



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-2306-01


TEST DATES: 03/12/2024 – 03/26/2024

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

PREPARED BY: _____


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REVIEWED and APPROVED BY: _____


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Notice to Customer

This report and any recommendations it contain represent the result of BEC’s testing and assessment on behalf of your company. Testing has been conducted according to accepted engineering standards and practices. This report reflects testing and assessment of product samples provided by your company and may not reflect the characteristics of other samples, especially those produced at different times. This report and its findings and recommendations, if implemented, should not be construed as an assurance or implied warranty for the continuing electromagnetic compatibility (EMC) of the product. **BEC shall not be liable for incidental or consequential damages, even if advised of the possibility thereof.**

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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	04/10/2024



1.0 Administrative Information

1.1 General Project Details

Project Number	BEC-2306
Manufacturer	Lutron Electronics
Model Numbers Tested	QSERJ-EDU
EUT Description	Wireless Battery-operated Motor Drive
EUT Serial Number	D04BC0407D
EUT Sample Number	2306-01
EUT Sample Type	Radiated Emissions Test Sample with Test Code
EUT Condition Received	Prototype Unit Suitable for test
EUT Firmware Version	2.017
Frequency of Operation	431 MHz to 437 MHz
Antenna Gain	-2.85 dBi (-5.0 dBd)
Antenna Type	Monopole Antenna
Antenna Construction	Coax Wire Antenna
Equipment Transmitter Type	DTS
Modulation	FSK
FCC Classification	DSR, Part 15 Remote Control/Security Device Transceiver
Date Samples Received	03/11/2024
FCC ID	JPZ0152
ISED ID	2851A-JPZ0152
ISED HVIN	ARC-A
Applicable FCC and ISED Rules	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

Test Laboratory Location	BEC Incorporated 970 East High Street Pottstown, PA 19464
Test Personnel	Steve Fanella / JR Fanella
BEC Laboratory Number FCC Registration	US1118
BEC Laboratory Number ISED Registration	7342A-1
Test Performed For	Lutron Electronics Co Incorporated 7200 Suter Road Coopersburg, PA 18036
Customer Technical Contact	Geri Gonzalez
Customer Reference Number	PO # 5324162



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
4.1	15.203	-	6.8	-	Antenna Requirement	Compliant
4.2	15.203	-	6.8	-	Antenna Construction	Compliant
4.3	FCC 15.205, 15.209, 15.231(b)	A.1.2	6.13, 7.3 and 8.10	-	Radiated Emissions	PASS
4.4	IEEE/ANSI C63.10	-	-	11.6	Duty Cycle Measurement	Measured
4.5	FCC 15.231(c)	A.1.3	-	-	20 dB Bandwidth	PASS
4.6	-	-	6.7	-	99% Occupied Bandwidth	PASS
4.7	FCC 15.231(a)(1)	A.1.1 (a)	-	-	Deactivation Testing	PASS
4.8	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 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 2.0 RF Test Code. Range Test Mode provided the ability to Transmit a Single Packet.

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

- Radiated Fundamental and Spurious Measurement (Sample 2306-01)
- Fundamental Measurement (Sample 2306-01 and Sample 2306-01)
- 20 dB Bandwidth Measurement (Sample 2306-01)
- 99% Occupied Bandwidth Measurement (Sample 2306-01)

Lutron Model QSERJ-EDU with 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 2306-01)
- Automatic transmitter shut off after 5 seconds (Sample 2306-01)

Lutron Model QSERJ-EDU with 2.0 RF Test Code, Mode 2, State 4 RX Mode was used during the following test: Spurious Measurements (Sample 2306-01)



2.5 Test Configuration Rationale

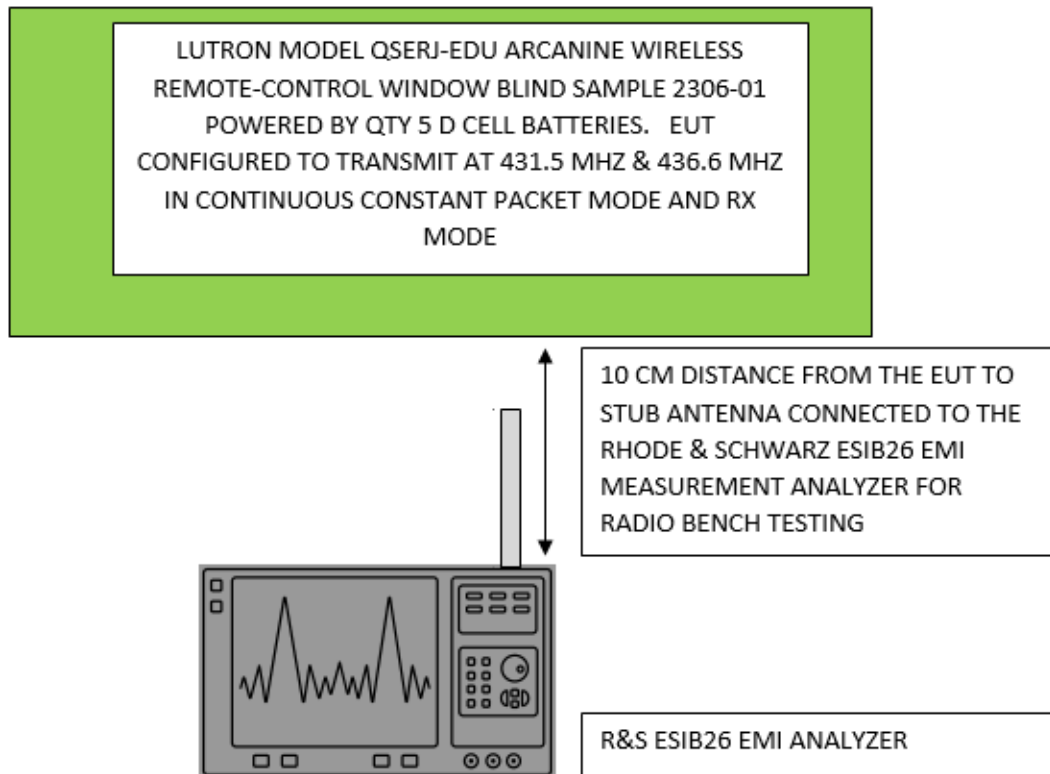
The tested configurations are based on the signal types required to make proper measurements for the testing to FCC Part 15.231 and RSS-210.

