U.S. TECH
A TRADITION IN TESTING SERVICES

May 25, 2004

Mr. Brian W. Jones
RELM Wireless Incorporated
DBA: BK Radio
7100 Technology Drive
West Melbourne, FL 32904

Dear Mr. Jones:

Enclosed please find RELM Wireless Incorporated's file copy of the FCC Parts 22, 74, and 90 Certification Report for the Model DPHX51.

RELM Wireless Incorporated should expect to receive a certification grant for this product within the next 8-12 weeks.

If you have any questions, please don't hesitate to call. Thank you for your business.

Sincerely,

Louis A. Feudi
Operations Manager

U.S. TECH
A TRADITION IN TESTING SERVICES

**RELM Wireless Incorporated**
**FCC Parts 22, 74, and 90, Certification Application**
**Model DPHX51**

**UST Project No: 04-0043**
**May 25, 2004**

# MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: **RELM Wireless Incorporated**

MODEL: **DPHX51**

FCC ID: **K95DPHX51**

DATE: **May 25, 2004**

This report concerns (check one): Original grant_X_
Class II change_____

Equipment type: **__VHF Transceiver__**

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? yes_____ No_X_

If yes, defer until:_____
date

__N.A.__ agrees to notify the Commission by__N.A.___
date
of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

United States Technologies, Inc.
3505 Francis Circle
Alpharetta, GA 30004

Phone Number: (770) 740-0717
Fax Number: (770) 740-1508

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# SECTION 1

# GENERAL INFORMATION

# GENERAL INFORMATION

## 1.1 Product Description

The Equipment Under Test (EUT) is a RELM Wireless Incorporated's Model DPHX51. The EUT is a VHF Portable transceiver which operates within the 136 MHz to 174 MHz range.

## 1.2 Related Submittal(s)/Grant(s)

The EUT will be used with part of a system to send/receive data. The transceiver presented in this report will be used with other like transceivers.

The EUT is subject to the following authorizations:

a) Certification as a transmitter as specified by Parts 22, 74, and 90.

The information contained in this report is presented for the certification authorization(s) for the EUT.

# SECTION 2

# TESTS AND MEASUREMENTS

# TEST AND MEASUREMENTS

## 2.1 Configuration of Tested System

Prepared in accordance with the requirements of the FCC Rules and Regulations Part 2. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process. Interconnecting cables were manipulated as necessary to maximize emissions. A block diagram of the tested system is shown in Figure 1. Test configuration photographs for spurious emissions are shown in Figure 2.

The sample used for testing was received by U.S. Technologies on March 4, 2004 in good condition.

## 2.2 Test Facility

Unless otherwise stated, testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. Conducted and digital device testing was performed at US Tech's measurement facility. This site has been fully described and registered by the FCC under Registration Number 91037. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number IC2982.

## 2.3 Test Equipment

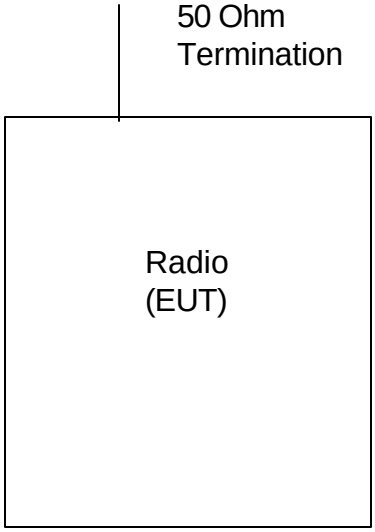
Table 2 describes test equipment used to evaluate this product.

## 2.4 Modifications

No modifications were made by US Tech to bring the EUT into compliance with FCC limits for the transmitter portion of the EUT.

**FIGURE 1**

**TEST CONFIGURATION**



**Test Date:** March 23, 2004
**UST Project:** 04-0043
**Customer:** RELM Wireless Incorporated
**Model:** DPHX51

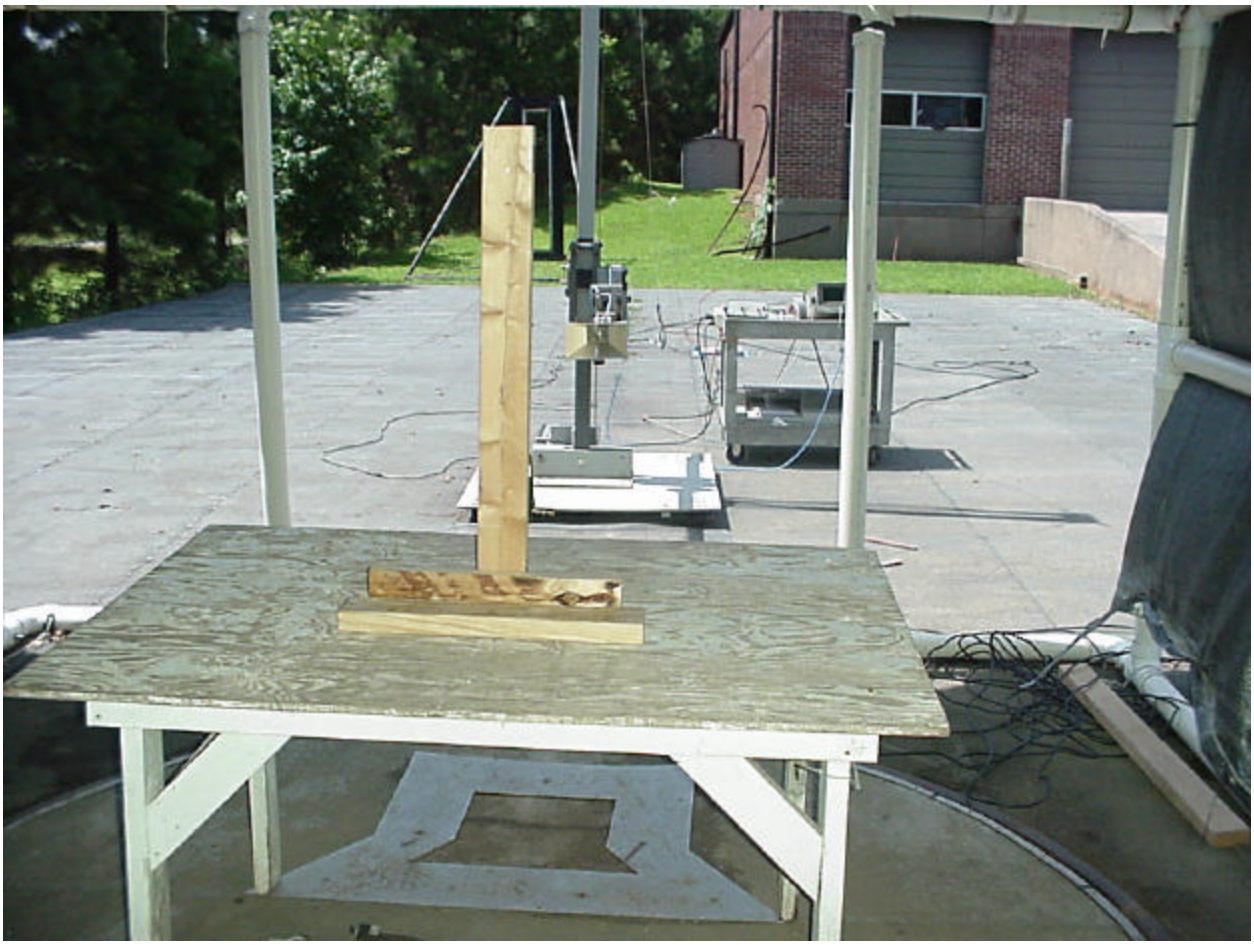
## FIGURE 2a

## Photograph(s) for Spurious Emissions (Front)

**Test Date:** **March 23, 2004**
**UST Project:** **04-0043**
**Customer:** **RELM Wireless Incorporated**
**Model:** **DPHX51**

## FIGURE 2b

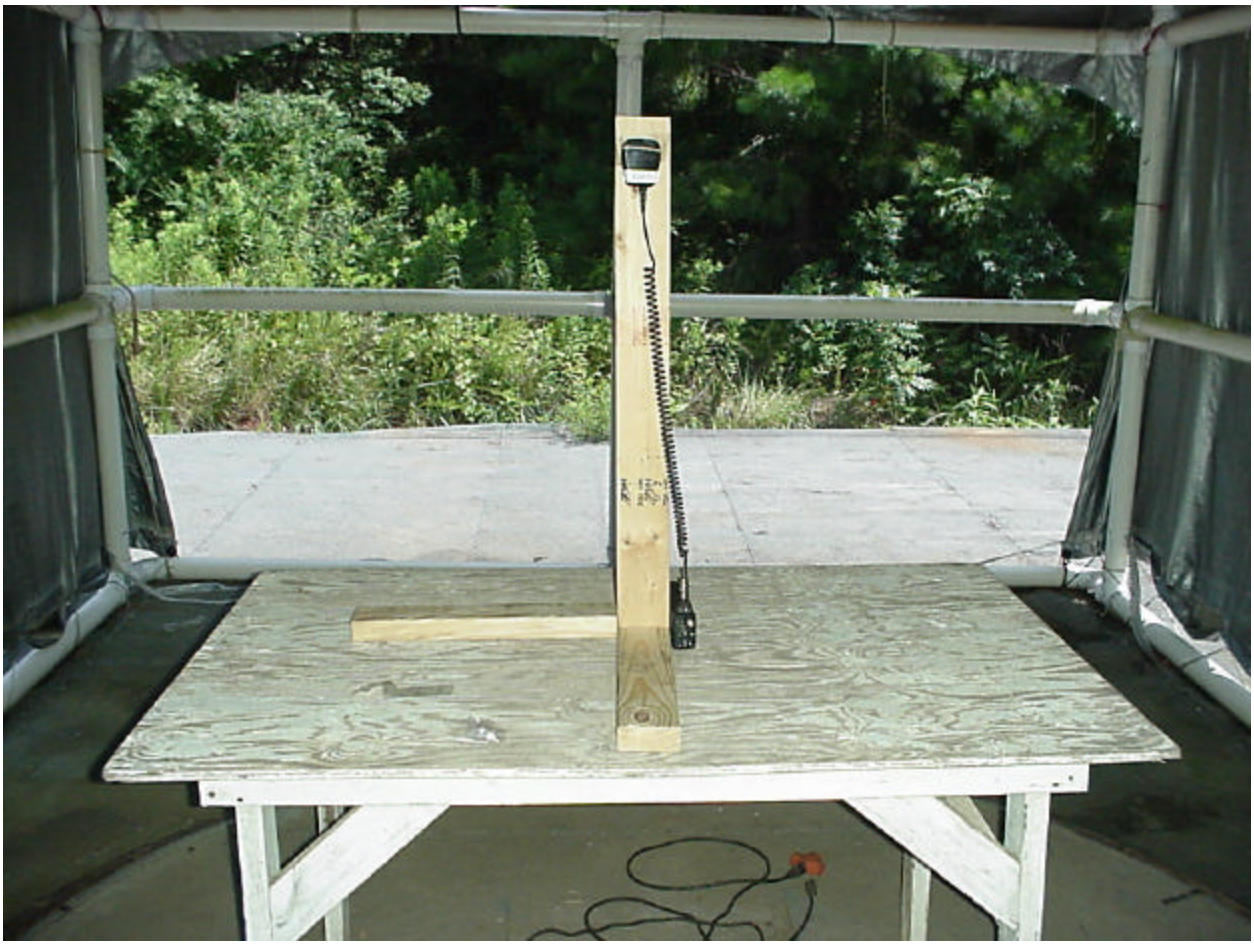
## Photograph(s) for Spurious Emissions



**Test Date:** **March 23, 2004**
**UST Project:** **04-0043**
**Customer:** **RELM Wireless Incorporated**
**Model:** **DPHX51**

## FIGURE 2c

## Photograph(s) for Spurious Emissions



**Test Date:** **March 23, 2004**
**UST Project:** **04-0043**
**Customer:** **RELM Wireless Incorporated**
**Model:** **DPHX51**

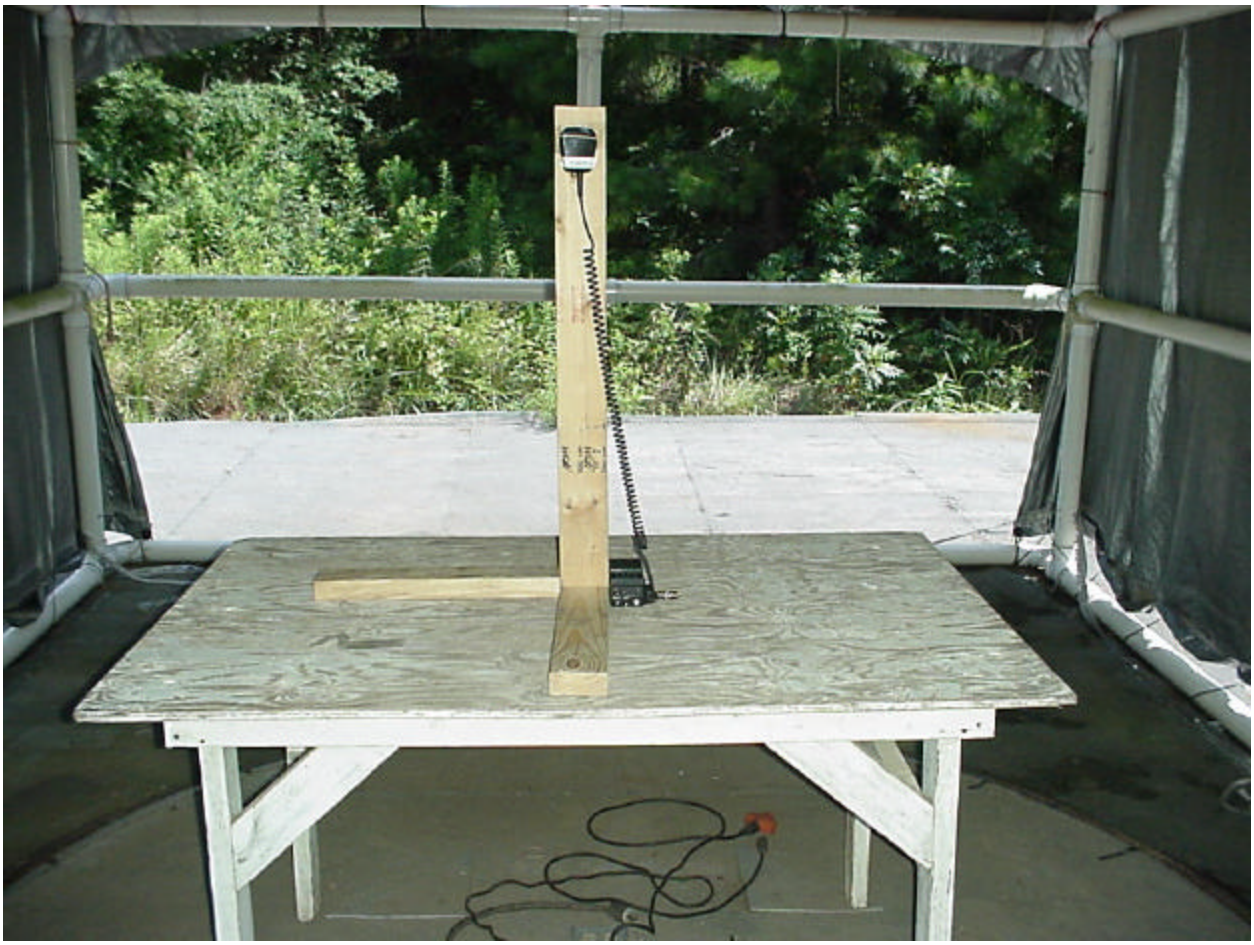
## FIGURE 2d

## Photograph(s) for Spurious Emissions

**Test Date:** **March 23, 2004**
**UST Project:** **04-0043**
**Customer:** **RELM Wireless Incorporated**
**Model:** **DPHX51**

