



中认信通

CHINA CERTIFICATION ICT CO., LTD (DONGGUAN)



TEST REPORT

Applicant: Shenzhen ZBeetle Intelligence Co., Ltd.

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Guangdong 518100

FCC ID: 2A78SR2-ST

Product Name: XWOW Robot Vacuum and Mop (Station)

Standard(s): 47 CFR Part 15, Subpart C(15.231)
ANSI C63.10-2013

The above equipment has been tested and found compliant with the requirement of the relative standards by China Certification ICT Co., Ltd (Dongguan)

Report Number: CR22070024-00A

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Title: Manager

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Test Facility

The Test site used by China Certification ICT Co., Ltd (Dongguan) to collect test data is located on the No. 113, Pingkang Road, Dalang Town, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 ZC201EN and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 442868, the FCC Designation No. : CN1314.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0123.

Declarations

China Certification ICT Co., Ltd (Dongguan) is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol “▲”. Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

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CONTENTS

TEST FACILITY	2
DECLARATIONS	2
1. GENERAL INFORMATION	5
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	5
1.2 DESCRIPTION OF TEST CONFIGURATION	6
1.2.2 Support Equipment List and Details	6
1.2.3 Support Cable List and Details	6
1.2.4 Block Diagram of Test Setup	6
1.3 MEASUREMENT UNCERTAINTY	8
2. SUMMARY OF TEST RESULTS	9
3. REQUIREMENTS AND TEST PROCEDURES	10
3.1 AC LINE CONDUCTED EMISSIONS.....	10
3.1.1 Applicable Standard.....	10
3.1.2 EUT Setup.....	11
3.1.3 EMI Test Receiver Setup	11
3.1.4 Test Procedure	12
3.1.5 Corrected Amplitude & Margin Calculation.....	12
3.2 RADIATION SPURIOUS EMISSIONS.....	13
3.2.1 Applicable Standard.....	13
3.2.2 EUT Setup.....	14
3.2.3 EMI Test Receiver & Spectrum Analyzer Setup	15
3.2.4 Test Procedure	15
3.2.5 Corrected Amplitude & Margin Calculation.....	15
3.3 20 dB EMISSION BANDWIDTH:	16
3.3.1 Applicable Standard.....	16
3.3.2 EUT Setup.....	16
3.3.3 Test Procedure	16
3.4 DEACTIVATION TESTING	17
3.4.1 Applicable Standard.....	17
3.4.2 EUT Setup.....	17
3.4.3 Test Procedure	17
3.5 ANTENNA REQUIREMENT	18
3.5.1 Applicable Standard.....	18
3.5.2 Judgment.....	18
4. Test DATA AND RESULTS	19
4.1 AC LINE CONDUCTED EMISSIONS.....	19
4.2 RADIATION SPURIOUS EMISSIONS.....	22
4.3 20 dB EMISSION BANDWIDTH:	27
4.4 DEACTIVATION TESTING:	29

5. RF EXPOSURE EVALUATION	31
5.1 APPLICABLE STANDARD	31
5.2 MEASUREMENT RESULT.....	31

1. GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

EUT Name:	XWOW Robot Vacuum and Mop (Station)
EUT Model:	R2-ST
Multiple Models:	R3-ST, R4-ST, R5-ST
Operation Frequency:	433.595 MHz
Modulation Type:	GFSK
Rated Input Voltage:	AC 120V/60Hz
Serial Number:	CR22070024-RF-S1
EUT Received Date:	2022.07.21
EUT Received Status:	Good
Note: The Multiple models is electrically identical with test model, please refer to the declaration letter for more detail, which was provided by manufacturer.	

Antenna Information Detail▲:

Antenna Manufacturer	Antenna Type	input impedance (Ohm)	Frequency Range	Antenna Gain
Shenzhen surbanger Technology Co.; LTD	FPC	50	433-434MHz	Unknown
The Method of §15.203 Compliance: ☒ Antenna must be permanently attached to the unit. ☐ Antenna must use a unique type of connector to attach to the EUT. ☐ Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.				

Accessory Information:

No.

1.2 Description of Test Configuration

1.2.1 EUT Operation Condition:

EUT Operation Mode:	The system was configured for testing in Engineering Mode, which was provided by the manufacturer.
Equipment Modifications:	No
EUT Exercise Software:	No
Engineering Mode was provided by manufacturer▲. The maximum power was configured default setting.	

1.2.2 Support Equipment List and Details

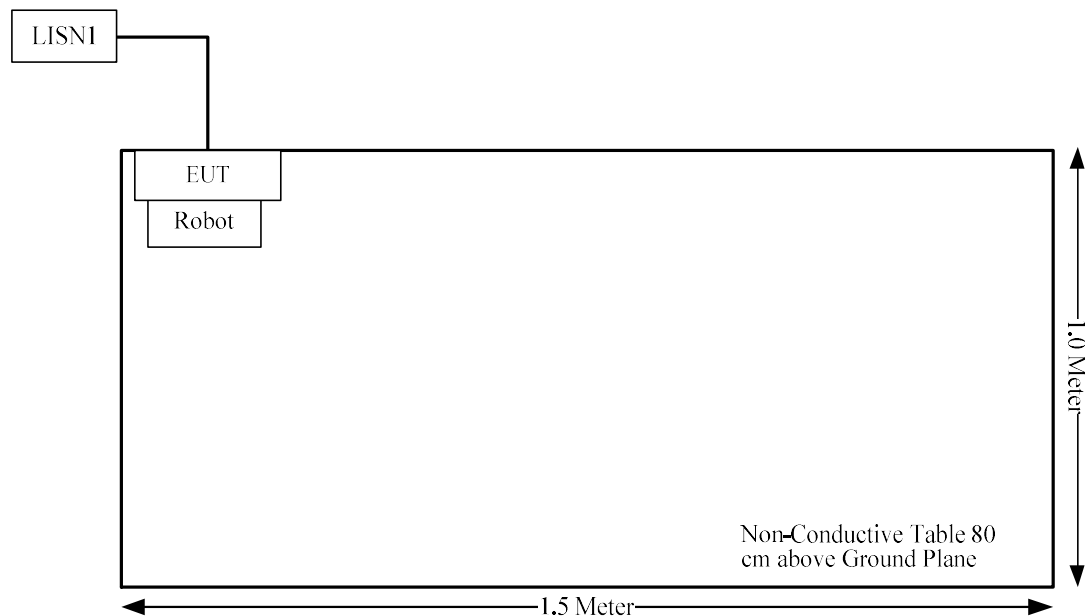
Manufacturer	Description	Model	Serial Number
Shenzhen ZBeetle Intelligence Co., Ltd.	Robot	R2	CR22070023-RF-S1

