



**BEC INCORPORATED**

**CERTIFICATION APPLICATION TEST REPORT**

**TEST STANDARDS:  
FCC Part 15 Subpart C Section 15.231  
RSS-Gen/RSS-210 Annex A  
Intentional Radiator**

**Lutron Model QSERJ-EDU  
Wireless Battery-Operated Motor Drive**

**REPORT# BEC-2312-01**

**TEST DATES: 03/12/2024 – 03/29/2024**

**CUSTOMER:  
Lutron Electronics Company Incorporated  
7200 Suter Road  
Coopersburg, PA 18036**

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## Notice to Customer

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The BEC Decision Rule: Measurement Uncertainty is not applied to any testing measurements or test results provided to the customer by BEC Incorporated at this time.

## Revision History

Revision #	Description of Changes	Date of Changes	Date Released
0	Test Report Initial Release	N/A	03/29/2024



## 1.0 Administrative Information

### 1.1 General Project Details

<b>Project Number</b>	BEC-2312
<b>Manufacturer</b>	Lutron Electronics
<b>Model Numbers Tested</b>	QSERJ-EDU
<b>EUT Description</b>	Basenji Wireless Battery-operated Motor Drive
<b>EUT Serial Number</b>	04BC03EC
<b>EUT Sample Number</b>	2312-01
<b>EUT Sample Type</b>	Radiated Emissions Test Sample with Test Code
<b>EUT Serial Number</b>	04BC03EB
<b>EUT Sample Number</b>	2312-02
<b>EUT Sample Type</b>	Antenna Conducted Test Sample with Test Code
<b>EUT Condition Received</b>	Prototype Unit Suitable for test
<b>EUT Firmware Version</b>	2.017
<b>Frequency of Operation</b>	431 MHz to 437 MHz
<b>Antenna Gain</b>	-6 dBi (-8.15 dBd)
<b>Antenna Type</b>	Monopole Antenna
<b>Modulation</b>	FSK
<b>FCC Classification</b>	DSR, Part 15 Remote Control/Security Device Transceiver
<b>Date Samples Received</b>	03/18/2024
<b>FCC ID</b>	JPZ0147
<b>ISED ID</b>	2851A-JPZ0147
<b>ISED HVIN</b>	BRJ-B
<b>Applicable FCC and ISED Rules</b>	FCC Rules Part 15.231: Periodic operation in the band 40.66-40.70 MHz and above 70 MHz. RSS-210 Annex A: Momentarily operated and remote-control devices.



## 1.2 Preface

This report documents product testing conducted to verify compliance of the specified EUT with applicable standards and requirements as identified herein. EUT, test instrument configurations, test procedures, and recorded data are generally described in this report. The reader is referred to the applicable test standards for detailed procedures. The following table summarizes the test results obtained during this evaluation.

## 1.3 Laboratory and Customer Information

<b>Test Laboratory Location</b>	BEC Incorporated 970 East High Street Pottstown, PA 19464
<b>Test Personnel</b>	Steve Fanella / JR Fanella
<b>BEC Laboratory Number FCC Registration</b>	US1118
<b>BEC Laboratory Number ISED Registration</b>	7342A-1
<b>Test Performed For</b>	Lutron Electronics Co Incorporated 7200 Suter Road Coopersburg, PA 18036
<b>Customer Technical Contact</b>	Geri Gonzalez
<b>Customer Reference Number</b>	PO # 5325174



## 1.4 Measurement Uncertainty

Test Measurement	ETSI EN 300 220-1 Limit	BEC Value
Radio Frequency	±0.5 ppm	±0.027 ppm
RF Power, Conducted	±1.5 dB	±1.45 dB
Radiated Emission of Transmitter, Valid up to 6 GHz	±6 dB	±4.87 dB
Radiated Emission of Receiver, Valid up to 6 GHz	±6 dB	±4.87 dB
RF Level Uncertainty for a given BER	±1.5 dB	N/A
Occupied Bandwidth	±5 %	±2 %
Temperature	±2.5 °C	±0.5 °C
Humidity	±10 %	±2.5%

These uncertainties, provided for informational purposes, have a coverage factor of  $k = 1.96$  or  $k = 2$ , (which provide confidence levels of respectively 95 % and 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)). Principles for the calculation of measurement uncertainty are contained in ETSI TR 100 028 [i.3], in particular in annex D of ETSI TR 100 028-2 [i.3].

Measurement	Measurement Distance	Frequency Range	Measurement Limit	Expanded Uncertainty
Radiated Disturbance Open Area Test Site	3 Meter	30 MHz – 1 GHz	Class A or B	4.65
Radiated Disturbance Fully Anechoic Chamber	3 Meter	1 GHz – 18 GHz	Class A or B	5.33
Conducted Disturbance AC Mains	N/A	150 kHz – 30 MHz	Class A or B	2.69

No adjustments to measured data presented in this report are required because all values of uncertainty are less than the CISPR 16-4-2:2018 recommendations. These uncertainties have a coverage factor of  $k = 2$ , which yields approximately a 95% level of confidence for the near-normal distribution typical of most measurement results.



## 1.5 Test Result Summary Table

The Lutron Model QSERJ-EDU Wireless Battery-operated Motor Drive was tested and found to be compliant to the sections of the FCC Part 15 Subpart C and RSS-210/RSS-Gen standard listed below:

BEC Report Section	FCC: 47 CFR Part	RSS-210	RSS-Gen	IEEE / ANSI C63.10	Test Description	Result
<a href="#">4.1</a>	15.203	-	6.8	-	Antenna Requirement	Compliant
<a href="#">4.2</a>	15.203	-	6.8	-	Antenna Construction	Compliant
<a href="#">4.3</a>	FCC 15.205, 15.209, 15.231(b)	A.1.2	6.13, 7.3 and 8.10	-	Radiated Emissions	<b>PASS</b>
<a href="#">4.4</a>	IEEE/ANSI C63.10	-	-	11.6	Duty Cycle Measurement	Measured
<a href="#">4.5</a>	FCC 15.231(c)	A.1.3	-	-	20 dB Bandwidth	<b>PASS</b>
<a href="#">4.6</a>	-	-	6.7	-	99% Occupied Bandwidth	<b>PASS</b>
<a href="#">4.7</a>	FCC 15.231(a)(1)	A.1.1 (a)	-	-	Deactivation Testing	<b>PASS</b>
<a href="#">4.8</a>	15.207(a)	-	7.2	-	AC Mains Conducted Emissions	EUT is Battery Powered and therefore the testing is not required

**Interpretation of Test Results:** The EUT was tested using typical radio modulation. The resultant data is presented by showing the worst-case levels for each modulation type and/or frequency. All recorded results are maintained at BEC Incorporated and are available upon request.





## **1.6 Condition of Received Sample**

An evaluation of the EUT was conducted in order to verify test subject identity and condition and to ensure suitability for testing. No evidence of physical damage was noted. The test item condition was deemed acceptable for the performance of the requested test services.

## **1.7 Climatic Environment**

The following were the general environmental conditions inside the laboratory during testing:

Temperature:  $22^{\circ}\text{C} \pm 5^{\circ}\text{C}$

Humidity:  $50\% \pm 20\%$

Barometric Pressure:  $1010 - 1050\text{ mb} \pm 20\%$

## **1.8 Test Equipment**

All test equipment is checked to manufacturer's specifications and, when applicable, have current N.I.S.T. traceable, ISO 9002 conforming certificates of calibration. Test equipment used for the tests described herein is listed in Appendix A.



## 2.0 Equipment Under Test

Unless otherwise noted in the individual test results sections, testing was performed on the EUT as follows.

### 2.1 EUT Description

The Lutron Model QSERJ-EDU Wireless Battery-operated Motor Drive is a battery-powered shade solution. The Lutron Model QSERJ-EDU Wireless Battery-operated Motor Drive uses a Lutron Designed Transceiver Radio which operates momentarily in the 431 MHz to 437 MHz frequency range.

### 2.2 Product Category Standards

47 CFR, Part 15 Subpart C – Section 15.231  
RSS-210 Annex A-Momentarily operated and remote-control devices.

### 2.3 Product Classification

Intentional Radiator Testing Requirements, Periodic operation in the band 40.66 MHz - 40.70 MHz and above 70 MHz. The EUT is a momentarily operated transmitter and receiver, and/or remote-control device.

### 2.4 Test Configurations

The Lutron Model QSERJ-EDU Wireless Battery-operated Motor Drive sample was programmed to provide control of the radio to enable transmission at Low Channel Frequency of 431.5 MHz or at High Channel Frequency of 436.6 MHz in multiple modes using Basenji 2.0 RF Test Code firmware. Available transmission modes in the Standard FCC Mode were Constant Wave, Constant Packet or Continuous Constant Packet when transmitting. Receive Mode was also available in the Basenji 2.0 RF Test Code. Range Test Mode provided the ability to Transmit a Single Packet.

Lutron Model QSERJ-EDU with Basenji 2.0 RF Test Code, Mode 2, State 3 Continuous Constant Packet was used during the following tests:

- Radiated Fundamental and Spurious Measurement (Sample 2312-01)
- Fundamental Measurement (Sample 2312-01 and Sample 2312-02)
- 20 dB Bandwidth Measurement (Sample 2312-02)
- 99% Occupied Bandwidth Measurement (Sample 2312-02)

Lutron Model QSERJ-EDU with Basenji 2.0 RF Test Code, Mode 3, State 1, Operation 2: Single Packet Transmit with Shade Button Tap was used during the following tests:

- Duty Cycle Measurement (Sample 2312-02)
- Automatic transmitter shut off after 5 seconds (Sample 2312-02)

Lutron Model QSERJ-EDU with Basenji 2.0 RF Test Code, Mode 2, State 4 RX Mode was used during the following test: Spurious Measurements (Sample 2312-01)



## 2.5 Test Configuration Rationale

The tested configurations are based on the signal types required to make proper measurements for the testing to FCC Part 15.231 and RSS-210.

