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EMC TEST REPORT

Product name .....**:** Banana Pi BPI-R4

Trademark .....**:** BPI

Model No. .....**:** BPI-R4

Test Standards.....**:** **EN 55032:2015+A11:2020+A1:2020**
EN 55035:2017+A11:2020
EN IEC 61000-3-2:2019+A1:2021
EN 61000-3-3:2013+A1:2019+A2:2021

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 Test Date .....**:** Nov. 30, 2023 - Dec. 06, 2023

Date of issue. .....**:** Dec. 06, 2023

Report No.……..….**:** YRT202312204E

Test result	**Pass ***

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

CE

The CE mark as shown above can be used, under the responsibility of the manufacturer, after completion of an EC Declaration of Conformity and compliance with all relevant EC Directives. The protection requirements with respect to electromagnetic compatibility contained in Directive 2014/30/EU are considered.

GENERAL DESCRIPTION OF EUT

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 Source	DC
Power Rating	Input: 12VDC

Compiled Engineer _____
(David Zhong)

Reviewed By: _____
(Tony Wang)

Approved Signatory _____
(Lily Yu)

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1. TEST SUMMARY

1.1.Description of Standards and Results

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

EMISSION (EN 55032:2015+A11:2020+A1:2020)			
Description of Test Item	**Standard**	**Limits**	**Results**
Conducted disturbance at mains terminals	EN 55032:2015+A11:2020+A1:2020	Class B	N/A
Conducted disturbance at telecommunication port	EN 55032:2015+A11:2020+A1:2020	Class B	N/A
Radiated disturbance	EN 55032:2015+A11:2020+A1:2020	Class B	PASS
Harmonic current emissions	EN IEC 61000-3-2:2019+A1:2021	Class A	N/A
Voltage fluctuations & flicker	EN 61000-3-3:2013+A1:2019 +A2:2021	---	N/A

IMMUNITY (EN 55035:2017+A11:2020)			
Description of Test Item	**Basic Standard**	**Performance Criteria**	**Results**
Electrostatic discharge (ESD)	EN 55035:2017+A11:2020	B	PASS
Radio-frequency, Continuous radiated disturbance	EN 55035:2017+A11:2020	A	PASS
Electrical fast transient (EFT)	EN 55035:2017+A11:2020	B	N/A
Surge (Input a.c. power ports)	EN 55035:2017+A11:2020	B	N/A
Surge (Telecommunication ports)		B	N/A
Radio-frequency, Continuous conducted disturbance	EN 55035:2017+A11:2020	A	N/A
Power frequency magnetic field	EN 55035:2017+A11:2020	A	PASS
Voltage dips, >95% reduction	EN 55035:2017+A11:2020	B	N/A
Voltage dips, 30% reduction		C	N/A
Voltage interruptions		C	N/A
N/A is an abbreviation for Not Applicable.			

Test mode:		
Mode 1	No load	Pre-scan
Mode 2	Half Load	Pre-scan
Mode 3	Full Load	Record

1.2.Description of Performance Criteria

General Performance Criteria

Examples of functions defined by the manufacturer to be evaluated during testing include, but are not limited to, the following:

— essential operational modes and states;
— tests of all peripheral access (hard disks, floppy disks, printers, keyboard, mouse, etc.);
— quality of software execution;
— quality of data display and transmission;
— quality of speech transmission.

1.2.1.Performance criterion A

The equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a performance level specified by the manufacture when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deriver from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

1.2.2.Performance criterion B

After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacture, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance.

During the test, degradation of performance is allowed. However, no change of operation state or stored data is allowed to persist after the test.

If the minimum performance level (or the permissible performance loss) is not specified by the manufacturer, then either of these may be deliver from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

1.2.3.Performance criterion C

Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacture’s instructions. Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be loss.

2.Measurement Uncertainty

Test	Parameters	Expanded uncertainty (Ulab)	Expanded uncertainty (Ucispr)
Radiated Emission	Level accuracy (9kHz to 30MHz)	± 3.68 dB	N/A
Radiated Emission	Level accuracy (30MHz to 1000MHz)	± 3.48 dB	± 5.2 dB
Radiated Emission	Level accuracy (above 1000MHz)	± 3.90 dB	N/A

(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. MEASUREMENT INSTRUMENTS EQUIPMENTS LIST

3.1 RADIATED EMISSION（3M）

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	Dec. 26, 2023
2	EMI Test Receiver	ROHDE & SCHWARZ	ESR 7	101181	Dec. 26, 2023
3	Log per Antenna	SCHWARZBECK	VULB9163	9163-470	Dec. 26, 2023
4	EMI Test Software	AUDIX	E3	N/A	Dec. 26, 2023
5	Positioning Controller	MF	MF-7082	/	Dec. 26, 2023

