TESTING
No. L2264

EN301 489-1&-17
Test Report

Product Name	Wi-Fi Internet of Things Module
Model	ESP-WROOM-02
Brand Name	WROOM
Client	ESPRESSIF SYSTEMS (SHANGHAI) PTE LTD
Manufacturer	ESPRESSIF SYSTEMS (SHANGHAI) PTE LTD
Date of issue	April 9, 2015

TA Technology (Shanghai) Co., Ltd.

GENERAL SUMMARY

Reference Standard(s)	**ETSI EN 301 489-1 V1.9.2** （**2011-09**）Electromagnetic compatibility and Radio spectrum Matters(ERM) ; Electro Magnetic Compatibility (EMC)standard for radio equipment and services; Part 1: Common technical requirements. **ETSI EN 301 489-17 V2.2.1 (2012-09)** Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment; Part 17: Specific conditions for Broadband Data Transmission Systems
Conclusion	This wireless equipment has been measured in all cases requested by the relevant standards. Test results in Chapter 3 of this test report are below limits specified in the relevant standards. General Judgment: Pass
Comment	The test result only responds to the measured sample.

Approved by Guangchang Fan	**Revised by** Wei Liu	**Performed by** Xianqing Li
Guangchang Fan Director	Wei Liu EMC Manager	Xianqing Li EMC Engineer

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1. Competence and Warranties

1.1. Notes of the test report

TA Technology (Shanghai) Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS), and accreditation number: L2264.

TA Technology (Shanghai) Co., Ltd. guarantees the reliability of the data presented in this test report, which is the results of measurements and tests performed for the items under test on the date and under the conditions stated in this test report and is based on the knowledge and technical facilities available at TA Technology (Shanghai) Co., Ltd. at the time of execution of the test.

TA Technology (Shanghai) Co., Ltd. is liable to the client for the maintenance by its personnel of the confidentiality of all information related to the items under test and the results of the test. The sample under test was selected by the Client. This report only refers to the item that has undergone the test.

The test results in this test report relate only to the devices specified in this report.This report shall not be reproduced except in full without the written approval of **TA Technology (Shanghai) Co., Ltd.**

If the electronic report is inconsistent with the printed one, it should be subject to the latter.

1.2. Testing laboratory

Company: TA Technology (Shanghai) Co., Ltd.
Address: No.145, Jintang Rd, Tangzhen Industry Park, Pudong
City: Shanghai
Post code: 201201
Country: P. R. China
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Website: http://www.ta-shanghai.com
E-mail: xukai@ta-shanghai.com

1.3. Applicant Information

Company:	ESPRESSIF SYSTEMS (SHANGHAI) PTE LTD
Address:	Room 204，Building 2 , 690 Bibo Road, Zhangjiang Hi-tech Park, 201203,Shanghai/China

1.4. Manufacturer Information

Company:	ESPRESSIF SYSTEMS (SHANGHAI) PTE LTD
Address:	Room 204，Building 2 , 690 Bibo Road, Zhangjiang Hi-tech Park, 201203,Shanghai/China

1.5. Information of EUT

General information

SN:	ESPWROOM02-292014-1
Hardware Version:	HW V1.0
Software Version:	SW V1.0
Support Function(s)	WIFI(802.11b/g/n HT20);
power source	External Power Supply

Note：During the test the EUT is in Traffic mode/Idle mode. The test data of the worst-case condition (traffic mode) was recorded.

1.6. Test Date

The test is performed from March 28, 2015 to April 5, 2015.

2. Reference Standards

2.1. Radiated Emission

Standard: ETSI EN 301 489-1, ETSI EN 301 489-17
Limit: ETSI EN 301 489-1
Method: EN 55022

2.2. Conducted Emission

Standard: ETSI EN 301 489-1, ETSI EN 301 489-17
Limit: ETSI EN 301 489-1
Method: EN 55022

2.3. Harmonic Current Emission

Standard: ETSI EN 301 489-1, ETSI EN 301 489-17
Limit: EN 61000-3-2
Method: EN 61000-3-2

2.4. Voltage Fluctuation and Flicker

Standard: ETSI EN 301 489-1, ETSI EN 301 489-17
Limit: EN 61000-3-3
Method: EN 61000-3-3

2.5. Electrostatic Discharge

Standard: ETSI EN 301 489-1, ETSI EN 301 489-17
Fail criteria: ETSI EN 301 489-1, ETSI EN 301 489-17
Method: EN 61000-4-2

2.6. RF Electromagnetic Field

Standard: ETSI EN 301 489-1, ETSI EN 301 489-17
Fail criteria: ETSI EN 301 489-1, ETSI EN 301 489-17
Method: EN 61000-4-3

2.7. Fast Transients Common Mode

Standard: ETSI EN 301 489-1, ETSI EN 301 489-17
Limit: EN 61000-4-4
Method: EN 61000-4-4

2.8. Surge

Standard: ETSI EN 301 489-1, ETSI EN 301 489-17
Fail criteria: ETSI EN 301 489-1, ETSI EN 301 489-17
Method: EN 61000-4-5

2.9. Radio Frequency Common Mode

Standard: ETSI EN 301 489-1, ETSI EN 301 489-17
Fail criteria: ETSI EN 301 489-1, ETSI EN 301 489-17
Method: EN 61000-4-6

2.10. Voltage Dips and Interruptions

Standard: ETSI EN 301 489-1, ETSI EN 301 489-17
Fail criteria: ETSI EN 301 489-1, ETSI EN 301 489-17
Method: EN 61000-4-11

3. Test results

3.1. Summary of measurement results

Number	Summary of measurements of results	Rules	Conclusion
1	Radiated Emission	EN 55022:2010	PASS
2	Conducted Emission	EN 55022:2010	PASS
3	Harmonic Current Emission	EN 61000-3-2:2006+A2:2009	N/A
4	Voltage fluctuation and flicker	EN 61000-3-3: 2008	N/A
5	Electrostatic discharge	EN 61000-4-2: 2009	PASS
6	RF electromagnetic Field	EN 61000-4-3:2006+A1:2008+A2:2010	PASS
7	Fast transients common mode	EN 61000-4-4:2004+A1:2010	PASS
8	Surge	EN 61000-4-5:2006	PASS
9	Radio frequency common mode	EN 61000-4-6:2009	PASS
10	Voltage dips and interruptions	EN 61000-4-11:2004	N/A

3.2. Radiated Emission

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~26°C	45%~50%	101.5kPa

Methods of Measurement

The EUT is placed on a non-metallic table 0.8m above the horizontal metal reference ground plane. The distance between EUT and receive antenna should be 3 meters. During the test, the EUT was operating in its typical mode. Sweep the whole frequency band through the range from 30MHz to 5 times the highest frequency or 6 GHz, whichever is less. During the test, the height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. The turn table shall be rotated from 0 to 360 degrees for detecting the maximum of radiated spurious signal level. The measurements shall be repeated with orthogonal polarization of the test antenna.

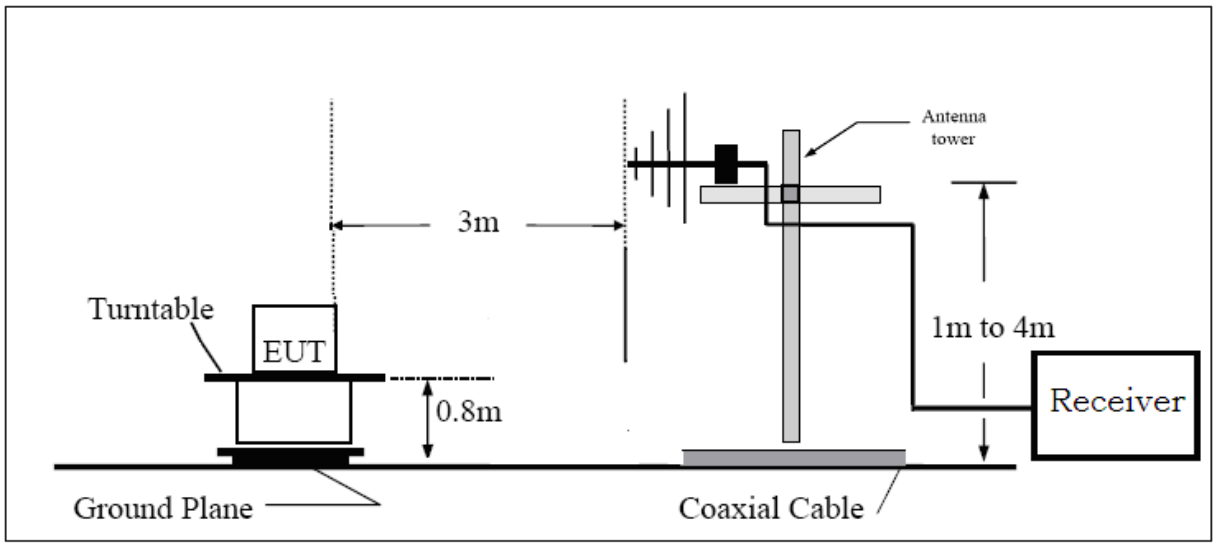
Below 1GHz, RBW is set to 100 kHz and VBW is set to 300kHz.Above 1GHz, RBW is set to 1MHz and VBW is set to 3MHz.

During the test the EUT is in traffic mode and idle mode. The test data of the worst-case condition (traffic mode) was recorded.

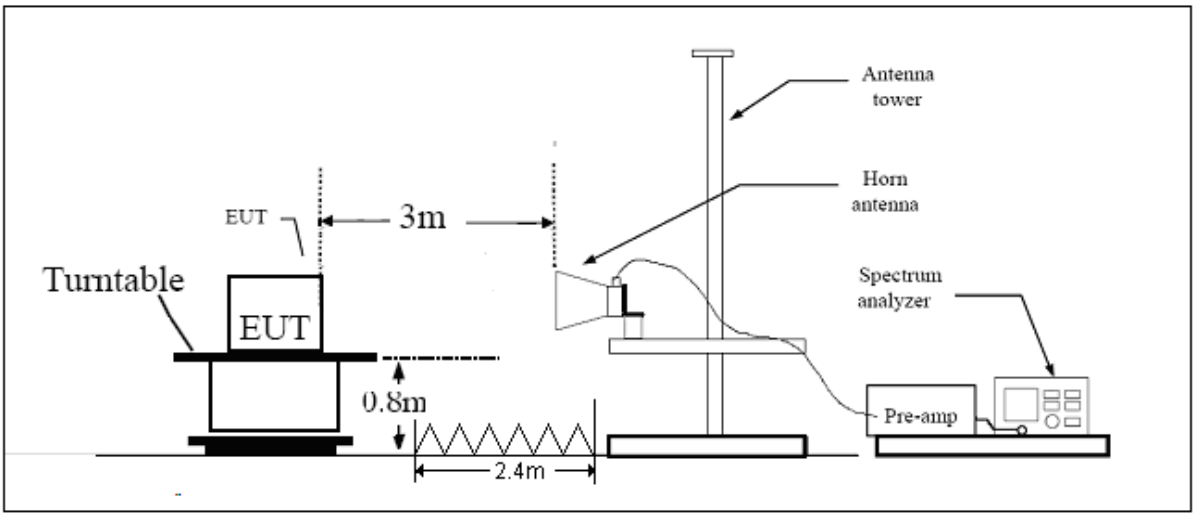
During the test, the EUT is worked at maximum output power. The Absolute Radio Frequency channel number is 7 in the case of WIFI.

Test Setup

Below 1 GHz



Above 1GHz



Note: Area side:2.4mX3.6m

Limits

Frequency (MHz)	Quasi-peak (dBμV/m)	Measurement distance (m)
30 -230	40	3
230-1000	47	3

Frequency (MHz)	Peak (dBμV/m)	Average (dBμV/m)	Measurement distance (m)
1000 -3000	70	50	3
3000- 6000	74	54	3

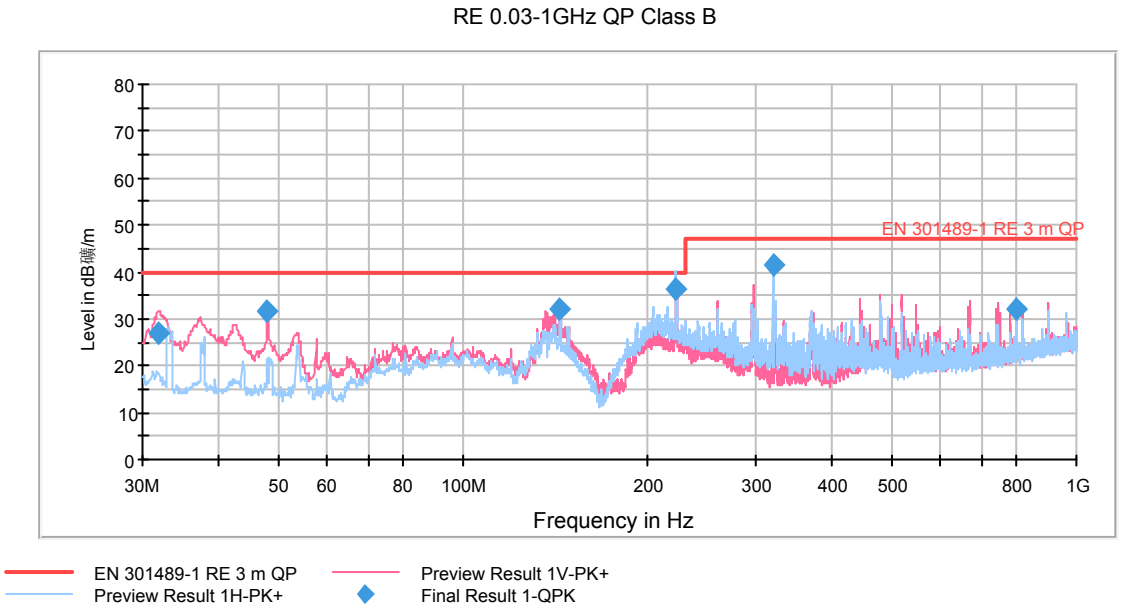
Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor *k* = 1.96.

