Industrial Internet Innovation Center (Shanghai) Co.,Ltd.

EMC TEST REPORT

PRODUCT	WiFi sensor
BRAND	N/A
MODEL	MUGIC 2.0
APPLICANT	KIMARI, LLC
FCC ID	2BHDJ-MUGIC
ISSUE DATE	August 12, 2024
STANDARD(S)	FCC Part 15, Subpart B, ANSI C63.4-2014

Prepared by: ***Li Liukai*** **Reviewed by:** ***Qin Yabin*** **Approved by:** ***Zhang Min***

CAUTION:
This report shall not be reproduced except in full without the written permission of the test laboratory and shall not be quoted out of context.

CONTENTS

1 SUMMARY OF TEST REPORT 3

1.1 TEST STANDARD (S) 3
1.2 SUMMARY OF TEST RESULTS 3

2 GENERAL INFORMATION OF THE LABORATORY 4

2.1 TESTING LABORATORY 4
2.2 LABORATORY ENVIRONMENTAL REQUIREMENTS 4
2.3 PROJECT INFORMATION 4

3 GENERAL INFORMATION OF THE CUSTOMER 5

3.1 APPLICANT 5
3.2 MANUFACTURER 5
3.3 FACTORY 5

4 GENERAL INFORMATION OF THE PRODUCT 6

4.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) 6
4.2 DESCRIPTION FOR AUXILIARY EQUIPMENT (AE) 6

5 TEST CONFIGURATION INFORMATION 7

5.1 LABORATORY ENVIRONMENTAL CONDITIONS 7
5.2 DECISION OF FINAL TEST MODE 8
5.3 EUT SYSTEM OPERATION 8
5.4 EUT CONNECTION DIAGRAM OF TEST SYSTEM 8
5.5 TEST EQUIPMENT UTILIZED 9
5.6 MEASUREMENT UNCERTAINTY 9

6 TEST RESULTS 10

6.1 RADIATED EMISSION 10
6.2 CONDUCTED EMISSION 12

ANNEX A: MEASUREMENT DATA 14

ANNEX B: REVISED HISTORY 18

ANNEX C: ACCREDITATION CERTIFICATE 19

1 Summary of Test Report

1.1 Test Standard (s)

No.	Test Standard(s)	Title
1	FCC Part 15, Subpart B	Radio frequency devices
2	ANSI C63.4	Method of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
NOTE: According to customer requirements, test and report using the latest version of the standard.		

1.2 Summary of Test Results

No.	Item(s)	FCC Standard(s)	Verdicts for Single Item	Detaied Results
1	Radiated Emission	15.109(a)	Pass	See section 6.1
2	AC Conducted Emission	15.107(a)	Pass	See section 6.2
NOTE: The MUGIC 2.0, manufactured by KIMARI, LLC is a new product for testing. Industrial Internet Innovation Center (Shanghai) Co., Ltd. only performed test cases which identified with Pass/Fail/Inc result in section 1.3. Industrial Internet Innovation Center (Shanghai) Co., Ltd. has verified that the compliance of the tested device specified in section 4 of this test report is successfully evaluated according to the procedure and test methods as defined in type certification requirement listed in section 1 of this test report.				

2 General Information of The Laboratory

2.1 Testing Laboratory

Lab Name	Industrial Internet Innovation Center (Shanghai) Co.,Ltd.
Address	Building 4, No. 766, Jingang Road, Pudong, Shanghai, China
Telephone	021-68866880
FCC Registration No.	708870
FCC Designation No.	CN1364
IC designation No.	10766A
CAB identifier	CN0067

2.2 Laboratory Environmental Requirements

Temperature	15℃~35℃
Relative Humidity	25%RH~75%RH
Atmospheric Pressure	86kPa~106kPa
Supply Voltage	120V/60Hz

2.3 Project Information

Project Manager	Zhang Heng
Test Date	June 27, 2024 to July 30, 2024

3 General Information of The Customer

3.1 Applicant

Company	KIMARI, LLC
Address	13 Misty Meadows, Irvine CA 92612 USA
Telephone	+33625028368

