125 Technology Parkway
Norcross, Georgia, US 30092

Test Report

LXE Model: 6526

FCC ID: KDZLXE6526P

Direct Sequence Spread Spectrum Transmitter

Portable Equipment Certification

Applicant:	LXE Inc. 125 Technology Parkway Norcross, GA 30092
Purpose of Testing:	To demonstrate compliance with FCC Part 15 Subpart C

Report Prepared By: R. Sam Wismer

R. Sam Wismer
RF Approvals Engineer

Issue Date: December 18, 2000

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1.0 GENERAL

1.1 Introduction
The purpose of this report is to demonstrate compliance with Part 15, Subpart C of the FCC's Code of Federal Regulations.

1.2 Product Description

1.2.1 General
The Equipment Under Test(EUT) is the LXE Model 6526 2.4GHz Spread Spectrum transceiver. It is offered with three capabilities of Wired Equivalent Privacy(WEP). LXE part numbers for the three versions are:

- 480631-4710 - No WEP
- 480631-4410 - 40 bit WEP
- 480631-4610 - 128 bit WEP

The differences in the three version are insignificant for this filing as the transmitter portion of all three versions are identical. The degree of WEP only determines how the data is processed after it has been received or before it has been transmitted.

The LXE 6526 is an OEM Direct Sequence Spread Spectrum product manufactured by Cisco Systems. It is IEEE 802.11b compliant and operates in the band of 2400-2483.5 GHz. The radio is capable of 4 data rates and self adjusts to the most appropriate rate depending on the performance required. The data rates are 11, 5.5, 2 and 1 Mbps, where 11 Mbps gives the maximum throughput for data transfer, and 1 Mbps gives the best coverage where only small data packets are sent.

The radio has 2 ports. The main port is TX/RX and the auxiliary port is RX only. The card can be used either with a single antenna scheme in the main port, or a diverse antenna scheme using both ports.

1.2.1 Intended Use
The LXE 6526 transceiver is intended to be integrated into LXE terminals defined as portable according to section 2.1093 of the FCC rules. A separate certification has been obtained for this same radio for LXE devices defined as mobile according to section 2.1091 of the FCC rules. FCC ID for the mobile certification is KDZ480631-4410.

Terminals currently targeted for integration of the 6526 radio card are LXE Models MX3 and CX1 hand-held terminals. The MX3 and CX1 are identical in form factor and use the same antenna, however the MX3 is a DOS based terminal and the CX1 is a Windows CE® based terminal. These devices are considered portable devices because they are offered with an accessory that allows the user to use the terminals from a hip position. In this configuration, the antenna is approximately 15cm from the users torso. Photographs of the operating configuration and exposure conditions are included separately in this filing as part of the RF exposure submittal.

The portable terminals are LXE PC based mini-computers equipped with PCMCIA slots to accommodate the various radio cards offered, or they can be used as batch terminals with no radio card at all. For batch operations, the PCMCIA slots are utilized as memory or storage space enhancements.

All terminals have been evaluated to, and found to comply with, FCC Part 15, Subpart B, Class A, and in some cases Class B emission requirements.

1.2.2 Technical Specifications

Table 1: Specifications

Frequency Band	2400-2483.5 MHz
Number of Channels	11
Modulation Technique	BPSK 1 Mbps QPSK 2 Mbps CCK 5.5 and 11 Mbps
Interface	PC Card Type II Size
Dimensions	85.0 mm X 53.95 mm X 5.0 mm (PC Card)
Output power	14 dBm nominal
Power Consumption PC Card	Doze mode 10 mA
	Receive mode 280 mA
	Transit mode 400 mA at max output power
Temperature Range (operational)	0-70ºC 95% max. humidity (non condensing)
Operating Systems	Windows 95 Windows 98 Windows NT® Windows 2000
Standards	IEEE 802.11b
Regulations	FCC Part 15 Subpart C
	RSS 139 & RSS 102
	ETS 300 328 & 300 826

1.2.3 Antennas

The MX3 and CX1 that use the 6526 radio use the same antenna since the form factor of the two devices are identical. The antenna is identified as LXE part number 157368-0001. It is a proprietary design, 0dBi patch. Photographs of the antenna are included separately in this filing.

2.0 LOCATION OF TEST FACILTY

The LXE test facility is located at the following address:

LXE, Inc.
An Electromagnetic Sciences Company
125 Technology Parkway
Norcross, GA US 30092-2993

2.1 DESCRIPTION OF OPEN AREA TEST SITE

All tests were conducted at the manufacture'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 55022:1998. This site has been fully described and submitted to the FCC, and accepted in their letter marked 31040/SIT, 1300F2.

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 meter radiated emissions test site is an open, flat area approximately 6.2m x 9.2m in dimension. All reflecting objects including test personnel lie outside the perimeter of the ellipse. The site has a ground plane 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.

A nonconductive 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.

The radiated emissions test setup is shown in figure 1.

2.2 Radiated Emissions Testing Facility Drawing

All dimensions are in meters(m)

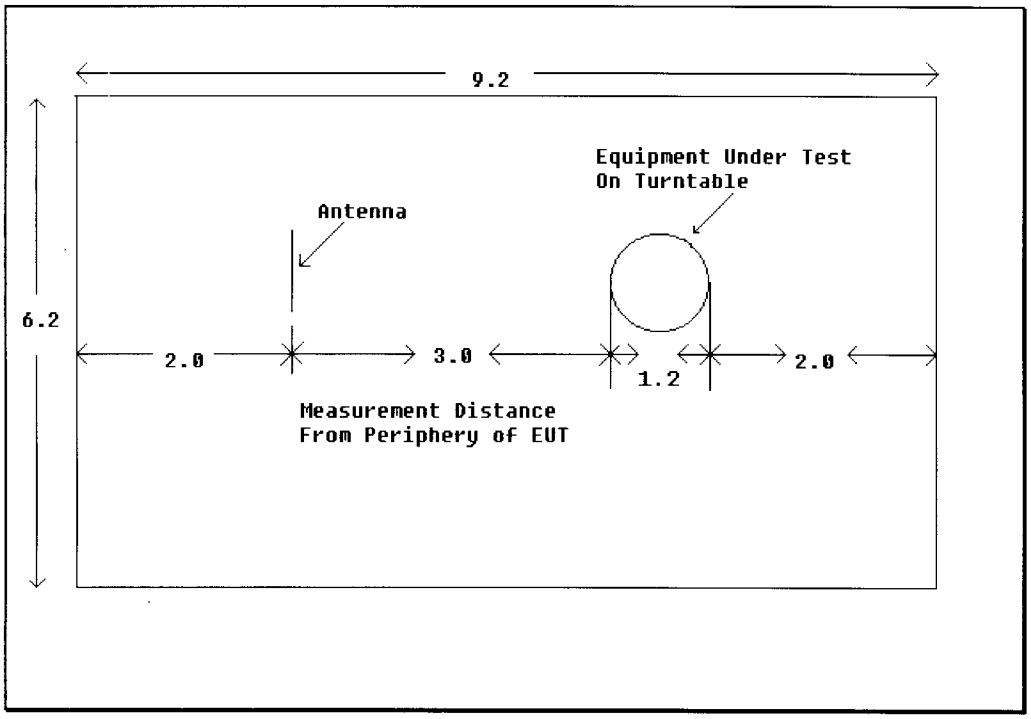


Figure 1: Open Area Test Site(OATS)

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

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 (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators (October 1997)

3 - FCC Bulletin 97-114 Appendix C - Guidance on Measurements for Direct Sequence Spread Spectrum Systems

4 - FCC OET Bulletin 65 Appendix C - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

4.0 LIST OF TEST EQUIPMENT

All test equipment used for regulatory testing is calibrated yearly or according to manufacturers specifications. Some or all of the equipment shown below in table 2 was used during this testing.

Table 2: 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	11/30/01
228	Electro-Metrics	Antenna	RGA-60	6165	8/20/01
229	Electro-Metrics	Antenna	RGA-60	6166	4/10/01
230	EMCO	LISN	3810/2NM	9505-1024	5/16/01
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	11/17/01
451	LXE	RF Cables (High Freq. Double)	7015/6986	MFR-57500	11/17/01
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

5.0 SUPPORT EQUIPMENT

Table 3: Support Equipment

Manufacturer	Equipment Type	Model Number	Serial Number	FCC ID
WinBook*xp*	LapTop Computer	ANL-4	10AUA01756	JRUANL-4D75

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

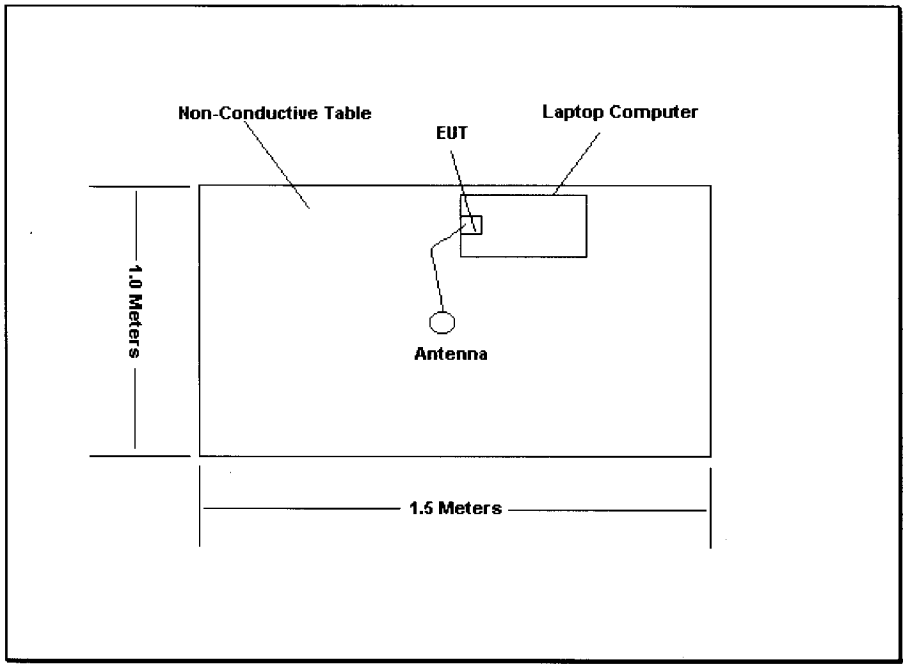


Figure 2: EUT Test Setup

7.0 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement - FCC Section 15.203

The antenna described in section 1.2.4 is designed with a unique and/or proprietary connector and is not interchangeable with standard antennas without electrical and mechanical modification of the radio card or host unit. In addition the antenna is integral to the unit and requires that the host unit be disassembled to be accessed.

7.2 Power Line Conducted Emissions - FCC Section 15.207

The EUT is powered by a PCMCIA bus of host device supplying 3.3 or 5VDC, and has no connection to the AC Mains. Conducted emissions are not required.

7.3 Radiated Emissions - FCC Section 15.209

Radiated emissions tests were attempted over the frequency range of 30MHz to 25GHz, 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. Radiated measurements were made with the Spectrum Analyzer's resolution bandwidth set to 120KHz for measurements above 30MHz.

The EUT was caused to go into a "Receive Only" mode of operation for this test. No emissions attributed to the EUT could be detected in the band.

7.4 6dB Bandwidth Requirement - FCC Section 15.247(a)(2)

For the 6dB bandwidth test, the EUT was caused to generate a continuous carrier on the high, middle and low channels at all available data rates. Tabulated data is shown below in table 4 and a plot of the worst case is shown in figure 3 below. The plot is of the high channel(2462 MHz) at a data rate of 11Mbps.

Table 4: 6dB Bandwidth

Data Rate (Mbps)	Channel 1 - 2412MHz (MHz)	Channel 7 - 2442MHz (MHz)	Channel 11 - 2462MHz (MHz)
1	10.20	11.13	10.17
2	10.03	9.83	10.03
5.5	10.53	11.10	9.83
11	10.07	10.00	9.37

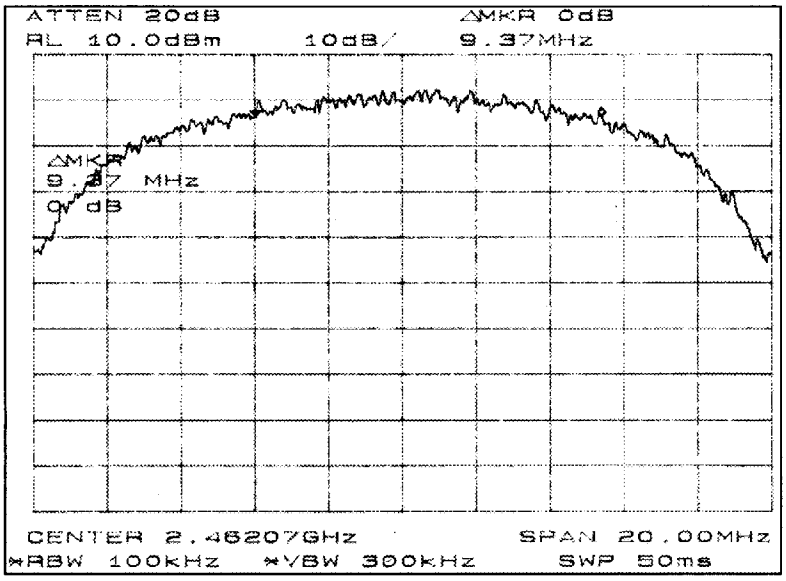


Figure 3: Worst Case 6dB Bandwidth

7.5 Peak Output Power Requirement - FCC Section 15.247(b)

The peak output power of the EUT was made at the antenna connector using an HP436A power meter and an HP8482H power sensor. The EUT was caused to generate a constant carrier on high, mid and low channels of the device. On each channel the EUT was then cycled through each of it's data rates. Table 5 below shows the results of this test.

