



TEST SPECIFICATION:

**FCC "Rules and Regulations", Part 74,**  
Experimental Radio, Auxiliary, Special Broadcast and Other Program  
Distribution Services for Operation in the

470 MHz to 608 MHz & 614 MHz to 806 MHz Frequency Bands

Subpart H, Low Power Auxiliary Stations  
Sections 74.801 to 74.882

THE FOLLOWING **MEETS** THE ABOVE TEST SPECIFICATION

Formal Name: UHF Wireless System

Kind of Equipment: Wireless Microphone

Test Configuration: Tested at 9 vdc

Emission Designator: 120KF3E

Transmitter FCC ID: DD4ULX1

Model Number: ULX1

Serial Number: NA

Dates of Test: September 4, 5, 7 & 10

Test Conducted For: Shure, Inc.

222 Hartrey Avenue

Evanston, Illinois 60015

NOTICE: Please see change information listed inside of this report. This report must not be used by the customer to claim product endorsement by NVLAP or any agency of the United States Government, and it cannot be reproduced (except in full), without the approval of D.L.S. Electronic Systems Inc.



C Test Services  
0 Peterson Drive, Wheeling, Illinois 60090, USA

Report No. 9273

## SIGNATURE PAGE

Report Written By:

Arnom C. Rowe

A handwritten signature in black ink that reads "Arnom C. Rowe". The signature is written in a cursive style with a large initial 'A'.

Test Engineer  
EMC-001375-NE

Report Reviewed by:

A handwritten signature in black ink that reads "Jack Prawica". The signature is written in a cursive style with a large initial 'J'.

Jack Prawica  
Lab Manager

Report Approved by:

A handwritten signature in black ink that reads "Brian J. Mattson". The signature is written in a cursive style with a large initial 'B'.

Brian J. Mattson  
General Manager

Company Official:

Shure, Inc.



C Test Services  
0 Peterson Drive, Wheeling, Illinois 60090, USA

Report No. 9273

NVLAP Certificate of Accreditation available upon request.



C Test Services  
0 Peterson Drive, Wheeling, Illinois 60090, USA

Report No. 9273

NVLAP Scope of Accreditation available upon request.



## TABLE OF CONTENTS

i.	Cover Page.....	1
ii.	Signature Page.....	2
iii.	NVLAP Certificate of Accreditation available upon request of Contents.....	3
iv.	NVLAP Scope Certificate of Accreditation available upon request of Contents.....	4
v.	Table of Contents.....	5
1.0	Summary of Test Report.....	6
2.0	Introduction.....	6
3.0	Object.....	6
4.0	Test Set-Up.....	6
5.0	Test Equipment (Bandwidths and Detector Function).....	7
6.0	Modulation Characteristics.....	7
6.0	Graphs Taken Showing the Frequency Response of the Audio Modulating Circuit.....	8
7.0	Occupied Bandwidth – Part 2.1049.....	11
7.0	Graphs taken of the Occupied Bandwidth Part 2.1049.....	12
8.0	RF Power Output – Part 2.1046.....	19
8.0	Graphs Taken of the RF Power.....	20
9.0	Frequency Deviation and Tolerance – Part 74.861.....	27
10.0	Spurious Conducted Emission Measurements made at Antenna Terminals Part 2.105.....	28
10.0	Spurious Conducted Emission Data taken at the Antenna Terminals Part 2.1051.....	29
10.0	Spurious Conducted Emission Graphs made at the Antenna Terminals Part 2.1051.....	30
11.0	Field Strength of Spurious Emission Measurements Part 2.1053.....	31
11.0	Field Strength of Spurious Emission Measurements Part 2.1053.....	32
11.0	Radiated Data & Graphs Taken for Field Strength Spurious Emission Measurements Part 2.1053.....	33
12.0	Frequency Stability Part 2.1055a (Temperature).....	49
12.0	Graphs taken for Frequency Stability when varying the temperature Part 2.1055a.....	50
13.0	Frequency Stability Part 2.1055d (Voltage).....	61
13.0	Graphs taken for Frequency Stability when varying the Primary Supply Part 2.1055d.....	62
14.0	Photo Information and Test Set-Up.....	66
15.0	Radiated Photos taken during Testing.....	67
16.0	Change Information.....	69
17.0	Results of Tests.....	71
18.0	Conclusion.....	71
18.0	Table 1 Equipment List.....	72



## 1.0 SUMMARY OF TEST REPORT

It was found that the UHF Wireless System S/N NA meets the radio interference emission requirements of the FCC "Rules and Regulations", Part 74, Subpart H, Sections 74.801 to 74.882 for Low Power Auxiliary Stations operating in the 554-806 MHz Frequency Band. This report contains the following number of pages.

Text, Data Summary & Charts: 72 pages

## 2.0 INTRODUCTION

On September 4, 5, 7 & 10, a series of radio frequency interference measurements were performed on Wireless Microphone, S/N NA. The tests were performed according to the procedures of FCC as stated in Part 2 Subpart J, Equipment Authorization Procedures of the Code of Federal Regulations 47, by personnel of D.L.S. Electronic Systems, Inc. who are responsible to Donald L. Sweeney, Senior EMC Engineer.

## 3.0 OBJECT

The purpose of this series of tests was to determine if the test sample could meet the radio frequency emission requirements of the FCC "Rules and Regulations", Part 74, Subpart H, Sections 74.801 to 74.882 for Low Power Auxiliary Stations operating in the 554-806 MHz Frequency Band.

## 4.0 TEST SET-UP

All radiated emission tests were performed at D.L.S. Electronic Systems, Inc. The radiated tests were made with the test item placed on a wooden turntable located in the Test Room with the receive antenna placed at 3 meters, or one meter from the device under test, as indicated on the charts.



## 5.0 TEST EQUIPMENT (Bandwidths and Detector Function)

All data was automatically plotted using peak detector function. This information was then used to determine the frequencies of maximum emissions. Manual measurements were performed on these frequencies using a Quasi Peak or Average Detector with the bandwidths specified by the FCC. From 200 MHz to 1000 MHz a bandwidth of 100 kHz was used (except for Occupied Bandwidth), and above 1000 MHz, wide enough bandwidths were used, depending upon the test being made, to ensure proper measurement of the narrowband signal. A list of the equipment used can be found in Table 1. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

## 6.0 Modulation Characteristics - Part 2.1047

### a. Voice modulated communication equipment

A curve showing the frequency response of the audio modulating circuit over a range of 20 to 20000 Hz is submitted with this report.

**NOTE:** See the following pages for the actual chart made during testing.

### b. Equipment using modulation limiting

A family of curves showing the percentage of modulation versus the modulation input voltage with sufficient information showing the modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

**NOTE:**

These tests were not run because the device under test does not use limiting.



C Test Services  
0 Peterson Drive, Wheeling, Illinois 60090, USA

Report No. 9273

**GRAPHS TAKEN SHOWING THE FREQUENCY**

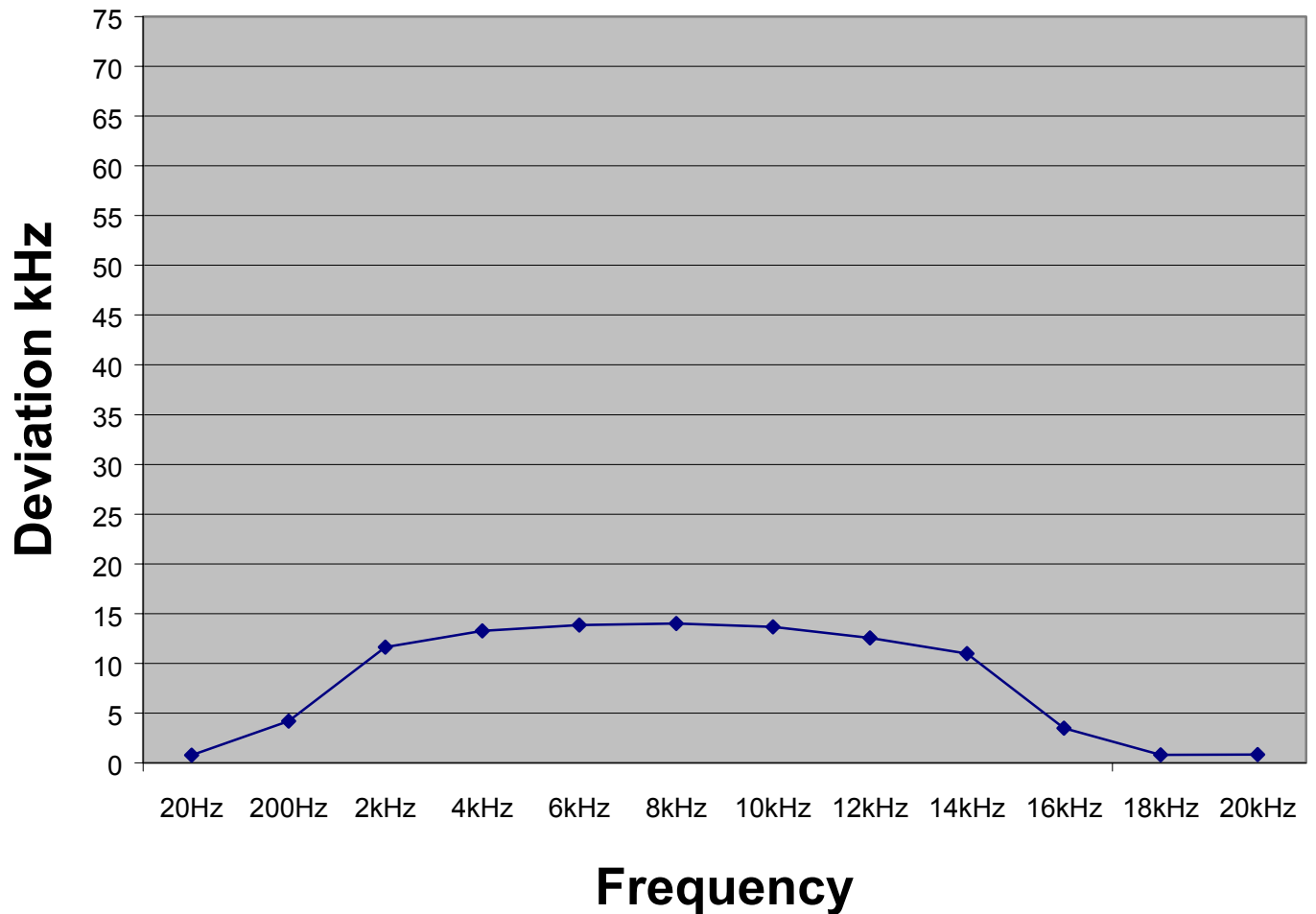
**RESPONSE OF THE**

**AUDIO MODULATING CIRCUIT**

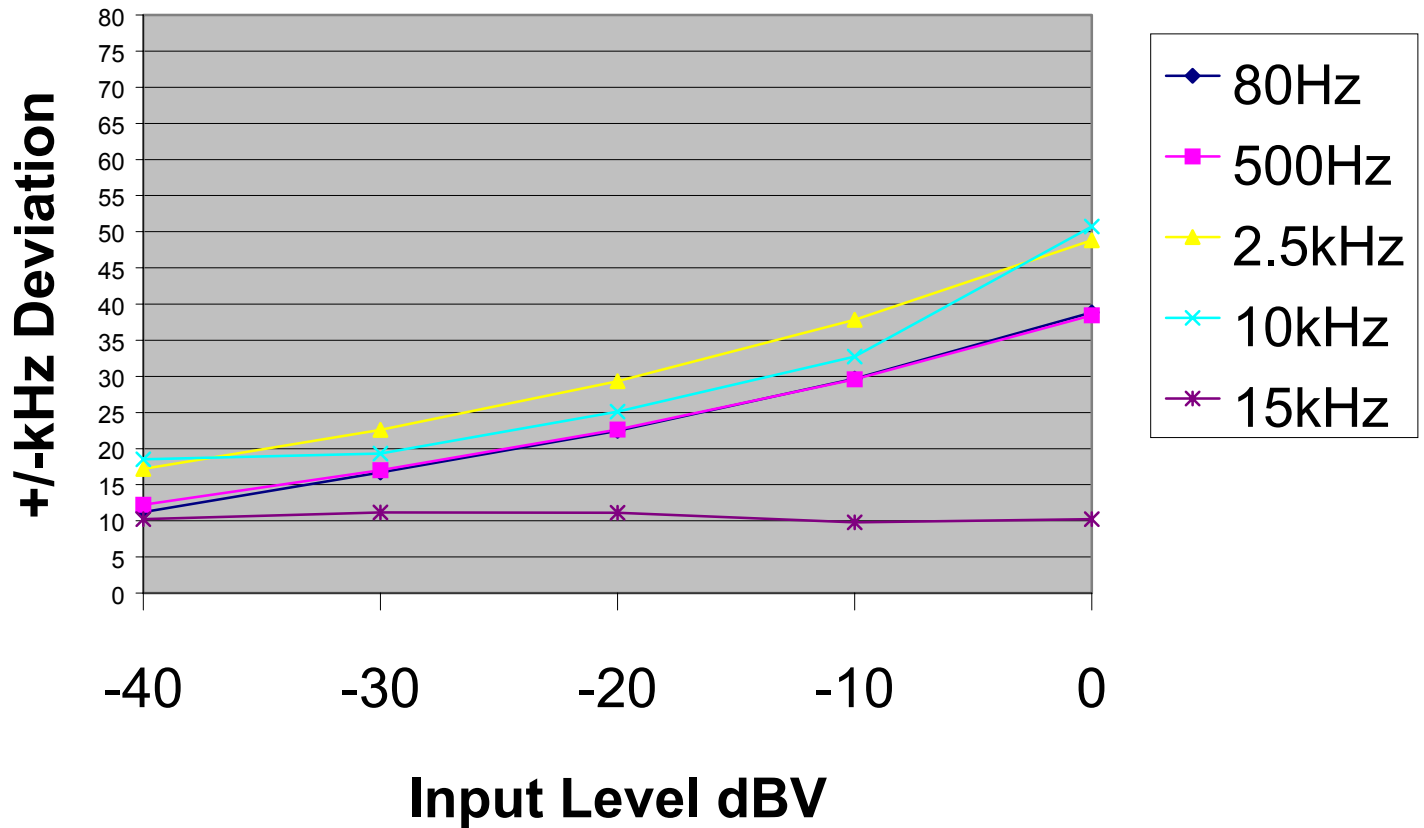
**PART 2.1047**



## UIX1 (679MHz) Modulation vs Frequency for -45dBV RMS Input



## ULX1 (679MHz) Input Level Vs Deviation





## 7.0 OCCUPIED BANDWIDTH – PART 2.1049

The frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to .5% of the total mean power radiated by a given emission.

As stated in Part 2.1049 c-1, the UHF Wireless System was modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. This input level was established at the frequency of maximum response of the audio modulating circuit.

The UHF Wireless System uses the same frequency range as television broadcast monaural transmitters so the test was also run using a 15 kHz input signal modulated by 85% as stated in Part 2.1049 e-6.

Paragraph e-5 states that the maximum authorized bandwidth shall be 200 kHz for all emissions inside these frequency bands.

### Carson's Rule:

Section 2.202 (g)

$B_n = 2M + 2DK, K=1$        $B_n$  = Bandwidth

$M = 15 \text{ kHz},$        $M$  = Maximum Modulating Frequency

$D = 45 \text{ kHz},$        $D$  = Peak Deviation

**$B_n = 2(15) + 2(45)(1) = 120 \text{ kHz}$**

**NOTE:** See the following pages for the graphs of the actual measurements made:



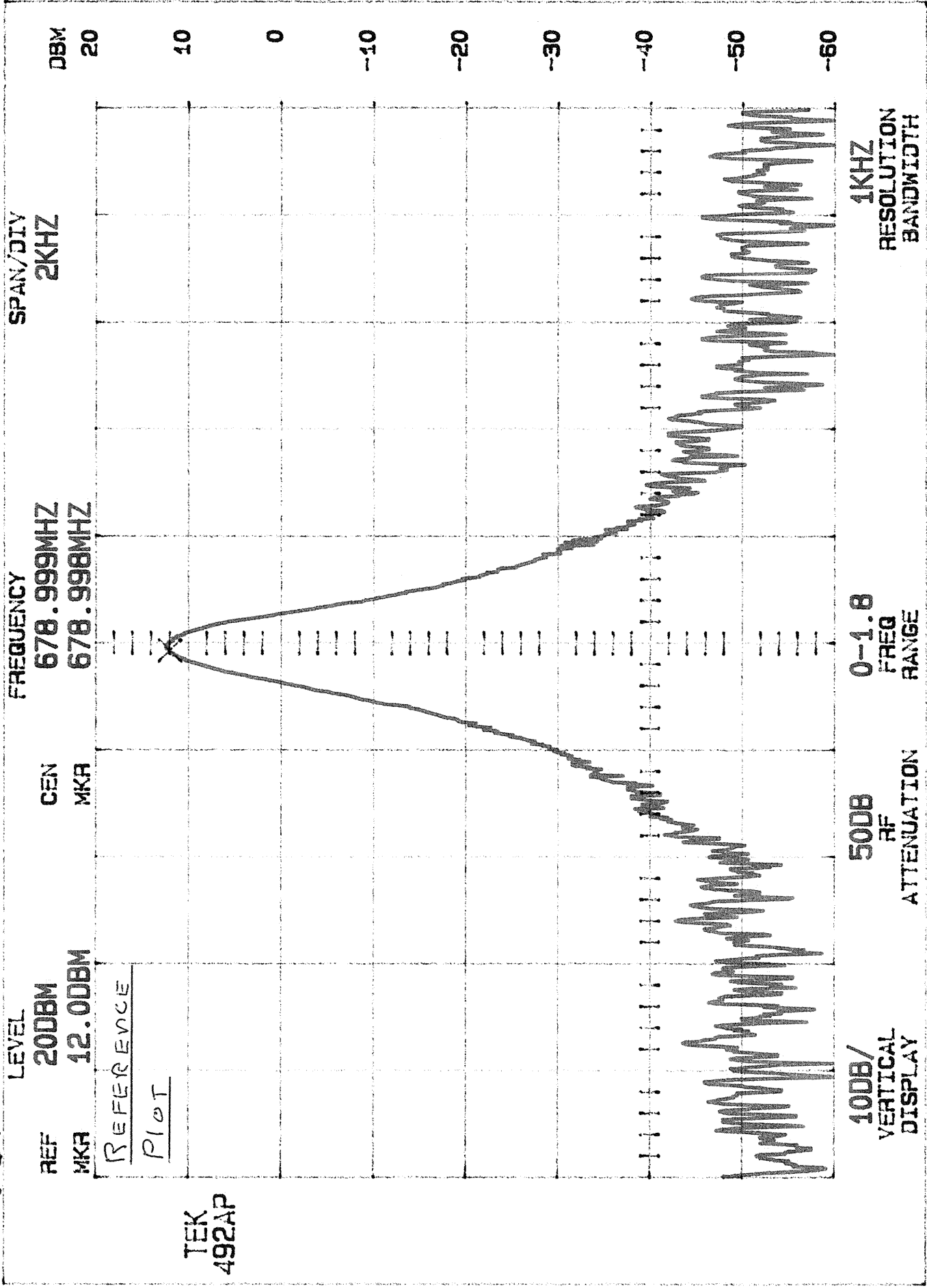
C Test Services  
0 Peterson Drive, Wheeling, Illinois 60090, USA

