Product Name: Multfunctional Controller	**Report No: FCC022022-1076RF0**
Product Model: ZH-2.4G	**Security Classification: Open**
Version: V1.0	**Total Page: 23**

TIRT Testing Report

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Stone Tang	Randy LV	Daniel chen	

RF TEST REPORT

FCC ID: 2A5SXWTZWD8T5V

According to

47 CFR FCC Part 15, Subpart C(Section 15.231)

ANSI C63.10:2013

Equipment	:	Multfunctional Controller
Model No.	:	ZH-2.4G
Trademark	:	/
Product No.	:	20220314003421
Applicant	:	Zhongshan Henglan zhuhan Lighting Factory One of the third floor, No. 2 jiehui West Street, Sansha village, Henglan Town, Zhongshan City, China

- The test result referred exclusively to the presented test model /sample.
- Without written approval of TIRT Inc. the test report shall not reproduced except in full.
- Test Date: 2022.03.14-2022.05.12
- Receipt date: 2022.03.14

Lab: Beijing TIRT Technology Service Co.,Ltd Shenzhen
Add: 101, 3 # Factory Building, Gongjin Electronics Shatin Community, Kengzi Street, Pingshan District, Shenzhen, China
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History of this test report

Original Report Issue Date: 2022.05.12

● No additional attachment

○ Additional attachments were issued following record

Attachment No.	Issue Date	Description

1. General Information

1.1 Applicant

Zhongshan Henglan zhuhan Lighting Factory

One of the third floor, No. 2 jiehui West Street, Sansha village, Henglan Town, Zhongshan City, China

1.2 Manufacturer

Zhongshan Henglan zhuhan Lighting Factory

One of the third floor, No. 2 jiehui West Street, Sansha village, Henglan Town, Zhongshan City, China

1.3 Factory

Zhongshan Henglan zhuhan Lighting Factory

One of the third floor, No. 2 jiehui West Street, Sansha village, Henglan Town, Zhongshan City, China

1.4 Basic Description of Equipment Under Test

Items	Description	
Equipment Name	Multfunctional Controller	
Model Number	ZH-2.4G	
Trademark	/	
Power Supply	DC 3V 150mAh by Li-Mn Battery	
Operating Temperature	0-55℃	
EUT Stage	○ Product Unit	●Final-Sample
Modulation Type	ASK	
Operating Frequency	433.81 MHz	
Antenna Type	PCB	
Antenna Gain	0 dBi	

Note：

1. The EUT is used for LED GROW LIGHT, It also comes with a wired remote control.
2. The LED GROW LIGHT model includes:
   WT-ZWD-4T-5V-HE,WT-ZWD-5T-5V-HE,
   WT-ZWD-1T-5V-HE,WT-ZWD-2T-5V-HE,
   WT-ZWD-3T-5V-HE,WT-ZWD-6T-5V-HE,
   WT-ZWD-7T-5V-HE,WT-ZWD-8T-5V-HE,
   WT-ZWD-1T-5V-LD,WT-ZWD-2T-5V-LD,
   WT-ZWD-3T-5V-LD,WT-ZWD-4T-5V-LD,
   WT-ZWD-5T-5V-LD,WT-ZWD-6T-5V-LD,
   WT-ZWD-7T-5V-LD,WT-ZWD-8T-5V-LD
3. For a more detailed features description, please refer to the manufacturer’s specifications or the User's Manual.
4. LED GROW LIGHT photographs and wired remote control see the Appendix of External Photographs.

2. Summary of Test Results

2.1 Summary of Test Items

47 CFR FCC Part 15, Subpart C (Section 15.231)			
Test item	FCC Clause	Results	Remarks
Conducted Emissions	15.207(a)	NA	The EUT is powered by battery only
Radiated Emissions	15.205/15.209 /15.231(b)	Compliance	Meet the requirement of the limit
20dB Emission Bandwidth	15.231(c)	Compliance	Meet the requirement of the limit
Deactivation	15.231(a)(1)	Compliance	Meet the requirement of the limit
Antenna Requirement	15.203	Compliance	Meet the requirement of the limit
Note: NA denotes Not Applicable in this part			