3.2 Electrostatic Discharge

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	ESD Simulator	EM TEST	DITO	N/A	Dec. 26, 2023

3.3 RF Field Strength Susceptibility

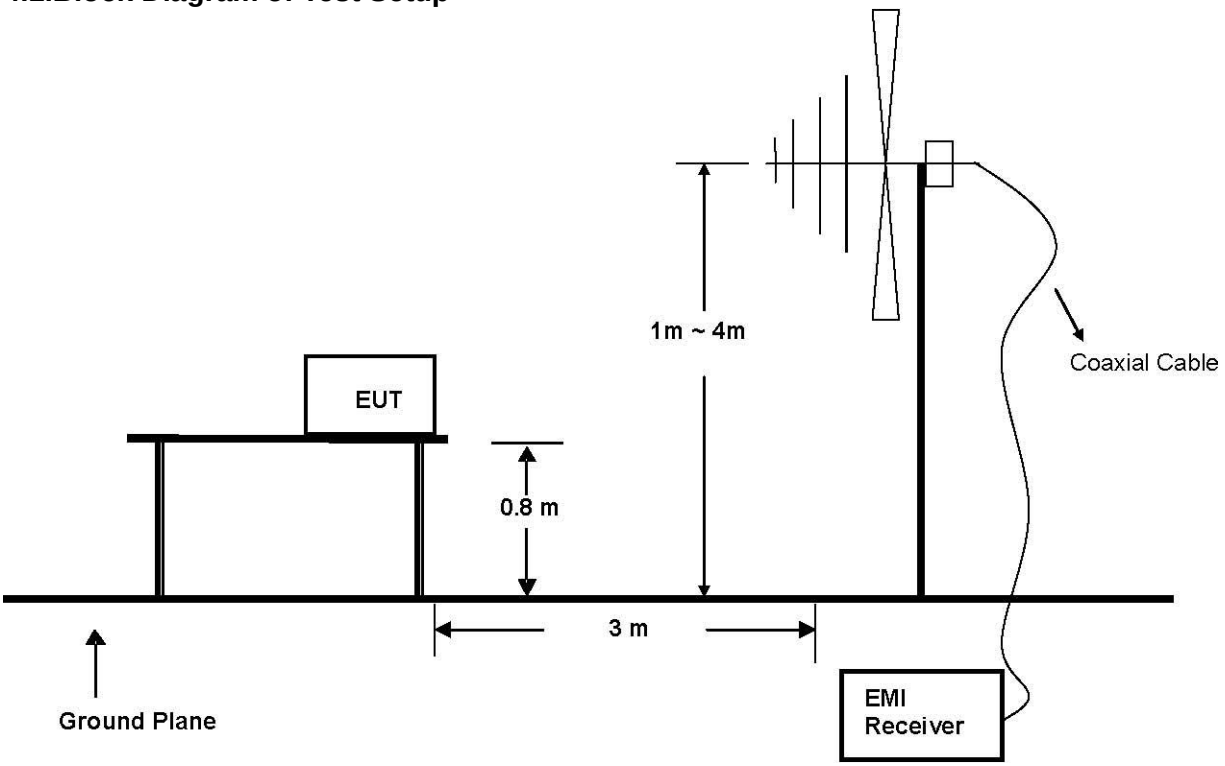
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	SIGNAL GENERATOR	R&S	SMB100A	105942	Dec. 26, 2023
2	RF Power Amplifier	BONN Elektronik	BLWA0830-160 /100/40D	128740	Dec. 26, 2023
3	Log-periodic Antenna	SCHWARZBECK	STLP9128D	043	Dec. 26, 2023

3.4 Power Frequency Magnetic Field Susceptibility

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	Power frequency mag-field generator System	EVERFINE	EMS61000-8K	906003	Dec. 26, 2023

4. RADIATED EMISSION MEASUREMENT

4.1.Block Diagram of Test Setup



4.2.Measuring Standard

EN 55032:2015+A11:2020+A1:2020

4.3.Radiated Emission Limits

EN 55032 Limits:
All emanations from a class B device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified below:

Limits for radiated disturbance Blow 1GHz

FREQUENCY (MHz)	DISTANCE (Meters)	FIELD STRENGTHS LIMIT (dBμV/m)
30 ~ 230	3	40
230 ~ 1000	3	47
Note:(1)The smaller limit shall apply at the combination point between two frequency bands. (2)Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the EUT.		

