FCC TEST REPORT

For

Beijing MADV Technology Co., Ltd

Dling Smart Video Doorbell

Model No.: FJ02MLWJ

Prepared For	:	Beijing MADV Technology Co., Ltd
Address	:	No.80, Floor 4, building17, Yard 30, Shixingdajie, Shijingshan District, Beijing, China
Prepared By	:	Shenzhen Anbotek Compliance Laboratory Limited
Address	:	1/F, Building D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.518102 Tel: (86) 755-26066440 Fax: (86) 755-26014772
Report Number	:	SZAWW181116002-02
Date of Receipt	:	Nov. 16, 2018
Date of Test	:	Nov. 16~Dec. 03, 2018
Date of Report	:	Dec. 03, 2018

Contents

TEST REPORT

Applicant	:	Beijing MADV Technology Co., Ltd
Manufacturer	:	Beijing MADV Technology Co., Ltd
Product Name	:	Dling Smart Video Doorbell
Model No.	:	FJ02MLWJ
Trade Mark	:	
Rating(s)	:	Input: DC 3V battery inside, 250mA "AA"

Test Standard(s)	**:**	**FCC Part15 Subpart C 2018, Section 15.231**
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: Nov. 16~Dec. 03, 2018

Prepared by: (Engineer / Oliay Yang)

Reviewer: (Supervisor / Snowy Meng)

Approved & Authorized Signer: (Manager / Sally Zhang)

1. General Information

1.1. Client Information

Applicant	:	Beijing MADV Technology Co., Ltd
Address	:	No.80, Floor 4, building17, Yard 30, Shixingdajie, Shijingshan District, Beijing, China
Manufacturer	:	Beijing MADV Technology Co., Ltd
Address	:	No.80, Floor 4, building17, Yard 30, Shixingdajie, Shijingshan District, Beijing, China
Factory	:	Beijing MADV Technology Co., Ltd
Address	:	No.80, Floor 4, building17, Yard 30, Shixingdajie, Shijingshan District, Beijing, China

1.2. Description of Device (EUT)

Product Name	:	Dling Smart Video Doorbell	
Model No.	:	FJ02MLWJ	
Trade Mark	:		
Test Power Supply	:	DC 3V battery inside	
Test Sample No.	:	S1(Normal Sample), S2(Engineering Sample)	
Product Description	:	Operation Frequency:	433.920 MHz
		Modulation Type:	ASK
		Antenna Type:	Spring Antenna
		Antenna Gain(Peak):	2 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		

1.4. Description of Test Modes

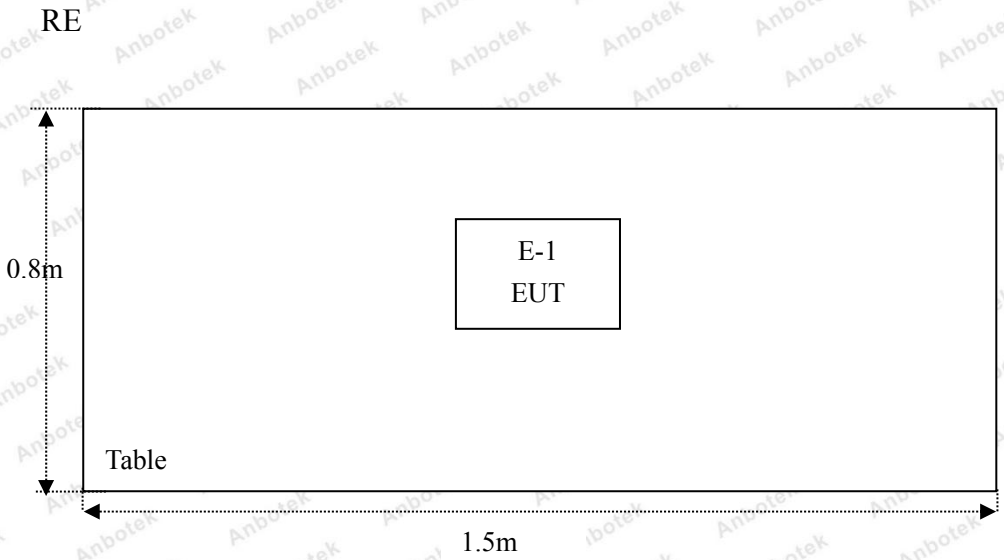
To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration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

Pretest Mode	Description
Mode 1	Keeping TX Mode

For Radiated Emission	
Final Test Mode	Description
Mode 1	Keeping TX Mode

Note: During the test, the EUT was keeping continuous transmission.

1.5. Description Of Test Setup



1.6. 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. 05, 2018	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESPI3	101604	Nov. 05, 2018	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Nov. 05, 2018	1 Year
4.	Spectrum Analysis	Agilent	E4407B	US39390582	Nov. 05, 2018	1 Year
5.	MAX Spectrum Analysis	Agilent	N9020A	MY51170037	Nov. 05, 2018	1 Year
6.	Preamplifier	SKET Electronic	BK1G18G30D	KD17503	Nov. 05, 2018	1 Year
7.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Nov. 20, 2018	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Nov. 19, 2018	1 Year
9.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Nov. 20, 2018	1 Year
10.	Horn Antenna	A-INFO	LB-180400-KF	J211060628	Nov. 20, 2018	1 Year
11.	Pre-amplifier	SONOMA	310N	186860	Nov. 05, 2018	1 Year
12.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
13.	RF Test Control System	YIHENG	YH3000	2017430	Nov. 05, 2018	1 Year
14.	Power Sensor	DAER	RPR3006W	15I00041SN045	Nov. 05, 2018	1 Year
15.	Power Sensor	DAER	RPR3006W	15I00041SN046	Nov. 05, 2018	1 Year
16.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Nov. 05, 2018	1 Year
17.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Nov. 05, 2018	1 Year
18.	Signal Generator	Agilent	E4421B	MY41000743	Nov. 05, 2018	1 Year
19.	DC Power Supply	IVYTECH	IV3605	1804D360510	Apr. 02, 2018	1 Year
20.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80B	N/A	Nov. 01, 2018	1 Year

1.7. 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

Shenzhen Anbotek Compliance Laboratory Limited.

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

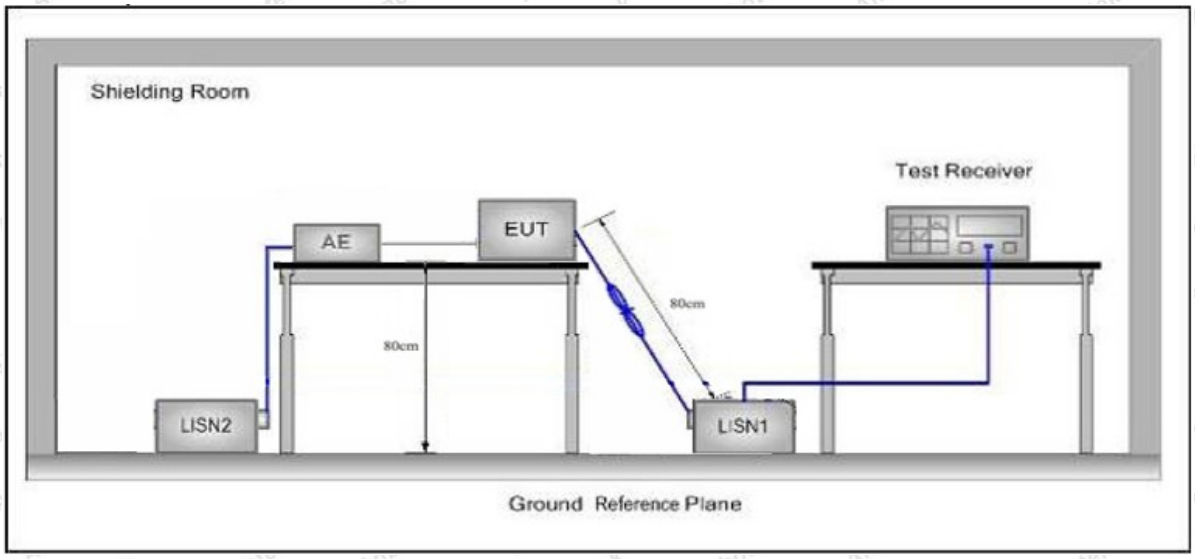
Standard Section	Test Item	Result
15.203	Antenna Requirement	PASS
15.207	Conducted Emission	N/A
15.205/15.209/15.231(b)	Spurious Emission	PASS
15.231(c)	20dB Occupied Bandwidth	PASS
15.231(a)	Dwell time	PASS
Remark: "N/A" is an abbreviation for Not Applicable.		

