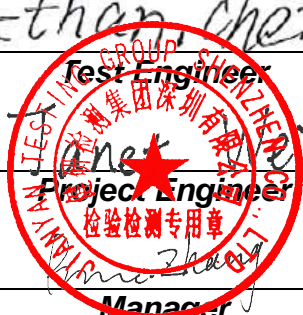


# FCC EMC Test Report

**Applicant:** Ham-Let Singapore Valves & Fittings Pte Ltd  
**Address of Applicant:** #05-22, 2 Woodlands Sector 1, Spectrum 1, Singapore 738068  
**Equipment Under Test (EUT)**  
**Product Name:** IoT-COMMBOX-IoT MANIFOLD  
**Model No.:** IoTHFEE  
**FCC ID:** 2A3I5-HFEE  
**Applicable Standards:** FCC CFR Title 47 Part 15B  
**Date of Sample Receipt:** 09 Aug., 2023  
**Date of Test:** 10 Aug., to 14 Aug., 2023  
**Date of report Issued:** 15 Aug., 2023  
**Test Result:** PASS

**Tested by:** Ethan Chen **Date:** 15 Aug., 2023  
**Reviewed by:** Alex **Date:** 15 Aug., 2023  
**Approved by:** Manager **Date:** 15 Aug., 2023



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 above the application standard version. Test results reported herein relate only to the item(s) tested.

This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

## 1 Version

Version No.	Date	Description
00	15 Aug., 2023	Original

## 2 Contents

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### 3 General Information

#### 3.1 Client Information

Applicant:	Ham-Let Singapore Valves & Fittings Pte Ltd
Address:	#05-22, 2 Woodlands Sector 1, Spectrum 1, Singapore 738068
Manufacturer:	Ham-Let Singapore Valves & Fittings Pte Ltd
Address:	#05-22, 2 Woodlands Sector 1, Spectrum 1, Singapore 738068

#### 3.2 General Description of E.U.T.

Product Name:	IoT-COMMBOX-IoT MANIFOLD
Model No.:	IoTHFEE
AC Adapter:	Model: DYS850-240210W-K Input: AC100-240V, 50/60Hz, 1.3A Output: DC24.0V, 2.1A
Test Sample Condition:	The test samples were provided in good working order with no visible defects.

#### 3.3 Test Mode

Operating Mode	Detail Description
Working with HF mode	Keep the EUT in High Frequency motor working mode(Worst mode)
Working with MV mode	Keep the EUT in Metering valve motor working mode
<p>The sample was placed 0.8m above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y &amp; Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.</p>	

### 3.4 Description of Test Auxiliary Equipment

Manufacturer	Description	Model	S/N	FCC ID/DoC
N/A				

### 3.5 Description of Cable Used

Cable Type	Description	Length	From	To
Detached USB Cable	Shielding	0.4m	EUT	PC/Adapter
Power line	Shielding	1.1m	EUT	Adapter

### 3.6 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%(U = 2Uc(y)))
Conducted Emission for LISN (9kHz ~ 10MHz)	1.9 dB
Conducted Emission for LISN (10MHz ~ 30MHz)	2.6 dB
Radiated Emission (1GHz ~ 18GHz) (3m SAC)	3.6 dB
Radiated Emission (30MHz ~ 1GHz) (10m SAC)	3.7 dB

**Note:** All the measurement uncertainty value were shown with a coverage  $k=2$  to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

### 3.7 Additions to, Deviations, or Exclusions from the Method

No
----

### 3.8 Laboratory Facility

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

● **FCC - Designation No.: CN1211**

JianYan Testing Group Shenzhen Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551.

● **ISED – CAB identifier.: CN0021**

The 3m Semi-anechoic chamber and 10m Semi-anechoic chamber of JianYan Testing Group Shenzhen Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

● **CNAS - Registration No.: CNAS L15527**

JianYan Testing Group Shenzhen Co., Ltd. is accredited to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L15527.

● **A2LA - Registration No.: 4346.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: <https://portal.a2la.org/scopepdf/4346-01.pdf>

### 3.9 Laboratory Location

JianYan Testing Group Shenzhen Co., Ltd.

Address: No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.

