



# TEST REPORT

Report Reference No.....	TRE18110053	R/C.....: 64901
FCC ID .....	2ACJPRM12	
Applicant's name .....	Rayrun Technology Co., Ltd	
Address.....	3F East, G Building, Xinghui Industry park,Huaning W. R., Dalng, LonghuaP.O. Box 3F East,Shenzhen, 518109 China	
Manufacturer.....	Rayrun Technology Co., Ltd	
Address.....	3F East, G Building, Xinghui Industry park,Huaning W. R., Dalng, LonghuaP.O. Box 3F East,Shenzhen, 518109 China	
Test item description .....	Remote Controller	
Trade Mark .....	RAYRUN	
Model/Type reference.....	RM12	
Listed Model(s) .....	-	
Standard .....	FCC CFR Title 47 Part 15 Subpart C Section 15.231(a)	
Date of receipt of test sample.....	Nov.09,2018	
Date of testing.....	Nov.09,2018 ~ Nov.16,2018	
Date of issue.....	Nov.16,2018	
Result.....	PASS	
Compiled by ( position+printed name+signature)...	File administrators Yueming Li	
Supervised by ( position+printed name+signature)...	Project Engineer Tom Ouyang	
Approved by ( position+printed name+signature)...	RF Manager Hans Hu	
Testing Laboratory Name .....	Shenzhen Huatongwei International Inspection Co., Ltd	
Address.....	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China	
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The test report merely correspond to the test sample.		

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## 1. **TEST STANDARDS AND REPORT VERSION**

### 1.1. **Test Standards**

The tests were performed according to following standards:

[FCC Rules Part 15.231\(a\)](#): Periodic operation in the band 40.66–40.70 MHz and above 70 MHz.

[ANSI C63.10-2013](#): American National Standard for Testing Unlicensed Wireless Devices.

### 1.2. **Report version**

Revision No.	Date of issue	Description
N/A	2018-11-16	Original

## 2. **TEST DESCRIPTION**

Test Item	Section in CFR 47	Result	Test Enigeer
Antenna requirement	15.203	Pass	Xiaokang Tan
Conducted Emissions	15.207	N/A	N/A
Field Strength of the Fundamental	15.231(b)	Pass	Tony Duan
20dB Bandwidth	15.231(c)	Pass	Xiaokang Tan
Continue Transmission Time	15.231(a)	Pass	Xiaokang Tan
Radiated Emissions	15.209/15.231(b)	Pass	Michael Jie

Note: The measurement uncertainty is not included in the test result.

### 3. **SUMMARY**

#### 3.1. Client Information

Applicant:	Rayrun Technology Co., Ltd
Address:	3F East, G Building, Xinghui Industry park, Huaning W. R., Dalong, Longhua P.O. Box 3F East, Shenzhen, 518109 China
Manufacturer:	Rayrun Technology Co., Ltd
Address:	3F East, G Building, Xinghui Industry park, Huaning W. R., Dalong, Longhua P.O. Box 3F East, Shenzhen, 518109 China

#### 3.2. Product Description

Name of EUT:	Remote Controller
Trade Mark:	RAYRUN
Model No.:	RM12
Listed Model(s):	-
Power supply:	DC 3.0V
<b>RF Specification</b>	
Operation frequency:	433.92MHz
Channel number:	1
Modulation Type:	OOK
Antenna type:	PCB track antenna
Antenna gain:	3 dBi

### 3.3. EUT operation mode

The EUT has been tested under typical operating condition. The Applicant provides software to control the EUT for staying in continuous transmitting mode for testing.

### 3.4. EUT configuration

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

- - supplied by the manufacturer
- - supplied by the lab

	/	Manufacturer :	/
		Model No. :	/
	/	Manufacturer :	/
		Model No. :	/

### 3.5. Modifications

No modifications were implemented to meet testing criteria.

## 4. **TEST ENVIRONMENT**

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

Laboratory: Shenzhen Huatongwei International Inspection Co., Ltd.

Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

Phone: 86-755-26748019 Fax: 86-755-26748089

### 4.2. **Test Facility**

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

#### **CNAS-Lab Code: L1225**

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

#### **A2LA-Lab Cert. No. 3902.01**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

#### **FCC-Registration No.: 762235**

Shenzhen Huatongwei International Inspection 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 762235.

#### **IC-Registration No.: 5377B-1**

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377B-1.

#### **ACA**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

### 4.3. Environmental conditions

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

Temperature:	15~35°C
Relative Humidity:	30~60 %
Air Pressure:	950~1050mba

### 4.4. 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 TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics;Part 1" and TR-100028-02 "Electromagnetic compatibilityand Radio spectrum Matters (ERM);Uncertainties in the measurementof mobile radio equipment characteristics;Part 2 " and is documented in the Shenzhen Huatongwei International Inspection 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 Shenzhen Huatongwei laboratory is reported:

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.63 dB	(1)
Transmitter power Radiated	2.38 dB	(1)
Conducted spurious emissions 9kHz~40GHz	0.63 dB	(1)
Conducted Disturbance 150kHz~30MHz	3.35 dB	(1)
Radiated Emissions below 1GHz	4.28 dB	(1)
Radiated Emissions above 1GHz	5.16 dB	(1)
Occupied Bandwidth	18 Hz	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=1.96$ .

