FCC Test Report

Client Name	:	**Hangzhou ADD Window Energy Saving Technology Co.LTD**
Client Address	:	**Room 506,Building 2,650 Yunxi Road, Cangqian Street,Yuhang District, Hangzhou, Zhejiang, China**
Product Name	:	**Remote control**
Report Date	:	**Nov. 21, 2022**

Shenzhen Anbotek Compliance Laboratory Limited

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TEST REPORT

Applicant	:	Hangzhou ADD Window Energy Saving Technology Co.LTD
Manufacturer	:	Hangzhou ADD Window Energy Saving Technology Co.LTD
Product Name	:	Remote control
Model No.	:	HUNTER101, HUNTER102, HUNTER201, HUNTER202
Trade Mark	:	
Rating(s)	:	Input: 3V⎓ with “CR2032” 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	Sept. 05, 2022
Date of Test	Sept. 05~Nov. 09, 2022
Prepared by	(TuTu Hong)
Approved & Authorized Signer	(Kingkong Jin)

Revision History

Report Version	Description	Issued Date
R00	Original Issue.	Nov. 21, 2022

1. General Information

1.1. Client Information

Applicant	:	Hangzhou ADD Window Energy Saving Technology Co.LTD
Address	:	Room 506,Building 2,650 Yunxi Road, Cangqian Street,Yuhang District, Hangzhou, Zhejiang, China
Manufacturer	:	Hangzhou ADD Window Energy Saving Technology Co.LTD
Address	:	Room 506,Building 2,650 Yunxi Road, Cangqian Street,Yuhang District, Hangzhou, Zhejiang, China
Factory	:	Hangzhou ADD Window Energy Saving Technology Co.LTD
Address	:	Room 506,Building 2,650 Yunxi Road, Cangqian Street,Yuhang District, Hangzhou, Zhejiang, China

1.2. Description of Device (EUT)

Product Name	:	Remote control
Model No.	:	HUNTER101, HUNTER102, HUNTER201, HUNTER202 (Note: All samples are the same except the model number & appearance, so we prepare "HUNTER101" for test only.)
Trade Mark	:	
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)	:	0 dBi
Remark: 1)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

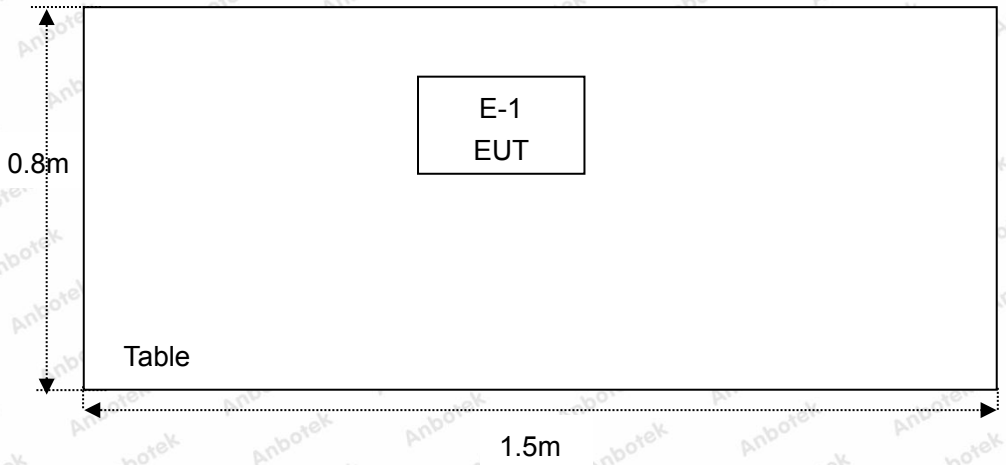
Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
01	433.92								

