

15.247 Certification
FCC ID: NVCRM10003

EMI TEST REPORT
LOW POWER GAS RMI REV.E

Prepared for

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Prepared by

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Test Report Number: A809003

Date of Test: August 31, 1998

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1.0 TEST FACILITY

Name: Electronic Compliance Laboratories

Location: 1249 Birchwood Dr.
Sunnyvale, CA 94089

Site Filing: A site description is on file at the
Federal Communications Commission
P.O. Box 429
Columbia, MD 21045

Types of Sites: Open Field Radiated and Indoor Screen Room (Line Conducted).
All sites are constructed and calibrated to meet ANSI C63.4-1994 requirements.
Test facility is recognized by the National Voluntary Laboratory Accreditation Program for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations.

NVLAP Code: 20089 effective through: March 31, 1999

2.0 TEST EQUIPMENT

Description	Manufacturer	Model	SN
EMI Receiver	HP	8546A	3325A00137
Power Meter	HP	437B	3125U13399
Power Sensor	HP	8481	3318A16275
Spectrum Analyzer	HP	8563E	3137A01183
Preamp	HP	8447F	3113A05849
Preamp	HP	8449B	3008A00527
LISN	EM	ANS-25/2	2532
Biconical Antenna	EM	EM 6912	677
Log Periodic Ant	EM	EM 6950	858
Double Ridge Horn	EM	EM 6961	6231
Filter BP 1.2-4 GHz	FSY	HM1160-11SS	001
Filter BP 4-10 GHz	FSY	HM2950-15SS	001
Filter BP10-18 GHz	FSY	HP8601-7SS	001

3.0 EUT

Product: LOW POWER GAS RMI REV.E
Model Number: 100G-XX00-XX
Serial Number: 0001B69F9

Description:

The Whisper Communication Inc. LOW POWER GAS RMI REV.E is a spread spectrum frequency hopping radio transceiver operating in the 902 - 928 MHz band that resides in a gas meter "trace" housing. The RMI unit transmits gas consumption information to a remote cell.

4.0 SUPPORT EQUIPMENT

Equipment Type: N/A
Model Number: N/A
Serial Number: N/A
Manufacturer: N/A

:

5.0 EQUIPMENT CONFIGURATION

All of the equipment and cables were placed in worst case positions to maximize emissions.

Interconnecting cables were of the type and length specified in the individual equipment requirements.

Grounding was in accordance with the manufacturers requirements and conditions for intended use.

EUT	CONNECTED TO	CABLE TYPE
PORT		

6.0 SUMMARY OF TESTS

The LOW POWER GAS RMI REV.E is a frequency hopping spread spectrum (FHSS) radio system operating in the 902-928 MHz band. Tests were performed with one standard antenna. Test firmware resident in the EUT and was used to do the test.

6.1 15.247(a)(1) FREQUENCY HOPPING SYSTEMS

The LOW POWER GAS RMI REV.E uses 50 channels, each 120 kHz wide. The system hops using pseudorandom sequences. On average, each channel is used equally.

6.1.1 15.247(a)(1)(i) CHANNEL UTILIZATION

Three spectrum analyzer plots labeled "**CHANNEL UTILIZATION 903 - 912**", "**CHANNEL UTILIZATION 912 - 920**", and "**CHANNEL UTILIZATION 920 - 928**". The total number of channels shown is 67, which exceeds the minimum requirement of 50. The channels used have nominal center frequencies of 902 through 918 MHz.

Three spectrum analyzer MAX HOLD plots labeled "**BANDWIDTH**" show the 20 dB bandwidth of the hopping channel to be < 500 kHz (110/ 113 / 113 kHz) at the low/midband/high frequencies of 904.32 / 914.94 / 925.38 MHz. **Plots are in Appendix A.**

Zero span spectrum analyzer plots labeled "**CHANNEL DWELL TIME**" shows Worst case transmission time in a given slot: 270ms msec elapsed time, <100 % Low Power Gas RMI Rev. E

Maximum allowed: 400 msec.

The test plots are in Appendix A.

6.1.2 15.247(b) MAXIMUM PEAK OUTPUT POWER

The maximum power of the hopping channel to be +10.17 dBm or .010 W. The EUT was made to transmit uninterrupted random data on each of the low/mid/high channels.

The output was fed directly via cable soldered to the antenna connection point on the circuit board, spectrum analyzer set on MAX HOLD with no additional attenuation. See Appendix A for Plots.

Pout = +10.17 dBm / 10.4 mW
Limit: +30 dBm / 1 W maximum power

-3.0 dBi Internal Antenna

EIRP = +10.17 (peak power) -3 dBi (peak gain, dBi) = +7.17 dBm / .005 W EIRP

6.1.3 15.247(c) OUT OF BAND EMISSIONS

The spectrum analyzer plots, in Appendix A, titled "**OUT OF BAND -Lower Band Edge**", "**OUT OF BAND - Upper Band Edge**" and shows the output spectrum of the EUT while hopping one of the pseudorandom sequences and continuously transmitting the packetized data. The analyzer was placed in MAX HOLD mode, and individual sweeps were recorded continually for 10 minutes with the same spectrum analyzer connection as was used for peak output power. The resultant plot shows that the EUT emissions remain inside the 902-928 MHz band .

The spectrum analyzer plots labeled "**OUT OF BAND Emissions 0 Hz - 1 GHz**", "**OUT OF BAND Emissions 1 - 2.75 GHz**", "**OUT OF BAND Emissions 2.75 - 26.5 GHz**" show that emissions are more than 20 dB below the highest level of the desired power outside of the 902 - 928 MHz band.

6.2 15.203 ANTENNA REQUIREMENT

This product has an antenna which is permanently connected to the circuit board and is not removable by the user. The antenna has a gain of -3 dBi.

6.3 15.205 RESTRICTED BAND RADIATION LIMITS

The EUT was placed on a wooden table resting on a turntable. The wooden table was approximately 1 meter above the groundplane of the 3 meter test site. The search antenna was moved in to 1 meter when necessary to improve the noise floor, and the appropriate range factor was applied. While the EUT was transmitting uninterrupted random data on each of the low/mid/high channels and with the spectrum analyzer on MAX HOLD, the turntable was rotated, and the search antenna raised and lowered in an attempt to maximize the received radiated emission level. Test results are attached in tabular form showing that no spurious signals were detected above the 74 dBuV/m peak/54dBuV/m average limits. Peak measurements were taken with an RBW and VBW = 1MHz. Average readings were taken with an RBW = 1MHz and a VBW = 10 Hz. **Test data is in Appendix B.**

6.4 15.209 RADIATED EMISSIONS

The data sheets in Appendix C show that the Class B radiated limits from 30 - 1000 MHz are not exceeded by the EUT. The EUT was operating normally with a combination of transmission and reception and hopping using a pseudorandom sequence during this test. The EUT was placed near one edge of a wooden table resting on a turntable. The wooden table was approximately 1 meter above the groundplane. The search antennas were located at 3 meters. Measurements were made in accordance with ANSI C63.4-1994.