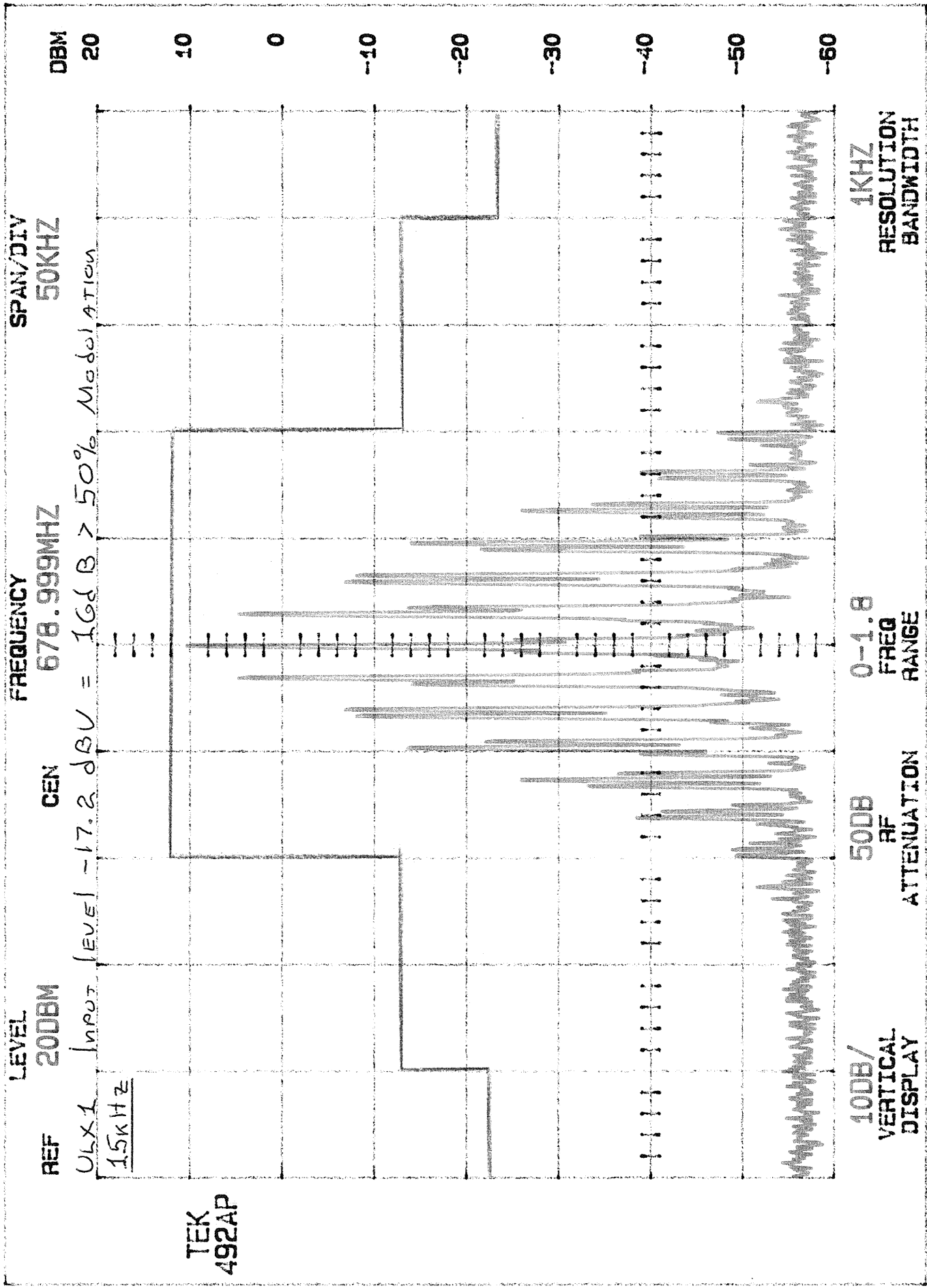
Report No. 9273

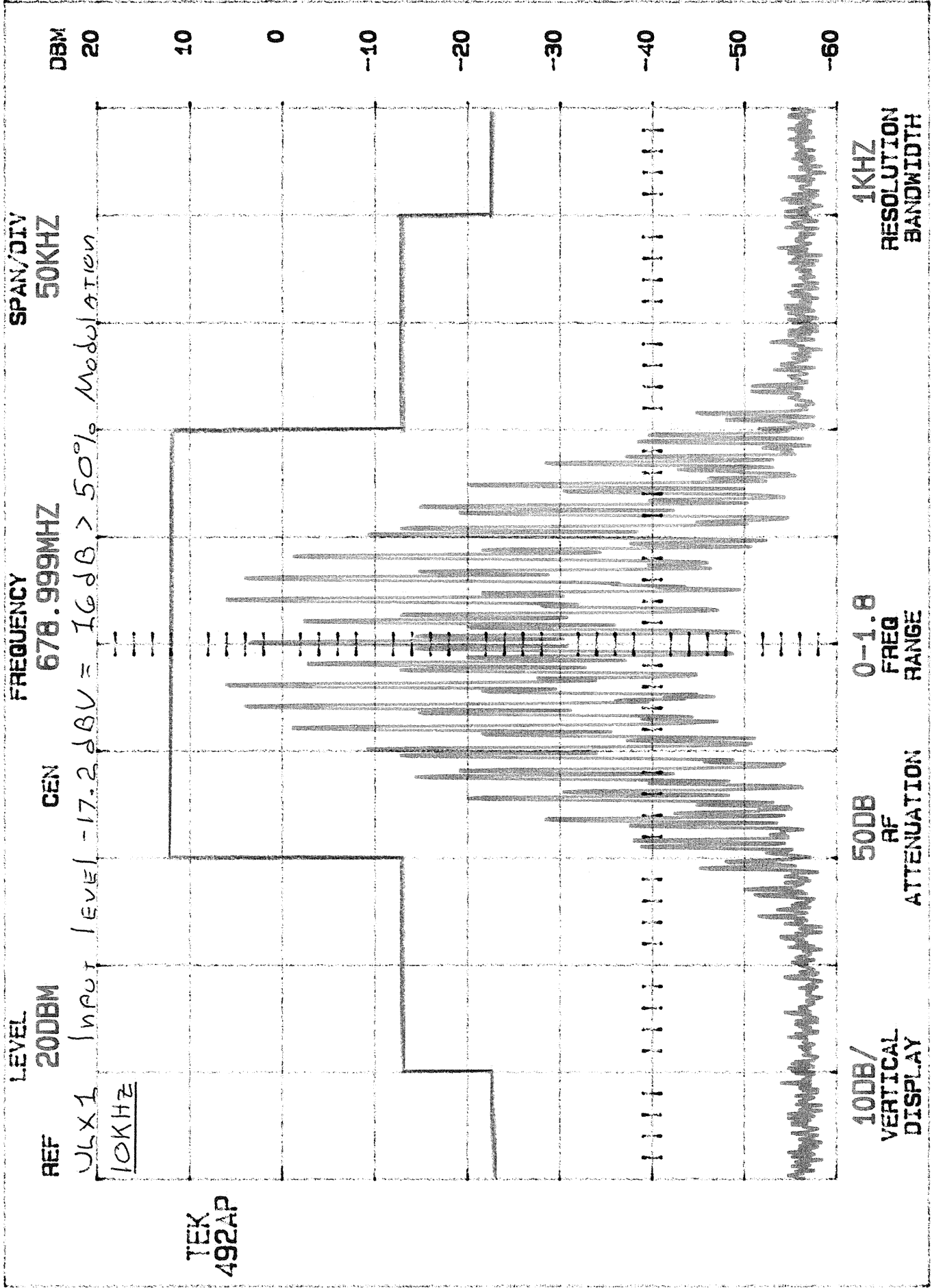
## **GRAPHS TAKEN OF THE OCCUPIED BANDWIDTH**

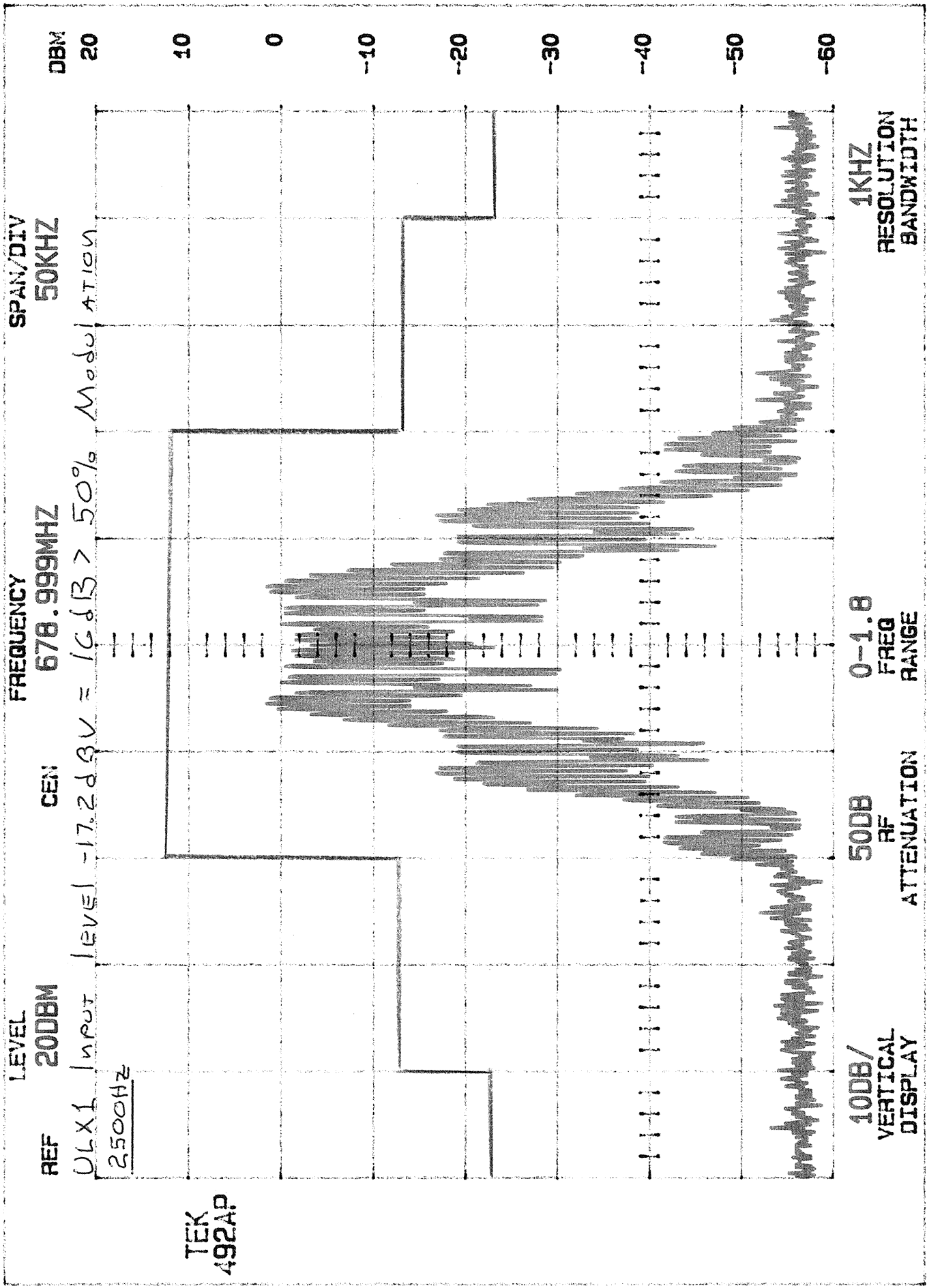
### **PART 2.1049**

VLX1



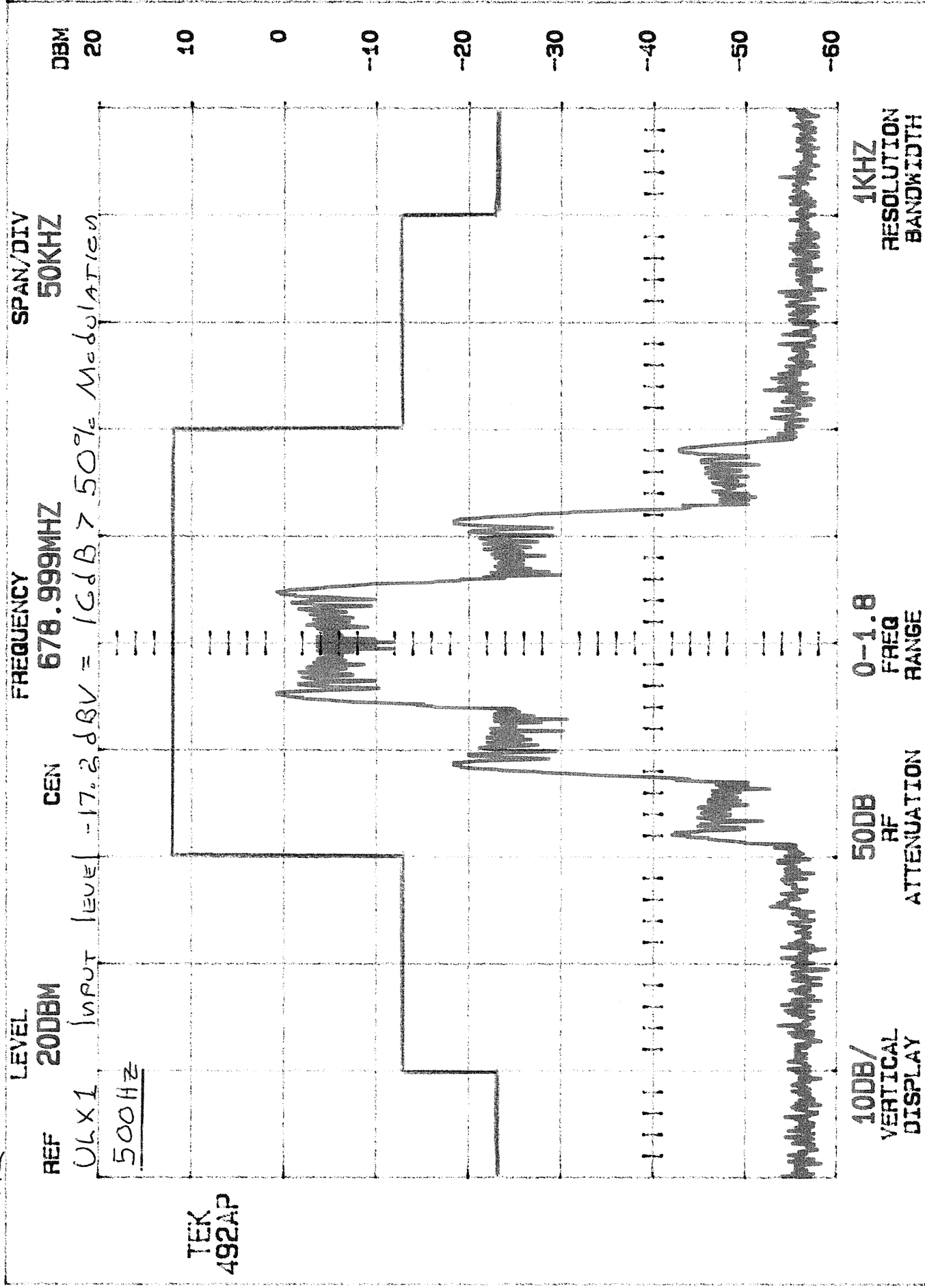


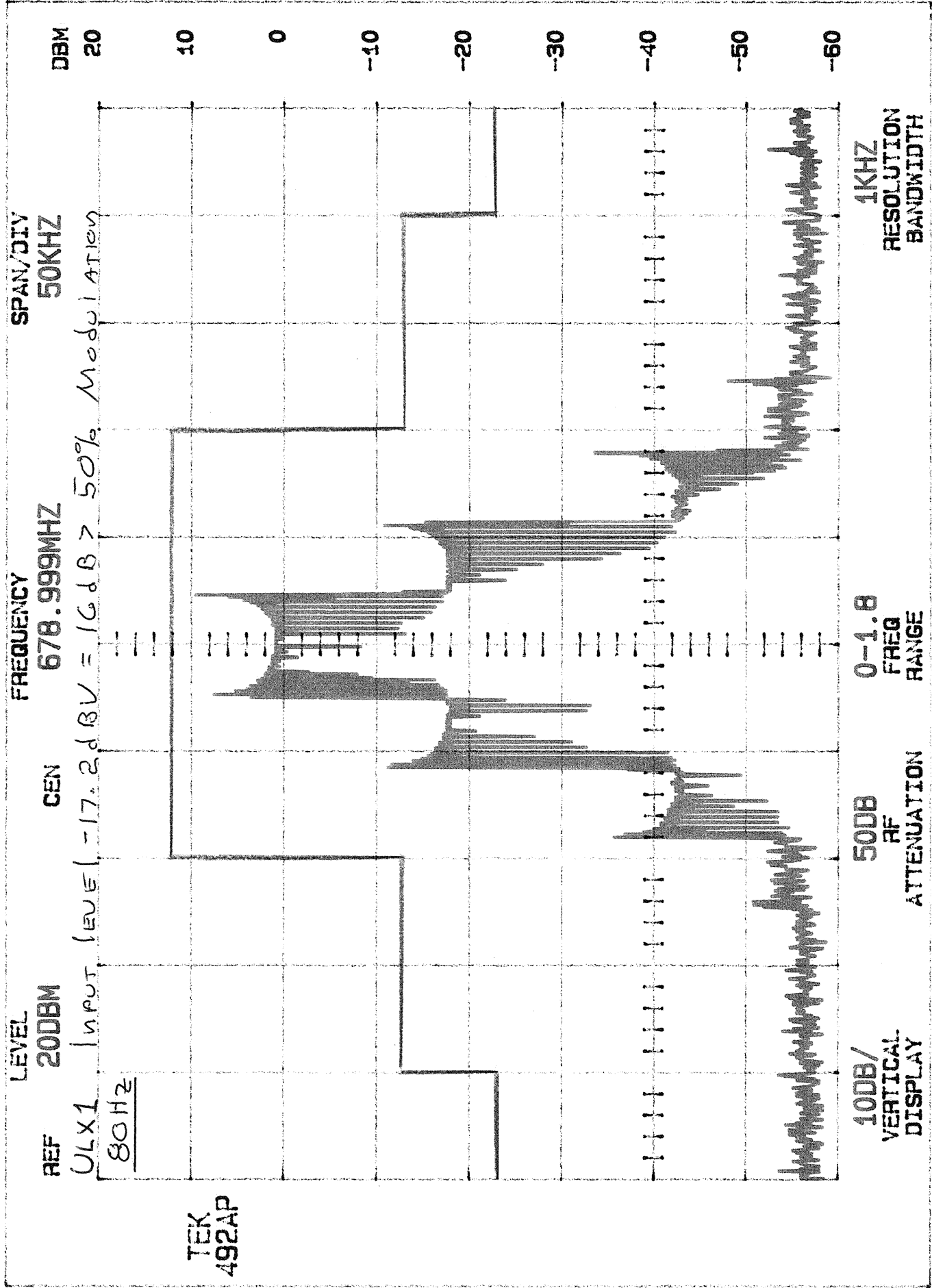






ULX1







## 8.0 RF POWER OUTPUT - PART 2.1046

As stated in PART 74.861 (e-1), the output power should not exceed 250 milliwatts (24 dBm). The UHF Wireless System was tuned according to the tune-up procedures specified in Part 2.1033 (c-9), and adjusted for its maximum output power. The RF output power was measured in the open field, using one of the following test methods:

For the radiated test measurement, the signal from the EUT was measured. The EUT was then substituted with a signal generator and a tuned dipole antenna. The output of the signal generator was increased until the level received by the tuned dipole equaled that of the previous measured from the EUT.

Actual measurements were made at a room temperature of **72 °F** with a humidity of **60%**.

