Certificate of Test

NCT CO., LTD. 211-71, Geumgok-ro, Hwaseong-si, Gyeonggi-do, 18511, Republic of Korea (Tel: +82-31-323-6070 / Fax: +82-31-323-6071)	Report No.: NE2210-F001-1 Page (1) / (31)	NCT

1. **Client**
   - ○ Name : NARMA INC.
   - ○ Address : 169-84 Gwahak-ro, yuseong-gu, Daejeon, 34133, Korea
   - ○ Date of Receipt : Jun. 28, 2022

2. **Use of Report :** FCC SDoC

3. **Test Sample**
   - ○ Product Name / Model Name : Delivery and Search Drone / AF200

4. **Place of Test :** ☒ Fixed test ☐ Field test
   (Address: 211-71, Geumgok-ro, Hwaseong-si, Gyeonggi-do, Republic of Korea(NCT CO., LTD.))

5. **Date of Test :** Jul. 06, 2022

6. **Test method used :** FCC Part 15 Subpart B

7. **Testing Environment :** Refer to 2.3 Test Condition

8. **Test Results :** Refer to the test results

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
This Test Report cannot be reproduced, except in full
This test report is not related to KOLAS recognition and RRA designation.

Affirmation	**Tested by** Sungun SIN (signature)	**Technical Manager** Byeongcheol YOO (signature)

Oct. 31, 2022

NCT CO., LTD. (seal)

Contact us at report@nct.re.kr to confirm the authenticity of this report

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211-71 Geumgok Road, Dongtan-myeon, Hwaseong-si, Gyeonggi-do, Republic of Korea
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1. General information

1.1 Test Performed

Electromagnetic compatibility measurement facility (18511) is located at 211-71 Geumgok Road, Dongtan-myeon, Hwaseong-si, Gyeonggi-do, Republic of Korea.

Laboratory	:	NCT Co., Ltd.
Address	:	211-71, Geumgok-ro, Hwaseong-si, Gyeonggi-do, Republic of Korea
Telephone	:	+82 (0)31-323-6070
Facsimile	:	+82 (0)31-323-6071

SITE MAP

2. Information about test item

2.1 Applicant information

Company name	:	NARMA INC.
Address	:	169-84 Gwahak-ro, yuseong-gu, Daejeon, 34133, Korea
Telephone / Facsimile	:	+82 42-870-3650 / -
Contact name	:	Sunggyu Lee
Manufacturer	:	NARMA INC.
Factory Address	:	169-84 Gwahak-ro, yuseong-gu, Daejeon, 34133, Korea

2.2 Equipment Under Test (EUT) description

Product name	Delivery and Search Drone
Trademark	-
Model and/or type reference	AF200
Additional model name	-
Serial number	N/A
Date (s) of performance of tests	Jul. 06, 2022
Date of receipt of test item	Jun. 28, 2022
EUT condition	Pre-productions, not damaged
Device Type	All other devices
Device Class	CLASS A
Interface Ports	DC IN
EUT Power Source	DC 50.4 V
Highest internal frequency	250 MHz
Firmware version	-
Note	-

2.3 Test condition

Environment Conditions	- Radiated Emissions	Below 1 GHz : (26.1 ± 1.0) ℃ / (43.6 ± 1.0) % R.H. Above 1 GHz : (20.7 ± 1.0) ℃ / (41.2 ± 1.0) % R.H.
	- Conducted Emissions	(- ± 1.0) ℃ / (- ± 1.0) % R.H.
Test mode	Operating Mode	
Test Voltage	DC 22 V	

2.4 Ancillary Equipment

Equipment	Model No.	Serial No.	Manufacturer
Notebook #1	NT550EAA-K24A	0XF891JKC00199A	SAMSUNG
Notebook #1_ Adapter	PA-1400-96	AD-4019A	LITE-ON TECHNOLOGY CHANGZHOU CO.,LTD

2.5 Cable List

Cable List				
Type	Length (m)	Shielding (Cable/backshell)	Remarks	
			From	to
EUT	1.5	YES/NO	5PIN USB	Notebook(USB-A)
Notebook	1.2	YES/NO	DC IN	ADAPTER(DC OUT)

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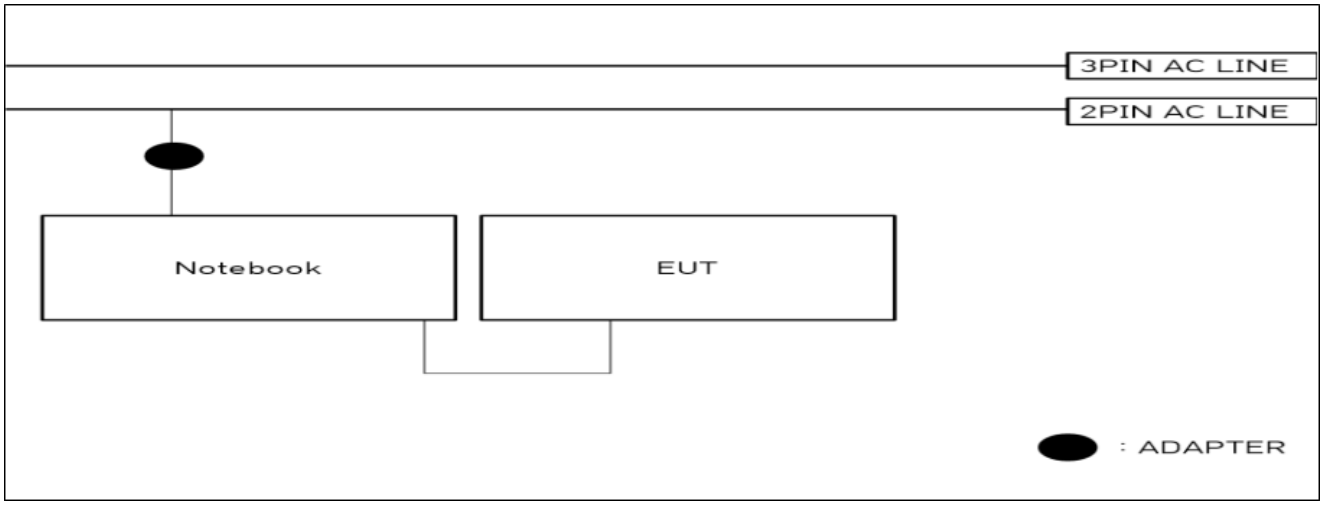
2.6 Block diagram of the EUT test



Note) The EUT(AF200) was arranged as a layout diagram.

1. Test Mode / Operating Status

- Operating Mode / Test equipment is tested under continuous operation by connecting the laptop USB port to the 5PIN USB cable of the test equipment while receiving power from the battery.

2.7 Modification

- Not Applicable

2.8 Configuration

Equipment	Model No.	Serial No.	Manufacturer
DCDC Converter	N/A	N/A	N/A
ESD 1	TM168_KZ1_V1.3	N/A	N/A
ESD 2	TM186_GL1_V1.21	N/A	N/A
FC	N/A	N/A	N/A
Sub Motor	ZUL1700501EM0031	N/A	N/A
Channel	HW213--YT1-V1.0	N/A	N/A
Connector	EXT-8P-V1.0	N/A	N/A
Trigger	N/A	N/A	N/A

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3. Test Report

3.1 Test Summary

Applied	Test items	Test method	Result
☒	Radiated disturbance	FCC Part 15.109 : (November 2, 2017)	**C**
☐	Conducted disturbance	FCC Part 15.107 : (November 2, 2017)	**N/A**

Note 1 : C=Complies, N/C=Not Complies, N/T=Not Tested, N/A=Not Applicable

* The data in this test report are traceable to the national or international standards.

* Uncertainties was taken into consideration through consultation with the client, and only the test results were determined to meet the requested specifications.