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 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, 15.205 and 15.231(b)				
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.					

the formulas for calculating the maximum permitted fundamental field strengths are as follows:
for the band 260-470 MHz, μV/m at 3 meters = 41.6667(F) - 7083.3333.
The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level

Emission Level (dBuV/m)=20log Emission Level(uV/m)

The field strength of emission limits have been calculated in below table:

Fundamental Frequency (MHz)	Field Strength of Fundamental (dBuV/m)@3m
433.920	80.82 (AVG)
433.920	100.82 (Peak)

4.2. Test Setup

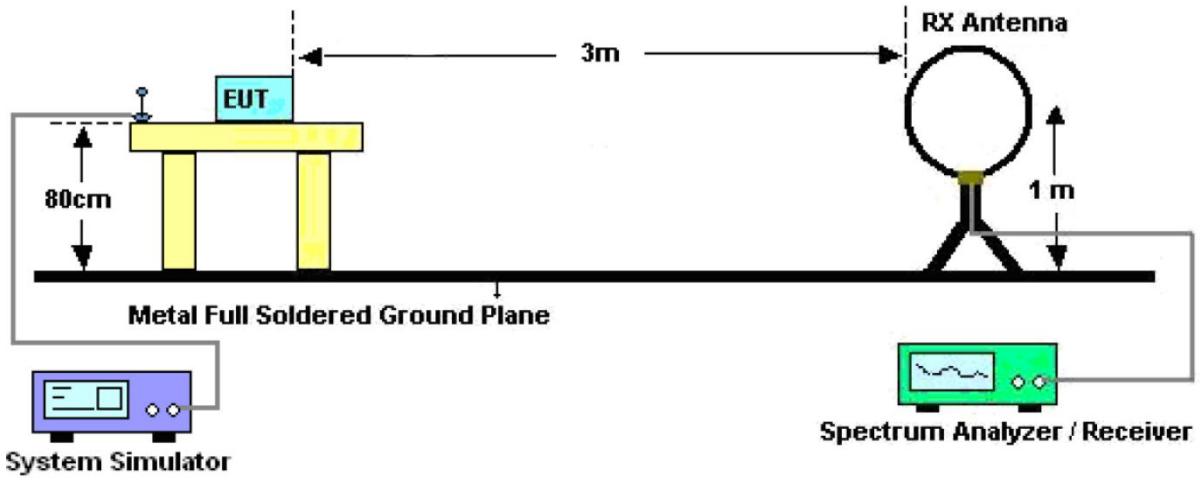


Figure 1. Below 30MHz

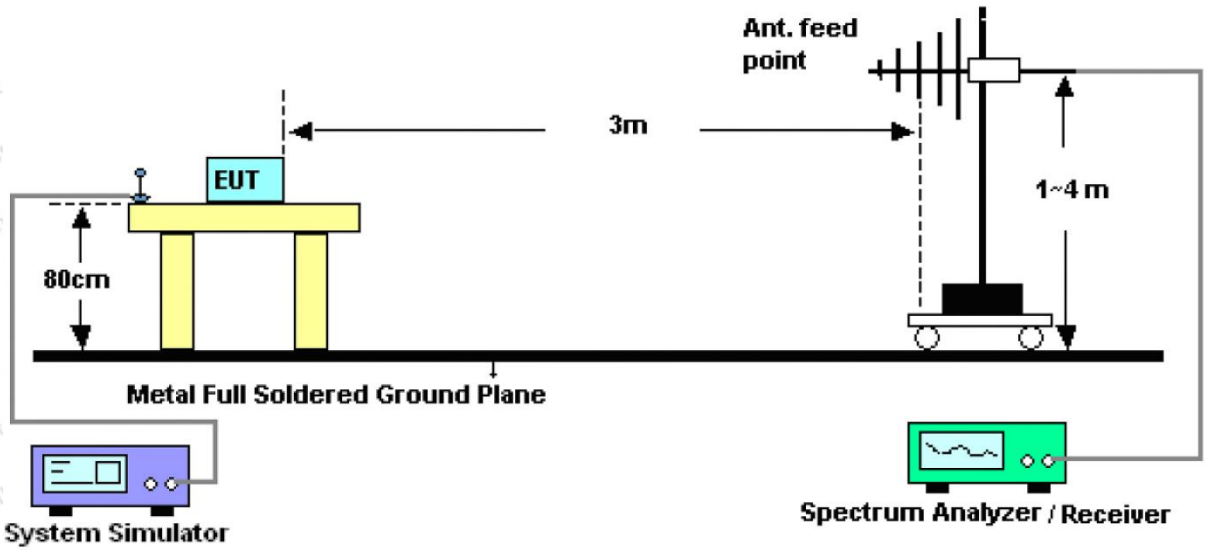


Figure 2. 30MHz to 1GHz

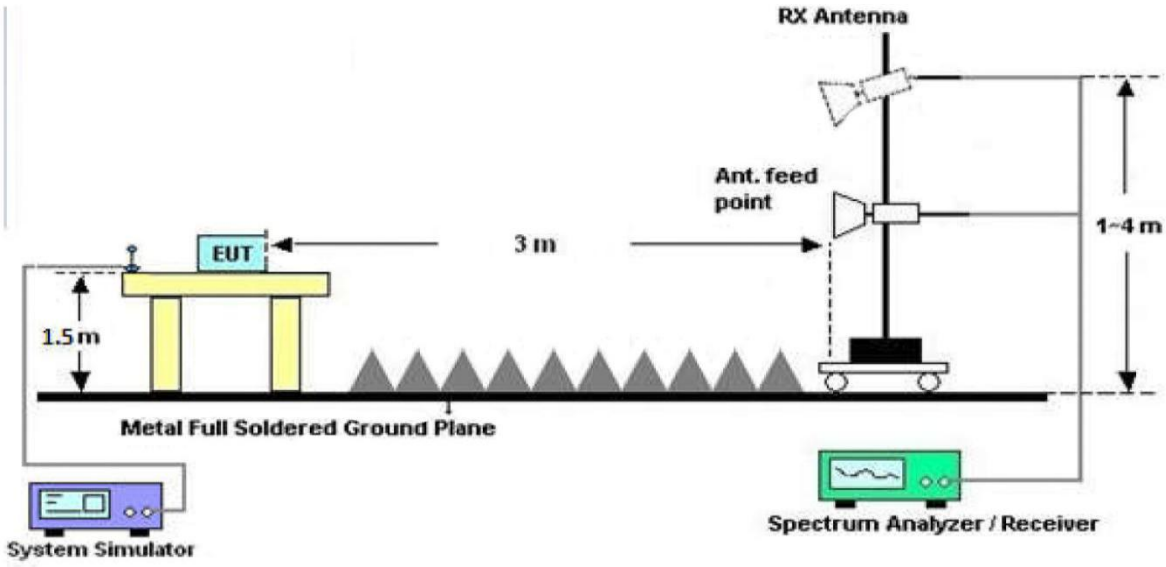


Figure 3. Above 1 GHz

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 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 (Fundamental 433.920MHz)

Frequency	Antenna	Reading	Cable Loss	Ant Factor	Amplifier	Duty cycle Factor	Results	Limits	Det.
(MHz)	Pol.	(dBuV/m)	(dB)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	Mode
433.92	H	94.77	1.52	12.64	31.45	-	77.48	100.82	PK
433.92	H	94.77	1.52	12.64	31.45	-8.44	69.04	80.82	AV
433.92	V	97.52	1.52	12.64	31.45	-	80.23	100.82	PK
433.92	V	97.52	1.52	12.64	31.45	-8.44	71.79	80.82	AV

Remark:

1. Result = Reading + Cable Loss +Ant Factor –Amplifier + Duty cycle Factor
2. Pulse Desensitization Correction Factor

   Pulse Width (PW)= 0.362ms

   2/PW=2/0.362=5.52kHz

   RBW(1000kHz)＞ 2/PW (5.52KHz)

   Therefore PDCF is not needed.