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. 23, 2022	1 Year
2.	Three Phase V-type Artificial Power Network	CYBERTEK	EM5040DT	E215040DT001	Jul. 05, 2022	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Oct. 13, 2022	1 Year
4.	EMI Test Receiver	Rohde & Schwarz	ESR26	101481	Oct. 23, 2022	1 Year
5.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Oct. 22, 2022	1 Year
6.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Oct. 13, 2022	1 Year
7.	EMI Preamplifier	SKET Electronic	LNPA-0118G -45	SKET-PA-002	Oct. 13, 2022	1 Year
8.	Double Ridged Horn Antenna	SCHWARZBECK	BBHA 9120D	02555	Oct. 16, 2022	3 Year
9.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Oct. 23, 2022	1 Year
10.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Oct. 23, 2022	1 Year
11.	Horn Antenna	A-INFO	LB-180400-K F	J211060628	Oct. 23, 2022	1 Year
12.	Pre-amplifier	SONOMA	310N	186860	Oct. 23, 2022	1 Year
13.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
14.	MXA Spectrum Analysis	KEYSIGHT	N9020A	MY53280032	Oct. 13, 2022	1 Year
15.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Oct. 13, 2022	1 Year
16.	Signal Generator	Agilent	E4421B	MY41000743	Oct. 13, 2022	1 Year
17.	DC Power Supply	IVYTECH	IV3605	1804D360510	Oct. 22, 2022	1 Year
18.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80 B	N/A	Oct. 19, 2022	1 Year

1.7. Measurement Uncertainty

Radiation Uncertainty	:	Ur = 3.9 dB (Horizontal)
		Ur = 3.8 dB (Vertical)
Conduction Uncertainty	:	Uc = 3.4 dB

1.8. Description of Test Facility

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

FCC-Registration No.: 184111

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. 184111.

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.518102

2. Summary of Test Results

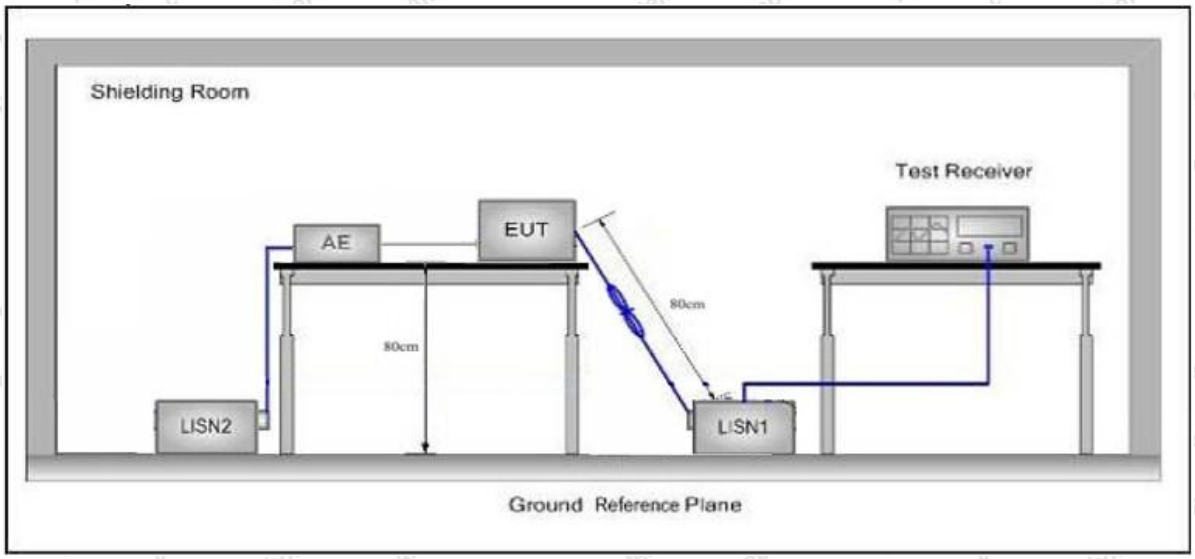
Standard Section	Test Item	Result
15.203	Antenna Requirement	PASS
15.207	Conducted Emission	N/A
15.205/15.209/15.231(b)	Radiated emission, Spurious Emission and Field Strength of Fundamental	PASS
15.231(c)	20dB Occupied Bandwidth	PASS
15.231(a)	Dwell time	PASS
Remark: "N/A" is an abbreviation for Not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