Frequency range to be scanned:

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)	Status (note 1)
Below 1.705	30	**NA**
1.705 ~ 108	1 000	**C**
108 ~ 500	2 000	**NA**
500 ~ 1 000	5 000	**NA**
Above 1 000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.	**C**

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

* The data in this test report are traceable to the national or international standards.

0.15 ㎒ ~ 30 ㎒ as conducted measurement

30 ㎒ ~ 1 000 ㎒ as Radiated measurement

1 ㎓ ~ 6 ㎓ as Radiated measurement

Bandwidth:

Measured by the CISPR quasi-peak function Bandwidth is 9 ㎑ in the frequency 0.15 ㎒ ~ 30 ㎒ and 120 ㎑ in the frequency 30 ㎒ ~ 1 000 ㎒.

Measured by the CISPR Peak function Bandwidth is 1 ㎒ in the frequency 1 ㎓ ~ 40 ㎓.

A sample calculation:

COR. F (correction factor) = Antenna factor + Cable loss - Amp.gain

Emission Level = meter reading + COR.F

3.2 Test Report Version

Test Report No.	Date	Description
NE2210-F001	Oct. 27, 2022	Initial Issue
NE2210-F001-1	Oct. 31, 2022	Issuance of correction of the Contact name, EUT Power Source according to the customer's request for correction

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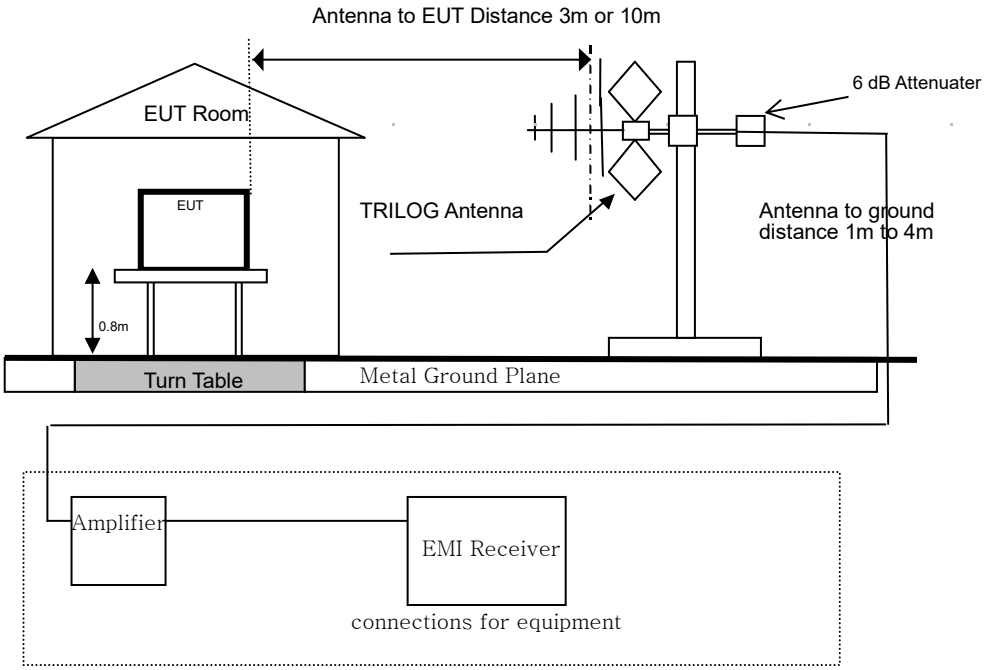
4. General information

4.1 Test Site Description

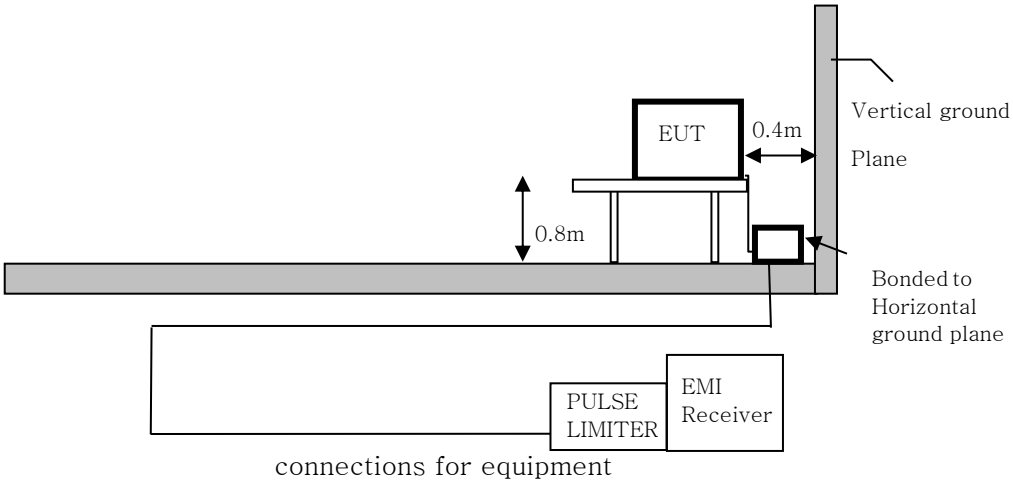
Facility

All the testing facilities are periodically serviced as a daily check for equipment and cables systems, an every 6 months facility check for the facilities and a monthly check and annual calibration for testing equipment according to ISO/IEC 17025. All the testing facilities are used as the same specifications shown below. There are descriptions both for radiated disturbance measurement and conducted disturbance measurement conformed by ANSI C 63.4:2014.
The NSA measurement of the OATS was performed on Jul 6, 2022 according to ANSI C 63.4:2017

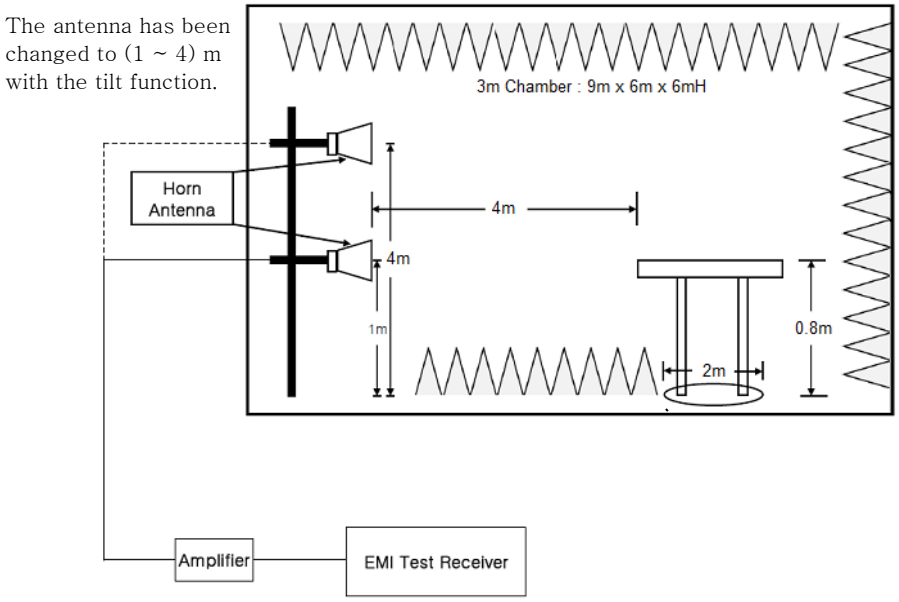
4.2 Radiated Disturbance Measurement – Below 1 ㎓