2.2 Application of Standard

47 CFR FCC Part 15, Subpart C (Section 15.231)

ANSI C63.10:2013

2.3 Test Instruments

No.	Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	EMI Receiver	Rohde&Schwarz	ESR7	102013	2022/11/09
2	Integral Antenna	Schwarzbeck	VULB 9163	VULB 9163-361	2022/11/09
3	Integral Antenna	Schwarzbeck	BBHA 9120D	BBHA 9120D 1201	2022/11/09
4	Integral Antenna	Schwarzbeck	BBHA 9170	9170#685	2022/11/09
5	Preamplifier	CD Systems Inc	PAP-03036-30	85060000	2022/11/09
6	Preamplifier	emci	EMC01264 5SE	980417	2022/11/09
7	ECSI RF IN RF Cable	Rohde&Schwarz	AP-X1	\	2022/11/09
8	Spectrum Analyzer	Agilent	N9010A	MY52221119	2022/11/09
9	Temp&Humidity Recorder	Anymetre	JR900	NA	2022/11/03

2.4 Test Condition

Applicable to	Environmental conditions	Input Power	Tested by
20dB Emission Bandwidth	24.5°C, 56 % RH	3.0V DC	Stone Tang
Radiated Emissions	24.2°C, 55 % RH	3.0V DC	Stone Tang
Deactivation	24.6°C, 56 % RH	3.0V DC	Stone Tang

2.5 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT.
This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Uncertainty	
Parameter	Uncertainty
20dB Emission Bandwidth	±142.12 KHz
Radiated Emissions (9KHz～30MHz)	±4.2dB
Radiated Emissions (30MHz～1GHz)	±4.6dB
Radiated Emissions (Above 1GHz)	±4.9dB
Humidity	±4.6%
Temperature	±0.7°C
Time	±1.25%

2.6 Test Location

Company:	Beijing TIRT Technology Service Co.,Ltd Shenzhen
Address:	101, 3 # Factory Building, Gongjin Electronics Shatin Community, Kengzi Street, Pingshan District, Shenzhen, China
CNAS Registration Number:	CNAS L14158
A2LA Registration Number	6049.01
Telephone:	+86-0755-27087573

2.7 Deviation from Standards

None

2.8 Abnormalities from Standard Conditions

None

3. Test Procedure And Results

3.1 Antenna Requirement

3.1.1 Applicable Standard

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.

3.1.2 Antenna Connector Construction

The EUT has one internal PCB antenna arrangement which was permanently attached, fulfill the requirement of this section. Please refer to EUT photos for detail.

3.1.3 Test Result

Compliance.

3.2 Radiated Emissions

3.2.1 Limit

Spurious Emissions Limit(Below 1GHz):

Frequency	Field strength (microvolt/meter)	Measurement distance (m)
0.009MHz-0.490MHz	1.705MHz	300
0.490MHz-1.705MHz	1.705MHz	30
1.705MHz-30MHz	30	30
30MHz-88MHz	100	3
88MHz-216MHz	150	3
216MHz-960MHz	200	3
960MHz-1GHz	500	3
Above 1GHz	500	3

Spurious Emissions Limit(Above 1GHz):

Frequency	Limit (dBuV/m @3m)	Remark
Above 1GHz	54	Average Value
	74	Peak Value

Field strength of the fundamental signal Limit:

Frequency	Limit (dBuV/m @3m)	Remark
433.81MHz	80.83	Average Value
	100.83	Peak Value

Note:

(1) The emission limits shown in the above table are based on measurements employing a CISPR QP detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000MHz.Radiated emissions limits in these three bands are based on measurements employingan average detector.

