

**EXHIBIT 10: Test Report for Utilicom Radio FCC ID: LFO-ISM900**

The Utilicom ISM 900 spread spectrum radio (FCC ID LFO-ISM900) is identical to the SafeTran Systems spread spectrum radio model LongRanger 2020 (FCC ID LTY53311). The test data submitted to the FCC for authorization of the SafeTran Systems radio was identical to the data submitted for the Utilicom ISM900 contained in this exhibit.

**30 Pages**

# INCHCAPE TESTING SERVICES

Dept. 206 - Belmont, CA

*Applicant: Utilicom, Inc.*  
*FCC ID: LFO-ISM900*

*Description of EUT: Spread Spectrum Transmitter*  
*ITS Belmont Folder: 90571*

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## TEST REPORT FOR SPREAD SPECTRUM INTENTIONAL RADIATOR

### RULE PART: 15.247 SPREAD SPECTRUM OPERATION

- (a) The EUT is a 590 mW spread spectrum radio using direct sequence techniques.
2. The minimum 6dB bandwidth is 900 kHz for 100 kHz resolution bandwidth. Please refer to the attached spectrum analyzer charts for output signal spectrum shape.
- (b) The maximum peak output of the transmitter with a spectrum analyzer at 3 MHz bandwidth is 27.7 dBm = 590 mW.
- (c) Please refer to the spectrum analyzer charts. These charts show the power in any 100 kHz or 1 MHz bandwidth to be at least 20 dB below the power in any 100 kHz within the band containing the highest level of desired power, i.e., the pass-band surrounding the 902 - 928 MHz carrier.

### RULE PART 15.205: RESTRICTED BANDS OF OPERATION

The EUT was tested for radiated emissions in the restricted bands of operation. The EUT was placed on a non-conductive turntable at 1 height of approximately 1 meter above the ground plane of a 3 meter open test site. For each frequency detected from the EUT, the turntable was rotated 360 degrees and the search antenna was raised and lowered in both horizontal and vertical polarizations, in an attempt to maximize the received emissions.

Test results, test equipment list, and test configurations are attached.

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## **RULE PART: 15.247(d) POWER DENSITY MEASUREMENTS**

The spectrum analyzer RESOLUTION BANDWIDTH was set to 3 kHz. The START and STOP frequencies were set to the band edges of the maximum output pass-band determined by the chart labelled "POWER OUTPUT". This bandwidth is approximately 900 kHz.

The specification calls for a 1 second interval at each 3 kHz bandwidth; for 900 kHz this calculates to approximately 300 seconds of total sweep. The 300 second sweep time was chosen for the analyzer of sweep. The spectrum analyzer chart labelled "POWER DENSITY" shows that the EUT emissions are approximately 1.5 dB below the 8 dBm limit line.

## **RULES PART: 15.247(e) PROCESSING GAIN MEASUREMENTS**

Processing gain data and test procedure were prepared by the radio module manufacturer and are attached.

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## RULE PART: 15.101 UNINTENTIONAL RADIATOR OPERATION

Emissions from the computer circuitry were measured to determine compliance with Class B limits. The Utilicom Inc. Model ISM 900 was found to comply with the Class B limits for digital devices.

A certificate of verification for the receiver and digital portions of the device has been submitted to the manufacturer.

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## RULE PART 15.107 CONDUCTED LIMITS

During tests for unintentional radiator emissions, line conducted measurements were made with the EUT transmitting at 915 MHz.

Data shows the EUT meets the 250 uV line conducted limit for intentional radiator.

## CONCLUSION

The Utilicom Inc. Model ISM 900, FCC ID: LFOISM900, meets all emissions requirements in Part 15 FCC Rules for a device of this type.

INCHCAPE TESTING SERVICES

AUGUST 29, 1994



Thomas N. Cokenias  
EMI Manager

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# INCHCAPE TESTING SERVICES

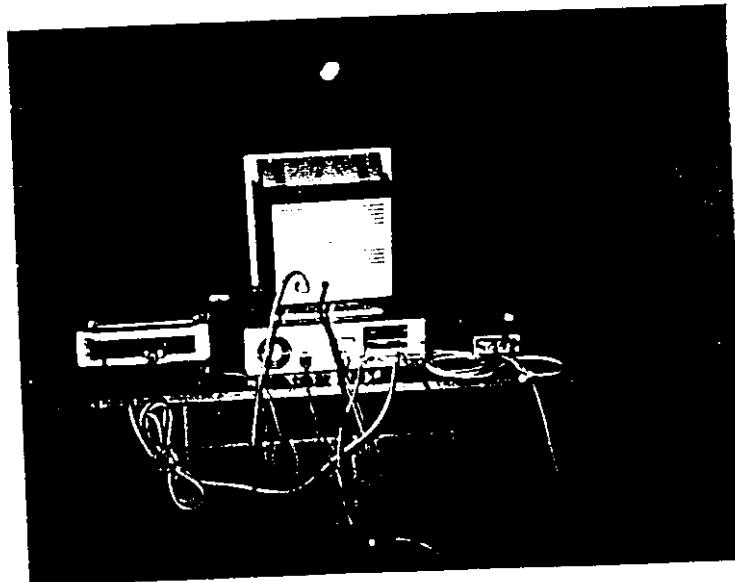
Dept. 206 - Belmont, CA

*Applicant: Utilicom, Inc.*  
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## TEST CONFIGURATION SET-UP



# INCHCAPE TESTING SERVICES

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## RADIATED EMISSIONS DATA SHEET

Frequency Investigated: 903 MHz  
Measurements Performed: 3 meters

FREQ. MHz	READING dBuV		ANT. CORR. FACTOR dB	CABLE LOSS dB	OTHER CORR. FACTOR dB	TOTAL CORR. READING dBuV/m		FCC LIMIT dBuV/m	
	Peak	Ave.				Peak	Ave.	Peak	Ave.
2709	44	41.0	31.1	1.5	-27.7	48.9	45.9	74	54
4515	39.9	36.9	34.8	2.2	-26.1	50.8	47.8	74	54
5418	44	40.0	36.0	2.4	-26.4	56	52.0	74	54

### Description of Other Correction Factor

- Pre-amplifier gain, dB: 27.7, 26.1, 26.4  
 External Attenuator, dB:  
 Duty Cycle, dB:

### Calculation of Duty Cycle:

Total on Time in 100 msec:  
Duty Cycle =  $20 * \log(\text{ON time}/100 \text{ msec})$

- Filter Insertion Loss, dB = 1.0

### Analyzer Settings:

Peak  
Resolution Bandwidth: 1 MHz  
Video Bandwidth: 1 MHz

Average  
Resolution Bandwidth: 1 MHz  
Video Bandwidth: 30 Hz

# INCHCAPE TESTING SERVICES

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Description of EUT: Spread Spectrum Transmitter  
ITS Belmont Folder: 90571

## RADIATED EMISSIONS (CONTINUED)

Frequency Investigated: 915 MHz  
Measurements Performed: 3 meters

FREQ. MHz	READING dBuV		ANT. CORR. FACTOR dB	CABLE LOSS dB	OTHER CORR. FACTOR dB	TOTAL CORR. READING dBuV/m		FCC LIMIT dBuV/m	
	Peak	Ave.				Peak	Ave.	Peak	Ave.
2745	38.9	34.9	31.1	1.5	-27.7	43.8	39.8	74	54
4575	35.8	33.7	34.8	2.2	-26.1	46.7	44.6	74	54

### Description of Other Correction Factor

- Preamplicifier gain, dB: 27.7, 26.1, 26.4  
 External Attenuator, dB:  
 Duty Cycle, dB:

### Calculation of Duty Cycle:

Total on Time in 100 msec:  
Duty Cycle =  $20 * \text{Log} (\text{ON time}/100 \text{ msec})$

Filter Insertion Loss, dB = 1.0

### Analyzer Settings:

Peak  
Resolution Bandwidth: 1 MHz  
Video Bandwidth: 1 MHz

Average  
Resolution Bandwidth: 1 MHz  
Video Bandwidth: 30 Hz



# INCHCAPE TESTING SERVICES

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Description of EUT: Spread Spectrum Transmitter  
ITS Belmont Folder: 90571

## RADIATED EMISSIONS (CONTINUED)

Frequency Investigated: 927 MHz  
Measurements Performed: 3 meters

FREQ. MHz	READING dBuV		ANT. CORR. FACTOR dB	CABLE LOSS dB	OTHER CORR. FACTOR dB	TOTAL CORR. READING dBuV/m		FCC LIMIT dBuV/m	
	Peak	Ave.				Peak	Ave.	Peak	Ave.
2781	38.5	35.1	31.1	1.5	-27.7	43.4	40.0	74	54
4635	33.3	30.2	34.8	2.2	-26.1	43.2	41.1	74	54

### Description of Other Correction Factor

- Preamplifier gain, dB: 27.7, 26.1, 26.4  
 External Attenuator, dB:  
 Duty Cycle, dB:

### Calculation of Duty Cycle:

Total on Time in 100 msec:  
Duty Cycle =  $20 * \log(\text{ON time}/100 \text{ msec})$

- Filter Insertion Loss, dB = 1.0

### Analyzer Settings:

Peak  
Resolution Bandwidth: 1 MHz  
Video Bandwidth: 1 MHz

Average  
Resolution Bandwidth: 1 MHz  
Video Bandwidth: 30 Hz

# INCHCAPE TESTING SERVICES

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*Description of EUT: Spread Spectrum Transmitter  
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## Equipment Used To Perform Tests:

### Amplifiers

- Watkins-Johnson 6882-813, 2-8 GHz
- Avantek AFT-18855, 8-18 GHz
- Other: CDI P-1000 +

### Filter

+ 1 dB

### Analyzer

- Tektronix 2784 Spectrum Analyzer, 100 Hz - 40 GHz
- HP 8566B Spectrum Analyzer, 100 Hz - 22 GHz

### Antennas

- EMCO 3115 Waveguide Horn, 1-18 GHz
-

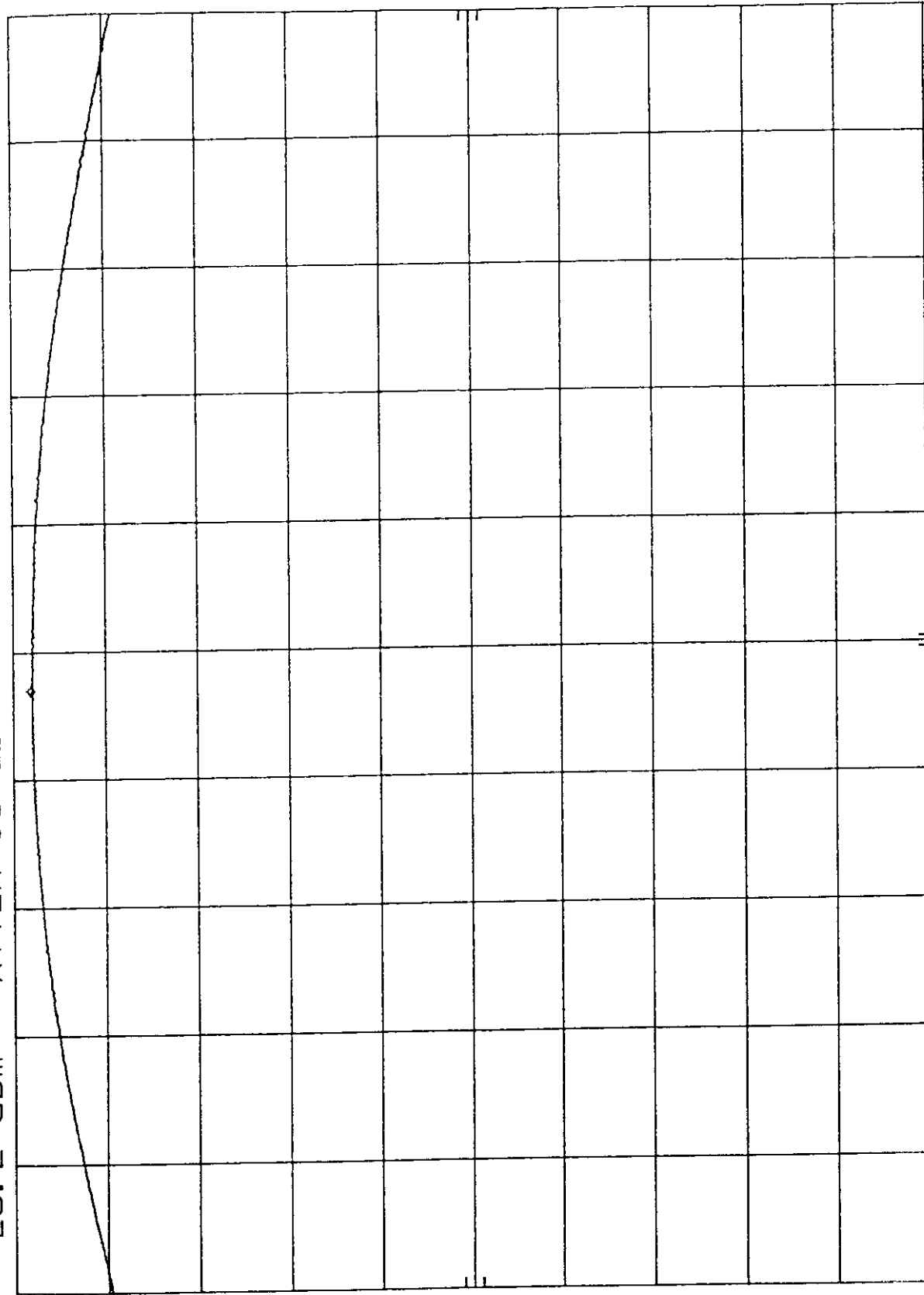
JTILICOM SAFETRAN 08/17/94  
REF 29.2 dBm ATTEN 10 dB

MKR 902.845 MHz  
27.30 dBm

hp

10 dB/

OFFSET  
29.2  
dB



CENTER 903.00 MHz  
RES BW 3 MHz  
SPAN 5.00 MHz  
SWP 1.00 sec  
VBW 3 MHz

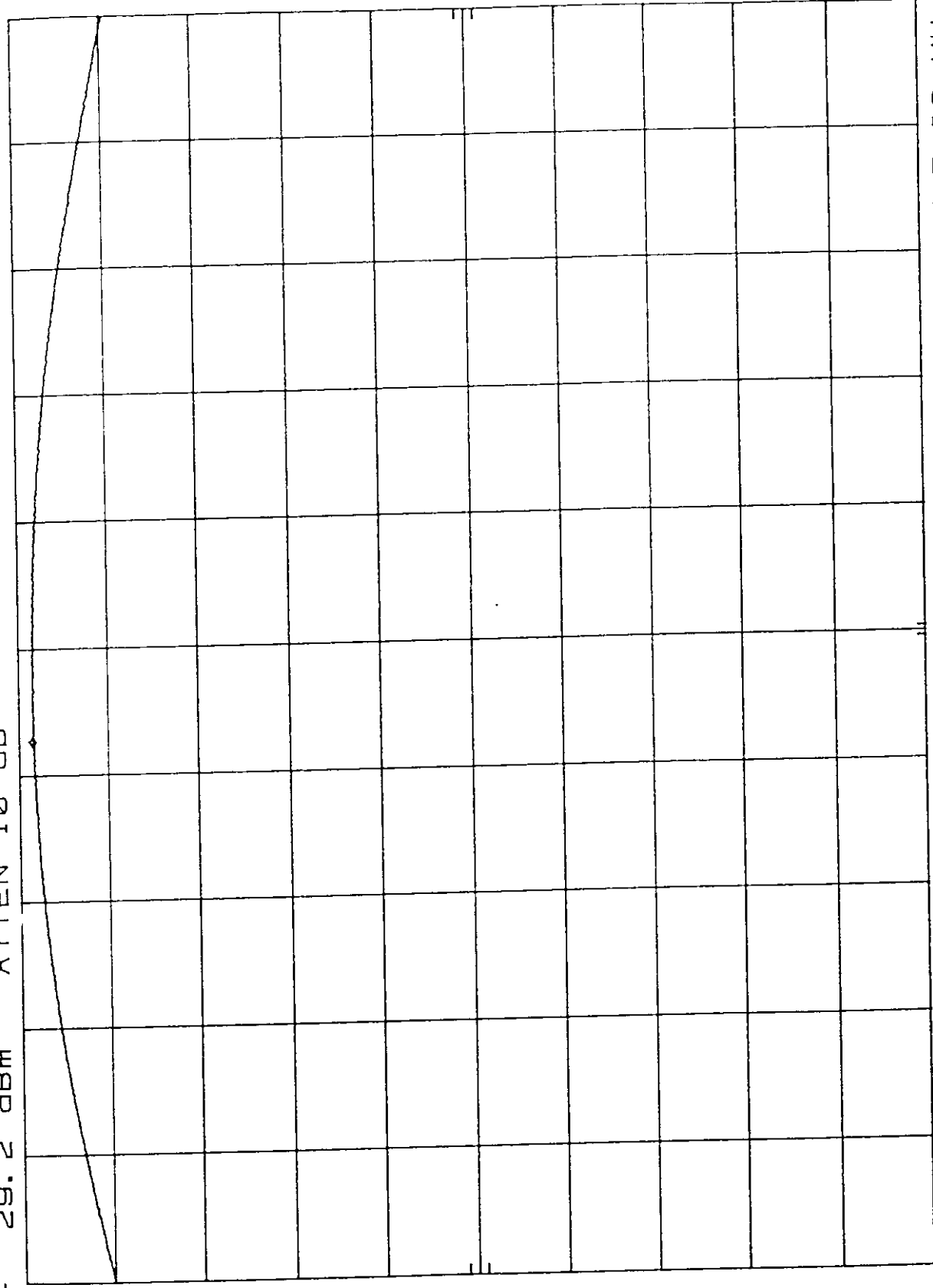
MKR 914.634 MHz  
27.70 dBm

JTILICOM SAFETLAN 08/17/94  
REF 29.2 dBm ATTEN 10 dB

hp

10 dB/

OFFSET  
29.2  
dB



SPAN 5.00 MHz  
SWP 1.00 sec

VBW 3 MHz

CENTER 915.00 MHz  
RES BW 3 MHz

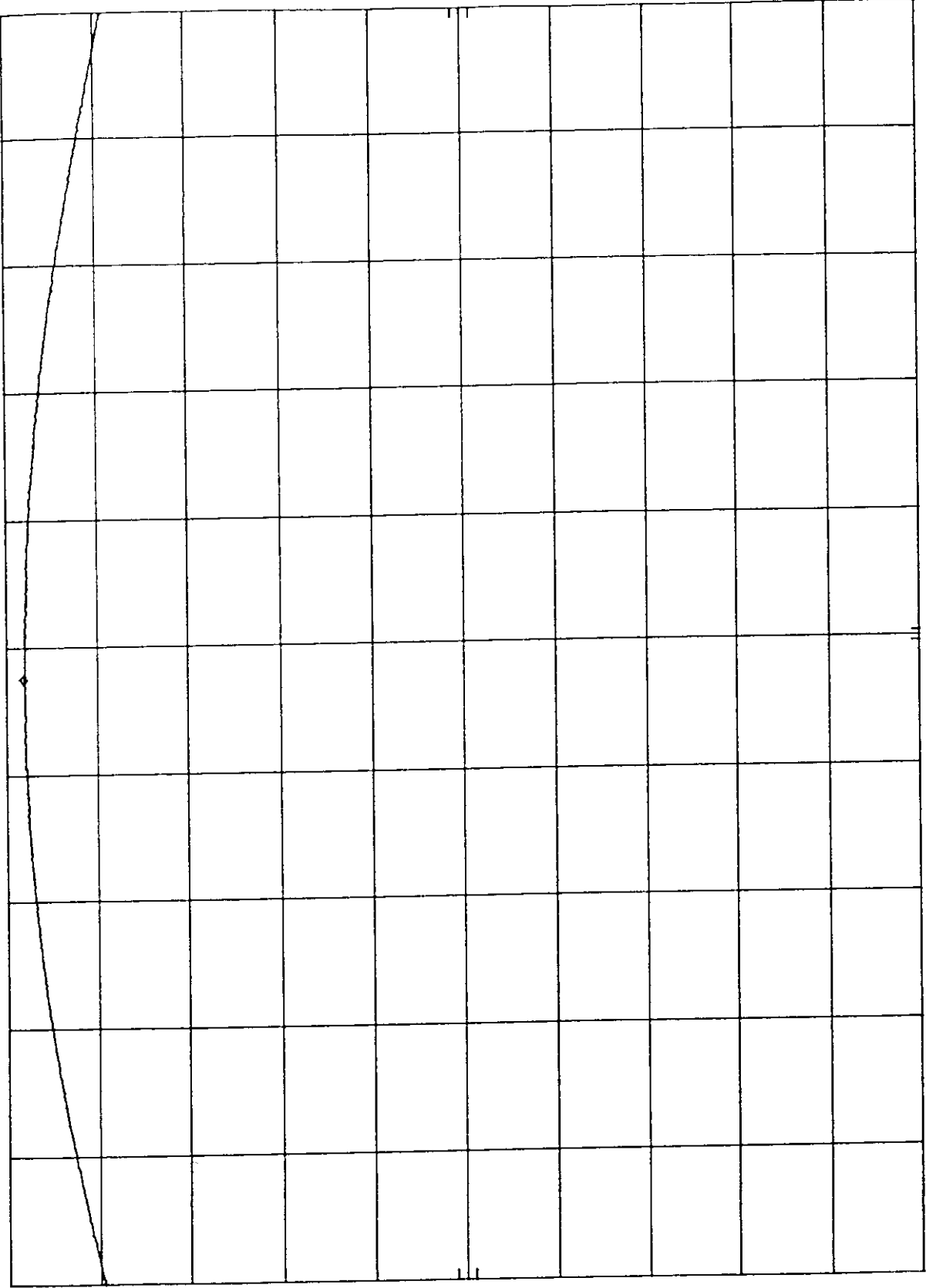
UTILICOM SAFETRAN 08/17/94  
REF 29.2 dBm ATTEN 10 dB