3. Duty Cycle Factor

Calculate Formula:

AV=PEAK +Duty Cycle Factor

Duty Cycle Factor=20log(Duty Cycle)

Duty Cycle= on time/ period

Test Data:

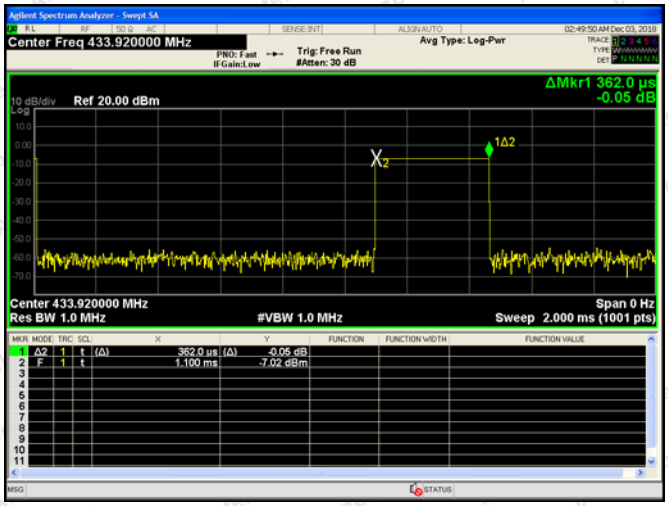
T on time=0.362ms*26+1.076ms*15=25.552 ms

T period=67.55ms

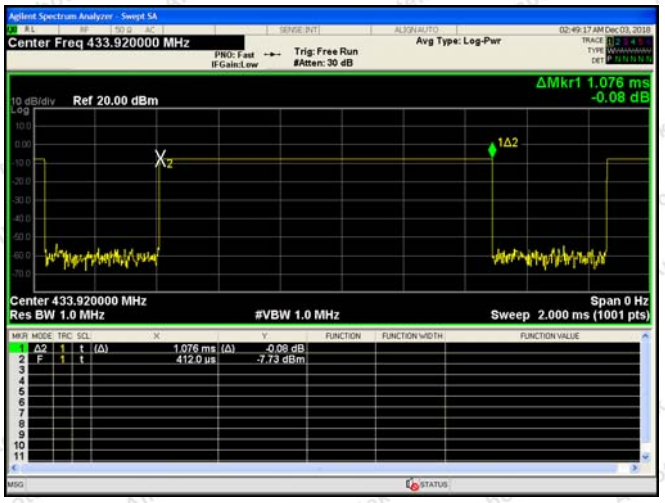
Duty Cycle=37.83%

Duty Cycle Factor =20log(Duty Cycle)=-8.44

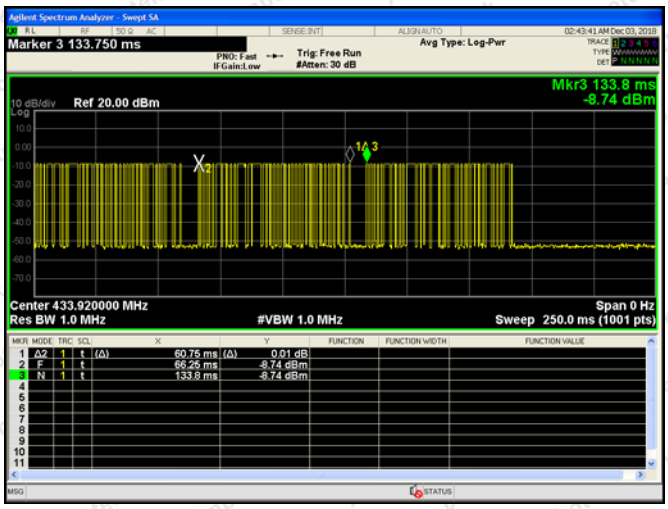
T on time slot-1



T on time slot-2



T period



Test Results (Harmonics Emissions)

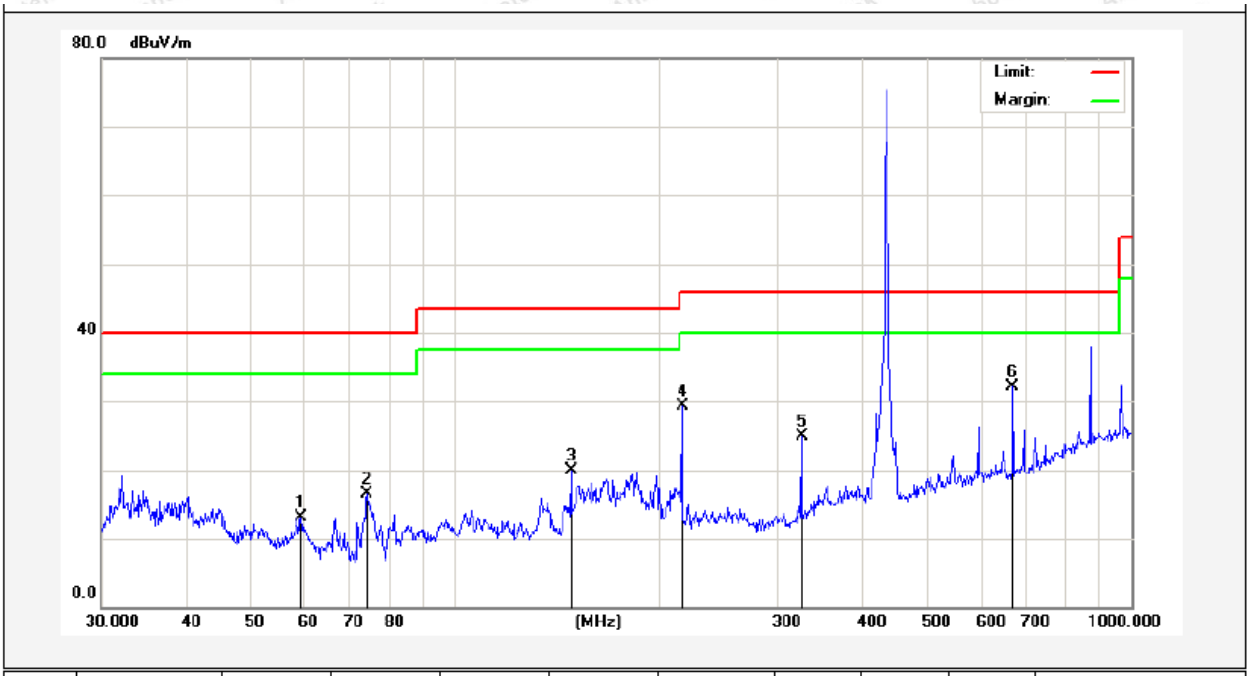
Frequency	Antenna	Reading	Cable Loss	Ant Factor	Amplifier	Duty cycle Factor	Results	Limits	Det
(MHz)	Pol.	(dBuV/m)	(dB)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	Mode
867.84	H	74.32	1.92	12.71	31.72	-	57.23	80.82	PK
867.84	H	74.32	1.92	12.71	31.72	-8.44	48.79	60.82	AV
867.84	V	76.53	1.92	12.71	31.72	-	59.44	80.82	PK
867.84	V	76.53	1.92	12.71	31.72	-8.44	51.00	60.82	AV
1301.76	H	63.59	2.38	21.43	32.45	-	54.95	74	PK
1301.76	H	63.59	2.38	21.43	32.45	-8.44	46.51	54	AV
1301.76	V	65.57	2.38	18.56	32.45	-	54.06	74	PK
1301.76	V	65.57	2.38	18.56	32.45	-8.44	45.62	54	AV

Remark:

1. Result = Reading + Cable Loss +Ant Factor –Amplifier + Duty cycle Factor
2. Pulse Desensitization Correction Factor
   Pulse Width (PW)= 0.362ms
   2/PW=2/0.362=5.52kHz
   RBW(1000kHz)＞ 2/PW (5.52KHz)
   Therefore PDCF is not needed.
3. Duty Cycle Factor=-8.44

Test Results (30~1000MHz)

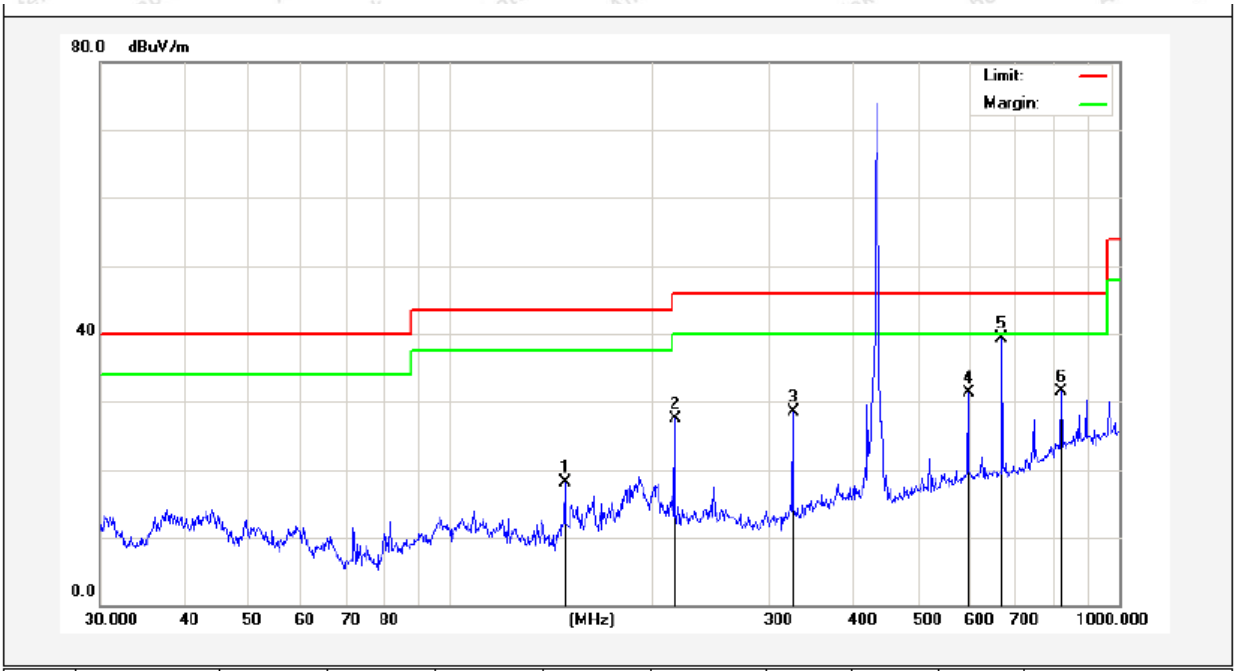
Job No.:	SZAWW181116002-02	Temp.(℃)/Hum.(%RH):	24.6℃/53%RH
Standard:	FCC PART 15C	Power Source:	DC 3V Battery inside
Test Mode:	Keeping TX Mode	Polarization:	Horizontal



