BEC INCORPORATED

CERTIFICATION APPLICATION TEST REPORT

TEST STANDARDS:
U.S. 47 CFR Part 15 Subpart C, ISED RSS-Gen & RSS-247
DTS Intentional Radiator

Lutron Electronics Model KL01
Wireless Controlled LED Lamp

FCC ID: JPZ0125
ISED ID: 2851A-JPZ0125

REPORT BEC-2008-01

TEST DATES: 07/29/2019 – 08/26/2019

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

PREPARED BY: _____
Paul Banker**,** Test Engineer

REVIEWED and APPROVED BY: _____
Steve Fanella**,** Quality Manager

ACCREDITED
Testing Cert #2957.01

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Notice To Customer

This report and any recommendations it contains 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. Therefore 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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Revision History

Revision #	Description of Changes	Date of Changes	Date Released
0	Test Report Initial Release	N/A	09/12/2019
1	Section 2.12: Removed EUT Pictures from the report. Section 4.4.1 Conducted Emissions: Corrected 802.15.4 Low Frequency to 2405 MHz in and Clarified that the EUT was tested @ 50% Brightness in the results section of 4.4.2 for TX Conducted Emissions. Section 4.10.1 Band Edge: Correction to BLE OBW measured values. "The OBW of the EUT at 2.402 GHz is *1.0521* MHz" and "The OBW of the EUT at 2.480 GHz is *1.0581* MHz". Added IEEE 802.15.4 *2.405 GHz* OBW which was not defined for the 2.216 MHz value. Section 5.10: Test Setup Pictures Removed from the report.	10/09/2019	10/10/2019

1.0 Administrative Information

1.1 General Project Information

Project Number	BEC-2008	
Manufacturer	Lutron Electronics Company Incorporated	
Model Number	KL01	
Model Configuration	Radio module only with SMA connector for Conducted Configuration	Un-Modified for Radiated Configuration
Serial Numbers	KLALV001_C01	KLALV001_05
Sample Numbers	2008-01	2008-04
FCC ID	JPZ0125	
ISED ID	2851A-JPZ0125	
Radio Chip Manufacturer	Silicon Labs	
Radio Chip Model Number	EFR32MG12	
Frequency of Operation	2402 MHz – 2480 MHz	
Antenna Gain	+ 2.2 dBi	
Wireless Technology Used	BLE and IEEE 802.15.4	
FCC & ISED Classification	Digital Transmission System (DTS)	
Date Samples Received	07/28/2019	
Condition Samples Received	Suitable for test	
Sample Type	Production unit	
EUT Description	Wireless Controlled LED Light Bulb Using BLE and IEEE 802.15.4	
Applicable FCC Rules	47 CFR Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz Direct Sequence System	
Applicable ISED Rules	RSS-Gen: General Requirements for Compliance of Radio Apparatus RSS-247: Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) 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	Paul Banker / Steve Fanella
BEC Laboratory Number FCC Registration	US1118
BEC Laboratory Number ISED Registration	7342A-1
Test Performed For	Lutron Electronics 7200 Suter Road Coopersburg, PA 18036
Customer Technical Contact	Keith Kennedy
Customer Reference Number	PO # 5196687

1.4 Measurement Uncertainty

Measurement	Measurement Distance	Frequency Range	Measurement Limit	Expanded Uncertainty
Conducted Disturbance	N/A	.15 – 30 MHz	Class A or B	2.69
Radiated Disturbance	3 Meter	30 MHz – 1 GHz	Class A or B	4.12
Radiated Disturbance	3 Meter	1 – 18 GHz	Class A or B	4.93

No adjustments to measured data presented in this report are required because all values of uncertainty are less that the CISPR 16-4-2:2011 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.

FCC Registered Test Site Number: US1118
ISED Registered Test Site Number: 7342A-1

1.5 Test Result Summary Table

The Lutron Model KL01 Wireless Controlled LED Lamp was tested and found to be compliant to the sections of the FCC Part 15 Subpart C and RSS standards listed below:

Report Section	FCC Part 15, Subpart C	RSS-Gen	RSS-247	Test Description	Result
4.1	15.203(b)	Annex A 10(g)		Antenna Requirement	**PASS**
4.2	15.204	8.3		External RF power amplifiers and antenna modifications	**PASS**
4.3	15.205(a)	8.9	3.3	Restricted Bands of Operation 30 MHz to 25 GHz	**PASS**
4.4	15.207	7.2, 8.7		Conducted Limits (AC Power)	**PASS**
4.5	15.209	8.10		Radiated Emissions, 30 MHz to 25 GHz	**PASS**
4.6.1	15.247(a)(2)		5.2 (a)	DTS 6 dB Bandwidth	**PASS**
4.6.2		6.7		99% Occupied Bandwidth	**PASS**
4.7	15.247(b)(3)		5.4 (d)	Maximum Peak Power Output and EIRP	**PASS**
4.8	15.247(d)		5.5	Antenna Port, Conducted Spurious Emissions	**PASS**
4.9	15.247(e)		5.2 (b)	Antenna Port, Power Spectral Density	**PASS**
4.10	15.247(d)		5.5	Band Edge Measurement	**PASS**

Interpretation of Test Results: The EUT was tested with BLE with 2FSK modulation and IEEE 802.15.4 with OQPSK modulation. 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

Unless noted elsewhere in this report, the following were the ambient conditions in the laboratory during testing:

Temperature: 22 ° ± 5 °
Humidity: 50% ± 20%
Barometric Pressure: 1000mb ± 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 EUT is a line voltage, fully tunable, and dimmable LED lamp with integrated wireless communication. It contains a RF transceiver and antenna that cannot be changed by the user. The device is used as part of an integrated lighting system. The purpose of the wireless communication is to receive commands and transmit status back to the control system.

2.2 Product Category

FCC Part 15, Subpart C (Section 15.247), IC RSS-Gen, IC RSS-247

2.3 Product Classification

The EUT was tested to Intentional Radiator Testing Requirements, DTS Operation, within the band of 2402 - 2480 MHz.

2.4 Test Configuration

The EUT is configured to operate in receive mode with the load at maximum output, 50% dimming, 1% dimming, and off state.

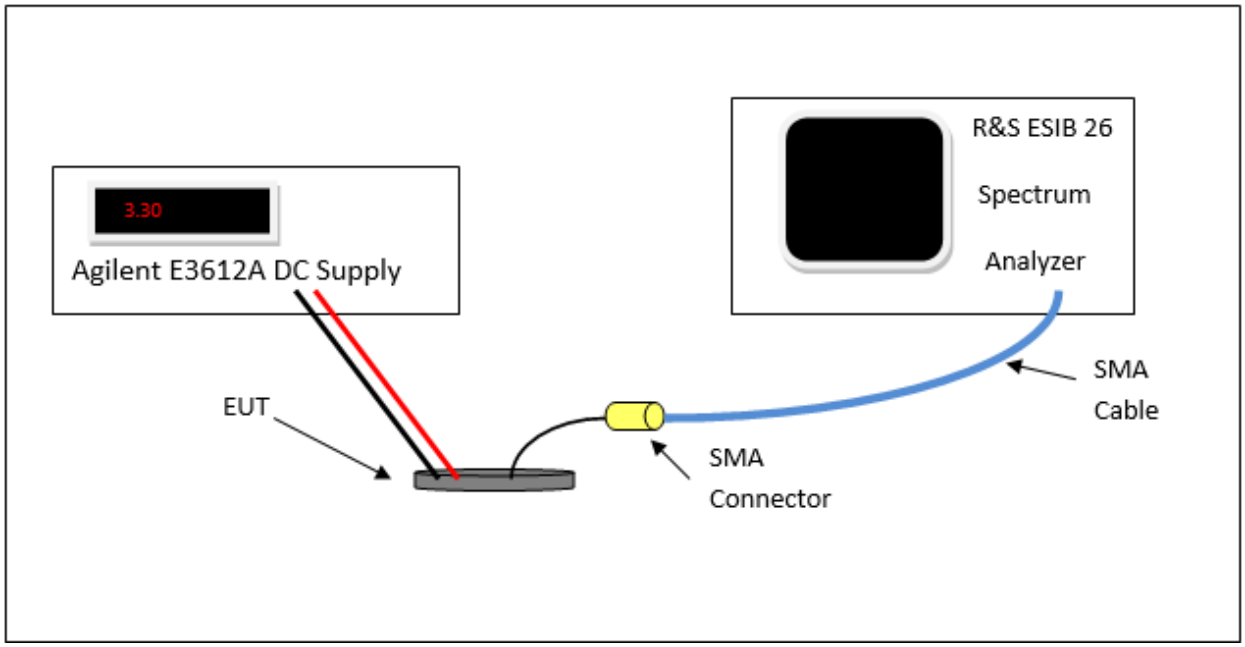
The EUT contains test software to allow for different modes of transmission, different channels of operation, and maximum output, 50% dimming, 1% dimming, and load off states. The EUT is controlled via a wireless interface to select between constant wave, streaming, or maximum duty cycle transmission on the low, middle, or high channel. The radio can be configured to operate in either of its two modulation modes of IEEE 802.15.4 or BLE. A device with antenna installed was provided for radiated testing, and a device with a coaxial connection was provided for conducted testing.

2.5 Test Configuration Rationale

The software control of the radios allows the EUT to be set to specific frequencies with maximum output along with settings for specific modulation types if applicable for the test requirements.

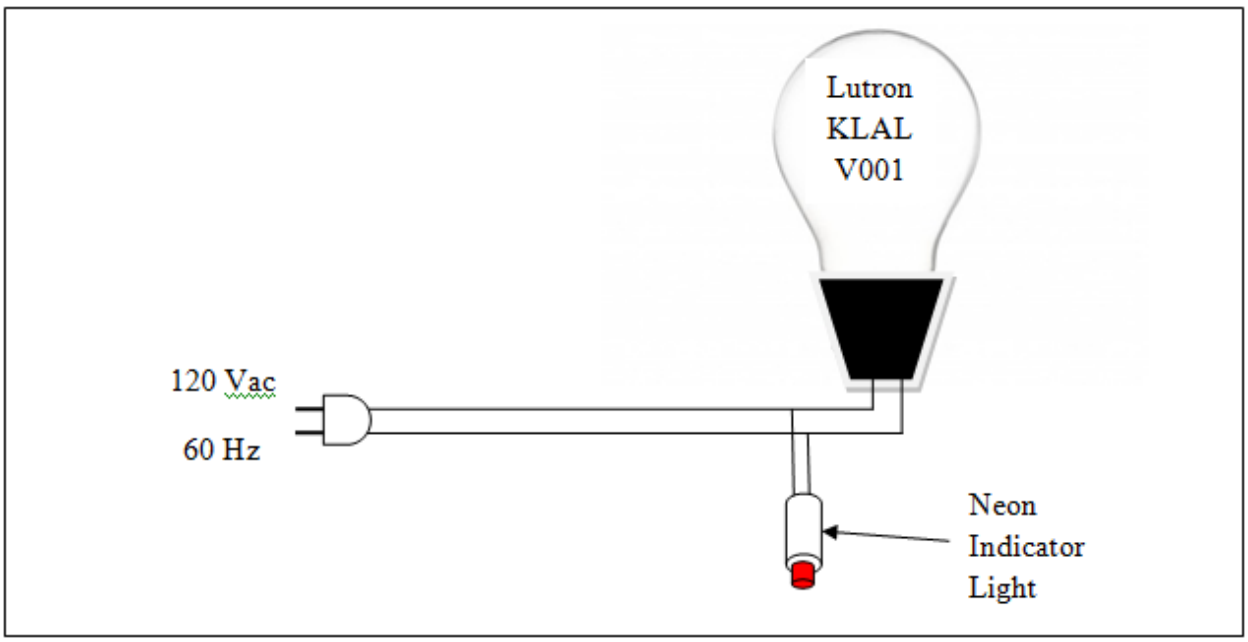
2.6 Test Configuration Diagram (Transmitter Conducted Measurements)

A block diagram of the EUT configuration showing interconnection cables is illustrated below.



2.7 Test Configuration Diagrams (Radiated Measurements)

A block diagram of the EUT configuration showing interconnection cables is illustrated below. The drawing shows the physical hardware layout and AC power distribution.



2.8 EUT Information, Interconnection Cabling and Support Equipment

EUT Hardware

Description	Manufacturer	Model	Serial Number	Sample Number
Wireless Controlled LED Lamp Conducted Configuration Sample with BLE / IEEE 802.15.4 Wireless Transceiver	Lutron Electronics	KL01	KLALV001_C01	2008-01
Wireless Controlled LED Lamp Radiated Configuration Sample	Lutron Electronics	KL01	KLALV001_05	2008-04

Interconnection Cable List (Conducted Configuration Test Setup)

Manufacturer	Model	Type	Shielding	Length	Description
Flexco Microwave Inc.	52214-FC102 4949 0293 A6B	High Frequency RF Cable 1 to 26.5 GHz	Braid	0.7 Meter	Measurement Cable from the Antenna SMA Connector to the Rohde and Schwarz ESIB26 Receiver. Asset # BEC-814
Polar / Solar	16 AWG 3/C	3-wire, 16 AWG	None	9’	AC line cord providing power to the EUT (ground wire: no connection to light fixture)

Interconnection Cable List (Radiated Configuration Test Setup)

Type	Shielding	Length	Description
Qty 3: AC Output 14 Gauge Wire	None	3 Ft	Power Cord Connected from the Light Bulb Fixture to the AC Power Source Feed

Support Equipment

Description	Manufacturer	Model	Serial Number
Porcelain Light Fixture Radiated Configuration	Leviton	NOM057	None
Neon Indicator Light with 4", 22 AWG leads Radiated Configuration	VCC	2150A1	None
USB Wireless Modem Conducted Configuration	NCD.IO	13A200	416B9AC7
Lap Top Computer Conducted Configuration	HP	EliteBook 745 G5	5CG91913XJ
DC Power Supply Conducted Configuration	Agilent	E3612A	MY40000669

2.9 Test Signals and Test Modulation

By design this product does not have an external Modulation input connector, therefore, normal operating modulation was used for all testing reported herein. The only test where modulation was not active was during testing of the Maximum Peak Power Output FCC Section 15.247(b) (3) (Section 4.6 of this report) to ensure that the un-modulated carrier was not higher than the modulated carrier.

The intentional radiator contained in this EUT can be operated as either a BLE transmitter or an IEEE 802.15.4 transmitter. The table below lists the channel frequencies that are utilized by each of the two transmitters.

BLE

BLE	Channel	37	0	1	2	3	4	5	6
	Frequency	2.4020	2.4040	2.4060	2.4080	2.4100	2.4120	2.4140	2.4160
BLE	Channel	7	8	9	10	38	11	12	13
	Frequency	2.4180	2.4200	2.4220	2.4240	2.4260	2.4280	2.4300	2.4320
BLE	Channel	14	15	16	17	18	19	20	21
	Frequency	2.4340	2.4360	2.4380	2.4400	2.4420	2.4440	2.4460	2.4480
BLE	Channel	22	23	24	25	26	27	28	29
	Frequency	2.4500	2.4520	2.4540	2.4560	2.4580	2.4600	2.4620	2.4640
BLE	Channel	30	31	32	33	34	35	36	39
	Frequency	2.4660	2.4680	2.4700	2.4720	2.4740	2.4760	2.4780	2.4800

IEEE 802.15.4

IEEE 802.15.4	Channel	11	12	13	14	15	16	17	18
	Frequency	2.4050	2.4100	2.4150	2.4200	2.4250	2.4300	2.4350	2.4400
IEEE 802.15.4	Channel	19	20	21	22	23	24	25	26
	Frequency	2.4450	2.4500	2.4550	2.4600	2.4650	2.4700	2.4750	2.4800

For the BLE testing, the EUT was configured to transmit at low Channel 37 (2.4020 GHz), middle Channel 18 (2.4420 GHz) and high Channel 39 (2.4800 GHz). The signal was modulated with 2FSK.

For the IEEE 802.15.4 testing, the EUT was configured to transmit at low Channel 11 (2.4050 GHz), middle Channel 18 (2.4400 GHz) and high Channel 26 (2.4800 GHz). The signal was modulated with Offset Quadrature Phase Shift Keying (OQPSK)

2.10 Grounding

There was no ground connection. During the conducted antenna measurements DC power was supplied directly to the EUT. Radiated and conducted emissions measurements were made with the EUT installed in the base of an LED lamp. The LED lamp was connected to AC through a porcelain fixture with phase and neutral connections only.

2.11 EUT Modifications

With the exception for the attachment of an SMA connector directly to the antenna output on the main board of the Lutron Model KL01, no modifications were made to the EUT.

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 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

3.1.2 Innovative Science and Economic Development Canada (ISED) Requirements

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

RSS-247 Issue 2 February 2017: Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

3.1.3 Basic Test Methods and Test Procedures

558074 D01 15.247 Meas Guidance v05r01, Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating under Section 15.247.

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.

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 ANNEX A (10)(g))

The antenna used by the Lutron Model KL01 Wireless Controlled LED Lamp is a Monopole with permanent connect to the PCB and no user access. There are no detachable parts of the antenna. The antenna is not replaceable, nor changeable, and therefore complies with the requirements of this section.

4.2 External RF power amps/antenna modifications (47 CFR 15.204)(RSS-GEN 8.3)

There are no RF power amplifier kits available to be used with the Lutron Model KL01 Wireless Controlled LED Lamp. There are no detachable parts of the antenna. The antenna is not replaceable, nor changeable, and therefore complies with the requirements of this section.

4.3 Restricted Bands of Operation 30 MHz - 25 GHz (47 CFR 15.205)(RSS-GEN 8.9)

The emissions from the Lutron Model KL01 Wireless Controlled LED Lamp, which fall in the restricted bands of operation, detailed in this section, comply with the limits of 15.209.

Measurement of the signals was performed with the EUT on a turntable and a variable height antenna mast at 3 meters distance. The signals residing in restricted bands of operation are listed in the tables below.

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 enclosure is free of reflective metallic objects and extraneous electromagnetic signals and complies with the attenuation measurements specified in ANSI C63.4 and CISPR 22. This non-metallic enclosure and the 3 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 was placed on a table, 80 cm high (30 – 1000 MHz) and 150 cm (1 – 25 GHz).

SR#1
The Semi-Anechoic Shielded Room (SR#1) is an 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 and complies with the attenuation measurements specified in ANSI C63.4. 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 was placed on a table, 80 cm high (30 – 1000 MHz) and 150 cm (1 – 25 GHz).

4.3.2 Restricted Bands Radiated Emissions Test Procedure

Radiated Emissions 30 MHz – 25 GHz
The EMI receiver was set to peak and quasi-peak mode for frequencies from 30MHz to 1GHz and peak and average for frequencies from 1 – 25 GHz. The appropriate CISPR bandwidths were employed. 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 (dBµV/m) = Meter Reading (dBµV) + Antenna Factor (dB/m) + Cable Loss (dB) – Amplifier Gain (dB)

4.3.3 Restricted Bands of Operation 30 MHz – 25 GHz Test Results (08/14/2019)

The Lutron KL01 was measured for radiated emissions from 30 MHz to 25 GHz. The test was performed for three channels each in both BLE and IEEE 802.15.4 transmit modes. The data is presented in Section 4.5 of this report. Those signals residing in a restricted band, according to 47 CFR Part 15.205 and RSS-Gen Section 8.10, are marked as "Restricted Band Signals."

Test Results: Signals, emitting from the Lutron Model KL01 Wireless Controlled LED Lamp, that are marked as "Restricted Band Signals," comply with the requirements of 47 CFR Part 15.205 and RSS-Gen Section 8.10 for restricted bands of operation with a margin of 9.48 dB.

