



R&TTE TEST REPORT

for

WIFI Module

MODEL: ESP-12

Trademark: AI-THINKER

Test Report Number: BCTC-141212471

Issued Date: Dec. 10, 2014

Issued for

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2 TEST RESULT SUMMARY

Test Items	Test Results
Equivalent Isotropic Radiated Power	Pass
Maximum spectral power density	N.A*
Frequency Range	Pass
Frequency hopping requirements	Pass
Medium access protocol	Pass *
Transmitter Spurious Emissions	Pass
Receiver spurious emissions	Pass

Note:

N.A*- This item has no requirement for FHSS equipment.

Pass *- The manufacturer has verified that medium access protocol has been implemented by the EUT.



3 EUT DESCRIPTION

Product	WIFI Module
Model	ESP-12
Trademark	AI-THINKER
Applicant	Shenzhen Anxinke technology co., LTD
Antenna Type	Internal Antenna
EUT Power Rating	DC4.5V===
Temperature Range(Operating)	0 ~ 30℃
Operating Frequency	2.4GHz
Modulation type	FHSS

Note: N/A. stand for no applicable.

**Bluetooth module channel form:**

Channel	Frequency (GHz)	Channel	Frequency (GHz)
01	2.40202	42	2.44302
02	2.40302	43	2.44402
03	2.40402	44	2.44502
04	2.40502	45	2.44602
05	2.40602	46	2.44702
06	2.40702	47	2.44802
07	2.40802	48	2.44902
08	2.40902	49	2.45002
09	2.41002	50	2.45102
10	2.41102	51	2.45202
11	2.41202	52	2.45302
12	2.41302	53	2.45402
13	2.41402	54	2.45502
14	2.41502	55	2.45602
15	2.41602	56	2.45702
16	2.41702	57	2.45802
17	2.41802	58	2.45902
18	2.41902	59	2.46002
19	2.42002	60	2.46102
20	2.42102	61	2.46202
21	2.42202	62	2.46302
22	2.42302	63	2.46402
23	2.42402	64	2.46502
24	2.42502	65	2.46602
25	2.42602	66	2.46702
26	2.42702	67	2.46802
27	2.42802	68	2.46902
28	2.42902	69	2.47002
29	2.43002	70	2.47102
30	2.43102	71	2.47202
31	2.43202	72	2.47302
32	2.43302	73	2.47402
33	2.43402	74	2.47502



34	2.43502	75	2.47602
35	2.43602	76	2.47702
36	2.43702	77	2.47802
37	2.43802	78	2.47902
38	2.43902	79	2.48002
39	2.44002		
40	2.44102		
41	2.44202		



4 TEST METHODOLOGY

4.1. DECISION OF FINAL TEST MODE

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

The measurement was performed at 3 axis for lie orientation, side orientation and stand orientation. The lie orientation is the worst mode, so only the worst mode test data was reported.

The following test mode was recorder in this report.

Items	Test Content	Test mode
1	Maximum transmit power	Operating
2	Frequency range	Operating
3	Dwell time	Operating
4	Channel separation	Operating
5	Channel number	Operating
6	Transmitter spurious emission	Operating & Standby
7	Receiver spurious emissions	Operating

4.2. EUT SYSTEM OPERATION

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



5 SETUP OF EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF SUPPORT UNITS

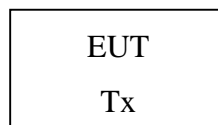
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Equipment	Model No.	Serial No.	FCC ID	Trade Name	Data Cable	Power Cord
1.	PC	DX2700	CNG714077P	N/A	HP	shielded 1.5m	Unshielded 1.8m
2.	LCD Monitor	L1706V	CON74535YZ	N/A	HP	Shielded 1.8m	Unshielded 1.8m
3.	Keyboard	SK-2800	435302-AA1	N/A	HP	Unshielded 1.5m	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.

5.2. CONFIGURATION OF SYSTEM UNDER TEST



(EUT: WIFI Module)



6 FACILITIES AND ACCREDITATIONS

6.1. FACILITIES

All measurement facilities used to collect the measurement data are located at A.Floor 3, 44 Building, Tanglang Industrial Park B, Taoyuan Street, Nanshan District, Shenzhen, 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."

6.2. ACCREDITATIONS

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

USA	FCC (certificate registration number is 131636) TIMCO (certificate registration number is Q2004)
Canada	INDUSTRY CANADA (certificated registration number is 46403-7712)



7 ETSI EN 300 328 REQUIREMENTS

7.1. TRANSMITTER REQUIREMENTS

7.1.1 Maximum transmit Power

LIMIT

ETSI EN 300 328 (V1.8.1) clause 4.3.1.2

The maximum transmit power is defined as the maximum isotropic radiated power of the equipment. The equivalent isotropic radiated power (e.i.r.p) shall be equal to or less than -10dBW(100mW).

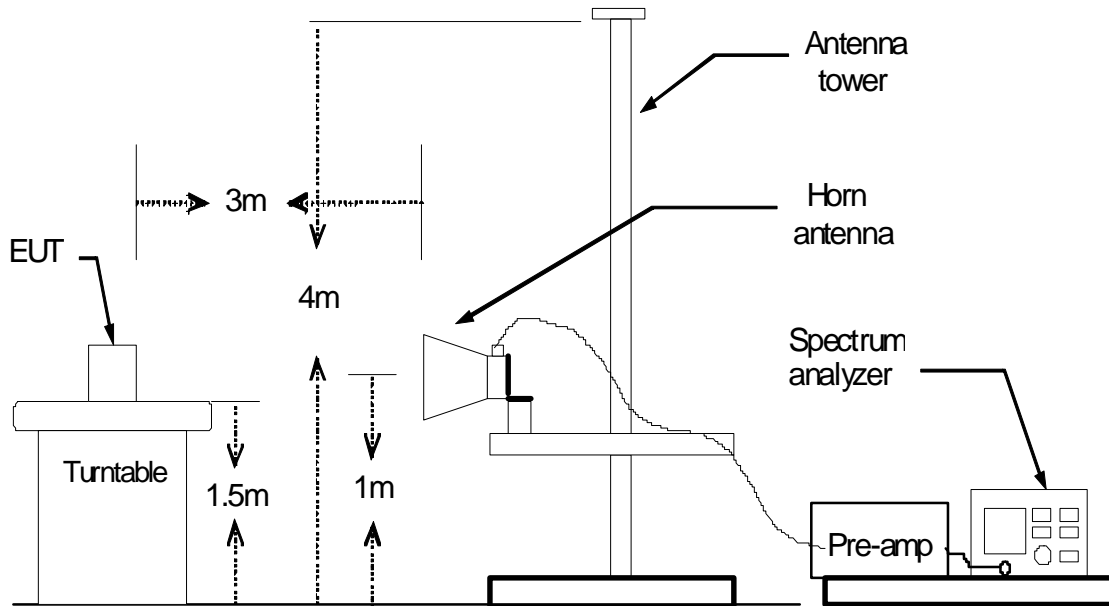
MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	100114	08/24/2015
EMI Test Receiver	R&S	ESCI	100005	08/24/2015
Pre Amplifier	H.P.	HP8447E	2945A02715	08/24/2015
Pre-Amplifier	Compliance	PAM0118	1360976	08/24/2015
Bilog Antenna	SUNOL Sciences	JB3	A021907	08/24/2015
Turn Table	EMCO	2081-1.21	N/A	N.C.R
Antenna Tower	CT	N/A	N/A	N.C.R
Controller	CT	N/A	N/A	N.C.R
RF Comm. Test set	HP	8920B	US36142090	N.C.R
Site NSA	C&C	N/A	N/A	08/24/2015
Horn Antenna	Compliance	CE18000	001	08/24/2015

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration

Above 1GHz



TEST PROCEDURE

1. Please refer to ETSI EN 300 328 (V1.8.1) Sub-clause 5.3 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.8.1) Sub-clause 5.7.2 for the measurement method.