4.4.EUT Configuration on Test

The EN 55032 regulations test method must be used to find the maximum emission during radiated emission measurement.

4.5.Operating Condition of EUT

4.5.1.Turn on the power.
4.5.2.After that, let the EUT work in test Mode3 and measure it.

4.6.Test Procedure

The EUT is placed on a turntable, which is 0.8 meter high above the ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna, which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. By-log antenna is used as a receiving antenna. Both horizontal and vertical polarization of the antenna is set on test.

The bandwidth of the Receiver is set at 120kHz.

The frequency range from 30MHz to 1000MHz is investigated.

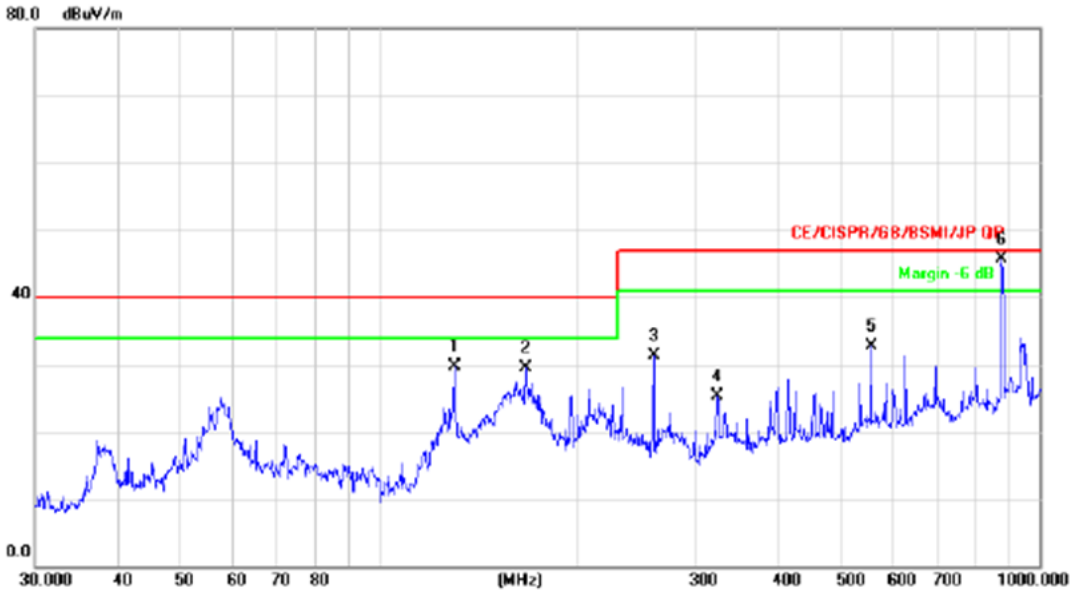
4.7.Test Results

PASS.

The test result please refer to the next page.

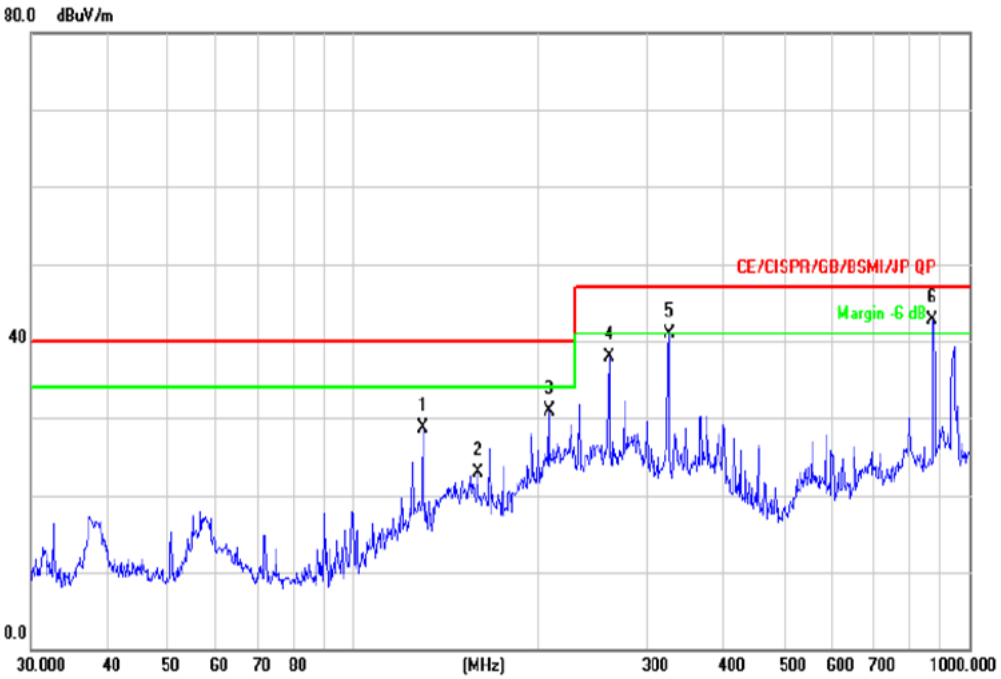
Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	101 Kpa	Test Date：	2023-12-05
Test Mode ：	Mode 3	Polarization：	Vertical
Test Engineer	David Zhong		

