

FCC TEST REPORT

For

Elexa Consumer Products Inc.

Guardian Leak Detector

Model No.: GLD1

Prepared For : Elexa Consumer Products Inc.
Address : 2275 Half Day Road, Suite 333, Bannockburn, Illinois, United States

Prepared By : Shenzhen Anbotek Compliance Laboratory Limited
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Report Number : SZAWW180306001-01

Date of Test : Mar. 06~14, 2018

Date of Report : Mar. 15, 2018

Contents

1. General Information.....	4
1.1. Client Information.....	4
1.2. Description of Device (EUT).....	4
1.3. Auxiliary Equipment Used During Test.....	4
1.4. Description of Test Modes.....	5
1.5. List of Channels.....	5
1.6. Description of Test Setup.....	6
1.7. Test Equipment List.....	7
1.8. Measurement Uncertainty.....	8
1.9. Description of Test Facility.....	8
2. Summary of Test Results.....	9
3. Conducted Emission Test.....	10
3.1. Test Standard and Limit.....	10
3.2. Test Setup.....	10
3.3. Test Procedure.....	10
3.4. Test Data.....	10
4. Radiation Spurious Emission and Band Edge.....	11
4.1. Test Standard and Limit.....	11
4.2. Test Setup.....	12
4.3. Test Procedure.....	13
4.4. Test Data.....	13
5. 20dB Bandwidth Test.....	17
5.1. Test Standard and Limit.....	17
5.2. Test Setup.....	17
5.3. Test Procedure.....	17
5.4. Test Data.....	17
6. Antenna Requirement.....	19
6.1. Test Standard and Requirement.....	19
6.2. Antenna Connected Construction.....	19
APPENDIX I -- TEST SETUP PHOTOGRAPH.....	20
APPENDIX II -- EXTERNAL PHOTOGRAPH.....	21
APPENDIX III -- INTERNAL PHOTOGRAPH.....	24

TEST REPORT

Applicant : Elexa Consumer Products Inc.
Manufacturer : Zmartgears Limited.
Product Name : Guardian Leak Detector
Model No. : GLD1
Trade Mark : N.A.
Rating(s) : DC 3.6V

Test Standard(s) : FCC Part15 Subpart C, Paragraph 15.249

Test Method(s) : ANSI C63.10: 2013

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 : Mar. 06~14, 2018

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	:	Elexa Consumer Products Inc.
Address	:	2275 Half Day Road, Suite 333, Bannockburn, Illinois, United States
Manufacturer	:	Zmartgears Limited.
Address	:	4/F, Building A3, Digital Tech Park Gaoxin South 7th Rd, Science Park, Nanshan District, SZ 518057, GD, CN

1.2. Description of Device (EUT)

Product Name	:	Guardian Leak Detector	
Model No.	:	GLD1	
Trade Mark	:	N.A.	
Test Power Supply	:	DC 3.6V	
Product Description	:	Operation Frequency:	915MHz
		Number of Channel:	1 Channels
		Modulation Type:	LoRa/FSK
		Antenna Type:	PCB antenna
		Antenna Gain(Peak):	0 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

N/A	:	
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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

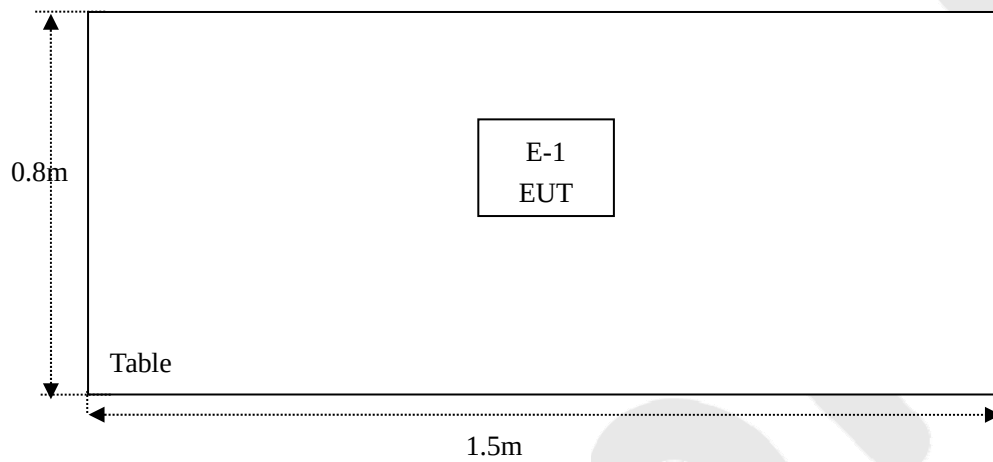
For Radiated Emission	
Final Test Mode	Description
Mode 1	CH01

1.5. List of Channels

Channel	Frequency (MHz)
01	915

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	Nov.17, 2017	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Nov.17, 2017	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Nov.17, 2017	1 Year
4.	Spectrum Analysis	Agilent	E4407B	US39390582	Nov.17, 2017	1 Year
5.	Spectrum Analysis	Agilent	N9038A	MY53227295	Nov.17, 2017	1 Year
6.	Preamplifier	SKET Electronic	BK1G18G3 0D	KD17503	Nov.17, 2017	1 Year
7.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Nov.17, 2017	1 Year
8.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Nov.20, 2017	1 Year
9.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Nov. 20, 2017	1 Year
10.	Loop Antenna	Schwarzbeck	HFH2-Z2	100047	Nov.17, 2017	1 Year
11.	Horn Antenna	Schwarzbeck	BBHA9170	9170-375	Nov.17, 2017	1 Year
12.	Pre-amplifier	SONOMA	310N	186860	Nov.17, 2017	1 Year
13.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
14.	RF Test Control System	YIHENG	YH3000	2017430	Nov.18, 2017	1 Year
15.	Power Sensor	DAER	RPR3006W	15I00041SN045	Nov.17, 2017	1 Year
16.	Power Sensor	DAER	RPR3006W	15I00041SN046	Nov.17, 2017	1 Year
17.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Nov.18, 2017	1 Year
18.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Nov.18, 2017	1 Year
19.	Signal Generator	Agilent	E4421B	MY41000743	Nov.18, 2017	1 Year
20.	DC Power Supply	LW	TPR-6410D	349315	Nov.01, 2017	1 Year
21.	Constant Temperature Humidity Chamber	Sertep	ZJ-HWHS8 0B	ZJ-17042804	Nov.01, 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 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. 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 D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District,
Shenzhen, Guangdong, China.518102

2. Summary of Test Results

Standard Section	Test Item	Result
15.203	Antenna Requirement	PASS
15.207	Conducted Emission	N.A.
15.249	Spurious Emission	PASS
15.215(c)	20dB Bandwidth	PASS
15.249(c)	Band Edge	PASS
Remark: "N/A" is an abbreviation for Not Applicable.		

