



# 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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*EQUIPMENT: UT-4D400 UHF Transmitter Family*

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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.

**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 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) 12.5kHz Ch. Spacing</b>	11K0F3E
<b>25kHz Ch. Spacing</b>	16K0F3E
<b>Emission Designator (Digital) 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
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**Minimum Standard:** ± 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
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**Minimum Standard:** Not applicable.

**Test Results:** Complies

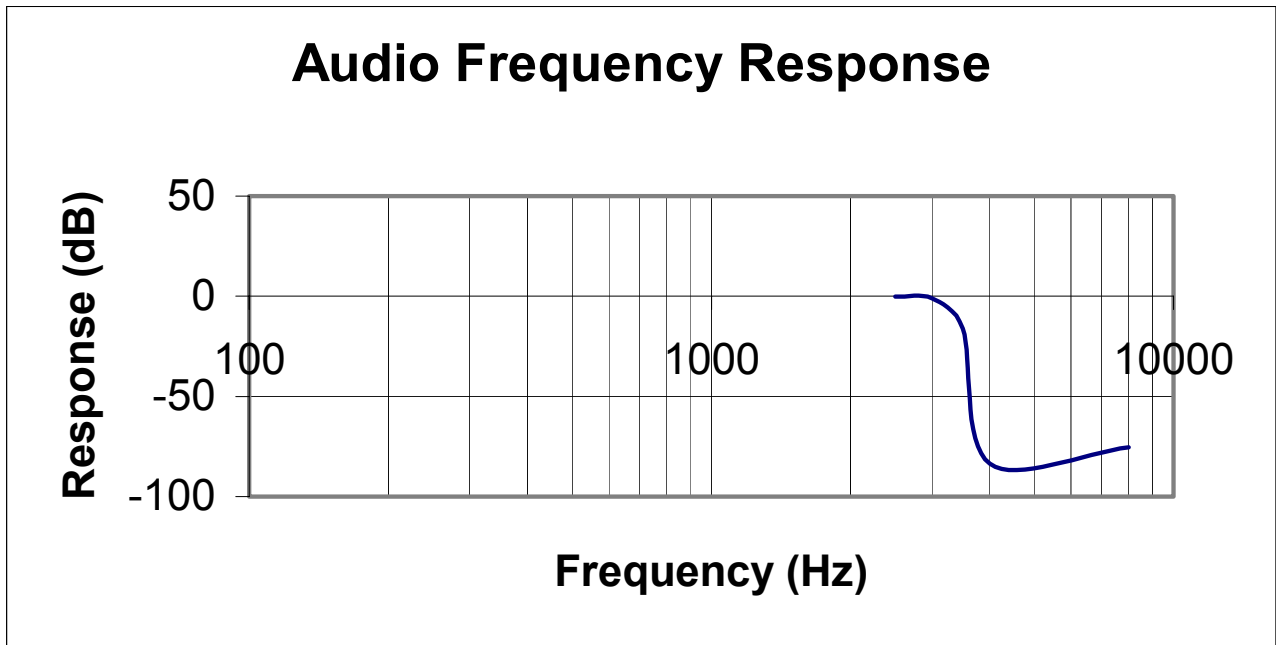
The equipment has provisions for audio low pass filter.

**Measurement Data:** See attached graph.

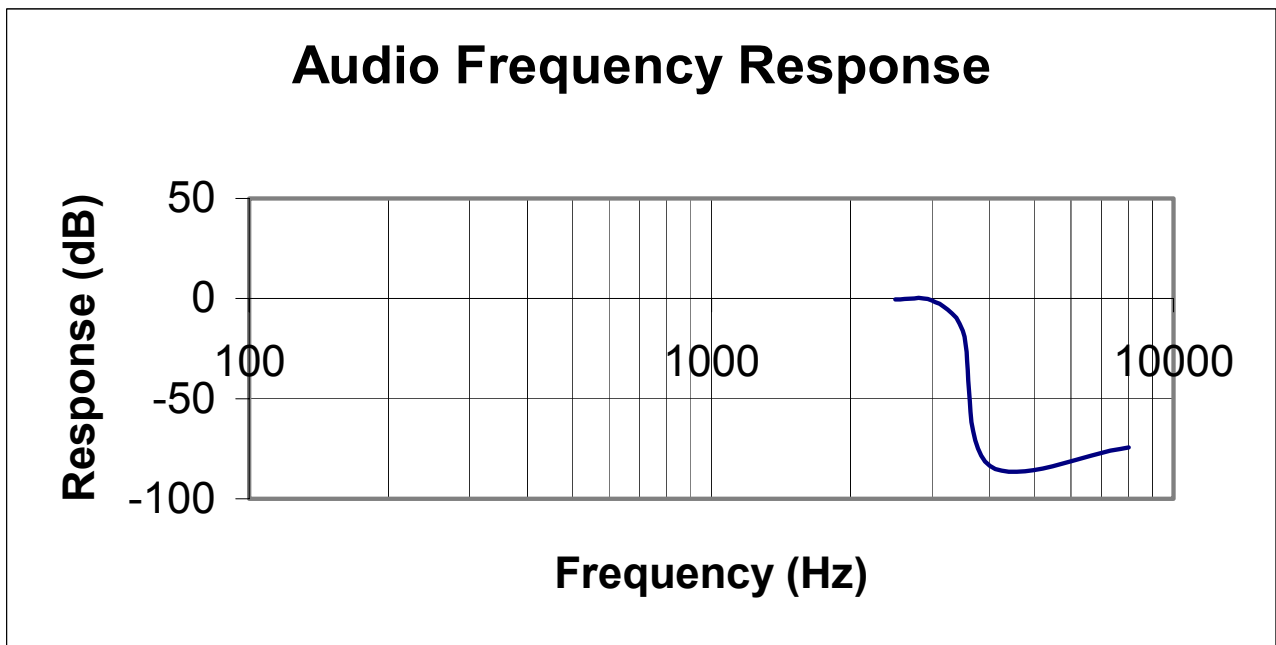
EQUIPMENT: UT-4D400 UHF Transmitter Family

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Worst Case, 25 kHz, Ch. Spacing



Worst Case, 12.5 kHz, Ch. Spacing





*EQUIPMENT: UT-4D400 UHF Transmitter Family*

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**Section 5. Occupied Bandwidth**

**Para. No.: 2.1049**

<b>Test Performed By:</b> Kevin Carr	<b>Date of Test:</b> 29 July 2003
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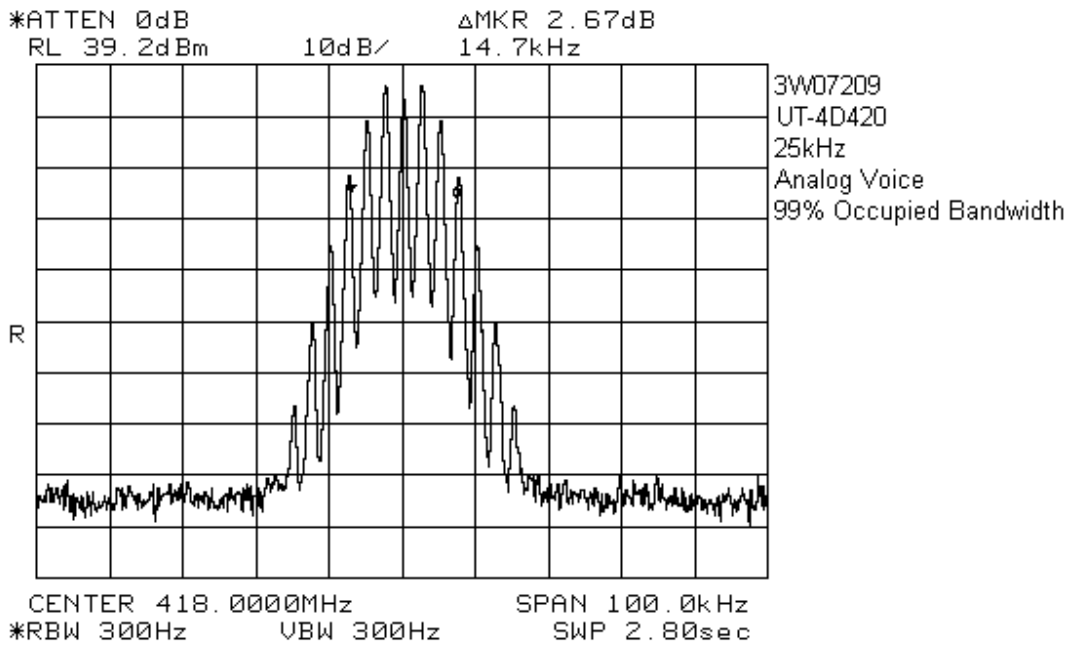
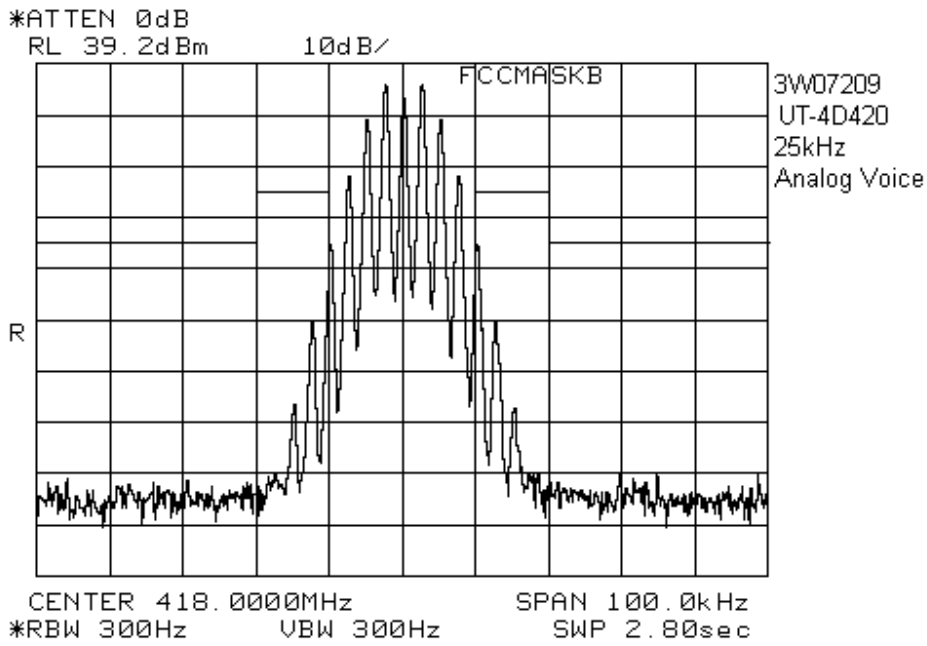
**Minimum Standard:** Para. No.'s 90.210(b)  
90.210(d)  
22.359(a), (b)(1) & (b)(2)

**Test Results:** Complies

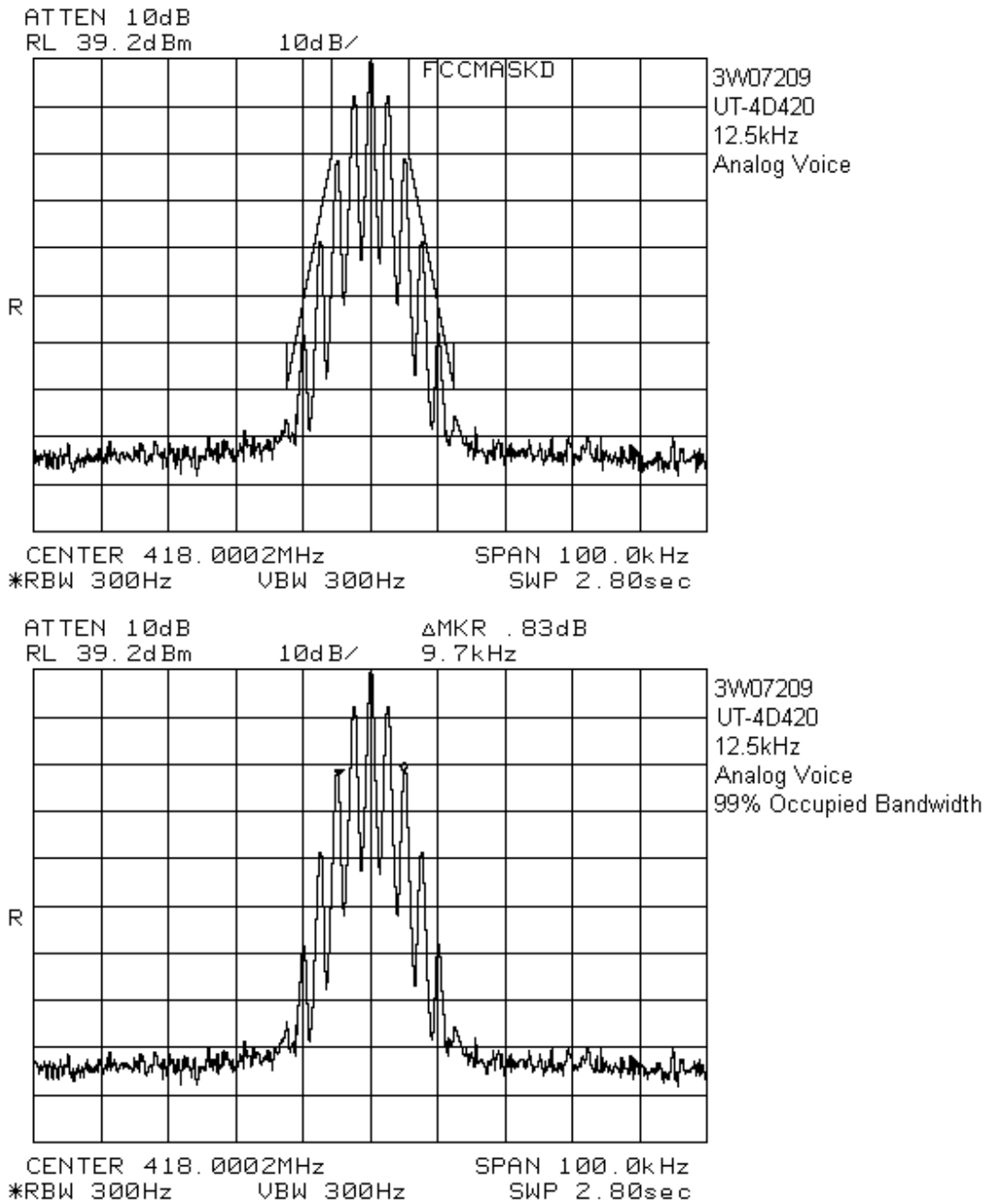
**Measurement Data:** See attached graphs.

