# FCC TEST REPORT

for

## Jie Du Electronics Technology Co., LTD

## RF-Remote Controller

## Model Number: FDI-R668, FDI-R730, FDI-R731

## FCC ID: 2AMNJ-39154-T

Prepared for : Jie Du Electronics Technology Co., LTD
Address : Shui Wei Industrial Area, Tangjiao Village, ChaShan Town, Dongguan, Guangdong

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Report No. : TR17050040-E-001
Date of Test : Jul. 5~10, 2017
Date of Report : Jul. 10, 2017

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# Keyway Testing Technology Co., Ltd.

| | | | |
|---|---|---|---|
| **Applicant:**<br>**Address:** | Jie Du Electronics Technology Co., LTD<br>Shui Wei Industrial Area, Tangjiao Village, ChaShan Town, Dongguan, Guangdong | | |
| **Manufacturer:**<br>**Address:** | Jie Du Electronics Technology Co., LTD<br>Shui Wei Industrial Area, Tangjiao Village, ChaShan Town, Dongguan, Guangdong | | |
| **E.U.T:** | RF-Remote Controller | | |
| **Model Number:** | FDI-R668, FDI-R730, FDI-R731 | | |
| **Trade Name:** | SMK/Fando | **Serial No.:** | ------ |
| **Date of Receipt:** | Jul. 4, 2017 | **Date of Test:** | Jul. 5~10, 2017 |
| **Test Specification:** | FCC Part 15, Subpart C Section 15.231: 2016<br>ANSI C63.10-2013 | | |
| **Test Result:** | The equipment under test was found to be compliance with the requirements of the standards applied.<br>**Issue Date: Jul. 10, 2017** | | |

| Tested by: | Reviewed by: | Approved by: |
|---|---|---|
| Keven Wu / Engineer | Mark Li / Supervisor | Andy Gao / Supervisor |

**Other Aspects:**

*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 | N/A |
| Radiated Emissions | 15.231(b) | PASS |
| Occupied Bandwidth | 15.231(c) | PASS |
| Transmitter Time out | 15.231(a)(1) | PASS |
| Antenna Requirement | 15.203 | PASS |

# 2. GENERAL PRODUCT INFORMATION

## 2.1. Product Function

Refer to Technical Construction Form and User Manual.

## 2.2. Description of Device (EUT)

| | | |
|---|---|---|
| Description | : | RF-Remote Controller |
| M/N | : | FDI-R668, FDI-R730, FDI-R731 |
| Model Difference | : | Only the appearance is different, others are the same. |
| Power Supply | : | DC12V from battery |
| Operation Frequency | : | 433.92MHz |
| Modulation Technology | : | OOK |
| Antenna Type | : | Integral Antenna |
| Antenna Gain | : | 0dBi |

## 2.3. Independent Operation Modes

The basic operation modes are:

### 2.3.1. Transmitting mode(TX Mode)

## 2.4. Product Version

| | |
|---|---|
| SW Version: | A401B |
| HW Version: | 35-66800-000-000 |

# 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. 08,17 | Apr. 08,18 |
| System Simulator | Agilent | E5515C | GB43130245 | Apr. 08,17 | Apr. 08,18 |
| Power Splitter | Weinschel | 1506A | NW425 | Apr. 08,17 | Apr. 08,18 |
| Bilog Antenna | ETS-LINDGREEN | 3142D | 135452 | Apr. 08,17 | Apr. 08,18 |
| Loop antenna | teseq | HLA6120 | 22032 | Apr. 08,17 | Apr. 08,18 |
| Spectrum Analyzer | Keysight | N9020A | MY56070279 | Apr. 08,17 | Apr. 08,18 |
| 3m Semi-anechoic Chamber | ETS-LINDGREEN | 966 | KW01 | Apr. 08,17 | Apr. 08,18 |
| Signal Amplifier | SONOMA | 310 | 187016 | Apr. 08,17 | Apr. 08,18 |
| Signal Amplifier | Agilent | 8449B | 3008A00251 | Apr. 08,17 | Apr. 08,18 |
| RF Cable | IMRO | IMRO-400 | 966 Cable 1# | Apr. 08,17 | Apr. 08,18 |
| RF Cable | IMRO | IMRO-400 | 966 Cable 2# | Apr. 08,17 | Apr. 08,18 |
| RF Cable | IMRO | IMRO-400 | 966 Cable 3# | Apr. 08,17 | Apr. 08,18 |
| MULTI-DEVICE Controller | ETS-LINDGREEN | 2090 | 126913 | N/A | N/A |
| Horn Antenna | DAZE | ZN30701 | 11003 | Apr. 08,17 | Apr. 08,18 |
| Horn Antenna | SCHWARZBECK | BBHA9170 | 9170-068 | Apr. 08,17 | Apr. 08,18 |
| Spectrum Analyzer | Agilent | 8593E | 3911A04271 | Apr. 08,17 | Apr. 08,18 |
| Spectrum Analyzer | Agilent | E4408B | MY44211125 | Apr. 08,17 | Apr. 08,18 |
| Signal Amplifier | DAZE | ZN3380C | 11001 | Apr. 08,17 | Apr. 08,18 |
| High Pass filter | Micro | HPM50111 | 324216 | Apr. 08,17 | Apr. 08,18 |
| Filter | COM-MW | ZBSF-C836.5-25-X | KW032 | Apr. 08,17 | Apr. 08,18 |
| Filter | COM-MW | ZBSF-C1747.5-75-X2 | KW035 | Apr. 08,17 | Apr. 08,18 |
| Filter | COM-MW | ZBSF-C1880-60-X2 | KW037 | Apr. 08,17 | Apr. 08,18 |
| DC Power Supply | LongWei | PS-305D | 010964729 | Apr. 08,17 | Apr. 08,18 |
| Constant temperature and humidity box | GF | GTH-800-40-1P | MAA9906-005 | Apr. 08,17 | Apr. 08,18 |
| Splitter | Agilent | 11636B | 0025164 | Apr. 08,17 | Apr. 08,18 |

# 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

*(EUT: RF-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 (℃) | 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 | |
|---|---|---|---|
| | | μV/m | dB(μV)/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 dB(μV)/m (Peak)<br>54.0 dB(μV)/m (Average) | |

### 5.1.2. Fundamental and harmonics emission limits(15.231(b))

| Fundamental frequency (MHz) | Field strength of fundamental (microvolts/meter) | Field strength of spurious emissions (microvolts/meter) |
|---|---|---|
| 40.66-40.70 | 2,250 | 225 |
| 70-130 | 1,250 | 125 |
| 130-174 | [1]1,250 to 3,750 | [1]125 to 375 |
| 174-260 | 3,750 | 375 |
| 260-470 | [1]3,750 to 12,500 | [1]375 to 1,250 |
| Above 470 | 12,500 | 1,250 |

[1]Linear interpolations.

Note:
1. 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.
2. 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.
3. Linear interpolation with frequency F in MHz:
   For 130–174 MHz: FS (microvolts/m) = (56.82 × F)-6136
   For 260–470 MHz: FS (microvolts/m) = (41.67 × 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 $10^{th}$ 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.

