FCC REPORT

Applicant:	NLU Products, L.L.C.
Address of Applicant:	2801 N Thanksgiving Way #300, Lehi, UT 84043 USA

Equipment Under Test (EUT)

Product Name:	Lantern
Model No.:	Boulder
Trade mark:	Lander
FCC ID:	2ALQR-BLDCTT20
Applicable standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.209
Date of sample receipt:	30 Nov., 2020
Date of Test:	01 Dec., to 09 Dec., 2020
Date of report issue:	10 Dec., 2020
Test Result:	PASS*

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Bruce Zhang
Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the JYT product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

2 Version

Version No.	Date	Description
00	*10 Dec., 2020*	*Original*

Tested By: YT Yang ***Date:*** *10 Dec., 2020*

Test Engineer

Reviewed By: Winner Zhang ***Date:*** *10 Dec., 2020*

Project Engineer

3 Contents

Page

1 COVER PAGE **1**

2 VERSION **2**

3 CONTENTS **3**

4 TEST SUMMARY **4**

5 GENERAL INFORMATION **5**

5.1 CLIENT INFORMATION 5
5.2 GENERAL DESCRIPTION OF E.U.T. 5
5.3 TEST MODE AND TEST SAMPLES PLANS 5
5.4 DESCRIPTION OF SUPPORT UNITS 5
5.5 MEASUREMENT UNCERTAINTY 6
5.6 ADDITIONS TO, DEVIATIONS, OR EXCLUSIONS FROM THE METHOD 6
5.7 LABORATORY FACILITY 6
5.8 LABORATORY LOCATION 6
5.9 TEST INSTRUMENTSLIST 7

6 TEST RESULTS AND MEASUREMENT DATA **8**

6.1 ANTENNA REQUIREMENT 8
6.2 RADIATED EMISSION 9
6.3 CONDUCTED EMISSION 16
6.4 BANDWIDTH 19

7 TEST SETUP PHOTOS **21**

8 EUT CONSTRUCTIONAL PHOTOS **23**

4 Test Summary

Test Item	Section in CFR 47	Result
Spurious emissions	15.209	Pass
20dB Bandwidth	15.215(c)	Pass
Conducted Emission	15.207	Pass

Remark:

1. *Pass: The EUT complies with the essential requirements in the standard.*
2. *The cable insertion loss used by "RF Output Power" and other conduction measurement items is 0.5dB (provided by the customer).*

Test Method:	*ANSI C63.4-2014* *ANSI C63.10-2013*

5 General Information

5.1 Client Information

Applicant:	NLU Products, L.L.C.
Address:	2801 N Thanksgiving Way #300, Lehi, UT 84043 USA
Manufacturer:	NLU Products, L.L.C.
Address:	2801 N Thanksgiving Way #300, Lehi, UT 84043 USA
Factory:	CTT Co., Ltd
Address:	Building 2 of Industrial park, No. 197, Xinhua Blvd, Tongqiao town, Zhongkai High-tech zone, Huizhou, Guangdong, China 516032.

5.2 General Description of E.U.T.

Product Name:	Lantern
Model No.:	Boulder
Operation Frequency:	110kHz ~ 205kHz
Modulation type:	ASK
Antenna Type:	Coil Antenna
Power supply: (Wireless charging)	Input: 5V, 3A / 9V, 2A /12V, 1.5A Output: 5W, 7.5W
Test Sample Condition:	The test samples were provided in good working order with no visible defects.

5.3 Test mode and test samples plans

Transmitting mode:	Keep the EUT in transmitting mode with modulation

5.4 Description of Support Units

Manufacturer	Description	Model	S/N	FCC ID/DoC
Skytek	Wireless charging match load	N/A	N/A	N/A
Apple	Adapter	A1695	N/A	N/A

5.5 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%)
Conducted Emission (9kHz ~ 30MHz)	±1.60 dB
Radiated Emission (9kHz ~ 30MHz)	±3.12 dB
Radiated Emission (30MHz ~ 1000MHz)	±4.32 dB
Radiated Emission (1GHz ~ 18GHz)	±5.16 dB
Radiated Emission (18GHz ~ 26.5GHz)	±3.20 dB

5.6 Additions to, deviations, or exclusions from the method

No

5.7 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC - Designation No.: CN1211**

JianYan Testing Group Shenzhen Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551.

- **ISED – CAB identifier.: CN0021**

The 3m Semi-anechoic chamber of JianYan Testing Group Shenzhen Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

- **A2LA - Registration No.: 4346.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: https://portal.a2la.org/scopepdf/4346-01.pdf

5.8 Laboratory Location

Shenzhen Zhongjian Nanfang Testing Co., Ltd.
Address: No.110~116, Building B, Jinyuan Business Building, Xixiang Road,
Bao'an District, Shenzhen, Guangdong, China
Tel: +86-755-23118282, Fax: +86-755-23116366
Email: info@ccis-cb.com, Website: http://www.ccis-cb.com

