

TEST REPORT

Reference No...... : WTF17S0579248E
FCC ID : BRWRVOF1200
Applicant..... : Horizon Hobby, LLC
Address..... : 4105 Fieldstone Road Champaign, Illinois 61822 Unite States
Manufacturer : The same as above
Address..... : The same as above
Product Name..... : Ascent SPx RTF
Model No..... : RVOF1200
Standards : FCC CFR47 Part 15 Section 15.249: 2016
Date of Receipt sample : May 15, 2017
Date of Test : May 16 – 25, 2017
Date of Issue..... : May 26, 2017
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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3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTF17S0579248E	May 15, 2017	May 16 – 25, 2017	May 26, 2017	original	-	Valid

4 General Information

4.1 General Description of E.U.T.

Product Name	: Ascent SPx RTF
Model No.	: RVOF1200
Model Differences	: N/A
Type of Modulation	: GFSK
Frequency Range	: 2405MHz ~ 2475MHz, 3 Channels in total
The Lowest Oscillator	: 8MHz
Antenna installation	: Integrated Antenna

4.2 Details of E.U.T.

Technical Data	: DC 6V by batteries (4* 1.5V size "AAA")
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4.3 Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2405	2	2445	3	2475

4.4 Test Facility

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

- **IC – Registration No.:7760A-1**

Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration number 7760A-1, Oct 15, 2015.

- **FCC Test Site 2#– Registration No.: 328995**

Waltek Services(Shenzhen) 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 328995, December 3, 2014.

4.5 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.

Table 1 Tests carried out under FCC part 15.249

Test mode	Low channel	Middle channel	High channel
Transmitting	2405MHz	2445MHz	2475MHz

Table 2 Tests carried out under FCC part 15.209

Test Item	Test Mode
Radiated Emissions	Transmitting

5 Equipment Used during Test

5.1 Equipments List

3m Semi-anechoic Chamber for Radiation Emissions Test site 2# Test ,Software: EZ-EMC , Version:V3A1						
Item	Equipment	Manufacturer	Model No.	Serial No	Last Calibration Date	Calibration Due Date
1	Test Receiver	R&S	ESCI	101296	Apr.13, 2017	Apr.12, 2018
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	Apr.09, 2017	Apr.08, 2018
3	Amplifier	ANRITSU	MH648A	M43381	Apr.13, 2017	Apr.12, 2018
4	Cable	HUBER+SUHNER	CBL2	525178	Apr.13, 2017	Apr.12, 2018
RF Conducted Testing Test ,Software: System defaults						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	Sep.12, 2018	Sep.11, 2018
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	Sep.12, 2017	Sep.11, 2018
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	Sep.12, 2017	Sep.11, 2018

5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 5.47 dB (Horn antenna 1000M~25000MHz)

5.3 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.

6 Test Summary

Test Items	Test Requirement	Result
Radiated Emission	15.249(a) 15.209 15.205(a)	PASS
Outside of Band Emission	15.249 15.205 15.209	PASS
20dB Bandwidth	15:215(c)	PASS
Antenna Requirement	15.203	PASS
Human Exposure	1.1307(b)(1)	PASS

7 Radiation Emission Test

Test Requirement: FCC Part15 Paragraph 15.249&15.209&15.205

Test Method: ANSI 63.10: 2010;ANSI 63.4: 2014

Measurement Distance: 3m

Test Result: PASS

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	$2400/F(\text{kHz})$	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	$24000/F(\text{kHz})$	30	$100 * 24000/F(\text{kHz})$	$20\log^{(24000/F(\text{kHz}))} + 40$
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: 51.1 % RH

Atmospheric Pressure: 101.2kPa

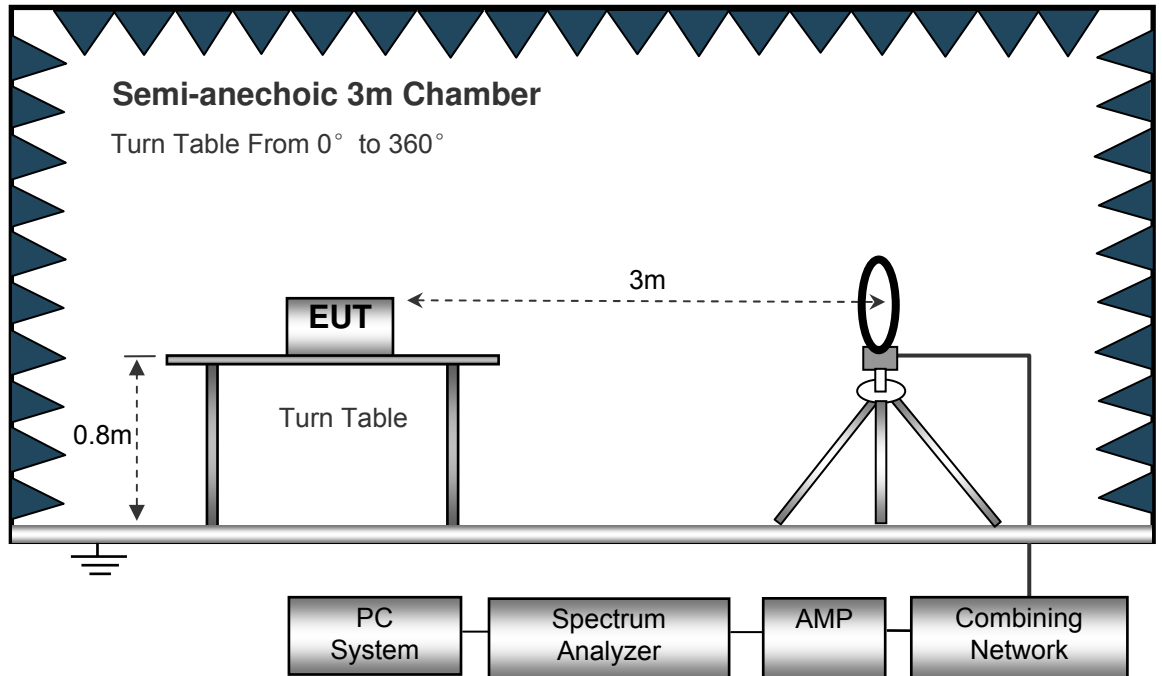
EUT Operation :

Refer to section 4.5.

