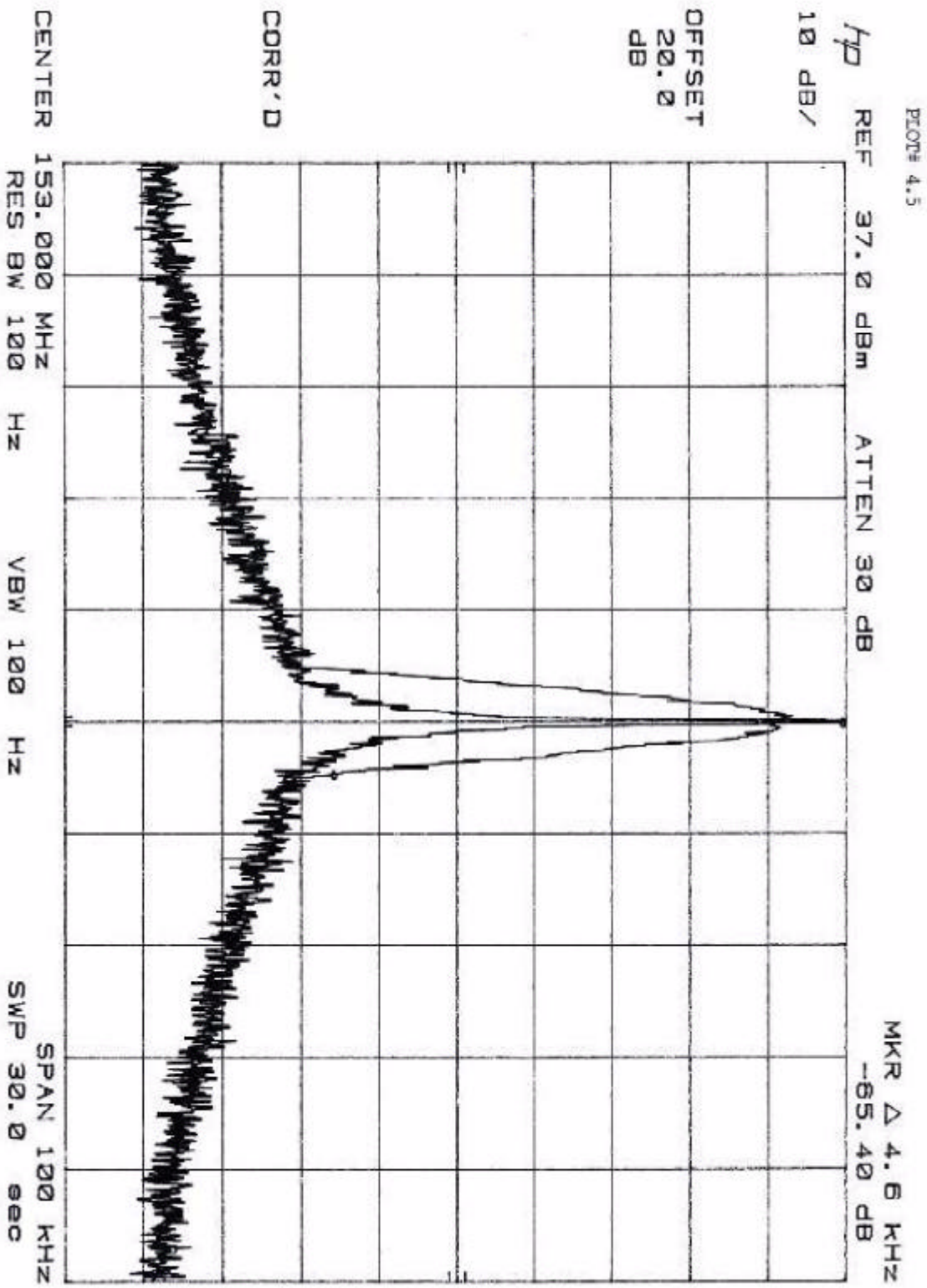
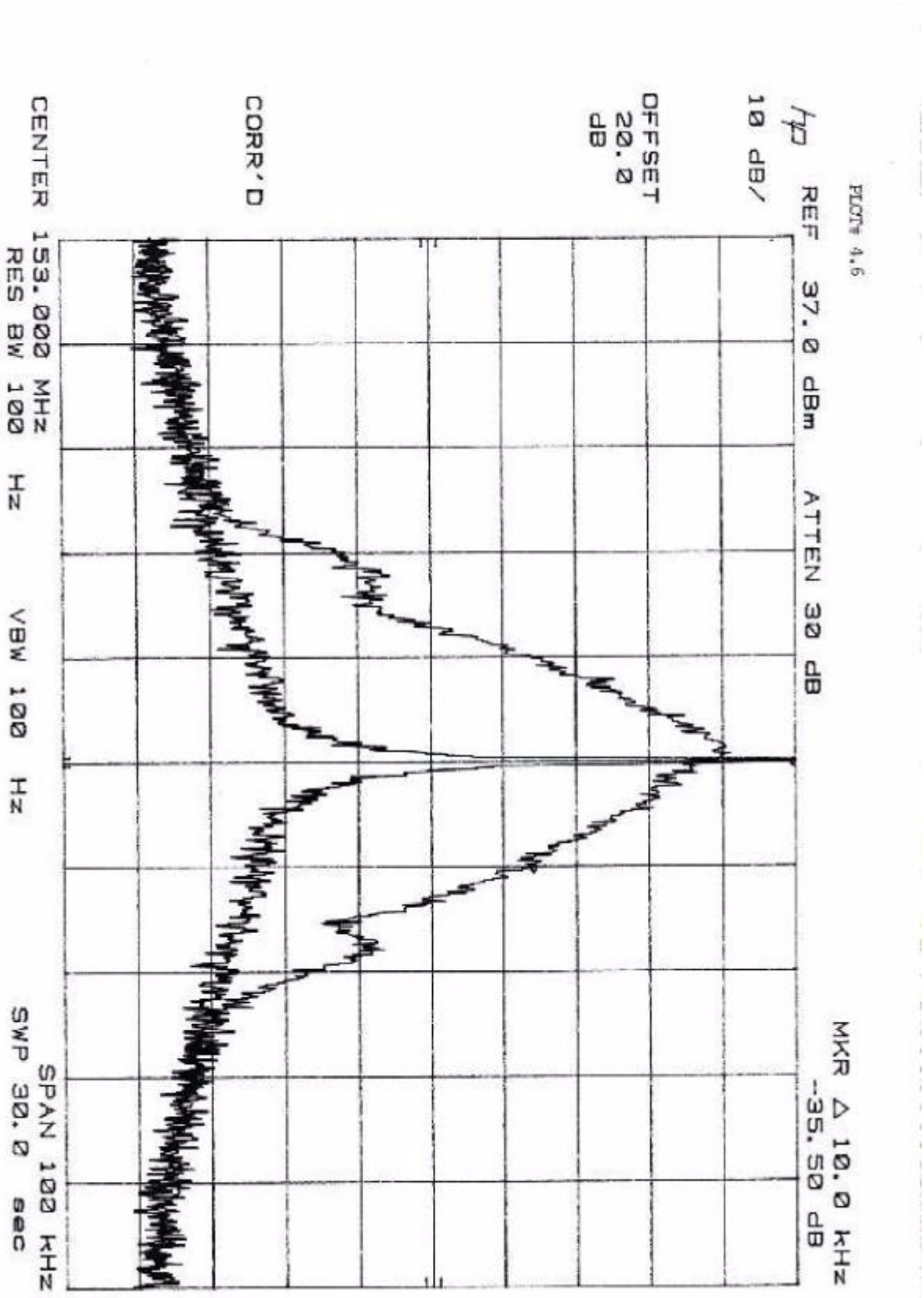
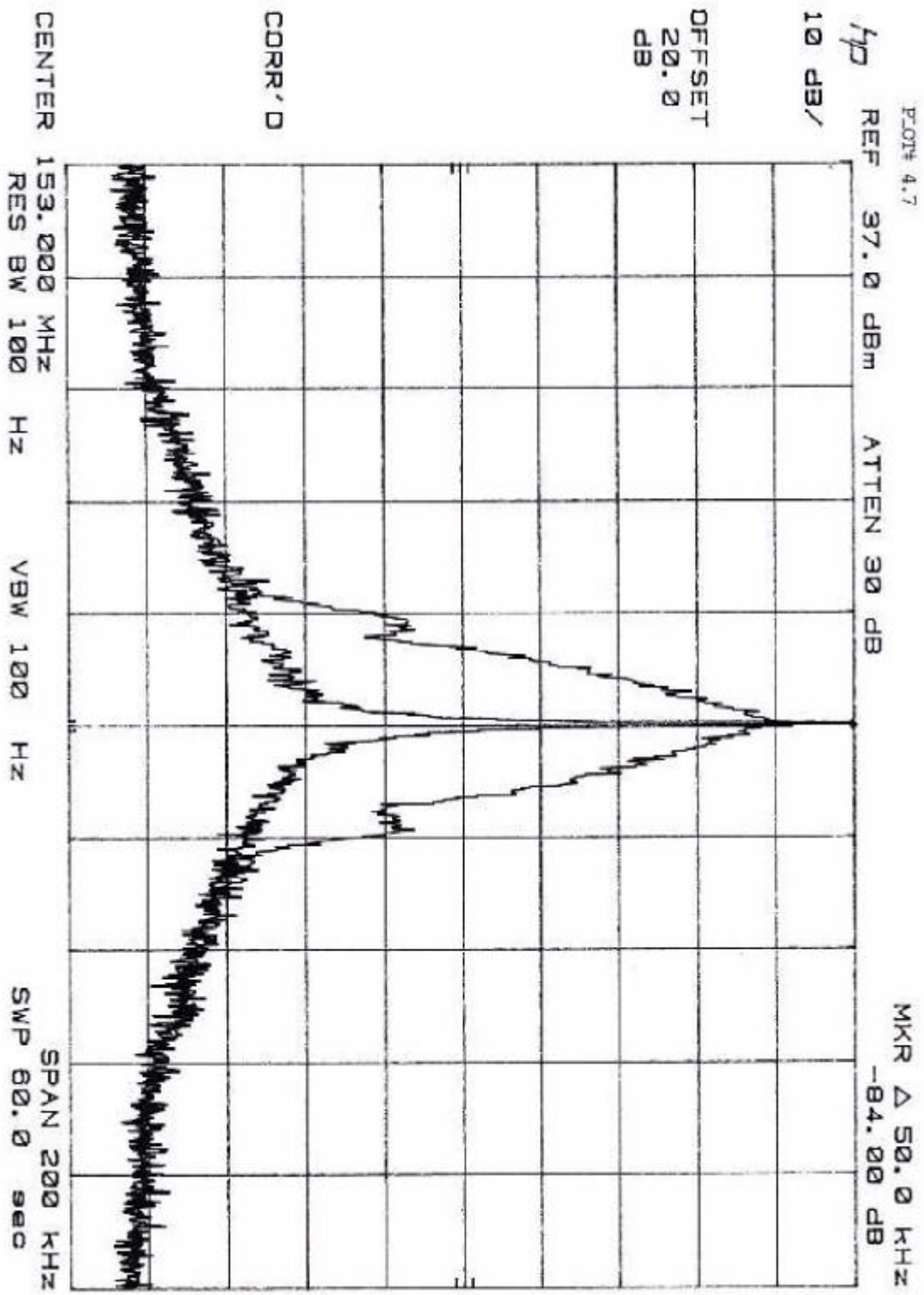
REF 37.0 dBm
10 dB/
ATTEN 30 dB
OFFSET
20.0
dB
CORR'D
CENTER 153.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 100 kHz
SWP 30.0 sec
MKR Δ 10.0 kHz
-39.30 dB


PLOT 4.4
hp
REF 37.0 dBm
ATTEN 30 dB
10 dB/
OFFSET
20.0
dB
CORR'D
CENTER 153.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 100 kHz
SWP 30.0 sec
MKR Δ 12.5 kHz
-72.20 dB


PLOT# 4.5
REF 37.0 dBm
10 dB/
ATTEN 30 dB
OFFSET
20.0
dB
CORR'D
CENTER 153.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 100 kHz
SWP 30.0 sec
MKR Δ 4.6 kHz
-65.40 dB