5.9 Test Instrumentslist

Radiated Emission:					
Test Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
3m SAC	SAEMC	9m*6m*6m	966	07-22-2020	07-21-2021
BiConiLog Antenna	SCHWARZBECK	VULB9163	497	03-07-2020	03-06-2021
Horn Antenna	SCHWARZBECK	BBHA9120D	916	03-07-2020	03-06-2021
Loop Antenna	SCHWARZBECK	FMZB 1519 B	00044	03-07-2020	03-06-2021
EMI Test Software	AUDIX	E3	6.110919b	N/A	N/A
Pre-amplifier	HP	8447D	2944A09358	03-07-2020	03-06-2021
Pre-amplifier	CD	PAP-1G18	11804	03-07-2020	03-06-2021
Spectrum analyzer	Rohde & Schwarz	FSP30	101454	03-05-2020	03-04-2021
EMI Test Receiver	Rohde & Schwarz	ESRP7	101070	03-05-2020	03-04-2021
Simulated Station	Anritsu	MT8820C	6201026545	03-07-2020	03-06-2021
Cable	ZDECL	Z108-NJ-NJ-81	1608458	03-07-2020	03-06-2021
Cable	MICRO-COAX	MFR64639	K10742-5	03-07-2020	03-06-2021
Cable	SUHNER	SUCOFLEX100	58193/4PE	03-07-2020	03-06-2021

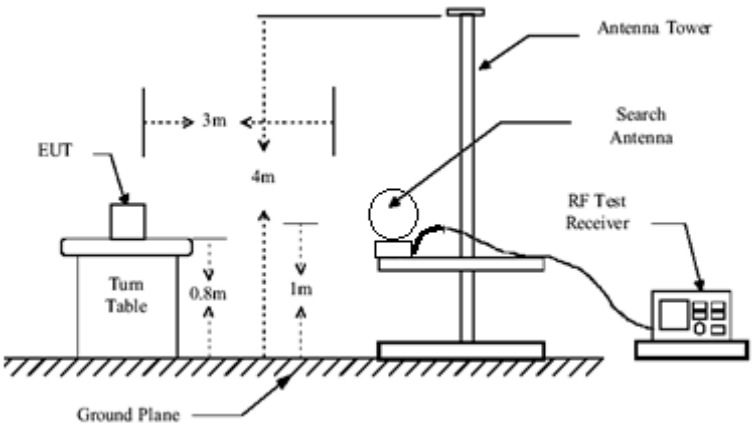
Conducted Emission:					
Test Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
EMI Test Receiver	Rohde & Schwarz	ESCI	101189	03-05-2020	03-04-2021
Pulse Limiter	SCHWARZBECK	OSRAM 2306	9731	03-05-2020	03-04-2021
LISN	CHASE	MN2050D	1447	03-05-2020	03-04-2021
LISN	Rohde & Schwarz	ESH3-Z5	8438621/010	07-21-2020	07-20-2021
Cable	HP	10503A	N/A	03-05-2020	03-04-2021
EMI Test Software	AUDIX	E3	6.110919b	N/A	N/A

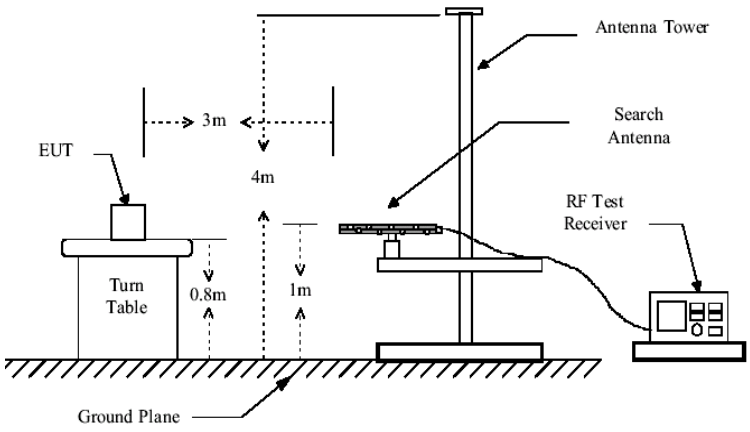
6 Test results and Measurement Data

6.1 Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203
15.203 requirement: 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 use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.	
E.U.T Antenna:	Coil antenna

6.2 Radiated Emission

Test Requirement:	FCC Part15 C Section 15.209				
Test Frequency Range:	9kHz to 1000MHz				
Test site:	Measurement Distance: 3m(Semi-Anechoic Chamber)				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	9kHz-150kHz	Quasi-peak	200Hz	600Hz	Quasi-peak Value
	150kHz-30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value
	30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
Limit:	Frequency (MHz)	Limit (uV/m @3m)			Distance (m)
	0.009-0.490	2400/F(kHz)			300
	0.490-1.705	24000/F(kHz)			30
	1.705-30	30			30
	30-88	100			3
	88-216	150			3
	216-960	200			3
	Above 1GHz	500			3
Test Procedure:	a. The EUT was placed on the top of a rotating table 0.8 meters above the groundat a 3 meter semi-anechoic camber. The table was rotated 360 degrees todetermine the position of the highest radiation. b. The EUT was set 3 meters away from the interference-receiving antenna, whichwas mounted on the top of a variable-height antenna tower. c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. d. For each suspected emission, the EUT was arranged to its worst case and thenthe antenna was tuned to heights from 1 meter to 4 meters and the rotatabletable was turned from 0 degrees to 360 degrees to find the maximum reading. e. The test-receiver system was set to Peak Detect Function and SpecifiedBandwidth with Maximum Hold Mode. f. If the emission level of the EUT in peak mode was 10dB lower than the limitspecified, then testing could be stopped and the peak values of the EUT wouldbe reported. Otherwise the emissions that did not have 10dB margin would bere-tested one by one using peak, quasi-peak or average method as specified andthen reported in a data sheet.				
Test setup:	9kHz-30MHz  30MHz-1GHz				

