FCC TEST REPORT

Digital Matter Embedded South Africa

HAWK-PCB-LITE

Test Model: HAWK-PCB-LITE

Prepared for	:	Digital Matter Embedded South Africa
Address	:	The Oval, St George Building, Ground Floor Corner Meadowbrook Lane and Sloane St, Bryanston, 2021
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Address	:	Room 101, 201, Building A and Room 301, Building C, Juji Industrial Park, Yabianxueziwei, Shajing Street, Bao'an District, Shenzhen, Guangdong, China
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Web	:	www.LCS-cert.com
Mail	:	webmaster@LCS-cert.com
Date of receipt of test sample	:	June 11, 2024
Number of tested samples	:	2
Sample number	:	A240607014-1, A240607014-2
Serial number	:	Prototype
Date of Test	:	June 11, 2024 ~ June 18, 2024
Date of Report	:	June 19, 2024

FCC TEST REPORT
FCC 47 CFR Part 15 Subpart B, Class B, ANSI C63.4 -2014

Report Reference No.	**: LCSA06114023E**
Date Of Issue.....	: June 19, 2024
Testing Laboratory Name.....	**: Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address.....	: Room 101, 201, Building A and Room 301, Building C, Juji Industrial Park, Yabianxueziwei, Shajing Street, Bao'an District, Shenzhen, Guangdong, China
Testing Location/ Procedure....	: Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name.....	**: Digital Matter Embedded South Africa**
Address.....	: The Oval, St George Building, Ground Floor Corner Meadowbrook Lane and Sloane St, Bryanston, 2021
Test Specification	
Standard.....	: FCC 47 CFR Part 15 Subpart B, Class B, ANSI C63.4 -2014
Test Report Form No.....	: LCSEMC-1.0
TRF Originator.....	: Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF.....	: Dated 2011-03

Test Item Description.....	**: HAWK-PCB-LITE**
Trade Mark.....	: Digital Matter
Test Model	: HAWK-PCB-LITE
Ratings.....	: Input: DC 2-5.5V
Result	**: Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Li Huan/Administrator	Cary Luo/ Technique principal	Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : **LCSA06114023E**	June 19, 2024 Date of issue

Test Model	: HAWK-PCB-LITE
EUT.....	: HAWK-PCB-LITE
Applicant.....	**: Digital Matter Embedded South Africa**
Address.....	: The Oval, St George Building, Ground Floor Corner Meadowbrook Lane and Sloane St, Bryanston, 2021
Telephone.....	: /
Fax.....	: /
Manufacturer.....	**: Digital Matter Embedded South Africa**
Address.....	: The Oval, St George Building, Ground Floor Corner Meadowbrook Lane and Sloane St, Bryanston, 2021
Telephone.....	: /
Fax.....	: /
Factory.....	**: Digital Matter Embedded South Africa**
Address.....	: The Oval, St George Building, Ground Floor Corner Meadowbrook Lane and Sloane St, Bryanston, 2021
Telephone.....	: /
Fax.....	: /

Test Result according to the standards on page 6: **Positive**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Report Version	Issue Date	Revision Content	Revised By
000	June 19, 2024	Initial Issue	--

TABLE OF CONTENTS

Test Report Description Page

1. SUMMARY OF STANDARDS AND RESULTS

1.1. Description of Standards and Results

The EUT have been tested according to the applicable standards as referenced below.

EMISSION			
Description of Test Item	Standard	Limits	Results
Conducted disturbance at mains terminals	FCC 47 CFR Part 15 Subpart B, Class B, ANSI C63.4 -2014	Class B	N/A
Radiated disturbance	FCC 47 CFR Part 15 Subpart B, Class B, ANSI C63.4 -2014	Class B	PASS
N/A is an abbreviation for Not Applicable.			

Test mode:		
Mode 1	Normal operation	Record

2. GENERAL INFORMATION

2.1. Description of Device (EUT)

EUT : HAWK-PCB-LITE

Trade Mark : Digital Matter

Test Model : HAWK-PCB-LITE

Power Supply : Input: DC 2-5.5V

Highest internal frequency (Fx)	Highest measured frequency
Fx ≤ 108 MHz 108 MHz < Fx ≤ 500 MHz 500 MHz < Fx ≤ 1 GHz Fx > 1 GHz	1 GHz 2 GHz 5 GHz 5 × Fx up to a maximum of 6 GHz
NOTE 1 For FM and TV broadcast receivers, Fx is determined from the highest frequency generated or used excluding the local oscillator and tuned frequencies. Where Fx is unknown, the radiated emission measurements shall be performed up to 6 GHz.	

2.2. Support Equipment List

Manufacturer	Description	Model	Serial Number	Certificate
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2.3. Description of Test Facility

Site Description

EMC Lab. : NVLAP Accreditation Code is 600167-0.
FCC Designation Number is CN5024.
CAB identifier is CN0071.
CNAS Registration Number is L4595.

2.4. Statement of the Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

2.5. Measurement Uncertainty

Test	Parameters	Expanded Uncertainty (Ulab)	Expanded Uncertainty (Ucispr)
Conducted Emission	Level accuracy (9kHz to 150kHz) (150kHz to 30MHz)	± 2.63 dB ± 2.35 dB	± 3.8 dB ± 3.4 dB
Radiated Emission	Level accuracy (9kHz to 30MHz)	± 3.68 dB	N/A
Radiated Emission	Level accuracy (30MHz to 1000MHz)	± 3.48 dB	± 5.3 dB
Radiated Emission	Level accuracy (above 1000MHz)	± 3.90 dB	± 5.2 dB

（1）Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus.

