TEST REPORT

Reference No.	:	WTZ23F03063366W
FCC ID	:	2AXNF-R324G
Applicant	:	Foshan Carro Electrical Co.,Ltd
Address	:	No.78 Shunxiang Rd. Fengxiang Industrial park, Daliang, Shunde, Foshan, Guangdong, China
Manufacturer	:	The same as above
Address	:	The same as above
Product Name	:	Remote Control
Model No.	:	R324G
Test specification	:	FCC CFR47 Part 15 Subpart C (Section 15.249): 2021
Date of Receipt sample	:	2023-03-31
Date of Test	:	2023-05-17
Date of Issue	:	2023-07-12
Test Report Form No.	:	WEW-15249A-01A
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 approver.

Prepared By:
Waltek Testing Group (Foshan) Co., Ltd.
Address: No.13-19, 2/F., 2nd Building, Sunlink International Machinery City, Chencun, Shunde District, Foshan, Guangdong, China
Tel:+86-757-23811398 Fax:+86-757-23811381 E-mail:info@waltek.com.cn

Tested by:

Roy Hong

Approved by:

Danny Zhou

1 Revision History

Test Report No.	Date of Issue	Description	Status
WTZ23F03063366W	2023-07-12	Original	Valid

2 Contents

Page

1 REVISION HISTORY 2

2 CONTENTS 3

3 GENERAL INFORMATION 4

3.1 GENERAL DESCRIPTION OF E.U.T 4
3.2 TECHNICAL CHARACTERISTICS OF EUT 4
3.3 STANDARDS APPLICABLE FOR TESTING 4
3.4 TEST FACILITY 5
3.5 SUBCONTRACTED 5
3.6 ABNORMALITIES FROM STANDARD CONDITIONS 5
3.7 DISCLAIMER 5

4 EUT SETUP AND TEST MODE 6

5 EQUIPMENT USED DURING TEST 7

5.1 EQUIPMENT LIST 7
5.2 TEST SOFTWARE 8
5.3 SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT 8
5.4 MEASUREMENT UNCERTAINTY 8

6 SUMMARY OF TEST RESULT 9

6.1 ANTENNA REQUIREMENT 10
6.1.1 Standard Applicable 10
6.1.2 Evaluation Information 10
6.2 RADIATED SPURIOUS EMISSIONS 11
6.2.1 Standard Applicable 11
6.2.2 Test Procedure 11
6.2.3 Corrected Amplitude & Margin Calculation 13
6.2.4 Test Results 14
6.3 OUT OF BAND EMISSIONS 17
6.3.1 Standard Applicable 17
6.3.2 Test Procedure 17
6.3.3 Test Result 17
6.4 EMISSION BANDWIDTH 21
6.4.1 Standard Applicable 21
6.4.2 Test Procedure 21
6.4.3 Test Result 21
6.5 DUTY CYCLE 23
6.5.1 Standard Applicable 23
6.5.2 Test Procedure 23
6.5.3 Test Result 23

7 PHOTOGRAPHS TEST SETUP 25

7.1 PHOTOGRAPHS - RADIATED EMISSION TEST SETUP 25

8 PHOTOGRAPHS - CONSTRUCTIONAL DETAILS 26

8.1 EUT - EXTERNAL PHOTOS 26
8.2 EUT – INTERNAL PHOTOS 30

3 General Information

3.1 General Description of E.U.T

Product Name ..... : Remote Control

Model No. ..... : R324G

Model Description ..... : ---

Rated Voltage..... : Battery 3V (CR2032)

Battery Capacity ..... : ---

Power Adapter ..... : ---

3.2 Technical Characteristics of EUT

Frequency Range ..... : 2426 MHz

Max. Field Strength ..... : 85.93 dBμV/m

Modulation ..... : GFSK

Quantity of Channels ..... : 1

Type of Antenna ..... : PCB Printed Antenna

Antenna Gain ..... : 1 dBi

3.3 Standards Applicable for Testing

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	American National Standard for Testing Unlicensed Wireless Devices

3.4 Test Facility

The test facility has a test site registered with the following organizations:

- **ISED – Registration No.: 21895**

Waltek Testing Group (Foshan) Co., Ltd. has been registered and fully described in a report filed with the Innovation, Science an Economic Development Canada(ISED). The acceptance letter from the ISED is maintained in our files. Registration ISED number:21895, March 12, 2019

- **FCC – Registration No.: 820106**

Waltek Testing Group (Foshan) 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 820106, August 16, 2018

- **FCC – Designation No.: CN5034**

Waltek Testing Group (Foshan) 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. Designation No. CN5034.

- **NVLAP – Lab Code: 600191-0**

Waltek Testing Group (Foshan) Co., Ltd. EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 600191-0.
This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

3.5 Subcontracted

Whether parts of tests for the product have been subcontracted to other labs:

☐ Yes ☒ No

If Yes, list the related test items and lab information:

Test items: ---

Lab information: ---

3.6 Abnormalities from Standard Conditions

None.

3.7 Disclaimer

The antenna gain information is provided by the customer. The laboratory is not responsible for the accuracy of the antenna gain information.

4 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, with a duty cycle equal to 100%, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List

Test Mode	Description	Remark
TM1	Transmit	2426MHz

Test Conditions

Temperature:	22~25℃
Relative Humidity:	50~55%
Atmospheric pressure:	101.9kPa

5 Equipment Used during Test

5.1 Equipment List

☐Conducted Emissions 1#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal Date**	**Cal Due Date**
1.	EMI Test Receiver	R&S	ESR3	102423	2023-01-05	2024-01-04
2.	LISN	R&S	ENV216	101343	2023-01-05	2024-01-04
3.	Cable	HUBER+SUHNER	CBL2-NN-6M	223NN624	2023-01-05	2024-01-04
4.	Switch	CD	RSU-A4 18G	RSUA4008	2023-01-05	2024-01-04

☐Conducted Emissions 2#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal Date**	**Cal Due Date**
1.	EMI Test Receiver	R&S	ESCI	101178	2023-01-05	2024-01-04
2.	LISN	R&S	ENV216	101215	2023-01-05	2024-01-04
3.	Cable	HUBER+SUHNER	CBL2-NN-6M	6102701	2023-01-05	2024-01-04
4.	Switch	ESE	RSU/M2	---	2023-01-05	2024-01-04

☐Conducted Emissions 3#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal Date**	**Cal Due Date**
1.	EMI Test Receiver	R&S	ESR3	102842	2023-01-05	2024-01-04
2.	LISN	R&S	ENV216	101542	2023-01-05	2024-01-04
3.	Cable	YIHENG	LMR195UF-NMNM-2.5	---	2023-01-05	2024-01-04
4.	Manual RF Switch	YIHENG	SW-2	RSU0402	2023-01-05	2024-01-04

