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## FCC PART 15 SUBPART C TEST REPORT

**Report Reference No.:** CTL1605301952-WF

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**Product Name**.....: MINI COPTER

**Model/Type reference**.....: MW409

**Trade Mark**.....: N/A

**FCC ID**.....: 2AFHF-MW409

**Applicant's name**.....: **RUICHUANG TOYS INDUSTRIAL CO.,LTD**

**Address of applicant**.....: Mid of Laimei Road and Fengxiang Steet, Chenghai District, Shantou City, China

**Test Firm**.....: **Shenzhen CTL Testing Technology Co., Ltd.**

**Address of Test Firm**.....: Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055

**Test specification**.....:

Standard.....: **FCC Part 15.249:** Operation within the bands 920-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz and 24.0 - 24.25 GHz.

TRF Originator.....: Shenzhen CTL Testing Technology Co., Ltd.

Master TRF.....: Dated 2011-01

**Date of Receipt**.....: June 03, 2016

**Date of Test Date**.....: June 03, 2016 - June 16, 2016

**Data of Issue**.....: June 16, 2016

**Result**.....: **PASS**

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# TEST REPORT

<b>Test Report No. :</b>	<b>CTL1605301952-WF</b>	June 16, 2016
		Date of issue

Equipment under Test : MINI COPTER

Model /Type : MW409

**Applicant** : **RUICHUANG TOYS INDUSTRIAL CO.,LTD**

Address : Mid of Laimei Road and Fengxiang Steet, Chenghai District, Shantou City, China

**Manufacturer** : **RUICHUANG TOYS INDUSTRIAL CO.,LTD**

Address : Mid of Laimei Road and Fengxiang Steet, Chenghai District, Shantou City, China

<b>Test Result</b> according to the standards on page 4:	<b>PASS</b>
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The test report merely corresponds to the test sample.  
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.



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## 1. TEST STANDARDS

The tests were performed according to following standards:

[FCC Rules Part 15.249](#): Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz.

[ANSI C63.10-2013](#)

[ANSI C63.4-2014](#)



## 2. SUMMARY

### 2.1. Equipment Under Test

#### Power supply system utilised

Power supply voltage :  120V / 60 Hz  115V / 60Hz  
 12 V DC  24 V DC  
 Other (specified in blank below)

DC 6V from battery (4\*AA)

### 2.2. Description of the Equipment under Test (EUT)

Name of EUT	MINI COPTER
Model Number	MW409
Antenna Type	Internal
Operation frequency	2410MHz-2473MHz
Modulation Type	GFSK
Antenna Gain	0dBi

#### Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2410	24	2433	47	2456
02	2411	25	2434	48	2457
03	2412	26	2435	49	2458
04	2413	27	2436	50	2459
05	2414	28	2437	51	2460
06	2415	29	2438	52	2461
07	2416	30	2439	53	2462
08	2417	31	2440	54	2463
09	2418	32	2441	55	2464
10	2419	33	2442	56	2465
11	2420	34	2443	57	2466
12	2421	35	2444	58	2467
13	2422	36	2445	59	2468
14	2423	37	2446	60	2469
15	2424	38	2447	61	2470
16	2425	39	2448	62	2471
17	2426	40	2449	63	2472
18	2427	41	2450	64	2473
19	2428	42	2451		
20	2429	43	2452		
21	2430	44	2453		
22	2431	45	2454		
23	2432	46	2455		

For more details, refer to the user's manual of the EUT.

Serial number: Prototype

### 2.3. EUT operation mode

Test Mode(TM)	Description	Remark
TM1	Bottom Channel Transmitting	/
TM2	Middle Channel Transmitting	/
TM3	Top Channel Transmitting	/

The field strength of radiation emission was measured in the following position: EUT stand-up position (Y axis), lie-down position (X, Z axis).

The following data show only with the worst case setup.

The worst case of X axis was reported.

Based on client request, all normal using modes of the normal function were tested but only the worst test data of the worst mode is reported by this report.

### 2.4. EUT configuration

**The following peripheral devices and interface cables were connected during the measurement:**

○ - supplied by the manufacturer

● - supplied by the lab

### 2.5. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: 2AFHF-MW409 filing to comply with Section 15.249 of the FCC Part 15, Subpart C Rules.

### 2.6. Modifications

No modifications were implemented to meet testing criteria.



### **3. TEST ENVIRONMENT**

#### **3.1. Address of the test laboratory**

Shenzhen CTL Testing Technology Co., Ltd.  
Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 China

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 22/EN 55022 requirements.

#### **3.2. Test Facility**

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

##### **IC Registration No.: 9618B**

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 9618B on November 13, 2013.

##### **FCC-Registration No.: 970318**

Shenzhen CTL Testing Technology 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 970318, December 19, 2013.

#### **3.3. Environmental conditions**

During the measurement the environmental conditions were within the listed ranges:

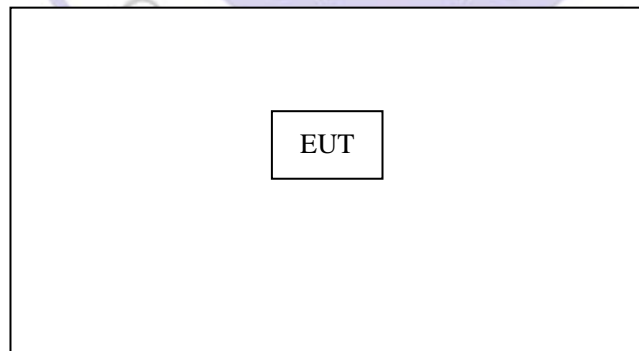
Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 950-1050mbar

#### **3.4. Configuration of Tested System**

**Fig. 2-1 Configuration of Tested System**



### 3.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen CTL Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for CTL laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10dB	(1)
Radiated Emission	1~26.5GHz	4.32dB	(1)
Conducted Disturbance	0.15~30MHz	3.20dB	(1)

- (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .





### 3.6. Equipments Used during the Test

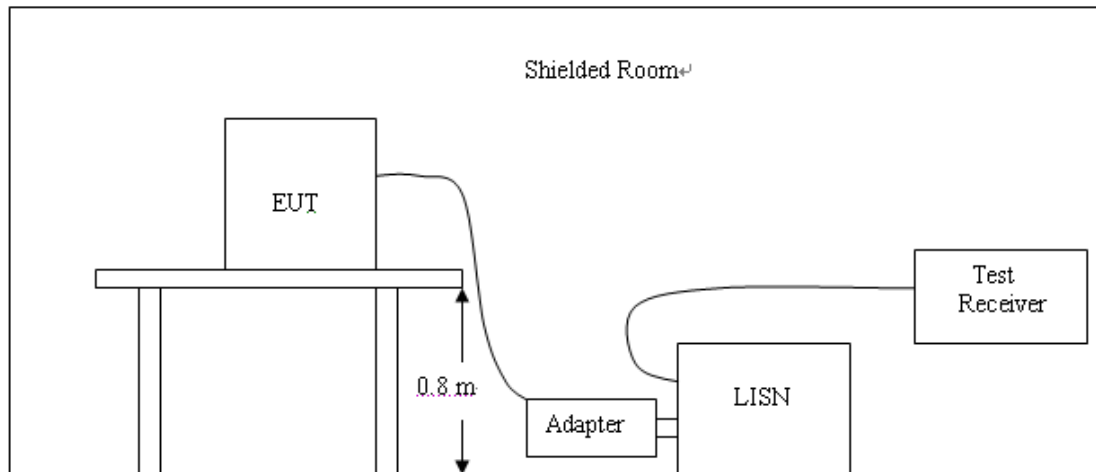
Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
BilogAntenna	Sunol Sciences Corp.	JB1	A061713	2016/06/02	2017/06/01
EMI Test Receiver	R&S	ESCI3	103710	2016/06/02	2017/06/01
Spectrum Analyzer	Agilent	E4407B	MY45108355	2016/05/21	2017/05/20
Spectrum Analyzer	Agilent	N9020A	US46220290	2016/12/10	2017/12/09
Controller	EM Electronics	Controller EM 1000	N/A	2016/05/21	2017/05/20
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2016/05/19	2017/05/18
Active Loop Antenna	Daze	ZN30900A	N/A	2016/05/19	2017/05/18
LISN	R&S	ENV216	101316	2016/06/02	2017/06/01
LISN	SCHWARZBECK	NSLK8127	8127687	2016/06/02	2017/06/01
Microwave Preamplifier	HP	8349B	3155A00882	2016/05/19	2017/05/18
Amplifier	HP	8447D	3113A07663	2016/05/19	2017/05/18
Transient Limiter	Com-Power	LIT-153	532226	2016/06/02	2017/06/01
Temperature/Humidity Meter	Gangxing	CTH-608	02	2016/05/20	2017/05/19
Climate Chamber	ESPEC	EL-10KA	A20120523	2016/05/20	2017/05/19
High-Pass Filter	K&L	9SH10-2700/X12750-O/O	N/A	2016/05/20	2017/05/19
High-Pass Filter	K&L	41H10-1375/U12750-O/O	N/A	2016/05/20	2017/05/19
Ultra-Broadband Antenna	ShwarzBeck	BBHA9170	25841	2016/05/19	2017/05/18
The temporary antenna connector	MMCX - SMA	1547	23657478	2016/05/20	2017/05/19
RF Cable(1-25GHz)	HUBER+SUHNER	RG214	N/A	2016/05/20	2017/05/19
RF Cable(0-1GHz)	HUBER+SUHNER	RG174	N/A	2016/05/20	2017/05/19

Note: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

## 4. TEST CONDITIONS AND RESULTS

### 4.1. Conducted Emissions Test

#### TEST CONFIGURATION



#### TEST PROCEDURE

- 1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10.
- 2 Support equipment, if needed, was placed as per ANSI C63.10.
- 3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
- 4 If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
- 5 All support equipments received AC power from a second LISN, if any.
- 6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
- 8 During the above scans, the emissions were maximized by cable manipulation.

**The RBW/VBW for 150KHz to 30MHz: 9KHz**

**CONDUCTED POWER LINE EMISSION LIMIT**

For unintentional device, according to § 15.207(a) Line Conducted Emission Limits is as following :

Frequency (MHz)	Maximum RF Line Voltage (dB $\mu$ V)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

\* Decreasing linearly with the logarithm of the frequency

For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

**TEST RESULTS**

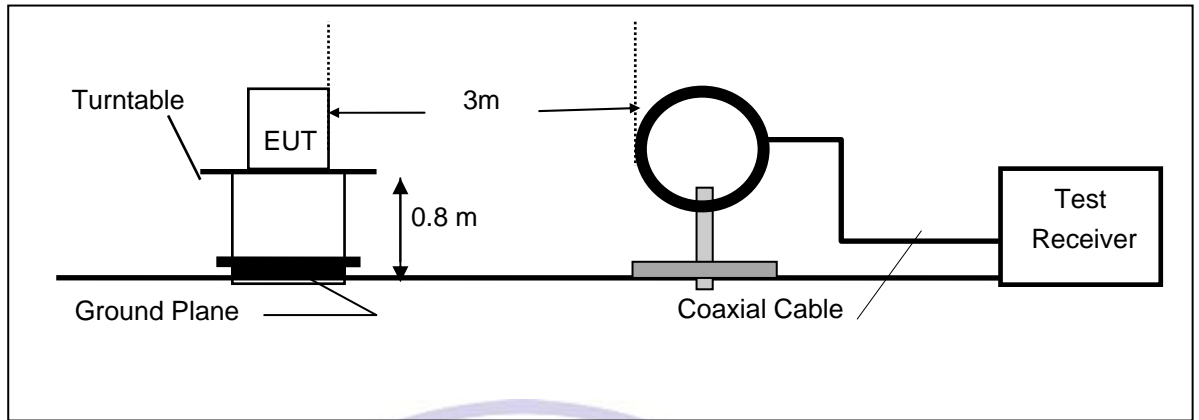
Not applicable to this device.



