



TESTING LABORATORY  
CERTIFICATE#4323.01



FCC PART 15.225

## TEST REPORT

For

**Zhejiang Okai Vehicle Co., Ltd.**

No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang, China

**FCC ID: 2AYF8-ZK115M**

<b>Report Type:</b> Original Report	<b>Product Type:</b> GPS Tracker
<b>Project Engineer:</b>	Chao Gao
<b>Report Number:</b>	RSHA210507002-00B
<b>Report Date:</b>	2021-06-07
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## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

Applicant	Zhejiang Okai Vehicle Co., Ltd.
Tested Model	ZK115M
Product Type	GPS Tracker
Power Supply	DC 3.65V from battery, DC 12V from external power source
RF Function	NFC
Operating Band/Frequency	13.56 MHz
Antenna Type	PCB antenna
*Maximum Antenna Gain:	0.0 dBi

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

*\*All measurement and test data in this report was gathered from production sample serial number: RSHA210507002-1 (Assigned by the BACL. The EUT supplied by the applicant was received on 2021-05-07)*

### Objective

This Type approval report is prepared on behalf of *Zhejiang Okai Vehicle 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, 15.209 and 15.225.

### Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS submissions with FCC ID: 2AYF8-ZK115M

### 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
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 is tested in the engineering mode.

### Equipment Modifications

No modification on the EUT.

### Support Equipment List and Details

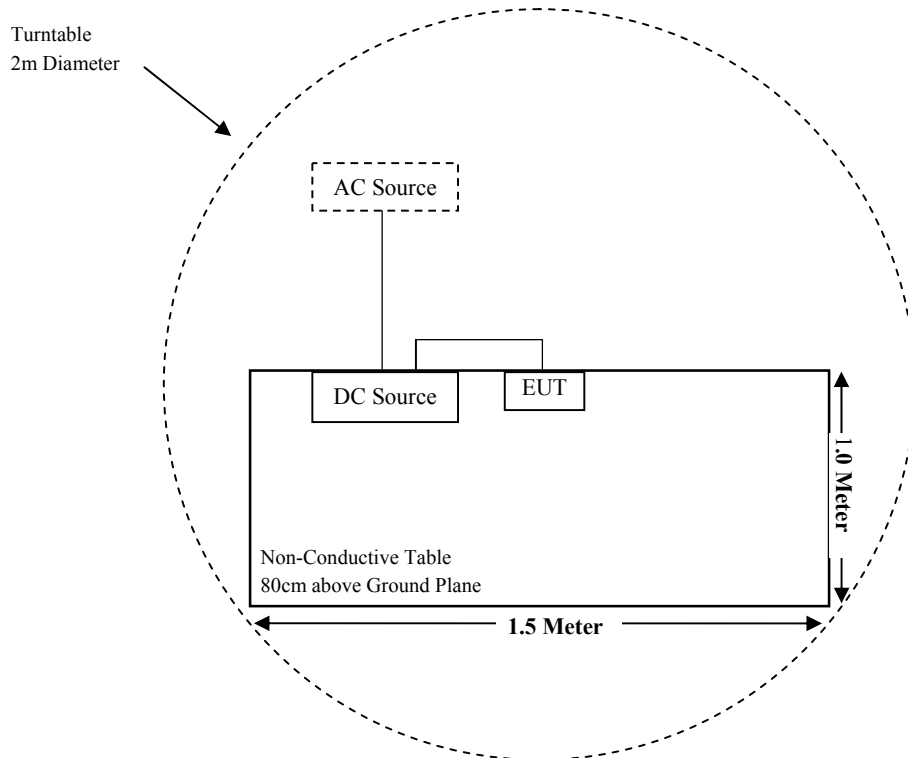
Manufacturer	Description	Model	Serial Number
ZHAOXIN	DC Source	PS-6005D	DC003

### External I/O Cable

Cable Description	Length (m)	From Port	To
Power Cable	1.0	EUT	DC Source
Power Cable	1.0	DC Source	AC Source

## Block Diagram of Test Setup

For Radiated Emissions (Below 30 MHz & Above 30 MHz):



**SUMMARY OF TEST RESULTS**

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliant
§15.207 (a)	AC Line Conducted Emissions	Not Applicable (See Note)
§15.225 §15.209 §15.205	Radiated Emission Test	Compliant
§15.225(e)	Frequency Stability	Compliant
§15.215(c)	20dB Emission Bandwidth Testing	Compliant

Note: The EUT is used in scooter and powered by battery.

