FCC TEST REPORT

For

OVAL DIGITAL INC.

OVAL SMART SENSOR SYSTEM

Model No.: OVAL SENSOR & OVAL EXTERNAL SENSOR, OVAL_v01

Prepared For	:	OVAL DIGITAL INC.
Address	:	6 Peter Cooper Road #4F, New York, NY 10010, United States
Prepared By	:	Shenzhen Anbotek Compliance Laboratory Limited
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Report Number	:	R0217080056W
Date of Test	:	Aug. 18~Sept. 18, 2017
Date of Report	:	Sept. 18, 2017

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TEST REPORT

Applicant	:	OVAL DIGITAL INC.
Manufacturer	:	DAH SUN MANUFACTURING CO. LTD.
Product Name	:	OVAL SMART SENSOR SYSTEM
Model No.	:	OVAL SENSOR & OVAL EXTERNAL SENSOR, OVAL_v01
Trade Mark	:	OVAL
Rating(s)	:	DC 3V, 950mAh with battery "CR2477" inside

Test Standard(s)	**:**	**FCC Part15 Subpart C 2016, Section 15.247**
Test Method(s)	**:**	**ANSI C63.10: 2013, KDB558074 D01 DTS Meas Guidance v04**

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart C requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Test : : Aug. 18~Sept. 18, 2017

Prepared by : : Winkey Wang

(Tested Engineer / Winkey Wang)

Reviewer : : Tangcy. T.

(Project Manager / Tangcy. T)

Approved & Authorized Signer : : Tom Chen

(Manager / Tom Chen)

1. General Information

1.1. Client Information

Applicant	:	OVAL DIGITAL INC.
Address	:	6 Peter Cooper Road #4F, New York, NY 10010, United States
Manufacturer	:	DAH SUN MANUFACTURING CO. LTD.
Address	:	Unit 2611, 26/F, 1 Hung To Road, No.1 Hung To Road, Kwun Tong, Kowloon, Hong Kong

1.2. Description of Device (EUT)

Product Name	:	OVAL SMART SENSOR SYSTEM	
Model No.	:	OVAL SENSOR & OVAL EXTERNAL SENSOR, OVAL_v01 (Note: All samples are the same except the model number and colour, so we prepare "OVAL SENSOR & OVAL EXTERNAL SENSOR" for test only.)	
Trade Mark	:	OVAL	
Test Power Supply	:	DC 3V	
Product Description	:	Operation Frequency:	2405MHz~2480MHz
		Number of Channel:	16 Channels
		Modulation Type:	GFSK
		Antenna Type:	PCB Antenna
		Antenna Gain(Peak):	3.3 dbi
Remark: 1)For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.			

1.3. Auxiliary Equipment Used During Test

Adapter	:	N.A.

1.4. Description of Test Modes

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	CH01
Mode 2	CH08
Mode 3	CH16
Mode 4	Keeping TX mode

For Radiated Emission	
Final Test Mode	Description
Mode 1	CH01
Mode 2	CH08
Mode 3	CH16

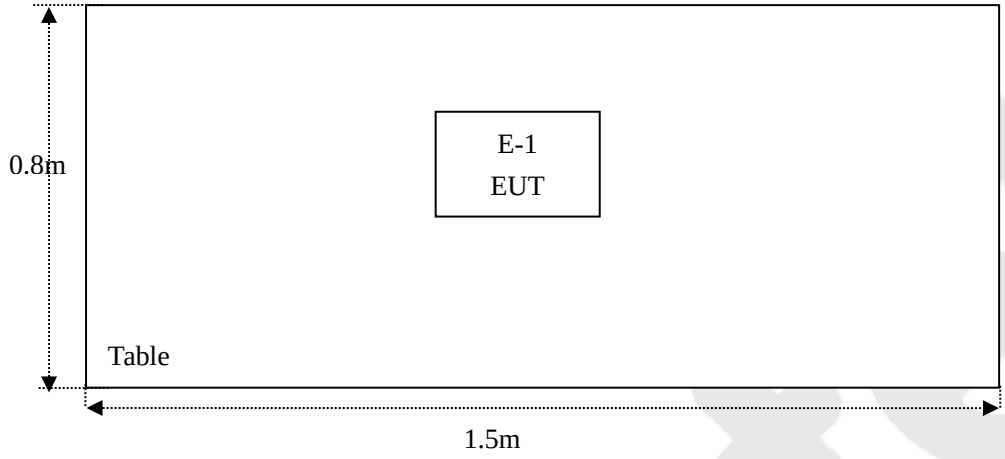
Note:
(1) The measurements are performed at the highest, middle, lowest available channels.
(2)The data rate was set in 1Mbps for radiated emission due to the highest RF output power.

1.5. List of channels

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
01	2405	05	2425	09	2445	13	2465
02	2410	06	2430	10	2450	14	2470
03	2415	07	2435	11	2455	15	2475
04	2420	08	2440	12	2460	16	2480

1.6. Description Of Test Setup

RE



1.7. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	Rohde & Schwarz	ENV216	100055	May 27, 2017	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	May 27, 2017	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	May 27, 2017	1 Year
4.	Spectrum Analysis	Agilent	E4407B	US39390582	May 27, 2017	1 Year
5.	Preamplifier	SKET Electronic	BK1G18G30D	KD17503	May 27, 2017	1 Year
6.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	May 27, 2017	1 Year
7.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	May 31, 2017	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	May 31, 2017	1 Year
9.	Loop Antenna	Schwarzbeck	HFH2-Z2	100047	Apr. 03, 2017	1 Year
10.	Pre-amplifier	SONOMA	310N	186860	May 27, 2017	1 Year
11.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
12.	Power Sensor	DAER	RPR3006W	15I00041SN045	May 27, 2017	1 Year
13.	Power Sensor	DAER	RPR3006W	15I00041SN046	May 27, 2017	1 Year
14.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	May 27, 2017	1 Year
15.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	May 27, 2017	1 Year
16.	Signal Generator	Agilent	E4421B	MY41000743	May 27, 2017	1 Year
17.	DC Power supply	IVYTECH	IV6003	1601D6030007	May 26, 2017	1 Year
18.	TEMP&HUMI PROGRAMMABLE CHAMBER	Sertep	ZJ-HWHS80B	ZJ-17042804	Mar. 03, 2017	1 Year

1.8. Measurement Uncertainty

Radiation Uncertainty	:	Ur = 4.1 dB (Horizontal)
		Ur = 4.3 dB (Vertical)
Conduction Uncertainty	:	Uc = 3.4dB

1.9. Description of Test Facility

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

FCC-Registration No.: 184111

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registed and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No. 184111, July 31, 2017.

ISED-Registration No.: 8058A-1

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (ISED) Innovation, Science and Economic Development Canada. The acceptance letter from the ISED is maintained in our files. Registration 8058A-1, June 13, 2016.

Test Location

All Emissions tests were performed at

Shenzhen Anbotek Compliance Laboratory Limited. at 1/F., Building 1, SEC Industrial Park, No.0409 Qianhai Road, Nanshan District, Shenzhen, Guangdong, China

2. Summary of Test Results

Standard Section	Test Item	Result
15.203/15.247(c)	Antenna Requirement	PASS
15.207	Conducted Emission	N/A
15.205/15.209	Spurious Emission	PASS
15.247(b)(3)	Maximum Peak Output Power	PASS
15.247(a)(2)	6dB Occupied Bandwidth	PASS
15.247(e)	Power Spectral Density	PASS
15.247(d)	Band Edge	PASS
Remark: "N/A" is an abbreviation for Not Applicable.		

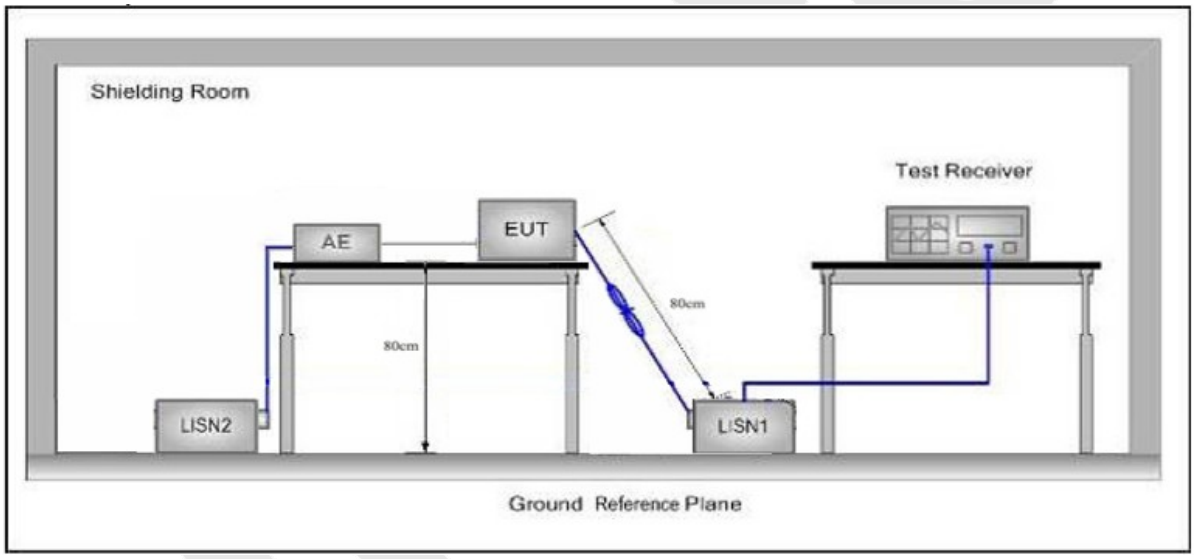
3. Conducted Emission Test

3.1. Test Standard and Limit

Test Standard	FCC Part15 Section 15.207		
Test Limit	Frequency	Maximum RF Line Voltage (dBuV)	
		Quasi-peak Level	Average Level
	150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
	500kHz~5MHz	56	46
	5MHz~30MHz	60	50

Remark: (1) *Decreasing linearly with logarithm of the frequency.
(2) The lower limit shall apply at the transition frequency.

3.2. Test Setup



3.3. Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.10-2013 on Conducted Emission Measurement.
The bandwidth of test receiver (ESCI) set at 9kHz.
The frequency range from 150kHz to 30MHz is checked.

3.4. Test Data

The EUT is powered by DC 3V battery inside, so there is no need to conduct this test.

4. Radiation Spurious Emission and Band Edge

4.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.209 and 15.205				
Test Limit	Frequency (MHz)	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz~0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz~88MHz	100	40.0	Quasi-peak	3
	88MHz~216MHz	150	43.5	Quasi-peak	3
	216MHz~960MHz	200	46.0	Quasi-peak	3
	960MHz~1000MHz	500	54.0	Quasi-peak	3
	Above 1000MHz	500	54.0	Average	3
		-	74.0	Peak	3

Remark:

(1)The lower limit shall apply at the transition frequency.