Table 5: Peak Output Power

Data Rate (Mbps)	Channel 1 - 2412 MHz (dBm)	Channel 7 - 2442 MHz (dBm)	Channel 11 - 2462 MHz (dBm)
1	13.54	13.56	13.42
2	13.43	13.52	13.39
5.5	13.82	13.87	13.61
11	13.68	13.75	13.50

7.6 Spurious Emissions - FCC Section 15.247(c)

7.6.1 RF Conducted Spurious Emissions

The EUT was investigated for conducted spurious emissions from 30MHz to 25GHz, 10 times the highest fundamental frequency. For each measurement, the spectrum analyzer's VBW was set to 100kHz and the RBW was set to 1MHz.

The RF conducted spurious emissions found in the band of 30MHz to 25GHz are reported in Table 6 below. Each emission was compared to the fundamental reference level, also reported in the table below, to determine if they were at least 20dB below the reference level. Plots of the emissions were taken and filed separately as Appendix A

Table 6: Conducted Spurious Emissions

Channel	Fundamental Frequency (MHz)	Fundamental Reference Level (dBm)	Frequency of Spurious Emissions (MHz)	Level (dBm)	Δ(dB)
1	2412	1.83	447	-54.33	56.16
			2396	-28.50	30.33
			2427	-26.83	28.66
			4820	-55.67	57.50
			8862	-60.67	62.50
7	2442	3.17	1071	-60.50	63.67
			2429	-26.17	29.34
			2454	-26.67	29.84
			4884	-61.50	64.67
11	2462	2.33	638	-60.00	62.33
			2449	-27.83	30.16
			2475	-29.67	32.00
			7054	-59.67	62.00

7.6.2 Radiated Spurious Emissions(Restricted Bands) - FCC Section 15.205

Radiated emissions tests were made over the frequency range of 30MHz to 25GHz, 10 times the highest fundamental frequency. For convenience, peak measurements were taken and compared to the average limits. If the peak measurement did not meet the average limit, then an average measurement was made and compared to the average limit.

Due to high ambient noise levels and small EUT size, radiated emission measurements were made at a distance of 1 meter. An inverse proportionality factor of 20 dB per decade was 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. A correction factor of 9.54dB applied to the measurements.

The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. The spectrum analyzer's video and resolution bandwidths were set to 1MHz.

The EUT was caused to generate a constant carrier on the high, mid and low channels of operation at each of the data rates available. Table 7 below shows the results of all detectable points in the band of evaluation. Plots of each significant signal were taken and were filed separately as appendix B.

Table 7: Peak Measurements Compared to Average Limits

Frequency (MHz)	Antenna Distance (m)	Peak Level @ 1m (dBm)	Correction Factors (dB)	Corrected Peak Level (dBm)	Corrected Peak Level (uV/m)	Average Limit @ 3m (uV/m)	Margin (uV)	Final Result (Pass/Fail)
Bit Rate 1Mb/s								
Channel 1								
4824	1	-64.83	7.51	-57.32	304.94	500	195.06	PASS
7236	1	-73	12.20	-60.80	204.16	500	295.84	PASS
Channel 7								
4884	1	-61.5	7.70	-53.80	457.11	500	42.89	PASS
7326	1	-72.8	12.49	-60.31	216.09	500	283.91	PASS
Channel 11								
4924	1	-61.5	7.82	-53.68	463.68	500	36.32	PASS
7386	1	-73	12.69	-60.31	215.98	500	284.02	PASS
Bit Rate 5.5Mb/s								
Channel 1								
4824	1	-66.5	7.51	-58.99	251.61	500	248.39	PASS
7236	1	-71.7	12.20	-59.50	237.12	500	262.88	PASS
Channel 7								
4884	1	-64.83	7.70	-57.13	311.54	500	188.46	PASS
7326	1	-71.7	12.49	-59.21	245.27	500	254.73	PASS
Channel 11								
4924	1	-63.5	7.82	-55.68	368.32	500	131.68	PASS
7386	1	-73	12.69	-60.31	215.98	500	284.02	PASS
Bit Rate 11Mb/s								
Channel 1								
4824	1	-65.17	7.51	-57.66	293.24	500	206.76	PASS
7236	1	-74.33	12.20	-62.13	175.17	500	324.83	PASS
Channel 7								
4884	1	-64	7.70	-56.30	342.78	500	157.22	PASS
7326	1	-74.33	12.49	-61.84	181.19	500	318.81	PASS
Channel 11								
4924	1	-63.5	7.82	-55.68	368.32	500	131.68	PASS
7386	1	-73	12.69	-60.31	215.98	500	284.02	PASS

Correction Factors

AF = Antenna Factor
CA = Cable Attenuation
AG = Amplifier Gain
RL = Receiver Level
RC = Range Correction = 20Log(D1/D2) Where D1 is the specified distance used and D2 is the distance used to make measurements = [20Log(3/1)] = 9.54 dB

Therefore:
CF_T = Total Correction Factor = RL+AF+CA-AG-RC

Sample Calculations

Corrected Level(dBm) = RL+ CF_T
Conversion from dBm to uV/m = Antilog(dBm + 107)/20)

8.7 Power Spectral Density - FCC Section 15.247(d)

The spectral density was measured in accordance with OET bulletin 97-114, appendix C. The EUT was caused to generate a constant carrier on a high, middle and low channels at all the available data rates. The results are recorded in Table 8 below. A plot of the worst case measurement was taken of each of the emissions and is shown in figure 4 below.

Table 8: Spectral Density

Channel	Data Rate (Mbps)	Receiver Level (dBm)	Limit (dBm)	Margin (dB)
1 (2412 MHz)	1	-16.00	8	24.00
	2	-13.83	8	21.83
	5.5	-13.83	8	21.83
	11	-12.50	8	20.50
7 (2442 MHz)	1	-26.67	8	34.67
	2	-22.67	8	30.67
	5.5	-13.83	8	21.83
	11	-12.17	8	20.17
11 (2462 MHz)	1	-27.00	8	35.00
	2	-23.70	8	31.70
	5.5	-14.33	8	22.33
	11	-13.00	8	21.00

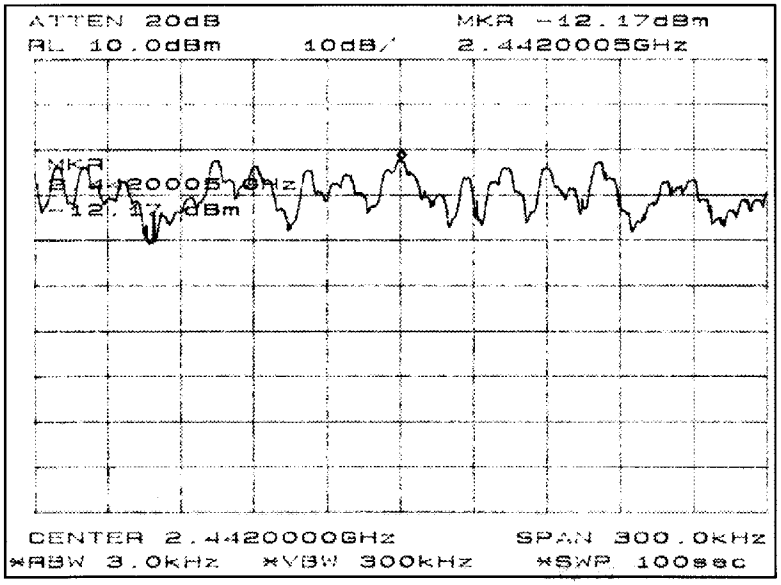
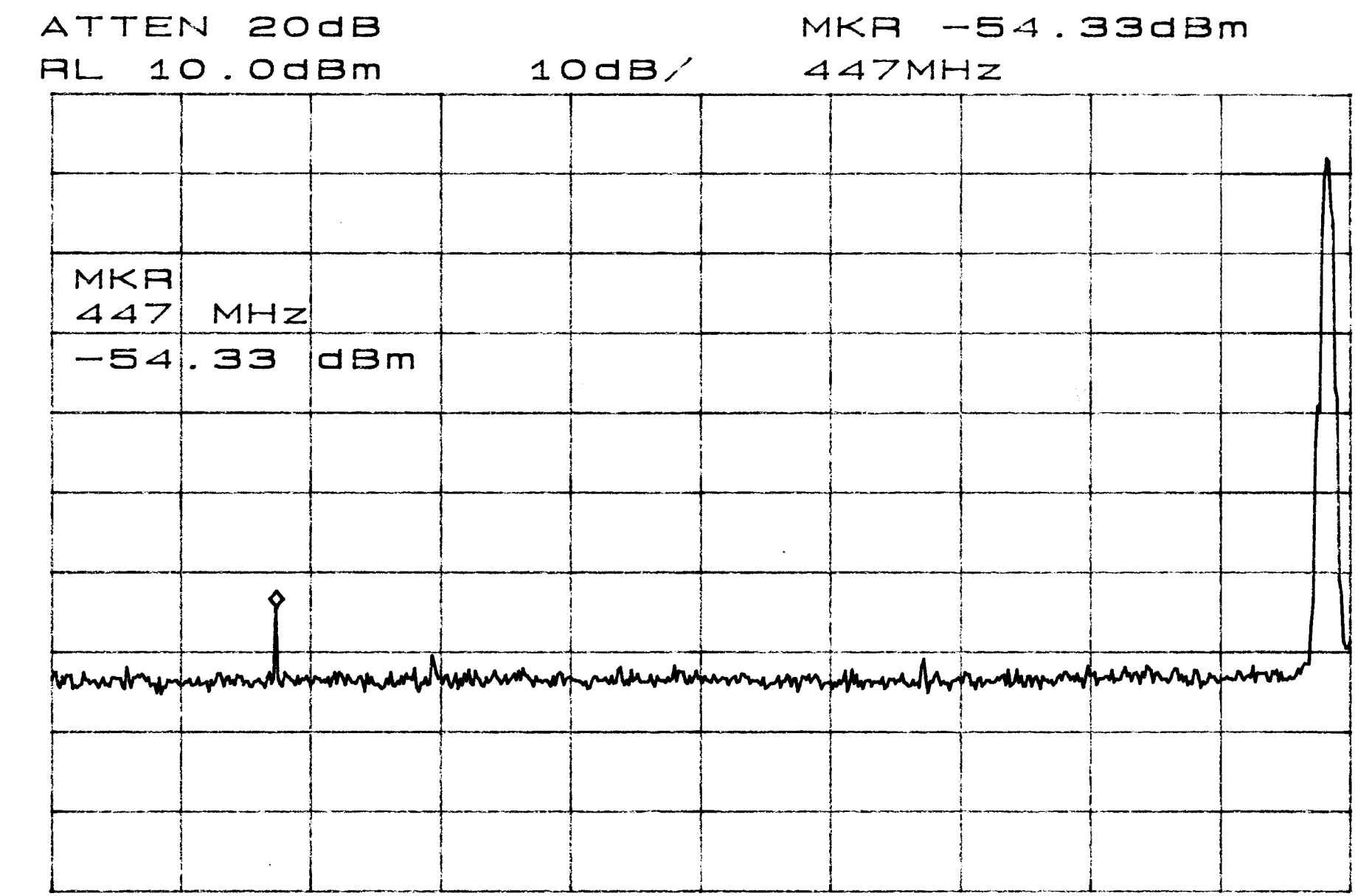