	
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass
Remark:	The emission levels of above 1 GHz are very lower than the limit and not show in test report.

Measurement Data:

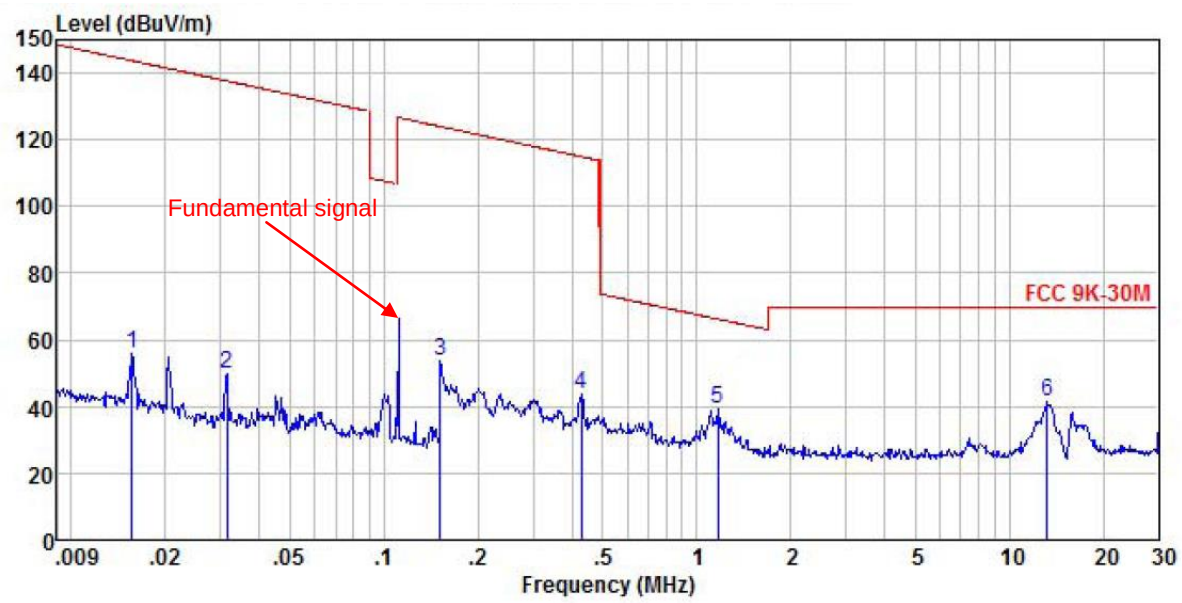
a) Fundamental field strength

Peak value				
Test Polarization	Frequency (kHz)	H-field@3m (dBμV)	Limit@3m (dBμV)	Result
Horizontal	143.25	62.34	81.49	Pass
Vertical	143.25	67.15	81.49	Pass
Average value				
Test Polarization	Frequency (kHz)	H-field@3m (dBμV)	Limit@3m (dBμV)	Result
Horizontal	143.25	45.19	61.49	Pass
Vertical	143.25	51.37	61.49	Pass

b) Radiated spurious:

Below 1GHz:

Product Name:	Lantern	Product Model:	Boulder
Test By:	YT	Test mode:	Charing mode
Test Frequency:	9kHz~30MHz	Polarization:	Vertical
Test Voltage:	AC 120V/60Hz	Environment:	Temp: 24℃ Huni: 57%