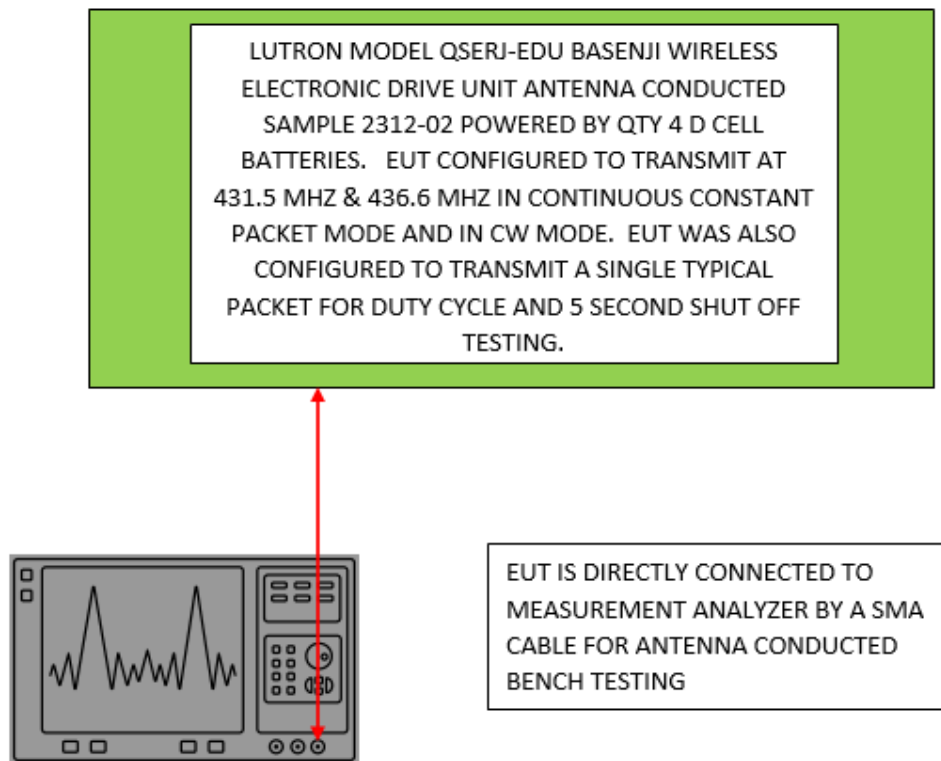
## 2.6 Test Setup Configuration Block Diagrams

A block diagram of the EUT configuration showing interconnection cables is illustrated below. The drawing shows the physical hardware layout used for the tests along with I/O cables and AC power distribution.

Radio Bench Testing Test Setup Diagram

### LUTRON MODEL QSERJ-EDU

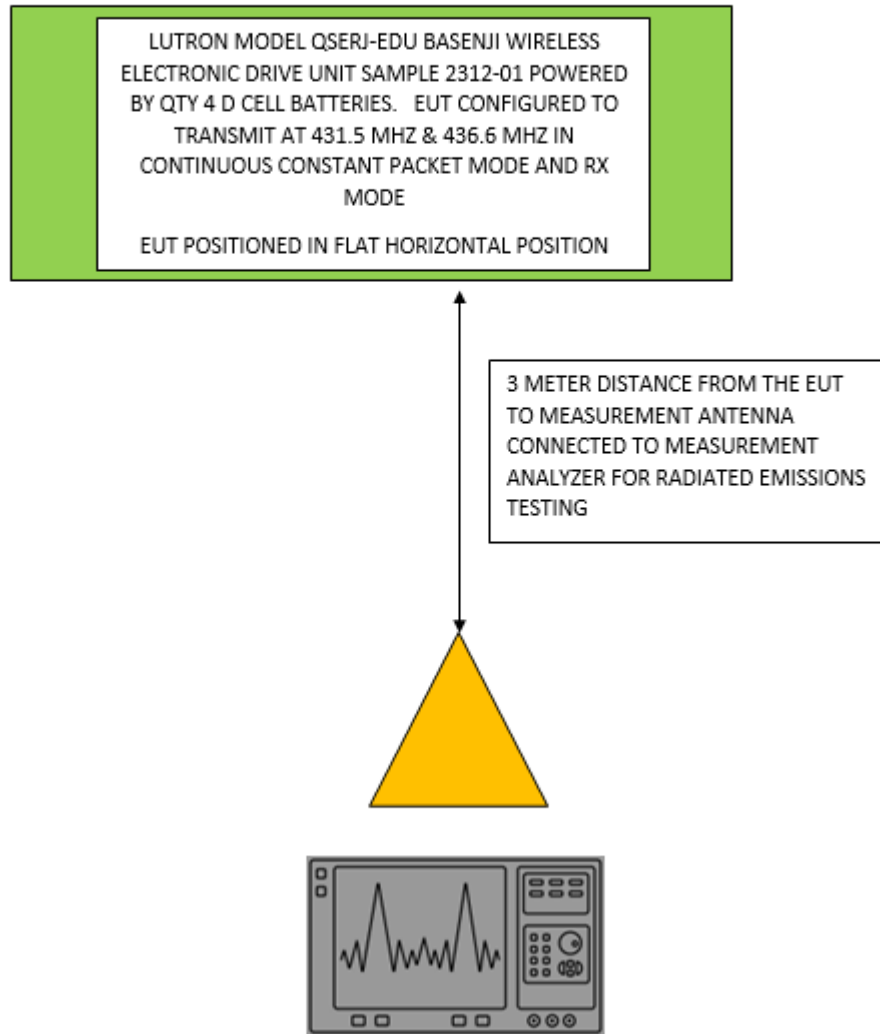
### ANTENNA CONDUCTED TEST SETUP DIAGRAM





## Fundamental and Spurious Radiated Emissions Test Setup Diagram

### LUTRON MODEL QSERJ-EDU RADIATED EMISSIONS TEST SETUP DIAGRAM





## 2.7 EUT Information, Interconnection Cabling and Support Equipment

### EUT Hardware and Software/Firmware

EUT Description	Manufacturer	Model	Serial Number	Software Firmware Version	Sample Number
QSERJ-EDU Wireless Battery-operated Motor Drive Radiated Test Sample with Basenji 2.0 RF Test Code	Lutron	QSERJ-EDU	04BC03EC	2.010	2312-01
QSERJ-EDU Wireless Battery-operated Motor Drive Antenna Conducted Test Sample with Basenji 2.0 RF Test Code	Lutron	QSERJ-EDU	04BC03EB	2.010	2312-02

### Support Equipment

EUT Description	Manufacturer	Model	Serial Number
Qty 4, 1.5 V DC D Cell Alkaline Batteries	Rayovac	12-2031	None

### Interconnection Cable List-None

## 2.8 Test Signals and Test Modulation

Testing was performed at either 431.5 MHz Low Transmit or 436.6 MHz High Transmit or both Low and High Transmit Frequencies. Specific signal type configurations tested are detailed in the sections within this report. Continuous Constant Packet Mode or Single Packet Transmit Mode using the Shade Button were used during specific testing as detailed in Section 2.4 of this Report (EUT Configuration). Transmission Modulation for this product utilizes FSK.

## 2.9 Grounding

There was no ground connection used; the EUT is battery powered and self-contained.



## **2.10 EUT Power**

The Lutron QSERJ-EDU Wireless Battery-operated Motor Drive was powered by Qty four (4) 1.5 V DC D Cell Alkaline Batteries.

## **2.11 EUT Modifications**

No physical modifications were made to the EUTs tested to achieve compliance.



## **3.0 Applicable Requirements, Methods, and Procedures**

### **3.1 Applicable Requirements**

The results of the measurement of the radio disturbance characteristics of the EUT described herein may be applied and where appropriate, provide a presumption of compliance to one or more of the following requirements or to other requirements at the discretion of the customer, regulatory agencies, or other entities.

#### **3.1.1 FCC and ISED Requirements**

Code of Federal Regulations: Title 47 – Telecommunication

Chapter I - Federal Communications Commission

Sub-chapter A – General

Part 15 – Radio Frequency Devices

Subpart C - Intentional Radiators

15.231 Periodic operation in the band 40.66-40.70 MHz and above 70 MHz

RSS-210 Issue 10 December 2019 License-Exempt Radio Apparatus: Annex A-Momentarily operated and remote control devices.

RSS-Gen Issue 5 April 2018, General Requirements for Compliance of Radio Apparatus

TRC-43 Issue 3 November 2012, Designation of Emissions, Class of Station and Nature of Service

#### **3.1.2 Basic Test Methods and Test Procedures**

IEEE/ANSI C63.4: 2014, 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.

IEEE/ANSI C63.10: 2020, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

### **3.2 Deviations or Exclusions from the Requirements**

No deviations or exclusions were made.



## 4.0 Test Results

### 4.1 Antenna Requirement (47 CFR 15.203) (RSS-Gen, 6.2)

According to Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The antenna used by the Lutron Model QSERJ-EDU is a Monopole type antenna mounted perpendicular to the PCB inside the enclosure. There are no detachable parts of the antenna. The antenna is not replaceable, nor changeable, and therefore complies with the antenna requirements of FCC Part 15 C Section 15.203.

### 4.2 Antenna Construction (47 CFR 15.203) (RSS-Gen, 6.2)

The device is equipped with permanent attached antenna, which is not displaced by any other antenna. The Antenna gain of the EUT is -6.0 dBi. Therefore, the equipment complies with the antenna requirements of FCC Part 15 C Section 15.203.

### 4.3 Radiated Emissions (47 CFR 15.209 and 15.231 (b) and 15.35(b)) (RSS-210 A.1.2)

According to FCC Part 15 C Section 15.231(b) and RSS-210 Annex A.1.2 the field strength of emissions from the intentional radiators operated under this section shall not exceed the following limits:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	<sup>1</sup> 1,250 to 3,750	<sup>1</sup> 125 to 375
174-260	3,750	375
260-470	<sup>1</sup> 3,750 to 12,500	<sup>1</sup> 375 to 1,250
Above 470	12,500	1,250

<sup>1</sup>Linear interpolations.

(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.