(2) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

4.2. Test Setup

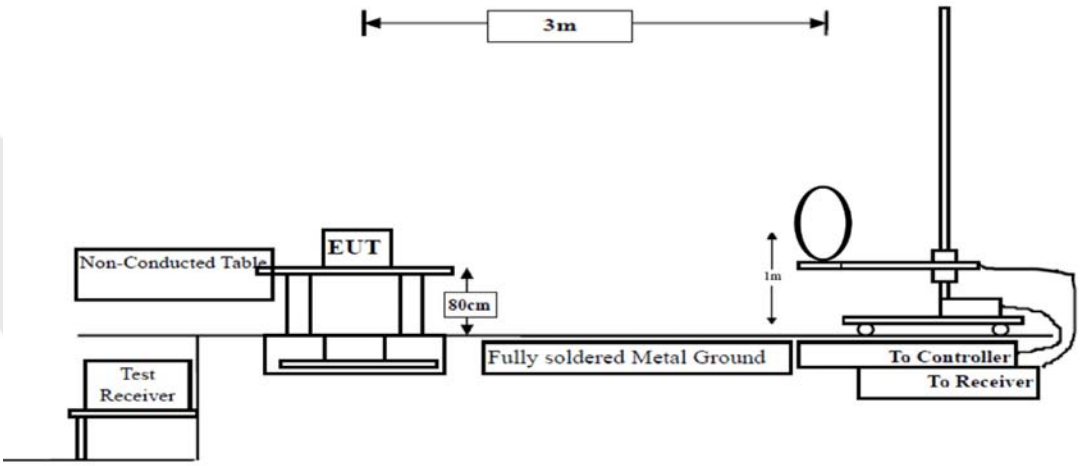


Figure 1. Below 30MHz

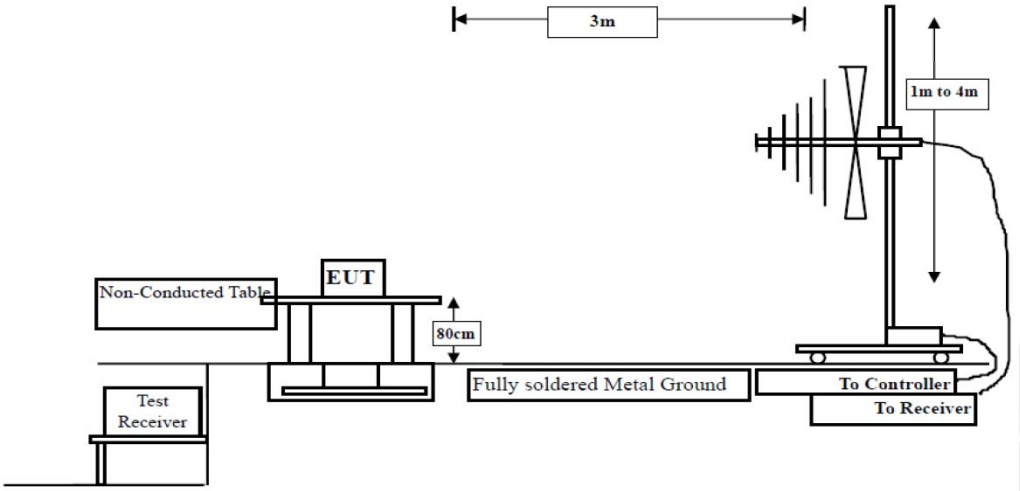


Figure 2. 30MHz to 1GHz

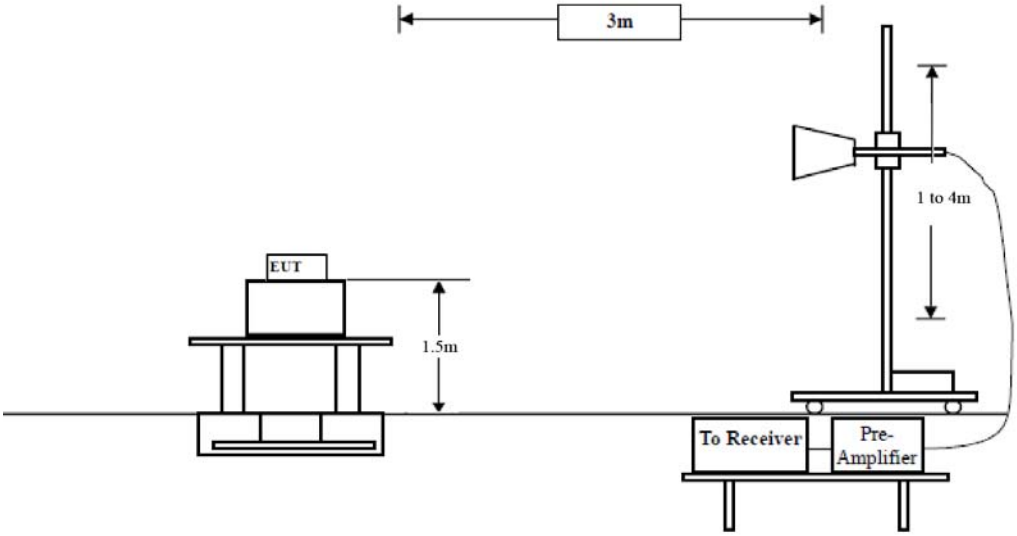


Figure 3. Above 1 GHz

4.3. Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane.
For above 1GHz: The EUT is placed on a turntable, which is 1.5m above the ground plane.
The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Rotated the EUT through three orthogonal axes to determine the maximum emissions, both horizontal and vertical polarization of the antenna are set on test. The EUT is tested in 9*6*6 Chamber. The device is evaluated in xyz orientation.

For 9kHz to 150kHz, Set the spectrum analyzer as:
RBW = 200Hz, VBW =1kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 9kHz to 150kHz, Set the spectrum analyzer as:
RBW = 200Hz, VBW =1kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 150kHz to 30MHz, Set the spectrum analyzer as:
RBW = 9KHz, VBW =30kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 30MHz to 1000MHz, Set the spectrum analyzer as:
RBW = 100kHz, VBW =300kHz,Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For above 1GHz,Set the spectrum analyzer as:
RBW =1MHz, VBW =1MHz, Detector= Peak, Trace mode= Max hold, Sweep- auto couple.
RBW =1MHz, VBW =10Hz, Detector= Average, Trace mode= Max hold, Sweep- auto couple.

4.4. Test Data

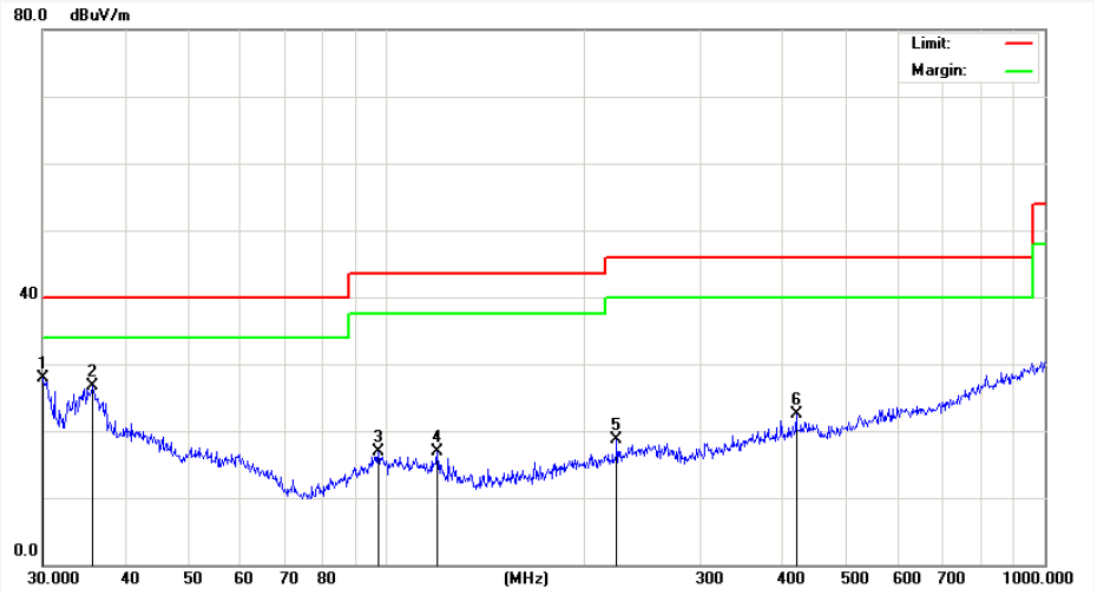
PASS

During the test, Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis is the worst case.

The test results of 9kHz-30MHz and above 18000MHz are attenuated more than 20dB below the permissible limits, so the results don't record in the report.

Test Results (30~1000MHz)

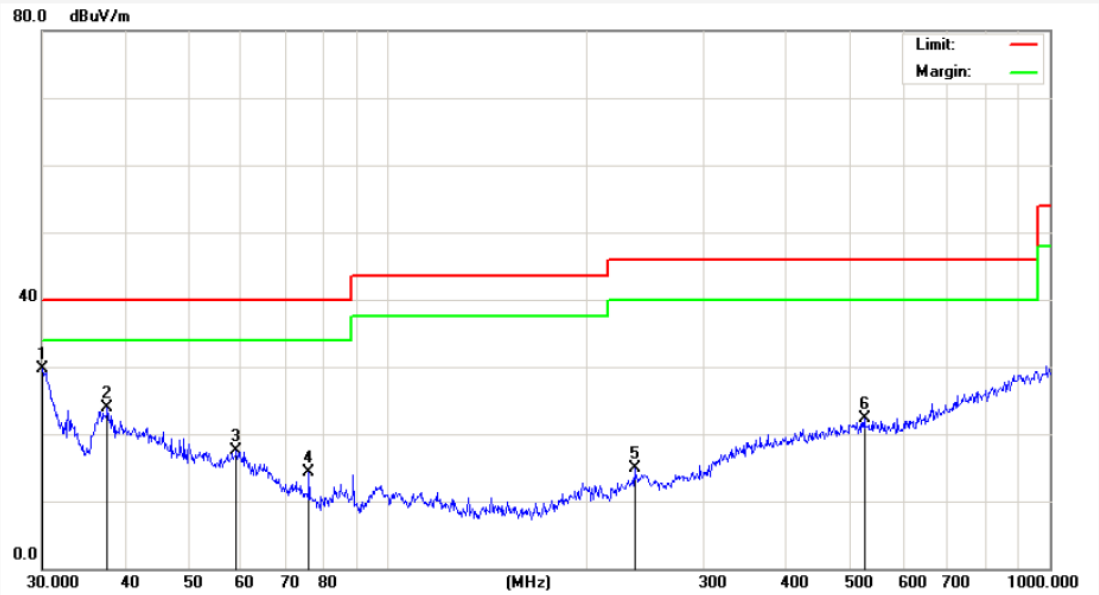
Job No.:	0217080056W	Temp.(℃)/Hum.(%RH):	24.3℃/55%RH
Standard:	FCC PART 15C	Power Source:	DC 3V
Test Mode:	TX Mode	Polarization:	Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	30.0000	44.86	-16.95	27.91	40.00	-12.09	QP	300	12	
2	35.7490	40.66	-13.99	26.67	40.00	-13.33	QP	300	53	
3	97.1148	37.80	-20.91	16.89	43.50	-26.61	QP	300	99	
4	119.4361	38.14	-21.29	16.85	43.50	-26.65	QP	300	143	
5	223.7334	38.52	-19.73	18.79	46.00	-27.21	QP	300	204	
6	419.1081	34.88	-12.40	22.48	46.00	-23.52	QP	300	314	

Test Results (30~1000MHz)

Job No.:	0217080056W	Temp.(℃)/Hum.(%RH):	24.3℃/55%RH
Standard:	FCC PART 15C	Power Source:	DC 3V
Test Mode:	TX Mode	Polarization:	Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	30.0000	46.68	-16.95	29.73	40.00	-10.27	QP	300	31	
2	37.6798	36.47	-12.57	23.90	40.00	-16.10	QP	300	64	
3	59.0251	32.88	-15.31	17.57	40.00	-22.43	QP	300	124	
4	75.9773	34.76	-20.48	14.28	40.00	-25.72	QP	300	210	
5	235.8164	29.12	-14.31	14.81	46.00	-31.19	QP	300	243	
6	524.5541	32.80	-10.53	22.27	46.00	-23.73	QP	300	305	

Test Results (Above 1000MHz)

Test Mode: TX Mode					Test channel: Lowest			
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4810.00	38.23	34.04	6.58	34.09	44.76	74.00	-29.24	V
7215.00	32.45	37.11	7.73	34.50	42.79	74.00	-31.21	V
9620.00	32.02	39.31	9.23	34.79	45.77	74.00	-28.23	V
12025.00	*					74.00		V
14430.00	*					74.00		V
4810.00	42.71	34.04	6.58	34.09	49.24	74.00	-24.76	H
7215.00	34.28	37.11	7.73	34.50	44.62	74.00	-29.38	H
9620.00	31.53	39.31	9.23	34.79	45.28	74.00	-28.72	H
12025.00	*					74.00		H
14430.00	*					74.00		H
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4810.00	26.87	34.04	6.58	34.09	33.40	54.00	-20.60	V
7215.00	21.03	37.11	7.73	34.50	31.37	54.00	-22.63	V
9620.00	20.05	39.31	9.23	34.79	33.80	54.00	-20.20	V
12025.00	*					54.00		V
14430.00	*					54.00		V
4810.00	31.20	34.04	6.58	34.09	37.73	54.00	-16.27	H
7215.00	23.26	37.11	7.73	34.50	33.60	54.00	-20.40	H
9620.00	19.85	39.31	9.23	34.79	33.60	54.00	-20.40	H
12025.00	*					54.00		H
14430.00	*					54.00		H

