



Intertek Testing Services

ETL SEMKO

FCC Part 90 & Part 24 Test Report

for

Advantra (UK) Limited

on the

4 Line Alphanumeric ReFlex Pager

Model: AR1800

FCC ID: XXXAR1800

Test Report #: 99030958A

Date of Report: May 23, 2000

Job #: J99030958

Date of Test: April 30, 2000

Total No. of Pages Contained in this Report: 14 + data pages



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FCC Part 90 Cert, Rev 9/99



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Warnock Hersey



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Advantra (UK) Limited, Model No. AR1800
FCC ID: XXXAR1800

Date of Test: April 30, 2000

1.0 Summary of Tests**FCC ID: XXXAR1800**
Model No.: AR1800

FCC RULE	DESCRIPTION OF TEST	RESULTS
2.1046	RF Power Output	Pass
90.205	Effective Radiated Power	Pass
2.1049, 90.209(b)(5), 90.210	Occupied Bandwidth, Bandwidth Limitation, Emission Masks	Pass
2.1051	Spurious Emissions at Antenna Terminals	Pass
2.1053, 15.109	Field Strength of Spurious Radiation	Pass
15.107	Line Conducted Emissions	Pass
2.1055	Frequency Stability vs. Temperature	Pass
2.1055	Frequency Stability vs. Voltage	Pass
2.914	Transient Frequency Behavior	N/A

Test Engineer:

Xi-Ming Yang
Xi-Ming Yang

Date:

5-30-2000

EMC Site Manager:

David Chernomordik
David Chernomordik, Ph.D.
EMC Site Manager

Date:

5/30/00

Advantra (UK) Limited, Model No. AR1800
FCC ID: XXXAR1800

Date of Test: April 30, 2000

2.0 General Description**2.1 Product Description**

The Advantra Model AR1800 is an easy to use 4 line alphanumeric ReFlex pager that uses a standard 1.5 volt alkalineAA high capacity battery

A production version of the sample was received on April 30, 2000 in good condition.

Overview of 4 Line Alphanumeric ReFlex Pager

Applicant	Advantra (UK) Limited
Trade Name & Model No.	Advantra, AR1800
FCC Identifier	XXXAR1800
Use of Product	Digital Data Communication (Two-Way Pager)
Type of Transmission	4 Level FSK
Bit Rate	RX – 6400, tx – 9600
Maximum Deviation	± 2.4 kHz
Range of RF Output	1 watt nominal into antenna, 100 mW EIRP, 8 position average
The dc voltage applied to and current into the several elements of the final RF amplifying device	Voltage: 2.5V Current: 0.4A
Frequency Range	896 – 902 MHz
Antenna(e) & Gain	-10 dBi
Detachable Antenna?	☐ Yes ☒ No
Receiver L.O. Frequency	884 – 897 MHz
External Input	☐ Audio ☒ Digital Data

2.2 Related Submittal(s) Grants

None.

2.3 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.

Advantra (UK) Limited, Model No. AR1800
FCC ID: XXXAR1800

Date of Test: April 30, 2000

3.0 RF Power Output, FCC § 2.985(a)**3.1 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 3 MHz and 30 kHz respectively. The attenuator was included in spectrum analyzer OFFSET function.

Transmitter output was read off the spectrum analyzer in dBm.

3.2 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

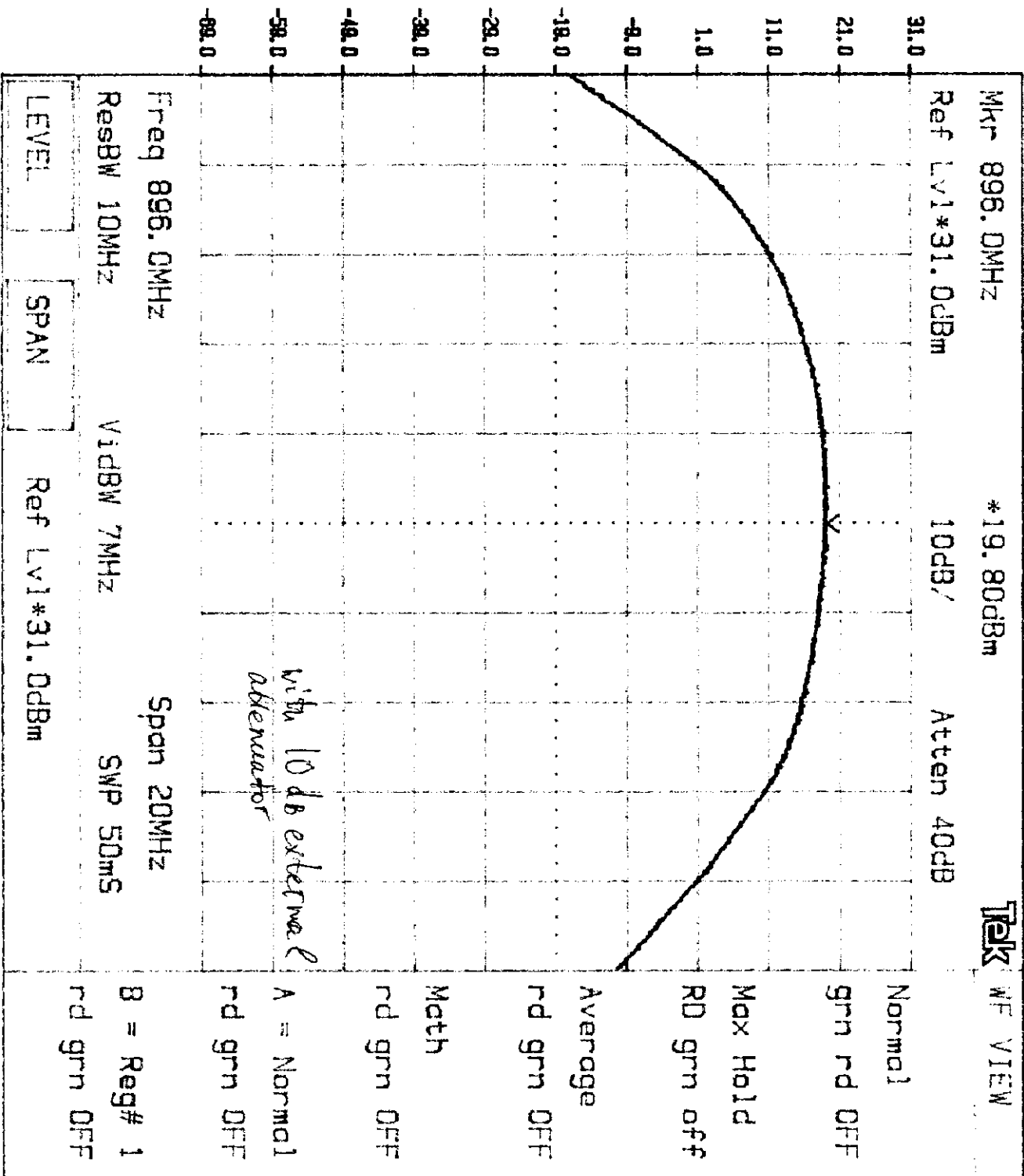
3.3 Test Results

Refer to the attached plots.

Plot Number	Power, dBm	Description
3-1	29.8	Low Channel - 896 MHz
3-2	30.0	Middle Channel - 898.5 MHz
3-3	29.9	High Channel - 902 MHz