TEST RESULTS

No non-compliance noted

EUT	: WiFi Module	Temperature	: 25°C
Model No.	: ESP-12	Humidity	: 55%
Test Mode	: Operating	Test Engineer	: Snowy Yang

Test condition	CH	EIRP (dBm)	Limit (dBm)	Margin (dB)	Conclusion
DC4.5V 25°C	2402MHz	0.45	20	-19.55	PASS
	2441MHz	0.38	20	-19.62	PASS
	2480MHz	0.26	20	-19.74	PASS
DC4.5V -20°C	2402MHz	0.53	20	-19.47	PASS
	2441MHz	0.18	20	-19.82	PASS
	2480MHz	0.39	20	-19.61	PASS
DC4.5V 55°C	2402MHz	0.33	20	-19.67	PASS
	2441MHz	0.31	20	-19.69	PASS
	2480MHz	0.37	20	-19.63	PASS
Measurement uncertainty		±6dB			

- Note: 1. EIRP = Reading -cable loss + antenna gain
 2. Cable Loss: 2 dB, Antenna Gain: 1 dBi



7.1.2 Frequency range

LIMIT

ETSI EN 300 328 (V1.8.1) clause 4.3.1.2

The frequency range shall lie with the band N/A to 2.4835GHz($f_L > N/A$ and $f_H < 2.4835GHz$)

MEASUREMENT EQUIPMENT USED

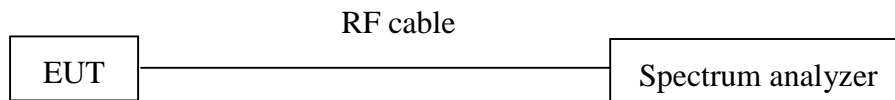
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	100114	08/24/2015
EMI Test Receiver	R&S	ESCI	100005	08/24/2015

Remark: Each piece of equipment is scheduled for calibration once a year.

TEST PROCEDURE

1. Please refer to ETSI EN 300 328 (V1.8.1) Sub-clause 5.3 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.8.1) Sub-clause 5.7.4 for the measurement method.

Test Configuration





7.1.3 Frequency hopping requirement

7.1.3.1 Dwell time

LIMIT

ETSI EN 300 328 (V1.8.1) Sub-clause 4.3.4.1.2

The maximum dwell time shall be 0.4s

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	100114	08/24/2015
EMI Test Receiver	R&S	ESCI	100005	08/24/2015

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration

Same as frequency range.

TEST PROCEDURE

- 1.The EUT was placed on a turntable which is 0.8m above ground plane.
- 2.Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
3. Set the EUT work on the CH1
4. Set SPA Center Frequency = Operation frequency, RBW=1MHz,VBW=3MHz,Span:0Hz.
5. Set SPA trace max hold, then view.



TEST RESULTS

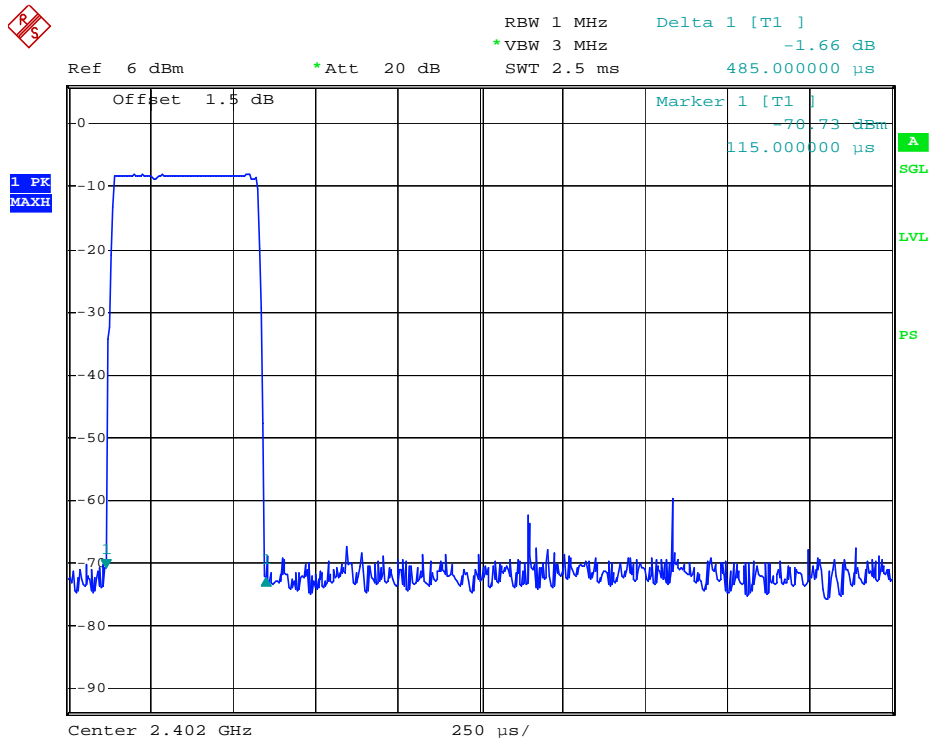
EUT : WIFI Module Temperature : 25°C
 Model No. : ESP-12 Humidity : 55%
 Test Mode : Operating Test Engineer : Snowy Yang

Channel	Pulse width (ms)	Dwell time (s)	Limit (s)	Result
Low	0.485	0.1552	0.4	Pass
Mid	0.490	0.1568	0.4	Pass
High	0.490	0.1568	0.4	Pass

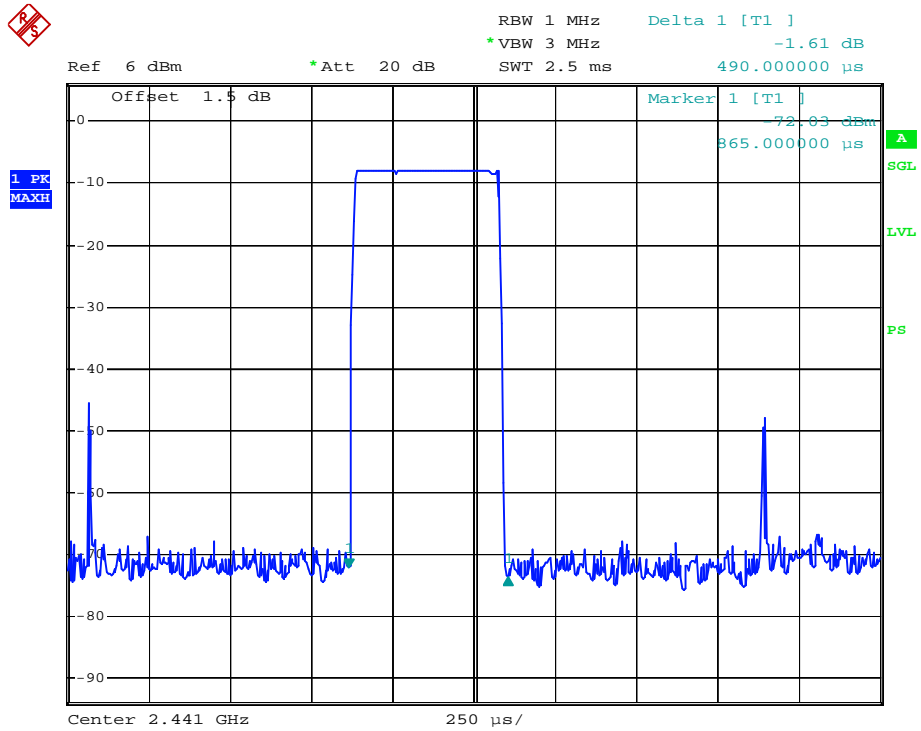
NOTE: Dwell time = Pulse time*(1600/2/79)*31.6S

Please refer to the following plots.