### **4.3.1 Radiated Emissions Test Facility**

#### **OATS**

The Open Area Test Site (OATS) is an all-weather facility with a wooden enclosure that contains a ground level 4-foot diameter turntable capable of rotating equipment 360 degrees. The site is free of reflective metallic objects and extraneous electromagnetic signals. This non-metallic enclosure and the 3-meter and 10-meter test range existing outside the enclosure rest upon a protective insulating material, which in turn covers a flat, metal, continuous ground plane.

Instrumentation for remote control of the antenna mast, turntable, and other equipment are controlled by personnel indoors. The EUT and support peripherals required for EUT operation were placed on a table at a height of 80 cm for measurement of signals below 1 GHz and a table of 150 cm for measurement of signals above 1 GHz.

The test site complies with the attenuation measurements specified in ANSI C63.4.

#### **SR#1**

The Semi-Anechoic Shielded Room (SR#1) is a ferrite and absorber lined chamber which houses a 5-foot diameter turntable capable of rotating equipment 360 degrees and antenna mast for Horizontal and Vertical polarity measurements. The enclosure is free of reflective metallic objects and extraneous electromagnetic signals. This 3-meter shielded enclosure has a raised computer floor with metal tile bottoms providing a continuous ground plane.

Instrumentation for remote control of the antenna mast, turntable, and other equipment are controlled by personnel outside the chamber. The EUT and support peripherals required for EUT operation were placed on tables 80 cm high (9 kHz – 1 GHz) and 150 cm high (1 – 18 GHz) for tabletop equipment or directly on the turntable surface for floor standing equipment.

The test site complies with the attenuation measurements specified in ANSI C63.4.

See Appendix B and Appendix C for Test Site Diagrams.



### **4.3.2 Restricted and Non-restricted Bands Radiated Emissions Test Procedure**

#### **Radiated Emissions 9 kHz – 40 GHz**

The EMI receiver was set to quasi-peak mode for frequencies from 9 kHz to 1000 MHz and the appropriate CISPR bandwidths were employed. The receiver was set to average mode for frequencies above 1 GHz with the appropriate CISPR bandwidths were employed.

Three orthogonal positions of the EUTs were evaluated for maximum emissions. The position of the EUTs placed Flat (X Axis) on the horizontal surface of the 80-cm table was determined to be the axis that produced the highest emissions for the Lutron Model QSERJ-EDU.

Significant emissions found during the preliminary scans were maximized by rotating the turntable and varying the antenna height. Both horizontal and vertical antenna polarities were also investigated for suspect emissions. The signals are maximized and measured using the in house generated RADE or off the shelf TILE software. The support equipment and test item(s) were powered off in turn to determine the source of the emissions where appropriate.

Field strengths were calculated as follows:

Field Strength (dB $\mu$ V/m) = Meter Reading (dB $\mu$ V) + Antenna Factor (dB/m) + Cable Loss (dB) – Amplifier Gain (dB) - Duty Cycle Correction Factor

The Duty Cycle measurement and calculation of the Duty Cycle Correction Factor are contained in Section 4.4 of this report.

Measurements were made with the Lutron Model QSERJ-EDU transmitting at low frequency of 431.5 MHz and high frequency of 436.6 MHz. The transmit frequencies were configured in Continuous Constant Packet Test Mode.

The following tables are the highest emissions recorded and summarized. The emissions are separated into signals in the restricted bands, described in FCC Part 15.205 and RSS-Gen, and signals not within restricted bands subject to the limits specified in 15.231 and RSS-210 A.1.2.



### 4.3.3 Radiated Emissions General Test Information

The following information is related to the testing performed for Radiated Emissions in the frequency range of 9 kHz to 5 GHz.

<b>Frequency Range</b>	9 kHz to 5 GHz
<b>Test Standards</b>	FCC Part 15.209, FCC Part 15.231 (b) and RSS-210
<b>Class Limits</b>	FCC Part 15.209, FCC Part 15.231 (b) and RSS-210 A.1.2
<b>EUT Type</b>	Wireless Battery-operated Motor Drive - Radiated Sample
<b>Manufacturer/Model</b>	Lutron Model QSERJ-EDU
<b>Sample Number</b>	2312-01
<b>Port Tested</b>	Enclosure
<b>EUT Power</b>	Battery Powered (Qty 4 1.5V DC D Cells Alkaline)
<b>Transmit Frequencies</b>	431.5 MHz and 436.6 MHz
<b>Transmission Mode</b>	Continuous Constant Packet Mode with FSK Modulation
<b>Test Date(s)</b>	03/21/2024
<b>Temperature</b>	20°C
<b>Humidity</b>	30% RH
<b>Test Date(s)</b>	03/22/2024
<b>Temperature</b>	20°C
<b>Humidity</b>	30% RH
<b>Test Date(s)</b>	03/25/2024
<b>Temperature</b>	12°C
<b>Humidity</b>	31% RH
<b>Test Date(s)</b>	03/26/2024
<b>Temperature</b>	20°C
<b>Humidity</b>	32% RH

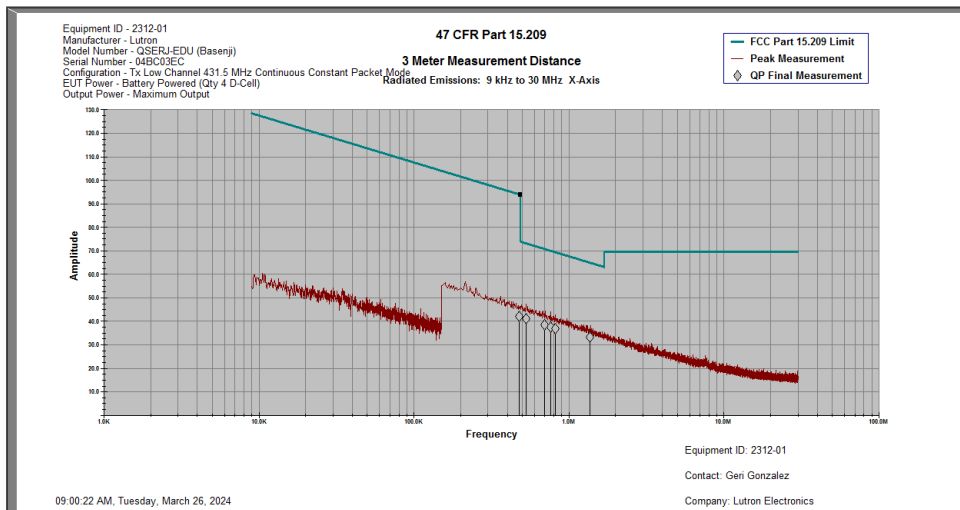


### 4.3.4 Radiated Emissions 9 kHz – 30 MHz Test Results (03/26/2024)

Measurements were made in the frequency range of 9 kHz to 30 MHz, at three orthogonal axes, with the Lutron Model QSERJ-EDU transmitting at low frequency of 431.5 MHz and high frequency of 436.6 MHz. The transmit frequencies were configured in Continuous Constant Packet Mode with FSK Modulation. In addition, the Lutron Model QSERJ-EDU was tested in Receive Mode at X, Y & Z axes.

The measured signals from the EUT in this frequency range are noise floor measurements. The table below depicts the highest measured levels of the noise floor with the EUT tested in the X Axis. All other polarizations and transmit frequencies and receive modes showed noise floor measurements and data results are available upon request.

Continuous Constant Packet Mode Tx @ 431.53 MHz									
X Axis	Frequency	Peak Level	QP Level	Azimuth	Ant Height	Corr. Factor	Limit	QP Margin	Result
		dBuV/m	dBuV/m	degrees	cm	dB	dBuV/m	dB	Pass/Fail
	479748.000	41.54	41.95	000	100	-19.47	93.98	-52.03	PASS
	531170.000	40.19	41.22	000	100	-19.42	73.10	-31.88	PASS
	691800.000	39.24	38.62	001	100	-19.49	70.80	-32.19	PASS
	760889.000	36.24	37.60	000	100	-19.50	69.98	-32.37	PASS
	813703.000	36.05	36.80	000	100	-19.48	69.39	-32.59	PASS
	1367430.000	33.16	33.19	-001	100	-19.15	64.89	-31.70	PASS



**Test Results:** The Lutron Model QSERJ-EDU Wireless Battery-operated Motor Drive complies with the requirements of 47 CFR Part 15.205, RSS-Gen Sections 6.13 and 7.3 and 47 CFR Part 15.231 RSS-210 A.1.2 for radiated emissions in the frequency range of 9 kHz to 30 MHz. The margin of compliance is 31.70 dB.



### 4.3.5 Radiated Emissions 30 MHz – 5 GHz Test Results

Measurements were made in the frequency range of 30 MHz to 5 GHz with the Lutron Model QSERJ-EDU transmitting at low frequency of 431.5 MHz and high frequency of 436.6 MHz. The transmit frequencies were configured in Continuous Constant Packet Test Mode.

#### 4.3.5.1 Field Strength of Fundamental Emissions (03/25/2024)

The table below shows the measured field strength of the fundamental frequencies. Preliminary comparison of radiated measurements were made of the transmission without modulation (CW) and with Continuous Constant Packet Test Mode with FSK modulation. The EUT was tested with Continuous Constant Packet Test Mode with FSK modulation and the application of the Duty Cycle Correction Factor was required to demonstrate compliance. The signals are compared to the limits of 47 CFR Part 15.231(b) and RSS-210 A.1.2 for Fundamental Emissions.