4.3 Conducted Disturbance Measurement



4.4 Radiated Disturbance Measurement – Above 1 ㎓



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5. Test Procedure

5.1 Radiated Disturbance Measurements – Below 1 ㎓

- Test site is met the requirements of ANSI C 63.4:2014 and the distance between the EUT and the antenna is adjusted 3 m / 10 m.
- The turntable can be rotated 360 degrees.
- The antenna can be adjusted between 1 m and 4 m in height above the ground.
- The EUT is placed on the non-conducting table with 0.8 m height on the turntable.
- Measurements are carried out using a EMI test receiver with peak detectors (100 ㎑ bandwidth) and an EMI receiver with quasi-peak detectors(120 ㎑ bandwidth).
- Refer to the list of test equipment used for the test.
- TRILOG antenna are used as wideband antenna.
- The TRILOG antenna is used in the frequency range of 30 ㎒ ~ 1 000 ㎒, the Horn antenna is used in the frequency range of 1 ㎓ ~ 40 ㎓.
- A variable attenuator is used for verifying amplifier's linearity.
- Rotating the turntable and adjusting the height of the antenna are carried out by control buttons on the console.
- Refer to "Brief Information"(page 4 ~ 6) about details of the EUT and configuration of the cables.
- Measurement is carried out by a NCT EMC Lab. operator as manual operation.
  – searching for some of High disturbance frequency points than the other points with the following settings;
  bandwidth 100 ㎑, frequency range 10 ㎒ between 30 ㎒ and 300 ㎒ and frequency range 50 ㎒ between 300 ㎒ and 1 ㎓.
  – searching the worst direction with the maximum level of the disturbance wave in rotating the turntable 360 degrees at each searched frequency point.
  – setting the height of the antenna with the maximum level of the disturbance wave from 1 m to 4 m.
  – reading the disturbance level by the EMI receiver with quasi-peak detectors (120 ㎑ bandwidth) according to ANSI C 63.4:2014.
  – measuring to vertical and horizontal polarization.
  – calculating the measurement result with the following formula or equation:
  (Measurement result = Measured value + Antenna factor + Cable loss - Amp. factor)

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5.2 Radiated Disturbance Measurements – Above 1 ㎓

- Test site is met the requirements of ANSI C 63.4:2014 and the distance between the EUT and the antenna isadjusted 3 m.
- The turntable can be rotated 360 degrees.
- The antenna can be adjusted between 1 m in height above the ground.
- The EUT is placed on the non-conducting table with 1 m height on the turntable.
- Measurements are carried out using a EMI test receiver with peak detectors (1 ㎒ bandwidth) and an EMI receiver with peak and average detectors(1 ㎒ bandwidth).
- Refer to the list of test equipment used for the test.
- HORN antenna are used as wideband antenna.
- The HORN antenna is used in the frequency range of 1 ㎓ ~ 40 ㎓.
- A variable attenuator is used for verifying amplifier's linearity.
- Rotating the turntable and adjusting the height of the antenna are carried out by control buttons on the console.
- Refer to "Brief Information"(page 4 ~ 6) about details of the EUT and configuration of the cables.
- Measurement is carried out by a NCT Lab. operator as manual operation.
  – searching the worst direction with the maximum level of the disturbance wave in rotating the turn table 360 degrees at each searched frequency point.
  – setting the height of the antenna with the maximum level of the disturbance wave from 1 m
  – reading the disturbance level by the EMI receiver with peak and average detectors (1 ㎒ bandwidth) according to ANSI C 63.4:2014.
  – measuring to vertical and horizontal polarization.
  – calculating the measurement result with the following formula or equation:
  (Measurement result = Measured value + Antenna factor + Cable loss - Amp. factor)

5.3 Conducted Disturbance Measurements

- The measurement is carried out on an open site with horizontal and metallic ground plane.
- An AMN(Artificial Mains Network) with a nominal impedance (50 Ω / 50 μH) as defined in ANSI C 63.4:2014, shall be utilized.
- The AMN is grounded on a horizontal metal ground plane.
- Measurement is carried out using an EMI receiver with quasi-peak detectors and average detector. (Refer to the List of test equipment used for the test.)
- The shortest distance between the EUT and the AMN is 0.8 m.
- The EUT is placed on the non-conducting table with 0.8 m height.
- A remote switch is used for changing phases between Line (L) and Neutral (N).
- Refer to "Brief Information"(page 5-8) about details of the EUT and configuration of the cables.
- Measurement is carried out as manual operation.

  -detecting the maximized emission level using the maxhold function after setting the spectrum analyzer bandwidth 1㎒ and the frequency range from 150 ㎑ ~ 1 ㎒ , 1 ㎒ ~ 5 ㎒ and 5 ㎒ ~ 30 ㎒.

  – searching the maximum frequency point of the disturbance wave in each frequency range.

  – reading the disturbance level of quasi-peak, average and Line (L) and Neutral (N) in 9 ㎑ bandwidth by the EMI receiver.

  – calculating the measurement result with the following formula or equation.

  (Result = Reading + Cor.F.)

  (Margin = Limit- Result)

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6. List of Equipment Used For the Tests

No.	Item	Model Name	Manufacturer	Serial No.	Interval	Next Cal.
1	Receiver	ESVS30	ROHDE&SCHWARZ	826006/015	1 Year	2023.05.24
2	RF AMPLIFIER	8447F	H.P	3113A05434	1 Year	2023.05.24
3	TRILOG Broadband Antenna(KOLAS)	VULB 9168	Schwarzbeck	01027	2 Year	2023.05.11
4	EMI Test Receiver	ESR7	ROHDE&SCHWARZ	102138	1 Year	2023.05.24
5	Double Ridged Broadband Horn Antenna(KOLAS)	BBHA 9120D	Schwarzbeck	02087	1 Year	2023.05.27
6	EMI Test Receiver	ESRP3	ROHDE&SCHWARZ	102116	1 Year	2023.05.24
7	LISN(Without cord)	NSLK 8127	Schwarzbeck	00984	1 Year	2023.05.24
8	LISN(with cord)	NSLK 8127	Schwarzbeck	00984	1 Year	2023.05.24
9	LISN_SUB	NSLK 8127	Schwarzbeck	00983	1 Year	2023.05.24
10	DUMY RESISTOR	PE6147	PASTERNACK	N/A	1 Year	2023.05.25
11	PULSE LIMITER	VTSD 9561-F	SCHWARZBECK	00623	1 Year	2023.03.07
12	Amplifier	TK-PA18H	TESTEK	190007-L	1 Year	2022.07.27

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7. EMI DATA

7.1 Radiated Disturbance Measurements (Below 1 ㎓)

■ FCC CLASS A

TEST SHEET(RE)

EUT Description

Order No : NE-220628-0967

PRODUCT : Delivery and Search Drone	Company : NARMA INC.
MODEL : AF200	Serial No. : -
POWER RATING : Portable	Ambient : (26.1)℃, (43.6) % R.H.
Test Date : 2022. 07. 06	Test Engineer : Sungun SIN
Mode : Operating	

VULB9168(2021.05.11~2023.05.11) / Cable Loss(2022.06.28~2022.12.28)

8447F(2022.05.24~2023.05.24)

Freq.	Reading(dBμV)		A	H	Antenna	Cable Loss	Amp.	Result	Limit	Margin
(MHz)	H	V	(°)	(m)	(dB/m)	(dB)	(dB)	(dBμV/m)	(dB)	(dB)
47.79	-	29.60	215	1.00	19.48	0.70	28.13	21.65	40.00	18.35
70.54	-	31.90	360	2.53	17.49	1.01	28.08	22.32	40.00	17.68
120.00	41.70	-	127	2.63	16.50	1.40	27.86	31.74	43.50	11.76
160.00	46.90	-	105	1.25	19.10	1.80	27.65	40.15	43.50	3.35
224.00	48.70	-	129	1.00	15.74	2.09	27.52	39.01	46.00	6.99
417.92	44.50	-	189	3.43	22.02	3.13	27.81	41.84	46.00	4.16