1.2.3 Support Cable List and Details

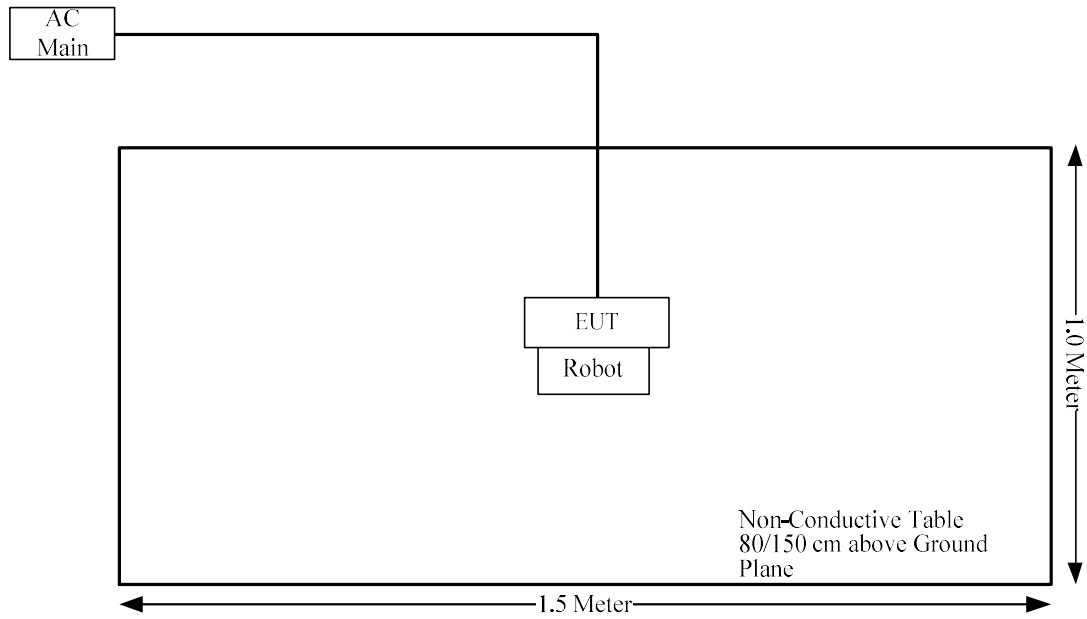
Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
/	/	/	/	/	/

1.2.4 Block Diagram of Test Setup

AC Line Conducted Emission Test:



Radiation Emission Test:



1.3 Measurement Uncertainty

Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
Unwanted Emissions, radiated	30M~200MHz: 4.15 dB, 200M~1GHz: 5.61 dB, 1G~6GHz: 5.14 dB, 6G~18GHz: 5.93 dB, 18G~26.5G: 5.47 dB, 26.5G~40G: 5.63 dB
Unwanted Emissions, conducted	±1.26 dB
Temperature	±1 °C
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	2.8 dB (150 kHz to 30 MHz)

2. SUMMARY OF TEST RESULTS

Standard(s) Section	Test Items	Result
§ 15.207 (a)	Conducted Emissions	Compliant
§ 15.205, § 15.209, § 15.231 (b)	Radiated Emissions	Compliant
§ 15.231 (c)	20dB Bandwidth	Compliant
§ 15.231 (a)	Deactivation Testing	Compliant
§ 15.203	Antenna Requirement	Compliant
§ 1.1307	RF Exposure Evaluation	Compliant

3. REQUIREMENTS AND TEST PROCEDURES

3.1 AC Line Conducted Emissions

3.1.1 Applicable Standard

FCC§15.207(a).

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

(b) The limit shown in paragraph (a) of this section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

(1) For carrier current system containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 μ V within the frequency band 535-1705 kHz, as measured using a 50 μ H/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits in §15.205, §15.209, §15.221, §15.223, or §15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

3.1.4 Test Procedure

The frequency and amplitude of the six highest ac power-line conducted emissions relative to the limit, measured over all the current-carrying conductors of the EUT power cords, and the operating frequency or frequency to which the EUT is tuned (if appropriate), should be reported, unless such emissions are more than 20 dB below the limit. AC power-line conducted emissions measurements are to be separately carried out only on each of the phase (“hot”) line(s) and (if used) on the neutral line(s), but not on the ground [protective earth] line(s). If less than six emission frequencies are within 20 dB of the limit, then the noise level of the measuring instrument at representative frequencies should be reported. The specific conductor of the power-line cord for each of the reported emissions should be identified. Measure the six highest emissions with respect to the limit on each current-carrying conductor of each power cord associated with the EUT (but not the power cords of associated or peripheral equipment that are part of the test configuration). Then, report the six highest emissions with respect to the limit from among all the measurements identifying the frequency and specific current-carrying conductor identified with the emission. The six highest emissions should be reported for each of the current-carrying conductors, or the six highest emissions may be reported over all the current-carrying conductors.