### **Actual Measurements Taken in open field:**

114 dBuV measured output of the transmitter  
+0 dBuV total system losses (Antenna, Pads & Cable)  
114 dBuV

### **LIMIT:**

Manufacturer's rated output power (50 ohm system) = 0.03 watts  
Manufacturer's actual output power (50 ohm system) = 0.01742 watts

### **NOTE:**

**See the following pages for the graphs of the actual measurements made:**



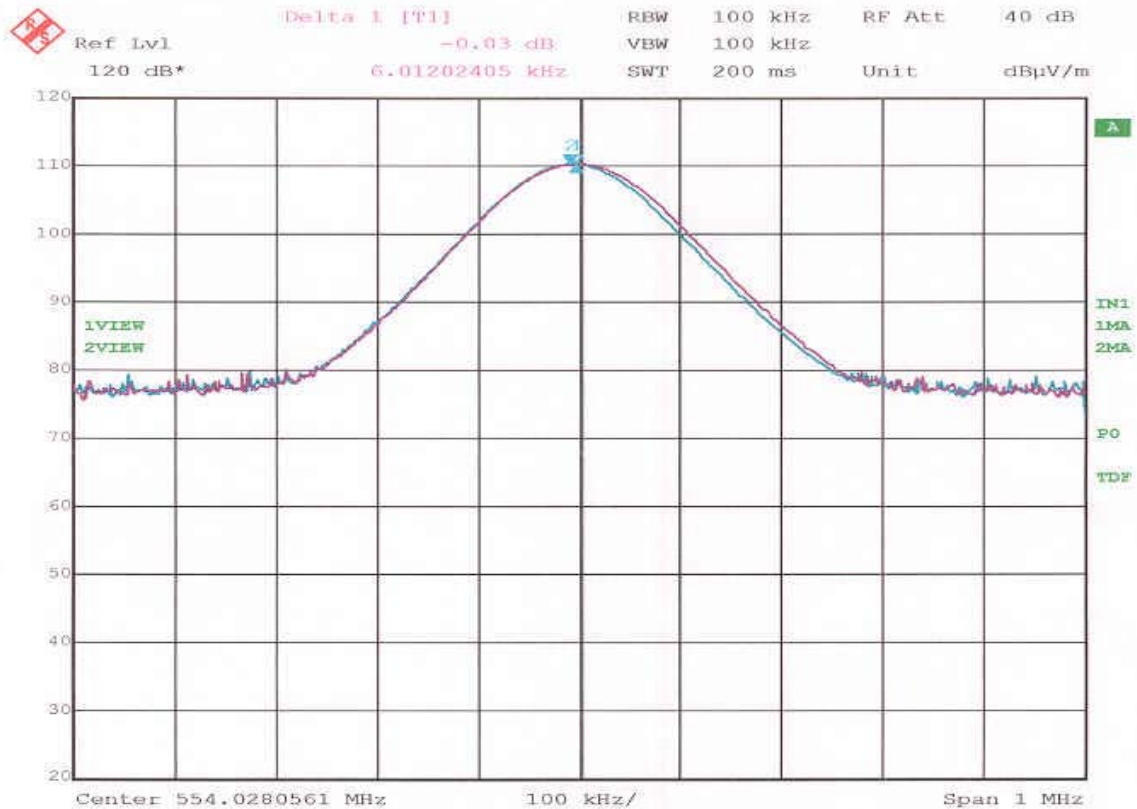
Test Services  
Peterson Drive, Wheeling, Illinois 60090, USA

Report No. 9273

## **GRAPHS TAKEN OF THE RF POWER**

### **OUTPUT MEASUREMENTS**

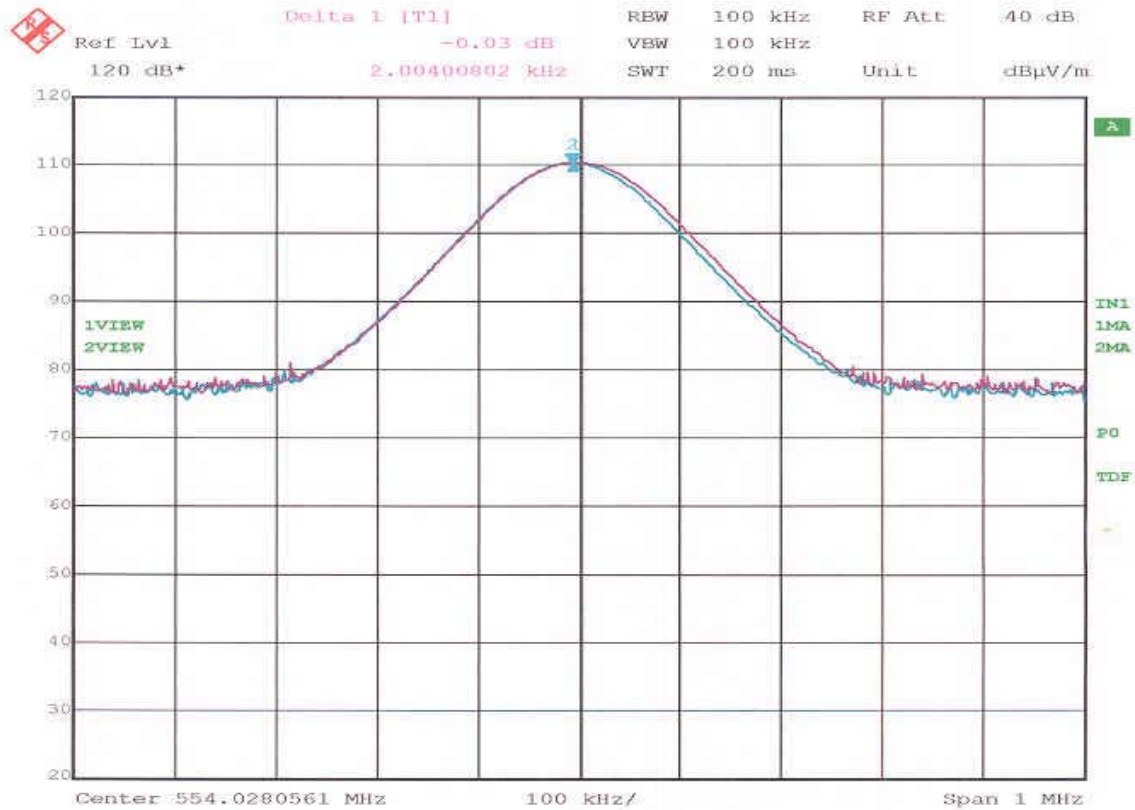
#### **PART 2.1046**



Title: Output Power Substitution Method: Shure Inc. Model# ULX1  
Comment A: Vertical Rx Ant.; Sig. Gen. Output Level = 117.2 dBuV  
Date: 4.SEP.2001 14:01:59

≈ 10.5 mW

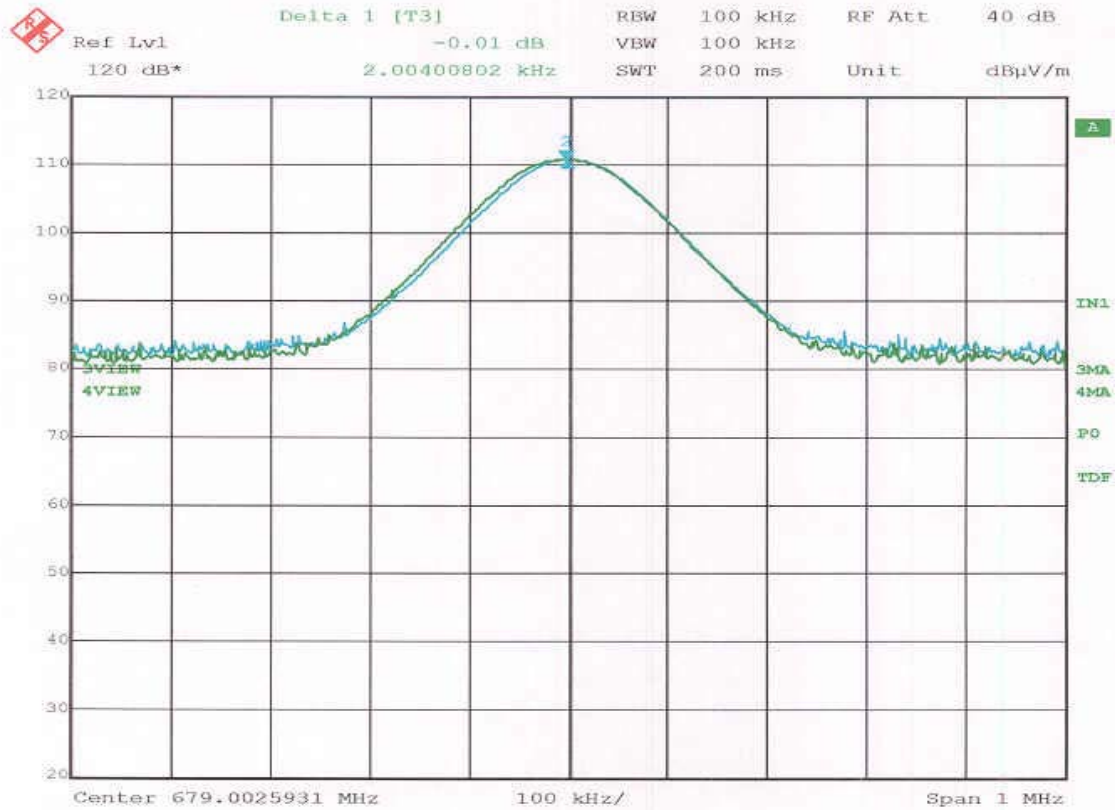
**FINAL**  
Genoa



Title: Output Power Substitution Method: Shure Inc. Model# ULX1  
Comment A: Horizontal Rx Ant.; Sig. Gen. Output Level = 117.7 dBμV  
Date: 4.SEP.2001 14:42:35

= 11.78 mW

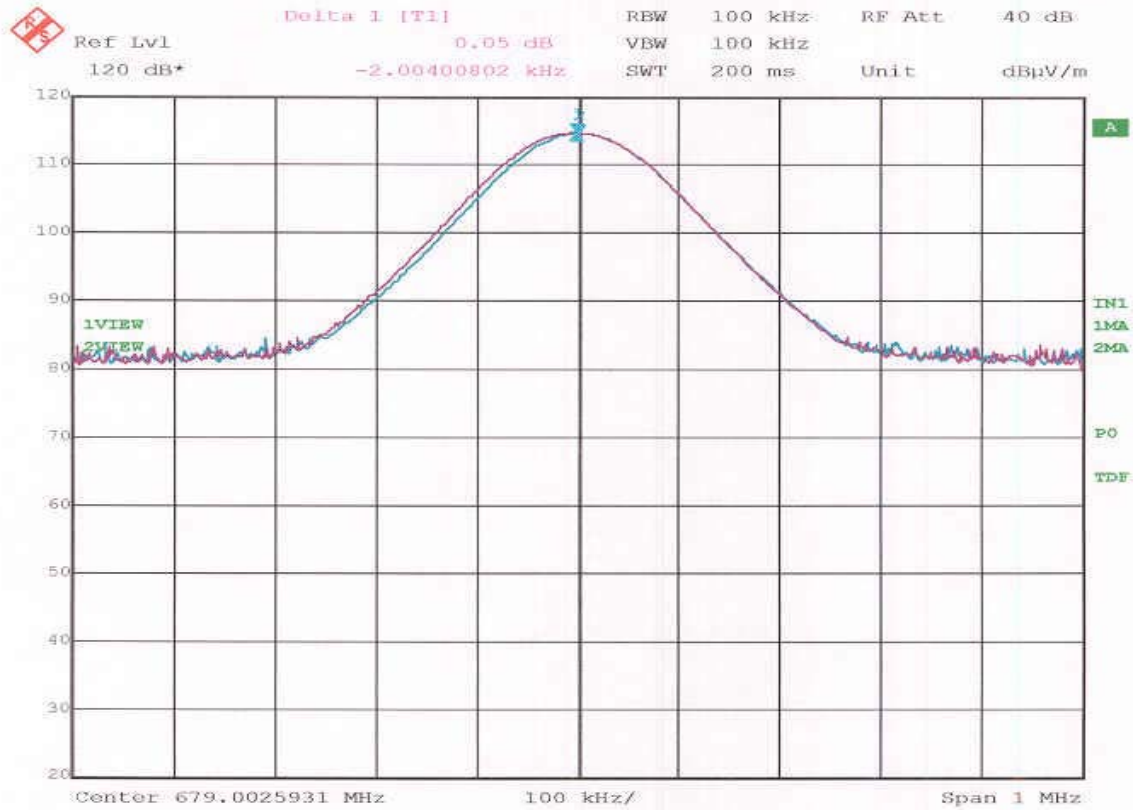
**FINAL**  
Genoa



Title: Output Power Substitution Method: Shure Inc. Model# ULX1  
Comment A: Vertical Rx Ant.; Sig. Gen. Output Level = 117.4 dBuV  
Date: 4.SEP.2001 15:47:18

≈ 11.0 mW

**FINAL**  
Genoa

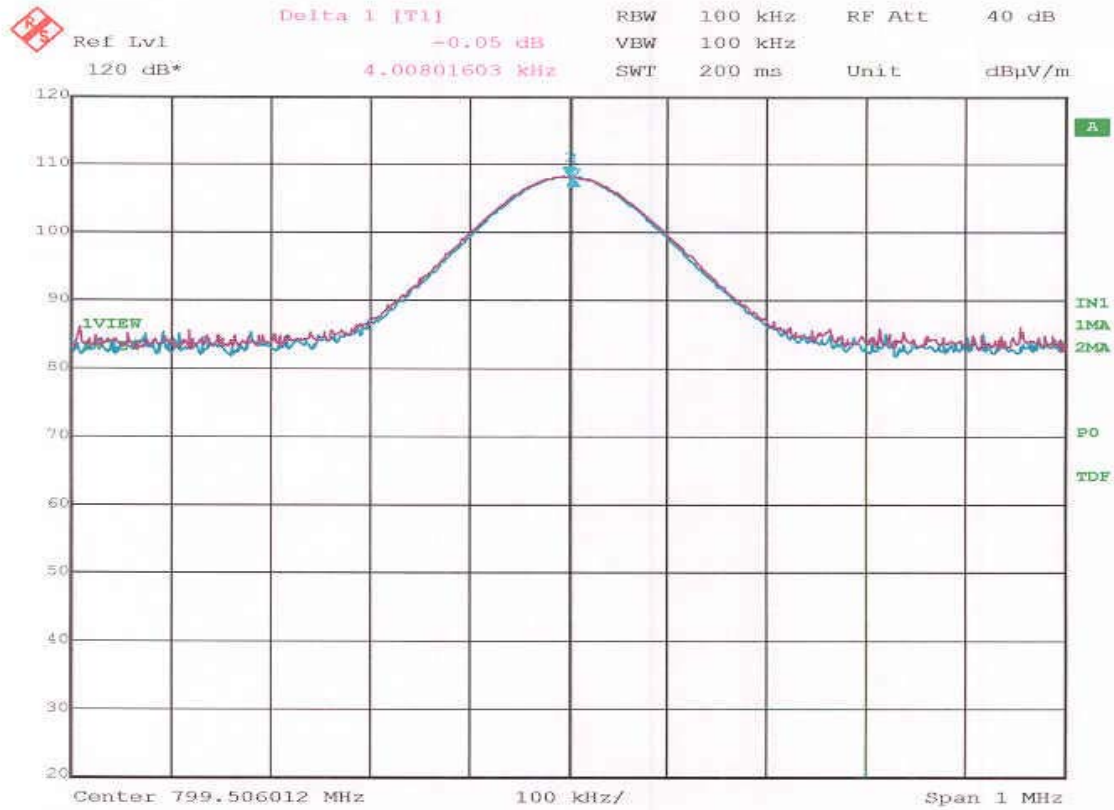


Title: Output Power Substitution Method: Shure Inc. Model# ULX1  
Comment A: Horizontal Rx Ant.; Sig. Gen. Output Level = 119.4 dBμV  
Date: 4.SEP.2001 15:44:04

= 17.42 mW

**FINAL**  
Genoa

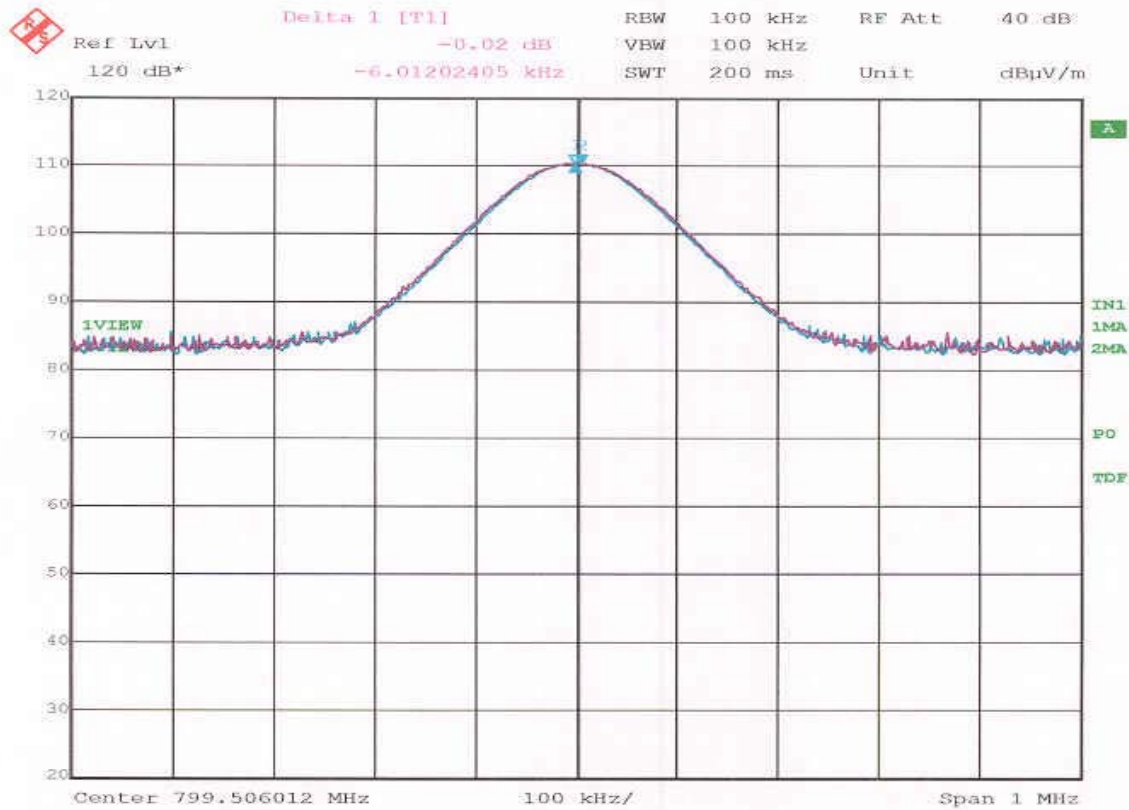




Title: Output Power Substitution Method: Shure Inc. Model# ULX1  
Comment A: Vertical Rx Ant.; Sig. Gen. Output Level = 115.3 dBuV  
Date: 5.SEP.2001 09:08:10

= 6.78 mW

**FINAL**  
Genoa



Title: Output Power Substitution Method: Shure Inc. Model# ULX1  
 Comment A: Horizontal Rx Ant.; Sig. Gen. Output Level = 115.0 dBμV  
 Date: 5.SEP.2001 08:55:50

= 6.32 mW

**FINAL**  
Genoa



## 9.0 Frequency Deviation and Tolerance - PART 74.861

Paragraph e-3 states that the maximum authorized deviation shall be 75 kHz for all frequency modulation emissions in the frequency bands 554 MHz to 806 MHz.

Frequency Deviation used: + or -45 kHz for 100% modulation

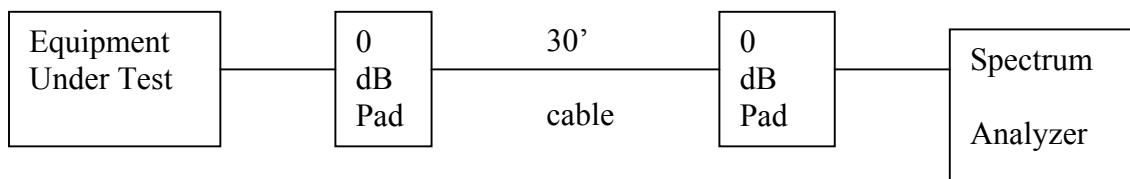
Paragraph e-4 states that the frequency tolerance of the transmitter shall be .005 percent.

