FCC Part 15C
Measurement and Test Report

For

RVLOCK & CO, LLC

FCC ID: 2BDX6-R009V

FCC Rule(s):	FCC Part 15.231(a)
Product Description:	4 BUTTON KEY FOB
Tested Model:	R009V
Report No.:	BSL231231901601RF
Tested Date:	Dec. 01~15, 2023
Issued Date:	Dec. 15, 2023
Tested By:	Lris. Yao / Engineer
Reviewed By:	Livi. Xiao / EMC Manager
Approved & Authorized By:	Salon.ouyang/ PSQ Manager

Prepared By:

BSL Testing Co.,LTD.
1/F, Building B, Xinshidai GR Park, Shiyan Street,
Bao'an District, Shenzhen, ShiyanStreet, Bao'an District,
Shenzhen,Guangdong,518052,People's Republic of China
Tel: 400-882-9628 Fax: 86- 755-26508703

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant:	RVLOCK & CO, LLC
Address of applicant:	1770 WEST 2690 SOUTH WELLSVILLE, UT 84339 USA
Manufacturer:	Eazylift (Guangdong) Electromechanical Co., Ltd.
Address of manufacturer:	No. 16 Chaoyang Road, National Ecological Industrial Demonstration Park, Danzao Town, Nanhai District, Foshan，China

General Description of EUT	
Product Name:	4 BUTTON KEY FOB
Trade Name:	/
Model No.:	R009V
Adding Model(s):	N/A
Rated Voltage:	3.0V by battery
Power Adapter Model:	N/A

Technical Characteristics of EUT	
Frequency Range:	433.94 MHz
Max. Field Strength:	69.38dBuV/m
Data Rate:	N/A
Modulation:	ASK
Antenna Type:	PCB antenna

1.2 Test Standards

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.231, 15.203, 15.205 and 15.209 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission/immunity, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices, and 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.

1.4 Test Facility

BSL Testing Co.,LTD.
1/F, Building B, Xinshidai GR Park, Shiyan Street, Bao'an District, Shenzhen, ShiyanStreet, Bao'an District, Shenzhen,Guangdong,518052,People’s Republic of China

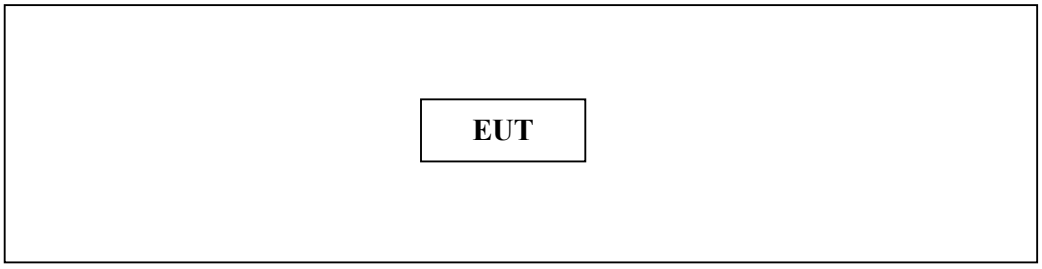
FCC Test Firm Registration Number: 562200
Designation Number: CN1338

Tel: 400-882-9628
Fax: 86-755-26508703

1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

TX Mode



1.5 EUT Setup and Test Mode

The EUT was operated at continuous transmitting mode that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	Transmitting	Modulation
TM2		
TM3		

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
Occupied Bandwidth	Conducted	±1.5%
Conducted Spurious Emission	Conducted	±2.17dB
Transmission Time	Conducted	±5%
Conducted Emissions	Conducted	±2.88dB
Transmitter Spurious Emissions	Radiated	±5.1dB