3.1.5 Corrected Amplitude & Margin Calculation

The basic equation is as follows:

Result = Reading + Factor

Factor = attenuation caused by cable loss + voltage division factor of AMN

The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. The equation for margin calculation is as follows:

Margin = Limit – Result

3.2 Radiation Spurious Emissions

3.2.1 Applicable Standard

FCC §15.231 (b);

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

¹Linear interpolations.

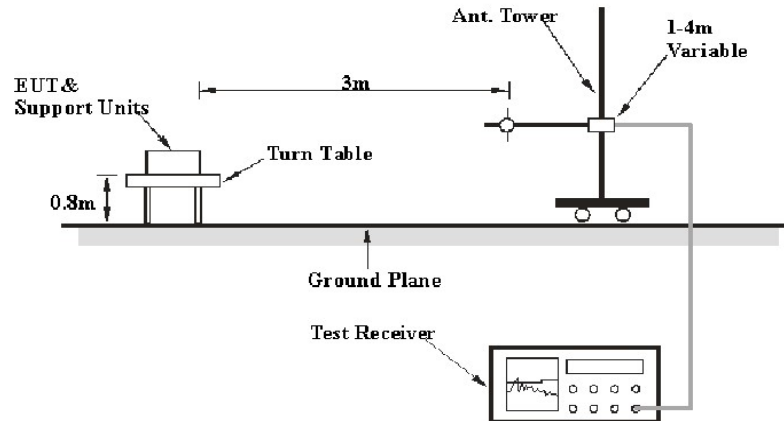
(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

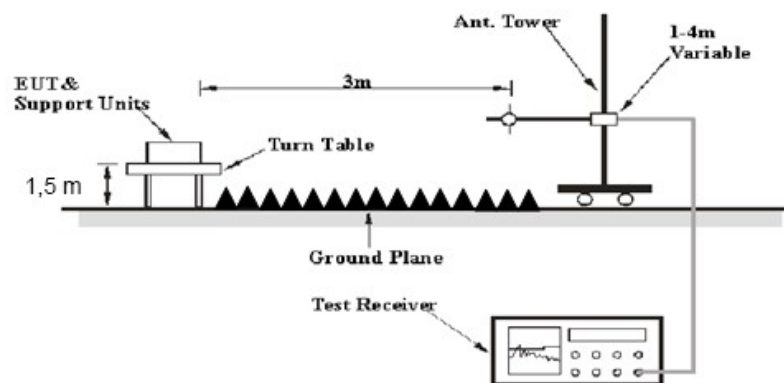
(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in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

3.2.2 EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emissions were performed in the 3 meters distance, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.205, 15.209, and FCC 15.231 limits.

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.

3.2.3 EMI Test Receiver & Spectrum Analyzer Setup

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

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	100 kHz	PK
Above 1 GHz	1 MHz	3 MHz	/	PK

3.2.4 Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

According to §15.231, Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector

3.2.5 Corrected Amplitude & Margin Calculation

The basic equation is as follows:

Result = Reading + Factor

Factor = Antenna Factor + Cable Loss- Amplifier Gain

The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. The equation for margin calculation is as follows:

Margin = Limit – Result

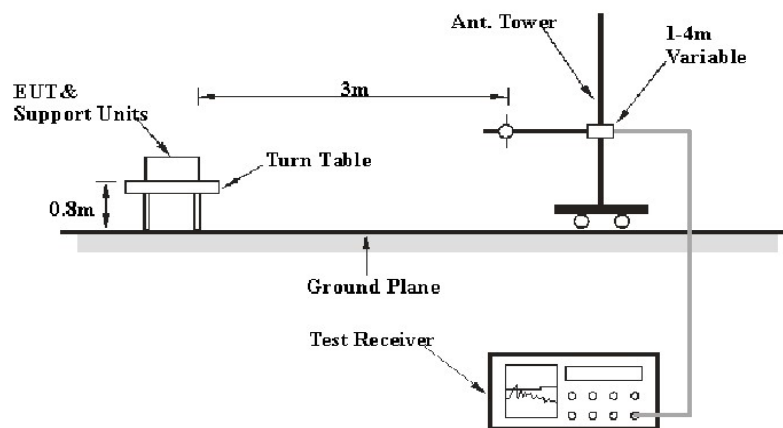
3.3 20 dB Emission Bandwidth:

3.3.1 Applicable Standard

FCC §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.

3.3.2 EUT Setup



3.3.3 Test Procedure

- The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, unless otherwise specified by the applicable requirement.
- Set the video bandwidth (VBW) $\geq 3 \times \text{RBW}$.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

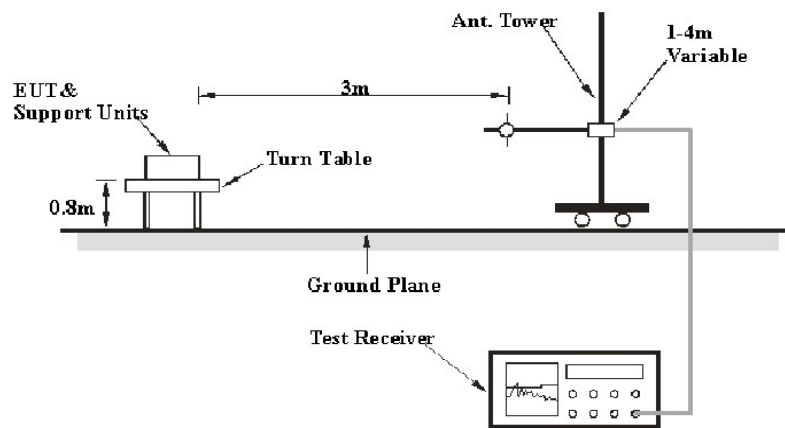
3.4 DEACTIVATION TESTING

3.4.1 Applicable Standard

FCC §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.