Electronic Compliance Laboratories

Chris Byleckie
Technical Director

Date

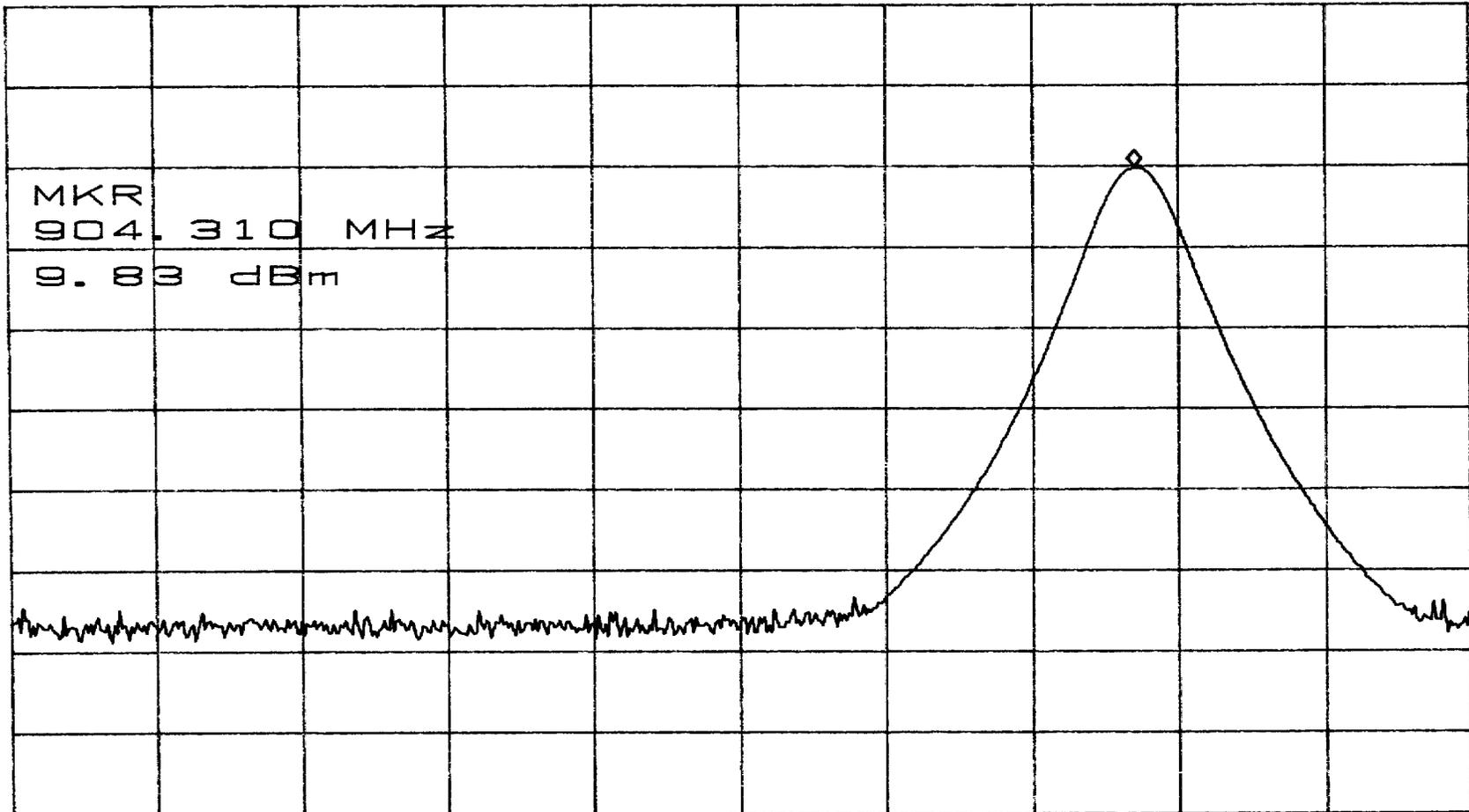
APPENDIX A
SPREAD SPECTRUM PLOTS

Out of Band - Lower Band Edge

ATTEN 40dB
RL 29.8dBm

10dB/

MKR 9.83dBm
904.310MHz



MKR
904.310 MHz
9.83 dBm

START 902.000MHz

STOP 905.000MHz

←RBW 100kHz

*VBW 100kHz

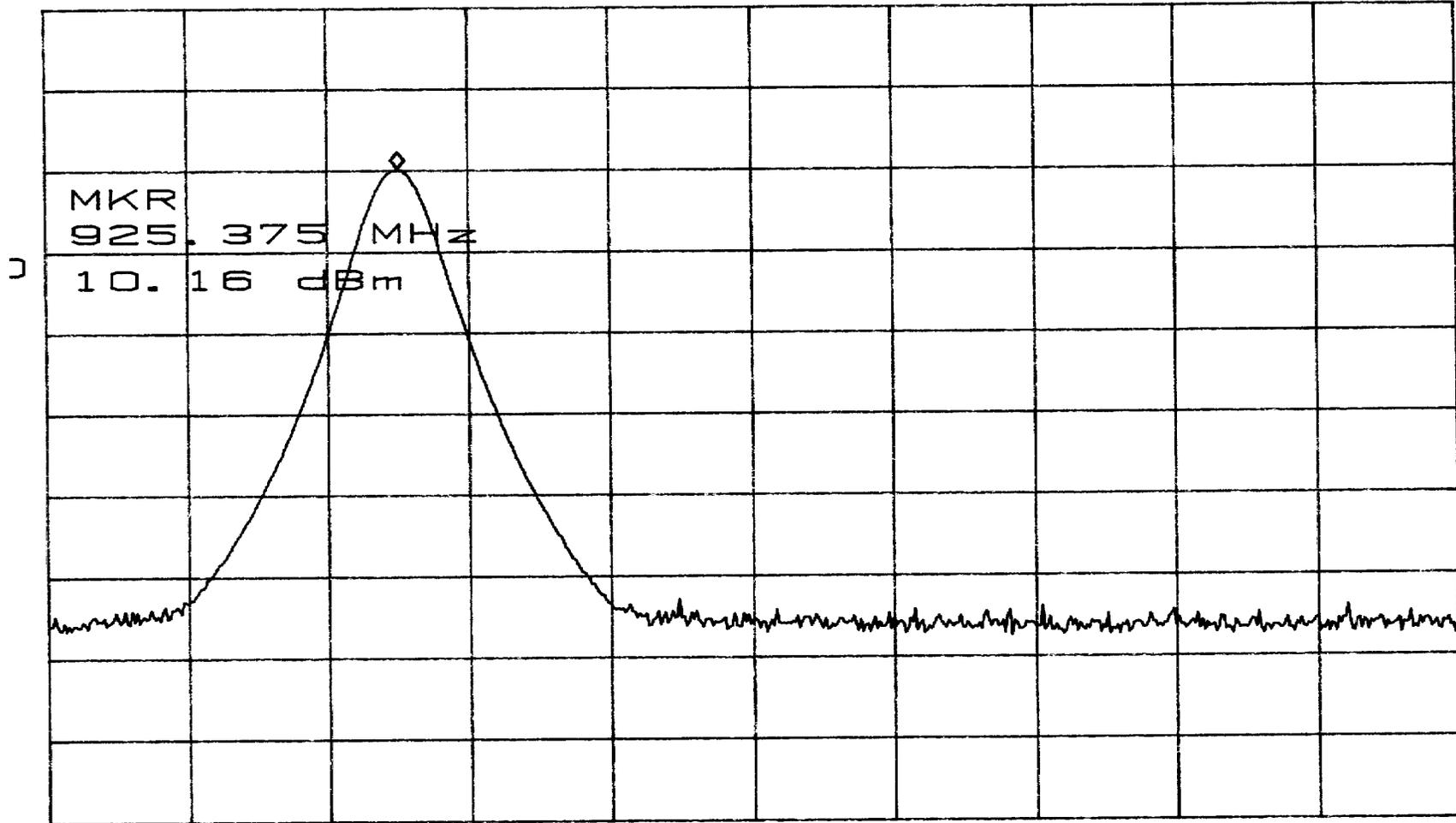
SWP 50ms

Out of Band - Upper Band Edge

ATTEN 40dB
RL 29.8dBm

10dB/

MKR 10.16dBm
925.375MHz



START 924.500MHz STOP 928.000MHz
*RBW 100kHz *VBW 100kHz SWP 50ms

Out of Band Emissions 0 Hz - 1GHz

