



Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

FCC Rules and Regulations / Intentional Radiators

Low Power Auxiliary Stations

Part 74, Subpart H, Sections 74.801 - 74.882

Part 74.861 (e) TV Broadcasting

THE FOLLOWING **MEETS** THE ABOVE TEST SPECIFICATION

Formal Name: Wireless Boundary Microphone
Kind of Equipment: Wireless Microphone Transmitter
Frequency Range: 494 MHz - 518 MHz
Test Configuration: Stand Alone (Tested at 3 vdc)
Model Number(s): MX690
Model(s) Tested: MX690 G5
Serial Number(s): N/a
Emission Designator: DD4MX690G5
Date of Tests: March 12, 13, 14, 18, & 20, 2008
Test Conducted For: Shure Incorporated
5800 W. Touhy Avenue
Niles, Illinois 60714-4608

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.



Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

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 Incorporated
 Model Tested: MX690 G5
 Report Number: 13996

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 10

11.0 Radiated Photos Taken During Testing 11

12.0 Results of Tests 13

13.0 Conclusion 13

TABLE 1 – EQUIPMENT LIST 14

Appendix A – Electric Field Radiated Emissions Test 15

1.0 Test Set-Up 16

2.0 RF Power Output 16

2.0 Data taken of the RF Power Output 17

3.0 RF Output Power Photos Taken During Testing 21

4.0 Modulation Characteristics 22

4.0 Graph(s) taken of the Modulation Characteristics 23

5.0 Occupied Bandwidth 30

5.0 Data and Graph(s) taken of the 99% Occupied Bandwidth 31

5.0 Data and Graph(s) taken of the 99% Occupied Bandwidth (Emission Mask) 35

6.0 Spurious Emissions At Antenna Terminals 42

7.0 Field Strength of Spurious Emission Measurements 43

7.0 Radiated Data and Charts taken for Fundamental Emissions using the Substitution Method 44

7.0 Radiated Data and Graph(s) Taken During Testing for Spurious Emissions 48

8.0 Frequency Stability (Temperature) 52

9.0 Frequency Stability (Voltage Variation) 52

8.0 & 9.0 Data Taken for Frequency Stability Temperature & Voltage Variation 53

10.0 Frequency Stability Photos Taken During Testing 55

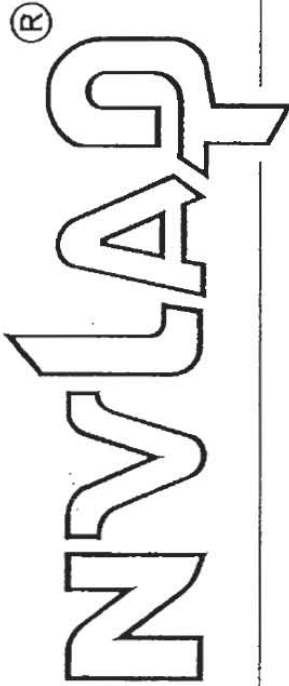


Company:
Model Tested:
Report Number:

Shure Incorporated
MX690 G5
13996

1250 Peterson Dr., Wheeling, IL 60090

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 Communique dated 18 June 2005).



2007-10-01 through 2008-09-30

Effective dates

Dolly S. Buce

For the National Institute of Standards and Technology

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



Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

1.0 SUMMARY OF TEST REPORT

It was found that the Wireless Boundary Microphone, Model Number(s) MX690 G5, **meets** the radio interference radiated emission requirements of the FCC "Rules and Regulations", Part 74, Subpart H, Section 74.861 (e), for low power auxiliary stations. The AC Power Line conducted emissions test was not required because the Wireless Boundary Microphone 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 March 12, 13, 14, 18, & 20, 2008, a series of radio frequency interference measurements was performed on Wireless Boundary Microphone, Model Number(s) MX690 G5, Serial Number: N/A. 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

O.A.T.S. Test Facility:

D.L.S. Electronic Systems, Inc.
166 S. Carter Street
Genoa City, Wisconsin 53128

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 (e), for low power auxiliary stations.



Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

4.0 TEST SET-UP

All tests were performed at D.L.S. Electronic Systems, Inc. and set up according to the FCC and TIA-603C regulations. 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 Incorporated
Model Tested: MX690 G5
Report Number: 13996

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 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 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 Incorporated
Model Tested: MX690 G5
Report Number: 13996

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.

7.0 AC POWER LINE CONDUCTED EMISSION MEASUREMENTS – Part 15.207

The Wireless Boundary Microphone 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.



Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

8.0 DESCRIPTION OF TEST SAMPLE:

8.1 Description:

The Shure Model MX690 is a uP (microprocessor) controlled frequency agile UHF transmitter operating over the frequency range of 470 to 865 MHz and 944 to 952 MHz (in different frequency bands). The products are identical, with the exception of the frequency components needed for each range. The User Interface includes "mode", "set" and "mute" buttons, and an LCD that displays battery status, group/channel, and transmitter/receiver frequency synchronization. This product is intended for corporate boardroom, educational facilities and fixed installations.

8.2 PHYSICAL DIMENSIONS OF EQUIPMENT UNDER TEST

Length: 148 mm x Width: 87mm x Height: 43 mm

8.3 LINE FILTER USED:

N/A

8.4 INTERNAL CLOCK FREQUENCIES:

Switching Power Supply Frequencies:

N/A

Clock Frequencies:

0.32768 MHz & 16 MHz

8.5 DESCRIPTION OF ALL CIRCUIT BOARDS:

1. Printed Circuit Board 1

PN: 190-11080 rev.01

2. Printed Circuit Board 2

PN: 190A11076 rev.01



Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

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:

Low, Mid and High channels were tested.

10.0 PHOTO INFORMATION AND TEST SET-UP

Item 0 Wireless Boundary Microphone
Model Number: MX690 G5, Serial Number: N/A



Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

11.0 RADIATED PHOTOS TAKEN DURING TESTING



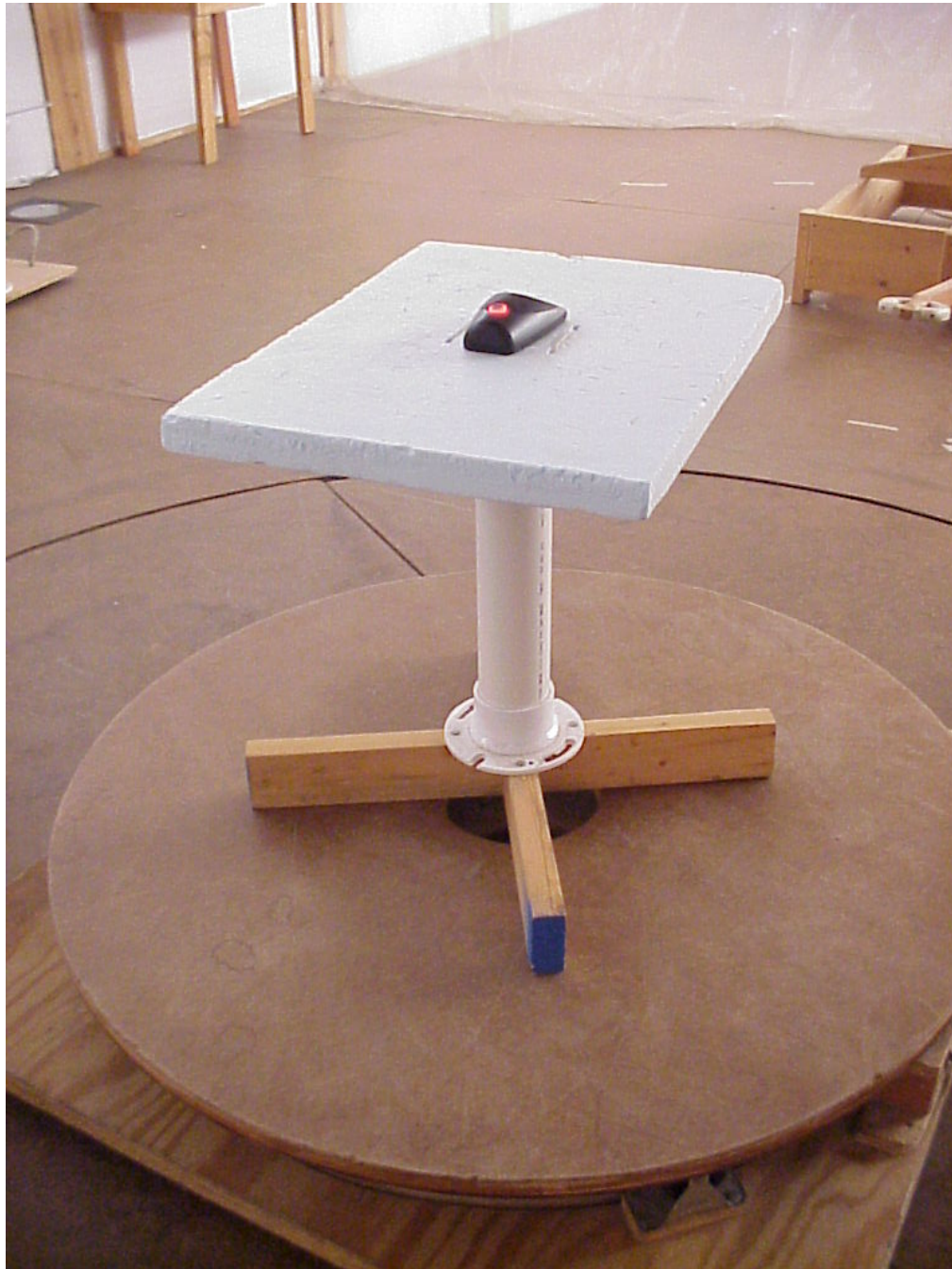
FRONT



Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

11.0 RADIATED PHOTOS TAKEN DURING TESTING



BACK



Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

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 Wireless Boundary Microphone, Model Number(s) MX690 G5 **meets** the radio interference radiated emission requirements of the FCC "Rules and Regulations", Part 74, Subpart H, Section 74.861 (e), for low power auxiliary stations. The AC Power Line conducted emissions test was not required because the Wireless Boundary Microphone 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 Incorporated
 Model Tested: MX690 G5
 Report Number: 13996

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	11/08
Preamp	Miteq	AMF-6D-100200-50	313936	1 GHz-10 GHz	5/08
Antenna	EMCO	3104C	97014785	20 MHz – 200 MHz	2/08
Antenna	EMCO	3146	97024895	200 MHz – 1 GHz	3/08
Horn Antenna	EMCO	3115	5731	1-18 GHz	6/08
Function Generator	Hewlett-Packard	HP3312A	2501A18150		8/08
Attenuator-20dB Fixed	Aeroflex Weinschel	75A-20-12	1071	DC – 40GHz	7/08
Power Meter	Anritsu	ML2487A	6K00002069		10/08
Power Sensor	Anritsu	MA2490A		50MHz-8GHz	10/08
Filter- High-Pass	Q-Microwave	100460		1.1GHz	5/08
Filter- High-Pass	Mini Circuits	NHP-600	438727	600MHz-7GHz	9/08

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



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

APPENDIX A

TEST PROCEDURE

SUBPART H

LOW POWER AUXILIARY STATIONS OPERATING IN THE BANDS ALLOCATED FOR TV BROADCASTING



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

APPENDIX A

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 (e)(1)(ii), the RF output power should not exceed .25 watt(s). The RF output of the Wireless Boundary Microphone was connected to a Spectrum Analyzer or a Power Meter 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:

