FCC TEST REPORT

Test report

On Behalf of

Shenzhen kylin world technology development co., LTD

For

Sensor

Model No.: RO011-1, RO011-2, RO011-3, RO011-4, RO011-5, RO011-6, RO011-7, RO011-8, RO011-9, RO011-10, RO011-11

FCC ID:2ASQZ-RO011-1

Prepared for : Shenzhen kylin world technology development co., LTD.,
503 building A, bantian hepinggang industrial park, longgang district, shenzhen,China

Prepared By : Shenzhen HUAK Testing Technology Co., Ltd.
1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China

TEST REPORT

Applicant's name.....:	**Shenzhen kylin world technology development co., LTD**
Address.....:	503 building A, Bantian hepinggang industrial park, longgang district, shenzhen,China
Manufacture's Name .....:	**Shenzhen kylin world technology development co., LTD**
Address.....:	503 building A, bantian hepinggang industrial park, longgang district, shenzhen,China

Product description

Trade Mark:	/
Product name.....:	Sensor
Model and/or type reference ..:	RO011-1, RO011-2, RO011-3, RO011-4, RO011-5, RO011-6, RO011-7, RO011-8, RO011-9, RO011-10, RO011-11
Standards.....:	47 CFR FCC Part 15 Subpart C 15.231 ANSI C63.10: 2013

This publication may be reproduced in whole or in part for non-commercial purposes as long as the Shenzhen HUAK Testing Technology Co., Ltd. is acknowledged as copyright owner and source of the material. Shenzhen HUAK Testing Technology Co., Ltd. takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

Date of Test..... :

Date (s) of performance of tests ..... :	Feb. 22, 2019 ~. March. 18, 2019
Date of Issue ..... :	March. 18, 2019
Test Result ..... :	**Pass**

Testing Engineer : Gary Qian

(Gary Qian)

Technical Manager : Eden Hu

(Eden Hu)

Authorized Signatory : Jason Zhou

(Jason Zhou)

Contents

1. TEST STANDARDS 4

2. SUMMARY 5

2.1. Product Description 5
2.2. Equipment Under Test 5
2.3. Short description of the Equipment under Test (EUT) 5
2.4. Block Diagram of Test Setup 5
2.5. Modifications 5

3. TEST ENVIRONMENT 6

3.1. TEST FACILITY 6
3.2. Environmental conditions 6
3.3. Summary of measurement results 6
3.4. Statement of the measurement uncertainty 6
3.5. Equipments Used during the Test 6

4. TEST CONDITIONS AND RESULTS 8

4.1. Conducted Emission (AC Main) 8
4.2. Radiated Emission 9
4.3. 20dB Bandwidth 14
4.4. Transmission Time 15
4.5. Antenna Requirement 16

5. TEST SETUP PHOTOS OF THE EUT 17

6. EXTERNAL AND INTERNAL PHOTOS OF THE EUT 18

1. TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.231: Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.

ANSI C63.10:2013 : American National Standard for Testing Unlicensed Wireless Devices

ANSI C63.4: 2014: –American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40GHz
Range of 9 kHz to 40GHz

2. SUMMARY

2.1. Product Description

Name of EUT	Sensor
Trade Mark:	/
Model Number	RO011-1
List Model:	RO011-2, RO011-3, RO011-4, RO011-5, RO011-6, RO011-7, RO011-8, RO011-9, RO011-10, RO011-11
Power Rating	DC 3V From Battery
FCC ID	2ASQZ-RO011-1
Modulation:	ASK
Operation frequency:	433.92MHz
Channel number:	1
Antenna type:	External antenna
Antenna gain:	0dBi

2.2. Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	230V / 50 Hz	○	120V / 60Hz
		○	12 V DC	○	24 V DC
		●	Other (specified in blank below)		

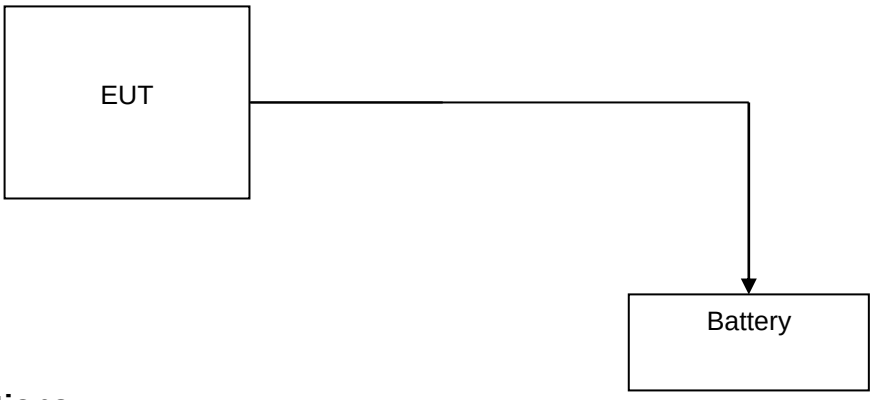
DC 3V From Battety

2.3. Short description of the Equipment under Test (EUT)

This is a Sensor.

For more details, refer to the user's manual of the EUT.

2.4. Block Diagram of Test Setup



2.5. Modifications

No modifications were implemented to meet testing criteria.

