

FCC REPORT

Applicant: Ecovacs Robotics Co., Ltd.

Address of Applicant: No. 18 You Xiang Road, Wuzhong District, Suzhou City, Jiangsu Province, P.R.China

Manufacturer: Ecovacs Robotics Co., Ltd.

Address of Manufacturer: No. 18 You Xiang Road, Wuzhong District, Suzhou City, Jiangsu Province, P.R.China

Factory: SHENZHEN CHUAN QISHENG INDUSTRIAL Co.,LTD

Address of Factory: 3F West,Building No.2,Jiuzhou Industrial Park,Jiazitang Village East Songbai Road,Gongming Street, Guangming New District,Shenzhen City,P.R.China

Equipment Under Test (EUT)

Product Name: Remote control

Model No.: RC1712

FCC ID: 2AAL3-RC1712

Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.249:2017

Date of sample receipt: January 08, 2018

Date of Test: January 09-11, 2018

Date of report issued: January 12, 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	January 12, 2018	Original

Prepared By:

Bill. yuan

Date:

January 12, 2018

Project Engineer

Check By:

Andy. wu

Date:

January 12, 2018

Reviewer

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4 Test Summary

Test Item	Section in CFR 47	Result
Antenna requirement	15.203	Pass
AC Power Line Conducted Emission	15.207	N/A
Field strength of the fundamental signal	15.249 (a)	Pass
Spurious emissions	15.249 (a) (d)/15.209	Pass
Band edge	15.249 (d)/15.205	Pass
20dB Occupied Bandwidth	15.215 (c)	Pass

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

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

N/A: Not applicable

4.1 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:	Remote control
Sample(s) Status:	Engineer sample
Quantity of tested samples	1
Tested Sample(s) ID:	GTS201712000166-1
Model No.:	RC1712
Hardware Version:	V1.0
Software Version:	V1.2
Operation Frequency:	2437MHz
Channel numbers:	1
Modulation type:	GFSK
Antenna Type:	PCB antenna
Antenna gain:	1.5 dBi(declare by Applicant)
Power supply:	DC 3.3V

Operation Frequency each of channel	
Channel	Frequency
1	2437MHz

Test Frequency:

Channel	Frequency
1	2437MHz

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>	

Per-test mode.

We have verified the construction and function in typical operation, The EUT was placed on three different polar directions; i.e. X axis, Y axis, Z axis. which was shown in this test report and defined as follows:

Axis	X	Y	Z
Field Strength(dBuV/m)	85.44	86.62	84.29

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, Jan. 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

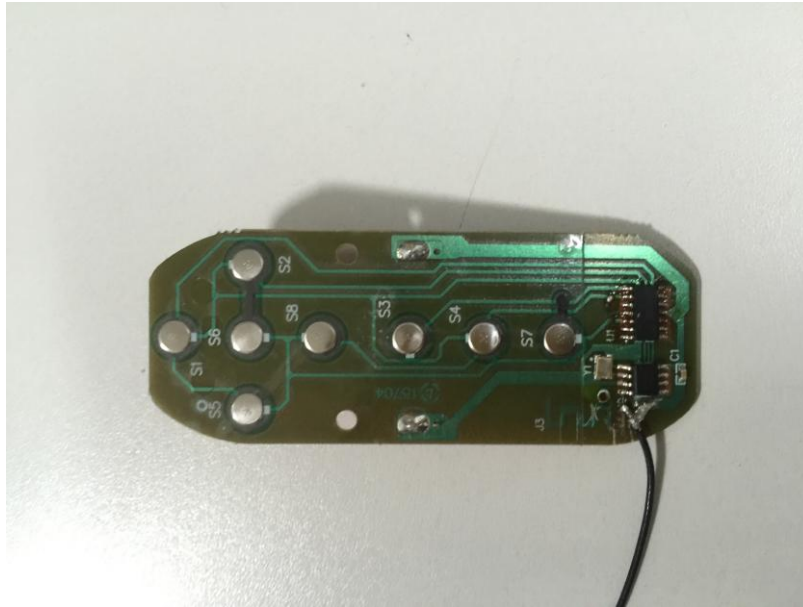
5.6 Other Information Requested by the Customer

None.

5.7 Additional Instructions

EUT Settings:

Engineering plate fixed transmit.