## FIGURE 2e

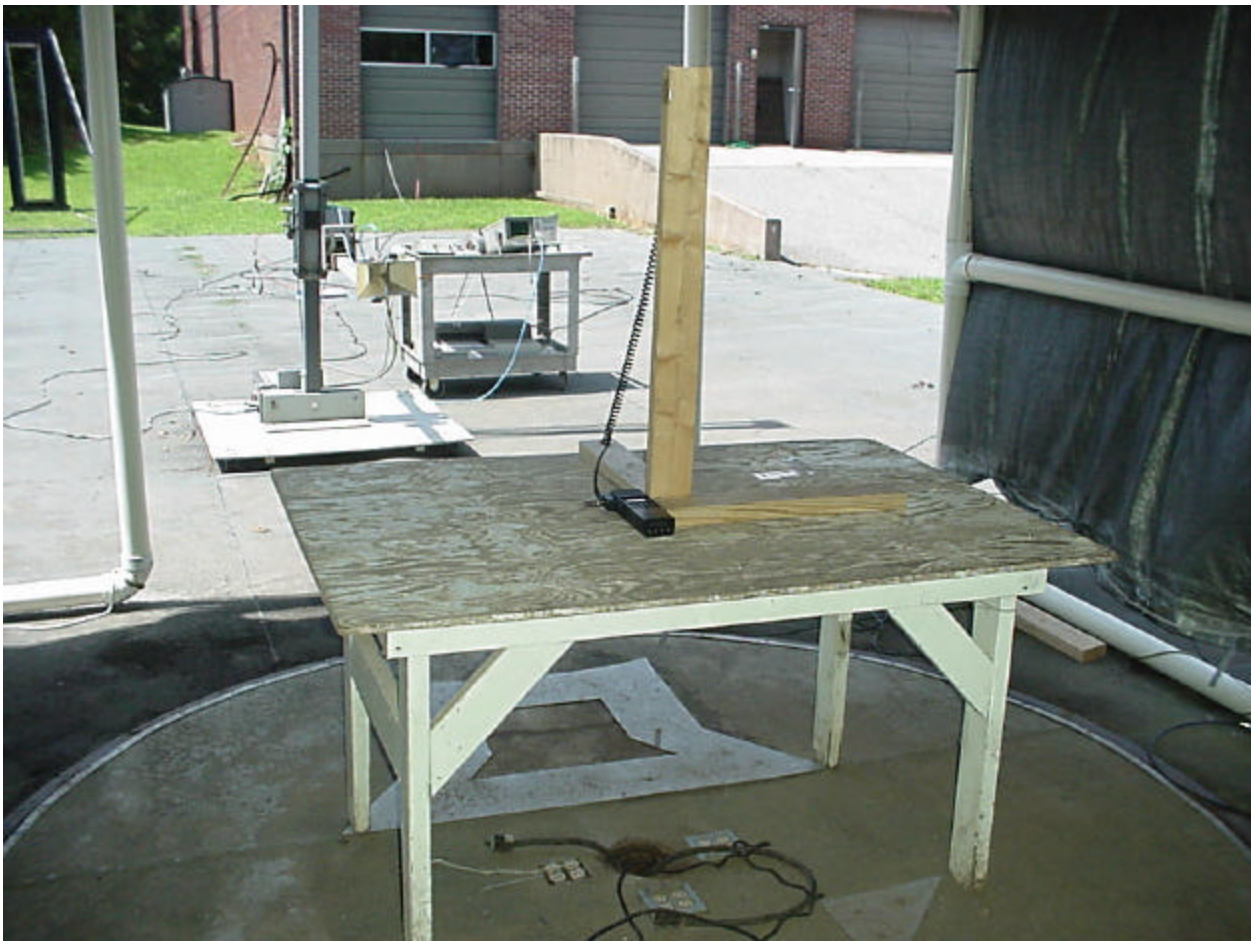
## Photograph(s) for Spurious Emissions



**Test Date:** March 23, 2004
**UST Project:** 04-0043
**Customer:** RELM Wireless Incorporated
**Model:** DPHX51

## FIGURE 2f

## Photograph(s) for Spurious Emissions



## TABLE 1

## EUT and Peripherals

| PERIPHERAL MANUFACTURER | MODEL NUMBER | SERIAL NUMBER | FCC ID: | CABLES P/D |
|---|---|---|---|---|
| Radio (EUT)<br>RELM Wireless Incorporated | DPHX51 | DPH5102XX | K95DPHX51<br>(Pending) | None |

## TABLE 2
## TEST INSTRUMENTS

| TYPE | MANUFACTURER | MODEL | SN. | DATE OF LAST CALIBRATION |
|---|---|---|---|---|
| SPECTRUM ANALYZER | HEWLETT-PACKARD | 8593E | 3205A00124 | 2/19/04 |
| HORN ANTENNA | EMCO | 3115 | 3723 | 1/20/04 |
| LOG PERIODIC ANTENNA | EMCO | 3146 | 9110-3600 | 7/11/03 |
| PLOTTER | HEWLETT-PACKARD | 7475A | 2325A65394 | N/A |
| SIGNAL GENERATOR | HEWLETT-PACKARD | 8648B | 3642U01679 | 10/13/03 |
| ROBERTS DIPOLE | CDI | A100 Element #3 | None | 04/26/04 |
| ROBERTS DIPOLE | CDI | A100 Element #4 | None | 04/26/04 |

## 2.5 Antenna Description

Antenna 1:

Manufacturer: Centurion

Type: ¼Wave Dipole

Model Number: LAA0820 (Short)

Gain: <1.6 dBi

Connector: SMA

Antenna 2:

Manufacturer: Centurion

Type: ¼Wave Dipole

Model Number: LAA0818 (Long))

Gain: <1.6 dBi

Connector: SMA

## 2.6 RF Power Output (FCC Section 2.1046)

Information regarding this requirement has been supplied by RELM Wireless Incorporated. The EUT was directly connected to an HP 8901A Modulation Analyzer (Cal Due 04/11/02). The measured results are shown in Table 3 and Figure 3.

### FCC Minimum Standard

FCC Part 22
<150 Watts

FCC Part 74.461
Power delivered to antenna must be < 100 Watts

FCC Part 90.205
Power dependent upon station's antenna HAAT and required service area and may be from 1 to 500 Watts.

**TABLE 3**
**RF POWER OUTPUT**

**Test Date:** **March 23, 2004**
**UST Project:** **04-0043**
**Customer:** **RELM Wireless Incorporated**
**Model:** **DPHX51**

| Frequency | Power | Voltage | Current |
|---|---|---|---|
| 136.0 | 6.15W | 10.0V | 1.40A |
| 155.0 | 6.05W | 10.0V | 1.28A |
| 174.0 | 6.05W | 10.0V | 1.41A |

Note: The power output may depend upon the intended use of the EUT. For all tests, the EUT was set to near maximum conditions. The EUT requires a FCC license and is programmed for use by local RELM Radio Dealers.

**Test Results Reviewed By**
**Signature:** _____ **Name:** **Louis A. Feudi**

## Modulation Characteristics (FCC Section 2.1047)

Where applicable, the modulation characteristics of the EUT have been supplied by RELM Wireless Incorporated as stipulated by the following FCC requirements:

a) Equipment which utilizes voice modulated communication shall show the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz. For equipment which is required to have a low pass filter, the frequency response of the filter, or all of the circuitry installed between the modulation limited and the modulated stage shall be supplied.

b) Equipment which employs modulation limiting, a curve showing the percentage of modulation versus the modulation input voltage shall be supplied.

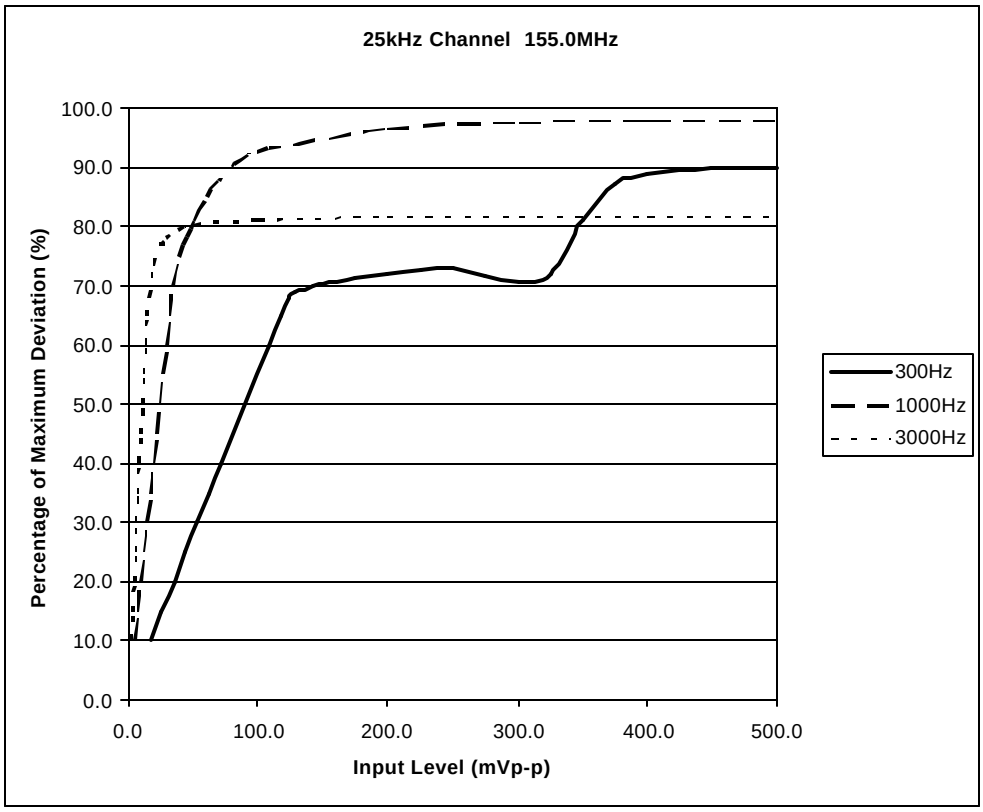
## FCC Minimum Standard

FCC Part 22
None

FCC Part 74.463
Each new remote pickup broadcast station with a power output in excess of 3 watts shall be equipment with a device which will automatically prevent modulation in excess of the limits. If frequency modulation is employed, the emissions shall conform to the emission requirements of 74.462.

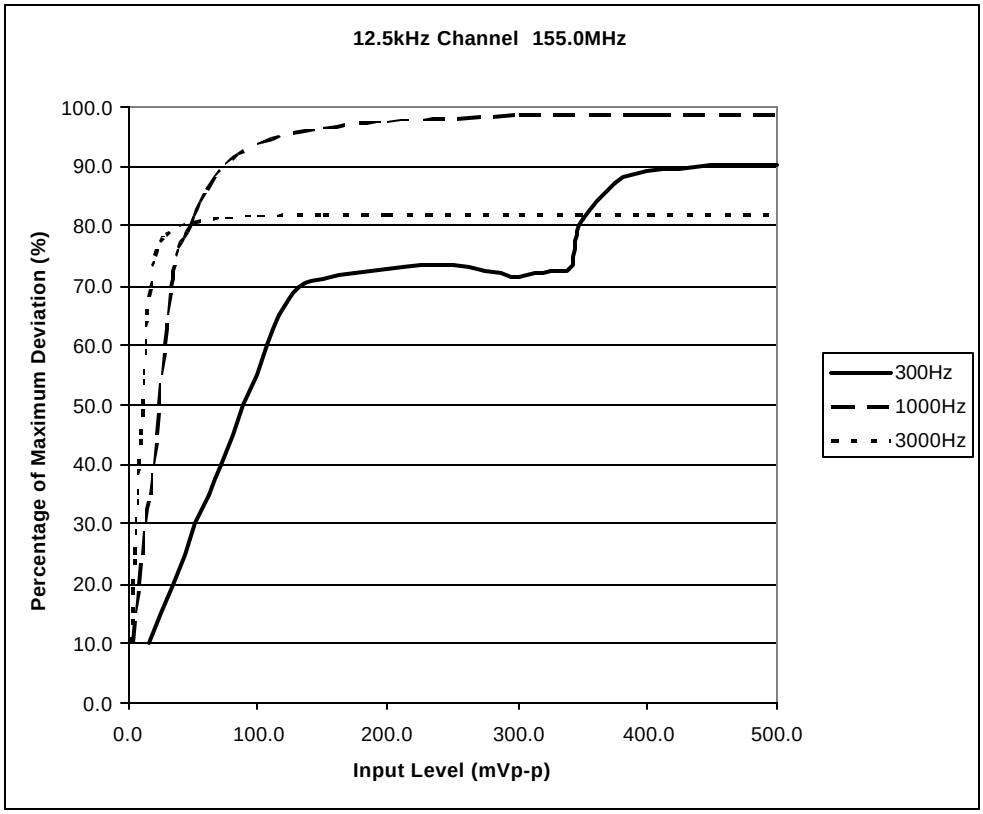
FCC Part 90.205
Transmitters utilizing analog emissions that are equipped with an audio low-pass filter must meet the emission limitations must meet proper emissions mask of 90.210.

**Figure 3a.**
**Modulation Characteristics**




Test Method: TIA/EIA-603-A 2.2.3
Equipment Used: HP8901B Modulation Analyzer(12-11-04), 33250A Function Gen (9-24-04)

**Figure 3b.**
**Modulation Characteristics**




Test Method: TIA/EIA-603-A 2.2.3
Equipment Used: HP8901B Modulation Analyzer(12-11-04), 33250A Function Gen (9-24-04)

## 2.8 Occupied Bandwidth (FCC Section 2.1049)

EUT was modulated by a 2500 Hz signal. The bandwidth of the fundamental was measured by RELM Wireless Incorporated using a spectrum analyzer, as shown in Figure 4a through Figure 4b.

### FCC Minimum Standard

FCC Part 22.359, 74.462, and 90.210 (25 kHz bandwidth only)
For any frequency removed from the center of the assigned channel by more than 50 percent up to and including 100 percent of the authorized bandwidth, at least 25 dB.

On any frequency removed from the center of the assigned channel by more than 100 percent up to and including 250 percent, at least 35 dB.

On any frequency removed from the center of the assigned channel by more than 250 percent at least:

Low: $43 + 10 \log (P_{Watts}) = 43 + 10 \log (6.15) = 50.9$ dB
Middle: $43 + 10 \log (P_{Watts}) = 43 + 10 \log (6.05) = 50.8$ dB
High: $43 + 10 \log (P_{Watts}) = 43 + 10 \log (6.05) = 50.8$ dB

The resolution bandwidth was 300 Hz or greater for measuring up to 250 kHz from the edge of the authorized frequency segment, and 30 kHz or greater for measuring more than 250 kHz from the authorized frequency segment.

FCC Part 90.210 (12.5 kHz Bandwidth only)
For any frequency removed from the center of the authorized bandwidth $f_0$ to 5.625 kHz removed from $f_0$, 0 dB.

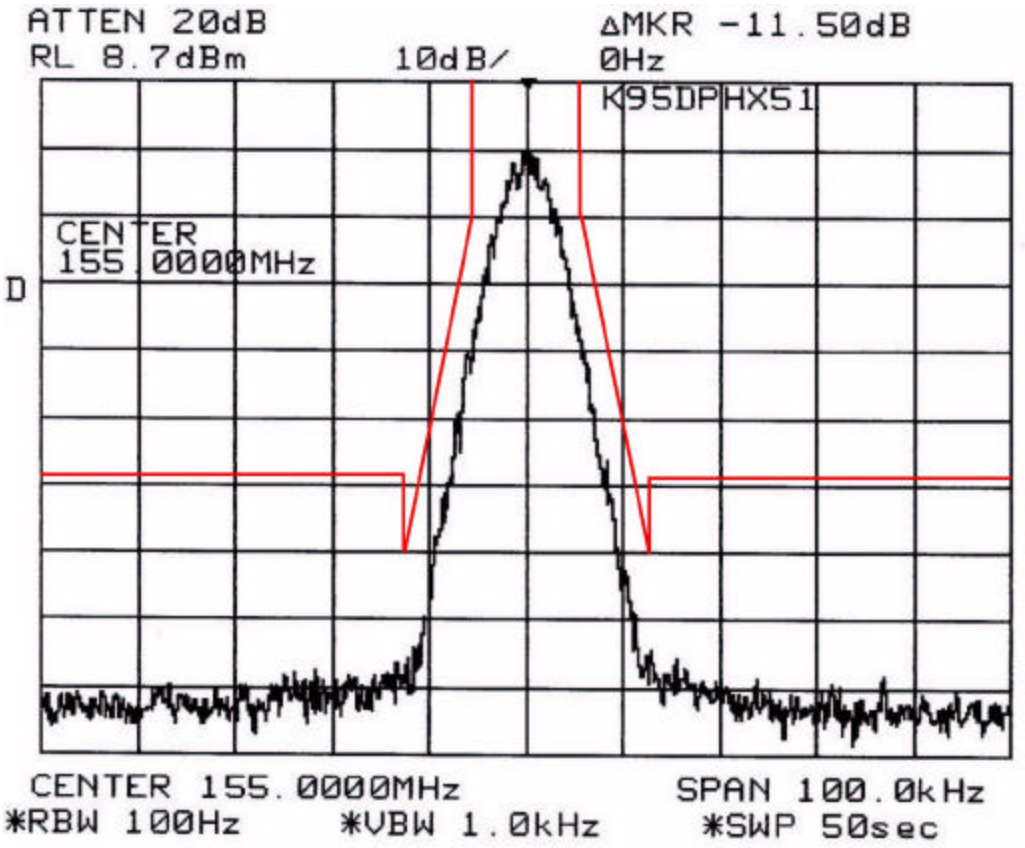
On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 5.626 kHz but no more than 12.5 kHz, at least 7.27 ($f_d$ - 2.88 kHz) dB.

