

## FCC REPORT

**Applicant:** Mingbo Education Technology Co.,Ltd.

**Address of Applicant:** Room 801,802,803,Tower C,No.9,Shangdi 3rd Street,Haidian District,Beijing,China

**Manufacturer:** Mingbo Education Technology Co.,Ltd.

**Address of Manufacturer:** Room 801,802,803,Tower C,No.9,Shangdi 3rd Street,Haidian District,Beijing,China

### Equipment Under Test (EUT)

**Product Name:** GATEWAY

**Model No.:** ZWG8100XX, ZWG2000AG, ZWG2100XX, ZWG3000XX, ZWG3100XX, ZWG4000XX, ZWG4100XX, ZWG5000XX, ZWG5100XX, ZWG6000XX, ZWG6100XX, ZWG7000XX , ZWG7100XX, ZWG8000XX

Remark: X stands for letters(A-Z) and numbers(0-9)

**FCC ID:** 2AM4Q-ZWG81000B

**Applicable standards:** FCC CFR Title 47 Part 15 Subpart C Section 15.249:2017

**Date of sample receipt:** July 08, 2017

**Date of Test:** July 08-12, 2017

**Date of report issued:** July 12, 2017

**Test Result :** PASS \*

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

Authorized Signature:



Robinson Lo  
Laboratory Manager

This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

## 2 Version

Version No.	Date	Description
01	July 12, 2017	Original

Prepared By:

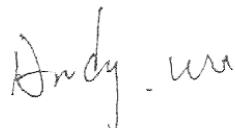


Date:

July 12, 2017

Project Engineer

Check By:



Date:

July 12, 2017

Reviewer

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## 4 Test Summary

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

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

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	± 4.34dB	(1)
Radiated Emission	30MHz ~ 1000MHz	± 4.24dB	(1)
Radiated Emission	1GHz ~ 26.5GHz	± 4.68dB	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	± 3.45dB	(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 General Description of EUT

Product Name:	GATEWAY
Model No.:	ZWG8100XX, ZWG2000AG, ZWG2100XX, ZWG3000XX, ZWG3100XX, ZWG4000XX, ZWG4100XX, ZWG5000XX, ZWG5100XX, ZWG6000XX, ZWG6100XX, ZWG7000XX, ZWG7100XX, ZWG8000XX Remark: X stands for letters(A-Z) and numbers(0-9)
Test Model No:	ZWG81000B
<i>Remark: All above models are identical in the same PCB layout, interior structure and electrical circuits. The differences are color and model name for commercial purpose.</i>	
Operation Frequency:	908.42MHz
Channel numbers:	1
Modulation type:	Z-wave
Antenna Type:	Reversed polarity NON standards external antenna port
Antenna gain:	2.0dBi(declare by Applicant)
Power supply:	Power Supply Model:SAW12-050-2000CD Input: AC 100-240V, 50/60Hz, 0.3A Output: DC 5V/2000mA

## 5.2 Test mode

Transmitting mode	Keep the EUT in continuously transmitting mode
<p><i>Remark: During the test, the dutycycle &gt;98%, 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></p>	

### Final Test Mode:

According to ANSI C63.4 standards, the test results are both the “worst case” and “worst setup”:  
Y axis (see the test setup photo)

## 5.3 Description of Support Units

None

## 5.4 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 22, 2016.

• **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, August 15, 2016

## 5.5 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.

No. 301-309, 3/F., Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102

Tel: 0755-27798480

Fax: 0755-27798960

## 5.6 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	July 03 2015	July 02 2020
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	June 28 2017	June 27 2018
4	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June 28 2017	June 27 2018
5	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June 28 2017	June 27 2018
6	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	9120D-829	GTS208	June 28 2017	June 27 2018
7	Horn Antenna	ETS-LINDGREN	3160	GTS217	June 28 2017	June 27 2018
8	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
9	Coaxial Cable	GTS	N/A	GTS213	June 28 2017	June 27 2018
10	Coaxial Cable	GTS	N/A	GTS211	June 28 2017	June 27 2018
11	Coaxial cable	GTS	N/A	GTS210	June 28 2017	June 27 2018
12	Coaxial Cable	GTS	N/A	GTS212	June 28 2017	June 27 2018
13	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June 28 2017	June 27 2018
14	Amplifier(2GHz-20GHz)	HP	8349B	GTS206	June 28 2017	June 27 2018
15	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June 28 2017	June 27 2018
16	Band filter	Amindeon	82346	GTS219	June 28 2017	June 27 2018
17	Power Meter	Anritsu	ML2495A	GTS540	June 28 2017	June 27 2018
18	Power Sensor	Anritsu	MA2411B	GTS541	June 28 2017	June 27 2018