☒Radiation Emissions						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	3m Semi-anechoic Chamber	CHANGCHUANG	9m×6m×6m	-	2021-01-11	2024-01-10
2.	EMI Test Receiver	RS	ESR7	101566	2023-01-05	2024-01-04
3.	EMC Analyzer	Agilent	N9020A	MY48011796	2023-05-15	2024-05-14
4.	Active Loop Antenna	SCHWARZBECK	FMZB1519B	00004	2023-01-05	2024-01-04
5.	Trilog Broadband Antenna	SCHWARZBECK	VULB 9162	9162-117	2023-03-10	2024-03-09
6.	Coaxial Cable (below 1GHz)	H+S	CBL3-NN-12+3 m	214NN320	2023-01-06	2024-01-05
7.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	01561	2023-01-06	2024-01-05
8.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	01119	2023-01-06	2024-01-05
9.	Coaxial Cable (above 1GHz)	Times-Micorwave	CBL5-NN	-	2023-01-05	2024-01-04
10.	Amplifier	Lunar E M	LNA1G18-40	20160501002	2023-01-05	2024-01-04

☒RF Conducted Testing						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	Spectrum Analyzer	Agilent	N9020A	MY48011796	2023-05-15	2024-05-14
2.	Analog Signal Generator	Agilent	N5181A	MY48180720	2023-01-05	2024-01-04
3.	RF Control Unit	CHANGCHUANG	JS0806-2	-	2023-01-06	2024-01-05

☐: ***Not Used***

☒: ***Used***

5.2 Test Software

Description	Manufacturer	Model	Version
EMI Test Software (Conducted Emission 1#)	FARATRONIC	EZ-EMC	EMEC-3A1
EMI Test Software (Conducted Emission 2#)	FARATRONIC	EZ-EMC	CON-03A1
EMI Test Software (Conducted Emission 3#)	FARATRONIC	EZ-EMC	COM 3A1.1
EMI Test Software (Radiated Emission)	FARATRONIC	EZ-EMC	RA-03A1-1
RF Conducted Test Software	TONSCEND	JS1120-2	V2.6

5.3 Special Accessories and Auxiliary Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.
1.	/	/	/	/

5.4 Measurement Uncertainty

Parameter	Uncertainty
RF Output Power	±2.2dB
Occupied Bandwidth	±1.5%
Conducted Emission	±2.6dB
Transmitter Spurious Emission	±3.8dB (for 25MHz-1GHz)
	±5.0dB (for 1GHz-18GHz)

6 Summary of Test Result

Test Items	FCC Rules	Result
Antenna Requirement	§15.203	Compliant
Restricted Band of Operation	§15.205	Compliant
Conducted Emissions	§15.207(a)	N/A
Radiated Spurious Emissions	§15.209(a)	Compliant
Field Strength of Emissions	§15.249(a)	Compliant
Out of Band Emission	§15.249(d)	Compliant
Emission Bandwidth	§15.215(c)	Compliant

Remark:

Pass Test item meets the requirement

Fail Test item does not meet the requirement

N/A Test case does not apply to the test object

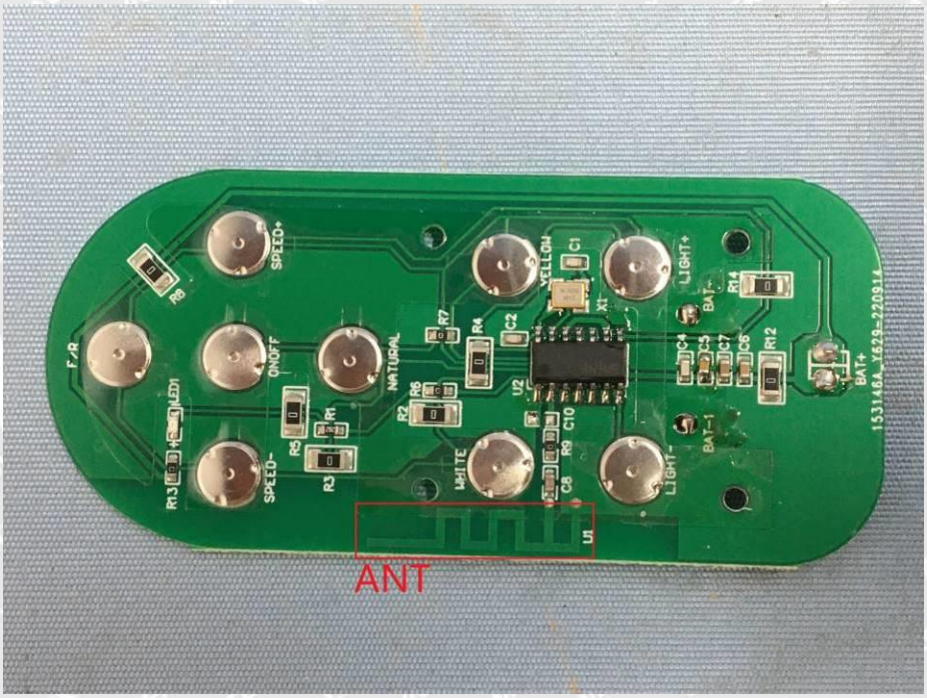
6.1 Antenna Requirement

6.1.1 Standard Applicable

According to FCC Part 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 shall be considered sufficient to comply with the provisions of this section.

6.1.2 Evaluation Information

The EUT has a PCB Printed Antenna, the gain is 1dBi, fulfil the requirement of this section.



6.2 Radiated Spurious Emissions

6.2.1 Standard Applicable

According to §15.249(a), the field strength of emissions from intentional radiators operated within thesefrequency bands shall comply with the following:

Fundamental Frequency	Field strength of fundamental (milli-volts/meter)	Field strength of Harmonics (micro-volts/meter)
902-928MHz	50	500
2400-2483.5MHz	50	500
5725-5875MHz	50	500
24.0-24.25GHz	250	2500

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated byat least 50dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