**TEST EQUIPMENT LIST**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>Radiated Emission Test</b>					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2020-11-27	2021-11-26
Sunol Sciences	Broadband 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	2020-11-25	2021-11-24
ZHAOXIN	DC Power Supply	PS-6005D	DC003	2020-10-10	2021-10-09

\* **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**

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### **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 for 13.56 MHz, 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.

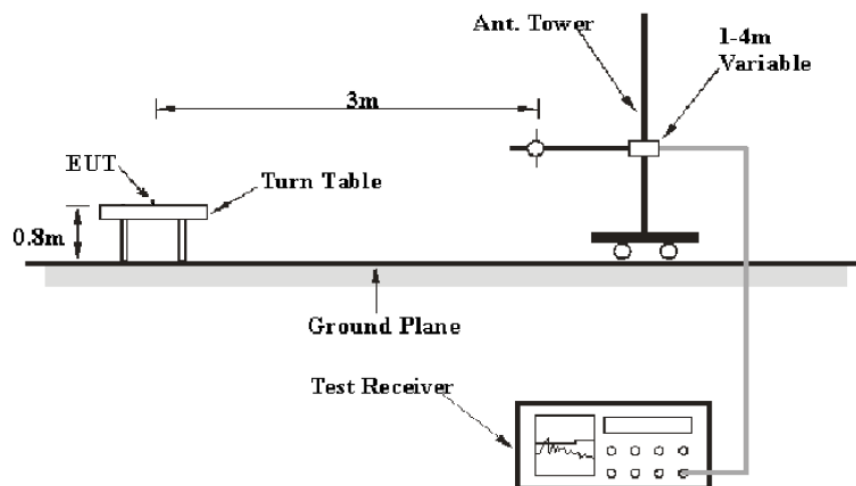
## **FCC§15.225, §15.205 & §15.209 - RADIATED EMISSIONS TEST**

### **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	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	QP

## Factor & Over Limit Calculation

The factor is calculated by adding Antenna Factor, Cable Loss and Amplifier Gain. The basic equation is as follows:

$$\text{Factor (dB)} = \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + \text{Amplifier Gain (dB)}$$

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

$$\text{Over Limit (dB)} = \text{Read level (dB}\mu\text{V)} + \text{Factor (dB)} - \text{Limit (dB}\mu\text{V)}$$