PLOT# 4.6
REF 37.0 dBm
10 dB/
ATTEN 30 dB
OFFSET
20.0
dB
CORR'D
CENTER 153.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 100 kHz
SWP 30.0 sec
MKR Δ 10.0 kHz
-35.50 dB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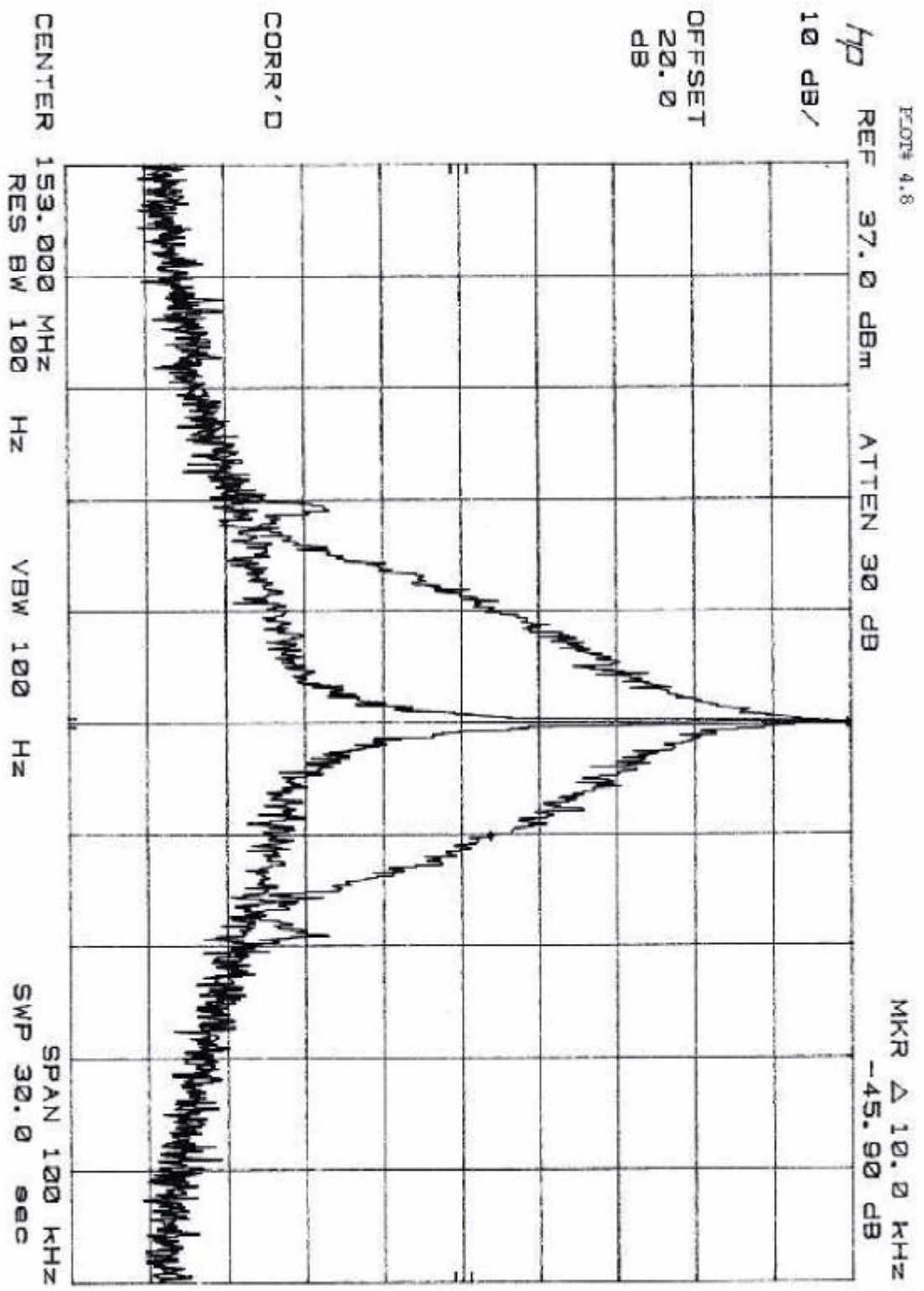
REF 37.0 dBm
10 dB/
ATTEN 30 dB
OFFSET
20.0
dB
CORR'D
CENTER 153.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 200 kHz
SWP 60.0 sec
MKR Δ 50.0 kHz
-84.00 dB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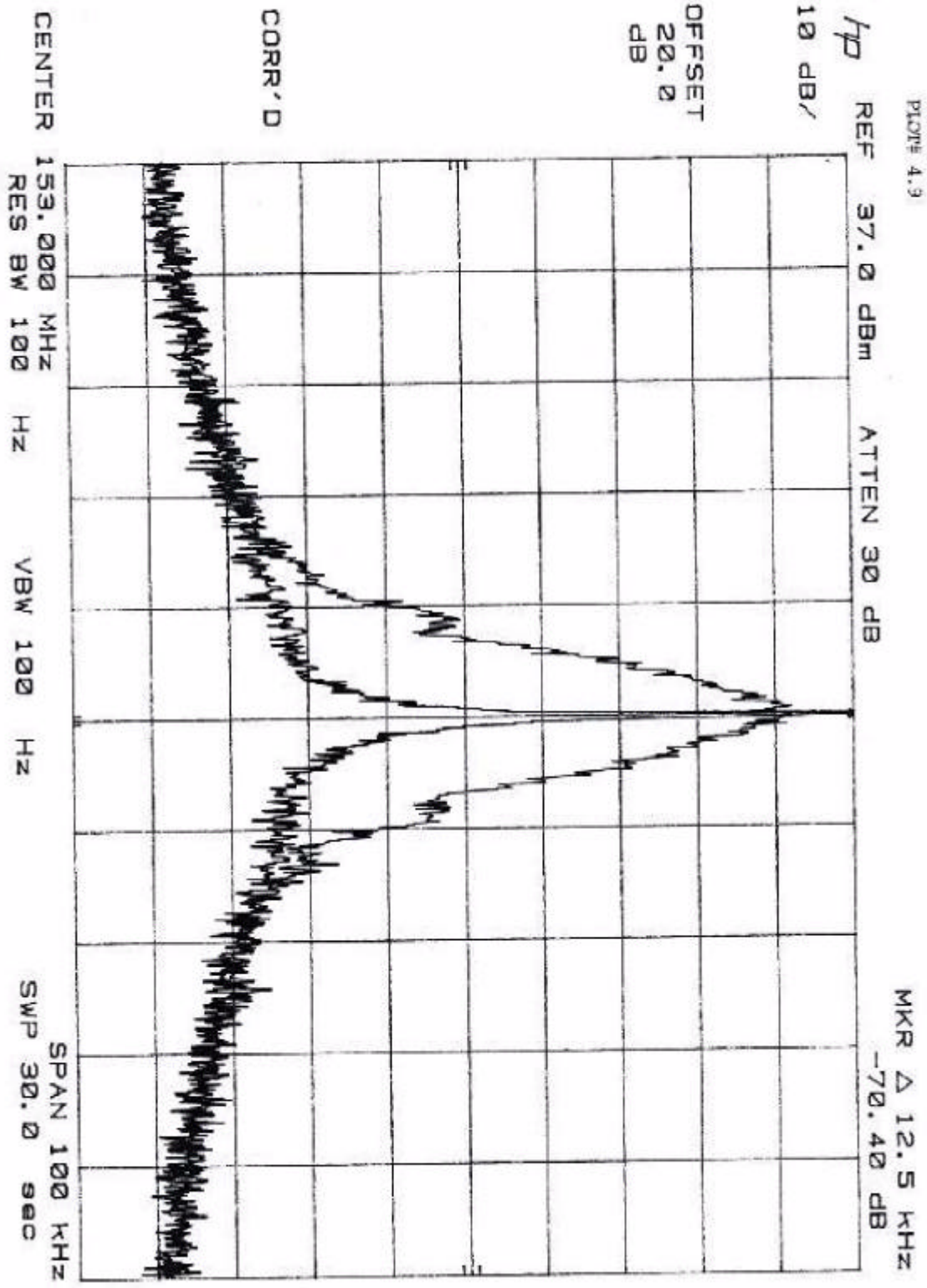
REF 37.0 dBm
10 dB/
ATTEN 30 dB
OFFSET
20.0
dB
CORR'D
CENTER 153.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 100 kHz
SWP 30.0 sec
MKR Δ 10.0 kHz
-45.90 dB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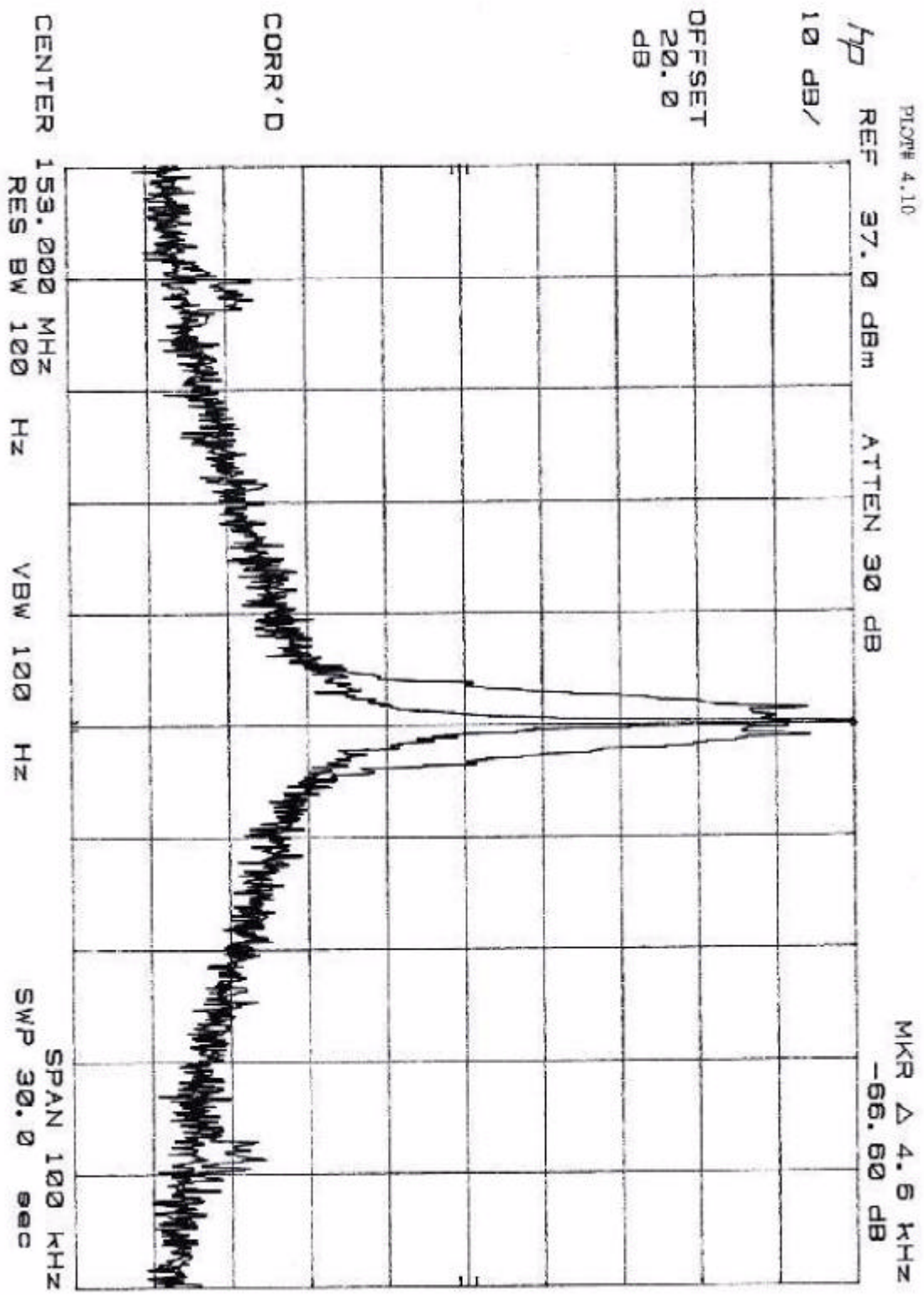
REF 37.0 dBm
10 dB/
ATTEN 30 dB
OFFSET
20.0
dB
CORR'D
CENTER 153.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 100 kHz
SWP 30.0 sec
MKR Δ 12.5 kHz
-70.40 dB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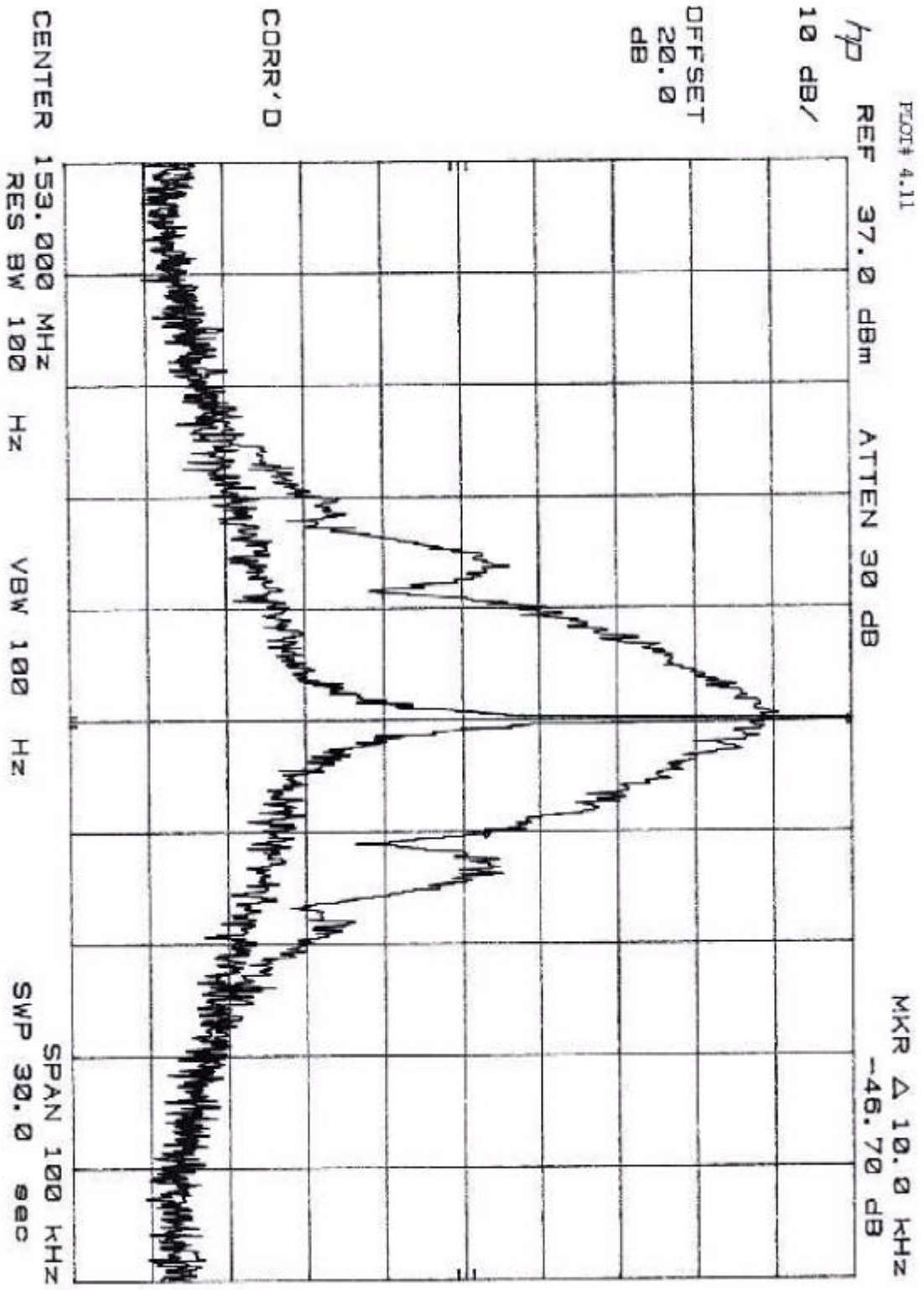
REF 37.0 dBm
10 dB/
ATTEN 30 dB
OFFSET
20.0
dB
CORR'D
CENTER 153.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 100 kHz
SWP 30.0 sec
MKR Δ 4.6 kHz
-66.60 dB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ATTEN 30 dB
10 dB/
OFFSET
20.0
dB
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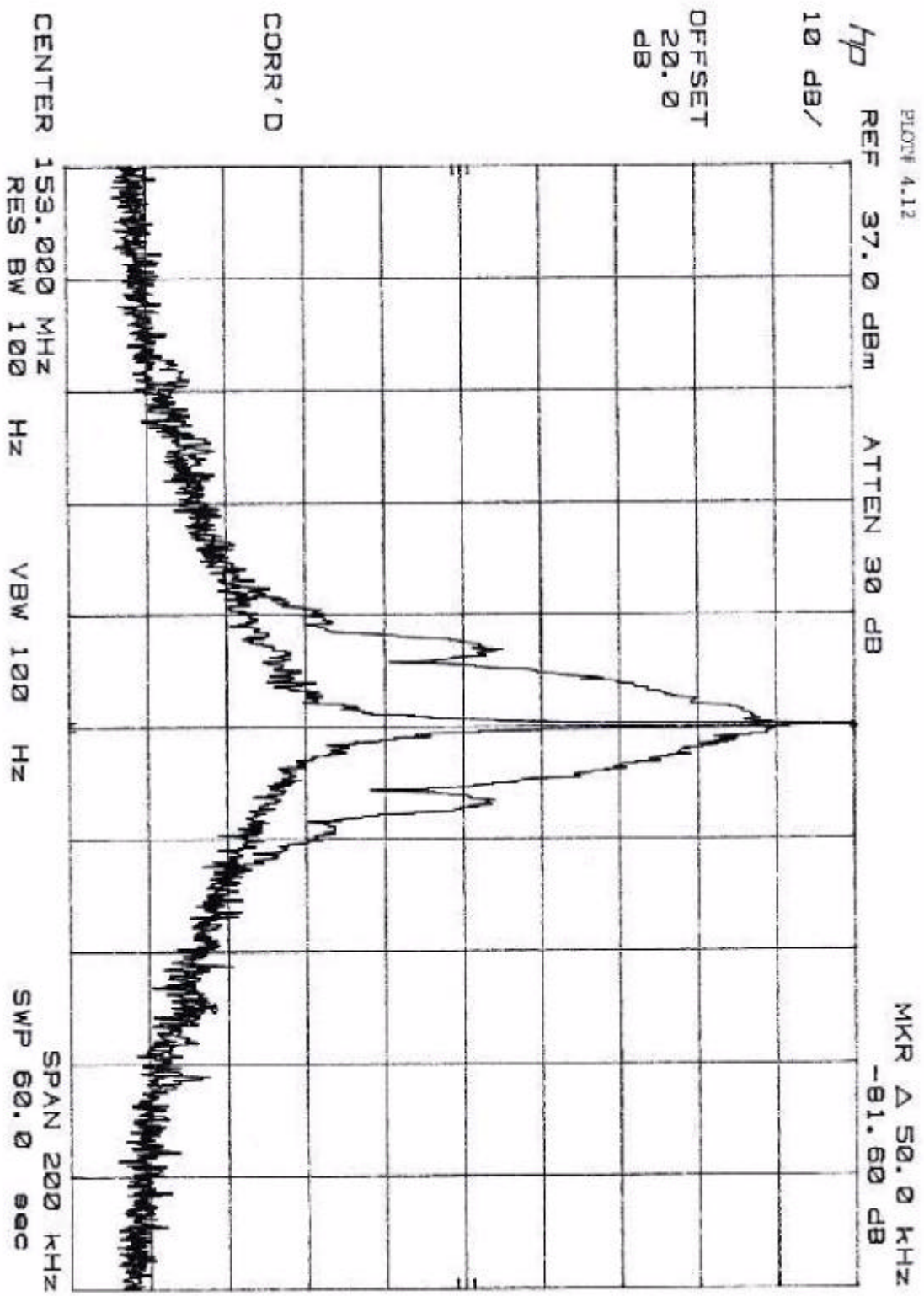
CENTER 153.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 100 kHz
SWP 30.0 sec
MKR Δ 10.0 kHz
-46.70 dB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10 dB/
REF 37.0 dBm
ATTEN 30 dB
OFFSET
20.0
dB
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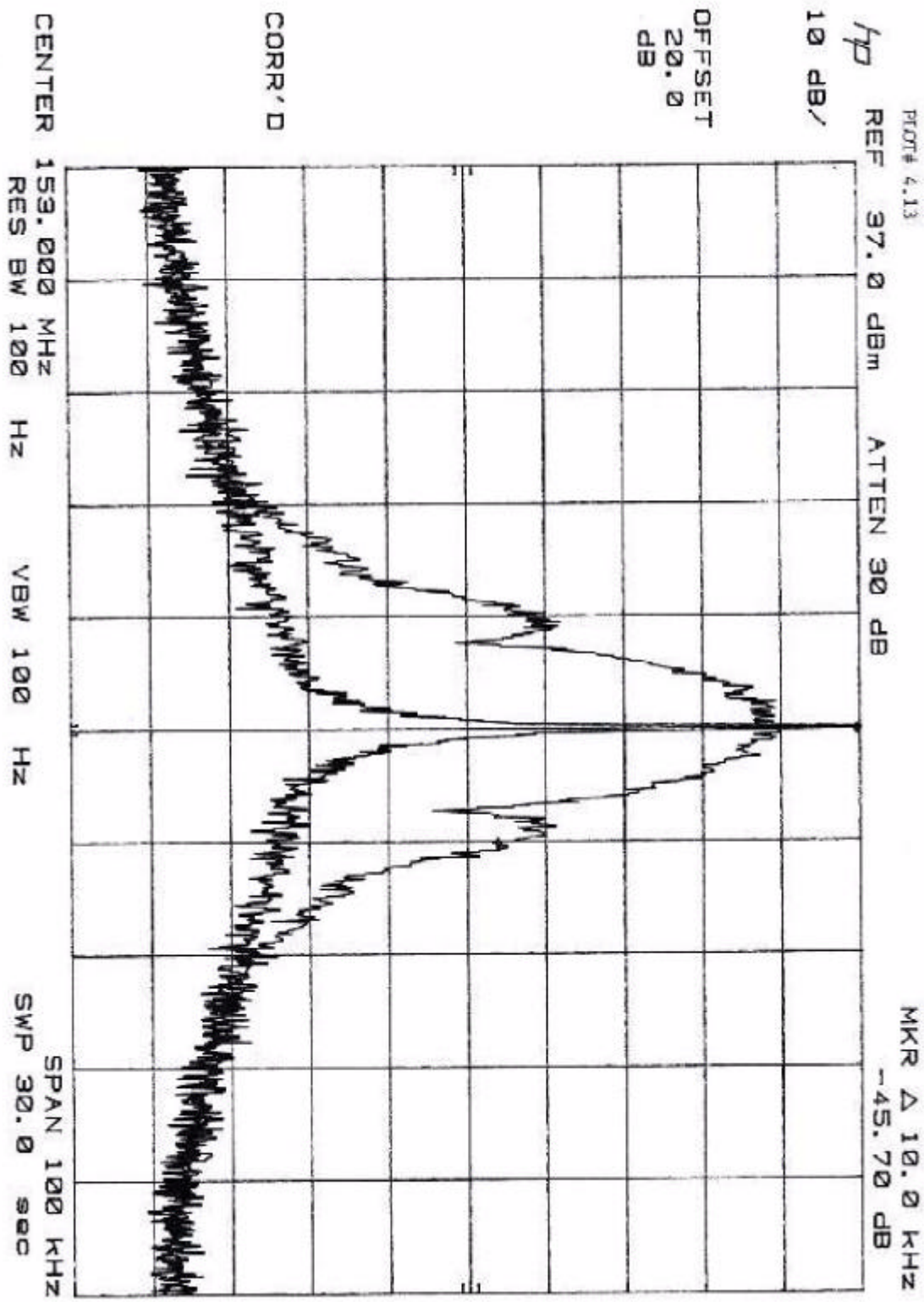
CENTER 153.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 200 kHz
SWP 60.0 sec
MKR Δ 50.0 kHz
-81.60 dB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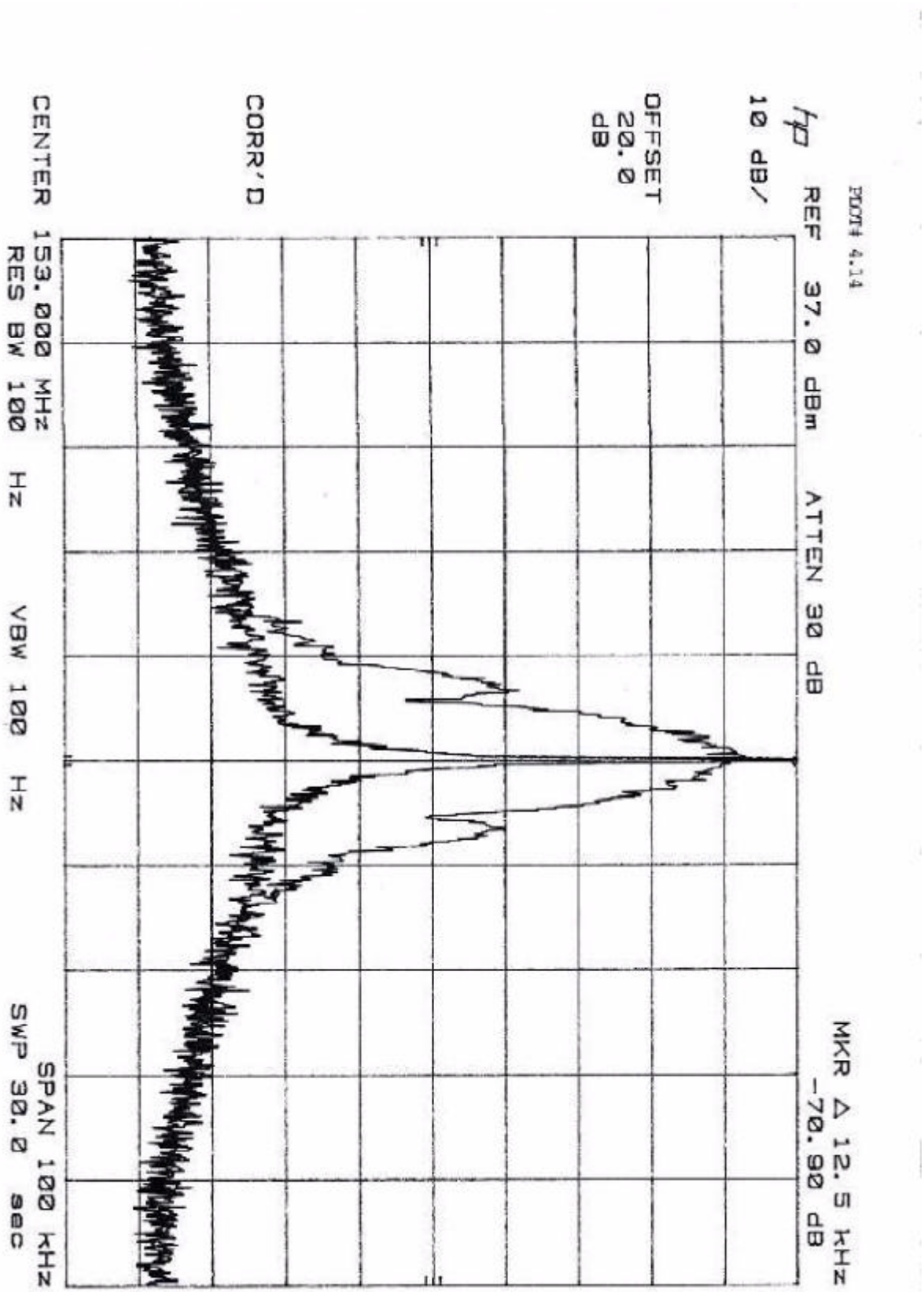
ATTEN 30 dB
10 dB/
OFFSET
20.0
dB
CORR'D
CENTER 153.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 100 kHz
SWP 30.0 sec
MKR Δ 10.0 kHz
-45.70 dB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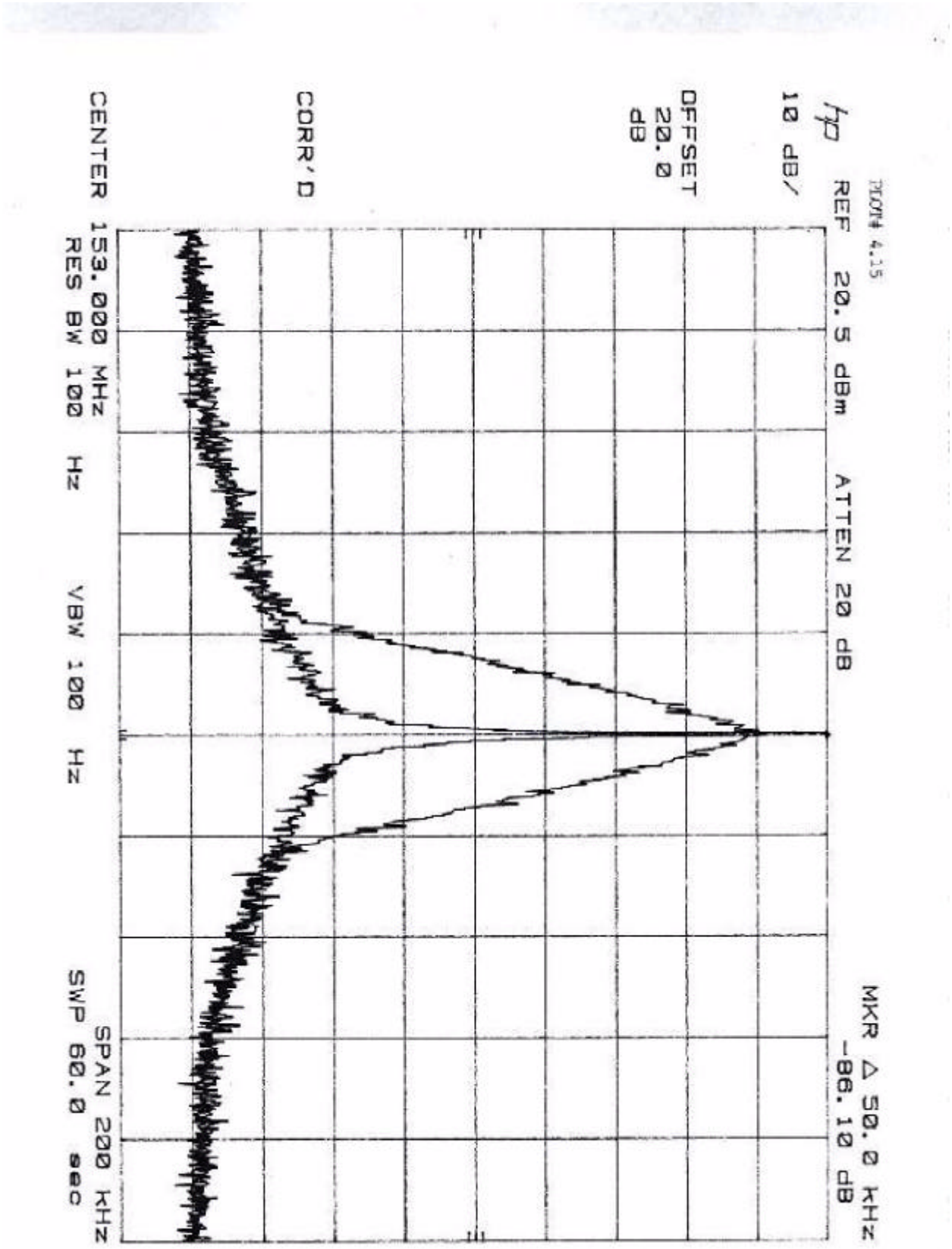
ATTEN 30 dB
10 dB/
OFFSET
20.0
dB
CORR'D
CENTER 153.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 100 kHz
SWP 30.0 sec
MKR Δ 12.5 kHz
-70.90 dB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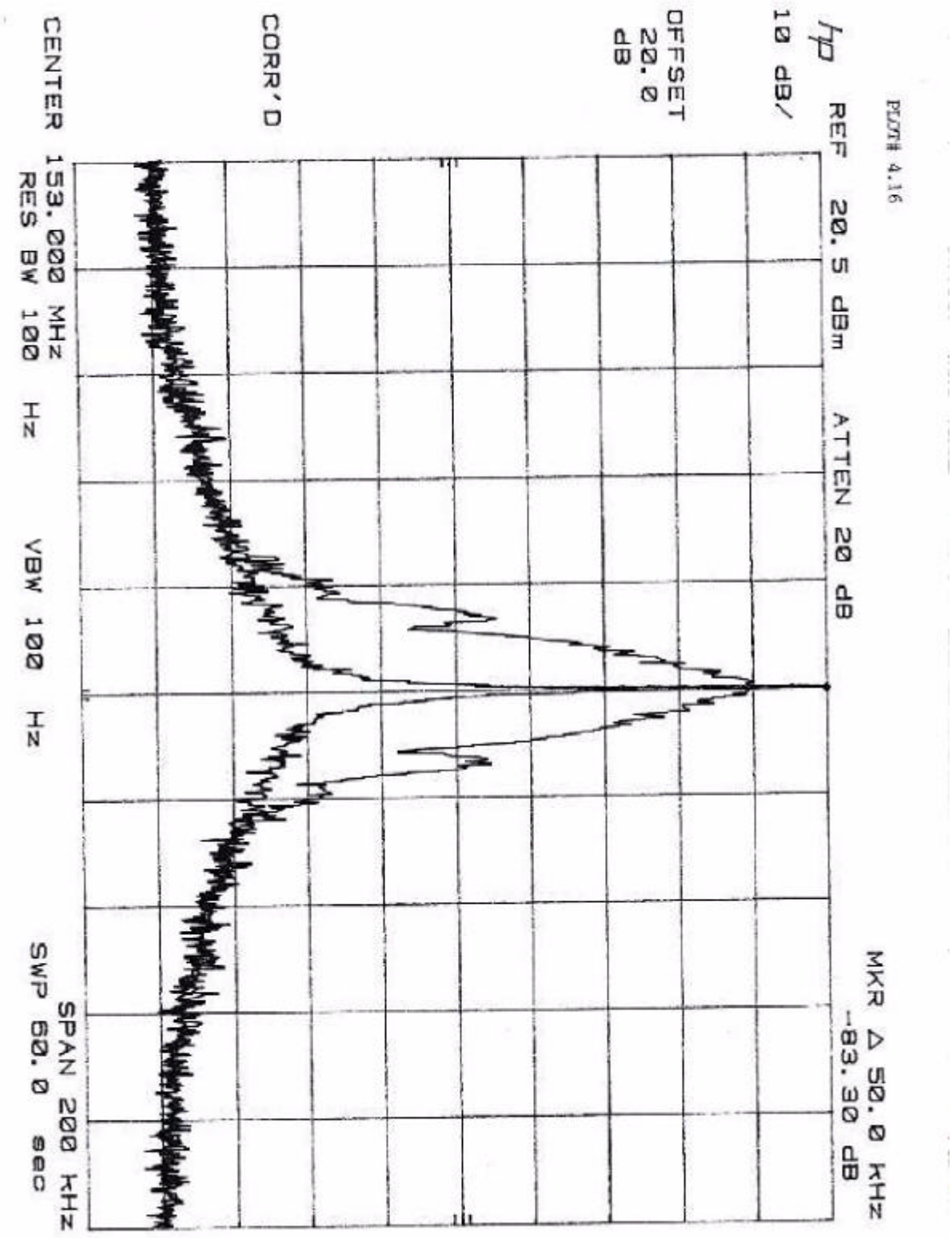
REF 20.5 dBm
10 dB/
ATTEN 20 dB
OFFSET
20.0
dB
CORR'D
CENTER 153.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 200 kHz
SWP 60.0 sec
MKR Δ 50.0 kHz
-86.10 dB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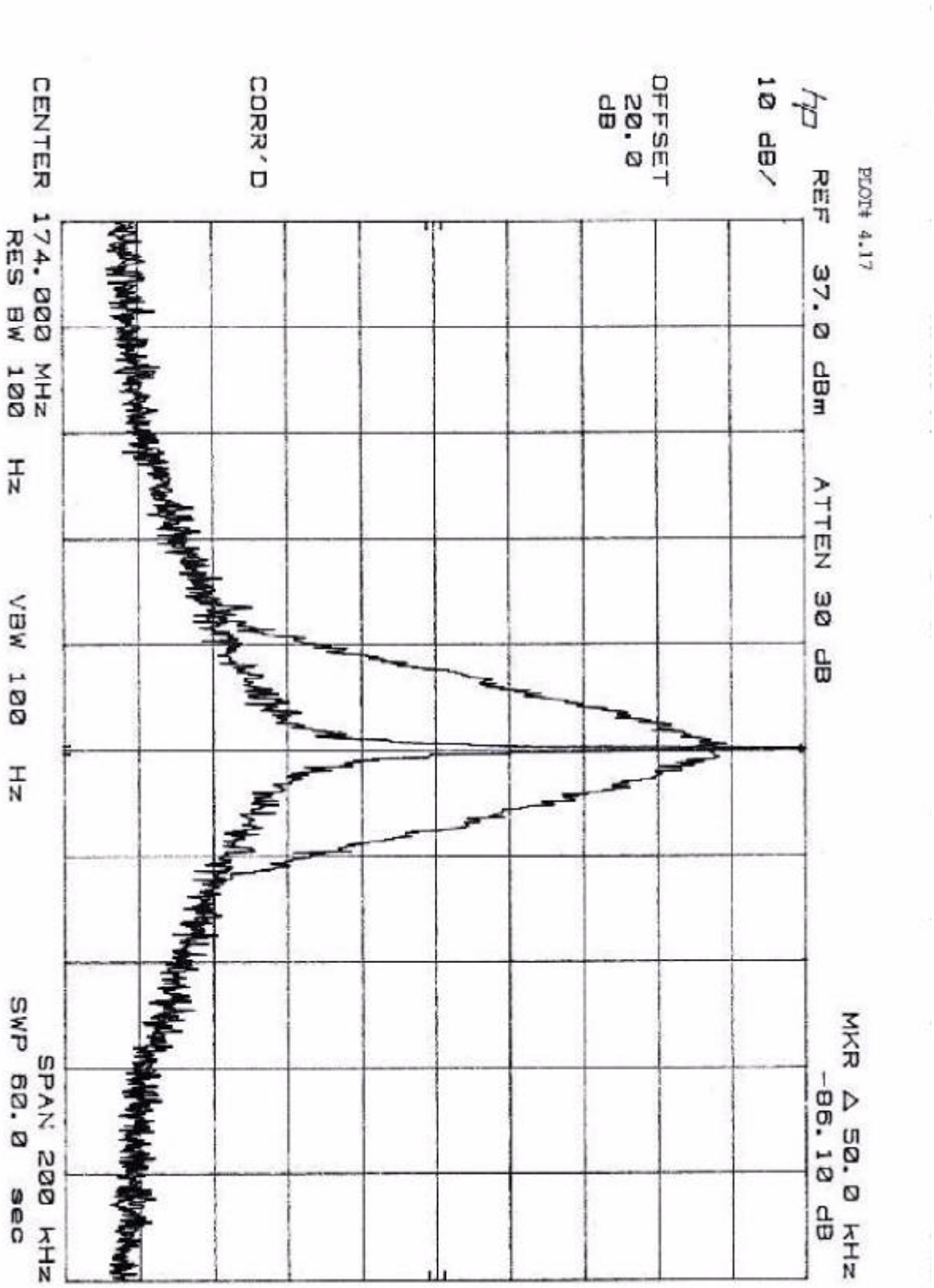
REF 20.5 dBm
ATTEN 20 dB
10 dB/
OFFSET
20.0
dB
CORR'D
CENTER 153.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 200 kHz
SWP 60.0 sec
MKR Δ 50.0 kHz
-83.30 dB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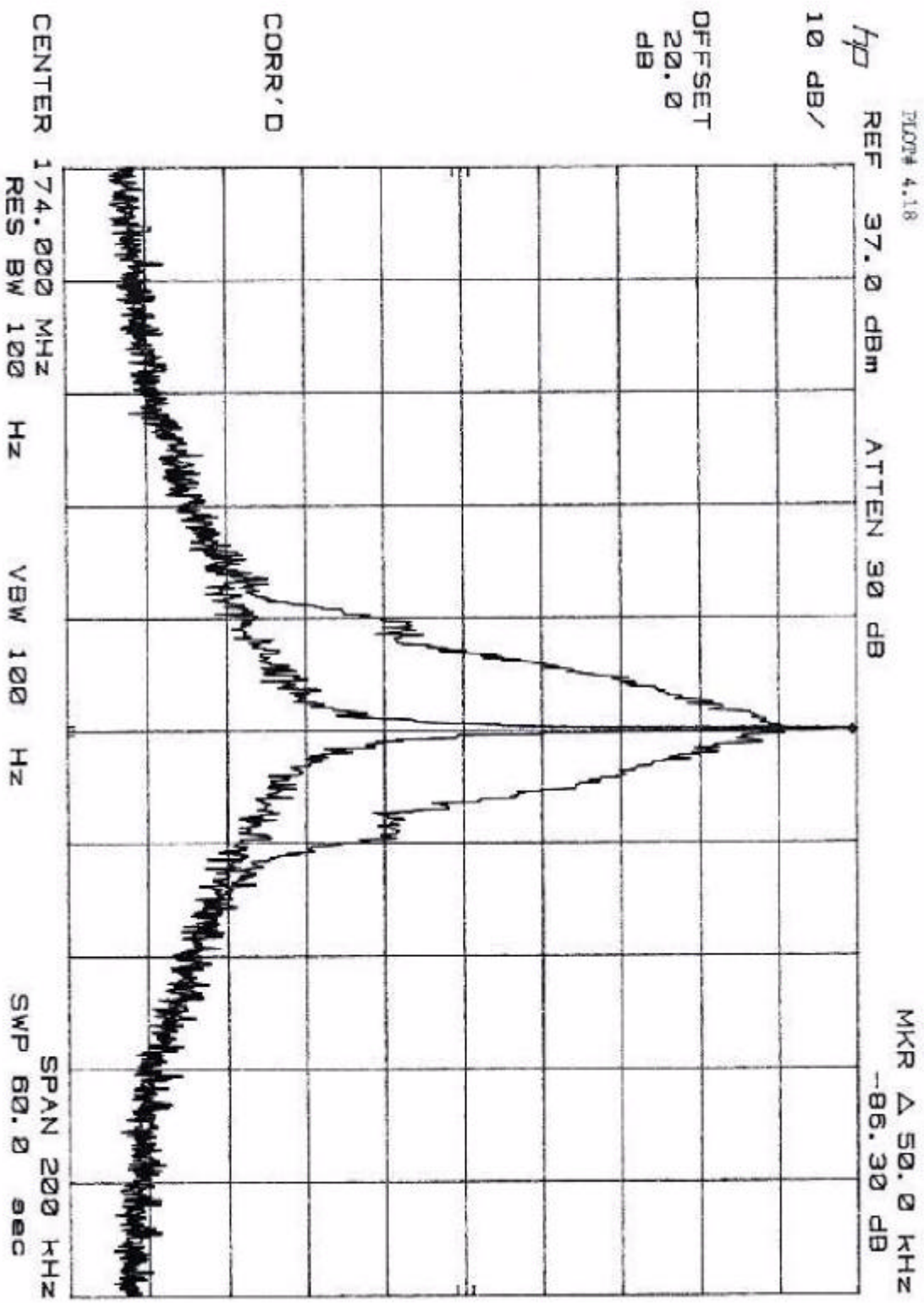
ATTEN 30 dB
10 dB/
OFFSET
20.0
dB
CORR'D
CENTER 174.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 200 kHz
SWP 60.0 sec
MKR Δ 50.0 kHz
-86.10 dB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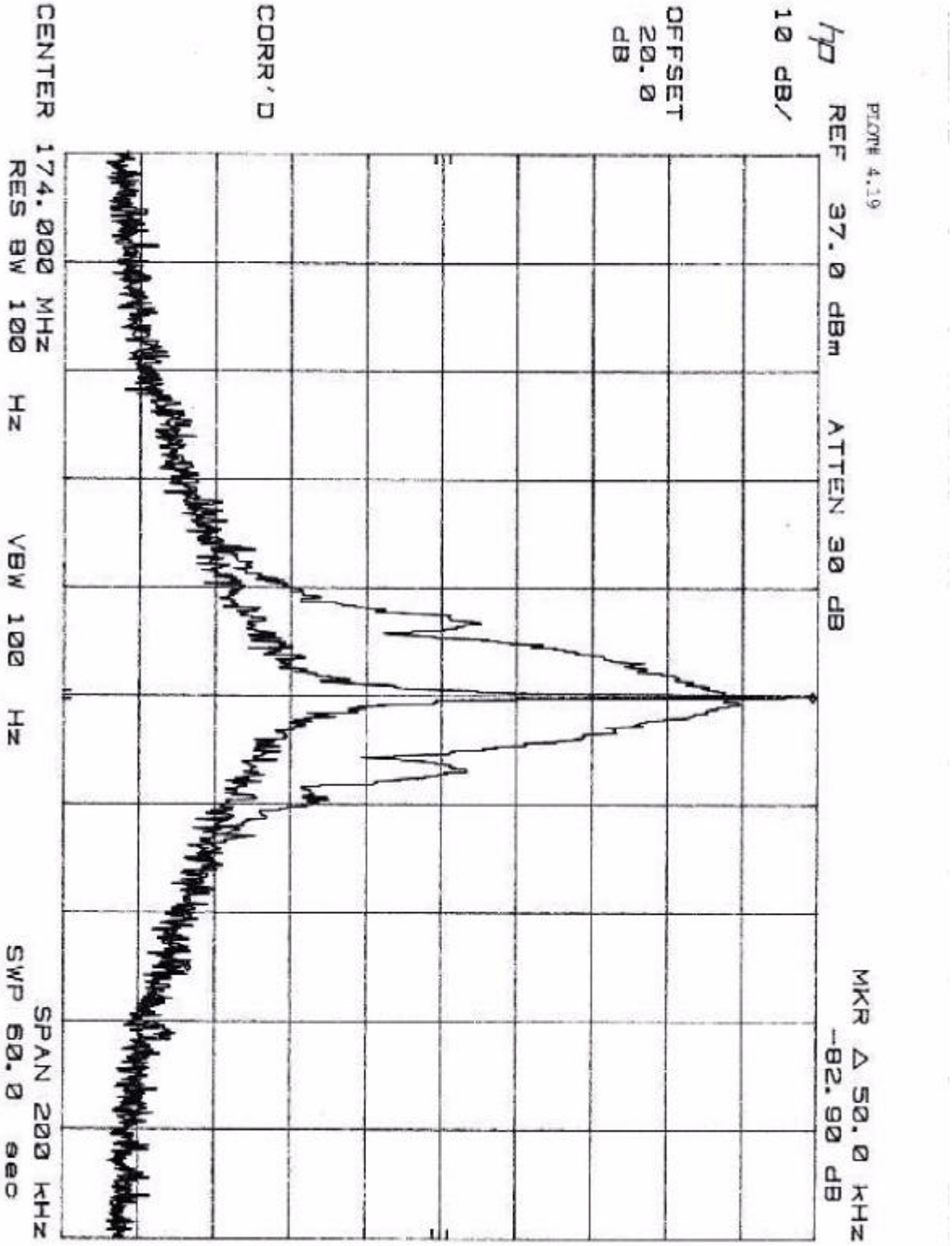
10 dB/
REF 37.0 dBm
ATTEN 30 dB
OFFSET
20.0
dB
CORR'D
CENTER 174.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 200 kHz
SWP 60.0 sec
MKR Δ 50.0 kHz
-86.30 dB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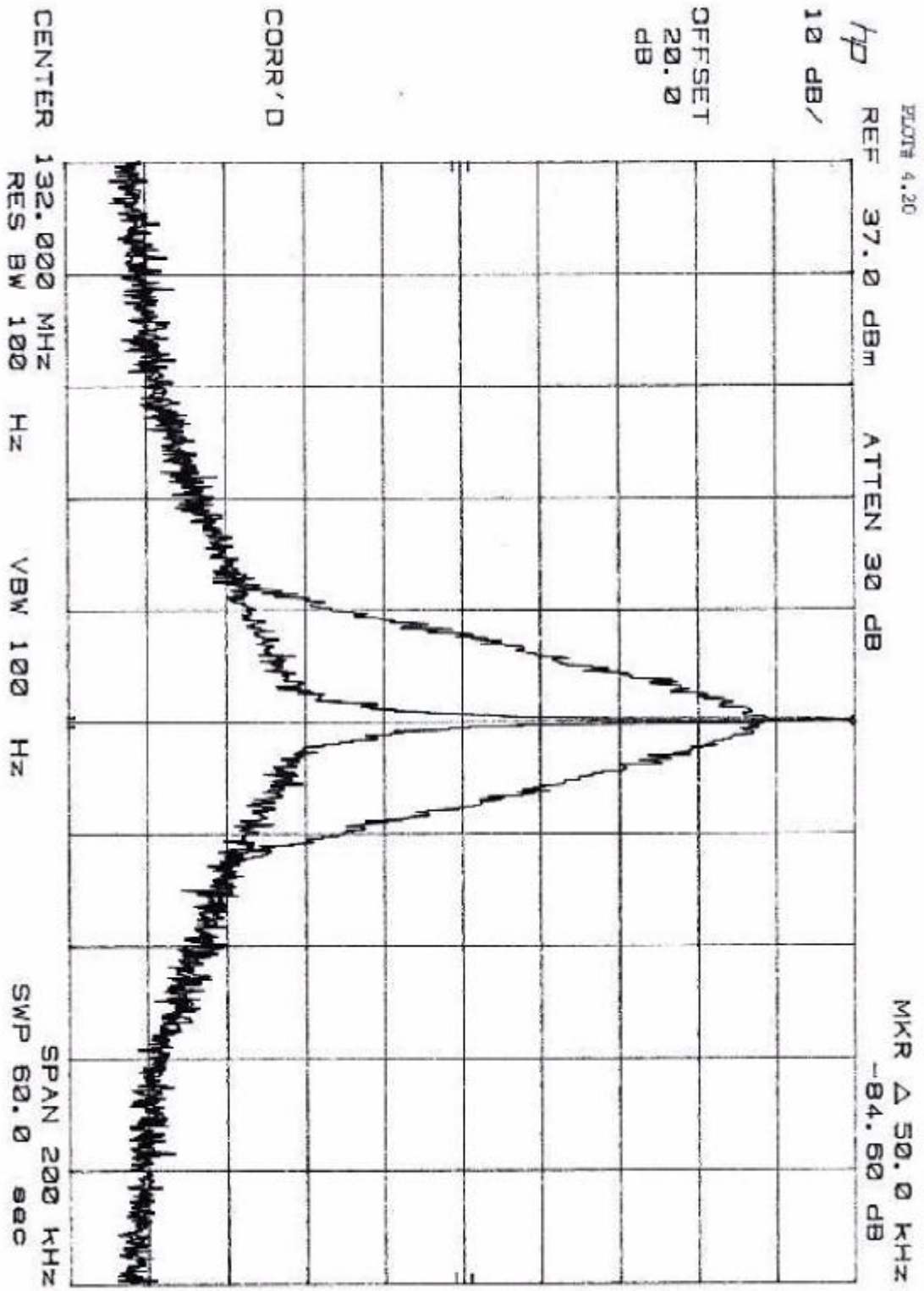
ATTEN 30 dB
10 dB/
OFFSET
20.0
dB
CORR'D
CENTER 174.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 200 kHz
SWP 60.0 sec
MKR Δ 50.0 kHz
-82.90 dB