(2) At frequencies below 30MHz, measurement may be performed at a distance closer then that specified, and the limit at closer measurement distance can be extrapolated by below formula:
Limit3m(dBuV/m)= Limit300m(dBuV/m) + 40Log(300m/3m) = Limit300m(dBuV/m) + 80
Limit3m(dBuV/m)= Limit30m(dBuV/m) + 40Log(30m/3m) = Limit30m(dBuV/m) + 40

(3) Limit for this EUT
All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions include fundamental emission shall not exceed FCC 15.231 section (b) limit of comply with FCC 15.209 limit which permit higher emission leve

(4) Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters =

56.81818(F) - 6136.3636; for the band 260-470 MHz, uV/m at 3 meters = 41.6667(F) - 7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

3.2.2 Test Procedure

Test Method	
○Conducted Measurement	●Radiated Measurement
Environmental conditions	
●Normal	○Normal and Extreme
Note:●:Test ○:No Test	

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was 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 then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

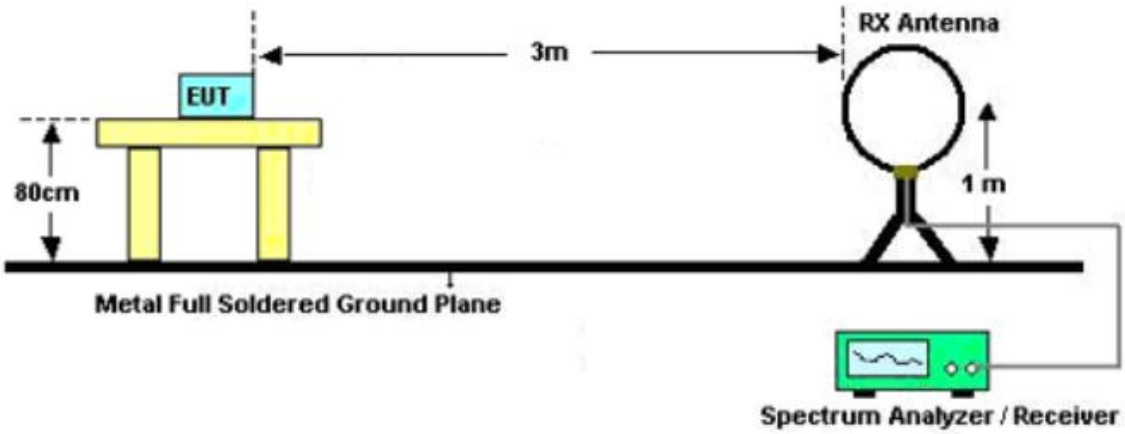
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

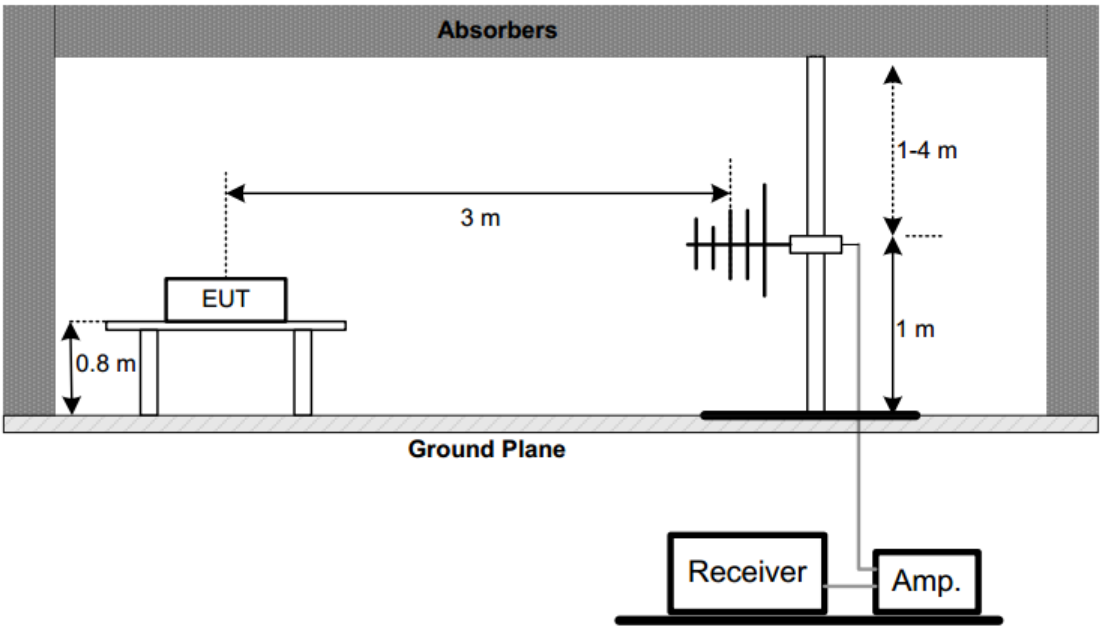
g. The radiation measurements are performed in X, Y, Z axis positioning. And found the Z axis positioning which it is worse case, only the test worst case.