Test Results (Above 1000MHz)

Test Mode: TX Mode					Test channel: Middle			
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4880.00	37.11	34.38	6.69	34.09	44.09	74.00	-29.91	V
7320.00	31.70	37.22	7.78	34.53	42.17	74.00	-31.83	V
9760.00	31.35	39.46	9.35	34.80	45.36	74.00	-28.64	V
12200.00	*					74.00		V
14640.00	*					74.00		V
4880.00	41.35	34.38	6.69	34.09	48.33	74.00	-25.67	H
7320.00	33.44	37.22	7.78	34.53	43.91	74.00	-30.09	H
9760.00	30.75	39.46	9.35	34.80	44.76	74.00	-29.24	H
12200.00	*					74.00		H
14640.00	*					74.00		H
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4880.00	25.97	34.38	6.69	34.09	32.95	54.00	-21.05	V
7320.00	20.42	37.22	7.78	34.53	30.89	54.00	-23.11	V
9760.00	19.50	39.46	9.35	34.80	33.51	54.00	-20.49	V
12200.00	*					54.00		V
14640.00	*					54.00		V
4880.00	30.18	34.38	6.69	34.09	37.16	54.00	-16.84	H
7320.00	22.58	37.22	7.78	34.53	33.05	54.00	-20.95	H
9760.00	19.22	39.46	9.35	34.80	33.23	54.00	-20.77	H
12200.00	*					54.00		H
14640.00	*					54.00		H

Test Results (Above 1000MHz)

Test Mode: TX Mode					Test channel: Highest			
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4960.00	36.32	34.72	6.79	34.09	43.74	74.00	-30.26	V
7440.00	31.18	37.34	7.82	34.57	41.77	74.00	-32.23	V
9920.00	30.89	39.62	9.46	34.81	45.16	74.00	-28.84	V
12400.00	*					74.00		V
14880.00	*					74.00		V
4960.00	40.41	34.72	6.79	34.09	47.83	74.00	-26.17	H
7440.00	32.85	37.34	7.82	34.57	43.44	74.00	-30.56	H
9920.00	30.22	39.62	9.46	34.81	44.49	74.00	-29.51	H
12400.00	*					74.00		H
14880.00	*					74.00		H
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4960.00	25.38	34.72	6.79	34.09	32.80	54.00	-21.20	V
7440.00	20.01	37.34	7.82	34.57	30.60	54.00	-23.40	V
9920.00	19.15	39.62	9.46	34.81	33.42	54.00	-20.58	V
12400.00	*					54.00		V
14880.00	*					54.00		V
4960.00	29.51	34.72	6.79	34.09	36.93	54.00	-17.07	H
7440.00	22.13	37.34	7.82	34.57	32.72	54.00	-21.28	H
9920.00	18.80	39.62	9.46	34.81	33.07	54.00	-20.93	H
12400.00	*					54.00		H
14880.00	*					54.00		H

Remark:

1. Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

2. “*”, means this data is the too weak instrument of signal is unable to test.

Radiated Band Edge:

Test Mode: GFSK					Test channel: Lowest			
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
2390.00	55.21	29.15	3.41	34.01	53.76	74.00	-20.24	H
2400.00	60.10	29.16	3.43	34.01	58.68	74.00	-15.32	H
2390.00	54.20	29.15	3.41	34.01	52.75	74.00	-21.25	V
2400.00	63.12	29.16	3.43	34.01	61.70	74.00	-12.30	V
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
2390.00	41.63	29.15	3.41	34.01	40.18	54.00	-13.82	H
2400.00	45.21	29.16	3.43	34.01	43.79	54.00	-10.21	H
2390.00	41.22	29.15	3.41	34.01	39.77	54.00	-14.23	V
2400.00	44.96	29.16	3.43	34.01	43.54	54.00	-10.46	V

Test Mode: GFSK					Test channel: Highest			
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
2483.50	51.22	29.28	3.53	34.03	50.00	74.00	-24.00	H
2500.00	47.26	29.30	3.56	34.03	46.09	74.00	-27.91	H
2483.50	50.23	29.28	3.53	34.03	49.01	74.00	-24.99	V
2500.00	48.22	29.30	3.56	34.03	47.05	74.00	-26.95	V
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
2483.50	42.36	29.28	3.53	34.03	41.14	54.00	-12.86	H
2500.00	36.55	29.30	3.56	34.03	35.38	54.00	-18.62	H
2483.50	44.21	29.28	3.53	34.03	42.99	54.00	-11.01	V
2500.00	36.99	29.30	3.56	34.03	35.82	54.00	-18.18	V

Remark:

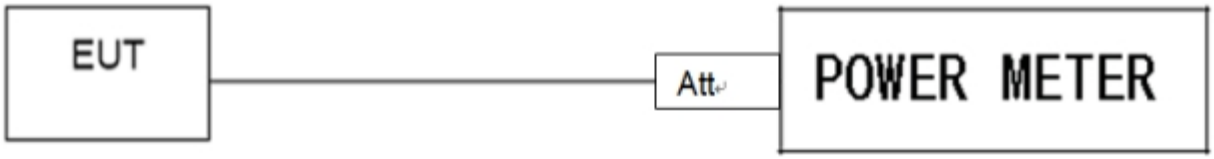
1. Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

5. Output Power Test

5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (b)(3)
Test Limit	30dBm

5.2. Test Setup



5.3. Test Procedure

1. The Transmitter output (antenna port) was connected to the power meter.
2. Turn on the EUT and power meter and then record the power value.
3. Repeat above procedures on all channels needed to be tested.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

5.4. Test Data

Test Item	:	output power	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 3V	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

Channel Frequency (MHz)	Maximum Power output(AV) (dBm)	Limit (dBm)	Results
2405	1.106	30	PASS
2440	0.564	30	PASS
2480	0.385	30	PASS

For power test the duty cycle is 100% in continous transmitting mode

6. Dutycycle

a.Test Procedure

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal.

Set the center frequency of the instrument to the center frequency of the transmission.

Set RBW ≥OBW if possible; otherwise, set RBW to the largest available value.

Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT was operating in controlled its channel.

Use the following spectrum analyzer settings:

Span = Zero Span

RBW = 8MHz

VBW =8MHz

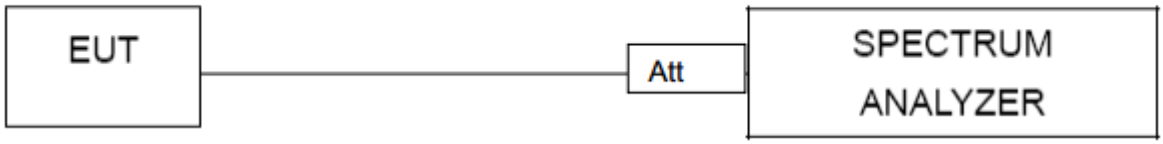
Number of points in Sweep >100

Detector function = peak

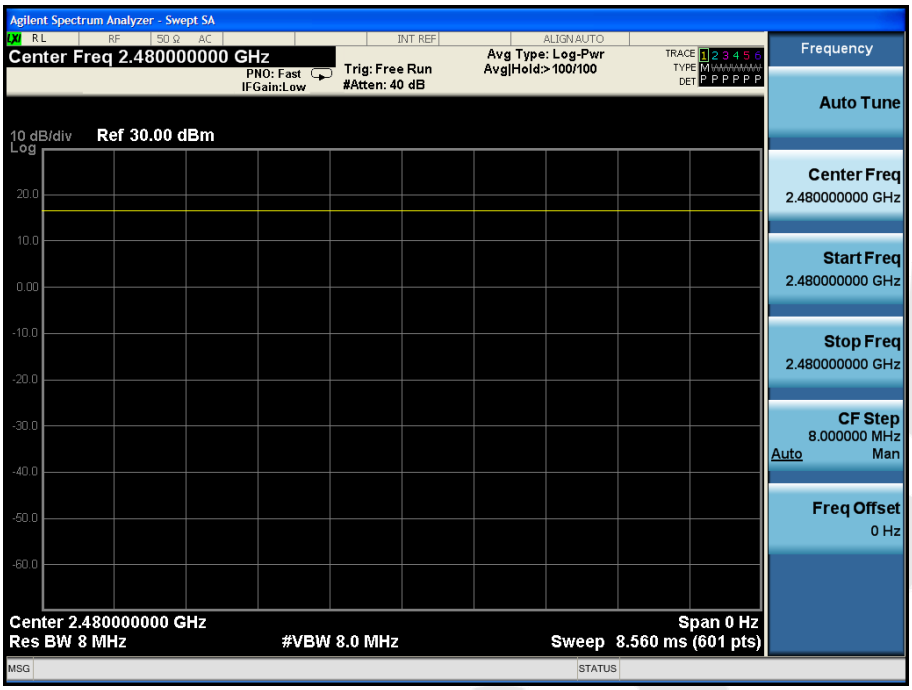
Trace = Clear write Measure Ttotal and Ton

Calculate Duty Cycle = Ton / Ttotal and Duty Cycle Factor=10*log(1/Duty Cycle)

b.TEST SETUP



Test plot of Duty Cycle for Middle Channel

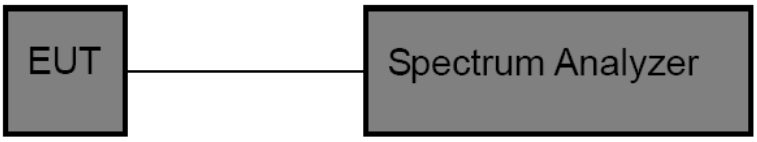


7. 6DB Occupy Bandwidth Test

7.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (a)(2)
Test Limit	>500kHz

7.2. Test Setup



7.3. Test Procedure

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as:

RBW = 100kHz, VBW⩾3*RBW =300kHz,

Detector= Peak

Trace mode= Max hold.

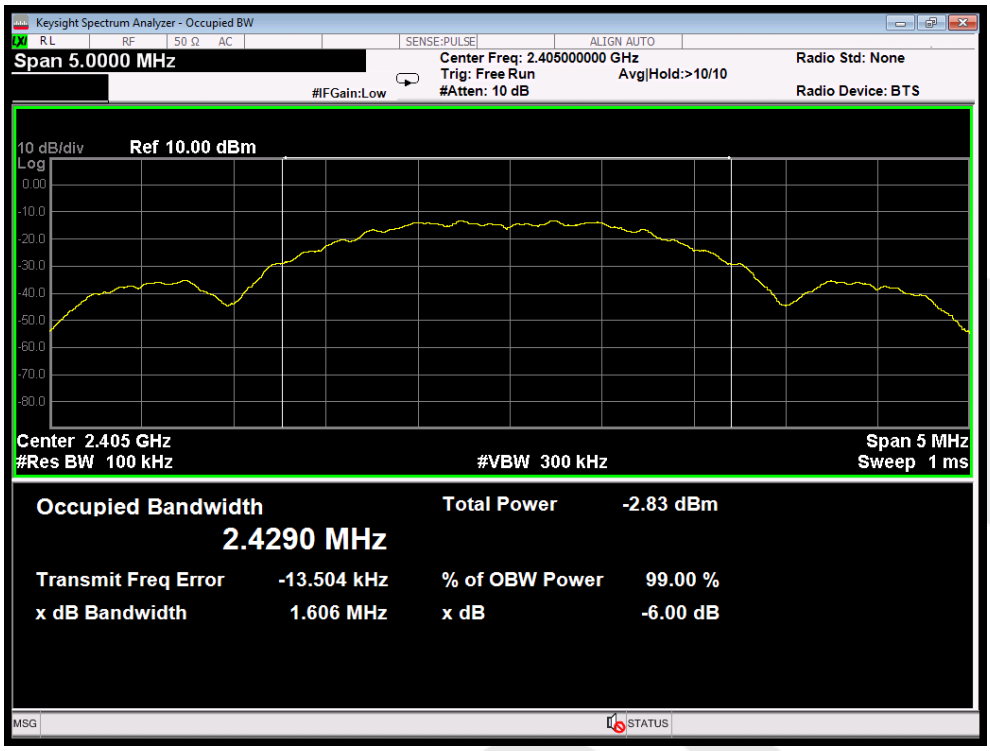
Sweep- auto couple.