MKR 926.876 MHz  
27.40 dBm

hp

10 dB/

OFFSET  
29.2  
dB



CENTER 927.00 MHz  
RES BW 3 MHz  
SPAN 5.00 MHz  
SWP 1.00 sec  
VBW 3 MHz

UTILICOM SAFETRAN 08/17/94

MR 926.971 MHz

REF 29.2 dBm ATTN 10 dB

5.90 dBm

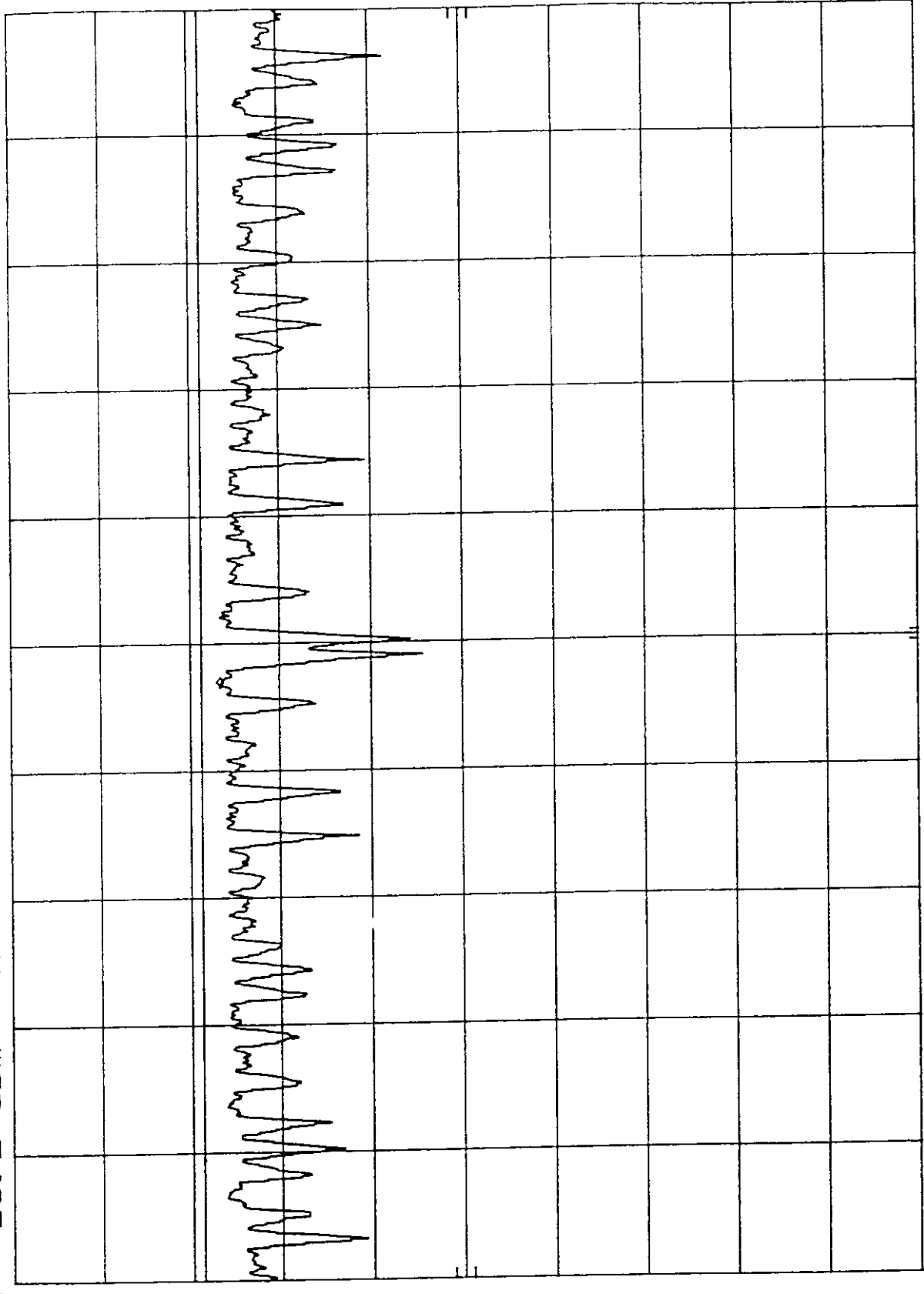
hp

10 dB/

OFFSET

29.2 dB

DL  
8.0 dBm



CENTER 927.000 MHz

RES BW 3 KHZ

VBW 3 KHZ

SPAN 906 KHZ

SWP 302 sec

MKR 914.972 1 MHz  
6.50 dBm

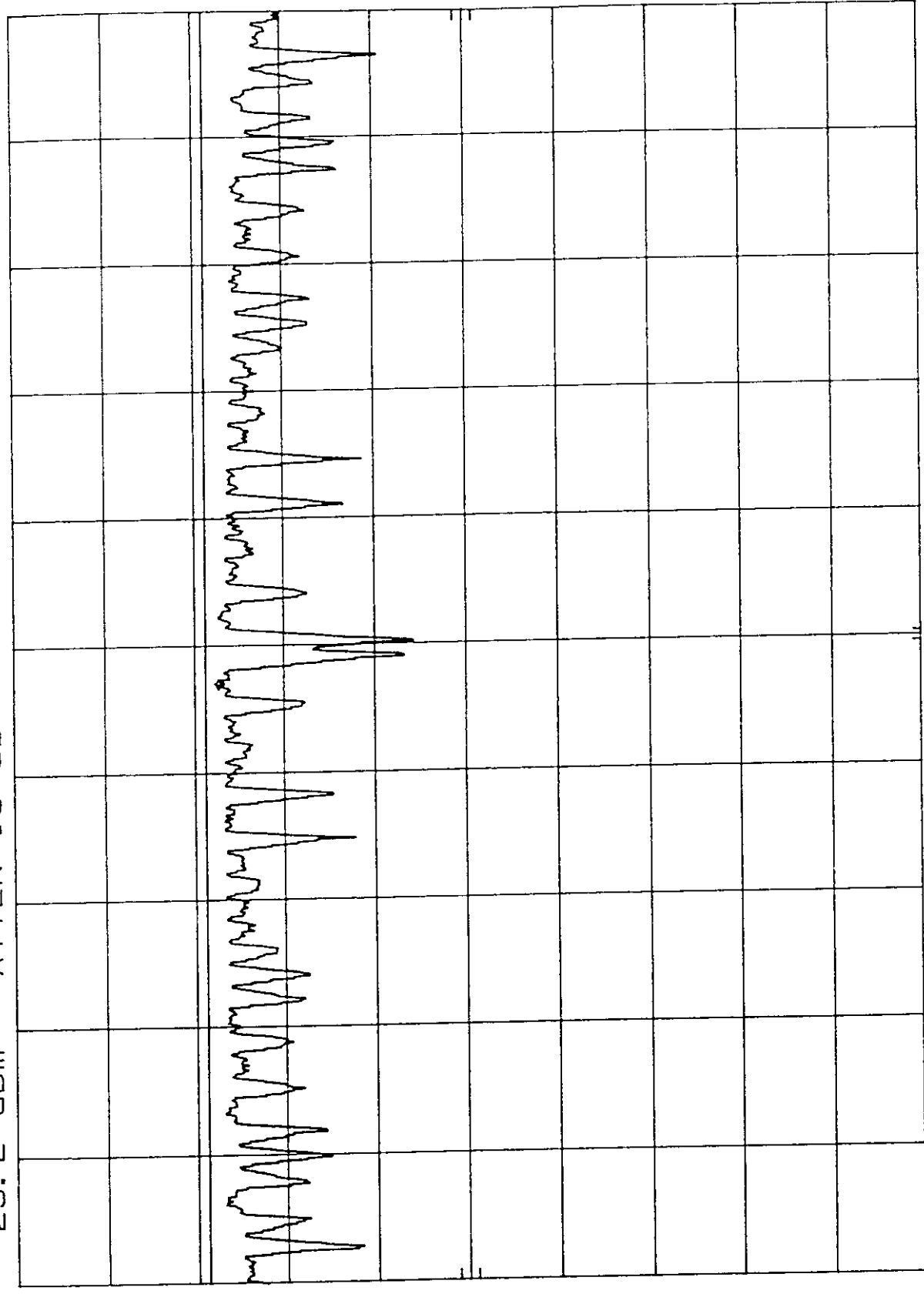
JTILICOM SAFETAN 08/17/94  
REF 29.2 dBm ATTEN 10 dB

hp

10 dB/

OFFSET  
29.2  
dB

DL  
8.0  
dBm



SPAN 900 KHZ  
SWP 300 sec

VBW 3 KHZ

CENTER 915.000 MHZ  
RES BW 3 KHZ

JTILICOM SAFETRAN 08/17/94  
REF 29.2 dBm ATTEN 10 dB

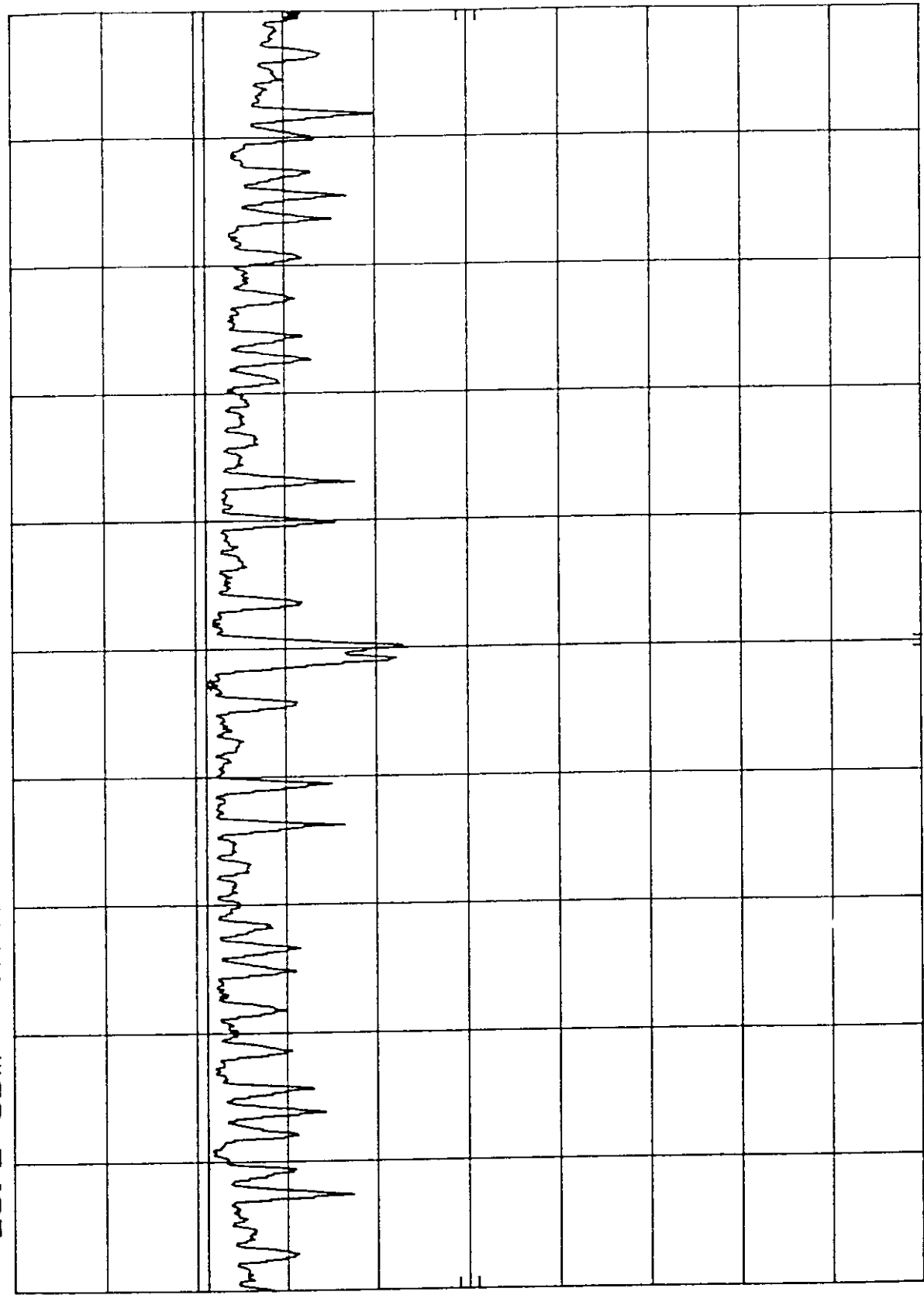
MKR 902.972 MHz  
7.50 dBm

hp

10 dB/

OFFSET  
29.2  
dB

DL  
8.0  
dBm



CENTER 903.00 MHz  
RES BW 3 KHz  
SPAN 1.00 MHz  
SWP 350 sec  
VBW 3 KHz



UTILICOM 07/20/94  
REF 29.4 dBm  
ATTEN 10 dB

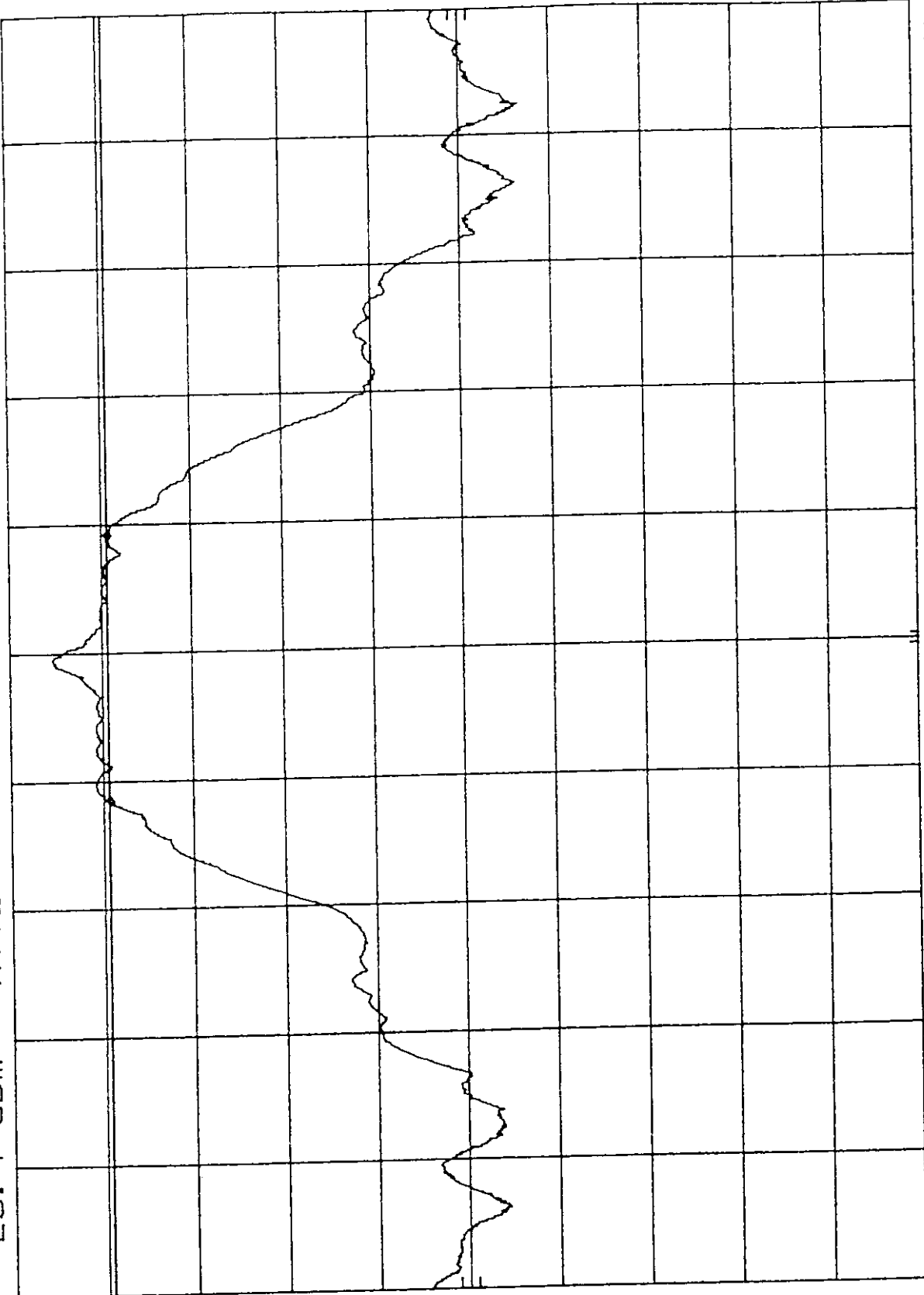
MKR  $\Delta$  1.03% MHz  
0.00 dB

hp

10 dB/

OFFSET  
29.4  
dB

DL  
18.8  
dBm



CENTER 903.00 MHz  
RES BW 100 kHz  
SPAN 5.00 MHz  
SWP 2.00 sec  
VBW 300 kHz

h<sub>p</sub>

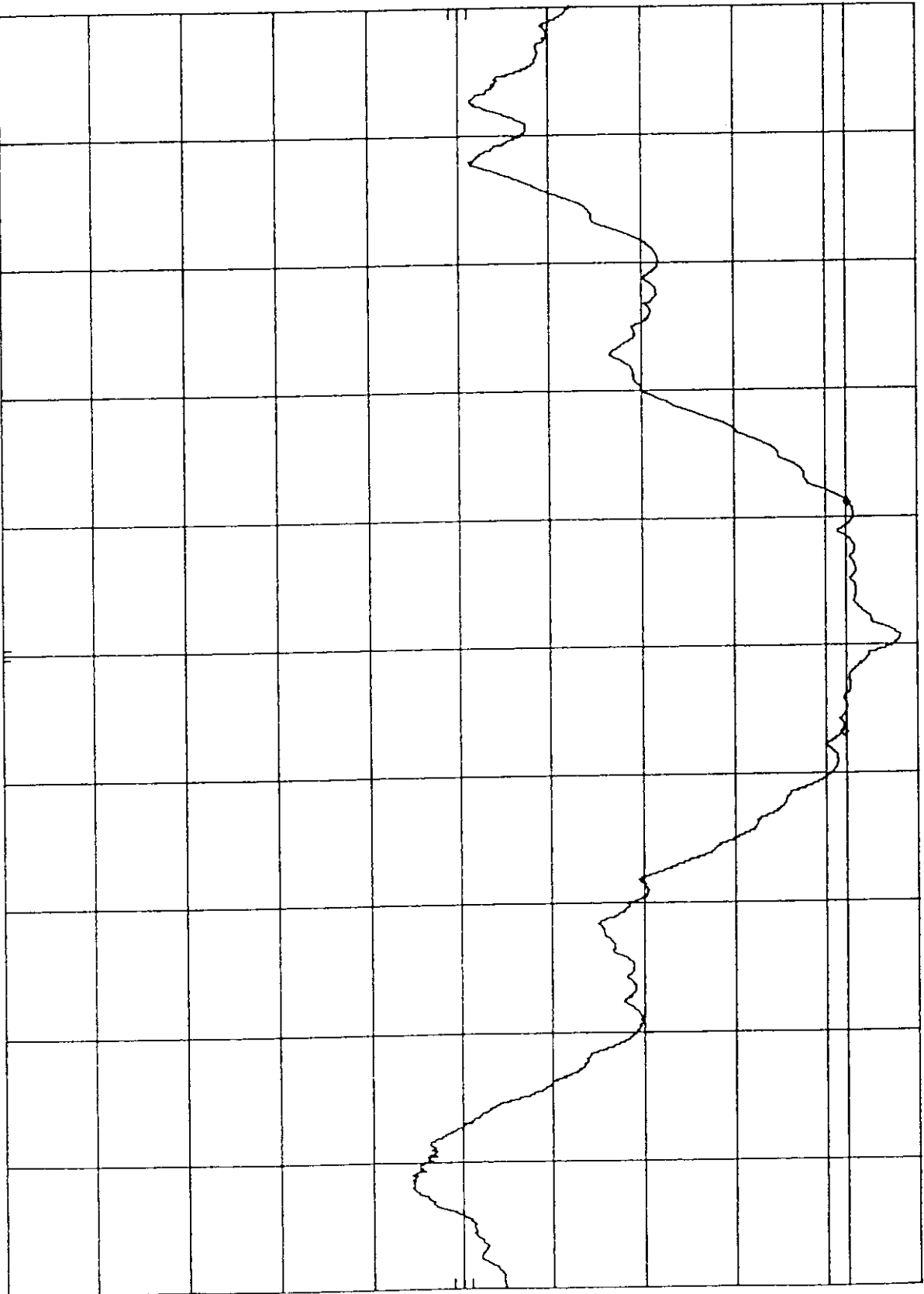
UTILICOM 07/20/94  
REF 29.4 dBm ATTEN 10 dB

