



# Nemko

**Test Report:** 3W07209.2, Issue 2

**Applicant:** Daniels Electronics Ltd.  
43 Eire Street  
Victoria, BC  
V8V-1P8

**Equipment Under Test:  
(EUT)** UT-4D400 UHF Transmitter Family

**In Accordance With:** **FCC Part 22**  
**FCC Part 90**

**Tested By:** Nemko Canada Inc.  
303 River Road, R.R. 5  
Ottawa, Ontario K1V 1H2

**Authorized By:**   
Glen Westwell, Wireless Technologist

**Date:** 26 August 2003

**Total Number of Pages:** 45

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## **Section 1. Summary of Test Results**

### **General**

**All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 22 and FCC Part 90.

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE. NONE  
See " Summary of Test Data".



TESTED BY: \_\_\_\_\_  
Kevin Carr, EMC Specialist

DATE: 26 August 2003

Nemko Canada Inc., a testing laboratory, is accredited by the Standards Council of Canada. The tests included in this report are within the scope of this accreditation. The results apply only to the samples tested.

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This report applies only to the items tested.

*EQUIPMENT: UT-4D400 UHF Transmitter Family*

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**Summary Of Test Data**

| <b>Name Of Test</b>                        | <b>Para. No.</b> | <b>Result</b> |
|--------------------------------------------|------------------|---------------|
| RF Power Output                            | 2.1046           | Complies      |
| Audio Frequency Response                   | 2.1047           | Complies      |
| Audio Low-Pass Filter Response             | 2.1047           | Complies      |
| Modulation Limiting                        | 2.1047           | Complies      |
| Occupied Bandwidth                         | 2.1049           | Complies      |
| Spurious Emissions at Antenna<br>Terminals | 2.1051           | Complies      |
| Field Strength of Spurious Emissions       | 2.1053           | Complies      |
| Frequency Stability                        | 2.1055           | Complies      |
| Transient Frequency Behavior               | —                | Complies      |

**Footnotes For N/A's:****Test Conditions:**

**Indoor**                      Temperature: 21°C  
                                    Humidity:     47%

**Outdoor**                    Temperature: 21°C  
                                    Humidity:     95%

## **Section 2.           General Equipment Specification**

|                                                                     |                          |
|---------------------------------------------------------------------|--------------------------|
| <b>Manufacturer:</b>                                                | Daniels Electronics Ltd. |
| <b>Family No.:</b>                                                  | UT-4D400                 |
| <b>Date Received In Laboratory:</b>                                 | 28 July 2003             |
| <b>Nemko Identification No.:</b>                                    | 1 & 2                    |
| <b>Primary Power</b>                                                | 13.8 VDC                 |
| <b>Power Output</b>                                                 | Variable: 0.5 - 8 Watts  |
| <b>Channel Spacing</b>                                              | 12.5/25 kHz              |
| <b>Emission Designator (Analog)<br/>12.5kHz Ch. Spacing</b>         | 11K0F3E                  |
| <b>25kHz Ch. Spacing</b>                                            | 16K0F3E                  |
| <b>Emission Designator (Digital)<br/>Voice: 12.5kHz Ch. Spacing</b> | 8K10F1E                  |
| <b>Data: 12.5 kHz Ch. Spacing</b>                                   | 8K10F1D                  |
| <b>Frequency Range</b>                                              |                          |
| <b>UT-4D420</b>                                                     | 406.1 – 430 MHz          |
| <b>UT-4D460</b>                                                     | 450 – 470 MHz            |

### **Section 3. RF Power Output**

**Para. No.: 2.1046**

|                                      |                                   |
|--------------------------------------|-----------------------------------|
| <b>Test Performed By:</b> Kevin Carr | <b>Date of Test:</b> 29 July 2003 |
|--------------------------------------|-----------------------------------|

**Minimum Standard:**  $\pm 1$  dB

**Test Results:** Complies

**Measurement Data:**      Manufacturer's Rating:      39.0 dBm, 8.0Watts  
                                         Measured Power Output:      39.2dBm, 8.3Watts

Note: The EUT is variable from 0.5 – 8 Watts

## **Section 4.        Audio Low-Pass Filter Response**

**Para. No.: 2.1047**

|                                      |                                   |
|--------------------------------------|-----------------------------------|
| <b>Test Performed By:</b> Kevin Carr | <b>Date of Test:</b> 30 July 2003 |
|--------------------------------------|-----------------------------------|

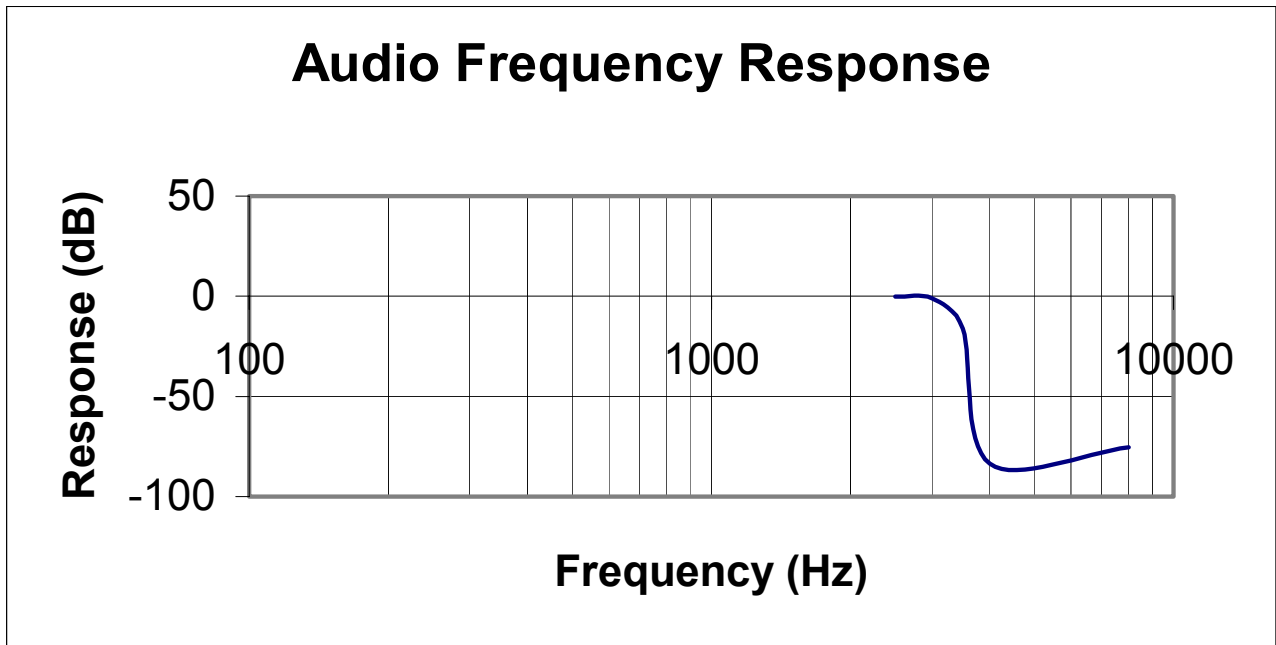
**Minimum Standard:**        Not applicable.

**Test Results:**                Complies

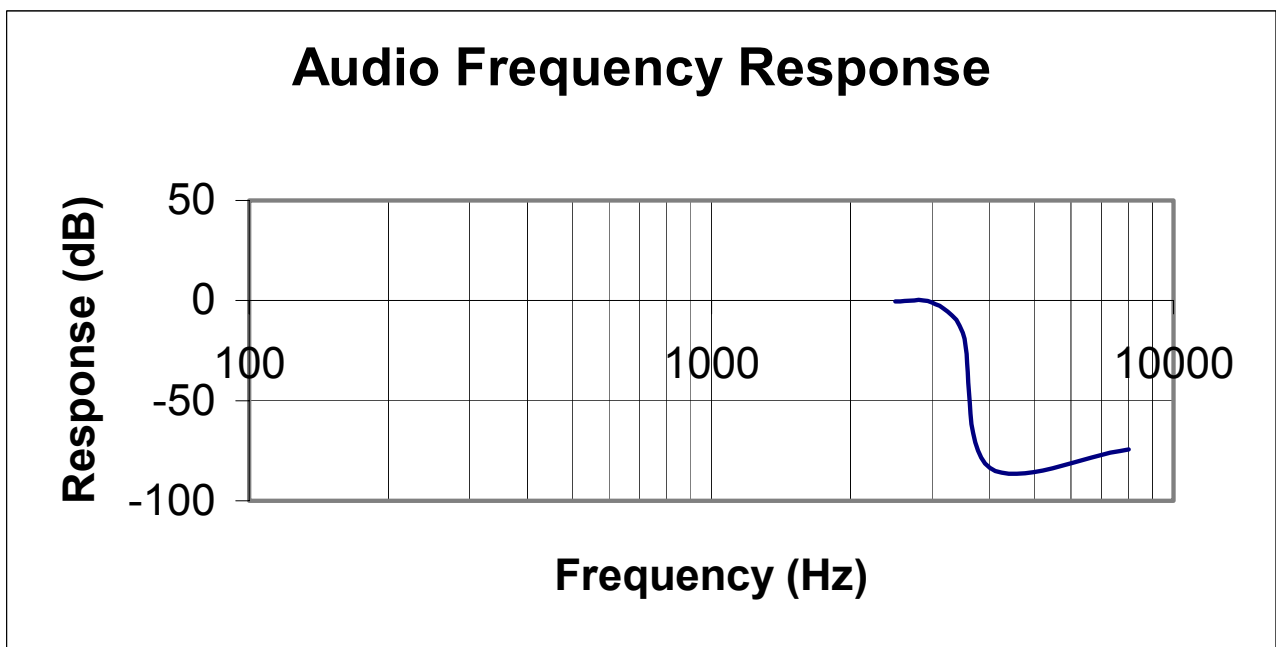
The equipment has provisions for audio low pass filter.

**Measurement Data:**        See attached graph.

Worst Case, 25 kHz, Ch. Spacing



Worst Case, 12.5 kHz, Ch. Spacing



## **Section 5.        Occupied Bandwidth**

**Para. No.: 2.1049**

|                                      |                                   |
|--------------------------------------|-----------------------------------|
| <b>Test Performed By:</b> Kevin Carr | <b>Date of Test:</b> 29 July 2003 |
|--------------------------------------|-----------------------------------|

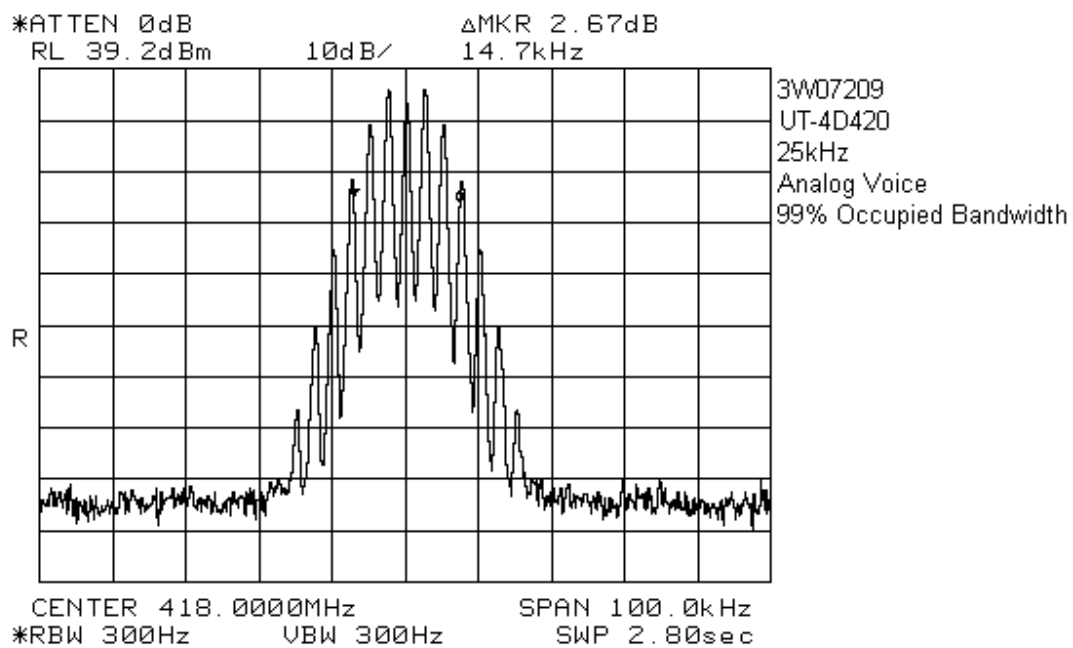
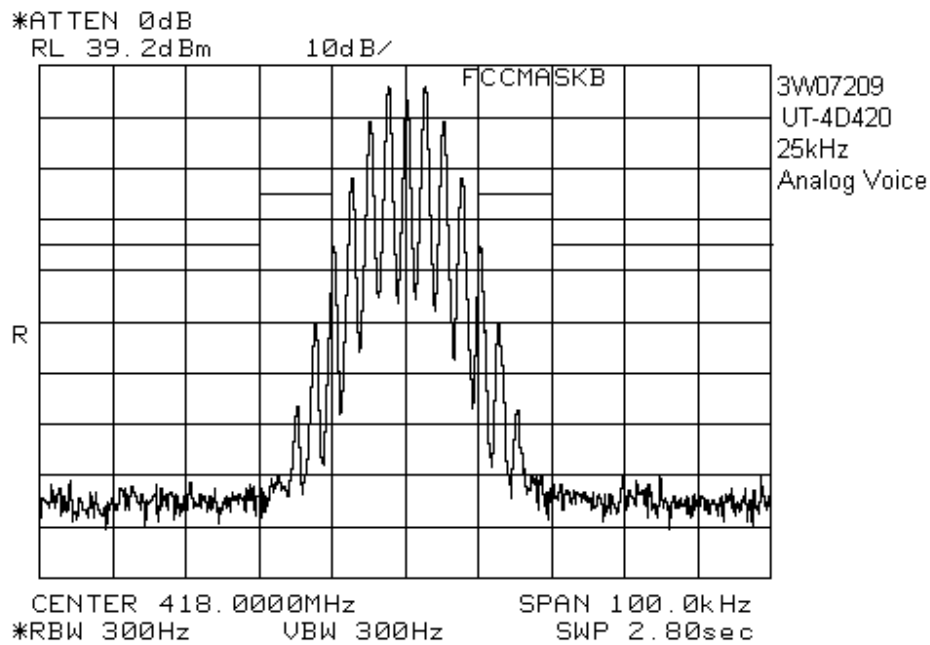
**Minimum Standard:**        Para. No.'s    90.210(b)  
                                                                                 90.210(d)  
                                                                                 22.359(a), (b)(1) & (b)(2)

**Test Results:**                Complies

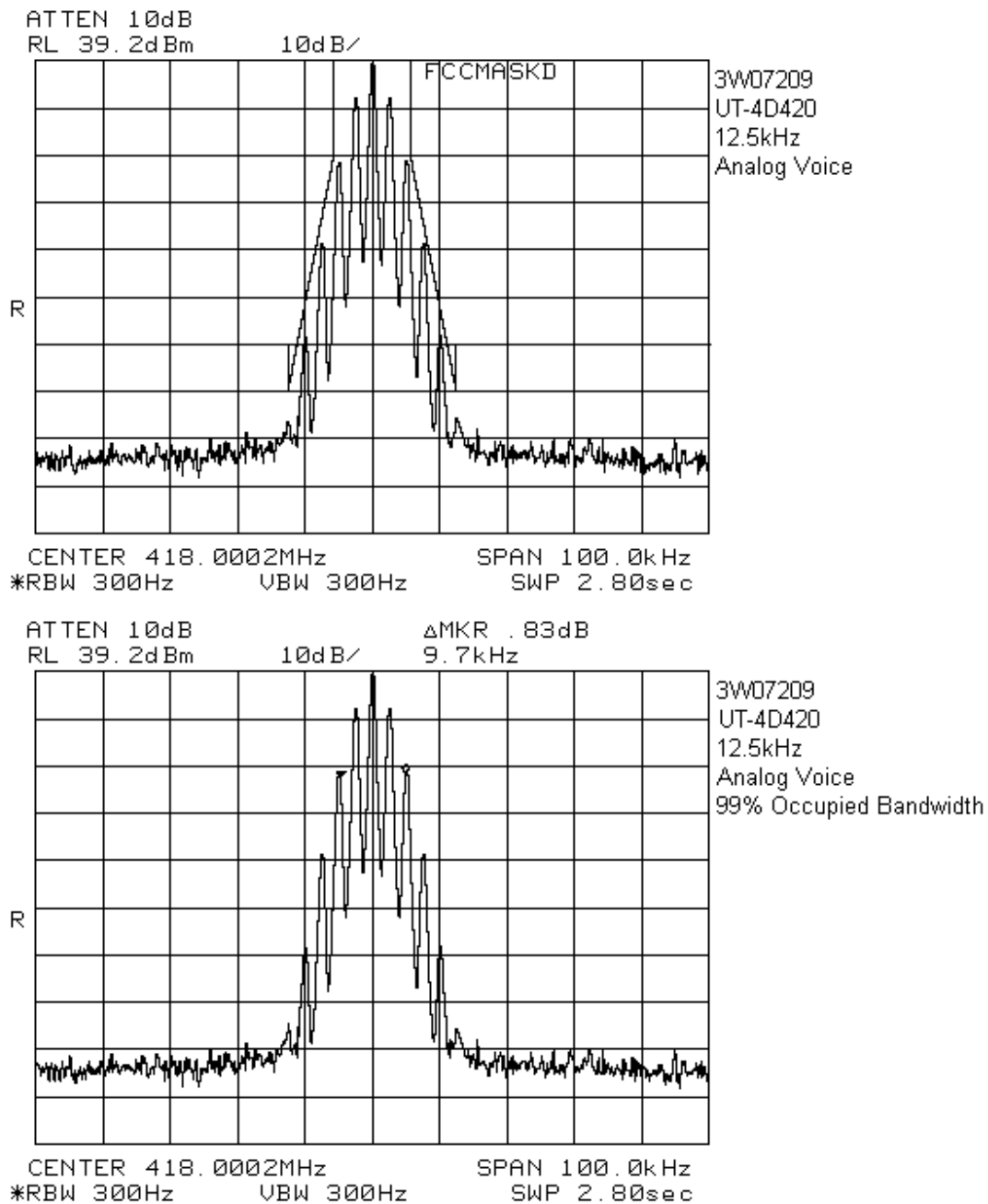
**Measurement Data:**        See attached graphs.

