FCC Test Report

Applicant	:	**Dongguan MingHeng Plastic Products Co., Ltd.**
Address	:	**Room 101, No. 3, Dongfu Road, Miaobianwang, Shipai Town, Dongguan City, Guangdong Province, 523350, China**
Product Name	:	**Christmas Bulb Controller**
Report Date	:	**Feb. 01, 2024**

Shenzhen Anbotek Compliance Laboratory Limited

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TEST REPORT

Applicant	:	Dongguan MingHeng Plastic Products Co., Ltd.
Manufacturer	:	Dongguan MingHeng Plastic Products Co., Ltd.
Product Name	:	Christmas Bulb Controller
Test Model No.	:	39620
Reference Model No.	:	39621, 39622, 39623, 39624, 39625, 39626, 39627, 39628, 39629
Trade Mark	:	MR CHRISTMAS
Rating(s)	:	Input: DC 3V with "AAA*2" battery
Test Standard(s)	**:**	**FCC Part15 Subpart C, Section 15.231**
Test Method(s)	**:**	**ANSI C63.10: 2020**

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart C requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Receipt: Jan. 11, 2024

Date of Test: Jan. 11 ~ 23, 2024

Prepared By: Nianxiu Chen

(Nianxiu Chen)

Approved & Authorized Signer: Edward Pan

(Edward Pan)

Revision History

Report Version	Description	Issued Date
R00	Original Issue.	Feb. 01, 2024

1. General Information

1.1. Client Information

Applicant	:	Dongguan MingHeng Plastic Products Co., Ltd.
Address	:	Room 101, No. 3, Dongfu Road, Miaobianwang, Shipai Town, Dongguan City, Guangdong Province, 523350, China
Manufacturer	:	Dongguan MingHeng Plastic Products Co., Ltd.
Address	:	Room 101, No. 3, Dongfu Road, Miaobianwang, Shipai Town, Dongguan City, Guangdong Province, 523350, China
Factory	:	Dongguan MingHeng Plastic Products Co., Ltd.
Address	:	Room 101, No. 3, Dongfu Road, Miaobianwang, Shipai Town, Dongguan City, Guangdong Province, 523350, China

1.2. Description of Device (EUT)

Product Name	:	Christmas Bulb Controller
Test Model No.	:	39620
Reference Model No.	:	39621, 39622, 39623, 39624, 39625, 39626, 39627, 39628, 39629 (Note: All samples are the same except the model number, so we prepare “39620” for test only.)
Trade Mark	:	MR CHRISTMAS
Test Power Supply	:	DC 3V battery
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)
Adapter	:	N/A
RF Specification		
Operation Frequency	:	433.92MHz
Number of Channel	:	1 Channel
Modulation Type	:	ASK
Antenna Type	:	PCB Antenna
Antenna Gain(Peak)	:	-5.84 dBi
Remark: 1) All of the RF specification are provided by customer. 2) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.		

1.3. Auxiliary Equipment Used During Test

Description	Rating(s)
/	/

1.4. Description of Test Configuration

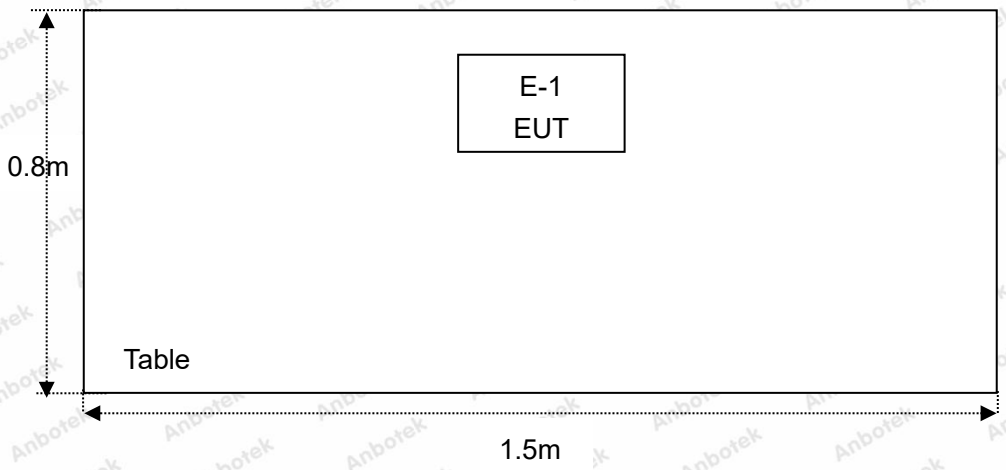
Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
01	433.92								

Note:

1. During the test, the EUT was keeping continuous transmission.

1.5. Description of Test Setup

RE



1.6. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	Rohde & Schwarz	ENV216	100055	Oct. 12, 2023	1 Year
2.	Three Phase V-type Artificial Power Network	CYBERTEK	EM5040DT	E215040DT001	Jul. 05, 2023	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Oct. 12, 2023	1 Year
4.	EMI Test Receiver	Rohde & Schwarz	ESR26	101481	Oct. 12, 2023	1 Year
5.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Oct. 12, 2023	1 Year
6.	EMI Preamplifier	SKET Electronic	LNPA-0118G-45	SKET-PA-002	Oct. 12, 2023	1 Year
7.	Double Ridged Horn Antenna	SCHWARZBECK	BBHA 9120D	02555	Oct. 16, 2022	3 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	345	Oct. 23, 2022	3 Year
9.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Oct. 12, 2023	1 Year
10.	Horn Antenna	A-INFO	LB-180400-KF	J211060628	Oct. 12, 2023	1 Year
11.	Pre-amplifier	SONOMA	310N	186860	Oct. 12, 2023	1 Year
12.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
13.	MXA Spectrum Analysis	KEYSIGHT	N9020A	MY53280032	Oct. 12, 2023	1 Year
14.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Oct. 12, 2023	1 Year
15.	Signal Generator	Agilent	E4421B	MY41000743	Oct. 12, 2023	1 Year
16.	DC Power Supply	IVYTECH	IV3605	1804D360510	Oct. 20, 2023	1 Year
17.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80B	N/A	Oct. 16, 2023	1 Year
18.	Spectrum Analyzer	Rohde & Schwarz	FSV40-N	101792	May. 26, 2023	1 Year

1.7. Measurement Uncertainty

Parameter	Uncertainty
Conducted emissions (AMN 150kHz~30MHz)	3.8dB
Occupied Bandwidth	925Hz
Conducted Output Power	0.76dB
Conducted Spurious Emission	1.24dB
Radiated spurious emissions (Below 30MHz)	3.53dB
Radiated spurious emissions (30MHz~1GHz)	Horizontal: 3.92dB; Vertical: 4.52dB
Radiated spurious emissions (above 1GHz)	1G-6GHz: 4.78dB; 6G-18GHz: 4.88dB 18G-40GHz: 5.68dB
The measurement uncertainty and decision risk evaluated according to AB/WI-RF-F-032. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

1.8. Description of Test Facility

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

FCC-Registration No.: 434132

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No. 434132.

ISED-Registration No.: 8058A

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (ISED) Innovation, Science and Economic Development Canada. The acceptance letter from the ISED is maintained in our files. Registration 8058A.

Test Location

Shenzhen Anbotek Compliance Laboratory Limited.
1/F, Building D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.

1.9. Disclaimer

1. The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
2. The test report is invalid if there is any evidence and/or falsification.
3. The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.
4. This document may not be altered or revised in any way unless done so by Anbotek and all revisions are duly noted in the revisions section.
5. Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.
6. The authenticity of the information provided by the customer is the responsibility of the customer and the laboratory is not responsible for its authenticity.

The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.

2. Summary of Test Results

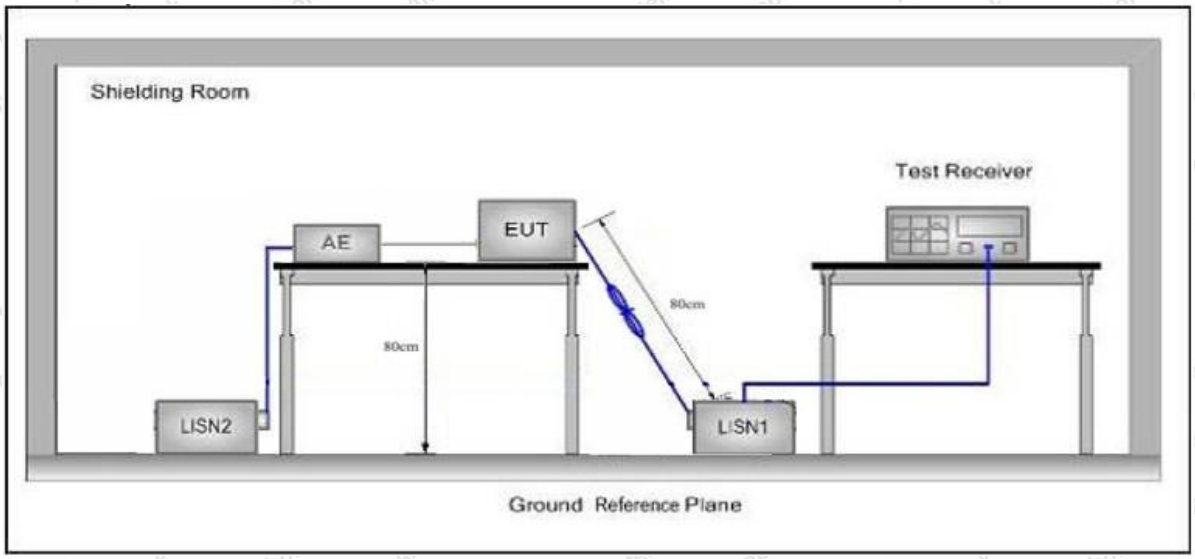
Standard Section	Test Item	Result
15.203	Antenna Requirement	PASS
15.207	Conducted Emission	N/A
15.205/15.209/15.231(b)	Radiated emission, Spurious Emission and Field Strength of Fundamental	PASS
15.231(c)	20dB Occupied Bandwidth	PASS
15.231(a)	Dwell time	PASS
Remark: “N/A” is an abbreviation for Not Applicable.		

