

TEST REPORT

Reference No. : WTF19F04024494W
FCC ID..... : 2ASZJ-VP010005
Applicant : JSP GROUP INTL BVBA
Address : GEELSEWEG 80 - 2250 OLEN - BELGIUM
Product : VARIOPROP S2R
Model(s)..... : VP-010-005
Standards : FCC CFR47 Part 15 Section 15.249:2017
Date of Receipt sample.... : 2019-04-22
Date of Test : 2019-05-17
Date of Issue : 2019-05-17
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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Approved by:

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Yellow Huang / Manager

1 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

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

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3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTF19F04024494W	2019-04-22	2019-05-17	2019-05-17	Original	-	Valid

4 General Information

4.1 General Description of E.U.T.

Product : VARIOPROP S2R
Model(s) : VP-010-005
Model Differences : N/A
Type of Modulation : GFSK
Frequency Range : 2410MHz, 2445MHz, 2480MHz
Antenna installation : Internal Integrated Antenna
Antenna Gain : 0dBi

4.2 Details of E.U.T.

Ratings : Battery 4*1.5V AA

4.3 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.

Table 1 Tests carried out under FCC part 15.249

Test mode	Low channel	Middle channel	High channel
Transmitting	2410MHz	2445MHz	2480MHz

4.4 Test Facility

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

- **IC – Registration No.: 21895-1**

Waltek Services (Foshan) Co., Ltd. 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 IC number:21895-1, Nov. 14, 2016.

- **FCC – Registration No.: 820106**

Waltek Services (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 Services (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 Services (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.

5 Equipment Used during Test

5.1 Equipment List

3m Semi-anechoic Chamber for Spurious Emission						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	EMI TEST RECEIVER	RS	ESR7	101566	2019-01-18	2020-01-17
2	Spectrum Analyzer	Agilent	N9020A	MY48011796	2019-01-26	2020-01-25
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9162	9162-117	2019-02-22	2020-02-21
4	Coaxial Cable (below 1GHz)	H+S	CBL3-NN-12+3 m	214NN320	2019-01-10	2020-01-09
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	01561	2019-04-28	2020-04-27
6	Broadband Preamplifier (Above 1GHz)	Lunar E M	LNA1G18-40	20160501002	2019-04-03	2020-04-02
7	Coaxial Cable (above 1GHz)	Times-Microwave	CBL5-NN	-	2019-01-10	2020-01-09
RF Conducted test						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Environmental Chamber	KSON	THS-D4C-100	5244K	2019-01-10	2020-01-09
2	Spectrum Analyzer	Agilent	N9020A	MY48011796	2019-01-26	2020-01-25
3	ESG VECTOR SIGNAL GENERATOR	Agilent	N5182A	MY50141533	2019-03-03	2020-03-02
4	EXG Analog Signal Generator	Agilent	N5181A	MY48080720	2019-01-26	2020-01-25
5	RF Control Unit	CHANGCHUANG	JS0806-2	-	2019-04-10	2020-04-09

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	± 4.56 dB(Bilog antenna 30M~1000MHz)
	± 4.96 dB(Horn antenna 1000M~6000MHz)
	± 5.02 dB(Horn antenna 6000M~25000MHz)

6 Radiation Emission Test

Test Requirement.....: FCC Part15 Paragraph 15.249&15.209&15.205

Test Method.....: ANSI 63.10:2010

Measurement Distance.....: 3m

Test Result.....: PASS

Limit:

15.249(a)

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

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	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	24000/F(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 log₁₀ RF Voltage(uV)

6.1 EUT Operation

Operating Environment:

Temperature	24.2 °C
Humidity	60.8 % RH
Atmospheric Pressure	101.2kPa
Test Voltage	DC 6V by Batteries

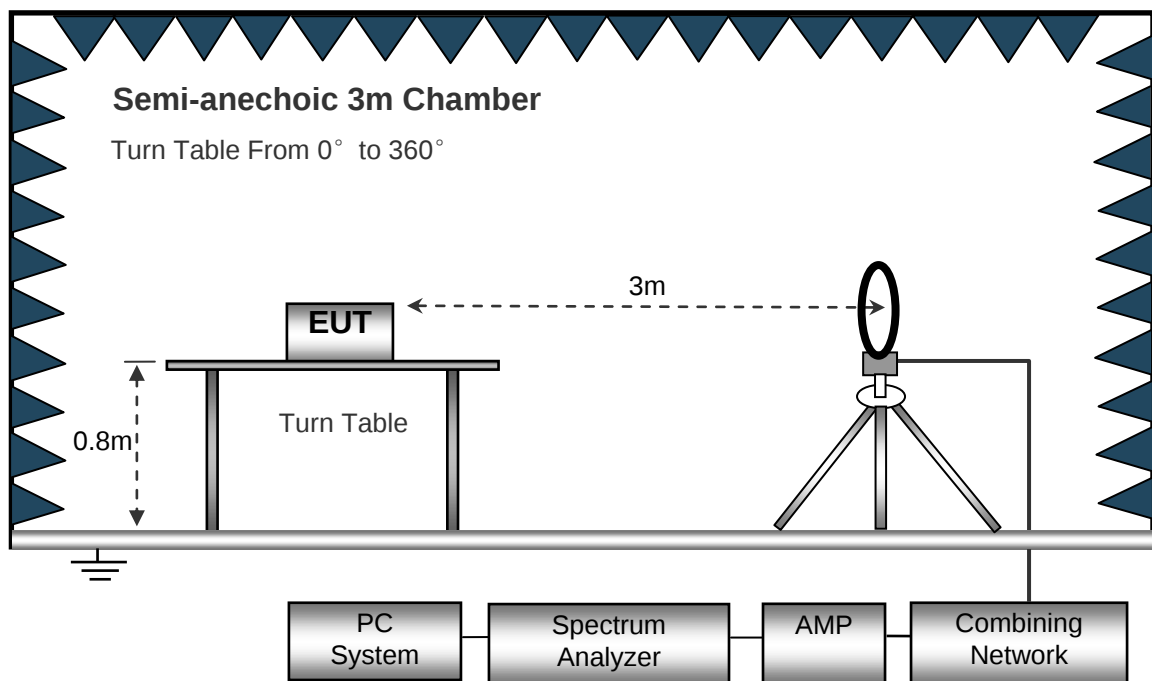
EUT Operation:

The test was performed in Transmitting mode.