1.7 Test Equipment List and Details

Description	Manufacturer	Model	Serial No.	Cal Date	Due. Date
Communication Tester	Rohde & Schwarz	CMW500	100358	2023-10-27	2024-10-26
Spectrum Analyzer	R&S	FSP40	100550	2023-10-27	2024-10-26
Test Receiver	R&S	ESCI7	US47140102	2023-10-27	2024-10-26
Signal Generator	HP	83630B	3844A01028	2023-10-27	2024-10-26
Test Receiver	R&S	ESPI-3	100180	2023-10-27	2024-10-26
Amplifier	Agilent	8449B	4035A00116	2023-10-27	2024-10-26
Amplifier	HP	8447E	2945A02770	2023-10-27	2024-10-26
Signal Generator	IFR	2023A	202307/242	2023-10-27	2024-10-26
Broadband Antenna	SCHAFFNER	2774	2774	2023-10-27	2024-10-26
Biconical and log periodic antennas	ELECTRO-METRICS	EM-6917B-1	171	2023-10-27	2024-10-26
Horn Antenna	R&S	HF906	100253	2023-10-27	2024-10-26
Horn Antenna	EM	EM-6961	60.8762	2023-10-27	2024-10-26
LISN	R&S	ESH3-Z5	100196	2023-10-27	2024-10-26
LISN	COM-POWER	LI-115	02027	2023-10-27	2024-10-26
3m Semi-Anechoic Chamber	Chengyu Electron	9 (L)*6 (W)* 6 (H)	BSL086	2023-10-27	2024-10-26
Horn Antenna	A-INFOMW	LB-180400KF	BSL088	2023-10-27	2024-10-26
20dB Attenuator	ICPROBING	IATS1	BSL1003	2023-10-27	2024-10-26
POWER DIVIDER	Mini-circuits	PD-2SF-0010	N/A	2023-10-27	2024-10-26
POWER DIVIDER	Mini-circuits	PD-2SF-0010	N/A	2023-10-27	2024-10-26
Loop Antenna	Schwarz beck	FMZB 1516	9773	2023-10-27	2024-10-26

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 15.203	Antenna Requirement	Compliant
§ 15.207(e)	Conducted Emission	N/A
§15.231(a)	Release Time	Compliant
	Radiation Emission	Compliant
	20 dB Bandwidth	Compliant
	Duty Cycle	Compliant

Note: PASS: applicable, N/A: not applicable.

3. Antenna Requirement

3.1 Standard Applicable

According to FCC Part 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 use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

3.2 Test Result

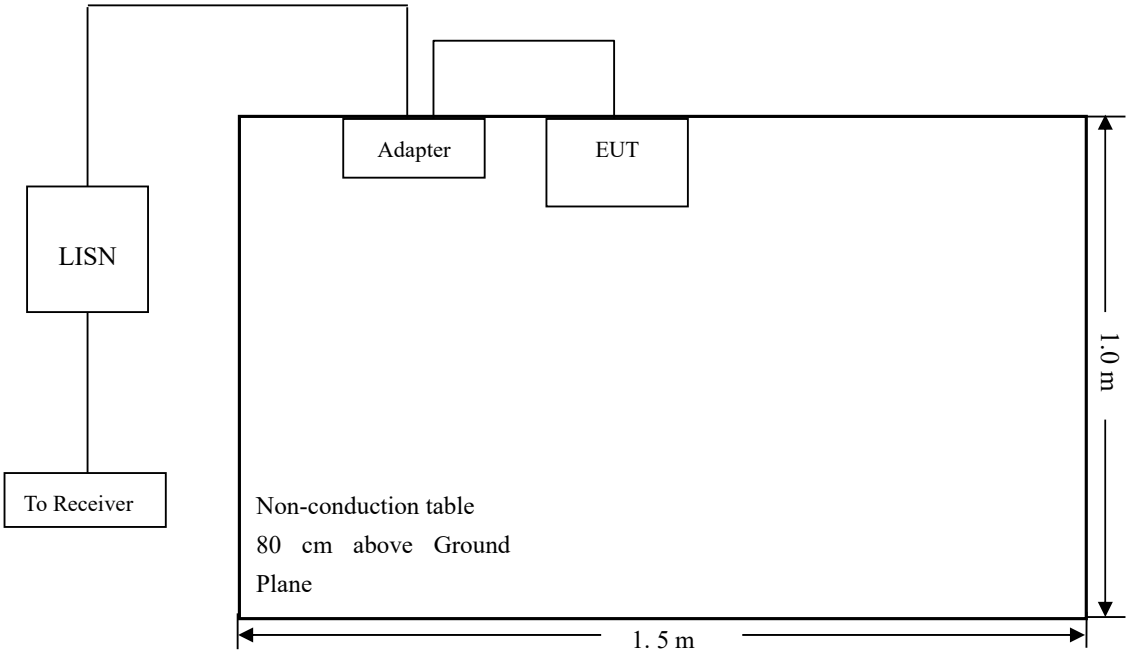
This product has a PCB antenna, fulfill the requirement of this section.

4. Conducted Emissions

4.1 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 Limit.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.
The spacing between the peripherals was 10 cm.

