



FCC REPORT

Applicant: Atoms Labs LLC

Address of Applicant: 2670 Firewheel Dr. Suite D Flower Mound TX 75028
United States

Equipment Under Test (EUT)

Product Name: Control hub

Model No.: AHS-6R, AHS-7R

FCC ID: 2ACMYAHS6R

Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.249:2014

Date of sample receipt: January 21, 2016

Date of Test: January 25-26, 2016

Date of report issued: January 27, 2016

Test Result : PASS *

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

Authorized Signature:

Robinson Lo

Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the GTS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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2 Version

Version No.	Date	Description
00	June 24, 2015	Original
01	January 27, 2016	Add model name

Prepared By:

Edward Pan

Date:

January 27, 2016

Project Engineer

Check By:

Hank Yan

Date:

January 27, 2016

Reviewer

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4 Test Summary

Test Item	Section in CFR 47	Result
Antenna requirement	15.203	N/A
AC Power Line Conducted Emission	15.207	Pass
Field strength of the fundamental signal	15.249 (a)	N/A
Spurious emissions	15.249 (a) (d)/15.209	Pass
Band edge	15.249 (d)/15.205	N/A
20dB Occupied Bandwidth	15.215 (c)	N/A

Pass: The EUT complies with the essential requirements in the standard.

N/A: Not applicable

Remark: Test according to ANSI C63.4:2014 and ANSI C63.10:2013.

4.1 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	9kHz ~ 30MHz	$\pm 4.34\text{dB}$	(1)
Radiated Emission	30MHz ~ 1000MHz	$\pm 4.24\text{dB}$	(1)
Radiated Emission	1GHz ~ 26.5GHz	$\pm 4.68\text{dB}$	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	$\pm 3.45\text{dB}$	(1)

Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.

5 General Information

5.1 Client Information

Applicant:	Atoms Labs LLC
Address of Applicant:	2670 Firewheel Dr. Suite D Flower Mound TX 75028 United States

5.2 General Description of EUT

Product Name:	Control hub
Model No.:	AHS-6R, AHS-7R
Operation Frequency:	916.8MHz
Modulation type:	GFSK
Antenna Type:	Integral antenna
Antenna gain:	2dBi (declare by Applicant)
Power supply:	AC/DC Adapter 1: Model No.:CS12N120100FUF Input: 100-240V~50/60Hz 500mA Output: 12.0V $\overline{\text{---}}$ 1.0A AC/DC Adapter 2: Model No.:KSAS0121200100HU Input: 100-240V~50/60Hz 0.4A Output: 12V $\overline{\text{---}}$ 1.0A AC/DC Adapter 3: Model No.:GQ15-120100-AU Input: 100-240V~50/60Hz 0.5A Max Output: 12.0V $\overline{\text{---}}$ 1.0A
Remark:	Two adapters were tested, and the adapter 2 is worse. So only the data of adapter is reported.

5.3 Test mode

Transmitting mode	Keep the EUT in continuously transmitting mode
<i>Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.</i>	

Per-test mode.

We have verified the construction and function in typical operation, The EUT was placed on three different polar directions; i.e. X axis, Y axis, Z axis. which was shown in this test report and defined as follows:

Axis	X	Y	Z
Field Strength(dBuV/m)	77.26	77.33	76.22

Final Test Mode:

The EUT was tested in GFSK modulation is the worst case.

According to ANSI C63.4 standards, the test results are both the "worst case" and "worst setup":

Y axis (see the test setup photo)

5.4 Description of Support Units

None

5.5 Test Facility

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

- **FCC —Registration No.: 600491**

Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files. Registration 600491, June 28, 2013.

- **Industry Canada (IC) —Registration No.: 9079A-2**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-2, June 26, 2013.

5.6 Test Location

All tests were performed at:
Global United Technology Services Co., Ltd. Room 301-309, 3th Floor, Block A, Huafeng Jinyuan Business Building, No. 300 Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, China Tel: 0755-27798480 Fax: 0755-27798960

5.7 Other Information Requested by the Customer

None.

6 Test Instruments list

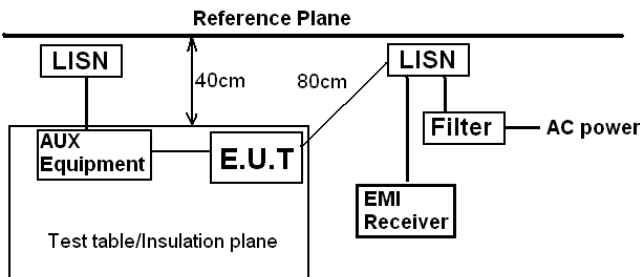
Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	Mar. 28 2015	Mar. 27 2016
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	Spectrum Analyzer	Agilent	E4440A	GTS533	Jun 30 2015	Jun 29 2016
4	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	Jun 30 2015	Jun 29 2016
5	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	Jun 30 2015	Jun 29 2016
6	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	9120D-829	GTS208	June 26 2015	June 25 2016
7	Horn Antenna	ETS-LINDGREN	3160	GTS217	Mar. 27 2015	Mar. 26 2016
8	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
9	Coaxial Cable	GTS	N/A	GTS213	Mar. 28 2015	Mar. 27 2016
10	Coaxial Cable	GTS	N/A	GTS211	Mar. 28 2015	Mar. 27 2016
11	Coaxial cable	GTS	N/A	GTS210	Mar. 28 2015	Mar. 27 2016
12	Coaxial Cable	GTS	N/A	GTS212	Mar. 28 2015	Mar. 27 2016
13	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	Jun 30 2015	Jun 29 2016
14	Amplifier(2GHz-20GHz)	HP	8349B	GTS206	Jun 30 2015	Jun 29 2016
15	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June 26 2015	June 25 2016
16	Band filter	Amindeon	82346	GTS219	Mar. 28 2015	Mar. 27 2016

