FCC PART 15C TEST REPORT FOR CERTIFICATION
On Behalf of

WUHU MUCHEN E-COMMERCE CO.,LTD.

Robot Vacuum Cleaner

Model Number: R2

Additional Model: R2Pro, R3, R3Pro

FCC ID: 2AZA3-3Y16X2

Prepared for:	WUHU MUCHEN E-COMMERCE CO.,LTD
	No.080 3rd Floor Complex Block E Nanxiang Wanshang,
	International Trade City Phase I, Wuhu, Anhui, China
Prepared By:	EST Technology Co., Ltd.
	Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China
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Report Number:	ESTE-R2103329-1
Date of Test:	Jan. 19~Mar. 29, 2021; Apr. 12~21, 2021
Date of Report:	Apr. 24, 2021

TABLE OF CONTENTS

Description Page

TEST REPORT VERIFICATION....3
1. GENERAL INFORMATION....5
1.1. Description of Device (EUT)....5
1.2. Antenna Information....5
2. SUMMARY OF TEST....6
2.1. Summary of test result....6
2.2. Test Facilities....7
2.3. Measurement uncertainty....8
2.4. Assistant equipment used for test....8
2.5. Block Diagram....8
2.6. Test Mode....9
2.7. Power Setting of Test Software....9
2.8. Duty Cycle....10
2.9. Channel List....13
2.10. Test Equipment List....14
3. 6DB BANDWIDTH....15
3.1. Limit....15
3.2. Test Setup....15
3.3. Spectrum Analyzer Setting....15
3.4. Test Procedure....15
3.5. Test Result....16
4. MAXIMUM PEAK OUTPUT POWER....23
4.1. Limit....23
4.2. Test Setup....23
4.3. Spectrum Analyzer Setting....23
4.4. Test Procedure....23
4.5. Test Result....24
5. POWER SPECTRAL DENSITY....31
5.1. Limit....31
5.2. Test Setup....31
5.3. Spectrum Analyzer Setting....31
5.4. Test Procedure....31
5.5. Test Result....32
6. CONDUCTED BAND EDGE....39
6.1. Limit....39
6.2. Test Setup....39
6.3. Spectrum Analyzer Setting....39
6.4. Test Procedure....39
6.5. Test Result....40
7. CONDUCTED SPURIOUS EMISSIONS....41
7.1. Limit....41
7.2. Test Setup....41
7.3. Spectrum Analyzer Setting....41
7.4. Test Procedure....41

7.5. Test Result 42
8. RADIATED SPURIOUS EMISSIONS AND BAND EDGE 44
8.1. Limit 44
8.2. Test setup 45
8.3. Spectrum Analyzer Setting 46
8.4. Test Procedure 47
8.5. Test Result 48
9. AC POWER LINE CONDUCTED EMISSIONS 64
9.1. Limit 64
9.2. Test Setup 64
9.3. Spectrum Analyzer Setting 64
9.4. Test Procedure 64
9.5. Test Result 65
10. ANTENNA REQUIREMENTS 69
10.1. Limit 69
10.2. Test Result 69
11. TEST SETUP PHOTO 70
12. EUT PHOTO 72

EST Technology Co., Ltd.

Applicant: **Address:**	WUHU MUCHEN E-COMMERCE CO.,LTD No.080 3rd Floor Complex Block E Nanxiang Wanshang, International Trade City Phase I, Wuhu, Anhui, China
Manufacturer: **Address:**	Shenzhen Optimal Electronic Commerce Co., Ltd. 506,Block A,Haoda New Times Building,263 Xuefu Road,Sunshine Palm Community, Nanshan Street,Nanshan District,Shenzhen
E.U.T:	Robot Vacuum Cleaner
Model Number:	R2
Additional Model:	R2Pro, R3, R3Pro (They are identical except model name)
Power Supply:	Adapter Input: AC 100-240V, 50/60Hz, 0.35A Charging Base Input: DC 20V, 0.6A Charging Base Output: DC 20V, 0.6A Battery Output: DC 14.4V
Trade Name:	Redkey Serial No.: ------
Date of Receipt:	Jan. 19, 2021; Apr. 12, 2021 Date of Test: Jan. 19~Mar. 29, 2021; Apr. 12~21, 2021
Test Specification:	FCC Part 15 Subpart C (15.247) ANSI C63.10:2013 FCC KDB 558074 D01 15.247 Meas Guidance v05r02 FCC KDB 662911 D01 Multiple Transmitter Output v02r01
Test Result:	The device described above is tested by EST Technology Co., Ltd. The measurement results were contained in this test report and EST Technology Co., Ltd. was assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT to be technically compliance with the FCC Rules and Regulations Part 15 Subpart C requirements. This report applies to above tested sample only and shall not be reproduced in part without written approval of EST Technology Co., Ltd. **Date:** Apr. 24, 2021

Prepared by:	Reviewed by:	Approved by:
Ring Yang	Seven Wang	
Ring Yang / Assistant	Seven Wang / Engineer	Iceman Hu / Manager

Other Aspects: This report base on the previous report with report number: ESTE-R2103329, Add fan motor and gyroscope, so just re-tested spurious emissions (30-1000MHz), other test item needn't re-tested.(S20-DL4516OSF & Saber A2-S)

Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested

This test report is based on a single evaluation of one sample of above mentioned products ,It is not permitted to be duplicated in extracts without written approval of EST Technology Co., Ltd.

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

Product Name	:	Robot Vacuum Cleaner
Model Number	:	R2
Software Version	:	N/A
Hardware Version	:	N/A
Operation frequency	:	2412MHz~2462MHz
Number of channel	:	IEEE 802.11b: 11 Channels IEEE 802.11g: 11 Channels IEEE 802.11n HT20: 11 Channels
Max Output Power (PEAK)	:	IEEE 802.11b: 12.94dBm IEEE 802.11g: 17.54dBm IEEE 802.11n HT20: 17.48dBm
Modulation Type	:	IEEE 802.11b mode: DSSS(CCK,QPSK, BPSK) IEEE 802.11g mode: OFDM (BPSK/QPSK/16QAM/64QAM) IEEE 802.11n mode: OFDM (BPSK/QPSK/16QAM/64QAM)
Sample Type	:	Prototype production

Note:

For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

1.2. Antenna Information

Ant No.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	N/A	N/A	Internal	N/A	1

2. SUMMARY OF TEST

2.1. Summary of test result

Report Section	Description of Test Item	FCC Standard Section	Results
3	6dB Bandwidth	15.247(a)(2)	PASS
4	Maximum Peak Output Power	15.247(b)(3)	PASS
5	Power Spectral Density	15.247(e)	PASS
6	Conducted Band Edge	15.247(d)	PASS
7	Conducted Spurious Emissions	15.247(d)	PASS
8	Radiated Spurious Emissions and Band Edge	15.205 15.209 15.247(d)	PASS
9	AC Power Line Conducted Emissions	15.207	PASS
10	Antenna Requirement	15.203	PASS

Note:

(1) “N/A” denotes test is not applicable in this test report

2.2. Test Facilities

EMC Lab	:	Certificated by CNAS, CHINA Registration No.: L5288 This Certificate is valid until: November 12, 2023 Certificated by FCC, USA Designation Number: CN1215 This Certificate is valid until: January 31, 2022 Certificated by A2LA, USA Registration No.: 4366.01 This Certificate is valid until: January 31, 2022 Certificated by Industry Canada CAB identifier No.: CN0035 This Certificate is valid until: January 31, 2022 Certificated by VCCI, Japan Registration No.:C-14103; T-20073; R-13663; R-20103; G-20097 Date of registration: Apr. 20, 2020 This Certificate is valid until: Apr. 19, 2023 Certificated by TUV Rheinland, Germany Registration No.: UA 50413872 0001 Date of registration: July 31, 2018 Certificated by Intertek Registration No.: 2011-RTL-L2-64 Date of registration: November 08, 2018
Name of Firm	:	EST Technology Co., Ltd.
Site Location	:	Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China

2.3. Measurement uncertainty

Test Item	Uncertainty
Uncertainty for Conduction emission test	±3.48dB
Uncertainty for spurious emissions test (30MHz-1GHz)	±4.60 dB(Polarize: H)
	±4.68 dB(Polarize: V)
Uncertainty for spurious emissions test (1GHz to 25GHz)	±4.96dB
Uncertainty for radio frequency	7×10^{-8}
Uncertainty for conducted RF Power	0.20dB
Uncertainty for Power density test	0.26dB

Note：This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

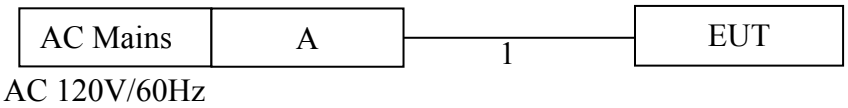
2.4. Assistant equipment used for test

Item	Equipment	Brand	Model Name/Type No.	FCC ID	Series No.
A	Adapter	Debom	DBS012A-2000600G	-	-

Item	Shielded Type	Ferrite Core	Length	Note
1	NO	NO	1.2m	DC Cable

2.5. Block Diagram

For radiated emissions test: EUT was placed on a turn table, which is 0.8 (or 1.5) meter high above ground. EUT was beset into 2.4G WIFI test mode by software before test.



(EUT: Robot Vacuum Cleaner)

2.6. Test Mode

The test mode was selected for the final test as listed below.