EQUIPMENT: UT-4D400 UHF Transmitter Family

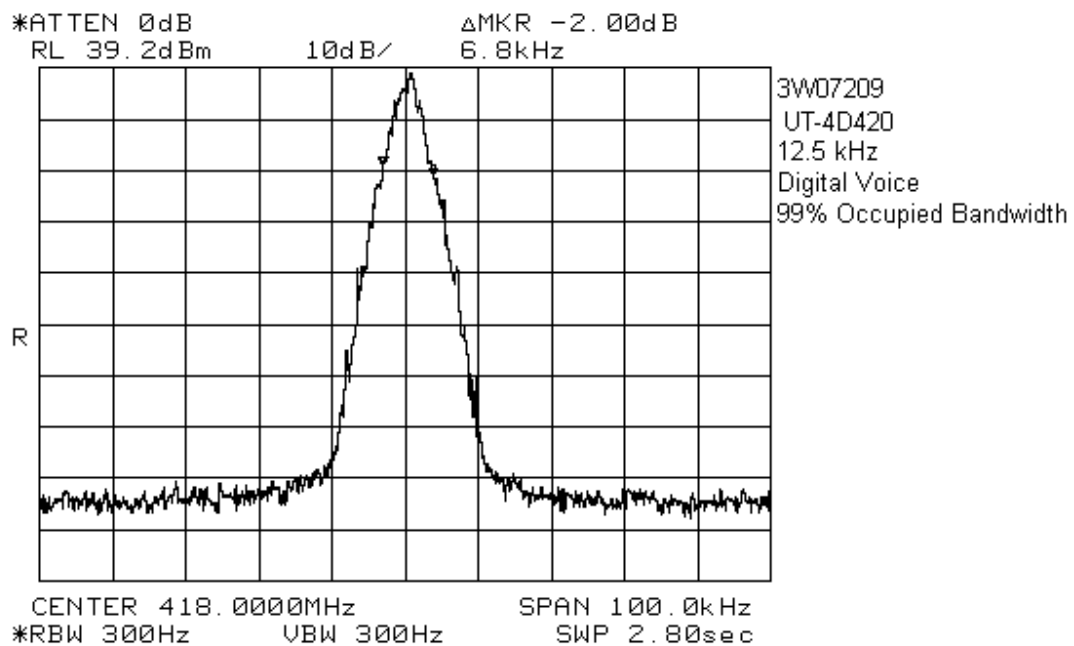
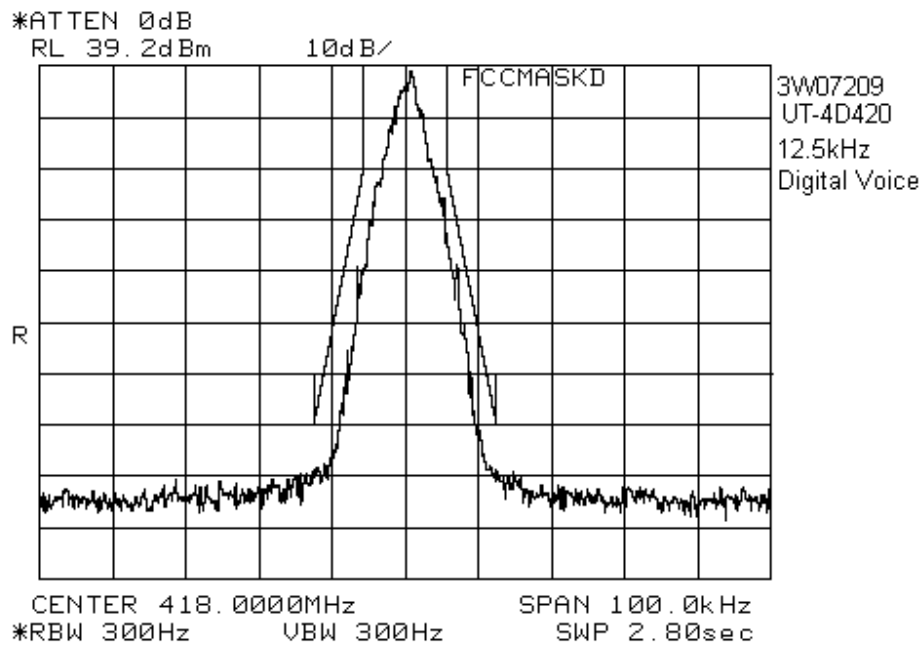
UT-4D420



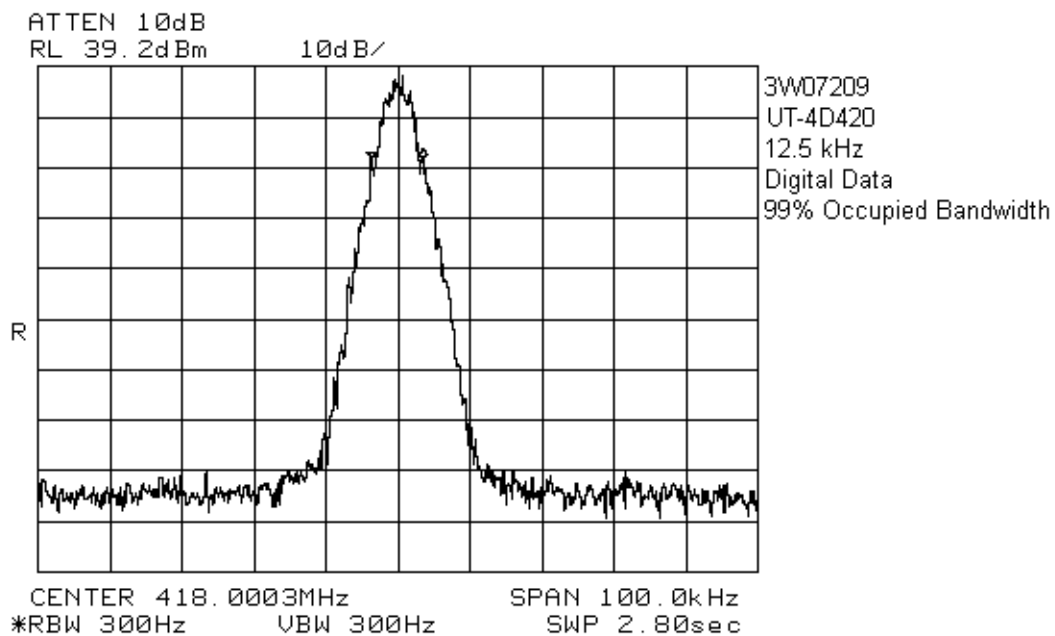
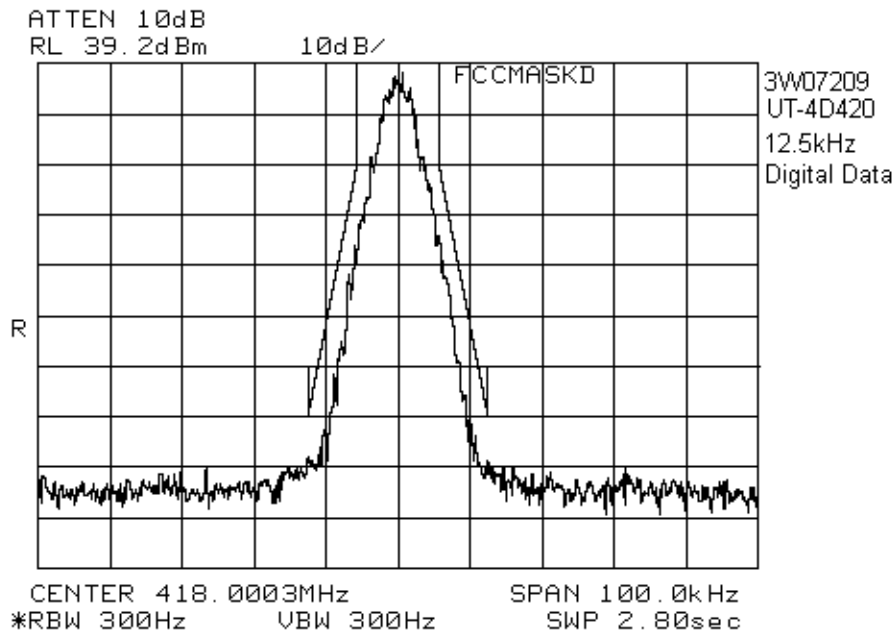
EQUIPMENT: UT-4D400 UHF Transmitter Family



EQUIPMENT: UT-4D400 UHF Transmitter Family

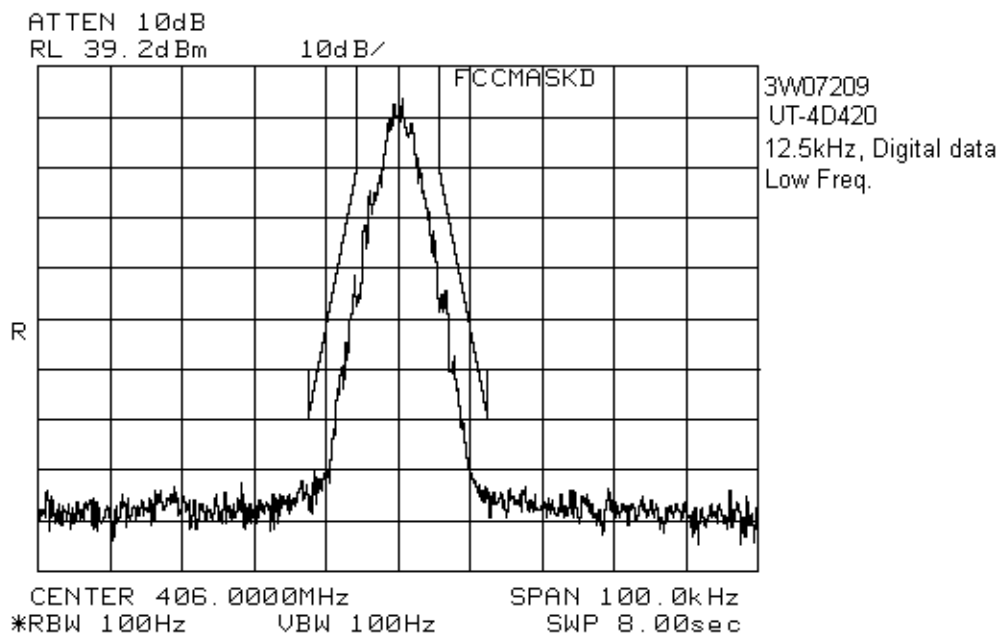
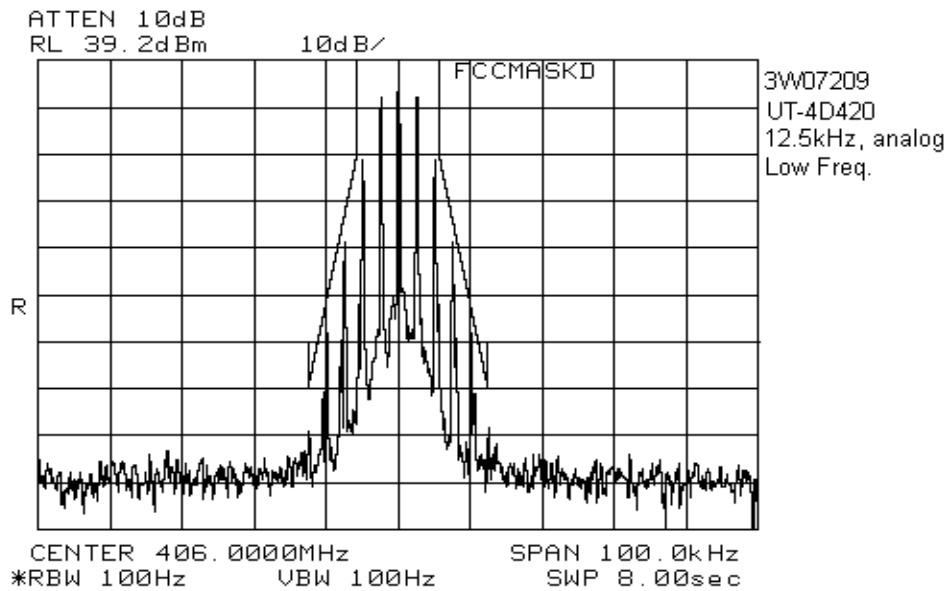


EQUIPMENT: UT-4D400 UHF Transmitter Family

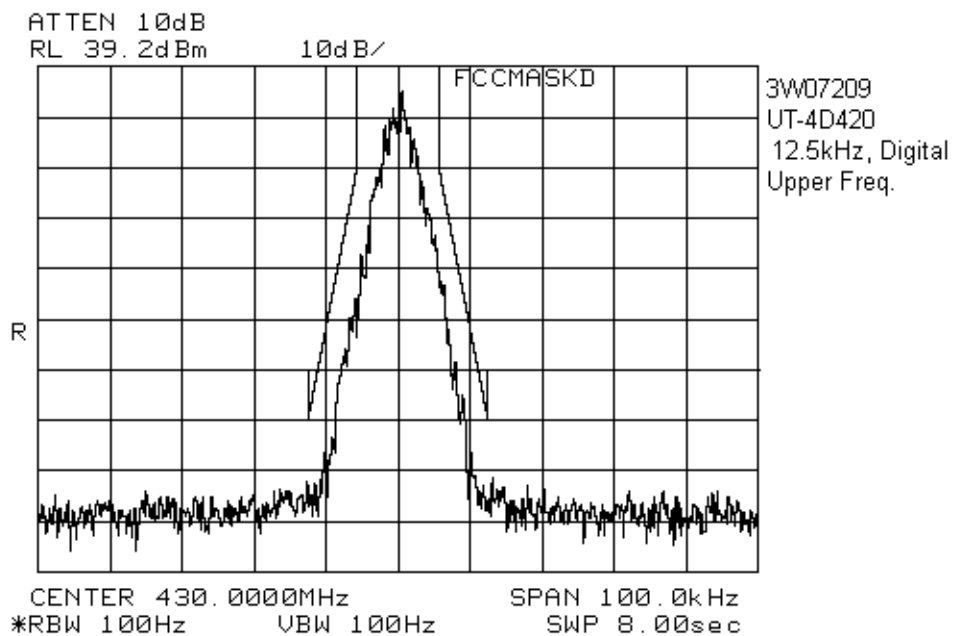
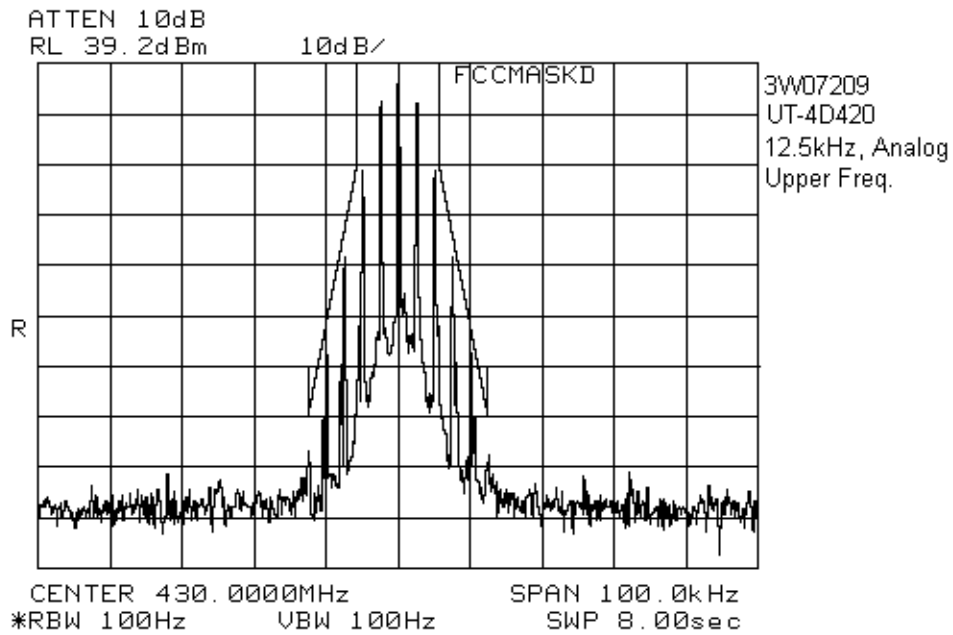


