FCC RADIO TEST REPORT

FCC ID: 2APJJ-RF1276D27

Product： LoRa module

Trade Name： Appconwireless

Model Name： RF1276D27

Report No.： HK2009243369-E

Prepared for

APPCON WIRELESS TECHNOLOGY LIMITED

28#,Longjin road,Xili zone,Nanshan District, Shenzhen, 518000 China

Prepared by

Shenzhen HUAK Testing Technology Co., Ltd.

1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park,
Heping Community, Fuhai Street, Bao'an District, Shenzhen, China

TEST RESULT CERTIFICATION

Applicant's name ..... :	APPCON WIRELESS TECHNOLOGY LIMITED
Address ..... :	28#,Longjin road,Xili zone,Nanshan District, Shenzhen, 518000 China
Manufacture's Name ..... :	APPCON WIRELESS TECHNOLOGY LIMITED
Address ..... :	28#,Longjin road,Xili zone,Nanshan District, Shenzhen, 518000 China

Product description

Product name ..... :	LoRa module
Trade Mark ..... :	Appconwireless
Model and/or type reference :	RF1276D27
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 HUAK 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.

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Date of Test .....:

Date (s) of performance of tests.....:	Sep. 24, 2020 – Dec. 04, 2020
Date of Issue .....:	Dec. 04, 2020
Test Result .....:	Pass

Testing Engineer : Gary Qian

(Gary Qian)

Technical Manager : Eden Hu

(Eden Hu)

Authorized Signatory : Jason Zhou

(Jason Zhou)

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**** Modifited History ****

Revison	Description	Issued Data	Remark
Revsion 1.0	Initial Test Report Release	Dec. 04, 2020	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	§15.249 (a)	COMPLIANT
Spurious Emissions	§15.249 (a) / §15.209	COMPLIANT
Band Edge	§15.249 (d) / §15.209	COMPLIANT
20dB Occupied Bandwidth	§15.215 (c)	COMPLIANT COMPLIANT
Antenna requirement	§15.203	COMPLIANT

1.2 TEST FACILITY

Test Firm : Shenzhen HUAK Testing Technology Co., Ltd.

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

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19.The testing quality system of our laboratory meets with ISO/IEC-17025 requirements, which is approved by CNAS. This approval result is accepted by MRA of APLAC.

Our test facility is recognized, certified, or accredited by the following organizations:

CNAS-LAB Code: L9589

The EMC Laboratory has been assessed and in compliance with CNAS-CL01 accreditation criteria for testing Laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of testing Laboratories.

Designation Number: CN1229

Test Firm Registration Number: 616276

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission. The acceptance letter from the FCC is maintained in our files.

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	LoRa module
Trade Mark	Appconwireless
Model Name	RF1276D27
Serial Model	/
Model Difference	/
FCC ID	2APJJ-RF1276D27
Antenna Type	Spring antenna
Antenna Gain	1.5dBi
Operation frequency	902.3- 914.9 MHz
Number of Channels	64CH
Modulation Type	LORA
Battery	N/A
Hardware Version	V2.0
Software Version	V2.9
Power Source	DC 5V 3A From AC Adapter
Adapter Information	Model:503000 Input:AC100-240V, 50/60Hz Output:DC5V 3A

2.2 Carrier Frequency of Channels

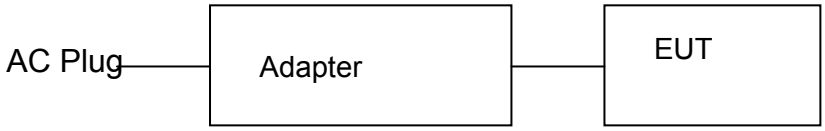
Channel List			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	902.3	33	908.7
2	902.5	34	908.9
3	902.7	35	909.1
4	902.9	36	909.3
5	903.1	37	909.5
6	903.3	38	909.7
7	903.5	39	909.9
8	903.7	40	910.1
9	903.9	41	910.3
10	904.1	42	910.5
11	904.3	43	910.7
12	904.5	44	910.9
13	904.7	45	911.1
14	904.9	46	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

2.3 Operation of EUT during testing

Operating Mode
The mode is used: **Transmitting mode**
Low Channel: 902.3MHz
Middle Channel: 908.5MHz
High Channel: 914.9MHz

2.4 DESCRIPTION OF TEST SETUP

Operation of EUT during testing:



- Adapter information

Model: 503000

Input: AC100-240V, 50/60Hz

Output: DC5V 3A

2.5 MEASUREMENT INSTRUMENTS LIST

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
CONDUCTED EMISSIONS TEST					
1	LISN	R&S	ENV216	HKE-002	Jun. 17, 2021
2	LISN	R&S	ENV216	HKE-029	Jun. 17, 2021
3	EMI Test Receiver	R&S	ESCI-7	HKE-010	Jun. 17, 2021
RADIATED EMISSION TEST					
1	Broadband antenna	Schwarzbeck	VULB 9163	HKE-012	Jun. 17, 2021
2	Horn antenna	Schwarzbeck	9120D	HKE-013	Jun. 17, 2021
3	Receiver	R&S	ESCI 7	HKE-010	Jun. 17, 2021
4	Position controller	Taiwan MF	MF7802	HKE-011	Jun. 17, 2021
5	Preamplifier	EMCI	EMC051845SE	HKE-015	Jun. 17, 2021
6	Preamplifier	Agilent	83051A	HKE-016	Jun. 17, 2021
7	High pass filter unit	Tonscend	JS0806-F	HKE-055	Jun. 17, 2021
8	Spectrum analyzer	Agilent	N9020A	HKE-048	Jun. 17, 2021
9	Spectrum analyzer	Agilent	N9020A	HKE-048	Jun. 17, 2021
10	Signal generator	Agilent	83630A	HKE-028	Jun. 17, 2021
11	Signal generator	Agilent	N5182A	HKE-029	Jun. 17, 2021
12	RF automatic control unit	Tonscend	JS0806-2	HKE-060	Jun. 17, 2021
13	Power meter	Agilent	E4419B	HKE-085	Jun. 17, 2021

3 CONDUCTED EMISSION TEST

3.1 Test Limit

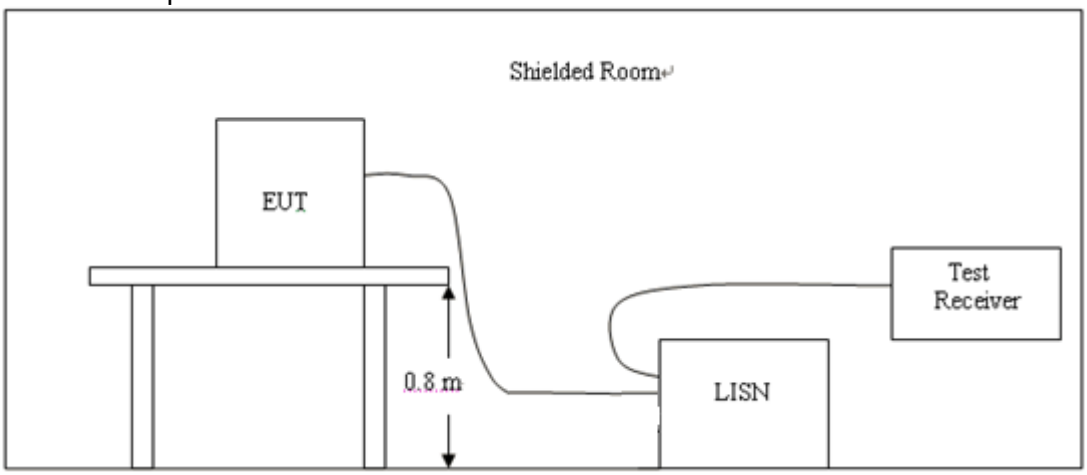
For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following

Frequency (MHz)	Maximum RF Line Voltage(dBμV)			
	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.