MKR Δ 895 KHZ  
-0.30 dB

10 dB/

OFFSET  
29.4  
dB

DL  
21.6  
dBm



CENTER 915.00 MHZ  
RES BW 100 KHZ  
VBW 300 KHZ  
SPAN 5.00 MHZ  
SWP 2.00 sec

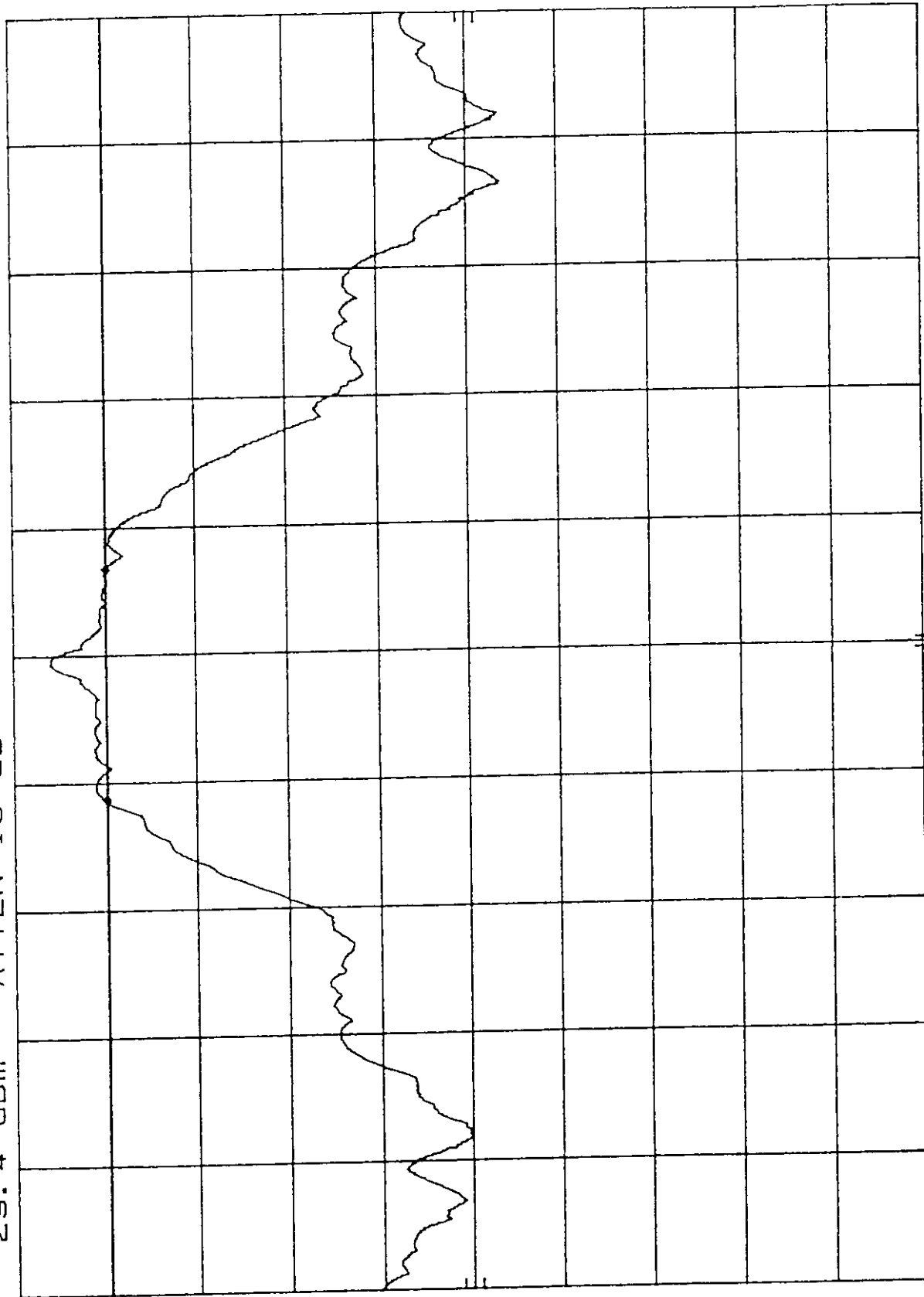
MKR Δ 905 KHz  
0.00 dB

UTILICOM 07/20/94  
REF 29.4 dBm  
ATTEN 10 dB

hp  
10 dB/

OFFSET  
29.4  
dB

DL  
19.3  
dBm



SPAN 5.00 MHz  
SWP 2.00 sec

VBW 300 KHz

CENTER 927.00 MHz  
RES BW 100 KHz

MKR  $\Delta$ -12.95 MHz  
-68.30 dB

UTILICOM 07/20/94  
REF 29.4 dBm ATTEN 10 dB

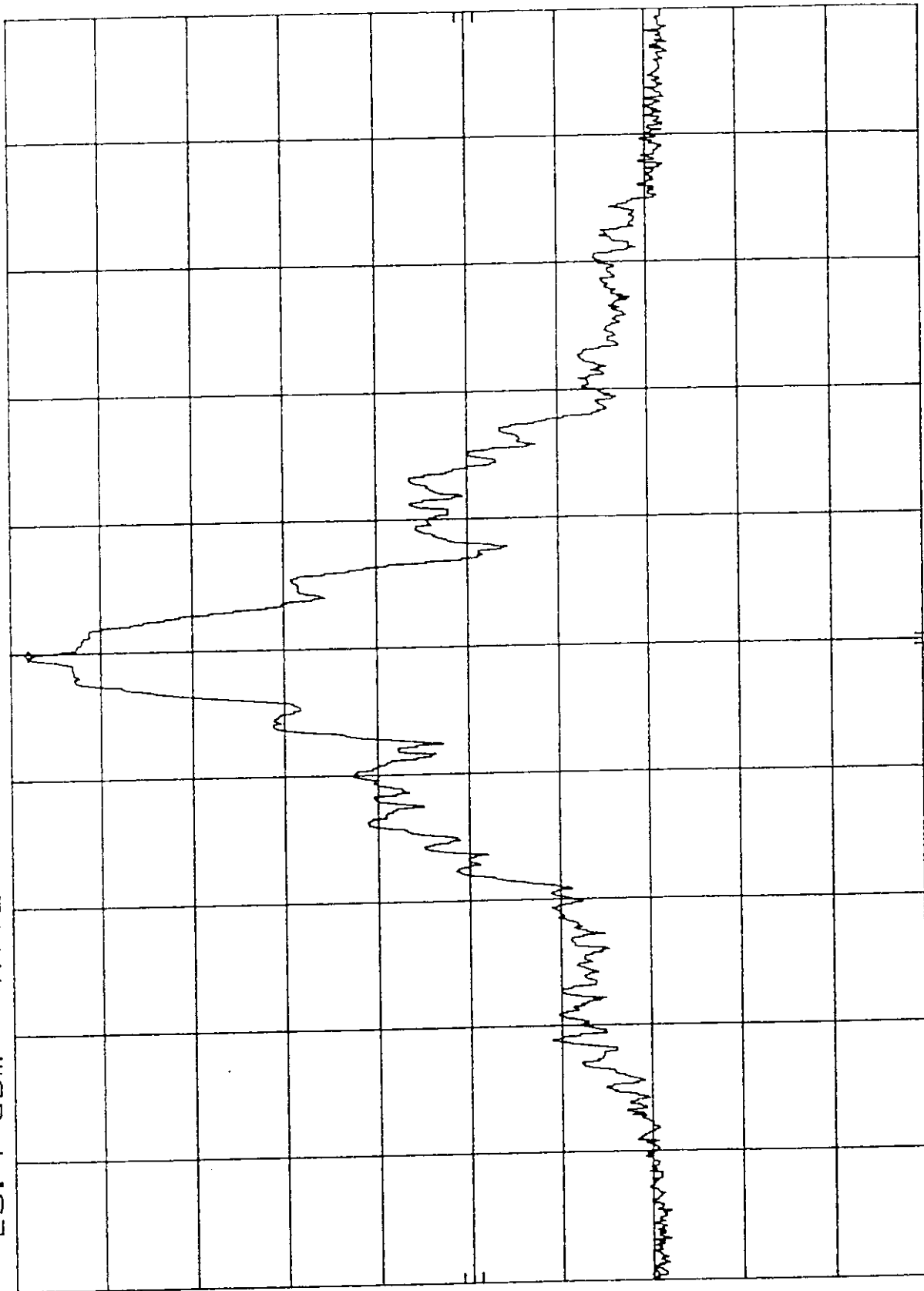
hp

10 dB/

OFFSET

29.4

dB



START 902.0 MHz  
RES BW 100 kHz

VBW 300 kHz

STOP 928.0 MHz  
SWP 2.00 sec

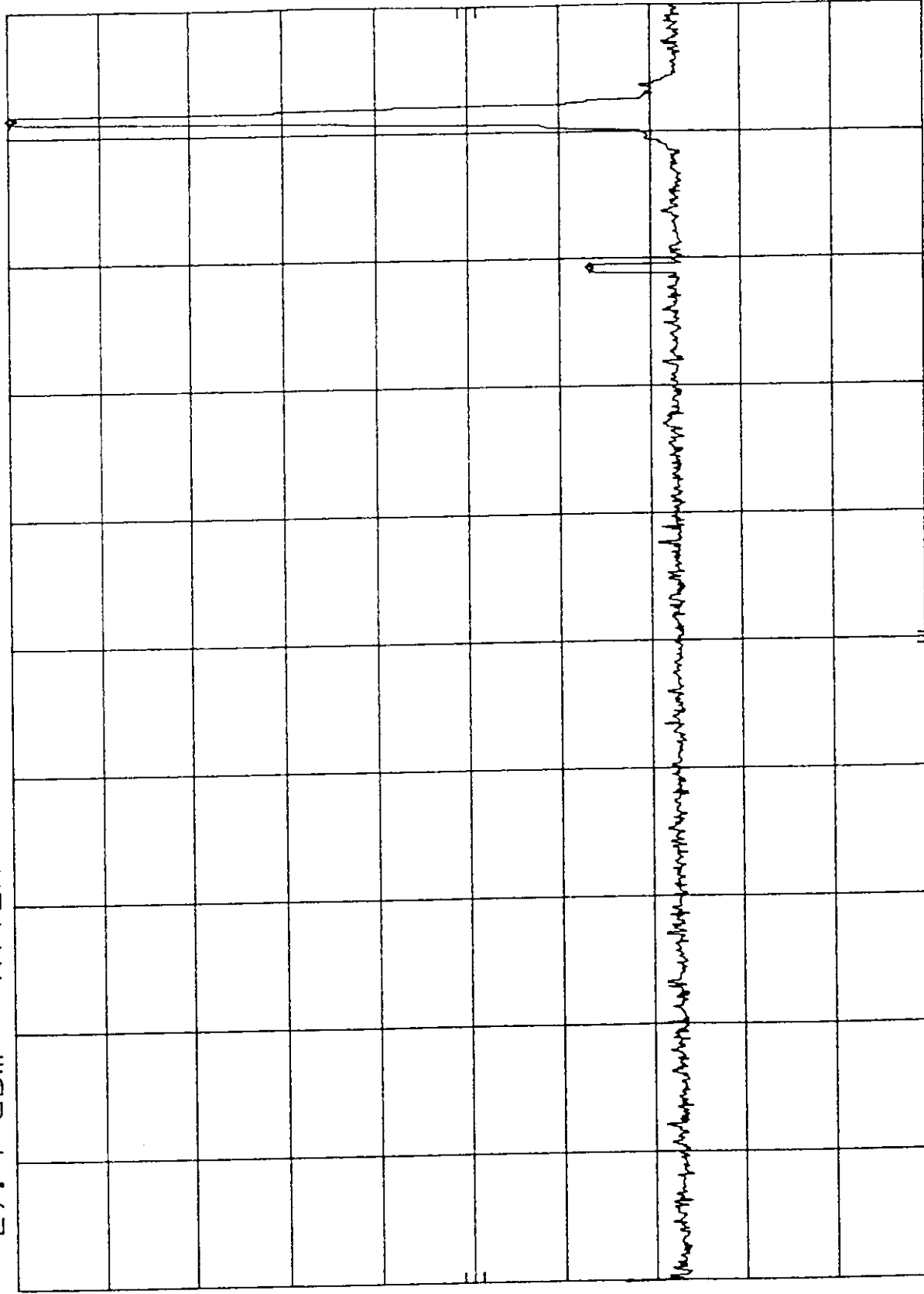
MKR  $\Delta$ -121 MHz  
-63.10 dB

UTILICOM 07/20/94  
REF 27.4 dBm ATTEN 10 dB

hp

10 dB/

OFFSET  
29.4  
dB



START 1 MHz RES BW 100 KHz VBW 300 KHz STOP 1.00 GHz  
SWP 2.00 sec

MKR 1.830 GHz  
-5.90 dBm

UTILICOM 07/20/94  
REF 27.4 dBm ATTEN 10 dB

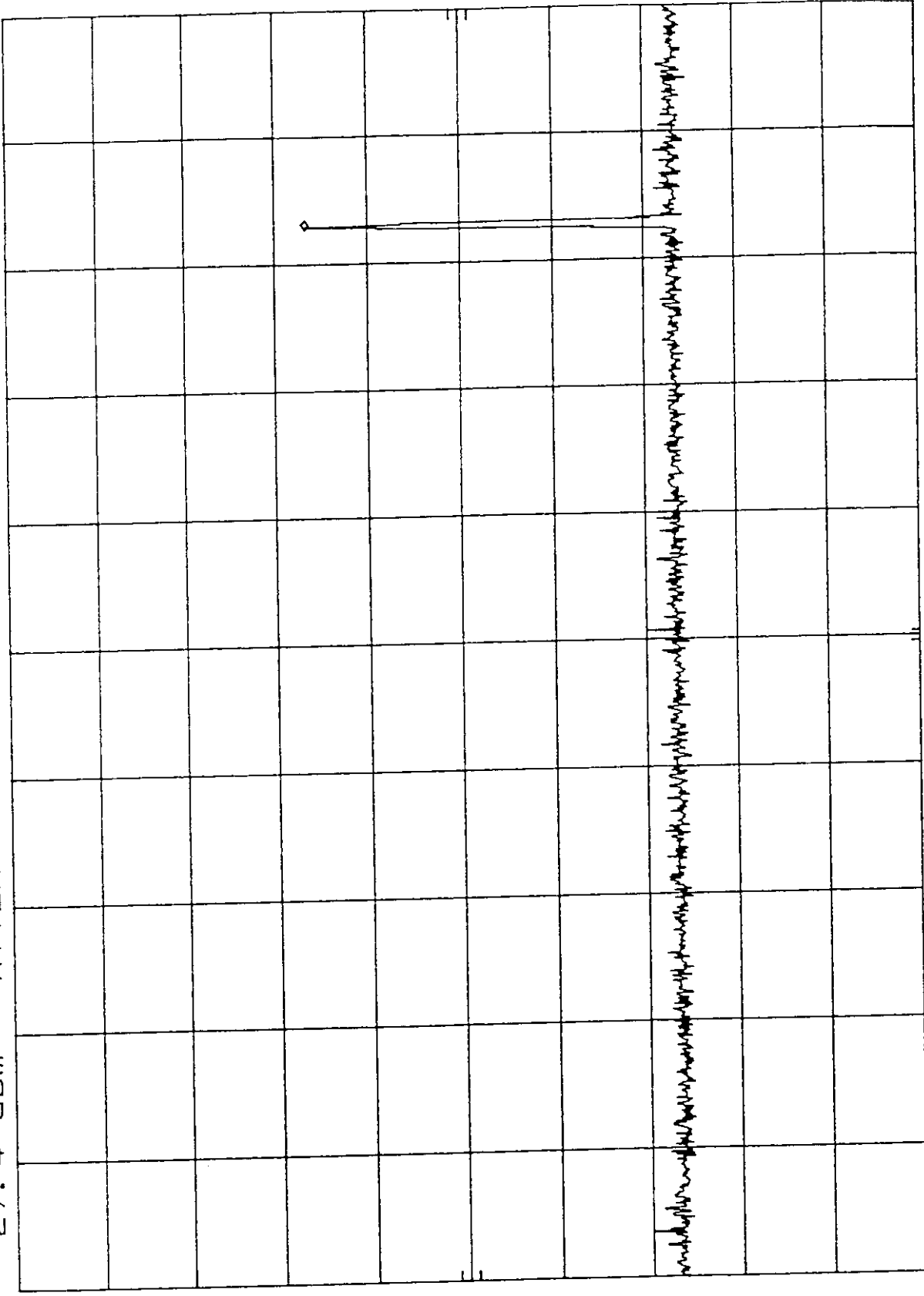
hp

10 dB/

OFFSET

29.4

dB



START 1.00 GHz

RES BW 100 KHz

VBW 300 KHz

STOP 2.00 GHz

SWP 10.0 sec

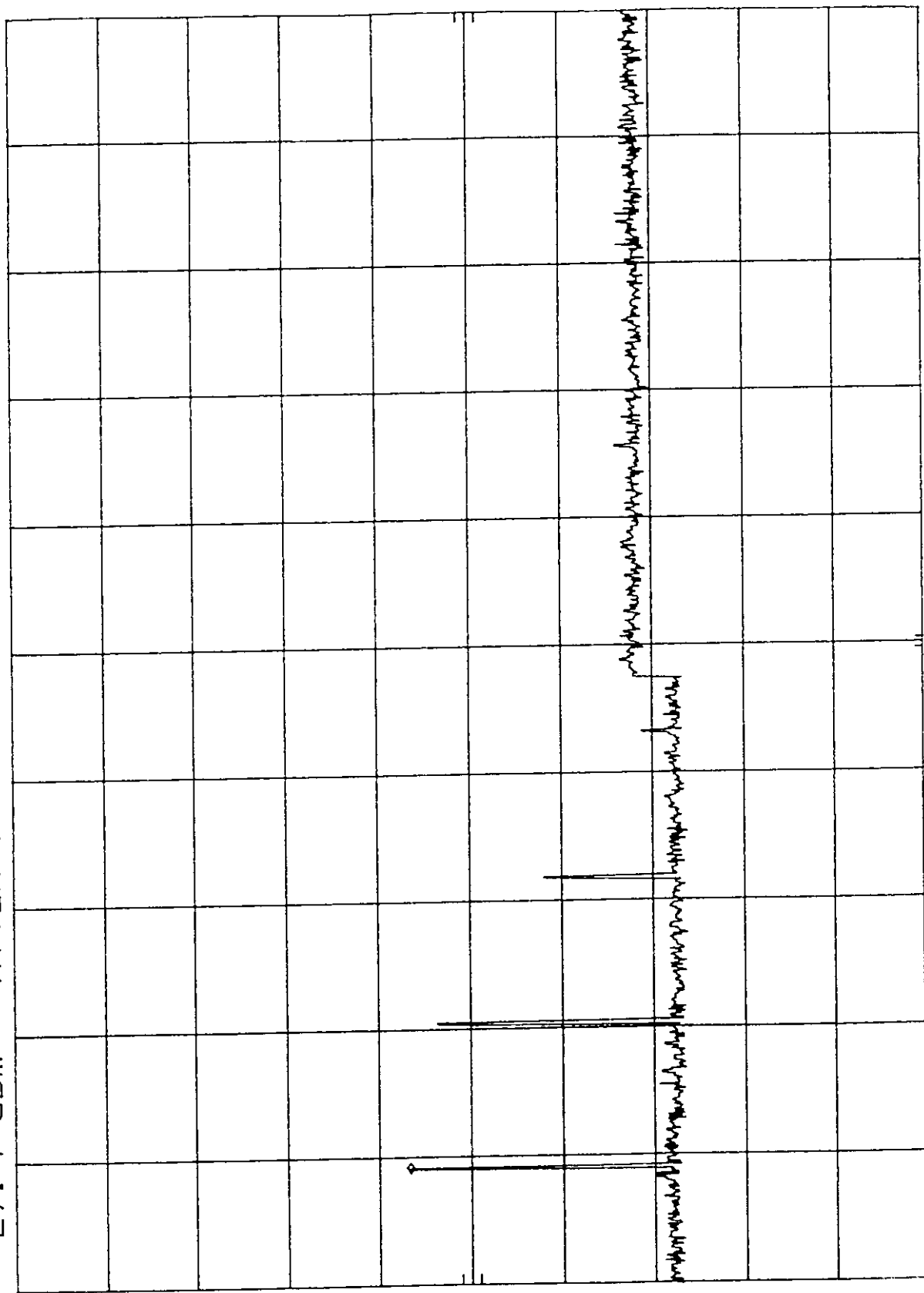
MKR 2.728 GHz  
-16.00 dBm

UTILICOM 07/20/94  
REF 27.4 dBm ATTEN 10 dB

hp

10 dB/

OFFSET  
29.4  
dB



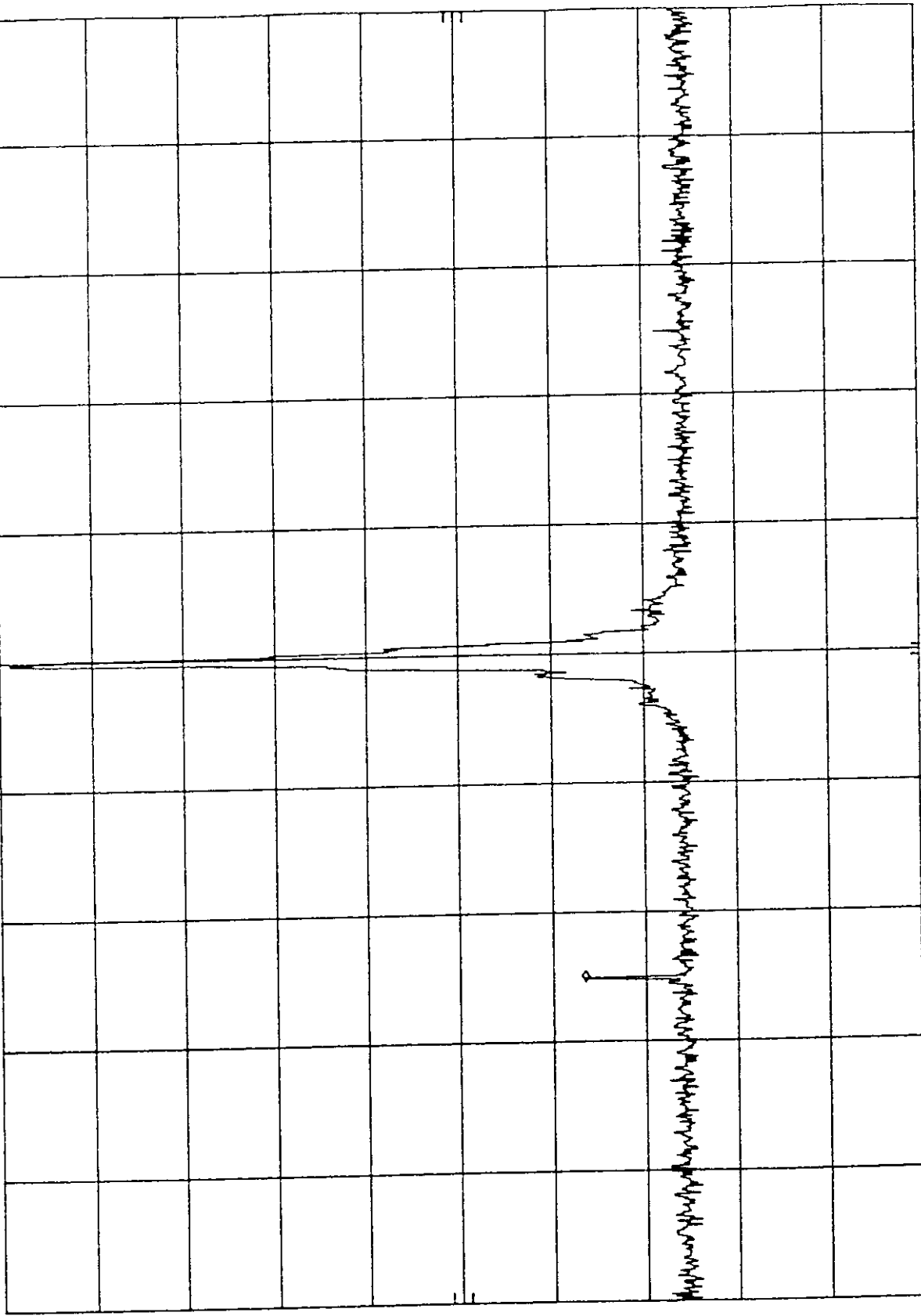
STOP 10.00 GHz  
SWP 10.0 sec

START 2.00 GHz  
RES BW 100 kHz  
VBW 3 MHz

MKR 793.0 MHz  
-36.10 dBm

UTILICOM 07/20/94  
REF 27.4 dBm ATTEN 10 dB

hp  
10 dB/  
OFFSET  
29.4  
dB



CENTER 915 MHz  
RES BW 100 kHz  
VBW 300 kHz  
SPAN 488 MHz  
SWP 1.00 sec



Company Name :UTIIACOM  
 Equipment Tested :SS DEVICE  
 Model :SAFETRAM  
 FCC ID# :N/A  
 Date Tested :07/25/94  
 Test Engineer :Eugene Payzner  
 ETL LTO Number :89536

ETL FCC Class B Radiated Data at 3 meter distance

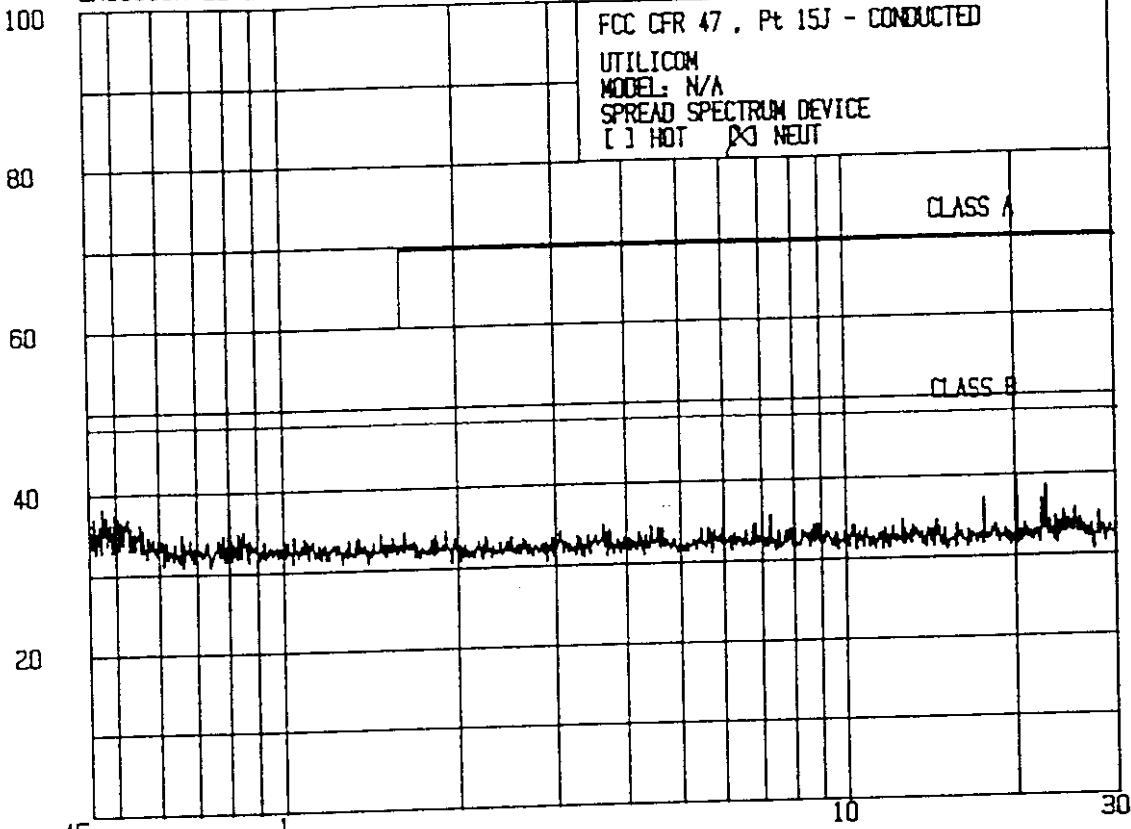
FREQ. (Mhz)	RDG. (uv)	COR. FACTOR	COR. RDG. (uv)	FCC LIMIT(uv)	DELTA (dB)
34.9	6.0	4.02	24.12	100	-12.35
40.2	6.0	3.51	21.06	100	-13.53
154.3	5.0	4.95	24.75	150	-15.65
164.8	6.0	5.03	30.18	150	-13.93
266.1	9.0	4.98	44.82	200	-12.99
303.1	6.0	5.34	32.04	200	-15.91
400	6.0	6.17	37.02	200	-14.65

20 JUL 1994 15:49:53

hp

EMISSION LEVEL [ dBuV]

FCC CFR 47, Pt 15J - CONDUCTED  
UTILICOM  
MODEL: N/A  
SPREAD SPECTRUM DEVICE  
 HOT  NEUT



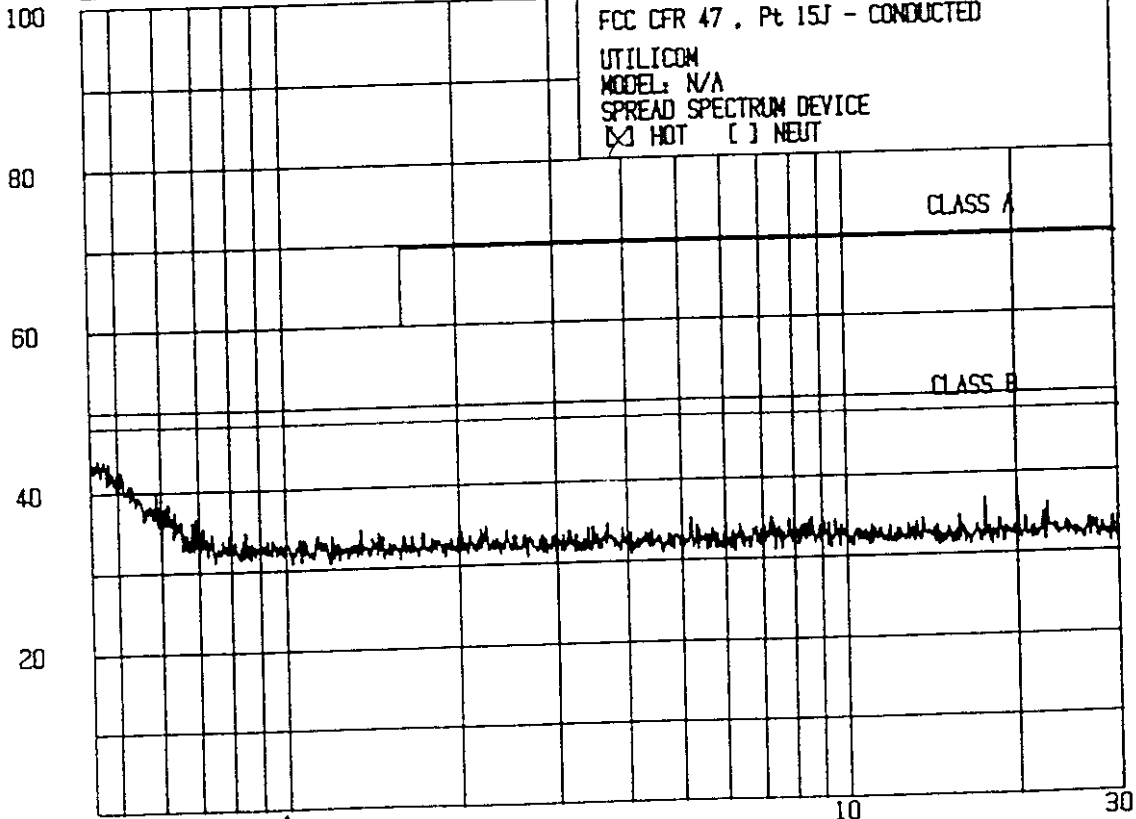
FREQUENCY [MHz]

20 JUL 1994 15:54:18

hp

EMISSION LEVEL [ dBuV]

FCC CFR 47, Pt 15J - CONDUCTED  
UTILICOM  
MODEL: N/A  
SPREAD SPECTRUM DEVICE  
 HOT  NEUT



FREQUENCY [MHz]

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Frequency Investigated: 927 MHz  
Measurements Performed: 3 meters

FREQ. MHz	READING dBuV	ANTENNA CORR. FACTOR dB	CABLE LOSS dB	OTHER CORR. FACTOR dB	TOTAL CORR. READING dBuV/m	FCC LIMIT dBuV/m
2781	35.1	31.1	1.5	-27.7	40.0	54
4635	30.2	34.8	2.2	-26.1	41.1	54

## Equipment Used To Perform Tests:

### Amplifiers

- Watkins-Johnson 6882-813, 2-8 GHz
