



125 Technology Parkway
Norcross, Georgia, US 30092

Frequency Hopping Spread Spectrum Transmitter

Testing Performed by: LXE Inc.

Model:
4400L20 Transceiver
with Maxrad MFBZ592 Antenna

FCC ID: DNYLXE4400L20

LXE Project No.: 00-023

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1.0 GENERAL

1.1 Introduction

The purpose of this class 2 permissive change filing is to report findings of compliance testing performed to add the Maxrad MFBZ592 antenna as an option to the LXE Model 4400L20 Transceiver. The following report demonstrates compliance with Part 15, Subpart C of the FCC's Code of Federal Regulations.

1.2 Product Description

The EUT is the combination of the LXE Model 4400L20 Transceiver and the Maxrad MFBZ592 antenna.

The 4400L20 is a UHF, Frequency Hopping, Spread Spectrum, 1 Watt Transceiver intended for data link applications in the 902-928 MHz band.

The Maxrad MFBZ592 antenna is a unity gain, omni-directional antenna. Specification pages and photographs of this antenna are included separately in this filing.

2.0 LOCATION OF TEST FACILITY

The LXE test facility is located at the following address:

LXE, Inc.
An Electromagnetic Sciences Company
125 Technology Parkway
Norcross, GA US 30092-2993
Tel: (770) 447-4224
Fax: (770) 447-6928

Radiated emission tests were conducted at the manufacturer's test facility at a location specifically prepared for this testing. The radiated emissions test site meets the characteristics of ANSI C63.4:1992, CISPR 16 and EN 55022:1994. This site has been fully described and submitted to the FCC, and accepted in their letter marked 31040/SIT, 1300F2.

3.0 DESCRIPTION OF OPEN AREA TEST SITE

The open area test site(OATS) is located in the center of the rooftop of the building. The roof is located at a height of approximately 8 meters above the ground. The 3 meters radiated emissions test site is an open, flat area (open area) test site approximately 6.2m x 9.2m in dimension. All reflecting objects including test personnel lie outside the perimeter of the ellipse. The 3 meters test site ground plane is made of a 1/4" metal screen mesh which extends 2 meters past the mast and equipment under test(EUT). Material of the ground plane, comprised of individual 1/4" metal screen mesh rolls, were soldered at the seams with gaps smaller than 1/10 of the wavelength at 1000MHz. The ground plane is connected to the earth ground by ground rods. All wiring is done at floor level around the test site periphery. The radiated emissions test setup is shown in figure 1.

3.1 Radiated Emissions Testing Facility Drawing

All dimensions are in meters(m)

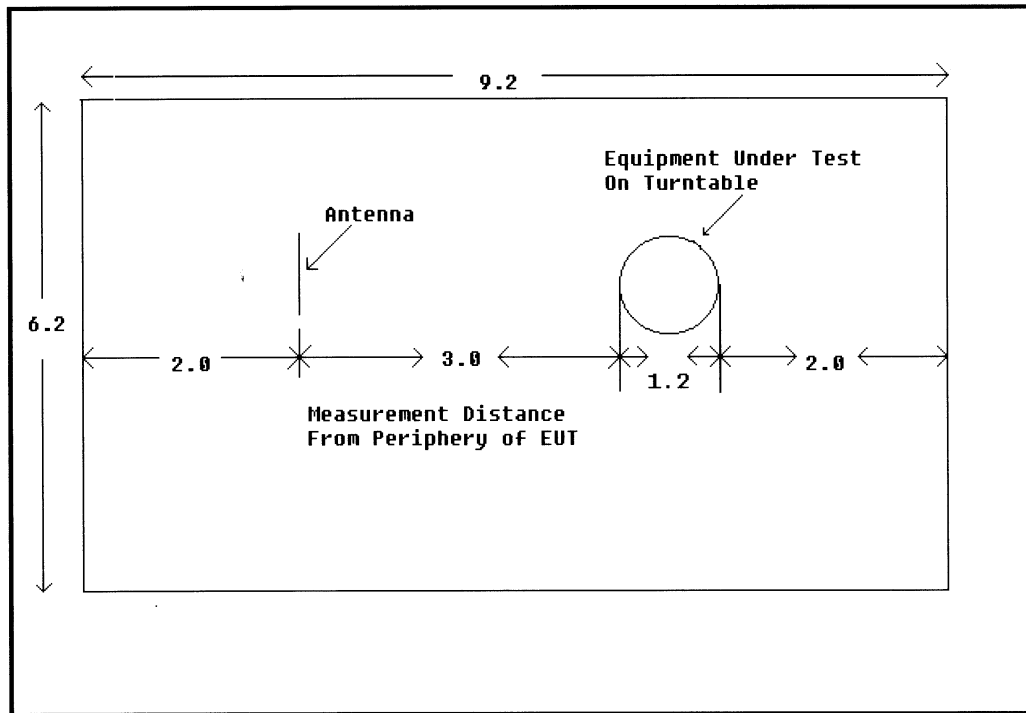


Figure 1: Open Area Test Site(OATS)

4.0 APPLICABLE STANDARD REFERENCES

The following standards were used to determine compliance:

- 1 - ANSI C63.4-1992: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- 2 - US Code of Federal Regulations (CRF): Title 47, Part 15, Radio Frequency Devices, Subpart C, Intentional Radiators (October 1997)
- 3 - FCC Report and Order 97-114: Amendment of Parts 2 and 15 of the Commission's rules regarding Spread Spectrum Transmitters.
- 4 - OET Bulletin 65, Supplement C, Section 3: RF Exposure Compliance for Spread Spectrum Transmitters.

5.0 LIST OF TEST EQUIPMENT

Radiated field strength measurements are taken with a spectrum analyzer. For peak measurements the spectrum analyzer was set with both the VBW and the RBW at 1MHz. Average measurements were taken with the RBW at 1MHz and the VBW at 10Hz. The sweep rate was set to auto to optimize the measurement. Adequate attenuation was used to protect the analyzer from damage.

Table 1: Test Equipment

Cal #	MFG Name	Item Name	Model #:	Serial #	Recal Date:
53	Hewlett Packard	Spectrum Analyzer	8563E	3304A00657	5/4/01
62	Compliance Design, Inc.	Antenna, Dipole	B1000	265	4/12/01
202	Hewlett Packard	Amp, .01-26.5 GHz	83006A	3104A00543	11/9/00
228	Electro-Metrics	Antenna	RGA-60	6165	8/28/00
229	Electro-Metrics	Antenna	RGA-60	6166	4/10/01
230	EMCO	LISN	3810/2NM	9505-1024	5/16/01
232	Electro-Metrics	Antenna, Biconical	BIA-25	1165	7/10/00
233	EMCO	Antenna, Biconical	3104C	9012-4360	5/22/01
234	EMCO	Antenna, Log Periodic	3146	9011-2946	6/21/01
238	Hewlett Packard	Spectrum Analyzer	8591A	3131A02254	5/8/01
239	LXE	Pre-Amp	20-1000GHz	001	4/7/01
394	Microwave Circuits	High-Pass Filter	H3G020G2	0001 DC9853	1/27/01
399	Mini Circuits	High-Pass Filter	SHP-1000	none	N/A
450	LXE	RF Cables (High Freq. Short)	none	Copper	11/5/00
451	LXE	RF Cables (High Freq. Double)	7015/6986	MFR-57500	11/5/00
452	EMCO	Mast, Antenna, Mini	2075	PN399235	N/A
453	EMCO	Turntable	2065	PN399230	N/A
99998	Lindgren Enclosure	RF Enclosure	14-2/2-0	8147	N/A

6.0 TEST METHODOLOGY

For the radiated emissions tests, measurements were made over the frequency range of 30MHz to 10 times the highest fundamental frequency. Measurements of the radiated field strength were made at a distance of 3m from the boundary of the equipment under test(EUT) and the receiving antenna. The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. A non-conductive remotely controlled turntable approximately 0.91m x 1.2m x 0.8m was used to measure radiated emissions from all sides of the EUT. The turntable has a center opening that allows cabling to be routed directly down to the conducting ground plane.