#### 4.5. Equipments Used during the Test

RF Conducted Method						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. (mm-dd-yy)	Next Cal. (mm-dd-yy)
1	Signal and spectrum analyzer	R&S	FSV40	100048	10/28/2018	10/27/2019

Radiated Emissions						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. (mm-dd-yy)	Next Cal. (mm-dd-yy)
1	Semi-Anechoic Chamber	Albatross projects	SAC-3m-01	C11121	10/16/2016	10/15/2019
2	EMI Test Receiver	R&S	ESCI	100900	10/28/2018	10/27/2019
3	Loop Antenna	R&S	HFH2-Z2	100020	11/20/2017	11/19/2020
4	Ultra-Broadband Antenna	SCHWARZBECK	VULB9163	538	4/5/2017	4/4/2020
5	Horn Antenna	SCHWARZBECK	9120D	1011	3/27/2017	3/26/2020
6	Pre-amplifier	SCHWARZBECK	BBV 9743	9743-0022	10/17/2018	10/16/2019
7	Broadband Pre-amplifier	SCHWARZBECK	BBV 9718	9718-248	4/28/2018	4/27/2018
8	Spectrum Analyzer	R&S	FSP40	100597	10/27/2018	10/26/2019
9	RF Connection Cable	HUBER+SUHNER	RE-7-FL	N/A	11/21/2017	11/20/2018
10	RF Connection Cable	HUBER+SUHNER	RE-7-FH	N/A	11/21/2017	11/20/2018
11	Test Software	Audix	E3	N/A	N/A	N/A
12	Test Software	R&S	ES-K1	N/A	N/A	N/A
13	Turntable	Maturo Germany	TT2.0-1T	N/A	N/A	N/A
14	Antenna Mast	Maturo Germany	CAM-4.0-P-12	N/A	N/A	N/A

## 5. **TEST CONDITIONS AND RESULTS**

### 5.1. Antenna requirement

#### Requirement

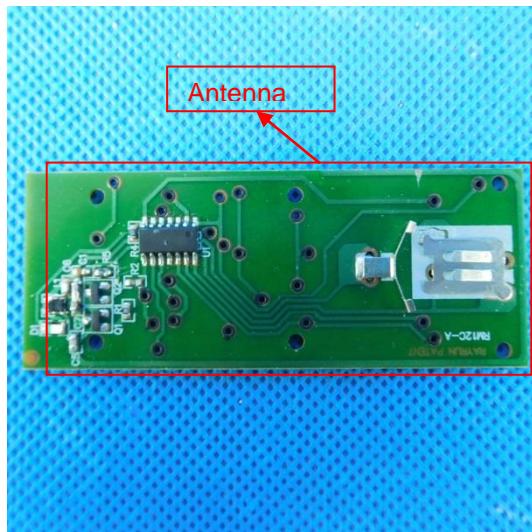
##### **FCC CFR Title 47 Part 15 Subpart C Section 15.203:**

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

#### TEST RESULTS

Passed       Not Applicable

The directional gain of the antenna less than 6 dBi, please refer to the below antenna photo.



## 5.2. Conducted Emission (AC Main)

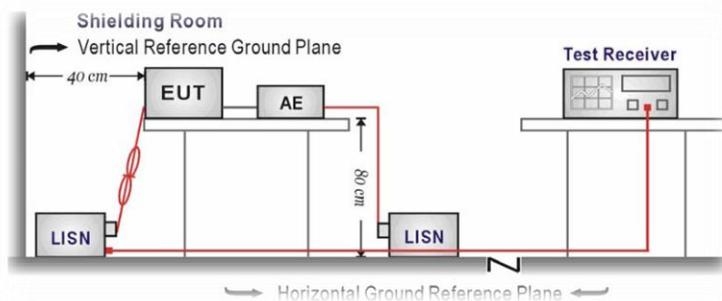
### LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.207:

Frequency range (MHz)	Limit (dB <sub>u</sub> V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\* Decreases with the logarithm of the frequency.

### TEST CONFIGURATION



### TEST PROCEDURE

1. The EUT was setup according to ANSI C63.10:2013 for compliance to FCC 47CFR 15.247 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment.
4. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
5. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
6. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
7. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
8. During the above scans, the emissions were maximized by cable manipulation.

