



# FCC RADIO TEST REPORT

**FCC ID: 2A25WPM-2**

**Product :** PM2.5 Air Quality Sensor

**Trade Name :** N/A

**Model Name :** PM-2

**Report No. :** HK2108303202-E

## Prepared for

ZHEJIANG LEWANG TRADING CO., LTD  
ROOM 531, BUILDING 1, NO. 10, YUESHUAIQIAO, XIACHENG DISTRICT,  
HANGZHOU CITY, ZHEJIANG PROVINCE, CHINA

## Prepared by

Shenzhen HUAKE Testing Technology Co., Ltd.  
1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fu  
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## TEST RESULT CERTIFICATION

**Applicant's name** ..... : ZHEJIANG LEWANG TRADING CO., LTD  
**Address** ..... : ROOM 531, BUILDING 1, NO. 10, YUESHUAIQIAO, XIACHENG  
DISTRICT, HANGZHOU CITY, ZHEJIANG PROVINCE, CHINA  
**Manufacture's Name** ..... : ZHEJIANG LEWANG TRADING CO., LTD  
**Address** ..... : ROOM 531, BUILDING 1, NO. 10, YUESHUAIQIAO, XIACHENG  
DISTRICT, HANGZHOU CITY, ZHEJIANG PROVINCE, CHINA

**Product description**

**Product name** ..... : PM2.5 Air Quality Sensor  
**Trade Mark** ..... : N/A  
**Model and/or type reference** : PM-2

**Standards** ..... : FCC Rules and Regulations Part 15 Subpart C Section 15.249  
ANSI C63.10: 2013

This device described above has been tested by Shenzhen HUAKE Testing Technology Co., Ltd., and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report. This report shall not be reproduced except in full, without the written approval of UNI, this document may be altered or revised by Shenzhen HUAKE Testing Technology Co., Ltd., personnel only, and shall be noted in the revision of the document.

**Date of Test** .....

**Date (s) of performance of tests** ..... : Sept. 01, 2021 ~ Sept. 09, 2021

**Date of Issue** ..... : Sept. 09, 2021

**Test Result** ..... : Pass

Testing Engineer :

(Gary Qian)

Technical Manager :

(Eden Hu)

Authorized Signatory :

(Jason Zhou)

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**\*\* Modified History \*\***

Revision	Description	Issued Data	Remark
Revision 1.0	Initial Test Report Release	Sept. 09, 2021	Jason Zhou



## 1 TEST SUMMARY

### 1.1 TEST PROCEDURES AND RESULTS

#### DESCRIPTION OF TEST

#### RESULT

AC Power Line Conducted  
Emission

§15.207

COMPLIANT

Field Strength of Fundamental  
Spurious Emissions  
Band Edge

§15.249 (a)  
§15.249 (a) / §15.209  
§15.249 (d) / §15.209

COMPLIANT  
COMPLIANT  
COMPLIANT

20dB Occupied Bandwidth

§15.215 (c)

COMPLIANT

Antenna requirement

§15.203

COMPLIANT

COMPLIANT

### 1.2 Information of the Test Laboratory

Shenzhen HUAKE Testing Technology Co., Ltd.

Add.: 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping,  
Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Testing Laboratory Authorization :

A2LA Accreditation Code is 4781.01.

FCC Designation Number is CN1229.

Canada IC CAB identifier is CN0045.

CNAS Registration Number is L9589.

### 1.3 MEASUREMENT UNCERTAINTY

#### Measurement Uncertainty

Conducted Emission Expanded Uncertainty

= 2.71dB, k=2

Radiated emission expanded uncertainty(9kHz-30MHz)

= 4.26dB, k=2

Radiated emission expanded uncertainty(30MHz-1000MHz)

= 3.90dB, k=2

Radiated emission expanded uncertainty(Above 1GHz)

= 4.28dB, k=2





## 2 GENERAL INFORMATION

### 2.1 GENERAL DESCRIPTION OF EUT

Equipment	PM2.5 Air Quality Sensor
Trade Mark	N/A
Model Name	PM-2
Serial Model	N/A
Model Difference	N/A
FCC ID	2A25WPM-2
Antenna Type	External antenna
Antenna Gain	3dBi
Operation frequency	902.3-914.9 MHz
Number of Channels	64CH
Modulation Type	LORA
Battery	N/A
Hardware Version	V1.0
Software Version	V1.0
Power Source	5V/1A by MINI-USB Port

**2.2 Carrier Frequency of Channels**

<b>Channel List</b>			
<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Channel</b>	<b>Frequency (MHz)</b>
1	902.3	33	908.7
2	902.5	34	908.9
3	902.7	35	909.1
4	902.9	36	909.3
5	903.1	37	909.5
6	903.3	38	909.7
7	903.5	39	909.9
8	903.7	40	910.1
9	903.9	41	910.3
10	904.1	42	910.5
11	904.3	43	910.7
12	904.5	44	910.9
13	904.7	45	911.1
14	904.9	46	911.3
15	905.1	47	911.5
16	905.3	48	911.7
17	905.5	49	911.9
18	905.7	50	912.1
19	905.9	51	912.3
20	906.1	52	912.5
21	906.3	53	912.7
22	906.5	54	912.9
23	906.7	55	913.1
24	906.9	56	913.3
25	907.1	57	913.5
26	907.3	58	913.7
27	907.5	59	913.9
28	907.7	60	914.1
29	907.9	61	914.3
30	908.1	62	914.5
31	908.3	63	914.7
32	908.5	64	914.9

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by HUAKE, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.cer-mark.com>.



