

TEST REPORT

Product Name : RF remote control
Brand Mark : AK
Model No. : AKRF-433MHZ-V1
FCC ID : 2A5THAKRF
Report Number : BLA-EMC-202202-A4001
Date of Sample Receipt : 2022/2/25
Date of Test : 2022/2/25 to 2022/3/16
Date of Issue : 2022/3/16
Test Standard : 47 CFR Part 15, Subpart C 15.231
Test Result : Pass

Prepared for:

Dongguan Aoke Lighting Technology Co., LTD
Room 503, building 9, no. 47, Longzhou Industrial Road, Changping Town,
Dongguan City, Guangdong Province

Prepared by:

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Compiled by:

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Review by:

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Approved by:

Blue Zhong

Date:

2022/3/16



REPORT REVISE RECORD

Version No.	Date	Description
00	2022/3/16	Original

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1 TEST SUMMARY

Test Item	Section in CFR 47	Result
Antenna requirement	15.203	Pass
Field strength of the fundamental signal	15.231 (b)	Pass
Spurious emissions	15.231 (b)/15.209	Pass
20dB Bandwidth	15.231(c)	Pass
Dwell time	15.231 (a)(2)	Pass
Conducted Emission	15.207	N/A

Remarks:

N/A: The EUT not applicable of the test item.

Pass: The EUT complies with the essential requirements in the standard.

Test according to ANSI C63.4:2014 and ANSI C63.10:2013.

2 GENERAL INFORMATION

Applicant	Dongguan Aoke Lighting Technology Co., LTD
Address	Room 503, building 9, no. 47, Longzhou Industrial Road, Changping Town, Dongguan City, Guangdong Province
Manufacturer	Dongguan Aoke Lighting Technology Co., LTD
Address	Room 503, building 9, no. 47, Longzhou Industrial Road, Changping Town, Dongguan City, Guangdong Province
Factory	Dongguan Aoke Lighting Technology Co., LTD
Address	Room 503, building 9, no. 47, Longzhou Industrial Road, Changping Town, Dongguan City, Guangdong Province
Product Name	RF remote control
Test Model No.	AKRF-433MHZ-V1

3 GENERAL DESCRIPTION OF E.U.T.

Hardware Version	N/A
Software Version	N/A
Operation Frequency:	433.92MHz
Channel numbers:	1
Modulation type:	ASK
Antenna Type:	Internal antenna
Antenna gain:	0dBi(Provided by customer)
Power supply:	DC 3V

4 TEST ENVIRONMENT

Environment	Temperature	Voltage
Normal	25°C	DC3V

5 TEST MODE

TEST MODE	TEST MODE DESCRIPTION
Transmitting mode	Keep the EUT in continuously transmitting mode with modulation.
<i>Remark: Full battery is used during all test except ac conducted emission. Only the data of the worst mode would be recorded in this report.</i>	

6 MEASUREMENT UNCERTAINTY

Parameter	Expanded Uncertainty (Confidence of 95%)
Radiated Emission(9kHz-30MHz)	±4.34dB
Radiated Emission(30Mz-1000MHz)	±4.24dB
Radiated Emission(1GHz-18GHz)	±4.68dB
AC Power Line Conducted Emission(150kHz-30MHz)	±3.45dB

7 DESCRIPTION OF SUPPORT UNIT

Device Type	Manufacturer	Model Name	Serial No.	Remark
--	--	--	--	--

Note:

“--” means no any support device during testing.

8 LABORATORY LOCATION

All tests were performed at:

BlueAsia of Technical Services(Shenzhen) Co., Ltd.

Building C, No. 107, Shihuan Road, Shiyao Sub-District, Baoan District, Shenzhen, Guangdong Province, China

Telephone: TEL: +86-755-28682673 FAX: +86-755-28682673

No tests were sub-contracted.

9 TEST INSTRUMENTS LIST

Test Equipment Of Radiated Emissions					
Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Chamber	SKET	966	N/A	2020/11/10	2023/11/9
Spectrum	R&S	FSP40	100817	2021/10/12	2022/10/11
Receiver	R&S	ESR7	101199	2021/10/12	2022/10/11
broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	2020/9/26	2022/9/25
Horn Antenna	Schwarzbeck	9120D	01892 P:00331	2020/9/26	2022/9/25
Amplifier	SKET	PA-000318G-45	N/A	2021/10/12	2022/10/11
EMI software	EZ	EZ-EMC	EEMC-3A1	N/A	N/A
Loop antenna	SCHNARZBECK	FMZB1519B	00102	2020/9/26	2022/9/25
Controller	SKET	N/A	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-02	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-03	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-01	N/A	N/A	N/A

Test Equipment Of Field Strength of the Fundamental Signal (15.231(b))					
Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Chamber	SKET	966	N/A	2020/11/10	2023/11/9
Spectrum	R&S	FSP40	100817	2021/10/12	2022/10/11
Receiver	R&S	ESR7	101199	2021/10/12	2022/10/11
broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	2020/9/26	2022/9/25
Horn Antenna	Schwarzbeck	9120D	01892 P:00331	2020/9/26	2022/9/25

Amplifier	SKET	PA-000318G-45	N/A	2021/10/16	2022/10/15
EMI software	EZ	EZ-EMC	EEMC-3A1	N/A	N/A
Loop antenna	SCHNARZBECK	FMZB1519B	00102	2020/9/26	2022/9/25
Controller	SKET	N/A	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-02	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-03	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-01	N/A	N/A	N/A

Test Equipment Of Dwell Time (15.231(a))

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	2021/10/12	2022/10/11
Spectrum	Agilent	N9020A	MY49100060	2021/10/12	2022/10/11
Signal Generator	Agilent	N5182A	MY49060650	2021/10/12	2022/10/11
Signal Generator	Agilent	E8257D	MY44320250	2021/10/12	2022/10/11

Test Equipment Of 20dB Bandwidth

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	2021/10/12	2022/10/11
Spectrum	Agilent	N9020A	MY49100060	2021/10/12	2022/10/11
Signal Generator	Agilent	N5182A	MY49060650	2021/10/12	2022/10/11
Signal Generator	Agilent	E8257D	MY44320250	2021/10/12	2022/10/11