4.2 Basic Test Setup Block Diagram



4.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

4.4 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency ..... 150 kHz
Stop Frequency ..... 30 MHz
Sweep Speed ..... Auto
IF Bandwidth..... 10 kHz
Quasi-Peak Adapter Bandwidth ..... 9 kHz

Quasi-Peak Adapter Mode ..... Normal

4.6 Conducted Emissions Test Data

The test not applicable.

5. Radiated Emissions

5.1 Standard Applicable

According to §15.231(a), In addition to the provisions of § 15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

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

(1) Linear interpolations.

(2) Emission level (dB)uV = 20 log Emission level uV/m

(3) The smaller limit shall apply at the cross point between two frequency bands.

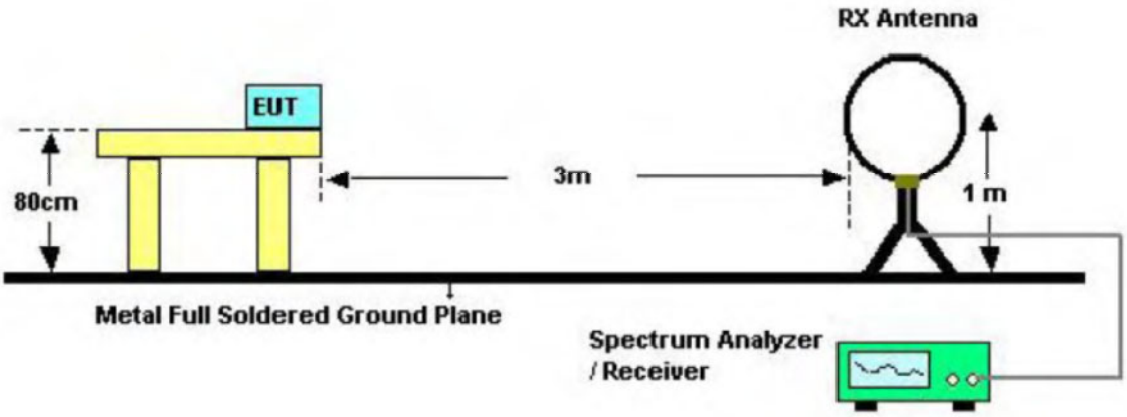
The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209,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

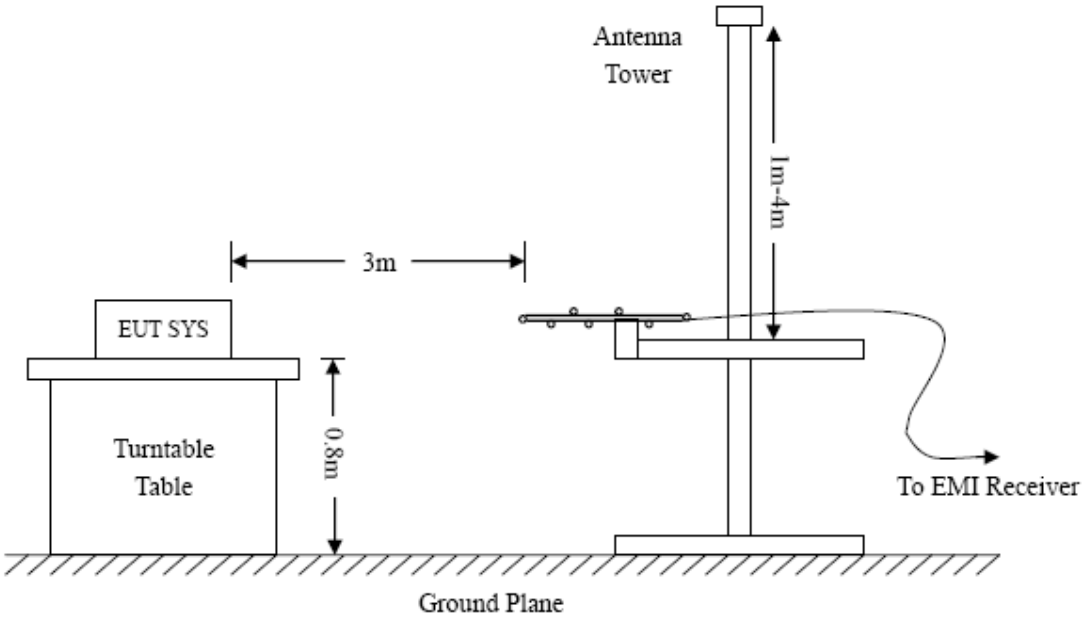
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