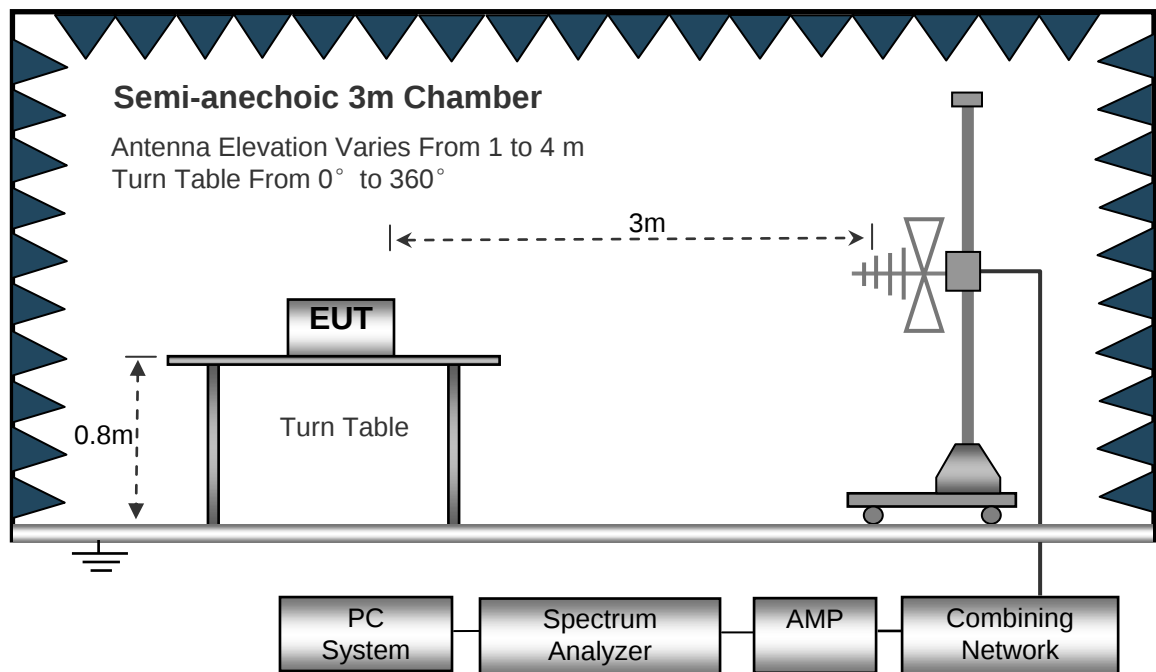
6.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI 63.10:2010.

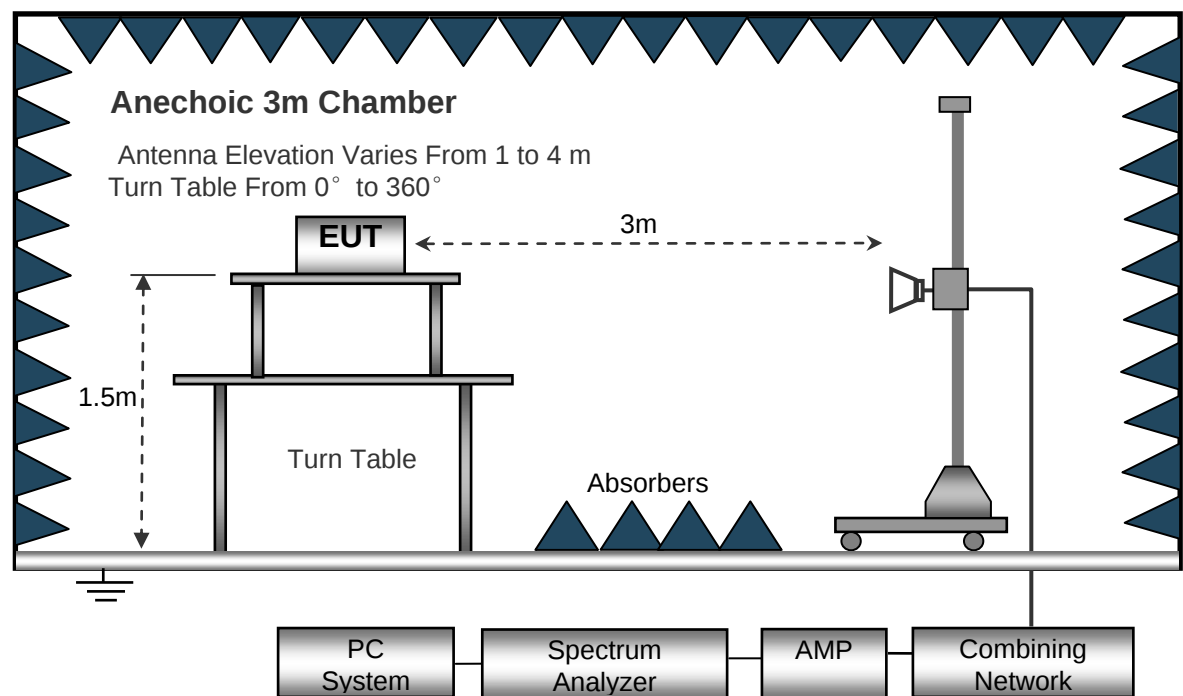
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



6.3 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

6.4 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.

6.5 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 (MHz)	Receiver Reading (dBμV/m)	Detector (PK/QP/AVG)	Turn table Angle (°)	RX Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249	
				Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
GFSK_Low Channel									
115.73	29.34	QP	118	1.2	H	10.53	18.81	46	-27.19
115.73	28.00	QP	164	1.8	V	10.53	17.47	46	-28.53
2410.00	68.61	PK	137	1.6	H	-12.33	80.94	114	-33.06
2410.00	70.68	PK	172	1.6	V	-12.33	83.01	114	-30.99
3849.38	31.57	PK	185	1.9	H	-8.92	40.49	74	-33.51
3849.38	34.82	PK	129	1.6	V	-8.92	43.74	74	-30.26
4818.75	36.14	PK	221	1.6	H	-6.68	42.82	74	-31.18
4818.75	42.32	PK	262	1.1	V	-6.68	49.00	74	-25.00
6023.13	38.31	PK	259	1.7	H	-3.95	42.26	74	-31.74
6023.13	43.47	PK	169	1.9	V	-3.95	47.42	74	-26.58
6933.75	43.07	PK	202	1.7	H	-2.20	45.27	74	-28.73
6933.75	50.19	PK	110	1.5	V	-2.20	52.39	74	-21.61