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	59.2325	29.99	-16.95	13.04	40.00	-26.96	QP	300	45	
2	74.1351	37.87	-21.46	16.41	40.00	-23.59	QP	300	225	
3	148.4410	38.27	-18.36	19.91	43.50	-23.59	QP	300	163	
4	216.7828	44.77	-15.40	29.37	46.00	-16.63	QP	300	312	
5	325.5958	39.63	-14.73	24.90	46.00	-21.10	QP	300	274	
6	668.1422	40.76	-8.71	32.05	46.00	-13.95	QP	300	354	

Test Results (30~1000MHz)

Job No.:	SZAWW181116002-02	Temp.(℃)/Hum.(%RH):	24.6℃/53%RH
Standard:	FCC PART 15C	Power Source:	DC 3V Battery inside
Test Mode:	Keeping TX Mode	Polarization:	Vertical



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	148.4410	40.39	-22.36	18.03	43.50	-25.47	QP	300	152	
2	216.7828	47.80	-20.24	27.56	46.00	-18.44	QP	300	263	
3	325.5958	44.14	-15.73	28.41	46.00	-17.59	QP	300	360	
4	595.1329	42.43	-11.22	31.21	46.00	-14.79	QP	300	25	
5	668.1423	48.72	-9.35	39.37	46.00	-6.63	QP	300	233	
6	818.8341	37.75	-6.22	31.53	46.00	-14.47	QP	300	245	

Remark:

1. Results = Reading + Cable Loss +Ant Factor –Amplifier

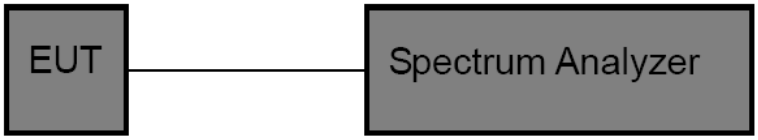
5. 20DB Occupy Bandwidth Test

5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.231 (c)
Test Limit	According to FCC Part 15.231(c), The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. For devices operating above 900MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20dB down from the modulated carrier. So the emission bandwidth limits have been calculated in below table:

Fundamental Frequency	Limit of 20dB Bandwidth
433.920 MHz	433920 * 0.0025=1084.80 kHz

5.2. Test Setup



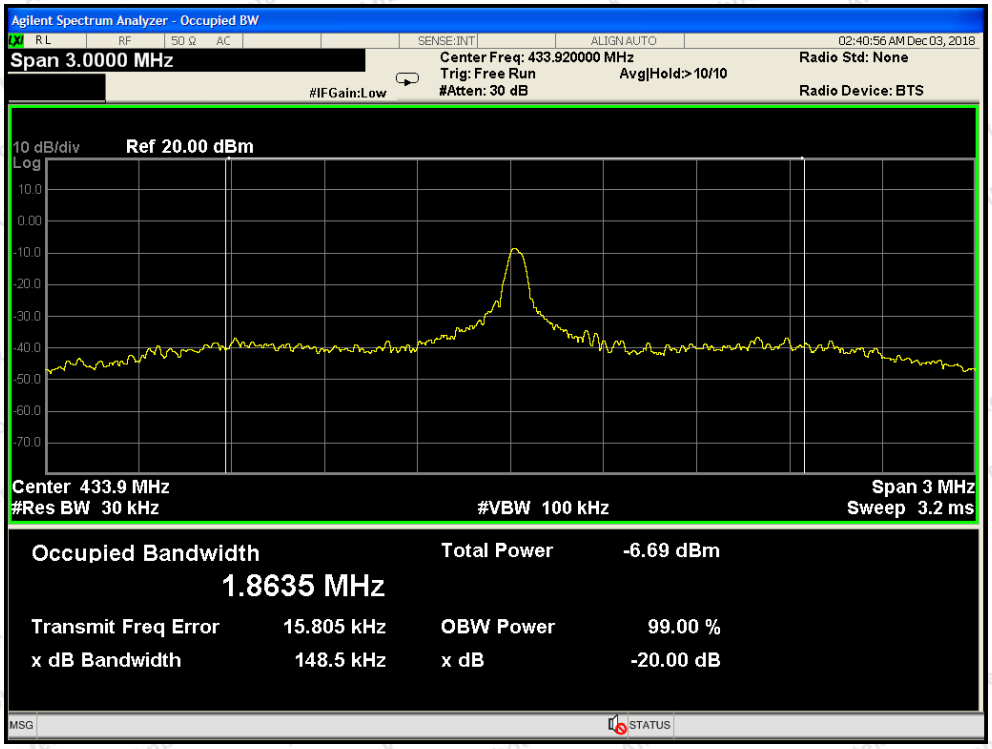
5.3. Test Procedure

1. Place the EUT on the table and set it in the continuously 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 = 30kHz, VBW≥3*RBW =100kHz,
   Span= 1MHz
   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	:	Continuously transmitting
Test Voltage	:	DC 3V battery inside	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

Freq. (MHz)	Modulation Type	Bandwidth (kHz)	Limit (kHz)	Results
433.920	ASK	148.5	<1084.80	PASS



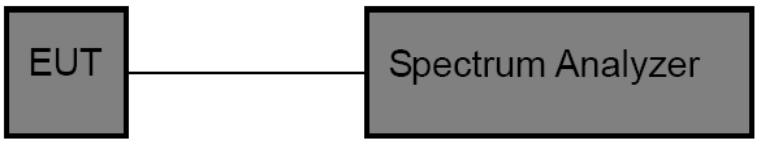
433.920MHz

6. Dwell Time Test

6.1. Test Standard and Limit

Test Standard	FCC Part 15.231(a)(1)
Test Limit	According to FCC Part 15.231(a)(1), A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released

6.2. Test Setup



6.3. Test Procedure

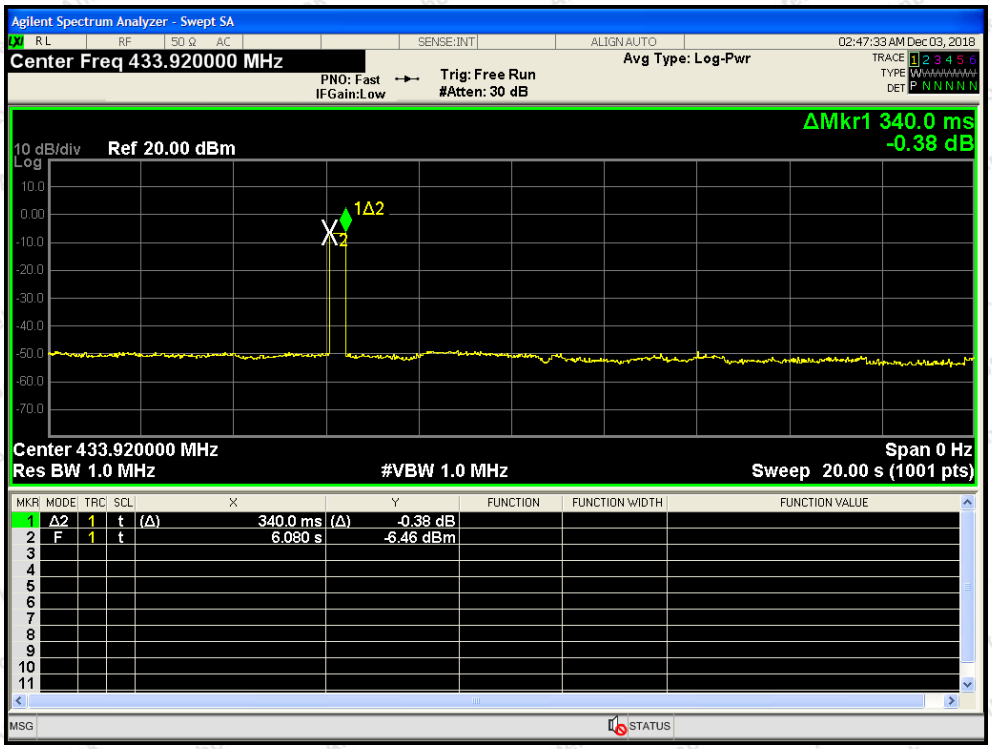
1. Place the EUT on the table and set it in continuously transmitting mode. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as
   RBW=1000kHz, VBW= 1000 kHz, Span= 0Hz, Sweep Time= 80 Seconds.
3. Record the Delta mark time.