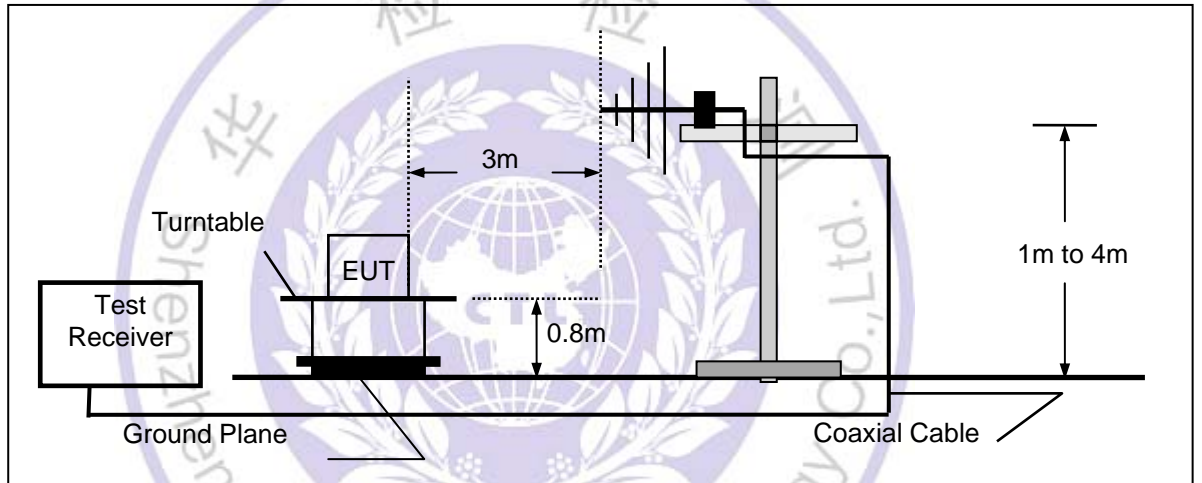
### 4.2. Transmitter Radiated Unwanted Emissions and Bandedge

#### TEST CONFIGURATION

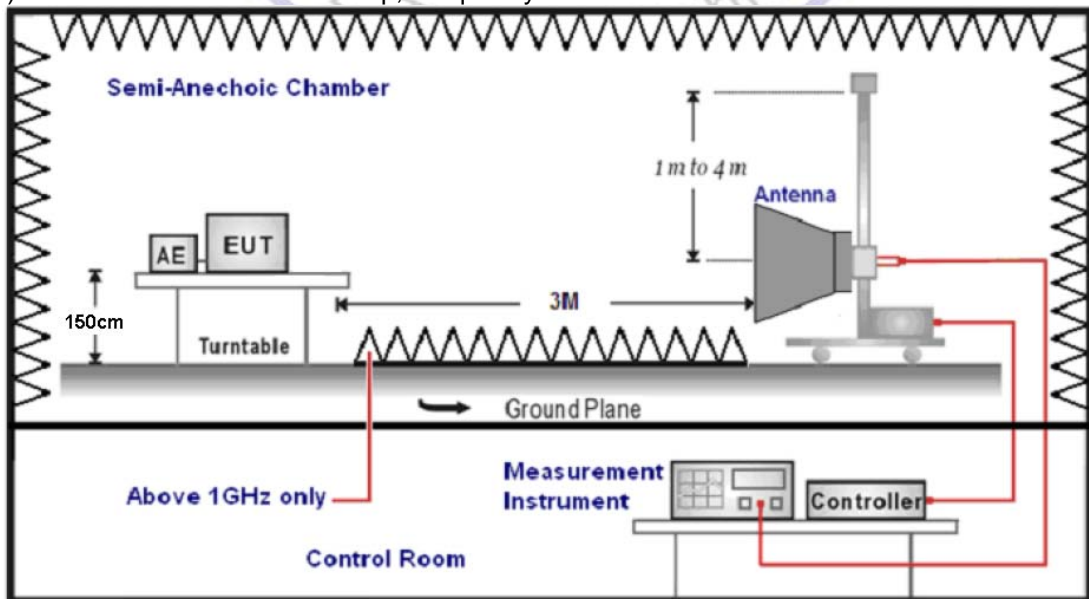
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



**FIELD STRENGTH CALCULATION**

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

**RADIATION LIMIT**

For unintentional device, according to § 15.209(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Distance (Meters)	Radiated (dBµV/m)	Radiated (µV/m)
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

**TEST PROCEDURE**

1. The EUT is placed on a turntable, which is 0.8m above ground plane below 1GHz and 1.5m above ground plane above 1GHz.
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 varied from 1m to 4m to find out the highest emissions.
4. 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.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Repeat above procedures until the measurements for all frequencies are complete.
8. Based on the Frequency Generator in the device include 16MHz. The test frequency range from 9KHz to 25GHz per FCC PART 15.33(a).