Tel: +86-755-23118282, Fax: +86-755-23116366

Email: info-JYTee@lets.com, Website: <http://jyt.lets.com>

### 3.10 Test Instruments List

<b>Radiated Emission(3m SAC):</b>					
<b>Test Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Manage No.</b>	<b>Cal. Date (mm-dd-yy)</b>	<b>Cal. Due date (mm-dd-yy)</b>
3m SAC	ETS	9m*6m*6m	WXJ001-1	04-14-2021	04-13-2024
BiConiLog Antenna	Schwarzbeck	VULB9163	WXJ002	02-09-2023	02-08-2024
Horn Antenna	Schwarzbeck	BBHA9120D	WXJ002-2	02-09-2023	02-08-2024
Pre-amplifier (30MHz ~ 1GHz)	Schwarzbeck	BBV9743B	WXJ001-2	01-10-2023	01-09-2024
Pre-amplifier (1GHz ~ 18GHz)	SKET	LNPA_0118G-50	WXJ001-3	01-10-2023	01-09-2024
EMI Test Receiver	Rohde & Schwarz	ESRP7	WXJ003-1	01-11-2023	01-10-2024
Spectrum Analyzer	Rohde & Schwarz	FSP 30	WXJ004	01-10-2023	01-09-2024
Coaxial Cable (30MHz ~ 1GHz)	JYTSZ	JYT3M-1G-NN-8M	WXG001-4	01-18-2023	01-17-2024
Coaxial Cable (1GHz ~ 18GHz)	JYTSZ	JYT3M-18G-NN-8M	WXG001-5	01-18-2023	01-17-2024
Band Reject Filter Group	Tonscend	JS0806-F	WXJ089	N/A	
Test Software	Tonscend	TS+	Version: 3.0.0.1		

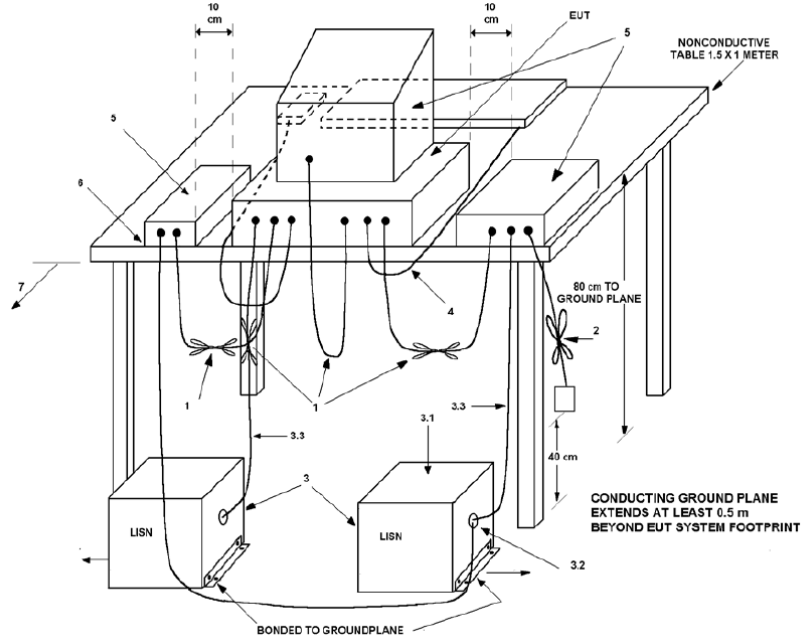
<b>Radiated Emission(10m SAC):</b>					
<b>Test Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Manage No.</b>	<b>Cal. Date (mm-dd-yy)</b>	<b>Cal. Due date (mm-dd-yy)</b>
10m SAC	ETS	RFSD-100-F/A	WXJ090	04-28-2021	04-27-2024
BiConiLog Antenna	SCHWARZBECK	VULB 9168	WXJ090-1	01-17-2023	01-16-2024
BiConiLog Antenna	SCHWARZBECK	VULB 9168	WXJ090-2	01-10-2023	01-09-2024
EMI Test Receiver	R&S	ESR 3	WXJ090-3	01-10-2023	01-09-2024
EMI Test Receiver	R&S	ESR 3	WXJ090-4	01-11-2023	01-09-2024
Low Pre-amplifier	Bost	LNA 0920N	WXJ090-6	01-10-2023	01-09-2024
Low Pre-amplifier	Bost	LNA 0920N	WXJ090-7	01-10-2023	01-09-2024
Cable	Bost	JYT10M-1G-NN-10M	WXG002-7	01-18-2023	01-17-2024
Cable	Bost	JYT10M-1G-NN-10M	WXG002-8	01-18-2023	01-17-2024
Test Software	R&S	EMC32	Version: 10.50.40		