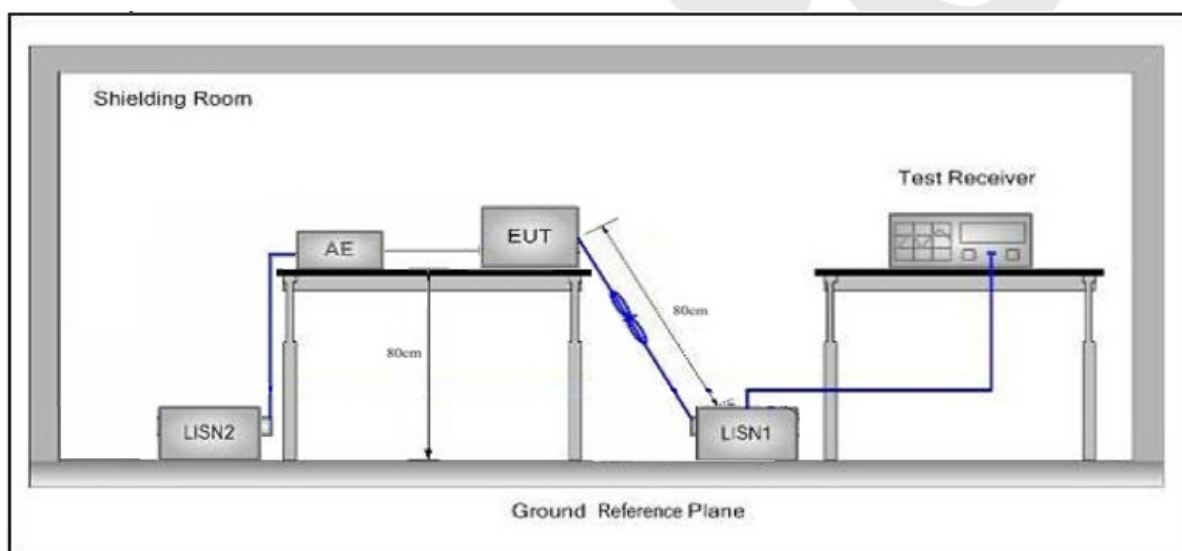
3. Conducted Emission Test

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

There is DC 3.6V battery inside, So there is no need to 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.

Test Standard	FCC Part15 C Section 15.249					
Test Limit	Frequency (MHz)	Field Strength of fundamental ((millivolts /meter)	Field Strength of Harmonics (microvolts/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	902~908	50	-	94.0	Average	3
		-	-	114.0	Peak	3

Remark:

(1) 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

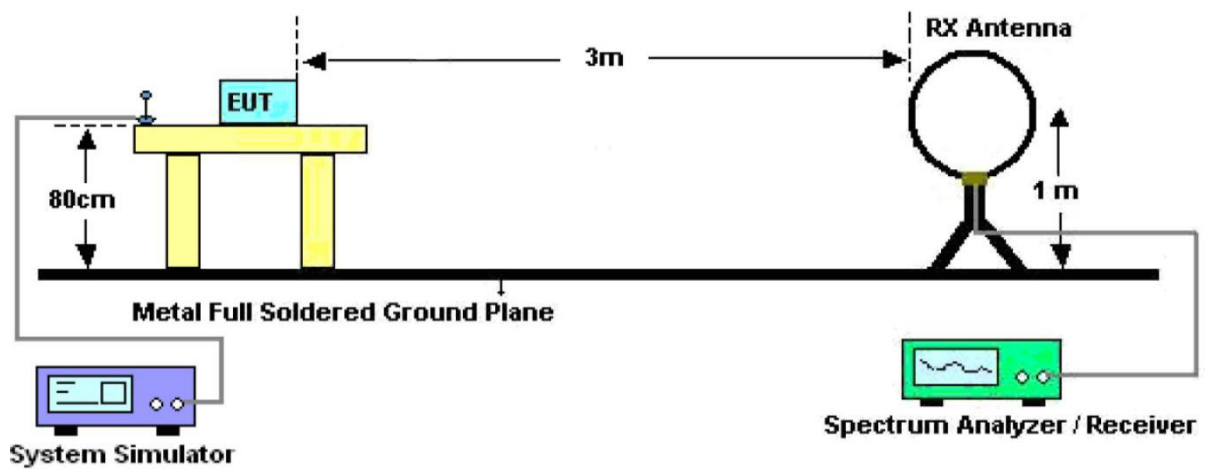


Figure 1. Below 30MHz

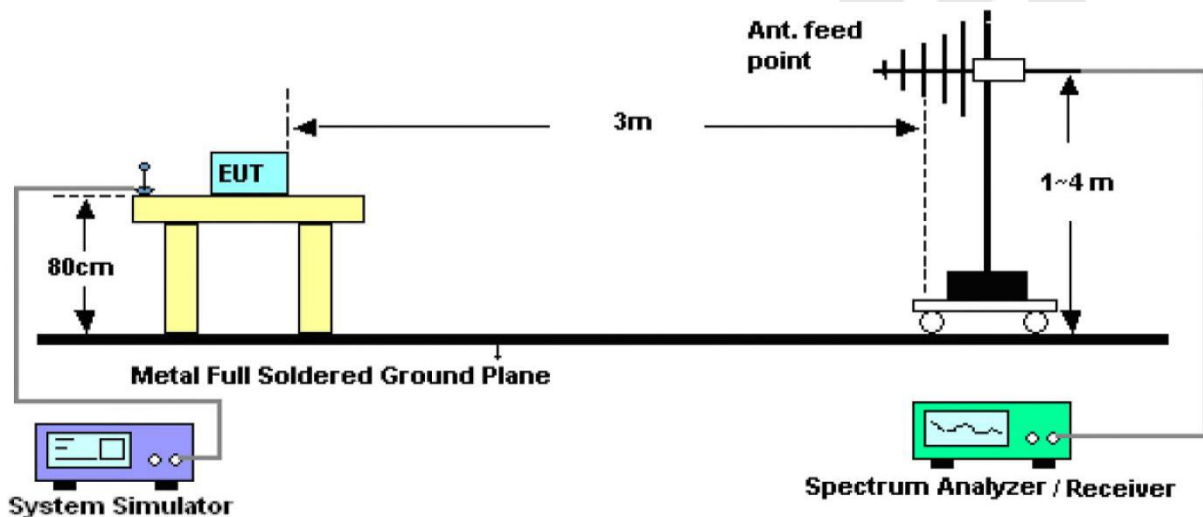


Figure 2. 30MHz to 1GHz

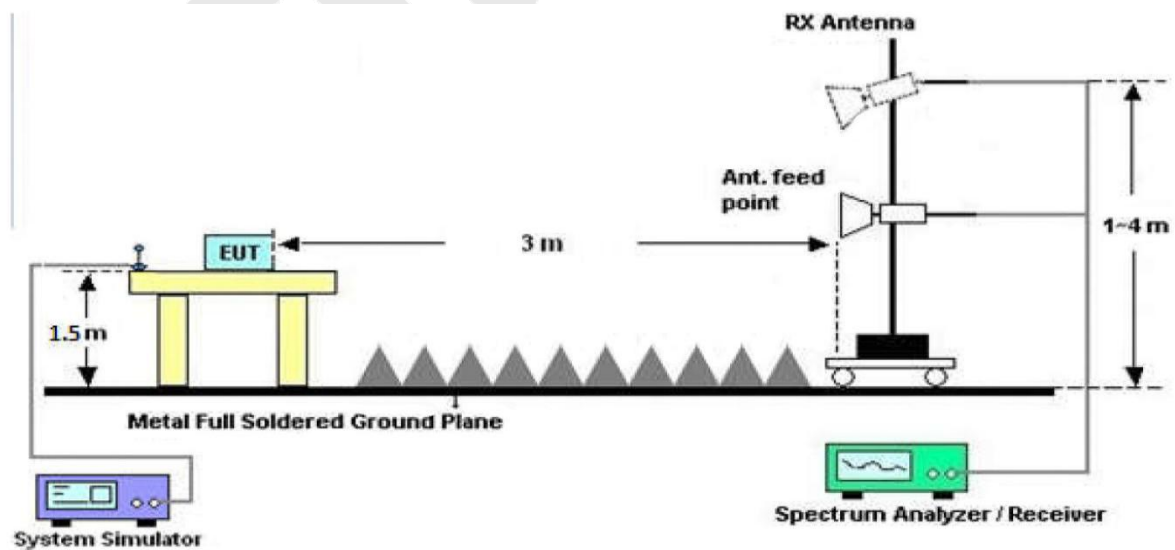


Figure 3. Above 1 GHz

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 the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

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 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

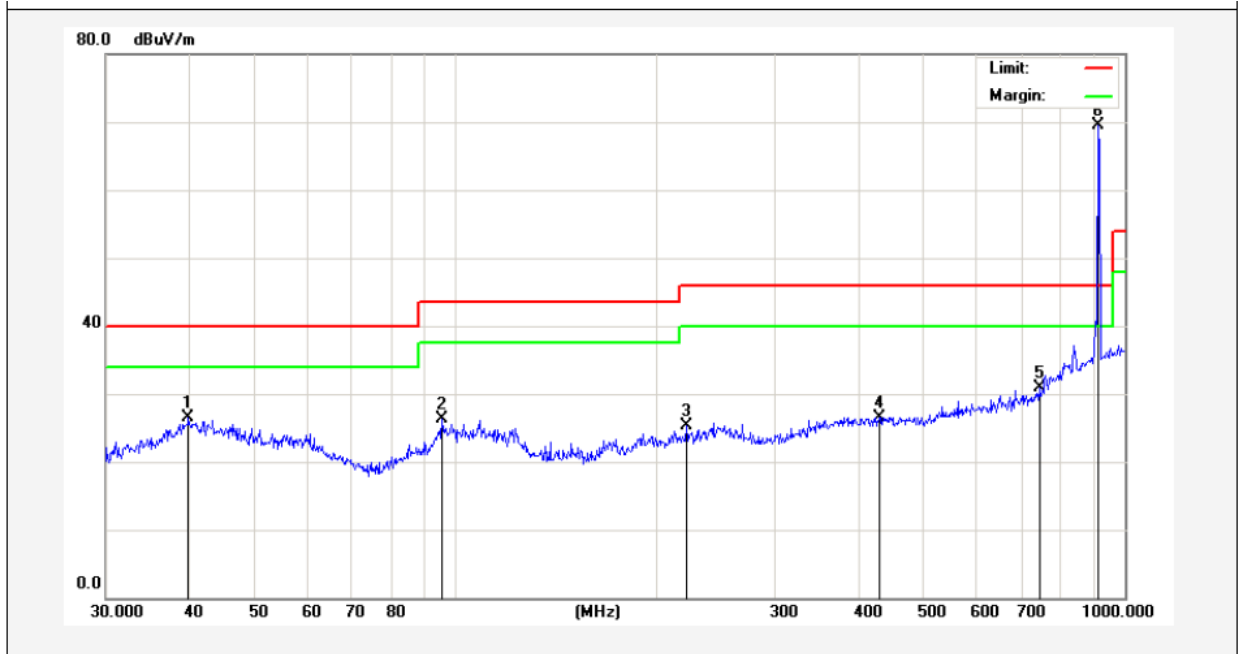
PASS

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 was attenuated more than 20dB below the permissible limits, so the results don't record in the report.

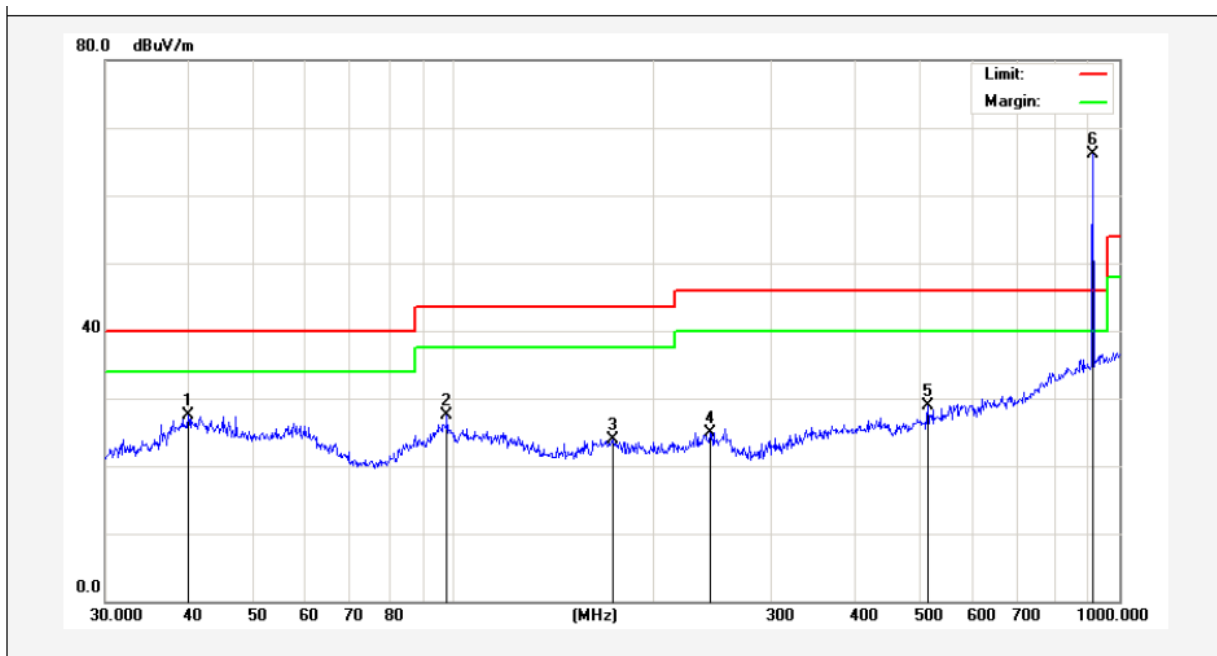
Test Results (30~1000MHz)