Figure 4: Worst Case Spectral Density Measurement

Appendix A

Conducted Spurious Emission Plots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RL 10.0dBm
10dB/
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MKR
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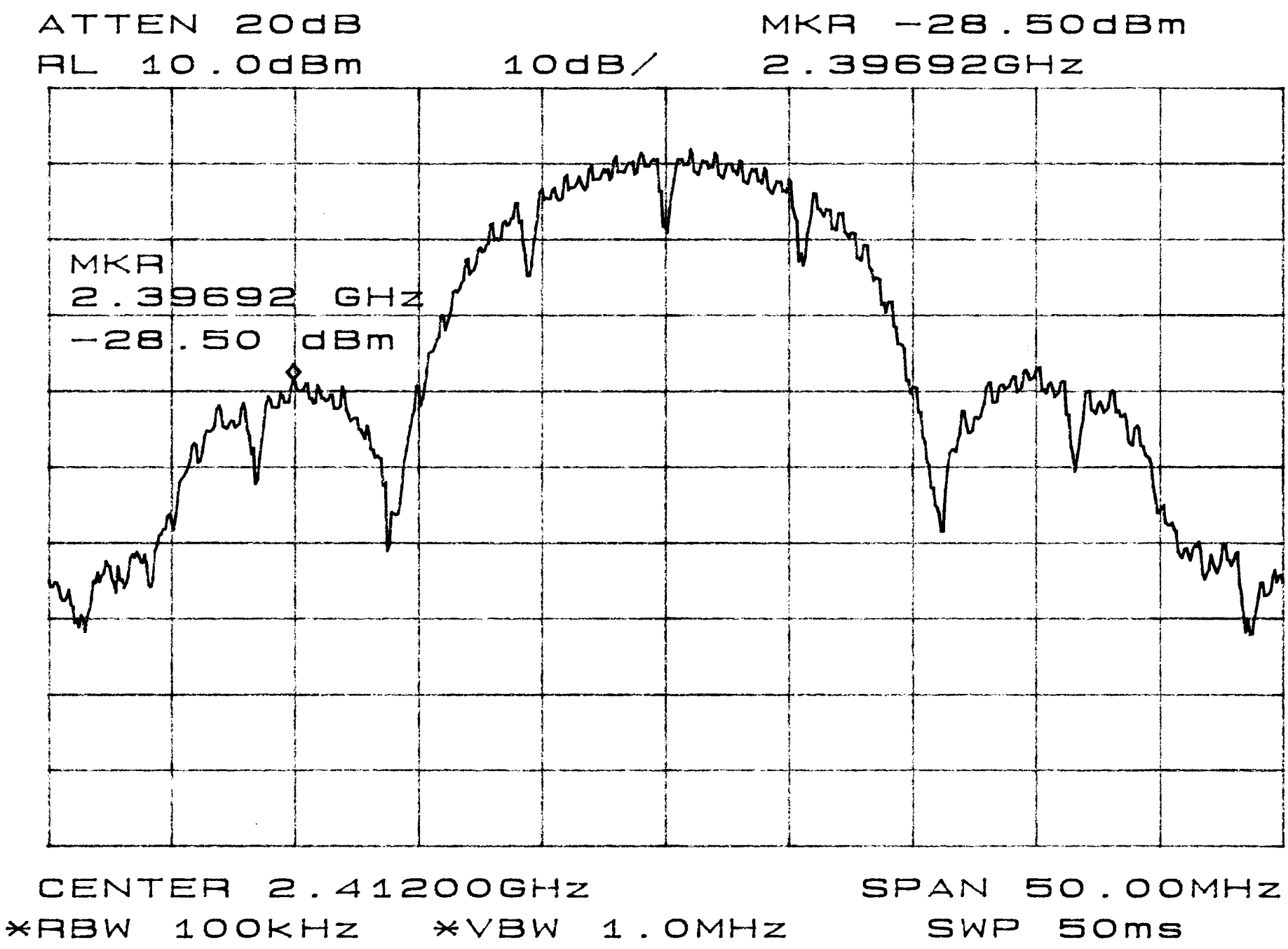
*RBW 100KHz
*VBW 1.0MHz
SWP 610ms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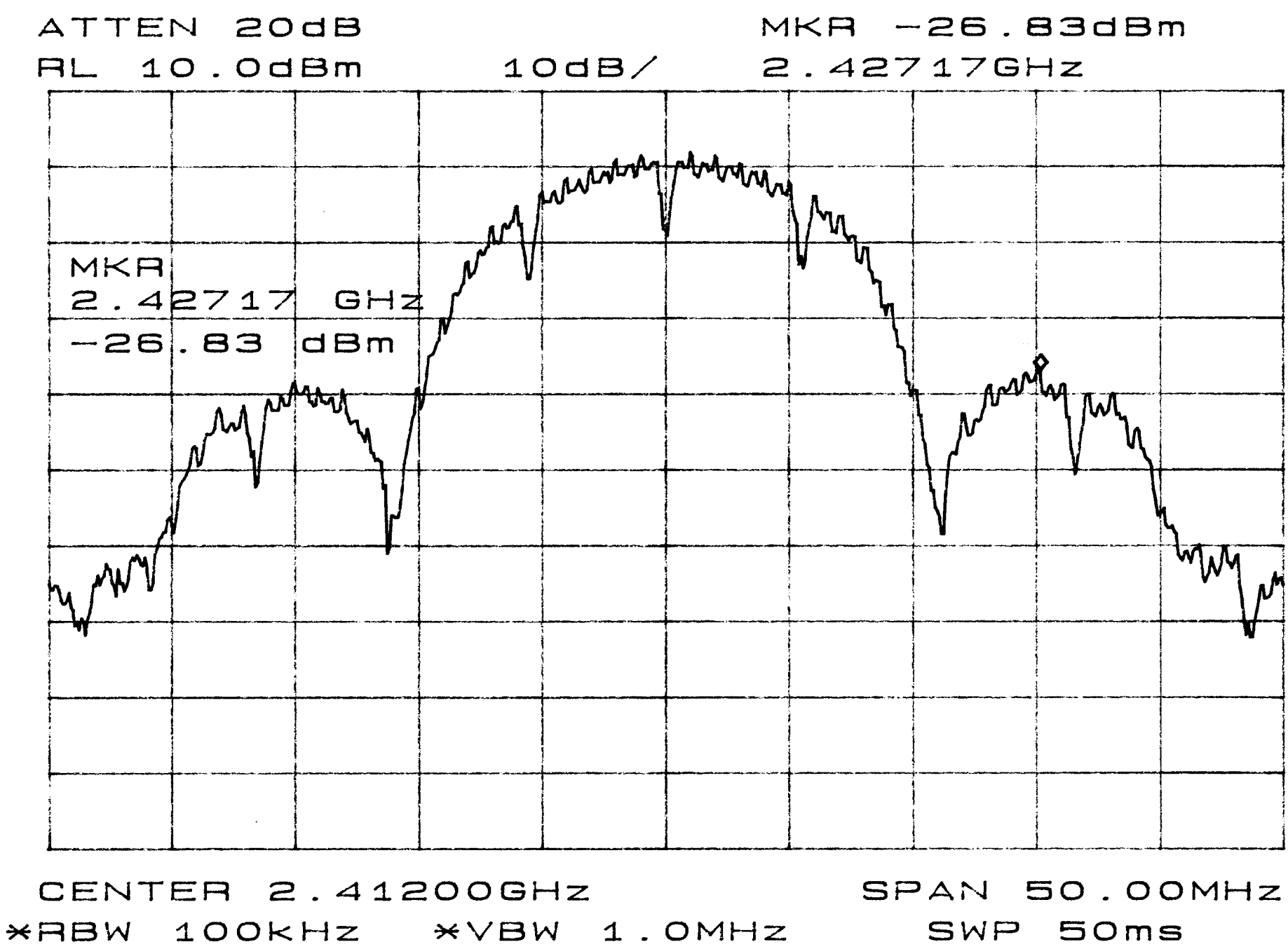
*RBW 100KHz
*VBW 1.0MHz
SWP 50ms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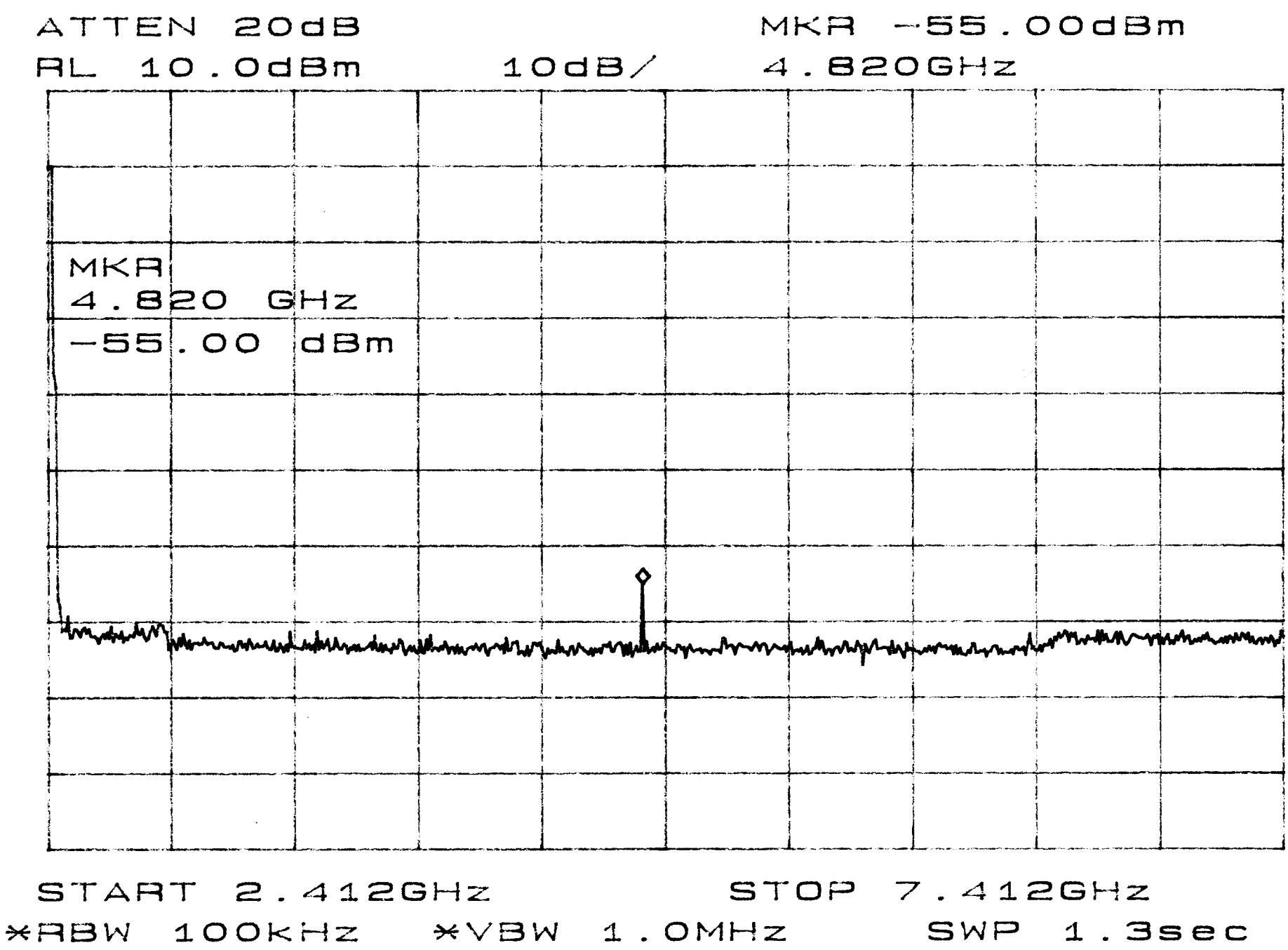
10dB/
2.42717GHz
MKR
2.42717 GHz
-26.83 dBm
CENTER 2.41200GHz
SPAN 50.00MHz
*RBW 100kHz
*VBW 1.0MHz
SWP 50ms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MKR
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-55.00 dBm
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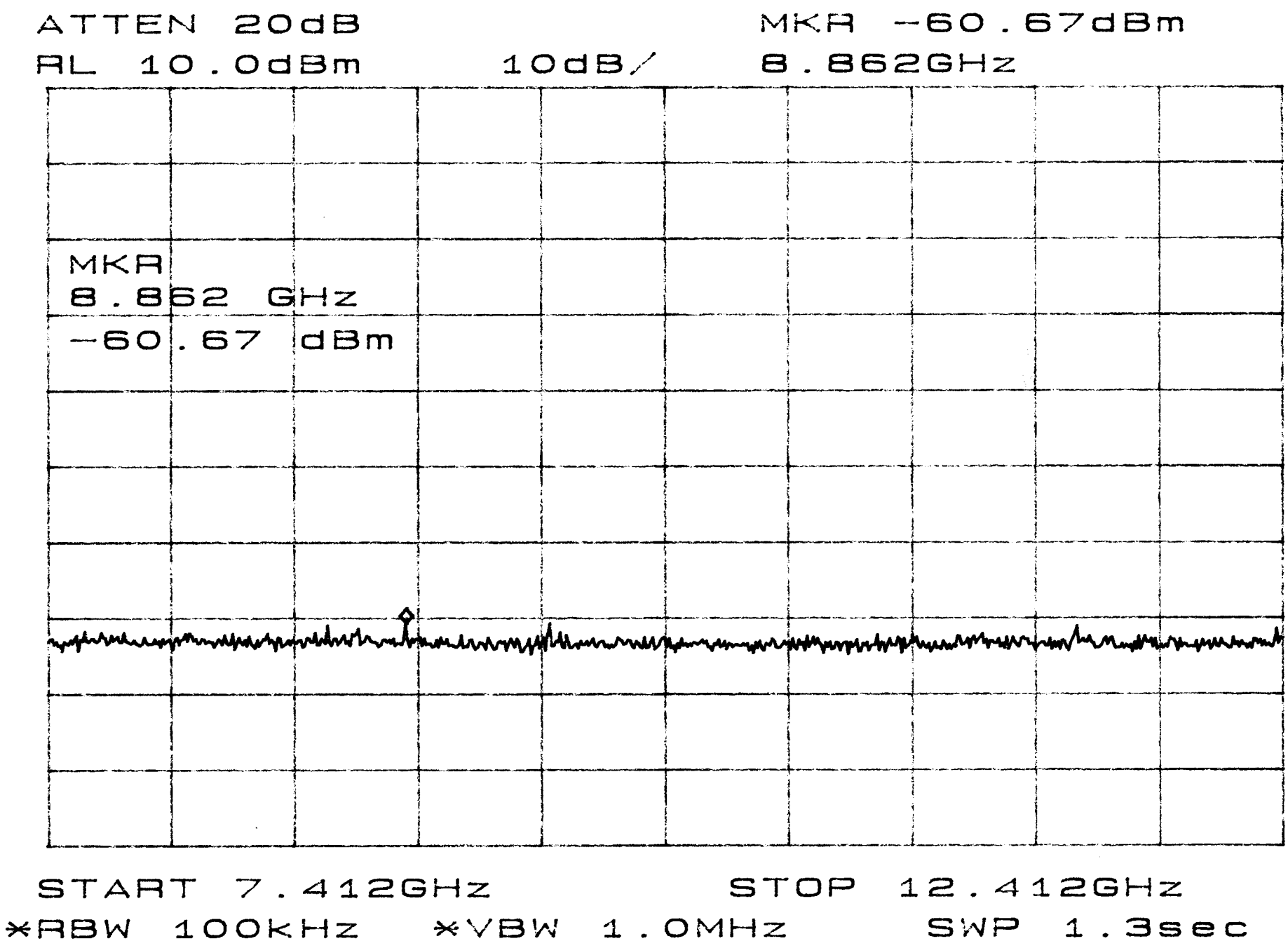