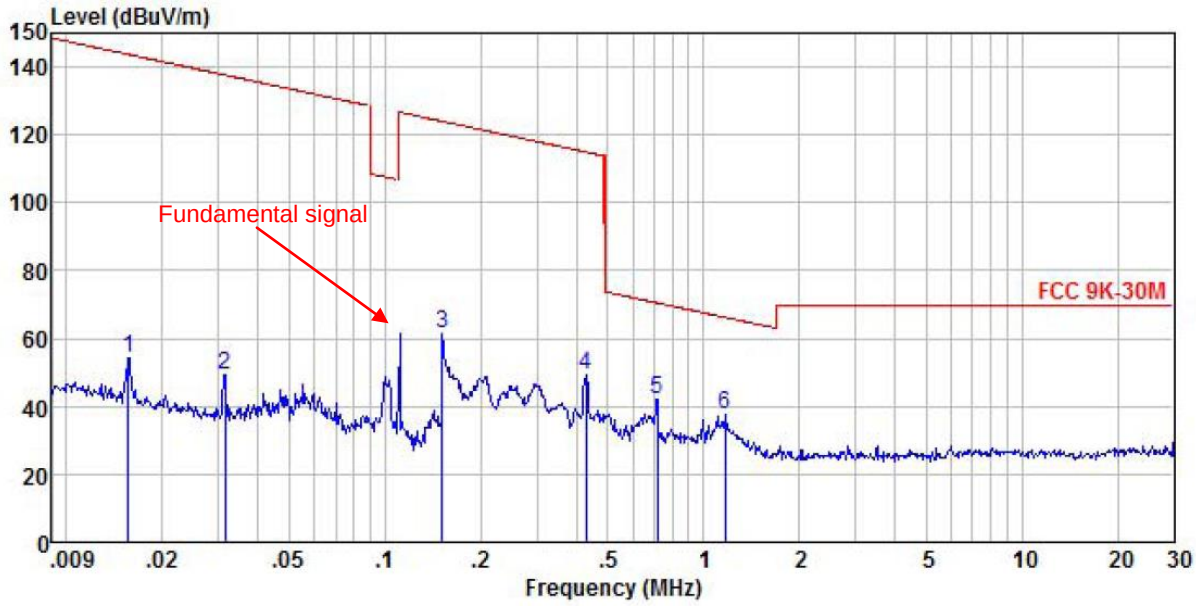


	Freq	Read Level	Antenna Factor	Cable Loss	Aux Factor	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dB	dBuV/m	dBuV/m	dB	
1	0.016	35.55	20.38	0.01	0.00	0.00	55.94	143.71	-87.77	Peak
2	0.031	29.34	20.24	0.02	0.00	0.00	49.60	137.65	-88.05	Peak
3	0.151	33.73	20.20	0.03	0.00	0.00	53.96	124.02	-70.06	Peak
4	0.428	22.83	20.72	0.07	0.00	0.00	43.62	114.98	-71.36	Peak
5	1.169	18.39	20.49	0.17	0.00	0.00	39.05	66.27	-27.22	Peak
6	13.222	21.35	19.66	0.39	0.00	0.00	41.40	69.50	-28.10	Peak

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Product Name:	Lantern	Product Model:	Boulder
Test By:	YT	Test mode:	Charing mode
Test Frequency:	9kHz~30MHz	Polarization:	Horizontal
Test Voltage:	AC 120V/60Hz	Environment:	Temp: 24℃ Huni: 57%

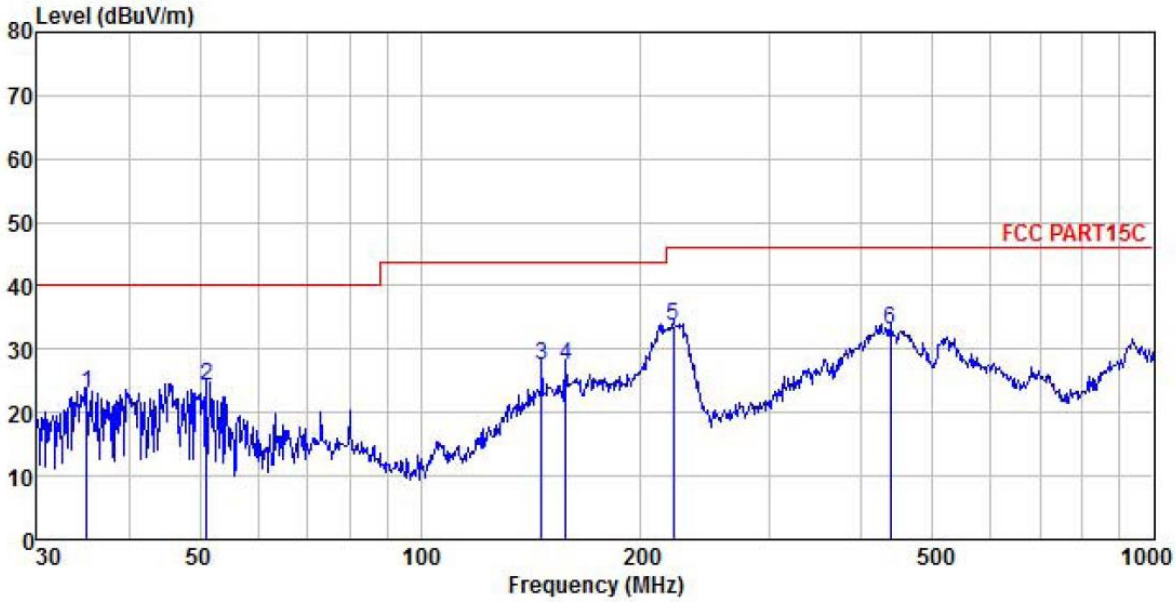


	Freq	Read Level	Antenna Factor	Cable Loss	Aux Factor	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dB	dBuV/m	dBuV/m	dB	
1	0.016	34.02	20.38	0.01	0.00	0.00	54.41	143.71	-89.30	Peak
2	0.031	29.06	20.24	0.02	0.00	0.00	49.32	137.65	-88.33	Peak
3	0.151	41.13	20.20	0.03	0.00	0.00	61.36	124.02	-62.66	Peak
4	0.428	28.45	20.72	0.07	0.00	0.00	49.24	114.98	-65.74	Peak
5	0.719	21.36	20.64	0.10	0.00	0.00	42.10	70.48	-28.38	Peak
6	1.169	16.76	20.49	0.17	0.00	0.00	37.42	66.27	-28.85	Peak

