

FCC Report (WIFI)

Applicant: Stadlbauer Marketing + Vertrieb Ges.M.B.H.
Address of Applicant: Rennbahnallee 1, 5412 Puch, Salzburg, Austria
Equipment Under Test (EUT)
Product Name: Short Range Device - Radio Controlled Toy Helicopter (2.4GHz)
Model No.: 370503019
FCC ID: YFA370503019
Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247
Date of sample receipt: March 02, 2018
Date of Test: March 03-14, 2018
Date of report issued: March 15, 2018
Test Result : PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



Robinson Lo

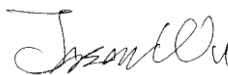
Laboratory Manager

This 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.

2 Version

Version No.	Date	Description
00	March 15, 2018	Original

Prepared By:

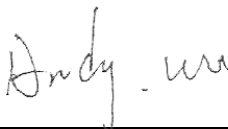


Date:

March 15, 2018

Project Engineer

Check By:



Date:

March 15, 2018

Reviewer

3 Contents

Page

1	COVER PAGE	1
2	VERSION	2
3	CONTENTS	3
4	TEST SUMMARY	4
5	GENERAL INFORMATION	5
5.1	GENERAL DESCRIPTION OF EUT	5
5.2	TEST MODE	6
5.3	DESCRIPTION OF SUPPORT UNITS	6
5.4	TEST FACILITY	6
5.5	TEST LOCATION	6
6	TEST INSTRUMENTS LIST	7
7	TEST RESULTS AND MEASUREMENT DATA	8
7.1	ANTENNA REQUIREMENT	8
7.2	CONDUCTED PEAK OUTPUT POWER	9
7.3	CHANNEL BANDWIDTH	10
7.4	POWER SPECTRAL DENSITY	11
7.5	BAND EDGES	12
7.5.1	Conducted Emission Method	12
7.5.2	Radiated Emission Method	14
7.6	SPURIOUS EMISSION	16
7.6.1	Conducted Emission Method	16
7.6.2	Radiated Emission Method	19
8	TEST SETUP PHOTO	24
9	EUT CONSTRUCTIONAL DETAILS	25

4 Test Summary

Test Item	Section in CFR 47	Result
Antenna requirement	15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	15.207	N/A
Conducted Peak Output Power	15.247 (b)(3)	Pass
Channel Bandwidth	15.247 (a)(2)	Pass
Power Spectral Density	15.247 (e)	Pass
Band Edge	15.247(d)	Pass
Spurious Emission	15.205/15.209	Pass

Pass: The EUT complies with the essential requirements in the standard.

Remark: Test according to ANSI C63.4:2014 and ANSI C63.10:2013.

Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	9kHz ~ 30MHz	$\pm 4.34\text{dB}$	(1)
Radiated Emission	30MHz ~ 1000MHz	$\pm 4.24\text{dB}$	(1)
Radiated Emission	1GHz ~ 26.5GHz	$\pm 4.68\text{dB}$	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	$\pm 3.45\text{dB}$	(1)

Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.

5 General Information

5.1 General Description of EUT

Product Name:	Short Range Device - Radio Controlled Toy Helicopter (2.4GHz)
Model No.:	370503019
Serial No.:	A000577676-002
Test sample(s) ID:	GTS201803000095-1
Sample(s) Status	Engineer sample
Operation Frequency:	2412MHz
Channel numbers:	1
Modulation technology:	802.11b: Direct Sequence Spread Spectrum (DSSS)
Antenna Type:	Internal Antenna
Antenna gain:	0 dBi(declare by manufacture)
Power supply:	DC3.7V rechargeable battery

Test channel	Operation Frequency (MHz)
1	2412MHz

5.2 Test mode

Transmitting mode	Keep the EUT in continuously transmitting mode
<i>Remark: During the test, the dutycycle >98%, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.</i>	

We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:

Pre-scan all kind of data rate in lowest channel, and found the follow list which it was worst case.

Mode	802.11b
Data rate	1Mbps

5.3 Description of Support Units

None

5.4 Test Facility

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

- **FCC —Registration No.: 381383**

Global United Technology Services Co., Ltd., Shenzhen 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 files. Registration 381383, January 08, 2018.

- **Industry Canada (IC) —Registration No.: 9079A-2**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-2, August 15, 2016.

5.5 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.