3. Conducted Emission Test

3.1. Test Standard and Limit

Test Standard	FCC Part15 Section 15.207		
Test Limit	Frequency	Maximum RF Line Voltage (dBuV)	
		Quasi-peak Level	Average Level
	150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
	500kHz~5MHz	56	46
	5MHz~30MHz	60	50
Remark: (1) *Decreasing linearly with logarithm of the frequency. (2) The lower limit shall apply at the transition frequency.			

3.2. Test Setup



3.3. Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.10: 2020 on Conducted Emission Measurement.

The bandwidth of test CAR REMOTE (ESCI) set at 9kHz.

The frequency range from 150kHz to 30MHz is checked.

3.4. Test Data

Not applicable. The EUT is powered by DC 3V battery, so there is no need to conduct this test.

4. Field Strength of Fundamental and Spurious Emission

4.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.209, 15.205 and 15.231(b)				
Test Limit	Frequency (MHz)	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz~0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz~88MHz	100	40.0	Quasi-peak	3
	88MHz~216MHz	150	43.5	Quasi-peak	3
	216MHz~960MHz	200	46.0	Quasi-peak	3
	960MHz~1000MHz	500	54.0	Quasi-peak	3
	Above 1000MHz	500	54.0	Average	3
		-	74.0	Peak	3

Remark:

(1)The lower limit shall apply at the transition frequency.

(2) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

the formulas for calculating the maximum permitted fundamental field strengths are as follows:
for the band 260-470 MHz, μV/m at 3 meters = 41.6667(F) - 7083.3333.

The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level Emission Level (dBuV/m)=20log Emission Level(uV/m)

The field strength of emission limits have been calculated in below table:

Fundamental Frequency (MHz)	Field Strength of Fundamental (dBuV/m)@3m
433.92	80.82 (AVG)
433.92	100.82 (Peak)