3.2 Manufacturer

Company	KIMARI, LLC
Address	13 Misty Meadows, Irvine CA 92612 USA
Telephone	+33625028368

3.3 Factory

Company	N/A
Address	N/A

4 General Information of The Product

4.1 Product Description for Equipment under Test (EUT)

Product	WiFi sensor
Model	MUGIC 2.0
Date of Receipt	June 26, 2024
EUT ID*	S04aa (For WLAN Test) S09aa (For BLE Test)
SN/IMEI	N/A
Supported Radio Technology and Bands	WLAN 802.11b,g,n (2412MHz-2462MHz) BLE (2402MHz-2480MHz)
Hardware Version	P2
Software Version	MU218 v1.1.4
Power Supply	DC 3.7V from Battery & DC 5V from Adapter
NOTE1: EUT ID is the internal identification code of the laboratory. NOTE2: Photographs of EUT are shown in ANNEX A of this test report. NOTE3: Samples in the test report are provided by the customer. The test results are only applicable to the samples received by the laboratory.	

4.2 Description for Auxiliary Equipment (AE)

AE ID*	Description	Model	SN/Remark
CA06	Adapter	ASUC65a-050100	Shenzhen Aquilstar Technology Co.,Ltd. INPUT: 100-240V~50/60Hz 0.35A OUTPUT: 5V 1A
UA06	AC Cable	N/A	N/A
AE1	Notebook PC	ThinkPad X1 Carbon	N/A
AE2	Software	ESP32	N/A
AE3	PC Adapter	ADLX65NCC3A	INPUT: 100-240V~1.8A 50-60Hz OUTPUT: 20V 3.25A
NOTE: *AE ID is the internal identification code of the laboratory.			

5 Test Configuration Information

5.1 Laboratory Environmental Conditions

5.1.1 Permanent Facilities

Semi-anechoic chamber SAC3-1 (9 m*8m*6.2m) & SAC3-2 (9.8m*6.7m*6.7m)	
Shielding effectiveness	0.014MHz ~1MHz, >60dB; 1MHz~1000MHz, >90dB.
Electrical insulation	> 2MΩ
Ground system resistance	< 4Ω
Normalised site attenuation (NSA)	< ± 4 dB, 3m distance, from 30 to 1000 MHz
Site voltage standing-wave ratio (SVSWR)	Between 0 and 6 dB, from 1GHz to 18GHz
Uniformity of field strength	Between 0 and 6 dB, from 80 to 6000 MHz

Shielded room	
Shielding effectiveness	0.014MHz~1MHz, >60dB; 1MHz~1000MHz, >90dB.
Electrical insulation	> 2 MΩ
Ground system resistance	< 4Ω

5.2 Decision of final test mode

The EUT was tested in conjunction with the accessories in Section 4.2. We tested all of the following test modes and selected the worst mode from the test results and recorded them in the report.

The test configuration modes are as the following:

Test Item	Test setup and operating modes
Radiated emission	30MHz-18GHz frequency range: Mode 1: Charging mode+ CA06+ UA06+ S04aa Mode 2: WLAN RX mode+ UA06+ AE1+ AE2+ S04aa Mode 3: BLE RX mode+ UA06+ AE1+ AE2+ S09aa
AC Conducted emission	Mode 1: Charging mode+ CA06+ UA06+ S04aa Mode 2: WLAN RX mode+ UA06+ AE1+ AE2+ AE3+ S04aa Mode 3: BLE RX mode+ UA06+ AE1+ AE2+ AE3+ S09aa
Note: 1. The worst case of radiated emission for 30MHz-1GHz is Mode 2 and for 1GHz -18GHz is Mode 1. 2. The worst case for conducted emission is mode 1.	

5.3 EUT System Operation

1. Connect the EUT with AE.
2. Setup the EUT according to the standard.
3. Start testing and monitoring the function.
4. The EUT is connected to the computer through the USB cable, and the ESP32 software on the computer controls the EUT enter the BLE and WLAN RX state.

