

FCC/IC TEST REPORT

for

POLYGROUP LIMITED(MACAO COMMERCIAL OFFSHORE)

Remote Controller

Model Number: RC5A1

FCC ID: 2AABT-1702

IC: 11131A-1702

Prepared for : POLYGROUP LIMITED(MACAO COMMERCIAL OFFSHORE)  
Address : Avenida Xian Xing Hai,Centro Golden Dragon 11 Andar M,  
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Report No. : 17KWE025118F  
Date of Test : Feb. 13~27, 2017  
Date of Report : Feb. 28, 2017

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## Keyway Testing Technology Co., Ltd.

<b>Applicant:</b> <b>Address:</b>	POLYGROUP LIMITED(MACAO COMMERCIAL OFFSHORE) Avenida Xian Xing Hai, Centro Golden Dragon 11 Andar M, Macau, China		
<b>Manufacturer1:</b> <b>Address:</b>	Crownwell (He Yuan) CO., Ltd. No 11, Meizi Road, Xian Tang Industrial Park, Xian Tang Town, Dong Yuan County, Heyuan City, Guangdong Province, China		
<b>Manufacturer2:</b> <b>Address:</b>	Nixan(He Yuan) CO.,LTD Xiantang Industrial zone, Xiantang Town, Dongyuan County, Heyuan City, Guangdong Province, China		
<b>Manufacturer3:</b> <b>Address:</b>	Glenealy Plastic Crafts (Dongguan) Company Ltd. Kiu Lik Village, Changping Town, Dongguan City, Guangdong Province, China		
<b>E.U.T:</b>	Remote Controller		
<b>Model Number:</b>	RC5A1		
<b>Trade Name:</b>	-----	<b>Serial No.:</b>	-----
<b>Date of Receipt:</b>	Feb. 10, 2017	<b>Date of Test:</b>	Feb. 13~27, 2017
<b>Test Specification:</b>	FCC Part 15, Subpart C Section 15.231: 2016 ANSI C63.10-2013 RSS-210, Issue 9, August 2016 RSS-Gen Issue 4 November 2014		
<b>Test Result:</b>	The equipment under test was found to be compliance with the requirements of the standards applied.  <b>Issue Date: Feb. 28, 2017</b>		
Tested by:	Reviewed by:	Approved by:	
			
Keven Wu / Engineer	Mark Li / Supervisor	Andy Gao / Supervisor	
<b>Other Aspects:</b>	None.		
Abbreviations: OK/P=passed    fail/F=failed    n.a/N=not applicable    E.U.T=equipment under tested			
This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Keyway Testing Technology Co., Ltd.			

## 1. TEST SUMMARY

FCC Part15, Subpart C (15.231)		
Test Items	Test Requirement	Result
Conducted Emissions	15.207/RSS-Gen § 8.8	N/A
Radiated Emissions	15.231(b)/ RSS-Gen § 6.13& RSS-210 clause A.1.2	PASS
Occupied Bandwidth	15.231(c)/RSS-210 A.1.3	PASS
Transmitter Time out	15.231(a)(1)/RSS-210 A.1.1(a)	PASS
Antenna Requirement	15.203/ RSS-210 § 3.1/ RSS-Gen § 8.3	PASS

## 2. GENERAL PRODUCT INFORMATION

### 2.1. Product Function

Refer to Technical Construction Form and User Manual.

### 2.2. Description of Device (EUT)

Description : Remote Controller  
M/N : RC5A1  
Power Supply : DC 3.0V  
Operation Frequency : 433.99MHz  
Modulation Technology : ASK  
Antenna Type : PCB  
Antenna Gain : 0dBi

### 2.3. Independent Operation Modes

The basic operation modes are:

#### 2.3.1. Transmitting mode(TX Mode)

### 2.4. Product Version

Product SW version	461E64
Product HW version	V01
Radio SW version	461E64
Radio HW version	V01
Test SW Version	461E64
RF power setting in TEST SW	0dBm

### 3. TEST SITES

#### 3.1. Test Facilities

Lab Qualifications : 944 Shielded Room built by ETS-Lindgren, USA  
Date of completion: March 28, 2011

966 Chamber built by ETS-Lindgren, USA  
Date of completion: March 28, 2011

Certificated by TUV Rheinland, Germany.  
Registration No.: UA 50207153  
Date of registration: July 13, 2011

Certificated by UL, USA  
Registration No.: 100567-237  
Date of registration: September 1, 2011

Certificated by Intertek  
Registration No.: 2011-RTL-L1-31  
Date of registration: October 11, 2011

Certificated by FCC, USA  
Registration No.: 370994  
Date of registration: February 21, 2012

Certificated by Industry Canada  
Registration No.: 9868A  
Date of registration: December 8, 2011

## 3.2. List of Test and Measurement Instruments

### 3.2.1. For radiated emission test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 09,16	Apr. 09,17
System Simulator	Agilent	E5515C	GB43130245	Apr. 09,16	Apr. 09,17
Power Splitter	Weinschel	1506A	NW425	Apr. 09,16	Apr. 09,17
Bilog Antenna	ETS-LINDGREEN	3142D	135452	Apr. 09,16	Apr. 09,17
Loop antenna	teseq	HLA6120	22032	Apr. 09,16	Apr. 09,17
Spectrum Analyzer	Keysight	N9020A	MY56070279	Apr. 09,16	Apr. 09,17
3m Semi-anechoic Chamber	ETS-LINDGREEN	966	KW01	Apr. 09,16	Apr. 09,17
Signal Amplifier	SONOMA	310	187016	Apr. 09,16	Apr. 09,17
Signal Amplifier	Agilent	8449B	3008A00251	Apr. 09,16	Apr. 09,17
RF Cable	IMRO	IMRO-400	966 Cable 1#	Apr. 09,16	Apr. 09,17
RF Cable	IMRO	IMRO-400	966 Cable 2#	Apr. 09,16	Apr. 09,17
RF Cable	IMRO	IMRO-400	966 Cable 3#	Apr. 09,16	Apr. 09,17
MULTI-DEVICE Controller	ETS-LINDGREEN	2090	126913	N/A	N/A
Horn Antenna	DAZE	ZN30701	11003	Apr. 09,16	Apr. 09,17
Horn Antenna	SCHWARZBECK	BBHA9170	9170-068	Apr. 09,16	Apr. 09,17
Spectrum Analyzer	Agilent	8593E	3911A04271	Apr. 09,16	Apr. 09,17
Spectrum Analyzer	Agilent	E4408B	MY44211125	Apr. 09,16	Apr. 09,17
Signal Amplifier	DAZE	ZN3380C	11001	Apr. 09,16	Apr. 09,17
High Pass filter	Micro	HPM50111	324216	Apr. 09,16	Apr. 09,17
Filter	COM-MW	ZBSF-C836.5-25-X	KW032	Apr. 09,16	Apr. 09,17
Filter	COM-MW	ZBSF-C1747.5-75-X2	KW035	Apr. 09,16	Apr. 09,17
Filter	COM-MW	ZBSF-C1880-60-X2	KW037	Apr. 09,16	Apr. 09,17
DC Power Supply	LongWei	PS-305D	010964729	Apr. 09,16	Apr. 09,17
Constant temperature and humidity box	GF	GTH-800-40-1P	MAA9906-005	Apr. 09,16	Apr. 09,17
Splitter	Agilent	11636B	0025164	Apr. 09,16	Apr. 09,17