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	7.3(L)x3.1(W)x2.9(H)	GTS252	May.16 2014	May.15 2019
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June 28 2017	June 27 2018
3	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June 28 2017	June 27 2018
4	Artificial Mains Network	SCHWARZBECK MESS	NSLK8127	GTS226	June 28 2017	June 27 2018
5	Coaxial Cable	GTS	N/A	GTS227	N/A	N/A
6	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
7	Thermo meter	KTJ	TA328	GTS233	June 28 2017	June 27 2018

## 7 Test results and Measurement Data

### 7.1 Antenna requirement

<b>Standard requirement:</b>	FCC Part15 C Section 15.203
<b>15.203 requirement:</b> An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.	
<b>EUT Antenna:</b>	
<i>Reversed polarity NON standards external antenna port, the best case gain of the antenna is 2.0dBi</i> 	

## 7.2 Conducted Emissions

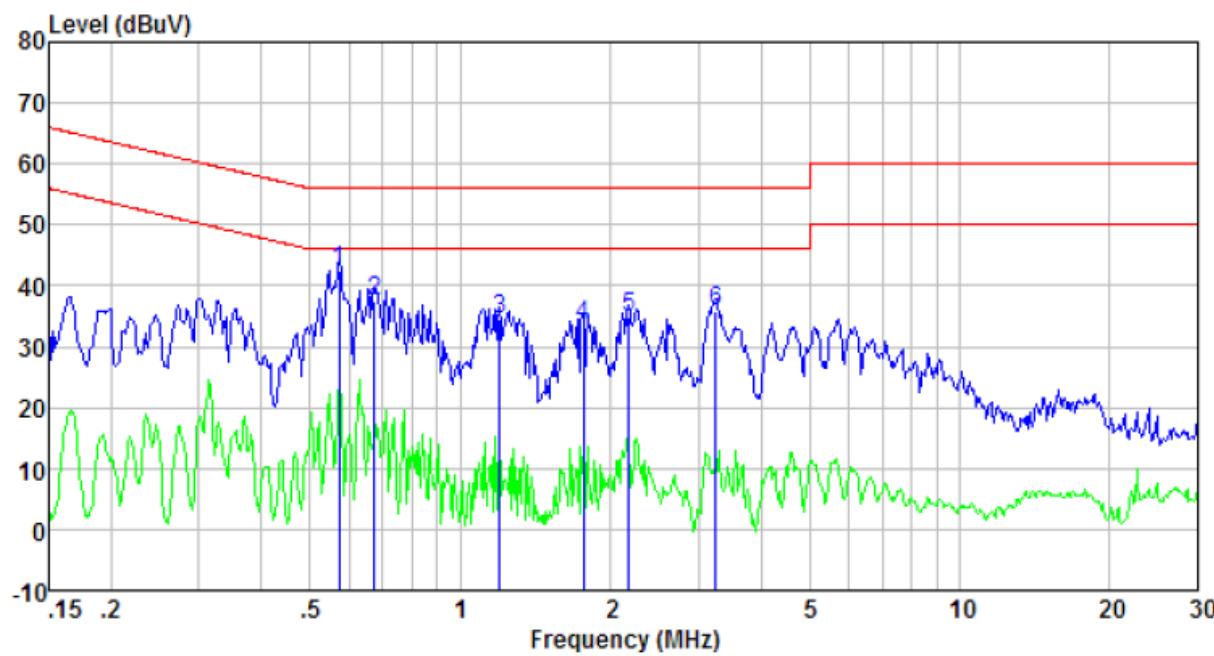
Test Requirement:	FCC Part15 C Section 15.207		
Test Method:	ANSI C63.10:2013		
Test Frequency Range:	150KHz to 30MHz		
Class / Severity:	Class B		
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50

\* Decreases with the logarithm of the frequency.