3.4.2 EUT Setup



3.4.3 Test Procedure

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the ON and OFF times of the transmitted signal:

- 1) Set the center frequency of the instrument to the center frequency of the transmission.
- 2) Set $RBW \geq OBW$ if possible; otherwise, set RBW to the largest available value.
- 3) Set $VBW \geq RBW$. Set detector = peak or average.

3.5 Antenna Requirement

3.5.1 Applicable Standard

FCC §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. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

3.5.2 Judgment

Result: Compliant. Please refer to the Antenna Information detail in Section 1.

4. Test DATA AND RESULTS

4.1 AC Line Conducted Emissions

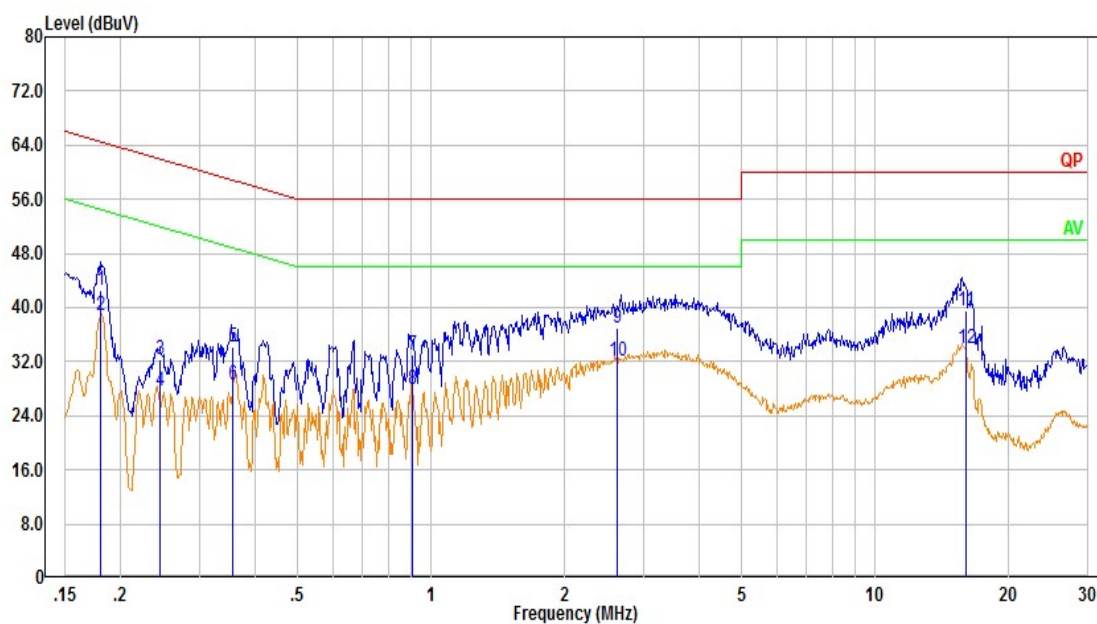
Serial Number:	CR22070024-RF-S1	Test Date:	2022-08-04
Test Site:	CE	Test Mode:	Transmitting
Tester:	Vic Du	Test Result:	Pass

Environmental Conditions:					
Temperature: (°C)	27.3	Relative Humidity: (%)	59	ATM Pressure: (kPa)	100.1

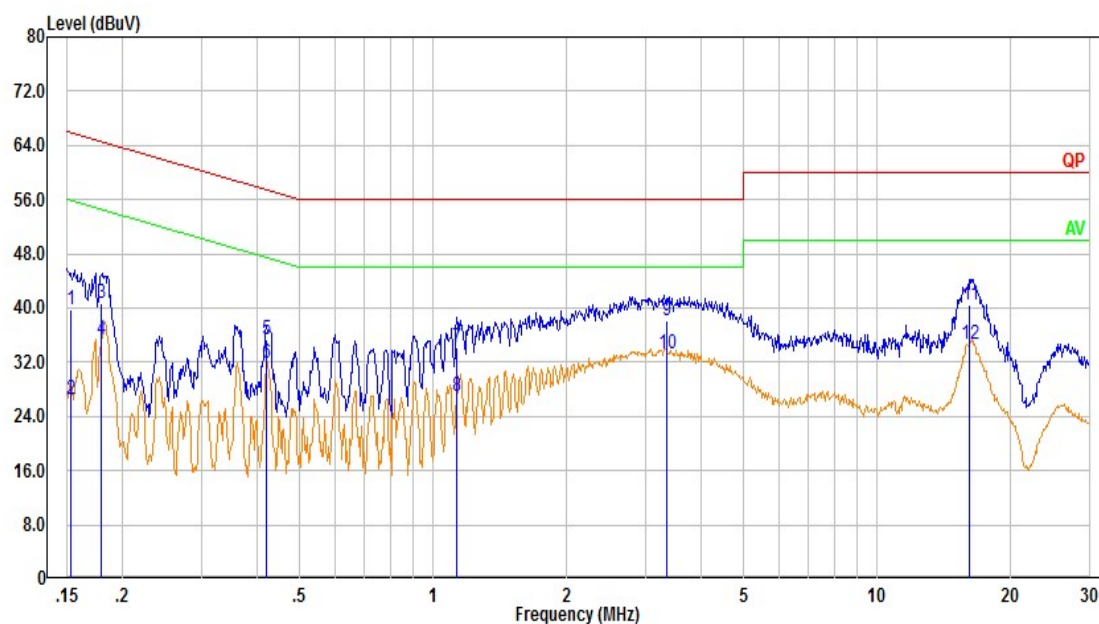
Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	LISN	ENV216	101134	2022-04-01	2023-03-31
R&S	EMI Test Receiver	ESR3	102726	2022-07-15	2023-07-14
MICRO-COAX	Coaxial Cable	UTIFLEX	C-0200-01	2021-08-08	2022-08-07
Audix	Test Software	E3	190306 (V9)	N/A	N/A

** Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

Line:

No.	Frequency (MHz)	Reading (dB μ V)	Factor (dB)	Result (dB μ V)	Limit (dB μ V)	Margin (dB)	Detector
1	0.180	32.89	9.61	42.50	64.47	21.97	QP
2	0.180	29.12	9.61	38.73	54.47	15.74	Average
3	0.246	22.75	9.61	32.36	61.90	29.54	QP
4	0.246	17.99	9.61	27.60	51.90	24.30	Average
5	0.358	24.58	9.61	34.19	58.78	24.59	QP
6	0.358	18.88	9.61	28.49	48.78	20.29	Average
7	0.904	23.49	9.62	33.11	56.00	22.89	QP
8	0.904	18.32	9.62	27.94	46.00	18.06	Average
9	2.628	27.24	9.64	36.88	56.00	19.12	QP
10	2.628	22.50	9.64	32.14	46.00	13.86	Average
11	16.004	29.90	9.71	39.61	60.00	20.39	QP
12	16.004	24.32	9.71	34.03	50.00	15.97	Average

Neutral:

No.	Frequency (MHz)	Reading (dBμV)	Factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.153	30.17	9.61	39.78	65.84	26.06	QP
2	0.153	16.90	9.61	26.51	55.84	29.33	Average
3	0.179	31.11	9.61	40.72	64.55	23.83	QP
4	0.179	25.82	9.61	35.43	54.55	19.12	Average
5	0.422	25.68	9.61	35.29	57.40	22.11	QP
6	0.422	22.20	9.61	31.81	47.40	15.59	Average
7	1.131	24.61	9.62	34.23	56.00	21.77	QP
8	1.131	17.25	9.62	26.87	46.00	19.13	Average
9	3.366	28.40	9.65	38.05	56.00	17.95	QP
10	3.366	23.63	9.65	33.28	46.00	12.72	Average
11	16.155	30.81	9.69	40.50	60.00	19.50	QP
12	16.155	24.98	9.69	34.67	50.00	15.33	Average

4.2 Radiation Spurious Emissions

Serial Number:	CR22070024-RF-S1	Test Date:	2022-08-15~2022-08-17
Test Site:	966-1~966-2	Test Mode:	Transmitting
Tester:	Gary Ling, Carl Xue, Mack Huang	Test Result:	Pass

Environmental Conditions:

Temperature: (°C)	24.3~28.1	Relative Humidity: (%)	46~66	ATM Pressure: (kPa)	99.8~99.9
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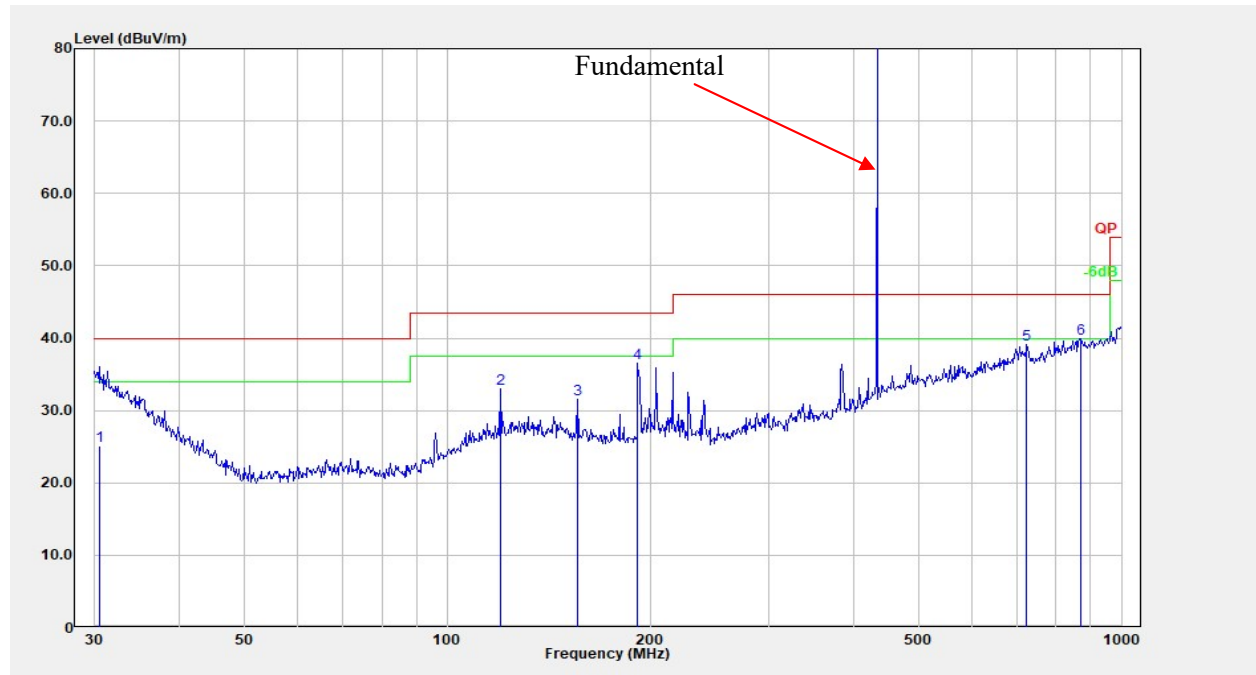
Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sunol Sciences	Antenna	JB6	A082520-5	2020-10-19	2023-10-18
R&S	EMI Test Receiver	ESR3	102724	2022-07-15	2023-07-14
TIMES MICROWAVE	Coaxial Cable	LMR-600-UltraFlex	C-0470-02	2022-07-17	2023-07-16
TIMES MICROWAVE	Coaxial Cable	LMR-600-UltraFlex	C-0780-01	2022-07-17	2023-07-16
Sonoma	Amplifier	310N	186165	2022-07-17	2023-07-16
Audix	Test Software	E3	201021 (V9)	N/A	N/A
ETS-Lindgren	Horn Antenna	3115	9912-5985	2020-10-13	2023-10-12
R&S	Spectrum Analyzer	FSV40	101591	2022-07-15	2023-07-14
MICRO-COAX	Coaxial Cable	UFA210A-1-1200-70U300	217423-008	2022-08-07	2023-08-06
MICRO-COAX	Coaxial Cable	UFA210A-1-2362-300300	235780-001	2022-08-07	2023-08-06
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2021-11-10	2022-11-09

* Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

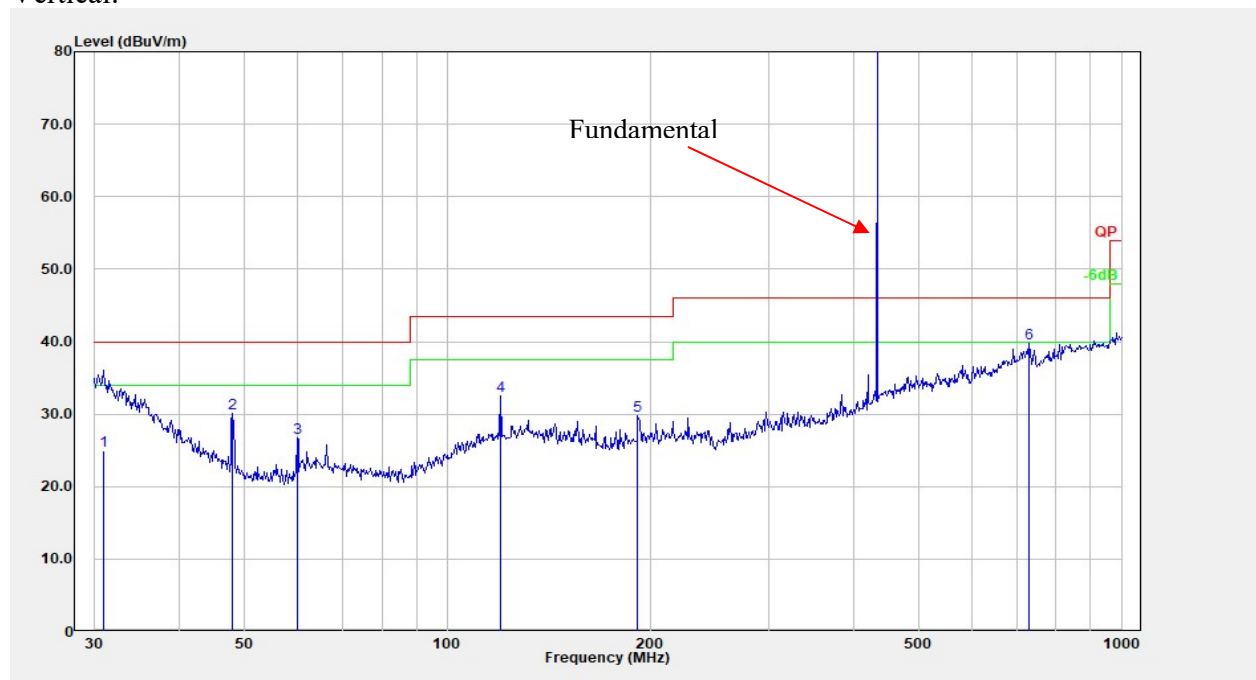
30MHz-1GHz

Horizontal:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	30.424	-2.32	27.36	25.04	40.00	14.96	QP
2	119.856	13.29	19.68	32.97	43.50	10.53	Peak
3	155.910	12.47	19.05	31.52	43.50	11.98	Peak
4	191.745	18.44	18.07	36.51	43.50	6.99	Peak
5	724.261	11.30	27.81	39.11	46.00	6.89	Peak
6	869.130	10.56	29.30	39.86	46.00	6.14	Peak

Vertical:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	30.853	-1.99	27.02	25.03	40.00	14.97	QP
2	47.994	14.80	15.26	30.06	40.00	9.94	Peak
3	59.859	12.82	13.84	26.66	40.00	13.34	Peak
4	119.856	12.76	19.68	32.44	43.50	11.06	Peak
5	191.745	11.76	18.07	29.83	43.50	13.67	Peak
6	729.358	11.78	27.91	39.69	46.00	6.31	Peak