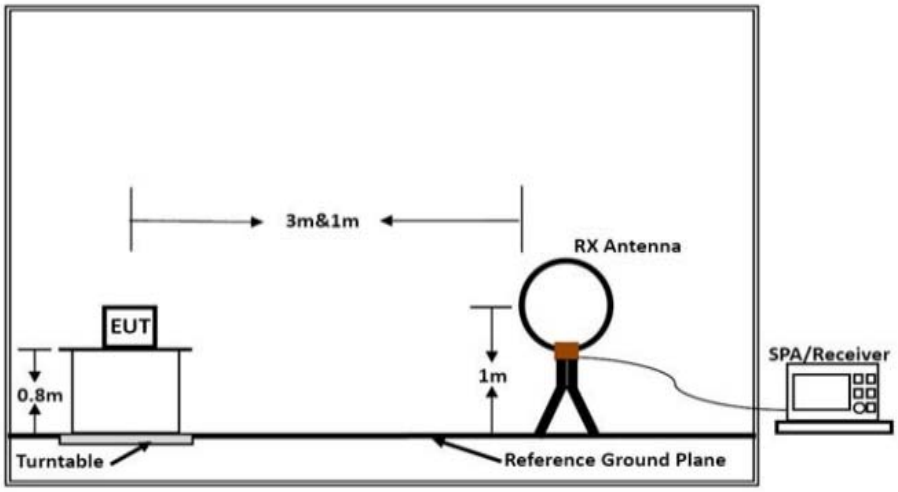
By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "Y axis" position was the worst, then the final test was executed the worst condition and test data were recorded in this report.

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

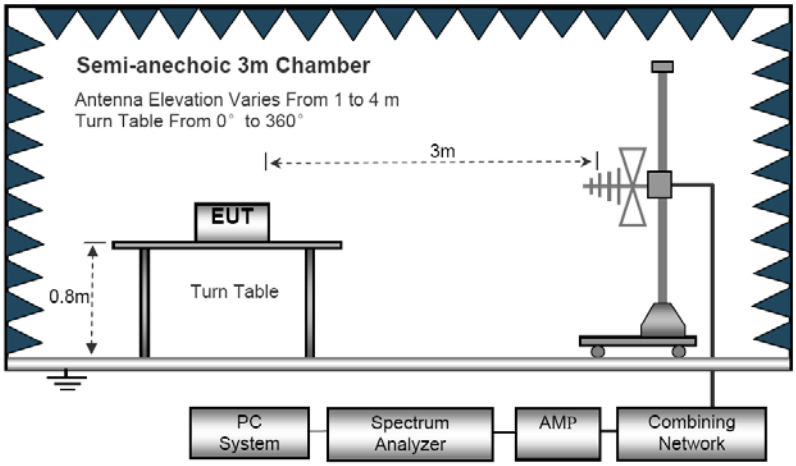
Notes:
1. Emission Level = Antenna Factor + Cable Loss + Meter Reading-Preamp Factor.
2. Measurement Uncertainty: ±3.2 dB at a level of confidence of 95%.
3. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.
4. The emission of below 30MHz is background, the data of it is not reflected.
5. We pretest all fourteen keys, The test data of the worst case condition(s) was reported on the following pages.

# Radiated Emission Test-Up

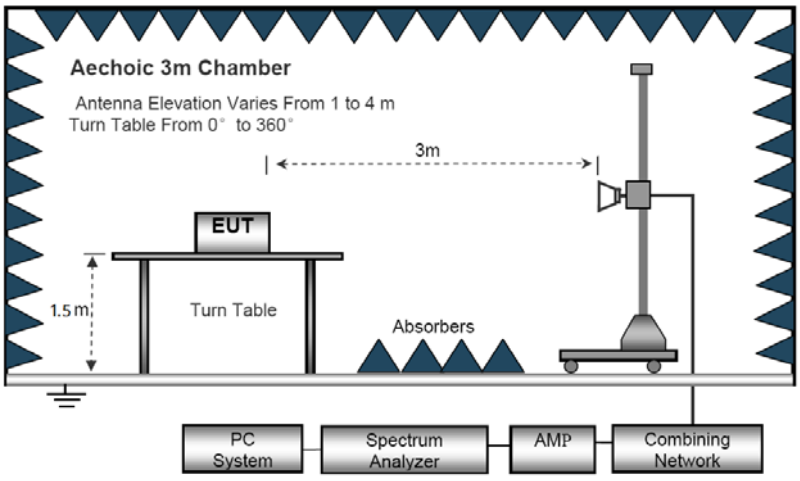
## Below 30MHz




## 30MHz-1GHz




## Above 1GHz



## Test Data Below 30MHz

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

Note:

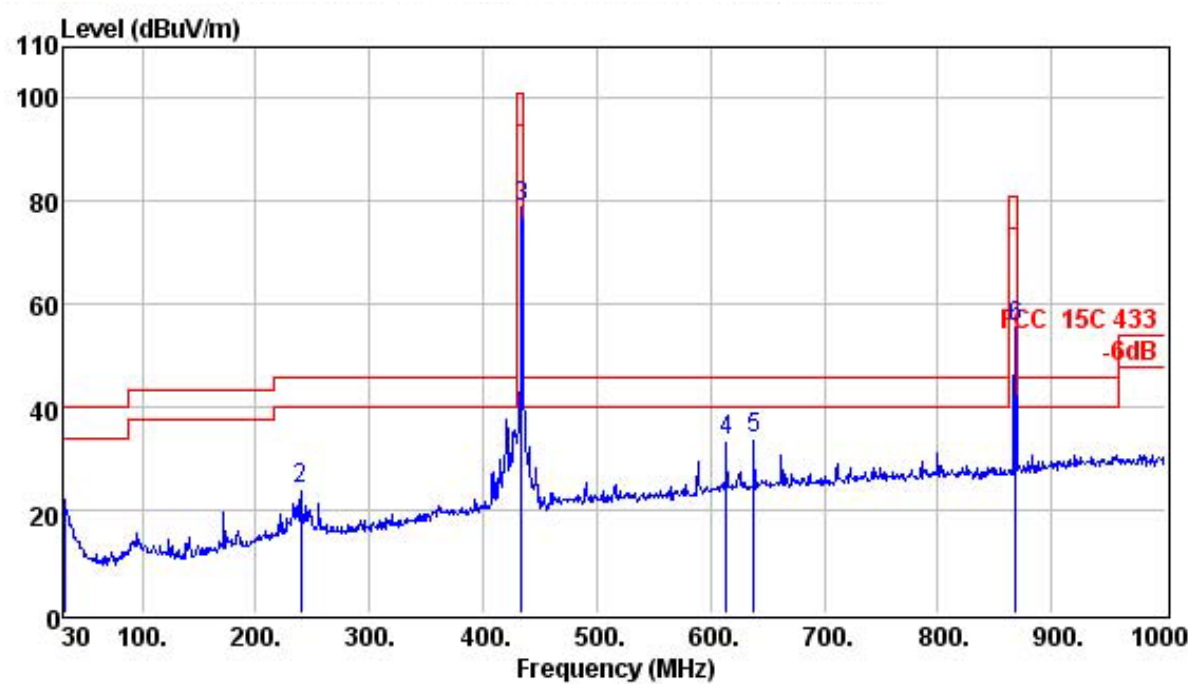
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =40 log (specific distance/test distance)(dB);