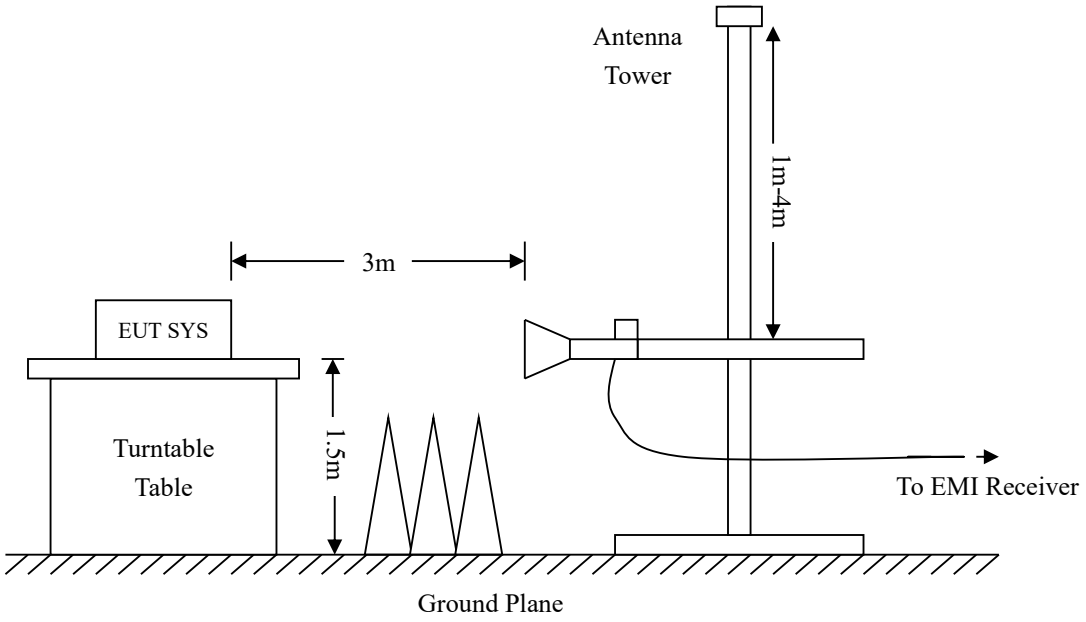
Compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

5.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.231(e) and FCC Part 15.209 Limit.






Antenna
Tower
1m-4m
3m
EUT SYS
Turntable
Table
1.5m
To EMI Receiver
Ground Plane

5.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading +Ant.Loss +Cab. Loss – Ampl.Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dBμV means the emission is 6dBμV below the maximum limit. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – FCC Part 15C Limit

5.4 Environmental Conditions

Temperature:	21° C
Relative Humidity:	50%
ATM Pressure:	1011 mbar

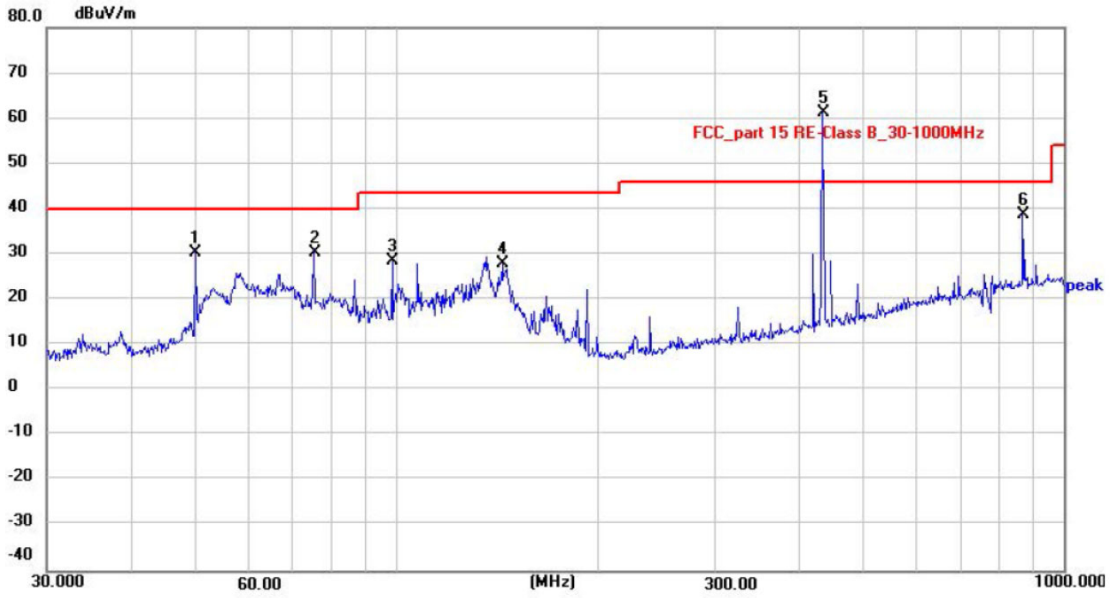
5.5 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.231 standards, and had the worst margin of:

-18.23 dB at **433.94 MHz** in the *Vertical* polarization, **Ave Detector**, **9 kHz to 5 GHz**,

Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

Horizontal

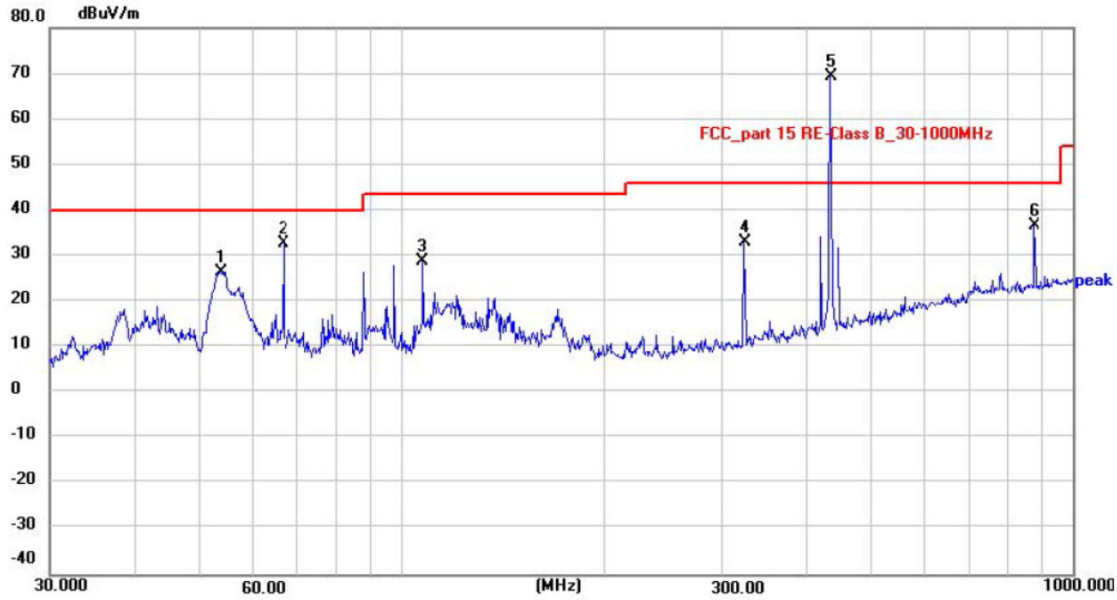


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	50.0566	46.75	-16.40	30.35	40.00	-9.65	peak	100	360	P	
2	75.4464	50.17	-19.74	30.43	40.00	-9.57	peak	100	360	P	
3	98.8326	48.55	-19.98	28.57	43.50	-14.93	peak	100	360	P	
4	144.3348	44.42	-16.40	28.02	43.50	-15.48	peak	100	360	P	
5 *	434.0651	73.25	-12.11	61.14	46.00	15.14	peak	100	360	F	
6	868.6667	42.26	-3.63	38.63	46.00	-7.37	peak	100	360	P	

*:Maximum data x:Over limit !:over margin

Below 1GHz									
Frequency	**Reading**	**Corr.**	**Duty cycle**	**Result**	**Limit**	**Margin**	**Deg.**	**Height**	**Remark**
MHz	**dBuV/ m**	**Factor(dB)**	**Factor (dB)**	**dBuV/ m**	**dBuV/ m**	**(dB)**	**(°)**	**(cm)**	
433.94	73.25	-12.11	N/A	61.14	100.83	-39.69	360	100	peak
433.94	/	/	-6.74	54.40	80.83	-26.43	360	100	Ave
867.88	42.26	-3.63	N/A	38.63	80.83	-42.20	360	100	peak
867.88	/	/	-6.74	31.89	60.83	-28.94	360	100	Ave
Above 1GHz									
1301.82	55.21	-12.91	N/A	42.30	74.00	-31.70	125	150	Peak
1301.82	/	/	-6.74	35.56	54.00	-18.44	150	150	Ave
1735.76	47.30	-9.20	N/A	38.10	80.83	-42.73	181	150	Peak
1735.76	/	/	-6.74	31.36	60.83	-29.47	163	150	Ave