Results: Passed

Plot 3-1



KN0B 2

KN0B 1

KEYPAD

Takttronix

2784

Plot 3-2

HP

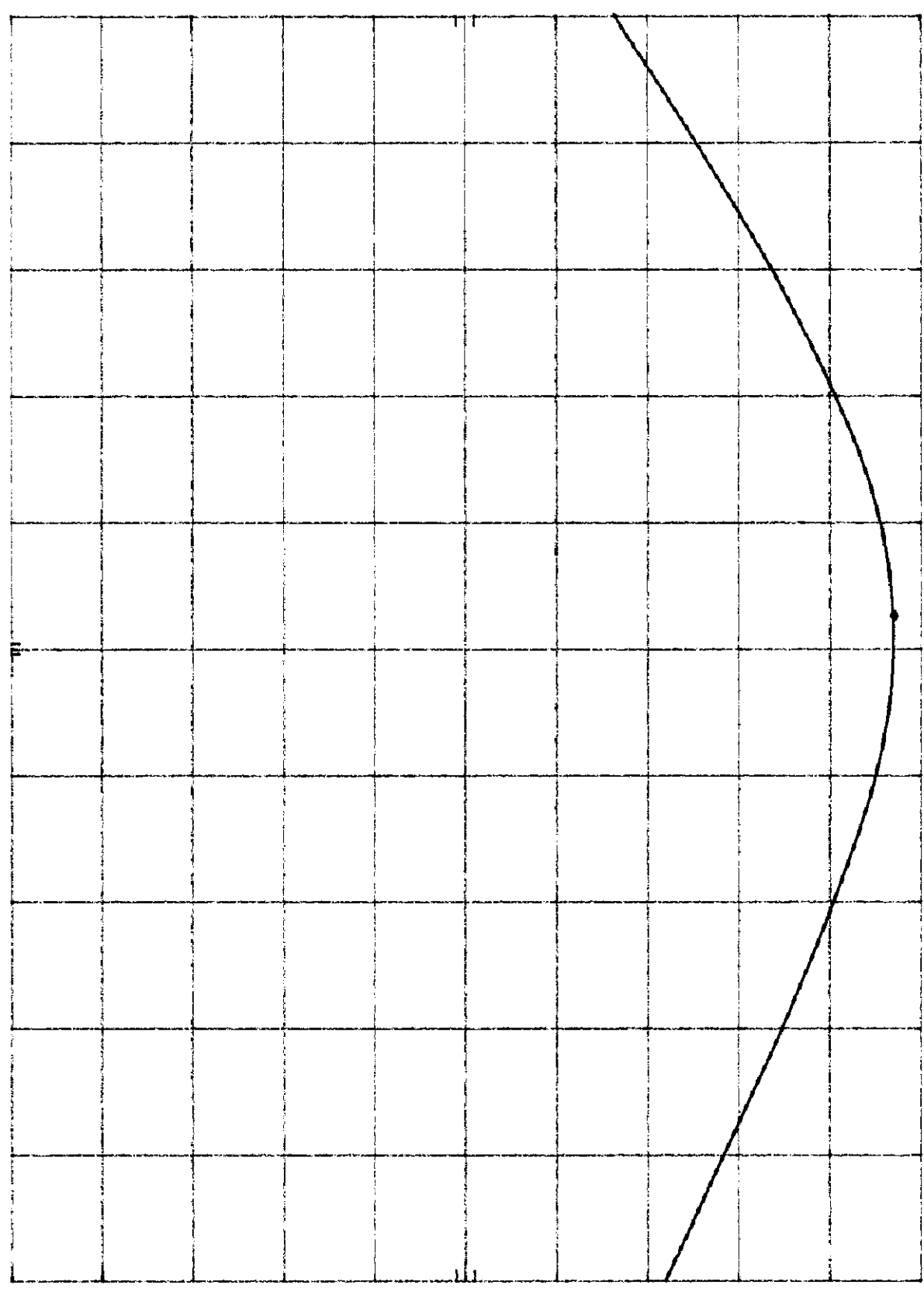
REF 33.0 dBm

ATTEN 30 dB

MKR 898.23 MHz
30.00 dBm

10 dB/

OFFSET
13.0
dB



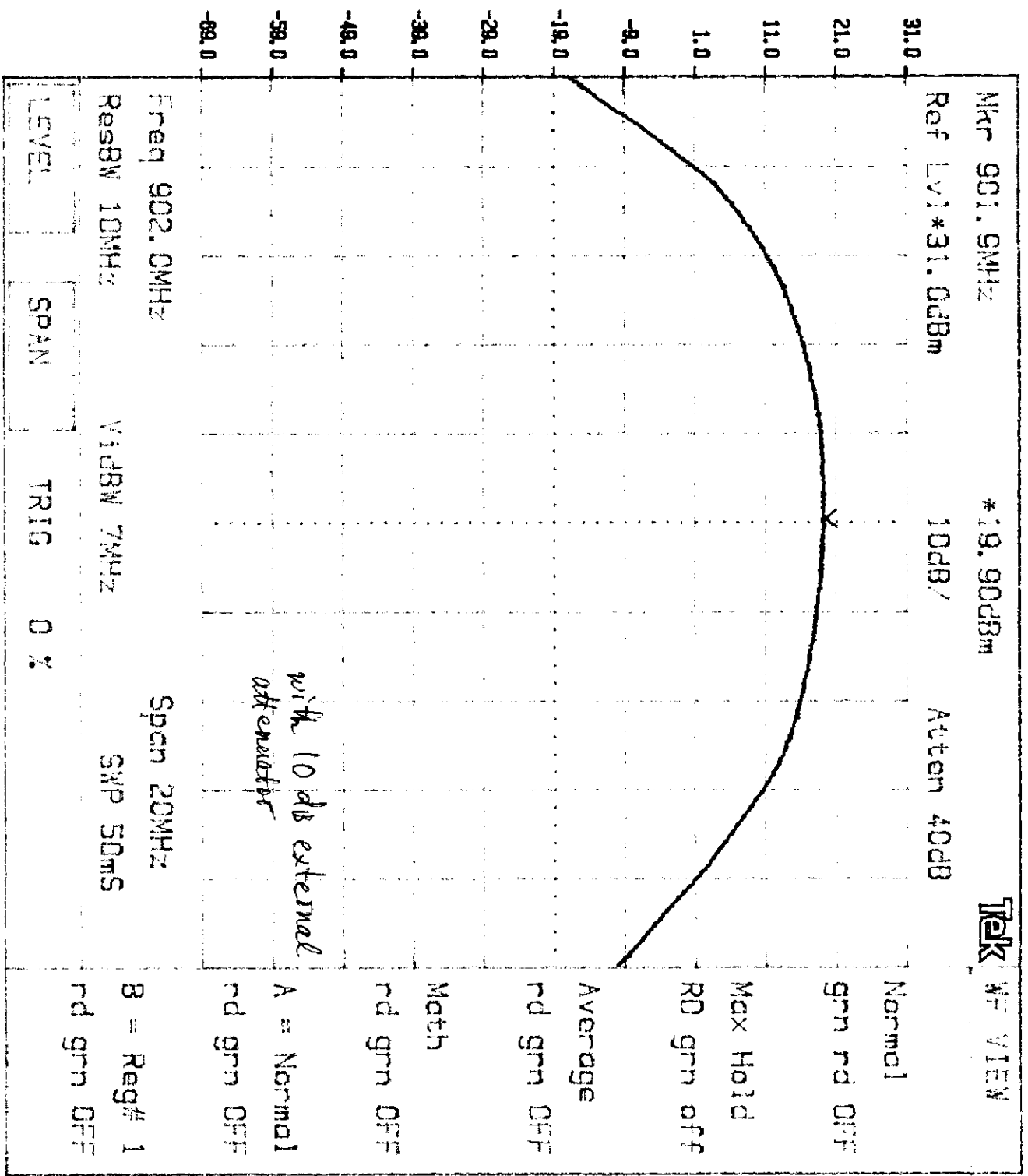
CENTER 898.5 MHz

RES BW 3 MHz

VBW 3 MHz

SPAN 10.0 MHz
SWP 2.00 sec

Plot 3-3



Knob 2 Knob 1 Keypad Tektronix 2784

Advantra (UK) Limited, Model No. AR1800
FCC ID: XXXAR1800

Date of Test: April 30, 2000

4.0 Occupied Bandwidth, Bandwidth Limitation, Emission Masks
FCC §2.989(I), 90.209(B)(5), 90.210, 24.133(a)(2)**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 was recorded. This spectrum was compared to the required emission mask.

The emission designator was defined as 13K6F1D, where 13.6 kHz is the Authorized Bandwidth.

4.2 Test Equipment

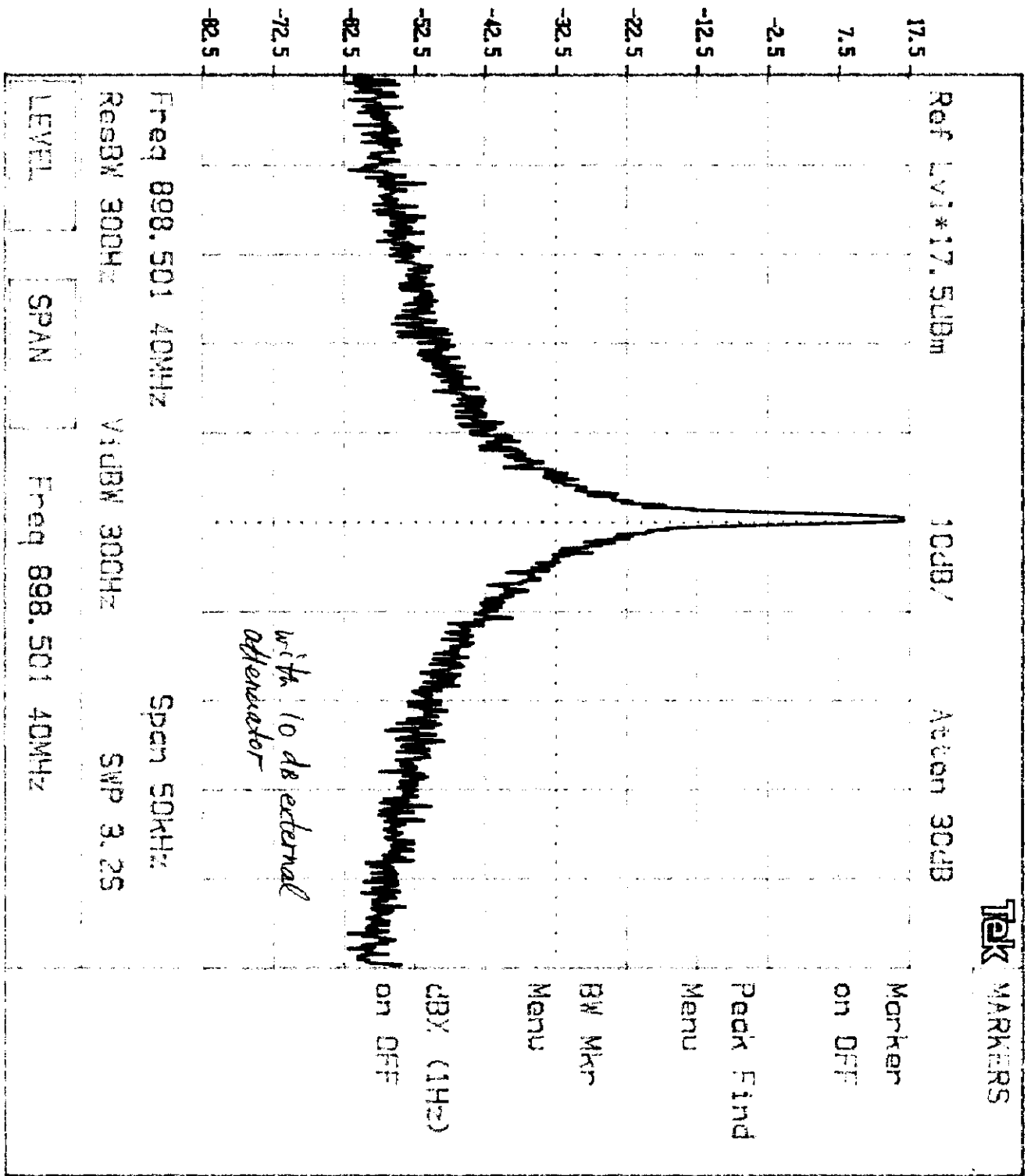
Hewlett Packard 8481A Power Sensor, 435B Power Meter
Hewlett Packard HP8566B Spectrum Analyzer, 100 Hz - 22 GHz
Tektronix 2782 Spectrum Analyzer, 100 Hz - 40 GHz

4.3 Test Results

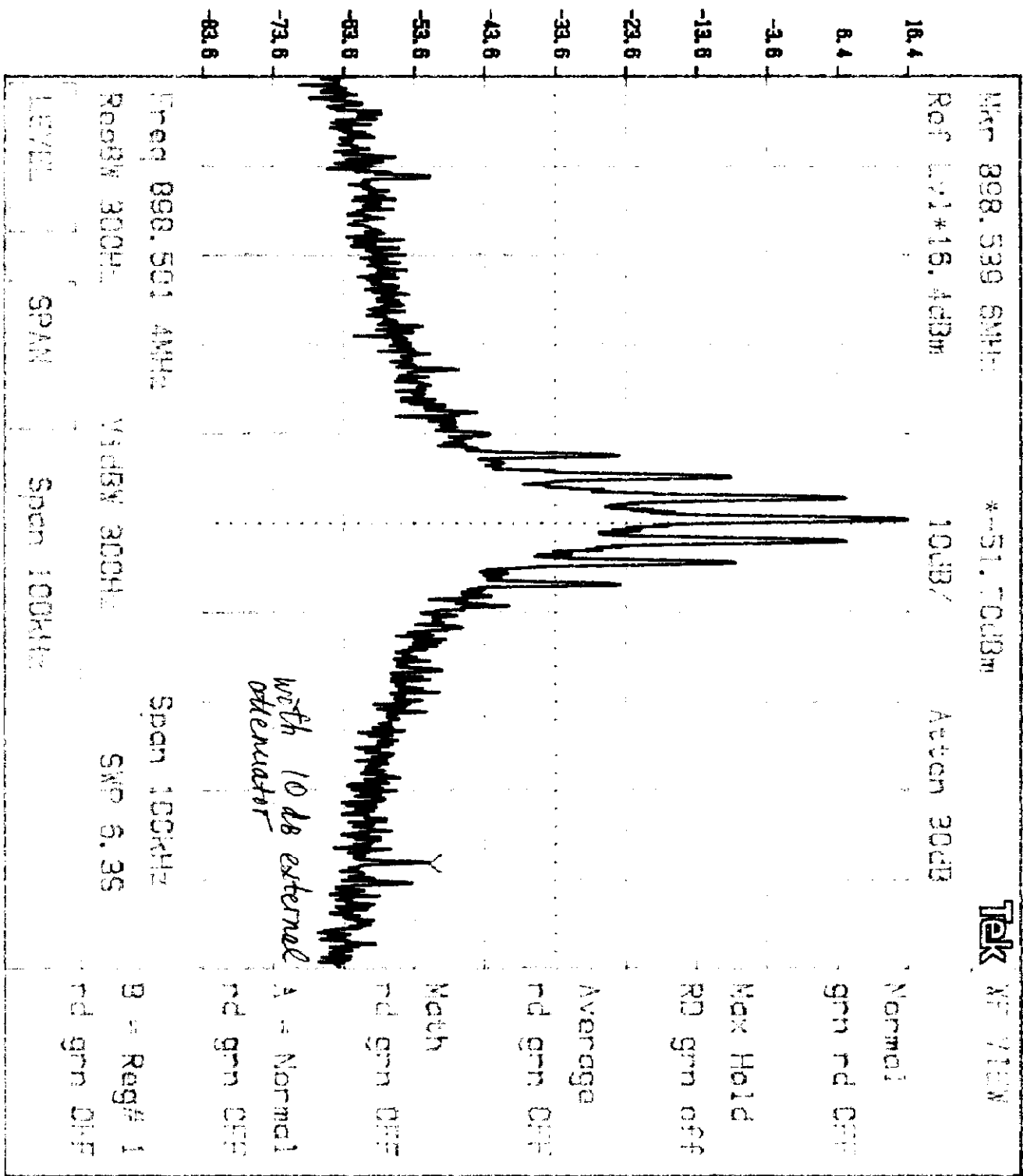
Plot Number	Description
4-1-1	898 MHz, Unmodulated
4-1-2	898 MHz, Modulated 50 kHz Span
4-1-3	898 MHz, Modulated 100 kHz Span
4-1-4	898 MHz, Modulated 200 kHz Span
4-1-5	898 MHz, Modulated 1 MHz Span
4-2-1	902 MHz, Unmodulated
4-2-2	902 MHz, Modulated 50 kHz Span
4-2-3	902 MHz, Modulated 100 kHz Span
4-2-4	902 MHz, Modulated 200 kHz Span
4-2-5	902 MHz, Modulated 1 MHz Span