4.2. Test Setup

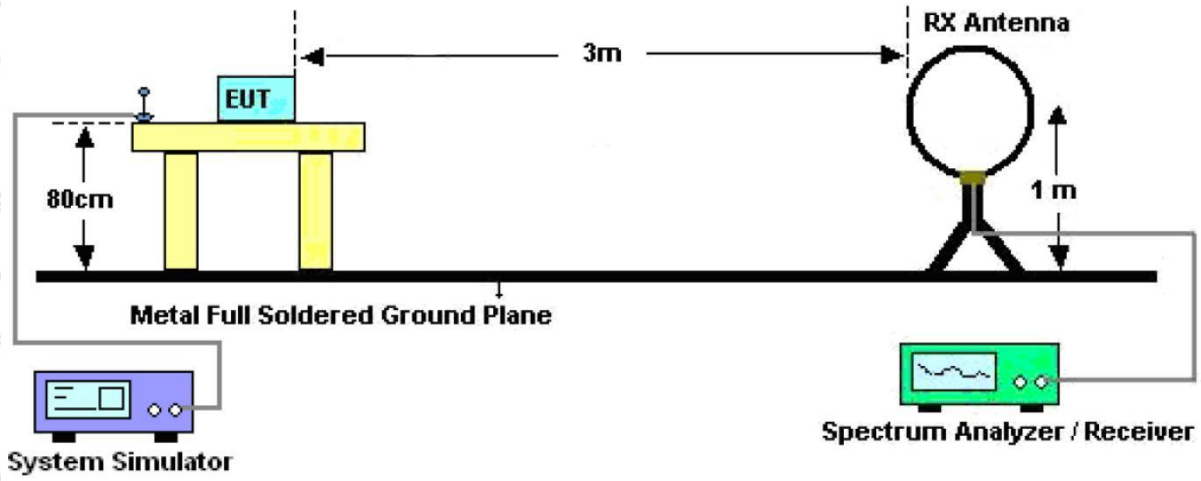


Figure 1. Below 30MHz

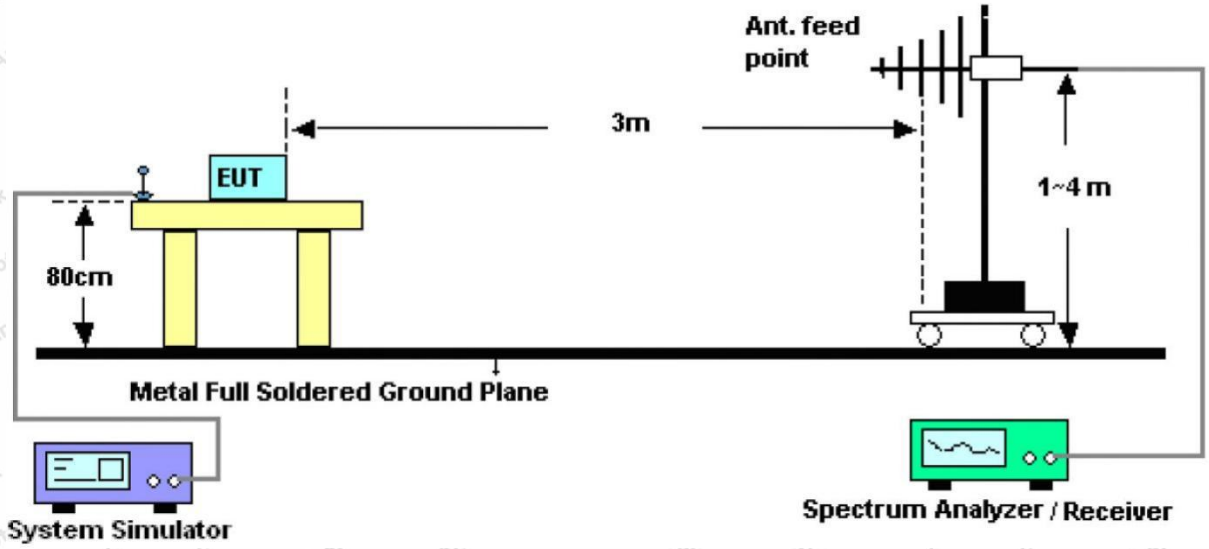


Figure 2. 30MHz to 1GHz

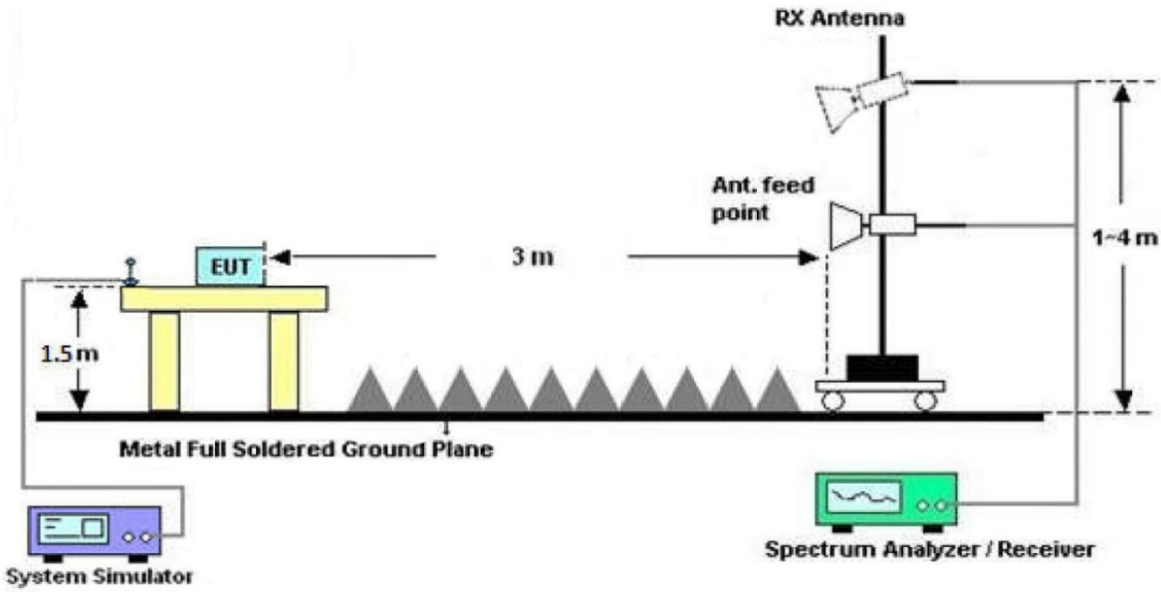


Figure 3. Above 1 GHz

4.3. Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane.

For above 1GHz: The EUT is placed on a turntable, which is 1.5m above the ground plane.

The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Rotated the EUT through three orthogonal axes to determine the maximum emissions, both horizontal and vertical polarization of the antenna are set on test. The EUT is tested in 9*6*6 Chamber. The device is evaluated in xyz orientation.