### TEST MODE:

Please refer to the clause 3.3

### TEST RESULTS

Passed       Not Applicable

### 5.3. Field Strength of the Fundamental

#### LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.231(b).

The field strength of emissions from intentional radiators operated **average value** under this section shall not exceed the following

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Unwanted emissions (millivolts/meter)
260 - 470 MHz	3,750 to 12,500 **	375 to 1,250 **

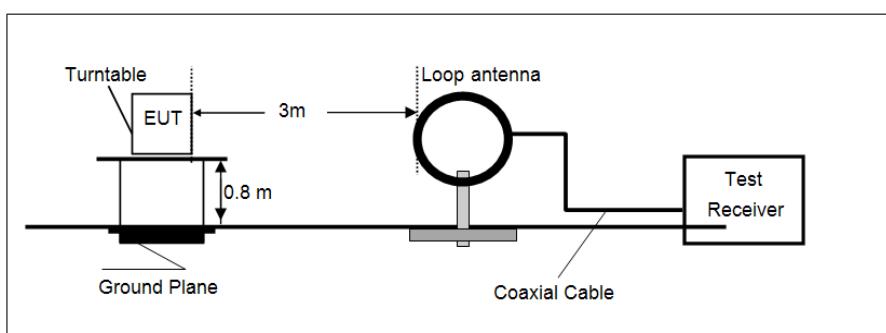
\*\* linear interpolation with frequency, f, in MHz:

F is **433.92MHz**

Field strength of fundamental: Limit at 3 meters =  $41.67 \times F - 7083.34 = 80.83 \text{ dBuV/m}$

Field strength of harmonics: Limit at 3 meters =  $4.167 \times F - 708.334 = 60.83 \text{ dBuV/m}$

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10:2013 requirements.
2. The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.

#### TEST MODE:

Please refer to the clause 3.3

#### TEST RESULTS

Passed

Not Applicable

**Peak value:**

Frequency(MHz)	Level(dBuV/m)	Limit(dBuV/m)	Polarization	Test Result
433.92	72.3	100.83	Horizontal	Pass
433.92	78.5	100.83	Vertical	Pass

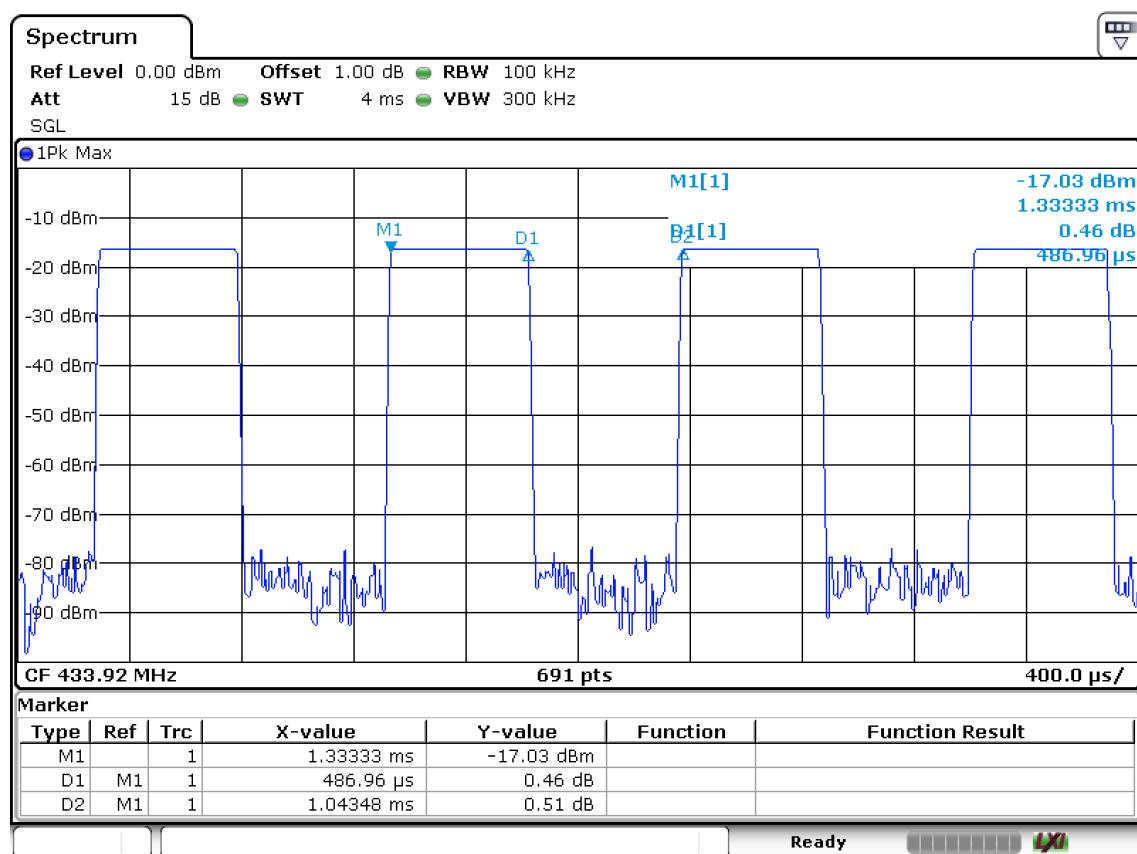
**Average value:**

Frequency(MHz)	Peak Level (dBuV/m)	Dutycycle Factor	Average Level (dBuV/m)	Limit (dBuV/m)	Polarization	Test Result
433.92	72.3	-6.62	68.68	80.83	Horizontal	Pass
433.92	78.5	-6.62	71.88	80.83	Vertical	Pass