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

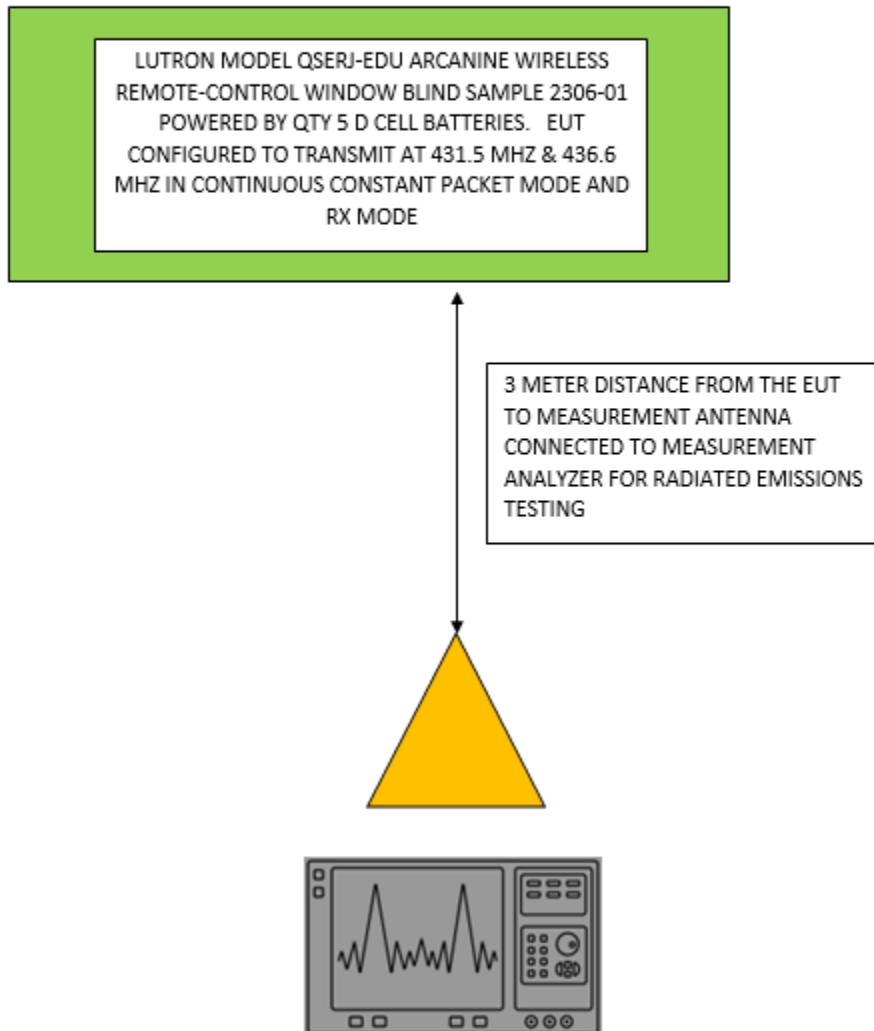
LUTRON MODEL QSERJ-EDU RADIO BENCH TESTING TEST SETUP DIAGRAM





Fundamental and Spurious Radiated Emissions Test Setup Diagram

LUTRON MODEL QSERJ-EDU FUNDAMENTAL & SPURIOUS 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 2.0 RF Test Code	Lutron	QSERJ-EDU	D04BC0407D	2.017	2306-01

Support Equipment

EUT Description	Manufacturer	Model	Serial Number
Qty 5, 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 five (5) 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 -2.85 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	¹ 1,250 to 3,750	¹ 125 to 375
174-260	3,750	375
260-470	¹ 3,750 to 12,500	¹ 375 to 1,250
Above 470	12,500	1,250

¹Linear 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 μ V/m) = Meter Reading (dB μ 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.

Frequency Range	9 kHz to 5 GHz
Test Standards	FCC Part 15.209, FCC Part 15.231 (b) and RSS-210
Class Limits	FCC Part 15.209, FCC Part 15.231 (b) and RSS-210 A.1.2
EUT Type	Wireless Battery-operated Motor Drive - Radiated Sample
Manufacturer/Model	Lutron Model QSERJ-EDU
Sample Number	2306-01
Port Tested	Enclosure
EUT Power	Battery Powered (Qty 5 1.5V DC D Cells Alkaline)
Transmit Frequencies	431.5 MHz and 436.6 MHz
Transmission Mode	Continuous Constant Packet Mode with FSK Modulation
Test Date(s)	03/12/2024
Temperature	20°C
Humidity	30% RH
Test Date(s)	03/13/2024
Temperature	21°C
Humidity	40% RH
Test Date(s)	03/14/2024
Temperature	21°C
Humidity	43% RH
Test Date(s)	03/25/2024
Temperature	12°C
Humidity	31% RH

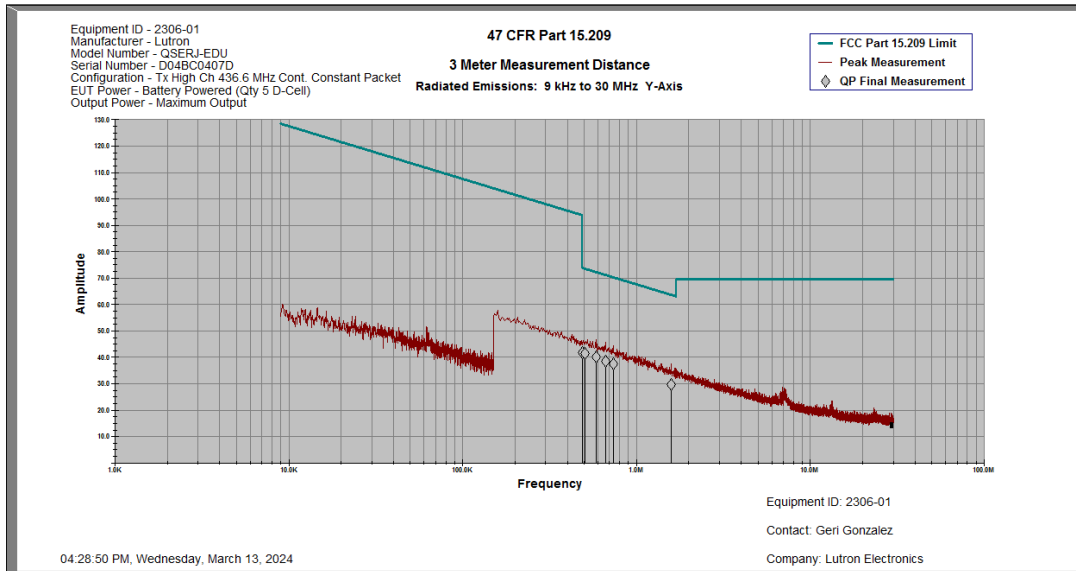


4.3.4 Radiated Emissions 9 kHz – 30 MHz Test Results (03/13/2024)

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 Y Axis. All other polarizations and transmit frequencies and receive modes showed noise floor measurements and data results are available upon request.