Conducted Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Shielding Room	ZhongYu Electron	7.0(L)x3.0(W)x3.0(H)	GTS264	Jun 30 2015	Jun 29 2016
2	EMI Test Receiver	Rohde & Schwarz	ESCS30	GTS223	Jun 30 2015	Jun 29 2016
3	10dB Pulse Limita	Rohde & Schwarz	N/A	GTS224	Jun 30 2015	Jun 29 2016
4	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	Jun 30 2015	Jun 29 2016
5	LISN	SCHWARZBECK MESS-ELEKTRONIK	NSLK 8127	GTS226	Jun 30 2015	Jun 29 2016
6	Coaxial Cable	GTS	N/A	GTS227	Jun 30 2015	Jun 29 2016
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A

General used equipment:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Barometer	ChangChun	DYM3	GTS257	July 07 2015	July 06 2016

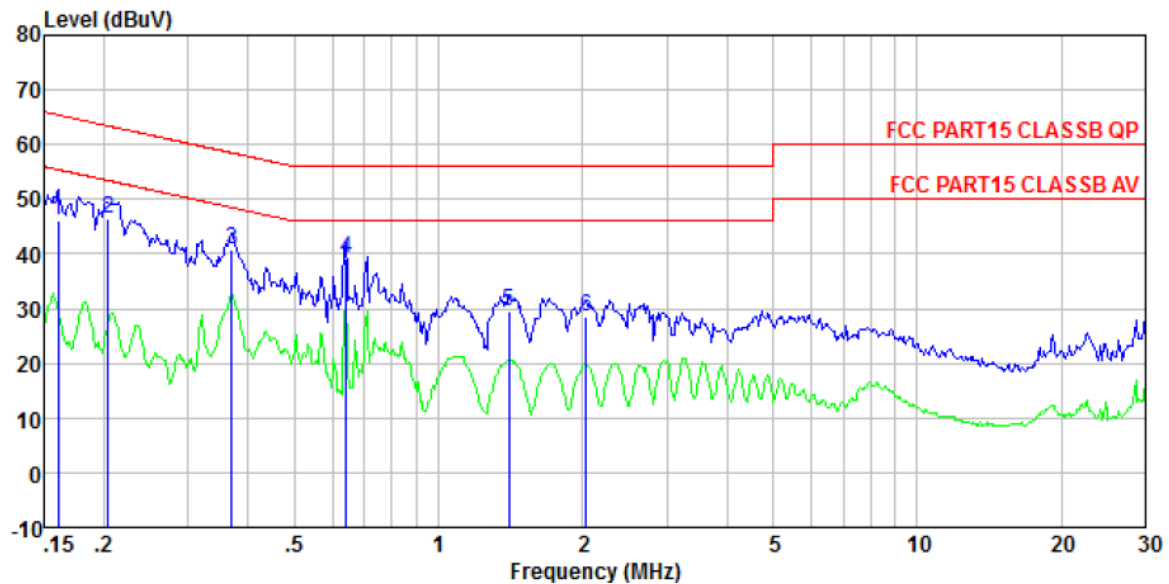
7 Test results and Measurement Data

7.1 Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207		
Test Method:	ANSI C63.4:2014		
Test Frequency Range:	150KHz to 30MHz		
Class / Severity:	Class B		
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		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.			
Test setup:	 Remark: E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m		
Test procedure:	1. The EUT 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. 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). 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: 2014 on conducted measurement.		
Test Instruments:	Refer to section 6.0 for details		
Test mode:	Refer to section 5.3 for details		
Test results:	Pass		

Measurement data

Line:



Condition : FCC PART15 CLASSB QP LISN-2013 LINE

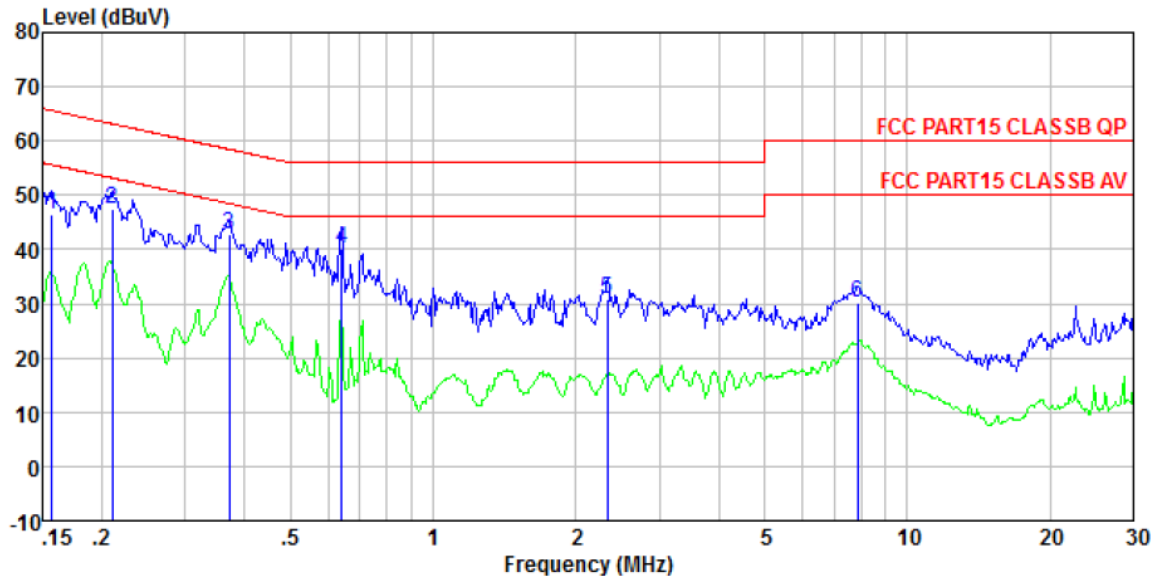
Job No. : 0136

Test mode : Transmitting mode

Test Engineer: Arslan

	Freq	Read Level	LISN Level	Cable Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
1	0.161	45.85	46.12	0.15	0.12	65.43	-19.31	QP
2	0.204	46.23	46.49	0.13	0.13	63.45	-16.96	QP
3	0.369	40.52	40.73	0.11	0.10	58.52	-17.79	QP
4	0.641	38.89	39.15	0.13	0.13	56.00	-16.85	QP
5	1.403	29.26	29.51	0.12	0.13	56.00	-26.49	QP
6	2.033	28.26	28.53	0.12	0.15	56.00	-27.47	QP

Neutral:



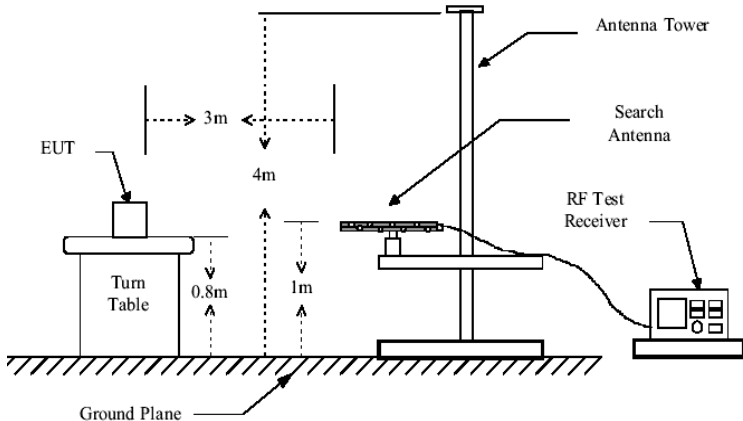
Condition : FCC PART15 CLASSB QP LISN-2013 NEUTRAL
 Job No. : 0136
 Test mode : Transmitting mode
 Test Engineer: Arslan

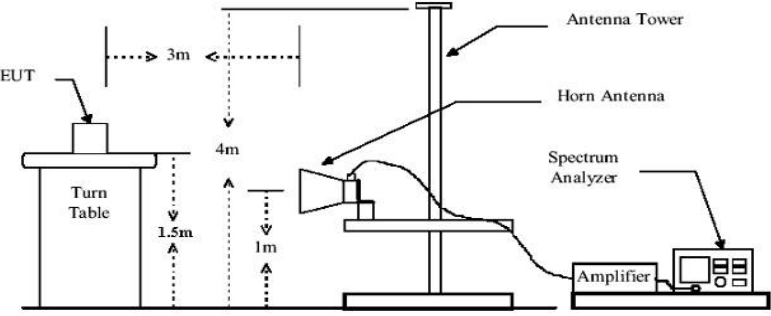
	Freq	Read Level	LISN Level	Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
1	0.157	46.36	46.55	0.07	0.12	65.60	-19.05	QP
2	0.211	47.35	47.55	0.07	0.13	63.18	-15.63	QP
3	0.371	42.54	42.70	0.06	0.10	58.47	-15.77	QP
4	0.641	39.87	40.07	0.07	0.13	56.00	-15.93	QP
5	2.334	30.55	30.80	0.10	0.15	56.00	-25.20	QP
6	7.852	29.65	30.02	0.19	0.18	60.00	-29.98	QP

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss
4. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.

7.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	30MHz to 10GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		Peak	1MHz	10Hz	Average Value
Limit: (Field strength of the fundamental signal)	Frequency		Limit (dBuV/m @3m)		Remark
	902MHz ~ 928MHz		94.00		Quasi-peak Value
Limit: (Spurious Emissions)	Frequency		Limit (dBuV/m @3m)		Remark
	30MHz-88MHz		40.00		Quasi-peak Value
	88MHz-216MHz		43.50		Quasi-peak Value
	216MHz-960MHz		46.00		Quasi-peak Value
	960MHz-1GHz		54.00		Quasi-peak Value
	Above 1GHz		54.00		Average Value
			74.00		Peak Value
Limit: (band edge)	Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.				
Test setup:	Below 1GHz				
					
	Above 1GHz				

	 The diagram illustrates the test setup. An EUT (Equipment Under Test) is placed on a Turn Table at a height of 1.5m. The Turn Table is 3m away from an Antenna Tower. The Antenna Tower has a Horn Antenna at a height of 4m. A Spectrum Analyzer is connected to the Antenna Tower via an Amplifier. The distance between the EUT and the Antenna Tower is 3m. The height of the Antenna Tower is 4m. The height of the Turn Table is 1.5m. The height of the Antenna Tower is 4m. The height of the Antenna Tower is 4m.
Test Procedure:	1. The EUT was placed on the top of a rotating table (0.8m for below 1GHz and 1.5 meters for above 1GHz) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

Measurement data:

7.2.1 Spurious emissions

■ Below 1GHz

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
36.13	43.59	14.63	0.62	30.06	28.78	40.00	-11.22	Vertical
49.88	44.70	15.26	0.77	30.00	30.73	40.00	-9.27	Vertical
125.45	35.40	11.61	1.40	29.54	18.87	43.50	-24.63	Vertical
251.18	34.65	14.07	2.13	29.65	21.20	46.00	-24.80	Vertical
462.35	32.30	17.65	3.14	29.37	23.72	46.00	-22.28	Vertical
640.61	28.97	20.60	3.87	29.26	24.18	46.00	-21.82	Vertical
916.80	68.13	23.21	4.91	29.10	67.15	94.00	-26.85	Vertical
33.10	43.25	14.31	0.59	30.08	28.07	40.00	-11.93	Horizontal
45.22	41.29	15.54	0.72	30.02	27.53	40.00	-12.47	Horizontal
93.44	35.65	14.58	1.14	29.73	21.64	43.50	-21.86	Horizontal
149.49	39.90	10.26	1.56	29.41	22.31	43.50	-21.19	Horizontal
258.33	37.27	14.05	2.16	29.71	23.77	46.00	-22.23	Horizontal
406.09	35.70	17.18	2.88	29.49	26.27	46.00	-19.73	Horizontal
916.80	78.31	23.21	4.91	29.10	77.33	94.00	-16.67	Horizontal

■ Above 1GHz

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
1833.60	40.59	25.45	4.88	34.17	36.75	74.00	-37.25	Vertical
2750.40	38.38	28.26	5.71	33.61	38.74	74.00	-35.26	Vertical
3667.20	36.76	29.20	7.28	32.56	40.68	74.00	-33.32	Vertical
4584.00	33.68	31.49	8.41	31.98	41.60	74.00	-32.40	Vertical
5500.80	32.64	31.98	9.51	32.43	41.70	74.00	-32.30	Vertical
6417.60	31.64	33.49	10.78	32.12	43.79	74.00	-30.21	Vertical
7334.40	30.19	36.41	11.72	31.88	46.44	74.00	-27.56	Vertical
8251.20	28.38	36.76	12.51	31.77	45.88	74.00	-28.12	Vertical
9168.00	29.76	37.31	13.80	32.13	48.74	74.00	-25.26	Vertical
1833.60	40.93	25.45	4.88	34.17	37.09	74.00	-36.91	Horizontal
2750.40	38.52	28.26	5.71	33.61	38.88	74.00	-35.12	Horizontal
3667.20	37.64	29.20	7.28	32.56	41.56	74.00	-32.44	Horizontal
4584.00	34.49	31.49	8.41	31.98	42.41	74.00	-31.59	Horizontal
5500.80	32.64	31.98	9.51	32.43	41.70	74.00	-32.30	Horizontal
6417.60	32.64	33.49	10.78	32.12	44.79	74.00	-29.21	Horizontal
7334.40	31.54	36.41	11.72	31.88	47.79	74.00	-26.21	Horizontal
8251.20	30.52	36.76	12.51	31.77	48.02	74.00	-25.98	Horizontal
9168.00	29.51	37.31	13.80	32.13	48.49	74.00	-25.51	Horizontal

Average value:

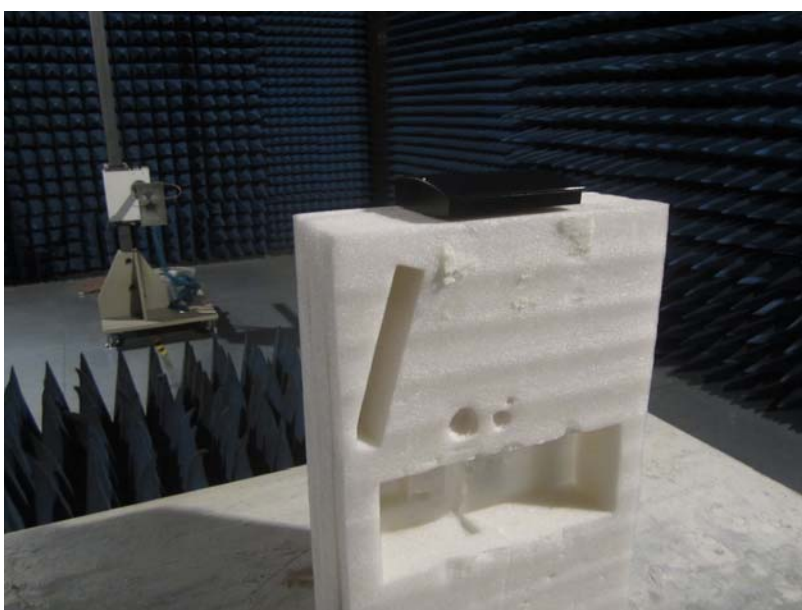
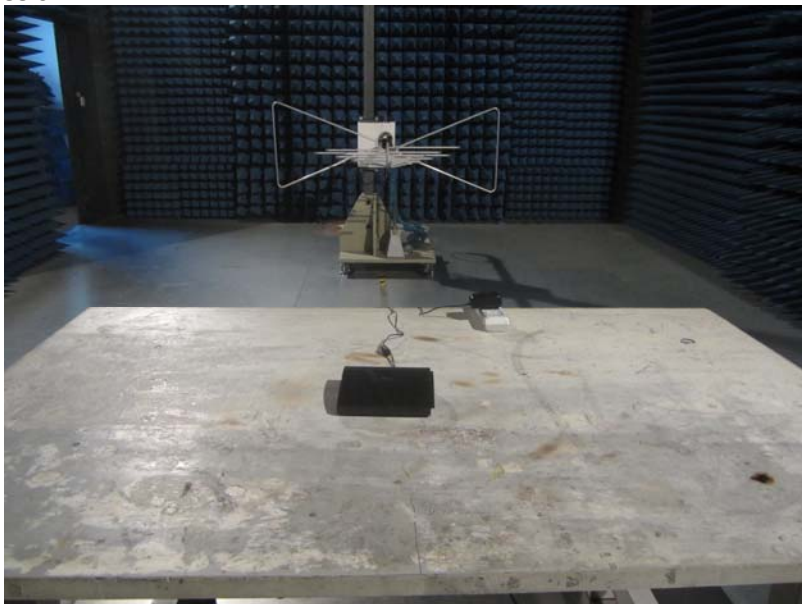
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
1833.60	30.76	25.45	4.88	34.17	26.92	54.00	-27.08	Vertical
2750.40	28.64	28.26	5.71	33.61	29.00	54.00	-25.00	Vertical
3667.20	26.77	29.20	7.28	32.56	30.69	54.00	-23.31	Vertical
4584.00	23.57	31.49	8.41	31.98	31.49	54.00	-22.51	Vertical
5500.80	22.43	31.98	9.51	32.43	31.49	54.00	-22.51	Vertical
6417.60	22.85	33.49	10.78	32.12	35.00	54.00	-19.00	Vertical
7334.40	20.27	36.41	11.72	31.88	36.52	54.00	-17.48	Vertical
8251.20	18.37	36.76	12.51	31.77	35.87	54.00	-18.13	Vertical
9168.00	19.97	37.31	13.80	32.13	38.95	54.00	-15.05	Vertical
1833.60	30.68	25.45	4.88	34.17	26.84	54.00	-27.16	Horizontal
2750.40	28.81	28.26	5.71	33.61	29.17	54.00	-24.83	Horizontal
3667.20	27.77	29.20	7.28	32.56	31.69	54.00	-22.31	Horizontal
4584.00	24.43	31.49	8.41	31.98	32.35	54.00	-21.65	Horizontal
5500.80	22.51	31.98	9.51	32.43	31.57	54.00	-22.43	Horizontal
6417.60	22.73	33.49	10.78	32.12	34.88	54.00	-19.12	Horizontal
7334.40	21.39	36.41	11.72	31.88	37.64	54.00	-16.36	Horizontal
8251.20	20.64	36.76	12.51	31.77	38.14	54.00	-15.86	Horizontal
9168.00	19.89	37.31	13.80	32.13	38.87	54.00	-15.13	Horizontal