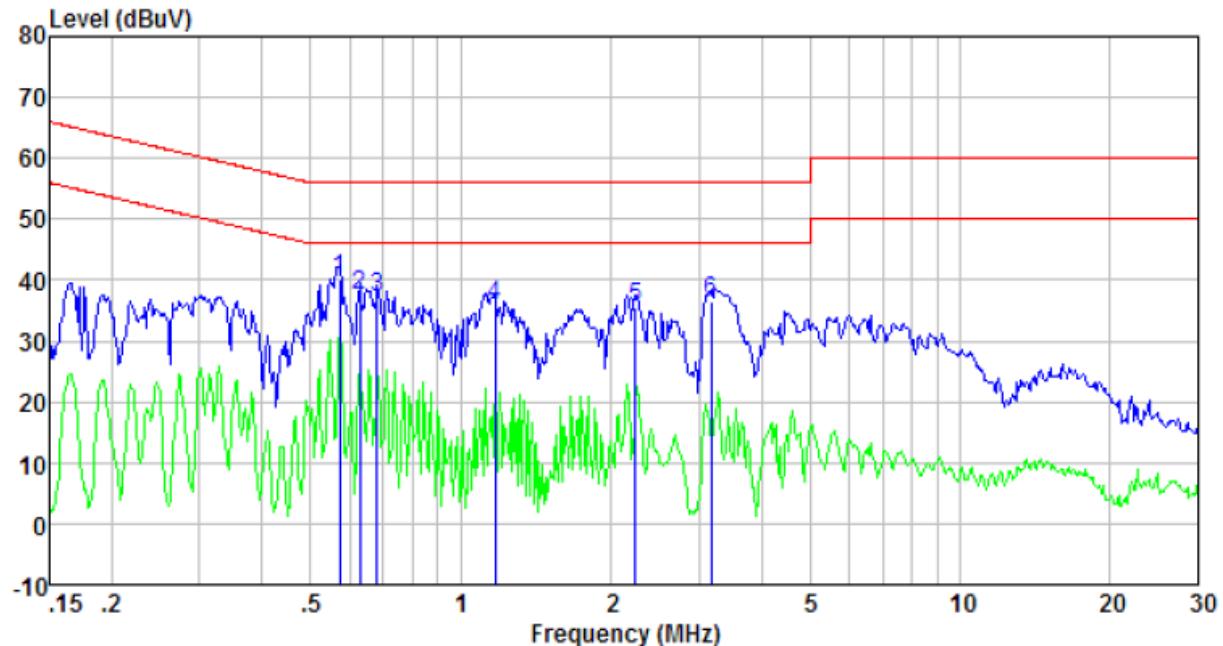
Test setup:	Reference Plane  LISN  40cm  80cm  AUX Equipment  E.U.T  Test table/Insulation plane  EMI Receiver  Filter  AC power  Remark: E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m		
Test procedure:	1. The E.U.T and simulators are connected to the main 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 C63.10:2013 on conducted measurement.		
Test Instruments:	Refer to section 6.0 for details		
Test mode:	Refer to section 5.2 for details		
Test results:	Pass		

### Measurement data:

Line:



Freq MHz	Reading level dBuV	11SN/ISN factor dB	Cable loss dB	level dBuV	Limit level dBuV	Over limit dB	Remark
0.573	42.18	0.32	0.12	42.62	56.00	-13.38	QP
0.672	37.23	0.29	0.13	37.65	56.00	-18.35	QP
1.197	34.25	0.24	0.13	34.62	56.00	-21.38	QP
1.762	33.26	0.21	0.14	33.61	56.00	-22.39	QP
2.178	34.43	0.20	0.15	34.78	56.00	-21.22	QP
3.241	35.40	0.21	0.15	35.76	56.00	-20.24	QP