### NOTE:

See Section 12 of this test report for the frequency tolerance test results.

## 10.0 SPURIOUS CONDUCTED EMISSION MEASUREMENTS AT ANTENNA TERMINALS PART 2.1051

Spurious conducted emissions were measured at the antenna terminals using an artificial load. Plots were made showing the amplitude of each harmonic emission with the equipment operated as specified in 2.1049. As shown by the radiated charts there was no reason to believe that there were any spurious emissions other than the harmonics that were than individually investigated when doing the conducted test at the antenna terminals. Measurements were made up to the 10th Harmonic of the fundamental. The following setup was used showing placement of the attenuators:



The allowed emissions for transmitters operating in the 554 MHz to 806 MHz bands for UHF Wireless System equipment are found under Part 74, Section 74.861, Paragraph e-6 for Low Power Auxiliary Stations. This paragraph states the mean power of the emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

- (1) On any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB.
- (2) On any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB.
- (3) On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least  $43+10\log_{10}$  (mean output power in watts) dB.

**NOTE:** See the following pages for the data and graphs of the actual measurements made:

**NOTE:** This test was not run because there is no detachable antenna.



Test Services  
Peterson Drive, Wheeling, Illinois 60090, USA

Report No. 9273

**CONDUCTED EMISSION DATA TAKEN FOR  
SPURIOUS EMISSION MEASUREMENTS MADE  
AT THE ANTENNA TERMINALS**

**PART 2.1051**

**NOTE: This test was not run because there is no detachable antenna.**



Test Services  
Peterson Drive, Wheeling, Illinois 60090, USA

Report No. 9273

**CONDUCTED EMISSION GRAPHS TAKEN FOR  
SPURIOUS EMISSION MEASUREMENTS MADE  
AT THE ANTENNA TERMINALS**

**PART 2.1051**

**NOTE: This test was not run because there is no detachable antenna.**



## 11.0 FIELD STRENGTH OF SPURIOUS EMISSION MEASUREMENTS PART 2.1053

Radiated measurements were performed at a 1 or 3 meter test distance automatically scanning the frequency range from 200 MHz to 8000 MHz, depending upon the fundamental frequency.

For the UHF Wireless System, the highest fundamental frequency is 799.5 MHz so the scans were made up to 8000 MHz, to cover the tenth harmonic.

All signals in the frequency range of 30 MHz to 200 MHz were measured with a Biconical Antenna and from 200 MHz to 1000 MHz a Log Periodic Antenna was used as the pickup devices. From 1000 MHz to 10000 MHz, a Double Ridge Horn Antenna was used. The cables and equipment were placed and moved within the range of positions likely to find their maximum emissions. Tests were made in both the horizontal and vertical planes of polarization.

The allowed emissions for transmitters operating in the 554 MHz to 806 MHz bands for UHF Wireless System equipment are found under Part 74, Section 74.861, Paragraph e-6 for Low Power Auxiliary Stations. This paragraph states the mean power of the emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

- (1) On any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB.
- (2) On any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB.
- (3) On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least  $43 + 10 \log_{10}$  (mean output power in watts) dB.

11.0 FIELD STRENGTH OF SPURIOUS EMISSION MEASUREMENTS (CON'T)  
PART 2.1053

To determine the **LIMIT** for Spurious Emissions the following method was used:

**Maximum output power in watts:**

Maximum Transmitter output power in watts **0.01742**

**Free Space Formula:**

Convert to 3 meter test distance using the Free Space Formula

$$\frac{\sqrt{49.2 * \text{rated wattage}}}{\text{Distance}} = \frac{(49.2 * 0.01742)^{.5}}{3} = 0.3085925 \text{ volts/meter}$$

$$0.3085925 \text{ v/m} = 308592.5 \text{ uV/m}$$

$$20 * \text{Log}(308592.5) = 109.79 \text{ dBuV/m}$$

Spurious emission limit at three meters equals **109.79 dBuV**

**The emissions must be reduced by:**

$$43 + 10 * \text{LOG}_{10}(0.01742) = \underline{25.41 \text{ dB}}$$

Therefore, the **LIMIT** at three meters equals:

$$\begin{aligned} &109.79 \text{ dBuV/m extrapolated level for 0.03 watts} \\ &\underline{-25.41 \text{ dB required reduction below the unmodulated fundamental}} \\ &\mathbf{84.38 \text{ dBuV/m spurious emissions limit}} \end{aligned}$$





Test Services  
Peterson Drive, Wheeling, Illinois 60090, USA

Report No. 9273

# **RADIATED DATA & GRAPHS TAKEN FOR FIELD STRENGTH SPURIOUS EMISSION MEASUREMENTS**

**PART 2.1053**

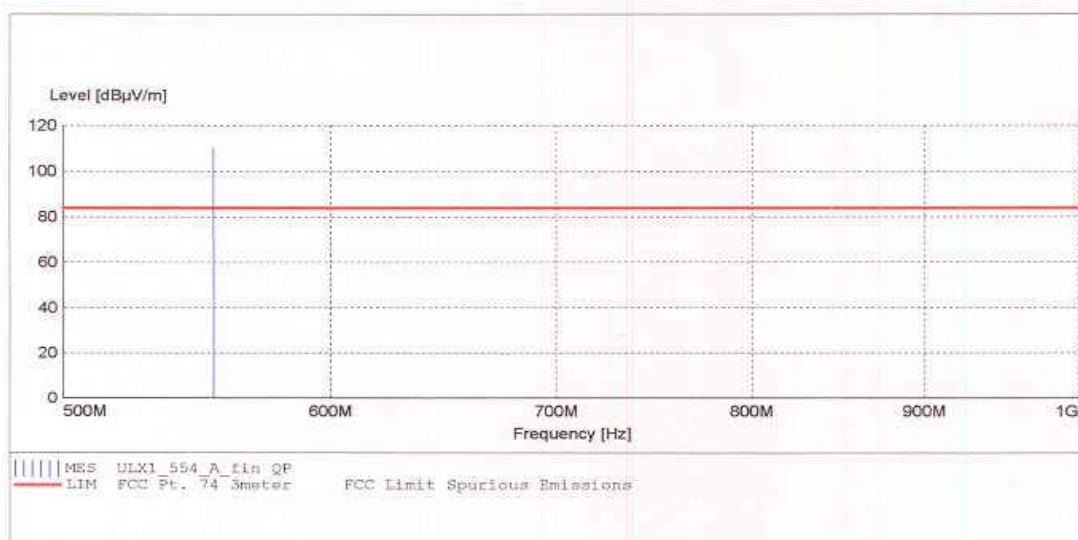
**Radiated Spurious Emissions**

**FCC Part 74.861**

EUT: ULX1  
Manufacturer: Shure Inc.  
Operating Condition: 72 deg F; 60% R.H.  
Test Site: O.F. Site 3  
Operator: Jason Lauer  
Test Specification: 3 Meter Test Distance  
Comment: 554 MHz Transmit Frequency  
Start of Test: 9/5/01 / 10:10:19AM

**SCAN TABLE: "FCC/RSS Tx 3meter"**

Short Description:	Below 1 GHz	Meas. Time	IF Bandw.	Transducer
Start Stop Step	Detector			
Frequency Frequency Width				
500.0 MHz 1000.0 MHz 20.0 kHz	MaxPeak Average	2.0 s	120 kHz	4895B



**MEASUREMENT RESULT: "ULX1\_554\_A\_fin QP"**

9/5/01 10:16AM

Frequency	Level	Transd	Limit	Margin	IFBW	Height	Azi.	Pol.	Comment
MHz	dBμV/m	dB	dBμV/m	dB	kHz	cm	deg		
554.030000	110.30	23.5	84.0	-26.3	120	100.0	40	VER	Fundamental
554.030000	110.20	23.5	84.0	-26.2	120	130.0	80	HOR	Fundamental

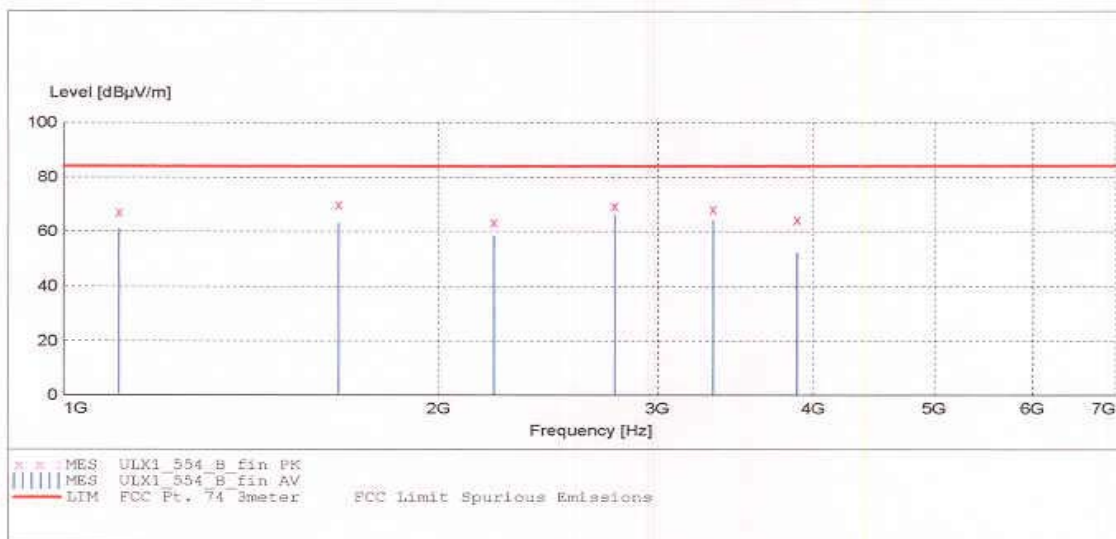
**Fundamental Radiated & Spurious Emissions**

**FCC Part 74.861**

EUT: ULX1  
Manufacturer: Shure Inc.  
Operating Condition: 75 deg F; 52% R.H.  
Test Site: O.F. Site 3  
Operator: Jason Lauer  
Test Specification: 3 Meter Test Distance  
Comment: 554 MHz Transmit Frequency  
Start of Test: 9/5/01 / 4:45:00PM

**SCAN TABLE: "FCC/RSS Tx 3meter H"**

Short Description:	Start	Stop	Step	Above 1 GHz Detector	Meas. Time	IF Bandw.	Transducer
Frequency	Frequency	Frequency	Width				
1.0 GHz	7.0 GHz	50.0 kHz	MaxPeak	2.0 s	1 MHz	5731 3M	
7.0 GHz	12.0 GHz	50.0 kHz	Average	2.0 s	1 MHz	5731 3M	
			MaxPeak				



**MEASUREMENT RESULT: "ULX1\_554\_B\_fin PK"**

9/5/01 5:10PM

Frequency	Level	Transd	Limit	Margin	IFBW	Height	Azi.	Pol.	Comment
MHz	dBuV/m	dB	dBuV/m	dB	kHz	cm	deg		
1108.000000	67.30	27.0	1000.0	932.7	1000	100.0	170	VER	2nd Harmonic
1662.000000	70.00	29.6	1000.0	930.0	1000	100.0	80	VER	3rd Harmonic
2216.000000	63.50	32.0	1000.0	936.5	1000	100.0	0	VER	4th Harmonic
2770.000000	69.30	33.8	1000.0	930.7	1000	100.0	0	VER	5th Harmonic
3324.000000	68.30	35.2	1000.0	931.7	1000	100.0	170	VER	6th Harmonic
3878.000000	64.30	37.2	1000.0	935.7	1000	100.0	220	VER	7th Harmonic

Page 1/2 9/5/01 5:10PM ULX1\_554\_B

**FINAL**  
Genoa



Test Services  
Peterson Drive, Wheeling, Illinois 60090, USA

Report No. 9273

MEASUREMENT RESULT: "ULX1\_554\_B\_fin AV"

9/5/01 5:10PM

Frequency	Level	Transd	Limit	Margin	IFBW	Height	Azi.	Pol.	Comment
MHz	dBµV/m	dB	dBµV/m	dB	kHz	cm	deg		
1108.000000	61.00	27.0	84.0	23.0	1000	100.0	170	VER	2nd Harmonic
1662.000000	63.10	29.6	84.0	20.9	1000	100.0	80	VER	3rd Harmonic
2216.000000	58.20	32.0	84.0	25.8	1000	100.0	0	VER	4th Harmonic
2770.000000	66.30	33.8	84.0	17.7	1000	100.0	0	VER	5th Harmonic
3324.000000	64.00	35.2	84.0	20.0	1000	100.0	170	VER	6th Harmonic
3878.000000	52.00	37.2	84.0	32.0	1000	100.0	220	VER	7th Harmonic

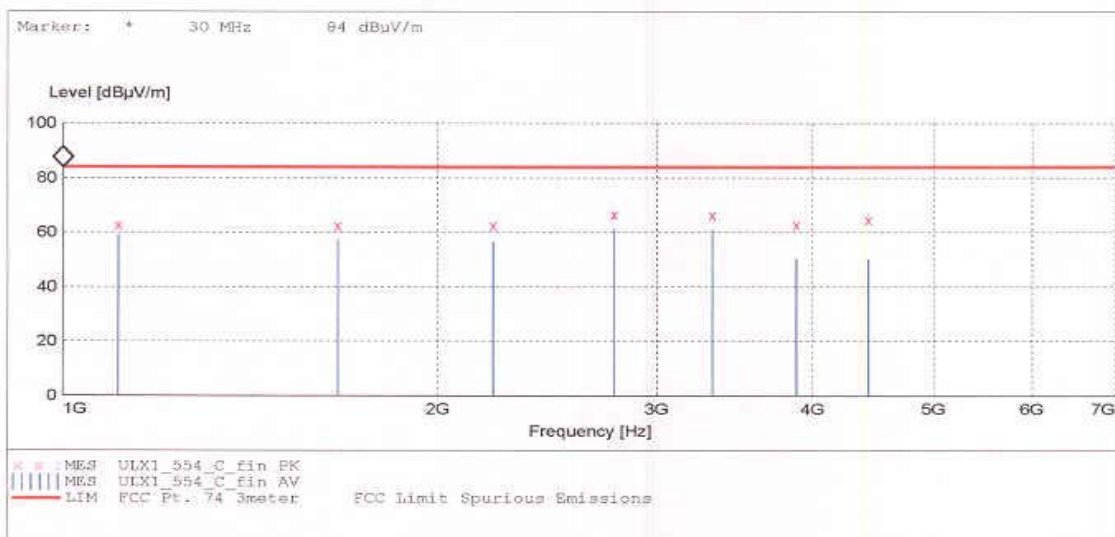
**Fundamental Radiated & Spurious Emissions**

**FCC Part 74.861**

EUT: ULX1  
Manufacturer: Shure Inc.  
Operating Condition: 77 deg F; 52% R.H.  
Test Site: O.F. Site 3  
Operator: Jason Lauer  
Test Specification: 3 Meter Test Distance  
Comment: 554 MHz Transmit Frequency  
Start of Test: 9/5/01 / 4:14:34PM

**SCAN TABLE: "FCC/RSS Tx 3meter H"**

Short Description:			Above 1 GHz			
Start	Stop	Step	Detector	Meas. Time	IF Bandw.	Transducer
Frequency	Frequency	Width				
1.0 GHz	7.0 GHz	50.0 kHz	MaxPeak	2.0 s	1 MHz	5731 3M
			Average			
7.0 GHz	12.0 GHz	50.0 kHz	MaxPeak	2.0 s	1 MHz	5731 3M



**MEASUREMENT RESULT: "ULX1\_554\_C\_fin PK"**

9/5/01 4:41PM

Frequency	Level	Transd	Limit	Margin	IFBW	Height	Azi.	Pol.	Comment
MHz	dBuV/m	dB	dBuV/m	dB	kHz	cm	deg		
1108.000000	62.70	27.0	1000.0	937.3	1000	100.0	110	HOR	2nd Harmonic
1662.000000	62.30	29.6	1000.0	937.7	1000	100.0	80	HOR	3rd Harmonic
2216.000000	62.50	32.0	1000.0	937.5	1000	100.0	0	HOR	4th Harmonic
2770.000000	66.50	33.8	1000.0	933.5	1000	100.0	260	HOR	5th Harmonic
3324.000000	66.30	35.2	1000.0	933.7	1000	100.0	170	HOR	6th Harmonic

Page 1/2 9/5/01 4:41PM ULX1\_554\_C

**FINAL**  
Genoa



**MEASUREMENT RESULT: "ULX1\_554\_C\_fin PK"**

(continued)

Frequency	Level	Transd	Limit	Margin	IFBW	Height	Azi.	Pol.	Comment
MHz	dBμV/m	dB	dBμV/m	dB	kHz	cm	deg		
3878.000000	62.80	37.2	1000.0	937.2	1000	100.0	170	HOR	7th Harmonic
4432.000000	64.50	37.0	1000.0	935.5	1000	100.0	170	HOR	8th Harmonic

**MEASUREMENT RESULT: "ULX1\_554\_C\_fin AV"**

9/5/01 4:41PM

Frequency	Level	Transd	Limit	Margin	IFBW	Height	Azi.	Pol.	Comment
MHz	dBμV/m	dB	dBμV/m	dB	kHz	cm	deg		
1108.000000	58.90	27.0	84.0	25.1	1000	100.0	110	HOR	2nd Harmonic
1662.000000	57.20	29.6	84.0	26.8	1000	100.0	80	HOR	3rd Harmonic
2216.000000	56.40	32.0	84.0	27.6	1000	100.0	0	HOR	4th Harmonic
2770.000000	61.30	33.8	84.0	22.7	1000	100.0	260	HOR	5th Harmonic
3324.000000	60.90	35.2	84.0	23.1	1000	100.0	170	HOR	6th Harmonic
3878.000000	50.20	37.2	84.0	33.8	1000	100.0	170	HOR	7th Harmonic
4432.000000	50.00	37.0	84.0	34.0	1000	100.0	170	HOR	8th Harmonic



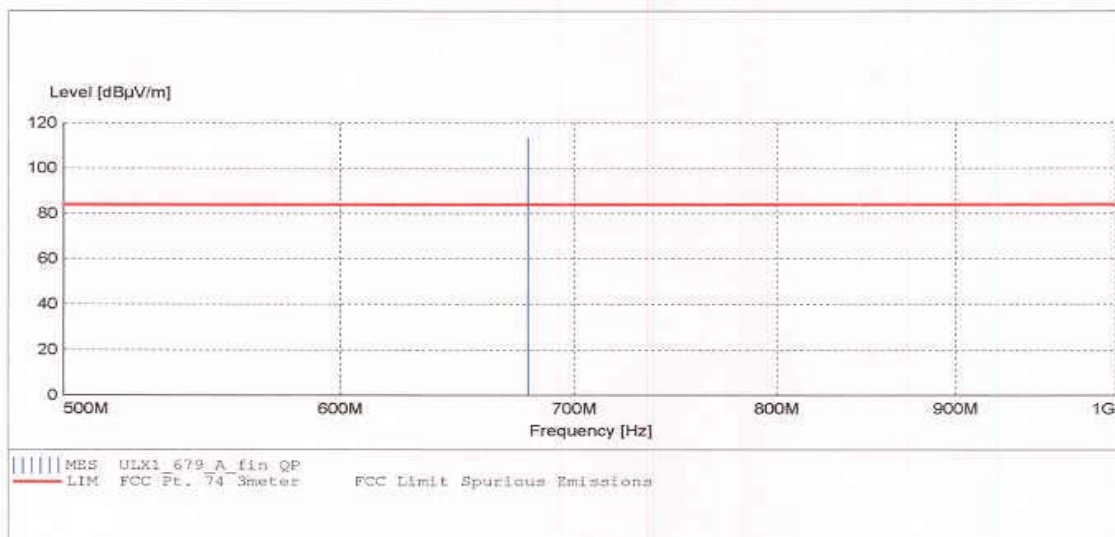
**Fundamental Radiated & Spurious Emissions**