## 4. TEST SET-UP AND OPERATION MODES

### 4.1. Principle of Configuration Selection

**Emission:** The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the Operating Instructions.

### 4.2. Block Diagram of Test Set-up

System Diagram of Connections between EUT and Simulators



*(EUT: Remote Controller)*

### 4.3. Test Operation Mode and Test Software

Refer to Test Setup in clause 4.

### 4.4. Special Accessories and Auxiliary Equipment

None.

### 4.5. Countermeasures to Achieve EMC Compliance

None.

### 4.6. Test Environment:

Ambient conditions in the test laboratory:

Items	Actual
Temperature (°C)	22~26
Humidity (%RH)	45~60



## 5. EMISSION TEST RESULTS

### 5.1. Radiated Emission Test

#### 5.1.1. Limit 15.209 limits

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		$\mu\text{V}/\text{m}$	$\text{dB}(\mu\text{V})/\text{m}$
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 $\text{dB}(\mu\text{V})/\text{m}$ (Peak) 54.0 $\text{dB}(\mu\text{V})/\text{m}$ (Average)	

#### 5.1.2. Fundamental and harmonics emission limits(15.231(b)/ RSS-210 clause A.1.2)

Funda- mental fre- quency (MHz)	Field strength of funda- mental (microvolts/ meter)	Field strength of spurious emissions (microvolts/meter)
40.66– 40.70.	2,250 .....	225
70–130 .....	1,250 .....	125
130–174 ....	<sup>1</sup> 1,250 to 3,750 .....	<sup>1</sup> 125 to 375
174–260 ....	3,750 .....	375
260–470 ....	<sup>1</sup> 3,750 to 12,500 .....	<sup>1</sup> 375 to 1,250
Above 470	12,500 .....	1,250

<sup>1</sup> Linear interpolations.

Note:

- Limits on the field strength of emissions, as shown in this table, are based on the average value of the measured emissions. As an alternative, compliance with the limits in this table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector.
- Frequency bands 225-328.6 MHz and 335.4-399.9 MHz are designated for the exclusive use of the Government of Canada. Manufacturers should be aware of possible harmful interference and degradation of their licence-exempt radio equipment in these frequency bands.
- Linear interpolation with frequency F in MHz:  
For 130–174 MHz:  $\text{FS (microvolts/m)} = (56.82 \times F) - 6136$   
For 260–470 MHz:  $\text{FS (microvolts/m)} = (41.67 \times F) - 7083$

### 5.1.3. Test setup

The EUT was placed on a turn table which was 0.8 m (above 1GHz, the high was 1.5m) above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

The EUT was tested in the Chamber Site. It was pre-scanned with a Peak detector from the spectrum, and all the final readings from the test receiver were measured with the Quasi-Peak detector.

The bandwidth of the EMI test receiver is set at 120kHz for frequency range from 30MHz to 1000 MHz. The frequency range from 30MHz to 10<sup>th</sup> harmonic (25GHz) are checked

The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz.

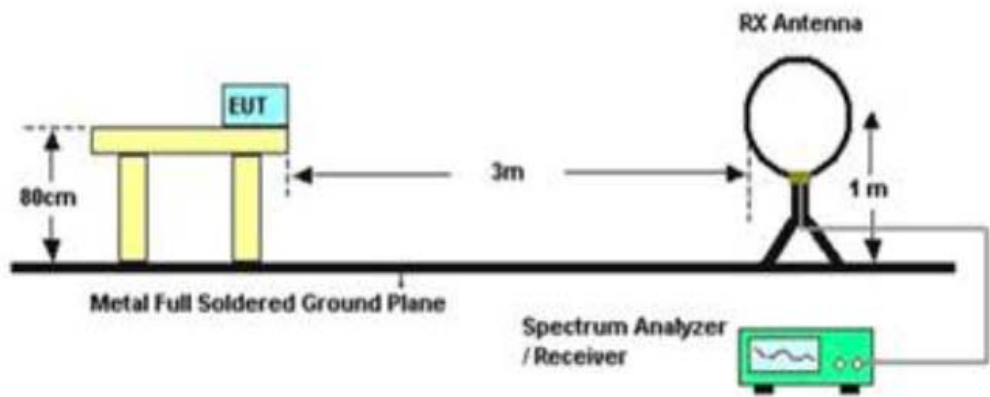
By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "Y axis" position was the worst, then the final test was executed the worst condition and test data were recorded in this report.

The test data of the worst case condition(s) was reported on the following pages.