## 2.3 Operation of EUT during testing

Operating Mode

The mode is used: **Transmitting mode**

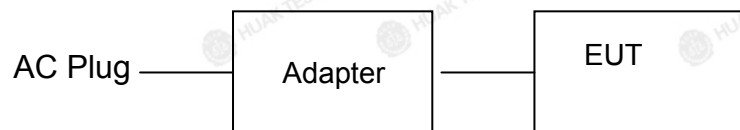
Low Channel: 902.3MHz

Middle Channel: 908.6MHz

High Channel: 914.9MHz

## 2.4 DESCRIPTION OF TEST SETUP

Operation of EUT during testing:



- Adapter information

Model: HW-059200CHQ

Input: AC100-240V, 50/60Hz, 0.5A

Output: DC5V 2A



**2.5 MEASUREMENT INSTRUMENTS LIST**

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
<b>CONDUCTED EMISSIONS TEST</b>					
1	LISN	R&S	ENV216	HKE-002	Dec. 09, 2021
2	LISN	R&S	ENV216	HKE-029	Dec. 09, 2021
3	EMI Test Receiver	R&S	ESCI-7	HKE-010	Dec. 09, 2021
<b>RADIATED EMISSION TEST</b>					
1	Broadband antenna	Schwarzbeck	VULB 9163	HKE-012	Dec. 09, 2021
2	Horn antenna	Schwarzbeck	9120D	HKE-013	Dec. 09, 2021
3	Receiver	R&S	ESCI 7	HKE-010	Dec. 09, 2021
4	Position controller	Taiwan MF	MF7802	HKE-011	Dec. 09, 2021
5	Preamplifier	EMCI	EMC051845SE	HKE-015	Dec. 09, 2021
6	Preamplifier	Agilent	83051A	HKE-016	Dec. 09, 2021
7	High pass filter unit	Tonscend	JS0806-F	HKE-055	Dec. 09, 2021
8	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 09, 2021
9	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 09, 2021
10	Signal generator	Agilent	83630A	HKE-028	Dec. 09, 2021
11	Signal generator	Agilent	N5182A	HKE-029	Dec. 09, 2021
12	RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 09, 2021
13	Power meter	Agilent	E4419B	HKE-085	Dec. 09, 2021

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1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China



### 3 CONDUCTED EMISSION TEST

#### 3.1 Test Limit

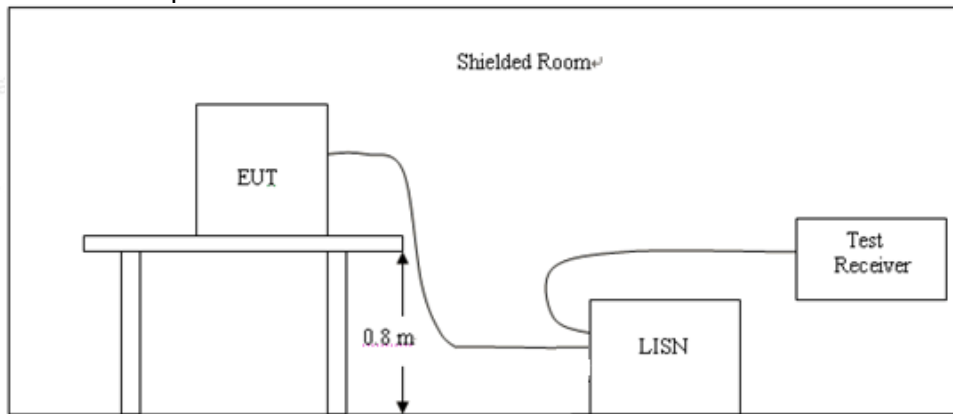
For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following

Frequency (MHz)	Maximum RF Line Voltage(dB $\mu$ V)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15~0.50	79	66	66~56*	56~46*
0.50~5.00	73	60	56	46
5.00~30.0	73	60	60	50

\* Decreasing linearly with the logarithm of the frequency

For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

#### 3.2 Test Setup



#### 3.3 Test Procedure

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. A wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10.
2. Support equipment, if needed, was placed as per ANSI C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer/Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.

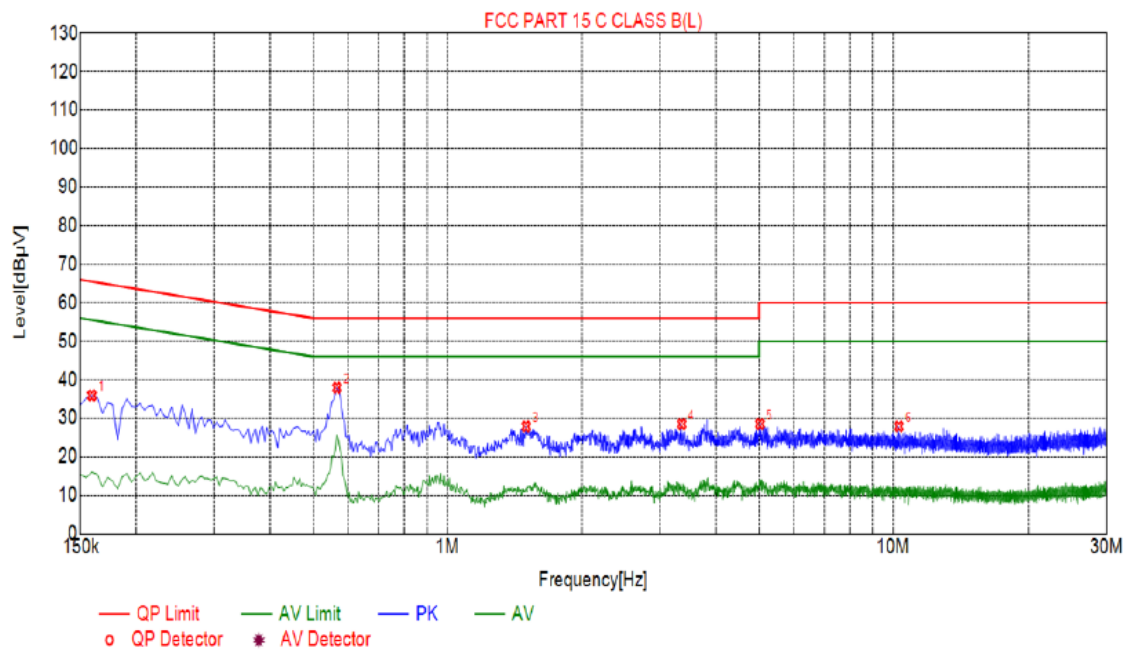
#### 3.4 Test Result

Pass

All the test modes completed for test. Only the worst result of of AC120V/60Hz (High Channel ) was reported as below:



## Test Specification: Line



## Suspected List

NO.	Freq. [MHz]	Level [dBμV]	Factor [dB]	Limit [dBμV]	Margin [dB]	Reading [dBμV]	Detector	Type
1	0.1590	35.90	20.01	65.52	29.62	15.89	PK	L
2	0.5640	37.92	20.06	56.00	18.08	17.86	PK	L
3	1.5000	27.84	20.10	56.00	28.16	7.74	PK	L
4	3.3540	28.48	20.24	56.00	27.52	8.24	PK	L
5	5.0280	28.50	20.26	60.00	31.50	8.24	PK	L
6	10.3110	27.85	20.05	60.00	32.15	7.80	PK	L

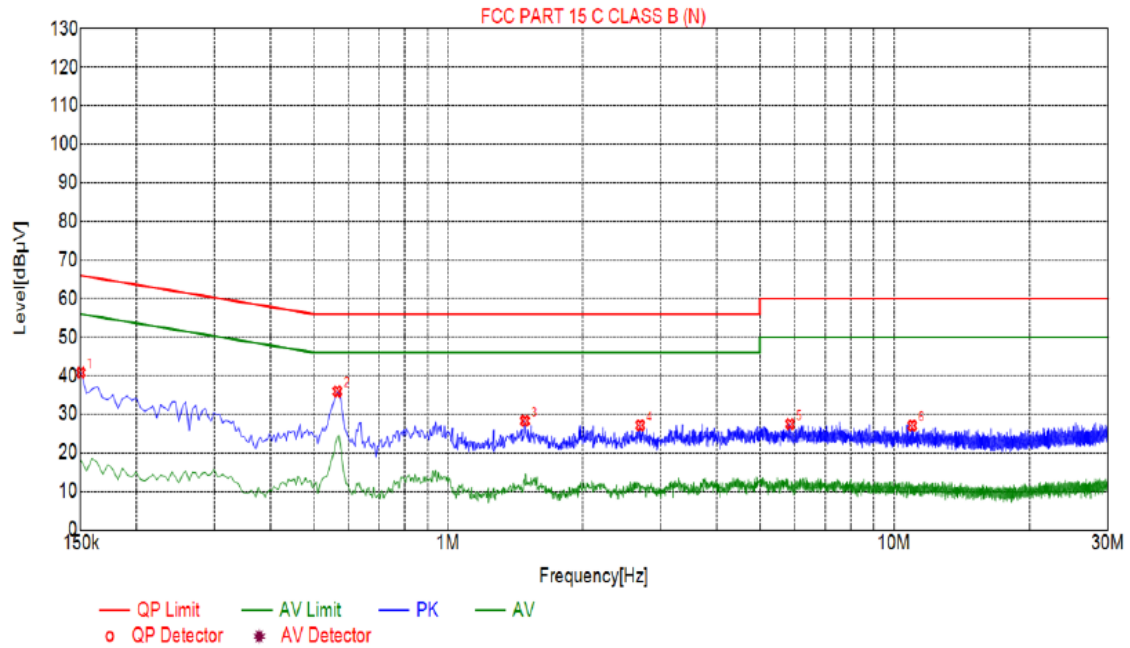
Remark: Margin = Limit – Level

Correction factor = Cable lose + LISN insertion loss

Level=Test receiver reading + correction factor



## Test Specification: Neutral



## Suspected List

NO.	Freq. [MHz]	Level [dBμV]	Factor [dB]	Limit [dBμV]	Margin [dB]	Reading [dBμV]	Detector	Type
1	0.1500	40.77	20.03	66.00	25.23	20.74	PK	N
2	0.5640	35.92	20.06	56.00	20.08	15.86	PK	N
3	1.4865	28.26	20.10	56.00	27.74	8.16	PK	N
4	2.6970	27.11	20.21	56.00	28.89	6.90	PK	N
5	5.8515	27.46	20.24	60.00	32.54	7.22	PK	N
6	10.9860	27.03	20.01	60.00	32.97	7.02	PK	N

Remark: Margin = Limit – Level

Correction factor = Cable loss + LISN insertion loss

Level = Test receiver reading + correction factor





## 4 RADIATED EMISSION TEST

### 4.1 Test Limit

#### 1. Limit (Field strength of the fundamental signal):

Frequency	Limit(dBuV/m@3m)	Remark
902MHz-928MHz	94.00	Average Value
	114.00	Peak Value

#### 2. Limit (Spurious Emissions):

Frequency	Limit(dBuV/m@3m)	Remark
0.009-0.490	2400/F(KHz)	Quasi-peak Value
0.490-1.705	24000/F(KHz)	Quasi-peak Value
1.705-30	30	Quasi-peak Value
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

#### 3. Limit (Band edge):

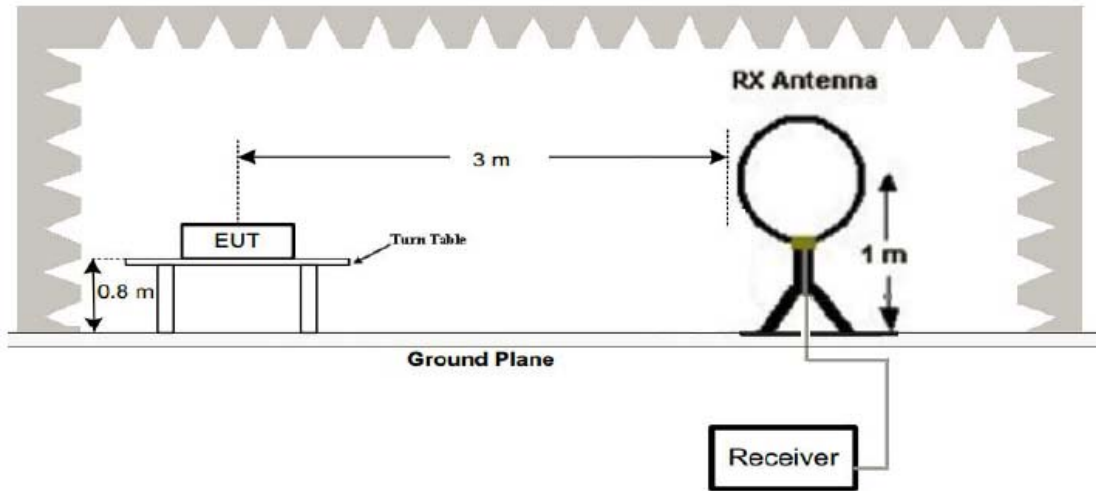
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.