Note:

Three axes are chosen for pretest, the X axis is the worst mode for final test.  
For battery operated equipment, the equipment tests shall be performed using a fully-charged battery.

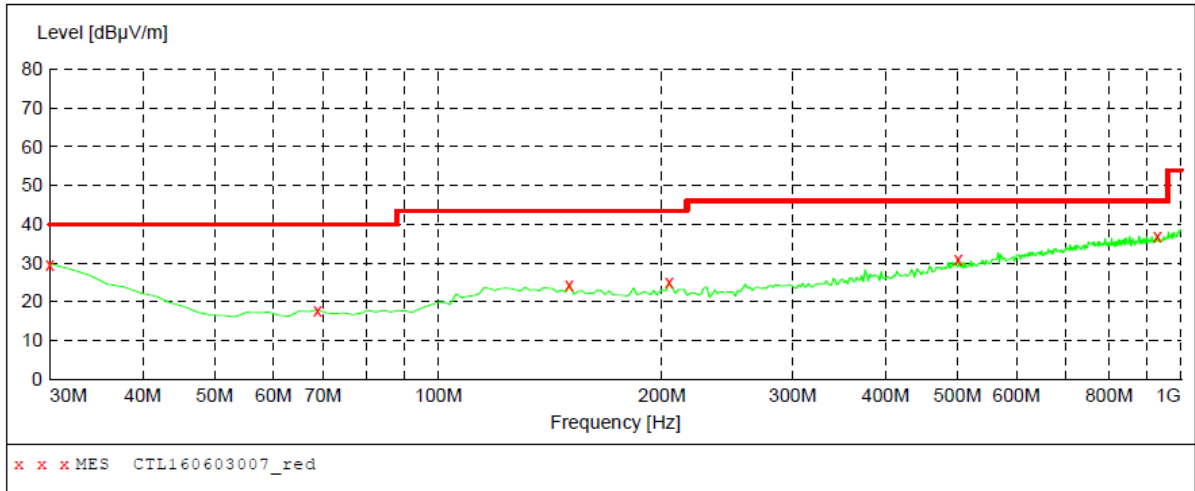
**TEST RESULTS**

All the test modes (TM1, TM2, TM3) completed for test. The worst case of Radiated Emission is TM1; the test data of this mode was reported.

Below 1GHz Test Results:

**SWEEP TABLE: "test (30M-1G)"**

Short Description:		Field Strength			
Start	Stop	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	300.0 ms	120 kHz	JB1



**MEASUREMENT RESULT: "CTL160603007\_red"**

6/3/2016 9:14AM

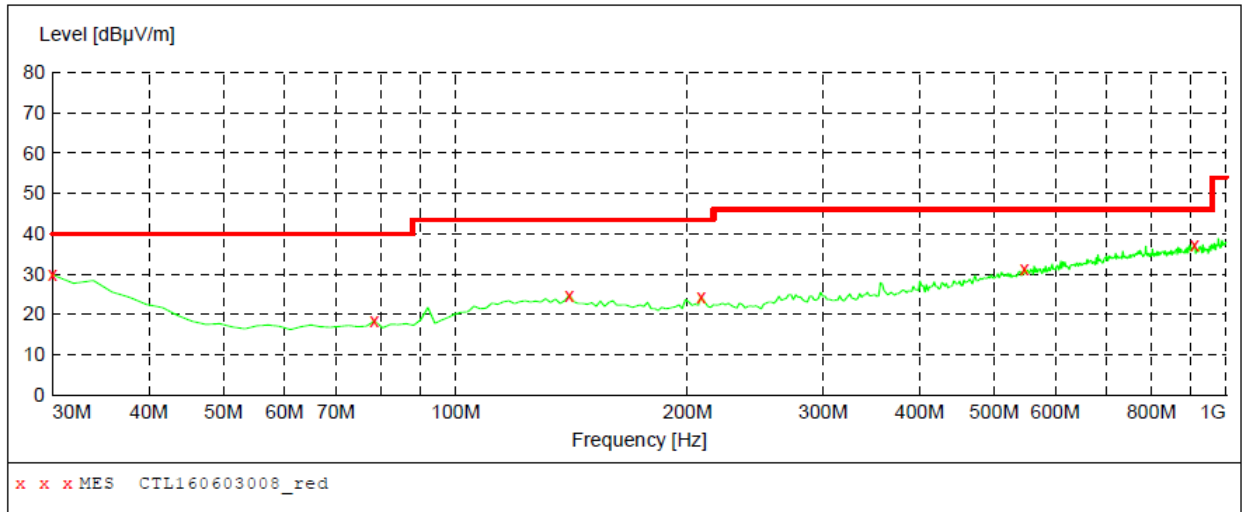
Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
30.000000	29.70	20.8	40.0	10.3	---	0.0	0.00	HORIZONTAL
68.800000	17.90	8.2	40.0	22.1	---	0.0	0.00	HORIZONTAL
150.280000	24.30	13.8	43.5	19.2	---	0.0	0.00	HORIZONTAL
204.600000	24.90	14.1	43.5	18.6	---	0.0	0.00	HORIZONTAL
501.420000	30.80	20.3	46.0	15.2	---	0.0	0.00	HORIZONTAL
930.160000	37.00	26.3	46.0	9.0	---	0.0	0.00	HORIZONTAL

**Remark:**

- (1) Measuring frequencies from 9 KHz to the 1 GHz, Radiated emission test from 9KHz to 30MHz was verified, and no any emission was found except system noise floor.
- (2) \* denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
- (3) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.

