



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

FCC Rules and Regulations / Intentional Radiators

Low Power Auxiliary Stations

Part 74, Subpart H, Sections 74.801 - 74.882

Part 74.861 (d) Other than TV Broadcasting

THE FOLLOWING **MEETS** THE ABOVE TEST SPECIFICATION

Formal Name: ULX1 Wireless Microphone Transmitter

Kind of Equipment: Wireless Microphone Transmitter

Test Configuration: It is only connected to a supplied microphone. (Tested at 9 vdc)

Model Number(s): ULX1-X1

Model(s) Tested: ULX1-X1

Serial Number(s): NA

Emission Designator: 88.6KF3E

Date of Tests: September 19 & 20, 2007 & January 17, 2008

Test Conducted For: Shure Inc.
5800 Touhy Avenue
Niles, Illinois 60714

NOTICE: “This report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government”. Please see the "Additional Description of Equipment Under Test" page listed inside of this report.

© Copyright 1983-2007 D.L.S. Electronic Systems, Inc

COPYRIGHT NOTICE

This report or any portion thereof, may not be reproduced or modified in any form without the expressed written consent of D.L.S. Electronic Systems, Inc.



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

SIGNATURE PAGE

Report By:

Arnom C. Rowe
Test Engineer
EMC-001375-NE

Reviewed By:

William Stumpf
OATS Manager

Approved By:

Brian Mattson
General Manager



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

TABLE OF CONTENTS

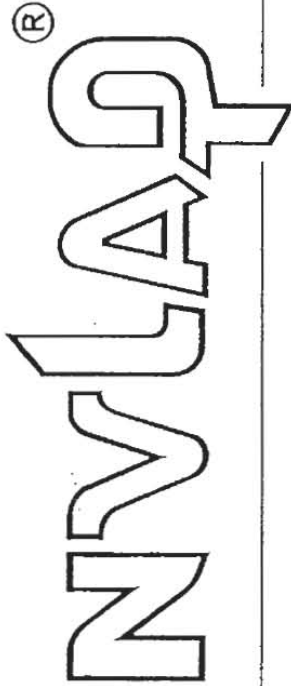
i.	Cover Page	1
ii.	Signature Page	2
iii.	Table of Contents	3
iv.	NVLAP Certificate of Accreditation	4
1.0	Summary of Test Report	5
2.0	Introduction	5
3.0	Object	5
4.0	Test Set-Up	6
5.0	Test Equipment	7
6.0	Ambient Measurements	8
7.0	AC Power Line Conducted Emission Measurements	8
8.0	Description of Test Sample	9
9.0	Additional Description of Test Sample	10
10.0	Photo Information and Test Set-Up	11
11.0	Radiated Photos Taken During Testing	12
12.0	Results of Tests	15
13.0	Conclusion	15
	TABLE 1 – EQUIPMENT LIST	16
	Appendix A – Electric Field Radiated Emissions Test	18
1.0	Test Set-Up	19
2.0	RF Power Output	19
2.0	Data taken of the RF Power Output	20
3.0	RF Output Power Photos Taken During Testing	23
4.0	Modulation Characteristics	24
4.0	Graph(s) taken of the Modulation Characteristics	25
5.0	Occupied Bandwidth	29
5.0	Data and Graph(s) taken of the 99% Occupied Bandwidth	30
6.0	Spurious Emissions at the Antenna Terminals	33
7.0	Data and Graph(s) taken of the Low Channel Band Edge Compliance	34
7.0	Data and Graph(s) taken of the High Channel Band Edge Compliance	45
8.0	Field Strength of Spurious Emission Measurements	56
8.0	Radiated Data taken for Fundamental Emissions using the Substitution Method	58
8.0	Radiated Data Taken During Testing for Spurious Emissions	60
9.0	Band Edge in Temperature Chamber Photos Taken During Testing	63



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 100276-0

D.L.S. Electronic Systems, Inc.
Wheeling, IL

is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-ILAC-IAF Communiqué dated 18 June 2005).



2007-10-01 through 2008-09-30

Effective dates

Dolly S. Buice
For the National Institute of Standards and Technology

NVL AP-01C (REV 2006-09-13)



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

1.0 SUMMARY OF TEST REPORT

It was found that the ULX1 Wireless Microphone Transmitter, Model Number(s) ULX1-X1, meets the radio interference radiated emission requirements of the FCC "Rules and Regulations", Part 74, Subpart H, Section 74.861 (d), for low power auxiliary stations. The AC Power Line conducted emissions test was not required because the ULX1 Wireless Microphone Transmitter is powered from a D.C. power source. It does not have a line cord to plug into the A.C. power line.

2.0 INTRODUCTION

On September 19 & 20, 2007 & January 17, 2008, a series of radio frequency interference measurements was performed on ULX1 Wireless Microphone Transmitter, Model Number(s) ULX1-X1, Serial Number: NA. The tests were performed according to the procedures of the FCC as stated in Part 2 - Frequency Allocations and Radio Treaty Matters: General Rules and Regulations, Subpart J, Equipment Authorization Procedures of the Code of Federal Regulations 47. Tests were performed by personnel of D.L.S. Electronic Systems, Inc. who are responsible to Donald L. Sweeney, Senior EMC Engineer.

D.L.S. Electronic Systems, Inc. is a full service EMC/Safety Testing Laboratory accredited to ISO Guide 17025. NVLAP Certificate and Scope can be viewed at <http://www.dlsemc.com/certificate>. Our facilities are registered with the FCC, Industry Canada, and VCCI. All immunity tests were performed by personnel of D.L.S. Electronic Systems, Inc. at the following location(s):

Main Test Facility:
D.L.S. Electronic Systems, Inc.
1250 Peterson Drive
Wheeling, Illinois 60090

3.0 OBJECT

The purpose of this series of tests was to determine if the test sample could meet the radio frequency interference requirements of the FCC "Rules and Regulations", Part 74, Subpart H, Section 74.861 (d), for low power auxiliary stations.



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

4.0 TEST SET-UP

All tests were performed at D.L.S. Electronic Systems, Inc. and set up according to the American National Standards Institute, ANSI C63.4-2003. The conducted tests if required were performed with the test item placed on a non-conductive table (table top equipment), located in the test room. Equipment normally operated on the floor was tested by placing it on the metal ground plane. The ground plane has an electrical isolation layer over its surface approximately 7mm thick. The power line supplied was connected to a dual line impedance stabilization network electrically bonded to the ground plane, located on the floor. The networks were constructed per the requirements of the American National Standards Institute, ANSI C63.4-2003.

All radiated emissions tests were performed with the test item placed on a 80 cm high rotating non-conductive table, located in the test room. Equipment normally operated on the floor was placed on a metal covered turntable, which is flush with the surrounding conducting ground plane. The ground plane has an electrical isolation layer over its surface approximately 7 mm thick. The EUT is separated from the turntable ground plane by a non-conductive layer. The equipment under test was set up according to TIA Standard, TIA-603-C:2004, Section 2.2.12.



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

5.0 TEST EQUIPMENT (Bandwidths and Detector Function)

All preliminary data below 1000 MHz was automatically plotted using the HP Spectrum Analyzer or ESI 26/ESI 40 Fixed Tuned Receiver. The data was taken using Peak, Quasi-Peak or the Average Detector Functions as required. This information was then used to determine the frequencies of maximum emissions. Above 1000 MHz, final data was taken using the Average Detector.

Below 1000 MHz, final data was taken using the HP Spectrum Analyzer and or ESI 26/ESI 40 fixed tuned receiver. These plots were made using the Peak or Quasi-Peak Detector functions, with manual measurements performed on the questionable frequencies using the Quasi-Peak or the Average Detector Function of the Analyzer or ESI 26/ESI 40 Receiver as required. Above 1000 MHz, final data was taken using the Average Detector on the ESI 26/ESI 40 Fixed Tuned Receiver.

The bandwidths shown below are specified by ANSI C63.4-2003.

Frequency Range	Bandwidth (-6 dB)
10 to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz
30 MHz to 1 GHz	120 kHz
Above 1 GHz	1 MHz

A list of the equipment used can be found in Table 1. All primary equipment was calibrated against known reference standards with a verified traceable path to NIST.



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

6.0 AMBIENT MEASUREMENTS

For emissions measurements, broadband antennas and an EMI Test Receiver with a panoramic spectrum display are used. First the frequency range is scanned and displayed on the test receiver display. Next the scanned frequency range is divided into smaller ranges, and then it is manually tuned through to determine the emissions from the EUT. A headset or loudspeaker is connected to the test receiver's AM/FM demodulated output as an aid in detecting ambient signals and finding frequencies of significant emission from the EUT. If there is any doubt as to the source of the emission, it is further investigated by rotating the EUT, or by disconnecting the power from the EUT.

The EUT is set up in its typical configuration and operated in its various modes. For tabletop systems, cables are manipulated within the range of likely configurations. For floor-standing equipment, the cables are located in the same manner as the user would install them and no further manipulation is made. If the manner of cable installation is not known, or if it changes with each installation, cables or wires for floor-standing equipment shall be manipulated to the extent possible to produce the maximum level of emissions. For each mode of operation, the frequency spectrum is monitored. Variations in antenna height, antenna polarization, EUT azimuth, and cable or wire placement (each variable within bounds specified elsewhere) are explored to produce the emission that has the highest amplitude relative to the limit. These methods are performed to the specifications in ANSI C63.4: 2003.

7.0 AC POWER LINE CONDUCTED EMISSION MEASUREMENTS – Part 15.207

The ULX1 Wireless Microphone Transmitter is powered from a D.C. power source and will not at any time be directly plugged into the public utility lines, therefore the conducted emissions test was not performed.



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

8.0 DESCRIPTION OF TEST SAMPLE:

8.1 Description:

The UXL1-X1 is a wireless microphone transmitter. It operates in the 944 MHz to 952 MHz band. It is powered by an internal 9 volt battery.

8.2 PHYSICAL DIMENSIONS OF EQUIPMENT UNDER TEST

Length: 26mm Width: 64mm Height: 83mm

8.3 LINE FILTER USED:

None

8.4 INTERNAL CLOCK FREQUENCIES:

Switching Power Supply Frequencies:

N/A

Clock Frequencies:

32.768 kHz and 16.0 MHz

8.5 DESCRIPTION OF ALL CIRCUIT BOARDS:

1. Populated PCB

PN: 90-11417, Rev 00

2. Unpopulated PCB

PN: 34A11418, Rev 00



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

9.0 ADDITIONAL DESCRIPTION OF TEST SAMPLE:
(See also Paragraph 8.0)

- 1: There were no additional descriptions noted at the time of test.

NOTE:

The EUT was tested in the following modes:

Transmit Low, Mid & High Channels



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

10.0 PHOTO INFORMATION AND TEST SET-UP

Item 0 ULX1 Wireless Microphone Transmitter
Model Number: ULX1-X1, Serial Number: NA