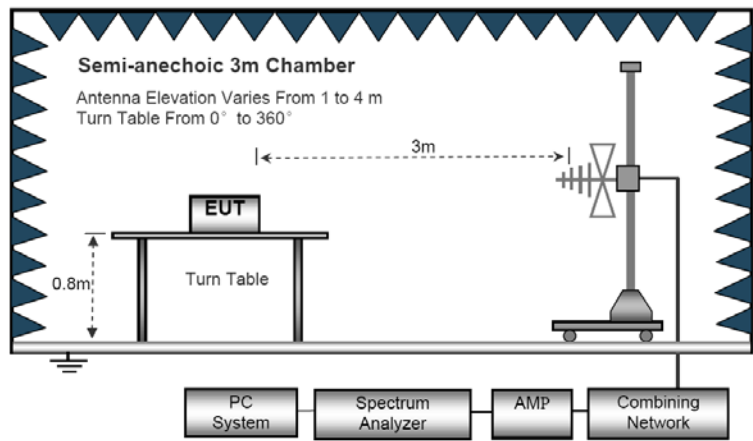
Notes:

1. Emission Level = Antenna Factor + Cable Loss + Meter Reading-Preamp Factor.
2. Measurement Uncertainty:  $\pm 3.2$  dB at a level of confidence of 95%.
3. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.
- 4: The emission of below 30MHz is background, the data no show it.
- 5: we pretest all five keys, The test data of the worst case condition(s) was reported on the following pages.

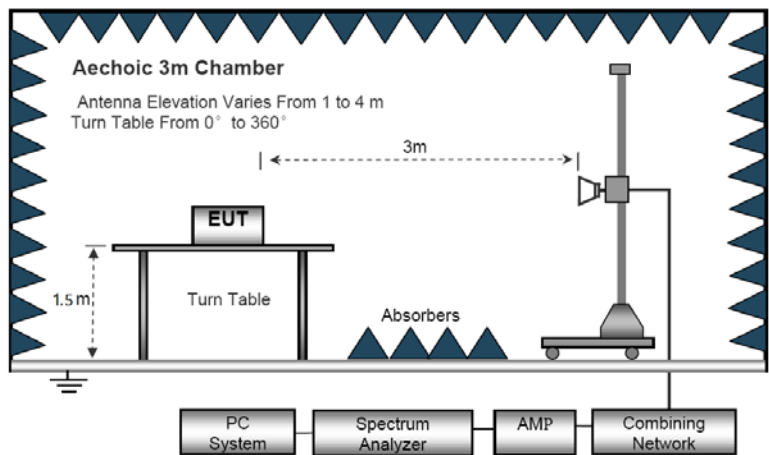
Radiated Emission Test-Up Frequency Below 30MHz



30MHz- 1GHz



Above 1GHz



**Below 30MHz**

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	P
--	--	--	--	P

**Note:**

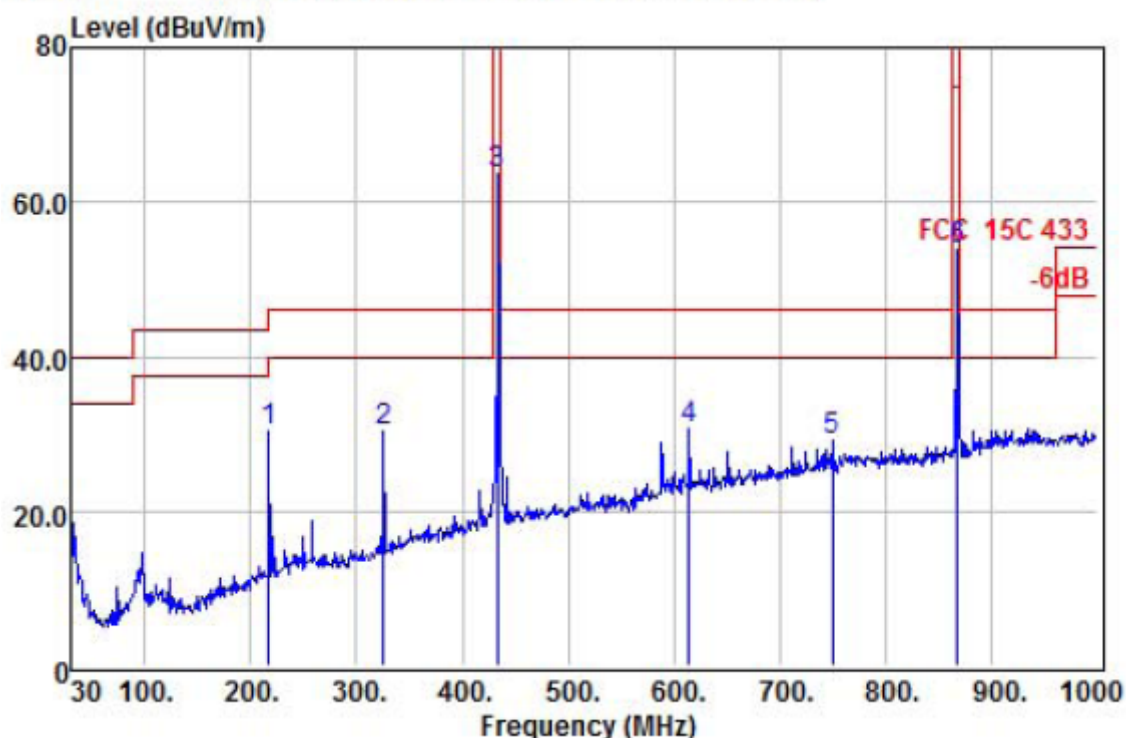
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =  $40 \log (\text{specific distance/test distance})(\text{dB})$ ;

Limit line = specific limits(dBuv) + distance extrapolation factor.