4.4 Conducted Emissions .15 – 30 MHz (47 CFR Part 15.207) (RSS-Gen 8.7)

4.4.1 Conducted Emissions 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 above. The significant amplitudes of emissions measured on the AC power lines of the EUT were recorded as follows:

Emission (dBμV) = Meter Reading (dBμv) + Cable Loss (dB) + LISN Factor (dB) + Limiter Loss (dB)

To determine the worst case conducted emissions, the Lutron KL01 was tested at three Controlled LED Lamp intensity levels: 0%, 50% and 100% while continuously transmitting at IEEE 802.15.4 Low Frequency of 2405 MHz. It was determined that the highest emissions occur when at 50% brightness. The EUT was then measured at middle and high frequencies, both BLE and IEEE 802.15.4 transmission, at 50% light intensity. The highest conducted emissions were measured with 50% light intensity at the Middle Tx Channels of 802.15.4 (2440 MHz) and BLE (2442 MHz).

The data below depicts the highest emissions, neutral and phase lines, for the frequency at both transmission modes which showed the highest levels. There is also data depicting the conducted emissions for the Lutron KL01 in receive mode. This data depicts the EUT, in receive mode, with light intensity of 1%. This level of intensity produced higher emissions than light intensity at 100%.

4.4.2 Conducted Emissions Test Results, Transmit Mode

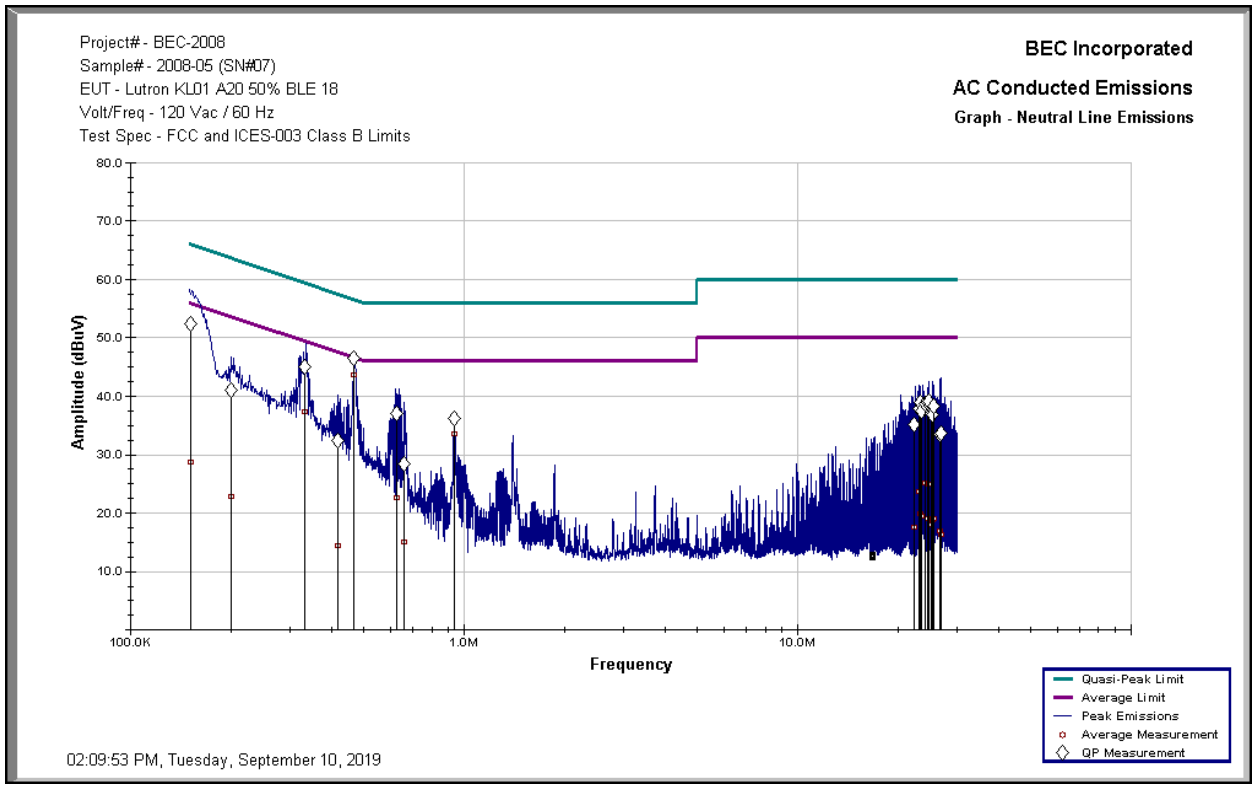
BLE Transmission, Middle Channel (18) 2442 MHz @ 50 % Brightness

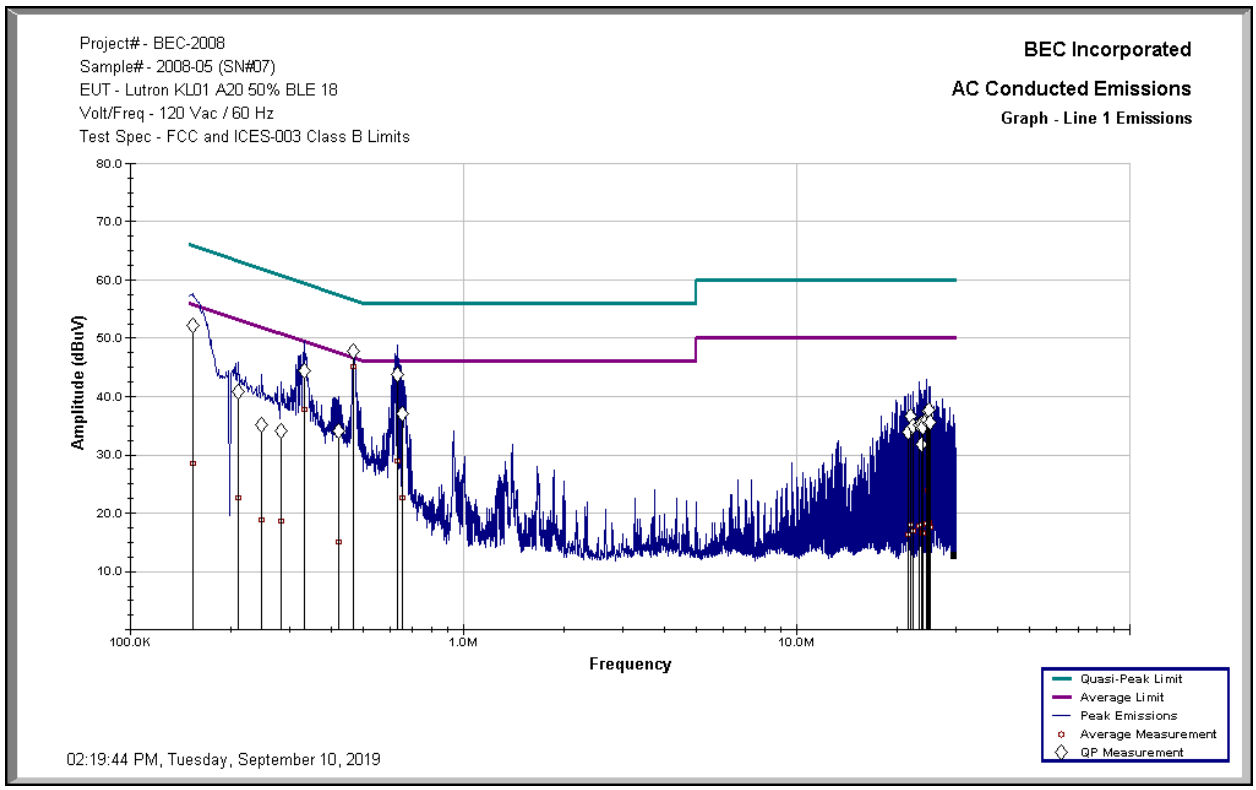
BEC Incorporated
Neutral Line Conducted Emissions
02:01:34 PM, Tuesday, September 10, 2019

	1	2	3	4	5	6	7
Frequency	AVG	AVG	AVG	QP	QP	QP	Correction
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor
151.669 KHz	28.78	55.95	-27.18	52.30	65.95	-13.65	14.57
200.828 KHz	23.00	54.55	-31.54	40.98	64.55	-23.57	13.28
333.872 KHz	37.43	50.75	-13.32	45.11	60.75	-15.63	11.03
418.078 KHz	14.51	48.34	-33.83	32.49	58.34	-25.85	10.76
466.407 KHz	43.86	46.96	-3.10	46.48	56.96	-10.48	10.71
628.047 KHz	22.75	46.00	-23.25	36.98	56.00	-19.02	10.62
658.254 KHz	15.12	46.00	-30.88	28.52	56.00	-27.48	10.61
934.450 KHz	33.63	46.00	-12.37	36.26	56.00	-19.74	10.58
22.279 MHz	17.62	50.00	-32.38	35.12	60.00	-24.88	11.21
23.042 MHz	23.71	50.00	-26.29	37.88	60.00	-22.12	11.21
23.265 MHz	19.95	50.00	-30.05	38.94	60.00	-21.06	11.21
23.594 MHz	19.50	50.00	-30.50	37.45	60.00	-22.55	11.21
24.042 MHz	25.33	50.00	-24.67	38.74	60.00	-21.26	11.22
24.593 MHz	19.23	50.00	-30.77	38.92	60.00	-21.08	11.22
24.715 MHz	25.09	50.00	-24.91	39.21	60.00	-20.79	11.22
25.257 MHz	18.16	50.00	-31.84	37.10	60.00	-22.90	11.22
25.270 MHz	18.98	50.00	-31.02	36.79	60.00	-23.21	11.22
25.595 MHz	19.12	50.00	-30.88	38.34	60.00	-21.66	11.23
26.609 MHz	17.15	50.00	-32.85	33.43	60.00	-26.57	11.24
26.937 MHz	16.46	50.00	-33.54	33.60	60.00	-26.40	11.25
Project# - BEC-2008							
Sample# - 2008-05 (SN#07)							
EUT - Lutron KL01 A20 50% BLE 18							
Volt/Freq - 120 Vac / 60 Hz							
Test Spec - FCC and ICES-003 Class B Limits							

BEC Incorporated
Line 1 Conducted Emissions
02:11:22 PM, Tuesday, September 10, 2019

	1	2	3	4	5	6	7
Frequency	AVG	AVG	AVG	QP	QP	QP	Correction
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor
153.532 KHz	28.54	55.90	-27.36	52.18	65.90	-13.72	14.42
211.107 KHz	22.68	54.25	-31.57	40.81	64.25	-23.44	13.04
247.340 KHz	19.03	53.22	-34.19	35.20	63.22	-28.02	12.15
284.084 KHz	18.75	52.17	-33.42	34.04	62.17	-28.13	11.52
334.170 KHz	37.98	50.74	-12.76	44.47	60.74	-16.27	11.04
420.293 KHz	15.16	48.28	-33.12	34.11	58.28	-24.17	10.77
466.234 KHz	45.25	46.96	-1.71	47.84	56.96	-9.12	10.72
633.205 KHz	28.98	46.00	-17.02	43.78	56.00	-12.22	10.64
657.225 KHz	22.72	46.00	-23.28	37.05	56.00	-18.95	10.63
21.623 MHz	16.53	50.00	-33.47	33.89	60.00	-26.11	11.14
21.943 MHz	18.20	50.00	-31.80	36.67	60.00	-23.33	11.14
22.284 MHz	17.13	50.00	-32.87	34.93	60.00	-25.07	11.14
23.289 MHz	17.98	50.00	-32.02	35.15	60.00	-24.85	11.13
23.616 MHz	18.05	50.00	-31.95	35.26	60.00	-24.74	11.13
23.779 MHz	16.93	50.00	-33.07	31.75	60.00	-28.25	11.14
23.861 MHz	16.74	50.00	-33.26	34.79	60.00	-25.21	11.14
24.607 MHz	18.23	50.00	-31.77	35.91	60.00	-24.09	11.14
24.708 MHz	24.08	50.00	-25.92	37.49	60.00	-22.51	11.14
24.927 MHz	18.45	50.00	-31.55	37.58	60.00	-22.42	11.14
25.266 MHz	17.78	50.00	-32.22	35.56	60.00	-24.44	11.14
Project# - BEC-2008							
Sample# - 2008-05 (SN#07)							
EUT - Lutron KL01 A20 50% BLE 18							
Volt/Freq - 120 Vac / 60 Hz							
Test Spec - FCC and ICES-003 Class B Limits							


Project# - BEC-2008
Sample# - 2008-05 (SN#07)
EUT - Lutron KL01 A20 50% BLE 18
Volt/Freq - 120 Vac / 60 Hz
Test Spec - FCC and ICES-003 Class B Limits
BEC Incorporated
AC Conducted Emissions
Graph - Neutral Line Emissions
Amplitude (dBuV)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
100.0K
1.0M
10.0M
Frequency
Quasi-Peak Limit
Average Limit
Peak Emissions
Average Measurement
QP Measurement
02:09:53 PM, Tuesday, September 10, 2019


Project# - BEC-2008
Sample# - 2008-05 (SN#07)
EUT - Lutron KL01 A20 50% BLE 18
Volt/Freq - 120 Vac / 60 Hz
Test Spec - FCC and ICES-003 Class B Limits
BEC Incorporated
AC Conducted Emissions
Graph - Line 1 Emissions
Amplitude (dBuV)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
100.0K
1.0M
10.0M
Frequency
Quasi-Peak Limit
Average Limit
Peak Emissions
Average Measurement
QP Measurement
02:19:44 PM, Tuesday, September 10, 2019

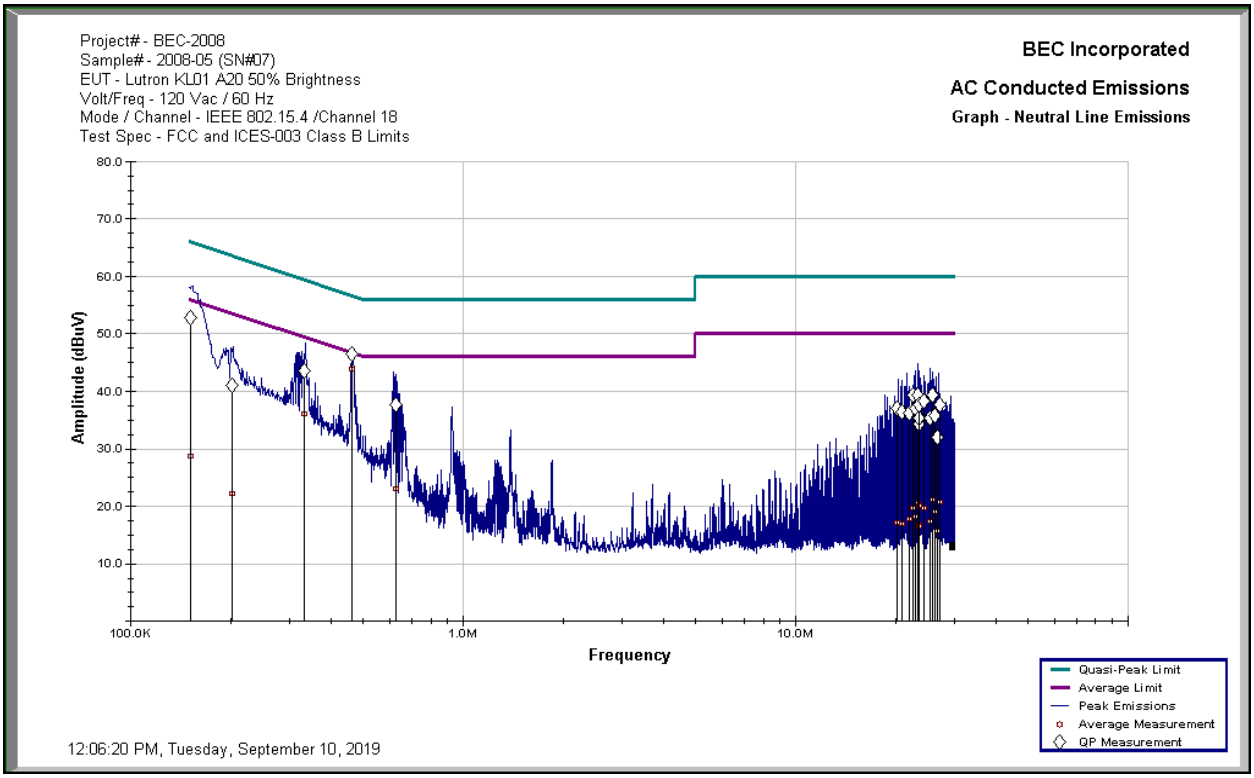
IEEE 802.15.4 Transmission, Middle Channel (18) 2440 MHz @ 50 % Brightness

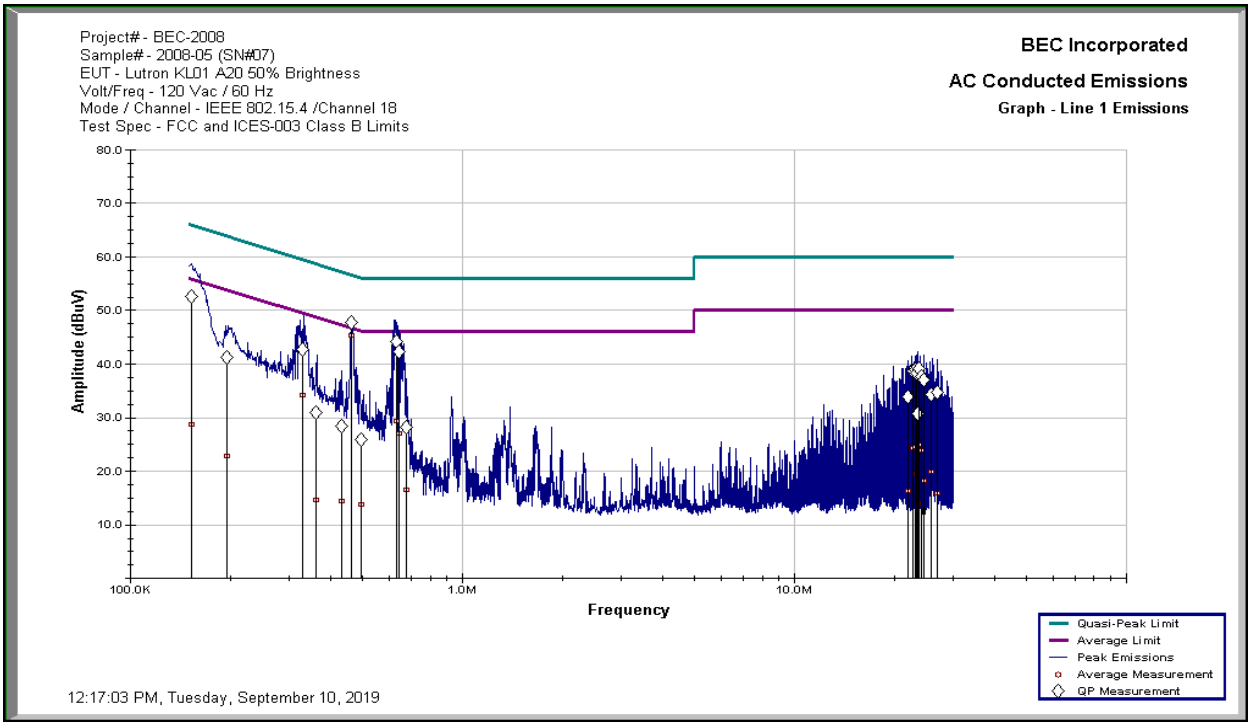
BEC Incorporated
Neutral Line Conducted Emissions
11:58:06 AM, Tuesday, September 10, 2019