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
3. *“*” means this data is too weak instrument of signal is unable to test.*

8 Test Setup Photo

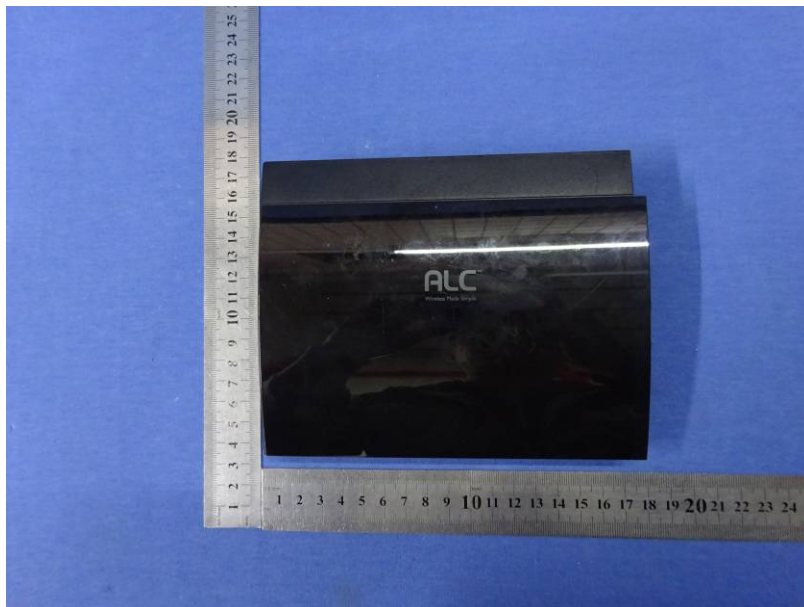