**SWEEP TABLE: "test (30M-1G)"**

Short Description:		Field Strength			
Start	Stop	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	300.0 ms	120 kHz	JB1



**MEASUREMENT RESULT: "CTL160603008\_red"**

6/3/2016 9:16AM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
30.000000	29.80	20.8	40.0	10.2	---	0.0	0.00	VERTICAL
78.500000	18.30	8.4	40.0	21.7	---	0.0	0.00	VERTICAL
140.580000	24.80	14.3	43.5	18.7	---	0.0	0.00	VERTICAL
208.480000	24.30	14.0	43.5	19.2	---	0.0	0.00	VERTICAL
547.980000	31.30	20.9	46.0	14.7	---	0.0	0.00	VERTICAL
910.760000	37.40	26.1	46.0	8.6	---	0.0	0.00	VERTICAL

**Remark:**

- (1) Measuring frequencies from 9 KHz to the 1 GHz, Radiated emission test from 9KHz to 30MHz was verified, and no any emission was found except system noise floor.
- (2) \* denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
- (3) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.

**Above 1 GHz Test Results:**

Note: Horizontal and Vertical polarity all have been tested , only worse case is reported.

Frequency	Emission		Limit	Margin	Raw	Antenna Factor	Cable	Pre-amplifier	Correction
(MHz)	Level		(dBuV/m)	(dB)	Value	(dB/m)	Factor	(dB)	Factor
	(dBuV/m)				(dBuV)		(dB)		(dB/m)
2410.00	97.28	PK	114	16.72	99.22	28.80	4.62	35.36	-1.94
2410.00	89.04	AV	94	4.96	90.98	28.80	4.62	35.36	-1.94
2390.00	64.51	PK	74	9.49	66.55	28.72	4.60	35.36	-2.04
2390.00	45.12	AV	54	8.88	47.16	28.72	4.60	35.36	-2.04
2400.00	65.34	PK	74	8.66	67.31	28.78	4.61	35.36	-1.97
2400.00	44.89	AV	54	9.11	46.86	28.78	4.61	35.36	-1.97
4820.00	68.04	PK	74	5.96	63.50	33.51	6.92	35.89	4.54
4820.00	49.33	AV	54	4.67	44.79	33.51	6.92	35.89	4.54
6020.00	65.48	PK	74	8.52	57.32	35.14	7.62	34.60	8.16
6020.00	46.91	AV	54	7.09	38.75	35.14	7.62	34.60	8.16
7230.00	65.82	PK	74	8.18	54.58	37.07	9.19	35.02	11.24
7230.00	46.52	AV	54	7.48	35.28	37.07	9.19	35.02	11.24

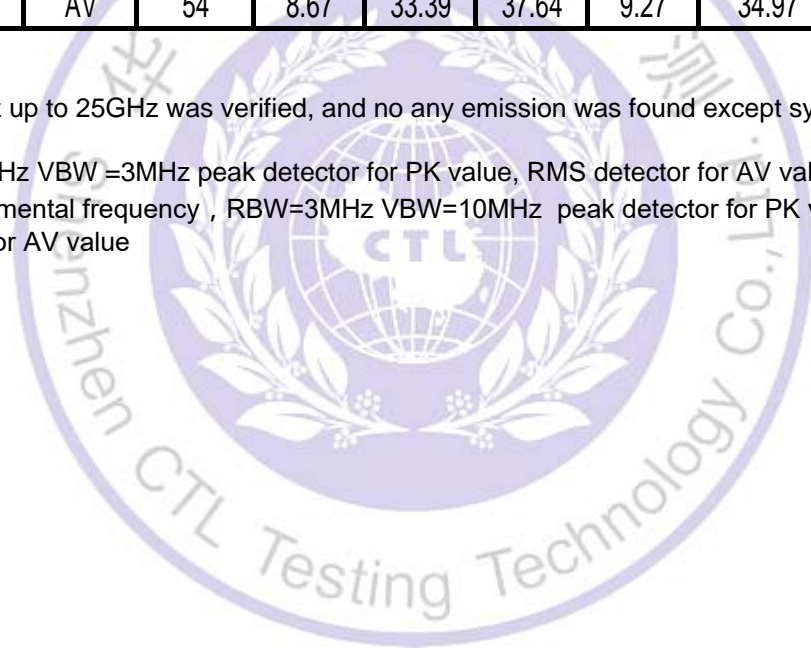
Frequency	Emission		Limit	Margin	Raw	Antenna Factor	Cable	Pre-amplifier	Correction
(MHz)	Level		(dBuV/m)	(dB)	Value	(dB/m)	Factor	(dB)	Factor
	(dBuV/m)				(dBuV)		(dB)		(dB/m)
2442.00	97.46	PK	114	16.54	99.32	28.86	4.66	35.37	-1.86
2442.00	89.15	AV	94	4.85	91.01	28.86	4.66	35.37	-1.86
3200.00	64.02	PK	74	9.98	62.66	31.24	5.47	35.35	1.36
3200.00	46.41	AV	54	7.59	45.05	31.24	5.47	35.35	1.36
3642.00	65.87	PK	74	8.13	62.65	32.28	5.99	35.05	3.22
3642.00	47.66	AV	54	6.34	44.44	32.28	5.99	35.05	3.22
4884.00	67.21	PK	74	6.79	60.84	33.61	6.95	34.19	6.37
4884.00	49.88	AV	54	4.12	43.51	33.61	6.95	34.19	6.37
6118.00	65.63	PK	74	8.37	57.31	35.20	7.77	34.65	8.32
6118.00	46.41	AV	54	7.59	38.09	35.20	7.77	34.65	8.32
7326.00	64.95	PK	74	9.05	53.25	37.47	9.23	35.00	11.70
7326.00	46.36	AV	54	7.64	34.66	37.47	9.23	35.00	11.70