.97 dBm Measured output of the transmitter

.97 dBm equals 0.00125 watt(s)

LIMIT:

Manufacturer's rated output power = .2 dBm \pm 2.0 dBm

MARGIN:

.25 - 0.00125 = 0.24875 watt(s)



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

APPENDIX A

DATA TAKEN OF THE RF POWER OUTPUT MEASUREMENT

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

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



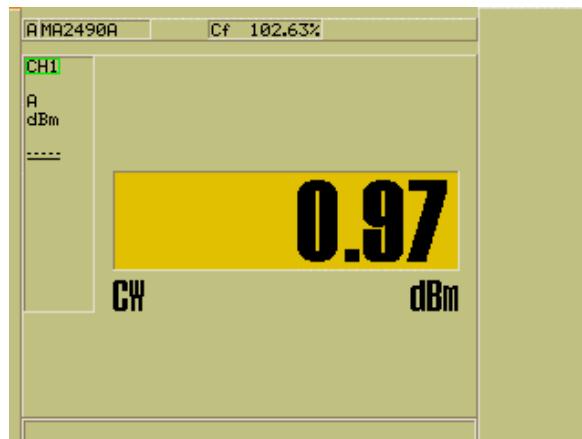
Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

Test Date: 03-13-2008
Company: Shure, Inc.
EUT: MX690-G5
Test: Peak Power Output - Conducted
Rule part: FCC Part 74; FCC Part 2.1046
Operator: Craig B
Comment: Channel: 494.125 MHz

Peak Output Power = 0.97 dBm = 1.25 mW





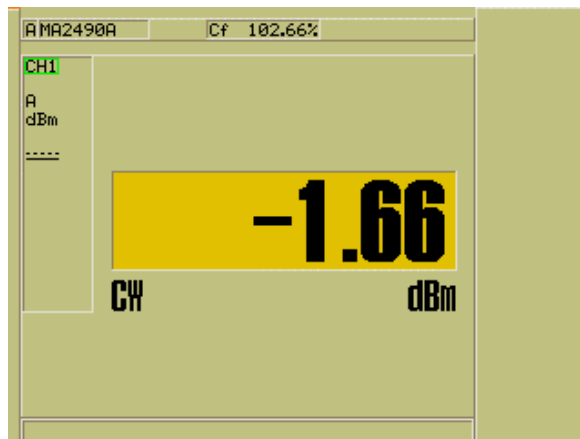
Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

Test Date: 03-13-2008
Company: Shure, Inc.
EUT: MX690-G5
Test: Peak Power Output - Conducted
Rule part: FCC Part 74; FCC Part 2.1046
Operator: Craig B
Comment: Channel: 505.750 MHz

Peak Output Power = -1.66 dBm = 0.68 mW





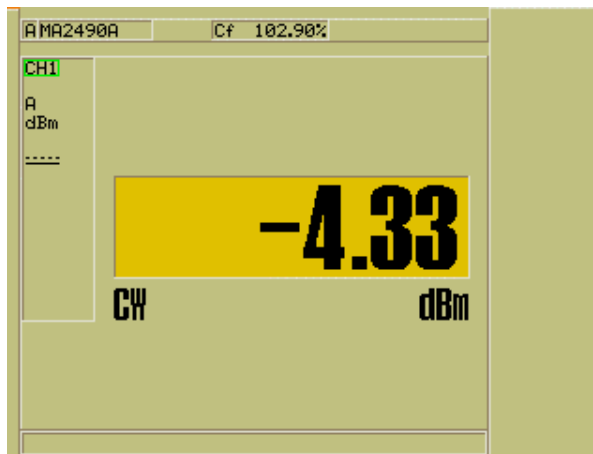
Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

Test Date: 03-13-2008
Company: Shure, Inc.
EUT: MX690-G5
Test: Peak Power Output - Conducted
Rule part: FCC Part 74; FCC Part 2.1046
Operator: Craig B
Comment: Channel: 517.750 MHz

Peak Output Power = -4.33 dBm = 0.37 mW





Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

3.0 RF POWER OUTPUT PHOTOS TAKEN DURING TESTING



RF COND PEAK OUTPUT POWER



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

APPENDIX A

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 50 Hz to 20 kHz ± 3.0 dB Hz 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 Incorporated
Model Tested: MX690 G5
Report Number: 13996