PLOT# 4.20
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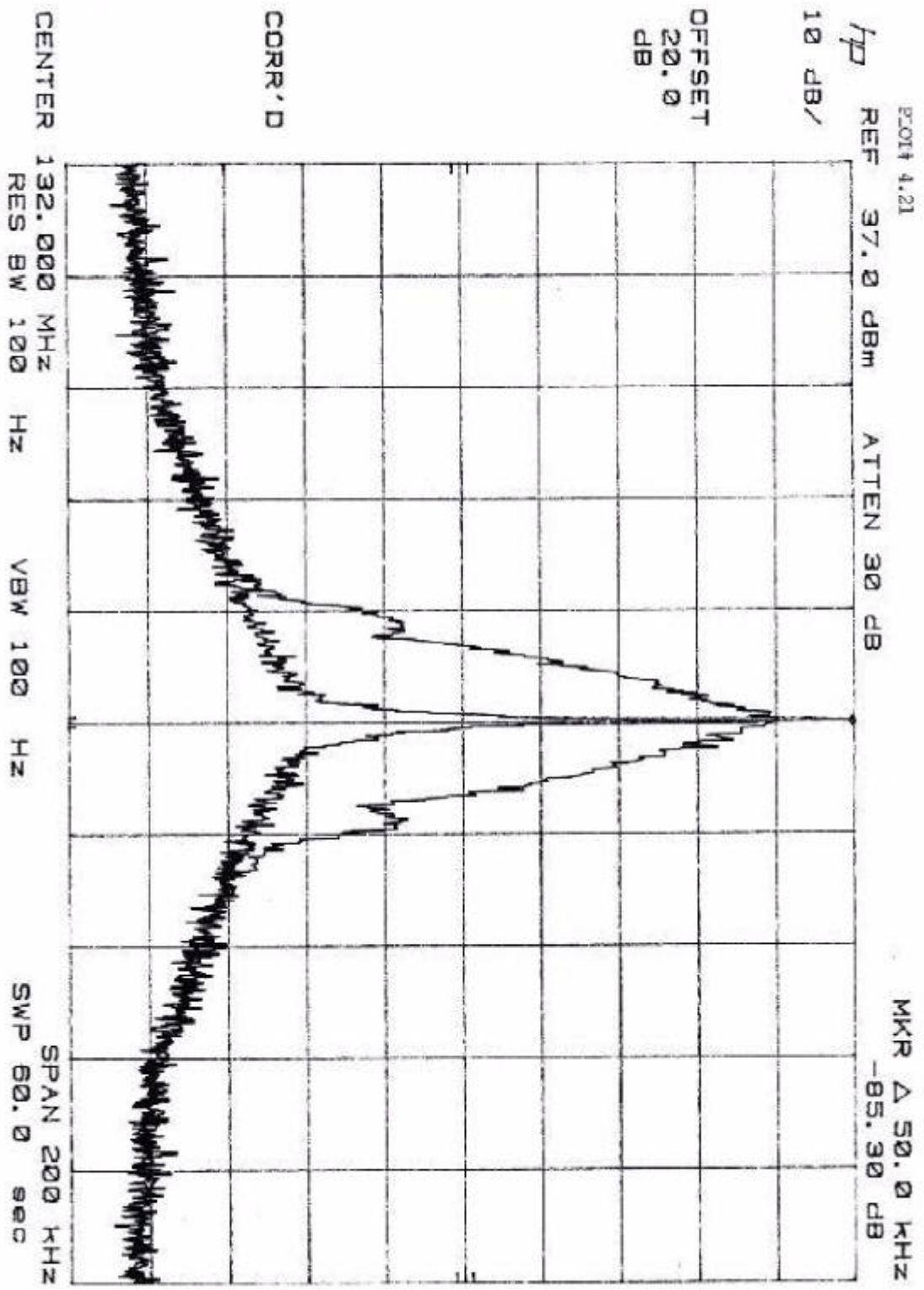
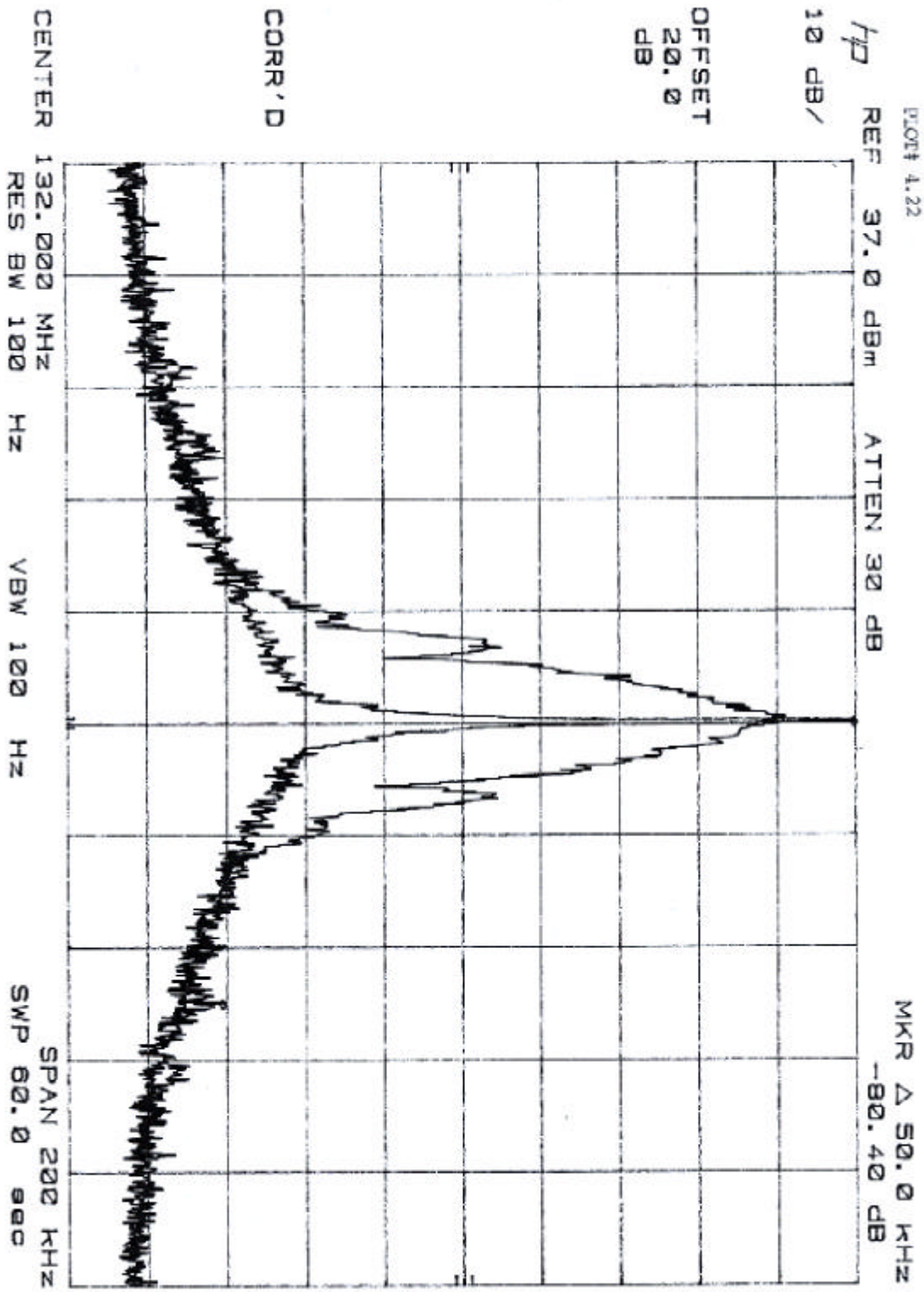
REF 37.0 dBm
10 dB/
ATTEN 30 dB
OFFSET
20.0
dB
CORR'D
CENTER 132.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 200 kHz
SWP 60.0 sec
MKR Δ 50.0 kHz
-84.60 dB