**Duty cycle factor:**

Calculate Formula:	Average value=Peak value + Duty Cycle Factor
	Duty cycle factor=20 log(Duty cycle)
	Duty cycle= $T_{on}/ T_{period}$
Test data:	$T_{on}$ time =486.96us
	$T_{period}$ =1043.48us
	Duty cycle=0.4667
	Duty cycle factor=-6.62

Test plot as follows:

 $T_{on}$  &  $T_{period}$  time:

## 5.4. 20 dB Bandwidth

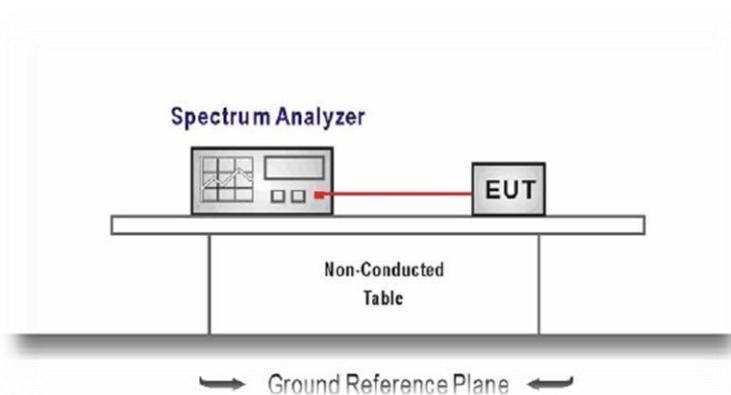
### LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.231(c).

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.

$$433.92\text{MHz} \times 0.25\% = 1.085\text{MHz}$$

### TEST CONFIGURATION



### TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:  
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a operation channel  
RBW  $\geq$  1% of the 20 dB bandwidth, VBW  $\geq$  RBW  
Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

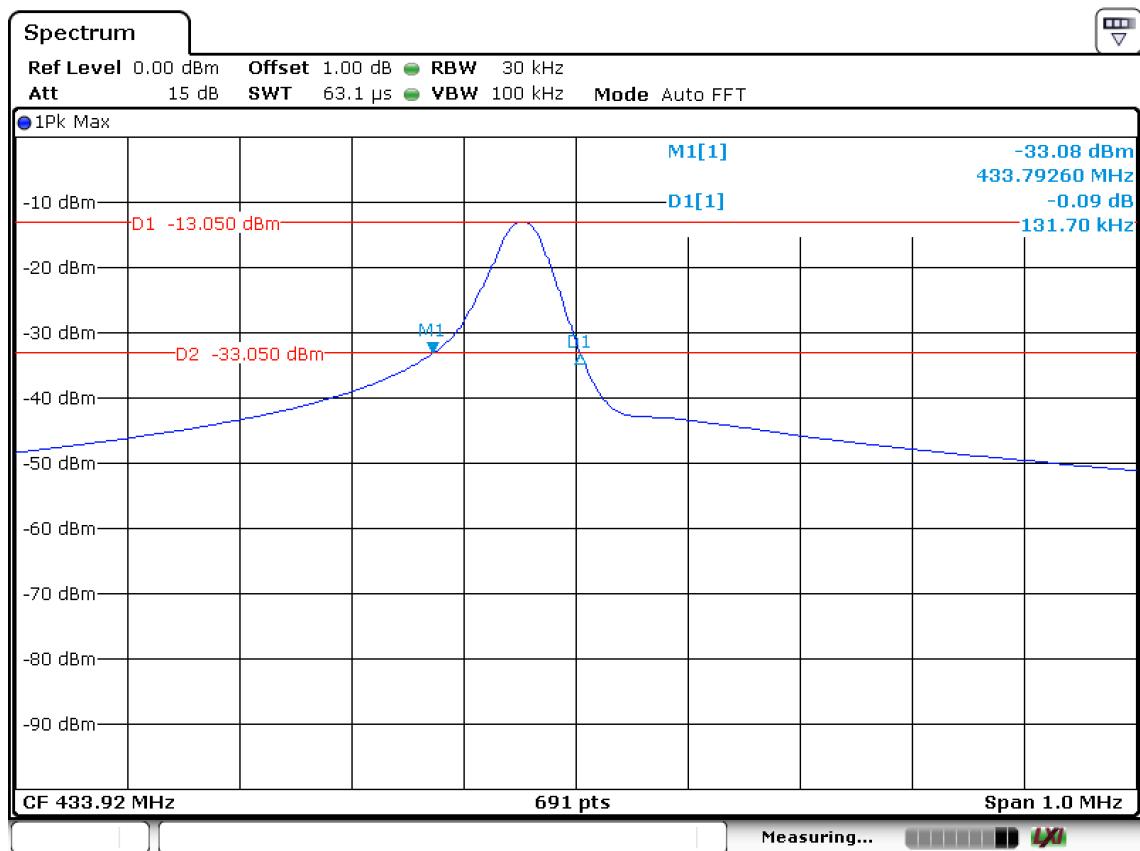
### TEST MODE:

Please refer to the clause 3.3

### TEST RESULTS

Passed       Not Applicable

Channel Frequency(MHz)	20dB Bandwidth(kHz)	Limit (MHz)	Result
433.92	131.70	1.085	PASS



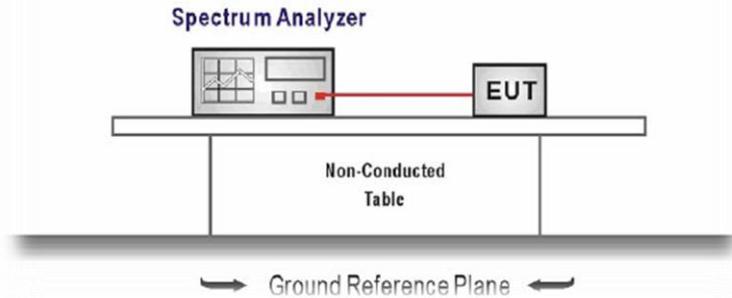
## 5.5. Continue Transmission Time

### LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.231(a).

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

### TEST CONFIGURATION



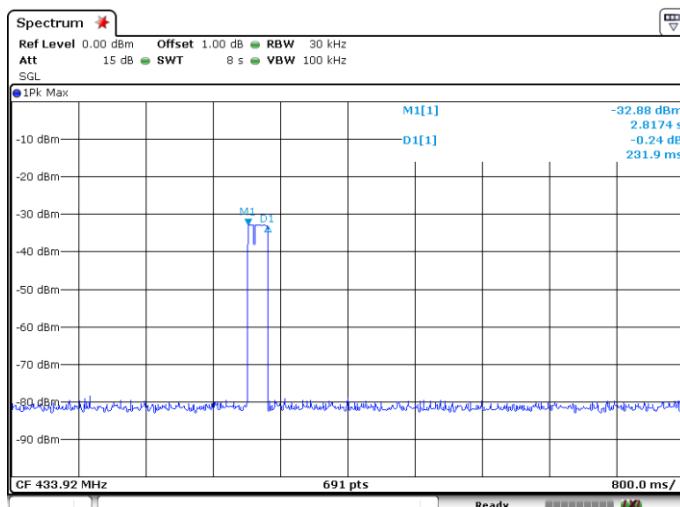
### TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:  
Frequency=Center carrier frequency  
RBW=100KHz, VBW=300KHz, Span= 0,  
Sweep time= 10second, Detector function = peak, Trace = single
4. Measure and record the results in the test report.

### TEST RESULTS

Passed       Not Applicable

Frequency (MHz)	Transmission time (s)	Limit (s)	Result
433.92	0.2319	<5.00	Pass



## 5.6. Radiated Emission

### LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.231(b) and 15.209.

Limit for frequency below 30MHz:

Frequency	Limit (uV/m)	Measurement Distance(m)	Remark
0.009~0.490	2400/F(kHz)	300	Quasi-peak
0.490~1.705	24000/F(kHz)	30	Quasi-peak
1.705~30.0	30	30	Quasi-peak

Note: Limit dBuV/m @3m = Limit dBuV/m @300m + 40\*log(300/3)= Limit dBuV/m @300m +80,

Limit dBuV/m @3m = Limit dBuV/m @30m +40\*log(30/3)= Limit dBuV/m @30m + 40.

Limit for frequency above 30MHz:

Frequency	Limit (dBuV/m @3m)	Remark
30MHz~88MHz	40.00	Quasi-peak
88MHz~216MHz	43.50	Quasi-peak
216MHz~960MHz	46.00	Quasi-peak
960MHz~1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

Unwanted emissions of the harmonic level:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Unwanted emissions (millivolts/meter)
260 - 470 MHz	3,750 to 12,500 **	375 to 1,250 **