Frequency	Emission		Limit	Margin	Raw	Antenna Factor	Cable	Pre-amplifier	Correction
(MHz)	Level		(dBuV/m)	(dB)	Value	(dB/m)	Factor	(dB)	Factor
	(dBuV/m)				(dBuV)		(dB)		(dB/m)
2473.00	97.82	PK	114	16.18	99.59	28.91	4.69	35.37	-1.77
2473.00	88.57	AV	94	5.43	90.34	28.91	4.69	35.37	-1.77
2483.50	64.05	PK	74	9.95	65.79	28.93	4.70	35.38	-1.74
2483.50	47.91	AV	54	6.09	49.65	28.93	4.70	35.38	-1.74
3720.00	63.48	PK	74	10.52	60.28	32.77	6.08	35.65	3.20
3720.00	46.12	AV	54	7.88	42.92	32.77	6.08	35.65	3.20
4946.00	68.58	PK	74	5.42	61.94	33.79	6.99	34.15	6.64
4946.00	49.27	AV	54	4.73	42.63	33.79	6.99	34.15	6.64
6200.00	64.16	PK	74	9.84	55.76	35.19	7.90	34.69	8.40
6200.00	47.34	AV	54	6.66	38.94	35.19	7.90	34.69	8.40
7419.00	66.42	PK	74	7.58	54.48	37.64	9.27	34.97	11.94
7419.00	45.33	AV	54	8.67	33.39	37.64	9.27	34.97	11.94

**Note:** above 10GHz up to 25GHz was verified, and no any emission was found except system noise floor.

Remark: RBW=1MHz VBW=3MHz peak detector for PK value, RMS detector for AV value  
 For fundamental frequency, RBW=3MHz VBW=10MHz peak detector for PK value, RMS detector for AV value



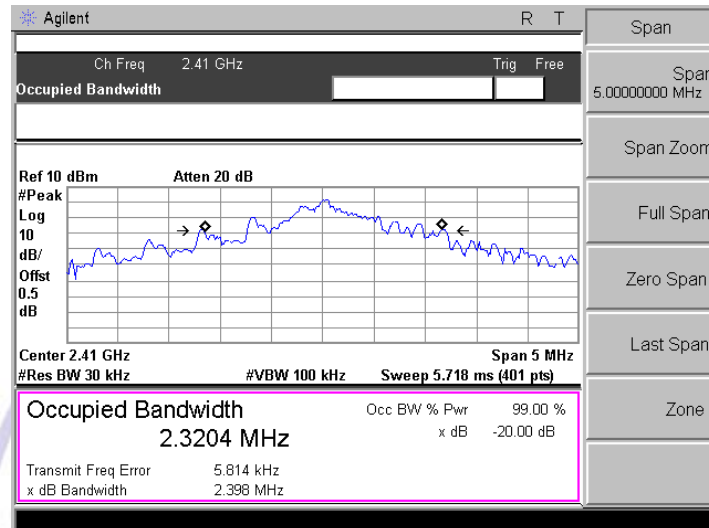
### 4.3. Occupied Bandwidth Measurement

#### Measurement Procedure

1. Set EUT as normal operation.
2.  $RBW \geq 1\%$  of the 20 dB bandwidth,  $VBW \geq RBW$ .
3. The useful conducted emission from the EUT was detected by the spectrum analyser with peak detector.

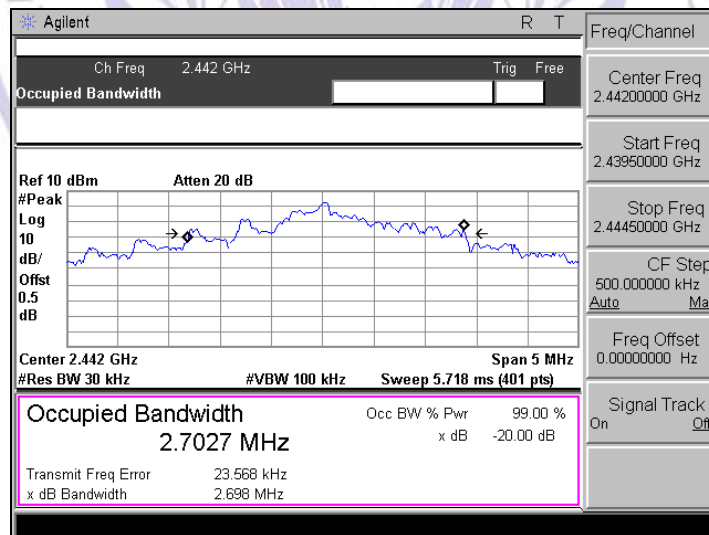
#### Measurement Results

##### 2410MHz



20dB Bandwidth: 2.398 MHz

##### 2442MHz



20dB Bandwidth: 2.698 MHz



## **5. Antenna Requirement**

### **Standard Applicable**

For intentional device, according to FCC 47 CFR Section 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.