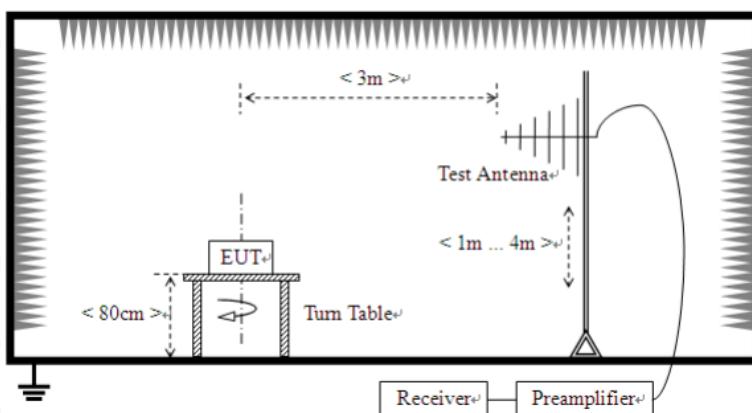
**Neutral:**


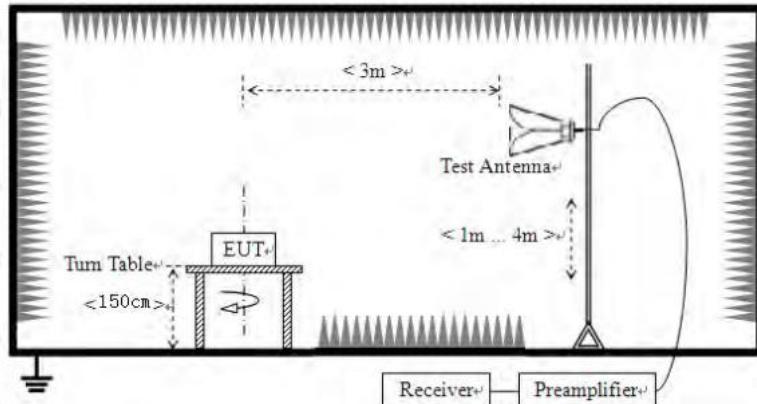
Freq MHz	Reading level dBuV	LISN/ISN factor dB	Cable loss dB	level dBuV	Limit level dBuV	Over limit dB	Remark
0.573	39.90	0.29	0.12	40.31	56.00	-15.69	QP
0.627	37.04	0.27	0.12	37.43	56.00	-18.57	QP
0.679	36.76	0.25	0.13	37.14	56.00	-18.86	QP
1.172	35.56	0.21	0.13	35.90	56.00	-20.10	QP
2.237	35.29	0.20	0.15	35.64	56.00	-20.36	QP
3.173	36.02	0.21	0.15	36.38	56.00	-19.62	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.

### 7.3 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				
Limit: (Field strength of the fundamental signal)	Peak	1MHz	10Hz	Average Value					
	Frequency	Limit (dBuV/m @3m)		Remark					
	908.42MHz	94.00		QP 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					
Limit: (band edge)		74.00		Peak Value					
	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.								
	Below 1GHz								
Test setup:									
	Above 1GHz								



Test Procedure:	<ol style="list-style-type: none"> <li>The EUT was placed on the top of a rotating table (0.8m for below 1G and 1.5m for above 1G) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.</li> <li>The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</li> <li>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.</li> <li>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.</li> <li>The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</li> <li>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.</li> </ol>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

## Measurement data:

### 7.3.1 Field Strength of The Fundamental Signal

QP 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
908.42	92.18	22.25	4.88	29.1	90.21	94.00	-3.79	Vertical
908.42	94.93	22.25	4.88	29.1	92.96	94.00	-1.04	Horizontal

Remark:

- Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

### 7.3.2 Bandedge emissions

All of the restriction bands were tested, and only the data of worst case was exhibited.

QP 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
902.00	38.46	22.22	4.87	29.1	36.45	46.00	-9.55	Horizontal
902.00	36.63	22.22	4.87	29.1	34.62	46.00	-11.38	Vertical
928.00	37.84	22.36	4.96	29.1	36.06	46.00	-9.94	Horizontal
928.00	35.08	22.36	4.96	29.1	33.30	46.00	-12.70	Vertical

Remark:

- Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

### 7.3.3 Spurious emissions

#### ■ Below 1GHz

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
52.21	46.25	12.20	0.79	29.98	29.26	40.00	-10.74	Vertical
60.07	47.16	11.40	0.86	29.92	29.50	40.00	-10.50	Vertical
113.71	55.54	10.60	1.31	29.61	37.84	43.50	-5.66	Vertical
350.48	49.40	14.50	2.62	29.73	36.79	46.00	-9.21	Vertical
451.14	43.00	16.53	3.09	29.39	33.23	46.00	-12.77	Vertical
935.55	38.32	22.41	4.99	29.10	36.62	46.00	-9.38	Vertical
59.86	41.42	11.40	0.86	29.92	23.76	40.00	-16.24	Horizontal
109.80	41.60	11.20	1.28	29.63	24.45	43.50	-19.05	Horizontal
150.01	52.24	7.50	1.57	29.41	31.90	43.50	-11.60	Horizontal
247.68	46.00	11.75	2.11	29.63	30.23	46.00	-15.77	Horizontal
375.94	48.42	14.97	2.75	29.61	36.53	46.00	-9.47	Horizontal
451.14	46.94	16.53	3.09	29.39	37.17	46.00	-8.83	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
1816.84	60.41	25.34	4.87	36.29	54.33	74	-19.67	Vertical
2725.26	56.45	28.2	5.69	36.97	53.37	74	-20.63	Vertical
3633.68	50.43	29.17	7.23	37.39	49.44	74	-24.56	Vertical
4542.10	47.47	30.44	8.1	37.55	48.46	74	-25.54	Vertical
5450.52	44.68	31.89	9.45	37.06	48.96	74	-25.04	Vertical
1816.84	62.28	25.34	4.87	36.29	56.2	74	-17.80	Horizontal
2725.26	57.39	28.2	5.69	36.97	54.31	74	-19.69	Horizontal
3633.68	50.18	29.17	7.23	37.39	49.19	74	-24.81	Horizontal
4542.10	46.07	30.44	8.1	37.55	47.06	74	-26.94	Horizontal
5450.52	44.34	31.89	9.45	37.06	48.62	74	-25.38	Horizontal

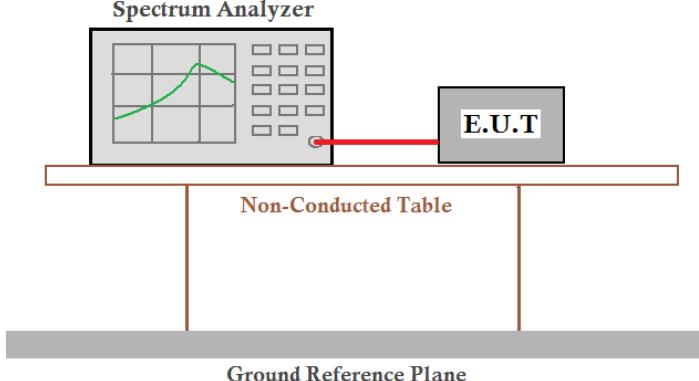
**Average value:**

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
1816.84	50.18	25.34	4.87	36.29	44.1	54	-9.9	Vertical
2725.26	47.06	28.2	5.69	36.97	43.98	54	-10.02	Vertical
3633.68	40.13	29.17	7.23	37.39	39.14	54	-14.86	Vertical
4542.10	38.04	30.44	8.1	37.55	39.03	54	-14.97	Vertical
5450.52	34.57	31.89	9.45	37.06	38.85	54	-15.15	Vertical
1816.84	52.11	25.34	4.87	36.29	46.03	54	-7.97	Horizontal
2725.26	48.09	28.2	5.69	36.97	45.01	54	-8.99	Horizontal
3633.68	40.24	29.17	7.23	37.39	39.25	54	-14.75	Horizontal
4542.10	37.17	30.44	8.1	37.55	38.16	54	-15.84	Horizontal
5450.52	33.08	31.89	9.45	37.06	37.36	54	-16.64	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 the too weak instrument of signal is unable to test.

