

**15.247 Certification  
FCC ID: NVCRM10004**

**EMI TEST REPORT  
Medium Power Gas RMI**

**Prepared for**

**Whisper Communication Inc.  
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**Prepared by**

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**Test Report Number: A903019**

**Date of Test: November 13, 1998**

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## Table of Contents

|                                                |    |
|------------------------------------------------|----|
| 1.0 Test Facility.....                         | 3  |
| 2.0 Test Equipment.....                        | 3  |
| 3.0 EUT .....                                  | 4  |
| 4.0 Support Equipment .....                    | 4  |
| 5.0 Equipment Configuration.....               | 4  |
| 6.0 Summary Of Tests.....                      | 5  |
| APPENDIX A 15.247 Spread Spectrum Plots.....   | 8  |
| APPENDIX B 15.205 Restricted Band Data.....    | 24 |
| APPENDIX C 15.209 Radiated Emissions.....      | 26 |
| APPENDIX D Antenna and Antenna Connector ..... | 28 |
| APPENDIX E Test Set-up Photographs .....       | 31 |

## 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: Medium Power Gas RMI  
Model Number: 100G-XX00-XX  
Serial Number: 0001ABFFA

#### Description:

The Whisper Communication Inc. Medium Power Gas RMI 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

| <u>PORT</u> | <u>CONNECTED TO</u> | <u>CABLE TYPE</u> |
|-------------|---------------------|-------------------|
|-------------|---------------------|-------------------|

## 6.0 SUMMARY OF TESTS

The Medium Power Gas RMI 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. Digital emissions testing was not performed on this version of the RMI since the Digital control board is the same for both the Low and Medium power versions. 15.209 testing was done on the Low Power version and is documented in report A809003.

### 6.1 15.247(a)(1) FREQUENCY HOPPING SYSTEMS

The Medium Power Gas RMI 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 (127/ 133 / 130 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 % Medium 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 +19.67 dBm or .92 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.

$P_{out} = +19.67 \text{ dBm} / 92 \text{ mW}$

Limit: +30 dBm / 1 W maximum power

#### **-3.0 dBi Internal Antenna**

$EIRP = +19.67 \text{ (peak power)} - 3 \text{ dBi (peak gain, dBi)} = +16.67 \text{ dBm} / .046 \text{ W EIRP}$

### 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 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

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Chris Byleckie  
Technical Director