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	53.6932	43.28	-16.71	26.57	40.00	-13.43	peak	100	360	P	
2	66.7325	50.82	-18.13	32.69	40.00	-7.31	peak	100	360	P	
3	107.8877	47.92	-19.15	28.77	43.50	-14.73	peak	100	360	P	
4	323.3204	47.92	-14.99	32.93	46.00	-13.07	peak	100	360	P	
5 *	434.0651	81.49	-12.11	69.38	46.00	23.38	peak	100	360	F	
6	868.6667	40.40	-3.63	36.77	46.00	-9.23	peak	100	360	P	

*:Maximum data x:Over limit !:over margin

Below 1GHz									
Frequency	**Reading**	**Corr.**	**Duty cycle**	**Result**	**Limit**	**Margin**	**Deg.**	**Height**	**Remark**
MHz	**dBuV/m**	**Factor(dB)**	**Factor (dB)**	**dBuV/m**	**dBuV/m**	**(dB)**	**(°)**	**(cm)**	
433.0651	81.49	-12.11	N/A	69.38	100.87	-31.49	360	100	peak
434.0651	/	/	-6.74	62.64	80.87	-18.23	360	100	Ave
868.6667	40.40	3.63	N/A	44.03	80.87	-36.84	360	100	peak
868.6667	/	/	-6.74	37.29	60.87	-23.58	360	100	Ave
Above 1GHz									
1299.1953	59.21	-12.91	N/A	46.30	80.87	-34.57	110	150	Peak
1302.1953	/	/	-6.74	39.56	60.87	-21.31	185	150	Ave
1732.2604	51.34	-9.20	N/A	42.14	80.87	-38.73	23	150	Peak
1736.2604	/	/	-6.74	35.40	60.87	-25.47	196	150	Ave

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 5th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
The measurements greater than 20dB below the limit from 9kHz to 30MHz..

The fundamental frequency is 433.925, so the fundamental and spurious emissions radiated limit base on the the operating frequency 433.925.

6. 20dB Bandwidth

6.1 Standard Applicable

According to FCC Part 15.231(c), 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. Bandwidth is determined at the points 20 dB down from the modulated carrier.

6.1 Test Procedure

With the EUT's antenna attached, the EUT's 20dBc Bandwidth power was received by the test antenna, which was connected to the spectrum analyzer with the START, and STOP frequencies set to the EUT's operation band.

6.2 Environmental Conditions

Temperature:	21° C
Relative Humidity:	52%
ATM Pressure:	1011 mbar

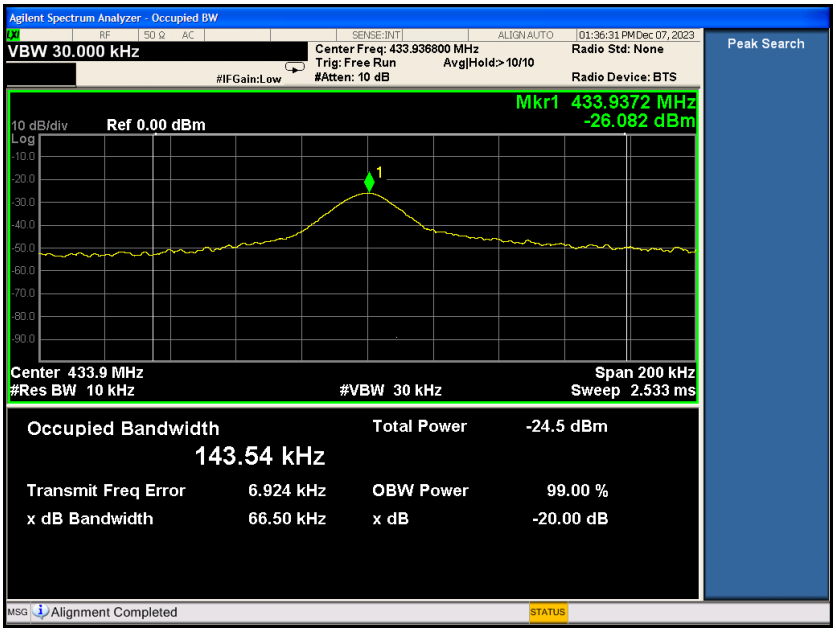
6.3 Summary of Test Results/Plots

Test Frequency MHz	20dBc Bandwidth kHz	Limit kHz	Result
433.94	66.5	1084	Pass

Limit = Fundamental Frequency X 0.25% = 433.953 MHz X 0.25% = 1084 kHz

Please refer to the attached plots.