3. TEST ENVIRONMENT

3.1. TEST FACILITY

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

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

3.2. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

3.3. Summary of measurement results

FCC and IC Requirements		
FCC Part 15.207	Conducted Emission	N/A
FCC Part 15.231(e)	Transmission Time	PASS
FCC Part 15.231(e)	Electric Field Strength of Fundamental Emission	PASS
FCC Part 15.205 &15.209& 15.231(e)	Electric Field Strength of Spurious Emission	PASS
FCC Part 15.231(c)	-20dB bandwidth	PASS

Remark:
1. The measurement uncertainty is not included in the test result.
2. NA = Not Applicable; NP = Not Performed

3.4. Statement of the measurement uncertainty

Measurement Uncertainty

Conducted Emission Expanded Uncertainty	=	2.23dB, k=2
Radiated emission expanded uncertainty(9kHz-30MHz)	=	3.08dB, k=2
Radiated emission expanded uncertainty(30MHz-1000MHz)	=	4.42dB, k=2
Radiated emission expanded uncertainty(Above 1GHz)	=	4.06dB, k=2

3.5. Equipments Used during the Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	R&S	ENV216	HKE-002	Dec. 27, 2018	1 Year
2.	Receiver	R&S	ESCI 7	HKE-010	Dec. 27, 2018	1 Year
3.	RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 27, 2018	1 Year
4.	Spectrum analyzer	R&S	FSP40	HKE-025	Dec. 27, 2018	1 Year
5.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 27, 2018	1 Year

6.	Preamplifier	Schwarzbeck	BBV 9743	HKE-006	Dec. 27, 2018	1 Year
7.	EMI Test Receiver	Rohde & Schwarz	ESCI 7	HKE-010	Dec. 27, 2018	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	HKE-012	Dec. 27, 2018	1 Year
9.	Loop Antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Dec. 27, 2018	1 Year
10.	Horn Antenna	Schewarzbeck	9120D	HKE-013	Dec. 27, 2018	1 Year
11.	Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	HKE-017	Dec. 27, 2018	1 Year
12.	Pre-amplifier	EMCI	EMC051845 SE	HKE-015	Dec. 27, 2018	1 Year
13.	Pre-amplifier	Agilent	83051A	HKE-016	Dec. 27, 2018	1 Year
14.	EMI Test Software EZ-EMC	Tonscend	JS1120-B Version	HKE-083	Dec. 27, 2018	N/A
15.	Power Sensor	Agilent	E9300A	HKE-086	Dec. 27, 2018	1 Year
16.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 27, 2018	1 Year
17.	Signal generator	Agilent	N5182A	HKE-029	Dec. 27, 2018	1 Year
18.	Signal Generator	Agilent	83630A	HKE-028	Dec. 27, 2018	1 Year
19.	Shielded room	Shiel Hong	4*3*3	HKE-039	Dec. 27, 2018	3 Year
20.	RF Cable(below 1GHz)	HUBER+SUHNER	RG214	HKE-055	Dec. 27, 2018	1 Year
21.	RF Cable(above 1GHz)	HUBER+SUHNER	RG214	HKE-056	Dec. 27, 2018	1 Year

Note: 1. The Cal.Interval was one year.

4. TEST CONDITIONS AND RESULTS

4.1. Conducted Emission (AC Main)

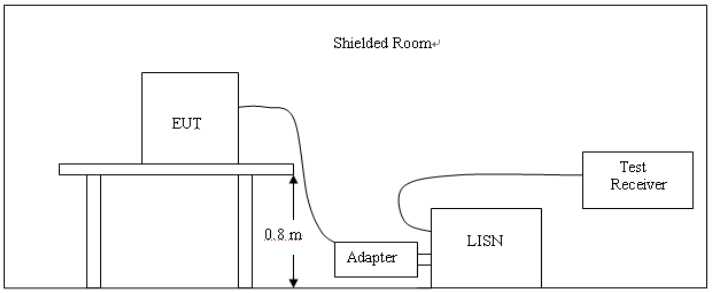
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.207

Frequency range (MHz)	Limit (dBuV)	
	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.

TEST CONFIGURATION



TEST PROCEDURE

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a flood stand system; a wooden table with a height of 0.1 meters is used and is placed on the ground plane as per ANSI C63.10-2013.
2. Support equipment, if needed, was placed as per ANSI C63.10-2013
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
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.
8. During the above scans, the emissions were maximized by cable manipulation.

TEST RESULTS

Not applicable for device which is battery supply.

4.2. Radiated Emission

Limit

For intentional device, according to 15.209(a) the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table.

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

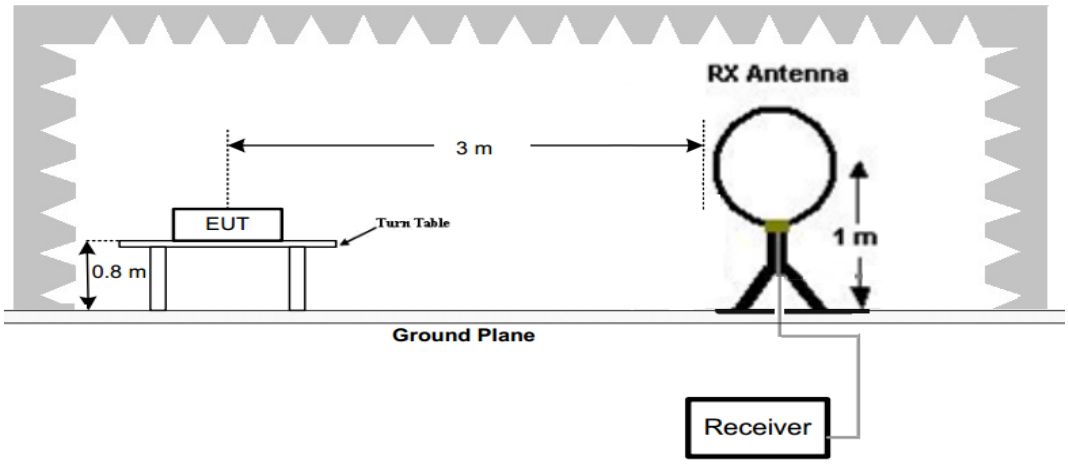
In addition to the provisions of 15.231(e) and RSS 210-A.1.4, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66-40.70	1,000	100
70-130	500	50
130-174	500 to 1,500[1]	50 to 150[1]
174-260	1,500	150
260-470	1,500 to 5,000[1]	150 to 500[1]
Above 470	5,000	500