EQUIPMENT: UT-4D400 UHF Transmitter Family

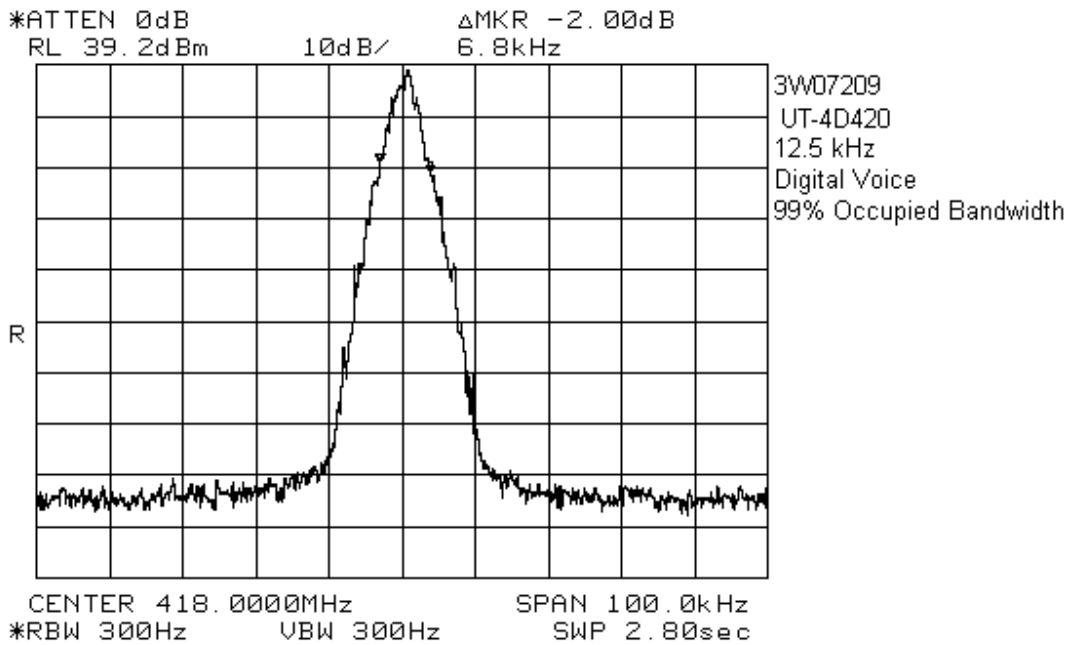
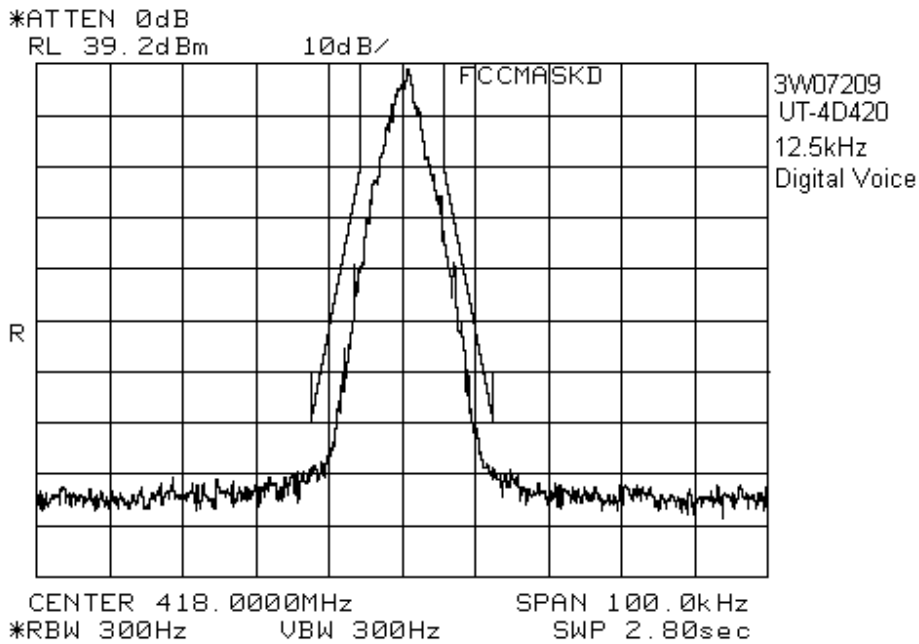
UT-4D420



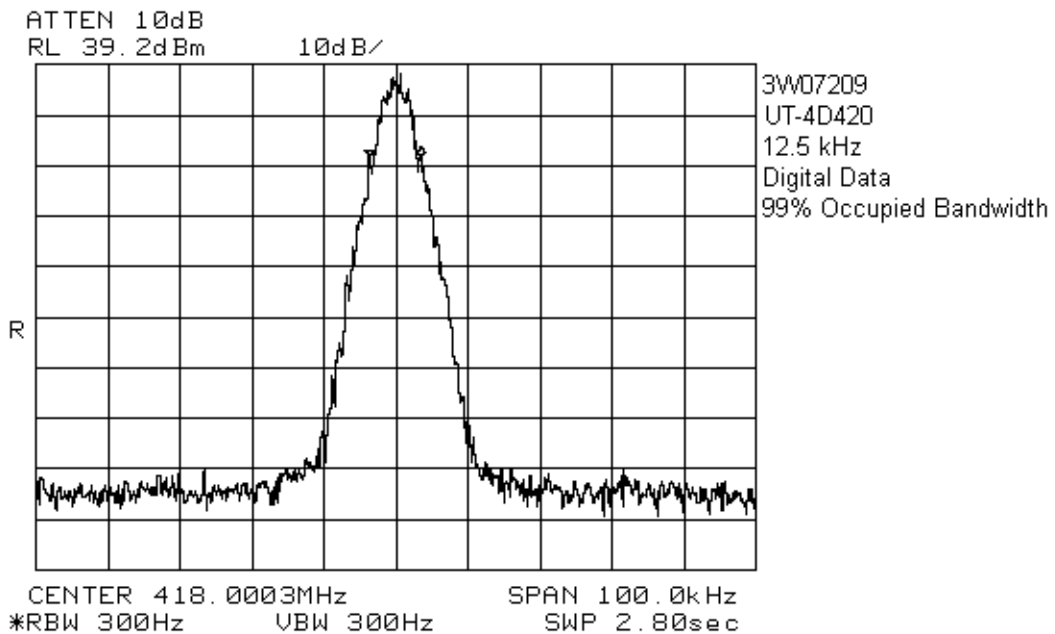
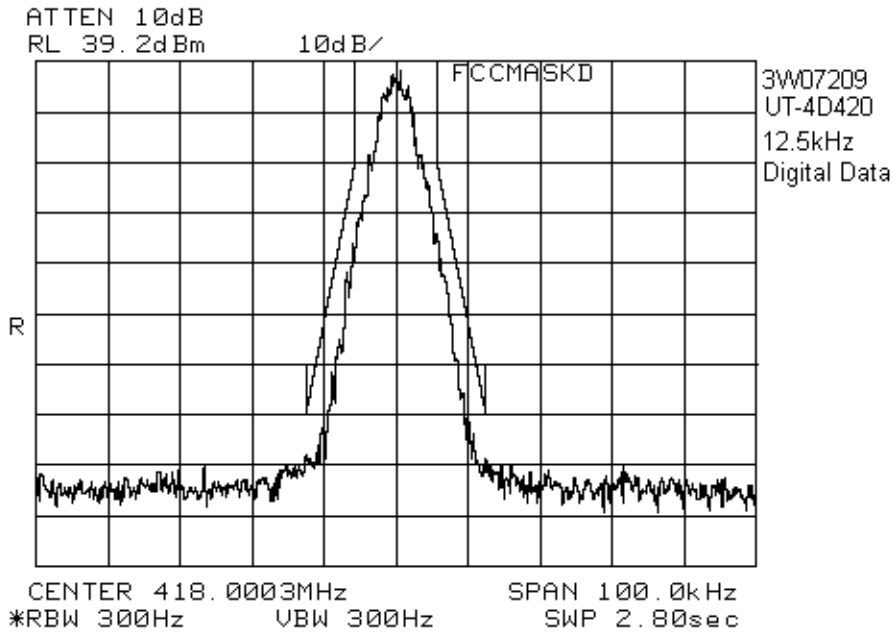
EQUIPMENT: UT-4D400 UHF Transmitter Family



EQUIPMENT: UT-4D400 UHF Transmitter Family

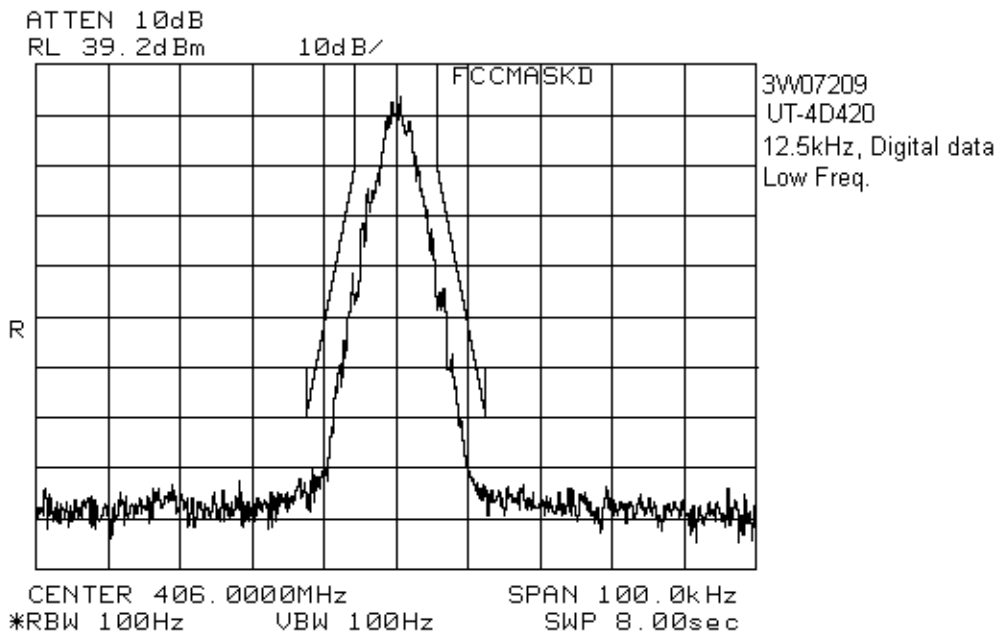
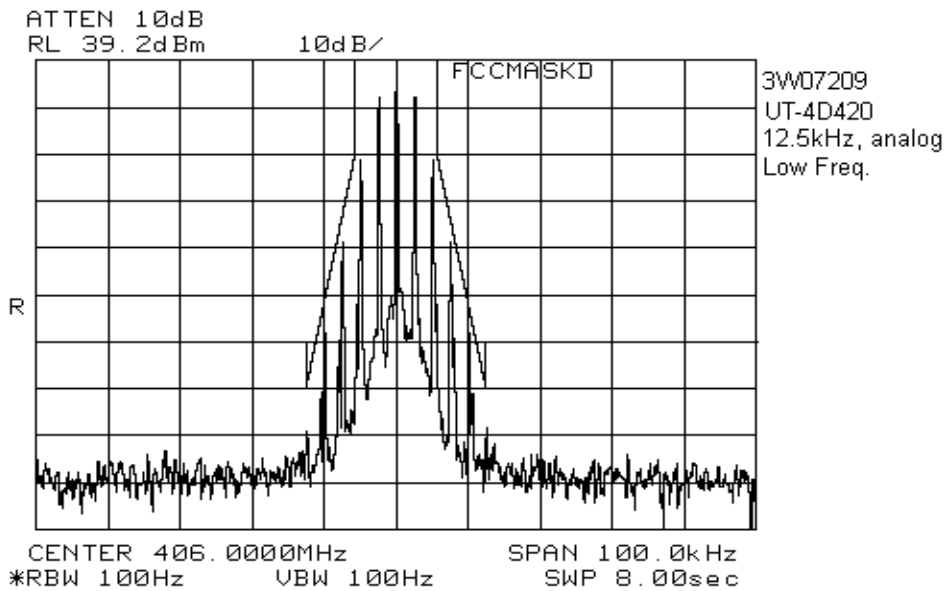


EQUIPMENT: UT-4D400 UHF Transmitter Family

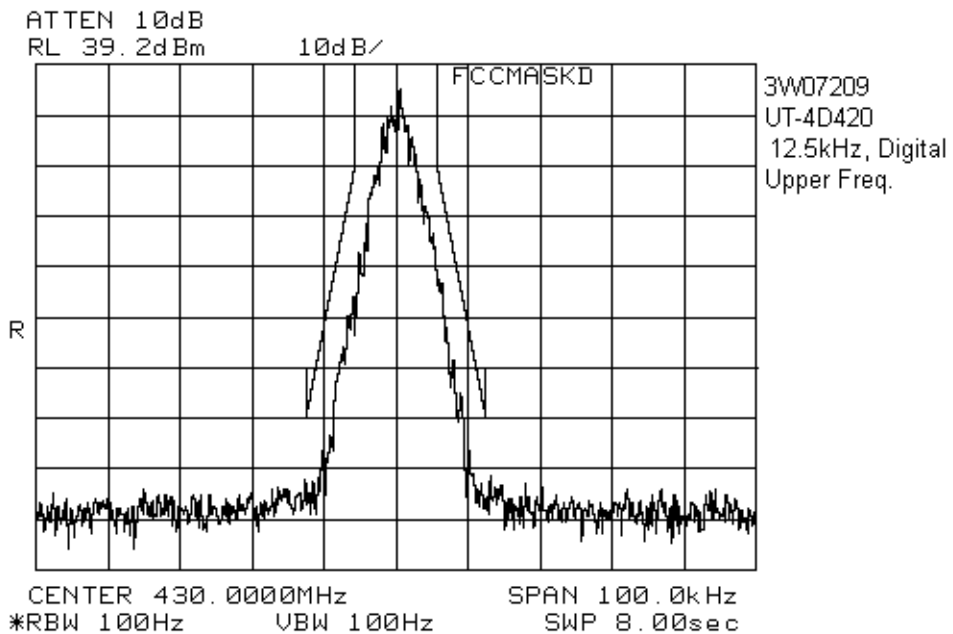
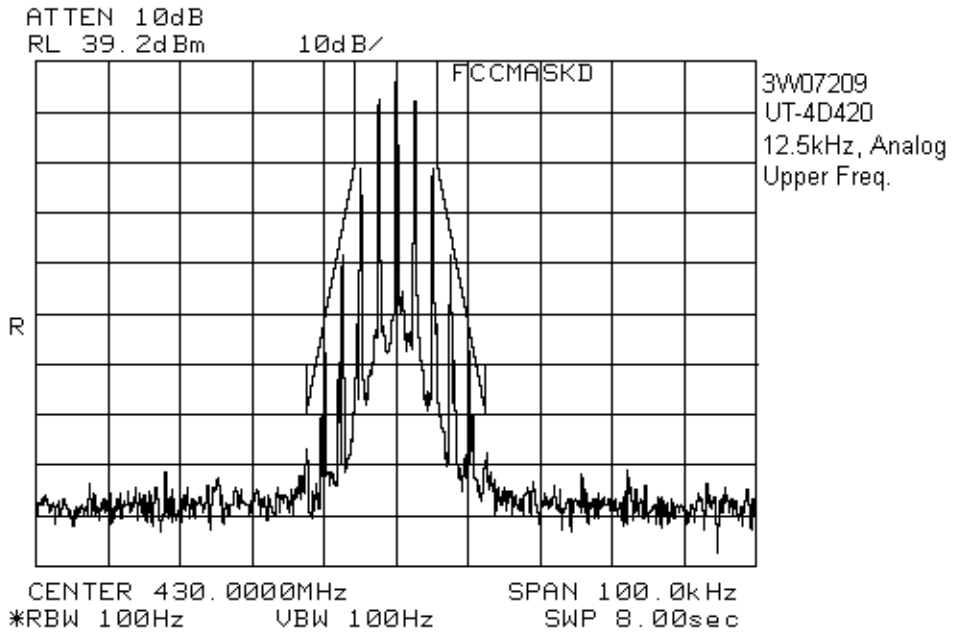