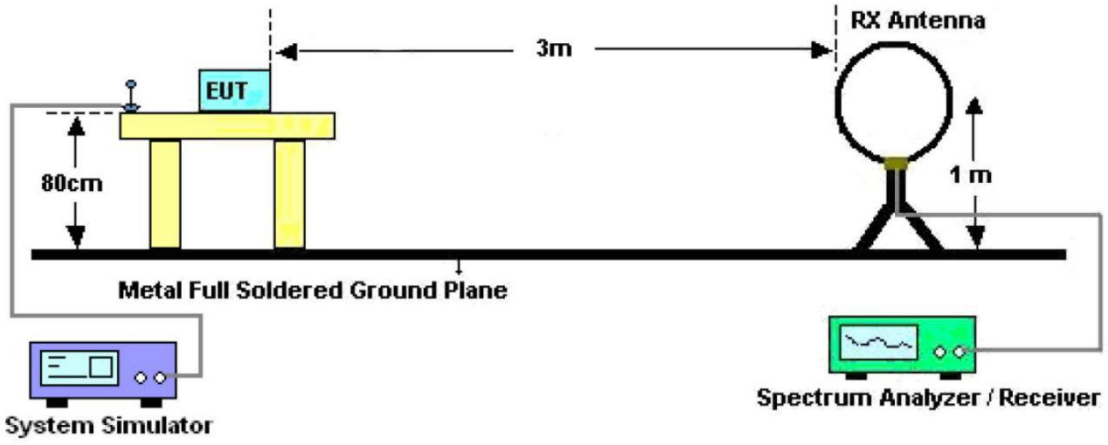


Figure 1. Below 30MHz

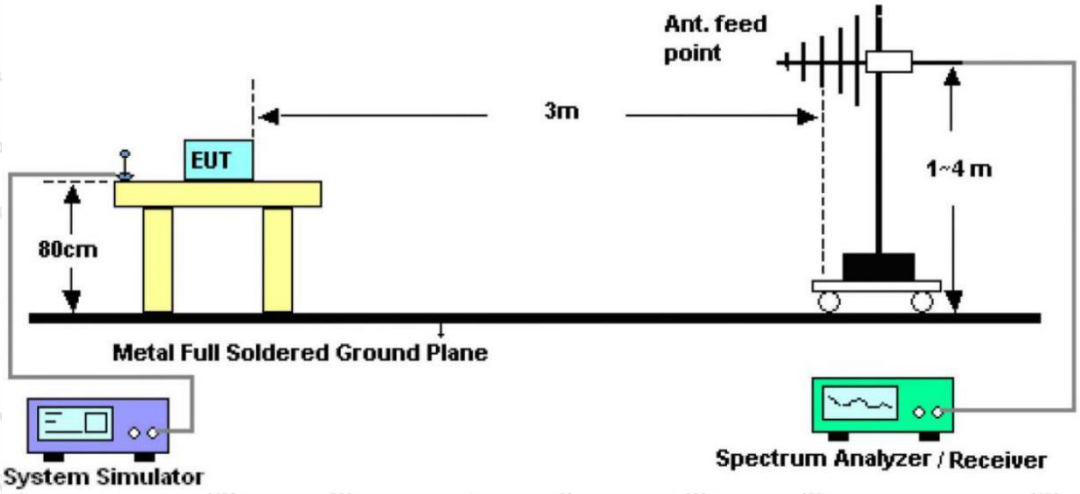


Figure 2. 30MHz to 1GHz

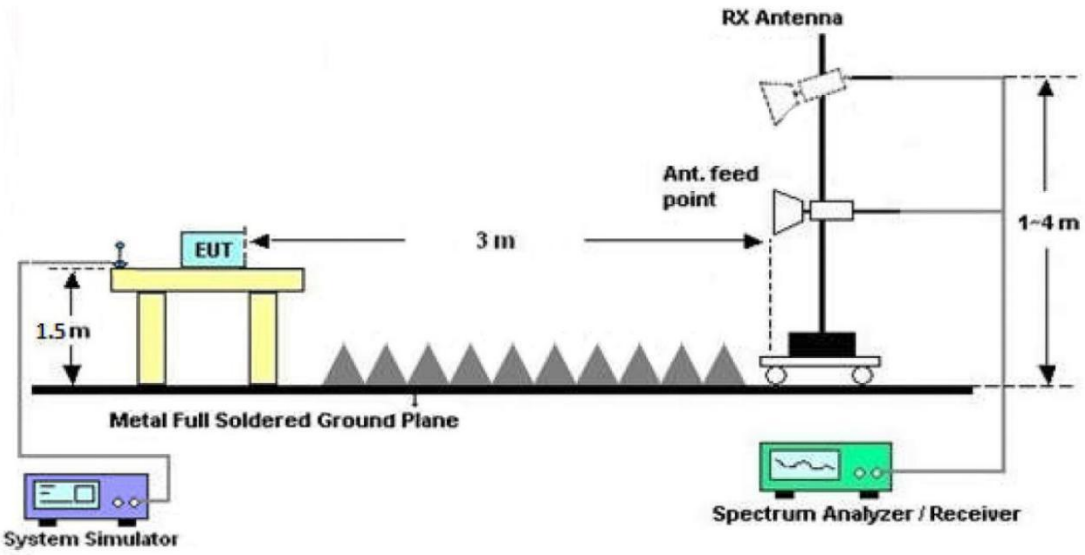