## 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

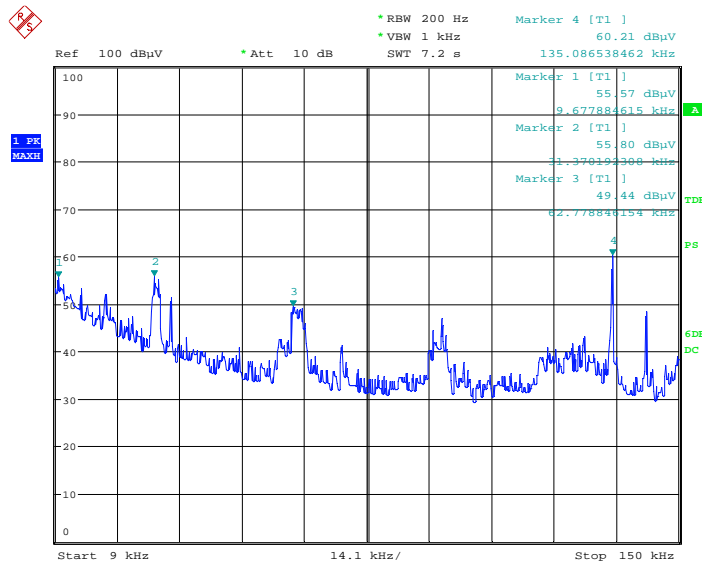
### Environmental Conditions

Temperature:	24.7 °C
Relative Humidity:	50 %
ATM Pressure:	102.7 kPa

*The testing was performed by Chao Gao on 2021-05-18.*

*Test mode: Transmitting*

1) (9 kHz~150 kHz):

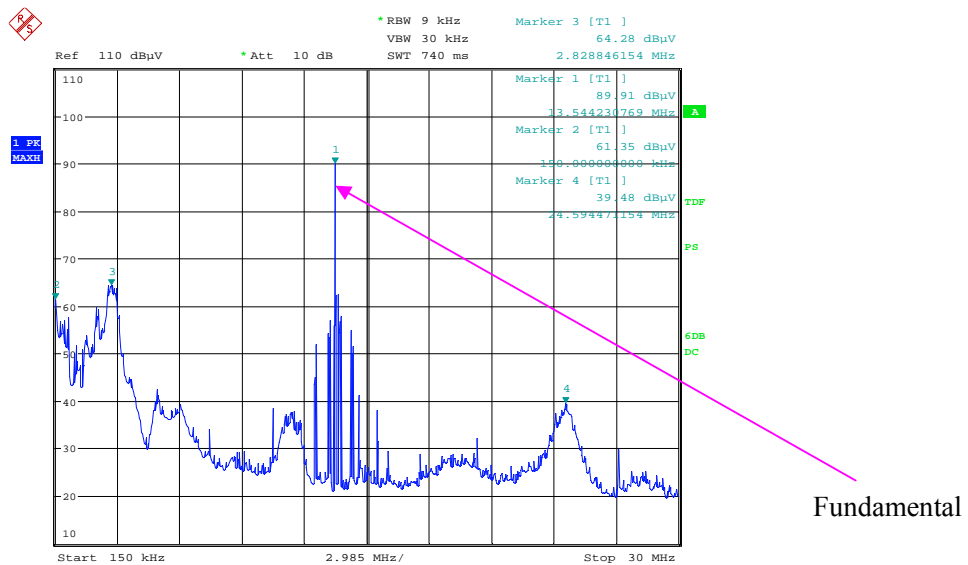


Date: 18.MAY.2021 00:24:45

Frequency (kHz)	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)
9.68	55.57	PK	56.57	127.89	72.32
31.37	55.80	PK	46.84	117.67	61.87
62.78	49.44	PK	44.10	111.65	62.21
135.09	60.21	PK	50.69	104.99	44.78

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) (150 kHz~30 MHz):

