# TEST REPORT

| | | |
|---|---|---|
| **Reference No.** ..... | : | WTS19S10071860W |
| **FCC ID**..... | : | 2AVGL-A-500R2 |
| **Applicant** ..... | : | RUN GUANG ELECTRONIC APPLIANCES CORPORATION |
| **Address** ..... | : | No. 11, 1st Jinlang Street, Diao Lang, Huangjiang Town, Dongguan City, Guangdong Province, China |
| **Manufacturer** ..... | : | RUN GUANG ELECTRONIC APPLIANCES CORPORATION |
| **Address** ..... | : | No. 11, 1st Jinlang Street, Diao Lang, Huangjiang Town, Dongguan City, Guangdong Province, China |
| **Product**..... | : | Remote control |
| **Model(s)**..... | : | A-500R2 |
| **Standards**..... | : | FCC CFR47 Part 15 Section 15.249 :2019 |
| **Date of Receipt sample**..... | : | 2019-10-22 |
| **Date of Test**..... | : | 2019-10-22 to 2019-11-12 |
| **Date of Issue** ..... | : | 2019-11-18 |
| **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.


**Prepared By:**
**Waltek Services (Shenzhen) Co., Ltd.**
Address: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China
Tel :+86-755-83551033
Fax:+86-755-83552400


Compiled by: Approved by:

Robin Zhou / Test Engineer Philo Zhong / Manager

# 1. Contents

Page

COVER PAGE ..... 1
1. CONTENTS ..... 2
2. REVISION HISTORY ..... 3
3. GENERAL INFORMATION ..... 4
3.1 GENERAL DESCRIPTION OF E.U.T ..... 4
3.2 DETAILS OF E.U.T ..... 4
3.3 TEST MODE ..... 4
4. EQUIPMENT USED DURING TEST ..... 5
4.1 EQUIPMENTS LIST ..... 5
4.2 MEASUREMENT UNCERTAINTY ..... 6
4.3 TEST EQUIPMENT CALIBRATION ..... 6
5. TEST FACILITY ..... 6
6. TEST SUMMARY ..... 7
7. RADIATED EMISSIONS ..... 8
7.1 EUT OPERATION ..... 8
7.2 TEST SETUP ..... 9
7.3 SPECTRUM ANALYZER SETUP ..... 10
7.4 TEST PROCEDURE ..... 11
7.5 CORRECTED AMPLITUDE & MARGIN CALCULATION ..... 11
7.6 SUMMARY OF TEST RESULTS ..... 12
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 – MODEL A-500R2 TEST SETUP PHOTOS ..... 18
12.1 PHOTOGRAPH – RADIATED EMISSIONS TEST SETUP PHOTOS ..... 18
13. PHOTOGRAPHS - CONSTRUCTIONAL DETAILS ..... 20
13.1 MODEL A-500R2 - EXTERNAL PHOTOS ..... 20
13.2 MODEL A-500R2 - INTERNAL PHOTOS ..... 24

## 2. Revision History

| Test Report No. | Date of Receipt Sample | Date of Test | Date of Issue | Purpose | Comment | Approved |
|---|---|---|---|---|---|---|
| WTS19S10071860W | 2019-10-22 | 2019-10-22 to 2019-11-12 | 2019-11-18 | original | - | Valid |

# 3. General Information

## 3.1 General Description of E.U.T

| | |
|---|---|
| Product Name: | Remote control |
| Model No.: | A-500R2 |
| Model Difference: | N/A |
| Type of Modulation: | GFSK |
| Frequency Range: | 2455MHz |
| Antenna installation: | PCB Printed Antenna |
| Antenna Gain: | 0dBi |

## 3.2 Details of E.U.T

| | |
|---|---|
| Ratings: | Input: DC 4.5V power by batteries (1.5V size “AAA” X 3 ). |