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

## Test Data Below 1GHz

## Horizontal



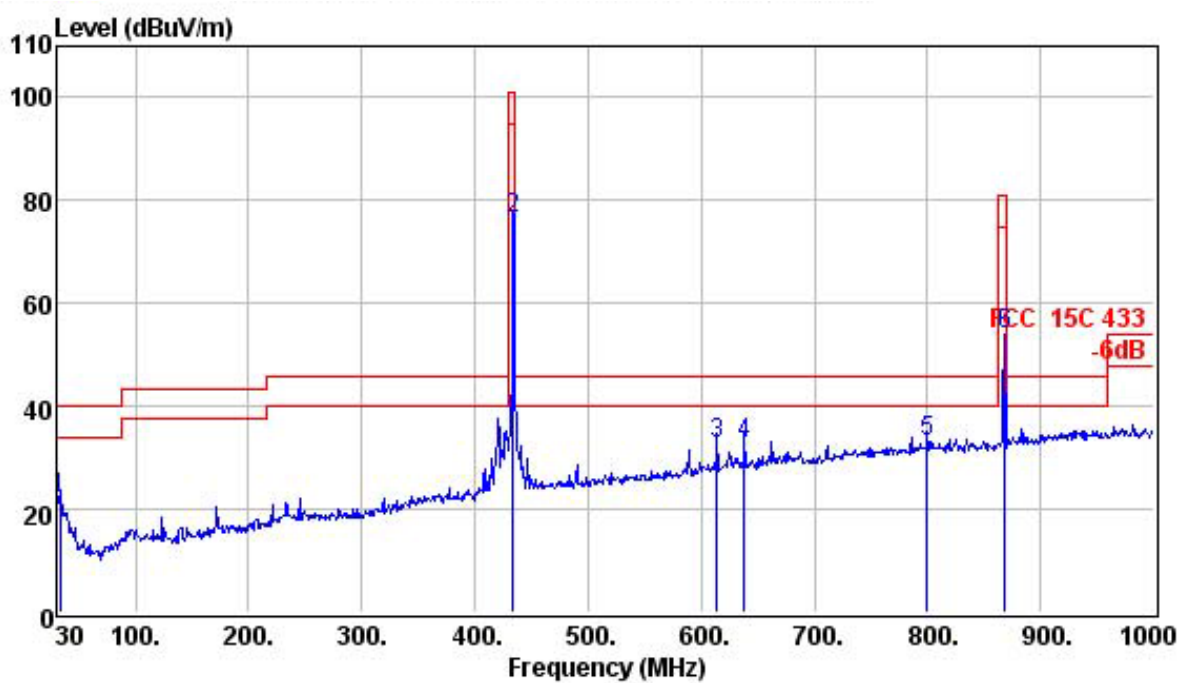

| | Freq | Read Level | Antenna Factor | Cable Loss | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dBuV/m | dBuV/m | dB | |
| 1 | 30.970 | 1.80 | 18.23 | 1.21 | 21.24 | 40.00 | -18.76 | QP |
| 2 | 239.520 | 8.61 | 12.61 | 2.76 | 23.98 | 46.00 | -22.02 | QP |
| 3 | 433.520 | 57.64 | 17.27 | 3.83 | 78.74 | 100.80 | -22.06 | Peak |
| 4 | 613.940 | 7.85 | 20.99 | 4.83 | 33.67 | 46.00 | -12.33 | QP |
| 5 | 638.190 | 7.85 | 21.35 | 4.93 | 34.13 | 46.00 | -11.87 | QP |
| 6 | 868.080 | 25.79 | 23.39 | 6.46 | 55.64 | 80.80 | -25.16 | Peak |

For average:

| Frequency MHz | Peak Level dBuV/m | Duty Cycle factor | Average Level dBuV/m | Limit | Margin dB |
|---|---|---|---|---|---|
| 433.52 | 78.74 | -3.62 | 75.12 | 80.80 | -5.68 |
| 868.08 | 55.64 | -3.62 | 52.02 | 60.80 | -8.78 |

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

## Vertical




| | Freq | ReadAntenna Level | Factor | Cable Loss | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dBuV/m | dBuV/m | dB | |
| 1 | 32.910 | 3.60 | 17.08 | 1.23 | 21.91 | 40.00 | -18.09 | QP |
| 2 | 433.520 | 55.51 | 17.27 | 3.83 | 76.61 | 100.80 | -24.19 | Peak |
| 3 | 613.940 | 6.01 | 20.99 | 4.83 | 31.83 | 46.00 | -14.17 | QP |
| 4 | 638.190 | 6.57 | 21.35 | 4.93 | 32.85 | 46.00 | -13.15 | QP |
| 5 | 800.180 | 4.03 | 23.00 | 6.29 | 33.32 | 46.00 | -12.68 | QP |
| 6 | 868.080 | 24.32 | 23.39 | 6.46 | 54.17 | 80.80 | -26.63 | Peak |

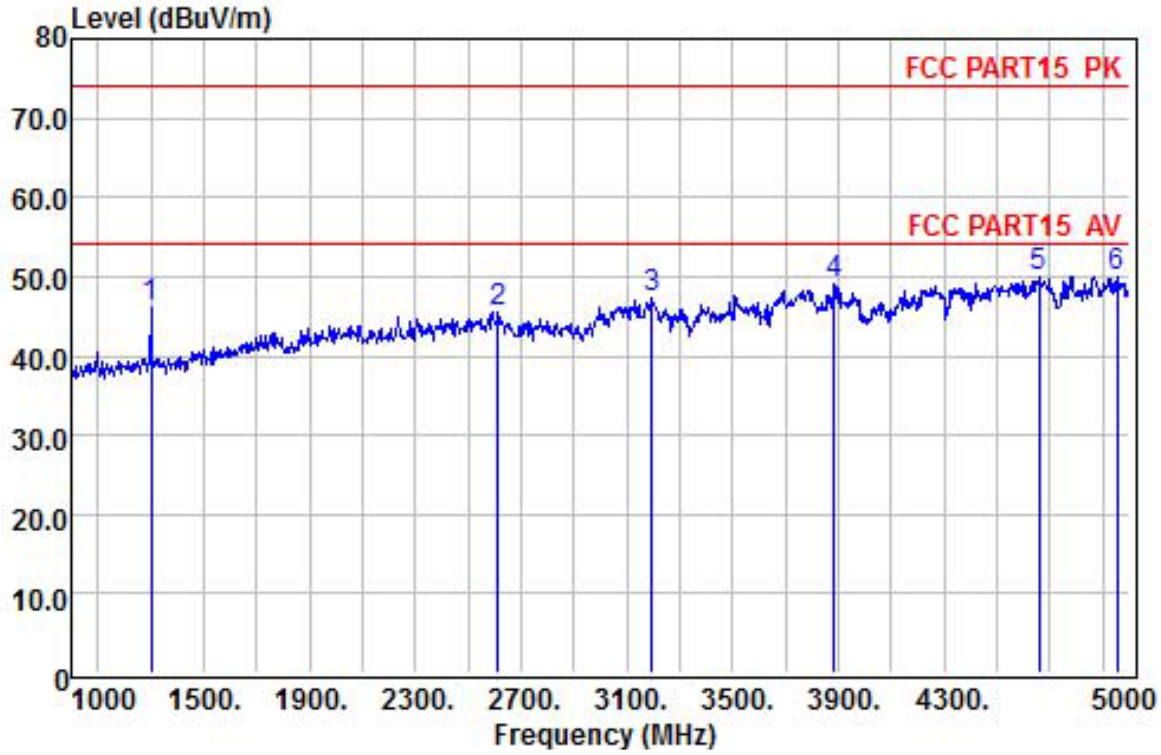
For average:

| Frequency MHz | Peak Level dBuV/m | Duty cycle factor | Average Level dBuV/m | Limit | Margin dB |
|---|---|---|---|---|---|
| 433.52 | 76.61 | -3.62 | 72.99 | 80.80 | -7.81 |
| 868.08 | 54.17 | -3.62 | 50.55 | 60.80 | -10.25 |