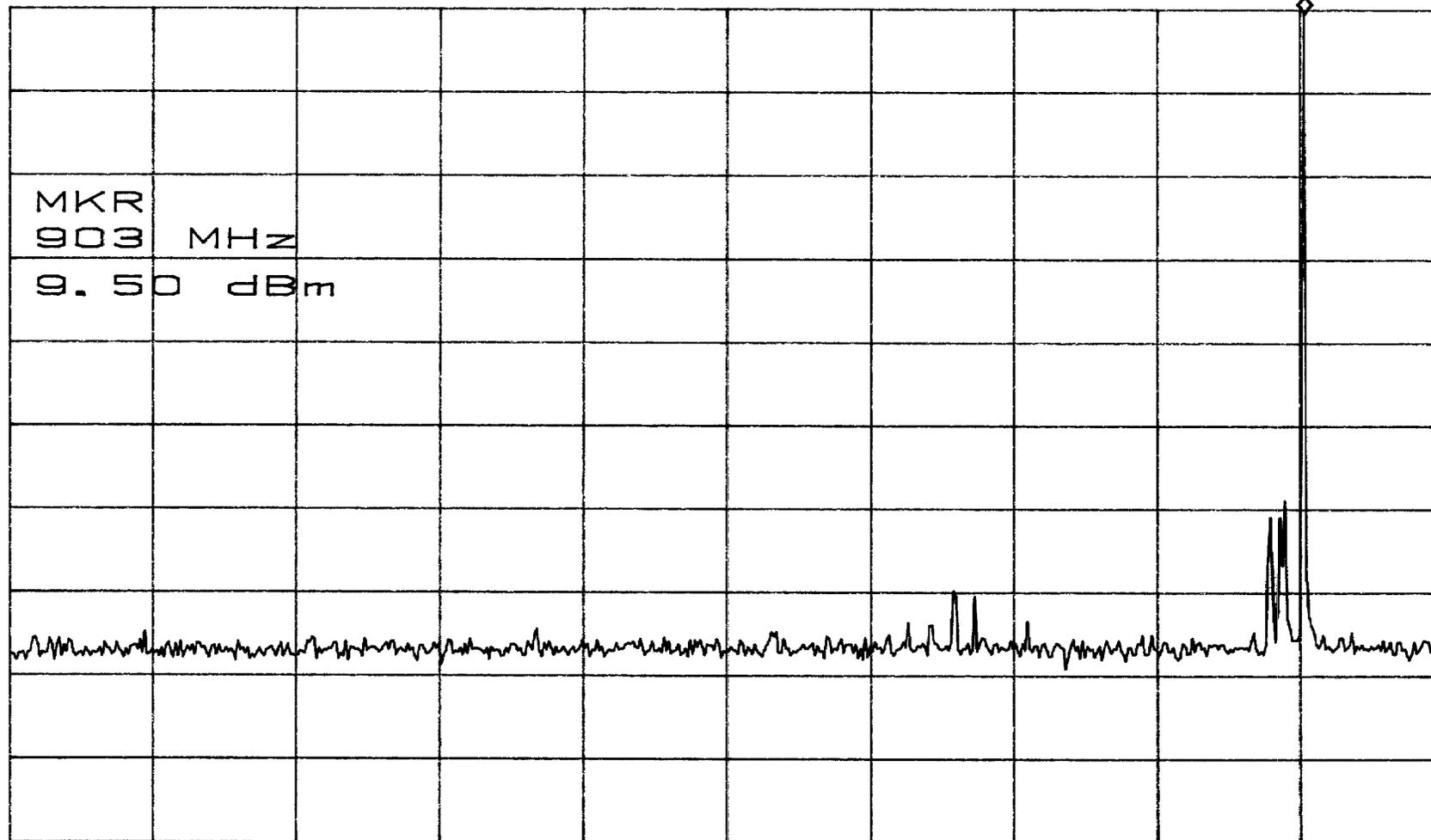
ATTEN 20dB

MKR 9.50dBm

RL 9.8dBm

10dB/

903MHz



MKR
903 MHz

9.50 dBm

START 0Hz

STOP 1.000GHz

RBW 100kHz

VBW 100kHz

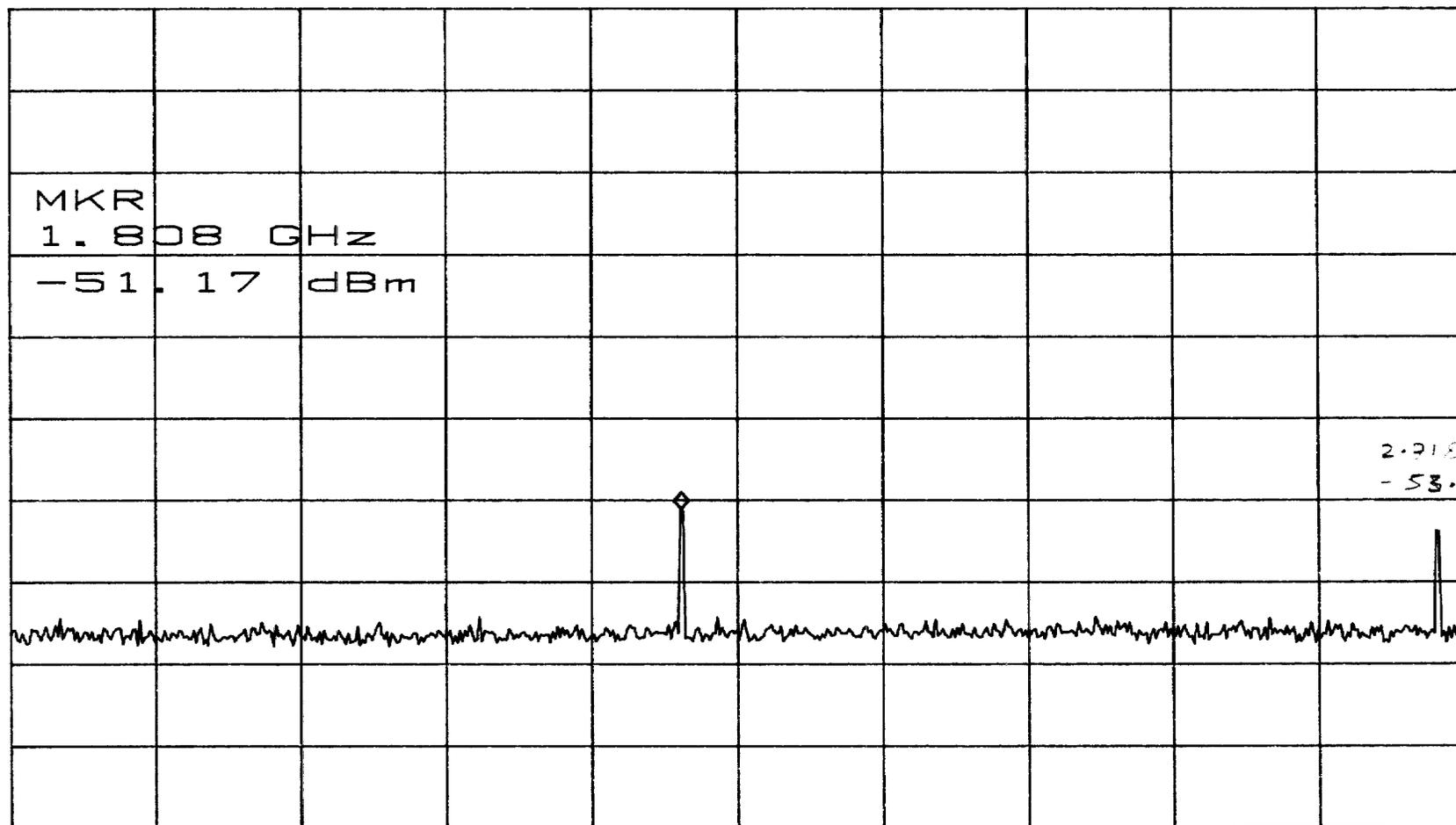
SWP 250ms

Out of Band Emissions 1- 2.75 GHz

ATTEN 20dB
RL 9.8dBm

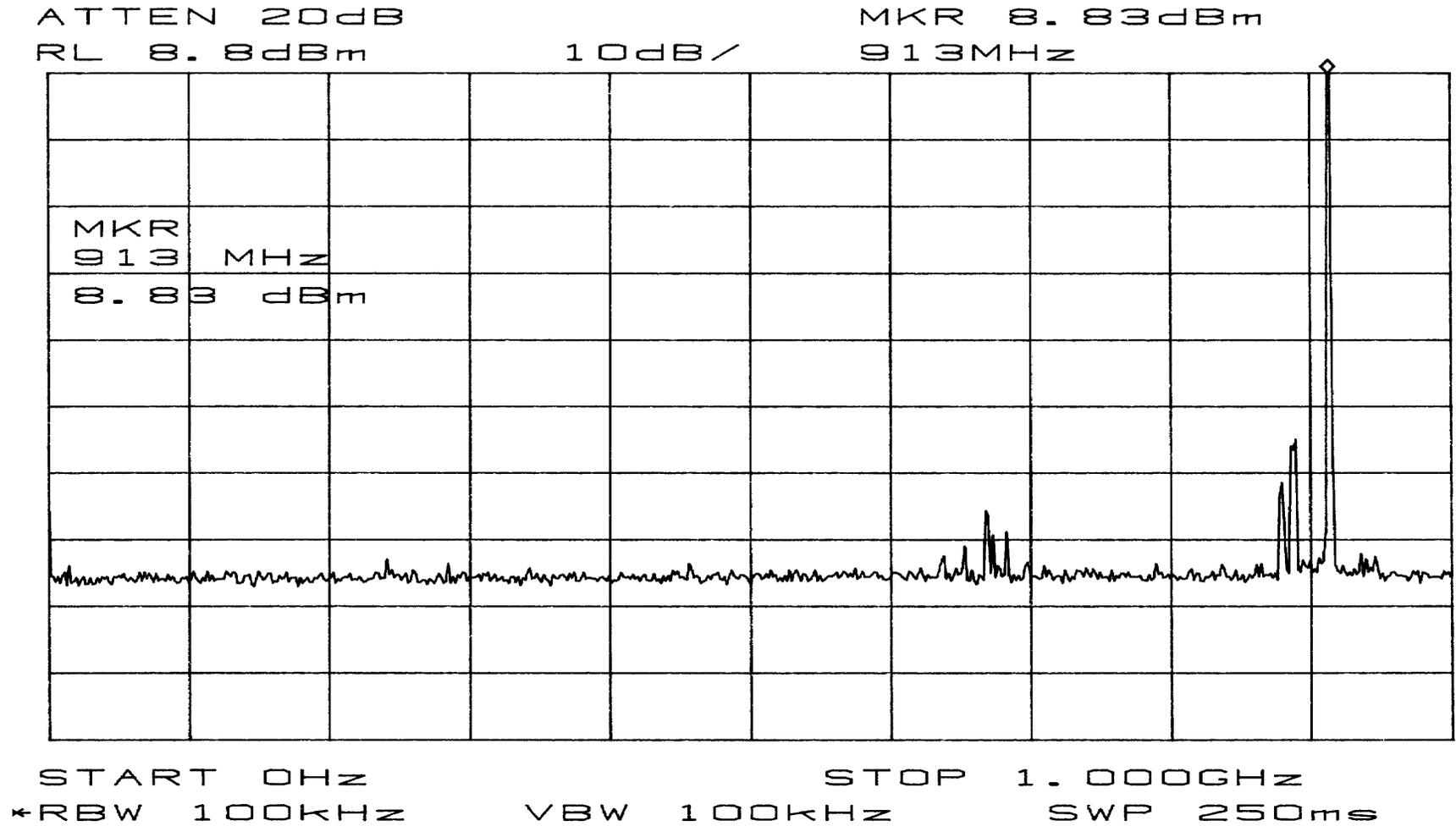
10dB/

MKR -51.17dBm
1.808GHz



START 1.000GHz STOP 2.750GHz
←RBW 100kHz VBW 100kHz SWP 440ms

Out of Band Emissions 0 Hz – 1GHz

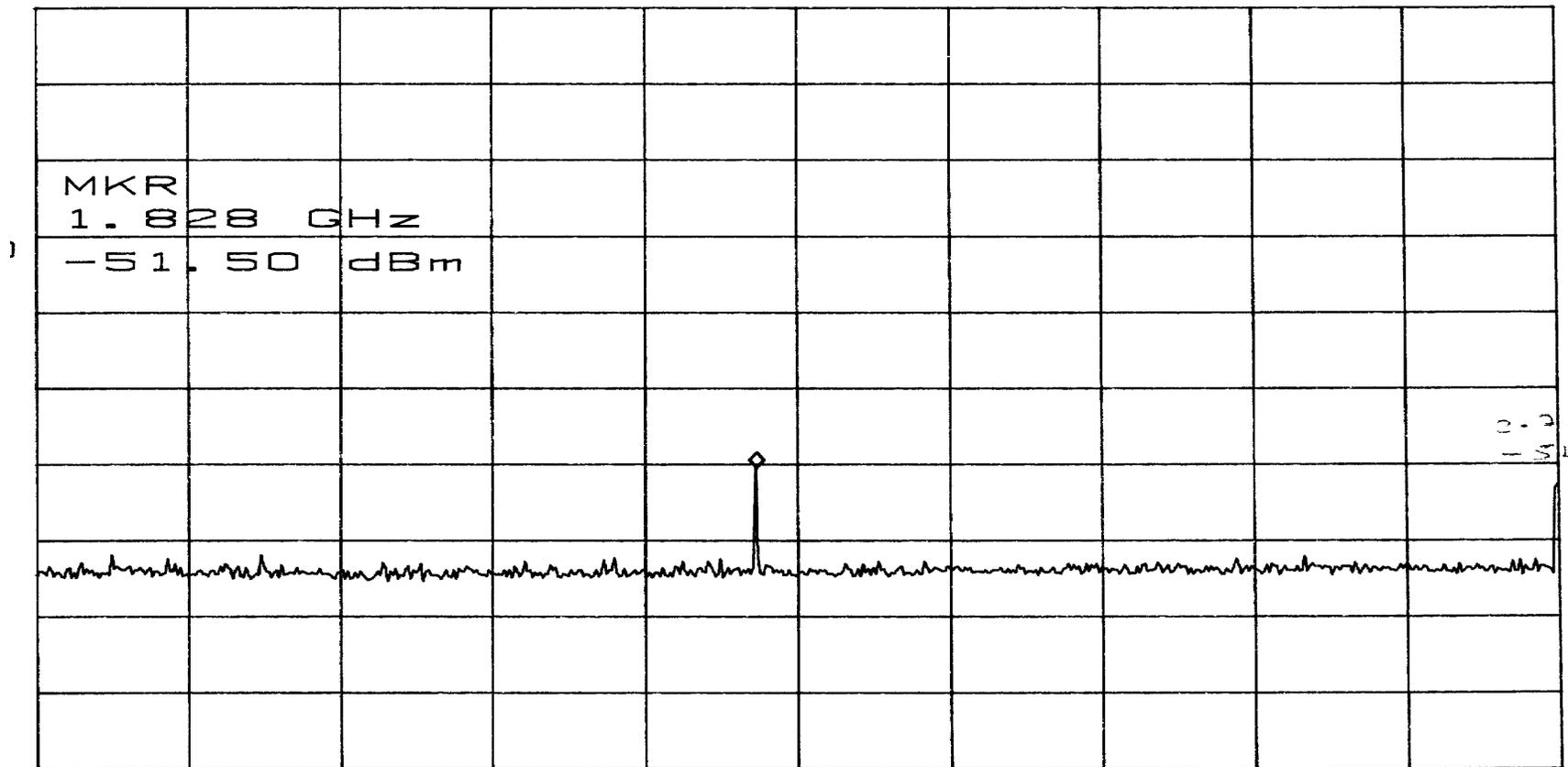


Out of Band Emissions 1- 2.75 GHz

ATTEN 20dB
RL 8.8dBm

10dB/

MKR -51.50dBm
1.828GHz