TEST EQUIPMENT USED : 1, 2, 3

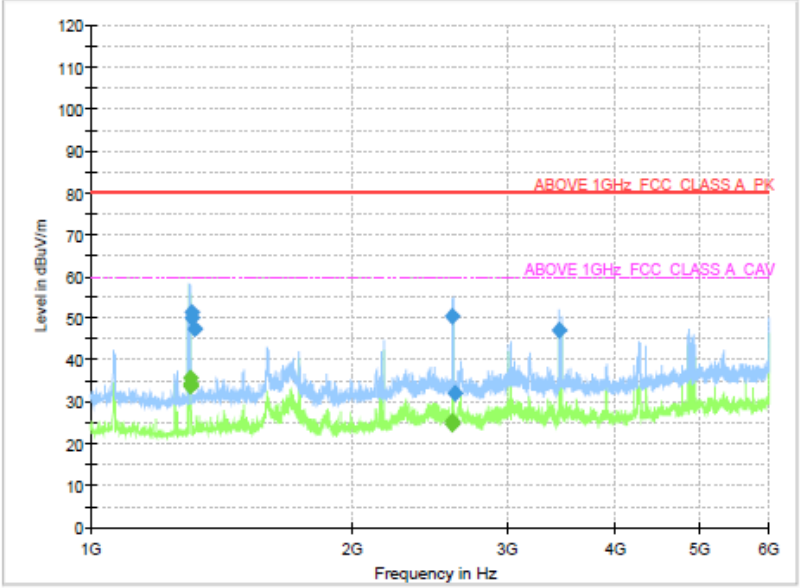
7.2 Radiated Disturbance Measurements (Above 1 ㎓)

1-6 1 / 1

Test Report

Common Information

Project Number:	NE-220628-0967
Test Standard:	FCC PART15, SUB B
Test Mode:	Operating
Test Conditions:	Portable / 20.7 ℃, 41.2 % R. H.
Operator Name:	Sungun SIN
Comment:	-



Final_Result

Frequency (MHz)	MaxPeak (dBuV/m)	CAverage (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1301.613636	---	34.50	60.00	25.50	1000.0	1000.000	200.0	V	313.0	-13.0
1301.636364	---	35.63	60.00	24.37	1000.0	1000.000	100.0	V	342.0	-13.0
1302.863636	---	34.11	60.00	25.89	1000.0	1000.000	200.0	H	334.0	-13.0
1303.363636	---	33.68	60.00	26.32	1000.0	1000.000	200.0	H	334.0	-13.0
1304.363636	50.28	---	80.00	29.72	1000.0	1000.000	200.0	H	334.0	-13.0
1305.613636	51.52	---	80.00	28.48	1000.0	1000.000	200.0	V	313.0	-13.0
1314.863636	47.36	---	80.00	32.64	1000.0	1000.000	200.0	H	334.0	-13.0
2598.772727	---	25.31	60.00	34.69	1000.0	1000.000	100.0	V	335.0	-9.8
2598.863636	---	24.90	60.00	35.10	1000.0	1000.000	100.0	V	328.0	-9.8
2598.863636	50.49	---	80.00	29.51	1000.0	1000.000	100.0	V	328.0	-9.8
2618.772727	32.05	---	80.00	47.95	1000.0	1000.000	100.0	V	335.0	-9.7
3448.727273	47.15	---	80.00	32.85	1000.0	1000.000	100.0	V	321.0	-7.0

2022-07-06

TEST EQUIPMENT USED : 4, 5, 12

- Due to the nature of the software, the [˚] symbol of the Test Conditions in the measurement data is denoted by ['], and the [μ] symbol of the graph and measured values is denoted by [u].

7.3 Conducted Disturbance Measurements

[LINE]

Not Applicable

TEST EQUIPMENT USED : -

- Due to the nature of the software, the [˚] symbol of the Test Conditions in the measurement data is denoted by ['], and the [μ] symbol of the graph and measured values is denoted by [u].

Not Applicable

TEST EQUIPMENT USED : -

- Due to the nature of the software, the [˚] symbol of the Test Conditions in the measurement data is denoted by ['], and the [μ] symbol of the graph and measured values is denoted by [u].

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8. PHOTOGRAPHS

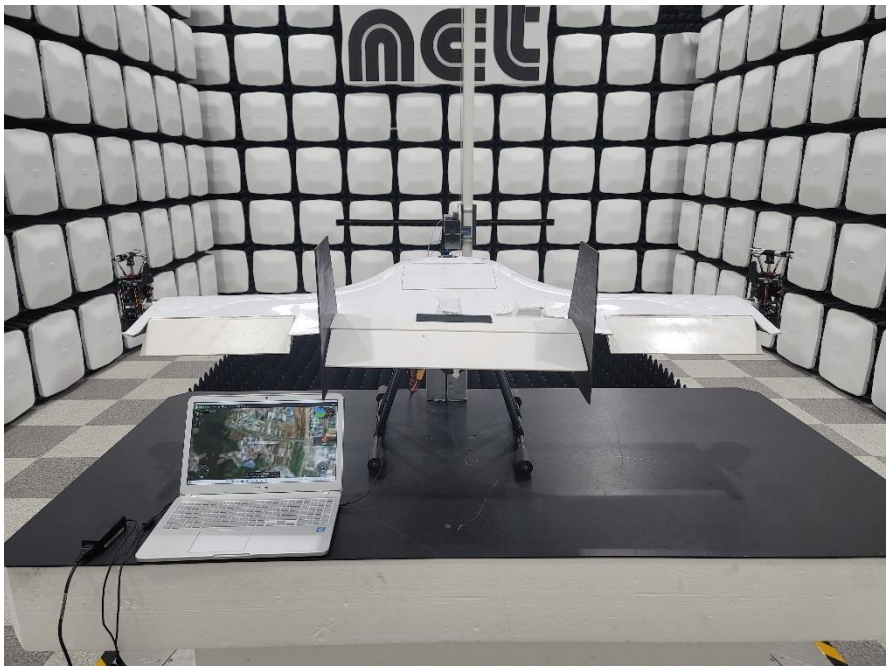
Photograph of the Radiated Disturbance Measurements (Maximum emission configuration) – Below 1 ㎓

[Front]

[Rear]

[Front]

[Rear]



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[Front]

Not Applicable

[Rear]

Not Applicable

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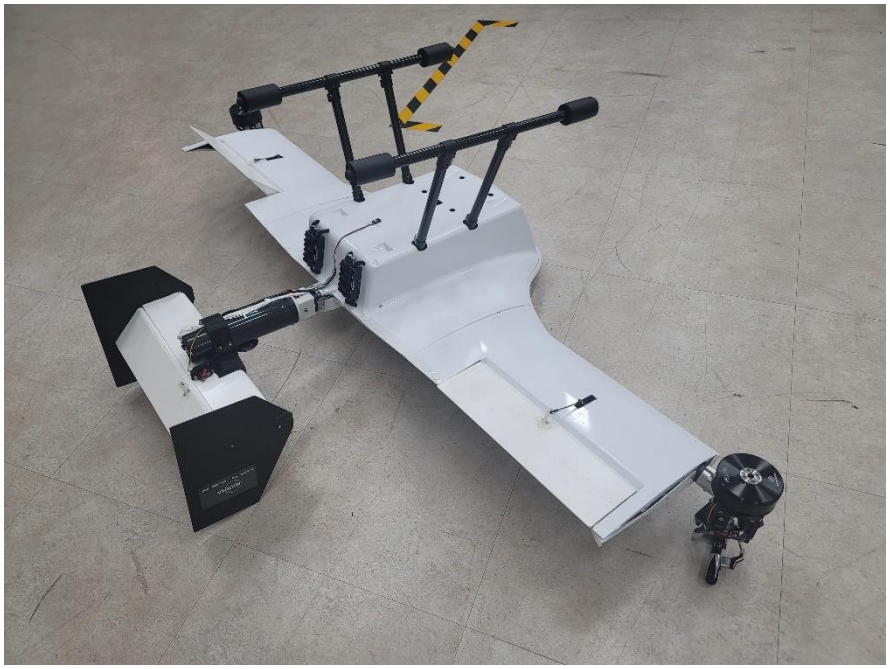
Front of EUT