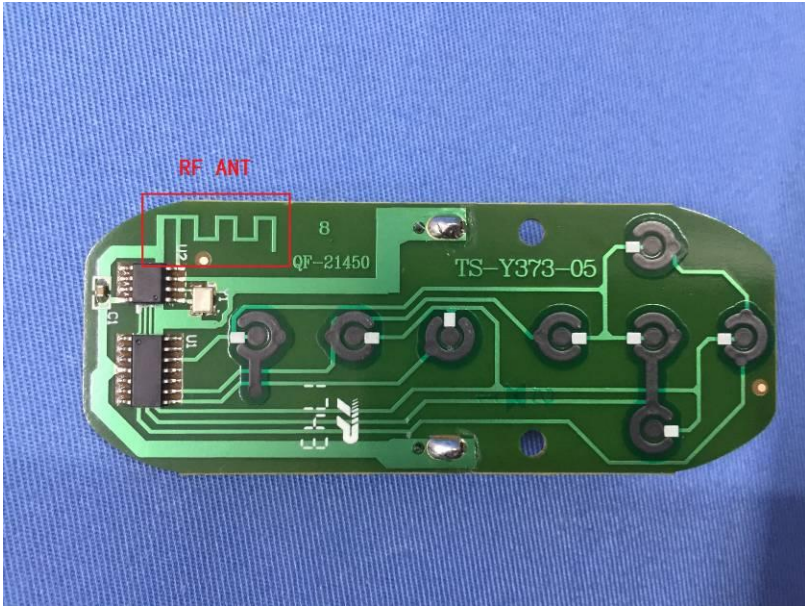
6 Test Instruments list

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	9.2(L)*6.2(W)* 6.4(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	Spectrum Analyzer	Agilent	E4440A	GTS533	June 28 2017	June 27 2018
4	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June 28 2017	June 27 2018
5	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June 28 2017	June 27 2018
6	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	9120D-829	GTS208	June 28 2017	June 27 2018
7	Horn Antenna	ETS-LINDGREN	3160	GTS217	June 28 2017	June 27 2018
8	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
9	Coaxial Cable	GTS	N/A	GTS213	June 28 2017	June 27 2018
10	Coaxial Cable	GTS	N/A	GTS211	June 28 2017	June 27 2018
11	Coaxial cable	GTS	N/A	GTS210	June 28 2017	June 27 2018
12	Coaxial Cable	GTS	N/A	GTS212	June 28 2017	June 27 2018
13	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June 28 2017	June 27 2018
14	Amplifier(2GHz-20GHz)	HP	8349B	GTS206	June 28 2017	June 27 2018
15	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June 28 2017	June 27 2018
16	Band filter	Amindeon	82346	GTS219	June 28 2017	June 27 2018
17	Power Meter	Anritsu	ML2495A	GTS540	June 28 2017	June 27 2018
18	Power Sensor	Anritsu	MA2411B	GTS541	June 28 2017	June 27 2018

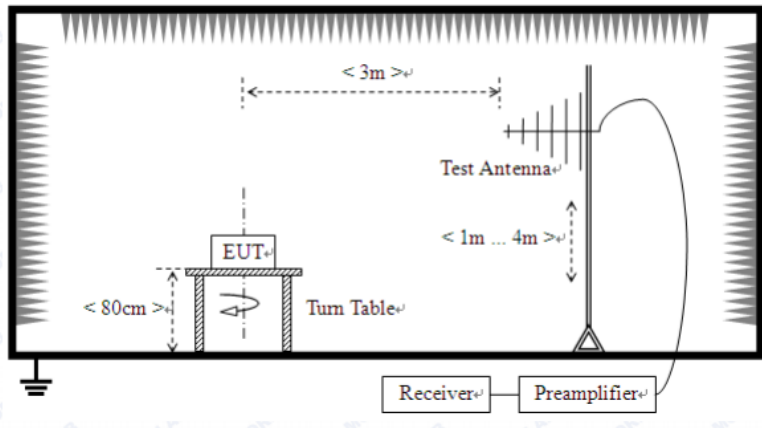
General used equipment:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Barometer	ChangChun	DYM3	GTS257	June 28 2017	June 27 2018

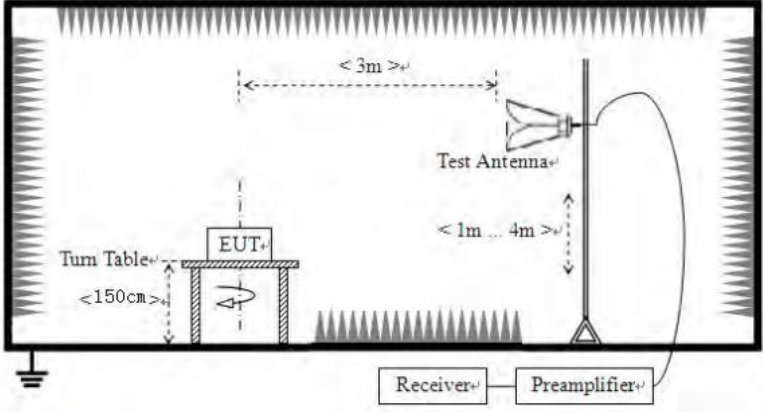
7 Test results and Measurement Data

7.1 Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203
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.	
EUT Antenna:	
<p><i>The antenna is PCB antenna, the best case gain of the antenna is 1.5 dBi</i></p> 	