## Test Data below 1GHz

### Horizontal



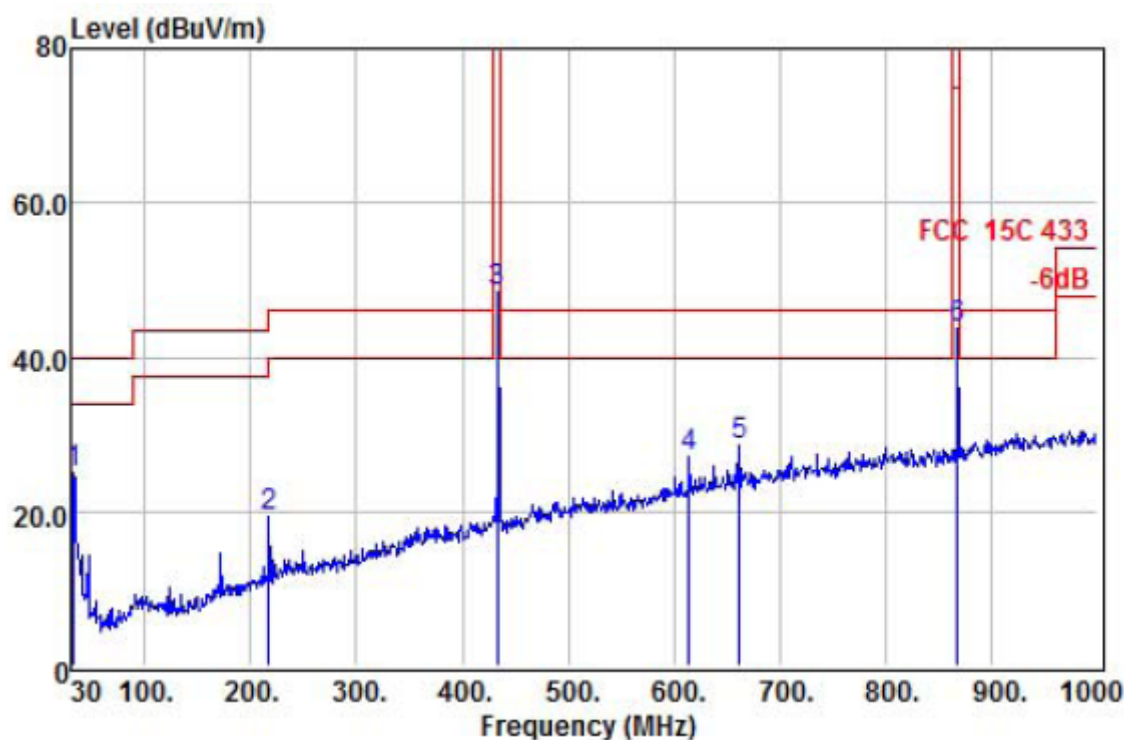
	Read Freq	Preamp Level	Antenna Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV/m	dB	
1	217.21	48.13	31.01	1.53	30.48	-15.52	QP
2	325.85	44.55	30.81	2.02	30.29	-15.71	QP
3	433.52	74.41	30.62	2.55	63.61	-37.19	Peak
4	613.94	36.93	30.63	3.38	30.67	-15.33	QP
5	749.74	32.82	30.67	4.12	29.07	-16.93	QP
6	868.08	56.16	30.27	4.67	53.95	-26.85	Peak

For average:

Frequency MHz	Peak Level dBuV/m	Duty cycle factor	Average Level dBuV/m	Limit	Margin dB
433.99	63.61	-7.47	56.14	80.80	-24.66
867.98	53.95	-7.47	46.48	60.80	-14.32

- Notes: 1. Average emission Level = Peak Level + Duty cycle factor  
2. Duty cycle level please see clause 6.  
3. we pretest all five keys, only worst case is presented in the report.

# Vertical



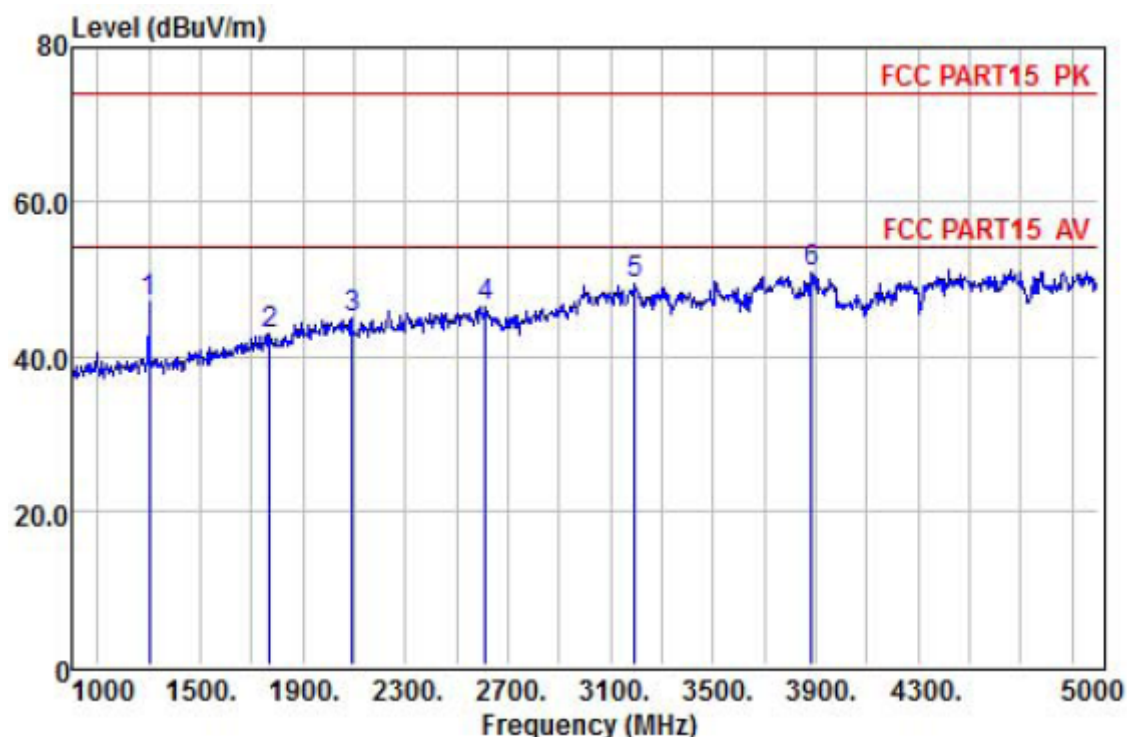
	Freq	Read Level	Preamp Factor	Antenna Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB	
1	32.91	38.68	31.39	17.08	0.56	24.93	40.00	-15.07	QP
2	217.21	37.01	31.01	11.83	1.53	19.36	46.00	-26.64	QP
3	433.52	59.19	30.62	17.27	2.55	48.39	100.80	-52.41	Peak
4	613.94	33.18	30.63	20.99	3.38	26.92	46.00	-19.08	QP
5	662.44	33.92	30.81	21.70	3.69	28.50	46.00	-17.50	QP
6	868.08	45.97	30.27	23.39	4.67	43.76	80.80	-37.04	Peak

For average:

Frequency MHz	Peak Level dBuV/m	Duty cycle factor	Average Level dBuV/m	Limit	Margin dB
433.99	48.39	-7.47	40.92	80.80	-39.88
867.98	43.76	-7.47	36.29	60.80	-24.51

Notes: 1. Average emission Level = Peak Level + Duty cycle factor  
2. Duty cycle level please see clause 6.  
3. we pretest all five keys, only worst case is presented in the report.