<b>Conducted Emission:</b>					
<b>Test Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Manage No.</b>	<b>Cal. Date (mm-dd-yy)</b>	<b>Cal. Due date (mm-dd-yy)</b>
EMI Test Receiver	Rohde & Schwarz	ESR3	WXJ003-2	07-05-2023	07-04-2024
LISN	Schwarzbeck	NSLK 8127	QCJ001-13	01-10-2023	01-09-2024
LISN	Rohde & Schwarz	ESH3-Z5	WXJ005-1	01-11-2023	01-10-2024
LISN Coaxial Cable (9kHz ~ 30MHz)	JYTSZ	JYTCE-1G-NN-2M	WXG003-1	01-18-2023	01-17-2024
RF Switch	TOP PRECISION	RSU0301	WXG003	N/A	
Test Software	AUDIX	E3	Version: 6.110919b		

## 4 Measurement Setup and Procedure

### 4.1 Test Setup

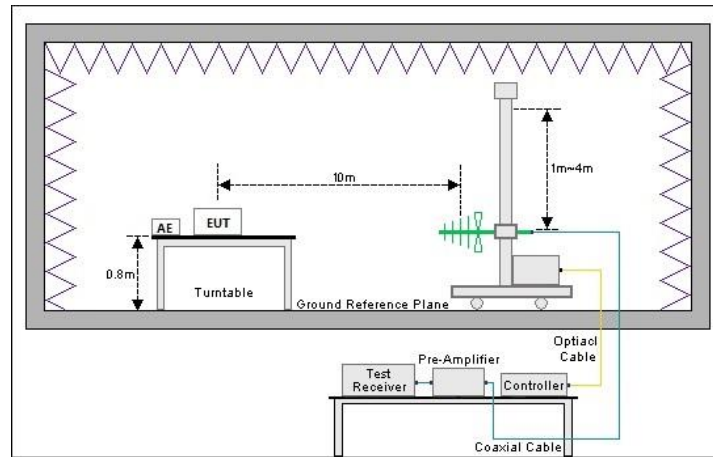
#### 1) Conducted emission measurement:

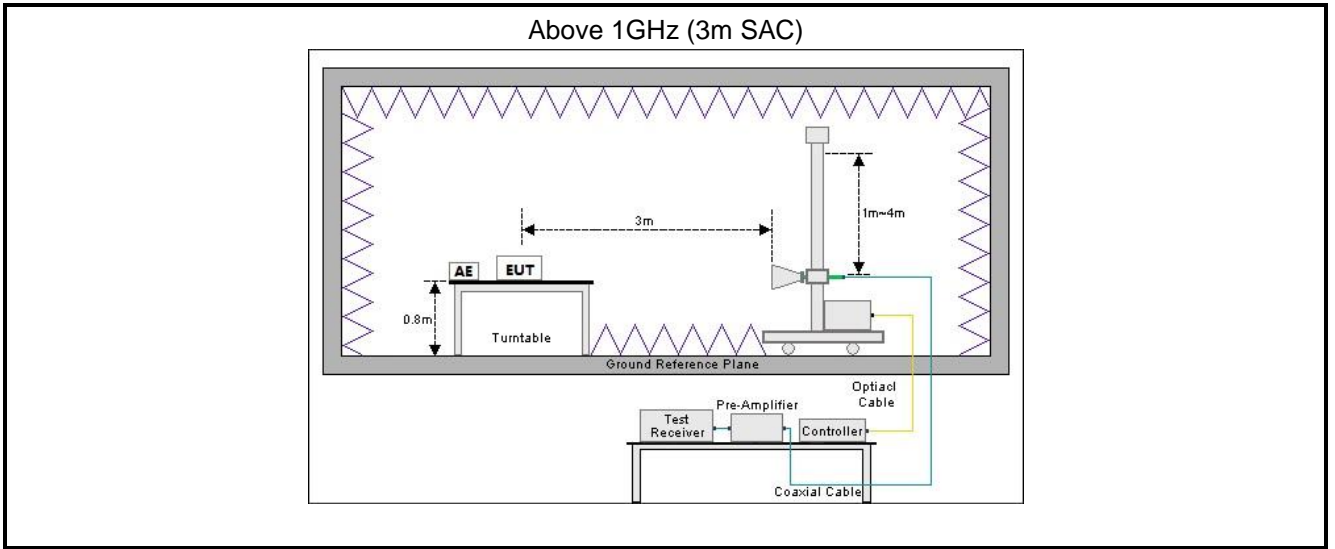


**Note:** The detailed descriptions please refer to Figure 8 of ANSI C63.4:2014.

#### 2) Radiated emission measurement:

Below 1GHz (10m SAC)