APPENDIX A

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

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

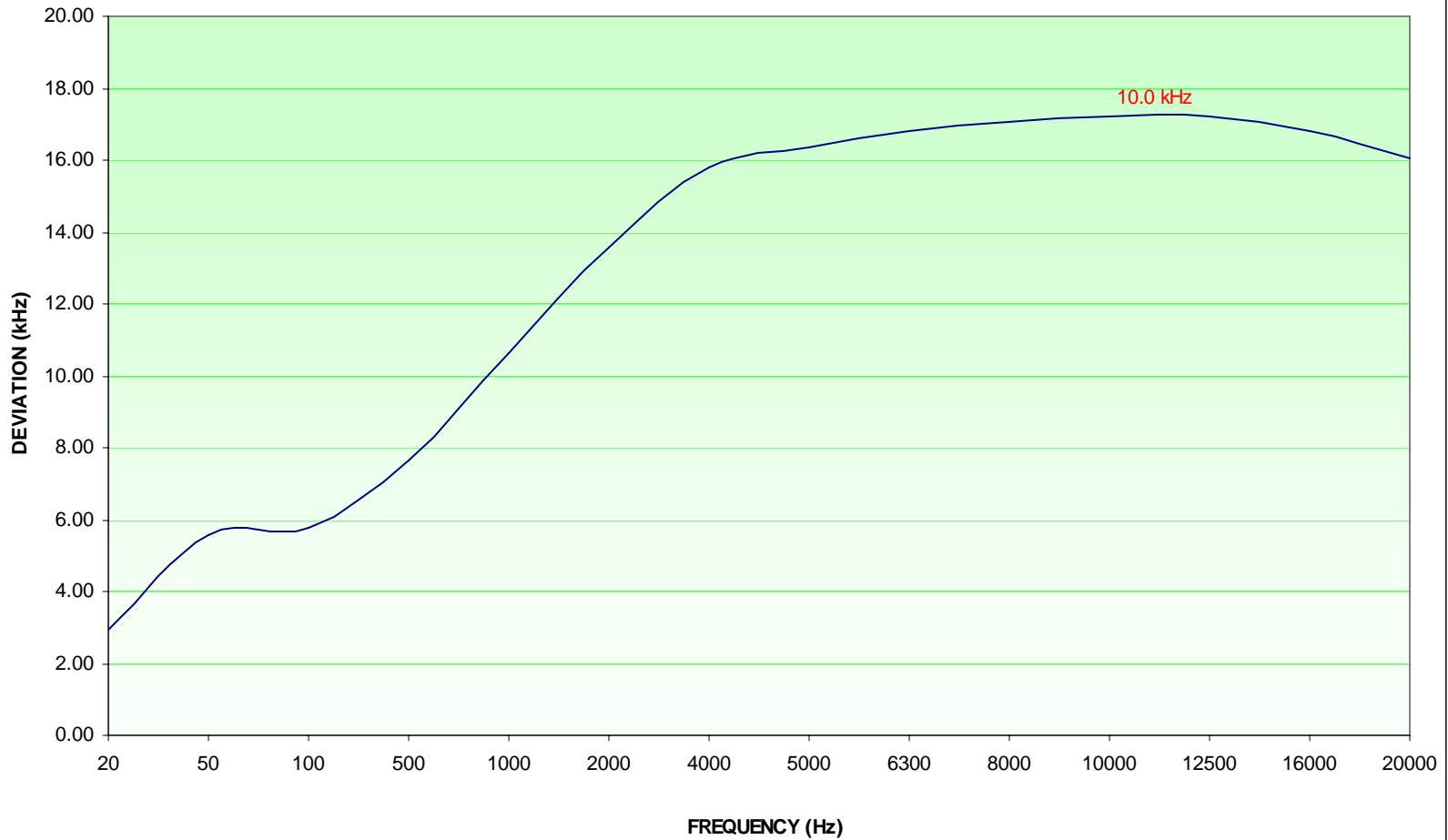
PART 2.1047



Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

MX690 #5 DEVIATION (kHz) FOR -60 dBu INPUT

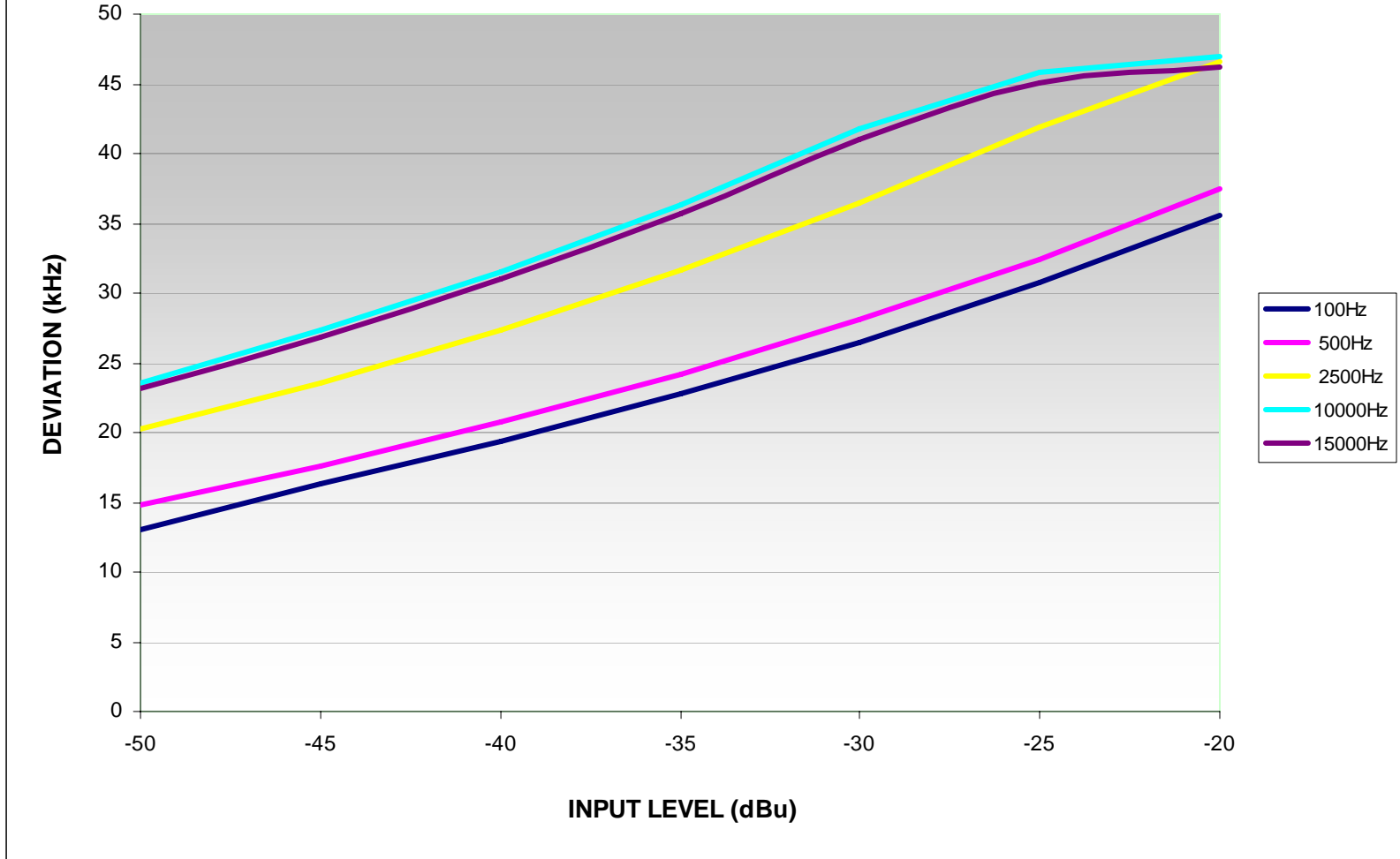




Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

MX690 #5 DEVIATION vs. INPUT LEVEL

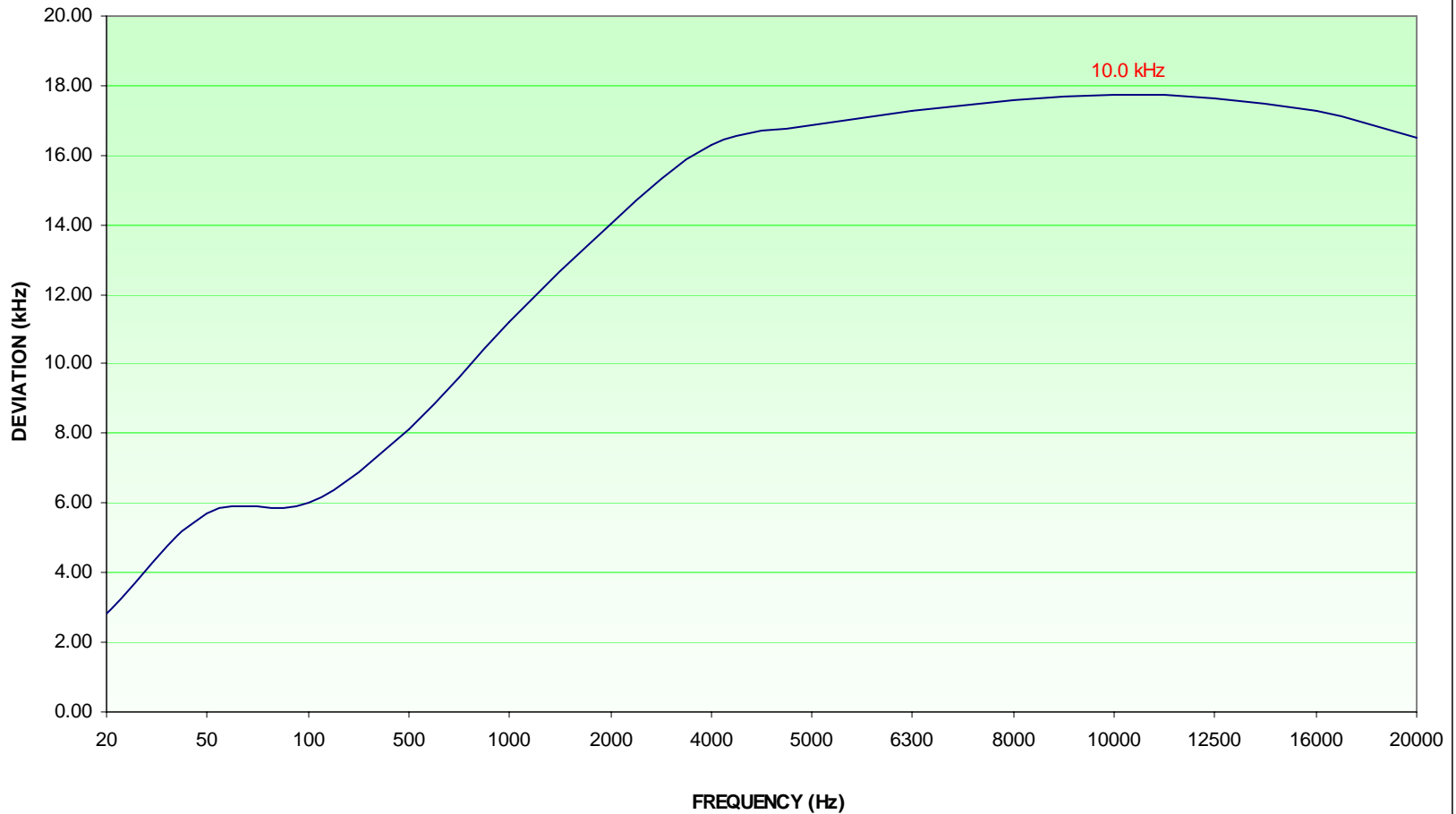




Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

MX690 #14 DEVIATION (kHz) FOR -60 dBu INPUT

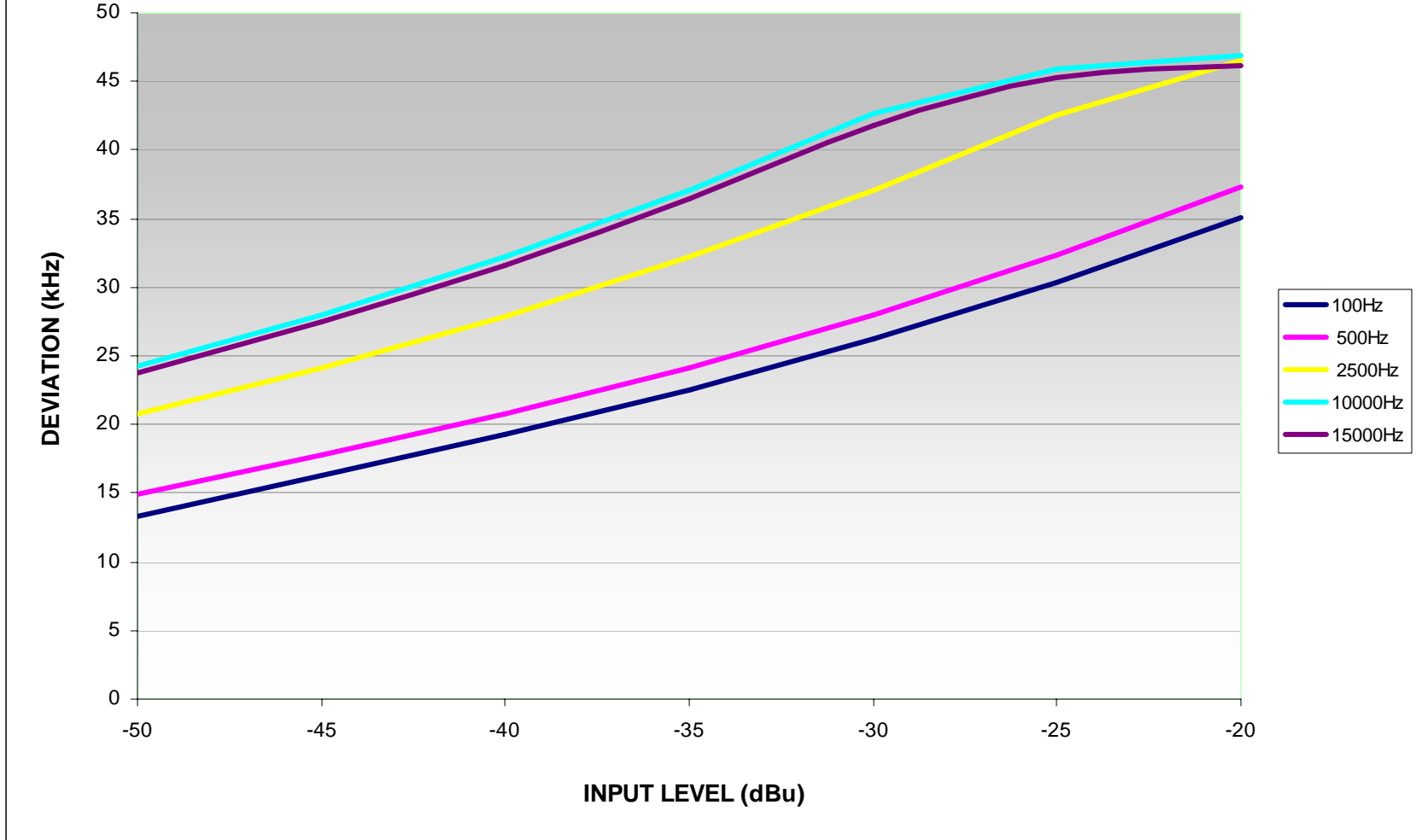




Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

MX690 #14 DEVIATION vs. INPUT LEVEL

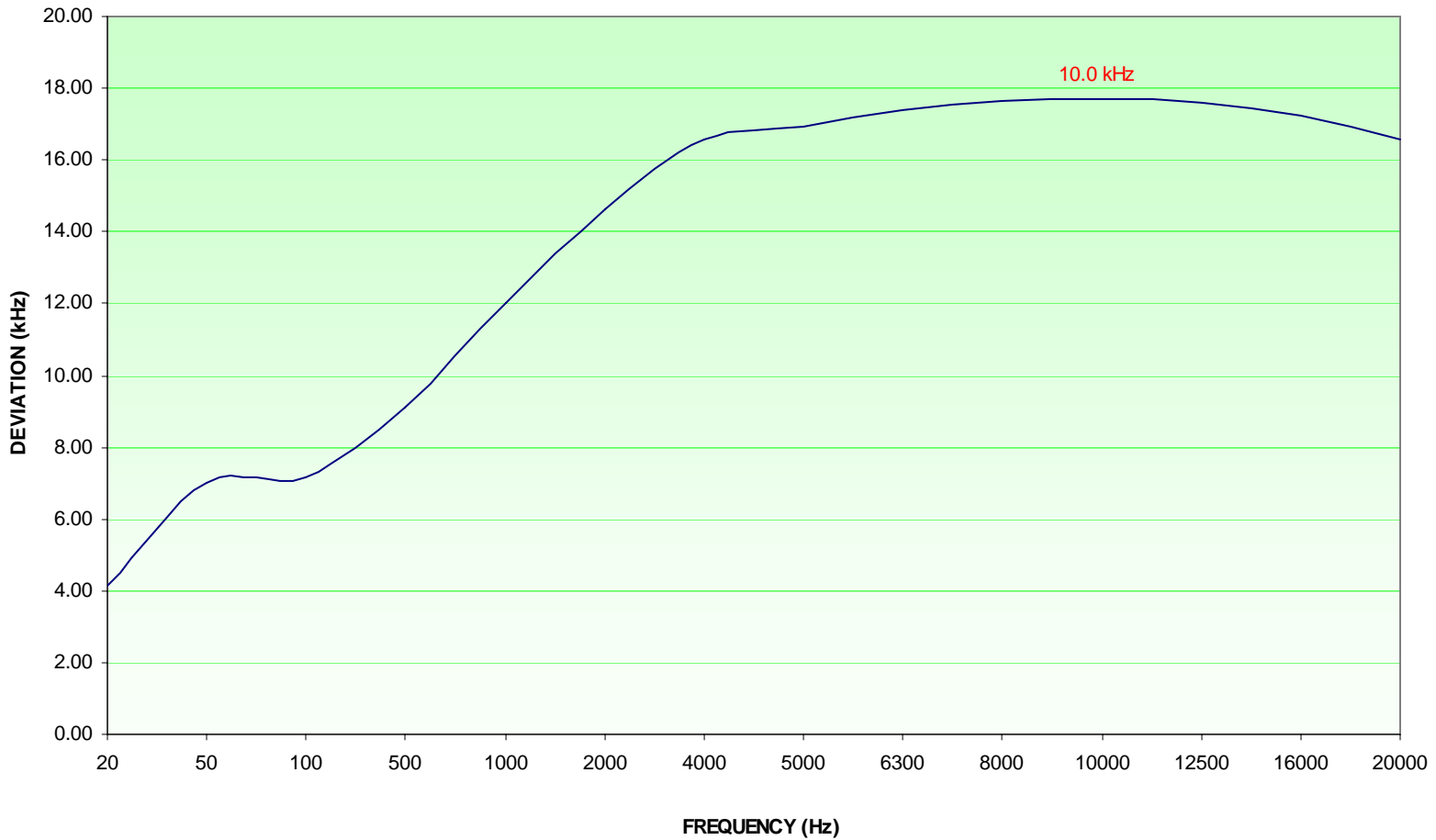




Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

MX690 #17 DEVIATION (kHz) FOR -60 dBu INPUT

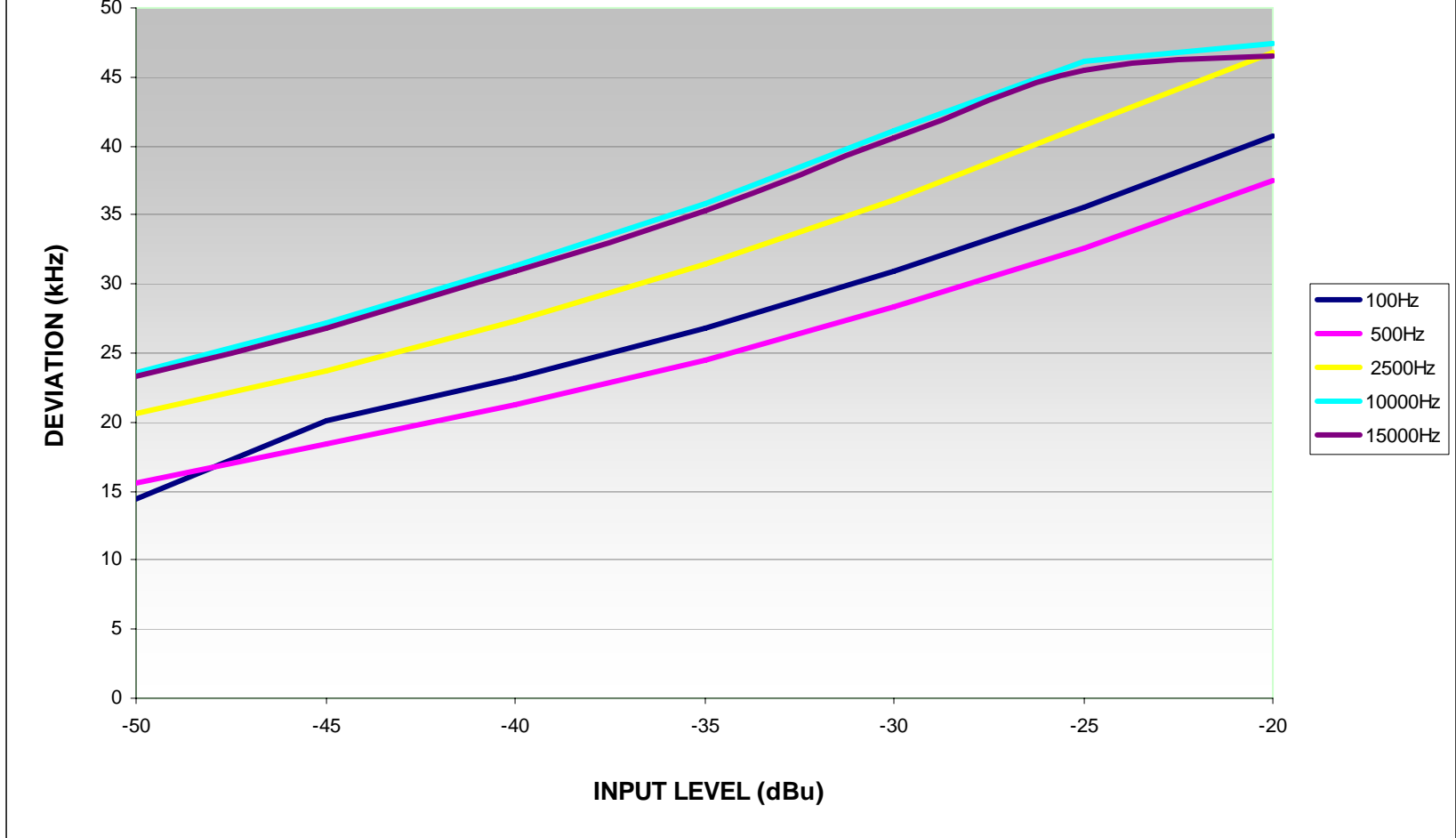




Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

