TEST REPORT

Reference No......	:	WTS15S0425545E
FCC ID	:	OZ3HC428VRF
Applicant.....	:	Hytronik Electronics Co.,Ltd.
Address.....	:	BlockA6,Haosi Linpo keng Ind.Park Shajing Town Ban'an District Shenzhen P.R.C
Manufacturer	:	Hytronik Electronics Co.,Ltd.
Address.....	:	BlockA6,Haosi Linpo keng Ind.Park Shajing Town Ban'an District Shenzhen P.R.C
Product Name.....	:	Lighting Control Switch
Model No.	:	HC428V/RF
Standards.....	:	FCC CFR47 Part 15 Section 15.249: 2014
Date of Receipt sample	:	Apr. 23, 2015
Date of Test	:	Apr. 24 ~ May.14, 2015
Date of Issue.....	:	May.15, 2015
Test Result.....	:	Pass

Remarks:
The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

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Compiled by:

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Approved by:

Philo Zhong / Manager

2 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207	PASS
Radiated Emission	15.249(a) 15.209 15.205(a)	PASS
Periodic Operation	15.35(c)	PASS
Outside of Band Emission	15.249 15.205 15.209	PASS
20dB Bandwidth	15:215(c)	PASS
Antenna Requirement	15.203	PASS

3 Contents

Page

1 COVER PAGE 1

2 TEST SUMMARY 2

3 CONTENTS 3

4 GENERAL INFORMATION 4

4.1 GENERAL DESCRIPTION OF E.U.T. 4
4.2 DETAILS OF E.U.T. 4
4.3 TEST FACILITY 4

5 EQUIPMENT USED DURING TEST 5

5.1 EQUIPMENTS LIST 5
5.2 MEASUREMENT UNCERTAINTY 5
5.3 TEST EQUIPMENT CALIBRATION 5

6 CONDUCTED EMISSION 6

6.1 E.U.T. OPERATION 6
6.2 EUT SETUP 6
6.3 MEASUREMENT DESCRIPTION 6
6.4 TEST RESULT 7

7 RADIATION EMISSION TEST 9

7.1 EUT OPERATION 9
7.2 TEST SETUP 10
7.3 SPECTRUM ANALYZER SETUP 11
7.4 TEST PROCEDURE 12
7.5 TEST RESULT 13

8 PERIODIC OPERATION 14

9 OUTSIDE OF BAND EMISSION 15

9.1 TEST PROCEDURE 15
9.2 TEST RESULT 15

10 20 DB BANDWIDTH MEASUREMENT 16

10.1 TEST PROCEDURE 16
10.2 TEST RESULT 16

11 ANTENNA REQUIREMENT 17

12 PHOTOGRAPHS- TEST SETUP 18

12.1 PHOTOGRAPH – CONDUCTED EMISSION TEST SETUP 18
12.2 RADIATION EMISSION FROM 30MHZ-1GHZ TEST SITE2# 18
12.3 RADIATION EMISSION ABOVE 1GHZ TEST SITE1# 19

13 PHOTOGRAPHS - CONSTRUCTIONAL DETAILS 20

13.1 EXTERNAL VIEW 20
13.2 INTERNAL VIEW 23

4 General Information

4.1 General Description of E.U.T.

Product Name	:Lighting Control Switch
Model No.	:HC428V/RF
Model Differences	: N/A
Type of Modulation	: FSK
Frequency Range	: 915MHz
The Lowest Oscillator	: 32.768kHz
Antenna installation	: Integrated Antenna

4.2 Details of E.U.T.

Technical Data : AC 120-277V, 60Hz, 200-500W

4.3 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: 7760A-1**

  Waltek Services (Shenzhen) Co., Ltd. has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration 7760A-1, July 12, 2012.

- **FCC Test Site 1#– Registration No.: 880581**

  Waltek Services(Shenzhen) Co., Ltd. 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 880581, April 29, 2014.

- **FCC Test Site 2#– Registration No.: 328995**

  Waltek Services(Shenzhen) Co., Ltd. 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 328995, December 3, 2014.

4.3.1 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Lower channel	Middle channel	Upper channel
Transmitting	915MHz	/	/

5 Equipment Used during Test

5.1 Equipments List

3m Semi-anechoic Chamber for Radiation						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1	EMC Analyzer	Agilent	E7405A	MY45114943	Sep.15,2014	Sep.14,2015
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr.19,2015	Apr.18,2016
3	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.15,2014	Sep.14,2015
4	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr.19,2015	Apr.18,2016
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	Apr.19,2015	Apr.18,2016
6	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Mar.17,2015	Mar.16,2016
7	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	Apr.10,2015	Apr.09,2016
RF Conducted Testing						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	Sep.15,2014	Sep.14,2015
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	Sep.15,2014	Sep.14,2015
3.	Humidity Chamber	GF	GTH-225-40-1P	IAA061213	May 16,2015	May 15,2016

5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	± 1 x 10^{-6}
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 5.47 dB (Horn antenna 1000M~25000MHz)

5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

6 Conducted Emission

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.4:2003
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class/Severity:	Class B
Limit:	66-56 dBμV between 0.15MHz & 0.5MHz
	56 dBμV between 0.5MHz & 5MHz
	60 dBμV between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth)

6.1 E.U.T. Operation

Operating Environment **:**

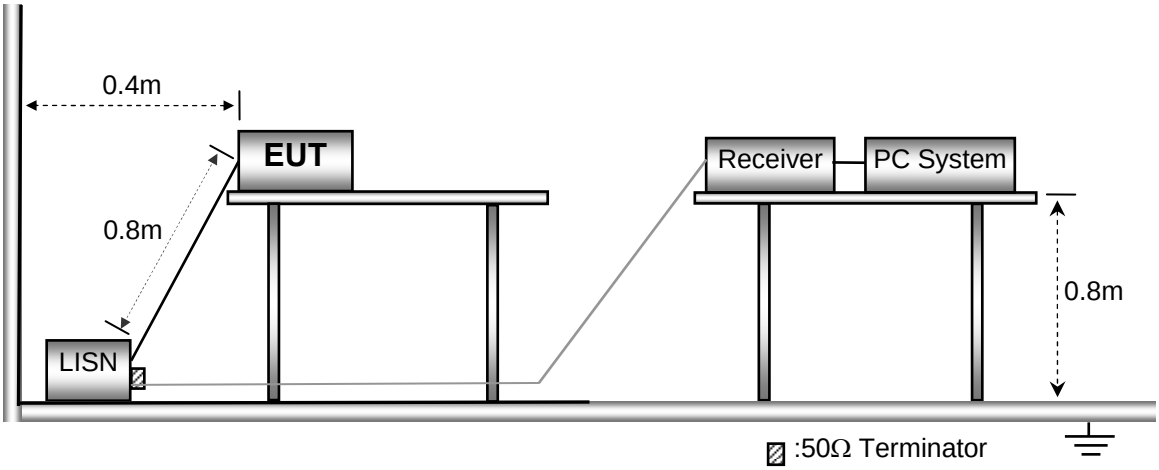
Temperature:	25.5 °C
Humidity:	51 % RH
Atmospheric Pressure:	101.2kPa

EUT Operation **:**

The test was performed in transmitting mode, the test data were shown in the report.

6.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.4:2003.