Job No.: SZAWW180306001-01 Temp.(°C)/Hum.(%RH): 24.3°C/55%RH
Standard: FCC PART 15C Power Source: DC 3.6V
Test Mode: CH01 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	39.8541	35.01	-8.45	26.56	40.00	-13.44	QP	300	0	
2	95.4270	41.51	-15.18	26.33	43.50	-17.17	QP	300	12	
3	221.3916	38.47	-13.18	25.29	46.00	-20.71	QP	300	23	
4	429.5228	32.87	-6.30	26.57	46.00	-19.43	QP	300	156	
5	744.8659	32.49	-1.60	30.89	46.00	-15.11	QP	300	235	
6	912.8618	68.15	1.44	69.59	94.00	-24.41	QP	300	360	

Job No.: SZAWW180306001-01 Temp.(°C)/Hum.(%RH): 24.3°C/55%RH
Standard: FCC PART 15C Power Source: DC 3.6V
Test Mode: CH01 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	39.9941	34.85	-7.37	27.48	40.00	-12.52	QP	300	0	
2	97.7980	36.46	-8.97	27.49	43.50	-16.01	QP	300	124	
3	173.8135	34.20	-10.29	23.91	43.50	-19.59	QP	300	135	
4	242.5252	32.39	-7.51	24.88	46.00	-21.12	QP	300	254	
5	515.4374	33.55	-4.68	28.87	46.00	-17.13	QP	300	302	
6	912.8618	63.72	2.44	66.16	94.00	-27.84	QP	300	360	

Harmonics Emissions

Frequency	Antenna	Reading	Cable Loss	Ant Factor	Amplifier	Level	Limits	Margin	Det.
(MHz)	Pol.	(dBuV/m)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	Mode
1830.9000	H	45.48	3.18	34.48	26.71	56.43	74.00	-17.57	PK
1830.9000	H	31.16	3.18	34.48	26.71	42.11	54.00	-11.89	AV
2746.6000	H	42.98	3.74	33.87	27.16	53.43	74.00	-20.57	PK
2746.6000	H	29.94	3.74	33.87	27.16	40.39	54.00	-13.61	AV
3662.2000	H	--	--	--	--	--	--	--	PK
3662.2000	H	--	--	--	--	--	--	--	AV
1830.9000	V	46.32	3.18	34.48	26.71	57.27	74.00	-16.73	PK
1830.9000	V	31.48	3.18	34.48	26.71	42.43	54.00	-11.57	AV
2746.6000	V	43.88	3.74	33.87	27.16	54.33	74.00	-19.67	PK
2746.6000	V	31.22	3.74	33.87	27.16	41.67	54.00	-12.33	AV
3662.2000	V	--	--	--	--	--	--	--	PK
3662.2000	V	--	--	--	--	--	--	--	AV

Remark :

1. Level = Reading + Cable Loss+Ant Factor-Amplifier
2. “ -- ” Mark indicated Background Noise Level

Radiated Band Edge:

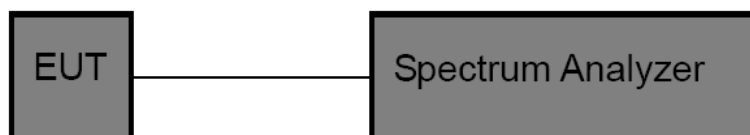
Frequency (MHz)	Read Level (dBuV/m)	Antenna Factor (dB)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.	Det.
902.0000	38.94	22.45	4.48	31.33	34.54	46.00	-11.46	H	QP
928.0000	39.65	22.59	4.54	31.35	35.43	46.00	-10.57	H	QP
902.0000	41.54	22.45	4.48	31.33	37.14	46.00	-8.86	V	QP
928.0000	41.98	22.59	4.54	31.35	37.76	46.00	-8.24	V	QP

5. 20dB Bandwidth Test

5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.249
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5.2. Test Setup



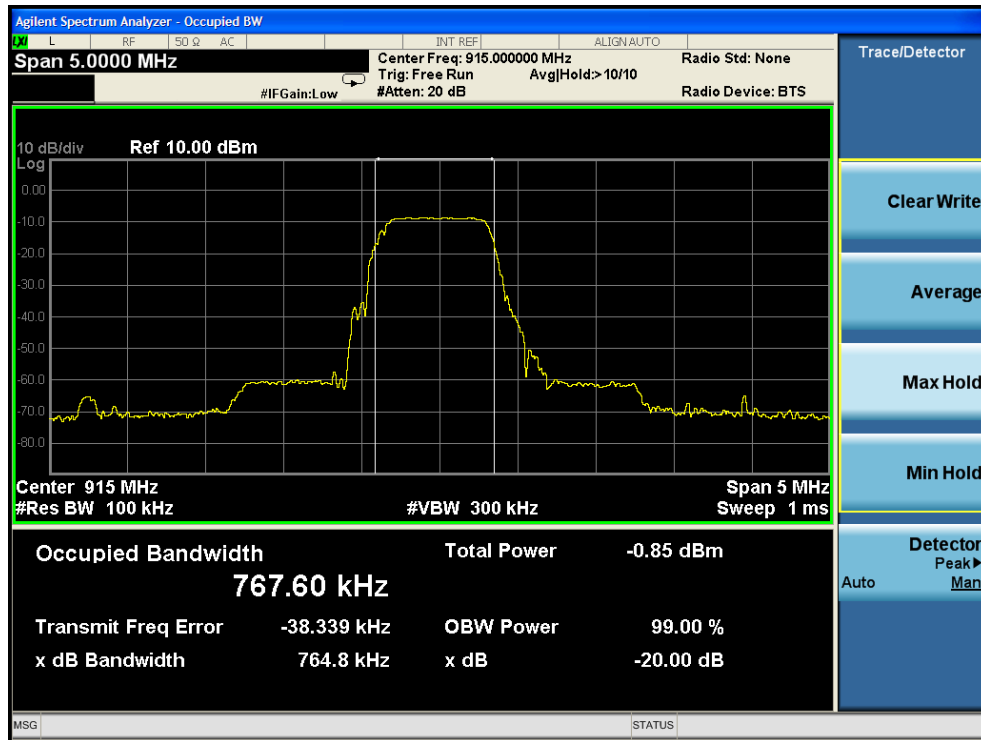
5.3. Test Procedure

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 $\geq 3 \times$ RBW = 300kHz,
Detector= peak
Trace mode= Max hold.
Sweep- auto couple.
4. Mark the peak frequency and -20dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