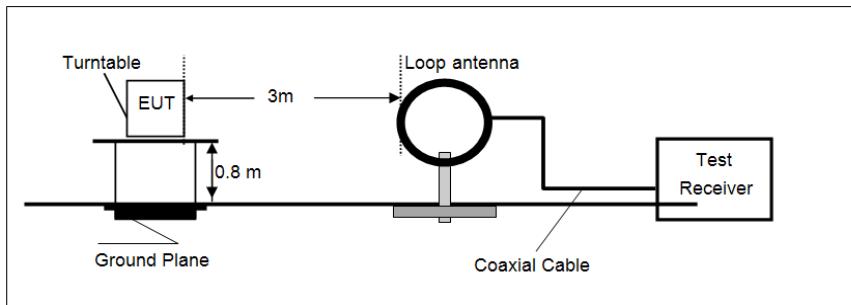
\*\* linear interpolation with frequency, f, in MHz:

F is **433.92MHz**

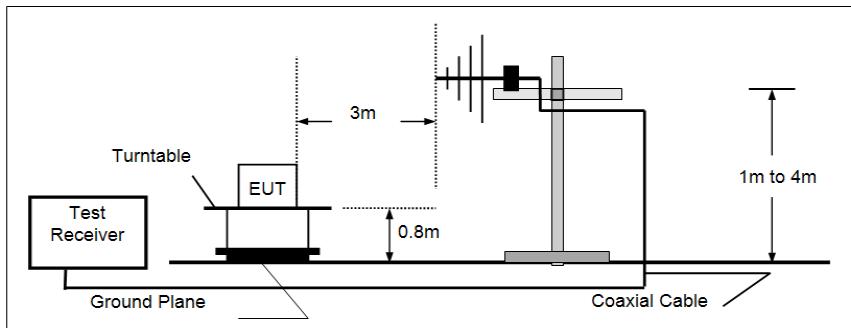
Field strength of harmonics: Limit at 3 meters =  $4.167 \cdot F - 708.334 = 60.83 \text{ dBuV/m}$

### TEST CONFIGURATION

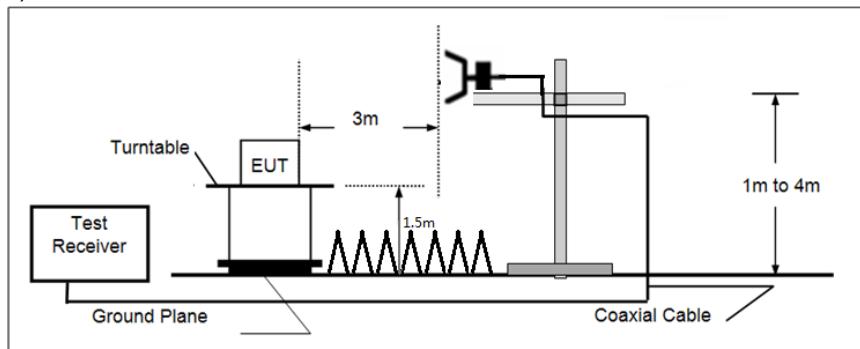
1) 9KHz ~30MHz



2) 30MHz ~ 1GHz



## 3) Above 1GHz

**TEST PROCEDURE**

1. The EUT was tested according to ANSI C63.10:2013 requirements.
2. The EUT is placed on a turn table which is 0.8/1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna.

**TEST RESULTS**

Passed       Not Applicable

**Below 30MHz:**

The EUT was pre-scanned the frequency band (9KHz~30MHz), found the radiated level lower than the limit, so don't show on the report.

**Above 30MHz:****Peak value:**

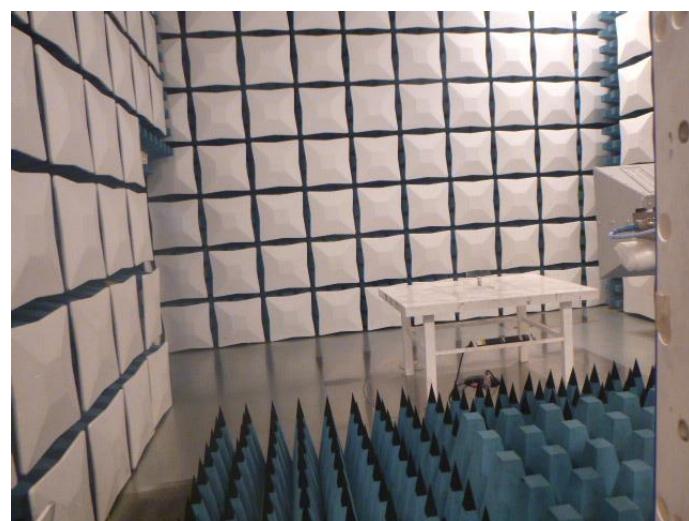
Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dBuV/m)	Polarization	Test Result
867.84	64.00	80.83	-16.83	Vertical	Pass
1301.76	53.62	74.00	-20.38	Vertical	Pass
1735.68	47.09	74.00	-26.91	Vertical	Pass
2169.60	54.01	74.00	-19.99	Vertical	Pass
2603.52	59.62	74.00	-14.38	Vertical	Pass
3037.44	55.15	74.00	-18.85	Vertical	Pass
867.84	59.60	80.83	-21.23	Horizontal	Pass
1301.76	52.27	74.00	-21.73	Horizontal	Pass
1735.68	51.32	74.00	-22.68	Horizontal	Pass
2169.60	54.23	74.00	-19.77	Horizontal	Pass
2603.52	58.70	74.00	-15.30	Horizontal	Pass
3037.44	53.85	74.00	-20.15	Horizontal	Pass