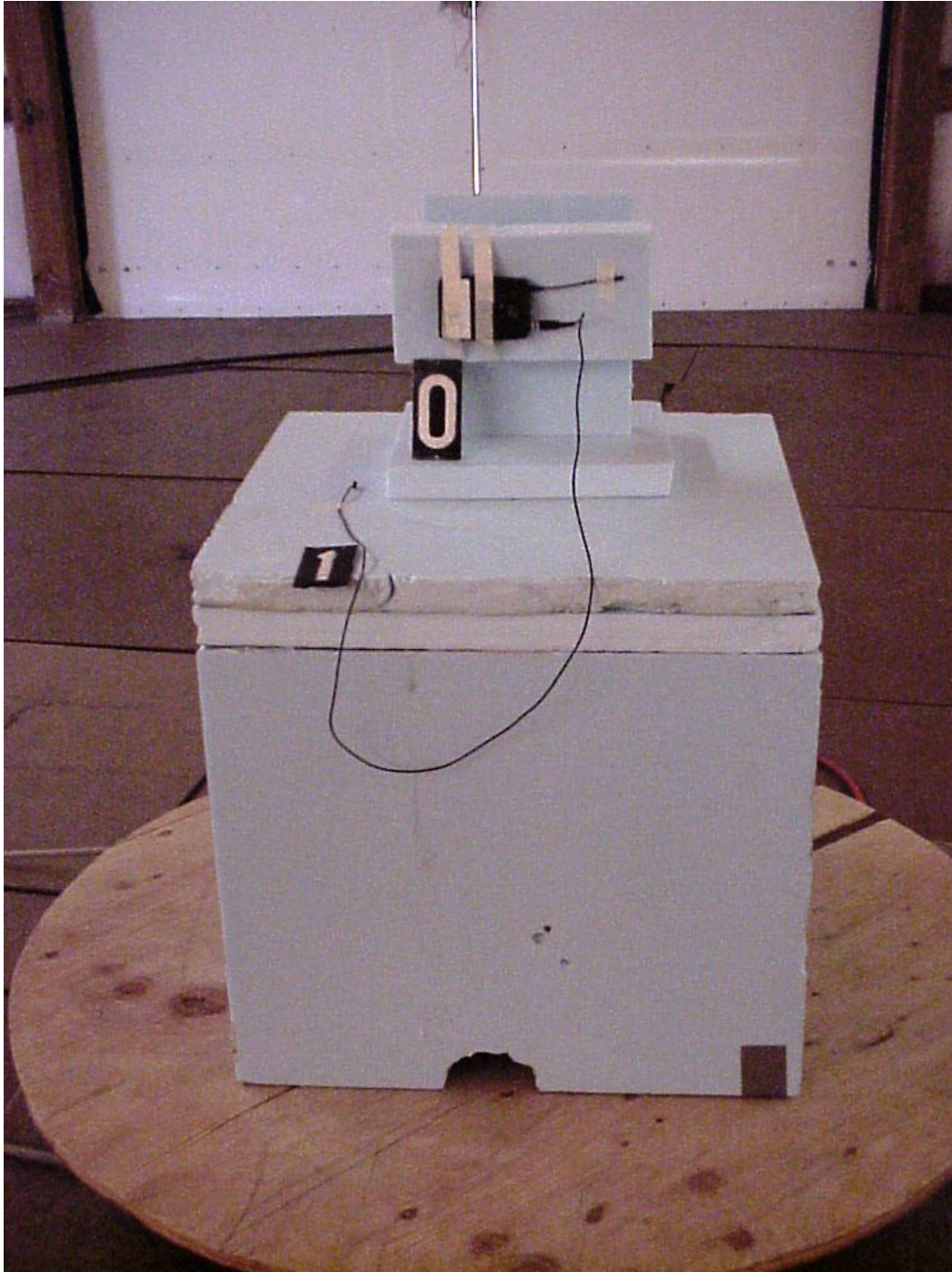
Item 1 Shure Microphone



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

11.0 RADIATED PHOTOS TAKEN DURING TESTING



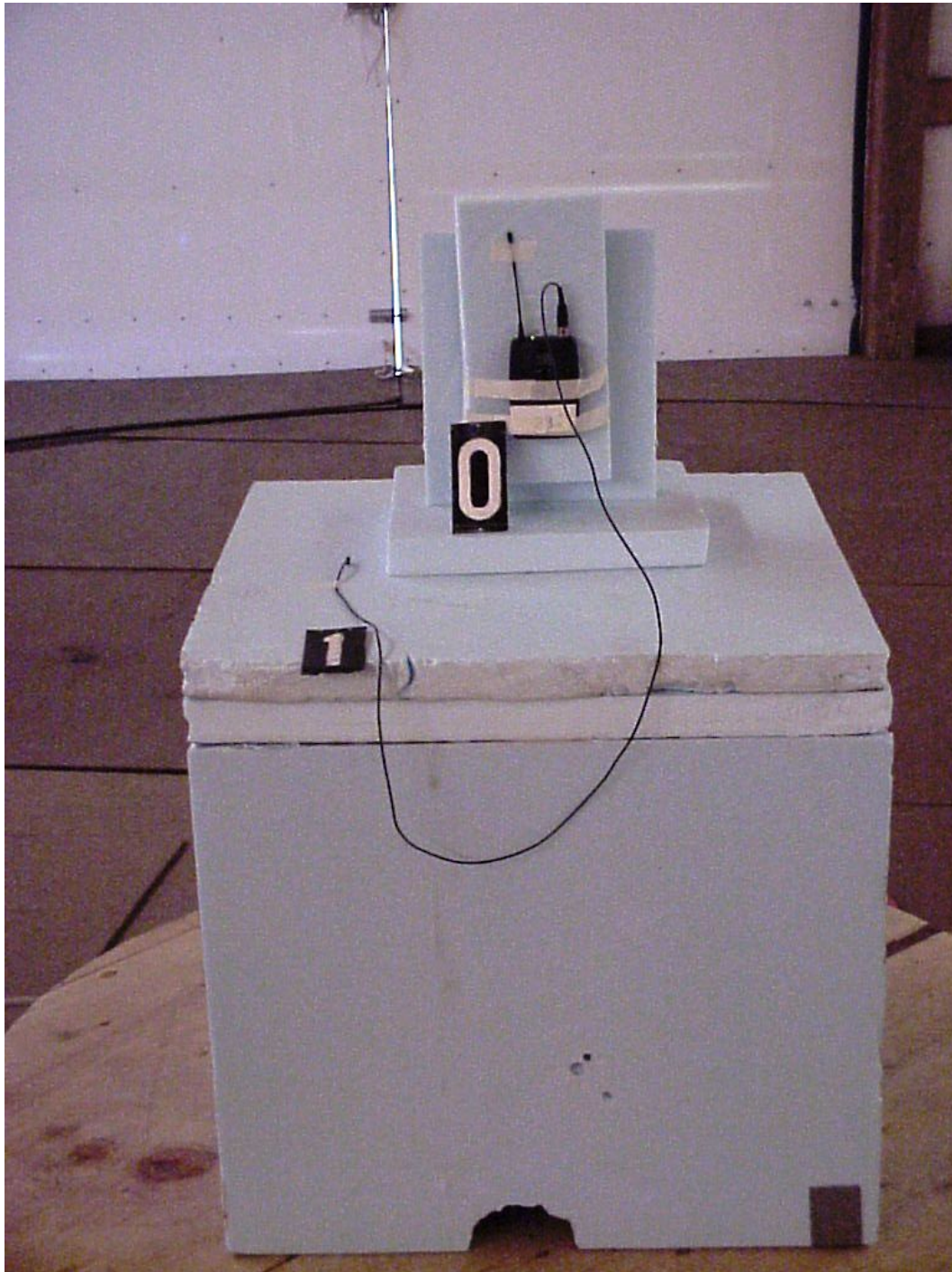
RADIATED X



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

11.0 RADIATED PHOTOS TAKEN DURING TESTING (CON'T)



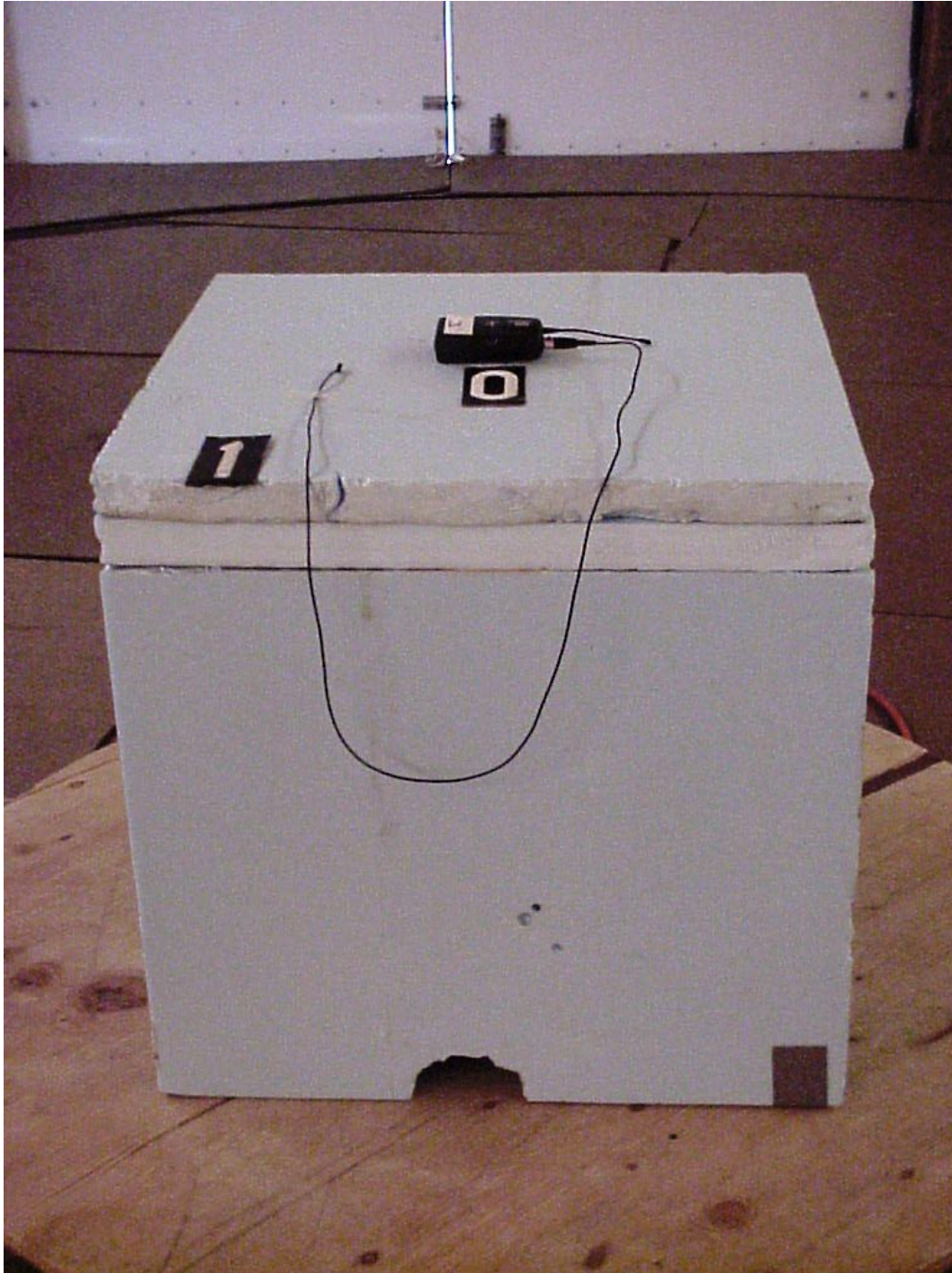
RADIATED Y



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

11.0 RADIATED PHOTOS TAKEN DURING TESTING (CON'T)



RADIATED Z



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

12.0 RESULTS OF TESTS

The radio interference emission charts can be seen on the pages at the end of this report. Data sheets indicating the test measurements taken during testing can also be found at the end of this report.

13.0 CONCLUSION

It was found that the ULX1 Wireless Microphone Transmitter, Model Number(s) ULX1-X1 **meets** the radio interference radiated emission requirements of the FCC "Rules and Regulations", Part 74, Subpart H, Section 74.861 (d), for low power auxiliary stations. The AC Power Line conducted emissions test was not required because the ULX1 Wireless Microphone Transmitter is powered from a D.C. power source. It does not have a line cord to plug into the A.C. power line.



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

TABLE 1 – EQUIPMENT LIST

Test Equipment	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Due Dates
Receiver	Rohde & Schwarz	ESI 26	837491/010	20 Hz – 26 GHz	11/07
Receiver	Rohde & Schwarz	ESI 40	837808/006	20 Hz – 40 GHz	12/07
Receiver	Rohde & Schwarz	ESI 40	837808/005	20 Hz – 40 GHz	12/07
Antenna	EMCO	3104C	00054891	20 MHz – 200 MHz	2/08
Antenna	Electrometrics	LPA-25	1114	200 MHz – 1 GHz	3/08
Antenna	EMCO	3104C	00054892	20 MHz – 200 MHz	3/08
Antenna	Electrometrics	3146	1205	200 MHz – 1 GHz	3/08
Antenna	EMCO	3104C	97014785	20 MHz – 200 MHz	2/08
Antenna	EMCO	3146	97024895	200 MHz – 1 GHz	3/08
Antenna	EMCO	3115	2479	1 GHz – 18 GHz	5/08
Antenna	EMCO	3115	99035731	1 GHz – 18 GHz	6/08
Antenna	Rohde & Schwarz	HUF-Z1	829381001	20 MHz – 1 GHz	2/08
Antenna	Rohde & Schwarz	HUF-Z1	829381005	20 MHz – 1 GHz	8/08

All primary equipment is calibrated against known reference standards with a verified traceable path to NIST.



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

TABLE 1 – EQUIPMENT LIST

Test Equipment	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Due Dates
LISN	Solar	8012-50-R-24-BNC	8305116	10 MHz – 30 MHz	8/08
LISN	Solar	8012-50-R-24-BNC	814548	10 MHz – 30 MHz	8/08
LISN	Solar	9252-50-R-24-BNC	961019	10 MHz – 30 MHz	12/07
LISN	Solar	9252-50-R-24-BNC	971612	10 MHz – 30 MHz	10/08
LISN	Solar	9252-50-R-24-BNC	92710620	10 MHz – 30 MHz	7/08

All primary equipment is calibrated against known reference standards with a verified traceable path to NIST.



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

APPENDIX A

TEST PROCEDURE

SUBPART H

LOW POWER AUXILIARY STATIONS



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1.0 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 non-conductive turntable located in the Test Room with the receive antenna placed three or one meter(s) from the device under test.

2.0 RF-POWER OUTPUT – PART 2.1046 and EIA /TIA-603-C:2004, SECTION 2.2.17

As stated in PART 74.861 (d)(1), the RF output power should not exceed 1 watt(s). The RF output of the ULX1 Wireless Microphone Transmitter was connected to a Spectrum Analyzer through suitable attenuation. All cables, connectors, and attenuators were calibrated prior to testing. The RF output power was measured using the following test method:

Actual Measurements Taken:

14.55 dBm Measured output of the transmitter

14.55 dBm equals 0.02851 watt(s)

LIMIT:

Manufacturer's rated output power = 30 mW maximum

MARGIN:

$1 - 0.02851 = 0.97149$ watt(s)



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

DATA TAKEN OF THE RF POWER OUTPUT MEASUREMENT

EIA /TIA-603-C:2004, SECTION 2.2.17

FCC Part 74.861(d)(1) & PART 2.1046

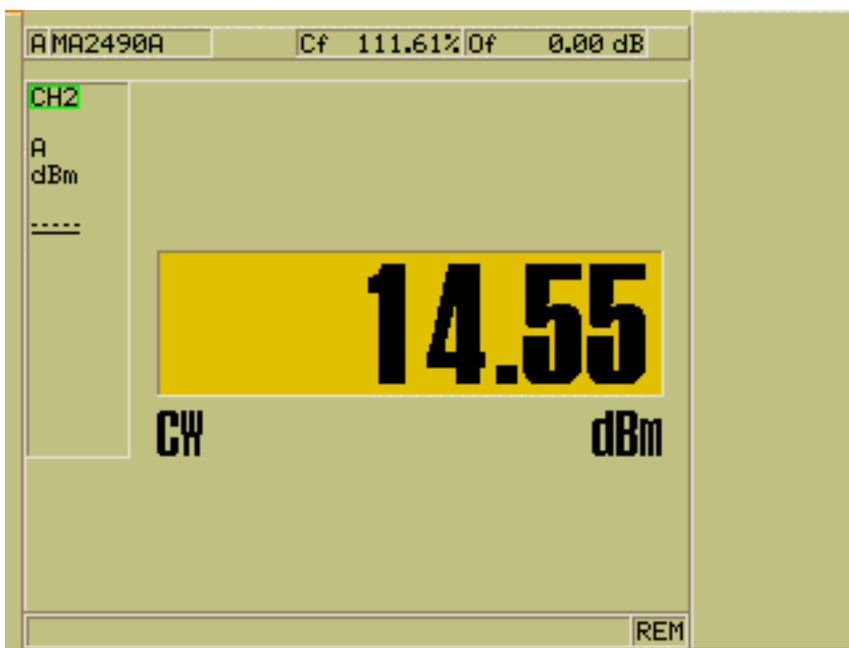


Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Peak Power Output - Conducted
Rule part: FCC Part 74; FCC Part 2.1046
Operator: Craig B
Comment: Channel: 944.125 MHz

Peak Output Power = 14.55 dBm = 28.51 mW



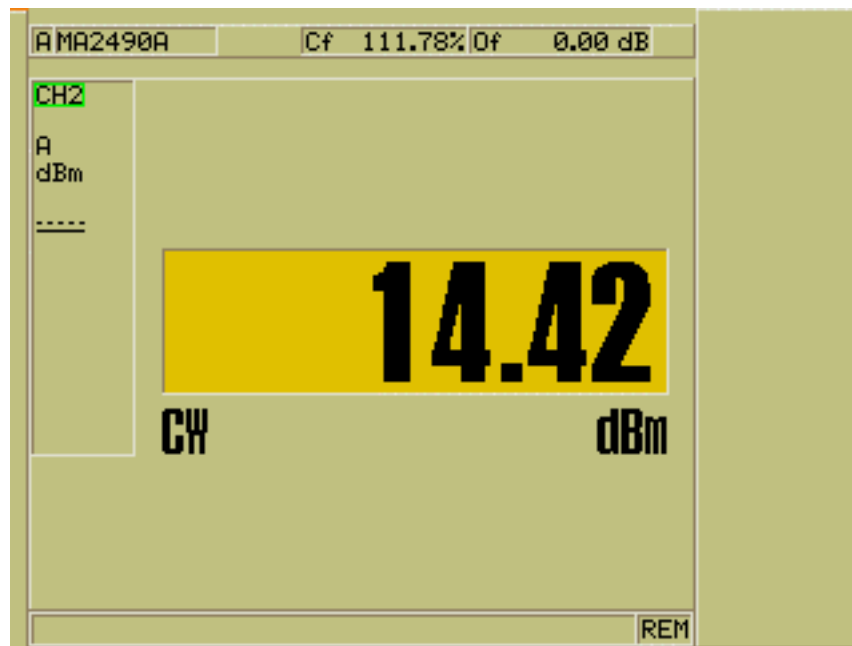


Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Peak Power Output - Conducted
Rule part: FCC Part 74; FCC Part 2.1046
Operator: Craig B
Comment: Channel: 951.875 MHz

Peak Output Power = 14.42 dBm = 27.67 mW

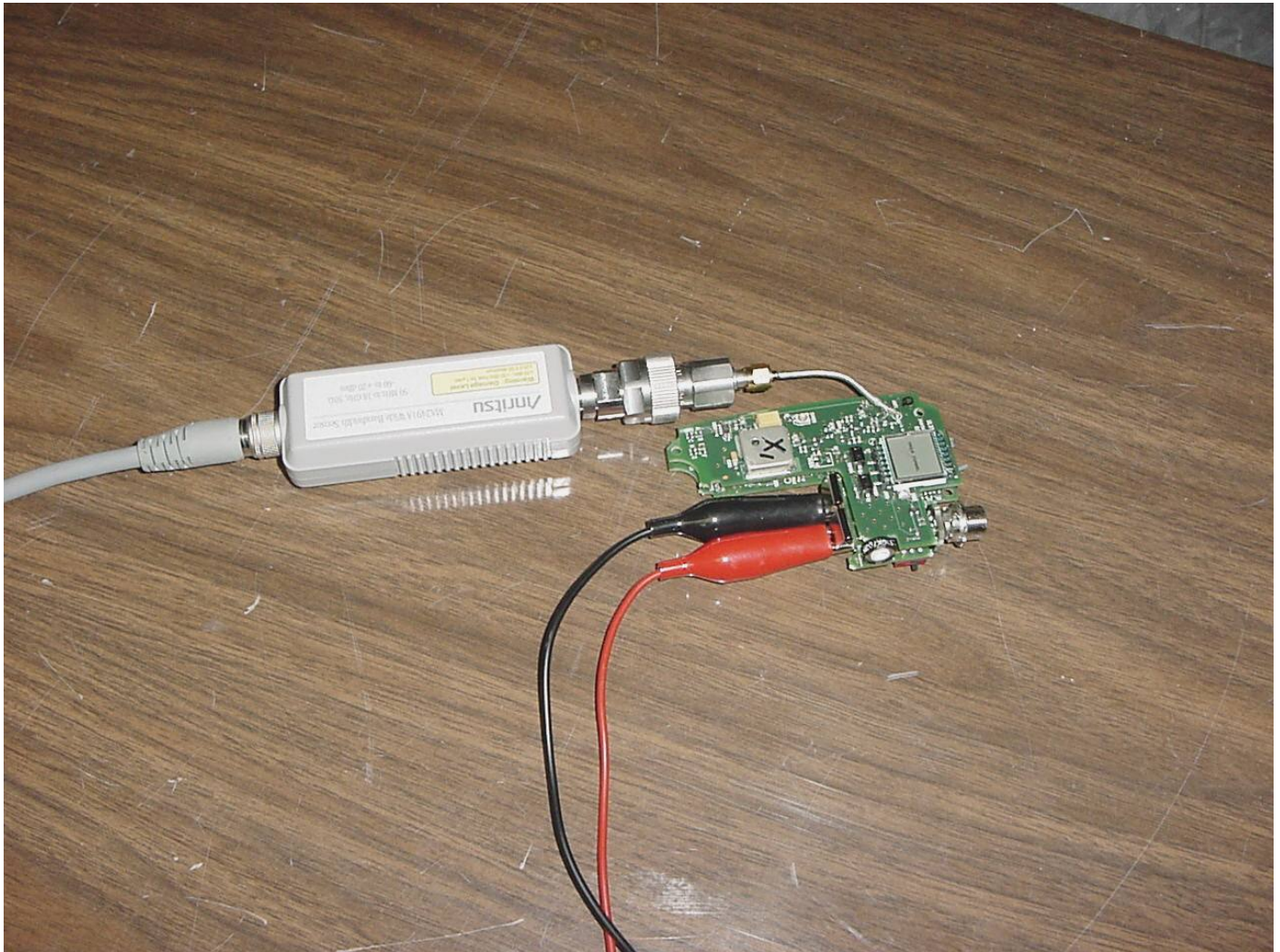




1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

3.0 RF POWER OUTPUT PHOTOS TAKEN DURING TESTING





Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

4.0 MODULATION CHARACTERISTICS – PART 2.1047 and EIA /TIA-603-C:2004,
SECTION 2.2.3

a. Voice modulated communication equipment.