5.4 EUT Connection Diagram of Test System

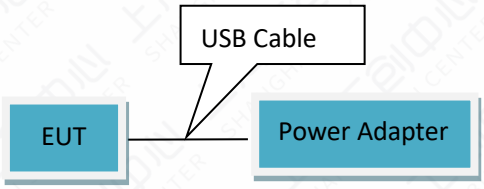

Figure 5.4-1 Mode 1

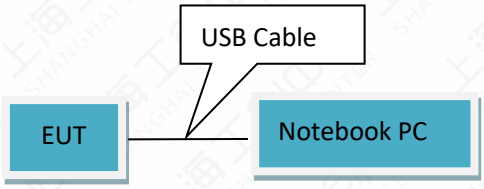

Figure 5.4-1 Mode 2,3

5.5 Test Equipment Utilized

No.	Name	Model	S/N	SW Version	HW Version	Manufacturer	Cal. Date	Cal. Interval
1	Test Receiver	ESCI	101235	V5.1-24-3	00	R&S	2023-12-19	1 year
2	Test Receiver	ESR7	102399	1.4	00	R&S	2024-06-07	1 year
3	Test Receiver	FSW43	101943	1.12	00	R&S	2023-08-31	1 year
4	Trilog Antenna	VULB9162	00426	N/A	N/A	Schwarzbeck	2023-07-18	1 year
							2024-07-17	1 year
5	Double Ridged Guide Antenna	ETS-3117	00135885	N/A	N/A	ETS	2024-03-26	1 year
6	2-Line V-Network	ENV216	101380	N/A	N/A	R&S	2023-12-19	1 year
7	EMI Test Software	EMC32 V10.35.02	N/A	N/A	N/A	R&S	N/A	N/A
8	EMI Test Software	EMC32 V10.60.20	N/A	N/A	N/A	R&S	N/A	N/A
9	Preamplifier	SCU08F1	8320024	N/A	N/A	R&S	2023-10-16	1 year
10	Preamplifier	SCU18	10155	N/A	N/A	R&S	2023-10-16	1 year

5.6 Measurement Uncertainty

Item (s)	Uncertainty
Radiated Emission 30MHz-1000MHz	4.86 dB
Radiated Emission 1000MHz-18000MHz	5.58 dB
Conducted Emission	3.30 dB
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of *k*=2.	

6 Test Results

6.1 Radiated Emission

6.1.1 Method of Measurement

a. For 30MHz -1000MHz, the EUT was placed on the top of a rotating 0.8m table above the ground at a semi-anechoic chamber. The distance between the EUT and the received antenna was 3 meters. The table was rotated 360 degree and the received antenna mounted on a variable-height antenna tower was varied from 1m to 4m to find the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna were set during the measurement.

b. For 1000MHz -18000MHz, the EUT was placed on the top of a 0.8m table above the ground at a 3m fully anechoic chamber. The maximal emission value was acquired by adjusting the antenna height, The table was rotated 360 degrees to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna were set during the measurement