（2）The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor of k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

3. TEST RESULTS

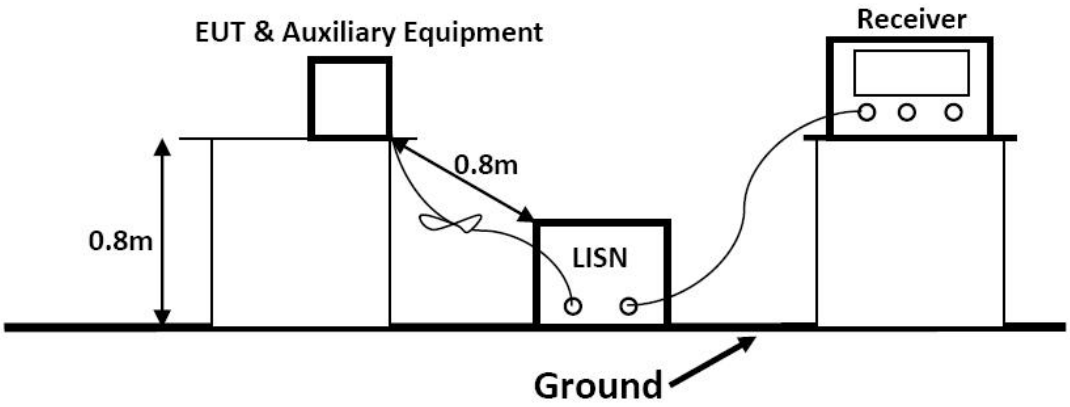
3.1. POWER LINE CONDUCTED EMISSION MEASUREMENT

3.1.1. Test Equipment

The following test equipments are used during the power line conducted measurement:

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	EMI Test Software	Farad	EZ	/	N/A	N/A
2	EMI Test Receiver	R&S	ESR3	102312	2024-03-02	2025-03-01
3	Artificial Mains	R&S	ENV216	101288	2025-06-05	2025-06-05
4	Pulse Limiter	R&S	ESH3-Z2	102750-NB	2023-08-15	2024-08-14
5	Impedance Stabilization Network	TESEQ	ISN T800	45130	2023-10-18	2024-10-17

3.1.2.Block Diagram of Test Setup



3.1.3.Test Standard

Power Line Conducted Emission Limits (Class B)

Frequency (MHz)			Limit (dBμV)	
			Quasi-peak Level	Average Level
0.15	~	0.50	66.0 ~ 56.0 *	56.0 ~ 46.0 *
0.50	~	5.00	56.0	46.0
5.00	~	30.00	60.0	50.0
NOTE1-The lower limit shall apply at the transition frequencies. NOTE2-The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.50MHz.				

3.1.4.EUT Configuration on Test

The following equipments are installed on Power Line Conducted Emission Measurement to meet the commission requirement and operating regulations in a manner, which tends to maximize its emission characteristics in a normal application.

3.1.5.Operating Condition of EUT

3.1.5.1.Setup the EUT as shown on Section 3.1.2

3.1.5.2.Turn on the power of all equipments.

3.1.5.3.Let the EUT work in measuring Mode 1 and measure it.

3.1.6.Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC/ANSI C63.4-2014 on Conducted Emission Measurement.

The bandwidth of the test receiver is set at 9kHz.

The frequency range from 150kHz to 30MHz is investigated

3.1.7.Test Results

Not applicable.

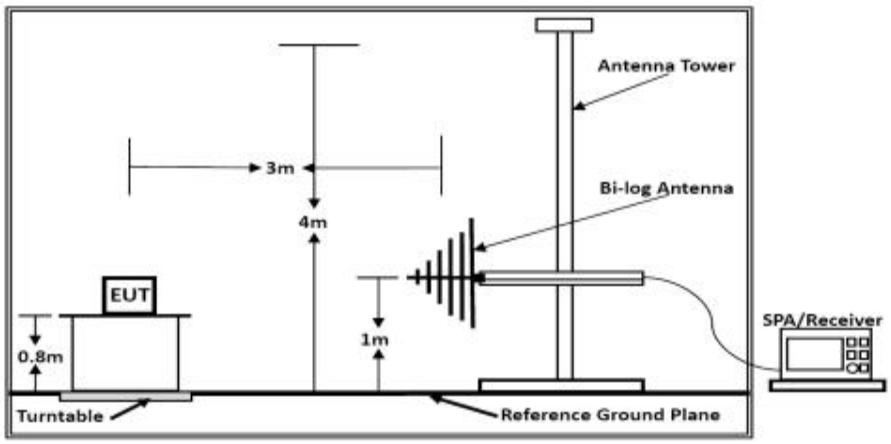
3.2. Radiated emission Measurement

3.2.1. Test Equipment

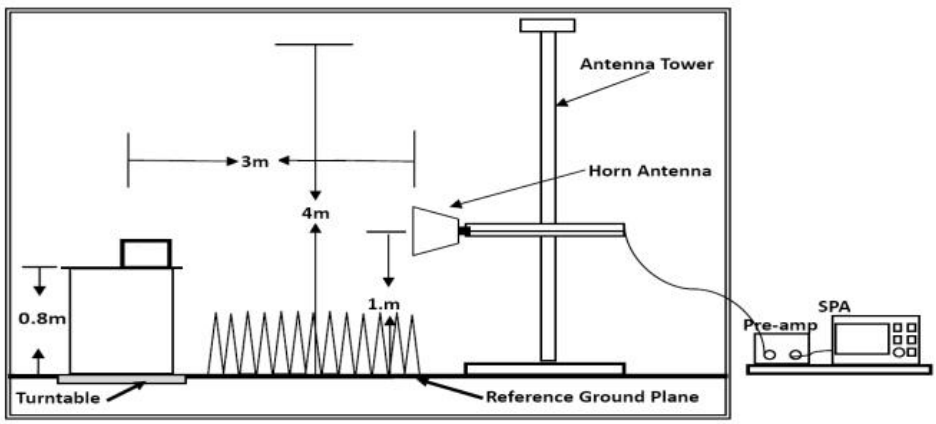
The following test equipments are used during the radiated emission measurement:

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	EMI Test Software	AUDIX	E3	/	N/A	N/A
2	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2024-06-06	2025-06-05
3	Positioning Controller	Max-Full	MF7802BS	MF780208586	N/A	N/A
4	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2021-09-12	2024-09-11
5	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1925	2021-09-05	2024-09-04
6	EMI Test Receiver	R&S	ESPI	101940	2023-08-15	2024-08-14
7	Low-frequency amplifier	SchwarzZBECK	BBV9745	00253	2023-10-18	2024-10-17
8	High-frequency amplifier	JS Denki Pte	PA0118-43	JSPA21009	2023-10-18	2024-10-17
9	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2023-10-18	2024-10-17
10	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2023-07-17	2024-07-16

3.2.2. Block Diagram of Test Setup



Below 1GHz



Above 1GHz

3.2.3. Radiated Emission Limit (Class B)

Limits for Radiated Disturbance Below 1GHz

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μV/m	dB(μV)/m
30 ~ 88	3	100	40
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46
960 ~ 1000	3	500	54
Remark: (1) Emission level (dB)μV = 20 log Emission level μV/m (2) The smaller limit shall apply at the cross point between two frequency bands. (3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.			