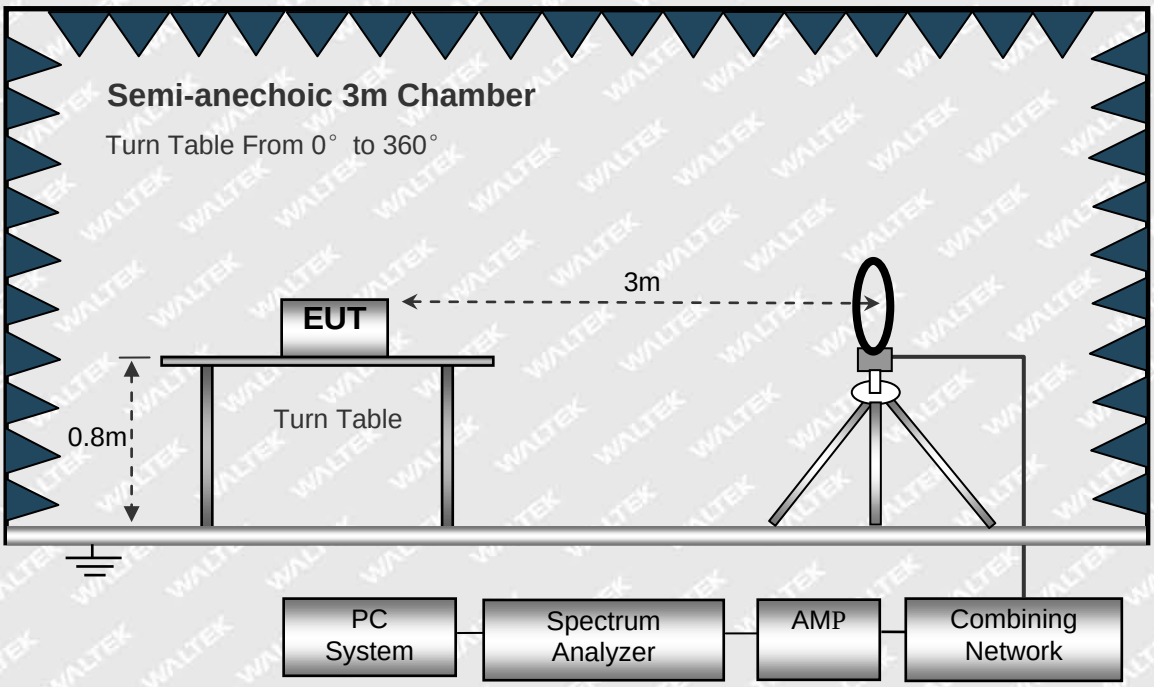
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

6.2.2 Test Procedure

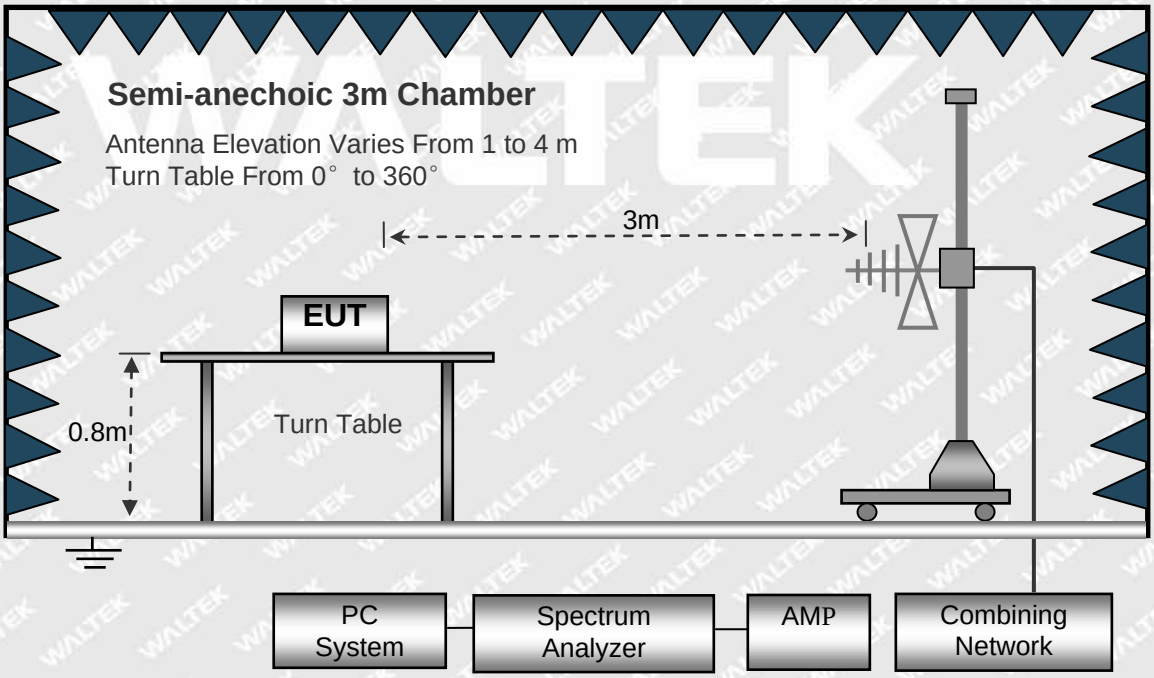
The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.249(a) and FCC Part 15.209 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40cm long in the middle. The spacing between the peripherals was 10cm.

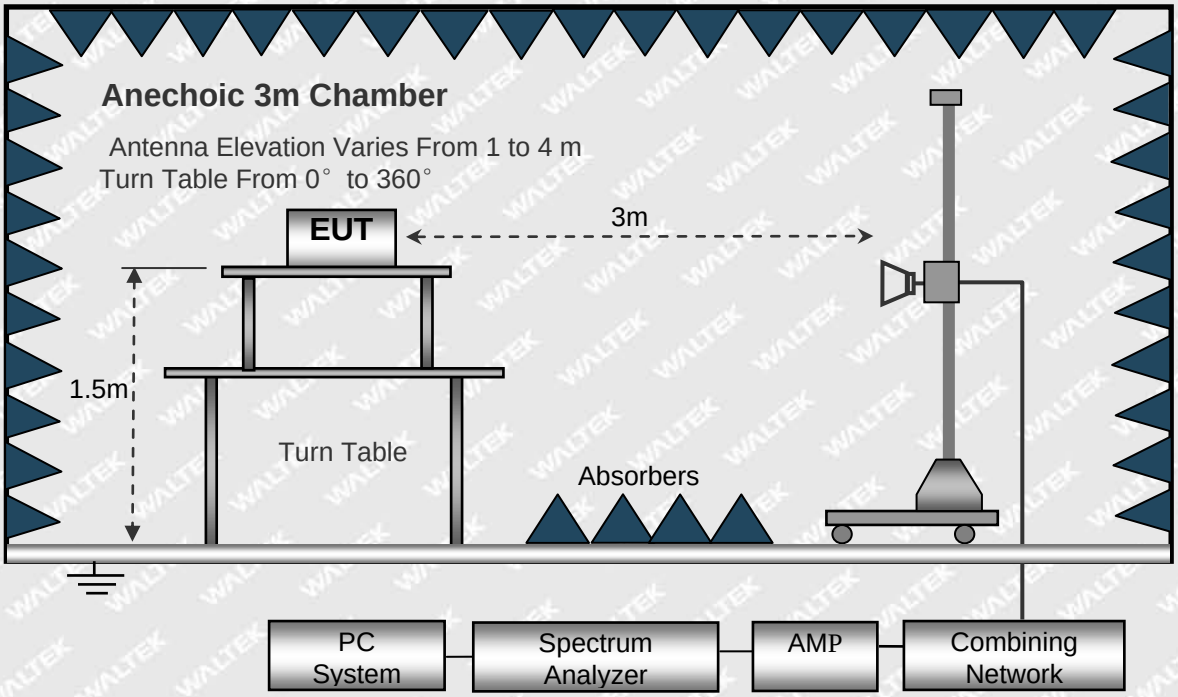
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