6.4. Test Data

Test Item	:	Dwell Time	Test Mode	:	Continuously transmitting
Test Voltage	:	DC 3V battery inside	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

Test Mode	Transmitting time(s)	Limit(s)	Result
ASK mode	0.340	≤5	PASS

Please refer the following plot.


Agilent Spectrum Analyzer - Swept SA
Center Freq 433.920000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
02:47:33 AM Dec 03, 2018
ΔMkr1 340.0 ms
-0.38 dB
10 dB/div
Log
Ref 20.00 dBm
1Δ2
Center 433.920000 MHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 20.00 s (1001 pts)
1 Δ2 1 t (Δ) 340.0 ms (Δ) -0.38 dB
2 F 1 t 6.080 s -6.46 dBm

Dwell Time

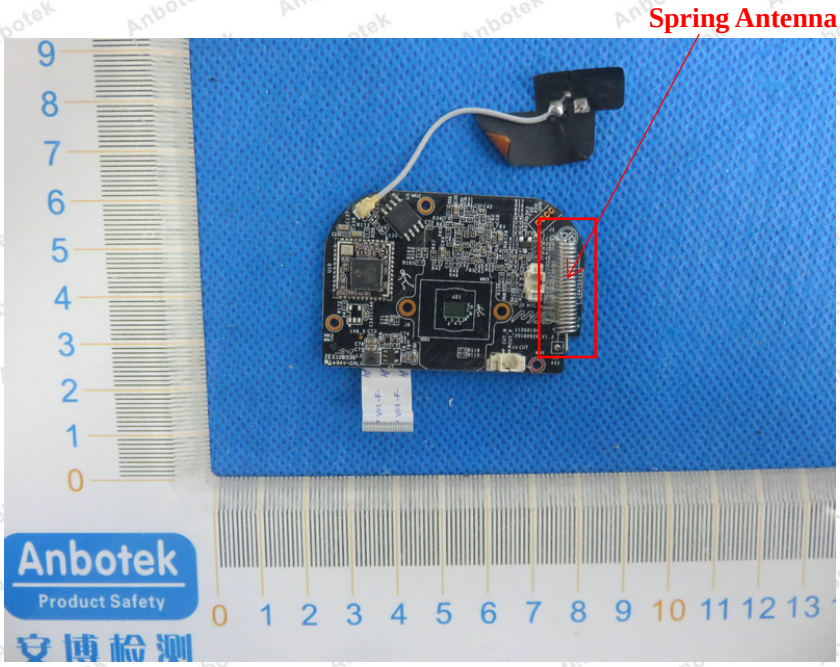
7. Antenna Requirement

7.1. 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. Antenna requirement must meet at least one of the following: 1) Antenna must be permanently attached to device. 2) The antenna must use a unique type of connector to attach to the device. 3) Device must be professionally installed. The installer shall be responsible for ensuring that the correct antenna is employed by the device.

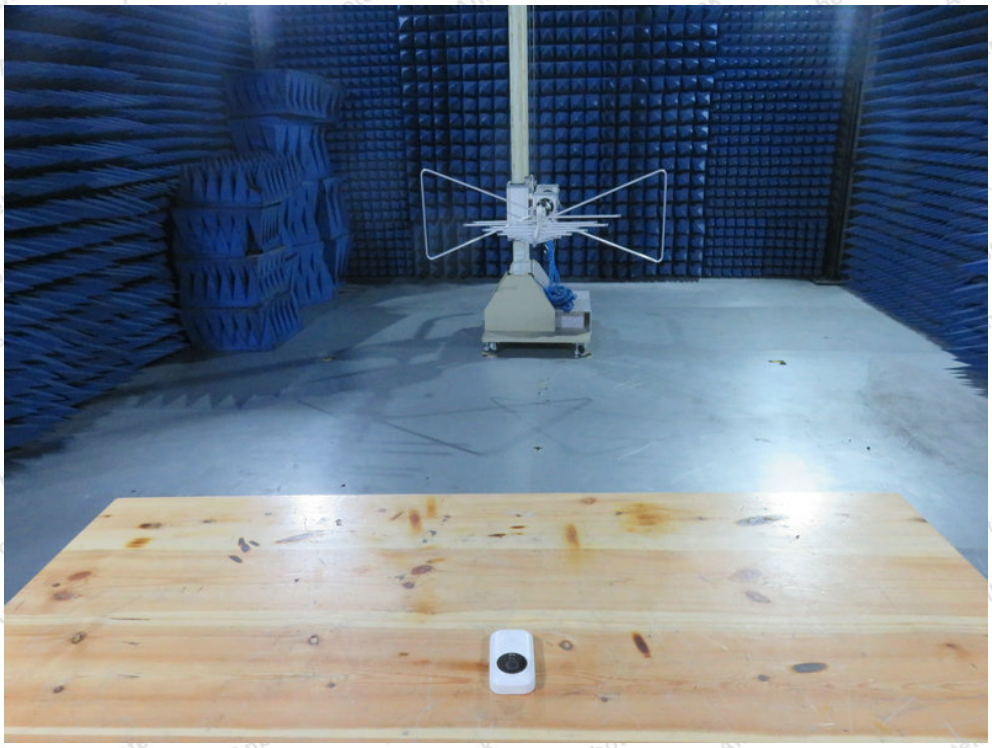
7.2. Antenna Connected Construction

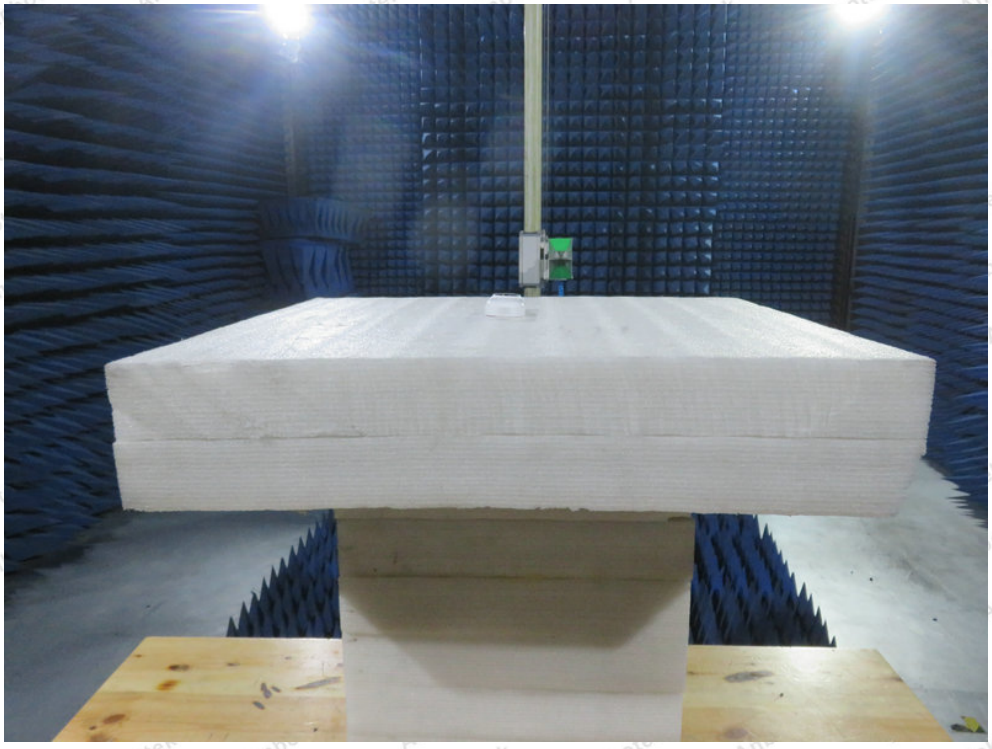
The antenna is a Spring Antenna which permanently attached, and the best case gain of the antenna is 2 dBi. It complies with the standard requirement.