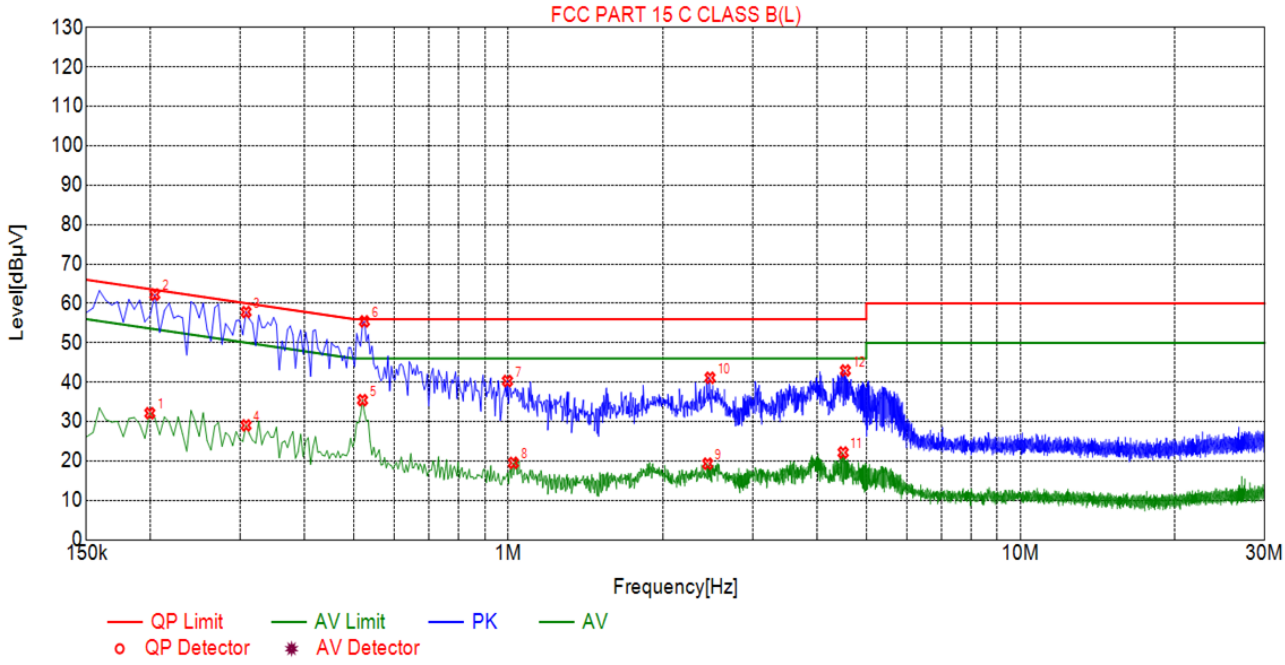
3.4 Test Result

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



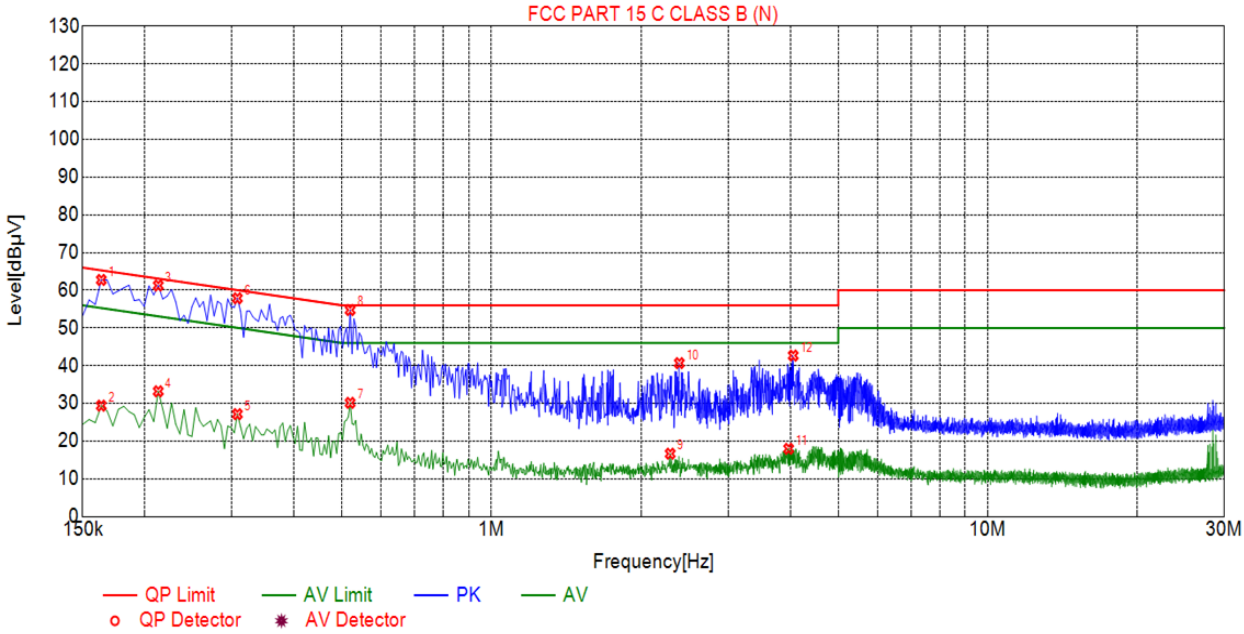
Suspected List								
NO.	Freq. [MHz]	Level [dBµV]	Factor [dB]	Limit [dBµV]	Margin [dB]	Reading [dBµV]	Detector	Type
1	0.1995	32.13	20.03	53.63	21.50	12.10	AV	L
2	0.2040	62.24	20.04	63.45	1.21	42.20	PK	L
3	0.3075	57.80	20.05	60.04	2.24	37.75	PK	L
4	0.3075	29.04	20.05	50.04	21.00	8.99	AV	L
5	0.5190	35.44	20.04	46.00	10.56	15.40	AV	L
6	0.5235	55.44	20.04	56.00	0.56	35.40	PK	L
7	0.9960	40.29	20.06	56.00	15.71	20.23	PK	L
8	1.0230	19.53	20.07	46.00	26.47	-0.54	AV	L
9	2.4495	19.33	20.19	46.00	26.67	-0.86	AV	L
10	2.4765	41.12	20.19	56.00	14.88	20.93	PK	L
11	4.5060	22.15	20.25	46.00	23.85	1.90	AV	L
12	4.5510	42.97	20.25	56.00	13.03	22.72	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	0.1635	62.74	19.98	65.28	2.54	42.76	PK	N
2	0.1635	29.39	19.98	55.28	25.89	9.41	AV	N
3	0.2130	61.26	20.05	63.09	1.83	41.21	PK	N
4	0.2130	33.21	20.05	53.09	19.88	13.16	AV	N
5	0.3075	27.15	20.05	50.04	22.89	7.10	AV	N
6	0.3075	57.87	20.05	60.04	2.17	37.82	PK	N
7	0.5190	30.15	20.04	46.00	15.85	10.11	AV	N
8	0.5190	54.76	20.04	56.00	1.24	34.72	PK	N
9	2.2920	16.67	20.18	46.00	29.33	-3.51	AV	N
10	2.3910	40.68	20.18	56.00	15.32	20.50	PK	N
11	3.9705	17.97	20.25	46.00	28.03	-2.28	AV	N
12	4.0560	42.68	20.25	56.00	13.32	22.43	PK	N

Remark: Margin = Limit – Level

Correction factor = Cable lose + 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):

