TEST REPORT

Reference No.	:	WTS19S10071859W
FCC ID.....	:	2AVGL-A-500R1
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-500R1
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.

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2. Revision History

Test Report No.	Date of Receipt Sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS19S10071859W	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:	Remote control
Model(s):	A-500R1
Model Difference:	N/A
Type of Modulation:	GFSK
Frequency Range:	2455MHz, one channel
Antenna installation:	PCB Printed Antenna

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) 15.209 15.205(a)	PASS
Periodic Operation	15.35(c)	PASS
Outside of Band Emission	15.249 15.205 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. *: 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

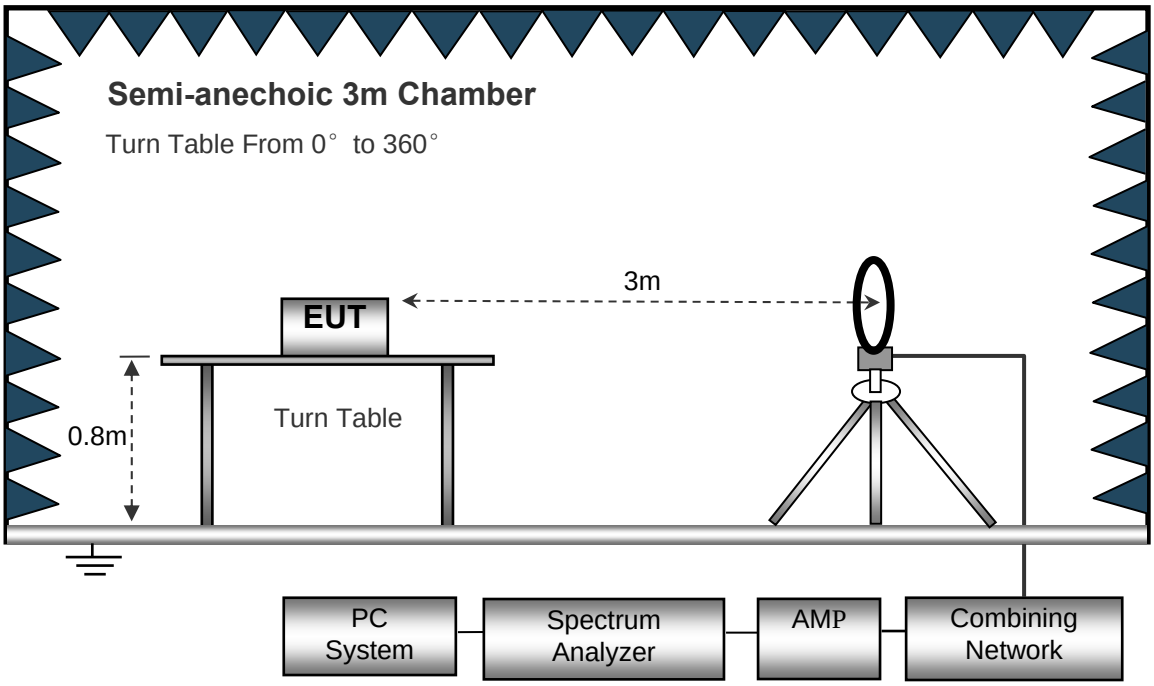
Atmospheric Pressure: 101.2kPa

EUT Operation **:**

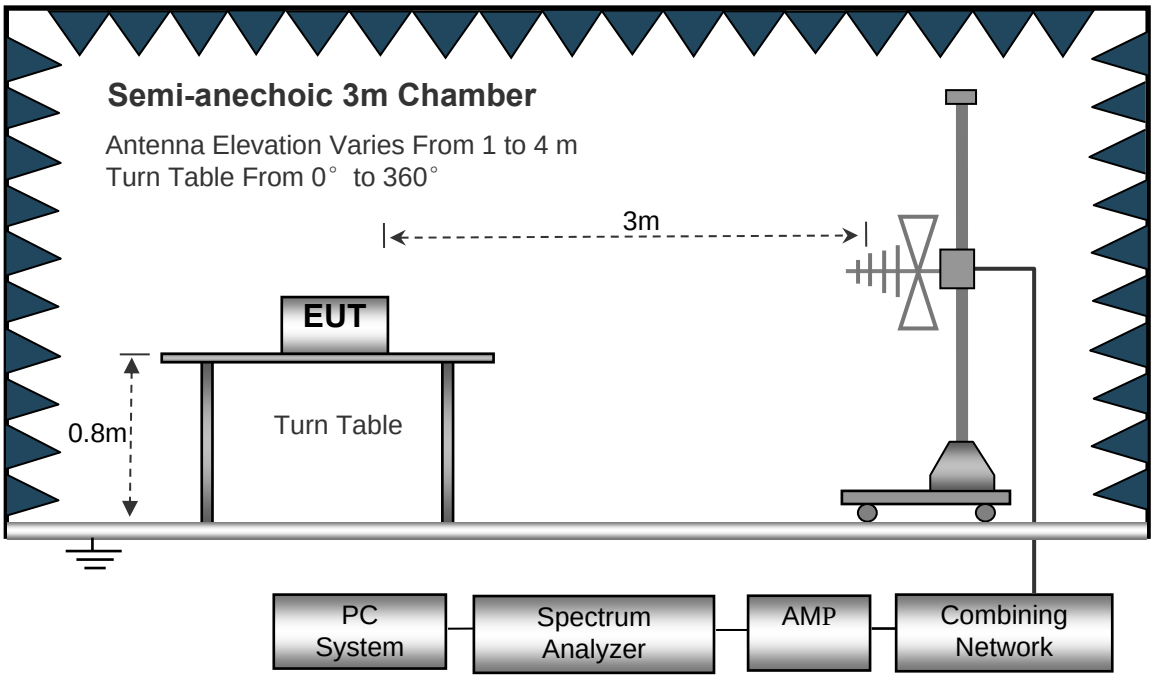
The test was performed in transmitting mode, the test data were shown in the report.

7.2 Test Setup

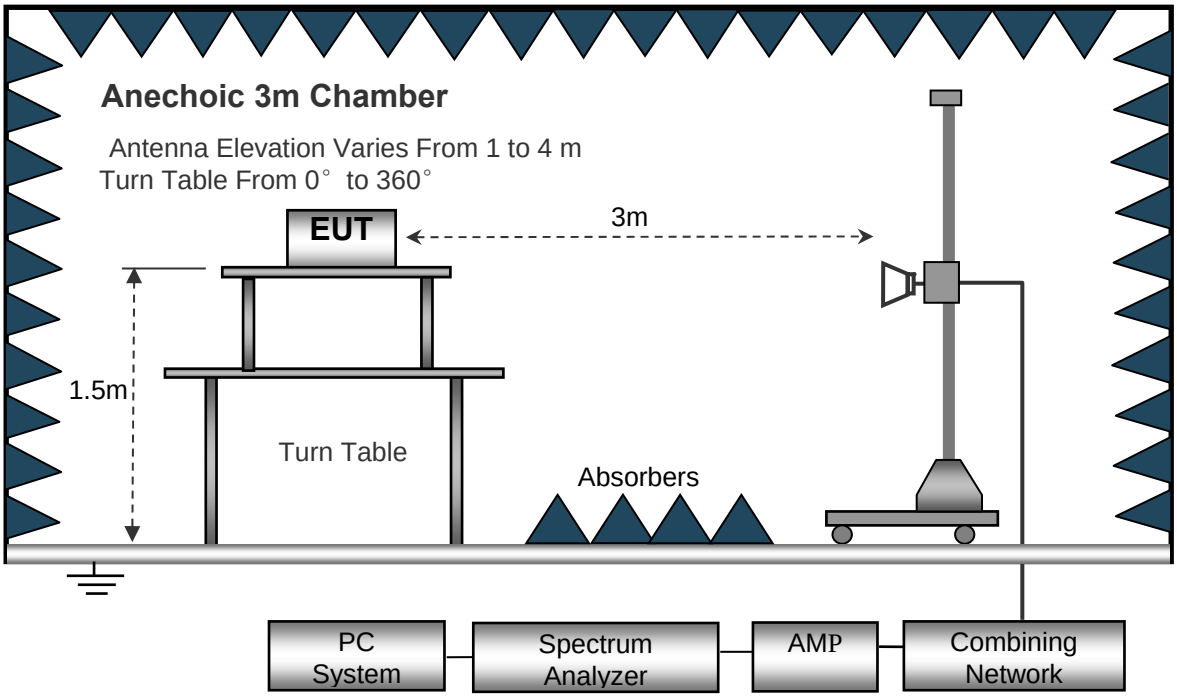
The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10: 2013
The test setup for emission measurement below 30MHz.