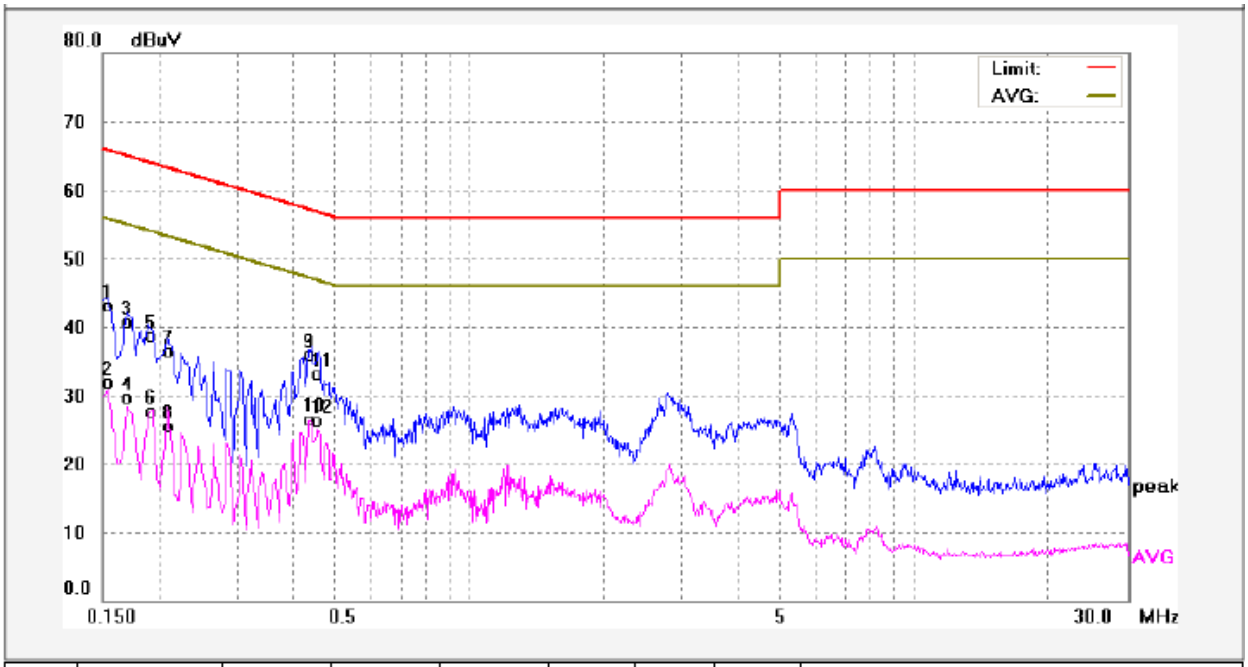


6.3 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

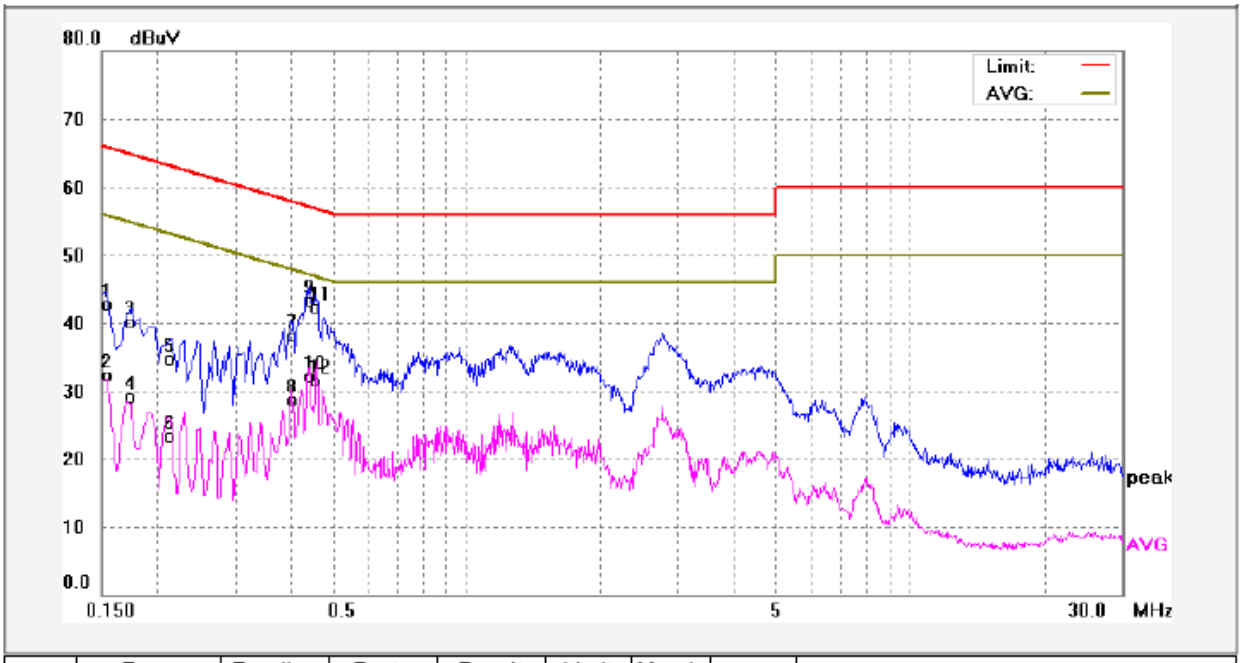
6.4 Test Result

Live Line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1539	32.89	10.13	43.02	65.78	-22.76	QP	
2	0.1539	21.73	10.13	31.86	55.78	-23.92	AVG	
3	0.1700	30.64	10.14	40.78	64.96	-24.18	QP	
4	0.1700	19.66	10.14	29.80	54.96	-25.16	AVG	
5	0.1900	28.55	10.15	38.70	64.03	-25.33	QP	
6	0.1900	17.56	10.15	27.71	54.03	-26.32	AVG	
7	0.2100	26.30	10.15	36.45	63.20	-26.75	QP	
8	0.2100	15.27	10.15	25.42	53.20	-27.78	AVG	
9	0.4420	25.73	10.18	35.91	57.02	-21.11	QP	
10	0.4420	16.29	10.18	26.47	47.02	-20.55	AVG	
11	0.4580	22.92	10.18	33.10	56.73	-23.63	QP	
12	0.4580	16.07	10.18	26.25	46.73	-20.48	AVG	

Neutral Line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1539	32.65	10.13	42.78	65.78	-23.00	QP	
2	0.1539	22.18	10.13	32.31	55.78	-23.47	AVG	
3	0.1740	29.93	10.14	40.07	64.76	-24.69	QP	
4	0.1740	19.01	10.14	29.15	54.76	-25.61	AVG	
5	0.2140	24.59	10.15	34.74	63.04	-28.30	QP	
6	0.2140	13.12	10.15	23.27	53.04	-29.77	AVG	
7	0.4020	27.83	10.18	38.01	57.81	-19.80	QP	
8	0.4020	18.60	10.18	28.78	47.81	-19.03	AVG	
9	0.4420	33.15	10.18	43.33	57.02	-13.69	QP	
10	0.4420	21.94	10.18	32.12	47.02	-14.90	AVG	
11	0.4540	32.22	10.18	42.40	56.80	-14.40	QP	
12	0.4540	21.25	10.18	31.43	46.80	-15.37	AVG	

7 Radiation Emission Test

Test Requirement: FCC Part15 Paragraph 15.249

Test Method: ANSI 63.4: 2003

Measurement Distance: 3m

Test Result: PASS

15.249(a)Limit:

Fundamental frequency	Field strength of fundamental		Field strength of harmonics	
	mV/m	dBuV/m	uV/m	dBuV/m
902-928 MHz	50	94	500	54
2400-2483.5 MHz	50	94	500	54
5725-5875 MHz	50	94	500	54
24.0-24.25 GHz	250	108	2500	68

15.209 Limit:

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

Note: RF Voltage(dBuV)=20 $\log_{10}$ RF Voltage(uV)

7.1 EUT Operation

Operating Environment **:**

Temperature: 23.5 °C

Humidity: 51.1 % RH

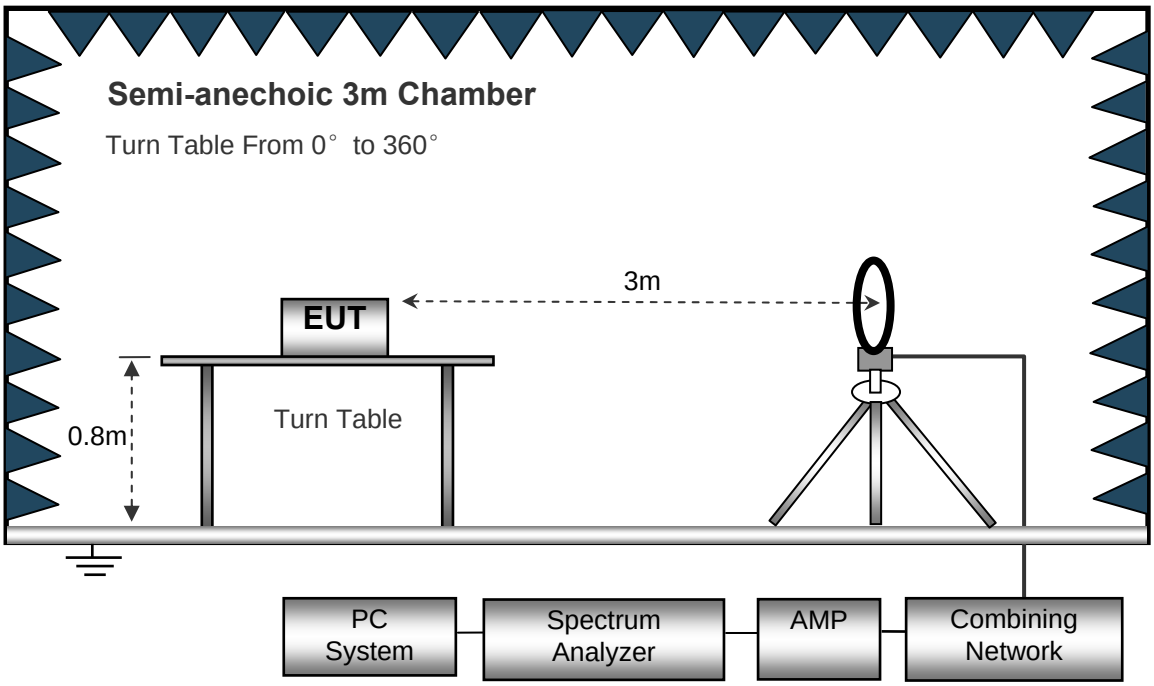
Atmospheric Pressure: 101.2kPa

EUT Operation **:**

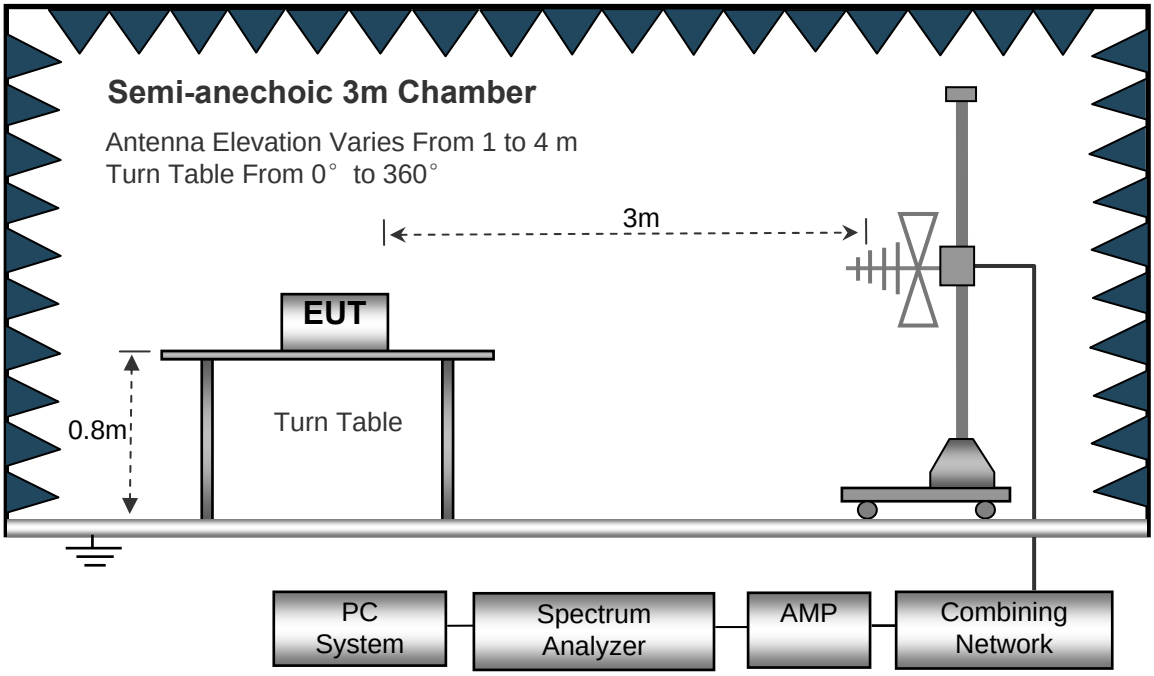
The test was performed in transmitting mode, the test data were shown in the report.