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		129.9226	41.76	-12.00	29.76	40.00	-10.24	peak			
2		166.0680	40.82	-11.34	29.48	40.00	-10.52	peak			
3		260.1444	41.01	-9.80	31.21	47.00	-15.79	peak			
4		324.4561	33.56	-8.35	25.21	47.00	-21.79	peak			
5		554.8254	35.24	-2.55	32.69	47.00	-14.31	peak			
6	*	875.2470	41.55	4.09	45.64	47.00	-1.36	peak			



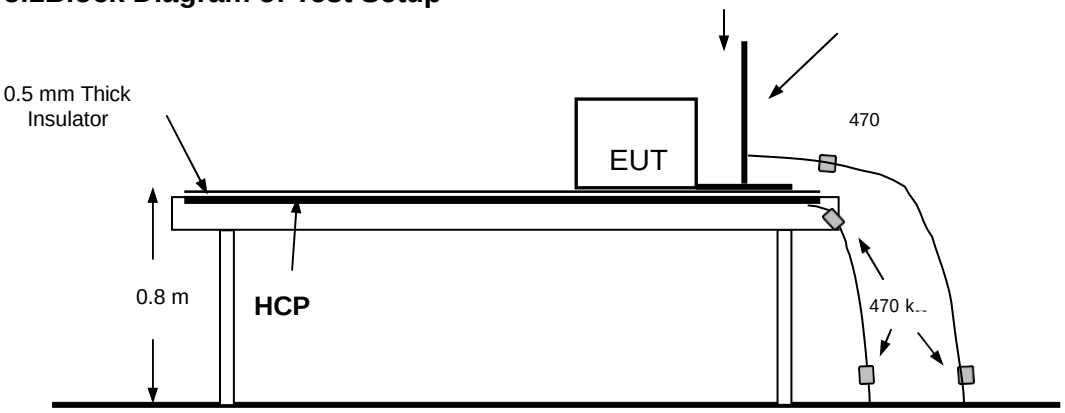
Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	101 Kpa	Test Date：	2023-12-05
Test Mode ：	Mode 3	Polarization：	Horizontal
Test Engineer	David Zhong		

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		129.9226	40.66	-12.00	28.66	40.00	-11.34	peak			
2		159.2251	33.88	-11.02	22.86	40.00	-17.14	peak			
3		207.8501	43.31	-12.41	30.90	40.00	-9.10	peak			
4		260.1444	47.76	-9.80	37.96	47.00	-9.04	peak			
5		325.5958	49.23	-8.30	40.93	47.00	-6.07	peak			
6	*	872.1832	38.66	4.00	42.66	47.00	-4.34	peak			



5. ELECTROSTATIC DISCHARGE IMMUNITY TEST

5.1Block Diagram of Test Setup



5.2 Test Standard

EN 55035:2017+A11:2020

Severity Level: 3 / Air Discharge: ±8KV, Level: 2 / Contact Discharge: ±4KV

5.3 Severity Levels and Performance Criterion

5.3.1 Severity level

Level	Test Voltage Contact Discharge (KV)	Test Voltage Air Discharge (KV)
1.	2	2
2.	4	4
3.	6	8
4.	8	15
X	Special	Special

5.3.2 Performance Criterion: B

5.3.3 EUT Configuration on Test
The configuration of EUT is listed in Section 2.1.

5.3.4 Operating Condition of EUT
Same as conducted emission measurement, which is listed in Section 4.5.
Except the test set up replaced by Section 5.1.