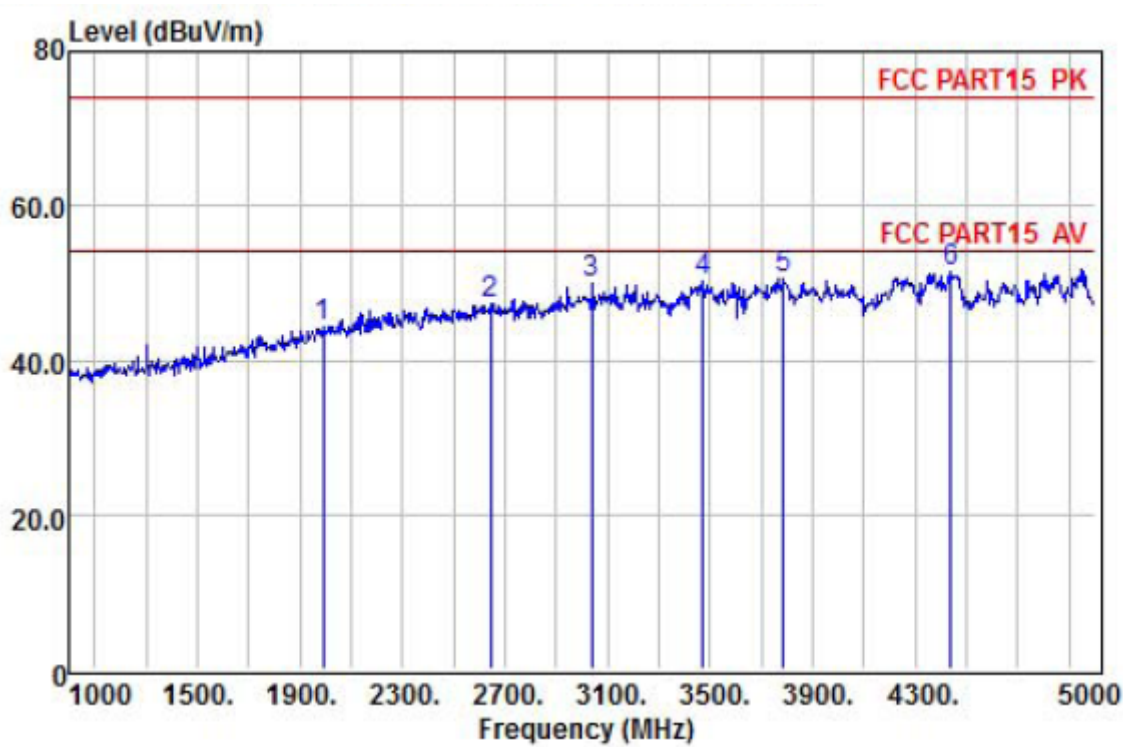
# Test Data for 1GHz~5GHz Horizontal



	Freq	Read Level	Preamp Factor	Antenna Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB	
1	1304.00	42.95	26.06	24.84	5.15	46.88	74.00	-27.12	Peak
2	1772.00	36.19	26.15	26.95	5.93	42.92	74.00	-31.08	Peak
3	2092.00	35.97	26.23	28.47	6.59	44.80	74.00	-29.20	Peak
4	2612.00	35.81	26.38	29.08	8.02	46.53	74.00	-27.47	Peak
5	3196.00	35.68	26.59	30.19	9.95	49.23	74.00	-24.77	Peak
6	3884.00	36.27	26.95	31.29	10.34	50.95	74.00	-23.05	Peak



Vertical



	Freq	Read Level	Preamp Factor	Antenna Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB	
1	1992.00	35.81	26.20	28.30	6.41	44.32	74.00	-29.68	Peak
2	2644.00	36.24	26.39	29.16	8.20	47.21	74.00	-26.79	Peak
3	3040.00	36.52	26.52	30.03	9.93	49.96	74.00	-24.04	Peak
4	3472.00	36.43	26.73	30.47	9.98	50.15	74.00	-23.85	Peak
5	3784.00	36.10	26.90	31.09	10.21	50.50	74.00	-23.50	Peak
6	4440.00	35.31	27.26	32.11	11.20	51.36	74.00	-22.64	Peak



## 6. CALCULATION OF AVERAGE FACTOR

The output field strengths of specification in accordance with the RSS rules specify measurements with an average detector. During the test, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The duty cycle is measured in 100 ms or the repetition cycle period, whichever is a shorter time frame. The duty cycle is measured by placing the spectrum analyzer to set zero span at 1000kHz resolution bandwidth.