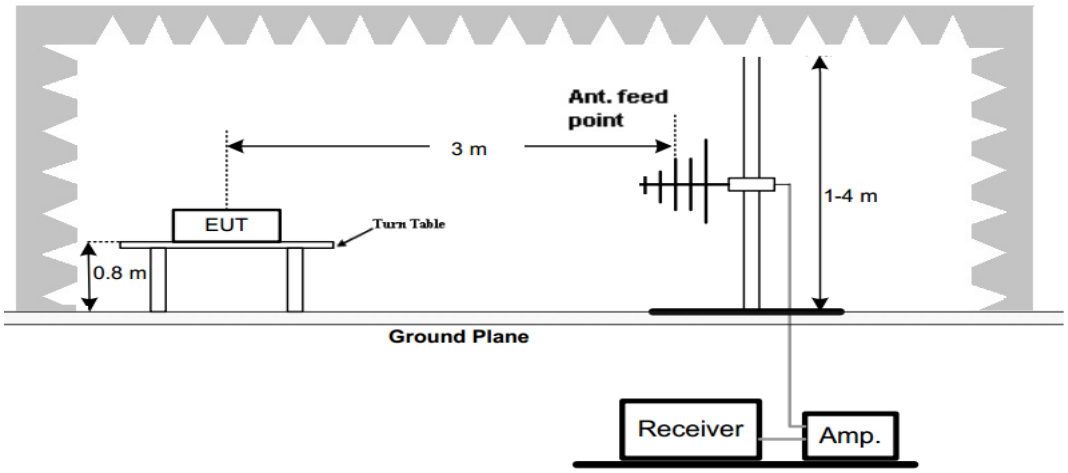
[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 260-470 MHz, μV/m at 3 meters = (16.67 x f)-2833.33. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

TEST CONFIGURATION

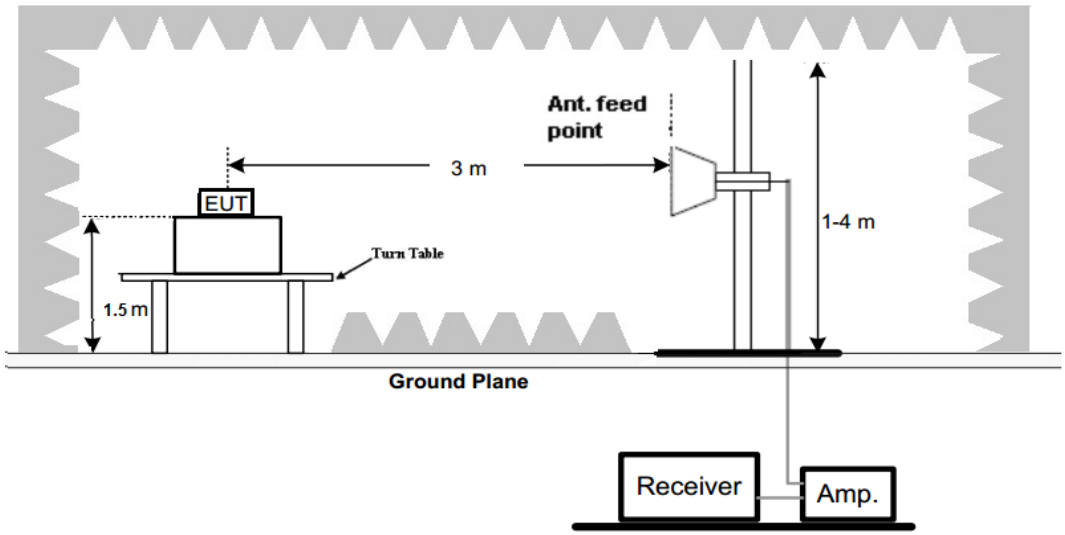
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



Test Procedure

1. Below 1GHz measurement the EUT is placed on a turntable which is 0.8m above ground plane, and above 1GHz measurement EUT was placed on a low permittivity and low loss tangent turn table which is 1.5m above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. Radiated emission test frequency band from 9KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Bilog Antenna	3
1GHz-18GHz	Horn Antenna	3
18GHz-25GHz	Horn Anternna	1

7. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

TEST RESULTS

The emissions from 30MHz to 5GHz are measured peak and average level, below 1 GHz measured QP level, detailed test data please see below. Besides, we tested 3 directions and recorded the worst data.

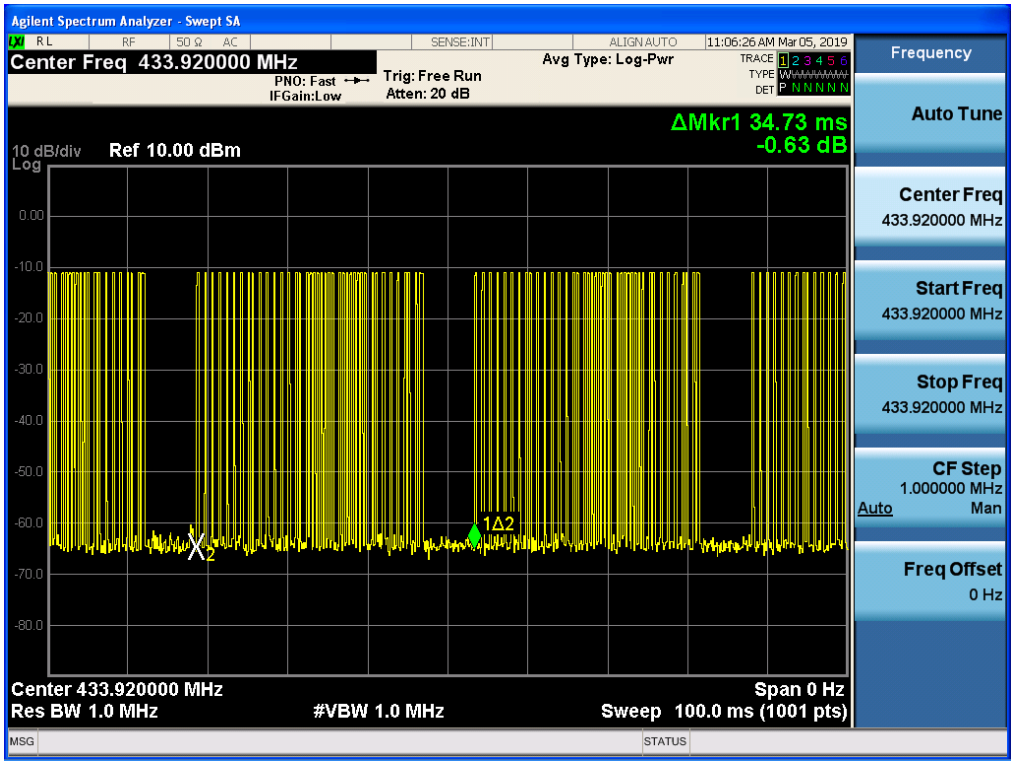
Emission Styles	Frequency (MHz)	Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Direction (H/V)
Fundamental	433.92	83.90	92.87	8.97	PK	H
Spurious	435.86	58.75	72.87	14.12	PK	H
Harmonics	867.84	62.03	72.87	10.84	PK	H
Harmonics	1735.68	60.23	72.87	12.64	PK	H
--	--	--	--	--	--	--
Fundamental	433.92	84.28	92.87	5.59	PK	V
Spurious	435.86	60.65	72.87	12.22	PK	V
Harmonics	867.84	62.37	72.87	10.5	PK	V
Harmonics	1735.68	59.79	72.87	13.08	PK	V
--	--	--	--	--	--	--