Fundamental Tx Frequency	Peak Measurement	Polarity	Turntable Table Angle	Antenna Height	Antenna Amplifier Cable Correction Factors	Duty Cycle C/F	Corrected Peak Level with Duty Cycle Correction Factor	FCC Part 15.231 Fundamental Limit	Margin
MHz	dBuV/m	H/V	degrees	cm	dB	dB	dBuV/m	dBuV/m	dB
431.53	95.94	H	145	115	25.46	19.98	75.96	80.75	-4.79
431.5	90.5	V	331	100	25.46	19.98	70.52	80.75	-10.23

Fundamental Tx Frequency	Peak Measurement	Polarity	Turntable Table Angle	Antenna Height	Antenna Amplifier Cable Correction Factors	Duty Cycle C/F	Corrected Peak Level with Duty Cycle Correction Factor	FCC Part 15.231 Fundamental Limit	Margin
MHz	dBuV/m	H/V	degrees	cm	dB	dB	dBuV/m	dBuV/m	dB
436.55	99.13	H	207	196	25.46	19.98	79.15	80.91	-1.76
436.56	90.49	V	150	131	25.46	19.98	70.51	80.91	-10.4

Test Results: The Lutron Model QSERJ-EDU Wireless Battery-operated Motor Drive BEC Sample 2312-01 complies with the requirements of 47 CFR Part 15.231 RSS-210 A.1.2 for fundamental radiated emissions in the frequency range of 30 MHz to 1000 MHz. The measured levels of the fundamental emissions compared to the Limits of 15.231 and RSS-210 A1.2 Table A1 have a margin of 1.76 dB.



### 4.3.5.2 Spurious Radiated Emissions 30 MHz – 1000 MHz Test Results (03/21/2024 and 03/22/2024)

Measurements were made in the frequency range of 30 MHz to 1000 MHz with the Lutron Model QSERJ-EDU transmitting at low frequency of 431.5 MHz and high frequency of 436.6 MHz and in RX Mode. The transmit frequencies were configured in Continuous Constant Packet Mode.

The following tables show the second harmonic signals of the low and high channel transmission frequencies. There were no other spurious signals between 30 MHz and 1000 MHz. The signals are compared to the limits of 47 CFR Part 15.231(b) and RSS-210 A.1.2 for spurious Emissions. The measured levels of restricted, spurious emissions (marked with an asterisk) compared to the average limit of 15.209, as directed by 15.205 and RSS-Gen.

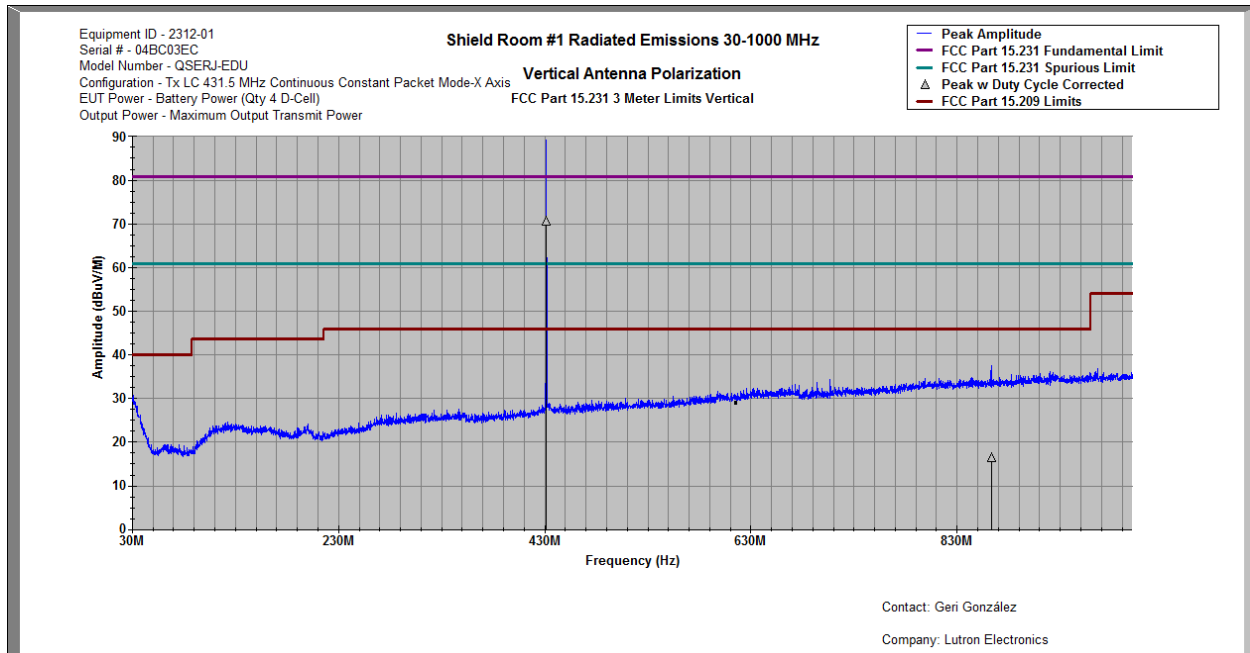
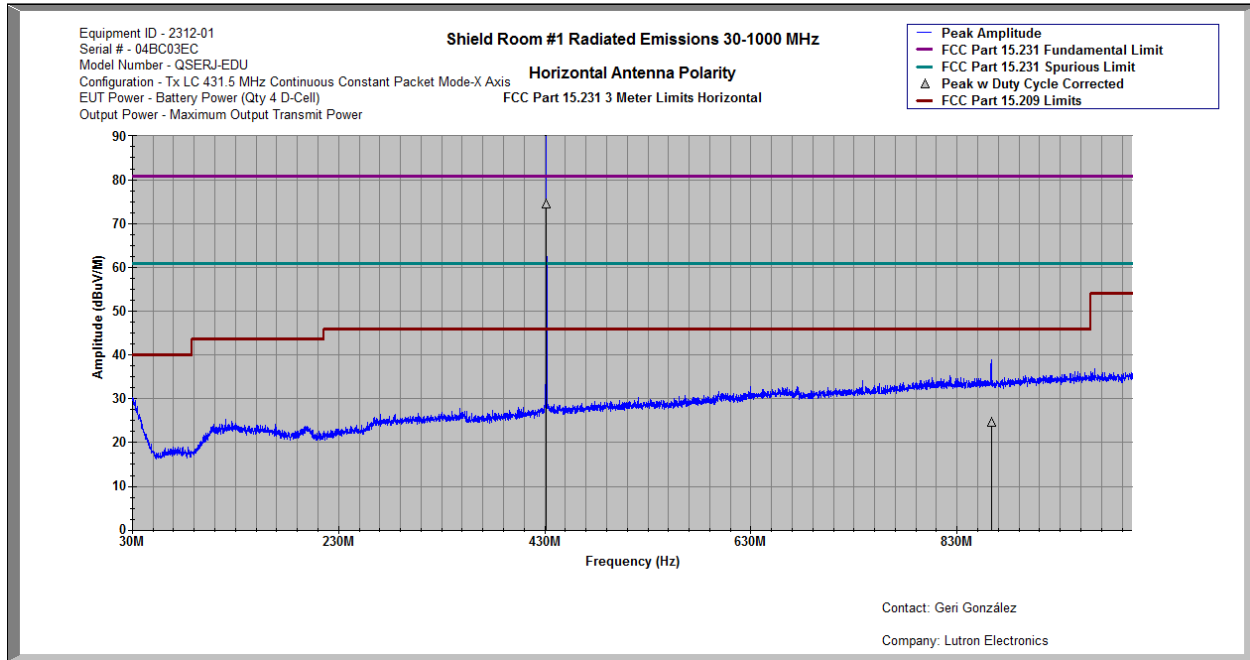
Tx Frequency of 431.5 MHz and 436.6 MHz  
Limit: FCC Part 15.231 and RSS-102 A.1.2

Tx Fundamental Frequency	Spurious Frequency	Peak Corrected	Quasi-Peak Corrected	Polarity	Turntable Angle	Antenna Height	Antenna Amplifier Cable Correction Factors	Peak with Duty Cycle CF	Spurious Limit	Spurious Margin	Duty Cycle Correction Factor
MHz	MHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dBuV/m	dB	dB
431.5	862.903	44.51	44.01	H	180	229	3.45	24.53	60.75	-36.22	19.98
431.5	863.065	36.47	35.02	V	12	131	3.44	16.49	60.75	-44.26	19.98
Frequency	Frequency	Peak Corrected	Quasi-Peak Corrected	Polarity	Turntable Angle	Antenna Height	Antenna Amplifier Cable Correction Factors	Peak with Duty Cycle CF	Spurious Limit	Spurious Margin	Duty Cycle Correction Factor
MHz	MHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dBuV/m	dB	dB
436.6	873.12	46.59	46.23	H	214	235	3.55	26.61	60.75	-34.14	19.98
436.6	873.114	39.6	38.43	V	22	121	3.55	19.62	60.75	-41.13	19.98

**Test Results:** The Lutron Model QSERJ-EDU Wireless Battery-operated Motor Drive Sample 2312-01 complies with the requirements of 47 CFR Part 15.231 RSS-210 A.1.2 for spurious and restricted band radiated emissions in the frequency range of 30 MHz to 1000 MHz. The measured levels of the spurious emissions compared to the limits of 15.231 and RSS-210 A1.2 Table A1 have a margin of 34.14 dB. The measured levels of the radiated emissions also meet the limits of FCC Part 15.205, 15.35(b) and RSS-Gen.