Averaging factor in dB =  $20\log(\text{duty cycle})$

The duration of one cycle = 135.6ms

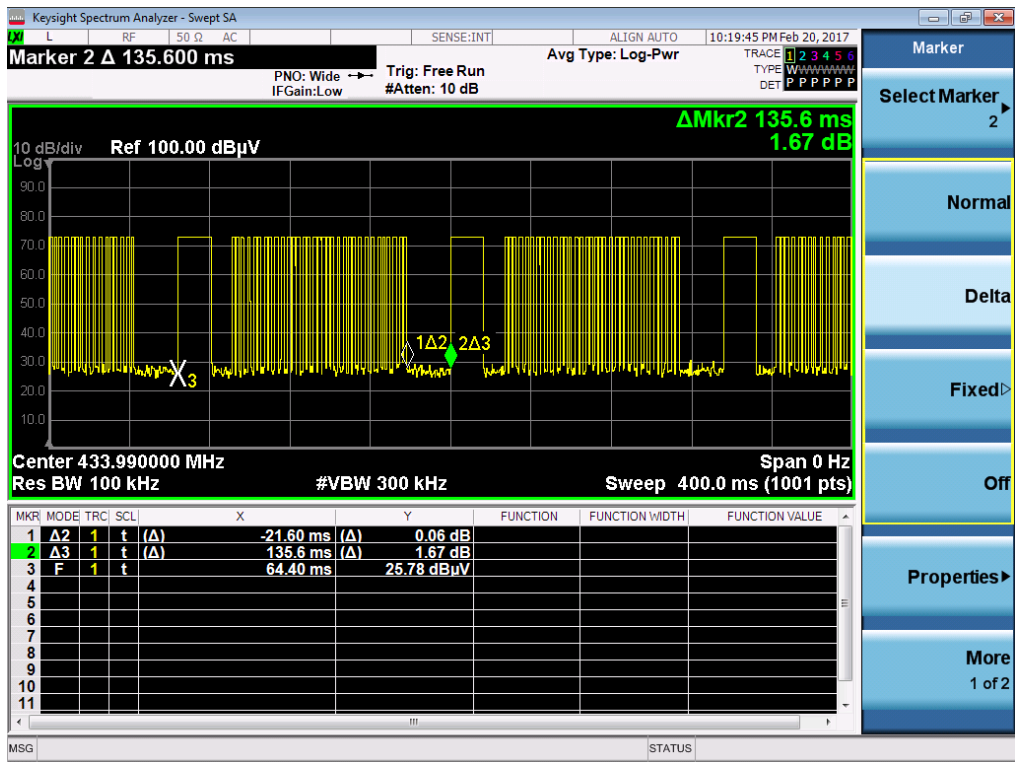
The duty cycle is simply the on-time divided the duration of one cycle

Duty Cycle =  $(16.15\text{ms} + 1.25\text{ms} \times 33) / 135.6 = 57.4\text{ms} / 135.6\text{ms} = 0.4233$

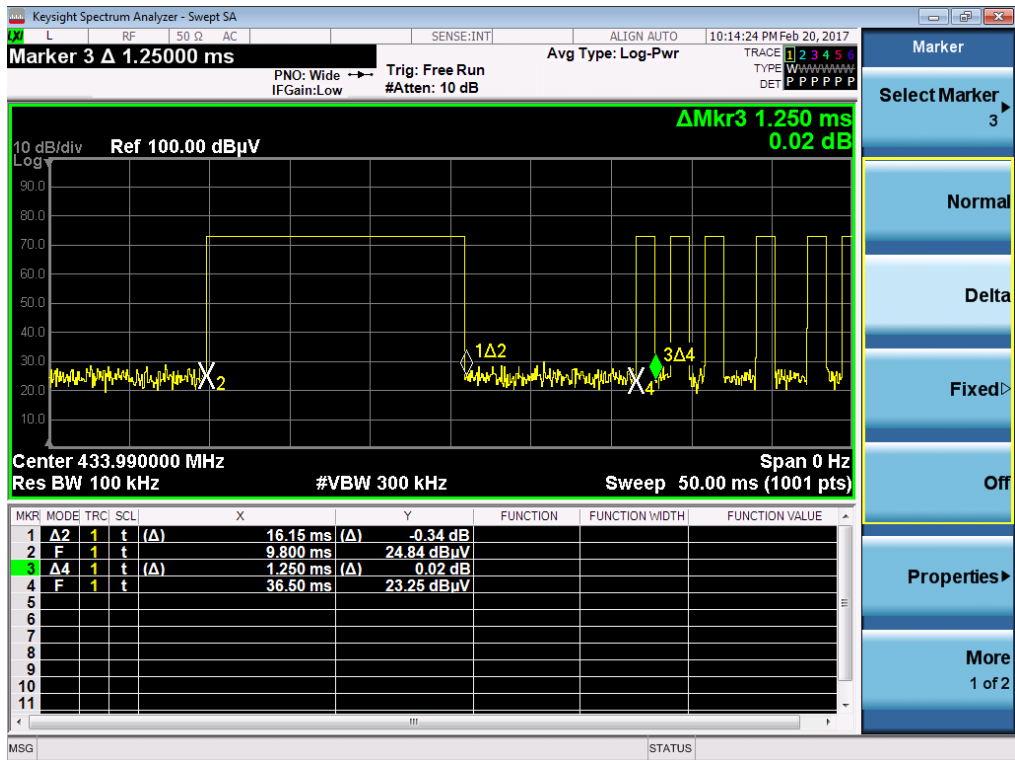
Therefore, the averaging factor is found by  $20\log 0.4233 = -7.47\text{dB}$

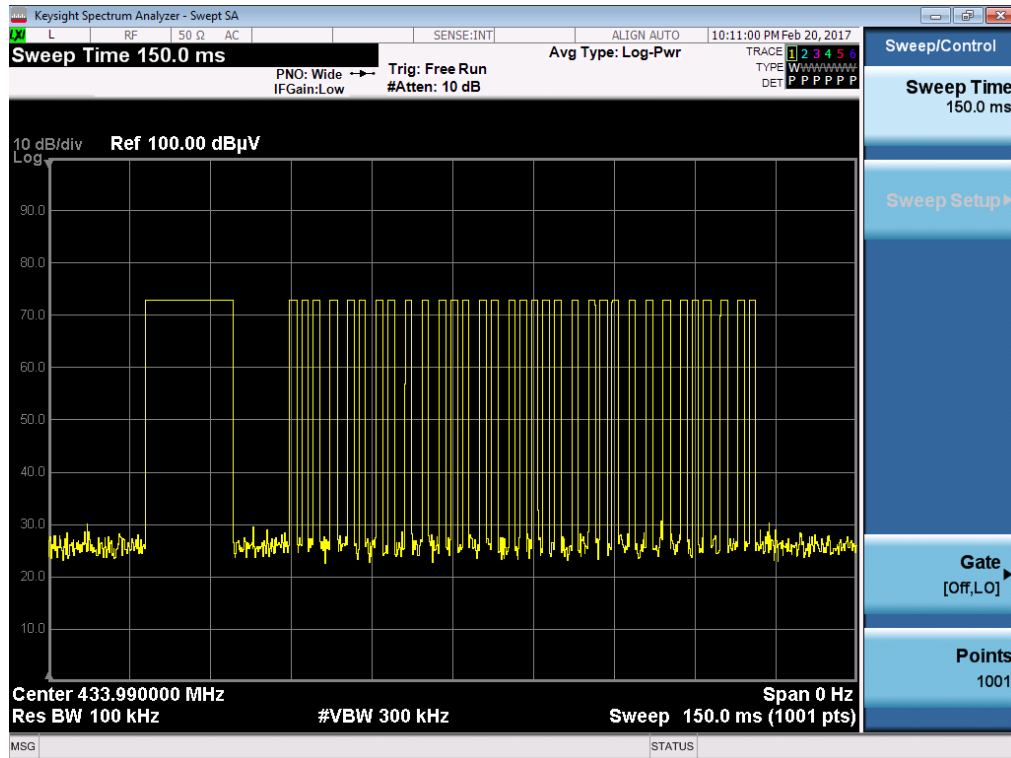
Test plot as follows:

T period



T on time slot





## 7. 20DB&99% OCCUPY BANDWIDTH

### 7.1. Limits

For FCC

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

For IC

According to RSS-210 A.1.3 requirement:

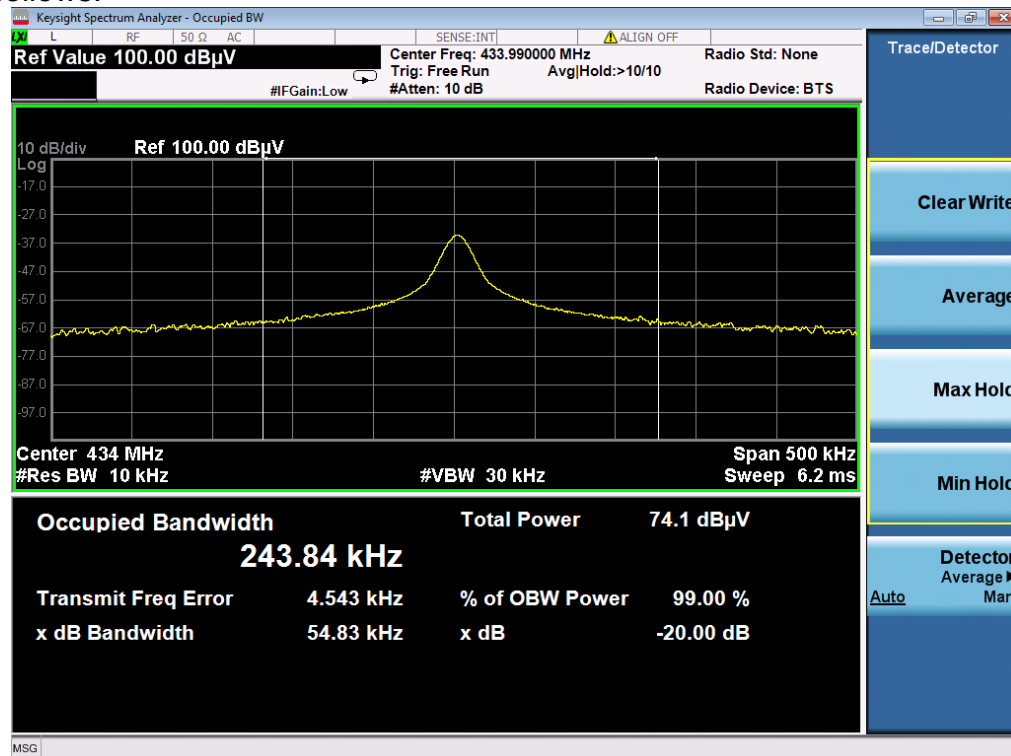
The 99% bandwidth of momentarily operated devices shall be less or equal to 0.25% of the centre frequency for devices operating between 70 MHz and 900 MHz. For devices operating above 900 MHz, the 99% bandwidth shall be less or equal to 0.5% of the centre frequency.

$$\text{B.W Limit} = 0.25\% * f(\text{MHz}) = 0.25\% * 433.99\text{MHz} = 1.08\text{MHz}$$

Test data:

Channel Frequency (MHz)	-20dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (MHz)	Result
433.99	0.055	0.244	1.08	Pass

Test plot as follows:



Note: we pretest all five keys, only worst case is presented in the report.