Results: Passed

Plot 4-1-1

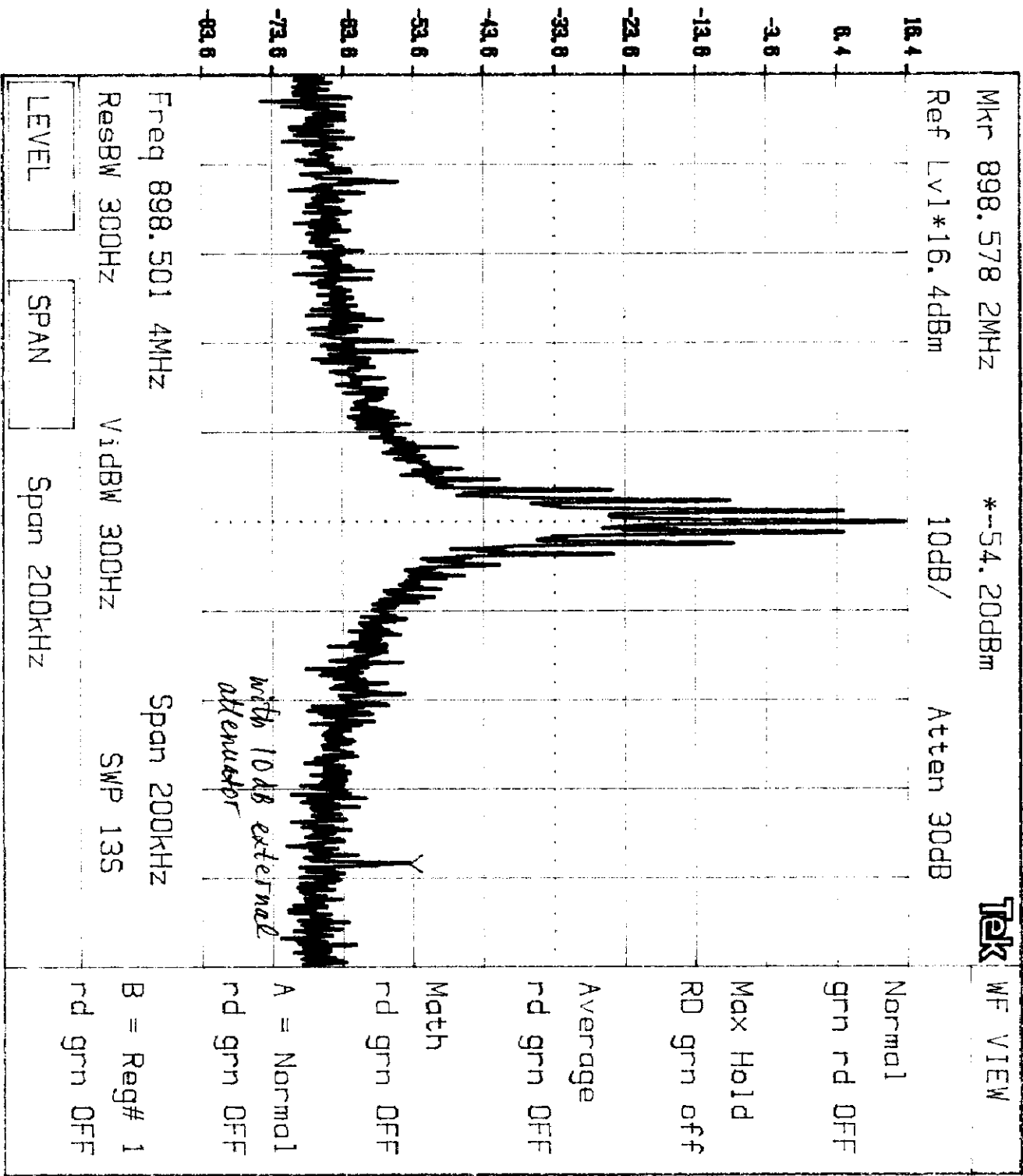


Plot 4-1-3

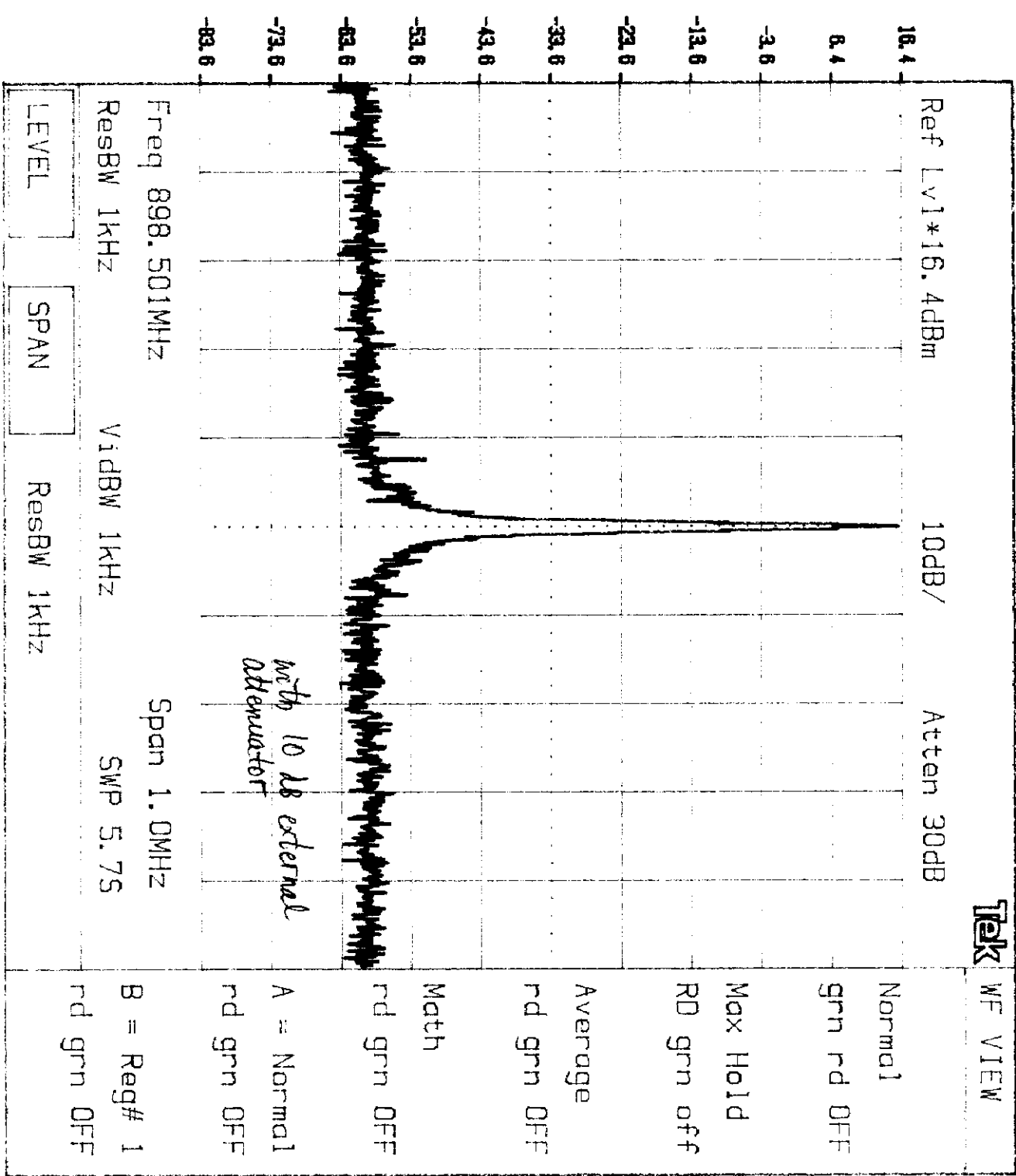


KN08 2 KN08 1 KEYPAD Tektronix 2784

Plot 4-1-4



Plot 4-1-5

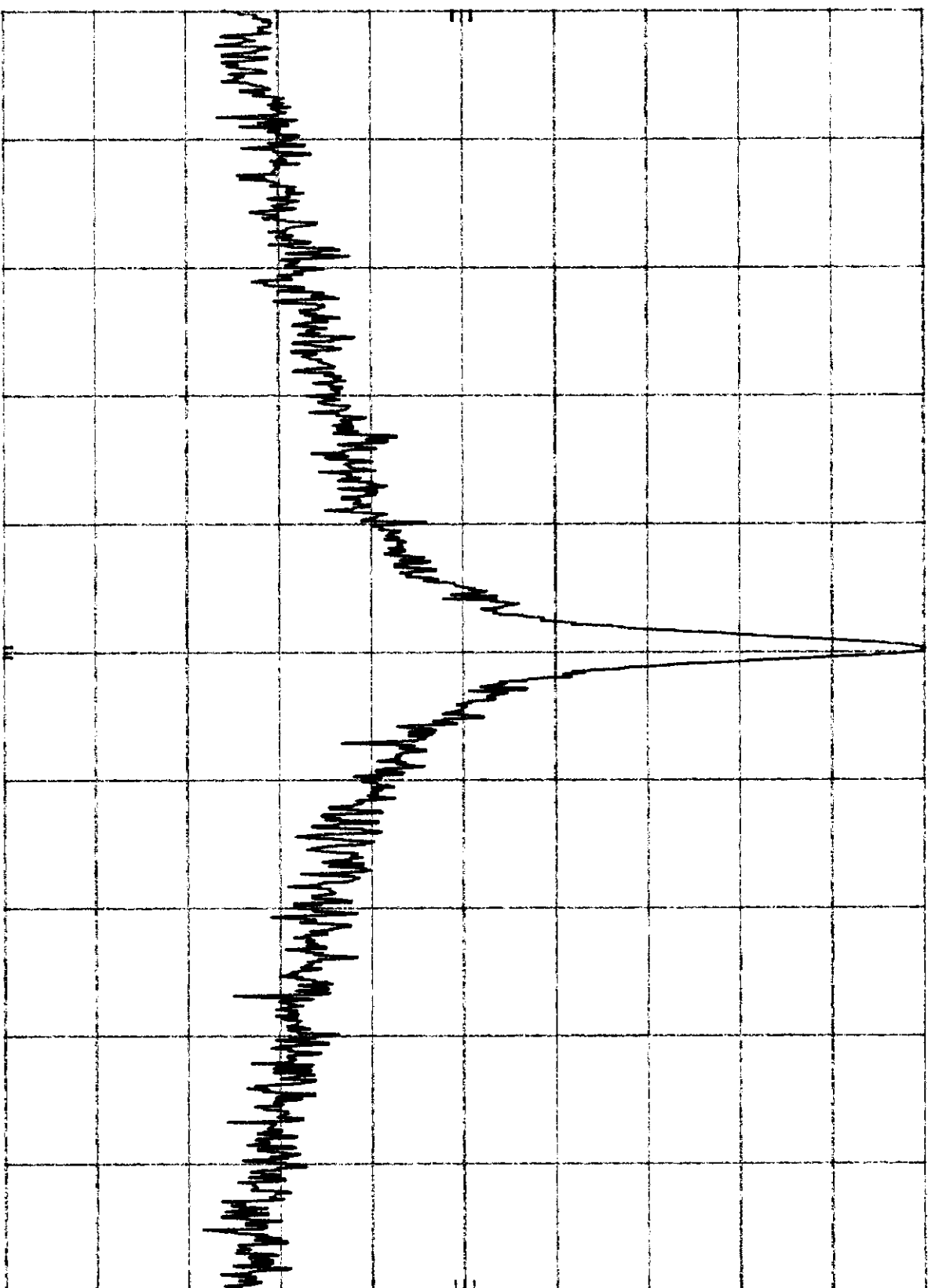


Plot 4-2-1

HP REF 30.0 dBm ATTN 30 dB

10 dB/

OFFSET
13.0
dB



CENTER 902.000 0 MHz

RES BW 300 Hz

VBW 300 Hz

SPAN 50.0 kHz
SWP 1.50 sec

Plot 4-2-2

HP

REF 30.0 dBm

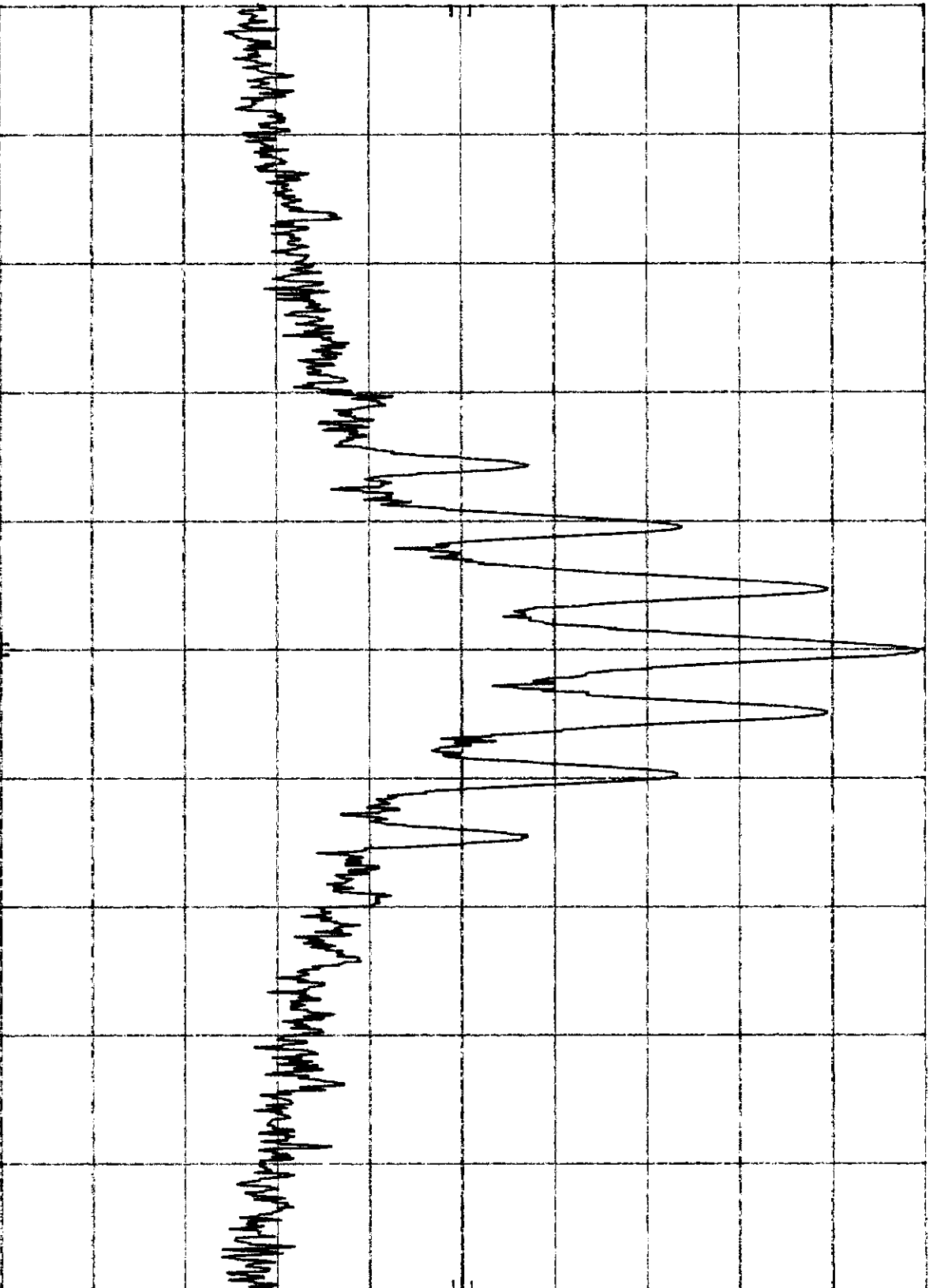
ATTEN 30 dB

10 dB/

OFFSET

13.0

dB



CENTER 902.000 0 MHz

RES BW 300 Hz

VBW 300 Hz

SPAN 50.0 kHz
SWP 1.50 sec

Plot 4-2-3

HP

REF 30.0 dBm

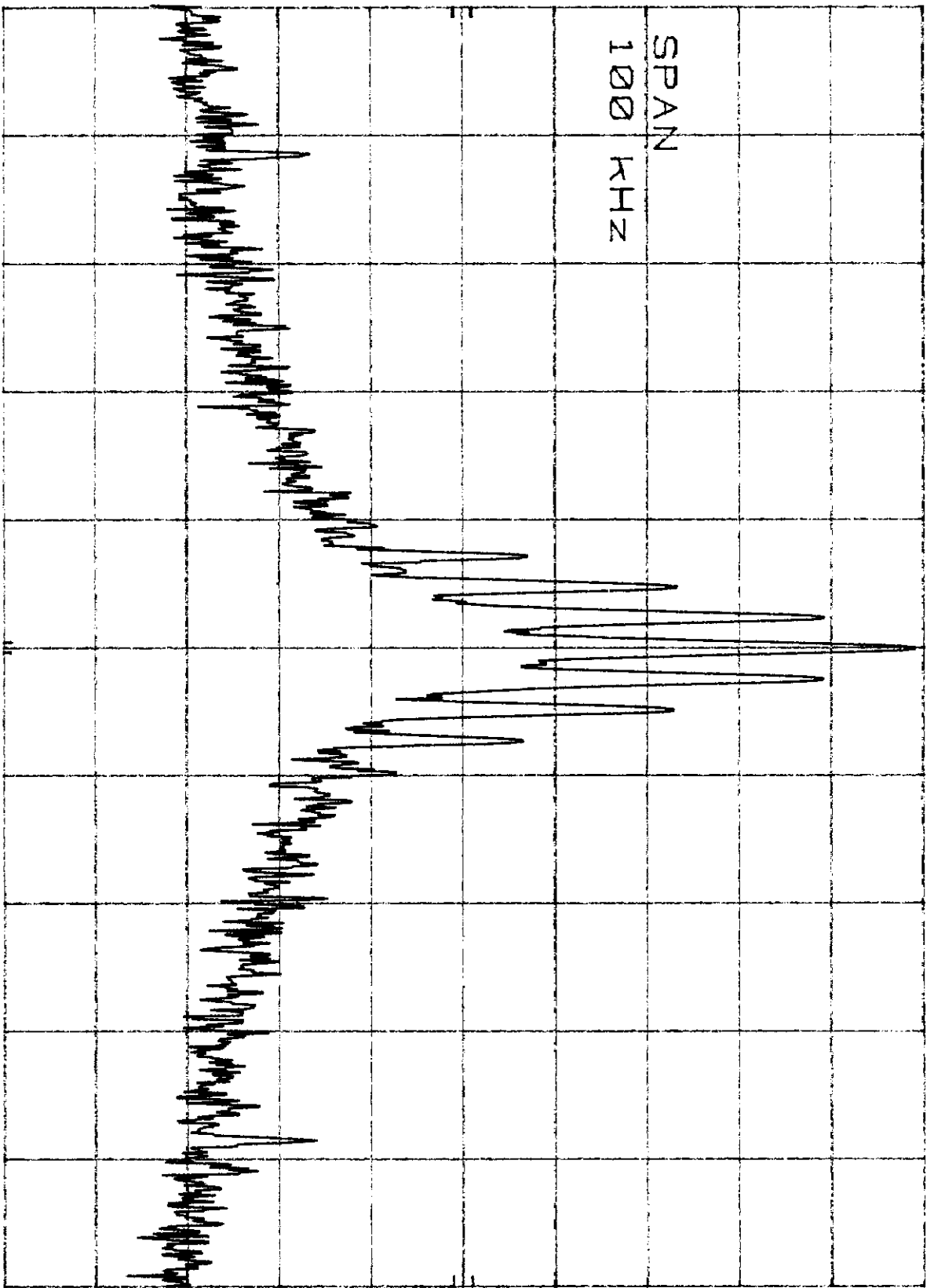
ATTEN 30 dB

10 dB/

OFFSET