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Date

## **APPENDIX A**

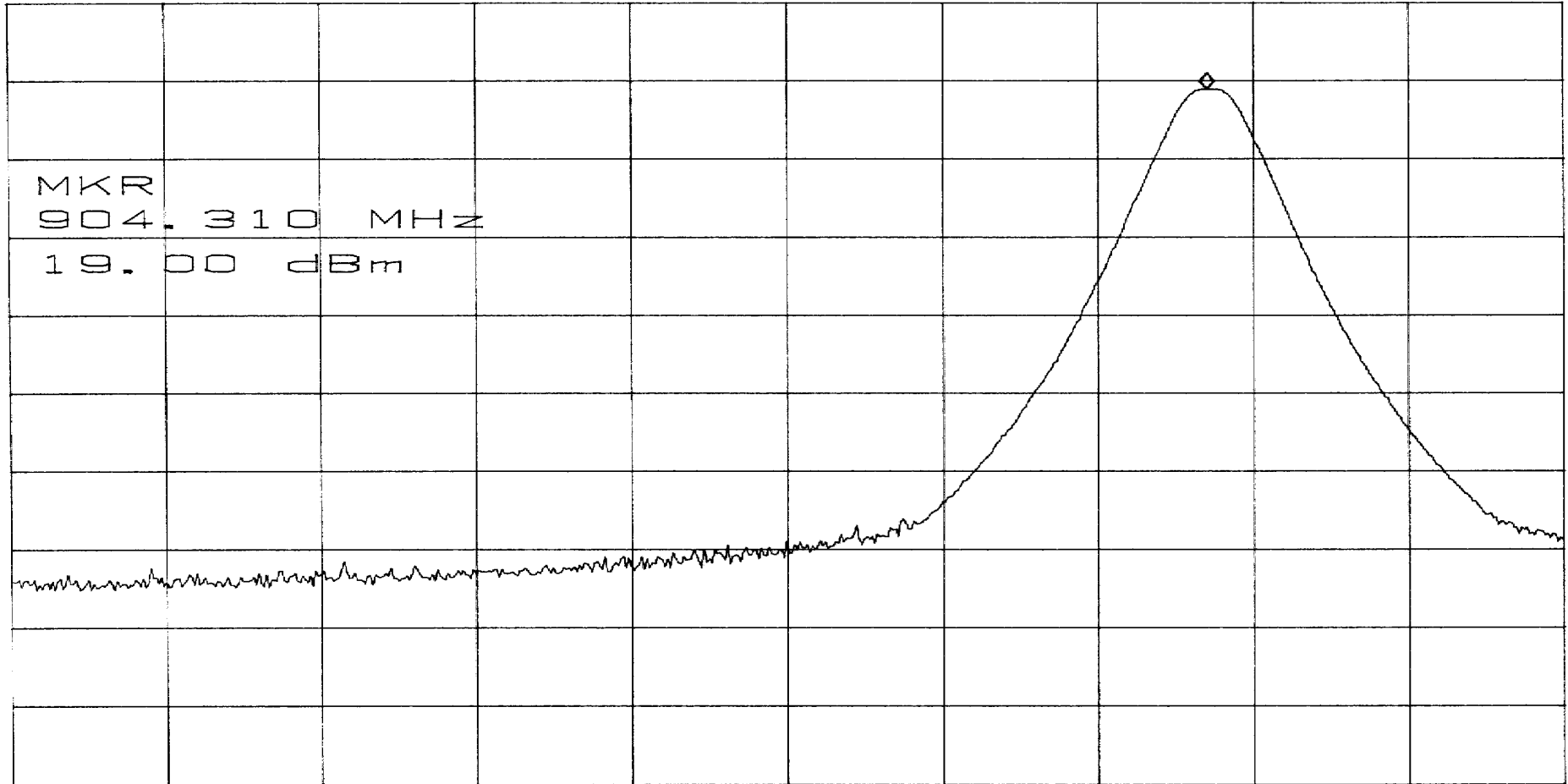
### **15.247 Spread Spectrum Plots**

# Out of Band - Lower Band Edge

ATTEN 40dB  
RL 30.0dBm

10dB/

MKR 19.00dBm  
904.310MHz



MKR  
904.310 MHz  
19.00 dBm

START 902.000MHz

STOP 905.000MHz

RBW 100kHz \*VBW 100kHz

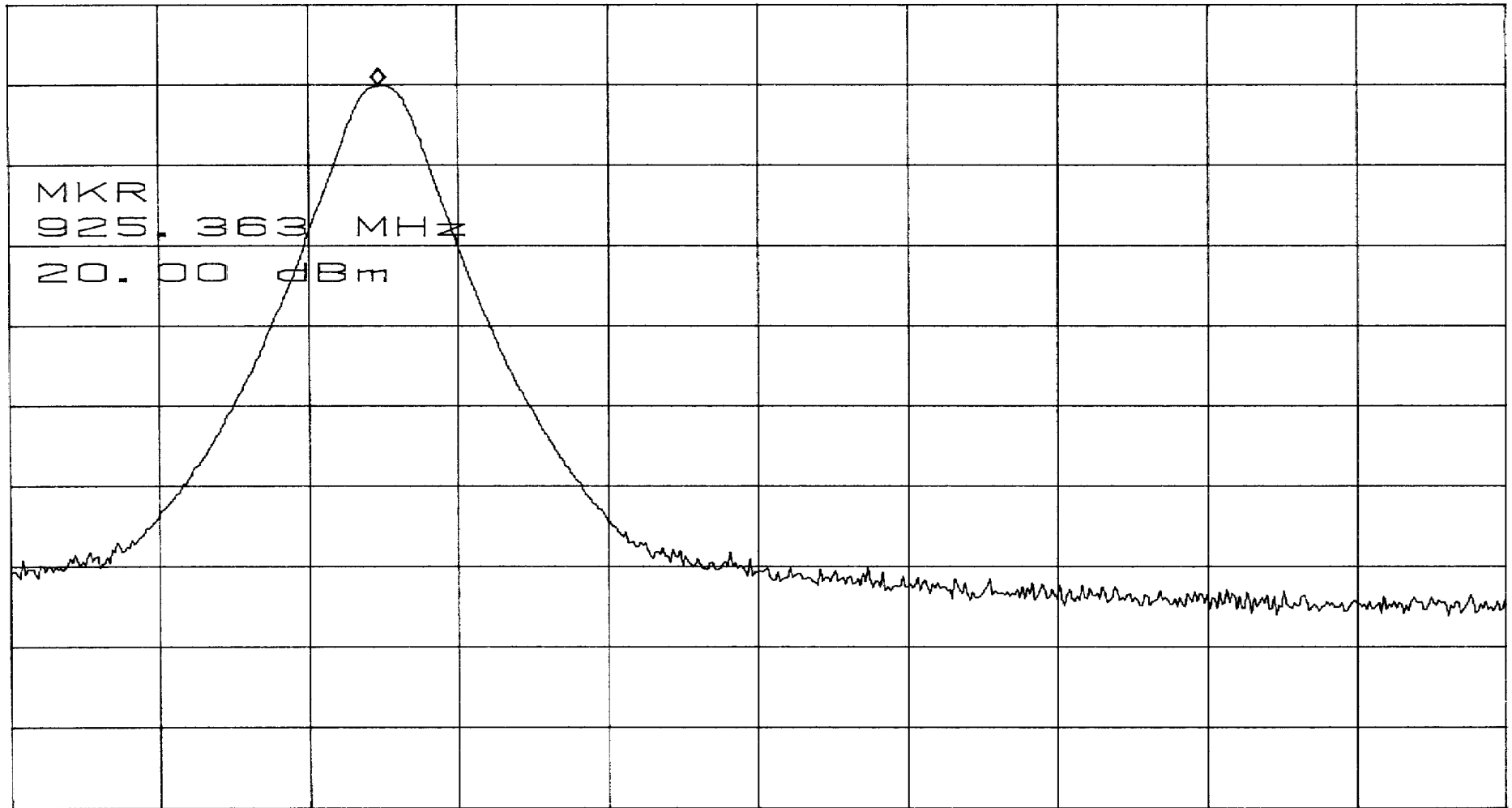
SWP 50ms

# Out of Band - Upper Band Edge

ATTEN 40dB  
RL 30.00dBm

10dB/

MKR 20.00dBm  
925.363MHz



START 924.500MHz

STOP 928.000MHz

RBW 100kHz \*VBW 100kHz

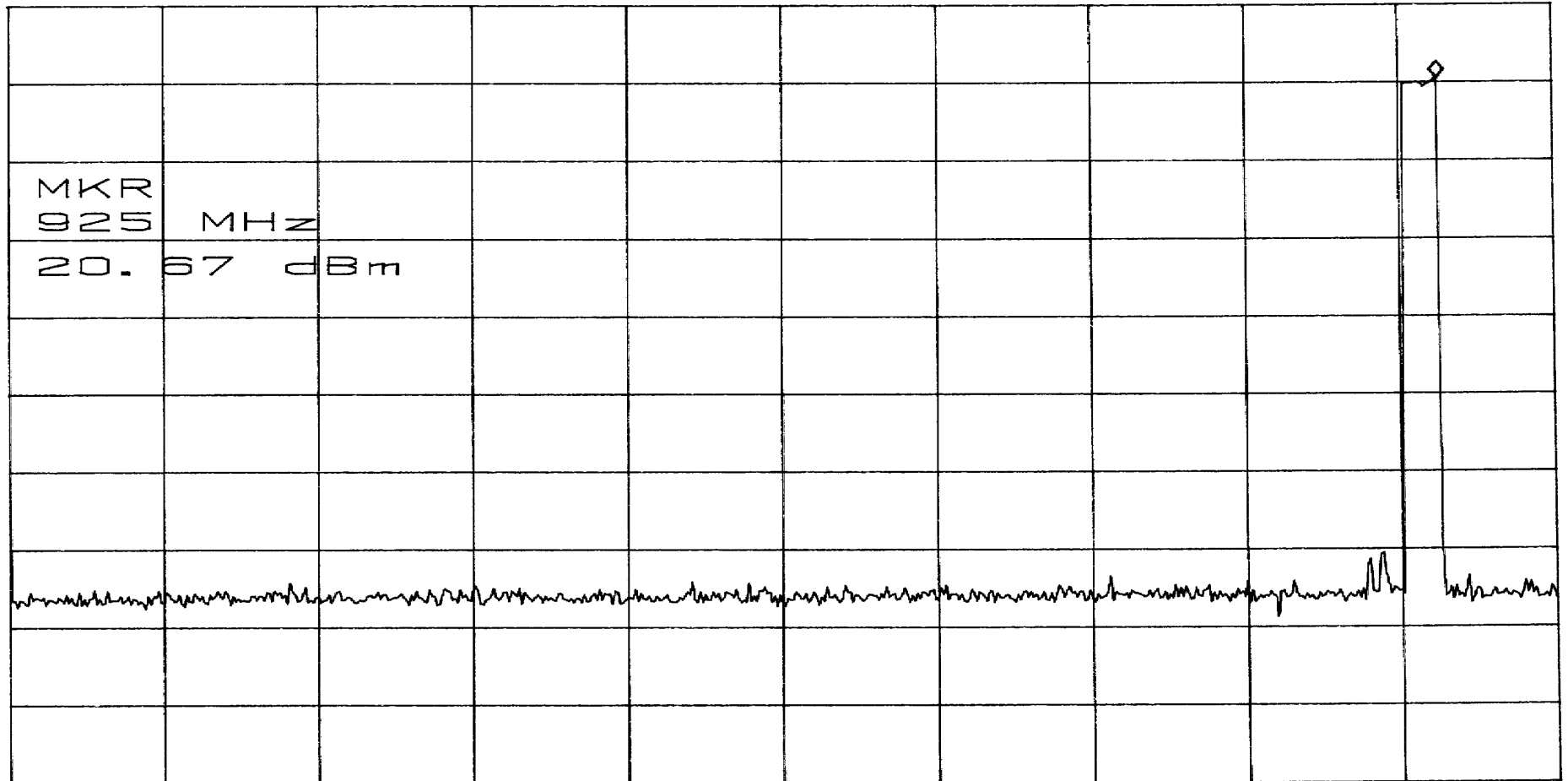
SWP 50ms