Frequency	Uncertainty
30MHz-200MHz	4.19 dB
200MHz-1GHz	3.63 dB
1GHz – 6GHz	3.68 dB

Test Results:

802.11b



Note: This graph displays the maximum values of horizontal and vertical by software

Note: a font (Level in dBµV/m)in the test plot =(level in dBuv/m)

Radiated Emission 30M-1GHz

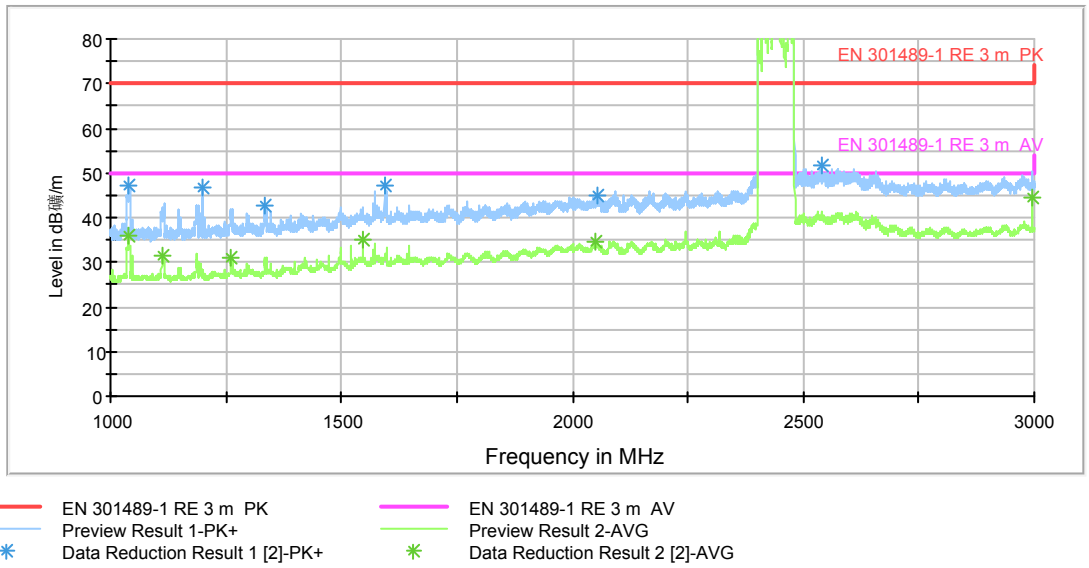
Frequency (MHz)	Quasi-Peak (dBuV/m)	Reading value (dBuV/m	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
31.861250	27.2	45.3	99.0	V	0.0	-18.1	12.8	40.0
47.985000	31.8	53.0	99.0	V	271.0	-21.2	8.2	40.0
143.975000	32.0	61.4	99.0	V	261.0	-29.4	8.0	40.0
222.262500	36.4	62.1	127.0	H	272.0	-25.7	3.6	40.0
319.990000	41.6	64.5	99.0	H	289.0	-22.9	5.4	47.0
799.978750	32.0	46.2	118.0	H	0.0	-14.2	15.0	47.0

Remark: 1. Quasi-Peak = Reading value + Correction factor

2. Correction Factor = Antenna factor+ Insertion loss(cable loss+amplifier gain)

3. Margin = Limit – Quasi-Peak

RE WLAN PK+AV



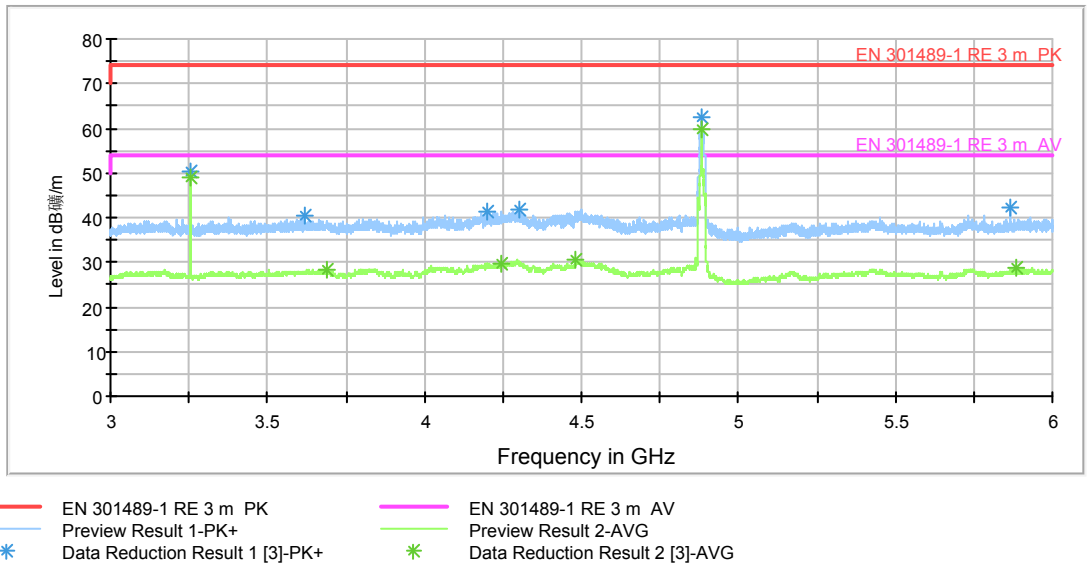
Note: This graph displays the maximum values of horizontal and vertical by software
Note: The signal beyond the limit is carrier. Carrier frequency (MHz): 2442
Note: a font (Level in dBµV/m)in the test plot =(level in dBuv/m)

Radiated Emission 1G-3GHz

Frequency (MHz)	Peak (dBuV/m)	Reading value (dBuV/m	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1038.000000	47.0	56.2	100.0	V	30.0	-9.2	23.0	70
1334.000000	42.9	50.8	100.0	V	50.0	-7.9	27.1	70
1596.500000	47.3	52.8	100.0	V	103.0	-5.5	22.7	70
2055.250000	44.8	46.3	100.0	H	265.0	-1.5	25.2	70
2539.000000	51.7	52.0	100.0	V	336.0	-0.3	18.3	70
1199.750000	46.7	55.8	100.0	V	113.0	-9.1	23.3	70

Frequency (MHz)	Average (dBuV/m)	Reading value (dBuV/m	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1038.000000	34.6	43.8	100.0	V	30.0	-9.2	15.4	50
1334.000000	30.4	38.3	100.0	V	50.0	-7.9	19.6	50
1596.500000	31.8	37.3	100.0	V	103.0	-5.5	18.2	50
2055.250000	33.6	35.1	100.0	H	265.0	-1.5	16.4	50
2539.000000	39.6	39.9	100.0	V	336.0	-0.3	10.4	50
1199.750000	27.2	36.3	100.0	V	113.0	-9.1	22.8	50

RE WLAN PK+AV



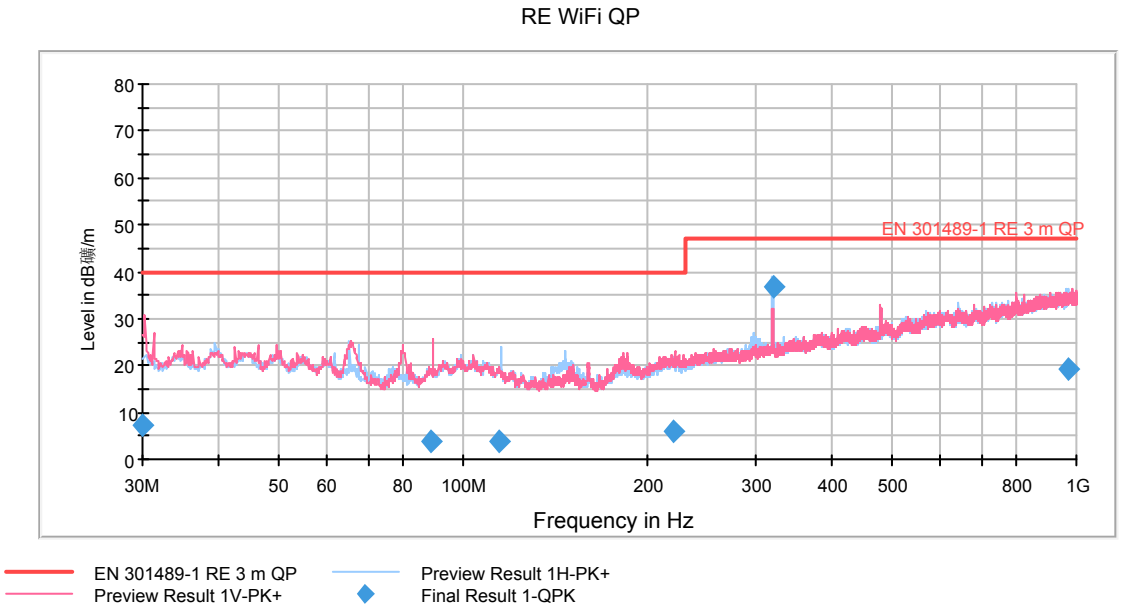
Note: This graph displays the maximum values of horizontal and vertical by software
Note: The higher signals are harmonic frequencies (MHz):4884
Note: a font (Level in dBµV/m)in the test plot =(level in dBuv/m)

Radiated Emission 3G-6GHz

Frequency (MHz)	Peak (dBuV/m)	Reading value (dBuV/m	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
3255.750000	50.3	51.8	100.0	V	346.0	-1.5	23.7	74
3616.125000	40.4	41.0	100.0	H	241.0	-0.6	33.6	74
4202.250000	41.4	43.7	100.0	H	0.0	-2.3	32.6	74
4299.000000	41.9	44.9	100.0	V	185.0	-3.0	32.1	74
4884.000000	62.3	65.3	100.0	V	31.0	-3.0	11.7	74
5867.625000	42.0	46.1	100.0	V	220.0	-4.1	32.0	74

Frequency (MHz)	Average (dBuV/m)	Reading value (dBuV/m	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
3255.750000	49.0	50.5	100.0	V	346.0	-1.5	5.0	54
3616.125000	27.7	28.3	100.0	H	241.0	-0.6	26.3	54
4202.250000	29.1	31.4	100.0	H	0.0	-2.3	24.9	54
4299.000000	29.9	32.9	100.0	V	185.0	-3.0	24.1	54
5867.625000	28.1	32.2	100.0	V	220.0	-4.1	25.9	54

802.11g



Note: This graph displays the maximum values of horizontal and vertical by software

Note: a font (Level in dBµV/m)in the test plot =(level in dBuv/m)

Radiated Emission 30M-1GHz

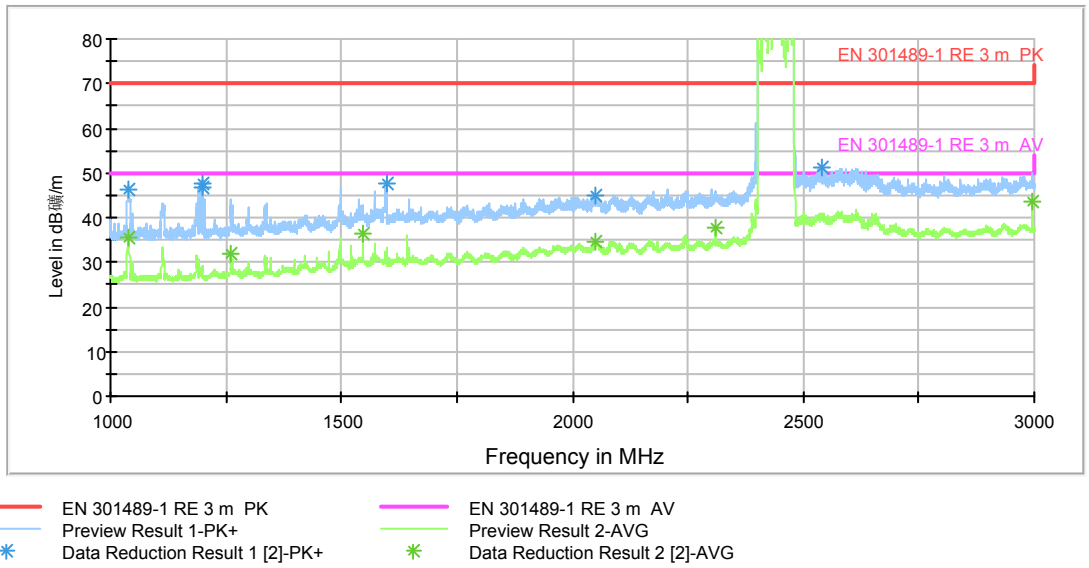
Frequency (MHz)	Quasi-Peak (dBuV/m)	Reading value (dBuV/m	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
30.040000	7.3	24.4	100.0	V	7.0	-17.1	32.7	40.0
88.610000	3.7	29.5	99.0	V	252.0	-25.8	36.3	40.0
114.517500	3.8	30.2	99.0	H	141.0	-26.4	36.2	40.0
220.731250	6.0	31.5	101.0	V	45.0	-25.5	34.0	40.0
319.988750	36.8	59.2	99.0	H	104.0	-22.4	10.2	47.0
972.228750	19.3	30.6	127.0	H	56.0	-11.3	27.7	47.0