5.6 Test Procedure

5.6.1 Air Discharge
This test is done on a non-conductive surface. The round discharge tip of the discharge electrode shall be approached as fast as possible to touch the EUT.
After each discharge, the discharge electrode shall be removed from the EUT. The generator is then re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. This procedure shall be repeated until all the air discharge completed

5.6.2 Contact Discharge
All the procedure shall be same as Section 5.6.1. Except that the tip of the discharge electrode shall touch the EUT before the discharge switch is operated.

5.6.3 Indirect Discharge For Horizontal Coupling Plane
At least 10 single discharges (in the most sensitive polarity) shall be applied at the front edge of each HCP opposite the center point of each unit (if applicable) of the EUT and 0.1m from the front of the EUT. The long axis of the discharge electrode shall be in the plane of the HCP and perpendicular to its front edge during the discharge.

5.6.4 Indirect Discharge For Vertical Coupling Plane
At least 10 single discharge (in the most sensitive polarity) shall be applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m X 0.5m, is placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges shall be applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.

5.7 Test Results

PASS.

Please refer to the following pages

Electrostatic Discharge Test Results			
Standard	☒ EN 55035:2017+A11:2020		
EUT	Banana Pi BPI-R4	Temperature	23.6℃
M/N	BPI-R4	Humidity	54.7
Criterion	B	Pressure	1021mbar
Test Mode	Mode 3	Test Engineer	David Zhong

Air Discharge							
Test Points	Test Levels			Results			
	±2kV	±4kV	±8kV	Passed	Fail	Performance Criterion	
Front	☒	☒	☒	☒	☐	☐A	☒B
Back	☒	☒	☒	☒	☐	☐A	☒B
Left	☒	☒	☒	☒	☐	☐A	☒B
Right	☒	☒	☒	☒	☐	☐A	☒B
Top	☒	☒	☒	☒	☐	☐A	☒B
Bottom	☒	☒	☒	☒	☐	☐A	☒B

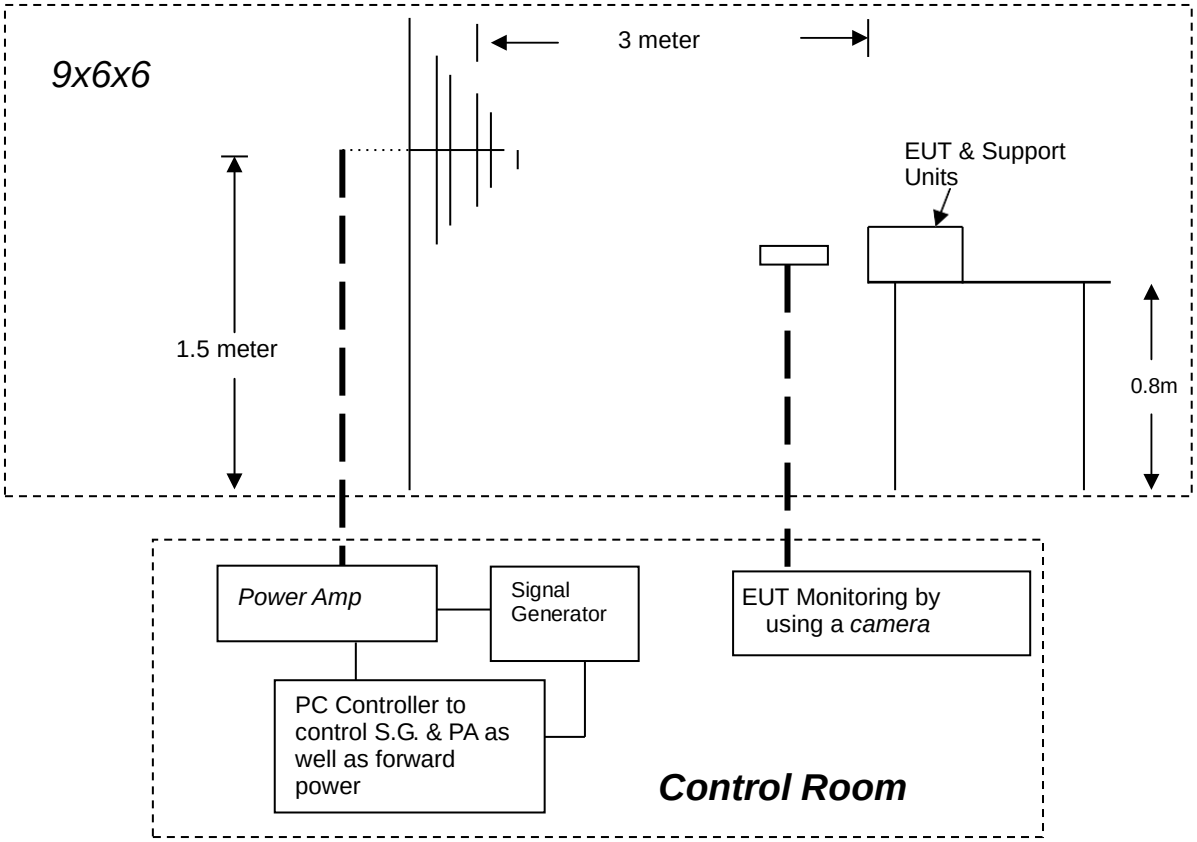
Contact Discharge						
Test Points	Test Levels		Results			
	±2 kV	±4 kV	Passed	Fail	Performance Criterion	
Front	☒	☒	☒	☐	☐A	☒B
Back	☒	☒	☒	☐	☐A	☒B
Left	☒	☒	☒	☐	☐A	☒B
Right	☒	☒	☒	☐	☐A	☒B
Top	☒	☒	☒	☐	☐A	☒B
Bottom	☒	☒	☒	☐	☐A	☒B