6.1.2 EUT Connection Diagram of Test System

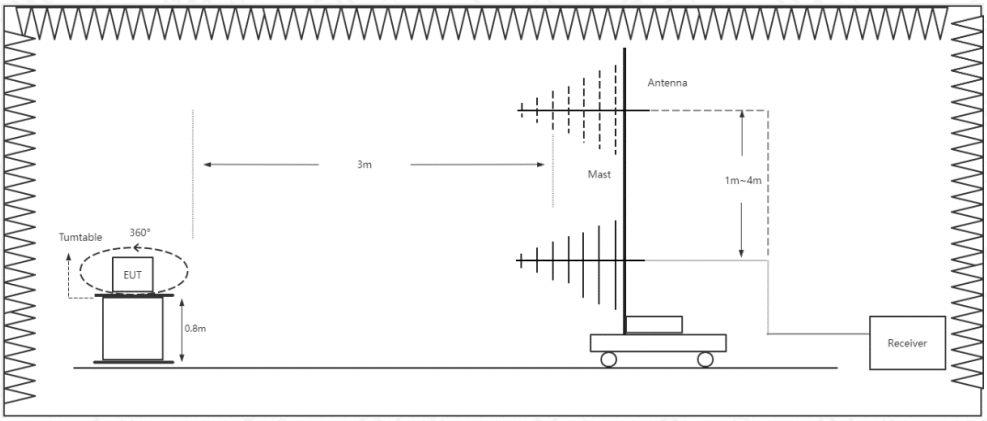

Figure 6.1.2-1 RE 30MHz-1GHz Connection Diagram

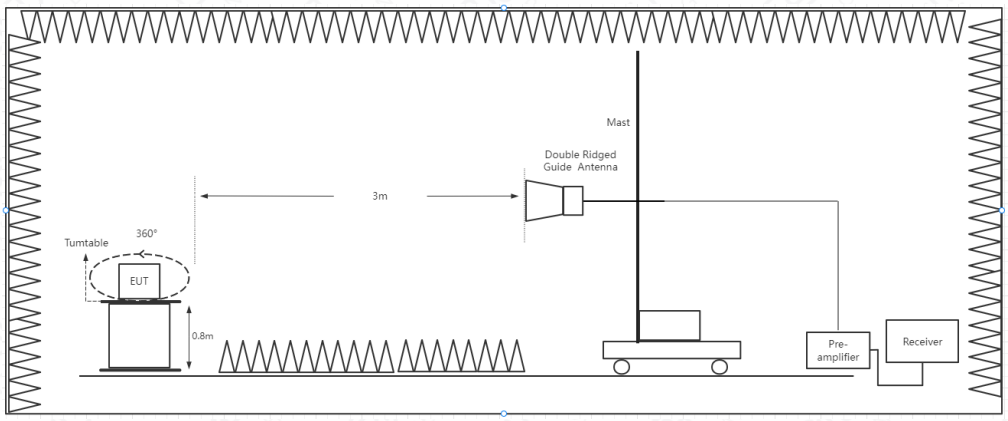

Figure 6.1.2-2 RE Above 1GHz Connection Diagram

6.1.3 Test Condition

Frequency Range (MHz)	RBW/VBW	Sweep Time (s)
30-1000	120kHz/300kHz	AUTO
1000-18000	1MHz/3MHz	AUTO

6.1.4 Limit/Criterion

Frequency Range (MHz)	Quasi-Peak (dBμV/m)	Peak (dBμV/m)	Average (dBμV/m)
30-88	40	N/A	N/A
88-216	43.5	N/A	N/A
216-960	46	N/A	N/A
Above 960	54	N/A	N/A
Above 1000	N/A	74	54

6.1.5 Test environmental conditions

Temperature	20.4℃
Relative Humidity	63.9%RH
Atmospheric Pressure	101.8 kPa

6.1.6 Test Results

Mode	Frequency (MHz)	Test Results	Verdicts
Mode 2: WLAN RX mode+ UA06+ AE1+ AE2+ S04aa	30-1000	See Annex A.1-1	Pass
Mode 1: Charging mode+ CA06+ UA06+ S04aa	1000-18000	See Annex A.1-2 &A.1-3	Pass
NOTE Abbreviations used in this clause: Pass—P; Fail—F; Not applicable—N/A			

6.2 Conducted Emission

6.2.1 Method of Measurement

The EUT was placed on a 0.8m height table with EUT being connected to the power mains through a line impedance stabilization network (LISN). Both lines of the power mains connected to the EUT were checked for maximum conducted interference. The frequency range from 150 kHz to 30 MHz was searched.