Remark: 1. Quasi-Peak = Reading value + Correction factor

2. Correction Factor = Antenna factor+ Insertion loss(cable loss+amplifier gain)

3. Margin = Limit – Quasi-Peak

RE WLAN PK+AV



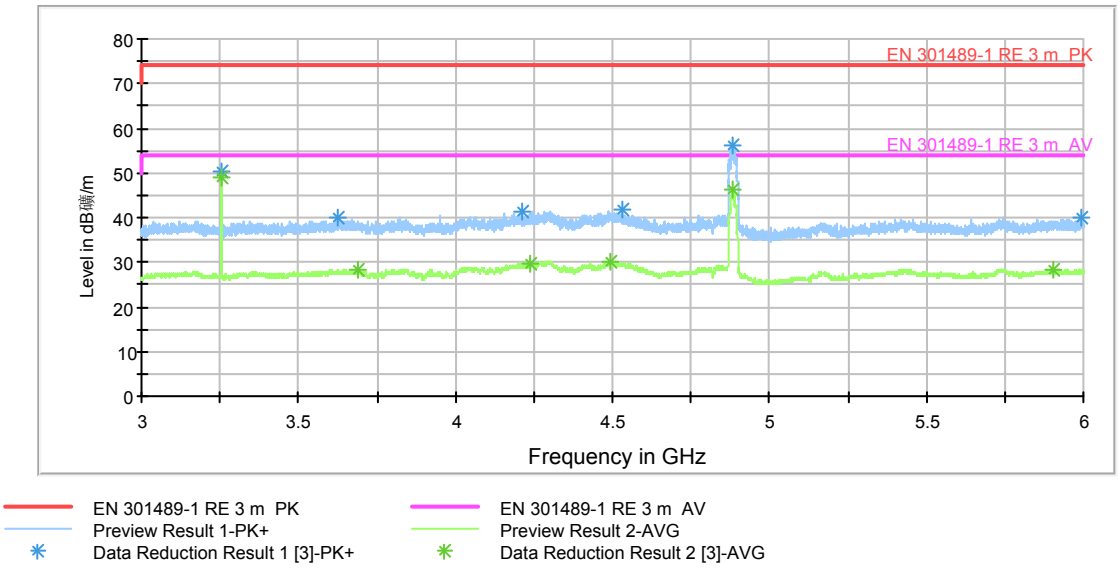
Note: This graph displays the maximum values of horizontal and vertical by software
Note: The signal beyond the limit is carrier. Carrier frequency (MHz):2442
Note: a font (Level in dBµV/m)in the test plot =(level in dBuv/m)

Radiated Emission 1G-3GHz

Frequency (MHz)	Peak (dBuV/m)	Reading value (dBuV/m	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1198.500000	47.6	56.6	100.0	V	58.0	-9.0	22.4	70
1201.000000	46.8	55.8	100.0	V	240.0	-9.0	23.2	70
1598.250000	47.7	53.3	100.0	V	336.0	-5.6	22.3	70
2052.000000	44.9	46.6	100.0	V	199.0	-1.7	25.1	70
2540.250000	51.2	51.5	100.0	V	348.0	0.3	18.8	70
1039.250000	46.3	55.5	100.0	V	17.0	-9.2	23.7	70

Frequency (MHz)	Average (dBuV/m)	Reading value (dBuV/m	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1198.500000	29.0	38.0	100.0	V	58.0	-9.0	21.0	50
1201.000000	27.0	36.0	100.0	V	240.0	-9.0	23.0	50
1598.250000	33.0	38.6	100.0	V	336.0	-5.6	17.0	50
2052.000000	33.8	35.5	100.0	V	199.0	-1.7	16.2	50
2540.250000	40.2	40.5	100.0	V	348.0	0.3	9.8	50
1039.250000	33.1	42.3	100.0	V	17.0	-9.2	16.9	50

RE WLAN PK+AV

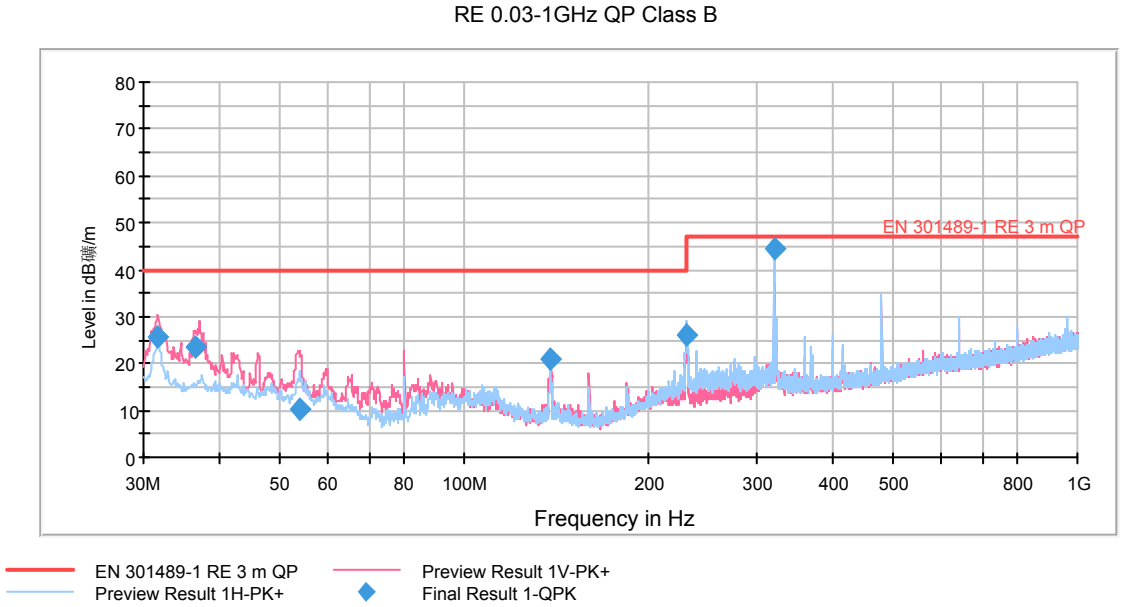


Note: This graph displays the maximum values of horizontal and vertical by software
Note: a font (Level in dBµV/m)in the test plot =(level in dBuv/m)
Radiated Emission 3G-6GHz

Frequency (MHz)	Peak (dBuV/m)	Reading value (dBuV/m	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
3255.750000	50.3	51.8	100.0	V	346.0	-1.5	23.7	74
3628.500000	40.1	40.6	100.0	H	214.0	-0.5	33.9	74
4210.125000	41.2	43.6	100.0	V	4.0	2.4	32.8	74
4528.875000	41.7	44.1	100.0	V	11.0	2.4	32.3	74
4884.375000	56.4	59.4	100.0	V	0.0	3.0	17.6	74
5992.500000	40.1	44.5	100.0	V	248.0	4.4	33.9	74

Frequency (MHz)	Average (dBuV/m)	Reading value (dBuV/m	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
3255.750000	49.2	50.7	100.0	V	346.0	-1.5	4.8	54
3628.500000	27.5	28.0	100.0	H	214.0	-0.5	26.5	54
4210.125000	28.5	30.9	100.0	V	4.0	2.4	25.5	54
4528.875000	29.3	31.7	100.0	V	11.0	2.4	24.7	54
4884.375000	46.0	49.0	100.0	V	0.0	3.0	8.0	54
5992.500000	28.0	32.4	100.0	V	248.0	4.4	26.0	54

802.11n HT20



Note: This graph displays the maximum values of horizontal and vertical by software

Note: a font (Level in dBµV/m)in the test plot =(level in dBuv/m)

Radiated Emission 30M-1GHz

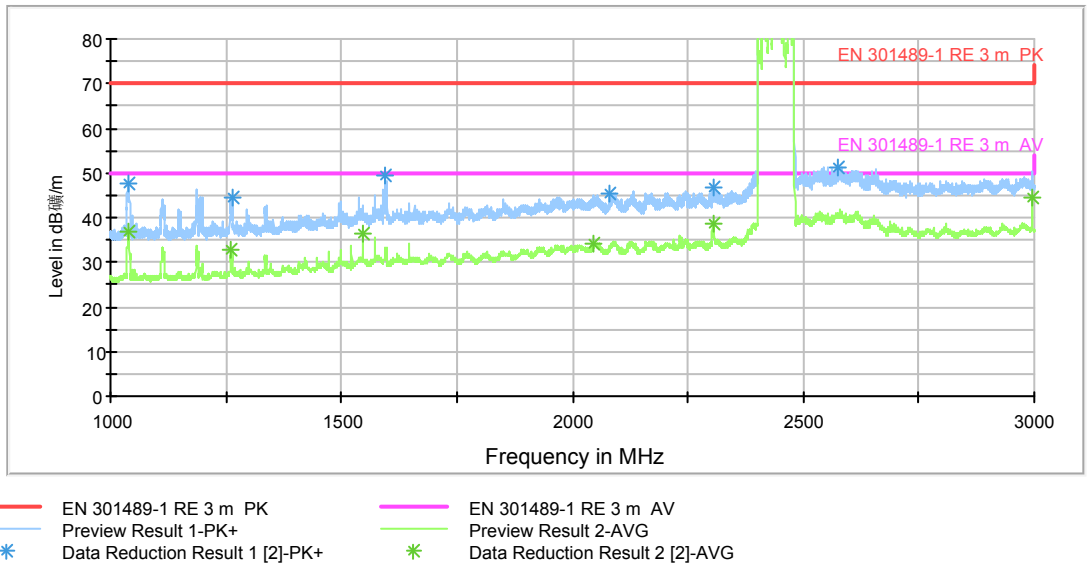
Frequency (MHz)	Quasi-Peak (dBuV/m)	Reading value (dBuV/m	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
31.617500	25.7	43.7	202.0	V	0.0	-18.0	14.3	40.0
36.432500	23.5	42.8	99.0	V	253.0	-19.3	16.5	40.0
54.007500	10.4	32.7	126.0	H	266.0	-22.3	29.6	40.0
138.313750	21.0	50.3	99.0	V	345.0	-29.3	19.0	40.0
230.420000	26.1	51.5	125.0	H	18.0	-25.4	20.9	47.0
319.990000	44.4	67.3	118.0	H	132.0	-22.9	2.6	47.0

Remark: 1. Quasi-Peak = Reading value + Correction factor

2. Correction Factor = Antenna factor+ Insertion loss(cable loss+amplifier gain)

3. Margin = Limit – Quasi-Peak

RE WLAN PK+AV



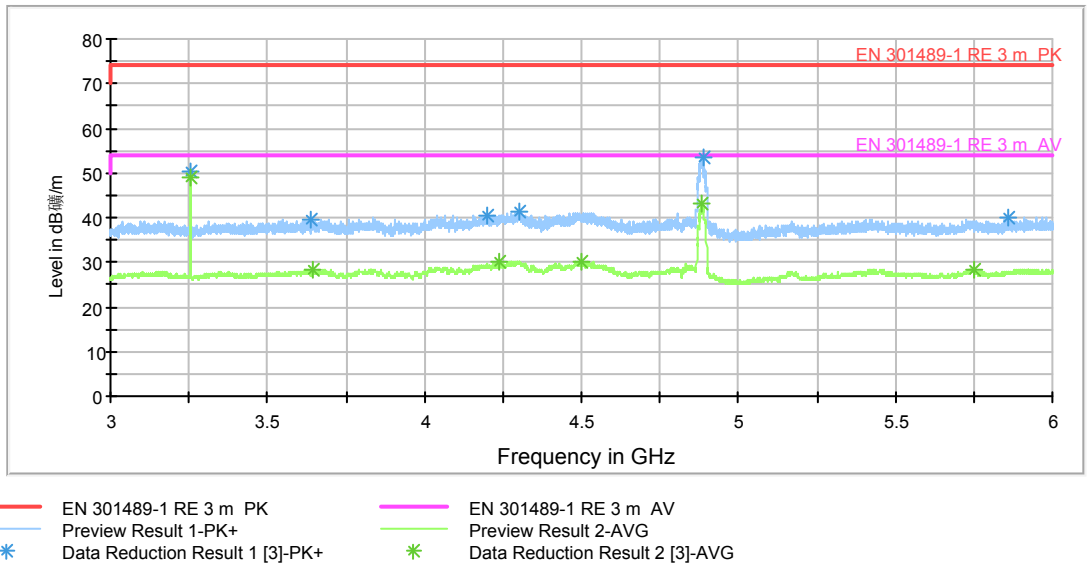
Note: This graph displays the maximum values of horizontal and vertical by software
Note: The signal beyond the limit is carrier. Carrier frequency (MHz): 2442
Note: a font (Level in dBµV/m)in the test plot =(level in dBuv/m)