9KHz-30MHz	**30MHz-1GHz**	**Above 1GHz**
RBW=10kHz	RBW=120kHz	RBW=1MHz
VBW=30kHz	VBW=300kHz	VBW=3MHz(Peak), 10MHz(AV)
Sweep time=Auto	Sweep time=Auto	Sweep time=Auto
Trace=Max hold	Trace=Max hold	Trace=Max hold
Detector function=peak	Detector function=peak, QP	Detector function=peak, AV

6.2.3 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 + Corr. Factor

Corr.Factor=Antenna Factor + Cable Factor - Amplifier Gain

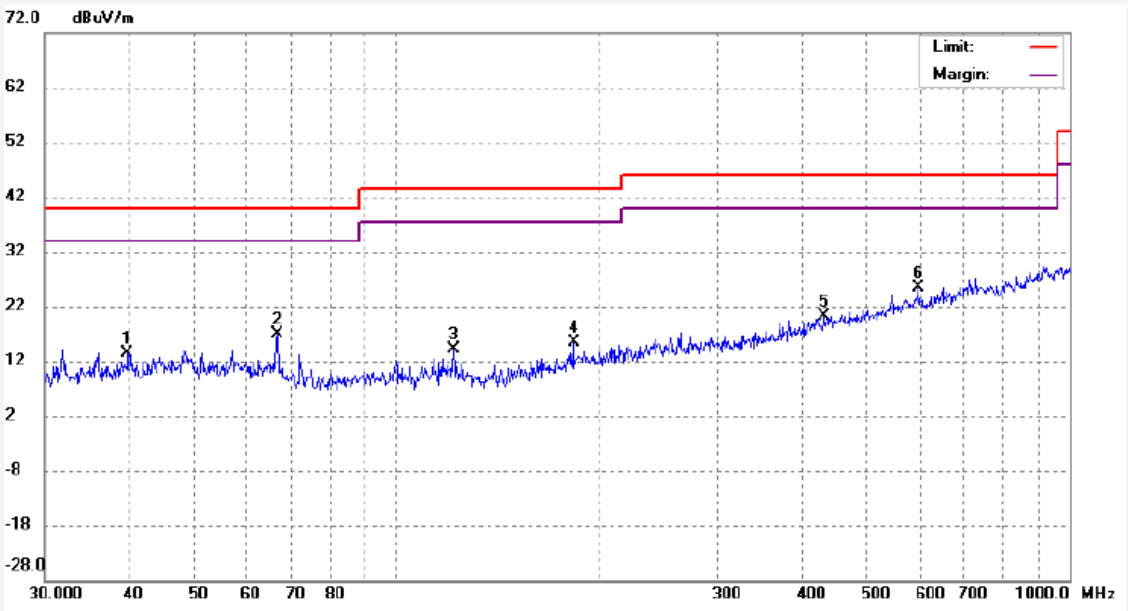
The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – Limit

6.2.4 Test Results

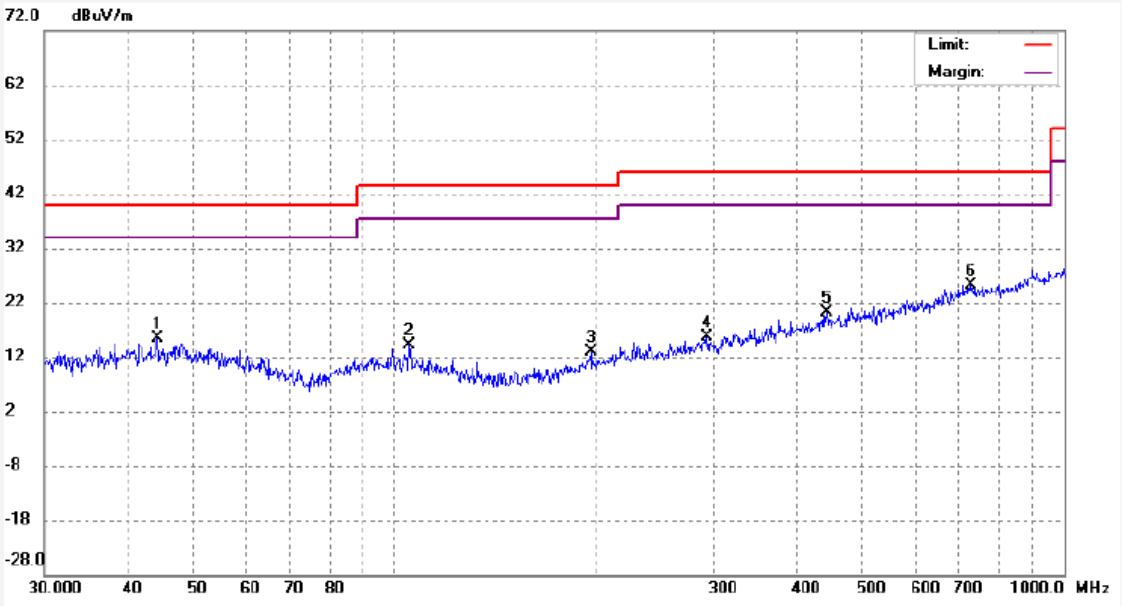
Test Frequency: Below 1GHz

Test Channel 2426 MHz **Polarization** Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	39.9801	0.39	12.88	13.27	40.00	-26.73	peak	
2	66.6390	5.58	11.38	16.96	40.00	-23.04	peak	
3	121.6765	1.84	12.27	14.11	43.50	-29.39	peak	
4	183.3290	1.75	13.71	15.46	43.50	-28.04	peak	
5	433.7608	0.37	19.66	20.03	46.00	-25.97	peak	
6	597.0140	1.90	23.43	25.33	46.00	-20.67	peak	