EQUIPMENT: UT-4D400 UHF Transmitter Family

## Upper and Lower Frequencies

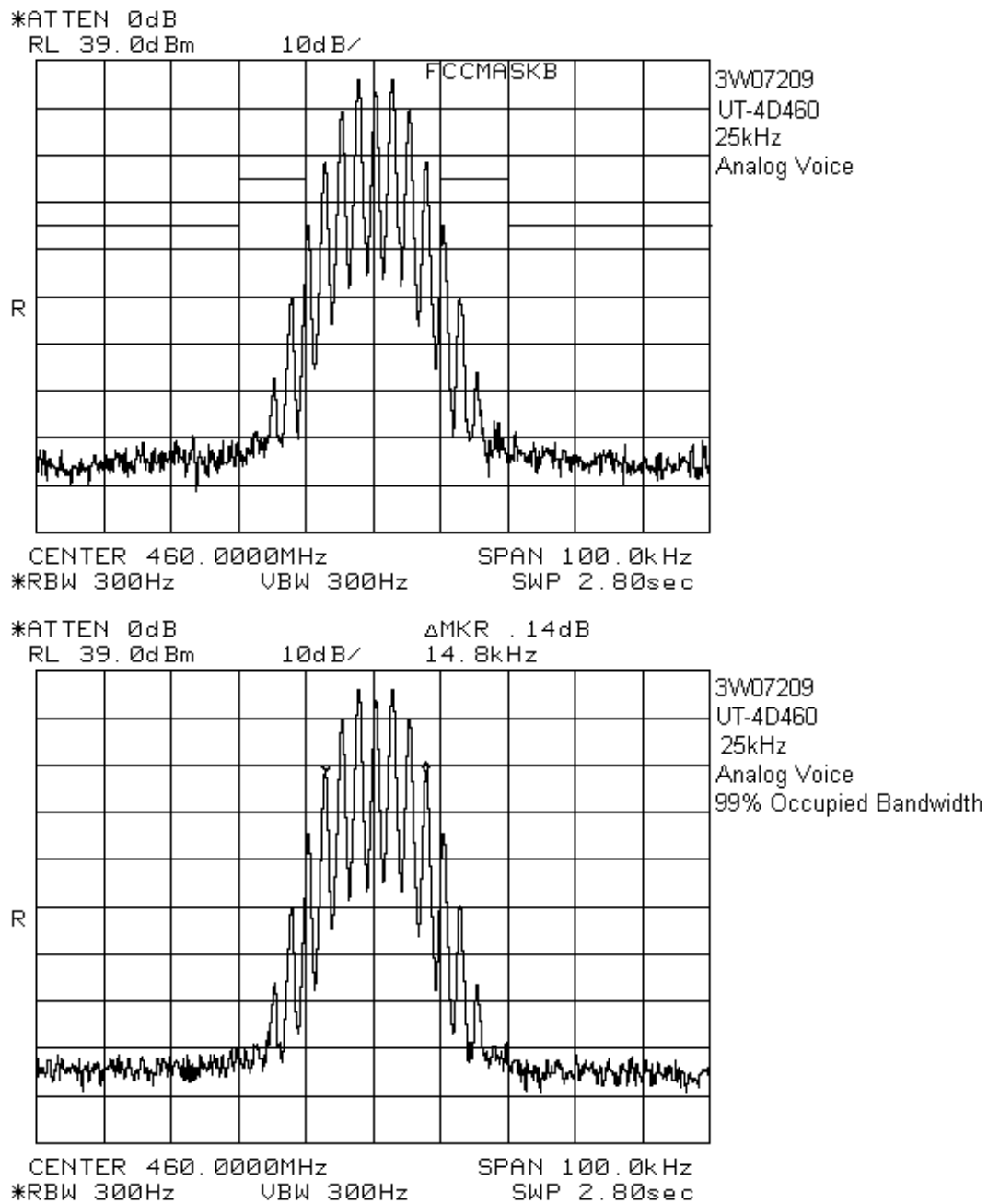


EQUIPMENT: UT-4D400 UHF Transmitter Family

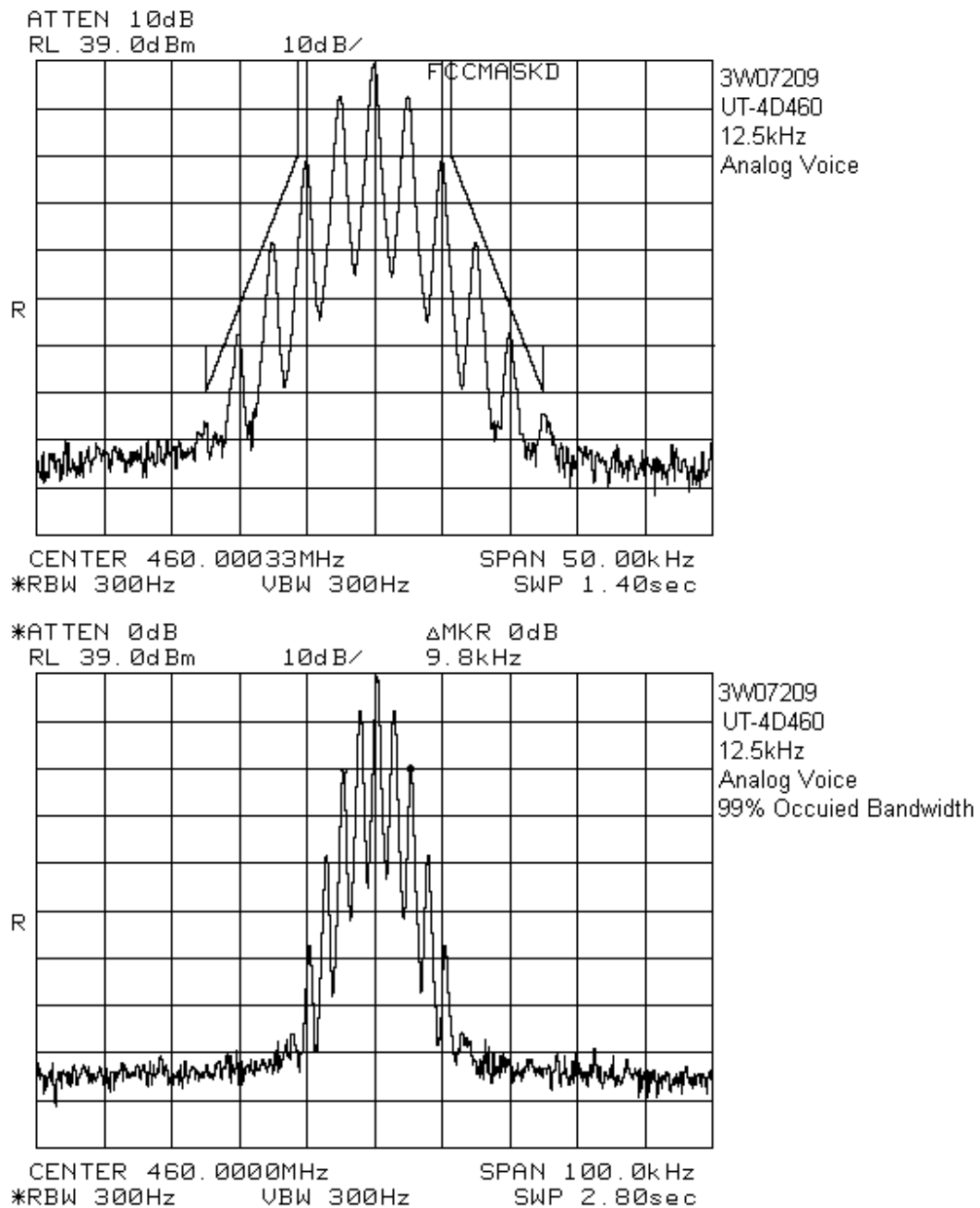


EQUIPMENT: UT-4D400 UHF Transmitter Family

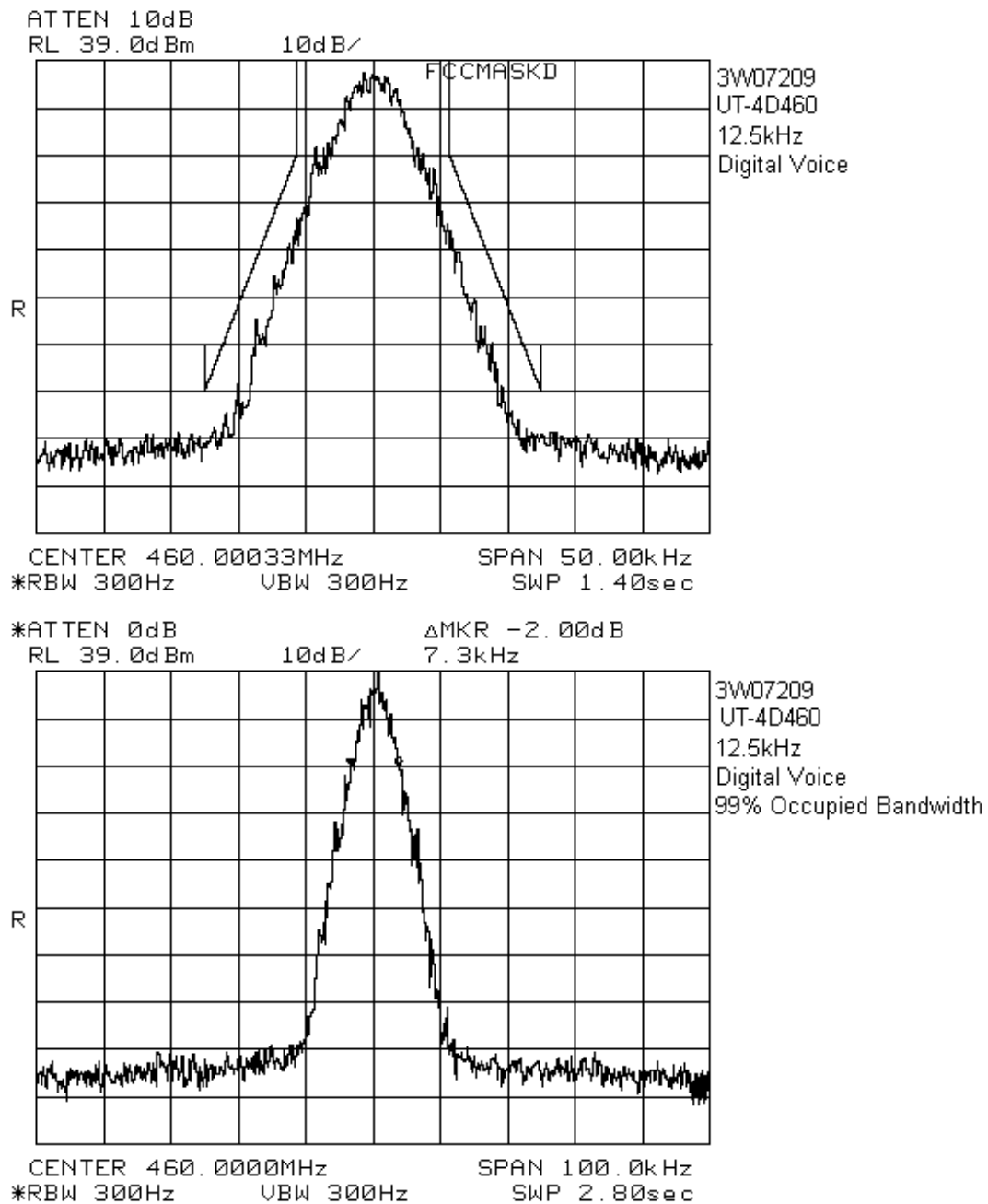
UT-4D460



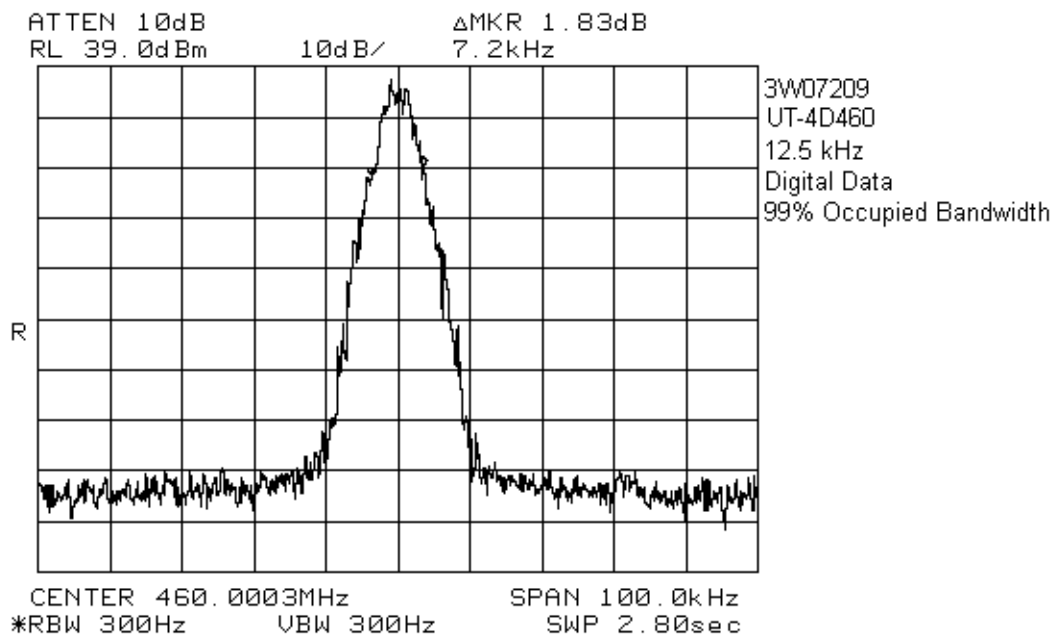
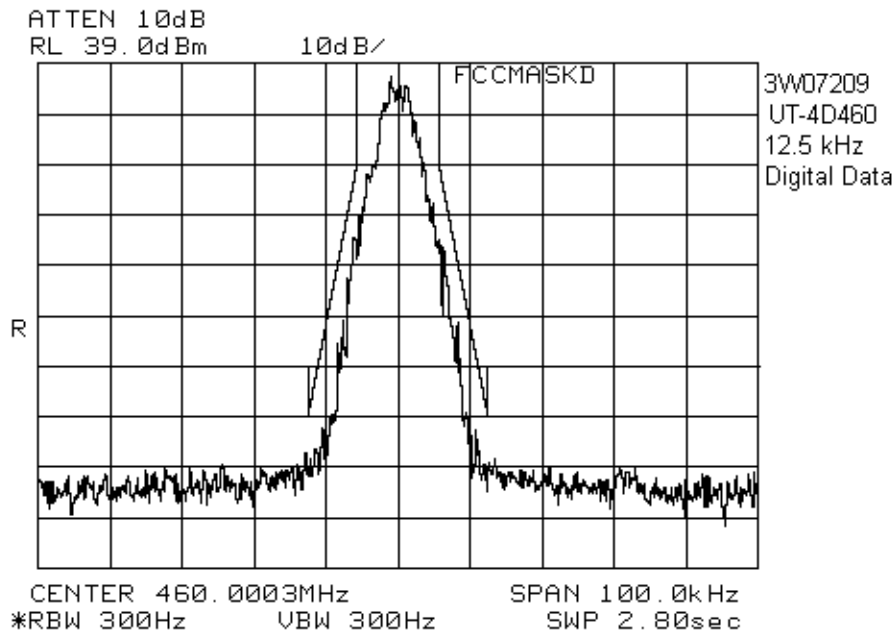
EQUIPMENT: UT-4D400 UHF Transmitter Family



EQUIPMENT: UT-4D400 UHF Transmitter Family

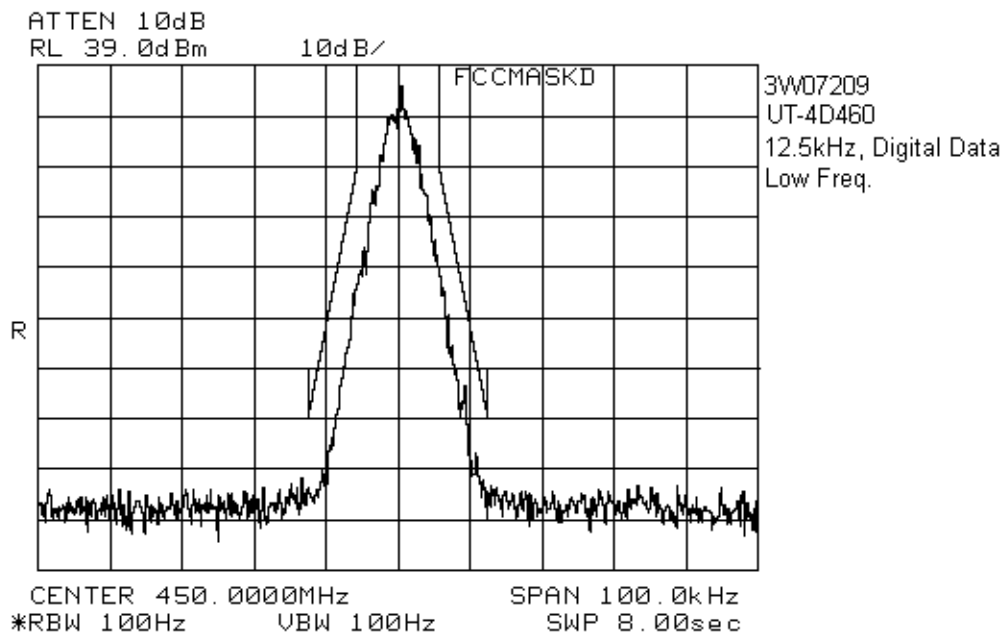
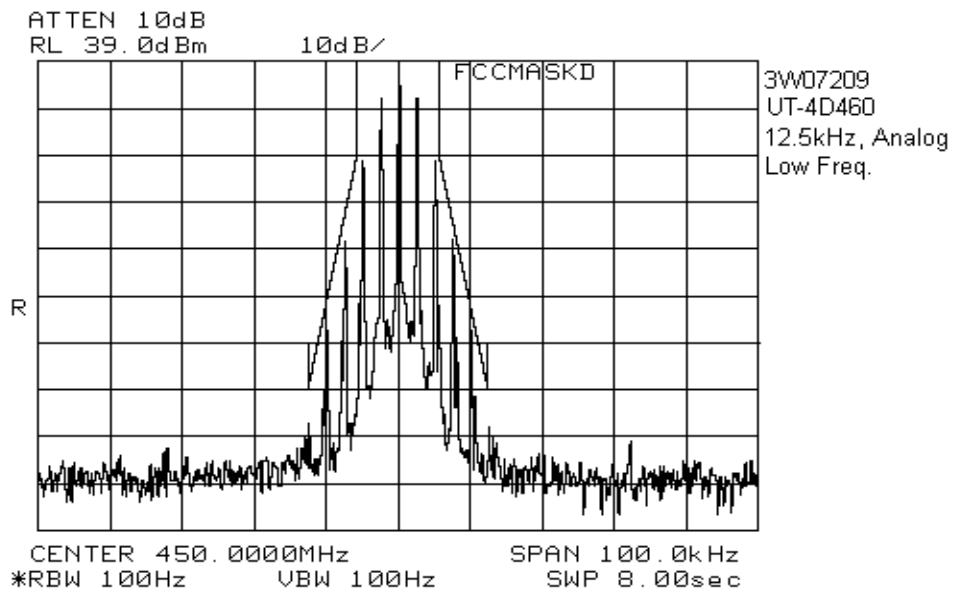