# Out of Band Emissions 0 Hz – 1GHz

ATTEN 40dB  
RL 30.0dBm

10dB/

MKR 20.67dBm  
925MHz



START 0Hz STOP 1.000GHz  
RBW 100kHz \*VBW 100kHz SWP 250ms

# Out of Band Emissions 1- 2.75 GHz

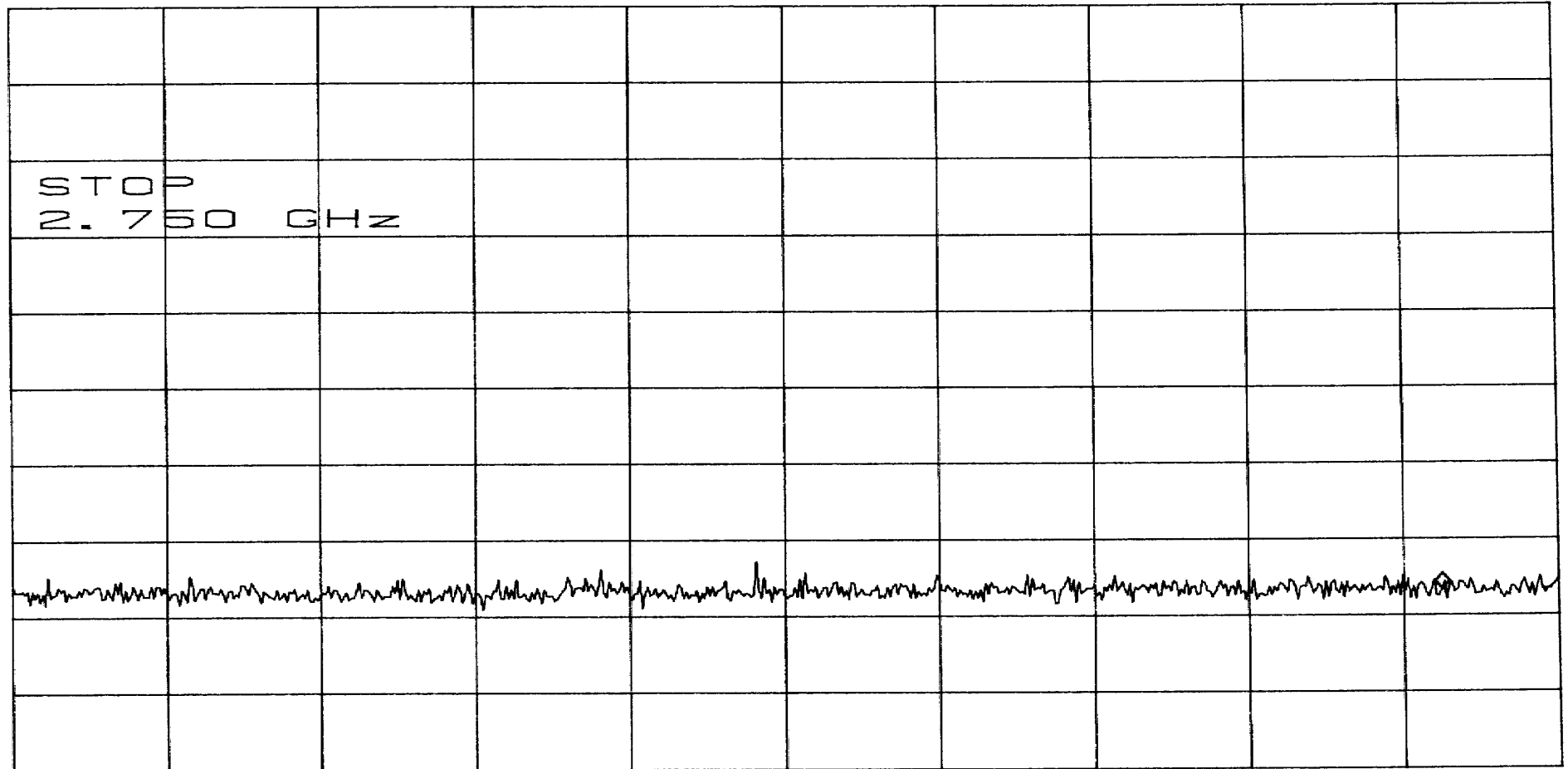
ATTEN 40dB

MKR -46.50dBm

RL 30.0dBm

10dB/

2.619GHz



START 1.000GHz

STOP 2.750GHz

·RBW 100kHz

\*VBW 100kHz

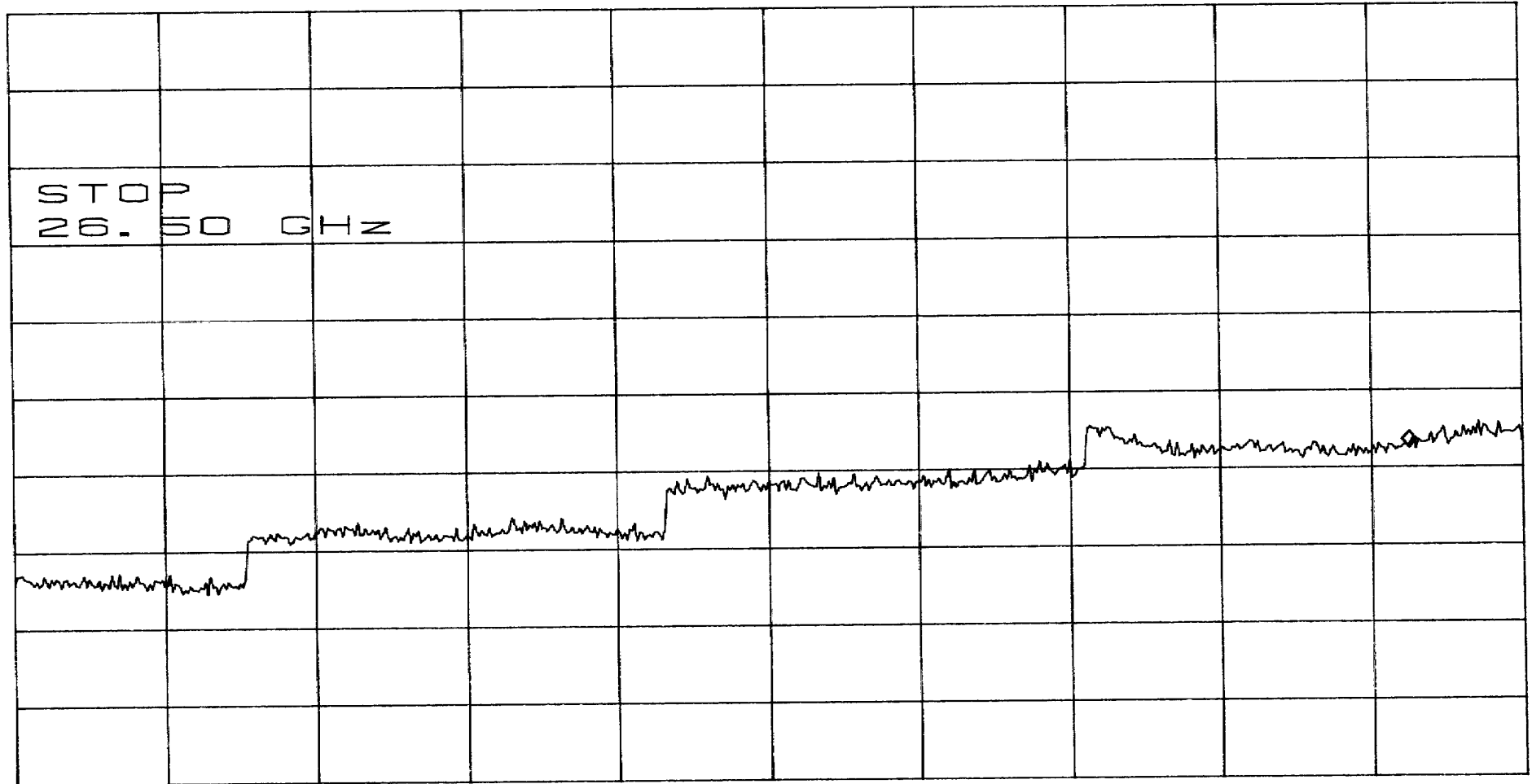
SWP 440ms

# Out of Band Emissions 2.75 – 26.5 GHz

ATTEN 40dB  
RL 30.0dBm

10dB/

MKR -27.33dBm  
24.72GHz



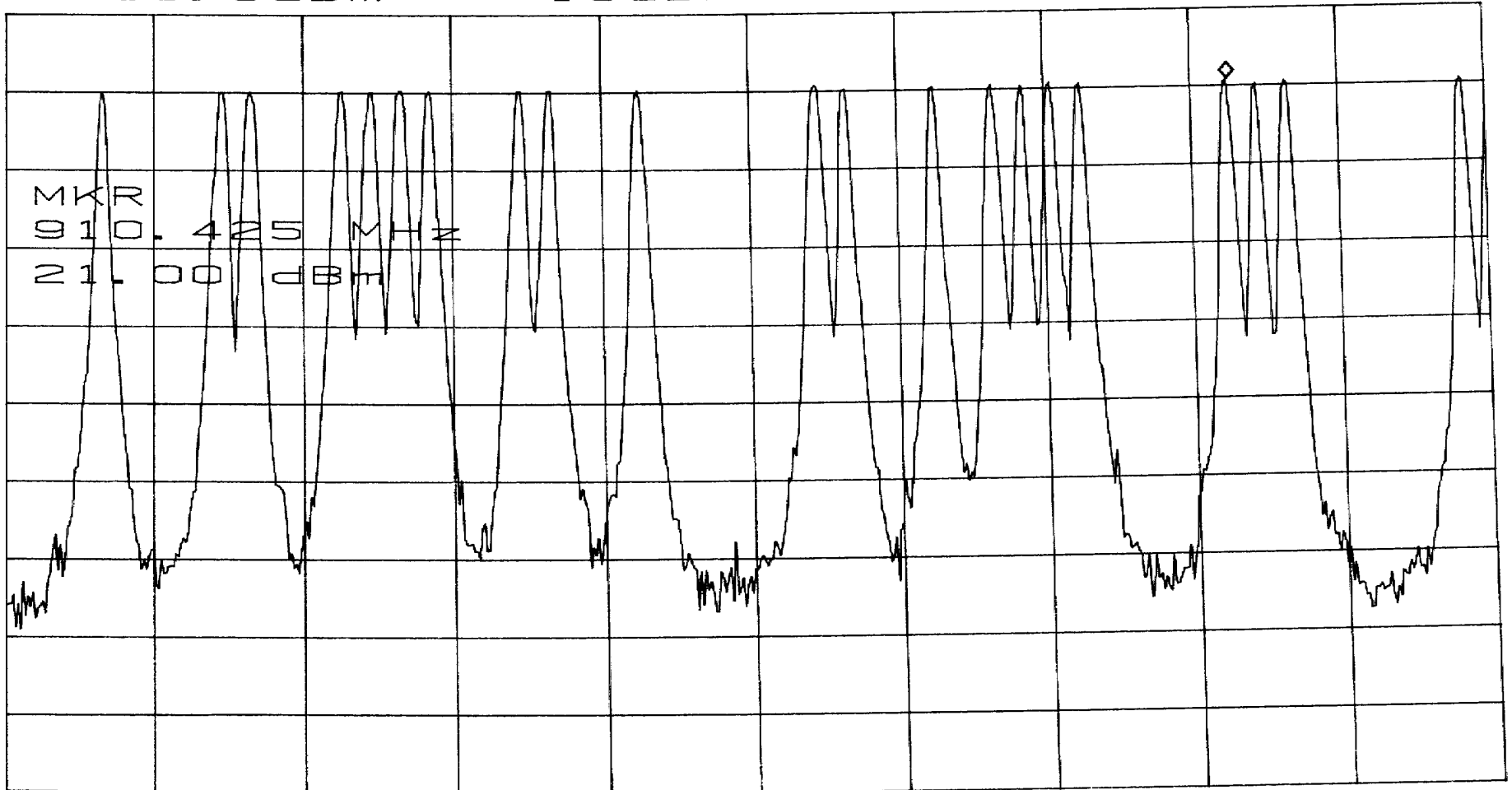
START 2.75GHz STOP 26.50GHz  
←RBW 100kHz \*VBW 100kHz SWP 6.0sec