Test Channel 2426 MHz **Polarization** Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	44.2752	0.04	15.43	15.47	40.00	-24.53	peak	
2	105.4565	0.14	14.11	14.25	43.50	-29.25	peak	
3	196.5787	0.06	12.71	12.77	43.50	-30.73	peak	
4	293.9076	0.24	15.50	15.74	46.00	-30.26	peak	
5	441.8975	1.08	19.07	20.15	46.00	-25.85	peak	
6	724.2611	0.80	24.32	25.12	46.00	-20.88	peak	

Test Frequency: Above 1GHz

Frequency (MHz)	Reading (dBμV/m)	Detector	Polar (H/V)	Corrected Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2426 MHz							
2426.00	90.46	Peak	H	-10.08	80.38	114	-33.62
2426.00	96.01	Peak	V	-10.08	85.93	114	-28.07
4852.00	61.74	Peak	H	-3.34	58.40	74	-15.60
4852.00	75.13	Peak	V	-3.34	71.79	74	-2.21
7278.00	38.99	Peak	H	3.06	42.05	74	-31.95
7278.00	39.14	Peak	V	3.06	42.20	74	-31.80

AV = Peak +20Log$_{10}$(duty cycle) =PK+(-19.21) [refer to section 6.6 for more detail]

Frequency (MHz)	PK (dBμV/m)	Polar (H/V)	Duty cycle Factor(dB)	Calculated AV (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2426.00	80.38	H	-19.21	61.17	94	-32.83
2426.00	85.93	H	-19.21	66.72	94	-27.28
4852.00	58.40	H	-19.21	39.19	54	-14.81
4852.00	71.79	V	-19.21	52.58	54	-1.42
7278.00	42.05	V	-19.21	22.84	54	-31.16
7278.00	42.20	V	-19.21	22.99	54	-31.01

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 5th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured. The measurements greater than 20dB below the limit from 9kHz to 30MHz..

6.3 Out of Band Emissions

6.3.1 Standard Applicable

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

6.3.2 Test Procedure

As the radiation test, set the Lowest and Highest Transmitting Channel, observed the outside band of 2400MHz to 2483.5MHz, than mark the higher-level emission for comparing with the FCC rules.

6.3.3 Test Result

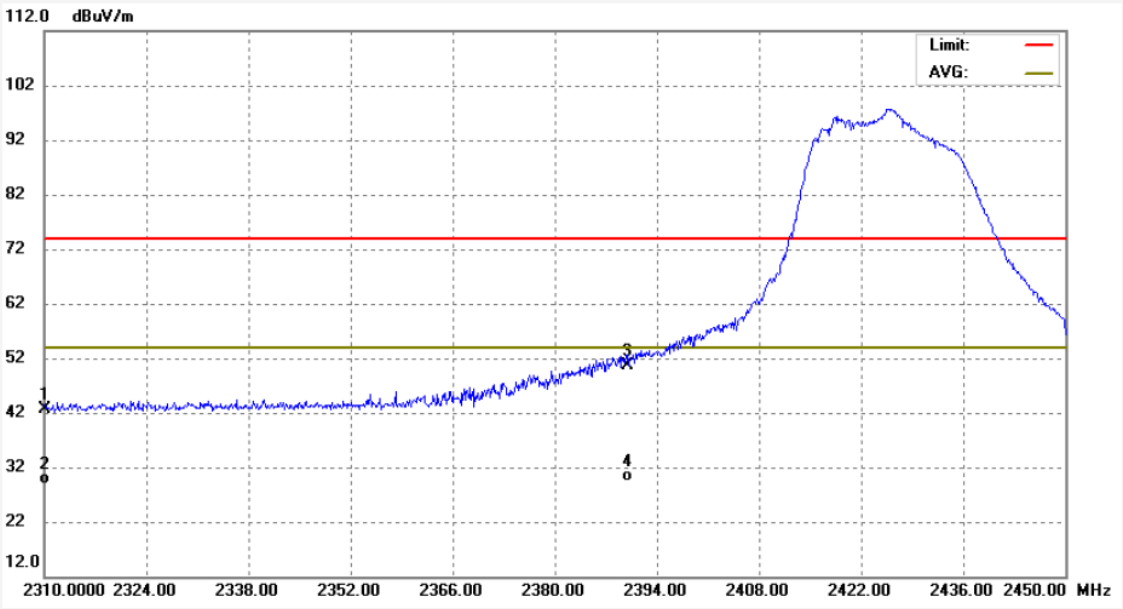
Test mode	Frequency (MHz)	Limit (dBuV / dBc)	Result
Lowest	2310.00	<54dBuV	Pass
	2390.00	<54dBuV	Pass
	2400.00	<54dBuV	Pass
Highest	2483.50	<54dBuV	Pass
	2500.00	<54dBuV	Pass

The edge emissions are below the FCC 15.209 Limits or complies with the 15.249 requirements.

Please refer to the test plots as below.

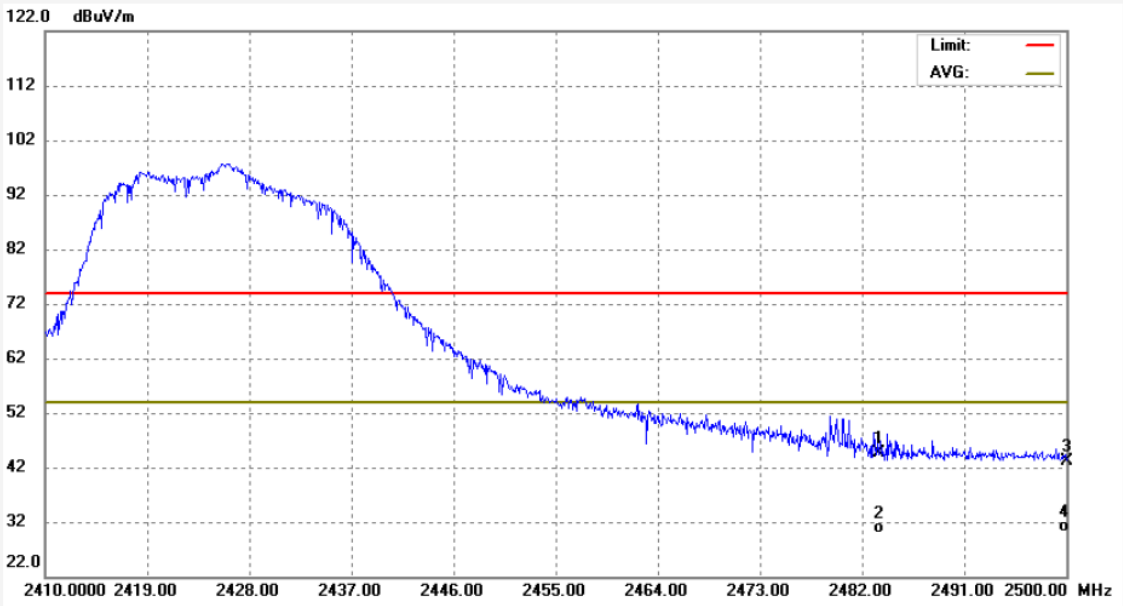
RBW: 1MHz; VBW: 3MHz

Test Channel Low Channel **Polarization** Horizontal (worst case)