Address: No. 301-309, 3/F., Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102

Tel: 0755-27798480

Fax: 0755-27798960

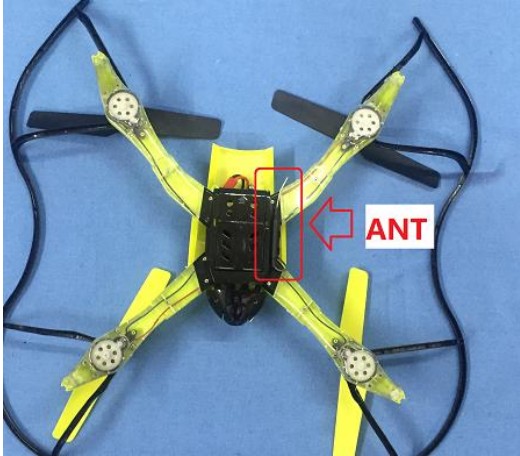
6 Test Instruments list

Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.0(L)*6.0(W)* 6.0(H)	GTS250	July. 03 2015	July 02 2020
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	ESU EMI Test Receiver	R&S	ESU26	GTS203	June 28 2017	June 27 2018
4	Loop Antenna	Zhinan	ZN30900A	GTS534	June 28 2017	June 27 2018
5	BiConiLog Antenna	SCHWARZBECK	VULB9163	GTS214	June 28 2017	June 27 2018
6	Double-ridged horn antenna	SCHWARZBECK	9120D	GTS208	June 28 2017	June 27 2018
7	Horn Antenna	ETS-LINDGREN	3160-09	GTS218	June 28 2017	June 27 2018
8	RF Amplifier	HP	8347A	GTS204	June 28 2017	June 27 2018
9	RF Amplifier	HP	8349B	GTS206	June 28 2017	June 27 2018
10	Broadband Preamplifier	SCHWARZBECK	BBV9718	GTS535	June 28 2017	June 27 2018
11	PSA Series Spectrum Analyzer	Agilent	E4440A	GTS536	June 28 2017	June 27 2018
12	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
13	Coaxial Cable	GTS	N/A	GTS210	June 28 2017	June 27 2018
14	Coaxial Cable	GTS	N/A	GTS211	June 28 2017	June 27 2018
15	Coaxial Cable	GTS	N/A	GTS210	June 28 2017	June 27 2018
16	Coaxial Cable	GTS	N/A	GTS212	June 28 2017	June 27 2018
17	Thermo meter	N/A	N/A	GTS256	June 28 2017	June 27 2018
18	D.C. Power Supply	Instek	PS-3030	GTS232	June 28 2017	June 27 2018

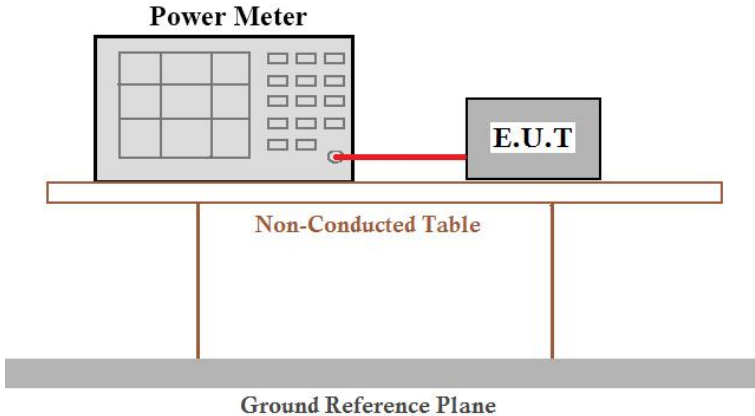
General used equipment:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Barometer	ChangChun	DYM3	GTS257	June 28 2017	June 27 2018

7 Test results and Measurement Data

7.1 Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)
15.203 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, 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.	
15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.	
EUT Antenna:	
The antenna is internal antenna, the best case gain of the antenna is 0 dBi 	

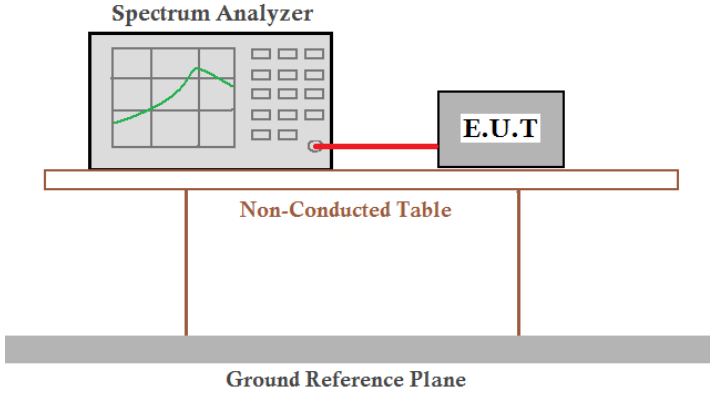
7.2 Conducted Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	KDB558074 D01 DTS Meas Guidance V03
Limit:	30dBm
Test setup:	 The diagram illustrates the test setup. A Power Meter is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Power Meter and the E.U.T. are placed on a Non-Conducted Table. The table is supported by two vertical legs and sits on a Ground Reference Plane.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

Test Frequency (MHz)	Peak Output Power (dBm)	Limit(dBm)	Result
	802.11b		
2412	11.847	30.00	Pass