On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 12.5 kHz at least:

Low: $50 + 10 \log (P_{Watts}) = 50 + 10 \log (6.15) = 57.9$ dB
Middle: $50 + 10 \log (P_{Watts}) = 50 + 10 \log (6.05) = 57.8$ dB
High: $50 + 10 \log (P_{Watts}) = 50 + 10 \log (6.05) = 57.8$ dB

**Figure 4a.**
**Occupied Bandwidth**

**Occupied Bandwidth Digital Voice 8K10F1D Mask D**

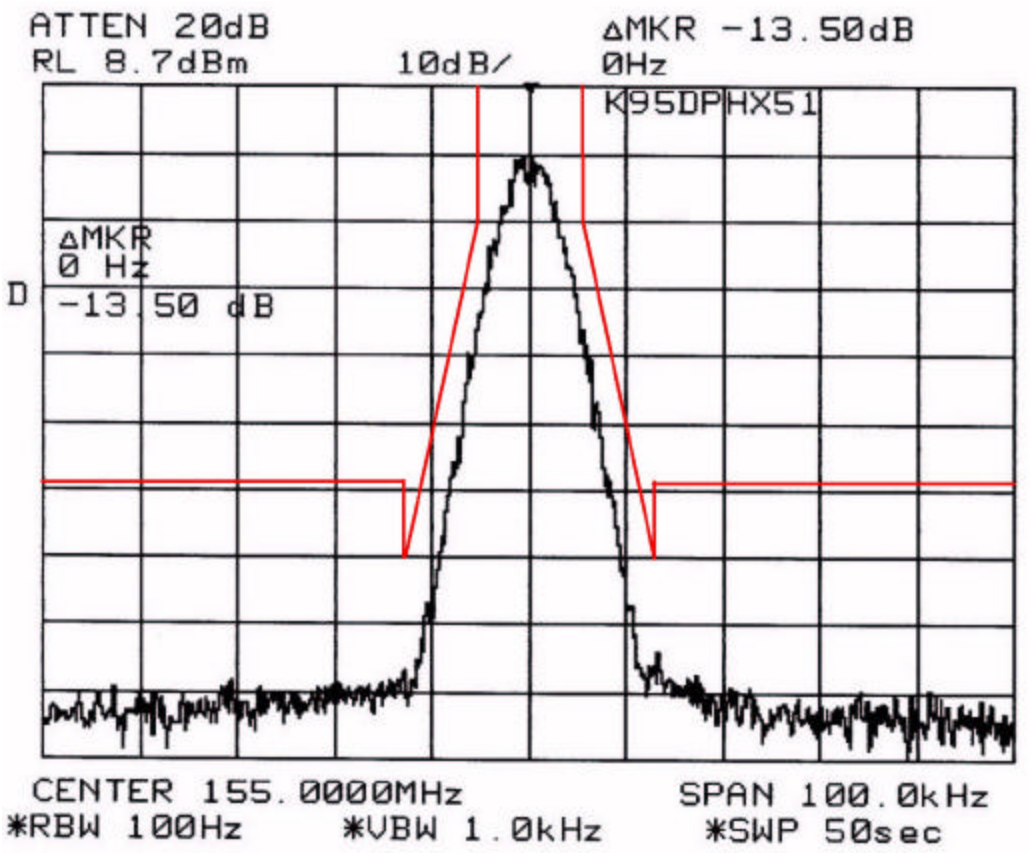



**Occupied Bandwidth /Emission Mask**
16K0F3E
11K0F3E
8K10F1D
8K10F1E

Test Method: TIA/EIA-603-A 2.2.11
Equipment Used: HP8560E Spectrum Analyzer(12-19-04)
.

**Figure 4b.**
**Occupied Bandwidth**

**Occupied Bandwidth Digital Data 8K10F1E Mask D**




**Occupied Bandwidth /Emission Mask**
16K0F3E
11K0F3E
8K10F1D
8K10F1E

Test Method: TIA/EIA-603-A 2.2.11
Equipment Used: HP8560E Spectrum Analyzer(12-19-04)

## 2.9 Spurious Emissions at Antenna Terminals (FCC Section 2.1051)

Spurious emissions appearing at the antenna terminals were measured with a spectrum analyzer by connecting the spectrum analyzer directly via a short cable to the antenna output terminals or across the antenna leads on the PCB as specified by the manufacturer. Results are shown in Figure 5a-5jj.

### FCC Minimum Standard

FCC Part 22.359, 74.462, and 90.210 (25 kHz bandwidth only)

On any frequency removed from the center of the assigned channel by more than 250 percent at least:

Low: $43 + 10 \log (P_{Watts}) = 43 + 10 \log (6.15) = 50.9$ dB
Middle: $43 + 10 \log (P_{Watts}) = 43 + 10 \log (6.05) = 50.8$ dB
High: $43 + 10 \log (P_{Watts}) = 43 + 10 \log (6.05) = 50.8$ dB

FCC Part 90.210 (12.5 kHz Bandwidth only)

On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 12.5 kHz at least:

Low: $50 + 10 \log (P_{Watts}) = 50 + 10 \log (6.15) = 57.9$ dB
Middle: $50 + 10 \log (P_{Watts}) = 50 + 10 \log (6.05) = 57.8$ dB
High: $50 + 10 \log (P_{Watts}) = 50 + 10 \log (6.05) = 57.8$ dB