Y Axis	Frequency	Peak Adjusted	QP Adjusted	Turntable Angle	Antenna Height	Correction Factors	Limits	QP Margin	Result
	kHz	dBuV/m	dBuV/m	degrees	cm	dB	dBuV/m	dB	Pass/Fail
	490.924	40.88	41.65	0	100	-19.45	73.78	-32.14	Pass
	506.063	40.86	41.32	0	100	-19.42	73.52	-32.20	Pass
	585.474	38.56	39.95	0	100	-19.41	72.25	-32.31	Pass
	667.268	38.96	38.58	0	100	-19.47	71.12	-32.54	Pass
	733.685	37.12	37.59	0	100	-19.51	70.29	-32.70	Pass
	1575.410	29.46	29.74	0	100	-19.13	63.66	-33.92	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 32.14 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.

Frequency	Peak Corrected	Polarity	Turntable Angle	Antenna Height	Antenna Amplifier Cable Correction Factors	Peak Level	Duty Cycle C/F	Corrected Peak Level With DCCF	FCC Part 15.231 & RSS-210 Fundamental Limit	Margin
MHz	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dBuV/m	dB
431.53	91.95	H	138	206	25.46	91.95	19.98	71.97	80.75	-8.78
431.53	87.66	V	198	233	25.46	87.66	19.98	67.68	80.75	-13.07
Frequency	Peak Corrected	Polarity	Turntable Angle	Antenna Height	Antenna Amplifier Cable Correction Factors	Peak Level	Duty Cycle C/F	Corrected Peak Level With DCCF	FCC Part 15.231 & RSS-210 Fundamental Limit	Margin
MHz	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dBuV/m	dB
436.55	92.79	H	137	205	25.46	92.79	19.98	72.81	80.91	-8.1
436.55	88.12	V	75	222	25.46	88.12	19.98	68.14	80.91	-12.77

Test Results: The Lutron Model QSERJ-EDU Wireless Battery-operated Motor Drive BEC Sample 2306-01 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 8.1 dB.



4.3.5.2 Spurious Radiated Emissions 30 MHz – 1000 MHz Test Results (03/13/2024 and 03/14/2024)

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.

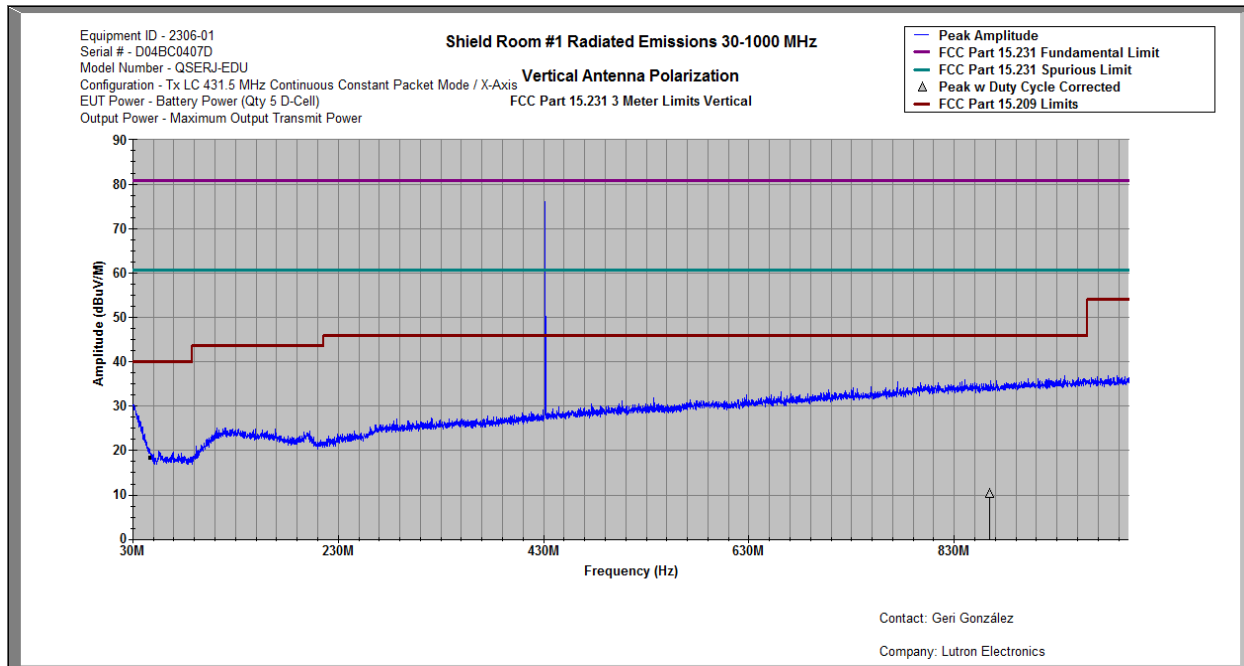
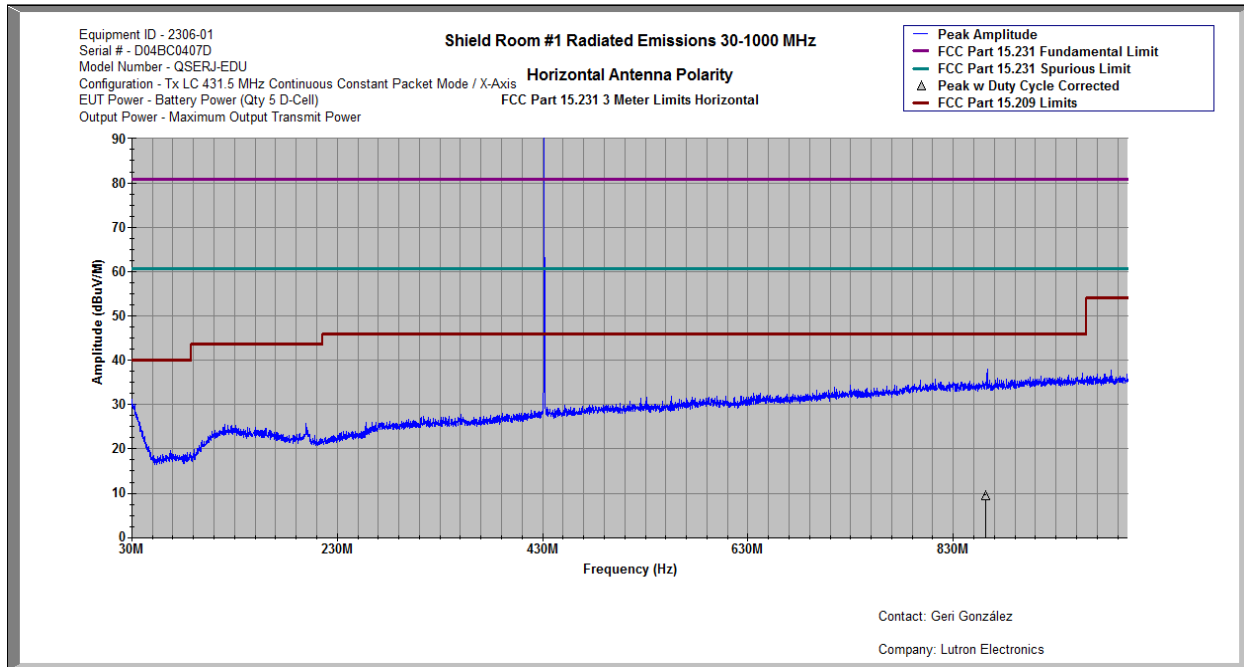
Tx Frequency of 431.5 MHz and 436.6 MHz
Limit: FCC Part 15.231 and RSS-102 A.1.2