Test Item	Mode	Date Rate	Test Channel
6dB Bandwidth	IEEE 802.11b	1Mbps	Low/Middle/High
	IEEE 802.11g	6Mbps	Low/Middle/High
	IEEE 802.11n HT20	MCS0	Low/Middle/High
Maximum Peak Output Power	IEEE 802.11b	1Mbps	Low/Middle/High
	IEEE 802.11g	6Mbps	Low/Middle/High
	IEEE 802.11n HT20	MCS0	Low/Middle/High
Power Spectral Density	IEEE 802.11b	1Mbps	Low/Middle/High
	IEEE 802.11g	6Mbps	Low/Middle/High
	IEEE 802.11n HT20	MCS0	Low/Middle/High
Conducted Band Edge	IEEE 802.11b	1Mbps	Low/ High
	IEEE 802.11g	6Mbps	Low/ High
	IEEE 802.11n HT20	MCS0	Low/ High
Conducted Spurious Emissions	IEEE 802.11b	1Mbps	Low/Middle/High
	IEEE 802.11g	6Mbps	Low/Middle/High
	IEEE 802.11n HT20	MCS0	Low/Middle/High
Radiated Spurious Emissions(Below 1GHz)	IEEE 802.11b	1Mbps	Low/Middle/High
	IEEE 802.11g	6Mbps	Low/Middle/High
	IEEE 802.11n HT20	MCS0	Low/Middle/High
Radiated Spurious Emissions(Above 1GHz)	IEEE 802.11b	1Mbps	Low/Middle/High
	IEEE 802.11g	6Mbps	Low/Middle/High
	IEEE 802.11n HT20	MCS0	Low/Middle/High
Radiated Band Edge	IEEE 802.11b	1Mbps	Low/Middle/High
	IEEE 802.11g	6Mbps	Low/Middle/High
	IEEE 802.11n HT20	MCS0	Low/Middle/High
AC Power Line Conducted Emissions	IEEE 802.11b	1Mbps	Low/Middle/High
	IEEE 802.11g	6Mbps	Low/Middle/High
	IEEE 802.11n HT20	MCS0	Low/Middle/High

Note:

1. In radiated measurement,the EUT had been pre-scan on the positioned of each 3 axis(X,Y,Z), the worst case was found when positioned on **X-plane.**

2.7. Power Setting of Test Software

Software Name	ESP_RF_test_tool_v2.5		
Frequency(MHz)	2412	2437	2462
IEEE 802.11b Setting	Default	Default	Default
IEEE 802.11g Setting	Default	Default	Default
IEEE 802.11n HT20 Setting	Default	Default	Default

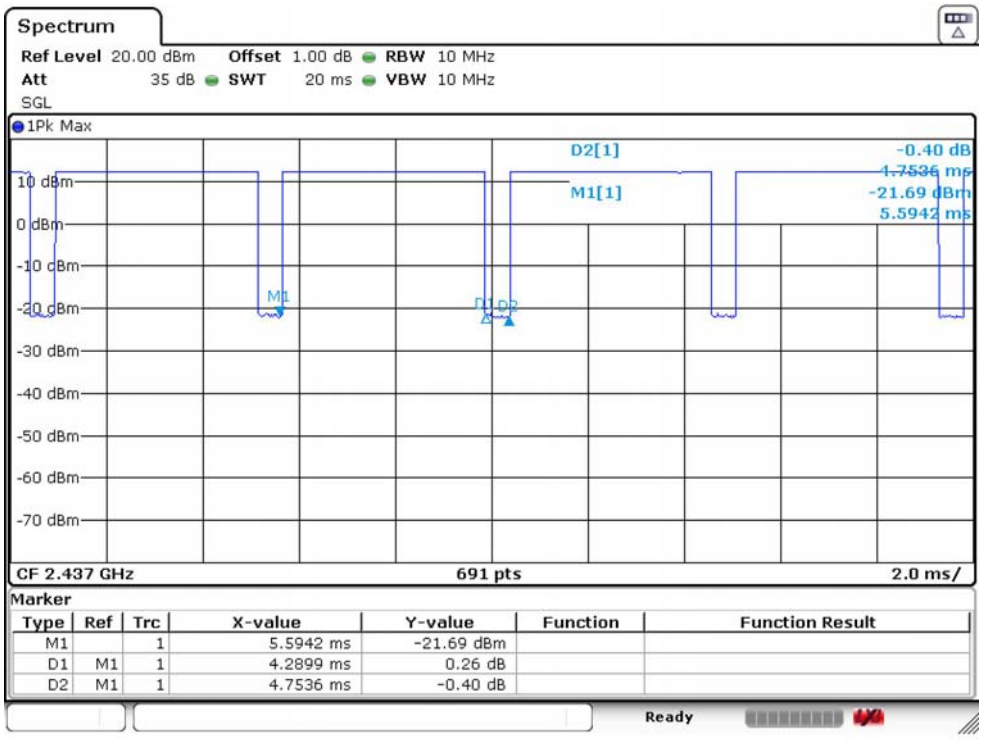
2.8. Duty Cycle

Temperature	21.5℃	Relative Humidity	48%	Test Voltage	AC 120V/60Hz
Mode	Fre(MHz)	On time(ms)	Total Time(ms)	Duty Cycle	Duty Factor
IEEE 802.11b	2437	4.2899	4.7536	90.25	0.45
IEEE 802.11g	2437	0.7015	0.7942	88.32	0.54
IEEE 802.11n HT20	2437	0.6667	0.7594	87.79	0.57

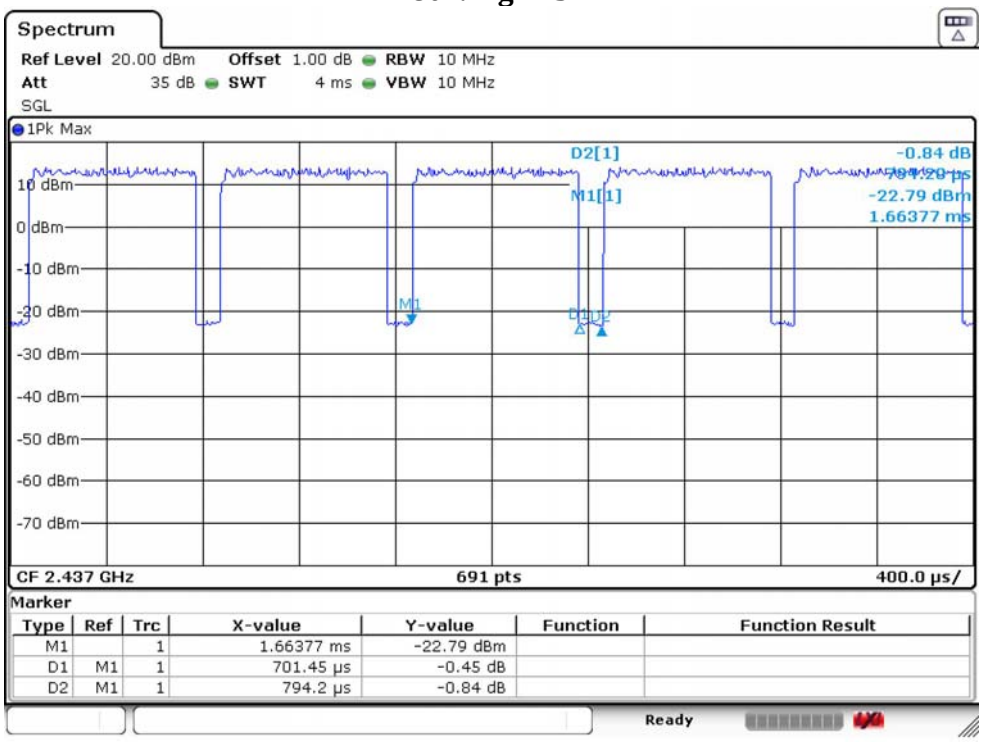
Note:

1. If duty cycle <98 %, the conducted average output power and average power spectral density should be add duty factor.
2. If duty cycle≥98 %,the EUT is consider to be transmitting continuously,the conducted average output power and average power spectral density no need to add duty factor(consider to be zero).
3. The conducted peak output power and peak power spectral density no need to consider duty factor.
4. The on-time time is transmission duration(T).

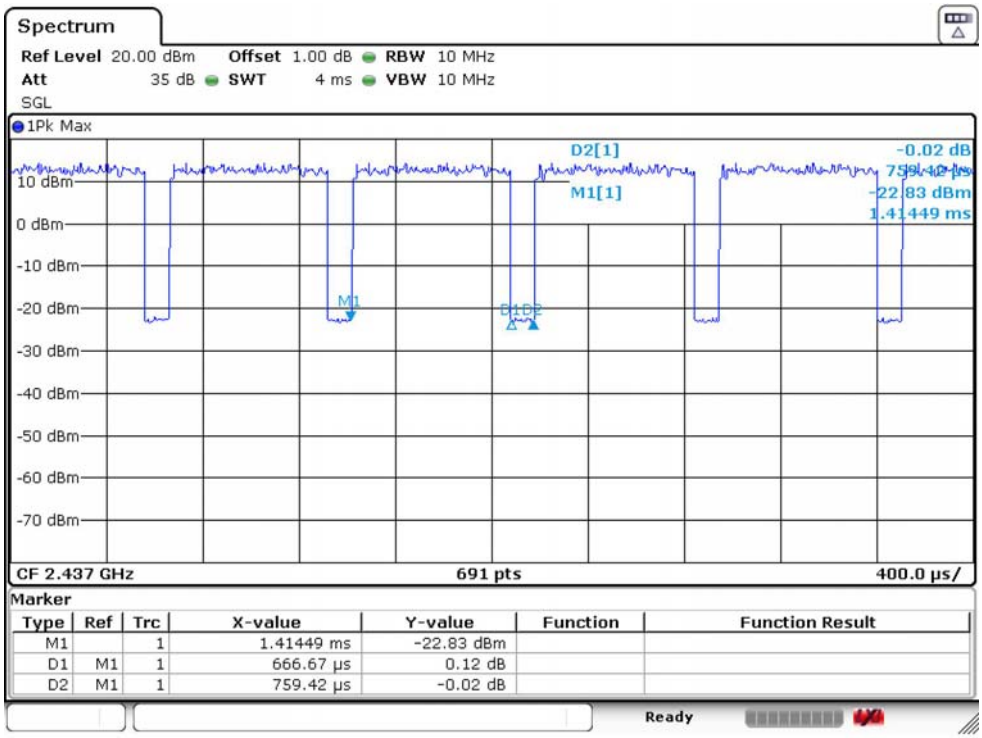
IEEE 802.11b 2437MHz



IEEE 802.11g 2437MHz



IEEE 802.11n HT20 2437MHz



2.9. Channel List

IEEE 802.11b/802.11g/802.11n HT20					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	6	2437	11	2462
2	2417	7	2442		
3	2422	8	2447		
4	2427	9	2452		
5	2432	10	2457		
IEEE 802.11n HT40					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	6	2437	9	2452
4	2427	7	2442		
5	2432	8	2447		