And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

### **Refer to statement below for compliance.**

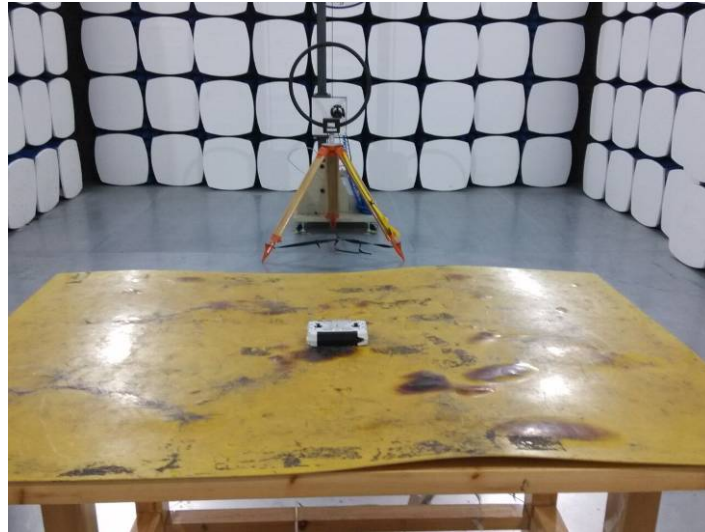
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

### **Antenna Connected Construction**

The antenna used in this product is an internal Antenna, The directional gains of antenna used for transmitting is 0 dBi.

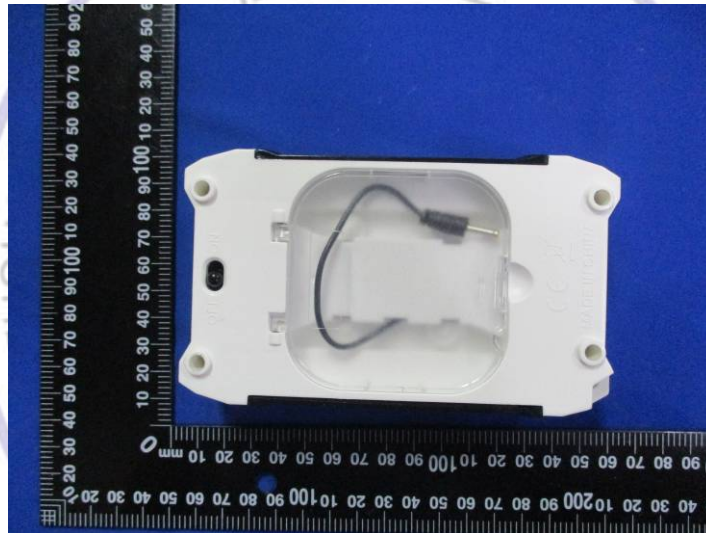
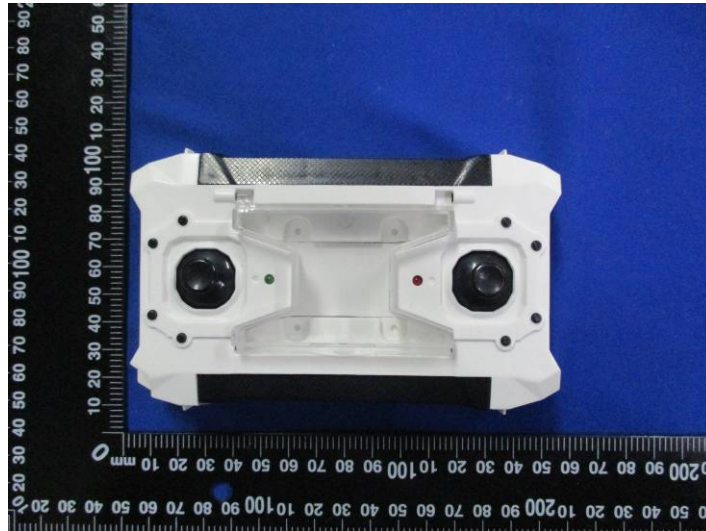