**FCC Part 74.861**

EUT: ULX1  
Manufacturer: Shure Inc.  
Operating Condition: 73 deg F; 56% R.H.  
Test Site: O.F. Site 3  
Operator: Jason Lauer  
Test Specification: 3 Meter Test Distance  
Comment: 679 MHz Transmit Frequency  
Start of Test: 9/5/01 / 10:51:14AM

**SCAN TABLE: "FCC/RSS Tx 3meter"**

Short Description:			Below 1 GHz	Meas.	IF	Transducer
Start	Stop	Step	Detector	Time	Bandw.	
Frequency	Frequency	Width				
500.0 MHz	1000.0 MHz	20.0 kHz	MaxPeak	2.0 s	120 kHz	4895B
			Average			



**MEASUREMENT RESULT: "ULX1\_679\_A\_fin QP"**

9/5/01 11:01AM

Frequency	Level	Transd	Limit	Margin	IFBW	Height	Azi.	Pol.	Comment
MHz	dBuV/m	dB	dBuV/m	dB	kHz	cm	deg		
679.000000	113.60	26.9	84.0	-29.6	120	110.0	80	HOR	Fundamental
679.000000	108.90	26.9	84.0	-24.9	120	100.0	220	VER	Fundamental

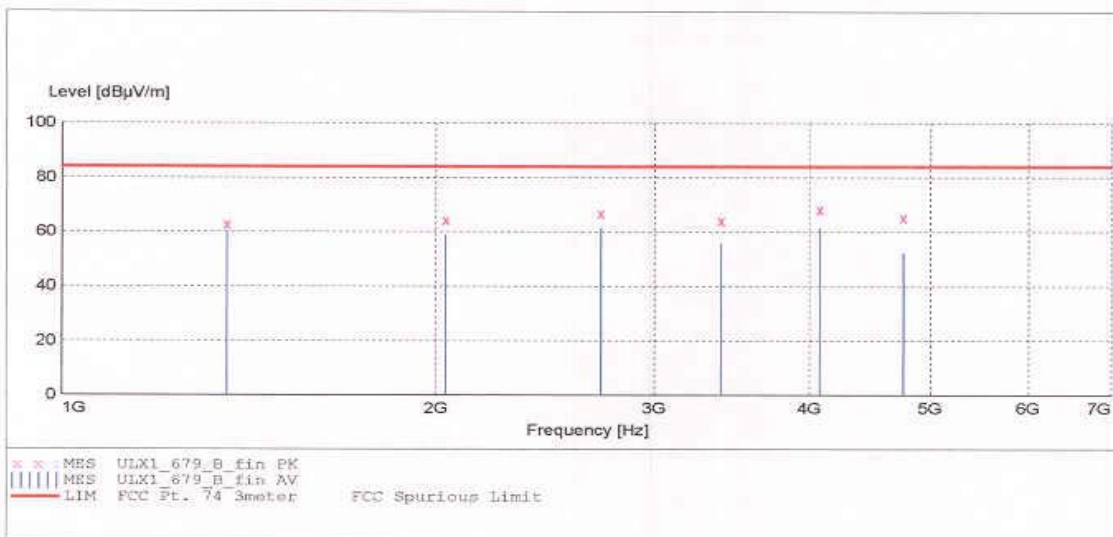
**Fundamental Radiated & Spurious Emissions**

**FCC Part 74.861**

EUT: ULX1  
Manufacturer: Shure Inc.  
Operating Condition: 77 deg F; 51% R.H.  
Test Site: O.F. Site 3  
Operator: Jason Lauer  
Test Specification: 3 Meter Test Distance  
Comment: 679 MHz Transmit Frequency  
Start of Test: 9/5/01 / 3:12:37PM

**SCAN TABLE: "FCC/RSS Tx 3meter H"**

Short Description:	Above 1 GHz	Meas. Time	IF Bandw.	Transducer
Start Stop Frequency Frequency Step Width	Detector			
1.0 GHz 7.0 GHz 50.0 kHz	MaxPeak	2.0 s	1 MHz	5731 3M
7.0 GHz 12.0 GHz 50.0 kHz	Average	2.0 s	1 MHz	5731 3M



**MEASUREMENT RESULT: "ULX1\_679\_B\_fin PK"**

9/10/01 10:31AM

Frequency	Level	Transd	Limit	Margin	IFBW	Height	Azi.	Pol.	Comment
MHz	dBµV/m	dB	dBµV/m	dB	kHz	cm	deg		
1358.000000	62.80	28.1	1000.0	937.2	1000	100.0	0	VER	2nd Harmonic
2037.000000	64.10	31.4	1000.0	935.9	1000	100.0	0	VER	3rd Harmonic
2716.000000	66.70	33.6	1000.0	933.3	1000	100.0	320	VER	4th Harmonic
3395.000000	64.00	35.4	1000.0	936.0	1000	100.0	90	VER	5th Harmonic
4074.000000	68.20	37.5	1000.0	931.8	1000	100.0	270	VER	6th Harmonic
4753.000000	65.30	37.9	1000.0	934.7	1000	100.0	0	VER	7th Harmonic

Page: 1/2 9/10/01 10:43AM ULX1\_679\_B

**FINAL**  
Genoa





Test Services  
Peterson Drive, Wheeling, Illinois 60090, USA

Report No. 9273

**MEASUREMENT RESULT: "ULX1\_679\_B\_fin AV"**

9/10/01 10:30AM

Frequency	Level	Transd	Limit	Margin	IFBW	Height	Azi.	Pol.	Comment
MHz	dBμV/m	dB	dBμV/m	dB	kHz	cm	deg		
1358.000000	59.60	28.1	84.0	24.4	1000	100.0	0	VER	2nd Harmonic
2037.000000	58.70	31.4	84.0	25.3	1000	100.0	0	VER	3rd Harmonic
2716.000000	61.20	33.6	84.0	22.8	1000	100.0	320	VER	4th Harmonic
3395.000000	55.80	35.4	84.0	28.2	1000	100.0	90	VER	5th Harmonic
4074.000000	61.70	37.5	84.0	22.3	1000	100.0	260	VER	6th Harmonic
4753.000000	52.30	37.9	84.0	31.7	1000	100.0	0	VER	7th Harmonic

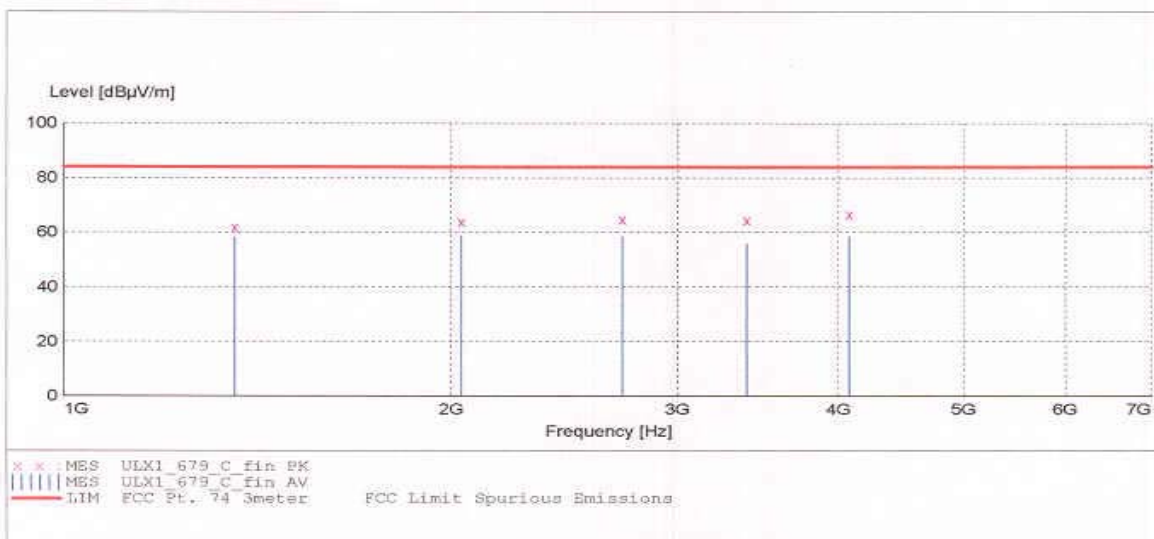
**Fundamental Radiated & Spurious Emissions**

**FCC Part 74.861**

EUT: ULX1  
Manufacturer: Shure Inc.  
Operating Condition: 77 deg F; 51% R.H.  
Test Site: O.F. Site 3  
Operator: Jason Lauer  
Test Specification: 3 Meter Test Distance  
Comment: 679 MHz Transmit Frequency  
Start of Test: 9/5/01 / 3:53:46PM

**SCAN TABLE: "FCC/RSS Tx 3meter H"**

Short Description:	Above 1 GHz	Meas.	IF	Transducer
Start Stop Step	Detector	Time	Bandw.	
Frequency Frequency Width				
1.0 GHz 7.0 GHz 50.0 kHz	MaxPeak	2.0 s	1 MHz	5731 3M
7.0 GHz 12.0 GHz 50.0 kHz	Average	2.0 s	1 MHz	5731 3M
	MaxPeak			



**MEASUREMENT RESULT: "ULX1\_679\_C\_fin PK"**

9/5/01 4:06PM

Frequency	Level	Transd	Limit	Margin	IFBW	Height	Azi.	Pol.	Comment
MHz	dBuV/m	dB	dBuV/m	dB	kHz	cm	deg		
1358.000000	61.90	28.1	1000.0	938.1	1000	100.0	80	HOR	2nd Harmonic
2037.000000	63.80	31.4	1000.0	936.2	1000	100.0	0	HOR	3rd Harmonic
2716.000000	64.70	33.6	1000.0	935.3	1000	100.0	80	HOR	4th Harmonic
3395.000000	64.40	35.4	1000.0	935.6	1000	100.0	170	HOR	5th Harmonic
4074.000000	66.60	37.5	1000.0	933.4	1000	100.0	170	HOR	6th Harmonic

Page 1/2 9/5/01 4:07PM ULX1\_679\_C

**FINAL**  
Genoa



Test Services  
Peterson Drive, Wheeling, Illinois 60090, USA

Report No. 9273

MEASUREMENT RESULT: "ULX1\_679\_C\_fin AV"

9/5/01 4:06PM

Frequency	Level	Transd	Limit	Margin	IFBW	Height	Azi.	Pol.	Comment
MHz	dBµV/m	dB	dBµV/m	dB	kHz	cm	deg		
1358.000000	58.10	28.1	84.0	25.9	1000	100.0	80	HOR	2nd Harmonic
2037.000000	58.60	31.4	84.0	25.4	1000	100.0	0	HOR	3rd Harmonic
2716.000000	58.30	33.6	84.0	25.7	1000	100.0	80	HOR	4th Harmonic
3395.000000	55.70	35.4	84.0	28.3	1000	100.0	170	HOR	5th Harmonic
4074.000000	58.50	37.5	84.0	25.5	1000	100.0	170	HOR	6th Harmonic

**FINAL**  
Genoa

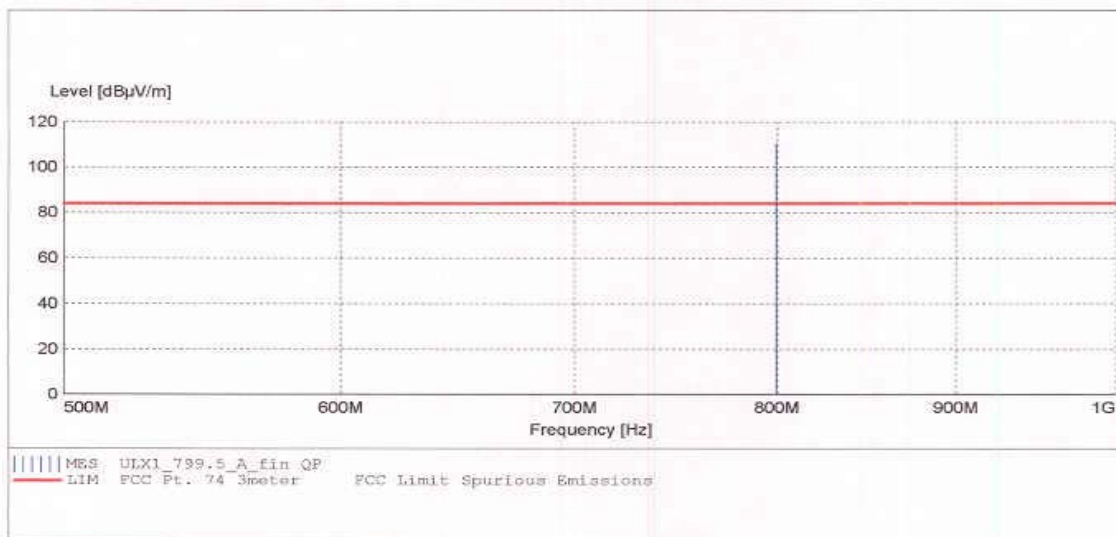
**Fundamental Radiated & Spurious Emissions**

**FCC Part 74.861**

EUT: ULX1  
Manufacturer: Shure Inc.  
Operating Condition: 73 deg F; 56% R.H.  
Test Site: O.F. Site 3  
Operator: Jason Lauer  
Test Specification: 3 Meter Test Distance  
Comment: 799.5 MHz Transmit Frequency  
Start of Test: 9/5/01 / 11:19:30AM

**SCAN TABLE: "FCC/RSS Tx 3meter"**

Short Description:			Below 1 GHz	Meas.	IF	Transducer
Start	Stop	Step	Detector	Time	Bandw.	
Frequency	Frequency	Width				
500.0 MHz	1000.0 MHz	20.0 kHz	MaxPeak	2.0 s	120 kHz	4895B
			Average			



**MEASUREMENT RESULT: "ULX1\_799.5\_A\_fin QP"**

9/5/01 11:26AM

Frequency	Level	Transd	Limit	Margin	IFBW	Height	Azi.	Pol.	Comment
MHz	dBμV/m	dB	dBμV/m	dB	kHz	cm	deg		
799.500000	110.40	27.4	84.0	-26.4	120	100.0	260	HOR	Fundamental
799.500000	107.40	27.4	84.0	-23.4	120	120.0	170	VER	Fundamental

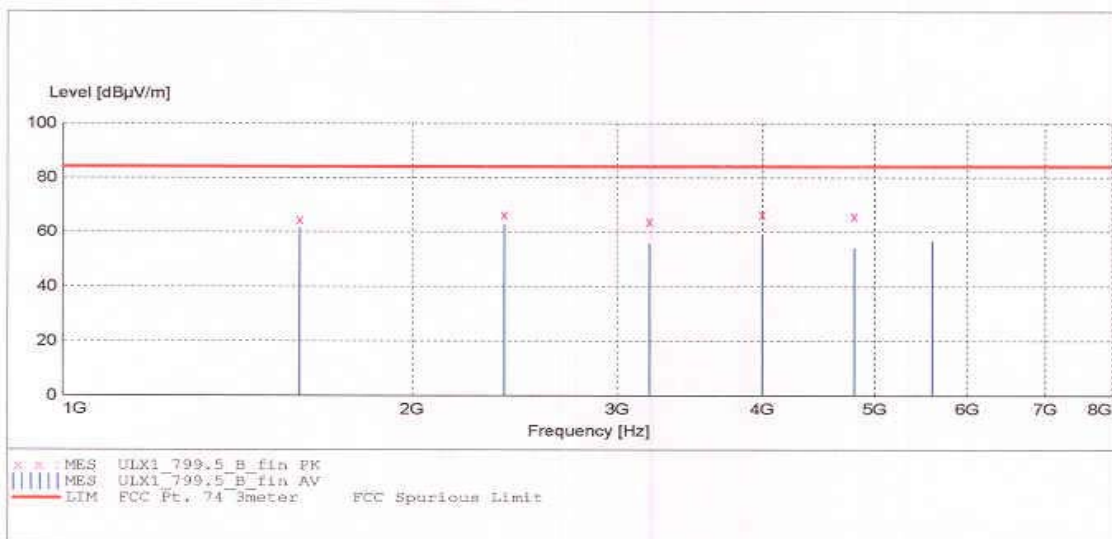
**Fundamental Radiated & Spurious Emissions**

**FCC Part 74.861**

EUT: ULX1  
Manufacturer: Shure Inc.  
Operating Condition: 77 deg F; 55% R.H.  
Test Site: O.F. Site 3  
Operator: Jason Lauer  
Test Specification: 3 Meter Test Distance  
Comment: 799.5 MHz Transmit Frequency  
Start of Test: 9/5/01 / 1:03:27PM

**SCAN TABLE: "FCC/RSS Tx 3meter H"**

Short Description:	Start	Stop	Step	Above 1 GHz Detector	Meas. Time	IF Bandw.	Transducer
Frequency	Frequency	Frequency	Width				
1.0 GHz	7.0 GHz	50.0 kHz	MaxPeak	2.0 s	1 MHz	5731	3M
7.0 GHz	12.0 GHz	50.0 kHz	Average	2.0 s	1 MHz	5731	3M
			MaxPeak				



**MEASUREMENT RESULT: "ULX1\_799.5\_B\_fin PK"**

9/10/01 10:50AM

Frequency	Level	Transd	Limit	Margin	IFBW	Height	Azi.	Pol.	Comment
MHz	dBµV/m	dB	dBµV/m	dB	kHz	cm	deg		
1599.000000	64.60	29.3	1000.0	935.4	1000	110.0	40	VER	2nd Harmonic
2398.500000	66.40	32.7	1000.0	933.6	1000	110.0	260	VER	3rd Harmonic
3198.000000	63.90	35.0	1000.0	936.1	1000	110.0	0	VER	4th Harmonic
3997.500000	66.50	37.6	1000.0	933.5	1000	110.0	10	VER	5th Harmonic
4797.000000	65.80	38.0	1000.0	934.2	1000	110.0	10	VER	6th Harmonic





Test Services  
Peterson Drive, Wheeling, Illinois 60090, USA

Report No. 9273

**MEASUREMENT RESULT: "ULX1\_799.5\_B\_fin AV"**

9/10/01 12:07PM

Frequency	Level	Transd	Limit	Margin	IFBW	Height	Azi.	Pol.	Comment
MHz	dBμV/m	dB	dBμV/m	dB	kHz	cm	deg		
1599.000000	61.60	29.3	84.0	22.4	1000	110.0	40	VER	2nd Harmonic
2398.500000	62.70	32.7	84.0	21.3	1000	110.0	270	VER	3rd Harmonic
3198.000000	55.70	35.0	84.0	28.3	1000	110.0	0	VER	4th Harmonic
3997.500000	57.90	37.6	84.0	26.1	1000	110.0	20	VER	5th Harmonic
4797.000000	53.90	38.0	84.0	30.1	1000	110.0	20	VER	6th Harmonic
5596.500000	56.50	40.1	84.0	27.5	1000	110.0	20	VER	7th Harmonic