7.2 Test Setup

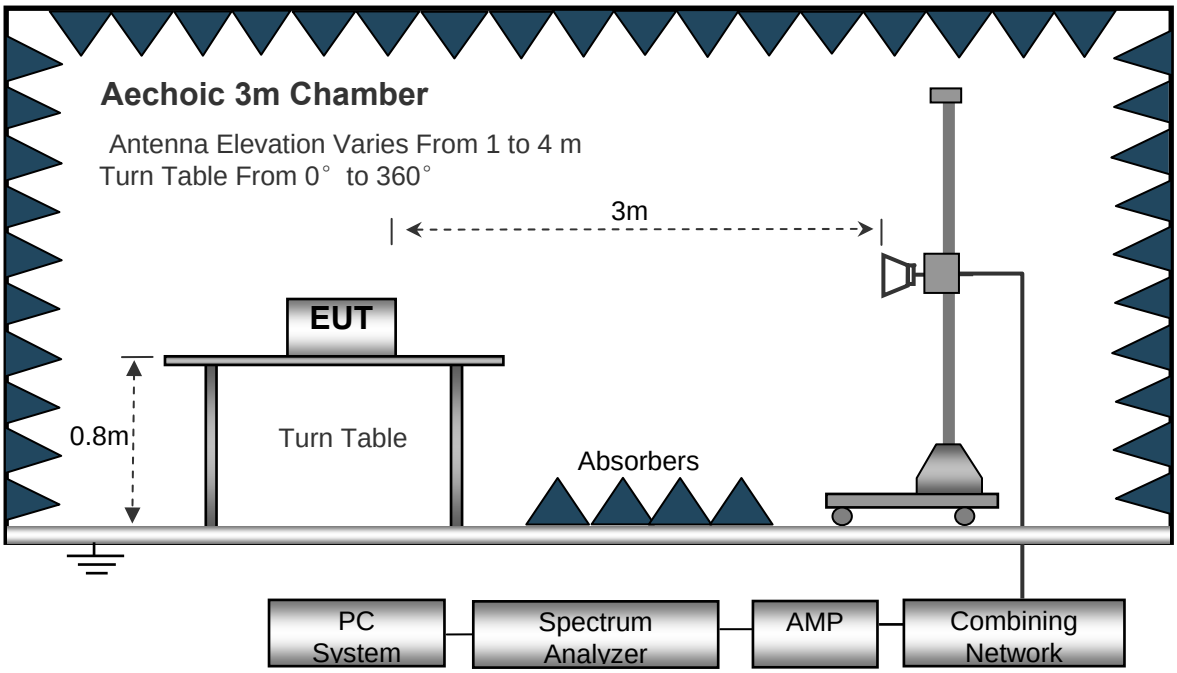
The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003.
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30MHz to 1GHz.



The test setup for emission measurement above 1 GHz.



7.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed ..... Auto
IF Bandwidth..... 10kHz
Video Bandwidth..... 10kHz

Resolution Bandwidth..... 10kHz

30MHz ~ 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 100kHz
Video Bandwidth..... 300kHz

Above 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 3MHz
Detector ..... Ave.
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 10Hz

7.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

7.5 Test Result

AV = Peak +20Log10(duty cycle)

Test Frequency: From 32.768kHz to 30MHz

The measurements were more than 20 dB below the limit and not reported.

Test Frequency: 30MHz ~ 10GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.249/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)
39.65	35.24	QP	342	1.3	V	-9.25	25.99	40.00	-14.01
99.03	42.37	QP	247	1.9	V	-7.94	34.43	43.50	-9.07
915.00	77.54	PK	351	1.5	H	0.62	78.16	114.00	-35.84
915.00	82.42	PK	355	1.5	V	0.62	83.04	114.00	-30.96
1830.00	49.61	PK	156	1.3	H	-13.21	36.40	74.00	-37.60
1830.00	55.04	PK	347	1.4	V	-13.21	41.83	74.00	-32.17
2745.00	50.55	PK	125	1.6	H	-13.08	37.47	74.00	-36.53
2745.00	50.07	PK	29	1.5	V	-13.08	36.99	74.00	-37.01
3660.00	49.24	PK	107	1.1	H	-9.08	40.16	74.00	-33.84
3660.00	50.36	PK	352	2.0	V	-9.08	41.28	74.00	-32.72

Frequency	PK	Turn table Angle	RX Antenna		Duty cycle Factor	AV	FCC Part 15.249/209/205	
			Height	Polar			Limit	Margin
(MHz)	(dBμV/m)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
915.00	78.16	351	1.5	H	-0.35	77.81	94.00	-16.19
915.00	83.04	355	1.5	V	-0.35	82.69	94.00	-11.31
1830.00	36.40	156	1.3	H	-0.35	36.05	54.00	-17.95
1830.00	41.83	347	1.4	V	-0.35	41.48	54.00	-12.52
2745.00	37.47	125	1.6	H	-0.35	37.12	54.00	-16.88
2745.00	36.99	29	1.5	V	-0.35	36.64	54.00	-17.36
3660.00	40.16	107	1.1	H	-0.35	39.81	54.00	-14.19
3660.00	41.28	352	2.0	V	-0.35	40.93	54.00	-13.07

8 Periodic Operation

The duty cycle was determined by the following equation:

To calculate the actual field intensity,the duty cycle correction factor in decibel is needed for later use and can be obtained from following conversion

Duty Cycle(%)=Total On interval in a complete pulse train/ Length of a complete pulse train * %

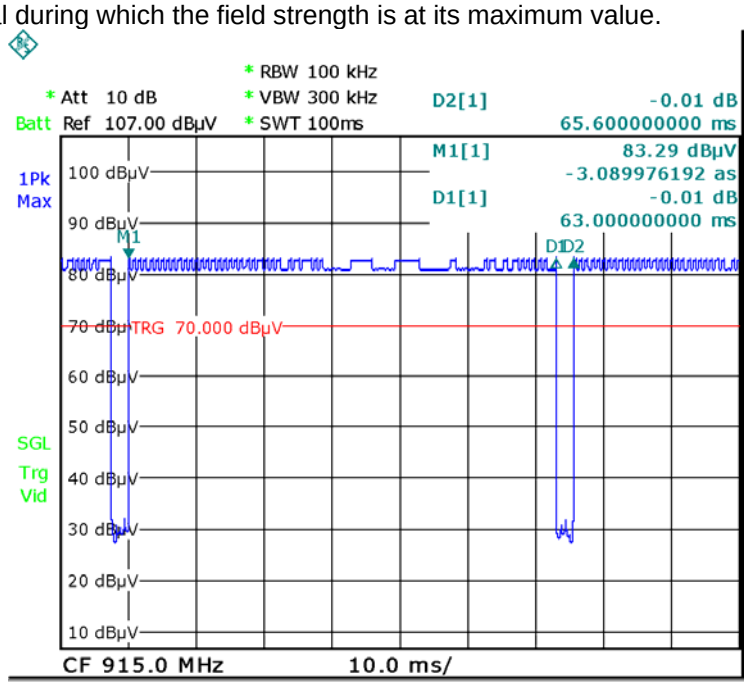
Duty Cycle Correction Factor(dB)=20 * Log_{10}(Duty Cycle(%))

Total transmission time(ms)	65.6
Length of a complete transmission period(ms)	63.0
Duty Cycle(%)	96.04
Duty Cycle Correction Factor(dB)	-0.35

Refer to the duty cycle plot (as below),This device meets the FCC requirement.

Length of a complete pulse train:

Remark: FCC part15.35(c) required that a complete pulse train is more than 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.