For 9kHz to 150kHz, Set the spectrum analyzer as:
RBW = 200Hz, VBW =1kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 150kHz to 30MHz, Set the spectrum analyzer as:
RBW = 9KHz, VBW =30kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 30MHz to 1000MHz, Set the spectrum analyzer as:
RBW = 100kHz, VBW =300kHz,Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For above 1GHz,Set the spectrum analyzer as:

RBW =1MHz, VBW =1MHz, Detector= Peak, Trace mode= Max hold, Sweep- auto couple.

RBW =1MHz, VBW =10Hz, Detector= Average, Trace mode= Max hold, Sweep- auto couple.

4.4. Test Data

PASS

During the test, Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis is the worst case.

The test results of 9kHz-30MHz are attenuated more than 20dB below the permissible limits, so the results don't record in the report.

Test Results (30~1000MHz)

Test Mode: 433.92MHz

Power Source: DC 3V battery

Polarization: Horizontal

Temp.(℃)/Hum.(%RH): 23.5℃/49%RH

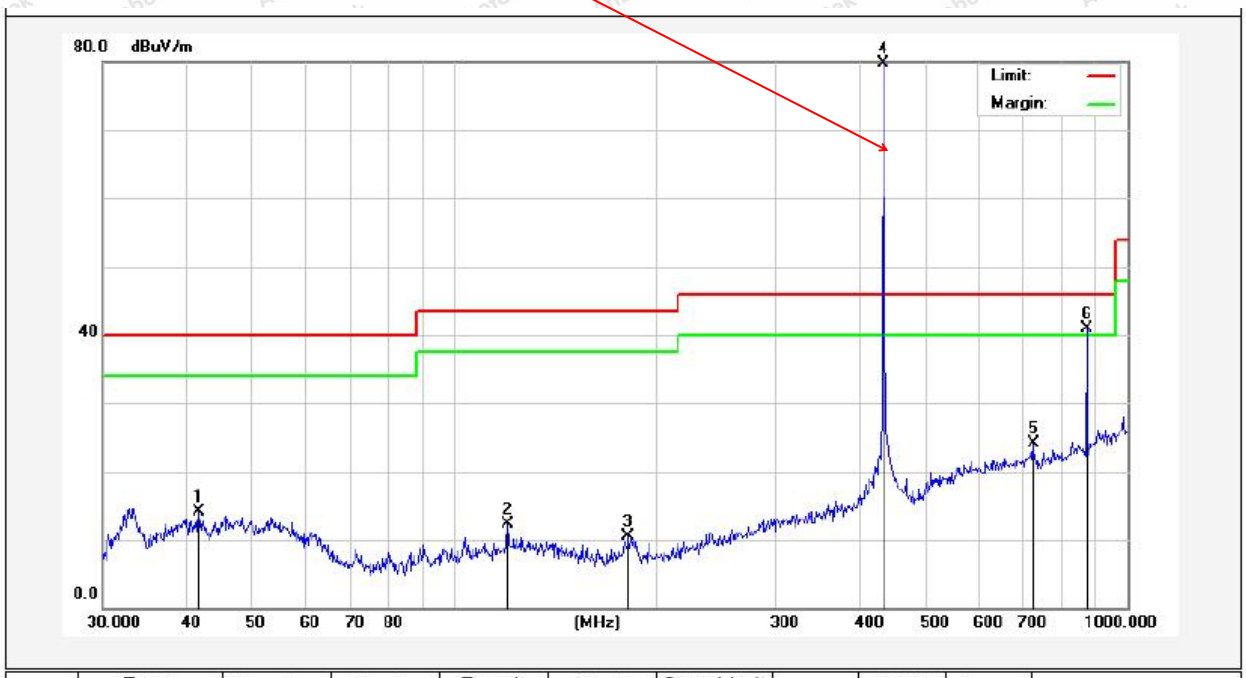
Fundamental

No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	39.8542	29.55	-16.10	13.45	40.00	-26.55	QP			
2	46.3402	29.41	-15.35	14.06	40.00	-25.94	QP			
3	214.5143	33.43	-22.09	11.34	43.50	-32.16	QP			
4	339.5888	33.02	-16.25	16.77	46.00	-29.23	QP			
5	434.0651	85.78	-15.70	70.08						
6	869.1300	41.39	-7.00	34.39	46.00	-11.61	QP			

Test Results (30~1000MHz)

Test Mode:	433.92MHz
Power Source:	DC 3V battery
Polarization:	Vertical
Temp.(℃)/Hum.(%RH):	23.5℃/49%RH