$AV = \text{Peak} + 20\log_{10}(\text{duty cycle}) = \text{Peak} + (-16.72)$ [refer to section 7 for more detail]

Frequency (MHz)	Peak (dBμV/m)	Turn table Angle (°)	RX Antenna		Duty Cycle Factor (dB)	AV (dBμV/m)	FCC Part 15.249	
			Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
2410.00	80.94	137	1.6	H	-16.72	64.22	94	-29.78
2410.00	83.01	172	1.6	V	-16.72	66.29	94	-27.71
3849.38	40.49	185	1.9	H	-16.72	23.77	54	-30.23
3849.38	43.74	129	1.6	V	-16.72	27.02	54	-26.98
4818.75	42.82	221	1.6	H	-16.72	26.10	54	-27.90
4818.75	49.00	262	1.1	V	-16.72	32.28	54	-21.72
6023.13	42.26	259	1.7	H	-16.72	25.54	54	-28.46
6023.13	47.42	169	1.9	V	-16.72	30.70	54	-23.30
6933.75	45.27	202	1.7	H	-16.72	28.55	54	-25.45
6933.75	52.39	110	1.5	V	-16.72	35.67	54	-18.33

Frequency (MHz)	Receiver Reading (dBμV/m)	Detector (PK/QP/AVG)	Turn table Angle (°)	RX Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249	
				Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
GFSK_Middle Channel									
153.20	27.73	QP	207	1.5	H	10.50	17.23	46	-28.77
153.20	30.49	QP	239	1.1	V	10.50	19.99	46	-26.01
2444.38	68.61	PK	97	1.7	H	-12.27	80.88	114	-33.12
2444.38	70.68	PK	216	1.2	V	-12.27	82.95	114	-31.05
3261.88	29.81	PK	265	1.5	H	-10.01	39.82	74	-34.18
3261.88	33.13	PK	86	1.6	V	-10.01	43.14	74	-30.86
3878.75	32.21	PK	105	1.8	H	-8.86	41.07	74	-32.93
3878.75	53.48	PK	210	1.7	V	-8.86	62.34	74	-11.66
4877.50	42.99	PK	145	1.2	H	-6.51	49.50	74	-24.50
4877.50	40.38	PK	200	1.5	V	-6.51	46.89	74	-27.11
5905.63	38.87	PK	153	1.1	H	-4.35	43.22	74	-30.78
5905.63	45.37	PK	227	1.8	V	-4.35	49.72	74	-24.28

AV=Peak+20Log10(duty cycle)=Peak+(-16.71)[refer to section 7 for more detail]

Frequency (MHz)	Peak (dBμV/m)	Turn table Angle (°)	RX Antenna		Duty Cycle Factor (dB)	AV (dBμV/m)	FCC Part 15.249	
			Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
2444.38	80.88	97	1.7	H	-16.71	64.17	94	-29.83
2444.38	82.95	216	1.2	V	-16.71	66.24	94	-27.76
3261.88	39.82	265	1.5	H	-16.71	23.11	54	-30.89
3261.88	43.14	86	1.6	V	-16.71	26.43	54	-27.57
3878.75	41.07	105	1.8	H	-16.71	24.36	54	-29.64
3878.75	62.34	210	1.7	V	-16.71	45.63	54	-8.37
4877.5	49.5	145	1.2	H	-16.71	32.79	54	-21.21
4877.5	46.89	200	1.5	V	-16.71	30.18	54	-23.82
5905.63	43.22	153	1.1	H	-16.71	26.51	54	-27.49
5905.63	49.72	227	1.8	V	-16.71	33.01	54	-20.99

Frequency (MHz)	Receiver Reading (dBμV/m)	Detector (PK/QP/AVG)	Turn table Angle (°)	RX Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249	
				Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
GFSK_High Channel									
275.16	35.20	QP	126	1.8	H	15.51	19.69	46	-26.31
275.16	34.65	QP	207	1.5	V	15.51	19.14	46	-26.86
2479.75	69.01	PK	289	1.9	H	-12.22	81.23	114	-32.77
2479.75	70.96	PK	148	1.8	V	-12.22	83.18	114	-30.82
3555.63	30.80	PK	279	1.5	H	-9.43	40.23	74	-33.77
3555.63	32.16	PK	205	1.3	V	-9.43	41.59	74	-32.41
4378.13	32.44	PK	127	1.7	H	-7.83	40.27	74	-33.73
4378.13	35.84	PK	148	1.1	V	-7.83	43.67	74	-30.33
4965.63	41.73	PK	254	1.7	H	-6.27	48.00	74	-26.00
4965.63	57.54	PK	144	1.2	V	-6.27	63.81	74	-10.19
6669.38	42.30	PK	223	1.1	H	-2.83	45.13	74	-28.87
6669.38	45.00	PK	163	1.2	V	-2.83	47.83	74	-26.17

AV=Peak+20Log10(duty cycle)=Peak+(-16.69)[refer to section 7 for more detail]

Frequency (MHz)	Peak (dBμV/m)	Turn table Angle (°)	RX Antenna		Duty Cycle Factor (dB)	AV (dBμV/m)	FCC Part 15.249	
			Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
2479.75	81.23	289	1.9	H	-16.69	64.54	94	-29.46
2479.75	83.18	148	1.8	V	-16.69	66.49	94	-27.51
3555.63	40.23	279	1.5	H	-16.69	23.54	54	-30.46
3555.63	41.59	205	1.3	V	-16.69	24.90	54	-29.10
4378.13	40.27	127	1.7	H	-16.69	23.58	54	-30.42
4378.13	43.67	148	1.1	V	-16.69	26.98	54	-27.02
4965.63	48	254	1.7	H	-16.69	31.31	54	-22.69
4965.63	63.81	144	1.2	V	-16.69	47.12	54	-6.88
6669.38	45.13	223	1.1	H	-16.69	28.44	54	-25.56
6669.38	47.83	163	1.2	V	-16.69	31.14	54	-22.86