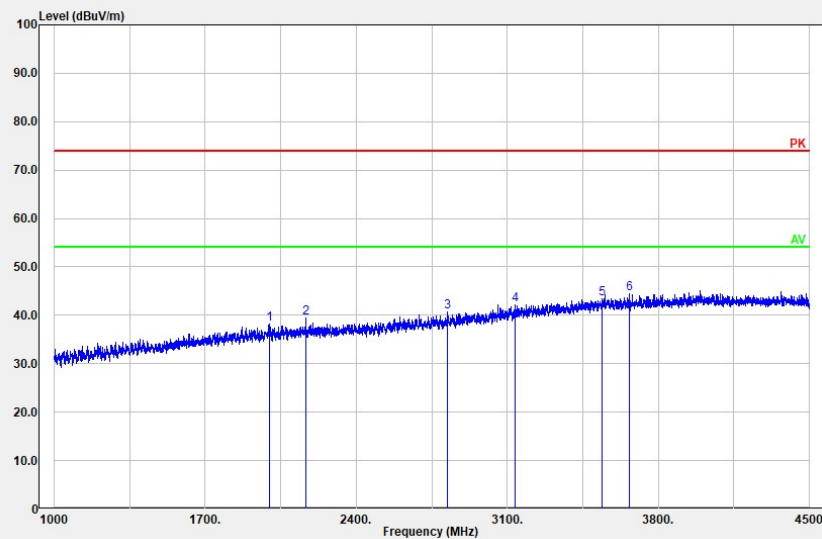
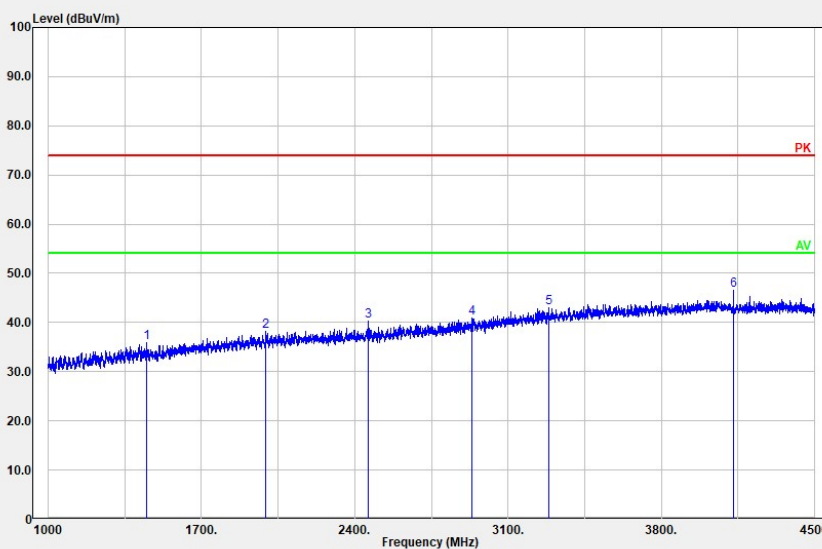
**30-4500MHz
Peak Strength**

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector					
433.595*	56.36	PK	H	23.65	80.01	100.81	20.80
433.595*	55.63	PK	V	23.65	79.28	100.81	21.53
867.19	10.56	PK	H	29.33	39.89	80.81	40.92
867.19	9.94	PK	V	29.33	39.27	80.81	41.54
1300.785	35.26	PK	H	-1.72	33.54	74.00	40.46
1300.785	35.18	PK	V	-1.72	33.46	74.00	40.54
1734.380	36.21	PK	H	0.89	37.10	80.81	43.71
1734.380	35.78	PK	V	0.89	36.67	80.81	44.14
2167.975	35.19	PK	H	2.85	38.04	80.81	42.77
2167.975	35.87	PK	V	2.85	38.72	80.81	42.09
2601.570	35.35	PK	H	4.25	39.60	80.81	41.21
2601.570	35.83	PK	V	4.25	40.08	80.81	40.73
3035.165	34.98	PK	H	6.18	41.16	80.81	39.65
3035.165	34.88	PK	V	6.18	41.06	80.81	39.75
3468.760	36.41	PK	H	7.52	43.93	80.81	36.88
3468.760	36.04	PK	V	7.52	43.56	80.81	37.25
3902.355	34.35	PK	H	9.02	43.37	74.00	30.63
3902.355	34.77	PK	V	9.02	43.79	74.00	30.21
4335.950	35.55	PK	H	9.76	45.31	74.00	28.69
4335.950	34.49	PK	V	9.76	44.25	74.00	29.75

Note:

*: Fundamental

All the peak emissions are under the peak limit more than 20dB, therefore average detector is unnecessary.

Test Plots**Horizontal****Vertical**

4.3 20 dB Emission Bandwidth:

Serial Number:	CR22070024-RF-S1	Test Date:	2022-08-17
Test Site:	966-2	Test Mode:	Transmitting
Tester:	Carl Xue	Test Result:	Pass

Environmental Conditions:

Temperature: (°C)	27.5	Relative Humidity: (%)	68	ATM Pressure: (kPa)	100.0
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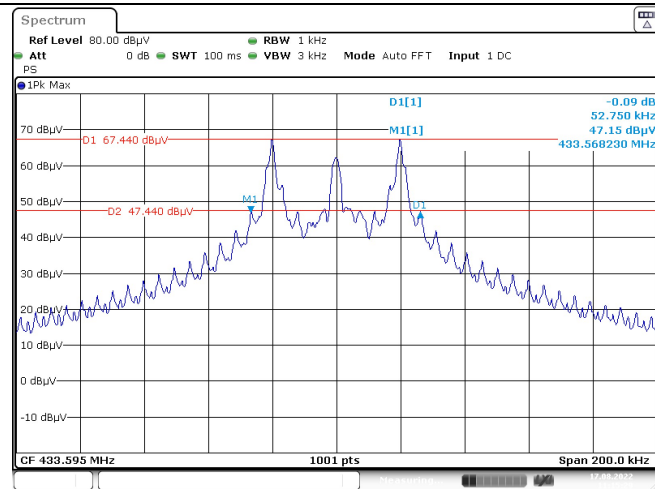
Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sunol Sciences	Antenna	JB6	A082520-5	2020-10-19	2023-10-18
R&S	EMI Test Receiver	ESR3	102724	2022-07-15	2023-07-14
TIMES MICROWAVE	Coaxial Cable	LMR-600-UltraFlex	C-0470-02	2022-07-17	2023-07-16
TIMES MICROWAVE	Coaxial Cable	LMR-600-UltraFlex	C-0780-01	2022-07-17	2023-07-16
Sonoma	Amplifier	310N	186165	2022-07-17	2023-07-16