	1	2	3	4	5	6	7
Frequency	AVG	AVG	AVG	QP	QP	QP	Correction
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor
151.945 KHz	28.77	55.94	-27.17	52.84	65.94	-13.11	14.55
201.657 KHz	22.25	54.52	-32.28	41.09	64.52	-23.44	13.26
332.517 KHz	36.19	50.79	-14.60	43.49	60.79	-17.29	11.04
463.051 KHz	43.91	47.06	-3.14	46.42	57.06	-10.63	10.71
627.219 KHz	23.12	46.00	-22.88	37.72	56.00	-18.28	10.62
20.268 MHz	17.32	50.00	-32.68	37.09	60.00	-22.91	11.21
20.939 MHz	16.99	50.00	-33.01	36.35	60.00	-23.65	11.20
21.921 MHz	17.97	50.00	-32.03	36.21	60.00	-23.79	11.21
22.597 MHz	19.79	50.00	-30.21	39.36	60.00	-20.64	11.21
22.944 MHz	18.32	50.00	-31.68	37.14	60.00	-22.86	11.21
23.270 MHz	20.57	50.00	-29.43	39.30	60.00	-20.70	11.21
23.522 MHz	16.82	50.00	-33.18	34.34	60.00	-25.66	11.21
23.529 MHz	16.70	50.00	-33.30	35.46	60.00	-24.54	11.21
23.607 MHz	20.13	50.00	-29.87	37.65	60.00	-22.35	11.21
24.269 MHz	19.80	50.00	-30.20	38.31	60.00	-21.69	11.22
25.270 MHz	17.48	50.00	-32.52	35.39	60.00	-24.61	11.22
25.919 MHz	21.17	50.00	-28.83	39.33	60.00	-20.67	11.23
26.246 MHz	19.26	50.00	-30.74	35.80	60.00	-24.20	11.23
26.605 MHz	15.73	50.00	-34.27	31.97	60.00	-28.03	11.24
27.046 MHz	20.89	50.00	-29.11	37.73	60.00	-22.27	11.25
Project# - BEC-2008							
Sample# - 2008-05 (SN#07)							
EUT - Lutron KL01 A20 50% Brightness							
Volt/Freq - 120 Vac / 60 Hz							
Mode / Channel - IEEE 802.15.4 /Channel 18							

BEC Incorporated
Line 1 Conducted Emissions
12:08:41 PM, Tuesday, September 10, 2019

	1	2	3	4	5	6	7
Frequency	AVG	AVG	AVG	QP	QP	QP	Correction
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor
152.479 KHz	28.88	55.93	-27.05	52.60	65.93	-13.33	14.52
195.983 KHz	23.05	54.69	-31.64	41.35	64.69	-23.33	13.26
329.675 KHz	34.27	50.87	-16.59	42.69	60.87	-18.18	11.07
362.583 KHz	14.82	49.93	-35.11	30.85	59.93	-29.07	10.90
433.749 KHz	14.55	47.89	-33.35	28.34	57.89	-29.55	10.75
463.193 KHz	45.36	47.05	-1.69	47.83	57.05	-9.22	10.72
497.228 KHz	13.83	46.08	-32.25	25.80	56.08	-30.28	10.71
630.976 KHz	29.39	46.00	-16.61	44.13	56.00	-11.87	10.64
643.721 KHz	27.20	46.00	-18.80	42.21	56.00	-13.79	10.64
678.650 KHz	16.64	46.00	-29.36	28.18	56.00	-27.82	10.63
21.951 MHz	16.39	50.00	-33.61	33.86	60.00	-26.14	11.14
22.704 MHz	24.48	50.00	-25.52	38.72	60.00	-21.28	11.13
23.042 MHz	24.74	50.00	-25.26	38.96	60.00	-21.04	11.13
23.267 MHz	19.53	50.00	-30.47	38.40	60.00	-21.60	11.13
23.498 MHz	14.06	50.00	-35.94	30.71	60.00	-29.29	11.13
23.704 MHz	25.06	50.00	-24.94	39.06	60.00	-20.94	11.13
24.038 MHz	23.97	50.00	-26.03	37.64	60.00	-22.36	11.14
24.603 MHz	18.43	50.00	-31.57	37.13	60.00	-22.87	11.14
25.930 MHz	20.10	50.00	-29.90	34.28	60.00	-25.72	11.15
26.940 MHz	15.98	50.00	-34.02	34.65	60.00	-25.35	11.16
Project# - BEC-2008							
Sample# - 2008-05 (SN#07)							
EUT - Lutron KL01 A20 50% Brightness							
Volt/Freq - 120 Vac / 60 Hz							
Mode / Channel - IEEE 802.15.4 /Channel 18							





Test Results: Conducted emissions, from the Lutron Model KL01 Wireless Controlled LED Lamp, in transmit mode, comply with the requirements of 47 CFR Part 15.207 and RSS-Gen Section 8.7 for restricted bands of operation with a margin of 1.69 dB.

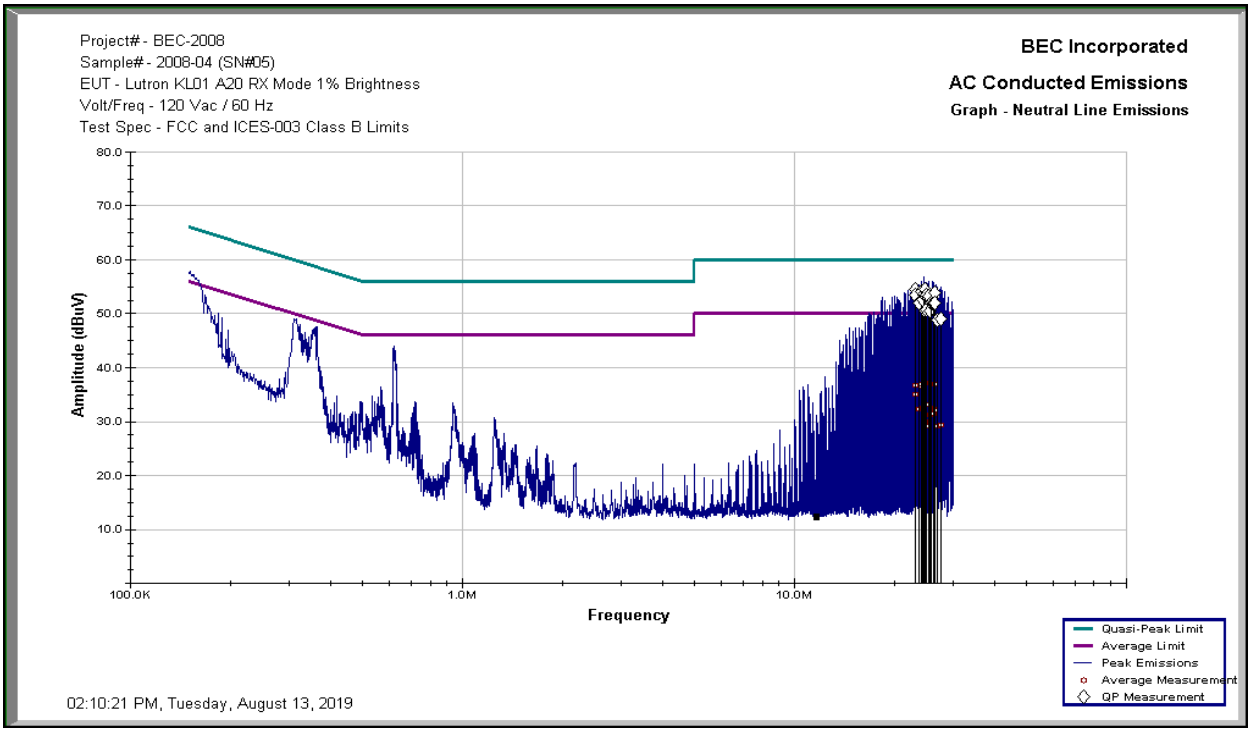
4.4.3 Conducted Emissions Test Results, Receive Mode at 1% Brightness

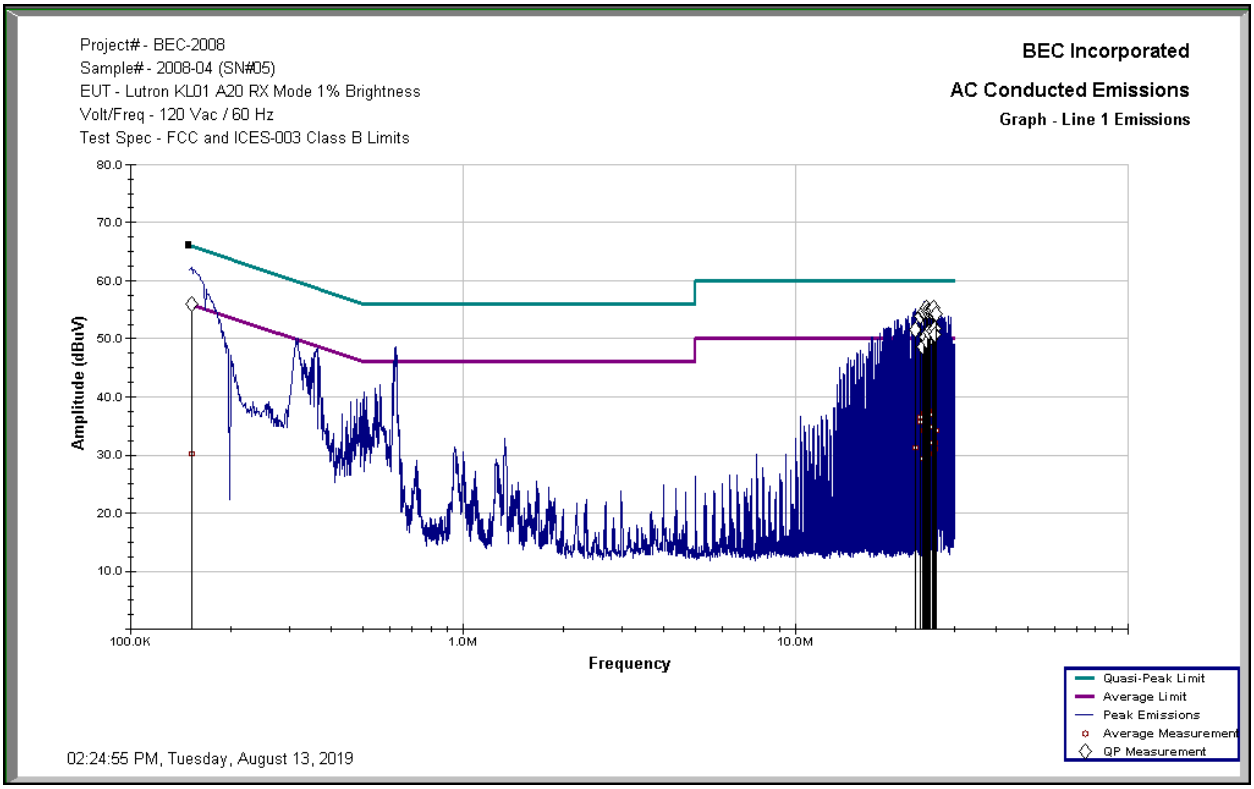
BEC Incorporated
Neutral Line Conducted Emissions
02:10:21 PM, Tuesday, August 13, 2019

	1	2	3	4	5	6	7
Frequency	AVG	AVG	AVG	QP	QP	QP	Correction
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor
23.050 MHz	36.92	50.00	-13.08	54.45	60.00	-5.55	11.21
23.055 MHz	35.07	50.00	-14.93	53.37	60.00	-6.63	11.21
23.619 MHz	32.43	50.00	-17.57	52.07	60.00	-7.93	11.21
24.052 MHz	36.52	50.00	-13.48	54.00	60.00	-6.00	11.22
24.053 MHz	37.06	50.00	-12.94	54.12	60.00	-5.88	11.22
24.287 MHz	32.59	50.00	-17.41	52.65	60.00	-7.35	11.22
24.618 MHz	33.80	50.00	-16.20	53.58	60.00	-6.42	11.22
24.691 MHz	30.08	50.00	-19.92	50.49	60.00	-9.51	11.22
24.716 MHz	37.24	50.00	-12.76	54.54	60.00	-5.46	11.22
24.939 MHz	33.35	50.00	-16.65	53.40	60.00	-6.60	11.22
24.960 MHz	31.28	50.00	-18.72	50.78	60.00	-9.22	11.22
25.272 MHz	29.18	50.00	-20.82	53.25	60.00	-6.75	11.22
25.581 MHz	31.39	50.00	-18.61	50.45	60.00	-9.55	11.23
25.905 MHz	32.61	50.00	-17.39	51.98	60.00	-8.02	11.23
26.235 MHz	31.56	50.00	-18.44	51.82	60.00	-8.18	11.23
26.238 MHz	32.31	50.00	-17.69	51.99	60.00	-8.01	11.23
26.386 MHz	37.06	50.00	-12.94	53.95	60.00	-6.05	11.24
26.576 MHz	32.27	50.00	-17.73	52.04	60.00	-7.96	11.24
26.927 MHz	29.35	50.00	-20.65	48.92	60.00	-11.08	11.25
27.590 MHz	29.39	50.00	-20.61	49.06	60.00	-10.94	11.31
Project# - BEC-2008							
Sample# - 2008-04 (SN#05)							
EUT - Lutron KL01 A20 RX Mode 1% Brightness							
Volt/Freq - 120 Vac / 60 Hz							
Test Spec - FCC and ICES-003 Class B Limits							

BEC Incorporated
Line 1 Conducted Emissions
02:24:55 PM, Tuesday, August 13, 2019

	1	2	3	4	5	6	7
Frequency	AVG	AVG	AVG	QP	QP	QP	Correction
MHz	dBuV	Limit	Margin	dBuV	Limit	Margin	Factor
152.266 KHz	30.23	55.94	-25.71	56.02	65.94	-9.92	14.54
22.925 MHz	31.41	50.00	-18.59	51.51	60.00	-8.49	11.13
23.714 MHz	35.82	50.00	-14.18	53.90	60.00	-6.10	11.13
23.717 MHz	36.53	50.00	-13.47	53.86	60.00	-6.14	11.13
24.037 MHz	29.46	50.00	-20.54	48.66	60.00	-11.34	11.14
24.380 MHz	34.23	50.00	-15.77	54.51	60.00	-5.49	11.14
24.381 MHz	37.30	50.00	-12.70	54.76	60.00	-5.24	11.14
24.566 MHz	30.77	50.00	-19.23	50.28	60.00	-9.72	11.14
24.706 MHz	36.88	50.00	-13.12	55.42	60.00	-4.58	11.14
25.019 MHz	28.93	50.00	-21.07	49.42	60.00	-10.58	11.14
25.038 MHz	37.66	50.00	-12.34	54.76	60.00	-5.24	11.14
25.233 MHz	30.39	50.00	-19.61	51.14	60.00	-8.86	11.14
25.375 MHz	34.98	50.00	-15.02	54.65	60.00	-5.35	11.14
25.715 MHz	37.63	50.00	-12.37	54.60	60.00	-5.40	11.15
25.716 MHz	37.09	50.00	-12.91	54.94	60.00	-5.06	11.15
25.918 MHz	32.17	50.00	-17.83	51.33	60.00	-8.67	11.15
26.048 MHz	37.74	50.00	-12.26	55.26	60.00	-4.74	11.15
26.247 MHz	32.16	50.00	-17.84	51.80	60.00	-8.20	11.15
26.260 MHz	31.18	50.00	-18.82	50.68	60.00	-9.32	11.15
26.385 MHz	34.40	50.00	-15.60	54.28	60.00	-5.72	11.15
Project# - BEC-2008							
Sample# - 2008-04 (SN#05)							
EUT - Lutron KL01 A20 RX Mode 1% Brightness							
Volt/Freq - 120 Vac / 60 Hz							
Test Spec - FCC and ICES-003 Class B Limits							





Test Results: Conducted emissions, from the Lutron Model KL01 Wireless Controlled LED Lamp, in receive mode, comply with the requirements of 47 CFR Part 15.207 and RSS-Gen Section 8.7 for restricted bands of operation with a margin of 4.58 dB.

4.5. Spurious Radiated Emissions 30 MHz to 25 GHz (47 CFR 15.209) (RSS-GEN 8.10)

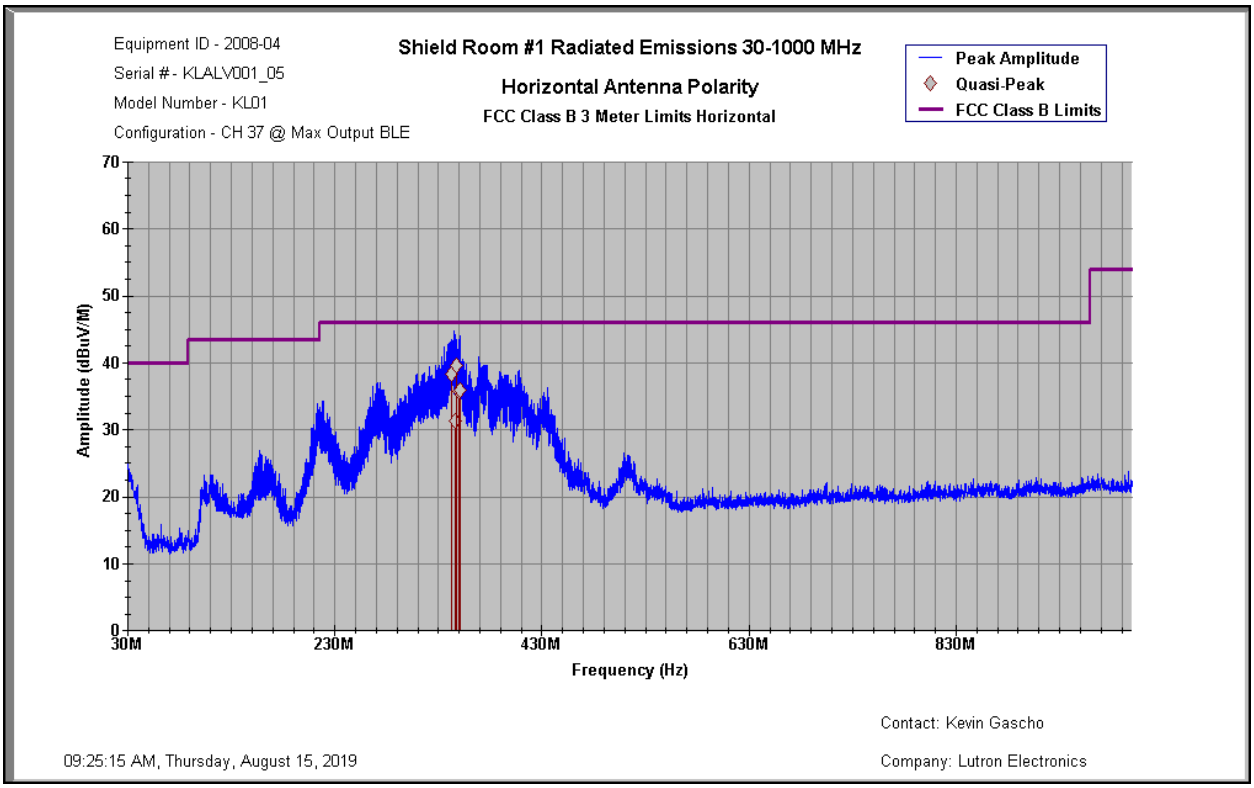
Emissions from the Lutron Model KL01 Wireless Controlled LED Lamp are required to meet the general limits of 47 CFR Part 15.209 and RSS-Gen Section 8.10. The EUT was operated as described in Section 2.9. The measurement parameters and methods are the same as Section 4.3, "Restricted Bands of Operation 30 MHz – 25 GHz." The Lutron KL01 was measured for radiated emissions from 30 MHz to 25 GHz. The test was performed for three channels each in both BLE and IEEE 802.15.4 transmit modes. The following data represent the worst-case emissions for both modes.