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	41.06	QP	74	1.4	V	-11.39	29.67	43.50	-13.83
2455.00	98.30	PK	173	1.7	H	-13.02	85.28	114.00	-28.72
2455.00	93.63	PK	272	1.1	V	-13.02	80.61	114.00	-33.39
4910.00	63.68	PK	234	1.7	H	0.19	63.87	74.00	-10.13
4910.00	58.60	PK	19	1.6	V	0.19	58.79	74.00	-15.21
7365.00	57.49	PK	56	1.4	H	3.07	60.56	74.00	-13.44
7365.00	54.57	PK	190	1.7	V	3.07	57.64	74.00	-16.36
9820.00	50.65	PK	216	1.1	H	5.42	56.07	74.00	-17.93
9820.00	49.53	PK	80	1.0	V	5.42	54.95	74.00	-19.05

AV = Peak +20Log10 (duty cycle) =Peak+ (-15.63)[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	85.28	H	-15.63	69.65	94.00	-24.35
2455.00	80.61	V	-15.63	64.98	94.00	-29.02
4910.00	63.87	H	-15.63	48.24	54.00	-5.76
4910.00	58.79	V	-15.63	43.16	54.00	-10.84
7365.00	60.56	H	-15.63	44.93	54.00	-9.07
7365.00	57.64	V	-15.63	42.01	54.00	-11.99
9820.00	56.07	H	-15.63	40.44	54.00	-13.56
9820.00	54.95	V	-15.63	39.32	54.00	-14.68

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

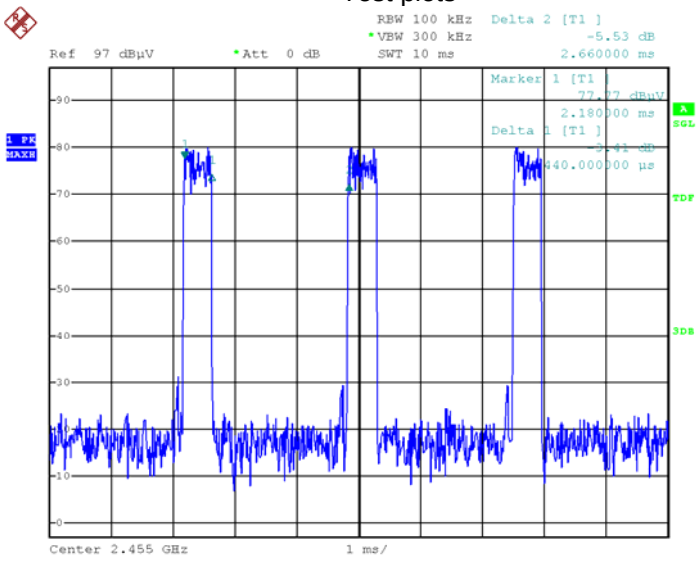
Duty Cycle(%)=Total On interval in a complete pulse train/ Length of a complete pulse train * %

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

Test Channel	Test Result
Total transmission time(ms)	0.44
Length of a complete transmission period(ms)	2.66
Duty Cycle(%)	16.54
Duty Cycle Correction Factor(dB)	-15.63

Refer to the duty cycle plot (as below)

Test plots



9. Outside of Band Emission

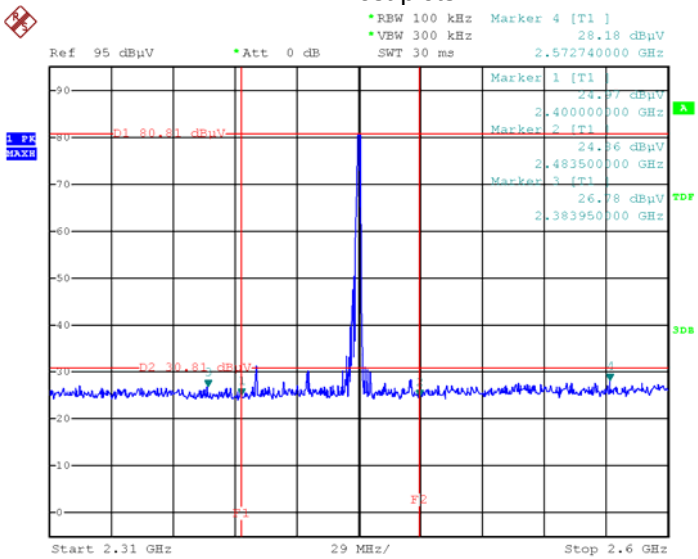
Test Requirement:	15.249(d):Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.
Test Method:	ANSI C63.10:2013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