START 1.000GHz

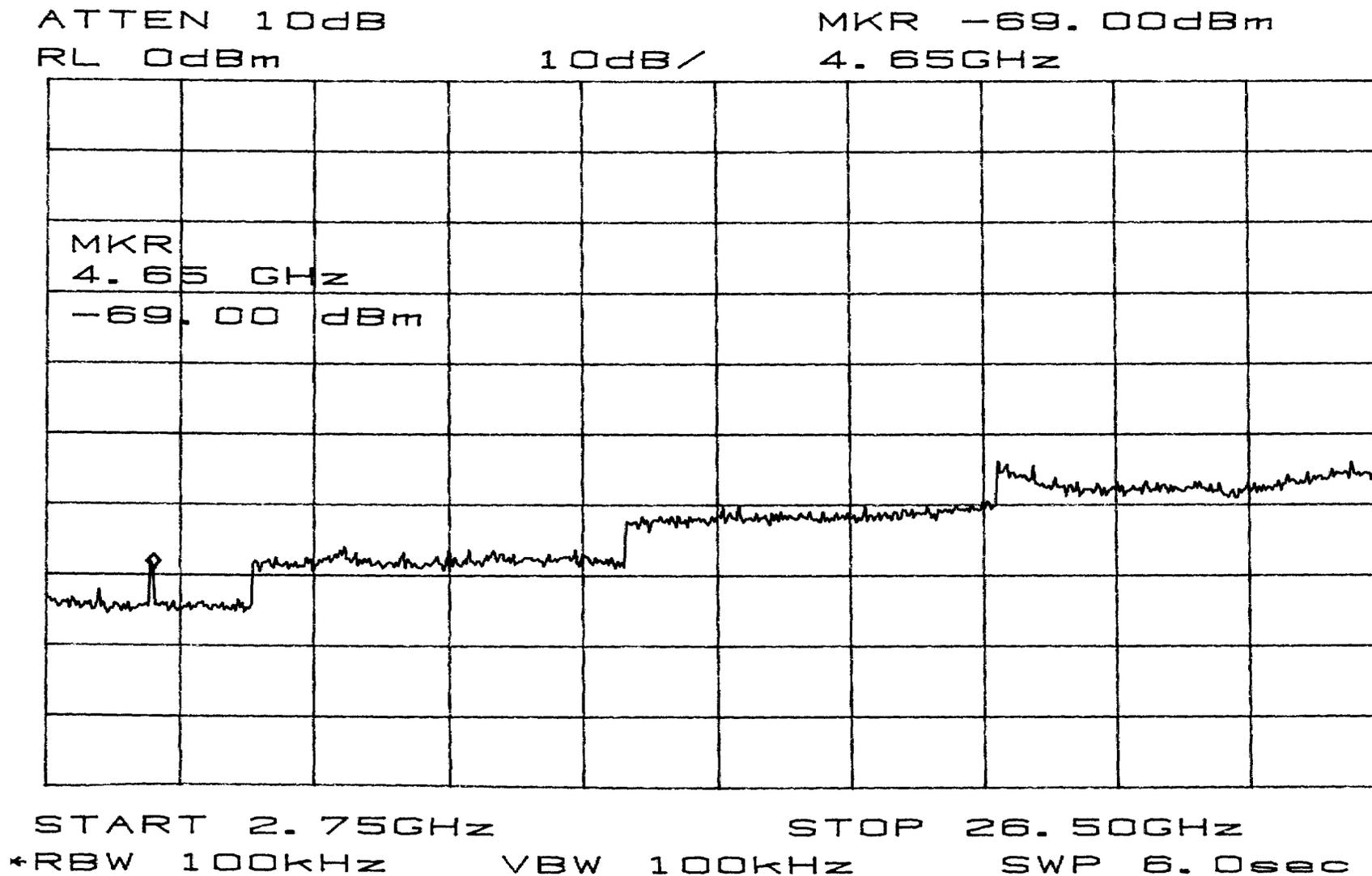
STOP 2.750GHz

-RBW 100kHz

VBW 100kHz

SWP 440ms

Out of Band Emissions 2.75 – 26.5 GHz

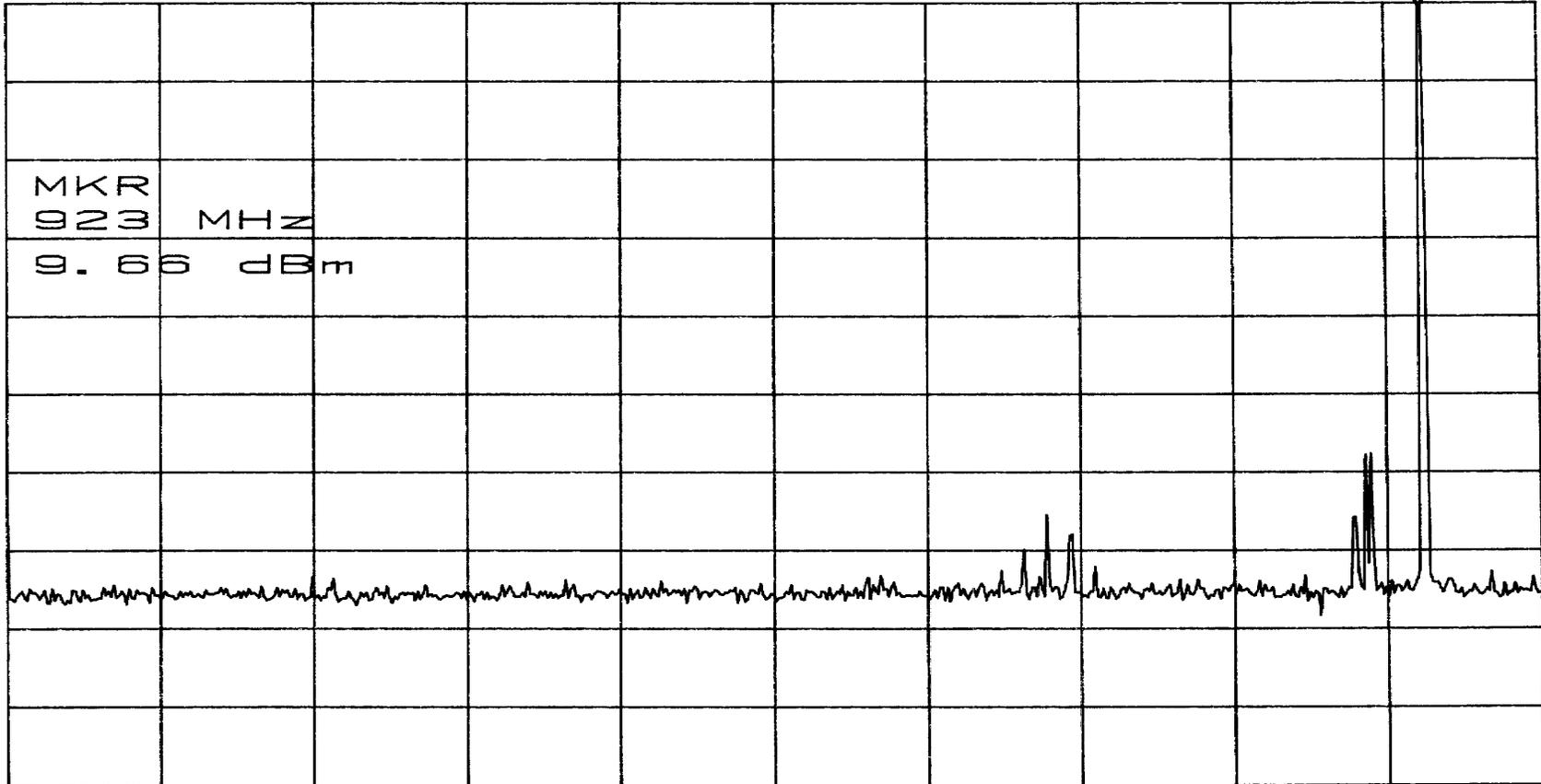


Out of Band Emissions 0 Hz – 1GHz

ATTEN 20dB
RL 9.8dBm

10dB/

MKR 9.66dBm
923MHz



MKR
923 MHz
9.66 dBm

START 0Hz
RBW 100kHz

VBW 100kHz

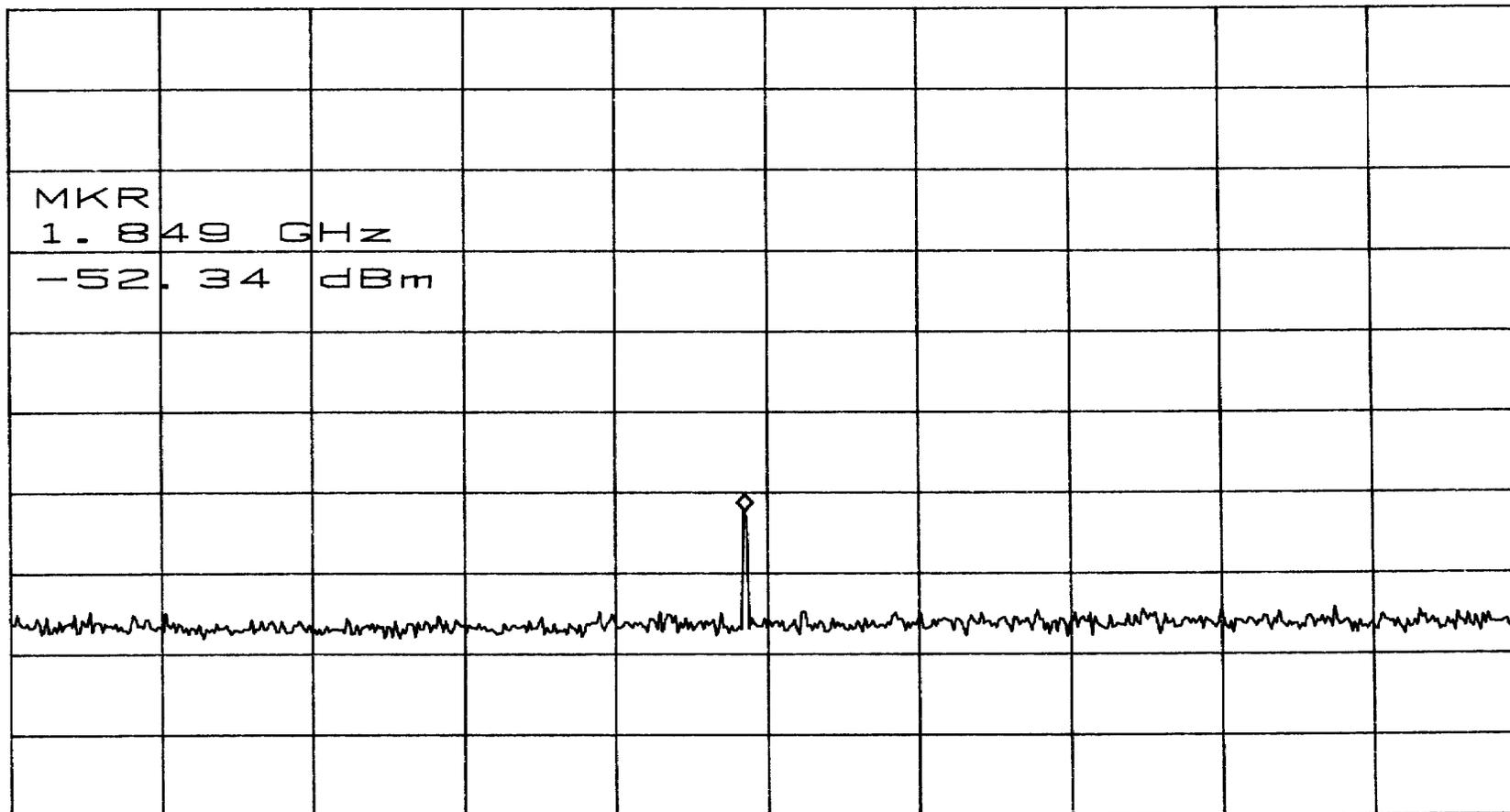
STOP 1.000GHz
SWP 250ms

Out of Band Emissions 1- 2.75 GHz

ATTEN 20dB
RL 9.8dBm

10dB/
/BP0

MKR -52.34dBm
1.849GHz



START 1.000GHz

STOP 2.750GHz

*RBW 100kHz

VBW 100kHz

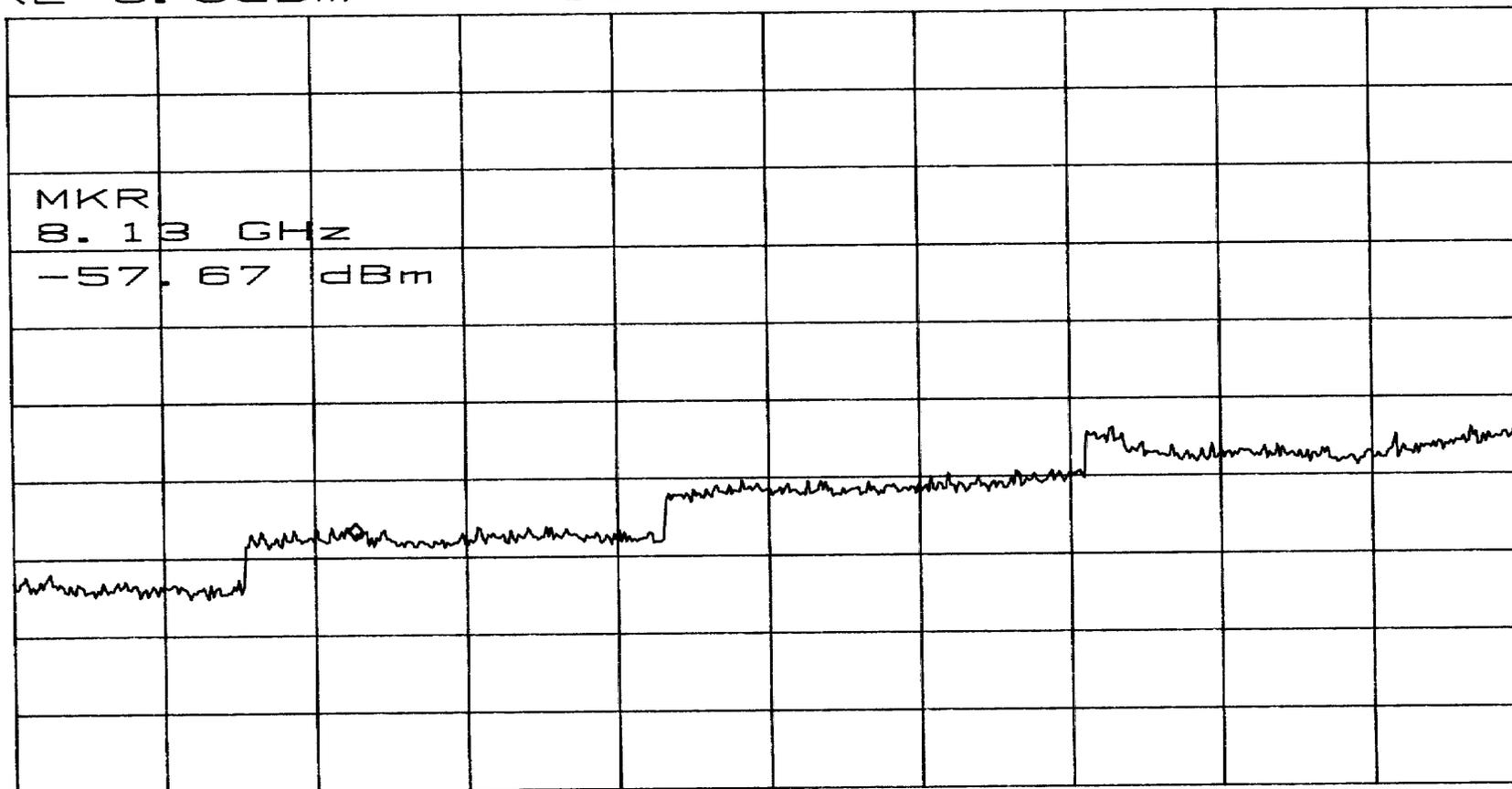