- AvanteK AFT-18855, 8-18 GHz
- Other: CDI P-1000+

### Filter

+ 1 dB

### Analyzer

- Tektronix 2784 Spectrum Analyzer, 100 Hz - 40 GHz
- HP 8566B Spectrum Analyzer, 100 Hz - 22 GHz

### Antennas

- EMCO 3115 Waveguide Horn, 1-18 GHz

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20 JUL 1994 15:49:53

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UTILICOM  
MODEL: N/A  
SPREAD SPECTRUM DEVICE  
 HOT  NEUT

PEAKS FOUND ABOVE 37 dBuV

PEAK#	FREQ (MHz)	AMPL (dBuV)
1	.4815	37.0
2	.4772	36.3
3	.5019	37.4
4	17.61	37.2
5	20.14	38.9
6	22.37	37.0
7	22.85	36.6

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20 JUL 1994 15:54:16

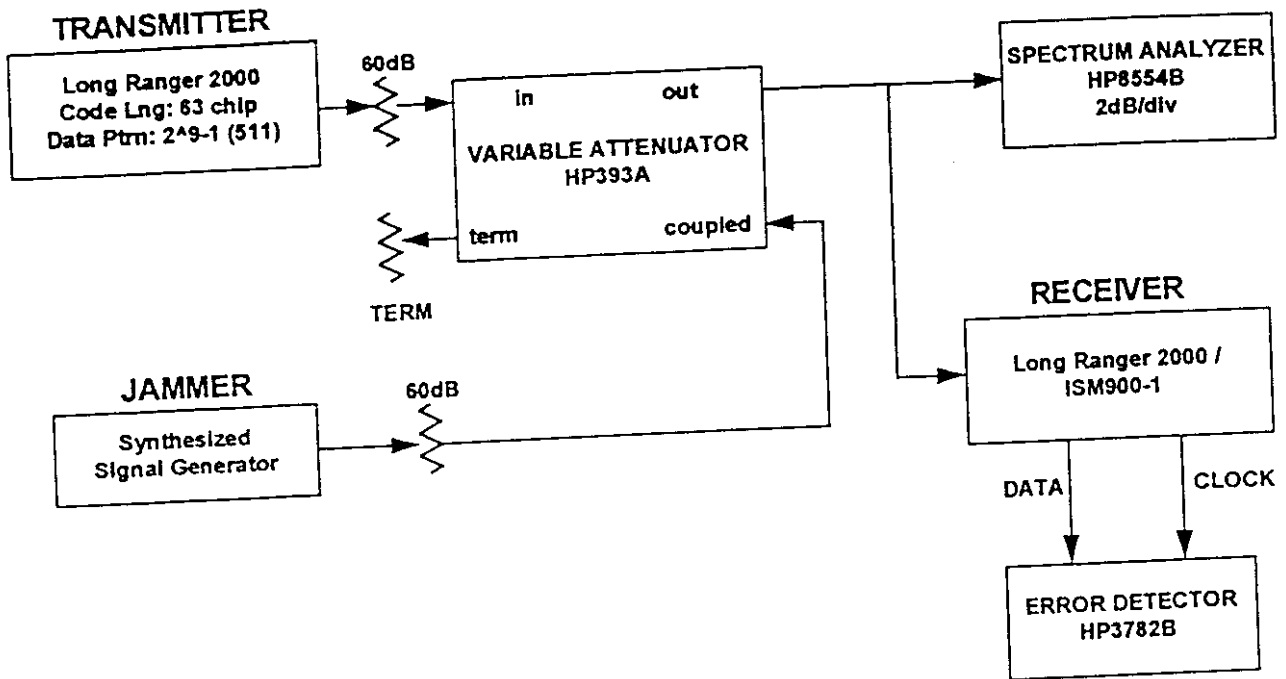
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UTILICOM  
MODEL: N/A  
SPREAD SPECTRUM DEVICE  
 HOT  NEUT

PEAKS FOUND ABOVE 38 dBuV

PEAK#	FREQ (MHz)	AMPL (dBuV)
1	.5311	39.7
2	.5218	38.3
3	.5374	37.3
4	.6548	36.0
5	.6560	36.4
6	17.61	36.8
7	20.14	36.7

Figure 1: Long Ranger 2000/ISM900-1 Processing Gain Setup

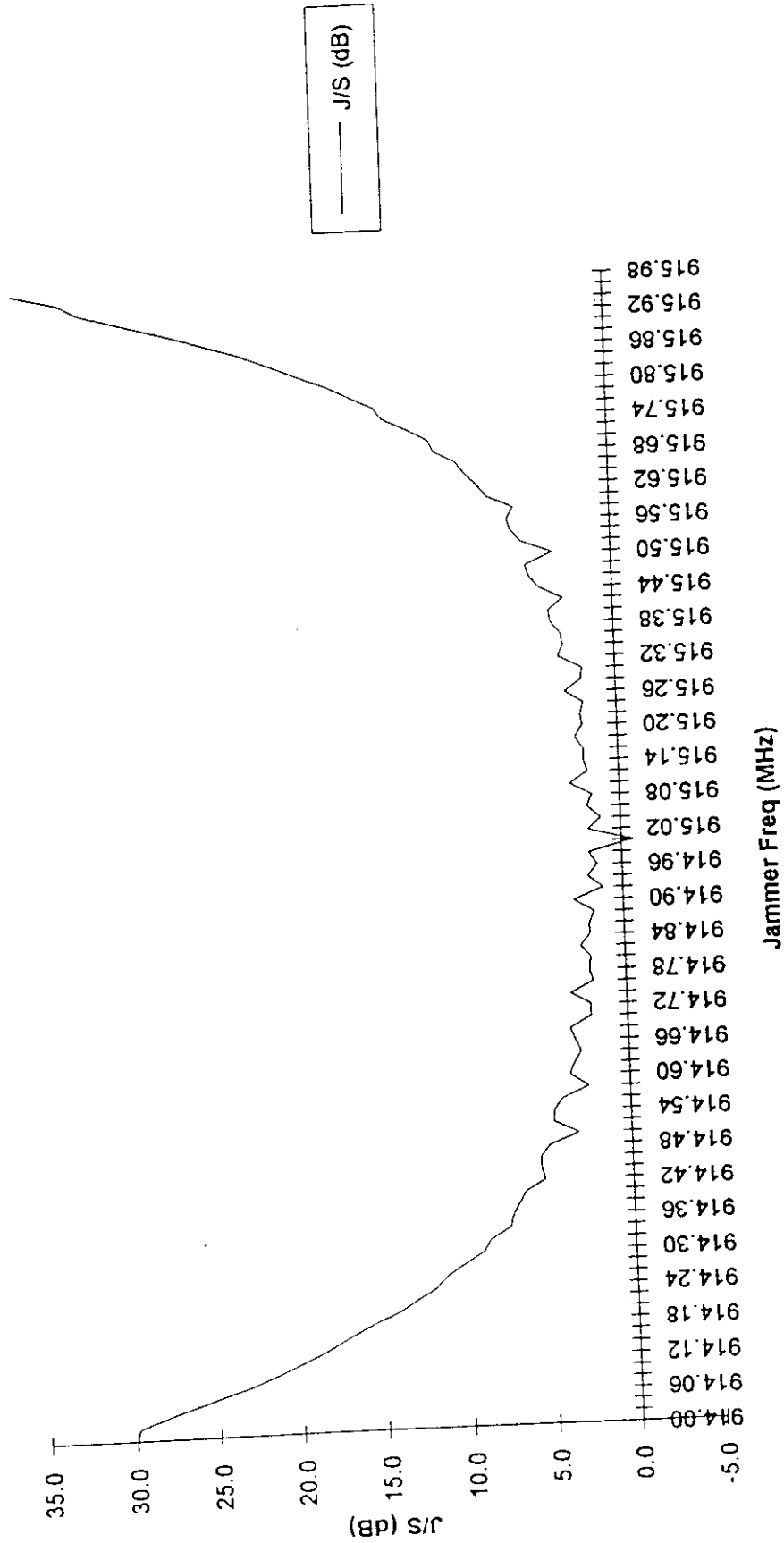


SSMPG16B.XLS

Jammer Freq (MHz)	J/S (dB)	P.G. (dB)	Jammer Freq (MHz)	J/S (dB)	P.G. (dB)
914.00	30.0	41.2	915.00	-0.7	10.50
914.02	29.8	41.0	915.02	2.0	13.20
914.04	27.9	39.1	915.04	1.2	12.40
914.06	25.7	36.9	915.06	2.0	13.20
914.08	23.5	34.7	915.08	1.7	12.90
914.10	21.7	32.9	915.10	3.0	14.20
914.12	20.1	31.3	915.12	1.9	13.10
914.14	18.5	29.7	915.14	2.1	13.30
914.16	17.1	28.3	915.16	2.1	13.30
914.18	15.8	27.0	915.18	2.6	13.80
914.20	14.2	25.4	915.20	2.1	13.30
914.22	13.1	24.3	915.22	2.2	13.40
914.24	12.0	23.2	915.24	2.0	13.20
914.26	11.3	22.5	915.26	3.1	14.30
914.28	10.2	21.4	915.28	2.1	13.30
914.30	9.1	20.3	915.30	2.0	13.20
914.32	8.7	19.9	915.32	3.4	14.60
914.34	7.5	18.7	915.34	3.1	14.30
914.36	7.3	18.5	915.36	3.2	14.40
914.38	6.9	18.1	915.38	3.8	15.00
914.40	6.5	17.7	915.40	3.9	15.10
914.42	5.3	16.5	915.42	3.0	14.20
914.44	5.5	16.7	915.44	4.4	15.60
914.46	5.5	16.7	915.46	5.0	16.20
914.48	5.0	16.2	915.48	5.2	16.40
914.50	3.2	14.4	915.50	3.5	14.70
914.52	4.7	15.9	915.52	5.4	16.60
914.54	4.6	15.8	915.54	6.0	17.20
914.56	4.1	15.3	915.56	6.2	17.40
914.58	2.5	13.7	915.58	5.8	17.00
914.60	3.6	14.8	915.60	7.3	18.50
914.62	3.3	14.5	915.62	7.9	19.10
914.64	2.9	14.1	915.64	8.6	19.80
914.66	3.2	14.4	915.66	9.1	20.30
914.68	3.5	14.7	915.68	10.4	21.60
914.70	2.2	13.4	915.70	10.7	21.90
914.72	2.2	13.4	915.72	11.9	23.10
914.74	3.4	14.6	915.74	13.3	24.50
914.76	2.0	13.2	915.76	13.8	25.00
914.78	2.2	13.4	915.78	15.2	26.40
914.80	2.1	13.3	915.80	16.6	27.80
914.82	2.7	13.9	915.82	18.3	29.50
914.84	2.1	13.3	915.84	20.0	31.20
914.86	2.1	13.3	915.86	21.7	32.90
914.88	1.8	13.0	915.88	23.9	35.10
914.90	3.0	14.2	915.90	26.1	37.30
914.92	1.2	12.4	915.92	28.5	39.70
914.94	2.1	13.3	915.94	30.9	42.10
914.96	1.5	12.7	915.96	32.1	43.30
914.98	2.0	13.2	915.98	34.8	46.00

