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FCC Part 15, Subpart B, Class B(sDoC)

TEST REPORT

Product name:	Banana Pi BPI-R4
Trademark:	BPI
Model No.:	BPI-R4
Test Standards:	**FCC Part 15, Subpart B, Class B(sDoC), ANSI C63.4-2014**
Applicant:	GUANGDONG BIPAI KEJI.CPA., LTD.
Address of applicant:	Room 701, RongYi Building, Songshan Lake High-tech Industrial Development Zone, Dongguan, Guangdong, China
Date of Date:	Nov. 30, 2023 - Dec. 06, 2023
Date of issue.:	Dec. 06, 2023
Report No.:	YRT202312205F

Test result :	Pass *

* In the configuration tested, the EUT complied with the standards specified above

The FCC mark as shown above can be used, The Sample was tested to conform to the applicable FCC Rules and Regulations. The method of testing was in accordance to the most accurate measurement standards possible, and that all necessary steps have been enforced to assure that all production units of the same equipment will continue to comply with the Federal Communications Commission’s requirements.

TEST Report

Equipment	Banana Pi BPI-R4
Model Name	BPI-R4
Model Difference	N/A
Manufacturer	Bipai Electronic Technology (Dongguan) Co., LTD
Manufacturer Address	Room 301, Building 3, No. 31 Lixiang Road, Dalang Town, Dongguan City,Guangdong Province, China
Product Description	The EUT is a Banana Pi BPI-R4 Operating frequency: N/A Connecting I/O port: N/A Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual.
Power Rating	Input: 12VDC

Testing Engineer : **(David Zhong)**

Reviewed By: : **(Tony Wang)**

Approved Signatory : **(Lily Yu)**

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1.TEST RESULT CERTIFICATION

Product:	Banana Pi BPI-R4
Model :	BPI-R4
Trade Mark:	BPI
Applicant:	GUANGDONG BIPAI KEJI.CPA., LTD.
	Room 701, RongYi Building, Songshan Lake High-tech Industrial Development Zone, Dongguan, Guangdong, China
Manufacturer:	Bipai Electronic Technology (Dongguan) Co., LTD
	Room 301, Building 3, No. 31 Lixiang Road, Dalang Town, Dongguan City,Guangdong Province, China
Test Voltage:	Input: 12VDC

EMISSION			
Standard	**Item**	**Result**	**Remarks**
FCC Part 15, Subpart B, Class B(sDoC), ANSI C63.4-2014	Conducted (Main Port)	N/A	N/A
	Radiated	PASS	Meet Class B limit

Note: 1. The test result judgment is decided by the limit of measurement standard
2. The information of measurement uncertainty is available upon the customer's request.

Deviation from Applicable Standard
None

The above equipment has been tested by Shenzhen YaRui Testing Technology Co., Ltd. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

2.EUT DESCRIPTION

Product	Banana Pi BPI-R4
Model :	BPI-R4
Trade Mark	BPI
Applicant	GUANGDONG BIPAI KEJI.CPA., LTD.
EUT Type	☒ Engineering Sample ☐ Product Sample ☐ Mass Product Sample
Serial Number	N/A
Power Rating	Input: 12VDC

I/O PORT

I/O PORT TYPES	Q'TY	TESTED WITH
N/A	N/A	N/A

3.TEST METHODOLOGY

3.1 DECISION OF FINAL TEST MODE

The EUT was tested together with the thereinafter additional components, and a configuration, which produced the worst emission levels, was selected and recorded in this report.

The following test mode(s) were scanned during the preliminary test:

Pre-Test Mode		
Emission	Conducted Emission	Mode: Full Load
	Radiated Emission	Mode: Full Load

After the preliminary scan, the following test mode was found to produce the highest emission level.

The Worst Test Mode		
Emission	Conducted Emission	Mode: Full Load
	Radiated Emission	Mode: Full Load

Then, the EUT configuration and cable configuration of the above highest emission mode was chosen for all final test items.