## 3.3 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 | Test Channel |
|---|---|
| Transmitting | 2455MHz |

# 4. Equipment Used during Test

## 4.1 Equipments List

| 3m Semi-anechoic Chamber for Radiation Emissions(SAEMC) | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Last Calibration Date** | **Calibration Due Date** |
| 1 | Spectrum Analyzer | R&S | FSP30 | 100091 | 2019-04-19 | 2020-04-18 |
| 2 | Broad-band Horn Antenna(1-18GHz) | SCHWARZBECK | BBHA 9120 D | 667 | 2019-04-19 | 2020-04-18 |
| 3 | Broadband Preamplifier | COMPLIANCE DIRECTION | PAP-1G18 | 2004 | 2019-04-19 | 2020-04-18 |
| 4 | Coaxial Cable (above 1GHz) | Top | 1GHz-18GHz | EW02014-7 | 2019-04-19 | 2020-04-18 |
| 5 | Spectrum Analyzer | R&S | FSP40 | 100501 | 2018-11-13 | 2019-11-12 |
| 6 | Broad-band Horn Antenna(18-40GHz) | SCHWARZBECK | BBHA 9170 | 335 | 2019-10-15 | 2020-10-14 |
| 7 | Microwave Broadband Preamplifier (18-40GHz) | SCHWARZBECK | BBV 9721 | 100472 | 2019-09-17 | 2020-09-16 |
| 8 | Cable | Top | 18-40GHz | - | 2019-10-15 | 2020-10-14 |
| **3m Semi-anechoic Chamber for Radiation Emissions(TDK)** | | | | | | |
| **Item** | **Equipment** | **Manufacturer** | **Model No.** | **Serial No** | **Last Calibration Date** | **Calibration Due Date** |
| 1 | Test Receiver | R&S | ESCI | 101296 | 2019-04-20 | 2020-04-19 |
| 2 | Trilog Broadband Antenna | SCHWARZBECK | VULB9160 | 9160-3325 | 2019-05-24 | 2020-05-23 |
| 3 | Active Loop Antenna | Com-power | AL-130R | 10160007 | 2019-04-28 | 2020-04-27 |
| 4 | Amplifier | ANRITSU | MH648A | M43381 | 2019-04-19 | 2020-04-18 |
| 5 | Cable | HUBER+SUHNER | CBL2 | 525178 | 2019-04-20 | 2020-04-19 |
| 6 | Coaxial Cable (below 1GHz) | Top | TYPE16 (13M) | - | 2019-09-12 | 2020-09-11 |
| **RF Conducted Testing** | | | | | | |
| **Item** | **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Last Calibration Date** | **Calibration Due Date** |
| 1. | Spectrum Analyzer | R&S | FSL6 | 100959 | 2018-11-18 | 2019-11-17 |
| 2 | Coaxial Cable | Top | 10Hz-30GHz | - | 2019-09-12 | 2020-09-11 |
| 3 | Antenna Connector* | Realacc | 45RSm | - | 2019-09-12 | 2020-09-11 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 4 | DC Block | Gwave | GDCB-3G-N-SMA | 140307001 | 2019-09-12 | 2020-09-11 |
| "*": 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. | | | | | | |

## 4.2 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 (30M~1000MHz) |
| | ± 5.47 dB (1000M~25000MHz) |
| Conducted Spurious Emissions test | ± 3.64 dB (AC mains 150KHz~30MHz) |

## 4.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by GUANG ZHOU GRG METROLOGY & TEST CO., LTD. address is No.163, Pingyun Rd. West of Huangpu Ave,Tianhe District, Guangzhou, Guangdong, China.

# 5. Test Facility

FCC Designation No.: CN1201. Test Firm Registration No.: 523476.
ISED CAB identifier: CN0013. Test Firm Registration No.: 7760A.

# 6. Test Summary

| Test Items | Test Requirement | Result |
|---|---|---|
| Conducted Emissions | 15.207 | N/A* |
| Radiated Emission | 15.249(a)<br>15.209<br>15.205(a) | PASS |
| Periodic Operation | 15.35(c) | PASS |
| Outside of Band Emission | 15.249<br>15.205<br>15.209 | PASS |
| 20dB Bandwidth | 15:215(c) | PASS |
| Antenna Requirement | 15.203 | PASS |
| Note: Pass=Compliance; NC=Not Compliance; NT=Not Tested; N/A=Not Applicable.<br>*: This requirement does not apply for device powered by battery. | | |

