TESTING LABORATORY
CERTIFICATE#4323.01

FCC PART 15.225

TEST REPORT

For

Zhejiang Libiao Robotics Co., Ltd.

Room 603, South Building No. 2, Chaofeng East Road, Yuhang Economic Development District, Hangzhou, Zhejiang, China

FCC ID: 2AQQMJTROBOTIIB

Report Type:	**Product Type:**
Original Report	Sorting Robot

Project Engineer:	Chao Gao
Report Number:	RSHA201013001-00B
Report Date:	2020-12-02
Reviewed By:	Oscar Ye EMC Manager
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road,Kunshan,Jiangsu province,China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Zhejiang Libiao Robotics Co., Ltd.
Tested Model	JTRobotIIB
Product Type	Sorting Robot
Power Supply	DC 4.6V from lithium batteries and DC 5.4V charged by charging pile
RF Function	RFID
Operating Band/Frequency	13.56 MHz
Antenna Type	PCB antenna
* Maximum Antenna Gain	0.0 dBi

Charging pile Information:
Model: LBPower5330A
Input: AC100-240V 50/60Hz 10A
Output:5.4V, 0~90A 486W

Note: The maximum antenna gain was provided by the applicant.

**All measurement and test data in this report was gathered from production sample serial number: 20201013001. (Assigned by the BACL. The EUT supplied by the applicant was received on 2020-10-13)*

Objective

This Type approval report is prepared on behalf of *Zhejiang Libiao Robotics Co., Ltd.* in accordance with Part 2- Subpart J, and Part 15-Subparts A and C of the Federal Communication Commission's rules.

The objective is to determine the Compliance of the EUT with FCC rules, sec 15.203, 15.205, 15.207, 15.209, 15.225, 15.215.

Related Submittal(s)/Grant(s)

Part of system is to be submitted with the FCC ID: 2AQQMLBAP-102LU-900.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Lab Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19 dB
RF conducted test with spectrum		0.9dB
Radiated emission	9kHz~30MHz	6.07dB
	30MHz~1GHz	6.11dB
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
Humidity		6%

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01), the FCC designation No. CN1185 under the FCC KDB 974614 D01 and CAB identifier CN0004 under the ISED requirement. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Justification

The system was configured for testing in a typical fashion (as normally used by a typical user).

EUT Exercise Software

The EUT was tested in the engineering mode.

Equipment Modifications

No modification on the EUT.

Support Equipment List and Details

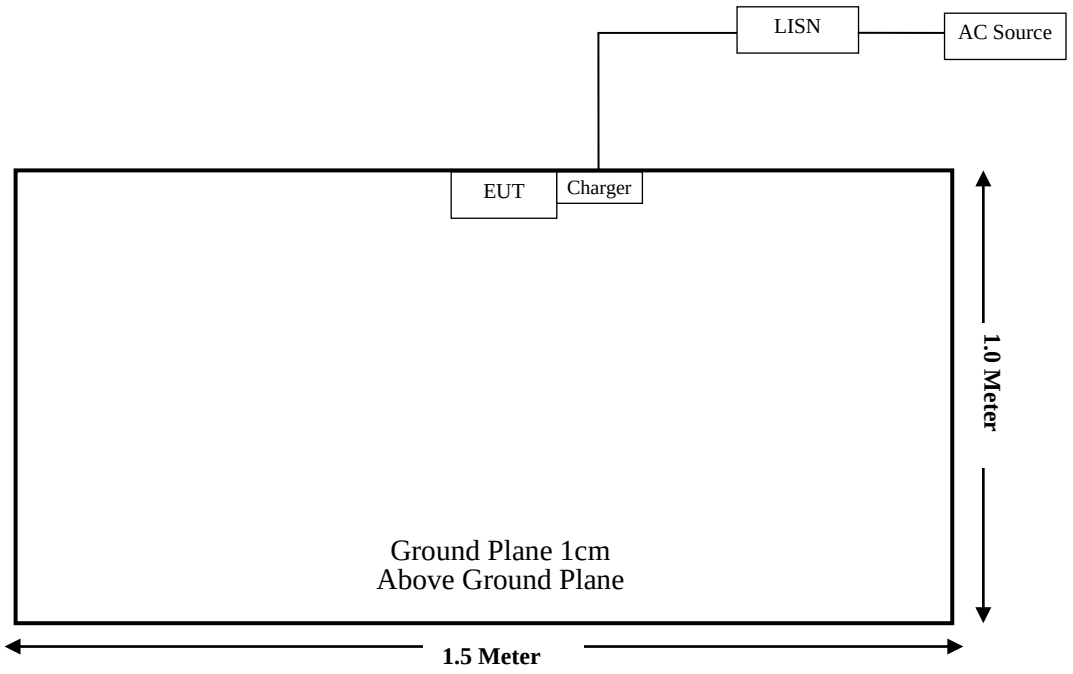
Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