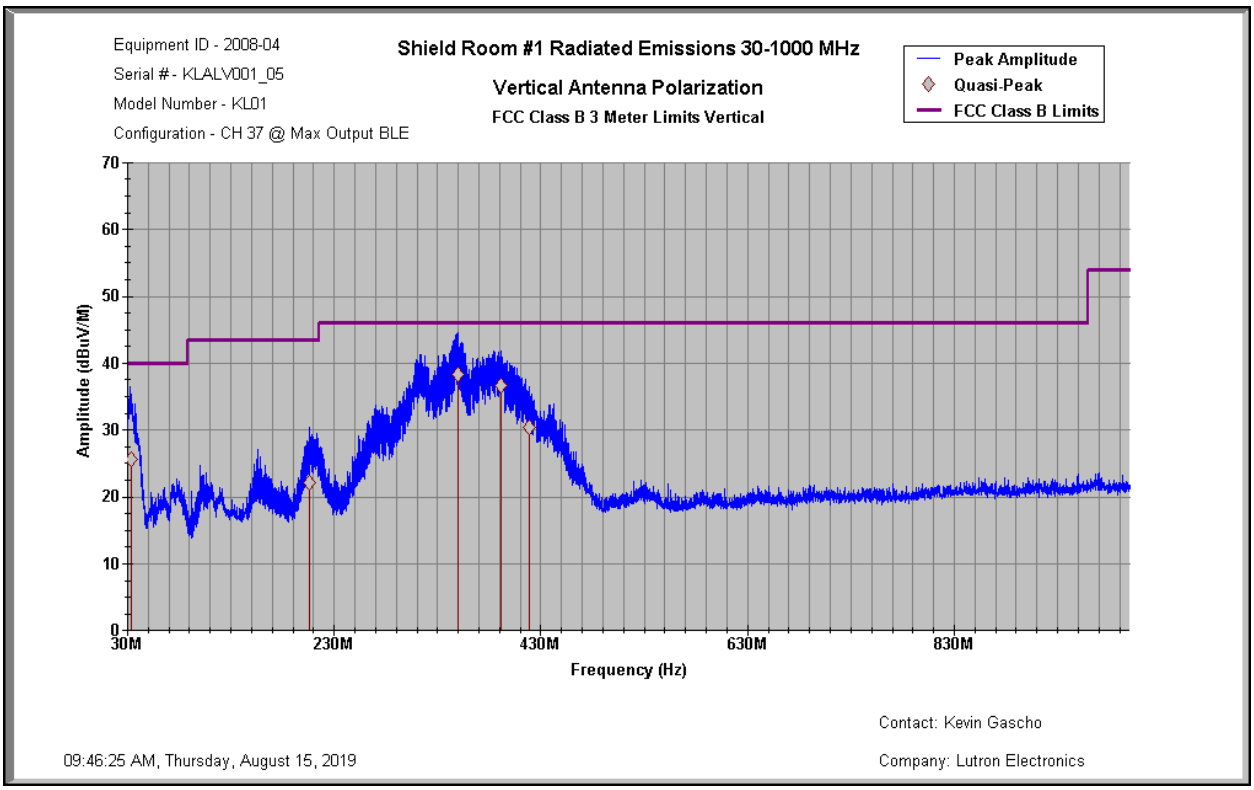
4.5.1 Spurious Radiated Emissions 30 MHz to 1 GHz Test Results (08/14/2019 and 08/15/2019)

BLE Channel 37 Data

Frequency	Peak	QP	Polarity	TT angle	Ant Height	Correction Factors	FCC 15.205 15.209 RSS-Gen Section 8.10 Limits	Margin
MHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB
33.935	27.95	25.66	V	214	177	-2.82	40.00	-14.34
206.095	18.70	22.14	V	064	163	-7.40	43.52	-21.38
342.663	37.55	38.36	H	229	100	-7.88	46.02	-7.66
345.745	22.87	31.35	H	229	209	-7.85	46.02	-14.67
347.054	33.43	39.61	H	221	100	-7.86	46.02	-6.41
349.548	30.11	35.72	H	201	111	-7.89	46.02	-10.30
349.880	42.17	38.25	V	349	115	-7.89	46.02	-7.77
351.298	36.90	35.92	H	221	100	-7.87	46.02	-10.10
391.762	32.80	36.62	V	103	104	-7.74	46.02	-9.40
419.158	29.42	30.37	V	160	100	-7.81	46.02	-15.65

BLE Channel 37 Graphs

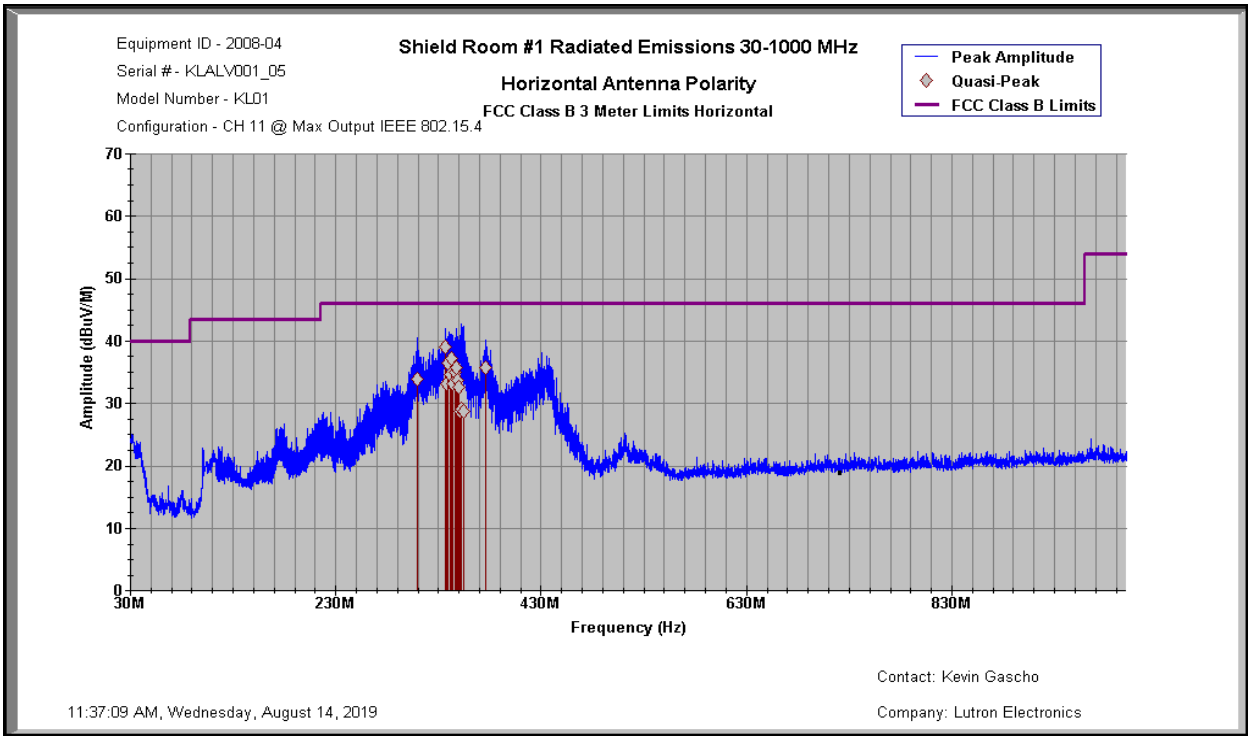


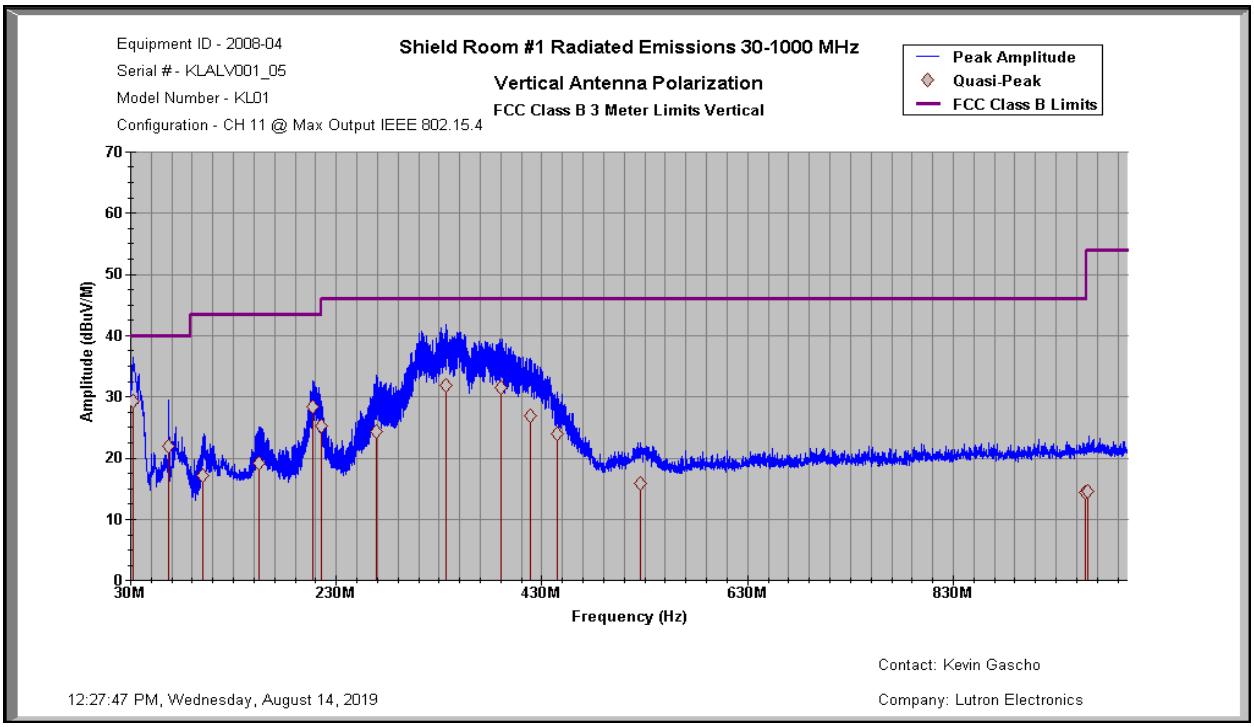


IEEE 802.15.4 Channel 11 Data

Frequency	Peak	QP	Polarity	TT angle	Ant Height	Correction Factors	FCC 15.205 15.209 RSS-Gen Section 8.10 Limits	Margin
MHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB
32.603	25.94	29.27	V	308	135	-2.05	40.00	-10.73
309.641	38.96	33.92	H	138	123	-8.04	46.02	-12.10
337.007	32.03	39.09	H	207	100	-7.92	46.02	-6.93
339.731	36.99	36.54	H	205	100	-7.93	46.02	-9.48
341.335	38.37	34.60	H	202	100	-7.91	46.02	-11.42
342.830	31.78	37.11	H	210	099	-7.88	46.02	-8.91
345.687	34.37	34.96	H	212	162	-7.85	46.02	-11.06
347.049	33.09	35.69	H	199	175	-7.86	46.02	-10.33
348.543	36.89	33.76	H	208	165	-7.88	46.02	-12.26
375.939	37.88	35.67	H	250	249	-7.74	46.02	-10.35

IEEE 802.15.4 Channel 11 Graphs





Test Results: Spurious radiated emissions, recorded at a distance of 3 meters from the Lutron Model KL01 Wireless Controlled LED Lamp, are below the 3-meter limit specified by FCC Section 15.209 and RSS-Gen Section 8.10 requirements by a margin of at least 6.41 dB.

4.5.2 Spurious Radiated Emissions 1 to 18 GHz Test Results (08/22/2019 and 08/23/2019)

BLE Channel 37

Frequency	Peak Measurement	Average Measurement	Antenna Polarity	Turntable Angle	Antenna Height	Correction Factor	FCC 15.205/15.209 & RSS-Gen Average Limit	Average Margin
GHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB
1.00004*	32.31	23.22	V	359	213	-12.49	53.98	-30.76
1.00901*	33.45	23.39	H	360	108	-12.49	53.98	-30.59
1.35564*	32.36	22.82	H	059	141	-11.11	53.98	-31.16
1.38013*	33.58	23.15	V	218	137	-10.81	53.98	-30.83
2.40194	45.41	39.49	V	203	143	-4.95	53.98	-14.49
2.40200	43.39	36.36	H	223	116	-4.95	53.98	-17.62
4.81200*	47.35	42.49	V	108	101	2.50	53.98	-11.49

*Restricted Band Signal (See Section 4.2)

IEEE 802.15.4 Channel 11

Frequency	Peak Measurement	Average Measurement	Antenna Polarity	Turntable Angle	Antenna Height	Correction Factor	FCC 15.205/15.209 & RSS-Gen Average Limit	Average Margin
GHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB
1.01050*	33.61	23.47	V	231	178	-12.49	53.98	-30.51
1.02120*	33.18	23.18	H	349	176	-12.48	53.98	-30.80
1.35020*	34.62	22.80	H	016	120	-11.18	53.98	-31.18
1.37680*	32.47	23.30	V	345	140	-10.85	53.98	-30.68
1.70980*	33.23	24.11	H	300	150	-8.99	53.98	-29.87
2.40511	44.67	40.88	V	152	159	-4.99	53.98	-13.10
4.81000*	49.00	44.30	V	114	100	2.50	53.98	-9.68

*Restricted Band Signal (See Section 4.2)

Test Results: Spurious radiated emissions, recorded at a distance of 3 meters from the Lutron Model KL01 Wireless Controlled LED Lamp, are below the 3 meter limit specified by FCC Section 15.209 and RSS-Gen Section 8.10 requirements by a margin of at least 9.68 dB.

4.5.3 Spurious Radiated Emissions 18 to 25 GHz Test Results (08/26/2019)

There were no signals detected from the Lutron Model KL01 Wireless Controlled LED Lamp during preliminary sweeps of the range 18 – 25 GHz. Three channels, low, middle and high, of each of the transmission methods, BLE and IEEE 802.15.4 were swept. Therefore, the Lutron KL01 complies with the requirements of 47 CFR Part 15.209. All measurement data has been collected and is available upon request.

4.6 DTS 6 dB & 99% Occupied Bandwidth (47 CFR Section 15.247(a)(2), RSS-Gen 6.7, RSS-247 5.2(a))

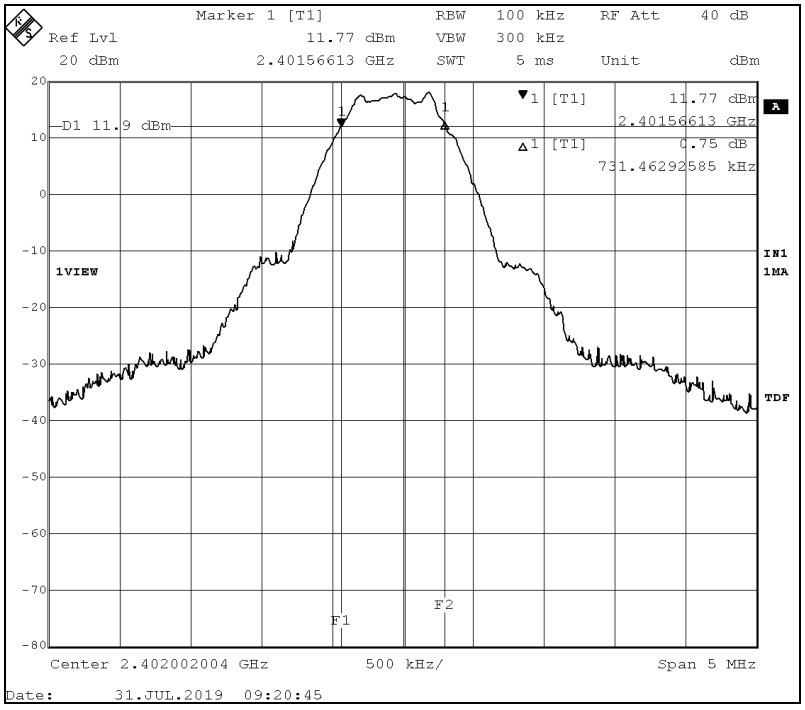
4.6.1 6 dB DTS Bandwidth – Test Procedure

The minimum DTS (6 dB) bandwidth, specified in 47 CFR Section 15.247(a)(2) and RSS-247 was measured using a Spectrum Analyzer with 100 kHz resolution bandwidth and 300 kHz video bandwidth. Clause 11.8 of ANSI C63.10 was applied.

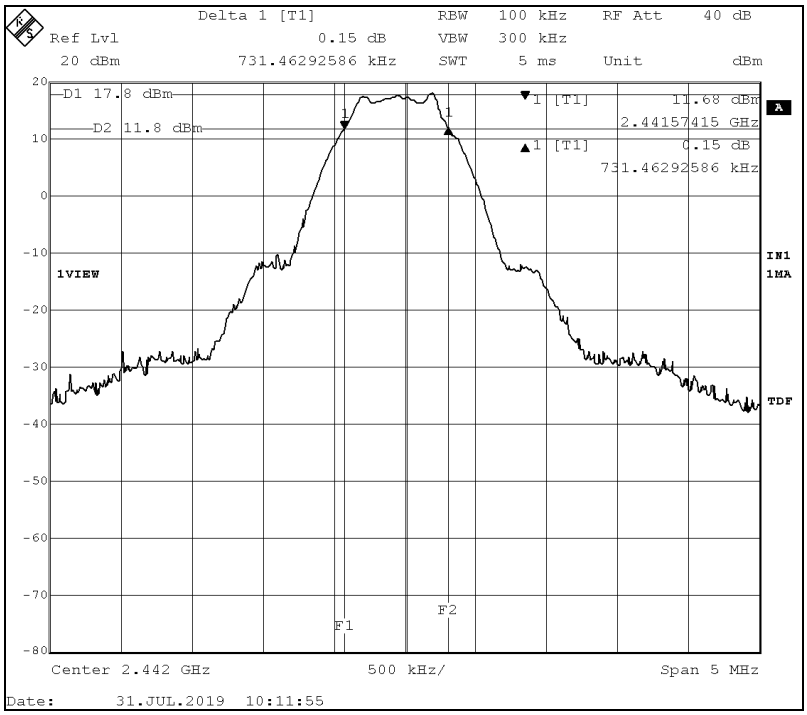
4.6.1.1 DTS (6 dB) Bandwidth BLE Test Results (07/30/2019)

6 dB Bandwidth BLE with FSK modulation				
Channel	Frequency	Measured	Required Minimum	Margin
#	GHz	kHz	kHz	kHz
37	2.402	731.463	500.00	-231.46
18	2.442	731.463	500.00	-231.46
39	2.480	731.463	500.00	-231.46

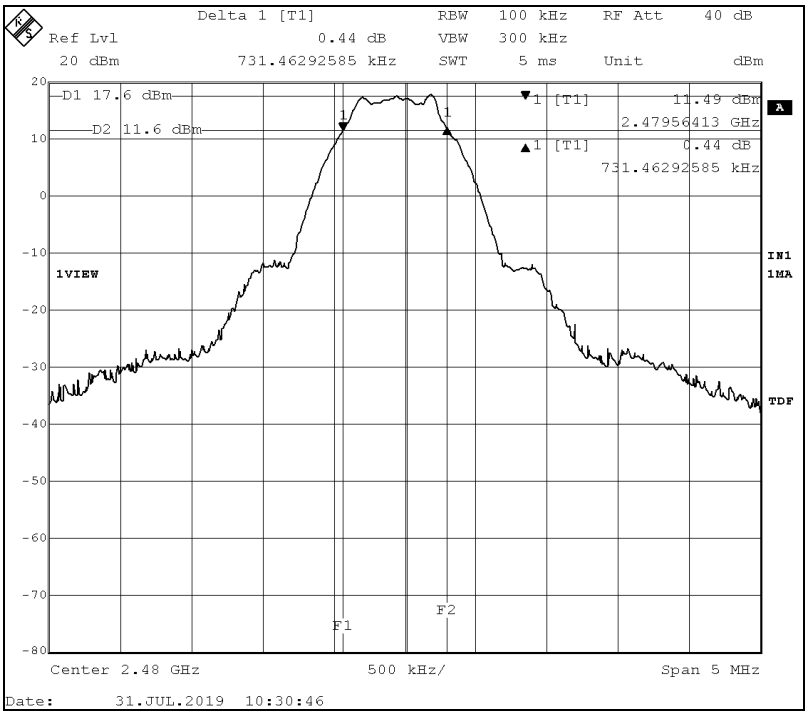
Low Channel Frequency, 2.402 GHz, with BLE 2FSK modulation