7.2 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	Remark
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		Peak	1MHz	10Hz	Average Value
Limit: (Field strength of the fundamental signal)	Frequency		Limit (dBuV/m @3m)		Remark
	2400MHz-2483.5MHz		94.00		Average Value
Limit: (Spurious Emissions)	Frequency		Limit (dBuV/m @3m)		Remark
	30MHz-88MHz		40.00		Quasi-peak Value
	88MHz-216MHz		43.50		Quasi-peak Value
	216MHz-960MHz		46.00		Quasi-peak Value
	960MHz-1GHz		54.00		Quasi-peak Value
	Above 1GHz		54.00		Average Value
			74.00		Peak Value
Limit: (band edge)	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 Section 15.209, whichever is the lesser attenuation.				
Test setup:	Below 1GHz				
	<div></div>				
	Above 1GHz				

	
Test Procedure:	<ol style="list-style-type: none"> 1. The EUT was placed on the top of a rotating table (0.8m for below 1GHz and 1.5 meters for above 1GHz) 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.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement data:

7.2.1 Field Strength of The Fundamental Signal

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
2437.00	77.73	27.46	5.43	24.76	85.86	114.00	-30.11	Vertical
2437.00	78.49	27.46	5.43	24.76	86.62	114.00	-26.83	Horizontal

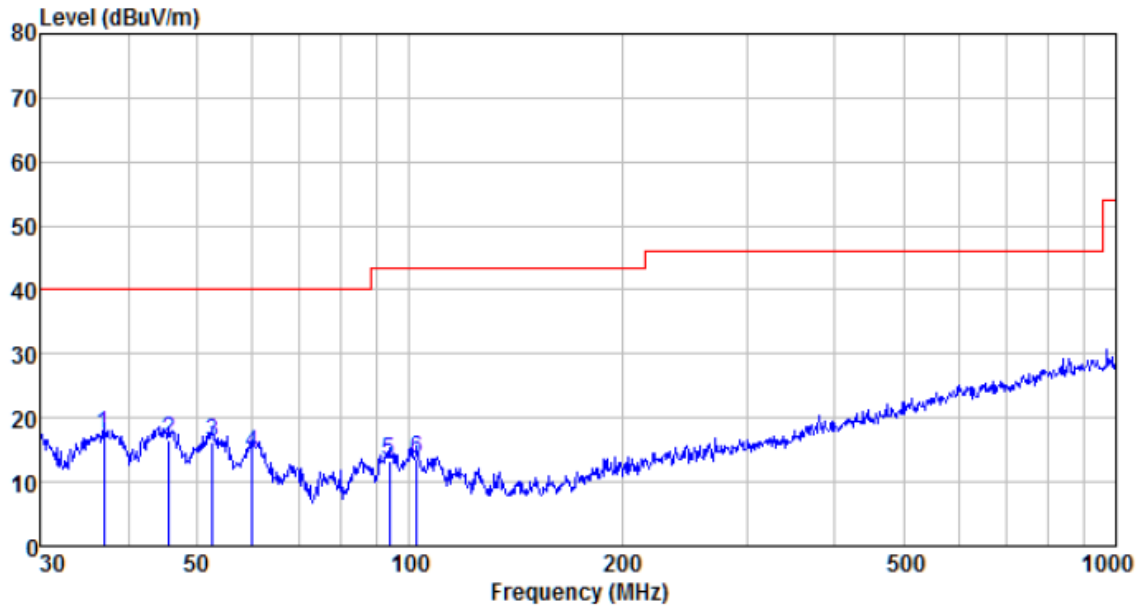
Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
2437.00	70.85	27.46	5.43	24.76	78.98	94.00	-17.98	Vertical
2437.00	71.62	27.46	5.43	24.76	79.75	94.00	-14.70	Horizontal