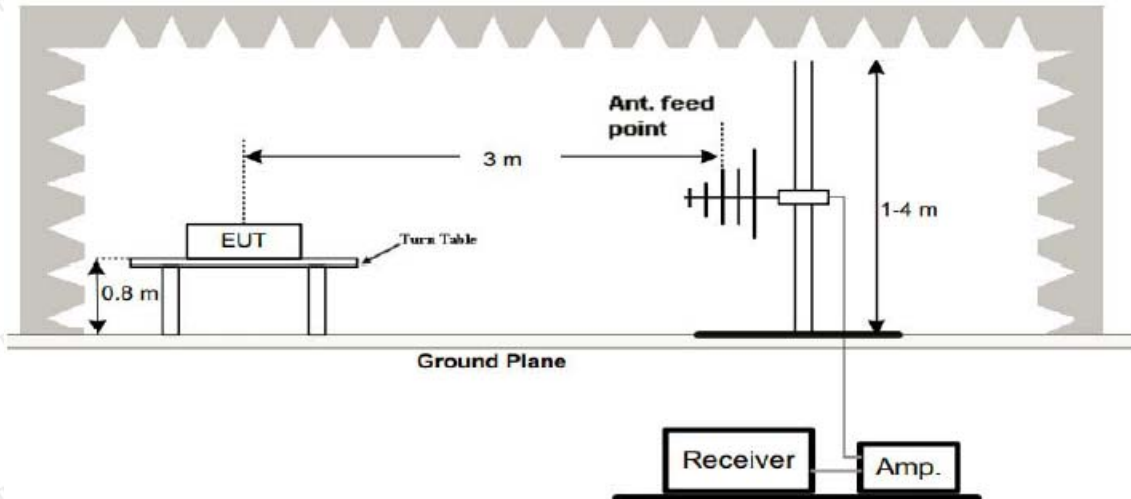


#### 4.2 Test Setup

##### 1. Radiated Emission Test-Up Frequency Below 30MHz

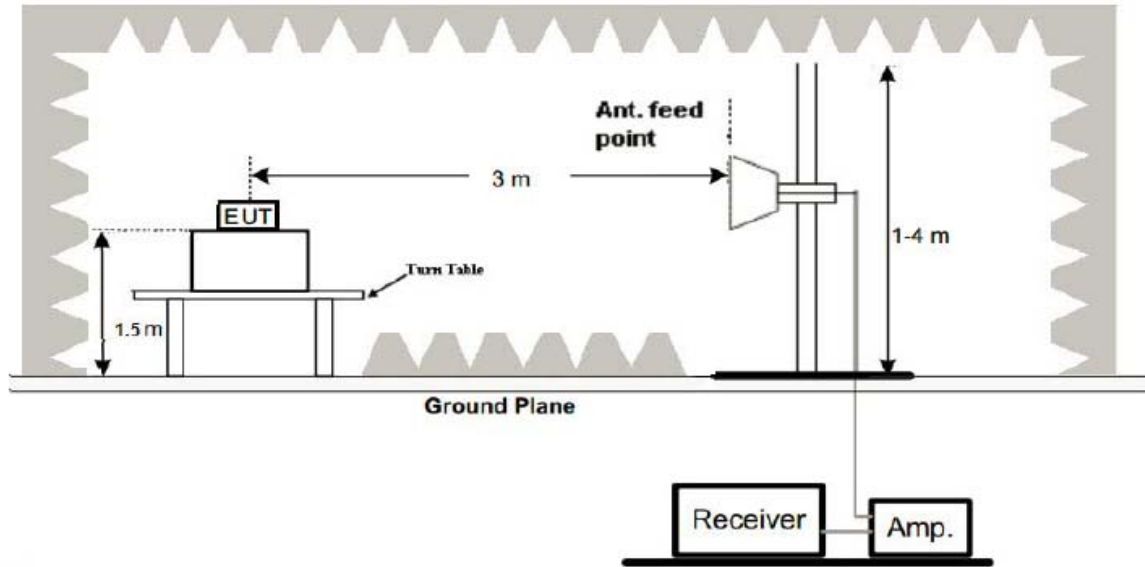


##### 2. Radiated Emission Test-Up Frequency 30MHz~1GHz





### 3. Radiated Emission Test-Up Frequency Above 1GHz



### 4. Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
9kHz- 150kHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value
150kHz-30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value
30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak Value
Above 1GHz	Peak	1MHz	3MHz	Peak Value
	Peak	1MHz	10Hz	Average Value



#### 4.3 Test Procedure

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber in below 1GHz, 1.5m above the ground in above 1GHz. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. 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.
4. 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 rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. 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.

#### 4.4 Test Result

##### Field Strength of Fundamental:

Frequency (MHz)	Emission (dBuV/m)	PK/AV	Ant. Pol.	Limits PK/AV (dBuV/m)	Margin (dB)
902.3	92.89	PK	H	114	-21.11
902.3	82.37	AV	H	94	-11.63
908.6	95.78	PK	H	114	-18.22
908.6	86.02	AV	H	94	-7.98
914.9	96.77	PK	H	114	-17.23
914.9	82.14	AV	H	94	-11.86
902.3	96.31	PK	V	114	-17.69
902.3	83.16	AV	V	94	-10.84
908.6	94.34	PK	V	114	-19.66
908.6	83.19	AV	V	94	-10.81
914.9	96.28	PK	V	114	-17.72
914.9	82.99	AV	V	94	-11.01