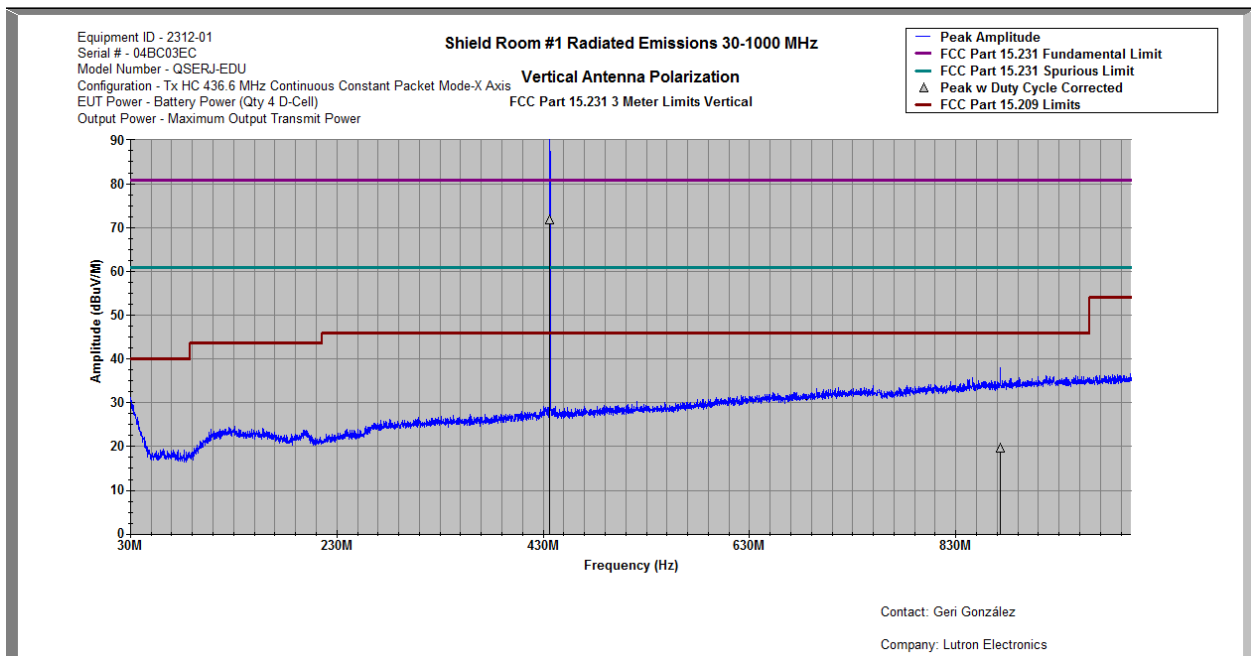
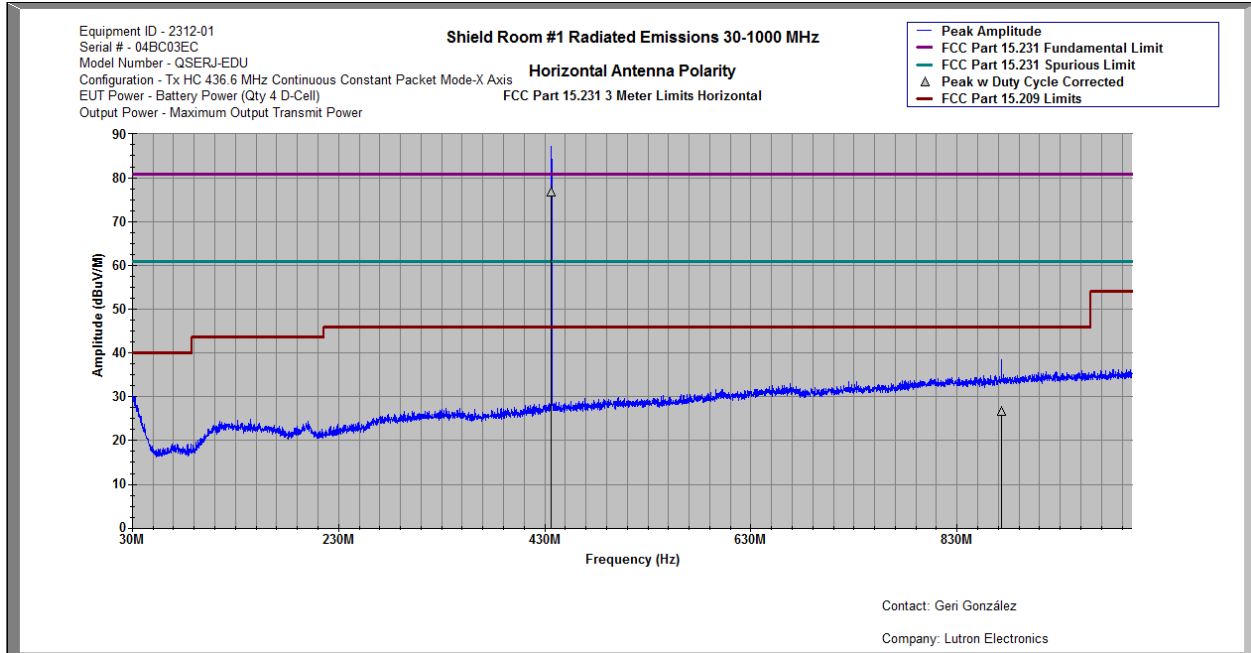


# Graphs of Radiated Emissions 30 MHz to 1000 MHz Tx Frequency of 431.5 MHz





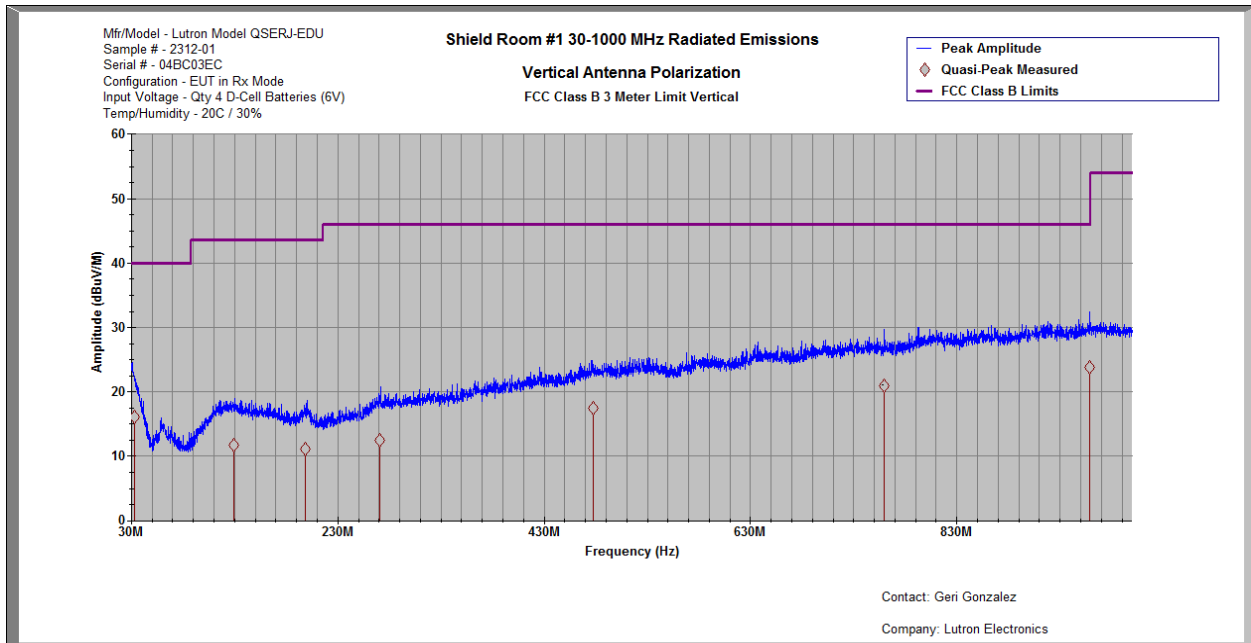
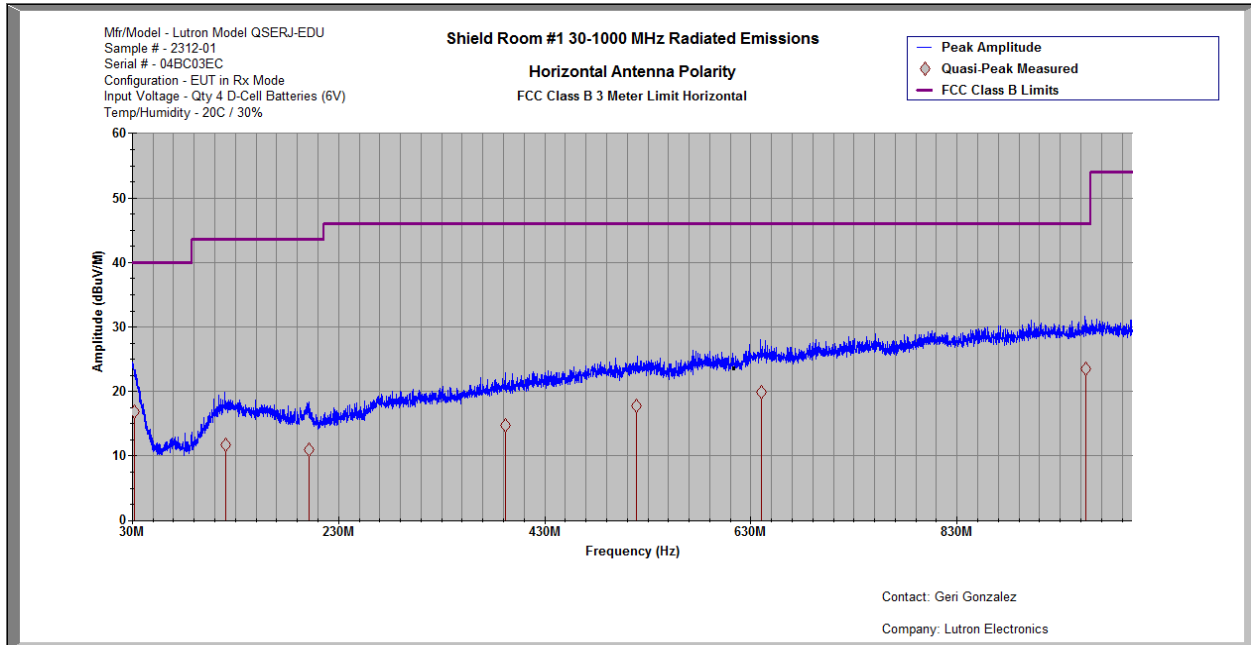
# Graphs of Radiated Emissions 30 MHz to 1000 MHz Tx Frequency of 436.6 MHz







# Graphs of Radiated Emissions 30 MHz to 1000 MHz Rx Mode





### 4.3.5.3 Spurious Radiated Emissions 1 GHz – 5 GHz Test Results (03/26/2024)

Measurements were made in the frequency range of 1 GHz to 5 GHz with the Lutron Model QSERJ-EDU transmitting at low frequency of 431.5 MHz and high frequency of 436.6 MHz and with the EUT in Rx Mode. The transmit frequencies were configured in Continuous Constant Packet Mode.