7.3 Channel Bandwidth

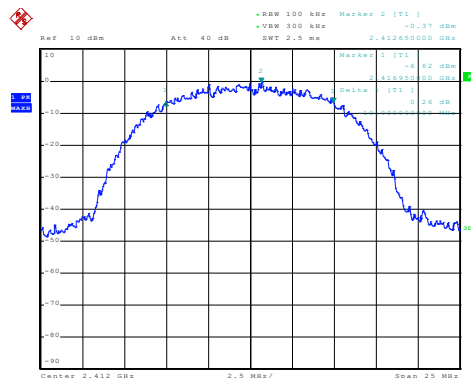
Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	KDB558074 D01 DTS Meas Guidance V03
Limit:	>500KHz
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

Test Frequency (MHz)	Channel Bandwidth (KHz)	Limit(KHz)	Result
	802.11b		
2412	10000	>500	Pass

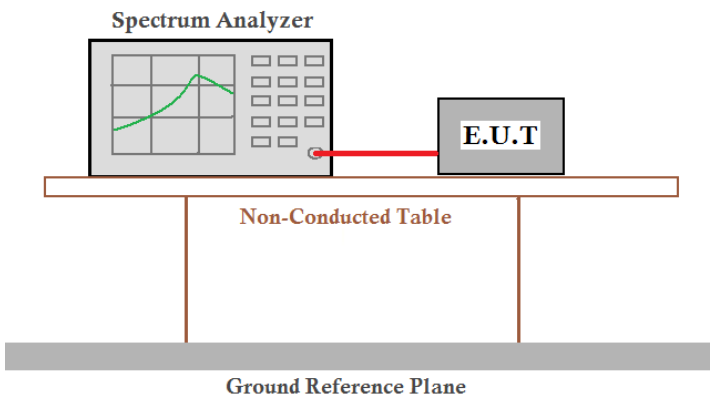
Test plot as follows:

Test mode:	802.11b
------------	---------



2412 MHz

7.4 Power Spectral Density

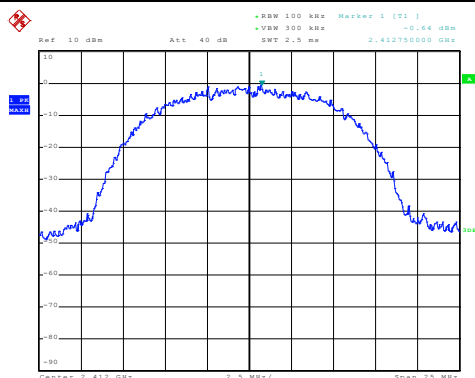
Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	KDB558074 D01 DTS Meas Guidance V03
Limit:	8dBm/3kHz
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

Test Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Result
	802.11b		
2412	-0.64	8.00	Pass

Test plot as follows:

Test mode:	802.11b
------------	---------

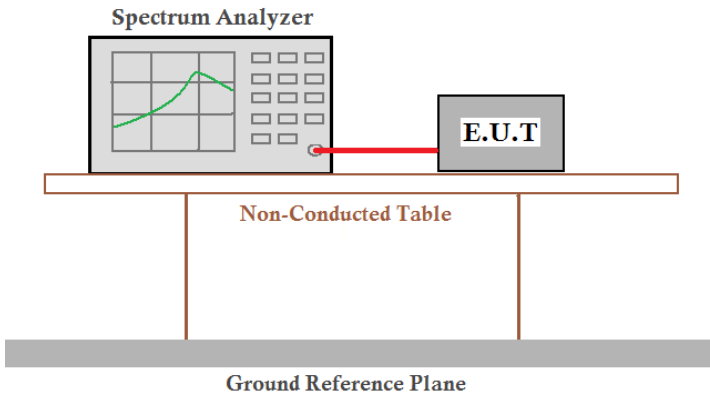


Date: 11.JUL.2017 12:03:35

2412 MHz

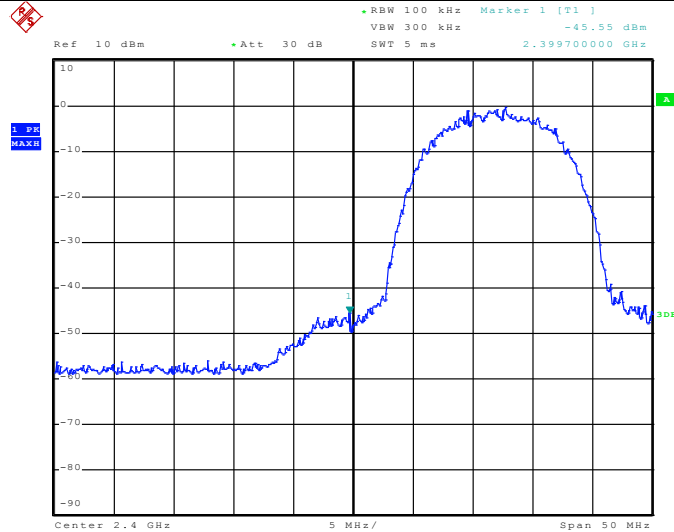
7.5 Band edges

7.5.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	KDB558074 D01 DTS Meas Guidance V03
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	 The diagram illustrates the test setup for conducted emission measurement. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table, which is supported by two vertical legs. Below the table is a thick grey bar representing the Ground Reference Plane.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