Tx Fundamental	Measured Frequency (Spurious)	Peak Corrected	QP Corrected	Polarity	TT angle	Ant Height	Antenna Amplifier Cable C/F	Peak Level (Duty Cycle Corrected)	FCC Part 15.231 and RSS-210 Section A.1.2 Table A1 Limits		Margin		Duty Cycle Correction Factors	
									Fundamental	Spurious	Fundamental	Spurious		
MHz	MHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	(dB)	(dB)	dB
431.50	861.875	29.32	27.25	H	192	116	3.53	9.34	N/A	60.75	N/A	-51.41	19.98	
431.50	864.642	30.37	27.16	V	249	194	3.45	10.39	N/A	60.75	N/A	-50.36	19.98	
Tx Fundamental	Measured Frequency (Spurious)	Peak Corrected	QP Corrected	Polarity	TT angle	Ant Height	Antenna Amplifier Cable C/F	Peak Level (Duty Cycle Corrected)	FCC Part 15.231 and RSS-210 Section A.1.2 Table A1 Limits		Margin		Duty Cycle Correction Factors	
MHz	MHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	Fundamental	Spurious	Fundamental	Spurious	dB	
431.50	873.122	37.78	35.77	H	36	101	3.55	17.8	N/A	60.91	N/A	-42.9	19.98	
431.50	872.547	32.09	27.28	V	243	204	3.54	12.11	N/A	60.91	N/A	-48.59	19.98	

Test Results: The Lutron Model QSERJ-EDU Wireless Battery-operated Motor Drive Sample 2306-01 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 42.90 dB. The measured levels of the radiated emissions also meet the limits of FCC Part 15.205, 15.35(b) and RSS-Gen.

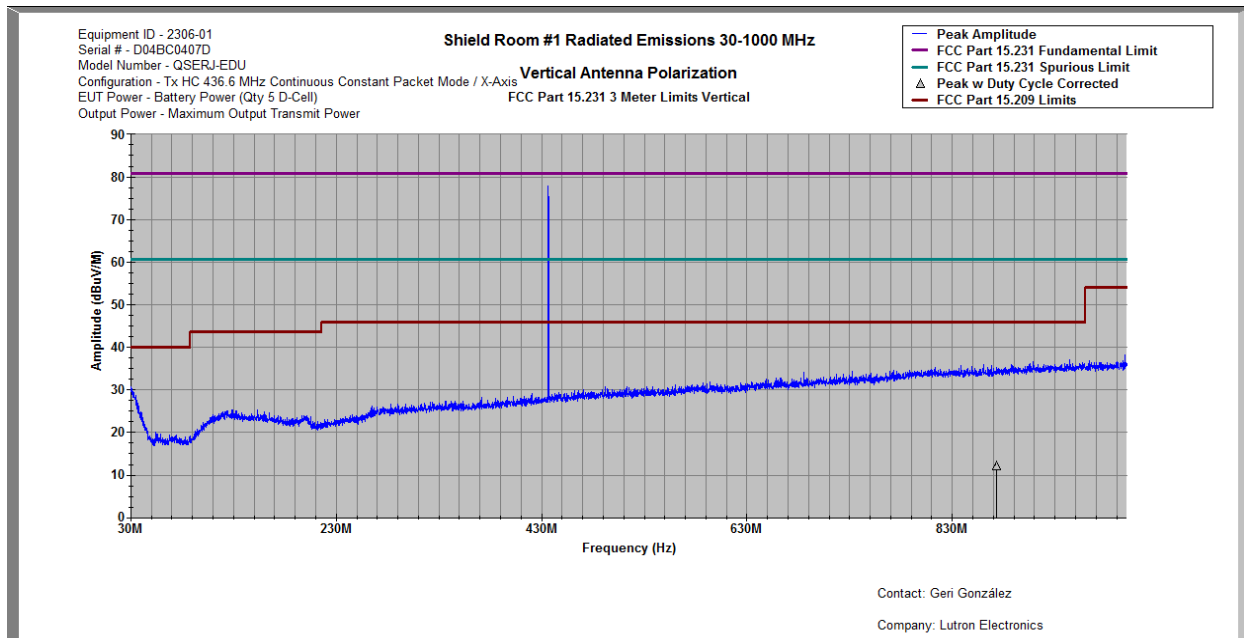
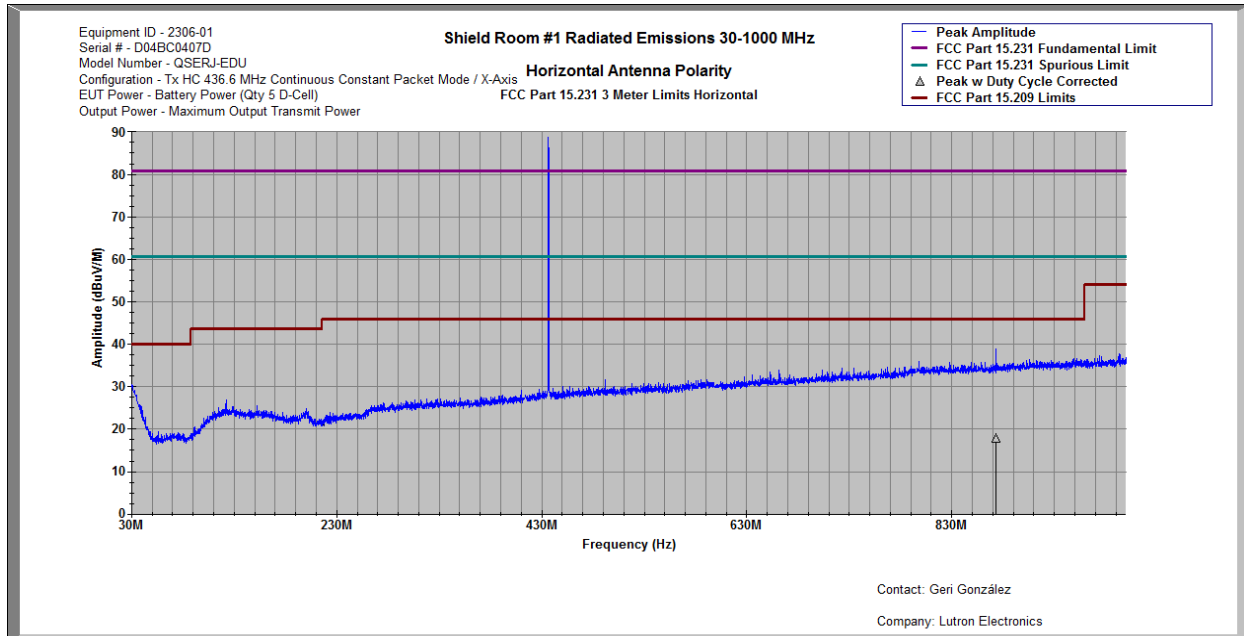