EQUIPMENT: UT-4D400 UHF Transmitter Family

Upper and Lower Frequencies

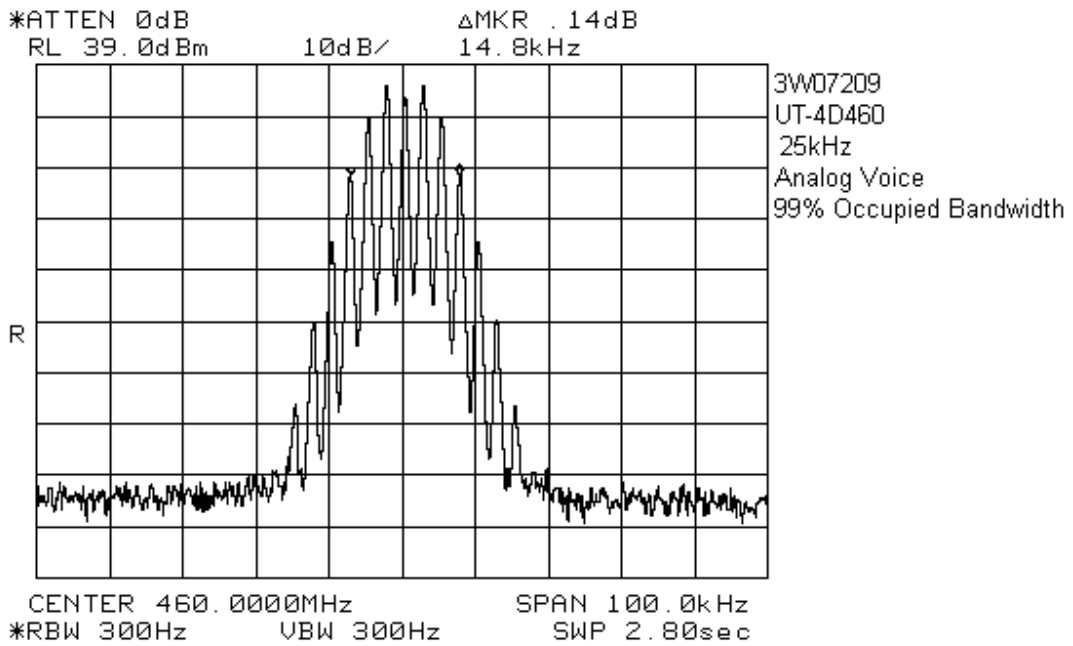
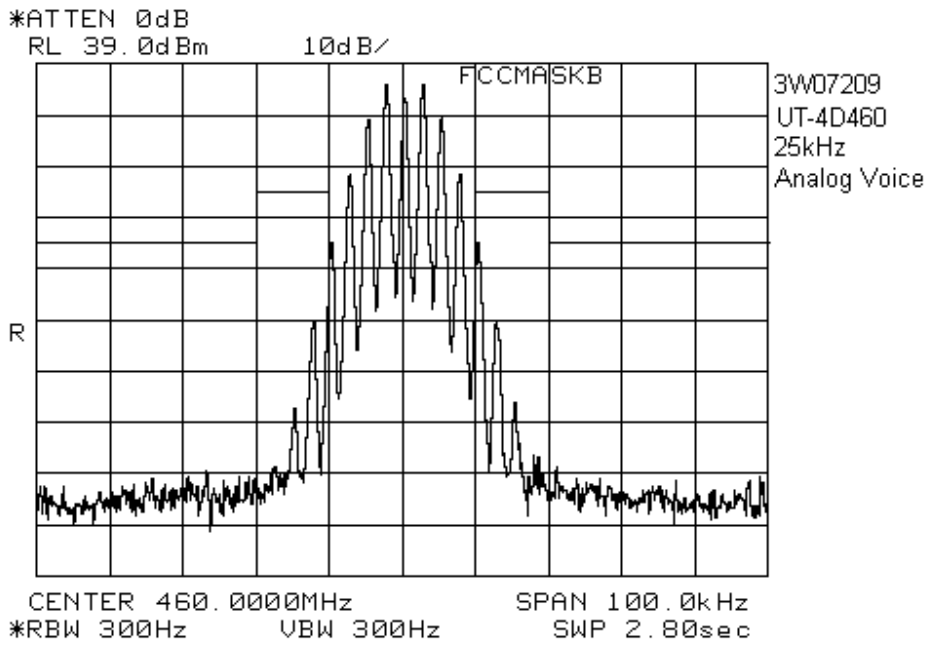


EQUIPMENT: UT-4D400 UHF Transmitter Family



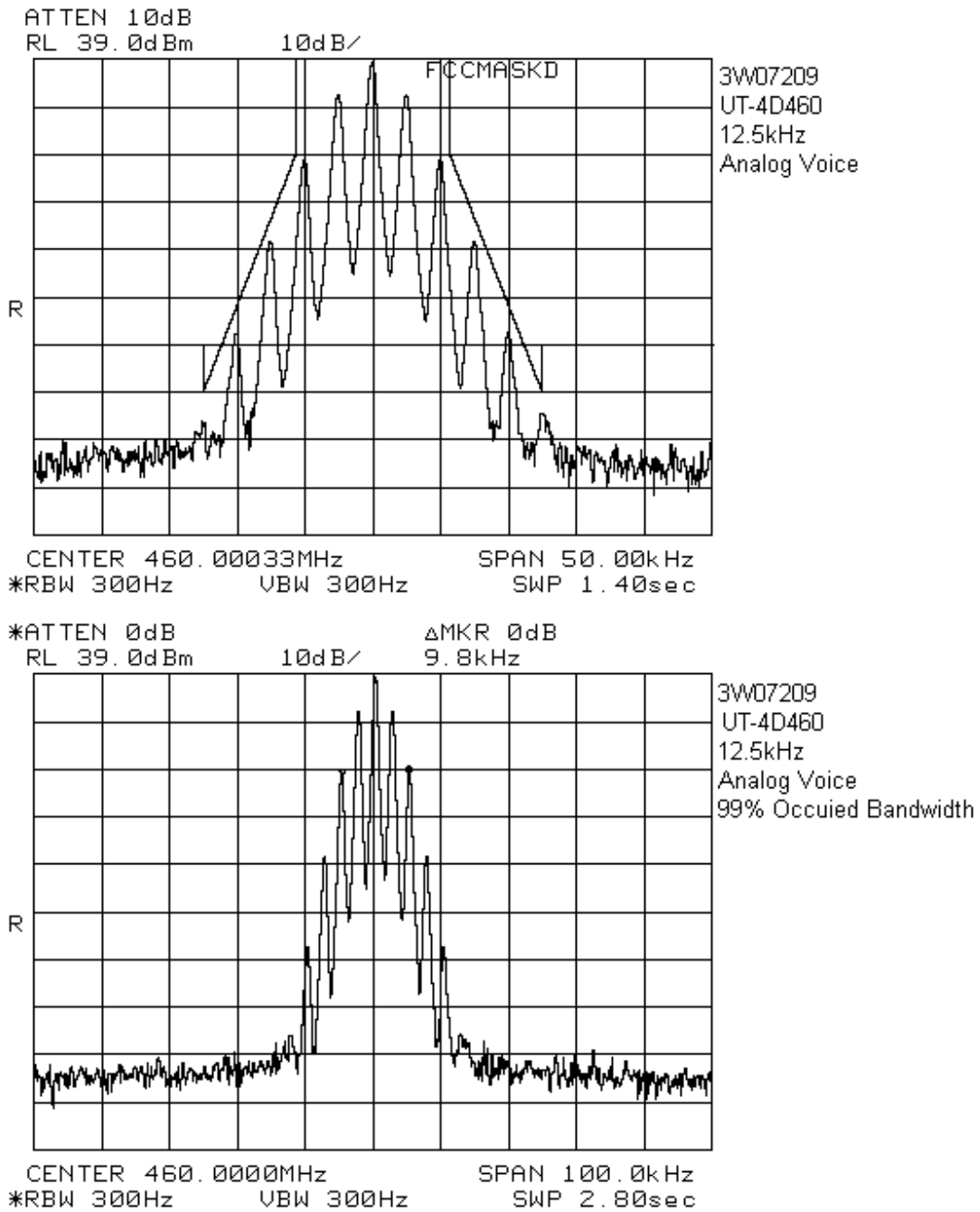
EQUIPMENT: UT-4D400 UHF Transmitter Family

UT-4D460

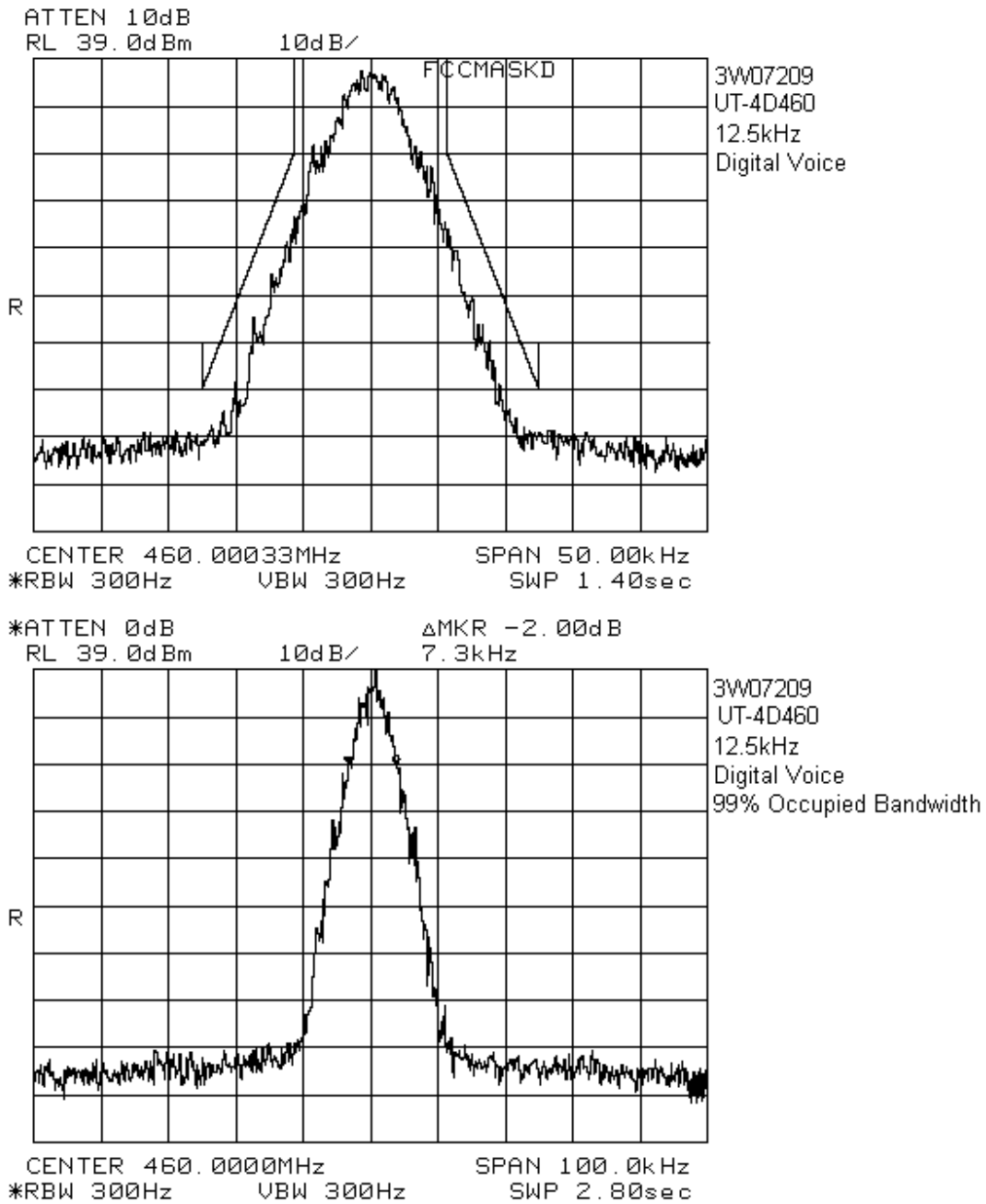




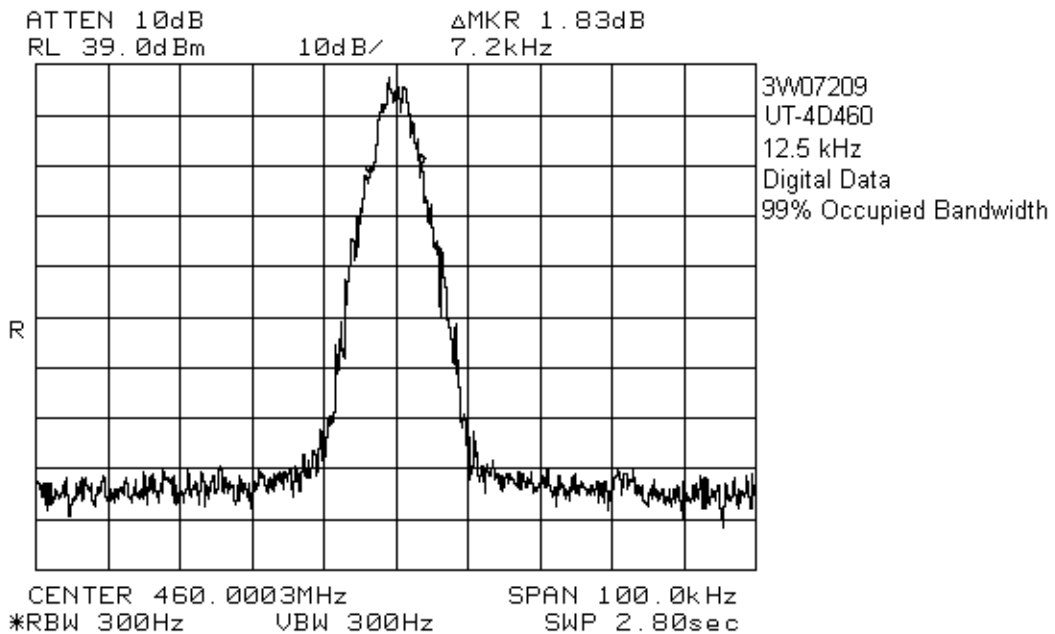
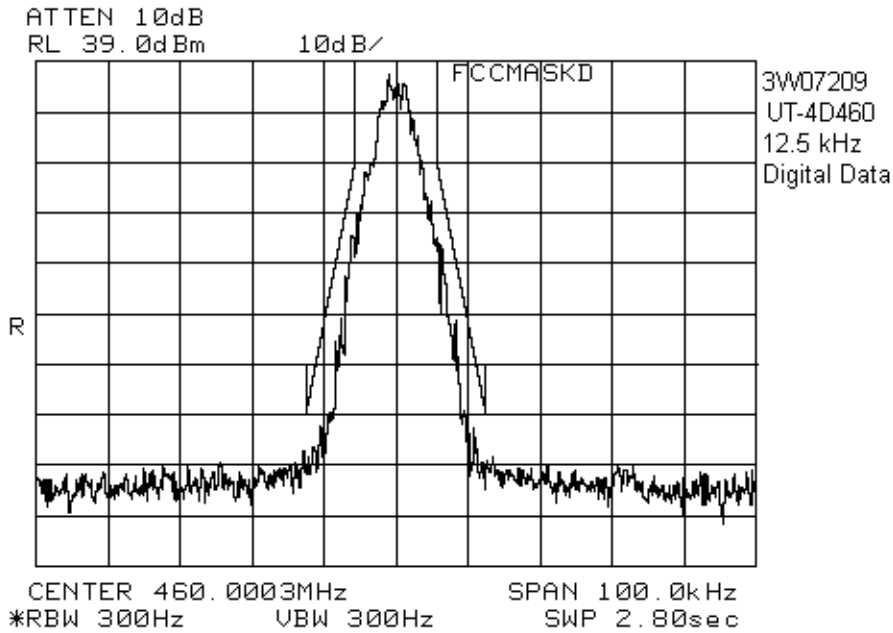
EQUIPMENT: UT-4D400 UHF Transmitter Family