13.0

dB

SPAN
100 KHz



CENTER 902.000 MHz
RES BW 300 Hz

VBW 300 Hz

SPAN 100 KHz
SWP 3.00 sec

Plot 4-2-4

h_p

REF 30.0 dBm

ATTEN 30 dB

10 dB/

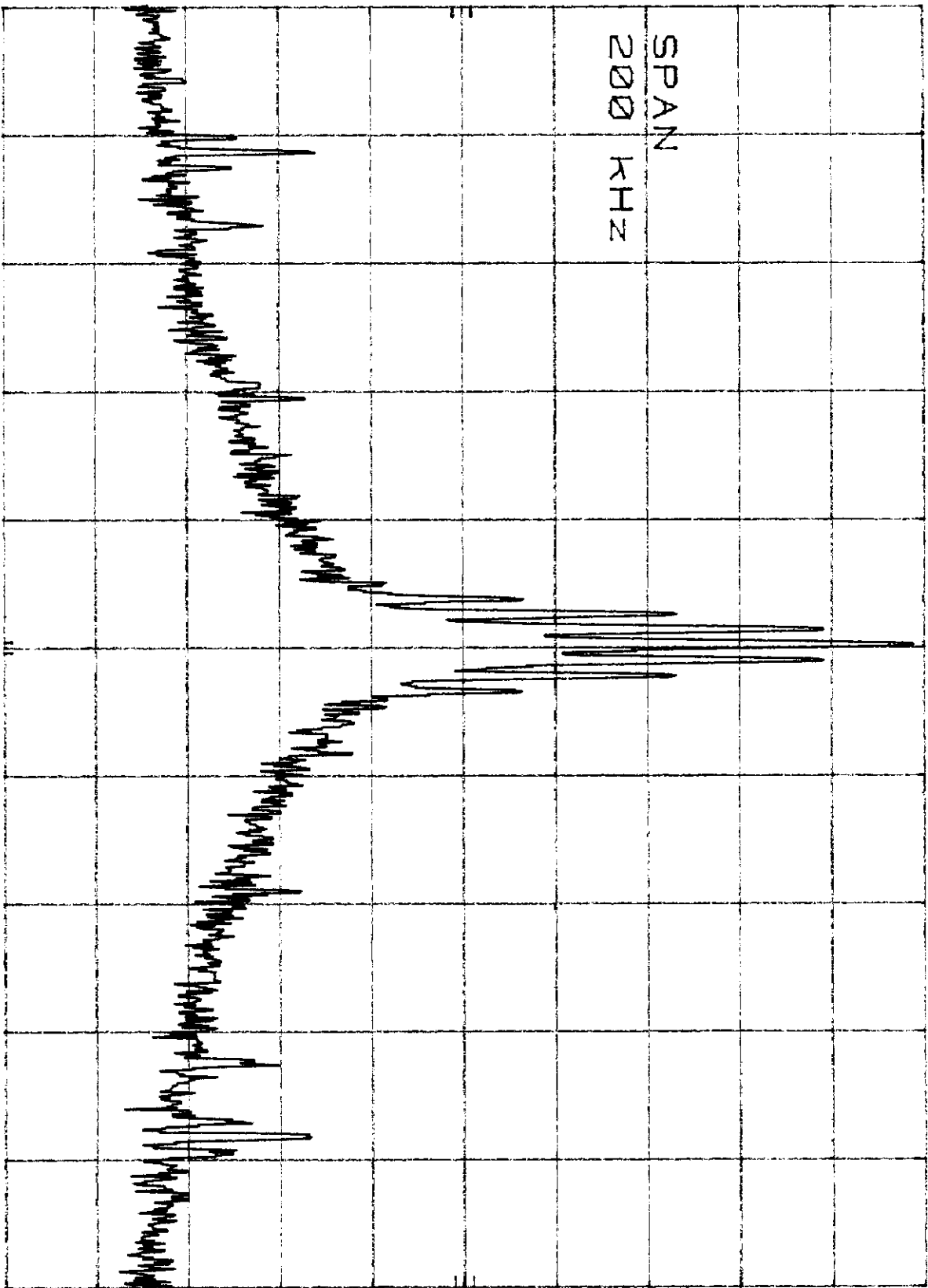
OFFSET

13.0

dB

SPAN

200 KHz



CENTER 902.000 MHz

RES BW 300

Hz

VBW 300

Hz

SWP 6.00

sec

SPAN 200 KHz

Plot 4-2-5

HP

REF 30.0 dBm

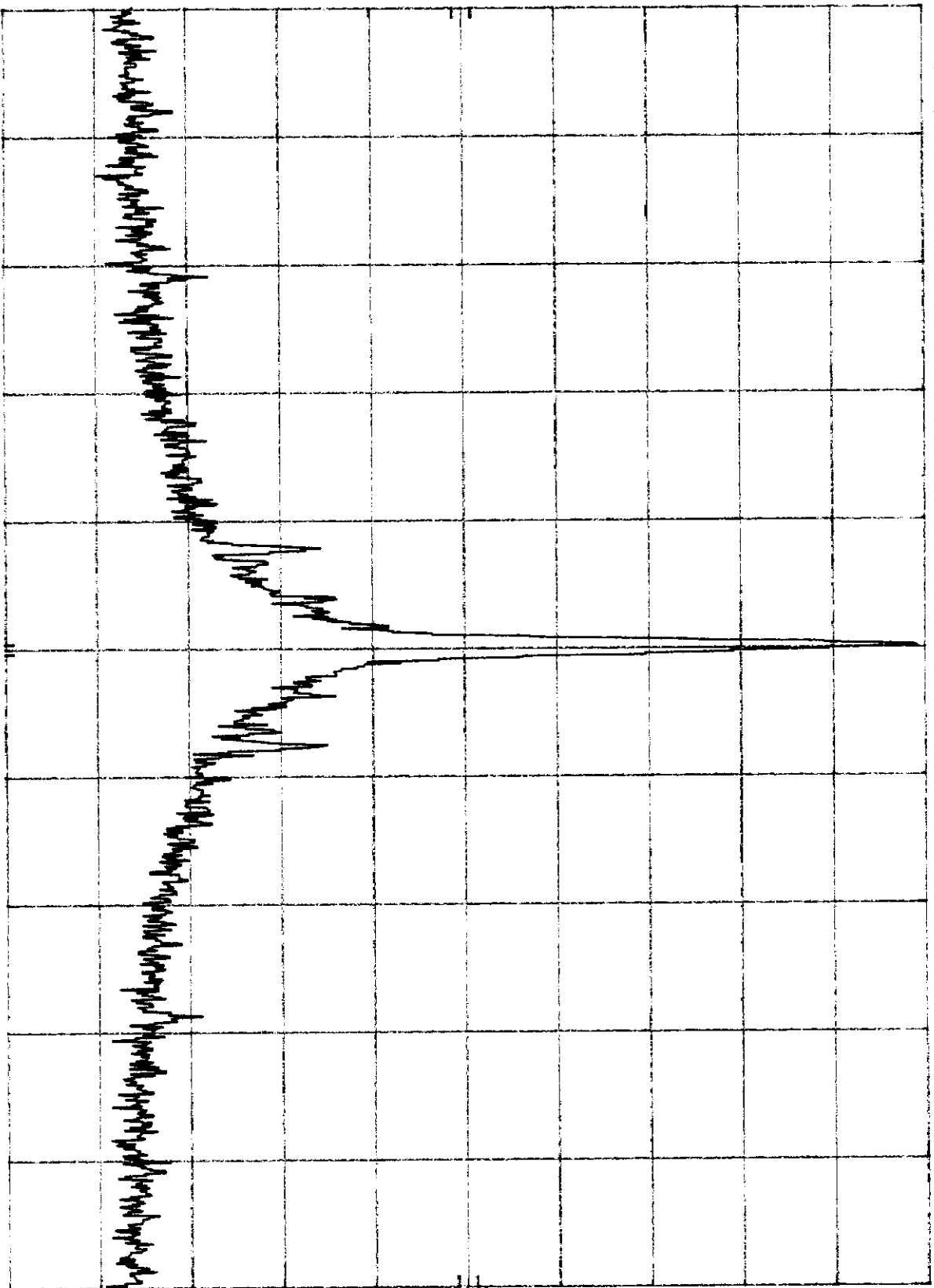
ATTEN 30 DB

10 dB/

OFFSET

13.0

dB



CENTER 902.00 MHz

RES BW 1 KHz

VBW 1 KHz

SPAN 1.00 MHz
SWP 3.00 sec

Advantra (UK) Limited, Model No. AR1800
FCC ID: XXXAR1800

Date of Test: April 30, 2000

5.0 Out of Band Emissions at Antenna Terminals, FCC §2.991