Graphs of Radiated Emissions 30 MHz to 1000 MHz Tx Frequency of 431.5 MHz



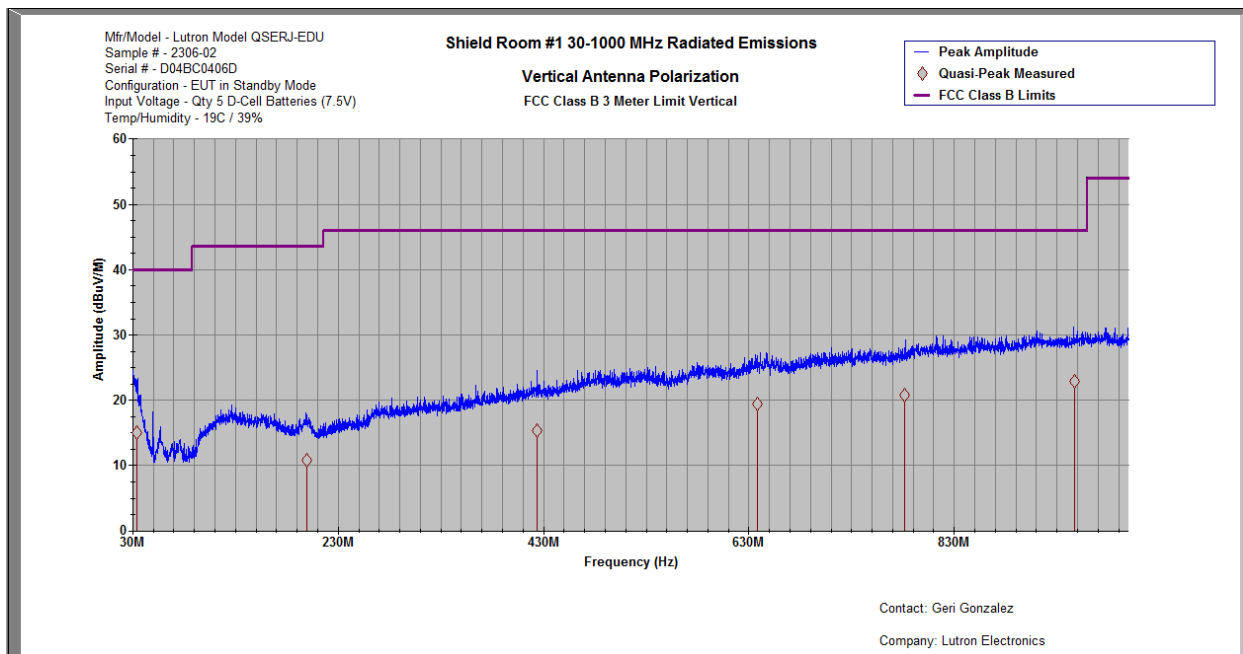
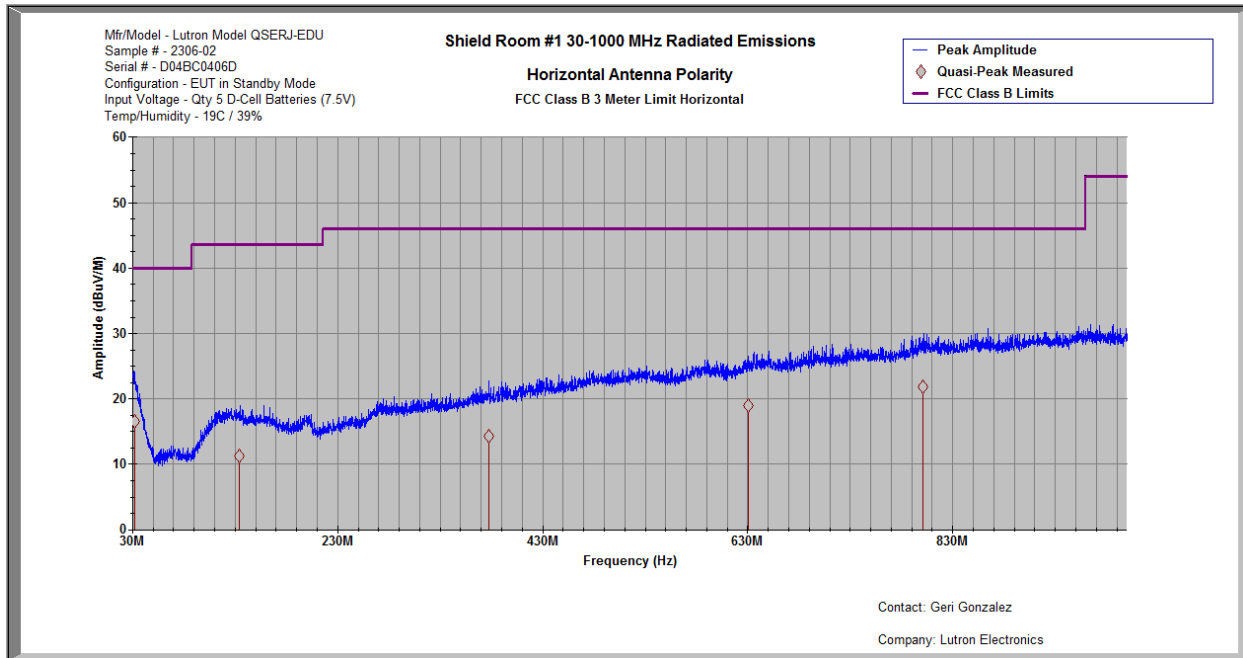


