Measurement of RF Emissions from a Model ULXD1 Bodypack Transmitter

For	Shure Incorporated 5800 West Touhy Avenue Niles, IL 60714
P.O. Number	4500479518
Date Tested	September 6, 2019
Test Personnel	Mark Longinotti
Test Specification	FCC "Code of Federal Regulations" Title 47 Part15, Subpart C, Section 249 ISED RSS-GEN ISED RSS-210

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REVISION HISTORY

Revision	Date	Description
—	09 SEP 2019	Initial release

Measurement of RF Emissions from a Bodypack Transmitter, Model No. ULXD1

1. INTRODUCTION

1.1. Scope of Tests

This report presents the results of the RF emissions measurements performed on a Bodypack Transmitter, Model No. ULXD1, Serial No. 4190790365, (hereinafter referred to as the Equipment Under Test (EUT)). The EUT was designed to transmit in the frequency range of 902.4MHz to 927.6MHz using a removable whip antenna. The EUT was manufactured and submitted for testing by Shure Incorporated located in Niles, IL.

1.2. Purpose

The test series was performed to determine if the EUT meets the fundamental radiated RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 249 for Intentional Radiators. Testing was performed in accordance with ANSI C63.10-2013.

The test series was also performed to determine if the EUT meets the fundamental radiated RF emission requirements of the Innovation Science, and Economic Development (ISED) Canada RSS-210, Annex B, Section B.10 for transmitters. Testing was performed in accordance with ANSI C63.10-2013.

1.3. Deviations, Additions and Exclusions

There were no deviations, additions to, or exclusions from the test specification during this test series.

1.4. EMC Laboratory Identification

This series of tests was performed by Elite Electronic Engineering Incorporated of Downers Grove, Illinois. The laboratory is accredited by The American Association for Laboratory Accreditation (A2LA). A2LA Certificate Number: 1786.01.

1.5. Laboratory Conditions

The temperature at the time of the test was 23°C and the relative humidity was 35%.

2. APPLICABLE DOCUMENTS

The following documents of the exact issue designated form part of this document to the extent specified herein:

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subpart C
- ANSI C63.10-2013, "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
- Innovation Science, and Economic Development (ISED) Canada Radio Standards Specification, RSS-Gen, “General Requirements and Information for Compliance of Radio Apparatus”, Issue 5, March 2019
- Innovation Science, and Economic Development (ISED) Canada, RSS-210, “License-exempt Radio Apparatus: Category I Equipment”, Issue 9, August 2016

3. EUT SETUP AND OPERATION

3.1. General Description

The EUT is a Shure Incorporated, Bodypack Transmitter, Model No. ULXD1. A block diagram of the EUT

setup is shown as Figure 1. A photograph of the EUT is shown as Figure 2.

3.1.1.Power Input

The EUT was powered with 3VDC from 2 “AA” internal batteries.

3.1.2.Peripheral Equipment

The following peripheral equipment was submitted with the EUT:

Item	Description
Microphone	Shure MX150 Subminiature Lavalier Microphone was connected to the microphone port of the EUT

3.1.3.Signal Input/Output Leads

The EUT was submitted for testing with no interconnect cables.

3.1.4.Grounding

The EUT was not grounded.

3.2. Software

For all tests, the EUT had Firmware Version 2.3.32.0 loaded onto the device to provide correct load characteristics.

3.3. Operational Mode

For all tests, the EUT and all peripheral equipment were placed on an 80cm high non-conductive stand. The EUT and all peripheral equipment were energized. The EUT was set to transmit separately at the following frequencies:

- 902.4MHz
- 915.0MHz
- 927.6MHz

3.4. EUT Modifications

No modifications were required for compliance to the FCC 15.249 requirements or the ISED RSS-210 requirements.

4. TEST FACILITY AND TEST INSTRUMENTATION

4.1. Shielded Enclosure

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. With the exception of the floor, the reflective surfaces of the shielded chamber are lined with ferrite tiles on the walls and ceiling. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2014 for site attenuation.

4.2. Test Instrumentation

The test instrumentation and auxiliary equipment used during the tests are listed in Table 9-1.

4.3. Calibration Traceability

Test equipment is maintained and calibrated on a regular basis with a calibration interval not greater than two years. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

4.4. Measurement Uncertainty

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

Values of Expanded Measurement Uncertainty (95% Confidence) are presented below:

Measurement Type	Expanded Measurement Uncertainty
Conducted disturbance (mains port) (150 kHz – 30 MHz)	2.7
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1
Radiated disturbance (electric field strength on an open area test site or alternative test site) (6 GHz – 18 GHz)	3.2

5. TEST PROCEDURES

5.1. Fundamental RF Radiated Emissions Measurements

5.1.1.Requirements

The EUT must comply with the requirements of FCC "Code of Federal Regulations Title 47", Part 15, Subpart C, Section 15.249 and ISED RSS-210, Annex B, Section B.10 which have the following fundamental RF radiated emissions limits:

Fundamental Frequency MHz	Field Intensity uV/m @ 3 meters
902 to 928	50,000

5.1.2.Procedures

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. The walls and ceiling of the shielded chamber are lined with ferrite tiles. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2014 for site attenuation.