3.2.3 Test Setup

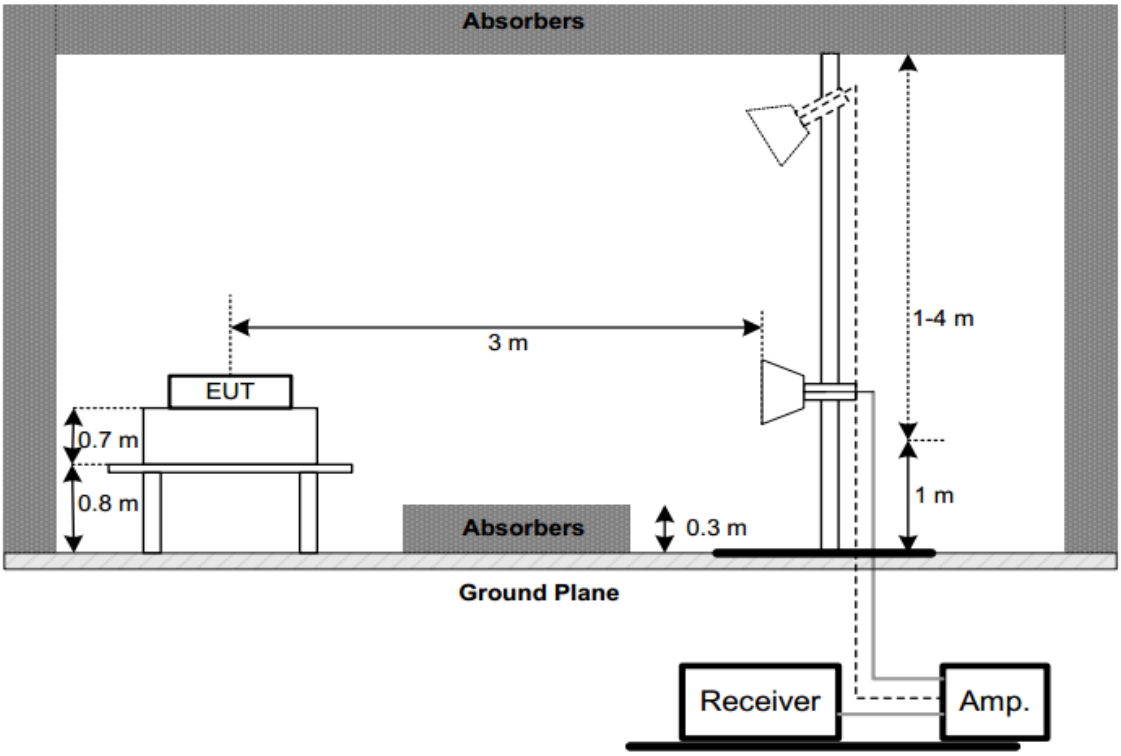
(A) Radiated Emission Test Set-Up Frequency Below 30 MHz



(B) Radiated Emission Test Set-Up Frequency 30 MHz-1000 MHz



(C) Radiated Emission Test Set-Up Frequency Above 1 GHz



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10 - 2013. The specification used was the FCC Part 15.209, 15.205 and 15.231.