** **Statement of Traceability:** China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

Test Data:

Test Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)
433.595	52.750	1084

20dB Emission Bandwidth

4.4 DEACTIVATION TESTING:

Serial Number:	CR22070024-RF-S1	Test Date:	2022-08-15
Test Site:	966-2	Test Mode:	Transmitting
Tester:	Carl Xue	Test Result:	Pass

Environmental Conditions:

Temperature: (°C)	27.2	Relative Humidity: (%)	67	ATM Pressure: (kPa)	99.9
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Test Equipment List and Details:

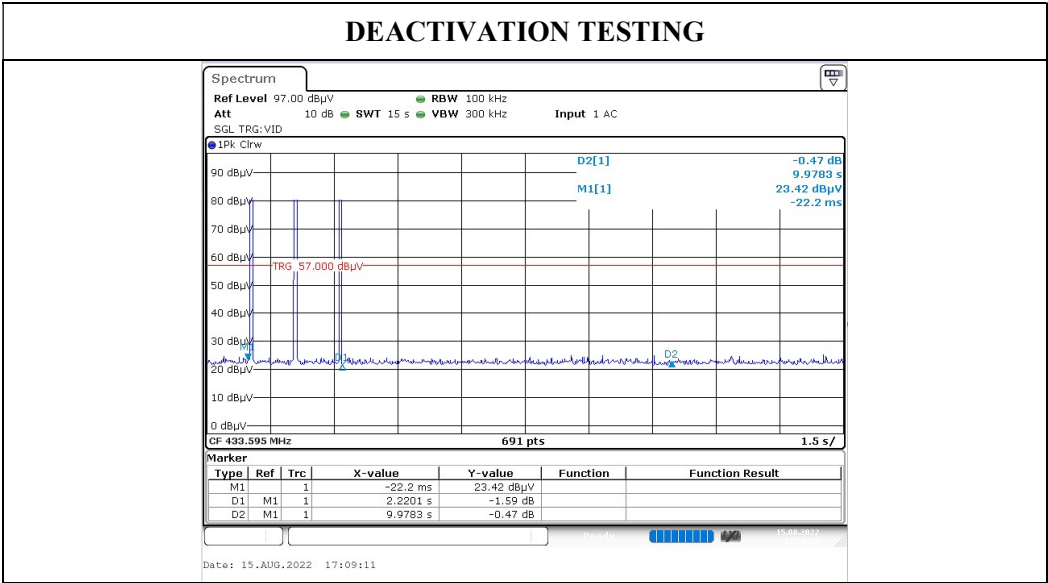
Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sunol Sciences	Antenna	JB6	A082520-5	2020-10-19	2023-10-18
R&S	EMI Test Receiver	ESR3	102724	2022-07-15	2023-07-14
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TIMES MICROWAVE	Coaxial Cable	LMR-600-UltraFlex	C-0780-01	2022-07-17	2023-07-16
Sonoma	Amplifier	310N	186165	2022-07-17	2023-07-16

** **Statement of Traceability:** China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

Test Data:

Test Frequency (MHz)	Maximum Deactivate Time (s)	Limit (s)
433.595	2.22	<5

DEACTIVATION TESTING



5. RF EXPOSURE EVALUATION

5.1 Applicable Standard

According to §1.1307(b)(3)(i)

(C) Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	$1,920 R^2$.
1.34-30	$3,450 R^2/f^2$.
30-300	$3.83 R^2$.
300-1,500	$0.0128 R^2 f$.
1,500-100,000	$19.2 R^2$.

5.2 Measurement Result

Operation Modes	Frequency (MHz)	$\lambda/2\pi$ (mm)	Distance (mm)	Exemption ERP		Maximum Conducted Power including Tune-up Tolerance (dBm)	Antenna Gain (dBi)	ERP (dBm)	ERP (mW)	MPE-Based Exemption
				(mW)	(dBm)					
WLAN 2.4G	2412-2462	19.80	200	768	28.85	17.56	3.26	18.67	73.62	Compliant
BLE	2402-2480	19.89	200	768	28.85	8.52	3.26	9.63	9.18	Compliant
433M	433.595	110	200	222	23.46	/	/	-17.34	0.02	Compliant

Note:

The device contains a certified module, FCC ID: 2AC7Z-ESPC3WROOM.

433M:

$E \text{ (dBuV/m)} = \text{EIRP (dBm)} + 104.8 - 20\log(d)$

Peak Filed strength is 80.01 dBuV/m = -15.19 dBm EIRP (ERP = -17.34dBm)

WLAN 2.4G or BLE can transmit simultaneously with 433M:

$$\sum_{i=1}^a \left(\frac{P_i}{P_{th_i}} \right) + \sum_{j=1}^b \left(\frac{ERP_j}{ERP_{th_j}} \right) + \sum_{k=1}^c \left(\frac{Evaluated_k}{Exposure Limit_k} \right)$$

$$= ERP_{2.4G}/ERP_{limit-2.4G} + ERP_{433M}/ERP_{limit-433M}$$

$$= 73.62/768 + 0.02/222$$

$$= 0.10$$

Result: The device compliant the MPE-Based Exemption at 20cm distances.

===== END OF REPORT =====