Discharge To Horizontal Coupling Plane						
Side of EUT	Test Levels		Results			
	±2 kV	±4 kV	Passed	Fail	Performance Criterion	
Front	☒	☒	☒	☐	☐A	☒B
Back	☒	☒	☒	☐	☐A	☒B
Left	☒	☒	☒	☐	☐A	☒B
Right	☒	☒	☒	☐	☐A	☒B

Discharge To Vertical Coupling Plane						
Side of EUT	Test Levels		Results			
	±2kV	±4 kV	Passed	Fail	Performance Criterion	
Front	☒	☒	☒	☐	☐A	☒B
Back	☒	☒	☒	☐	☐A	☒B
Left	☒	☒	☒	☐	☐A	☒B
Right	☒	☒	☒	☐	☐A	☒B

6. RF FIELD STRENGTH SUSCEPTIBILITY TEST

6.1 Block Diagram of Test



6.2Test Standard

EN 55035:2017+A11:2020 (Severity Level: 2, 3V / m)

6.3 Severity Levels and Performance Criterion

6.3.1 Severity Levels

Level	Field Strength (V/m)
1.	1
2.	3
3.	10
X.	Special

6.3.2 Performance Criterion: A

6.4 EUT Configuration on Test

The configuration of the EUT is same as Section 2.1.

6.5 Operating Condition of EUT

Same as radiated emission measurement, which is listed in Section 4.5, except the test setup replaced as Section 6.1.

6.6 Test Procedure

The EUT are placed on a table, which is 0.8 meter high above the ground. The EUT is set 3 meters away from the transmitting antenna, which is mounted on an antenna tower.

Both horizontal and vertical polarization of the antenna is set on test. Each of the four sides of the EUT must be faced this transmitting antenna and measured individually.

In order to judge the EUT performance, a CCD Recording is used to monitor its screen. All the scanning conditions are as following:

	Condition of Test	Remark
1.	Fielded Strength	3V/m (Severity Level 2)
2.	Radiated Signal	Unmodulated
3.	Scanning Frequency	80-1000MHz
4.	Sweep time of radiated	0.0015 Decade/s
5.	Dwell Time	3 Sec.

6.7 Test Results

PASS.

Please refer to the following page.

RF Field Strength Susceptibility Test Results			
Standard	☒ EN 55035:2017+A11:2020		
EUT	Banana Pi BPI-R4	Temperature	23.6℃
M/N	BPI-R4	Humidity	54.2
Criterion	A	Field Strength	3 V/m
Test Mode	Mode 3	Test Engineer	David Zhong
Frequency Range	80 MHz to 1000 MHz		
Modulation	☐None ☐Pulse ☒AM 1KHz 80%		
Steps	1%		