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 $43 + 10 \log P$ dB.

5.1 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. 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

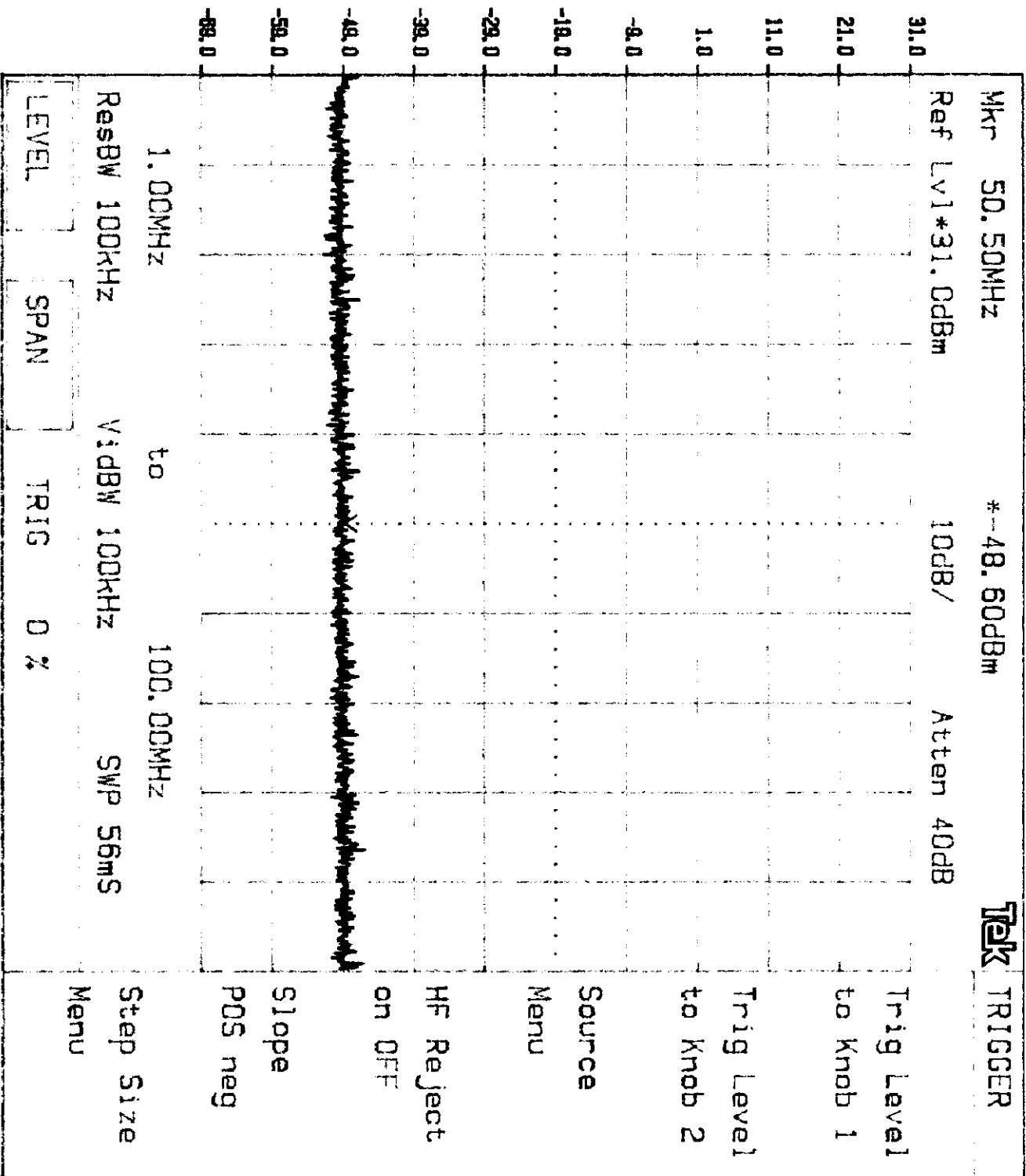
5.3 Test Results

Refer to the attached plots.

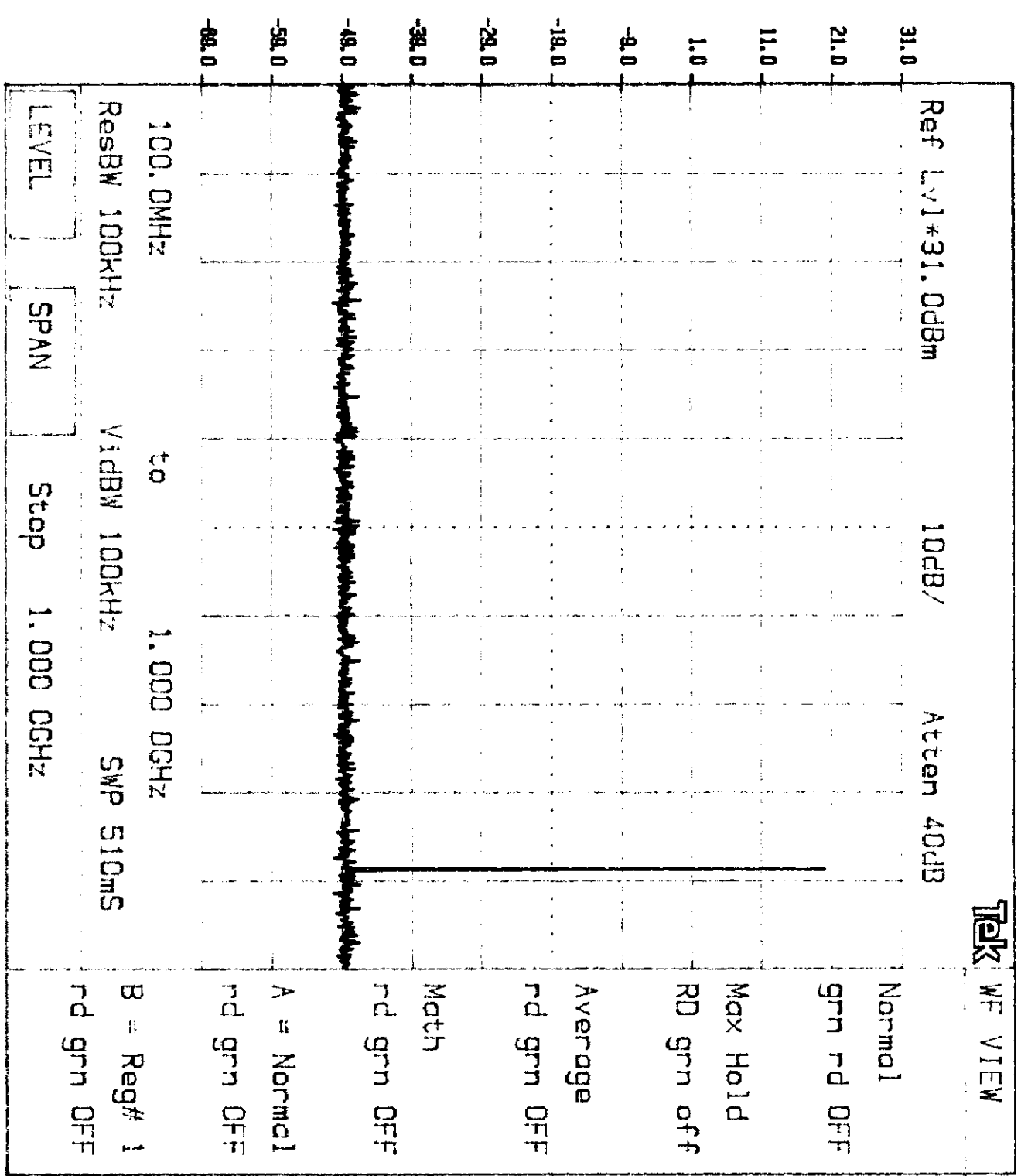
Plot Number	Description
5-1-1	Channel 896 MHz, 1 – 100 MHz
5-1-2	Channel 896 MHz , 100 – 1000 MHz
5-1-3	Channel 896 MHz, 1 – 10 GHz
5-2-1	Channel 898.5 MHz, 11 – 100 MHz
5-2-2	Channel 898.5 MHz , 1000 – 2500 MHz
5-2-3	Channel 898.5 MHz , 2.5 – 10 GHz
5-3-1	Channel 902 MHz , 1 – 100 MHz
5-3-2	Channel 902 MHz, 100 – 1000 MHz
5-3-3	Channel 902 MHz, 1 – 10 GHz