6.2.2 EUT Connection Diagram of Test System

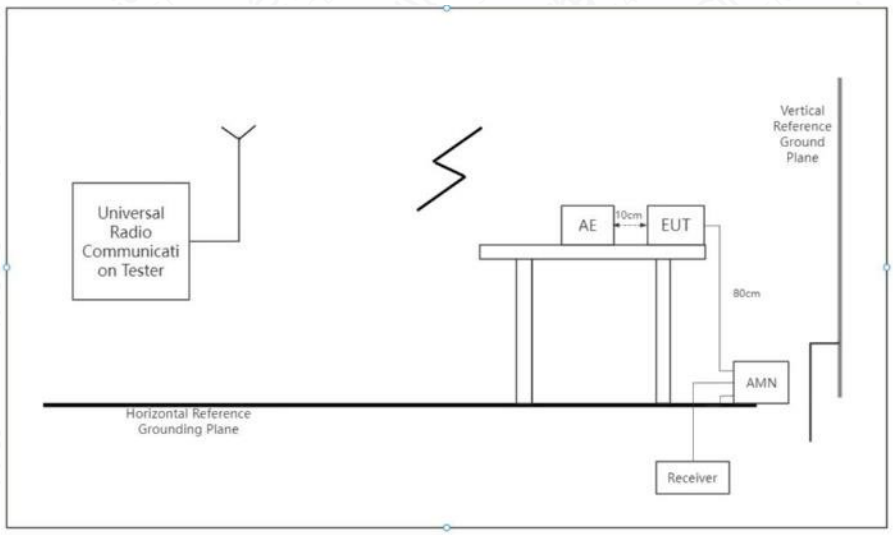

Figure 6.2.2-1 CE Connection Diagram

6.2.3 Test Condition

Test Condition in Charging Mode

Voltage (V)	Frequency (Hz)	RBW	Sweep Time (s)
120	60	9 kHz	AUTO

6.2.4 Limit

Frequency Range (MHz)	Conducted Limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
*Decreases with the logarithm of the frequency		

6.2.5 Testing environmental conditions

Temperature	23.8℃
Relative Humidity	62.5%RH
Atmospheric Pressure	101.0kPa

6.2.6 Test Results

Mode	Frequency (MHz)	Test Results	Verdicts
Mode 1: Charging mode+ CA06+ UA06+ S04aa	0.15-30	See Annex A.2-1	Pass
NOTE Abbreviations used in this clause: Pass—P; Fail—F; Not applicable—N/A			

Annex A: Measurement Data

A.1 Radiated Emission

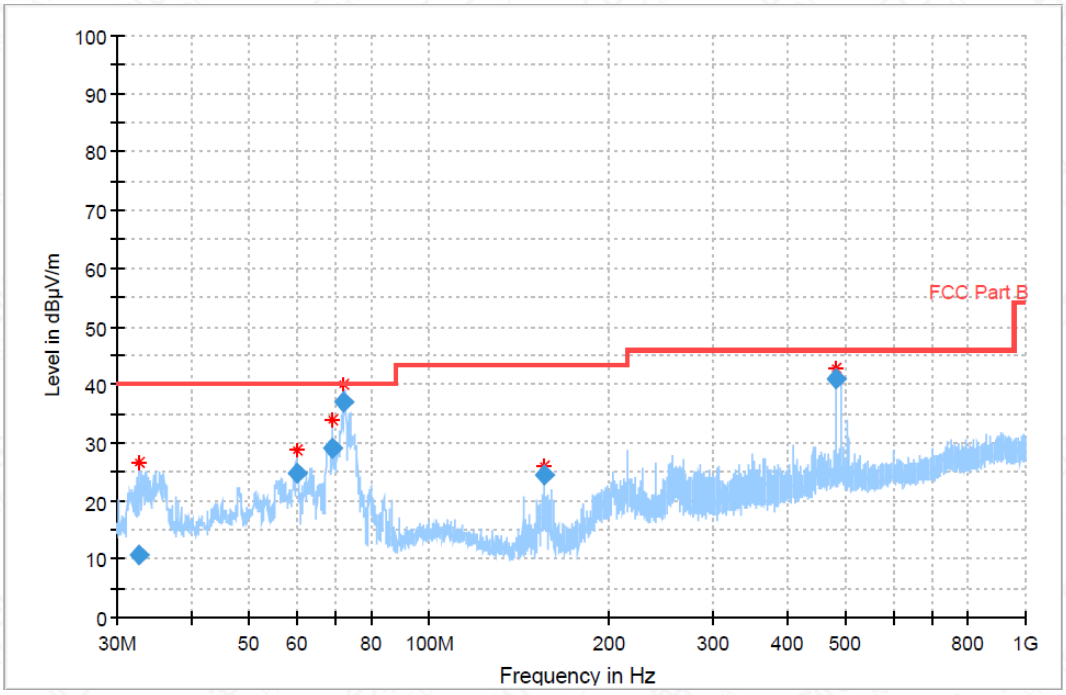

Figure A.1-1 Mode 2 (30M-1GHz)