Radiated Emission

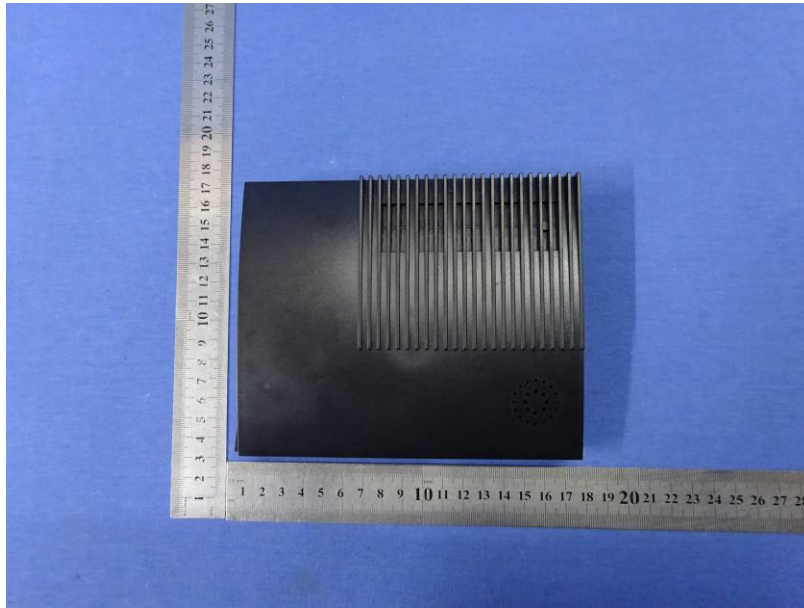


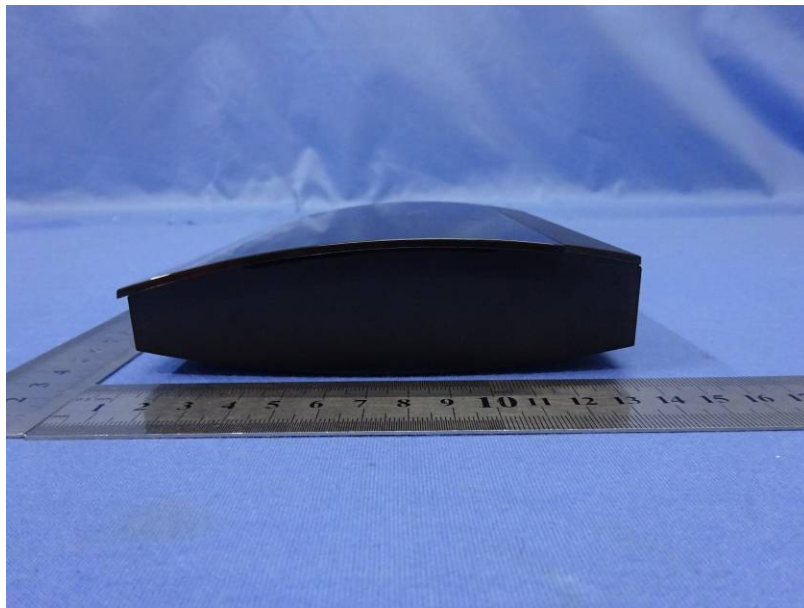
Conducted Emission

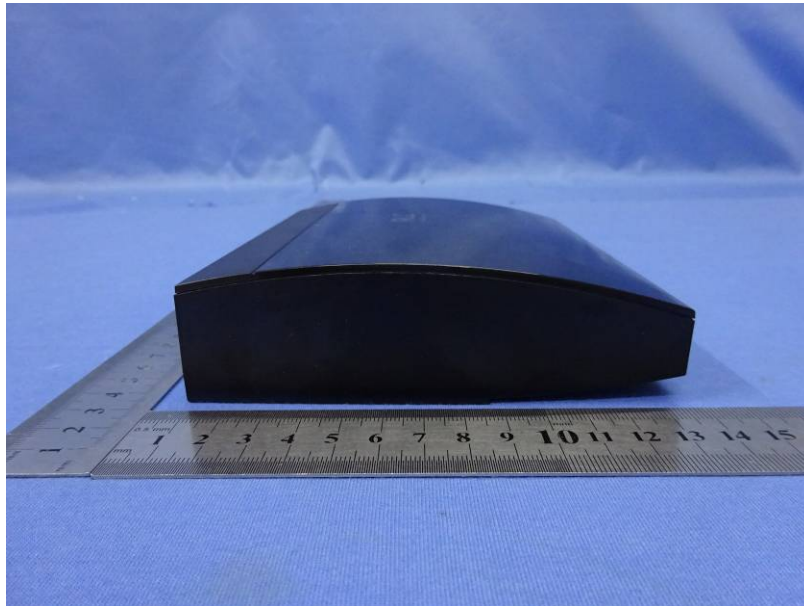


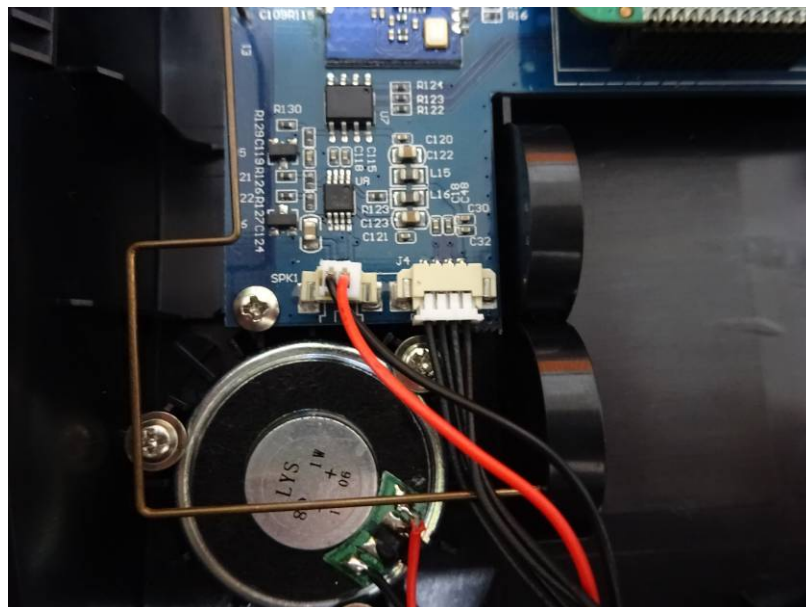