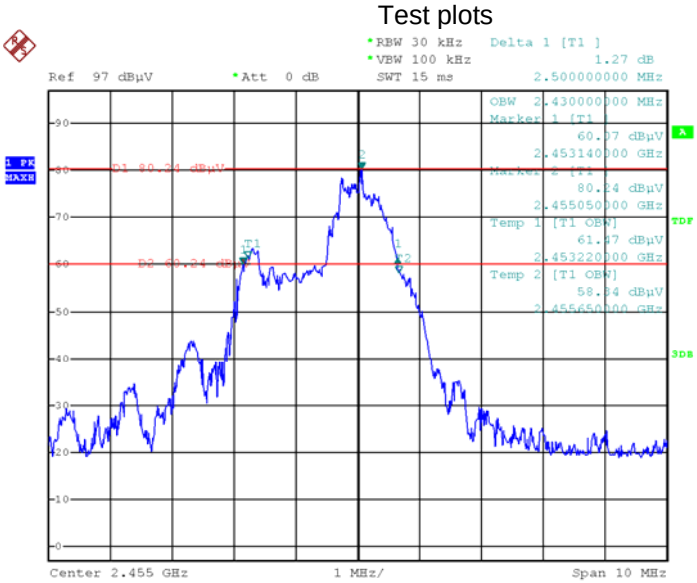
10.1 Test Procedure

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
2.50MHz	2.43MHz

Test plots



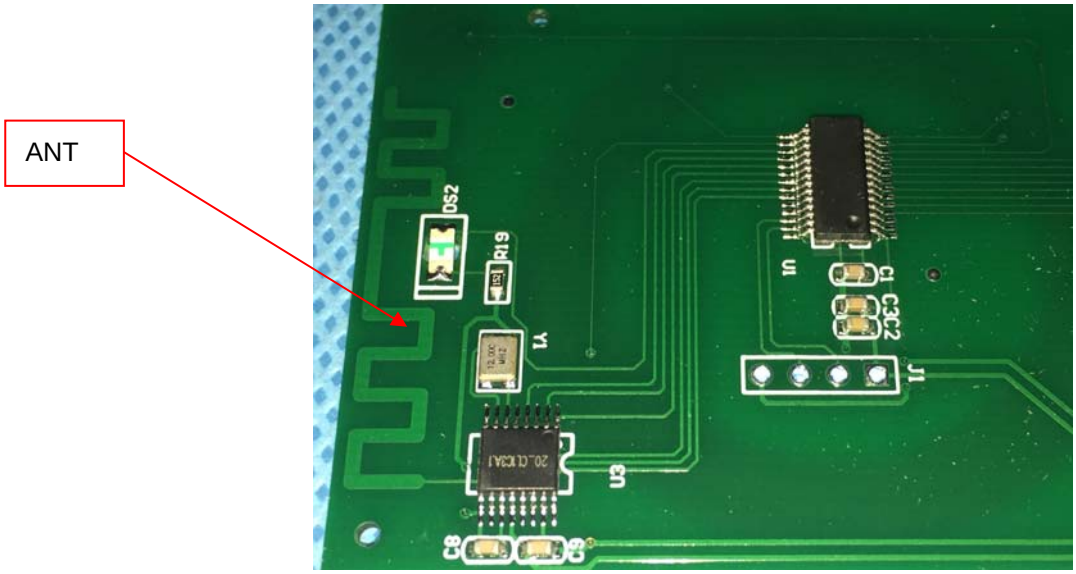
11. Antenna Requirement

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.