Figure 3. Above 1 GHz

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.

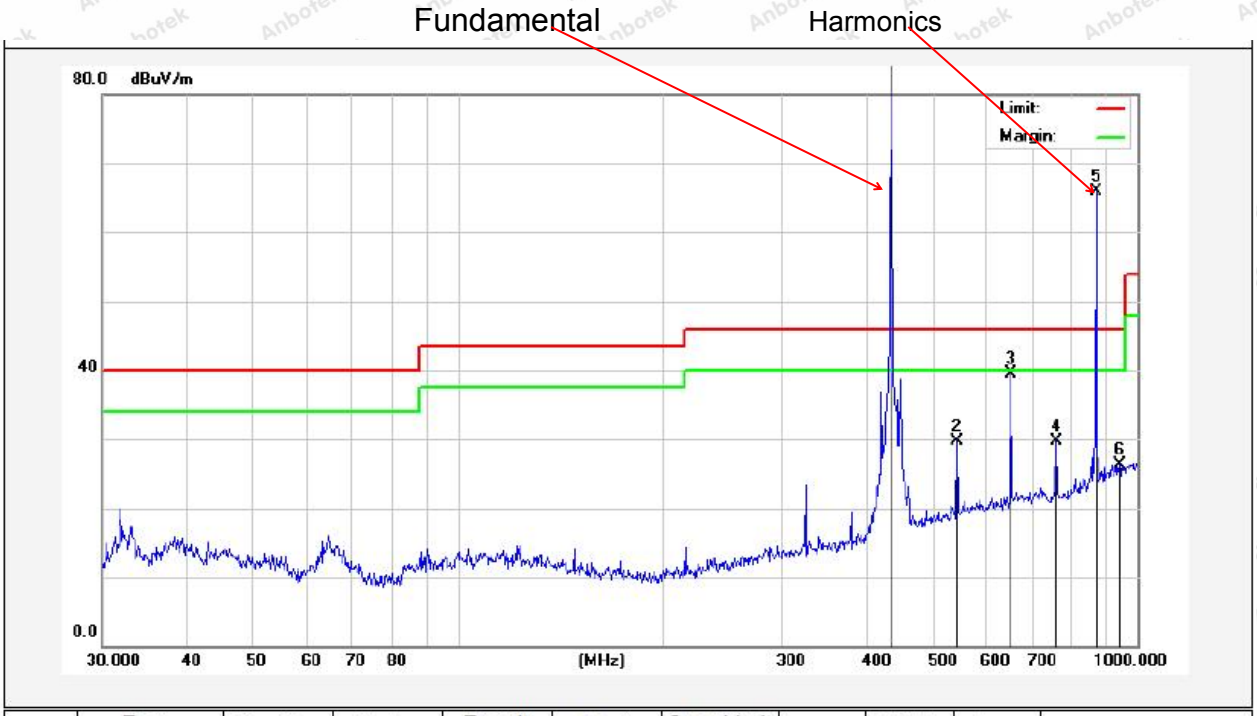
Test Results (30~1000MHz)