3.2.4 Test Result

1. Field Strength of the Fundamental Signal

Test Frequency	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
433.81MHz	78.92	100.83	-21.91	Peak	Vertical
	77.84	100.83	-22.99	Peak	Horizontal
	69.55	80.83	-11.28	AVG	Vertical
	68.47	80.83	-12.36	AVG	Horizontal

Remark:

1) If the Peak value below the AV Limit, the AV test doesn't perform for this submission.
2) Over Limit = Result Level - Limit Line
3) Average level=Peak level + Duty Cycle Factor
4) Duty Cycle Factor:

Ton 1=10*1.14ms=11.40ms

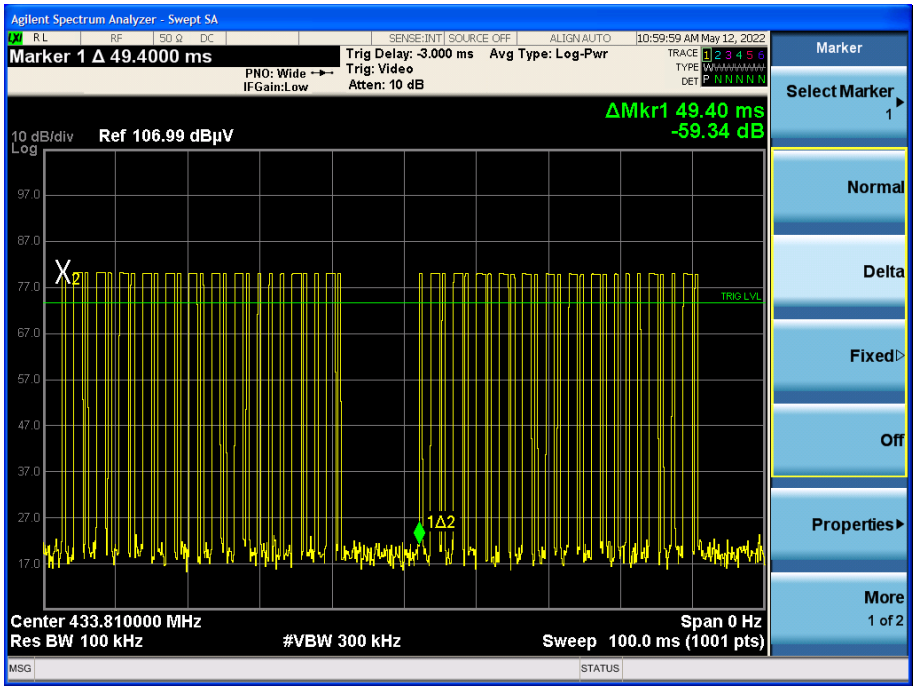
Ton 2=15*0.358ms=5.37ms

Tp=49.40ms

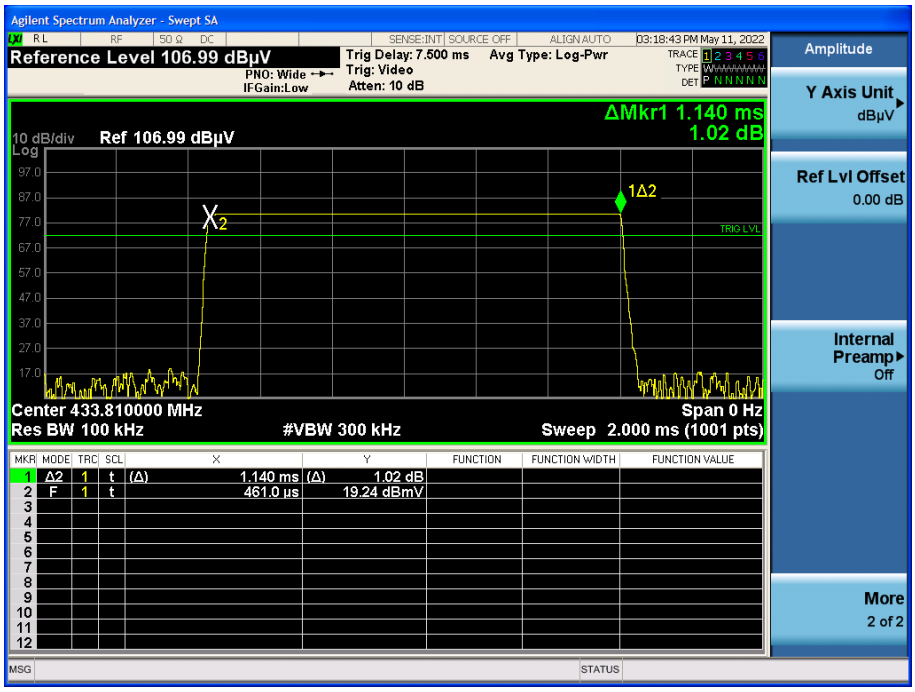
Duty cycle=Ton/Tp=(Ton 1+Ton 2)/49.40=(11.40+5.37)/49.40=0.34

