

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

Test Report No. : W174R-D056

AGR No. : A150A-150

Applicant : AIRO Co.,LTD.

Address : 203, Hanulteoo Bldg, 464-2, Sangsam-ri, Haeryong-myeon, Suncheon-si, Jeollanam-do,
South Korea, 58005

Manufacturer : AIRO Co.,LTD.

Address : 203, Hanulteoo Bldg, 464-2, Sangsam-ri, Haeryong-myeon, Suncheon-si, Jeollanam-do,
South Korea, 58005

Type of Equipment : Router for Aquarium Fish Robot

FCC ID. : 2ALUA-MIRO-9-ROUTER

Model Name : MIRO-9-ROUTER

Serial number : N/A

Total page of Report : 13 pages (including this page)

Date of Incoming : January 29, 2016

Date of issue : April 19, 2017

SUMMARY

The equipment complies with the regulation; *FCC PART 15 SUBPART C Section 15.247*

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

Reviewed by:



Jae-Ho Lee / Chief Engineer
ONETECH Corp.

Approved by:



Keun-Young, Choi / Vice President
ONETECH Corp.

CONTENTS

PAGE

1. VERIFICATION OF COMPLIANCE	4
2. TEST SUMMARY	5
2.1 TEST ITEMS AND RESULTS	5
2.2 ADDITIONS, DEVIATIONS, EXCLUSIONS FROM STANDARDS.....	5
2.3 RELATED SUBMITTAL(S) / GRANT(S)	5
2.4 PURPOSE OF THE TEST	5
2.5 TEST METHODOLOGY.....	5
2.6 TEST FACILITY	6
3. GENERAL INFORMATION	7
3.1 PRODUCT DESCRIPTION.....	7
3.2 ALTERNATIVE TYPE(S)/MODEL(S); ALSO COVERED BY THIS TEST REPORT.....	7
4. EUT MODIFICATIONS.....	7
5. SYSTEM TEST CONFIGURATION	8
5.1 JUSTIFICATION	8
5.2 PERIPHERAL EQUIPMENT	8
5.3 MODE OF OPERATION DURING THE TEST	9
5.4 CONFIGURATION OF TEST SYSTEM.....	9
5.5 ANTENNA REQUIREMENT	10
6. PRELIMINARY TEST	10
6.1 AC POWER LINE CONDUCTED EMISSIONS TESTS.....	10
6.2 GENERAL RADIATED EMISSIONS TESTS	10
7. SPURIOUS RADIATED EMISSION	11
7.1 TEST DATA FOR BELOW 30 MHZ.....	11
7.2 TEST DATA FOR 30 MHZ ~ 1 000 MHZ.....	12
7.3 TEST DATA FOR 1 GHZ ~ 6 GHZ	13

Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
W174R-D056	April 19, 2017	Initial Issue	All

DOCUMENT HISTORY

Revision No.	Issued Date	Revisions	Effect Section
Original	April 19, 2017	Initial Issue	-

1. VERIFICATION OF COMPLIANCE

APPLICANT : AIRO Co.,LTD.
 ADDRESS : 203, Hanulteo Bldg, 464-2, Sangsam-ri, Haeryong-myeon, Suncheon-si, Jeollanam-do,
 South Korea, 58005
 CONTACT PERSON : Ji-hoon Kim / Manager
 TELEPHONE NO : +82-61-727-6760
 FCC ID : 2ALUA-MIRO-9-ROUTER
 MODEL NAME : MIRO-9-ROUTER
 SERIAL NUMBER : N/A
 DATE : April 19, 2017

EQUIPMENT CLASS	<i>DSS – PART 15 SPREAD SPECTRUM TRANSMITTER</i>
KIND OF EQUIPMENT	Router for Aquarium Fish Robot
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART C Section 15.247
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	None
FINAL TEST WAS CONDUCTED ON	3 m Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.247 (a) (1)	Carrier Frequency Separation	PASS (See Note 1)
15.247 (a) (1) (iii)	Minimum Number of Hopping Channels	PASS (See Note 1)
15.247 (a) (1) (iii)	Average Time of Occupancy	PASS (See Note 1)
15.247 (b) (1)	Maximum Peak Conducted Output Power	PASS (See Note 1)
15.247 (d)	100 kHz Bandwidth Outside the Frequency Band	PASS (See Note 1)
15.247 (d)	Radiated Emission which fall in the Restricted Band	PASS (See Note 1)
15.209	Radiated Emission Limits, General Requirement	Met the Limit / PASS
15.207	Conducted Limits	PASS (See Note 1)
15.203	Antenna Requirement	Met requirement / PASS

Note 1: The conducted test items are substituted with the test results of the granted Bluetooth Module (FCC ID: U8D-FB155BC). The test report No. is LR500111506B. Refer to the test report for the detailed results.