5.4. Test Data

Test Item	: 20dB Bandwidth	Test Mode	: TX Mode
Test Voltage	: DC 3.6V	Temperature	: 24°C
Test Result	: PASS	Humidity	: 55%RH

Frequency (MHz)	Bandwidth (kHz)	Result
915	764.8	PASS



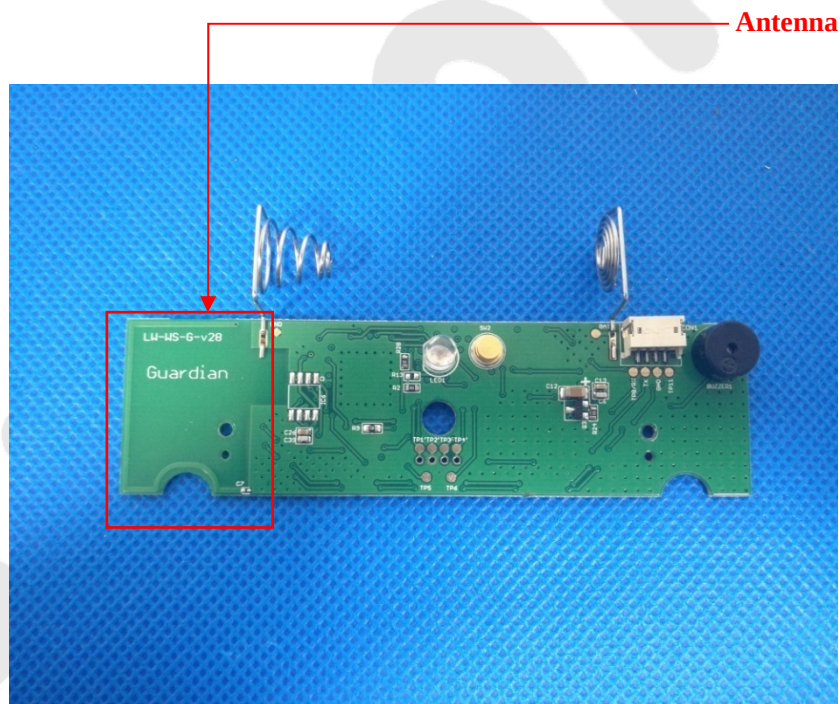
6. Antenna Requirement

6.1. Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203
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.

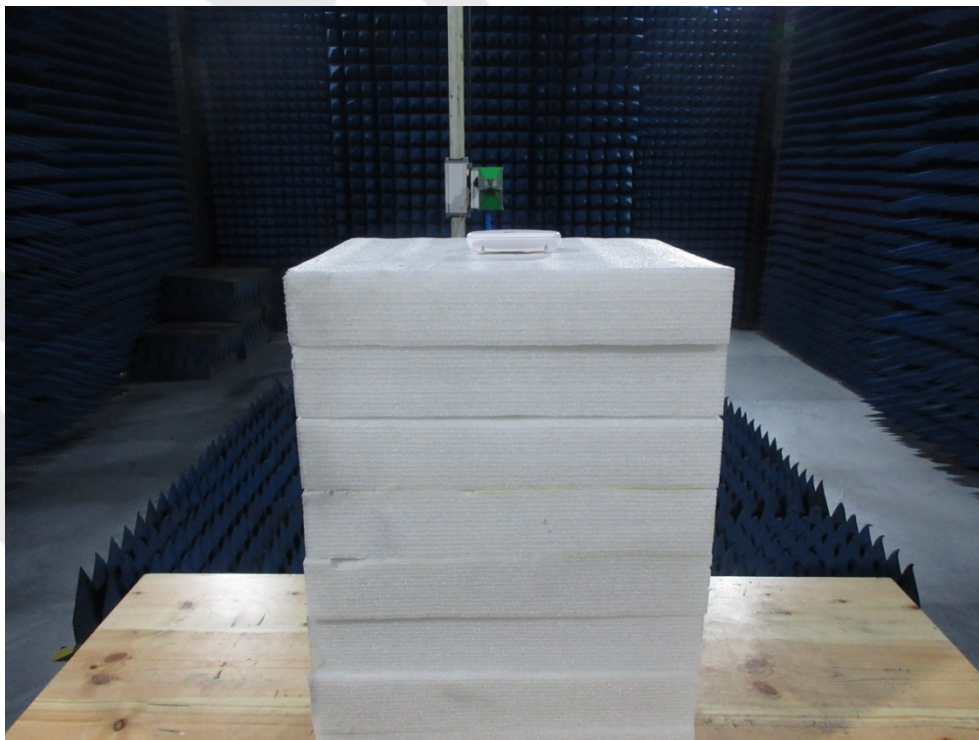
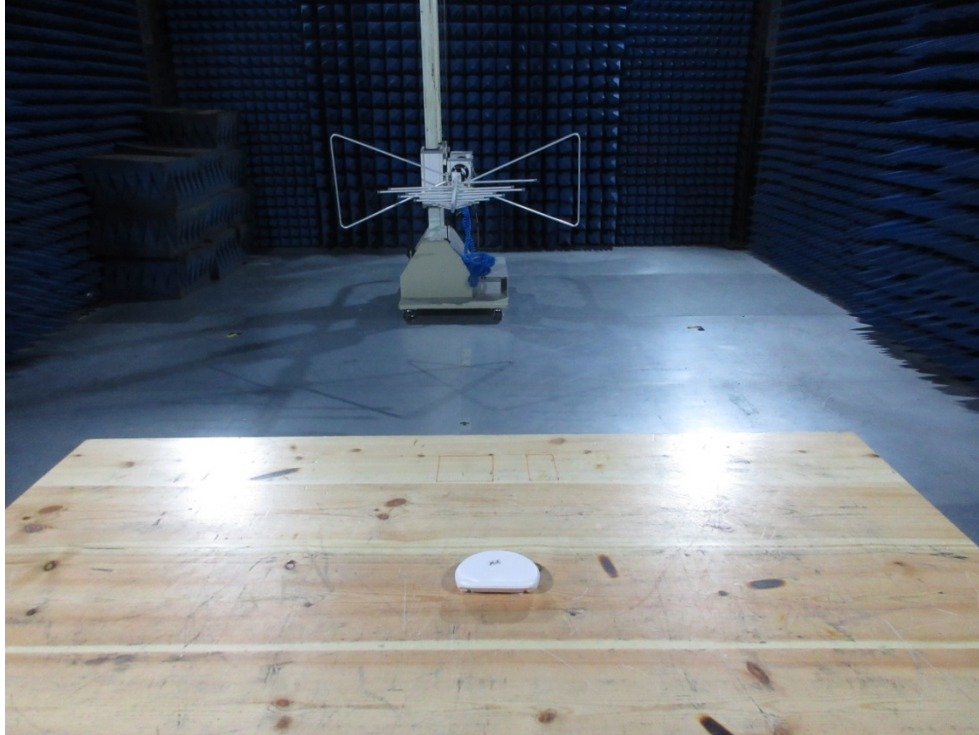
6.2. Antenna Connected Construction

The antenna is a PCB antenna which permanently attached, and the best case gain of the antenna is 0 dBi. It complies with the standard requirement.