Test Mode: 433.92MHz

Power Source: AC 120V, 60Hz for adapter

Polarization: Horizontal

Temp.(℃)/Hum.(%RH): 24.4℃/47%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	433.9219	102.65	-15.70	86.95	/	/	Peak			
2	543.2742	41.67	-12.03	29.64	46.00	-16.36	QP			
3	651.9417	50.16	-10.63	39.53	46.00	-6.47	QP			
4	760.7036	38.82	-9.03	29.79	46.00	-16.21	QP			
5	869.1302	72.85	-7.00	65.85	/	/	Peak			
6	942.1305	32.06	-5.74	26.32	46.00	-19.68	QP			

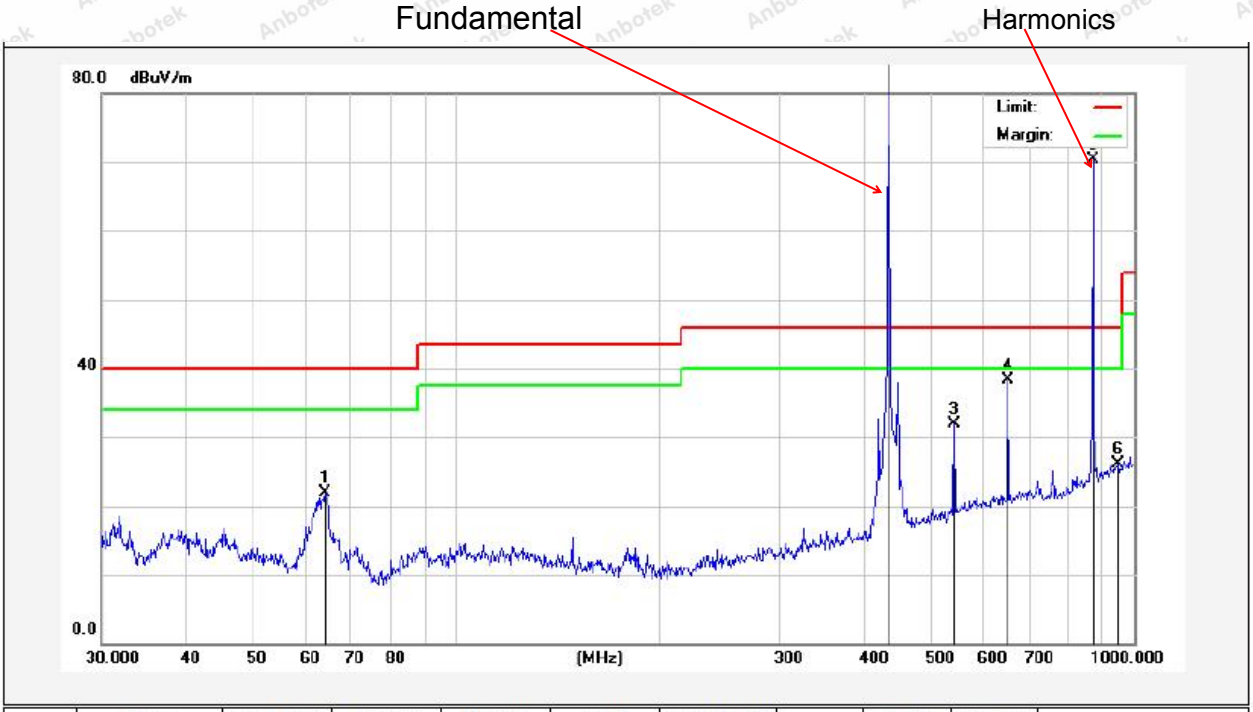
Test Results (30~1000MHz)