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2310.000	10.86	31.85	42.71	74.00	-31.29	peak	
2	2310.000	-2.00	31.85	29.85	54.00	-24.15	AVG	
3	2390.000	18.27	32.25	50.52	74.00	-23.48	peak	
4	2390.000	-1.78	32.25	30.47	54.00	-23.53	AVG	

Test Channel High Channel **Polarization** Horizontal (worst case)

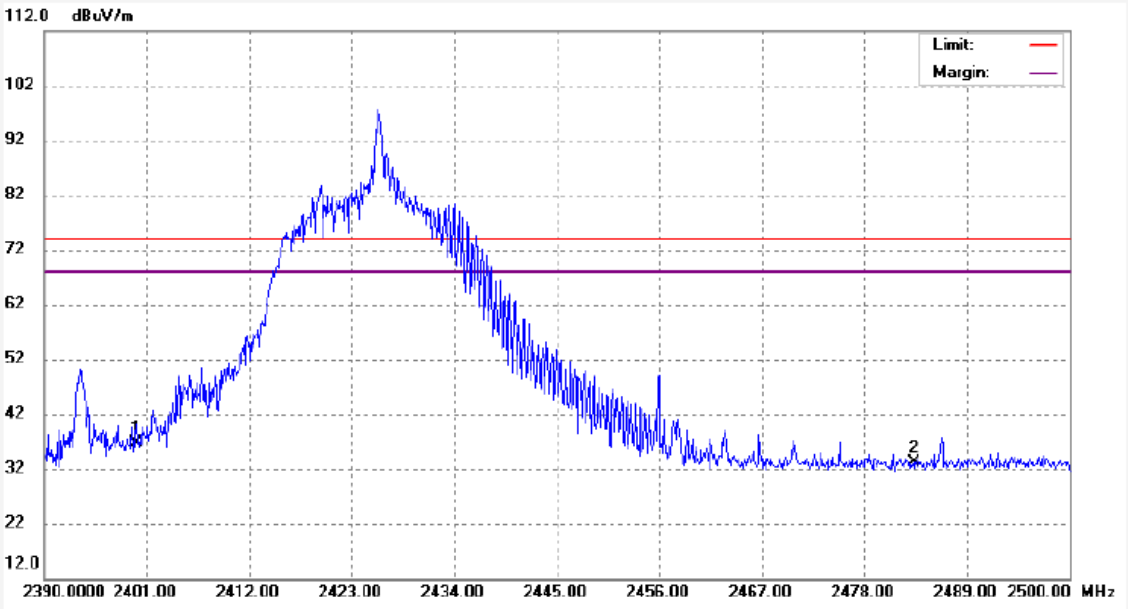


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2483.500	11.83	32.72	44.55	74.00	-29.45	peak	
2	2483.500	-1.81	32.72	30.91	54.00	-23.09	AVG	
3	2500.000	10.22	32.80	43.02	74.00	-30.98	peak	
4	2500.000	-1.60	32.80	31.20	54.00	-22.80	AVG	

Band Edge

RBW: 100kHz; VBW: 300kHz

Test Channel 2426 MHz **Polarization** Horizontal (worst case)



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2400.000	4.41	32.30	36.71	74.00	-37.29	peak	
2	2483.500	0.41	32.72	33.13	74.00	-40.87	peak	

6.4 Emission Bandwidth

6.4.1 Standard Applicable

According to §15.215(c), intentional radiators operating under the alternative provisions to the general emission limits must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

6.4.2 Test Procedure

According to the ANSI 63.10-2013, the emission bandwidth test method as follows.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Set span = 1MHz, centered on a transmitting channel RBW 1% 20dB Bandwidth, VBW RBW

Sweep = auto

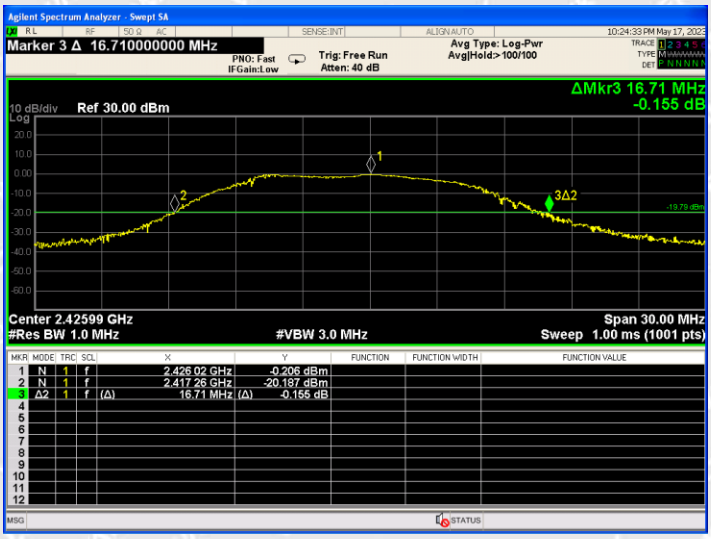
Detector function = peak Trace = max hold

All the trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission, use the marker-delta function to measure and record the 20dB down and 99% bandwidth of the emission.

6.4.3 Test Result

Test Channel	20dB Bandwidth (MHz)	Result
2426	16.71	Pass

Test result plot as follow:



6.5 Duty Cycle

6.5.1 Standard Applicable

According to FCC Part 15.35 (c), for pulse operation transmitter, the averaging pulsed emissions are calculated by peak value of measured emission plus duty cycle factor.