EQUIPMENT: UT-4D400 UHF Transmitter Family

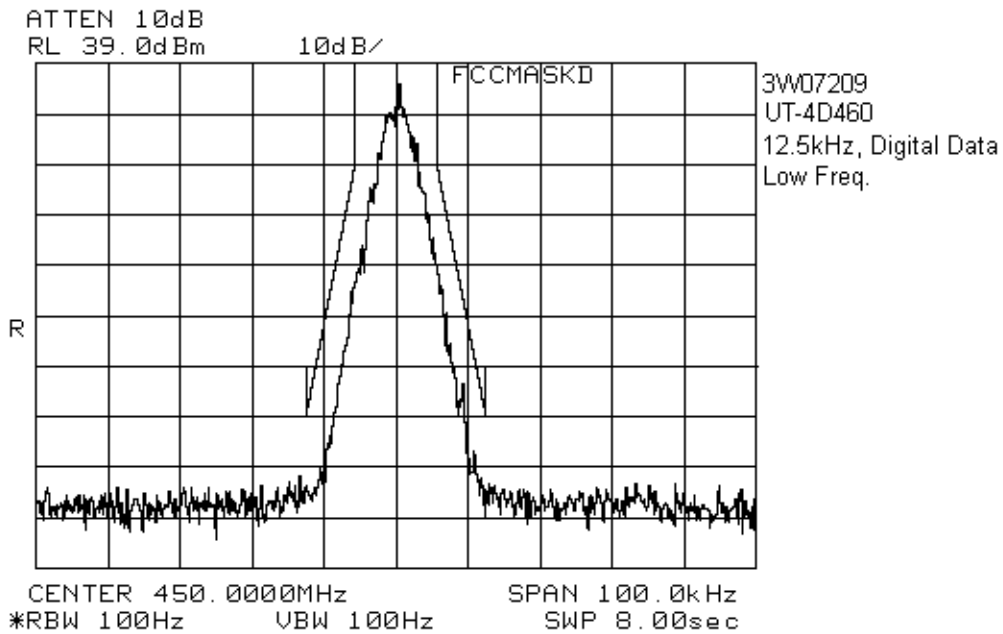
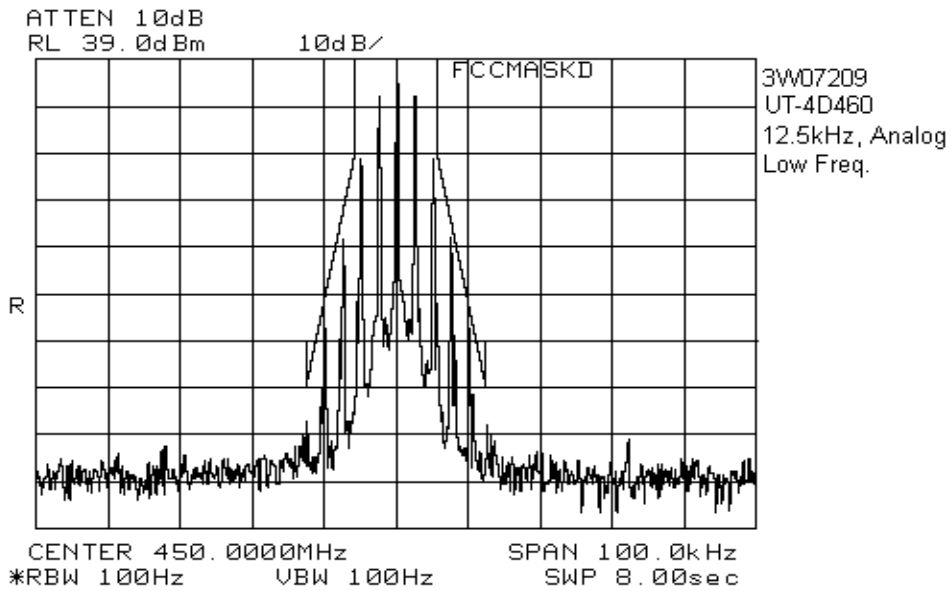


EQUIPMENT: UT-4D400 UHF Transmitter Family

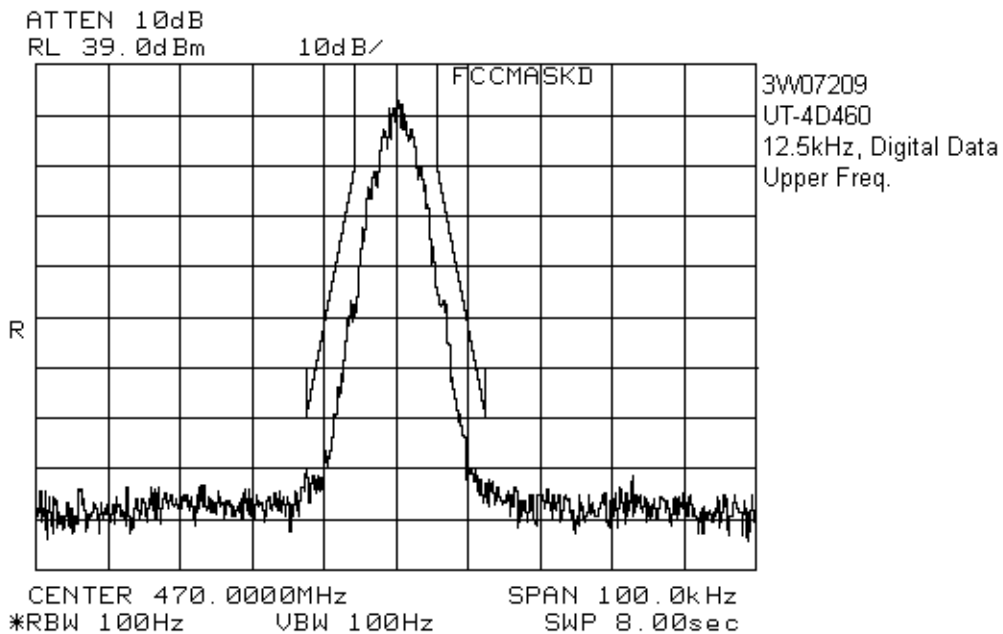
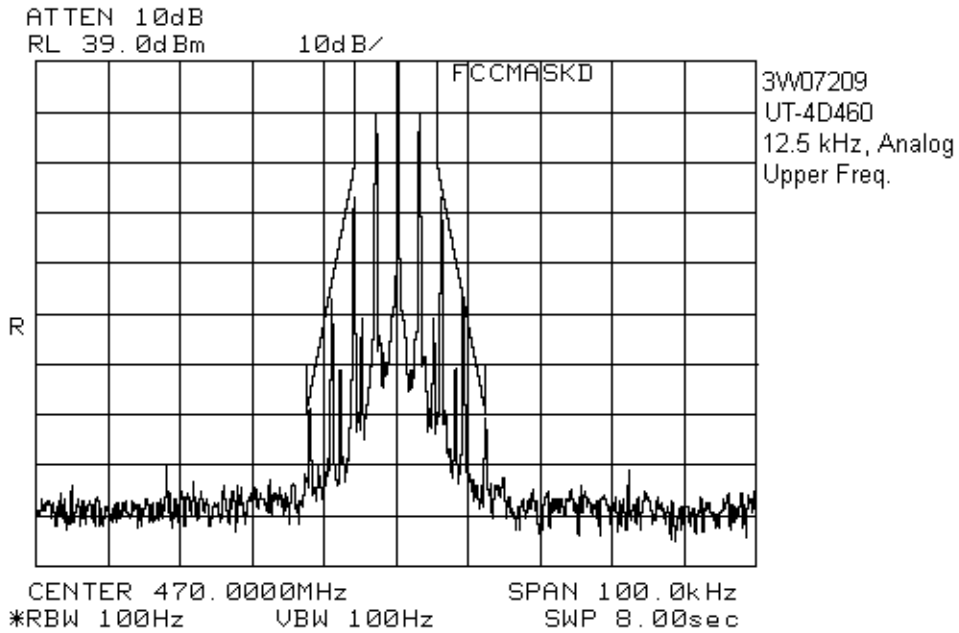


EQUIPMENT: UT-4D400 UHF Transmitter Family

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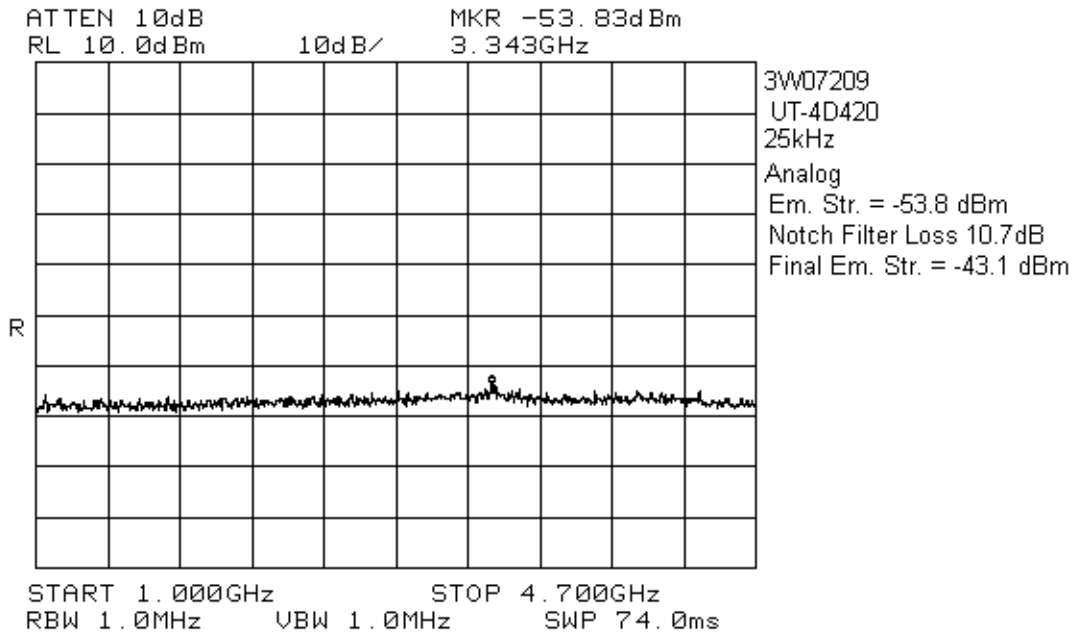
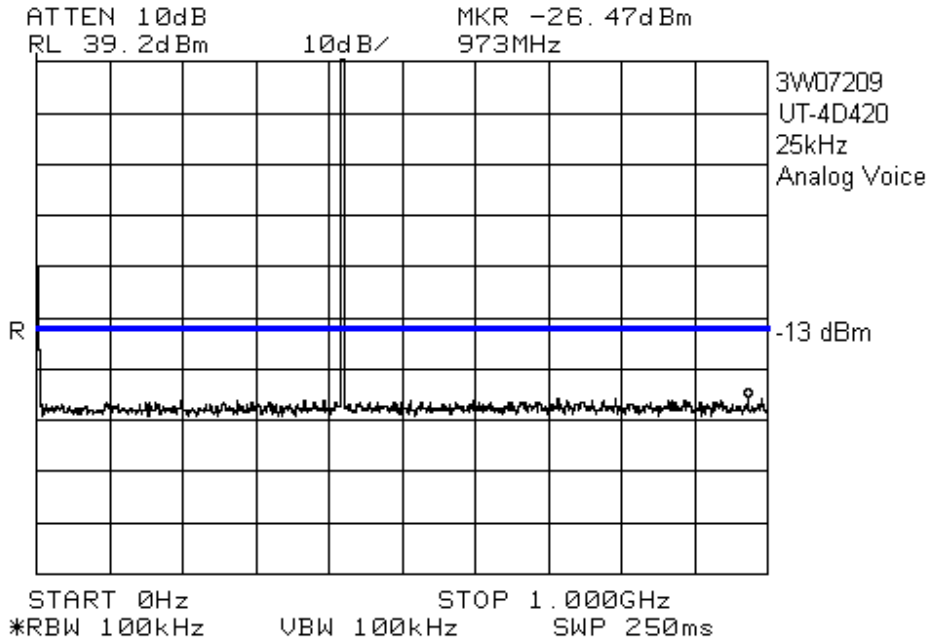
**Minimum Standard:** Para. No.'s 90.210 (b)(d)  
22.359(a), (b)(1) & (b)(2)