Test Mode: 433.92MHz

Power Source: AC 120V, 60Hz for adapter

Polarization: Vertical

Temp.(℃)/Hum.(%RH): 24.4℃/47%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	63.9828	40.88	-18.94	21.94	40.00	-18.06	QP			
2	433.9219	101.21	-13.93	87.28	/	/	Peak			
3	543.2742	43.63	-11.82	31.81	46.00	-14.19	QP			
4	651.9417	48.87	-10.63	38.24	46.00	-7.76	QP			
5	869.1302	77.27	-7.00	70.27	/	/	Peak			
6	948.7610	31.79	-5.65	26.14	46.00	-19.86	QP			

Test Results (Fundamental)								
Mode	Freq. (MHz)	Antenna Pol.	Reading (dBuV/m)	Factor (dB)	Duty cycle Factor (dB)	Results (dBuV/m)	Limits (dBuV/m)	Det. Mode
TX Mode	433.9219	H	102.65	-15.7	--	86.95	100.82	PK
	433.9219	H	102.65	-15.7	-7.02	79.93	80.82	AV
	433.9219	V	101.21	-13.93	--	87.28	100.82	PK
	433.9219	V	101.21	-13.93	-7.02	80.26	80.82	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)	Factor (dB)	Duty cycle Factor (dB)	Results (dBuV/m)	Limits (dBuV/m)	Det. Mode
869.1302	H	72.85	-7.00	--	65.85	80.82	PK
869.1302	H	72.85	-7.00	-7.02	58.83	60.82	AV
869.1302	V	77.27	-7.00	--	70.27	80.82	PK
869.1302	V	77.27	-7.00	-7.02	63.25	60.82	AV
1301.77	H	54.43	1.36	--	55.79	74.00	PK
1301.77	H	54.43	1.36	-7.02	48.77	54.00	AV
1301.77	V	53.47	1.36	--	54.83	74.00	PK
1301.77	V	53.47	1.36	-7.02	47.81	54.00	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	0.360	5.556

Remark:

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

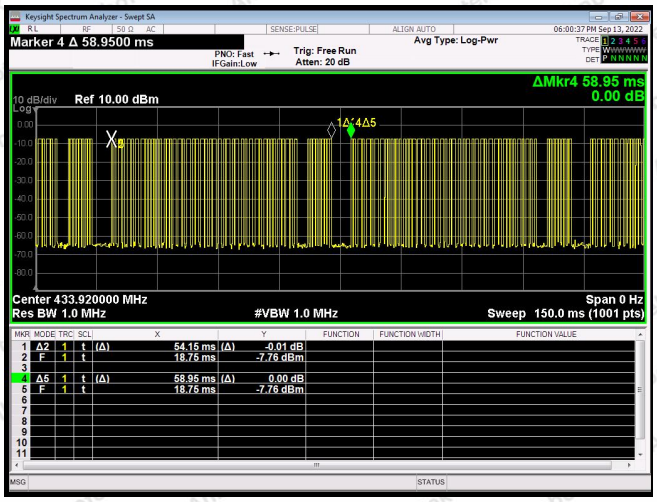
Duty Cycle Factor

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	0.360	38	0.7	18	26.280	58.95	44.58%	-7.02

