



MEASUREMENT REPORT

FCC PART 15C

Applicant: Multi Tech Systems Inc
Address: 2205 Woodale Drive Mounds View, MN 55112

Product: FireHUD Band
Model No.: 1
Brand Name: FireHUD
FCC Rule Part(s): Part15 Subpart C
Test Procedure(s): ANSI C63.10-2013
Test Date: January 08, 2020

Reviewed By: *Jame Yuan*
(Jame Yuan)

Approved By: *Robin Wu*
(Robin Wu)



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
1912RSU050-U2	Rev. 01	Initial Report	02-10-2020	Valid

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General Information

Applicant:	Multi Tech Systems Inc
Applicant Address:	2205 Woodale Drive Mounds View, MN 55112
Manufacturer:	Multi Tech Systems Inc
Manufacturer Address:	2205 Woodale Drive Mounds View, MN 55112
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
Test Device Serial No.:	N/A <input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production <input type="checkbox"/> Engineering

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- MRT facility is a FCC registered (MRT Reg. No. 893164) test facility with the site description report on file and has met all the requirements specified in ANSI C63.4-2014.
- MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.
- MRT facility is a VCCI registered (R-20025, G-20034, C-20020, T-20020) test laboratory with the site description on file at VCCI Council.
- MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications, Radio and SAR testing.



1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada and Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The measurement facility compliant with the test site requirements specified in ANSI C63.4-2014.



2. PRODUCT INFORMATION

2.1. Feature of Equipment under Test

Product Name:	FireHUD Band
Model No.:	1
Power Supply:	By Internal Battery
Radio Specification:	LoRa
Frequency Range:	902.3 ~ 914.9 MHz

Note: The device contains a LoRa module (FCC ID: AU792U13A16858).

2.2. Working Frequencies for this Report

Channel	Frequency
Low	902.3 MHz
Mid	908.7 MHz
High	914.9 MHz

2.3. Test Mode

Test Mode	Mode 1: Transmit at low channel
	Mode 2: Transmit at mid channel
	Mode 3: Transmit at high channel

2.4. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.5. Description of Test Software

N/A

3. DESCRIPTION OF TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013), and the guidance provided in ANSI C63.10-2013 were used in the measurement.

Deviation from measurement procedure.....None

3.2. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the Antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable. For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive Antenna height using a broadband Antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn Antennas were used. For frequencies below 30MHz, a calibrated loop Antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband Antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-40GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive Antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn Antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive Antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive Antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn Antenna, the horn Antenna should be always directed to the EUT when rising height.

4. TEST EQUIPMENT CALIBRATION DATE

Radiated Emissions - AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2020/08/01
PXA Signal Analyzer	Keysight	9030B	MRTSUE06395	1 year	2020/09/03
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2020/11/13
Bilog Period Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2020/03/31
Broad Band Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2020/10/13
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06597	1 year	2020/02/24
Microwave System Amplifier	Agilent	83017A	MRTSUE06076	1 year	2020/11/15
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2020/06/11
Thermohyrometer	Testo	608-H1	MRTSUE06403	1 year	2020/08/08
Anechoic Chamber	TDK	Chamber-AC1	MRTSUE06212	1 year	2020/04/30

Radiated Emission - AC2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Keysight	N9038A	MRTSUE06125	1 year	2020/08/01
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2020/11/13
Bilog Period Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2020/10/13
Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06171	1 year	2020/10/27
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06597	1 year	2020/02/24
Broadband Coaxial Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2020/11/15
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2020/06/11
Temperature/Humidity Meter	Minggao	ETH529	MRTSUE06170	1 year	2020/12/15
Anechoic Chamber	RIKEN	Chamber-AC2	MRTSUE06213	1 year	2020/04/30

Software	Version	Function
EMI Software	V3	EMI Test Software

5. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

Radiated Emission Measurement - AC1

Measurement Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$):

Horizontal: 30MHz~300MHz: 4.07dB

300MHz~1GHz: 3.63dB

1GHz~18GHz: 4.16dB

Vertical: 30MHz~300MHz: 4.18dB

300MHz~1GHz: 3.60dB

1GHz~18GHz: 4.76dB

Radiated Emission Measurement - AC2

Measurement Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$):

Horizontal: 30MHz~300MHz: 3.75dB

300MHz~1GHz: 3.53dB

1GHz~18GHz: 4.28dB

Vertical: 30MHz~300MHz: 3.86dB

300MHz~1GHz: 3.53dB

1GHz~18GHz: 4.33dB

6. TEST RESULT

6.1. Summary

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.205 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209	Radiated	Pass	Section 7.2

Notes:

- 1) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- 2) All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst case emissions.