APPENDIX I -- TEST SETUP PHOTOGRAPH

Photo of Radiation Emission Test





APPENDIX II -- EXTERNAL PHOTOGRAPH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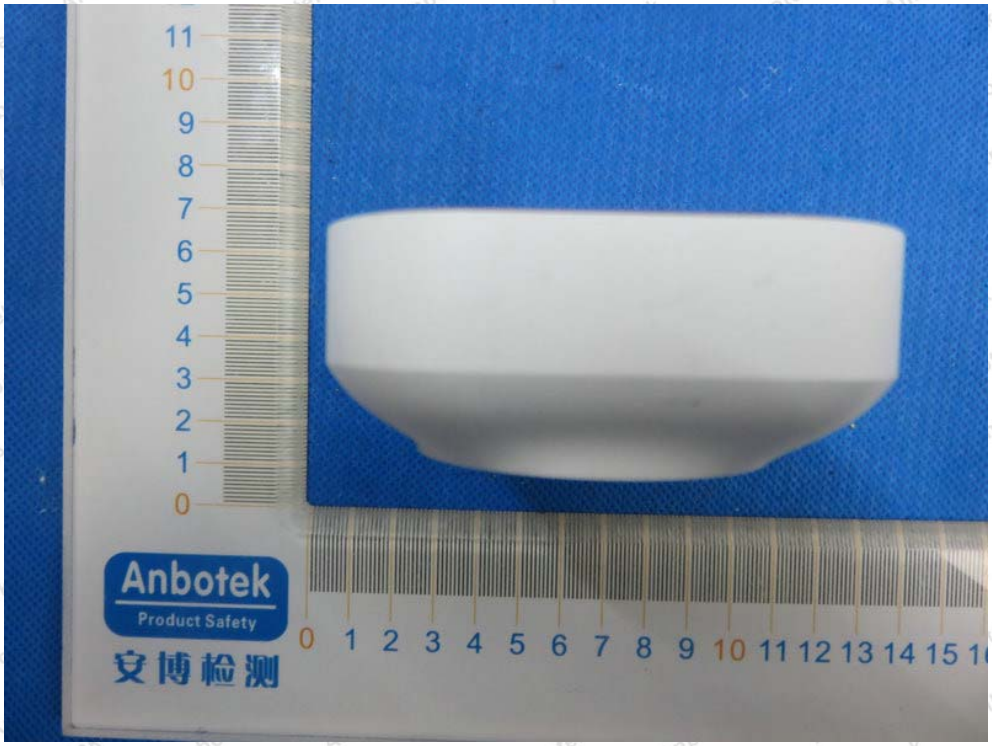
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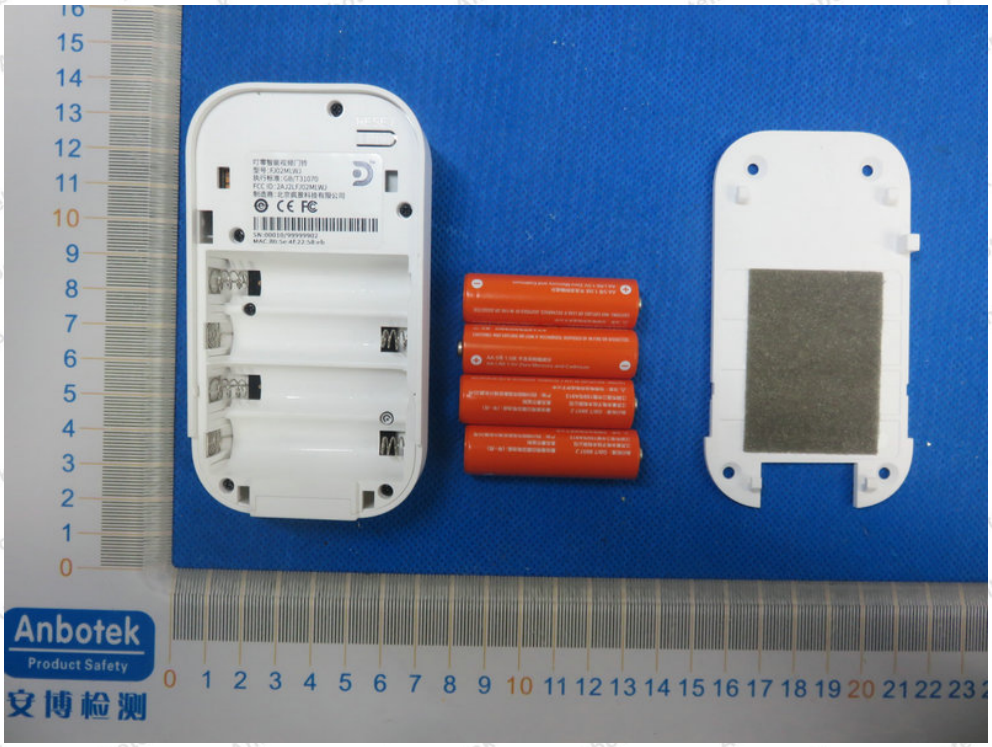
APPENDIX III -- INTERNAL PHOTOGRAPH