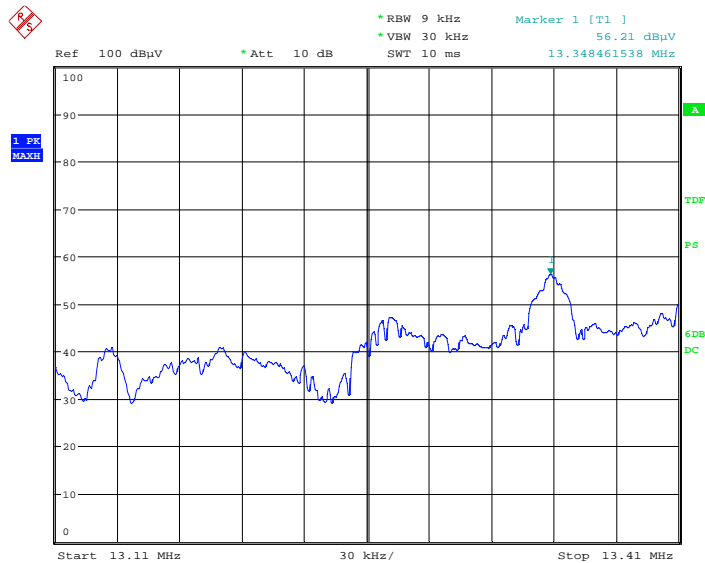


Date: 18.MAY.2021 00:07:02

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)
0.15	61.35	PK	50.90	104.08	42.73
2.83	64.28	PK	10.92	69.54	5.26
13.56	89.91	PK	6.12	124.00	34.09
24.59	39.48	PK	5.51	69.54	30.06

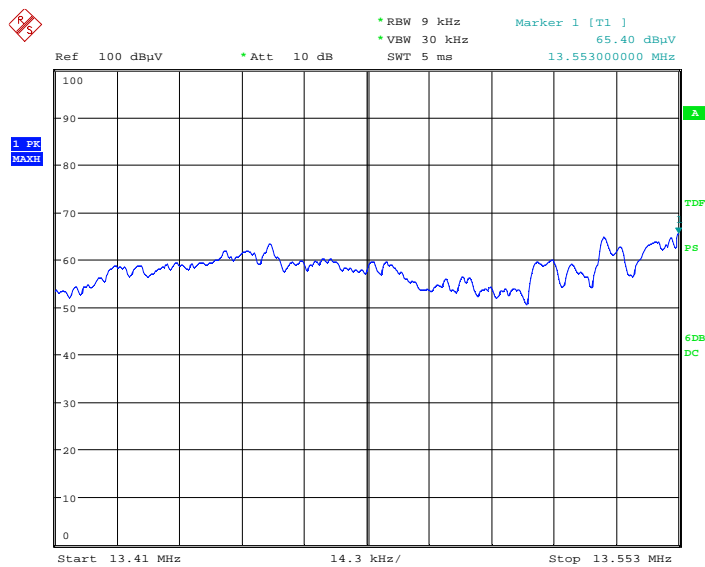
Note: The average emissions which fall into frequencies 9-90 kHz, 110-490 kHz was not recorded, because the peak emissions are below the average limit.

3) (13.11MHz~13.41 MHz):



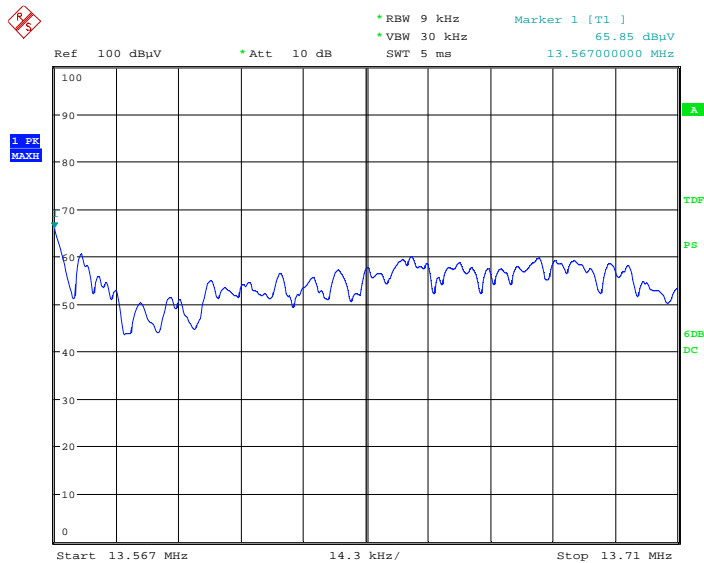
Date: 18.MAY.2021 00:42:38

(13.41MHz~13.553 MHz):