Due to high ambient noise levels and small EUT size, radiated emission measurements may be made at a distance of 1 meter. An inverse proportionality factor of 20 dB per decade is used to normalize the measured data to the specified distance to determine compliance. The formula used to calculate an inverse proportionality factor is $20 \log (D1/D2)$, where D1 is the distance used and D2 is the specified distance.

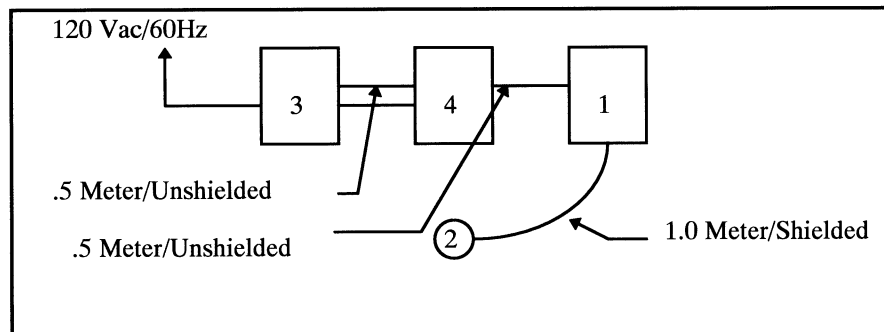
Radiated measurements were made with the Spectrum Analyzer's resolution bandwidth set to 120KHz for measurements above 30MHz and below 1000MHz, and 1MHz for measurements above 1000 MHz.

7.0 SUPPORT EQUIPMENT

Table 2: Support Equipment

Piece Number	Manufacturer	Equipment Type	Model Number	Serial Number	FCC ID
1	LXE	Transceiver	4400L20		DNYLXE4400L20
2	Maxrad	Antenna	MFBZ592	None	None
3	Tenma	DC Power Supply	72-42	9369111	None
4	LXE	Test Jig	None	None	None

7.1 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

**Figure 2**

8.0 SUMMARY OF TESTS

Along with the tabular data shown below, plots were also taken of all signals deemed important enough to document. Plots are included in the appendix.

8.1 Antenna Requirement - FCC Section 15.203

The Maxrad MFBZ592 employs a standard N-Type connector, however it will be used in a system that is professionally installed by LXE personnel or qualified subcontractors.

8.2 Radiated Spurious Emissions(Restricted Bands)

The peak radiated spurious emissions found in the restricted bands are reported below in table 3 and plots of each can be found in the appendix.

Table 3: Peak Radiated Spurious Emissions in Restricted Bands

Frequency (MHz)	Antenna Distance (m)	Level (dBm)	Detector Function (P/A)	Correction Factors (dB)	Corrected Level (dBm)	Corrected Level (uV/m)	Limit (uV/m)	Margin (uV)	Final Result (Pass/Fail)
Channel 1 = 904 MHz									
2713	1	-68.30	p	5.83	-62.47	168.46	500.00	331.54	PASS
3617	1	-65.20	p	8.92	-56.28	343.36	500.00	156.64	PASS
4521	1	-72.50	p	10.44	-62.06	176.57	500.00	323.43	PASS
5425	1	-73.33	p	13.44	-59.89	226.63	500.00	273.37	PASS
6329	1	-73.00	p	13.73	-59.27	243.41	500.00	256.59	PASS
Channel 2 = 915 MHz									
2741	1	-71.17	p	5.92	-65.25	122.33	500.00	377.67	PASS
3655	1	-69.50	p	9.03	-60.47	212.17	500.00	287.83	PASS
4569	1	-74.67	p	10.59	-64.08	140.04	500.00	359.96	PASS
Channel 3 = 928 MHz									
2783	1	-69.50	p	6.06	-63.44	150.61	500.00	349.39	PASS
3711	1	-65.83	p	9.21	-56.62	330.31	500.00	169.69	PASS

** Due to slow duty cycle, average measurements were calculated. Peak measurements were reduced accordingly. Duty cycle plots are included with this filing.

Correction Factors

Correction factors include Antenna Factor, Cable Attenuation, High Pass Filter Insertion Loss, Range Correction and Duty Cycle corrections.

Duty Cycle Correction = $20 \log(\text{Duty Cycle})$ or $20 \log(9.3\%) = -20.6 \text{ dB}$

Range Correction = $20 \log(D1/D2)$ Where D1 is the specified distance used and D2 is the distance used to make measurements = $[20 \log(3/1)] = 9.54 \text{ dB}$

Sample Calculations

Corrected Level(dBm) = Receiver Level + Correction Factors - Range Correction

Conversion from dBm to uV/m = $\text{Antilog}(\text{dBm} + 107)/20$

9.0 CONCLUSION

The product covered by this report has been tested and found to comply with the requirements as described in Part 15, Subpart C, Section 15.247 of the FCC Code of Federal Regulations.

Testing Performed By:


Sam Wismer
Lead Approvals Engineer

Report Reviewed By:


Cyril Binnom
EMI/EMC Engineer

APPENDIX

This Appendix Includes:
Antenna Specification
Duty Cycle Plots
Spurious Emissions Plots

MFB 900 MHz Series

Omni-directional Fiberglass Base Stations

The MFB 900 MHz Series is a base matched half wave antenna encapsulated in a heavy duty fiberglass radome with a thick walled aluminum mounting base for reliable long term use. All models are DC grounded and are UPS shippable.

Features:

- ◆ White ultra-violet resistant pultruded fiberglass radome
- ◆ Thick walled aluminum mounting base
- ◆ Unity/3dB/5dB/7dB models (rated in dbd)
- ◆ UPS shippable
- ◆ Exceptional value

Electrical Specifications

MFB 900 MHz Series

Model #	Frequency Range	Factory Tuned Frequency	Gain	Bandwidth ② 1.5:1 VSWR	Vertical Beamwidth ② 1/2 Power
Z592	902-928 MHz	915 MHz	Unity	20 MHz	75°

Mechanical Specifications

MFB 900 MHz Series

Model #	Equivalent Flat Plate Area	Lateral Thrust ② Rated Wind	Bending Moment ② Rated Wind	Height	Weight
Z592	.06 sq ft	2.3 lbs	1.4 ft-lbs	14"	.75 lbs

General Specifications- MFB 900 MHz Series

Radiator Material:

Coated steel wire

Radome Material:

.65" Pultruded white fiberglass

Termination:

Unity "N" Female

1' RG58/U CABLE

Lightning Protection:

DC grounded

Wind Survival:

100 mph

Mounting Base Diameter:

1 5/6"

Maximum Power:

150 watts

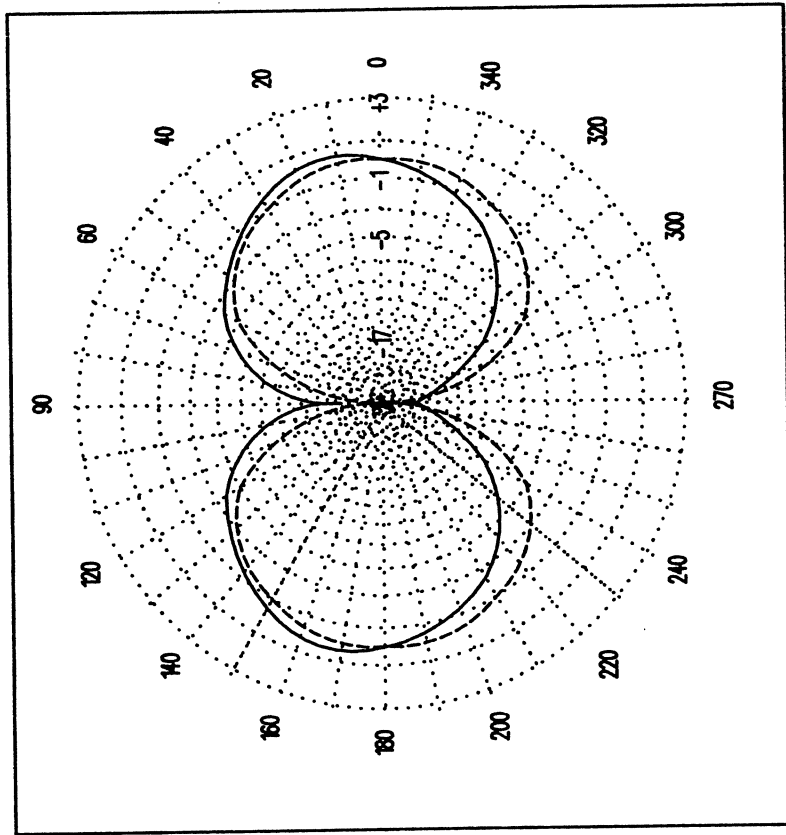
Base Station

MBS

MRX

MCR

MDA



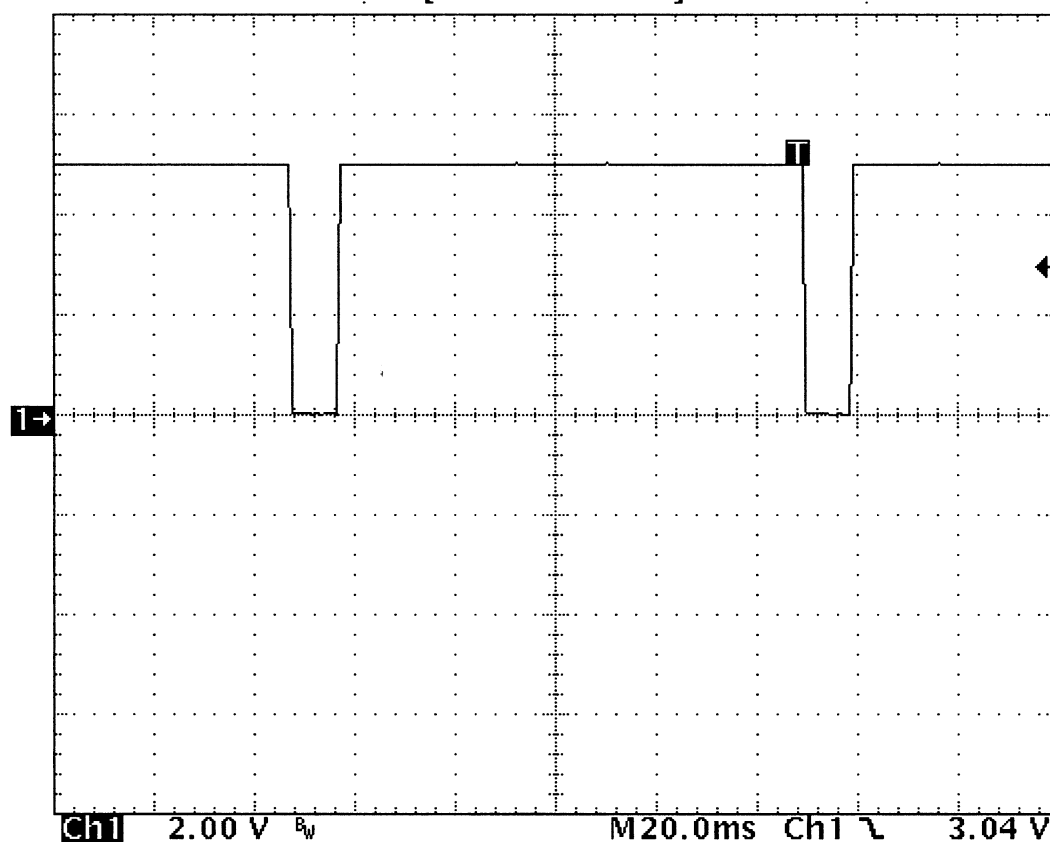
Z592 Radiation Pattern

----- Dipole Reference

Tek Run: 2.50kS/s

Hi Res

[T]