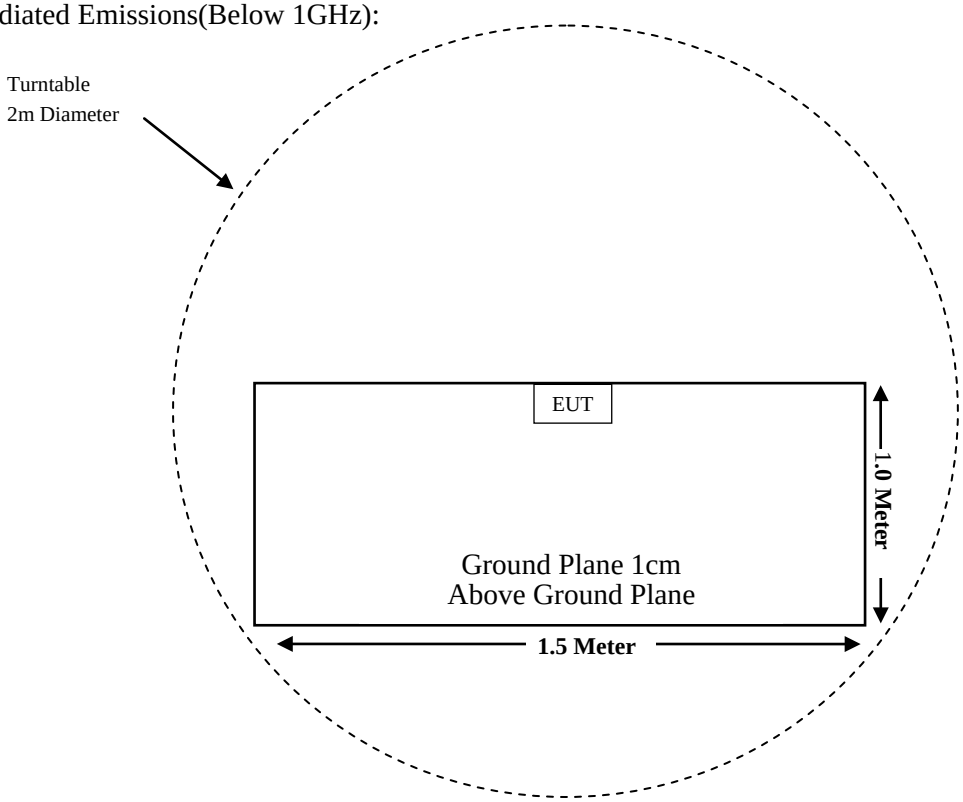
Cable Description	Length (m)	From Port	To
Power cable	0.8	Charger	LISN

Block Diagram of Test Setup

For Conducted Emissions:



For Radiated Emissions(Below 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliant
§15.207 (a)	AC Line Conducted Emissions	Compliant
§15.225 §15.209 §15.205	Radiated Emission Test	Compliant
§15.225(e)	Frequency Stability	Compliant
§15.215(c)	20dB Emission Bandwidth Testing	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2019-12-14	2020-12-13
Sunol Sciences	Hybrid Antenna	JB3	A090314-1	2020-08-05	2023-08-04
Sonoma Instrunent	Pre-amplifier	310N	171205	2020-08-14	2021-08-13
ETS-LINDGREN	Loop Antenna	6512	00108100	2019-04-25	2022-04-24
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-8	008	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2020-08-15	2021-08-14
BACL	Temperature & Humidity Chamber	BTH-150	30023	2019-12-20	2020-12-19
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESR	102454	2019-12-14	2020-12-13
Rohde & Schwarz	LISN	ENV216	101115	2019-12-14	2020-12-13
Audix	Test Software	e3	V9	/	/
Rohde & Schwarz	Pulse limiter	ESH3-Z2	100552	2020-03-01	2021-02-28
MICRO-COAX	Coaxial Cable	Cable-15	015	2020-08-15	2021-08-14

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC§15.203 - ANTENNA REQUIREMENT

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.

Antenna Connected Construction

The EUT has a PCB antenna and antenna gain is 0.0 dBi, the antenna was permanently attached, fulfill the requirement of this section, please refer to the EUT photos.

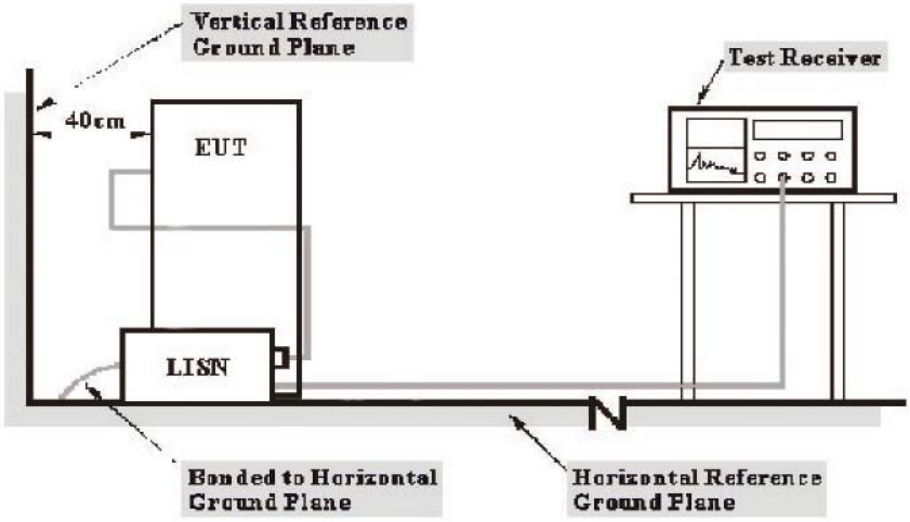
Result: Compliant.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207(a)