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
32.664336	10.82	40.00	29.18	100.0	V	242.0	-15
60.030068	24.79	40.00	15.21	100.0	V	272.0	-13
68.881404	29.17	40.00	10.83	100.0	V	152.0	-15
71.999392	37.14	40.00	2.86	100.0	V	107.0	-16
156.026644	24.52	43.50	18.98	200.0	H	12.0	-16
479.981392	40.92	46.00	5.08	100.0	V	175.0	-6

Note:

1.Horizontal and vertical polarity is all have been tested, the result of them is synthesized in the above data diagram.

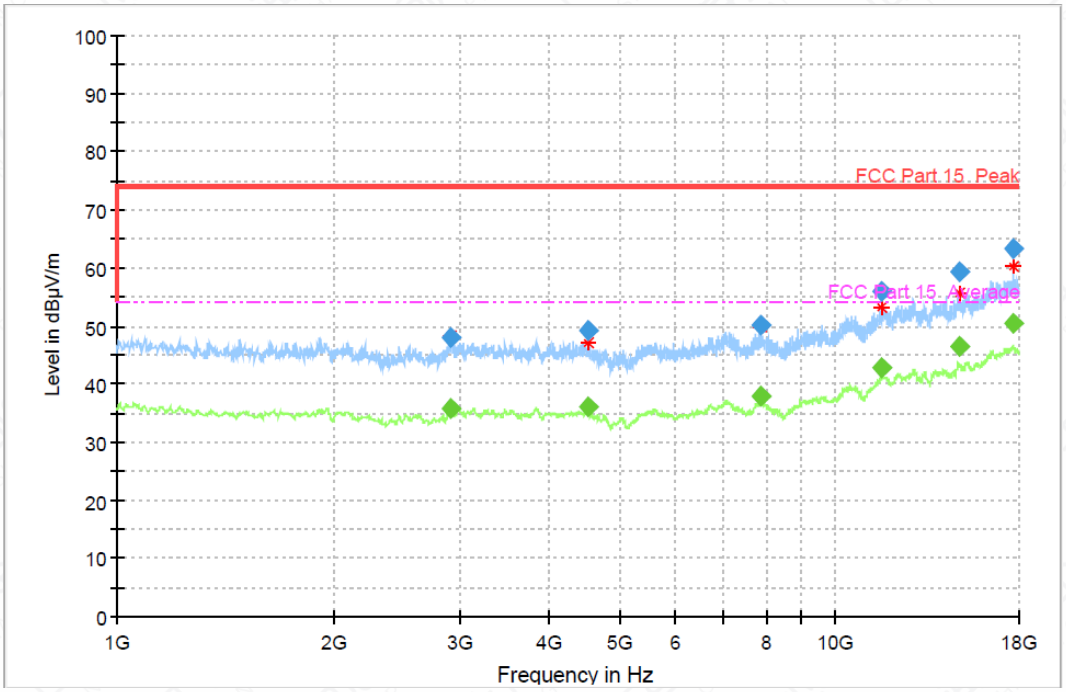

Figure A.1-2 Mode 1 (1GHz-18GHz)-H

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2919.375000	47.99	---	74.00	26.01	100.0	H	86.0	2
2919.375000	---	35.80	54.00	18.20	100.0	H	86.0	2
4537.625000	---	35.99	54.00	18.01	100.0	H	4.0	1
4537.625000	49.11	---	74.00	24.89	100.0	H	4.0	1
7859.500000	---	38.05	54.00	15.95	100.0	H	295.0	4
7859.500000	50.30	---	74.00	23.70	100.0	H	295.0	4
11604.875000	---	42.87	54.00	11.13	100.0	H	128.0	10
11604.875000	55.85	---	74.00	18.15	100.0	H	128.0	10
14879.500000	---	46.61	54.00	7.39	100.0	H	212.0	14
14879.500000	59.26	---	74.00	14.74	100.0	H	212.0	14
17712.000000	63.18	---	74.00	10.82	100.0	H	24.0	18
17712.000000	---	50.56	54.00	3.44	100.0	H	24.0	18