Graphs of Radiated Emissions 30 MHz to 1000 MHz Tx Frequency of 436.6 MHz





Graphs of Radiated Emissions 30 MHz to 1000 MHz Rx Mode





4.3.5.3 Spurious Radiated Emissions 1 GHz – 5 GHz Test Results (03/14/2024)

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 Corrected	Average Corrected	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
	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	dB	dB
* 1.29438	39.87	36.21	H	249	144	-11.90	53.98	-17.77	19.89	60.75	-40.86	19.98
* 1.73124	33.53	22.46	H	29	159	-9.01	53.98	-31.52	13.55	60.75	-47.20	19.98
1.9340	33.14	23.1	H	222	212	-7.29	53.98	-30.88	N/A	N/A	N/A	N/A
* 2.1575	38.05	31.26	H	45	212	-6.61	53.98	-22.72	18.07	60.75	-42.68	19.98
* 3.02024	29.55	20.17	H	66	101	-2.71	53.98	-33.81	9.57	60.75	-51.18	19.98
* 4.30945	32.55	22.29	H	274	102	0.33	53.98	-31.69	12.57	60.75	-48.18	19.98
* 1.29434	37.76	31.23	V	319	191	-11.90	53.98	-22.75	17.78	60.75	-42.97	19.98
* 1.72651	32.42	22.19	V	181	148	-9.10	53.98	-31.79	12.44	60.75	-48.31	19.98
* 2.592	34.91	24.15	V	138	146	-4.92	53.98	-29.83	14.93	60.75	-45.82	19.98
* 3.45231	29.98	21	V	13	122	-1.70	53.98	-32.98	10.00	60.75	-50.75	19.98
* 4.30483	33.34	22.25	V	76	144	0.32	53.98	-31.73	13.36	60.75	-47.39	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 Corrected	Average Corrected	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
	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	dB	dB
* 1.31009	38.25	36.09	H	246	140	-11.83	53.98	-17.89	18.27	60.91	-42.64	19.98
* 1.74621	30.59	21.66	H	174	101	-8.73	53.98	-32.32	10.61	60.91	-50.30	19.98
* 2.18276	36.36	28.74	H	213	191	-6.60	53.98	-25.24	16.38	60.91	-44.53	19.98
2.6055	35.72	23.89	H	125	131	-4.86	53.98	-30.09	N/A	N/A	N/A	N/A
3.0133	29.38	20.26	H	136	122	-2.75	53.98	-33.72	N/A	N/A	N/A	N/A
* 3.92964	37.68	28.94	H	273	198	0.61	53.98	-25.04	17.70	60.91	-43.21	19.98
* 4.3618	30.59	22.51	H	215	204	0.41	53.98	-31.47	10.61	60.91	-50.30	19.98
* 1.30994	36.04	30.32	V	316	103	-11.84	53.98	-23.66	16.06	60.91	-44.85	19.98
* 1.74544	30.78	21.52	V	137	131	-8.74	53.98	-32.46	10.80	60.91	-50.11	19.98
* 2.18331	33.88	26.37	V	115	108	-6.60	53.98	-27.61	13.90	60.91	-47.01	19.98
* 2.62532	33.54	23.3	V	91	101	-4.75	53.98	-30.68	13.56	60.91	-47.35	19.98
* 3.06927	30.04	20.13	V	63	173	-2.47	53.98	-33.85	10.06	60.91	-50.85	19.98
* 3.92918	37.6	29.58	V	133	207	0.60	53.98	-24.40	17.62	60.91	-43.29	19.98
* 4.37032	32.73	22.14	V	334	154	0.43	53.98	-31.84	12.75	60.91	-48.16	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	Peak Corrected	Average Corrected	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
	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	dB	dB
1.3184	30.4	20.18	H	108	173	-11.79	53.98	-33.80	N/A	N/A	N/A	N/A
1.7590	30.53	21.39	H	2	160	-8.58	53.98	-32.59	N/A	N/A	N/A	N/A
3.4880	30.84	20.94	H	70	102	-1.62	53.98	-33.04	N/A	N/A	N/A	N/A
4.2214	31.9	22.62	H	58	195	0.34	53.98	-31.36	N/A	N/A	N/A	N/A
1.3151	28.71	20.07	V	154	213	-11.81	53.98	-33.91	N/A	N/A	N/A	N/A
1.7486	31.13	21.32	V	282	103	-8.68	53.98	-32.66	N/A	N/A	N/A	N/A
3.4087	31.34	21.15	V	359	106	-1.82	53.98	-32.83	N/A	N/A	N/A	N/A
4.2975	31.76	22.58	V	16	167	0.31	53.98	-31.40	N/A	N/A	N/A	N/A
* 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 2306-01 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 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 1.2944 GHz, the closest margin for the spurious emission limit is 40.86 dB. The closest margin for the restricted band is 17.77 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 2306-01.

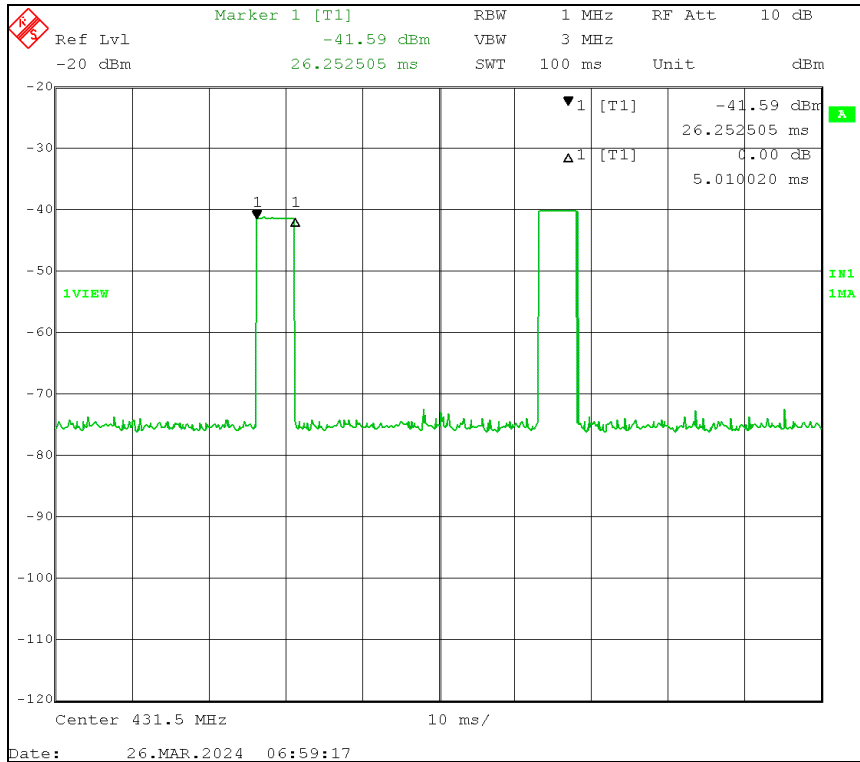
4.4.2 Duty Cycle Measurement General Test Information