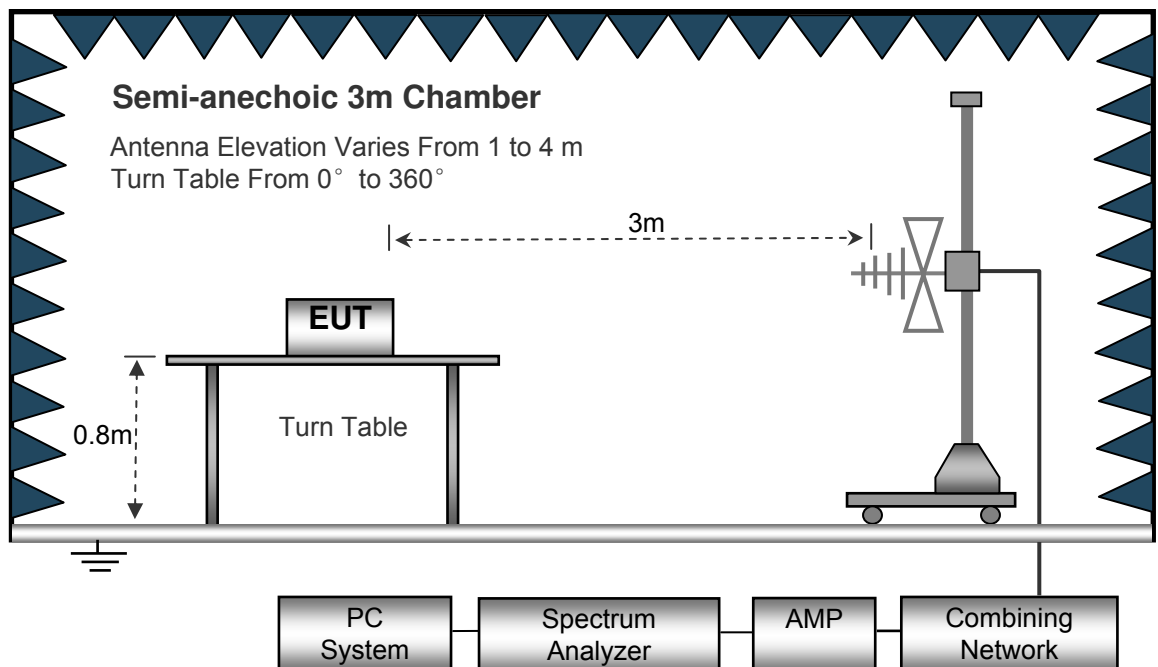
7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003.

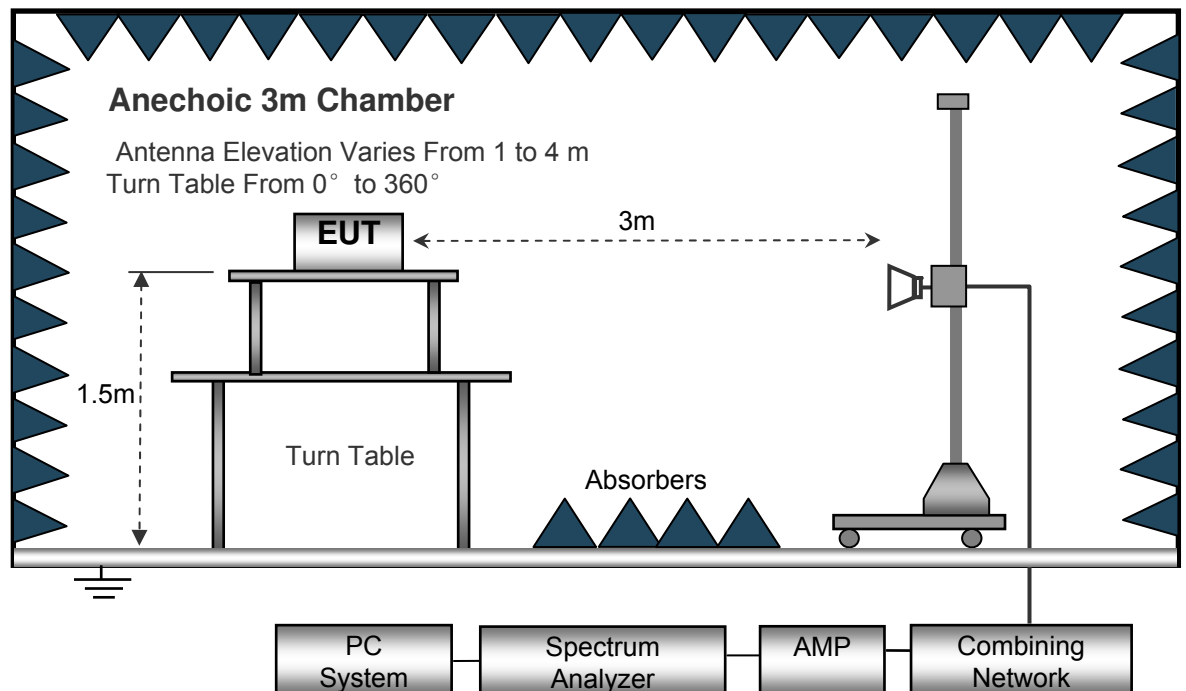
The test setup for emission measurement below 30MHz.



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



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 above 1GHz, 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. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
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 tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

7.5 Test Result

Test Frequency: 9 KHz ~ 30 MHz

The measurements were more than 20 dB below the limit and not reported.

Test Frequency: 30MHz ~ 18GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
GFSK Low Channel									
268.32	36.89	QP	188	1.0	H	-13.35	23.54	46.00	-22.46
268.32	41.33	QP	119	1.9	V	-13.35	27.98	46.00	-18.02
2405.00	102.50	PK	170	1.0	V	-11.88	90.62	114.00	-23.38
2405.00	100.30	Ave	170	1.0	V	-11.88	88.42	94.00	-5.58
4810.00	67.16	PK	264	1.0	H	-5.20	61.96	74.00	-12.04
4810.00	53.89	Ave	264	1.0	H	-5.20	48.69	54.00	-5.31
7215.00	46.21	PK	276	1.1	V	-10.89	35.71	74.00	-38.29
7215.00	39.29	Ave	276	1.1	V	-10.89	28.82	54.00	-25.18
2333.16	45.02	PK	325	1.0	V	-13.19	31.83	74.00	-42.17
2333.16	37.89	Ave	325	1.0	V	-13.19	24.70	54.00	-29.30
2382.86	44.72	PK	281	1.8	H	-13.14	31.58	74.00	-42.42
2382.86	37.88	Ave	281	1.8	H	-13.14	24.74	54.00	-29.26
2484.58	43.63	PK	123	1.7	V	-13.08	30.55	74.00	-43.45
2484.58	38.11	Ave	123	1.7	V	-13.08	25.03	54.00	-28.97

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
GFSK Middle Channel									
268.32	36.91	QP	17	1.1	H	-13.35	23.56	46.00	-22.44
268.32	40.36	QP	77	1.7	V	-13.35	27.01	46.00	-18.99
2445.00	100.28	PK	9	1.4	V	-11.71	88.57	114.00	-25.43
2445.00	97.28	Ave	9	1.4	V	-11.71	85.57	94.00	-8.43
4890.00	69.64	PK	296	1.1	H	-4.97	64.67	74.00	-9.33
4890.00	52.34	Ave	296	1.1	H	-4.97	47.37	54.00	-6.63
7335.00	45.65	PK	306	1.7	V	-13.19	32.46	74.00	-41.54
7335.00	38.15	Ave	306	1.7	V	-13.19	24.96	54.00	-29.04
2327.80	45.27	PK	302	1.5	V	-13.19	32.08	74.00	-41.92
2327.80	37.00	Ave	302	1.5	V	-13.19	23.81	54.00	-30.19
2372.86	44.29	PK	83	1.9	H	-13.14	31.15	74.00	-42.85
2372.86	37.72	Ave	83	1.9	H	-13.14	24.58	54.00	-29.42
2493.38	44.17	PK	236	1.1	V	-13.08	31.09	74.00	-42.91
2493.38	37.52	Ave	236	1.1	V	-13.08	24.44	54.00	-29.56