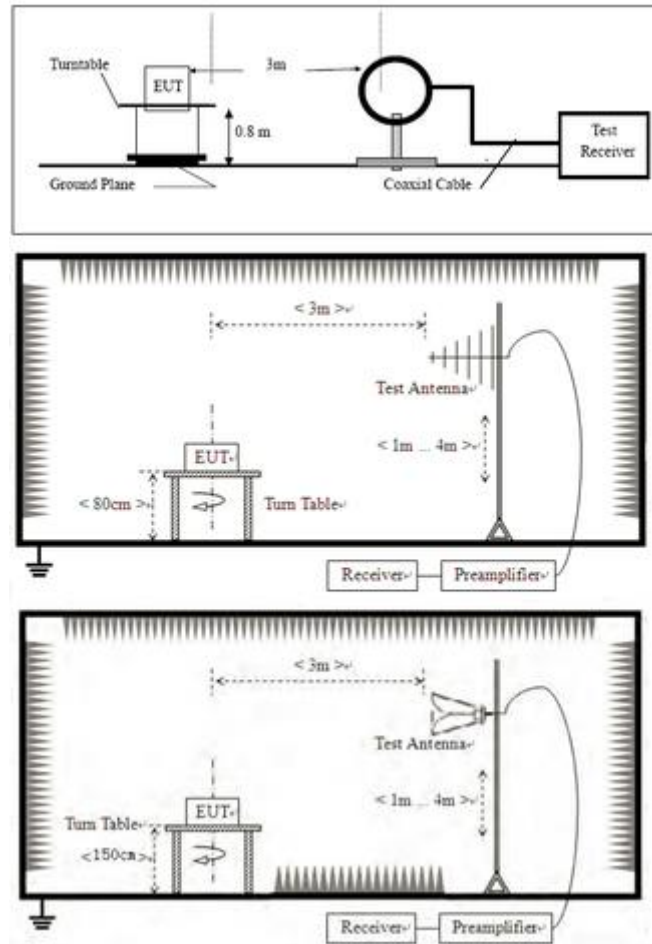
10 RADIATED EMISSIONS

Test Standard	47 CFR Part 15, Subpart C 15.231
Test Method	ANSI C63.10 (2013) Section 6.4&6.5&6.6
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Jozu
Temperature	25℃
Humidity	60%

10.1 LIMITS

Limit: (Field strength of the fundamental signal)	Frequency	Limit (dBuV/m @3m)	Remark
	433.92 MHz	80.8 100.8	Average Value Peak Value
Limit: (Spurious Emissions)	Frequency	Limit (dBuV/m @3m)	Remark
	30MHz-88MHz	40.0	Quasi-peak Value
	88MHz-216MHz	43.5	Quasi-peak Value
	216MHz-960MHz	46.0	Quasi-peak Value
	960MHz-1GHz	54.0	Quasi-peak Value
	Above 1GHz	54.0	Average Value
		74.0	Peak Value
	Or The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level whichever limit permits higher field strength.		
	a. The EUT was placed on the top of a rotating table 0.8m(below 1GHz) /1.5m(above 1GHz) above the ground at a 3 meter chamber. 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 and the rotating 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.		

10.2 BLOCK DIAGRAM OF TEST SETUP



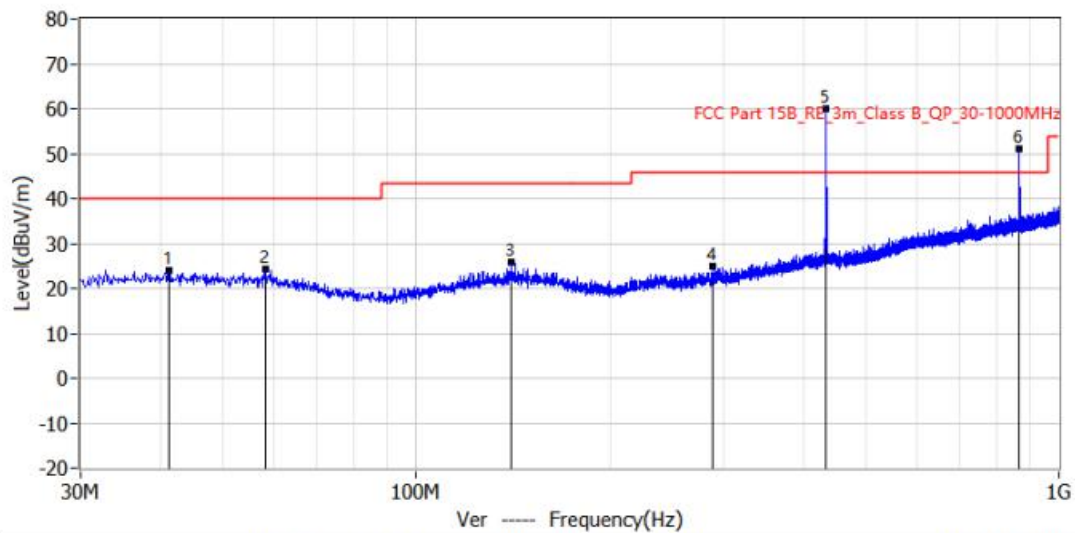
10.3 PROCEDURE

For testing performed with the loop antenna, the center of the loop was positioned 1 m above the ground and positioned with its plane vertical at the specified distance from the EUT. During testing the loop was rotated about its vertical axis for maximum response at each azimuth and also investigated with the loop positioned in the horizontal plane. Only the worst position of vertical was shown in the report.

10.1 TEST DATA

30M-1G Vertical

Test Lab: BlueAsia EMC Lab (RE #1)	Project: 202202-A40
EUT: RF remote control	Test Engineer: Charlie
M/N: AKRF-433MHz-V1	Temperature:
S/N:	Humidity:
Test Mode: TX mode	Test Voltage:
Note:	Test Data: 2022-03-11 14:50:19