A curve showing the frequency response of the audio modulating circuit over a range of 25 Hz to 15 kHz ± 2 dB is submitted with this report.

b. Equipment which employs 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.



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

GRAPH(S) TAKEN SHOWING THE FREQUENCY
RESPONSE OF THE
AUDIO MODULATING CIRCUIT

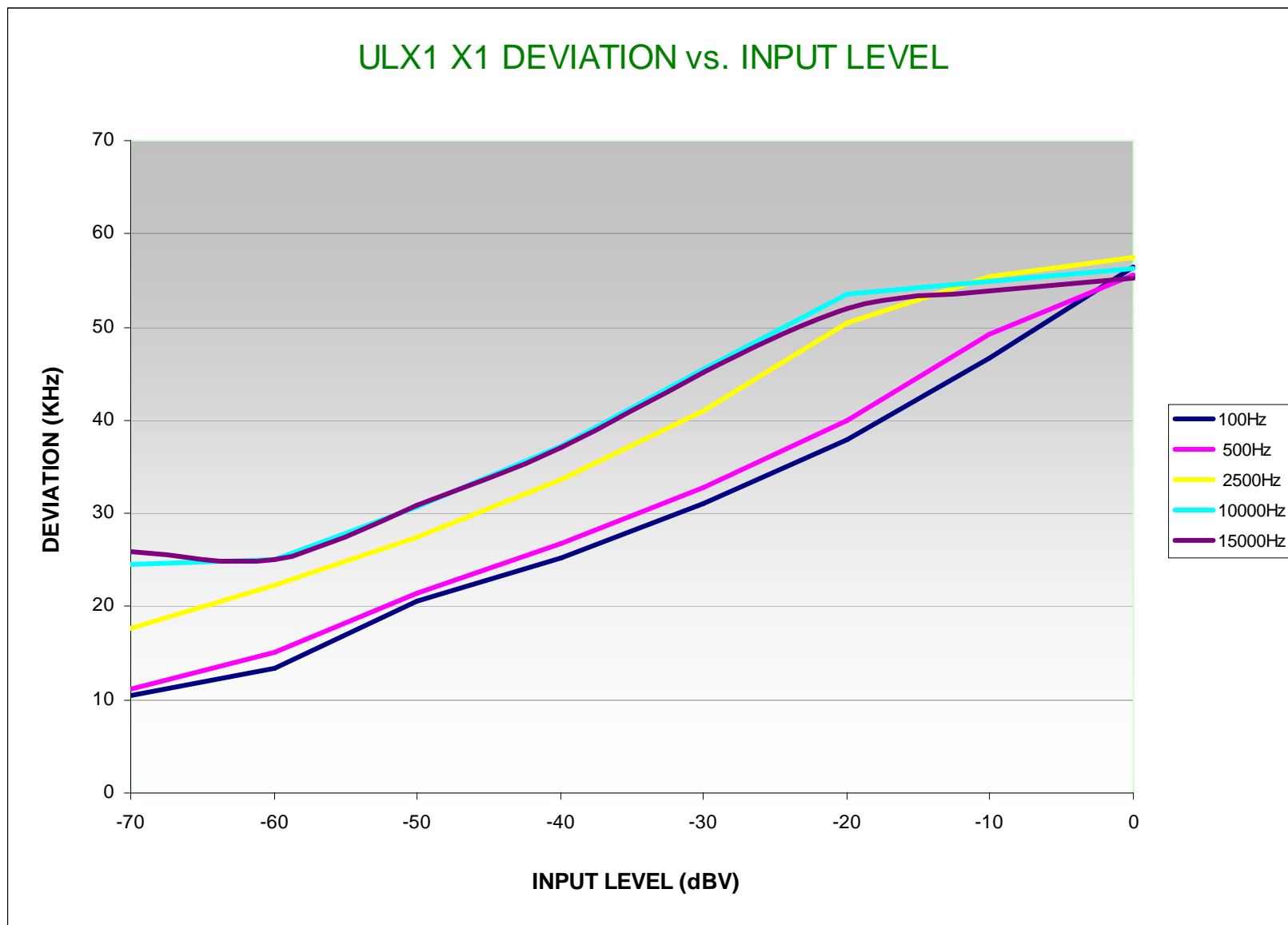
EIA /TIA-603-C:2004, SECTION 2.2.3

PART 2.1047



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

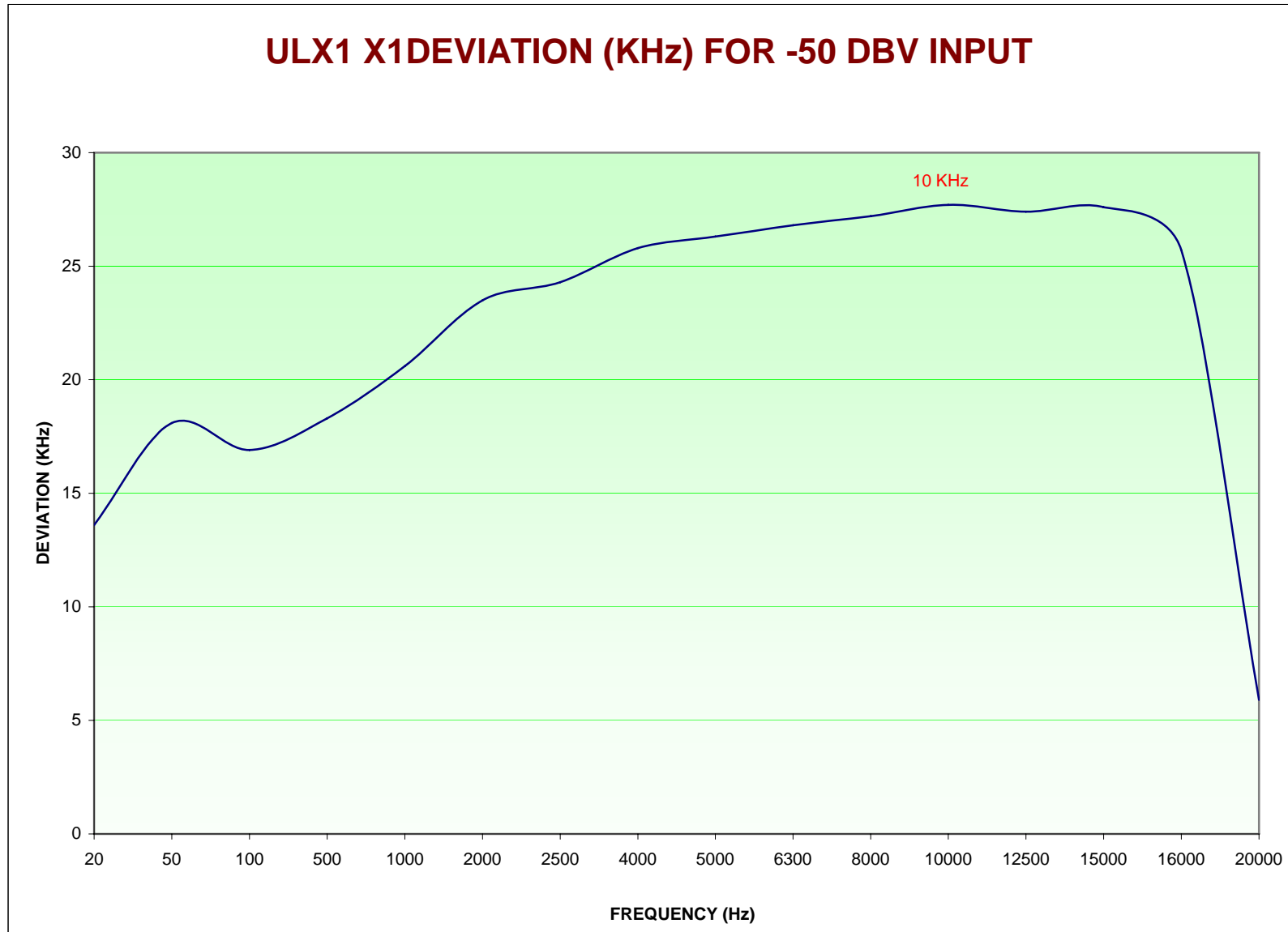
1250 Peterson Dr., Wheeling, IL 60090





Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090





Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

ULX1 X1

Notes: ULX1 has input attenuator been set at 0 dB during testing
Unit set to Group 1 Ch 5 - 947.475 MHz

Audio Limiting

LEVEL INPUT	DEVIATION (KHz) AT				
	100Hz	500Hz	2500Hz	10000Hz	15000Hz
dBV					
-70	10.50	11.1	17.60	24.50	25.90
-60	13.30	15.1	22.30	25.10	25.10
-50	20.60	21.5	27.40	30.70	30.80
-40	25.30	26.7	33.60	37.20	37.10
-30	31.00	32.7	41.00	45.50	45.20
-20	37.90	40	50.40	53.60	52.00
-10	46.60	49.3	55.50	54.90	53.80
0	56.40	55.6	57.40	56.30	55.30

Audio Frequency Response

ULX1	INPUT : -50dBV	
FREQUENCY (Hz)	DEVIATION (KHz)	
20	13.6	MAX Dev.
50	18.1	
100	16.9	
500	18.3	
1000	20.6	
2000	23.5	
2500	24.3	
4000	25.8	
5000	26.3	
6300	26.8	
8000	27.2	
10000	27.7	
12500	27.4	
15000	27.6	
16000	25.7	
20000	5.9	



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

APPENDIX A

5.0 OCCUPIED BANDWIDTH - PART 2.1049

The occupied bandwidth is that between the lower and upper limits of the signal where the mean power is 99.0% of the total mean power and measured under the following conditions:

For low power auxiliary stations operating in the bands other than those allocated for TV broadcasting, the occupied bandwidth shall not be greater than that necessary for satisfactory transmission and emissions appearing on any discrete frequency outside the authorize band shall be attenuated $43+10 \log^{10}$ (mean output power, in watts) dB below the mean output power of the transmitting unit (device under test).

For low power auxiliary stations operating in the bands allocated for TV broadcasting, any form of modulation may be used. A maximum of ± 75 kHz is permitted when frequency modulation is used. The operating bandwidth shall not exceed 200 kHz.

Carson's Rule:

Section 2.202 (g)

$$B_n = 2M + 2DK, \quad K=1$$

B_n = Bandwidth

$$M = 15 \text{ kHz},$$

M = Maximum Modulating Frequency

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

D = Peak Deviation

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



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

APPENDIX A

DATA AND GRAPH(S) TAKEN OF THE

99% OCCUPIED BANDWIDTH

Part 74.861(d)(3) & PART 2.1049



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

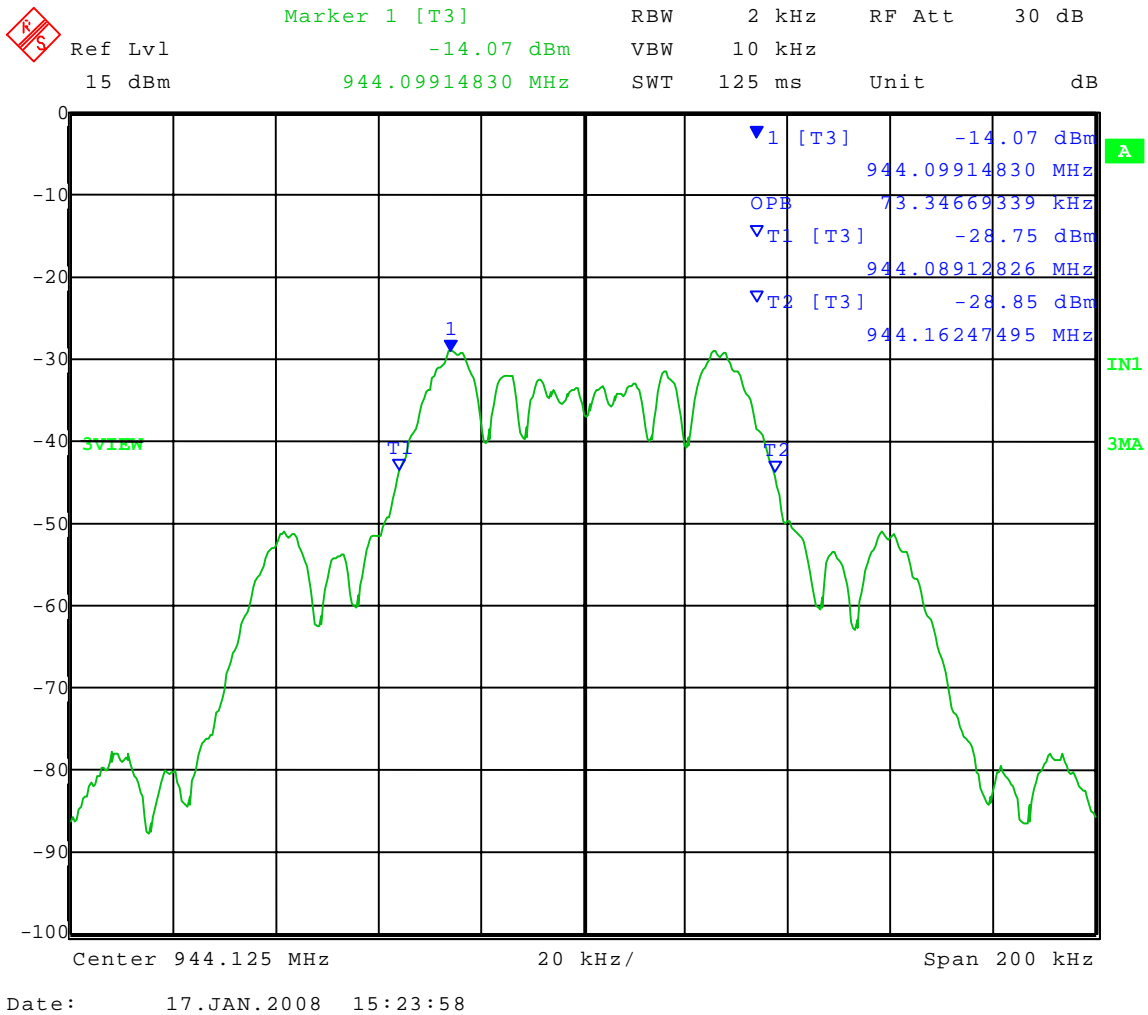
1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

Test Date: 01-17-2008
Company: Shure, Inc.
EUT: ULX1-X1
Test: Occupied Bandwidth; 99% bandwidth
Rule part: FCC Part 74; FCC Part 2.1049
Operator: Craig B