EQUIPMENT: UT-4D400 UHF Transmitter Family

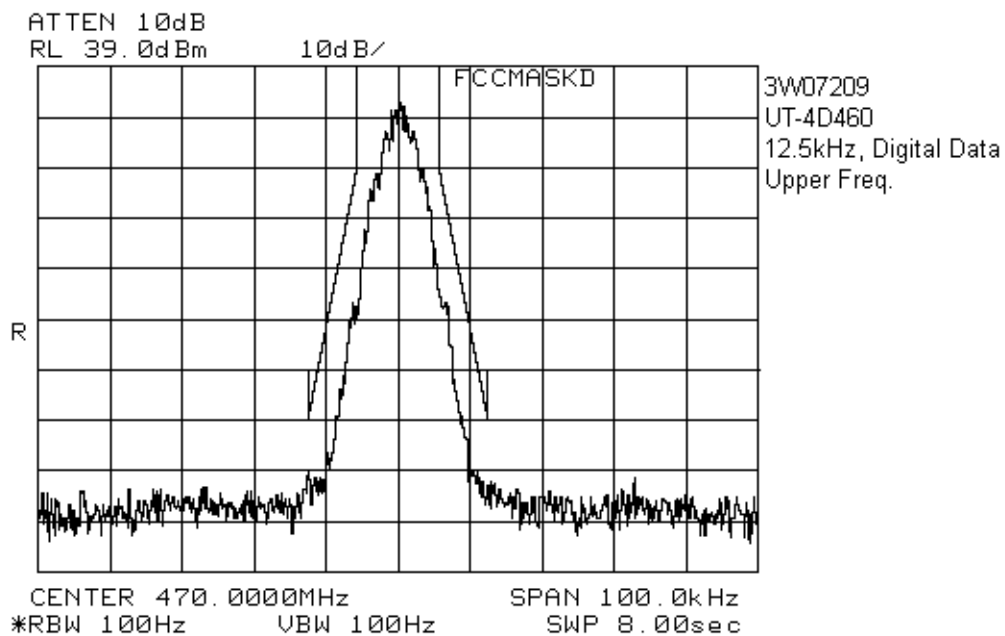
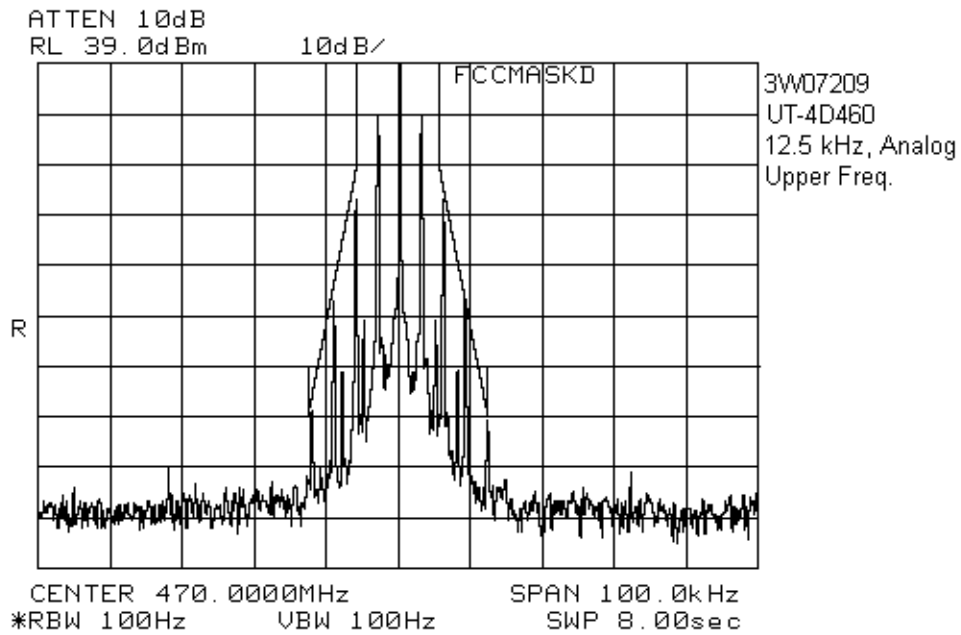


EQUIPMENT: UT-4D400 UHF Transmitter Family

## Upper and Lower Frequencies



EQUIPMENT: UT-4D400 UHF Transmitter Family



## **Section 6. Spurious Emissions at Antenna Terminals**

**Para. No.: 2.1051**

|                                      |                                   |
|--------------------------------------|-----------------------------------|
| <b>Test Performed By:</b> Kevin Carr | <b>Date of Test:</b> 29 July 2003 |
|--------------------------------------|-----------------------------------|

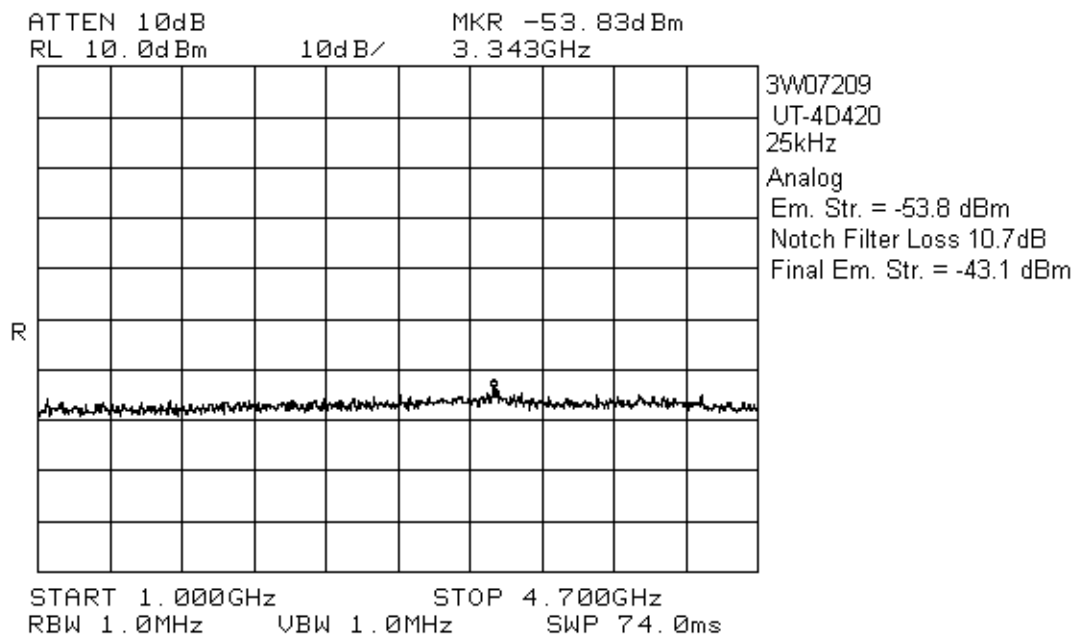
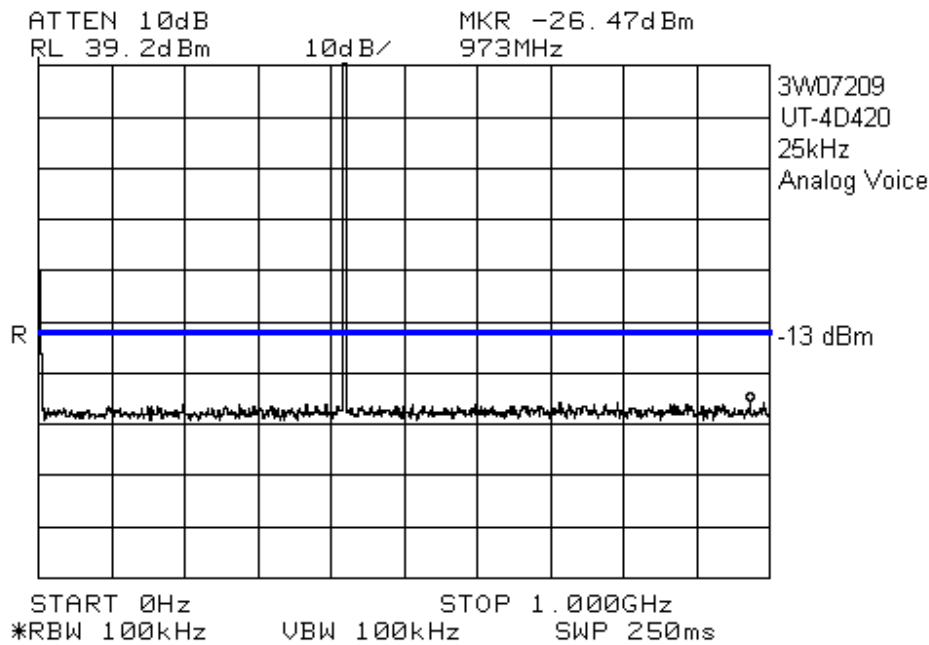
**Minimum Standard:** Para. No.'s 90.210 (b)(d)  
22.359(a), (b)(1) & (b)(2)

**Test Results:** Complies

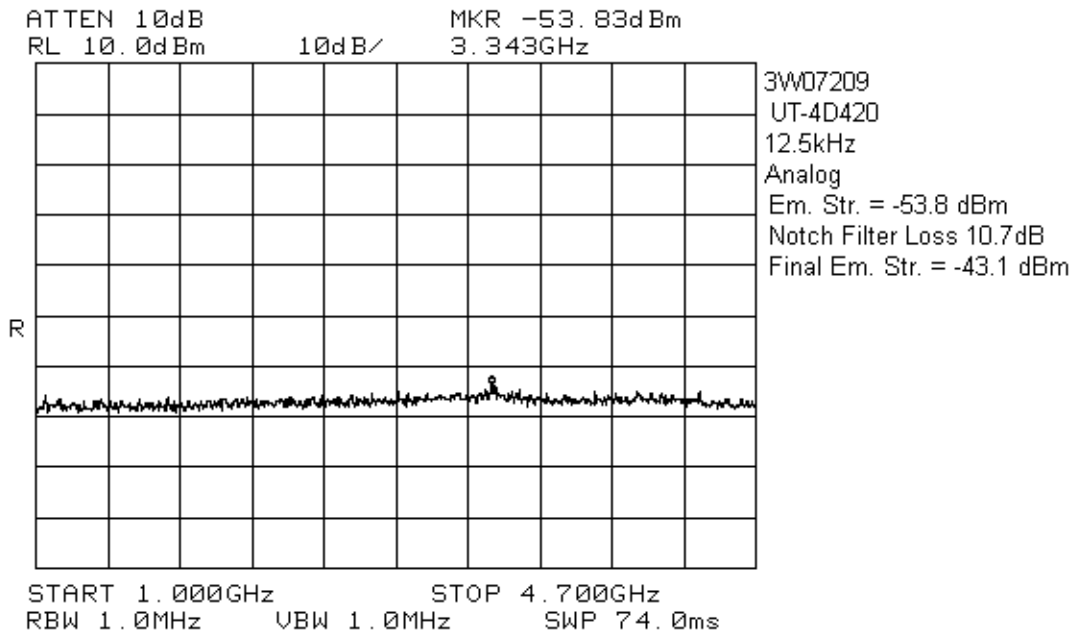
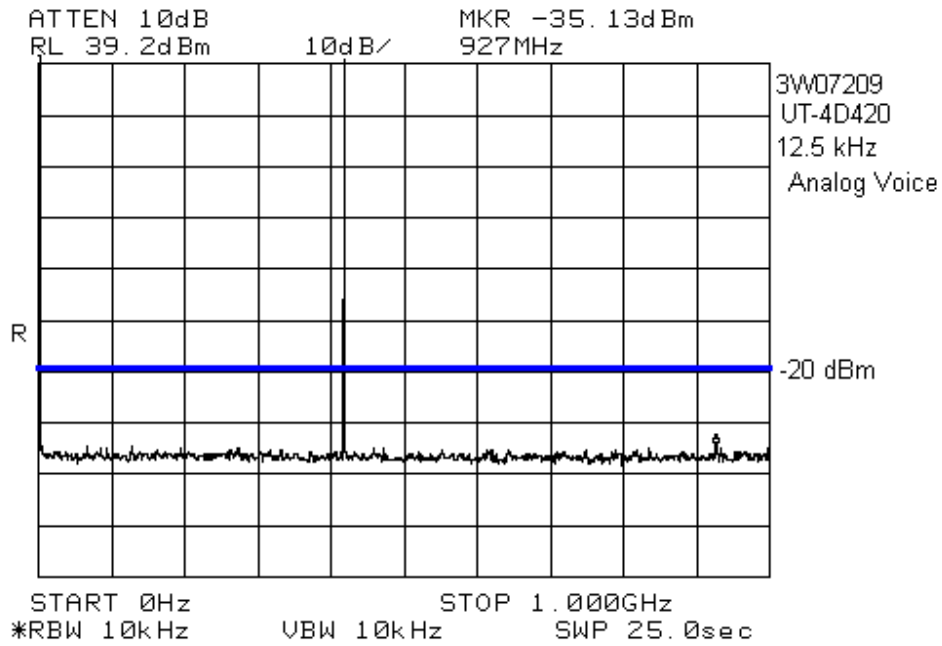
**Measurement Data:** See attached graphs.

EQUIPMENT: UT-4D400 UHF Transmitter Family

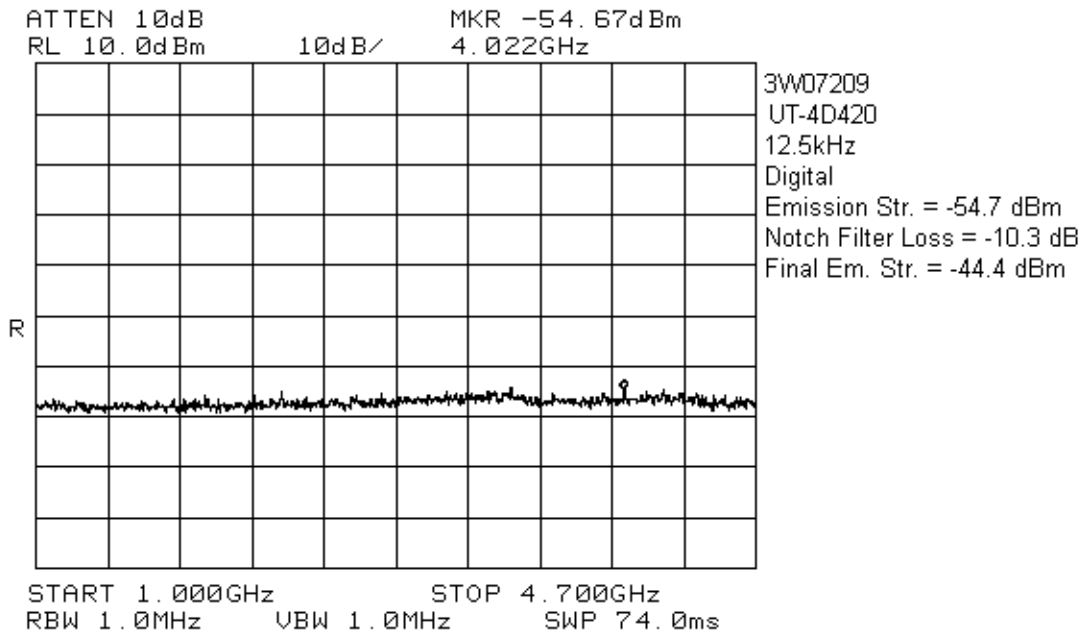
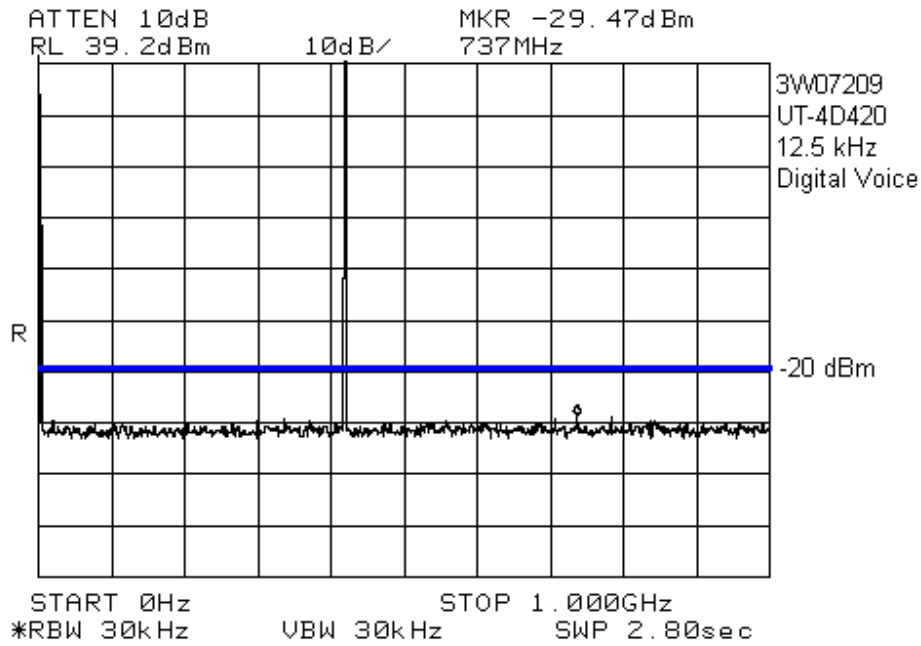
UT-4D420