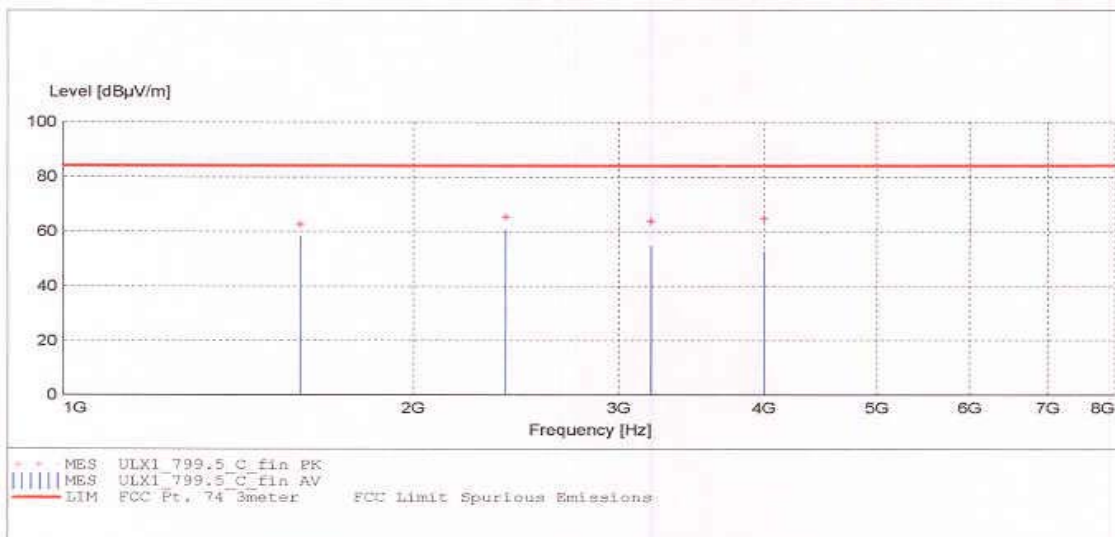
**Fundamental Radiated & Spurious Emissions**

**FCC Part 74.861**

EUT: ULX1  
Manufacturer: Shure Inc.  
Operating Condition: 77 deg F; 55% R.H.  
Test Site: O.F. Site 3  
Operator: Jason Lauer  
Test Specification: 3 Meter Test Distance  
Comment: 799.5 MHz Transmit Frequency  
Start of Test: 9/5/01 / 2:01:45PM

**SCAN TABLE: "FCC/RSS Tx 3meter H"**

Short Description:		Above 1 GHz		Meas. Time	IF Bandw.	Transducer
Start Frequency	Stop Frequency	Step Width	Detector			
1.0 GHz	7.0 GHz	50.0 kHz	MaxPeak	2.0 s	1 MHz	5731 3M
7.0 GHz	12.0 GHz	50.0 kHz	Average	2.0 s	1 MHz	5731 3M



**MEASUREMENT RESULT: "ULX1\_799.5\_C\_fin PK"**

9/5/01 3:03PM

Frequency	Level	Transd	Limit	Margin	IFBW	Height	Azi.	Pol.	Comment
MHz	dBμV/m	dB	dBμV/m	dB	kHz	cm	deg		
1599.000000	62.50	29.3	1000.0	937.5	1000	100.0	80	HOR	2nd Harmonic
2398.500000	65.20	32.7	1000.0	934.8	1000	100.0	260	HOR	3rd Harmonic
3198.000000	63.70	35.0	1000.0	936.3	1000	100.0	170	HOR	4th Harmonic
3997.500000	64.70	37.6	1000.0	935.3	1000	100.0	0	HOR	5th Harmonic



Test Services  
Peterson Drive, Wheeling, Illinois 60090, USA

Report No. 9273

MEASUREMENT RESULT: "ULX1\_799.5\_C\_fin AV"

9/5/01 3:03PM

Frequency	Level	Transd	Limit	Margin	IFBW	Height	Azi.	Pol.	Comment
MHz	dBµV/m	dB	dBµV/m	dB	kHz	cm	deg		
1599.000000	58.30	29.3	84.0	25.7	1000	100.0	80	HOR	2nd Harmonic
2398.500000	60.70	32.7	84.0	23.3	1000	100.0	260	HOR	3rd Harmonic
3198.000000	54.80	35.0	84.0	29.2	1000	100.0	170	HOR	4th Harmonic
3997.500000	52.70	37.6	84.0	31.3	1000	100.0	0	HOR	5th Harmonic





## 12.0 FREQUENCY STABILITY - PART 2.1055a (Temperature)

The frequency stability was measured from -30° to +50° centigrade at intervals of 10° centigrade throughout the range. Prior to each frequency measurement, the equipment was left alone for a sufficient period of time (approximately 30 minutes or more) to allow the components of the UHF Wireless System oscillator circuitry to stabilize. The following information was taken:

### **FREQUENCY STABILITY FOR TEMPERATURE VARIATION IN MHz:**

-30°	678.99828
-20°	679.00142
-10°	679.00132
0°	679.00038
+10°	678.99992
+20°	678.99984
+30°	678.99896
+40°	678.99744
+50°	678.99676

### **Worst Case Variance:**

**2680 Hz**

As stated in Part 74, Section 74.861 e-4 the Frequency Tolerance and Margin for this range are as follows:

<b>Frequency Tolerance:</b>	=	<b><u>0.00005</u></b>
<b>Ambient Frequency:</b>	=	<b><u>678.998740 MHz</u></b>
$678998740 * 0.00005$	=	<b><u>33949.937 Hz</u></b>
$2680 - 33949.937$	=	<b><u>561 Hz</u> Margin</b>

**This is well within the specified limits.**



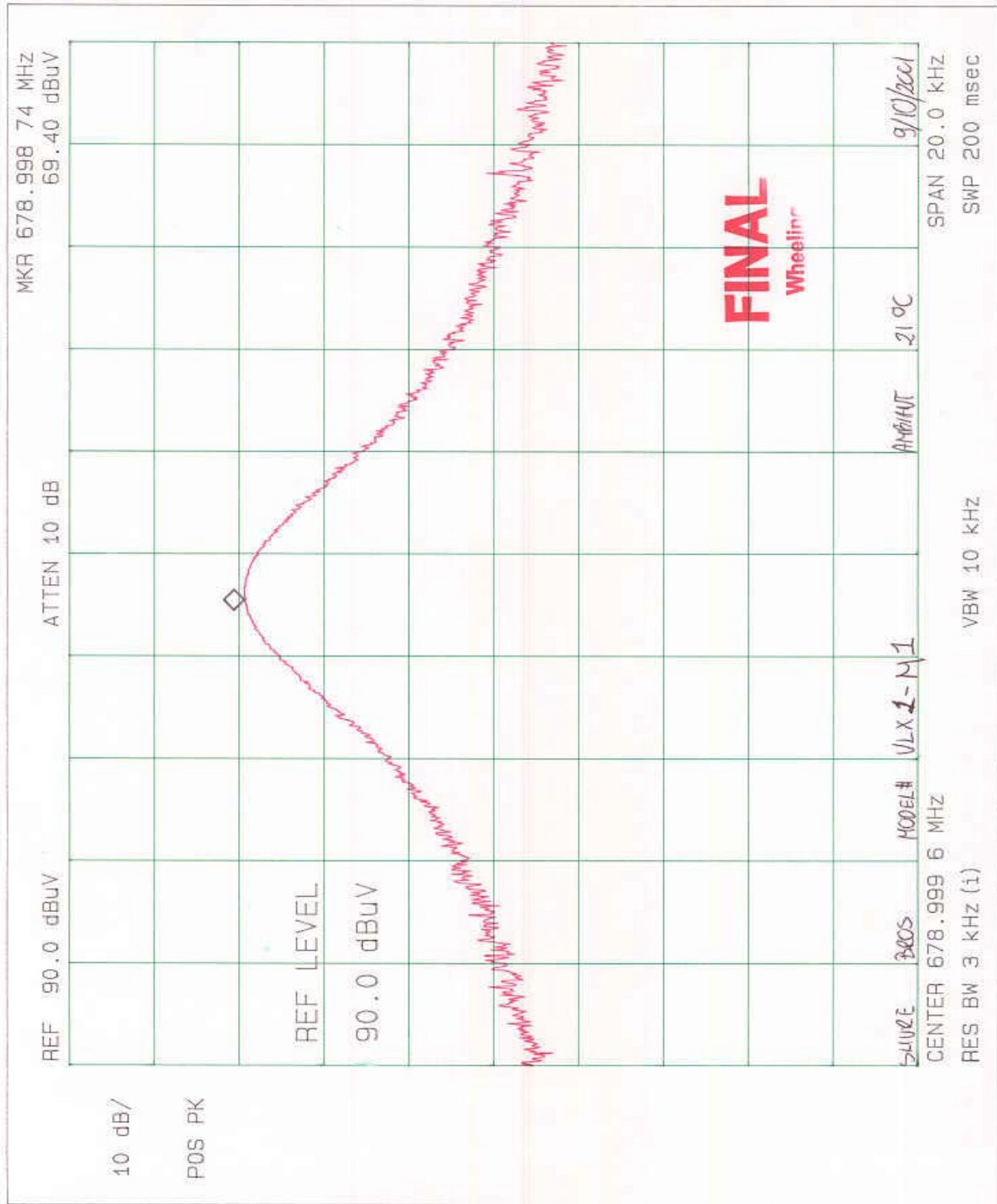
Test Services  
Peterson Drive, Wheeling, Illinois 60090, USA

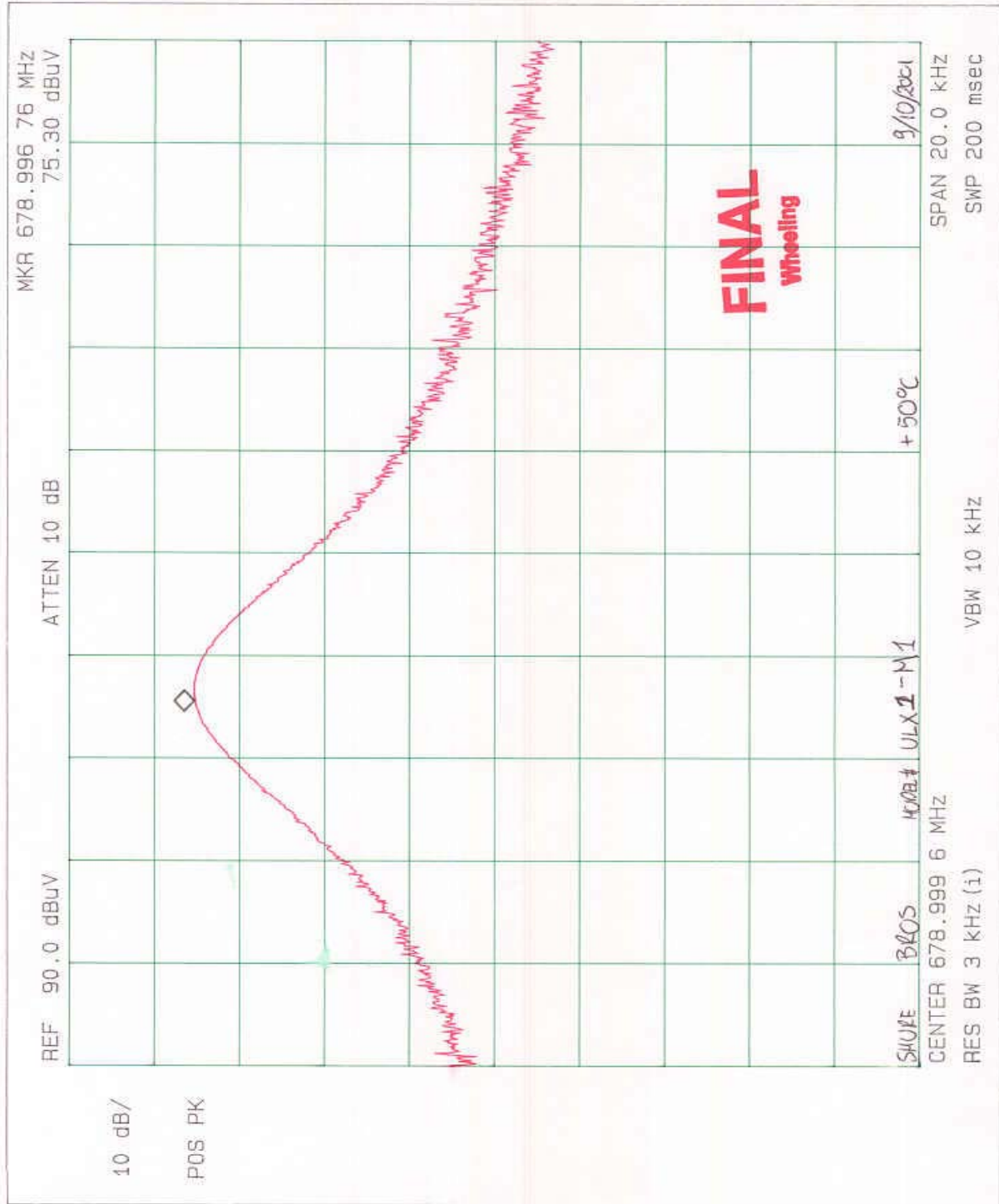
Report No. 9273

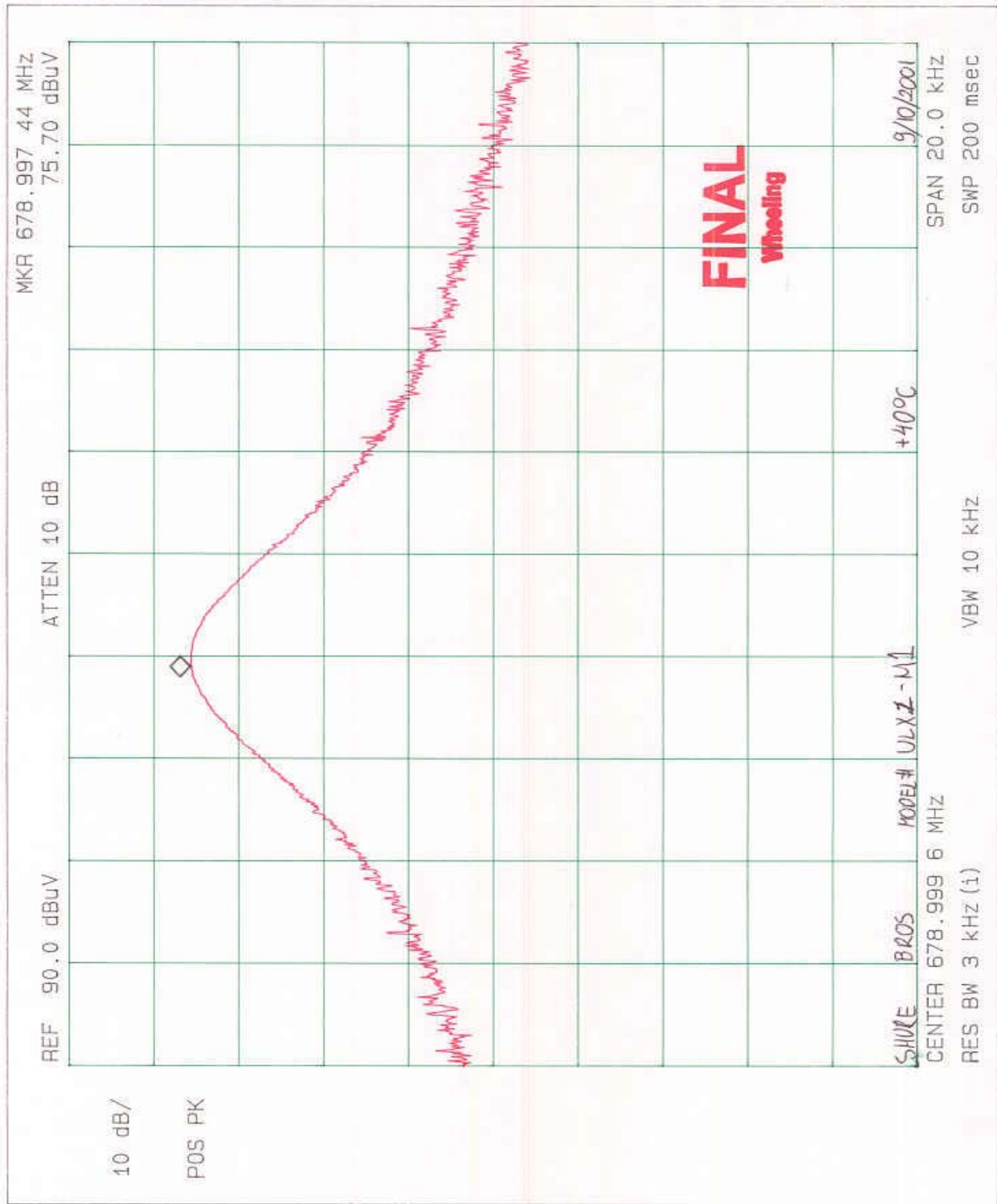
## **GRAPHS TAKEN FOR FREQUENCY**

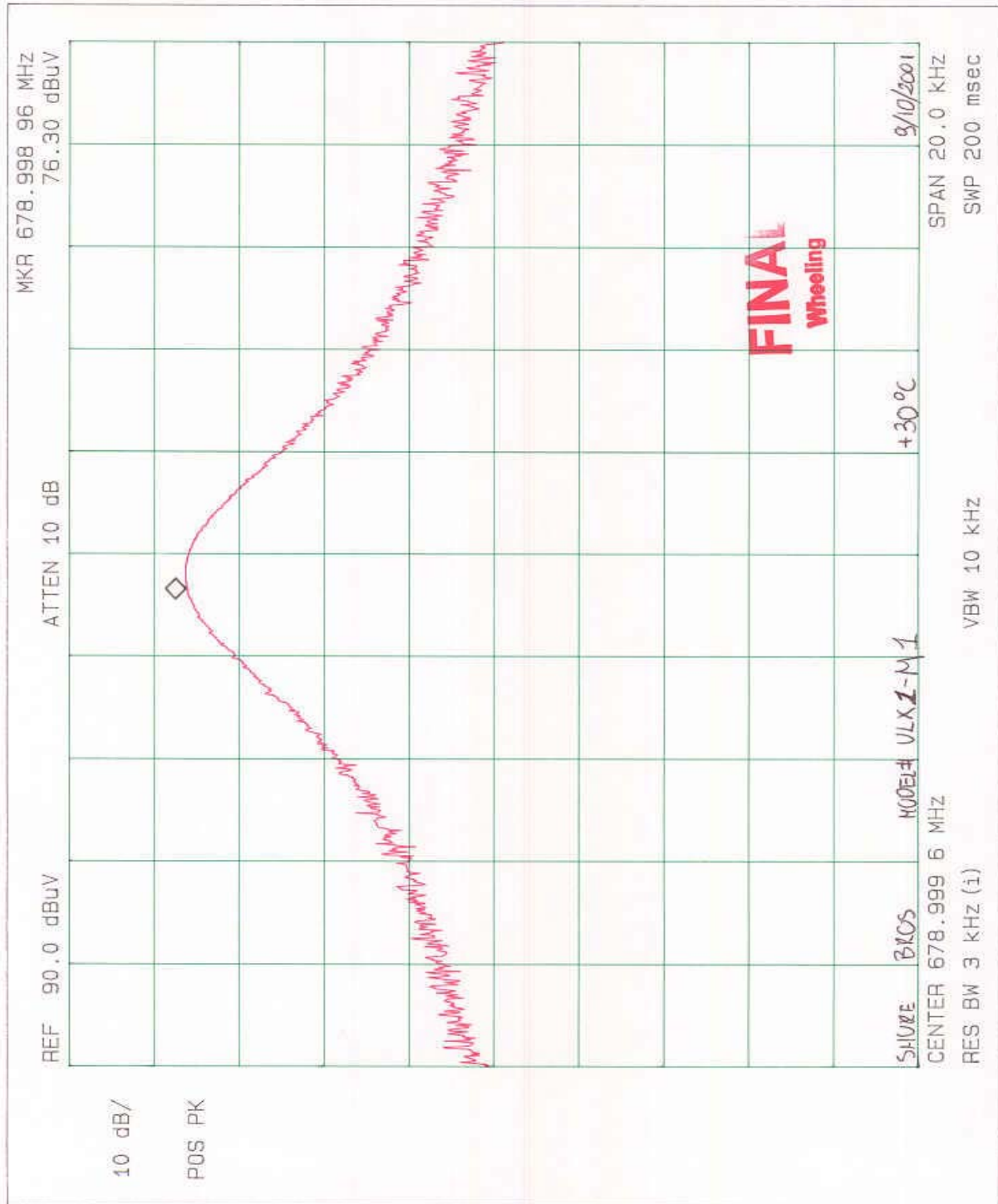
### **STABILITY WHEN VARYING THE TEMPERATURE**