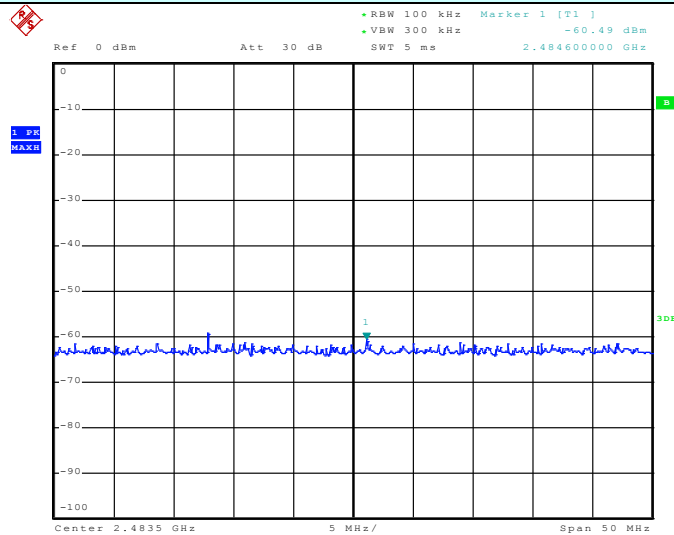
Test plot as follows:

Test mode: 802.11b



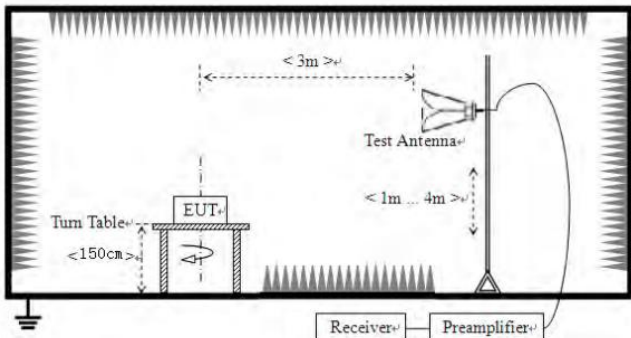
Lowest channel

Test mode: 802.11b



Highest channel

7.5.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209 and 15.205				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	All of the restrict bands were tested, only the worst band's (2310MHz to 2500MHz) data was showed.				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Average	1MHz	3MHz	Average
Limit:	Frequency		Limit (dBuV/m @3m)		Value
	Above 1GHz		54.00		Average
			74.00		Peak
Test setup:					
Test Procedure:	1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. 7. The radiation measurements are performed in X, Y, Z axis positioning. And found the Y axis positioning which it is worse case, only the test worst case mode is recorded in the report.				
Test Instruments:	Refer to section 6.0 for details				
Test mode:	Refer to section 5.2 for details				
Test results:	Pass				

Measurement data:

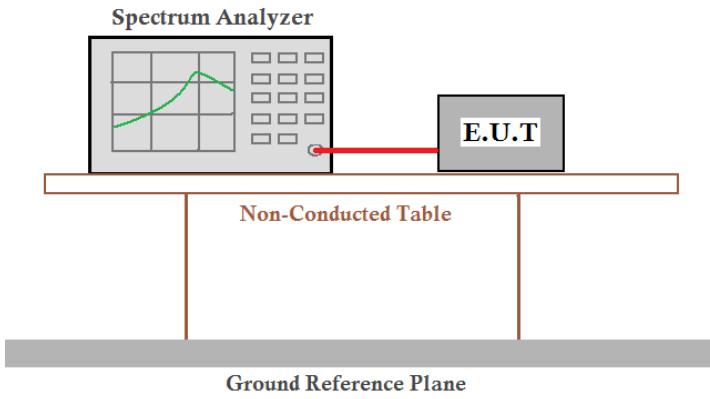
Frequency		Lowest channel 802.11b ch1			
Frequency (MHz)	Detector type (pk/av/qp)	Ant.Pol. (H/V)	Result (dBuV/m)	Limit (dBuV/m)	Margins&Comments
2355.384	PK	V	46.51	74.0	Pass
2342.692	AV	V	34.56	54.0	Pass
2388.846	PK	H	46.86	74.0	Pass
2358.589	AV	H	33.01	54.0	Pass
Frequency		High channel 802.11b ch1			
Frequency (MHz)	Detector type (pk/av/qp)	Ant.Pol. (H/V)	Result (dBuV/m)	Limit (dBuV/m)	Margins&Comments
2483.632	PK	V	68.49	74.0	Pass
2483.721	AV	V	36.30	54.0	Pass
2483.870	PK	H	59.24	74.0	Pass
2481.637	AV	H	33.94	54.0	Pass