20dBc Bandwidth Test Plot



7. Transmission Time

7.1 Standard Applicable

According to FCC Part 15.231 (a), the transmitter shall be complied the following requirements:
(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

7.2 Test Procedure

With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to 433.94, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

7.3 Environmental Conditions

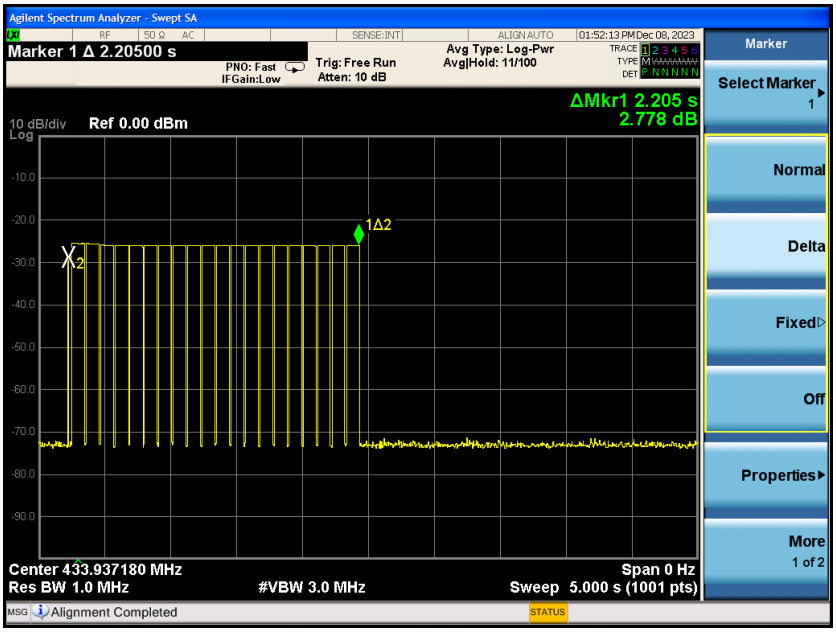
Temperature:	20° C
Relative Humidity:	52%
ATM Pressure:	1011 mbar

7.4 Summary of Test Results/Plots

Dwell Time(seconds)	Limit(s)	Result
2.2s	5s	PASS

Please refer to the attached plots.

Transmission Time:



8. Duty Cycle

8.1 Standard Applicable

According to FCC Part 15.231 (b)(2) and 15.35 (c), For pulse operation transmitter, the averaging pulsed emissions are calculated by peak value of measured emission plus duty cycle factor.

8.2 Test Procedure

With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to 433.925, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