# Channel Utilization 903 – 912 MHz

ATTEN 40dB  
RL 30.00dBm

10dB/

MKR 21.00dBm  
910.425MHz



START 903.000MHz

STOP 912.000MHz

RBW 30kHz

\*VBW 30kHz

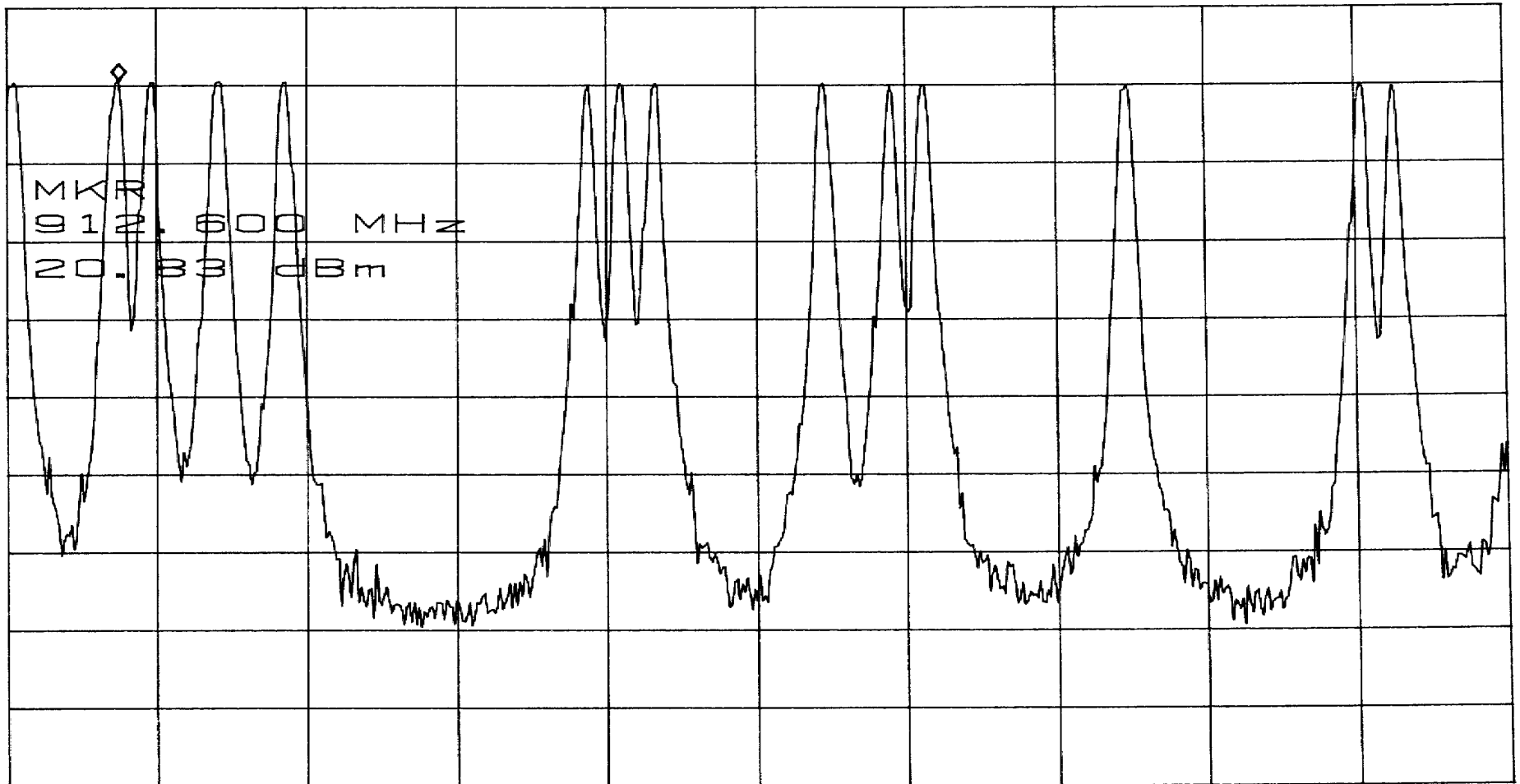
SWP 50ms

# Channel Utilization 912- 920 MHz

ATTN 40dB  
RL 30.0dBm

10dB/

MKR 20.83dBm  
912.600MHz



START 912.000MHz

STOP 920.000MHz

RBW 30kHz

\*VBW 30kHz

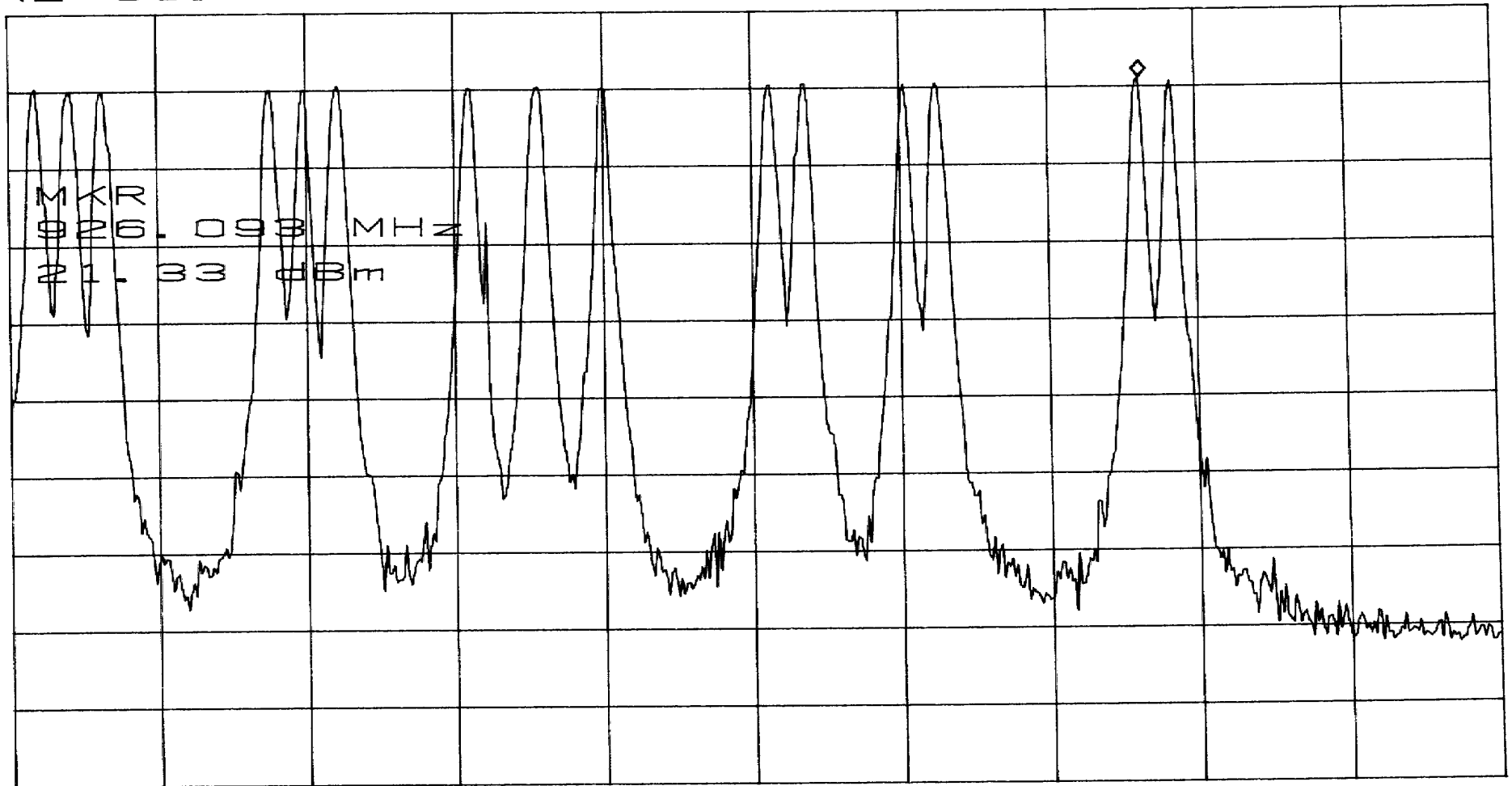
SWP 50ms

# Channel Utilization 920 - 928 MHz

ATTEN 40dB  
RL 30.0dBm

10dB/

MKR 21.33dBm  
926.093MHz



START 920.000MHz

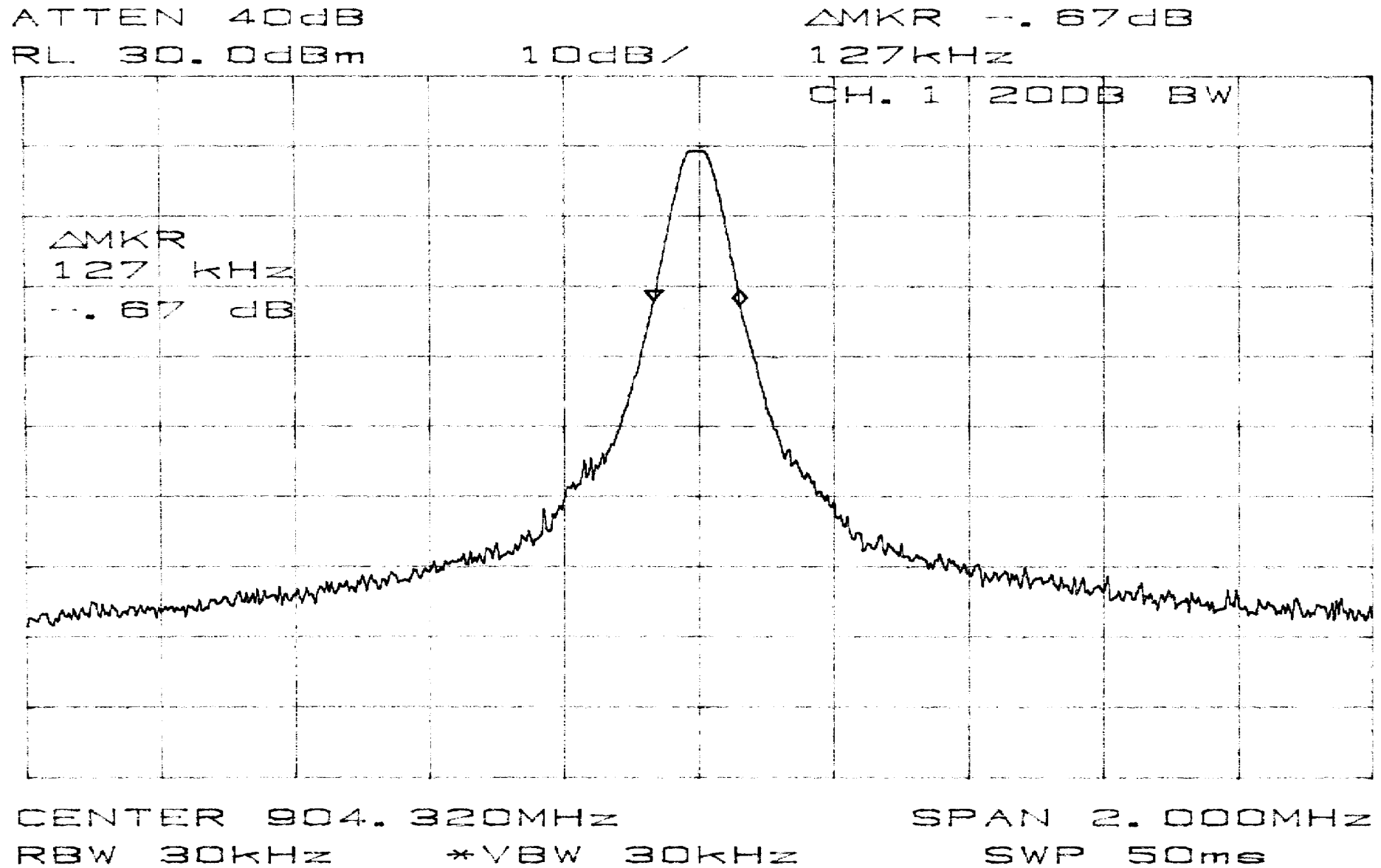
STOP 928.000MHz

RBW 30kHz

\*VBW 30kHz

SWP 50ms

# Bandwidth



# Bandwidth

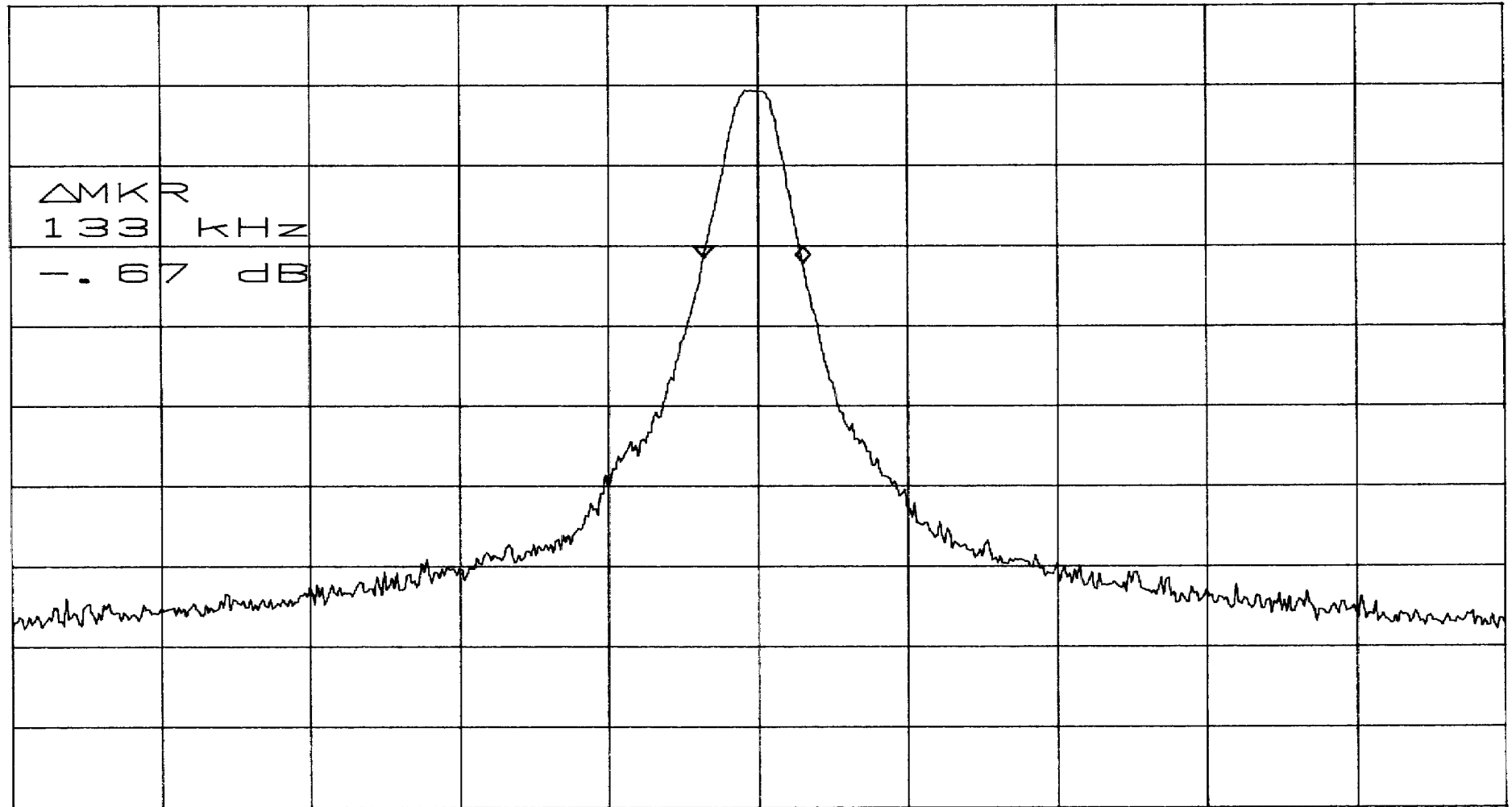
ATTEN 40dB

$\Delta MKR$  -.67dB

RL 30.0dBm

10dB/

133kHz



CENTER 914.940MHz

SPAN 2.000MHz

RBW 30kHz

\*VBW 30kHz

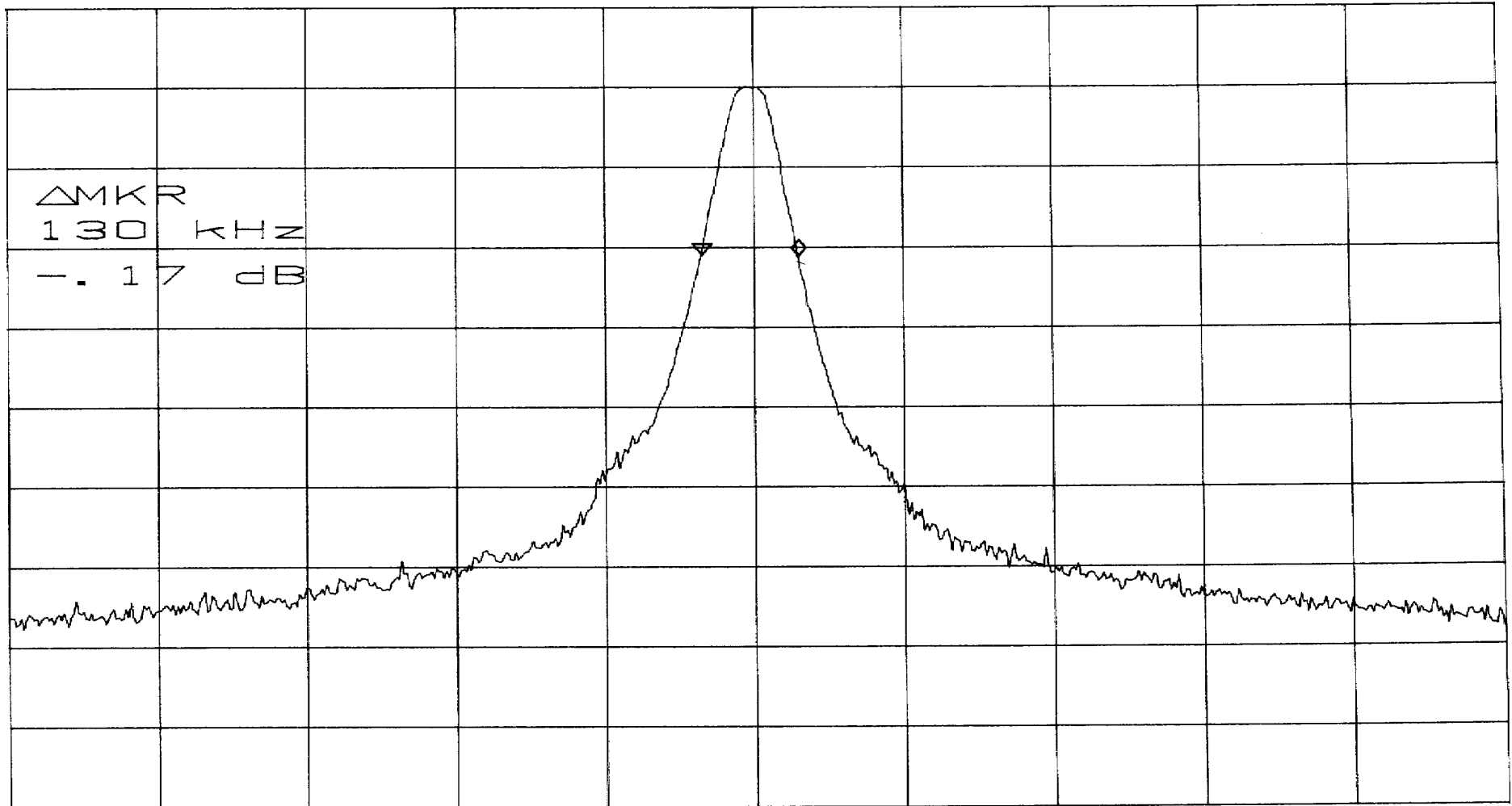
SWP 50ms

# Bandwidth

ATTEN 40dB  
RL 30.0dBm

10dB/

ΔMKR -.17dB  
130kHz



CENTER 925.380MHz

SPAN 2.000MHz

RBW 30kHz

\*VBW 30kHz

SWP 50ms

# Channel Dwell Time

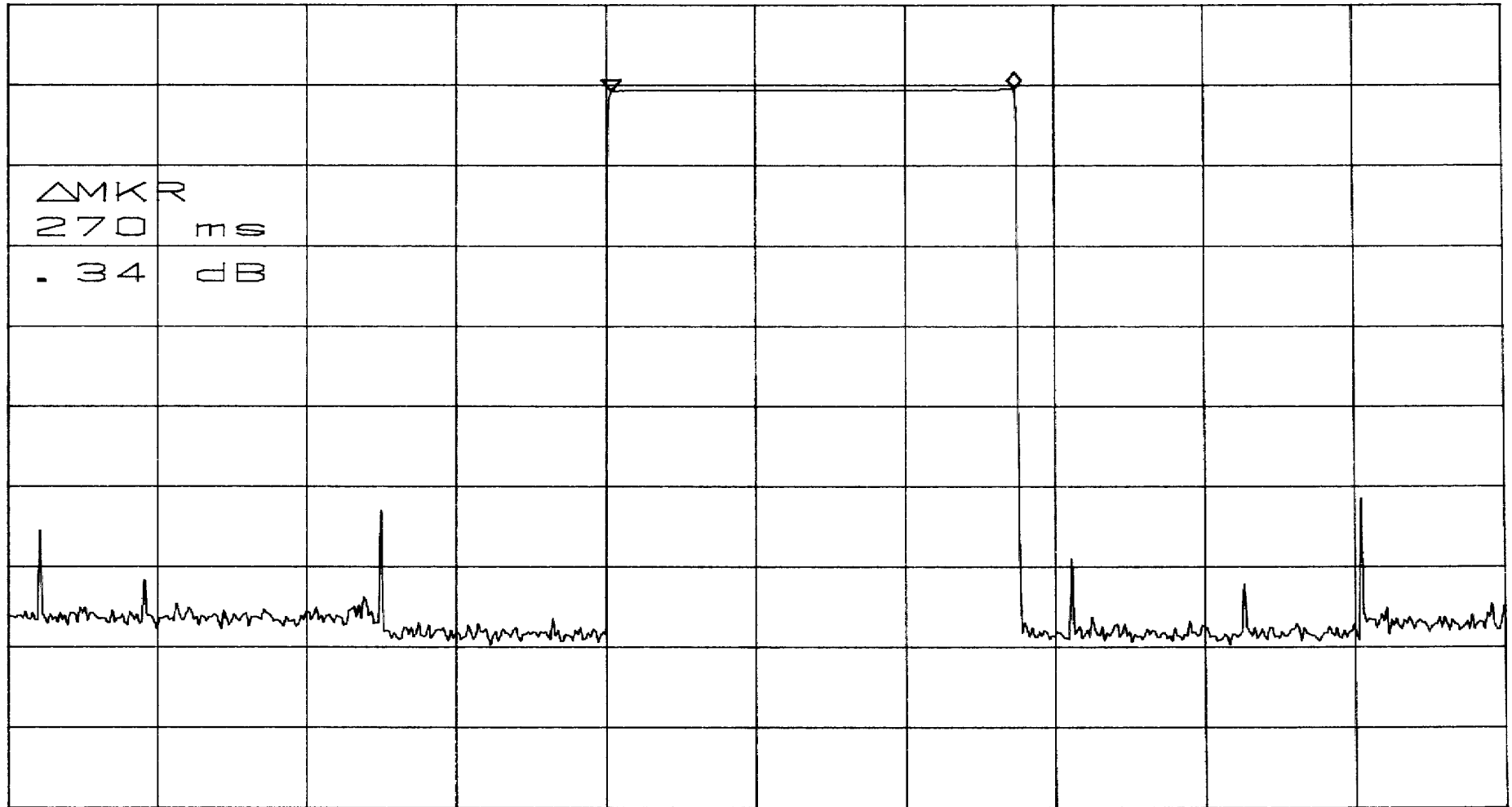
ATTEN 40dB

$\Delta MKR$  .34dB

RL 30.0dBm

10dB/

270ms



CENTER 915.120000MHz

SPAN 0Hz

RBW 100kHz \*VBW 30kHz

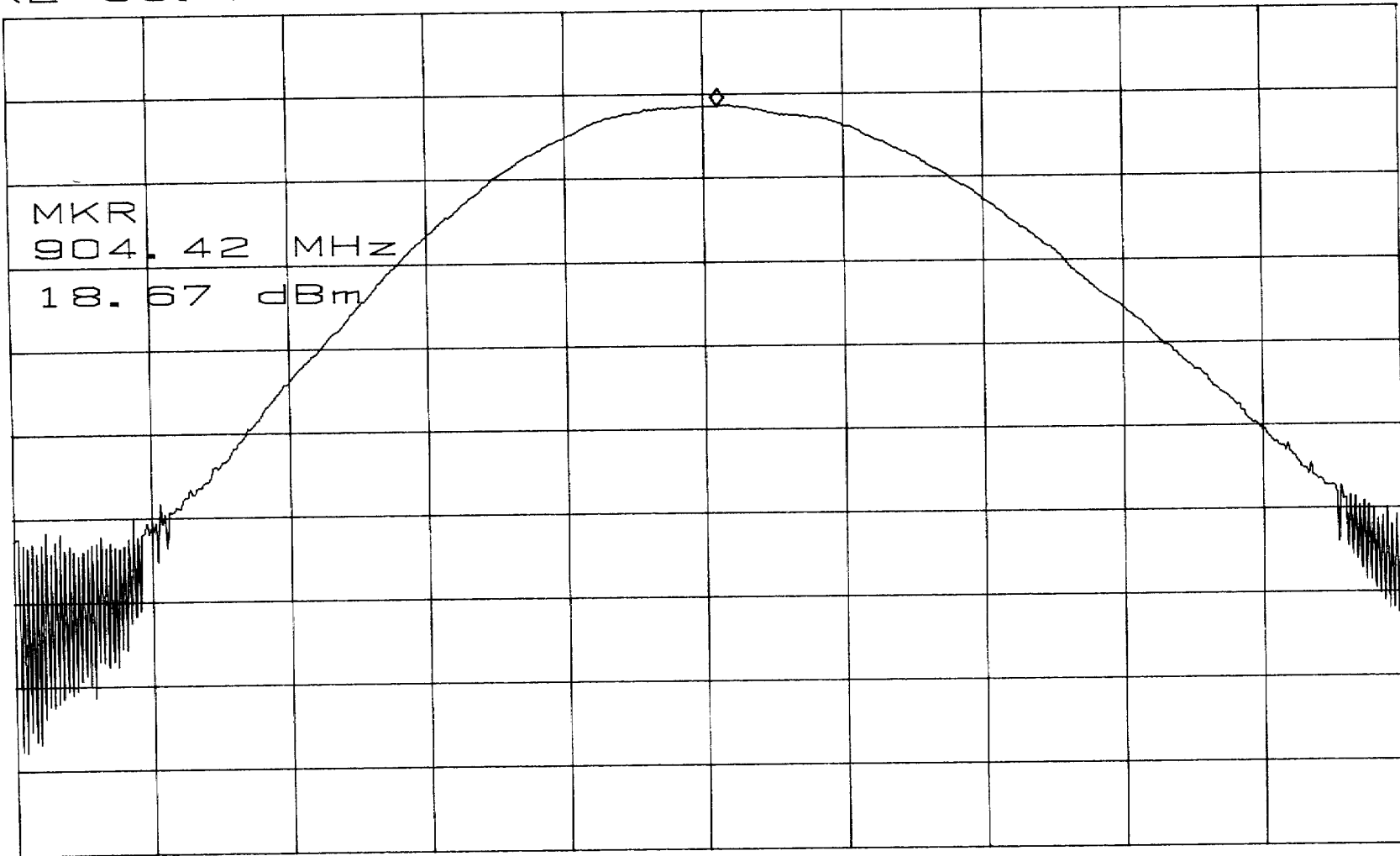
SWP 1.0sec

# Output Power

ATTEN 40dB  
RL 30.0dBm

10dB/

MKR 18.67dBm  
904.42MHz



CENTER 904.32MHz  
\*RBW 2.0MHz \*VBW 3.0MHz

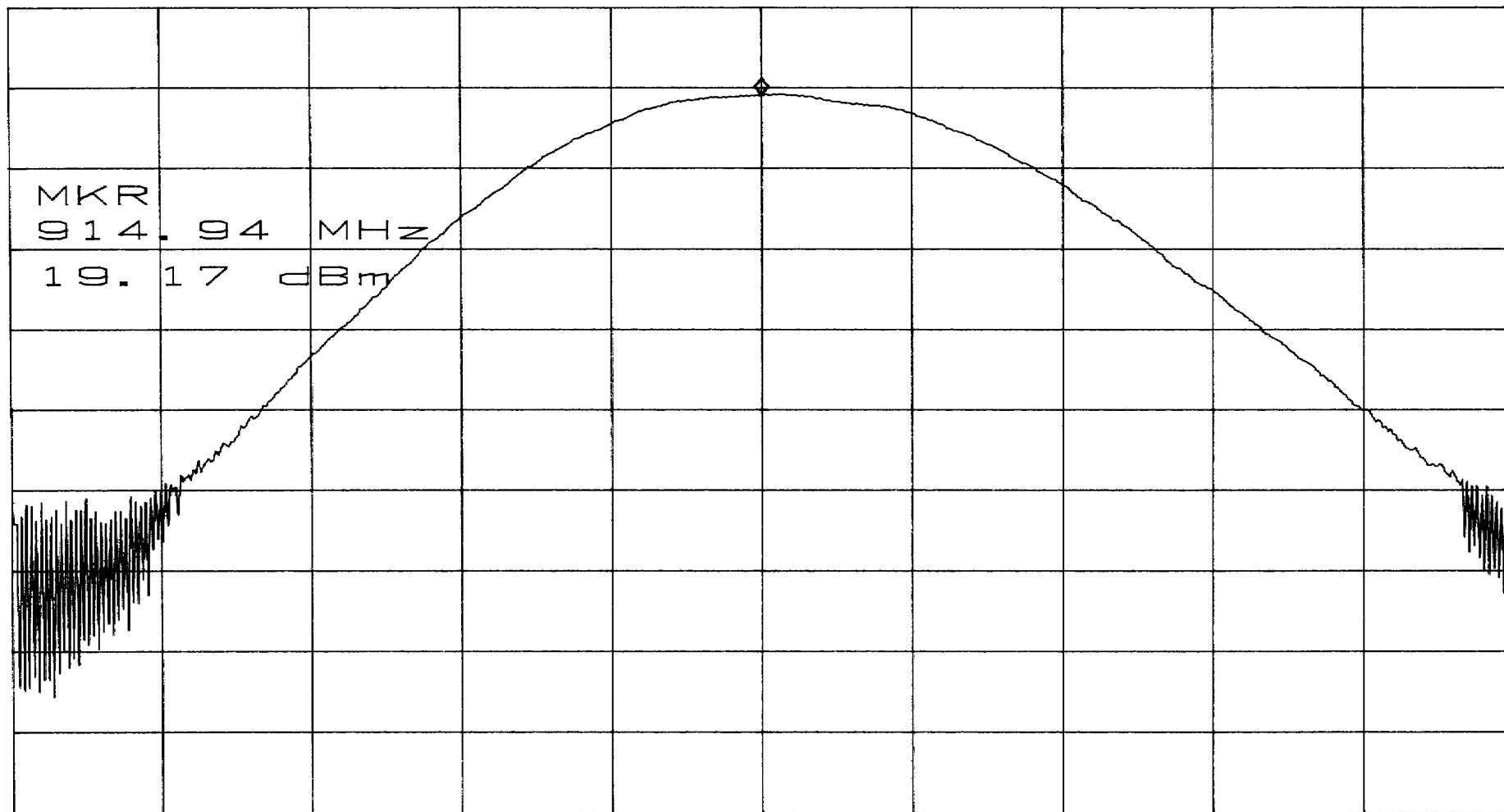
SPAN 10.00MHz  
SWP 50ms

# Output Power

ATTEN 40dB  
RL 30.00dBm

10dB/

MKR 19.17dBm  
914.94MHz



CENTER 914.94MHz  
RBW 2.0MHz \*VBW 3.0MHz

SPAN 10.00MHz  
SWP 50ms

# Output Power

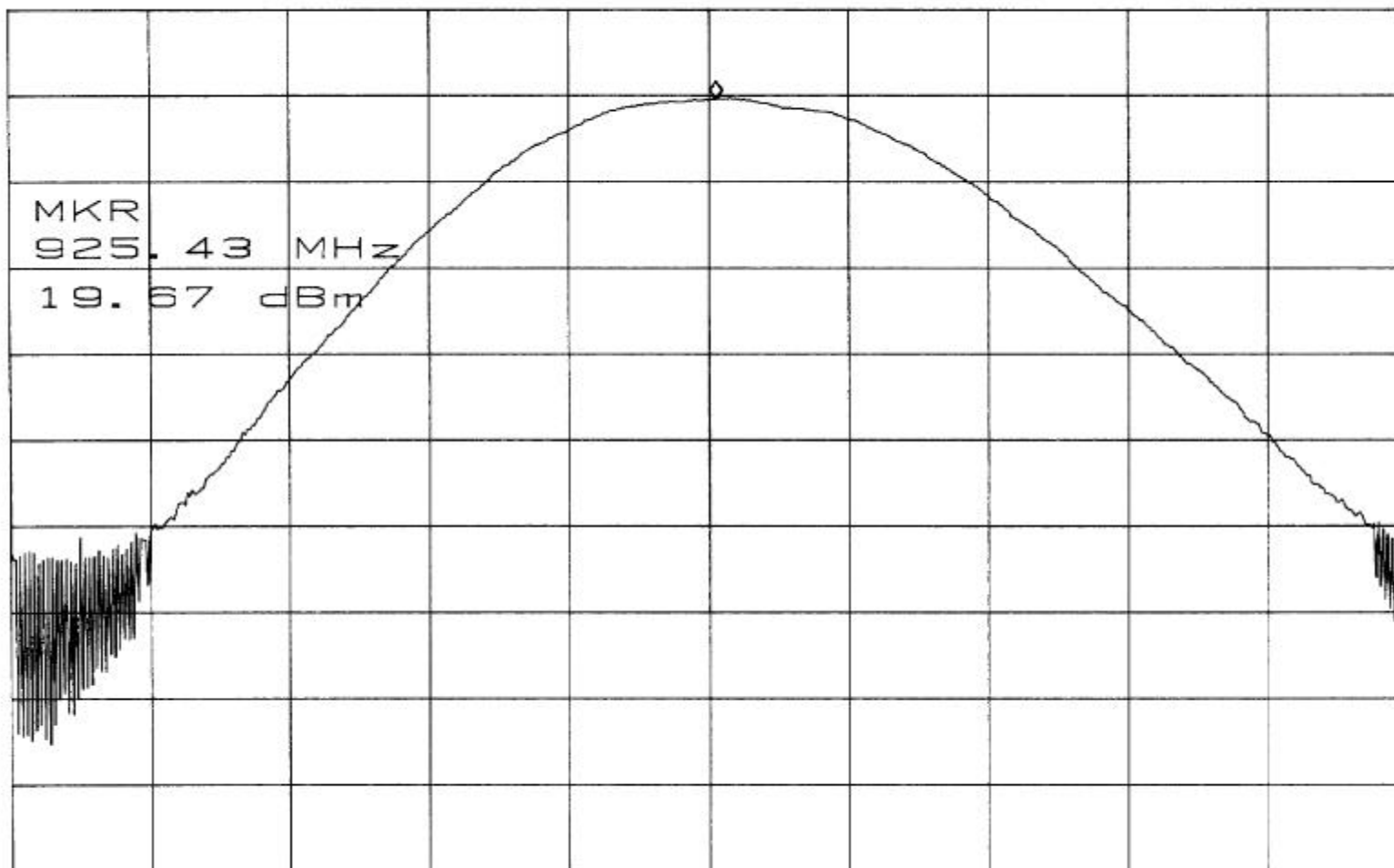
ATTEN 40dB

RL 30.0dBm

10dB/

MKR 19.67dBm

925.43MHz



MKR  
925.43 MHz  
19.67 dBm

CENTER 925.38MHz

SPAN 10.00MHz

RBW 2.0MHz \*VBW 3.0MHz

SWP 50ms

## **APPENDIX B**

### **15.205 Restricted Band Data**

| EUT:             |         | MP BACKUP GAS RMI |       |      |       |      | CUSTOMER NAME: WHISPER |          |          |       |