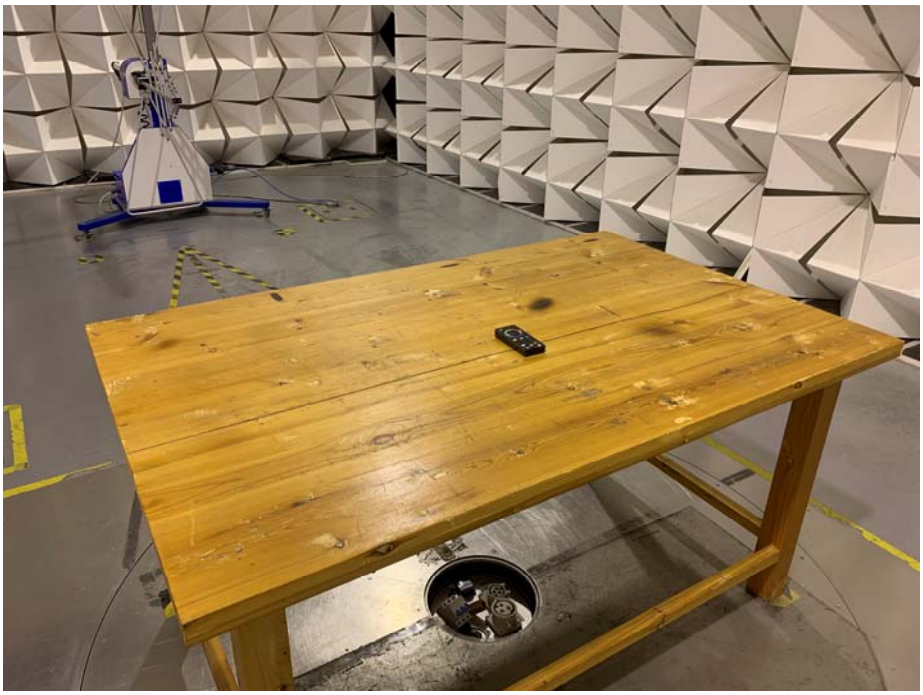


12. Photographs – Model A-500R1 Test Setup Photos

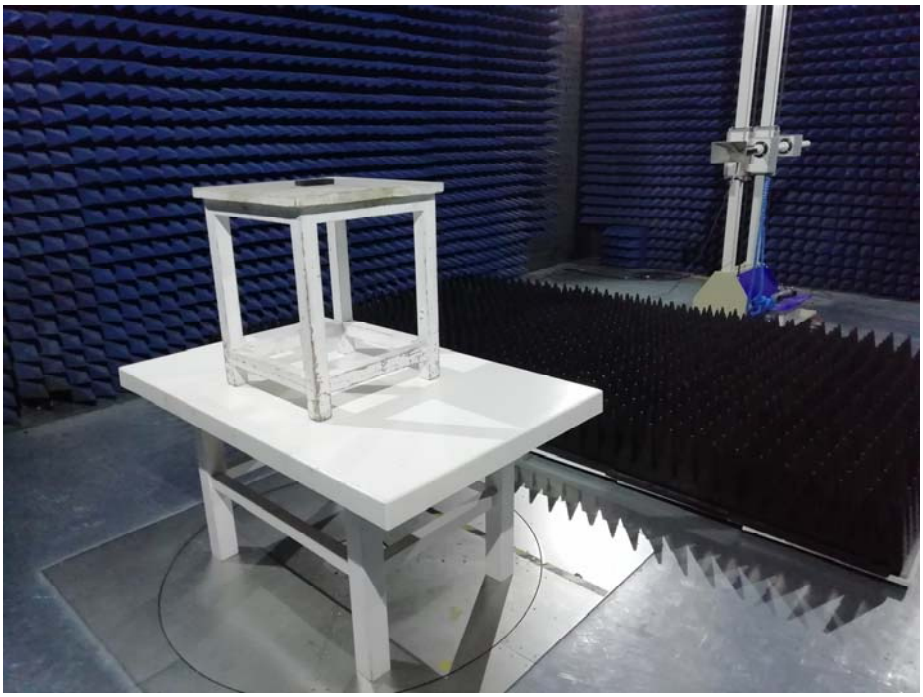
12.1 Photograph – Radiated Emissions Test Setup Photos