##### Spurious Emissions:

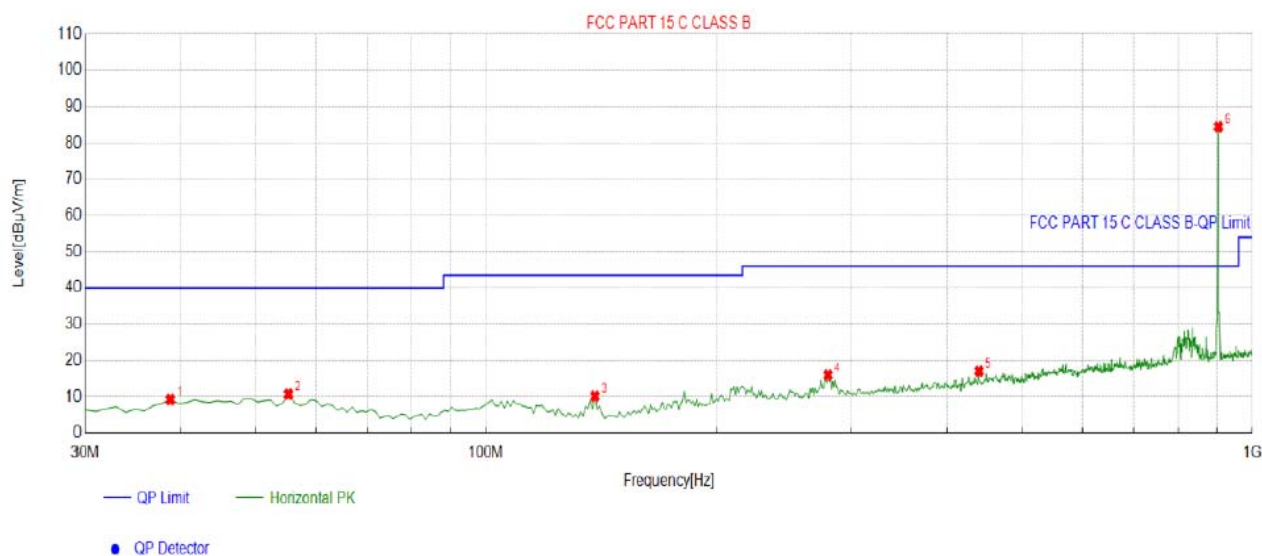
##### For 9 kHz-30MHz Test Results:

Note: The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement.



## For 30MHz-1GHz Test Results:

Temperature:	22°C	Relative Humidity:	46%
Test Date:	Aug. 30, 2021	Pressure:	1010hPa
Test Voltage:	5V/1A by MINI-USB Port	Polarization:	Horizontal
Test Mode:	Transmitting mode		



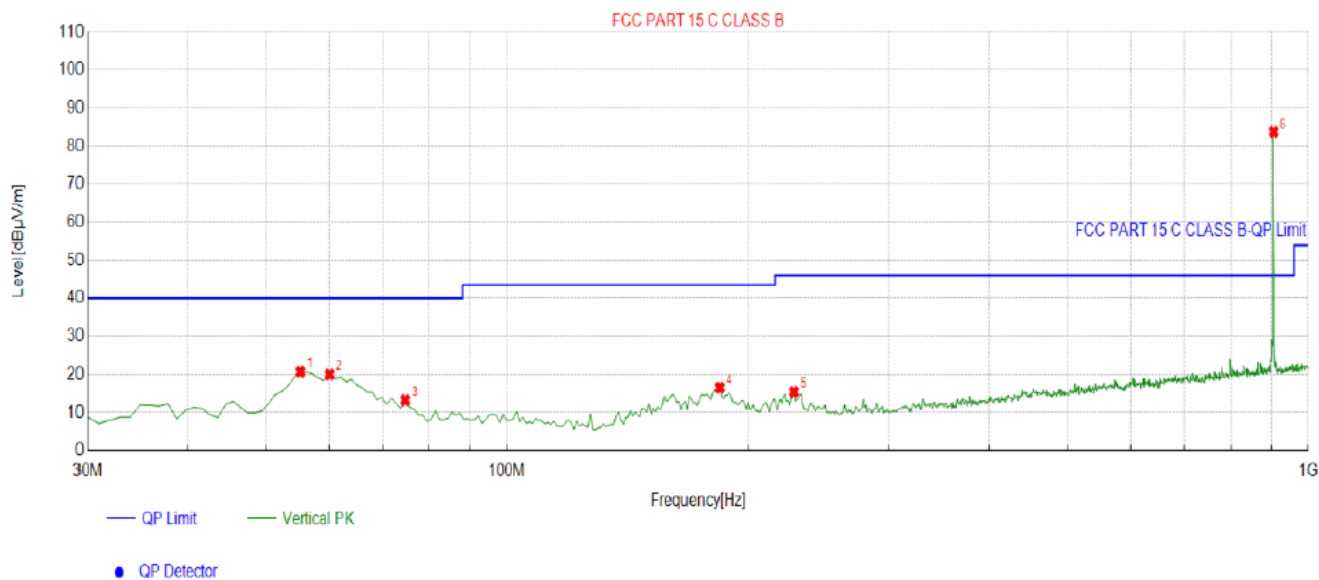
Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	38.7387	-14.95	24.16	9.21	40.00	30.79	100	193	Horizontal
2	55.2452	-14.44	25.15	10.71	40.00	29.29	100	153	Horizontal
3	138.7487	-19.10	29.25	10.15	43.50	33.35	100	54	Horizontal
4	279.5395	-13.27	29.23	15.96	46.00	30.04	100	208	Horizontal
5	439.7498	-9.43	26.49	17.06	46.00	28.94	100	10	Horizontal
6	902.9029	-1.77	86.24	84.47	46.00	-38.47	100	157	Horizontal

Remark: Factor = Cable loss + Antenna factor – Preamplifier; Level = Reading + Factor; Margin = Limit – Level





Temperature:	22°C	Relative Humidity:	46%
Test Date:	Aug. 30, 2021	Pressure:	1010hPa
Test Voltage:	5V/1A by MINI-USB Port	Polarization:	Vertical
Test Mode:	Transmitting mode		



Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	55.2452	-14.44	35.17	20.73	40.00	19.27	100	136	Vertical
2	60.1001	-15.19	35.24	20.05	40.00	19.95	100	92	Vertical
3	74.6647	-18.51	31.72	13.21	40.00	26.79	100	342	Vertical
4	184.3844	-16.48	33.02	16.54	43.50	26.96	100	310	Vertical
5	228.0781	-14.37	29.83	15.46	46.00	30.54	100	314	Vertical
6	904.8448	-1.76	85.48	83.72	46.00	-37.72	100	6	Vertical

Remark: Factor = Cable loss + Antenna factor – Preamplifier; Level = Reading + Factor; Margin = Limit – Level





## For Above 1GHz Test Results:

Frequency (MHz)	Ant. Pol.	PK Reading (dBμV)	AV Reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin Peak(dB)
					Peak (dBμV/m)	AV (dBμV/m)			
1804.6	H	51.32	---	-4.12	47.2	---	74	54	-26.8
2706.9	H	51.24	---	-0.56	50.68	---	74	54	-23.32
1804.6	V	55.79	---	-4.18	51.61	---	74	54	-22.39
2706.9	V	51.69	---	-0.67	51.02	---	74	54	-22.98
1817	H	52.46	---	-4.12	48.34	---	74	54	-25.66
2725.5	H	50.98	---	-0.34	50.64	---	74	54	-23.36
1817	V	55.34	---	-4.17	51.17	---	74	54	-22.83
2725.5	V	51.47	---	-0.36	51.11	---	74	54	-22.89
1829.8	H	50.28	---	-4.21	46.07	---	74	54	-27.93
2744.7	H	53.13	---	-0.74	52.39	---	74	54	-21.61
1829.8	V	55.28	---	-4.12	51.16	---	74	54	-22.84
2744.7	V	51.02	---	-0.39	50.63	---	74	54	-23.37

## Note:

1. Emission Level = Peak Reading + Correction Factor; Correction Factor = Antenna Factor + Cable loss – Pre-amplifier
2. Margin = Emission - Limit
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency.
5. The measured value Peak meets the AVG limit, so AVG is deemed to meet the requirements.



## Band Edge Requirement:

## 902.3MHz

Frequency (MHz)	Ant. Pol.	PK Reading (dBμV)	AV Reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin Peak(dB)
					Peak (dBμV/m)	AV (dBμV/m)			
902	H	56.34	---	-3.4	52.94	---	74	---	-21.06
928	H	56.37	---	-3.2	53.17	---	74	---	-20.83
902	V	55.18	---	-3.9	51.28	---	74	---	-22.72
928	V	52.52	---	-4.5	48.02	---	74	---	-25.98

## 914.9MHz

Frequency (MHz)	Ant. Pol.	PK Reading (dBμV)	AV Reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin Peak(dB)
					Peak (dBμV/m)	AV (dBμV/m)			
902	H	56.59	---	-3.6	52.99	---	74	---	-21.01
928	H	56.47	---	-3.4	53.07	---	74	---	-20.93
902	V	54.99	---	-4	50.99	---	74	---	-23.01
928	V	53.87	---	-4.8	49.07	---	74	---	-24.93

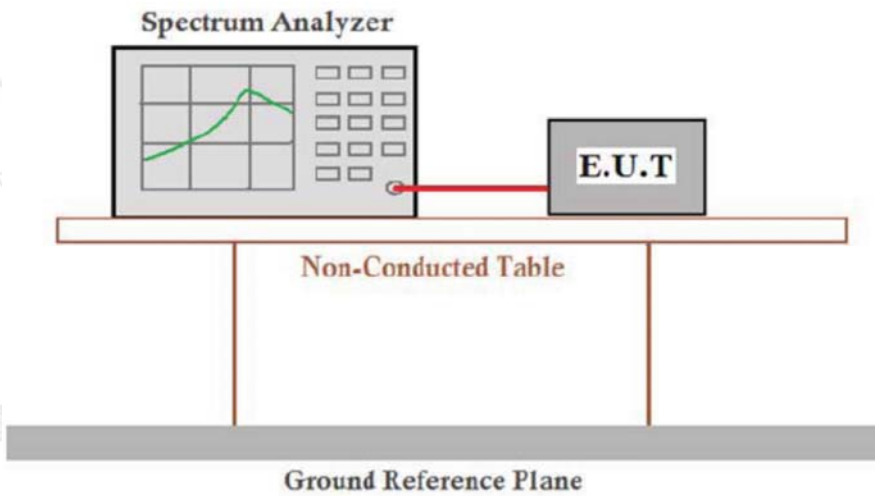
## Note:

1. Emission Level = Peak Reading + Correction Factor; Correction Factor = Antenna Factor + Cable loss – Pre-amplifier
2. Margin = Emission - Limit
3. The emission levels of other frequencies are very lower than the limit and not show in test report.



## 5 OCCUPIED BANDWIDTH TEST

### 5.1 Test Setup



### 5.2 Rules and specifications

CFR 47 Part 15.215(c)

ANSI C63.10: 2013

### 5.3 Test Procedure

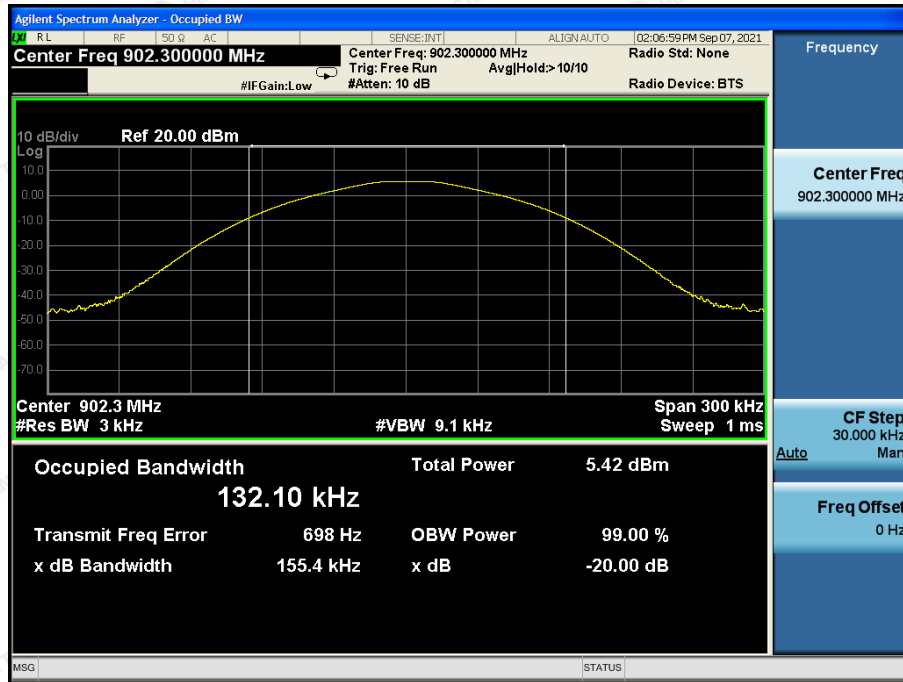
1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.  
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel; RBW=1% to 5% OBW; VBW=3RBW; Sweep = auto; Detector function = peak; Trace = max hold.
4. Measure and record the results in the test report.