Middle Channel Frequency, 2.442 GHz, with BLE 2FSK modulation



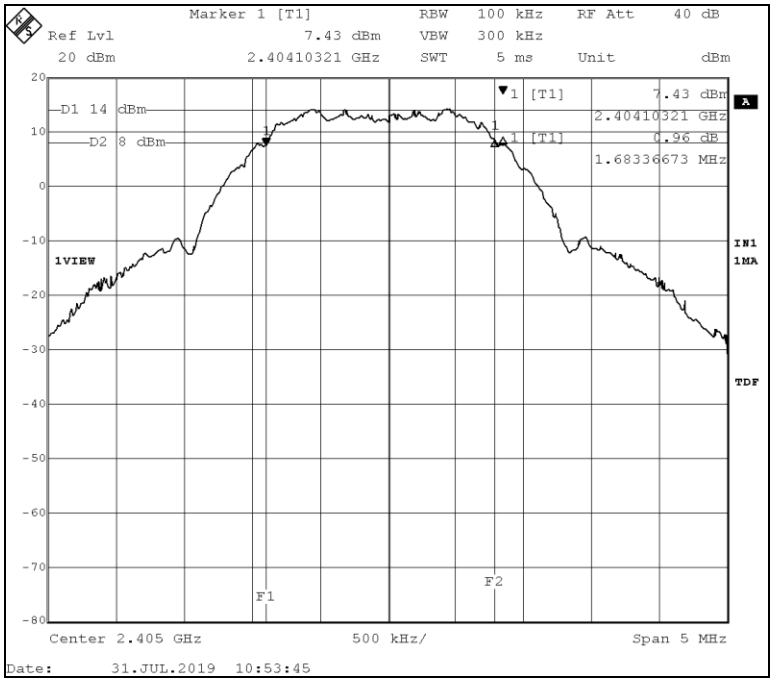
High Channel Frequency, 2.480 GHz, with BLE 2FSK modulation



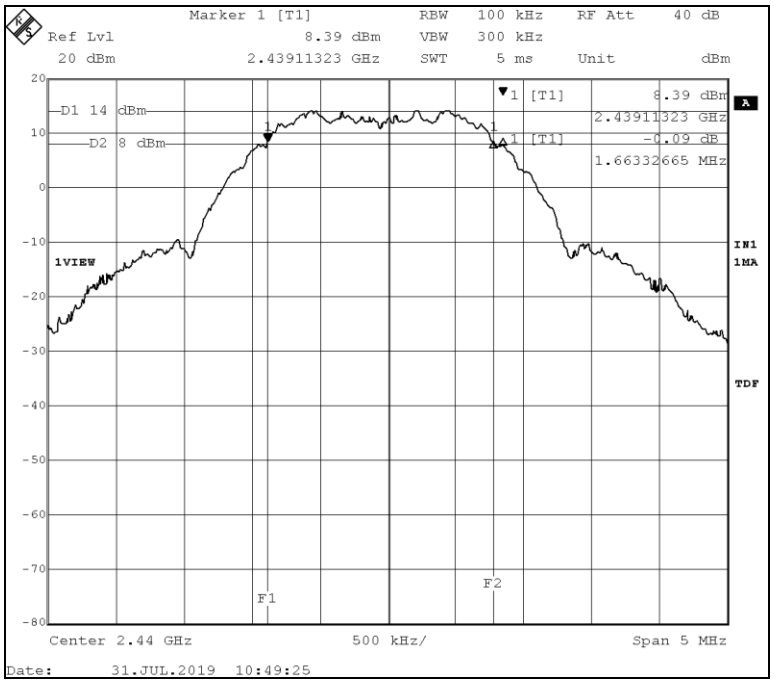
4.6.1.2 DTS (6 dB) Bandwidth IEEE 802.15.4 Test Results (07/30/2019)

6 dB Bandwidth IEEE 802.15.4 with OQPSK modulation				
Channel	Frequency	Measured	Required Minimum	Margin
#	GHz	kHz	kHz	kHz
31	2.405	1683.40	500.00	-1183.40
18	2.440	1663.30	500.00	-1163.30
26	2.480	1683.40	500.00	-1183.40

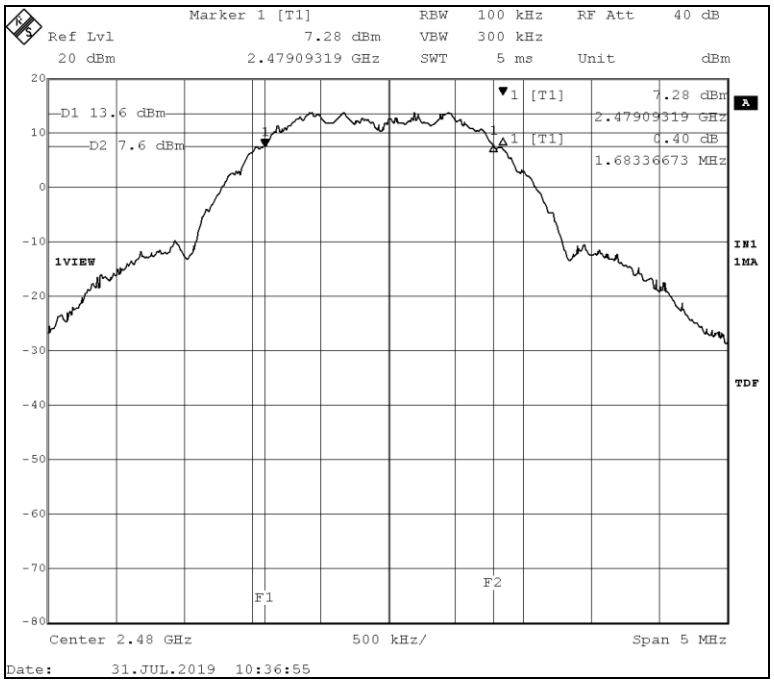
Low Channel Frequency, 2.405 GHz, with IEEE 802.15.4 OQPSK modulation



Middle Channel Frequency, 2.440 GHz, IEEE 802.15.4 with OQPSK modulation



High Channel Frequency, 2.480 GHz, IEEE 802.15.4 with OQPSK modulation



Test Results: The 6 dB, DTS Bandwidth measurements for the Lutron Model KL01 Wireless Controlled LED Lamp are compliant to 47 CFR Section 15.247(a)(2) and RSS-247 requirements of 500 kHz minimum.

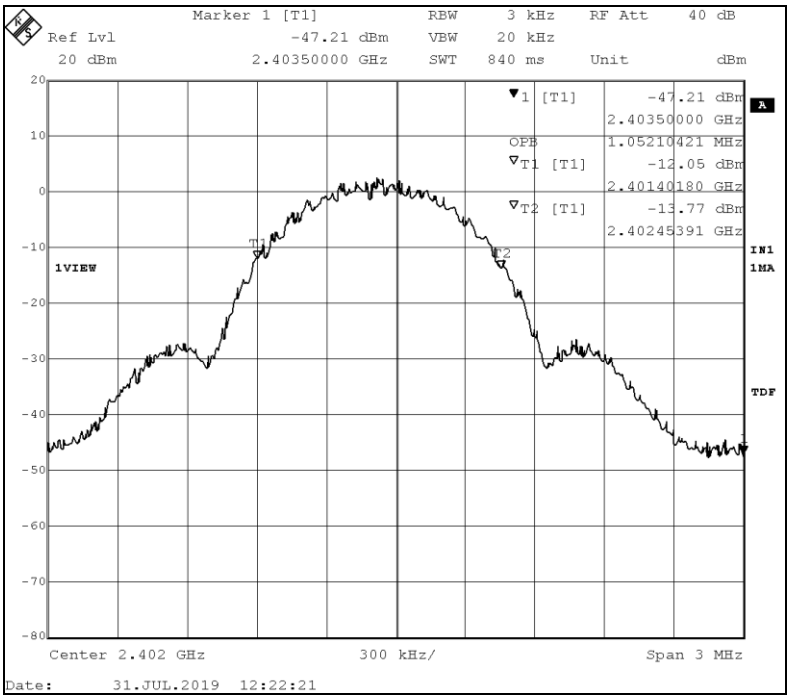
4.6.2 99% Occupied Bandwidth – Test Procedure

The 99% Occupied bandwidth, specified in Section 6.7 of RSS-Gen was measured using a Spectrum Analyzer with 3 kHz resolution bandwidth and 20 kHz video bandwidth for BLE and 5 kHz resolution bandwidth and 20 kHz video bandwidth for IEEE 802.15.4. Clause 6.9.3 of ANSI C63.10 was applied.

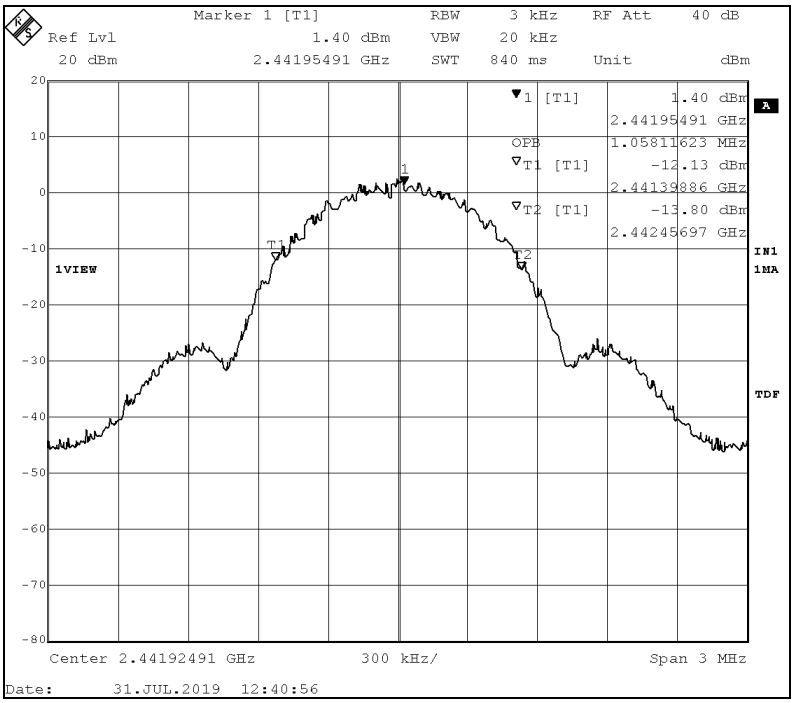
4.6.2.1 99% OBW BLE / 2FSK Modulation Test Results

Occupied Bandwidth		
Channel	Frequency	99% OBW
#	GHz	MHz
37	2.402	1.0521
18	2.442	1.0581
39	2.480	1.0581

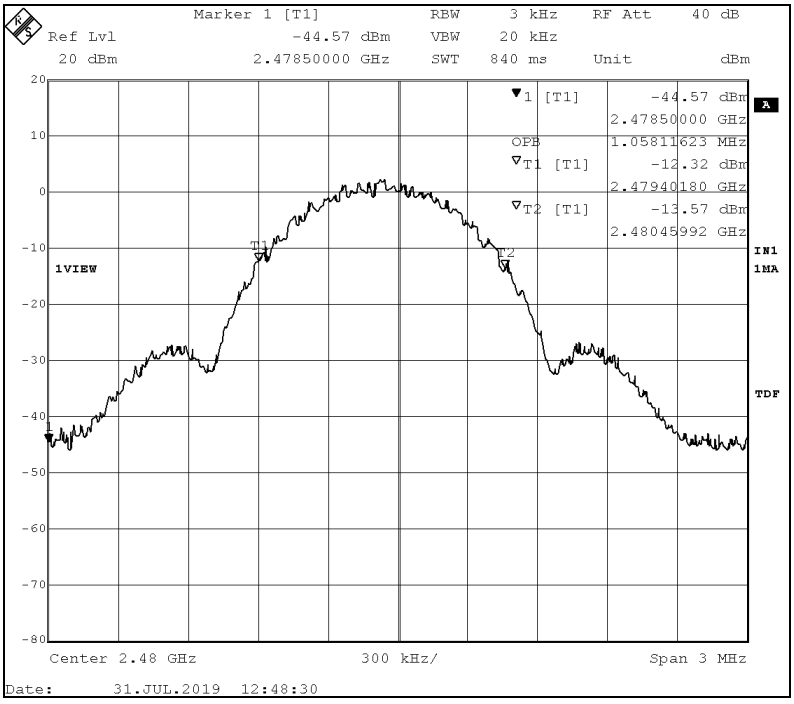
Low Channel Frequency, 2.402 GHz, with BLE 2FSK modulation



Middle Channel Frequency, 2.442 GHz, with BLE 2FSK modulation



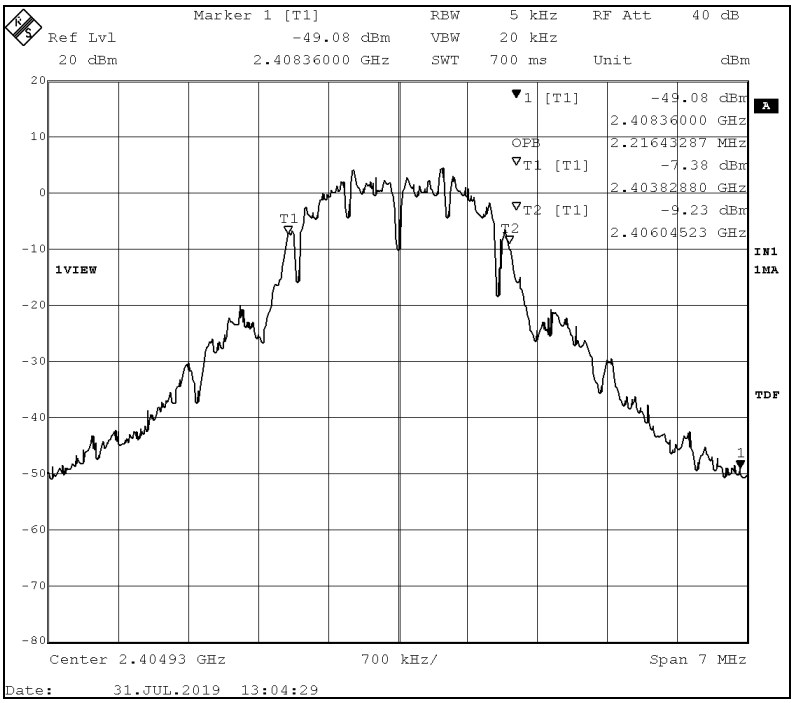
High Channel Frequency, 2.480 GHz, with BLE 2FSK modulation



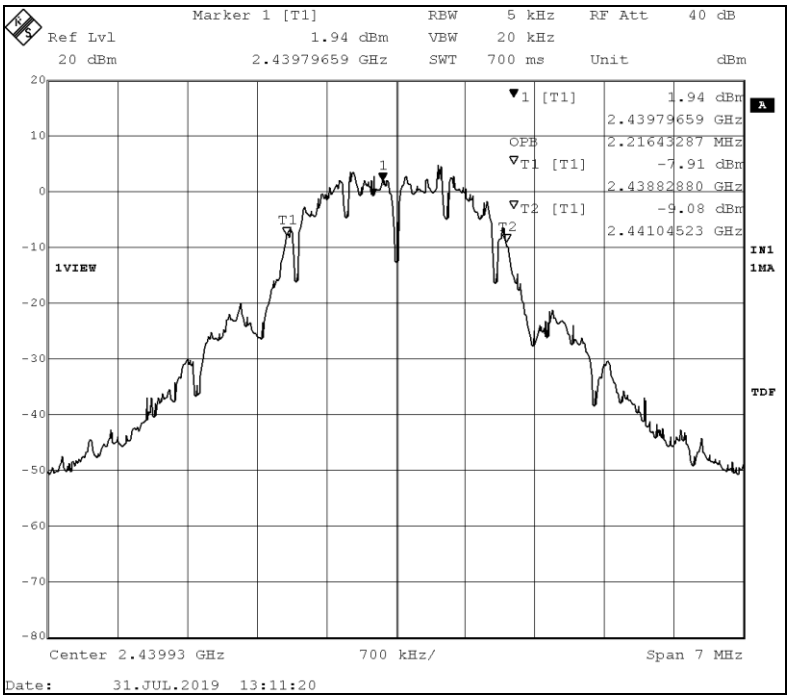
4.6.2.2 99% OBW IEEE 802.15.4 / OQPSK Modulation Test Results

Occupied Bandwidth		
Channel	Frequency	99% OBW
#	GHz	MHz
11	2.405	2.2164
18	2.440	2.2164
26	2.480	2.2305

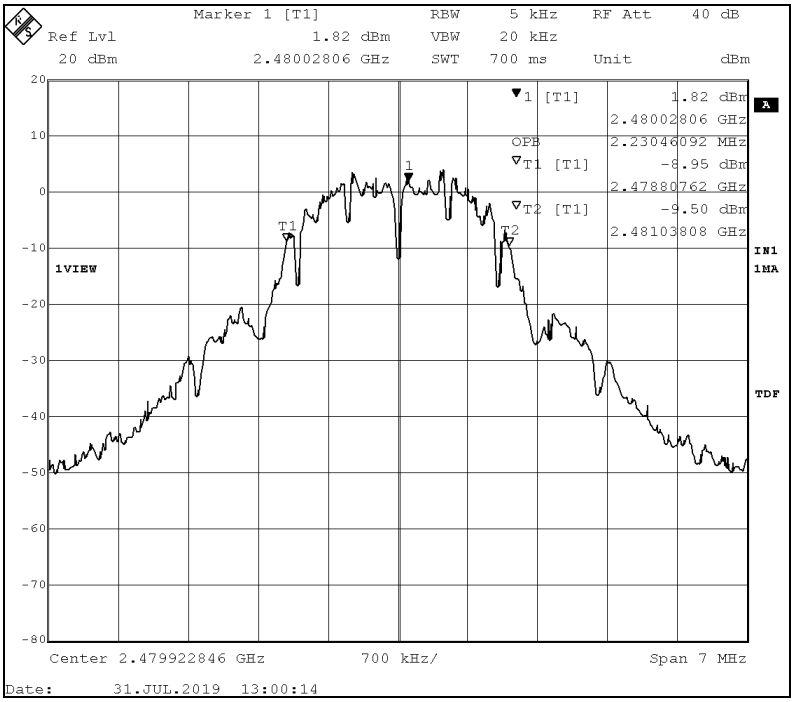
Low Channel Frequency, 2.405 GHz, with IEEE 802.15.4 OQPSK modulation



Middle Channel Frequency, 2.440 GHz, with IEEE 802.15.4 OQPSK modulation



High Channel Frequency, 2.480 GHz, with IEEE 802.15.4 OQPSK modulation



4.7 Maximum Peak Power Output and EIRP (FCC Part 15.247(b)(3), RSS-247 Section 5.4(d))

4.7.1 Maximum Peak Power Output Test Procedure

A conducted power measurement of the output frequency was measured according to the RBW ≥ DTS Bandwidth Method of 558074 D01 15.247 Meas Guidance v05r01. Clause 11.9.1.1 of ANSI C63.10 is applicable. Transmission frequencies at low, middle and high were measured with BLE no modulation, BLE with 2FSK modulation, IEEE 802.15.4 with no modulation and IEEE 802.15.4 with OQPSK modulation applied.