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

Frequency Tested	431.5 MHz
Test Standards	ANSI C63.10, 11.6
Class Limits	None
EUT Type	Wireless Battery-operated Motor Drive
Manufacturer/Model	Lutron Model QSERJ-EDU
Sample Number	2306-01
Temperature	20°C
Humidity	31% RH
EUT Power	Battery Powered (Qty 5 1.5V DC D Cells Alkaline)
Test Date(s)	03/26/2024



4.4.3 Duty Cycle Measurement Test Results (03/26/2024)



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 = $20\log(\text{On Time}/\text{Period})$	-19.98	dB

Test Results: The duty cycle measurement of the Lutron Model QSERJ-EDU Wireless Battery-operated Motor Drive BEC Sample 2306-01 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

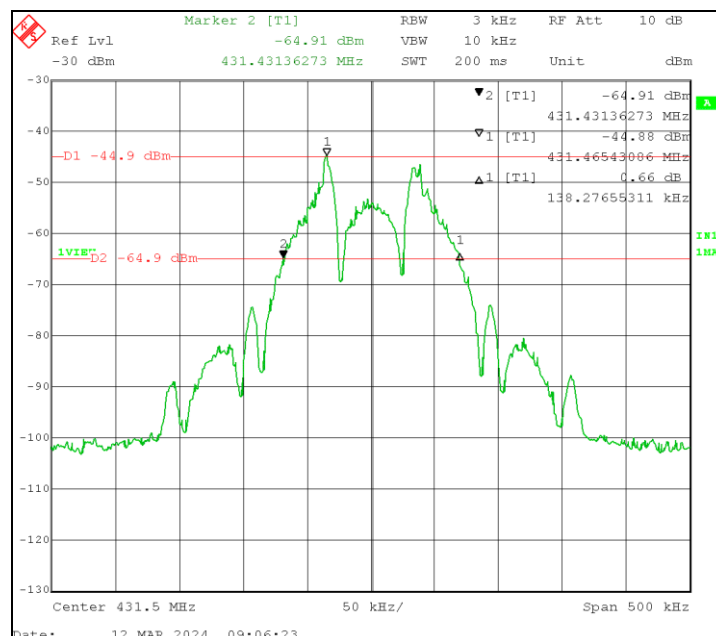
The 20 dB Bandwidth was measured by using the methods called out for in FCC Part 15.231(c) and RSS-210 A.1.23. The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. The Transmit frequencies of 431.5 MHz and 436.6 MHz were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

4.5.2 20 dB Bandwidth Measurement General Test Information

Fundamental Frequencies	431.5 MHz and 436.6 MHz
Test Standards	47 CFR 15.231(c) and RSS-210 A.1.3
Limit	.25 % of Fundamental Center Frequency
EUT Type	Wireless Battery-operated Motor Drive
Manufacturer/Model	Lutron Model QSERJ-EDU
Sample Number	2306-01
Temperature	20°C
Humidity	34% RH
EUT Power	Battery Powered (Qty 5 1.5V DC D Cells Alkaline)
Test Date(s)	03/12/2024

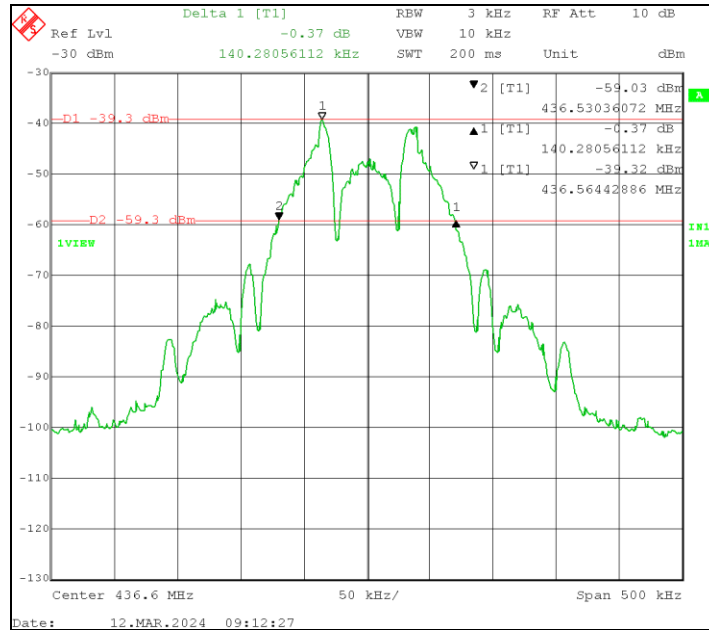
4.5.3 20 dB Bandwidth Measurement Test Results (03/12/2024)

Tx Frequency 431.5 MHz Continuous Constant Packet Mode





Tx Frequency 436.6 MHz Continuous Constant Packet Mode

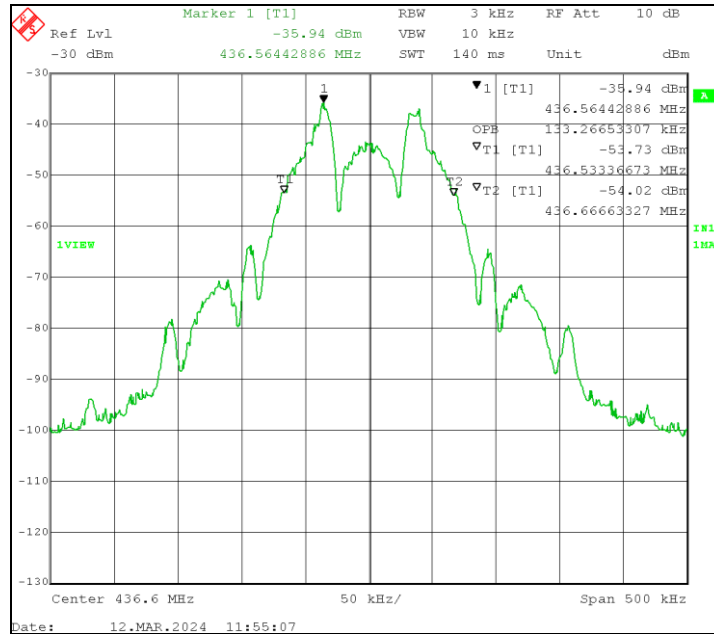


Frequency MHz	Modulation	Meaured BW kHz	20 dB BW Limit kHz	BW Margin kHz
431.50	Continuous Constant Packet	138.27	1078.75	-940.48
436.60	Continuous Constant Packet	140.28	1091.50	-951.22

Test Results: The Lutron Model QSERJ-EDU, BEC Sample 2306-01, complies with the requirements of 47 CFR Part 15.231 and RSS-210 A.1.3 for 20 dB Bandwidth Measurement.