|------------------|---------|-------------------|-------|------|-------|------|------------------------|----------|----------|-------|
| RULE PART:       |         | 15.205            |       |      |       |      | WORK ORDER: 8111301    |          |          |       |
|                  |         |                   |       |      |       |      | FILE: 8111301A.xls     |          |          |       |
| ANTENNA:         |         | HORN              |       |      |       |      | ATTN dB: 0             |          |          |       |
| POLARIZATION:    |         | Verticle          |       |      |       |      | DUTY dB: 0             |          |          |       |
| MODULATION TYPE: |         |                   |       |      |       |      | HP IL dB: 0            |          |          |       |
| TESTED BY:       |         | SHAWN             |       |      |       |      | DIST dB: 0             |          |          |       |
| COMMENT:         |         | S/N0001ABFFA      |       |      |       |      |                        |          |          |       |
| FREQ.            | READING |                   | Pk    | A.F. | Cbl   | FLTR | AMP                    | TOTAL,   | LIMIT    | DELTA |
| MHz              | dB(uV)  | NF                | or Av | dB   | dB    | dB   | dB                     | dB(uV/m) | dB(uV/m) | dB    |
| Ch 1 /904.32MHz  |         |                   |       |      |       |      |                        |          |          |       |
| 2716.47          | 46.50   |                   | Pk    | 30.6 | -5.3  | -0.4 | 35.6                   | 47.2     | 74.0     | -26.8 |
| 2716.47          | 36.80   |                   | Avg   | 30.6 | -5.3  | -0.4 | 35.6                   | 37.5     | 54.0     | -16.5 |
| 3622.00          | 47.83   |                   | Pk    | 32.5 | -6.2  | -0.4 | 35.1                   | 51.8     | 74.0     | -22.2 |
| 3622.00          | 38.70   |                   | Avg   | 32.5 | -6.2  | -0.4 | 35.1                   | 42.7     | 54.0     | -11.3 |