# 7. Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: ANSI C63.10:2013

Test Result: PASS

Measurement Distance: 3m

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: 52.1 % RH

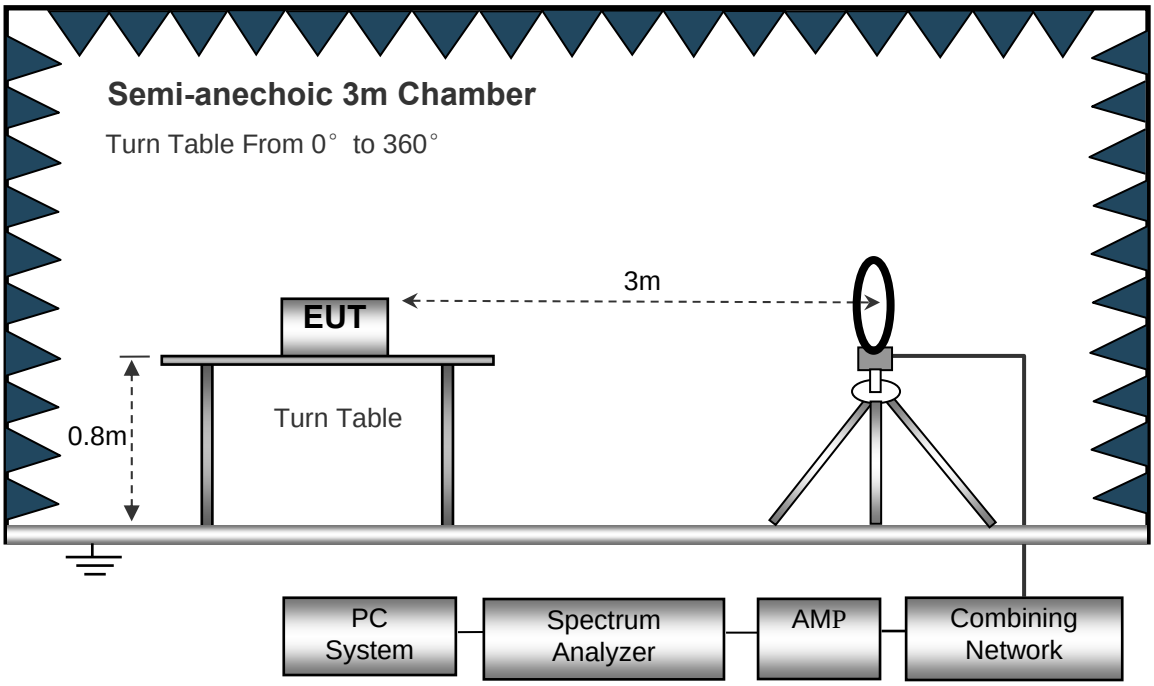
Atmospheric Pressure: 101.2kPa

EUT Operation **:**

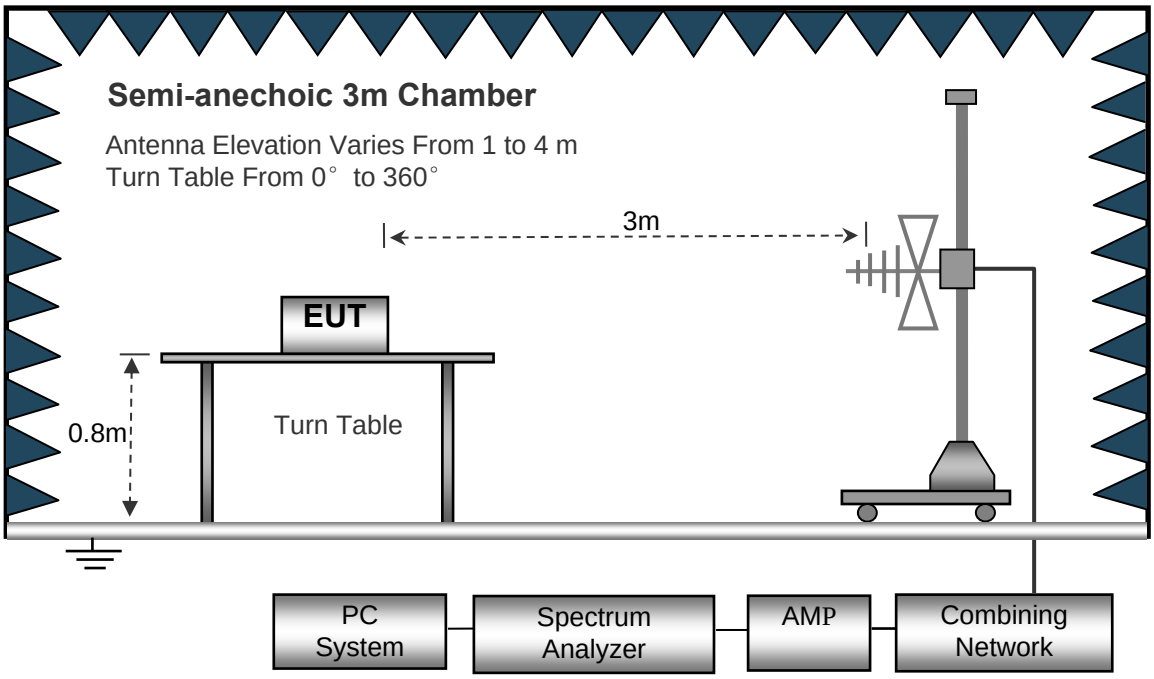
The test was performed in transmitting mode, the test data were shown in the report.

## 7.2 Test Setup

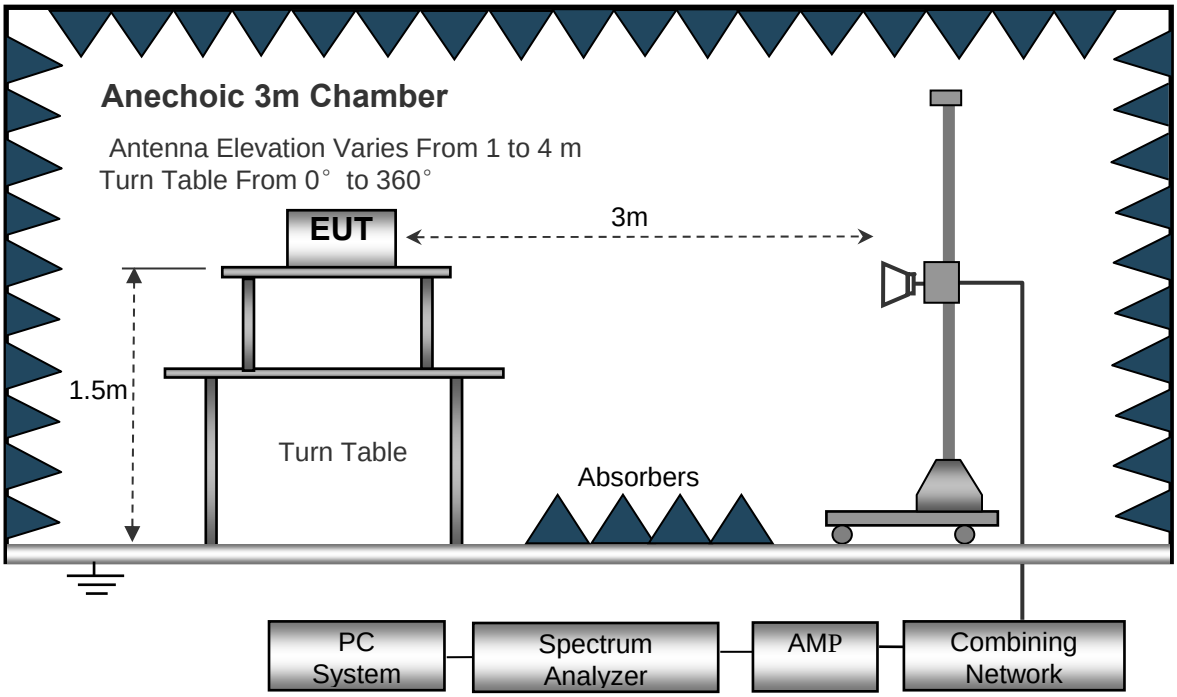
The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10: 2013
The test setup for emission measurement below 30MHz.