Frequency: 944.125 MHz

99% power bandwidth = 73.3 kHz





Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

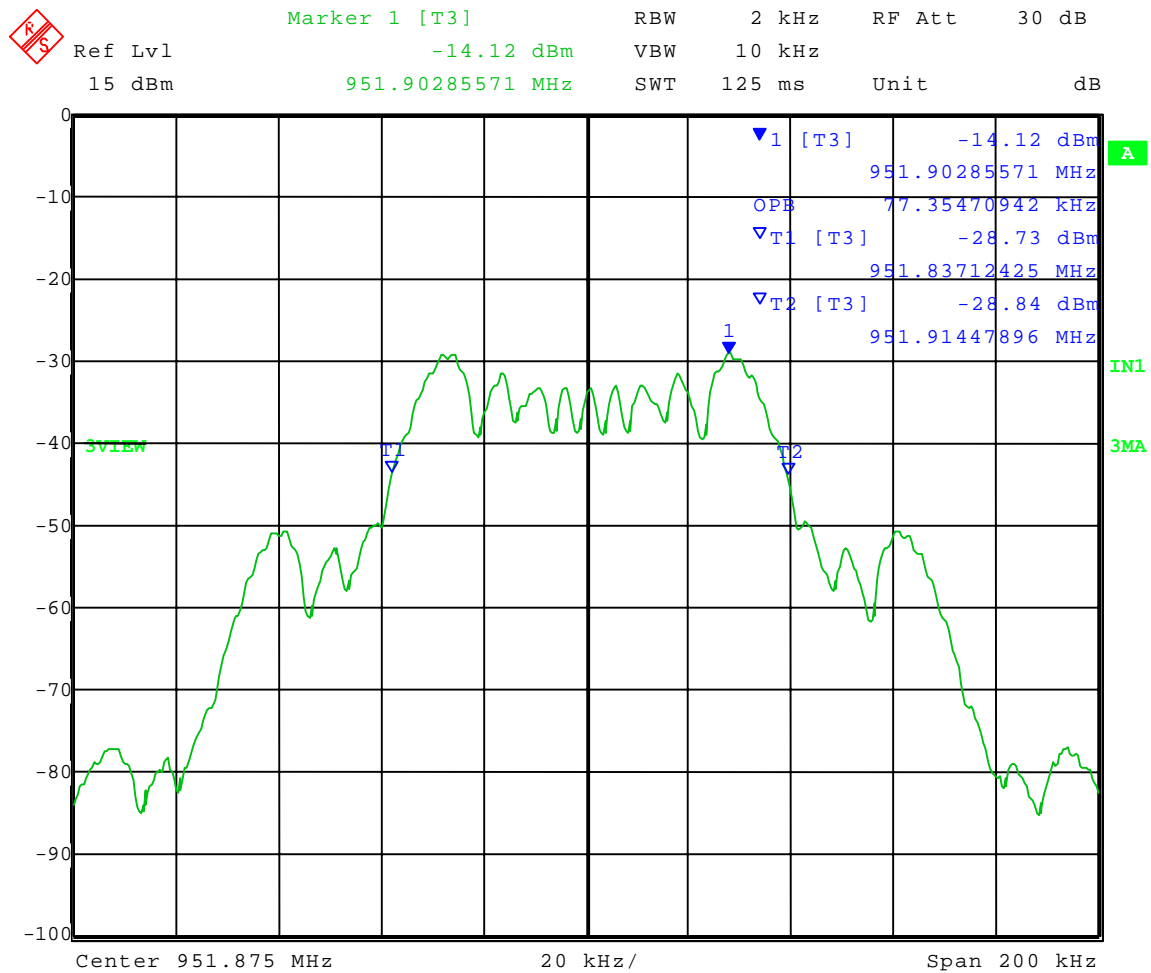
1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

Test Date: 01-17-2008
Company: Shure, Inc.
EUT: ULX1-X1
Test: Occupied Bandwidth; 99% bandwidth
Rule part: FCC Part 74; FCC Part 2.1049
Operator: Craig B

Frequency: 951.875 MHz

99% power bandwidth = 77.4 kHz



Date: 17.JAN.2008 15:29:15



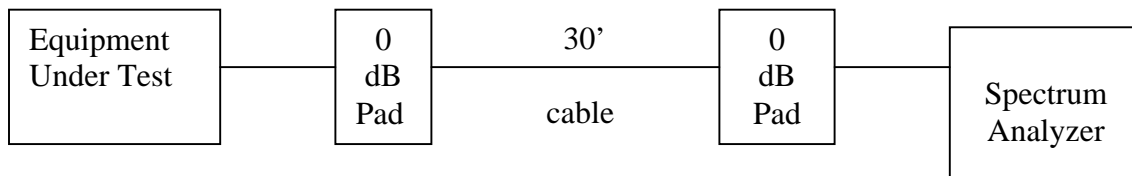
Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

6.0 SPURIOUS EMISSIONS AT THE ANTENNA TERMINALS – PART 2.1051 and EIA /TIA-603-C:2004, SECTION 2.2.13

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 2.989. 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 944 MHz - 952 MHz bands for ULX1 Wireless Microphone Transmitter equipment are found under Part 74, Section 74.861, Paragraph d-3 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) any discrete frequency outside the authorized band shall be attenuated, at least, $43+10\log^{10}$ (mean output power, in watts) dB below the mean output power of the transmitting unit.

NOTE:

The ULX1 Wireless Microphone Transmitter uses a permanently attached Antenna preventing any connection to the Antenna Port, therefore this test was not run.



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

APPENDIX A

DATA AND GRAPH(S) TAKEN OF THE

BAND EDGE COMPLIANCE

Part 74.861(d) & PART 2.1051

LOW CHANNEL



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 944.125 MHz

Operating conditions: 9.3 V -30° C

Band-Edge Frequency = 944 MHz
Band-Edge limit = -13 dBm



Date: 20.SEP.2007 16:40:41



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

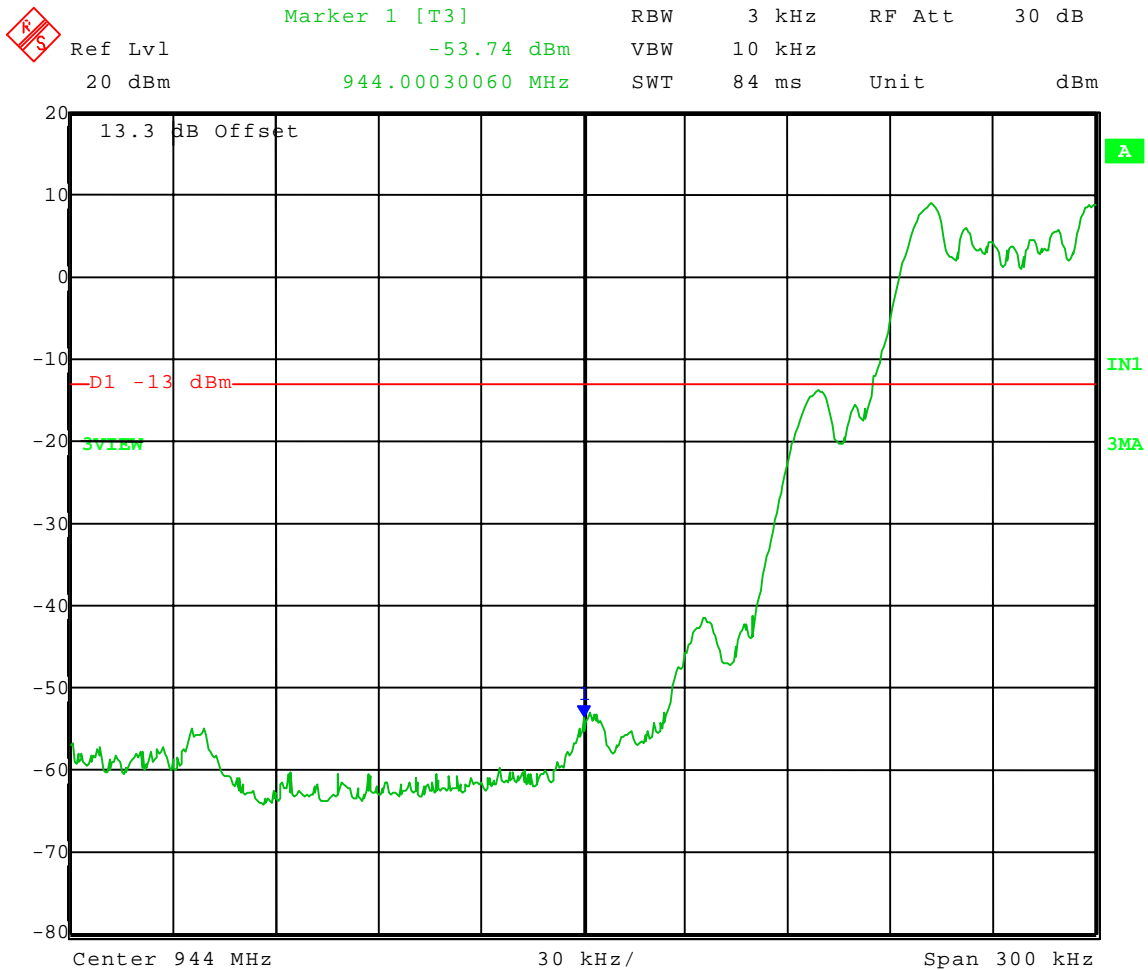
APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 944.125 MHz

Operating conditions: 9.3 V -20° C

Band-Edge Frequency = 944 MHz

Band-Edge limit = -13 dBm



Date: 20.SEP.2007 16:02:32



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

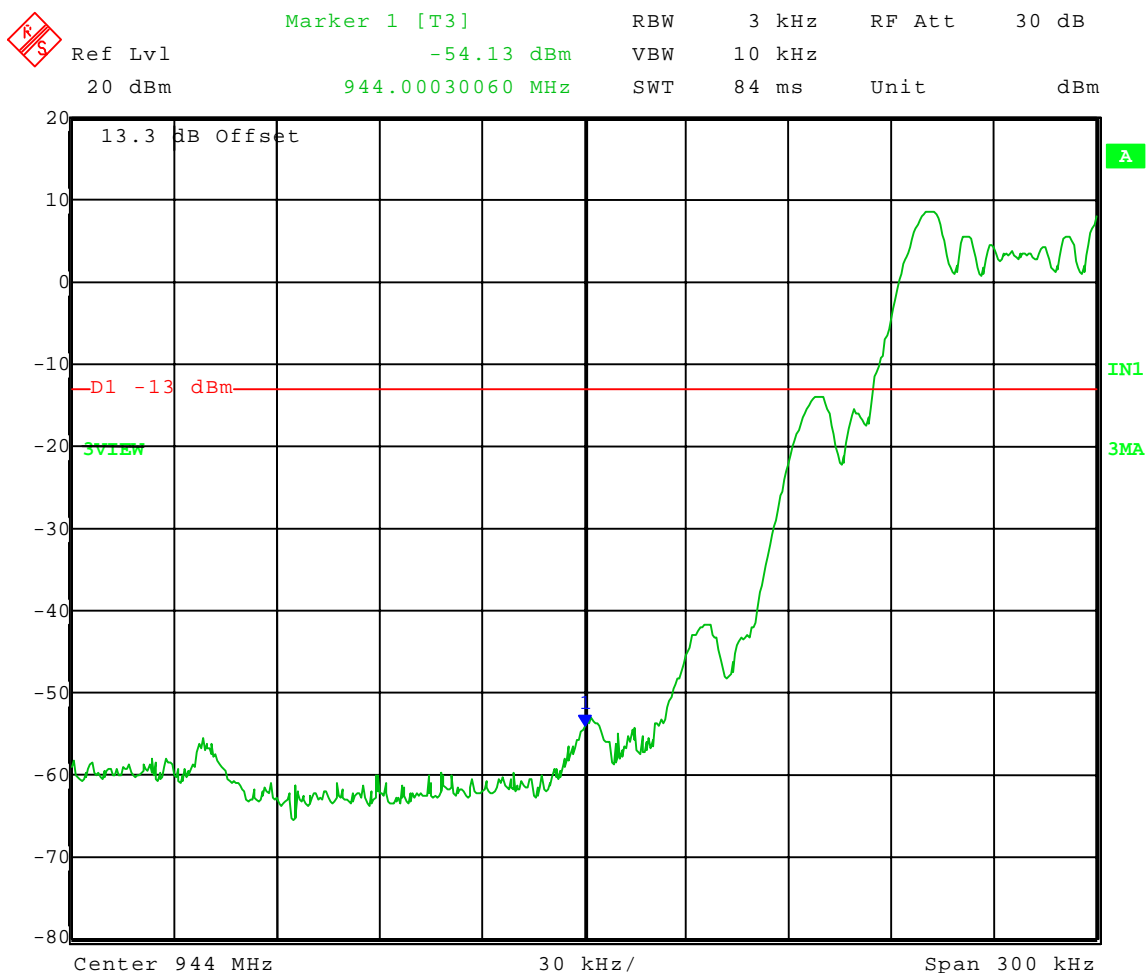
APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 944.125 MHz

Operating conditions: 9.3 V -10° C

Band-Edge Frequency = 944 MHz

Band-Edge limit = -13 dBm



Date: 20.SEP.2007 15:25:26



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

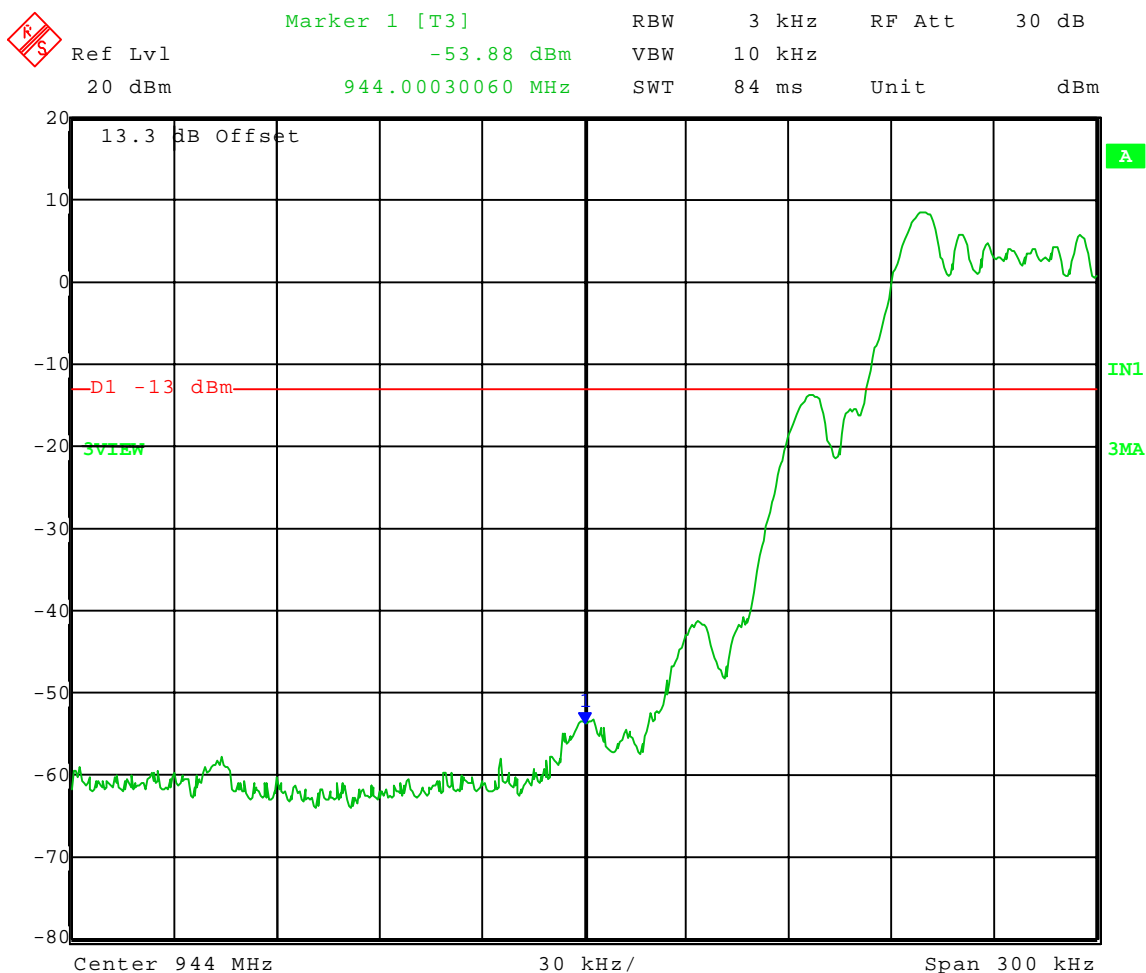
APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 944.125 MHz