The tables below show the measured levels of non-restricted, spurious emissions compared to Table 1 of 47CFR Part 15.231 and RSS A.1.2. The measured levels of restricted, spurious emissions (marked with an asterisk) compared to the average limit of 15.209, as directed by 15.205 and RSS-Gen.

#### TX FREQUENCY OF 431.5 MHZ FCC PART 15.231 RSS-210 A.1.2 LIMITS

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable Angle	Antenna Height	Antenna and Amplifier Correction Factors	FCC Part 15.205 Average Limit	FCC Part 15.205 Average Margin	Peak Corrected With Duty Cycle Correction Factor	FCC Part 15.231 Spurious Limit	FCC Part 15.231 Spurious Margin	Duty Cycle Correction Factor
GHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	dB	dB
1.29437	40.56	37.38	H	71	141.1	-11.9	53.98	-16.6	20.58	60.75	-40.17	19.98
2.14950	33.86	23.8	H	205	135.4	-6.62	53.98	-30.18	13.88	60.75	-46.87	19.98
* 2.36113	33.96	23.93	H	84	203.2	-5.8	53.98	-30.05	13.98	60.75	-46.77	19.98
* 3.88376	39.88	32.71	H	24	193.6	0.5	53.98	-21.27	19.9	60.75	-40.85	19.98
1.29442	38.07	33.33	V	348	196	-11.9	53.98	-20.65	18.09	60.75	-42.66	19.98
2.15795	36.4	27.68	V	27	156	-6.61	53.98	-26.3	16.42	60.75	-44.33	19.98
* 2.35373	33.99	23.6	V	191	176	-5.86	53.98	-30.38	14.01	60.75	-46.74	19.98
* 3.88599	32.91	23.54	V	126	170	0.5	53.98	-30.44	12.93	60.75	-47.82	19.98
* Spurious Emissions FCC 15.231/RSS-210 Limits												
Restricted Band Emissions to FCC 15.205/15.35(b) and RSS-Gen Limits												

#### TX FREQUENCY OF 436.6 MHZ FCC PART 15.231 RSS-210 A.1.2 LIMITS

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable Angle	Antenna Height	Antenna and Amplifier Correction Factors	FCC Part 15.205 Average Limit	FCC Part 15.205 Average Margin	Peak Corrected With Duty Cycle Correction Factor	FCC Part 15.231 Spurious Limit	FCC Part 15.231 Spurious Margin	Duty Cycle Correction Factor
GHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dBuV/m	dB	dB
* 1.30971	38.88	35.19	H	69	143.5	-11.84	53.98	-18.79	18.9	60.75	-41.85	19.98
1.88335	33.13	23.67	H	145	182.2	-7.55	53.98	-30.31	13.15	60.75	-47.6	19.98
2.30363	32.24	23.12	H	248	161.1	-6.36	53.98	-30.86	12.26	60.75	-48.49	19.98
* 3.74624	32.69	22.77	H	256	185.4	-0.01	53.98	-31.21	12.71	60.75	-48.04	19.98
* 3.92947	37.68	32.41	H	320	208.1	0.61	53.98	-21.57	17.7	60.75	-43.05	19.98
* 1.30987	37.34	31.28	V	9	200	-11.84	53.98	-22.7	17.36	60.75	-43.39	19.98
1.88015	32.83	23.42	V	201	195	-7.56	53.98	-30.56	12.85	60.75	-47.9	19.98
2.17320	32.96	23.51	V	209	163	-6.6	53.98	-30.47	12.98	60.75	-47.77	19.98
3.40711	32.39	21.57	V	254	102	-1.83	53.98	-32.41	12.41	60.75	-48.34	19.98
* 3.92967	37.9	28.4	V	77	205	0.61	53.98	-25.58	17.92	60.75	-42.83	19.98
* Spurious Emissions FCC 15.231/RSS-210 Limits												
Restricted Band Emissions to FCC 15.205/15.35(b) and RSS-Gen Limits												



RECEIVE MODE (RX) PART 15.205 AND RSS-GEN 8.9

Frequency GHz	Peak Level dBuV/m	Average Level dBuV/m	Antenna Polarity H/V	Turntable Angle degrees	Antenna Height cm	Antenna and Amplifier Correction Factors dB	FCC Part 15.205 Average Limit dBuV/m	FCC Part 15.205 Average Margin dB	Peak Corrected With Duty Cycle Correction Factor dBuV/m	FCC Part 15.231 Spurious Limit dBuV/m	FCC Part 15.231 Spurious Margin dB	Duty Cycle Correction Factor dB
1.72425	31.66	22.29	H	120	141	-9.14	53.98	-31.69	n/a	n/a	n/a	0
2.59983	33.19	24.29	H	320	197	-4.89	53.98	-29.69	n/a	n/a	n/a	0
* 3.90943	33.08	23.09	H	345	191.4	0.55	53.98	-30.89	n/a	n/a	n/a	0
1.77487	30.66	21.88	V	6	172	-8.44	53.98	-32.1	n/a	n/a	n/a	0
* 2.765	34.73	24.24	V	255	101	-4.41	53.98	-29.74	n/a	n/a	n/a	0
* 3.75445	33.79	22.68	V	5	214	0.05	53.98	-31.3	n/a	n/a	n/a	0
* Spurious Emissions FCC 15.231/RSS-210 Limits												
Restricted Band Emissions to FCC 15.205/15.35(b) and RSS-Gen Limits												

**Test Results:** The Lutron Model QSERJ-EDU BEC Sample 2312-01 complies with the requirements of 47 CFR Part 15.231 RSS-210 A.1.2 for non-restricted radiated emissions and Part 47 CFR Part 15.205, 15.35(b) and RSS-Gen restricted radiated emissions in the frequency range of 1.0 GHz to 5 GHz. The measured levels of restricted, spurious emissions were compared to the average limit of 15.209, as directed by 15.205. At 1.29437 GHz, the closest margin for the spurious emission limit is 40.17 dB. The closest margin for the restricted band is 16.60 dB.



## 4.4 Duty Cycle Measurement (ANSI C63.10)

### 4.4.1 Duty Cycle Measurement – Test Procedure

The duty cycle was measured by using the methods of ANSI C63.10. The spectrum analyzer screen images and tables related to the duty cycle measurements are shown below. The Lutron Model QSERJ-EDU transmitted at 436.6 MHz using Transmit Packet Mode of the FCC Test Software and activating the EUT transmitter by tapping the OFF button located on the Model QSERJ-EDU Sample 2312-01.

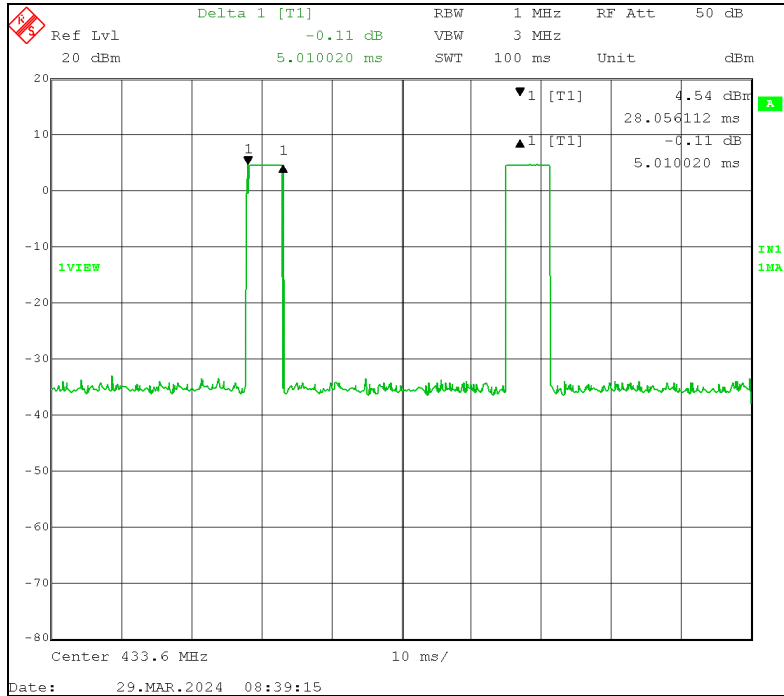
### 4.4.2 Duty Cycle Measurement General Test Information

The following information is related to the testing performed for Duty Cycle.

<b>Frequency Tested</b>	431.5 MHz
<b>Test Standards</b>	ANSI C63.10, 11.6
<b>Class Limits</b>	None
<b>EUT Type</b>	Wireless Battery-operated Motor Drive
<b>Manufacturer/Model</b>	Lutron Model QSERJ-EDU
<b>Sample Number</b>	2312-02
<b>Temperature</b>	21°C
<b>Humidity</b>	39% RH
<b>EUT Power</b>	Battery Powered (Qty 4 1.5V DC D Cells Alkaline)
<b>Test Date(s)</b>	03/29/2024



### 4.4.3 Duty Cycle Measurement Test Results (03/29/2024)



The measured on-times depicted on the spectrum analyzer screens above are used to calculate the Duty Cycle Correction Factor. This factor is used to reduce the emission level of spurious emissions measured and displayed in Section 4.3.

### 4.4.4 Duty Cycle Correction Factor Calculation

On Time pulse	5.01	ms
Number of Pulses	2	
Total On Time	10.02	ms
Period (T)	100	ms
Duty Cycle = On Time / T (100 ms)	0.1002	
	10.02	%
Duty Cycle Correction = 20Log(On Time/Period)	-19.98	dB

**Test Results:** The duty cycle measurement of the Lutron Model QSERJ-EDU Wireless Battery-operated Motor Drive BEC Sample 2312-02 produces a value of 10.02 %. The calculated Duty Cycle Correction Factor is 19.98 dB.