PLOT 4.21
hp
REF 37.0 dBm
10 dB/
ATTEN 30 dB
OFFSET
20.0
dB
CORR'D
CENTER 132.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 200 kHz
SWP 60.0 sec
MKR Δ 50.0 kHz
-85.30 dB


PLOT# 4.22
hp
REF 37.0 dBm
10 dB/
ATTEN 30 dB
OFFSET
20.0
dB
CORR'D
CENTER 132.000 MHz
RES BW 100 Hz
VBW 100 Hz
SPAN 200 kHz
SWP 60.0 sec
MKR Δ 50.0 kHz
-80.40 dB

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 dB = 50 + 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

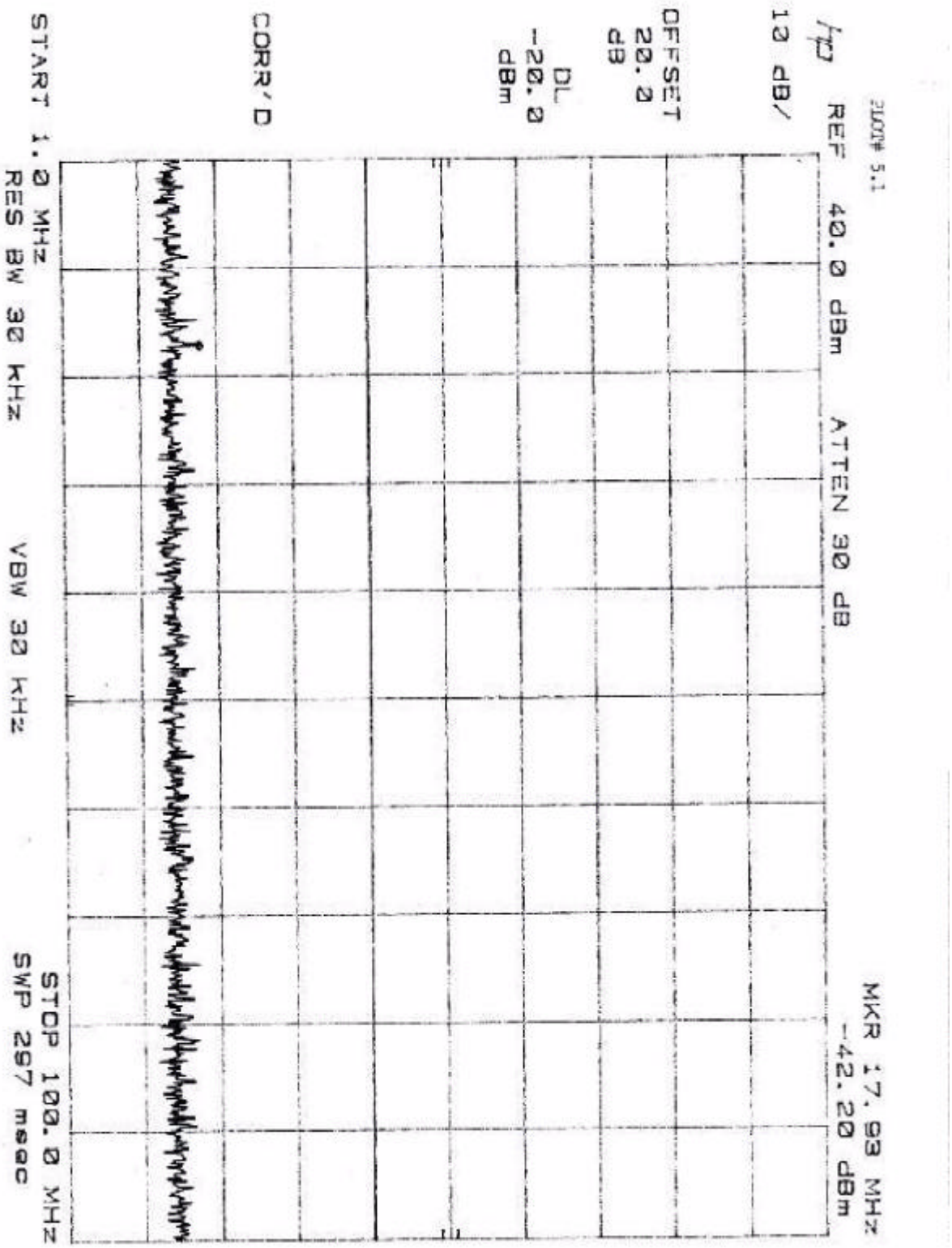
5.3 Test Results

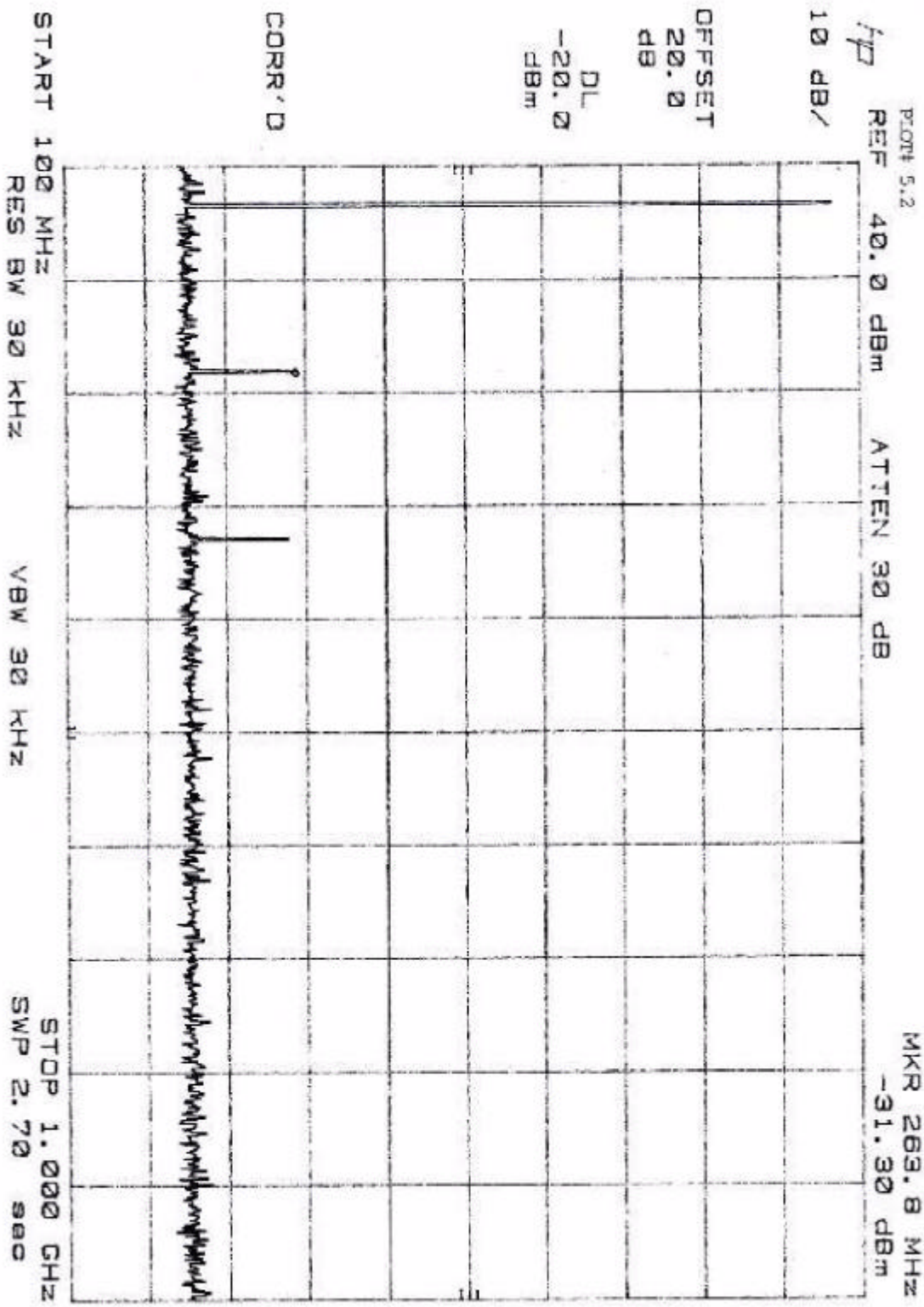
The EUT passed the test. Refer to the attached plots.

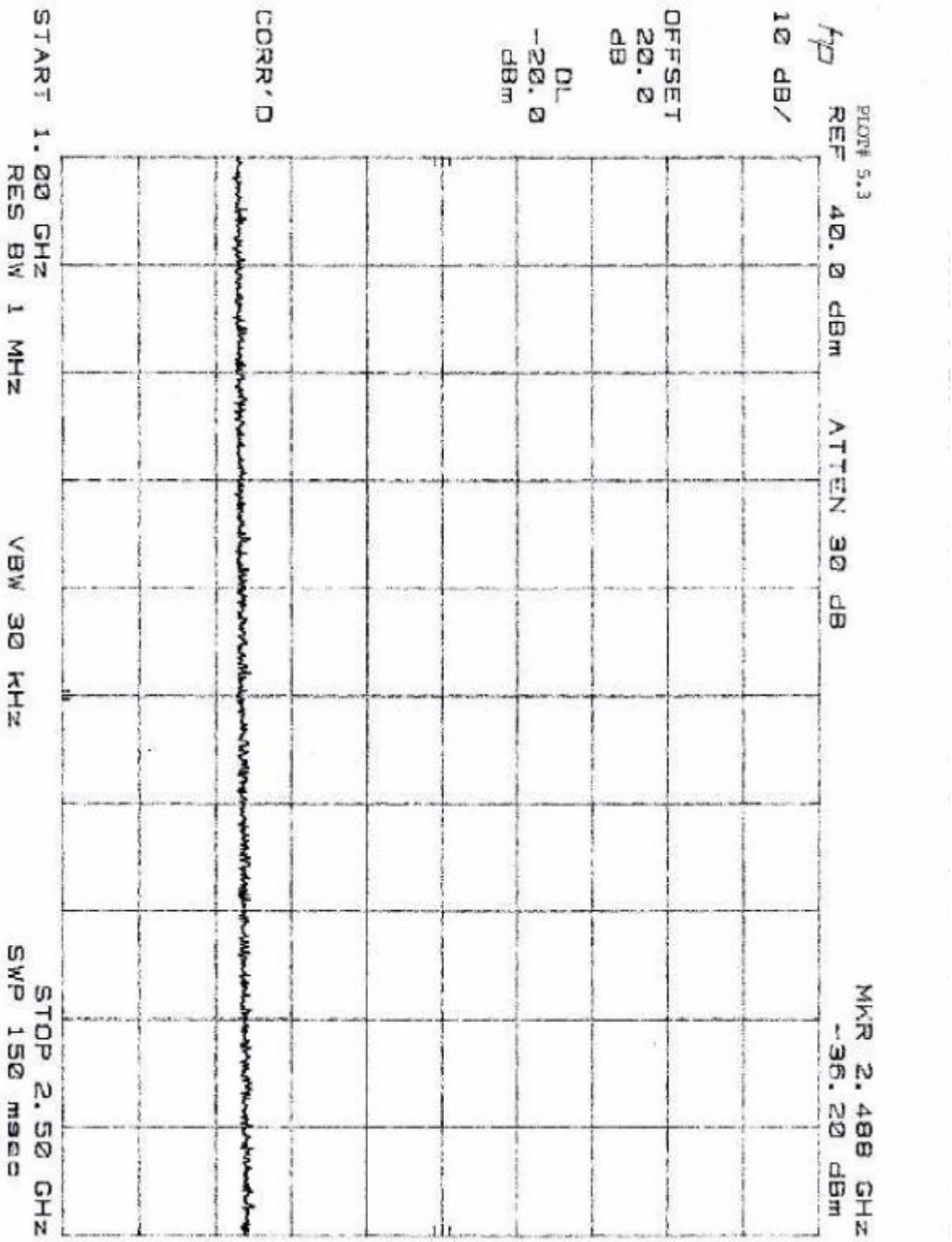
Transmitting at 132 MHz			
Plot Number	**Type of Modulation**	**Emission Designator**	**Description**
5.1	GMSK, BT=0.5	20K0F1D	Scan 1-100 MHz
5.2	GMSK, BT=0.5	20K0F1D	Scan 100-1000 MHz
5.3	GMSK, BT=0.5	20K0F1D	Scan 1-2.5 GHz

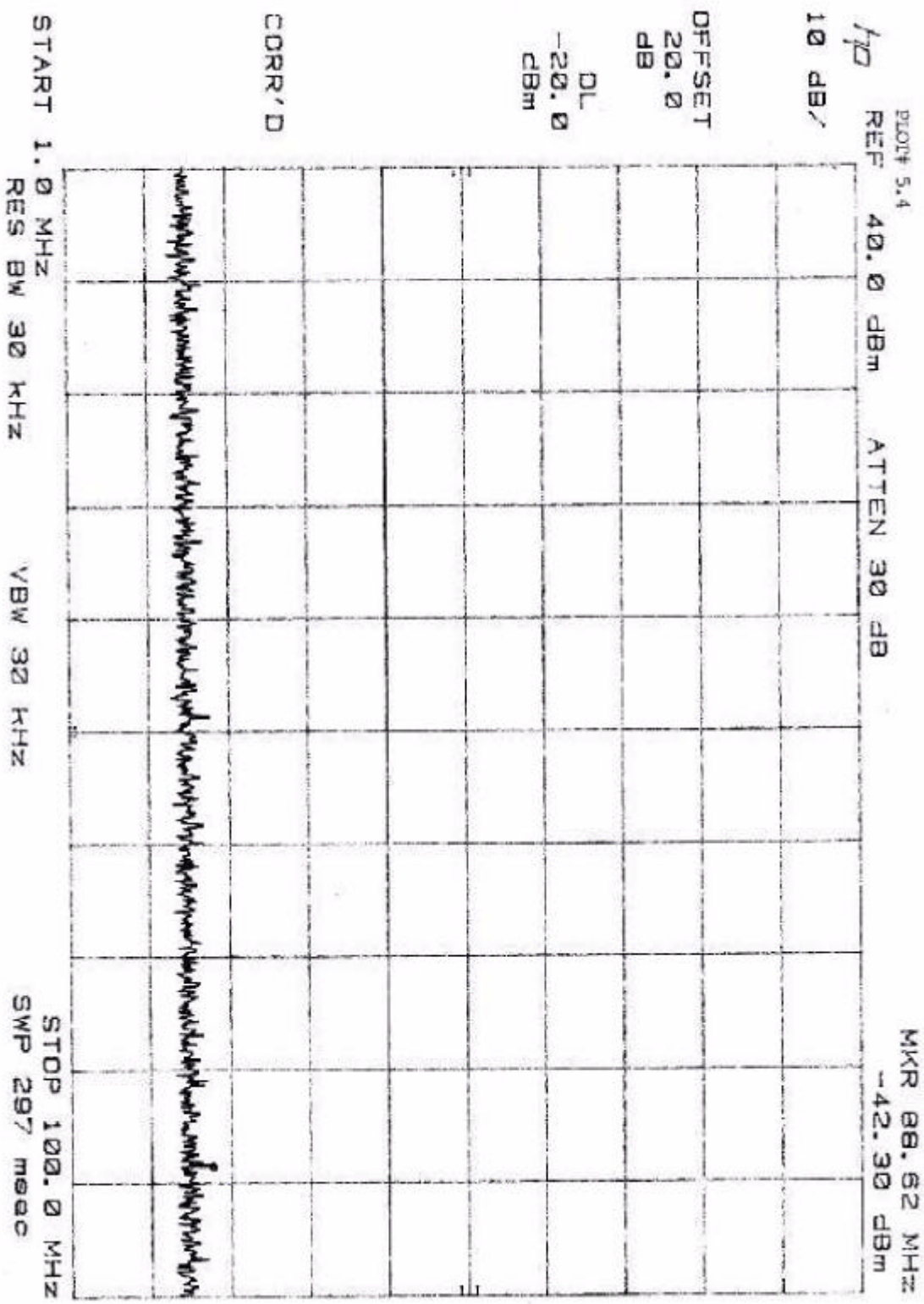
Transmitting at 153 MHz			
Plot Number	**Type of Modulation**	**Emission Designator**	**Description**
5.4	GMSK, BT=0.5	20K0F1D	Scan 1-100 MHz
5.5	GMSK, BT=0.5	20K0F1D	Scan 100-1000 MHz
5.6	GMSK, BT=0.5	20K0F1D	Scan 1-2.5 GHz

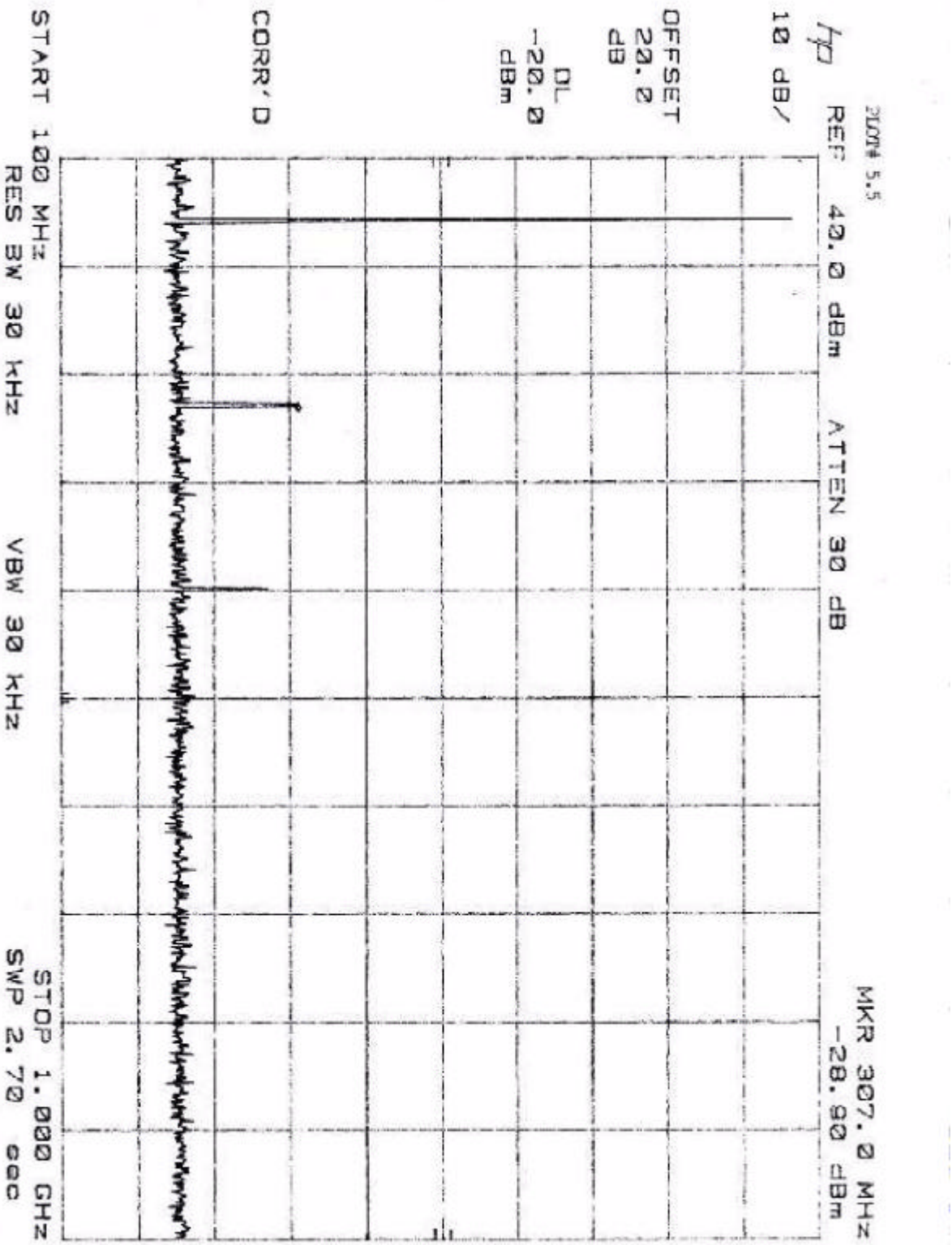
Transmitting at 174 MHz			
Plot Number	**Type of Modulation**	**Emission Designator**	**Description**
5.7	GMSK, BT=0.5	20K0F1D	Scan 1-100 MHz
5.8	GMSK, BT=0.5	20K0F1D	Scan 100-1000 MHz
5.9	GMSK, BT=0.5	20K0F1D	Scan 1-2.5 GHz