8.3 Environmental Conditions

Temperature:	20° C
Relative Humidity:	52%
ATM Pressure:	1011 mbar

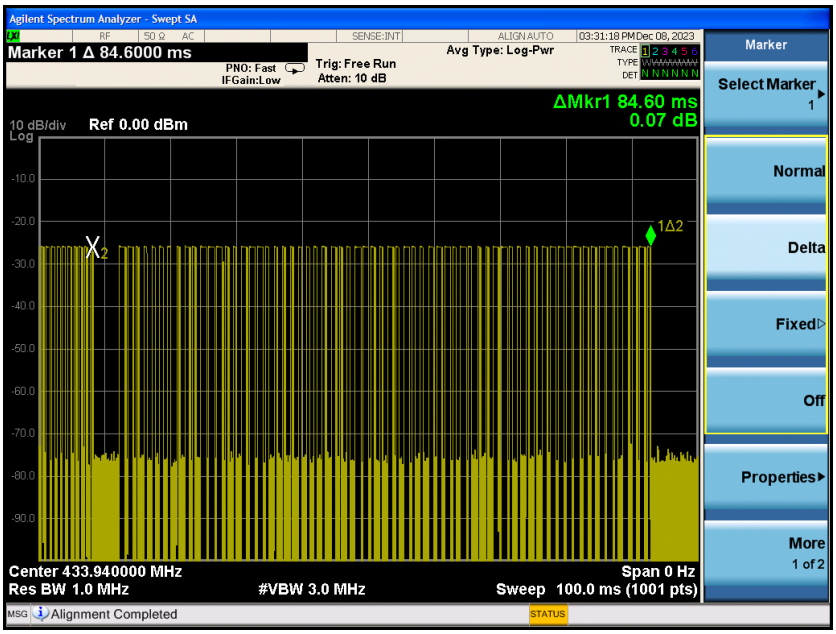
8.4 Summary of Test Results

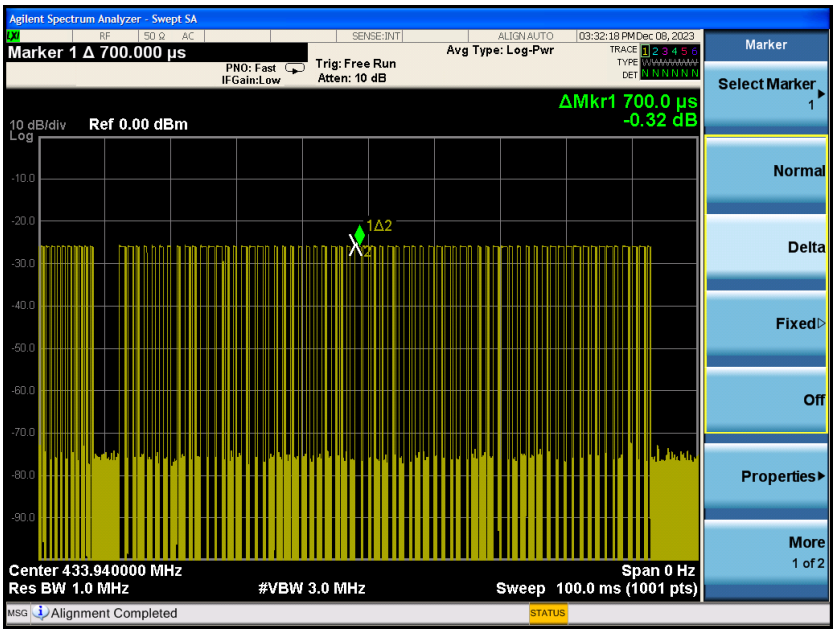
The duty cycle is simply the on-time divided the duration of one cycle
Duty Cycle =(0.7ms*45+0.2ms*37)/ 84.6=45.98%

Test Period (T_p) ms	Total Time (T_{on}) ms	Duty Cycle %	Duty Cycle Factor dB
84.6	38.9	45.98	-6.74

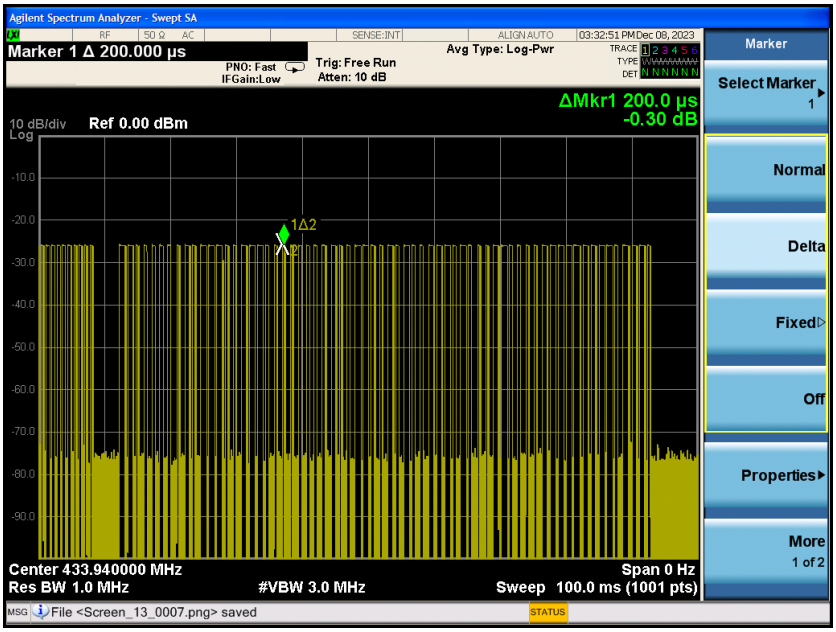
Duty Cycle Factor=20 log(Duty Cycle)=-6.74
Please refer to the attached test plots

Pulse:





Test Period:


Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 200.000 µs
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
03:32:51 PM Dec 08, 2023
ΔMkr1 200.0 µs
-0.30 dB
10 dB/div
Log
Ref 0.00 dBm
1Δ2
Center 433.940000 MHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 100.0 ms (1001 pts)
File <Screen_13_0007.png> saved
Marker
Select Marker
Normal
Delta
Fixed
Off
Properties
More
1 of 2

******END REPORT******