4. Mark the peak frequency and –6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

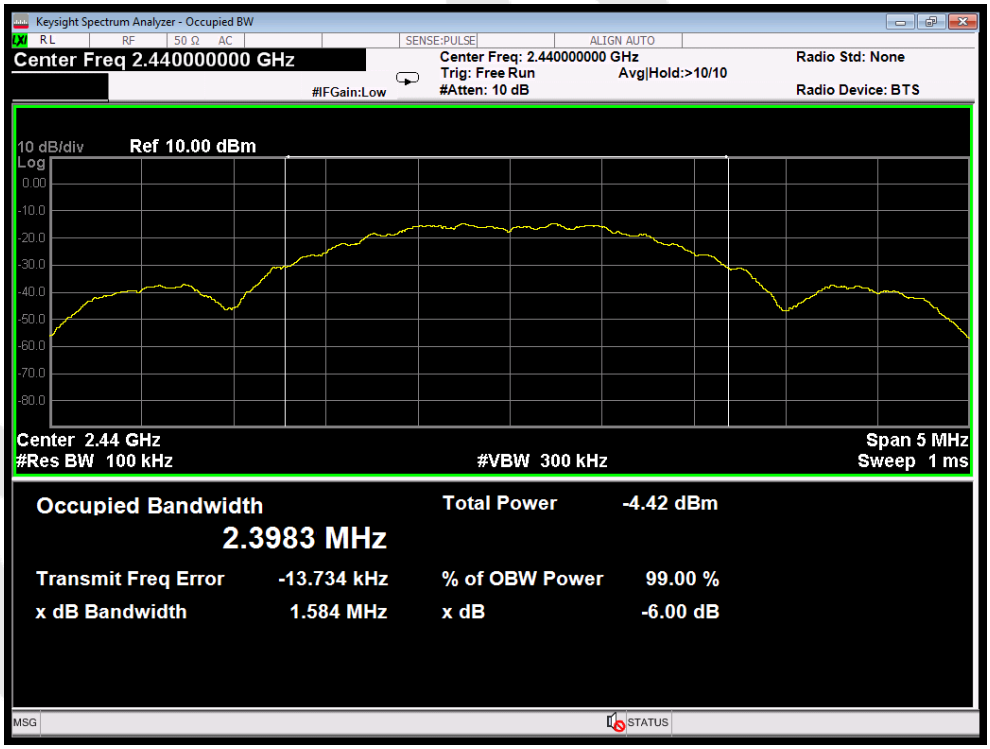
7.4. Test Data

Test Item	:	6dB Bandwidth	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 3V	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

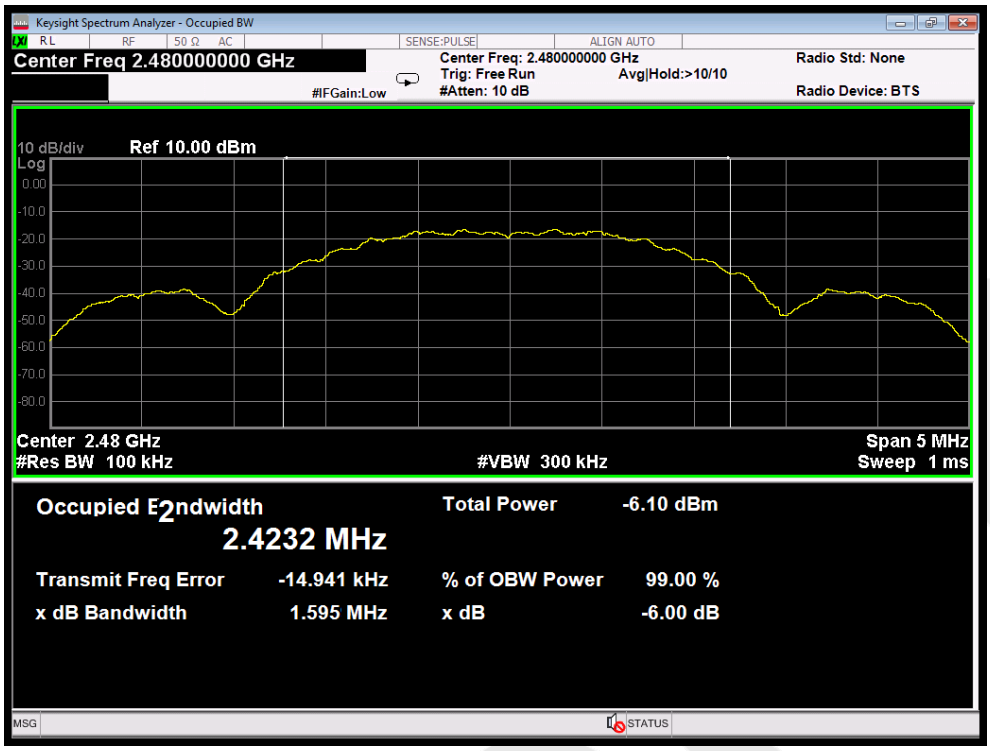
Channel	Frequency(MHz)	Bandwidth (kHz)	Limit (kHz)	Results
Low	2405	1606	>500	PASS
Middle	2440	1584		PASS
High	2480	1595		PASS



CH: Low



CH: Middle


Keysight Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
#Atten: 10 dB
Avg|Hold:>10/10
Radio Std: None
Radio Device: BTS
#IFGain:Low
10 dB/div
Ref 10.00 dBm
Center 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 5 MHz
Sweep 1 ms
Occupied Bandwidth
2.4232 MHz
Total Power -6.10 dBm
Transmit Freq Error -14.941 kHz
% of OBW Power 99.00 %
x dB Bandwidth 1.595 MHz
x dB -6.00 dB
MSG
STATUS

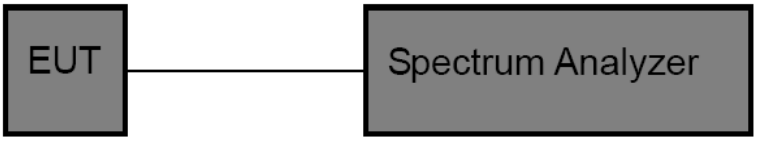
CH: High

8. Power Spectral Density Test

8.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (e)
Test Limit	8dBm

8.2. Test Setup



8.3. Test Procedure

1. Place the EUT on the table and set it in transmitting mode. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 3kHz, VBW = 10kHz, Span = 1.5xDTS BW
3. Record the max. reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

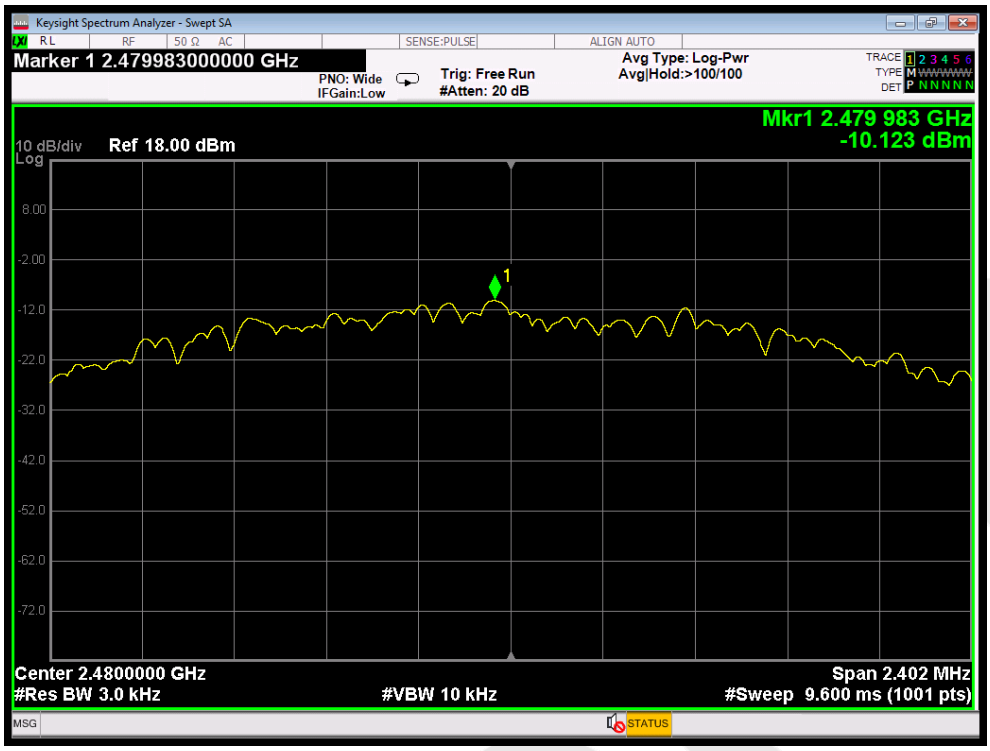
8.4. Test Data

Test Item	:	Power Spectral Density	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 3V	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

Channel	Frequency (MHz)	PSD (dBm/3KHz)	Limit (dBm/3KHz)	Results
Low	2405	**-14.088**	8.00	PASS
Middle	2440	-10.002	8.00	PASS
High	2480	-10.123	8.00	PASS

CH: Low

CH: Middle


Keysight Spectrum Analyzer - Swept SA
Marker 1 2.479983000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.479 983 GHz
-10.123 dBm
10 dB/div
Ref 18.00 dBm
Center 2.4800000 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 2.402 MHz
#Sweep 9.600 ms (1001 pts)

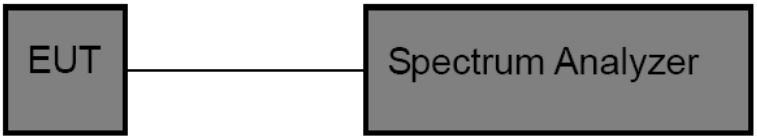
CH: High

9. 100kHz Bandwidth of Frequency Band Edge Requirement

9.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (d)
Test Limit	in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in15.209(a).

9.2. Test Setup



9.3. Test Procedure

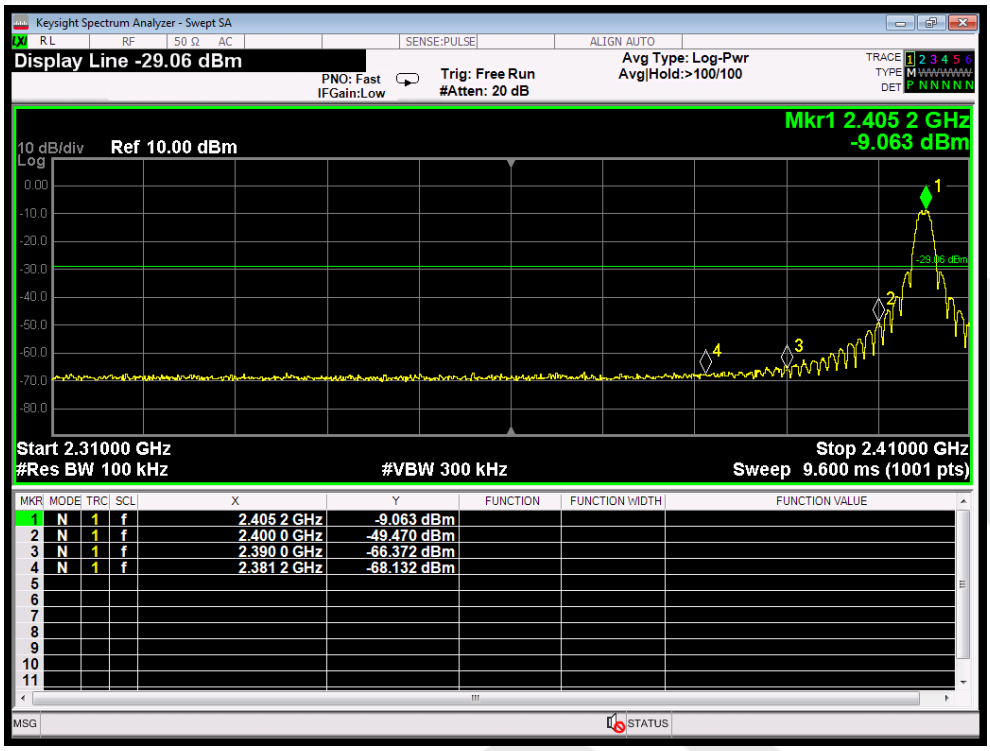
Using the following spectrum analyzer setting:

1. Set the RBW = 100KHz.
2. Set the VBW = 300KHz.
3. Sweep time = auto couple.
4. Detector function = peak.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.