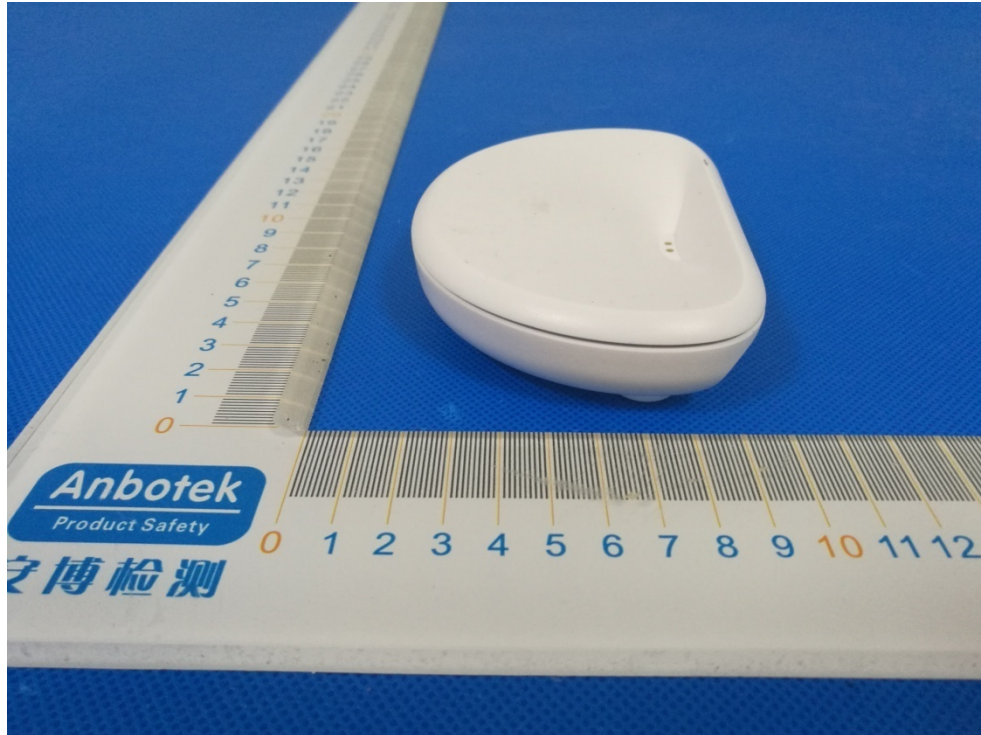


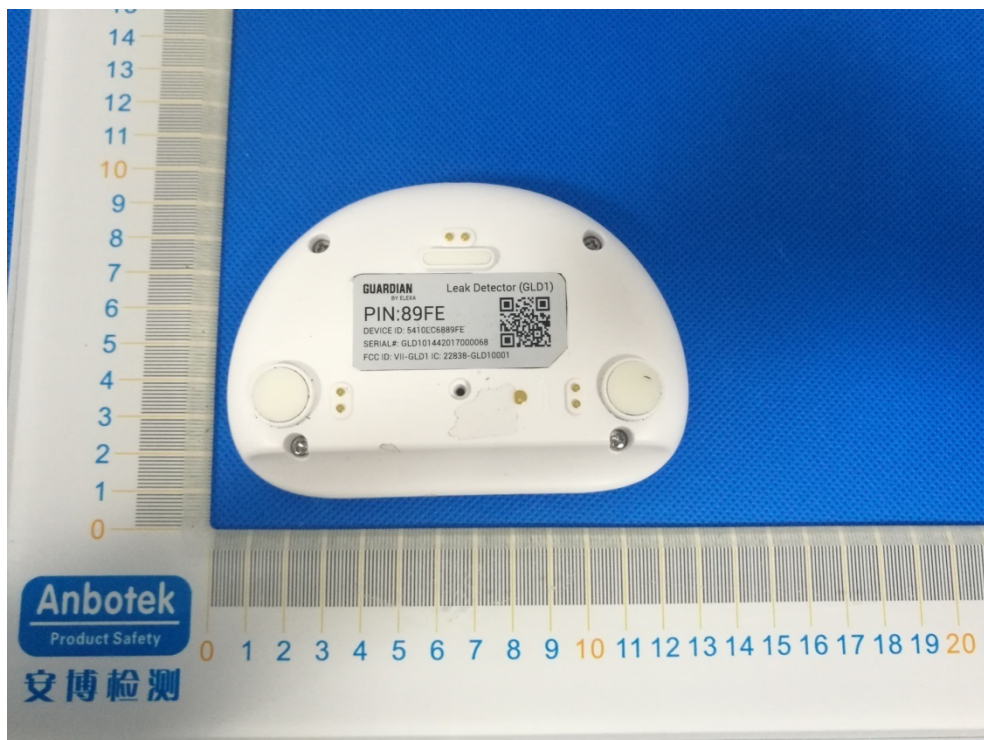
APPENDIX I -- TEST SETUP PHOTOGRAPH

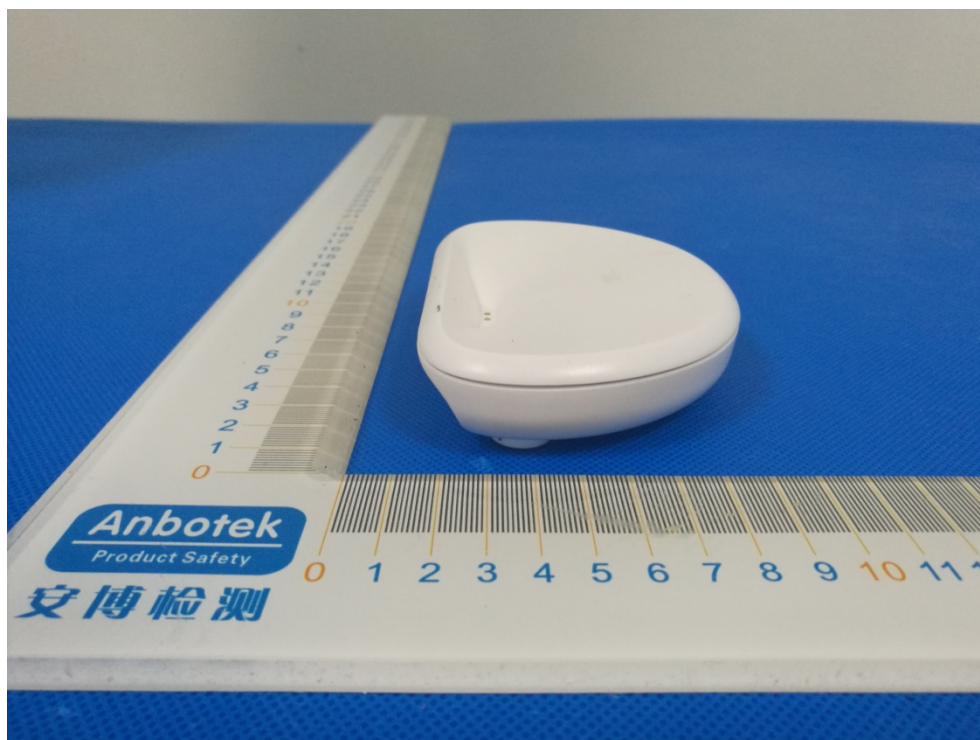