Duty Cycle Factor= 20*log(Duty Cycle)=-9.37dB

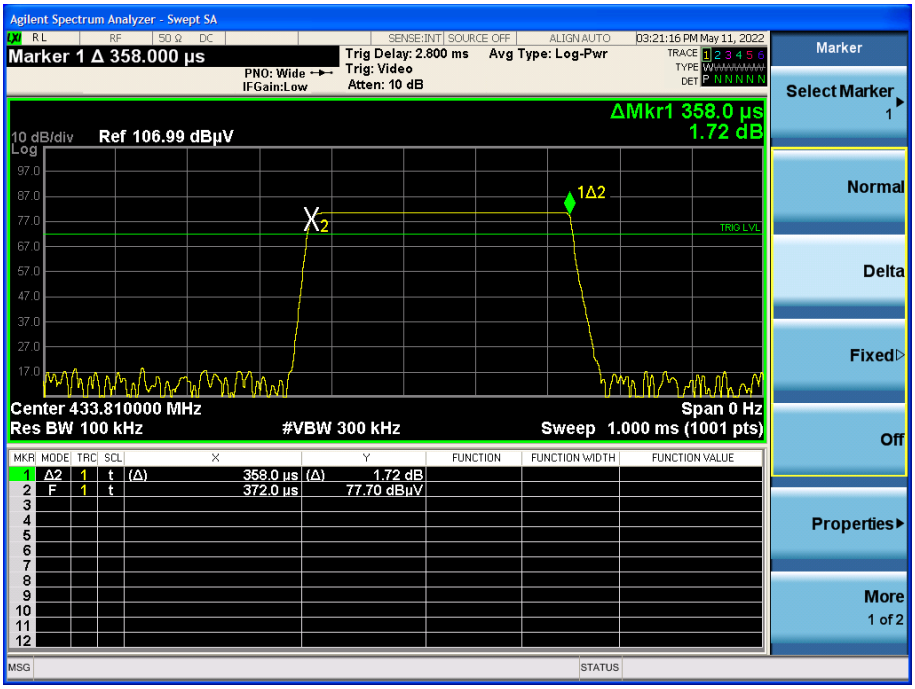
Duty Cycle



Pulse 1



Pulse 2



2. Spurious Emissions

Below 1GHz

433.81MHz Vertical:

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector
1	71.71	16.80	13.86	30.66	40.00	-9.34	QP
2	119.24	12.48	19.28	31.76	43.50	-11.74	QP
3	159.01	13.18	19.55	32.73	43.50	-10.77	QP
4	252.13	14.53	19.60	34.13	46.00	-11.87	QP
5	335.55	13.15	22.29	35.44	46.00	-10.56	QP
6	433.81	54.43	24.49	78.92	100.83	-21.91	peak
7	868.08	8.99	28.89	37.88	46.00	-8.12	QP

433.81MHz Horizontal:

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector
1	71.71	14.81	13.86	28.67	40.00	-11.33	QP
2	119.24	13.55	19.28	32.83	43.50	-10.67	QP
3	155.13	13.50	19.84	33.34	43.50	-10.16	QP
4	182.37	15.73	17.78	33.51	43.50	-9.99	QP
5	433.81	53.35	24.49	77.84	100.83	-22.99	peak
6	809.88	6.16	28.55	34.71	46.00	-11.29	QP
7	870.02	9.04	28.90	37.94	46.00	-8.06	QP

Remark:

1) Result= Reading+ Correct Factor
2) Over Limit = Result - Limit Line

Above 1GHz

433.81MHz

Mark	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	polarization
1	1882.00	48.99	-9.75	39.24	74.00	-34.76	peak	Vertical
2	2224.00	48.97	-7.73	41.24	74.00	-32.76	peak	Vertical
3	2908.00	50.47	-6.15	44.32	74.00	-29.68	peak	Vertical
4	1801.00	50.26	-10.78	39.48	74.00	-34.52	peak	Horizontal
5	2422.00	50.45	-7.25	43.20	74.00	-30.80	peak	Horizontal
6	2917.00	48.62	-6.12	42.50	74.00	-31.50	peak	Horizontal

Remark:

1) Result= Reading+ Correct Factor
2) Over Limit = Result - Limit Line

3.3 Deactivation Test

3.3.1 Applicable Standard

Per 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.

3.3.2 Test Procedure

Test Method	
●Conducted Measurement	○Radiated Measurement
Environmental conditions	
●Normal	○Normal and Extreme
Note:●:Test ○:No Test	

a) Make the EUT worke in the transmitting mode.

b) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.

c) Spectrum Setting as below:

Centre Frequency	The centre frequency of the channel under test
RBW	3 MHz
VBW	3 MHz
Frequency span	0
Detector Mode	Normal
Trace Mode	Clear Write
Sweep Time	10s

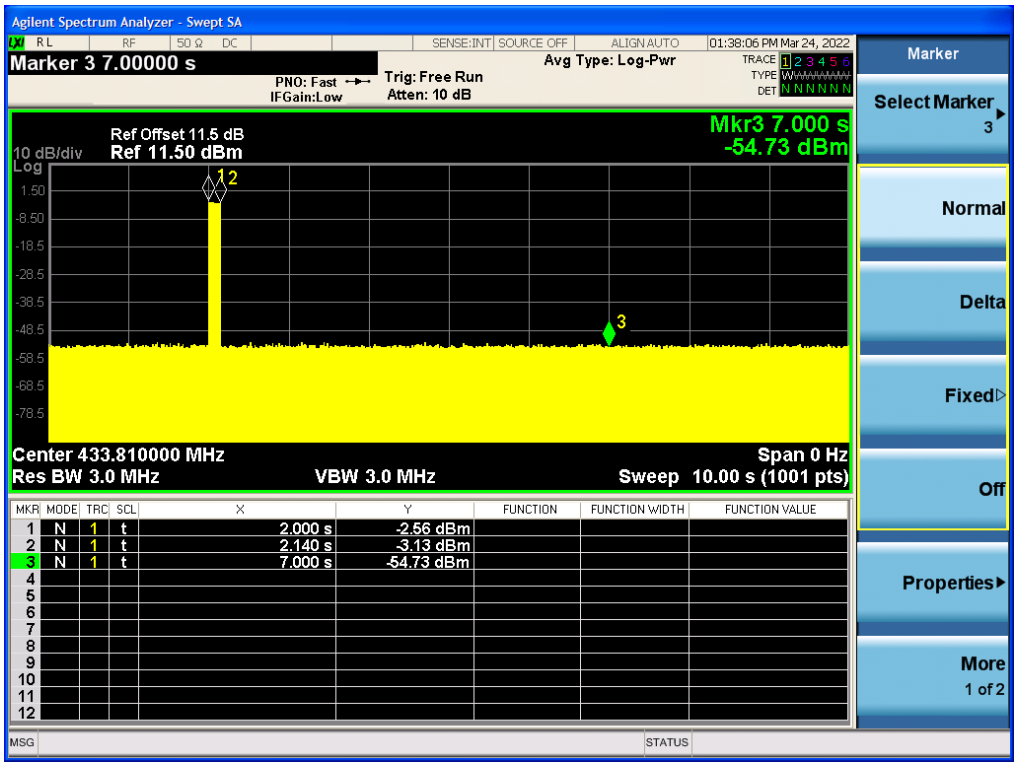
Allow trace to full stabilize.

d) Repeat above procedures until all frequency measured was complete.

3.3.3 Test Setup

3.3.4 The Result

Compliant, please refer to following plot.

Cease Transmission Time


3.4 20dB Emissions Bandwidth

3.4.1 Applicable Standard

Per 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.