**NOTE: In general, the worse case attenuation requirement shown above was applied.**

**Figure 5a**
**Spurious Emissions at Antenna Terminals**
**High Channel, Analog (12.5 kHz)**

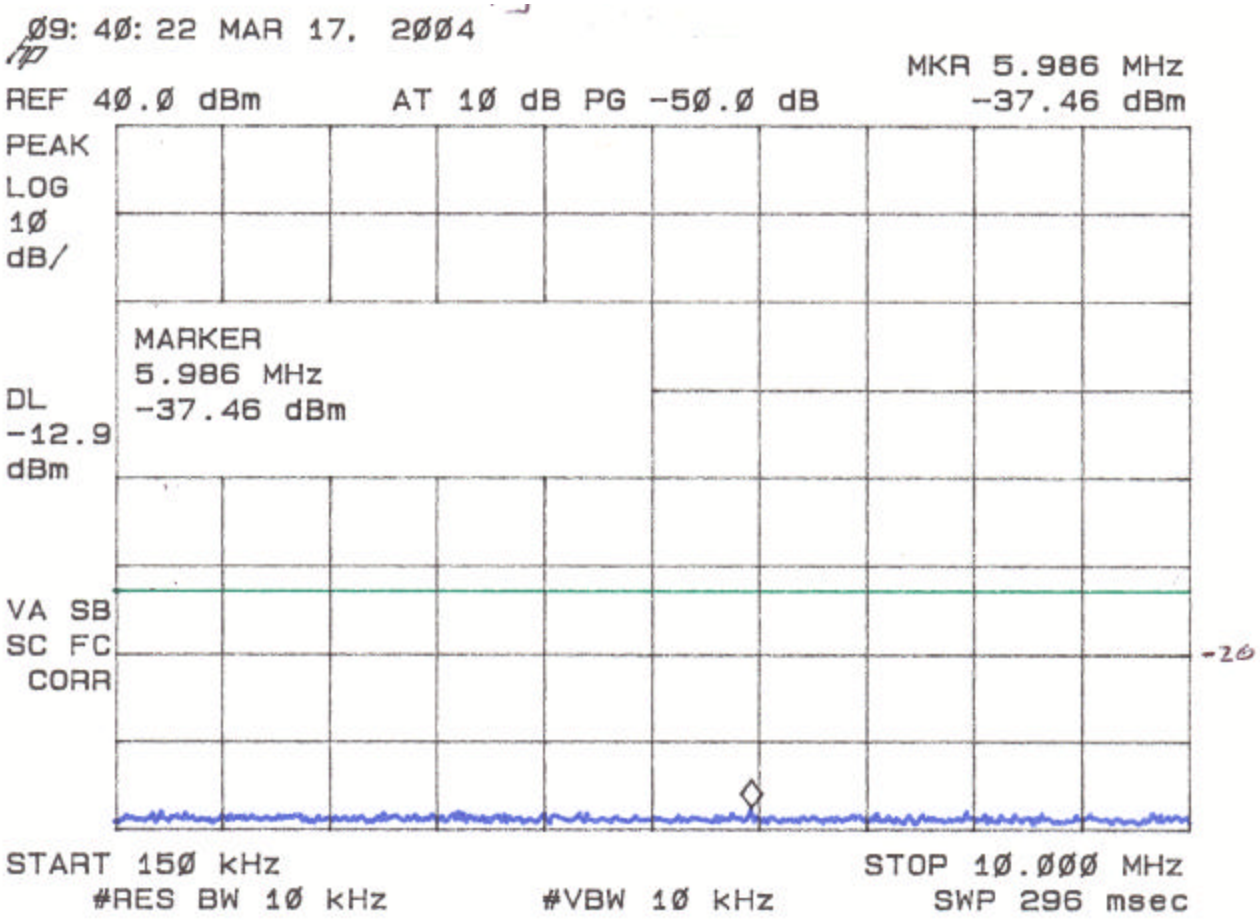


**Figure 5b**
**Spurious Emissions at Antenna Terminals**
**High Channel, Analog (12.5 kHz)**

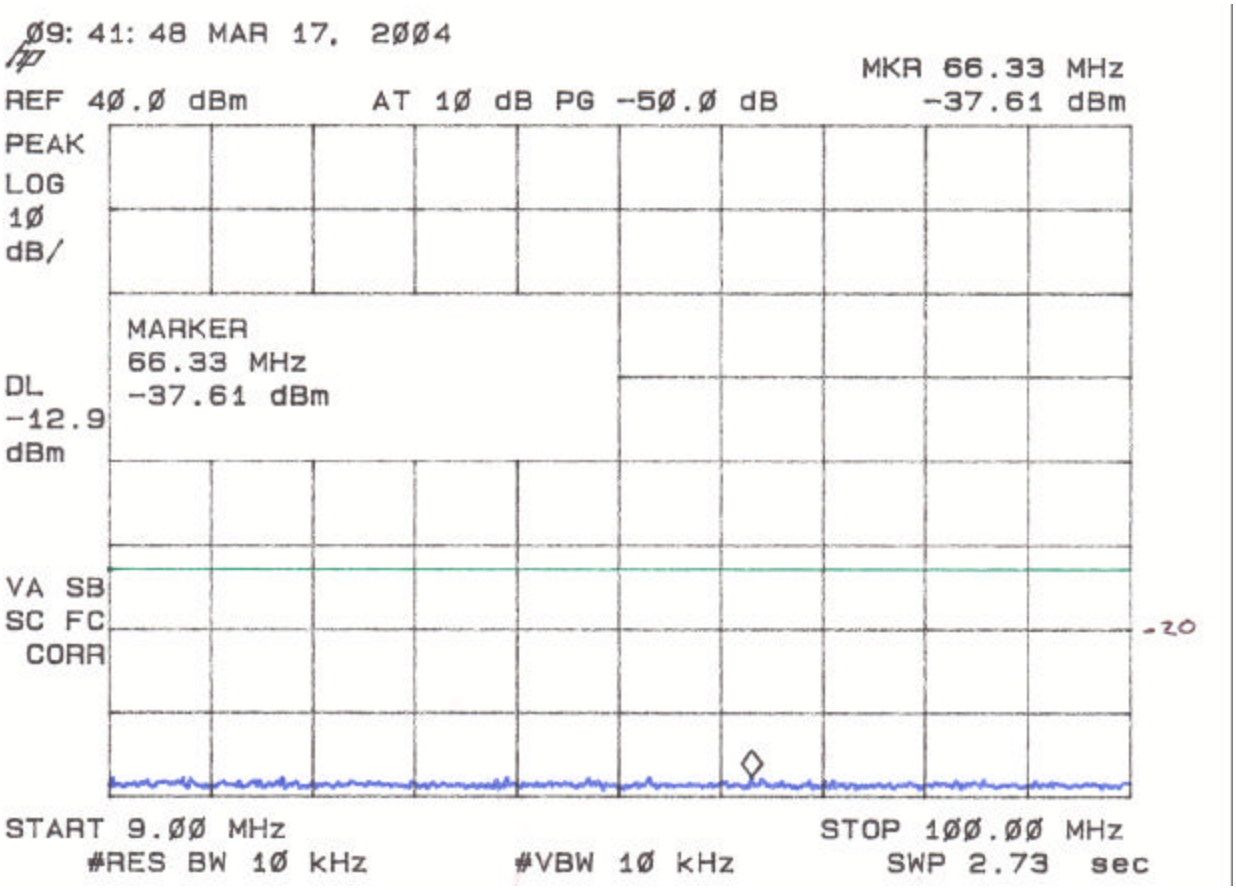


**Figure 5c**
**Spurious Emissions at Antenna Terminals**
**High Channel, Analog (12.5 kHz)**

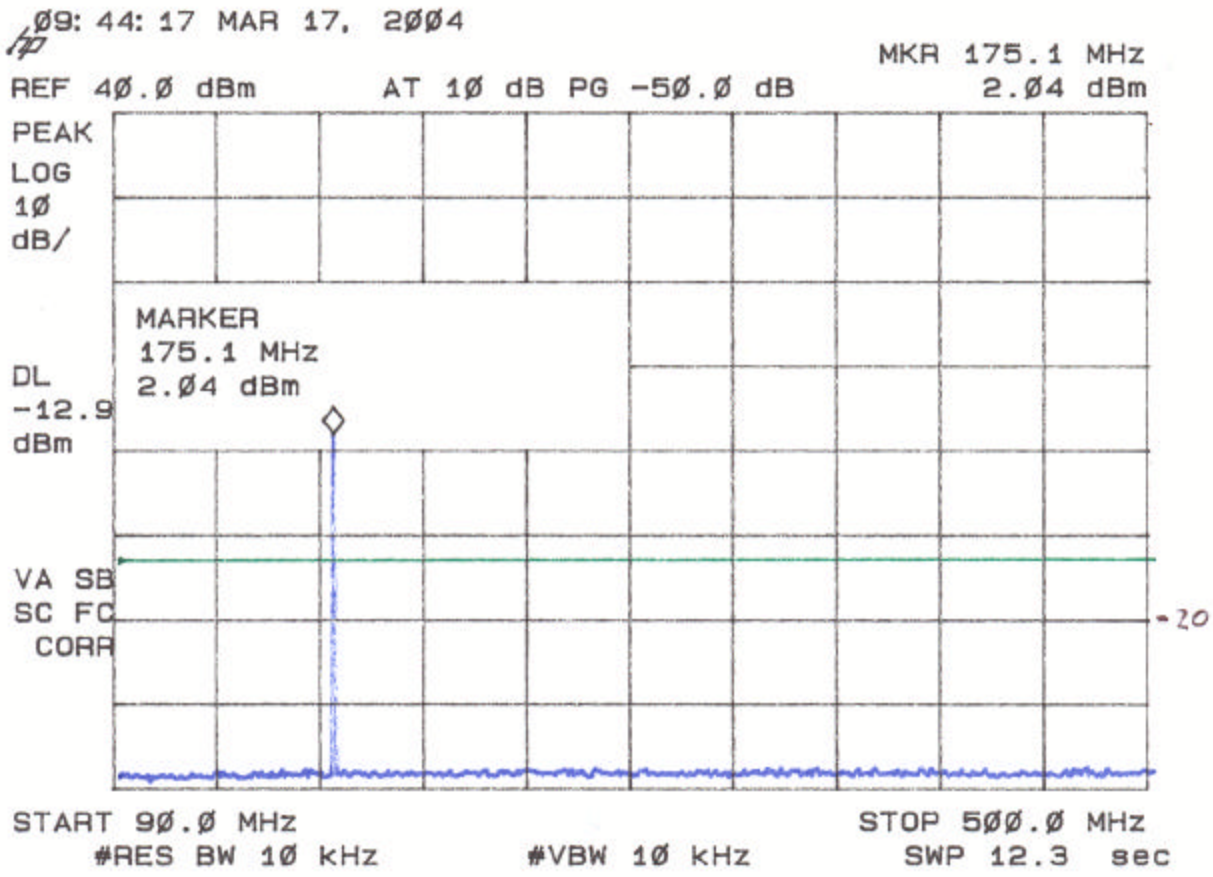


**Figure 5d**
**Spurious Emissions at Antenna Terminals**
**High Channel, Analog (12.5 kHz)**

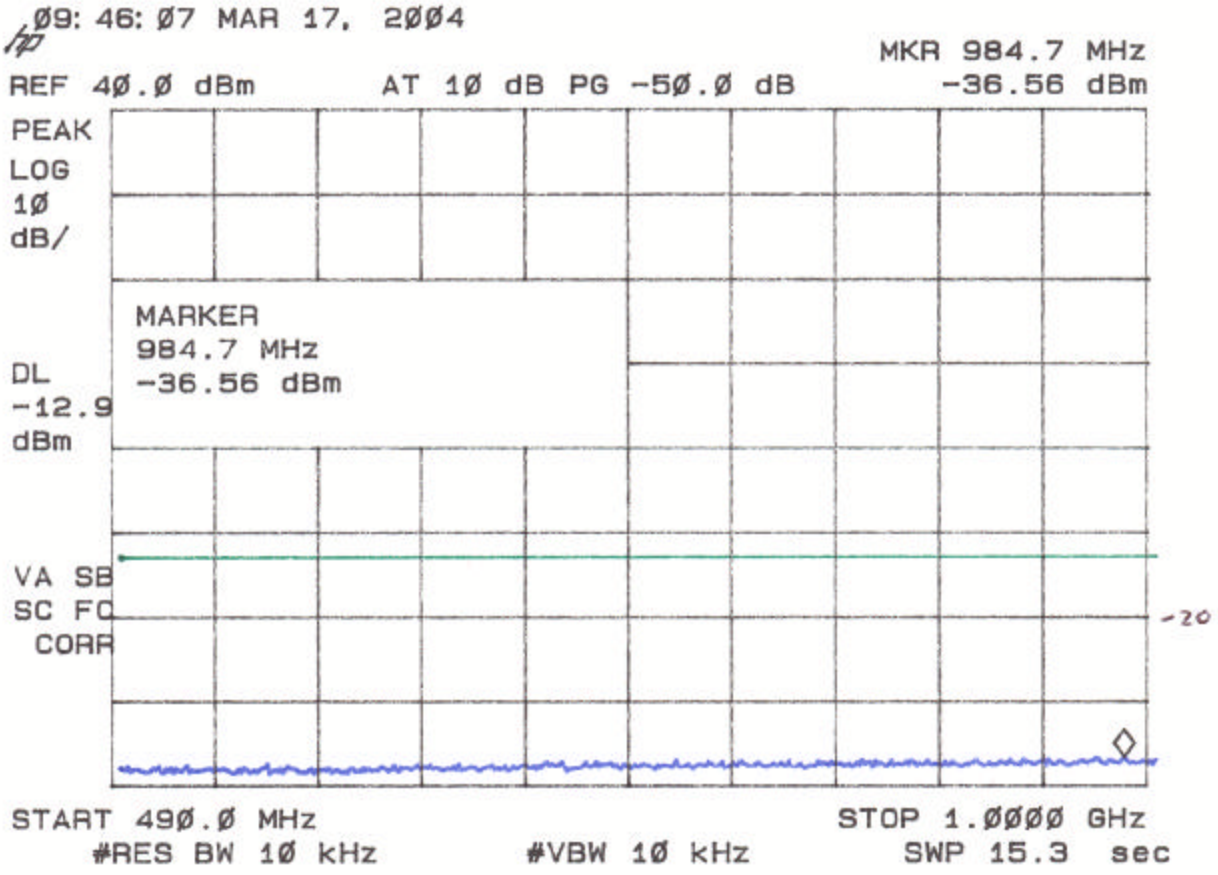


**Figure 5e**
**Spurious Emissions at Antenna Terminals**
**High Channel, Analog (12.5 kHz)**

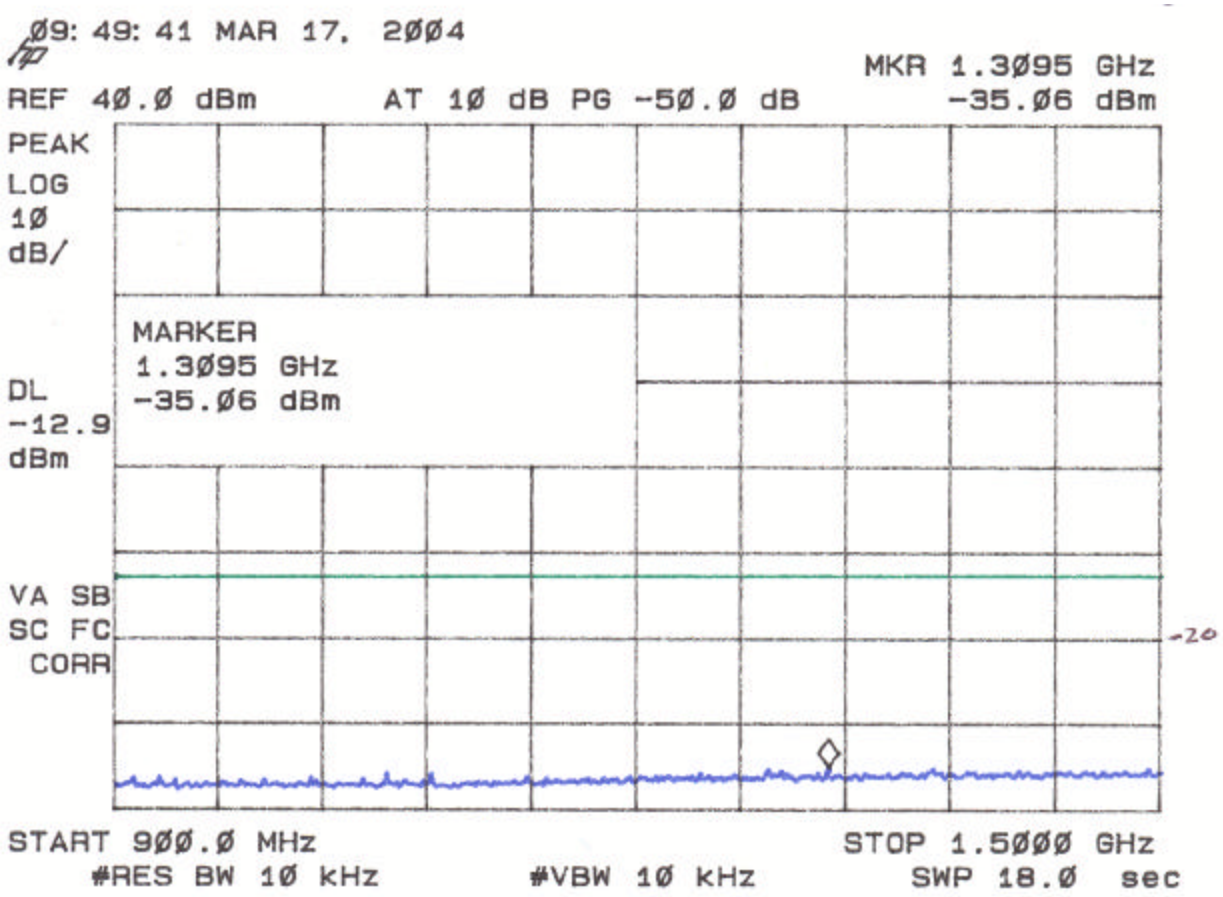