Tx Frequency 436.6 MHz Continuous Constant Packet Mode



Frequency MHz	EUT Test Configuration	Measured 99% BW kHz
431.5	Continuous Constant Packet Mode	134.27
436.6		133.26

Test Results: The Lutron Model QSERJ-EDU, BEC Sample 2306-01 has a maximum 99% Occupied Bandwidth of 134.27 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 2306-01.

4.7.2 Automatic Deactivation Testing General Test Information

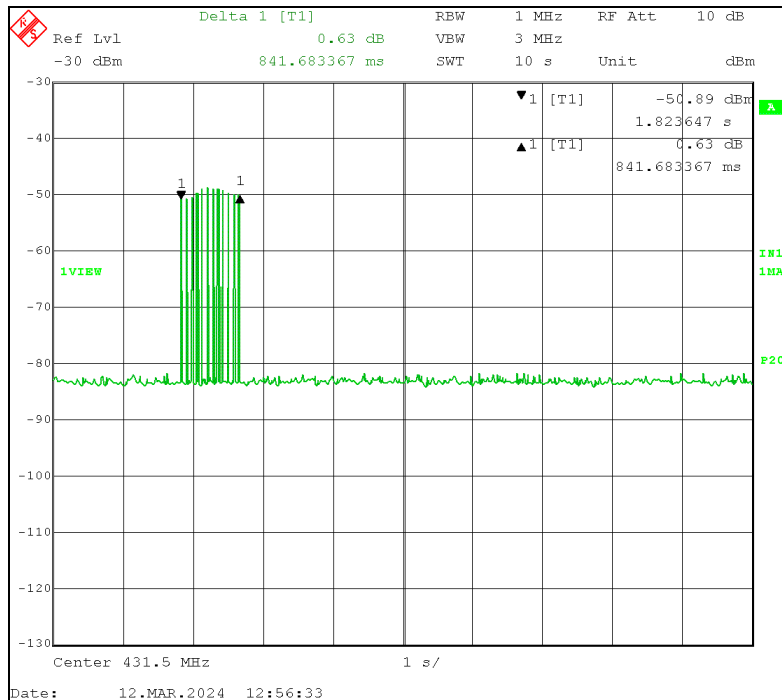
The following information is related to the testing performed for Automatic Deactivation.

Frequency Range	436.6 MHz
Test Standards	47 CFR 15.231(a)(1) and RSS-210 A.1.1 (a)
Limits	Automatic Deactivation 5 Seconds
EUT Type	Wireless Battery-operated Motor Drive
Manufacturer/Model	Lutron Model QSERJ-EDU
Sample Number	2306-01
Temperature	20°C
Humidity	34% RH
EUT Power	Battery Powered (Qty 5 1.5V DC D Cells Alkaline)
Test Date(s)	03/12/2024



4.7.3 Deactivation Testing Test Results (03/12/2024)

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 2306-01, 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 Ω , 50 μH 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 μV) = Meter Reading (dB μv) + 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.

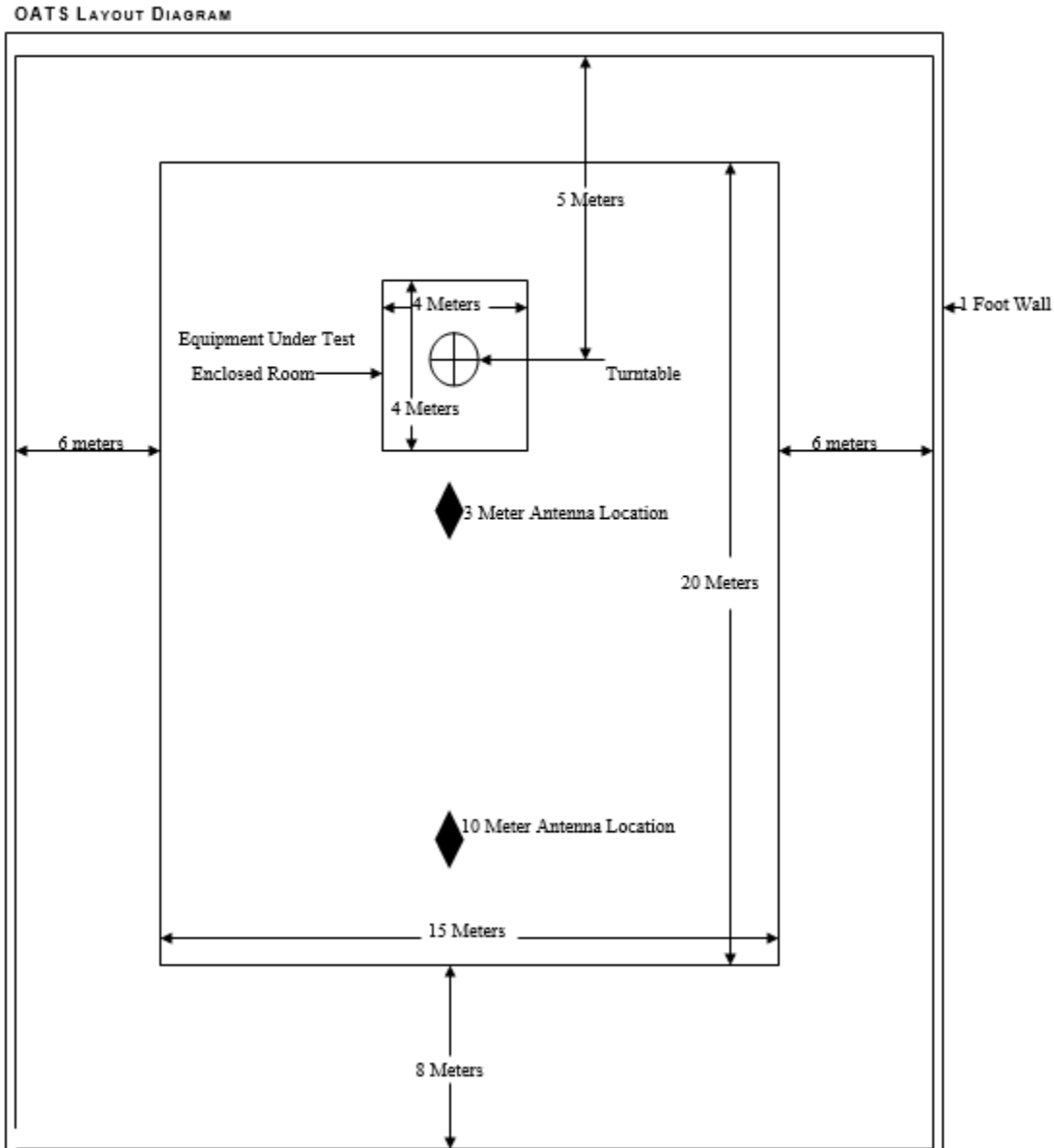


Appendix A – Test Equipment

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.