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

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

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the charger was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

Factor & Over Limit Calculation

The factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)

The "**Over Limit**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an over Limit of 7 dB means the emission is 7 dB above the limit. The equation for over limit calculation is as follows:

Over Limit (dB) = Read level (dBμV) + Factor (dB) - Limit (dBμV)

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

Test Data

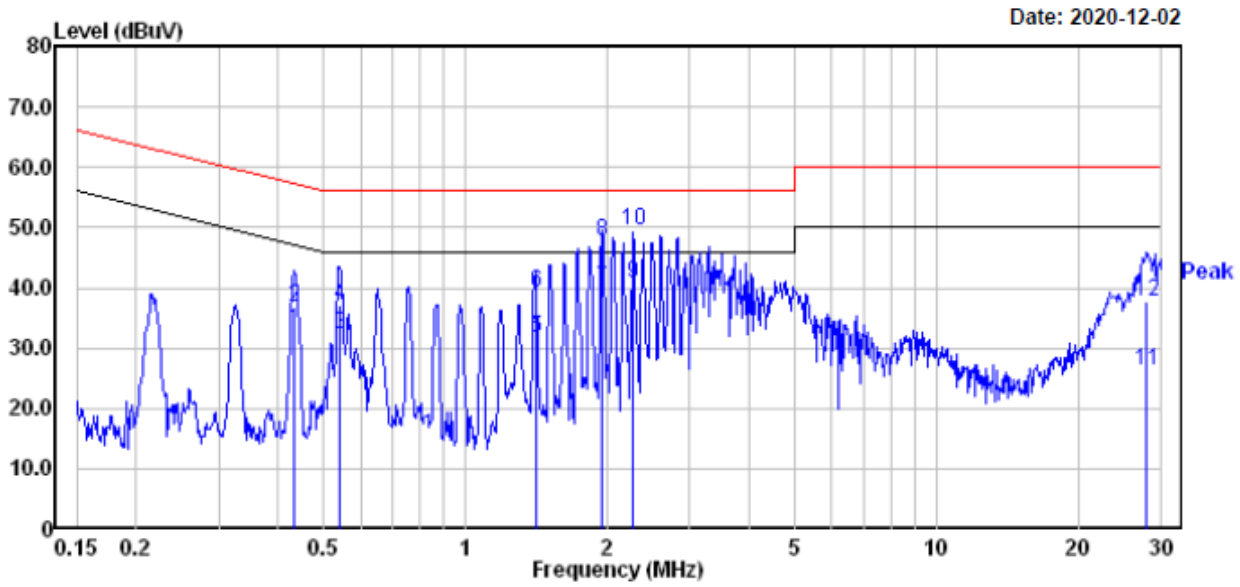
Environmental Conditions

Temperature:	24.0 ℃
Relative Humidity:	54 %
ATM Pressure:	101.1 kPa

The testing was performed by Chao Gao on 2020-12-02.