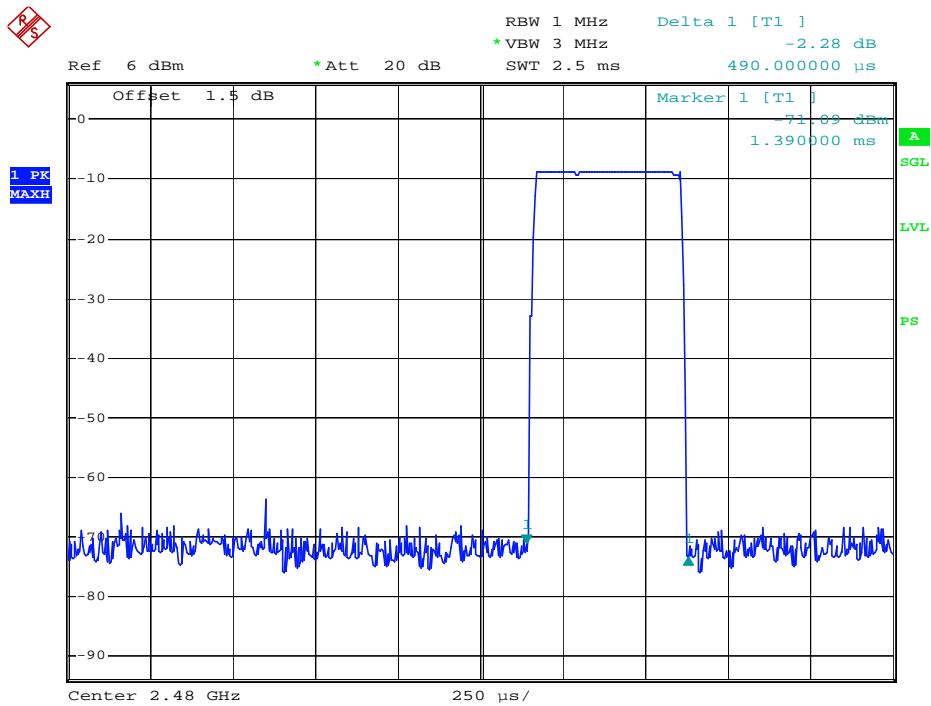
Low Channel



Middle Channel



High Channel





7.1.3.2 Channel Separation

LIMIT

ETSI EN 300 328 (V1.8.1) Sub-clause 4.3.4.2.2

Non-adaptive Frequency Hopping systems shall make use of non-overlapping hopping channels separated by the channel bandwidth as measured at 20dB below peak power

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	100114	08/24/2015
EMI Test Receiver	R&S	ESCI	100005	08/24/2015

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration

Same as frequency range.

TEST PROCEDURE

- 1.The EUT was placed on a turntable which is 0.8m above ground plane.
- 2.Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
3. Set the EUT work on the hopping mode.
4. Set SPA Center Frequency = Operation frequency, RBW=30kHz,VBW=100kHz,
5. Set SPA trace max hold, then view.



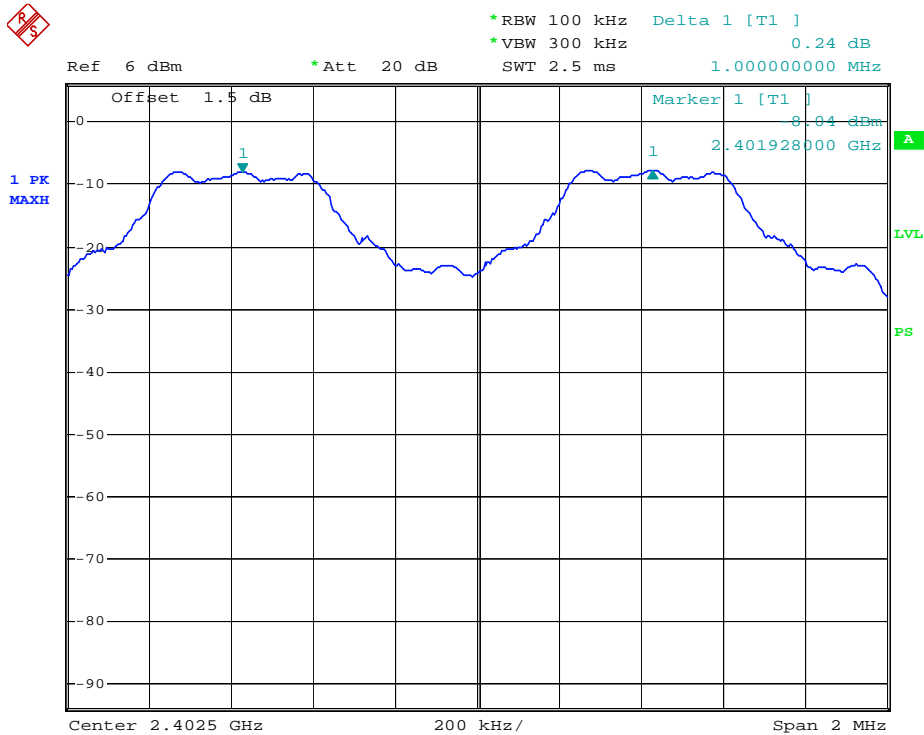
TEST RESULTS

EUT : WIFI Module Temperature : 25°C
 Model No. : ESP-12 Humidity : 55%
 Test Mode : Operating Test Engineer : Snowy Yang

Channel	Channel Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	Result
Low Channel	2402	1.000	1	Pass
Adjacent Channel	2403			
Middle Channel	2441	1.004	1	Pass
Adjacent Channel	2442			
High Channel	2480	1.000	1	Pass
Adjacent Channel	2479			