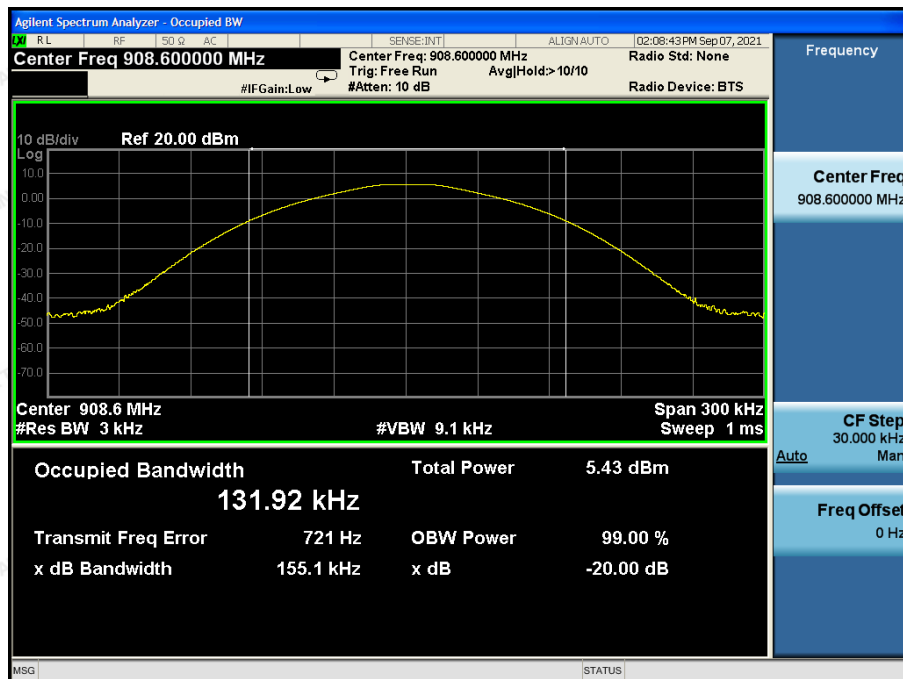
## 5.4 Test Result

PASS

Mode	Frequency(MHz)	20dB Bandwidth (KHz)	Limit (kHz)	Conclusion
TX	902.3	155.4	/	PASS
TX	908.6	155.1	/	PASS
TX	914.9	155.1	/	PASS



902.3Mhz



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908.6Mhz



914.9Mhz





## 6 ANTENNA REQUIREMENT

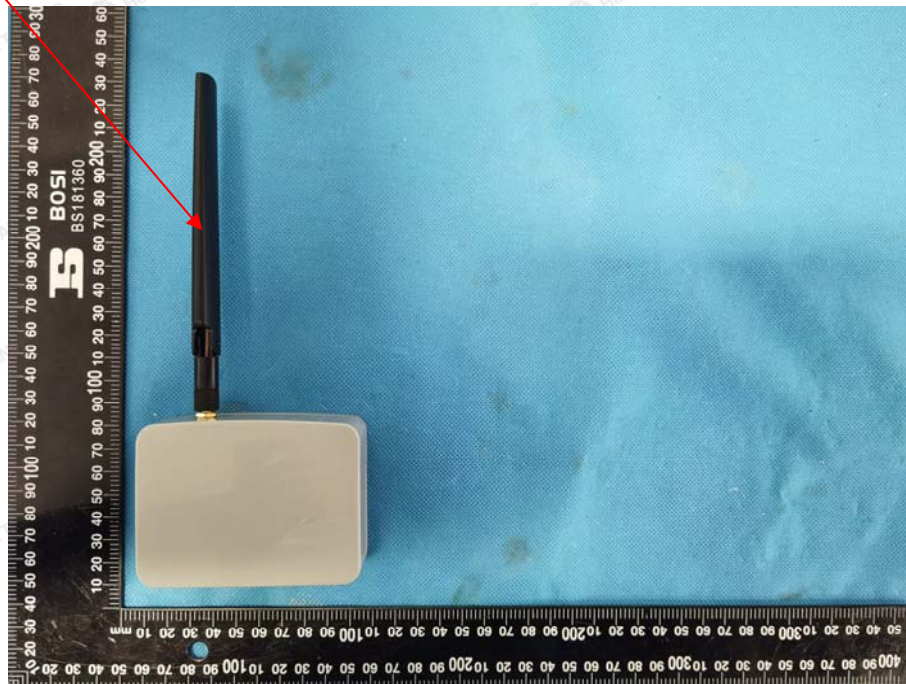
### Standard Applicable:

For intentional device, according to FCC 47 CFR Section 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.

### Antenna Connected Construction

The antenna used in this product is a External antenna which permanently attached. It conforms to the standard requirements. The directional gains of antenna used for transmitting is 3dBi.