3.2 EUT SYSTEM OPERATION

1. Set up EUT with the relative support equipments.
2. Make sure the EUT worked normally during the test.

4.SETUP OF EQUIPMENT UNDER TEST

4.1 DESCRIPTION OF SUPPORT UNITS

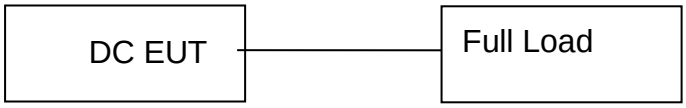
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Equipment	Model No.	Serial No.	FCC ID	Trade Name	Data Cable	Power Cord
	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note:

1) All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2) Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.2 CONFIGURATION OF SYSTEM UNDER TEST



(EUT: Banana Pi BPI-R4)

5.FACILITIES AND MEASUREMENT UNCERTAINTY

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at No.101, Yousong Road, Longhua District, Shenzhen, Guangdong, China

The sites are constructed in conformance with the requirements of ANSI C63.4 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

5.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency		Uncertainty
Conducted emissions	9kHz~30MHz		+/- 3.59dB
Radiated emissions	Horizontal	30MHz ~ 200MHz	+/- 4.77dB
		200MHz ~1000MHz	+/- 4.93dB
	Vertical	30MHz ~ 200MHz	+/- 5.04dB
		200MHz ~1000MHz	+/- 4.93dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

6.CONDUCTED EMISSION MEASUREMENT

6.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79	66	66 - 56	56 - 46
0.50 - 5.0	73	60	56	46
5.0 - 30.0	73	60	60	50

NOTE:
(1) The lower limit shall apply at the transition frequencies.
(2) The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
(3) All emanations from EUT or system shall not exceed the level of field strengths specified above.

6.2 TEST INSTRUMENTS

Conducted Emission Shielding Room Test Site 843				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	ROHDE&SCHWARZ	ESCI	100005	Dec.26, 2023
LISN	AFJ	LS16	16010222119	Dec.26, 2023
LISN	Meestec	AN3016	04/10040	Dec.26, 2023

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to International system of unit (SI).
2. N.C.R = No Calibration Request.

6.3 TEST PROCEDURES

Procedure of Preliminary Test

The EUT and Support equipment, if needed, was set up as per the test configuration to simulate typical usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.4 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor standing equipment, it is placed on the ground plane, which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.

All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4.

The EUT test program was started. Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.

The Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.

During the above scans, the emissions were maximized by cable manipulation.

The test mode(s) described in Item 3.1 were scanned during the preliminary test.

After the preliminary scan, we found the test mode described in Item 3.1 producing the highest emission level.

The EUT configuration and worse cable configuration of the above highest emission levels were recorded for reference of the final test.

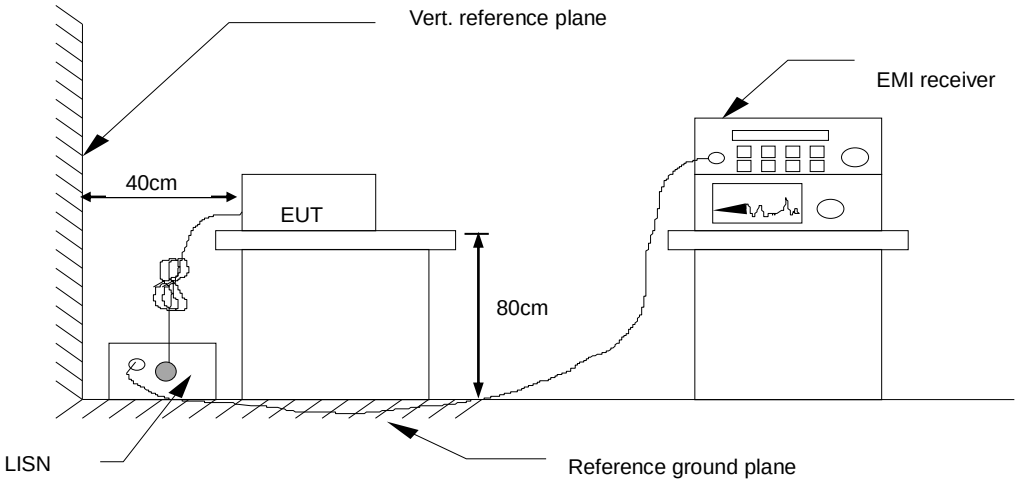
Procedure of Final Test

EUT and support equipment were set up on the test bench as per the configuration with highest emission level in the preliminary test.