2.10. Test Equipment List

For conducted emission test						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESHS30	EST-E001	LISAI	June 13,20	1 Year
Artificial Mains Network	Rohde & Schwarz	ENV216	EST-E002	LISAI	June 13,20	1 Year
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	EST-E078	LISAI	June 13,20	1 Year
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A

For radiated emission test(9kHz-30MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESR7	EST-E047	LISAI	June 13,20	1 Year
Active Loop Antenna	SCHWAREB ECK	FMZB 1519B	EST-E054	LISAI	June 13,20	1 Year
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A
9kHz-30MHz Cable	N/A	EST-001	N/A	N/A	N/A	N/A

For radiated emissions test (30MHz-1000MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESR7	EST-E047	LISAI	June 13,20	1 Year
Bilog Antenna	Teseq	CBL 6111D	EST-E034	LISAI	June 13,20	1 Year
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A
30-1000MHz Cable	N/A	EST-002	N/A	N/A	N/A	N/A

For radiated emission test(Above 1000MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
Horn Antenna	SCHWARZB ECK	BBHA9120D	EST-E031	LISAI	June 13,20	1 Year
Signal Amplifier	SCHWARZB ECK	BBV9718	EST-E032	LISAI	June 13,20	1 Year
Spectrum Analyzer	Rohde &Schwarz	FSV40	EST-E069	LISAI	June 13,20	1 Year
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A
Above 1GHz Cable	N/A	EST-003	N/A	N/A	N/A	N/A

For connect EUT antenna terminal test						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
Spectrum Analyzer	Rohde&Schwarz	FSV40	EST-E069	LISAI	June 13,20	1 Year

3. 6DB BANDWIDTH

3.1. Limit

Systems using digital modulation techniques operate in the 2400-2483.5 MHz,the minimum 6 dB bandwidth shall be at least 500 kHz.

3.2. Test Setup

3.3. Spectrum Analyzer Setting

6dB Bandwidth

Spectrum Parameters	Setting
RBW	100KHz
VBW	300KHz
Span	40MHz(20MHz Bandwidth mode)/80MHz(40MHz Bandwidth mode)
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

99% Occupied Bandwidth

Spectrum Parameters	Setting
RBW	300KHz(20MHz Bandwidth mode)/1MHz(40MHz Bandwidth mode)
VBW	1MHz(20MHz Bandwidth mode)/3MHz(40MHz Bandwidth mode)
Span	40MHz(20MHz Bandwidth mode)/80MHz(40MHz Bandwidth mode)
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

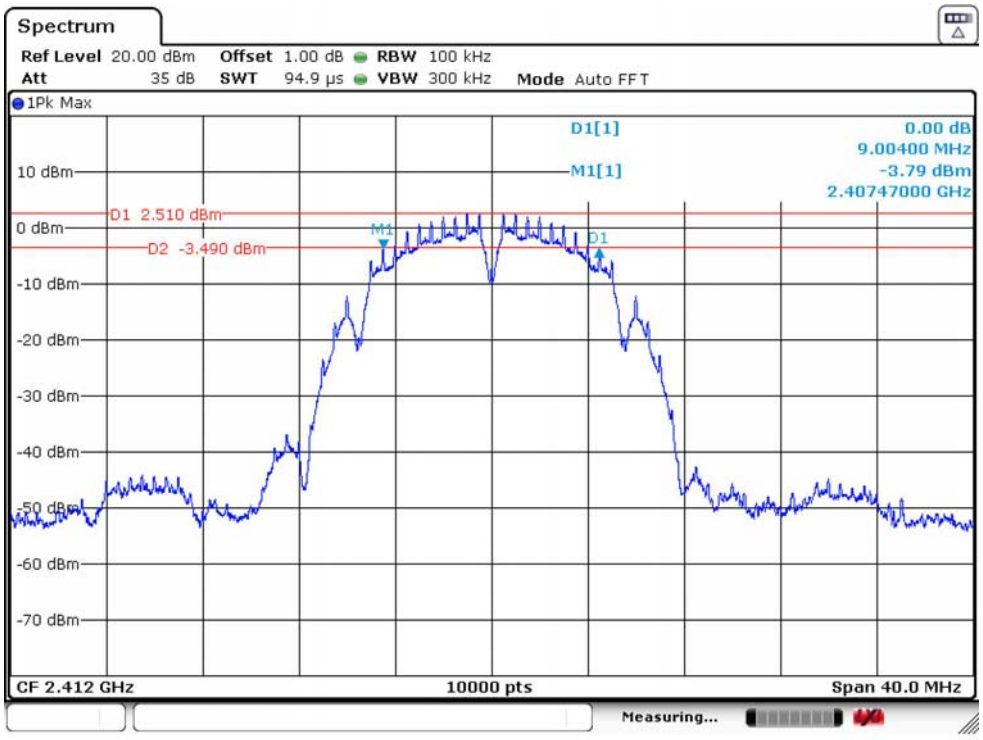
3.4. Test Procedure

a. Connect EUT antenna terminal to the spectrum analyzer with RF cable.
b. Spectrum analyzer setting parameters in accordance with section 3.3.
c. Set the EUT transmit continuously with maximum output power.
d. Allow trace to stabilize, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.
e. Repeat above procedures until all modes and channels were measured.
f. Record the results in the test report.

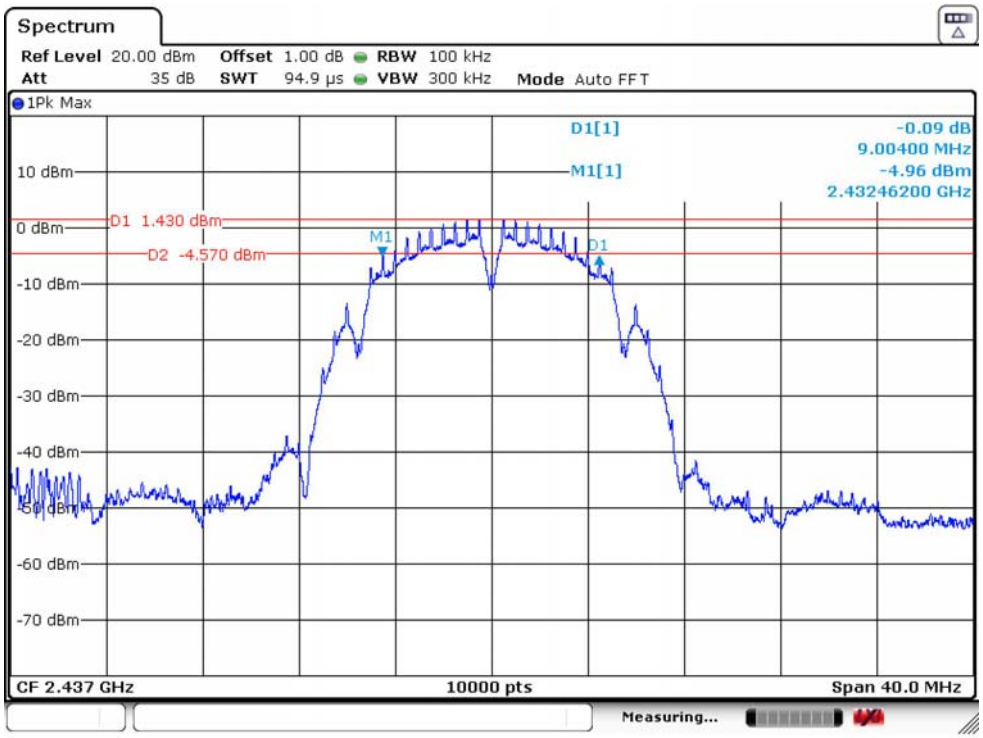
3.5. Test Result

Temperature	21.5℃	Relative Humidity	48%	
Test Voltage	AC 120V/60Hz			
Mode	Freq (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
IEEE 802.11b	2412	9.004	⩾0.5	PASS
	2437	9.004	⩾0.5	PASS
	2462	9.004	⩾0.5	PASS
IEEE 802.11g	2412	16.032	⩾0.5	PASS
	2437	16.252	⩾0.5	PASS
	2462	16.244	⩾0.5	PASS
IEEE 802.11n HT20	2412	16.252	⩾0.5	PASS
	2437	16.240	⩾0.5	PASS
	2462	16.268	⩾0.5	PASS