| 4530.00          | 46.10   |                   | Pk    | 34.2 | -7.0  | -0.4 | 35.1                   | 52.6     | 74.0     | -21.4 |
| 4530.00          | 35.20   |                   | Avg   | 34.2 | -7.0  | -0.4 | 35.1                   | 41.7     | 54.0     | -12.3 |
| 7248.00          | 41.00   | *                 | Pk    | 36.8 | -10.6 | -0.4 | 35.5                   | 53.4     | 74.0     | -20.7 |
| 7248.00          | 28.80   | *                 | Avg   | 36.8 | -10.6 | -0.4 | 35.5                   | 41.2     | 54.0     | -12.9 |
| 8154.00          | 40.30   | *                 | Pk    | 38.4 | -11.4 | -0.4 | 35.5                   | 55.0     | 74.0     | -19.0 |
| 8154.00          | 29.00   | *                 | Avg   | 38.4 | -11.4 | -0.4 | 35.5                   | 43.7     | 54.0     | -10.3 |
| 9060.00          | 41.45   | *                 | Pk    | 40.4 | -12.1 | -0.4 | 35.5                   | 58.9     | 74.0     | -15.2 |
| 9060.00          | 27.80   | *                 | Avg   | 40.4 | -12.1 | -0.4 | 35.5                   | 45.2     | 54.0     | -8.8  |
| CH 4/ 914.94MHz  |         |                   |       |      |       |      |                        |          |          |       |
| 2743.47          | 49.33   |                   | Pk    | 30.6 | -5.3  | -0.4 | 35.5                   | 50.1     | 74.0     | -23.9 |
| 2743.47          | 42.60   |                   | Avg   | 30.6 | -5.3  | -0.4 | 35.5                   | 43.4     | 54.0     | -10.6 |
| 3657.47          | 45.20   |                   | Pk    | 32.5 | -6.2  | -0.4 | 35.1                   | 49.2     | 74.0     | -24.8 |
| 3657.47          | 35.30   |                   | Avg   | 32.5 | -6.2  | -0.4 | 35.1                   | 39.3     | 54.0     | -14.7 |
| 4572.83          | 44.70   |                   | Pk    | 34.2 | -7.0  | -0.4 | 35.2                   | 51.1     | 74.0     | -22.9 |
| 4572.83          | 35.20   |                   | Avg   | 34.2 | -7.0  | -0.4 | 35.2                   | 41.6     | 54.0     | -12.4 |