A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit.

The test data of the worst-case condition(s) was recorded.

6.4 TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

6.5 TEST RESULTS

N/A

7.RADIATED EMISSION MEASUREMENT

7.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Maximum permissible level of Radiated Emission measured at 10 meter

FREQUENCY (MHz)	dBuV/m (At 3m)
	Class B
30~88	40.00
88~216	43.50
216~960	46.00
960~1000	54.00

NOTE: (1) The lower limit shall apply at the transition frequencies.
(2) Emission level (dBuV/m) = 20 log Emission level (uV/m).

7.2 TEST INSTRUMENTS

Radiated Emission Test Site 966				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
EMI Test Receiver	ROHDE&SCHWARZ	ESCI	100005	Dec.26, 2023
Spectrum Analyzer	R&S	FSU	100114	Dec.26, 2023
Pre Amplifier	H.P.	HP8447E	2945A02715	Dec.26, 2023
Bilog Antenna	SUNOL Sciences	JB3	A021907	Dec.26, 2023
Cable	TIME MICROWAVE	LMR-400	N-TYPE04	Dec.26, 2023
System-Controller	CCS	N/A	N/A	N.C.R
Turn Table	CCS	N/A	N/A	N.C.R
Antenna Tower	CCS	N/A	N/A	N.C.R

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to International system of unit (SI).
2. N.C.R = No Calibration Request.

7.3 TEST PROCEDURES

Procedure of Preliminary Test

The equipment was set up as per the test configuration to simulate typical usage per the user's manual. When the EUT is a tabletop system, a wooden turntable with a height of 0.8 meters is used which is placed on the ground plane. When the EUT is a floor standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.

Support equipment, if needed, was placed as per ANSI C63.4.

All I/O cables were positioned to simulate typical usage as per ANSI C63.4.

Mains cables, telephone lines or other connections to auxiliary equipment located outside the test are shall drape to the floor, be fitted with ferrite clamps or ferrite tubes placed on the floor at the point where the cable reaches the floor and then routed to the place where they leave the turntable. No extension cords shall be used to mains receptacle.

The antenna was placed at 10 meter away from the EUT as stated in ANSI C63.4. The antenna connected to the Spectrum Analyzer via a cable and at times a pre-amplifier would be used.

The Analyzer / Receiver quickly scanned from 30MHz to 1000MHz. The EUT test program was started. Emissions were scanned and measured rotating the EUT to 360 degrees and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.

The test mode(s) described in Item 3.1 were scanned during the preliminary test:

After the preliminary scan, we found the test mode described in Item 3.1 producing the highest emission level.

The EUT and worse cable configuration, antenna position, polarization and turntable position of the above highest emission level were recorded for the final test.

When measuring emissions above 1GHz, the frequencies of maximum emission shall be determined by manually positioning the antenna close to the EUT and by moving the antenna over all sides of the EUT while observing a spectral display. It will be advantageous to have prior knowledge of the frequencies of emissions above 1GHz.If the EUT is a device with dimensions approximately equal to that of the measurement antenna beam width, the measurement antenna shall be aligned with the EUT.

Procedure of Final Test

EUT and support equipment were set up on the turntable as per the configuration with highest emission level in the preliminary test.

The Analyzer / Receiver scanned from 30MHz to 1000MHz. Emissions were scanned and measured rotating the EUT to 360 degrees, varying cable placement and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.