MX690 #17 DEVIATION vs. INPUT LEVEL





Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

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 Incorporated
Model Tested: MX690 G5
Report Number: 13996

APPENDIX A

DATA AND GRAPH(S) TAKEN OF THE

99% OCCUPIED BANDWIDTH

Part 74.861 (e)(5) & PART 2.1049



Company: Shure Incorporated
 Model Tested: MX690 G5
 Report Number: 13996

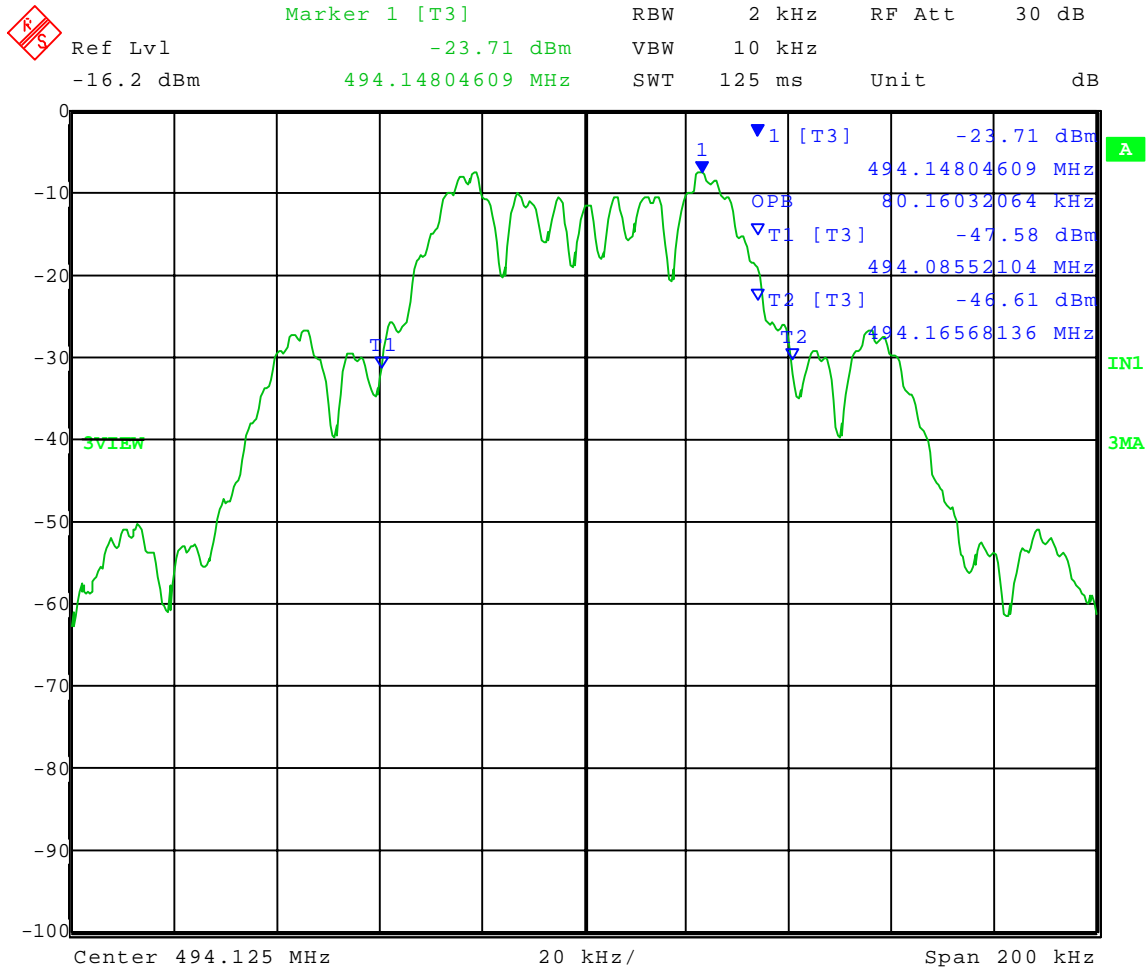
1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

Test Date: 03-18-2008
 Company: Shure, Inc.
 EUT: MX690-G5
 Test: Occupied Bandwidth; 99% bandwidth
 Rule part: FCC Part 74; FCC Part 2.1049
 Operator: Craig B

Frequency: 494.125 MHz

99% power bandwidth = 80.2 kHz



Date: 18.MAR.2008 11:33:20



Company: Shure Incorporated
 Model Tested: MX690 G5
 Report Number: 13996

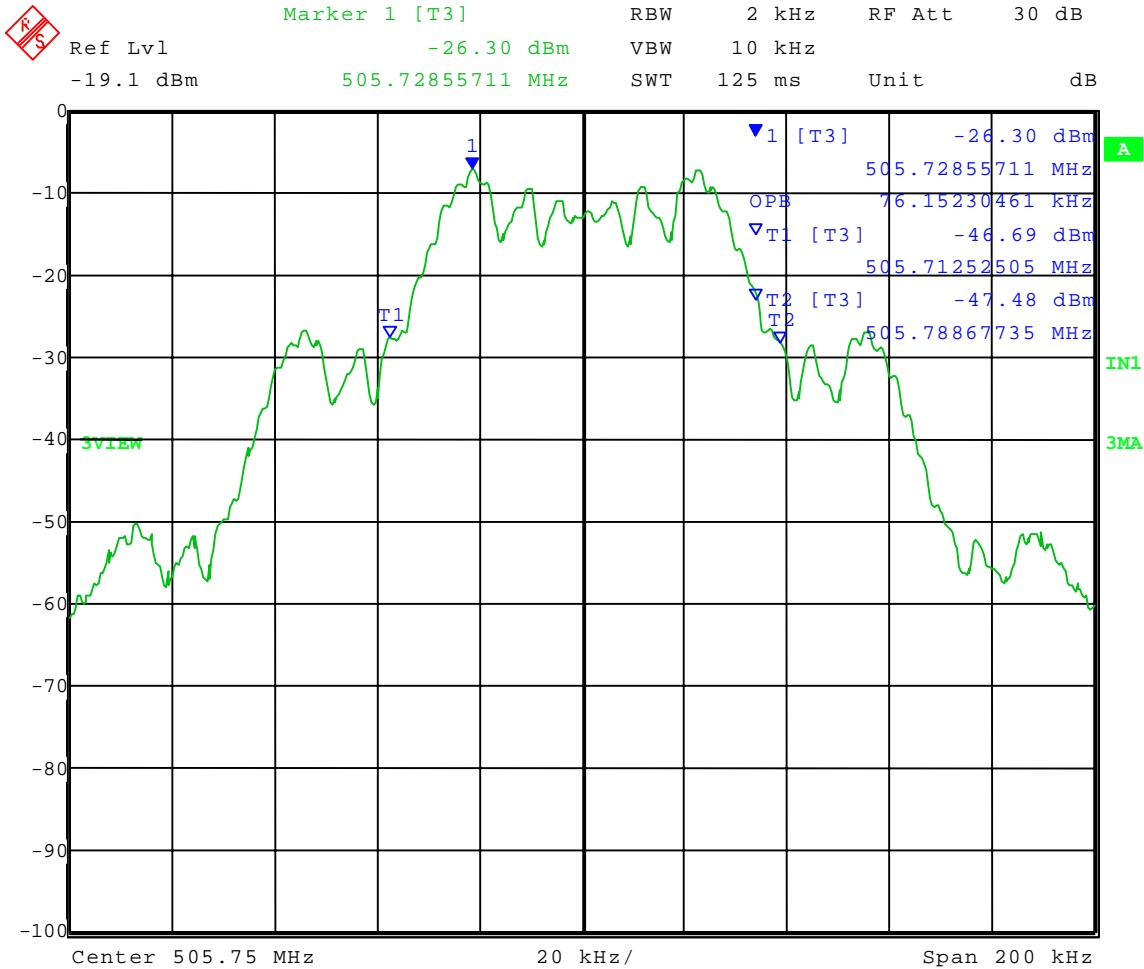
1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