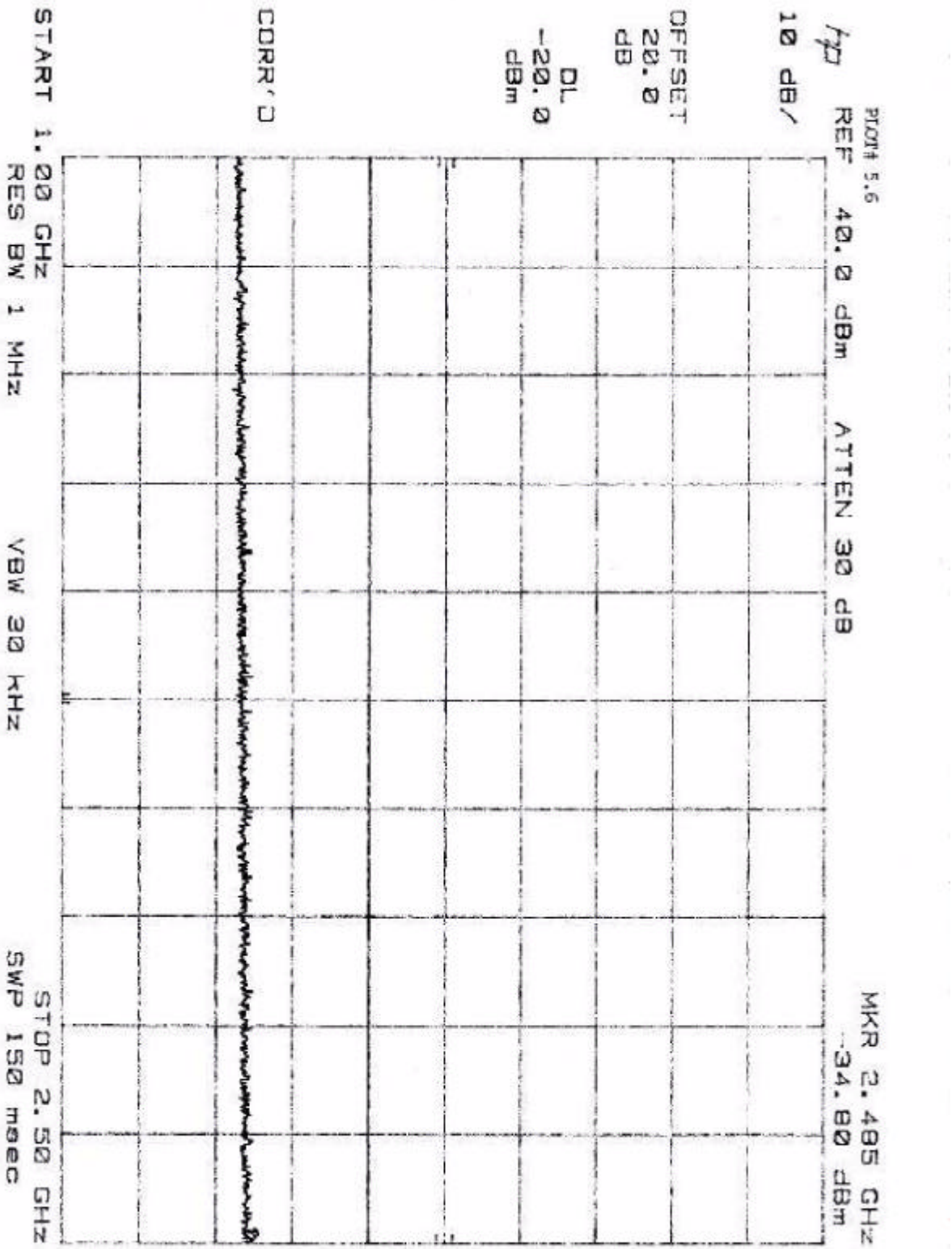

PLOT# 5.1
REF 40.0 dBm
ATTEN 30 dB
10 dB/
OFFSET 20.2 dB
DL -20.2 dBm
CORR'D
MKR 17.93 MHz -42.20 dBm
START 1.0 MHz
RES BW 30 kHz
VBW 30 kHz
STOP 100.0 MHz
SWP 297 msec

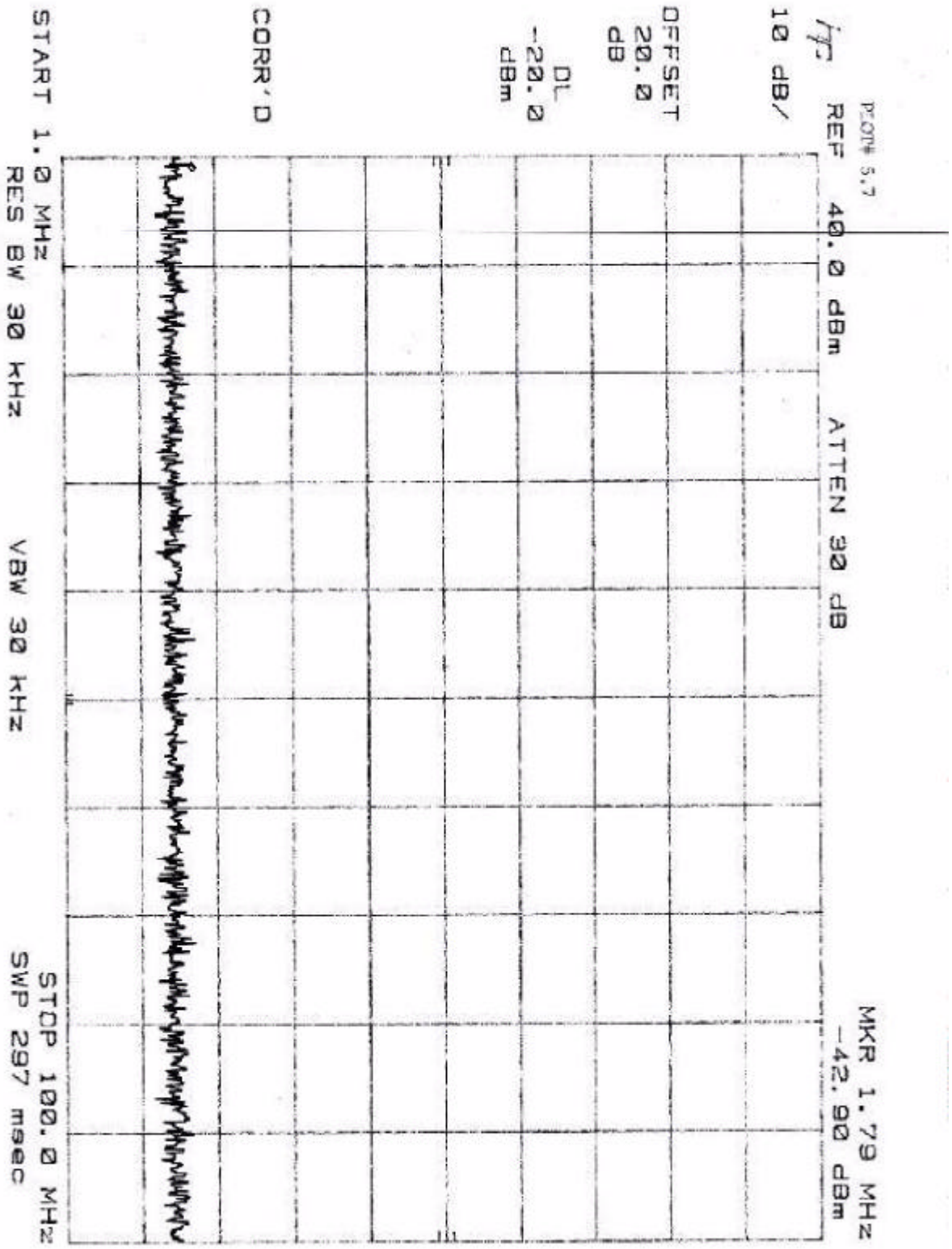

PLOT# 5.2
REF 40.0 dBm
ATTEN 30 dB
10 dB/
OFFSET
20.0
dB
DL
-20.0
dBm
CORR'D
START 100 MHz
RES BW 30 kHz
VBW 30 kHz
STOP 1.000 GHz
SWP 2.70 sec
MKR 263.8 MHz
-31.30 dBm

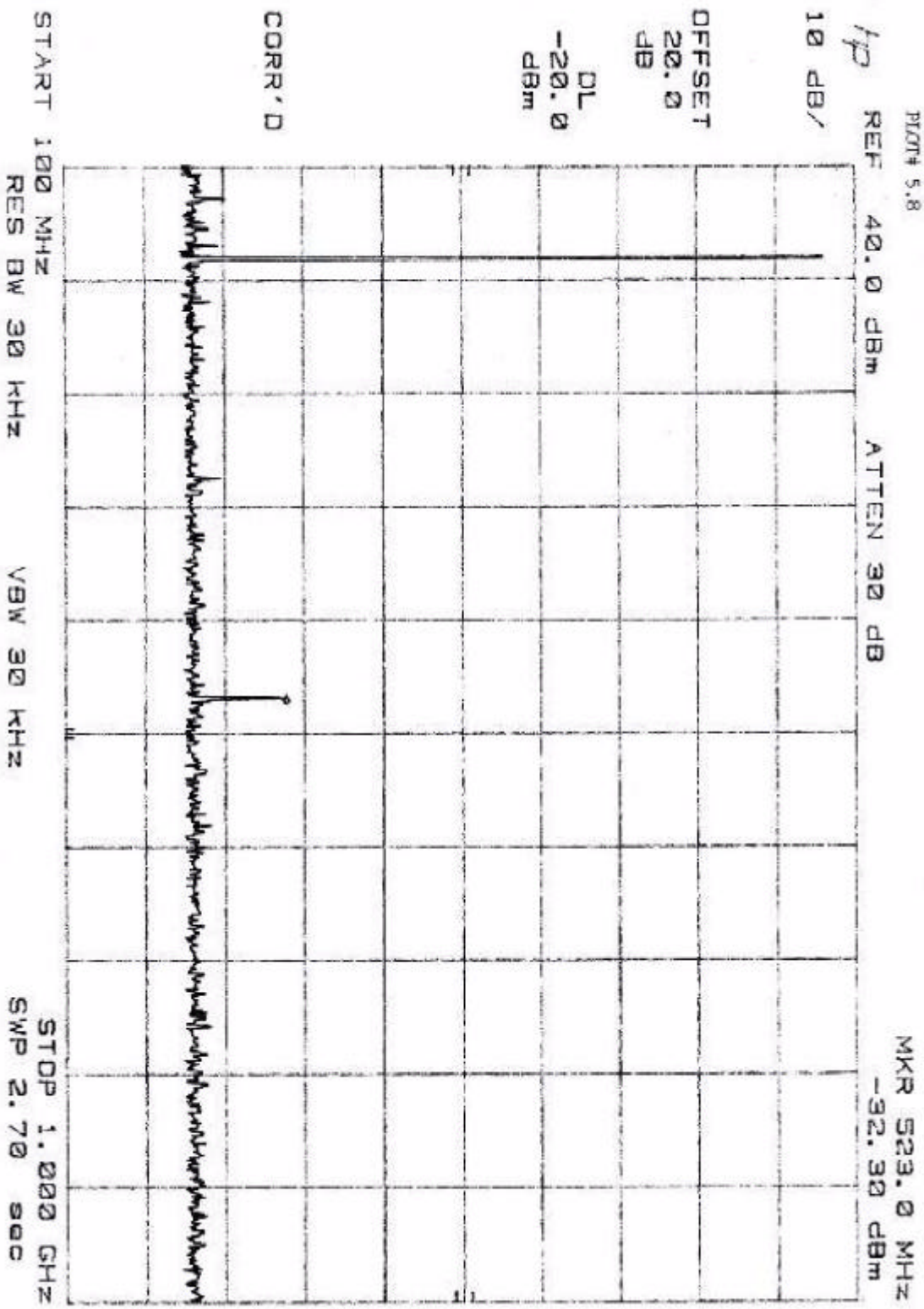

PLOT# 5.3
REF 40.0 dBm
ATTEN 30 dB
10 dB/
OFFSET 20.0 dB
DL -20.0 dBm
CORR'D
MKR 2.488 GHz -36.20 dBm
START 1.00 GHz
RES BW 1 MHz
VBW 30 KHz
STOP 2.50 GHz
SWP 150 msec

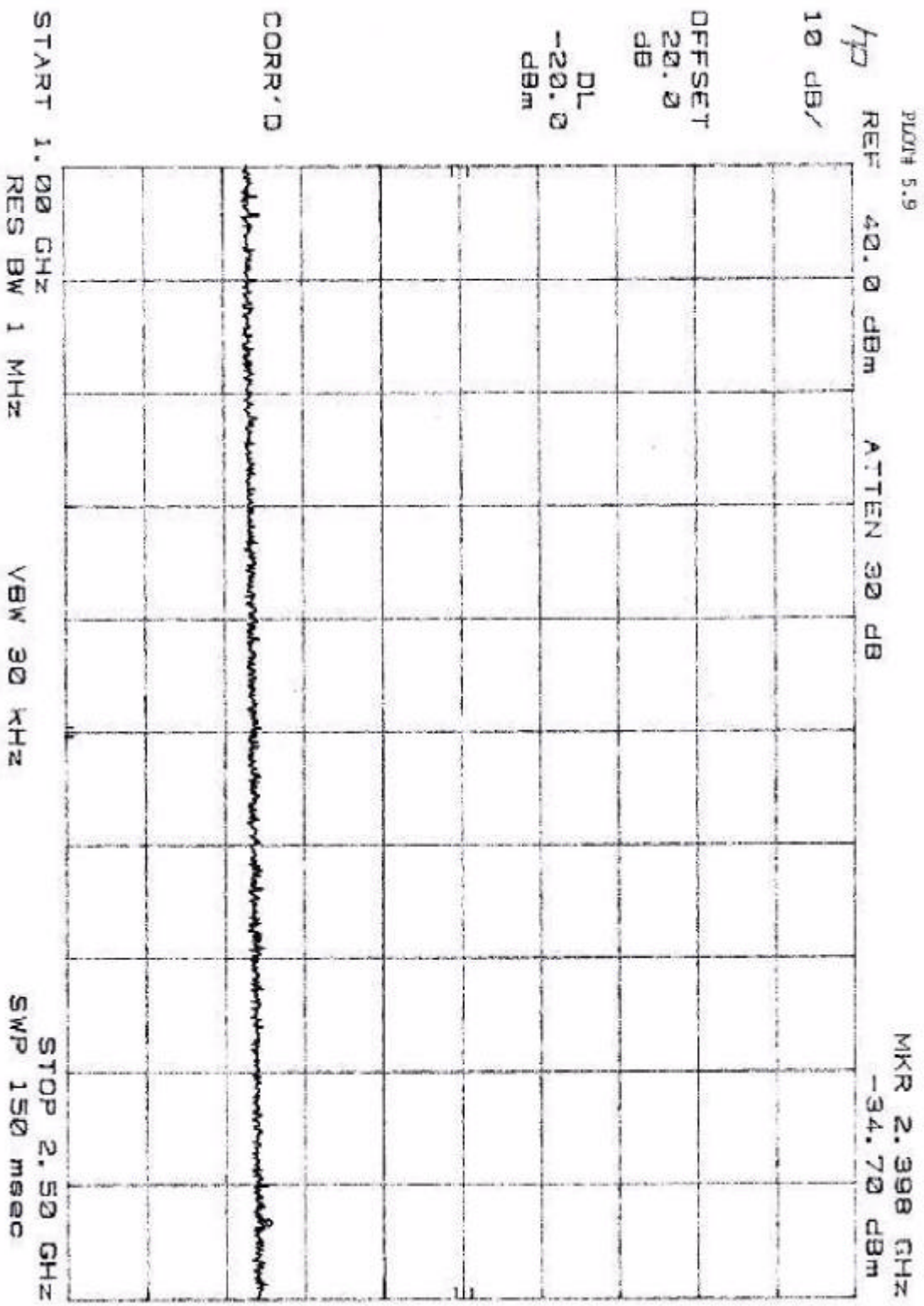

PLOT# 5.4
REF 40.0 dBm
ATTEN 30 dB
10 dB/
OFFSET 20.0 dB
DL -20.0 dBm
CORR'D
MKR 88.62 MHz -42.30 dBm
START 1.0 MHz
RES BW 30 kHz
VBW 30 kHz
STOP 100.0 MHz
SWP 297 msec


hp
REF 40.0 dBm
10 dB/
ATTEN 30 dB
OFFSET
20.0
dB
DL
-20.0
dBm
CORR'D
MKR 307.0 MHz
-28.90 dBm
START 100 MHz
RES BW 30 kHz
VBW 30 kHz
STOP 1.000 GHz
SWP 2.70 sec


PLOT# 5.6
REF 40.0 dBm
ATTEN 30 dB
10 dB/
OFFSET
20.0
dB
DL
-20.0
dBm
CORR'D
MKR 2.485 GHz
-34.80 dBm
START 1.00 GHz
RES BW 1 MHz
VBW 30 kHz
STOP 2.50 GHz
SWP 150 msec


PLOT# 5.7
REF 40.0 dBm
10 dB/
ATTEN 30 dB
OFFSET
20.0
dB
DL
-20.0
dBm
CORR'D
MKR 1.79 MHz
-42.90 dBm
START 1.0 MHz
RES BW 30 kHz
VBW 30 kHz
STOP 100.0 MHz
SWP 297 msec


PLOT# 5.8
hp
10 dB/
REF 40.0 dBm
ATTEN 30 dB
OFFSET
20.0
dB
DL
-20.0
dBm
CORR'D
MKR 523.0 MHz
-32.30 dBm
START 100 MHz
RES BW 30 kHz
VBW 30 kHz
STOP 1.000 GHz
SWP 2.70 sec


PLOT# 5.9
REF 40.0 dBm
10 dB/
ATTEN 30 dB
OFFSET
20.0
dB
DL
-20.0
dBm
CORR'D
MKR 2.398 GHz
-34.70 dBm
START 1.00 GHz
RES BW 1 MHz
VBW 30 kHz
STOP 2.50 GHz
SWP 150 msec

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

6.3 Test Results

Refer to the attached data sheets.

ITS Intertek Testing Services

Company: Teledesign System Inc.
Project #: J98033454
Model: JWFTS4000C (Tx @ 132.0 MHz)
Engineer: Xi-Ming Yang
Date of test: Dec. 18, 1998

FCC 90 Radiated Emissions

Frequency	Antenna Polarity	Reading	Antenna Factor	Pre-amp	Cable Loss	Field Strength	Spurious Attenuation	Margin
MHz	H/V	dB(uV)	dB(1/m)	dB	dB	dB(uV/m)	dB	dB
264.0	H	23.0	13.2	0.0	0.2	36.4	96.5	-39.5
396.0	V	21.0	16.5	0.0	0.4	37.9	95.0	-38.0
528.0	H	25.0	19.2	0.0	0.5	44.7	88.2	-31.2
660.0	H	36.0	21.0	0.0	0.6	57.6	75.3	-18.3
792.0	H	21.0	22.2	0.0	0.8	44.0	88.9	-31.9
924.0	V	20.0	24.8	0.0	0.9	45.7	87.2	-30.2
1056.0	V	20.0	23.1	0.0	1.0	44.1	88.8	-31.8
1188.0	V	20.0	23.5	0.0	1.1	44.6	88.3	-31.3
1320.0	V	20.0	24.3	0.0	1.3	45.6	87.3	-30.3

Note:
1. All measurement were made at 3 meters
2. Field Strength at the fundamental frequency equals 132.9 dBuV/m
3. Spurious emissions attenuation limit equals 50+10log P = 57.0 dB

ITS Intertek Testing Services

Company: Teledesign System Inc.
Project #: J98033454
Model: JWFTS4000C (Tx @ 153.0 MHz)
Engineer: Xi-Ming Yang
Date of test: Dec. 18, 1998

FCC 90 Radiated Emissions

Frequency	Antenna Polarity	Reading	Antenna Factor	Pre-amp	Cable Loss	Field Strength	Spurious Attenuation	Margin
MHz	H/V	dB(uV)	dB(1/m)	dB	dB	dB(uV/m)	dB	dB
306.0	H	29.0	12.6	0.0	0.3	41.9	90.6	-33.6
459.0	H	27.6	15.7	0.0	0.4	43.7	88.8	-31.8
612.0	H	45.0	18.7	0.0	0.6	64.3	68.2	-11.2
765.0	H	21.0	23.0	0.0	0.7	44.7	87.8	-30.8
918.0	H	31.0	24.5	0.0	0.9	56.4	76.1	-19.1
1071.0	H	29.0	23.1	0.0	1.0	53.1	79.4	-22.4
1224.0	H	25.0	24.0	0.0	1.2	50.2	82.3	-25.3
1377.0	H	25.2	24.5	0.0	1.3	51.0	81.5	-24.5
1530.0	H	25.2	24.9	0.0	1.5	51.6	80.9	-23.9

Note: 1. All measurement were made at 3 meters
2. Field Strength at the fundamental frequency equals 132.5 dBuV/m
3. Spurious emissions attenuation limit equals 50+10log P = 57.0 dB

ITS Intertek Testing Services

Company: Teledesign System Inc.
Project #: J98033454
Model: JWFTS4000C (Tx @ 174.0 MHz)
Engineer: Xi-Ming Yang
Date of test: Dec. 18, 1998

FCC 90 Radiated Emissions

Frequency	Antenna Polarity	Reading	Antenna Factor	Pre-amp	Cable Loss	Field Strength	Spurious Attenuation	Margin
MHz	H/V	dB(uV)	dB(1/m)	dB	dB	dB(uV/m)	dB	dB
348.0	V	40.7	16.0	0.0	0.3	57.0	75.2	-18.2
522.0	H	37.0	19.2	0.0	0.5	56.7	75.5	-18.5
696.0	H	41.0	21.2	0.0	0.7	62.9	69.3	-12.3
870.0	V	33.0	23.4	0.0	0.8	57.2	75.0	-18.0
1044.0	V	38.7	23.1	0.0	1.0	62.8	69.4	-12.4
1218.0	H	23.7	23.8	0.0	1.2	48.7	83.5	-26.5
1392.0	H	30.0	24.2	0.0	1.4	55.6	76.6	-19.6
1566.0	H	22.0	24.9	0.0	1.5	48.4	83.8	-26.8
1740.0	H	16.5	26.3	0.0	1.7	44.5	87.7	-30.7

Note:
1. **All measurement were made at 3 meters**
2. **Field Strength at the fundamental frequency equals 132.2 dBuV/m**
3. **Spurious emissions attenuation limit equals 50+10log P = 57.0 dB**

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

7.1 Test Procedure

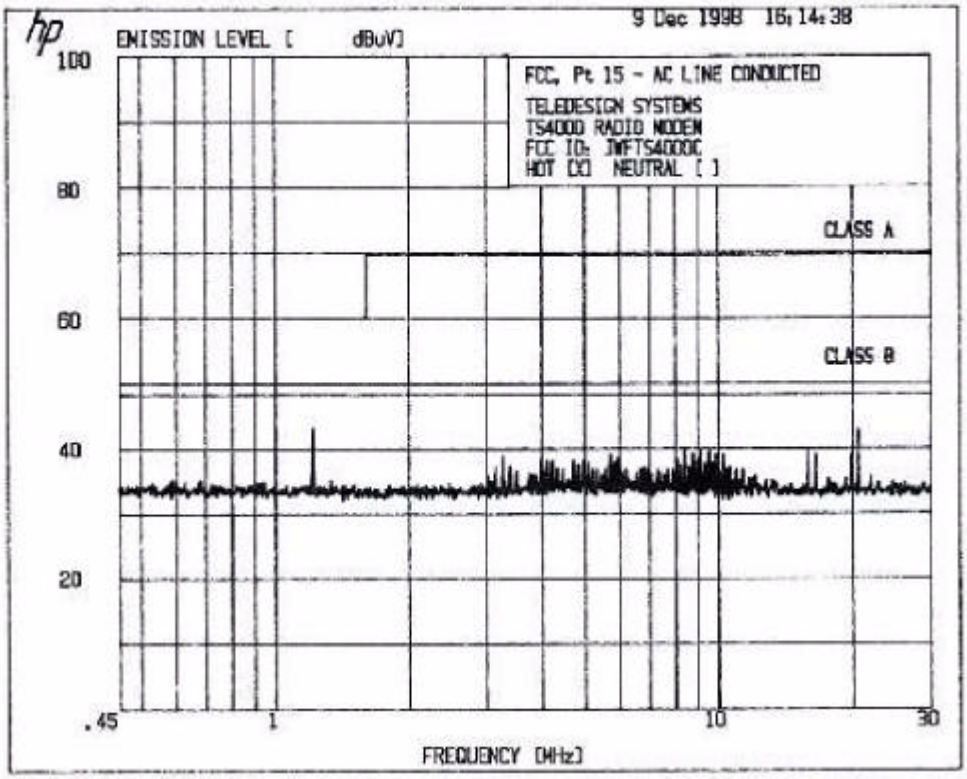
Test procedure described in the ANSI C63.4 Standard was employed.