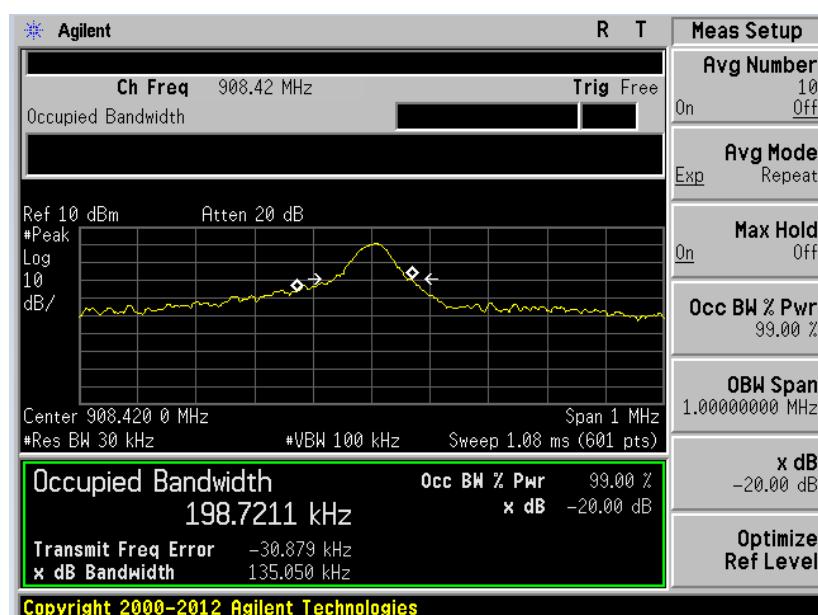
## 7.4 20dB Occupy Bandwidth

Test Requirement:	FCC Part15 C Section 15.249/15.215
Test Method:	ANSI C63.10:2013
Limit:	Operation Frequency range 902MHz~928MHz
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

### Measurement Data

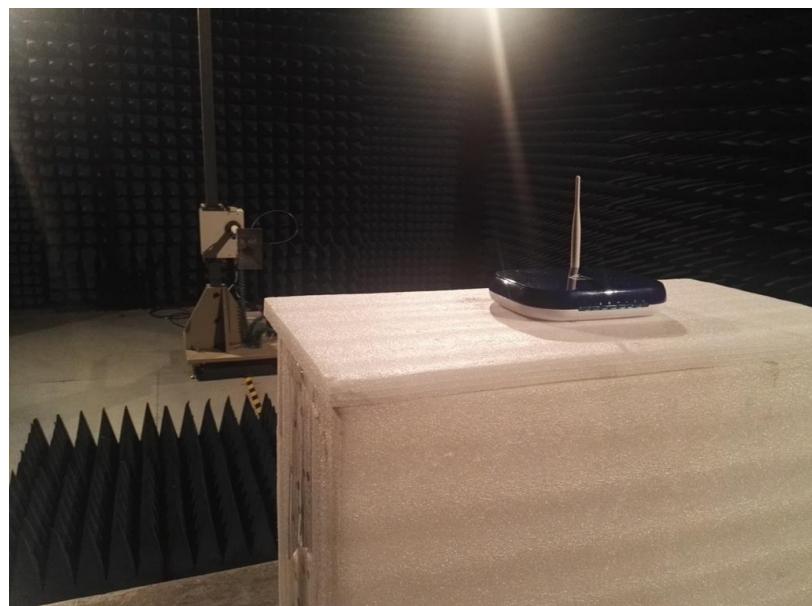
Test Frequency	20dB bandwidth(MHz)	Result
908.42	0.135	Pass

Test plot as follows:

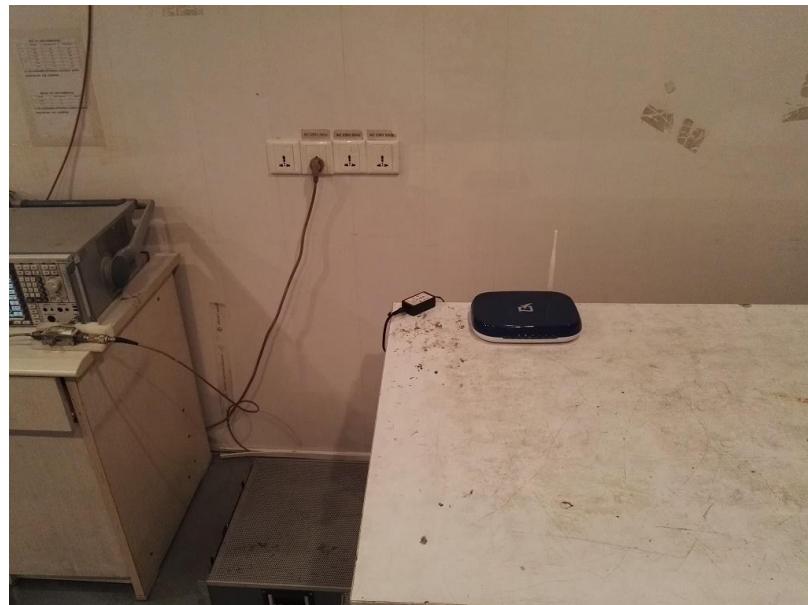


## 8 Test Setup Photo

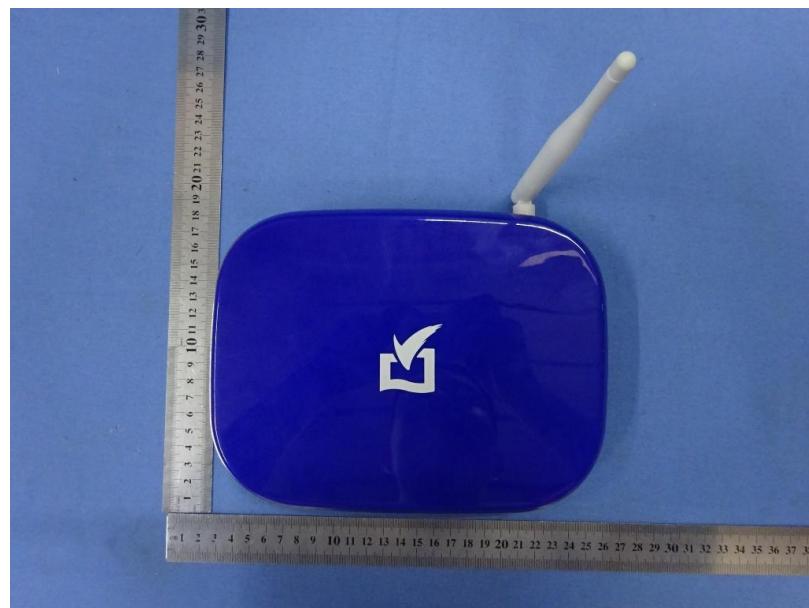
Radiated Emission



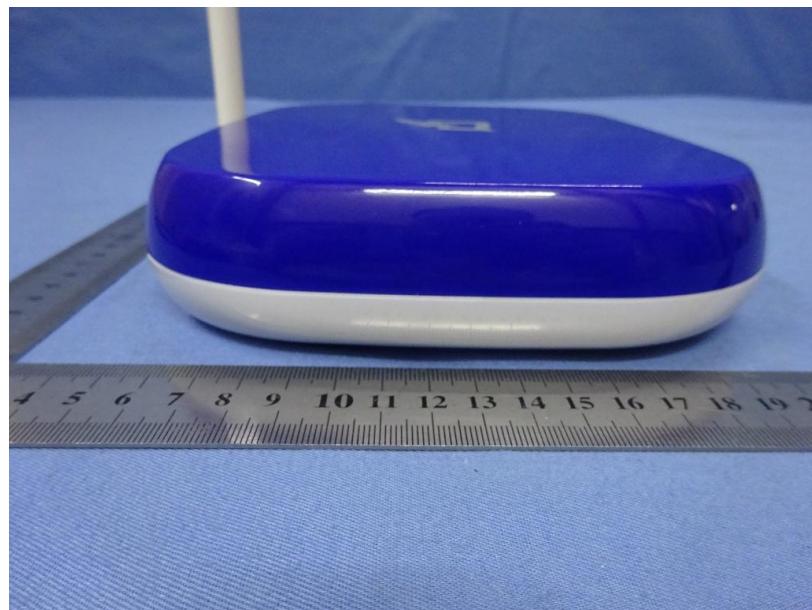
Conducted Emission