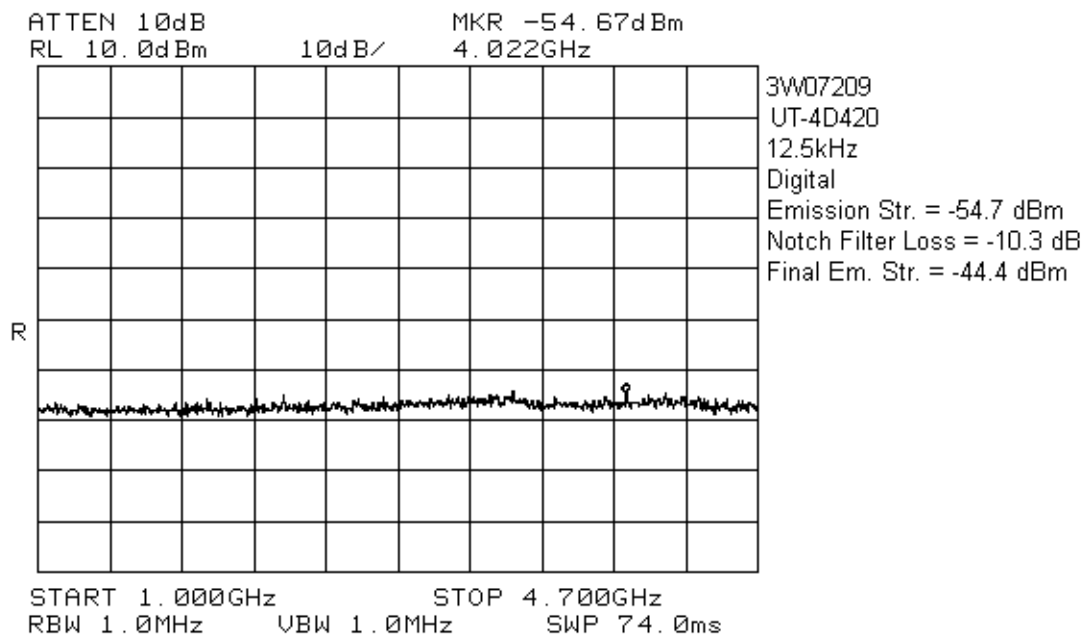
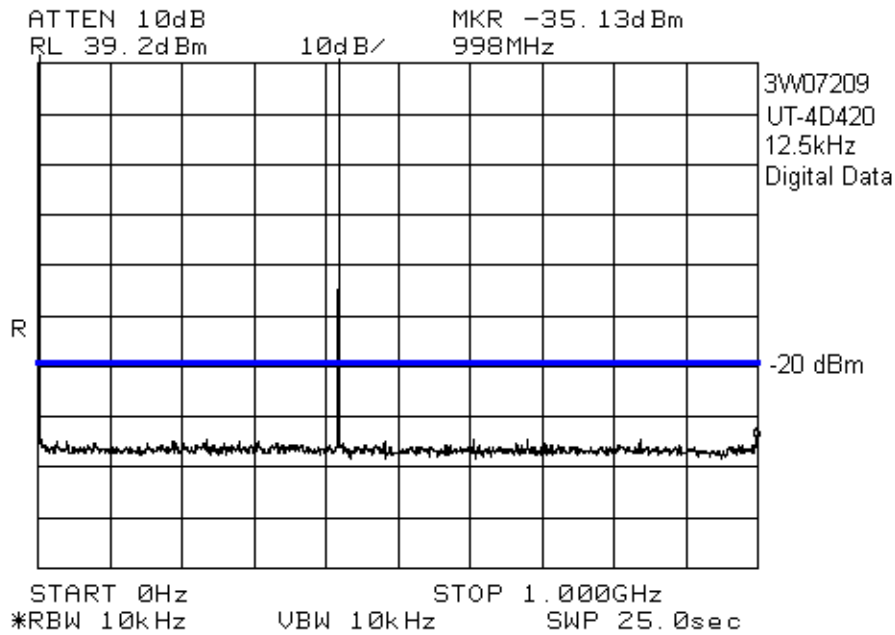
EQUIPMENT: UT-4D400 UHF Transmitter Family



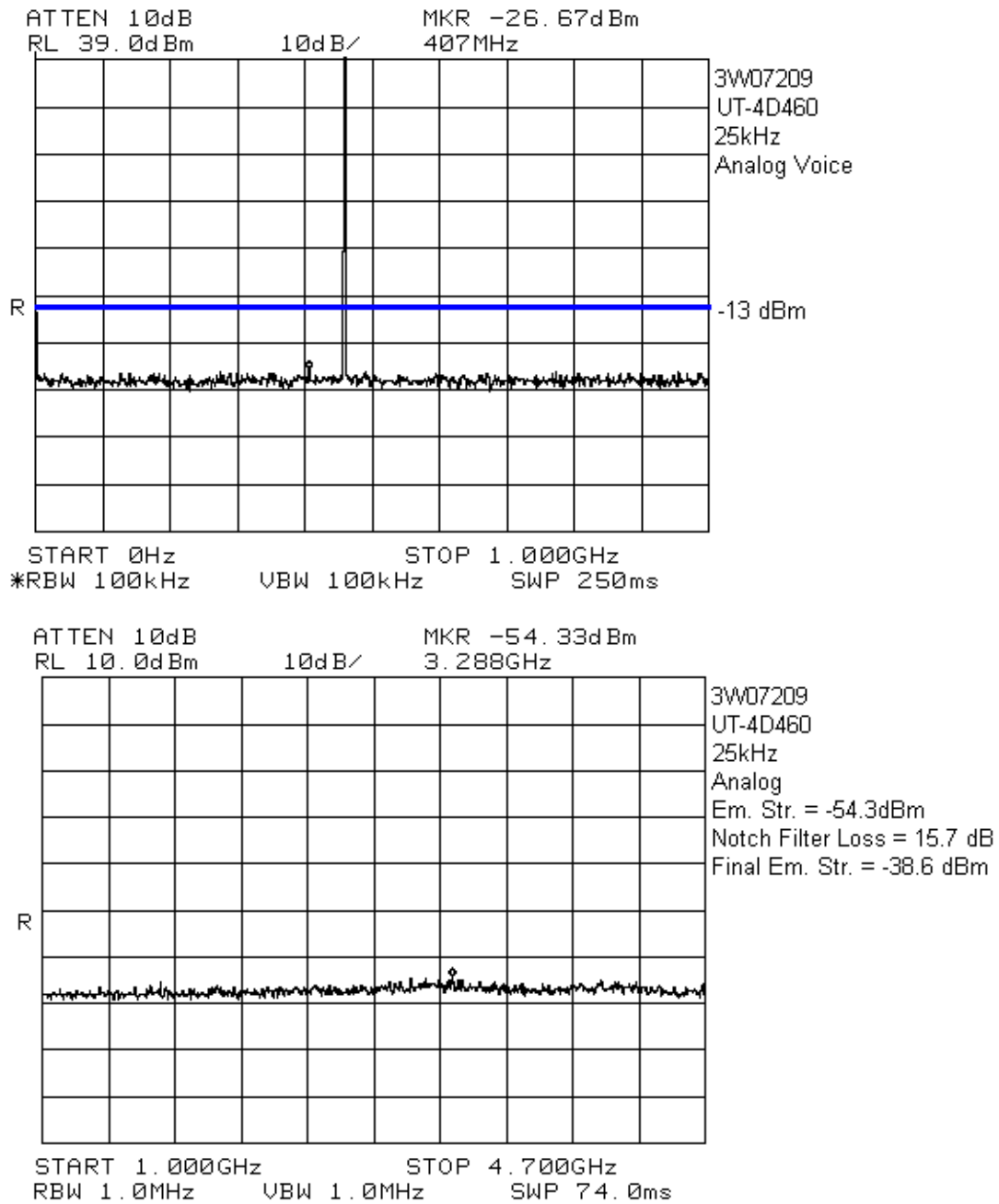
EQUIPMENT: UT-4D400 UHF Transmitter Family



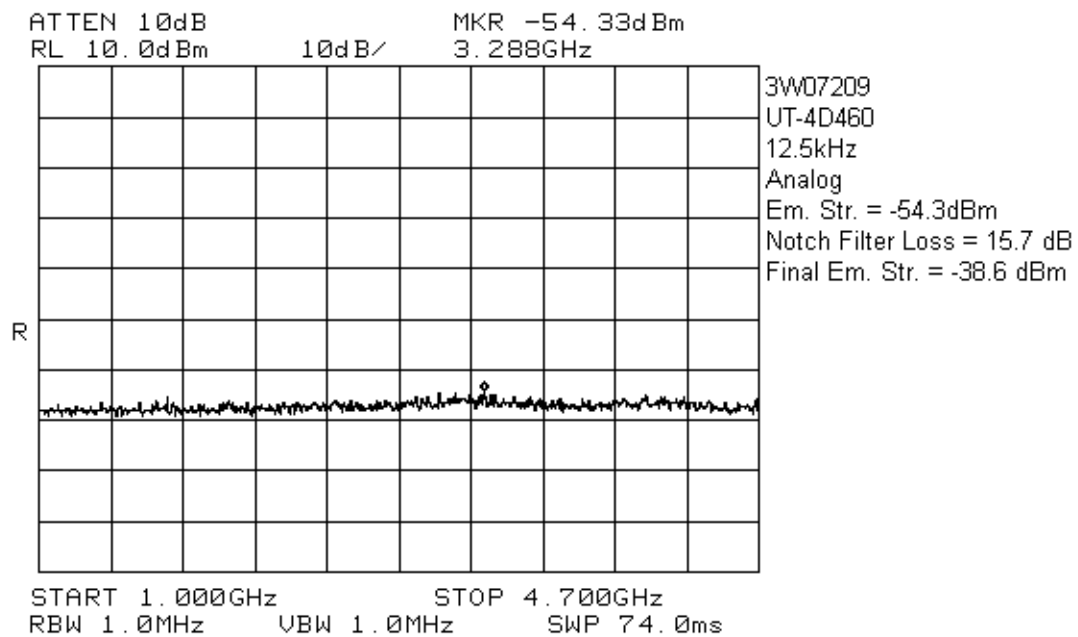
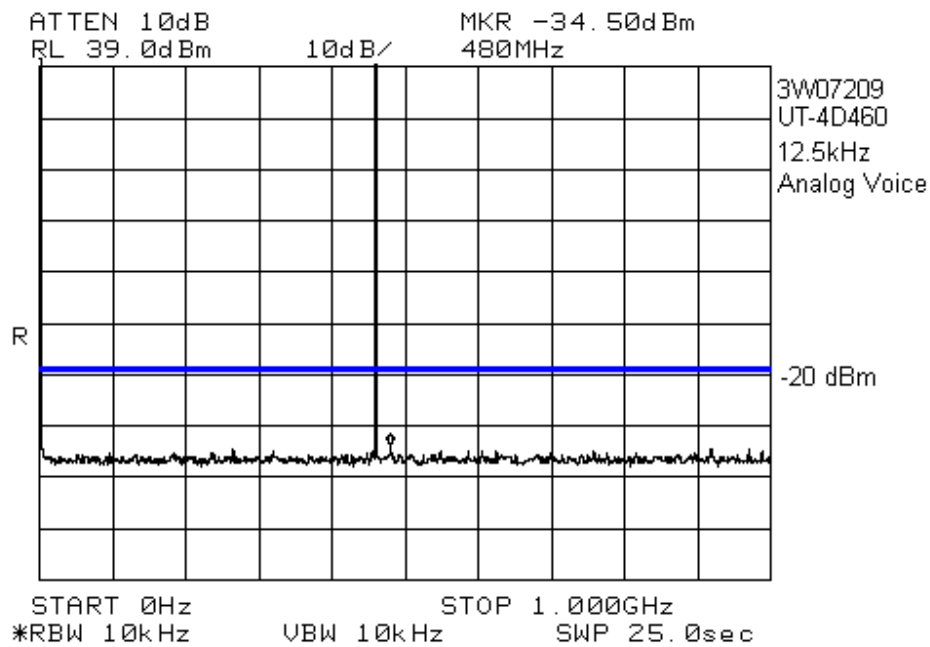
EQUIPMENT: UT-4D400 UHF Transmitter Family



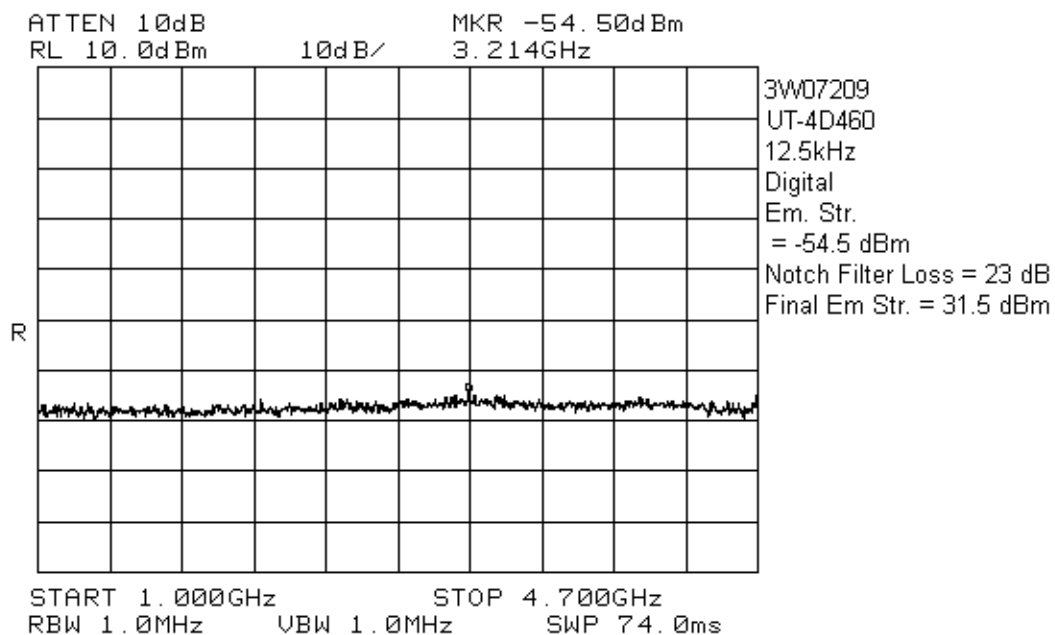
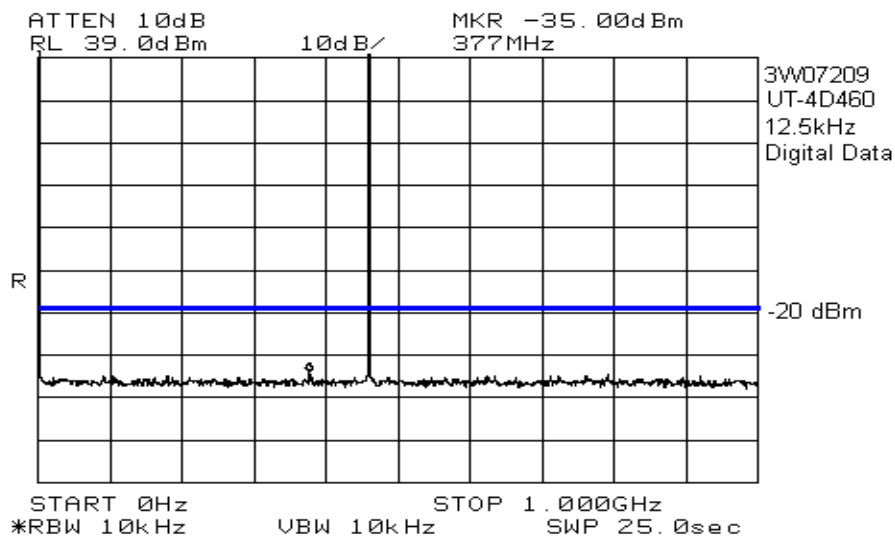
UT-4D460



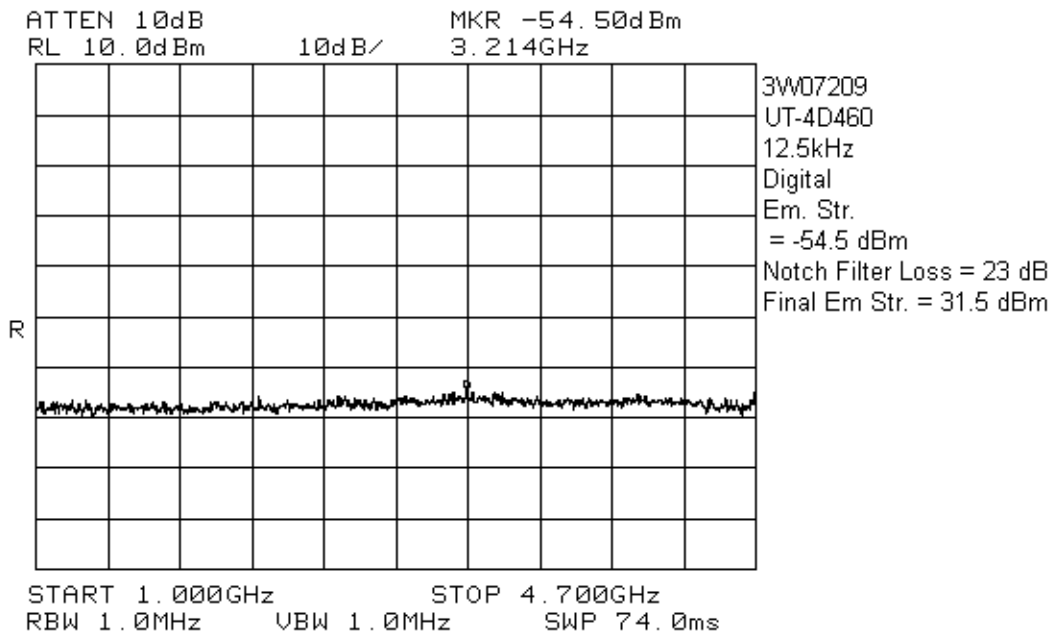
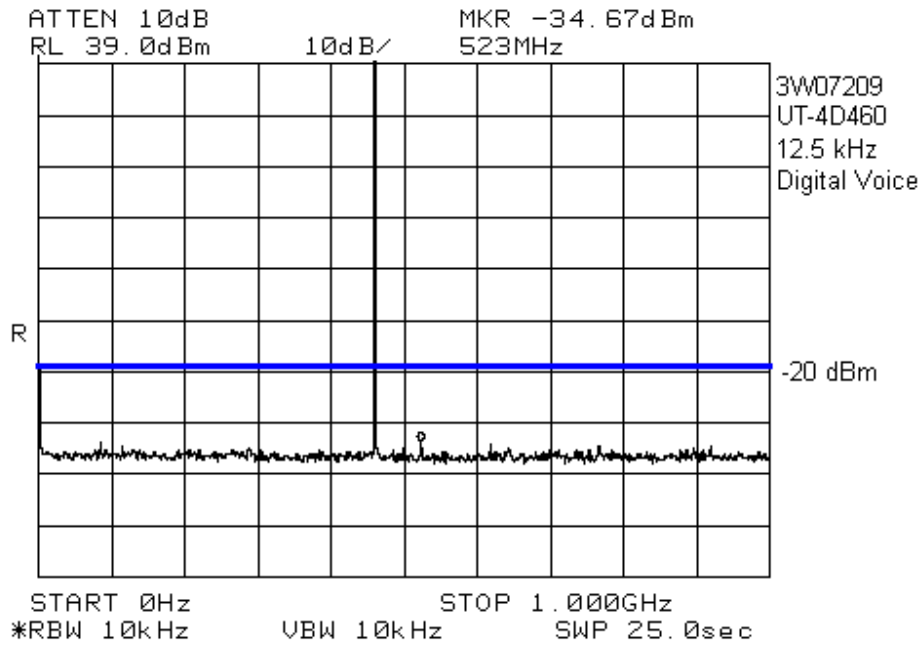
EQUIPMENT: UT-4D400 UHF Transmitter Family