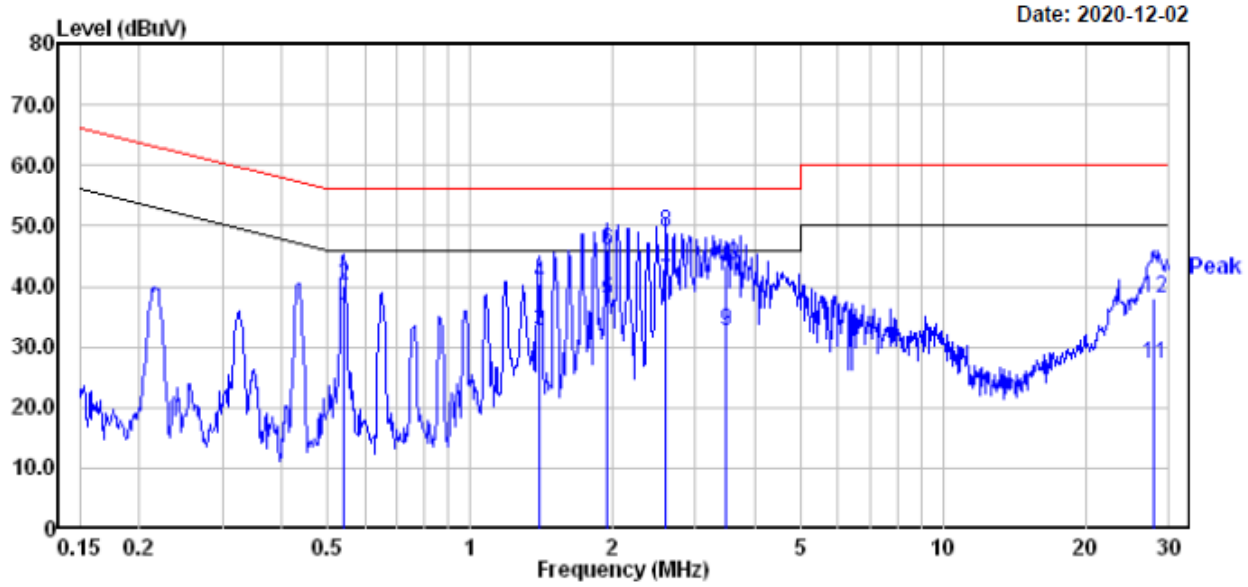
EUT operation mode: Transmitting

AC 120V/60 Hz, Line



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.433	13.20	19.75	32.95	47.20	-14.25	Average
2	0.433	17.00	19.75	36.75	57.20	-20.45	QP
3	0.541	12.51	19.75	32.26	46.00	-13.74	Average
4	0.541	17.51	19.75	37.26	56.00	-18.74	QP
5	1.411	12.01	19.83	31.84	46.00	-14.16	Average
6	1.411	19.51	19.83	39.34	56.00	-16.66	QP
7	1.949	19.90	19.83	39.73	46.00	-6.27	Average
8	1.949	27.80	19.83	47.63	56.00	-8.37	QP
9	2.273	21.01	19.62	40.63	46.00	-5.37	Average
10	2.273	29.81	19.62	49.43	56.00	-6.57	QP
11	28.003	6.51	19.74	26.25	50.00	-23.75	Average
12	28.003	18.01	19.74	37.75	60.00	-22.25	QP

AC 120V/60 Hz, Neutral



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.541	14.91	19.75	34.66	46.00	-11.34	Average
2	0.541	20.51	19.75	40.26	56.00	-15.74	QP
3	1.403	12.71	19.83	32.54	46.00	-13.46	Average
4	1.403	20.71	19.83	40.54	56.00	-15.46	QP
5	1.949	17.80	19.83	37.63	46.00	-8.37	Average
6	1.949	26.10	19.83	45.93	56.00	-10.07	QP
7	2.594	21.39	19.48	40.87	46.00	-5.13	Average
8	2.594	29.49	19.48	48.97	56.00	-7.03	QP
9	3.491	13.20	19.46	32.66	46.00	-13.34	Average
10	3.491	24.10	19.46	43.56	56.00	-12.44	QP
11	27.855	7.30	19.74	27.04	50.00	-22.96	Average
12	27.855	18.30	19.74	38.04	60.00	-21.96	QP

Note:

1) Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)
2) Over Limit (dB) = Read level (dBµV) + Factor (dB) - Limit (dBµV)

FCC§15.225, §15.205 & §15.209 - RADIATED EMISSIONS TEST

Applicable Standard

As per FCC Part 15.225

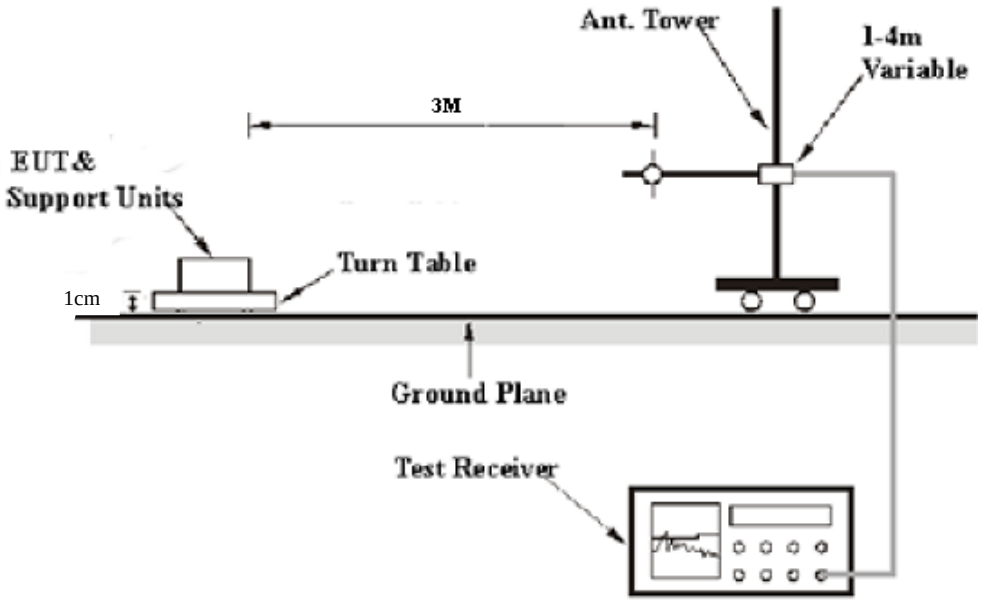
(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

EUT Setup



The radiated emission tests were performed in the 3-meter chamber a test site, using the setup accordance with the ANSI C63.10. The specification used was the FCC Part Subpart C limits.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

According to FCC Rules, 47 CFR 15.33, the EUT emissions were investigated up to 1000 MHz.