The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

The emission tests were manually performed using a bilog antenna. The broadband measuring antenna was positioned at a 3-meter distance from the EUT. The EUT was placed on an 80cm high non-conductive stand. To ensure that maximum or worst case, emission levels were measured, the following steps were taken:

1) The EUT was rotated so that all of its sides were exposed to the receiving antenna.
2) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
3) The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.

5.1.3.Results

The final radiated levels, with the EUT transmitting at 902.4MHz, 915.0MHz, and 927.6MHz are presented on data pages 12 through 14. As can be seen from the data, all fundamental RF radiated emissions measurements from the EUT were within the specification limits. The emissions level closest to the limit (worst case) occurred at 927.6MHz. The emissions level at this frequency was 1.5dB within the limit. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown in Figure 3.

6. OTHER TEST CONDITIONS

6.1. Test Personnel and Witnesses

All tests were performed by qualified personnel from Elite Electronic Engineering Incorporated. The test series was witnessed by Shure Incorporated personnel.

6.2. Disposition of the EUT

The EUT and all associated equipment were returned to Shure Incorporated upon completion of the tests.

7. CONCLUSIONS

It was determined that the Shure Incorporated Bodypack Transmitter, Model No. ULXD1, Serial No. 4190790365 did meet the fundamental radiated RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 249 for Intentional Radiators when tested in accordance with ANSI C63.10-2013.

It was also determined that the Shure Incorporated Bodypack Transmitter, Model No. ULXD1, Serial No. 4190790365, did meet the fundamental radiated RF emission requirements of the Innovation Science, and Economic Development (ISED) Canada RSS-210, Annex B, Section B.10 for transmitters when tested in accordance with ANSI C63.10-2013

8. CERTIFICATION

Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the test specifications.

The data presented in this test report pertains to the EUT at the test date as operated by Shure Incorporated personnel. Any electrical or mechanical modification made to the EUT subsequent to the specified test date will serve to invalidate the data and void this certification.

This report must not be used to claim product certification, approval, or endorsement by A2LA, NIST or any agency of the Federal Government.

9. EQUIPMENT LIST

Table 9-1 Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
NTA4	BILOG ANTENNA	TESEQ	6112D	46660	20-2000GHZ	9/5/2018	10/5/2019
RBG2	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101591	2HZ-44GHZ	2/21/2019	2/21/2020

I/O: Initial Only
N/A: Not Applicable
Note 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.