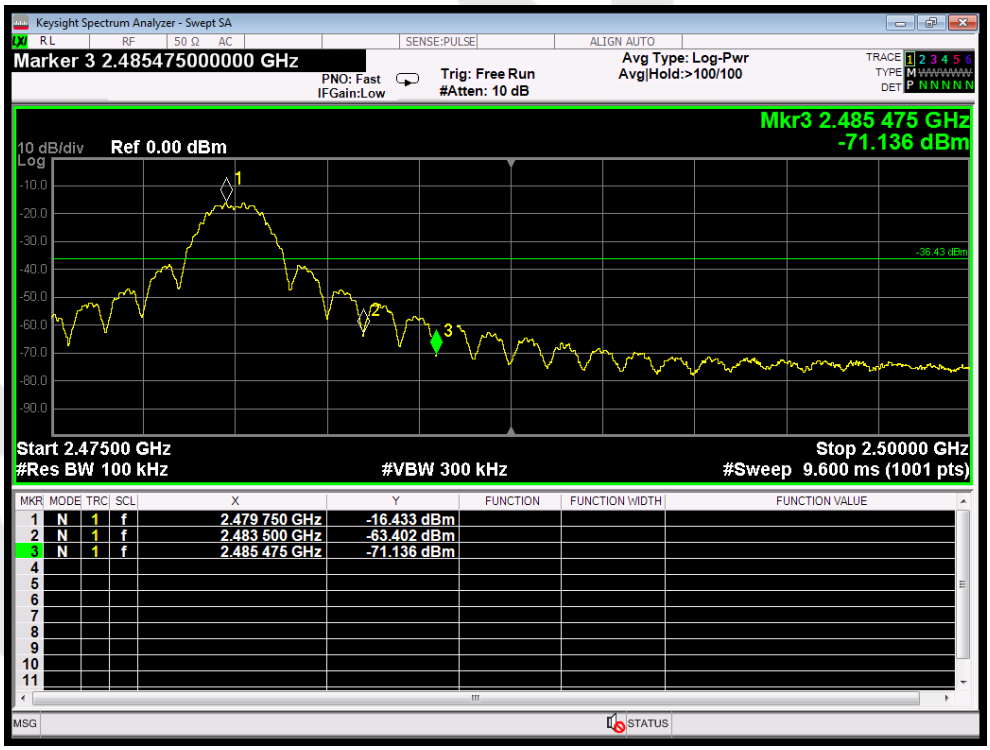
9.4. Test Data

Test Item	:	Band edge	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 3V	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

Frequency Band (MHz)	Delta Peak toBand Emission (dBc)	Limit (dBc)	Results
2405	40.407	>30	PASS
2480	46.969	>30	PASS

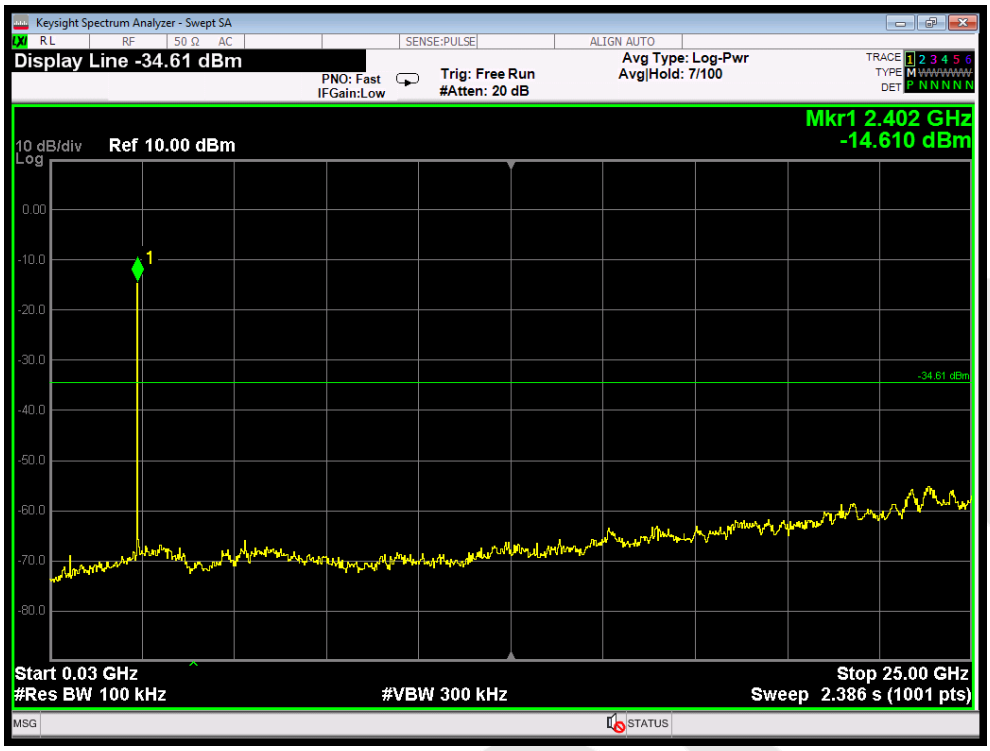


CH: Low

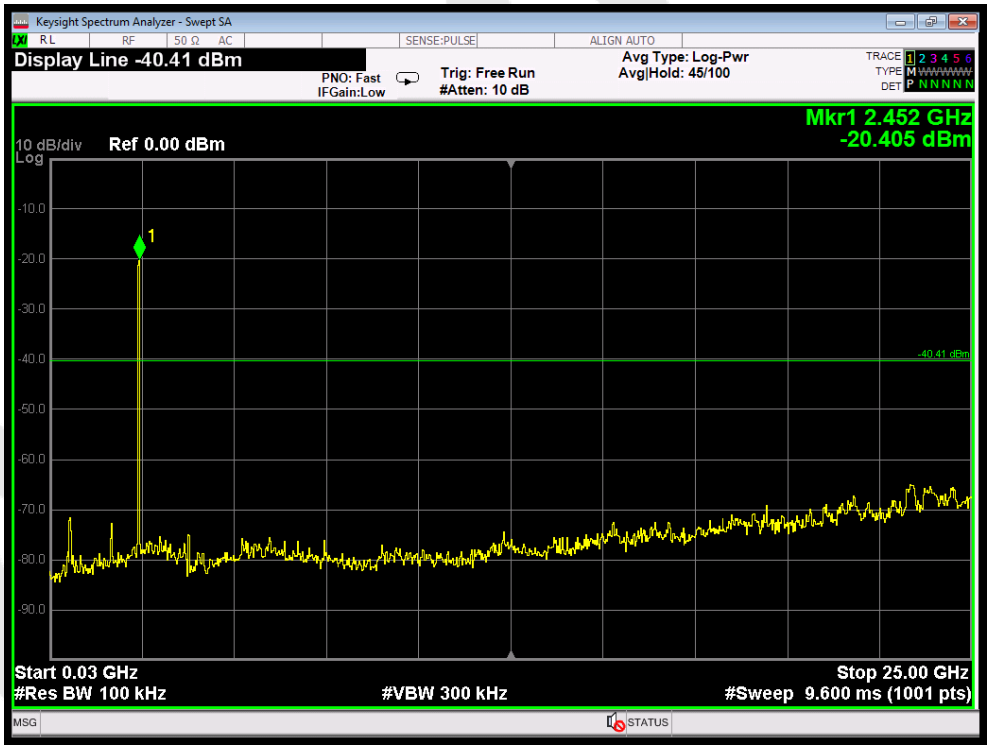


CH: High

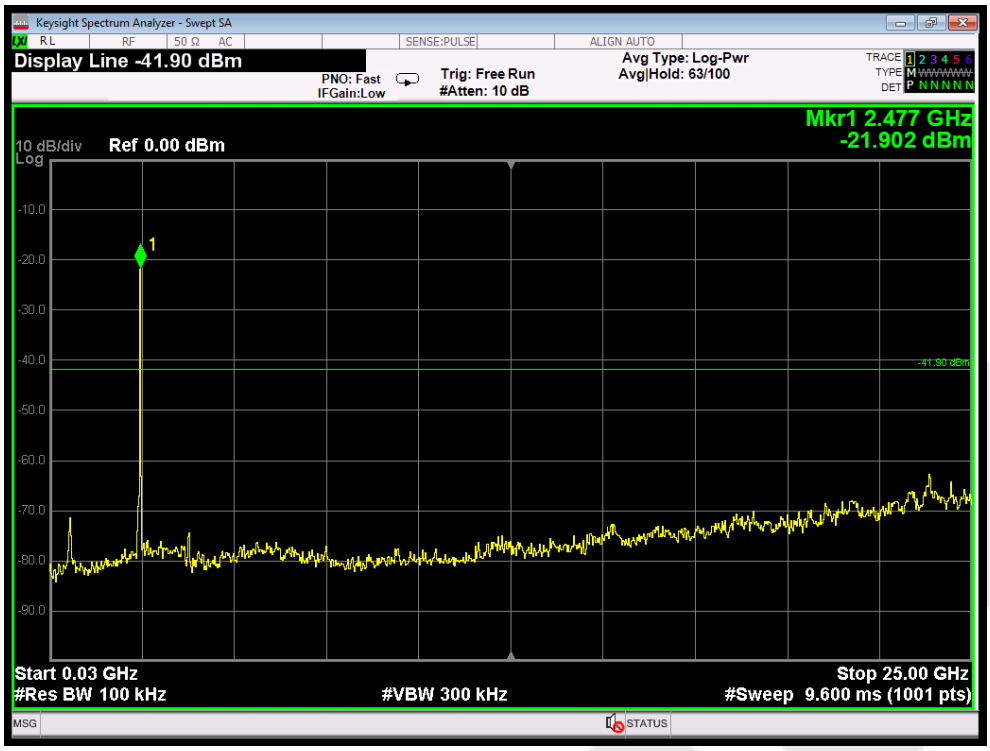
Conducted Emission Method



CH: Low



CH: Middle


Keysight Spectrum Analyzer - Swept SA
Display Line -41.90 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold: 63/100
Mkr1 2.477 GHz
-21.902 dBm
10 dB/div
Ref 0.00 dBm
Log
-41.90 dBm
Start 0.03 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
#Sweep 9.600 ms (1001 pts)

CH: High

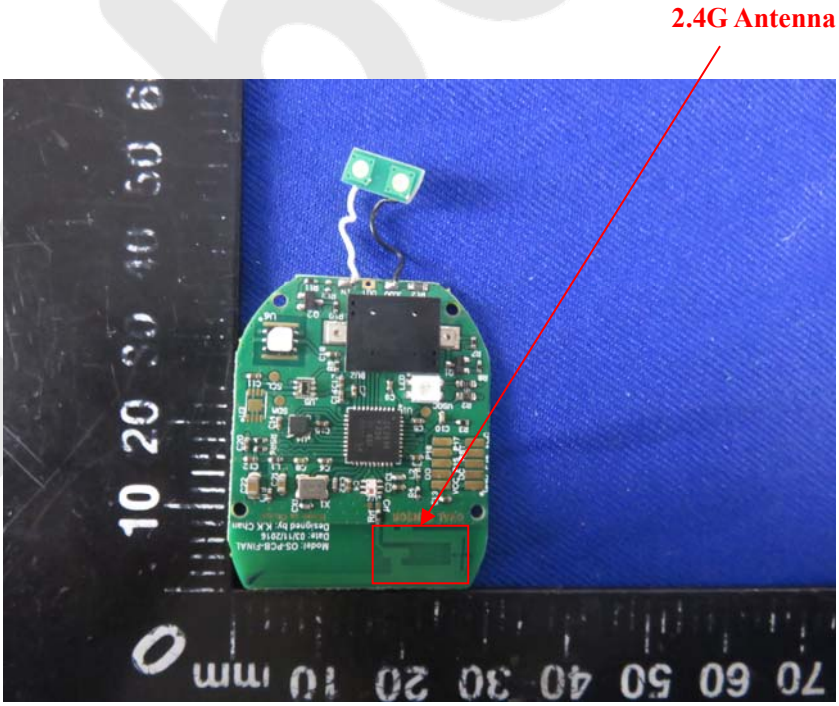
10. Antenna Requirement

10.1. Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203 /247(c)
Requirement	1) 15.203 requirement: 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, 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. 2) 15.247(c) (1)(i) requirement: Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