Remark:

1. Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

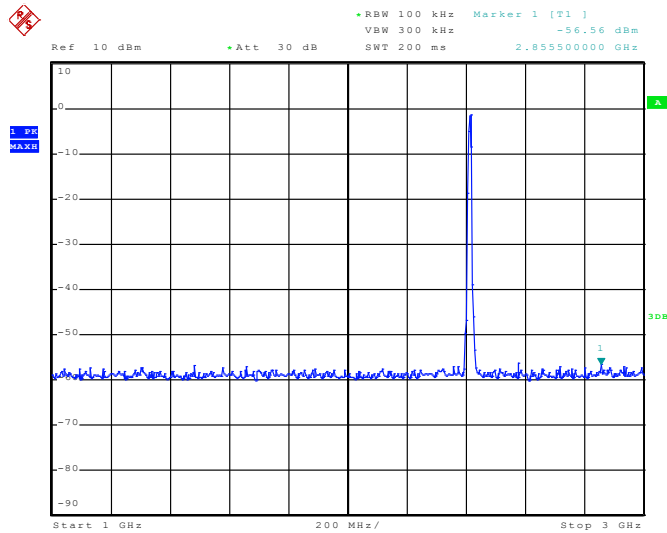
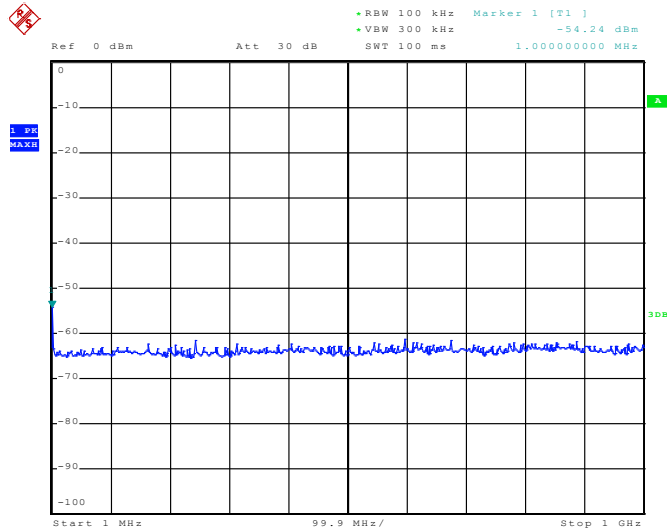
7.6 Spurious Emission

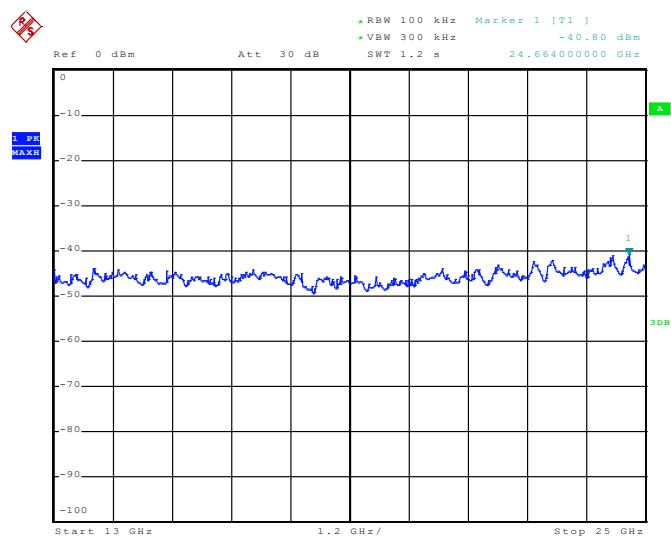
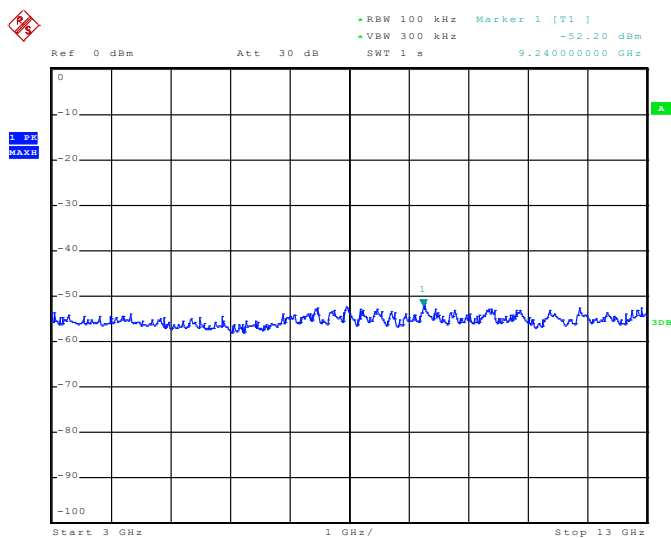
7.6.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	KDB558074 D01 DTS Meas Guidance V03
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	 The diagram illustrates the test setup for conducted emission measurement. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table, which is supported by a Ground Reference Plane.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