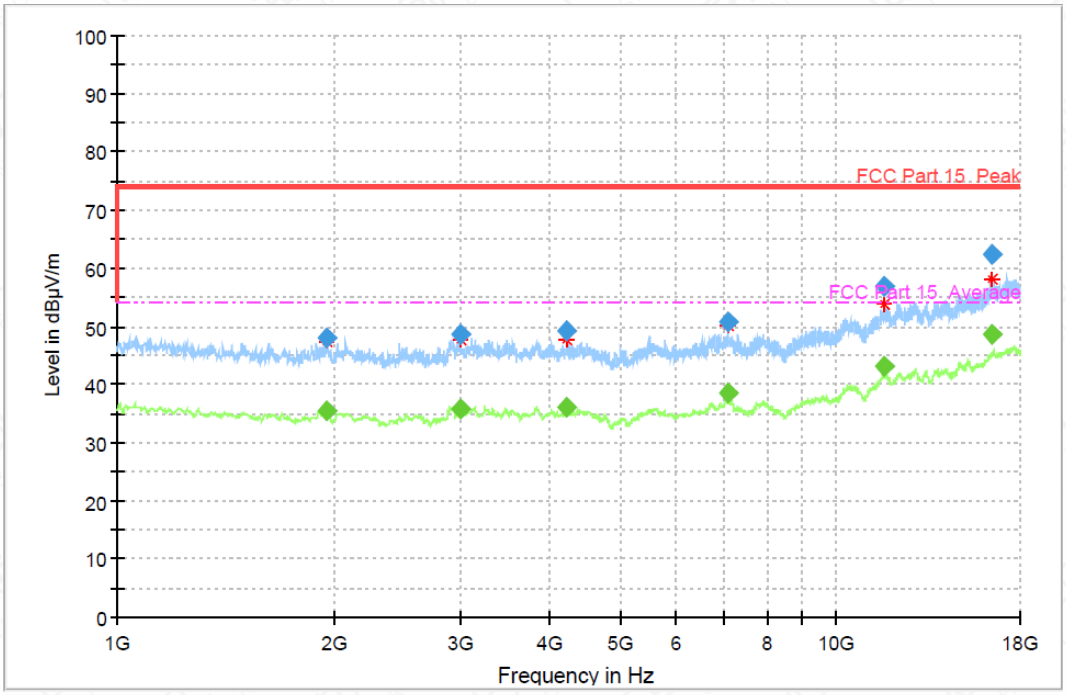

Figure A.1-3 Mode 1 (1GHz-18GHz)-V

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1960.500000	---	35.41	54.00	18.59	100.0	V	281.0	3
1960.500000	48.11	---	74.00	25.89	100.0	V	281.0	3
3007.000000	48.54	---	74.00	25.46	100.0	V	237.0	1
3007.000000	---	35.68	54.00	18.32	100.0	V	237.0	1
4209.750000	49.21	---	74.00	24.79	100.0	V	217.0	1
4209.750000	---	36.14	54.00	17.86	100.0	V	217.0	1
7066.875000	---	38.48	54.00	15.52	100.0	V	0.0	4
7066.875000	50.74	---	74.00	23.26	100.0	V	0.0	4
11658.000000	56.88	---	74.00	17.12	100.0	V	0.0	10
11658.000000	---	43.22	54.00	10.78	100.0	V	0.0	10
16458.875000	62.44	---	74.00	11.56	100.0	V	89.0	17
16458.875000	---	48.75	54.00	5.25	100.0	V	89.0	17