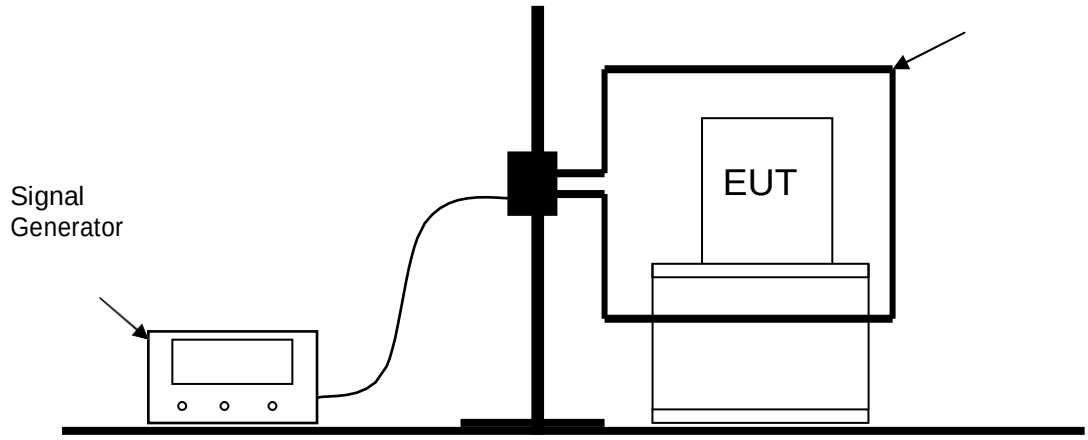
	Horizontal	Vertical
Front	PASS	PASS
Right	PASS	PASS
Rear	PASS	PASS
Left	PASS	PASS

Test Equipment:
1. Signal Generator: 2031 (MARCONI)
2. Power Amplifier: 500A100 & 100W/1000M1 (A&R)
Power Antenna: 3108 (EMCO) & AT1080 (A&R)
Field Monitor: FM2000 (A&R)

Note:--

7. MAGNETIC FIELD SUSCEPTIBILITY TEST

7.1Block Diagram of Test Setup



7.2 Test Standard

EN 55035:2017+A11:2020 (Severity Level: Level 1, 1A / m)

7.3 Severity Levels and Performance Criterion

7.3.1 Severity Levels

Level	Field Strength (A/m)
1	1
2	3
3	10
4	30
5	100
X	Special

7.3.2 Performance Criterion: A

7.4 EUT Configuration on Test

The configuration of the EUT is same as Section 2.1.

7.5 Test Procedure

The EUT is placed in the middle of a induction coil (1*1m), under which is a 1*1*0.1m (high) table, this small table is also placed on a larger table, 0.8 m above the ground.

Both horizontal and vertical polarization of the induction coil is set on test, so that each side of the EUT is affected by the magnetic field. Also can reach the same aim by change the position of the EUT.

7.6 Test Results

PASS.

Please refer to the following page.

Magnetic Field Immunity Test Result			
Standard	☒ EN 55035:2017+A11:2020		
EUT	Banana Pi BPI-R4	Temperature	23.6℃
M/N	BPI-R4	Humidity	54.2
Criterion	A	Test Mode	Mode 3
Test Engineer	David Zhong		

Test Level (A/M)	Testing Duration	Coil Orientation	Criterion	Result
1	5 mins	X	A	PASS
1	5 mins	Y	A	PASS
1	5 mins	Z	A	PASS