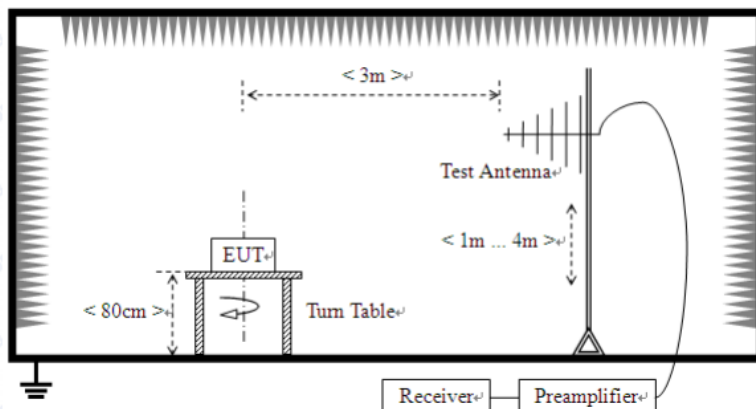
Test plot as follows:

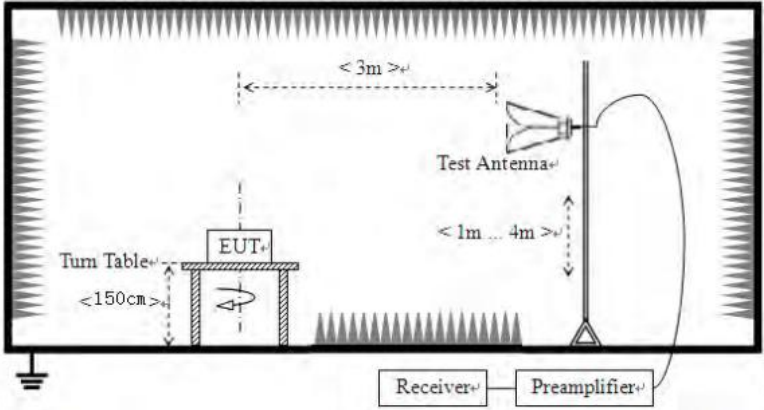
Test mode:	802.11b
------------	---------





7.6.2 Radiated Emission Method

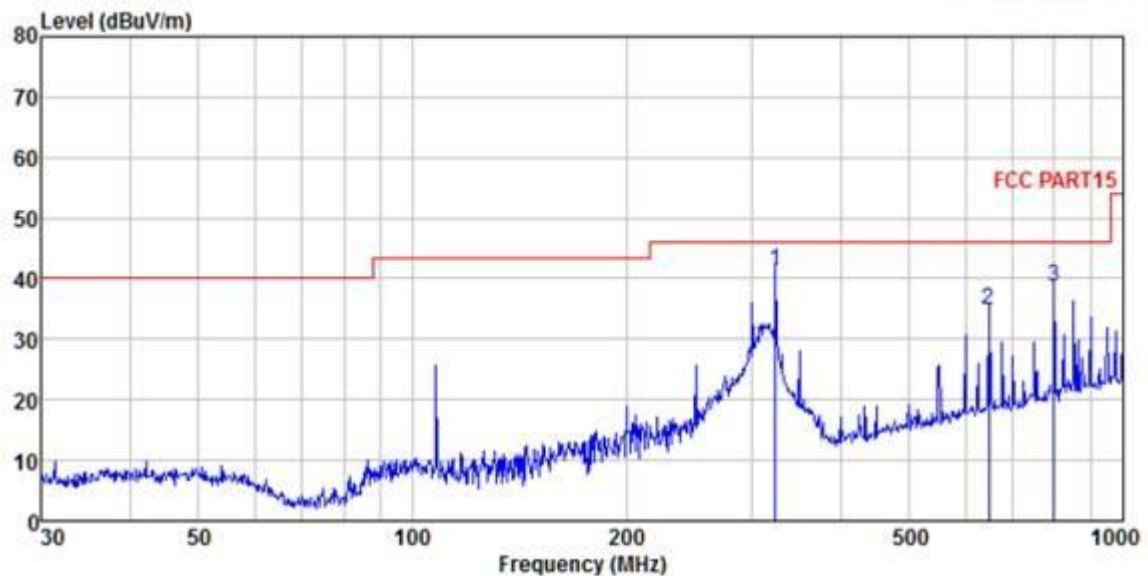
Test Requirement:	FCC Part15 C Section 15.209				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	30MHz to 25GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Average	1MHz	3MHz	Average
Limit:	Frequency		Limit (dBuV/m @3m)		Value
	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
Test setup:	Below 1GHz				
					