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
GFSK High Channel									
268.32	36.11	QP	173	1.7	H	-13.35	22.76	46.00	-23.24
268.32	41.79	QP	213	1.8	V	-13.35	28.44	46.00	-17.56
2475.00	103.03	PK	14	1.8	V	-11.59	91.44	114.00	-22.56
2475.00	101.23	Ave	14	1.8	V	-11.59	89.64	94.00	-4.36
4950.00	68.65	PK	202	1.8	H	-4.83	63.82	74.00	-10.18
4950.00	52.85	Ave	202	1.8	H	-4.83	48.02	54.00	-5.98
7425.00	46.70	PK	211	1.3	V	-13.19	33.51	74.00	-40.49
7425.00	37.77	Ave	211	1.3	V	-13.19	24.58	54.00	-29.42
2310.15	46.29	PK	101	1.4	V	-13.19	33.10	74.00	-40.90
2310.15	37.24	Ave	101	1.4	V	-13.19	24.05	54.00	-29.95
2380.38	44.37	PK	216	1.3	H	-13.14	31.23	74.00	-42.77
2380.38	38.38	Ave	216	1.3	H	-13.14	25.24	54.00	-28.76
2484.50	44.92	PK	53	1.4	V	-13.08	31.84	74.00	-42.16
2484.50	38.64	Ave	53	1.4	V	-13.08	25.56	54.00	-28.44

Test Frequency: From 18GHz to 25GHz

The measurements were more than 20 dB below the limit and not reported.

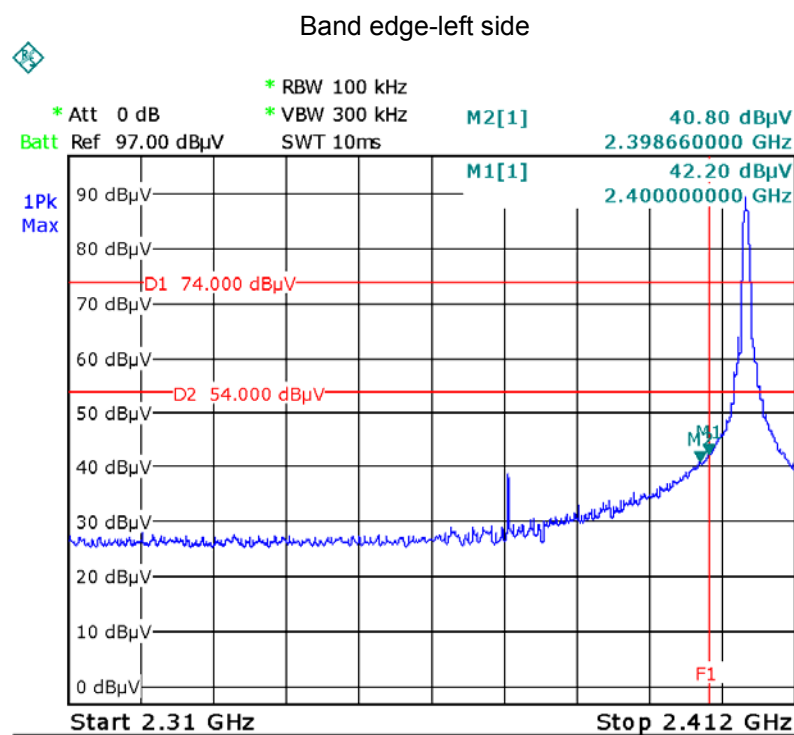
8 Outside of Band Emission

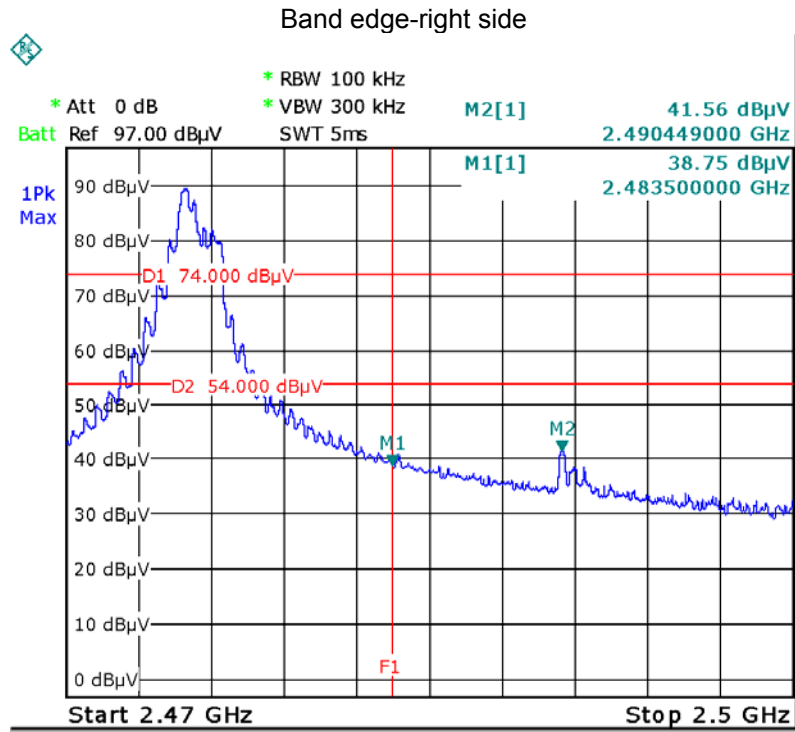
Test Requirement:	15.249(d):Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.
Test Method:	ANSI C63.10:2010
Test Mode:	Transmitting

8.1 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 = 100 kHz, VBW = 300 kHz, Sweep = auto
Detector function = peak, Trace = max hold

8.2 Test Result





9 Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.215(c)
 Test Method: ANSI C63.10:2010
 Test Mode: Transmitting