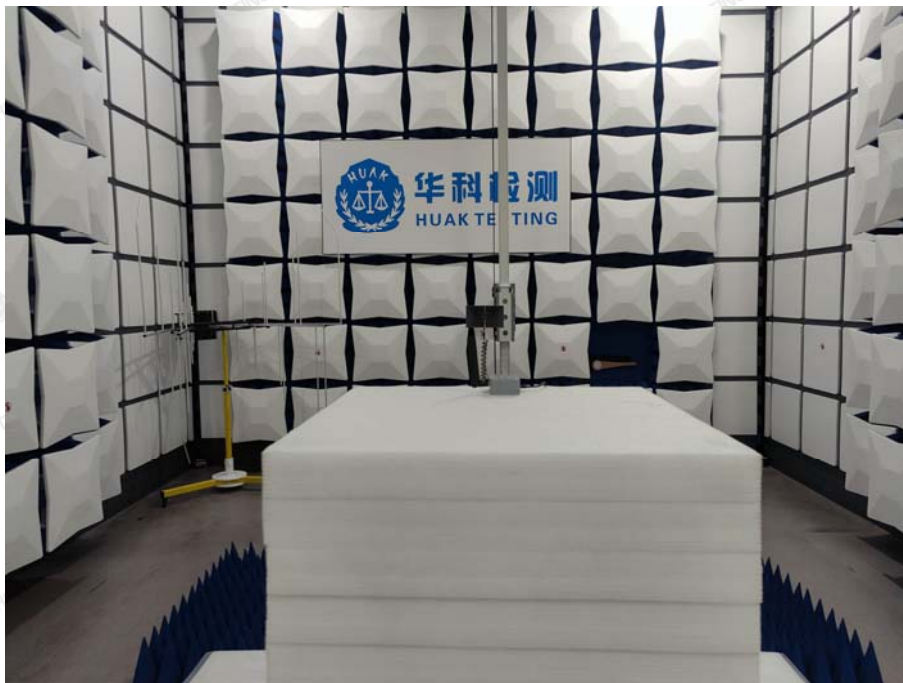
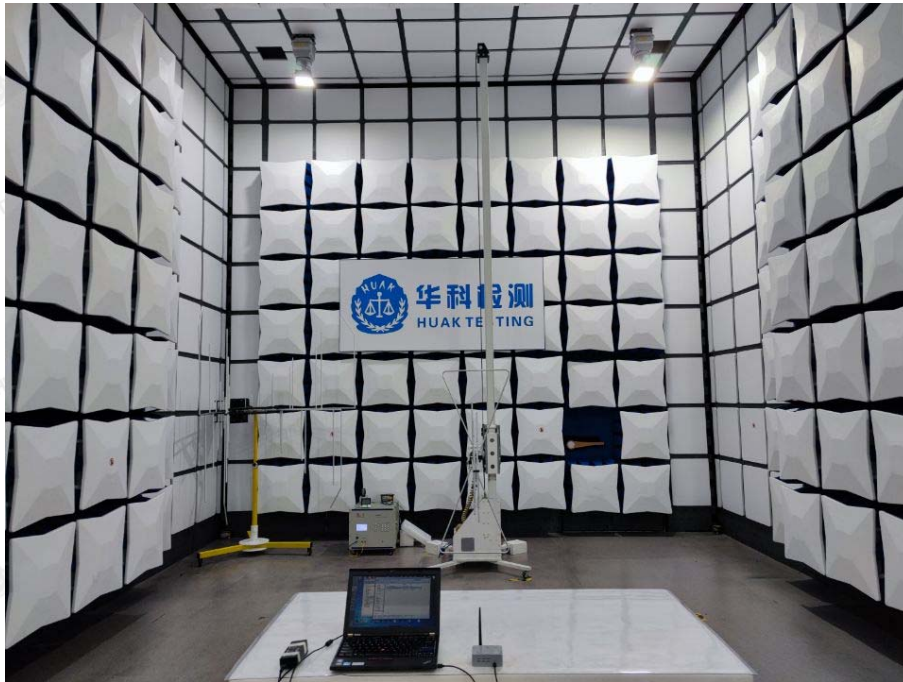
### ANTENNA





## 7 PHOTOGRAPH OF TEST

### 7.1 Radiated Emission



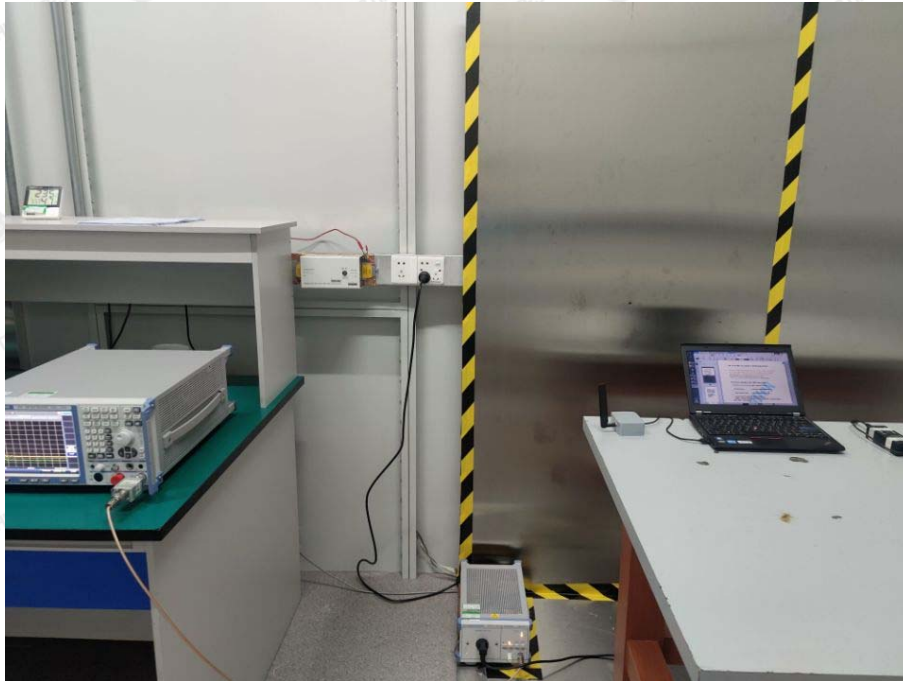
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## 7.2 Conducted Emission



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## 8 PHOTOGRAPH OF TEST

Reference to the report: ANNEX A of external photos and ANNEX B of PCB photos

\*\*\*End of Report\*\*\*