Radiated Emission 1G-3GHz

Frequency (MHz)	Peak (dBuV/m)	Reading value (dBuV/m	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1037.500000	47.8	57.0	100.0	V	28.0	-9.2	22.2	70
1264.000000	44.6	53.1	100.0	V	39.0	-8.5	25.4	70
1593.500000	49.5	54.9	100.0	V	255.0	-5.4	20.5	70
2079.000000	45.2	46.5	100.0	V	59.0	-1.3	24.8	70
2577.000000	51.4	51.8	100.0	V	349.0	0.4	18.6	70
2306.250000	46.9	48.2	100.0	V	309.0	-1.3	23.1	70

Frequency (MHz)	Average (dBuV/m)	Reading value (dBuV/m	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1037.500000	36.2	45.4	100.0	V	28.0	-9.2	13.8	50
1264.000000	31.4	39.9	100.0	V	39.0	-8.5	18.6	50
1593.500000	33.3	38.7	100.0	V	255.0	-5.4	16.7	50
2079.000000	32.4	33.7	100.0	V	59.0	-1.3	17.6	50
2577.000000	40.7	41.1	100.0	V	349.0	0.4	9.3	50
2306.250000	37.1	38.4	100.0	V	309.0	-1.3	12.9	50

RE WLAN PK+AV



Note: This graph displays the maximum values of horizontal and vertical by software

Note: a font (Level in dBµV/m)in the test plot =(level in dBuv/m)

Radiated Emission 3G-6GHz

Frequency (MHz)	Peak (dBuV/m)	Reading value (dBuV/m	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
3255.750000	50.3	51.8	100.0	V	346.0	-1.5	23.7	74
3639.375000	39.7	40.0	100.0	H	325.0	-0.3	34.3	74
4201.125000	40.4	42.7	100.0	H	18.0	2.3	33.6	74
4299.750000	41.3	44.3	100.0	H	256.0	3.0	32.7	74
4887.750000	53.5	56.5	100.0	V	0.0	3.0	20.5	74
5858.250000	40.2	44.2	100.0	V	30.0	4.0	33.8	74

Frequency (MHz)	Average (dBuV/m)	Reading value (dBuV/m	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
3255.750000	48.8	50.3	100.0	V	346.0	-1.5	5.2	54
3639.375000	27.5	27.8	100.0	H	325.0	-0.3	26.5	54
4201.125000	29.2	31.5	100.0	H	18.0	2.3	24.8	54
4299.750000	29.7	32.7	100.0	H	256.0	3.0	24.3	54
4887.750000	42.6	45.6	100.0	V	0.0	3.0	11.4	54
5858.250000	27.6	31.6	100.0	V	30.0	4.0	26.4	54

3.3. Conducted Emission

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~26°C	45%~50%	101.5kPa

Methods of Measurement

The EUT is placed on a non-metallic table of 80cm height above the horizontal metal reference ground plane. All telecommunication and signal ports must be correctly terminated using either appropriate associated equipment or a representative termination during the measurement of the conducted disturbances at the mains.

The frequency band range is from 150 kHz to 30 MHz. RBW is set to 9 kHz and VBW is set to 30 kHz on spectrum analyzer. During the test, the EUT was operating in its typical mode. Connect the DC power line of the EUT to the L.I.S.N. Use EMI receiver to detect the average and Quasi-peak value. The measurement result should include both L line and N line.

During the test the EUT is in traffic mode and idle mode. The test data of the worst-case condition (traffic mode) was recorded.

The EUT operated at maximum output power. The Absolute Radio Frequency channel number is 7 in the case of WIFI.

Test Setup



Limits

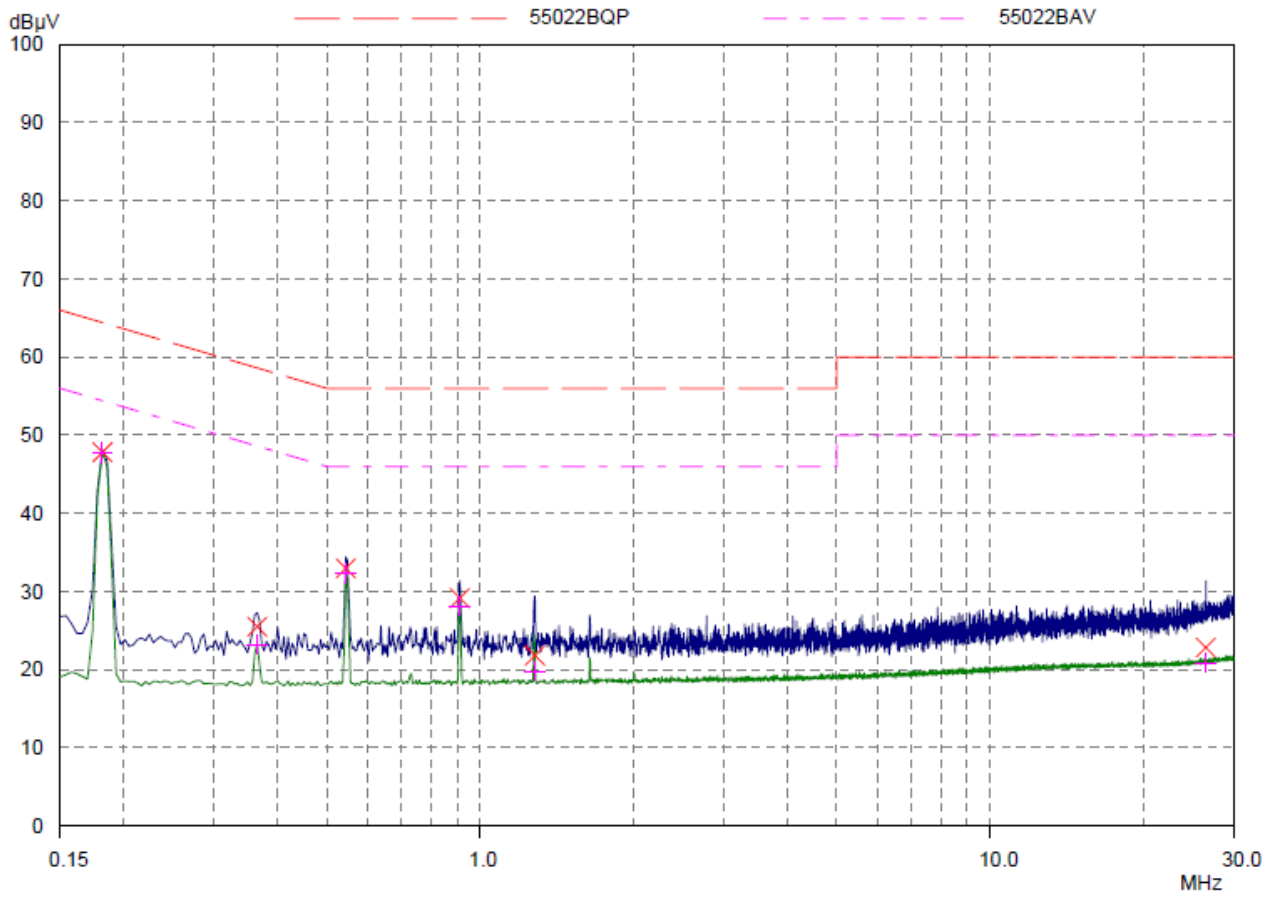
Frequency (MHz)	Conducted Limits(dBμV)	
	Quasi-Peak	Average
0.15 - 0.5	66 to 56 *	56 to 46*
0.5 - 5	56	46
5 - 30	60	50
*: Decreases with the logarithm of the frequency.		

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96, U= 2.69 dB.

Test Results:

802.11b

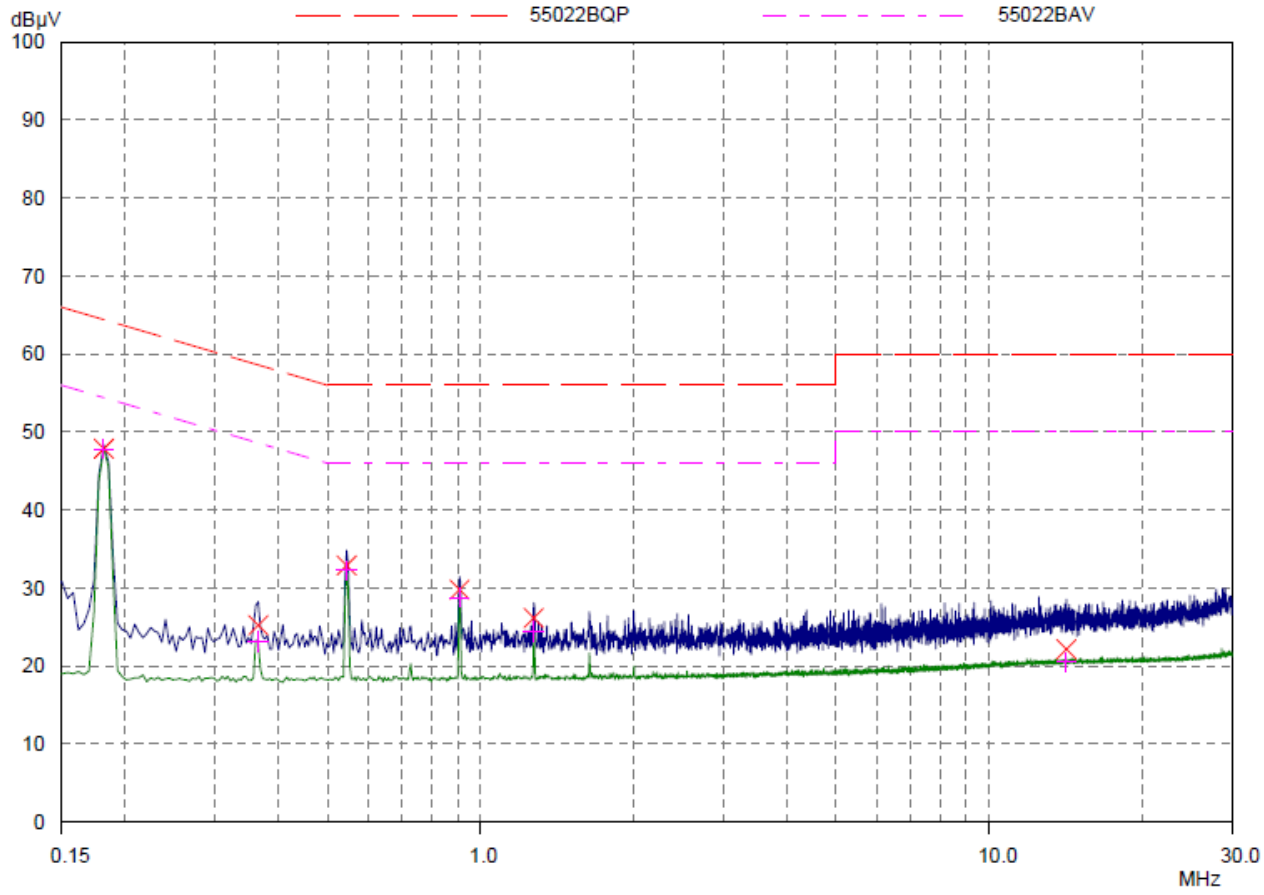


Final Measurement Results

Frequency MHz	QP Level dBµV	QP Limit dBµV	QP Delta dB	Phase -	PE -
0.18125	47.81	64.43	16.62	L1	gnd
0.36484	25.50	58.62	33.12	L1	gnd
0.54453	32.97	56.00	23.03	L1	gnd
0.91171	29.17	56.00	26.83	L1	gnd
1.2789	21.81	56.00	34.19	L1	gnd
26.49765	22.85	60.00	37.15	L1	gnd

Frequency MHz	AV Level dBµV	AV Limit dBµV	AV Delta dB	Phase -	PE -
0.18125	47.80	54.43	6.63	L1	gnd
0.36484	23.25	48.62	25.37	L1	gnd
0.54453	32.35	46.00	13.65	L1	gnd
0.91171	28.14	46.00	17.86	L1	gnd
1.2789	19.82	46.00	26.18	L1	gnd
26.49765	20.85	50.00	29.15	L1	gnd