6.5.2 Test Procedure

With the EUT"s antenna attached, the EUT"s output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency we need test, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

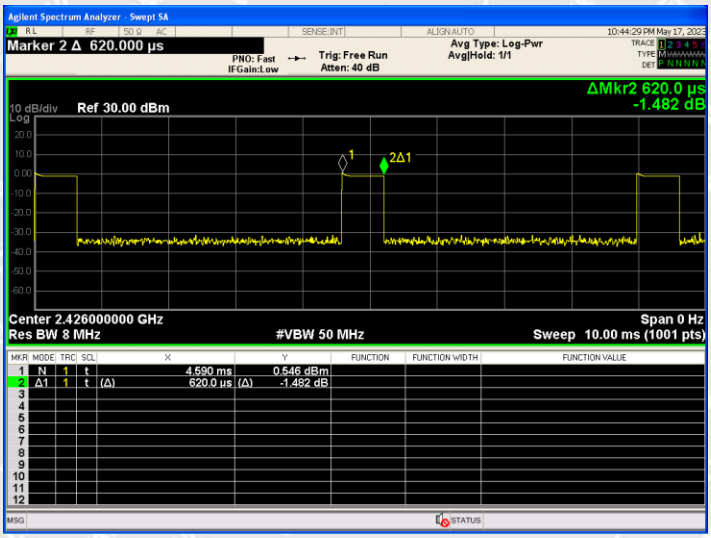
6.5.3 Test Result

Mode	Width of Pulse (ms)	Quantity ofPulse	Total Time (Ton)	Test Period (Periodic Time) (ms)	Duty Cycle (%)	Duty Cycle Factor (dB)
TM1	0.62	39	24.18	220.8	10.95	-19.21

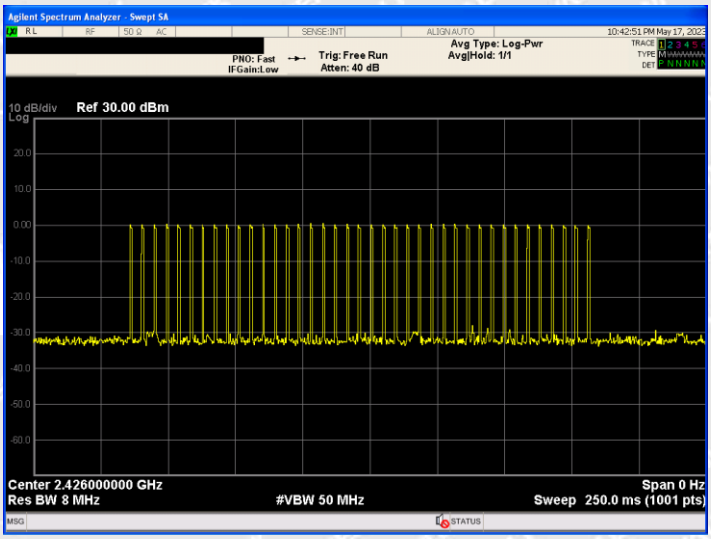
Remark: Duty Cycle Factor=20*log(Duty Cycle)

Test result plot as follow:

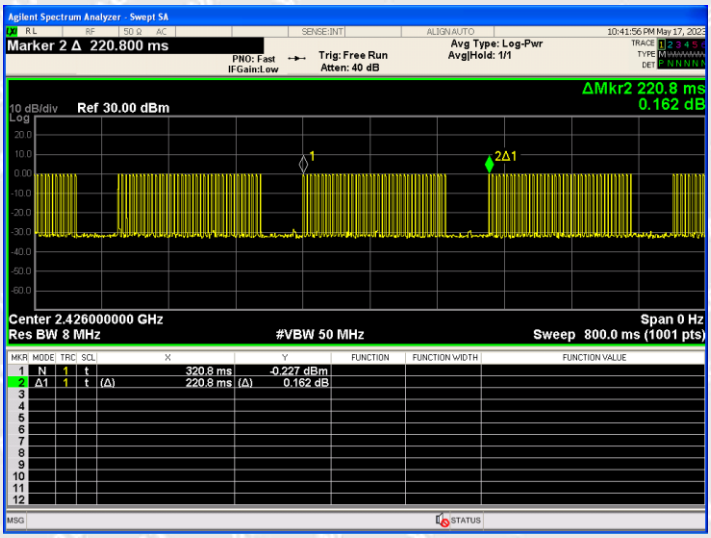
Test Pattern 1



Test Pattern 2



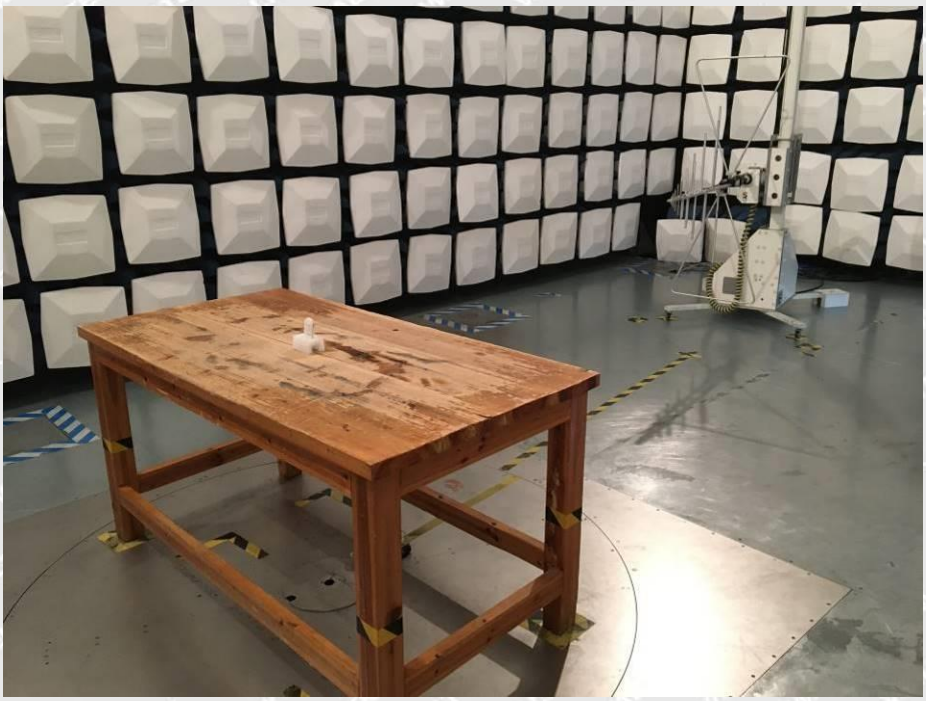
Test Pattern 3



7 Photographs Test Setup

7.1 Photographs - Radiated Emission Test Setup

30MHz-1GHz



Above 1GHz

8 Photographs - Constructional Details

8.1 EUT - External Photos

F/R
FAN OFF
Nature
pair
cool warm
CARRO

Within 1 min. of powering the fan, press and hold button for 3 sec. to pair remote to the fan.
Press and hold button for 5 sec. The fan will switch to AP mode.
More detail please check the manual.