9 Outside of Band Emission

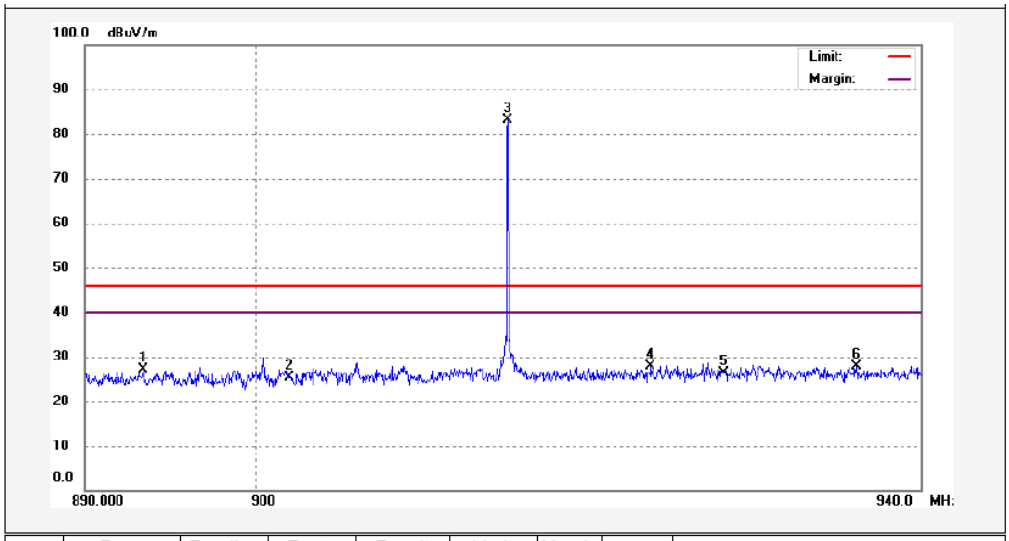
Test Requirement:	15.249(d):Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.
Test Method:	ANSI C63.4:2003
Test Mode:	Transmitting

9.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
   Detector function = peak, Trace = max hold

9.2 Test Result

Test plot



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	893.4500	27.53	-0.47	27.06	46.00	-18.94	peak	
2	902.0000	25.65	-0.19	25.46	46.00	-20.54	peak	
3	915.0000	82.42	0.62	83.04	114.00	-30.96	peak	
4	923.6000	26.85	0.97	27.82	46.00	-18.18	peak	
5	928.0000	25.44	1.02	26.46	46.00	-19.54	peak	
6	936.1000	26.72	1.23	27.95	46.00	-18.05	peak	

Remark: The worst case (Vertical) was recorded.

10 20 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.215(c)

Test Method: ANSI C63.4:2003

Test Mode: Transmitting

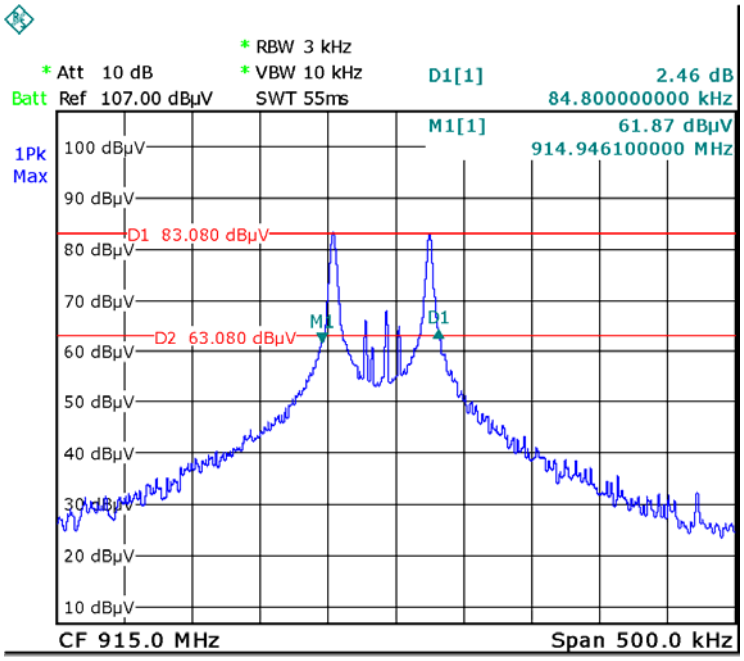
10.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 10kHz, VBW = 30kHz

10.2 Test Result

Test Frequency	Bandwidth
915.0MHz	84.80kHz

Test plots



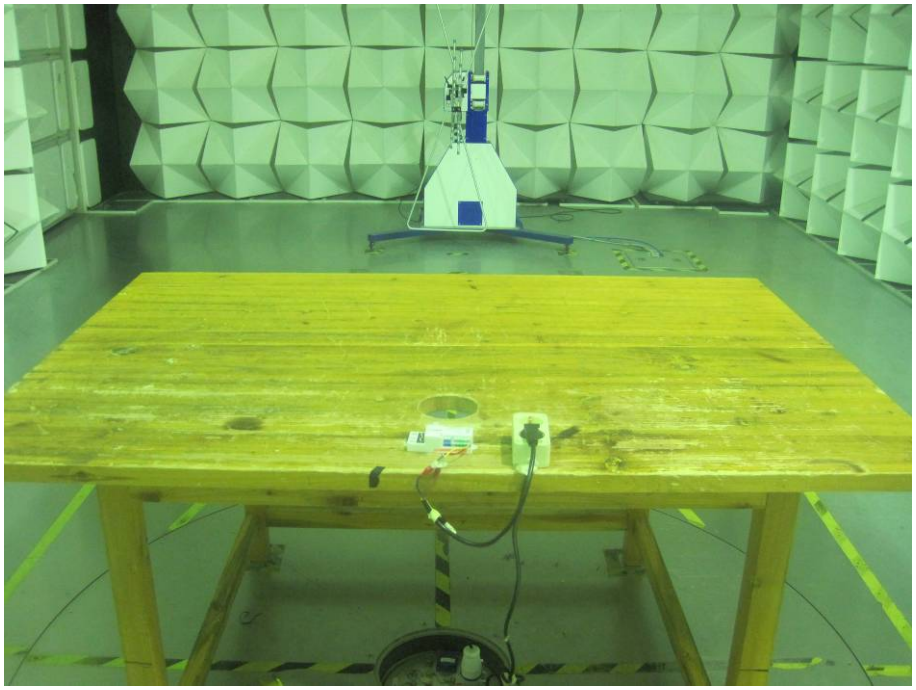
11 Antenna Requirement

According to the FCC Part 15 Paragraph 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. This product has an Integrated Antenna fulfil the requirement of this section.