## 4.2 Test Procedure

Test method	Test step
Conducted emission	<ol style="list-style-type: none"> <li>1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.</li> <li>2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).</li> <li>3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4 on conducted measurement.</li> </ol>
Radiated emission	<p><b>For below 1GHz:</b></p> <ol style="list-style-type: none"> <li>1. The EUT was placed on the tabletop of a rotating table 0.8 m the ground at a 10 m semi anechoic chamber. The measurement distance from the EUT to the receiving antenna is 10 m.</li> <li>2. EUT works in each mode of operation that needs to be tested, and having the EUT continuously working, respectively on 3 axis (X, Y &amp; Z) and considered typical configuration to obtain worst position. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations.</li> <li>3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data.</li> </ol> <p><b>For above 1GHz:</b></p> <ol style="list-style-type: none"> <li>1. The EUT was placed on the tabletop of a rotating table 0.8 m the ground at a 3 m fully anechoic room. The measurement distance from the EUT to the receiving antenna is 3 m.</li> <li>2. EUT works in each mode of operation that needs to be tested, and having the EUT continuously working, respectively on 3 axis (X, Y &amp; Z) and considered typical configuration to obtain worst position. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations.</li> <li>3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data.</li> </ol>

## 5 Test Results

### 5.1 Summary

#### 5.1.1 Clause and data summary

This report was amended on FCC ID: 2A3I5-HFEE follow FCC Class II Permissive Change. The original report: JYTSZ-R01-2200041, issued by JianYan Testing Group Shenzhen Co., Ltd. The differences between them as below: Update the address of applicant and manufacturer. Add motor. So retest the EMC.

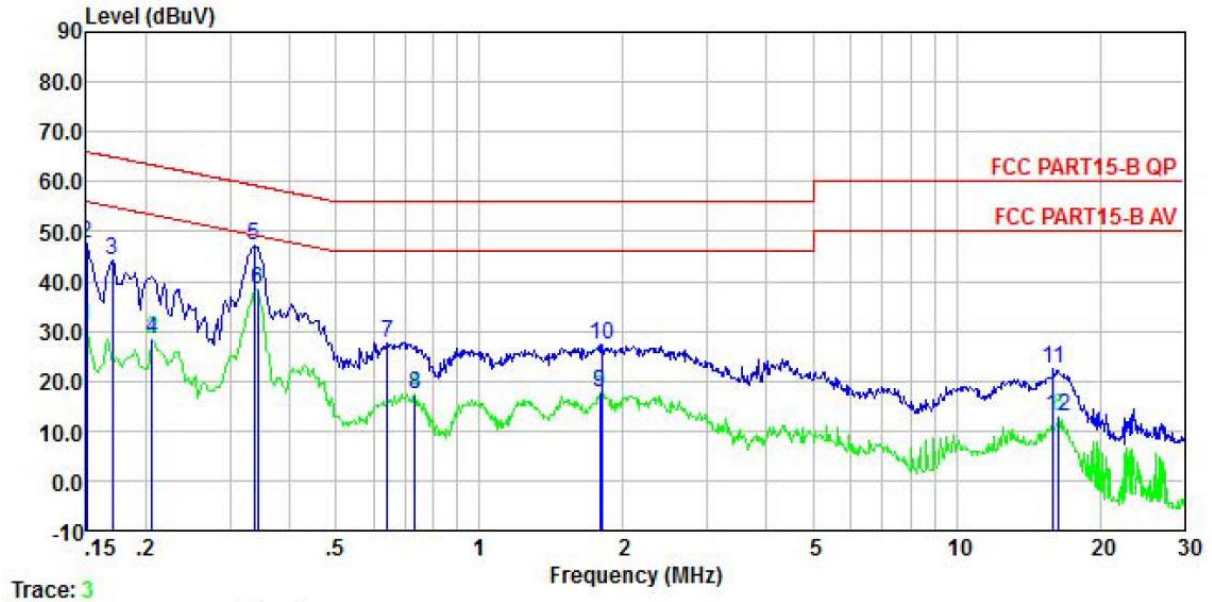
Test items	Standard clause	Test data	Result
Conducted Emission	Part 15.107	See Section 5.2	Pass
Radiated Emission	Part 15.109	See Section 5.3	Pass
<b>Remark:</b>			
1. The EUT is a <b>Class B</b> digital device.			
2. Pass: The EUT complies with the essential requirements in the standard.			
3. N/A: Not Applicable.			
<b>Test Method:</b>	ANSI C63.4:2014		