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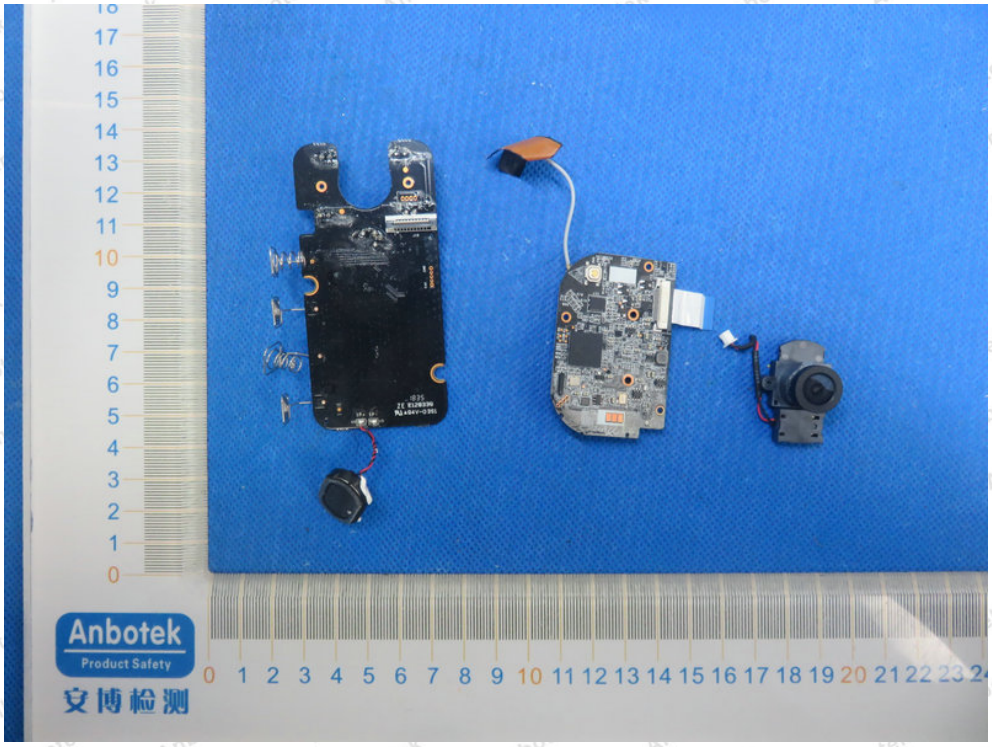
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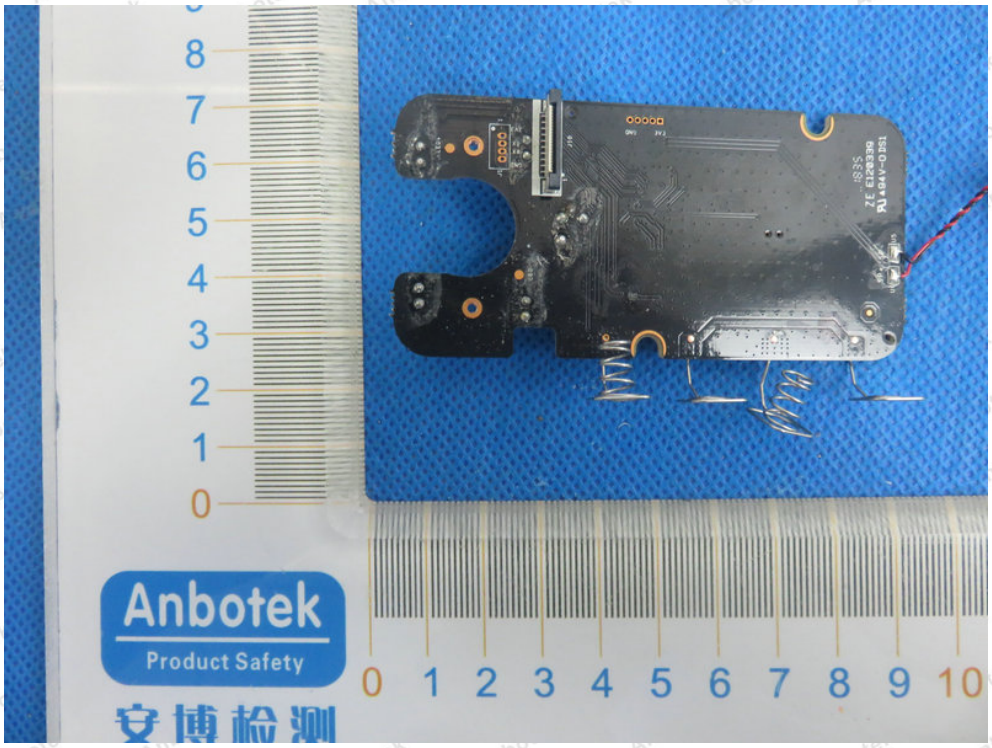
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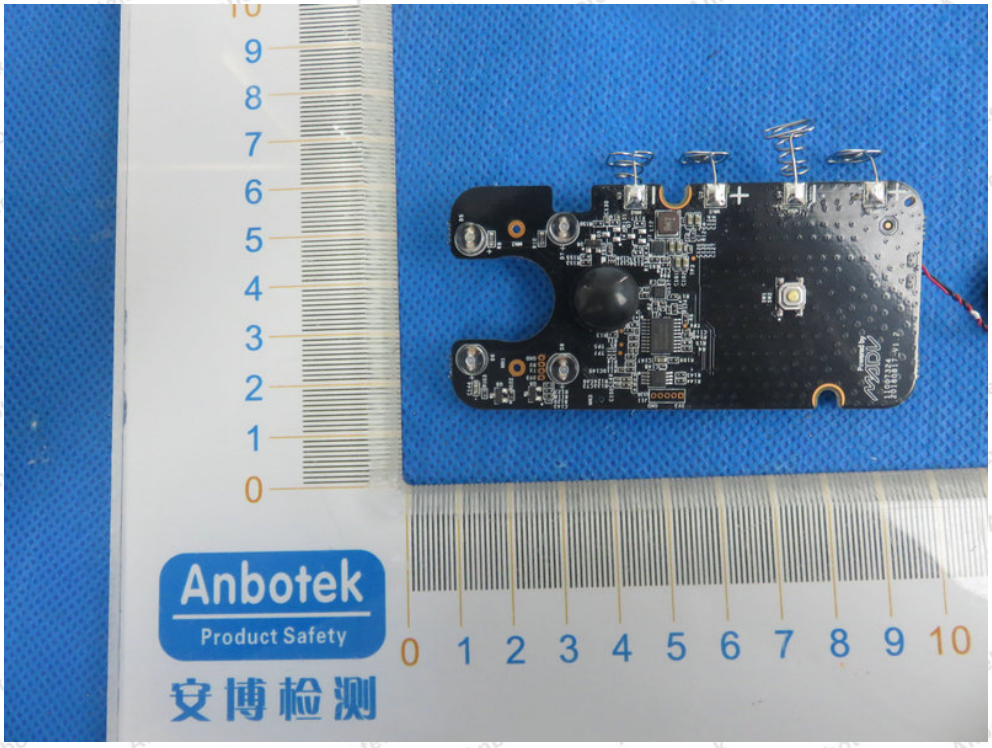
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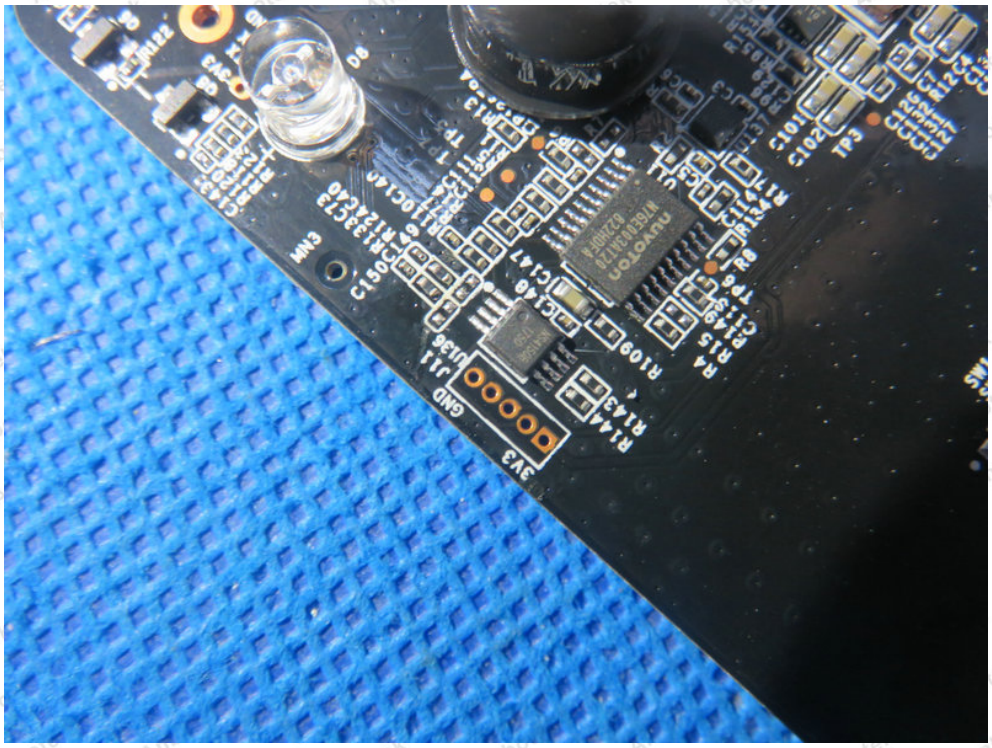