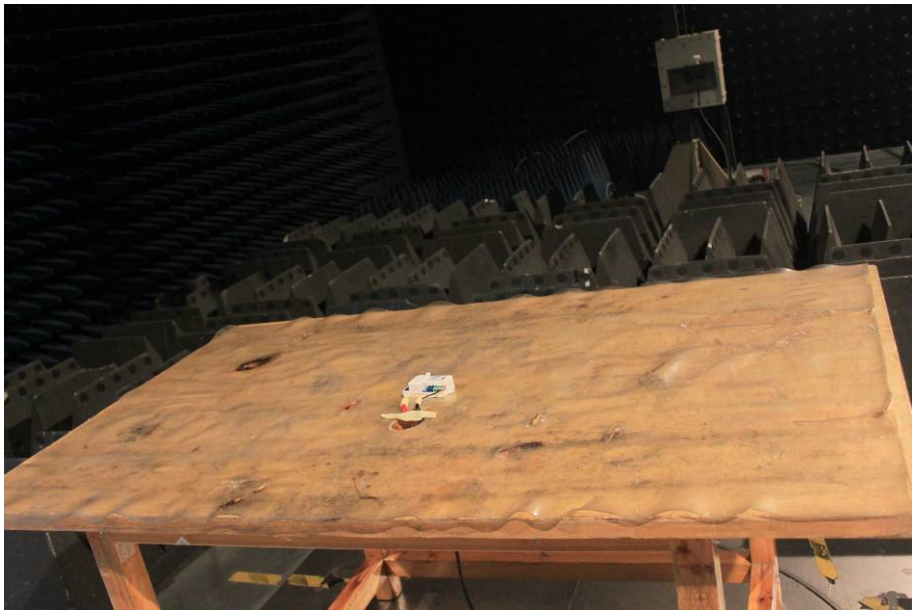
12 Photographs- Test Setup

12.1 Photograph – Conducted Emission Test Setup

12.2 Radiation Emission From 30MHz-1GHz Test Site2#

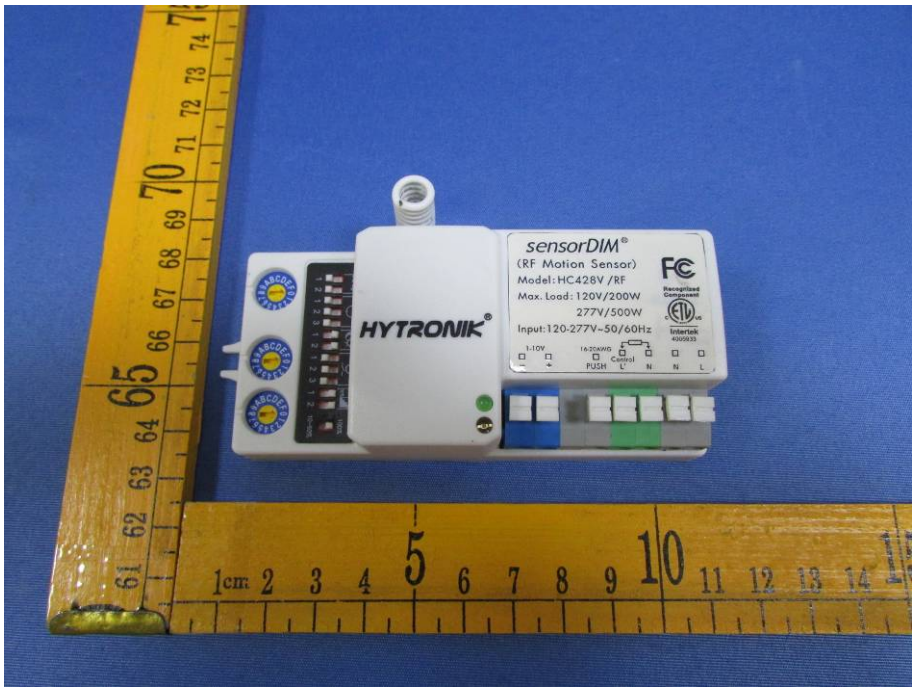


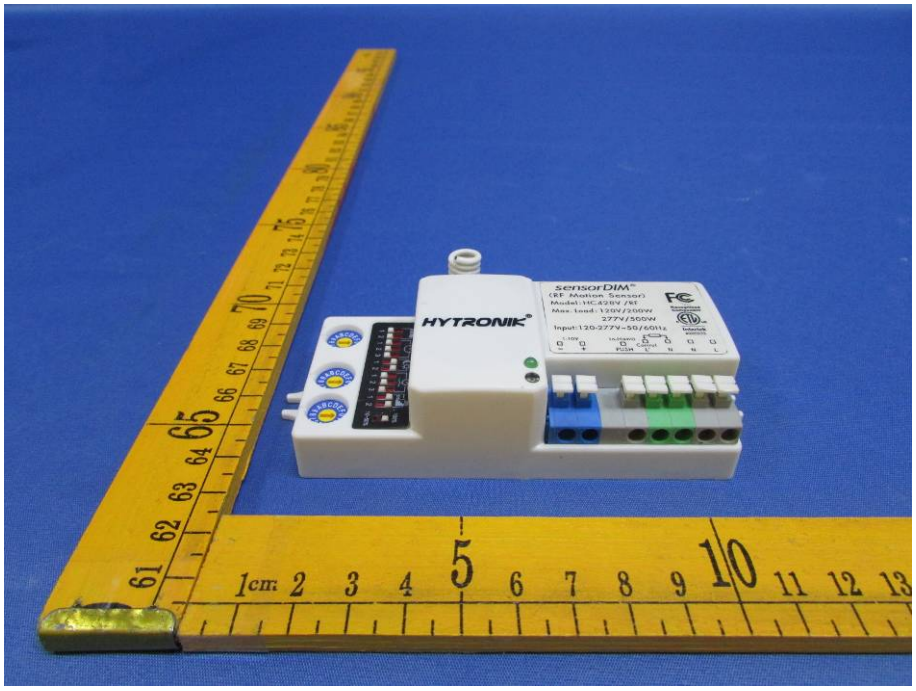
12.3 Radiation Emission Above 1GHz Test Site1#