7.2.2 Spurious emissions

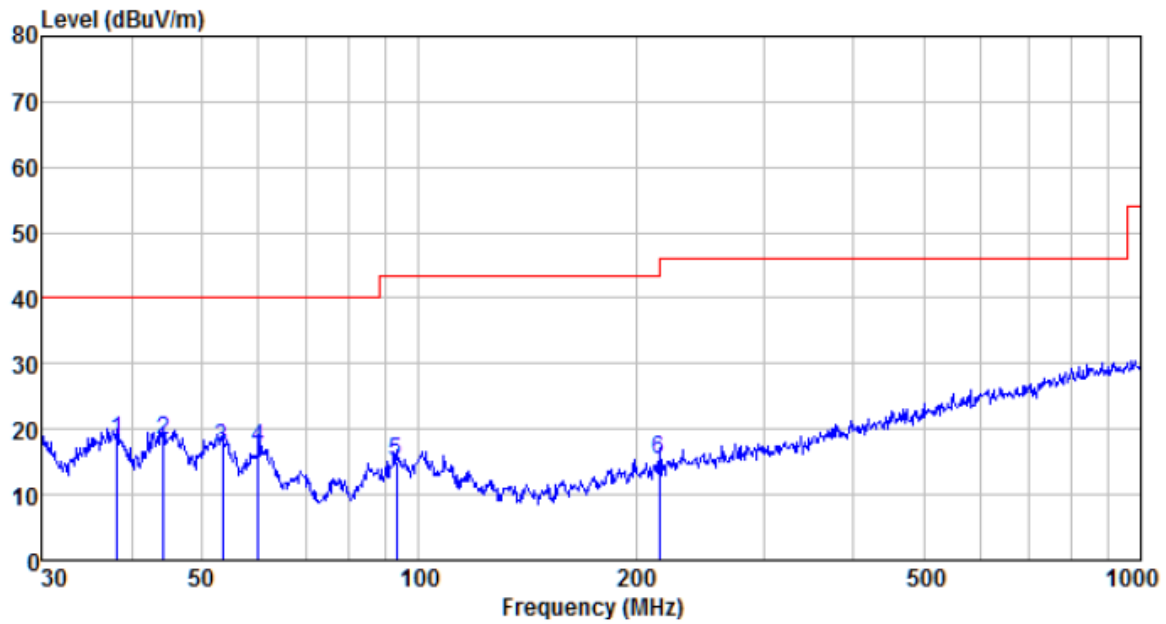
■ Below 1GHz

Horizontal :



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
36.895	35.12	11.67	0.63	30.12	17.30	40.00	-22.70	QP
45.695	33.62	12.26	0.73	30.04	16.57	40.00	-23.43	QP
52.575	33.42	12.03	0.79	29.99	16.25	40.00	-23.75	QP
59.859	32.18	11.32	0.86	29.97	14.39	40.00	-25.61	QP
93.768	30.73	11.25	1.14	29.91	13.21	43.50	-30.29	QP
102.360	30.30	11.89	1.21	29.89	13.51	43.50	-29.99	QP

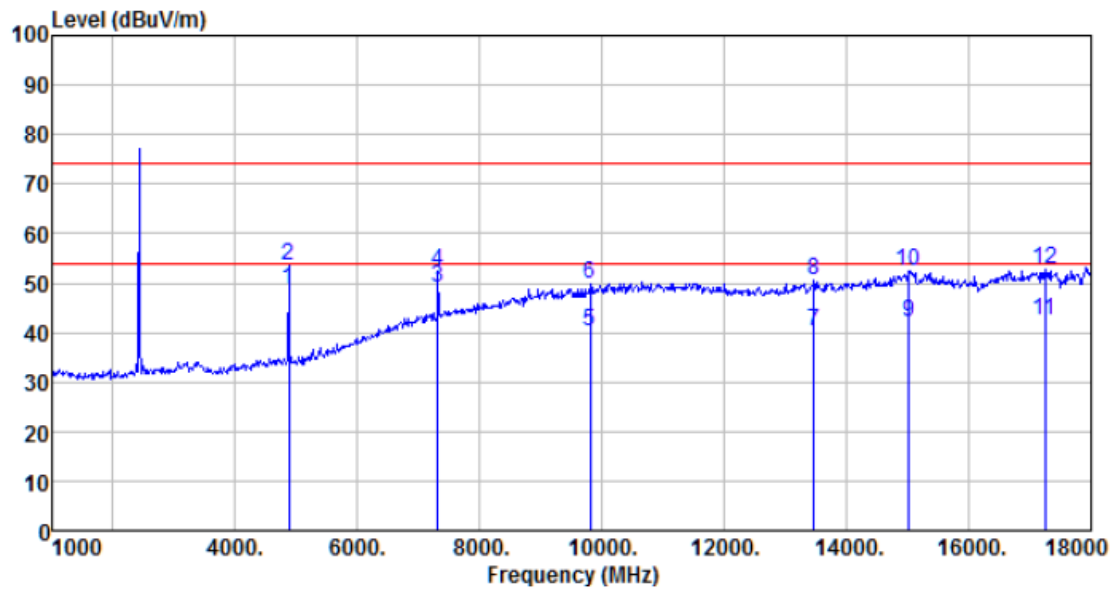
Vertical :