**Average value:**

Frequency (MHz)	Peak Value (dBuV/m)	Dutycycle Factor	Average Value(dBuV/m)	Limit (dBuV/m)	Over Limit (dBuV/m)	Polarization	Test Result
867.84	64.00	-6.62	57.38	60.83	-3.45	Vertical	Pass
1301.76	53.62	-6.62	47.00	54.00	-7.00	Vertical	Pass
1735.68	47.09	-6.62	40.47	54.00	-13.53	Vertical	Pass
2169.60	54.01	-6.62	47.39	54.00	-6.61	Vertical	Pass
2603.52	59.62	-6.62	53.00	54.00	-1.00	Vertical	Pass
3037.44	55.15	-6.62	48.53	54.00	-5.47	Vertical	Pass
867.84	59.60	-6.62	52.98	60.83	-7.85	Horizontal	Pass
1301.76	52.27	-6.62	45.65	54.00	-8.35	Horizontal	Pass
1735.68	51.32	-6.62	44.70	54.00	-9.30	Horizontal	Pass
2169.60	54.23	-6.62	47.61	54.00	-6.39	Horizontal	Pass
2603.52	58.70	-6.62	52.08	54.00		Horizontal	Pass
3037.44	53.85	-6.62	47.23	54.00	-6.77	Horizontal	Pass

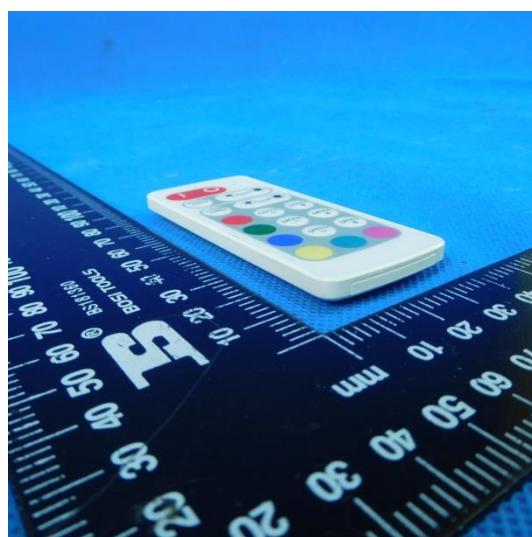
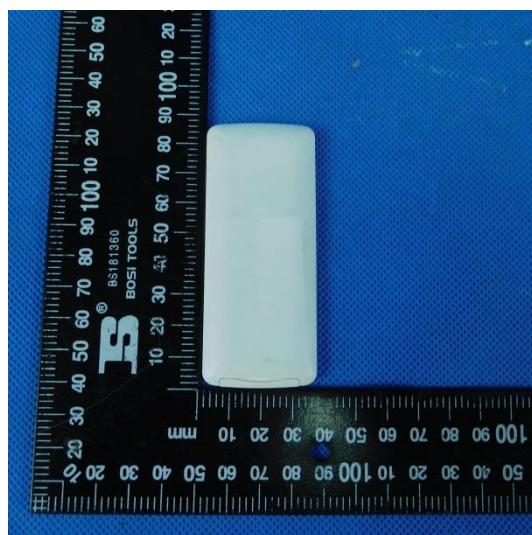
## 6. Test Setup Photos of the EUT

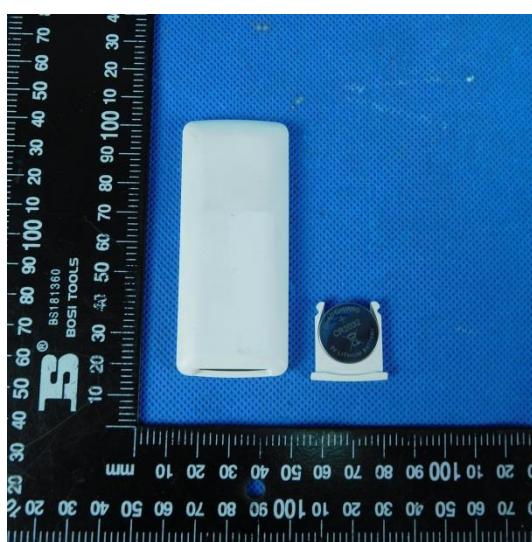
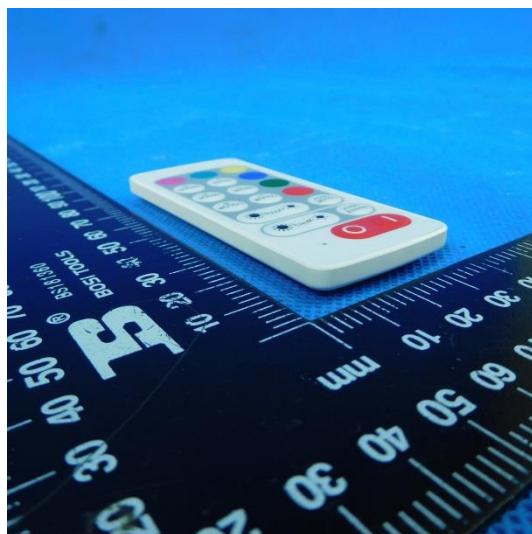
Radiated Emission