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



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. For below 1GHz, the EUT is 0.8m above ground plane; For above1GHz, the EUT is 1.5m 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.
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 performed in X,Y and Z axis positioning(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand),the worst condition was tested putting the eut in X axis,so the worst data were shown as follow.
8. A 2.4GHz high –pass filter is used druing radiated emissions above 1GHz measurement.

## 7.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – Limit

## 7.6 Summary of Test Results

**Test Frequency: 9 kHz ~25GHz**

Only the worst frequency test data were recorded in the report, other frequency are attenuated more than 20 dB below the permissible value and not reported.

| 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) | Degree | (m) | (H/V) | (dB/m) | (dBμV /m) | (dBμV /m) | (dB) |
| 302.70 | 41.14 | QP | 202 | 1.2 | V | -11.39 | 29.75 | 43.50 | -13.75 |
| 2455.00 | 93.30 | PK | 151 | 1.0 | H | -13.02 | 80.28 | 114.00 | -33.72 |
| 2455.00 | 97.63 | PK | 21 | 1.6 | V | -13.02 | 84.61 | 114.00 | -29.39 |
| 4910.00 | 64.56 | PK | 263 | 1.0 | H | 0.19 | 64.75 | 74.00 | -9.25 |
| 4910.00 | 58.83 | PK | 65 | 1.4 | V | 0.19 | 59.02 | 74.00 | -14.98 |
| 7365.00 | 58.15 | PK | 244 | 1.1 | H | 3.07 | 61.22 | 74.00 | -12.78 |
| 7365.00 | 55.21 | PK | 352 | 1.6 | V | 3.07 | 58.28 | 74.00 | -15.72 |
| 9820.00 | 51.28 | PK | 298 | 1.7 | H | 5.42 | 56.70 | 74.00 | -17.30 |
| 9820.00 | 50.36 | PK | 202 | 1.6 | V | 5.42 | 55.78 | 74.00 | -18.22 |

AV = Peak +20Log10 (duty cycle) =Peak+ (-16.52)[refer to section 8 for more detail]

| Frequency | PK | Polar | Duty cycle Factor | AV | FCC Part 15.249/209/205 | |
|---|---|---|---|---|---|---|
| | | | | | Limit | Margin |
| (MHz) | (dBμV/m) | (H/V) | (dB) | (dBμV/m) | (dBμV/m) | (dB) |
| 2455.00 | 80.28 | H | -16.52 | 63.76 | 94.00 | -30.24 |
| 2455.00 | 84.61 | V | -16.52 | 68.09 | 94.00 | -25.91 |
| 4910.00 | 64.75 | H | -16.52 | 48.23 | 54.00 | -5.77 |
| 4910.00 | 59.02 | V | -16.52 | 42.50 | 54.00 | -11.50 |
| 7365.00 | 61.22 | H | -16.52 | 44.70 | 54.00 | -9.30 |
| 7365.00 | 58.28 | V | -16.52 | 41.76 | 54.00 | -12.24 |
| 9820.00 | 56.70 | H | -16.52 | 40.18 | 54.00 | -13.82 |
| 9820.00 | 55.78 | V | -16.52 | 39.26 | 54.00 | -14.74 |