Limits for Radiated Emission Above 1GHz

Frequency (MHz)	Distance (Meters)	Peak Limit (dBμV/m)	Average Limit (dBμV/m)
Above 1000	3	74	54
***Note: The lower limit applies at the transition frequency.			

3.2.4. EUT Configuration on Measurement

The following equipment are installed on Radiated Emission Measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

3.2.5. Operating Condition of EUT

3.2.5.1.Setup the EUT as shown in Section 3.2.2.

3.2.5.2.Let the EUT work in test Mode 1 and measure it.

3.2.6. Test Procedure

EUT and its simulators are placed on a turntable, which is 0.8 meter high above ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. EUT is set 3.0 meters away from the receiving antenna, which is mounted on a antenna tower. The antenna can be moved up and down between 1.0 meter and 4 meters to find out the maximum emission level. Broadband antenna (calibrated by-log antenna) is used as receiving antenna. Both horizontal and vertical polarization of the antenna is set on measurement. In order to find the maximum emission levels, all of the interface cables must be manipulated according to ANSI C63.4-2014 on radiated emission measurement.

3.2.7. Measuring Instruments and Setting

Please refer to equipment list in this report. The following table is the setting of spectrum analyzer and receiver

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average

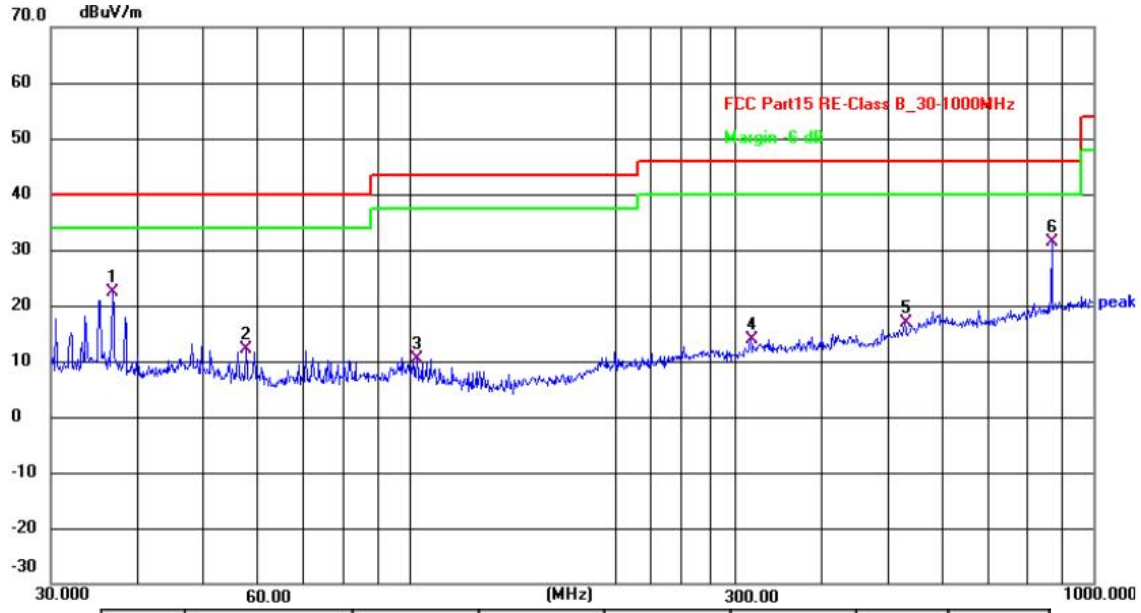
The frequency range from 30MHz to 1000MHz and above 1000MHz is checked.

3.2.8. Radiated Emission Noise Measurement Result

PASS.

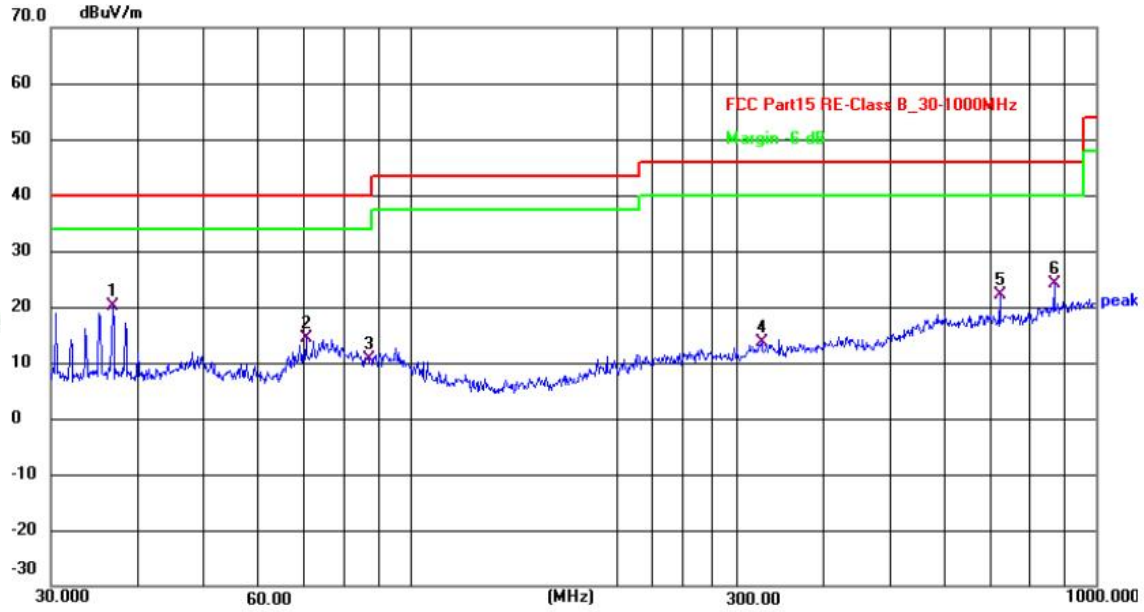
The scanning waveforms please refer to the next page.