Test Date: 03-18-2008
 Company: Shure, Inc.
 EUT: MX690-G5
 Test: Occupied Bandwidth; 99% bandwidth
 Rule part: FCC Part 74; FCC Part 2.1049
 Operator: Craig B

Frequency: 505.750 MHz

99% power bandwidth = 76.2 kHz



Date: 18.MAR.2008 11:30:23



Company: Shure Incorporated
 Model Tested: MX690 G5
 Report Number: 13996

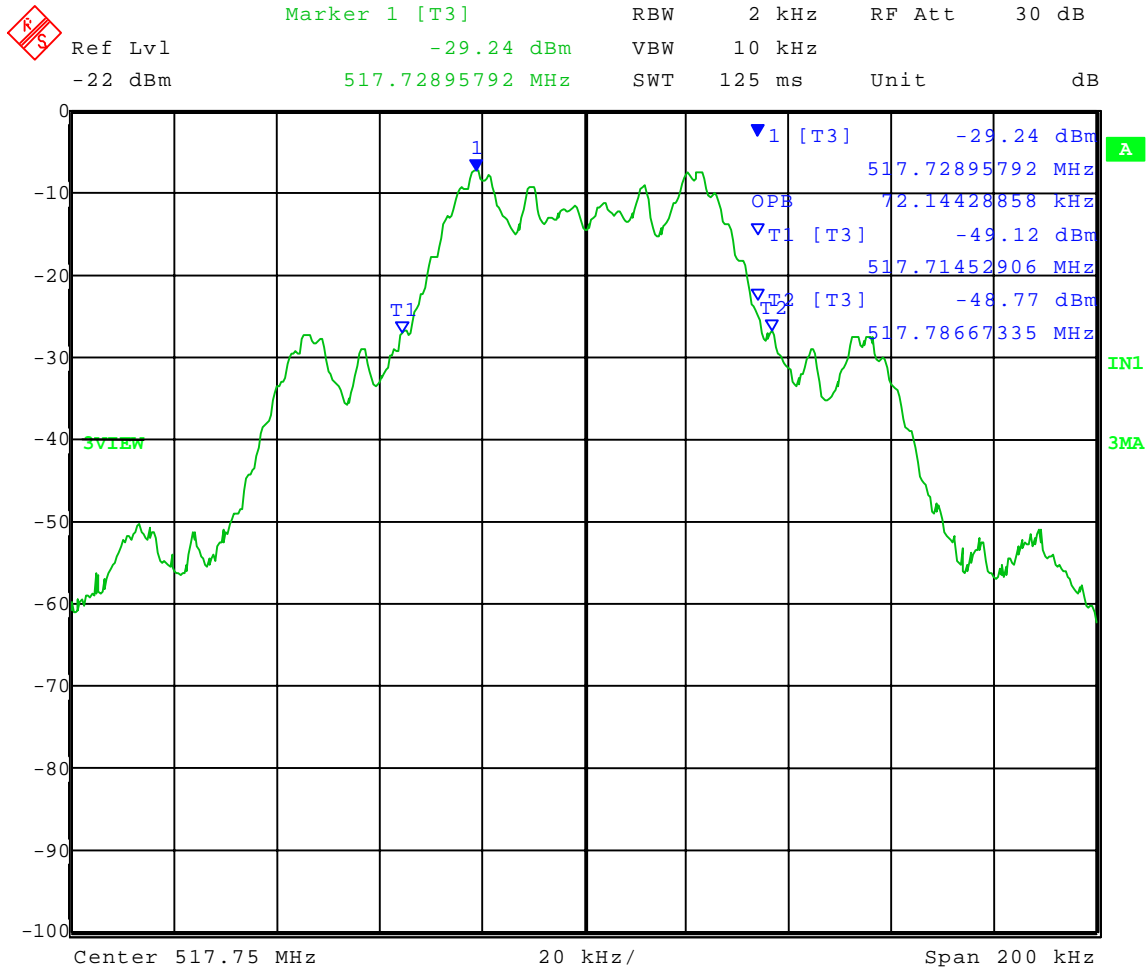
1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

Test Date: 03-18-2008
 Company: Shure, Inc.
 EUT: MX690-G5
 Test: Occupied Bandwidth; 99% bandwidth
 Rule part: FCC Part 74; FCC Part 2.1049
 Operator: Craig B

Frequency: **517.750 MHz**

99% power bandwidth = 72.1 kHz



Date: 18.MAR.2008 11:27:22



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

APPENDIX A

DATA AND GRAPH(S) TAKEN OF THE

EMISSION MASK

Part 74.861(d)(3) (e)(6) & PART 2.1049



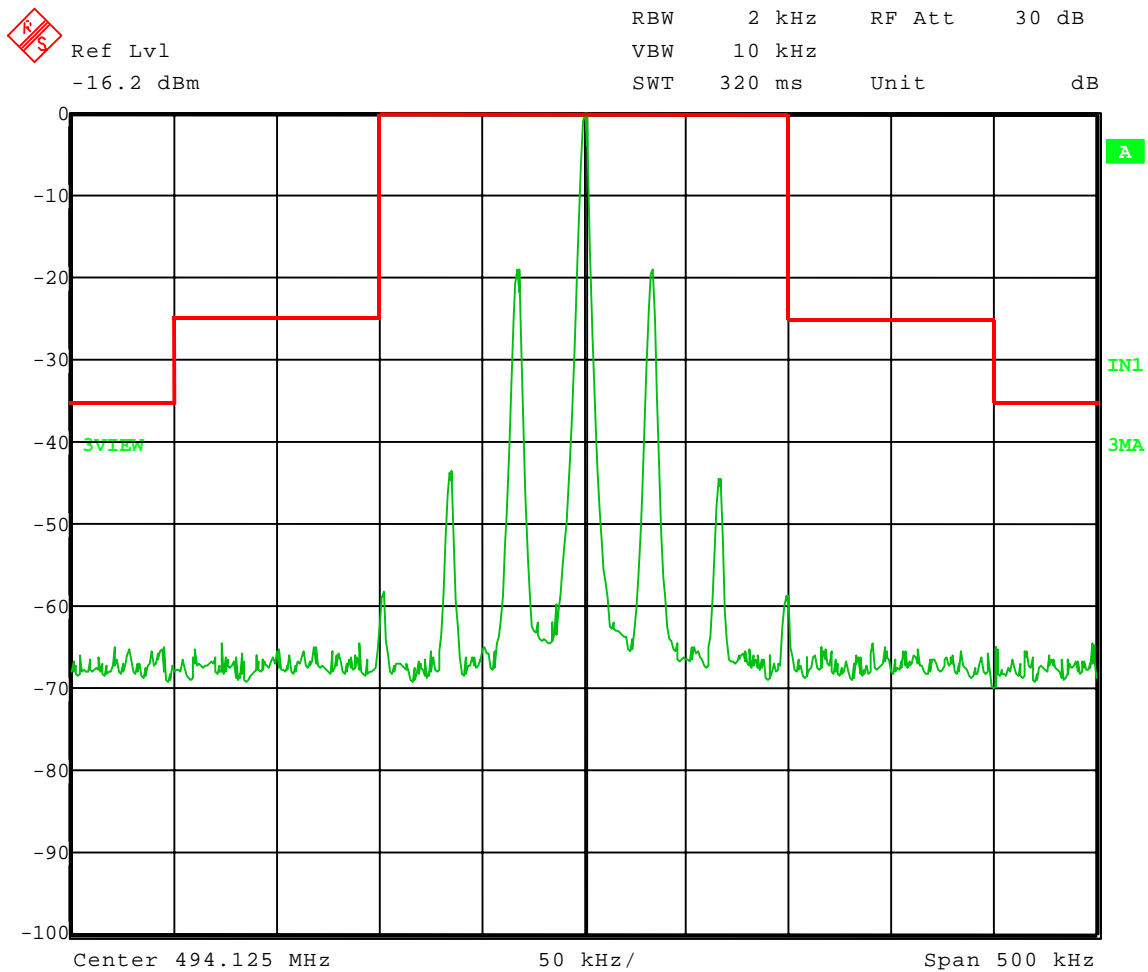
Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

Test Date: 03-18-2008
Company: Shure, Inc.
EUT: MX690-G5
Test: Occupied Bandwidth
Operator: Craig B

Nominal Frequency: 494.125 MHz
Unmodulated



Date: 18.MAR.2008 11:12:25



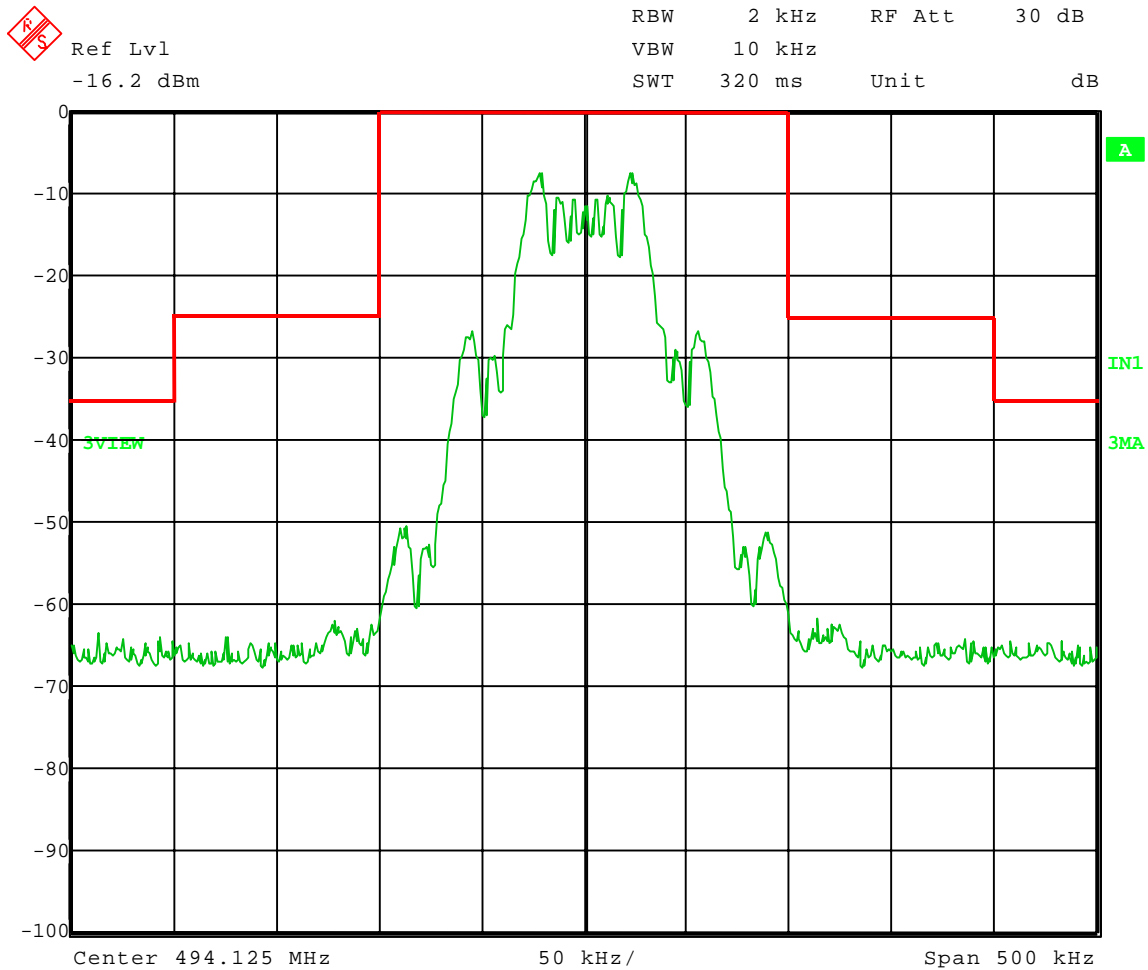
Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