# 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

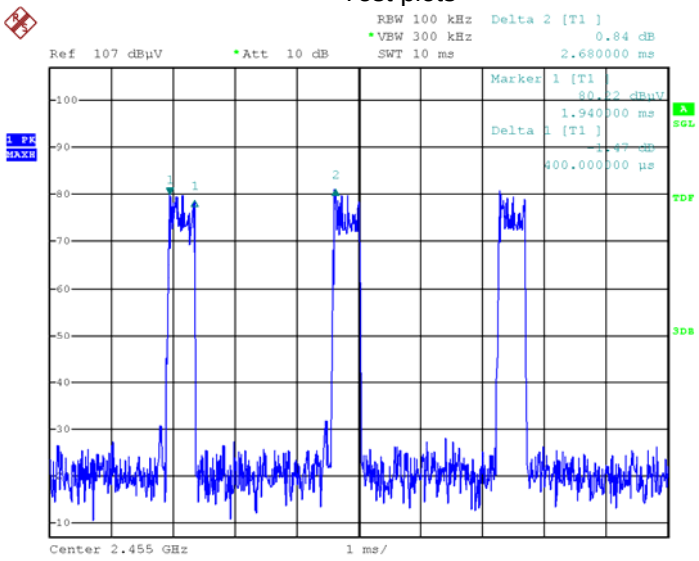
Duty Cycle(%)=Total On interval in a complete pulse train/ Length of a complete pulse train * %

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

| Test Channel | Test Result |
|---|---|
| Total transmission time(ms) | 0.4 |
| Length of a complete transmission period(ms) | 2.68 |
| Duty Cycle(%) | 14.93 |
| Duty Cycle Correction Factor(dB) | -16.52 |

Refer to the duty cycle plot (as below)

Test plots



# 9. Outside of Band Emission

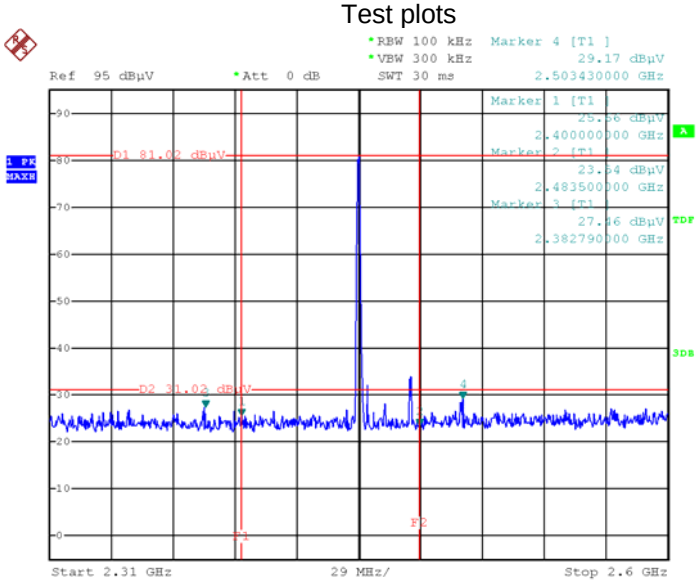
| | |
|---|---|
| Test Requirement: | 15.249(d):Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation. |
| Test Method: | ANSI C63.10:2013 |
| Test Mode: | Transmitting |

## 9.1 Test Procedure

Refer to section 7.4 of this test report.