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

Frequency Range	RBW	Video B/W	IF B/W	Detector
9 kHz – 150 kHz	200 Hz	1 kHz	/	QP/Average
150 kHz –30 MHz	9 kHz	30 kHz	/	QP/Average
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Factor = Antenna Factor + Cable Loss- Amplifier Gain
Corrected Amplitude = Meter Reading + Corrected Factor

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the data in the following table, the EUT complied with the FCC Part 15.209, 15.205, 15.225.

Test Data

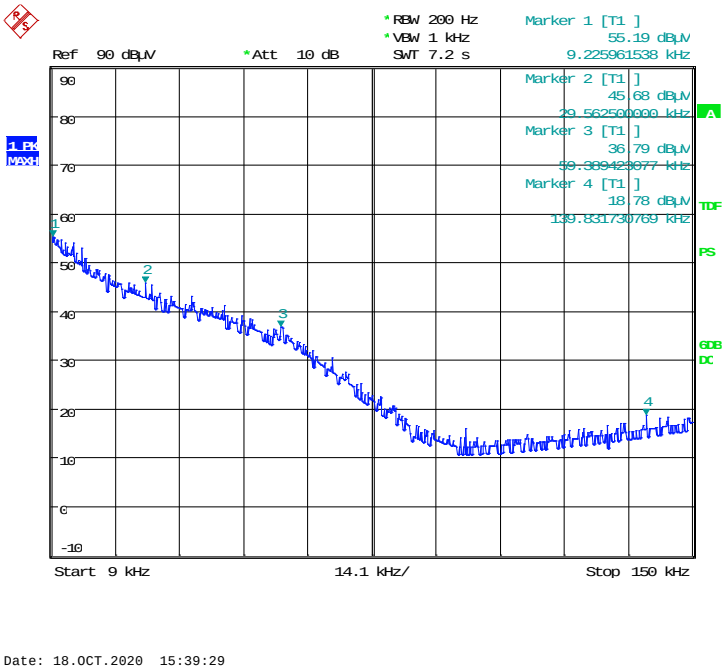
Environmental Conditions

Temperature:	23.8 ℃
Relative Humidity:	50 %
ATM Pressure:	101.3 kPa

The testing was performed by Chao Gao on 2020-10-18.

Test mode: Transmitting

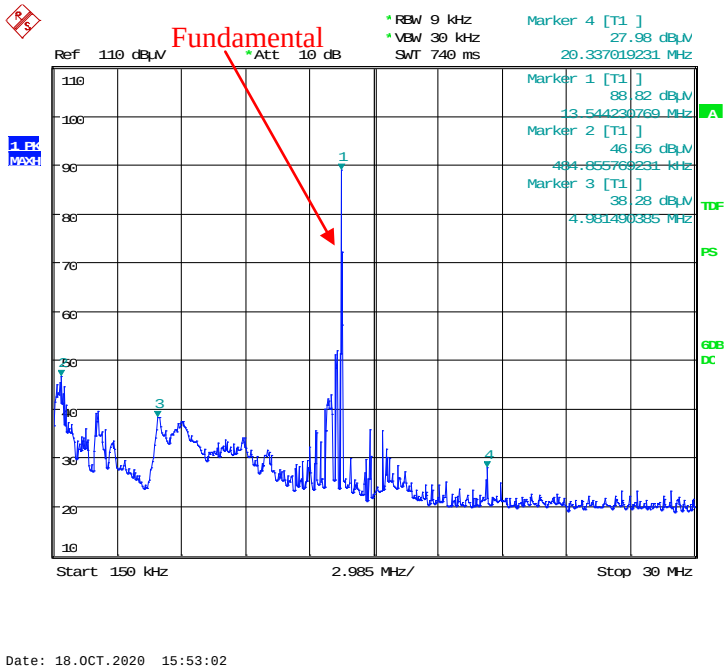
1) Spurious Emissions (9 kHz~150 kHz):



Frequency (MHz)	Corrected Amplitude (dBµV/m)@3m	Detector PK/QP/Ave.	Corrected Factor (dB/m)	FCC Part 15.225/15.209	
				Limit (dBµV/m) @3m	Margin (dB)
0.00923	55.19	PK	56.85	128.30	73.11
0.02956	45.68	PK	47.32	118.19	72.51
0.05939	36.79	PK	43.54	112.13	75.34
0.13983	18.78	PK	50.76	104.69	85.91

Note: The average emissions which fall into frequencies 9-90 kHz, 110-490 kHz was not recorded, because the peak emissions are below the average limit.