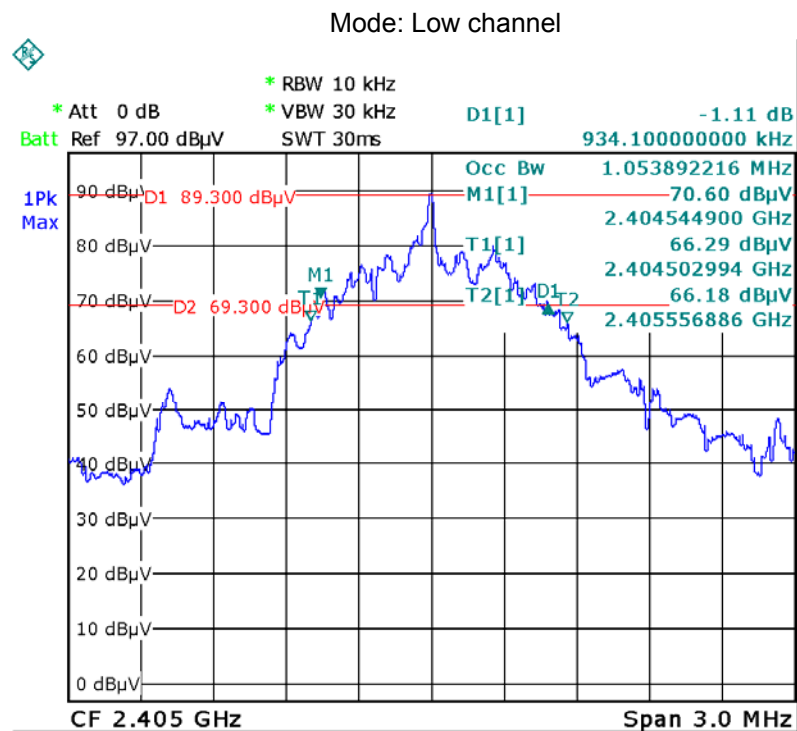
9.1 Test Procedure

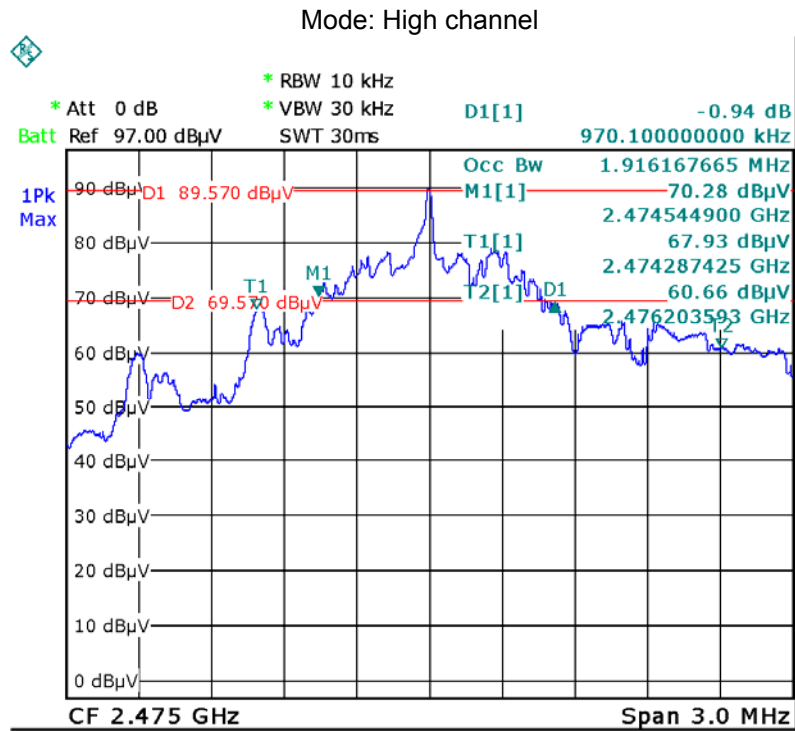
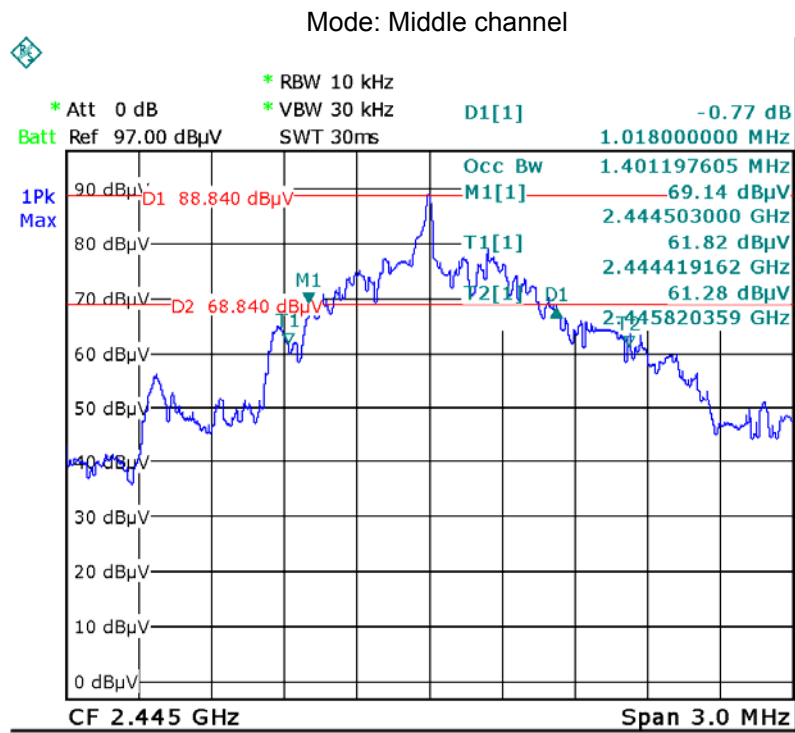
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 10 kHz, VBW = 30 kHz

9.2 Test Result

Operation mode	20dB Bandwidth (KHz)	99% Bandwidth (KHz)
Low channel	0.934MHz	1.054MHz
Middle channel	1.018MHz	1.401MHz
High channel	0.970MHz	1.916MHz

Test result plot as follows:





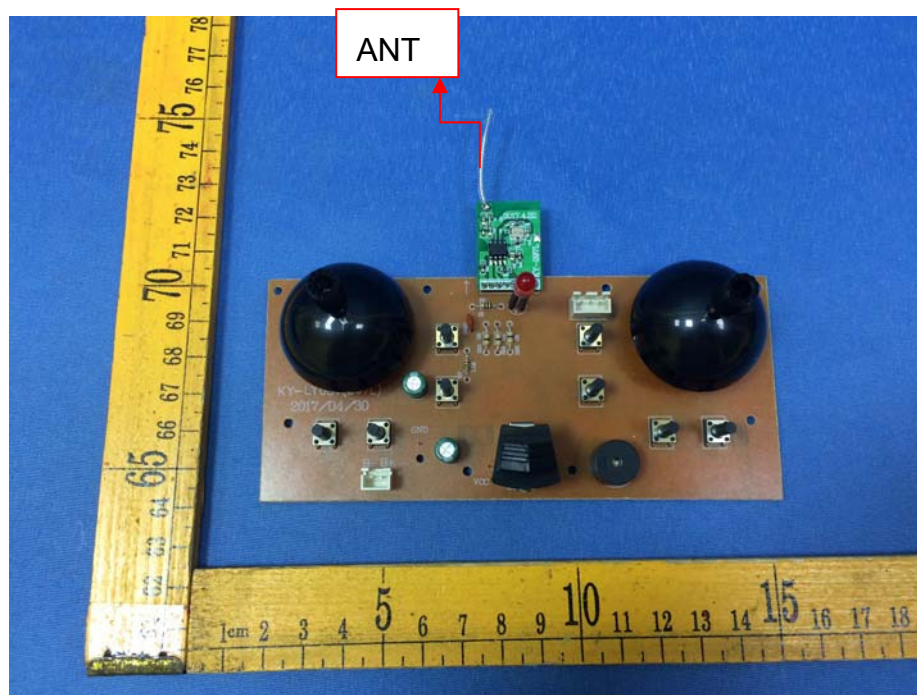
10 Antenna Requirement

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 one Integrated Antenna, the gain is 0dBi. meets the requirements of FCC 15.203.