3.4.2 Test Procedure

Test Method	
●Conducted Measurement	○Radiated Measurement
Environmental conditions	
●Normal	○Normal and Extreme
Note:●:Test ○:No Test	

a) Make the EUT worke in the transmitting mode.

b) The EUT shall be connected to the spectrum analyser, and the spectrum analyser is set as follow:

Centre Frequency	The centre frequency of the channel under test
RBW	3kHz
VBW	10kHz
Frequency span	100kHz
Detector Mode	Peak
Trace Mode	Max Hold
Sweep Time	Auto Couple

c) Wait for the trace to stabilize then find the peak value of the trace and place the analyser marker on this peak.

d) Plot the 20 dB emissions bandwidth, This value shall be recorded.

e) Make sure that the power envelope is sufficiently above the noise floor of the analyser to avoid the noise signals left and right from the power envelope being taken into account by this measurement.

3.4.3 Test Setup

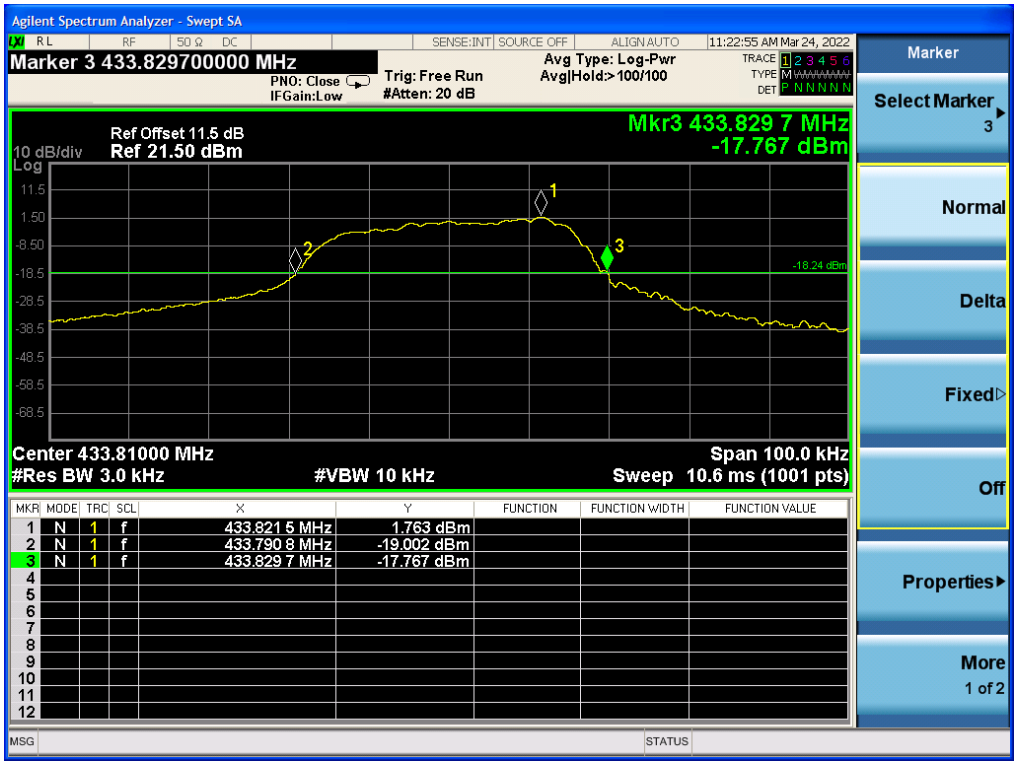
3.4.4 Test Result

Channel Frequency (MHz)	20 dB Emission Bandwidth (KHz)	Limit (KHz)	Result
433.81	38.9	≤1084.525	Pass

Note: Limit = 0.25% * center frequency = 0.25% * 433.81 MHz = 1084.525 KHz

20dB bandwidth = 38.9 KHz <1084.525 KHz

20 dB Emission Bandwidth



4. Photographs of Test Set-up

See the Appendix of Radiated Test setup Photographs.

5. Photographs of EUT

See the Appendix of External Photographs and Internal Photographs.

（END OF REPORT）