#### 5.1.2 Test Limit

Test items	Limit					
Conducted Emission	Frequency (MHz)	Class A Limit (dBµV)		Class B Limit (dBµV)		
		Quasi-Peak	Average	Quasi-Peak	Average	
	0.15 – 0.5	79	66	66 to 56 <small>Note 1</small>	56 to 46 <small>Note 1</small>	
	0.5 – 5	73	60	56	46	
	5 – 30	73	60	60	50	
<b>Note 1:</b> The limit level in dBµV decreases linearly with the logarithm of frequency.						
<b>Note 2:</b> The more stringent limit applies at transition frequencies.						
Radiated Emission	Frequency (MHz)	Class A Limit (dBµV/m)		Class B Limit (dBµV/m)		
		Quasi-Peak @ 3m	Quasi-Peak @ 10m	Quasi-Peak @ 3m	Quasi-Peak @ 10m	
	30 – 88	49.0	39.0	40.0	30.0	
	88 – 216	53.5	43.5	43.5	33.5	
	216 – 960	56.0	46.0	46.0	36.0	
	960 – 1000	60.0	50.0	54.0	44.0	
	<b>Note:</b> The more stringent limit applies at transition frequencies.					
	Frequency	Class A Limit (dBµV/m) @ 3m		Class B Limit (dBµV/m) @ 3m		
		Average	Peake	Average	Peake	
	Above 1 GHz	60.0	80.0	54.0	74.0	
<b>Note:</b> The measurement bandwidth shall be 1 MHz or greater.						

## 5.2 Conducted Emission

Product name:	IoT-COMMBOX-IoT MANIFOLD	Product model:	IoTTFEE
Test by:	Ethan	Test mode:	Working with HF mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Line
Test voltage:	AC 120 V/60 Hz		