Fundamental



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	41.7129	28.89	-14.73	14.16	40.00	-25.84	QP			
2	119.8556	32.12	-19.90	12.22	43.50	-31.28	QP			
3	181.2834	31.10	-20.54	10.56	43.50	-32.94	QP			
4	434.0651	93.58	-13.93	79.65						
5	724.2611	33.63	-9.59	24.04	46.00	-21.96	QP			
6	869.1301	47.94	-7.00	40.94	46.00	-5.06	QP			

Test Results (Fundamental)

Mode	Freq. (MHz)	Antenna Pol.	Reading (dBuV/m)	Factor (dB)	Duty cycle Factor (dB)	Results (dBuV/m)	Over Limit (dBuV/m)	Limits (dBuV/m)	Det. Mode
TX Mode	433.92	H	85.78	-15.70	--	72.11	-28.71	100.82	PK
	433.92	H	85.78	-15.70	-7.03	65.08	-15.74	80.82	AV
	433.92	V	93.85	-13.93	--	72.92	-27.90	100.82	PK
	433.92	V	93.85	-13.93	-7.03	65.88	-14.94	80.82	AV

Remark:

1. Results = Reading + Factor + Duty cycle Factor

Test Results (Radiated Emissions from 1G)

Mode	Freq. (MHz)	Antenna Pol.	Reading (dBuV/m)	Factor (dB)	Duty cycle Factor (dB)	Results (dBuV/m)	Over Limit (dBuV/m)	Limits (dBuV/m)	Det. Mode
TX Mode	869.13	H	41.39	-7.00	--	34.39	-46.43	80.82	PK
	869.13	H	41.39	-7.00	-7.03	27.36	-33.46	60.82	AV
	869.13	V	47.94	-7.00	--	40.94	-39.88	80.82	PK
	869.13	V	47.94	-7.00	-7.03	33.91	-26.91	60.82	AV

Remark:

1. Results = Reading + Factor + Duty cycle Factor

Test Results (Harmonics Emissions+Radiated Emissions from 1G-4G)

Test Mode: 433.92MHz

Frequency (MHz)	Antenna Pol.	Reading (dBuV/m)	Cable Loss (dB)	Factor (dB)	Amplifier (dB)	Duty cycle Factor (dB)	Results (dBuV/m)	Limits (dBuV/m)	Det. Mode
1301.76	H	61.96	2.38	21.43	32.45	--	53.32	74	PK
1301.76	H	61.96	2.38	21.43	32.45	-7.03	46.29	54	AV
1301.76	V	65.65	2.38	18.56	32.45	--	54.14	74	PK
1301.76	V	65.65	2.38	18.56	32.45	-7.03	47.11	54	AV

Remark:

1. Result = Reading + Factor + Duty cycle Factor

Pulse Desensitization Correction Factor

Mode	Freq. (MHz)	Pulse Width (ms)	2/Pulse Width (kHz)
TX Mode	433.92	26.1	0.077

Remark:

RBW(1000kHz)＞2/Pulse Width, Therefore PDCF is not needed.

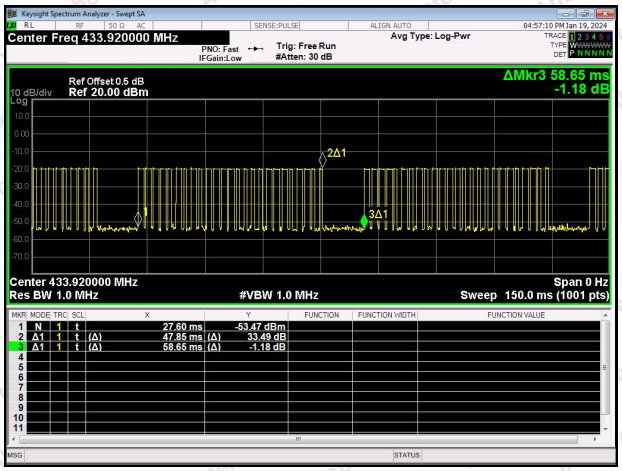
Duty Cycle Factor

Mode	Freq. (MHz)	T on1 (ms)	N1	T on2 (ms)	N2	T on (ms)	T period(ms)	Duty Cycle	Duty Cycle Factor
TX Mode	433.92	1.32	15	0.63	10	26.100	58.65	44.50%	-7.03

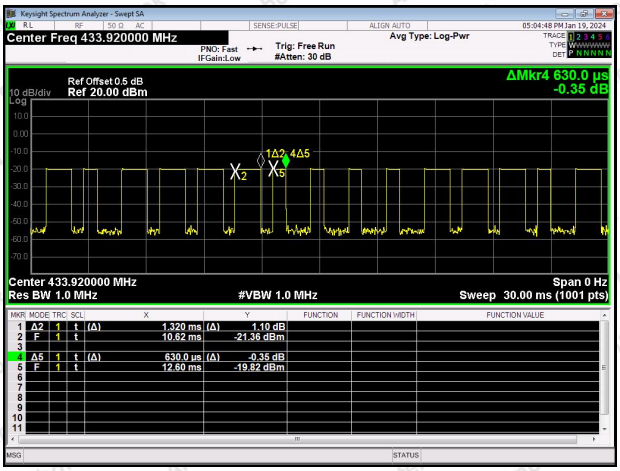
Remark:

1. T on=T on1*N1+T on2*N2
2. Duty Cycle=T on/T period
3. Duty Cycle Factor =20*lg(Duty Cycle)

T period



T on

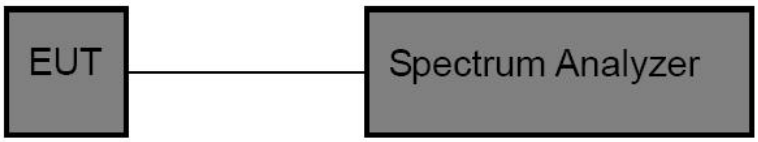


5. 20dB Occupy Bandwidth Test

5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.231 (c)
Test Limit	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 70MHz and below 900MHz. For devices operating above 900MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20dB down from the modulated carrier.

5.2. Test Setup



5.3. Test Procedure

1. Place the EUT on the table and set it in the continuously transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as:
   RBW = 1% to 5% of the OBW, VBW≥3*RBW,
   Span= 2*OBW~5*OBW
   Detector= Peak
   Trace mode= Max hold.
   Sweep- auto couple.
4. Mark the peak frequency and –20dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

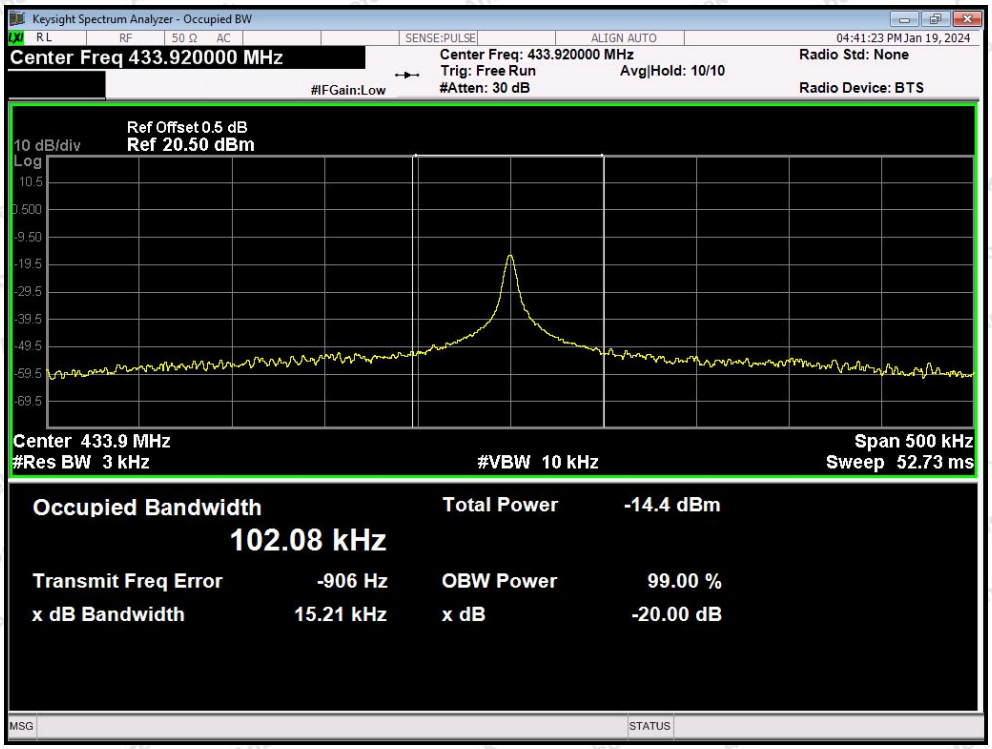
5.4. Test Data

Test Item	:	20dB Bandwidth	Test Mode	:	Continuously transmitting
Test Voltage	:	DC 3V battery	Temperature	:	23.4℃
Test Result	:	PASS	Humidity	:	50%RH

Mode	Freq. (MHz)	20DB Bandwidth (kHz)	Limit (kHz)	Results
TX Mode	433.92	15.21	≤1084.8	PASS

Note: Limit=0.0025*Freq.