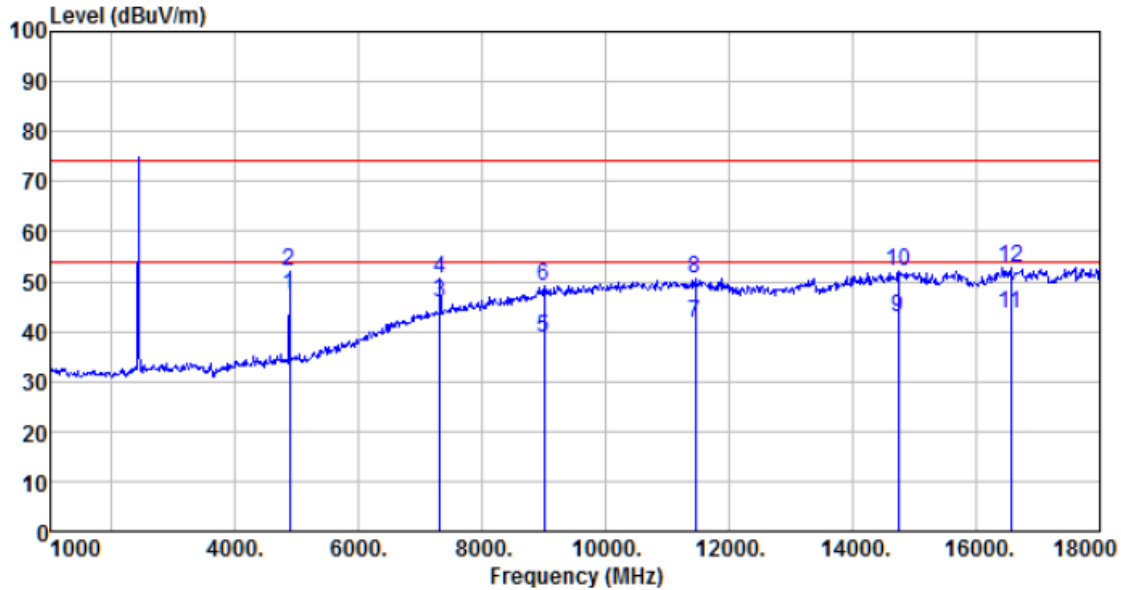
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
38.212	35.74	11.92	0.64	30.11	18.19	40.00	-21.81	QP
44.275	35.40	12.25	0.71	30.05	18.31	40.00	-21.69	QP
53.505	34.49	11.93	0.80	29.99	17.23	40.00	-22.77	QP
59.859	34.85	11.32	0.86	29.97	17.06	40.00	-22.94	QP
93.113	32.50	11.18	1.14	29.91	14.91	43.50	-28.59	QP
215.268	31.98	10.98	1.93	29.65	15.24	43.50	-28.26	QP

■ Above 1GHz

Horizontal:



Vertical:



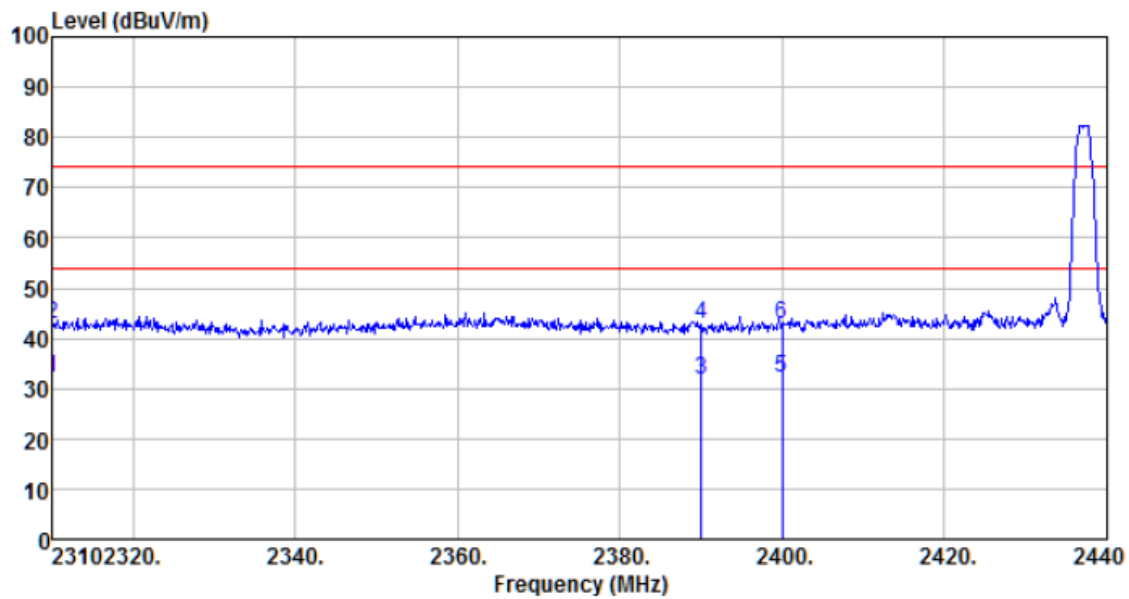
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
4876.000	45.05	31.31	8.66	37.75	47.27	54.00	-6.73	Average
4876.000	49.85	31.31	8.66	37.75	52.07	74.00	-21.93	Peak
7307.000	33.43	36.39	11.71	35.60	45.93	54.00	-8.07	Average
7307.000	37.93	36.39	11.71	35.60	50.43	74.00	-23.57	Peak
9007.000	22.06	37.50	13.65	34.50	38.71	54.00	-15.29	Average
9007.000	32.41	37.50	13.65	34.50	49.06	74.00	-24.94	Peak
11455.000	23.54	39.39	14.98	36.31	41.60	54.00	-12.40	Average
11455.000	32.47	39.39	14.98	36.31	50.53	74.00	-23.47	Peak
14736.000	20.13	40.90	17.32	35.65	42.70	54.00	-11.30	Average
14736.000	29.56	40.90	17.32	35.65	52.13	74.00	-21.87	Peak
16555.000	21.62	39.34	18.49	35.91	43.54	54.00	-10.46	Average
16555.000	30.71	39.34	18.49	35.91	52.63	74.00	-21.37	Peak

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.