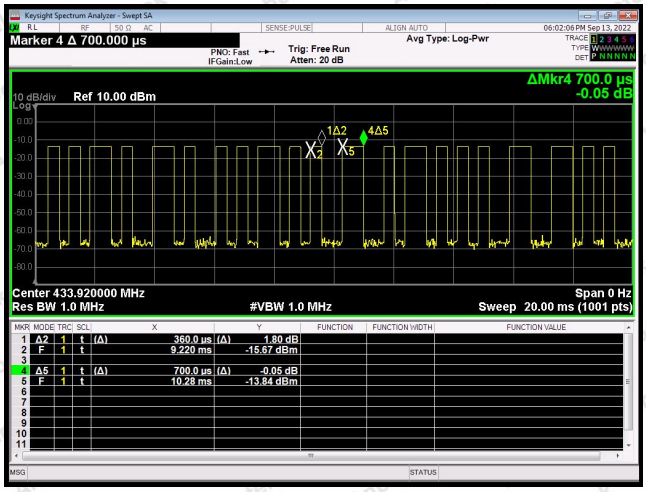
Remark:

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

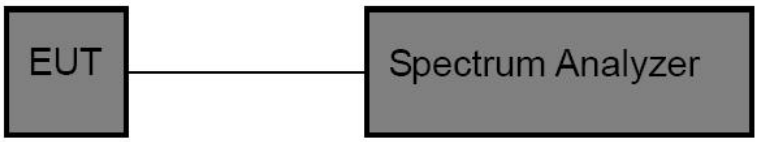


5. 20dB Occupy Bandwidth Test

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.

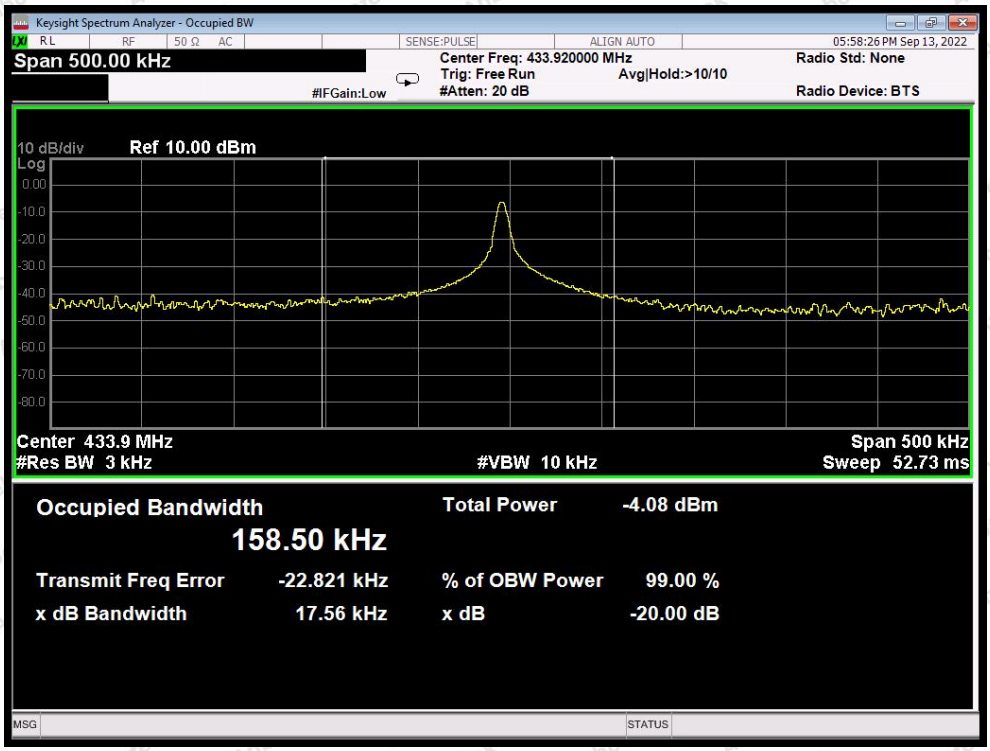
5.4. Test Data

Test Item	:	20dB Bandwidth	Test Mode	:	Continuously transmitting
Test Voltage	:	DC 3V Battery	Temperature	:	22.7℃
Test Result	:	PASS	Humidity	:	55%RH

Mode	Freq. (MHz)	20DB Bandwidth (kHz)	Limit (kHz)	Results
TX Mode	433.92	17.56	≤1084.8	PASS

Note: Limit=0.0025*Freq.