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

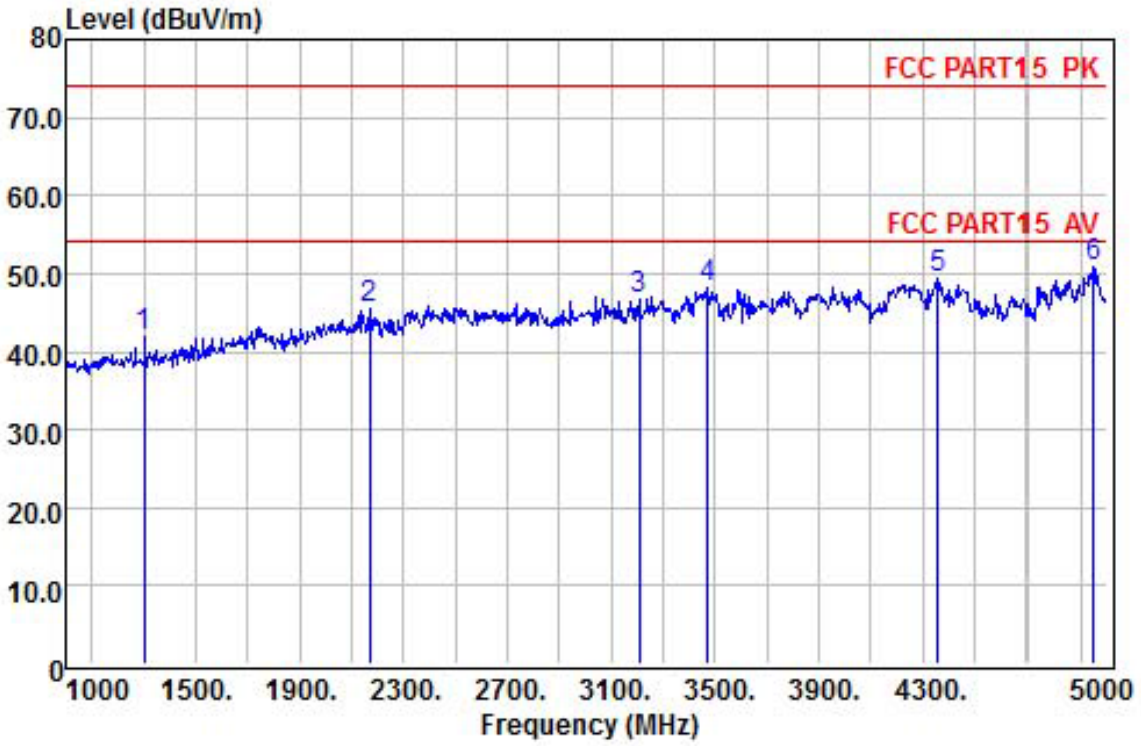
## Test Data for 1GHz~5GHz

### Horizontal




| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | |
| 1 | 1300.00 | 45.28 | 24.84 | 2.11 | 26.06 | 46.17 | 74.00 | -27.83 | Peak |
| 2 | 2612.00 | 39.18 | 29.08 | 3.65 | 26.38 | 45.53 | 74.00 | -28.47 | Peak |
| 3 | 3196.00 | 39.77 | 30.19 | 3.86 | 26.59 | 47.23 | 74.00 | -26.77 | Peak |
| 4 | 3884.00 | 41.37 | 31.29 | 3.24 | 26.95 | 48.95 | 74.00 | -25.05 | Peak |
| 5 | 4656.00 | 41.05 | 32.57 | 3.83 | 27.40 | 50.05 | 74.00 | -23.95 | Peak |
| 6 | 4952.00 | 41.05 | 32.28 | 4.12 | 27.57 | 49.88 | 74.00 | -24.12 | Peak |

## Vertical




| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | |
| 1 | 1304.00 | 40.96 | 24.84 | 2.12 | 26.06 | 41.86 | 74.00 | -32.14 | Peak |
| 2 | 2168.00 | 40.08 | 28.54 | 3.06 | 26.25 | 45.43 | 74.00 | -28.57 | Peak |
| 3 | 3208.00 | 39.11 | 30.21 | 3.86 | 26.60 | 46.58 | 74.00 | -27.42 | Peak |
| 4 | 3472.00 | 40.80 | 30.47 | 3.61 | 26.73 | 48.15 | 74.00 | -25.85 | Peak |
| 5 | 4356.00 | 40.93 | 31.99 | 3.54 | 27.21 | 49.25 | 74.00 | -24.75 | Peak |
| 6 | 4948.00 | 42.06 | 32.28 | 4.12 | 27.57 | 50.89 | 74.00 | -23.11 | Peak |

# 6. CALCULATION OF AVERAGE FACTOR

The output field strengths of specification in accordance with the 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 =20log (duty cycle)

The duration of one cycle = 57.8ms

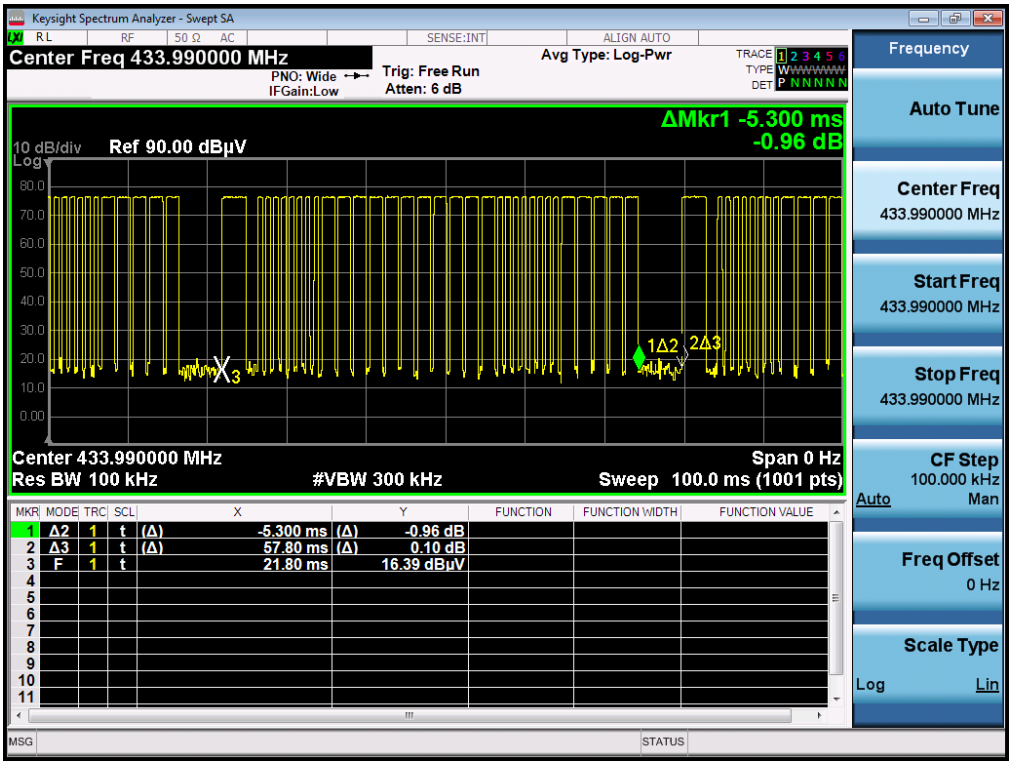
The duty cycle is simply the on-time divided the duration of one cycle