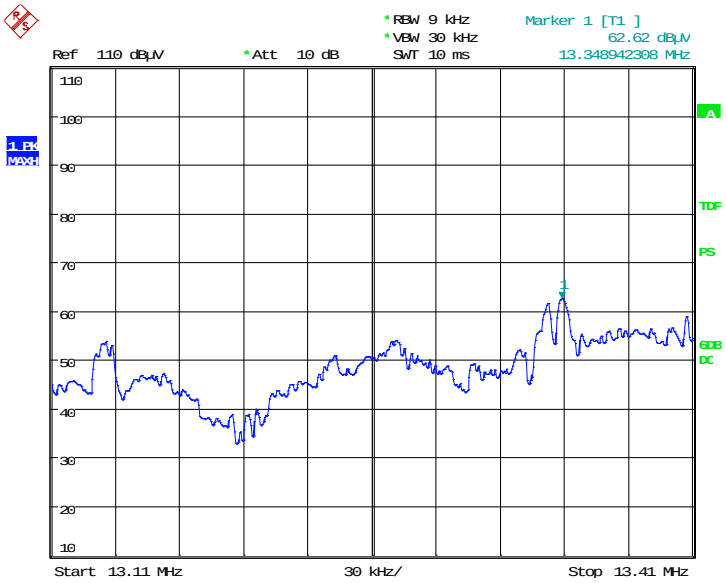
2) Spurious Emissions & Fundamental (150 kHz~30 MHz):



Frequency (MHz)	Corrected Amplitude (dBµV/m)@3m	Detector PK/QP/Ave.	Corrected Factor (dB/m)	FCC Part 15.225/15.209	
				Limit (dBµV/m) @3m	Margin (dB)
0.48486	46.56	PK	23.52	93.89	47.33
4.98149	38.28	PK	8.50	69.54	31.26
13.54423	88.82	PK	6.12	124.00	35.18
20.33702	27.98	PK	5.59	69.54	41.56

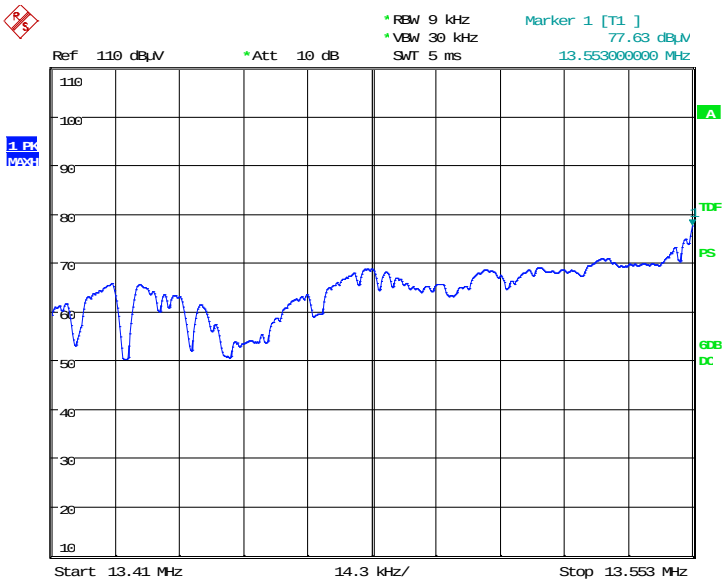
Note: The average emissions which fall into frequencies 9-90 kHz, 110-490 kHz was not recorded, because the peak emissions are below the average limit.

3) Spurious Emissions (13.11MHz~13.41 MHz):



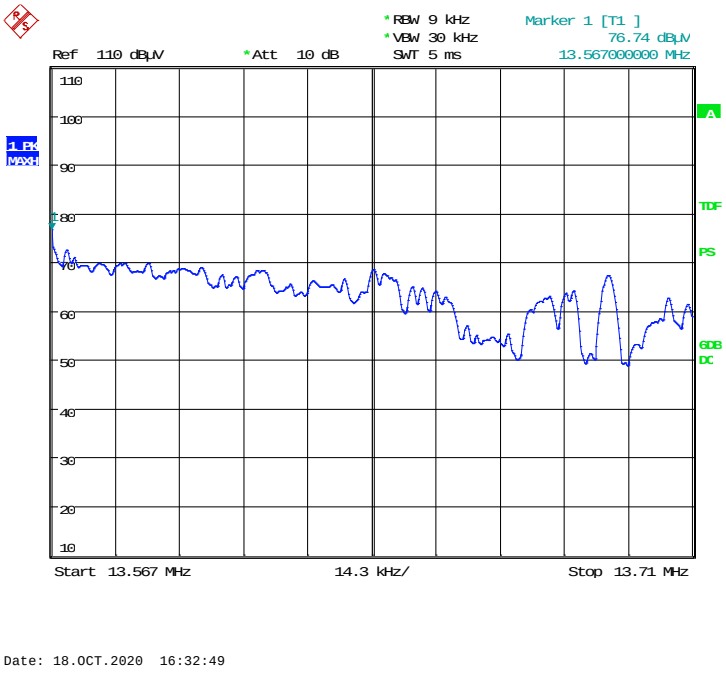
Date: 18.OCT.2020 16:15:07

Spurious Emissions (13.41MHz~13.553 MHz):