Operating conditions: 9.3 V 0° C

Band-Edge Frequency = 944 MHz

Band-Edge limit = -13 dBm



Date: 20.SEP.2007 14:53:29



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

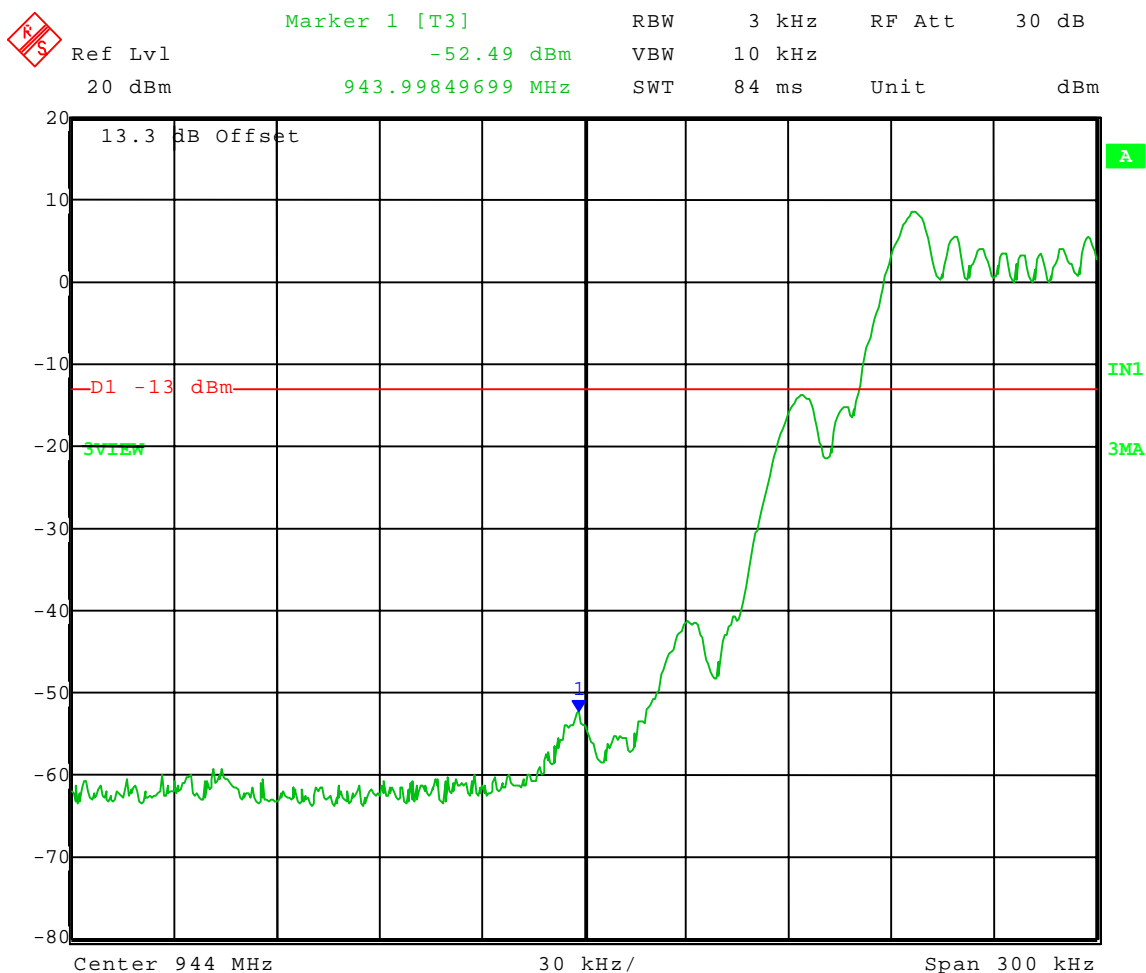
APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 944.125 MHz

Operating conditions: 9.3 V 10° C

Band-Edge Frequency = 944 MHz

Band-Edge limit = -13 dBm



Date: 20.SEP.2007 14:22:41



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

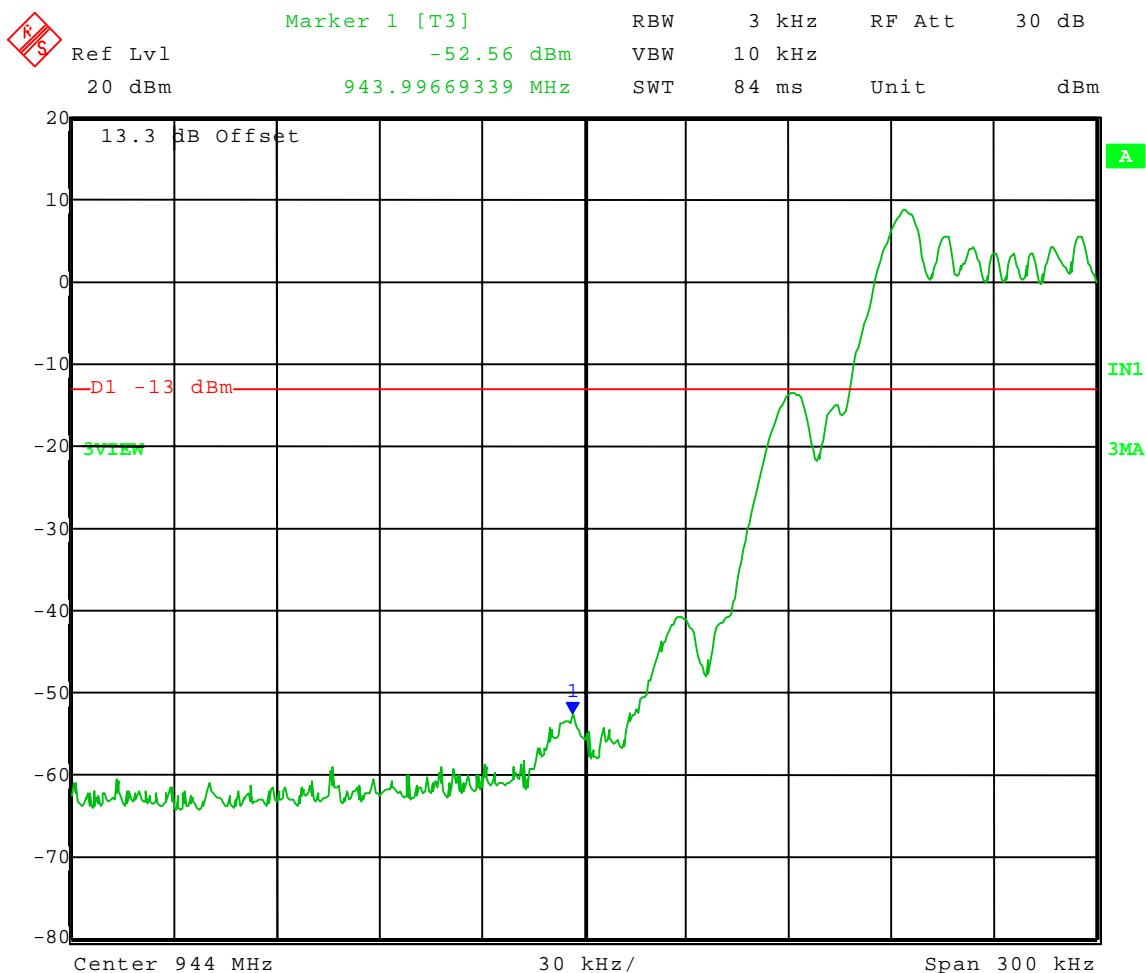
APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 944.125 MHz

Operating conditions: 9.3 V 20° C

Band-Edge Frequency = 944 MHz

Band-Edge limit = -13 dBm



Date: 20.SEP.2007 12:07:11



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

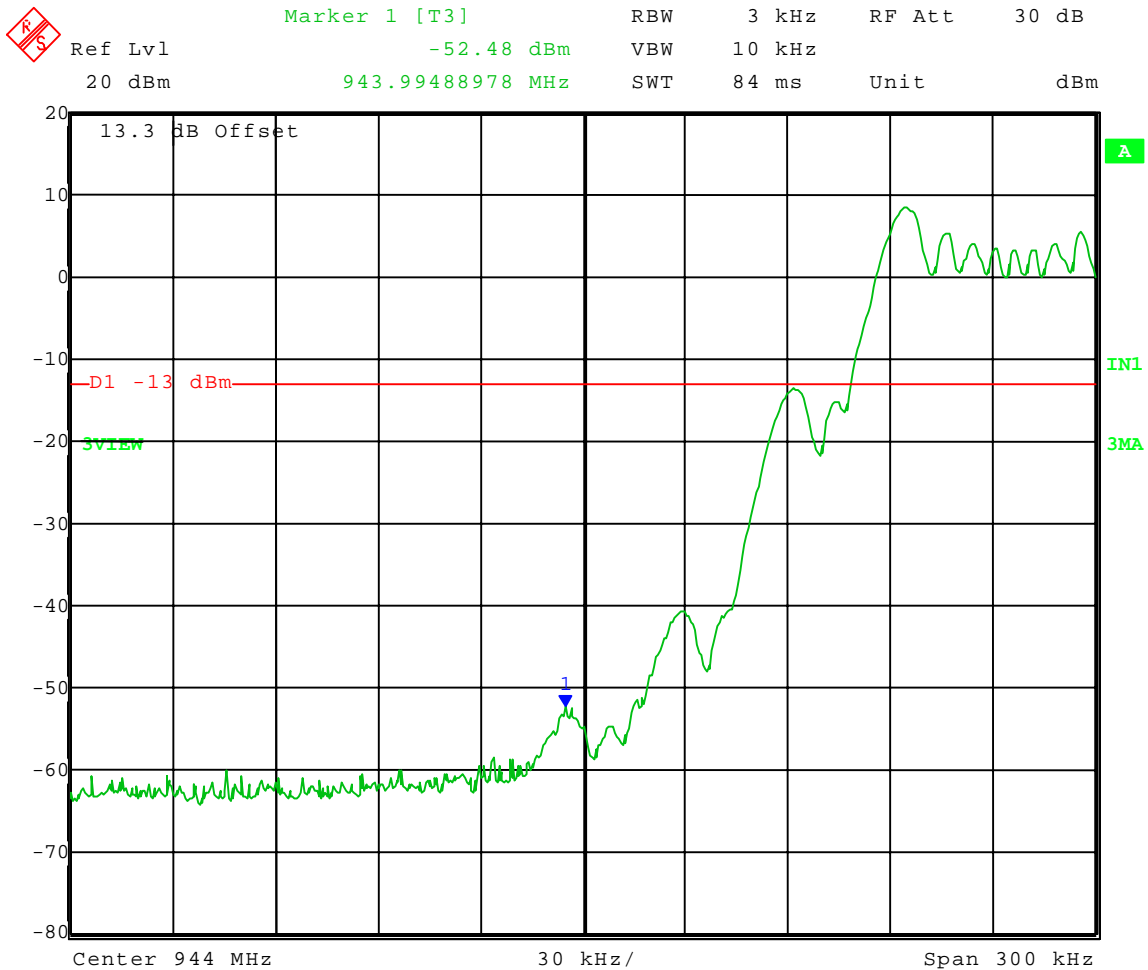
1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 944.125 MHz

Operating conditions: 9.3 V 30° C

Band-Edge Frequency = 944 MHz
Band-Edge limit = -13 dBm



Date: 20.SEP.2007 12:49:34



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

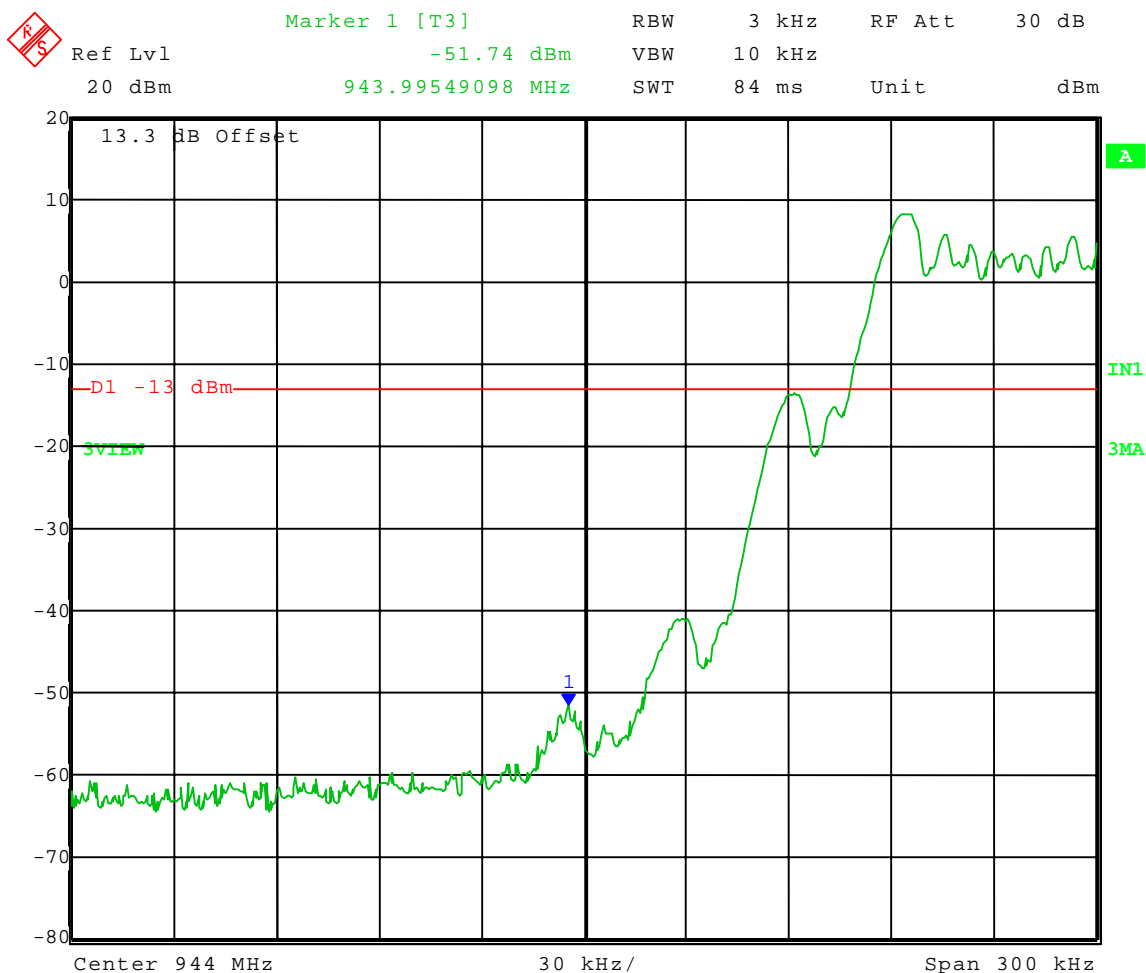
APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 944.125 MHz

Operating conditions: 9.3 V 40° C

Band-Edge Frequency = 944 MHz

Band-Edge limit = -13 dBm



Date: 20.SEP.2007 13:18:12



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

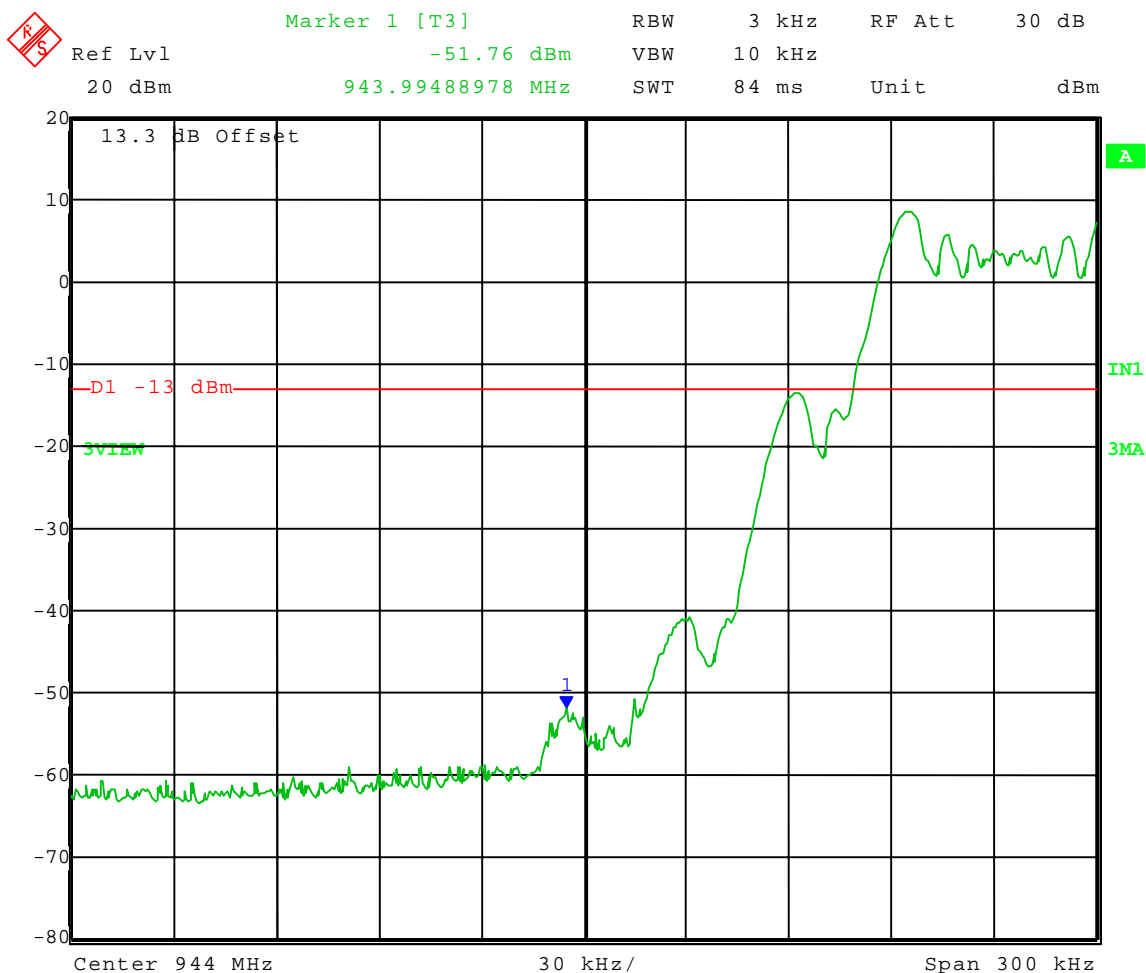
APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 944.125 MHz