Emission Styles	Frequency (MHz)	PK Level (dBuV/m)	AV Factor (dB/m)	AV Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Direction (H/V)
Fundamental	433.92	83.90	-13.23	70.67	72.87	2.20	H
Spurious	435.86	58.75	-13.23	45.52	52.87	7.35	H
Harmonics	867.84	62.03	-13.23	48.80	52.87	4.07	H
Harmonics	1735.68	60.23	-13.23	47.00	52.87	5.87	H
--	--	--	--	--	--	--	--
Fundamental	433.92	84.28	-13.23	71.05	72.87	1.82	V
Spurious	435.86	60.65	-13.23	47.42	52.87	5.45	V
Harmonics	867.84	62.37	-13.23	49.14	52.87	3.73	V
Harmonics	1735.68	59.79	-13.23	46.56	52.87	6.31	V
--	--	--	--	--	--	--	--

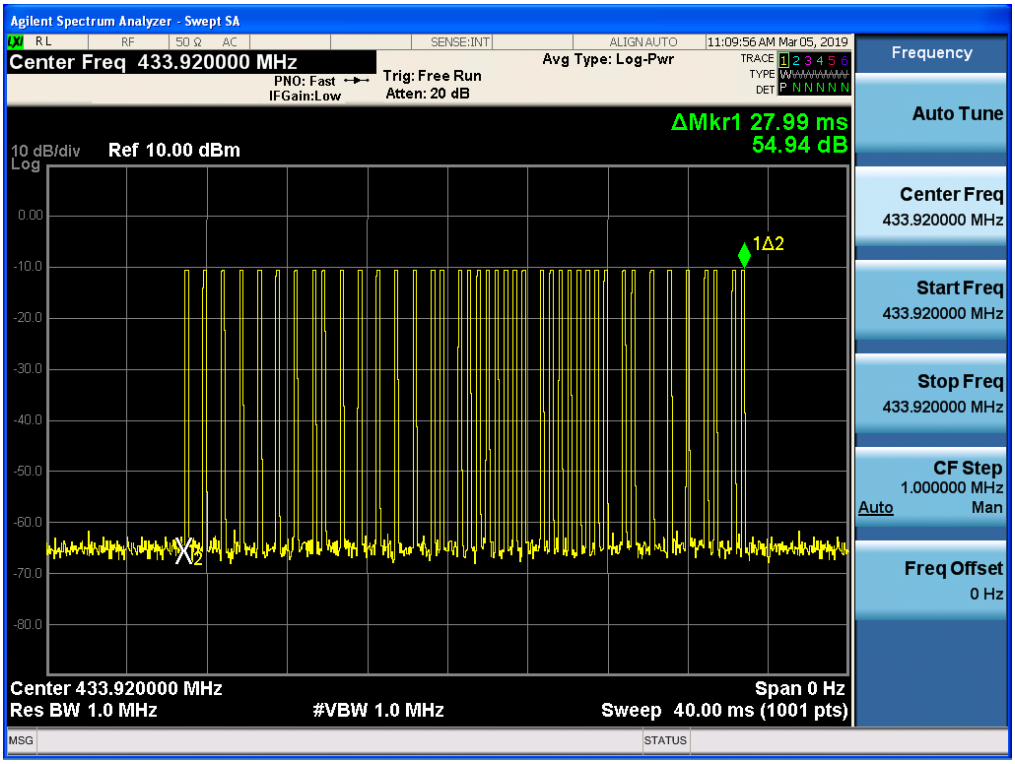
Note:

1. AV Level (dBuV/m)= PK Level (dBuV/m)+ AV Factor(dB)
2. In a transmit cycle 34.70ms period found 0.184ms burst 41pcs, the Duty Cycle can calculate as below:
   Duty Cycle= (0.185*41)/34.73=0.218
   AV Factor=20*log(Duty Cycle)=20*log(0.218)=-13.23