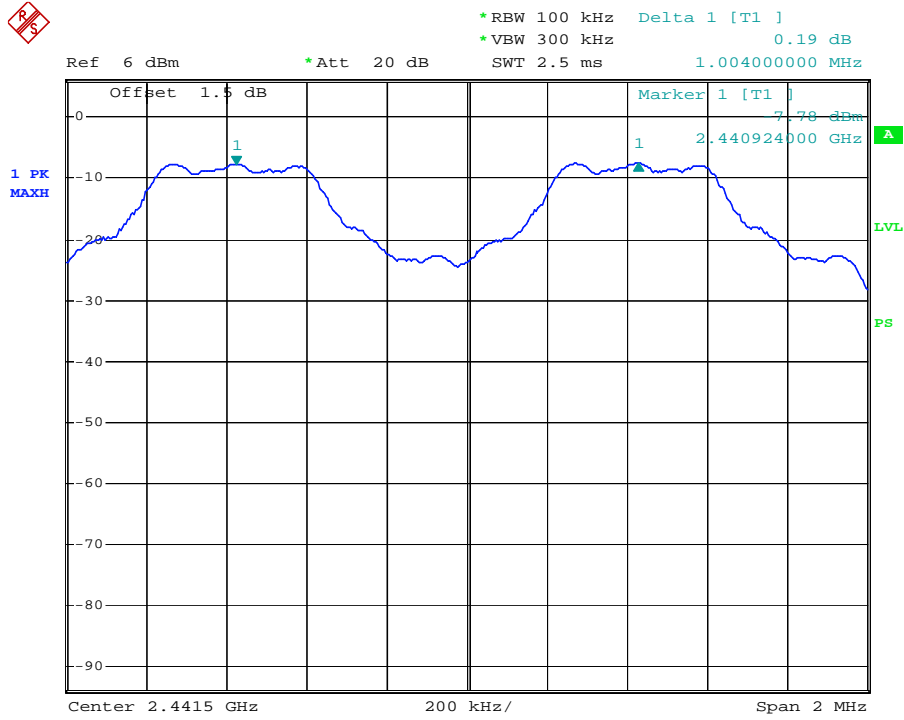
Please refer to following plots:

Low channel

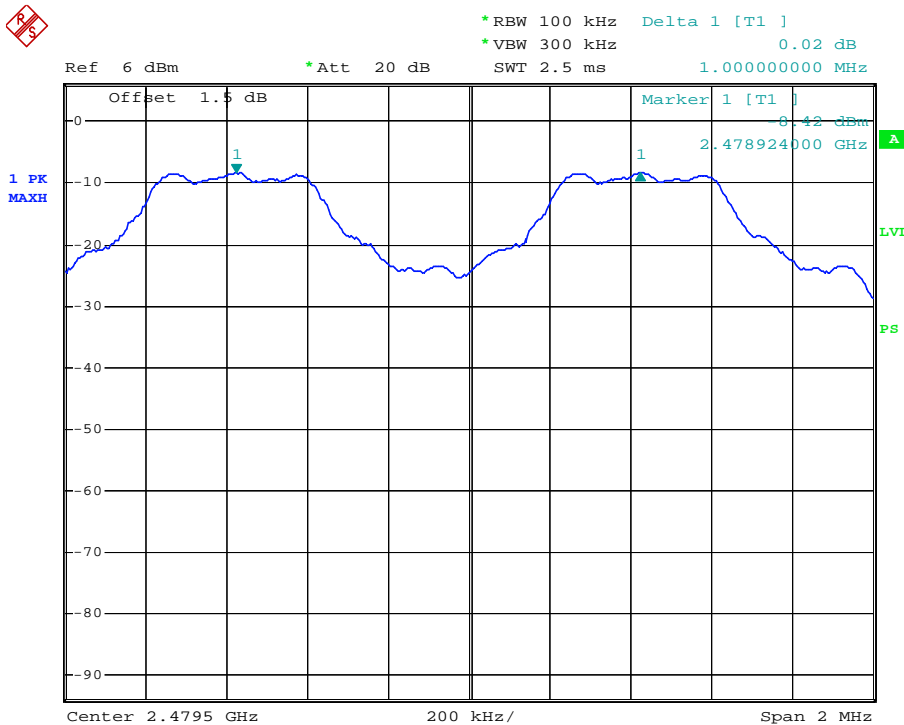




Middle channel



High channel





7.1.3.3 Channel number

LIMIT

ETSI EN 300 328 (V1.8.1) Sub-clause 4.3.4.2.2

Non-adaptive Frequency Hopping systems shall make use of a hopping sequence(s) that contains at least 15 hopping channels

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	100114	08/24/2015
EMI Test Receiver	R&S	ESCI	100005	08/24/2015

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration

Same as frequency range.

TEST PROCEDURE

- 1.The EUT was placed on a turntable which is 0.8m above ground plane.
- 2.Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
3. Set the EUT work on the hopping mode.
4. Set SPA Center Frequency = Operation frequency, RBW=300kHz,VBW=1MHz,.
5. Set SPA trace max hold, then view.

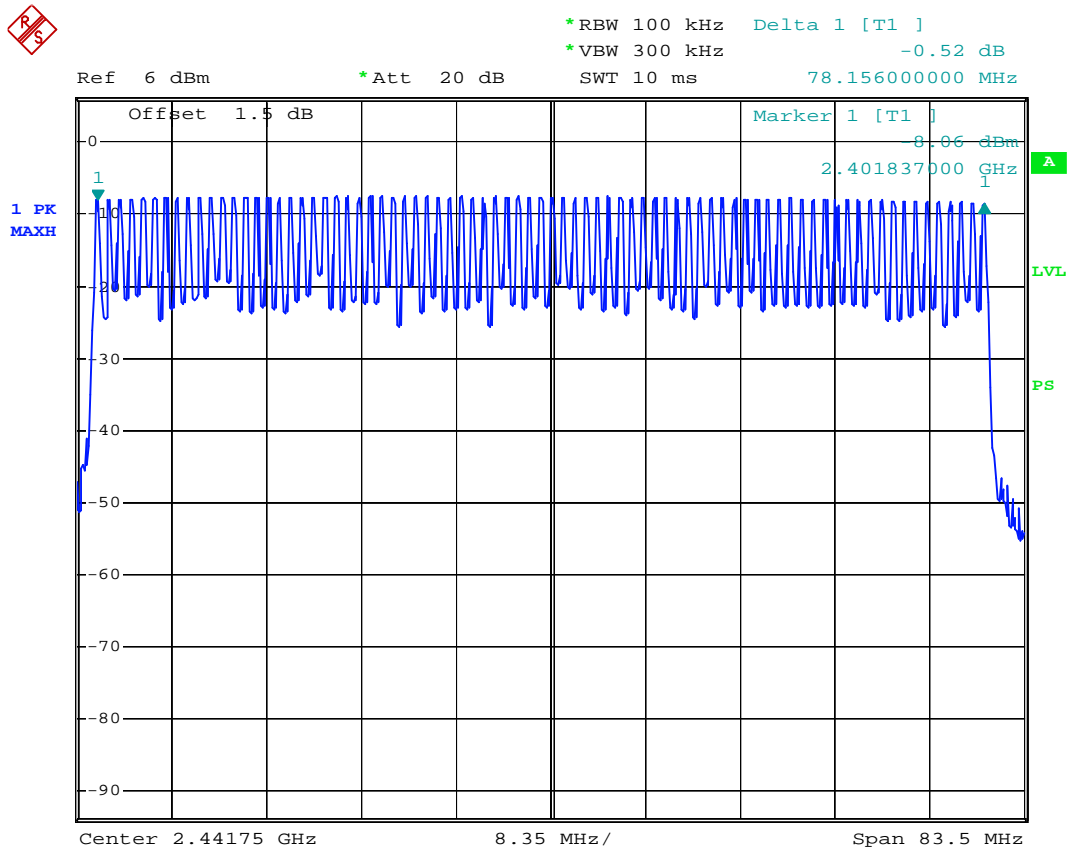


TEST RESULTS

Compliance standard requirement.

Details see following test plots.

EUT	: WiFi Module	Temperature	: 25°C
Model No.	: ESP-12	Humidity	: 55%
Test Mode	: Operating	Test Engineer	: Snowy Yang





7.1.4 Transmitter spurious emission

LIMIT

ETSI EN 300 328 (V1.8.1) clause 4.3.6.2

The spurious emissions of the transmitter shall not exceed the values of following table in the indicated bands.