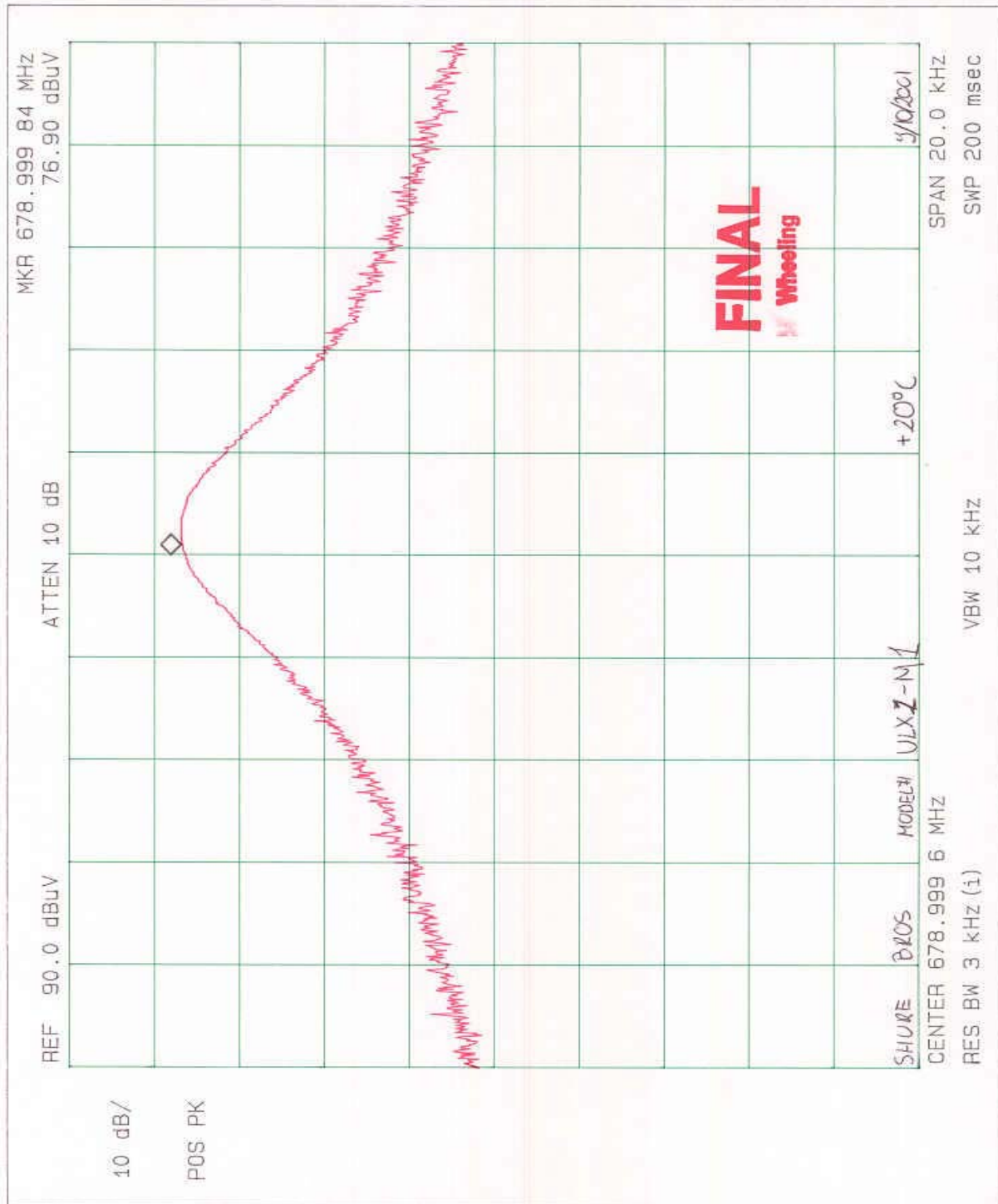
#### **PART 2.1055a**



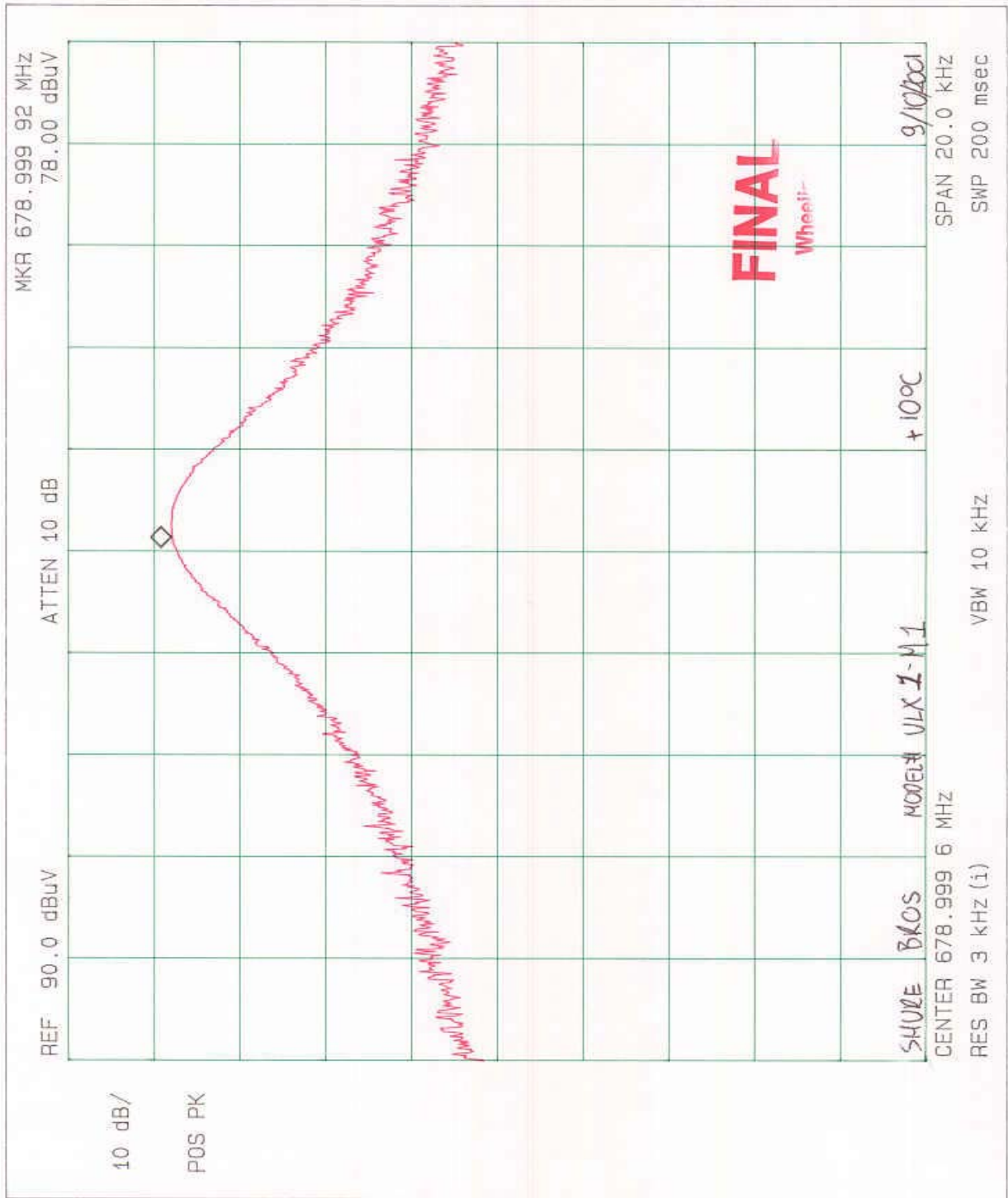




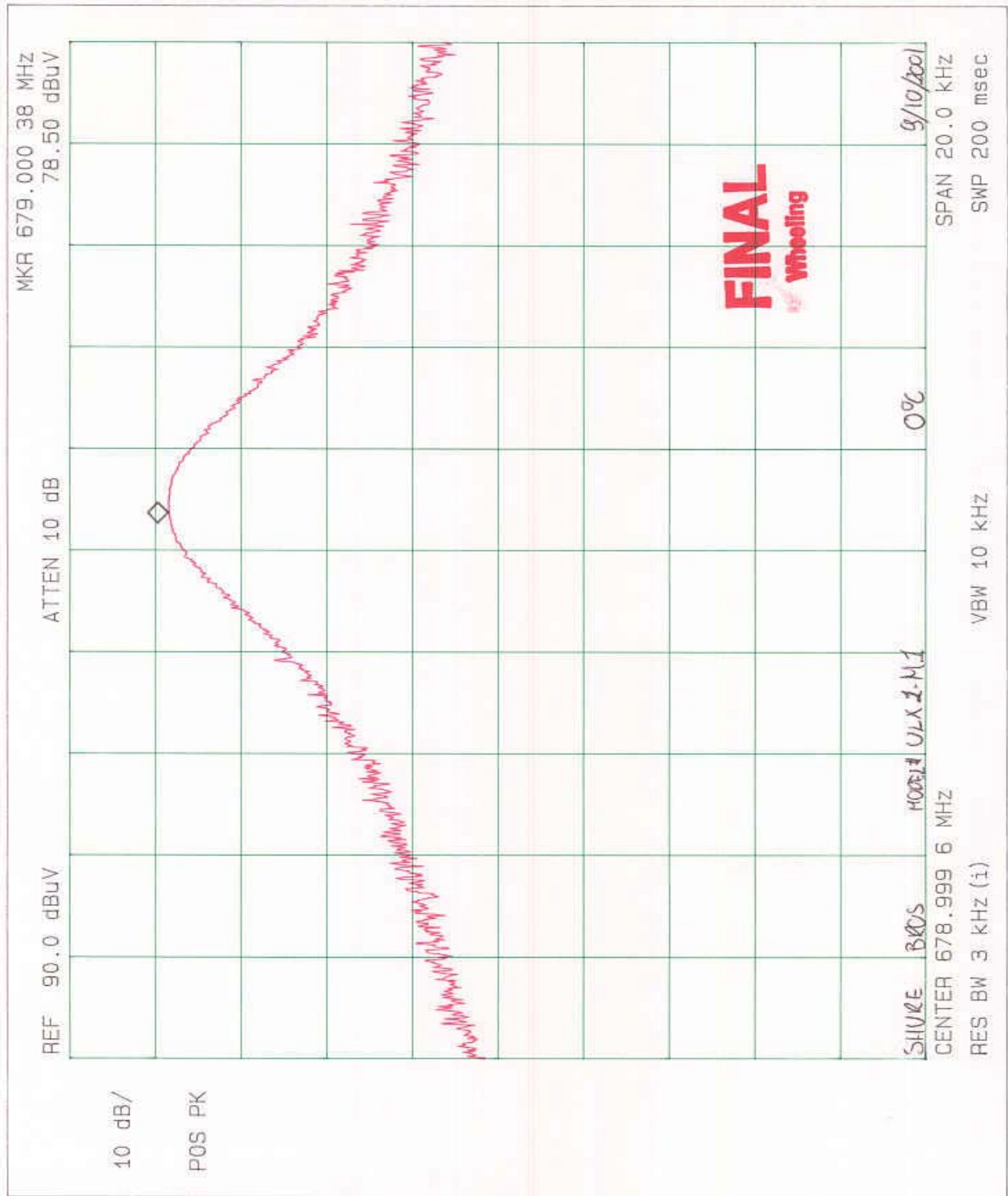


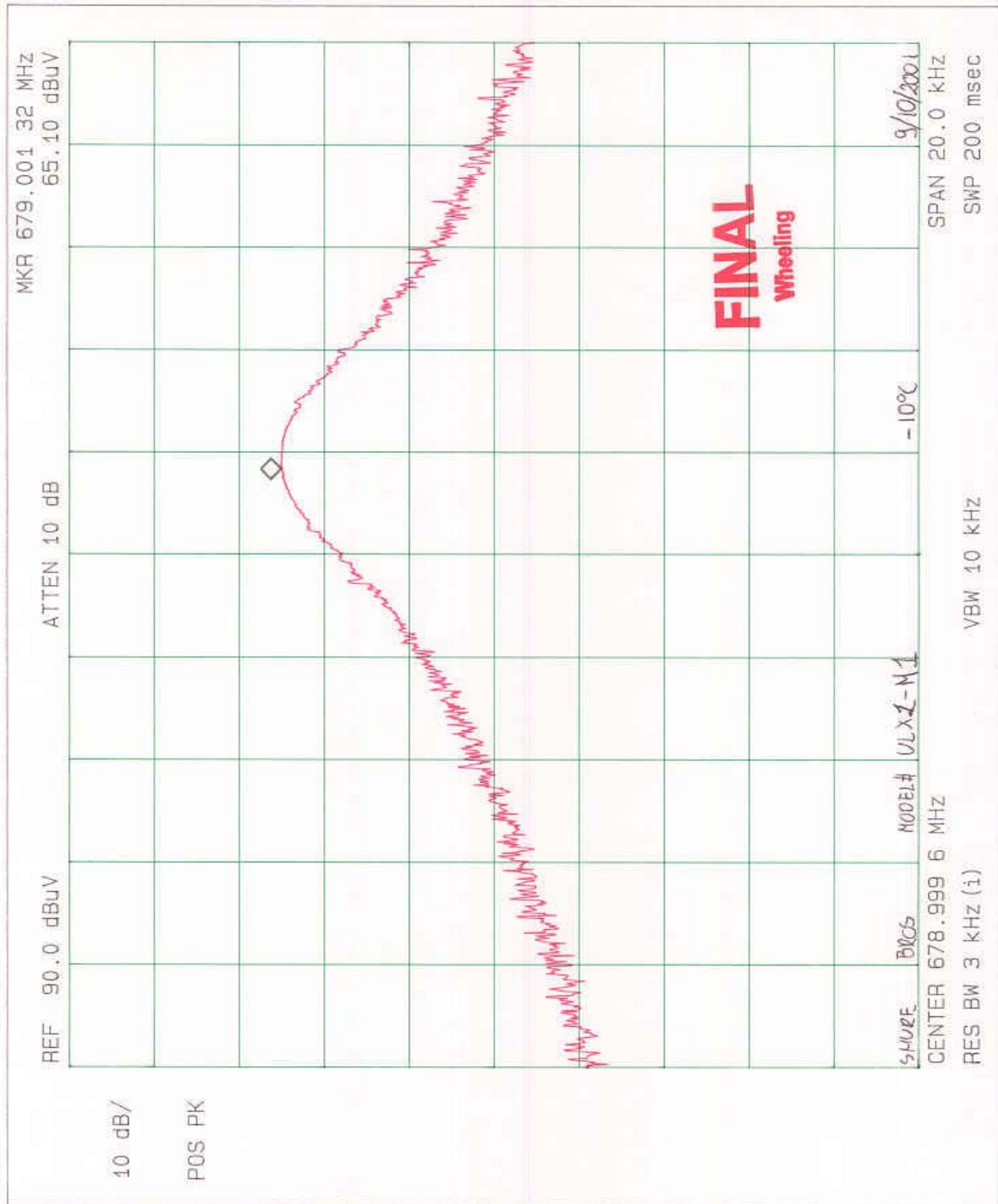


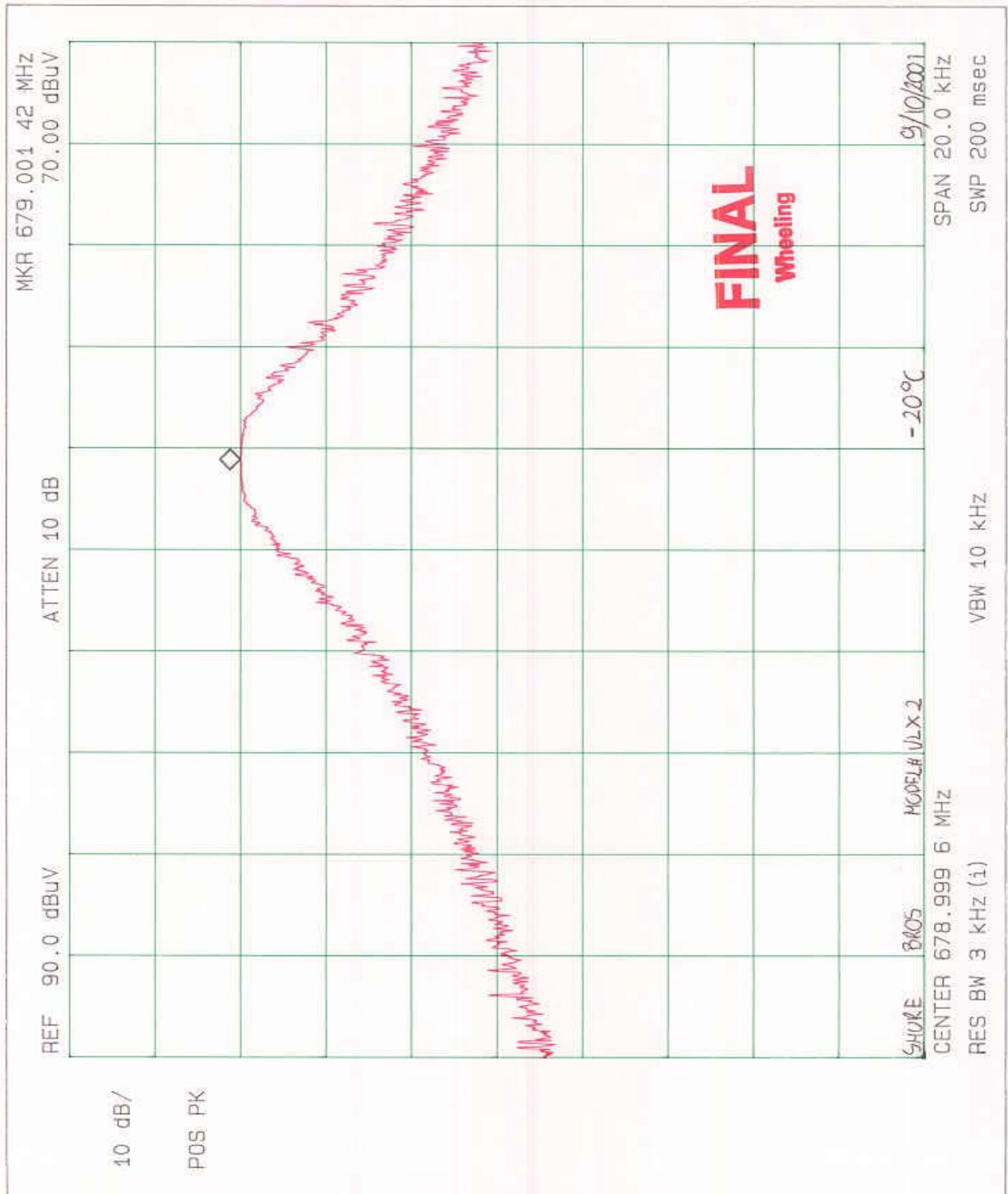


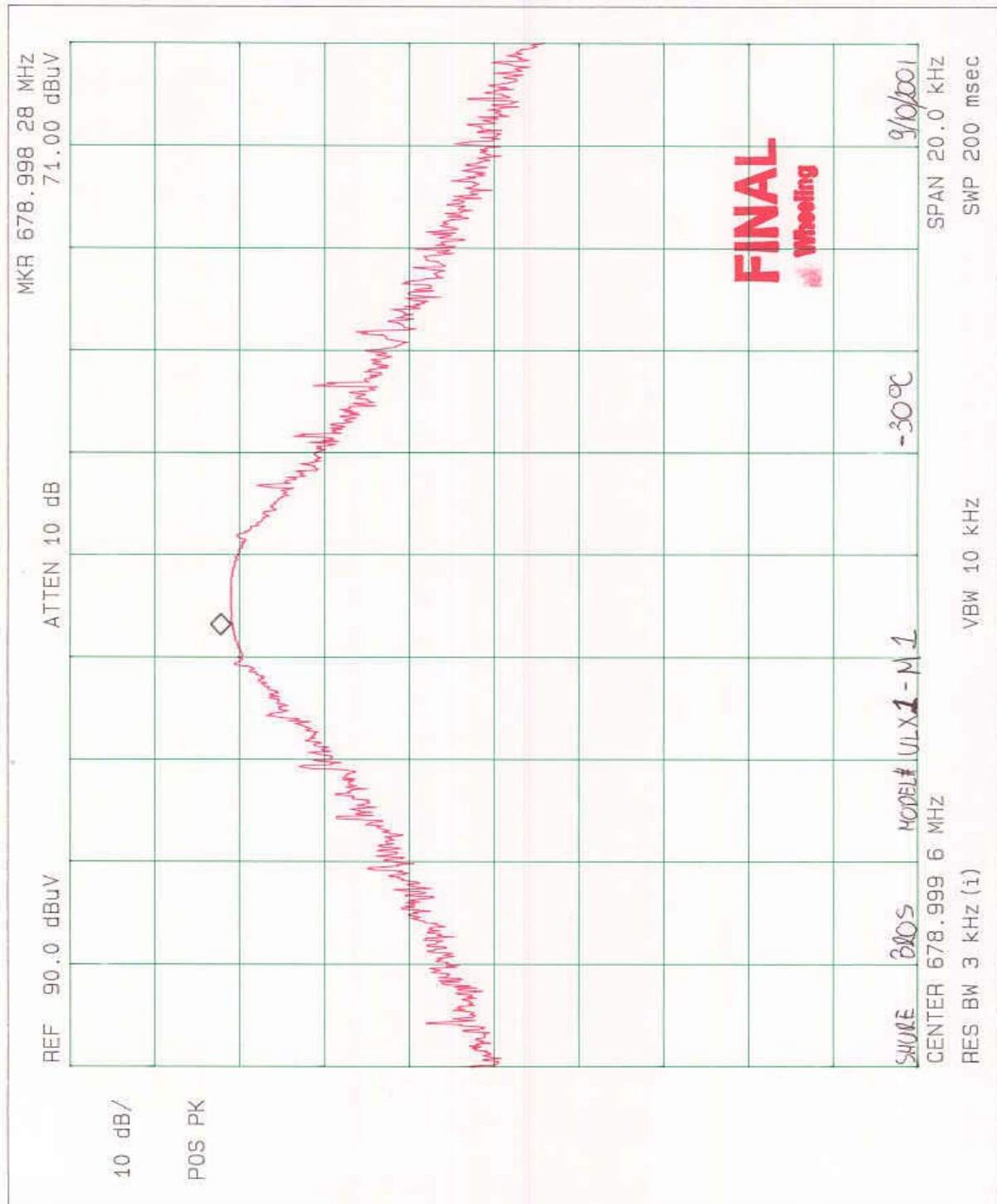














### 13.0 FREQUENCY STABILITY - PART 2.1055d (Voltage)

The frequency stability of UHF Wireless System was measured by varying the primary supply voltage from 85% to 115% of nominal value for all equipment other than hand carried battery equipment.

#### **FREQUENCY STABILITY FOR VOLTAGE VARIATION:**

85%	0
100%	0
115%	0

#### **FREQUENCY STABILITY FOR HAND HELD DEVICES:**

For hand carried, battery powered equipment, the supply voltage was reduced to the battery operating end point specified by the manufacturer. Readings were taken at the reduced end point and with a fresh battery:

#### **Fresh Battery verses Battery end point:**

Frequency #1 **100.2 Hz**  
Frequency #2 **0 Hz**  
Frequency #3 **0 Hz**  
Frequency #4 **0 Hz**  
Frequency #5 **0 Hz**  
Frequency #6 **0 Hz**

As stated in Part 74, Section 74.861 e-4 the Frequency Tolerance and Margin for this range are as follows:

**Frequency Tolerance: 0.00005**

**Limit: 39975 Hz**

**Margin: 39874.8 Hz**



Test Services  
Peterson Drive, Wheeling, Illinois 60090, USA

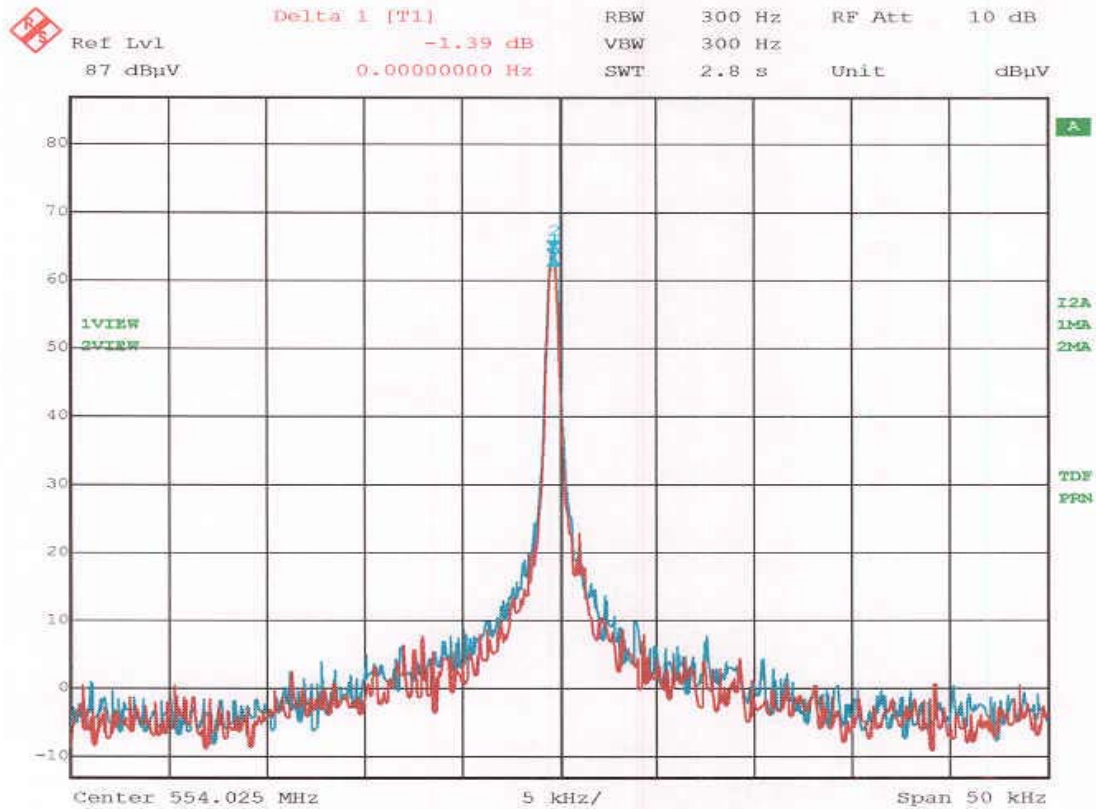
Report No. 9273

## **GRAPHS TAKEN FOR FREQUENCY**

## **STABILITY WHEN VARYING THE**

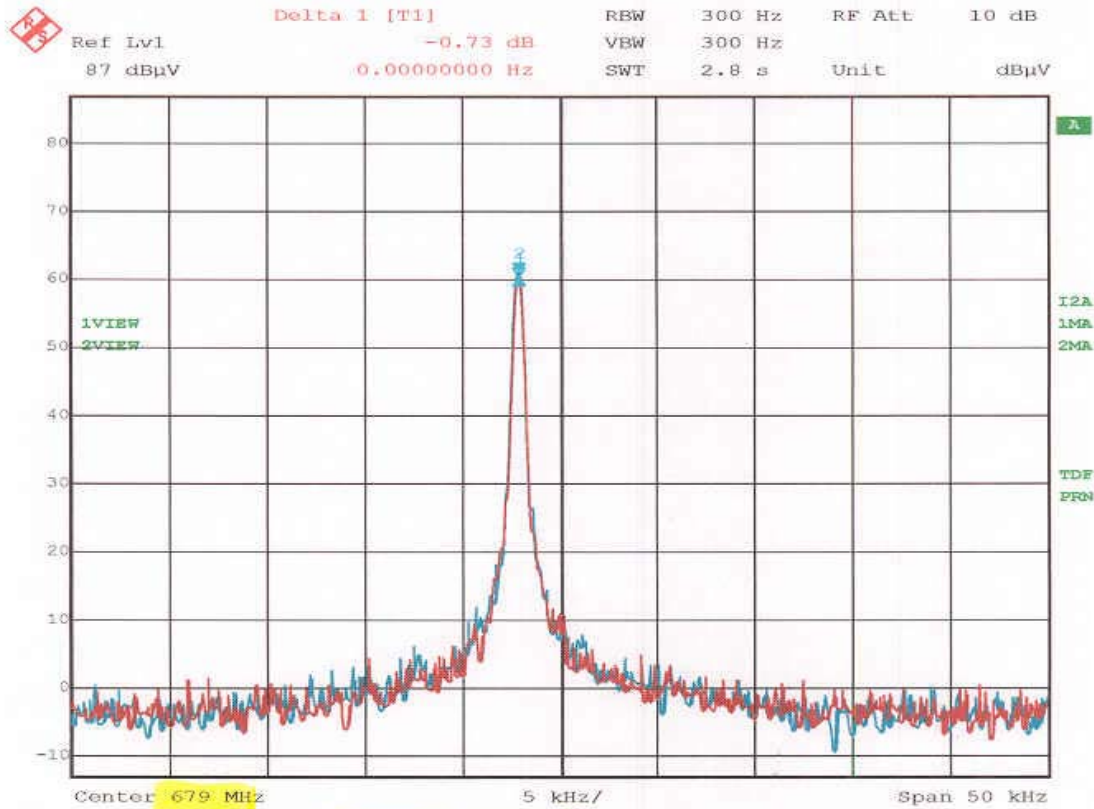
## **PRIMARY SUPPLY VOLTAGE**

**PART 2.1055d**



Title: Fundamental Frequency Stability; Shure Inc. Model# ULX1  
Comment A: Red Trace = 9 VDC; Blue Trace = 6.45 VDC      Limit = 27.7 kHz  
Date: 7.SEP.2001 11:32:55

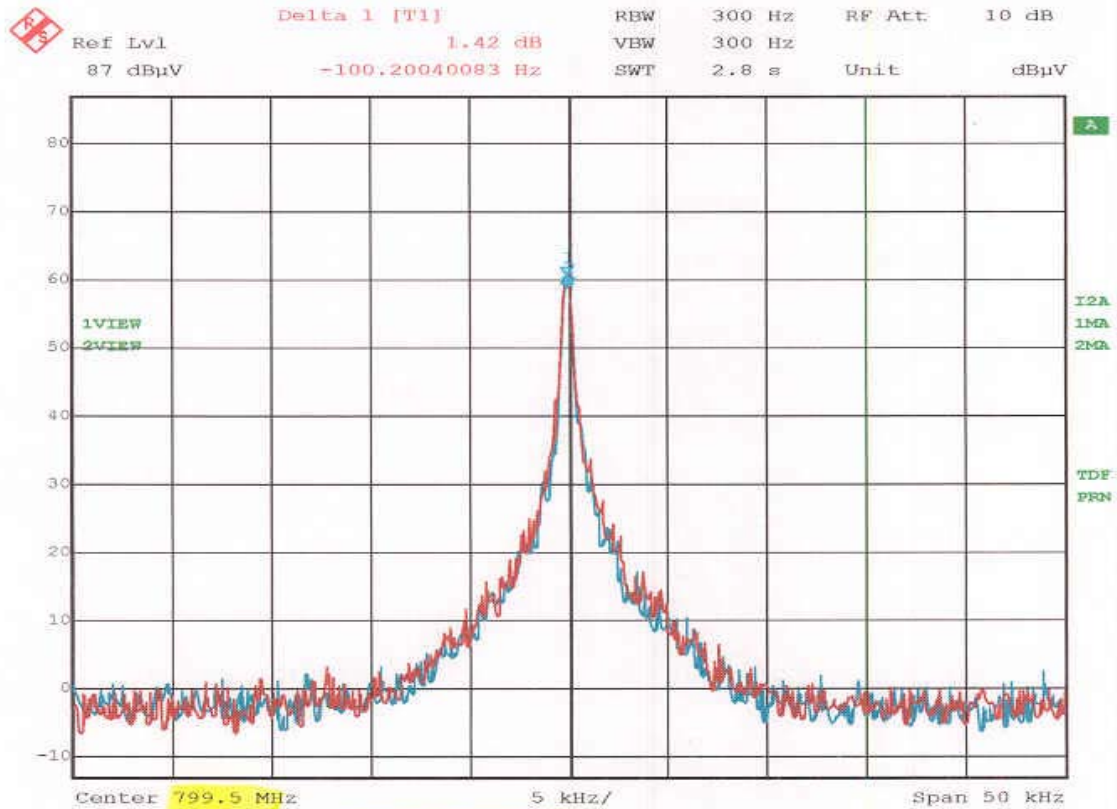
**FINAL**  
Genoa



Title: Fundamental Frequency Stability; Shure Inc. Model# ULX1  
Comment A: Red Trace = 9 VDC; Blue Trace = 6.45 VDC Limit = 33.95 kHz  
Date: 7.SEP.2001 11:41:09

**FINAL**  
Genoa





Title: Fundamental Frequency Stability; Shure Inc. Model# ULX1  
 Comment A: Red Trace = 9 VDC; Blue Trace = 6.45 VDC Limit = 39.975 kHz  
 Date: 7.SEP.2001 12:22:37

**FINAL**  
Genoa