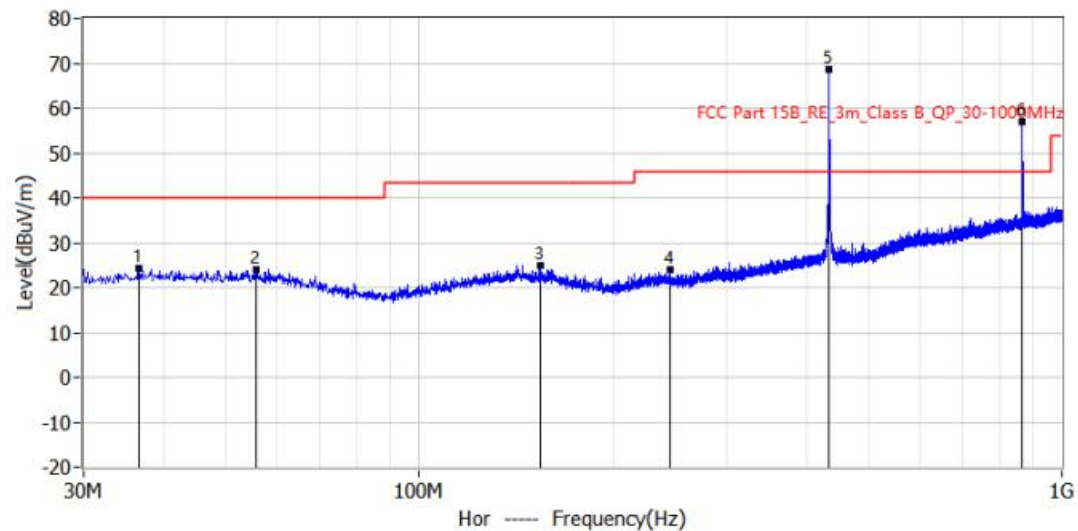


No.	Frequency	Limit dBuV/m	Level dBuV/m	Delta dB	Reading dBuV	Factor dB/m	Detector	Polar	Height cm	Angle deg
1*	41.155MHz	40.0	23.9	-16.1	-0.2	24.1	QP	Ver	100.0	280.0
2*	58.130MHz	40.0	24.2	-15.8	0.7	23.5	QP	Ver	100.0	208.0
3*	140.095MHz	43.5	25.8	-17.7	2.1	23.7	QP	Ver	100.0	321.0
4*	289.354MHz	46.0	24.8	-21.2	1.0	23.8	QP	Ver	100.0	75.0
15*	434.005MHz	46.0	60.0	14.0	32.3	27.7	QP	Ver	100.0	0.0
16*	867.959MHz	46.0	51.1	5.1	16.4	34.7	QP	Ver	100.0	35.0

No.	Frequency (MHz)	Peak Result (dBuV/m)	Duty cycle factor	Average Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Result
1	867.959	51.1	-9.92	41.18	60.8	-19.62	Pass

30M-1G Horizontal

Test Lab: BlueAsia EMC Lab (RE #1)	Project: 202202-A40
EUT: RF remote control	Test Engineer: Charlie
M/N: AKRF-433MHz-V1	Temperature:
S/N:	Humidity:
Test Mode: TX mode	Test Voltage:
Note:	Test Data: 2022-03-11 14:47:12



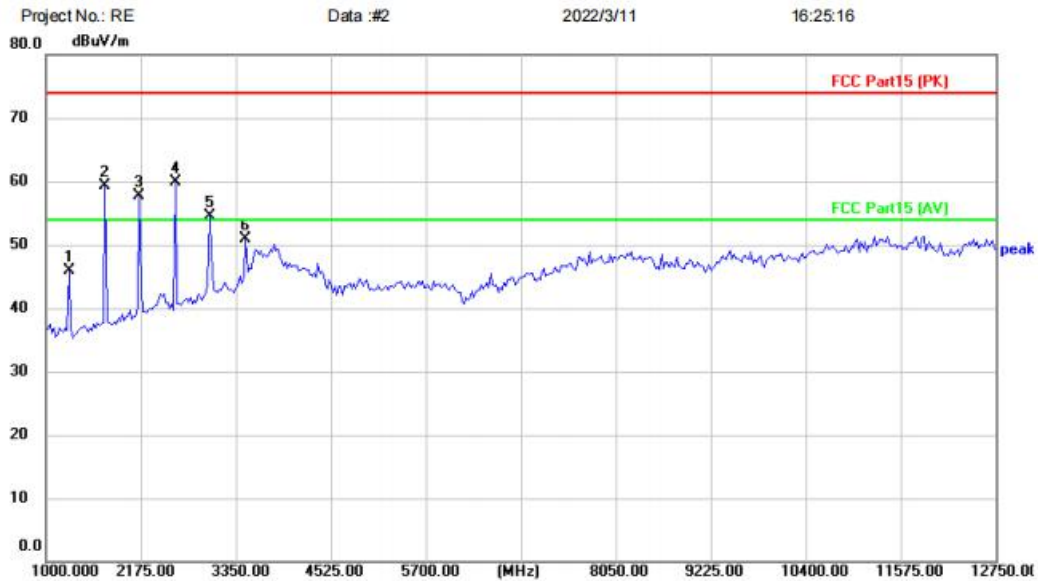
No.	Frequency	Limit dBuV/m	Level dBuV/m	Delta dB	Reading dBuV	Factor dB/m	Detector	Polar	Height cm	Angle deg
1*	36.548MHz	40.0	24.2	-15.8	0.4	23.8	QP	Hor	100.0	342.0
2*	55.584MHz	40.0	24.1	-15.9	0.5	23.6	QP	Hor	100.0	107.0
3*	153.918MHz	43.5	24.9	-18.6	1.5	23.4	QP	Hor	100.0	360.0
4*	244.976MHz	46.0	24.1	-21.9	1.3	22.8	QP	Hor	100.0	242.0
15*	434.005MHz	46.0	68.7	22.7	41.0	27.7	QP	Hor	100.0	0.0
16*	867.959MHz	46.0	56.8	10.8	22.1	34.7	QP	Hor	100.0	45.0

No.	Frequency (MHz)	Peak Result (dBuV/m)	Duty cycle factor	Average Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Result
1	867.959	56.8	-9.92	46.88	60.8	-13.92	Pass

Remark:

- 1.Final Level =Receiver Read level +Correct factor
- 2.Correct factor = Antenna Factor + Cable Loss – Preamplifier Factor
- 3.Average value = Peak value + Duty Cycle Factor