Rear of EUT



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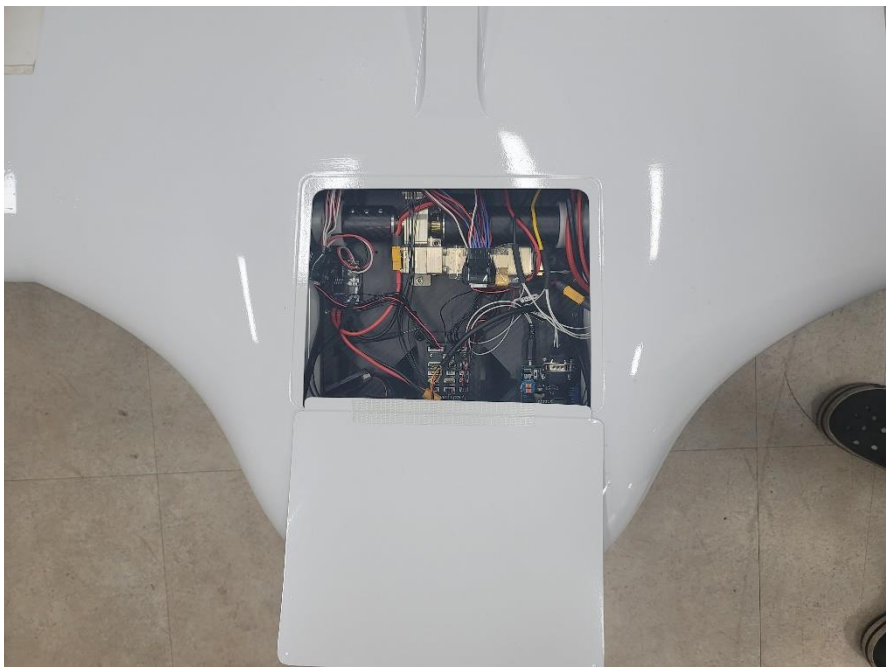
Internal of EUT



Position of Label

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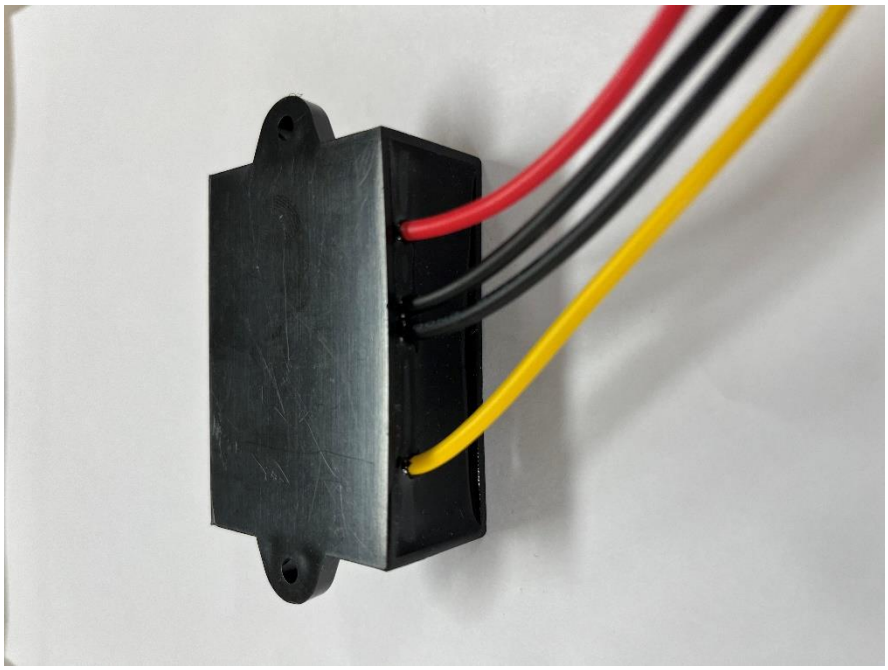
Front of DCDC Converter

Rear of DCDC Converter



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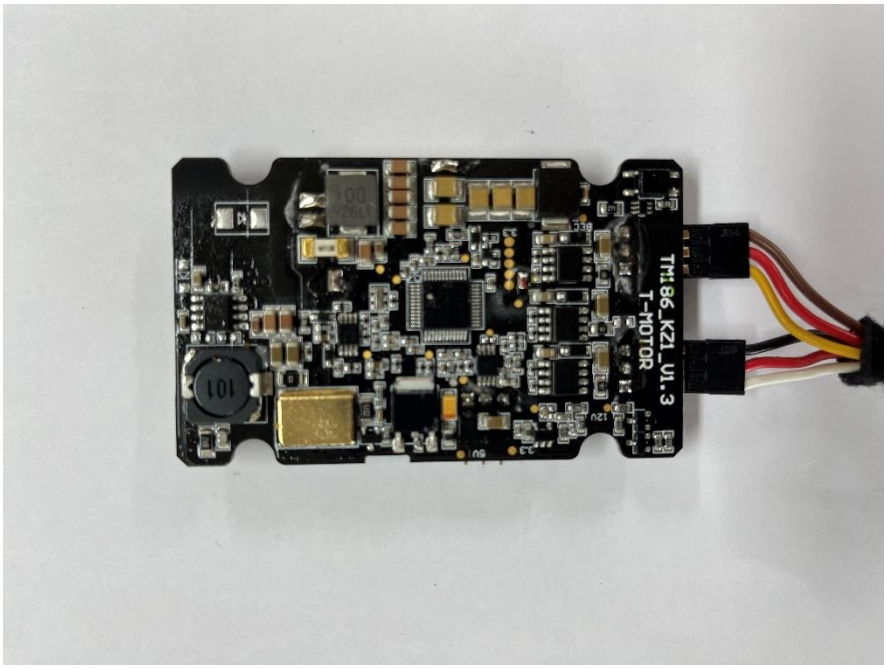
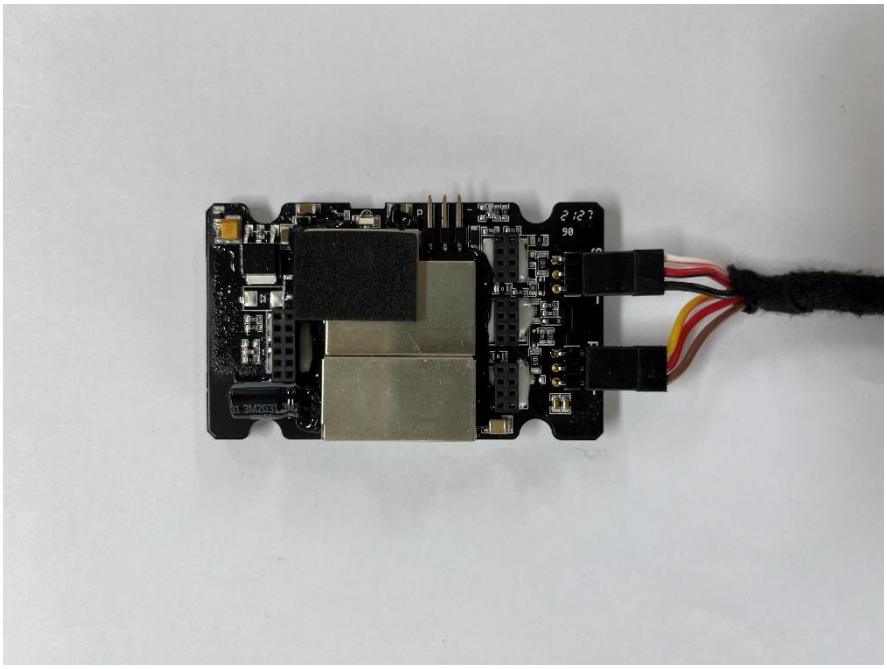
Front of ESD 1