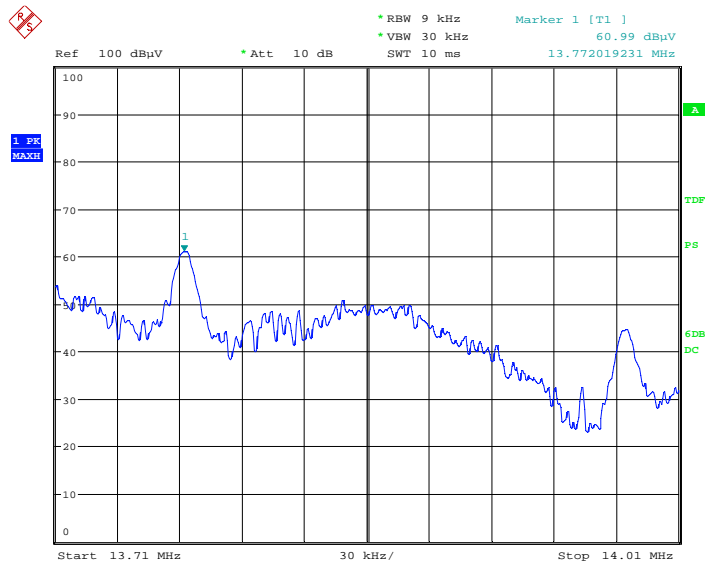
Date: 18.MAY.2021 00:50:48

(13.567MHz~13.710 MHz):



Date: 18.MAY.2021 01:01:12

(13.710MHz~14.010 MHz):

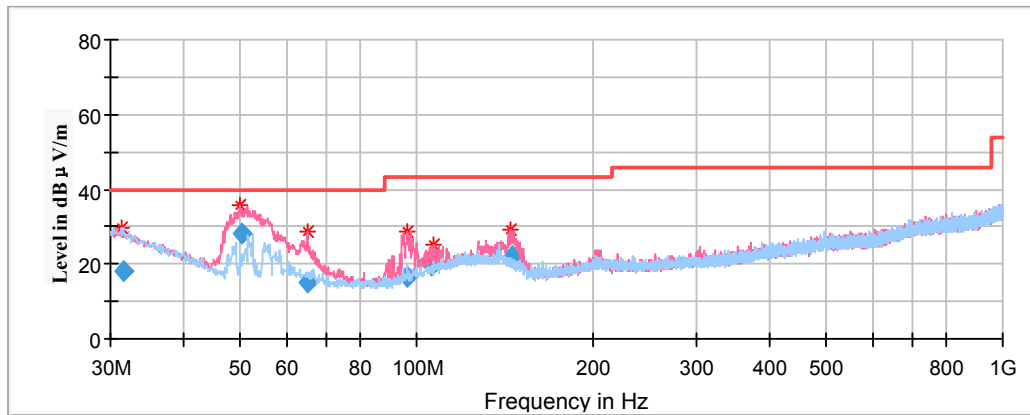


Date: 18.MAY.2021 00:57:51

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)
13.348	56.21	PK	6.13	80.5	24.29
13.553	65.40	PK	6.12	90.5	25.10
13.567	65.85	PK	6.12	90.5	24.65
13.772	60.99	PK	6.1	80.5	19.51



## 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)				
31.481150	18.28	200.0	H	103.0	-4.7	40.00	21.72
50.278050	28.08	100.0	V	87.0	-17.2	40.00	11.92
65.110200	15.24	100.0	V	248.0	-15.7	40.00	24.76
96.592050	16.79	100.0	V	131.0	-15.4	43.50	26.71
106.210800	19.63	100.0	V	71.0	-13.4	43.50	23.87
145.397300	22.13	100.0	V	93.0	-12.3	43.50	21.37

**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)

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**FCC§15.225(e) - FREQUENCY STABILITY**

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**Applicable Standard**

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  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 than  $10^{\circ}\text{C}$ , 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**

<b>Temperature:</b>	24.8 °C
<b>Relative Humidity:</b>	49 %
<b>ATM Pressure:</b>	102.3 kPa

The testing was performed by Chao Gao on 2021-06-04.

Test Mode: Transmitting.