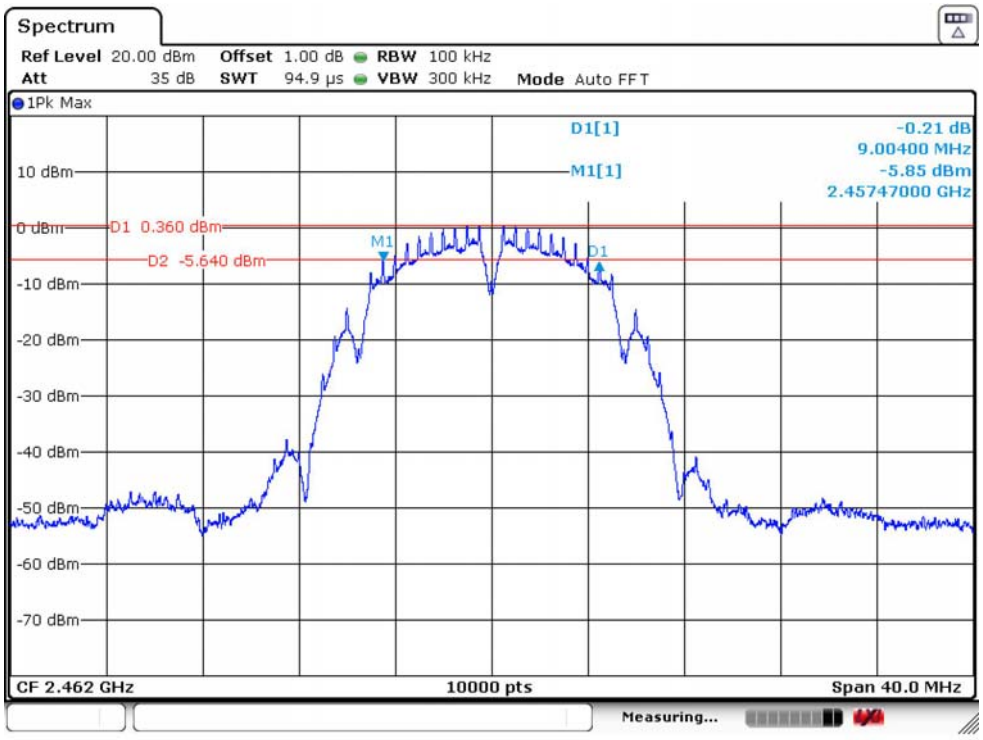
IEEE 802.11b 2412MHz



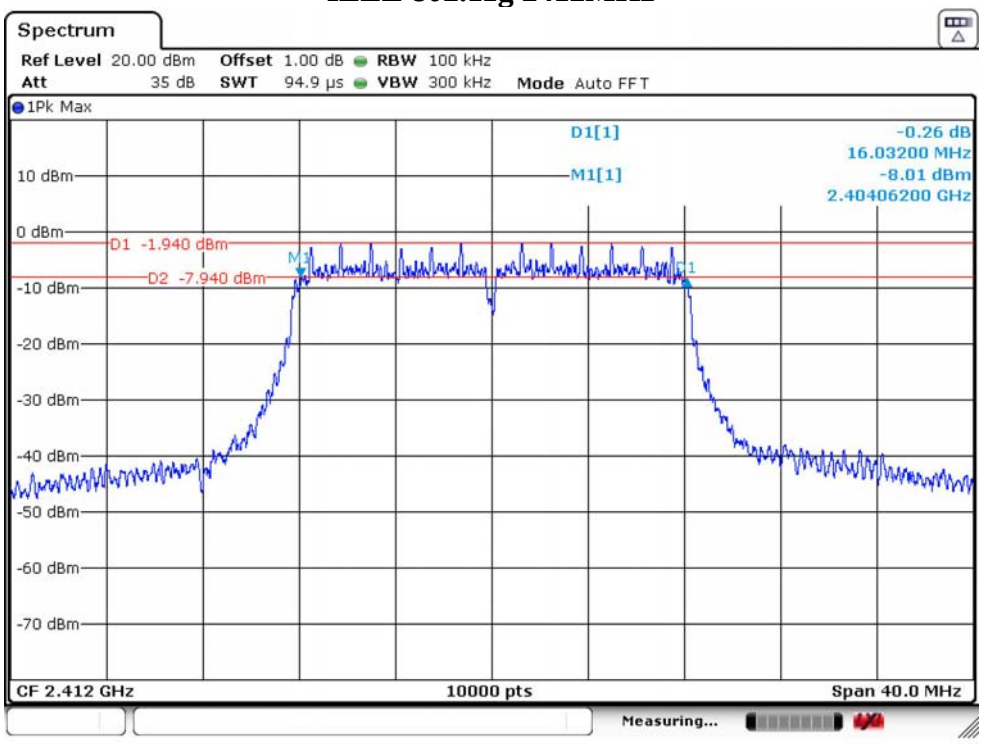
IEEE 802.11b 2437MHz



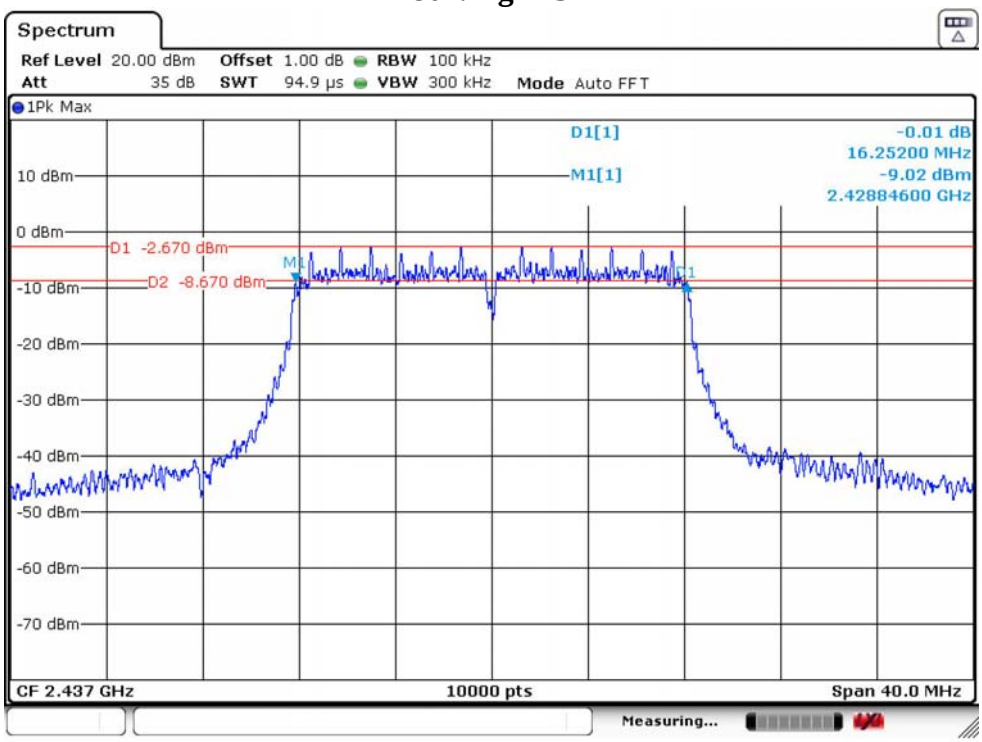
IEEE 802.11b 2462MHz



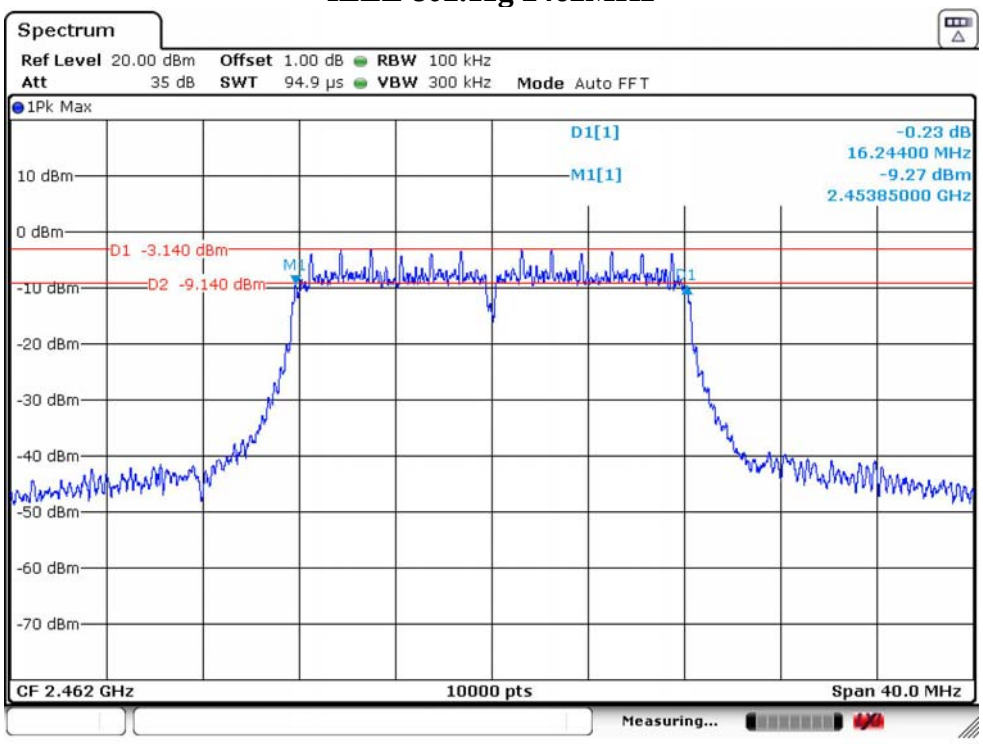
IEEE 802.11g 2412MHz



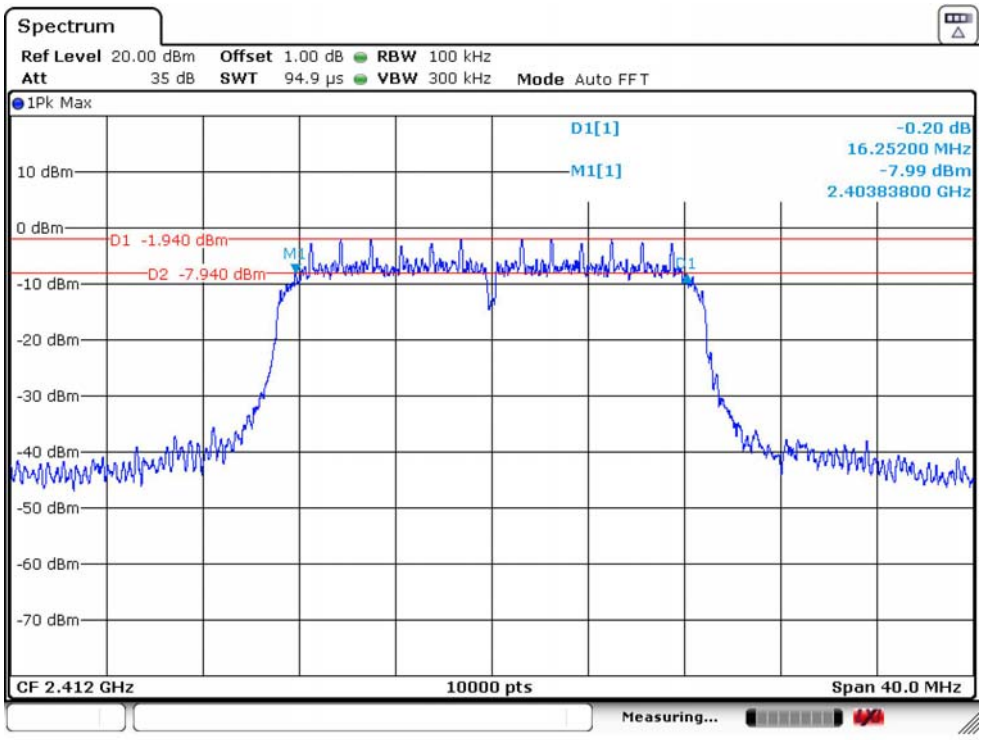
IEEE 802.11g 2437MHz



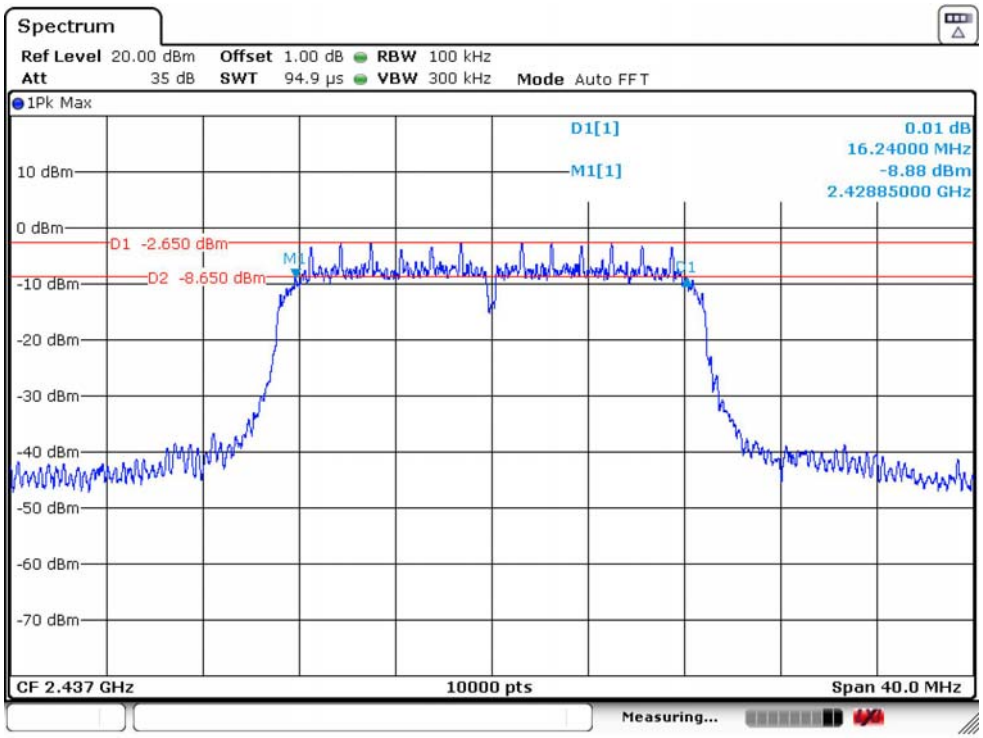