## 9.2 Test Result

Test plots



# 10. 20 dB Bandwidth Measurement

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

Test Method: ANSI C63.10:2013

Test Mode: Transmitting

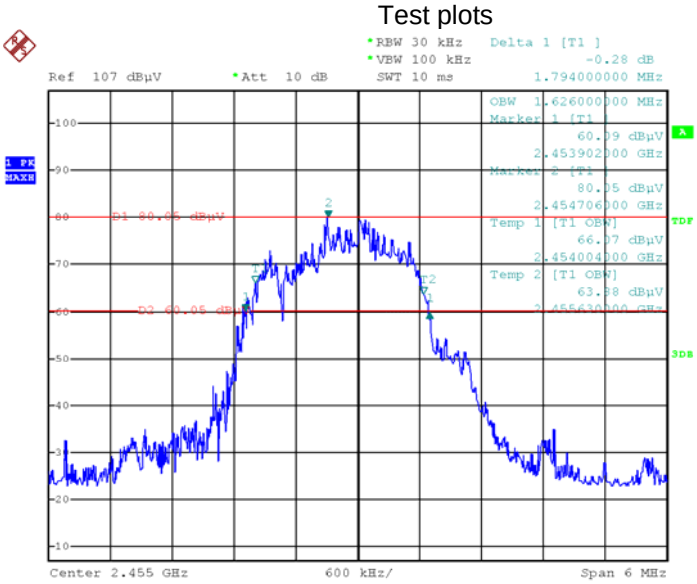
## 10.1 Test Procedure

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 = 30kHz, VBW = 100kHz

## 10.2 Test Result

| 20dB Bandwidth | 99% Bandwidth |
|---|---|
| 1.79MHz | 1.63MHz |

Test plots



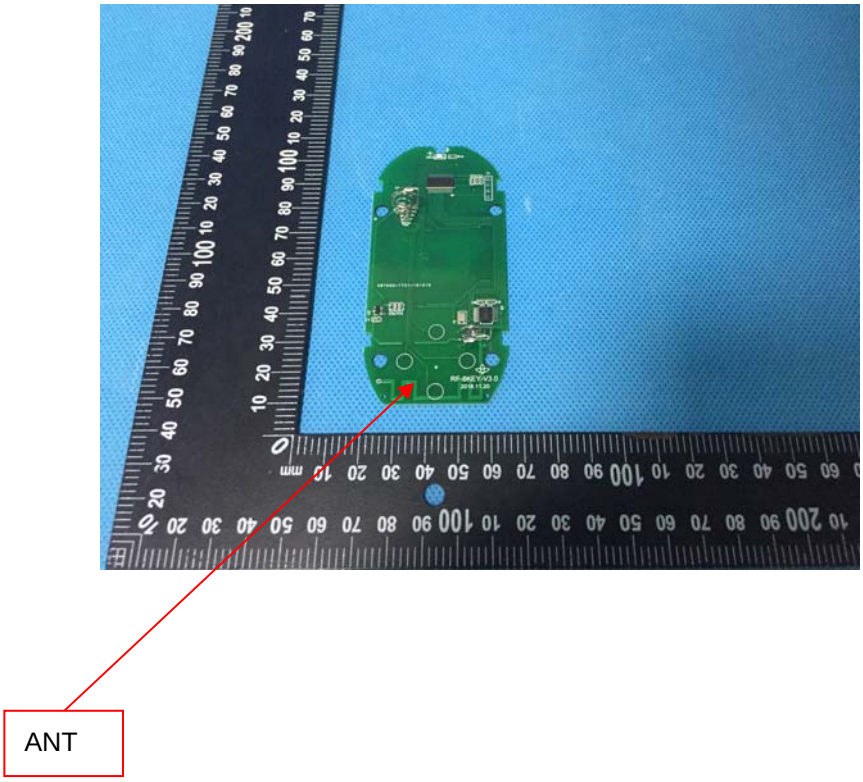
# 11. Antenna Requirement

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 shall be considered sufficient to comply with the provisions of this section. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

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.

Result:

The EUT has a PCB Printed Antenna for Bluetooth Antenna, meets the requirements of FCC 15.203.



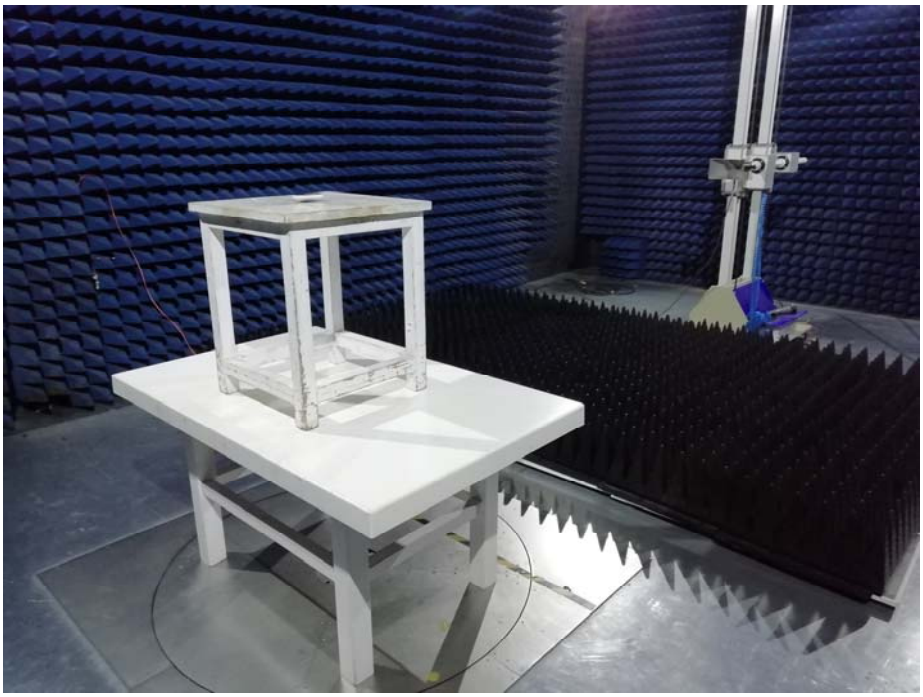
# 12. Photographs – Model A-500R2 Test Setup Photos