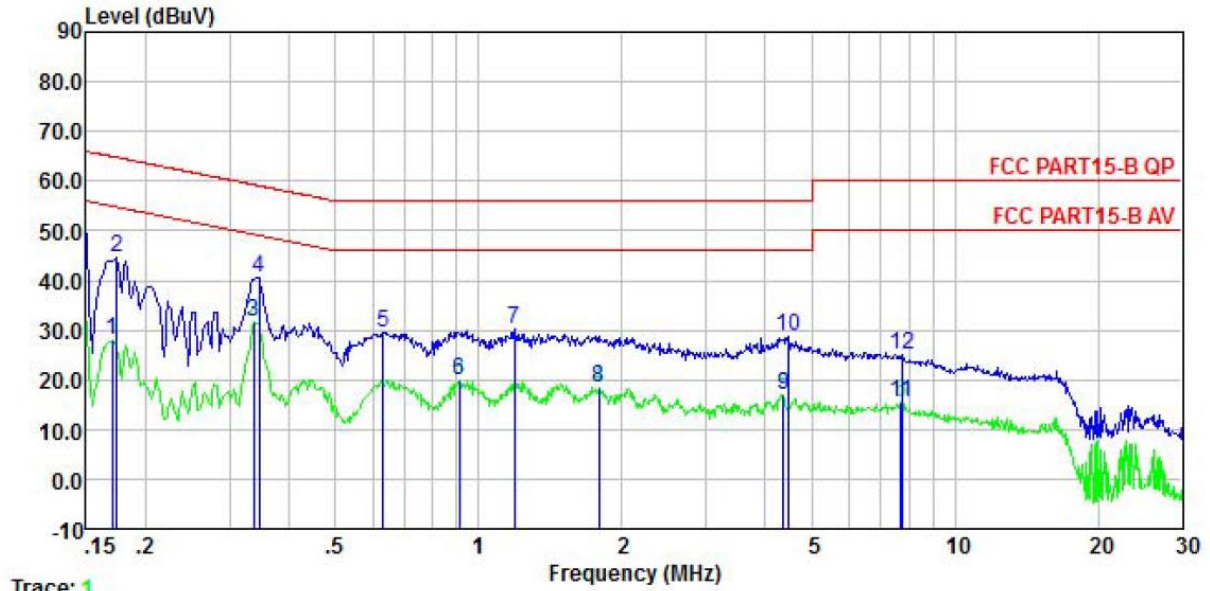


	Freq	Read Level	LISN Factor	Aux2 Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.150	20.26	0.04	10.50	0.01	30.81	56.00	-25.19	Average
2	0.150	37.12	0.04	10.50	0.01	47.67	66.00	-18.33	QP
3	0.170	33.83	0.04	10.50	0.01	44.38	64.94	-20.56	QP
4	0.206	17.96	0.05	10.50	0.04	28.55	53.36	-24.81	Average
5	0.337	36.56	0.06	10.50	0.02	47.14	59.27	-12.13	QP
6	0.343	27.88	0.06	10.50	0.02	38.46	49.13	-10.67	Average
7	0.641	17.19	0.06	10.50	0.02	27.77	56.00	-28.23	QP
8	0.731	6.69	0.07	10.50	0.03	17.29	46.00	-28.71	Average
9	1.790	6.85	0.08	10.50	0.19	17.62	46.00	-28.38	Average
10	1.810	16.59	0.08	10.50	0.19	27.36	56.00	-28.64	QP
11	15.970	11.54	0.30	10.50	0.16	22.50	60.00	-37.50	QP
12	16.398	1.91	0.31	10.50	0.16	12.88	50.00	-37.12	Average

**Remark:**

1. Level = Read level + LISN Factor + Cable Loss.

<b>Product name:</b>	IoT-COMMBOX-IoT MANIFOLD	<b>Product model:</b>	IoTHFEE
<b>Test by:</b>	Ethan	<b>Test mode:</b>	Working with HF mode
<b>Test frequency:</b>	150 kHz ~ 30 MHz	<b>Phase:</b>	Neutral
<b>Test voltage:</b>	AC 120 V/60 Hz		



Trace: 1

	Freq	Read Level	LISN Factor	Aux2 Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.170	17.36	0.06	10.50	0.01	27.93	54.94	-27.01	Average
2	0.174	33.87	0.05	10.50	0.01	44.43	64.77	-20.34	QP
3	0.337	20.99	0.05	10.50	0.02	31.56	49.27	-17.71	Average
4	0.346	30.15	0.05	10.50	0.02	40.72	59.05	-18.33	QP
5	0.630	18.95	0.05	10.50	0.02	29.52	56.00	-26.48	QP
6	0.909	9.45	0.06	10.50	0.04	20.05	46.00	-25.95	Average
7	1.191	19.57	0.06	10.50	0.09	30.22	56.00	-25.78	QP
8	1.790	7.68	0.07	10.50	0.19	18.44	46.00	-27.56	Average
9	4.361	6.31	0.10	10.50	0.08	16.99	46.00	-29.01	Average
10	4.454	18.05	0.11	10.50	0.08	28.74	56.00	-27.26	QP
11	7.687	4.75	0.17	10.50	0.10	15.52	50.00	-34.48	Average
12	7.728	14.28	0.17	10.50	0.10	25.05	60.00	-34.95	QP