C1 Period
102.20ms

C1 -width
9.48ms

C1 -Duty
9.3 %

5 Jul 2000
18:37:45

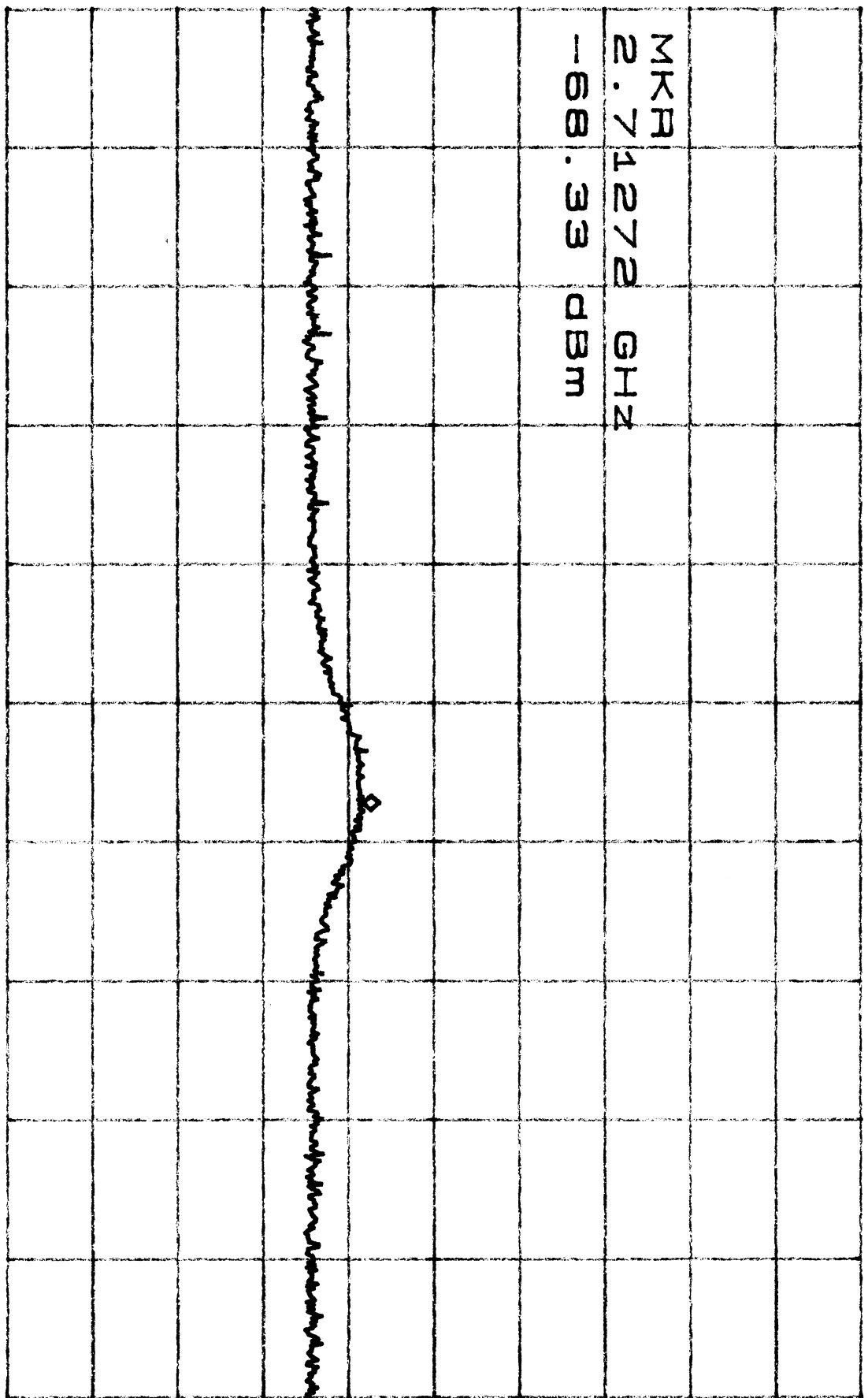
*ATTEN 0dB

RL -10.0dBm

10dB/

2.71272GHz

ΣΚΠ 100.33dBm



CENTER 2.71200GHz

SPAN 10.00MHz

*RBW 1.0MHz

*VBW 1.0MHz

SWP 50ms

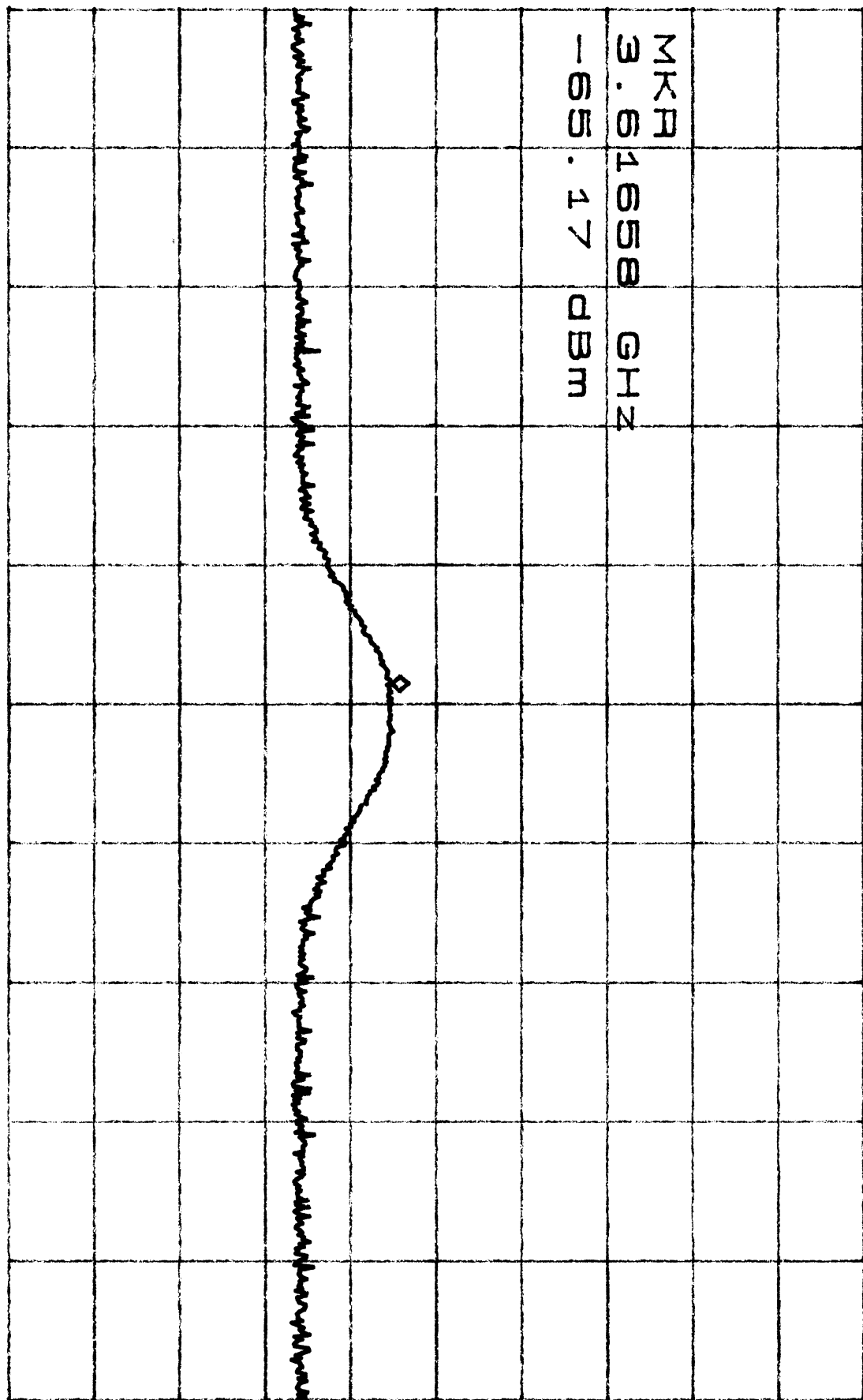
*ATTEN 0dB

NK11 -65.17dBm

FL -10.0dBm

10dB/

3.61658GHz