Test Model	HAWK-PCB-LITE	Test Mode	Mode 1
Environmental Conditions	23.8℃, 52.3% RH	Detector Function	Quasi-peak
Pol	Vertical	Distance	3m
Test Engineer	Paddi Chen	Test Voltage	DC 5V



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	36.8953	40.18	-17.69	22.49	40.00	-17.51	QP
2	57.7962	30.69	-18.45	12.24	40.00	-27.76	QP
3	102.7192	28.86	-18.41	10.45	43.50	-33.05	QP
4	315.4808	28.71	-14.74	13.97	46.00	-32.03	QP
5	530.1014	29.46	-12.54	16.92	46.00	-29.08	QP
6	869.1302	40.15	-8.75	31.40	46.00	-14.60	QP

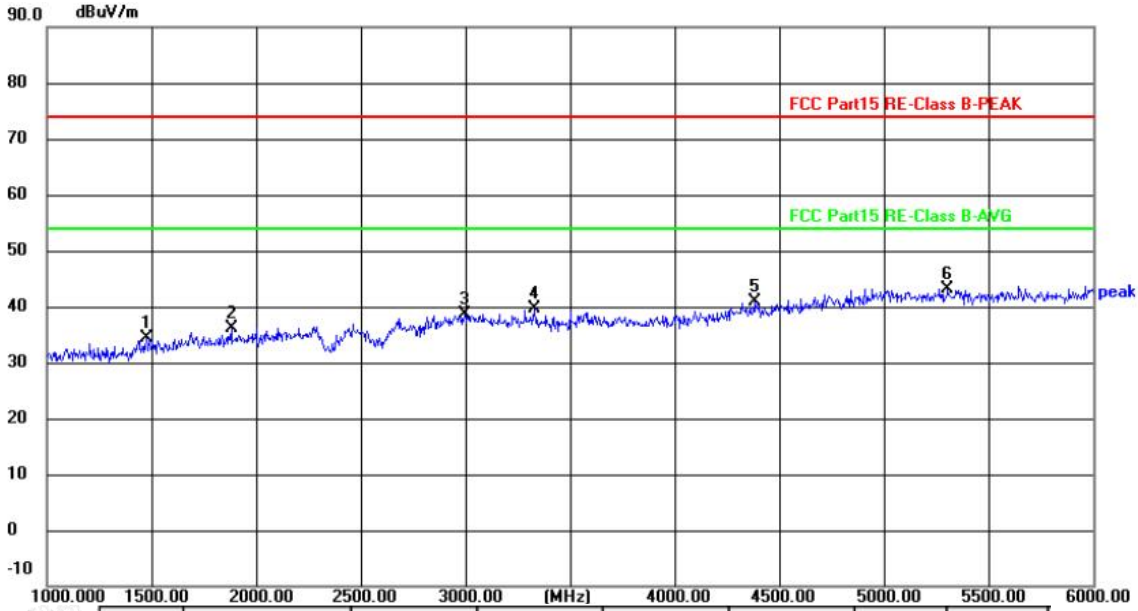
Test Model	HAWK-PCB-LITE	Test Mode	Mode 1
Environmental Conditions	23.8℃, 52.3% RH	Detector Function	Quasi-peak
Pol	Horizontal	Distance	3m
Test Engineer	Paddi Chen	Test Voltage	DC 5V



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	36.8953	37.91	-17.69	20.22	40.00	-19.78	QP
2	70.5836	33.89	-19.49	14.40	40.00	-25.60	QP
3	87.1117	29.79	-19.17	10.62	40.00	-29.38	QP
4	325.5958	27.93	-14.21	13.72	46.00	-32.28	QP
5	724.2611	32.66	-10.53	22.13	46.00	-23.87	QP
6	869.1302	32.79	-8.75	24.04	46.00	-21.96	QP

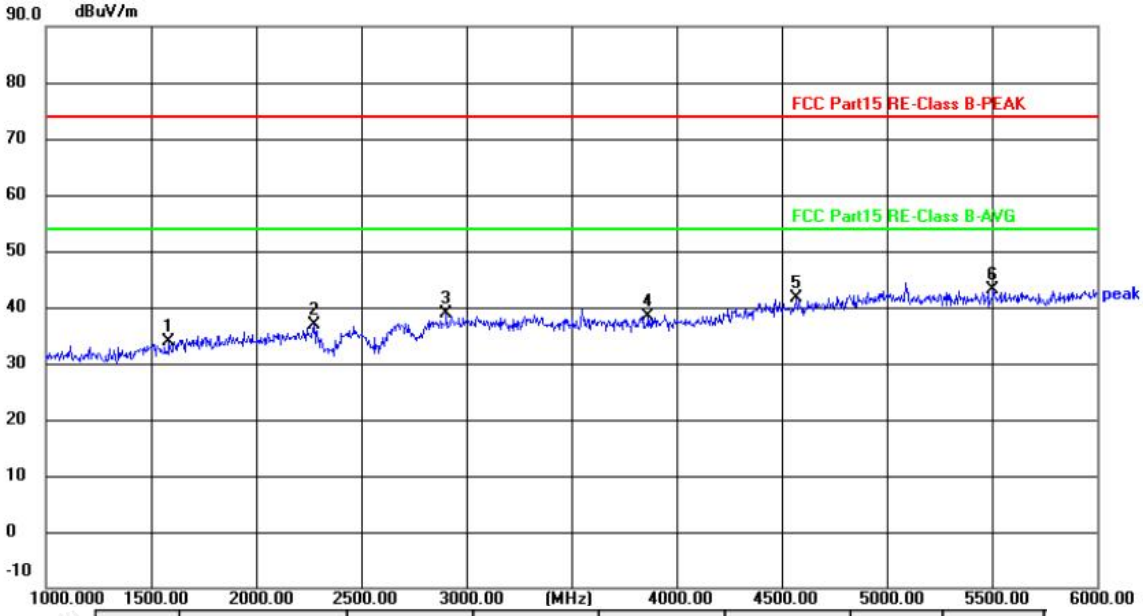
Note: 1. Pre-Scan all mode, Thus record worse case mode result in this report.
Note: Margin= Reading level + Correct factor – Limit
Correct Factor=Antenna Factor+Cable Factor- Pre-amplifier Factor