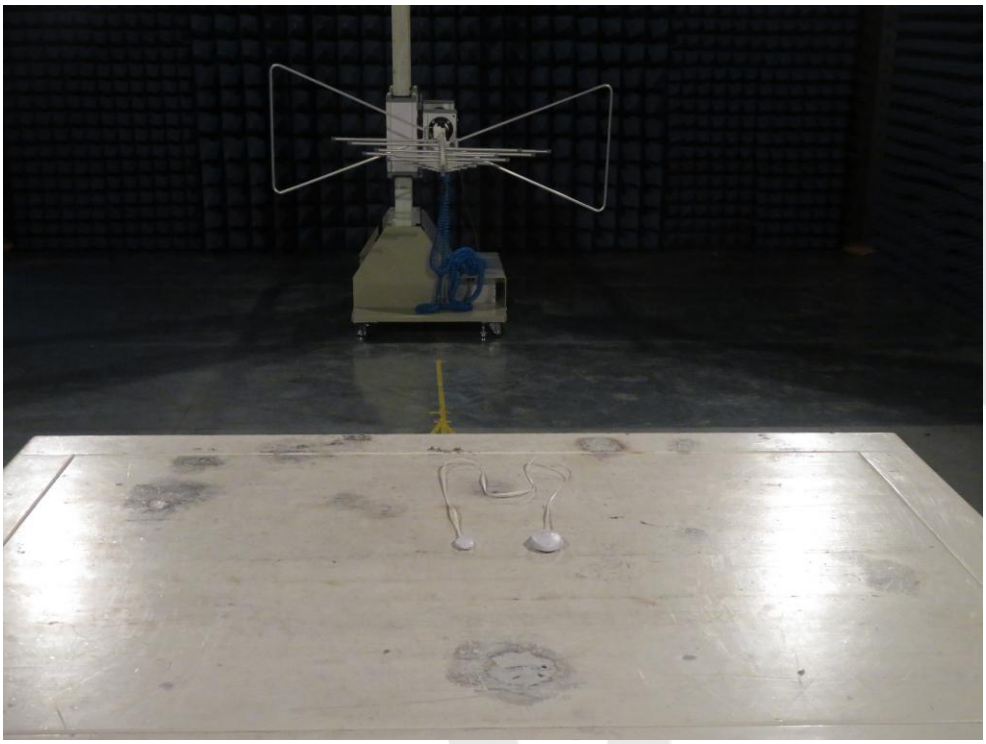
10.2. Antenna Connected Construction

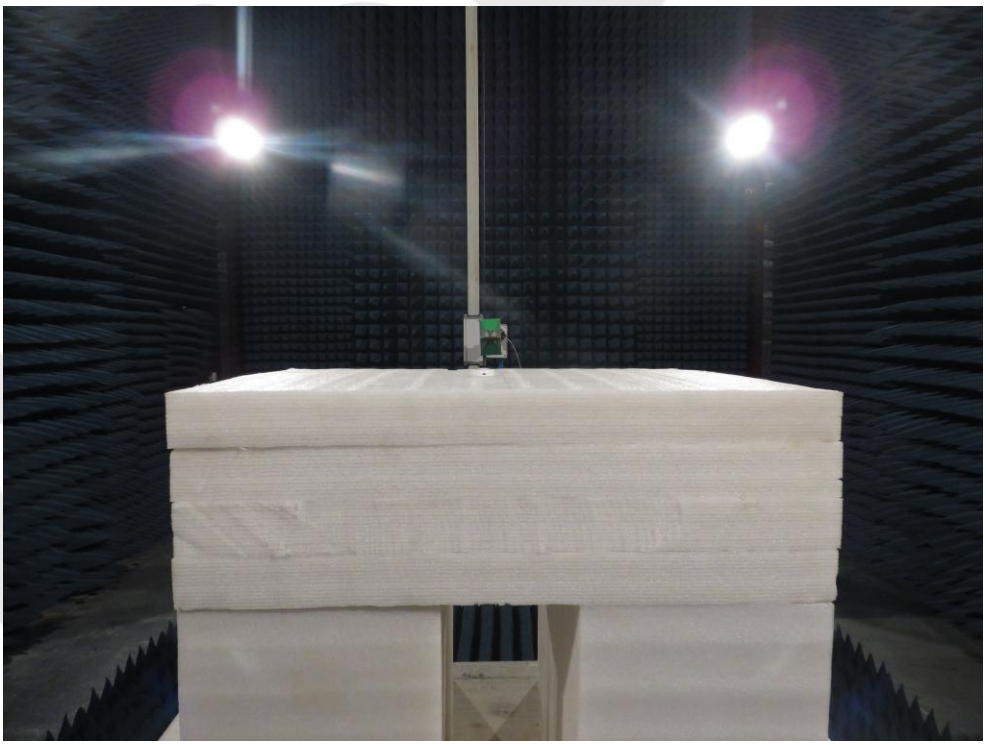
The bluetooth antenna is a PCB Antenna which permanently attached, and the best case gain of the antenna is 3.3dbi. It complies with the standard requirement.