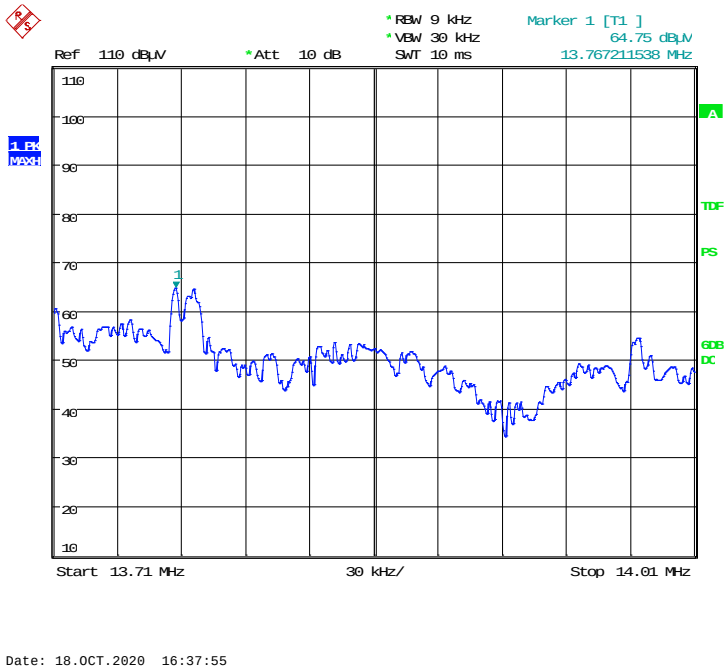


Date: 18.OCT.2020 16:23:52

Spurious Emissions (13.567MHz~13.710 MHz):

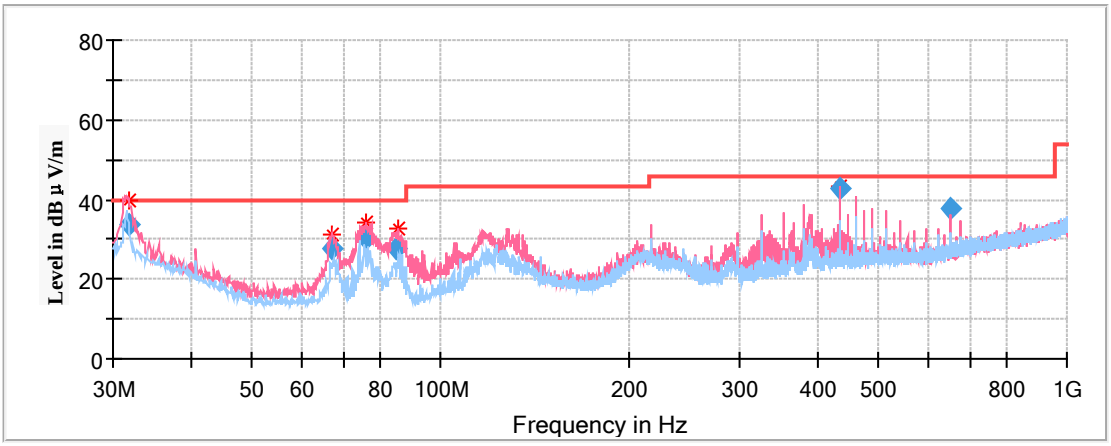


Spurious Emissions (13.710MHz~14.010 MHz):



Frequency (MHz)	Corrected Amplitude (dBµV/m)@3m	Detector PK/QP/Ave.	Corrected Factor (dB/m)	FCC Part 15.225/15.209	
				Limit (dBµV/m) @3m	Margin (dB)
13.349	62.62	PK	6.13	80.50	17.88
13.553	77.63	PK	6.12	90.50	12.87
13.567	76.74	PK	6.12	90.50	13.76
13.767	64.75	PK	6.10	80.50	15.75

4) Spurious Emissions (30 MHz ~1 GHz):



Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	QuasiPeak (dBµV/m)	Height (cm)	Polar (H/V)				
31.755300	33.65	100.0	V	62.0	-5.8	40.00	6.35
67.193300	27.78	100.0	V	158.0	-17.3	40.00	12.22
75.837650	29.94	100.0	V	196.0	-17.6	40.00	10.06
85.153350	27.72	100.0	V	126.0	-17.8	40.00	12.28
433.954900	42.83	100.0	V	94.0	-7.7	46.00	3.17
650.980050	37.55	100.0	V	164.0	-4.3	46.00	8.45

Note:
1) Factor (dB) =Antenna Factor (dB/m) + Cable Loss (dB) + Amplifier Gain (dB)
2) Over Limit (dB) = Read level (dBµV) + Factor (dB) - Limit (dBµV)