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Product Name:	Lantern	Product Model:	Boulder
Test By:	YT	Test mode:	Charing mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Vertical
Test Voltage:	AC 120V/60Hz	Environment:	Temp: 24℃ Huni: 57%

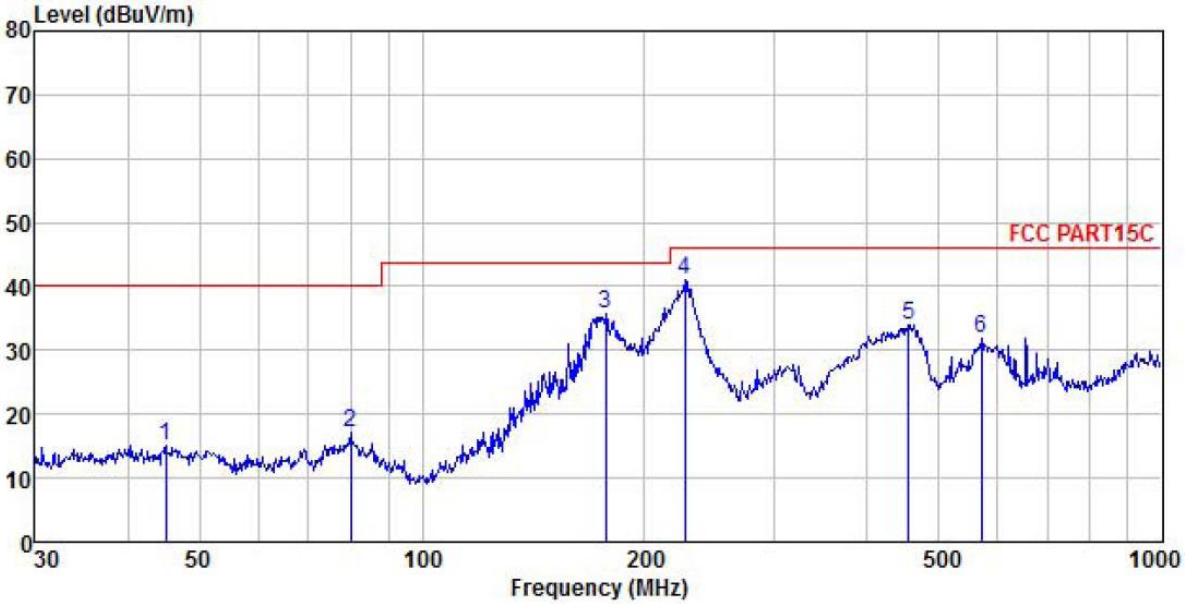


	Freq	Read Level	Antenna Factor	Cable Loss	Aux Factor	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dB	dBuV/m	dBuV/m	dB	
1	35.128	39.33	12.61	1.04	0.00	29.95	23.03	40.00	-16.97	QP
2	51.121	39.90	12.78	1.27	0.00	29.82	24.13	40.00	-15.87	QP
3	146.374	40.14	14.02	2.47	0.00	29.24	27.39	43.60	-16.21	QP
4	158.112	38.83	15.13	2.57	0.00	29.15	27.38	43.60	-16.22	QP
5	221.392	41.12	18.39	2.84	0.00	28.70	33.65	46.00	-12.35	QP
6	437.120	39.56	19.18	3.17	0.00	28.85	33.06	46.00	-12.94	QP

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss + Aux Factor – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
3. *The Aux Factor is a notch filter switch box loss, this item is not used.*

Product Name:	Lantern	Product Model:	Boulder
Test By:	YT	Test mode:	Charing mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Horizontal
Test Voltage:	AC 120V/60Hz	Environment:	Temp: 24℃ Huni: 57%

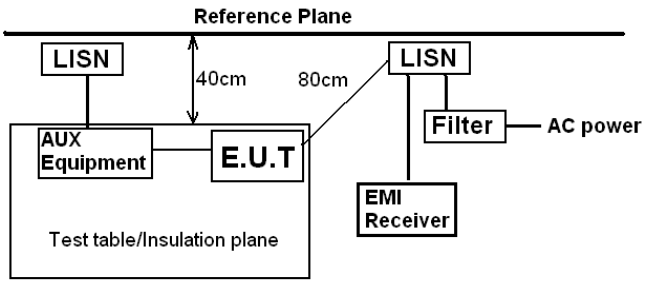


	Freq	Read Level	Antenna Factor	Cable Loss	Aux Factor	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dB	dBuV/m	dBuV/m	dB	
1	45.058	30.83	12.90	1.29	0.00	29.86	15.16	40.00	-24.84	QP
2	80.081	32.42	12.80	1.65	0.00	29.64	17.23	40.00	-22.77	QP
3	176.888	45.14	16.84	2.71	0.00	29.00	35.69	43.60	-7.91	QP
4	226.894	48.56	18.41	2.84	0.00	28.67	41.14	46.00	-4.86	QP
5	454.310	40.42	19.22	3.23	0.00	28.88	33.99	46.00	-12.01	QP
6	570.610	37.35	19.73	3.91	0.00	29.03	31.96	46.00	-14.04	QP