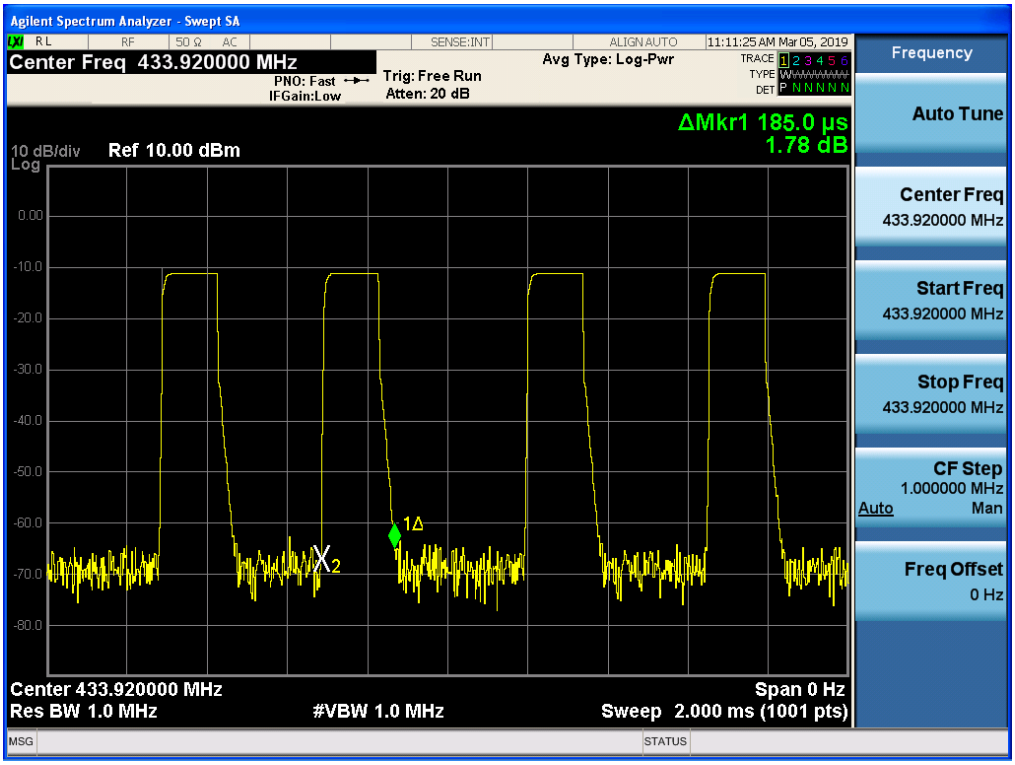
(The plot of Duty Cycle See the follow page)



(Transmit cycle 34.73ms)



(Total Bursts in a transmit cycle 41pcs)



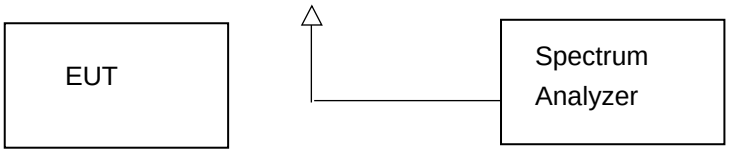
(Time per burst: 0.185ms)

4.3. 20dB Bandwidth

Limit

According to 47 CFR 15.231(c) The bandwidth of the emission shall be no wider than 0.25% of the centre frequency for devices operating above 70MHz and below 900MHz. Bandwidth is determined at the points 20dB down from the modulated carrier.

Test Configuration



Test Procedure

The 20dB bandwidth and 99% bandwidth is measured with a spectrum analyzer connected via a receive antenna placed near the EUT while the EUT is operating in transmission mode.

The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

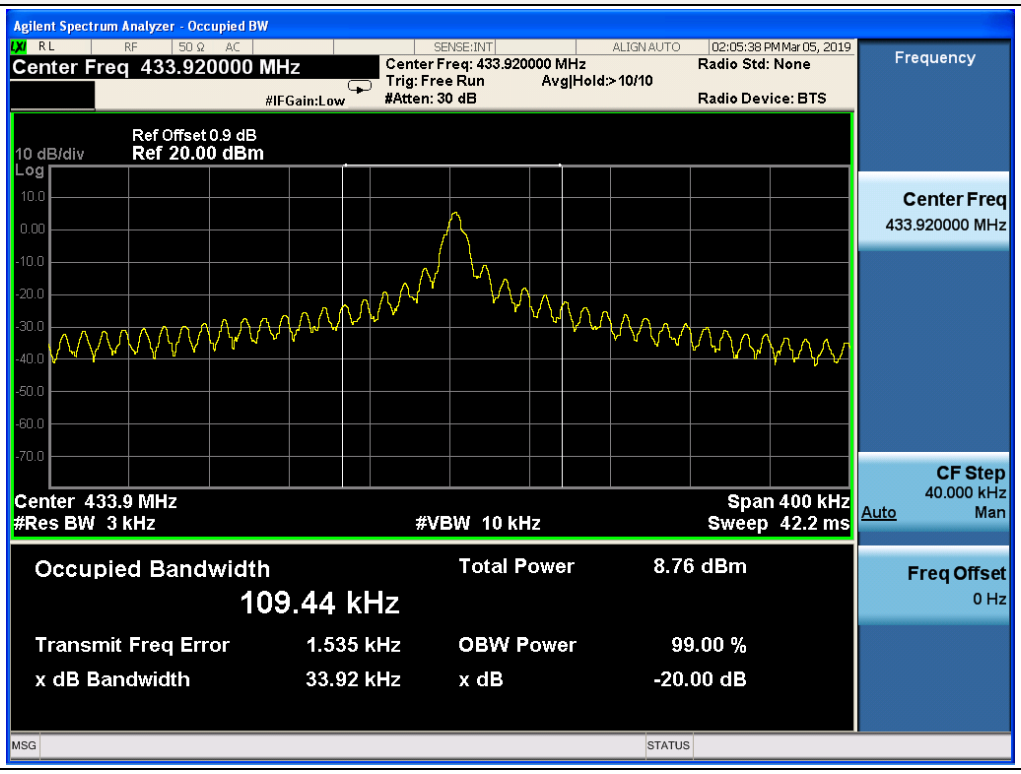
The occupied bandwidth (OBW), that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

Test Results

Modulation	Channel Frequency (MHz)	99% OBW (KHz)	20dB bandwidth (KHz)	Limit (KHz)	Result
ASK	433.92	109.44	33.92	0.25%*433.92=1084.8	Pass

Test plot as follows:

ASK Modulation

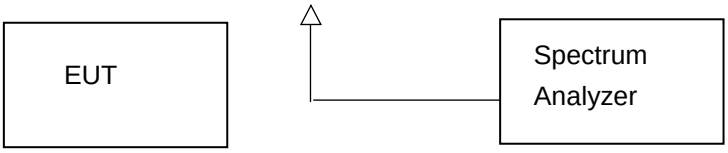


4.4. Transmission Time

Limit

According to FCC §15.231(e), devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds..