FCC§15.225(e) - FREQUENCY STABILITY

Applicable Standard

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Test Procedure

a) Supply the EUT with a nominal ac voltage or install a new or fully charged battery in the EUT. If possible, a dummy load shall be connected to the EUT because an antenna near the metallic walls of an environmental test chamber could affect the output frequency of the EUT. If the EUT is equipped with a permanently attached, adjustable-length antenna, then the EUT shall be placed in the center of the chamber with the antenna adjusted to the shortest length possible. Turn ON the EUT and tune it to one of the number of frequencies shown in 5.6.

b) Couple the unlicensed wireless device output to the measuring instrument by connecting an antenna to the measuring instrument with a suitable length of coaxial cable and placing the measuring antenna near the EUT (e.g., 15 cm away), or by connecting a dummy load to the measuring instrument, through an attenuator if necessary.
NOTE—An instrument that has an adequate level of accuracy as specified by the procuring or regulatory agency is the recommended measuring instrument.

c) Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument but is strong enough to allow measurement of the operating or fundamental frequency of the EUT).

d) Turn the EUT OFF and place it inside the environmental temperature chamber. For devices that have oscillator heaters, energize only the heater circuit.

e) Set the temperature control on the chamber to the highest specified in the regulatory requirements for the type of device and allow the oscillator heater and the chamber temperature to stabilize.

f) While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.

g) Measure the frequency at each of frequencies specified in 5.6.

h) Switch OFF the EUT but do not switch OFF the oscillator heater.

i) Lower the chamber temperature by not more that 10 °C, and allow the temperature inside the chamber to stabilize.

j) Repeat step f) through step i) down to the lowest specified temperature.

Test Data

Environmental Conditions

Temperature:	23.8 ℃
Relative Humidity:	50 %
ATM Pressure:	101.3kPa

The testing was performed by Chao Gao on 2020-11-30.

Test Mode: Transmitting.

Test Result: Compliant

F_0 =13.56MHz				
Power Supply(V_{DC})	**Temperature (℃)**	**Measured Frequency (MHz)**	**Frequency Error (%)**	**Part 15.225 Limit**
4.6	-20	13.55897132	-0.00759	±0.01%
	-10	13.55897654	-0.00755	±0.01%
	0	13.55897211	-0.00758	±0.02%
	10	13.55897823	-0.00754	±0.03%
	20	13.55897356	-0.00757	±0.01%
	30	13.55897465	-0.00756	±0.01%
	40	13.55897126	-0.00759	±0.01%
	50	13.55897589	-0.00755	±0.01%
3.91	20	13.55897763	-0.00754	±0.01%
5.29	20	13.55897693	-0.00754	±0.01%

§15.215(c) - 20dB EMISSION BANDWIDTH TESTING

Requirement

Per 15.215 (c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.

Test Data

Environmental Conditions

Temperature:	23.8 ℃
Relative Humidity:	50 %
ATM Pressure:	101.3kPa

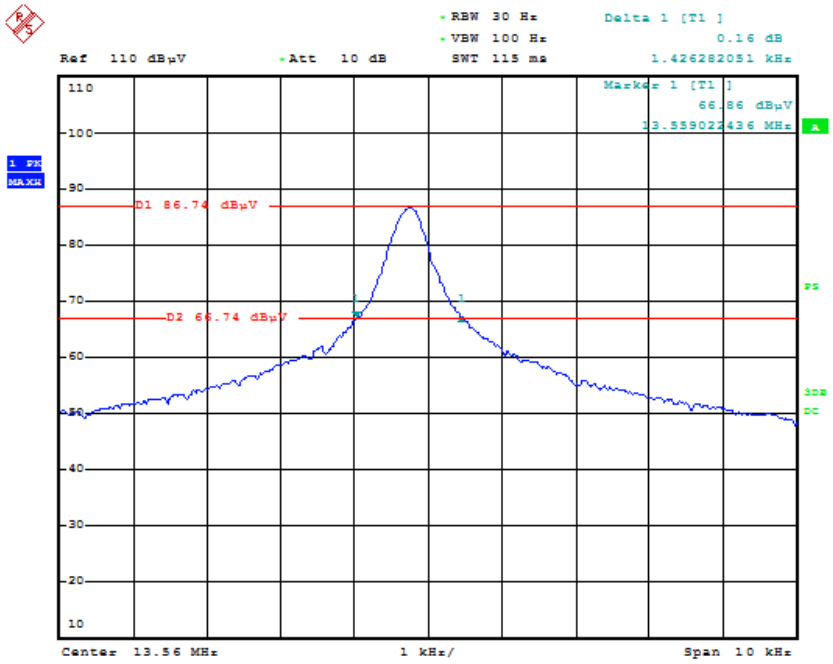
The testing was performed by Chao Gao on 2020-10-18.

Test Mode: Transmitting

Test Result: Compliant

Frequency (MHz)	20 dB Bandwidth (kHz)
13.56	1.426

20 dB Emission Bandwidth



Declarations

1: BACL 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 an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.

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

3: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

4: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

5: This report cannot be reproduced except in full, without prior written approval of the Company.

6: This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

******* END OF REPORT *******