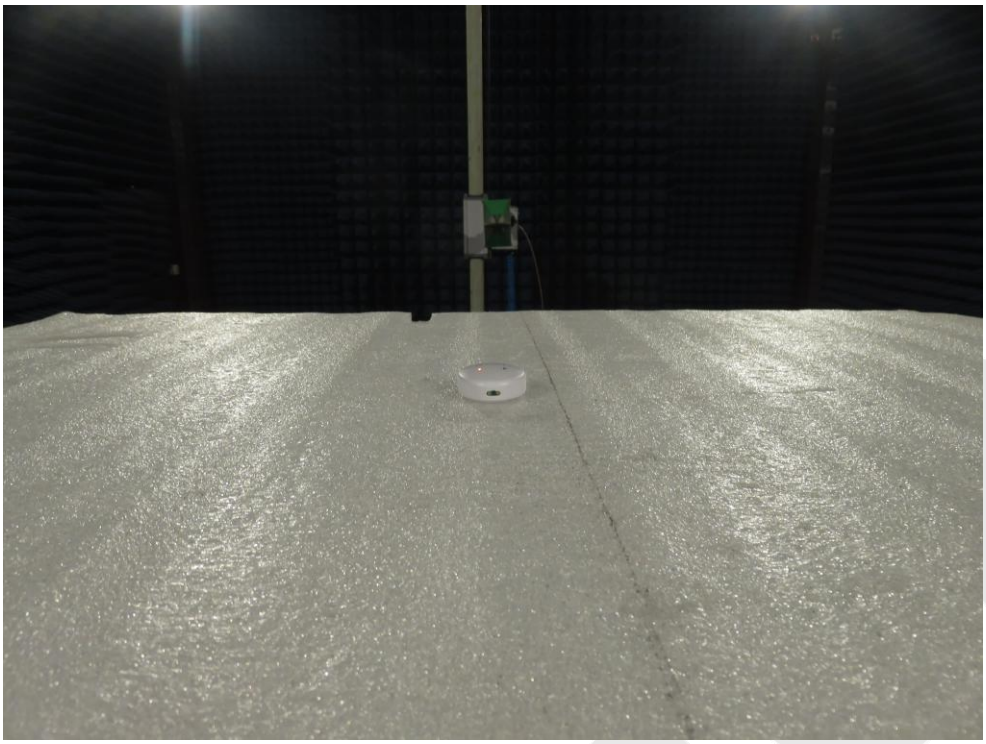


APPENDIX I -- TEST SETUP PHOTOGRAPH

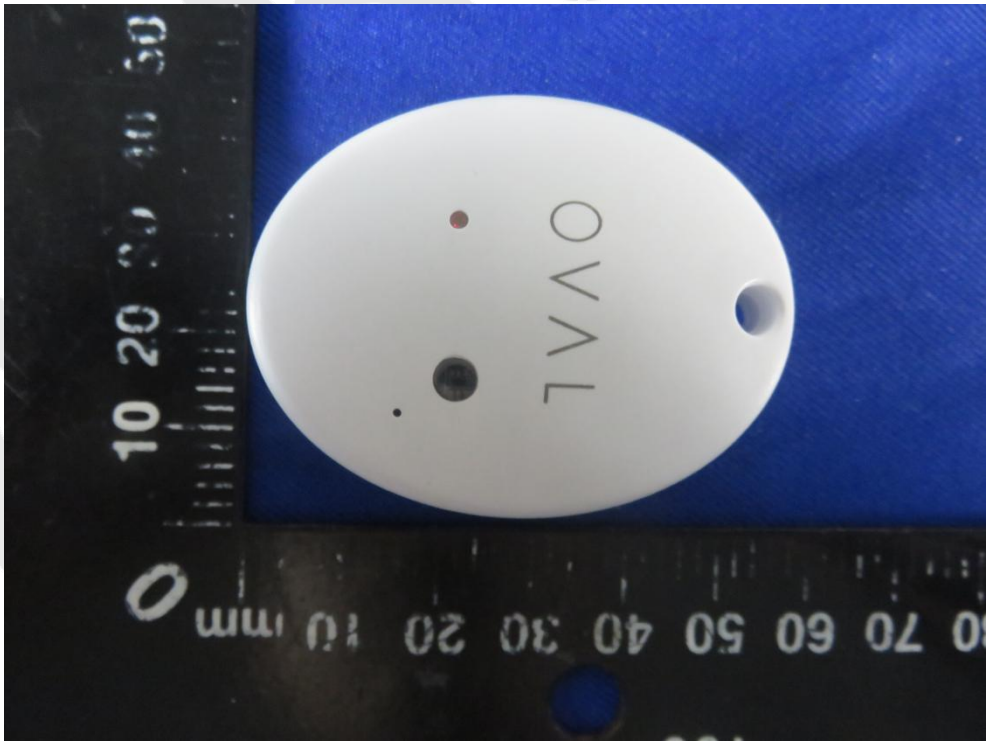
Photo of Radiation Emission Test





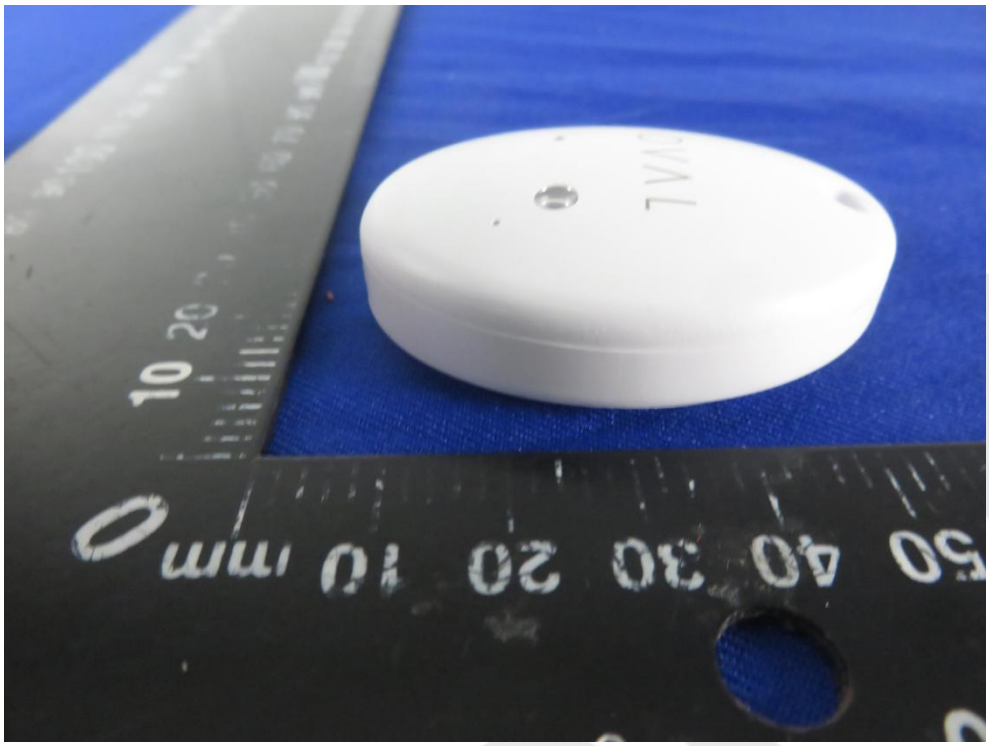


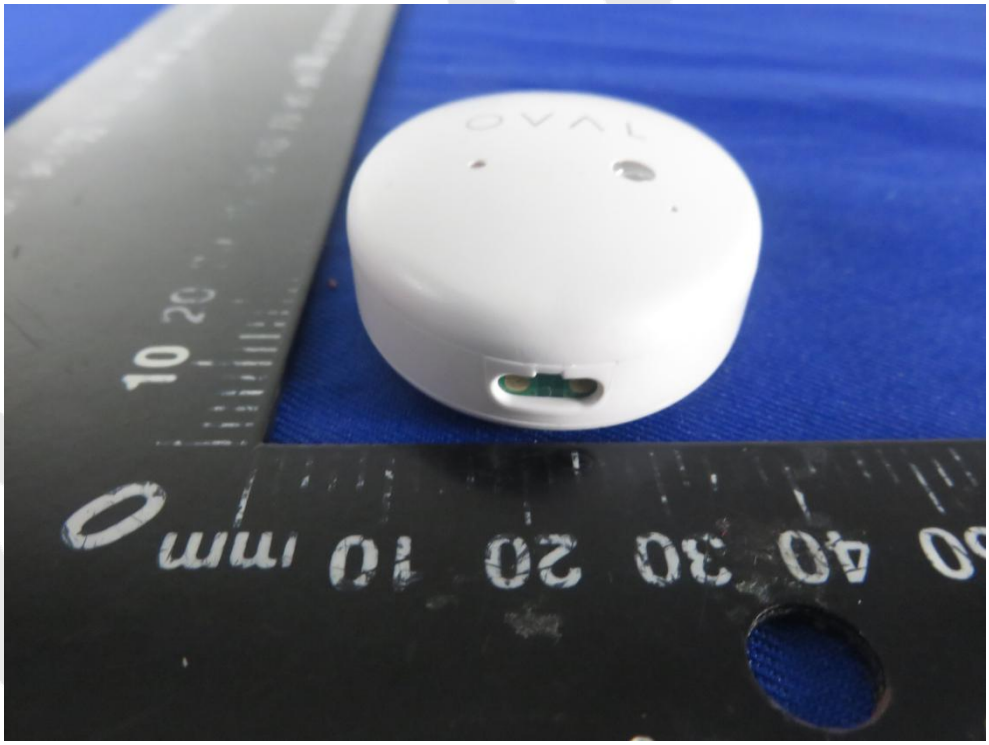
APPENDIX II -- EXTERNAL PHOTOGRAPH

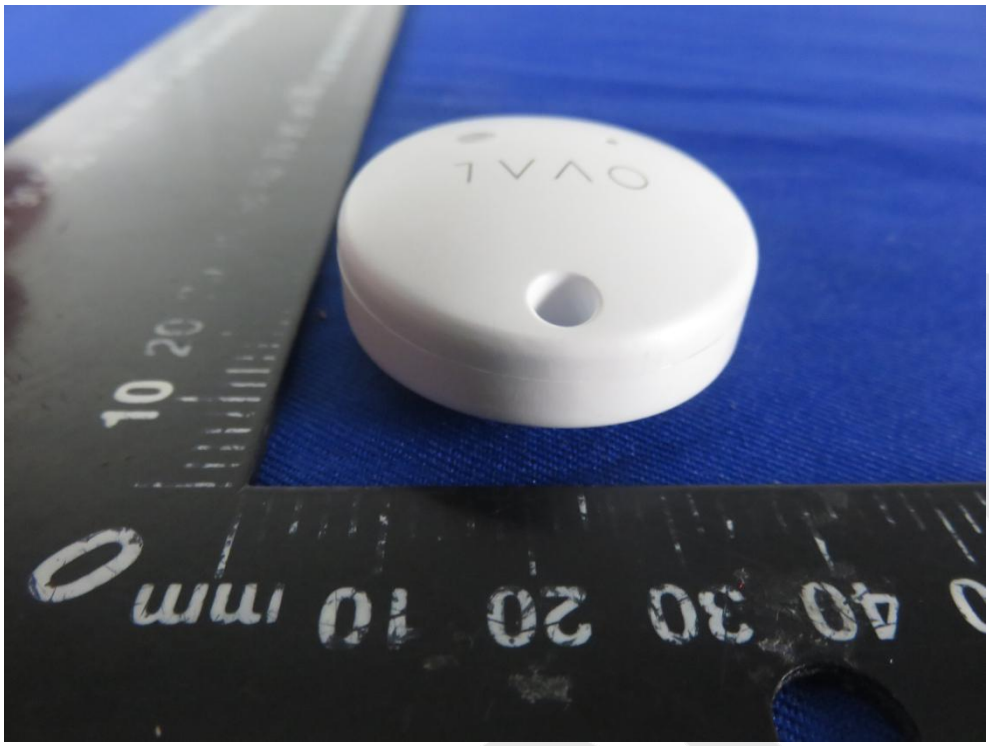


Made in China

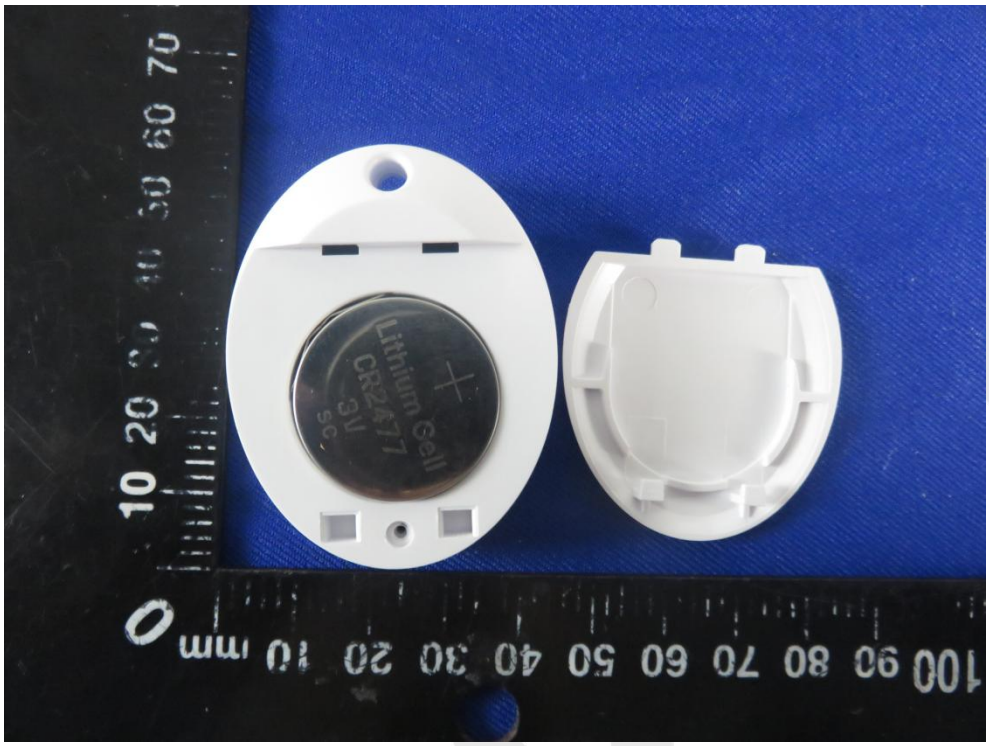
OVAL

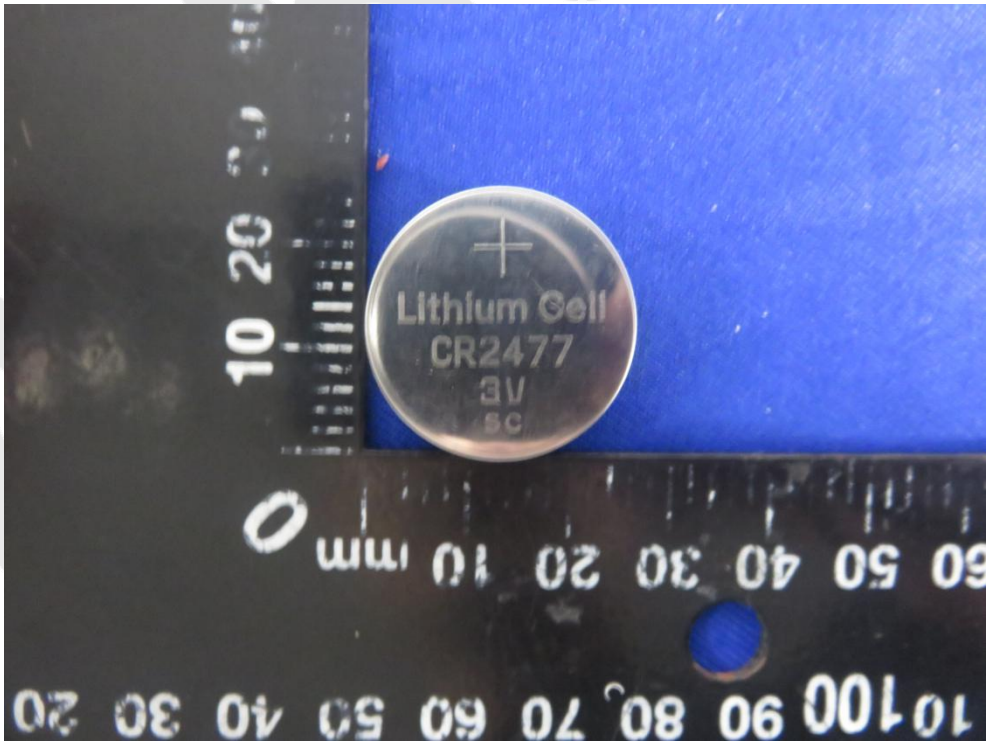