**Test Results:** Complies

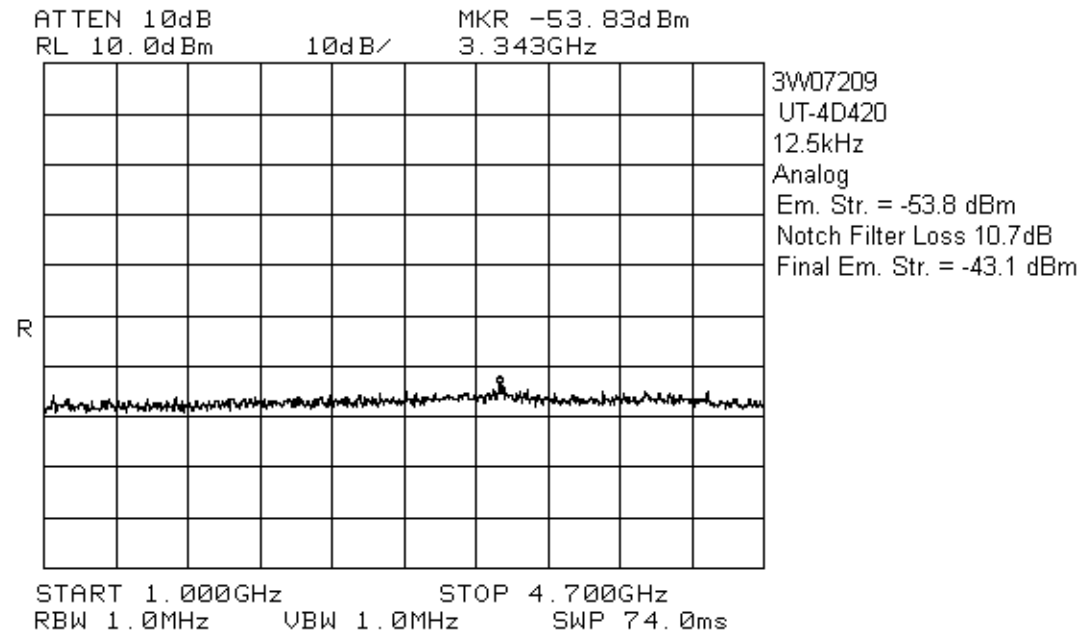
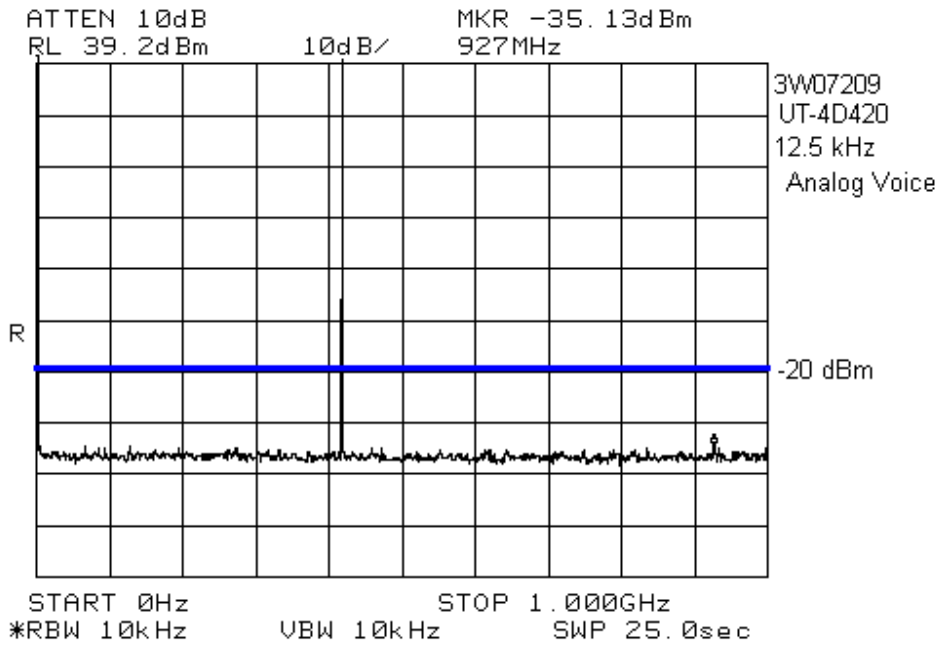
**Measurement Data:** See attached graphs.

EQUIPMENT: UT-4D400 UHF Transmitter Family

UT-4D420

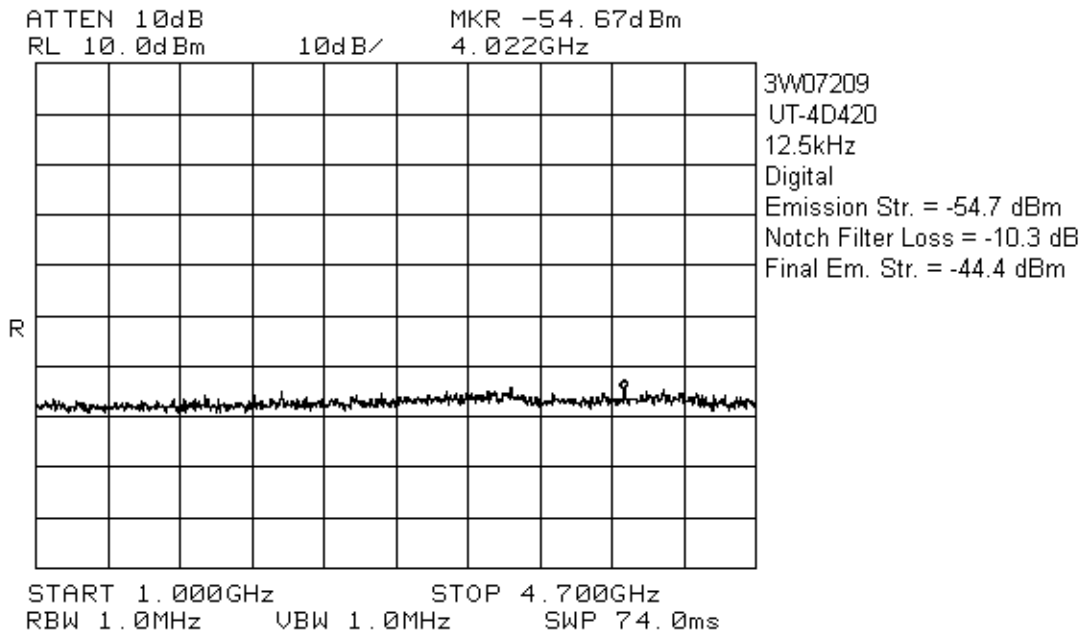
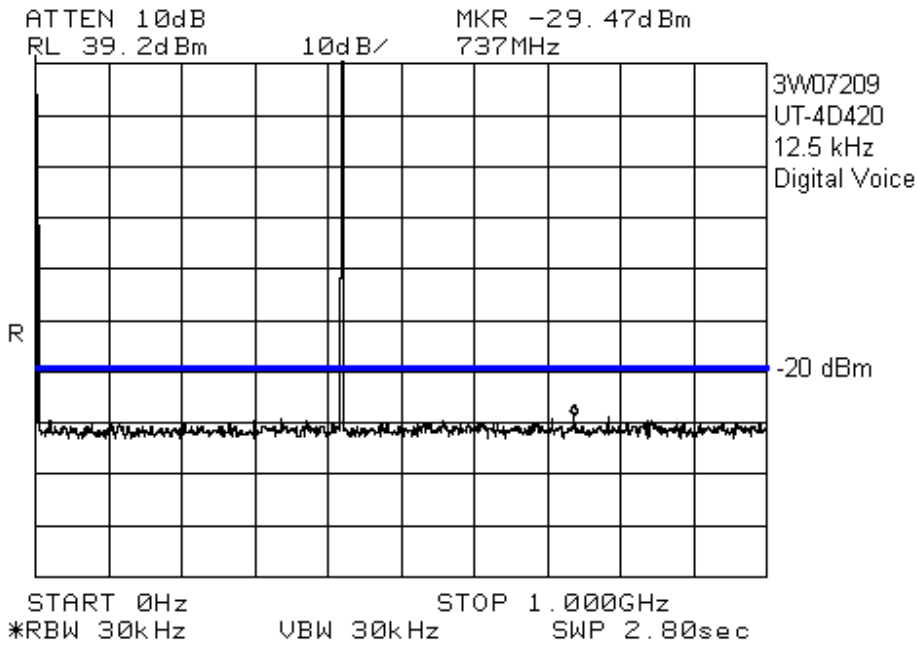


EQUIPMENT: UT-4D400 UHF Transmitter Family

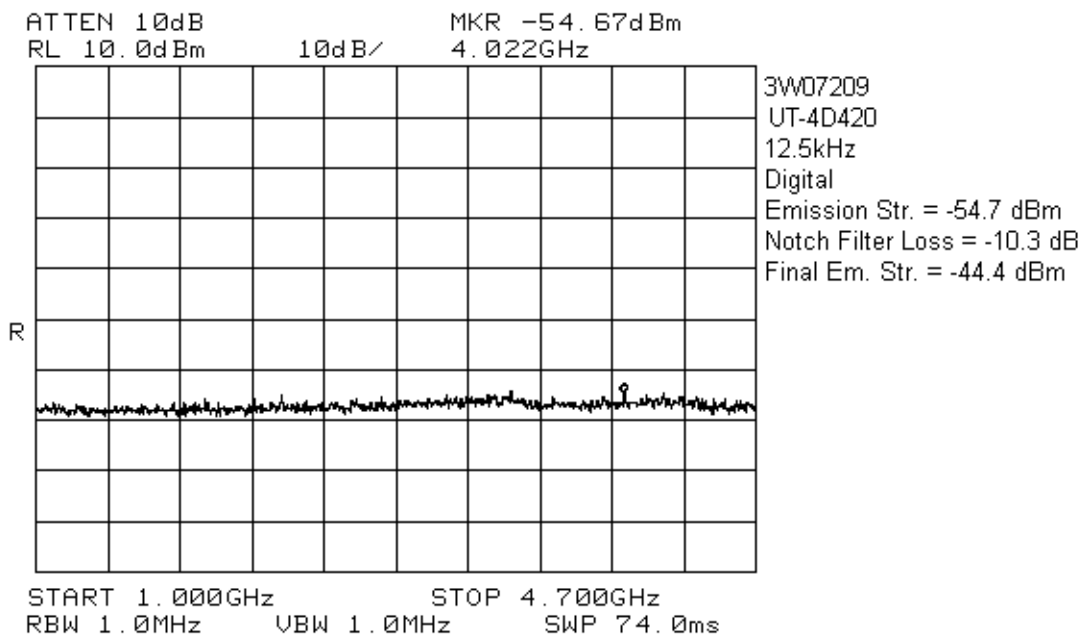
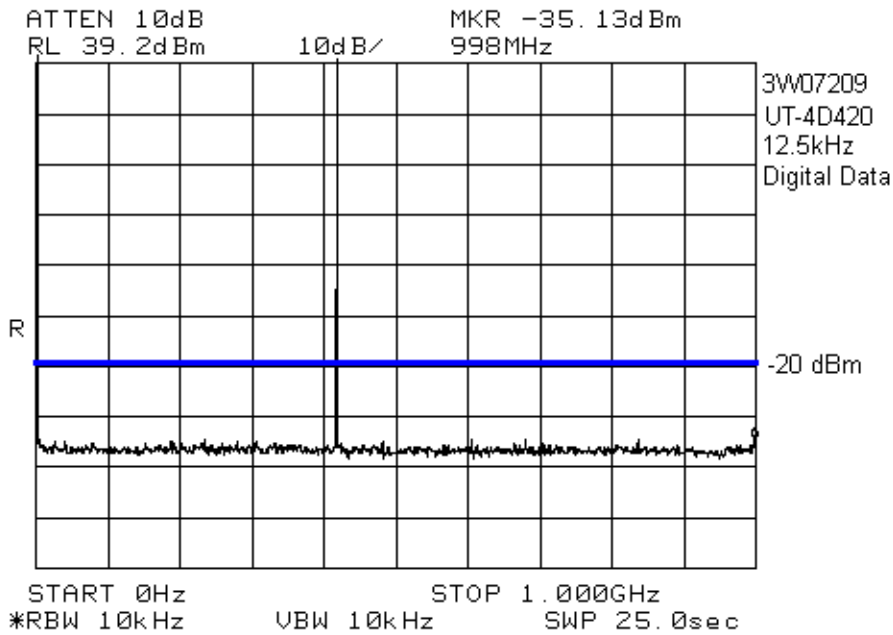




EQUIPMENT: UT-4D400 UHF Transmitter Family

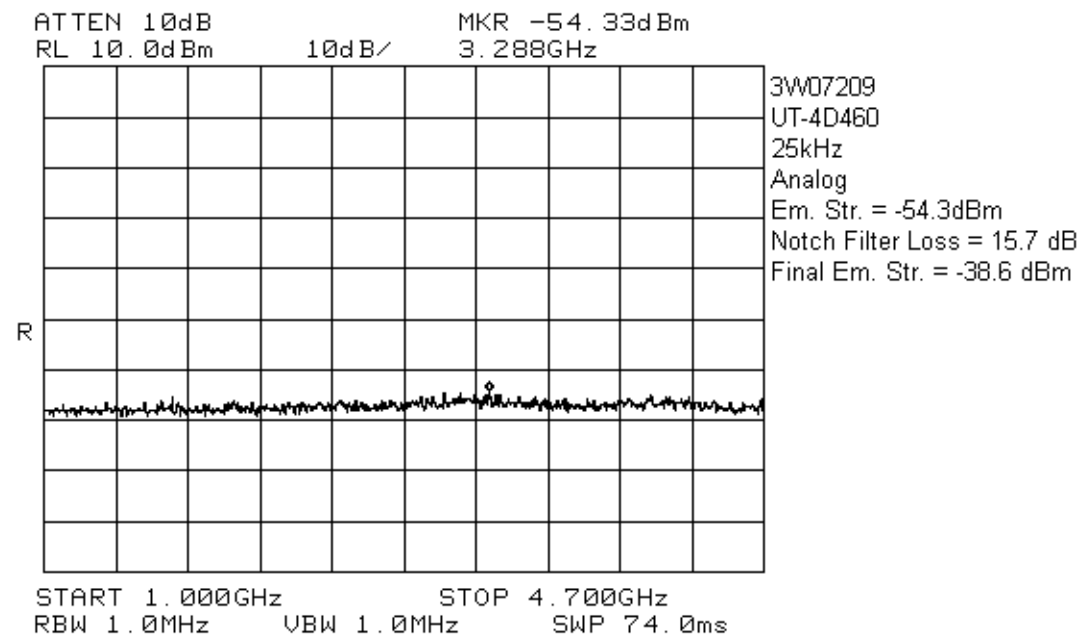
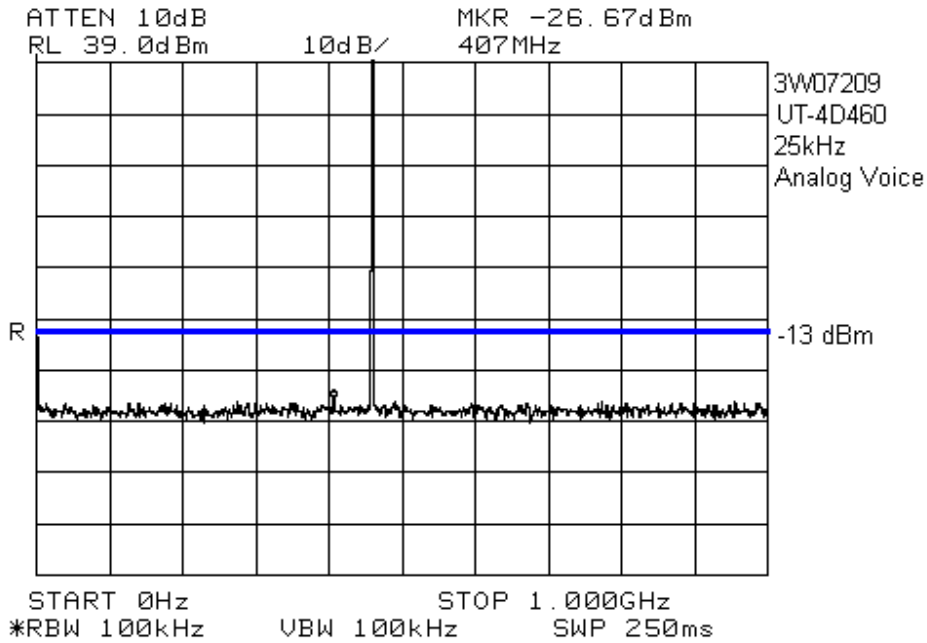