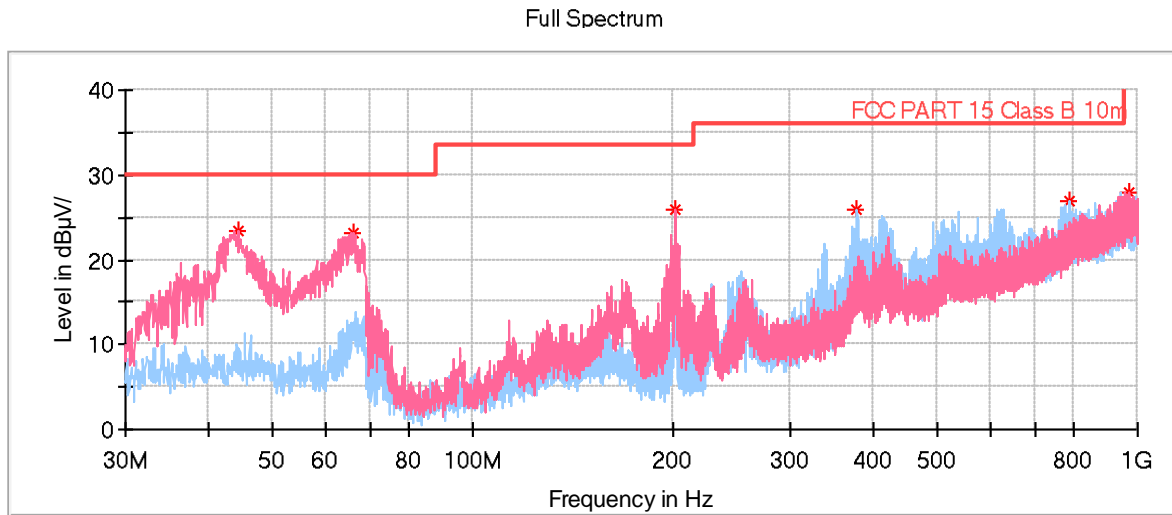
**Remark:**

1. Level = Read level + LISN Factor + Cable Loss.

### 5.3 Radiated Emission

Below 1GHz:

<b>Product Name:</b>	IoT-COMMBOX-IoT MANIFOLD	<b>Product Model:</b>	IoTTHFEE
<b>Test By:</b>	Ethan	<b>Test mode:</b>	Working with HF mode
<b>Test Frequency:</b>	30 MHz ~ 1 GHz	<b>Polarization:</b>	Vertical & Horizontal
<b>Test Voltage:</b>	AC 120V/60Hz		



- \* Critical\_Freqs PK+
- ◆ Final\_Result QPK
- FCC PART 15 Class B 10m
- Preview Result 1H-PK+
- Preview Result 1V-PK+

#### Critical\_Freqs

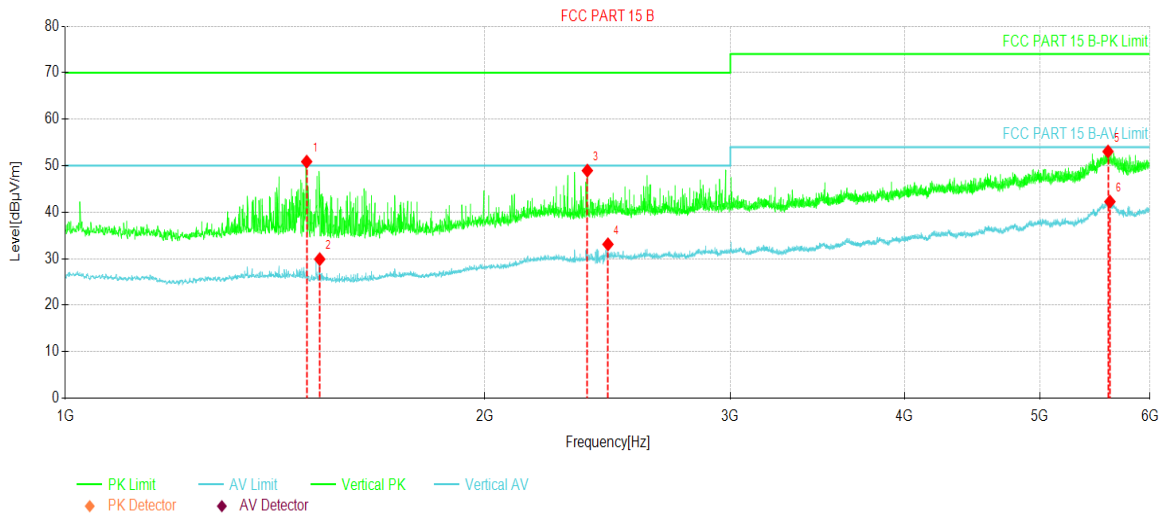
Frequency (MHz)	MaxPeak (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
44.307500	23.36	30.00	6.64	100.0	V	162.0	-15.5
65.938500	23.16	30.00	6.84	100.0	V	0.0	-17.5
201.302000	25.89	33.50	7.61	100.0	V	246.0	-17.8
378.763500	25.82	36.00	10.18	100.0	H	276.0	-12.7
789.704000	26.90	36.00	9.10	100.0	H	206.0	-2.8
974.392000	27.94	44.00	16.06	100.0	V	56.0	0.2