L Line



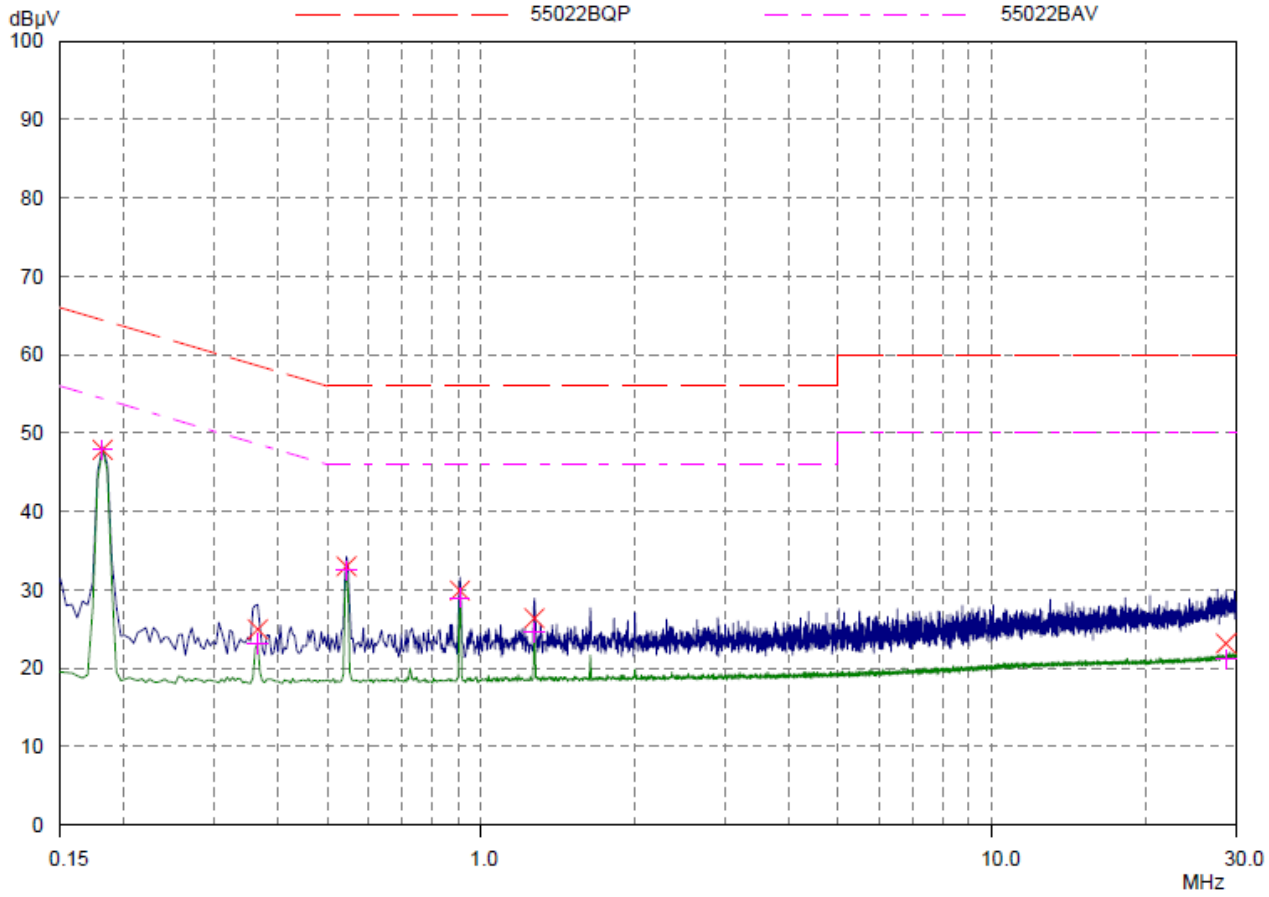
Final Measurement Results

Frequency MHz	QP Level dBµV	QP Limit dBµV	QP Delta dB	Phase -	PE -
0.18125	47.87	64.43	16.56	N	gnd
0.36484	25.24	58.62	33.38	N	gnd
0.54453	32.89	56.00	23.11	N	gnd
0.90781	29.79	56.00	26.21	N	gnd
1.27109	26.17	56.00	29.83	N	gnd
14.17343	22.17	60.00	37.83	N	gnd

Frequency MHz	AV Level dBµV	AV Limit dBµV	AV Delta dB	Phase -	PE -
0.18125	47.85	54.43	6.58	N	gnd
0.36484	23.15	48.62	25.47	N	gnd
0.54453	32.28	46.00	13.72	N	gnd
0.90781	28.77	46.00	17.23	N	gnd
1.27109	24.44	46.00	21.56	N	gnd
14.17343	20.49	50.00	29.51	N	gnd

N Line

802.11g

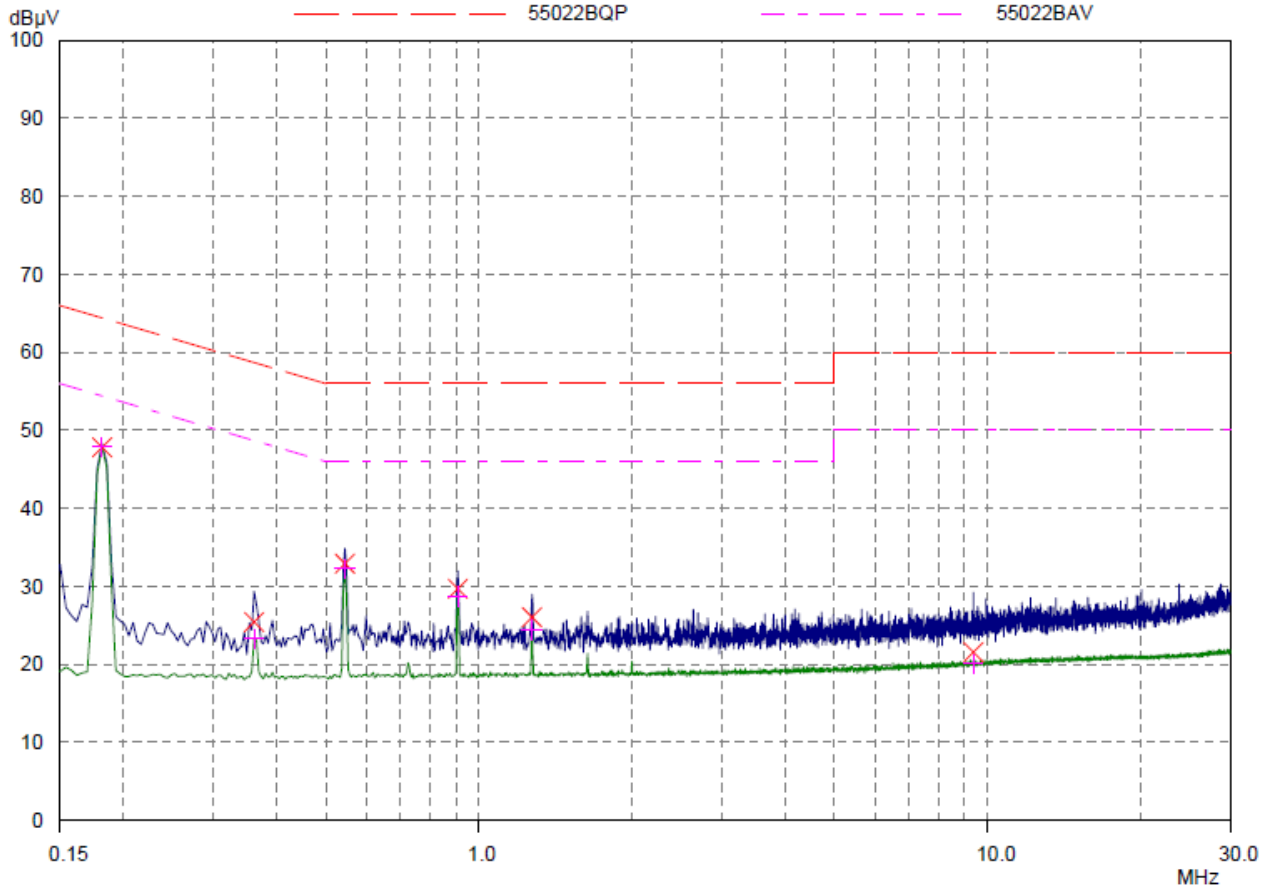


Final Measurement Results

Frequency MHz	QP Level dBµV	QP Limit dBµV	QP Delta dB	Phase -	PE -
0.18125	47.89	64.43	16.54	L1	gnd
0.36484	24.98	58.62	33.64	L1	gnd
0.54453	33.03	56.00	22.97	L1	gnd
0.90781	29.93	56.00	26.07	L1	gnd
1.27109	26.39	56.00	29.61	L1	gnd
28.7125	23.17	60.00	36.83	L1	gnd

Frequency MHz	AV Level dBµV	AV Limit dBµV	AV Delta dB	Phase -	PE -
0.18125	47.89	54.43	6.54	L1	gnd
0.36484	23.15	48.62	25.47	L1	gnd
0.54453	32.50	46.00	13.50	L1	gnd
0.90781	28.99	46.00	17.01	L1	gnd
1.27109	24.58	46.00	21.42	L1	gnd
28.7125	21.18	50.00	28.82	L1	gnd

L Line



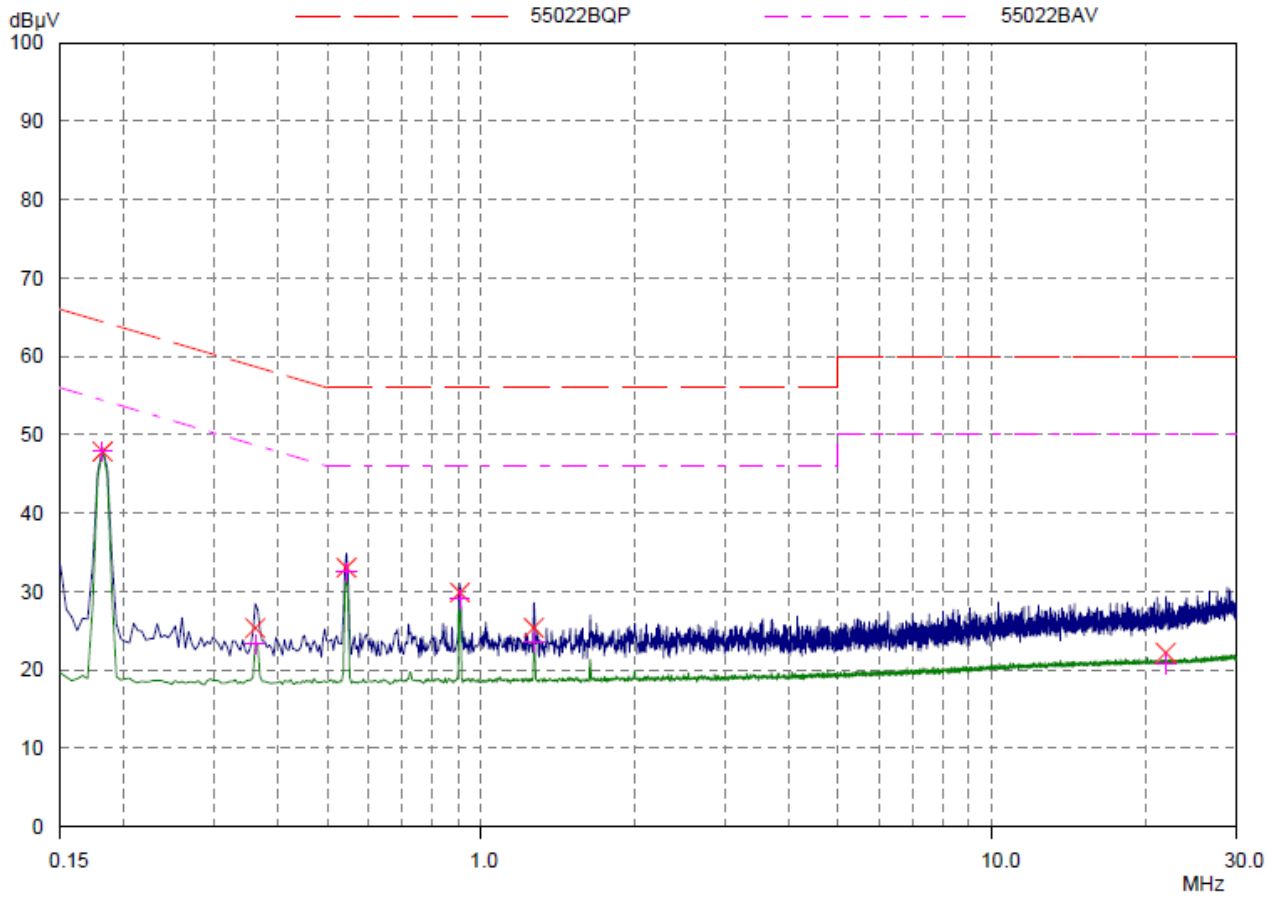
Final Measurement Results

Frequency MHz	QP Level dBµV	QP Limit dBµV	QP Delta dB	Phase -	PE -
0.18125	47.85	64.43	16.58	N	gnd
0.36093	25.44	58.71	33.27	N	gnd
0.54453	32.93	56.00	23.07	N	gnd
0.90781	29.73	56.00	26.27	N	gnd
1.27109	26.05	56.00	29.95	N	gnd
9.38046	21.59	60.00	38.41	N	gnd