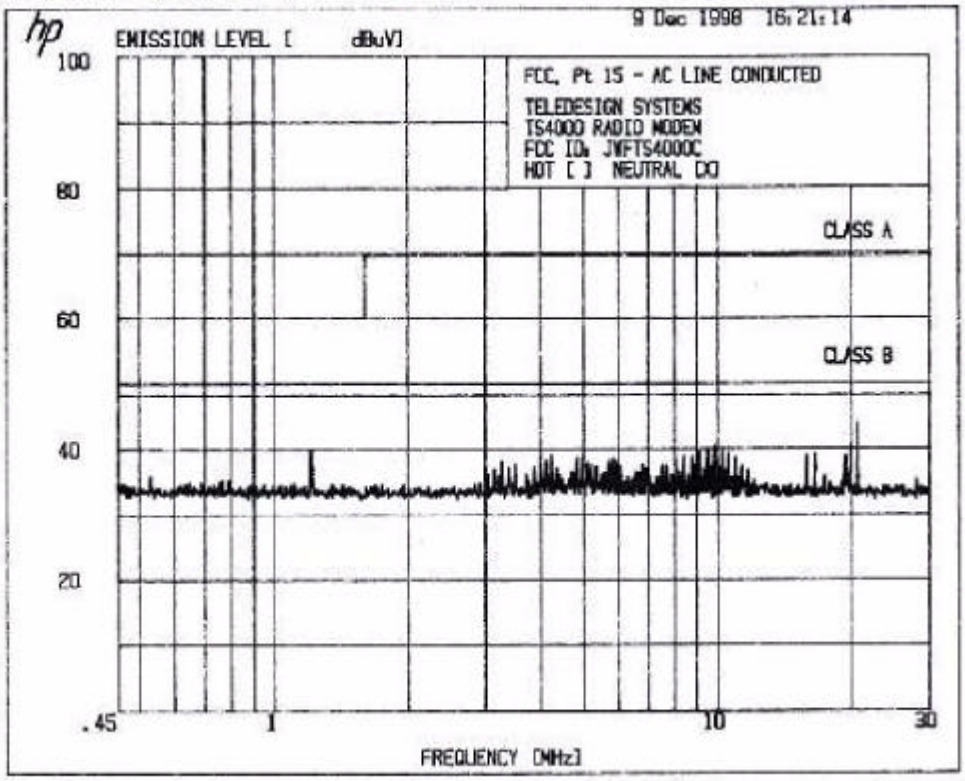
The EUT was connected to the DC power supply, that was connected to the AC line through the LISNs.

Both HOT and NEUTRAL leads were tested.

7.2 Test Results

See attached pages.


9 Dec 1998 16:14:38
EMISSION LEVEL [dBuV]
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]
FCC, Pt 15 - AC LINE CONDUCTED
TELEDESIGN SYSTEMS
TS4000 RADIO MODEM
FCC ID: JWFTS4000C
HOT [X] NEUTRAL [ ]
CLASS A
CLASS B


9 Dec 1998 16:21:14
EMISSION LEVEL [dBuV]
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]
FCC, Pt 15 - AC LINE CONDUCTED
TELEDESIGN SYSTEMS
TS4000 RADIO MODEM
FCC ID: JWFTS4000C
HOT [ ] NEUTRAL [X]
CLASS A
CLASS B

9 Dec 1998 15:21:14

3. FCC CFR 47, Pt 15
   3.1 FCC, Pt 15 - AC LINE CONDUCTED

TELEDESIGN SYSTEMS
TS4000 RADIO MODEM
FCC ID: JWFTS4000C
HOT [ ] NEUTRAL [X]

PEAKS FOUND ABOVE 39 dBuV

PEAK#	FREQ (MHz)	AMPL(dBuV)
1	1.221	39.7
2	4.246	39.0
3	9.190	39.5
4	9.583	39.9
5	9.910	40.2
6	10.29	39.5
7	10.64	39.2
8	15.60	39.0
9	15.97	40.4
10	20.74	43.7

9 Dec 1998 16:14:38

3. FCC CFR 47, Pt 15
   3.1 FCC, Pt 15 - AC LINE CONDUCTED

TELEDESIGN SYSTEMS
TS4000 RADIO MODEM
FCC ID: JWFTS4000C
HOT [X] NEUTRAL [ ]

PEAKS FOUND ABOVE 30 dBuV

PEAK#	FREQ (MHz)	AMPL(dBuV)
1	1.227	42.0
2	3.280	39.7
3	4.021	38.1
4	4.141	38.0
5	4.246	38.0
6	4.756	38.0
7	5.001	38.0
8	5.744	38.0
9	5.965	38.4
10	8.103	38.1
11	8.450	39.6
12	8.612	39.3
13	8.693	38.1
14	9.190	39.9
15	9.583	39.5
16	9.910	39.1
17	10.29	38.9
18	15.92	39.6
19	16.69	39.1
20	19.97	39.1
21	29.74	42.6

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: 153 MHz, Tolerance ±382.5 Hz

Frequency Stability vs Temperature	
Temperature, C	**Difference (Hz)**
+60	170
+50	100
+40	110
+30	35
+20	115
+10	140
0	80
-10	80
-20	165
-30	205

Justification: Passed

9.0 **Frequency Stability vs Voltage**, FCC 2.995(d)(2)

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: 153.00 MHz, Tolerance ±382.5 Hz

Frequency Stability vs. Voltage	
Voltage	**Difference (Hz)**
11	85
14	95
20	10
24	100
28	105

Justification: Passed

10.0 **Transient Frequency Behavior,** FCC 90.214

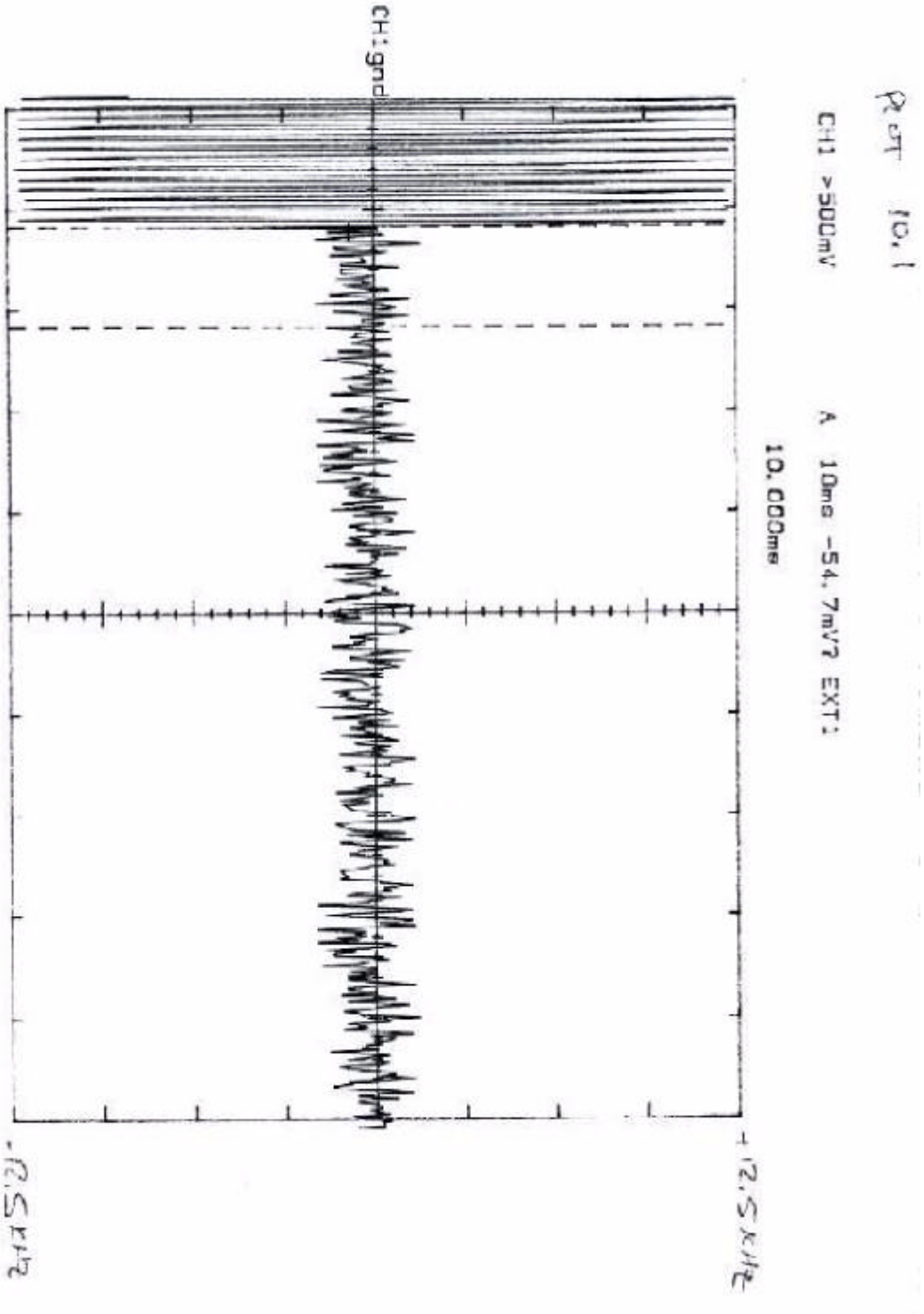
10.1 Test Procedure

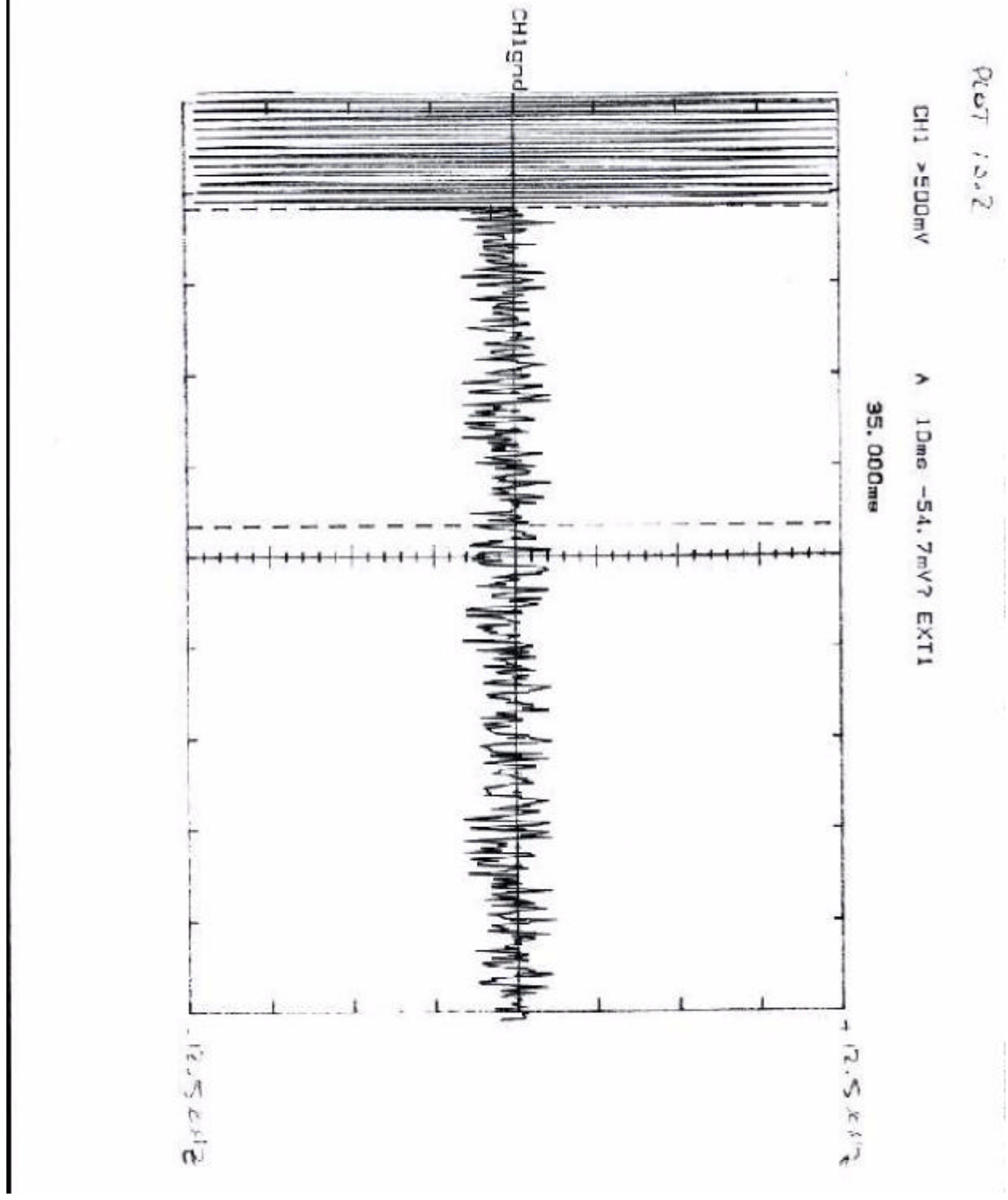
Test was performed according the TIA/EIA/IS-102.CAAA, Section 2.2.18. The transmitter was continuously transmitting an unmodulated signal. The generator was generating FM signal (1 kHz tone, 12.5 kHz deviation). Several plots were made on the FM demodulator output with the EUT turned ON and OFF.

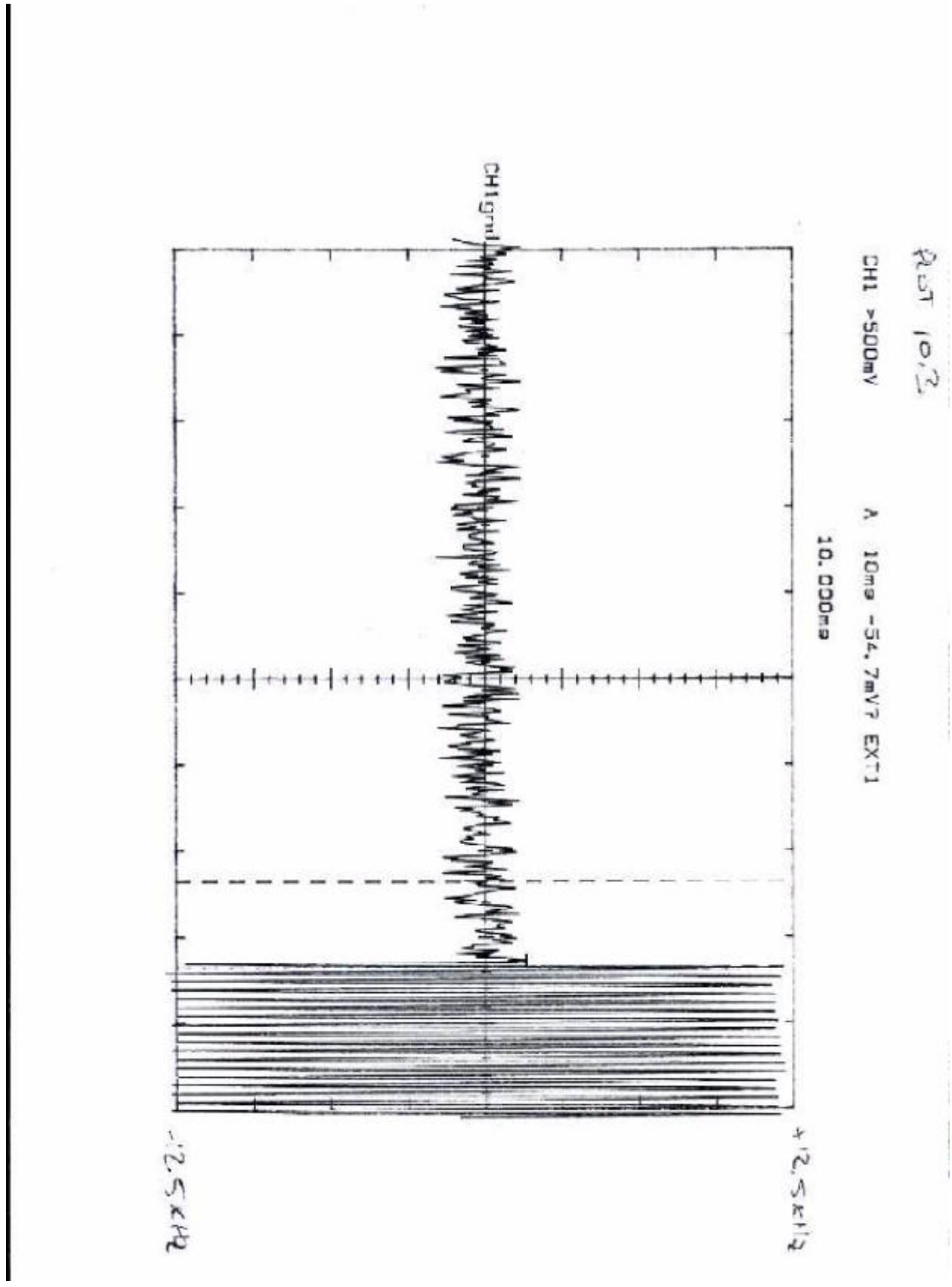
PLOT #	FREQ. MHz	TRANSMIT MODULATION	DESCRIPTION
10.1	132	Low	Transmitter On, T1
10.2	132	Low	Transmitter On, T2
10.3	132	Low	Transmitter Off, T3
10.4	132	High	Transmitter On, T1, T2
10.5	132	High	Transmitter Off, T3
10.6	153	Low	Transmitter On, T1
10.7	153	Low	Transmitter On, T2
10.8	153	Low	Transmitter Off, T3
10.9	153	High	Transmitter On, T1, T2
10.10	153	High	Transmitter Off, T3
10.11	174	Low	Transmitter On, T1
10.12	174	Low	Transmitter On, T2
10.13	174	Low	Transmitter Off, T3
10.14	174	High	Transmitter On, T1, T2
10.15	174	High	Transmitter Off, T3