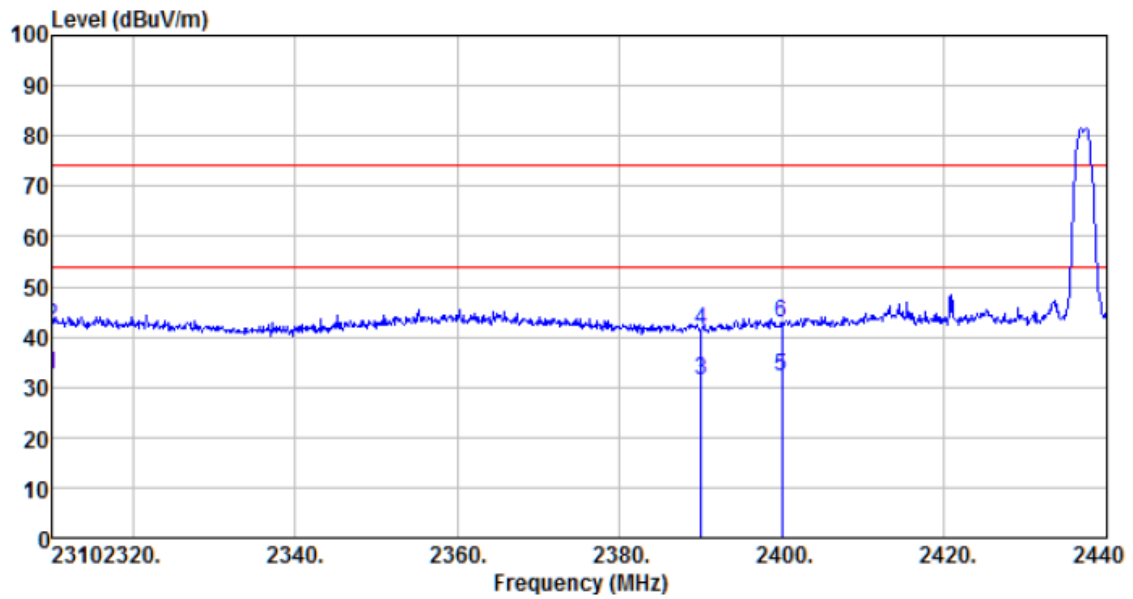
7.2.3 Bandedge emissions

Horizontal:



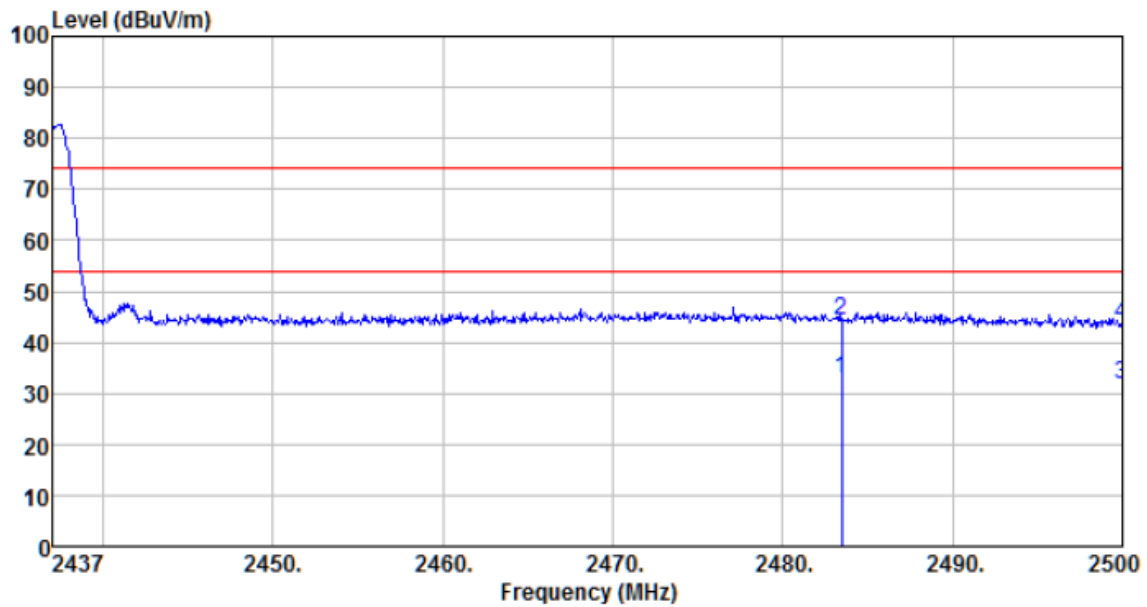
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
2310.000	24.45	27.07	5.30	24.64	32.18	54.00	-21.82	Average
2310.000	34.96	27.07	5.30	24.64	42.69	74.00	-31.31	Peak
2390.000	23.78	27.31	5.38	24.71	31.76	54.00	-22.24	Average
2390.000	34.65	27.31	5.38	24.71	42.63	74.00	-31.37	Peak
2400.000	24.05	27.31	5.39	24.72	32.03	54.00	-21.97	Average
2400.000	34.66	27.31	5.39	24.72	42.64	74.00	-31.36	Peak