Test Model	HAWK-PCB-LITE	Test Mode	Mode 1 (Above 1GHz)
Environmental Conditions	23.9℃, 52.0% RH	Detector Function	Peak + AV
Pol	Vertical	Distance	3m
Test Engineer	Paddi Chen	Test Voltage	DC 5V



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1475.000	49.28	-15.01	34.27	74.00	-39.73	peak
2	1880.000	49.92	-13.73	36.19	74.00	-37.81	peak
3	2995.000	48.27	-9.61	38.66	74.00	-35.34	peak
4	3330.000	49.01	-9.47	39.54	74.00	-34.46	peak
5	4380.000	48.05	-7.05	41.00	74.00	-33.00	peak
6	5305.000	46.61	-3.56	43.05	74.00	-30.95	peak

Test Model	HAWK-PCB-LITE	Test Mode	Mode 1 (Above 1GHz)
Environmental Conditions	23.9℃, 52.0% RH	Detector Function	Peak + AV
Pol	Horizontal	Distance	3m
Test Engineer	Paddi Chen	Test Voltage	DC 5V



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	1585.000	48.51	-14.66	33.85	74.00	-40.15	peak
2	2275.000	48.95	-12.14	36.81	74.00	-37.19	peak
3	2905.000	48.89	-9.92	38.97	74.00	-35.03	peak
4	3865.000	47.05	-8.78	38.27	74.00	-35.73	peak
5	4570.000	47.93	-6.23	41.70	74.00	-32.30	peak
6	5505.000	46.38	-3.20	43.18	74.00	-30.82	peak

Note: 1. Pre-Scan all mode, Thus record worse case mode result in this report.