IEEE 802.11g 2462MHz



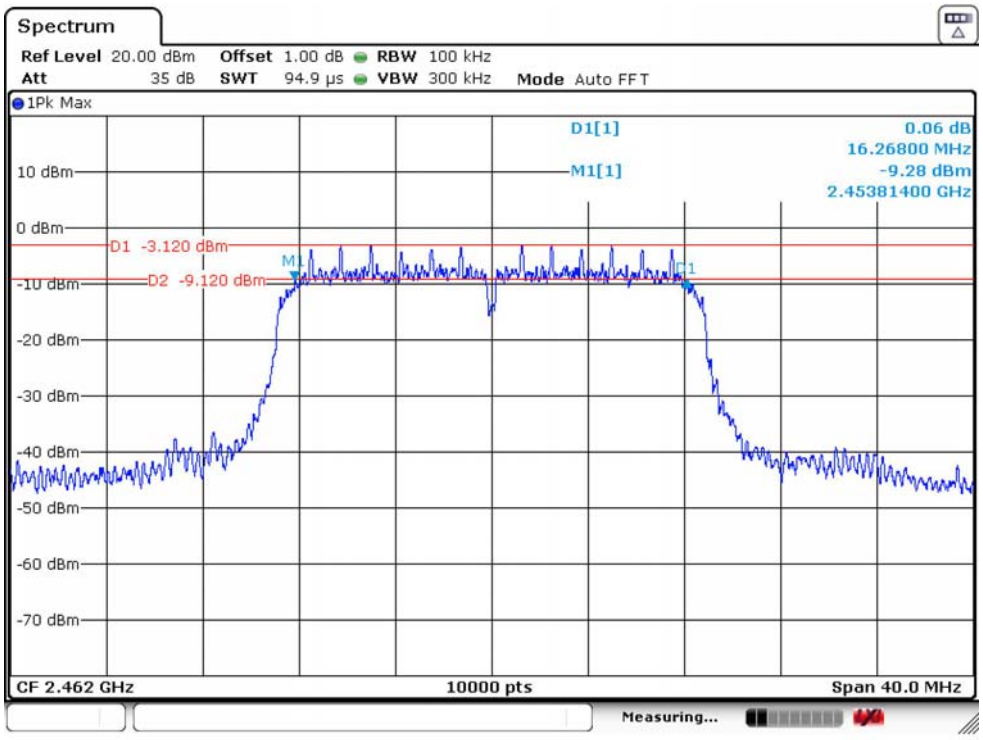
IEEE 802.11n HT20 2412MHz



IEEE 802.11n HT20 2437MHz



IEEE 802.11n HT20 2462MHz

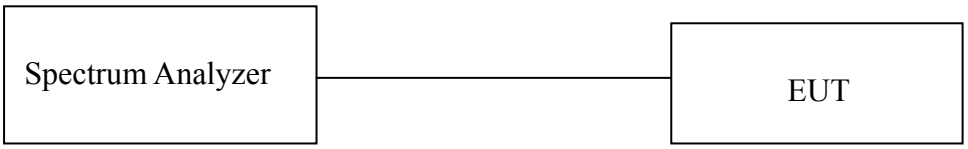


4. MAXIMUM PEAK OUTPUT POWER

4.1. Limit

For systems using digital modulation in 2400-2483.5MHz,the maximum peak output power is 1 Watt(30dBm).