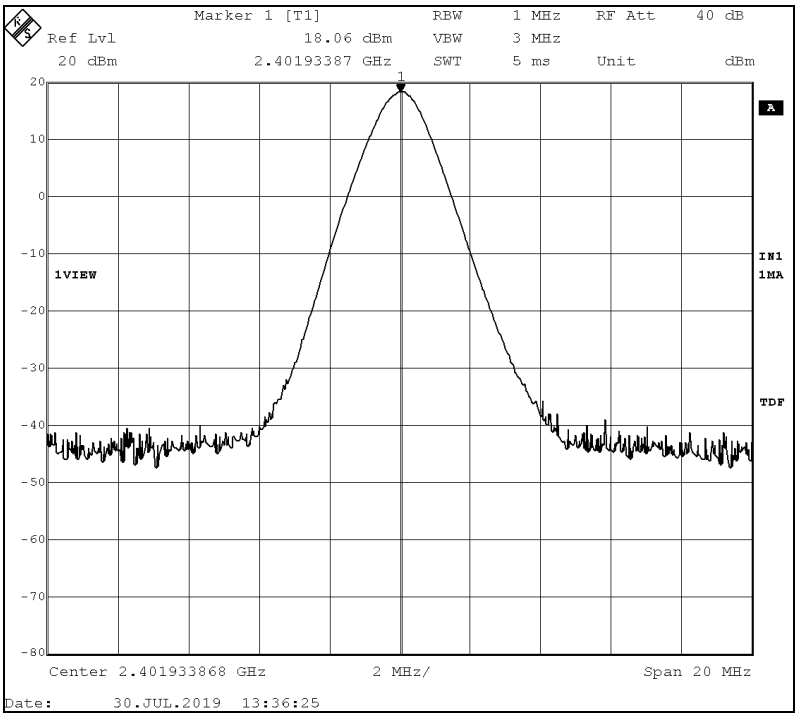
4.7.2 BLE Maximum Peak Power Output Test Results (07/29/2019)

Channel #	Modulation	Frequency (GHz)	Measured Level (dBm)	Cable # 814 Loss (dB)	Total		Limit		Margin	
					dBm	Watts	dBm	Watts	dBm	Watts
37	None	2.402	18.06	0.36	18.42	0.070	30.00	1.000	-11.58	0.930
18		2.442	17.93	0.46	18.39	0.069	30.00	1.000	-11.61	0.931
39		2.480	17.79	0.41	18.20	0.066	30.00	1.000	-11.80	0.934
37	BLE 2FSK	2.402	18.08	0.36	18.44	0.070	30.00	1.000	-11.56	0.930
18		2.442	17.93	0.46	18.39	0.069	30.00	1.000	-11.61	0.931
39		2.480	17.78	0.41	18.19	0.066	30.00	1.000	-11.81	0.934

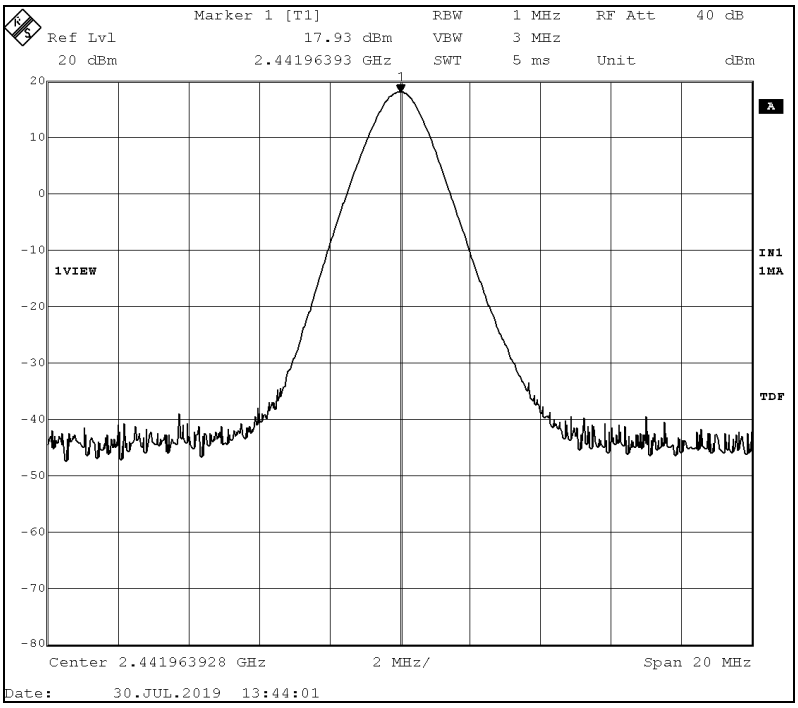
The gain of the antenna, used in the Lutron Model KL01 Wireless Controlled LED Lamp is 2.2 dB. Applying the antenna gain to the maximum peak transmitter output produces the following values of EIRP.

Channel #	Modulation	Frequency (GHz)	Measured Level (dBm)	Cable # 814 Loss (dB)	Antenna Gain dBi	EIRP dBm
37	None	2.402	18.06	0.36	2.20	20.62
18		2.442	17.93	0.46	2.20	20.59
39		2.480	17.79	0.41	2.20	20.40
37	BLE 2FSK	2.402	18.08	0.36	2.20	20.64
18		2.442	17.93	0.46	2.20	20.59
39		2.480	17.78	0.41	2.20	20.39

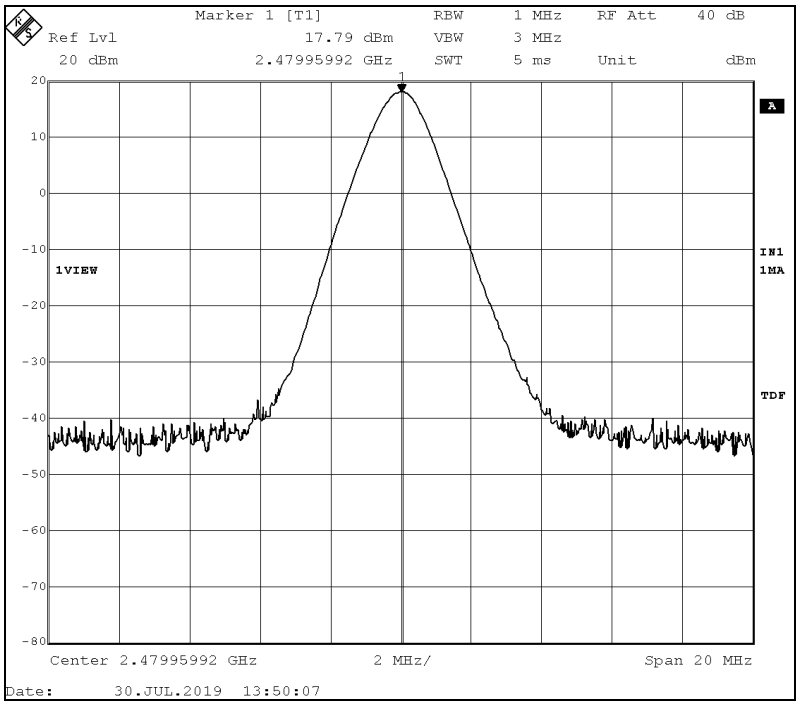
Low Channel (37) Frequency, 2.402 GHz, BLE without modulation



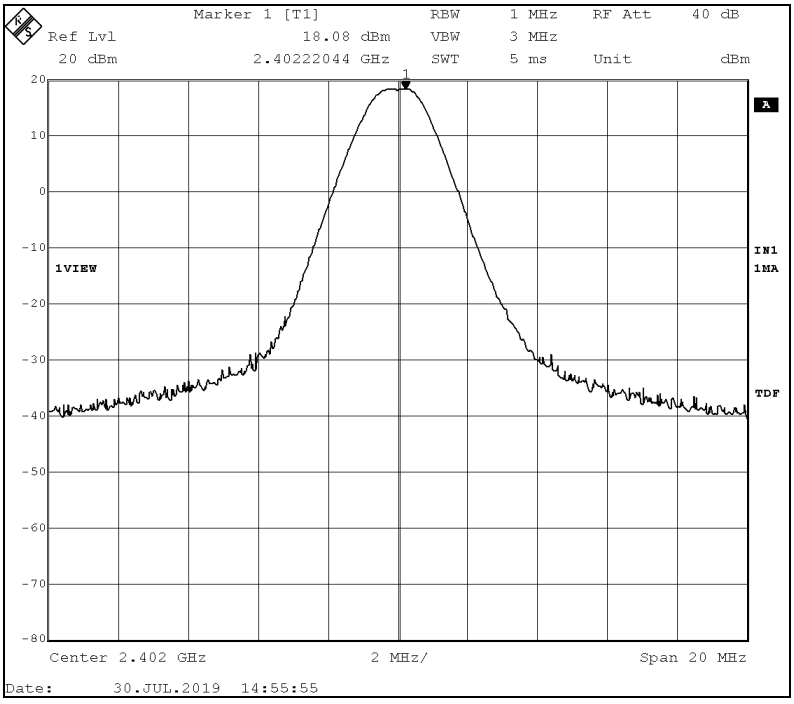
Middle Channel (18) Frequency, 2.442 GHz, BLE without modulation



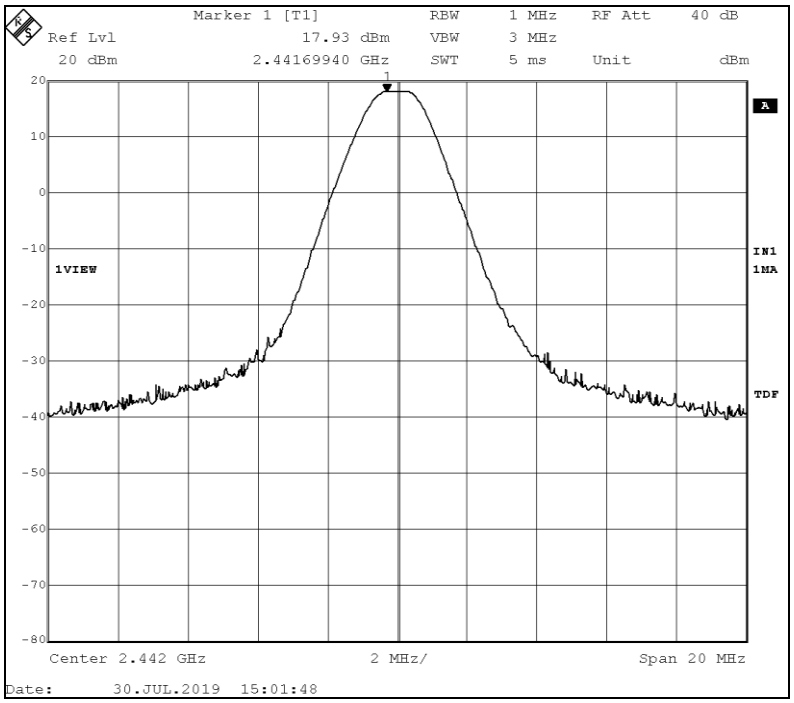
High Channel (39) Frequency, 2.480 GHz, BLE without modulation



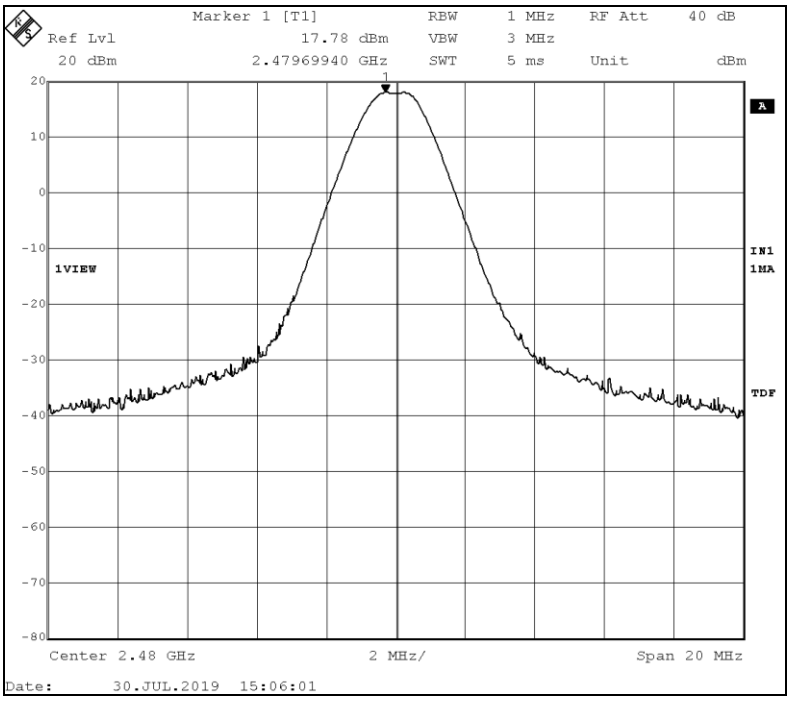
Low Channel (37) Frequency, 2.402 GHz, with BLE 2FSK modulation



Middle Channel (18) Frequency, 2.442 GHz, with BLE 2FSK modulation



High Channel (39) Frequency, 2.480 GHz, with BLE 2FSK modulation



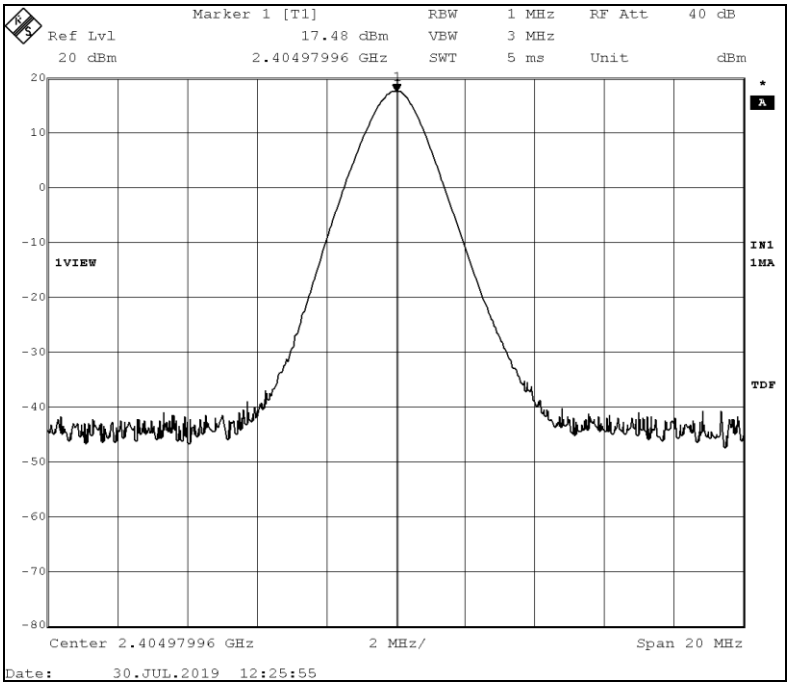
Test Results: The Peak Power Output measurements, with BLE, 2FSK modulation, for the Lutron Model KL01 Wireless Controlled LED Lamp are compliant with the limits specified in FCC Section 15.247(b)(3) and RSS-247 Section 5.4(d).

4.7.3 IEEE 802.15.4 Maximum Peak Power Output Test Results (07/29/2019)

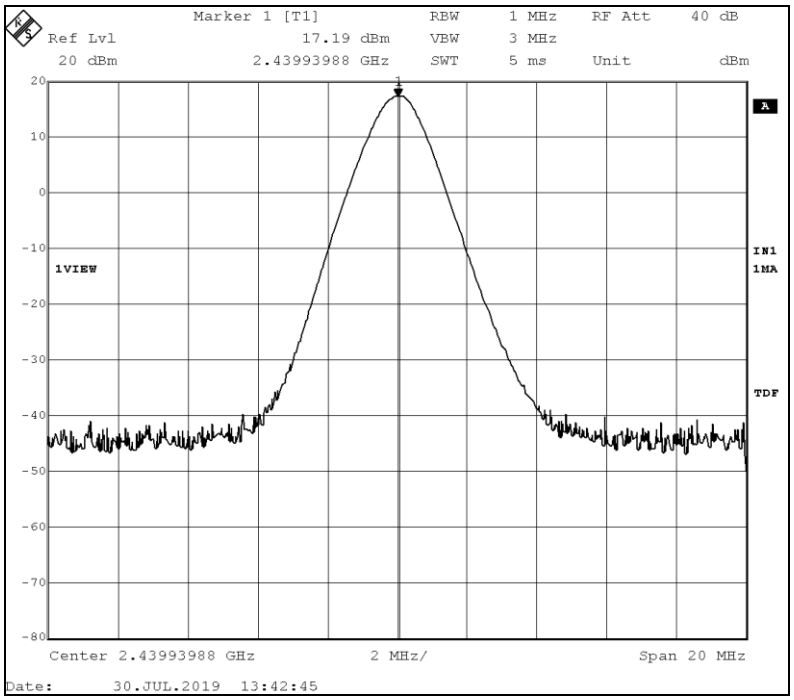
Channel #	Modulation	Frequency (GHz)	Measured Level (dBm)	Cable # 814 Loss (dB)	Total		Limit		Margin	
					dBm	Watts	dBm	Watts	dBm	Watts
11	None	2.405	17.48	0.36	17.84	0.061	30.00	1.000	-12.16	0.939
18		2.440	17.19	0.45	17.64	0.058	30.00	1.000	-12.36	0.942
26		2.480	16.95	0.41	17.36	0.054	30.00	1.000	-12.64	0.946
11	802.15.4 OQPSK	2.405	17.42	0.36	17.78	0.060	30.00	1.000	-12.22	0.940
18		2.440	17.19	0.45	17.64	0.058	30.00	1.000	-12.36	0.942
26		2.480	17.06	0.41	17.47	0.056	30.00	1.000	-12.53	0.944

Channel #	Modulation	Frequency (GHz)	Measured Level (dBm)	Cable # 814 Loss (dB)	Antenna Gain dBi	EIRP dBm
11	None	2.405	17.48	0.36	2.20	20.04
18		2.440	17.19	0.45	2.20	19.84
26		2.480	16.95	0.41	2.20	19.56
11	802.15.4 OQPSK	2.405	17.42	0.36	2.20	19.98
18		2.440	17.19	0.45	2.20	19.84
26		2.480	17.06	0.41	2.20	19.67

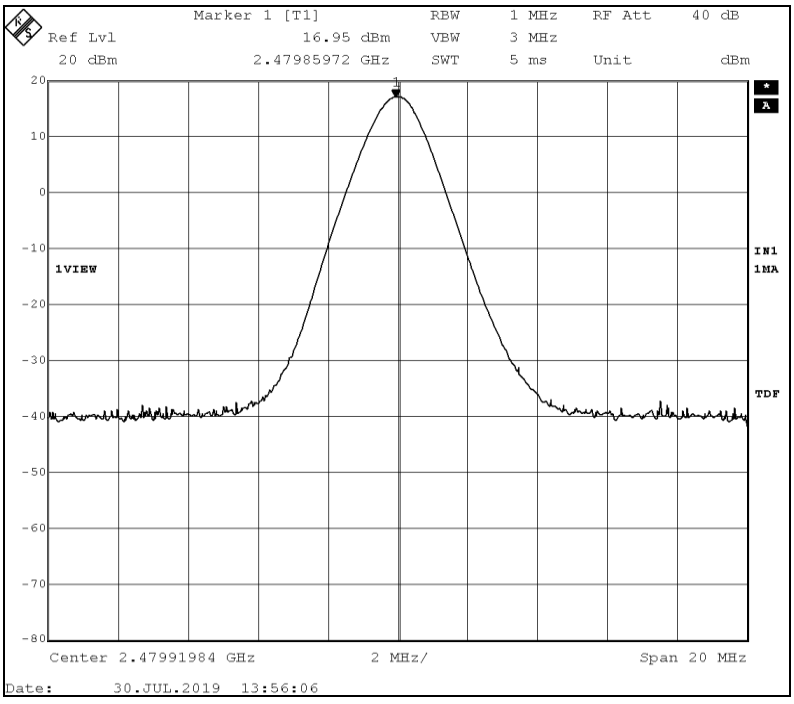
Low Channel (11) Frequency, 2.405 GHz, IEEE 802.15.4 without modulation



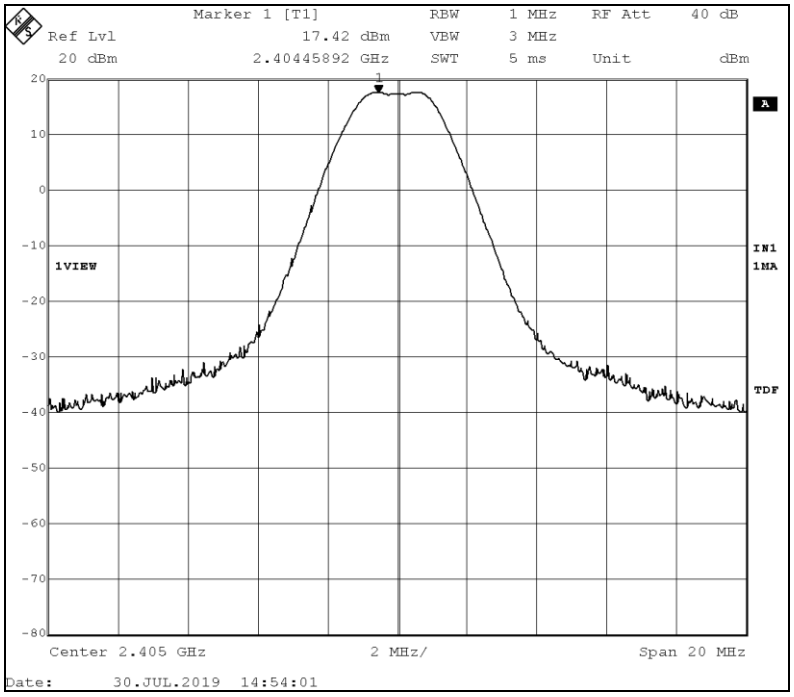
Middle Channel (18) Frequency, 2.440 GHz, IEEE 802.15.4 without modulation