Above 1GHz Horizontal Radiated Emission Measurement

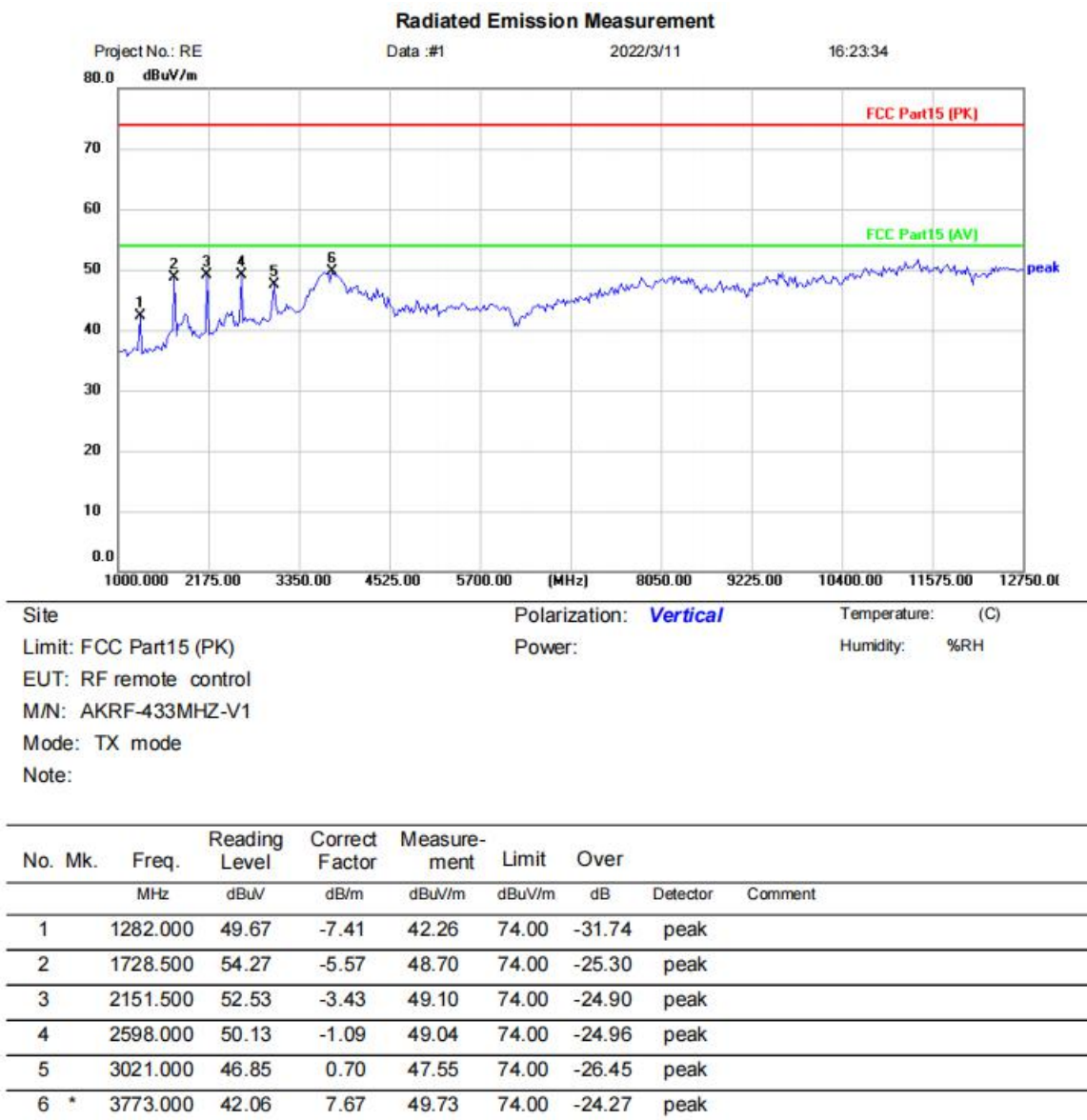


Site: Polarization: **Horizontal** Temperature: (C)
Limit: FCC Part15 (PK) Power: Humidity: %RH
EUT: RF remote control
M/N: AKRF-433MHZ-V1
Mode: TX mode
Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment
1		1282.000	53.34	-7.41	45.93	74.00	-28.07	peak	
2		1728.500	64.97	-5.57	59.40	74.00	-14.60	peak	
3		2151.500	61.22	-3.43	57.79	74.00	-16.21	peak	
4	*	2598.000	61.00	-1.09	59.91	74.00	-14.09	peak	
5		3021.000	53.85	0.70	54.55	74.00	-19.45	peak	
6		3467.500	47.53	3.44	50.97	74.00	-23.03	peak	

No.	Frequency (MHz)	Peak Result (dBuV/m)	Duty cycle factor	Average Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Result
1	1282.000	45.93	-9.92	36.01	60.8	-24.79	Pass
2	1728.500	59.40	-9.92	49.48	60.8	-11.32	Pass
3	2151.500	57.79	-9.92	47.87	60.8	-12.93	Pass
4	2598.000	59.91	-9.92	49.99	60.8	-10.81	Pass
5	3031.000	54.55	-9.92	44.63	60.8	-16.17	Pass
6	3467.500	50.97	-9.92	41.05	60.8	-19.75	Pass

Vertical



No.	Frequency (MHz)	Peak Result (dBuV/m)	Duty cycle factor	Average Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Result
1	1728.500	48.70	-9.92	38.78	60.8	-22.02	Pass

Remark:

- 1.Final Level =Receiver Read level +Correct factor
- 2.Correct factor = Antenna Factor + Cable Loss – Preamplifier Factor
- 3.Average value = Peak value + Duty Cycle Factor

11 FIELD STRENGTH OF THE FUNDAMENTAL SIGNAL (15.231(B))

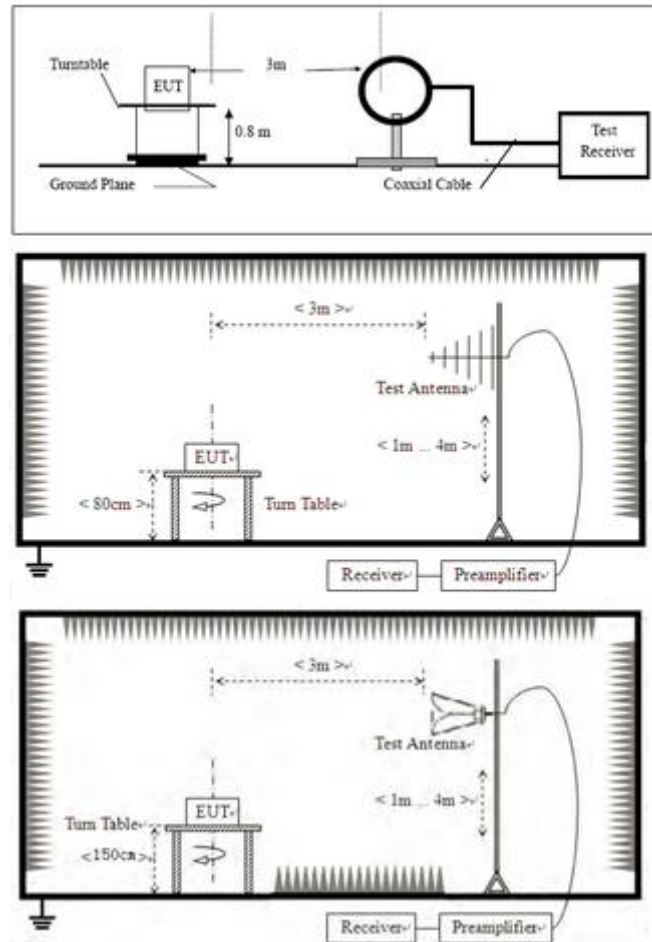
Test Standard	47 CFR Part 15, Subpart C 15.231
Test Method	ANSI C63.10 (2013) Section 6.5
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Jozu
Temperature	25℃
Humidity	60%

11.1 LIMITS

Fundamental frequency(MHz)	Field strength of fundamental(microvolts/meter)	Field strength of spurious emissions(microvolts/meter)
40.66-40.70	2250	225
70-130	1250	125
130-174	1250 to 3750	125 to 375
174-260	3750	375
260-470	3750 to 12500	375 to 1250
Above 470	12500	1250

Remark: the emission limit is based on measurement instrumentation employing an average detector at a distance of 3 meters. The frequencies above 1000MHz are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