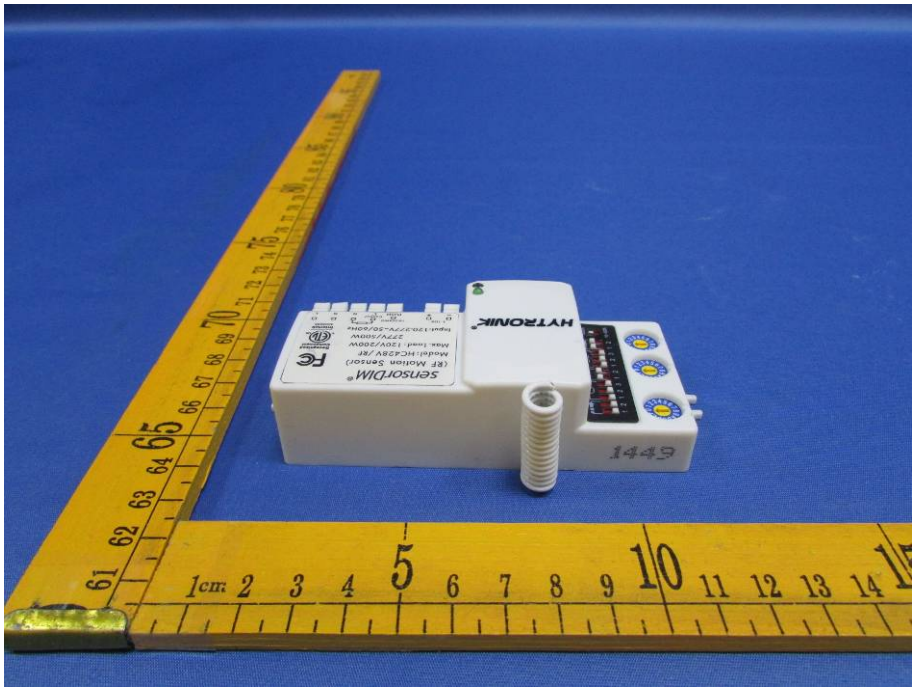


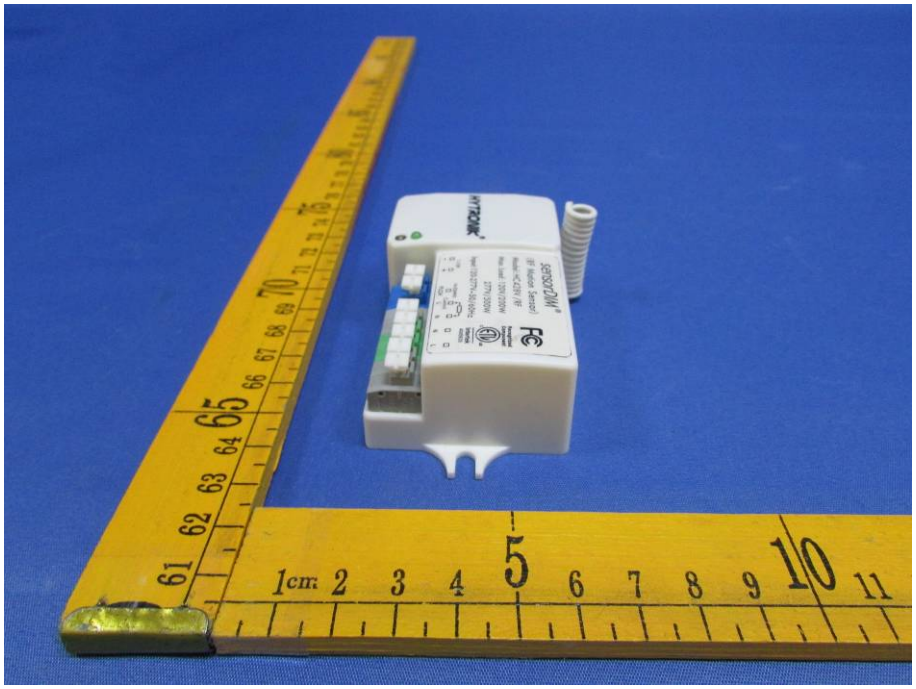
13 Photographs - Constructional Details

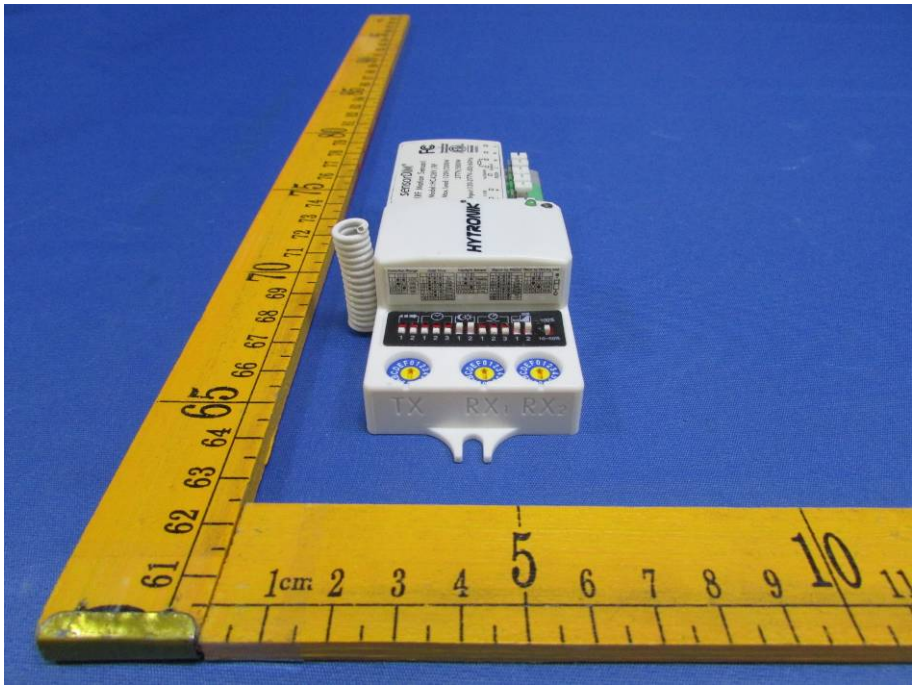
13.1 External View






HYTRONIK
1449

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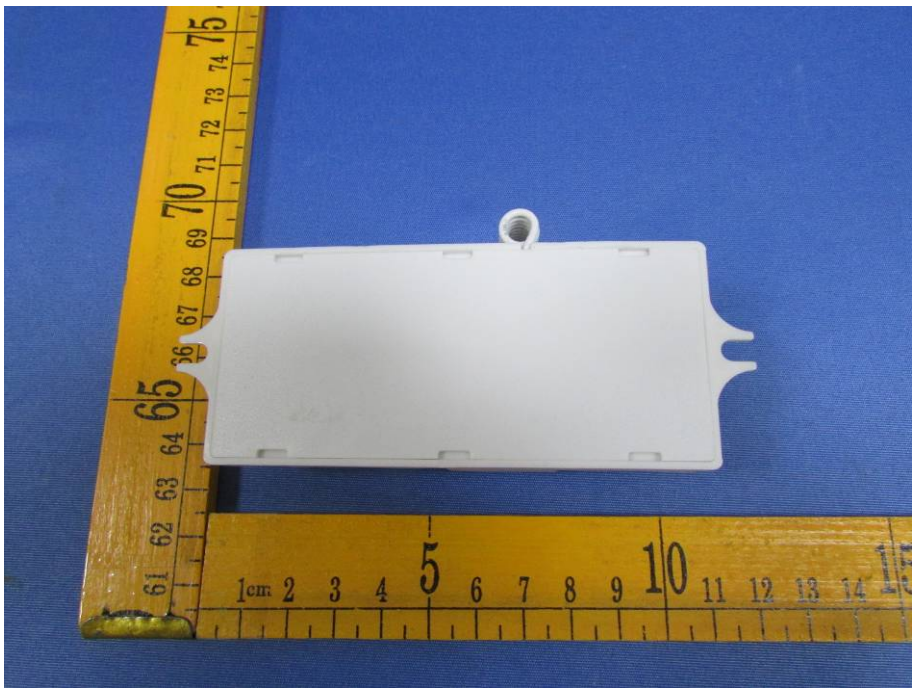
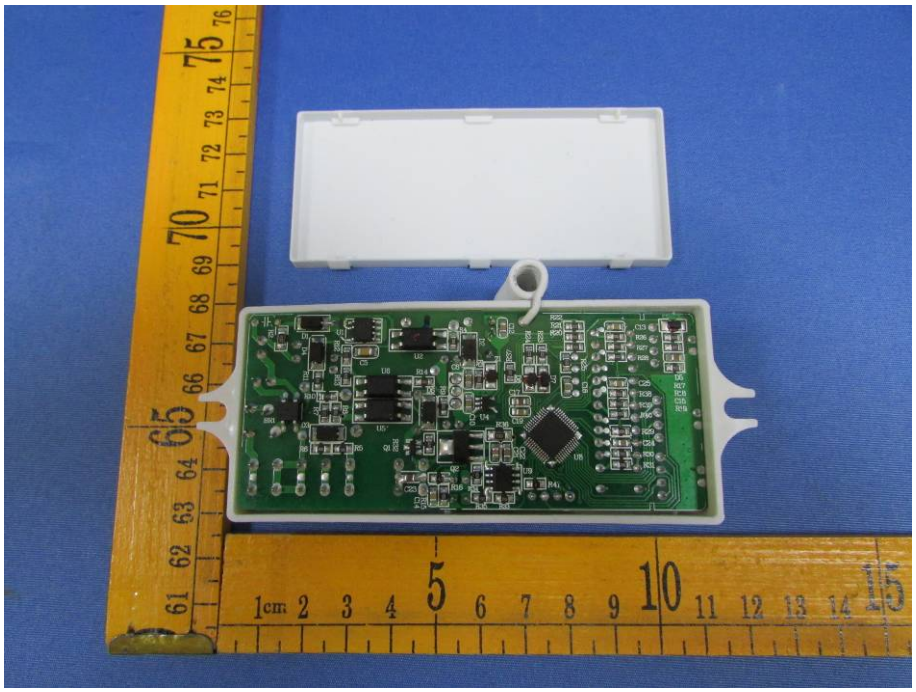
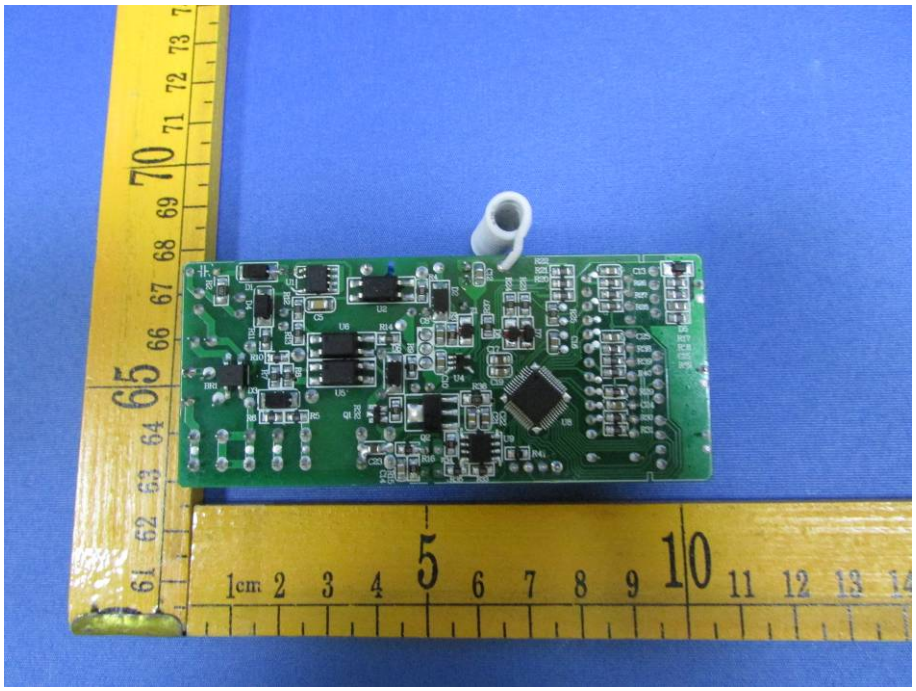
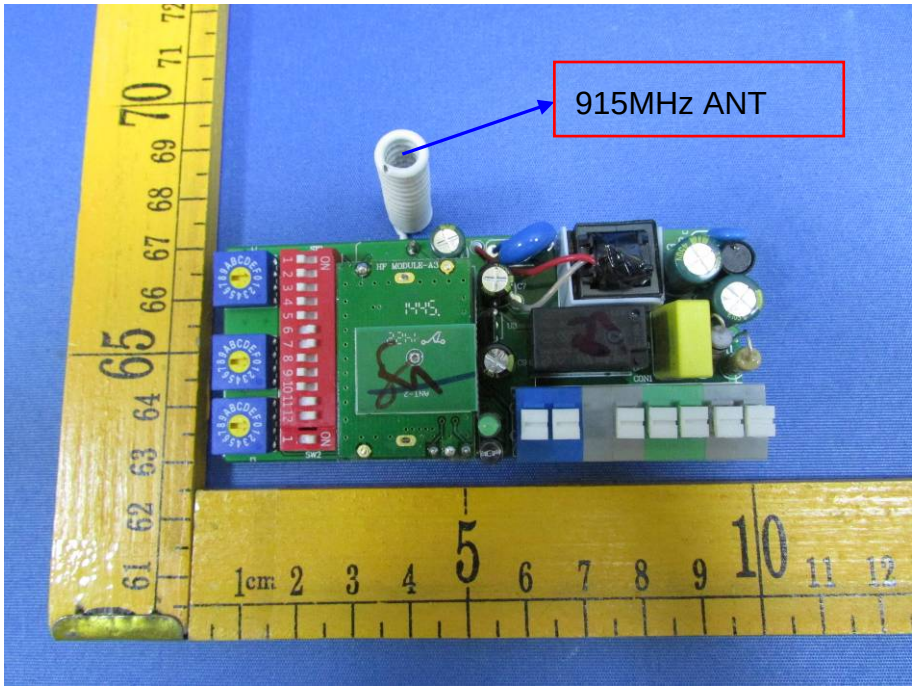