Vertical:



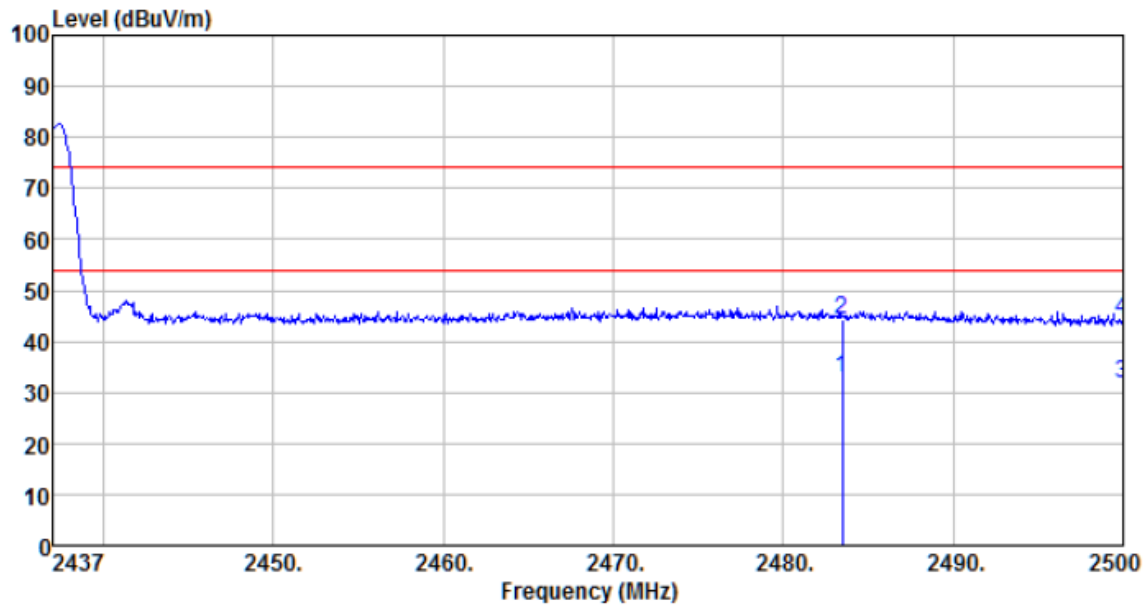
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamplifier factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
2310.000	24.60	27.07	5.30	24.64	32.33	54.00	-21.67	Average
2310.000	34.50	27.07	5.30	24.64	42.23	74.00	-31.77	Peak
2390.000	23.50	27.31	5.38	24.71	31.48	54.00	-22.52	Average
2390.000	33.52	27.31	5.38	24.71	41.50	74.00	-32.50	Peak
2400.000	24.02	27.31	5.39	24.72	32.00	54.00	-22.00	Average
2400.000	34.71	27.31	5.39	24.72	42.69	74.00	-31.31	Peak

Horizontal:



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
2483.500	24.75	27.55	5.47	24.80	32.97	54.00	-21.03	Average
2483.500	36.10	27.55	5.47	24.80	44.32	74.00	-29.68	Peak
2500.000	23.65	27.60	5.49	24.86	31.88	54.00	-22.12	Average
2500.000	35.31	27.60	5.49	24.86	43.54	74.00	-30.46	Peak

Vertical:

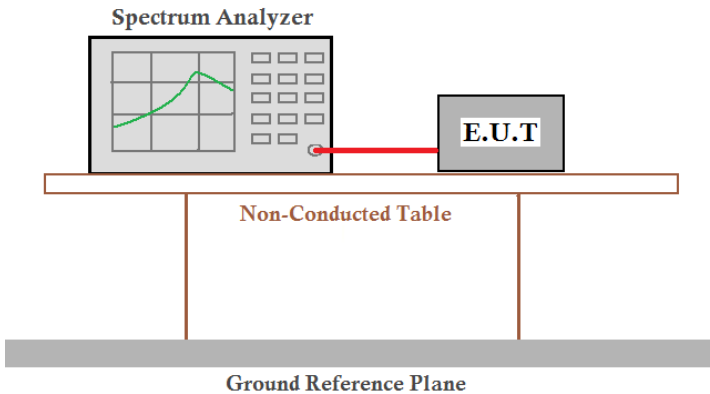


Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
2483.500	24.72	27.55	5.47	24.80	32.94	54.00	-21.06	Average
2483.500	35.97	27.55	5.47	24.80	44.19	74.00	-29.81	Peak
2500.000	23.66	27.60	5.49	24.86	31.89	54.00	-22.11	Average
2500.000	35.96	27.60	5.49	24.86	44.19	74.00	-29.81	Peak