Remark:

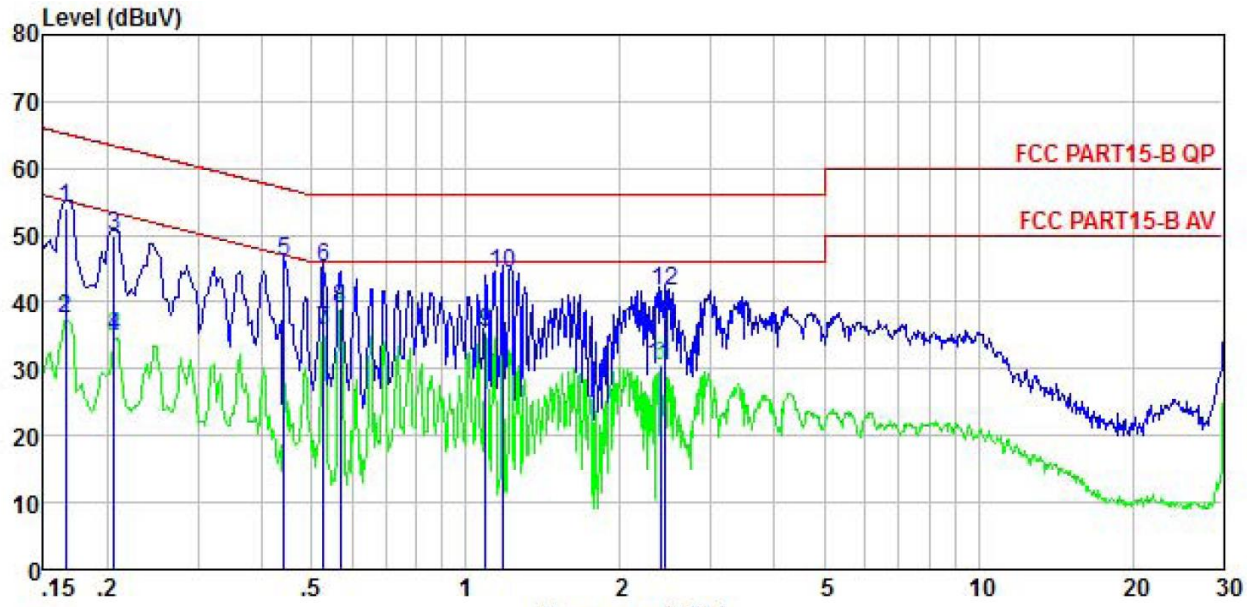
1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss + Aux Factor – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
3. *The Aux Factor is a notch filter switch box loss, this item is not used.*

6.3 Conducted Emission

Test Requirement:	FCC Part 15 B Section 15.207					
Test Frequency Range:	150kHz to 30MHz					
Class / Severity:	Class B					
Receiver setup:	RBW=9kHz, VBW=30kHz					
Limit:	Frequency range (MHz)	Limit (dBμV)				
		Quasi-peak	Average			
	0.15-0.5	66 to 56*	56 to 46*			
	0.5-5	56	46			
	0.5-30	60	50			
	* Decreases with the logarithm of the frequency.					
Test setup:	 *Remark:* *E.U.T: Equipment Under Test* *LISN: Line Impedence Stabilization Network* *Test table height=0.8m*					
Test procedure	1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network(L.I.S.N.). The provide a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.					
Test environment:	Temp.:	23 °C	Humid.:	56%	Press.:	101kPa
Test Instruments:	Refer to section 5.9 for details					
Test mode:	Refer to section 5.3 for details					
Test results:	Pass					

Measurement data:

Product name:	Lantern	Product Model:	Boulder
Test by:	YT	Test mode:	Charing mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Line
Test voltage:	AC 120 V/60 Hz	Environment:	Temp: 22.5℃ Huni: 55%