Note:--

8. EUT PHOTO

Photo 1

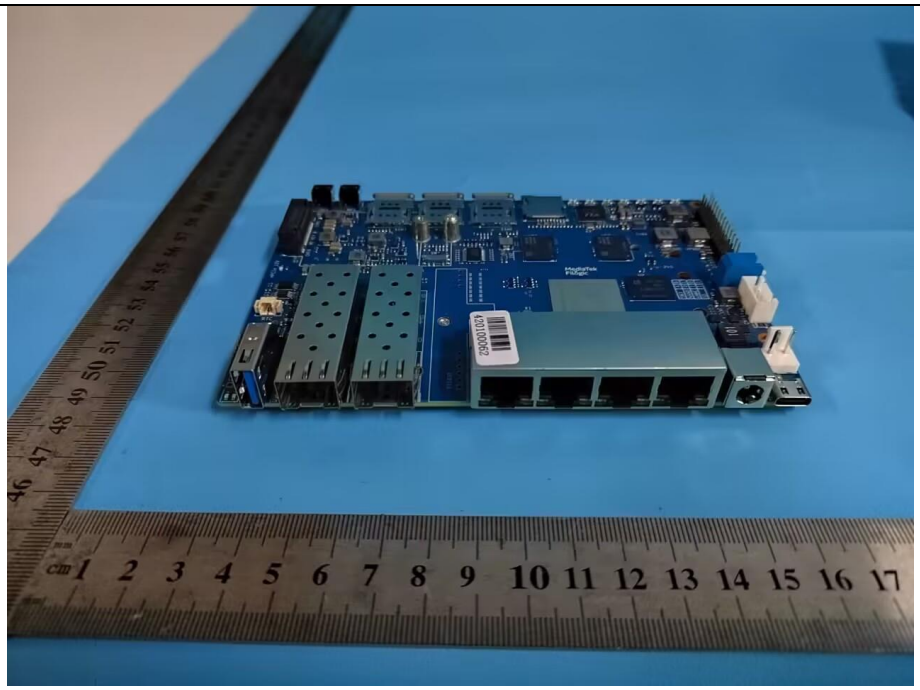


Photo 2

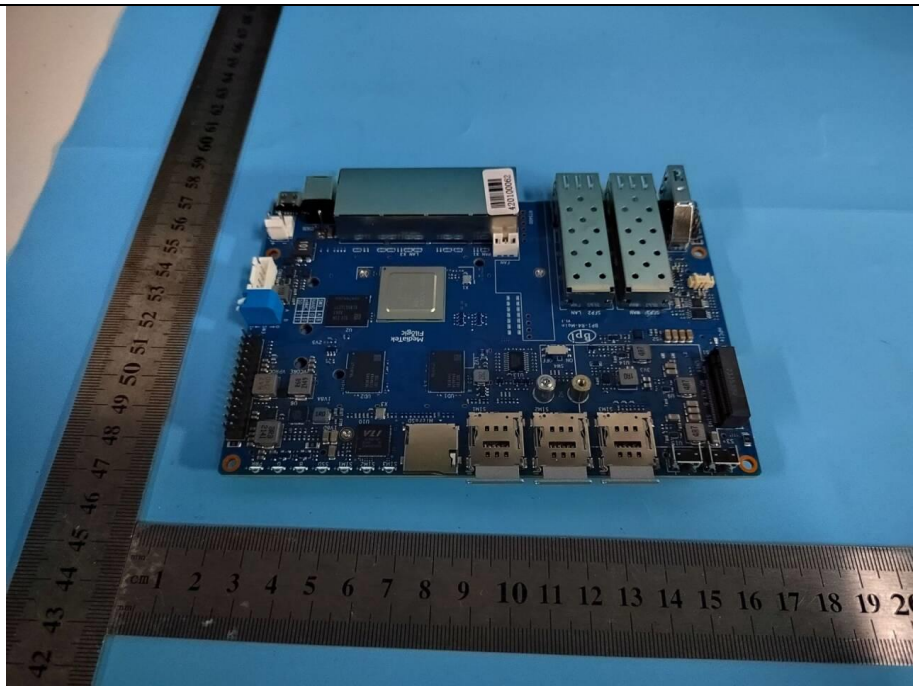
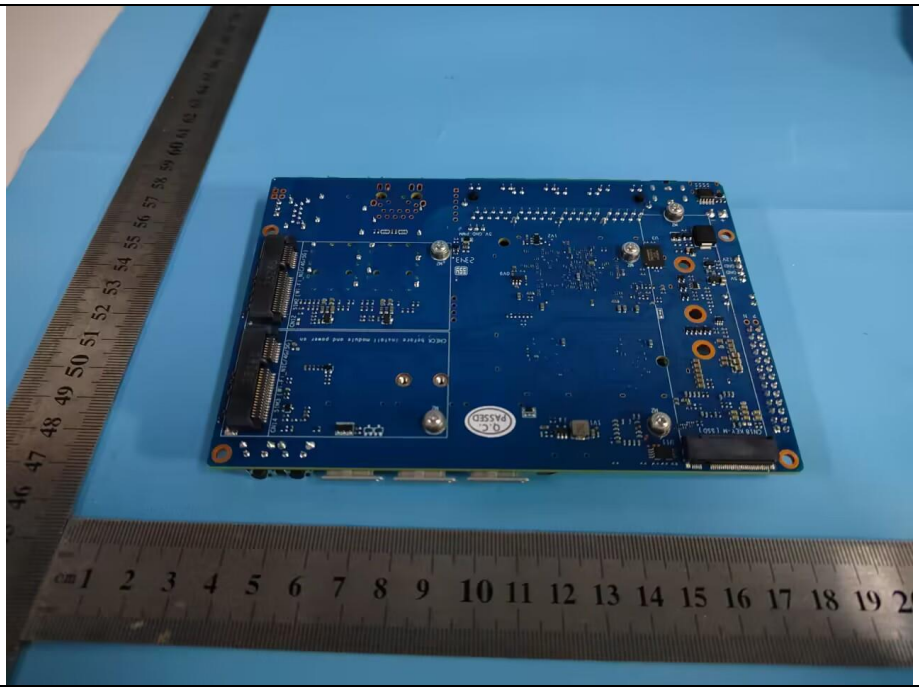


Photo 3	

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