*RBW 100kHz
*VBW 1.0MHz
SWP 1.3sec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10dB/
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-60.67 dBm
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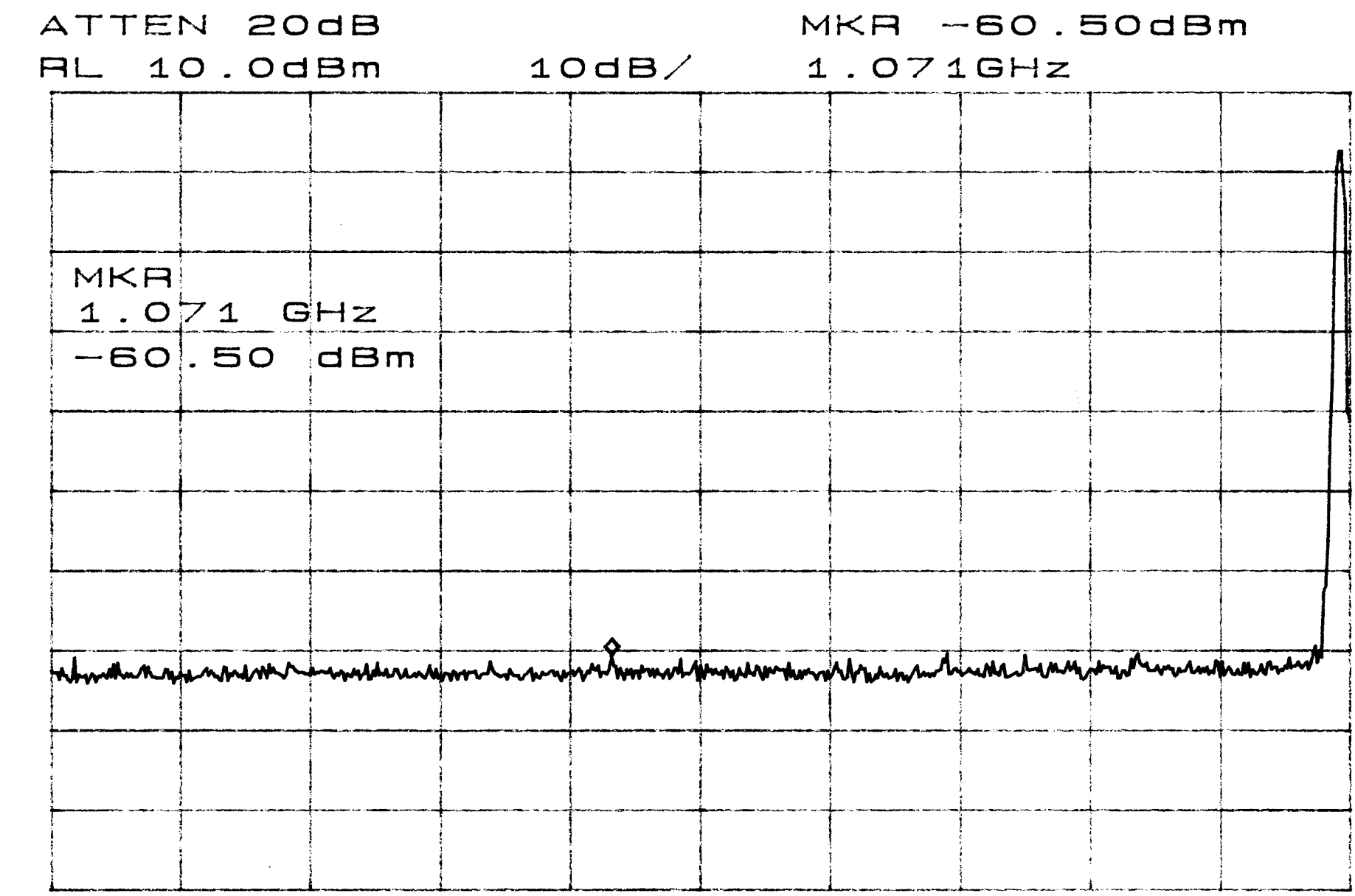
*VBW 1.0MHz
SWP 1.3sec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10dB/
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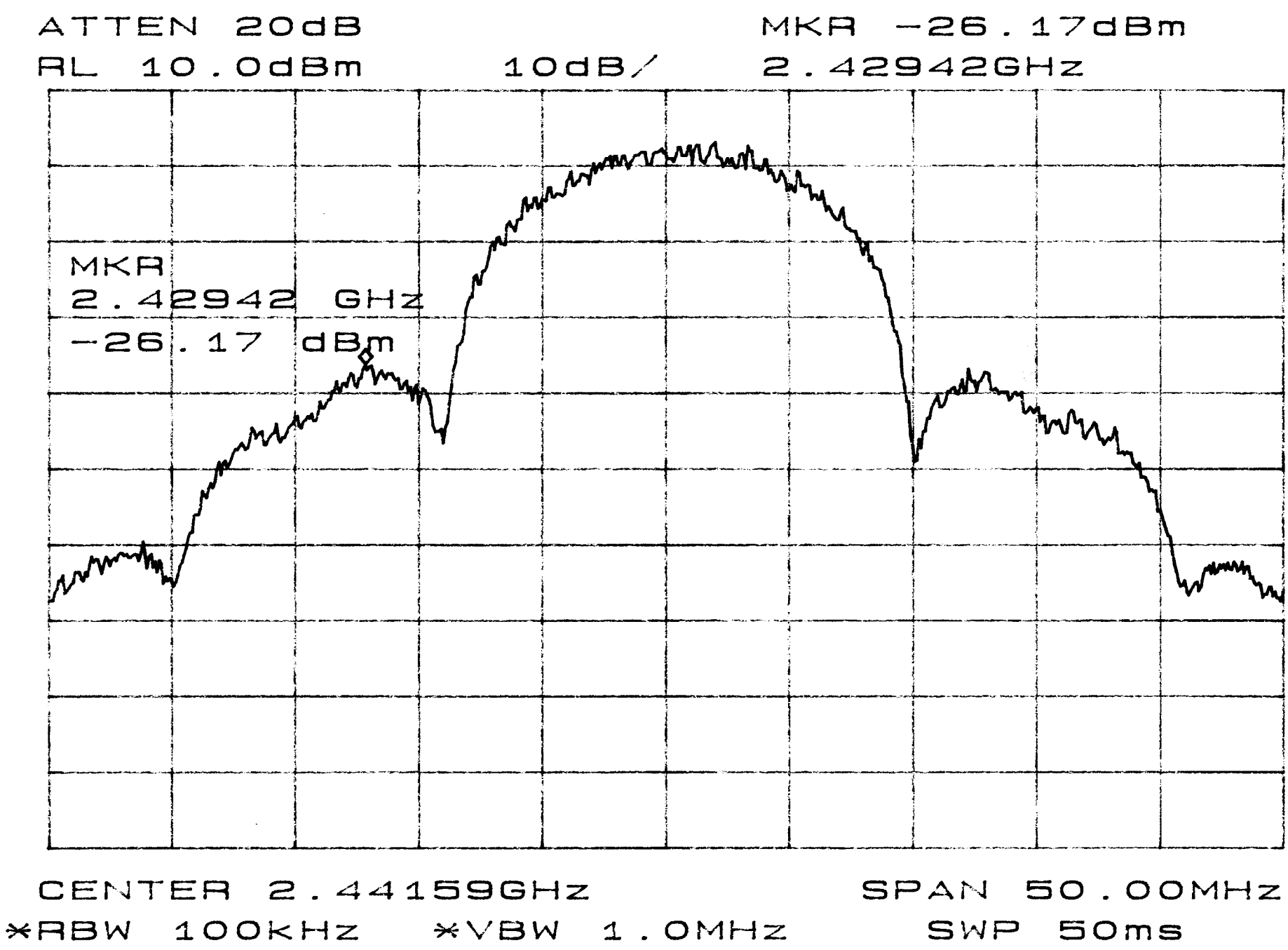
*RBW 100kHz
*VBW 1.0MHz
SWP 610ms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10dB/
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-26.17 dBm
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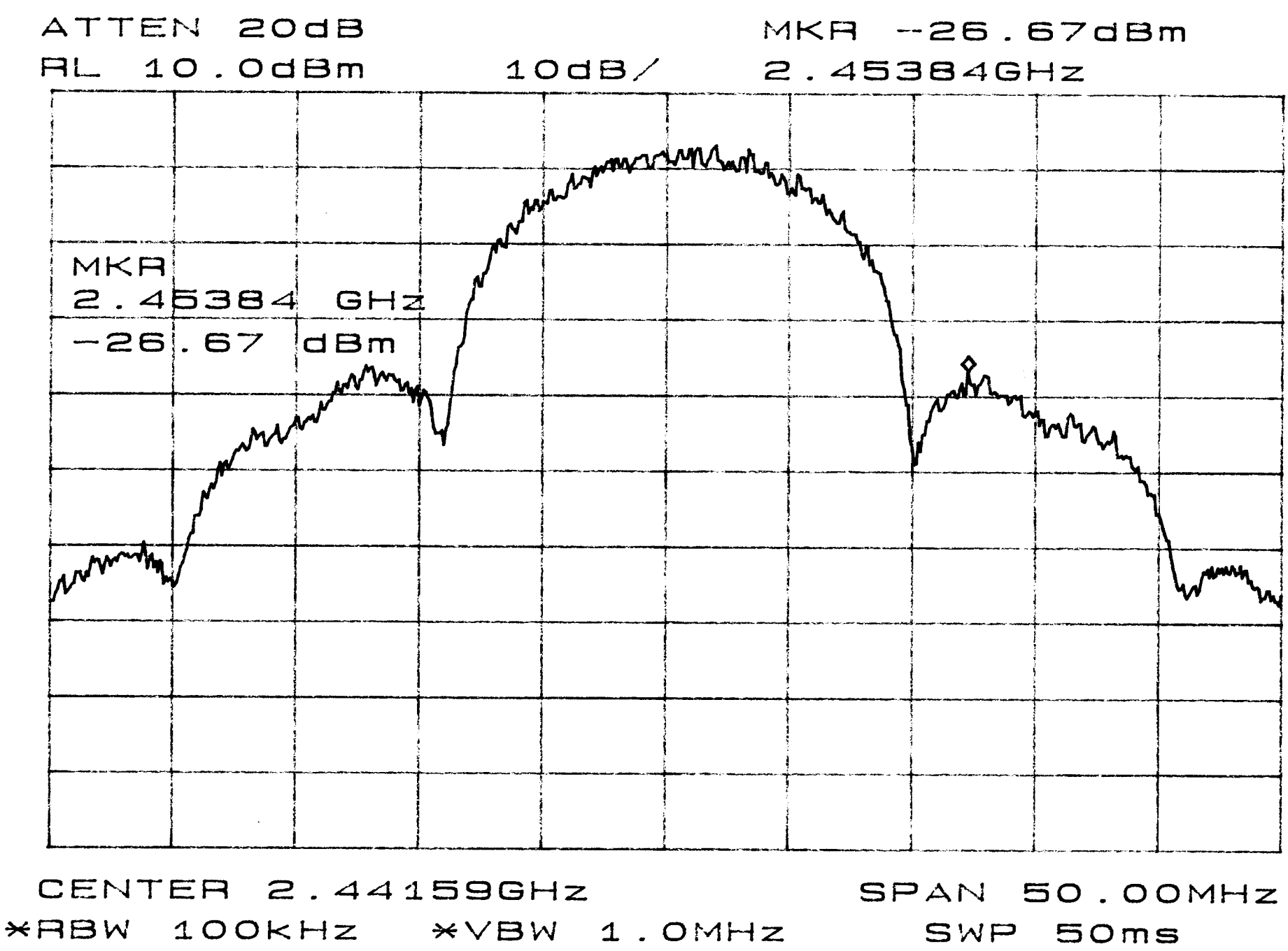
SPAN 50.00MHz
*RBW 100KHz
*VBW 1.0MHz
SWP 50ms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2.45384GHz