**Figure 5f**
**Spurious Emissions at Antenna Terminals**
**High Channel, Analog (12.5 kHz)**

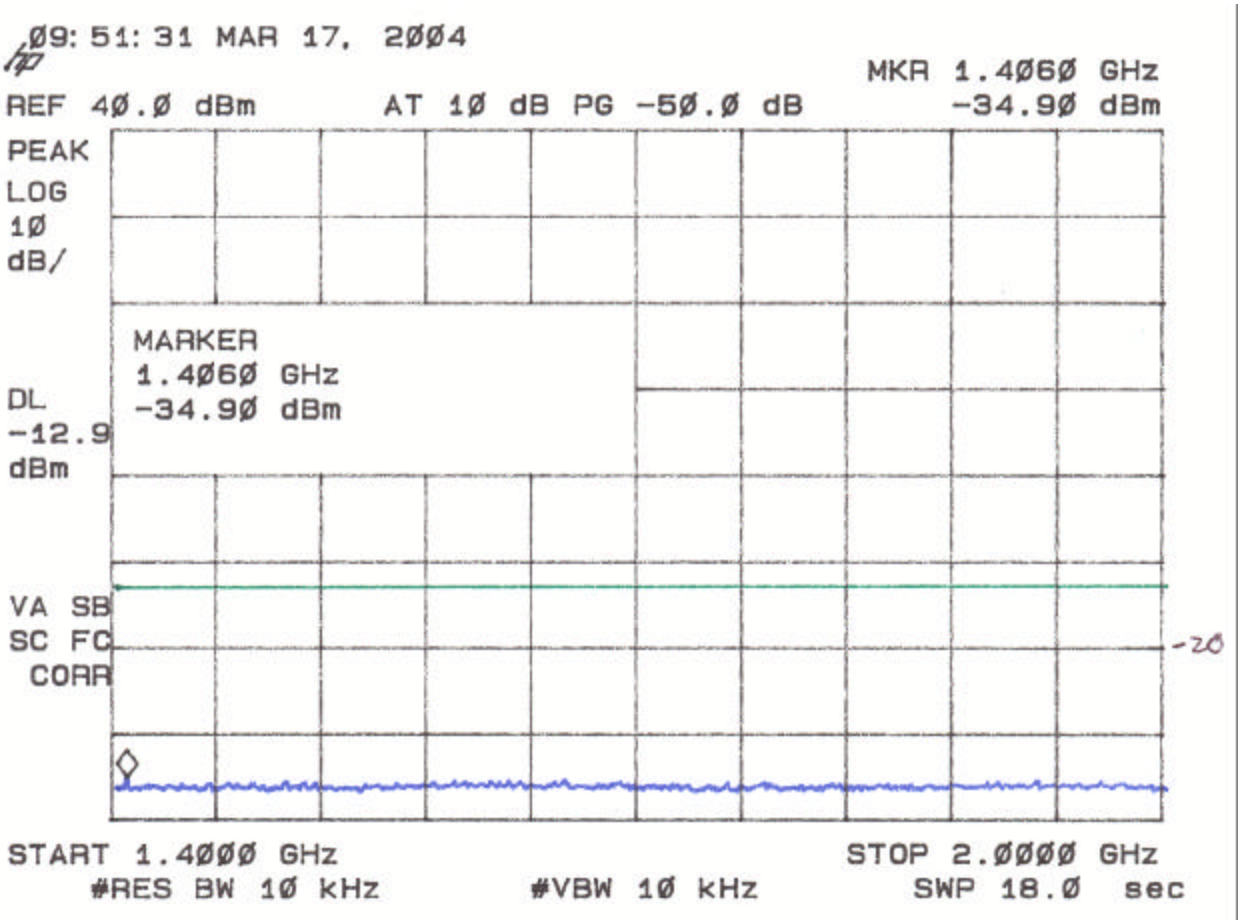


**Figure 5g**
**Spurious Emissions at Antenna Terminals**
**High Channel, Analog (25 kHz)**

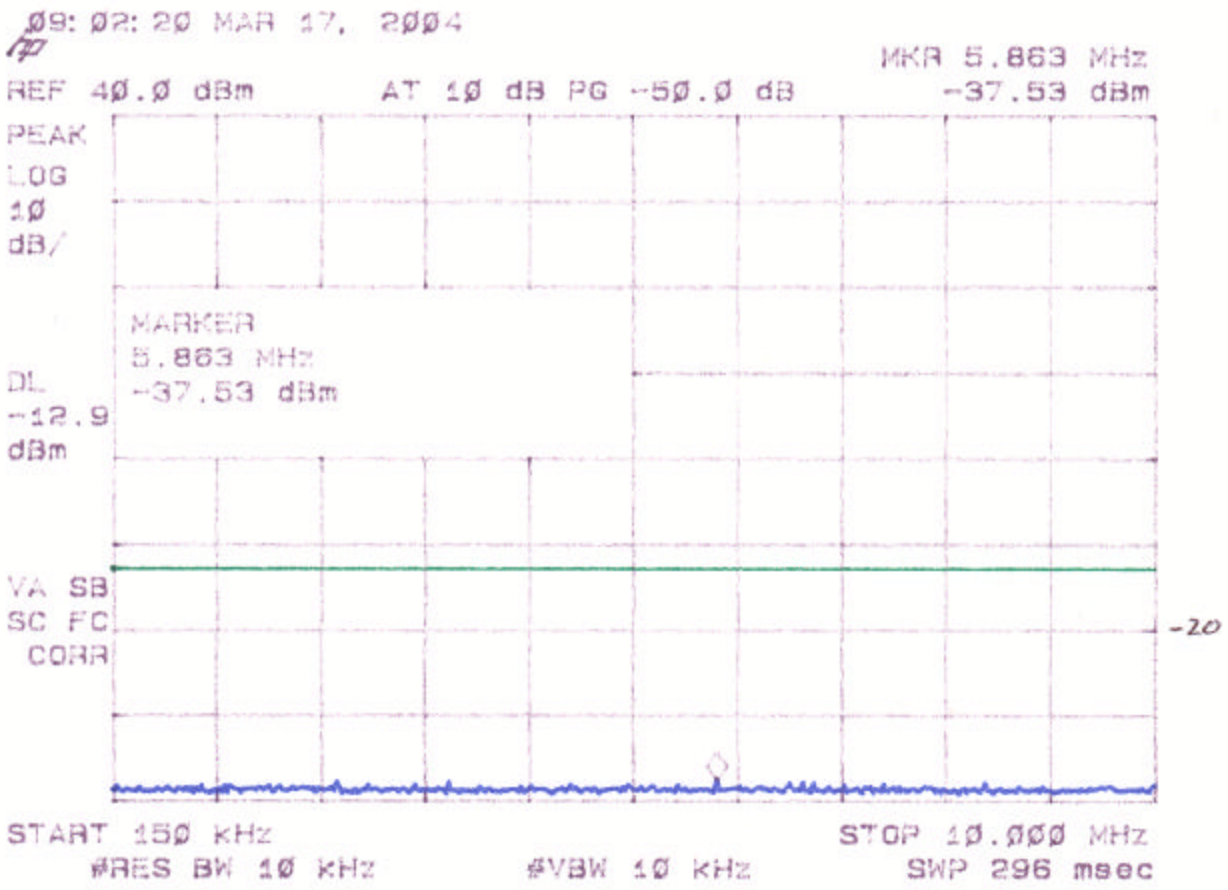


**Figure 5h**
**Spurious Emissions at Antenna Terminals**
**High Channel, Analog (25 kHz)**

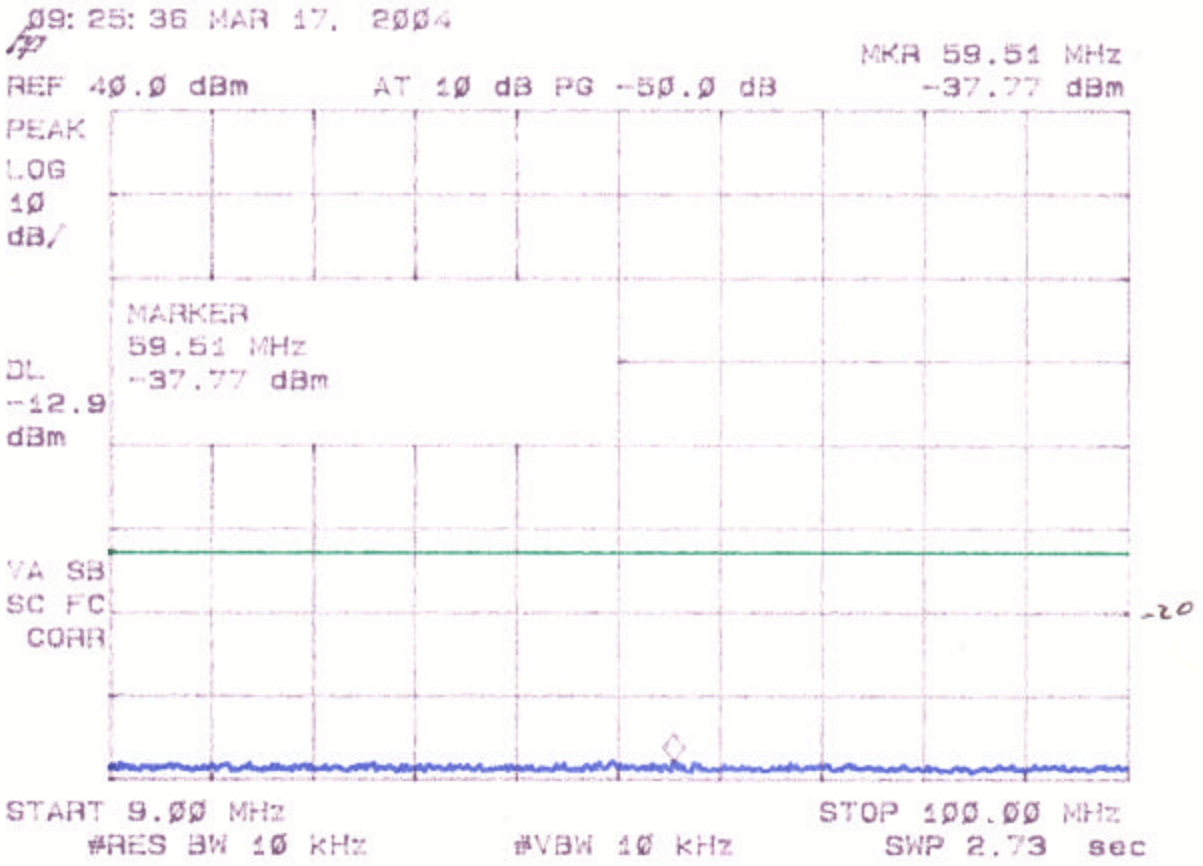


**Figure 5i**
**Spurious Emissions at Antenna Terminals**
**High Channel, Analog (25 kHz)**

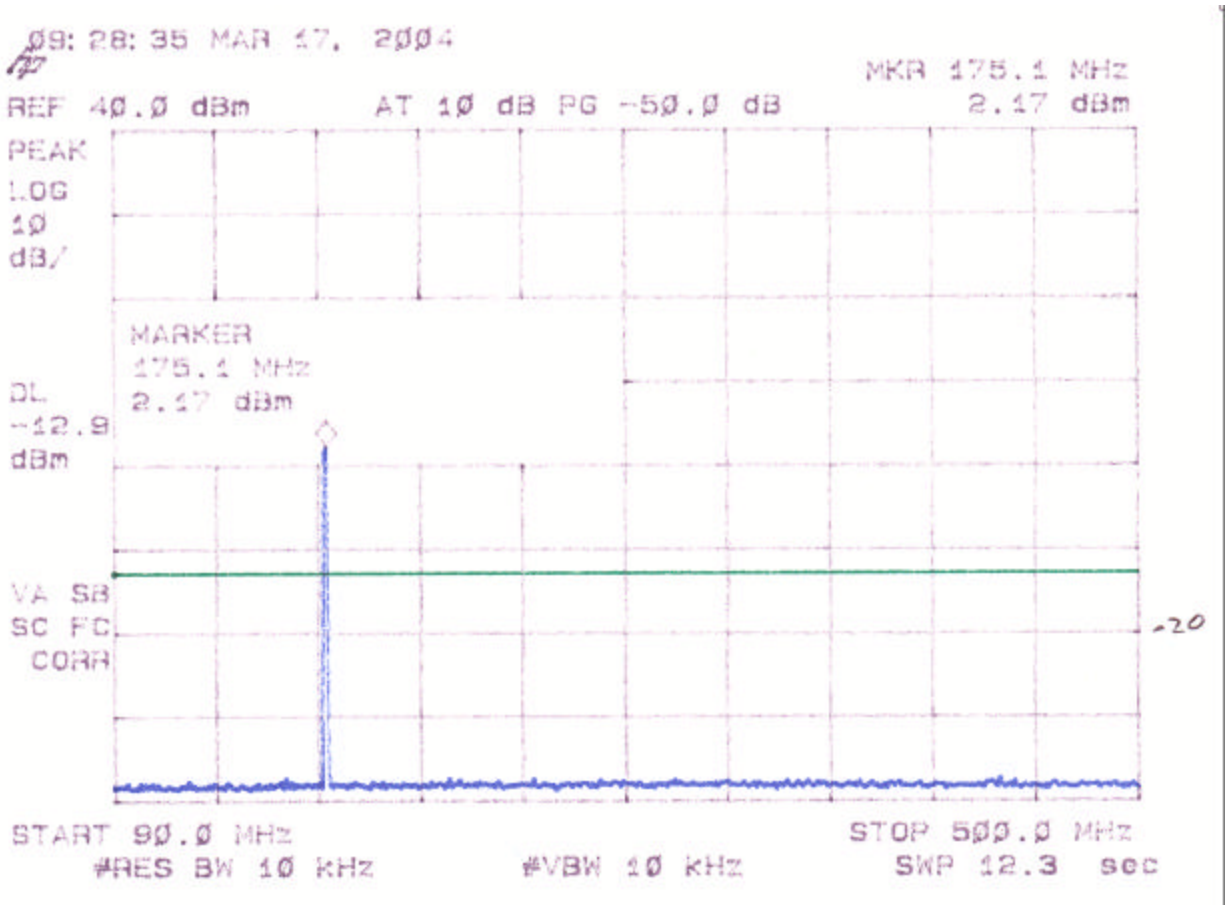


**Figure 5j**
**Spurious Emissions at Antenna Terminals**
**High Channel, Analog (25 kHz)**

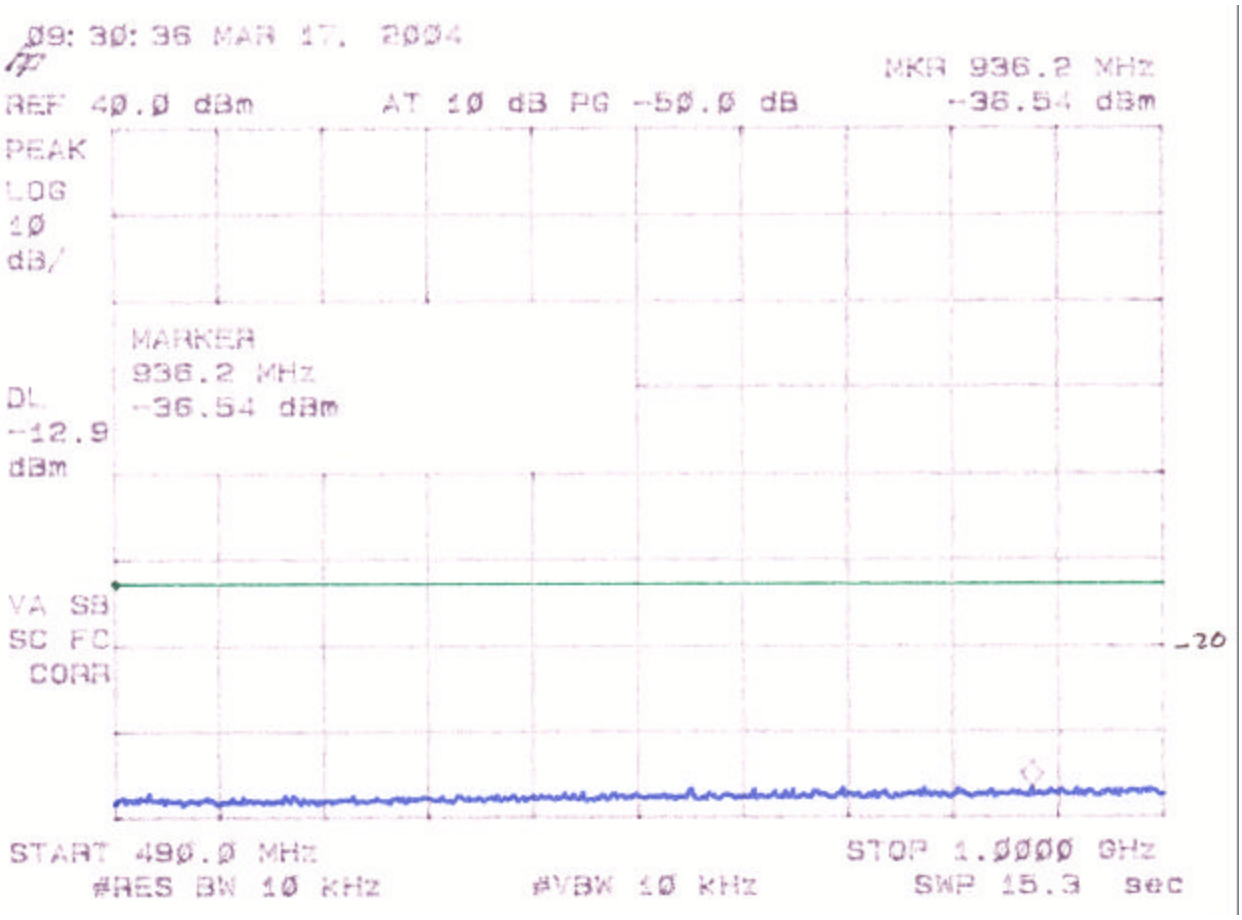