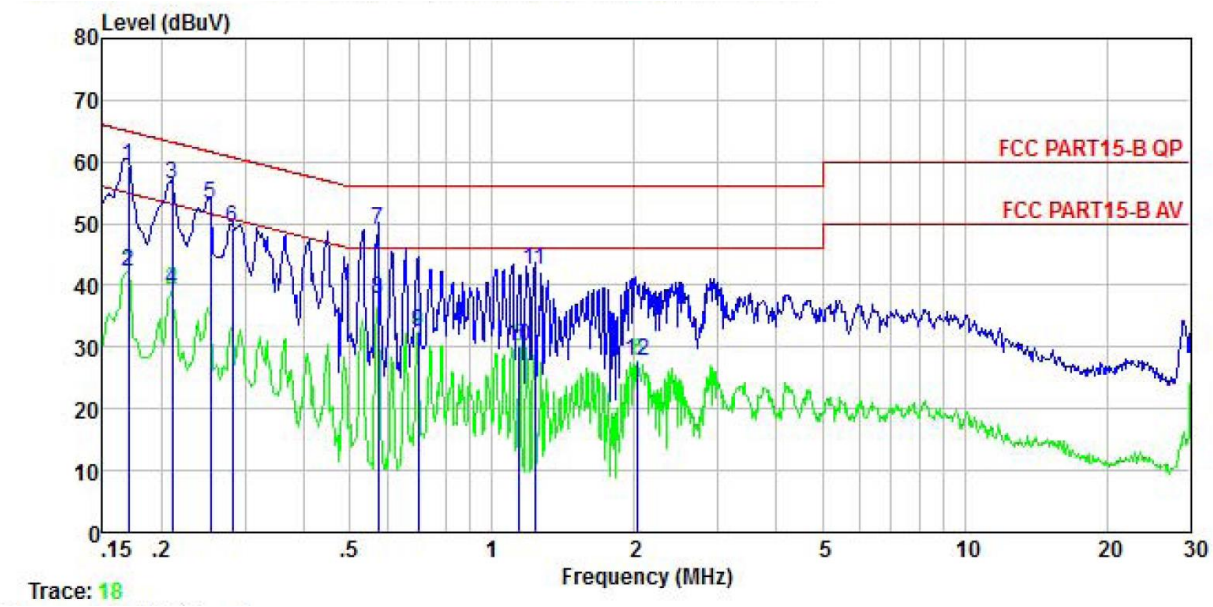


	Freq	Read Level	LISN Factor	Aux Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.166	44.00	-0.58	-0.09	10.77	54.10	65.16	-11.06	QP
2	0.166	27.40	-0.58	-0.09	10.77	37.50	55.16	-17.66	Average
3	0.206	39.83	-0.59	-0.17	10.76	49.83	63.36	-13.53	QP
4	0.206	24.74	-0.59	-0.17	10.76	34.74	53.36	-18.62	Average
5	0.442	35.55	-0.46	0.08	10.74	45.91	57.02	-11.11	QP
6	0.527	35.36	-0.45	-0.36	10.76	45.31	56.00	-10.69	QP
7	0.527	25.63	-0.45	-0.36	10.76	35.58	46.00	-10.42	Average
8	0.570	29.04	-0.47	-0.37	10.76	38.96	46.00	-7.04	Average
9	1.094	24.69	-0.61	0.36	10.88	35.32	46.00	-10.68	Average
10	1.184	33.82	-0.59	0.27	10.89	44.39	56.00	-11.61	QP
11	2.396	20.11	-0.47	-0.27	10.94	30.31	46.00	-15.69	Average
12	2.435	31.32	-0.47	-0.27	10.94	41.52	56.00	-14.48	QP

Notes:

1. *An initial pre-scan was performed on the line and neutral lines with peak detector.*
2. *Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.*
3. *Final Level =Receiver Read level + LISN Factor + Cable Loss.*

Product name:	Lantern	Product Model:	Boulder
Test by:	YT	Test mode:	Charing mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Neutral
Test voltage:	AC 120 V/60 Hz	Environment:	Temp: 22.5℃ Huni: 55%

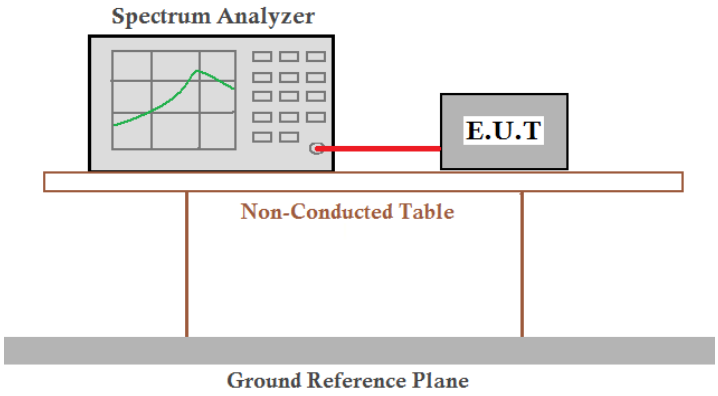


	Freq	Read Level	LISN Factor	Aux Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.170	49.35	-0.68	0.01	10.77	59.45	64.94	-5.49	QP
2	0.170	32.26	-0.68	0.01	10.77	42.36	54.94	-12.58	Average
3	0.211	46.27	-0.67	0.00	10.76	56.36	63.18	-6.82	QP
4	0.211	29.08	-0.67	0.00	10.76	39.17	53.18	-14.01	Average
5	0.253	42.98	-0.67	0.01	10.75	53.07	61.64	-8.57	QP
6	0.282	39.11	-0.67	0.01	10.74	49.19	60.76	-11.57	QP
7	0.573	38.99	-0.65	0.03	10.76	49.13	56.00	-6.87	QP
8	0.573	27.77	-0.65	0.03	10.76	37.91	46.00	-8.09	Average
9	0.697	22.37	-0.64	0.04	10.77	32.54	46.00	-13.46	Average
10	1.141	19.80	-0.69	0.10	10.89	30.10	46.00	-15.90	Average
11	1.229	32.32	-0.69	0.11	10.90	42.64	56.00	-13.36	QP
12	2.033	17.20	-0.71	0.18	10.96	27.63	46.00	-18.37	Average