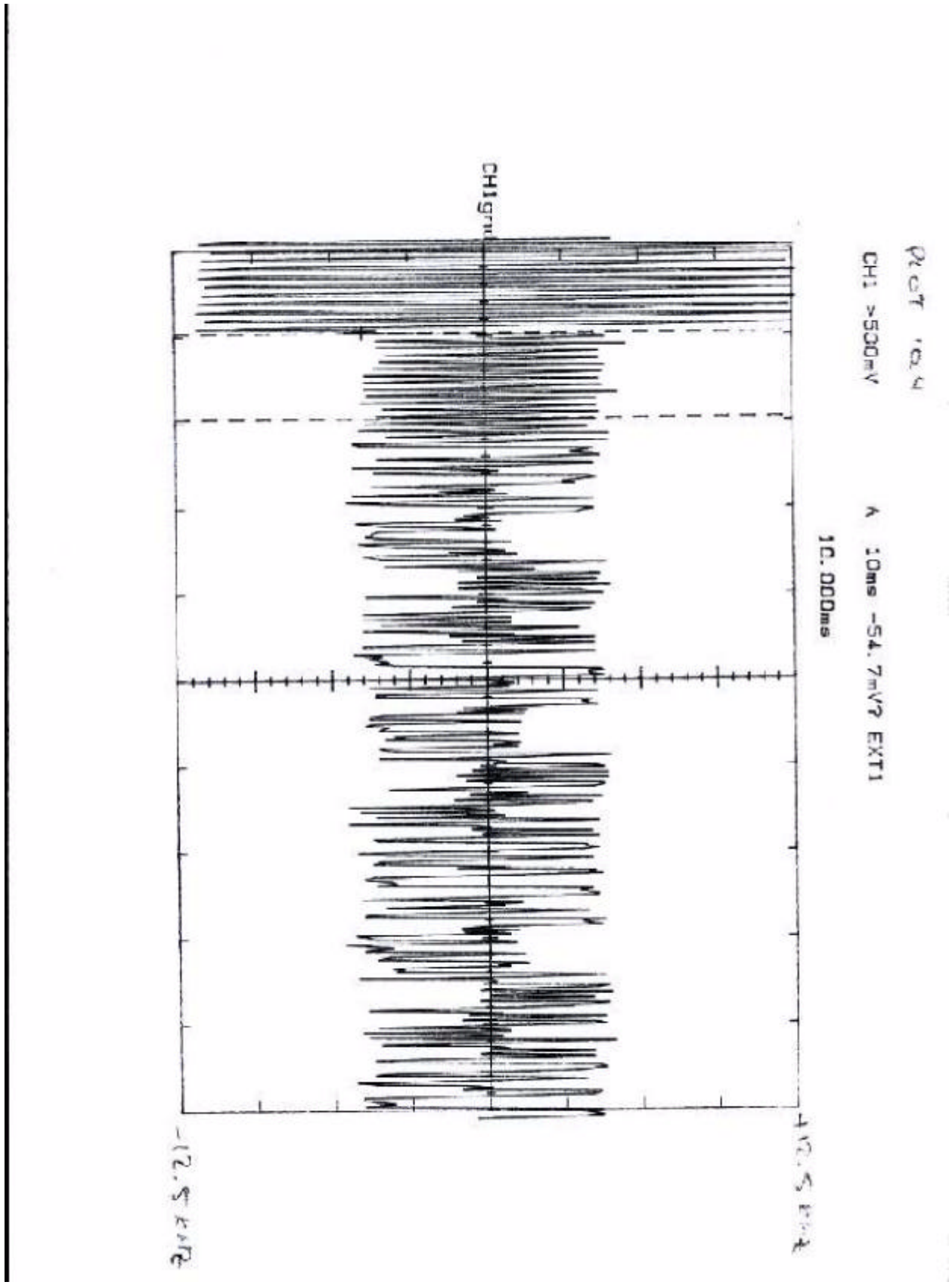
10.2 Test Result

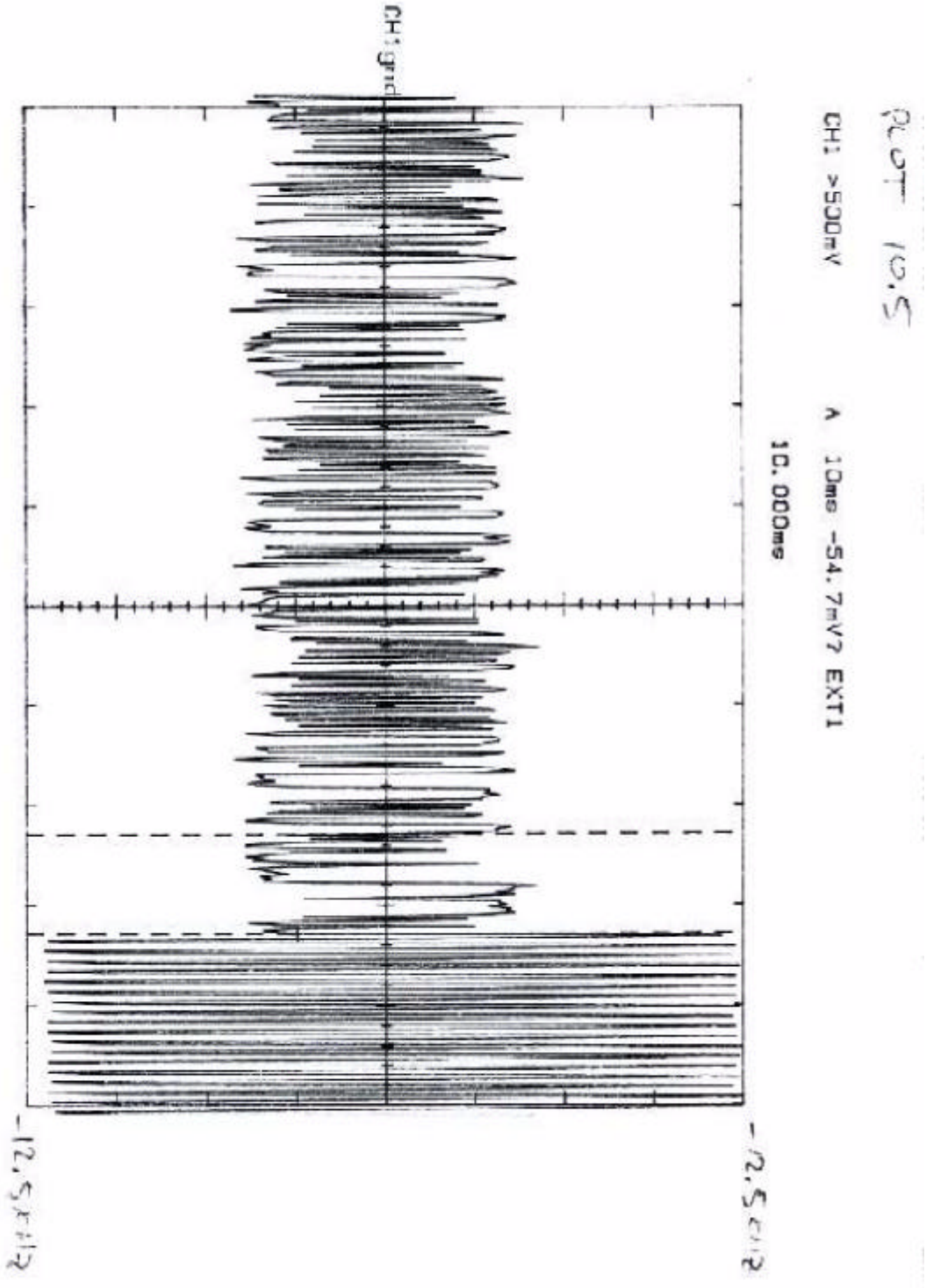
For the test result, see attached plots. The EUT passed the test.