| 7323.23          | 47.00   | *                 | Pk    | 36.8 | -10.6 | -0.4 | 35.4                   | 59.4     | 74.0     | -14.6 |
| 7323.23          | 31.00   | *                 | Avg   | 36.8 | -10.6 | -0.4 | 35.4                   | 43.4     | 54.0     | -10.6 |
| 8236.60          | 39.80   | *                 | Pk    | 38.4 | -11.4 | -0.4 | 35.5                   | 54.5     | 74.0     | -19.5 |
| 8236.60          | 28.70   | *                 | Avg   | 38.4 | -11.4 | -0.4 | 35.5                   | 43.4     | 54.0     | -10.6 |
| 9151.80          | 38.80   | *                 | Pk    | 40.4 | -12.1 | -0.4 | 35.5                   | 56.2     | 74.0     | -17.8 |
| 9151.80          | 28.90   | *                 | Avg   | 40.4 | -12.1 | -0.4 | 35.5                   | 46.3     | 54.0     | -7.7  |
| CH 7 /925.38MHz  |         |                   |       |      |       |      |                        |          |          |       |
| 2773.62          | 48.50   |                   | Pk    | 30.6 | -5.3  | -0.4 | 35.5                   | 49.3     | 74.0     | -24.7 |
| 2773.62          | 42.00   |                   | Avg   | 30.6 | -5.3  | -0.4 | 35.5                   | 42.8     | 54.0     | -11.2 |
| 3698.86          | 45.33   |                   | Pk    | 32.5 | -6.2  | -0.4 | 35.1                   | 49.3     | 74.0     | -24.7 |
| 3698.86          | 34.80   |                   | Avg   | 32.5 | -6.2  | -0.4 | 35.1                   | 38.8     | 54.0     | -15.2 |
| 4617.62          | 44.20   |                   | Pk    | 34.2 | -7.0  | -0.4 | 35.2                   | 50.6     | 74.0     | -23.4 |
| 4617.61          | 34.20   |                   | Avg   | 34.2 | -7.0  | -0.4 | 35.2                   | 40.6     | 54.0     | -13.4 |
| 7388.04          | 42.30   | *                 | Pk    | 36.8 | -10.6 | -0.4 | 35.4                   | 54.7     | 74.0     | -19.3 |
| 7388.04          | 28.00   | *                 | Avg   | 36.8 | -10.6 | -0.4 | 35.4                   | 40.4     | 54.0     | -13.6 |