11 Human Exposure

Test Requirement: FCC Part 1.1307

Evaluation Method: FCC Part2.1093 & 447498 D01 General RF Exposure Guidance v06

11.1 Requirements

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR and ≤ 7.5 for 10-g extremity SAR where

1. $f(\text{GHz})$ is the RF channel transmit frequency in GHz
2. Power and distance are rounded to the nearest mW and mm before calculation
3. The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

11.2 Evaluation Result

Source-based time-averaged maximum output power(dBm)	Source-based time-averaged maximum output power(mW)	Minimum test separation distance required for the exposure conditions(mm)	SAR Test Exclusion Thresholds(mW)	Evaluation Result
-3.76	0.42	5	9.53	PASS

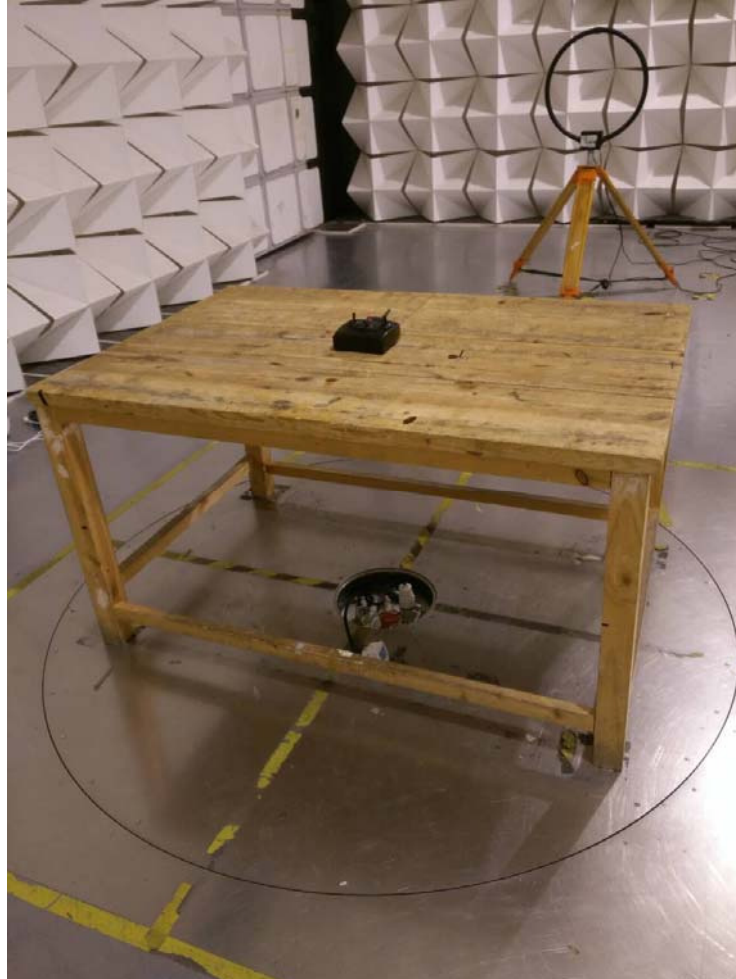
Note: the following is Source-based time-averaged maximum output power Calculation

Frequency	Source-based time-averaged maximum output power	Substituted (0dBm)	Source-based time-averaged maximum output power
(MHz)	(dB μ V/m)	(dB μ V/m)	(dBm)
2475	91.44	95.20	-3.76

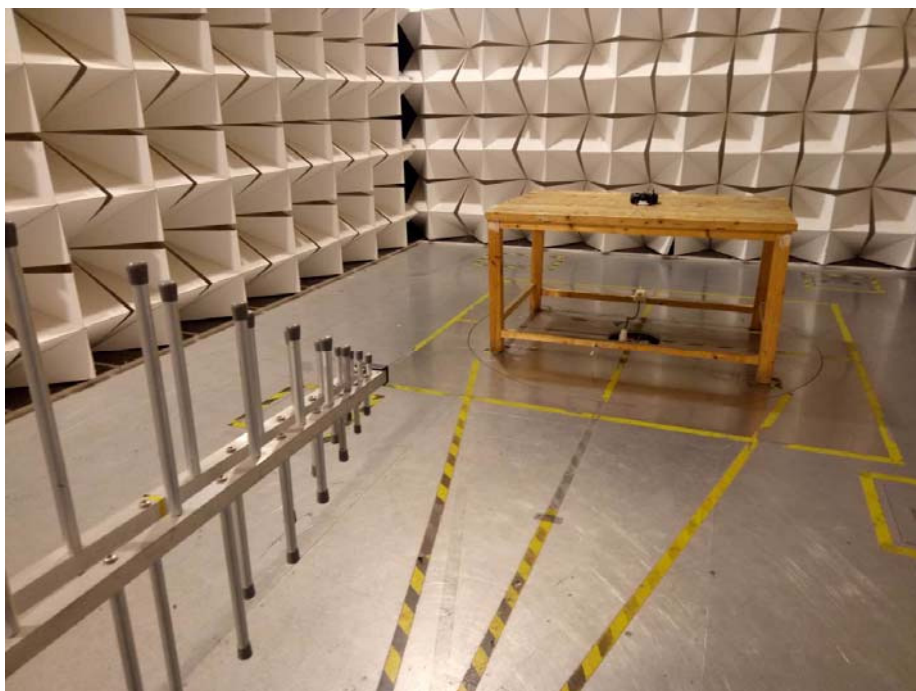
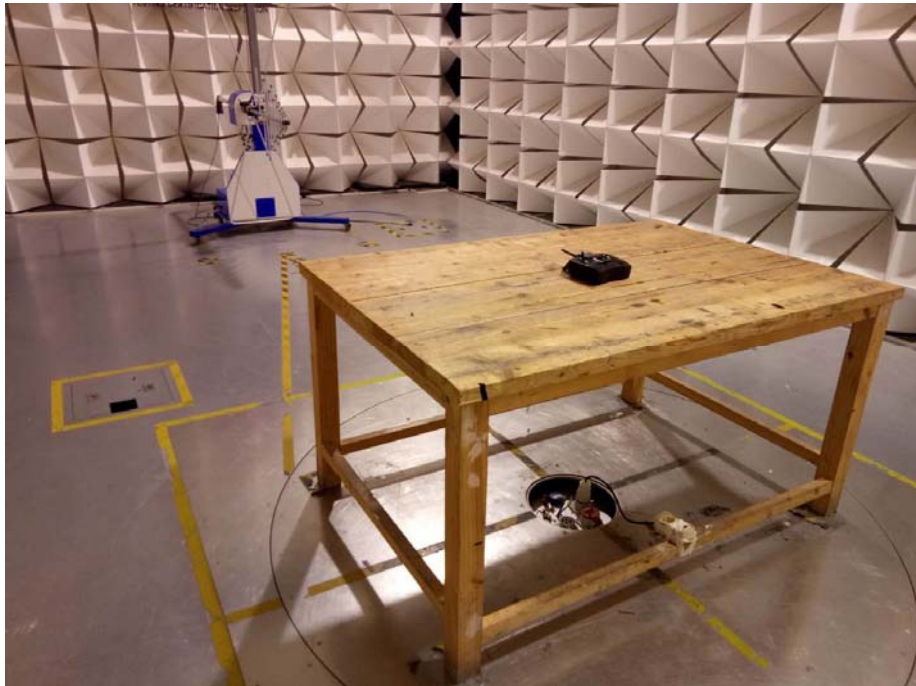
12 Photographs- Model RVOF1200 Test Setup Photos