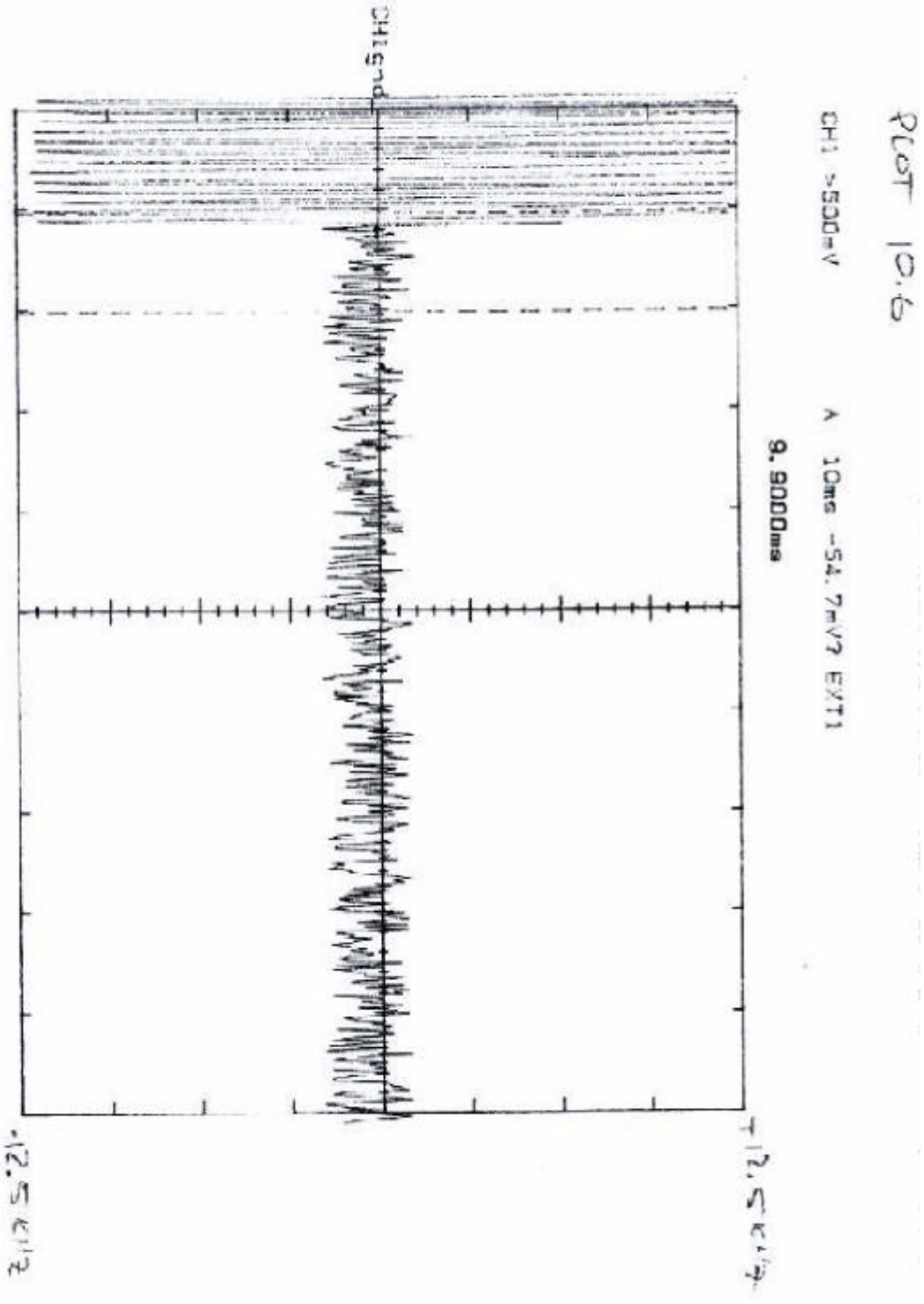

CH:gnd
CH1 >500mV
A 10ms -54.7mV? EXT:
10.000ms
Ref 10.1

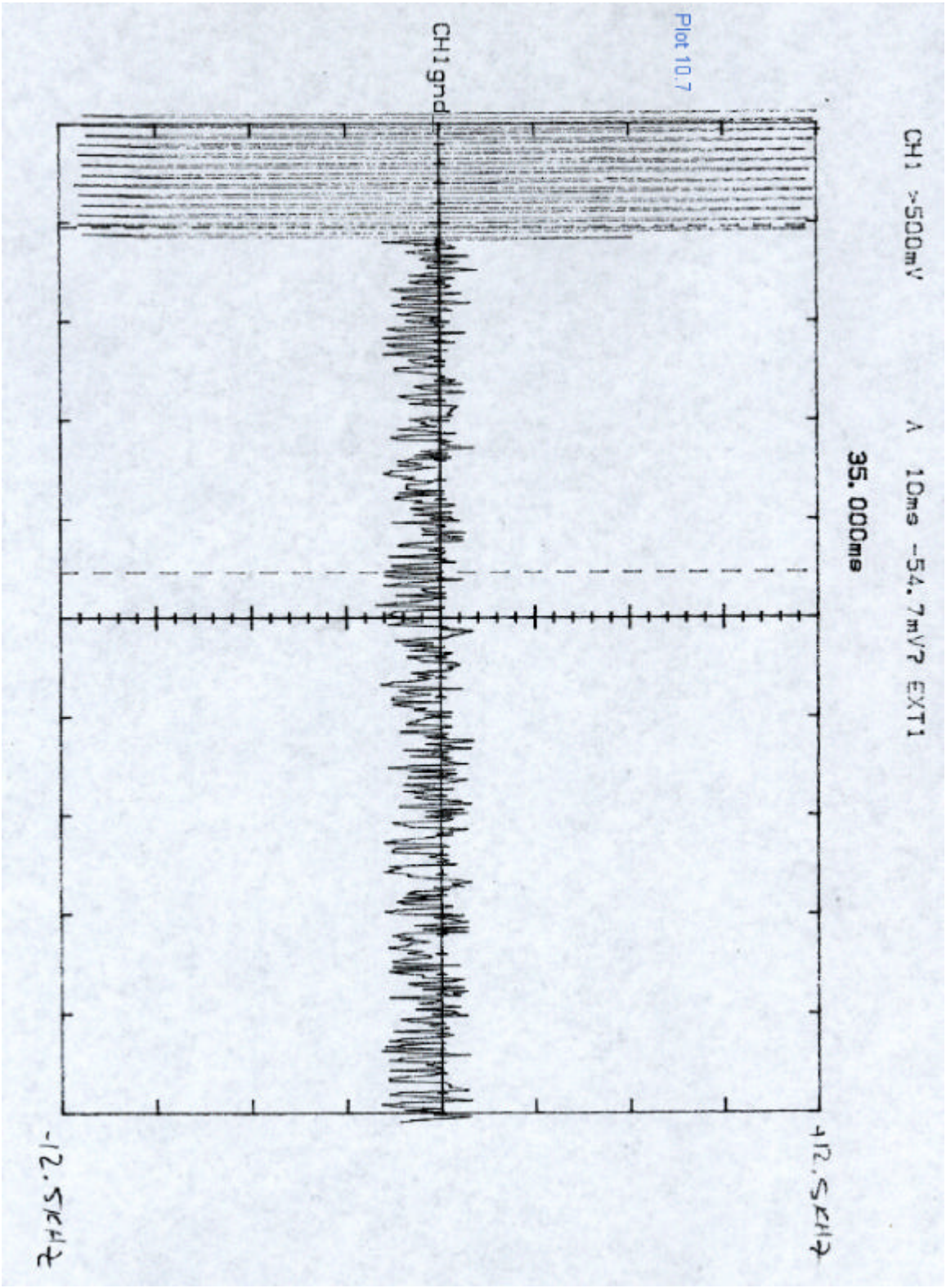

PLOT 13.2
CH1 >500mV
A 10ms -54.7mV? EXT1
35.000ms
CH1 Peak

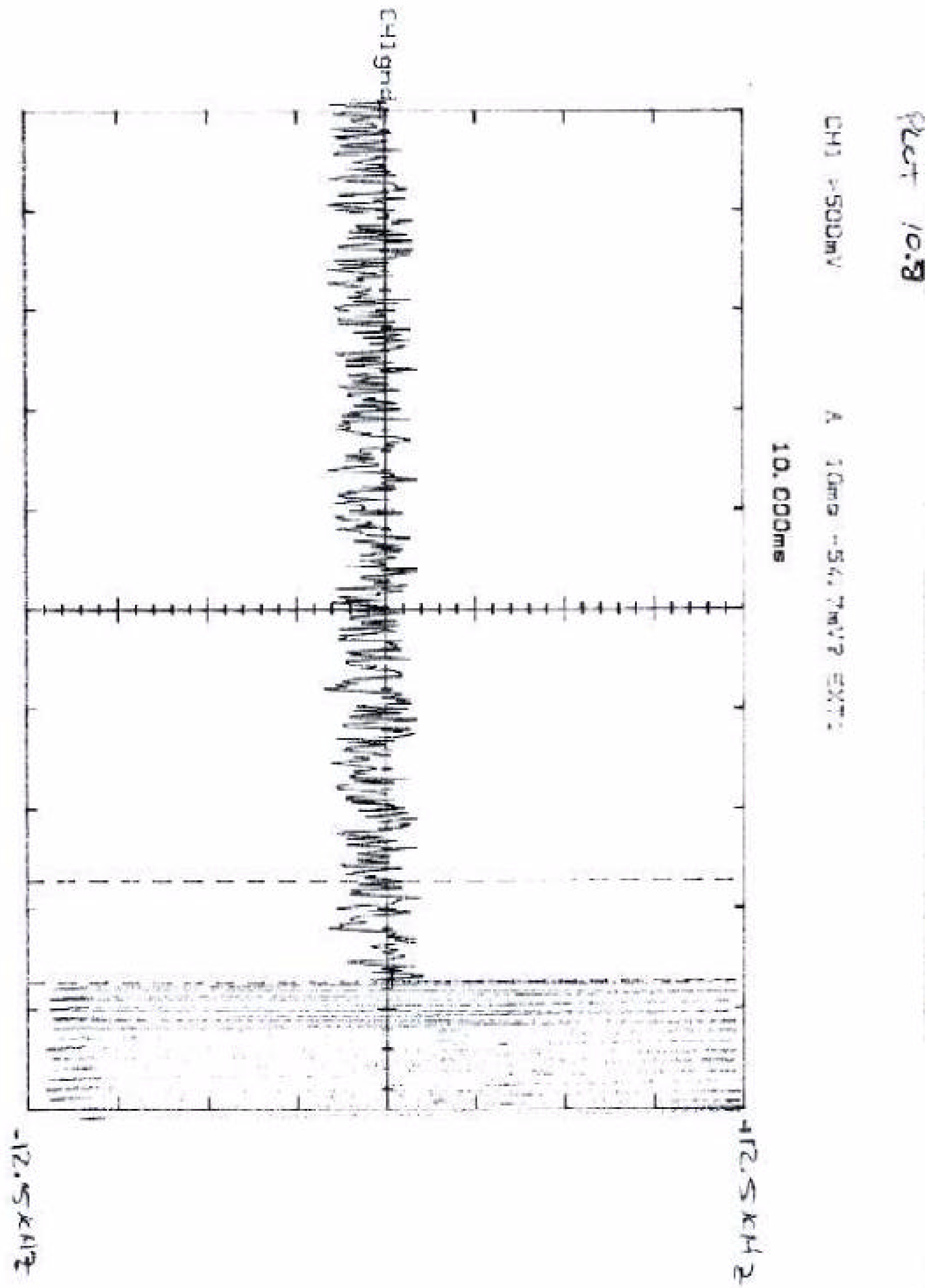

RBT 10/2
CH1 >500mV
A 10ms -54.7mV? EXT1
10.000ms
CH1 Ground
+12.5x12
-12.5x12

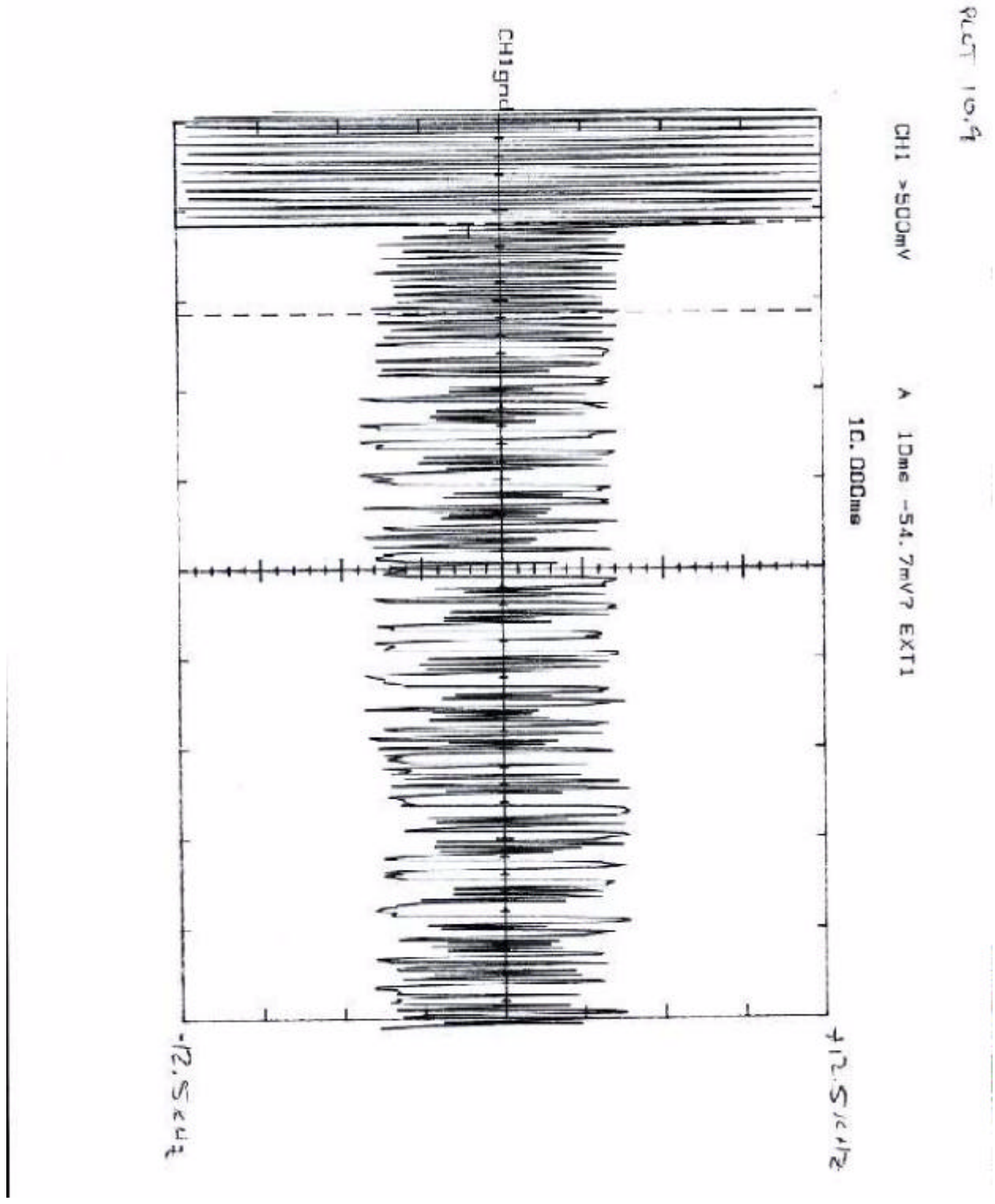

CH1 >500mV
A 10ms -54.7mV? EXT1
10.000ms

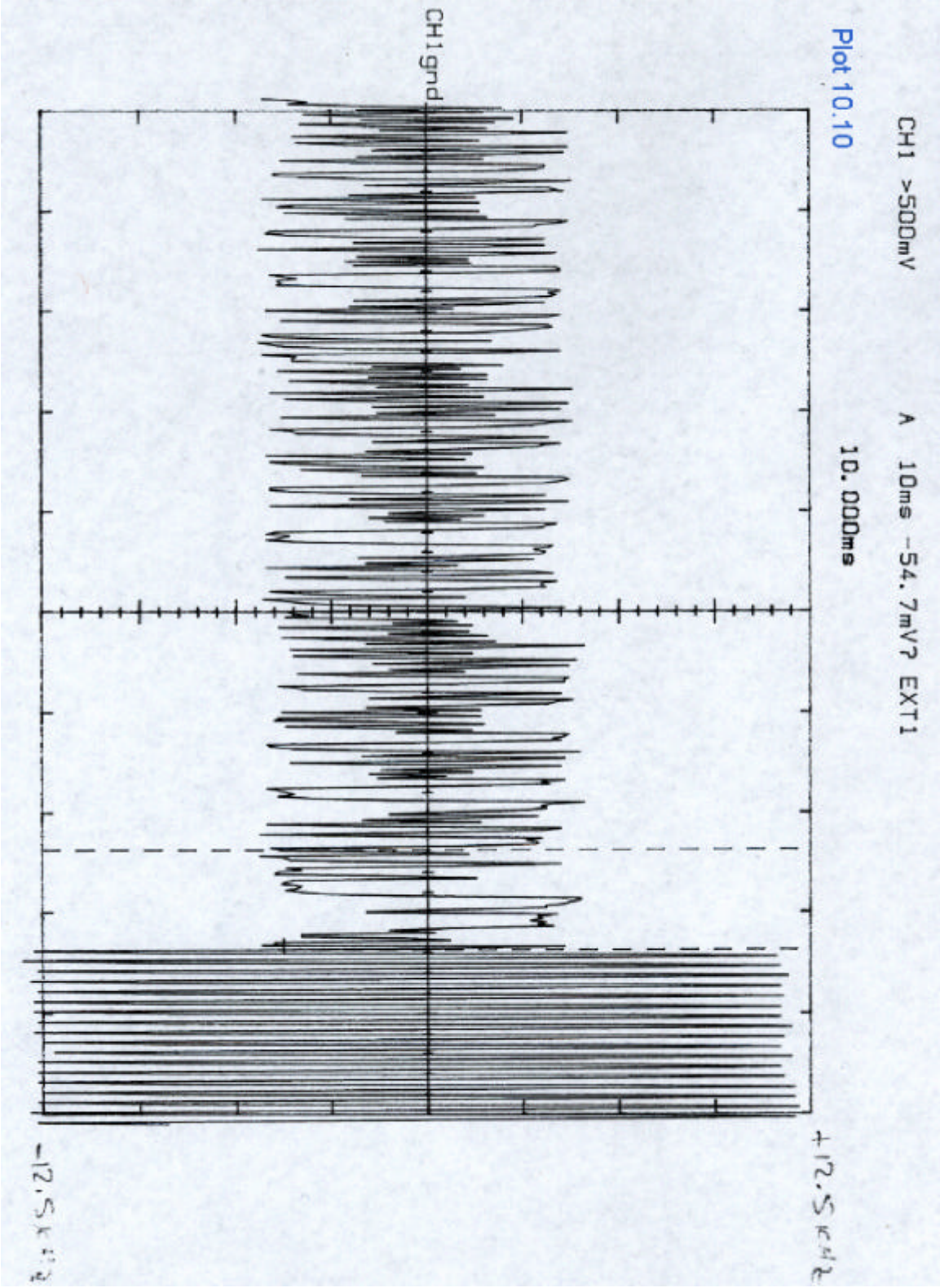

CH1 grid
CH1 >500mV
A 10ms -54.7mV? EXT1
10.000ms
-12.5mV?
-2.5mV?
Plot 10.5

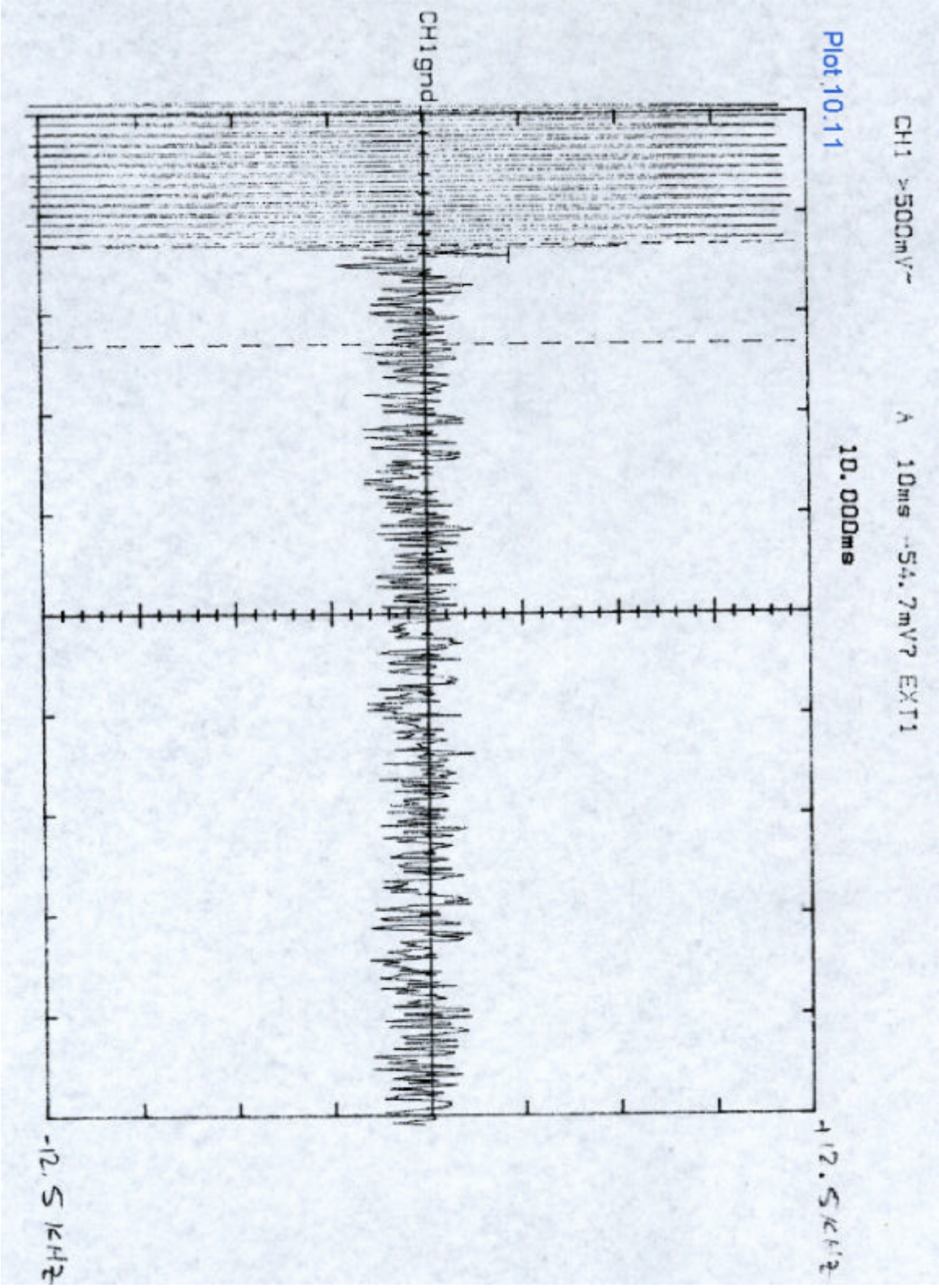

PLOT 10.6
CH1 >500mV
A 10ms -54.7mV? EXT1
9.9000ms
CH1 Pulse
+12.5 kHz
-12.5 kHz

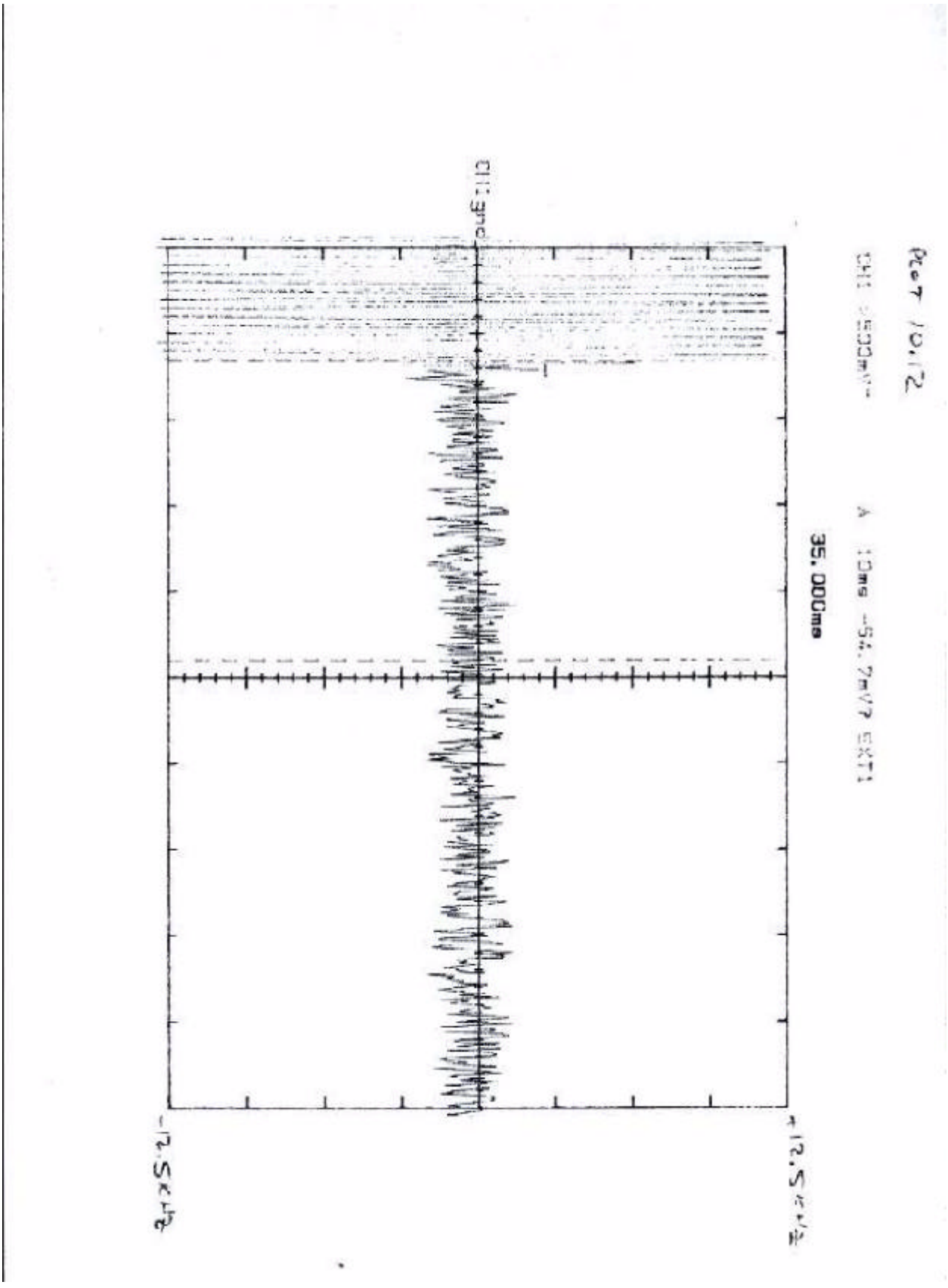

Plot 10.7
CH1 gnd
CH1 >500mV
A 10ms -54.7mV? EXT1
35.000ms
+12.5KHz
-12.5KHz

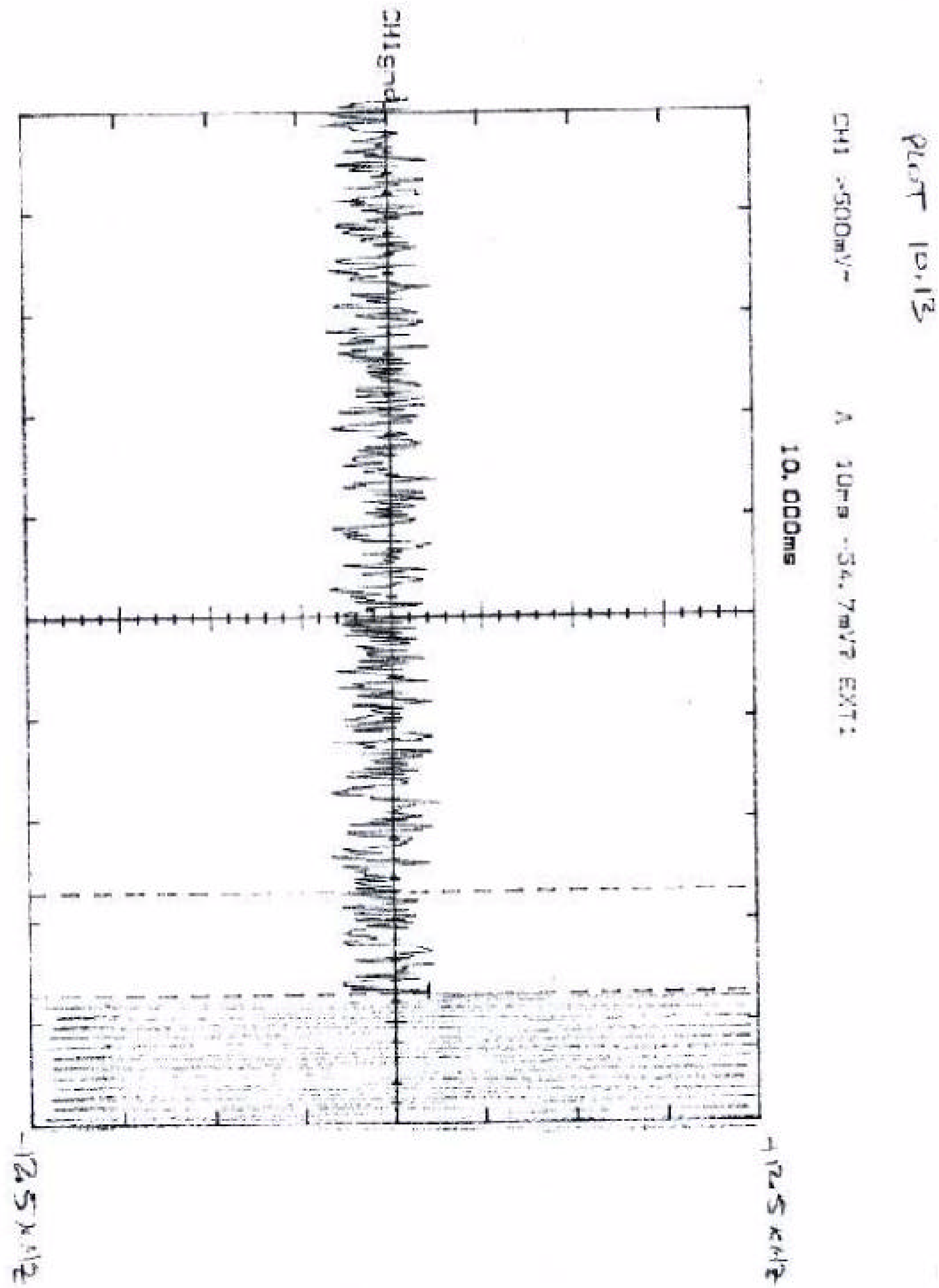

Plot 10.8
CH1 =500mV
10.000ms
CH1gnd
-12.5 kHz
+12.5 kHz


PLOT 10.4
CH1 >500mV
A 10ms -54.7mV? EXT1
10.000ms
CH1gnd
+12.5Vdc
-12.5Vdc

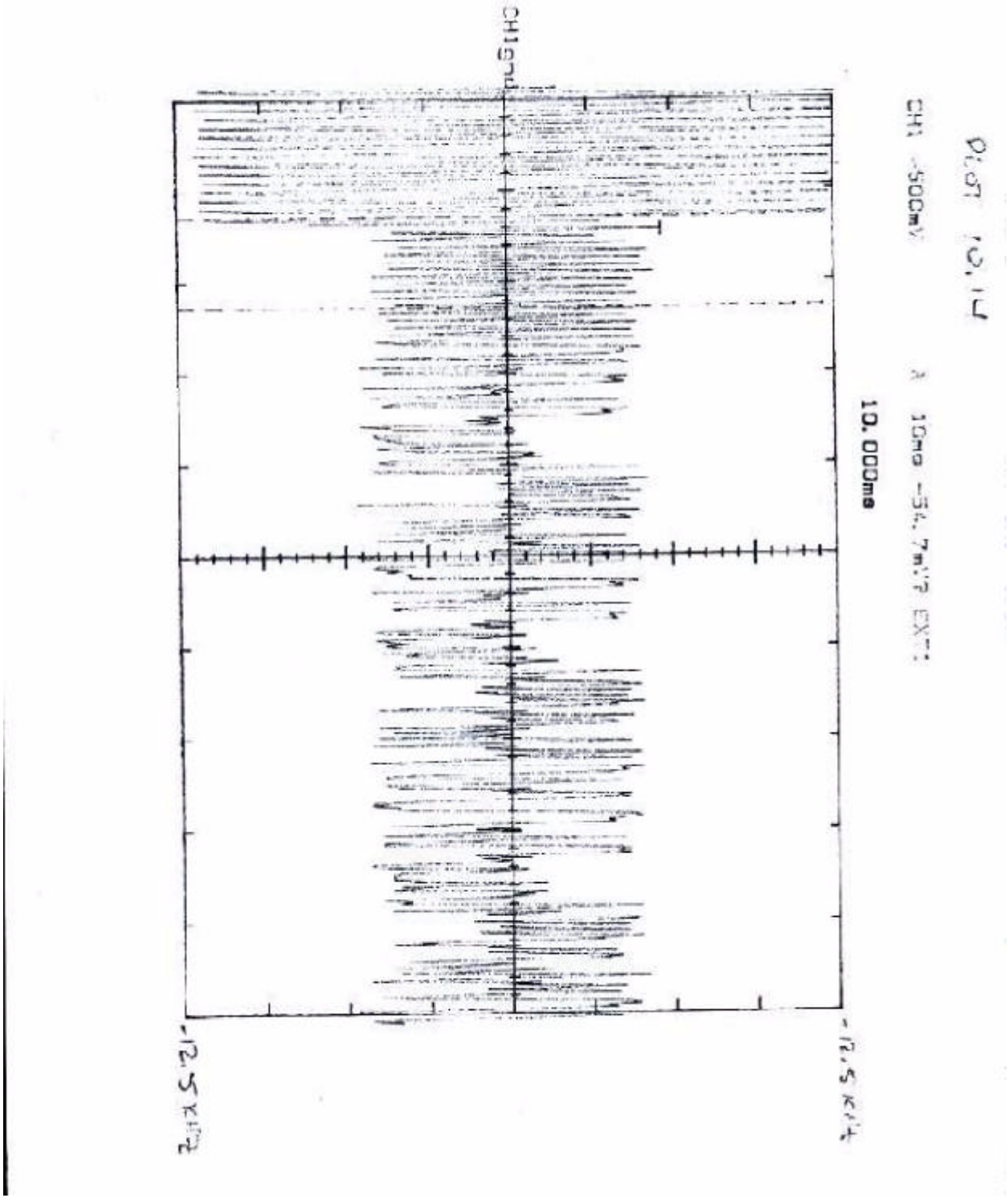

CH1grd
Plot 10.10
CH1 >500mV
A 10ms -54.7mV? EXT1
10.000ms
+12.5 KHz
-12.5 KHz

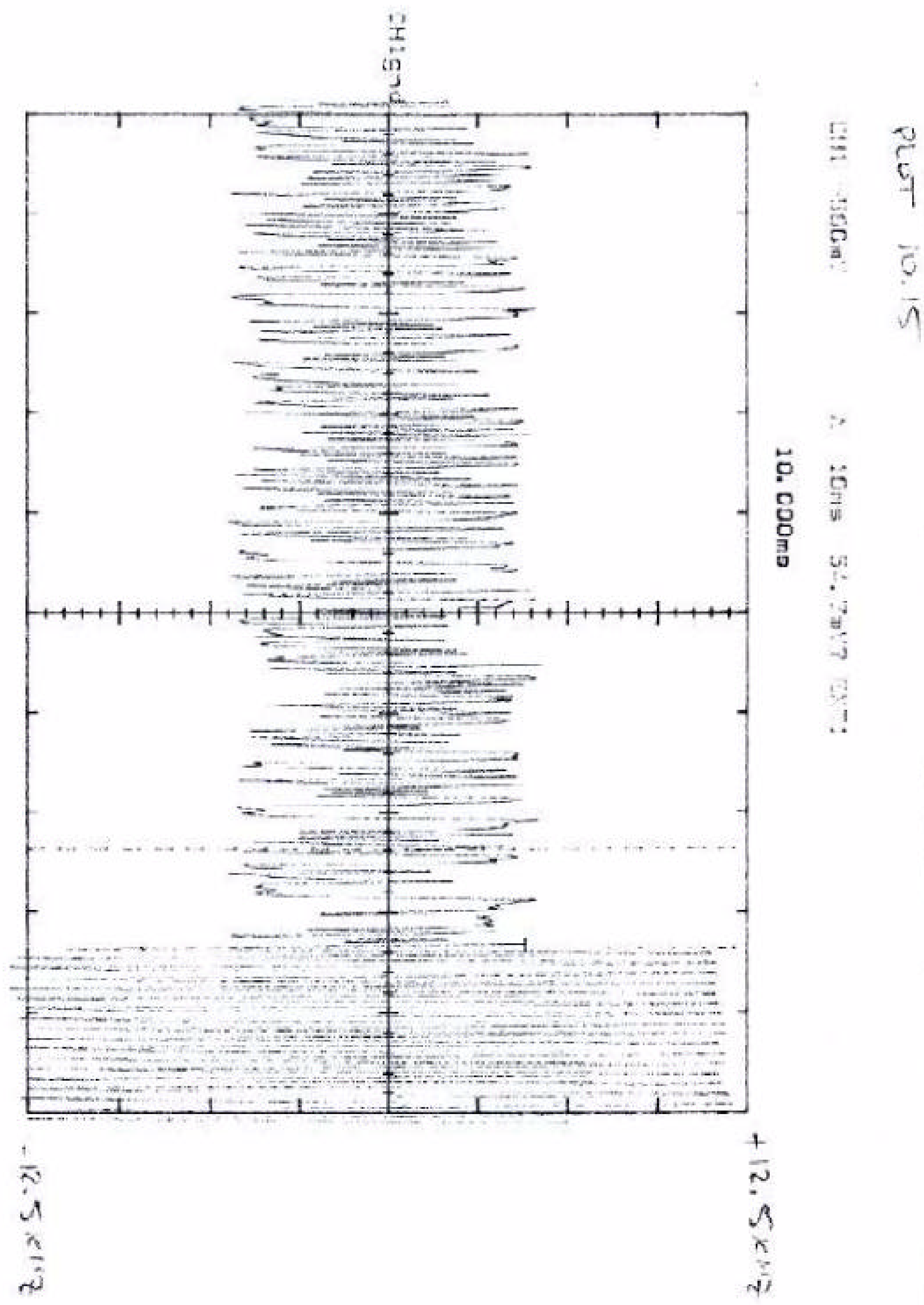

CH1 gnd
Plot 10.11
CH1 >500mV~
A 10ms -54.7mV? EXT1
10.000ms
-12.5 KHz
+12.5 KHz


Plot 10/12
35.000ms



PLOT 10.13
10.000ms
-12.5 kHz
+12.5 kHz


CH1 FCC
10.000ms



PLOT 10.15
10.000ms
-12.5KHz
+12.5KHz