Test Date: 03-18-2008
Company: Shure, Inc.
EUT: MX690-G5
Test: Occupied Bandwidth
Operator: Craig B

Nominal Frequency: 494.125 MHz
2500 Hz 16 dB > 50% modulated



Date: 18.MAR.2008 11:14:44



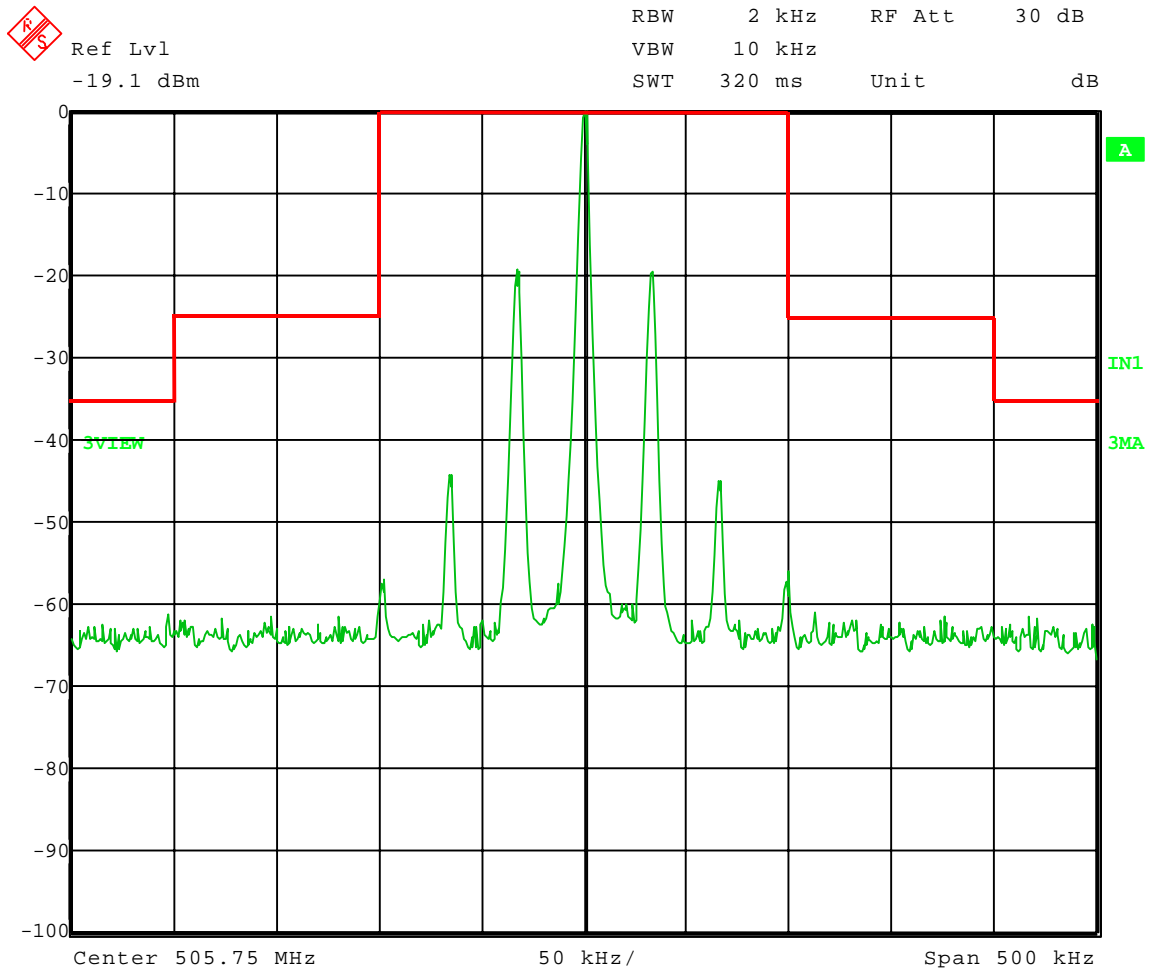
Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

Test Date: 03-18-2008
Company: Shure, Inc.
EUT: MX690-G5
Test: Occupied Bandwidth
Operator: Craig B

Nominal Frequency: 505.750 MHz
Unmodulated



Date: 18.MAR.2008 11:18:59



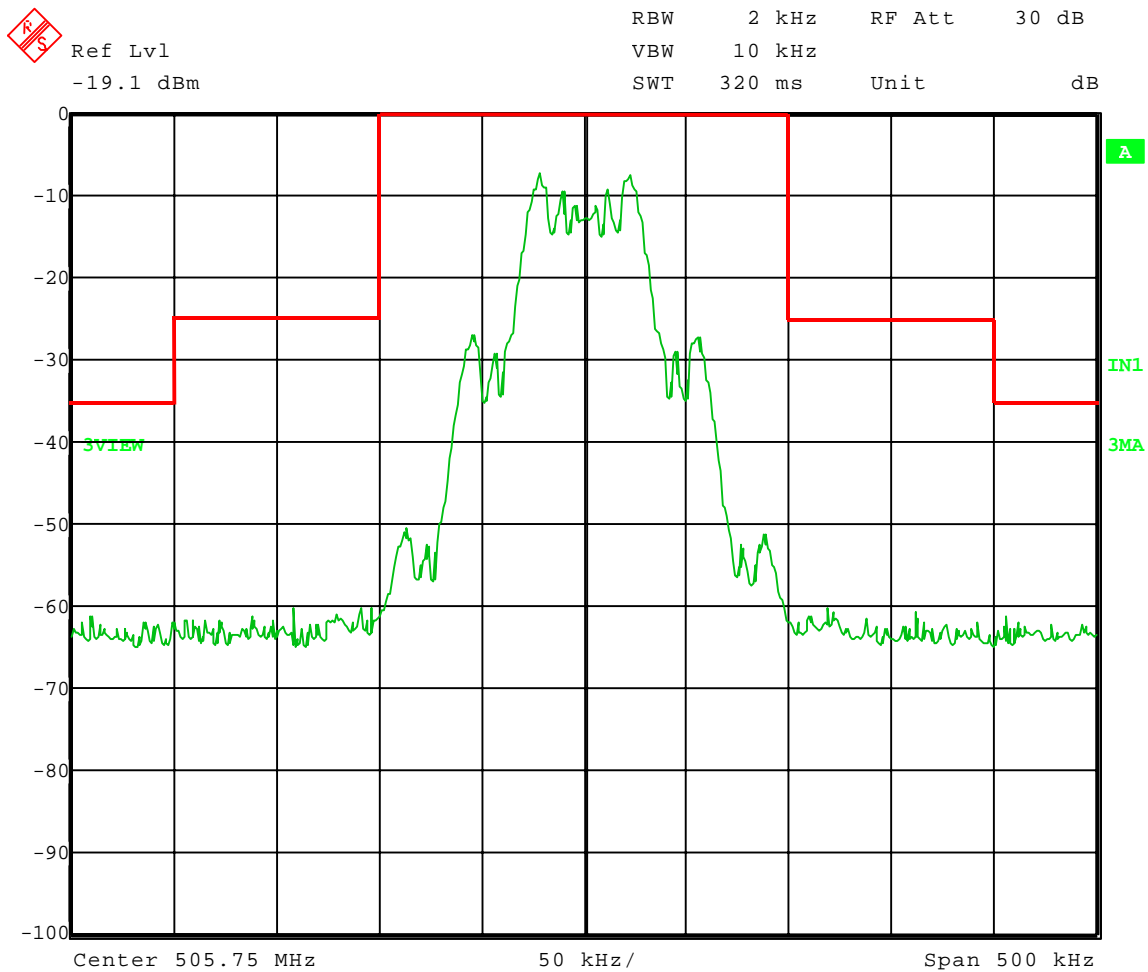
Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

Test Date: 03-18-2008
Company: Shure, Inc.
EUT: MX690-G5
Test: Occupied Bandwidth
Operator: Craig B