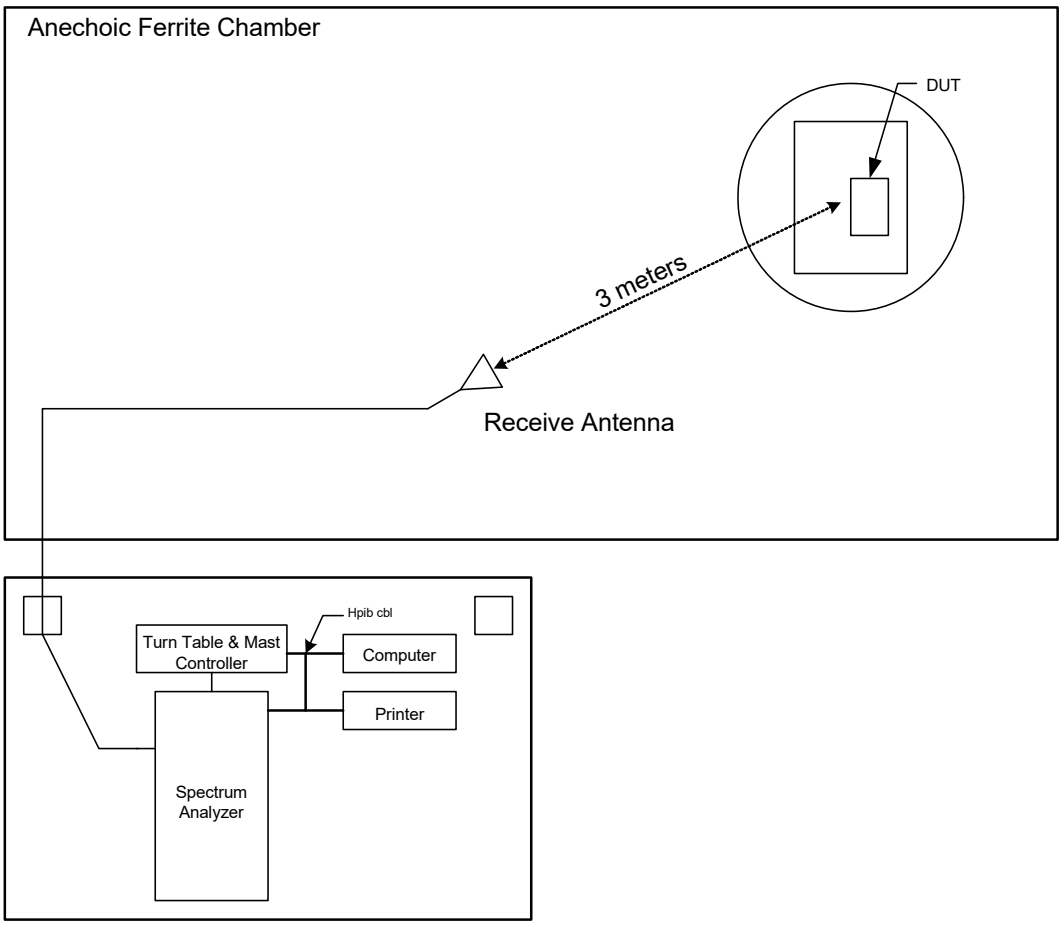
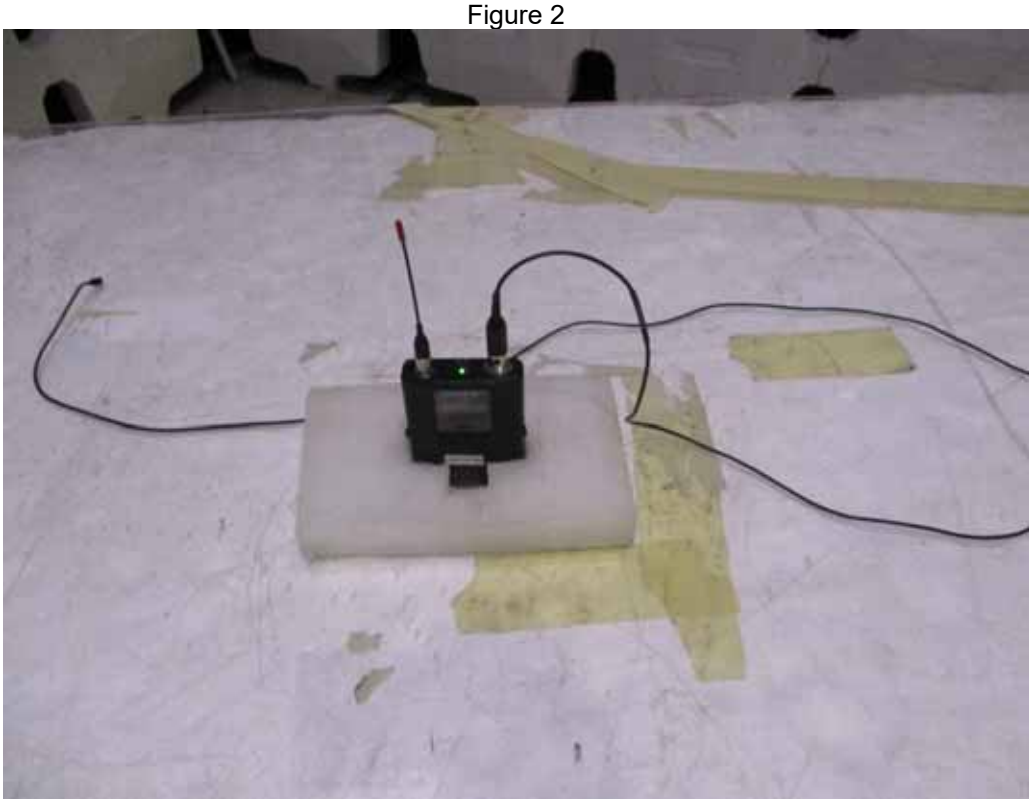