SWP 440ms

Out of Band Emissions 2.75 – 26.5 GHz

ATTEN 20dB
RL 9.8dBm

10dB/

MKR -57.67dBm
8.13GHz



START 2.75GHz

STOP 26.50GHz

*RBW 100kHz

VBW 100kHz

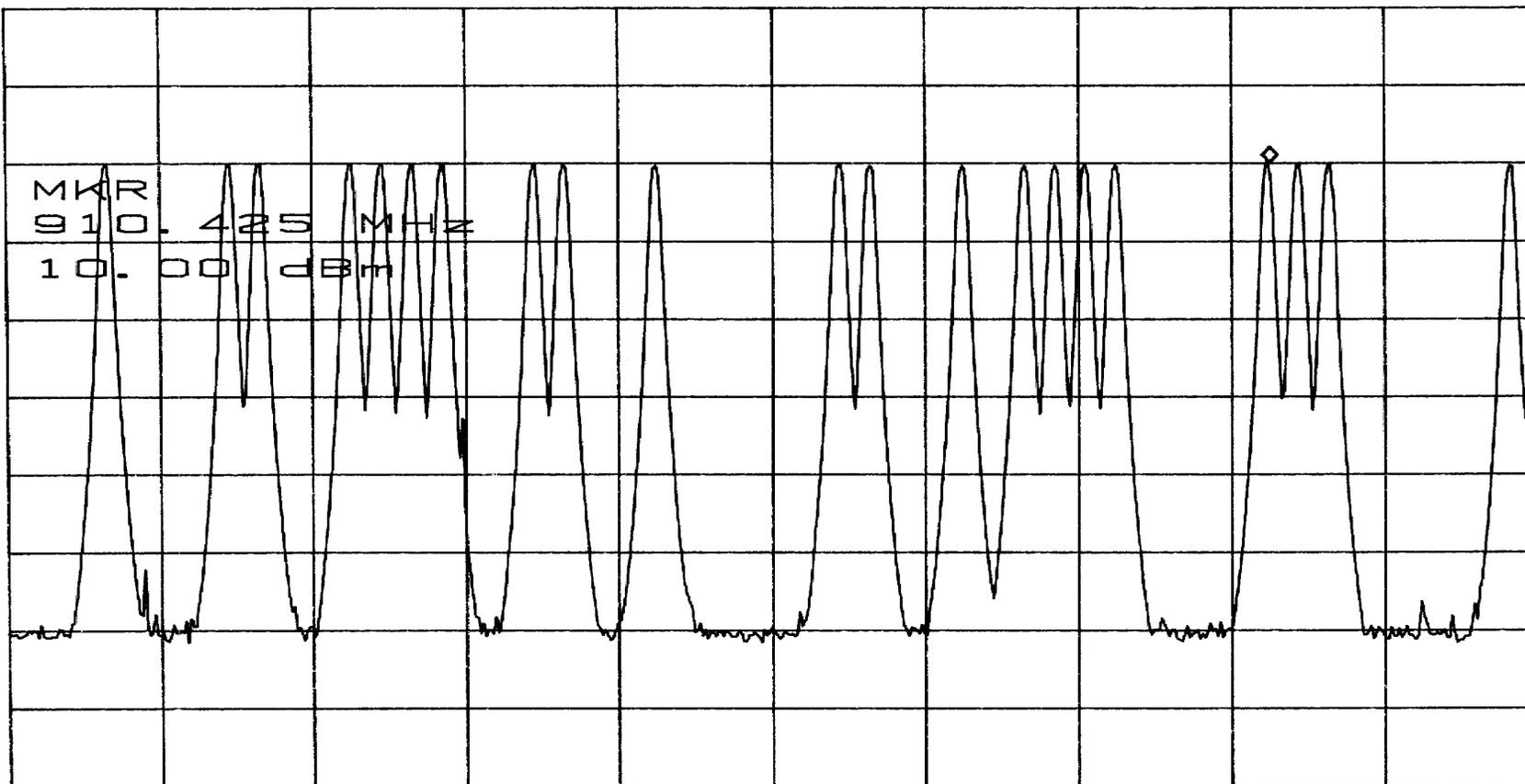
SWP 6.0sec

Channel Utilization 903 – 912 MHz

ATTEN 40dB
RL 29.8dBm

10dB/

MKR 10.00dBm
910.425MHz



START 903.000MHz

STOP 912.000MHz

RBW 30kHz

*VBW 30kHz

SWP 50ms

Channel Utilization 912- 920 MHz

ATTN 40dB
RL 29.8dBm
MKR -50.00dBm
10dB/
918.600MHz



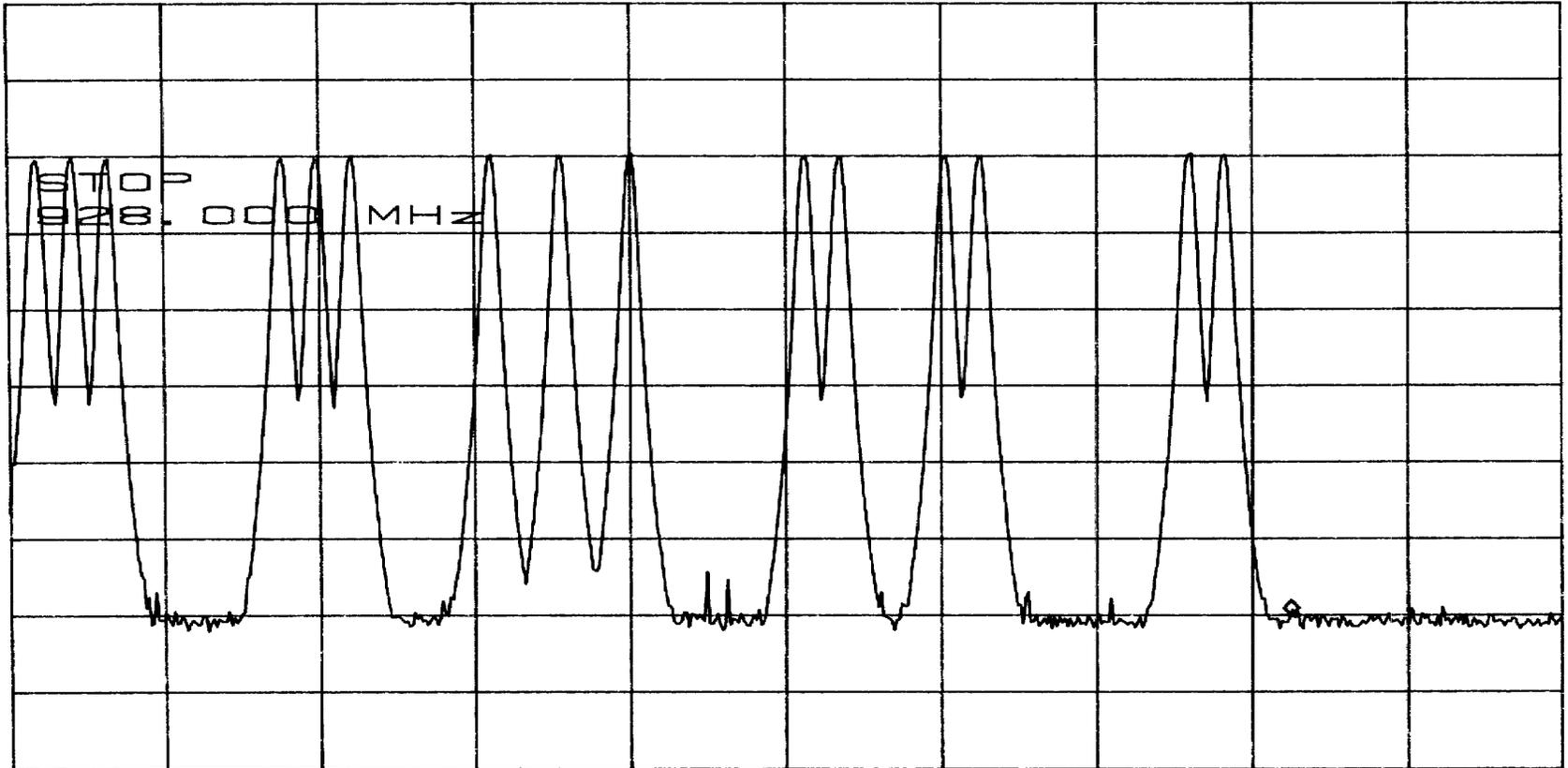
START 912.000MHz
*RBW 30kHz *VBW 30kHz
STOP 920.000MHz
SWP 50ms