	Above 1GHz				

	
Test Procedure:	1. The EUT was placed on the top of a rotating table(0.8 meters below 1G and 1.5 meters above 1G) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. 7. The radiation measurements are performed in X, Y, Z axis positioning. And found the Y axis positioning which it is worse case, only the test worst case mode is recorded in the report.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Remark:

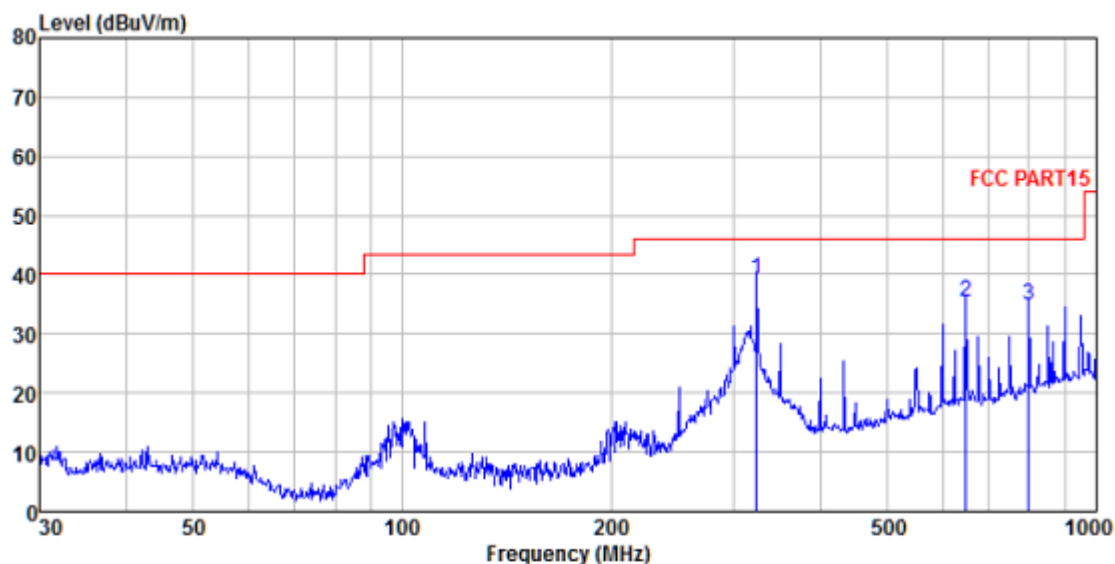
Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.

Measurement Data Below 1GHz:



Site : 3m chamber
 Condition : FCC PART15 3m HORIZONTAL
 EUT : WiFi Camera
 Model No. : TBC
 Sample No. : A000577676
 TUV Order No: 144153085
 Test Mode : 802.11b Tx mode
 : 2412MHz

	Read	Antenna	Preamp	Cable		Limit	Over	
Freq	Level	Factor	Factor	Loss	Level	Line	Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	324.456	54.83	13.97	29.86	2.49	41.43	46.00	-4.57 QP
2	647.386	40.57	19.54	29.25	3.91	34.77	46.00	-11.23 QP
3	798.980	42.20	21.30	29.20	4.45	38.75	46.00	-7.25 QP



Site : 3m chamber
 Condition : FCC PART15 3m VERTICAL
 EUT : WiFi Camera
 Model No. : TBC
 Sample No. : A000577676
 TUV Order No: 144153085
 Test Mode : 802.11b Tx mode
 : 2412MHz

	Read	Antenna	Preamp	Cable		Limit	Over	
Freq	Level	Factor	Factor	Loss	Level	Line	Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	324.456	52.79	13.97	29.86	2.49	39.39	46.00	-6.61 QP
2	649.660	41.27	19.55	29.25	3.91	35.48	46.00	-10.52 QP
3	798.980	38.18	21.30	29.20	4.45	34.73	46.00	-11.27 QP

Note:

There is no spurious found below 30MHz.