Results: Passed

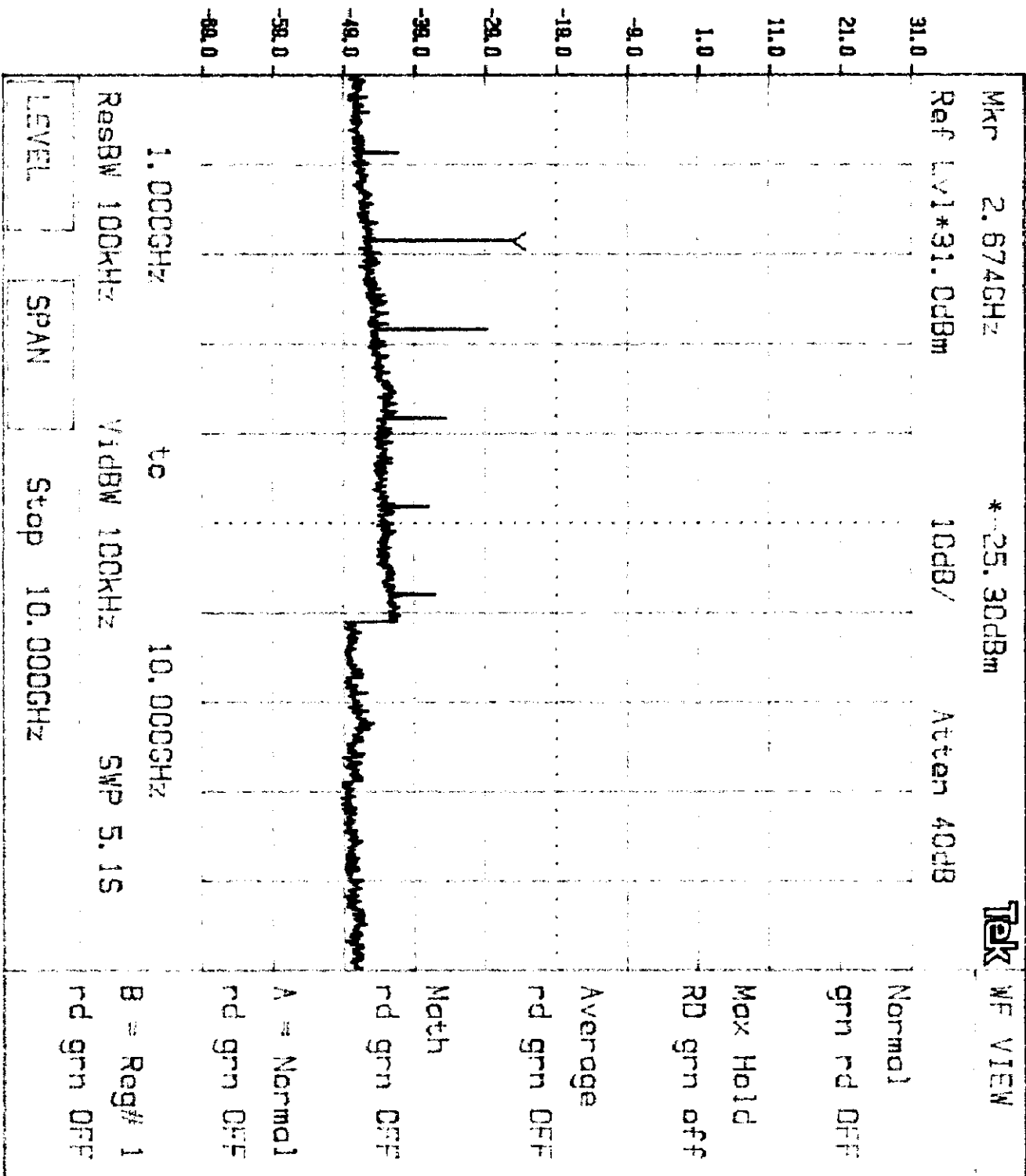
Plot 5-1-1



Plot 5-1-2



Plot 5-1-3



Plot 5-2-1

HP

REF 33.0 dBm

ATTEN 30 dB

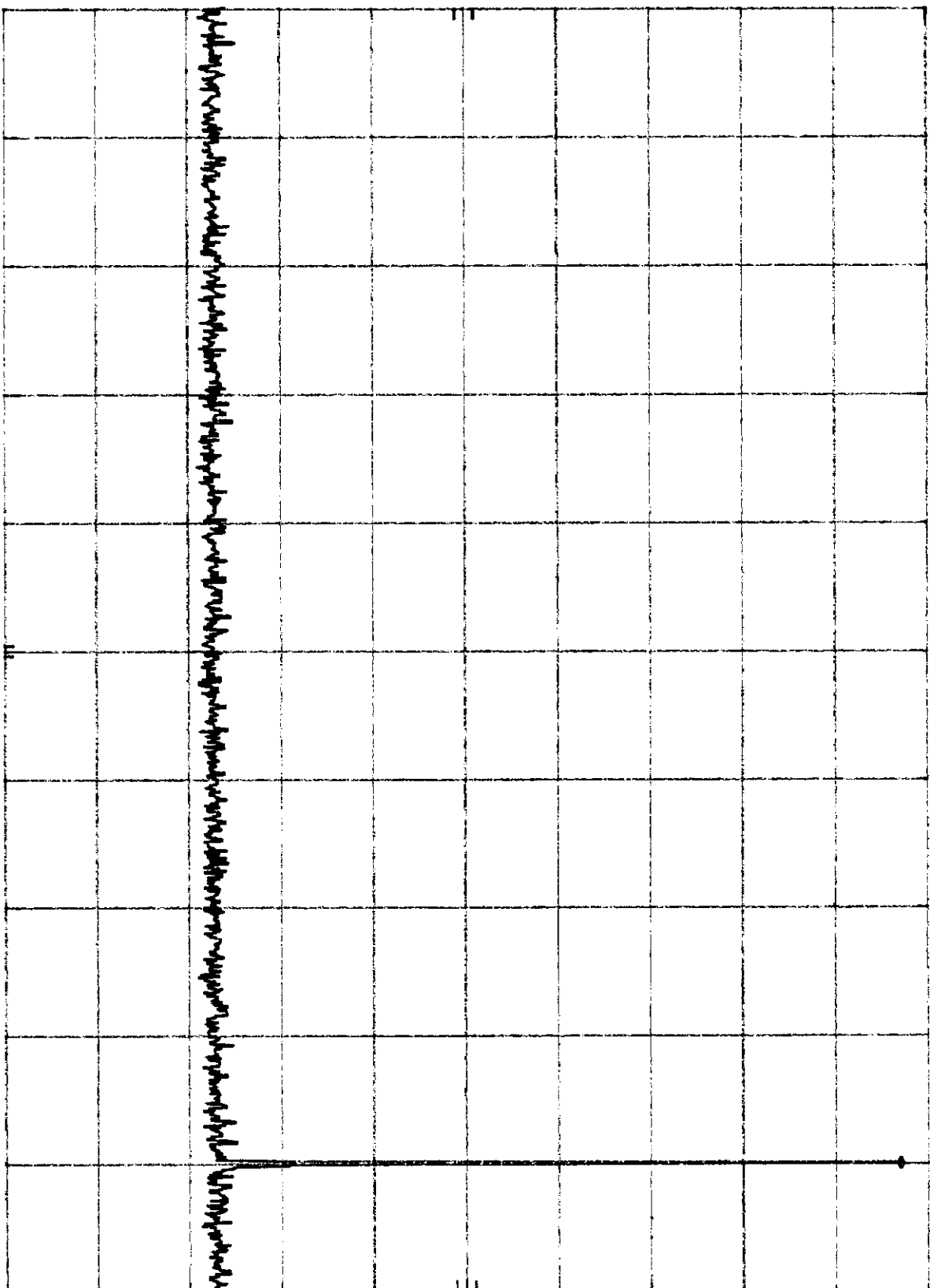
MKR 900.1 MHz
30.00 dBm

10 dB/

OFFSET

13.0

dB



START 11 MHz

RES BW 100 KHz

VBW 100 KHz

STOP 1.000 GHz
SWP 297 msec

Plot 5-2-2

10

REF 33.0 dBm

ATTEN 30 dB

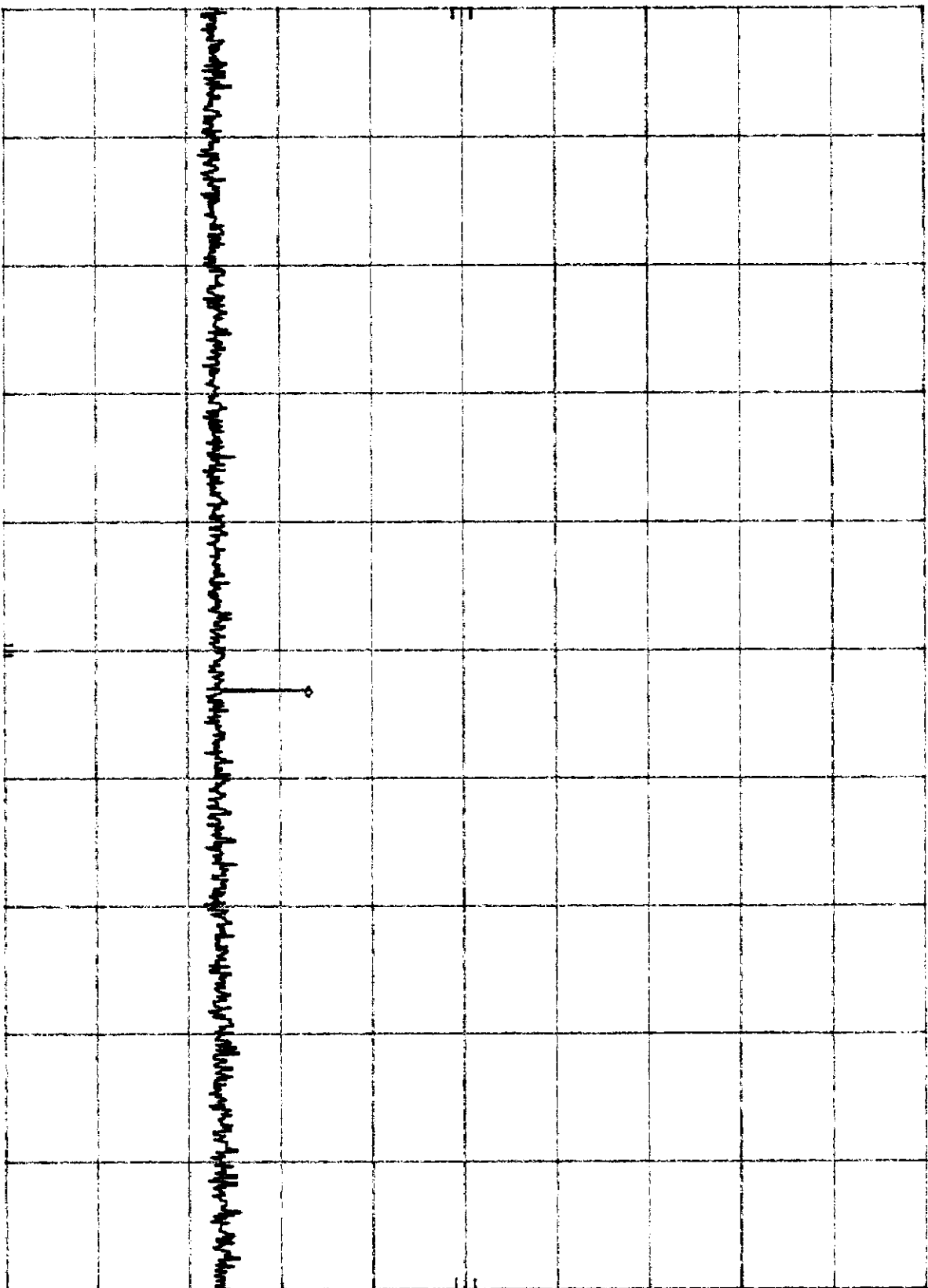
MKR 1.798 GHz
-33.90 dBm

10 dB/

OFFSET

13.0

dB



START 1.00 GHz

RES BW 100 KHz

VBW 100 KHz

STOP 2.50 GHz
SWP 450 msec

Plot 5-2-3

MKR 3.595 GHz

-22.30 dBm

HP

REF 33.0 dBm

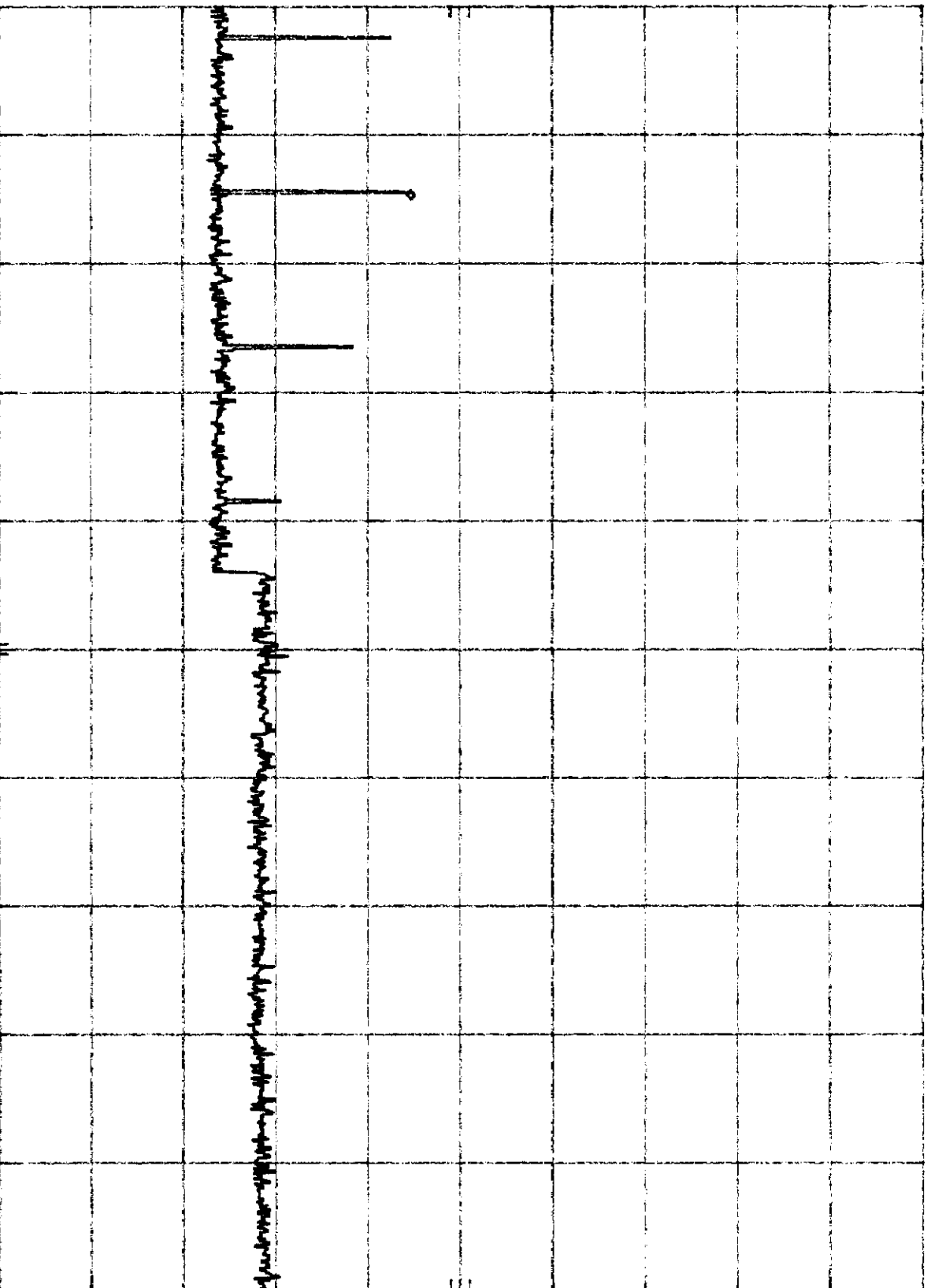
ATTEN 30 dB

10 dB/