System Center Frequency = 915.00 MHz

LONG RANGER 2000/ISM900-1



**EXHIBIT 11: Test Report for Utilicom Up/Down Converter FCC ID: LFO-ISM2400**

**33 Pages**



## EMISSIONS TEST REPORT FOR A LOW POWER TRANSMITTER

### I. GENERAL INFORMATION

Requirement: Federal Communications Commission (FCC)  
Certification under FCC Rule Part 15  
(Technical Requirements: 15.205, 15.247)

Applicant: Utilicom  
323 Love Place  
Goleta, CA 93117

Product ID: FCC ID: LFO-ISM2400

### II. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

The Utilicom 900/2400 Up/Down converter consists of a previously certificated spread spectrum transceiver (FCC ID: LFO-ISM900) connected via coaxial cable to a 2.4 GHz up/down converter. No hardware modifications were made to the LFO-ISM900. See Brief Product Description by Utilicom for further details of design and operation.

### III. TEST LOCATION

All emissions tests were performed at:

EC Labs  
Electronic Compliance Laboratories, Inc.  
1249 Birchwood Drive  
Sunnyvale, CA 94089

EC Labs has site descriptions on file with the FCC for 10m and 3m site configurations. Radiated emissions from the digital portion of the EUT were performed on the 10 m site.

AC line conducted emissions were performed in a screen room.

#### IV. TEST PROCEDURES

##### **Radiated Emissions**

##### **Test Requirement: 15.205**

1. The EUT was placed on a wooden turntable on the outdoor ground plane. The search antenna was placed 3m from the EUT. The EUT antenna was mounted vertically as per normal installation.
2. The turntable was slowly rotated to locate the direction of maximum emission at each harmonic and L.O. emission falling in the restricted bands of 15.205.
3. Once maximum direction was determined, the search antenna was raised and lowered in both vertical and horizontal polarizations. The maximum readings so obtained are recored in the data listed below.

**Test Results:** Refer to attached tabular data sheets

##### **Conducted Emissions**

##### **Test Requirement: 15.207**

1. The EUT was placed on a wooden table located near one wall of a screen room.
2. The AC-DC converter used by the LFO-ISM900 as a power supply was plugged into the LISN.
3. With EUT transmitting , line conducted data was taken.

**Test Results:** Refer to attached spectrum analyzer data charts

##### **Mimumum 6 dB Bandwidth for DSSS**

##### **Test Requirement: 15.247(a)(2)**

A spectrum analyzer was connected to the EUT antenna output port via a short coaxial cable. If required to protect the measurement instrument from overload, a coaxial attenuator was also used

The analyzer center frequency was set to the EUT carrier frequency. Using the analyzer DISPLAY LINE and MARKER DELTA functions, the 6 dB bandwidth of the emission was determined.

**Test Results:** Refer to attached spectrum analyzer data charts

Coaxial Attenuator:  Not used

Attenuation Used: \_\_\_\_\_dB

page 2      FCC ID: LFO-ISM2400

UTILICOM

**RF Power Output**

**Test Requirement: 15.247(b)**

The output of the EUT was connected directly to a power meter. If required to protect the measurement instrument from overload, a coaxial attenuator was also used.

Power level was read directly from the meter.

Coaxial Attenuator:  Not used                       Attenuation Used: \_\_\_\_\_dB

**Test Results**

<b>TX F, MHz</b>	<b>Power Meter Reading</b>	<b>Power Out (mW)</b>
2452	16.8	47.9
2464	16.6	45.7
2475	16.4	43.7

Antenna Gain: 3 - 4 dBi

Power reduction:                       Required                       Not required

**Out of Band Measurements**

**Test Requirement: 15.247(c)**

A spectrum analyzer was connected to the EUT antenna output port via a short coaxial cable. If required to protect the measurement instrument from overload, a coaxial attenuator was also used.

The analyzer RES BW was set to 100 kHz. Sufficient spectrum analyzer chartes were produced to cover up to the 10th harmonic of the transmit frequency.

The maximum transmitter power was recorded on each chart using the spectrum analyzer DISPLAY LINE function.

**Test Results:** Refer to attached spectrum analyzer data charts

Coaxial Attenuator:  Not used                       Attenuation Used: \_\_\_\_\_dB

**DSSS Power Density**

**Test Requirement: 15.247(d)**

A spectrum analyzer was connected to the EUT antenna output port via a short coaxial cable. If required to protect the measurement instrument from overload, a coaxial attenuator was also used.

The analyzer center frequency was set to the EUT carrier frequency. The frequencies between which maximum RF emissions occurred were determined using the analyzer DISPLAY LINE and MARKER DELTA functions. The START and STOP frequencies of the analyzer sweep were set to these frequencies.

Analyzer BW was set to 3 kHz. Analyzer SWEEP TIME was set according to the following formula:

$$\text{SWEEP TIME} = (\text{FSTOP,kHz} - \text{FSTART,kHz})/3 \text{ kHz.}$$

The transmitter emissions so measured were compared to the 8 dBm limit in the Rules.

**Test Results:** Refer to attached spectrum analyzer data charts

Coaxial Attenuator:  Not used                       Attenuation Used: \_\_\_\_\_dB

**Processing Gain of a DSSS**

**Test Requirement: 15.247(e)**

Processing gain was determined by analysis by the manufacturer. Please refer to the attached processing gain information provided by the manufacturer.

**V. CERTIFICATION OF DATA**

All radiated and conducted measurements described in this report were performed by, or were witnessed and supervised by, the undersigned. To the best of his knowledge and belief, test equipment calibrations, test procedures, and test data were accurate and as reported here.



T.N. COKENIAS

## EQUIPMENT USED TO PERFORM TESTS

DESCRIPTION	MFR.	MODEL	S/N	TEST
Horn Antenna	EMCO	3115	543	15.205
Spectrum Analyzer	HP	8563A	1183	above 6.9 GHz
Spectrum Analyzer	HP	85462A	3325A0137	.45 - 6900 MHz
Power Meter	HP	435B	n/a	15.247(b)
Preamplifier	HP	8449B	3008A00527	15.205
LISN	Electro Metrics	ANS-25/2	2532	15.207
High Pass AC Line Filter	Solar	7801-5.0	n/a	15.207
High Pass Microwave Filter	Microlab	HA-150	n/a	15.205
RF Cable	Andrews	helix	n/a	all

## RADIATED EMISSIONS (15.205)

34915		FCC RADIATED DATA SHEET	
EUT:	up/down	CUSTOMER NAME: Utilicom	
RULE PAI:	15.205	15.247, 15.205	
DIST dB: 0		DUTY dB: 0	ATTN dB: 0
		HP IL dB: 1	

FREQ. MHz	READING dB(uV)	Pk, QP, or Av	A.F. dB	Cable loss dB	AMP dB	O.C.F. dB	TOTAL, dB(uV/m)	LIMIT dB(uV/m)	DELTA dB
ch 128									
4925.8	44.8	Pk	31.4	7.0	-35.5	1	48.73	74.0	-25.3
4925.8	35.1	Av	31.4	7.0	-35.5	1	39.03	54.0	-15.0
1547	25.7	Pk	24.3	4.5	0.0	1	55.52	74.0	-18.5
1547	21.4	Av	24.3	4.5	0.0	1	51.22	54.0	-2.8
ch240									
4948	48.6	Pk	31.4	7.0	-35.9	1	52.13	74.0	-21.9
4948	41.2	Av	31.4	7.0	-35.9	1	44.73	54.0	-9.3
1547	21.5	Av	24.3	4.5	0.0	1	51.32	54.0	-2.7

NOTE:

$f_0 = 1547 \text{ MHz}$

## CONDUCTED EMISSIONS (15.207)





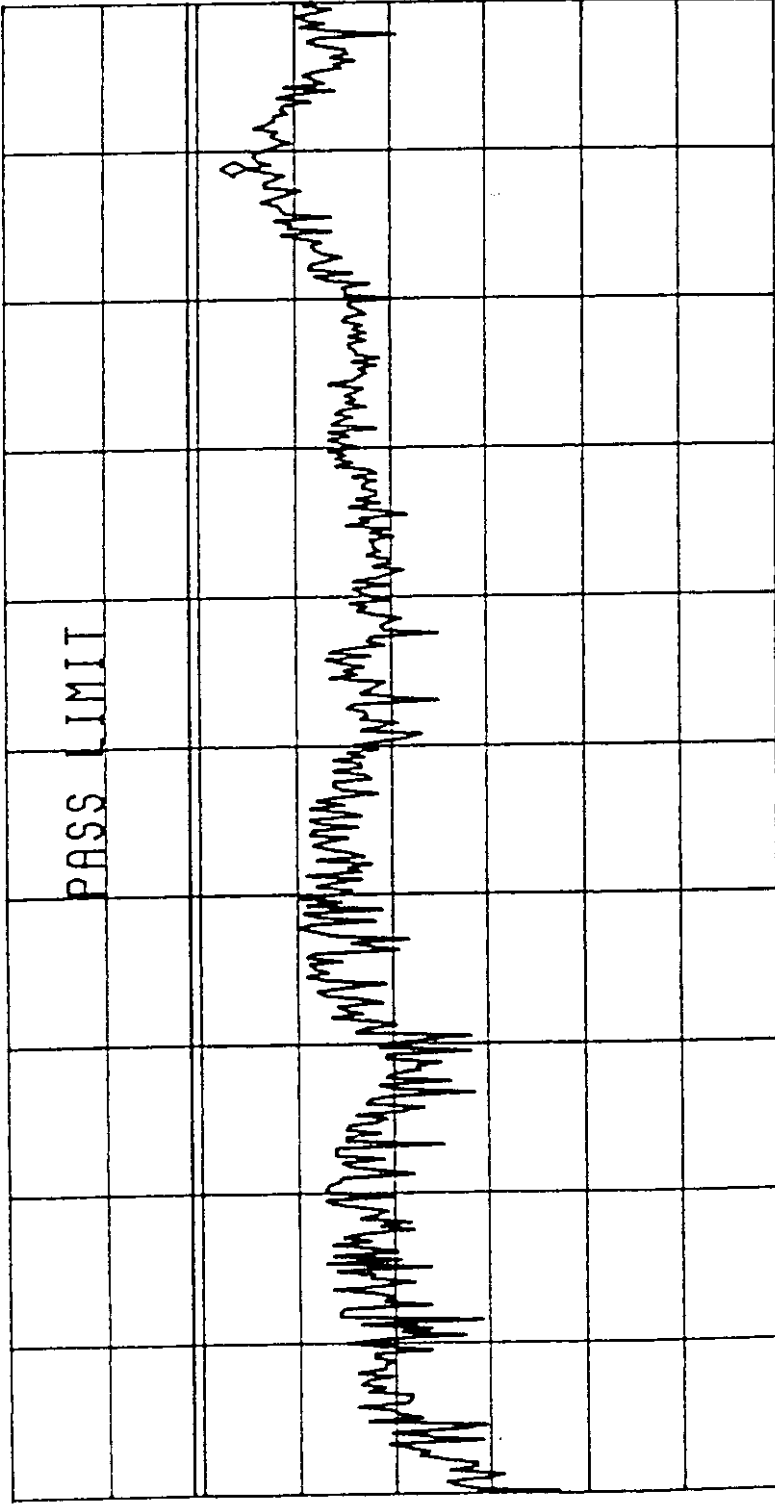
00:39:24 AUG 05, 1995  
AC LINE CONC UP/CONV L N

SWEPTIME  
2.46 sec

ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 26.68 MHz  
41.73 dB $\mu$ V

LOG REF 67.0 dB $\mu$ V

10  
dB/  
ATN  
10 dB



START 450 kHz #IF BW 9.0 kHz #AVG BW 10 kHz STOP 30.00 MHz  
SWP 2.46 sec

**MINIMUM 6 DB BANDWIDTH (15.247(a)(2))**

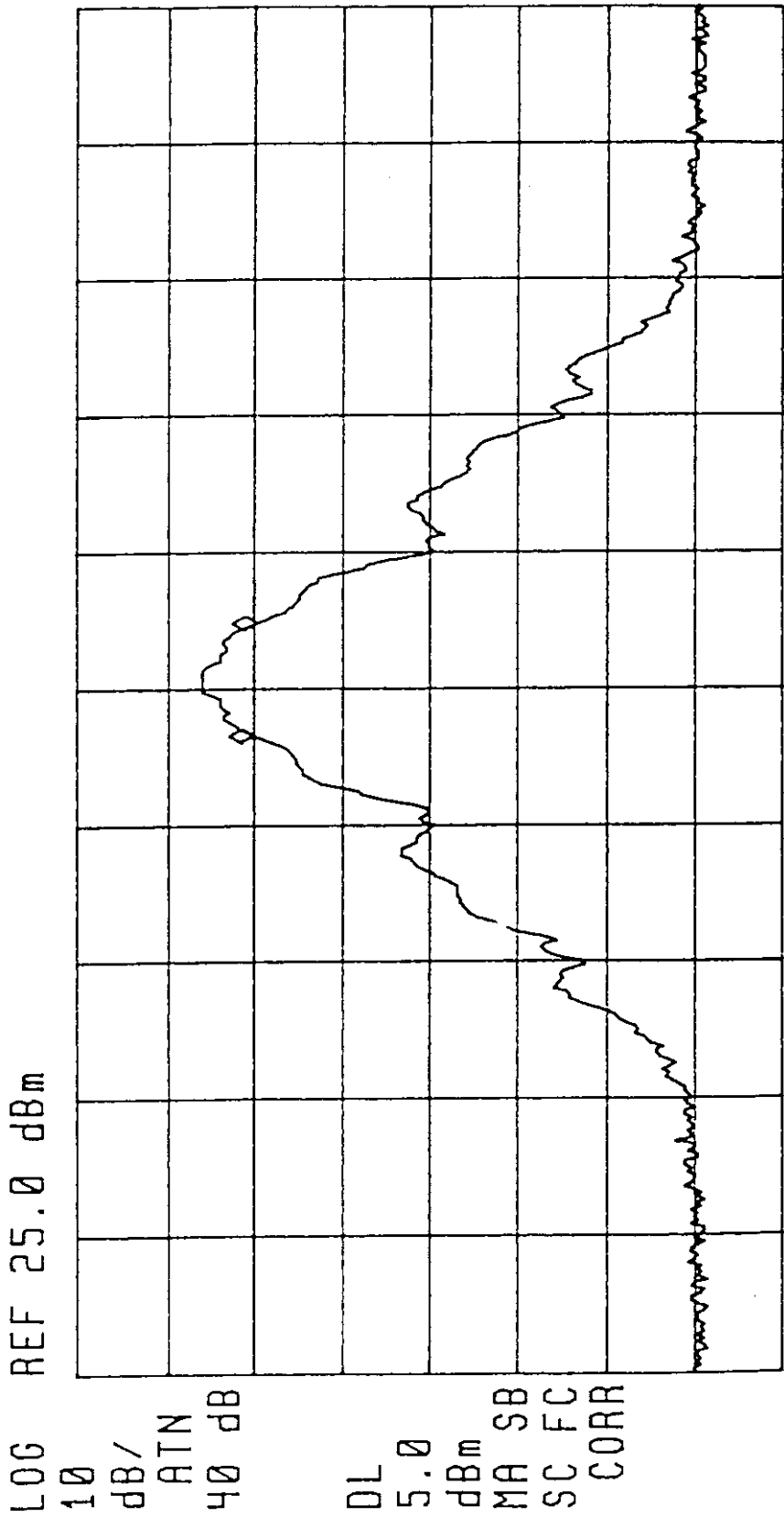


22:35:38 AUG 04, 1995  
UP/DOWN 100KHZ, OCC CH (128)

MARKER  $\Delta$   
830 kHz  
-.37 dB

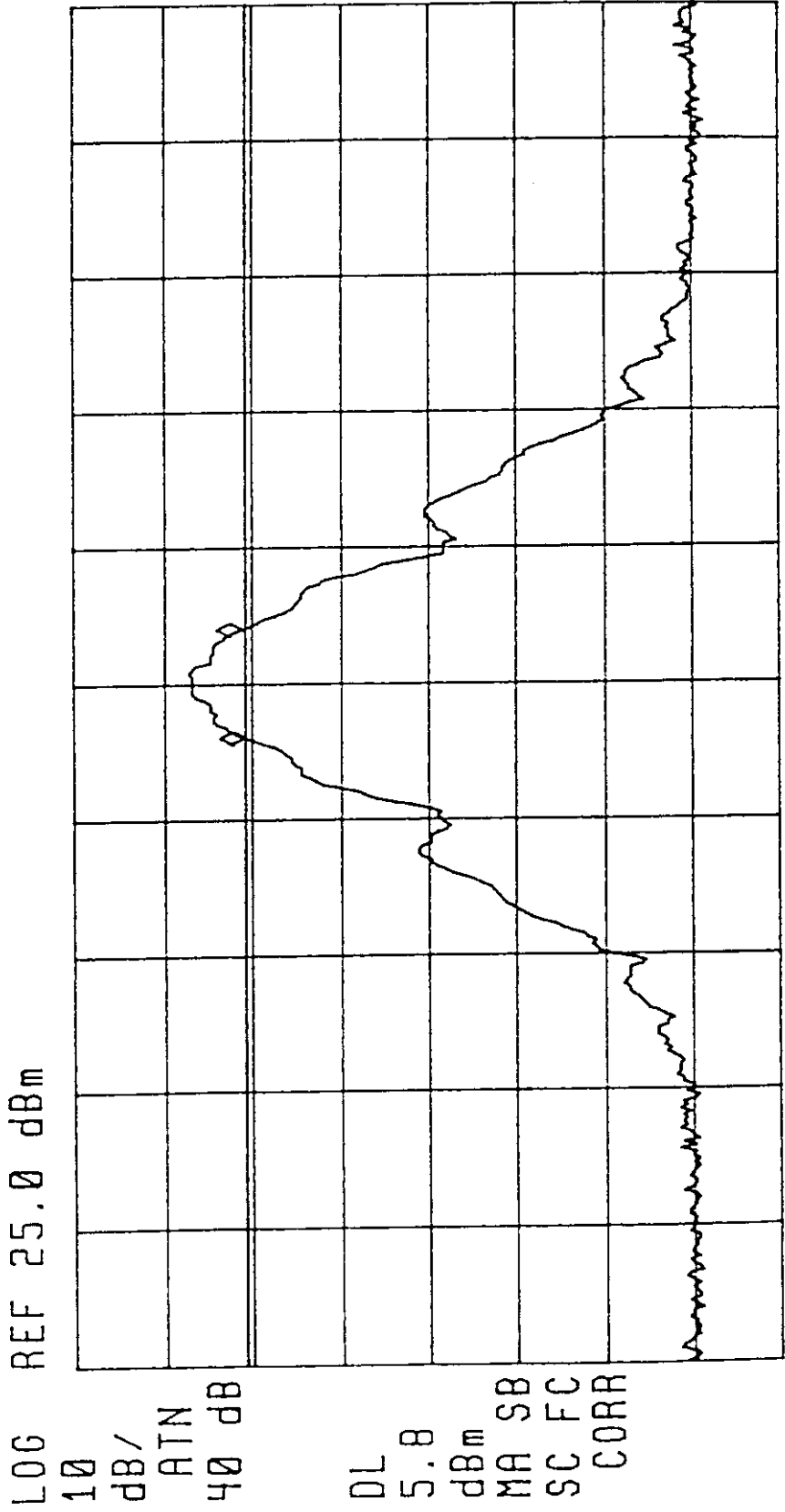
ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR  $\Delta$  830 kHz  
-.37 dB