6.2. Radiated Spurious Emission Measurement

6.2.1. Test Limit

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15.209 Limit		
Frequency (MHz)	Field Strength ($\mu\text{V}/\text{m}$)	Measured Distance (m)
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

6.2.2. Test Procedure Used

ANSI C63.10 - Section 6.3 (General Requirements)

ANSI C63.10 - Section 6.4 (Standard test method below 30MHz)

ANSI C63.10 - Section 6.5 (Standard test method above 30MHz to 1GHz)

ANSI C63.10 - Section 6.6 (Standard test method above 1GHz)

6.2.3. Test Setting

Table 1 - RBW as a function of frequency

Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000 MHz	1 MHz

Quasi-Peak Measurements below 1GHz

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Span was set greater than 1MHz
3. RBW = as specified in Table 1
4. Detector = CISPR quasi-peak
5. Sweep time = auto couple
6. Trace was allowed to stabilize

Peak Measurements above 1GHz

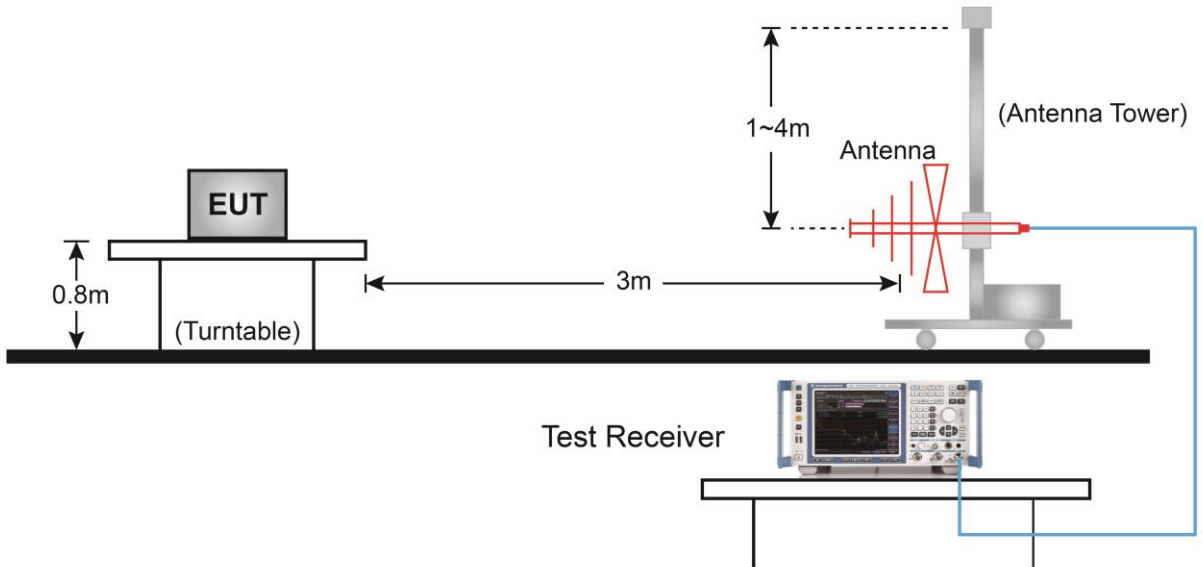
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Average Measurements above 1GHz (Method VB)