Frequency range	Limit when operating	Limit when in standby
30MHz to 1GHz	-36 dBm	-57dBm
Above 1 GHz to 12.75GHz	-30 dBm	-47dBm
1.8 GHz to 1.9 GHz 5.15 GHz to 5.3 GHz	-47 dBm	-47 dBm

MEASUREMENT EQUIPMENT USED

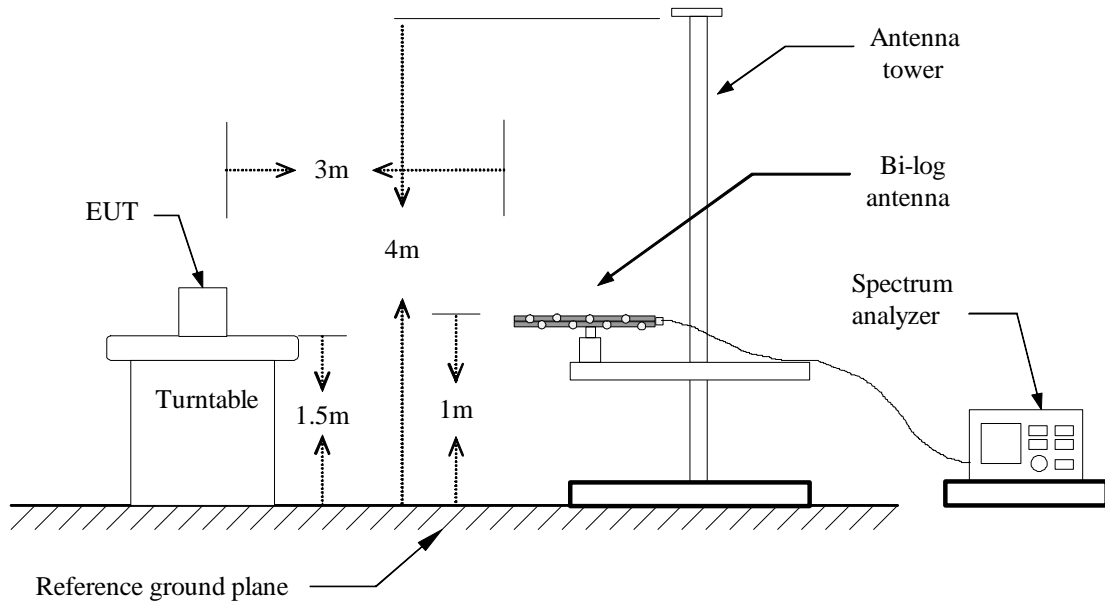
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	100114	08/24/2015
EMI Test Receiver	R&S	ESCI	100005	08/24/2015
Pre Amplifier	H.P.	HP8447E	2945A02715	08/24/2015
Pre-Amplifier	Compliance	PAM0118	1360976	08/24/2015
Bilog Antenna	SUNOL Sciences	JB3	A021907	08/24/2015
Turn Table	EMCO	2081-1.21	N/A	N.C.R
Antenna Tower	CT	N/A	N/A	N.C.R
Controller	CT	N/A	N/A	N.C.R
RF Comm. Test set	HP	8920B	US36142090	N.C.R
Site NSA	C&C	N/A	N/A	08/24/2015
Horn Antenna	Compliance	CE18000	001	08/24/2015

Remark: Each piece of equipment is scheduled for calibration once a year.

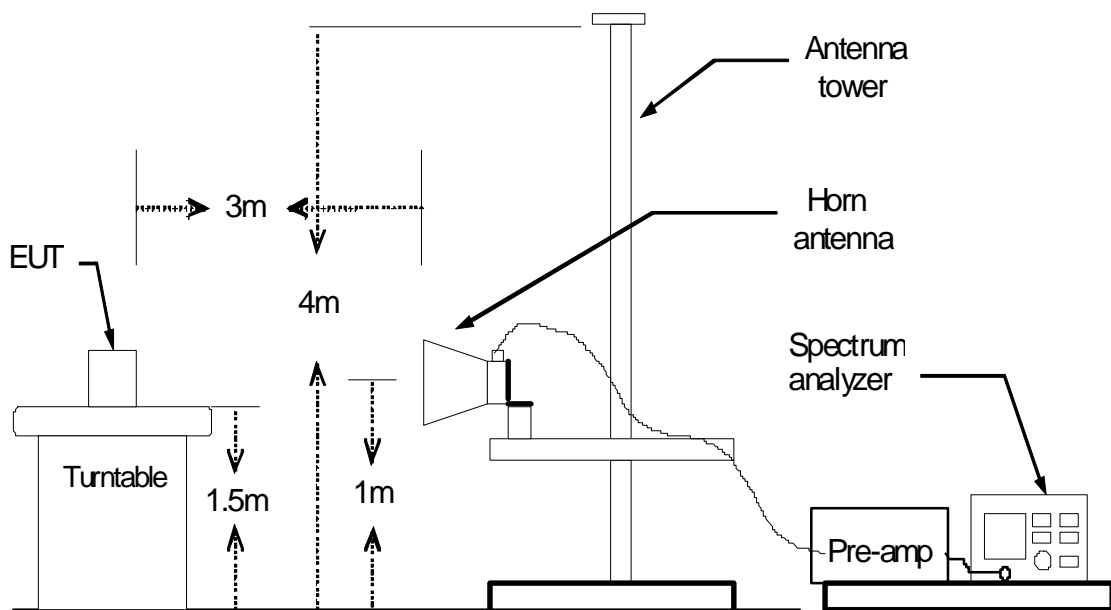


Test Configuration

Below 1GHz



Above 1GHz





TEST PROCEDURE

1. Please refer to ETSI EN 300 328 (V1.8.1) Sub-clause 5.3 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.8.1) Sub-clause 5.7.5 for the measurement method.



TEST RESULTS

EUT	: <u>WIFI Module</u>	Temperature	: <u>25°C</u>
Model No.	: <u>ESP-12</u>	Humidity	: <u>55%</u>
Test Mode	: <u>Operating & Standby</u>	Test Engineer	: <u>Snowy Yang</u>

Fre. (MHz)	ANT. Pol.	Result (dBm)	Limit	Margin	Conclusion
Test Mode: Lowest frequency					
434.0	H	-61.2	-36	-25.2	PASS
434.0	V	-63.3	-36	-27.3	PASS
2412.0	H	-71.8	-30	-41.8	PASS
2412.0	V	-69.1	-30	-39.1	PASS
2968.0	H	-68.2	-30	-38.2	PASS
2968.0	V	-62.9	-30	-32.9	PASS
4824.0	H	-66.8	-30	-36.8	PASS
4824.0	V	-65.1	-30	-35.1	PASS
Test Mode: Highest frequency					
434.0	H	-62.6	-36	-26.6	PASS
434.0	V	-62.5	-36	-26.5	PASS
2412.0	H	-56.1	-30	-26.1	PASS
2412.0	V	-57.3	-30	-27.3	PASS
4960.0	H	-71.2	-30	-41.2	PASS
4960.0	V	-73.7	-30	-43.7	PASS
8433.0	H	-63.4	-30	-33.4	PASS
8433.0	V	-69.1	-30	-39.1	PASS
Test Mode: Standby					
434.0	H	-64.3	-57	-7.3	PASS
434.0	V	-72.8	-57	-15.8	PASS
2412.0	H	-67.5	-47	-20.5	PASS
2412.0	V	-68.2	-47	-21.2	PASS
2968.0	H	-65.6	-47	-18.6	PASS
2968.0	V	-73.6	-47	-26.6	PASS
8433.0	H	-66.9	-47	-19.9	PASS
8433.0	V	-76.8	-47	-29.8	PASS

Note: 1. ERP = Reading -cable loss + antenna gain



7.1.5 Receiver Spurious Emissions

LIMIT

ETSI EN 300 328 (V1.8.1)

The spurious emissions of the transmitter shall not exceed the values of following table in the indicated bands.