Operating conditions: 9.3 V 50° C

Band-Edge Frequency = 944 MHz

Band-Edge limit = -13 dBm



Date: 20.SEP.2007 13:48:05



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

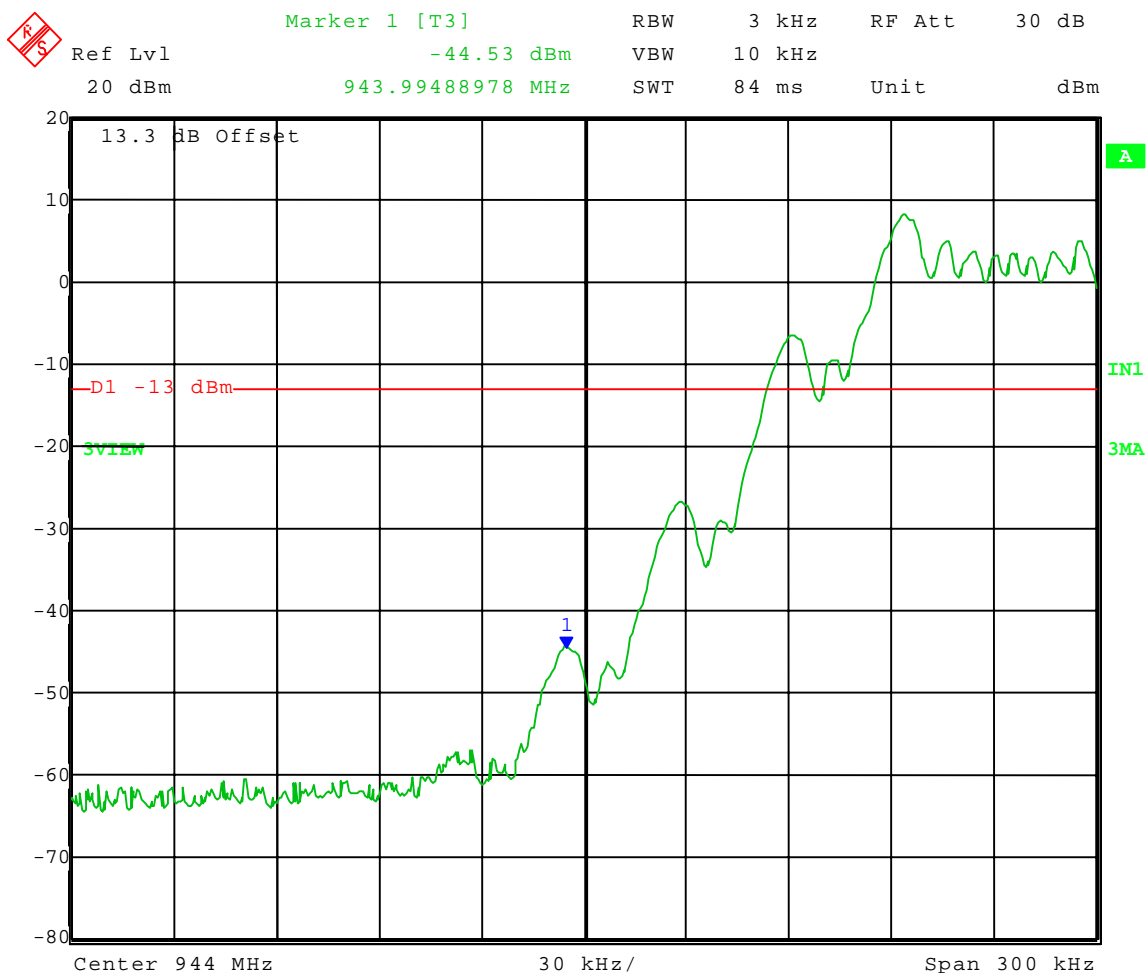
APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 944.125 MHz

Operating conditions: 6.6 V 20° C

Band-Edge Frequency = 944 MHz

Band-Edge limit = -13 dBm



Date: 20.SEP.2007 12:15:54



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

APPENDIX A

DATA AND GRAPH(S) TAKEN OF THE BAND EDGE COMPLIANCE Part 74.861(d) & PART 2.1051 HIGH CHANNEL



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

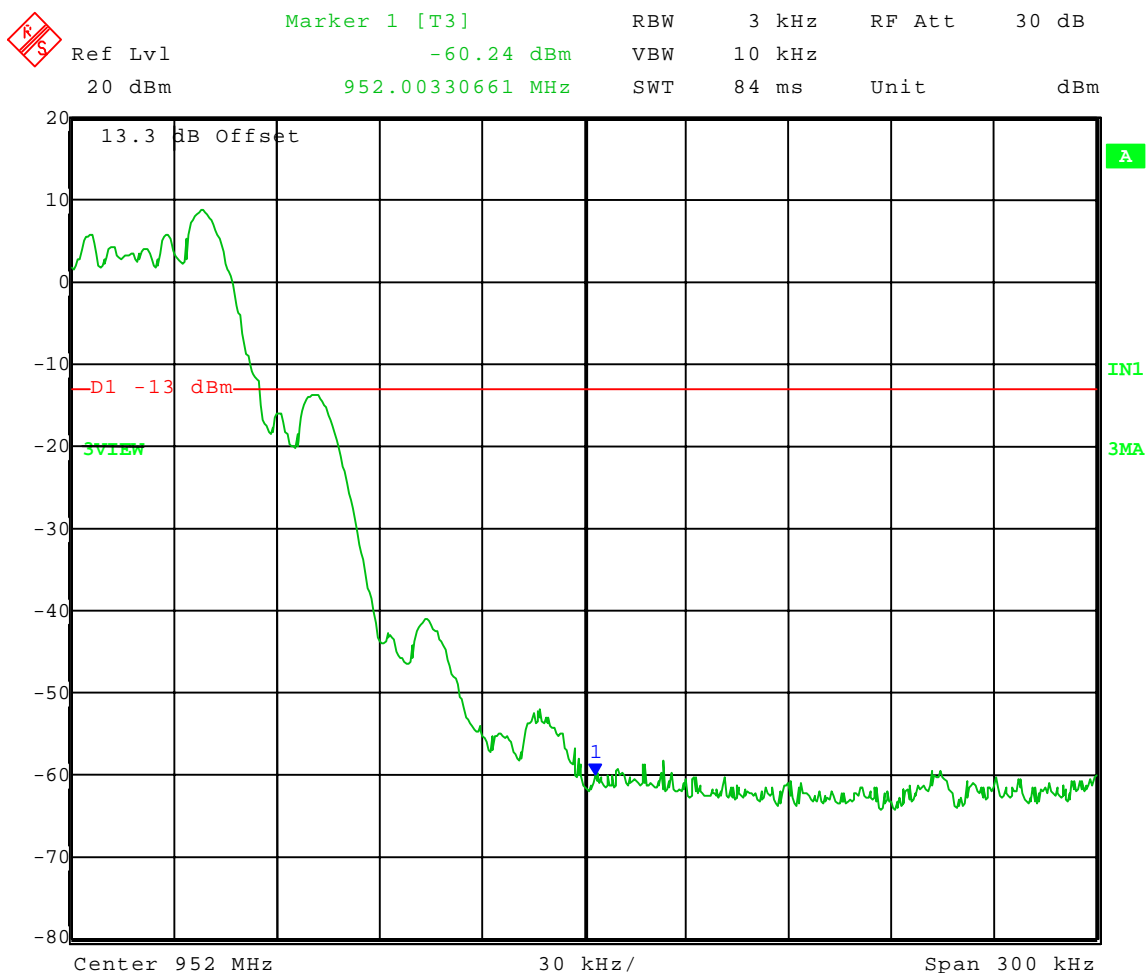
APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 951.875 MHz

Operating conditions: 9.3 V -30° C

Band-Edge Frequency = 952 MHz

Band-Edge limit = -13 dBm



Date: 20.SEP.2007 16:38:27



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

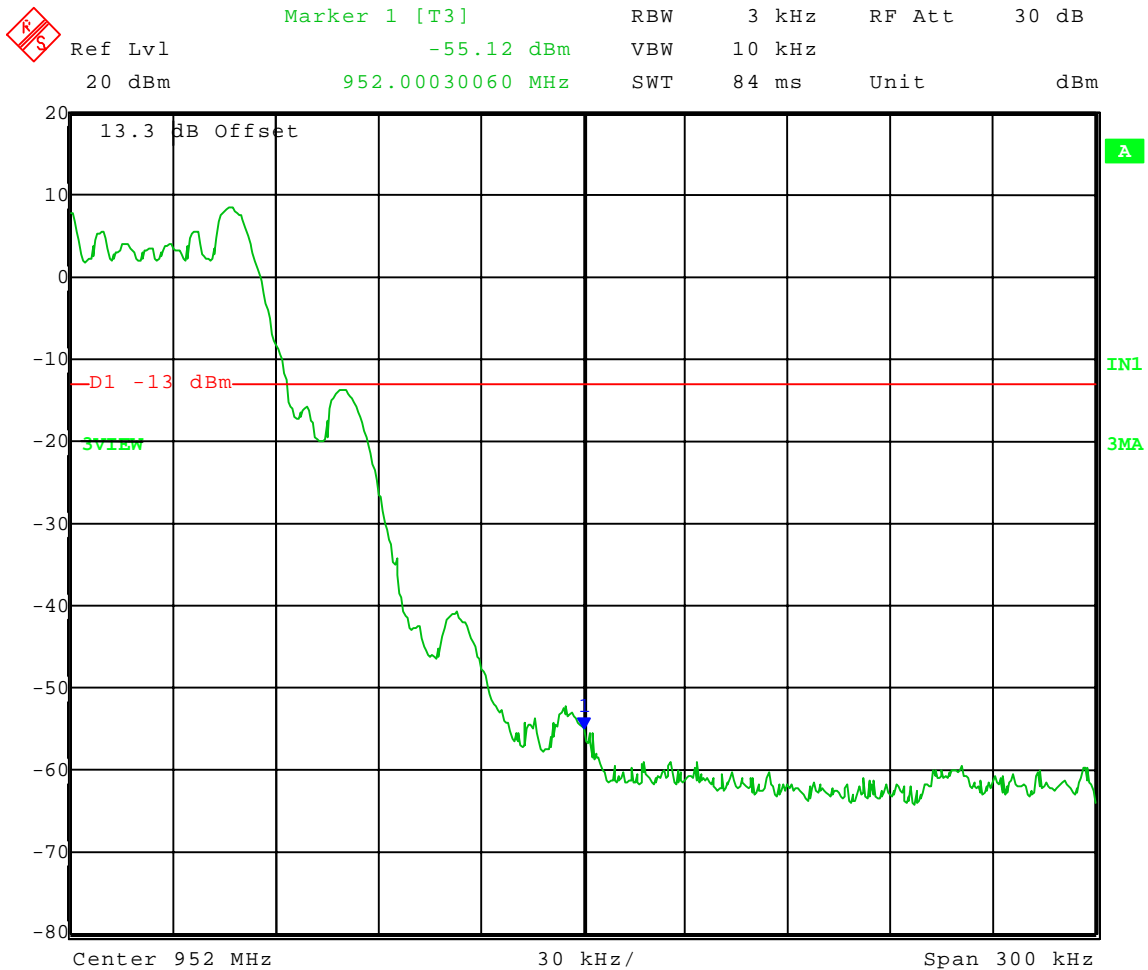
1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 951.875 MHz

Operating conditions: 9.3 V -20° C

Band-Edge Frequency = 952 MHz
Band-Edge limit = -13 dBm



Date: 20.SEP.2007 16:00:30



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

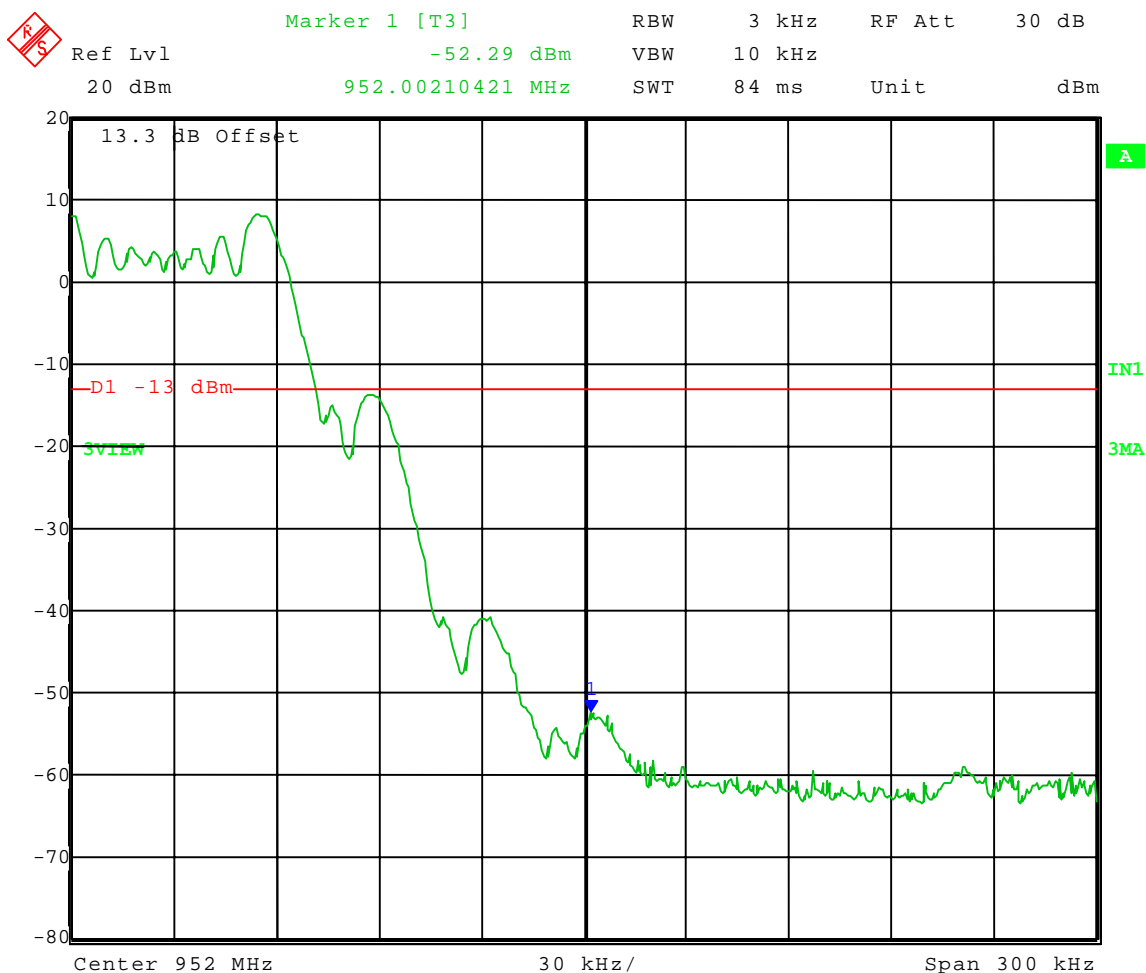
APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 951.875 MHz