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART C Section 15.247

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-4617/ G-10666 / T-1842

IC (Industry Canada) – Registration No. Site# 3736A-3

-. Site Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

3. GENERAL INFORMATION

3.1 Product Description

The AIRO Co.,LTD., Model MIRO-9-ROUTER (referred to as the EUT in this report) is a Router for Aquarium Fish Robot. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Router for Aquarium Fish Robot
OPERATING FREQUENCY	2 402 MHz ~ 2 480 MHz
RF OUTPUT POWER	2.70 dBm
NUMBER OF CHANNEL	79 Channels
MODULATION TYPE	GFSK for 1 Mbps
ANTENNA TYPE	Helical Antenna
LIST OF EACH OSC. OR CRYSTAL. FREQ.(FREQ.>=1 MHz)	16 MHz
RATED SUPPLY VOLTAGE	DC 5 V (Adapter) / DC 3.7 V (Battery)

3.2 Alternative type(s)/model(s); also covered by this test report.

-. None

4. EUT MODIFICATIONS

-. None

5. SYSTEM TEST CONFIGURATION

5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	AIRO Co.,LTD.	N/A	N/A
Battery	N/A	N/A	N/A
Module 1	Firmtech Co., Ltd	FB155BC	U8D-FB155BC
Module 2	N/A	N/A	N/A

5.2 Peripheral equipment

Model	Manufacturer	Description	Connected to
POP1770USB	Newland	Adapter	EUT

5.3 Mode of operation during the test

For Bluetooth function testing, software used to control the EUT for staying in continuous transmitting and receiving mode is programmed. The EUT was set at Low Channel (2 402 MHz), Middle Channel (2 441 MHz), and High Channel (2 480 MHz) with each data transfer rate, 1 Mbps, 2 Mbps, and 3 Mbps. To get a maximum radiated emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XY” axis, but the worst data was recorded in this test report.

5.4 Configuration of Test System

Line Conducted Test: The EUT was tested in a Charging & Transmitting Mode. The EUT was connected to Adapter. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions.

Radiated Emission Test: The EUT was tested in a charging mode and Transmitter mode. Preliminary radiated emissions test were conducted using the procedure in ANSI C63. 10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 m Semi Anechoic Chamber.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

5.5 Antenna Requirement

For intentional device, according to 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.

Antenna Construction:

The transmitter antenna of the EUT is a Helical Antenna(Reverse SMA type), so no consideration of replacement by the user.

6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Tests, the following operating mode was investigated

Operation Mode	The Worse operating condition (Please check one only)
Charging & Transmitting Mode	X

6.2 General Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

Operation Mode	The Worse operating condition (Please check one only)
Charging & Transmitting Mode	X

7. Spurious Radiated Emission

7.1 Test Data for Below 30 MHz

- . Test Date : April 16, 2017
- . Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- . Frequency range : 9 kHz ~ 30 MHz
- . Measurement distance : 3 m
- . Operating Condition : Highest Output Power Transmitting Mode
- . Result : PASSED

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
Any emissions were not observed from the EUT.								



Tested by: Min-Gu Ji / Assistant Manager

7.2 Test Data for 30 MHz ~ 1 000 MHz

Humidity Level : 44 % R.H.

Temperature: 23 °C

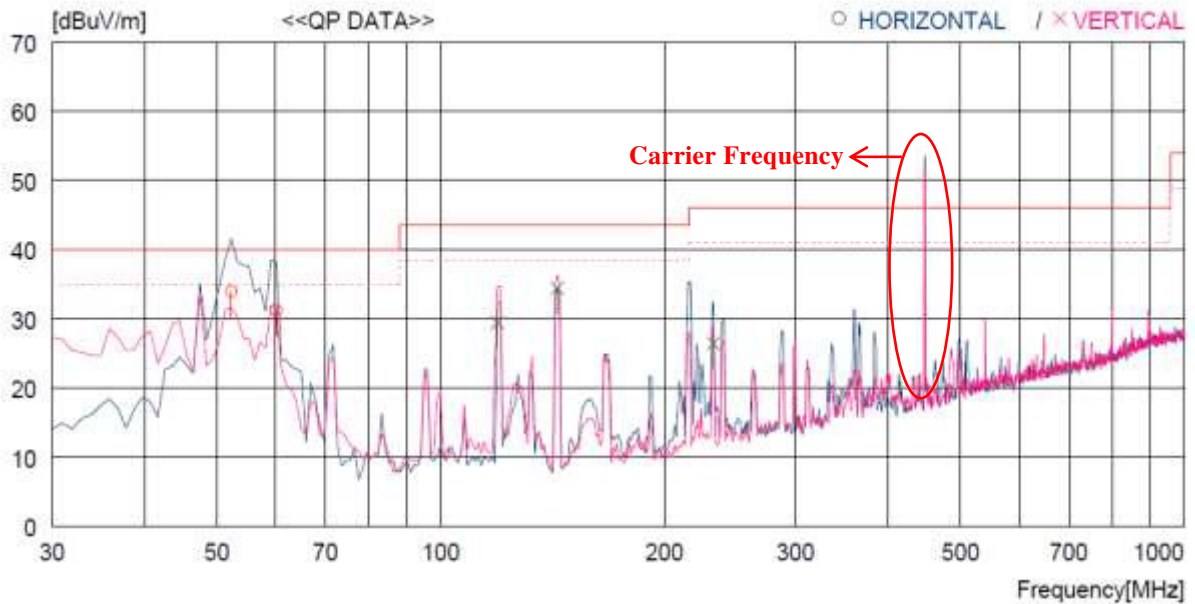
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT : Router for Aquarium Fish Robot