Frequency MHz	AV Level dBµV	AV Limit dBµV	AV Delta dB	Phase -	PE -
0.18125	47.89	54.43	6.54	N	gnd
0.36093	23.30	48.71	25.41	N	gnd
0.54453	32.28	46.00	13.72	N	gnd
0.90781	28.71	46.00	17.29	N	gnd
1.27109	24.44	46.00	21.56	N	gnd
9.38046	20.12	50.00	29.88	N	gnd

N Line

802.11n HT20

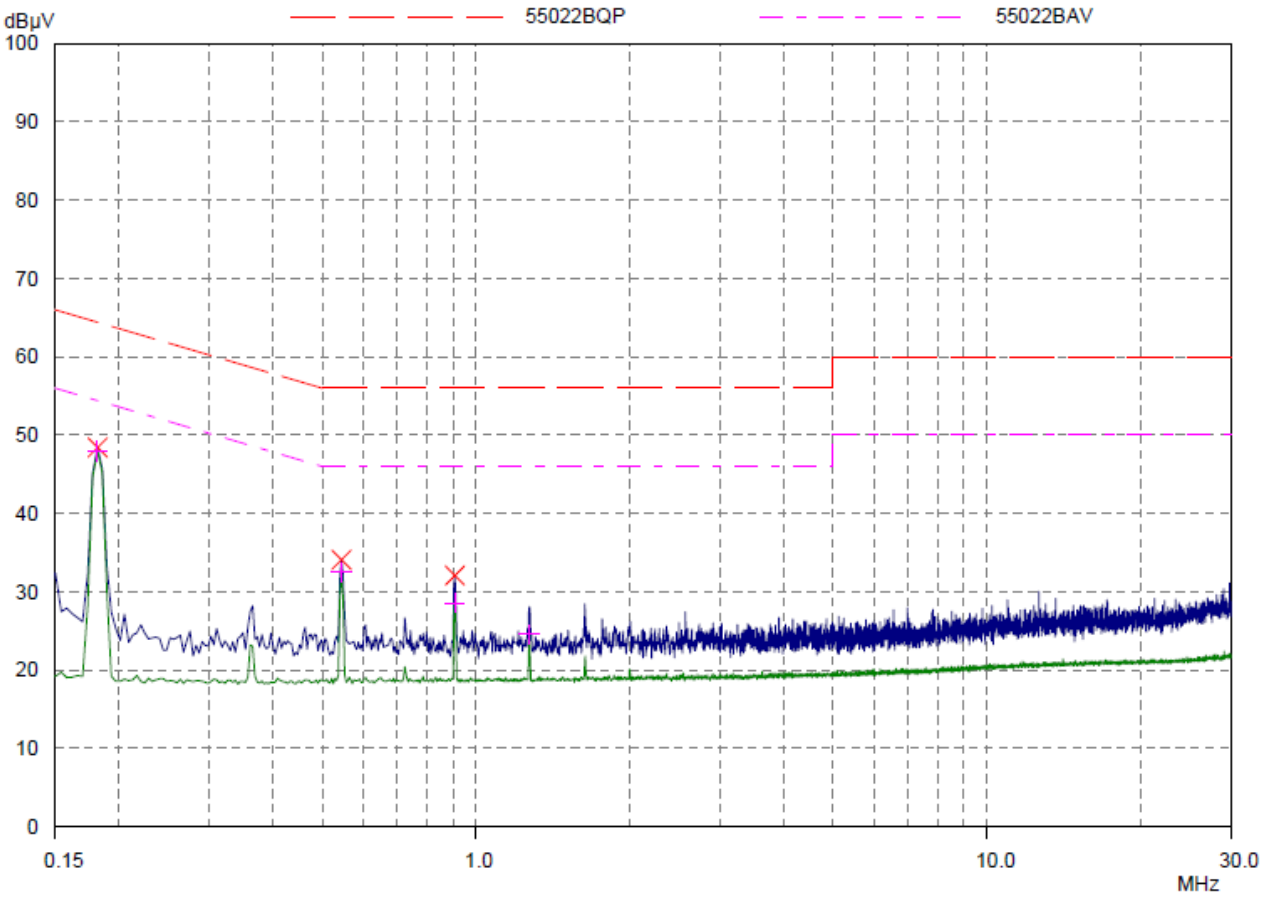


Final Measurement Results

Frequency MHz	QP Level dBµV	QP Limit dBµV	QP Delta dB	Phase -	PE -
0.18125	47.87	64.43	16.56	L1	gnd
0.36093	25.34	58.71	33.37	L1	gnd
0.54453	33.05	56.00	22.95	L1	gnd
0.90781	29.89	56.00	26.11	L1	gnd
1.26718	25.39	56.00	30.61	L1	gnd
21.9	22.20	60.00	37.80	L1	gnd

Frequency MHz	AV Level dBµV	AV Limit dBµV	AV Delta dB	Phase -	PE -
0.18125	47.89	54.43	6.54	L1	gnd
0.36093	23.30	48.71	25.41	L1	gnd
0.54453	32.50	46.00	13.50	L1	gnd
0.90781	29.04	46.00	16.96	L1	gnd
1.26718	23.62	46.00	22.38	L1	gnd
21.9	20.78	50.00	29.22	L1	gnd

L Line



Peak Search Results

Frequency MHz	PK Level dBµV	PK Limit dBµV	PK Delta dB	Phase -	PE -
0.18125	48.44	64.43	15.99	N	gnd
0.54453	34.11	56.00	21.89	N	gnd
0.90781	32.09	56.00	23.91	N	gnd

Frequency MHz	AV Level dBµV	AV Limit dBµV	AV Delta dB	Phase -	PE -
0.18125	47.94	54.43	6.49	N	gnd
0.54453	32.47	46.00	13.53	N	gnd
0.90781	28.61	46.00	17.39	N	gnd
1.27109	24.55	46.00	21.45	N	gnd

N Line

3.4. Harmonic Current Emission

Ambient condition

Temperature	Relative humidity	Pressure
24°C ~26°C	45%~50%	101.5kPa

Methods of Measurement

The EUT is to be powered from a clean (low distortion) 230V 50Hz AC Power source. The set-up and test methods were according to EN 61000-3-2.

The measurement of harmonic currents shall be performed as follows:

1. For each harmonic order, measure the 1.5 s smoothed r.m.s.
2. Calculate the arithmetic average of the measured values from the DFT time windows,

The value of the input power to be used for the calculation of limits shall be determined as follows:

1. Measure the 1.5 s smoothed active input power in each DFT time window;
2. Determine the maximum of the measured values of power from the DFT time windows over the entire duration of the test.

The Absolute Radio Frequency channel number is 7 in the case of WIFI.

Limits

Harmonic order n	**Maximum permissible Harmonic current A**
Odd harmonic	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
15≤n≤39	$0.15\frac{15}{n}$
Even harmonic	
2	1.08
4	0.43
6	0.30
8≤n≤40	$0.23\frac{8}{n}$

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96, U= 5.31 dB.

Test results:

Not applicable for DC power supply.

3.5. Voltage fluctuation and flicker

Ambient condition

Temperature	Relative humidity	Pressure
24°C ~26°C	45%~50%	101.5kPa

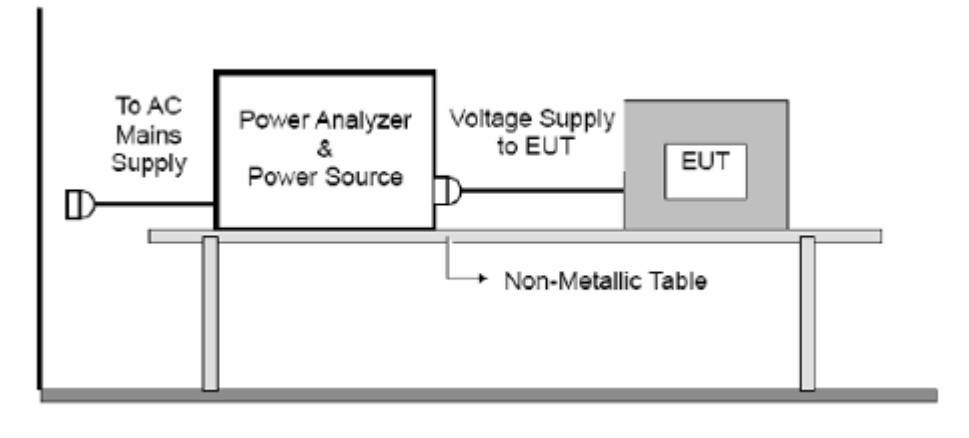
General

The EUT is to be powered from a clean (low distortion) 230V 50Hz AC Power Port source. The formal test ran 10mins and over a 2 hour period. The values of Pst, d(t), dmax and dc is measured. The set-up and test methods were according to EN 61000-3-3.

Whether the equipment operates with automatic, mixed or manual control, the measurements shall be made under normal load, or conditions for adequate heat discharge, and under normal operating conditions.

The Absolute Radio Frequency channel number is 7 in the case of WIFI.

Test Setup



Limits

1. The value of P_{st} shall not be greater than 1,0;
2. The value of P_{lt} shall not be greater than 0,65;
3. The value of d(t) during a voltage change shall not exceed 3,3 % for more than 500 ms;
4. The relative steady-state voltage change, dc, shall not exceed 3,3 %;
5. The maximum relative voltage change d_{max}, shall not exceed
   a) 4 % without additional conditions;
   b) 6 % for equipment which is:

– switched manually, or
– switched automatically more frequently than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds), or manual restart, after a power supply interruption.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.99, U=7.64%.

Test Results:

Not applicable for DC power supply.

3.6. Electrostatic Discharge

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	40%~45%	101.5kPa

General

The set-up and test methods were according to EN 61000-4-2.
During the test, the EUT was operating in its typical mode. The Absolute Radio Frequency channel number is 7 in the case of WIFI.
The EUT is placed on a non-metallic table of 80cm height above the ground reference plane.
A horizontal coupling plane (HCP) is placed on the table. The EUT and its cables shall be isolated from the coupling plane by an insulating support (0,5 ± 0,05) mm in thickness.
The test is performed as TR and TT mode.

Test Specifications

After the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible.

Test Results

802.11b

Coupling		Voltage	Description	Conclusion
Direct Application	Air Discharge	±2kV	No fail detected	PASS
		±4kV	No fail detected	PASS
		±8kV	No fail detected	PASS
	Contact Discharge	±2kV	No fail detected	PASS
		±4kV	No fail detected	PASS
Indirect Application	Horizontal Coupling Plane	±2kV	No fail detected	PASS
		±4kV	No fail detected	PASS
	Vertical Coupling Plane	±2kV	No fail detected	PASS
		±4kV	No fail detected	PASS

802.11g

Coupling		Voltage	Description	Conclusion
Direct Application	Air Discharge	±2kV	No fail detected	PASS
		±4kV	No fail detected	PASS
		±8kV	No fail detected	PASS
	Contact Discharge	±2kV	No fail detected	PASS
		±4kV	No fail detected	PASS
Indirect Application	Horizontal Coupling Plane	±2kV	No fail detected	PASS
		±4kV	No fail detected	PASS
	Vertical Coupling Plane	±2kV	No fail detected	PASS
		±4kV	No fail detected	PASS

802.11n HT20

Coupling		Voltage	Description	Conclusion
Direct Application	Air Discharge	±2kV	No fail detected	PASS
		±4kV	No fail detected	PASS
		±8kV	No fail detected	PASS
	Contact Discharge	±2kV	No fail detected	PASS
		±4kV	No fail detected	PASS
Indirect Application	Horizontal Coupling Plane	±2kV	No fail detected	PASS
		±4kV	No fail detected	PASS
	Vertical Coupling Plane	±2kV	No fail detected	PASS
		±4kV	No fail detected	PASS

3.7. RF Electromagnetic Field (RS)

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

General

The set-up and test methods were according to EN 61000-4-3.

Before testing, the intensity of the established of field strength is checked by the field sensor for the calibration, after that the EUT is placed in the center of the enclosure on a wooden table.

During the test, the EUT was operating in its typical mode. The EUT was tested for back side, front side, left side, right side, top side, and bottom side. The test for front side was found to be the worst mode, and this mode was recorded. The test frequency range is from 80MHz to 1000MHz and 1400MHz to 2700MHz, severity level of 3V/m .

The operator shall observe whether the communication link is maintained. It should be not more than 3. Use an audio analyzer such as UPV to measure uplink and downlink speech output levels to see whether audio breakthroughs are at least 35 dB less than reference measurement values of audio calibration. The test is performed as CR and CT mode. The Absolute Radio Frequency channel number is 7 in the case of WIFI.

Test Specifications

During and after the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer when the apparatus is used as intended.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96, U= 2.60dB.