Duty Cycle = (3.06ms+0.57ms*16+1.62ms*16)/57.8ms = 38.1ms / 57.8ms=0.6592

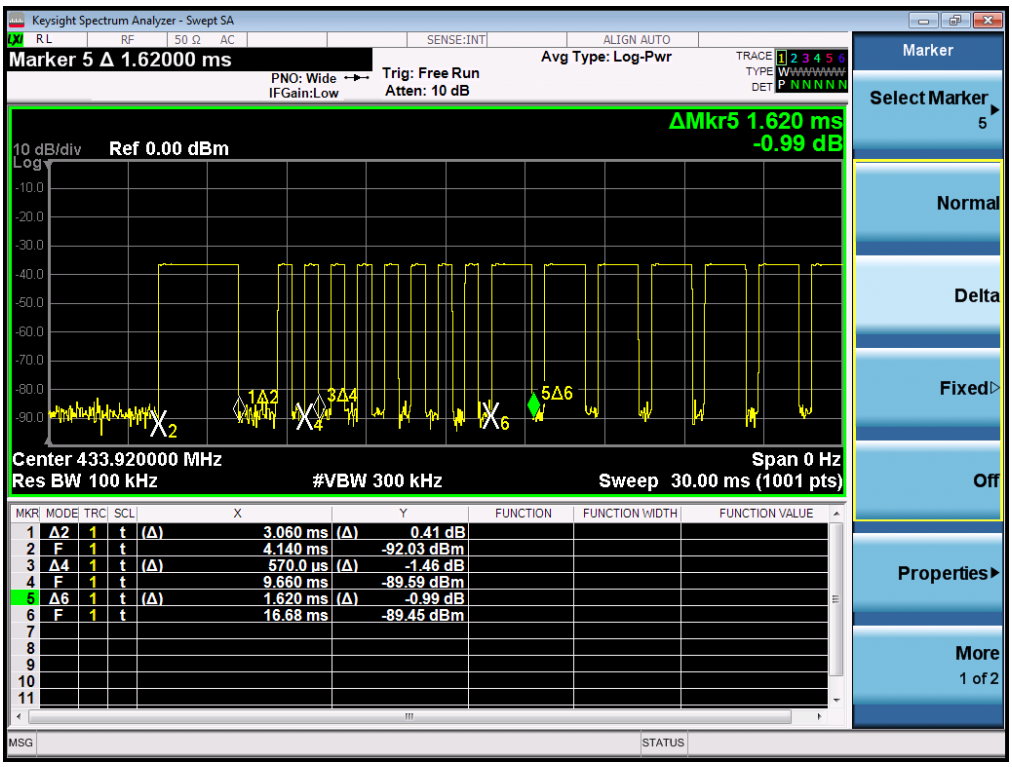
Therefore, the averaging factor is found by 20log0.6592 =-3.62dB

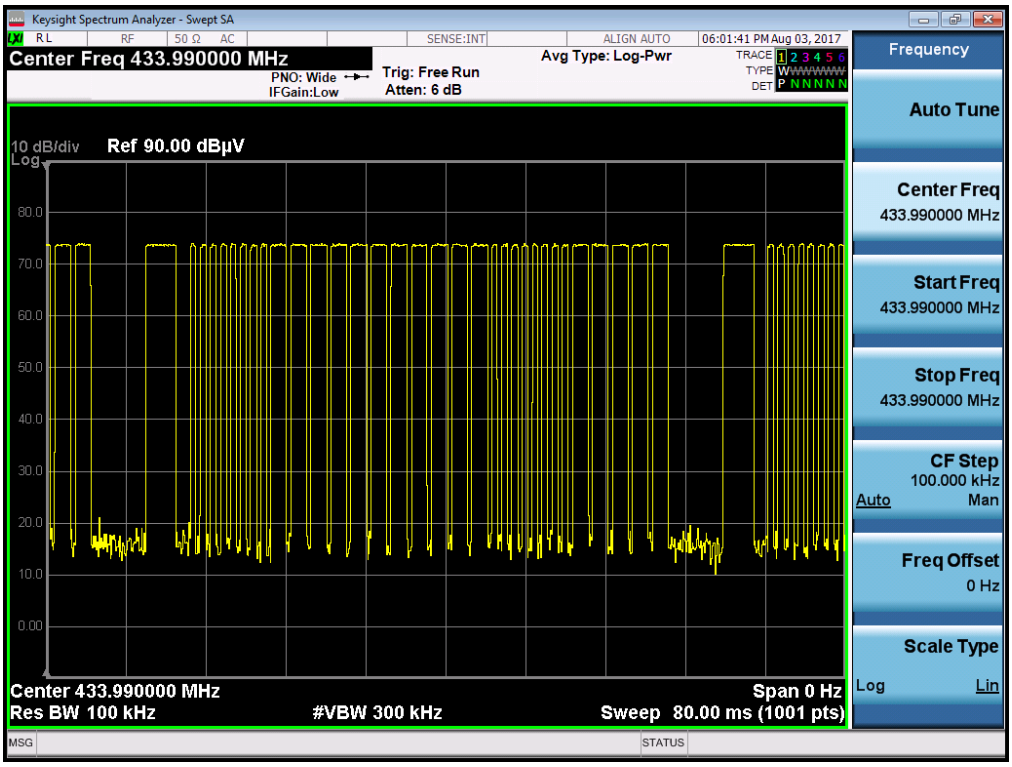
Test plot as follows:

T period



T on time slot



# 7. 20DB&99% OCCUPY BANDWIDTH

## 7.1. Limits

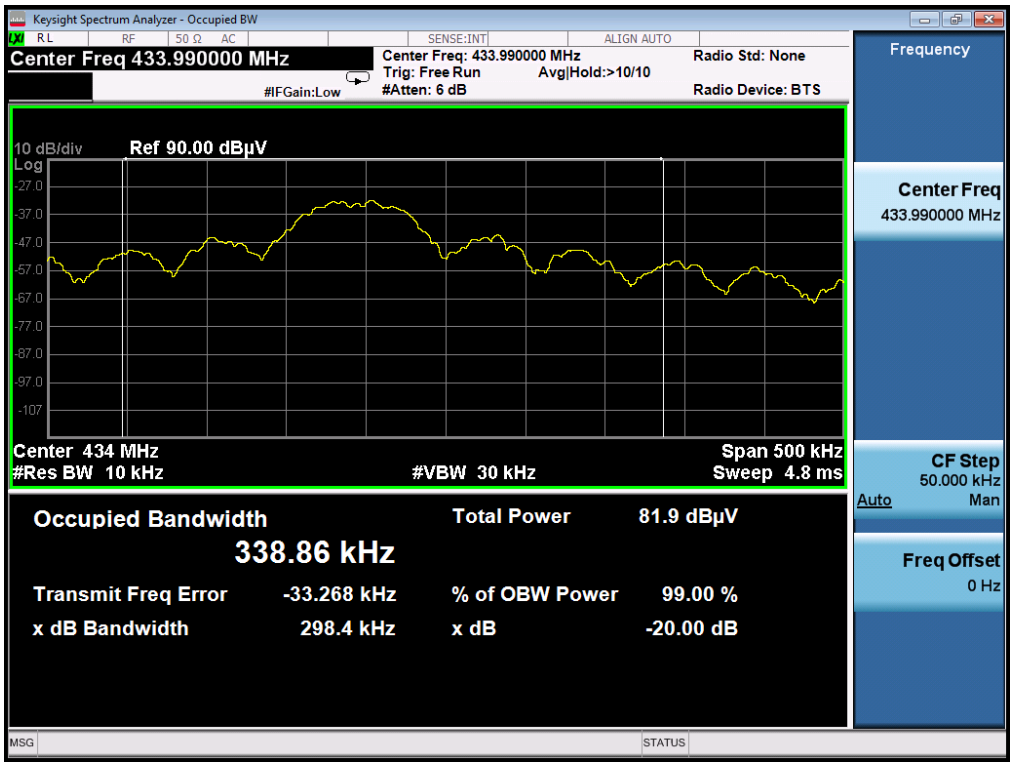
The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated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