EQUIPMENT: UT-4D400 UHF Transmitter Family

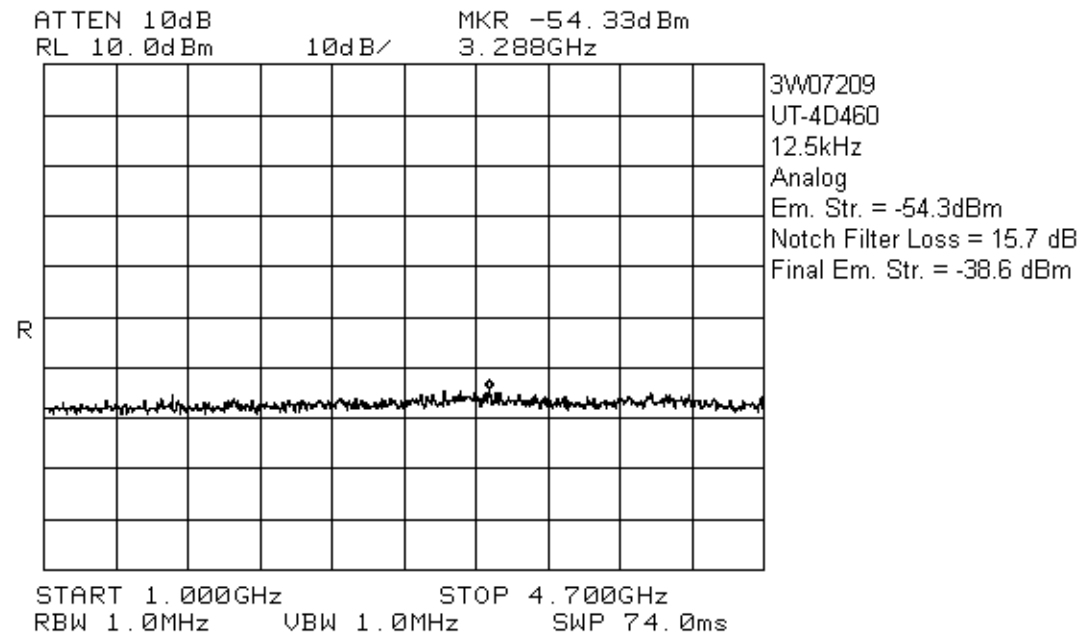
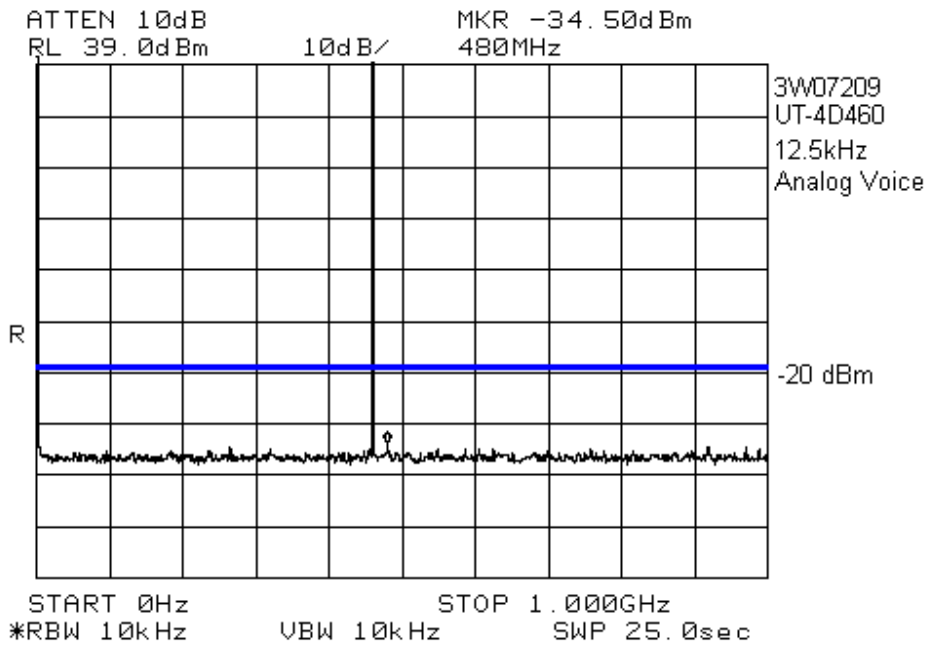


EQUIPMENT: UT-4D400 UHF Transmitter Family

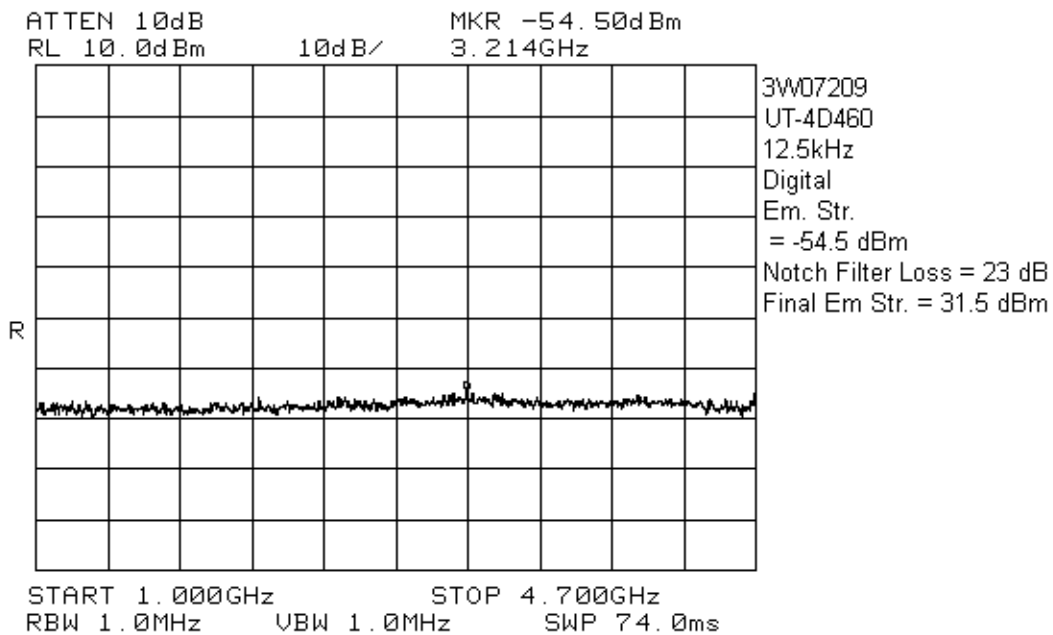
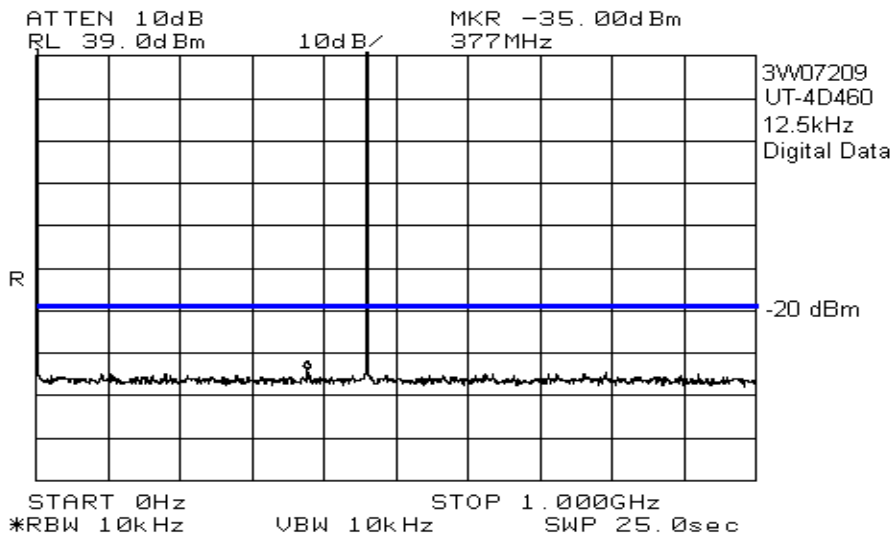
UT-4D460



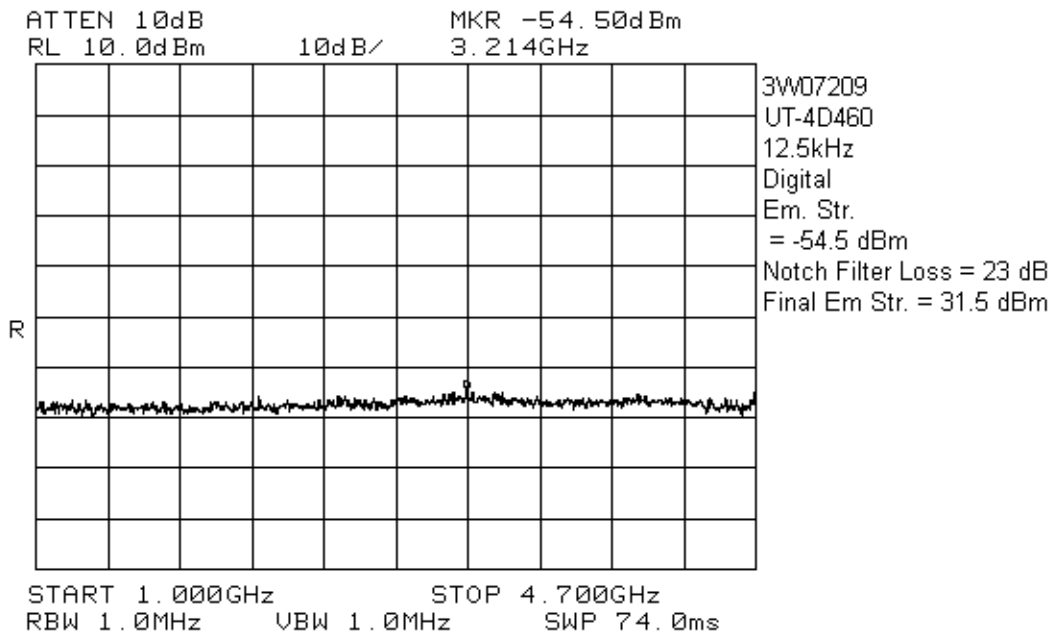
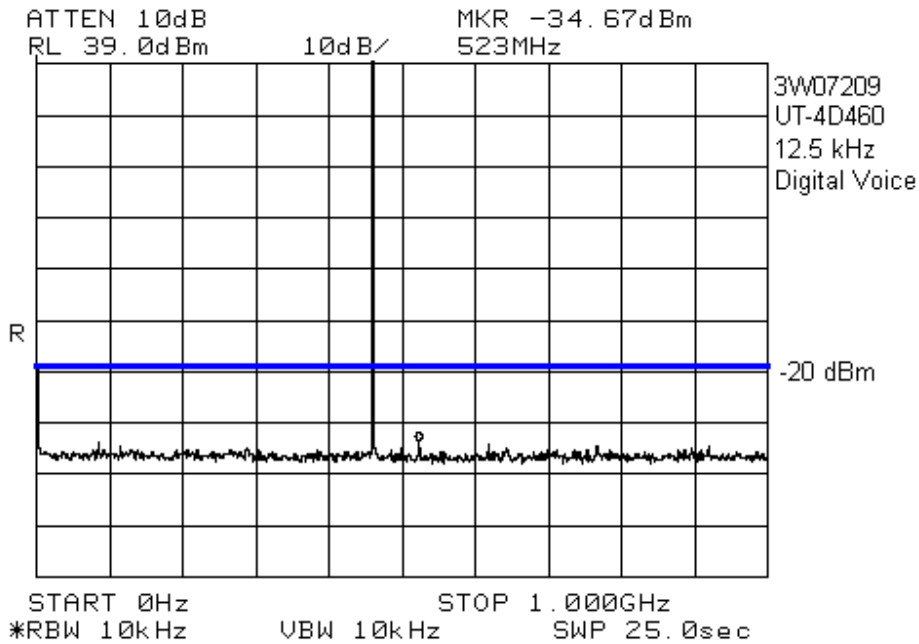
*EQUIPMENT: UT-4D400 UHF Transmitter Family*



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
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**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	
Frequency (MHz)	Antenna	Polarity	RCVD Signal (dBuV)	Sig. Sub. Factor	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Detector		
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
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**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*

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**UT-4D420**

**Voltage Stability**

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

**UT-4D460**

**Voltage Stability**

	Ref. Freq. (MHz)	Measured (MHz)	Variance (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. (MHz)	Measured (MHz)	Variance (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
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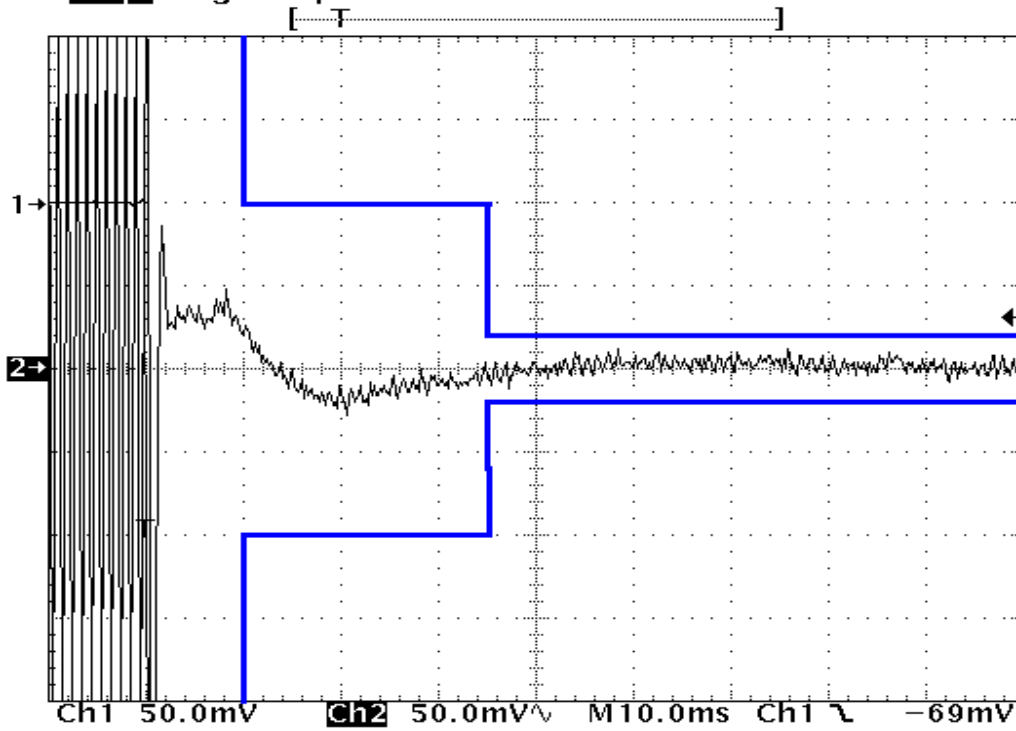
**Minimum Standard:** Para. No. 90.214