Test Results:

802.11b

Range	Level	Test Mode	Test Position	Polarization	Description	Results
80-1000MHz 1400-2700MHz	3V/m	Work Mode	Front	Vertical	No fail detected	PASS
				Horizontal		
	3V/m	Work Mode	Back	Vertical	No fail detected	PASS
				Horizontal		
	3V/m	Work Mode	Left	Vertical	No fail detected	PASS
				Horizontal		
	3V/m	Work Mode	Right	Vertical	No fail detected	PASS
				Horizontal		

802.11g

Range	Level	Test Mode	Test Position	Polarization	Description	Results
80-1000MHz 1400-2700MHz	3V/m	Work Mode	Front	Vertical	No fail detected	PASS
				Horizontal		
	3V/m	Work Mode	Back	Vertical	No fail detected	PASS
				Horizontal		
	3V/m	Work Mode	Left	Vertical	No fail detected	PASS
				Horizontal		
	3V/m	Work Mode	Right	Vertical	No fail detected	PASS
				Horizontal		

802.11n HT20

Range	Level	Test Mode	Test Position	Polarization	Description	Results
80-1000MHz 1400-2700MHz	3V/m	Work Mode	Front	Vertical	No fail detected	PASS
				Horizontal		
	3V/m	Work Mode	Back	Vertical	No fail detected	PASS
				Horizontal		
	3V/m	Work Mode	Left	Vertical	No fail detected	PASS
				Horizontal		
	3V/m	Work Mode	Right	Vertical	No fail detected	PASS
				Horizontal		

3.8. Fast Transients Common Mode (EFT)

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

General

The set-up and test methods were according to EN 61000-4-4.

The test intended to show the immunity of the EUT when subjected to type of transient interference such as originating from switching transients. Bursts consisting of a number of transient are employed, coupled into power supply, control and signal inputs of EUT, The transients must be short rise-time, the repetition rate and the low energy.

The EUT is arranged and connected according to its normal installation requirements. The length of the signal and power lines between the coupling device (clamp) and the EUT is 0.5m±0.05m. If a non-detachable cable more than 0.5m long with the equipment, the excess length of this cable is gathered into a flat coil with 0.4m diameter and situated at a distance of 0.1m above the ground reference plane. Bursts of 5ns/50ns pluses at a repetition rate of 5kHz with a duration of 15ms and period of 300ms, applied in both polarities between power supply terminals (including the protective earth) and a reference ground plane, or via a capacitate coupling clamp onto I/O circuits and communication lines for 3 minutes. The test level is 1kV on power supply, 0.5kV on I/O signal, data and control lines. The 0.5kV is applicable only to ports interfacing with cables whose total length according to the manufacturer’s functional specification may exceed 3m.

The test is performed as TR and TT mode. The Absolute Radio Frequency channel number is 7 in the case of WIFI.

Test Specifications

After the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the apparatus is used as intended.

Results

802.11b

Connected	Voltage	Test Line	Description	Conclusion
Power Line	±1 KV	L+N	No fail detected	PASS

802.11g

Connected	Voltage	Test Line	Description	Conclusion
Power Line	±1KV	L+N	No fail detected	PASS

802.11n HT20

Connected	Voltage	Test Line	Description	Conclusion
Power Line	±1 KV	L+N	No fail detected	PASS

3.9. Surge

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

General

The set-up and test methods were according to EN 61000-4-5.

The test level for ac mains power input ports shall be 2 kV line to ground, and 1 kV line to line, with the output impedance of the surge generator as given in EN 61000-4-5.
The test generator shall provide the 1.2/50ms pulse as defined in EN 61000-4-5
The object of this section to establish a common reference for evaluating the performance of equipment when subjected to high-energy disturbances on the power and interconnection lines. The test is to find the reaction of the EUT under specified operational conditions caused by surge voltages form switching and lighting effects at certain threat levels.

The test is performed as TR and TT mode. The Absolute Radio Frequency channel number is 7 in the case of WIFI.

Test Specifications

After the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the apparatus is used as intended.

Results

802.11b

Connected	Voltage	Angle	Duration	Description	Conclusion
Power Line (L-N)	±0.5KV(1.2/50μs)	0	1 Minute / time	No fail detected	PASS
Power Line (L-N)	±0.5KV(1.2/50μs)	90	1 Minute / time	No fail detected	PASS
Power Line (L-N)	±0.5KV(1.2/50μs)	180	1 Minute / time	No fail detected	PASS
Power Line (L-N)	±0.5KV(1.2/50μs)	270	1 Minute / time	No fail detected	PASS

802.11g

Connected	Voltage	Angle	Duration	Description	Conclusion
Power Line (L-N)	±0.5KV(1.2/50μs)	0	1 Minute / time	No fail detected	PASS
Power Line (L-N)	±0.5KV(1.2/50μs)	90	1 Minute / time	No fail detected	PASS
Power Line (L-N)	±0.5KV(1.2/50μs)	180	1 Minute / time	No fail detected	PASS
Power Line (L-N)	±0.5KV(1.2/50μs)	270	1 Minute / time	No fail detected	PASS

802.11n HT20

Connected	Voltage	Angle	Duration	Description	Conclusion
Power Line (L-N)	±0.5KV(1.2/50μs)	0	1 Minute / time	No fail detected	PASS
Power Line (L-N)	±0.5KV(1.2/50μs)	90	1 Minute / time	No fail detected	PASS
Power Line (L-N)	±0.5KV(1.2/50μs)	180	1 Minute / time	No fail detected	PASS
Power Line (L-N)	±0.5KV(1.2/50μs)	270	1 Minute / time	No fail detected	PASS

3.10. Radio Frequency Common Mode (CS)

Ambient condition

Temperature	Relative humidity	Pressure
23°C~26°C	45%~50%	101.5kPa

General

The set-up and test methods were according to EN 61000-4-6.
The applied level was Amplitude Modulated by a 1 kHz sinusoidal signal to a modulation depth of 80%.

Most electronic product is in some manner affected by environmental electromagnetic radiation; the performance will be degraded or totally un-function. The object of this part is to evaluate the susceptibility of the EUT whether it can operate property in the electromagnetic environment.

The operator shall observe whether the communication link is maintained. The test is performed as CR and CT mode. The Absolute Radio Frequency channel number is 7 in the case of WIFI.

Test Specifications

During and after the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer when the apparatus is used as intended.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96, U= 2.76dB.

Test Results

802.11b

Range (MHz)	Level	Connected	Description	Conclusion
0.15-50	3Vrms	Power Port	No fail detected	PASS
50-80	3Vrms	Power Port	No fail detected	PASS

802.11g

Range (MHz)	Level	Connected	Description	Conclusion
0.15-50	3Vrms	Power Port	No fail detected	PASS
50-80	3Vrms	Power Port	No fail detected	PASS

802.11n HT20

Range (MHz)	Level	Connected	Description	Conclusion
0.15-50	3Vrms	Power Port	No fail detected	PASS
50-80	3Vrms	Power Port	No fail detected	PASS

3.11. Voltage dips and interruptions

Ambient condition

Temperature	Relative humidity	Pressure
23°C~26°C	45%~50%	101.5kPa

General

The set-up and test methods were according to EN 61000-4-11.

The section of EN 61000-4-11 defines the immunity test methods and range of preferred test levels for electrical and electronic equipment connected to low – voltage power supply for voltage dips and short interruptions. EN 61000-4-11 applied to electrical and electronic equipment having a rated input current not exceeding 16A per phase.

The test is performed as CR and CT mode. The Absolute Radio Frequency channel number is 7 in the case of WIFI.

Test Specifications

After the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the apparatus is used as intended.

Test Results

Not applicable for DC power supply.

4. Main Test Instrument

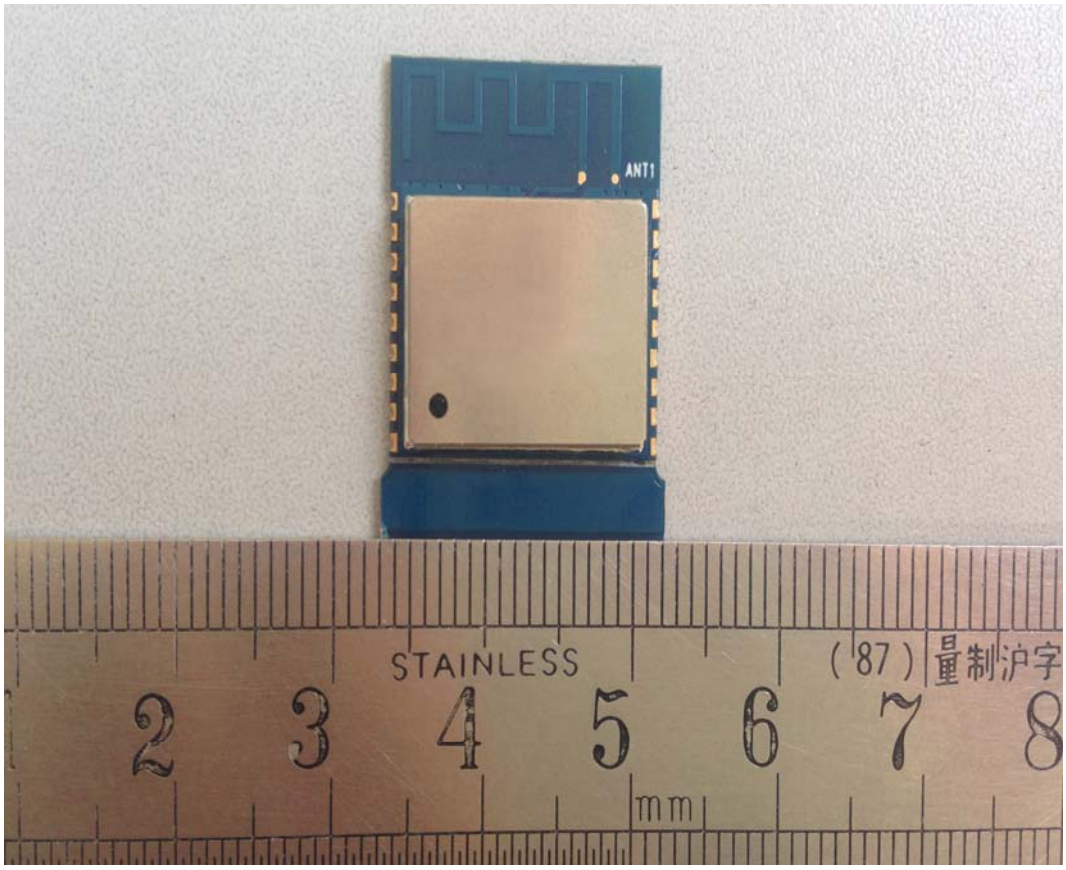
Table 1: List of Main Instruments

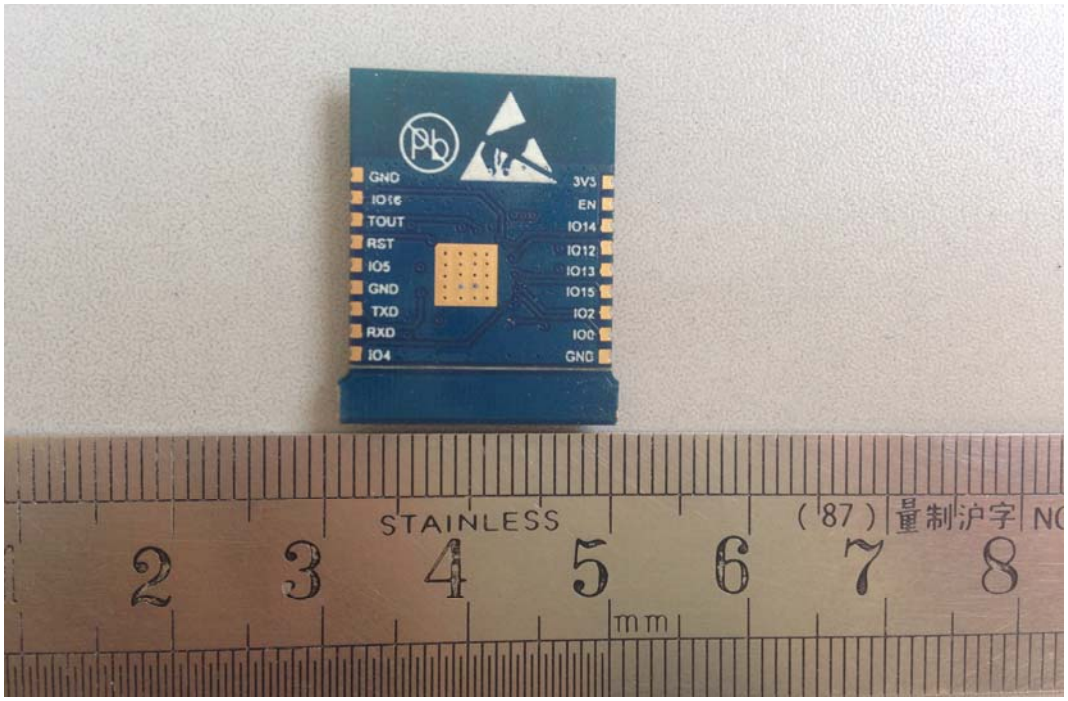
No.	Name	Type	Manufacturer	Serial Number	Calibration Date	Expiration Time	Valid Period
01	Signal Analyzer	FSV30	R&S	100815	2014-05-26	2015-05-25	1 year
02	EMI Test Receiver	ESCI	R&S	100948	2014-05-26	2015-05-25	1 year
03	TRILOG Broadband Antenna	VULB 9163	Schwarzbeck	9163-201	2012-06-18	2015-06-17	3 years
04	Double Ridged Waveguide Horn Antenna	HF907	R&S	100126	2012-07-01	2015-06-30	3 years
05	Horn Antenna	3160-09	ETS-Lindgren	00102643	2012-07-01	2015-06-30	3 years
06	EMI Test Receiver	ESCS30	R&S	100138	2015-01-13	2016-01-12	1 year
07	Artificial main network	ENV216	R&S	101171	2014-04-14	2015-04-13	1 year
08	Electro-Static Discharger Generator	Nosieken	ESS-2002EX	ES1111144	2014-03-17	2016-03-16	2 years
09	Compact Simulator of Conducted Immunity	UCS 500N6	EM TEST	V0902104 581	2012-07-25	2015-07-24	3 years
10	Audio Analyzer	UPV	R&S	101372	2014-05-26	2015-05-25	1 year
11	Power Amplifier	75A250A	AR	0331553	NA	NA	NA
12	Power Amplifier	BLWA 0830 -160/100 /40C	BONN	097490	NA	NA	NA
13	Signal Generator	SMB100 A	R&S	102594	2014-05-26	2015-05-25	1 year
14	High Gain Log-Periodic Antenna	HL046E	R&S	100063	NA	NA	NA
15	CDN	FCC-801 -M2/ M3-16A	FCC	091293	2012-07-08	2015-07-07	3 years