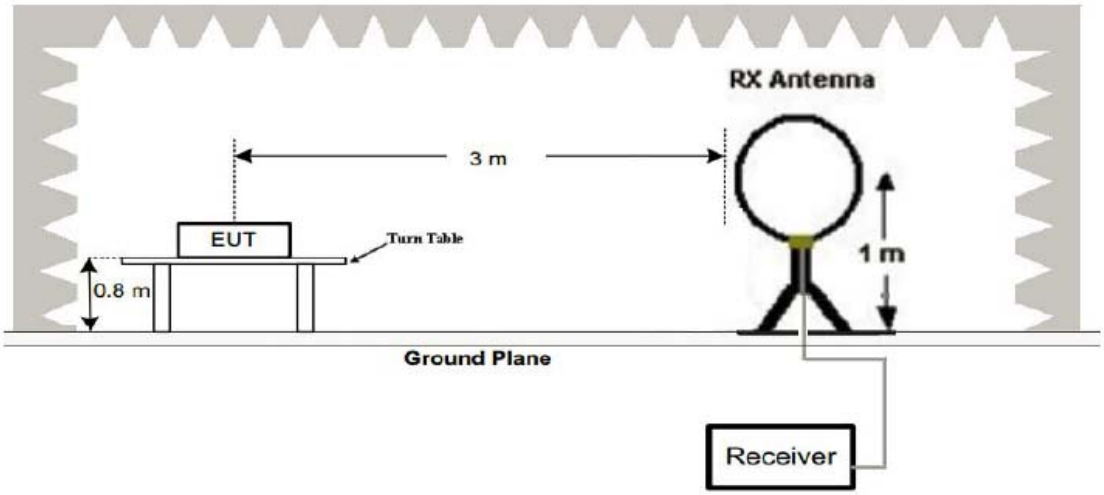
Frequency	Limit(dBuV/m@3m)	Remark
0.009-0.490	2400/F(KHz)	Quasi-peak Value
0.490-1.705	24000/F(KHz)	Quasi-peak Value
1.705-30	30	Quasi-peak Value
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz	54.0	Average Value
	74.0	Peak Value

3. Limit (Band edge):

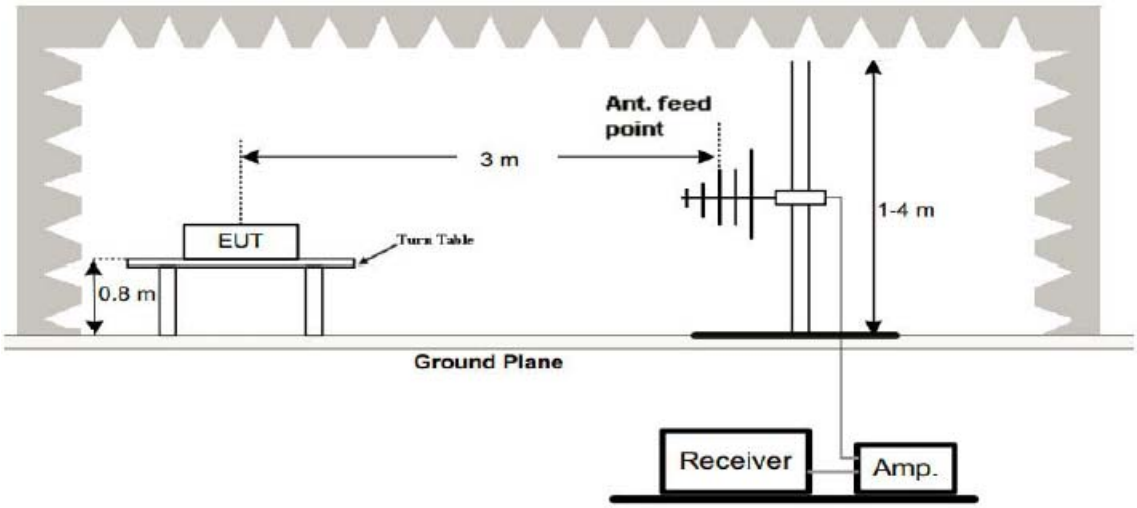
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