CENTER 3.61673GHz

SPAN 10.00MHz

*RBW 1.0MHz

*VBW 1.0MHz

SWP 50ms

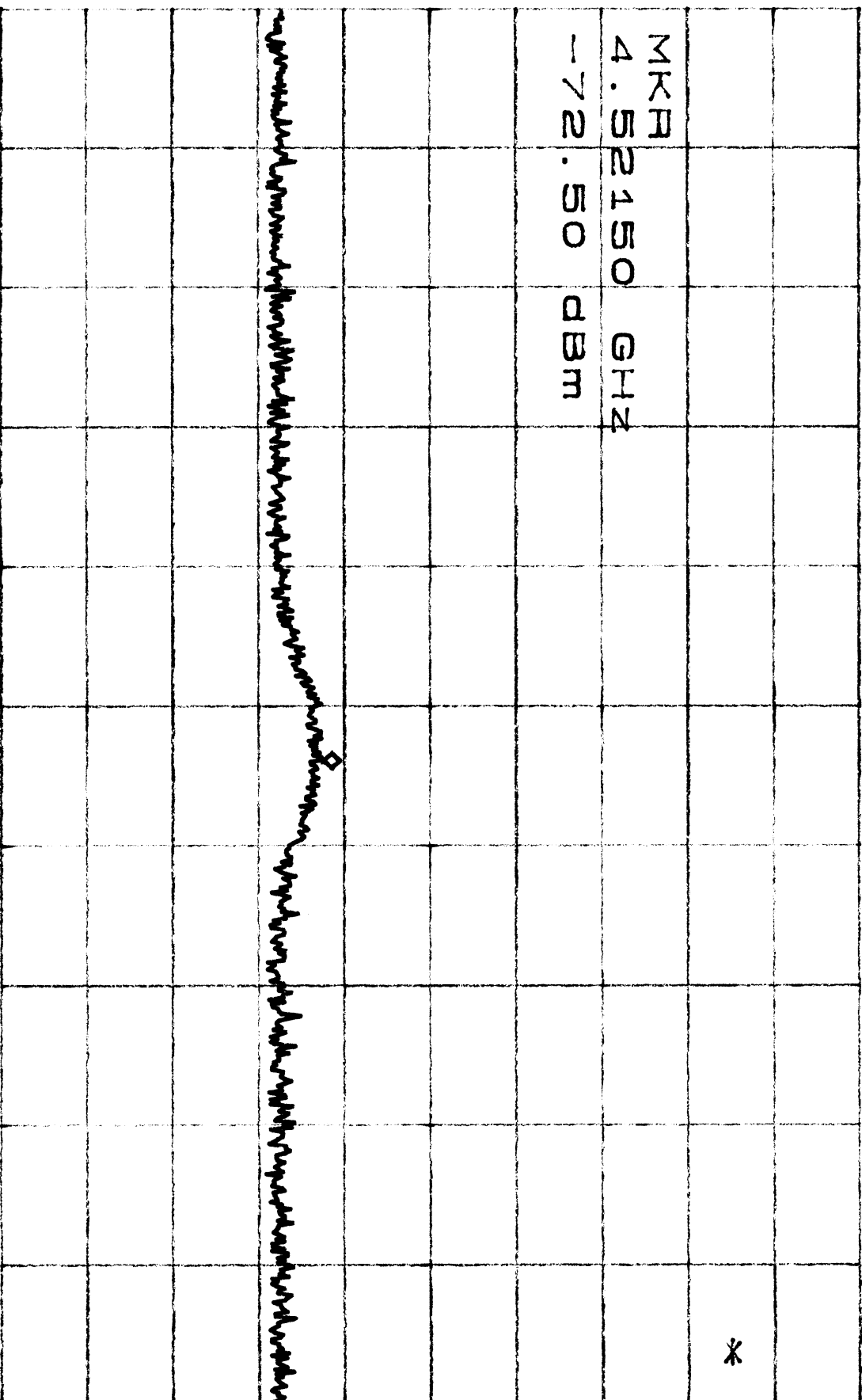
*ATTEN 0dB

MKII -72.50dBm

RL -10.0dBm

10dB/

4.52150GHz



CENTER 4.52112GHz

SPAN 10.00MHz

*RBW 1.0MHz

*VBW 1.0MHz

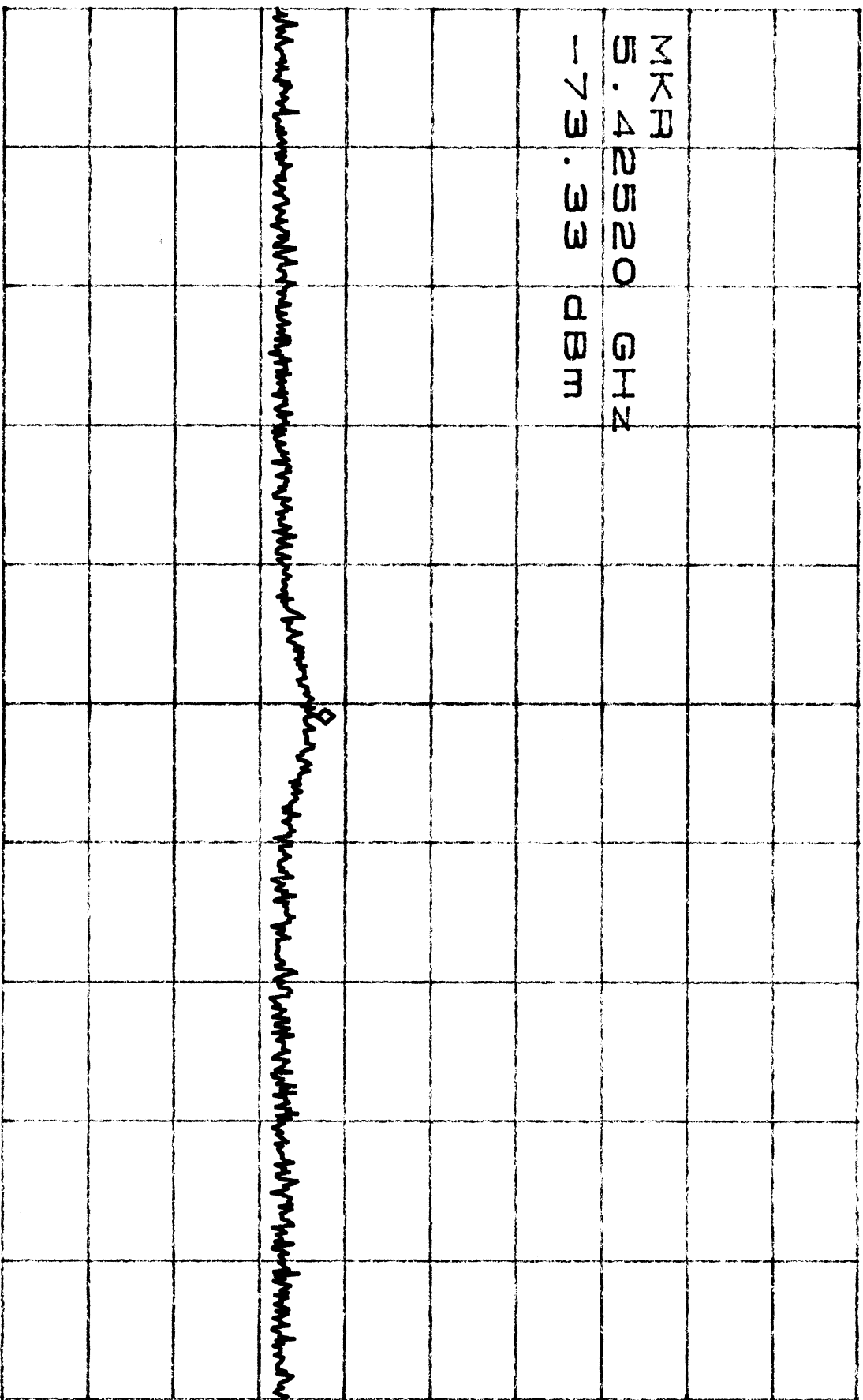
SWP 50ms

*ATTEN 0dB

PL -10.0dBm

10dB/

MKII -73.33dBm



CENTER 5.42512GHz