Operating conditions: 9.3 V -10° C

Band-Edge Frequency = 952 MHz

Band-Edge limit = -13 dBm



Date: 20.SEP.2007 15:27:27



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

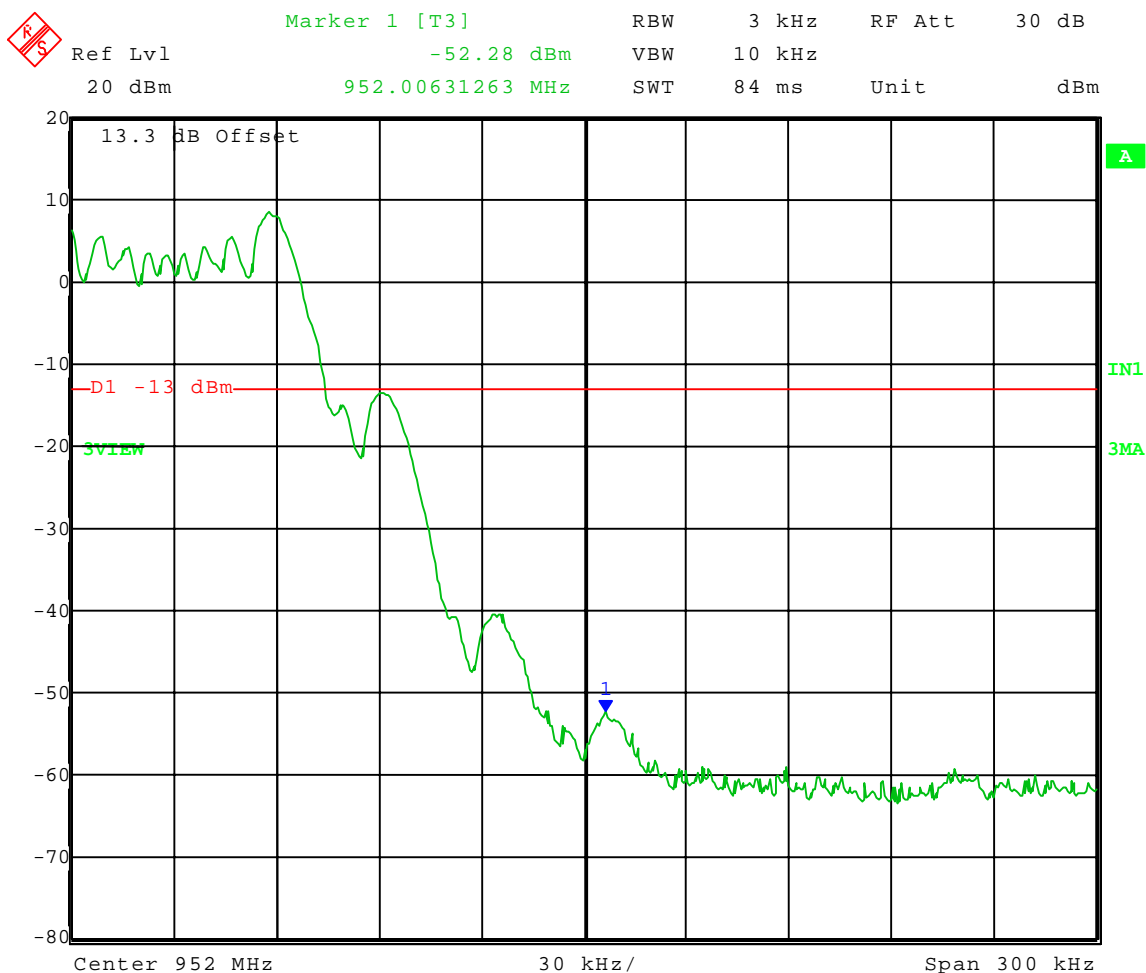
APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 951.875 MHz

Operating conditions: 9.3 V 0° C

Band-Edge Frequency = 952 MHz

Band-Edge limit = -13 dBm



Date: 20.SEP.2007 14:51:33



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

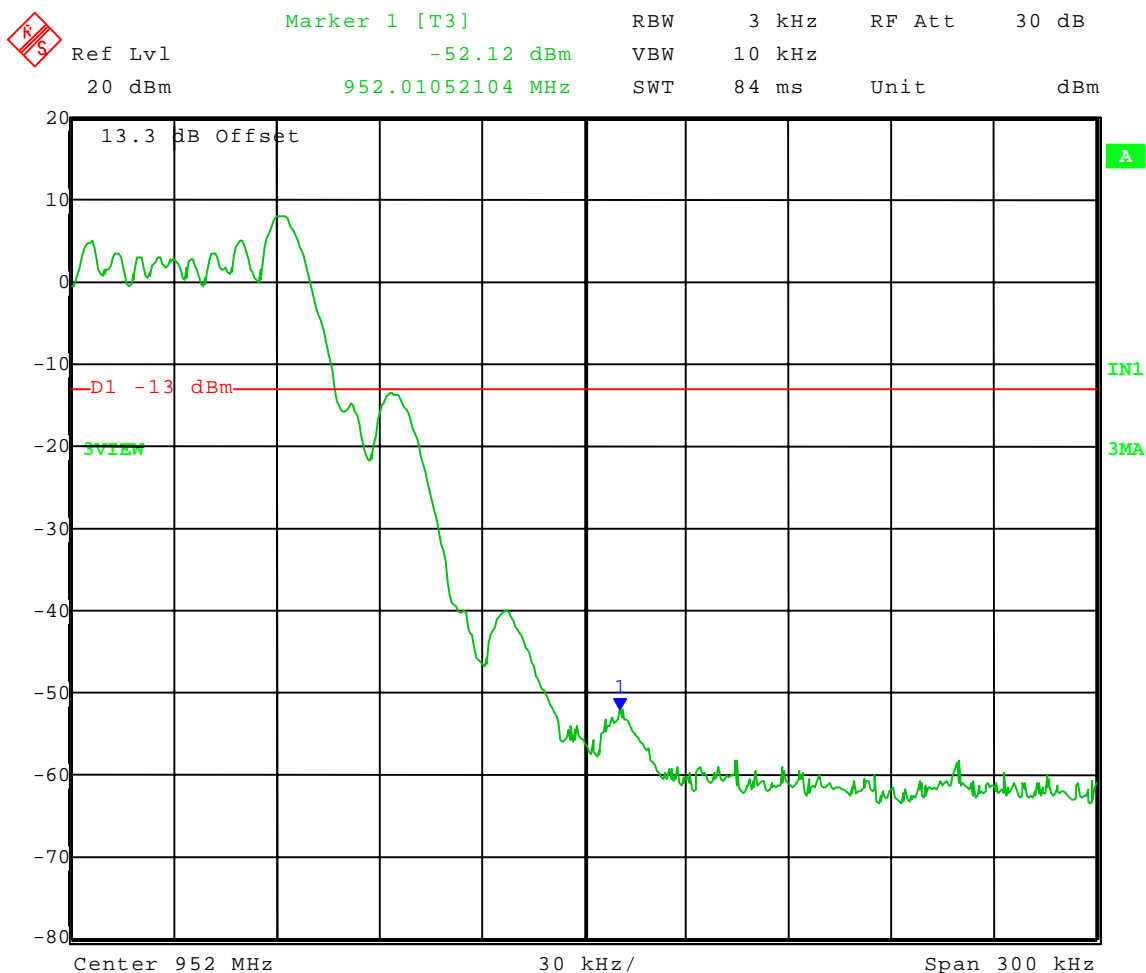
APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 951.875 MHz

Operating conditions: 9.3 V 10° C

Band-Edge Frequency = 952 MHz

Band-Edge limit = -13 dBm



Date: 20.SEP.2007 14:24:47



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

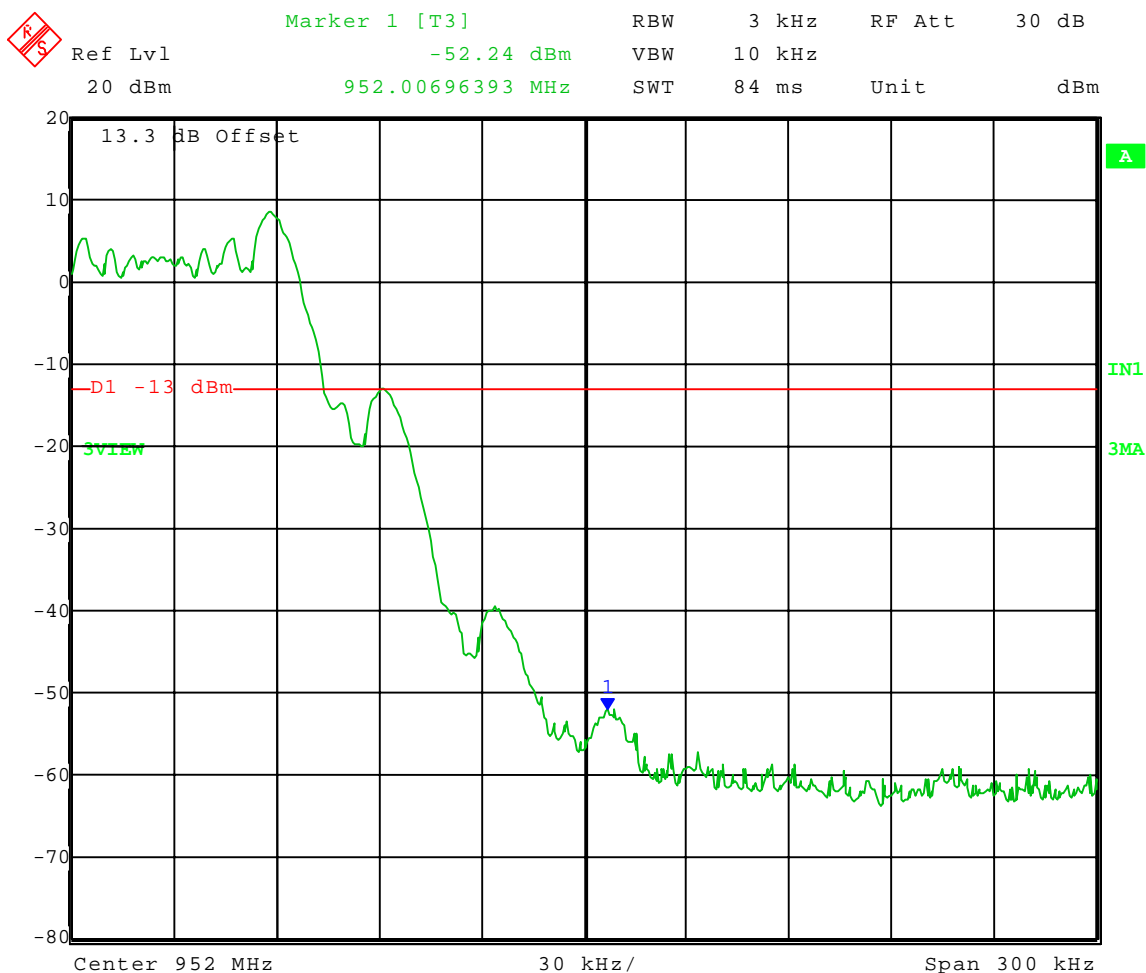
APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 951.875 MHz

Operating conditions: 9.3 V 20° C

Band-Edge Frequency = 952 MHz

Band-Edge limit = -13 dBm



Date: 20.SEP.2007 12:04:24



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

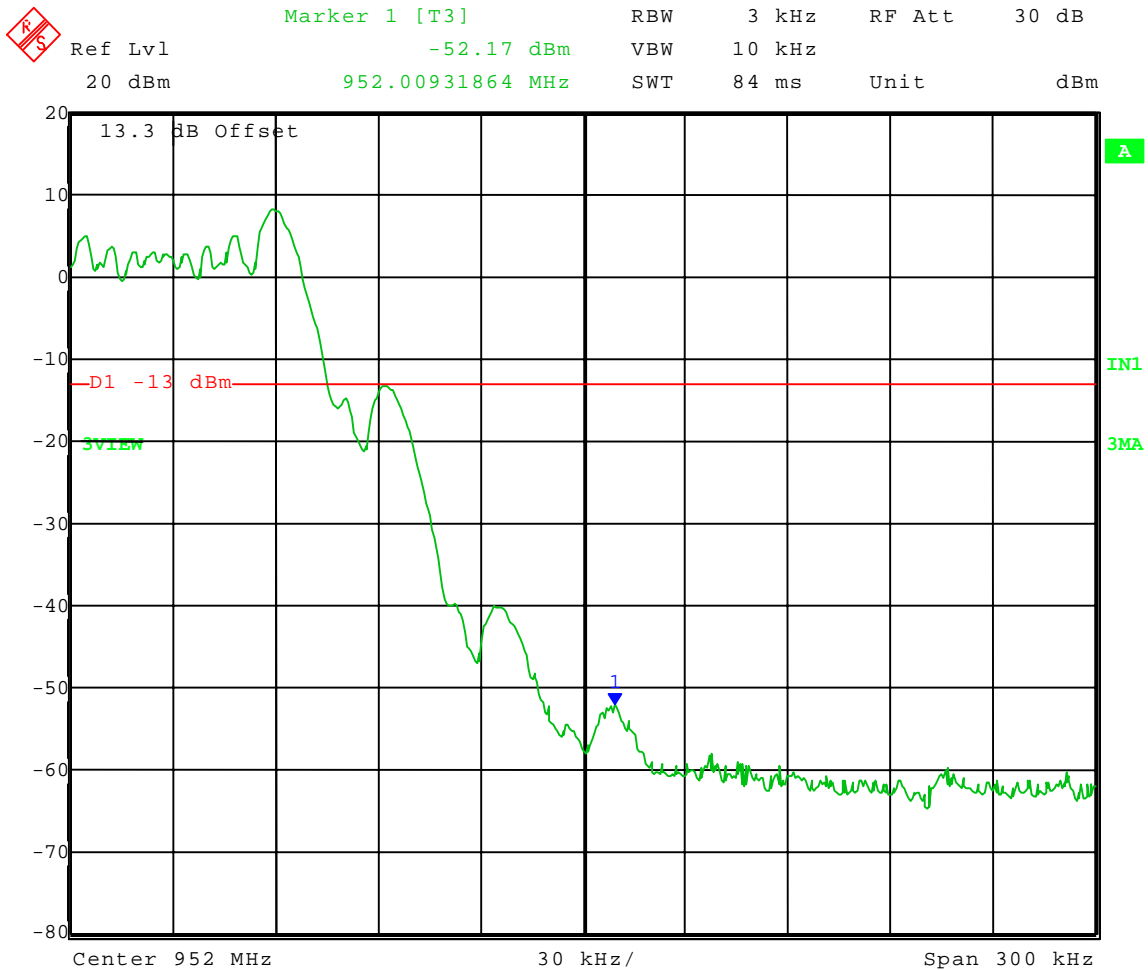
1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 951.875 MHz

Operating conditions: 9.3 V 30° C

Band-Edge Frequency = 952 MHz
Band-Edge limit = -13 dBm



Date: 20.SEP.2007 12:47:45



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

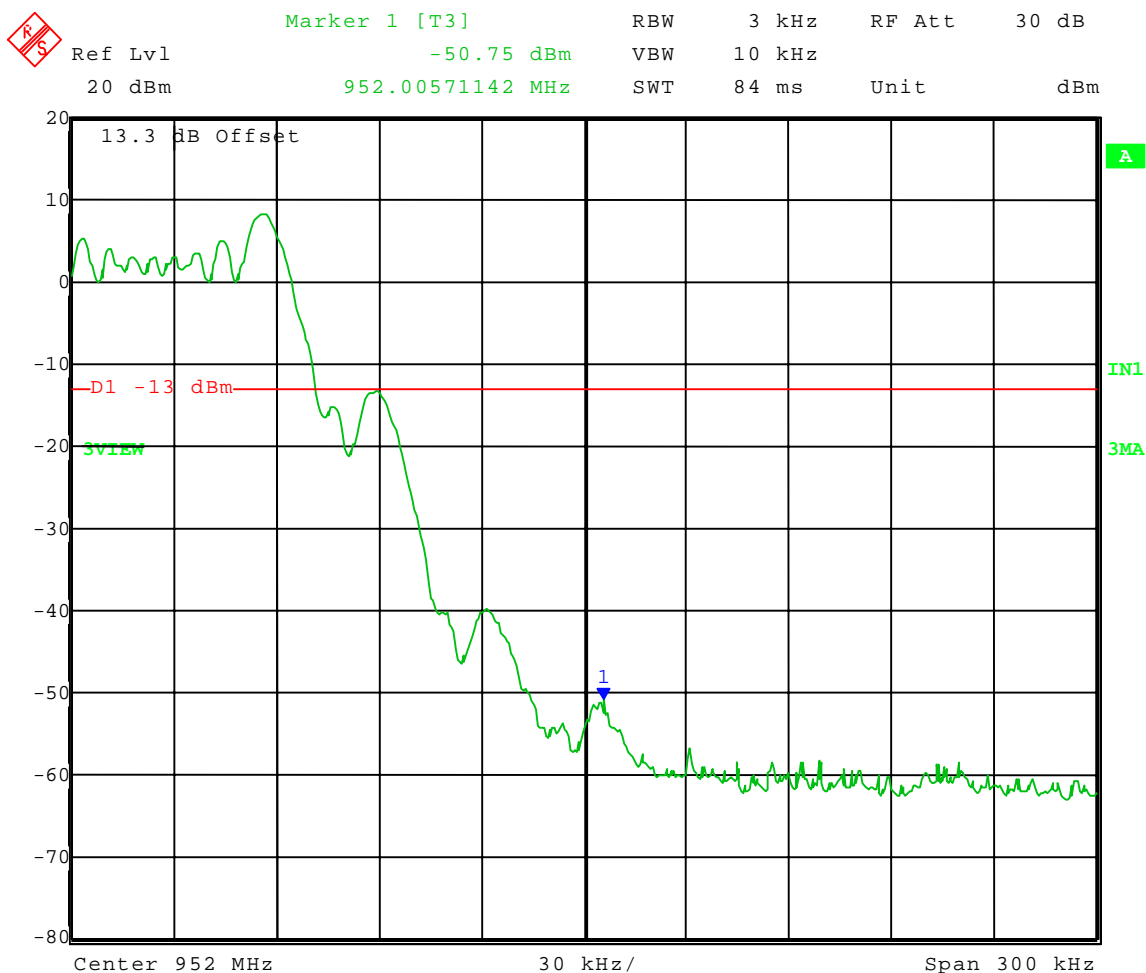
APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 951.875 MHz