Rear of ESD 1



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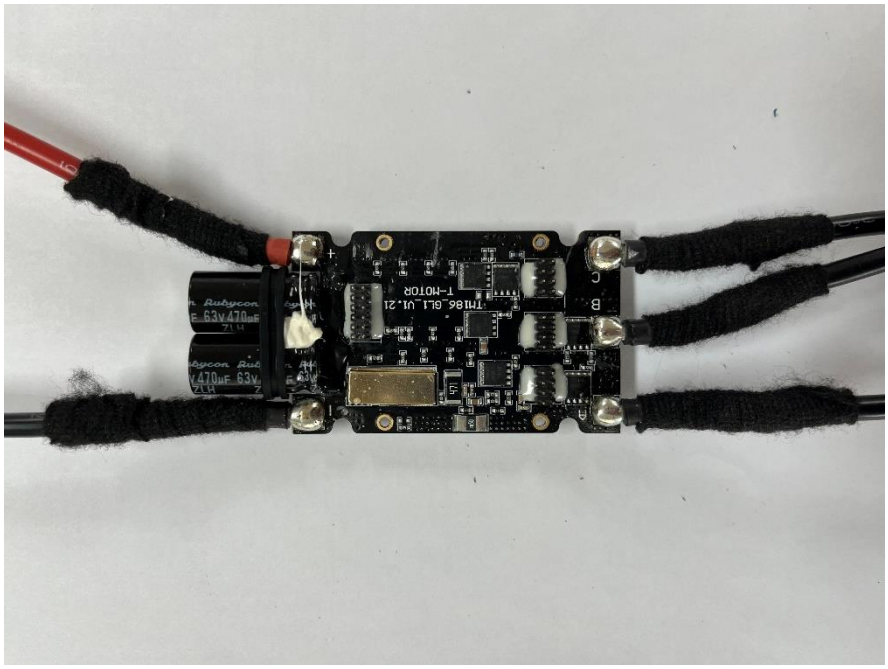
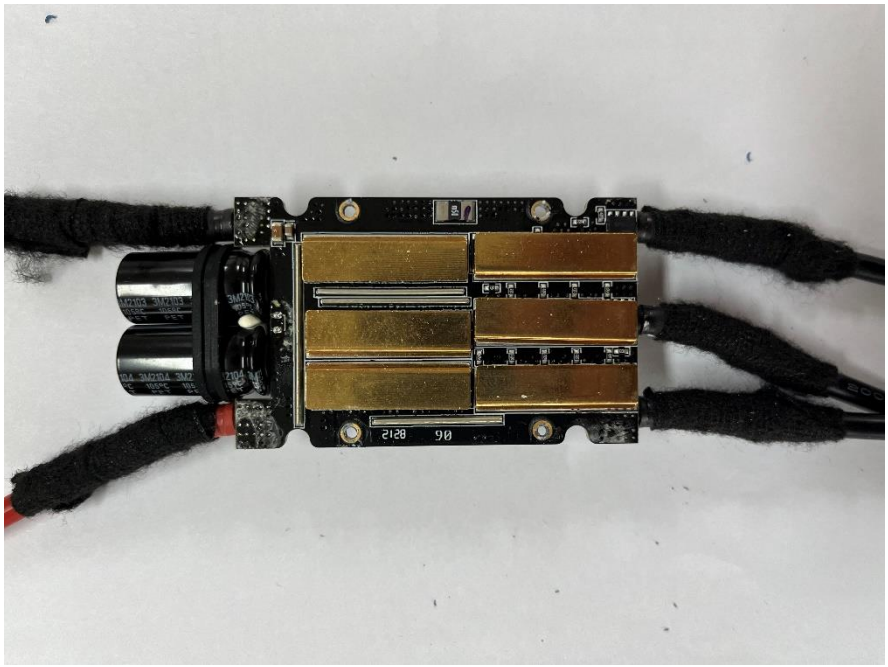
Front of ESD 2



Rear of ESD 2



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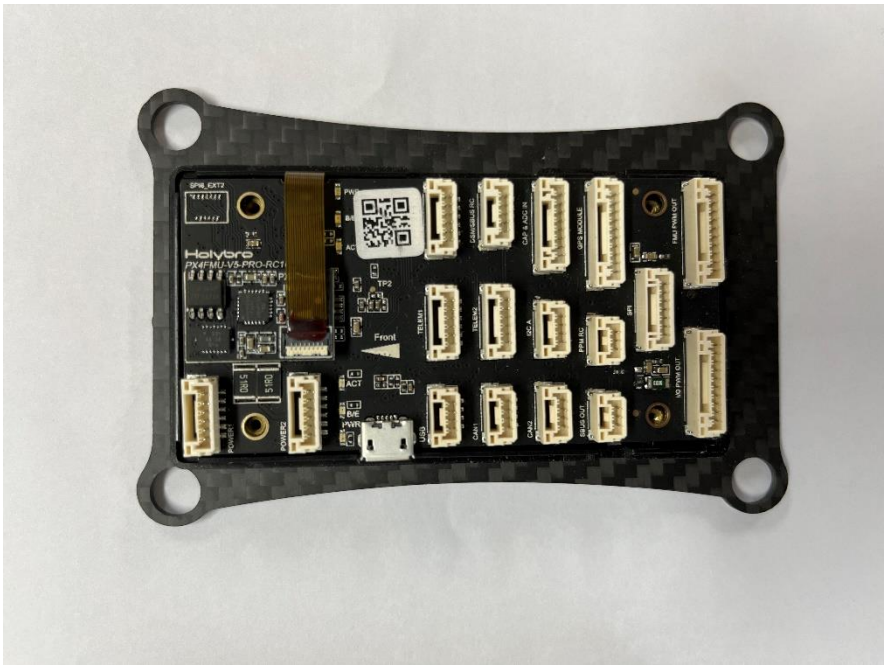
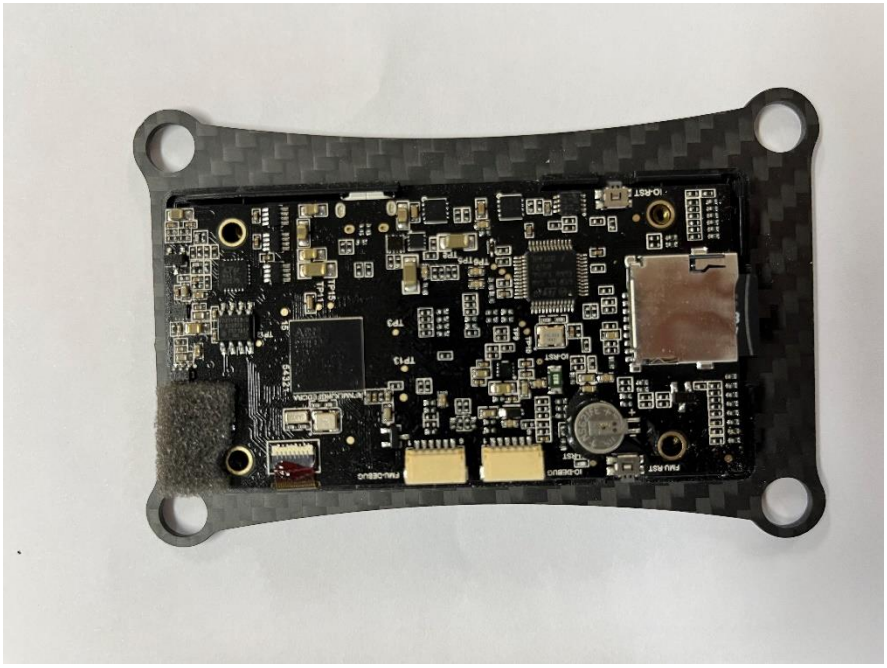
Front of FC