A.2 Conducted Emission

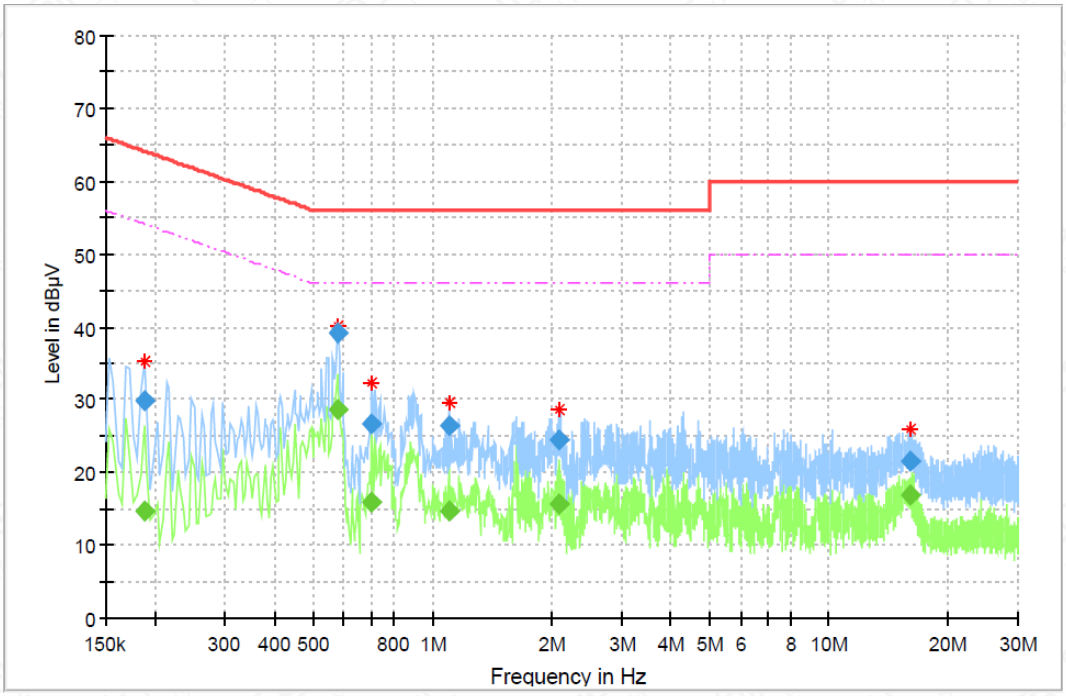

Figure A.2-1 Mode 1 (150kHz-30MHz)

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.187313	---	14.67	54.16	39.49	15000.0	9.000	L1	ON	9.6
0.187313	29.95	---	64.16	34.21	15000.0	9.000	L1	ON	9.6
0.579094	---	28.62	46.00	17.38	15000.0	9.000	L1	ON	9.6
0.579094	39.02	---	56.00	16.98	15000.0	9.000	L1	ON	9.6
0.702225	---	15.87	46.00	30.13	15000.0	9.000	L1	ON	9.6
0.702225	26.57	---	56.00	29.43	15000.0	9.000	L1	ON	9.6
1.101469	---	14.70	46.00	31.30	15000.0	9.000	L1	ON	9.6
1.101469	26.43	---	56.00	29.57	15000.0	9.000	L1	ON	9.6
2.079056	---	15.60	46.00	30.40	15000.0	9.000	N	ON	9.6
2.079056	24.43	---	56.00	31.57	15000.0	9.000	N	ON	9.6
16.123481	---	16.92	50.00	33.08	15000.0	9.000	N	ON	10.0
16.123481	21.55	---	60.00	38.45	15000.0	9.000	N	ON	10.0

Note: L1 and N line is all have been tested, the result of them is synthesized in the above data diagram.

Annex B: Revised History

Version	Revised Content
V0	Initial

Annex C: Accreditation Certificate

Accredited Laboratory

A2LA has accredited

INDUSTRIAL INTERNET INNOVATION CENTER (SHANGHAI) CO., LTD.

Shanghai, People's Republic of China

for technical competence in the field of

Electrical Testing

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*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 20th day of September 2023.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3682.01
Valid to February 28, 2025

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.