Recorded at least the six highest emissions. Emission frequency, amplitude, antenna position, polarization and turntable position were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit and only Q.P. reading is presented.

For the measurement above 1GHz, use the cable, EUT arrangement, and mode of operation determined in the exploratory testing to produce the emission that has the highest amplitude relative to the limit.

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the antenna in the “cone of radiation” from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.

The antenna may have to be higher or lower than the EUT, depending on the EUT’s size and mounting height, but the antenna should be restricted to a range of height of from 1m to 4m above the ground or reference ground plane.

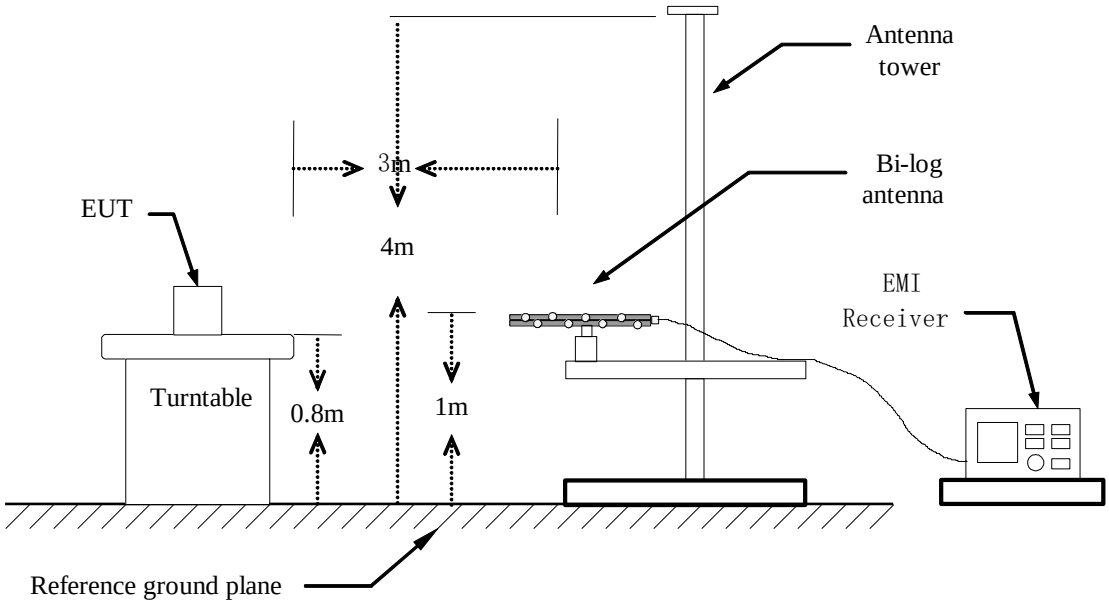
If the transmission line for the measurement antenna restricts its range of height and polarization, the steps needed to ensure the correct measurement of the maximum emissions, shall be described in detail in the report of the measurements.

using the procedures above to measure with peak detector function, if the result comply with the average limit specified by the appropriate regulation, record the EUT arrangement, mode of operation, and cable positions used for final radiated emission measurement , this can be done with either diagrams or photographs.

Set the detector function of the measuring instrument to average mode, using the procedures above and remeasure only those emissions that complied with the peak limits but exceeded the average limits.

Recorded at least the six highest emissions.