4. PHOTOGRAPH

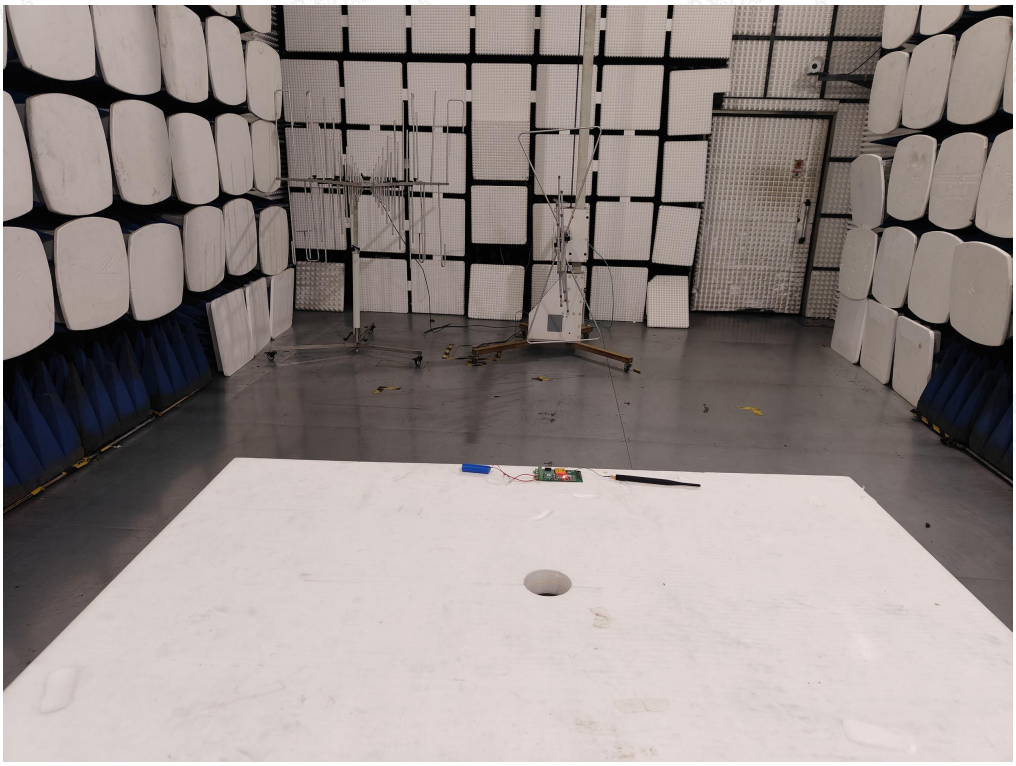


Photo of Radiated Measurement

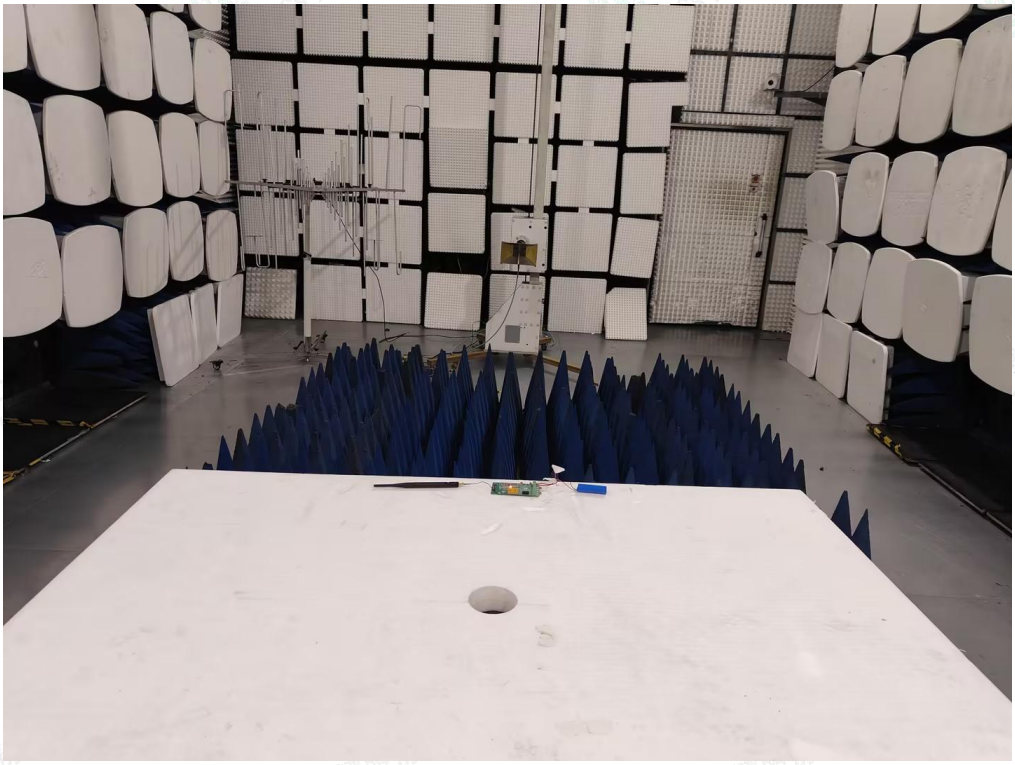


Photo of Radiated Measurement (Above 1GHz)