## 12.1 Photograph – Radiated Emissions Test Setup Photos

Test frequency Below 30MHz

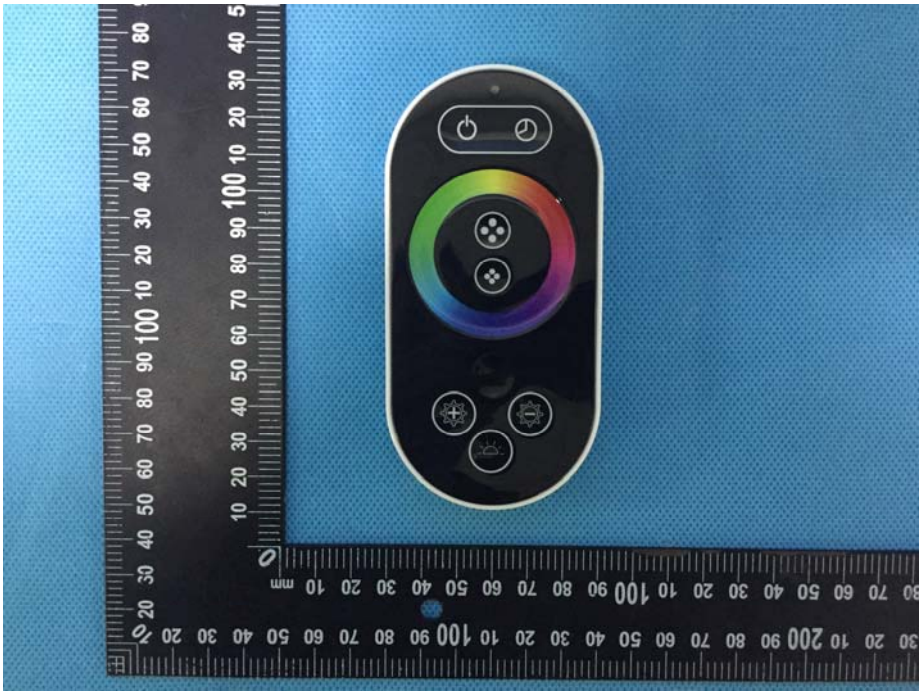
Test frequency from 30MHz to 1GHz

Test frequency Above 1GHz

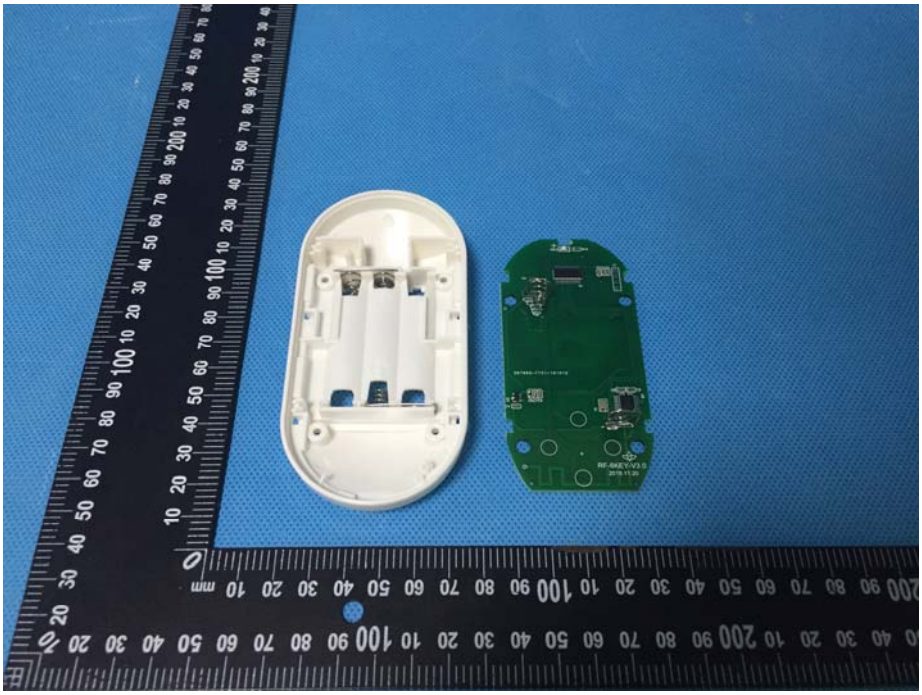


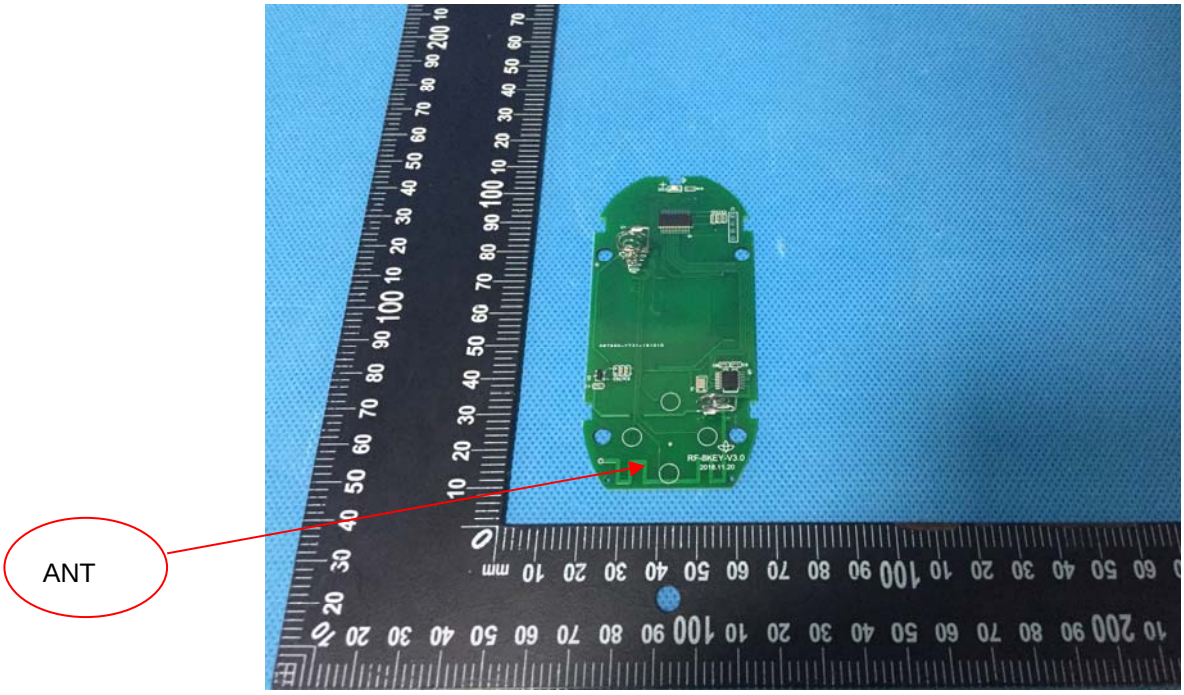
# 13. Photographs - Constructional Details