Date: April 16, 2017

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	52.310	51.0	13.9	2.0	33.0	33.9	40.0	6.1	400	359
2	60.070	48.9	13.2	2.1	33.0	31.2	40.0	8.8	400	177
----- Vertical -----										
3	119.240	48.6	10.5	3.4	33.1	29.4	43.5	14.1	200	81
4	143.490	55.8	8.5	3.2	33.1	34.4	43.5	9.1	100	151
5	232.730	43.6	11.8	4.0	33.0	26.4	46.0	19.6	100	359

Signature

Tested by: Min-Gu Ji / Assistant Manager

7.3 Test Data for 1 GHz ~ 6 GHz

Humidity Level : 44 % R.H.

Temperature: 23 °C

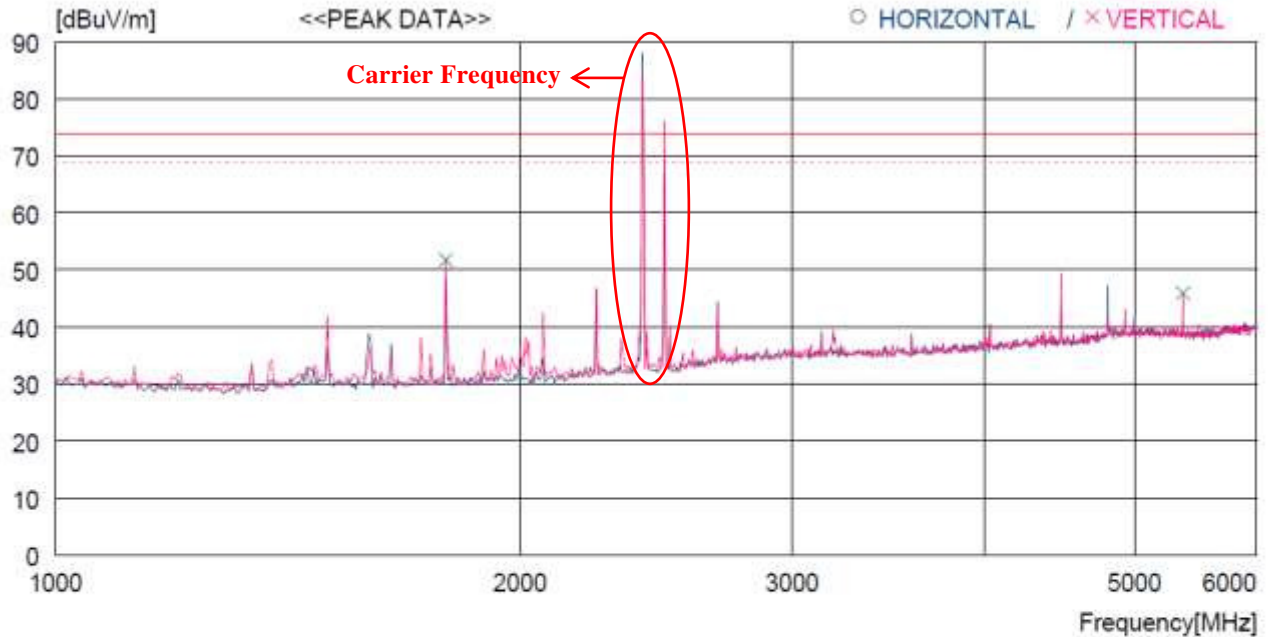
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT : Router for Aquarium Fish Robot

Date: April 16, 2017

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
---- Vertical ----										
1	1790.000	58.2	25.4	8.3	40.2	51.7	74.0	22.3	200	0
2	5375.000	43.0	31.5	12.3	40.9	45.9	74.0	28.1	100	0



Tested by: Min-Gu Ji / Assistant Manager