Test Frequency: From 18GHz to 25GHz

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

7 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

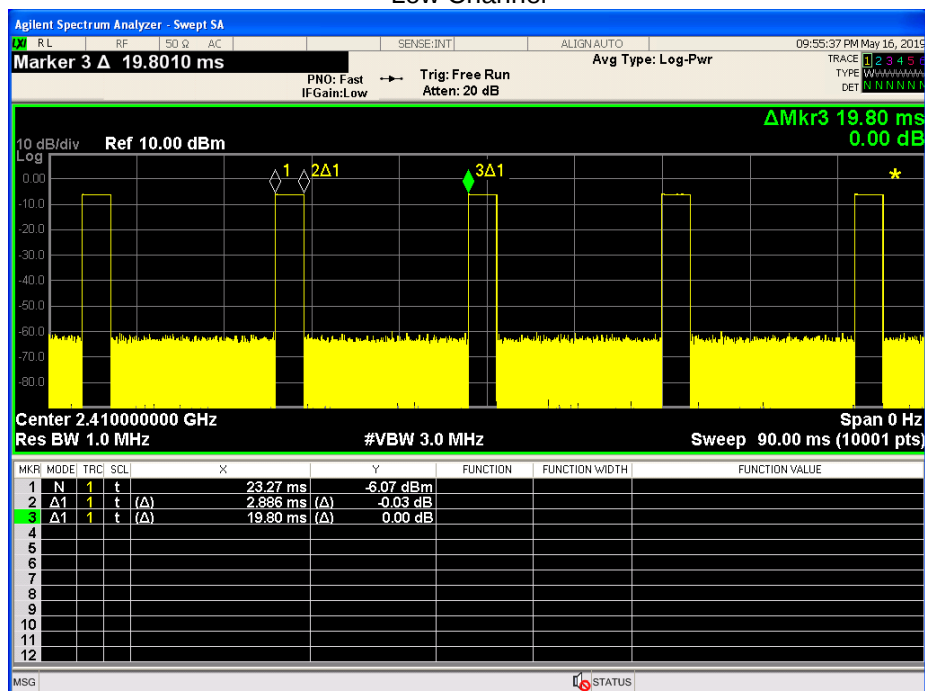
Duty Cycle(%)=Total On interval in a complete pulse train/ Length of a complete pulse train * %

Duty Cycle Correction Factor(dB)=20 * Log₁₀(Duty Cycle(%))

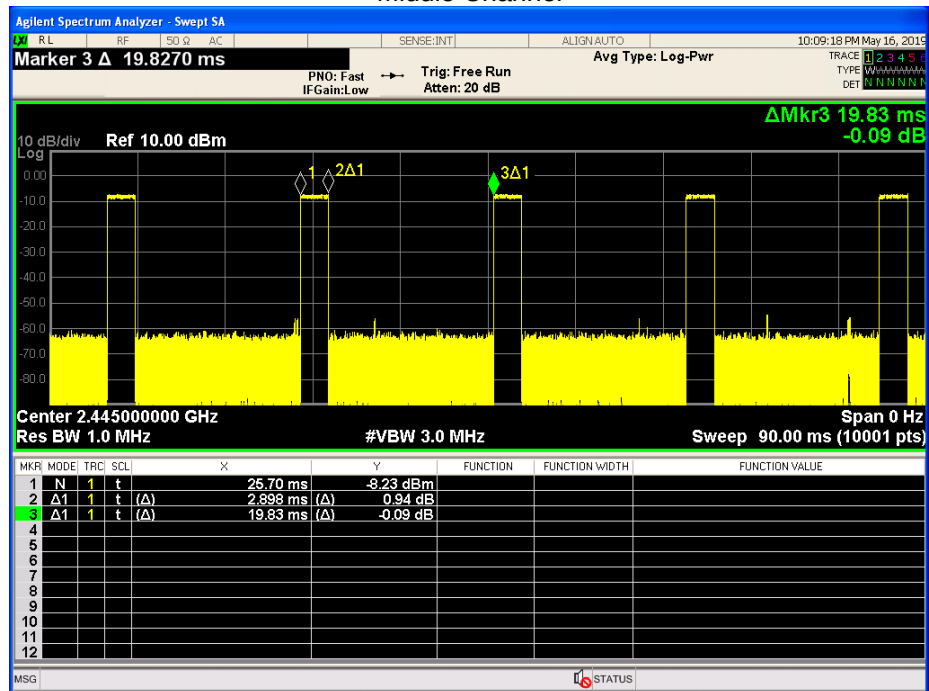
Test Channel	Low Channel	Middle Channel	High Channel
Total transmission time(ms)	19.80	19.83	19.80
Length of a complete transmission period(ms)	2.89	2.90	2.90
Duty Cycle(%)	14.58	14.61	14.64
Duty Cycle Correction Factor(dB)	-16.72	-16.71	-16.69