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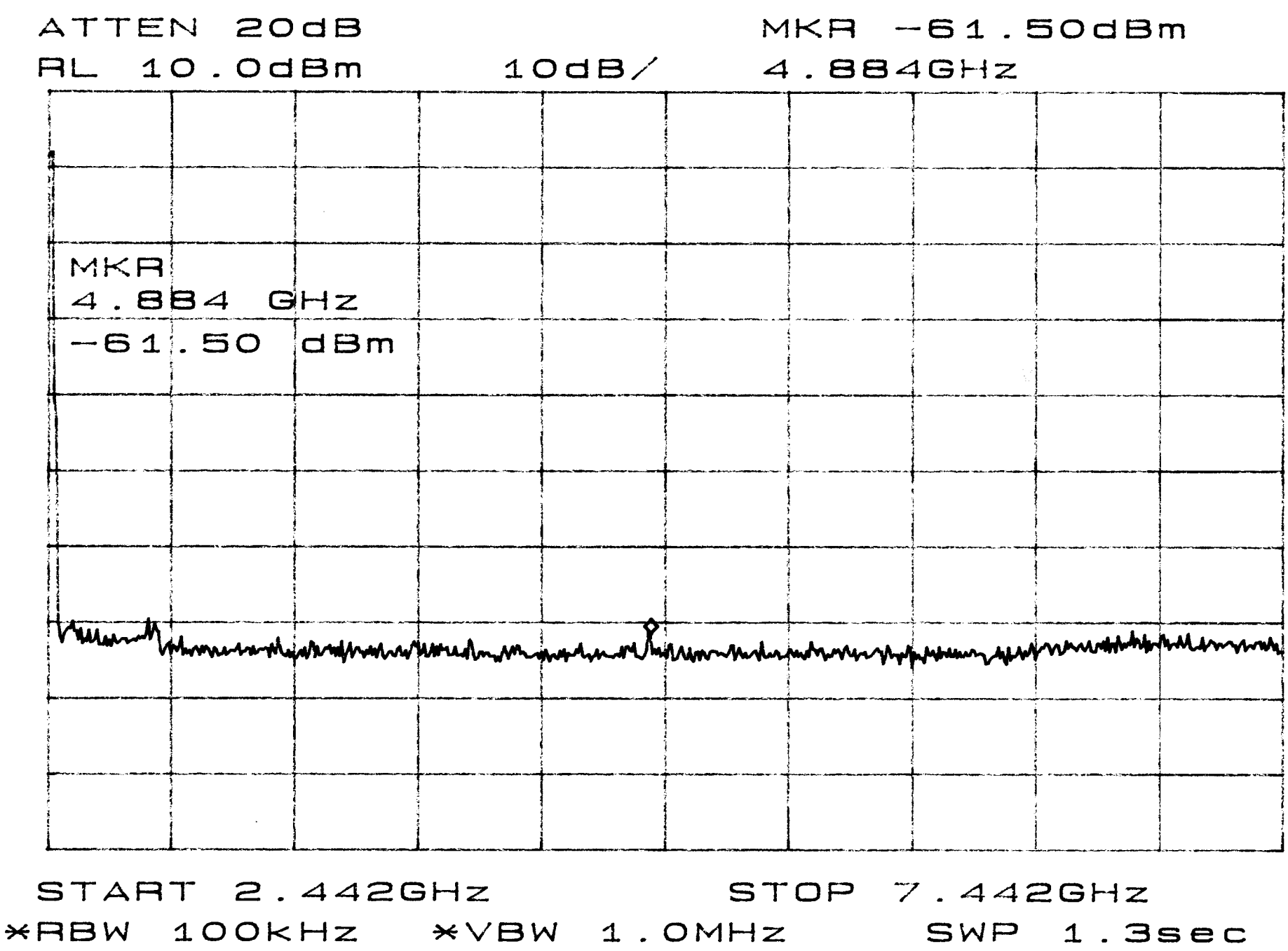
*VBW 1.0MHz
SWP 50ms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-61.50 dBm
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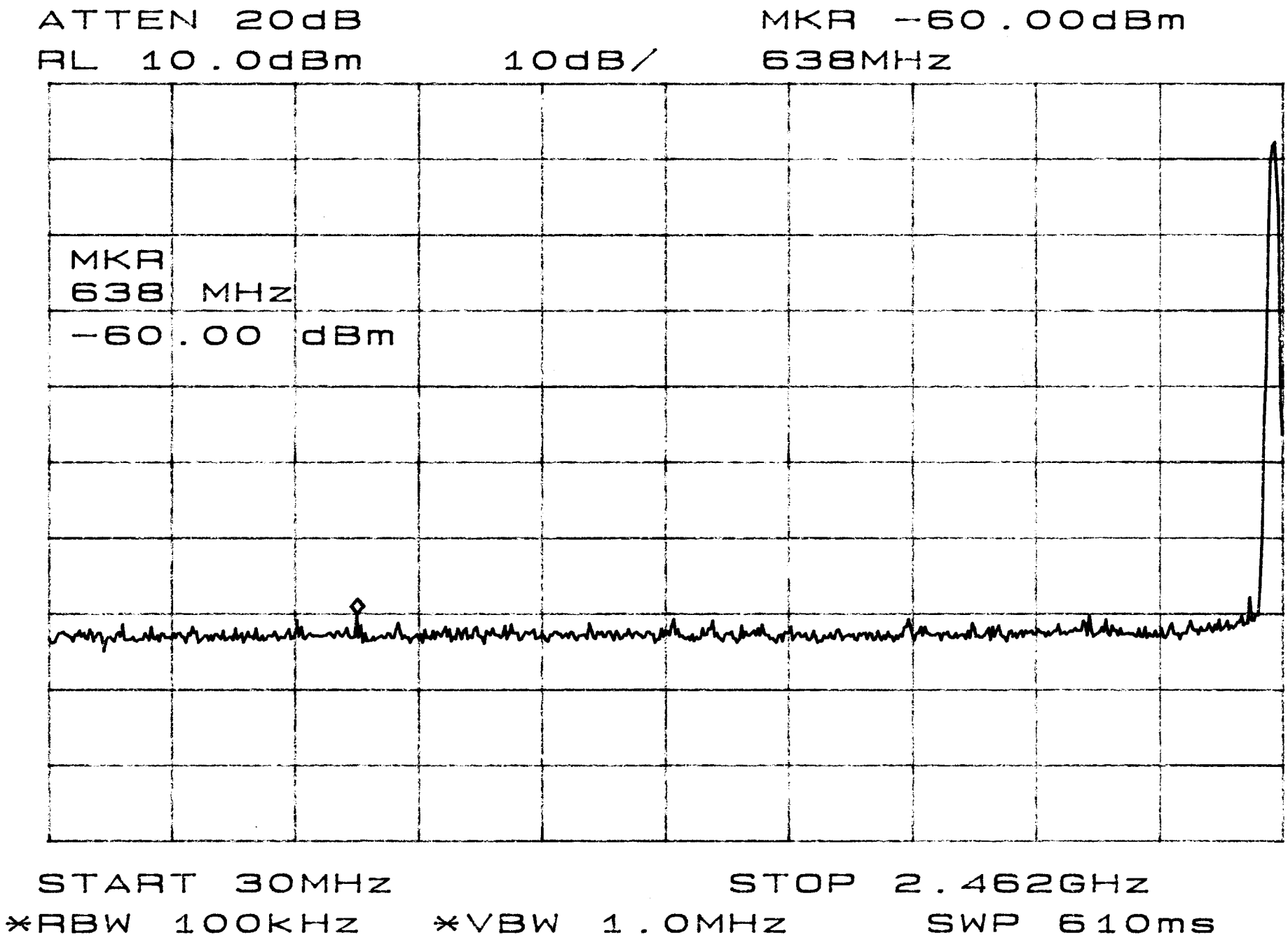
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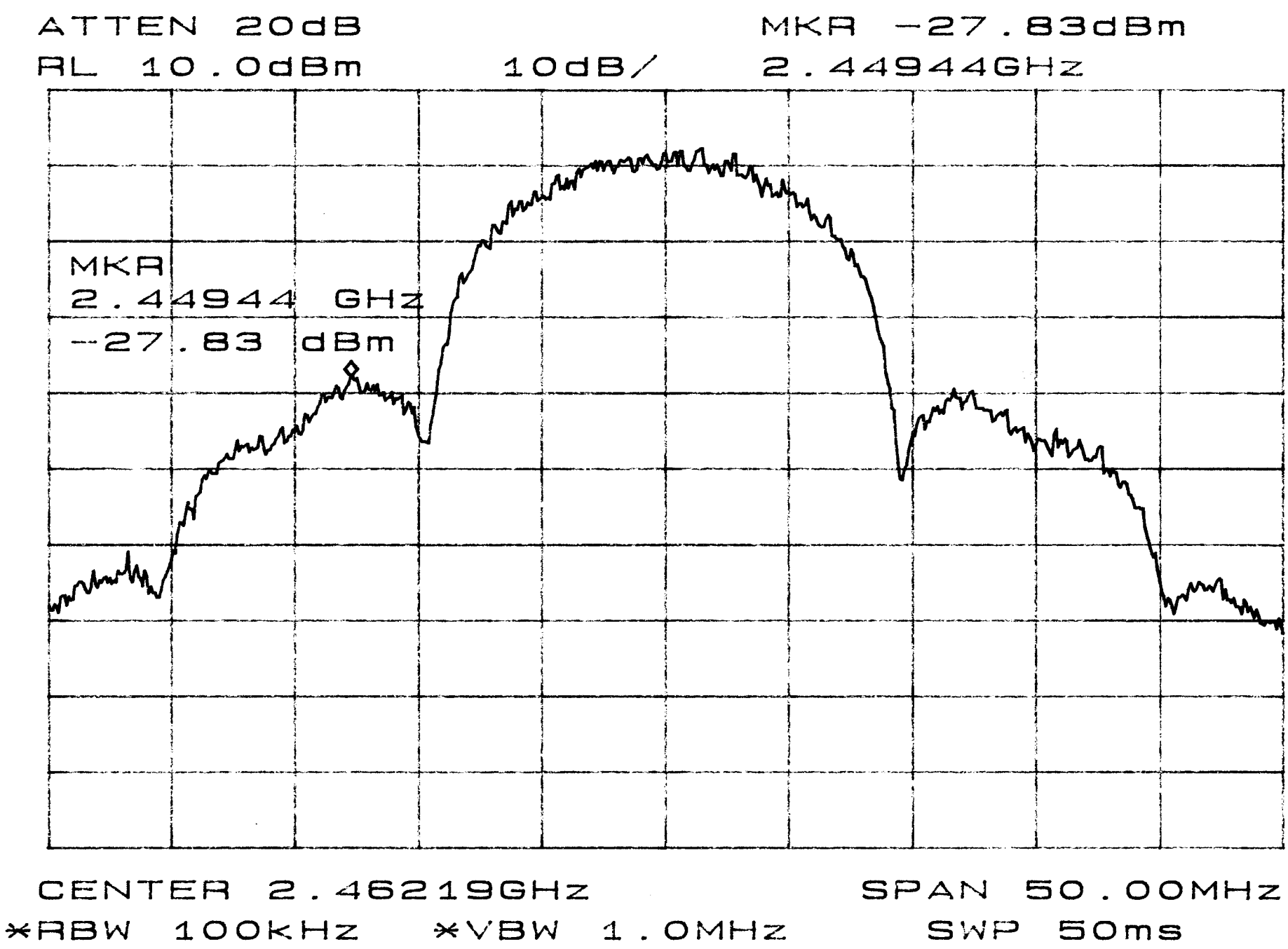
*VBW 1.0MHz
SWP 610ms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10dB/
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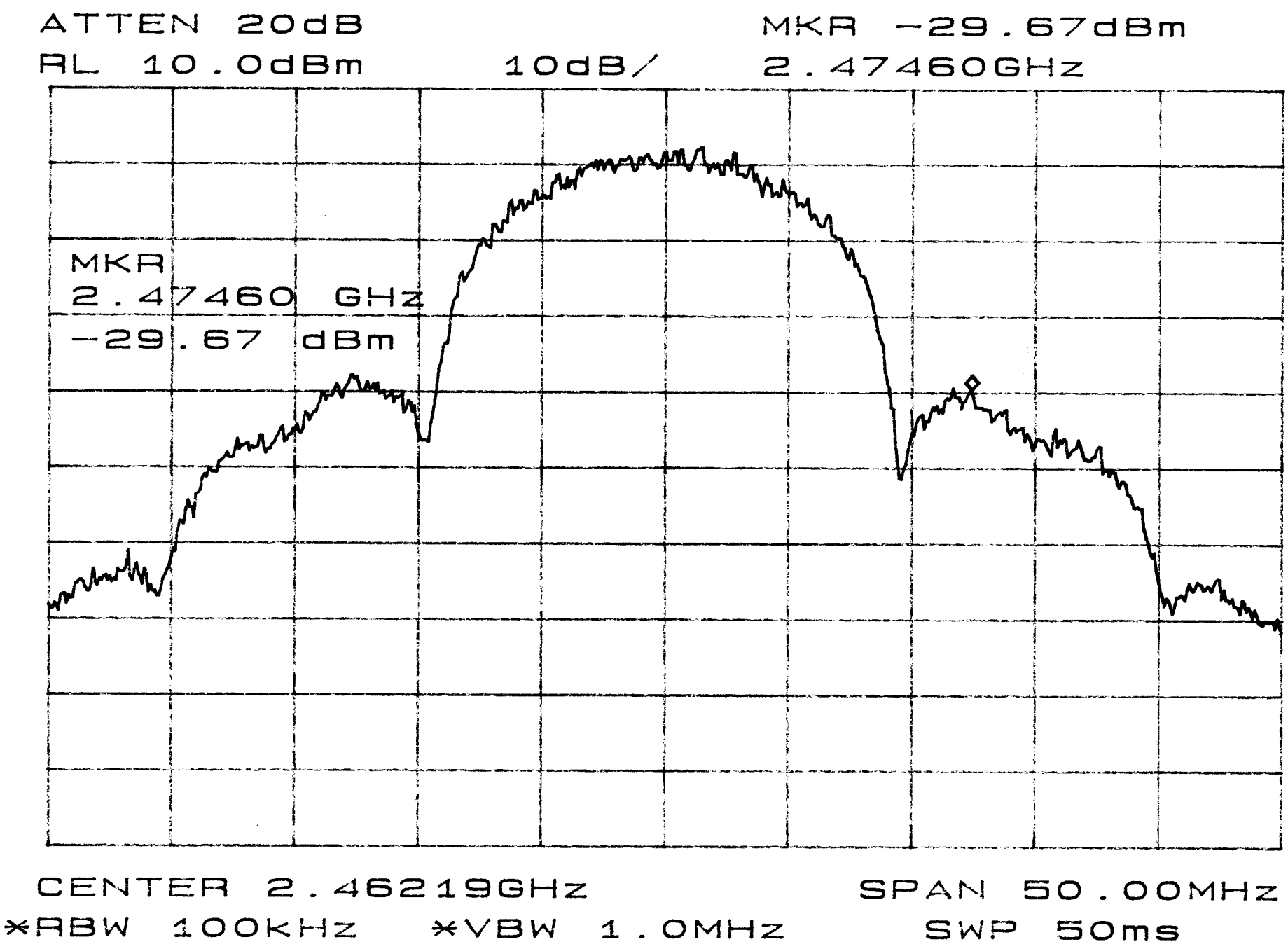
*RBW 100KHz
*VBW 1.0MHz
SWP 50ms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10dB/
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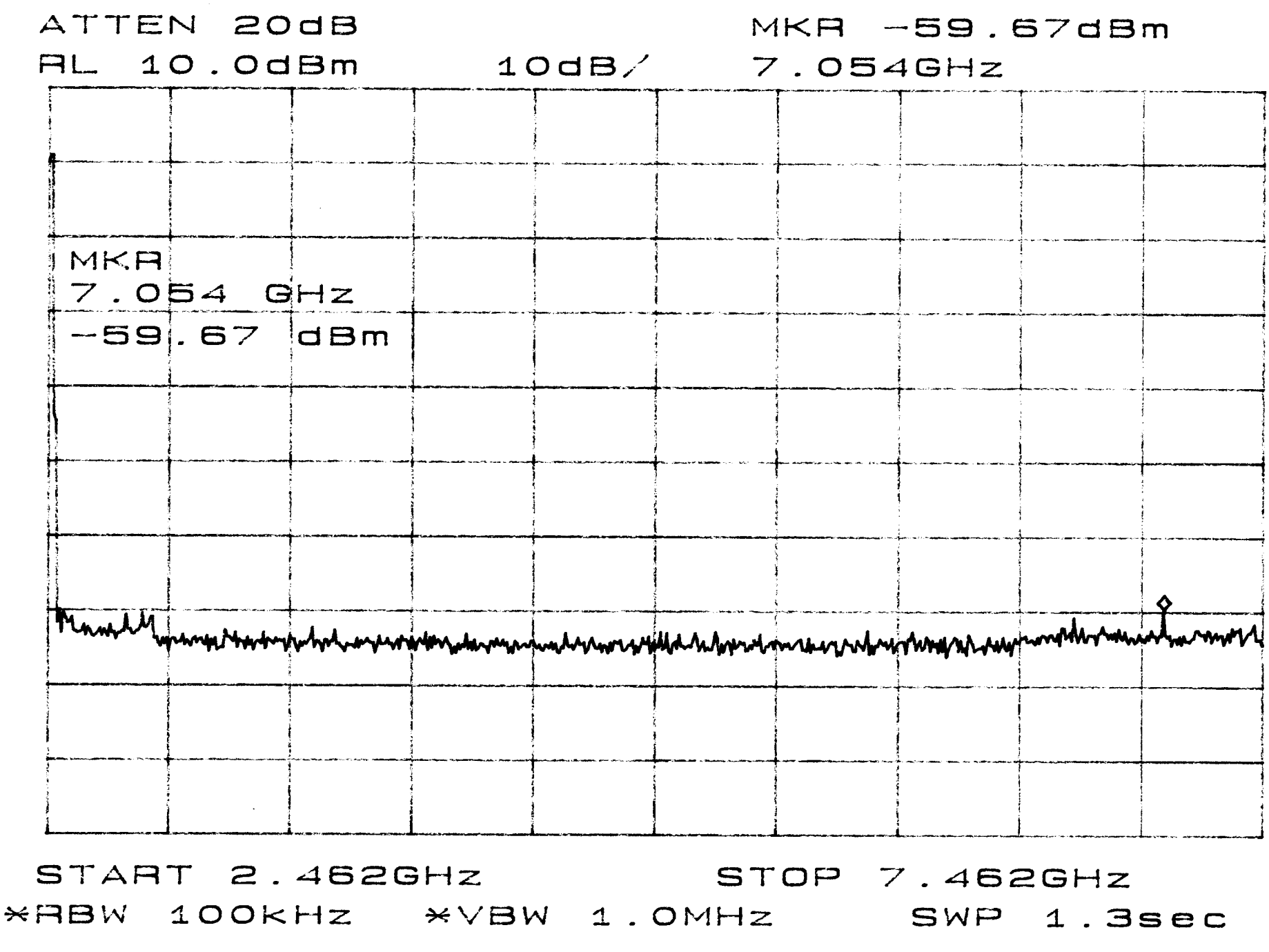
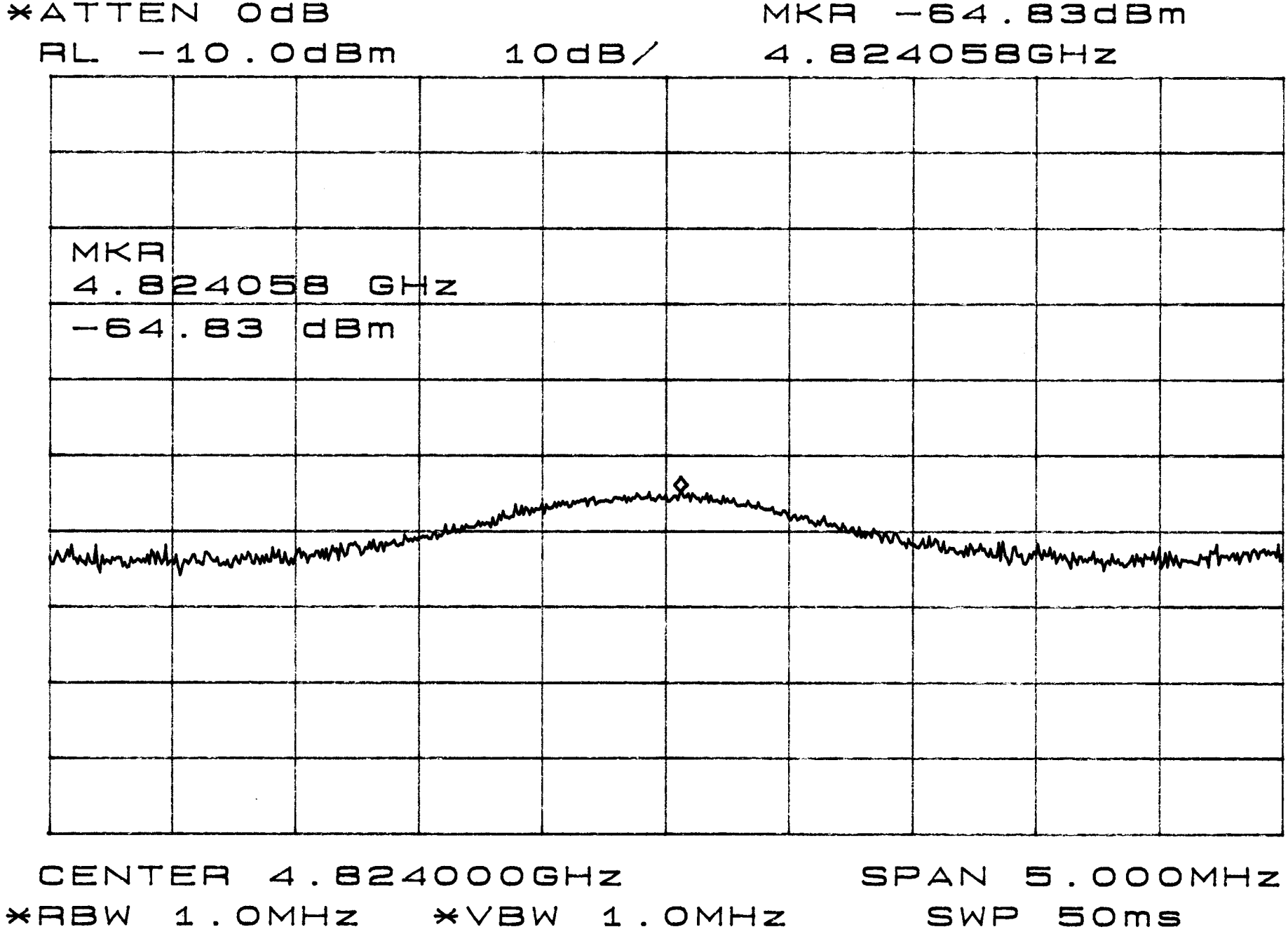
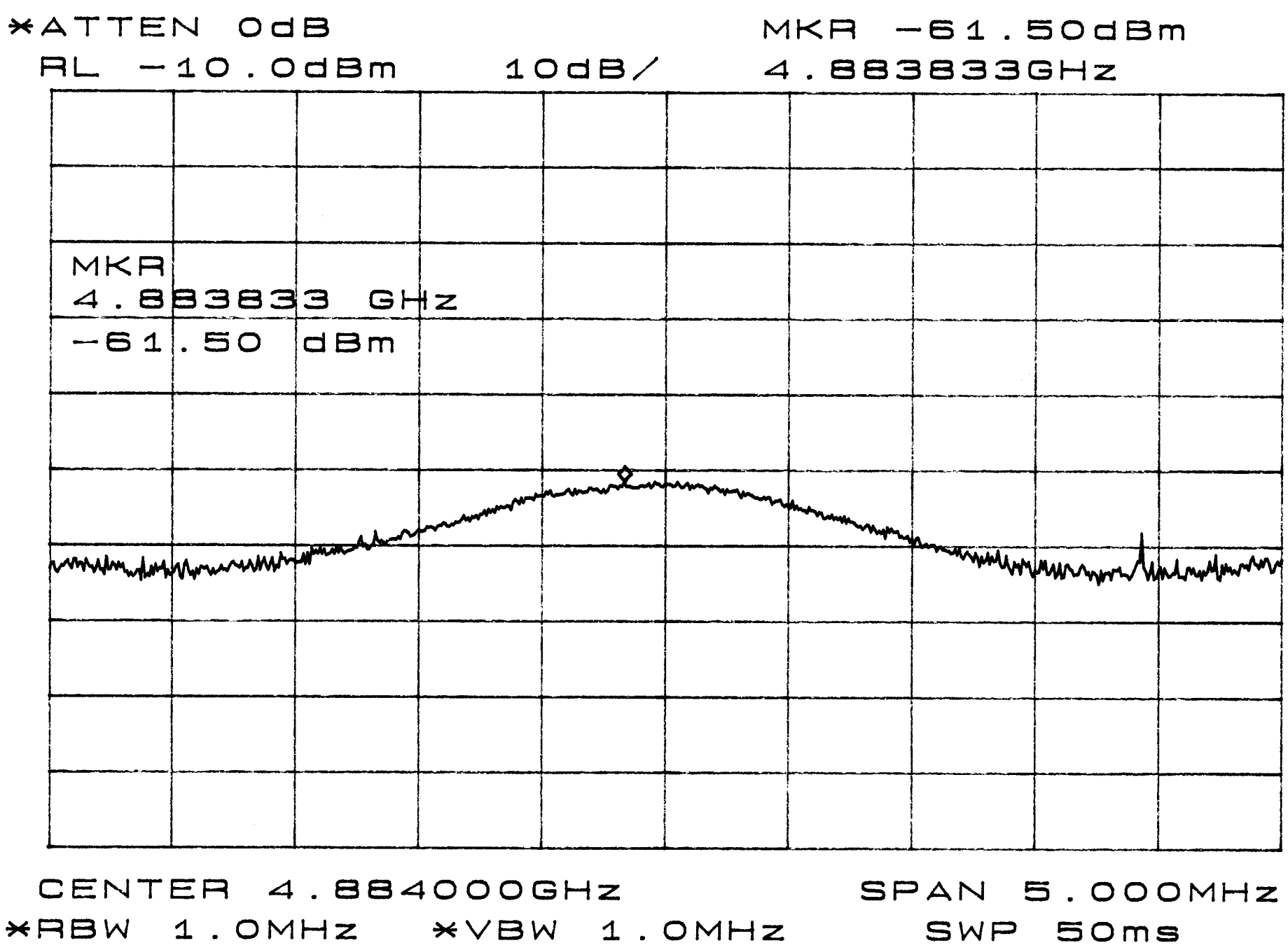
2.47460 GHz
-29.67 dBm
CENTER 2.46219GHz
SPAN 50.00MHz
*RBW 100KHz
*VBW 1.0MHz
SWP 50ms