SPAN 10.00MHz

*RBW 1.0MHz

*VBW 1.0MHz

SWP 50ms

*ATTEN 0dB

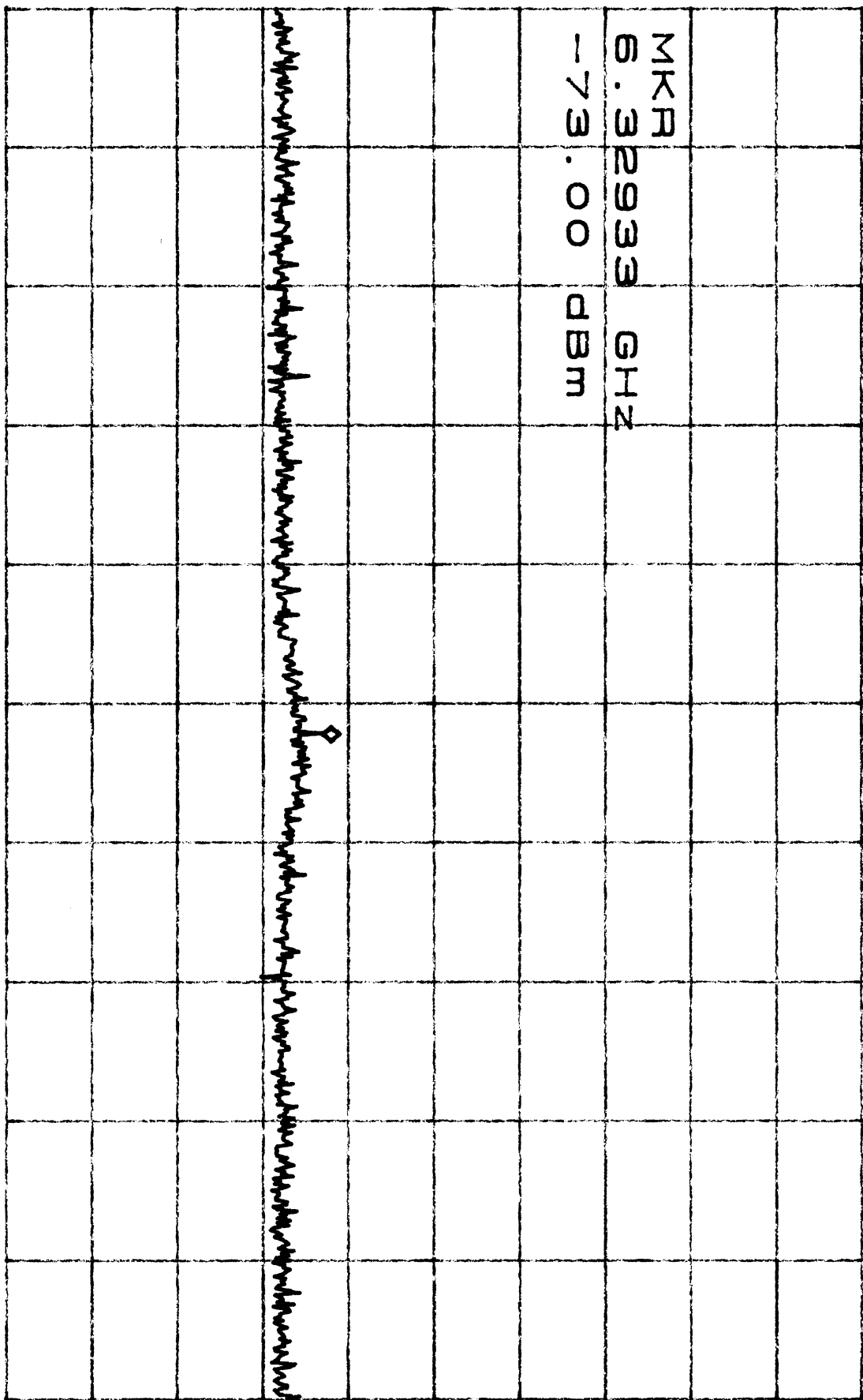
FL -10.0dBm

10dB/

NKP -73.00dBm

NKP
6.32933 GHz

-73.00 dBm



CENTER 6.32912GHz

SPAN 10.00MHz

*RBW 1.0MHz

*VBW 1.0MHz

SWP 50ms

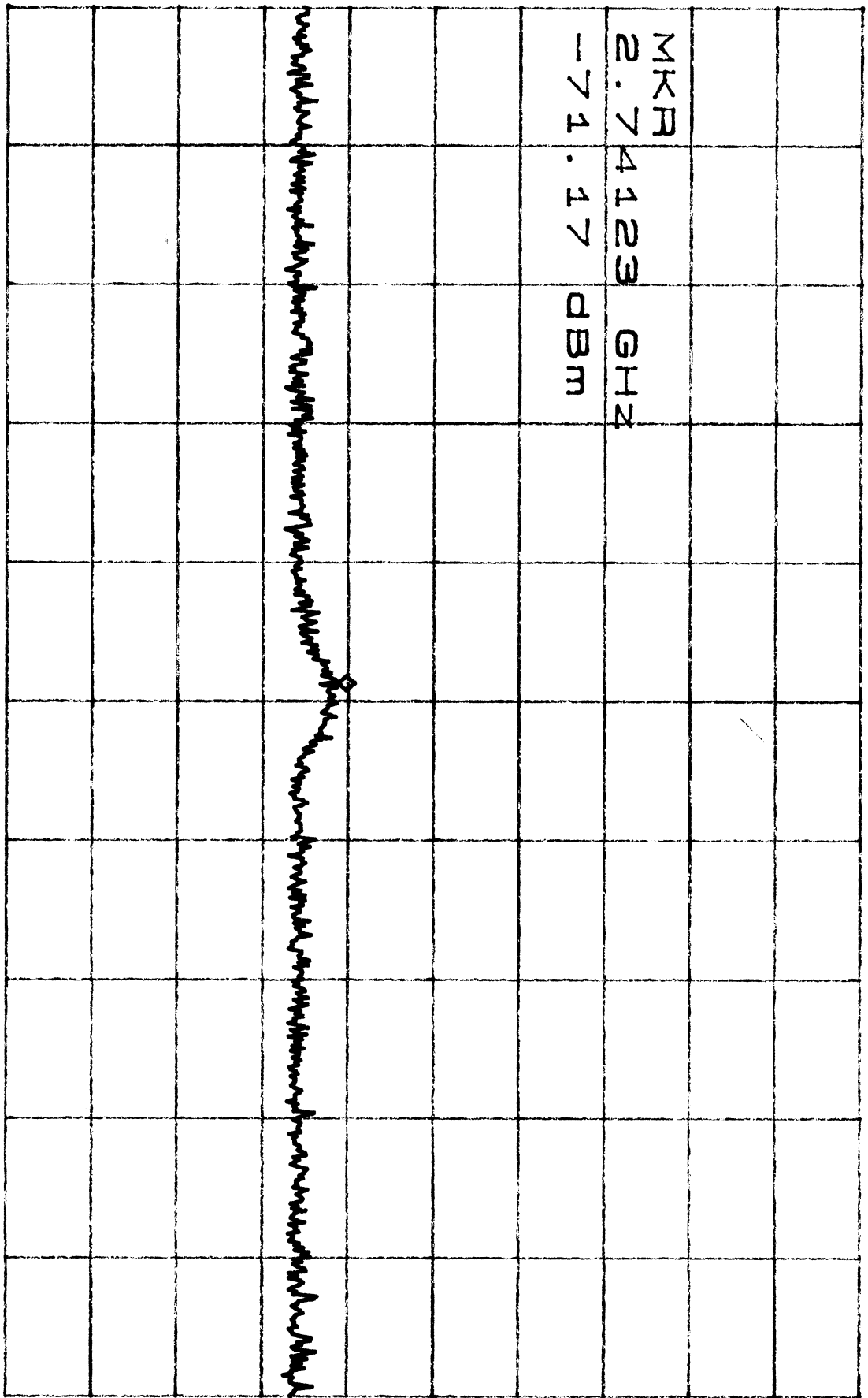
*ATTEN 0dB

RL -10.0dBm

10dB/

2.74123GHz

МКП -74.17dBm



CENTER 2.74150GHz