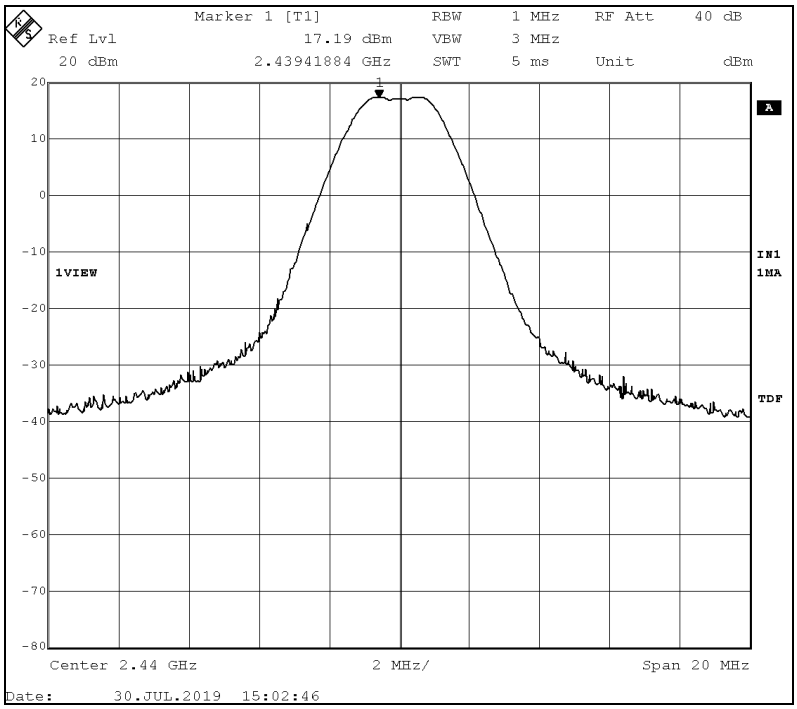
High Channel (26) Frequency, 2.480 GHz, IEEE 802.15.4 without modulation



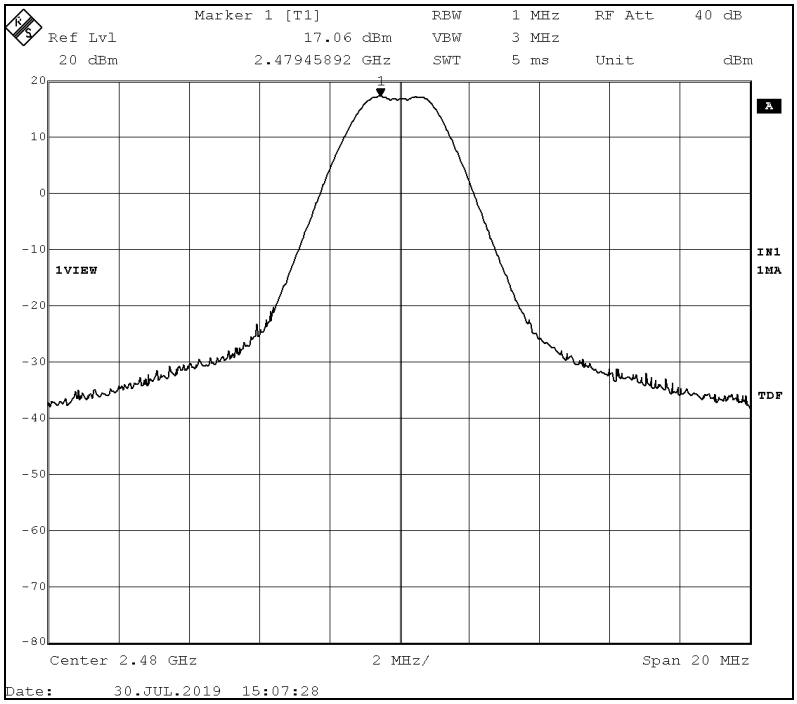
Low Channel (11) Frequency, 2.405 GHz, with IEEE 802.15.4 OQPSK modulation



Middle Channel (18) Frequency, 2.440 GHz, with IEEE 802.15.4 OQPSK modulation



High Channel (39) Frequency, 2.480 GHz, with IEEE 802.15.4 OQPSK modulation



Test Results: The Peak Power Output measurements, with IEEE 802.15.4, OQPSK modulation, for the Lutron Model KL01 Wireless Controlled LED Lamp are compliant with the limits specified in FCC Section 15.247(b)(3).

4.8 Antenna Conducted Spurious Emissions (FCC Section 15.247(d), RSS-247 Sec.5)

4.8.1 Antenna Conducted Spurious Emissions Test Procedure

558074 D01 DTS Meas Guidance v04 advises to use the Power Spectral Density (Section 4.9) results to determine which carrier frequency to use to determine the Reference Level for the Spurious conducted emissions test.

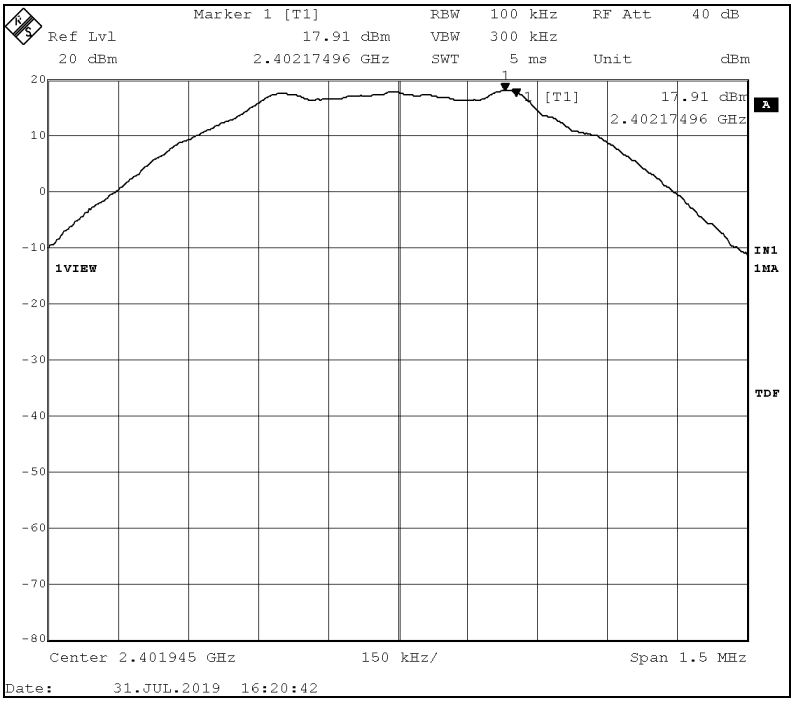
The low frequency of 2.402 GHz showed the highest PSD level in with BLE, 2FSK modulation. Therefore, 2.402 GHz is the frequency displayed below for BLE.

The low frequency of 2.405 GHz showed the highest PSD level in with IEEE 802.15.4, OQPSK modulation. Therefore, 2.405 GHz is the frequency displayed below for BLE.

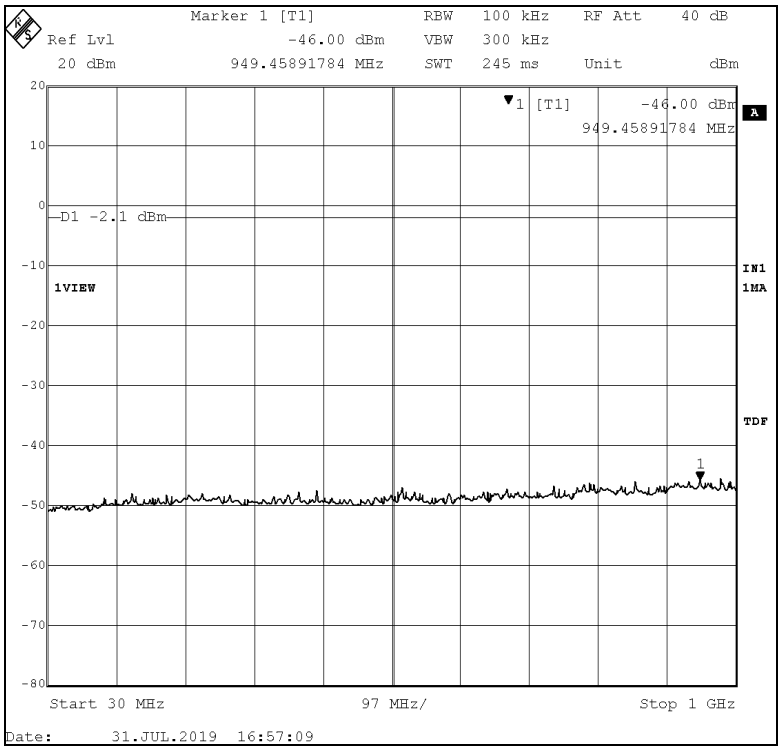
4.8.2 Antenna Conducted Spurious Emissions, BLE 2FSK Modulation (07/31/2019)

The peak level of 17.91 dBm is the maximum peak output of the Lutron Model KL01 Wireless Controlled LED Lamp with BLE 2FSK modulation. Since the maximum antenna conducted emission was measured with an average detector, the conducted spurious emissions limit is 20 dB down from this peak. The resultant limit is therefore -2.09 dBm. This peak is displayed on the plot below followed by three emission plots of the spectrum from 30 MHz to 25 GHz.

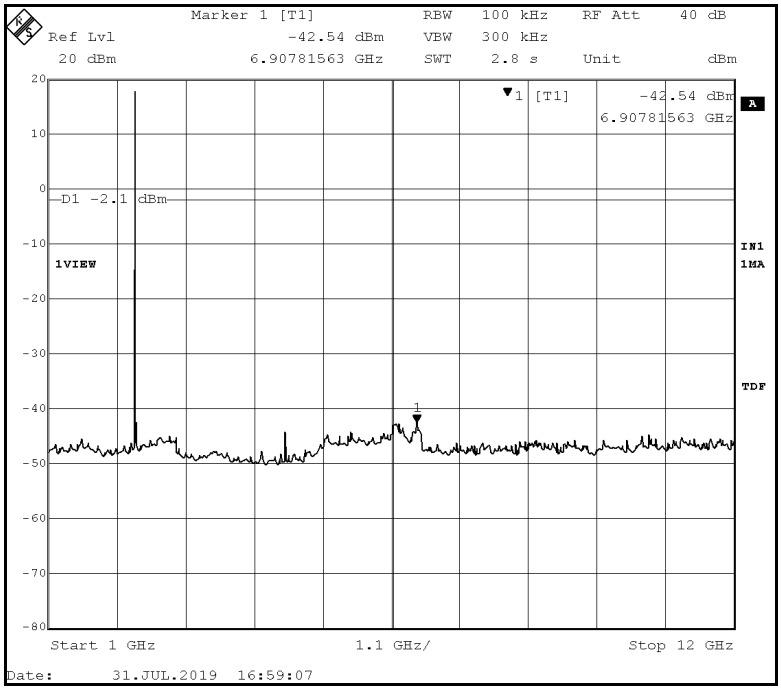
Low Channel (37) Frequency, 2.402 GHz, with BLE 2FSK modulation Reference Level



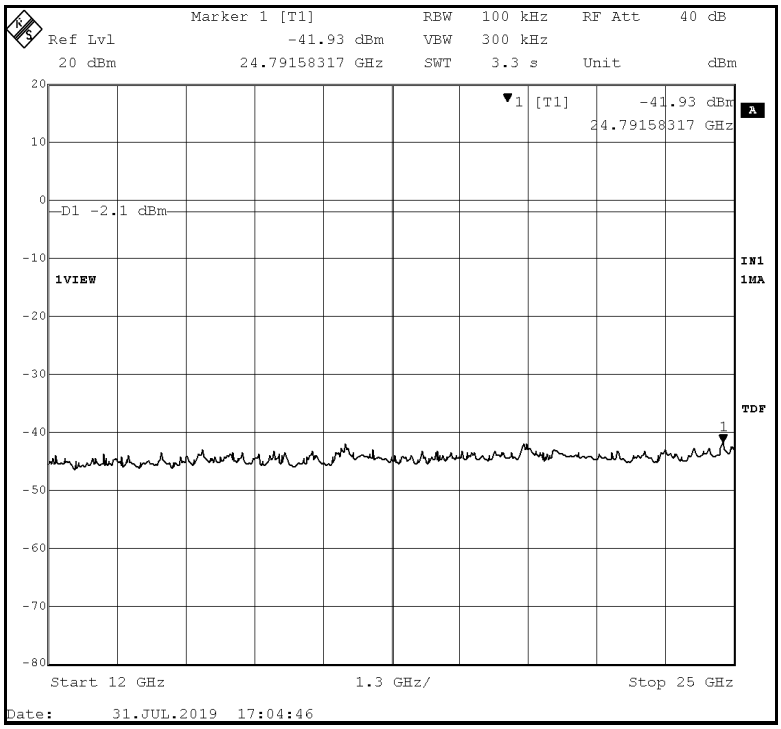
Low Channel (37) Frequency, 2.402 GHz, with BLE 2FSK modulation, 30 MHz – 1 GHz



Low Channel (37) Frequency, 2.402 GHz, with BLE 2FSK modulation, 1 – 12 GHz



Low Channel (37) Frequency, 2.402 GHz, with BLE 2FSK modulation, 12 – 25 GHz

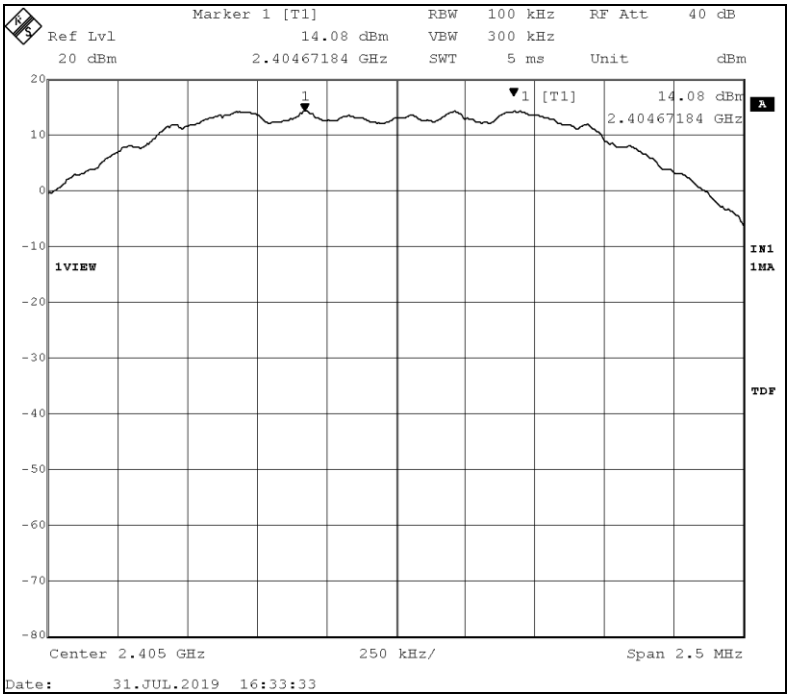


Test Results: The Antenna Conducted Spurious Emissions of the Lutron Model KL01 Wireless Controlled LED Lamp, operating with BLE, 2FSK modulation are below the carrier –20 dB limit and therefore compliant with the limits specified in FCC Section 15.247(d).

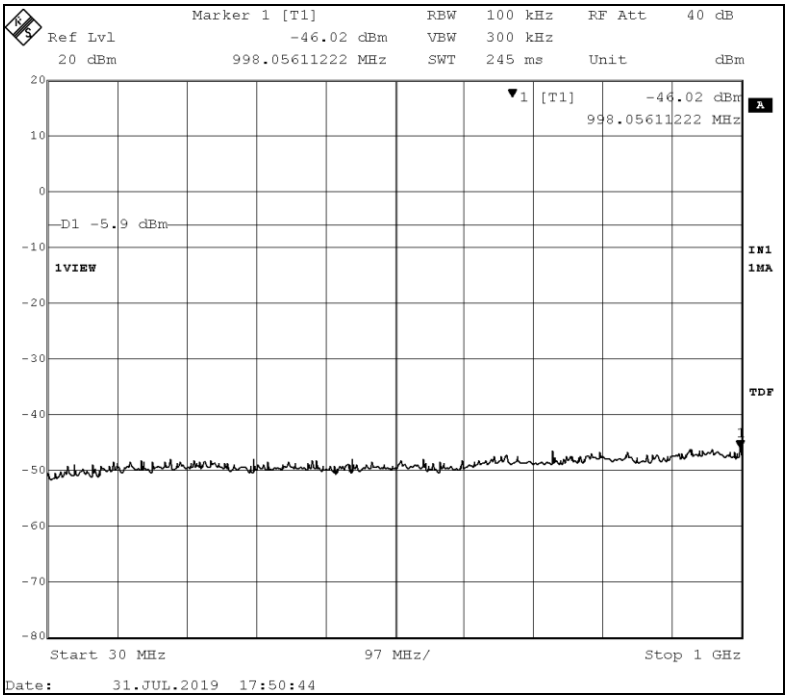
4.8.3 Antenna Conducted Spurious Emissions, IEEE 802.15.4 OQPSK Modulation (07/31/2019)

The peak level of 14.08 dBm is the maximum peak output of the Lutron Model KL01 Wireless Controlled LED Lamp with IEEE 802.15.4 OQPSK modulation. Since the maximum antenna conducted emission was measured with an average detector, the conducted spurious emissions limit is 20 dB down from this peak. The resultant limit is therefore -5.9 dBm. This peak is displayed on the plot below followed by three emission plots of the spectrum from 30 MHz to 25 GHz.