Above 1GHz:

Frequency	Lowest channel 802.11b ch1		
Frequency (MHz)	Detector type (pk/av/qp)	Limit (dBuV/m)	Margins&Comments
30MHz-88MHz	Quasi-peak	40.00	Pass*
88MHz-216MHz	Quasi-peak	43.50	Pass*
216MHz-960MHz	Quasi-peak	46.00	Pass*
960MHz-1GHz	Quasi-peak	54.00	Pass*

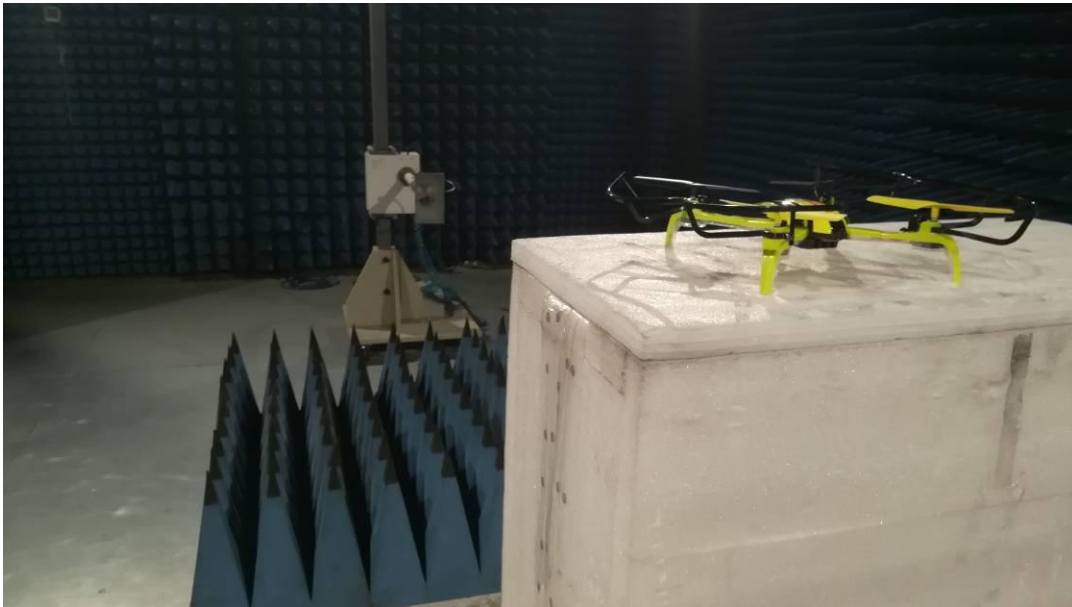
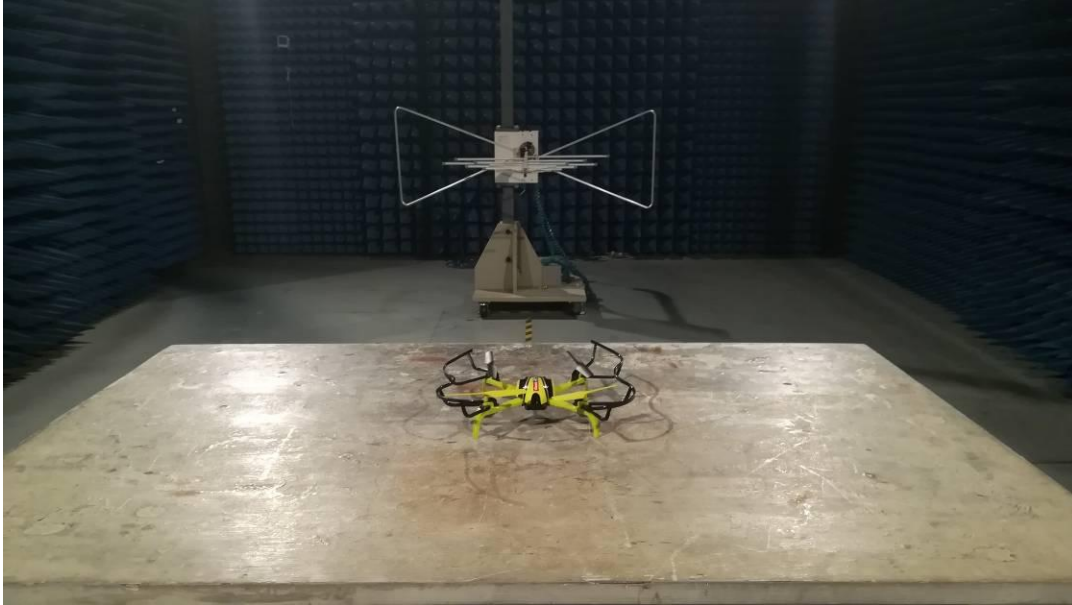
Frequency	Lowest channel 802.11b ch1				
Frequency (MHz)	Detector type (pk/av/qp)	Ant.Pol. (H/V)	Result (dBuV/m)	Limit (dBuV/m)	Margins&Comments
4823.990	PK	V	58.94	74.0	Pass
4823.990	AV	V	41.81	54.0	Pass
7223.166	PK	V	55.70	74.0	Pass
4823.685	PK	H	52.83	74.0	Pass
4823.974	AV	H	38.85	54.0	Pass

Remark:

- 1 Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
- 2 “*”, means this data is the too weak instrument of signal is unable to test.

8 Test Setup Photo

Radiated Emission



9 EUT Constructional Details







-----End-----