13.2 Internal View



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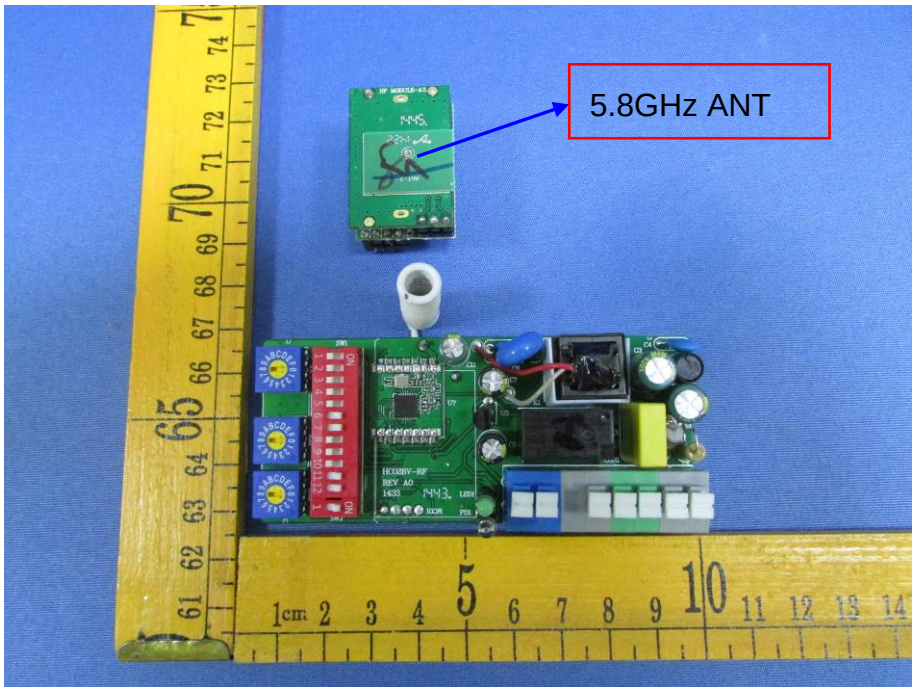
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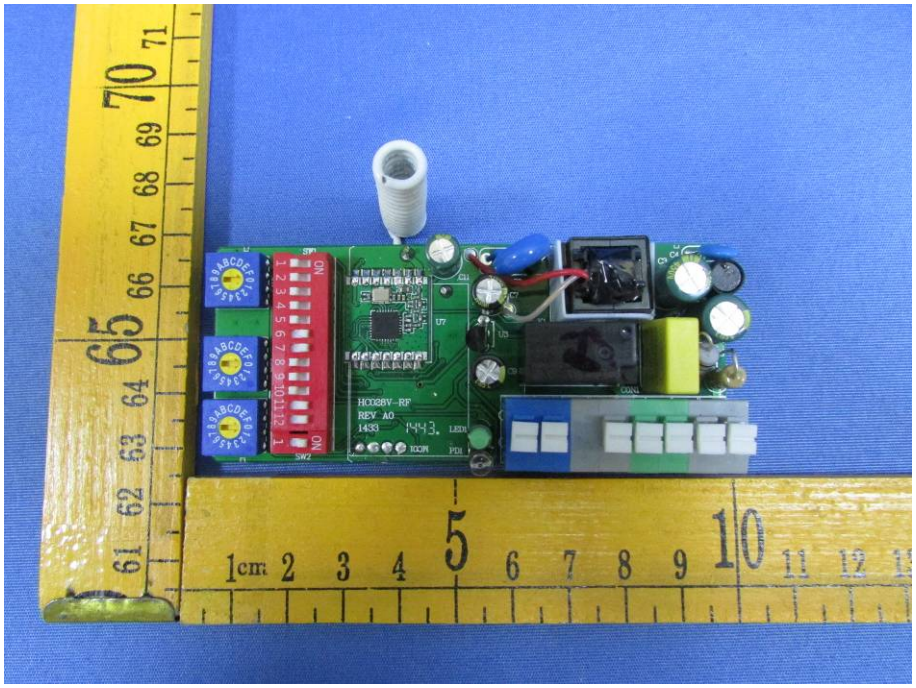
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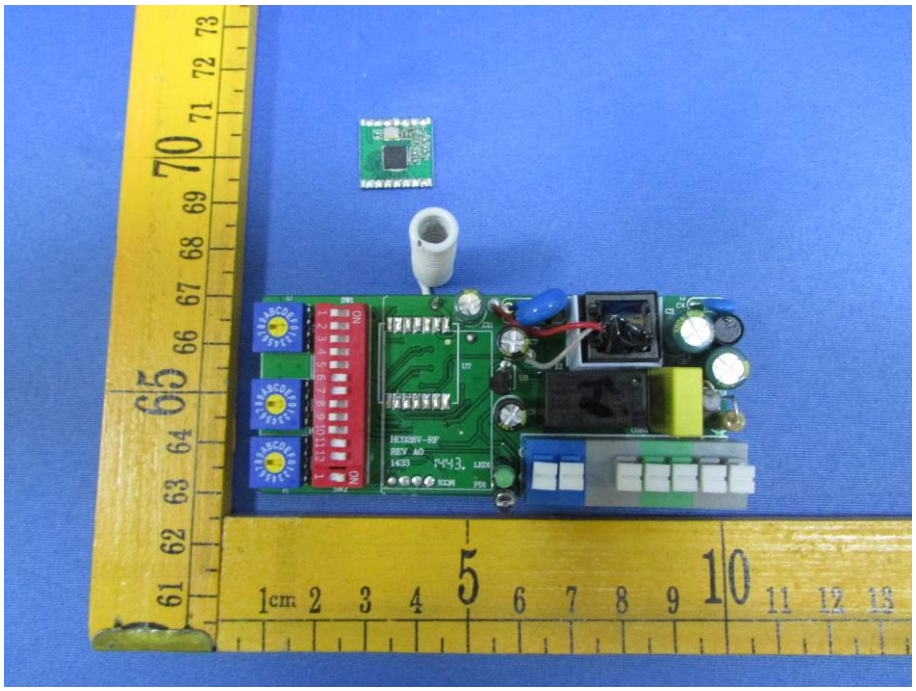
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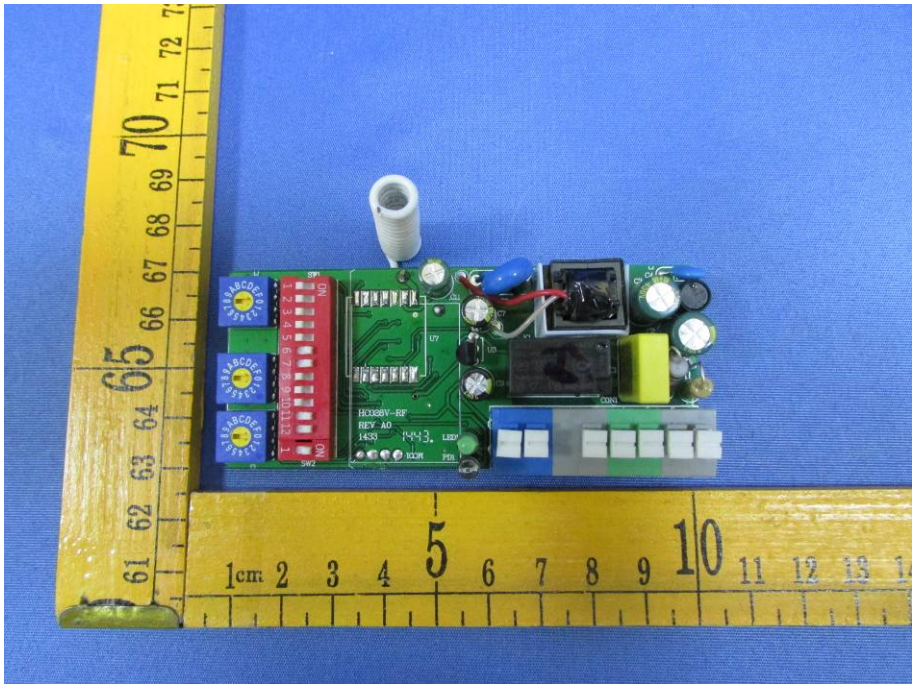
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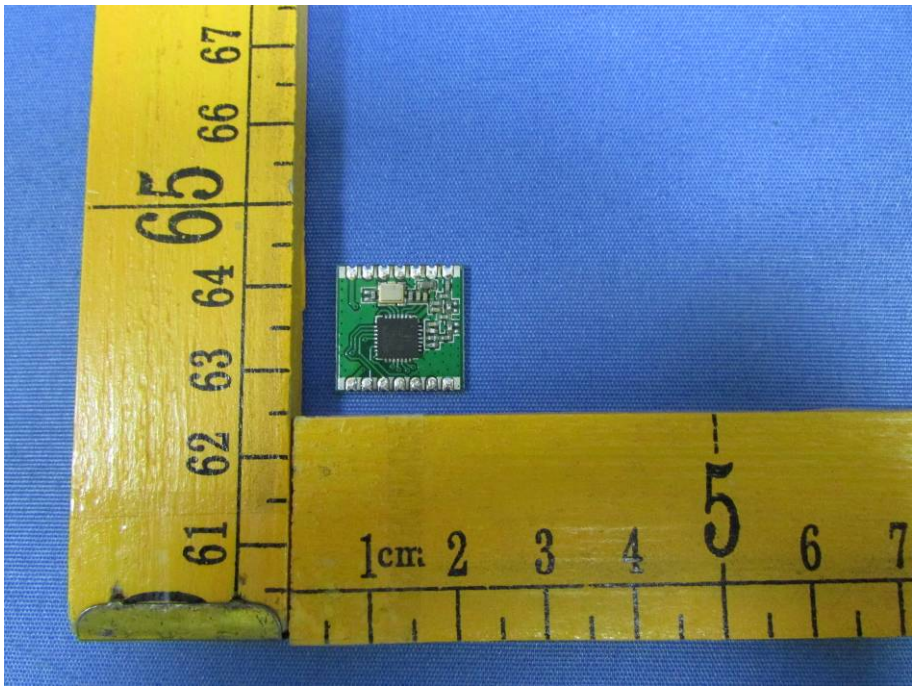