11.2 BLOCK DIAGRAM OF TEST SETUP



11.3 PROCEDURE

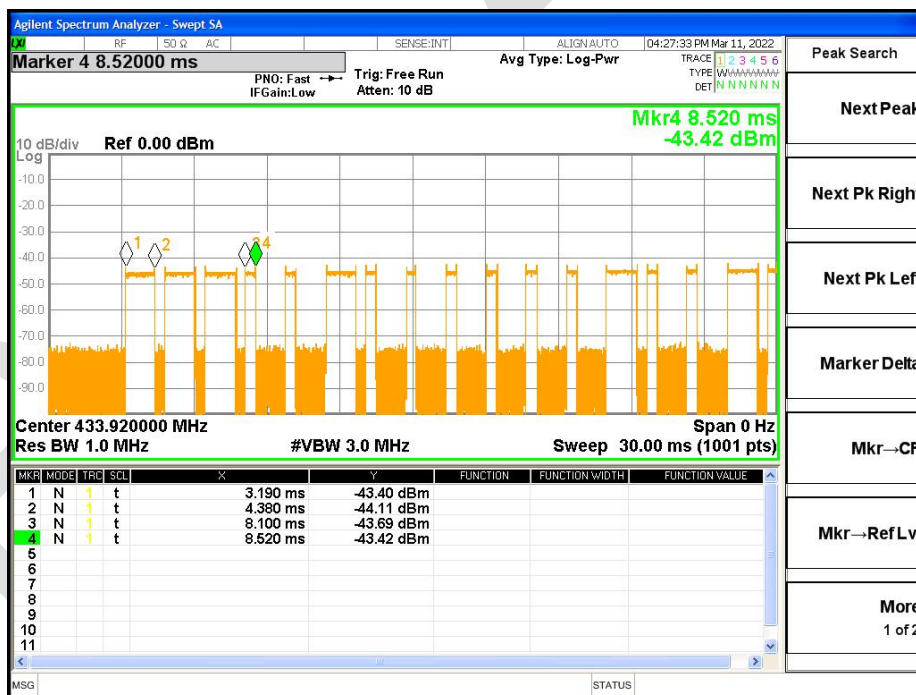
- For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 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.
- 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.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- 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.

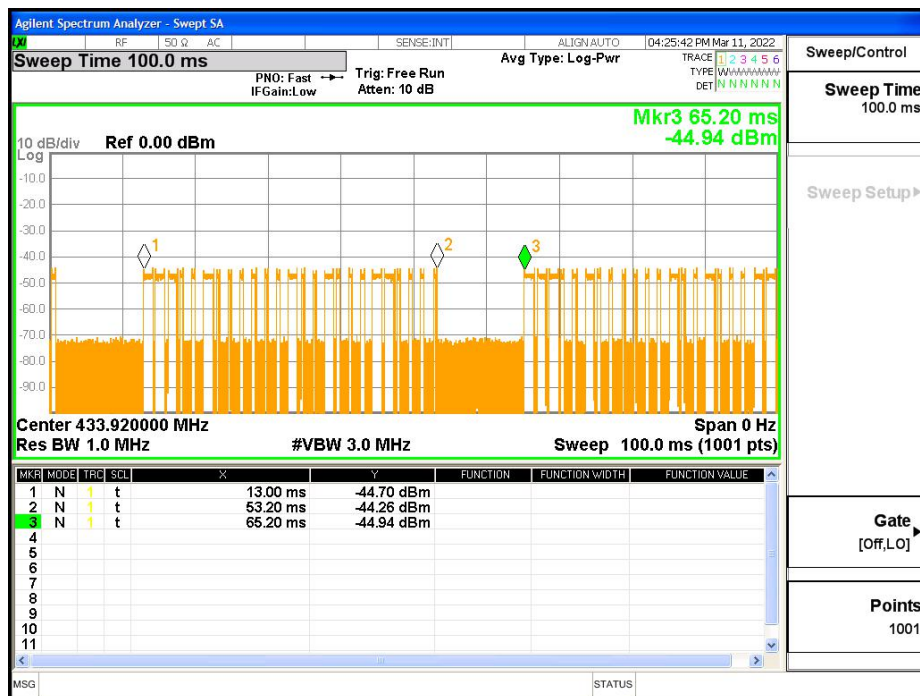
h. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.
Remark: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

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11.4 TEST DATA

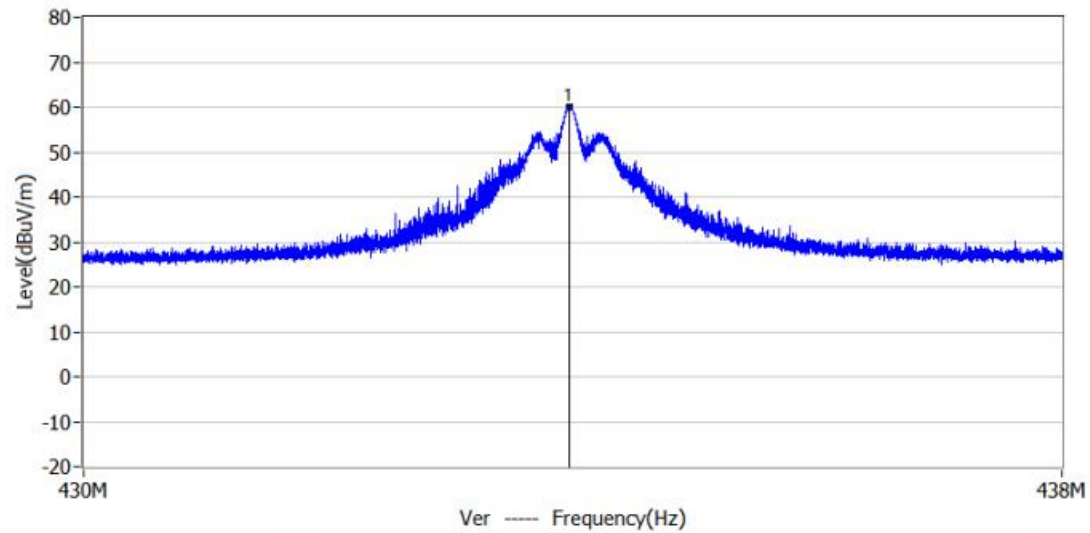
Peak value						
Frequency (MHz)	Read Level (dBuV)	Correct Facor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
433.92	41.0	27.7	68.7	100.80	-32.1	Horizontal
433.92	32.4	27.7	60.1	100.80	-40.7	Vertical
Average value						
Frequency (MHz)	Peak value	Duty cycle factor	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
433.92	68.7	-9.92	58.78	80.80	-22.02	Horizontal
433.92	60.1	-9.92	50.18	80.80	-30.62	Vertical
Calculate Formula:	Average value = Peak value + Duty Cycle Factor					
	Duty cycle factor = $20\log(\text{Duty cycle})$					
	Duty cycle = on time/ period					
Test data:	T on time = $1.19\text{ms} \times 8 + 0.42\text{ms} \times 17 = 16.66(\text{ms})$					
	T period = $52.2(\text{ms})$					
	Duty cycle = 31.92%					
	Duty cycle factor = $20\log(\text{Duty cycle}) = -9.92$					