Rear of FC



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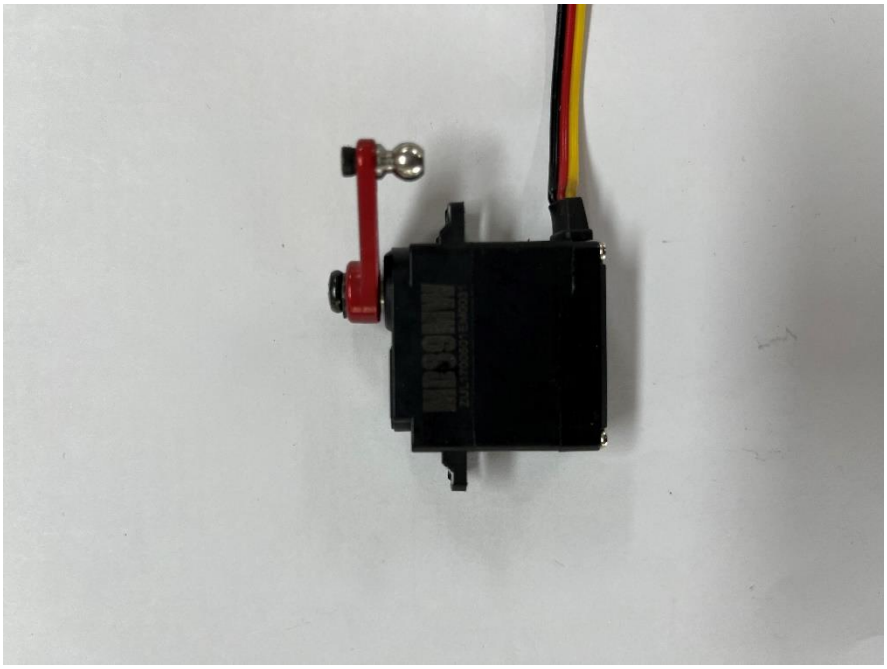
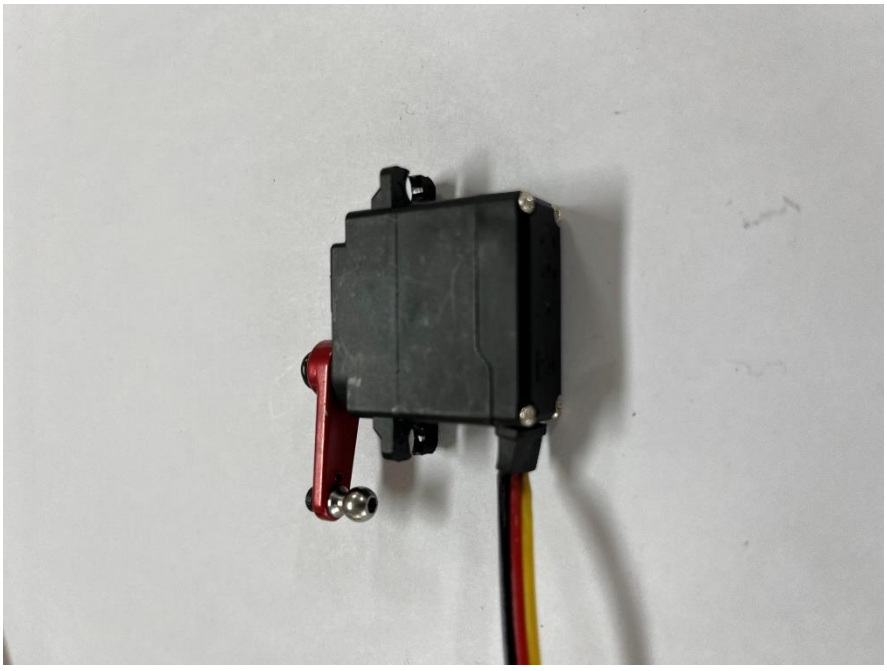
Front of Sub Motor



Rear of Sub Motor



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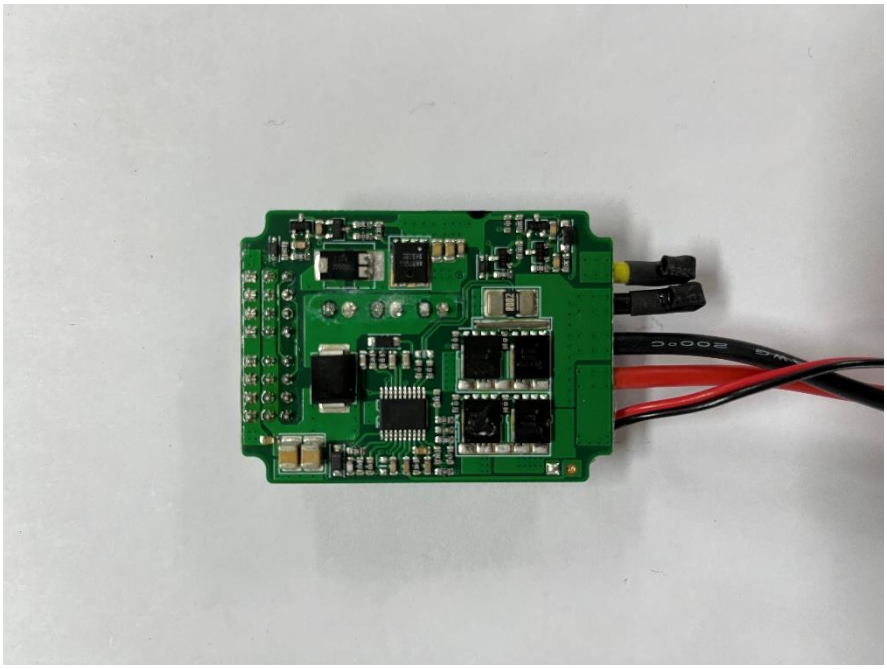
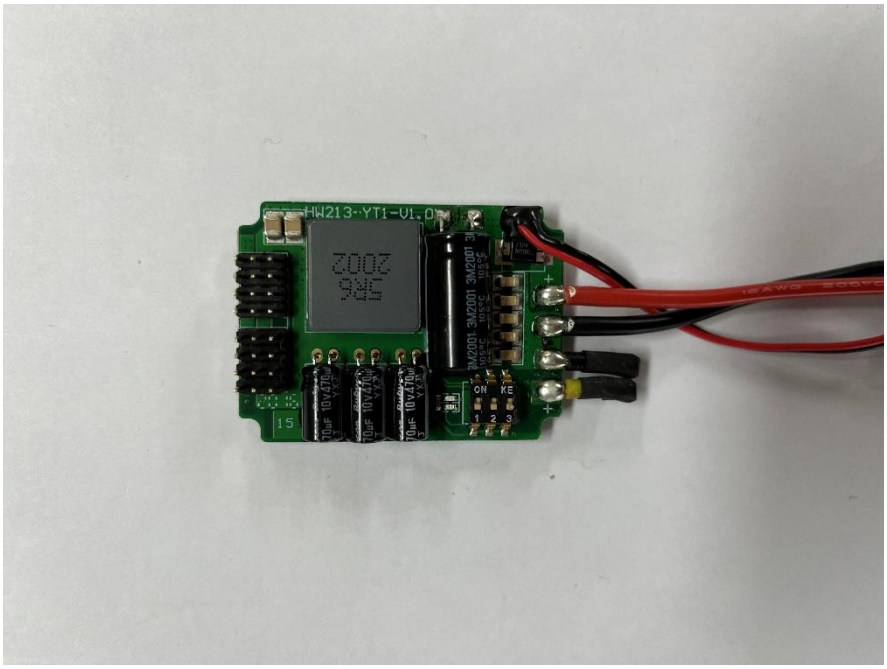
Front of Channel