Test Configuration

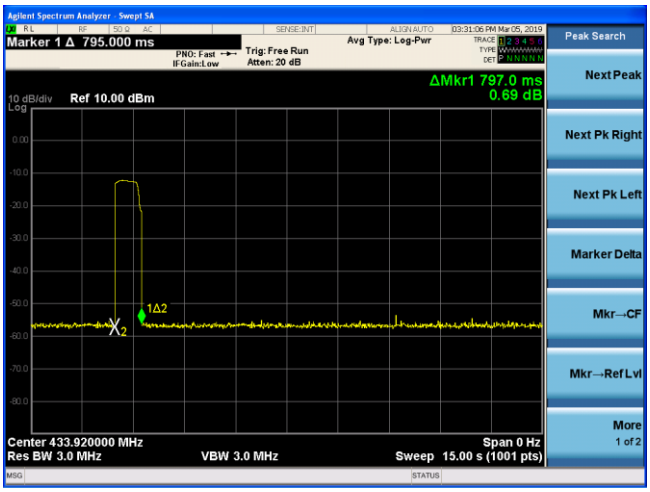


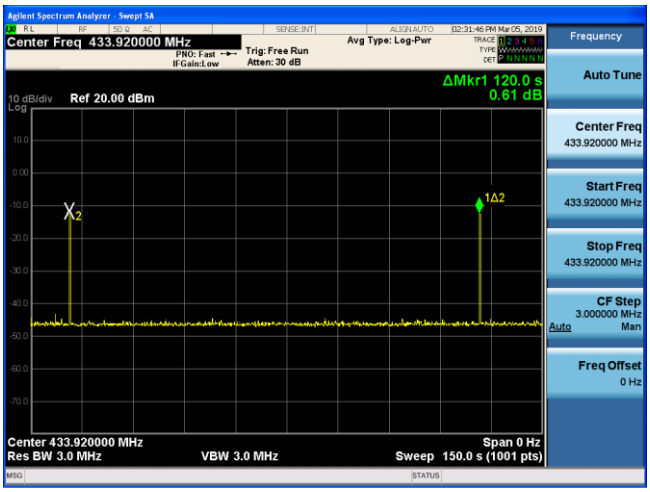
Test Procedure

1. The EUT was placed on a wooded table which is 0.8m height and close to receiver antenna of spectrum analyzer.
2. The spectrum analyzer resolution bandwidth was set to 3 MHz and video bandwidth was set to 3 MHz to encompass all significant spectral components during the test. The spectrum analyzer was operated in linear scale and zero span mode after tuning to the transmitter carrier frequency.

TEST RESULTS

Frequency (MHz)	Transmission time (S)	Limit (S)	Silent time (S)	Limit (S)	Result
433.92	0.797	1	120	30 times Transmission time; no less than 10s	Pass





4.5. Antenna Requirement

Standard Applicable

According to FCC Part 15C 15.203

a) An intentional radiator shall be de-signed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

b) 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.

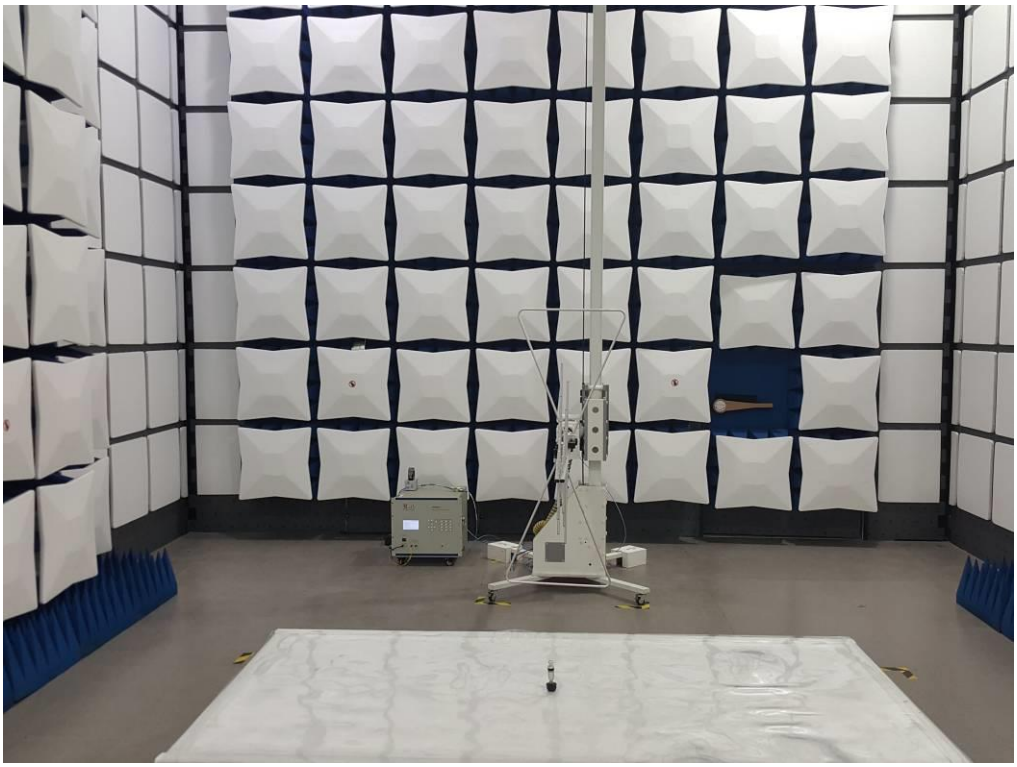
Refer to statement below for compliance.