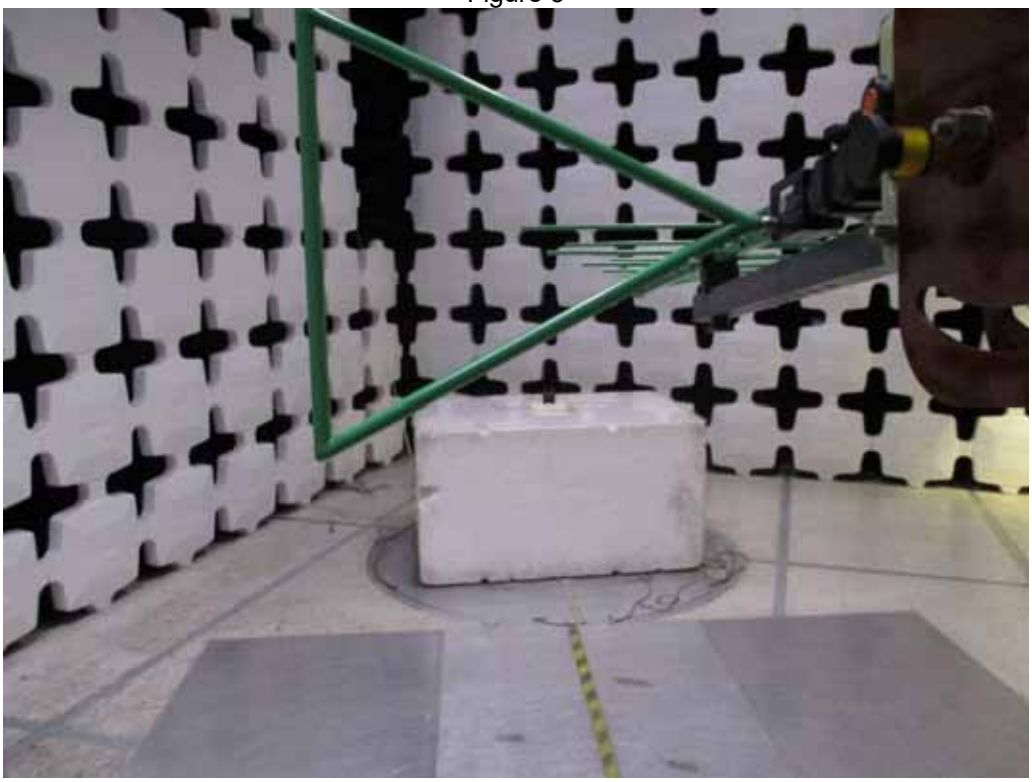
FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

Figure 2



Photograph of EUT

Figure 3



Test Setup for Radiated Emissions, 30MHz to 1GHz – Horizontal Polarization

Test Setup for Radiated Emissions, 30MHz to 1GHz – Vertical Polarization

Manufacturer : Shure Incorporated
Test Item : Bodypack Transmitter
Model No. : ULXD1
Serial No. : 4190790365
Mode : Transmit at 902.4MHz
Test Specification : FCC-15.249, RSS-210 Field Strength of the Fundamental
Date : September 6, 2019
Test Distance : 3 meters
Notes : Quasi-Peak Detector with 120kHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	QP Total dBuV/m at 3m	QP Total uV/m at 3 m	QP Limit uV/m at 3 m	Margin (dB)
902.400	H	61.8		1.5	26.4	0.0	89.8	30882.2	50000.0	-4.2
902.400	V	63.7		1.5	26.4	0.0	91.7	38433.4	50000.0	-2.3

FS (dBuV/m) = MTR (dBuV) + CF (dB/m) + AF (dB) + (- PA (dB))

FS (uV/m) = AntiLog [(FS (dBuV/m))/20]

Manufacturer : Shure Incorporated
Test Item : Bodypack Transmitter
Model No. : ULXD1
Serial No. : 4190790365
Mode : Transmit at 915MHz
Test Specification : FCC-15.249, RSS-210 Field Strength of the Fundamental
Date : September 6, 2019
Test Distance : 3 meters
Notes : Quasi-Peak Detector with 120kHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	QP Total dBuV/m at 3m	QP Total uV/m at 3 m	QP Limit uV/m at 3 m	Margin (dB)
915.000	H	62.2		1.6	26.4	0.0	90.1	32077.3	50000.0	-3.9
915.000	V	62.9		1.6	26.4	0.0	90.8	34769.4	50000.0	-3.2

FS (dBuV/m) = MTR (dBuV) + CF (dB/m) + AF (dB) + (- PA (dB))

FS (uV/m) = AntiLog [(FS (dBuV/m))/20]

Manufacturer : Shure Incorporated
Test Item : Bodypack Transmitter
Model No. : ULXD1
Serial No. : 4190790365
Mode : Transmit at 927.6MHz
Test Specification : FCC-15.249, RSS-210 Field Strength of the Fundamental
Date : September 6, 2019
Test Distance : 3 meters
Notes : Quasi-Peak Detector with 120kHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	QP Total dBuV/m at 3m	QP Total uV/m at 3 m	QP Limit uV/m at 3 m	Margin (dB)
927.600	H	60.9		1.6	26.6	0.0	89.1	28546.8	50000.0	-4.9
927.600	V	64.3		1.6	26.6	0.0	92.5	42223.8	50000.0	-1.5

FS (dBuV/m) = MTR (dBuV) + CF (dB/m) + AF (dB) + (- PA (dB))

FS (uV/m) = AntiLog [(FS (dBuV/m))/20]