## 4.5 20 dB Bandwidth (47 CFR 15.231(c) RSS-210 A.1.3)

### 4.5.1 20 dB Bandwidth Measurement – Test Procedure

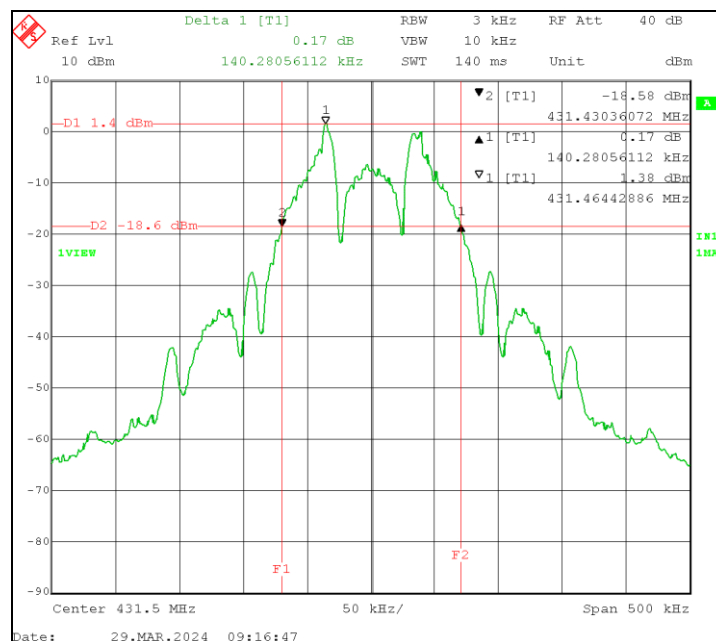
The 20 dB Bandwidth was measured by using the methods called out for in FCC Part 15.231(c) and RSS-210 A.1.23. The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. The Transmit frequencies of 431.5 MHz and 436.6 MHz were tested with the radio programmed to transmit in Continuous Constant Packet Mode.

### 4.5.2 20 dB Bandwidth Measurement General Test Information

<b>Fundamental Frequencies</b>	431.5 MHz and 436.6 MHz
<b>Test Standards</b>	47 CFR 15.231(c) and RSS-210 A.1.3
<b>Limit</b>	.25 % of Fundamental Center Frequency
<b>EUT Type</b>	Wireless Battery-operated Motor Drive
<b>Manufacturer/Model</b>	Lutron Model QSERJ-EDU
<b>Sample Number</b>	2312-02
<b>Temperature</b>	21°C
<b>Humidity</b>	39% RH
<b>EUT Power</b>	Battery Powered (Qty 4 1.5V DC D Cells Alkaline)
<b>Test Date(s)</b>	03/29/2024

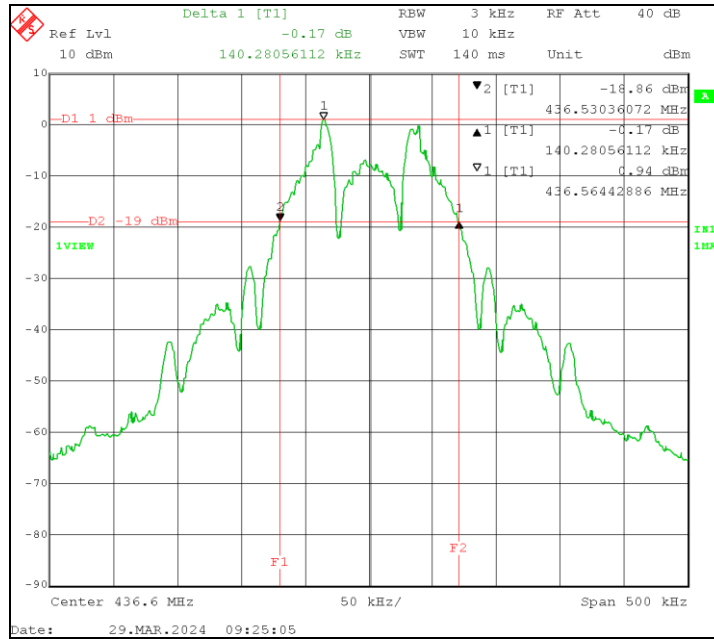
### 4.5.3 20 dB Bandwidth Measurement Test Results (03/29/2024)

Tx Frequency 431.5 MHz Continuous Constant Packet Mode





### Tx Frequency 436.6 MHz Continuous Constant Packet Mode



Frequency MHz	Modulation	Measured BW kHz	20 dB BW Limit kHz	BW Margin kHz
431.50	Continuous Constant Packet	140.28	1078.75	-938.47
436.60	Continuous Constant Packet	140.28	1091.50	-951.22

**Test Results:** The Lutron Model QSERJ-EDU, BEC Sample 2312-01, complies with the requirements of 47 CFR Part 15.231 and RSS-210 A.1.3 for 20 dB Bandwidth Measurement.



## 4.6 99% Occupied Bandwidth (RSS-Gen 6.7)

### 4.6.1 99% Occupied Bandwidth Measurement – Test Procedure

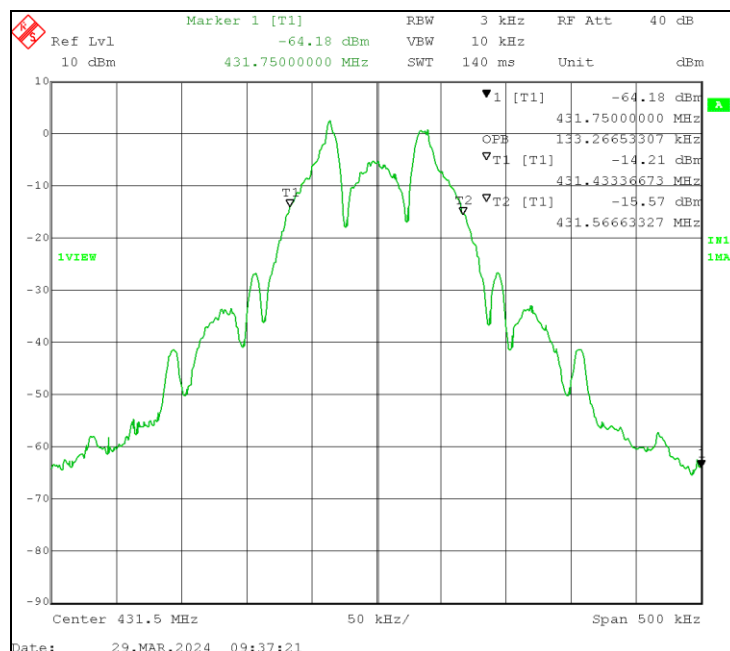
The 99% Occupied Bandwidth was measured using the specifications of RSS-Gen Section 6.7. Below are the screen captures and tables related to the 99% Occupied Bandwidth measurements. The Transmit frequencies of 431.5 MHz and 436.6 MHz were tested with the radio programmed to transmit in Continuous Constant Packet Mode.

### 4.6.2 99% Occupied Bandwidth Measurement General Test Information

<b>Channel Frequencies</b>	431.5 MHz and 436.6 MHz
<b>Test Standards</b>	RSS-Gen Section 6.7, ANSI C63.10, 6.9.3
<b>EUT Type</b>	Wireless Battery-operated Motor Drive
<b>Manufacturer/Model</b>	Lutron Model QSERJ-EDU
<b>Sample Number</b>	2312-02
<b>Temperature</b>	21°C
<b>Humidity</b>	39% RH
<b>EUT Power</b>	Battery Powered (Qty 4 1.5V DC D Cells Alkaline)
<b>Test Date(s)</b>	03/29/2024

### 4.6.3 99% Occupied Bandwidth Measurement Test Results (03/29/2024)

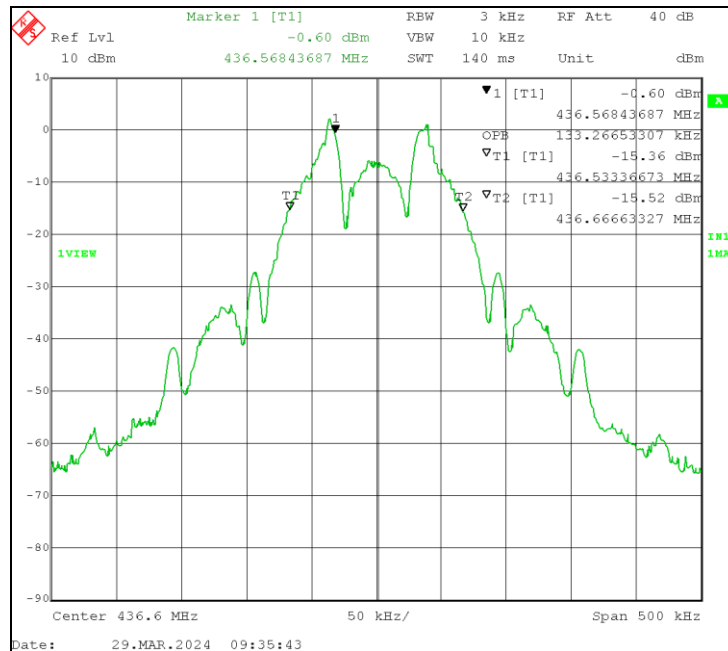
Tx Frequency 431.5 MHz Continuous Constant Packet Mode







Tx Frequency 436.6 MHz Continuous Constant Packet Mode



Frequency MHz	EUT Test Configuration	Measured 99% BW kHz
431.5	Continuous Constant Packet Mode	133.26
436.6		133.26

Test Results: The Lutron Model QSERJ-EDU, BEC Sample 2312-01 has a maximum 99% Occupied Bandwidth of 133.26 kHz.



## 4.7 Automatic Deactivation Testing (FCC Section 15.231(a)(1) RSS-210 A.1.1 (a))

### 4.7.1 Automatic Deactivation Testing Test Procedure

The Automatic Deactivation Testing was measured by using the methods called out for in FCC Part 15.231(a)(1) and RSS-210 A.1.1 (a).

FCC Part 15.231(a)(1)

A manually operated transmitter shall employ a switch that will automatically de-activated the transmitter within not more than 5 seconds of being released.

RSS-210 A.1.1 (a).

A manually operated transmitter shall be equipped with a push-to-operate switch and be under manual control at all times during transmission. When released, the transmitter shall cease transmission within no more than 5 seconds of being released.