6 dB BW



22:12:46 AUG 04, 1995  
UP/DOWN 100KHZ, OCC CH 2-40

MARKER  $\Delta$  ACTV DET: PEAK  
820 kHz MEAS DET: PEAK QP AVG  
.19 dB MKR  $\Delta$  820 kHz  
.19 dB  
6dB BW



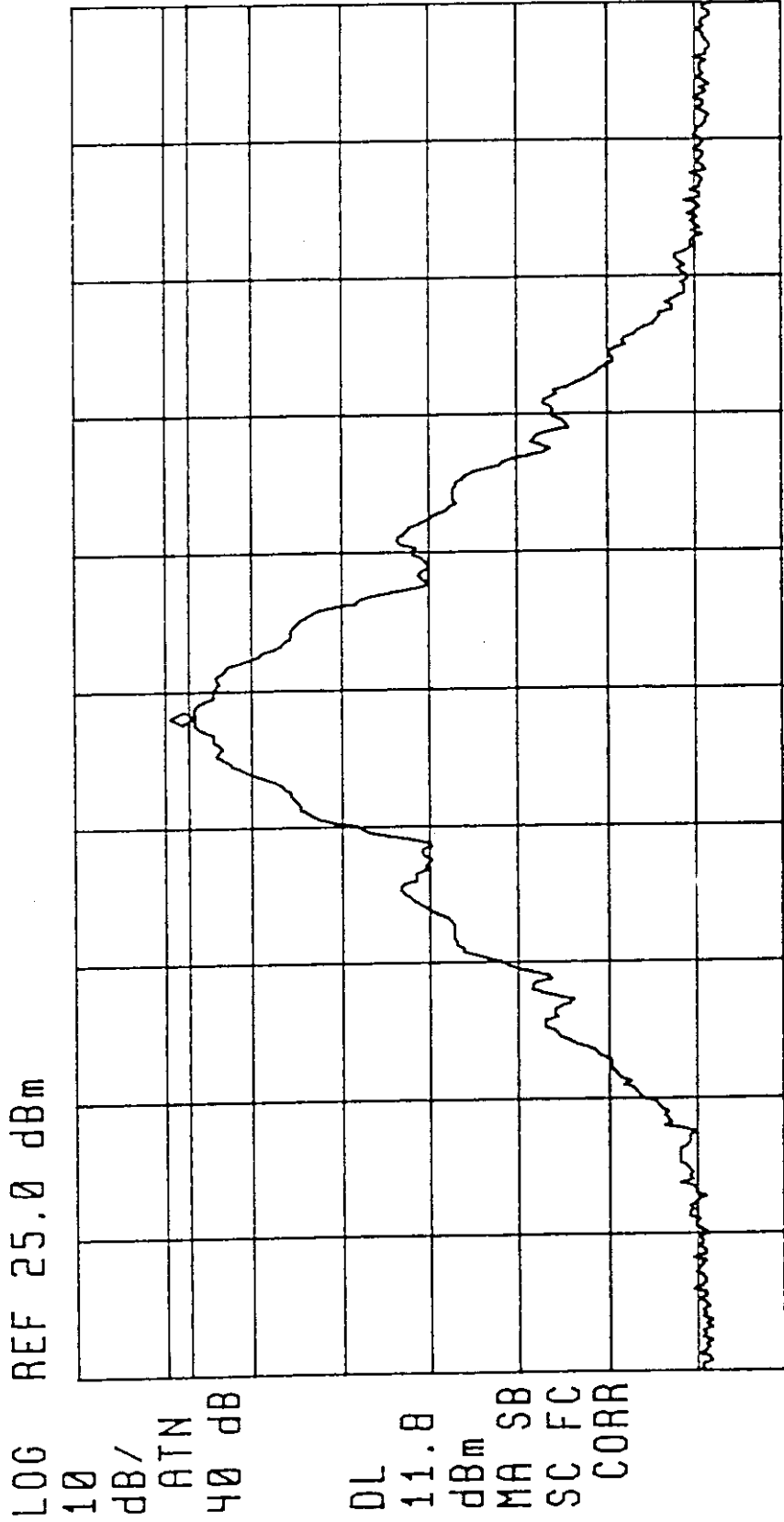
## OUT OF BAND MEASUREMENTS (15.247(c))



1:23:40 AUG 04, 1995  
 UTILICOM#(S)UP/DOWN CONV 100KHZ OCC

SPAN  
 10.00 MHz

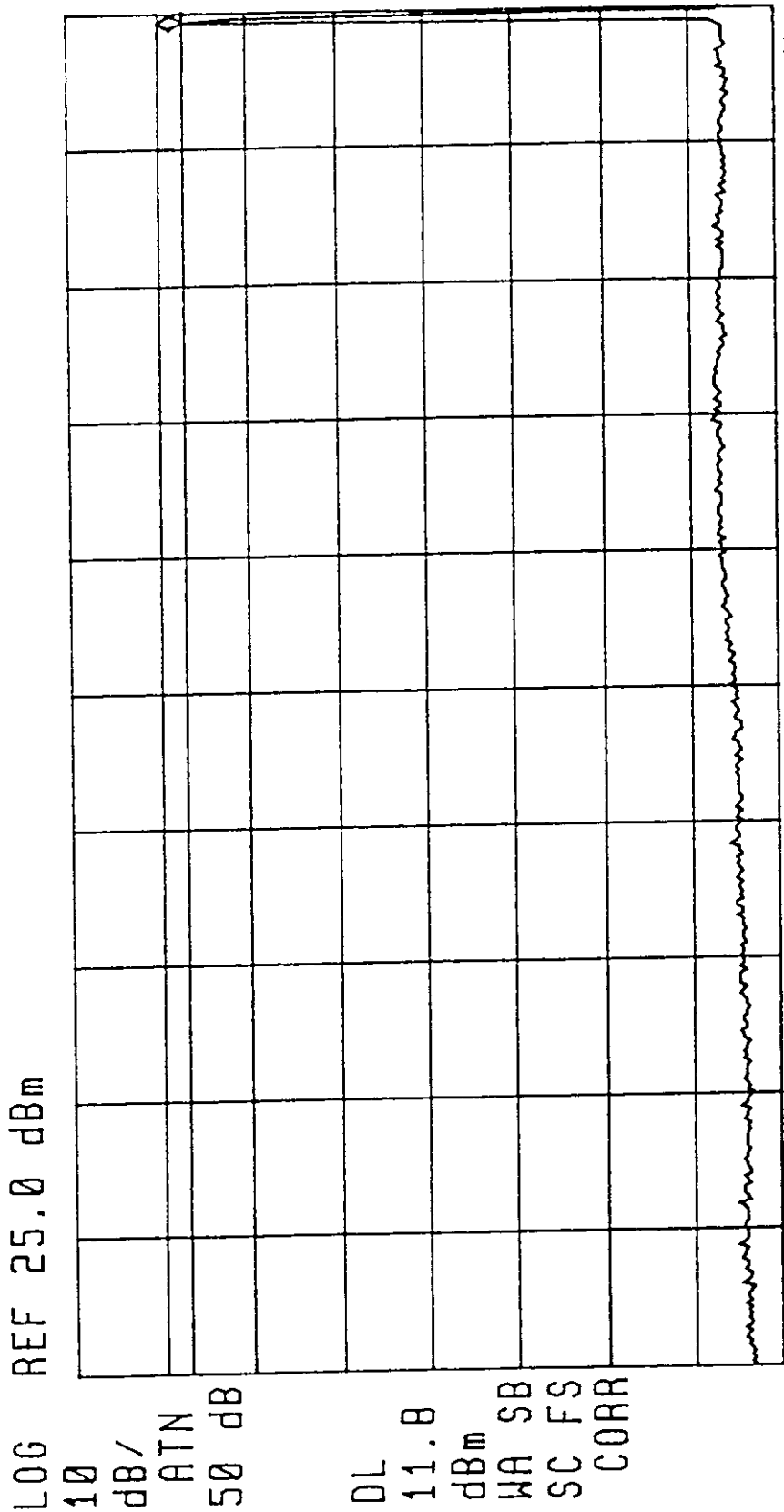
ACTV DET: PEAK  
 MEAS DET: PEAK QP AVG  
 MKR 2.45150 GHz  
 11.31 dBm





CP 06:51 AUG 04, 1995  
UTILICOM#15 UP/DOWN CONV 100KHZ OCC

ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 2.475 GHz  
11.81 dBm



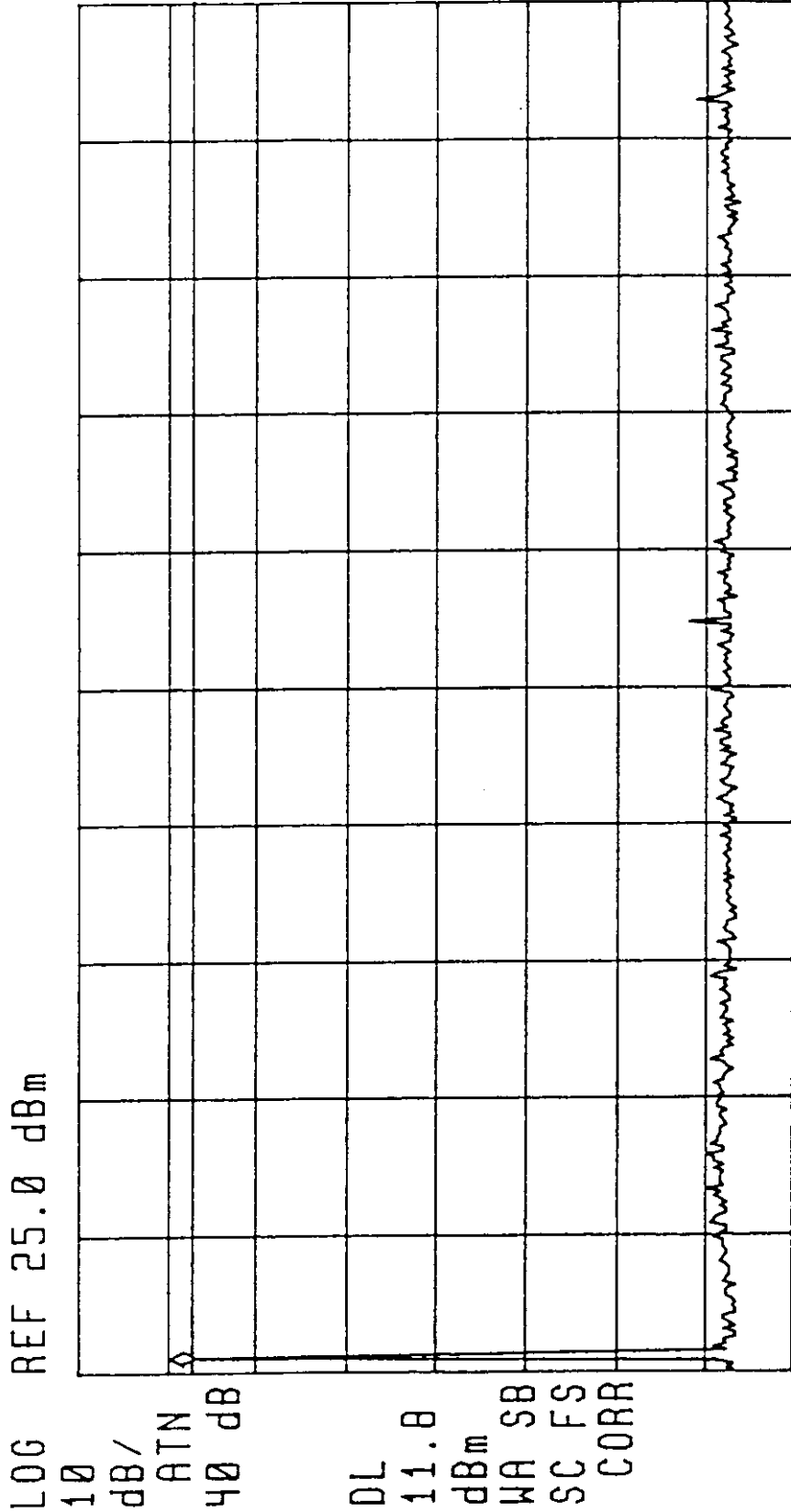
CENTER 1.257 GHz  
#IF BW 100 kHz  
AUG BW 30 kHz  
SPAN 2.474 GHz  
SWP 2.47 sec



21:11:57 AUG 04, 1995  
 UTILICOM#15 UP/DOWN CONV 100KHZ OCC

SWEPTIME  
 4.10 sec

ACTV DET: PEAK  
 MEAS DET: PEAK QP AVG  
 MKR 2.441 GHz  
 11.51 dBm



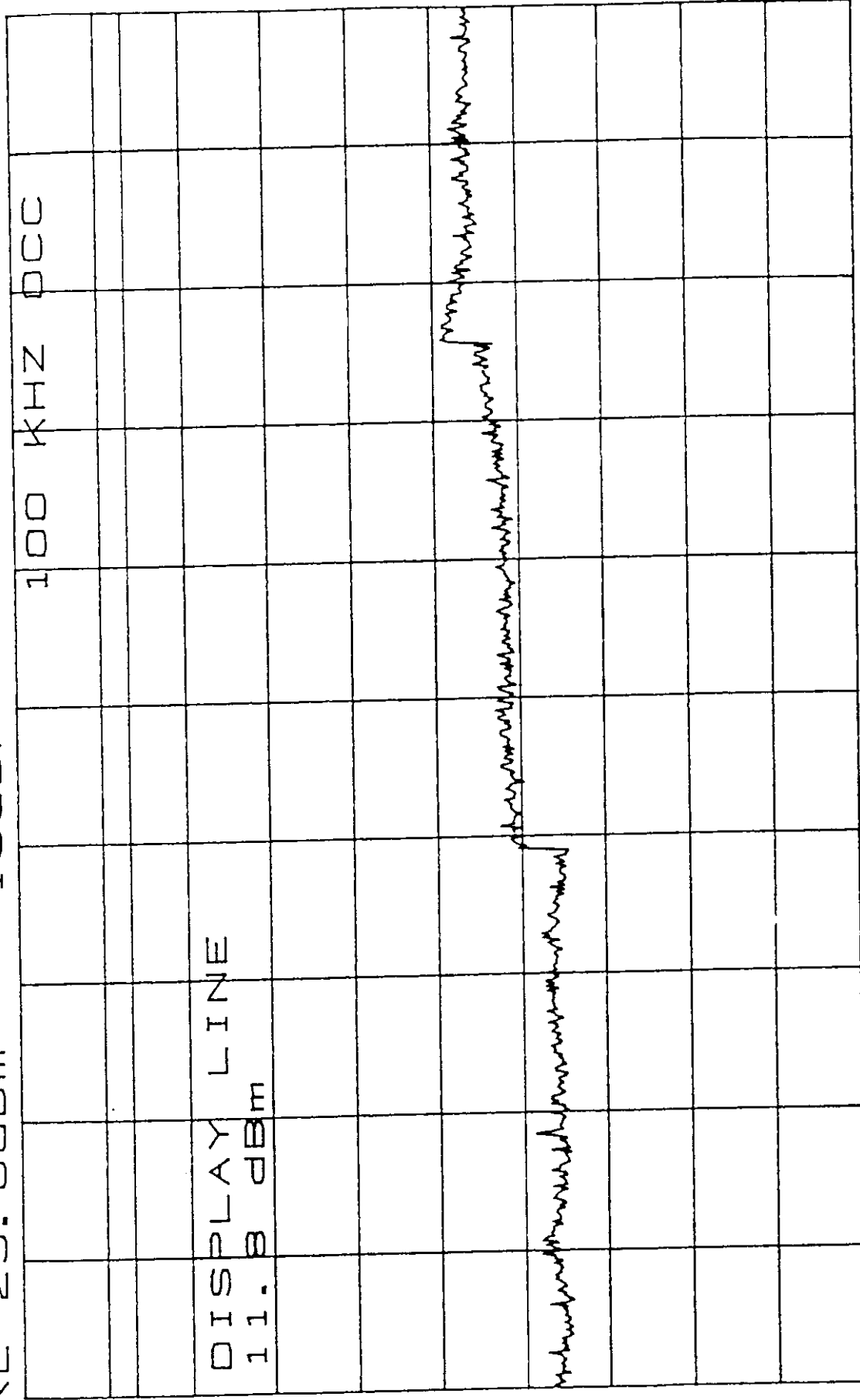
START 2.400 GHz      #IF BW 100 kHz      AVG BW 30 kHz      STOP 6.500 GHz  
 SWP 4.10 sec