OFFSET

13.0

dB



START 2.50 GHz

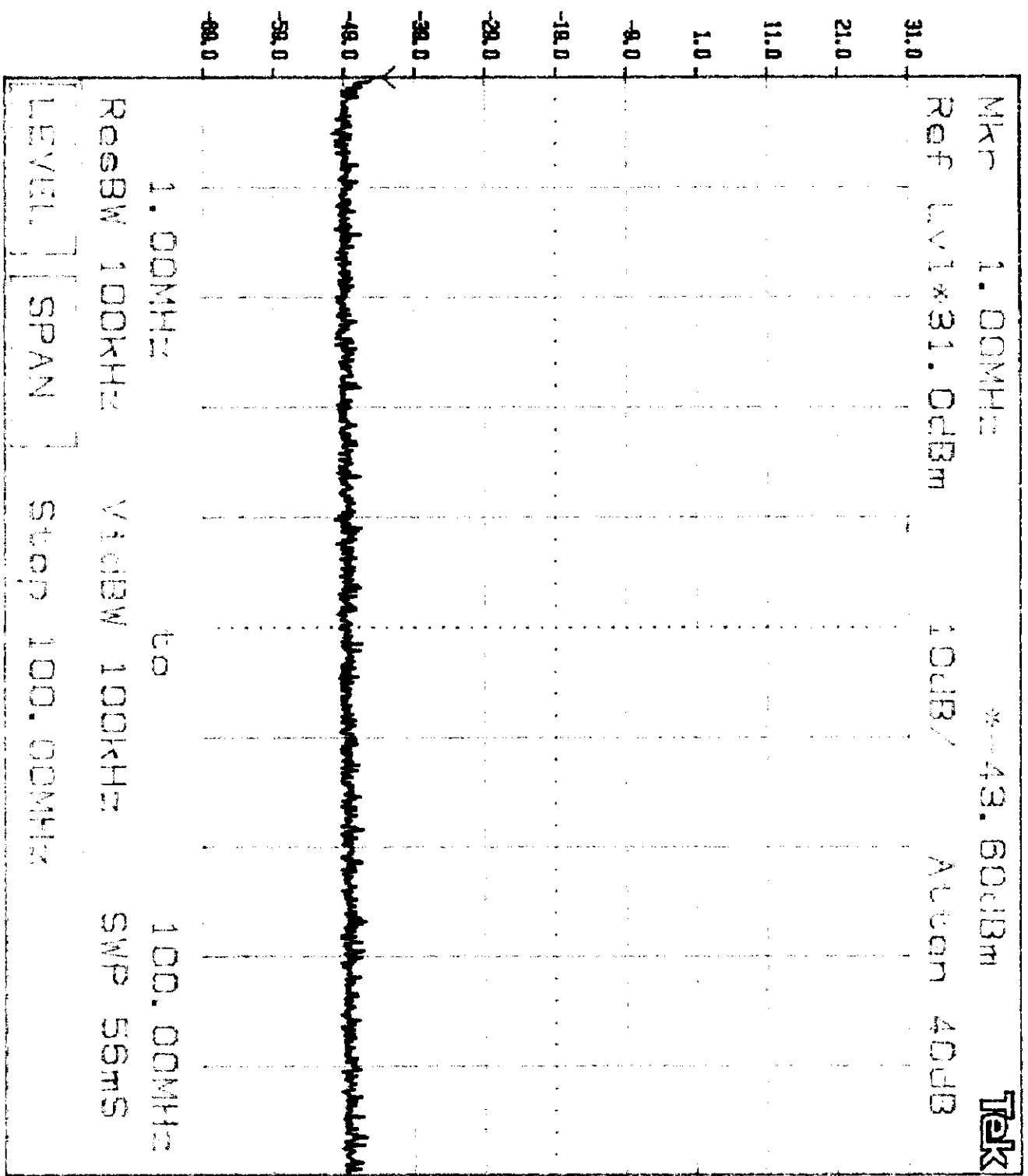
RES BW 100 KHz

VBW 100 KHz

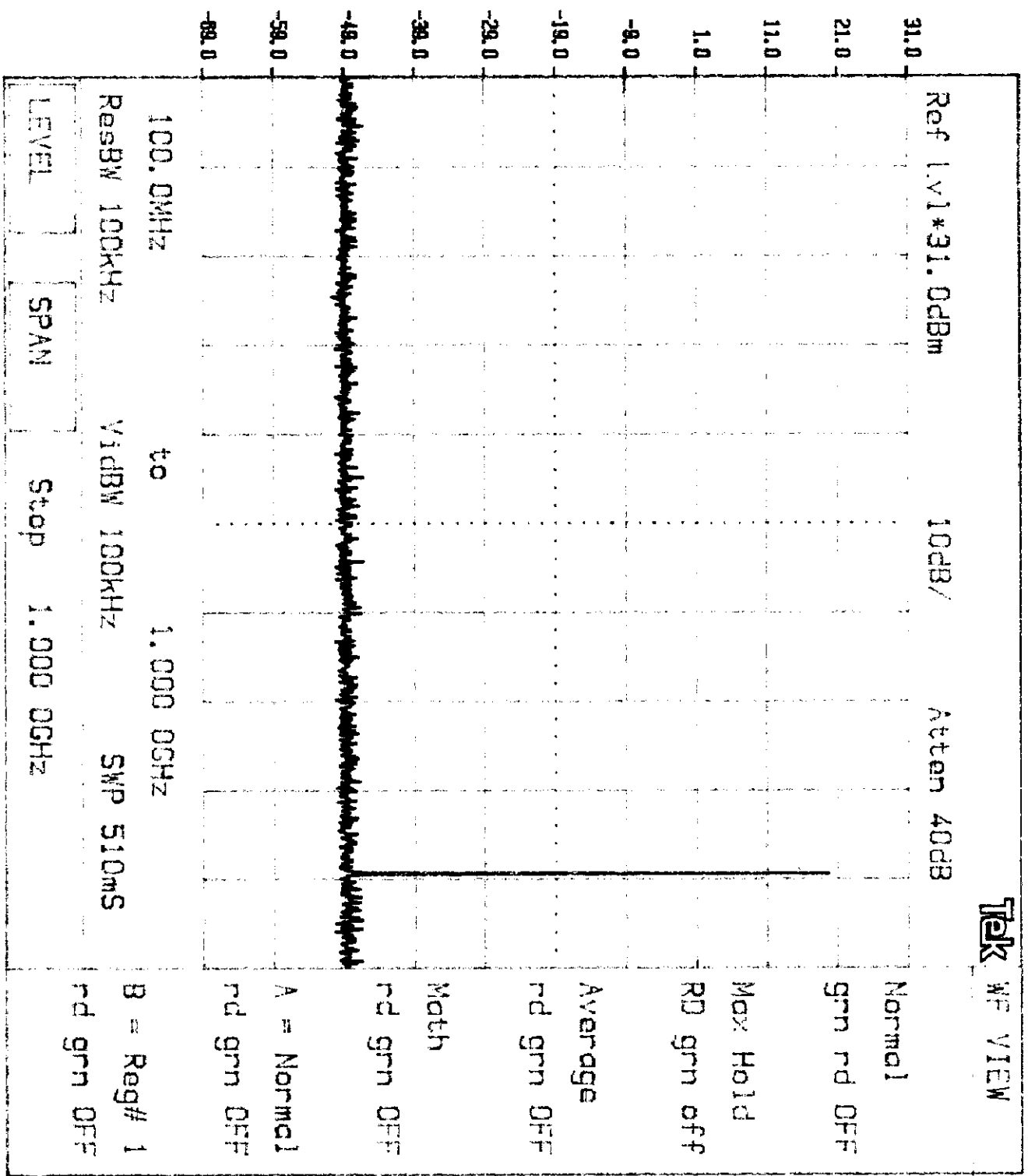
STOP 10.00 GHz

SWP 2.25 sec

Plot 5-3-1

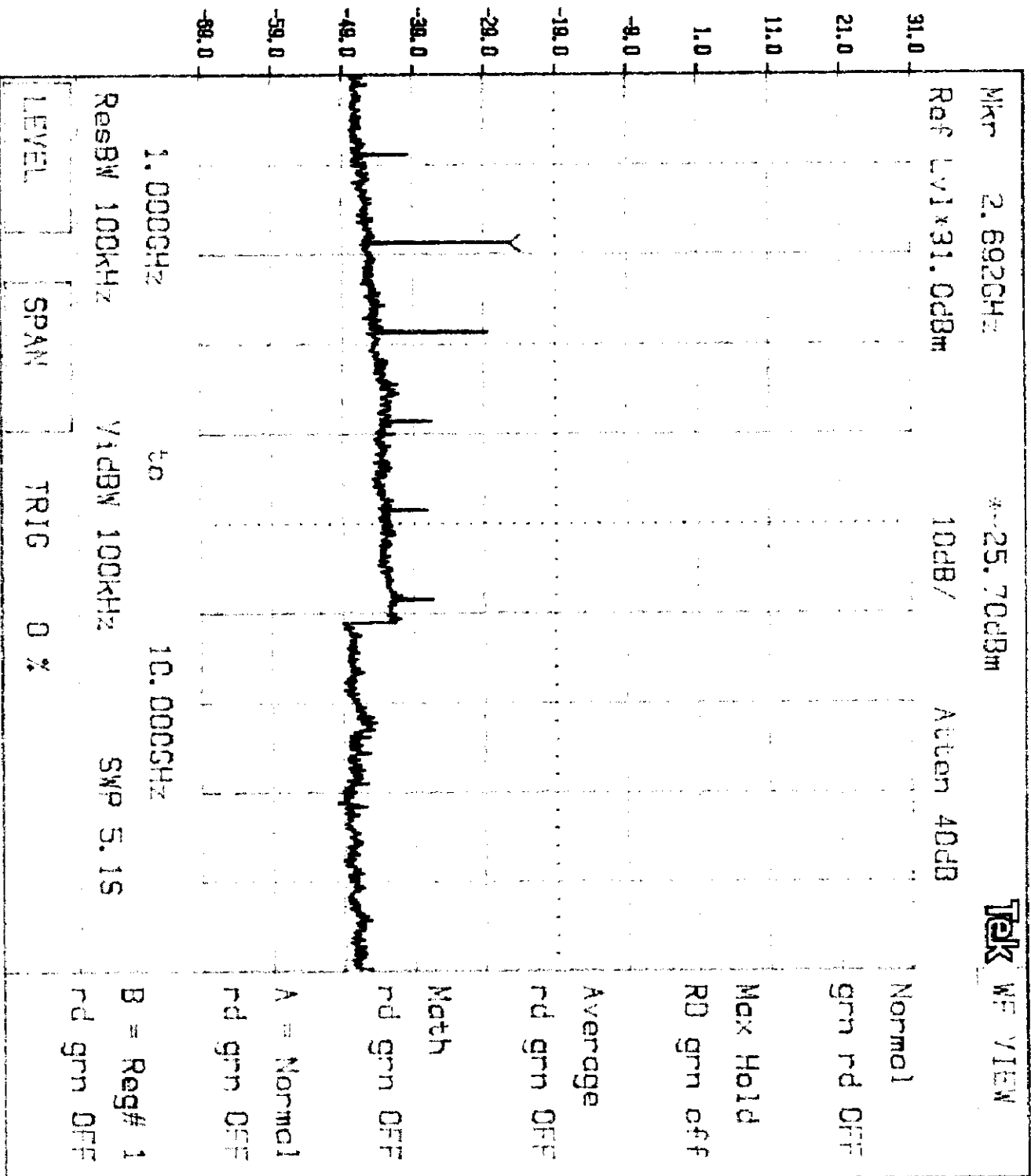


Plot 5-3-2



KN0B 2 KN0B 1 KEYPAD Tektronix 2784

Plot 5-3-3



KN0B 2 KN0B 1 KEYPAD Tektronix 2784

Advantra (UK) Limited, Model No. AR1800
FCC ID: XXXAR1800

Date of Test: April 30, 2000

6.0 Field Strength of Spurious Radiation, FCC §2.993, §15.109

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

CDI B100/200/300 Biconical Antennas
EMCO 3115 Horn Antenna
HP 8566B Spectrum Analyzer
Preamplifiers