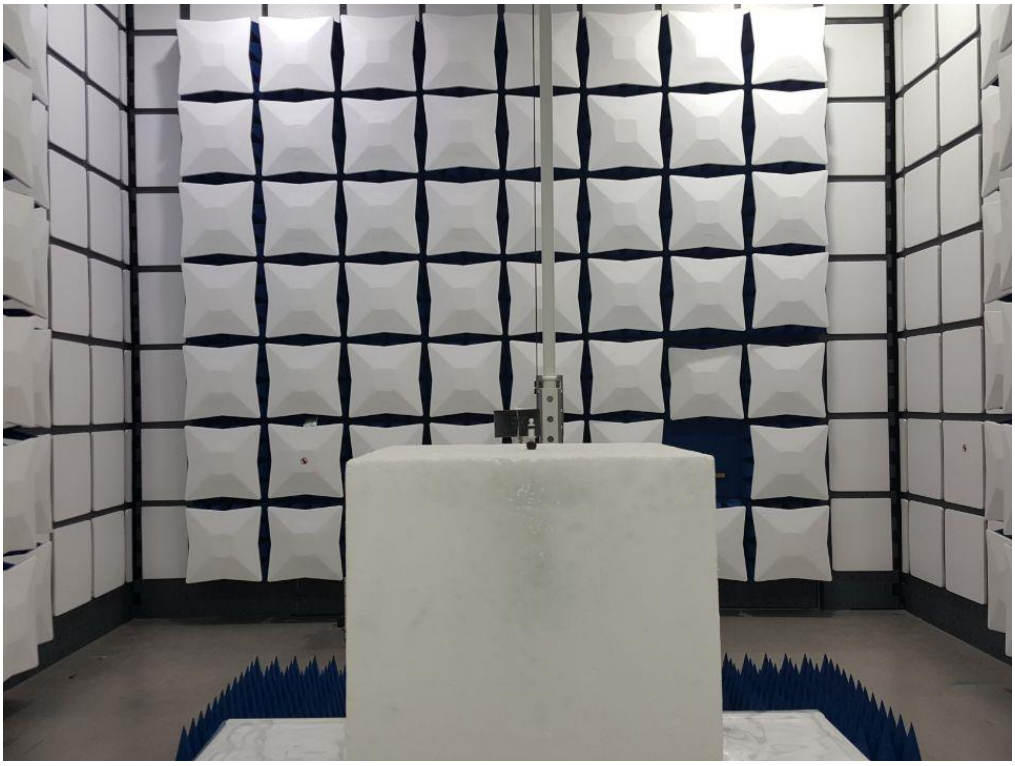
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction

The antenna used in this product is an external antenna, The directional gains of antenna used for transmitting is 0 dBi.