Vertical

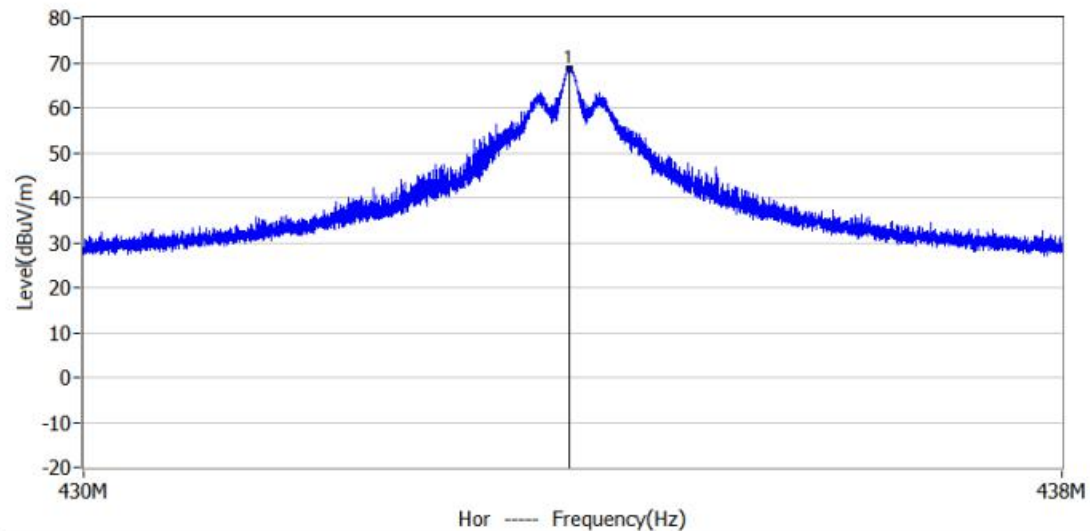
Test Lab: BlueAsia EMC Lab (RE #1)	Project: 202202-A40
EUT: RF remote control	Test Engineer: Charlie
M/N: AKRF-433MHz-V1	Temperature:
S/N:	Humidity:
Test Mode: Working mode	Test Voltage:
Note:	Test Data: 2022-03-11 15:01:06



No.	Frequency	Limit dBuV/m	Level dBuV/m	Delta dB	Reading dBuV	Factor dB/m	Detector	Polar	Height cm	Angle deg
1*	433.958MHz	NaN	60.1	NaN	32.4	27.7	PK	Ver	100.0	0.0

Horizontal

Test Lab: BlueAsia EMC Lab (RE #1)	Project: 202202-A40
EUT: RF remote control	Test Engineer: Charlie
M/N: AKRF-433MHz-V1	Temperature:
S/N:	Humidity:
Test Mode: Working mode	Test Voltage:
Note:	Test Data: 2022-03-11 14:59:05



No.	Frequency	Limit dBuV/m	Level dBuV/m	Delta dB	Reading dBuV	Factor dB/m	Detector	Polar	Height cm	Angle deg
1*	433.954MHz	NaN	68.7	NaN	41.0	27.7	PK	Hor	100.0	9.0

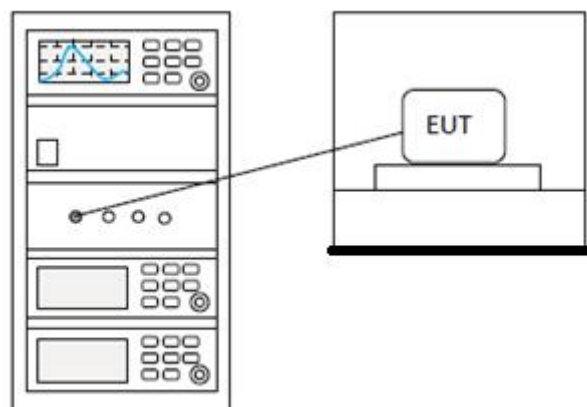
12 DWELL TIME (15.231(A))

Test Standard	47 CFR Part 15, Subpart C 15.231
Test Method	ANSI C63.10 (2013) Section 7.8.4
Test Mode (Pre-Scan)	Normal Working
Test Mode (Final Test)	Normal Working
Tester	Jozu
Temperature	25℃
Humidity	60%