Refer to the duty cycle plot (as below),

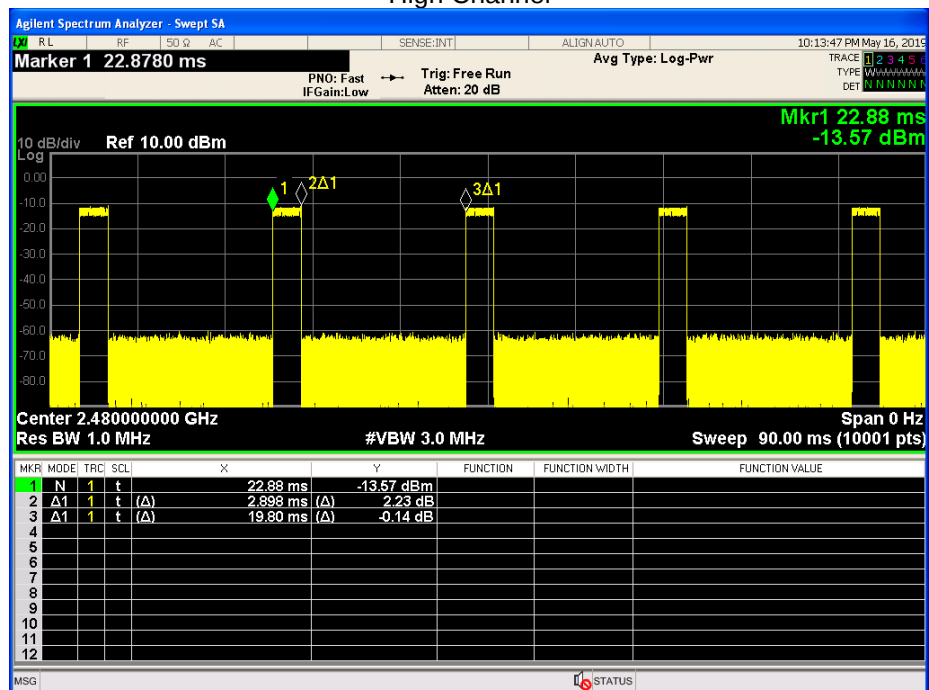
Low Channel



Middle Channel



High Channel



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 63.10:2010

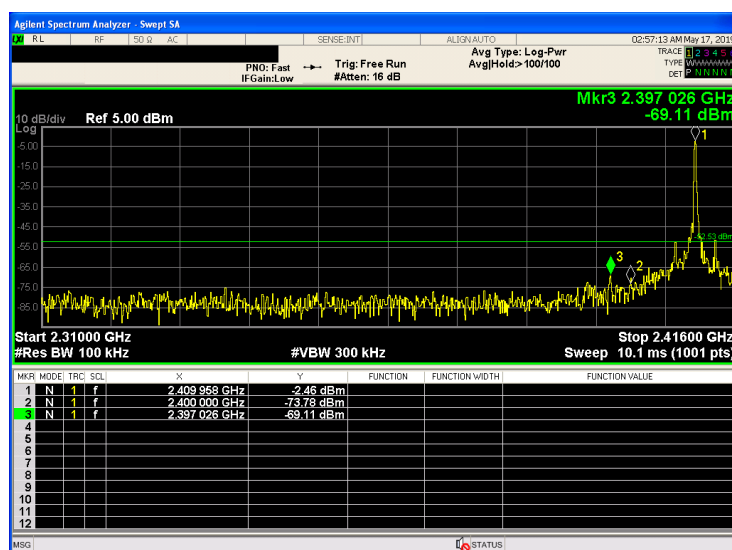
Test Mode: Transmitting

8.1 Test Procedure

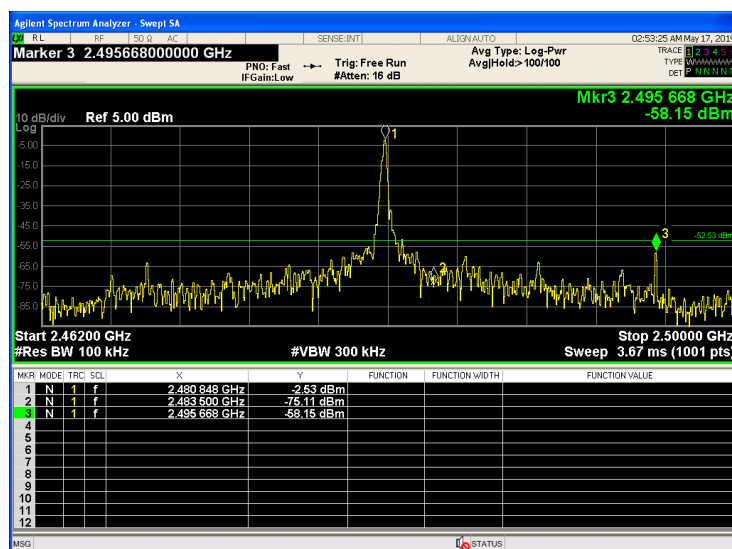
Refer to section 7.4 of this test report.

8.2 Test Result

Band edge-left side



Band edge-right side



9 20dB Bandwidth Measurement

Test Requirement.....: FCC CFR47 Part 15 Section 15.215(c)

Test Method.....: ANSI 63.10:2010

Test Mode: Transmitting

9.1 Test Procedure

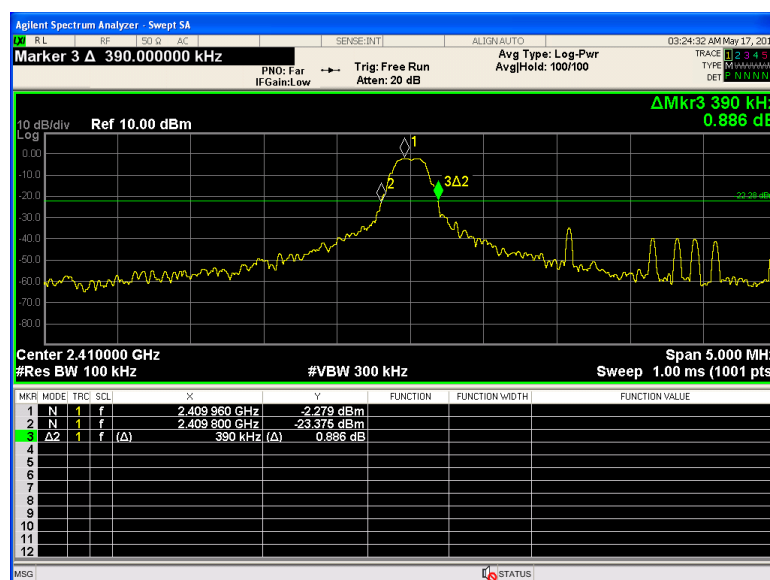
- 1) Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
- 2) Set the spectrum analyzer: RBW = 100 kHz, VBW = 300 kHz

9.2 Test Result

Operation mode	20dB Bandwidth (KHz)	99% Bandwidth (KHz)
Low channel	390	/
Middle channel	430	/
High channel	385	/

Test result plot as follows:

Mode: Low channel



Mode: Middle channel



Mode: High channel



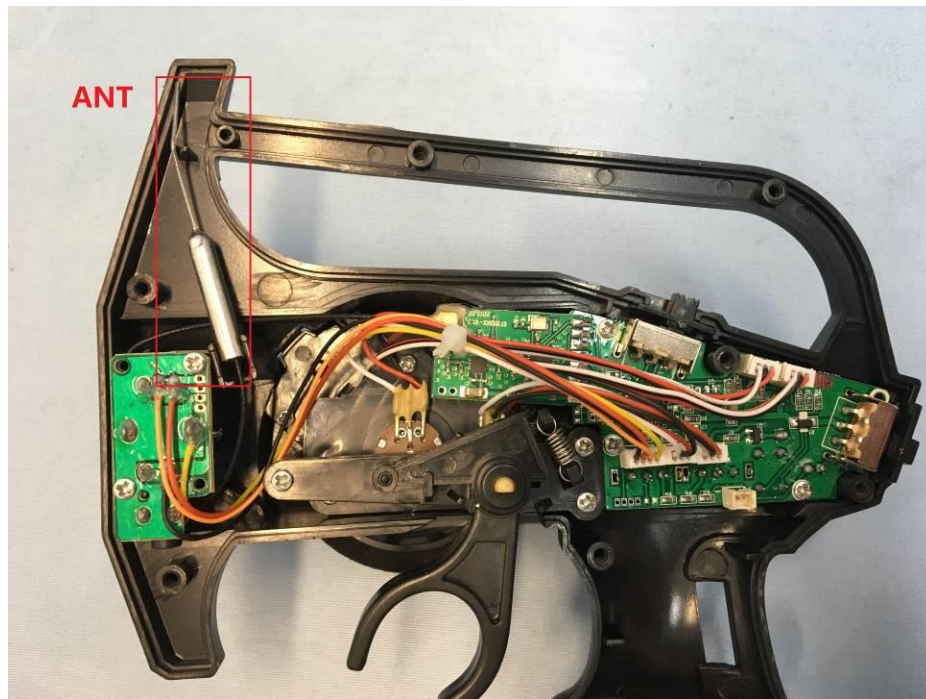
10 Antenna Requirement

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



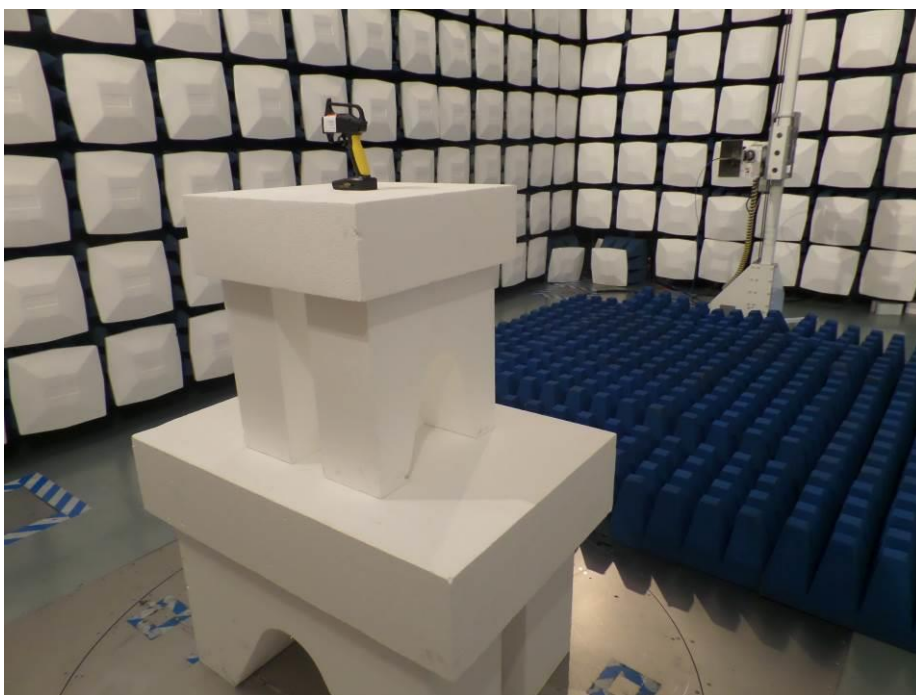
11 Photographs- Test Setup Photos

11.1 Photographs- Radiated Emission Test Setup