4.2 Test Setup

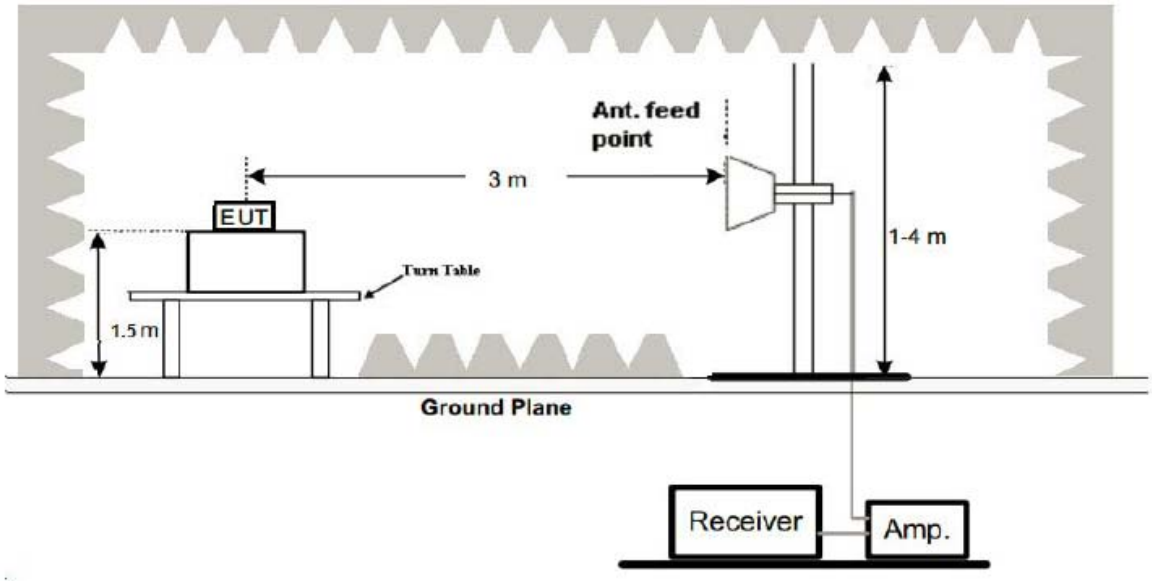
1. Radiated Emission Test-Up Frequency Below 30MHz



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	92.92	PK	H	114	-21.08
902.3	82.02	AV	H	94	-11.98
908.5	95.28	PK	H	114	-18.72
908.5	86.33	AV	H	94	-7.67
914.9	96.52	PK	H	114	-17.48
914.9	82.53	AV	H	94	-11.47
902.3	96.08	PK	V	114	-17.92
902.3	83.37	AV	V	94	-10.63
908.5	94.43	PK	V	114	-19.57
908.5	83.05	AV	V	94	-10.95
914.9	96.07	PK	V	114	-17.93
914.9	85.42	AV	V	94	-8.58

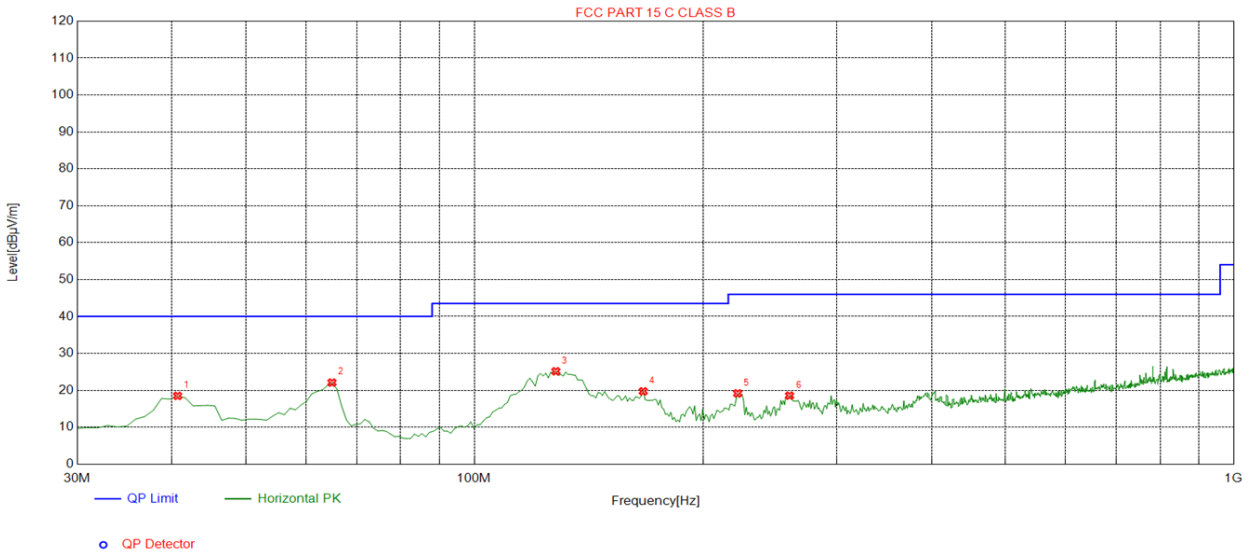
Spurious Emissions:

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:

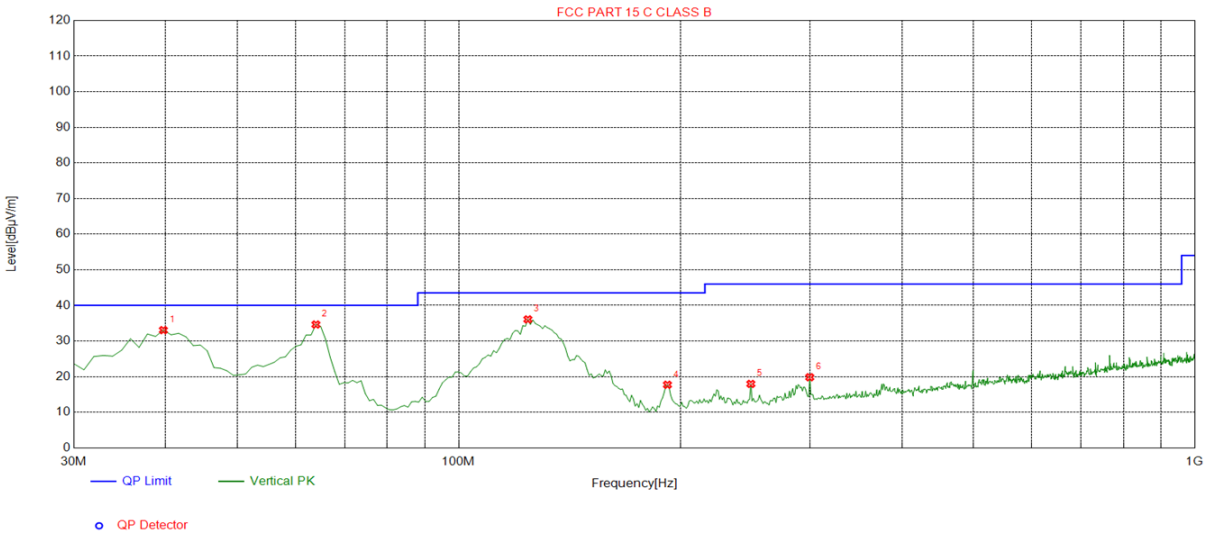
Temperature:	22℃	Relative Humidity:	46%
Test Date:	Sep. 27, 2020	Pressure:	1010hPa
Test Voltage:	DC 5V from adapter AC 120V, 60Hz	Polarization:	Horizontal
Test Mode:	Transmitting mode		



Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	40.6807	-14.42	32.92	18.50	40.00	21.50	100	51	Horizontal
2	64.9550	-16.40	38.50	22.10	40.00	17.90	100	348	Horizontal
3	128.0681	-18.29	43.44	25.15	43.50	18.35	100	264	Horizontal
4	166.9069	-17.58	37.31	19.73	43.50	23.77	100	22	Horizontal
5	222.2523	-14.51	33.69	19.18	46.00	26.82	100	8	Horizontal
6	260.1201	-13.53	32.09	18.56	46.00	27.44	100	316	Horizontal

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

Temperature:	22°C	Relative Humidity:	46%
Test Date:	Sep. 27, 2020	Pressure:	1010hPa
Test Voltage:	DC 5V from adapter AC 120V, 60Hz	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	39.7097	-14.64	47.71	33.07	40.00	6.93	100	283	Vertical
2	63.9840	-16.16	50.80	34.64	40.00	5.36	100	105	Vertical
3	124.1842	-17.72	53.81	36.09	43.50	7.41	100	141	Vertical
4	192.1522	-15.81	33.54	17.73	43.50	25.77	100	260	Vertical
5	249.4394	-13.42	31.39	17.97	46.00	28.03	100	352	Vertical
6	299.9299	-12.74	32.58	19.84	46.00	26.16	100	113	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	50.67	---	-4.34	46.33	---	74.00	54.00	-27.67
2706.9	H	50.58	---	-0.59	49.99	---	74.00	54.00	-24.01
1804.6	V	55.09	---	-4.22	50.87	---	74.00	54.00	-23.13
2706.9	V	51.49	---	-0.56	50.93	---	74.00	54.00	-23.07
1817	H	50.46	---	-4.18	46.28	---	74.00	54.00	-27.72
2725.5	H	50.48	---	-0.54	49.94	---	74.00	54.00	-24.06
1817	V	55.18	---	-4.34	50.84	---	74.00	54.00	-23.16
2725.5	V	51.04	---	-0.59	50.45	---	74.00	54.00	-23.55
1829.8	H	50.62	---	-4.22	46.4	---	74.00	54.00	-27.6
2744.7	H	50.41	---	-0.56	49.85	---	74.00	54.00	-24.15
1829.8	V	55.29	---	-4.18	51.11	---	74.00	54.00	-22.89
2744.7	V	51.07	---	-0.54	50.53	---	74.00	54.00	-23.47

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	56.22	---	-3.9	52.32	---	74	---	-21.68
928	H	56.41	---	-3.6	52.81	---	74	---	-21.19
902	V	55.09	---	-3.7	51.39	---	74	---	-22.61
928	V	52.66	---	-4.2	48.46	---	74	---	-25.54

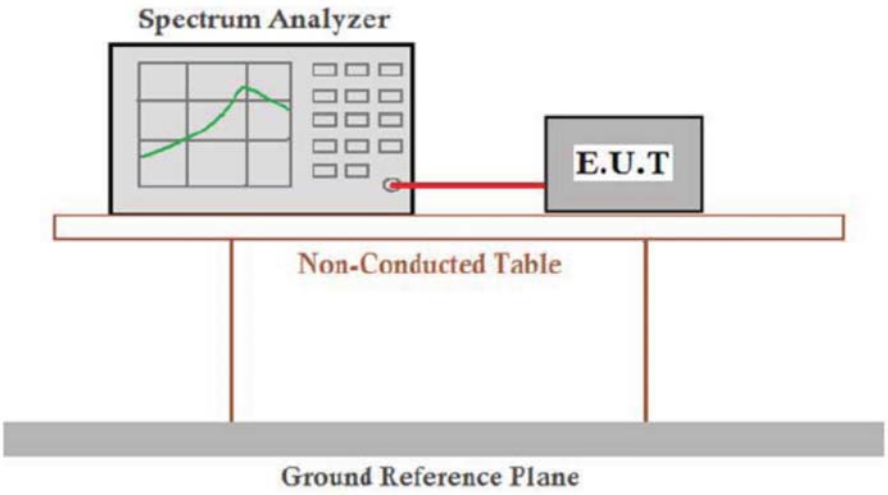
914.9MHz

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	56.35	---	-3.9	52.45	---	74	---	-21.55
928	H	56.35	---	-3.6	52.75	---	74	---	-21.25
902	V	55.10	---	-3.7	51.40	---	74	---	-22.60
928	V	52.73	---	-4.2	48.53	---	74	---	-25.47

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.