#### 14.0 PHOTO INFORMATION AND TEST SET-UP

The test set-up can be seen on the accompanying photo page.

Item 0 UHF Wireless System  
FCC ID#: 561 SN: NA

Item 1

Item 2

Item 3

Item 4

Item 5

Item 6

Item 7

Item 8

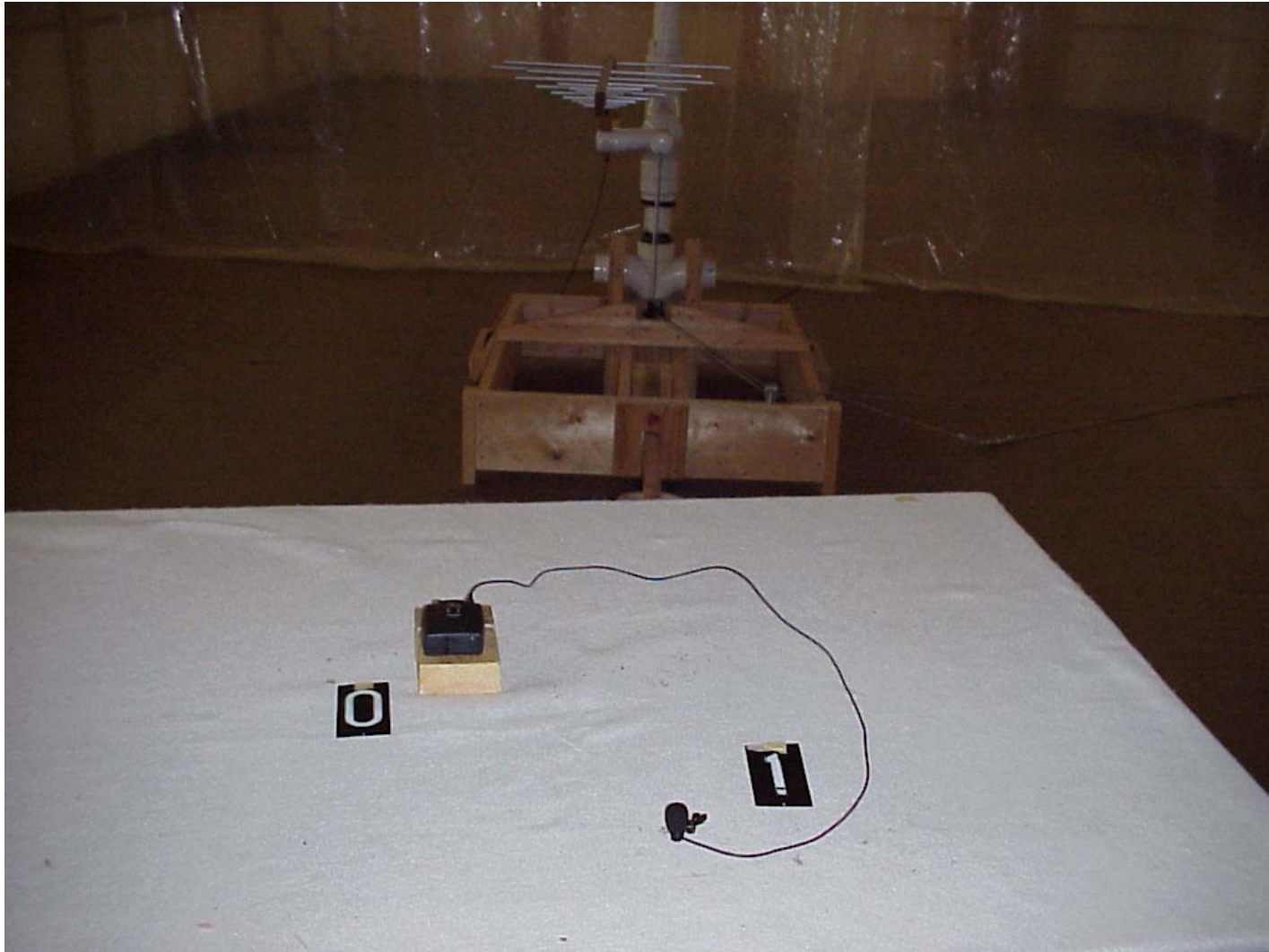
Item 9

Item 10

15.0 RADIATED PHOTOS TAKEN DURING TESTING.



## 15.0 RADIATED PHOTOS TAKEN DURING TESTING





## 16.0 CHANGE INFORMATION

The following changes were implemented during the testing and must be incorporated into the production units to ensure compliance.

Change 1.

Change 2.

Change 3.

Change 4.

Change 5.



16.0 CHANGE INFORMATION (CON'T)

Change 6.

Change 7.

Change 8.

Change 9.

Change 10.

The responsibility of implementing the changes listed in this report is accepted or I certify that no changes were made

by \_\_\_\_\_  
Signature Title

for \_\_\_\_\_  
Company Name Date



## 17.0 RESULTS OF TESTS

The emission test results can be seen on pages at the end of this report. Data sheets indicating the open field radiated measurements can also be found with this report. Those points on the radiated charts shown with a yellow mark are background frequencies that were verified during the test.

## 18.0 CONCLUSION

It was found that the UHF Wireless System, Model Number: ULX1, S/N: NA meets the radio interference emission requirements of the FCC "Rules and Regulations", Part 74, Subpart H, Sections 74.801 to 74.882 for Low Power Auxiliary Stations operating in the 554-806 MHz Frequency Band. This test report relates only to the items tested.



TABLE 1 - EQUIPMENT LIST

Test Equipment	Manufacturer/Description	Model Number	Serial Number	Frequency Range	Cal Due Date
Receiver	Rohde & Schwarz	ESI 40	837808/005	20 Hz – 40 GHz	12/01
Preamp	Rohde & Schwarz	TS-PR10	032001/005	9 kHz- 1000 MHz	3/02
Signal Generator	Marconi	2022A	119026	.01-1000 MHz	01/02
Antenna	Electrometrics	BIA-25	2453	20 - 200 MHz	4/02
Antenna	Electrometrics	LPA-25	1114	200 - 1000 MHz	4/02
Antenna	Electrometrics	BIA-25	2614	20 - 200 MHz	4/02
Antenna	Electrometrics	LPA-25	1205	200 - 1000 MHz	4/02
Antenna	Electrometrics	BIA-25	4785	20 - 200 MHz	4/02
Antenna	Electrometrics	LPA-25	4895	200 - 1000 MHz	4/02
Antenna	EMCO	3115	2479	1 – 18 GHz	8/02

I/O Initial Calibration Only