SPAN 20.20MHz

*RBW 1.0MHz

*VBW 1.0MHz

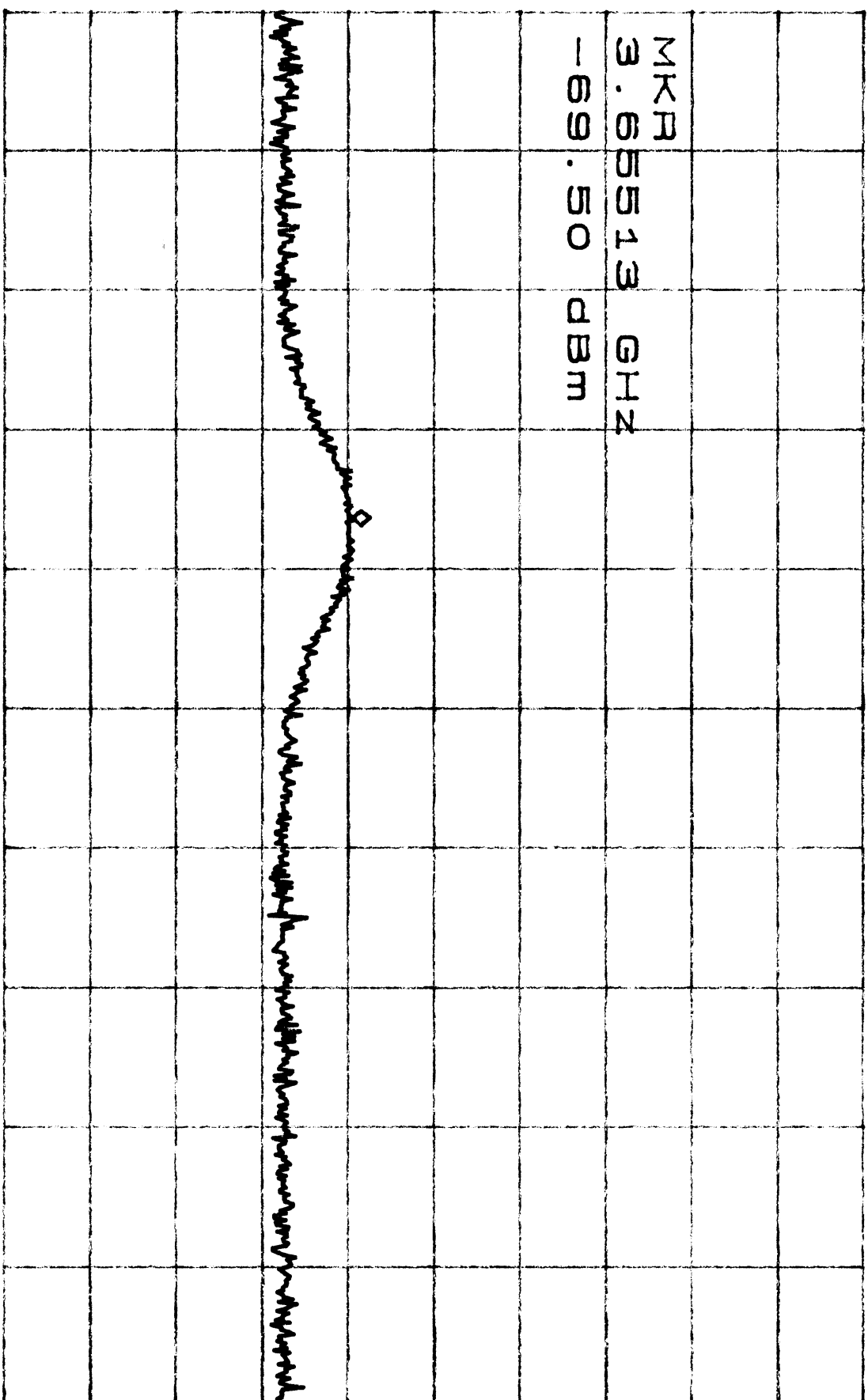
SWP 50ms

*ATTEN 0dB

PL -10.0dBm

10dB/

ΣKΠ 100.500MHz



ΣKΠ
3.00013 GHz
-60.50 dBm

CENTER 3.00013GHz

SPAN 10.000MHz

*RBW 1.0MHz

*VBW 1.0MHz

SWP 50ms

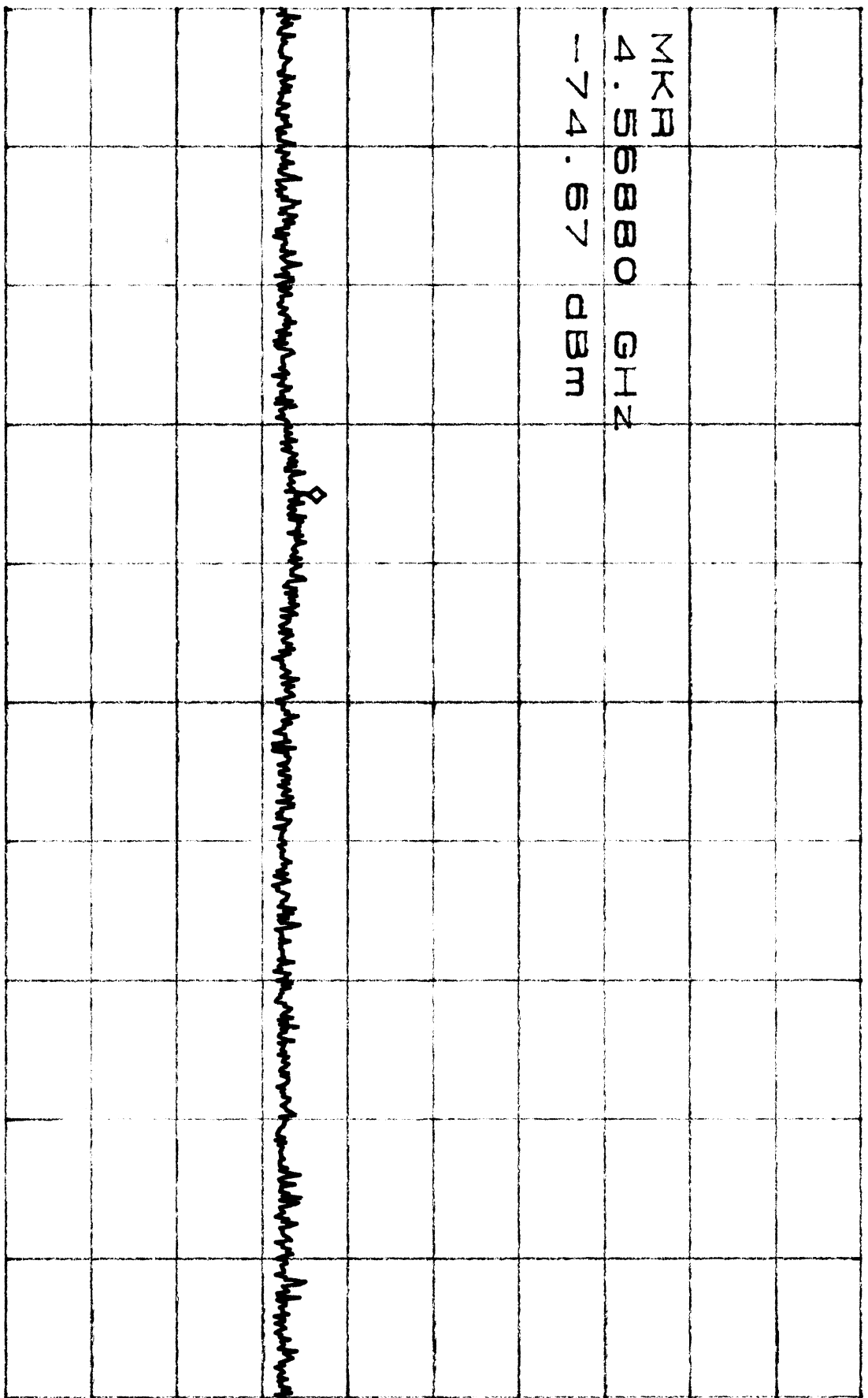
*ATTEN 0dB

RL -10.0dBm

10dB/

MKP 4.56880GHz

MKP -74.67dBm