7.4 TEST SETUP



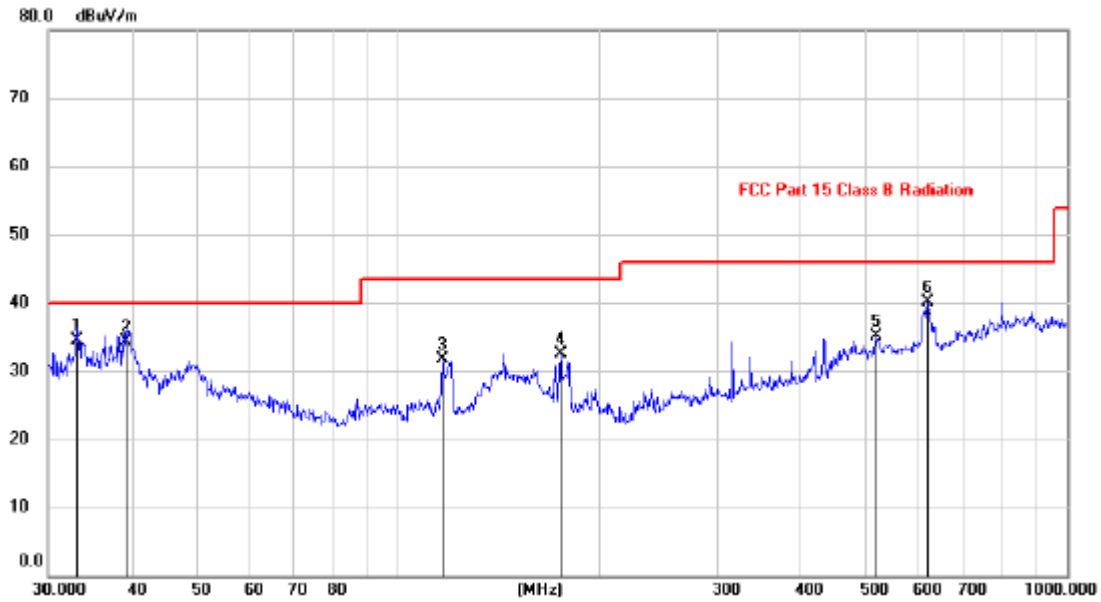
For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

7.5 TEST RESULTS

Model No.	BPI-R4	**Test Mode**	Full Load
Environmental Conditions	26°C, 55% RH	**6Db Bandwidth**	120 KHz
Antenna Pole	Vertical / Horizontal	**Antenna Distance**	3m
Detector Function	Peak / Quasi-peak	**Test Result**	Pass

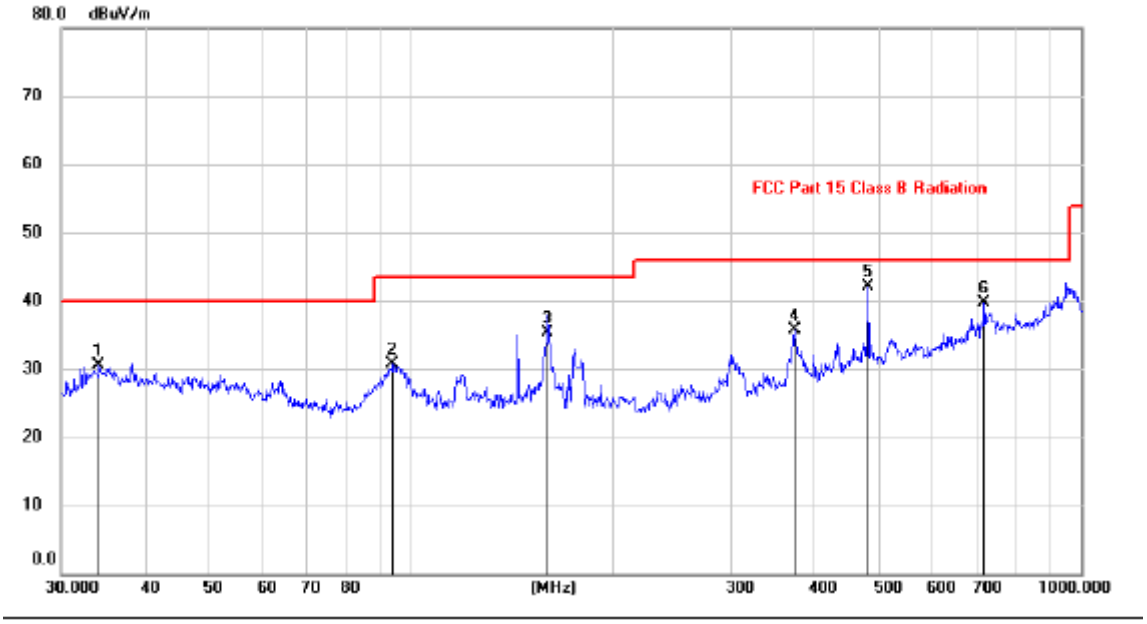
Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	1010hPa	Phase :	Vertical
Test Mode：	Full Load	Test Voltage ：	DC 12V