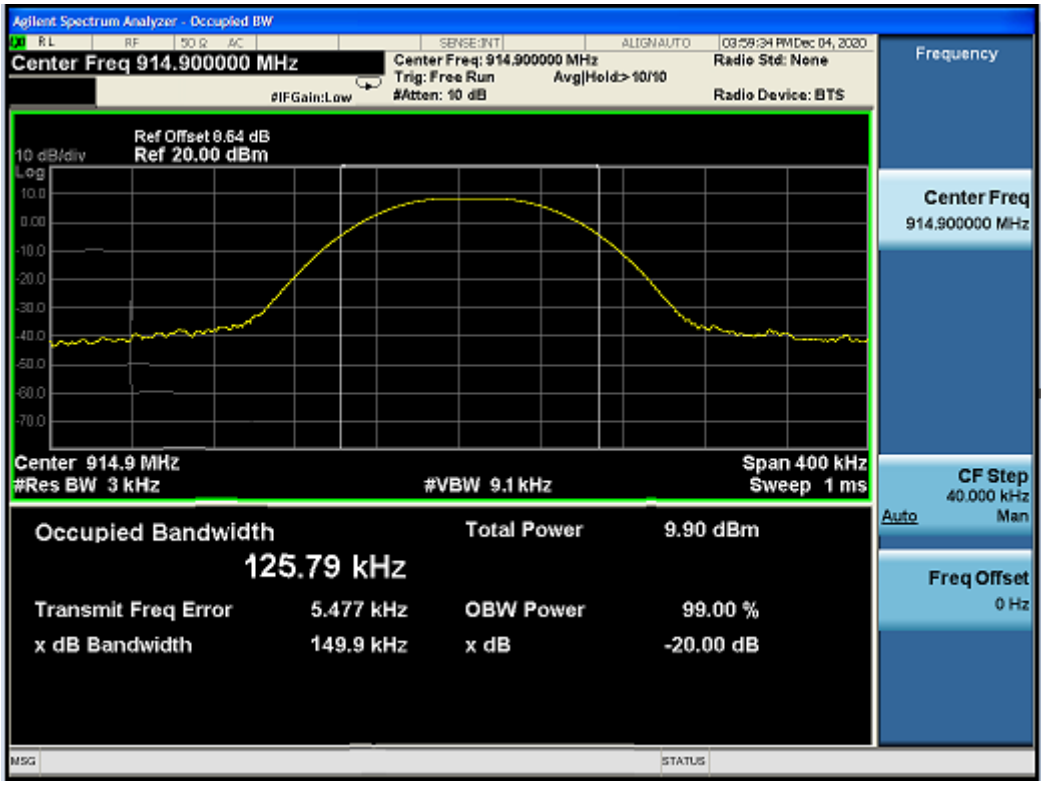
5.4 Test Result

PASS

Mode	Frequency(MHz)	20dB Bandwidth (KHz)	Limit (kHz)	Conclusion
TX	902.3	150.1	/	PASS
TX	908.5	149.9	/	PASS
TX	914.9	149.9	/	PASS

902.3Mhz

908.5Mhz



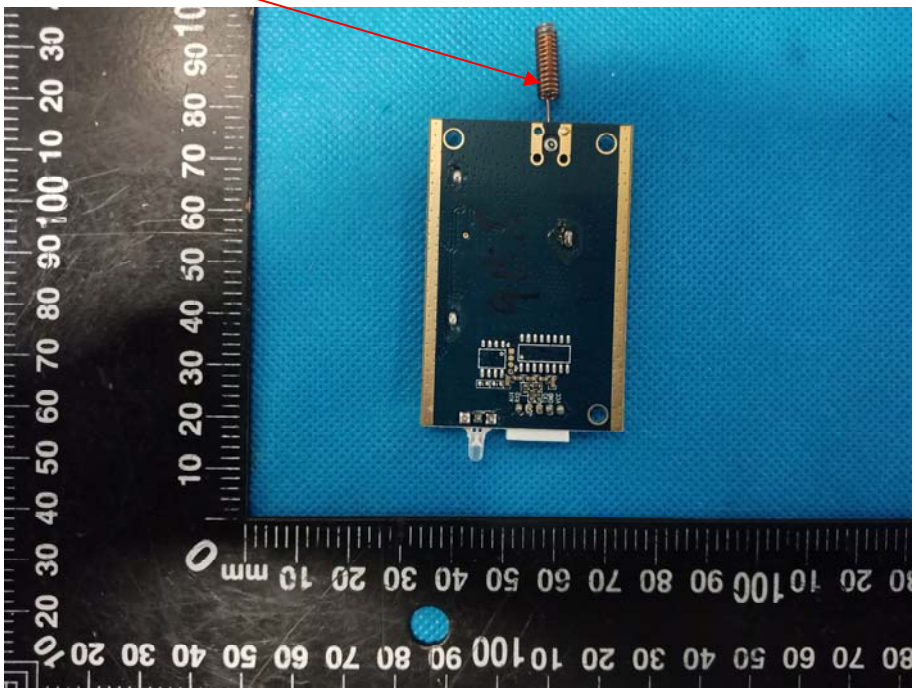
914.9Mhz

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.