9 EUT Constructional Details

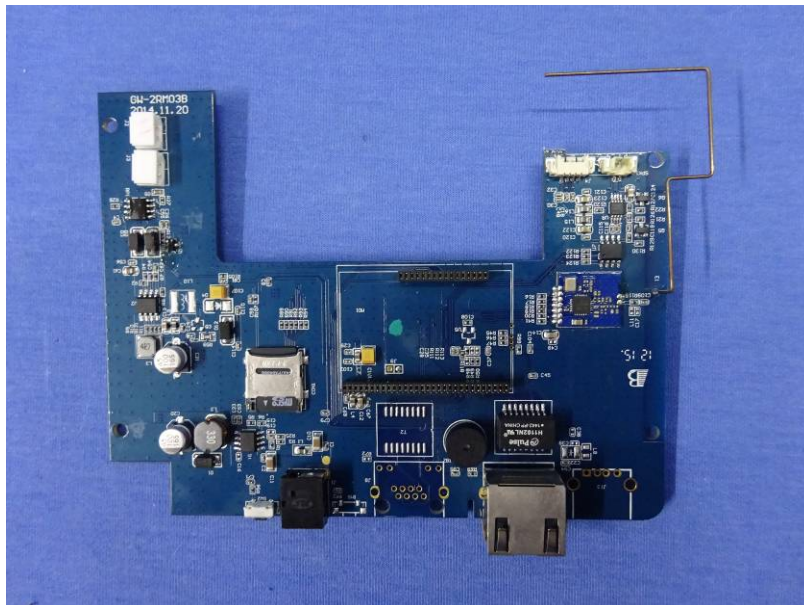
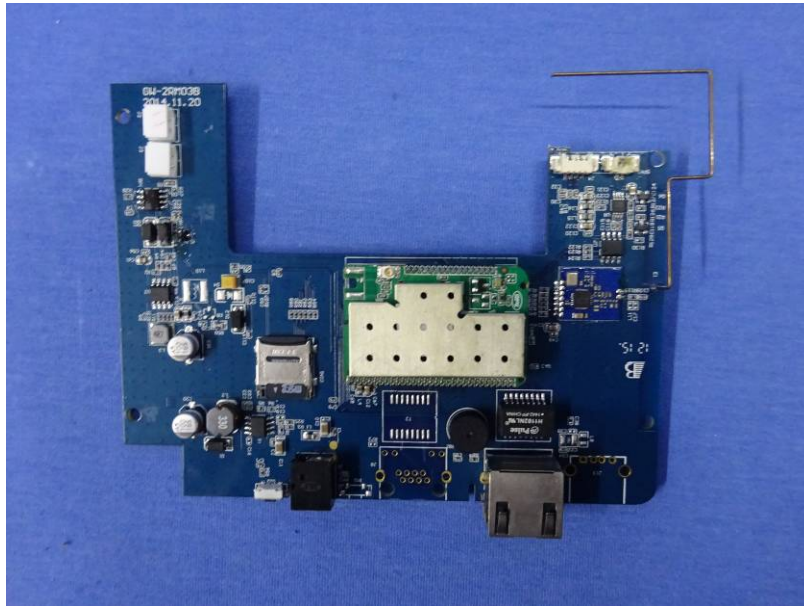


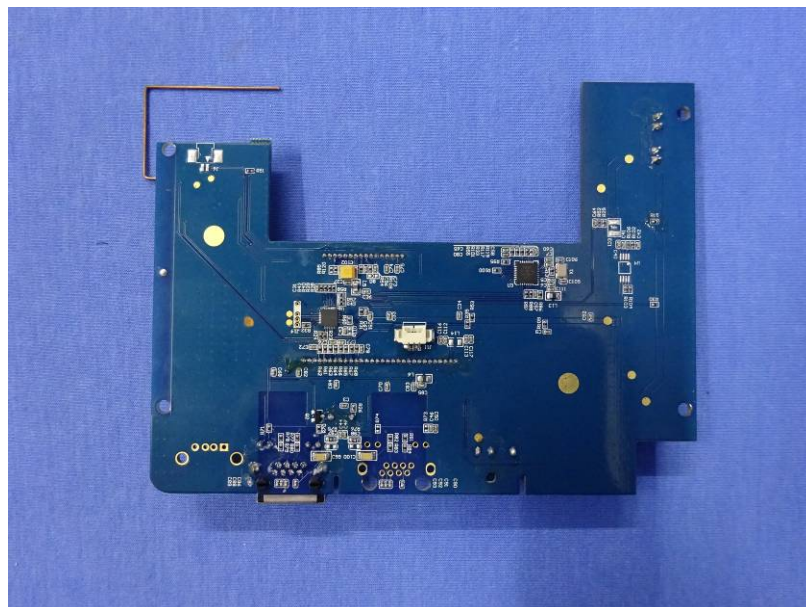
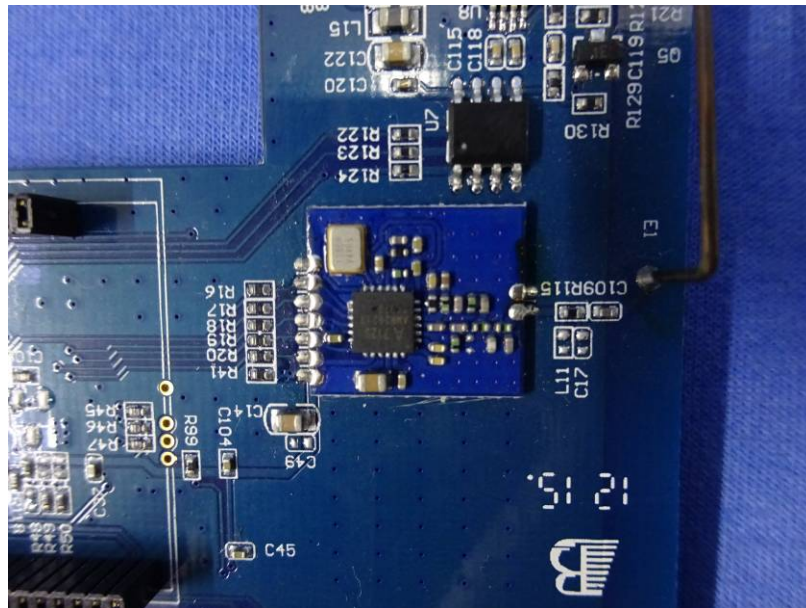