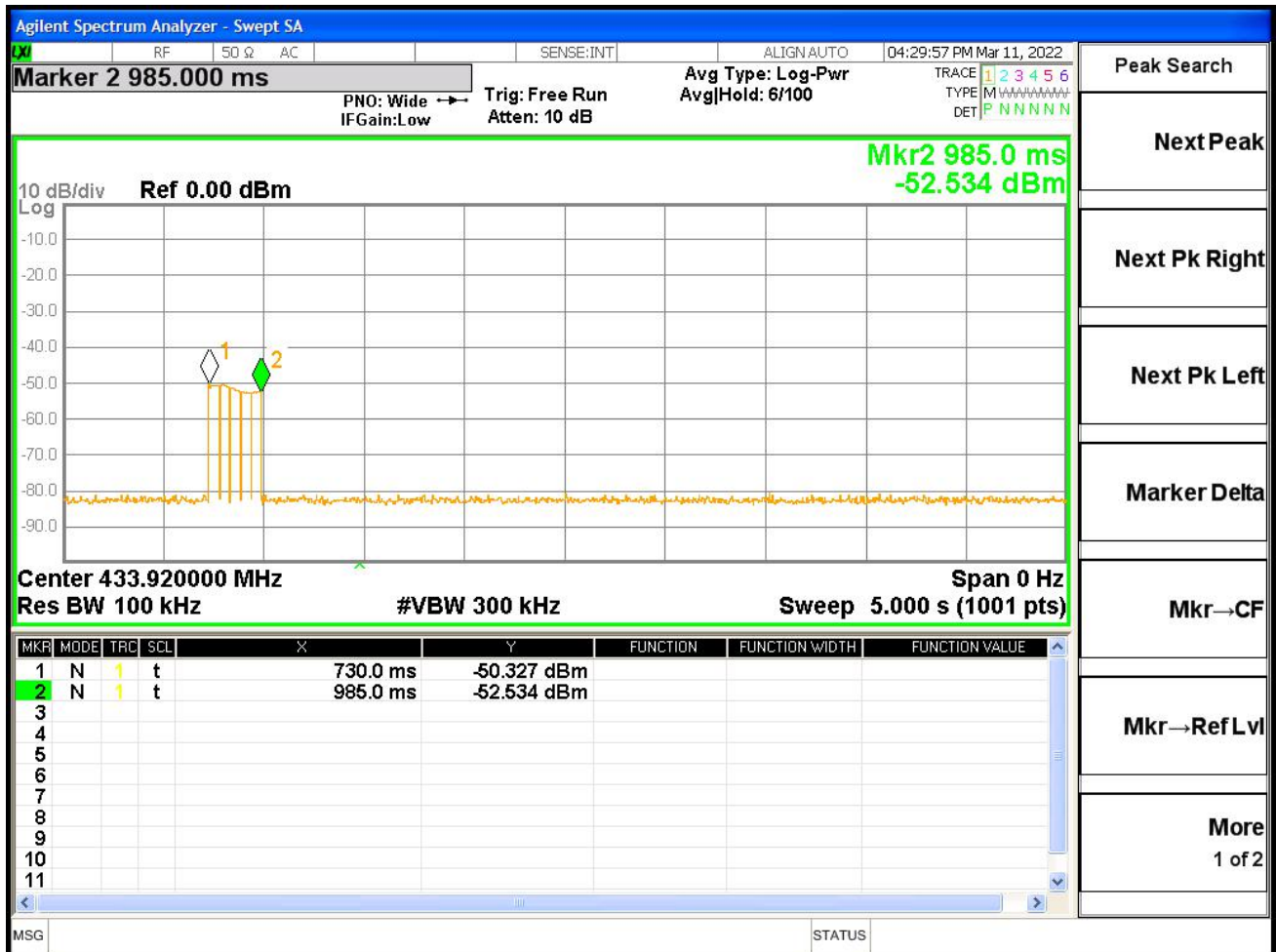
12.1 LIMITS

Device type	Limit
Manually operated transmitter	The switch automatically deactivate the transmitter within not more than 5 seconds of being released
Automatically activated transmitter	Cease transmission within 5 seconds after activation
Periodic transmissions to determine system integrity of transmitters used in security or safety applications	The total transmission time does not exceed 2 seconds per hour

12.2 BLOCK DIAGRAM OF TEST SETUP



12.3 TEST DATA



Measurement Data

Duration time (second)	Limit (second)	Result
0.985	<5.0	Pass

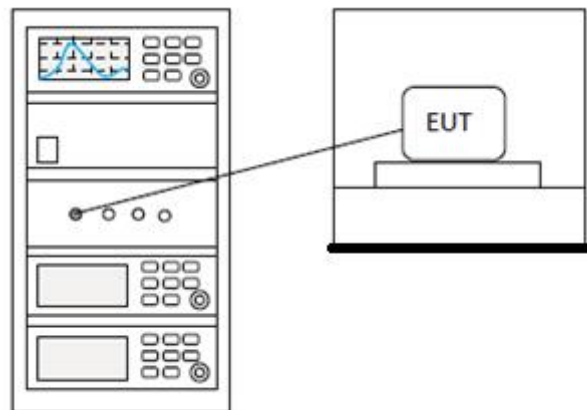
13 20DB BANDWIDTH

Test Standard	47 CFR Part 15, Subpart C 15.231
Test Method	ANSI C63.10 (2013) Section 6.9
Test Mode (Pre-Scan)	Normal Working
Test Mode (Final Test)	Normal Working
Tester	Jozu
Temperature	25℃
Humidity	60%

13.1 LIMITS

Frequency range(MHz)	Limit
70-900	No wider than 0.25% of the center frequency
Above 900	No wider than 0.5% of the center frequency

13.2 BLOCK DIAGRAM OF TEST SETUP



13.3 TEST DATA



Measurement Data

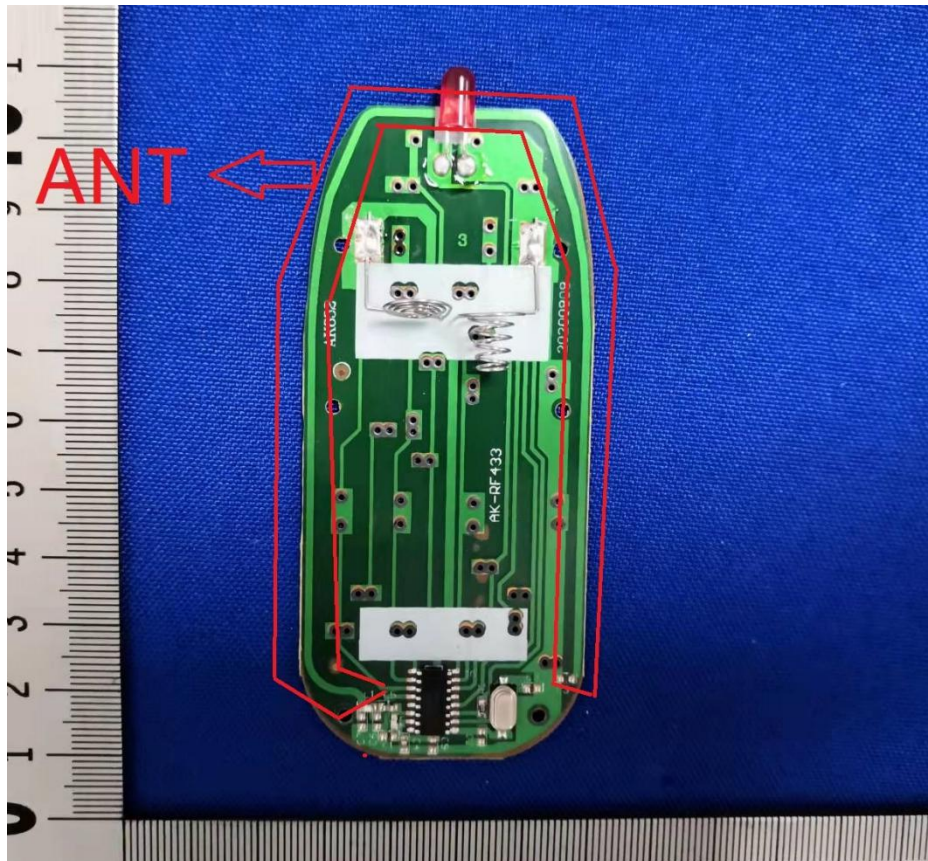
20dB bandwidth (MHz)	Limit (MHz)	Results
0.0654	1.0848	Passed

Note: Limit= Fundamental frequency $\times$ 0.25%=433.92 $\times$ 0.25%=1.0848MHz