20dB Bandwidth

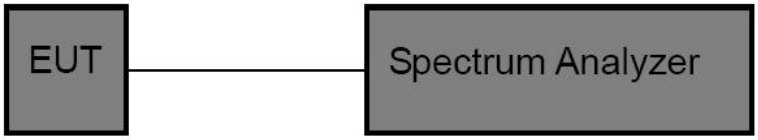


6. Dwell Time Test

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.

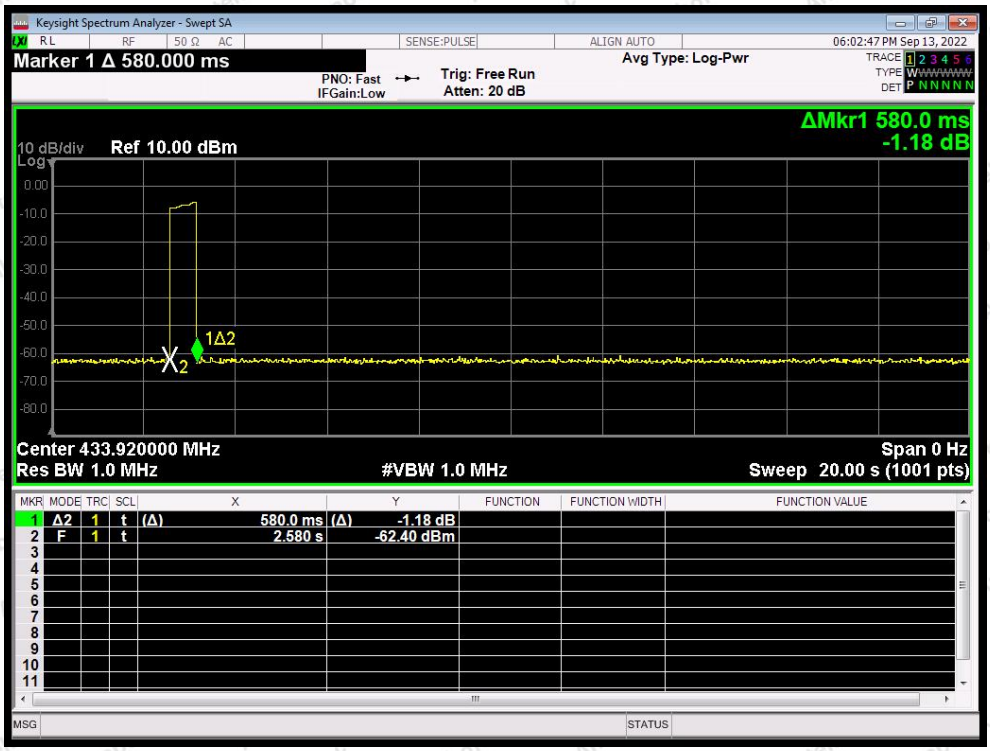
3. Record the Delta mark time.

6.4. Test Data

Test Item	:	Dwell Time	Test Mode	:	Continuously transmitting
Test Voltage	:	DC 3V Battery	Temperature	:	22.7℃
Test Result	:	PASS	Humidity	:	55%RH

Mode	Freq. (MHz)	Transmitting time(s)	Limit(s)	Results
TX Mode	433.92	0.58	≤5	PASS

433.92 MHz


Keysight Spectrum Analyzer - Swept SA
Marker 1 Δ 580.000 ms
Avg Type: Log-Pwr
06:02:47 PM Sep 13, 2022
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
ΔMkr1 580.0 ms
-1.18 dB
10 dB/div
Ref 10.00 dBm
Center 433.920000 MHz
Span 0 Hz
Res BW 1.0 MHz
#VBW 1.0 MHz
Sweep 20.00 s (1001 pts)
1 Δ2 1 t (Δ) 580.0 ms (Δ) -1.18 dB
2 F 1 t 2.580 s -62.40 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 0dBi. 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 ----------