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

ANNEX A： The EUT Appearance and Test Configuration

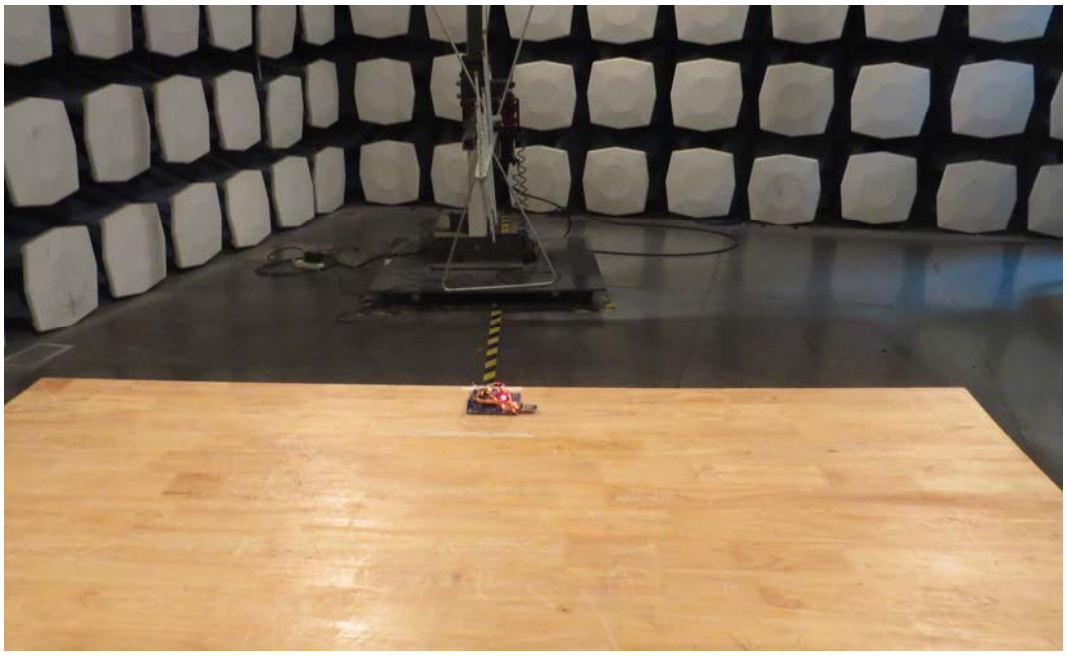
A.1 EUT Appearance

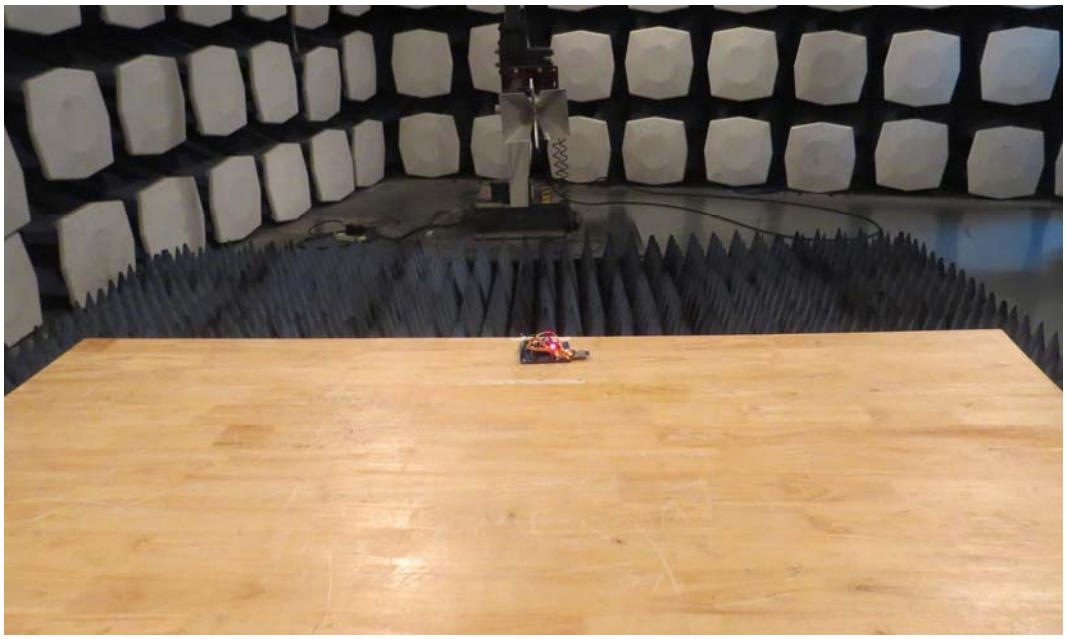




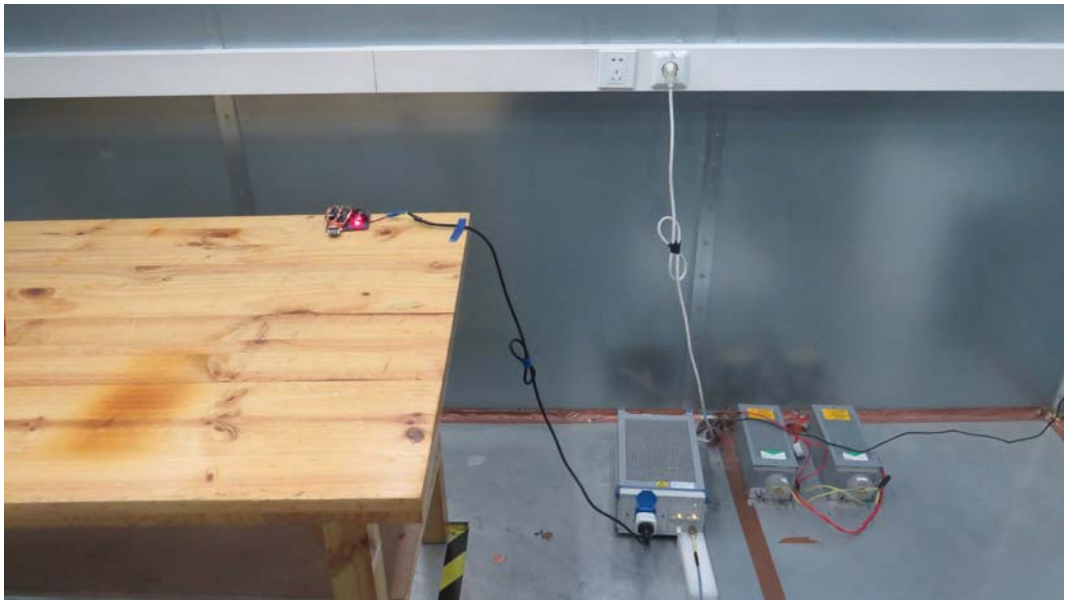
Picture 1 Constituents of EUT

A.2 Test Setup

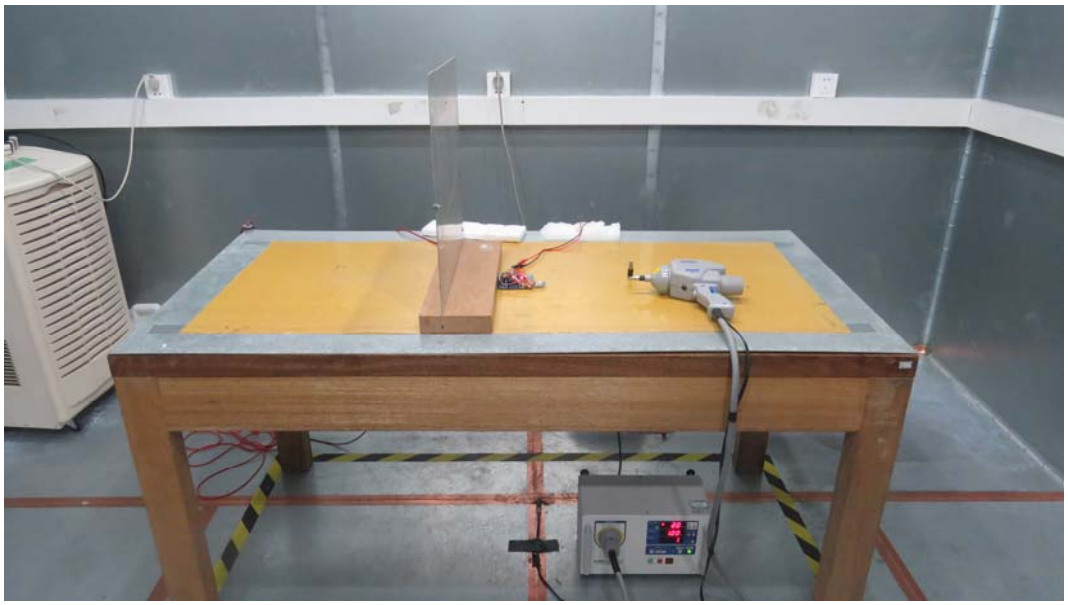




Picture 2 Radiated Emission Test Setup



Picture 3 Conducted Emission Test Setup



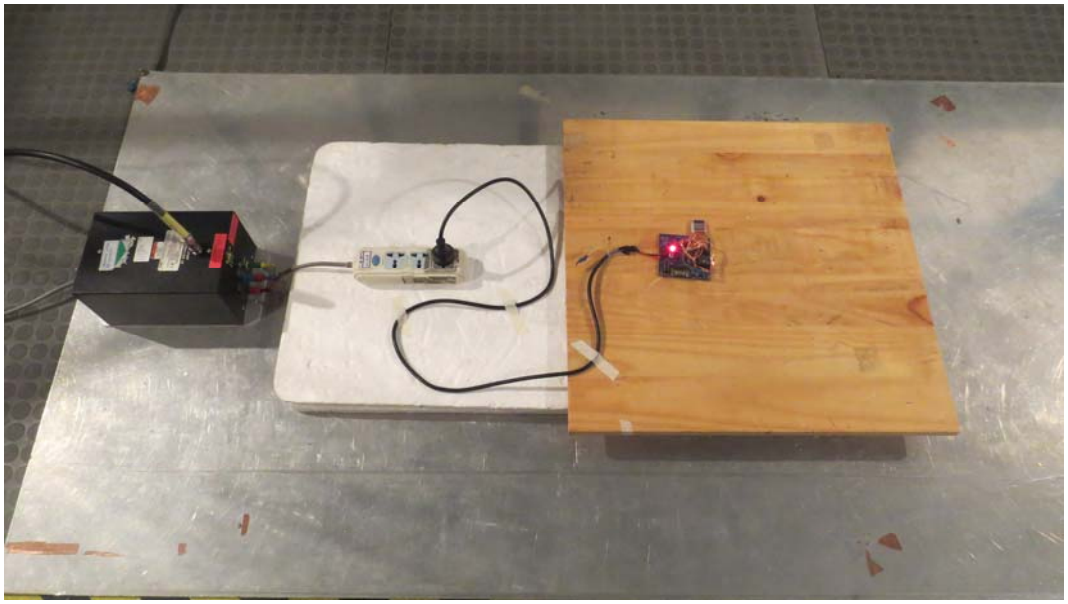
Picture 4 Electrostatic Discharge Test Setup



Picture 5 EFT& Surge &Dips Test Setup



Picture 6 RF Electromagnetic Field (RS) Test Setup



Picture 7: Radio Frequency Common Mode (CS) Test Setup