**Figure 5k**
**Spurious Emissions at Antenna Terminals**
**High Channel, Analog (25 kHz)**

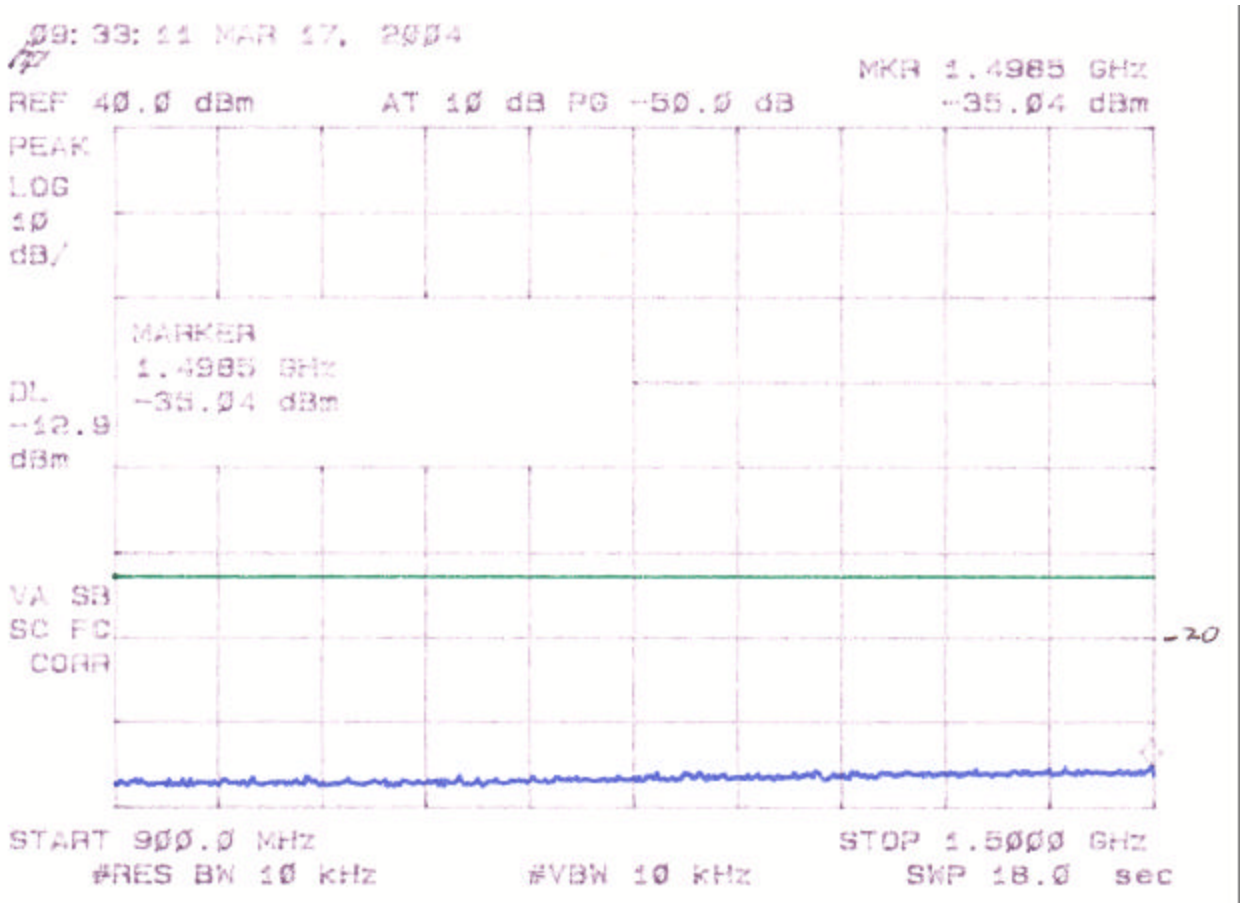


**Figure 5l**
**Spurious Emissions at Antenna Terminals**
**High Channel, Analog (25 kHz)**

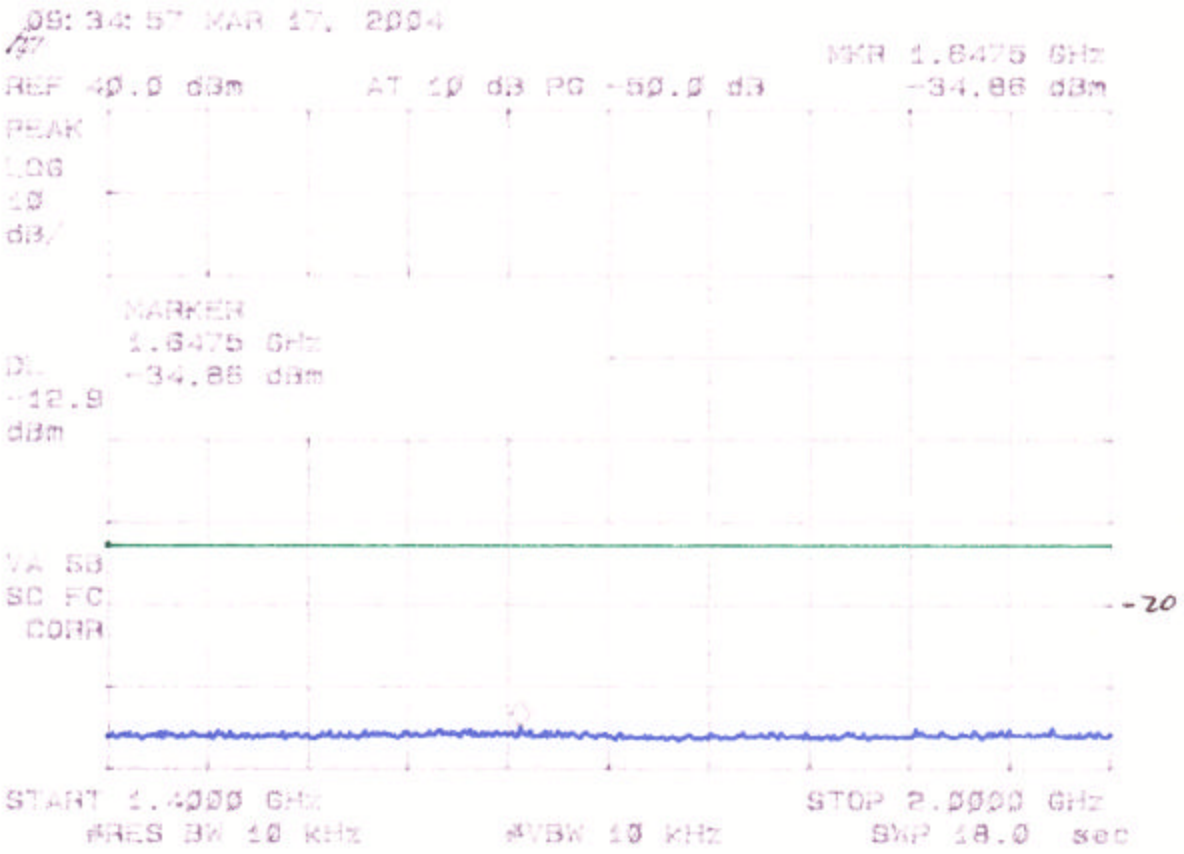


**Figure 5m**
**Spurious Emissions at Antenna Terminals**
**Mid Channel, Analog (12.5 kHz)**

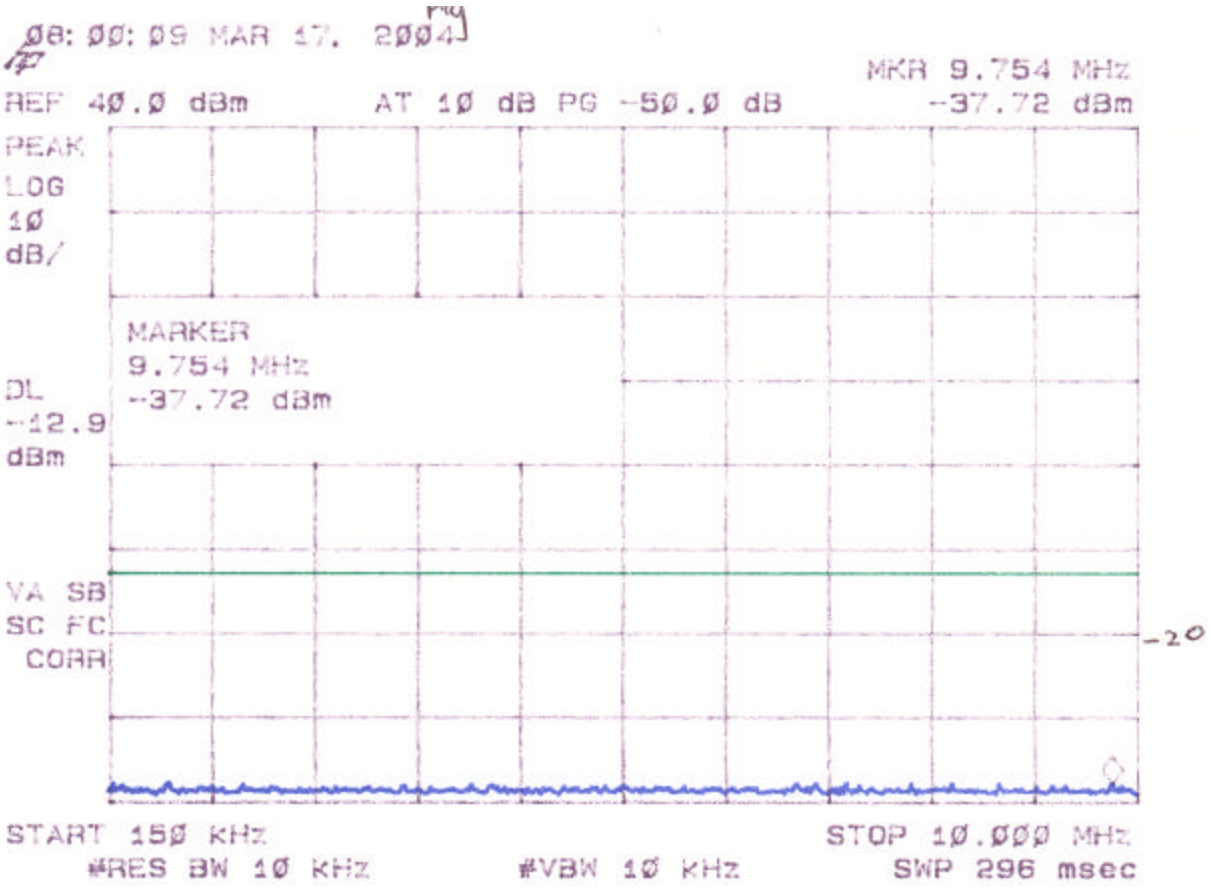


**Figure 5n**
**Spurious Emissions at Antenna Terminals**
**Mid Channel, Analog (12.5 kHz)**

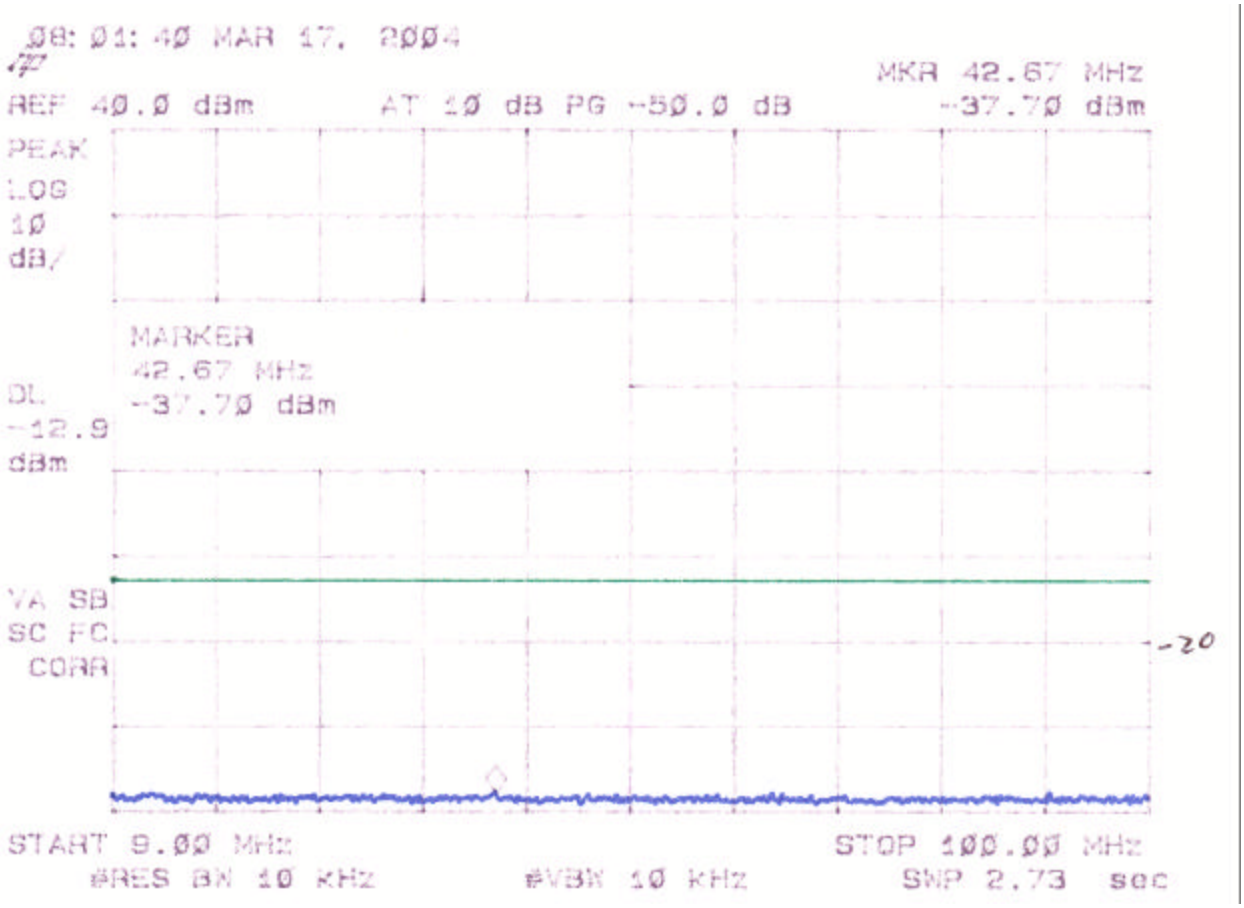


**Figure 5o**
**Spurious Emissions at Antenna Terminals**
**Mid Channel, Analog (12.5 kHz)**

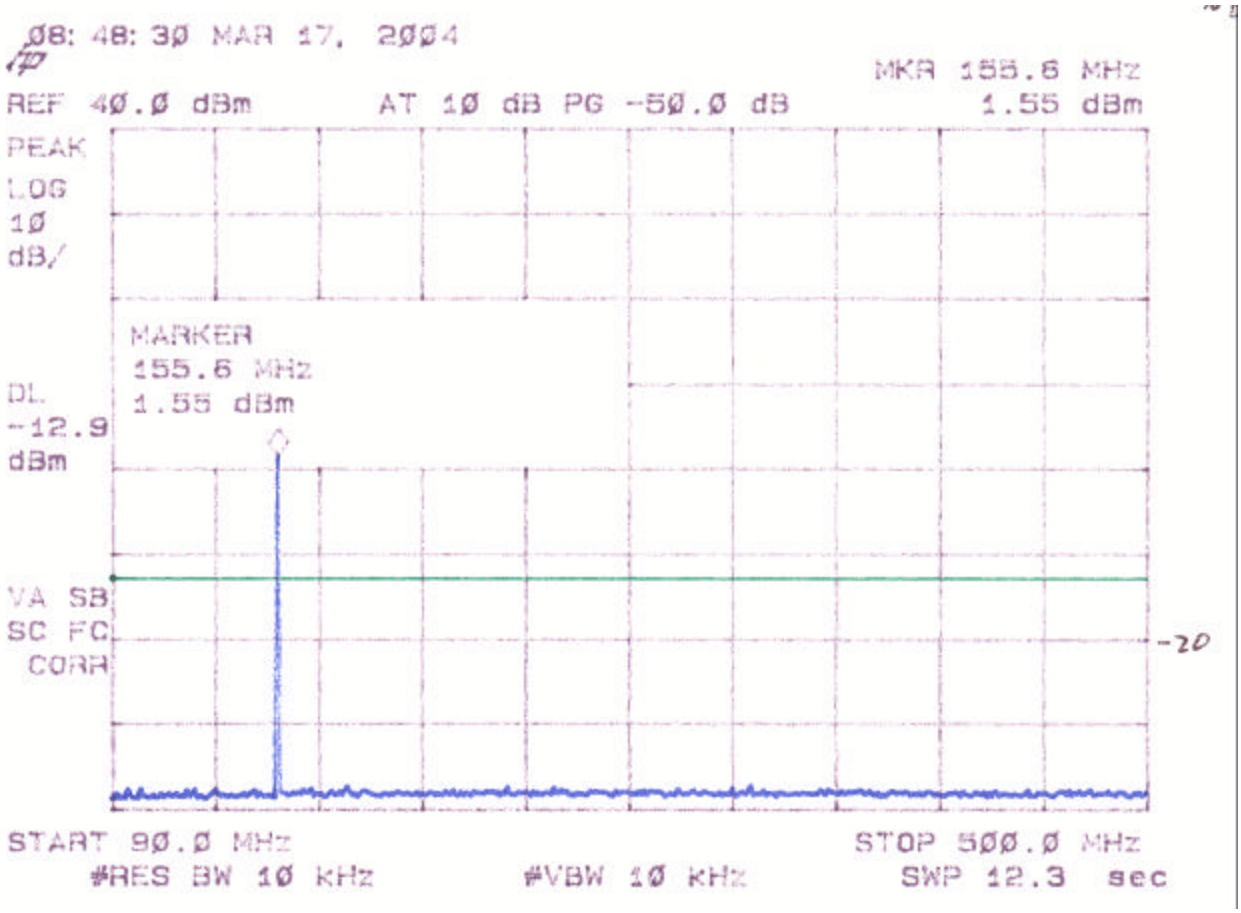