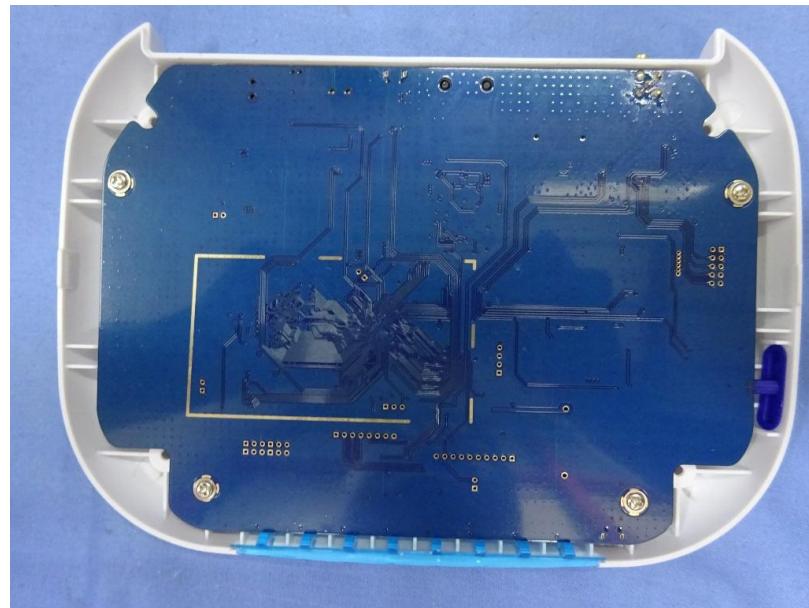


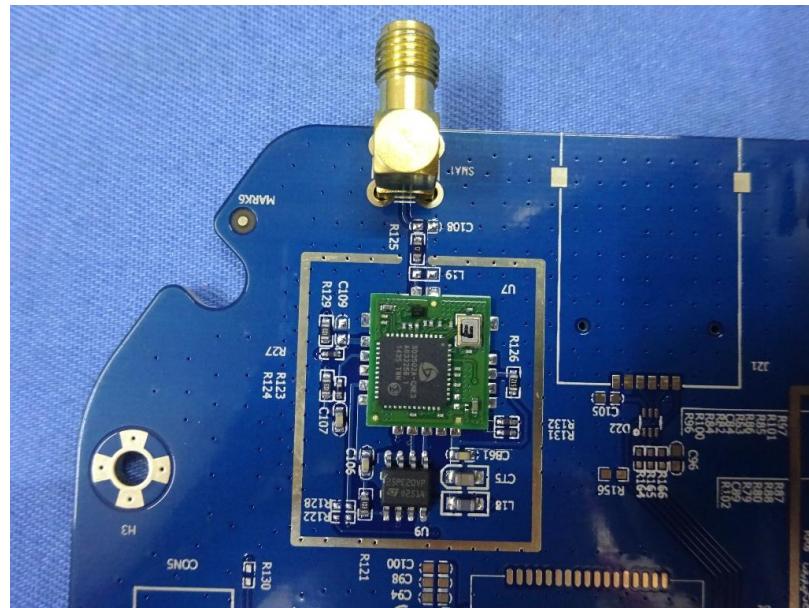
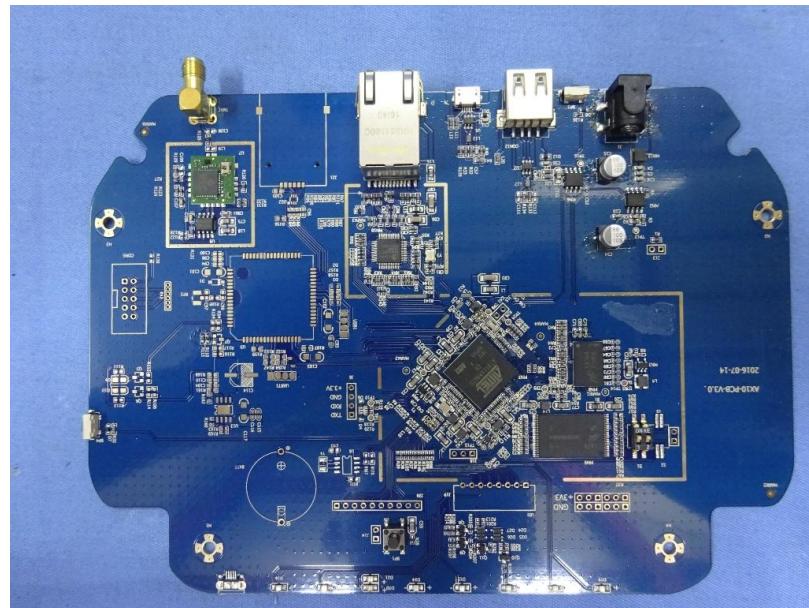
## 9 EUT Constructional Details















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