12.1 Photograph - Radiation Emission

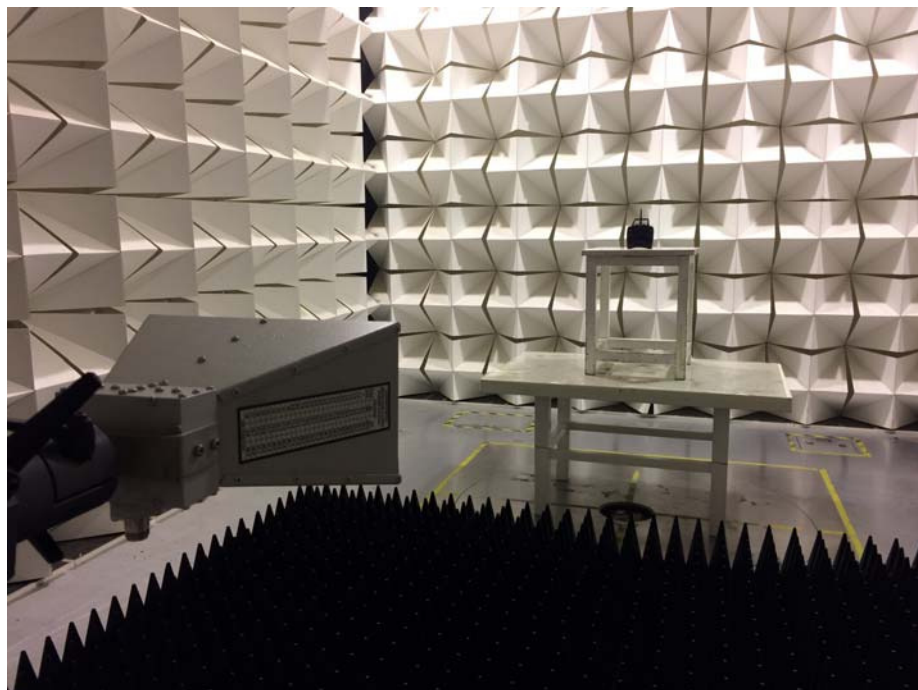
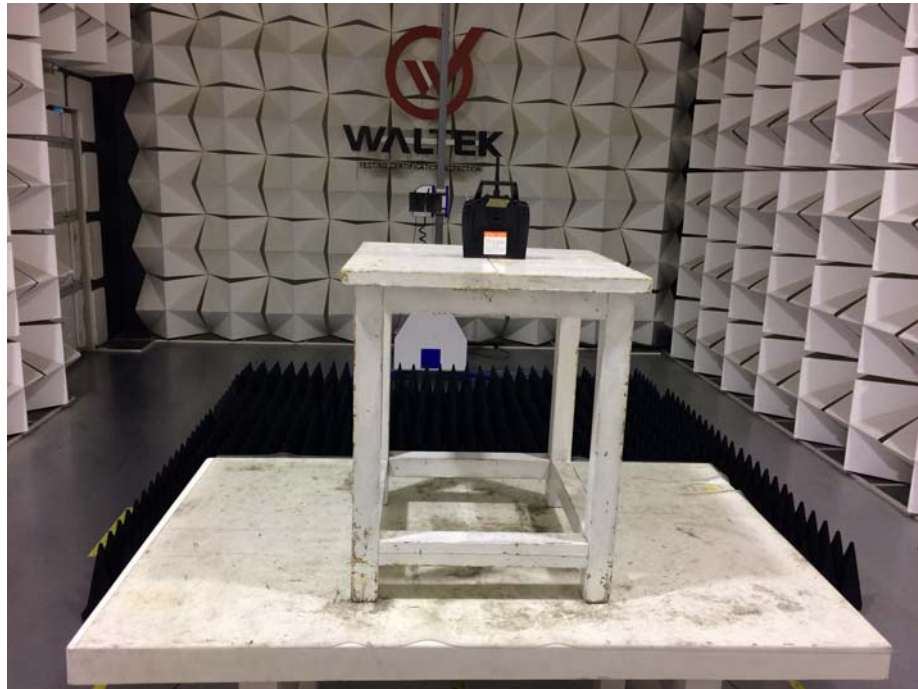
Test frequency from 9 KHz to 30MHz at test site 2#



Test frequency from 30MHz to 1GHz at test site 2#



Test frequency above 1GHz at test site 2#



13 Photographs - Constructional Details

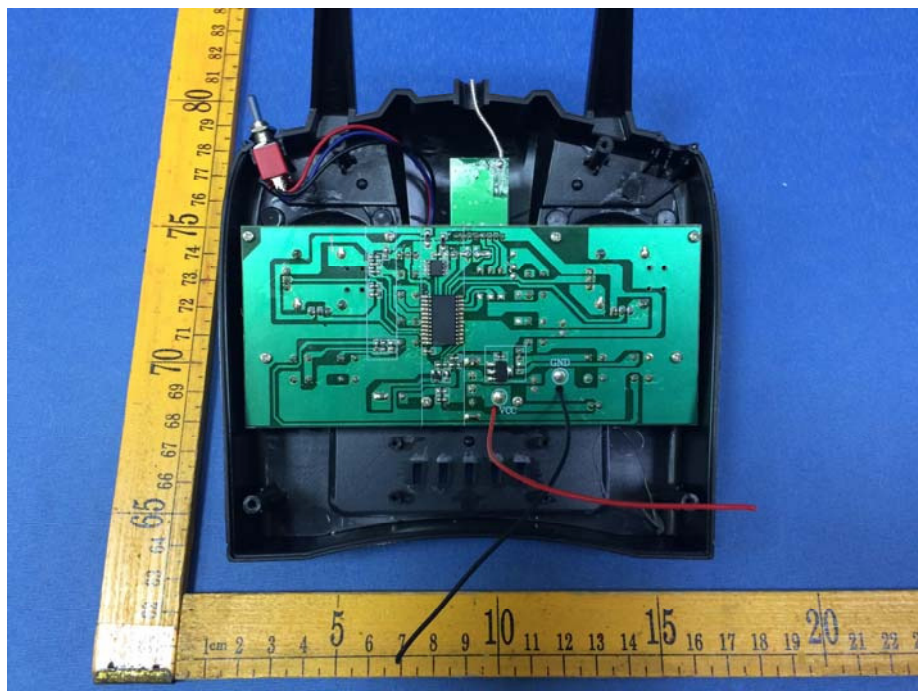
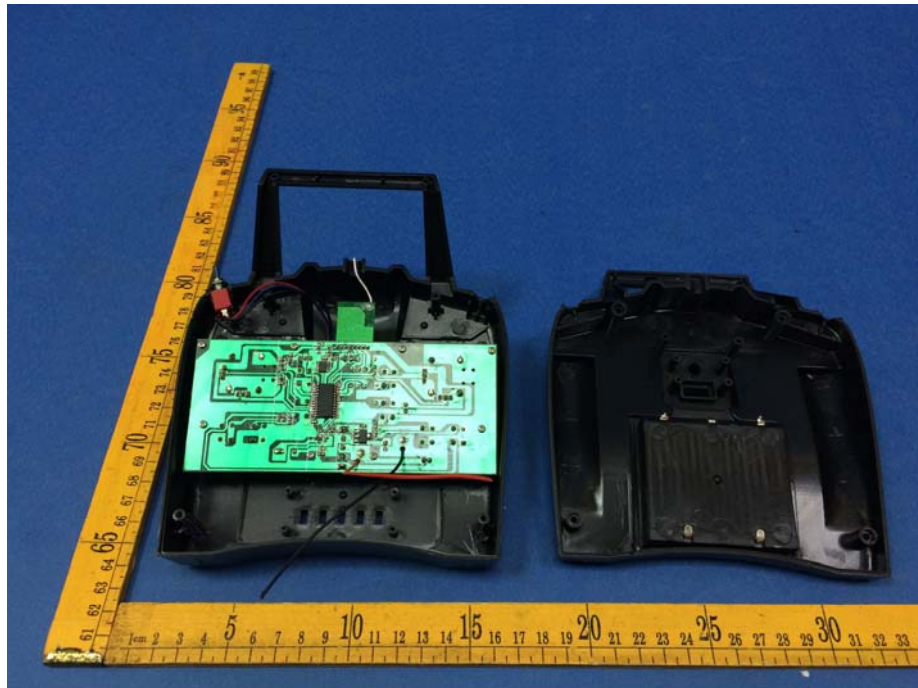
13.1 Photographs –Model RVOF1200 External Photos