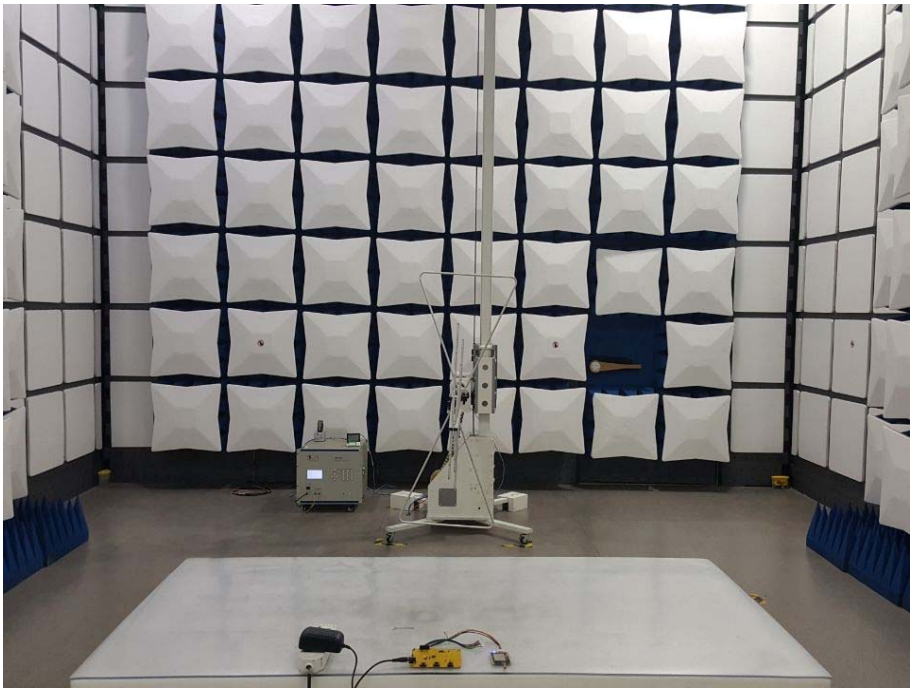
Antenna Connected Construction
The antenna used in this product is a Spring antenna which permanently attached. It conforms to the standard requirements. The directional gains of antenna used for transmitting is 1.5dBi.

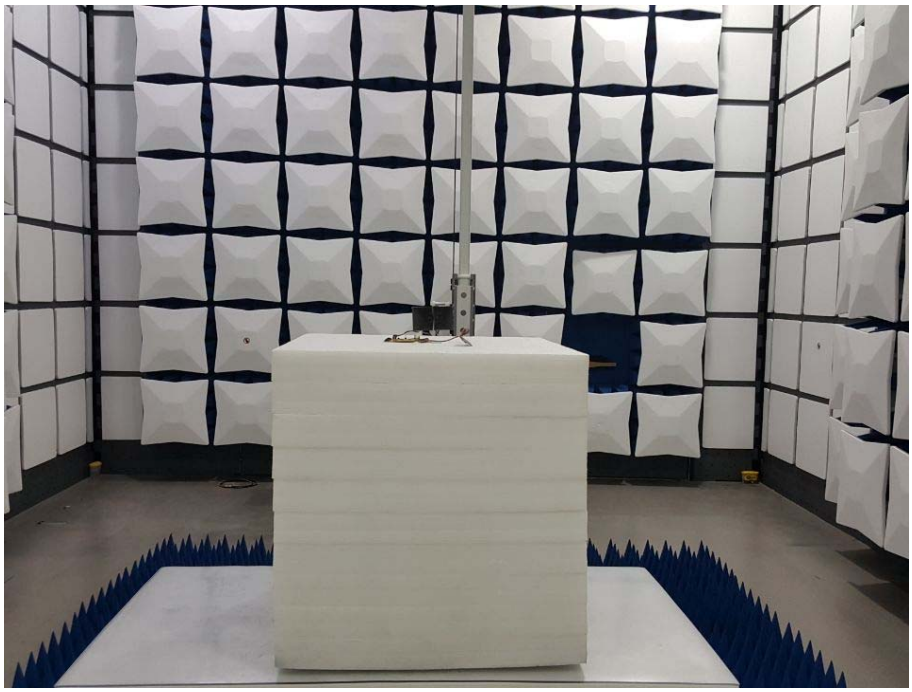
ANTENNA



7 PHOTOGRAPH OF TEST

7.1 Radiated Emission





7.2 Conducted Emission

8 PHOTOGRAPH OF TEST

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

End of Report