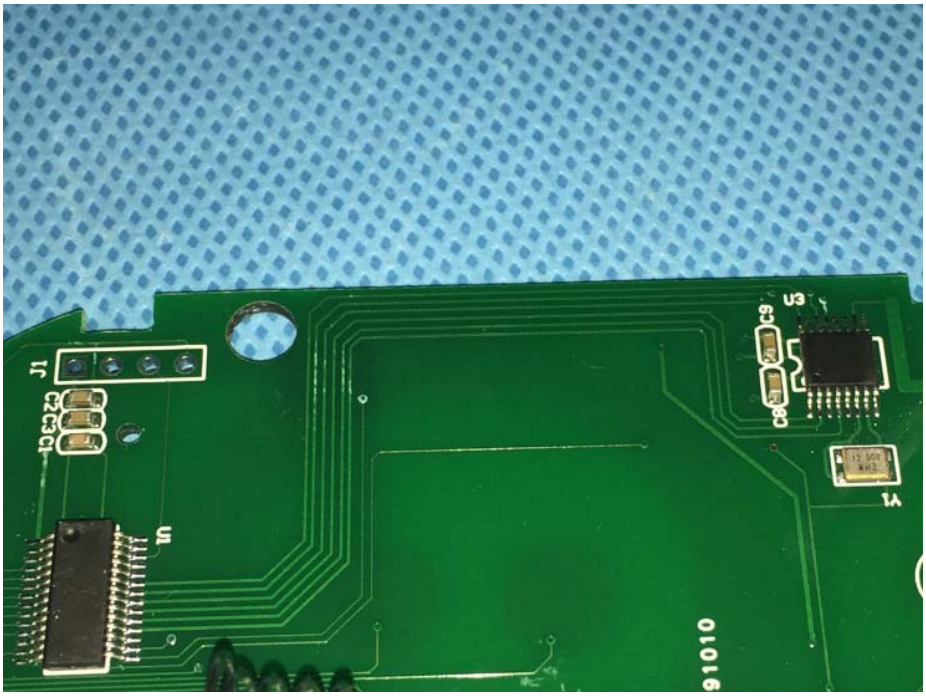
## 13.1 Model A-500R2 - External Photos

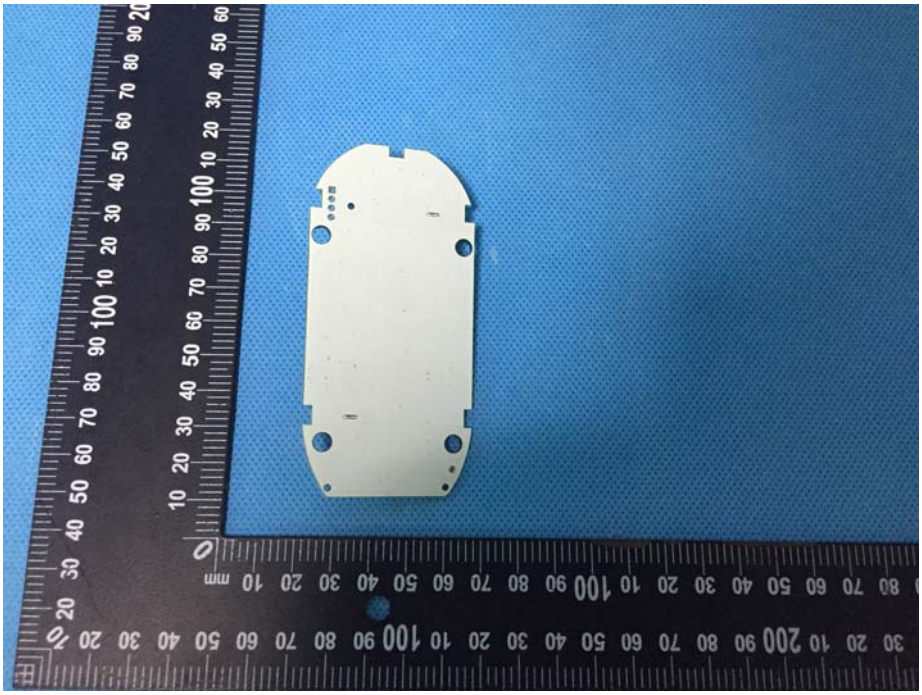


## 13.2 Model A-500R2 - Internal Photos







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