14 ANTENNA REQUIREMENT

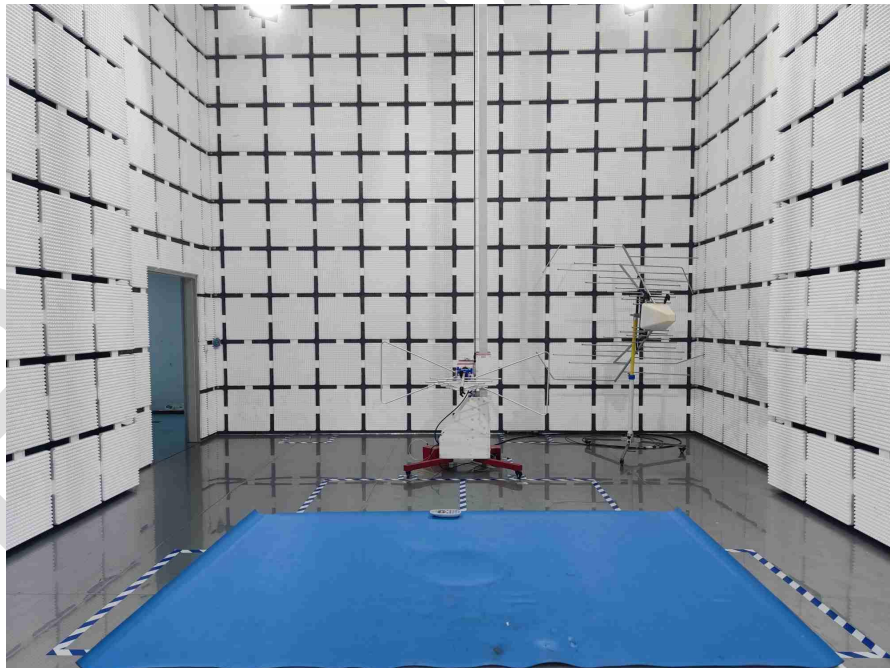
Test Standard	47 CFR Part 15, Subpart C 15.231
Test Method	N/A

14.1 CONCLUSION



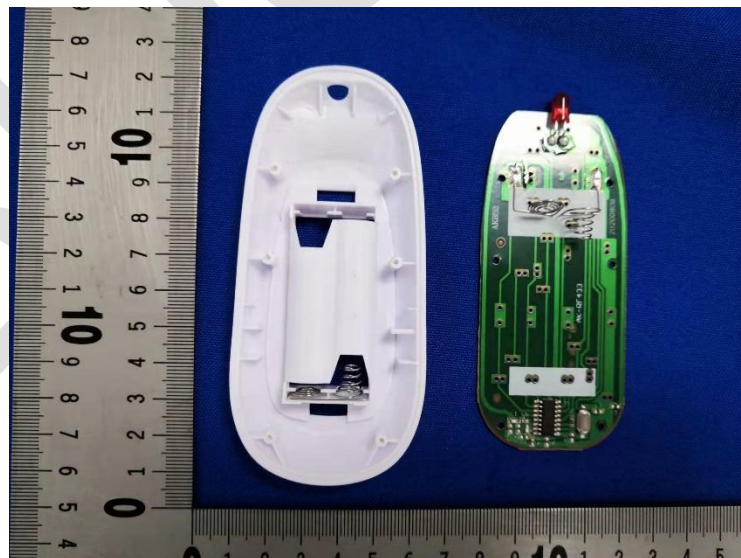
APPENDIX A: PHOTOGRAPHS OF TEST SETUP

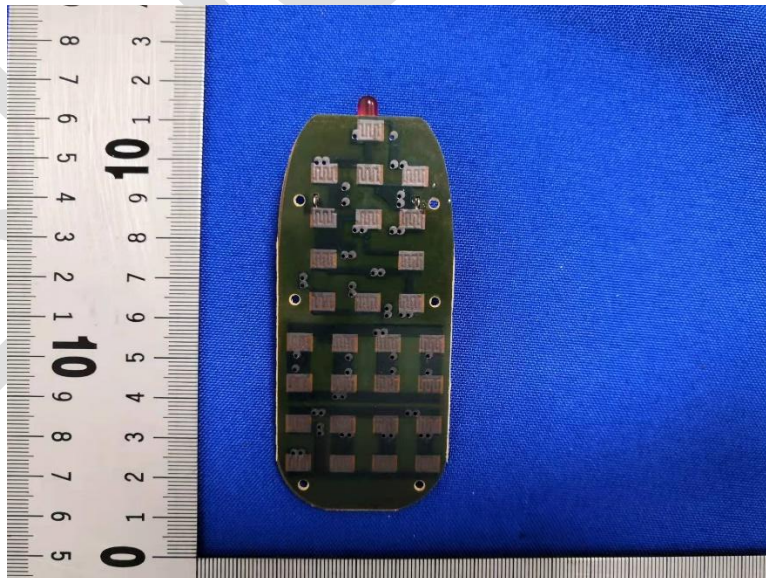
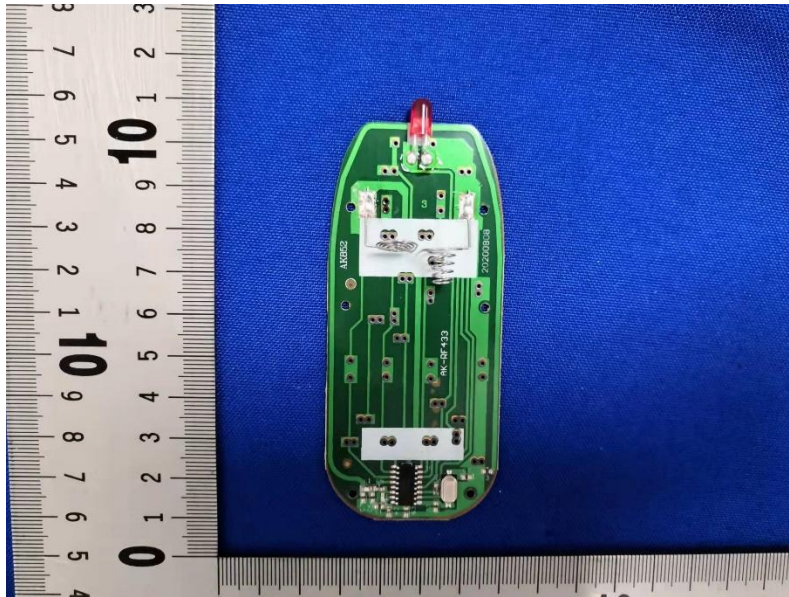
Radiated Emissions



APPENDIX B: PHOTOGRAPHS OF EUT







----END OF REPORT----

The test report is effective only with both signature and specialized stamp, The result(s) shown in this report refer only to the sample(s) tested. Without written approval of BlueAsia, this report can't be reproduced except in full.

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