B.W Limit = 0.25% * f(MHz) = 0.25% * 433.92MHz = 1.08MHz

Test data:

| Channel Frequency (MHz) | -20dB Bandwidth (MHz) | 99% Bandwidth (MHz) | Limit (MHz) | Result |
|---|---|---|---|---|
| 433.92 | 0.298 | 0.339 | 1.08 | Pass |

Test plot as follows:




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

# 8. TRANSMITTER TIMEOUT

## 8.1. Limits

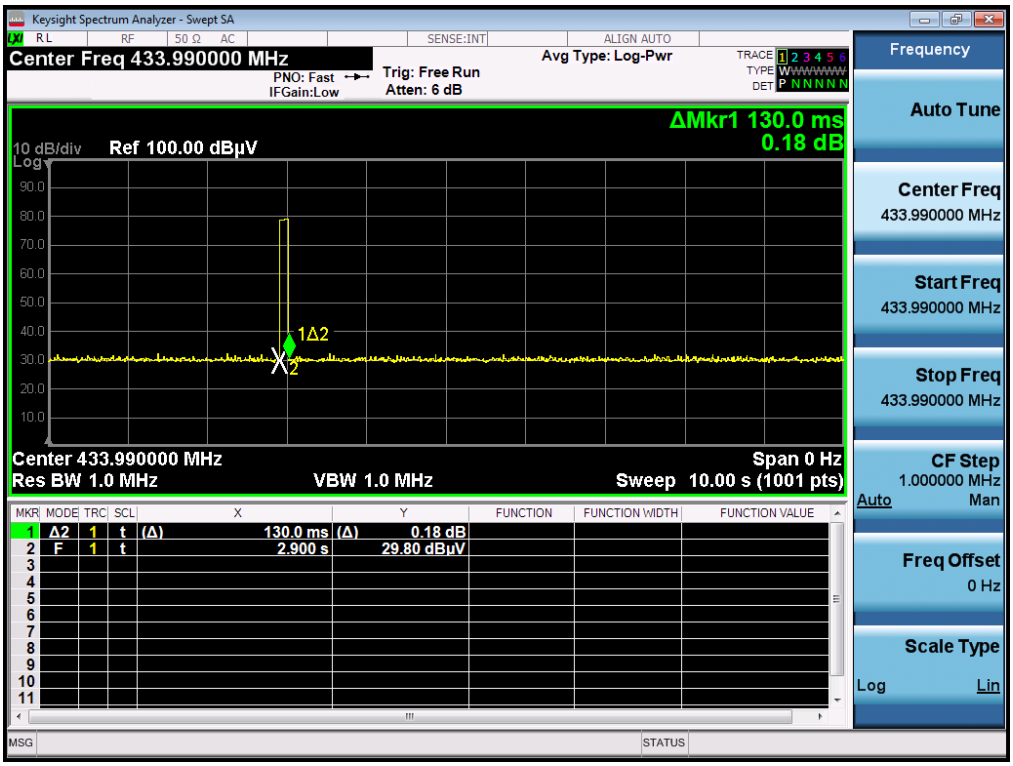
According to 15.231(a)(1) requirement:

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

Test data:

| | Dwell time (second) | Limit (second) | Result |
|---|---|---|---|
| Full voltage | 0.13s | <5s | Pass |

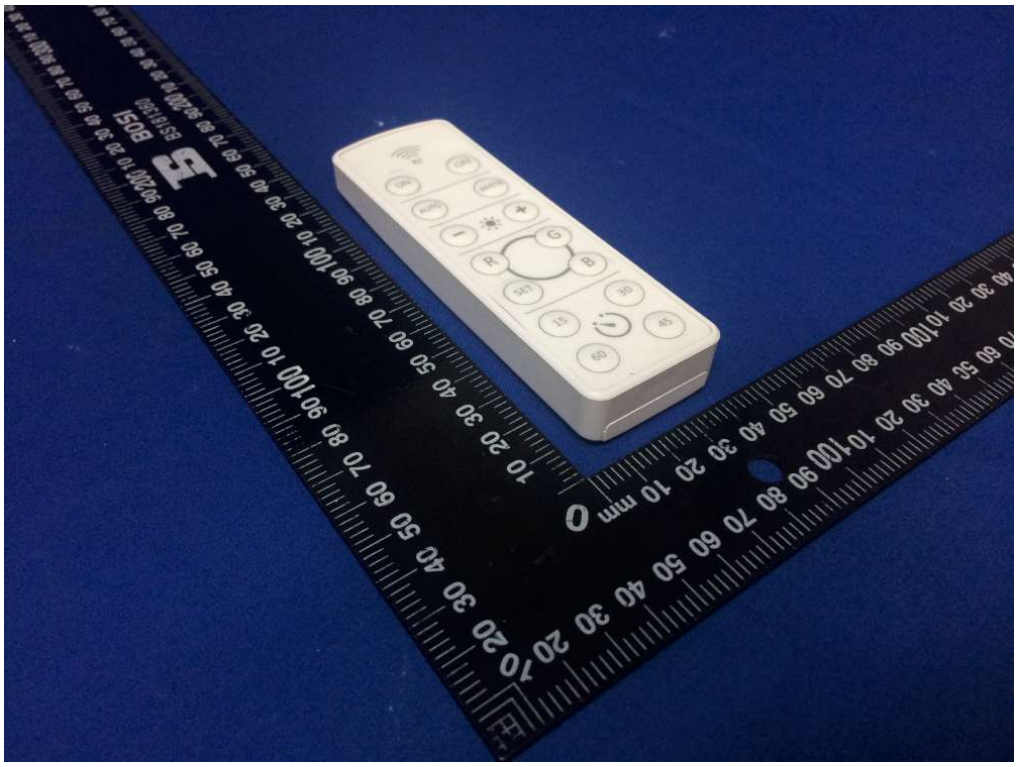
Test plot as follows:

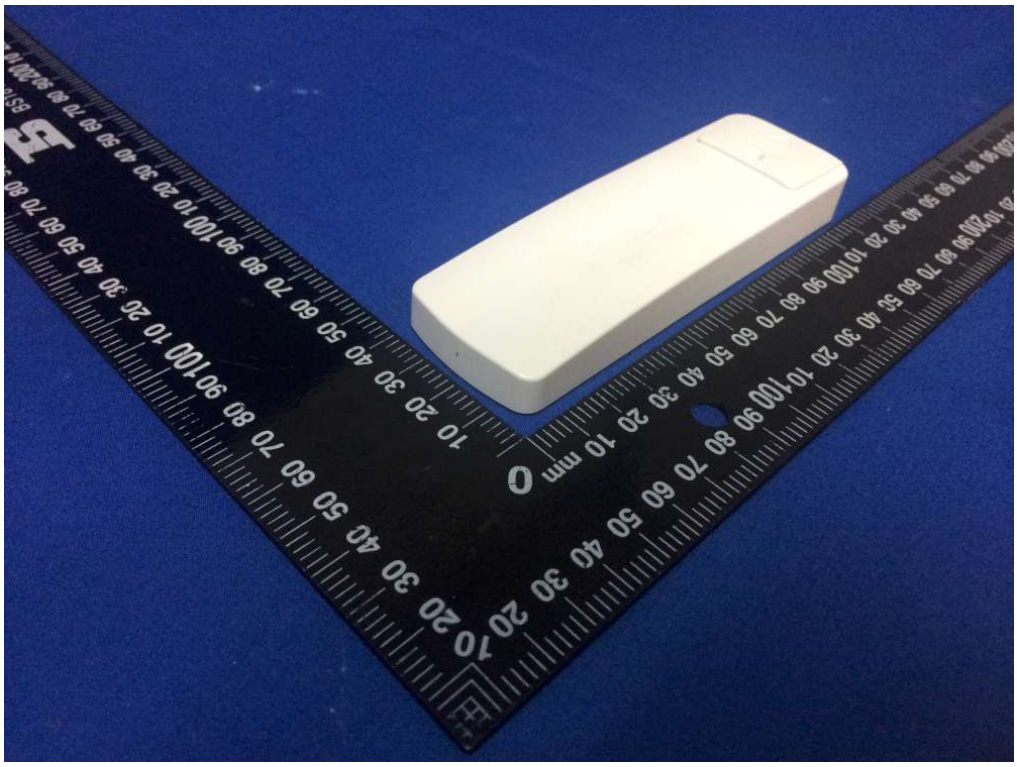


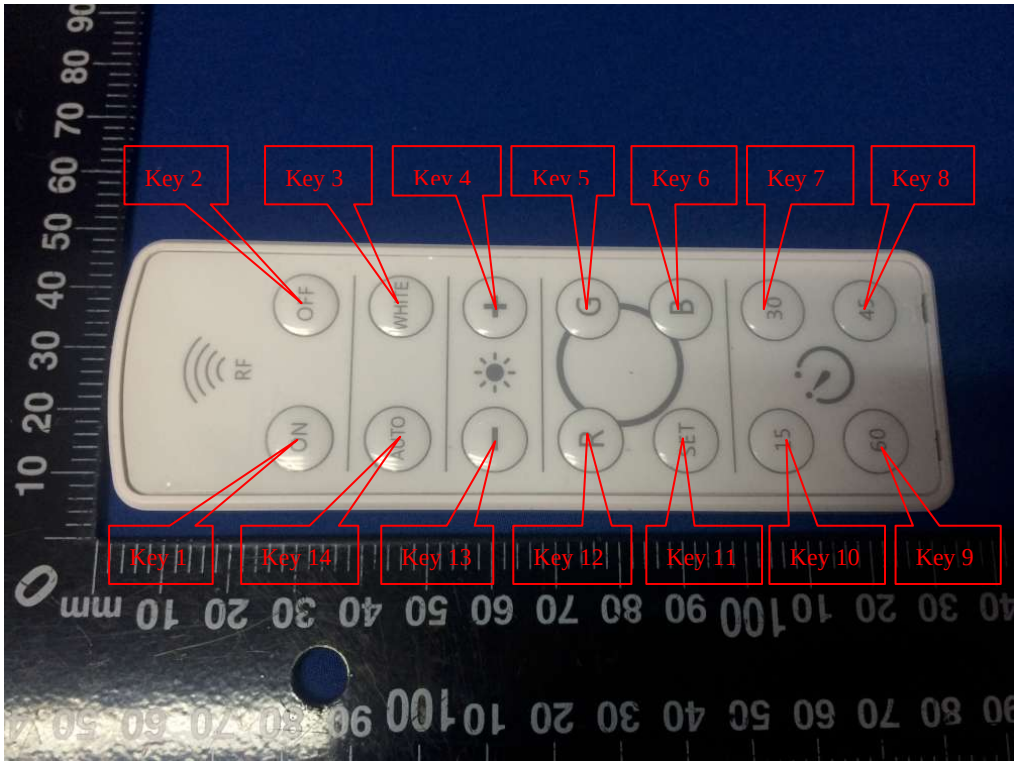

Note: we pretest all fourteen keys, only worst case is presented in the report.