Test frequency Below 30MHz

Test frequency from 30MHz to 1GHz

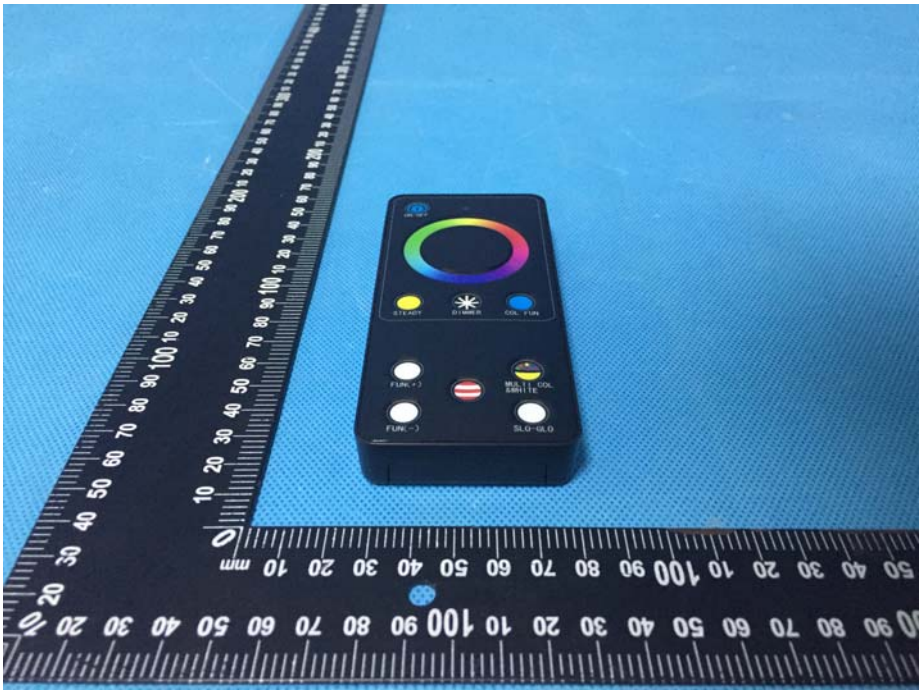


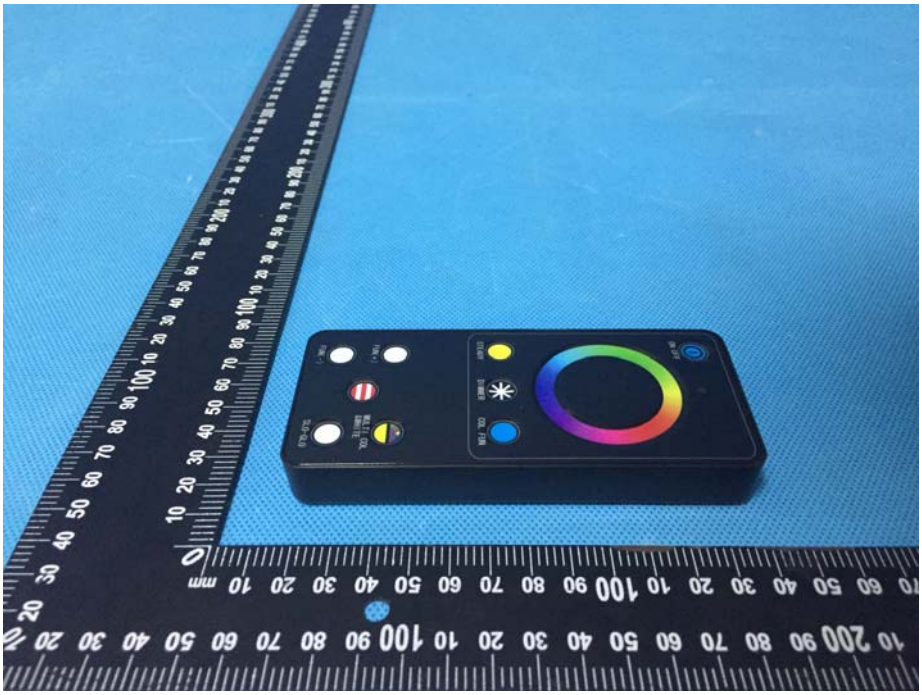
Test frequency Above 1GHz