30MHz-1GHz

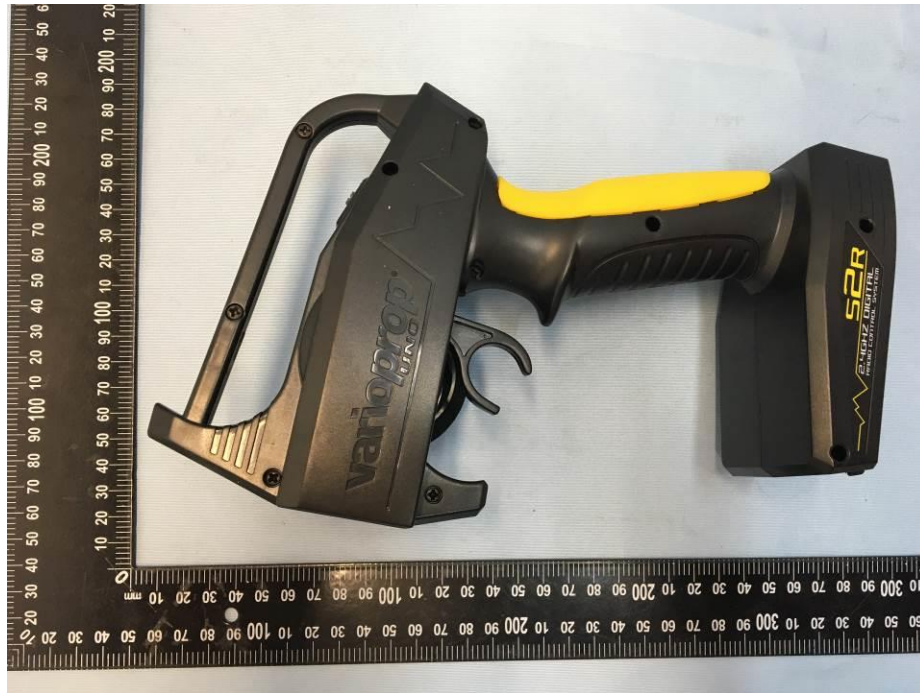


Above 1GHz



12 Photographs - Constructional Details

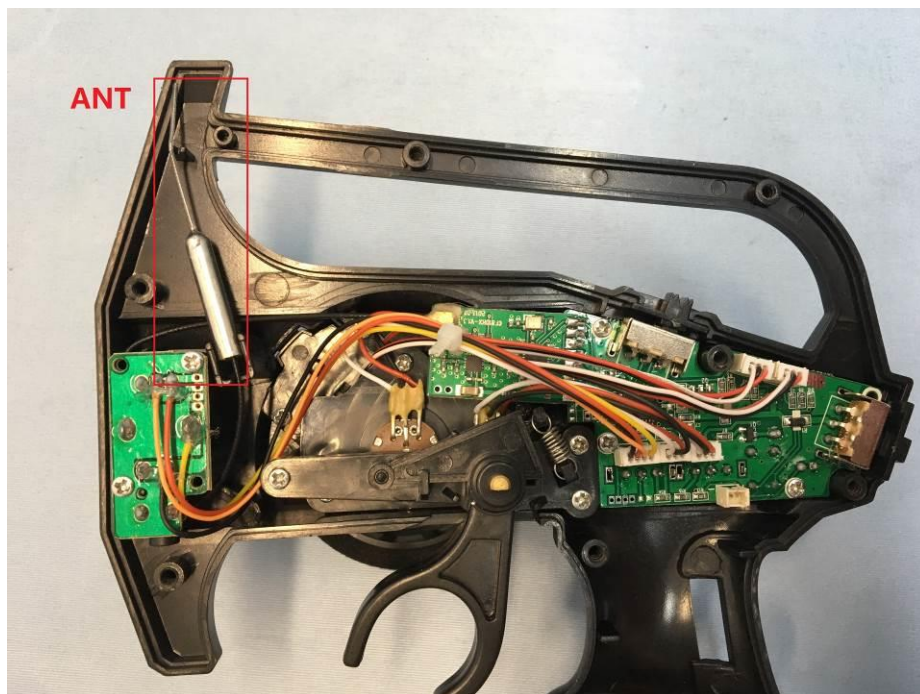
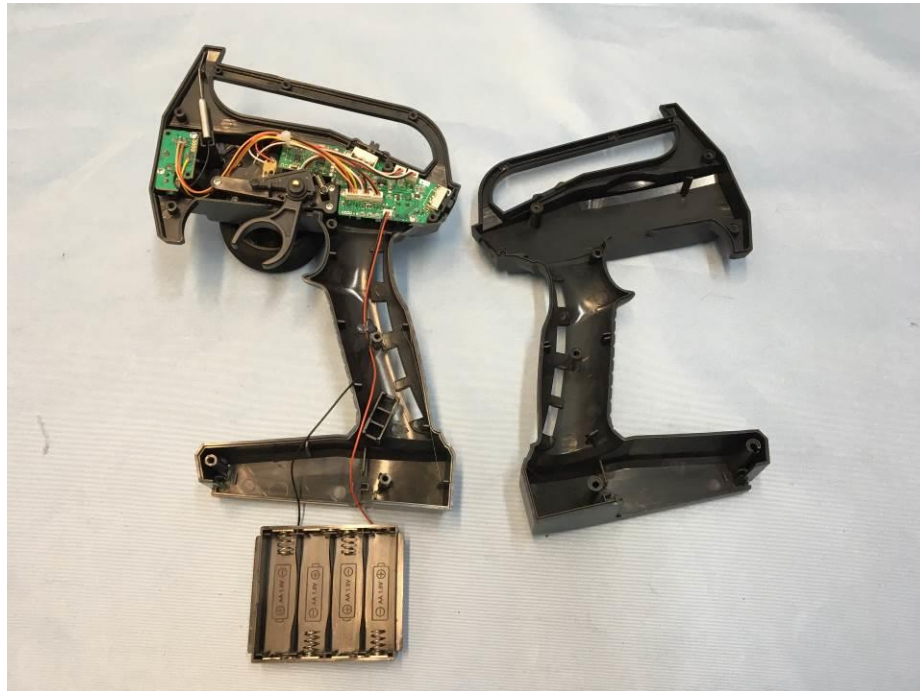
12.1 EUT - External View

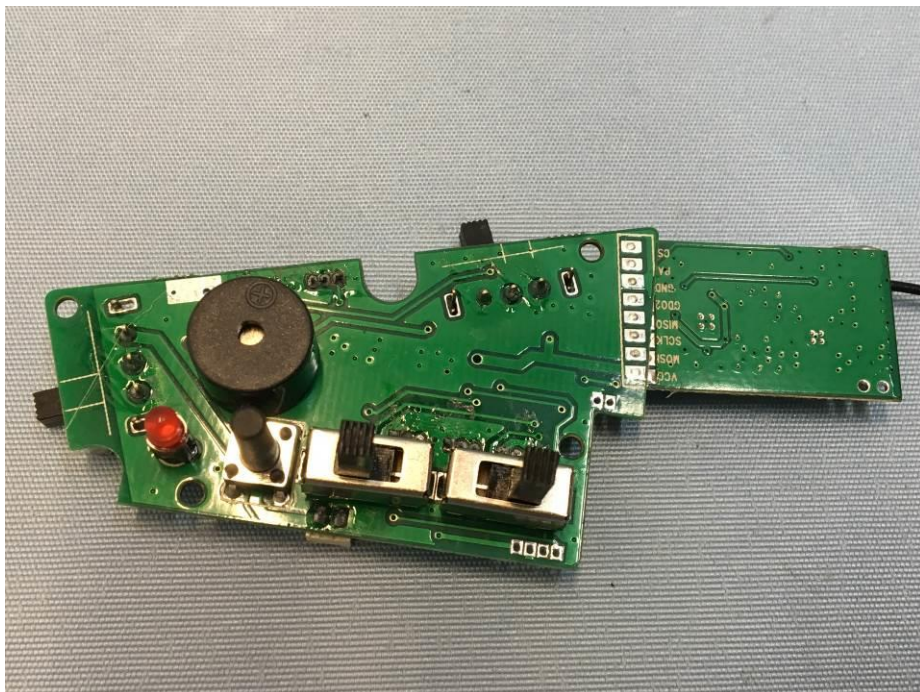
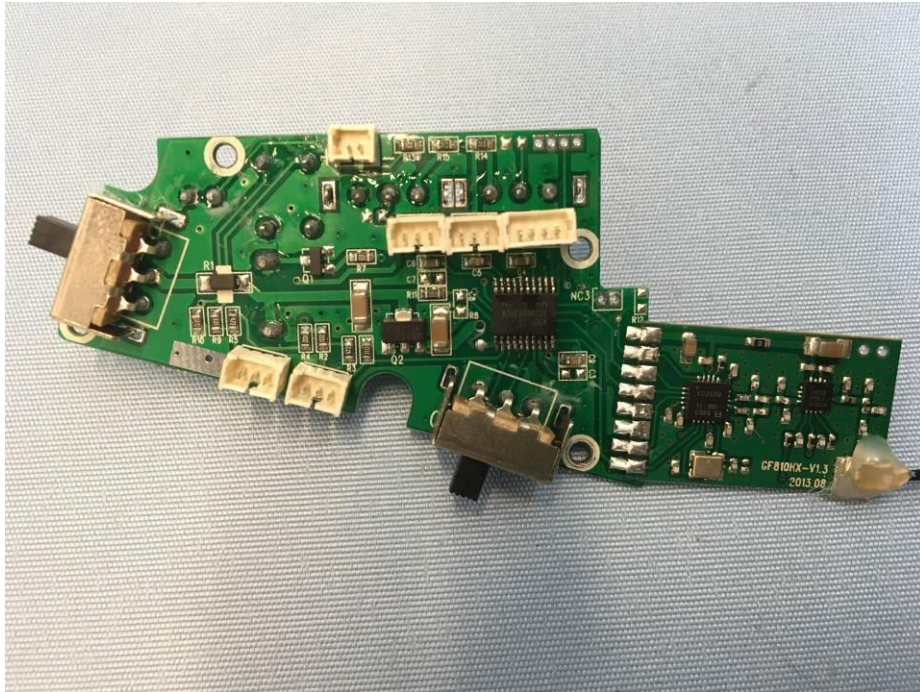