5. EXTERNAL AND INTERNAL PHOTOS OF THE EUT

Fig. 1

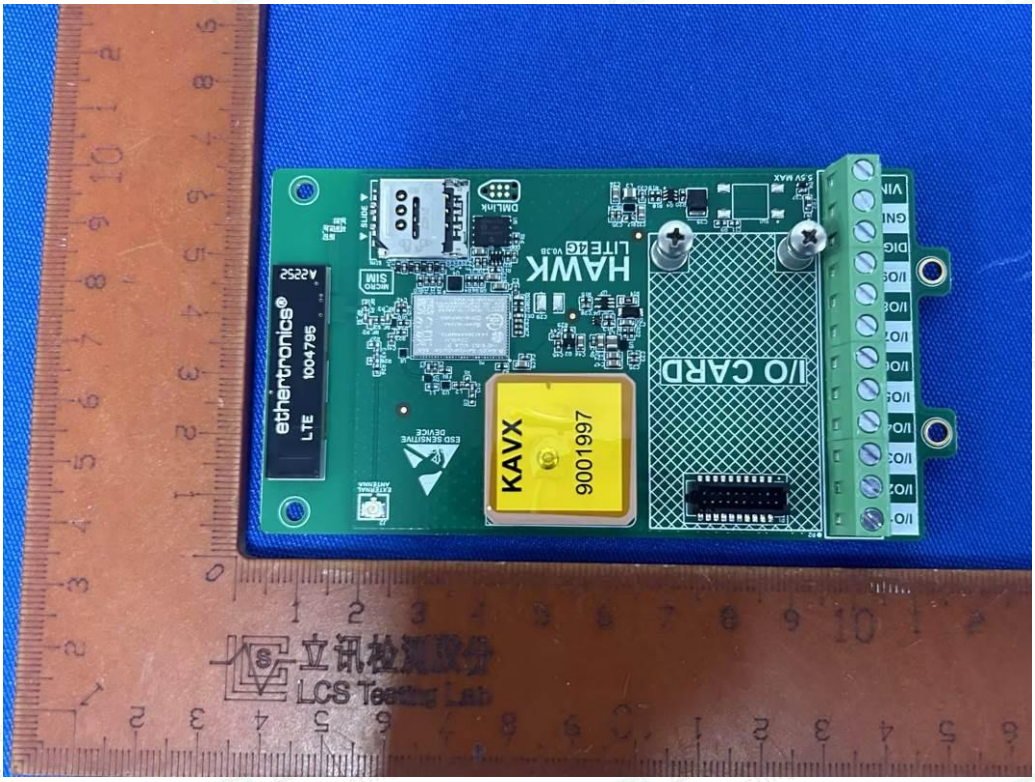


Fig. 2

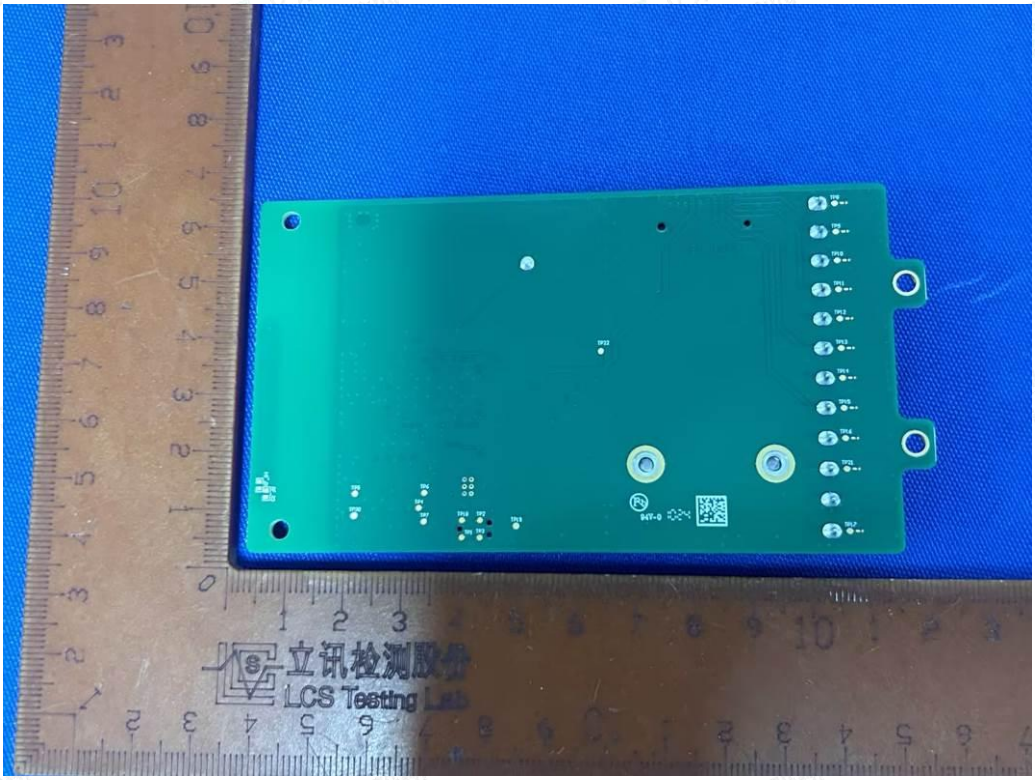

立讯检测股份
LCS Testing Lab

Fig. 3

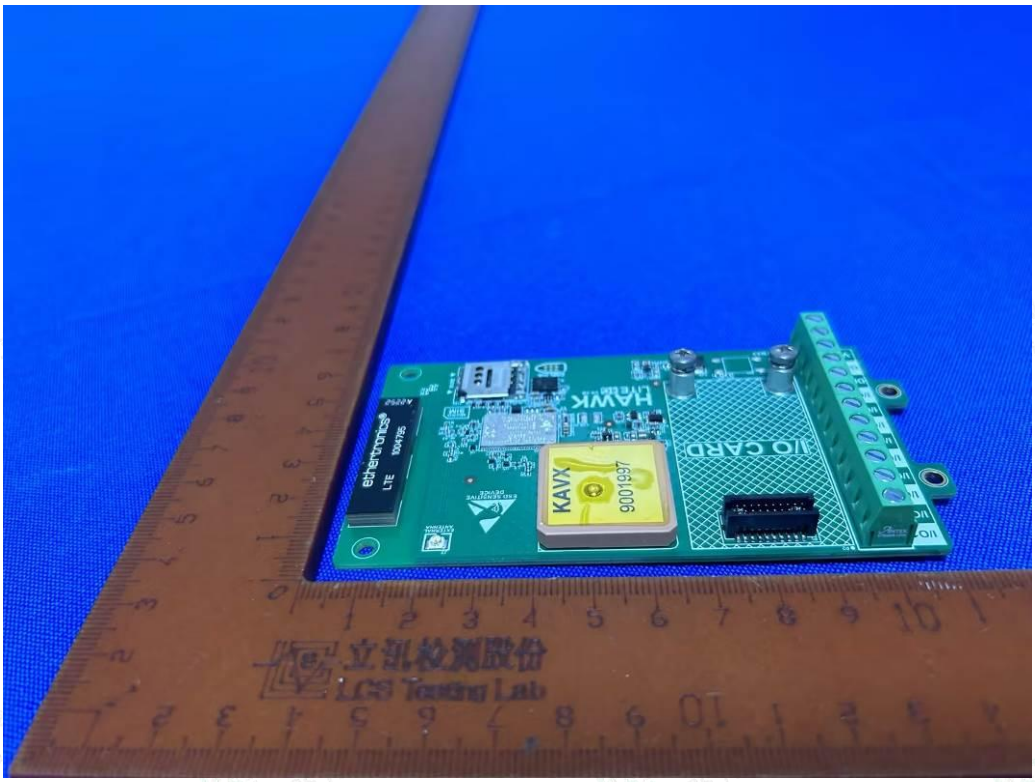
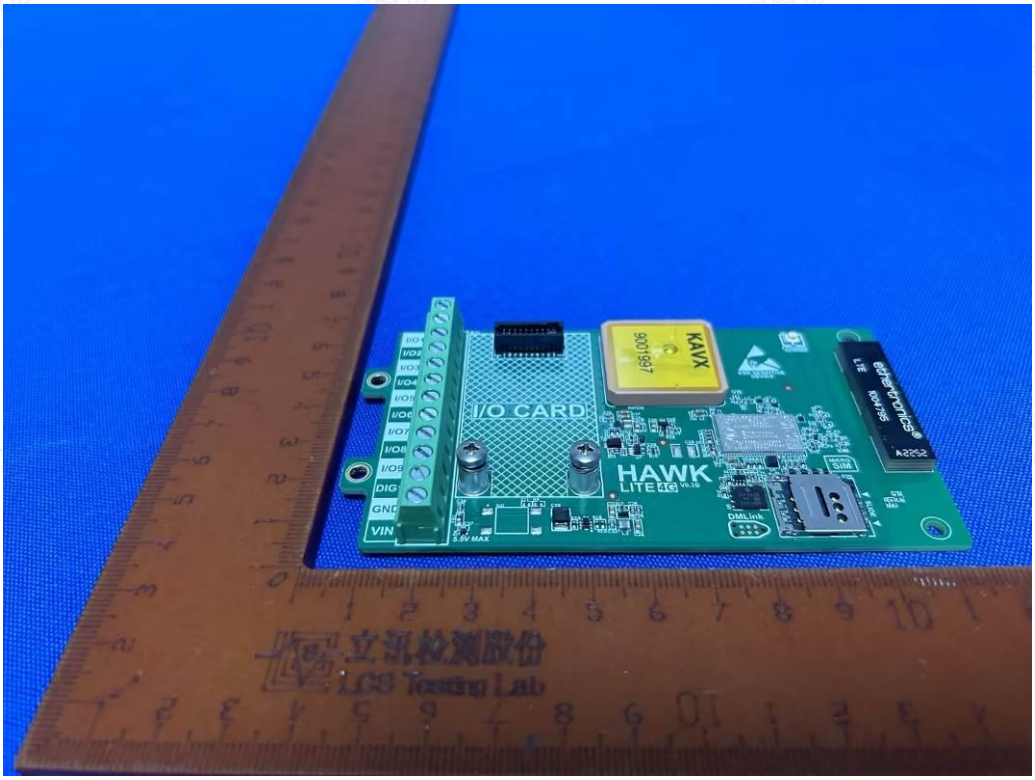