Channel Utilization 920 - 928 MHz

ATTEN 40dB
RL 29.8dBm

10dB/

MKR -50.17dBm
926.600MHz

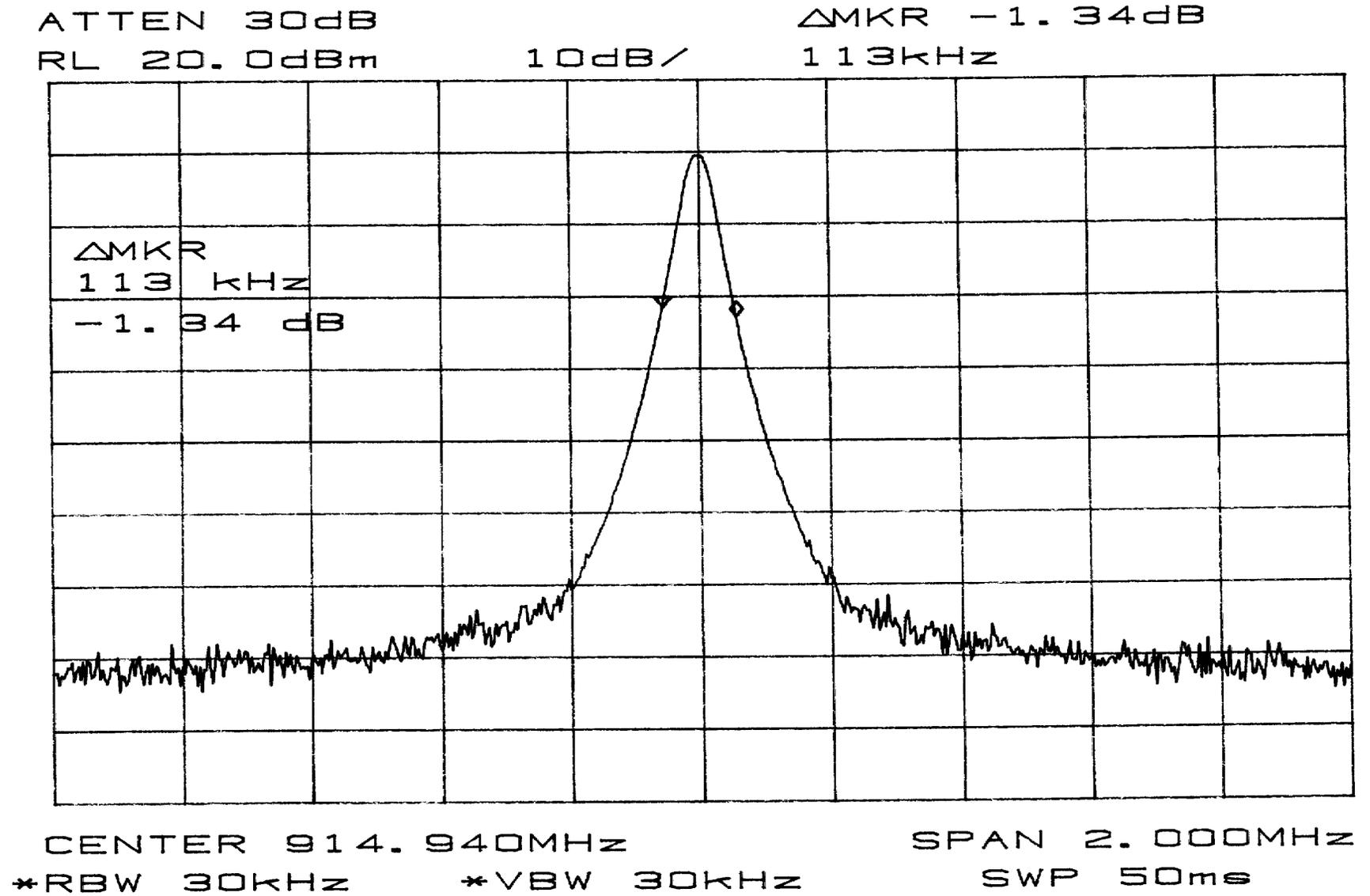


START 920.000MHz
*RBW 30kHz

*VBW 30kHz

STOP 928.000MHz
SWP 50ms

Bandwidth

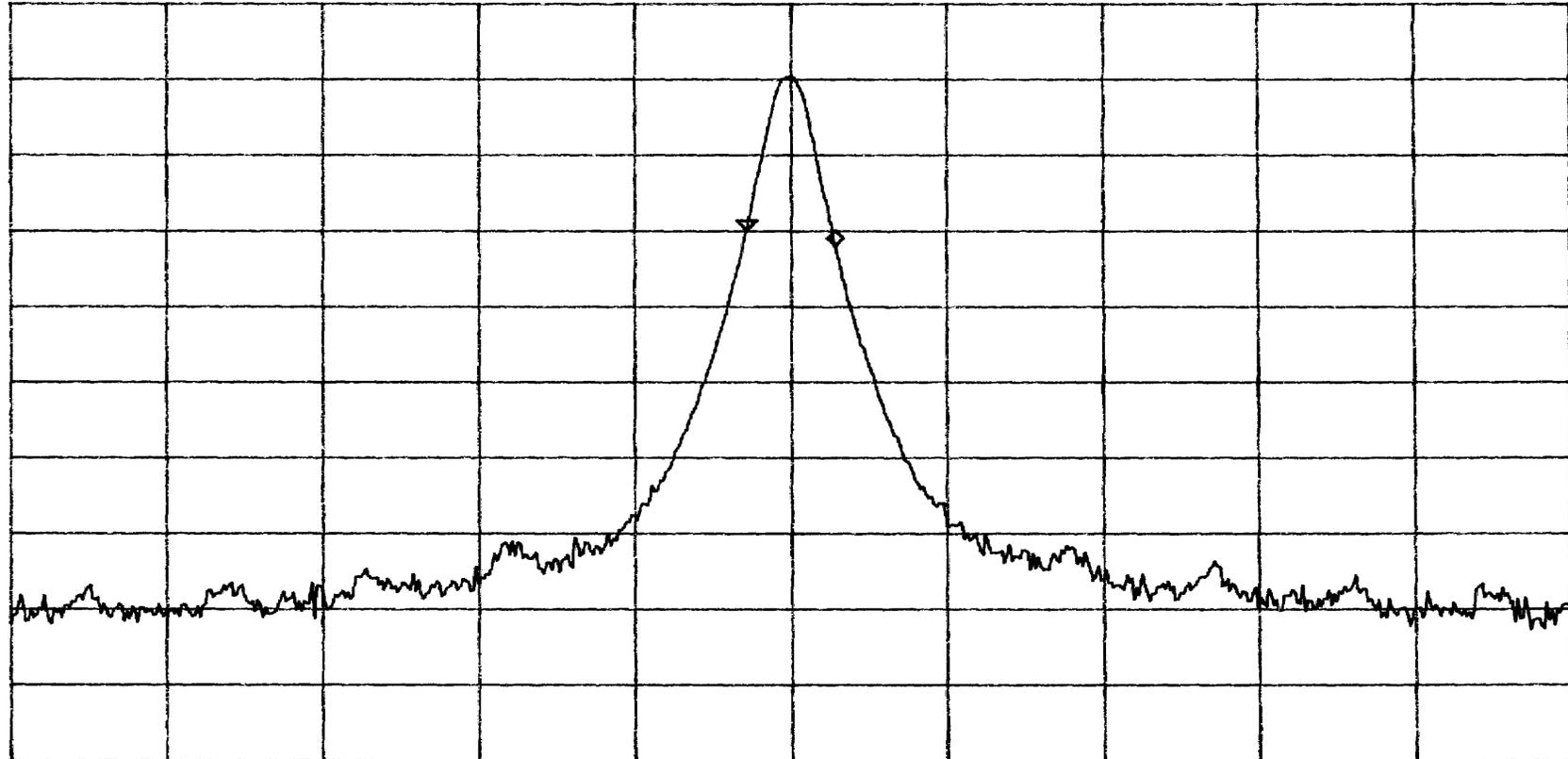


Bandwidth

ATTEN 30dB
RL 20.0dBm

10dB/

ΔMKR -2.00dB
113kHz



CENTER 925.380MHz
←RBW 30kHz VBW 30kHz

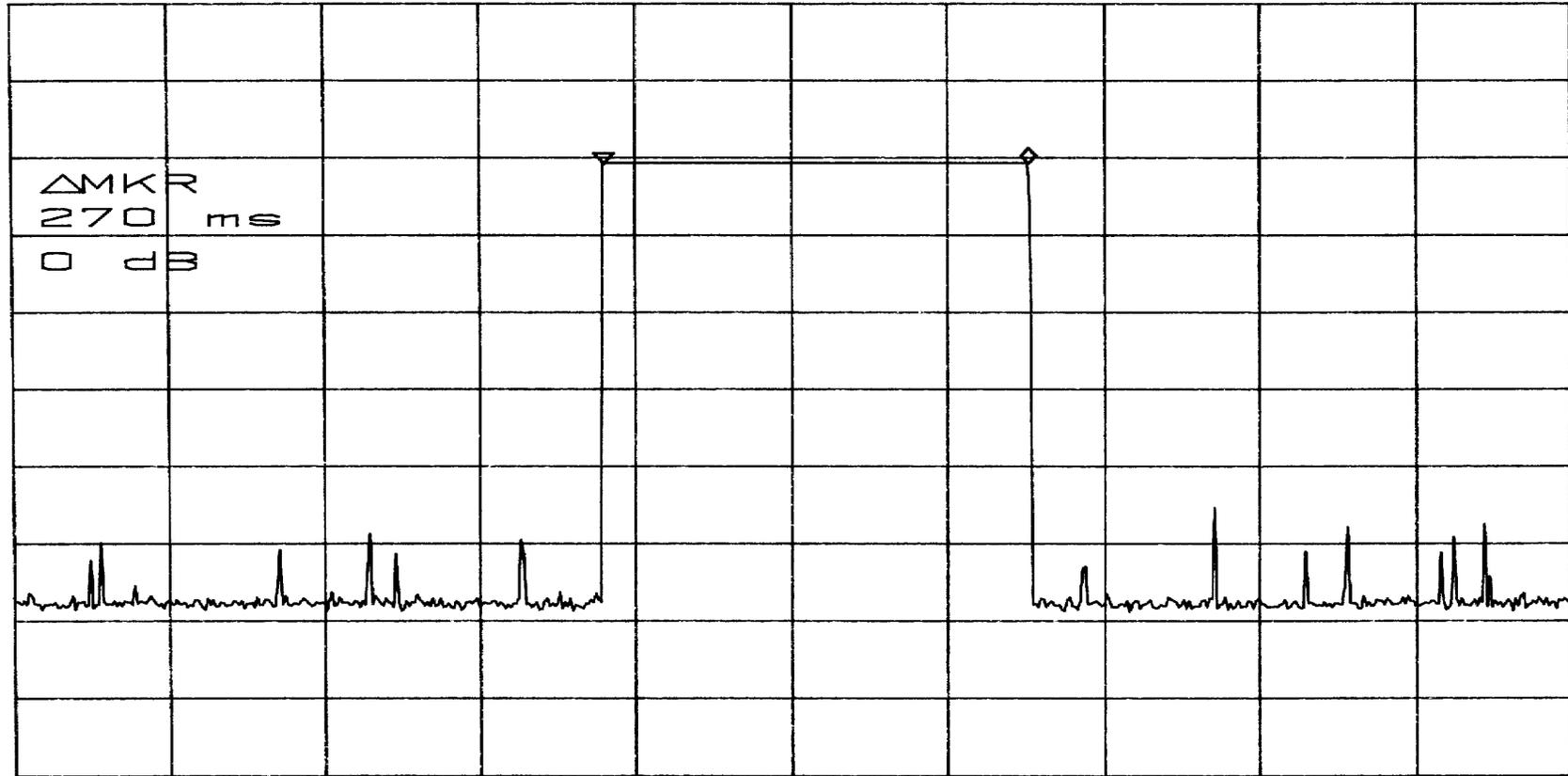
SPAN 2.000MHz
SWP 50ms

Channel Dwell Time

ATTEN 40dB
RL 29.8dBm

10dB/

Δ MKR 0dB
270ms



CENTER 915.120000MHz

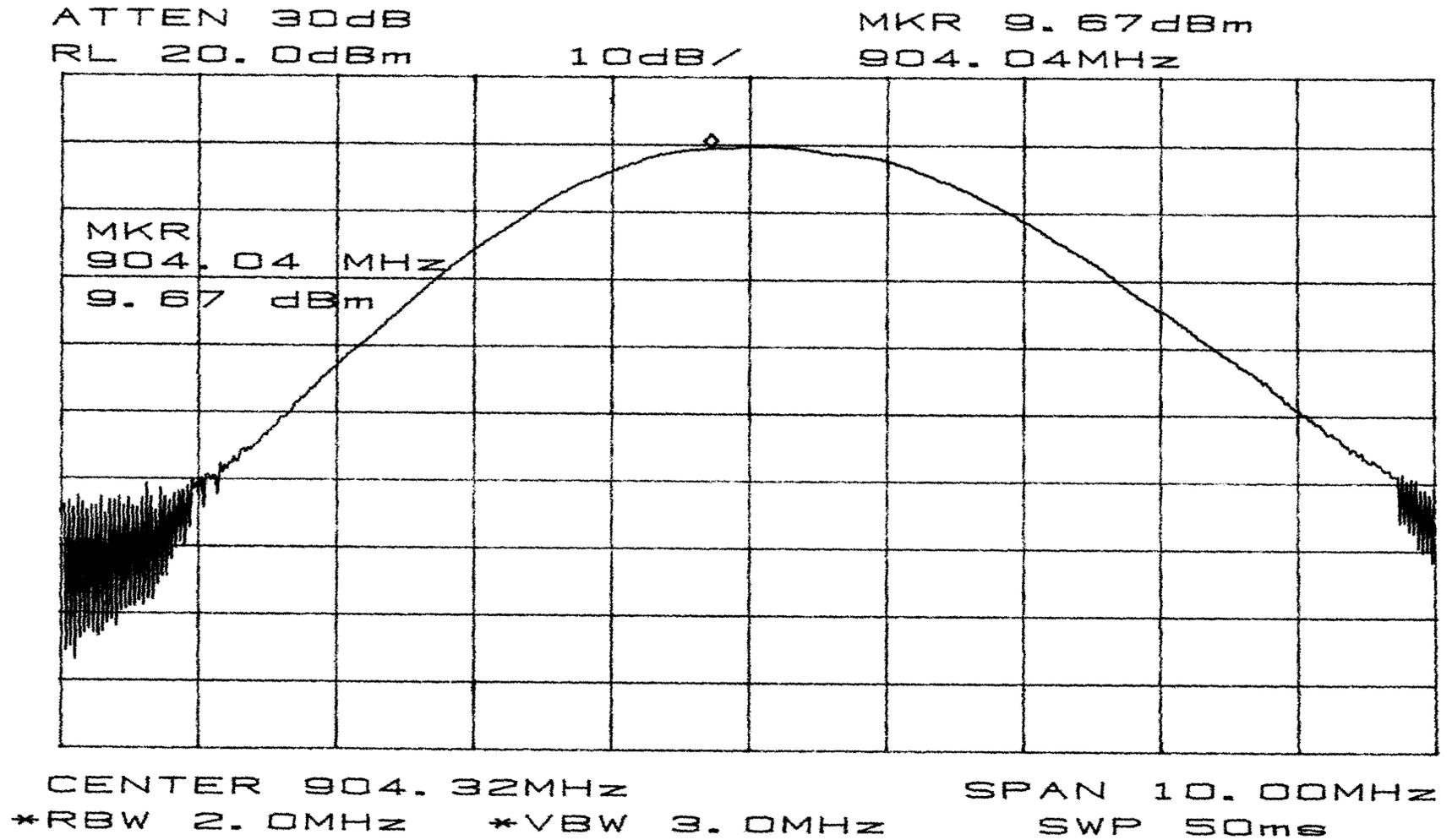
SPAN 0Hz

*RBW 100kHz

*VBW 30kHz

*SWP 1.0sec

Output Power

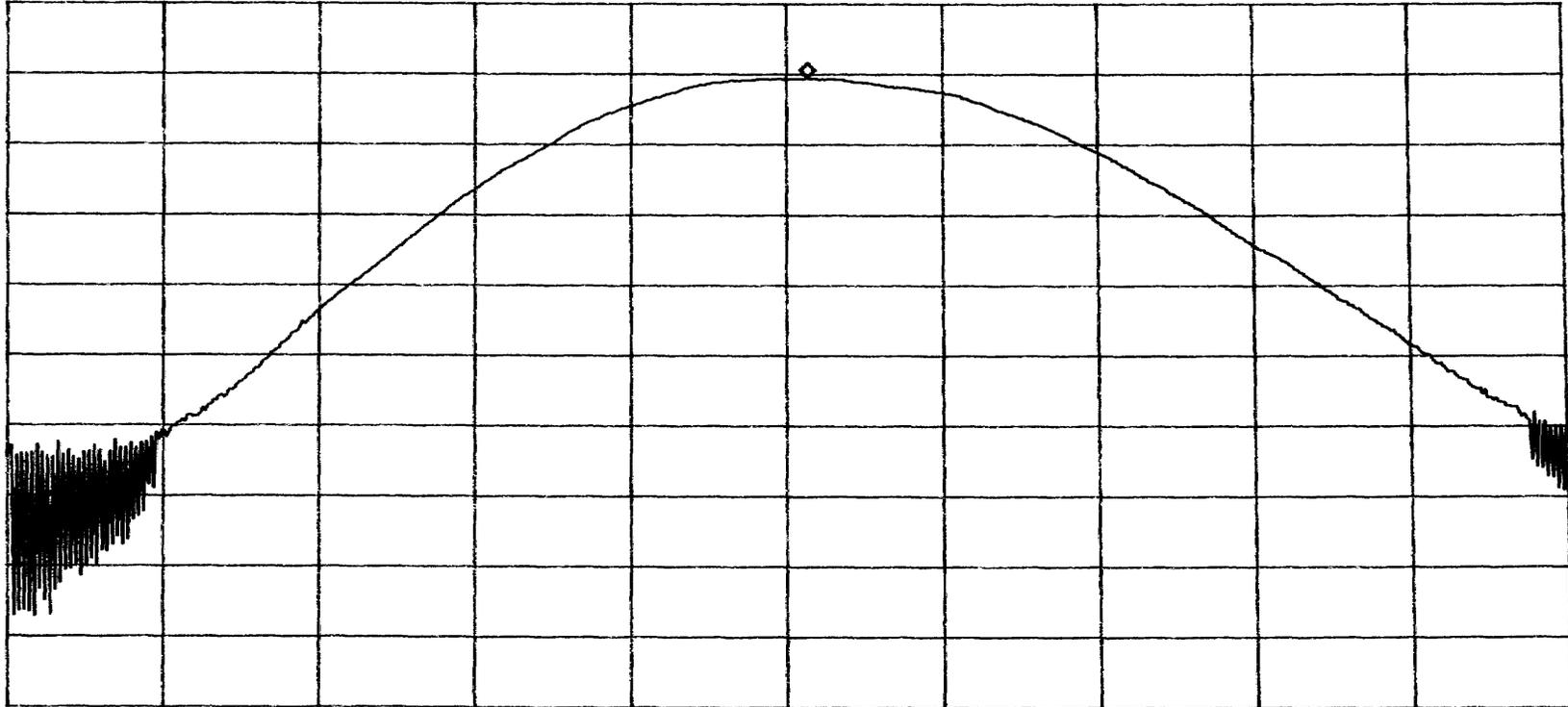


Output Power

ATTEN 30dB
RL 20.0dBm

10dB/

MKR 9.67dBm
915.07MHz



CENTER 914.94MHz
RBW 2.0MHz VBW 3.0MHz

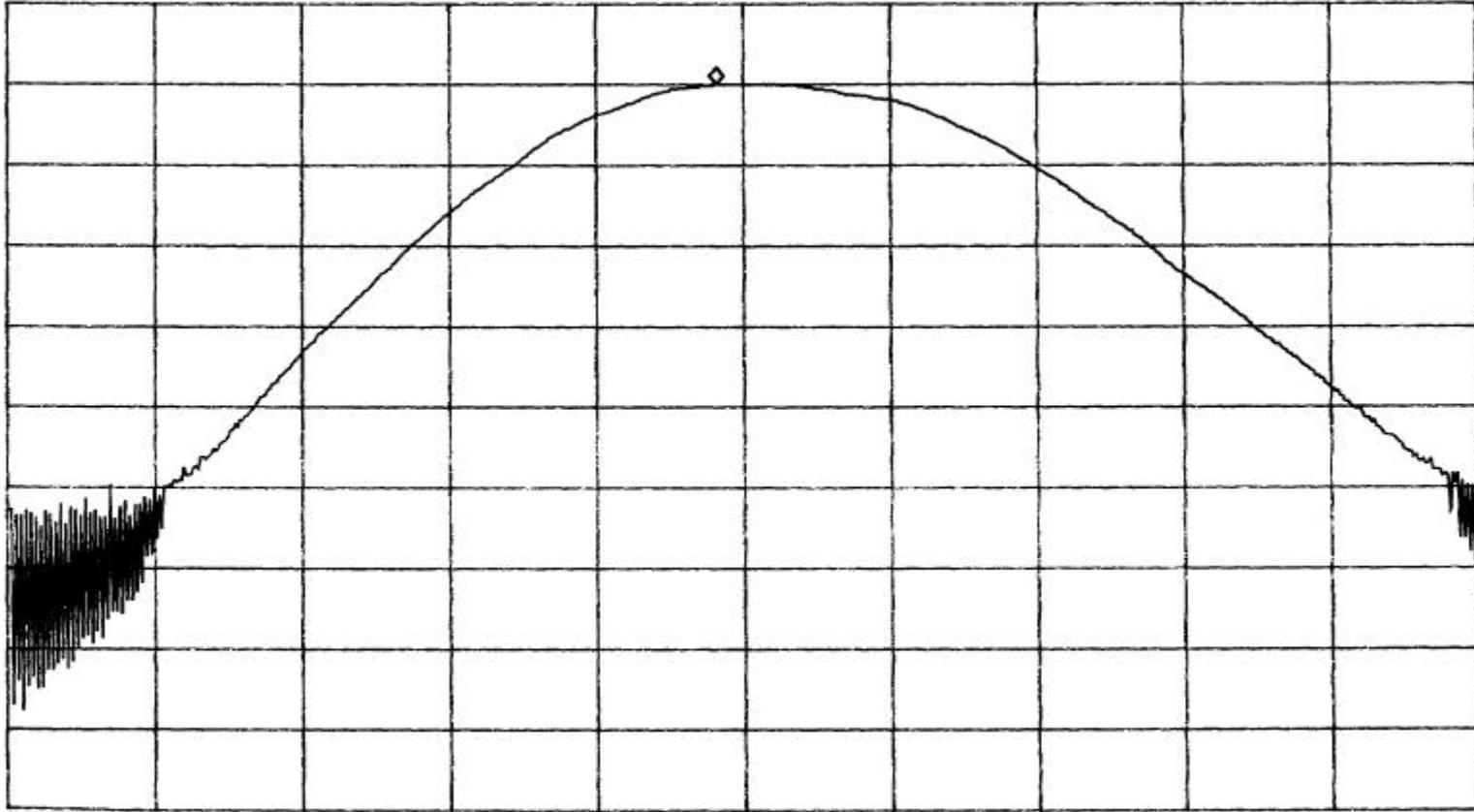
SPAN 10.00MHz
SWP 50ms

Output Power

ATTEN 30dB
RL 20.0dBm

10dB/

MKR 10.17dBm
925.20MHz



CENTER 925.38MHz
RBW 2.0MHz VBW 3.0MHz

SPAN 10.00MHz
SWP 50ms

APPENDIX B
RESTRICTED BAND DATA

EUT:	Low Power Gas RMI	CUSTOMER NAME:	Whisper Comm
RULE PART:	FCC PART 15.205	WORK ORDER:	8082701
		FILE:	8082701
ANTENNA:	HORN 0	ATTN dB	0
POLARIZATION:	VERTICAL	DUTY dB	0
MODULATION TYPE:		HP IL dB	0
TESTED BY:	SURESH	DIST dB:	0
COMMENT:	Sr No 0001B69F9		

FREQ. MHz	READING dB(uV)	NF	Pk or Av	A.F. dB	Cbl dB	FLTR dB	AMP dB	TOTAL, dB(uV/m)	LIMIT dB(uV/m)	DELTA dB
904.32 MHz										
2712.96	42.50		Pk	28.6	-5.3	-0.4	35.6	41.2	74.0	-32.8
2712.96	32.17		Avg	28.6	-5.3	-0.4	35.6	30.8	54.0	-23.2