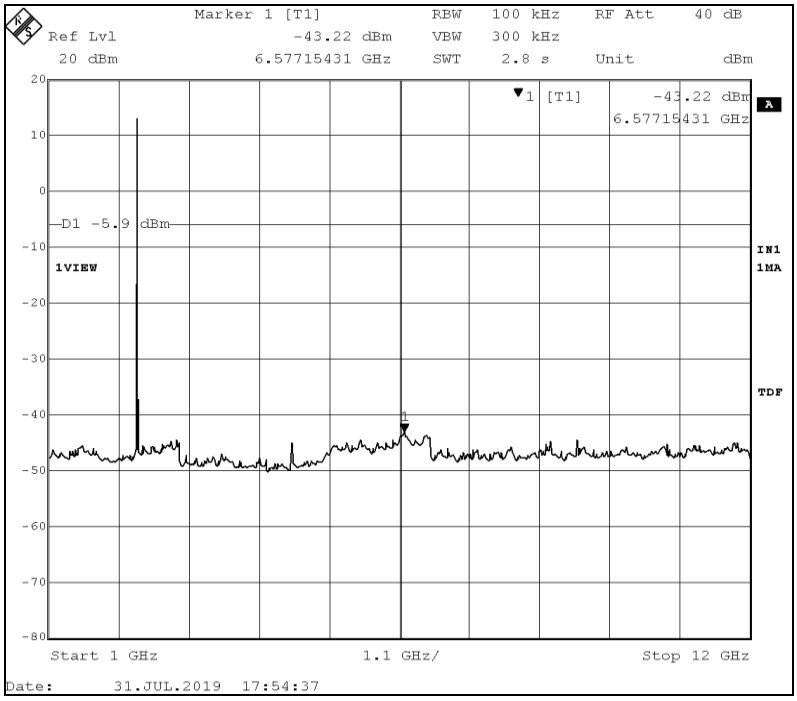
Low Channel (11) Frequency, 2.405 GHz, with IEEE 802.15.4 OQPSK modulation
Reference Level



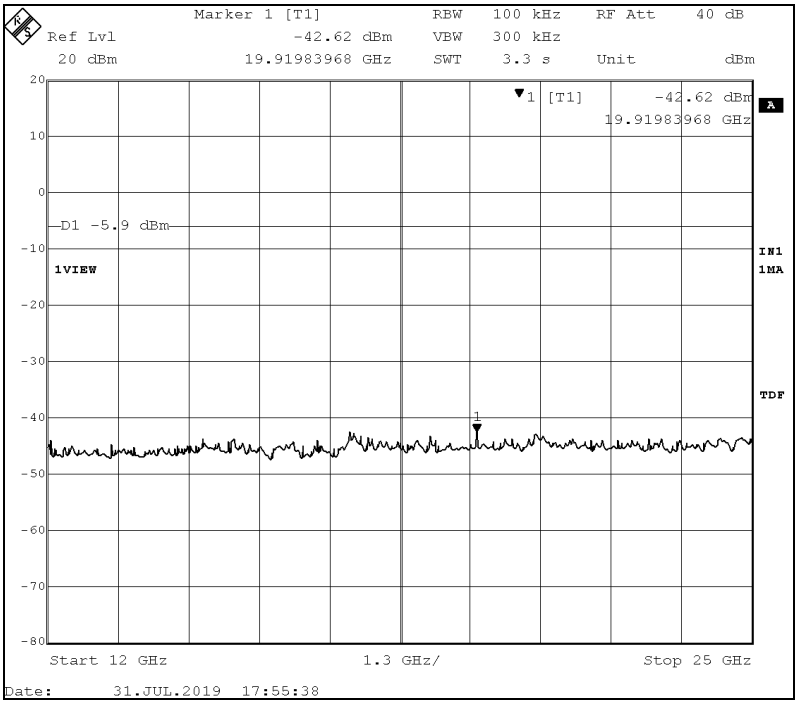
Low Channel (11) Frequency, 2.405 GHz, with IEEE 802.15.4 OQPSK modulation, 30 MHz – 1 GHz



Low Channel (11) Frequency, 2.405 GHz, with IEEE 802.15.4 OQPSK modulation, 1 – 12 GHz



Low Channel (11) Frequency, 2.405 GHz, with IEEE 802.15.4 OQPSK modulation, 12 – 25 GHz



Test Results: The Antenna Conducted Spurious Emissions of the Lutron Model KL01 Wireless Controlled LED Lamp, operating with IEEE 802.15.4, OQPSK modulation are below the carrier –20 dB limit and therefore compliant with the limits specified in FCC Section 15.247(d).

4.9 Power Spectral Density (FCC Section 15.247(e), RSS-247 Section 5.2(b))

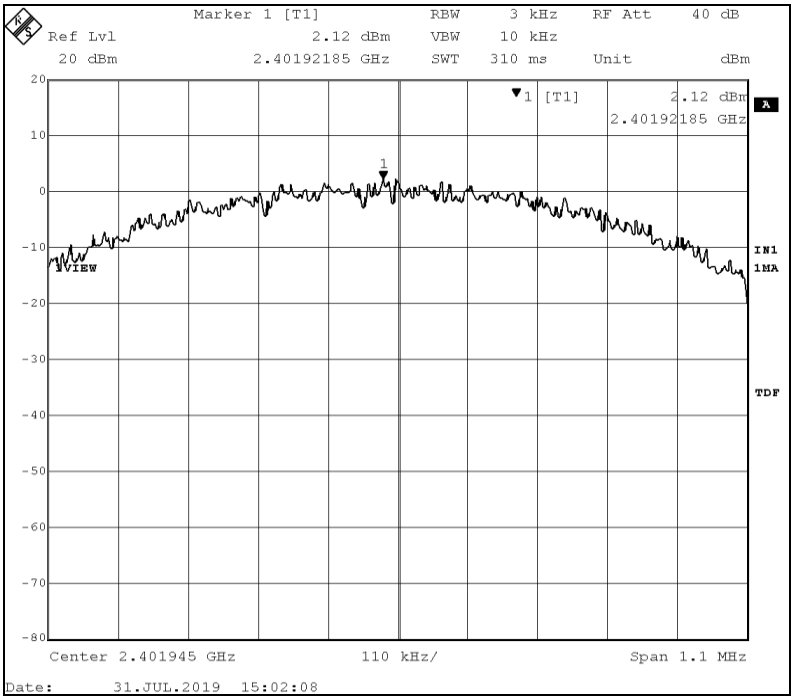
4.9.1 Power Spectral Density Test Procedure

A conducted, peak, power measurement of the output frequency was measured for the Lutron KL01 for each of the low, middle and high frequencies of both BLE and IEEE 802.15.4 operation. The Peak PSD procedure, PKPSD with 3 KHz bandwidth, was used to measure Power Spectral Density.

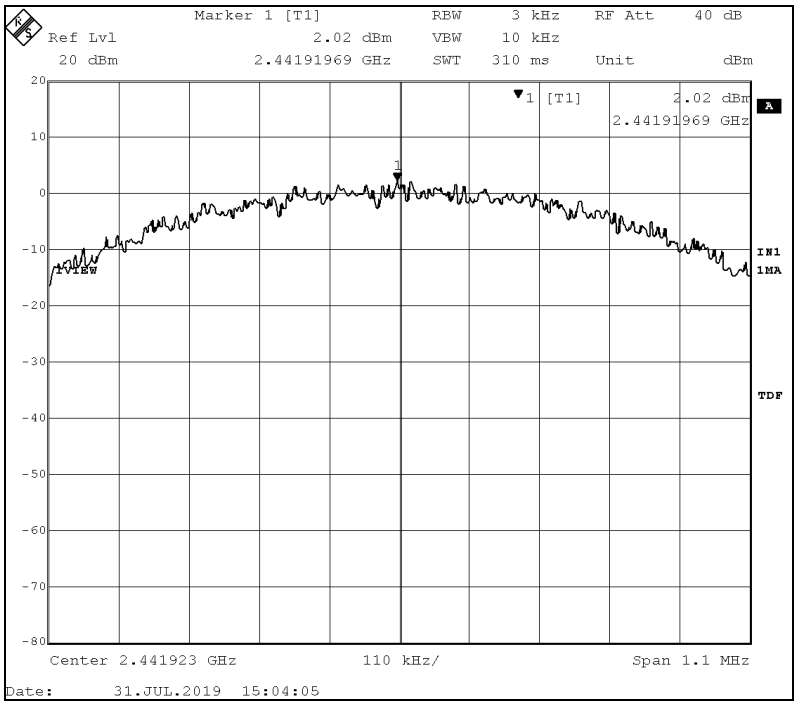
4.9.2 BLE Power Spectral Density Test Results (07/31/2019)

Channel	Freq (GHz)	Measured Power Spectral Density (dBm)	Cable Loss (dB)	Total Power Spectral Density (dBm)	Power Spectral Density Limit (dBm)	Margin	Pass/Fail
37	2.402	2.12	0.36	2.48	8.00	-5.52	**PASS**
18	2.442	2.02	0.46	2.48	8.00	-5.52	**PASS**
39	2.480	2.00	0.41	2.41	8.00	-5.59	**PASS**

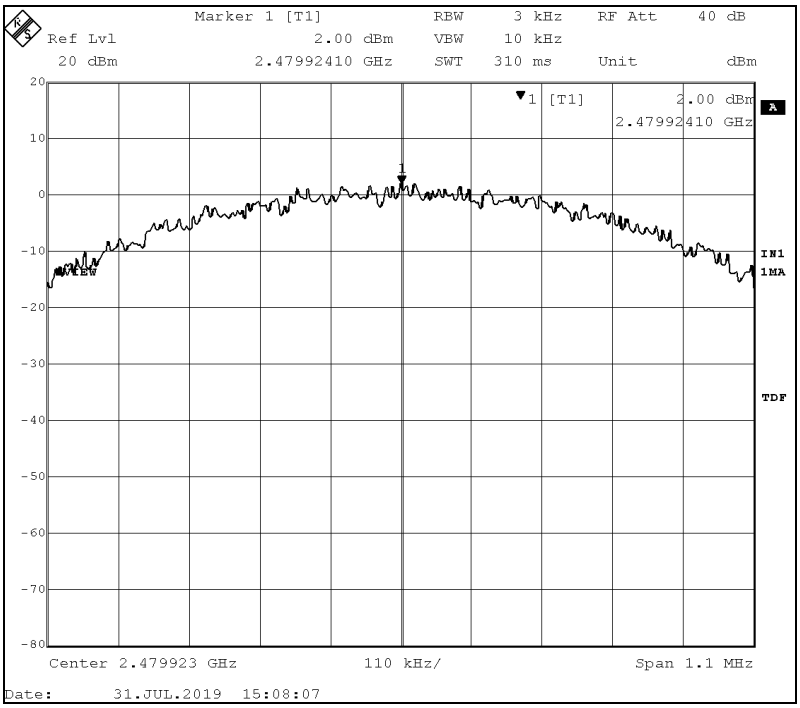
Low Channel (37) Frequency, 2.402 GHz, with BLE 2FSK modulation



Middle Channel (18) Frequency, 2.442 GHz, with BLE 2FSK modulation



High Channel (39) Frequency, 2.480 GHz, with BLE 2FSK modulation

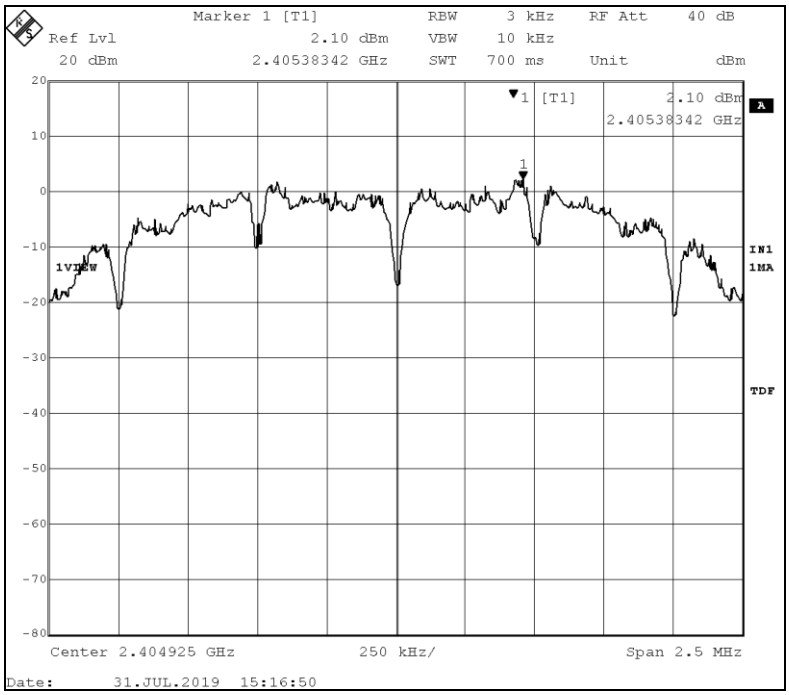


Test Results: The Power Spectral Density measurements of the Lutron Model KL01 Wireless Controlled LED Lamp are compliant with the limits specified in FCC Section 15.247(e) and RSS-247 Section 5.2(b).

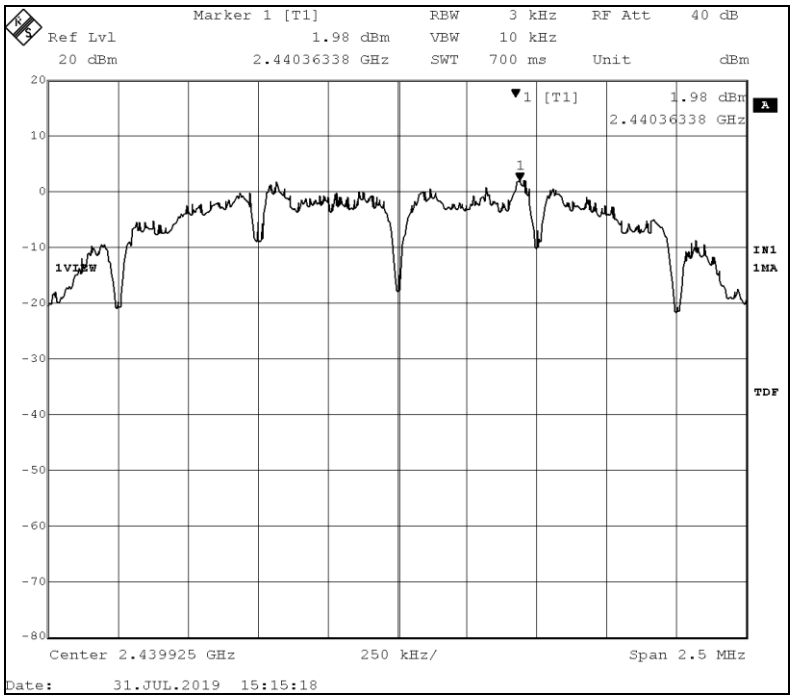
4.9.3 IEEE 802.15.4 Power Spectral Density Test Results (07/31/2019)

Channel	Freq (GHz)	Measured Power Spectral Density (dBm)	Cable Loss (dB)	Total Power Spectral Density (dBm)	Power Spectral Density Limit (dBm)	Margin	Pass/Fail
11	2.405	2.10	0.36	2.46	8.00	-5.54	**PASS**
18	2.440	1.98	0.45	2.43	8.00	-5.57	**PASS**
26	2.480	1.81	0.41	2.22	8.00	-5.78	**PASS**

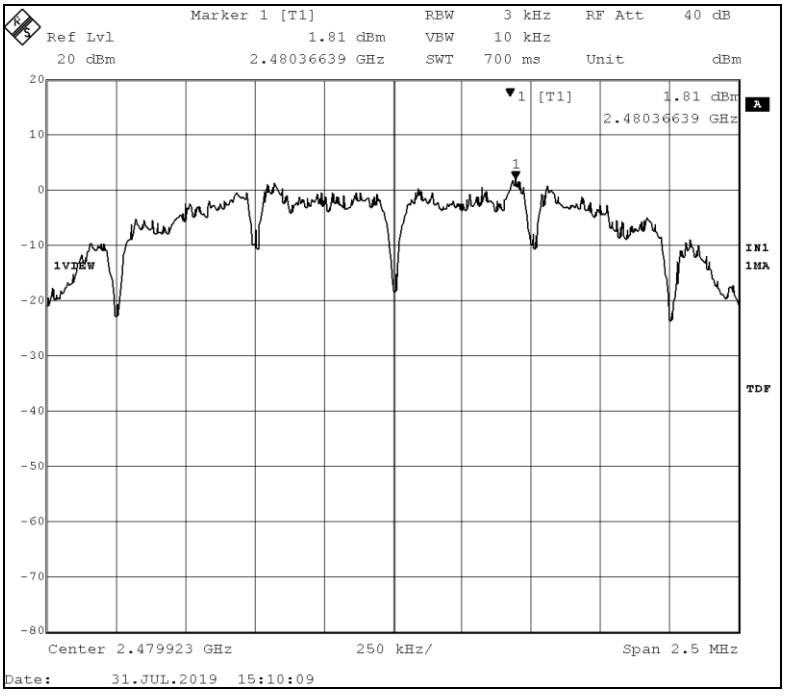
Low Channel (11) Frequency, 2.405 GHz, with IEEE 802.15.4 OQPSK modulation



Middle Channel (18) Frequency, 2.440 GHz, with IEEE 802.15.4 OQPSK modulation



High Channel (26) Frequency, 2.480 GHz, with IEEE 802.15.4 OQPSK modulation



Test Results: The IEEE 802.15.4, Power Spectral Density measurements of the Lutron Model KL01 Wireless Controlled LED Lamp are compliant with the limits specified in FCC Section 15.247(e) and RSS-247 Section 5.2(b).

4.10 Band Edge Measurement (FCC Part 15.247(d), RSS-247 5.5)

4.10.1 Band Edge Measurement Test Procedure

Band edge measurements are required for transmitters with Occupied Bandwidth (OBW) within 2 MHz of a restricted band. The Lutron KL01, with BLE, 2 FSK modulation operates in the range of 2.402 – 2.480 GHz. The OBW of the EUT at 2.402 GHz is 1.0521 MHz. The OBW/2 value below the lowest operating frequency of 2.402 GHz places the band edge 11.47 MHz above the restricted band of 2.390 GHz. The OBW of the EUT at 2.480 GHz is 1.0581 MHz. The OBW/2 value above the highest operating frequency places the upper band edge 2.97 MHz below the restricted band of 2.4835 GHz.

The Lutron KL01, with IEEE 802.15.4 OQPSK modulation operates in the range of 2.405 – 2.480 GHz. The OBW of the EUT at 2.405 GHz is 2.216 MHz. The OBW/2 value below the lowest operating frequency of 2.405 GHz places the band edge 13.89 MHz above the restricted band of 2.390 GHz. The OBW of the EUT at 2.480 GHz is 2.2305 MHz. The OBW/2 value above the highest operating frequency places the upper band edge 2.385 MHz below the restricted band of 2.4835 GHz.

Test Results: Band Edge measurements of the Lutron Model KL01 Wireless Controlled LED Lamp are not required because the transmission band edges do not fall within 2 MHz of any restricted band.

Appendix A – Test Equipment

Equipment	Manufacturer	Model #	Serial #	BEC #	Calibration Date	Calibration Cycle	Calibration Due Date
EMI Receiver (20 Hz – 26.5 GHz)	Rohde & Schwarz	ESIB 26	836119/006	1010	07/02/19	3 Years	07/02/22
Antenna (30 MHz - 6 GHz)	Sunol Sciences	JB6	A022108	712	06/26/18	2 Years	06/26/20
EMC Analyzer (9 kHz - 3 GHz)	Agilent	E7402A	US39440162	883	02/27/18	3 Years	02/27/21
Antenna (30 MHz - 6 GHz)	Sunol Sciences	JB6	A020714	882	05/16/18	2 Years	05/16/20
Amplifier (.09 – 1300 MHz)	Hewlett Packard	8447F	3313A06658	807	01/09/19	2 Years	01/09/21
EMC Analyzer (9 kHz - 26.5 GHz)	Hewlett Packard	8593EM	3710A00214	1026	03/02/17	3 Years	03/02/20
Amplifier System (0.5 – 50 GHz)	Hewlett Packard	83015A 83017A	3123A00360 & 3332A00219	1027	10/14/18	2 Years	10/14/20
Double Ridged Horn Antenna (1 - 18 GHz)	Eaton	3115	2113	836	11/19/18	2 Years	11/19/21
Antenna (18 - 26.5 GHz)	Hewlett Packard	84125-80008	N/A	1056	01/07/19	3 Years	01/07/22
Shielded Room #1	ETS Lindgren	12-2/2-0	4078	859	05/17/18	2 Years	05/17/20
OATS Site (30 MHz – 1 GHz)	BEC	N/A	N/A	705	05/16/19	1 Year	05/16/20
Intentional Radiator Testing High Frequency RF Test Cable	Workhorse	WHU18-3636-036	N/A	814	12/29/18	2 Years	12/29/20
EMI Receiver (9 kHz - 6.5 GHz)	Hewlett Packard	8546A	3325A00158	761	12/13/16	3 Years	12/13/19

Four Line V-LISN	Teseq	NNB 52	253551	950	06/18/19	1 Year	06/18/20
Temp/Humidity Meter	Control Company	4096	151872672	780	04/08/19	2 Years	04/08/21
Software (Tile Instrument Control System)	Quantum Change/EMC Systems	Version 3	N/A	N/A	No Cal. Required	No Cal. Required	No Cal. Required