**Remark:**

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

Above 1GHz:

<b>Product Name:</b>	IoT-COMMBOX-IoT MANIFOLD	<b>Product Model:</b>	IoTHFEE
<b>Test By:</b>	Ethan	<b>Test mode:</b>	Working with HF mode
<b>Test Frequency:</b>	1000 MHz ~ 6000 MHz	<b>Polarization:</b>	Vertical
<b>Test Voltage:</b>	AC 120V/60Hz		

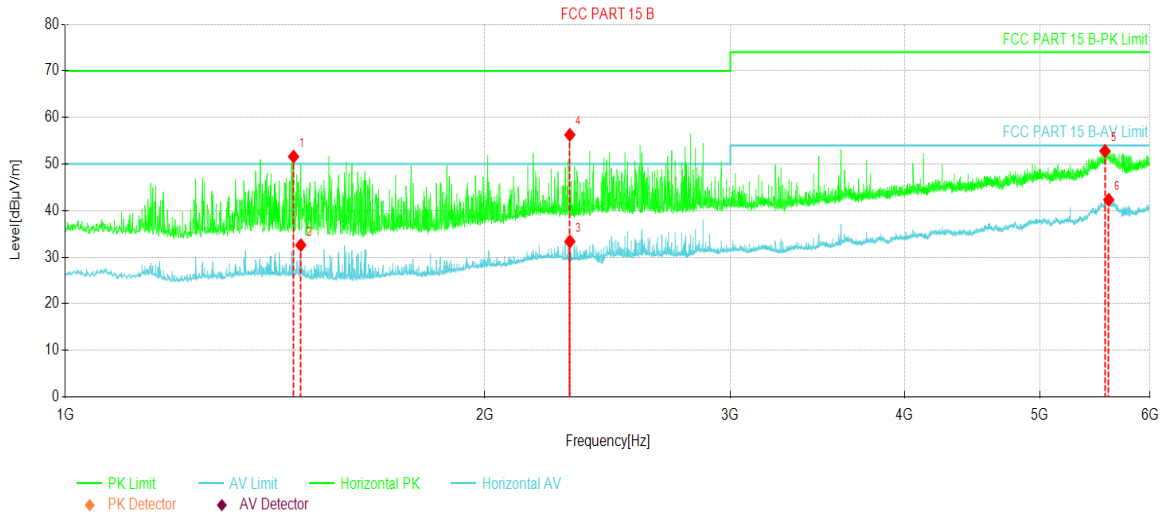


Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	1490.06	73.79	50.86	-22.93	70.00	19.14	PK	Vertical
2	1522.56	53.02	29.88	-23.14	50.00	20.12	AV	Vertical
3	2368.92	67.96	48.94	-19.02	70.00	21.06	PK	Vertical
4	2450.80	51.53	33.08	-18.45	50.00	16.92	AV	Vertical
5	5598.07	57.90	53.04	-4.86	74.00	20.96	PK	Vertical
6	5615.57	47.23	42.26	-4.97	54.00	11.74	AV	Vertical

**Remark:**

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

<b>Product Name:</b>	IoT-COMMBOX-IoT MANIFOLD	<b>Product Model:</b>	IoTHFEE
<b>Test By:</b>	Ethan	<b>Test mode:</b>	Working with HF mode
<b>Test Frequency:</b>	1000 MHz ~ 6000 MHz	<b>Polarization:</b>	Horizontal
<b>Test Voltage:</b>	AC 120V/60Hz		



Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	1458.18	74.10	51.59	-22.51	70.00	18.41	PK	Horizontal
2	1475.68	55.32	32.58	-22.74	50.00	17.42	AV	Horizontal
3	2301.41	52.63	33.37	-19.26	50.00	16.63	AV	Horizontal
4	2301.41	75.52	56.26	-19.26	70.00	13.74	PK	Horizontal
5	5569.94	58.01	52.77	-5.24	74.00	21.23	PK	Horizontal
6	5604.95	47.20	42.32	-4.88	54.00	11.68	AV	Horizontal

**Remark:**

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

-----End of report-----