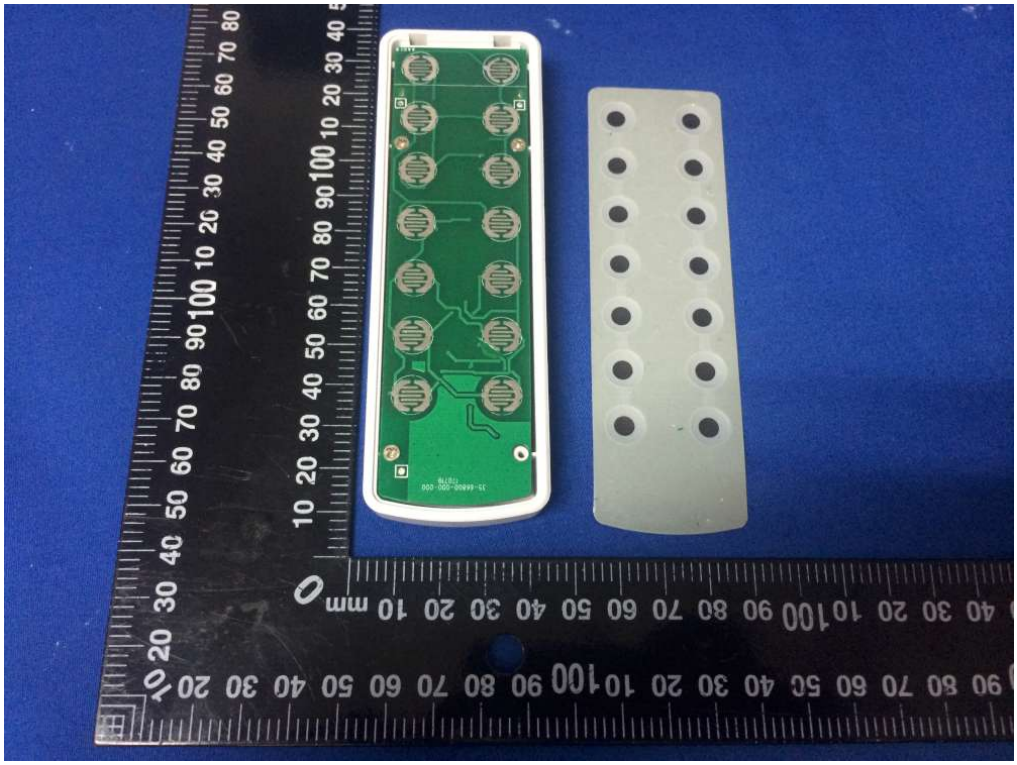
# 9. PHOTOGRAPHS OF TEST SET-UP

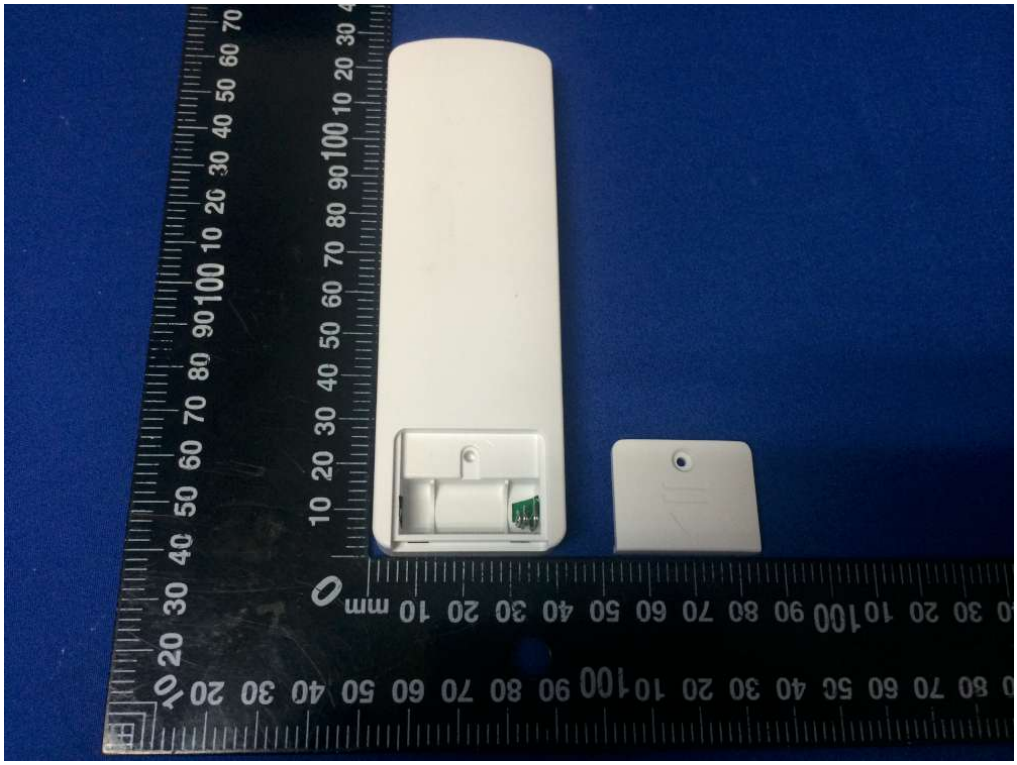
# 10. PHOTOGRAPHS OF THE EUT

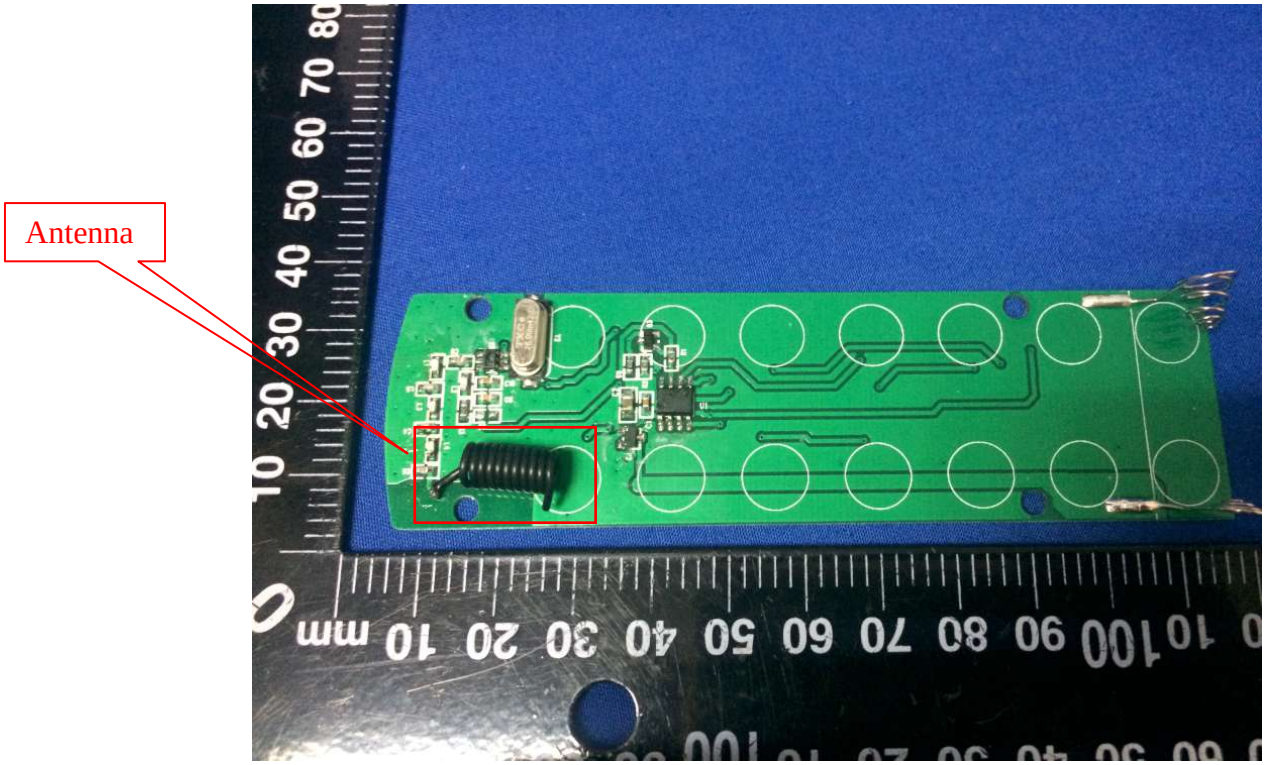


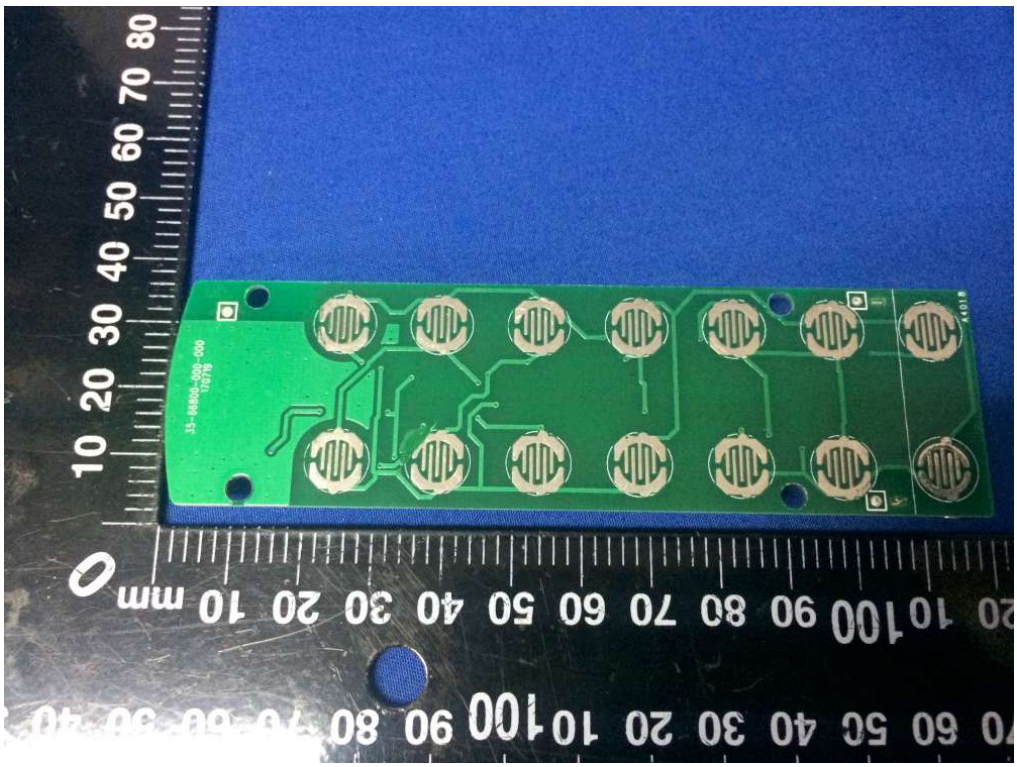



Key 2
Key 3
Key 4
Key 5
Key 6
Key 7
Key 8
Key 1
Key 14
Key 13
Key 12
Key 11
Key 10
Key 9
OFF
WHITE
ON
AUTO
SET
RF







*** the end of report ***