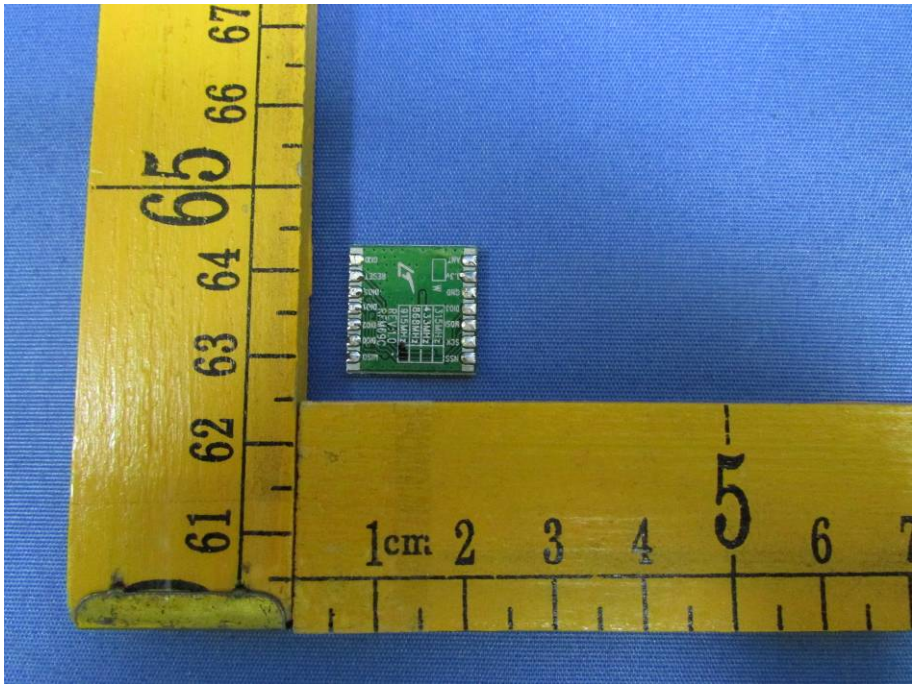

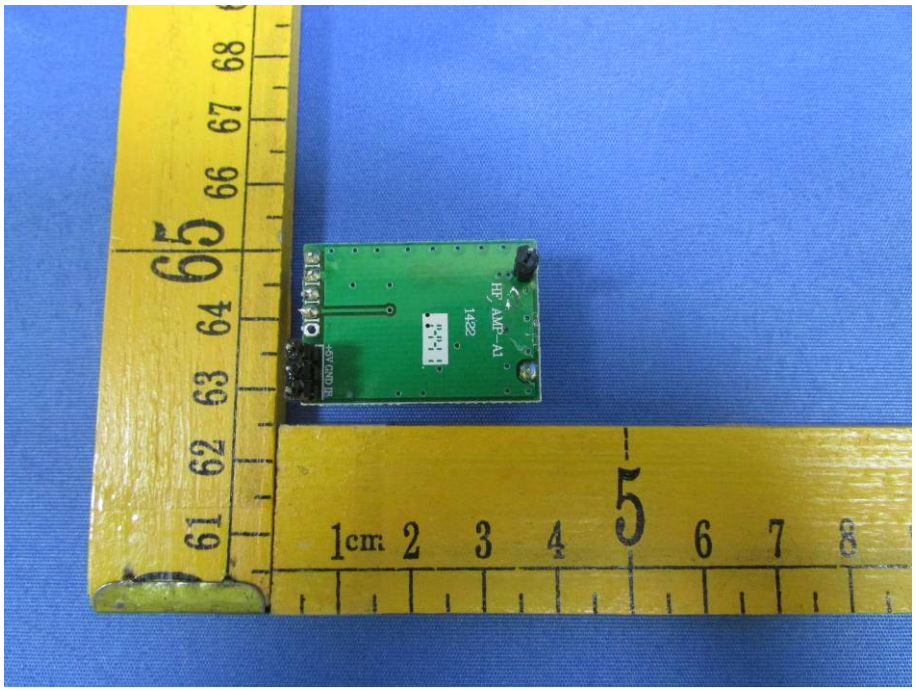
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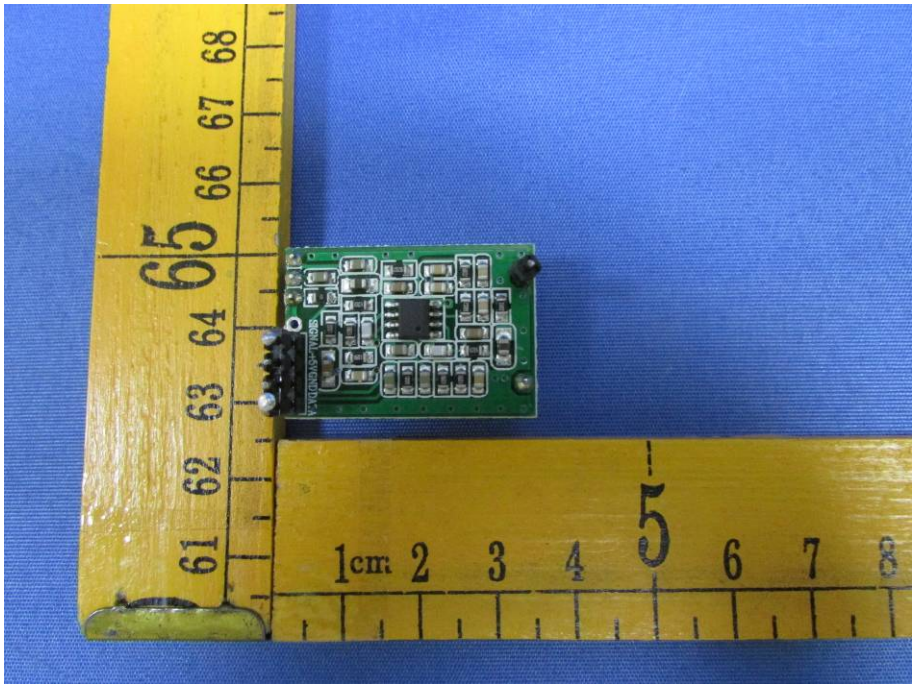

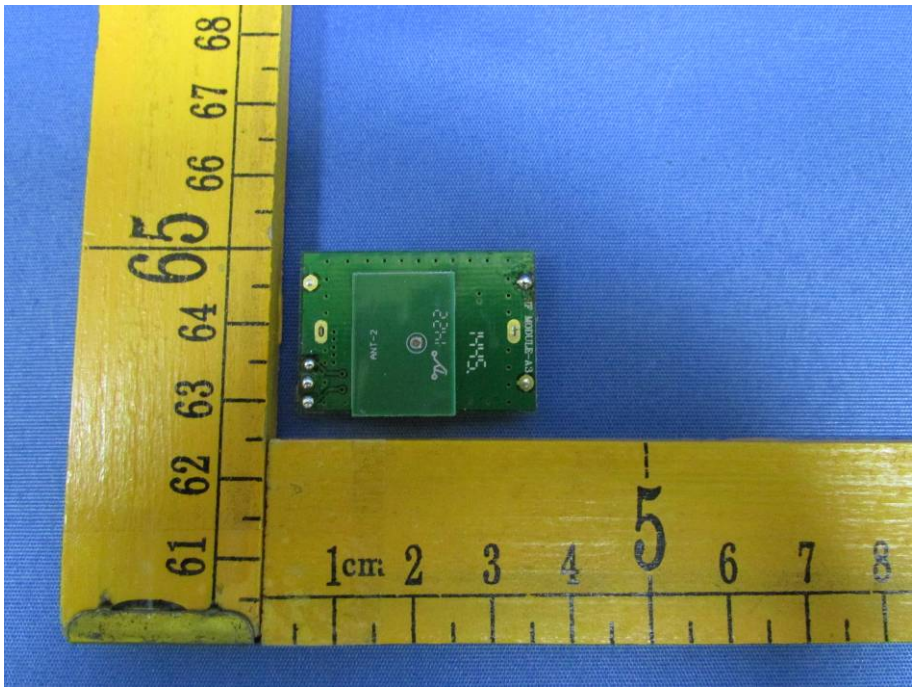

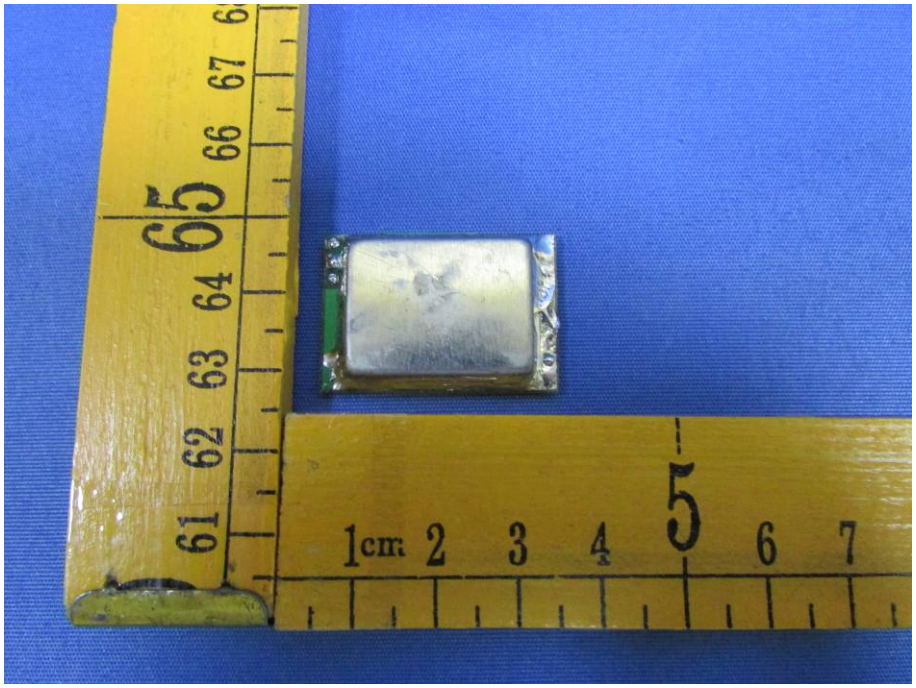

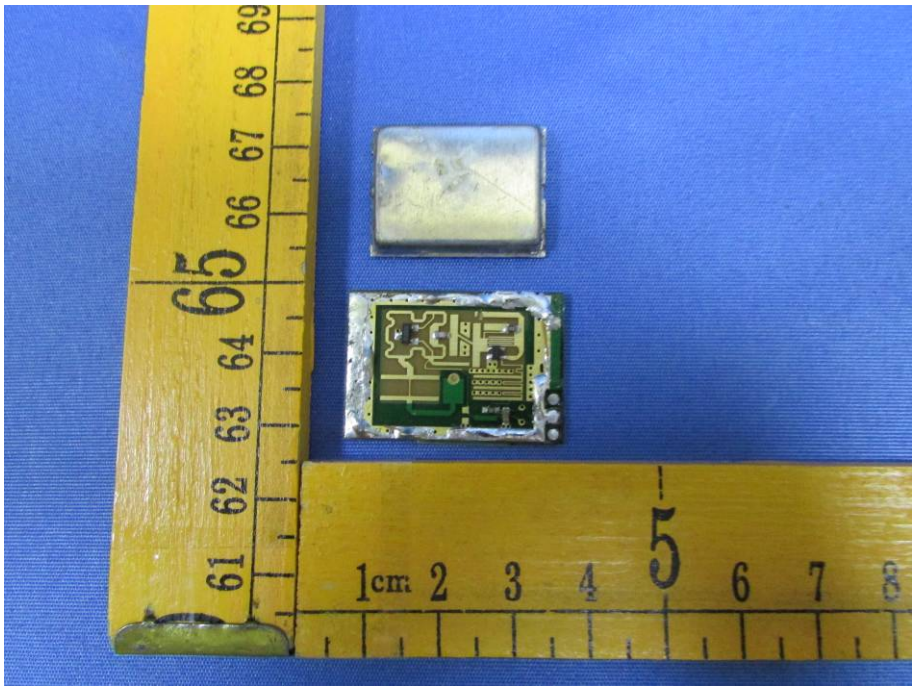

======End of Report======