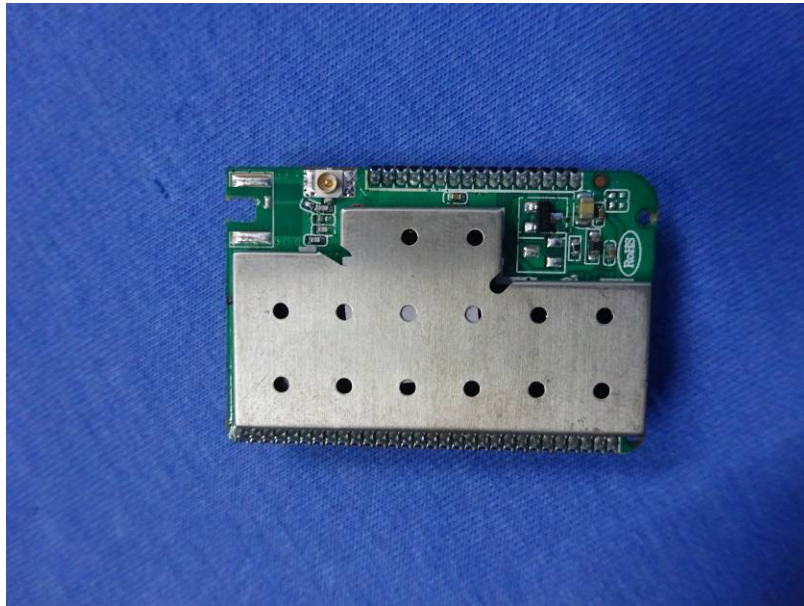


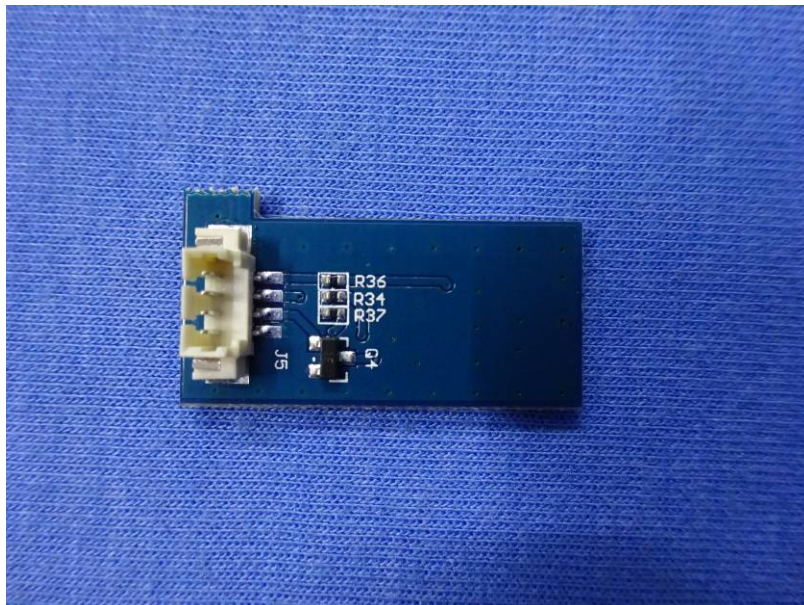
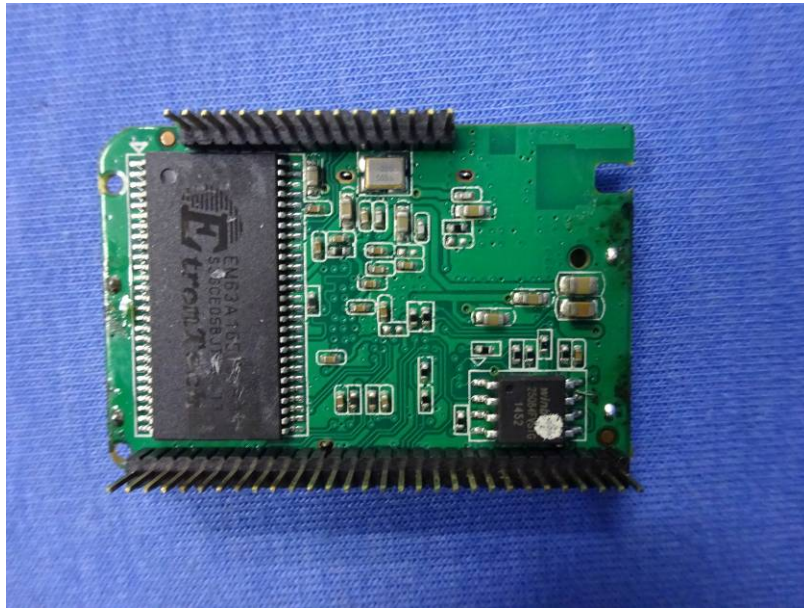


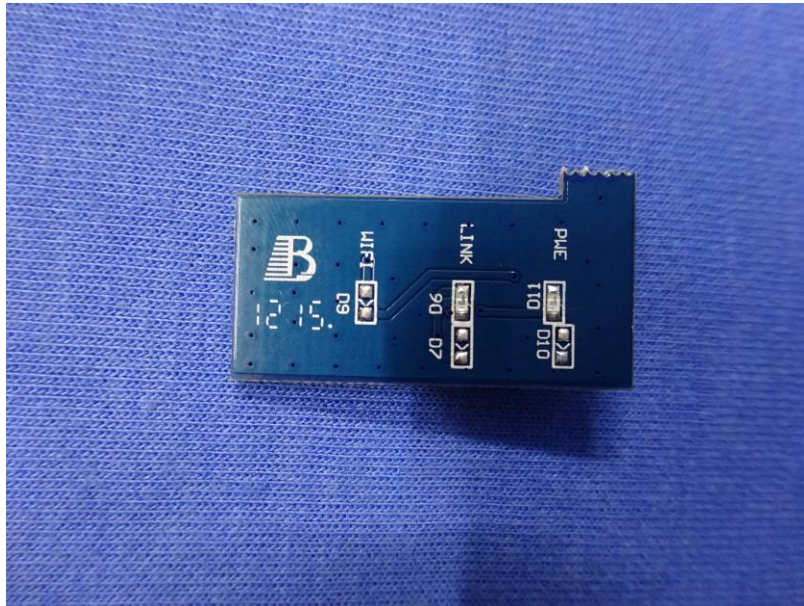














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