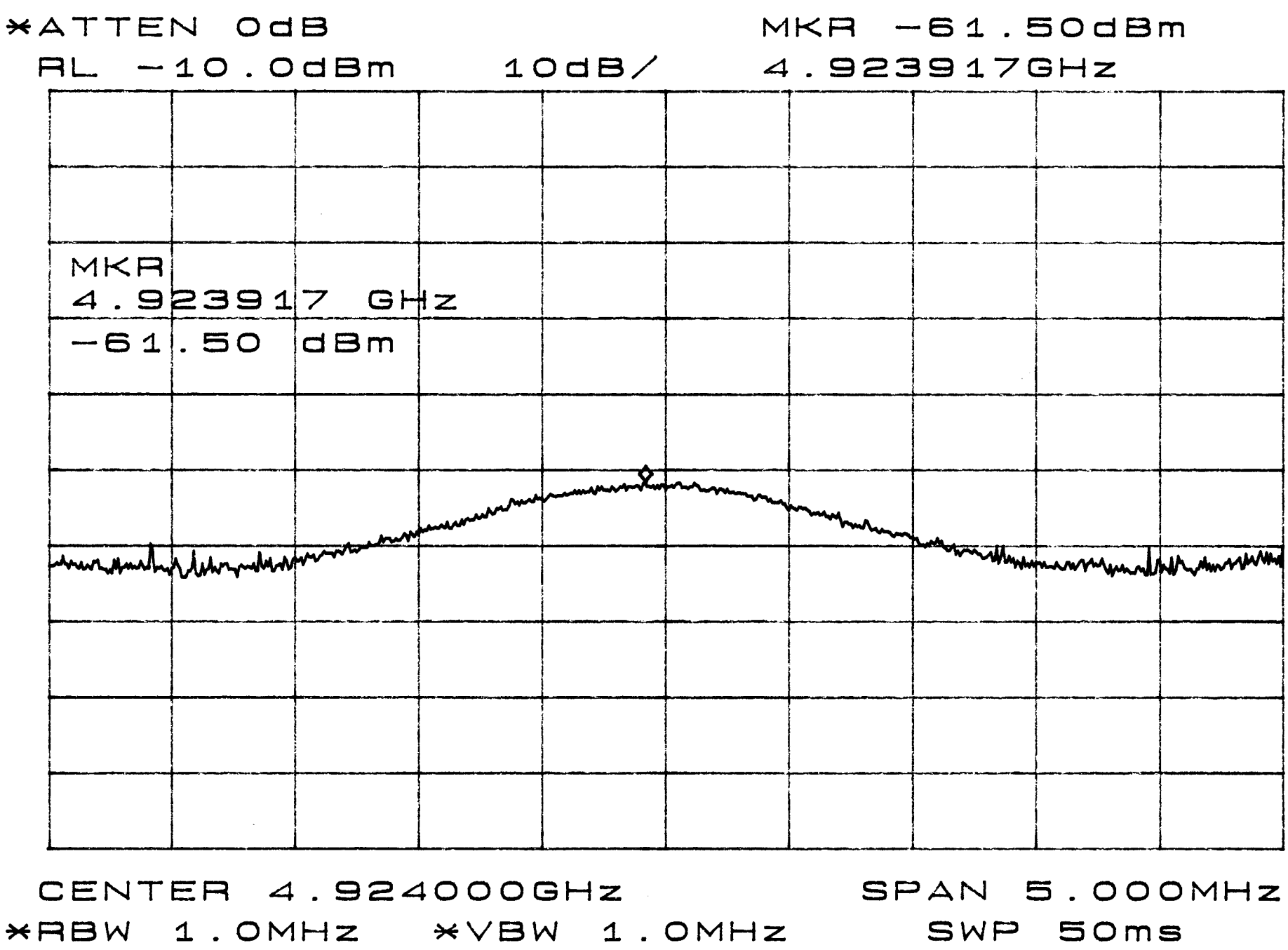

ATTEN 20dB
MKR -59.67dBm
RL 10.0dBm
10dB/
7.054GHz
MKR
7.054 GHz
-59.67 dBm
START 2.462GHz
STOP 7.462GHz
*RBW 100KHz
*VBW 1.0MHz
SWP 1.3sec