4.2. Test Setup



4.3. Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	1MHz
VBW	3MHz
Span	40MHz(20MHz Bandwidth mode)/80MHz(40MHz Bandwidth mode)
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

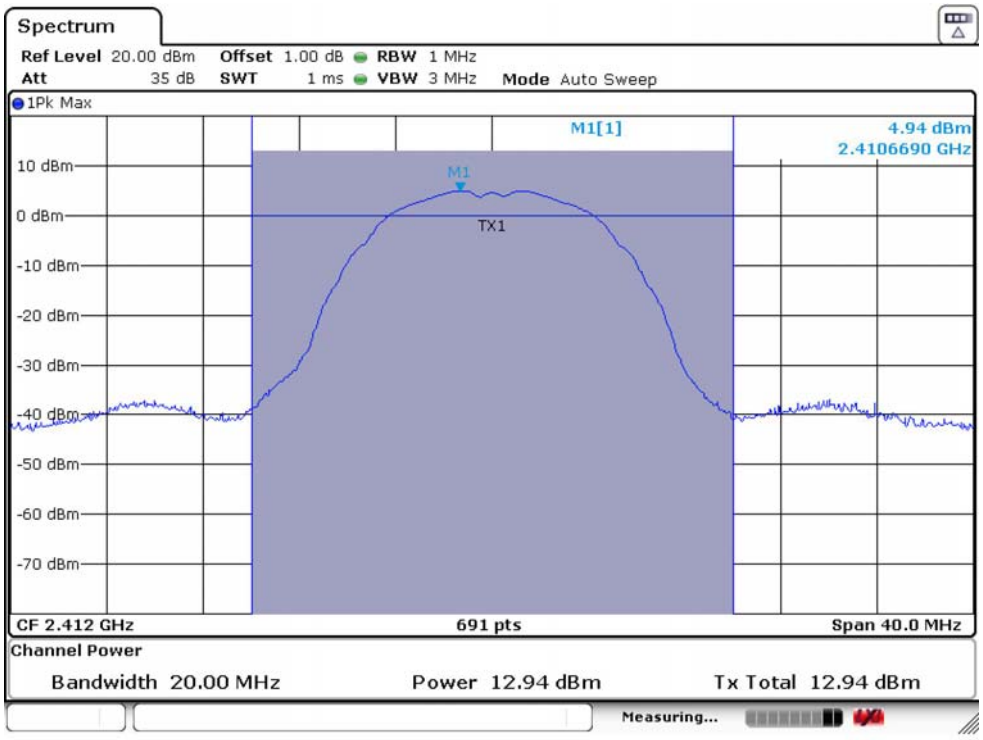
4.4. Test Procedure

a. Connect EUT antenna terminal to the spectrum analyzer with RF cable.
b. Spectrum analyzer setting parameters in accordance with section 4.3.
c. Set the EUT transmit continuously with maximum output power.
d. Use the channel power function to measure maximum peak output power, allow trace to stabilize, save test pictures.
e. Repeat above procedures until all modes and channels were measured.
f. Record the results in the test report.

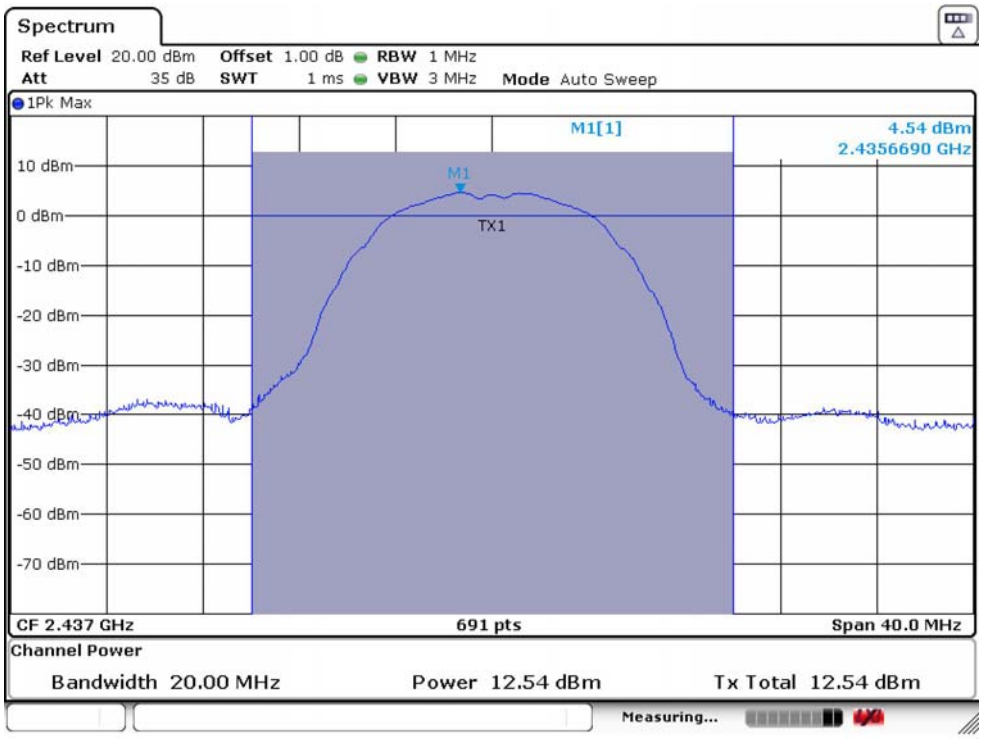
4.5. Test Result

Temperature	21.5℃	Relative Humidity	48%	Test Voltage		AC 120V/60Hz
Mode	Freq (MHz)	Peak Output Power		Limit		Result
		dBm	W	dBm	W	
IEEE 802.11b	2412	12.94	0.0197	30.00	1.0000	PASS
	2437	12.54	0.0179	30.00	1.0000	PASS
	2462	11.91	0.0155	30.00	1.0000	PASS
IEEE 802.11g	2412	17.54	0.0568	30.00	1.0000	PASS
	2437	17.01	0.0502	30.00	1.0000	PASS
	2462	16.36	0.0433	30.00	1.0000	PASS
IEEE 802.11n HT20	2412	17.48	0.0560	30.00	1.0000	PASS
	2437	16.90	0.0490	30.00	1.0000	PASS
	2462	16.35	0.0432	30.00	1.0000	PASS