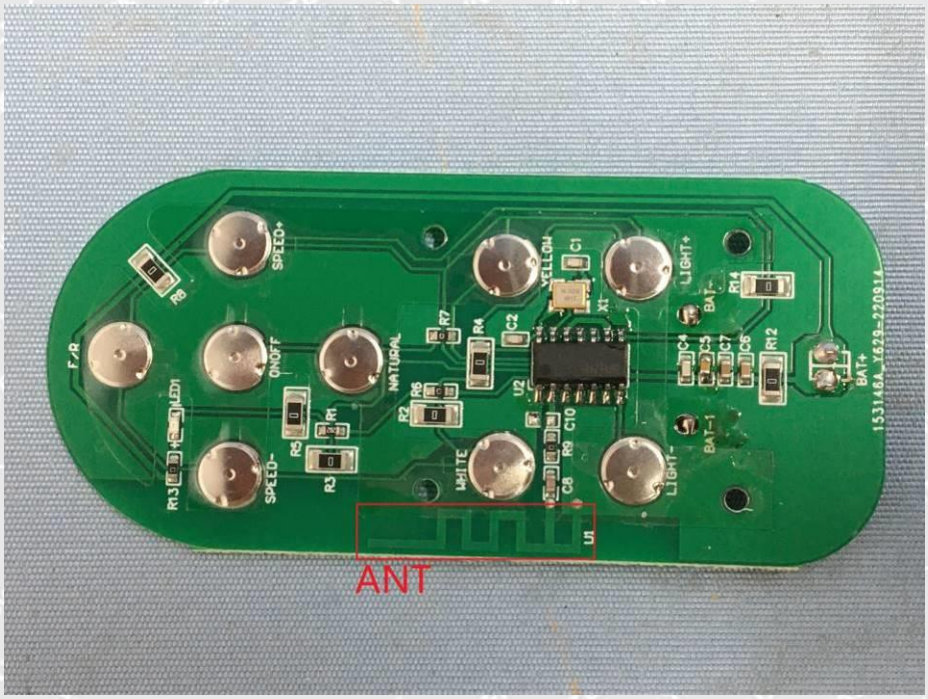
Nature
CARRO
1cm 2 3 4 5 6 7 8 9 10

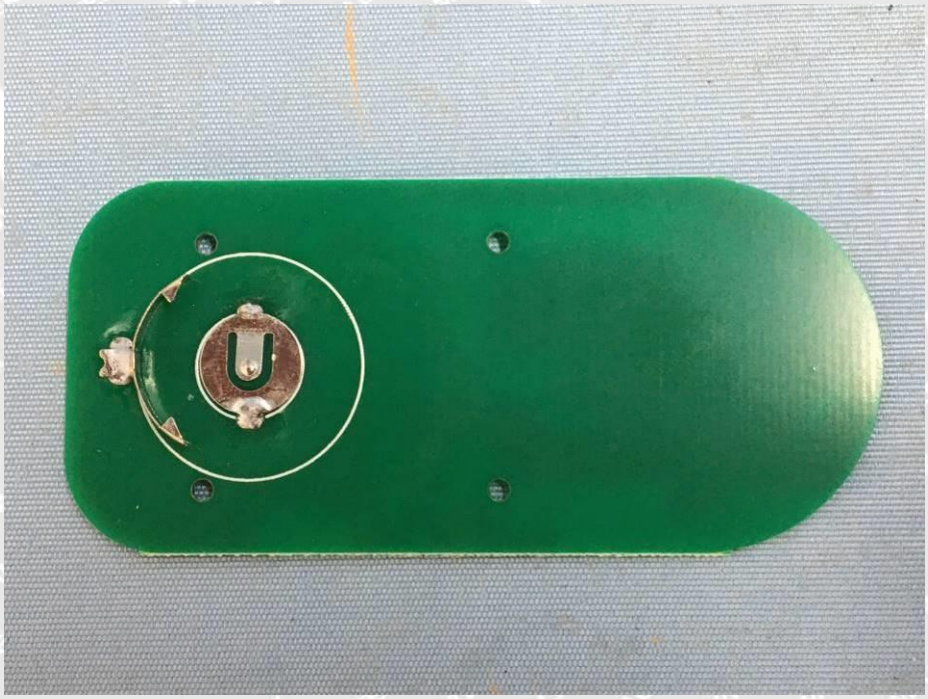
CARRO
cool
warm
Nature
FAN
OFF
1cm 2 3 4 5 6 7 8 9 10

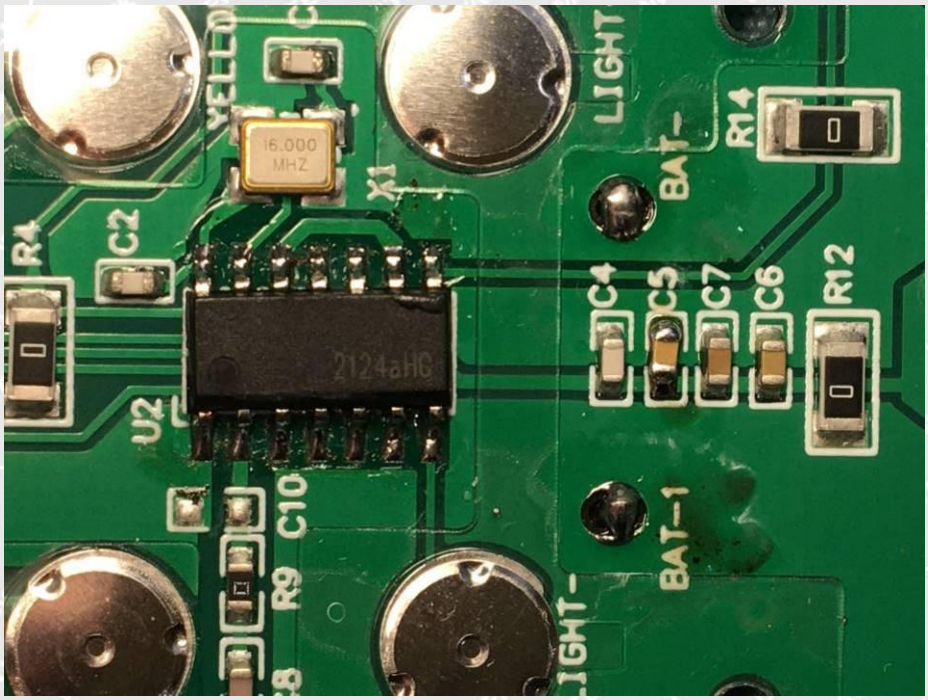
1cm 2 3 4 5 6 7 8 9 10

1cm 2 3 4 5 6 7 8 9 10

8.2 EUT – Internal Photos


SPEED+
F/R
ON/OFF
NATURAL
YELLOW
LIGHT+
BAT-
BAT+
SPEED-
WHITE
LIGHT-
ANT





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