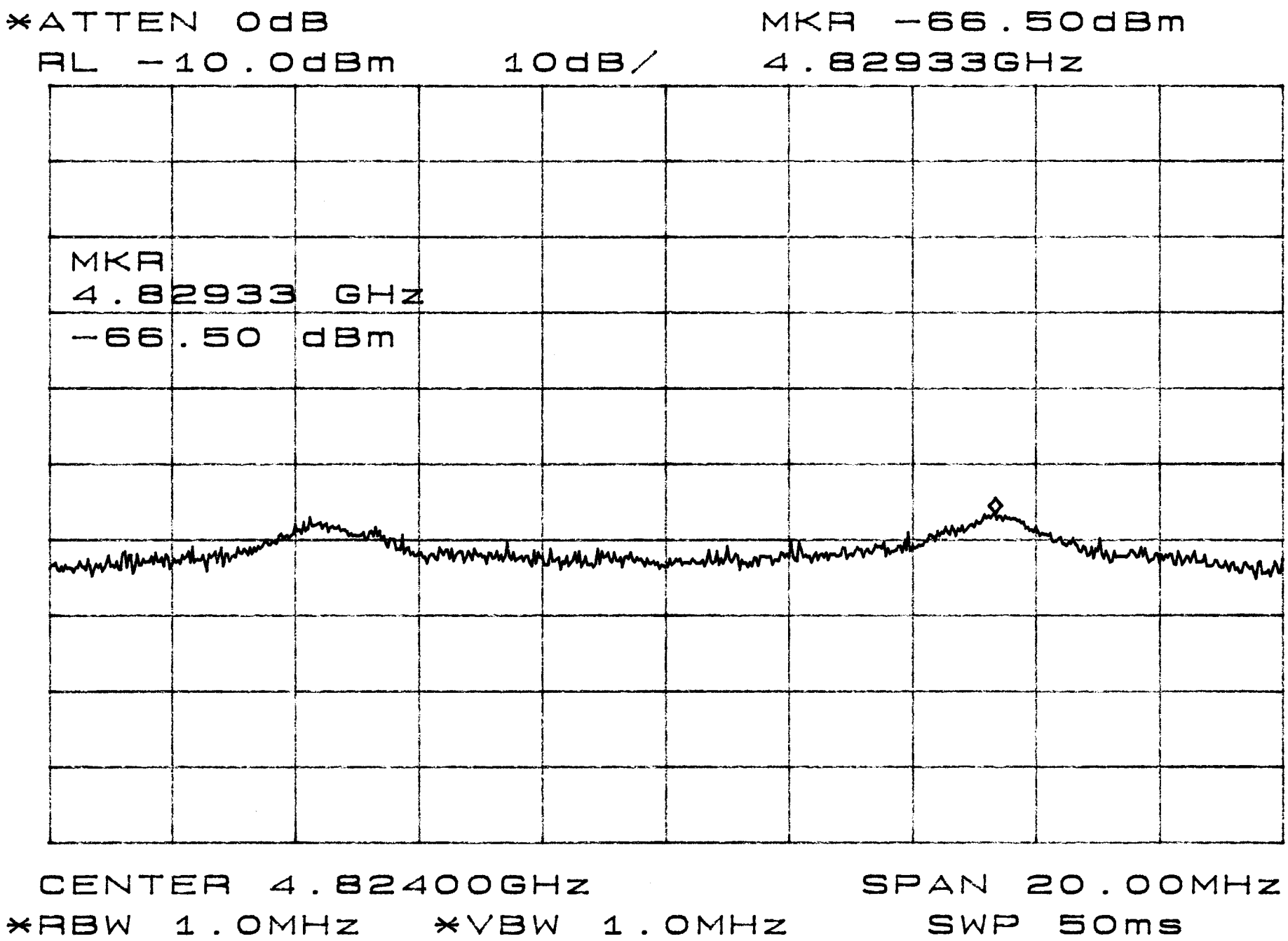
Appendix B

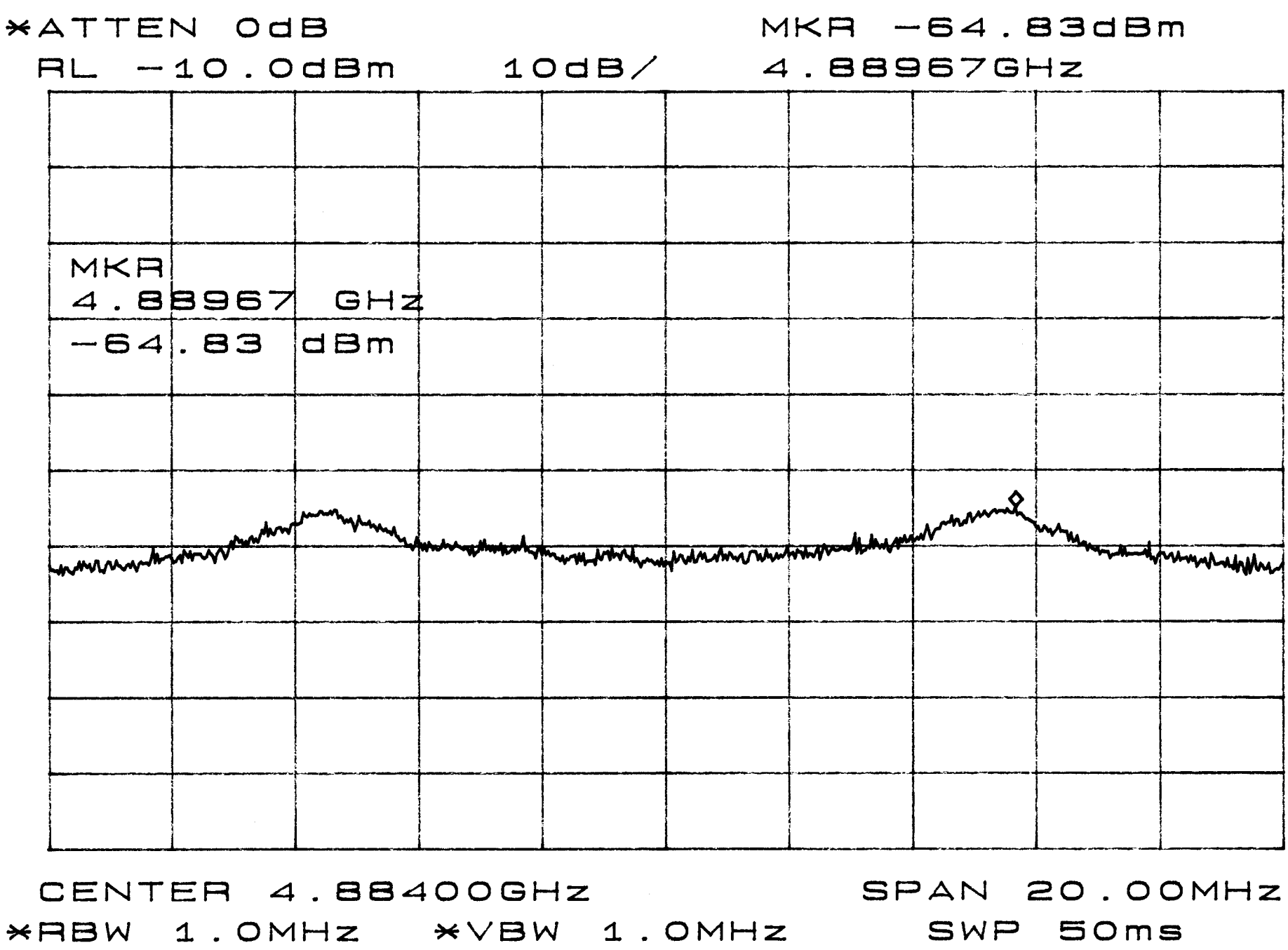
Radiated Spurious Emission Plots

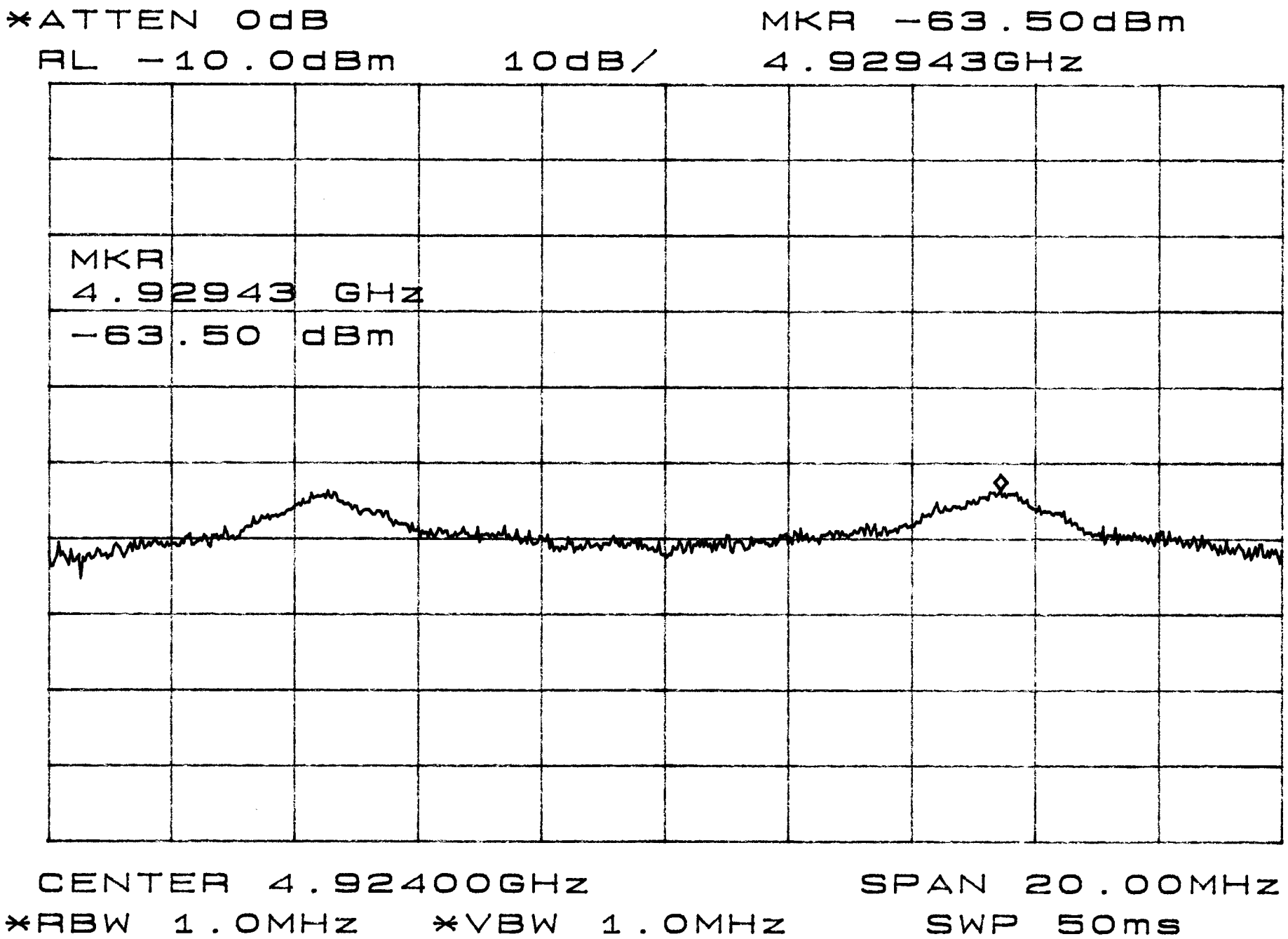

*ATTEN 0dB
MKR -64.83dBm
RL -10.0dBm
10dB/
4.824058GHz
MKR
4.824058 GHz
-64.83 dBm
CENTER 4.824000GHz
SPAN 5.000MHz
*RBW 1.0MHz
*VBW 1.0MHz
SWP 50ms