EQUIPMENT: UT-4D400 UHF Transmitter Family



EQUIPMENT: UT-4D400 UHF Transmitter Family



## **Section 7.        Field Strength of Spurious Emissions**

**Para. No.: 2.1053**

|                                      |                                 |
|--------------------------------------|---------------------------------|
| <b>Test Performed By:</b> Kevin Carr | <b>Date of Test:</b> 6 Aug 2003 |
|--------------------------------------|---------------------------------|

**Minimum Standard:**        Para. No.'s    90.210 (b), (d)  
                                                                                 22.359 (a), (b)(1) & (b)(2)

**Test Results:**                Complies.

The worst-case emission is -48.4dBm @ 3m at 836 MHz. This is 28.4 dB below the specification limit.

**Measurement Data:**        See attached tables.

*EQUIPMENT: UT-4D400 UHF Transmitter Family***UT-4D420, Radiated Emissions**

| <b>Standard:</b>       |                | Signal Substitution |                           |                         |                             | <b>Date:</b>       | 6-Aug-03           | <b>Tester:</b>   | <b>Dome #</b> 1 |
|------------------------|----------------|---------------------|---------------------------|-------------------------|-----------------------------|--------------------|--------------------|------------------|-----------------|
| <b>Tower:</b>          |                | A                   |                           | <b>Distance:</b>        | 3 m                         | <b>Location:</b>   | Ottawa             | Kevin Carr       |                 |
| <b>Receiver:</b>       |                | 8565E               |                           | <b>Comment:</b>         | Sys 1                       | <b>Temp:</b>       | 21                 | <b>Humidity:</b> | 95              |
| <b>Frequency (MHz)</b> | <b>Antenna</b> | <b>Polarity</b>     | <b>RCVD Signal (dBuV)</b> | <b>Sig. Sub. Factor</b> | <b>Emission Level (dBm)</b> | <b>Limit (dBm)</b> | <b>Margin (dB)</b> | <b>Detector</b>  |                 |
| 1                      | 836.0000       | LP2                 | V                         | 23.0                    | -71.4                       | -48.4              | -20.0              | 28.4             | Peak            |
| 2                      | 836.0000       | LP2                 | H                         | 23.2                    | -72.1                       | -48.9              | -20.0              | 28.9             | Peak            |
| 3                      | 1254.0000      | Horn2               | V                         | 50.5                    | -120.1                      | -69.6              | -20.0              | 49.6             | Peak            |
| 4                      | 1254.0000      | Horn2               | H                         | 50.0                    | -121.1                      | -71.1              | -20.0              | 51.1             | Peak            |
| 5                      | 1672.0000      | Horn2               | V                         | 54.7                    | -118.1                      | -63.4              | -20.0              | 43.4             | Peak            |
| 6                      | 1672.0000      | Horn2               | H                         | 52.2                    | -118.6                      | -66.4              | -20.0              | 46.4             | Peak            |
| 7                      | 2090.0000      | Horn2               | V                         | 63.3                    | -123.2                      | -59.9              | -20.0              | 39.9             | Peak            |
| 8                      | 2090.0000      | Horn2               | H                         | 61.5                    | -124.3                      | -62.8              | -20.0              | 42.8             | Peak            |
| 9                      | 2508.0000      | Horn2               | V                         | 63.5                    | -124.3                      | -60.8              | -20.0              | 40.8             | Peak            |
| 10                     | 2508.0000      | Horn2               | H                         | 61.5                    | -125.3                      | -63.8              | -20.0              | 43.8             | Peak            |
| 11                     | 2926.0000      | Horn2               | V                         | 61.8                    | -121.7                      | -59.9              | -20.0              | 39.9             | Peak            |
| 12                     | 2926.0000      | Horn2               | H                         | 61.5                    | -123.2                      | -61.7              | -20.0              | 41.7             | Peak            |
| 13                     | 3344.0000      | Horn2               | V                         | 61.8                    | -118.9                      | -57.1              | -20.0              | 37.1             | Peak            |
| 14                     | 3344.0000      | Horn2               | H                         | 58.1                    | -120.8                      | -62.7              | -20.0              | 42.7             | Peak            |
| 15                     | 3762.0000      | Horn2               | V                         | 60.3                    | -116.4                      | -56.1              | -20.0              | 36.1             | Peak            |
| 16                     | 3762.0000      | Horn2               | H                         | 61.2                    | -119.4                      | -58.2              | -20.0              | 38.2             | Peak            |
| 14                     | 4180.0000      | Horn2               | V                         | 53.5                    | -113.1                      | -59.6              | -20.0              | 39.6             | Peak            |
| 18                     | 4180.0000      | Horn2               | H                         | 53.8                    | -114.3                      | -60.5              | -20.0              | 40.5             | Peak            |

*EQUIPMENT: UT-4D400 UHF Transmitter Family***UT-4D460, Radiated Emissions**

| <b>Standard:</b> |           | Signal Substitution |          |                    |                  | <b>Date:</b>         | 6-Aug-03    | <b>Tester:</b>   | <b>Dome #</b> | 1 |
|------------------|-----------|---------------------|----------|--------------------|------------------|----------------------|-------------|------------------|---------------|---|
| <b>Tower:</b>    |           | A                   |          | <b>Distance:</b>   | 3 m              | <b>Location:</b>     | Ottawa      | Kevin Carr       |               |   |
| <b>Receiver:</b> |           | 8565E               |          | <b>Comment:</b>    | Sys 1            | <b>Temp:</b>         | 21          | <b>Humidity:</b> | 95            |   |
| Frequency (MHz)  |           | Antenna             | Polarity | RCVD Signal (dBuV) | Sig. Sub. Factor | Emission Level (dBm) | Limit (dBm) | Margin (dB)      | Detector      |   |
| 1                | 920.0000  | LP2                 | V        | 21.7               | -70.4            | -48.7                | -20.0       | 28.7             | Peak          |   |
| 2                | 920.0000  | LP2                 | H        | 22.3               | -70.6            | -48.3                | -20.0       | 28.3             | Peak          |   |
| 3                | 1380.0000 | Horn2               | V        | 48.5               | -119.8           | -71.3                | -20.0       | 51.3             | Peak          |   |
| 4                | 1380.0000 | Horn2               | H        | 51.0               | -119.0           | -68.0                | -20.0       | 48.0             | Peak          |   |
| 5                | 1840.0000 | Horn2               | V        | 54.4               | -116.2           | -61.8                | -20.0       | 41.8             | Peak          |   |
| 6                | 1840.0000 | Horn2               | H        | 51.7               | -116.4           | -64.7                | -20.0       | 44.7             | Peak          |   |
| 7                | 2300.0000 | Horn2               | V        | 65.5               | -124.1           | -58.6                | -20.0       | 38.6             | Peak          |   |
| 8                | 2300.0000 | Horn2               | H        | 66.5               | -126.1           | -59.6                | -20.0       | 39.6             | Peak          |   |
| 9                | 2760.0000 | Horn2               | V        | 75.5               | -123.0           | -47.5                | -20.0       | 27.5             | Peak          |   |
| 10               | 2760.0000 | Horn2               | H        | 72.2               | -124.0           | -51.8                | -20.0       | 31.8             | Peak          |   |
| 11               | 3220.0000 | Horn2               | V        | 63.5               | -119.2           | -55.7                | -20.0       | 35.7             | Peak          |   |
| 12               | 3220.0000 | Horn2               | H        | 62.5               | -121.1           | -58.6                | -20.0       | 38.6             | Peak          |   |
| 13               | 3680.0000 | Horn2               | V        | 67.3               | -117.1           | -49.8                | -20.0       | 29.8             | Peak          |   |
| 14               | 3680.0000 | Horn2               | H        | 63.7               | -119.8           | -56.1                | -20.0       | 36.1             | Peak          |   |
| 15               | 4140.0000 | Horn2               | V        | 57.2               | -113.0           | -55.8                | -20.0       | 35.8             | Peak          |   |
| 16               | 4140.0000 | Horn2               | H        | 55.2               | -114.2           | -59.0                | -20.0       | 39.0             | Peak          |   |
| 14               | 4600.0000 | Horn2               | V        | 54.3               | -112.3           | -58.0                | -20.0       | 38.0             | Peak          |   |
| 18               | 4600.0000 | Horn2               | H        | 57.2               | -113.1           | -55.9                | -20.0       | 35.9             | Peak          |   |

## **Section 8. Frequency Stability**

**Para. No.: 2.1055**

|                                      |                                   |
|--------------------------------------|-----------------------------------|
| <b>Test Performed By:</b> Kevin Carr | <b>Date of Test:</b> 30 July 2003 |
|--------------------------------------|-----------------------------------|

**Minimum Standard:** Para. No.'s 22.355  
90.213

**Test Results:** Complies

The maximum frequency drift is 347 Hz.  
This is 0.8 ppm.

**Measurement Data:** See attached tables.

|                              |                |
|------------------------------|----------------|
| Standard Test Voltage (STV): | 13.8 VDC       |
| Test Frequency:              |                |
| UT-4D420                     | 418.000072 MHz |
| UT-4D460                     | 460.000077 MHz |

*EQUIPMENT: UT-4D400 UHF Transmitter Family*

**UT-4D420**

**Voltage Stability**

|                | Ref. Freq. | Measured   | Variance |     |
|----------------|------------|------------|----------|-----|
|                | (MHz)      | (MHz)      | (Hz)     | ppm |
| 85%, 11.7VDC   | 418.000072 | 418.000063 | 9        | 0.0 |
| 100%, 13.8VDC  | 418.000072 | 418.000072 | 0        | 0.0 |
| 115%, 15.87VDC | 418.000072 | 418.000060 | 12       | 0.0 |

**Temperature Stability**

|     | Ref. Freq. | Measured   | Variance |      |
|-----|------------|------------|----------|------|
|     | (MHz)      | (MHz)      | (Hz)     | ppm  |
| -30 | 418.000072 | 418.000278 | -206     | -0.5 |
| 50  | 418.000072 | 418.000059 | 13       | 0.0  |

**UT-4D460**

**Voltage Stability**

|                | Ref. Freq. | Measured   | Variance |     |
|----------------|------------|------------|----------|-----|
|                | (MHz)      | (MHz)      | (Hz)     | ppm |
| 85%, 11.7VDC   | 460.000077 | 460.000077 | 0        | 0.0 |
| 100%, 13.8VDC  | 460.000077 | 460.000077 | 0        | 0.0 |
| 115%, 15.87VDC | 460.000077 | 460.000070 | 7        | 0.0 |

**Temperature Stability**

|     | Ref. Freq. | Measured  | Variance |      |
|-----|------------|-----------|----------|------|
|     | (MHz)      | (MHz)     | (Hz)     | ppm  |
| -30 | 460.000077 | 460.00022 | -143     | -0.3 |
| 50  | 460.000077 | 459.99973 | 347      | 0.8  |

## **Section 9. Transient Frequency Behaviour**

|                                      |                                  |
|--------------------------------------|----------------------------------|
| <b>Test Performed By:</b> Kevin Carr | <b>Date of Test:</b> 1 Aug. 2003 |
|--------------------------------------|----------------------------------|

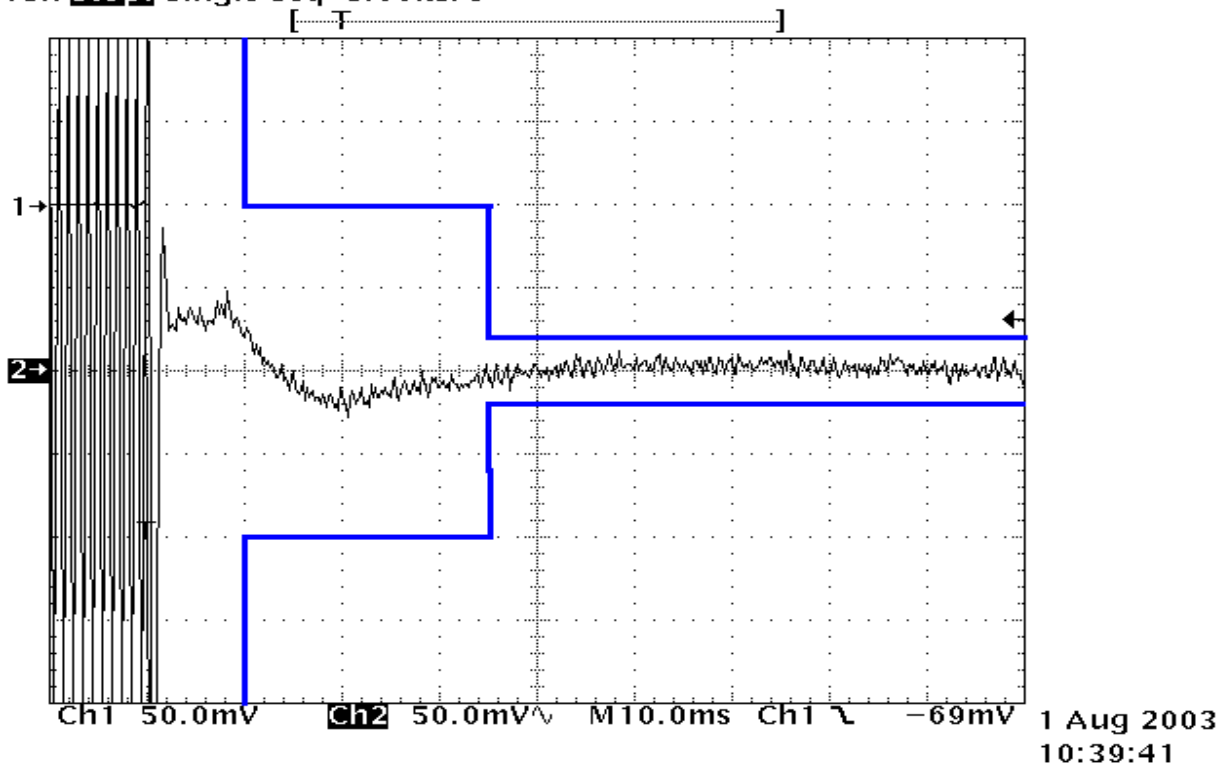
**Minimum Standard:** Para. No. 90.214

**Test Results:** Complies

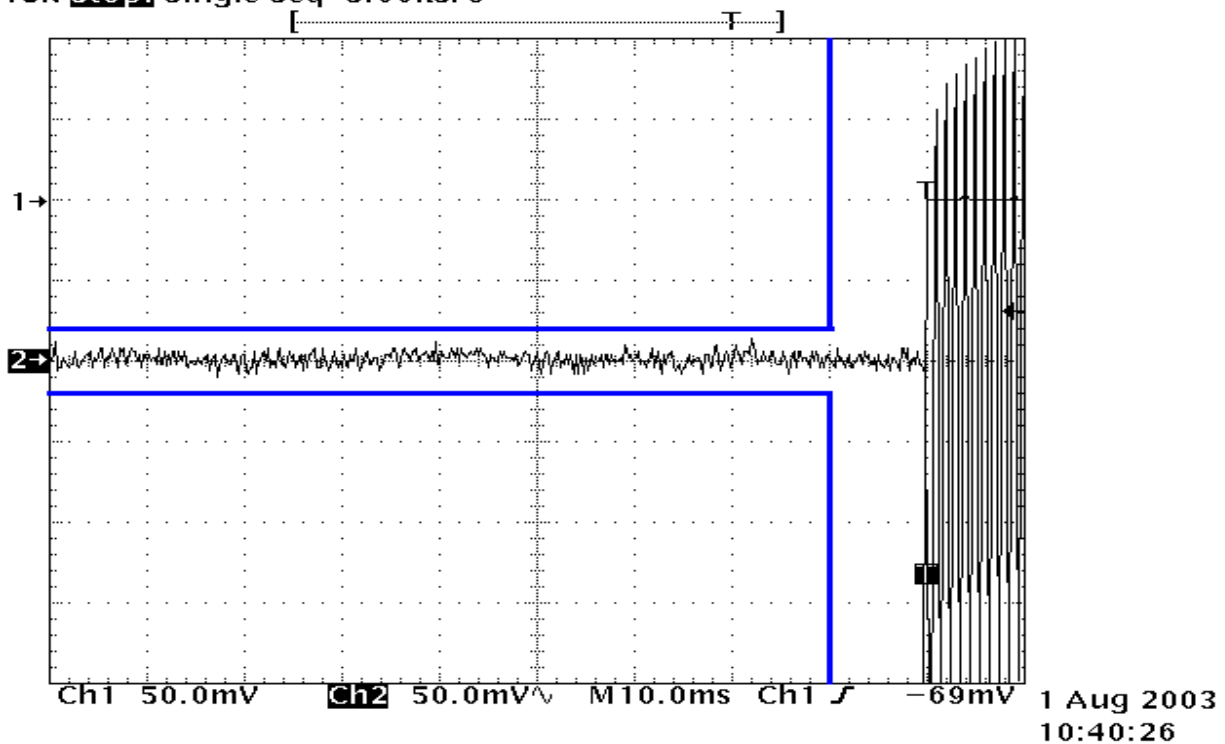
**Measurement Data:** See attached graphs.