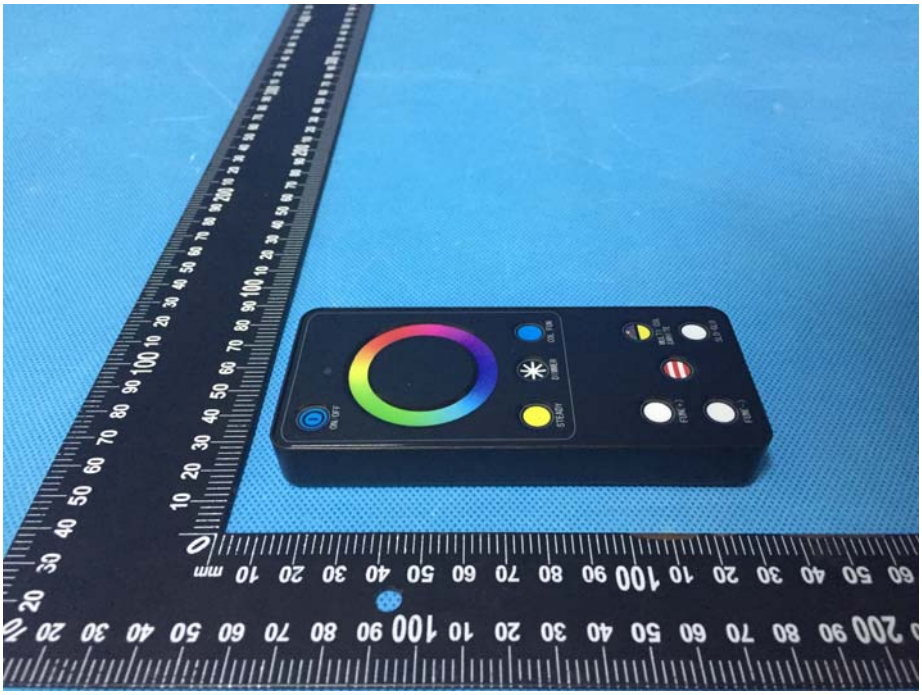


13. Photographs - Constructional Details

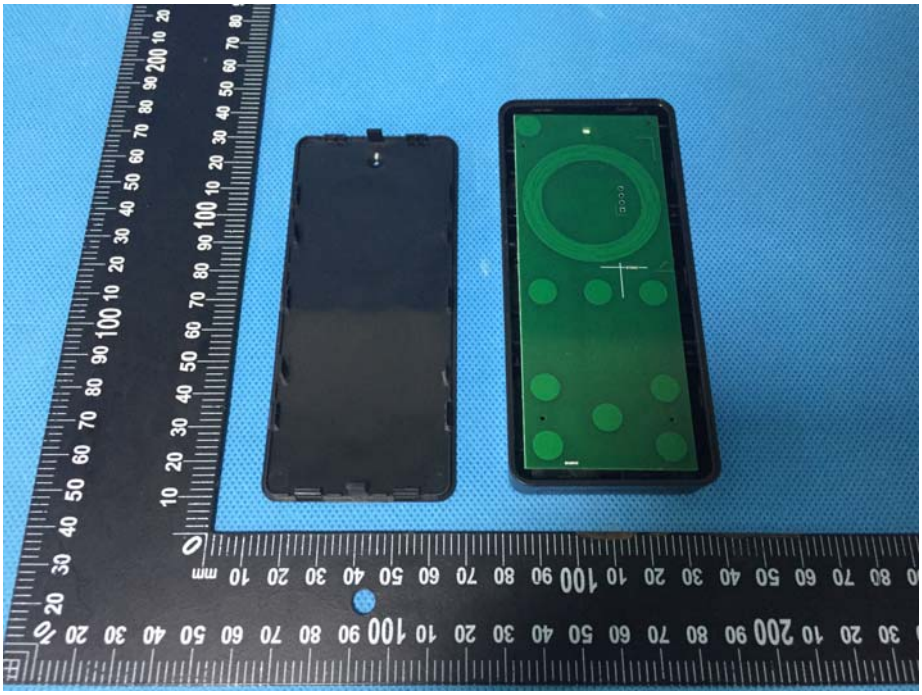
13.1 Model A-500R1 - External Photos

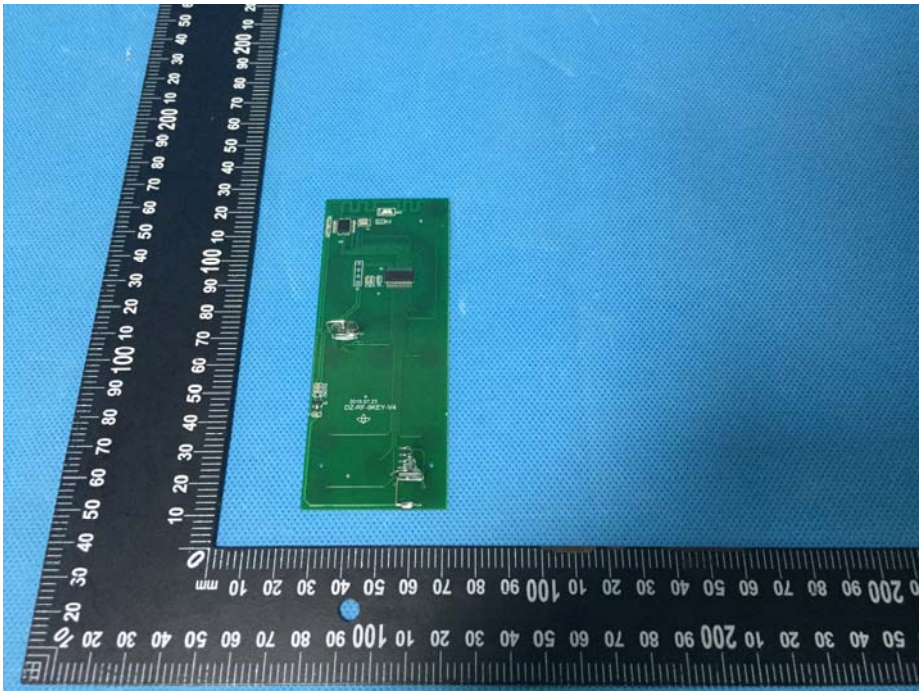