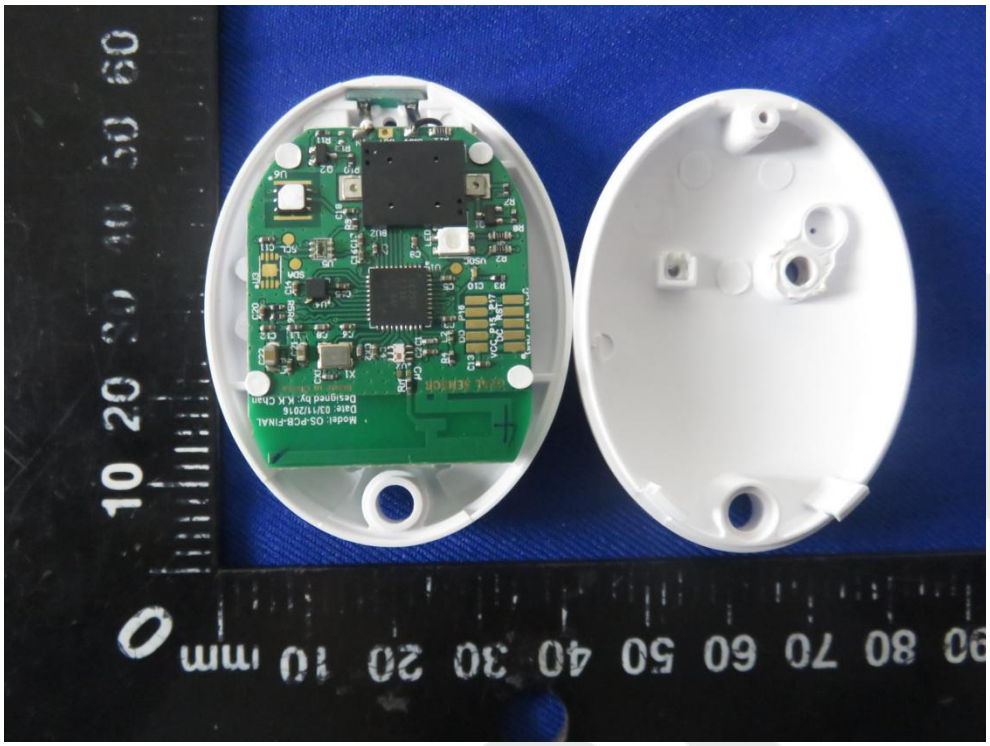


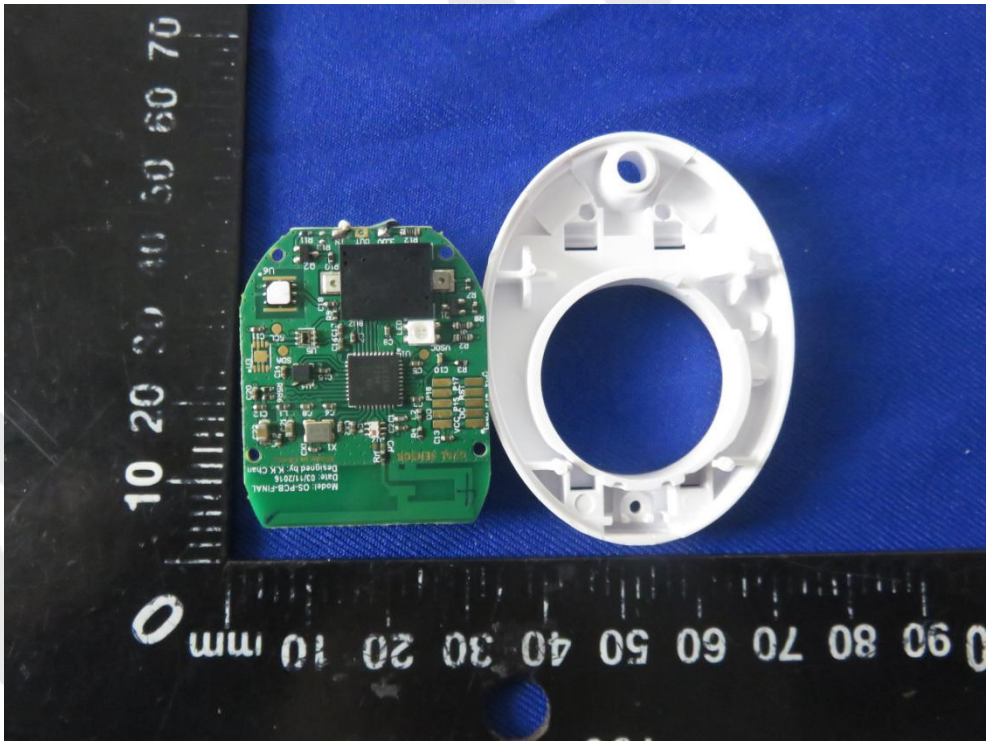

OVAL

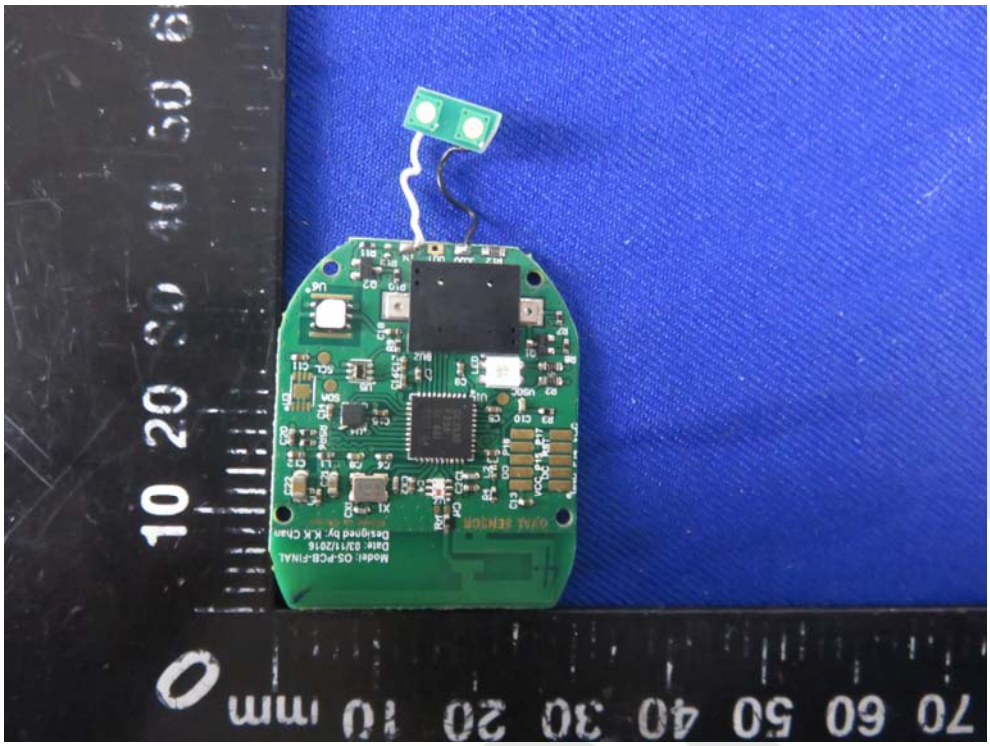
APPENDIX III -- INTERNAL PHOTOGRAPH

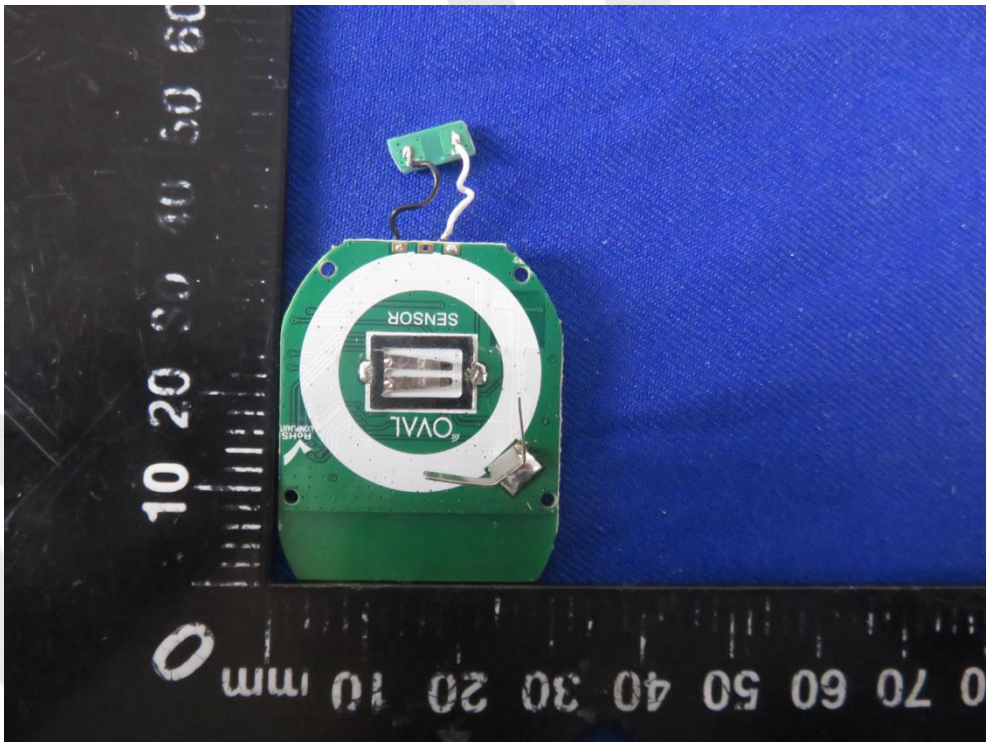


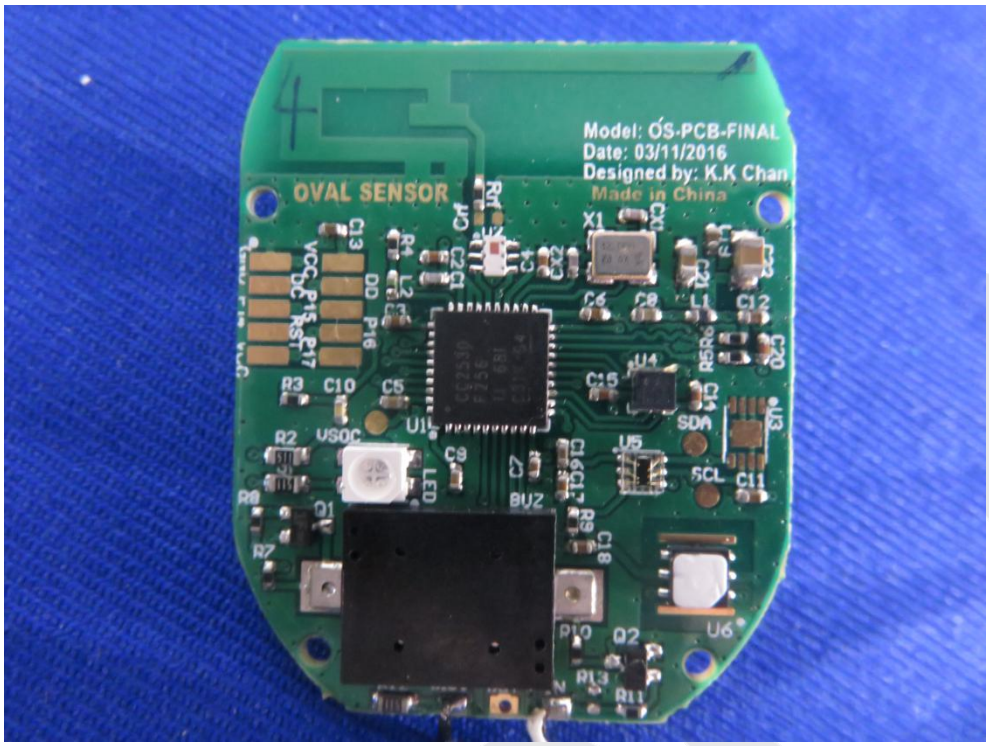


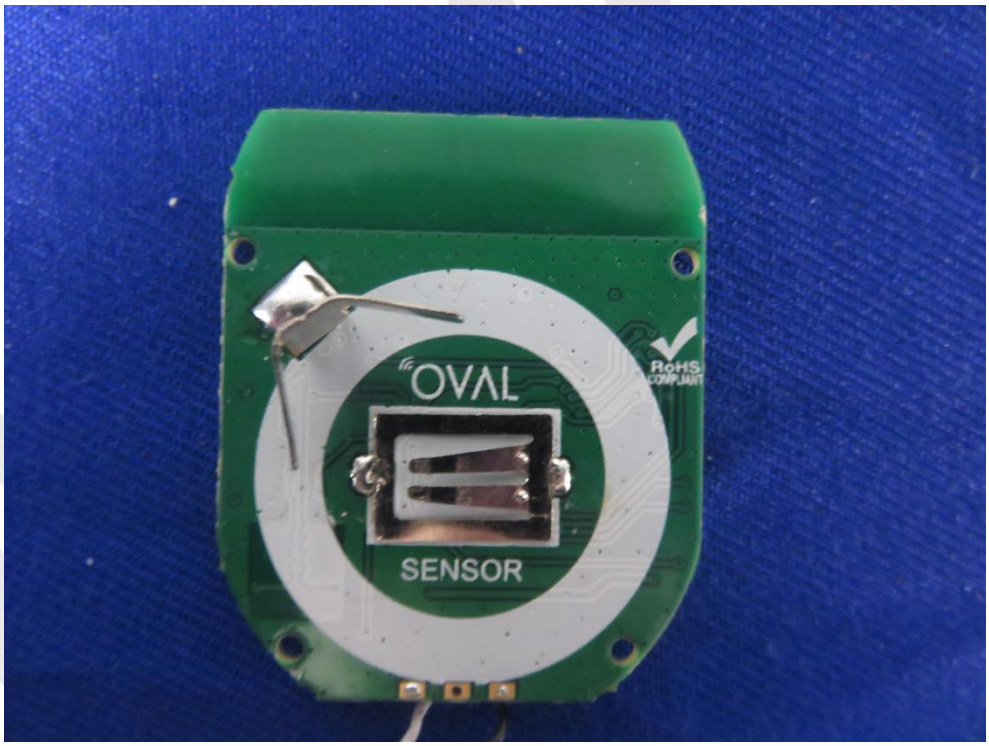







OVAL
SENSOR


Model: OS-PCB-FINAL
Date: 03/11/2016
Designed by: K.K Chan
Made in China
OVAL SENSOR


OVAL
SENSOR