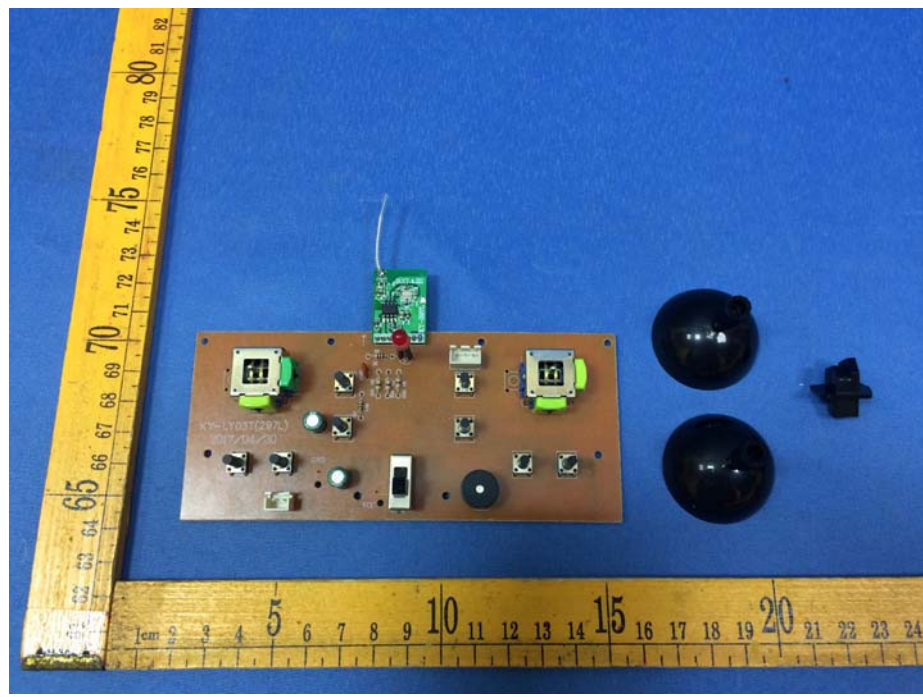
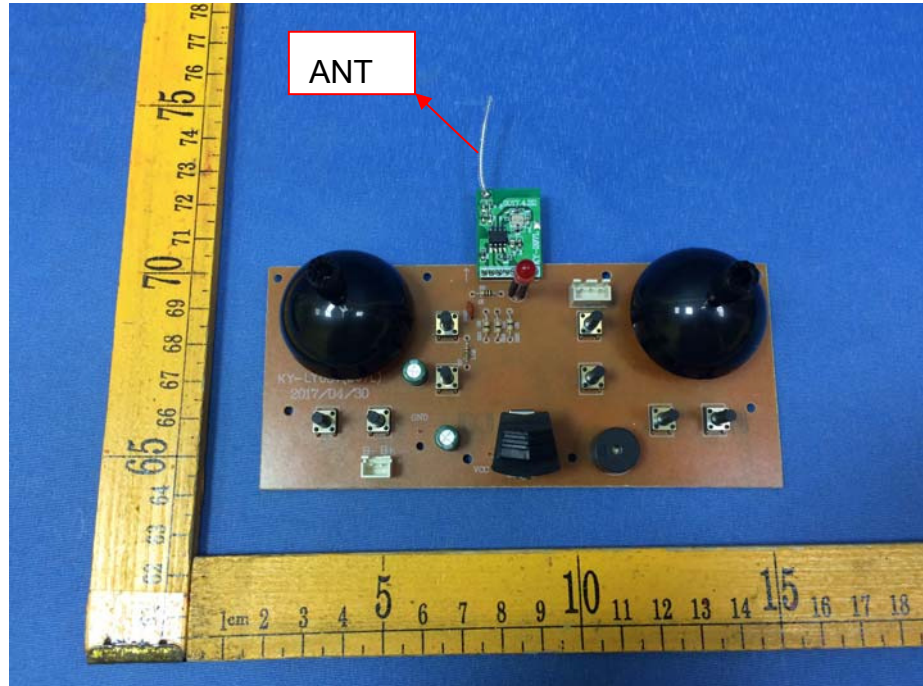