**Figure 5p**
**Spurious Emissions at Antenna Terminals**
**Mid Channel, Analog (12.5 kHz)**

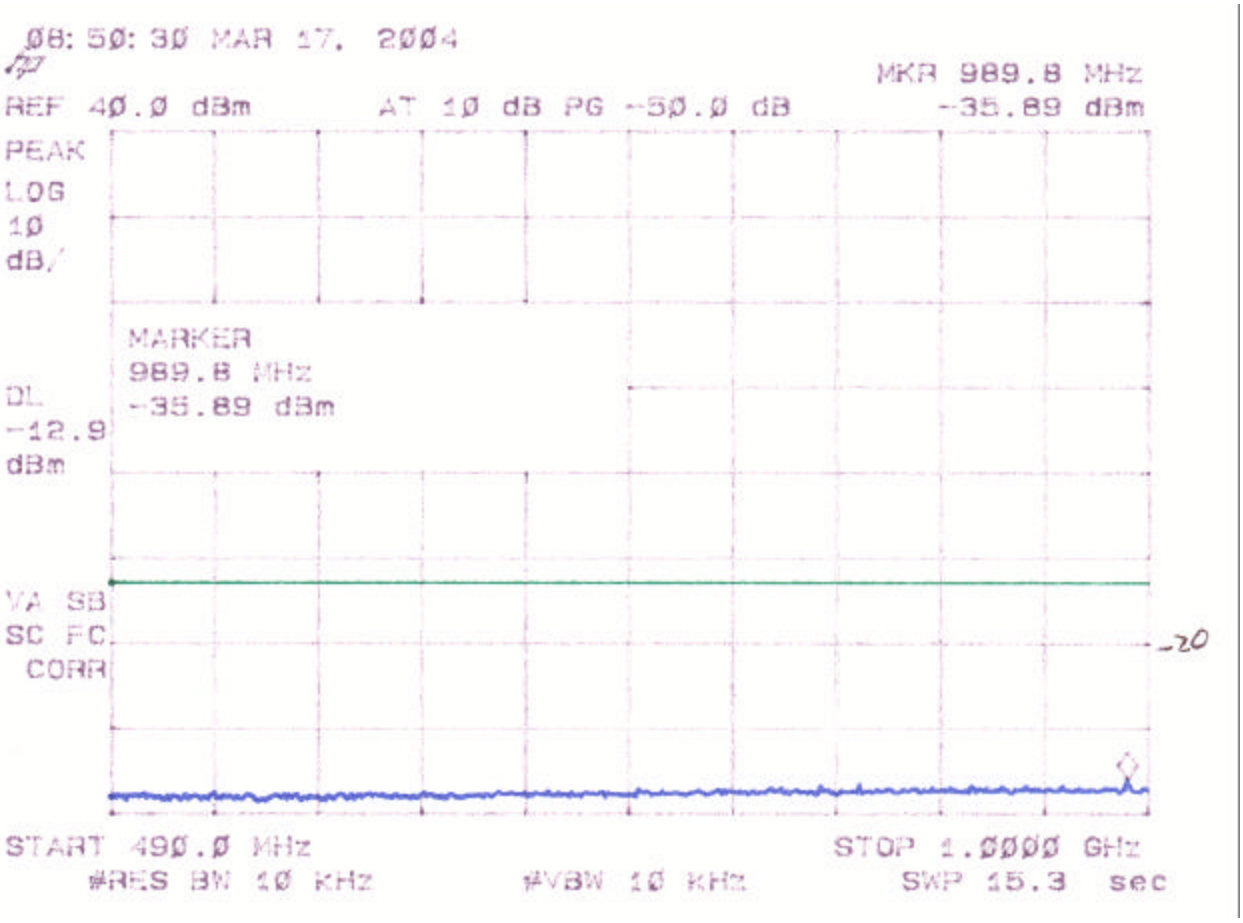


**Figure 5q**
**Spurious Emissions at Antenna Terminals**
**Mid Channel, Analog (12.5 kHz)**

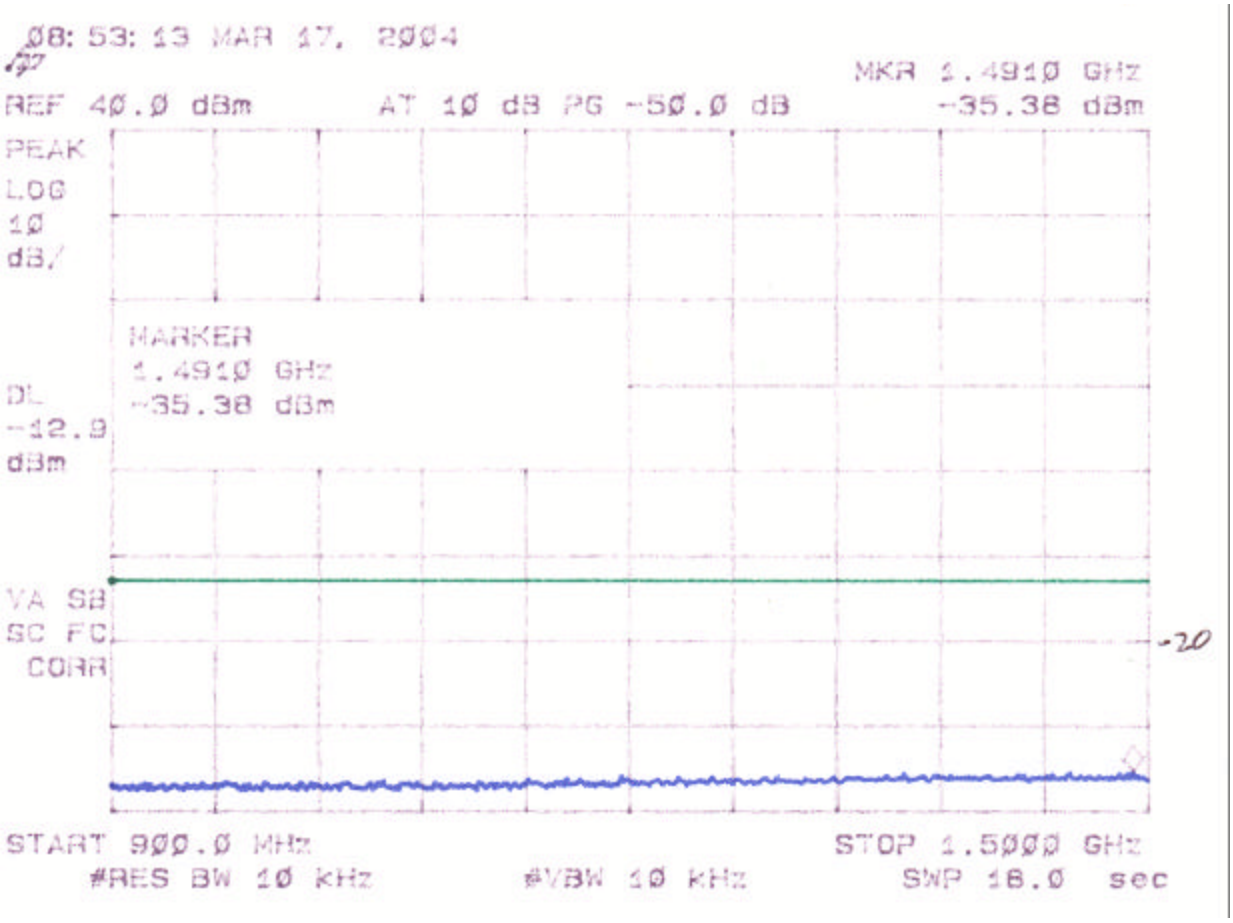


**Figure 5r**
**Spurious Emissions at Antenna Terminals**
**Mid Channel, Analog (12.5 kHz)**

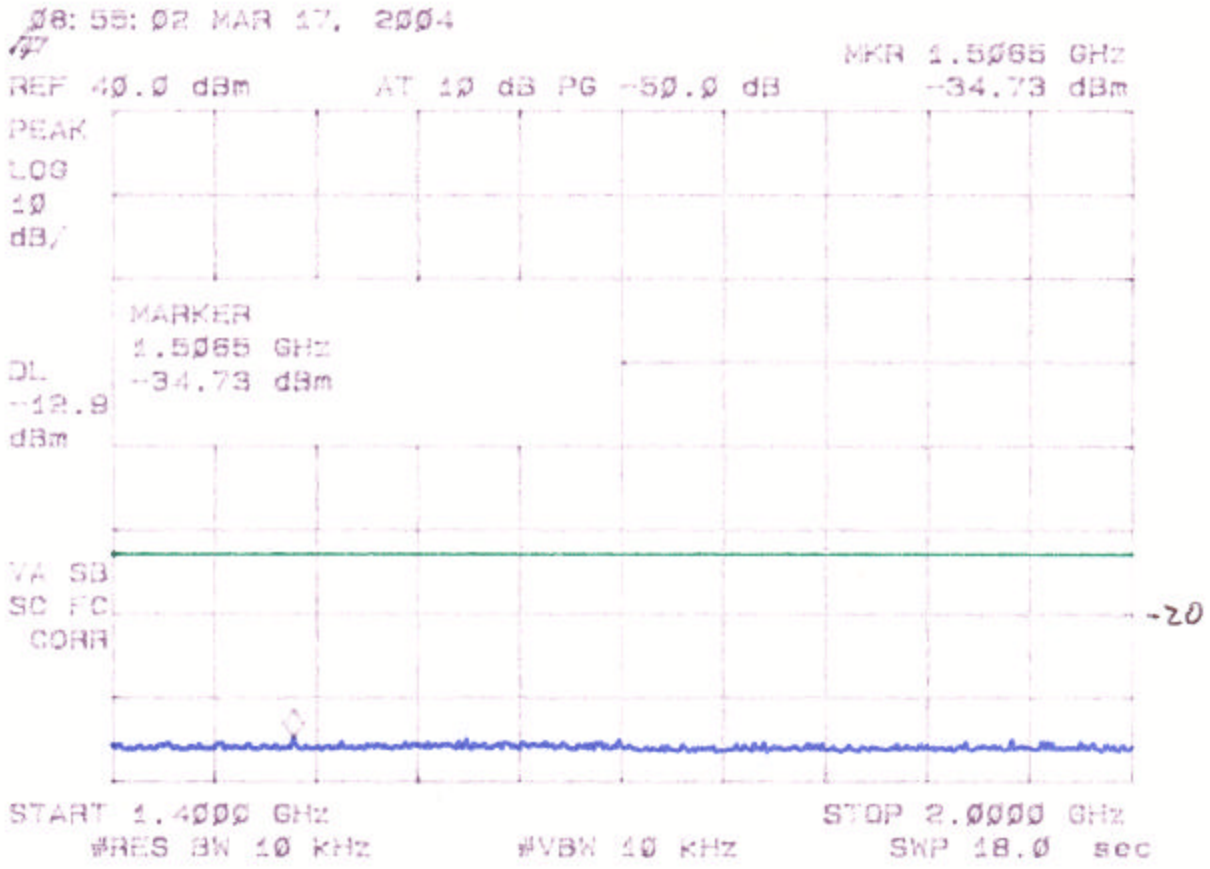


**Figure 5s**
**Spurious Emissions at Antenna Terminals**
**Mid Channel, Analog (25 kHz)**

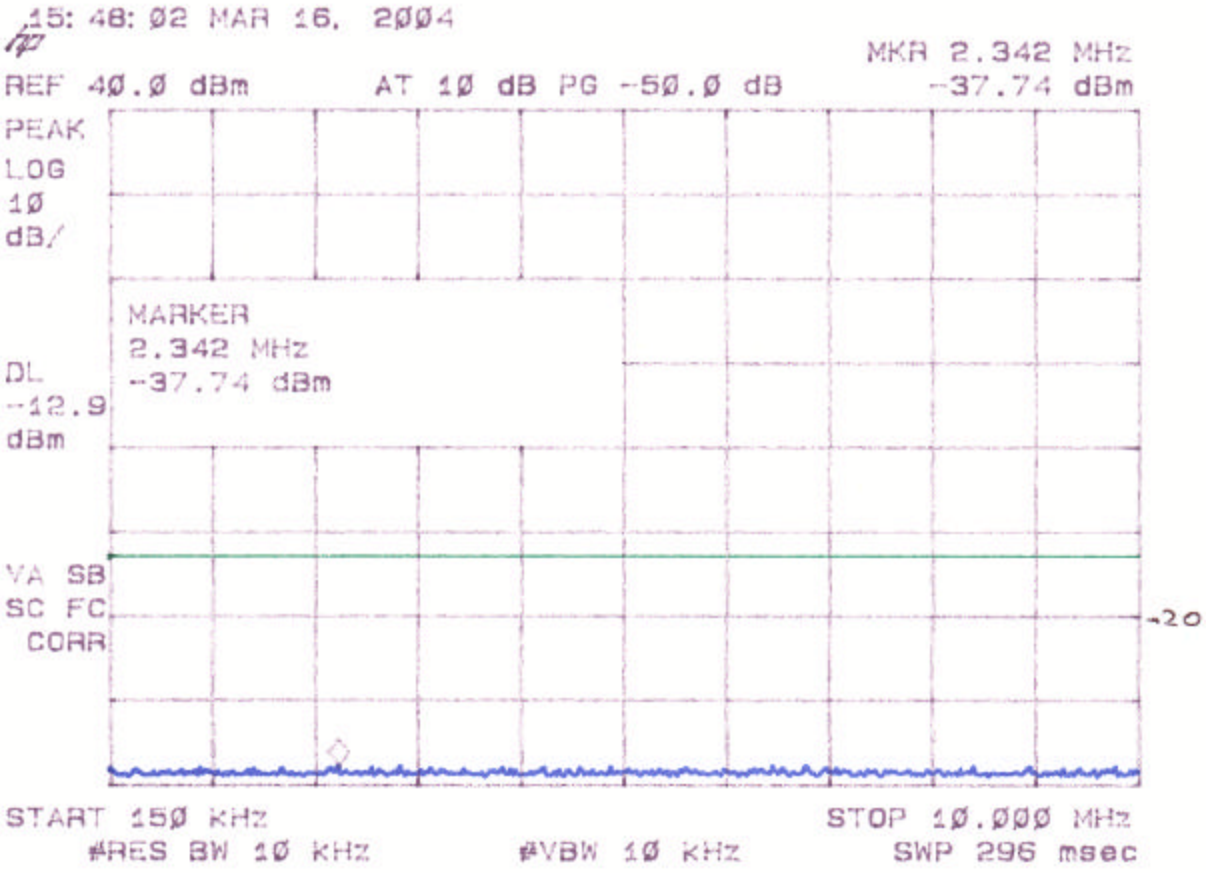


**Figure 5t**
**Spurious Emissions at Antenna Terminals**
**Mid Channel, Analog (25 kHz)**

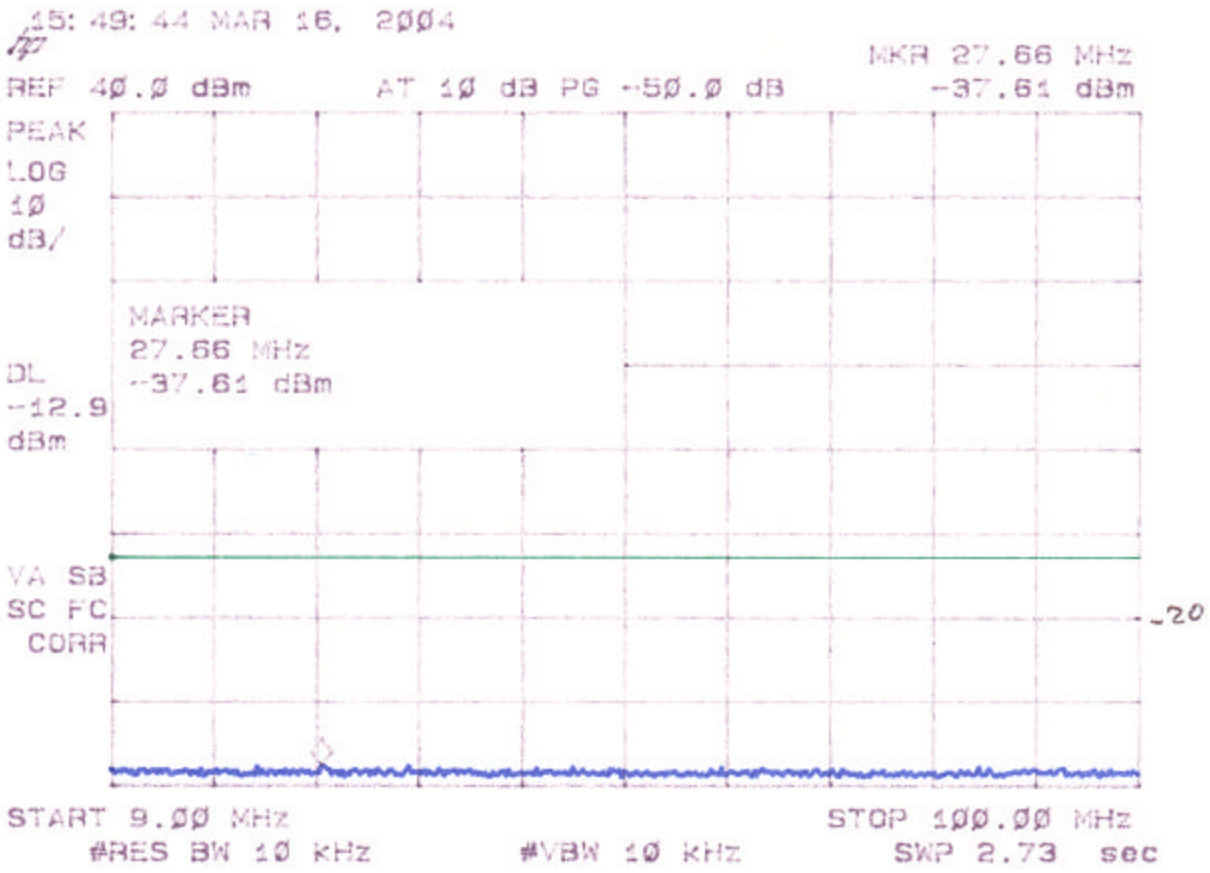