Rear of Channel



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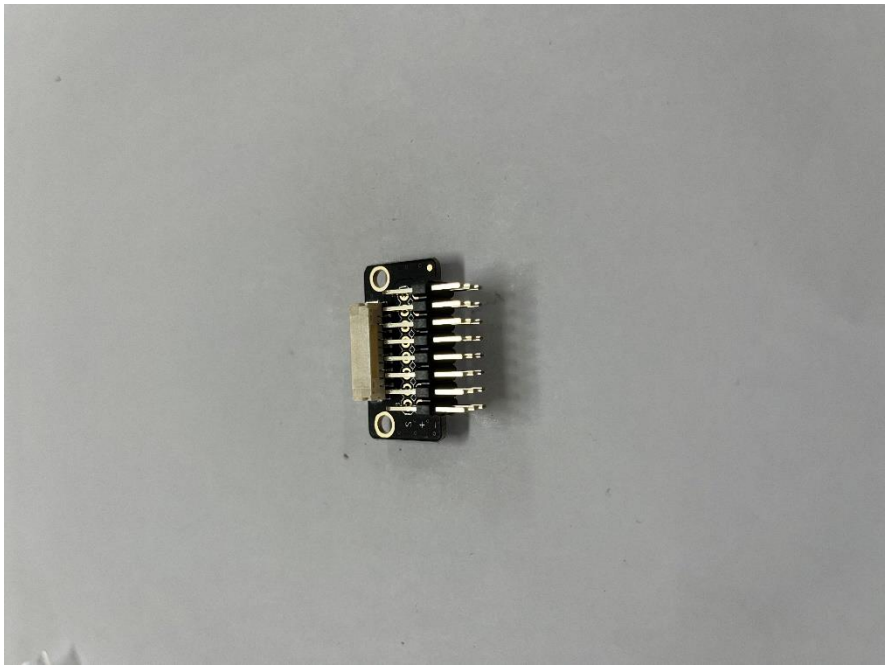
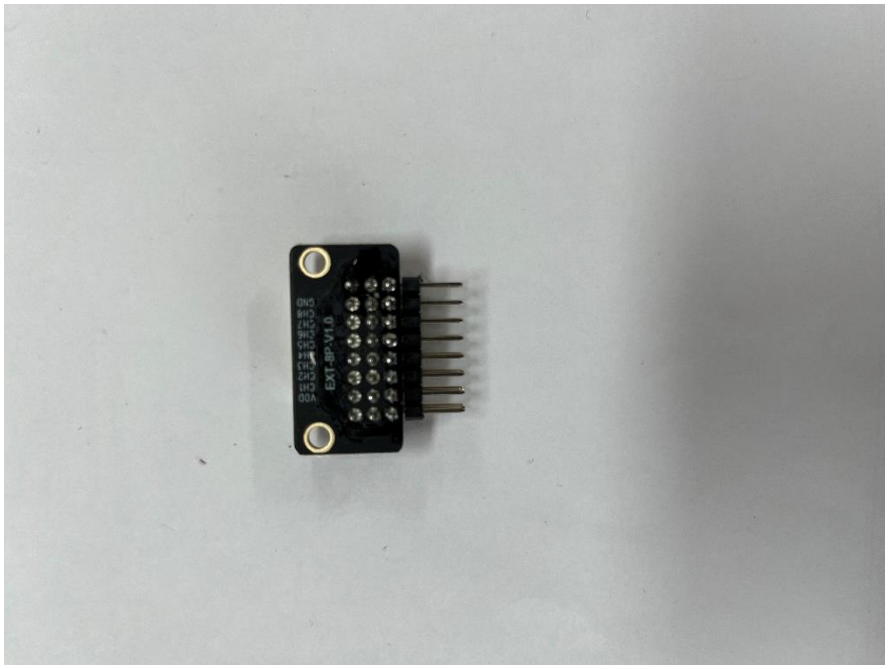
Front of Connector



Rear of Connector



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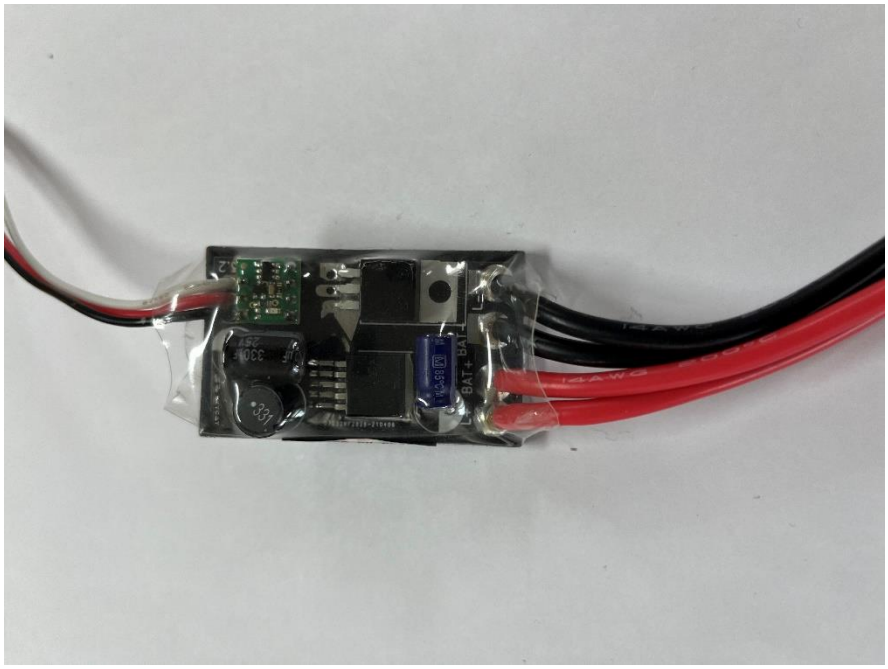
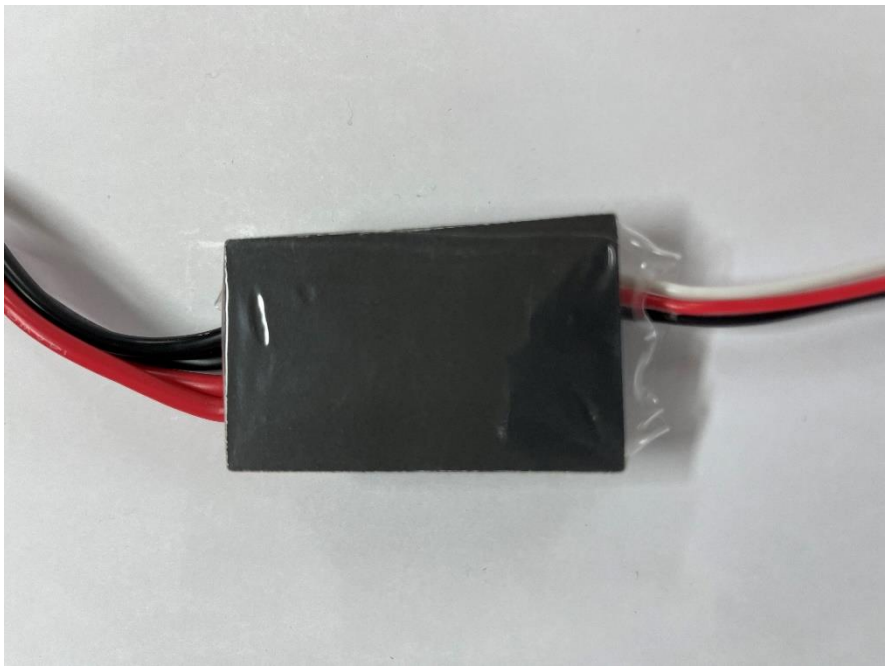
Front of Trigger



Rear of Trigger



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