3617.28	40.00		Pk	32.4	-6.2	-0.4	35.1	43.9	74.0	-30.1
3617.28	30.83		Avg	32.4	-6.2	-0.4	35.1	34.7	54.0	-19.3
4521.60	39.83	*	Pk	32.8	-7.0	-0.4	35.1	44.9	74.0	-29.1
4521.60	29.33	*	Avg	32.8	-7.0	-0.4	35.1	34.4	54.0	-19.6
5425.92	43.83		Pk	33.6	-8.1	-0.4	35.0	50.9	74.0	-23.1
5425.92	34.33		Avg	33.6	-8.1	-0.4	35.0	41.4	54.0	-12.6
8138.88	41.33	*	Pk	37.0	-11.4	-0.4	35.5	54.6	74.0	-19.4
8138.88	30.50	*	Avg	37.0	-11.4	-0.4	35.5	43.8	54.0	-10.2
9043.20	41.17	*	Pk	37.8	-12.1	-0.4	35.5	55.9	74.0	-18.1
9043.20	29.83	*	Avg	37.8	-12.1	-0.4	35.5	44.6	54.0	-9.4
914.94 MHz										
2744.82	41.50		Pk	28.6	-5.3	-0.4	35.5	40.3	74.0	-33.7
2744.82	31.33		Avg	28.6	-5.3	-0.4	35.5	30.1	54.0	-23.9
3659.76	40.50	*	Pk	32.4	-6.2	-0.4	35.1	44.4	74.0	-29.6
3659.76	29.17	*	Avg	32.4	-6.2	-0.4	35.1	33.0	54.0	-21.0
4574.70	40.67	*	Pk	32.8	-7.0	-0.4	35.2	45.7	74.0	-28.3
4574.70	30.00		Avg	32.8	-7.0	-0.4	35.2	35.0	54.0	-19.0
7319.52	41.67	*	Pk	36.0	-10.6	-0.4	35.4	53.3	74.0	-20.7
7319.52	31.50		Avg	36.0	-10.6	-0.4	35.4	43.1	54.0	-10.9
8234.46	40.33	*	Pk	37.0	-11.4	-0.4	35.5	53.6	74.0	-20.4
8234.46	30.17		Avg	37.0	-11.4	-0.4	35.5	43.4	54.0	-10.6
9149.40	40.50	*	Pk	37.8	-12.1	-0.4	35.5	55.3	74.0	-18.7
9149.40	29.67		Avg	37.8	-12.1	-0.4	35.5	44.4	54.0	-9.6
925.38 MHz										
2776.14	43.00		Pk	28.6	-5.3	-0.4	35.5	41.8	74.0	-32.2
2776.14	31.33		Avg	28.6	-5.3	-0.4	35.5	30.1	54.0	-23.9
3701.52	41.50		Pk	32.4	-6.2	-0.4	35.1	45.4	74.0	-28.6
3701.52	29.83		Avg	32.4	-6.2	-0.4	35.1	33.7	54.0	-20.3
4626.90	40.33		Pk	32.8	-7.0	-0.4	35.2	45.4	74.0	-28.6