**Test Results:** Complies

**Measurement Data:** See attached graphs.

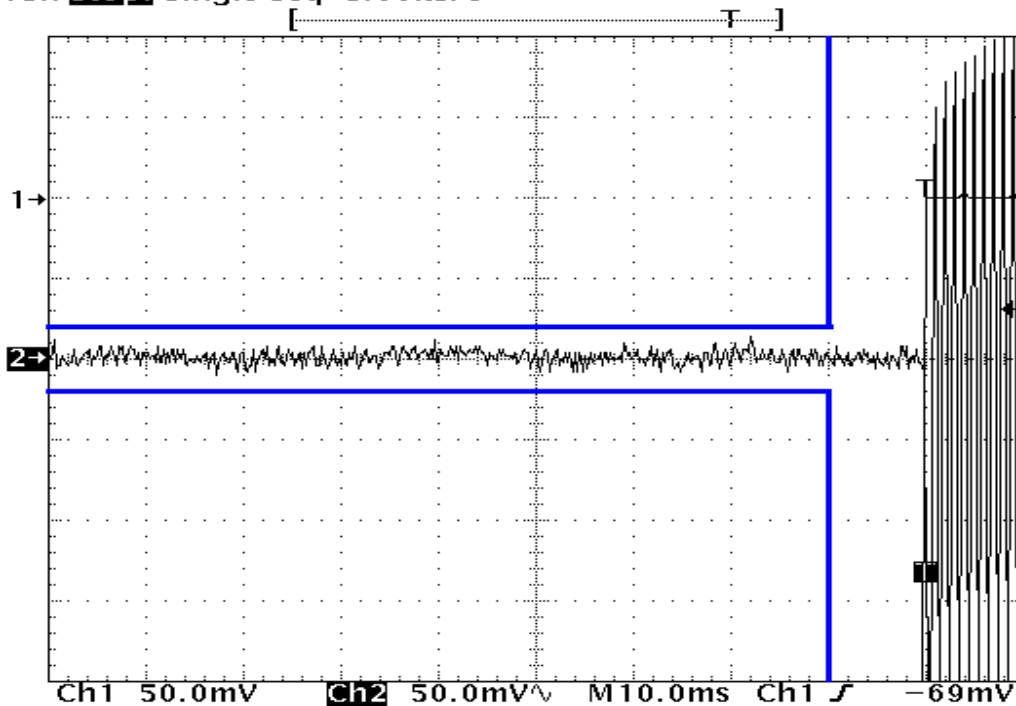
EQUIPMENT: UT-4D400 UHF Transmitter Family

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



1 Aug 2003  
10:39:41

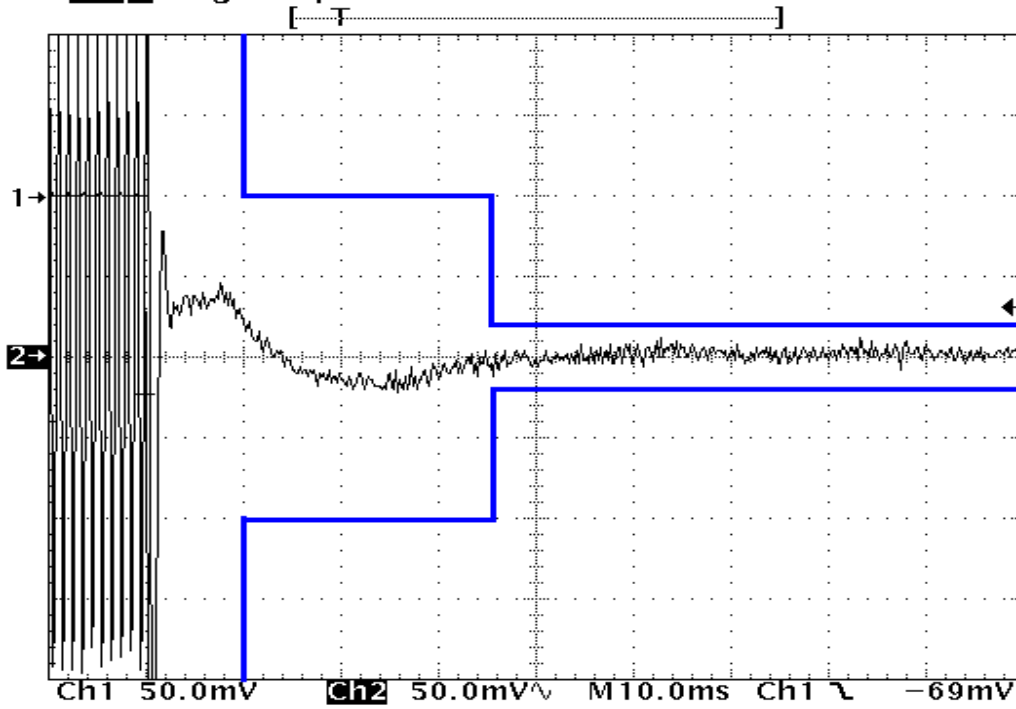
Tek **Stop**: Single Seq 5.00kS/s



1 Aug 2003  
10:40:26

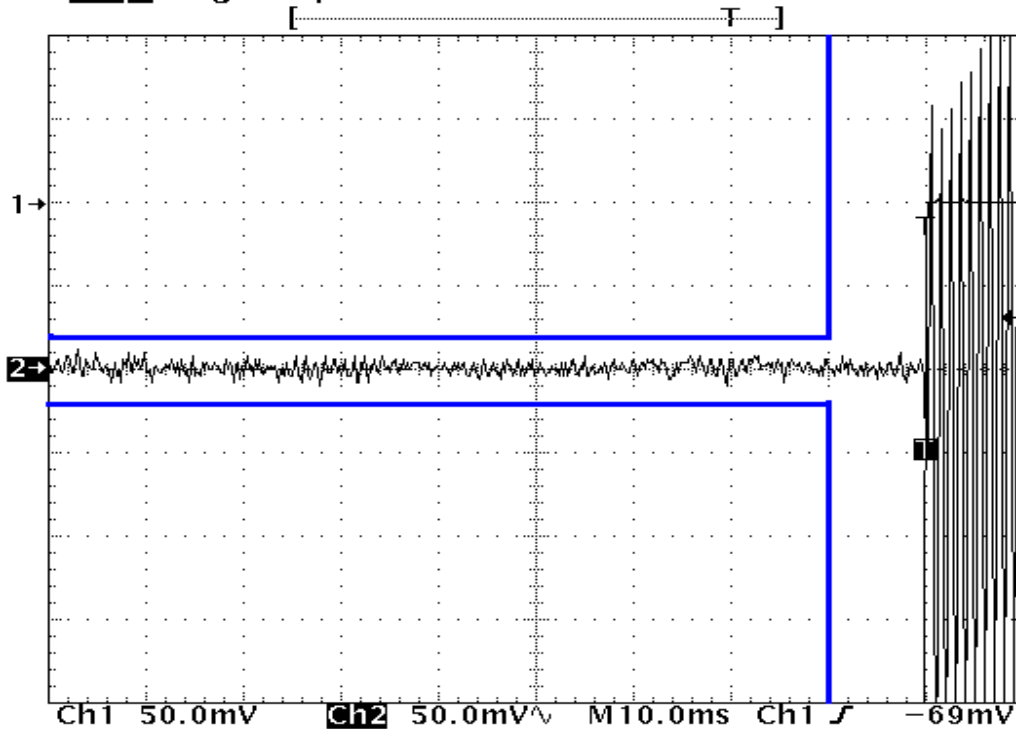
EQUIPMENT: UT-4D400 UHF Transmitter Family

UT-4D420, 25kHz Ch. Spacing  
Tek **Stop**: Single Seq 5.00kS/s



1 Aug 2003  
10:43:03

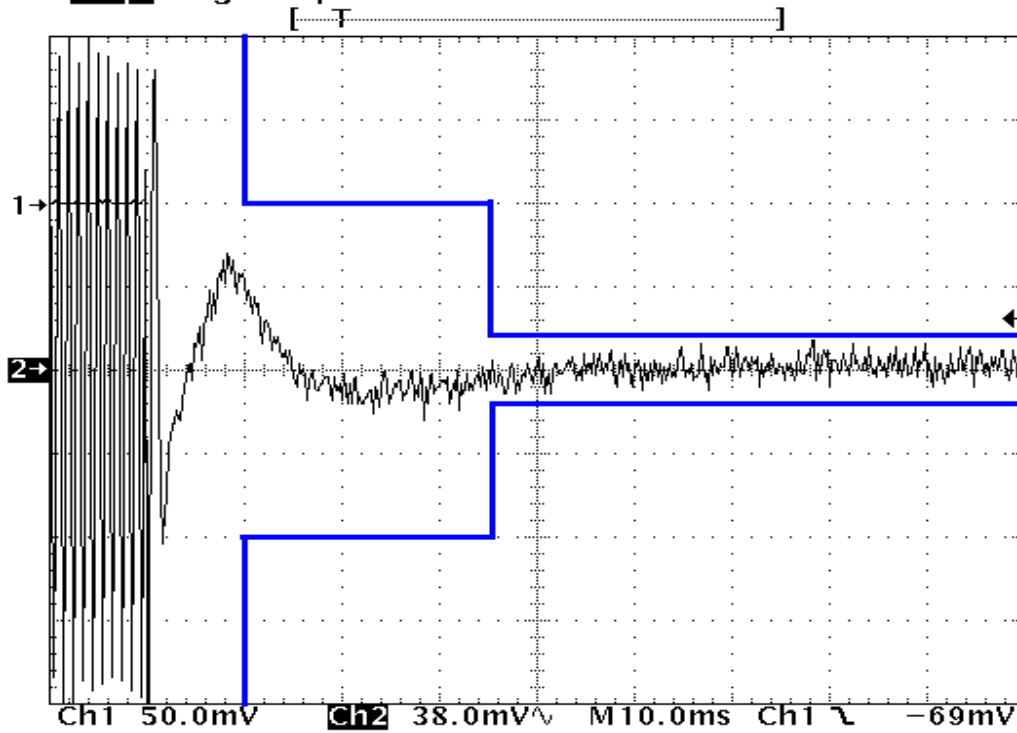
Tek **Stop**: Single Seq 5.00kS/s



1 Aug 2003  
10:42:27

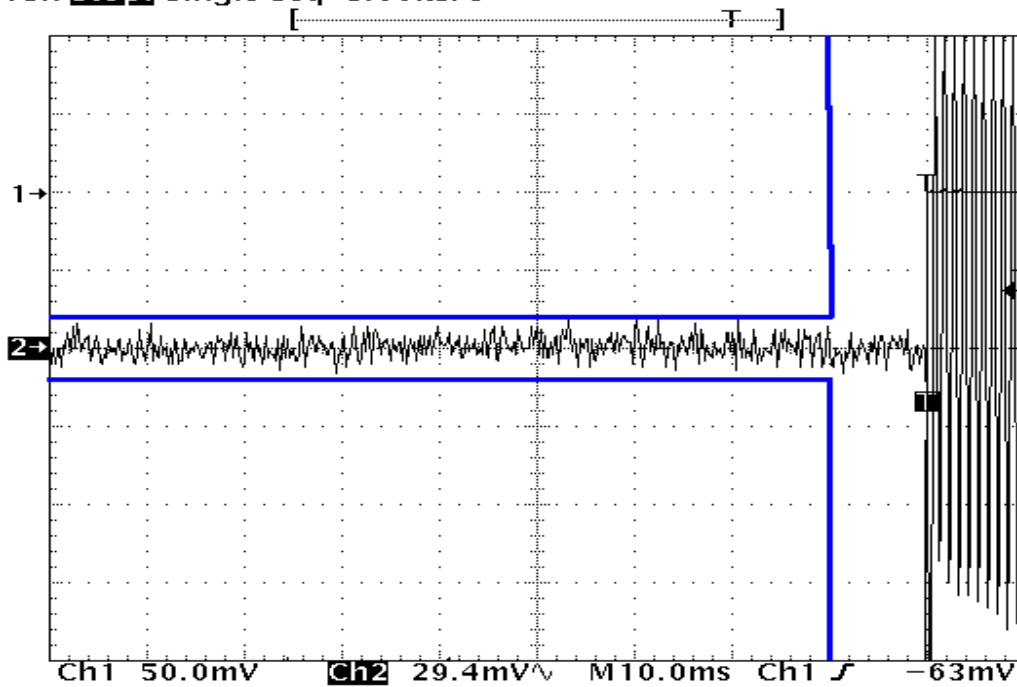
EQUIPMENT: UT-4D400 UHF Transmitter Family