EQUIPMENT: UT-4D400 UHF Transmitter Family

UT-4D420, 12,5kHz Ch. Spacing  
Tek **Stop** Single Seq 5.00kS/s



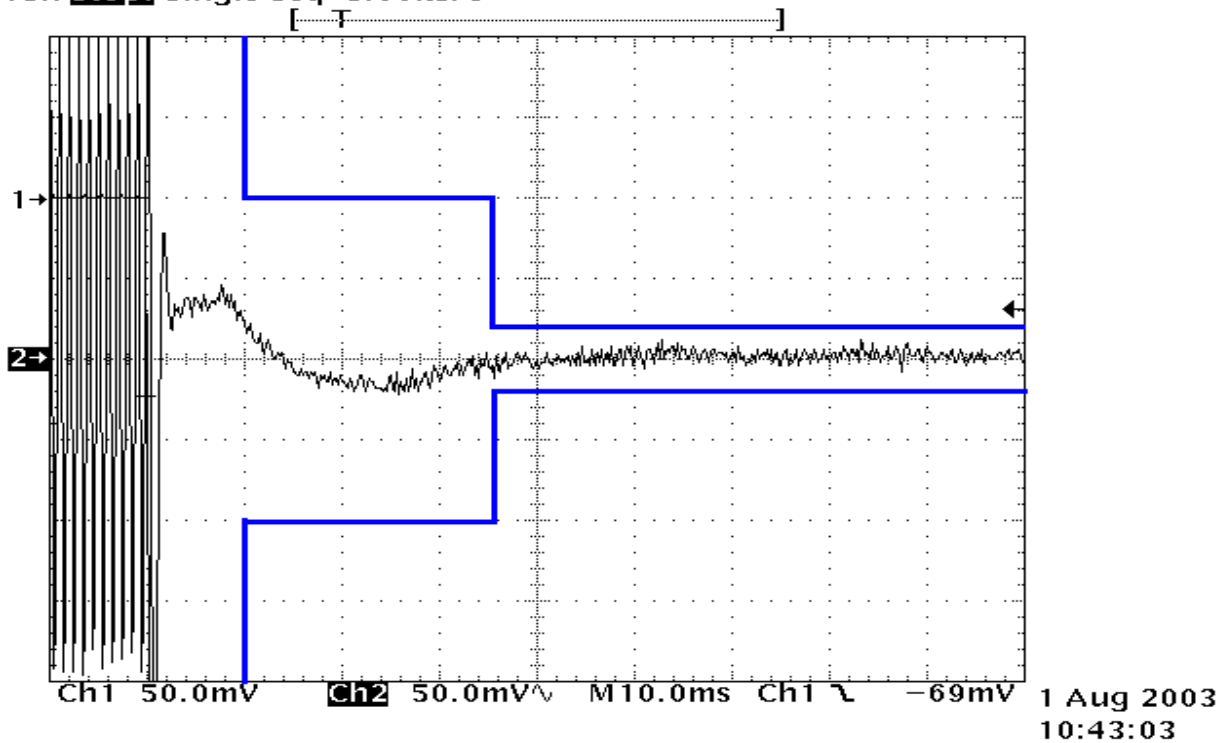
Tek **Stop** Single Seq 5.00kS/s



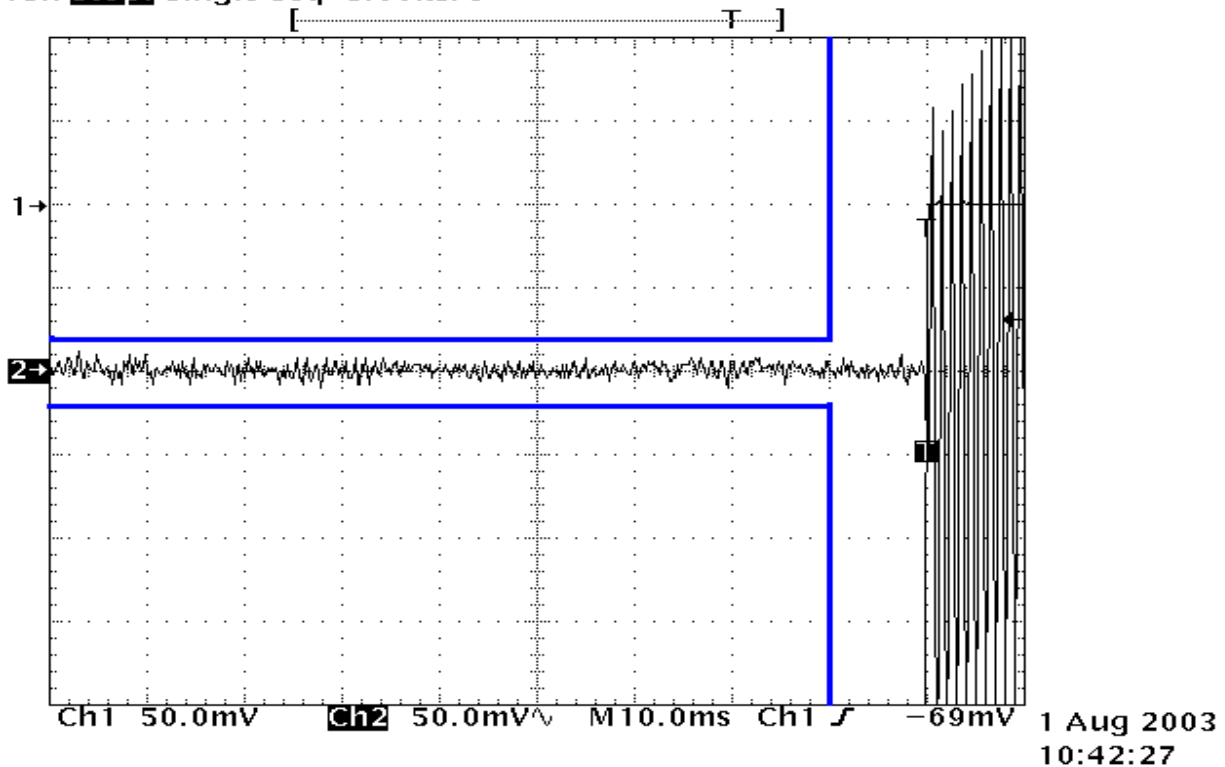
EQUIPMENT: UT-4D400 UHF Transmitter Family

UT-4D420, 25kHz Ch. Spacing

Tek **Stop**: Single Seq 5.00kS/s

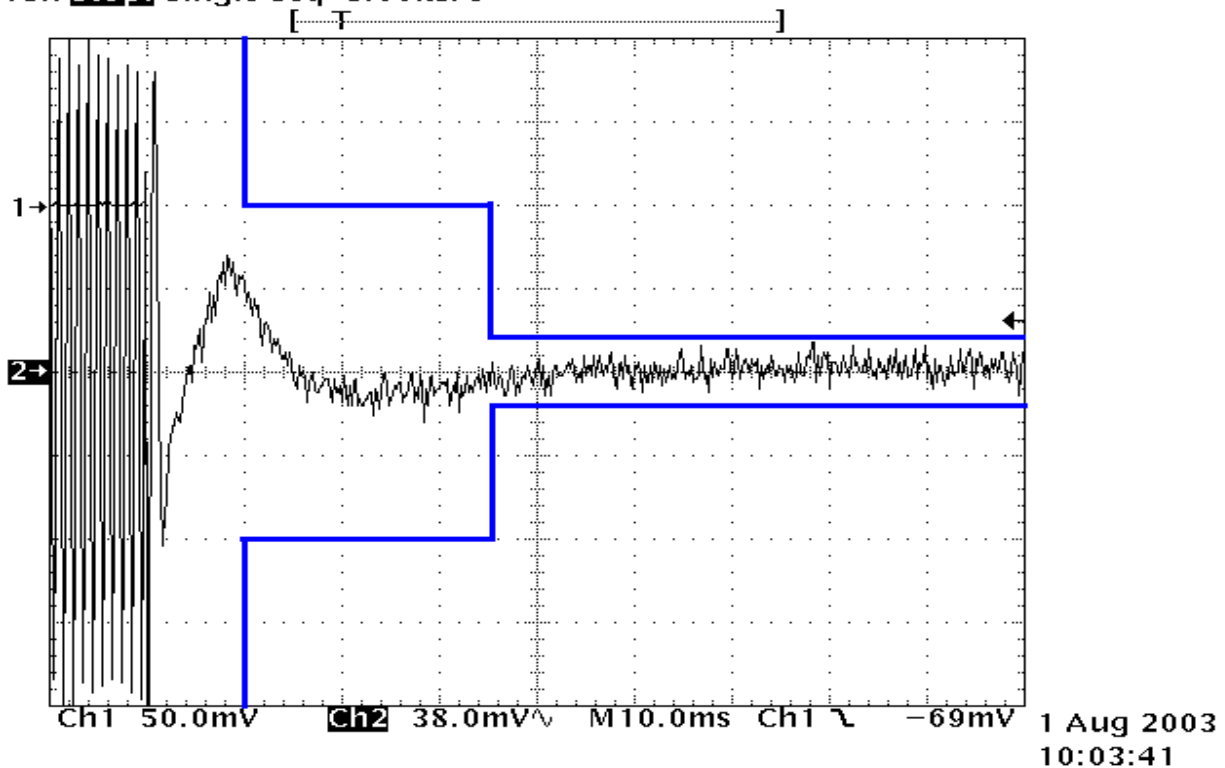


Tek **Stop**: Single Seq 5.00kS/s

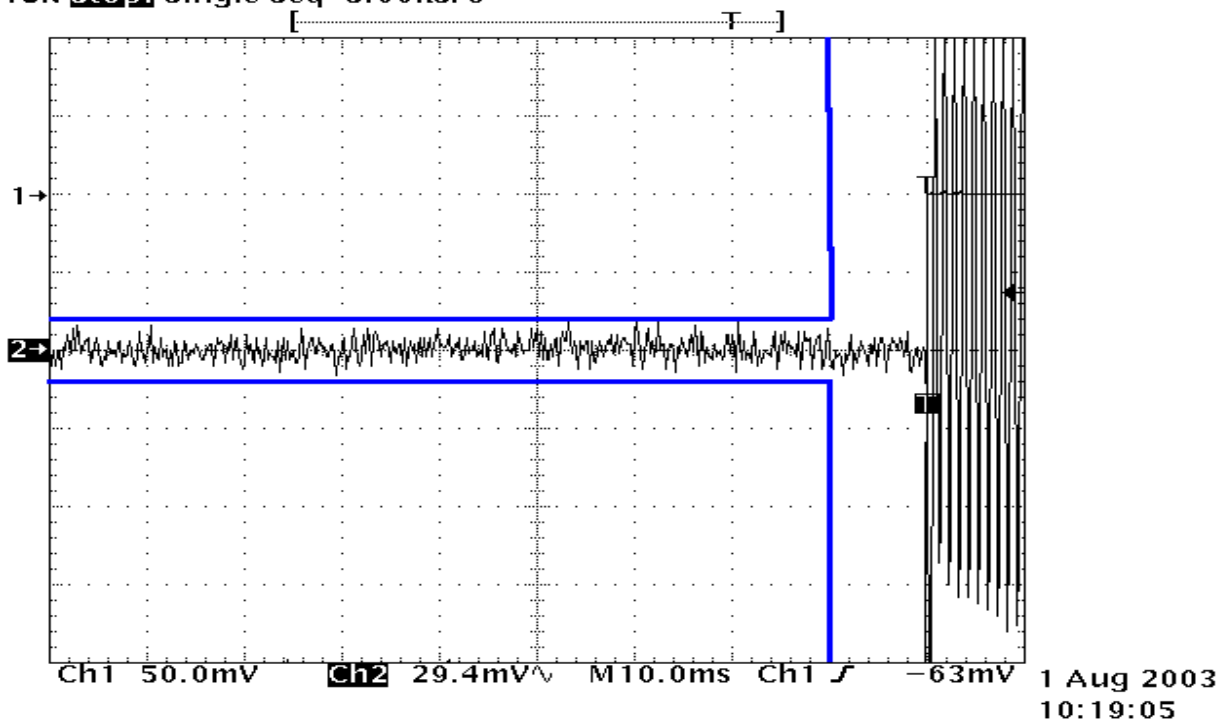


EQUIPMENT: UT-4D400 UHF Transmitter Family

UT-4D460, 12,5kHz Ch. Spacing  
Tek **Stop** Single Seq 5.00kS/s



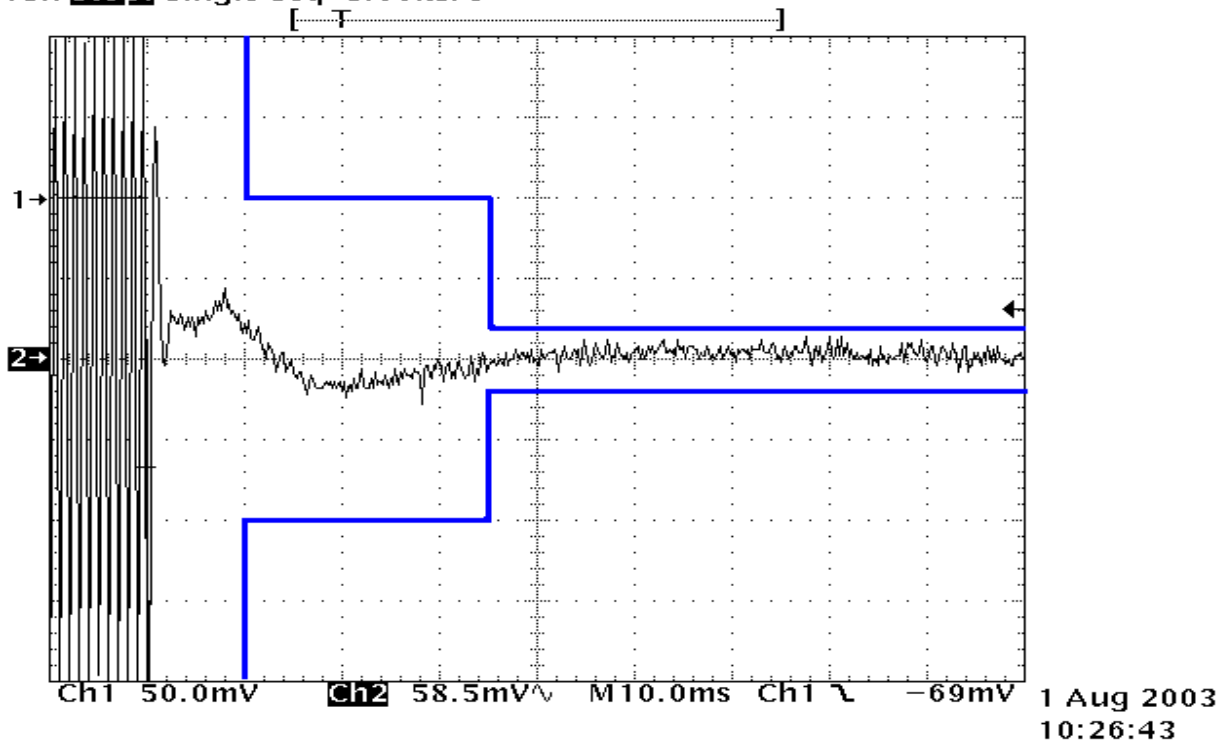
Tek **Stop** Single Seq 5.00kS/s



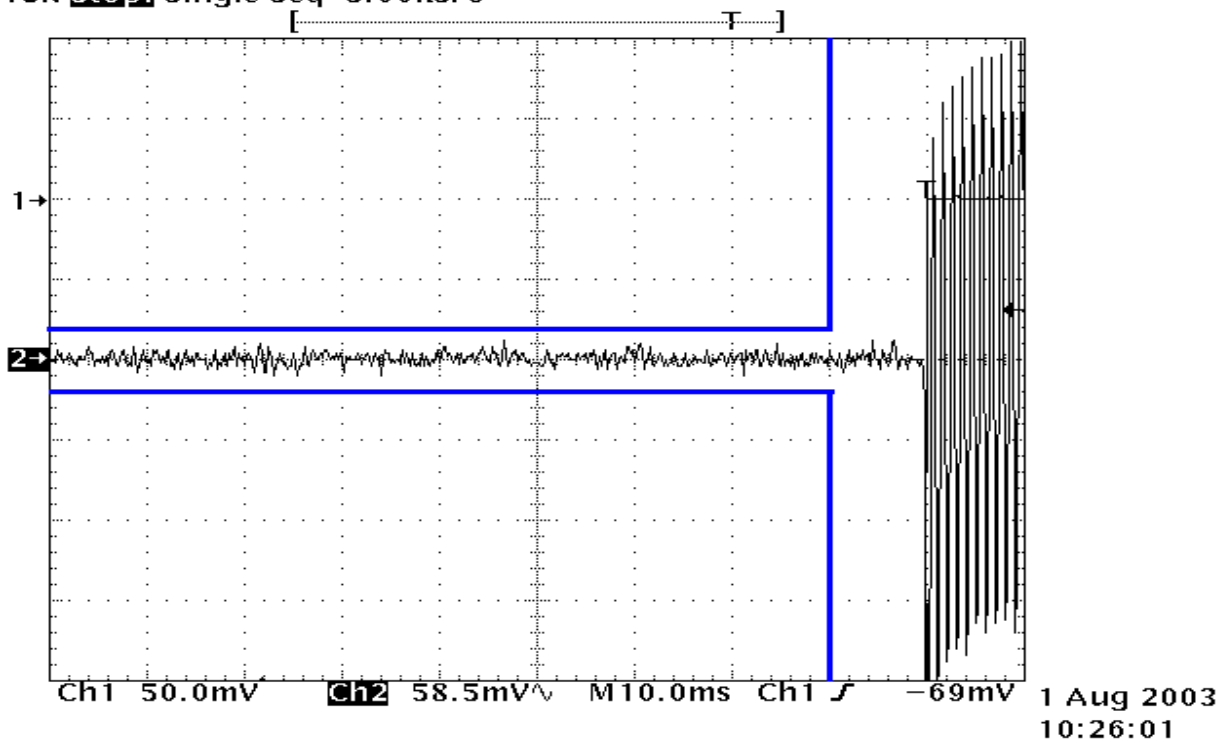
EQUIPMENT: UT-4D400 UHF Transmitter Family