Photo of Radiation Emission Test



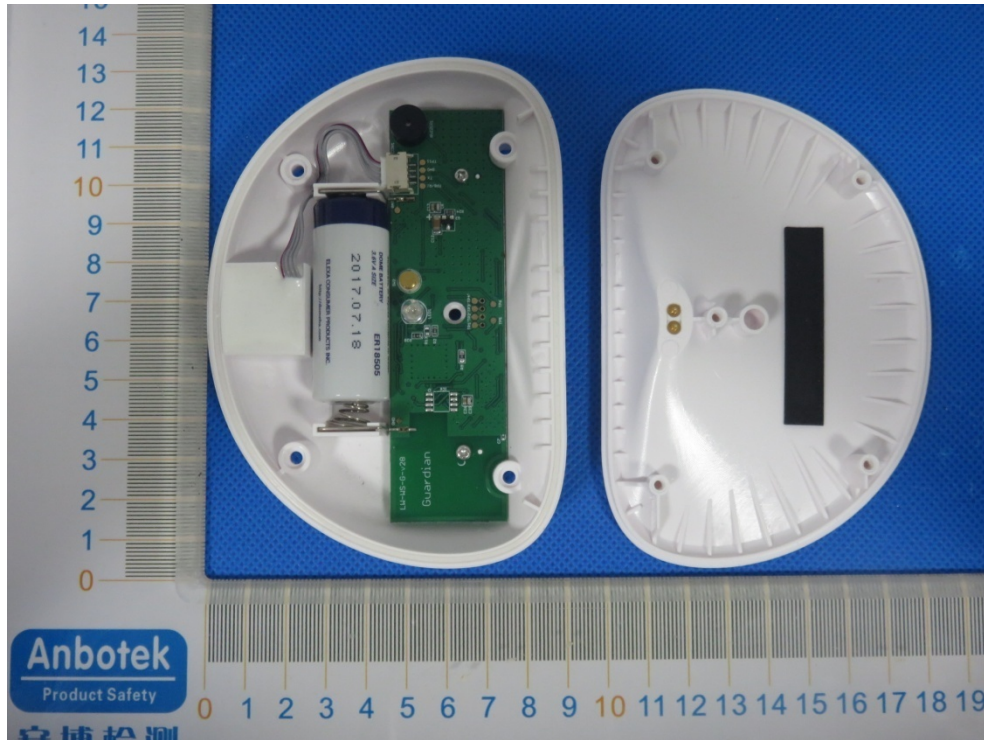
APPENDIX II -- EXTERNAL PHOTOGRAPH



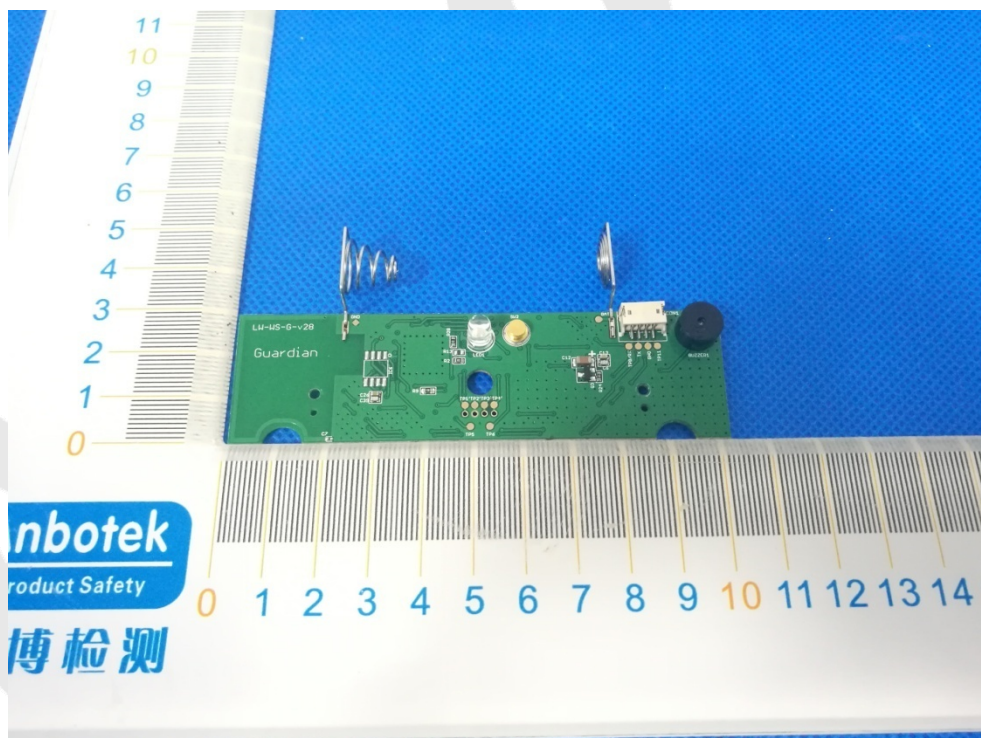