HAVIS
KAVX
I/O CARD
立讯检测股份
LCS Testing Lab

Fig. 4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9001997
HAWK
LITE HE
DMLink
I/O1
I/O2
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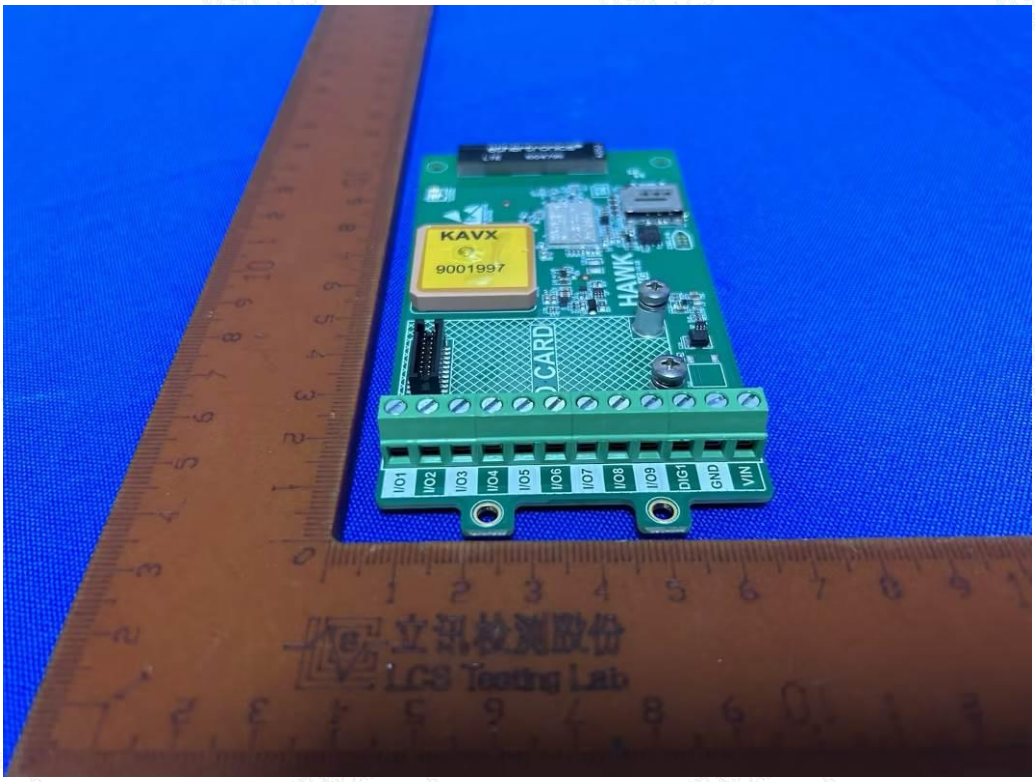
I/O7
I/O8
I/O9
DIG
GND
VIN

Fig. 5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HAWK
I/O CARD
I/O1
I/O2
I/O3
I/O4
I/O5
I/O6
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I/O8
I/O9
DIG1
GND
VIN

Fig. 6


HAWK
KAVX
LTE
ethertronics

Fig. 7

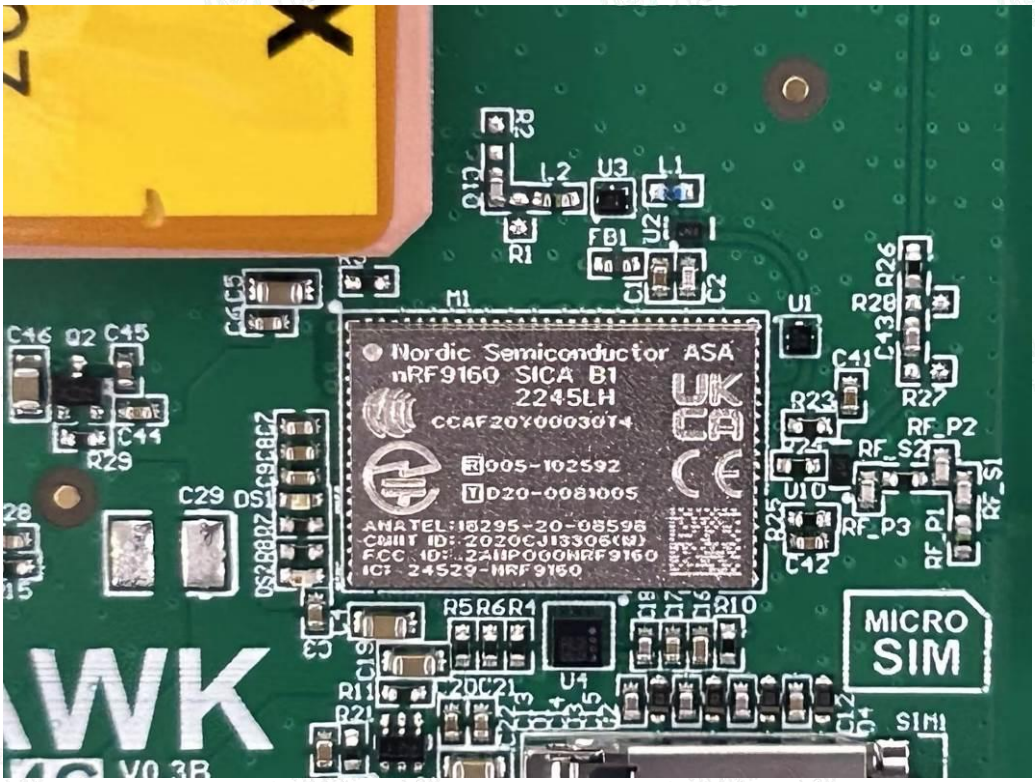
Nordic Semiconductor ASA
nRF9160 SICA B1
2245LH
MICRO
SIM
HAWK

Fig. 8

Fig. 9

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