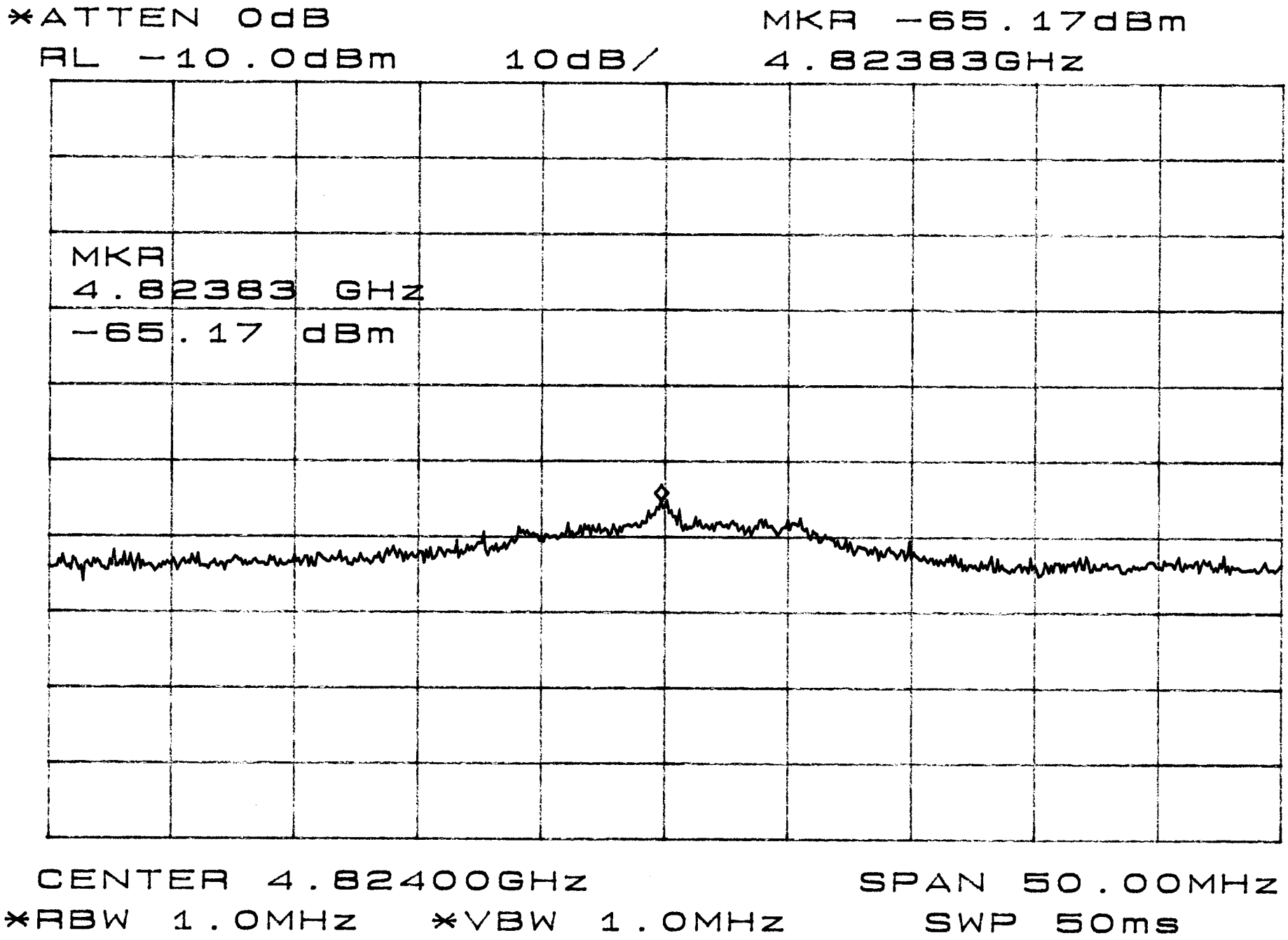

*ATTEN 0dB
MKR -61.50dBm
RL -10.0dBm
10dB/
4.883833GHz
MKR
4.883833 GHz
-61.50 dBm
CENTER 4.884000GHz
SPAN 5.000MHz
*RBW 1.0MHz
*VBW 1.0MHz
SWP 50ms

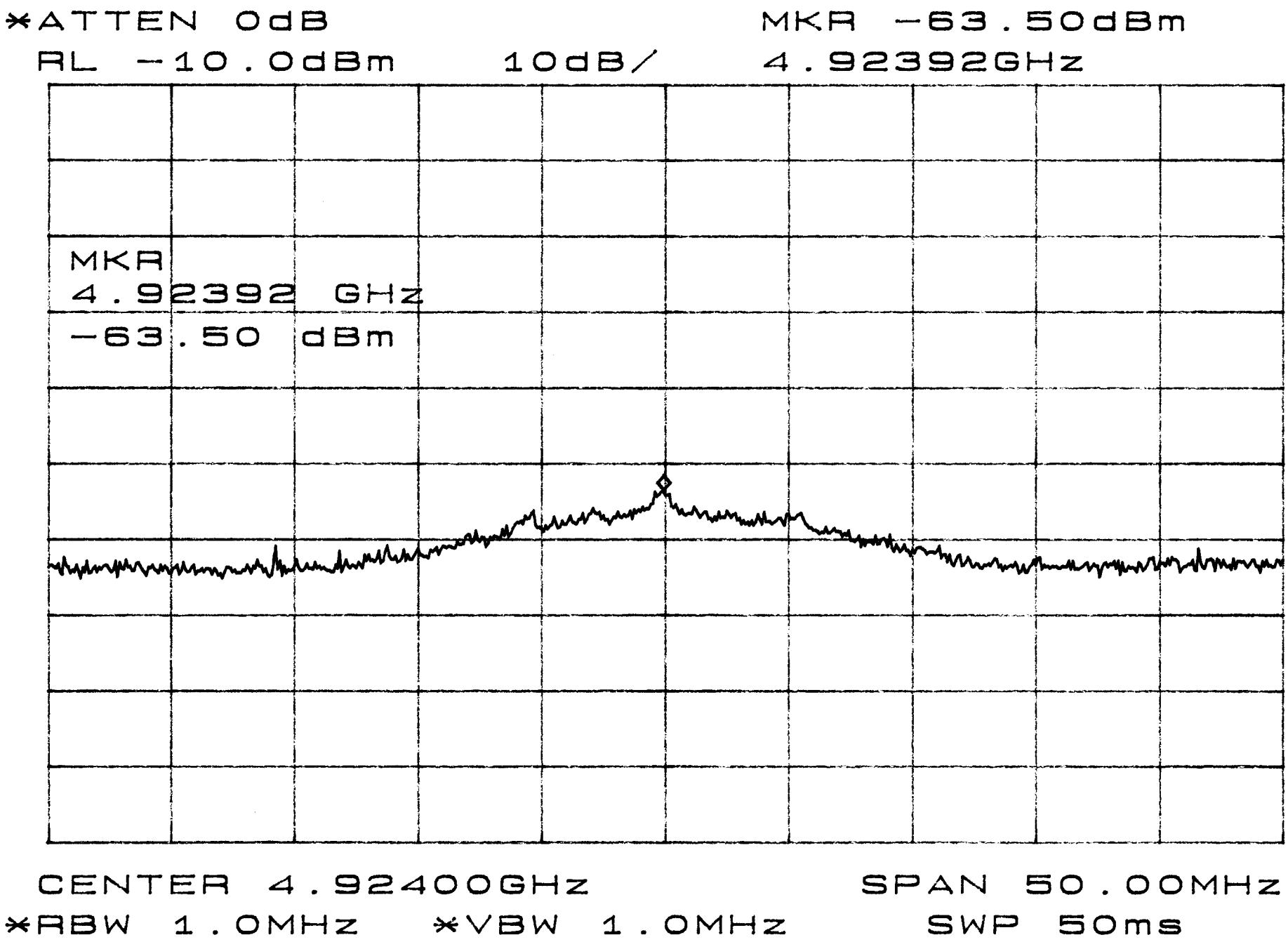

*ATTEN 0dB
MKR -61.50dBm
RL -10.0dBm
10dB/
4.923917GHz
MKR
4.923917 GHz
-61.50 dBm
CENTER 4.924000GHz
SPAN 5.000MHz
*RBW 1.0MHz
*VBW 1.0MHz
SWP 50ms

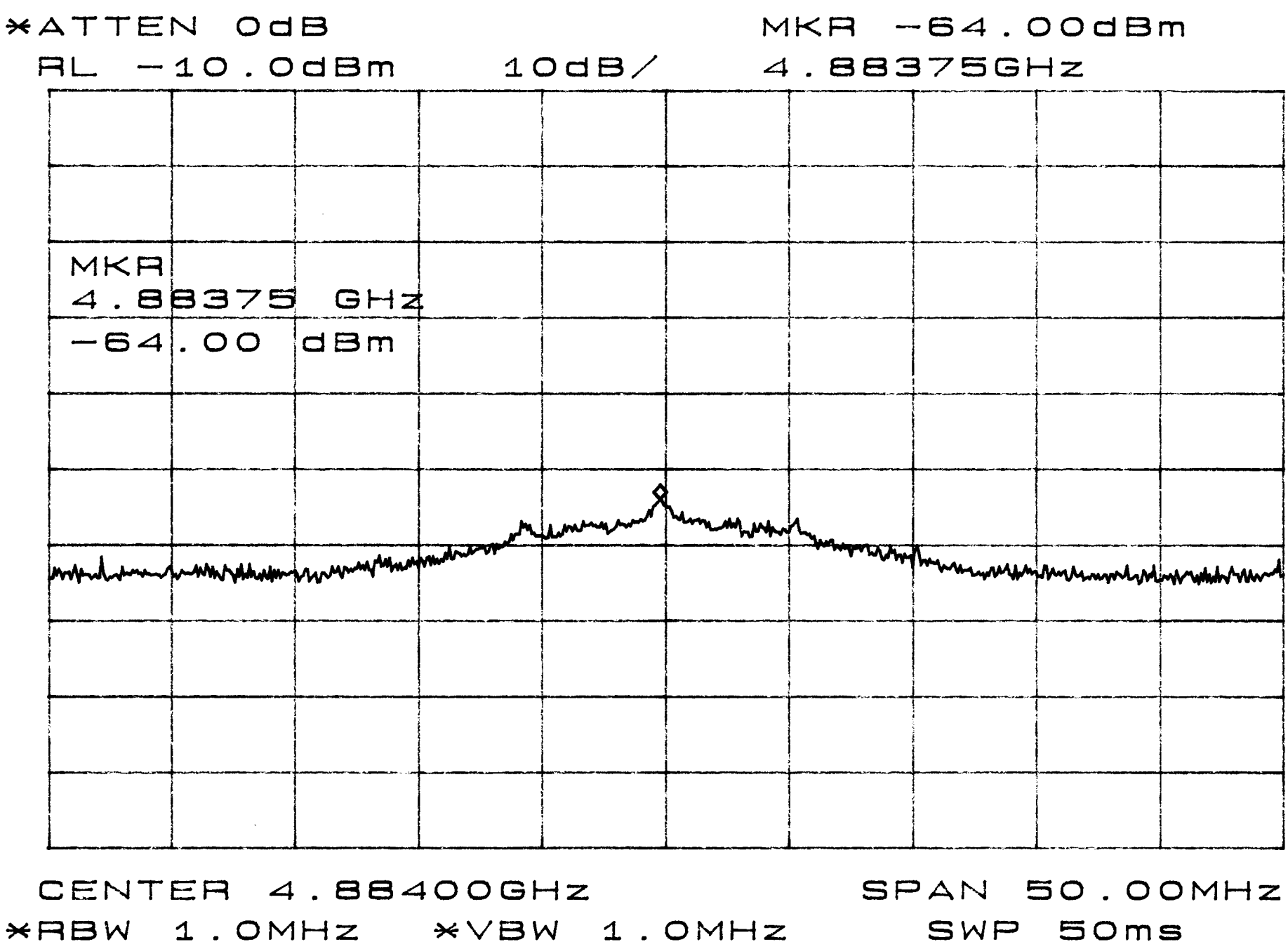

*ATTEN 0dB
MKR -66.50dBm
RL -10.0dBm
10dB/
4.82933GHz
MKR
4.82933 GHz
-66.50 dBm
CENTER 4.82400GHz
SPAN 20.00MHz
*RBW 1.0MHz
*VBW 1.0MHz
SWP 50ms


*ATTEN 0dB
MKR -64.83dBm
RL -10.0dBm
10dB/
4.88967GHz
MKR
4.88967 GHz
-64.83 dBm
CENTER 4.88400GHz
SPAN 20.00MHz
*RBW 1.0MHz
*VBW 1.0MHz
SWP 50ms


*ATTEN 0dB
MKR -63.50dBm
RL -10.0dBm
10dB/
4.92943GHz
MKR
4.92943 GHz
-63.50 dBm
CENTER 4.92400GHz
SPAN 20.00MHz
*RBW 1.0MHz
*VBW 1.0MHz
SWP 50ms


*ATTEN 0dB
MKR -65.17dBm
RL -10.0dBm
10dB/
4.82383GHz
MKR
4.82383 GHz
-65.17 dBm
CENTER 4.82400GHz
SPAN 50.00MHz
*RBW 1.0MHz
*VBW 1.0MHz
SWP 50ms


*ATTEN 0dB
MKR -63.50dBm
RL -10.0dBm
10dB/
4.92392GHz
MKR
4.92392 GHz
-63.50 dBm
CENTER 4.92400GHz
SPAN 50.00MHz
*RBW 1.0MHz
*VBW 1.0MHz
SWP 50ms


*ATTEN 0dB
MKR -64.00dBm
RL -10.0dBm
10dB/
4.88375GHz
MKR
4.88375 GHz
-64.00 dBm
CENTER 4.88400GHz
SPAN 50.00MHz
*RBW 1.0MHz
*VBW 1.0MHz
SWP 50ms