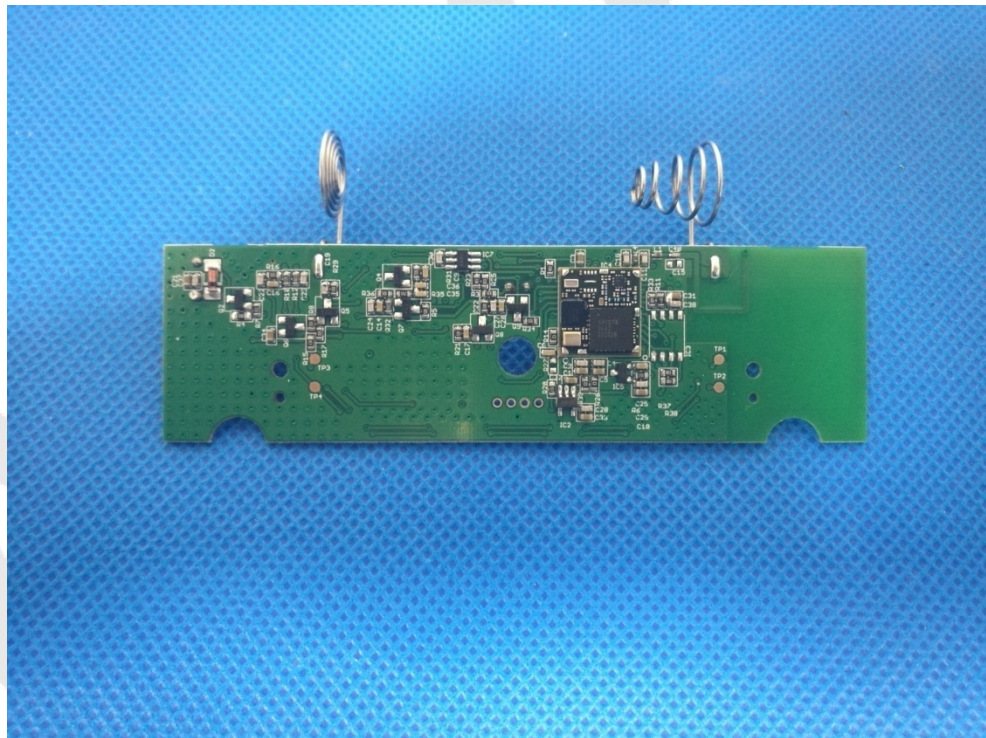
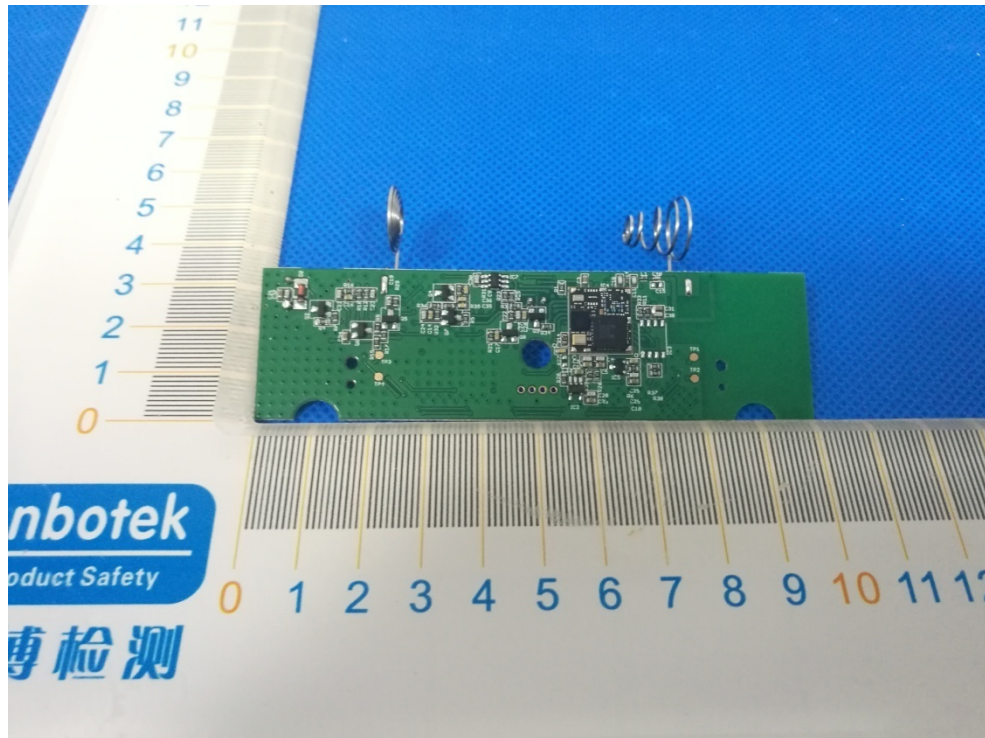


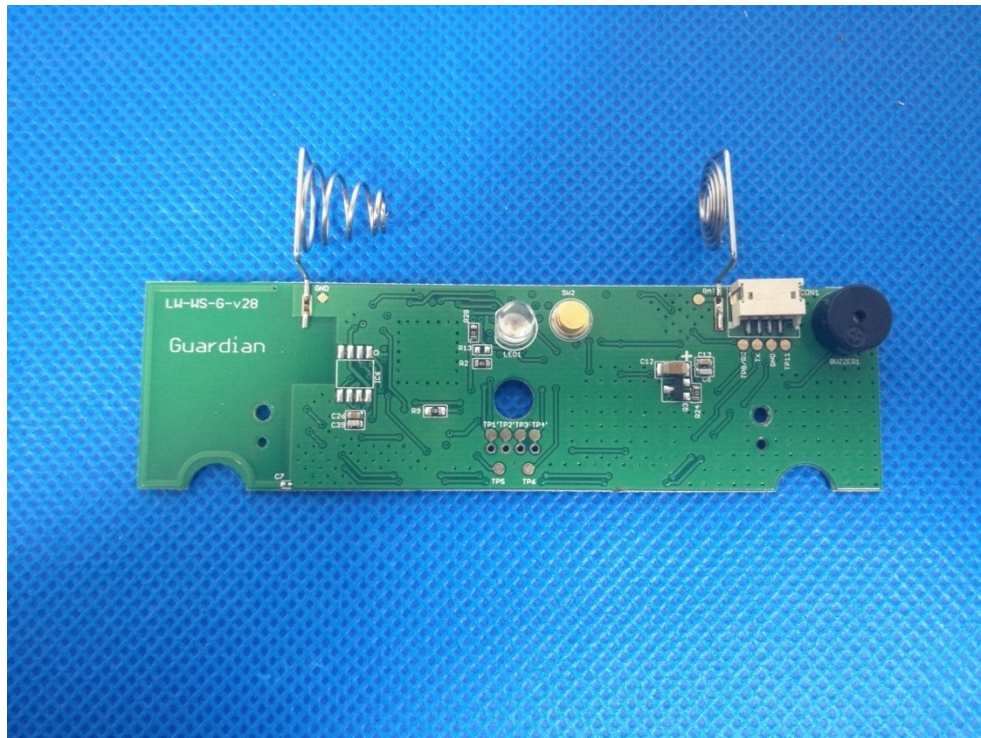
APPENDIX III -- INTERNAL PHOTOGRAPH











End of report