UT-4D460, 25kHz Ch. Spacing

Tek **Stop**: Single Seq 5.00kS/s

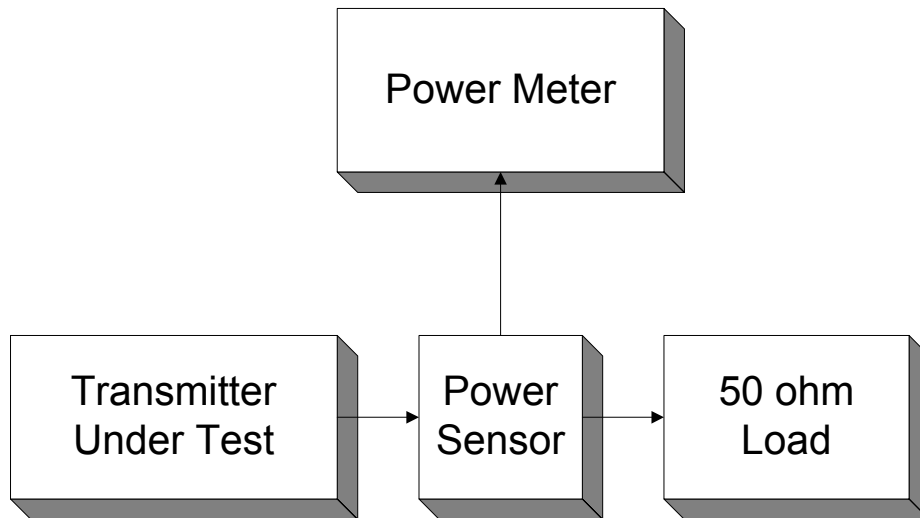


Tek **Stop**: Single Seq 5.00kS/s

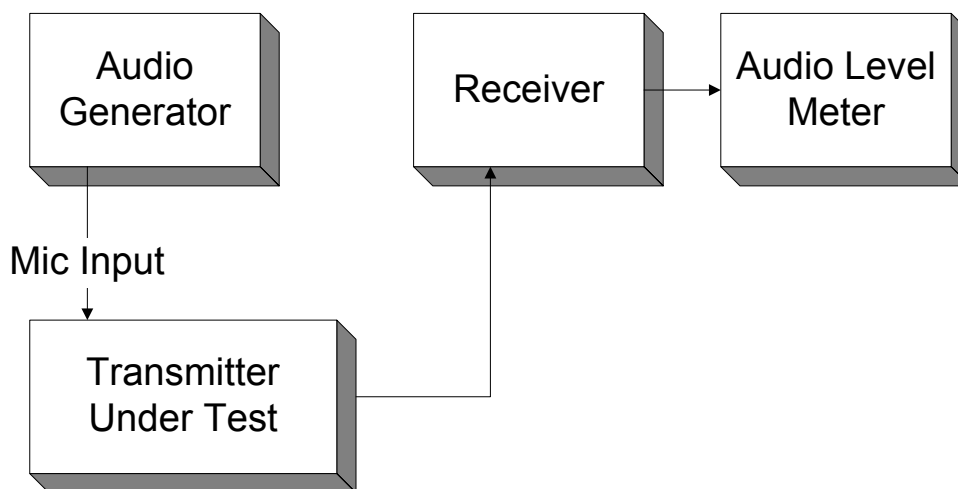


## **Section 10.      Block Diagrams**

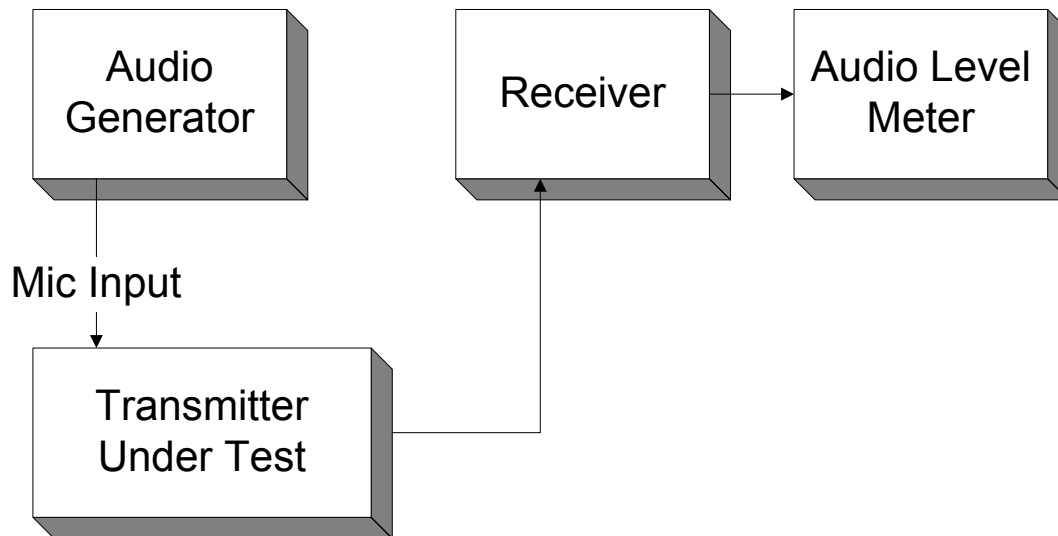
### **Para. No. 2.1046 - R.F. Power Output**



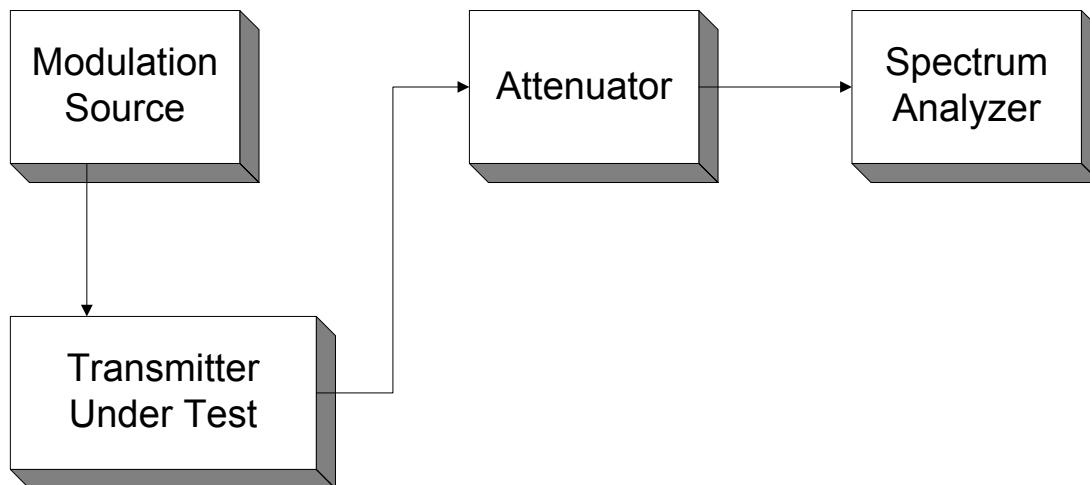
### **Para. No. 2.1047 - Audio Frequency Response**



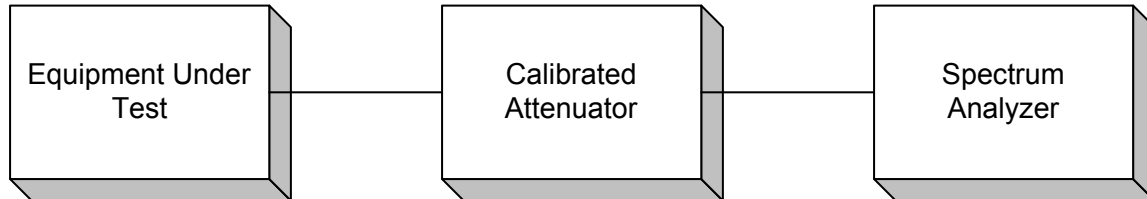
**Para. No. 2.1047 - Modulation Limiting**



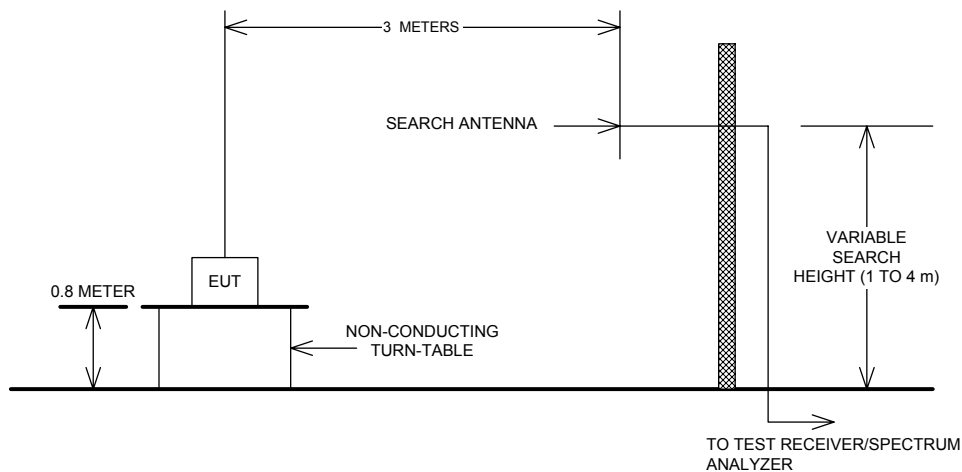
**Para. No. 2.1049 - Occupied Bandwidth**



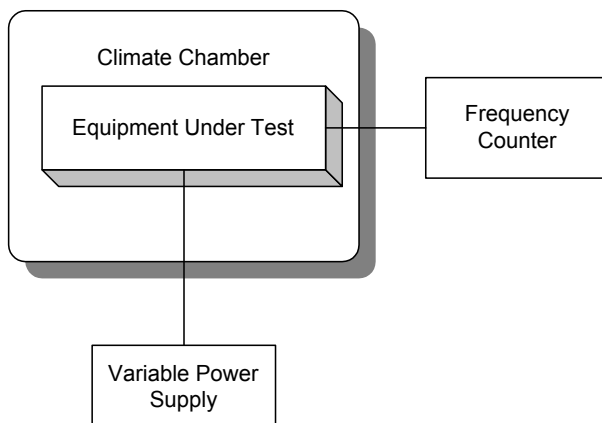
**Para. No. 2.1051 - Spurious Emissions at Antenna Terminals**



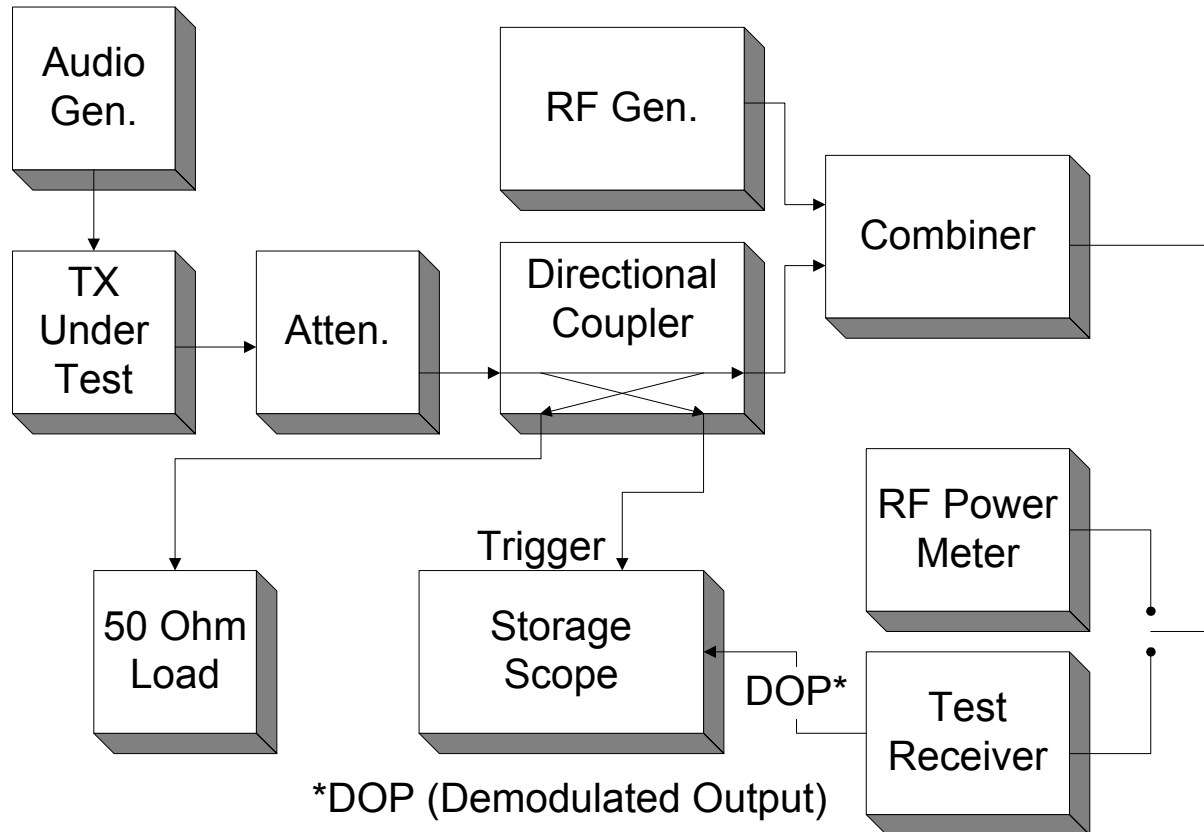
**Para. No. 2.1053 - Field Strength of Spurious Radiation**



**Para. No. 2.1055 - Frequency Stability**



**Para. No. 90.214 - Transient Frequency Behaviour**



**Voice**

This measurement was made using measurement procedure TIA/EIA Land Mobile FM or PM Communications Equipment Measurement and Performance Standards TIA/EIA-603 February 1993 Telecommunications Industry Association (American National Standard ANSI/TIA/EIA-603-1992 Approved: October 27, 1992) Para. no. 2.2 Methods of Measurement for Transmitters Para. no. 2.2.19 Transient Frequency Behaviour (page no. 83).

**Data**

This measurement was made using measurement procedure TIA/EIA Digital C4FM/CQPSK Transceiver Measurement Methods TSB102.CAAA Para. no. 2.2.17 Transient Frequency Behaviour (page no. 74).

*EQUIPMENT: UT-4D400 UHF Transmitter Family***Section 11. Test Equipment List***Equipment List - Radiated Emissions*

| CAL Cycle                                                                                     | Equipment               | Manufacturer    | Model No. | Asset/Serial No. | Last Cal.    | Next Cal.    |
|-----------------------------------------------------------------------------------------------|-------------------------|-----------------|-----------|------------------|--------------|--------------|
| 1 Year                                                                                        | Spectrum Analyzer       | Hewlett-Packard | 8565E     | FA000981         | July. 3/03   | July. 3/04   |
| 1 Year                                                                                        | Biconical (1) Antenna   | EMCO            | 3109      | FA000805         | April. 15/03 | April. 15/04 |
| 1 Year                                                                                        | Horn Antenna #2         | EMCO            | 3115      | FA000825         | Dec. 09/02   | Dec. 09/03   |
| 1 Year                                                                                        | Log Periodic Antenna #2 | EMCO            | 3148      | FA001355         | May. 09/03   | May. 09/04   |
| 1 Year                                                                                        | 1.0 – 2.0 GHz Amplifier | JCA             | 12-400    | FA001498         | June. 18/03  | June. 18/04  |
| 1 Year                                                                                        | 2.0 – 4.0 GHz Amplifier | JCA             | 24-600    | FA001496         | June. 18/03  | June. 18/04  |
| 1 Year                                                                                        | 4.0 – 8.0 GHz Amplifier | JCA             | 48-600    | FA001497         | June. 18/03  | June. 18/04  |
| COU                                                                                           | Notch Filter            | K&L             | 3TNF      | FA001666         | COU          | COU          |
| 1 Year                                                                                        | Pwr meter               | HP              | E4418B    | FA001413         | May 8/03     | May 8/04     |
| 1 Year                                                                                        | Pwr Head                | HP              | 8487A     | FA001419         | May 15/03    | May 15/04    |
| 1 year                                                                                        | CMTA                    | R&S             | 54        | FA001317         | Oct. 23/03   | Oct. 23/04   |
| Note: N/A = Not Applicable, NCR = No Cal Required, COU = CAL On Use, OUT = Out For CAL/Repair |                         |                 |           |                  |              |              |