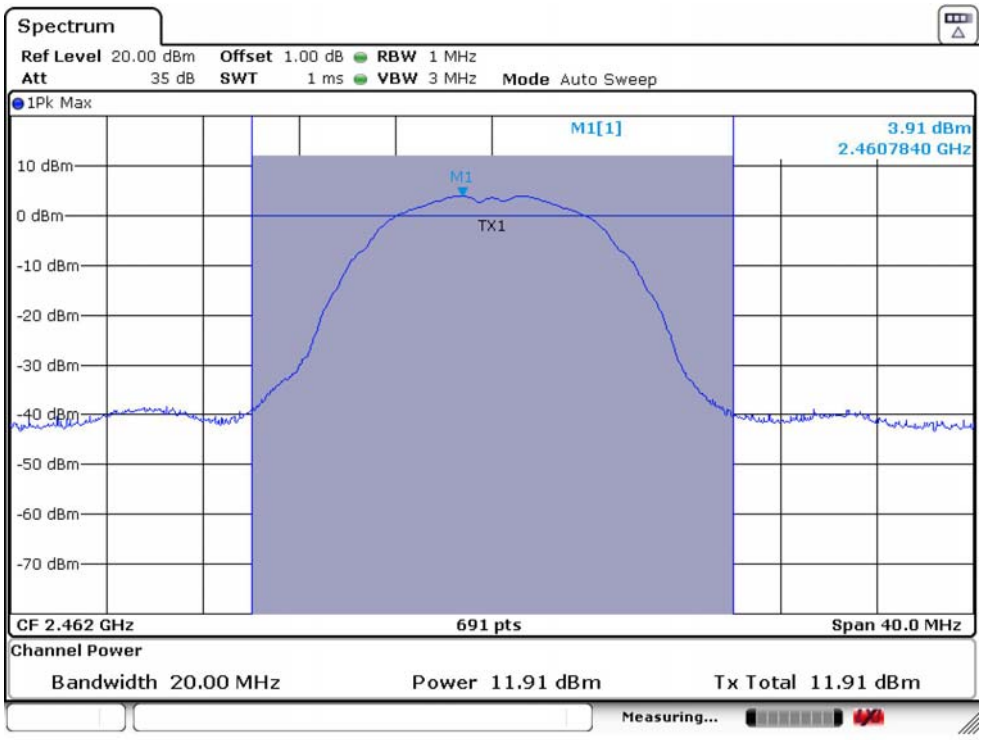
IEEE 802.11b 2412MHz



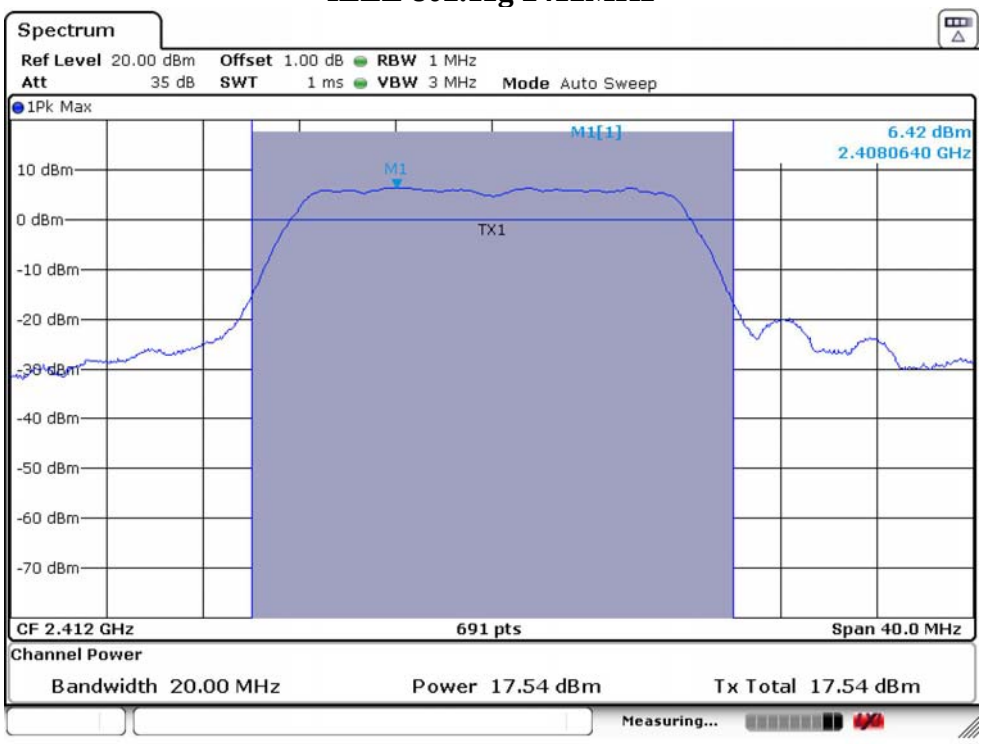
IEEE 802.11b 2437MHz



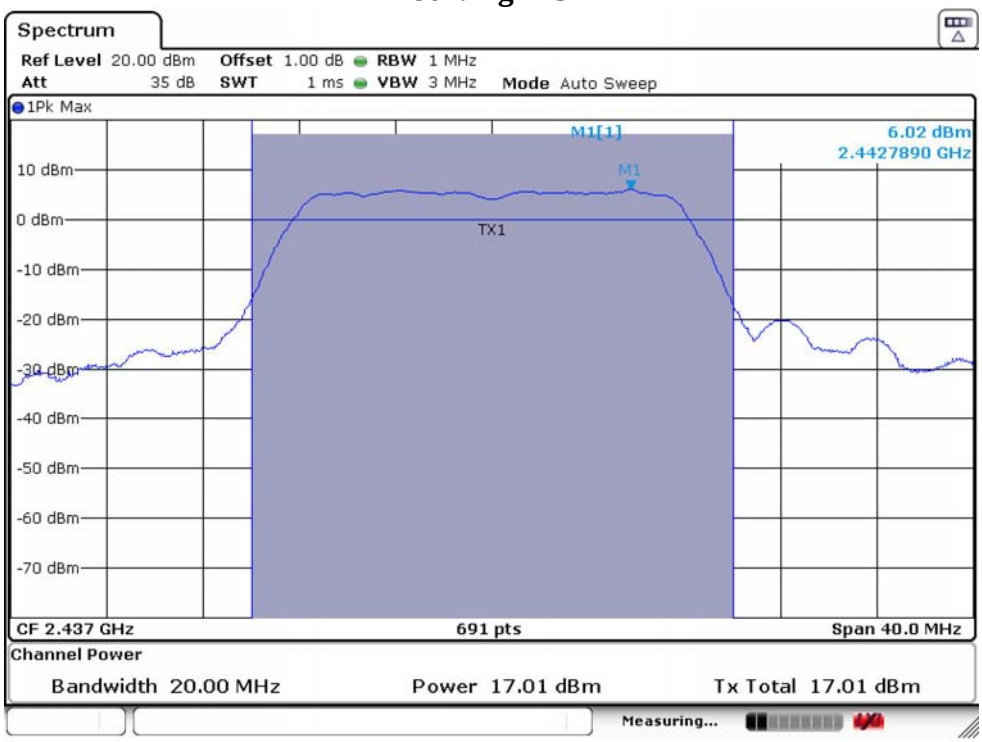
IEEE 802.11b 2462MHz



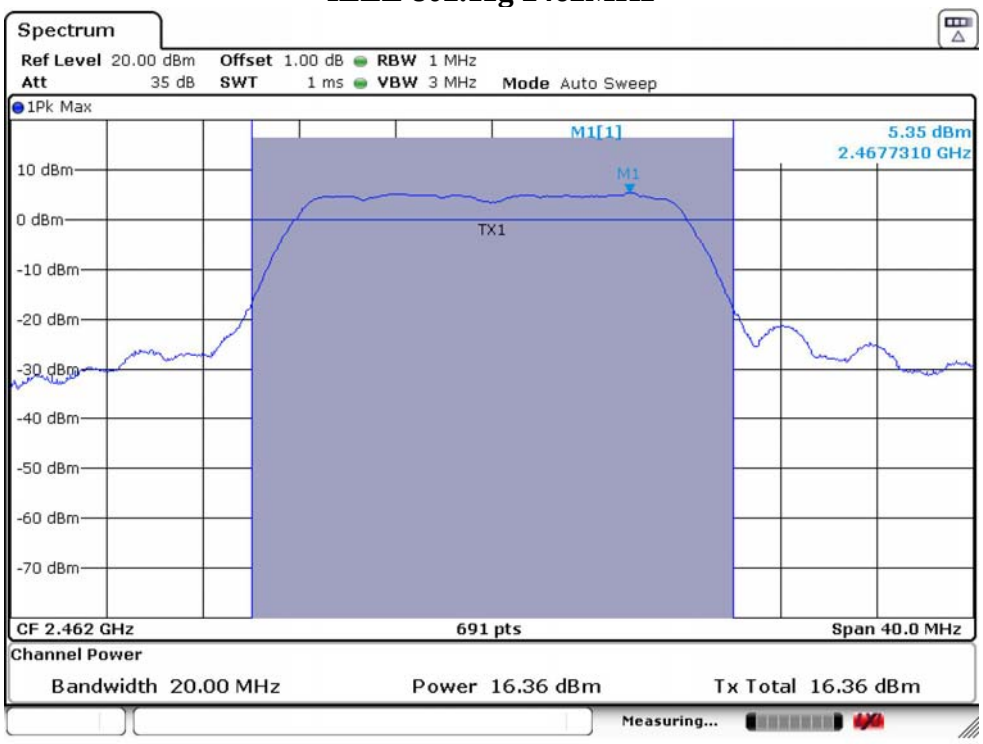
IEEE 802.11g 2412MHz



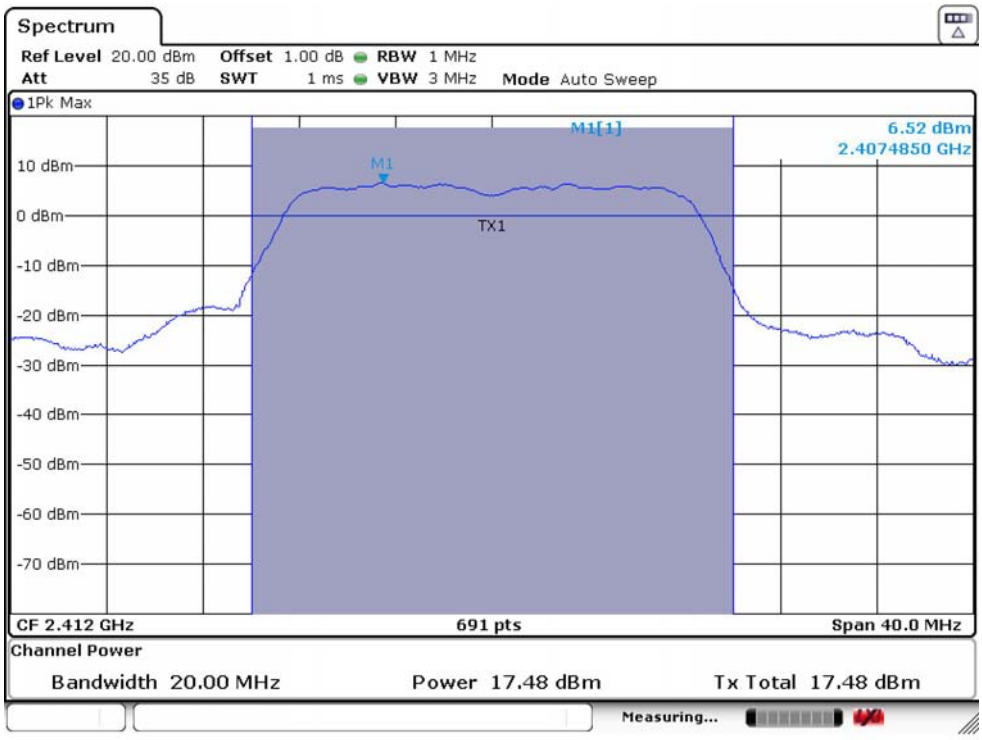
IEEE 802.11g 2437MHz



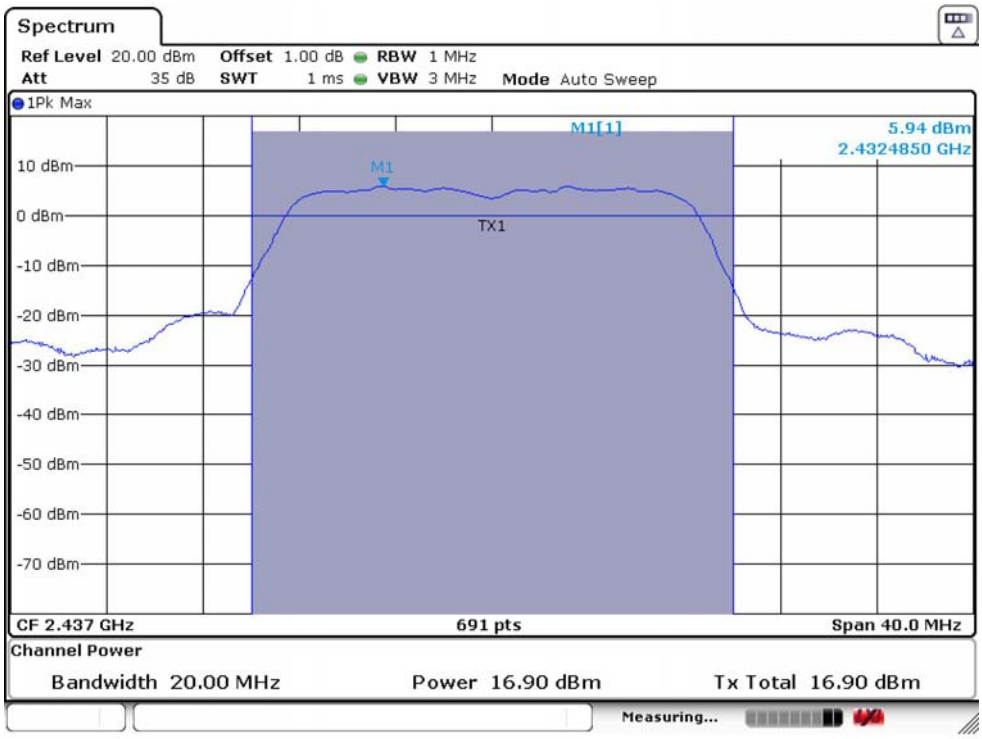
IEEE 802.11g 2462MHz



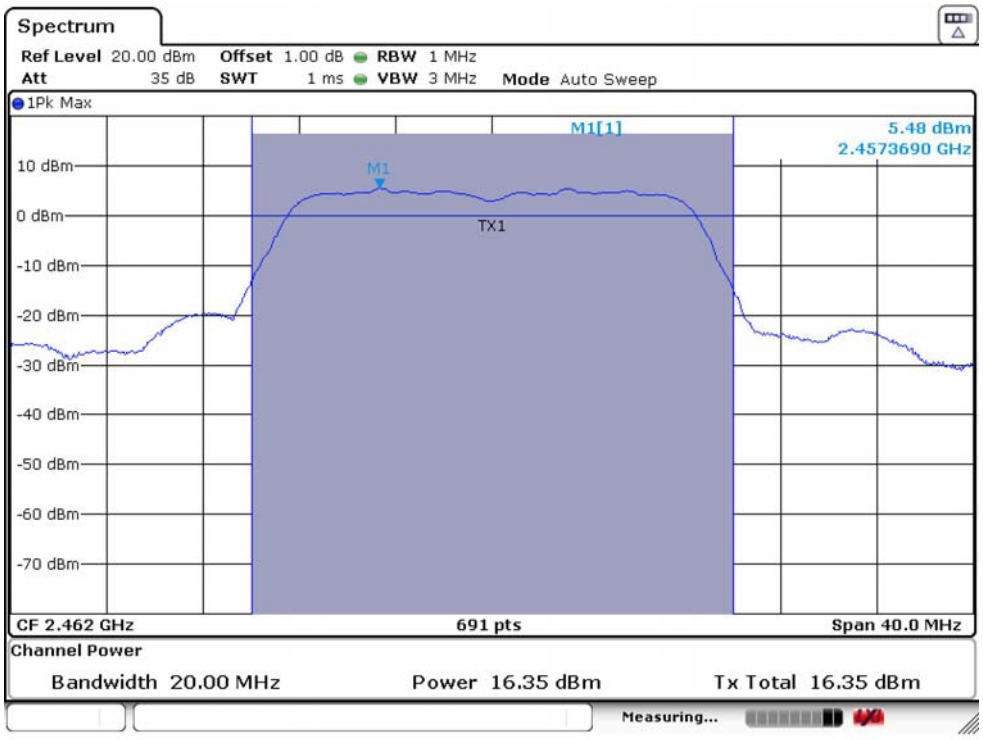
IEEE 802.11n HT20 2412MHz



IEEE 802.11n HT20 2437MHz



IEEE 802.11n HT20 2462MHz

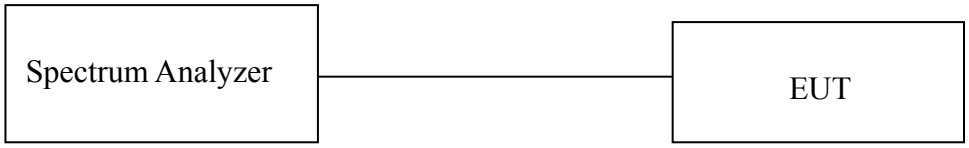


5. POWER SPECTRAL DENSITY

5.1. Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

5.2. Test Setup



5.3. Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	3KHz