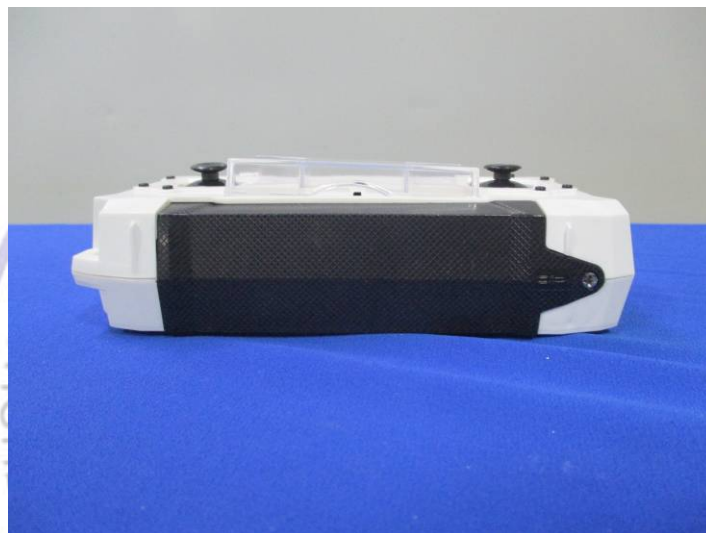
## 6. Test Setup Photos of the EUT



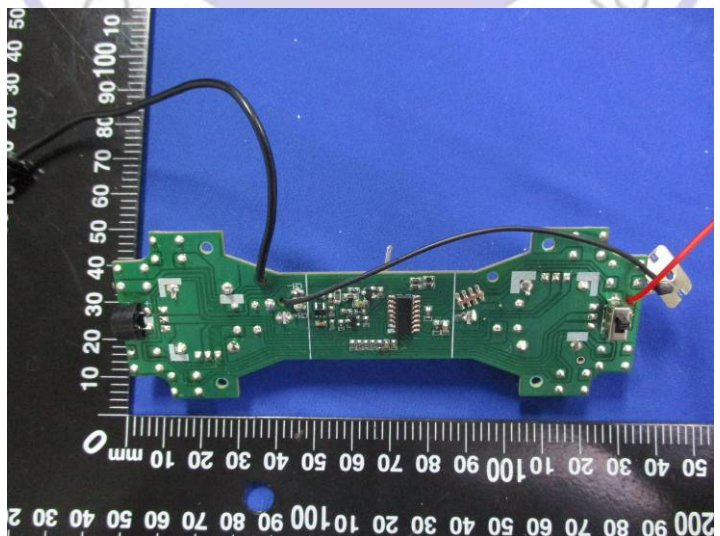
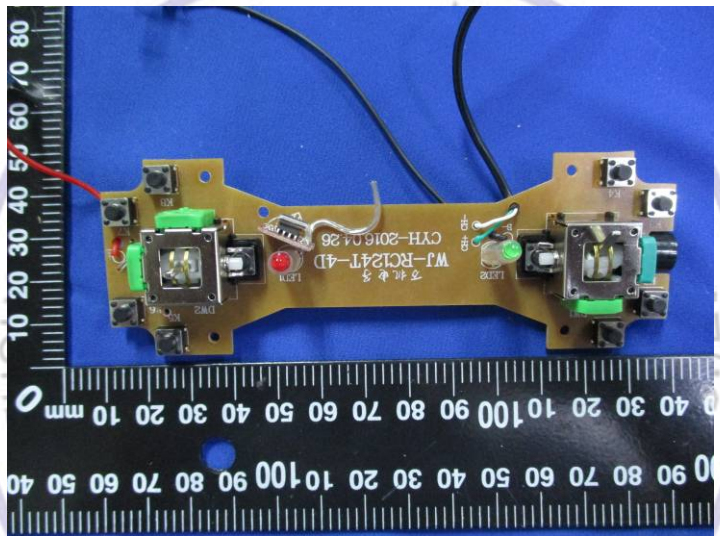
## 7. External and Internal Photos of the EUT

### External Photos of EUT

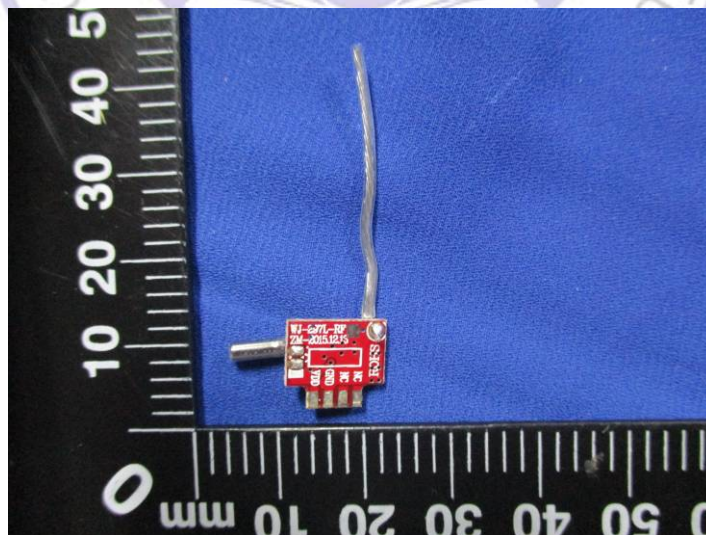
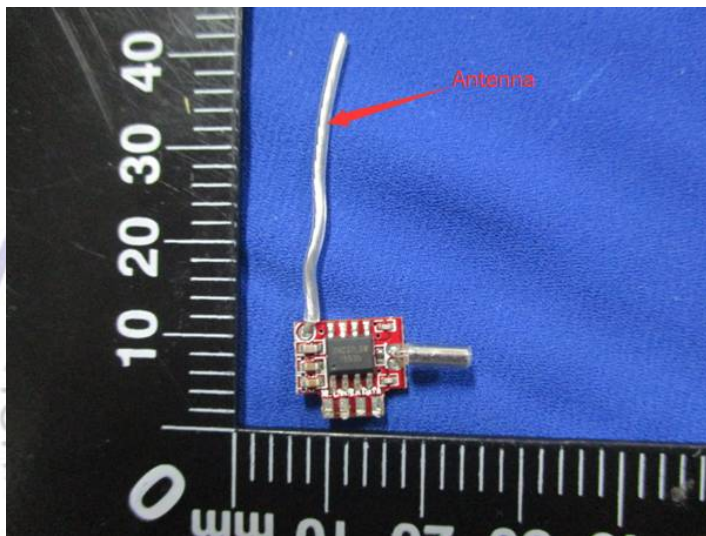
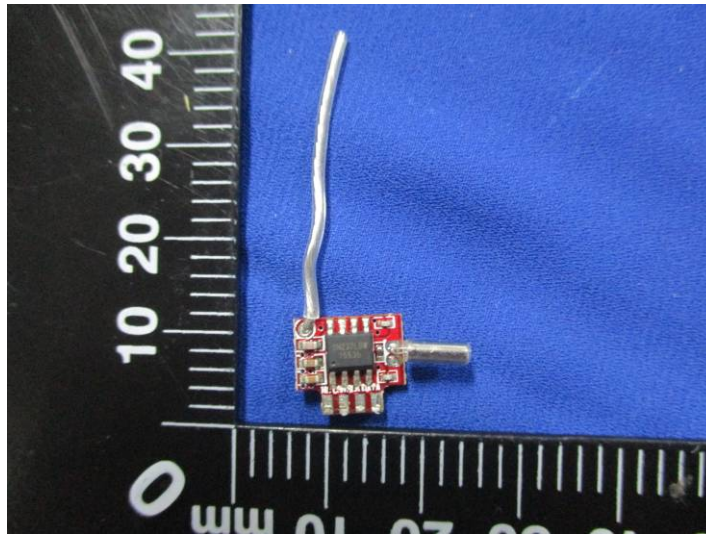




Internal Photos of EUT







.....End of Report.....