20dB Bandwidth

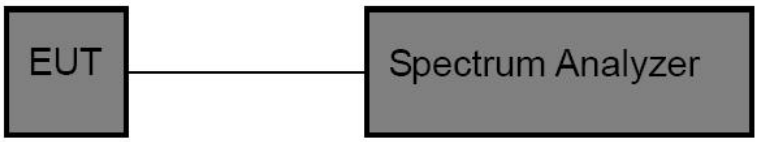


6. Dwell Time Test

6.1. Test Standard and Limit

Test Standard	FCC Part 15.231(a)
Test Limit	According to FCC Part 15.231(a)(1), A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

6.2. Test Setup



6.3. Test Procedure

1. Place the EUT on the table and set it in continuously transmitting mode. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

2. Set the spectrum analyzer as

   RBW= 1MHz
   VBW= 1MHz
   Span= 0Hz
   Sweep Time= 30 Seconds.

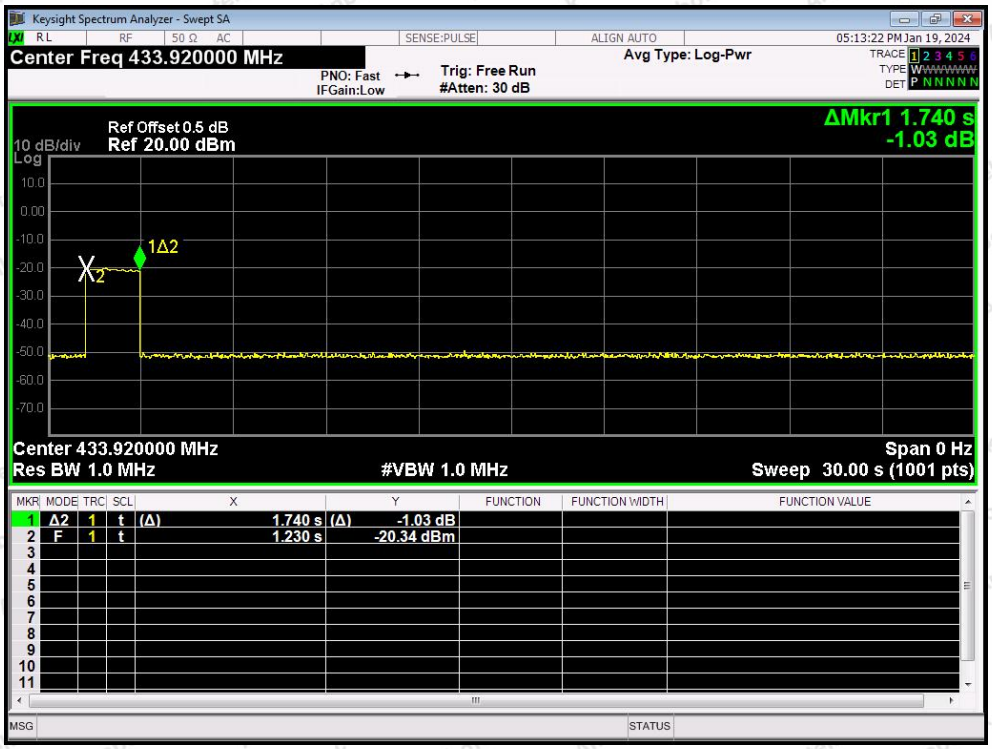
3. Record the Delta mark time.

6.4. Test Data

Test Item	:	Dwell Time	Test Mode	:	Continuously transmitting
Test Voltage	:	DC 3V battery	Temperature	:	23.4℃
Test Result	:	PASS	Humidity	:	50%RH

Mode	Freq. (MHz)	Transmitting time(s)	Limit(s)	Results
TX Mode	433.92	1.74	≤5	PASS

433.92 MHz


Keysight Spectrum Analyzer - Swept SA
Center Freq 433.920000 MHz
Avg Type: Log-Pwr
05:13:22 PM Jan 19, 2024
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Ref Offset 0.5 dB
10 dB/div
Ref 20.00 dBm
ΔMkr1 1.740 s
-1.03 dB
1Δ2
Center 433.920000 MHz
Span 0 Hz
Res BW 1.0 MHz
#VBW 1.0 MHz
Sweep 30.00 s (1001 pts)
1 Δ2 1 t (Δ) 1.740 s (Δ) -1.03 dB
2 F 1 t 1.230 s -20.34 dBm

7. Antenna Requirement

7.1. Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203
Requirement	1) 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.

7.2. Antenna Connected Construction

The antenna is a PCB Antenna which permanently attached, and the best case gain of the antenna is -5.84dBi. It complies with the standard requirement.

APPENDIX I -- TEST SETUP PHOTOGRAPH

Please refer to separated files Appendix I -- Test Setup Photograph

APPENDIX II -- EXTERNAL PHOTOGRAPH

Please refer to separated files Appendix II -- External Photograph

APPENDIX III -- INTERNAL PHOTOGRAPH

Please refer to separated files Appendix III -- Internal Photograph

---------- End of Report ----------