**Figure 5u**
**Spurious Emissions at Antenna Terminals**
**Mid Channel, Analog (25 kHz)**

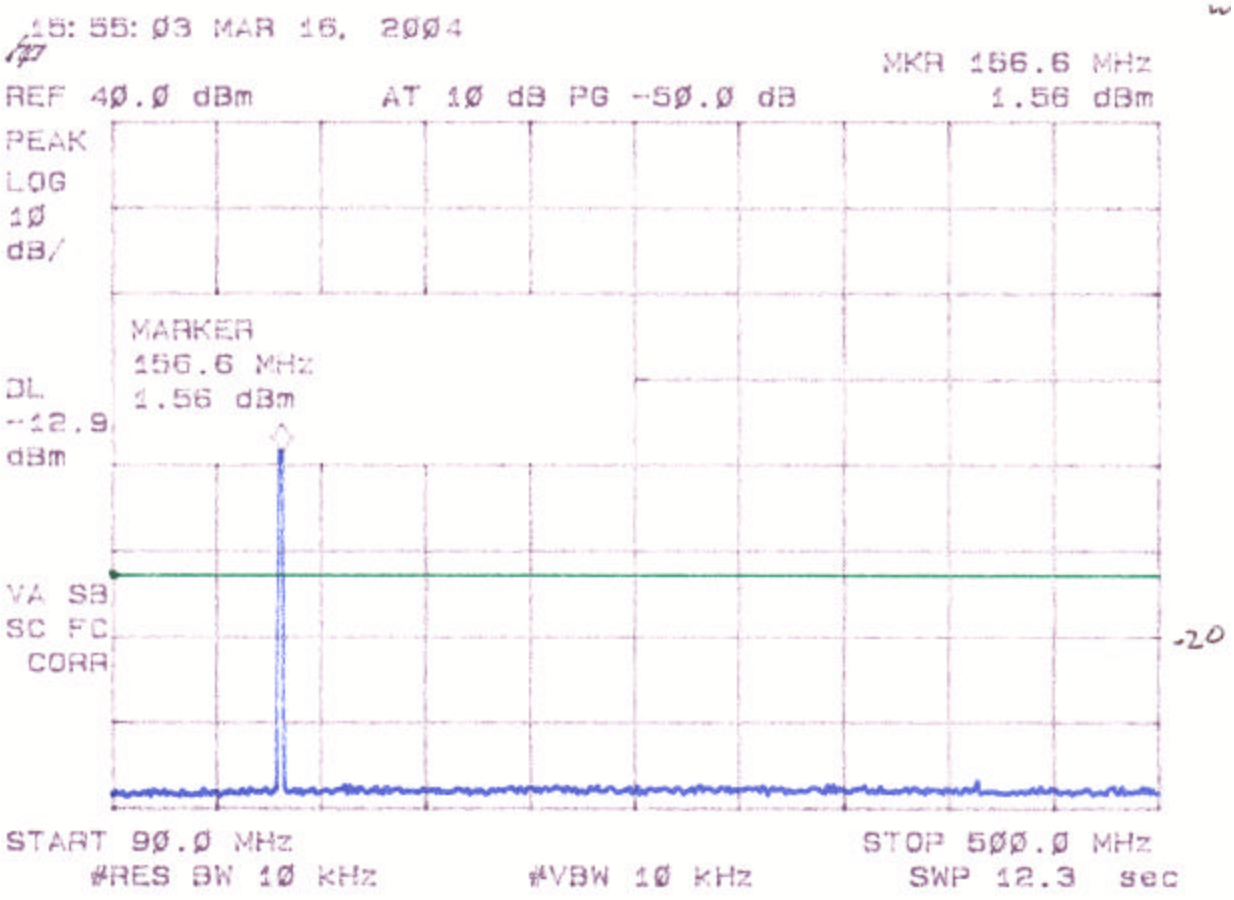


**Figure 5v**
**Spurious Emissions at Antenna Terminals**
**Mid Channel, Analog (25 kHz)**

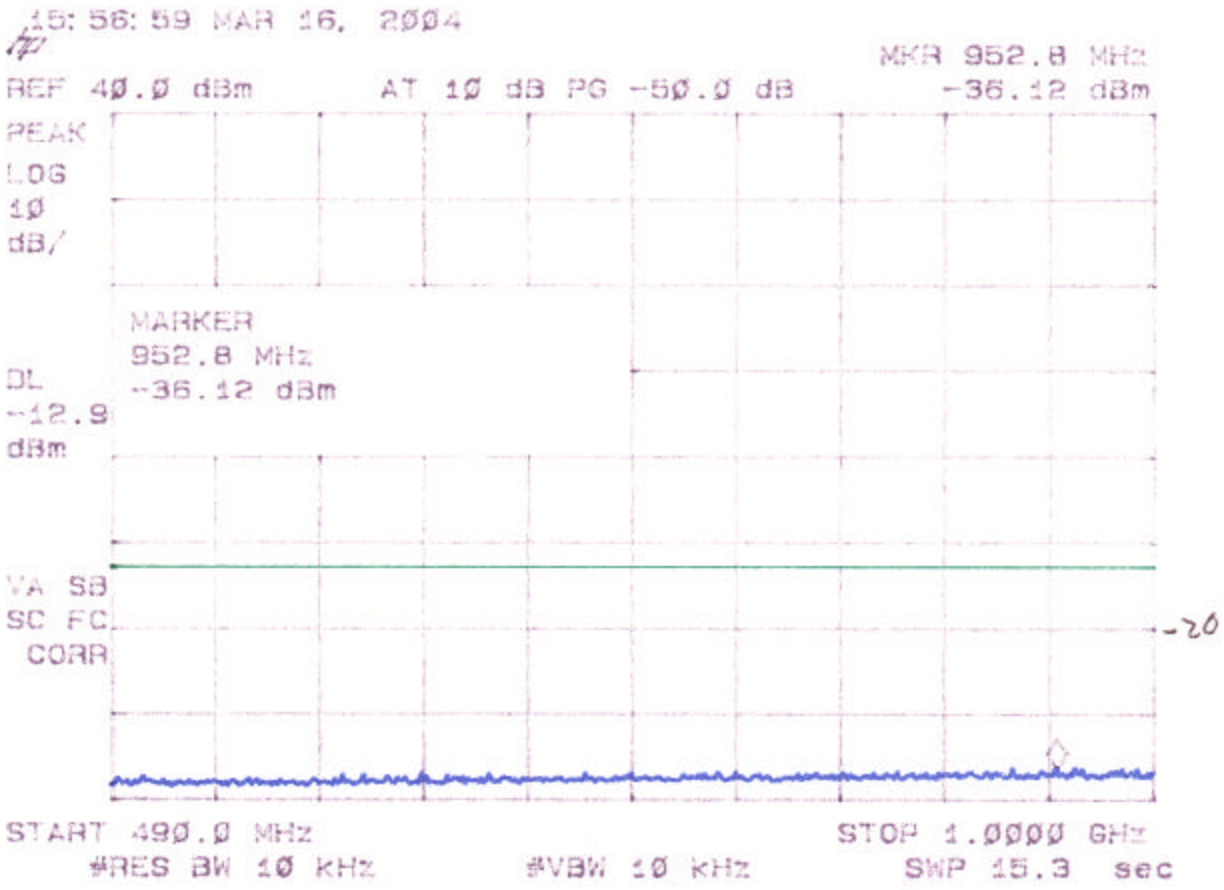


**Figure 5w**
**Spurious Emissions at Antenna Terminals**
**Mid Channel, Analog (25 kHz)**

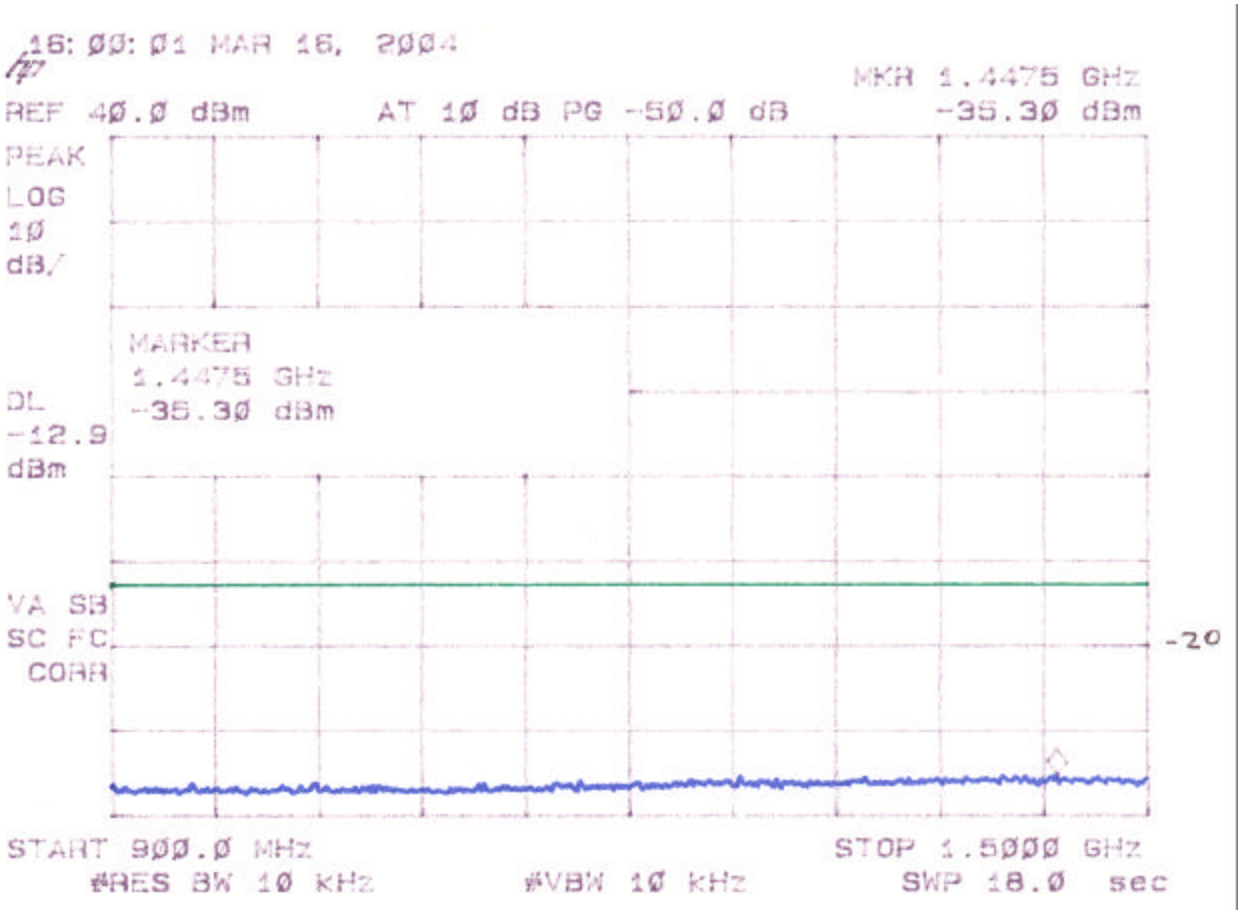


**Figure 5x**
**Spurious Emissions at Antenna Terminals**
**Mid Channel, Analog (25 kHz)**

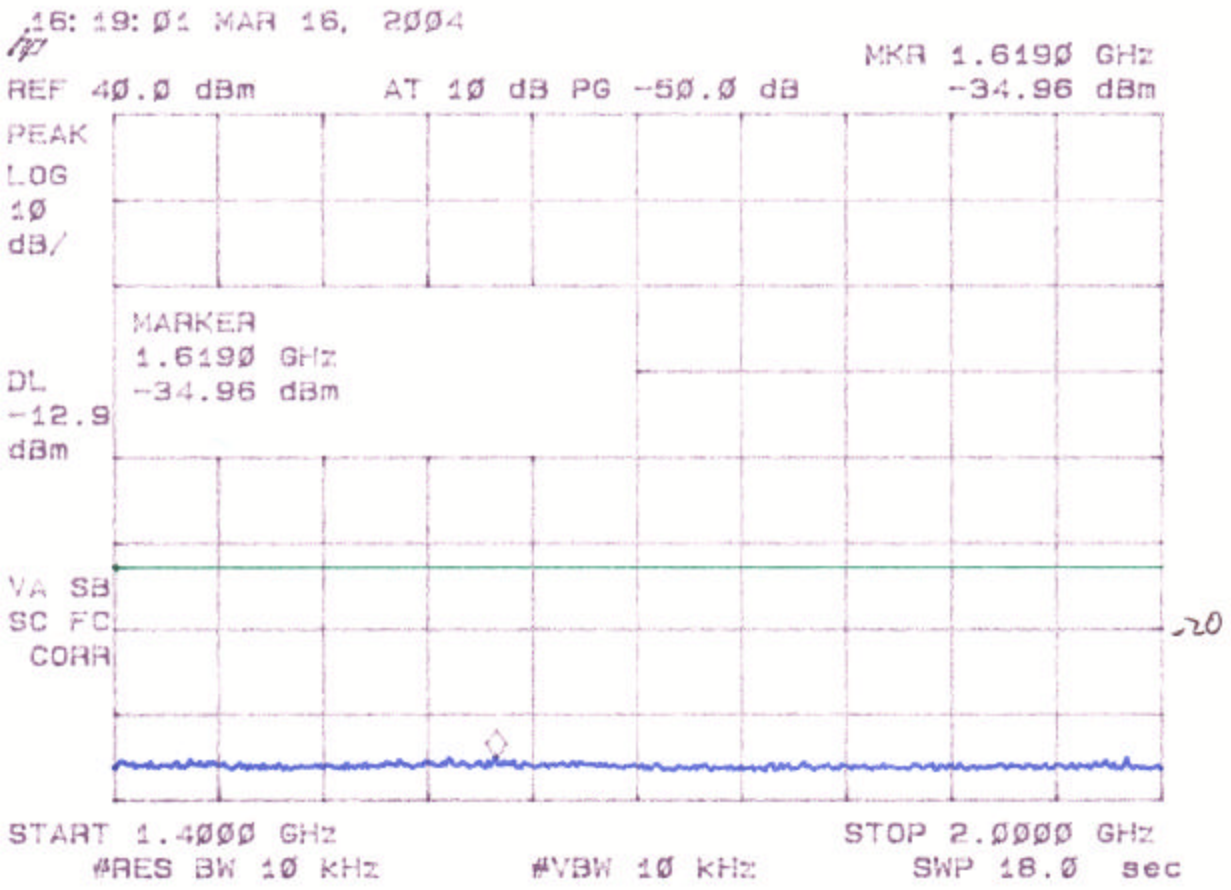


**Figure 5y**
**Spurious Emissions at Antenna Terminals**
**Low Channel, Analog (12.5 kHz)**

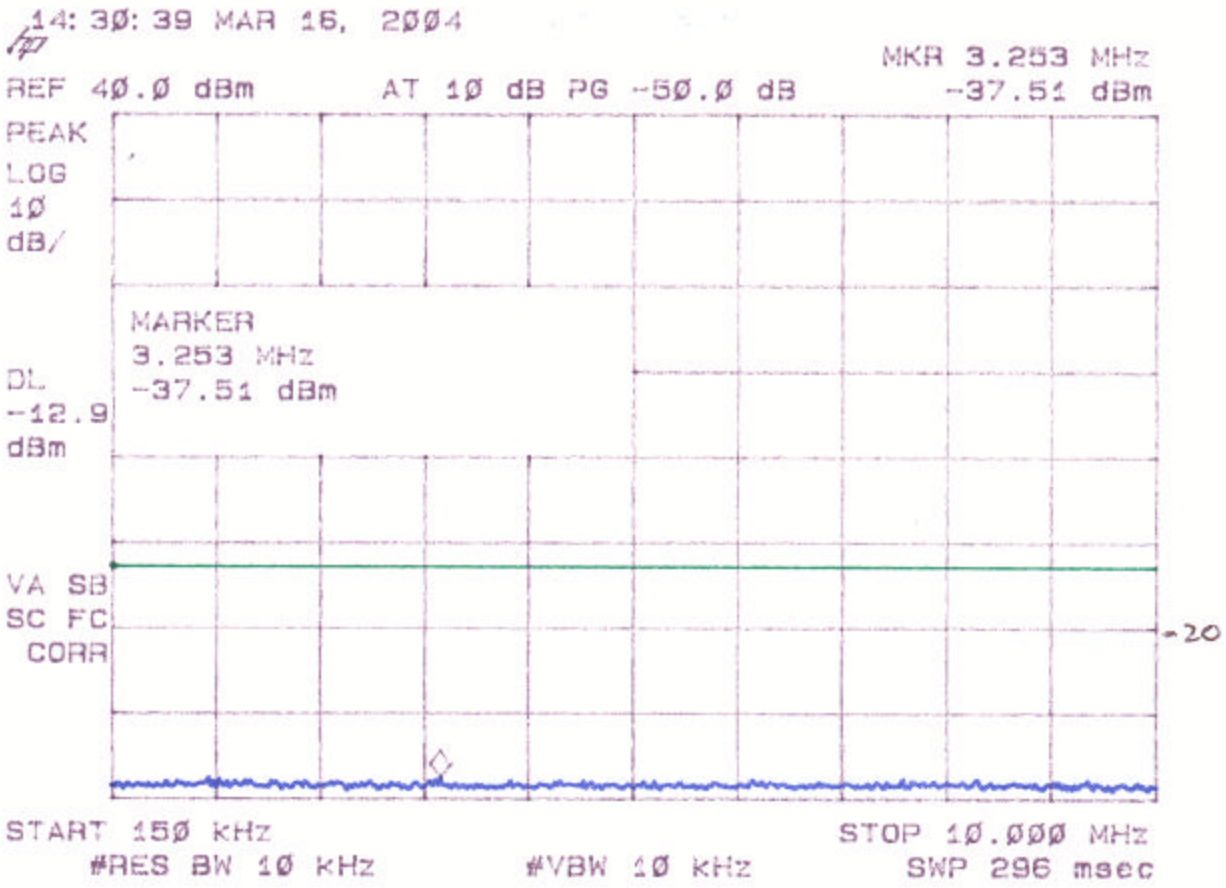


**Figure 5z**
**Spurious Emissions at Antenna Terminals**
**Low Channel, Analog (12.5 kHz)**