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



1 Aug 2003  
10:03:41

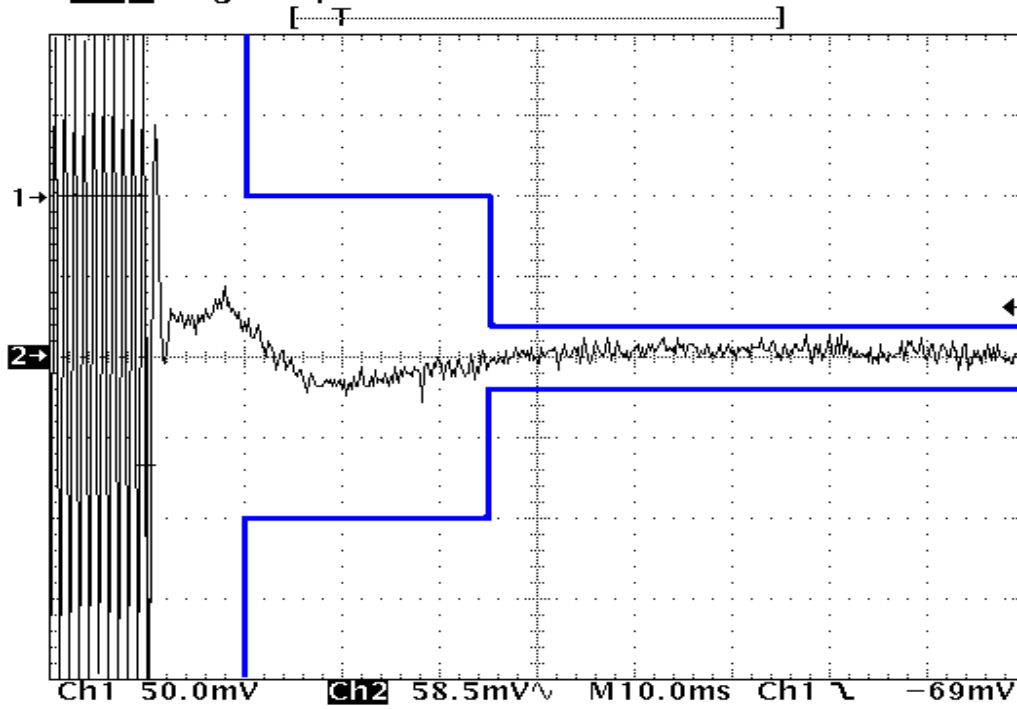
Tek **Stop** Single Seq 5.00kS/s



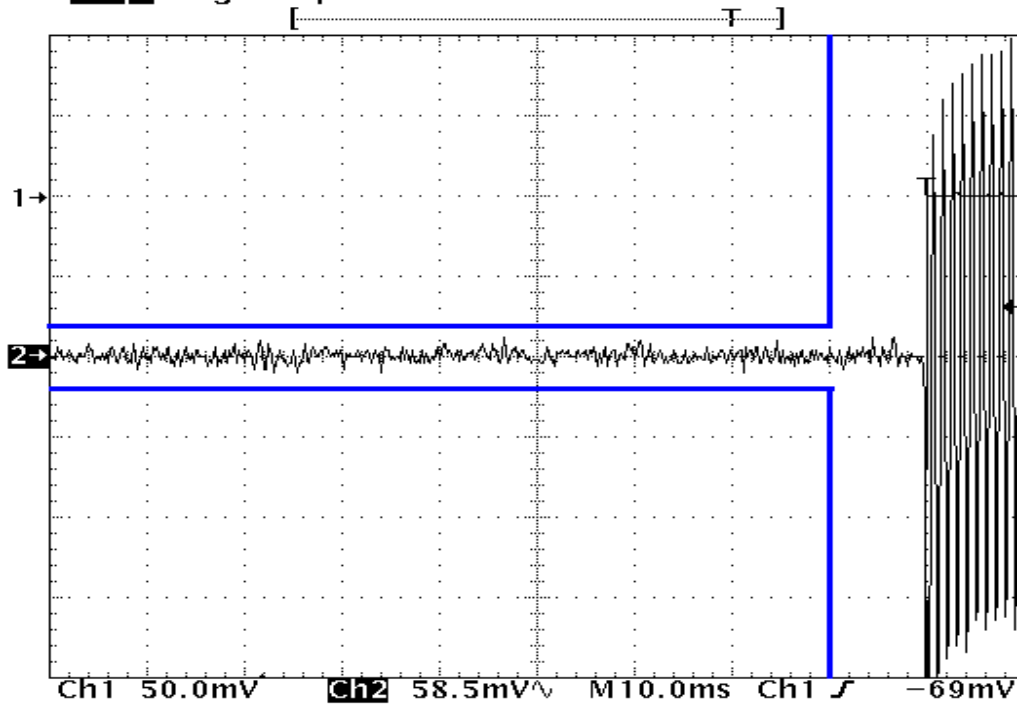
1 Aug 2003  
10:19:05

EQUIPMENT: UT-4D400 UHF Transmitter Family

UT-4D460, 25kHz Ch. Spacing  
Tek **Stop**: Single Seq 5.00kS/s



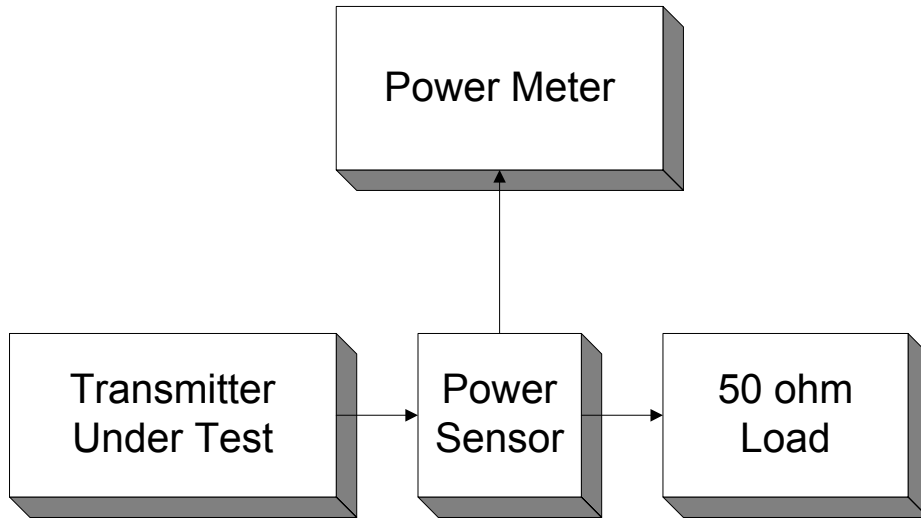
Tek **Stop**: Single Seq 5.00kS/s



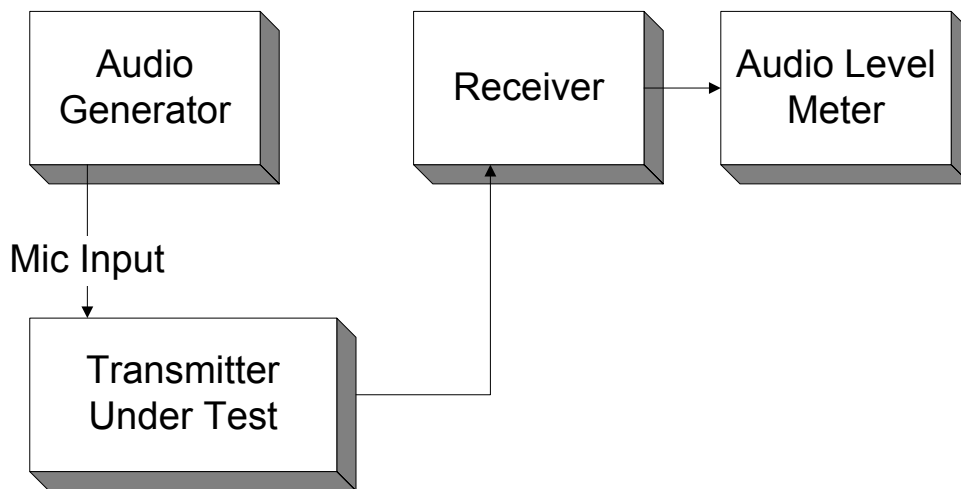


## Section 10. Block Diagrams

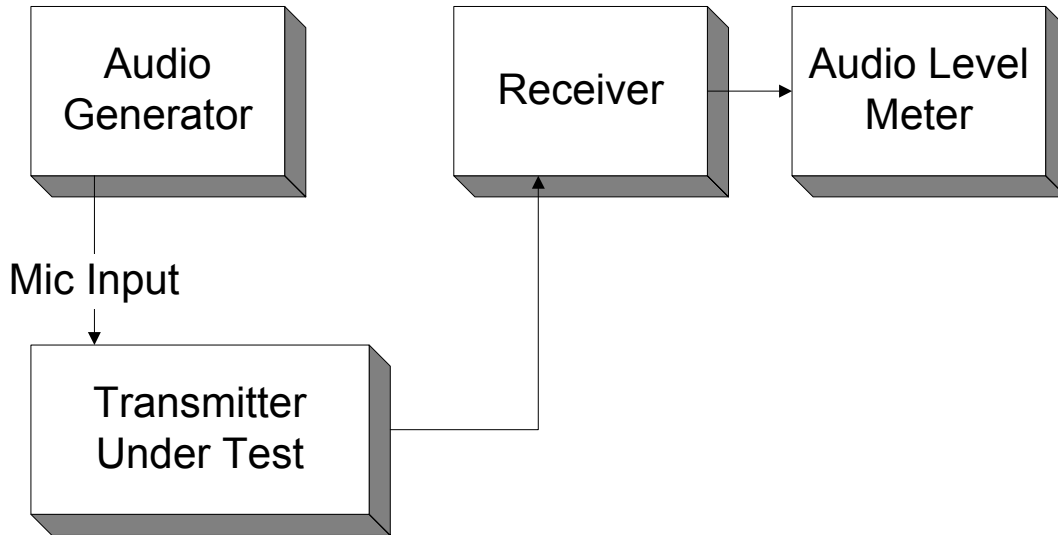
### Para. No. 2.1046 - R.F. Power Output



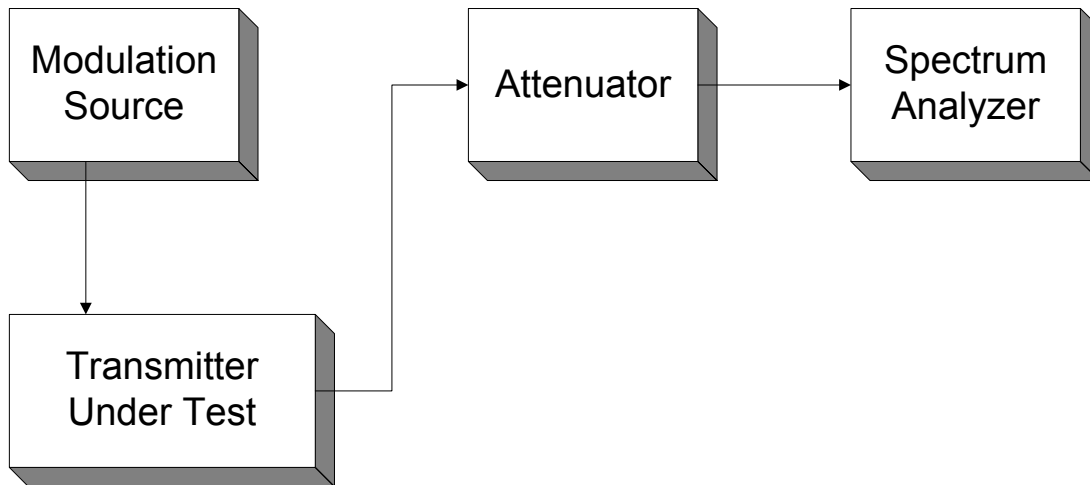
### Para. No. 2.1047 - Audio Frequency Response



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



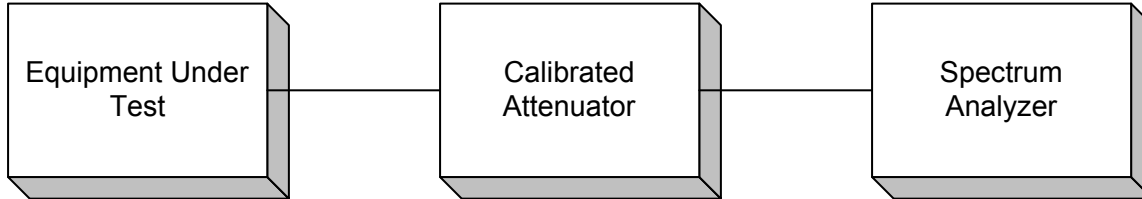
**Para. No. 2.1049 - Occupied Bandwidth**



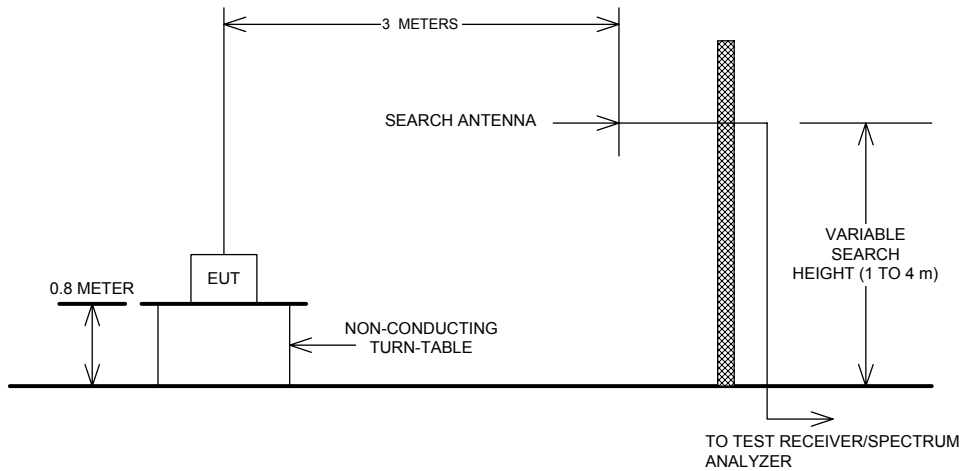
EQUIPMENT: UT-4D400 UHF Transmitter Family

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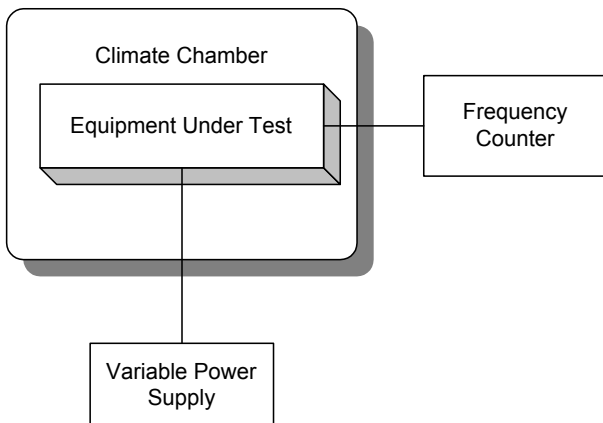
**Para. No. 2.1051 - Spurious Emissions at Antenna Terminals**



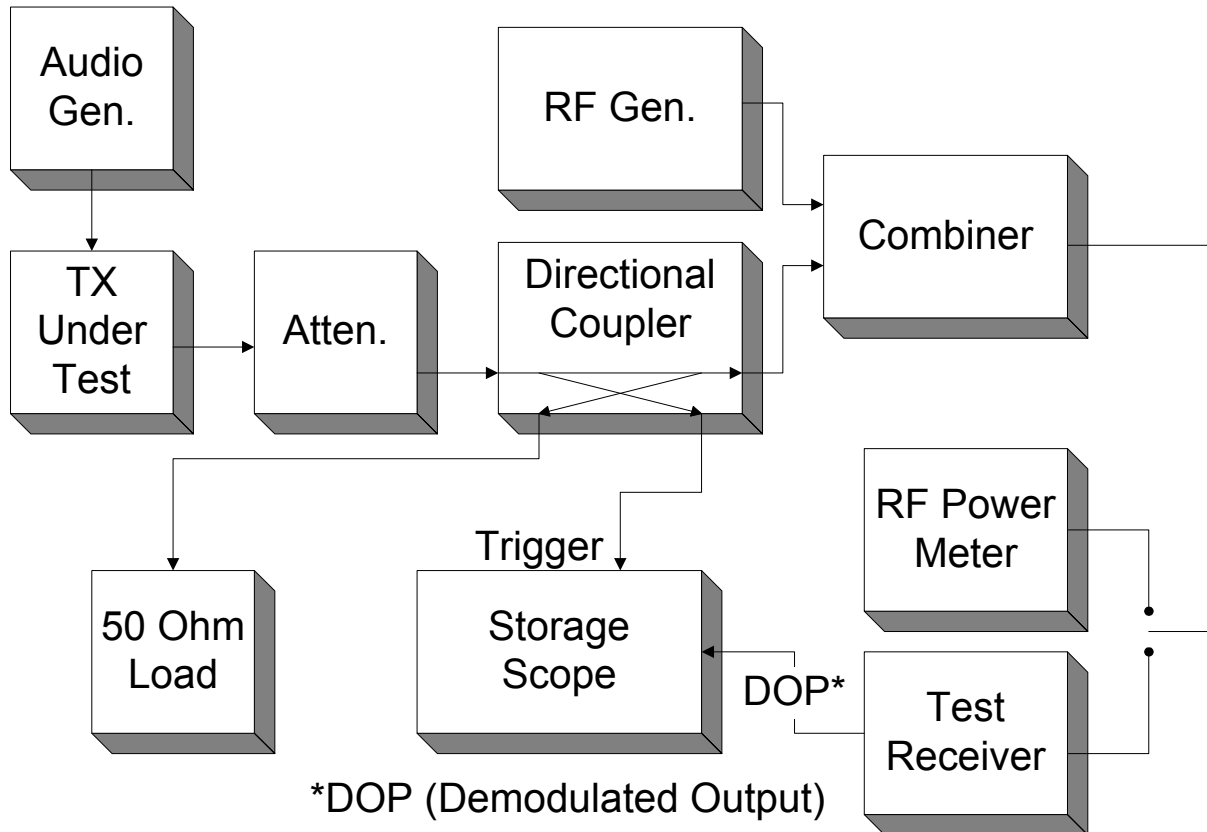
**Para. No. 2.1053 - Field Strength of Spurious Radiation**



**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