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

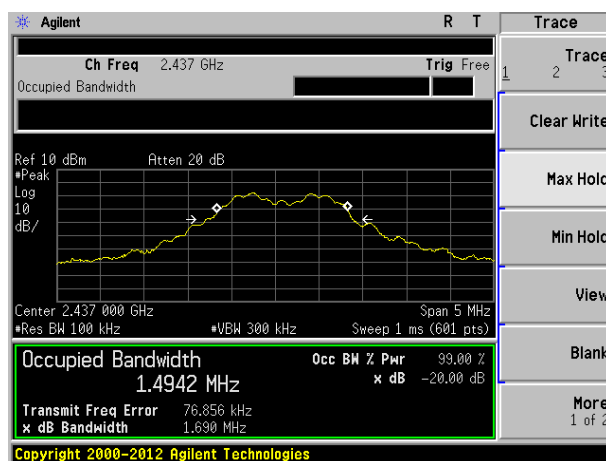
7.3 20dB Occupy Bandwidth

Test Requirement:	FCC Part15 C Section 15.249/15.215
Test Method:	ANSI C63.10:2013
Limit:	Operation Frequency range 2400MHz~2483.5MHz
Test setup:	 <p>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.</p>
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	20dB bandwidth(MHz)	Result
2437MHz	1.690	Pass

Test plot as follows:



8 Test Setup Photo

Radiated Emission

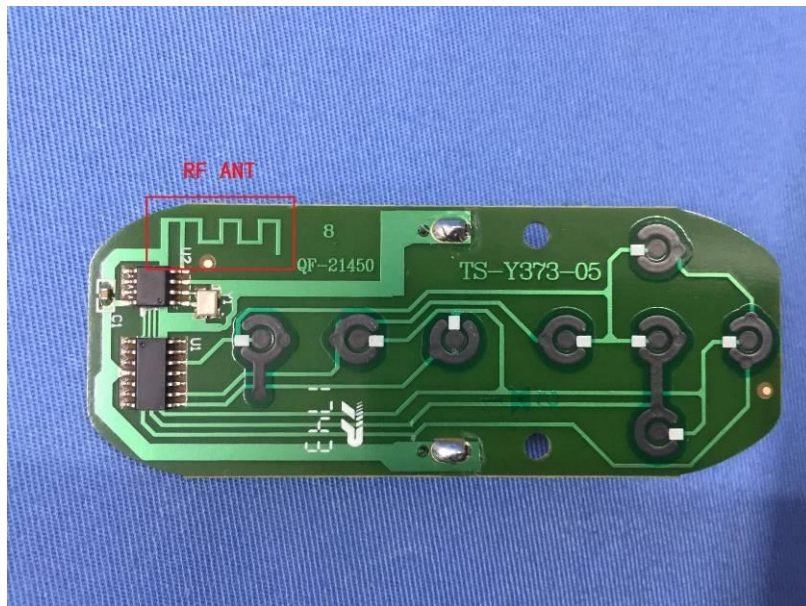
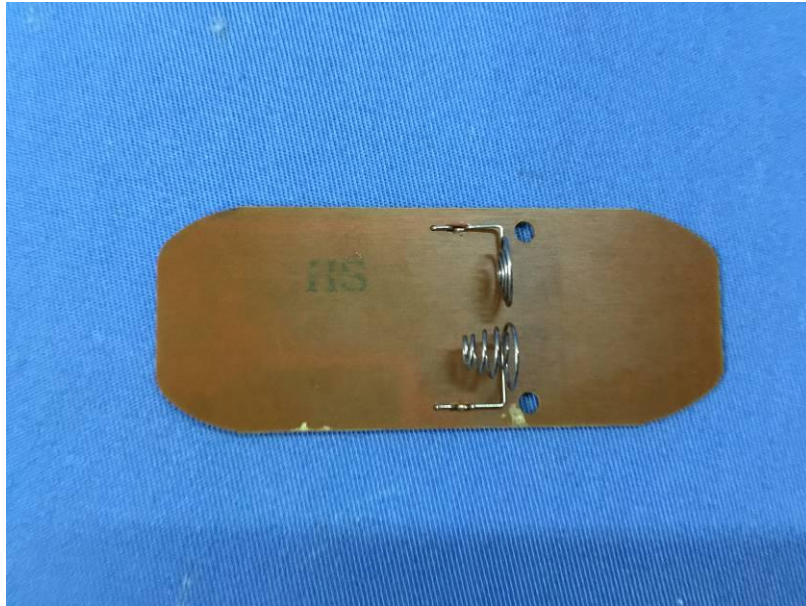


9 EUT Constructional Details









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