Frequency Range	Limit when in standby
30MHz to 1GHz	-57dBm
Above 1GHz to 12.75GHz	-47dBm

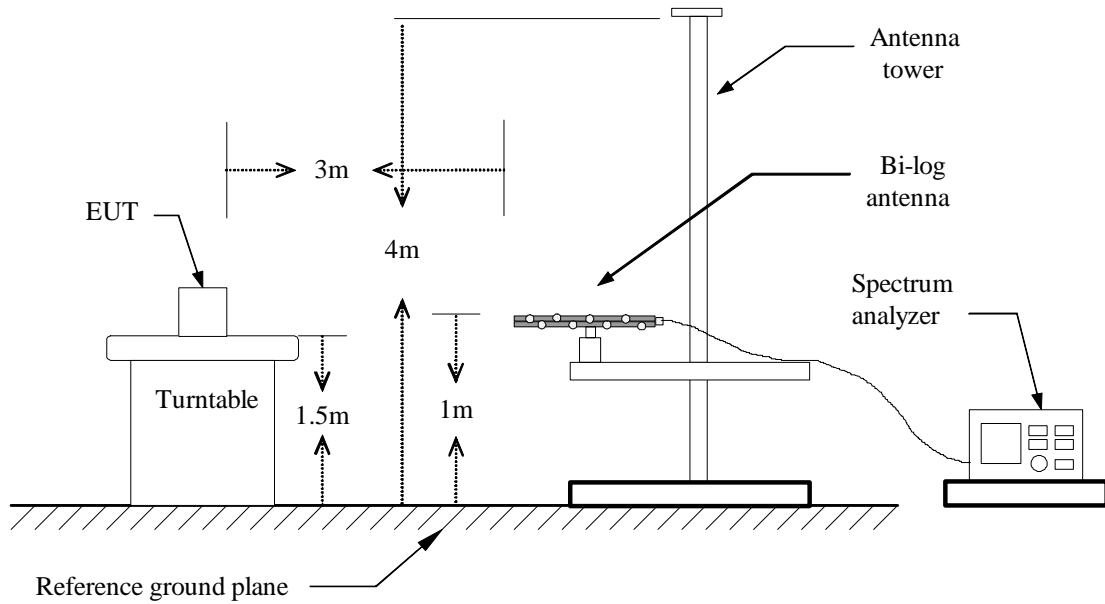
MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	100114	08/24/2015
EMI Test Receiver	R&S	ESCI	100005	08/24/2015
Pre Amplifier	H.P.	HP8447E	2945A02715	08/24/2015
Pre-Amplifier	Compliance	PAM0118	1360976	08/24/2015
Bilog Antenna	SUNOL Sciences	JB3	A021907	08/24/2015
Turn Table	EMCO	2081-1.21	N/A	N.C.R
Antenna Tower	CT	N/A	N/A	N.C.R
Controller	CT	N/A	N/A	N.C.R
RF Comm. Test set	HP	8920B	US36142090	N.C.R
Site NSA	C&C	N/A	N/A	08/24/2015
Horn Antenna	Compliance	CE18000	001	08/24/2015

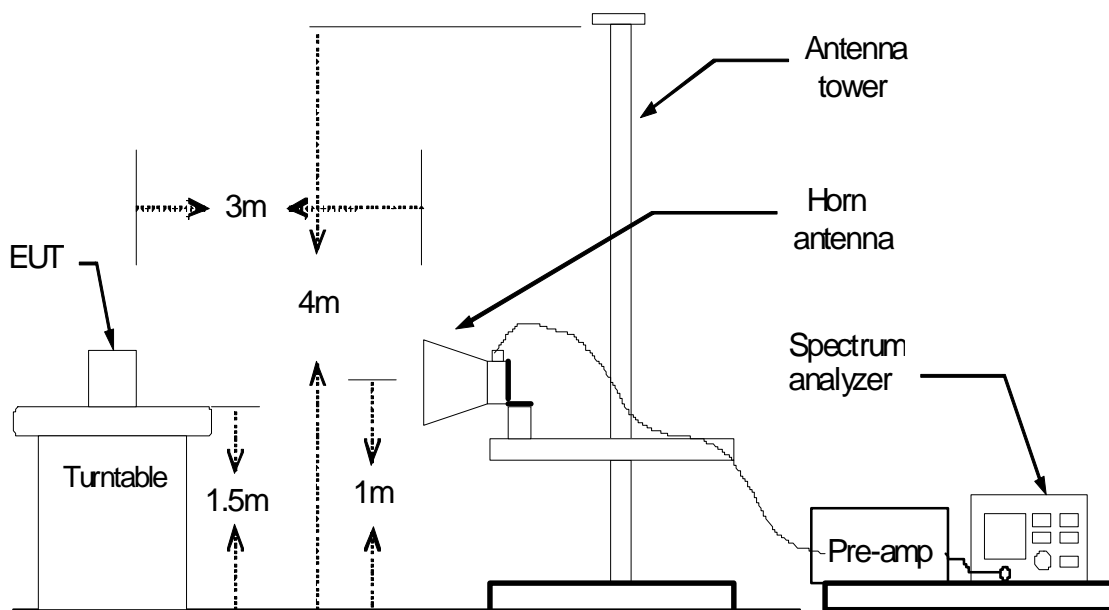
Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration

Below 1GHz



Above 1GHz





TEST PROCEDURE

1. Please refer to ETSI EN 300 328 (V1.8.1) Sub-clause 5.3 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.8.1) Sub-clause 5.7.5 for the measurement method.