UTILICE UP/DOWN CH.15 100kHz OCC

ATTEN 40dB

RL 25.0dBm

10dB/



DS

START 6.00GHZ

\*RBW 100KHZ

STOP 24.00GHZ

VBW 100KHZ

SWP 4.5sec

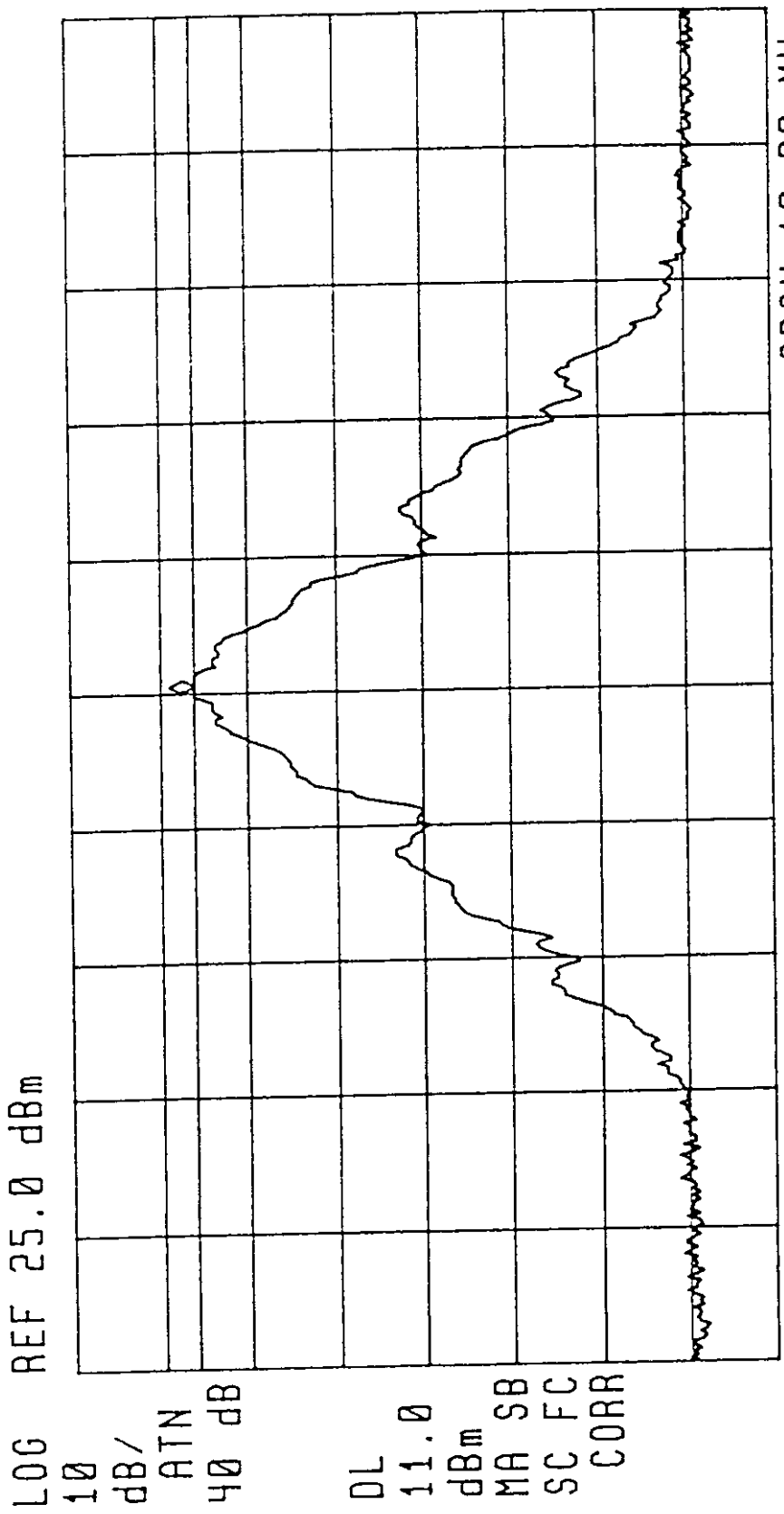


2:32:27 AUG 04, 1995  
 UP/DOWN 100KHZ, OCC CH

128

ADRS / OPERATION

ACTV DET: PEAK  
 MEAS DET: PEAK QP AVG  
 MKR 2.46280 GHz  
 11.01 dBm



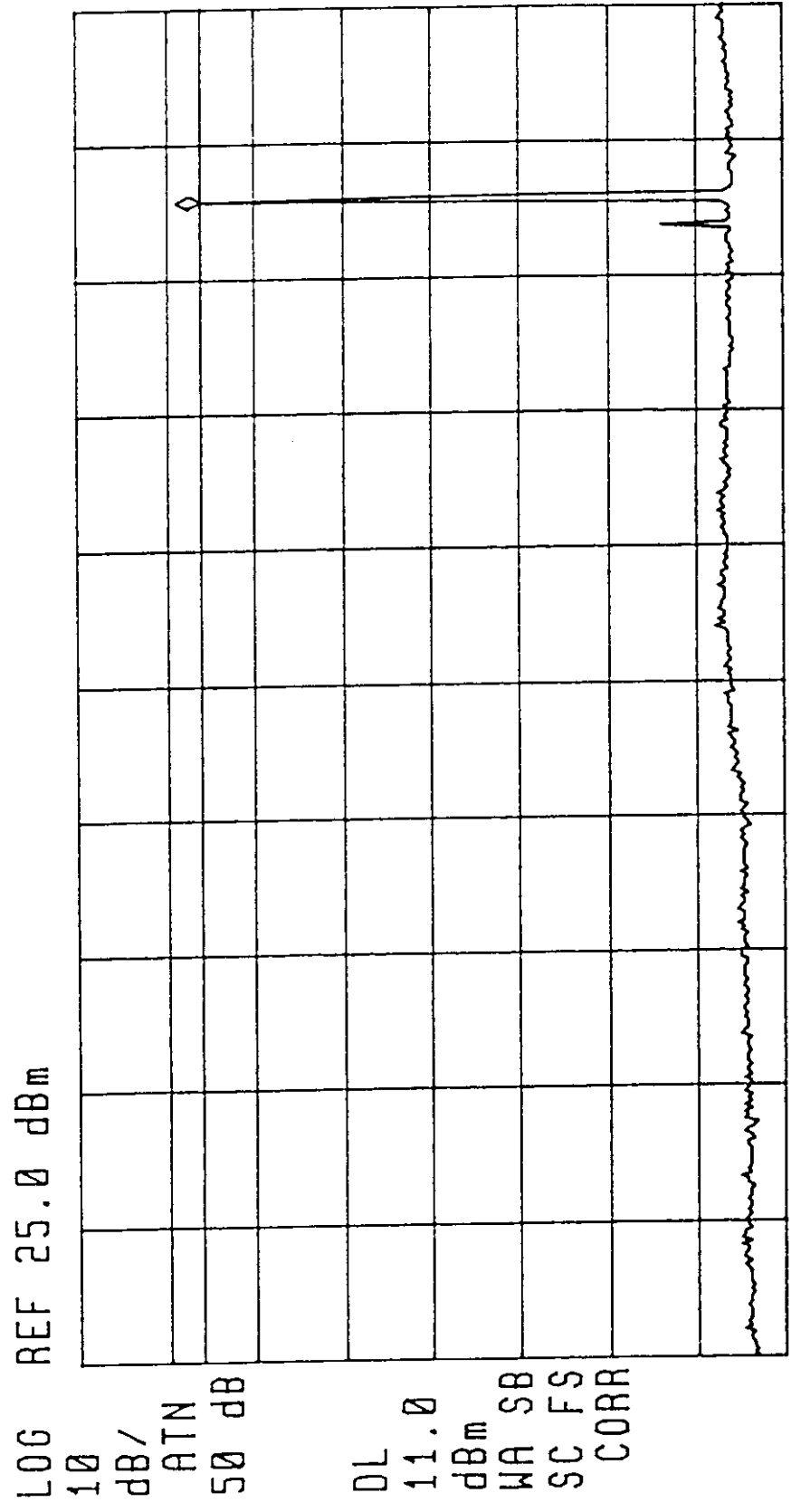
CENTER 2.46275 GHz  
 #IF BW 100 kHz  
 AVG BW 30 kHz  
 SPAN 10.00 MHz  
 SWP 20.0 msec



c2:39:53 AUG 04, 1995  
UP/DOWN 100KHZ, OCC CH (128)