Nominal Frequency: 505.750 MHz
2500 Hz 16 dB > 50% modulated



Date: 18.MAR.2008 11:20:52



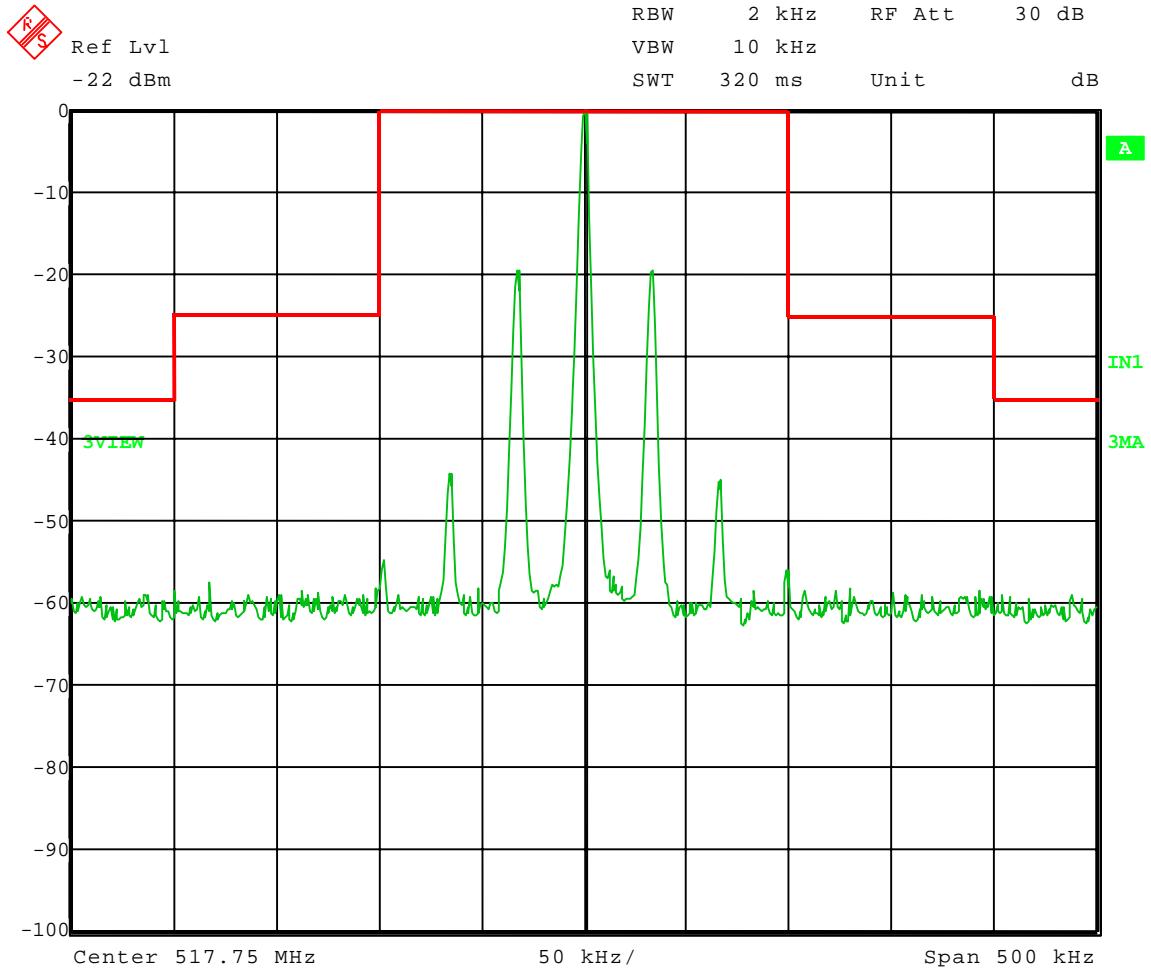
Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

Test Date: 03-18-2008
Company: Shure, Inc.
EUT: MX690-G5
Test: Occupied Bandwidth
Operator: Craig B

Nominal Frequency: **517.750 MHz**
Unmodulated



Date: 18.MAR.2008 11:24:01



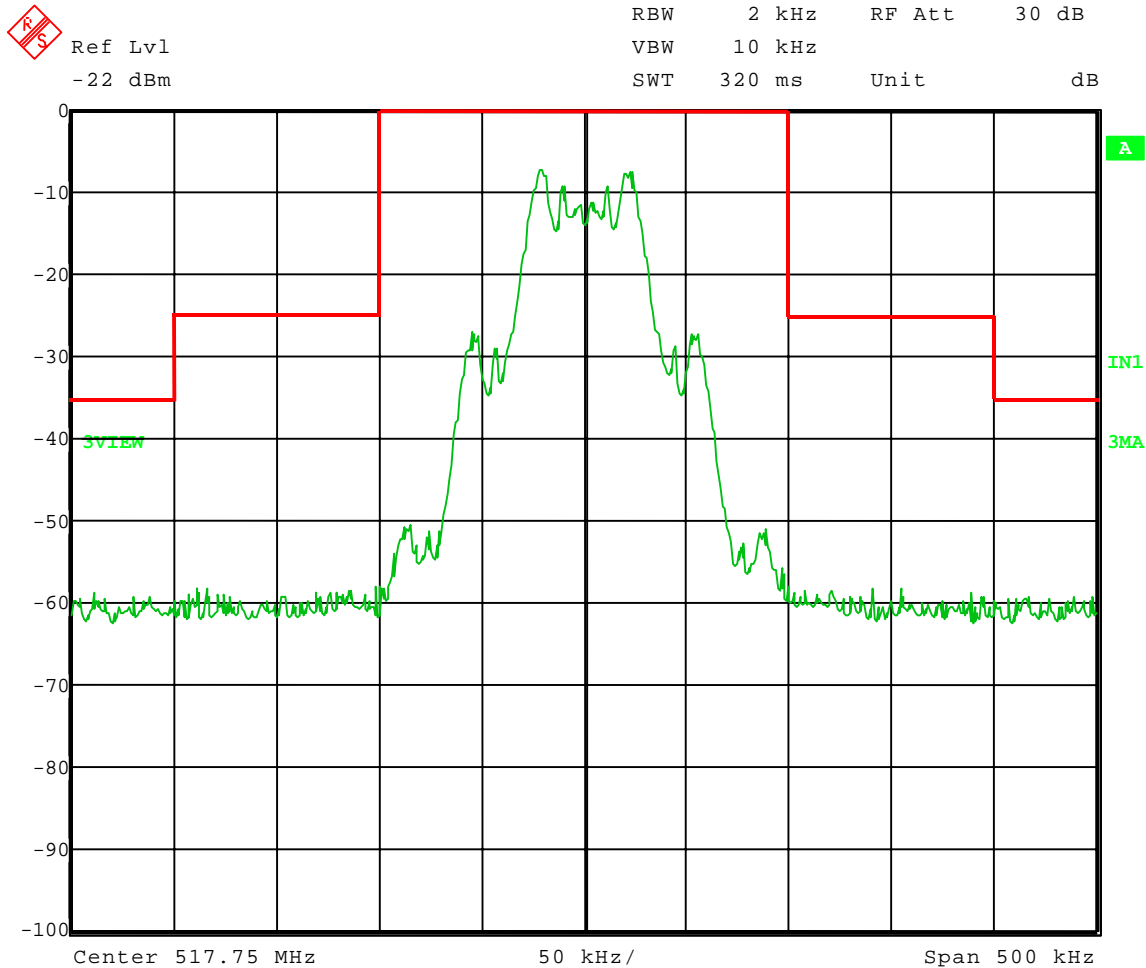
Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

Test Date: 03-18-2008
Company: Shure, Inc.
EUT: MX690-G5
Test: Occupied Bandwidth
Operator: Craig B

Nominal Frequency: **517.750 MHz**
2500 Hz 16 dB > 50% modulated



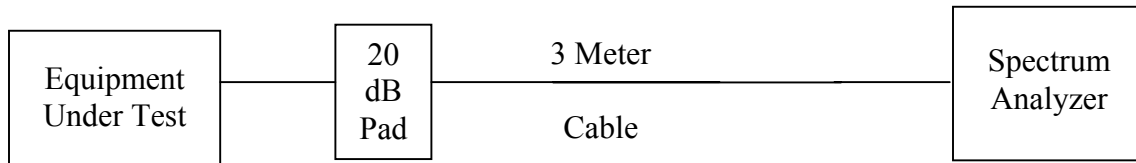
Date: 18.MAR.2008 11:26:02



APPENDIX A

6.0 SPURIOUS EMISSIONS AT 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 494 MHz - 518 MHz bands for Wireless Boundary Microphone 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:

The Wireless Boundary Microphone uses the Bent Monopole on Flex PCB (**non-removeable**).



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

APPENDIX A

7.0 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 Wireless Boundary Microphone, the highest fundamental frequency is 517.75 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 494 MHz - 518 MHz bands for Wireless Boundary Microphone are found under Part 74, Section 74.861, Paragraph e-6 for Low Power Auxiliary Stations. This paragraph states that 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 $43+10\text{Log}_{10}$ (mean output power in watts) dB.



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

APPENDIX A

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



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Incorporated
 Model Tested: MX690 G5
 Report Number: 13996

APPENDIX A

DLS Electronic Systems, Inc.

Company: Shure, Inc.
 Operator: Craig B
 Date of test: 03-12-2008
 Temperature: 70 deg. F
 Humidity: 23% R.H.

Rated Power = 0.2 dBm (conducted)

Output Power - ERP - Substitution Method

Model: MX690-G5								
Channel: 494.125 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)
494.125 vertical	76.09	-18.2	4.8	2.15	-23.0	24	47.0	0.00
494.125 horizontal	82.38	-11.5	4.8	2.15	-16.3	24	40.3	0.02

$EIRP = \text{Signal generator output} - \text{cable loss} + \text{antenna gain}$

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



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Incorporated
 Model Tested: MX690 G5
 Report Number: 13996

APPENDIX A

DLS Electronic Systems, Inc.

Company: Shure, Inc.
 Operator: Craig B
 Date of test: 03-12-2008
 Temperature: 70 deg. F
 Humidity: 23% R.H.

Rated Power = 0.2 dBm (conducted)

Output Power - ERP - Substitution Method

Model: MX690-G5								
Channel: 505.750 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)
505.750 vertical	76.39	-17.6	5.0	2.15	-22.6	24	46.6	0.01
505.750 horizontal	77.95	-15.8	5.0	2.15	-20.8	24	44.8	0.01

EIRP = Signal generator output - cable loss + antenna gain

ERP_(ref. to 1/2λ dipole) = Signal generator output - cable loss + antenna gain - 2.15



Company: Shure Incorporated
 Model Tested: MX690 G5
 Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

DLS Electronic Systems, Inc.

Company: Shure, Inc.
 Operator: Craig B
 Date of test: 03-12-2008
 Temperature: 70 deg. F
 Humidity: 23% R.H.

Rated Power = 0.2 dBm (conducted)

Output Power - ERP - Substitution Method

Model: MX690-G5								
Channel: 517.750 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)
517.750 vertical	71.89	-22.0	5.0	2.15	-27.0	24	51.0	0.00
517.750 horizontal	75.87	-18.0	5.0	2.15	-23.0	24	47.0	0.01

$EIRP = \text{Signal generator output} - \text{cable loss} + \text{antenna gain}$

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



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

APPENDIX A

RADIATED EMISSION DATA AND GRAPH(S)

TAKEN FOR

SPURIOUS EMISSION MEASUREMENTS

USING THE SUBSTITUTION METHOD

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

PART 2.1053



Company: Shure Incorporated
 Model Tested: MX690 G5
 Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

DLS Electronic Systems, Inc.

Company: Shure, Inc.
 Operator: Craig B
 Date of test: 03-14-2008
 Temperature: 72 deg. F.
 Humidity: 25% R.H.

Radiated Spurious Emissions (e.r.p. substitution method) FCC Part 74; FCC Part 2.1053								
Model: MX690-G5 Transmit Frequency: 494.125 MHz								
Frequency GHz	Field Strength Level dBuV/m	Factor to Convert to dBm	Power ERP dBm	Limit dBm	Margin dB	Receive Antenna Polarization	EUT Orientation (degrees)	Receive Antenna Height (m)
0.988250	41.9	96.2	-54.3	-13	41.3	Horizontal	200	1.2
1.482375	32.9	100.4	-67.5	-13	54.5	Horizontal	45	1.0
1.976500	39.5	100.3	-60.9	-13	47.9	Horizontal	270	1.2
2.470625	32.6	100.9	-68.3	-13	55.3	Horizontal	60	1.0
2.964750	37.9	101.5	-63.6	-13	50.6	Horizontal	90	1.0
3.458875	noise floor			-13		Horizontal		
3.953000	noise floor			-13		Horizontal		
4.447125	noise floor			-13		Horizontal		
4.941250	noise floor			-13		Horizontal		
5.435375	noise floor			-13		Horizontal		
0.988250	41.4	97.3	-55.9	-13	42.9	Vertical	75	1.1
1.482375	38.1	101.1	-63.0	-13	50.0	Vertical	90	1.1
1.976500	39.3	99.9	-60.6	-13	47.6	Vertical	270	1.1
2.470625	38.9	99.0	-60.1	-13	47.1	Vertical	190	1.1
2.964750	41.6	100.3	-58.7	-13	45.7	Vertical	310	1.2
3.458875	noise floor			-13		Vertical		
3.953000	noise floor			-13		Vertical		
4.447125	noise floor			-13		Vertical		
4.941250	noise floor			-13		Vertical		
5.435375	noise floor			-13		Vertical		



Company: Shure Incorporated
 Model Tested: MX690 G5
 Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

DLS Electronic Systems, Inc.