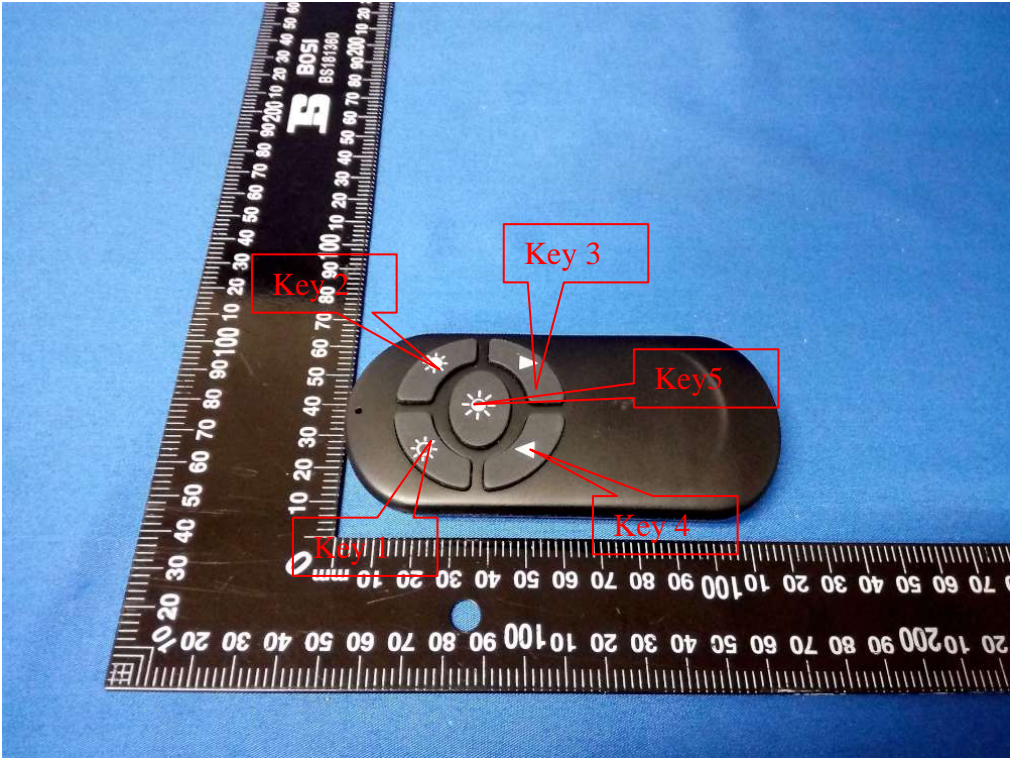


## 9. PHOTOGRAPHS OF TEST SET-UP





10.PHOTOGRAPHS OF THE EUT





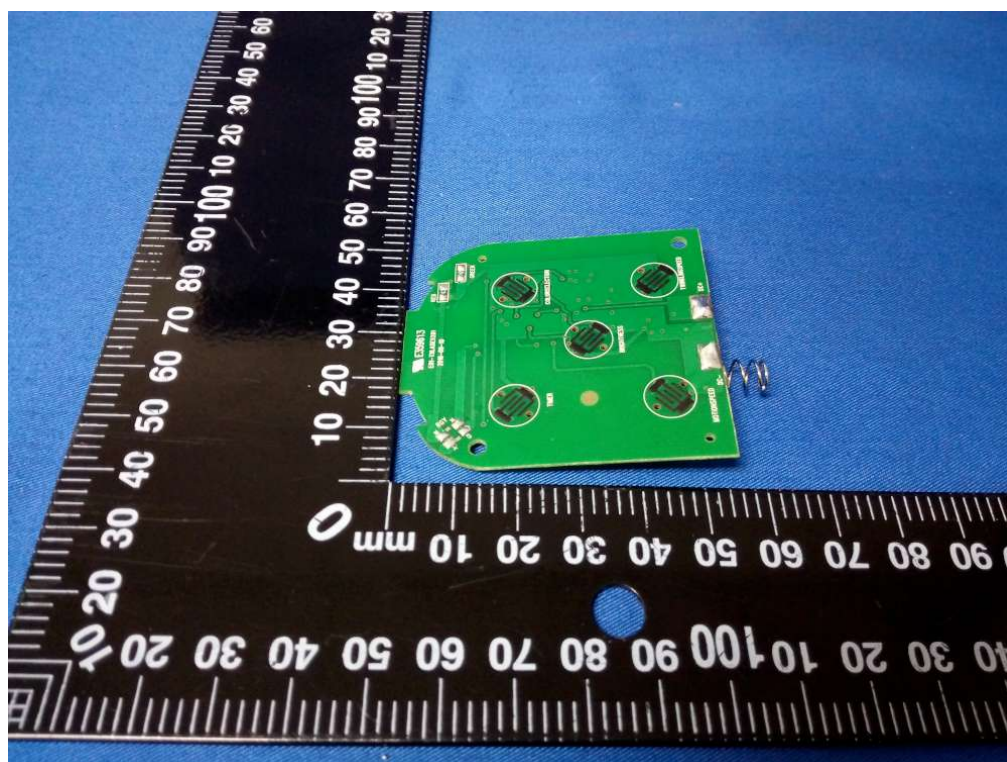
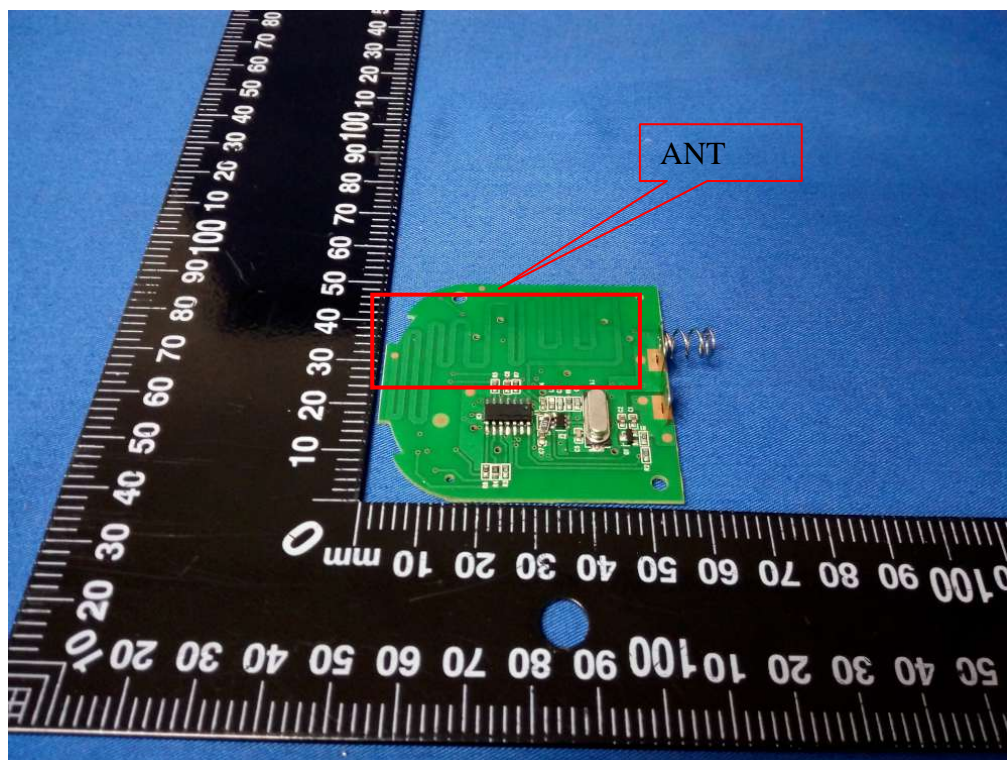












END.