Test Result: Compliant

<b>F<sub>0</sub>=13.56MHz</b>				
<b>Power Supply(V<sub>DC</sub>)</b>	<b>Temperature (°C)</b>	<b>Measured Frequency (MHz)</b>	<b>Frequency Error (%)</b>	<b>Part 15.225 Limit</b>
12	-20	13.56019995	0.00147	±0.01%
	-10	13.56020122	0.00148	±0.01%
	0	13.56020328	0.00150	±0.01%
	10	13.56020515	0.00151	±0.01%
	20	13.56020833	0.00154	±0.01%
	30	13.56020985	0.00155	±0.01%
	40	13.56021223	0.00157	±0.01%
	50	13.56021553	0.00159	±0.01%
10.2	20	13.56020756	0.00153	±0.01%
13.8	20	13.56020963	0.00155	±0.01%

<b>F<sub>0</sub>=13.56MHz</b>				
<b>Power Supply(V<sub>DC</sub>)</b>	<b>Temperature (°C)</b>	<b>Measured Frequency (MHz)</b>	<b>Frequency Error (%)</b>	<b>Part 15.225 Limit</b>
3.65	-20	13.56019993	0.00147	±0.01%
	-10	13.56020116	0.00148	±0.01%
	0	13.56020323	0.00150	±0.01%
	10	13.56020512	0.00151	±0.01%
	20	13.56020822	0.00154	±0.01%
	30	13.56020933	0.00154	±0.01%
	40	13.56021224	0.00157	±0.01%
	50	13.56021555	0.00159	±0.01%
3.10	20	13.56020753	0.00153	±0.01%
4.20	20	13.56020963	0.00155	±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**

<b>Temperature:</b>	24.8 °C
<b>Relative Humidity:</b>	49 %
<b>ATM Pressure:</b>	102.3 kPa

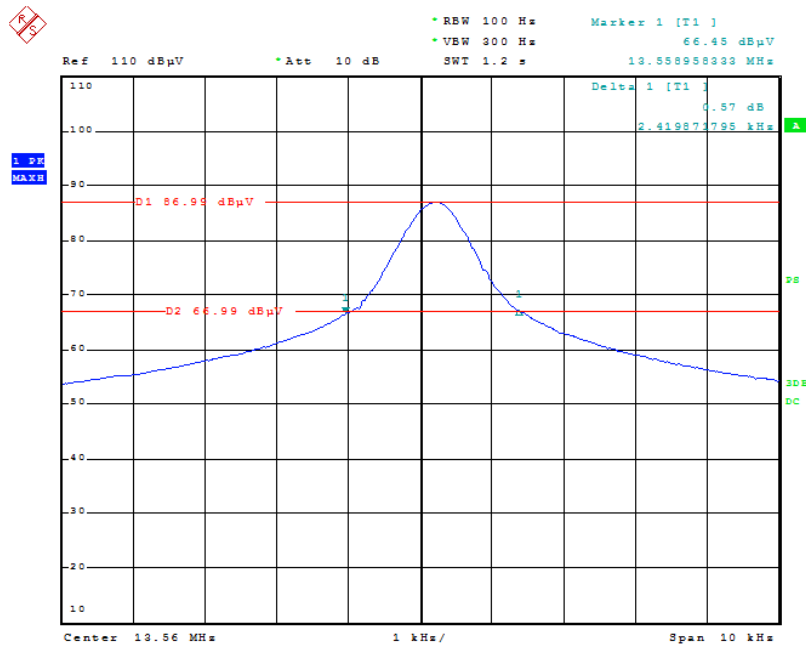
*The testing was performed by Chao Gao on 2021-05-17.*

*Test Mode: Transmitting*

*Test Result: Compliant*

Frequency (MHz)	20 dB Bandwidth (kHz)
13.56	2.420

20 dB Emission Bandwidth-13.56MHz



Date: 17.MAY.2021 23:53:49

### **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.

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