4626.90	29.83		Avg	32.8	-7.0	-0.4	35.2	34.9	54.0	-19.1
7403.04	40.83	*	Pk	36.0	-10.6	-0.4	35.4	52.4	74.0	-21.6
7403.04	30.67	*	Avg	36.0	-10.6	-0.4	35.4	42.3	54.0	-11.7
8328.42	41.00	*	Pk	37.0	-11.4	-0.4	35.5	54.3	74.0	-19.7
8328.42	30.17	*	Avg	37.0	-11.4	-0.4	35.5	43.4	54.0	-10.6

APPENDIX C
RADIATED EMISSIONS

Electronic Compliance Laboratories, Inc.
 1249 Birchwood Ave.
 Sunnyvale, CA
 Radiated Emissions
 Frequency range: 30MHz-1000MHz
 3 Meter Open Site
 Site Calibrated: June 1997

Government Agency and Limit: FCC Class B

QP = Quasi-Peak Note: Ignore peak readings when Quasi-Peak reading exists
 PK = Peak

Customer: WHISPER COMMUNICATION Operator: SURESH
 Date: 08-31-1998 Time: 12:04:18
 Temperature Range: 70 Deg F Percent Humidity: 60
 E.U.T.: LOW POWER GAS RMI
 Serial Number: 0001B69F9
 Support Devices:
 Serial Number:
 FCC ID:
 Exercise Program: NONE
 Modifications: NONE
 Report File Name: F:\TESTDATA\8082701.RF

Antenna Type: BICONICAL

TEST FREQ	TEST dBuV	ACTUAL dBuV/m	CLASS B LIMIT	VERSUS B LIMIT	TABLE DEGREES	ANTENNA HEIGHT	POLAR- IZATION	DETECTOR Type
=====	=====	=====	=====	=====	=====	=====	=====	=====
260.000	30.2	23.1	46.0	-22.9	90	2.0	H	PK
64.884	49.1	32.1	40.0	-7.9	90	1.5	V	PK
292.400	45.9	42.3	46.0	-3.7	270	1.5	V	PK
292.400	41.3	37.7	46.0	-8.3	270	1.5	V	QP

CHANGED ANTENNA TO LOG PERIODIC

NO EMISSIONS FOUND ABOVE NOISE FLOOR

APPENDIX D
ANTENNA DRAWINGS

APPENDIX E
SET-UP PHOTOS



**FCC Part 15.209 Class B
Radiated Emissions**



**FCC Part 15.205
Restricted Band**



FCC Part 15.247