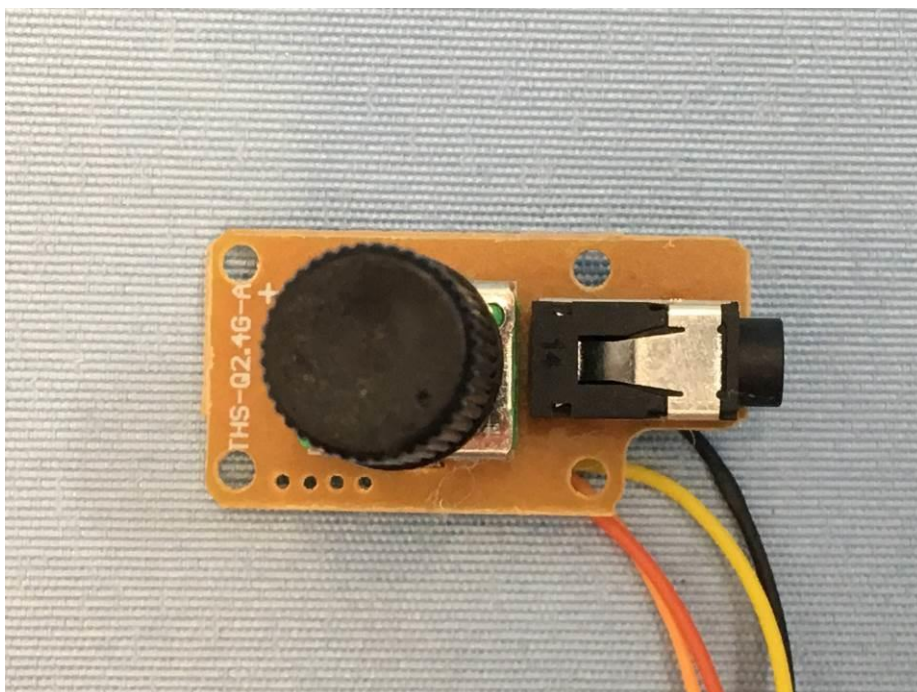
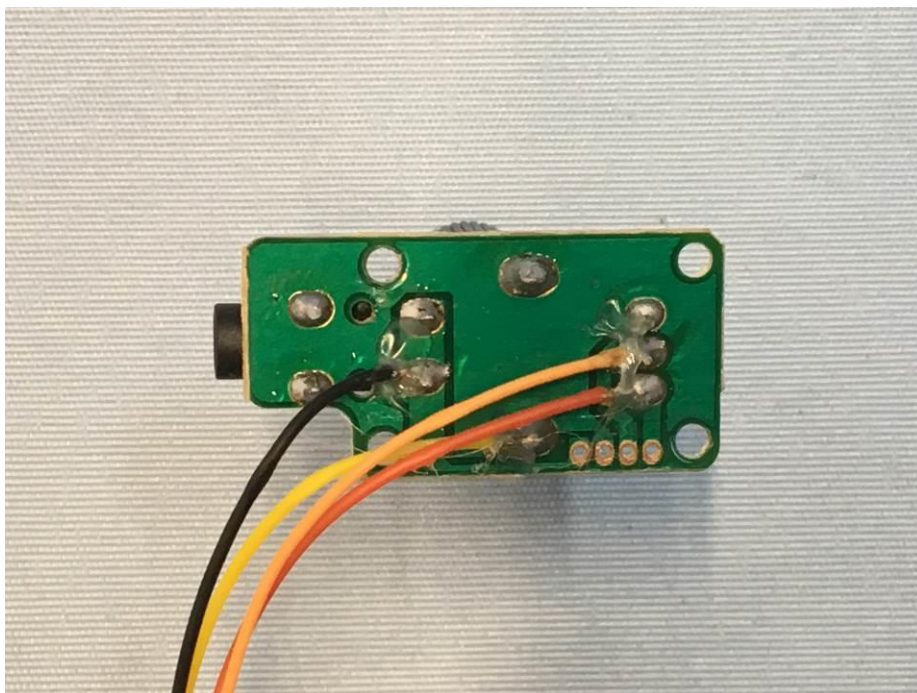


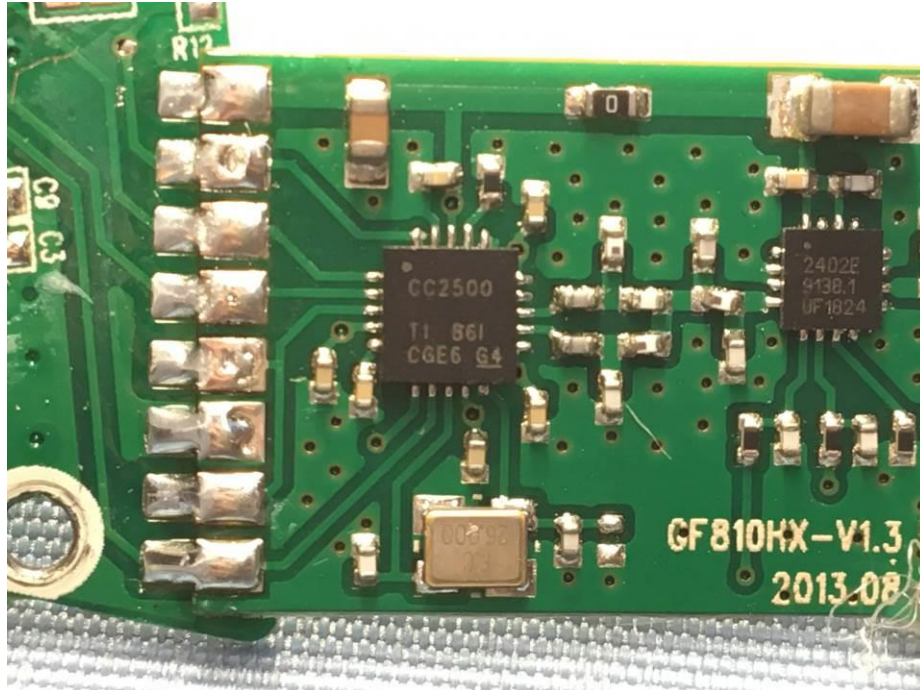


12.2 EUT- Internal View









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