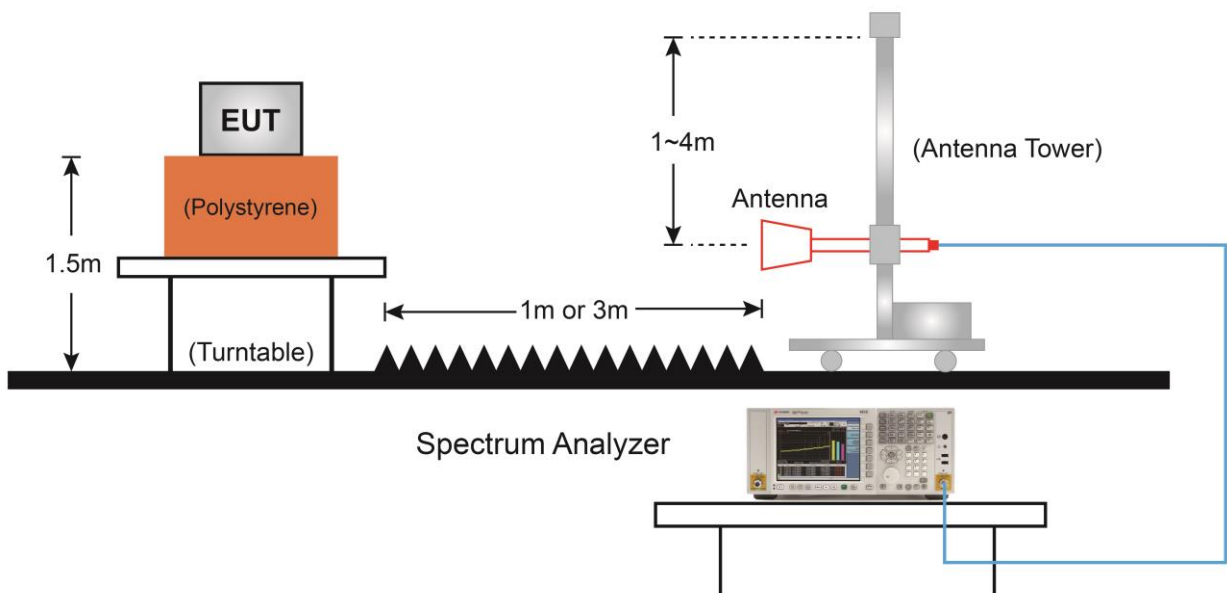
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; If the EUT is configured to transmit with duty cycle $\geq 98\%$, set VBW = 10Hz
If the EUT duty cycle is $< 98\%$, set VBW $\geq 1/T$. T is the minimum transmission duration
4. Detector = Peak
5. Sweep time = auto
6. Trace mode = max hold
7. Trace was allowed to stabilize

6.2.4. Test Setup

Below 1GHz Test Setup:



Above 1GHz Test Setup:



6.2.5. Test Result

Product	FireHUD Band	Temperature	25°C
Test Engineer	Jason Gao	Relative Humidity	54%
Test Site	AC1	Test Date	2020/01/08
Test Mode	Test Mode 1	Test Channel	Low
Remark	<ol style="list-style-type: none"> 1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report. 		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4646.5	37.8	5.3	43.1	74.0	-30.9	Peak	Horizontal
	5930.0	37.5	7.8	45.3	74.0	-28.7	Peak	Horizontal
	6584.5	38.4	9.8	48.2	74.0	-25.8	Peak	Horizontal
	7281.5	41.6	11.7	53.3	74.0	-20.7	Peak	Horizontal
	7281.7	24.8	11.7	36.5	54.0	-17.5	Average	Horizontal
	5420.0	38.1	7.0	45.1	74.0	-28.9	Peak	Vertical
	6287.0	37.9	8.4	46.3	74.0	-27.7	Peak	Vertical
	7196.5	37.6	11.6	49.2	74.0	-24.8	Peak	Vertical
	7519.5	37.9	11.8	49.7	74.0	-24.3	Peak	Vertical

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Product	FireHUD Band	Temperature	25°C
Test Engineer	Jason Gao	Relative Humidity	54%
Test Site	AC1	Test Date	2020/01/08
Test Mode	Test Mode 2	Test Channel	Mid
Remark	<ol style="list-style-type: none"> 1. Average measurement was not performed if peak level lower than average limit. So the margin was calculated using the average limit for emissions fall within the restricted bands. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report. 		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4969.5	36.4	6.3	42.7	74.0	-31.3	Peak	Horizontal
	6448.5	37.2	9.2	46.4	74.0	-27.6	Peak	Horizontal
	7043.5	36.1	10.9	47.0	74.0	-27.0	Peak	Horizontal
	7375.0	37.6	11.9	49.5	74.0	-24.5	Peak	Horizontal
	5403.0	36.3	7.0	43.3	74.0	-30.7	Peak	Vertical
	6533.5	37.8	9.5	47.3	74.0	-26.7	Peak	Vertical
	7052.0	37.7	10.9	48.6	74.0	-25.4	Peak	Vertical
	8114.5	37.4	12.6	50.0	74.0	-24.0	Peak	Vertical

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Product	FireHUD Band	Temperature	25°C
Test Engineer	Jason Gao	Relative Humidity	54%
Test Site	AC1	Test Date	2020/01/08
Test Mode	Test Mode 3	Test Channel	High
Remark	<ol style="list-style-type: none"> 1. Average measurement was not performed if peak level lower than average limit. So the margin was calculated using the average limit for emissions fall within the restricted bands. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report. 		