Operating conditions: 9.3 V 40° C

Band-Edge Frequency = 952 MHz

Band-Edge limit = -13 dBm



Date: 20.SEP.2007 13:20:59



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

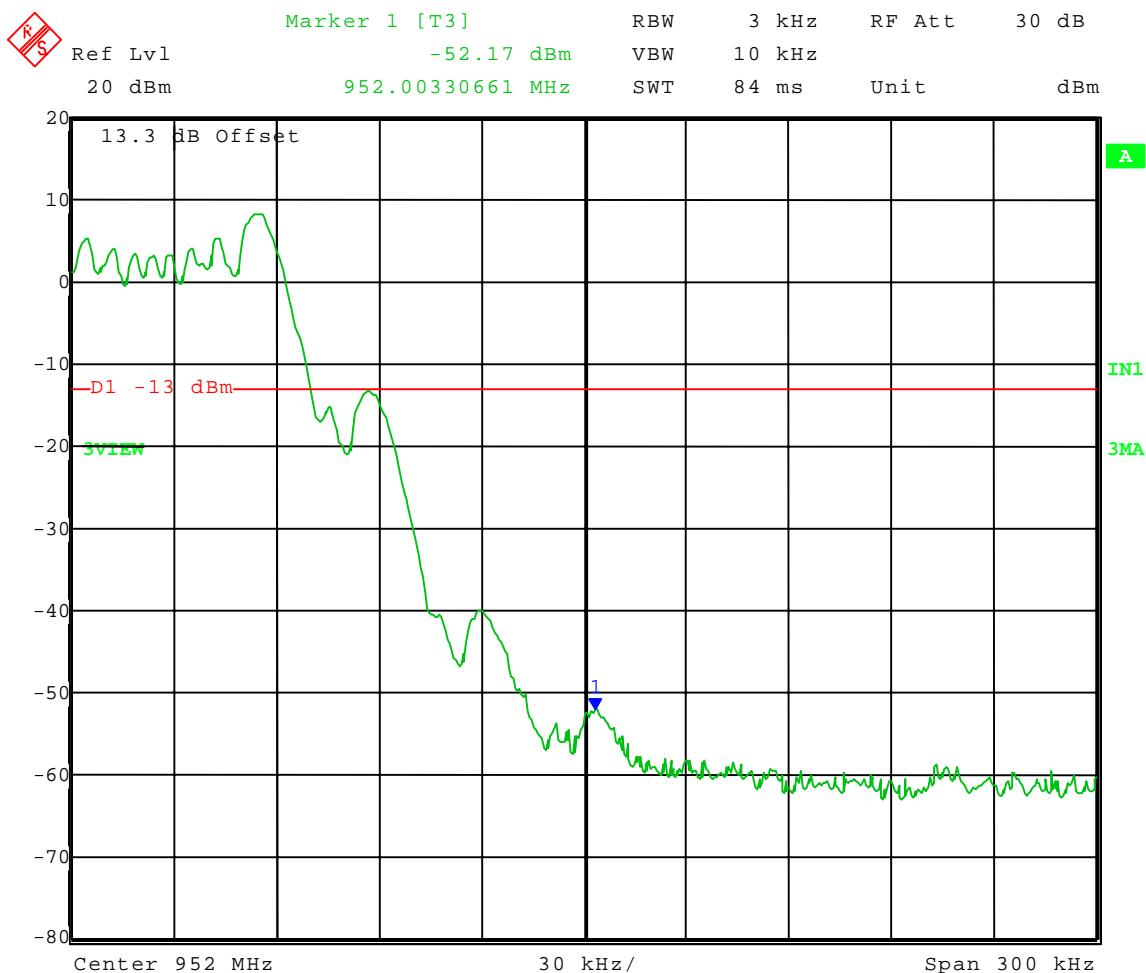
APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 951.875 MHz

Operating conditions: 9.3 V 50° C

Band-Edge Frequency = 952 MHz

Band-Edge limit = -13 dBm



Date: 20.SEP.2007 13:46:10



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

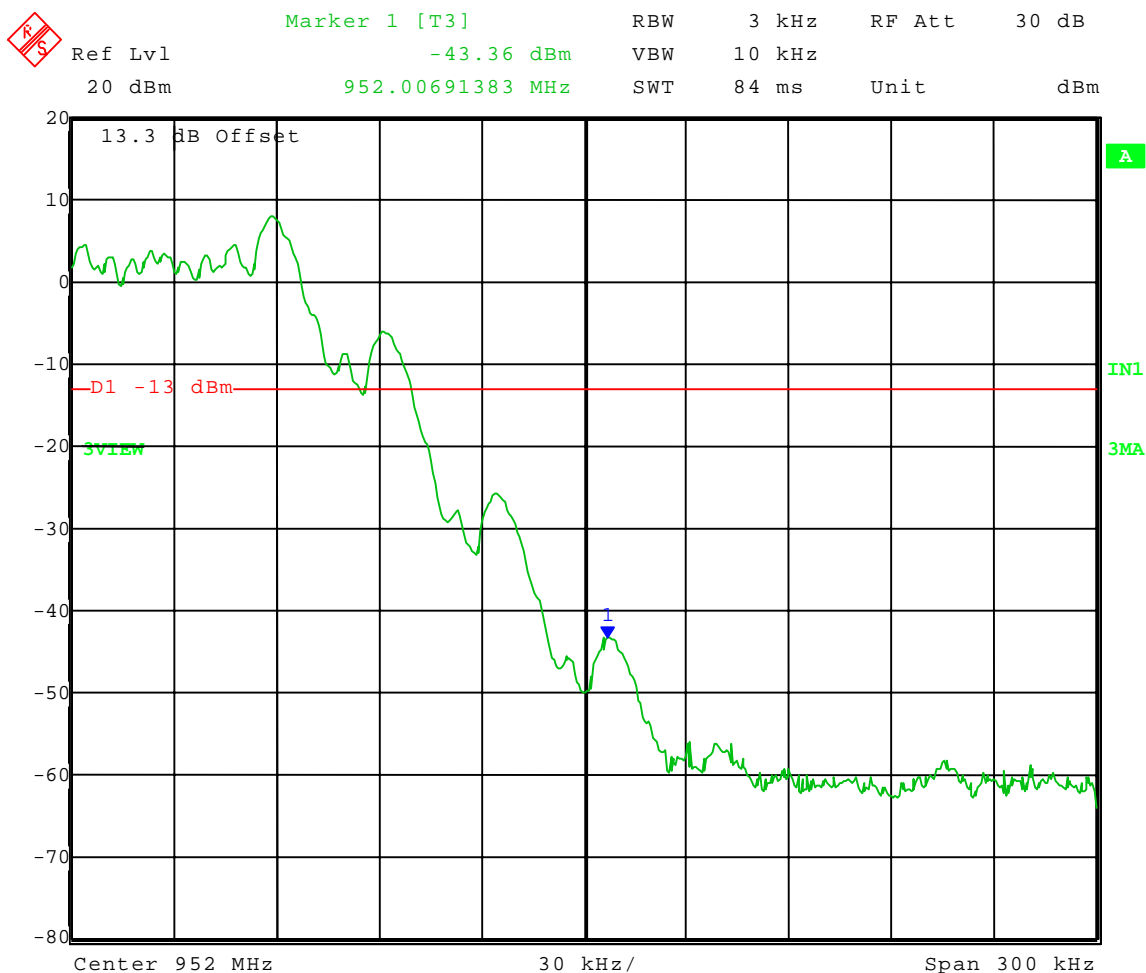
1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

Test Date: 09-20-2007
Company: Shure, Inc.
EUT: ULX1-X1
Test: Band-Edge Compliance - Conducted
Rule part: FCC Part 74.861(d); FCC Part 2.1051
Operator: Craig B
Comment: Channel; 951.875 MHz

Operating conditions: 6.6 V 20° C

Band-Edge Frequency = 952 MHz
Band-Edge limit = -13 dBm



Date: 20.SEP.2007 12:17:55



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

APPENDIX A

8.0 FIELD STRENGTH OF SPURIOUS EMISSION MEASUREMENTS – PART 2.1053 and EIA/TIA-603-C:2004, SECTION 2.2.12

Radiated measurements were performed scanning the frequency range from 200 MHz to at least the 10th harmonic of the fundamental frequency.

For the ULX1 Wireless Microphone Transmitter, the highest fundamental frequency is 704 MHz so the scans were made up to 10000 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 944 MHz - 952 MHz bands for ULX1 Wireless Microphone Transmitter are found under Part 74, Section 74.861, Paragraph d-3 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) any discrete frequency outside the authorized band shall be attenuated, at least, $43+10\log^{10}$ (mean output power, in watts) dB below the mean output power of the transmitting unit.



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

APPENDIX A

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

As stated in Part 74, Section 74.861 (d-1) the limit is 1 Watt in the frequency range 944 MHz - 952 MHz.

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

Mean output power in watts:

Manufacturer's rated wattage = **30 mW maximum Watt(s)**
(See Paragraph 2.0, page 2 of this Appendix)

Free Space Formula

Convert to 3 meter test distance using the Free Space Formula

$$\frac{\sqrt{49.2 * \text{rated wattage}}}{\text{Distance}} = 0.4049691 \text{ volts/meter} = 404969.1 \text{ uV/m}$$

$$20 * \text{Log}(404969.1) = 112.1484 \text{ dBuV}$$

Therefore, the Fundamental at three meters equals 112.1484 dBuV,

The emissions must be reduced by:

$$43 + 10 * \text{LOG}_{10}(0.03 \text{ watts}) = 27.77121 \text{ dB}$$

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

112.1484 dBuV extrapolated level for 0.03 watts
-27.77121 dB required reduction below the unmodulated fundamental
84.37723 dBuV maximum spurious emissions allowed



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

APPENDIX A

RADIATED EMISSION DATA TAKEN FOR FUNDAMENTAL EMISSIONS USING THE SUBSTITUTION METHOD EIA /TIA-603-C:2004, SECTION 2.2.12



Company: Shure Inc.
 Model Tested: ULX1-X1
 Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

DLS Electronic Systems, Inc.

Company: Shure, Inc.
 Operator: Craig B
 Date of test: 09-19-2007
 Temperature: 72 deg. F
 Humidity: 57% R.H.
 Part 74.861(d)
 Rated Power = 30 mW = 14.77 dBm

Spurious Emissions - ERP - Substitution Method

Model: ULX1-X1								
Channels: 944.125 MHz, and 951.875 MHz								
Frequency and Polarization (MHz)	Max. Field Strength of EUT @ 3 meters (dBuV/m)	Output of Signal Generator when field strength equals that of EUT (dBm)	Correction factor for cable between Signal Gen. and subst. antenna (dB)	Gain of subst. antenna (dBi)	Strength of emission [ERP] (dBm)	Limit (dBm)	Margin (dB)	Strength of emission [ERP] (mW)
944.125 vertical	109.31	19.41	7.10	2.15	12.3	30.0	17.7	17.02
944.125 horizontal	109.42	19.23	7.10	2.15	12.1	30.0	17.9	16.33
951.875 vertical	109.46	19.81	7.14	2.15	12.7	30.0	17.3	18.49
951.875 horizontal	110.02	19.30	7.14	2.15	12.2	30.0	17.8	16.44

EIRP = Signal generator output - cable loss + antenna gain

$ERP_{(ref. \text{ to } \frac{1}{2}\lambda \text{ dipole})} = \text{Signal generator output} - \text{cable loss} + \text{antenna gain} - 2.15$



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

APPENDIX A

RADIATED EMISSION DATA TAKEN FOR SPURIOUS EMISSION MEASUREMENTS

EIA /TIA-603-C:2004, SECTION 2.2.12

PART 2.1053



Company: Shure Inc.
 Model Tested: ULX1-X1
 Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

DLS Electronic Systems, Inc.

Company: Shure, Inc.
 Operator: Craig B
 Date of test: 09-19-2007
 Temperature: 72 deg. F.
 Humidity: 58% R.H.

Radiated Spurious Emissions (e.r.p. substitution method) FCC Part 74; FCC Part 2.1053								
Model: ULX1-X1 Transmit Frequency: 944.125 MHz								
Frequency GHz	Field Strength Level dBuV/m	Factor to Convert to dBm	Power ERP dBm	Limit dBm	Margin dB	Receive Antenna Polarization	EUT Antenna Orientation	Receive Antenna Height (m)
1.88825	74.0	99.0	-25.0	-13	12.0	Horizontal	0	1.3
2.83238	74.1	101.0	-26.9	-13	13.9	Horizontal	20	1.6
3.77650	69.8	100.1	-30.3	-13	17.3	Horizontal	0	1.1
4.72063	60.5	98.6	-38.1	-13	25.1	Horizontal	40	1.1
5.66475	58.8	98.5	-39.7	-13	26.7	Horizontal	270	1.1
6.60888	59.1	98.1	-39.0	-13	26.0	Horizontal	340	1.3
7.55300	65.4	98.7	-33.3	-13	20.3	Horizontal	45	1.2
8.49713	63.8	99.2	-35.4	-13	22.4	Horizontal	45	2.0
9.44125	50.0	98.3	-48.3	-13	35.3	Horizontal	60	2.0
1.88825	73.5	98.5	-25.0	-13	12.0	Vertical	40	1.1
2.83238	73.9	99.0	-25.1	-13	12.1	Vertical	315	1.1
3.77650	67.9	99.5	-31.6	-13	18.6	Vertical	0	1.4
4.72063	60.9	99.6	-38.7	-13	25.7	Vertical	30	1.1
5.66475	59.4	100.0	-40.6	-13	27.6	Vertical	315	1.1
6.60888	62.0	99.2	-37.2	-13	24.2	Vertical	0	1.0
7.55300	65.8	100.3	-34.5	-13	21.5	Vertical	0	1.3
8.49713	63.2	101.5	-38.3	-13	25.3	Vertical	20	1.2
9.44125	50.3	100.3	-50.0	-13	37.0	Vertical	20	1.2



Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

DLS Electronic Systems, Inc.

Company: Shure, Inc.
Operator: Craig B
Date of test: 09-19-2007
Temperature: 72 deg. F.
Humidity: 58% R.H.

Radiated Spurious Emissions (e.r.p. substitution method) FCC Part 74; FCC Part 2.1053								
Model: ULX1-X1 Transmit Frequency: 951.875 MHz								
Frequency GHz	Field Strength Level dBuV/m	Factor to Convert to dBm	Power ERP dBm	Limit dBm	Margin dB	Receive Antenna Polarization	EUT Antenna Orientation	Receive Antenna Height (m)
1.90375	73.8	99.7	-25.9	-13	12.9	Horizontal	350	1.3
2.85563	73.1	101.1	-28.0	-13	15.0	Horizontal	20	1.1
3.80750	68.2	99.7	-31.5	-13	18.5	Horizontal	10	1.1
4.75938	60.3	98.3	-38.0	-13	25.0	Horizontal	0	1.0
5.71125	62.4	98.9	-36.5	-13	23.5	Horizontal	60	1.9
6.66313	59.5	97.9	-38.4	-13	25.4	Horizontal	340	2.0
7.61500	64.1	98.9	-34.8	-13	21.8	Horizontal	315	2.0
8.56688	61.1	99.1	-38.0	-13	25.0	Horizontal	45	1.7
9.51875	46.6	98.0	-51.4	-13	38.4	Horizontal	0	2.2
1.90375	75.0	100.1	-25.1	-13	12.1	Vertical	0	1.1
2.85563	72.0	99.3	-27.3	-13	14.3	Vertical	40	1.5
3.80750	67.2	99.0	-31.8	-13	18.8	Vertical	0	1.1
4.75938	59.9	99.3	-39.4	-13	26.4	Vertical	40	1.1
5.71125	67.8	100.3	-32.5	-13	19.5	Vertical	30	1.2
6.66313	62.9	99.1	-36.2	-13	23.2	Vertical	330	1.3
7.61500	64.9	100.4	-35.5	-13	22.5	Vertical	45	1.0
8.56688	63.2	101.3	-38.1	-13	25.1	Vertical	10	1.4
9.51875	49.9	100.4	-50.5	-13	37.5	Vertical	315	1.0



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Inc.
Model Tested: ULX1-X1
Report Number: 13583

APPENDIX A

9.0 BAND EDGE IN TEMPERATURE CHAMBER PHOTOS TAKEN DURING TESTING