TEST RESULTS

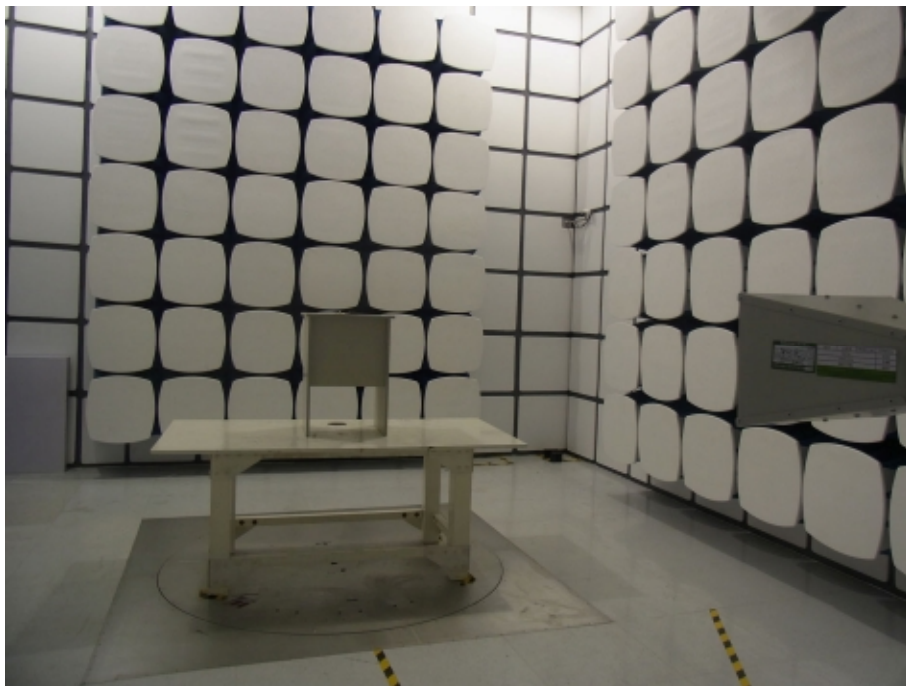
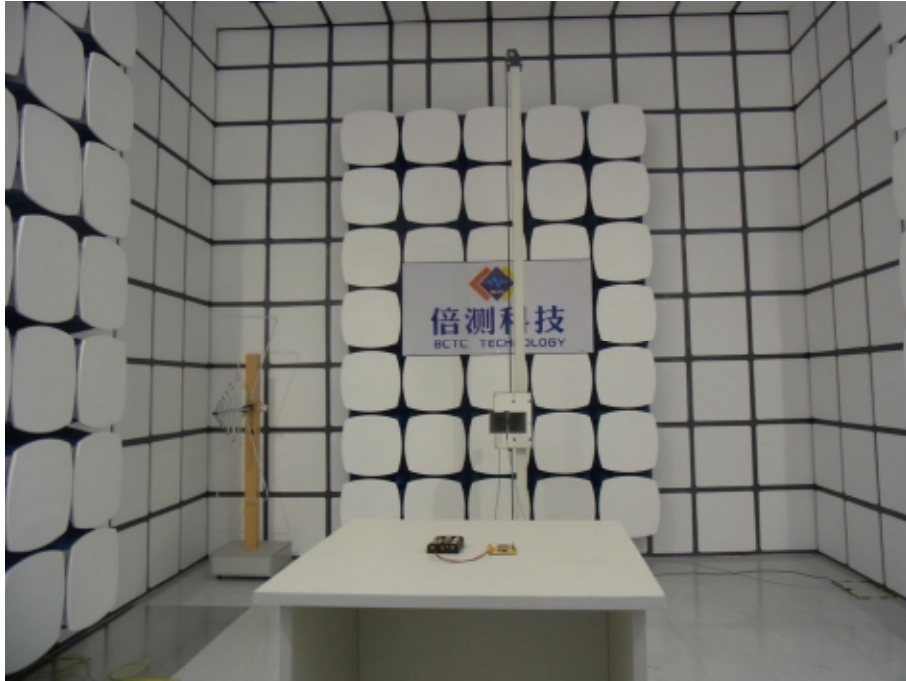
EUT	: WiFi Module	Temperature	: 25°C
Model No.	: ESP-12	Humidity	: 55%
Test Mode	: Operating	Test Engineer	: Snowy Yang

Fre. (MHz)	ANT. Pol.	ERP (dBm)	Limit	Margin	Conclusion
Test Mode: Lowest frequency					
434.0	H	-65.41	-57	-8.41	PASS
434.0	V	-66.53	-57	-9.53	PASS
2412.0	H	-67.12	-47	-20.12	PASS
2412.0	V	-73.32	-47	-26.32	PASS
2968.0	H	-66.18	-47	-19.18	PASS
2968.0	V	-62.32	-47	-15.32	PASS
4824.0	H	-61.67	-47	-14.67	PASS
4824.0	V	-65.46	-47	-18.46	PASS
Test Mode: Highest frequency					
434.0	H	-73.58	-57	-16.58	PASS
434.0	V	-72.14	-57	-15.14	PASS
2412.0	H	-63.51	-47	-16.51	PASS
2412.0	V	-62.49	-47	-15.49	PASS
2968.0	H	-71.47	-47	-24.47	PASS
2968.0	V	-67.28	-47	-20.28	PASS
4824.0	H	-76.49	-47	-29.49	PASS
4824.0	V	-69.87	-47	-22.87	PASS