Company: Shure, Inc.
 Operator: Craig B
 Date of test: 03-14-2008
 Temperature: 72 deg. F.
 Humidity: 25% R.H.

Radiated Spurious Emissions (e.r.p. substitution method) FCC Part 74; FCC Part 2.1053								
Model: MX690-G5 Transmit Frequency: 505.750 MHz								
Frequency GHz	Field Strength Level dBuV/m	Factor to Convert to dBm	Power ERP dBm	Limit dBm	Margin dB	Receive Antenna Polarization	EUT Orientation (degrees)	Receive Antenna Height (m)
1.011500	40.6	100.8	-60.2	-13	47.2	Horizontal	30	1.2
1.517250	35.1	101.0	-65.9	-13	52.9	Horizontal	315	1.4
2.023000	35.8	101.1	-65.3	-13	52.3	Horizontal	135	1.1
2.528750	30.9	101.7	-70.8	-13	57.8	Horizontal	90	1.0
3.034500	34.4	101.3	-66.9	-13	53.9	Horizontal	80	1.0
3.540250	34.4	101.1	-66.7	-13	53.7	Horizontal	225	1.5
4.046000	noise floor			-13		Horizontal		
4.551750	noise floor			-13		Horizontal		
5.057500	noise floor			-13		Horizontal		
5.563250	noise floor			-13		Horizontal		
1.011500	40.8	101.1	-60.3	-13	47.3	Vertical	90	1.1
1.517250	44.8	101.1	-56.3	-13	43.3	Vertical	110	1.2
2.023000	40.7	99.9	-59.3	-13	46.3	Vertical	25	1.1
2.528750	37.5	100.2	-62.7	-13	49.7	Vertical	180	1.1
3.034500	35.9	100.1	-64.2	-13	51.2	Vertical	225	1.1
3.540250	36.2	100.6	-64.4	-13	51.4	Vertical	180	1.4
4.046000	noise floor			-13		Vertical		
4.551750	noise floor			-13		Vertical		
5.057500	noise floor			-13		Vertical		
5.563250	noise floor			-13		Vertical		



Company: Shure Incorporated
 Model Tested: MX690 G5
 Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

DLS Electronic Systems, Inc.

Company: Shure, Inc.
 Operator: Craig B
 Date of test: 03-14-2008
 Temperature: 72 deg. F.
 Humidity: 25% R.H.

Radiated Spurious Emissions (e.r.p. substitution method) FCC Part 74; FCC Part 2.1053								
Model: MX690-G5 Transmit Frequency: 517.750 MHz								
Frequency GHz	Field Strength Level dBuV/m	Factor to Convert to dBm	Power ERP dBm	Limit dBm	Margin dB	Receive Antenna Polarization	EUT Orientation (degrees)	Receive Antenna Height (m)
1.035500	38.1	100.7	-62.6	-13	49.6	Horizontal	160	1.0
1.553250	41.0	101.1	-60.1	-13	47.1	Horizontal	290	1.4
2.071000	37.4	101.6	-64.2	-13	51.2	Horizontal	200	1.4
2.588750	33.7	100.7	-67.0	-13	54.0	Horizontal	170	1.2
3.106500	37.6	100.8	-63.3	-13	50.3	Horizontal	45	1.2
3.624250	33.0	101.2	-68.2	-13	55.2	Horizontal	290	1.0
4.142000	noise floor			-13		Horizontal		
4.659750	noise floor			-13		Horizontal		
5.177500	noise floor			-13		Horizontal		
5.695250	noise floor			-13		Horizontal		
1.035500	39.1	101.3	-62.2	-13	49.2	Vertical	90	1.1
1.553250	43.5	100.5	-57.0	-13	44.0	Vertical	290	1.2
2.071000	38.7	99.7	-61.0	-13	48.0	Vertical	270	1.1
2.588750	38.6	99.5	-60.9	-13	47.9	Vertical	215	1.1
3.106500	37.2	99.3	-62.1	-13	49.1	Vertical	225	1.1
3.624250	34.0	100.5	-66.5	-13	53.5	Vertical	180	1.1
4.142000	noise floor			-13		Vertical		
4.659750	noise floor			-13		Vertical		
5.177500	noise floor			-13		Vertical		
5.695250	noise floor			-13		Vertical		



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

APPENDIX A

8.0 FREQUENCY STABILITY (TEMPERATURE)– PART 2.1055(a1)

The frequency stability was measured from -30° to $+50^{\circ}$ 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 Wireless Boundary Microphone oscillator circuitry to stabilize.

See the following page for the data taken during testing.

9.0 FREQUENCY STABILITY (VOLTAGE VARIATION)– PART 2.1055(d2)

The frequency stability of Wireless Boundary Microphone was measured by reducing the primary supply voltage to the battery end point specified by the manufacturer.

See the following page for the data taken during testing.



1250 Peterson Dr., Wheeling, IL 60090

Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

APPENDIX A

DATA TAKEN FOR FREQUENCY

STABILITY WHEN VARYING THE TEMPERATURE

AND

PRIMARY SUPPLY VOLTAGE VARIATION

PART 2.1055a(1) & PART 2.1055d(d2)



Company: Shure Incorporated
 Model Tested: MX690 G5
 Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

DLS Electronic Systems, Inc.

Company: Shure, Inc.
 Operator: Craig B
 Date of test: 03-20-2008

Limit = 24.7 kHz (0.005% of 494 MHz)

Frequency Stability FCC Part 74; FCC Part 2.1055

Model	Nominal Frequency (MHz)	Measured Frequency									
		+50 deg. C	Error (kHz)	+40 deg. C	Error (kHz)	+30 deg. C	Error (kHz)	+20 deg. C	Error (kHz)	+10 deg. C	Error (kHz)
MX690-G5	494.125	494.12125	-3.750	494.12235	-2.650	494.12425	-0.750	494.12545	0.450	494.12720	2.200
MX690-G5	505.750	505.74605	-3.950	505.74710	-2.900	505.74900	-1.000	505.75030	0.300	505.75205	2.050
MX690-G5	517.750	517.74590	-4.100	517.74700	-3.000	517.74890	-1.100	517.75010	0.100	517.75200	2.000

Frequency Stability FCC Part 74; FCC Part 2.1055

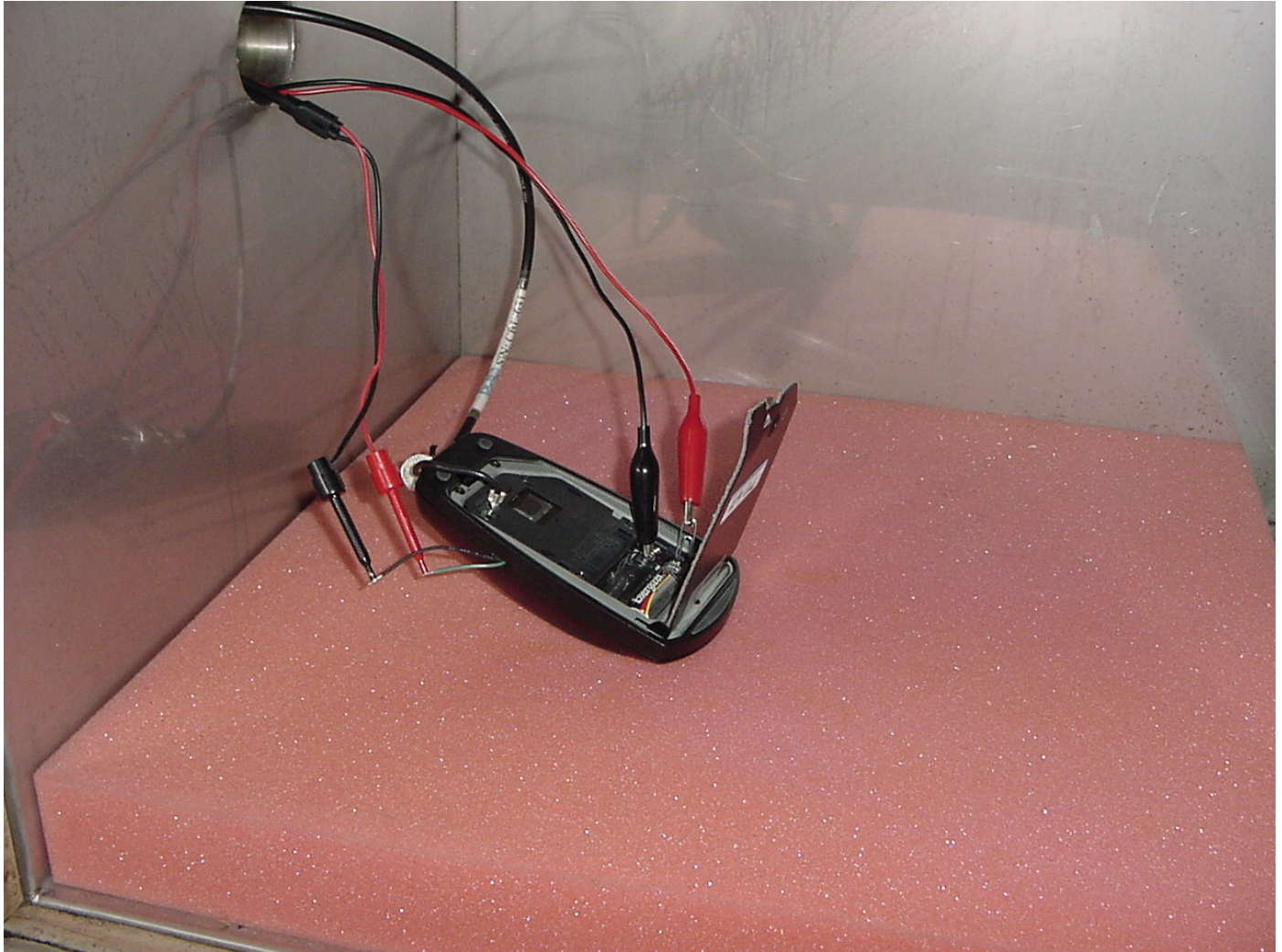
Model	Nominal Frequency (MHz)	Measured Frequency									
		0 deg. C	Error (kHz)	-10 deg. C	Error (kHz)	-20 deg. C	Error (kHz)	-30 deg. C	Error (kHz)	2.1 Volts	Error (kHz)
MX690-G5	494.125	494.12825	3.250	494.12865	3.650	494.12835	3.350	494.12675	1.750	494.12475	-0.250
MX690-G5	505.750	505.75320	3.200	505.75370	3.700	505.75355	3.550	505.75215	2.150	505.74980	-0.200
MX690-G5	517.750	517.75320	3.200	517.75375	3.750	517.75365	3.650	517.75235	2.350	517.74990	-0.100



Company: Shure Incorporated
Model Tested: MX690 G5
Report Number: 13996

1250 Peterson Dr., Wheeling, IL 60090

10.0 FREQUENCY STABILITY PHOTOS TAKEN DURING TESTING



RF CONDUCTED