CENTER 4.57030GHz

SPAN 10.00MHz

*RBW 1.0MHz

*VBW 1.0MHz

SWP 50ms

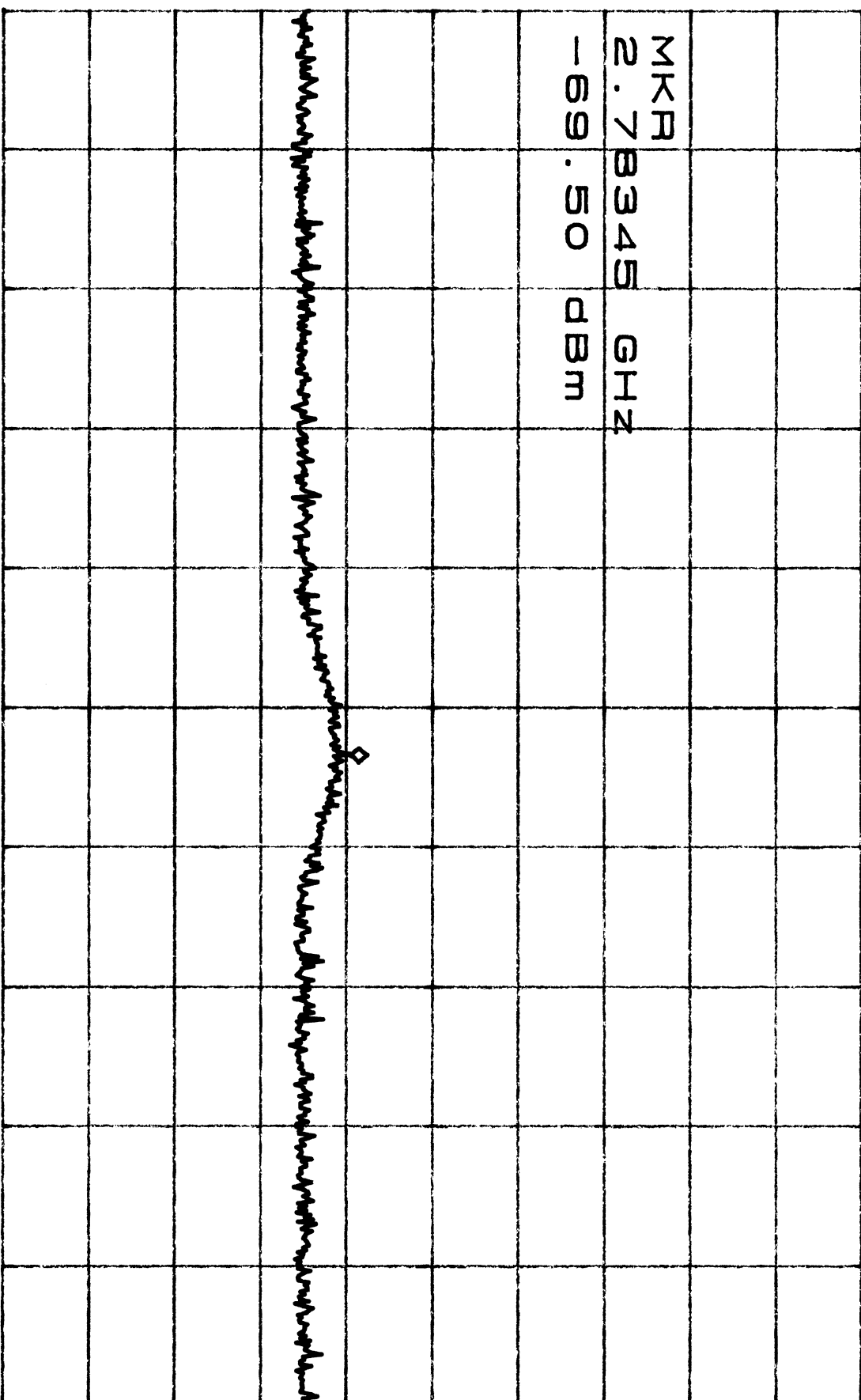
*ATTEN 0dB

NKP -69.50dBm

RL -10.0dBm

10dB/

2.78345GHz



CENTER 2.78345GHz

SPAN 10.00MHz

*RBW 1.0MHz

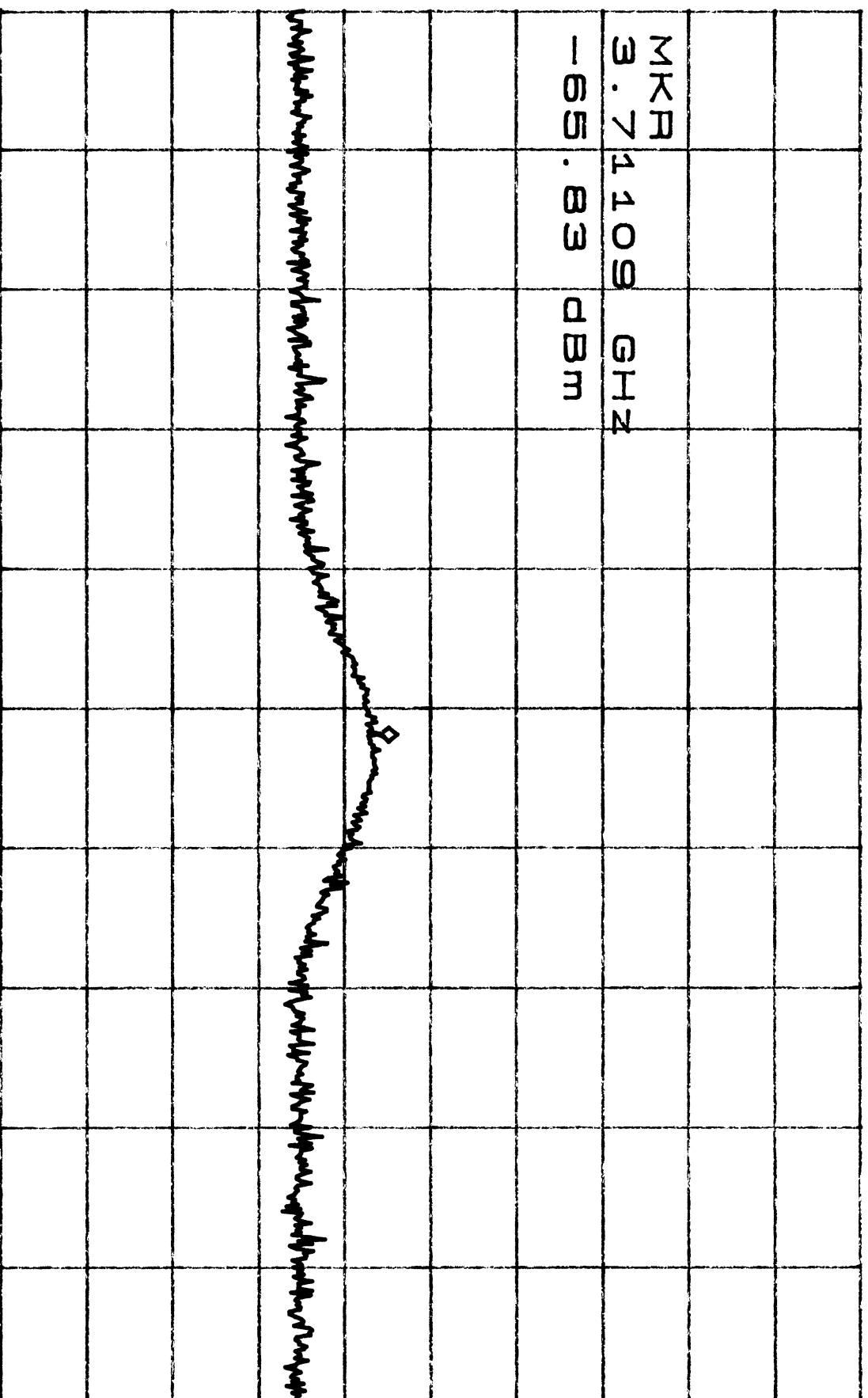
*VBW 1.0MHz

SWP 50ms

ΣΤΑΥΡΟΣ

1004/

3. 71109GHZ



SPAN 10.00MHZ

*VBM 3. ONIN

SMP SONS