| 8312.57          | 40.33   | *                 | Pk    | 38.4 | -11.4 | -0.4 | 35.5                   | 55.0     | 74.0     | -19.0 |
| 8312.57          | 28.20   | *                 | Avg   | 38.4 | -11.4 | -0.4 | 35.5                   | 42.9     | 54.0     | -11.1 |

## **APPENDIX C**

### **15.209 Radiated Emissions**

Electronic Compliance Laboratories, Inc.  
 1249 Birchwood Ave.  
 Sunnyvale, CA  
 Radiated Emissions  
 Frequency range: 30MHz-1000MHz  
 3 Meter Open Site  
 Site Calibrated: June 1998

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:                    Chris  
 Date:                        11-13-1998                    Time:                        10:20:42  
 Temperature Range:    70                            Deg F                    Percent Humidity: 60  
 E.U.T.:                      Medium Power GAS RMI  
 Exercise Program:        NONE  
 Modifications:            NONE  
 Report File Name:        F:\TESTDATA\8110301.RF

Antenna Type:              BICONICAL

| TEST<br>FREQ | TEST<br>dBuV | ACTUAL<br>dBuV/m | CLASS B<br>LIMIT | VERSUS<br>B LIMIT | TABLE<br>DEGREES | ANTENNA<br>HEIGHT | POLAR-<br>IZATION | DETECTOR<br>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

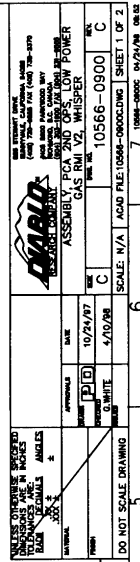
## **APPENDIX D**

### **15.203 Antenna and Antenna Connector**



1. INSTALL BARCODE LABEL (ITEM 4) ON THE PCA, ORIENTED AS SHOWN.

- | REVISIONS |      |                                |          |          |
|-----------|------|--------------------------------|----------|----------|
| ZONE      | REV. | DESCRIPTION                    | DATE     | APPROVED |
| N/A       | A    | PRODUCTION RELEASE             | 11/26/97 | G.WHITE  |
| C/4       | B    | ADDED INTERNAL FENCE TO SHIELD | 03/19/98 | G.WHITE  |
| D/6       | C    | REMOVED BATTERY                | 04/20/98 | G.WHITE  |



**DIABLO RESEARCH CO. LLC**  
**CONFIDENTIAL**

## **APPENDIX E**

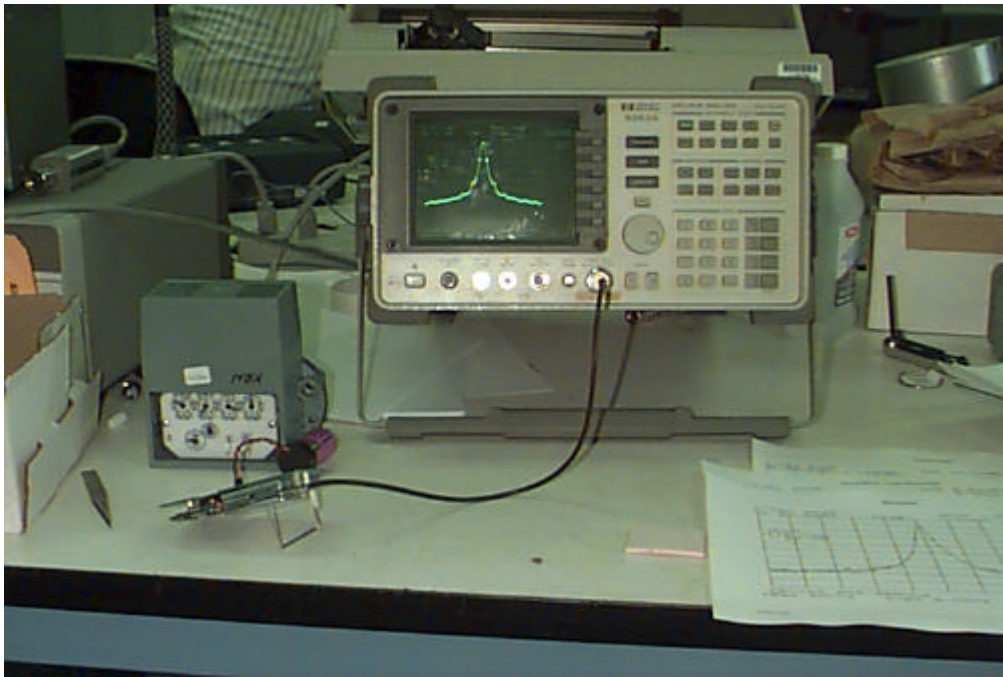
### **Set-up Photographs**



**15.209 Radiated Emissions**



**FCC Part 15.205  
Restricted Band**



**FCC Part 15.247**