Notes:

1. *An initial pre-scan was performed on the line and neutral lines with peak detector.*
2. *Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.*
3. *Final Level =Receiver Read level + LISN Factor + Cable Loss.*

6.4 Bandwidth

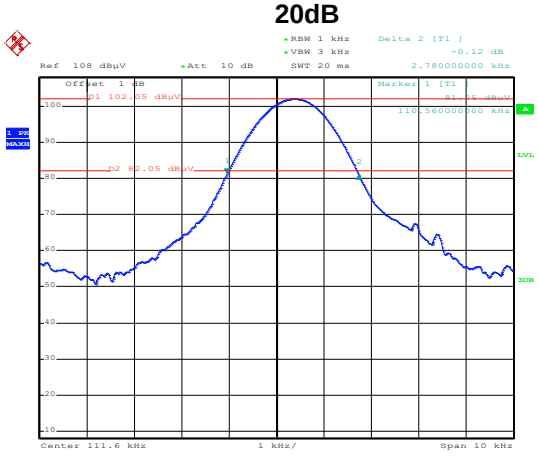
Test Requirement:	FCC Part15 C Section 15.215 (c)
Receiver setup:	RBW=1 kHz, VBW=3 kHz, detector: Peak
Limit:	The fundamental emission be kept within at least the central 80% of the permitted band
Test Procedure:	1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT. 2. Set the EUT to proper test channel. 3. Max hold the radiated emissions, mark the peak power frequency point and the -20dB upper and lower frequency points. 4. Read 20dB bandwidth.
Test setup:	
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data

Test CH	20dB Emission Bandwidth (kHz)	Limit(kHz)
Lowest	2.78	N/A
Highest	2.70	
Test CH	99% Occupy Bandwidth (kHz)	Limit(kHz)
Lowest	2.32	N/A
Highest	2.36	
Remark: For report purpose only.		

Test plot as follows:

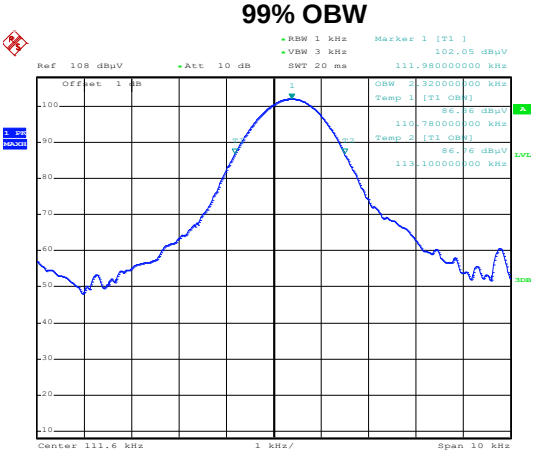
20dB



Date: 7.DEC.2020 09:41:19

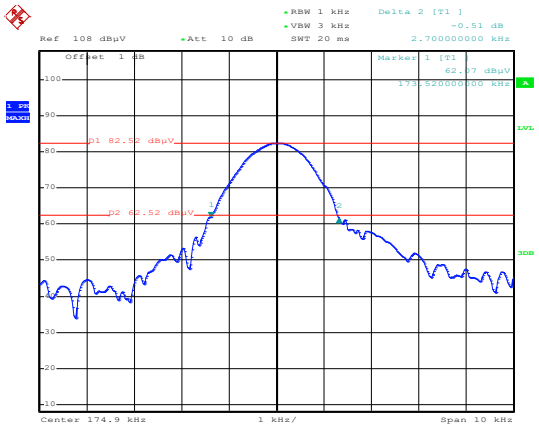
Test Frequency= 111.60 kHz

99% OBW



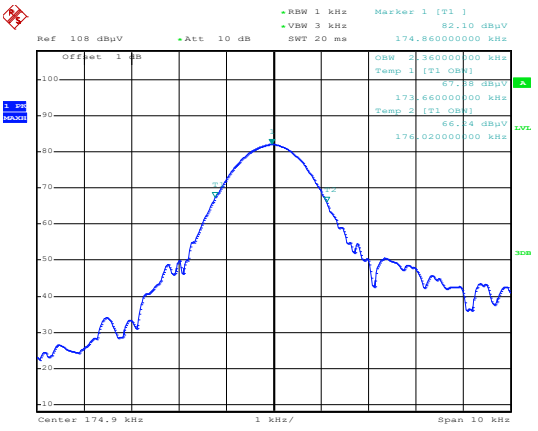
Date: 7.DEC.2020 09:40:25

Test Frequency= 111.60 kHz



Date: 7.DEC.2020 10:23:59

Test Frequency= 174.90 kHz



Date: 7.DEC.2020 10:23:25

Test Frequency= 174.90 kHz