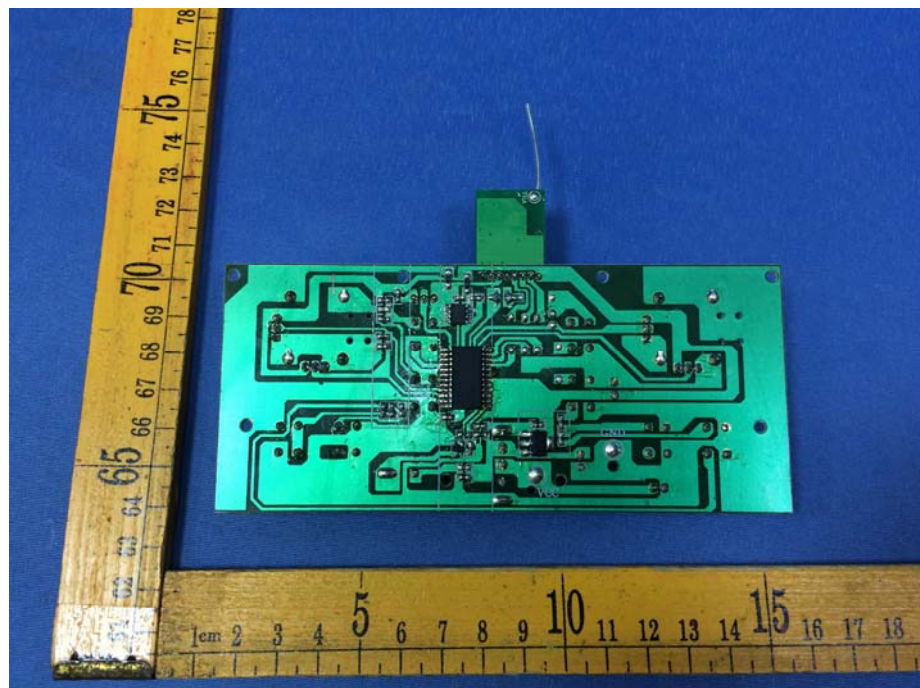
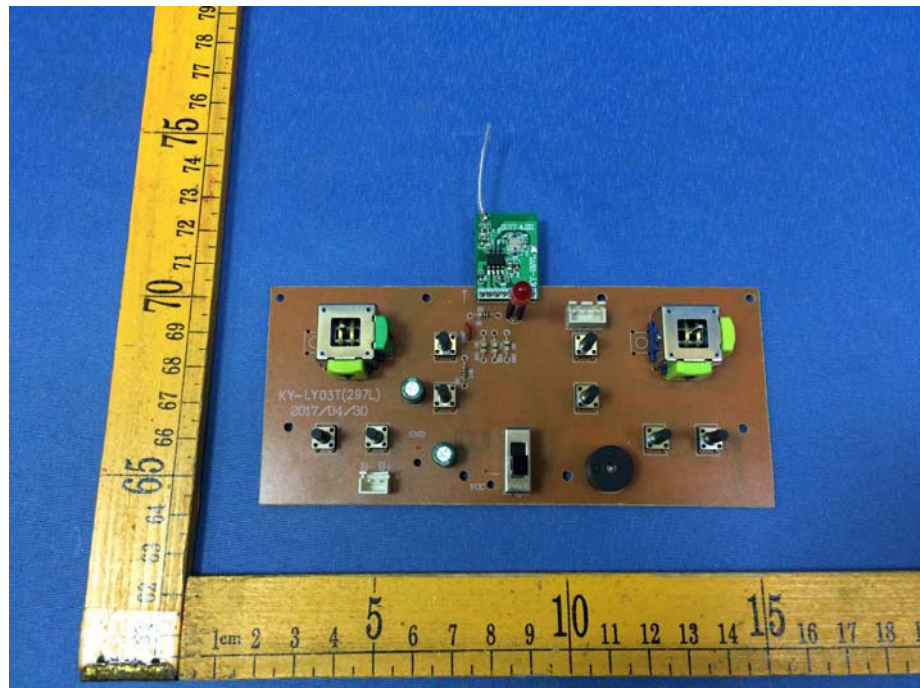


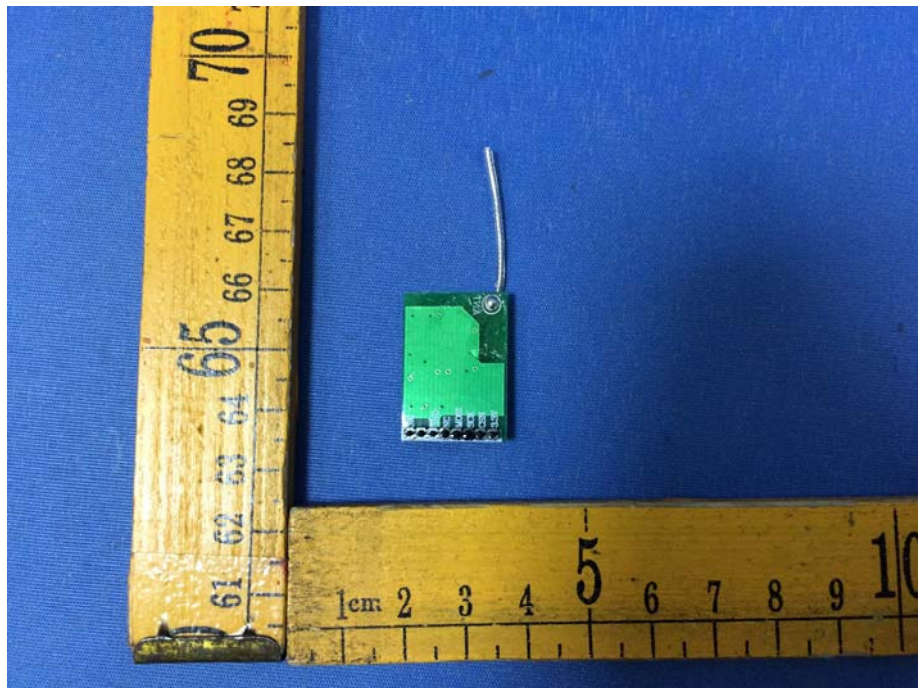
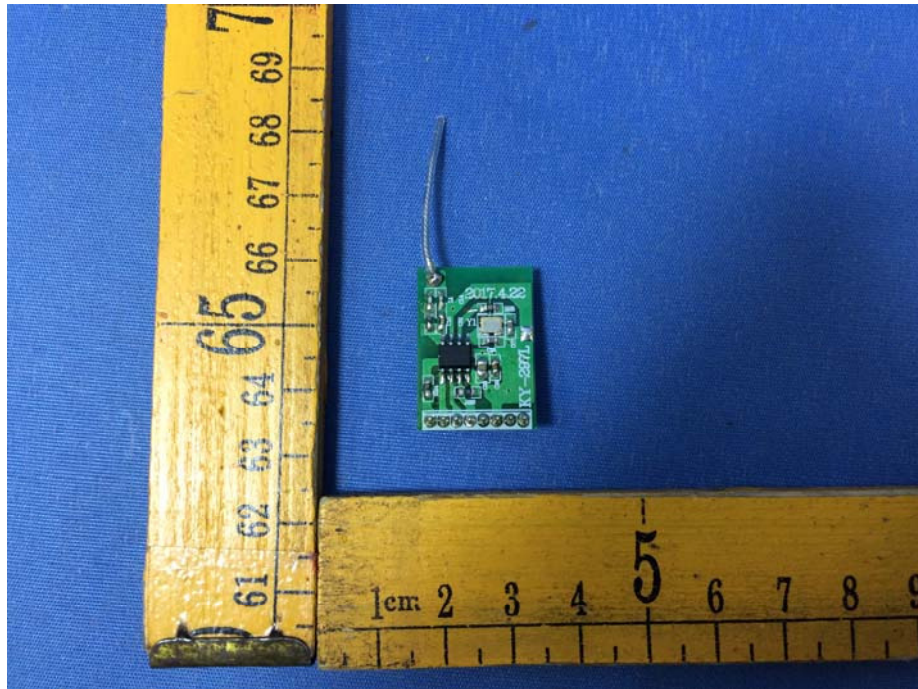


13.2 Photographs – Model RVOF1200 Internal Photos









====End of Report====