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	33.2112	21.14	13.44	34.58	40.00	-5.42	QP			
2		39.4371	20.01	14.22	34.23	40.00	-5.77	QP			
3		116.9495	19.47	12.27	31.74	43.50	-11.76	peak			
4		175.0368	19.63	12.95	32.58	43.50	-10.92	peak			
5		519.0649	17.26	17.84	35.10	46.00	-10.90	peak			
6		618.5369	20.45	19.68	40.13	46.00	-5.87	peak			



Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	1010hPa	Phase :	Horizontal
Test Mode：	Full Load	Test Voltage ：	DC 12V

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		34.1561	17.07	13.46	30.53	40.00	-9.47	peak			
2		94.0979	20.72	10.05	30.77	43.50	-12.73	peak			
3		159.7844	20.67	14.58	35.25	43.50	-8.25	QP			
4		373.3112	20.37	15.26	35.63	46.00	-10.37	peak			
5	*	480.5276	25.09	17.08	42.17	46.00	-3.83	peak			
6		716.6820	18.67	20.96	39.63	46.00	-6.37	peak			



8.ATTACHMENT PHOTOGRAPHS OF EUT

Photo 1

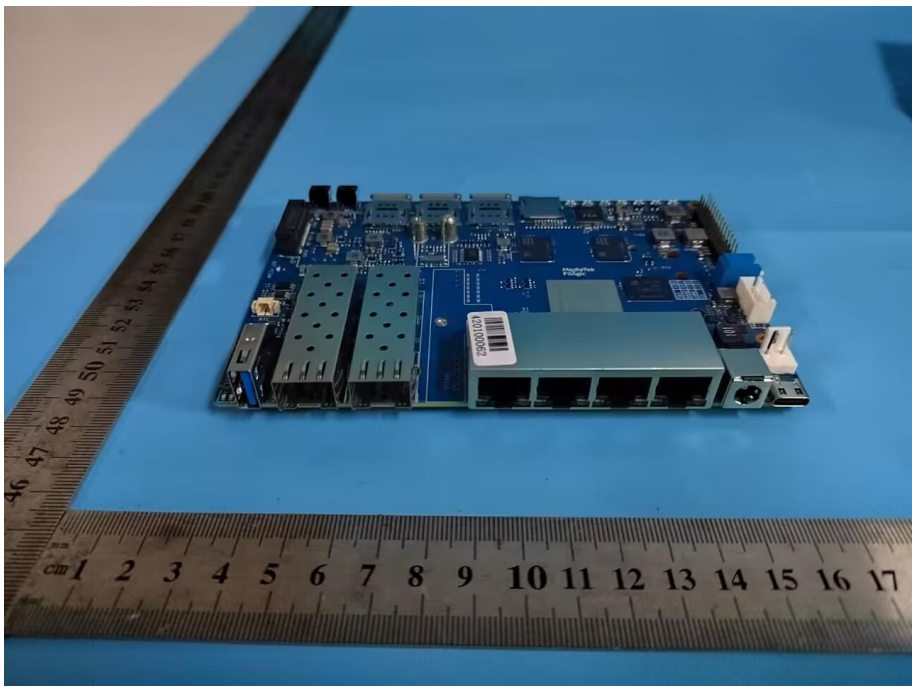


Photo 2

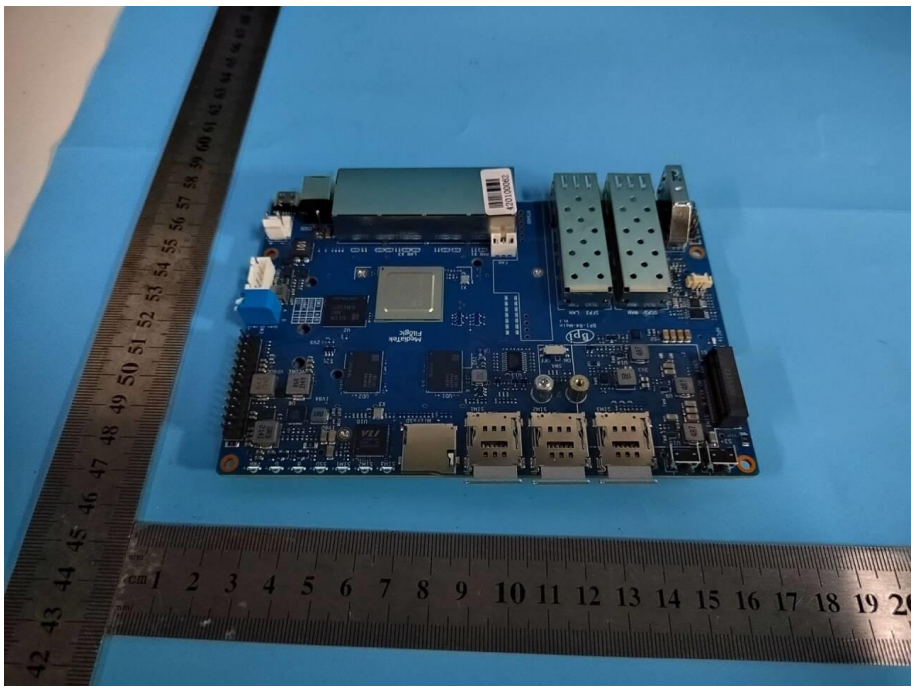
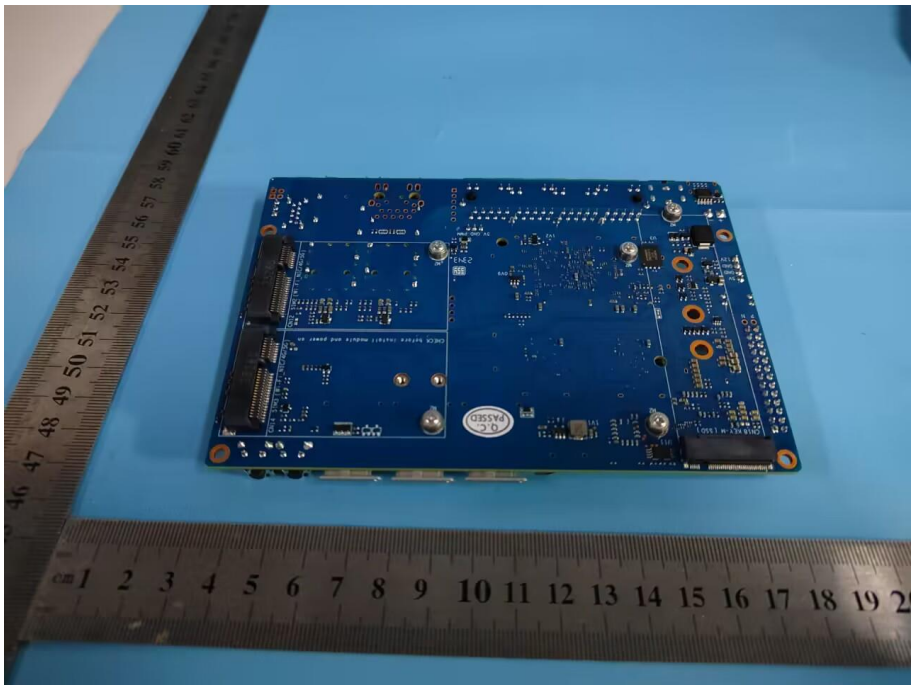


Photo 3



===== End of Test Report =====

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