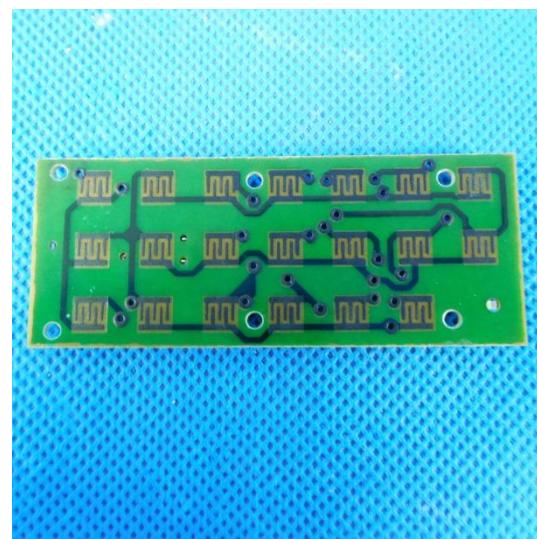
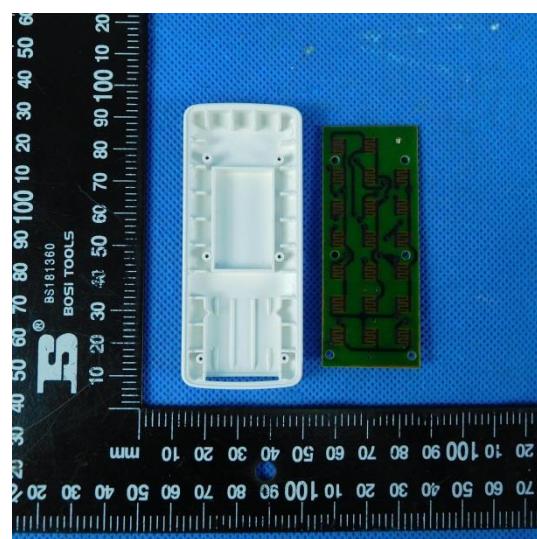
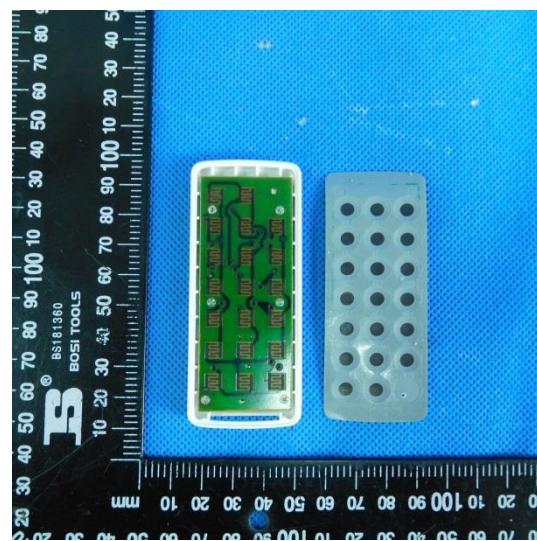
## 7. External and Internal Photos of the EUT

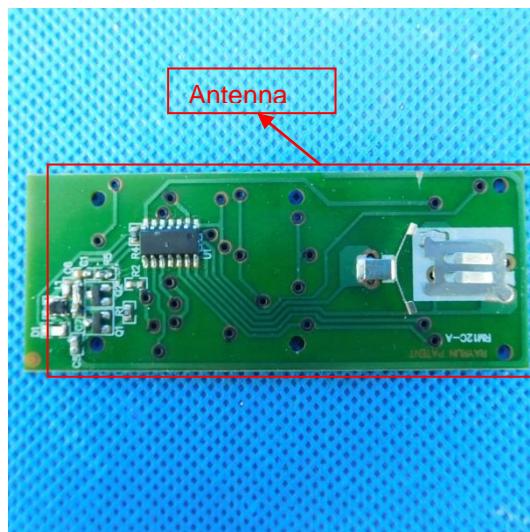
External photo





## Internal photo





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