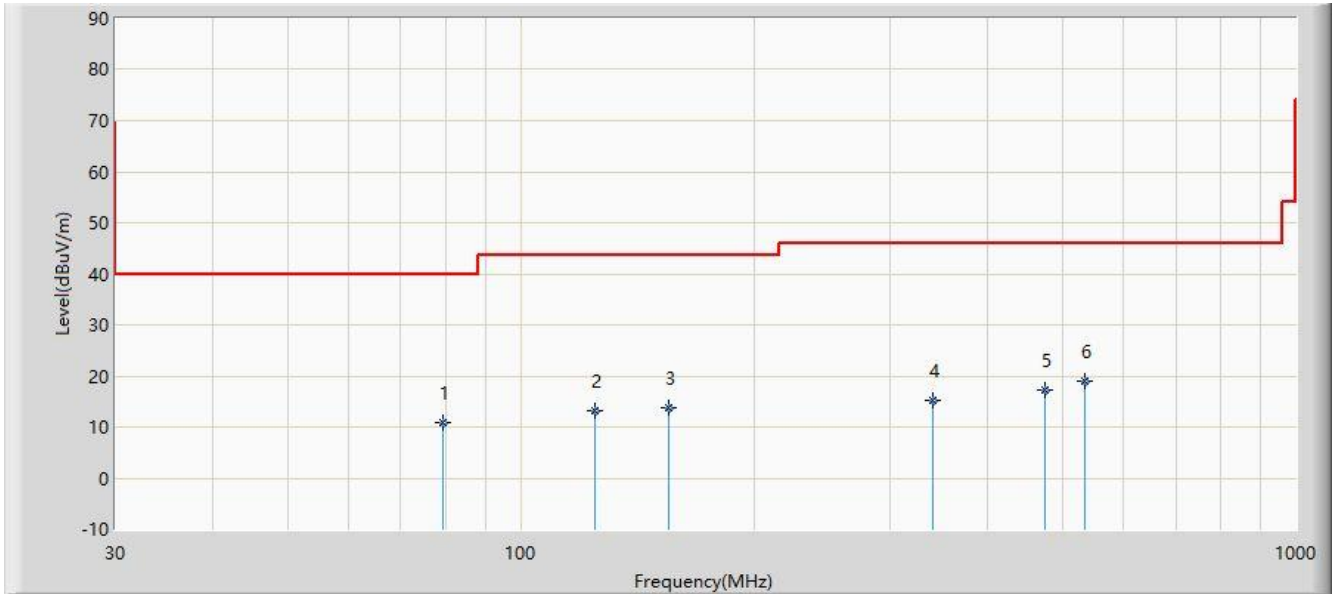
Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	5403.0	36.6	7.0	43.6	74.0	-30.4	Peak	Horizontal
	6032.0	37.4	7.9	45.3	74.0	-28.7	Peak	Horizontal
	7026.5	38.0	10.9	48.9	74.0	-25.1	Peak	Horizontal
	8191.0	37.4	12.4	49.8	74.0	-24.2	Peak	Horizontal
	4621.0	37.9	5.2	43.1	74.0	-30.9	Peak	Vertical
	5666.5	36.6	7.3	43.9	74.0	-30.1	Peak	Vertical
	6482.5	37.4	9.3	46.7	74.0	-27.3	Peak	Vertical
	7434.5	37.7	11.9	49.6	74.0	-24.4	Peak	Vertical

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

The Worst Case of Radiated Emission below 1GHz:

Site: AC1	Time: 2020/01/08 - 03:55
Limit: FCC_Part15.209_RSE(3m)	Engineer: Jason Gao
Probe: AC1_VULB 9168 _20-2000MHz	Polarity: Horizontal
EUT: FireHUD Band	Power: By Battery
Test Mode 2: Transmit at mid channel 908.7MHz	