SWEPTIME  
2.88 sec

ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 2.490 GHz  
11.02 dBm

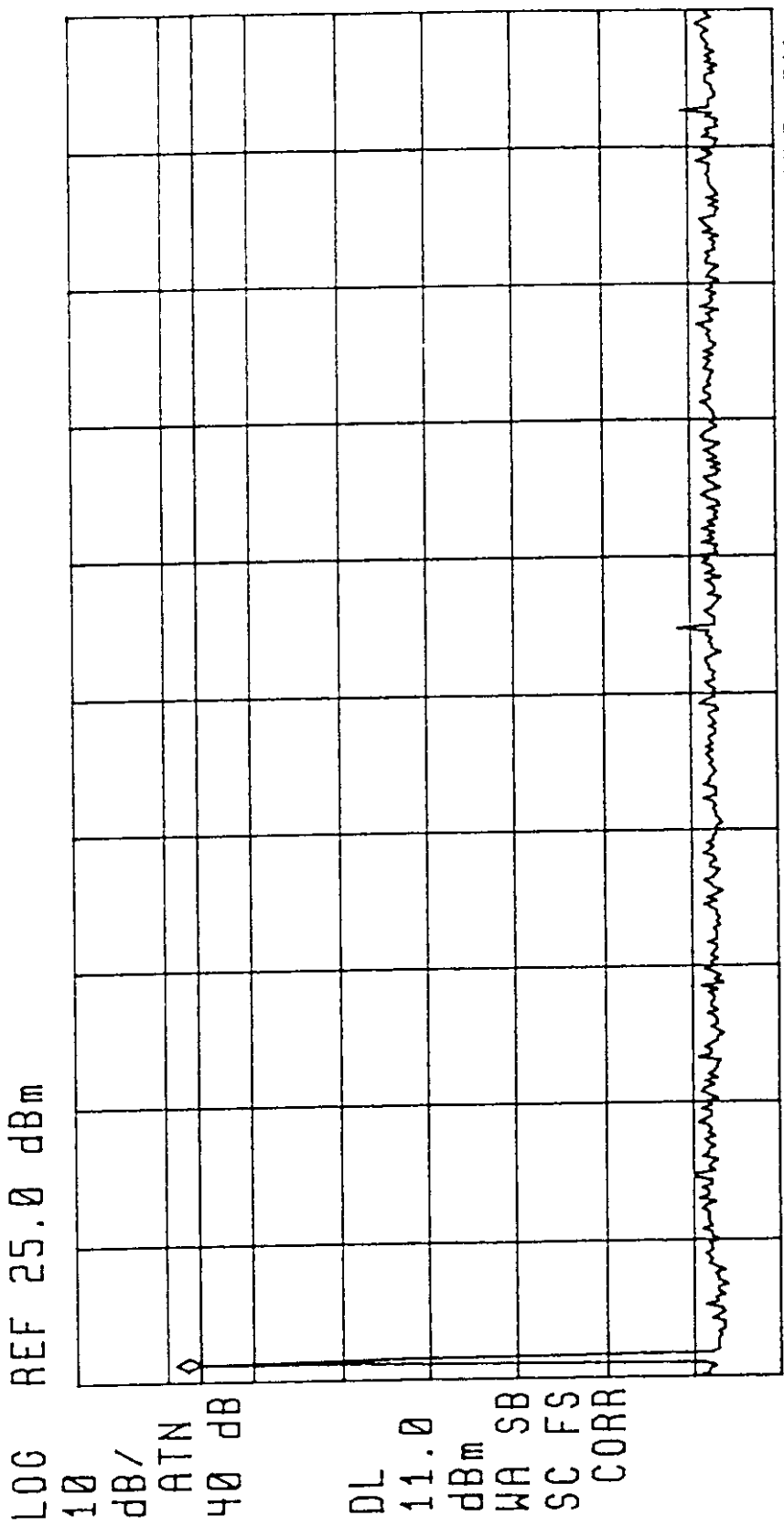


START 20 MHz #IF BW 100 kHz  
STOP 2.900 GHz SWP 2.88 sec  
AUG BW 30 kHz

2:42:59 AUG 04, 1995  
UP/DOWN 100KHZ, OCC CH 128

SWEPTIME  
4.10 sec

ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 2.451 GHz  
10.77 dBm

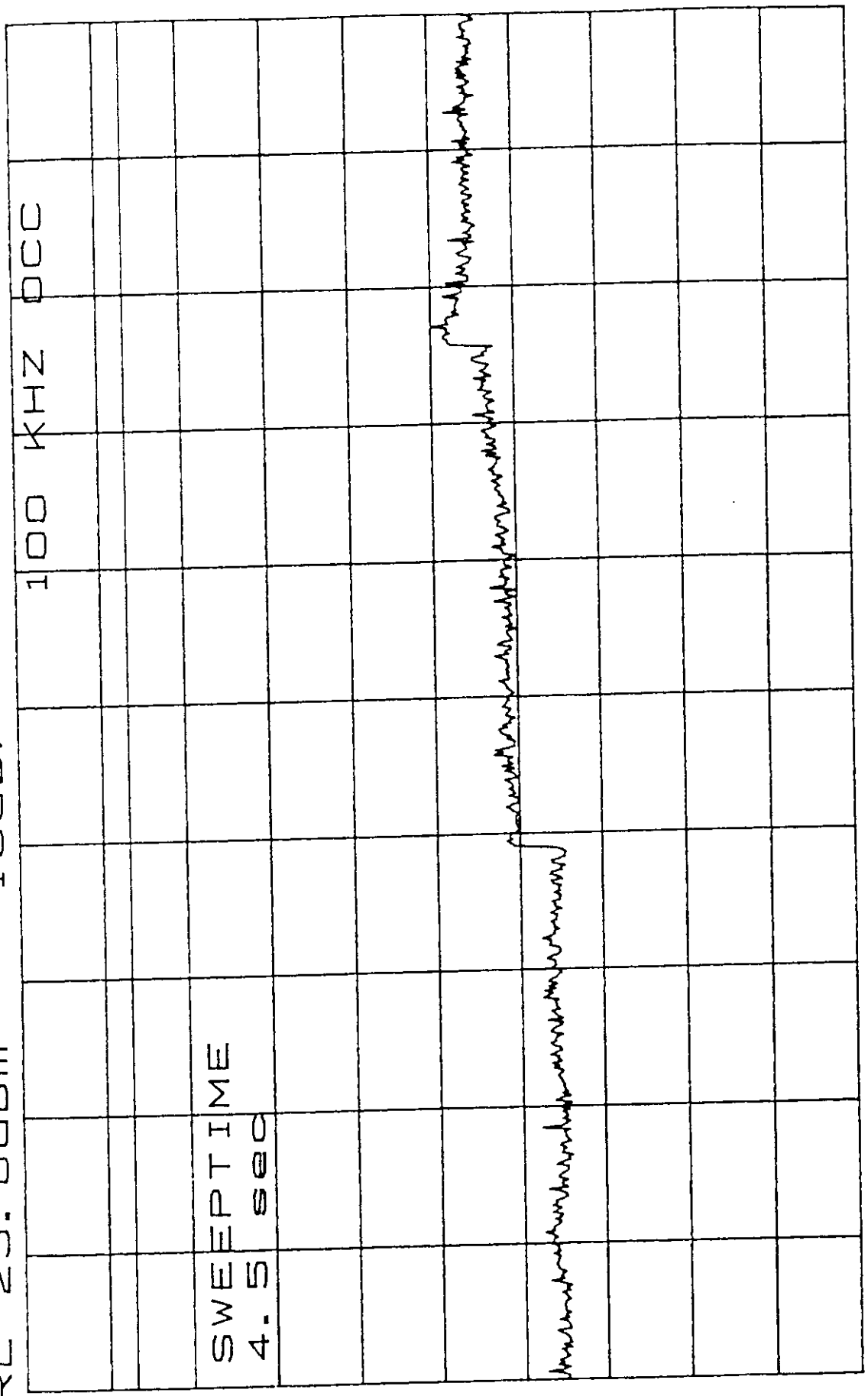


START 2.400 GHz #IF BW 100 kHz  
STOP 6.500 GHz AVG BW 30 kHz  
SWP 4.10 sec

Ch. 128

ATTEN 40dB  
RL 25.0dBm

10dB/



100 KHZ 0CC

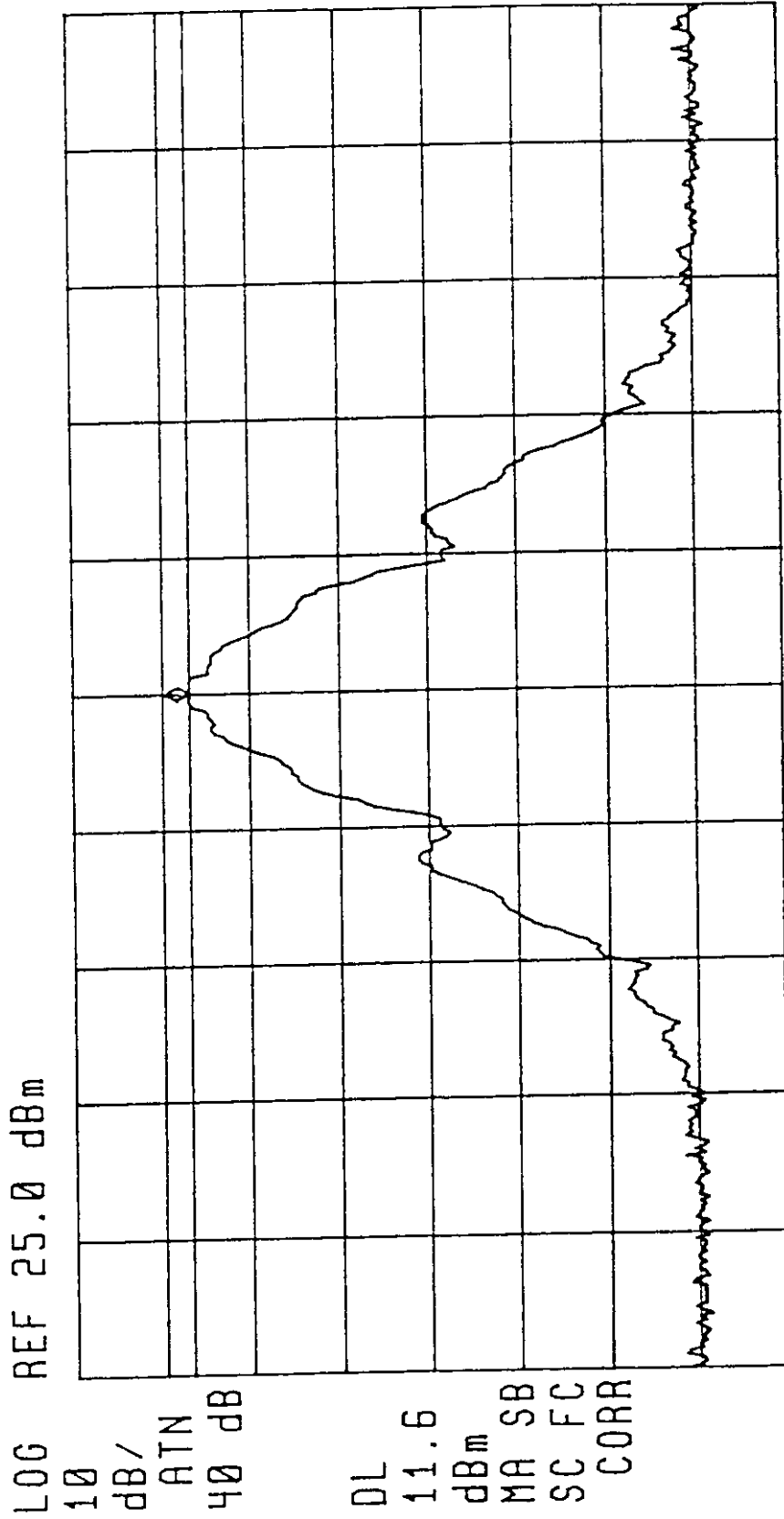
D S

START 6.00GHZ      STOP 24.00GHZ  
\*RBW 100KHZ      VBW 100KHZ      SWP 4.5sec

2:09:41 AUG 04, 1995  
UP/DOWN 100KHZ, OCC CH 240

ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 2.47407 GHz  
11.79 dBm

PREFIX= NATO



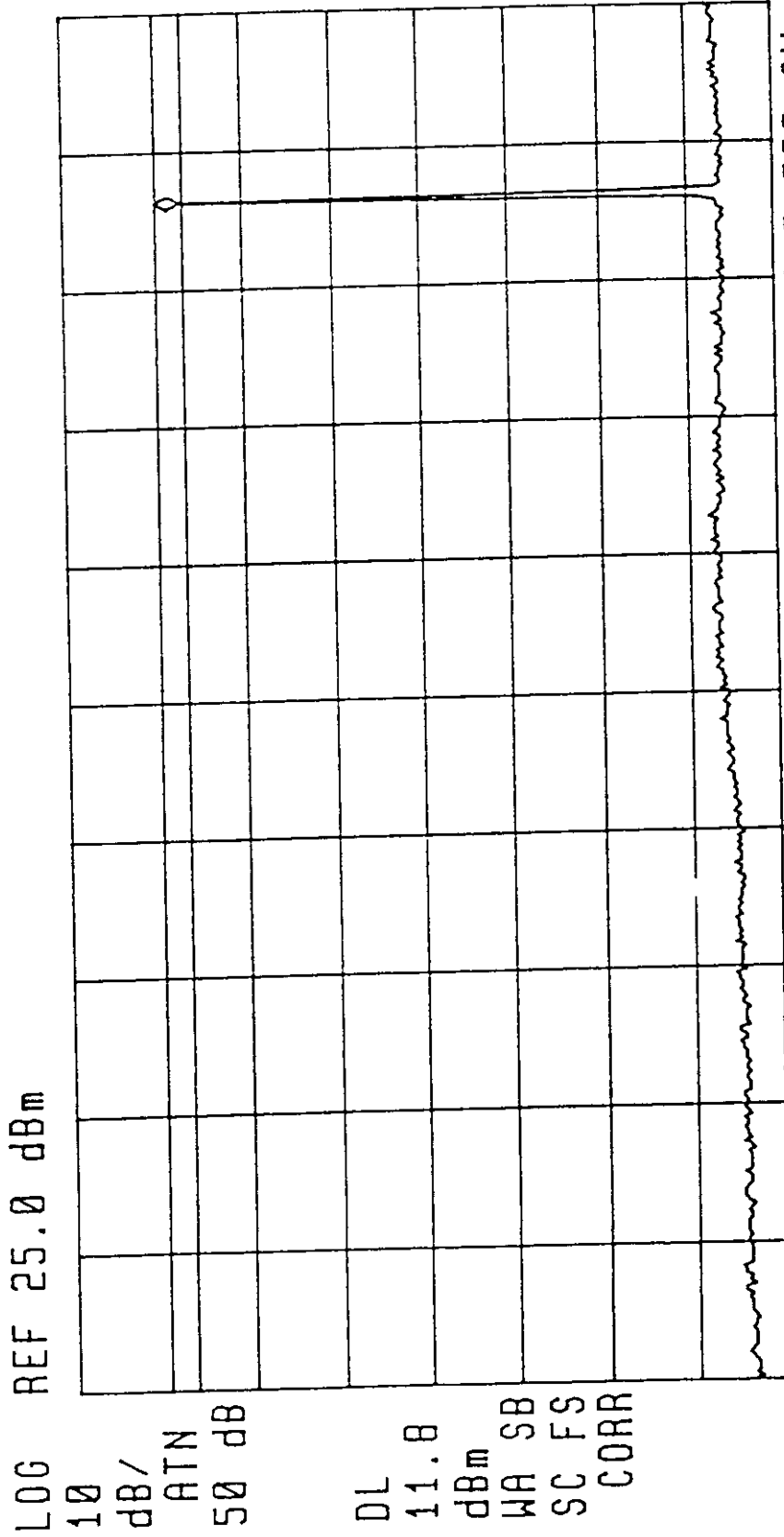




c2:17:15 AUG 04, 1995  
 UP/DOWN 100KHZ, OCC CH 240

SWEPTIME  
 2.88 sec

ACTV DET: PEAK  
 MEAS DET: PEAK QP AVG  
 MKR 2.504 GHz  
 11.88 dBm



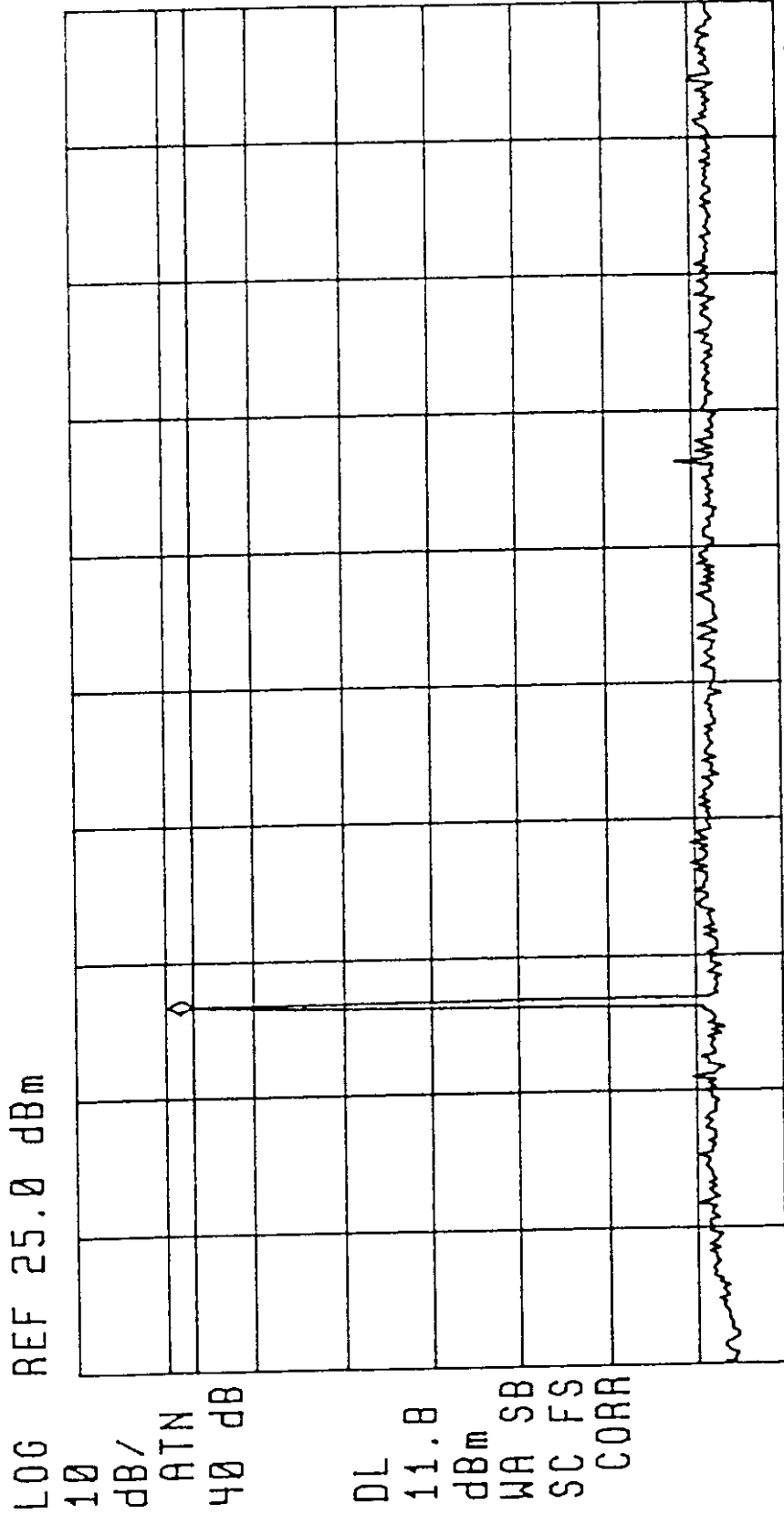
START 20 MHz #IF BW 100 kHz AVG BW 30 kHz STOP 2.900 GHz SWP 2.88 sec



2:20:17 AUG 04, 1995  
 UP/DOWN 100KHZ, OCC CH 240

SWEPTIME  
 5.50 sec

ACTV DET: PEAK  
 MEAS DET: PEAK QP AVG  
 MKR 2.471 GHz  
 11.62 dBm

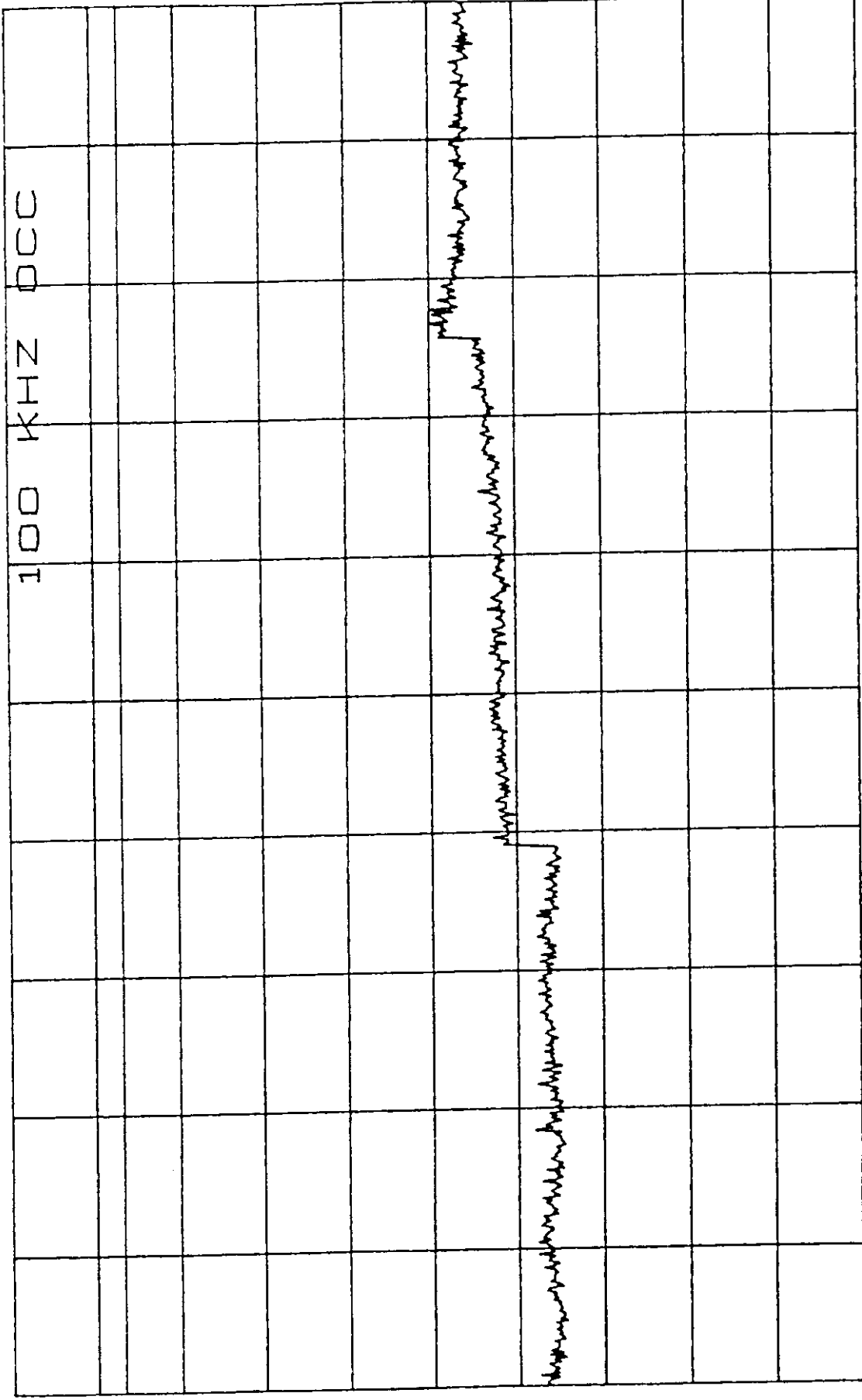


LOG REF 25.0 dBm  
 START 1.000 GHz #IF BW 100 kHz  
 STOP 6.500 GHz AVG BW 30 kHz  
 SWP 5.50 sec

Ch. 240

ATTEN 40dB  
RL 25.0dBm

10dB/



DS

START 6.00GHZ      STOP 24.00GHZ  
\*RBW 100KHZ      VBW 100KHZ      SWP 4.5sec

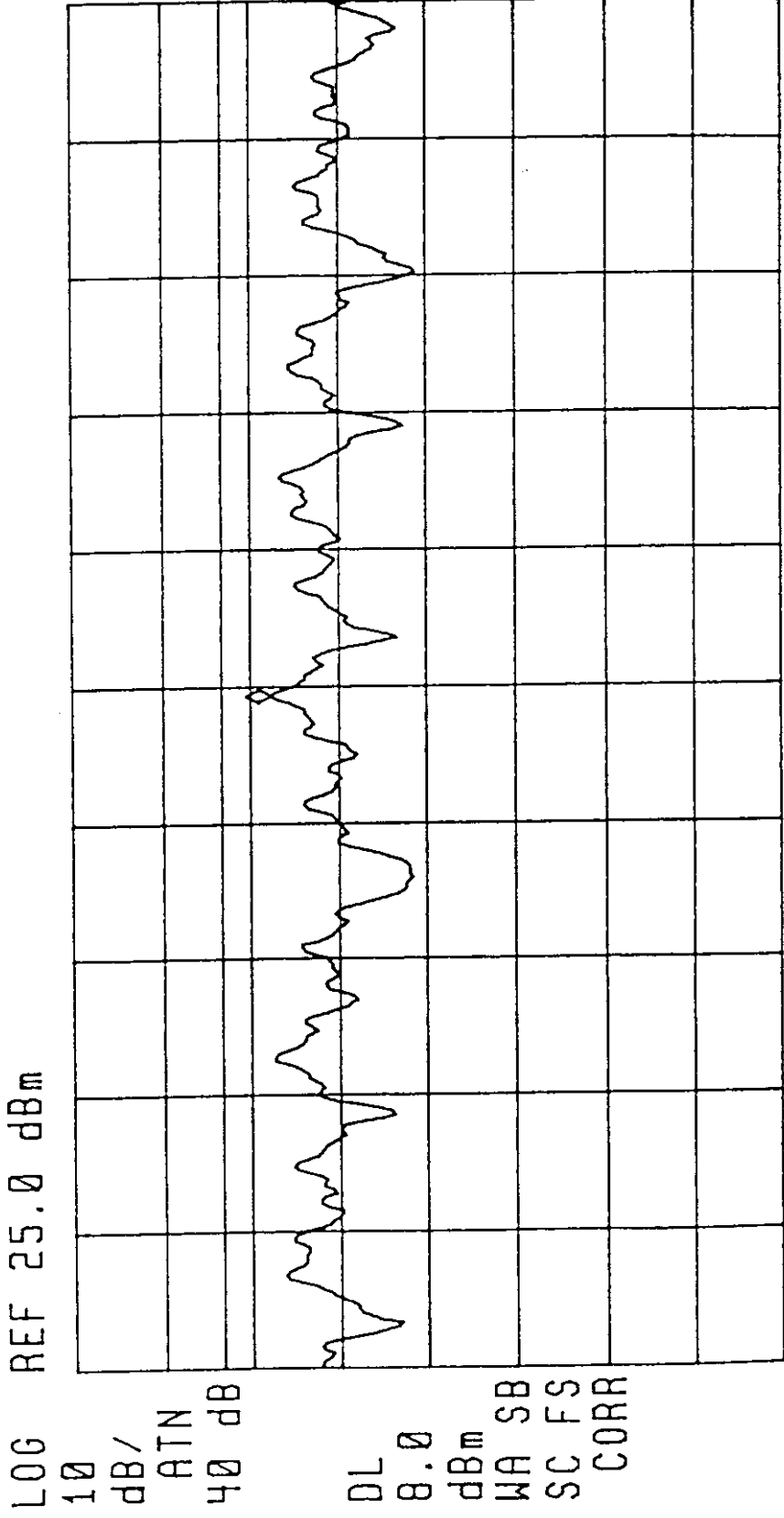
**DSSS POWER DENSITY (15.247(d))**

Ch. 15

21:56:17 AUG 04, 1995  
CH 15 UP/DOWN PWR DENSITY

SWEPTIME  
100 sec

ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 2.4515407 GHz  
2.30 dBm

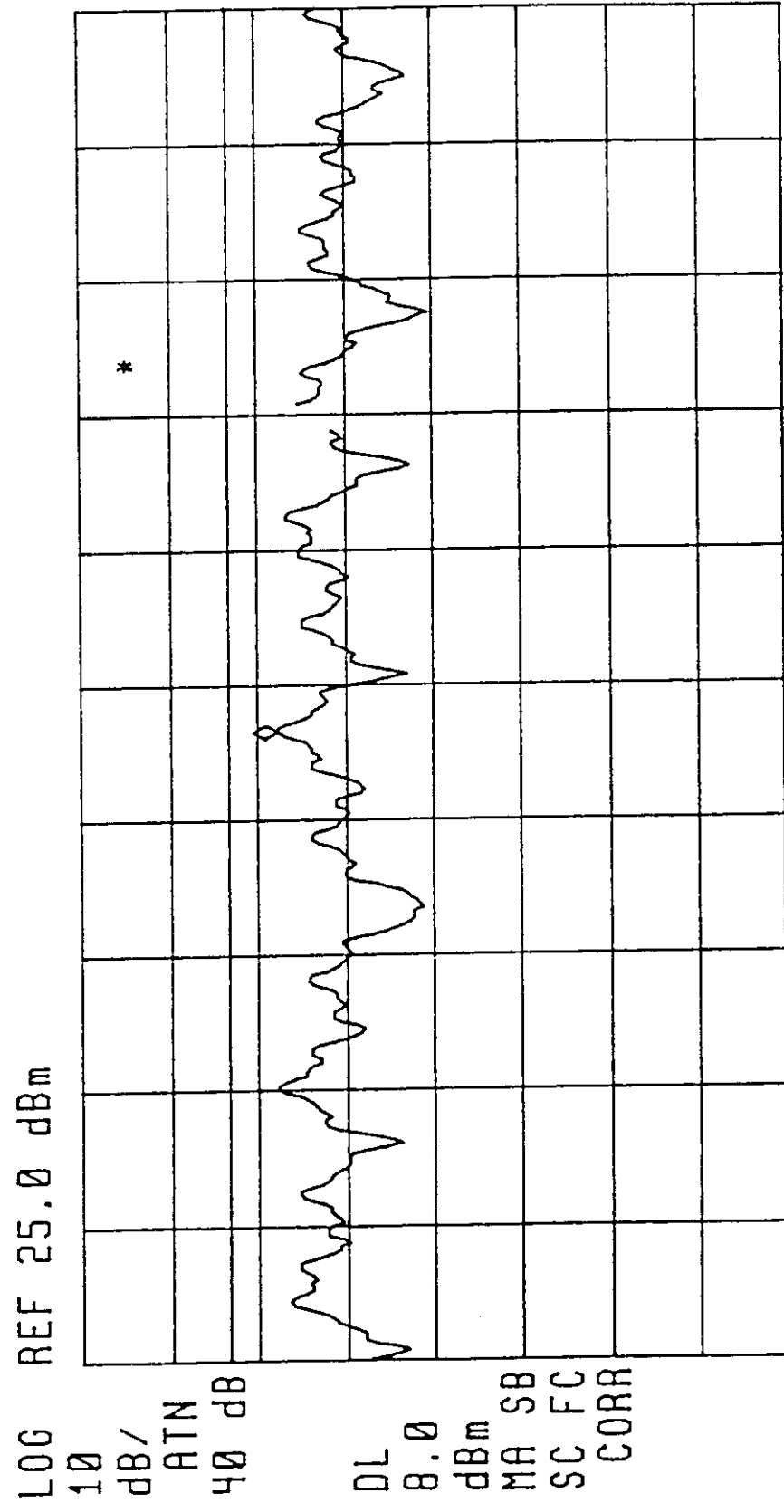


Ch 128

11:50:49 AUG 04, 1995  
CHUP/DOWN PWR DENSITY

SWEPTIME  
100 sec

ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 2.4628405 GHz  
2.35 dBm



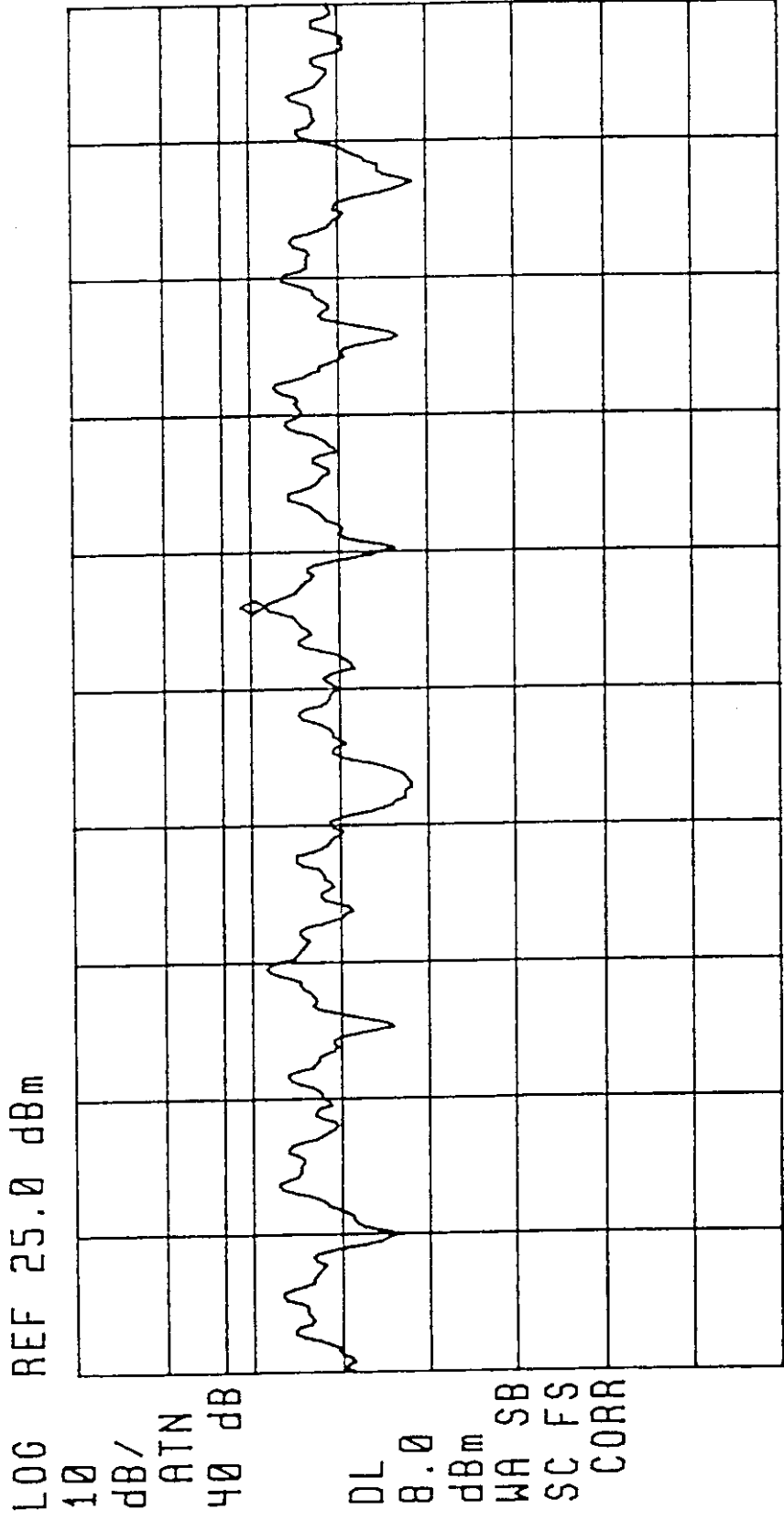
REF 25.0 dBm

CENTER 2.4628510 GHz  
#IF BW 3.0 kHz  
AUG BW 3 kHz  
SPAN 300.0 kHz  
#SWP 100 sec

22:02:47 AUG 04, 1995  
CH UP/DOWN PWR DENSITY

SWEPTIME  
100 sec

ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 2.4740407 GHz  
3.07 dBm



CENTER 2.4740227 GHz  
#IF BW 3.0 kHz  
AUG BW 3 kHz  
SPAN 300.0 kHz  
#SWP 100 sec

## DSSS PROCESSING GAIN CALCULATIONS

Processing gain for the LFO-ISM2400 is identical to the processing gain of the previously certificated LFO-ISM900, since the -2400 product is a frequency translation only of of the -900 product.

Please refer to processing gain information already on file for FCC ID: LFISM900.