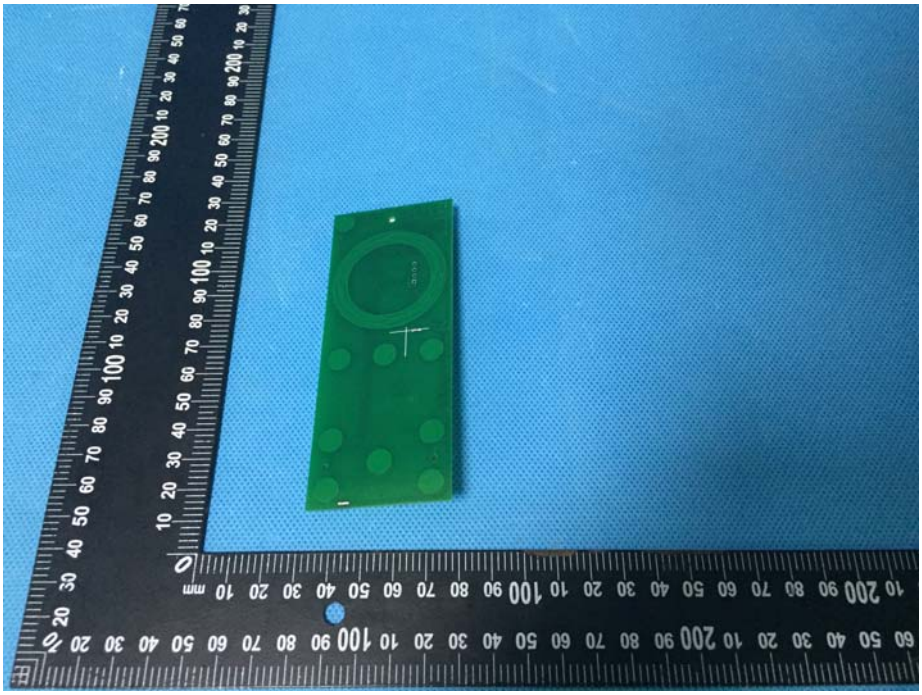


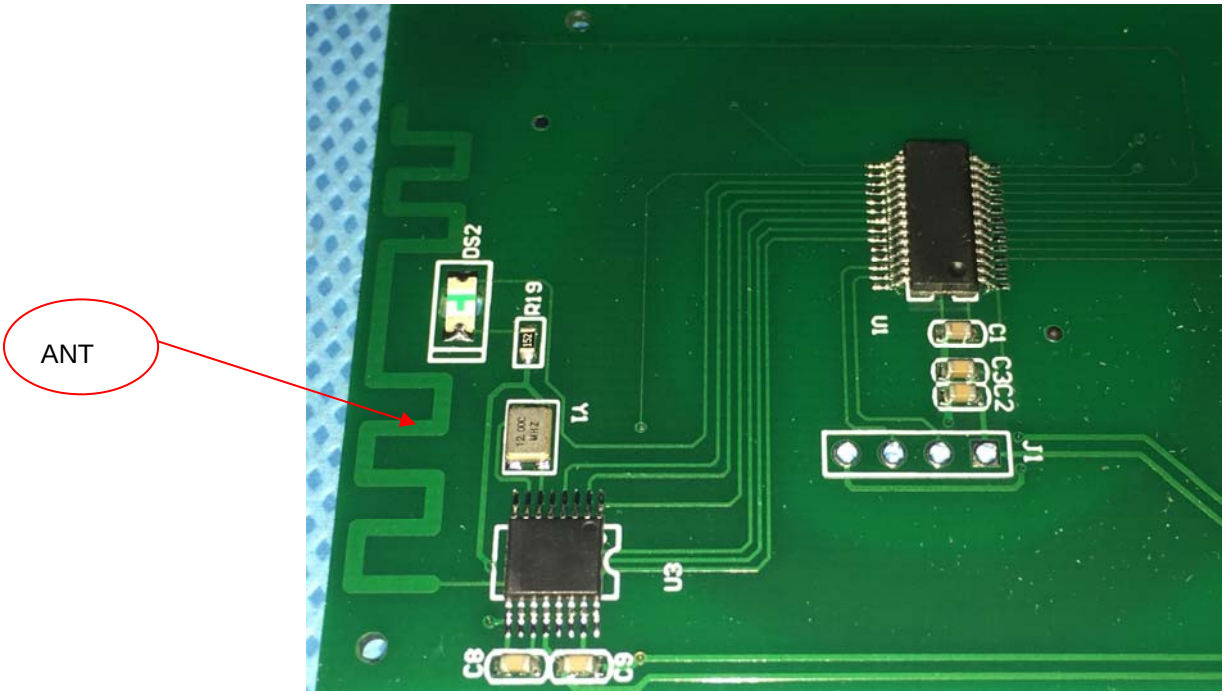


13.2 Model A-500R1 - Internal Photos









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