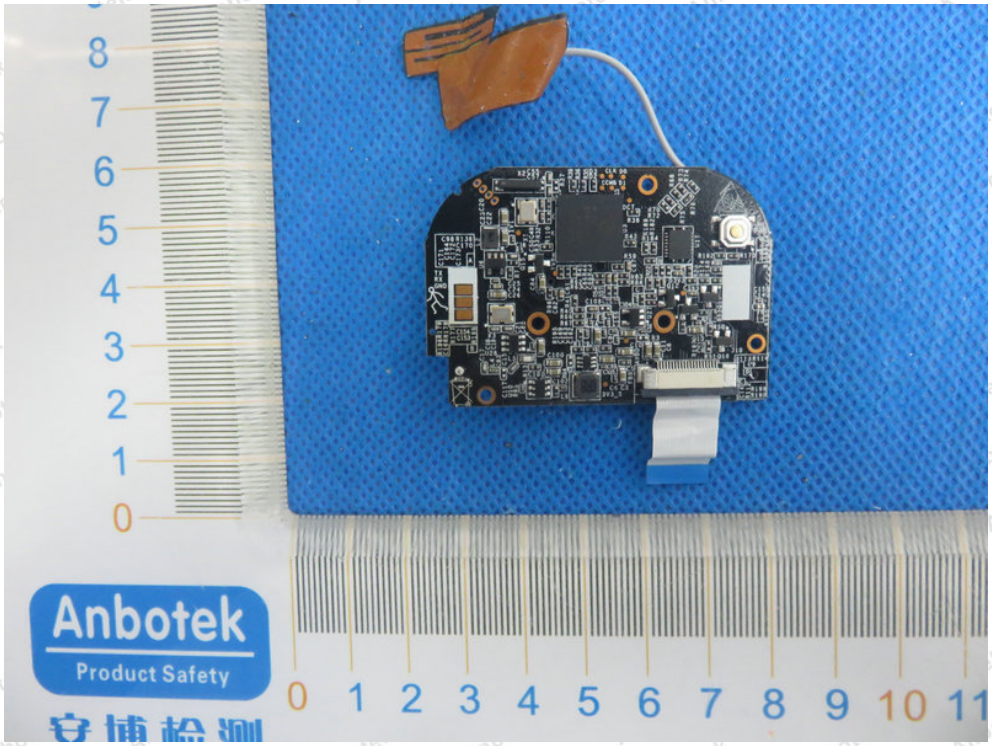
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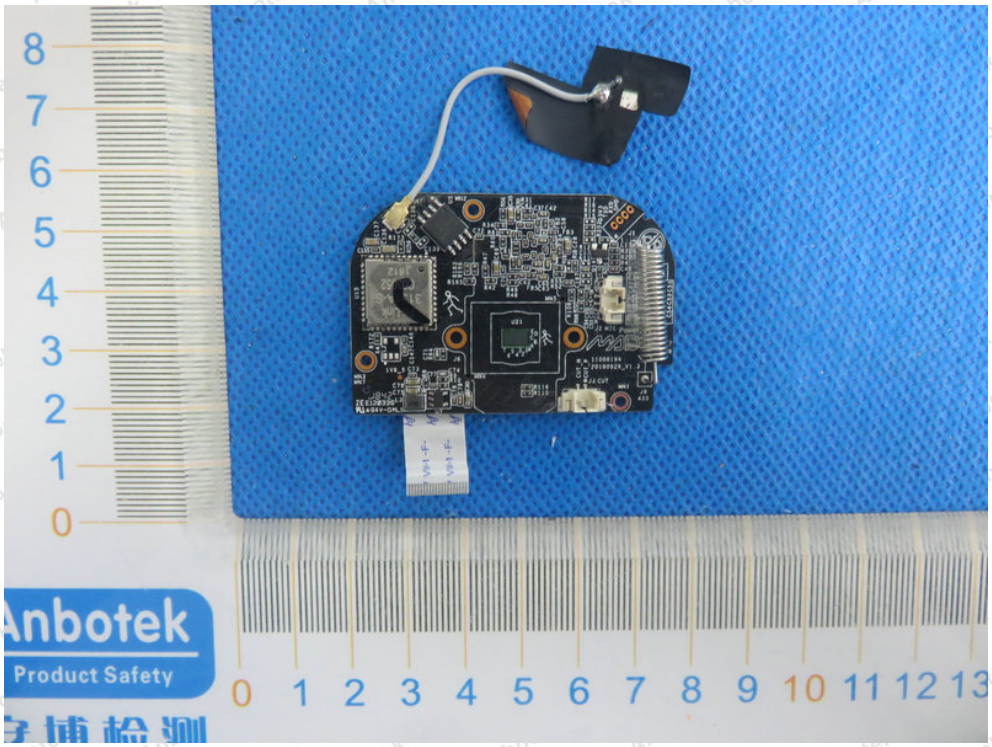
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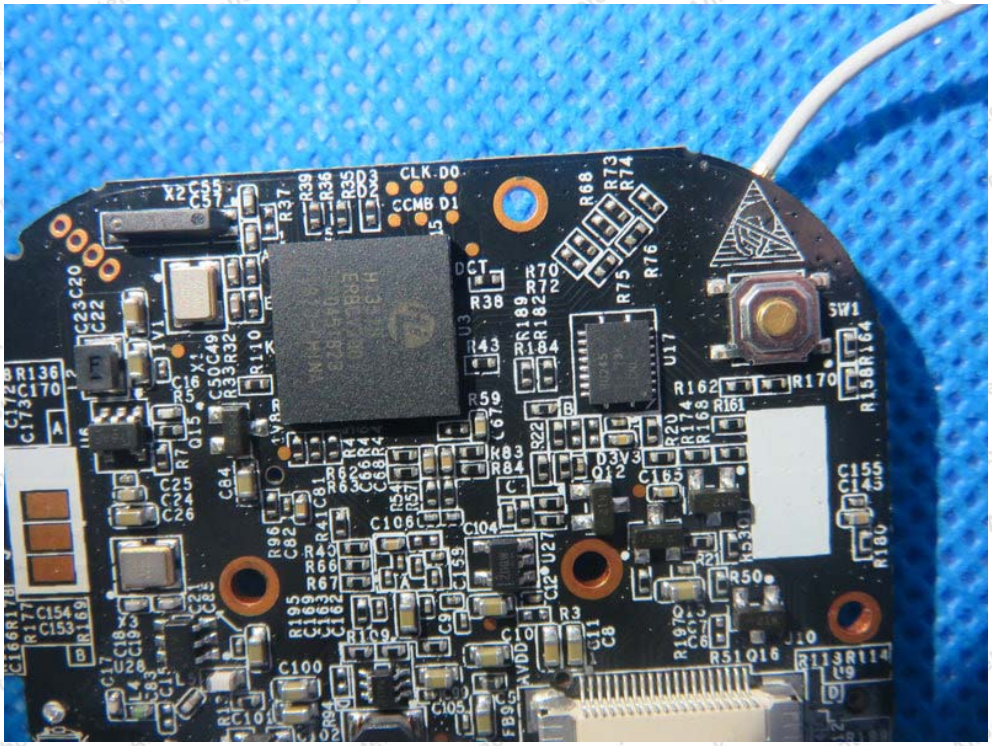

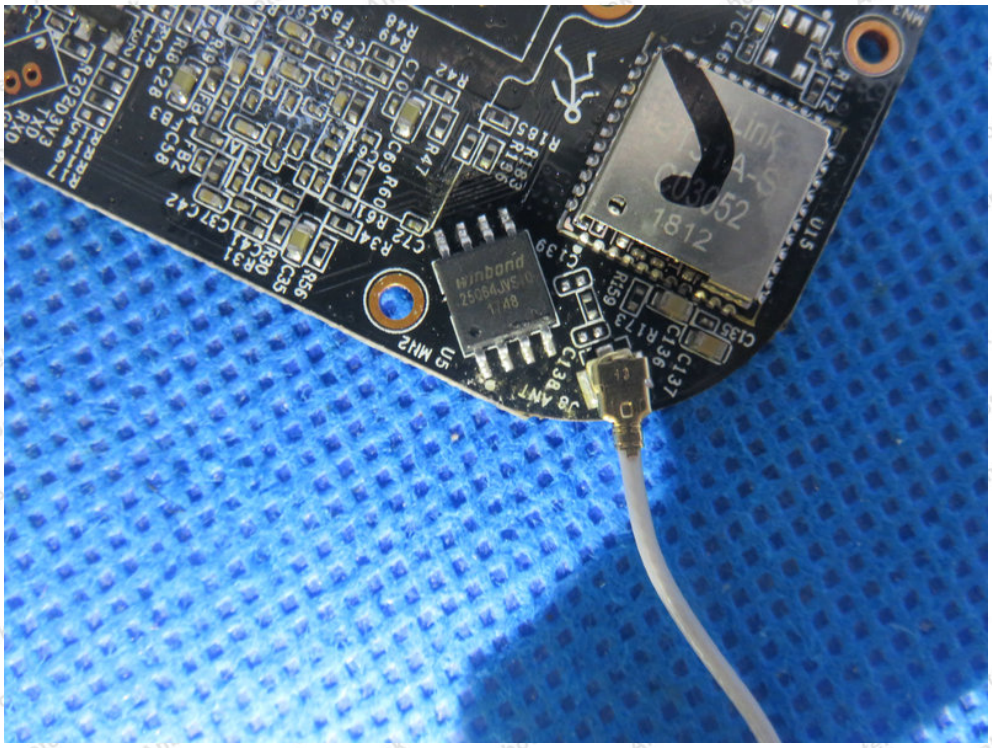
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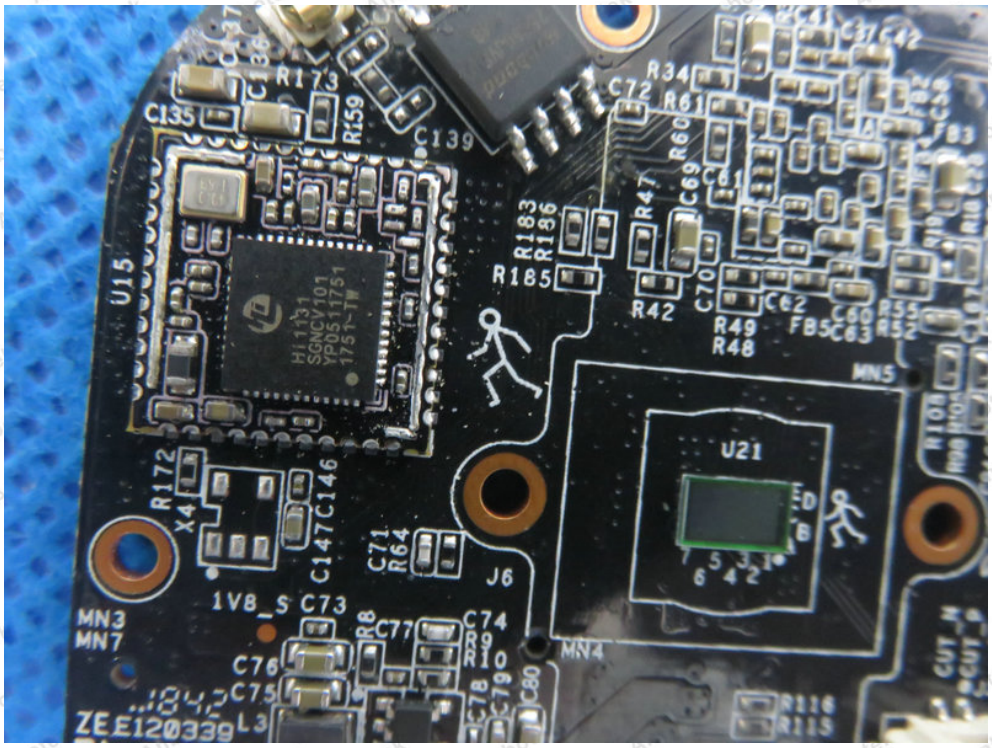

---------- End of Report ----------