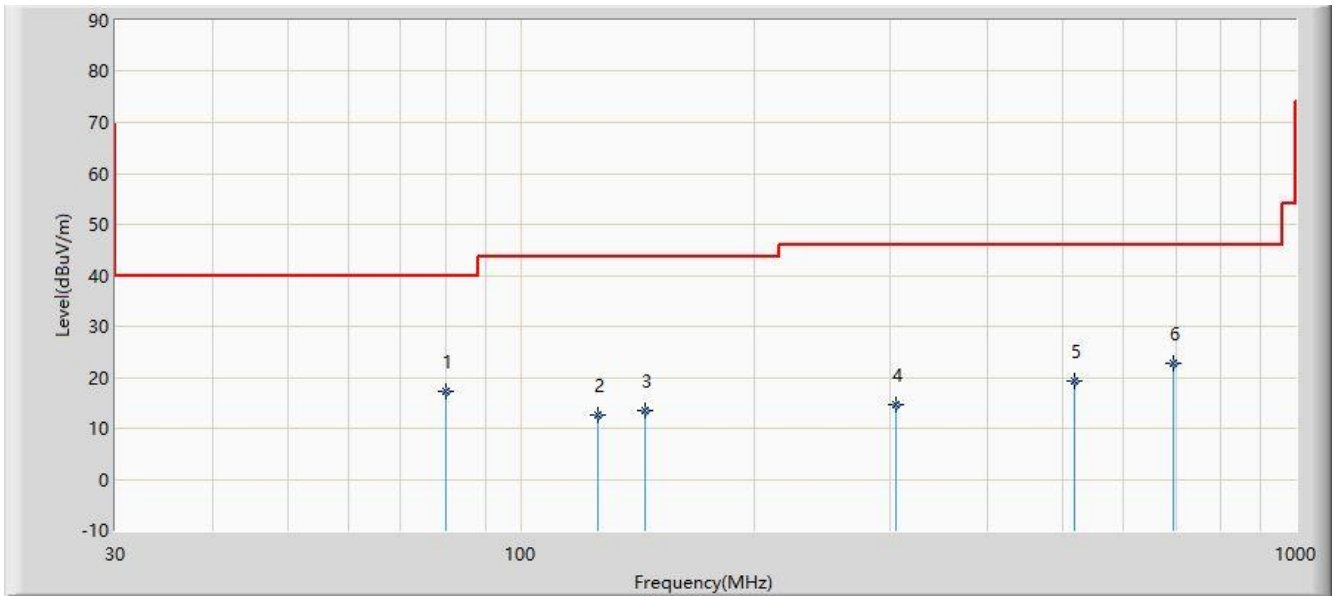
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			79.470	10.821	0.670	-29.179	40.000	10.151	QP
2			124.575	13.072	-0.404	-30.428	43.500	13.476	QP
3			155.130	13.771	-1.477	-29.729	43.500	15.248	QP
4			339.915	15.214	-0.089	-30.786	46.000	15.302	QP
5			473.775	17.317	-0.811	-28.683	46.000	18.128	QP
6		*	533.915	19.064	-0.196	-26.936	46.000	19.260	QP

Note 1: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz), therefore no data appear in the report.

Site: AC1	Time: 2020/01/08 - 03:59
Limit: FCC_Part15.209_RSE(3m)	Engineer: Jason Gao
Probe: AC1_VULB 9168 _20-2000MHz	Polarity: Vertical
EUT: FireHUD Band	Power: By Battery
Test Mode 2: Transmit at mid channel 908.7MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	79.955	17.302	7.167	-22.698	40.000	10.135	QP
2			126.030	12.658	-0.900	-30.842	43.500	13.558	QP
3			144.945	13.429	-1.462	-30.071	43.500	14.891	QP
4			304.510	14.704	0.240	-31.296	46.000	14.464	QP
5			517.425	19.415	0.480	-26.585	46.000	18.936	QP
6			693.965	22.813	0.819	-23.187	46.000	21.994	QP

Note 1: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz), therefore no data appear in the report.

7. CONCLUSION

The data collected relate only the item(s) tested and show that the unit is in compliance with radiated spurious emissions of FCC Part 15C rules.

————— The End —————

Appendix A - Test Setup Photograph

Refer to "1912RSU050-UT" file.

Appendix B - EUT Photograph

Refer to "1912RSU050-UE" file.