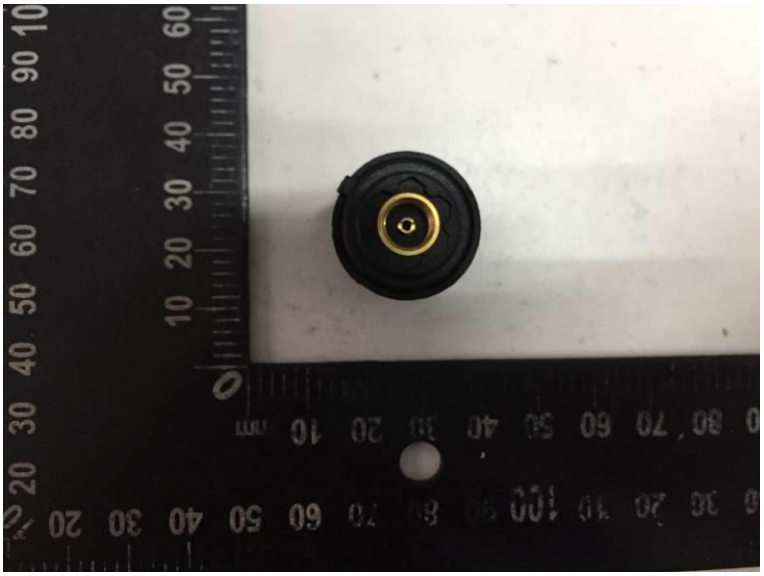
5. Test Setup Photos of the EUT

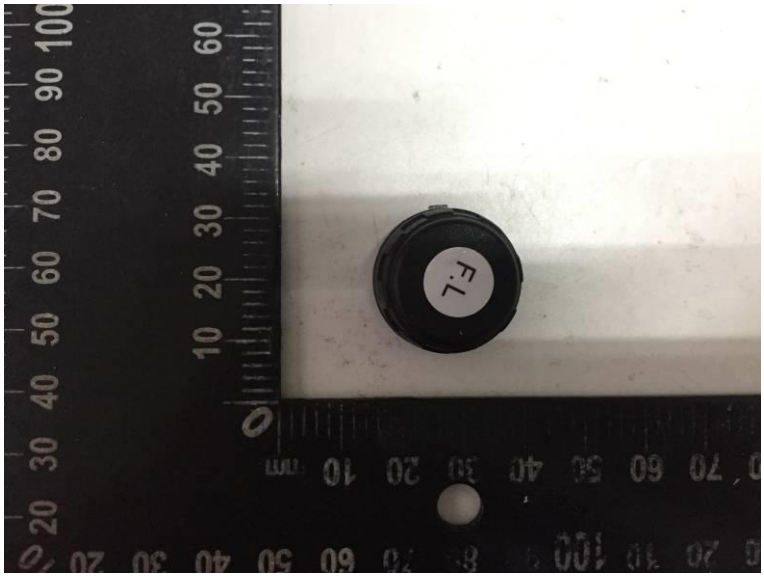




6. External and Internal Photos of the EUT

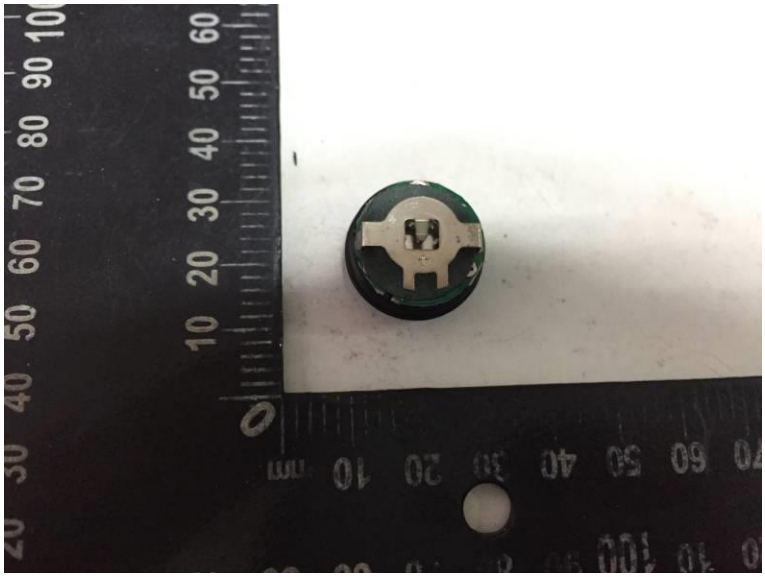
F.L

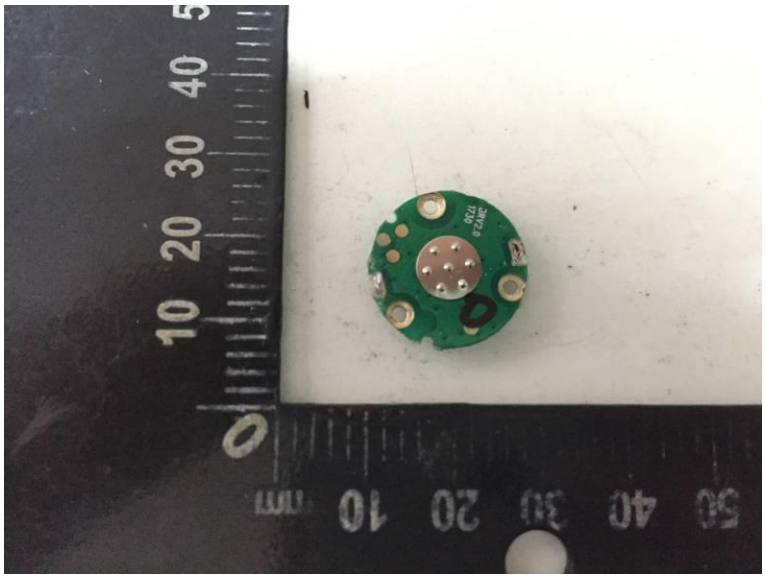


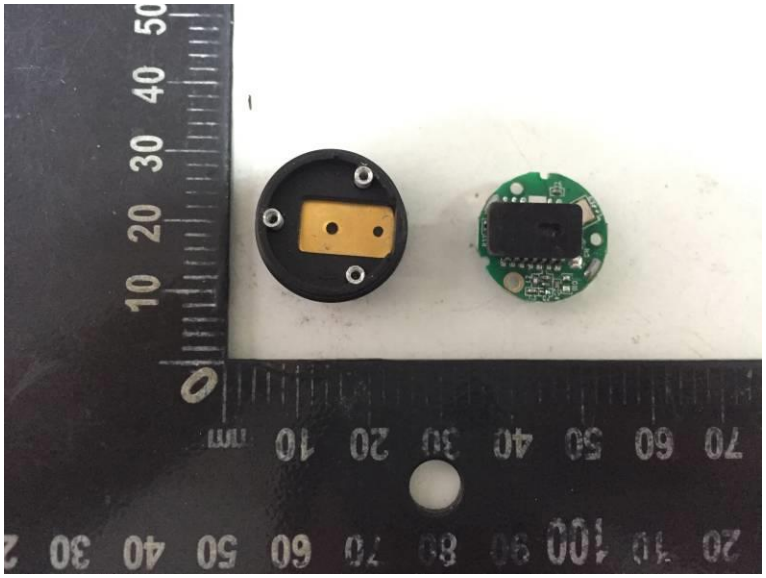

F.L

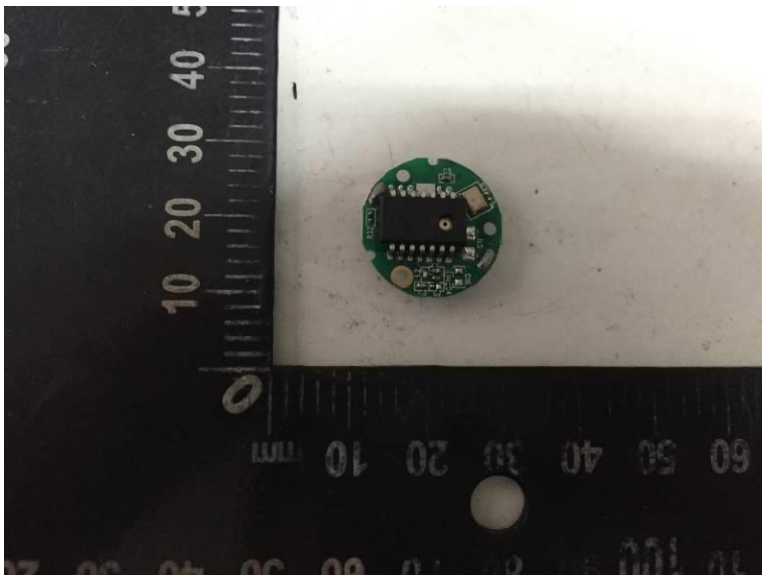
F.L

F.L









.....End of Report.....