Radiated Emissions Test Data

Company:	Advantra	Model #:	AR1800	Reg:	FCC 2.993
EUT:		S/N or FCC #:	OJ4ENT1	Test Dist:	3 meter
Project #:	J99030958	Test Date:	April 30, 2000	TP:	0.20 Watt
Test Mode:	Tx @ 896 MHz	Engineer:	Xi Ming Y.	Min. Attn:	36.01 dBc

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	7	21	8	13	8	10	0	0	12	0
Model:	EM LPA-25	3160-9	EMCO-3115	ACO/400	CDI_P1000	AFT18855	None	None	Gm_M+L	None

Frequency MHz	Reading dB(μV)	Detector P/A/G	Ant. #	Amp #	Ant. Pol. H/V	Ant. Factor dB(1/m)	Pre-Amp dB	Insert. Loss dB	Net dB(μV/m)	ERP mW	Attn dBc	Margin dB
896.00	94.0	Ave.	7	0	H	23.0	0.0	1.5	118.5	1.30E+02	0.0	N/A
1792.00	61.9	Ave.	8	8	V	27.2	29.4	2.0	61.7	2.71E-04	56.8	-20.8
2688.00	74.3	Ave.	8	8	V	30.6	28.4	2.3	78.8	1.39E-02	39.7	-3.7
3584.00	61.2	Ave.	8	8	H	33.5	27.8	2.7	69.6	1.65E-03	49.0	-12.9
4480.00	59.0	Ave.	8	8	V	34.2	27.9	2.9	68.2	1.19E-03	50.4	-14.3
5376.00	45.2	Ave.	8	8	V	34.9	28.3	3.5	55.3	6.20E-05	63.2	-27.2
6272.00	36.0	Ave.	8	8	V	36.9	28.0	3.9	48.8	1.40E-05	69.7	-33.6
7168.00	33.4	Ave.	8	8	V	38.0	27.9	4.3	47.8	1.11E-05	70.7	-34.7
8064.00	44.0	Ave.	8	8	V	38.7	27.2	4.8	60.3	1.95E-04	58.2	-22.2
8960.00	29.0	Ave.	8	8	V	37.6	27.0	4.7	44.3	4.96E-06	74.2	-38.2

- Notes:**
- a) O.C.F.: Other Correction Factor
 - b) Insert. Loss = Cable A + Cable B + Cable C + Transducer.
 - c) Net = Reading + Antenna Factor - Pre-Amp + Insert. Loss.
 - d) Attn. = Field Strength (Fundamental) - Field Strength (Harmonics).
 - e) Negative signs (-) in Margin column signify levels below the limits.



Radiated Emissions Test Data

Company:	Advantra	Model #:	AR1800	Reg.	FCC 2	993
EUT:		S/N or FCC #:	OJ4ENT1	Test Dist.	3	meters
Project #:	J99030958	Test Date:	April 30, 2000	TP	0.20	Watt
Test Mode:	Tx @ 898.5 MHz	Engineer:	Xi Ming Y.	Min. Attn.	36.01	dBc

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	7	21	8	13	8	10	0	0	12	0
Model:	EM_LPA-25	3160-9	EMCO 3115	ACO400	CDI_P1000	AFT18855	None	None	Gm_M+L	None

[illegible]

Notes:

- a) O.C.F.: Other Correction Factor
b) Insert. Loss = Cable A + Cable B + Cable C + Transducer.
c) Net = Reading + Antenna Factor - Pre-Amp + Insert. Loss.
d) Attn. = Field Strength (Fundamental) - Field Strength (Harmonics).
e) Negative signs (-) in Margin column signify levels below the limits.

Radiated Emissions Test Data

Compan	Advantra	Model #:	AR1800	Req	FCC 2	993
y:		S/N or	OJ4ENT1	Test Dist	3	meter
EUT:		FCC #:		TP	0.20	Watt
Project #:	J9903095	Test Date:	April 30, 2000	Min. Attn	36.01	dBc
Test Mode:	Tx @ 901 MHz	Engineer:	Xi Ming Y.			

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	7	21	8	13	8	10	0	0	12	0
Model:	EM_LPA-25	3160-9	EMCO 3115	ACO/400	CDL_P1000	AFT18655	None	None	Gm_M+L	None

[illegible]

Notes:

- a) O.C.F.: Other Correction Factor
b) Insert. Loss = Cable A + Cable B + Cable C + Transducer.
c) Net = Reading + Antenna Factor - Pre-Amp + Insert. Loss.
d) Attn. = Field Strength (Fundamental) - Field Strength (Harmonics).
e) Negative signs (-) in Margin column signify levels below the limits.

Radiated Emissions Test Data

Company:	Advantra	Model #:	AR1800	Req	FCC 2.993
EUT:		S/N or FCC #:	OJ4ENT1	Test Dist	3 meter
Project #:	J99030958	Test Date:	April 30, 2000	TP	0.20 Watt
Test Mode:	Tx @ 902 MHz	Engineer:	Xi Ming Y.	Min Attn	36.01 dBc

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number.	7	21	8	13	8	10	0	0	12	0
Model:	EM_LPA-25	3160-9	EMCO 3115	ACO400	CD_P1000	AFT18555	None	None	Gm_M+L	None

[illegible]

Notes:

- a) O.C.F.: Other Correction Factor
b) Insert. Loss = Cable A + Cable B + Cable C + Transducer.
c) Net = Reading + Antenna Factor - Pre-Amp + Insert. Loss.
d) Attn = Field Strength (Fundamental) - Field Strength (Harmonics).
e) Negative signs (-) in Margin column signify levels below the limits.

Radiated Emissions Test Data

Company:	Advantra				Model #:	AR1800	Standard:	FCC § 15B
EUT:					S/N #:	OJ4ENT1	Limits:	2
Project #:	J99030958				Test Date:	April 30, 2000	Test Distance:	3 meters
Test Mode:	Rx				Engineer:	Xi-Ming Y.	Duty Relaxation:	0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	2	21	8	0	8	13	0	0	4	0
Model:	EMCO 3143	3160-9	EMCO 3115	None	CDL P1000	ACO/400	None	None	Site 3 3m	None

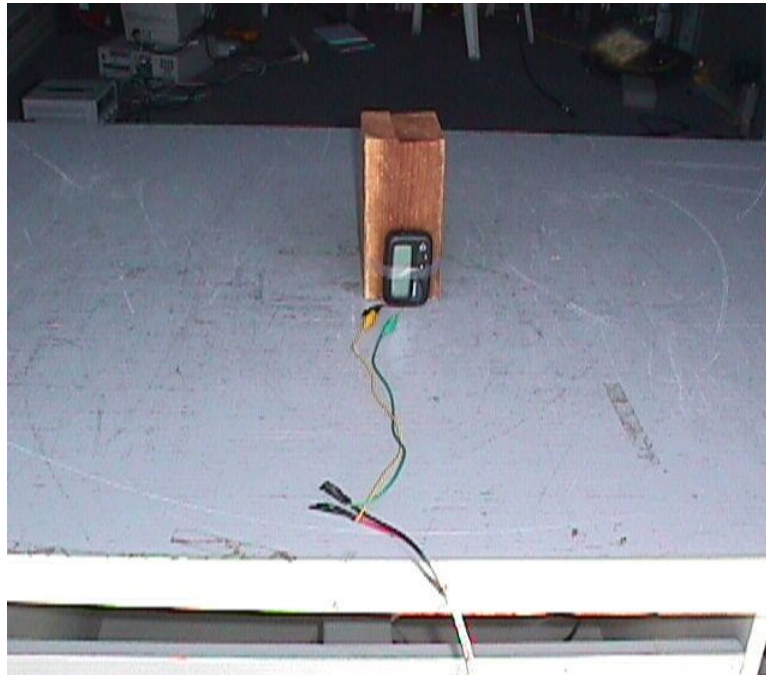
Frequency	Reading	Detector	Ant	Amp	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dB(μV)	P/A/G	#	#	H/V	dB(1m)	dB	dB	dB	dB(μV/m)	dB(μV/m)	dB
30.00	18.0	Peak	2	0	V	11.0	0.0	0.3	0.0	29.3	40.0	-10.7
70.00	21.0	Peak	2	0	V	5.6	0.0	0.8	0.0	27.4	40.0	-12.6
110.00	21.9	Peak	2	0	V	7.0	0.0	1.0	0.0	29.9	43.5	-13.6
200.00	22.0	Peak	2	0	V	10.1	0.0	1.5	0.0	33.6	43.5	-9.9
300.00	20.7	Peak	2	0	V	13.3	0.0	1.9	0.0	35.9	46.0	-10.1
600.00	11.0	Peak	2	0	V	18.9	0.0	2.4	0.0	32.3	46.0	-13.7
884.00	12.4	Peak	2	0	H	23.1	0.0	3.2	0.0	38.7	46.0	-7.3
887.00	10.0	Peak	2	0	H	23.3	0.0	3.2	0.0	36.5	46.0	-9.5
890.00	10.5	Peak	2	0	H	23.4	0.0	3.2	0.0	37.1	46.0	-8.9
897.00	10.2	Peak	2	0	H	23.6	0.0	3.2	0.0	37.0	46.0	-9.0
1768.00	34.5	Peak	8	8	H	27.4	29.4	4.2	0.0	36.7	54.0	-17.3
1774.00	35.0	Peak	8	8	H	27.4	29.4	4.2	0.0	37.2	54.0	-16.8
1780.00	35.5	Peak	8	8	H	27.4	29.4	4.2	0.0	37.7	54.0	-16.3
1794.00	35.0	Peak	8	8	H	27.4	29.4	4.2	0.0	37.2	54.0	-16.8

Notes:	a) D.C.F.: Distance Correction Factor
	b) Insert. Loss (dB) = Cable A + Cable B + Cable C
	c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only).
	d) Negative signs (-) in Margin column signify levels below the limits.
	e) All other emissions not reported are below the equipment noise floor which is at least 20 dB below the limits.

Advantra (UK) Limited, Model No. AR1800
FCC ID: XXXAR1800

Date of Test: April 30, 2000

6.3 Test Configuration Setup - Radiated Emission



Advantra (UK) Limited, Model No. AR1800
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Date of Test: April 30, 2000

6.4 Test Results

See attached.

Results: Passed

Advantra (UK) Limited, Model No. AR1800
FCC ID: XXXAR1800

Date of Test: April 30, 2000

7.0 Line Conducted Emissions, FCC § 15.107

7.1 Test Procedure

Not applicable, the EUT is battery powered.

Advantra (UK) Limited, Model No. AR1800
FCC ID: XXXAR1800

Date of Test: April 30, 2000

7.2 Test Configuration Setup – Line Conducted Emissions

Not applicable, the EUT is battery powered.

Advantra (UK) Limited, Model No. AR1800
FCC ID: XXXAR1800

Date of Test: April 30, 2000

7.3 Test Results

See attached test data.

Results: Not applicable, the EUT is battery powered.

Advantra (UK) Limited, Model No. AR1800
FCC ID: XXXAR1800

Date of Test: April 30, 2000

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.

Temperature, C	Difference (Hz)
+50	-337
+40	-50
+30	-75
+20	-50
+10	225
0	470
-5	697
-7	TX Inhibited

Results: Passed

Advantra (UK) Limited, Model No. AR1800
FCC ID: XXXAR1800

Date of Test: April 30, 2000

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 115% of the DC nominal value and for 85% of the nominal value.

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.

Voltage, VDC	Difference (Hz)
1.725	-51
1.5	-50
1.275	-55
1.05	-52

Results: Passed

Advantra (UK) Limited, Model No. AR1800
FCC ID: XXXAR1800

Date of Test: April 30, 2000

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 a modulated signal (FSK, 2400 bits/sec.). 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.

10.2 Test Results

Results: Not Applicable