The Lutron Model QSERJ-EDU transmitted at 431.5 MHz and 436.6 MHz using the Transmit Packet Mode of the FCC Test Software and activating the EUT transmitter by tapping the OFF button located on the Model QSERJ-EDU Sample 2312-01.

### 4.7.2 Automatic Deactivation Testing General Test Information

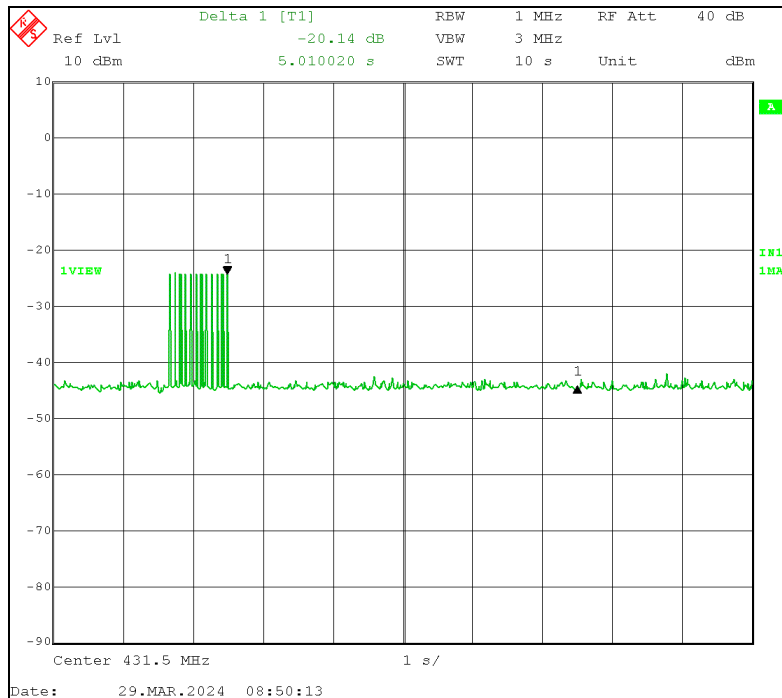
The following information is related to the testing performed for Automatic Deactivation.

<b>Frequency Range</b>	436.6 MHz
<b>Test Standards</b>	47 CFR 15.231(a)(1) and RSS-210 A.1.1 (a)
<b>Limits</b>	Automatic Deactivation 5 Seconds
<b>EUT Type</b>	Wireless Battery-operated Motor Drive
<b>Manufacturer/Model</b>	Lutron Model QSERJ-EDU
<b>Sample Number</b>	2312-02
<b>Temperature</b>	21°C
<b>Humidity</b>	39% RH
<b>EUT Power</b>	Battery Powered (Qty 4 1.5V DC D Cells Alkaline)
<b>Test Date(s)</b>	03/29/2024



### 4.7.3 Deactivation Testing Test Results (03/29/2024)

Tx Frequency 431.5 MHz FCC Part 15.231(a)(1) RSS-210 A.1.1(a) 5 Second Deactivation



Test Results: The Lutron Model QSERJ-EDU Wireless Battery-operated Motor Drive, BEC Sample 2312-01, complies with the 5 second deactivation requirements of 47 CFR Part 15.231 (a)(1) for Automatic Deactivation Measurement.



## 4.8 Conducted Emissions

### 4.8.1 Conducted Emissions AC Power Port Test Procedure

#### AC Power Line

Conducted emissions at the power line input of the EUT were measured with an EMI receiver set to the appropriate detector and CISPR bandwidth, which was connected to the RF output of a 50  $\Omega$ , 50  $\mu$ H Line Impedance Stabilization Network (LISN) installed in each power line.

Measurements were made over the frequency range of 150 kHz to 30 MHz while the EUT was operating as described in the EUT section of this report. The significant amplitudes of emissions measured on the AC power lines of the EUT were recorded as follows:

Emission (dB $\mu$ V) = Meter Reading (dB $\mu$ v) + Cable Loss (dB) + LISN Factor (dB) + Limiter Loss (dB)

**Results:** The Lutron Model QSERJ-EDU Wireless Battery-operated Motor Drive is battery powered and therefore does not need to meet these requirements. No testing required.

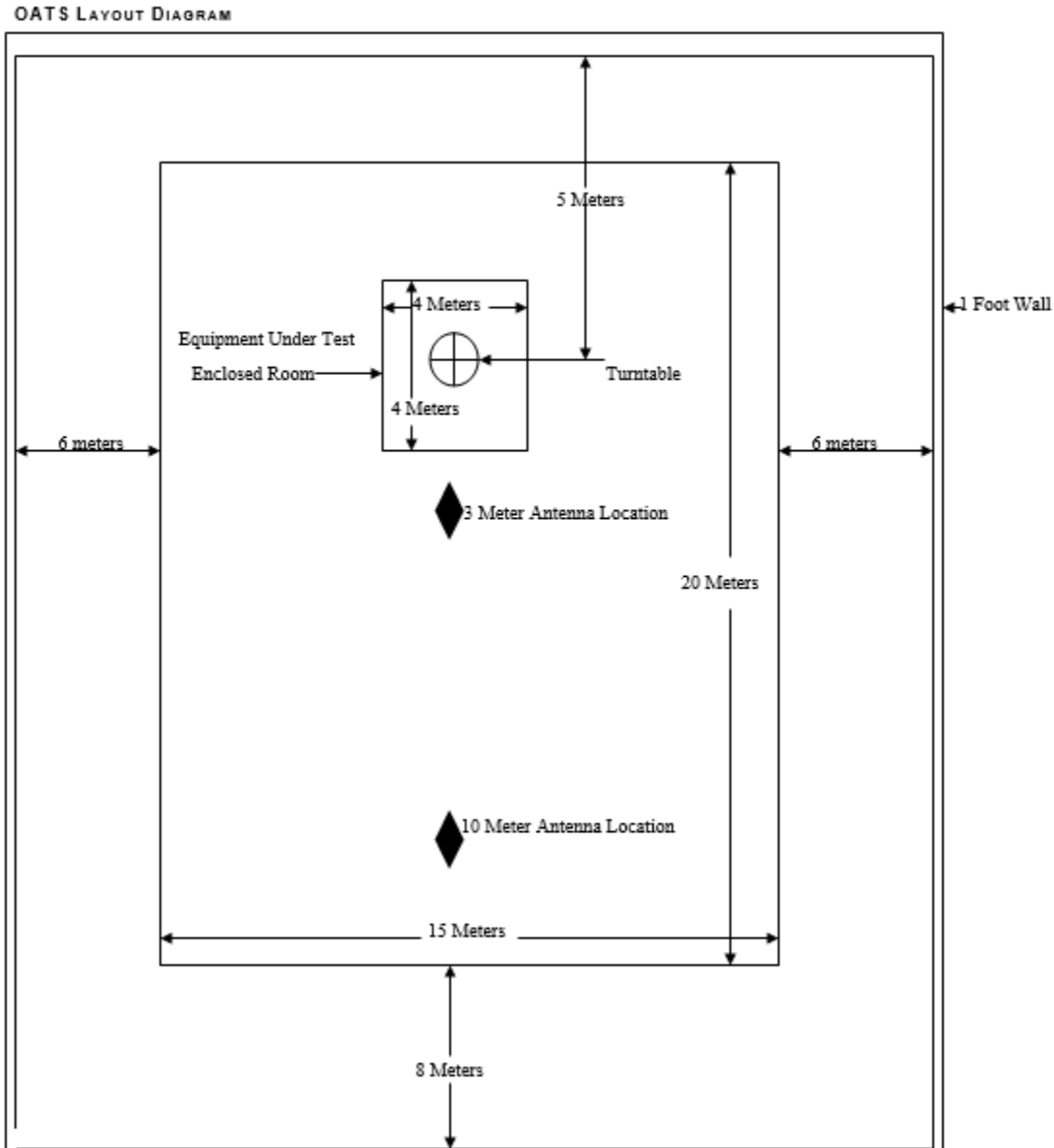


## Appendix A – Test Equipment

Equipment	Manufacturer	Model #	Serial #	BEC #	Calibration Date	Calibration Cycle	Calibration Due Date
Antenna (30 MHz - 6 GHz)	Sunol Sciences	JB6	A022108	712	06/21/21	3 Years	06/21/24
EMI Receiver (20 Hz – 26.5 GHz)	Rohde & Schwarz	ESIB 26	836119/006	1010	12/09/22	3 Years	12/09/25
OATS Site (30 MHz – 1 GHz)	BEC	N/A	N/A	705	10/07/23	1 Year	10/07/24
Antenna (30 MHz - 6 GHz)	Sunol Sciences	JB6	A020714	882	05/24/21	3 Years	05/24/24
EMC Analyzer (9 kHz - 3 GHz)	Agilent	E7402A	US39440162	883	06/21/21	3 Years	06/21/24
Antenna (30 MHz - 6 GHz)	Sunol Sciences	JB6	A020714	882	05/24/21	3 Years	05/24/24
EMC Analyzer (9 kHz - 26.5 GHz)	Hewlett Packard	8593EM	3710A00214	1026	03/23/20	5 Years	03/23/25
Double Ridged Horn Antenna (1 - 18 GHz)	EMCO	3115	9705-5225	1028	11/24/21	3 Years	11/21/24
Software (TILE)	Quantum Change/EMC Systems	Version 3	N/A	N/A	No Cal. Required	No Cal. Required	No Cal. Required
Radiated Emissions Test Software	BEC	RADE	2.2	N/A	No Cal. Required	No Cal. Required	No Cal. Required



## Appendix B – Open Area Test Site Layout Diagram





## Appendix C – Emissions Shielded Room Layout Diagram

### SITE DESCRIPTION

The chamber is a 3 Meter semi-anechoic chamber with the ferrite absorbers on all walls and ceiling and is re-categorized as a Fully anechoic chamber when absorbers are added in between the test area and measurement antenna. The turn-table and mast are controlled externally by the ETS Lindgren 2090 Controller. The metal computer floor provides the ground plane for the site. Inside room dimensions are 22' Long by 13' Wide by 11'5" High. Outside room dimensions are 22'8" Long by 14' Wide by 12'9" High.