Note: 1. ERP = Reading -cable loss + antenna gain



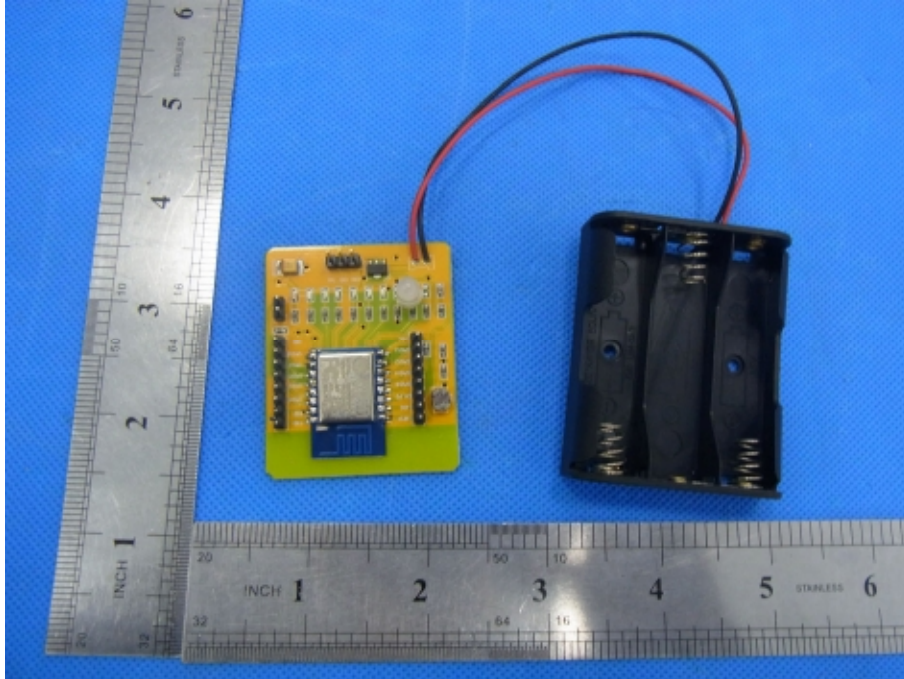
8 PHOTOGRAPHS OF THE TEST CONFIGURATION



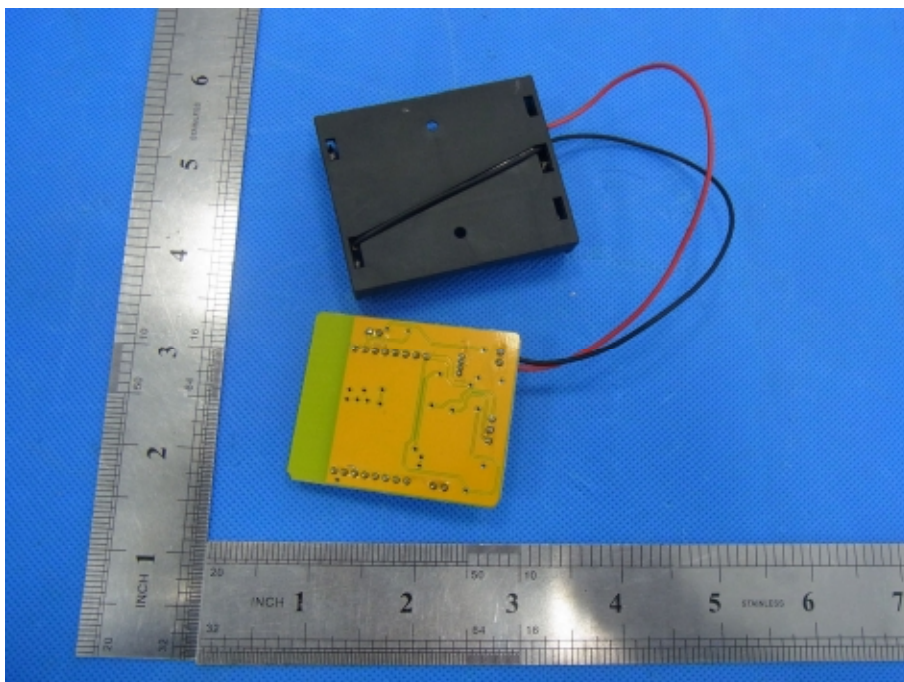


9 PHOTOGRAPHS OF EUT

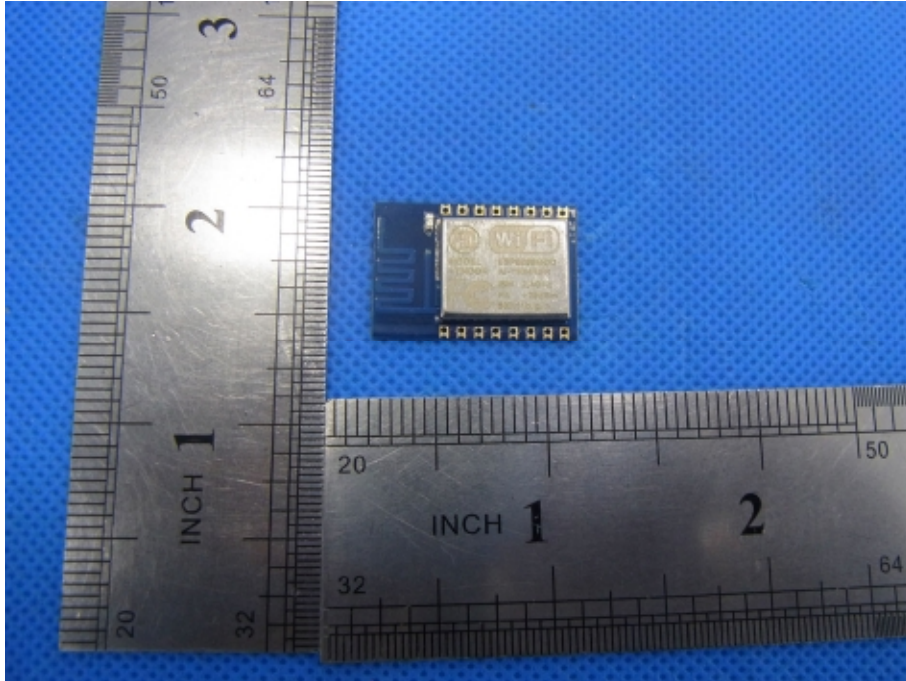
EUT Photo 1



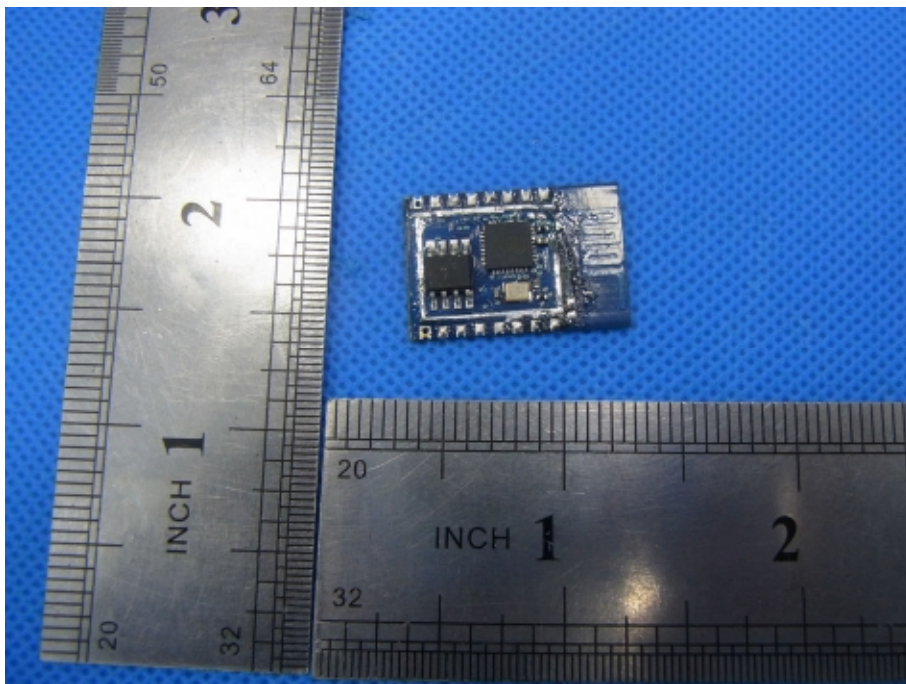
EUT Photo 2



EUT Photo 3

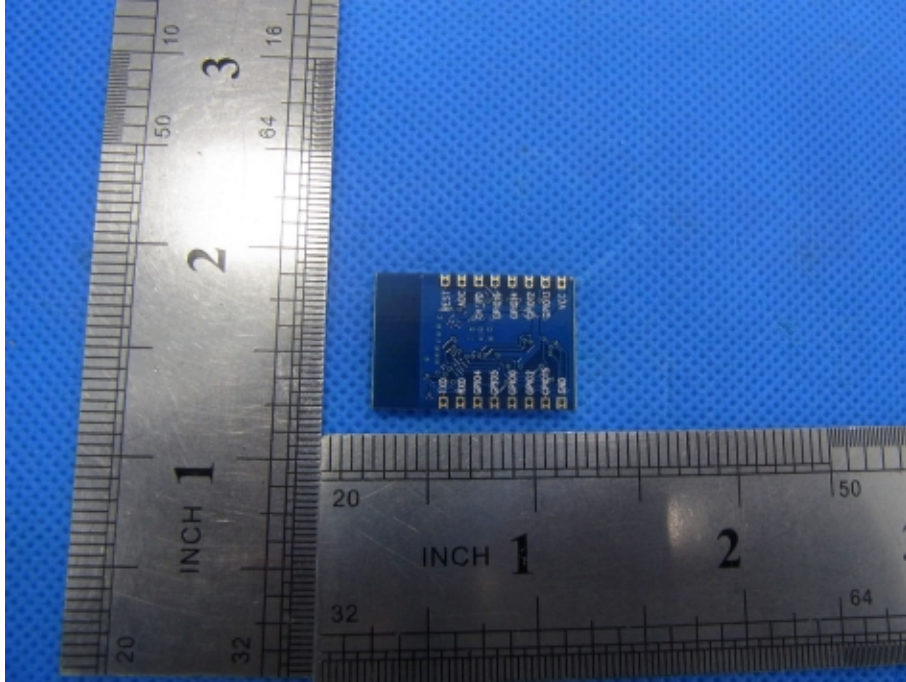


EUT Photo 4





EUT Photo 5



******* END OF REPORT *******