VBW	10KHz
Span	30MHz(20MHz Bandwidth mode)/60MHz(40MHz Bandwidth mode)
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

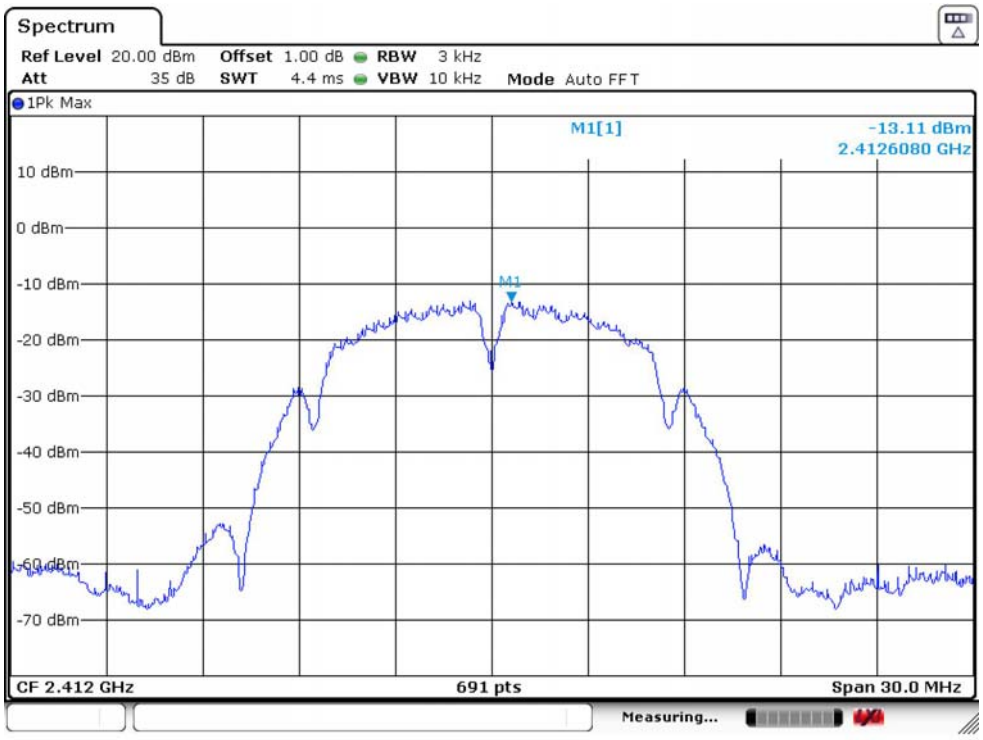
5.4. Test Procedure

a. Connect EUT antenna terminal to the spectrum analyzer with RF cable.
b. Spectrum analyzer setting parameters in accordance with section 5.3.
c. Set the EUT transmit continuously with maximum output power.
d. Allow trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission.
e. Repeat above procedures until all modes and channels were measured.
f. Record the results in the test report.

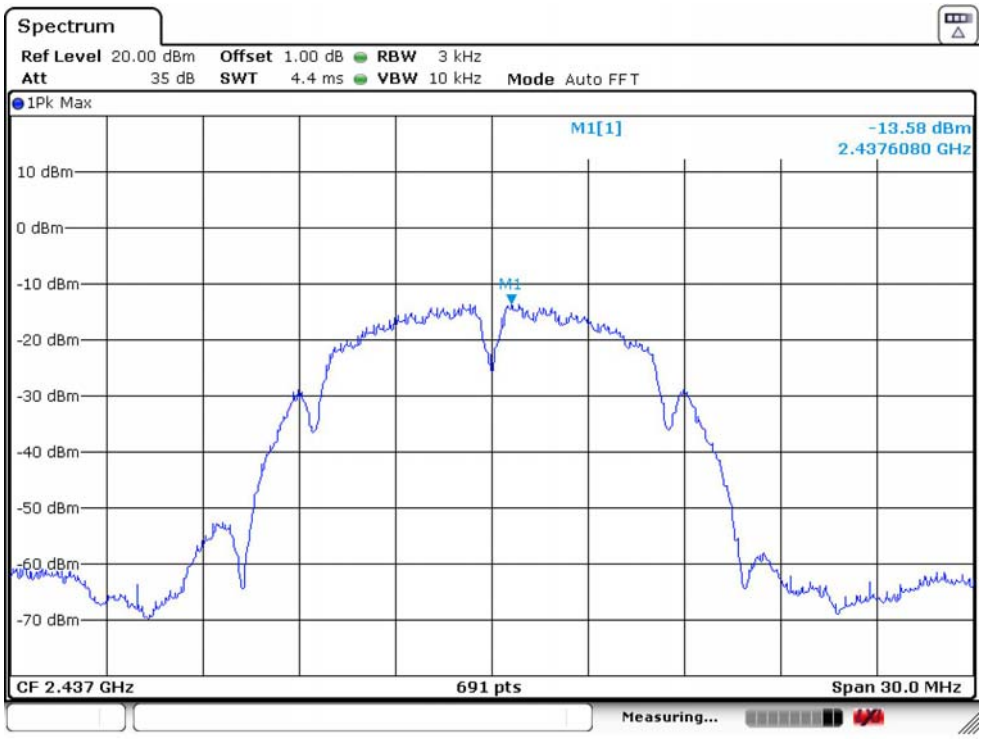
5.5. Test Result

Temperature	21.5℃	Relative Humidity	48%	Test Voltage	AC 120V/60Hz
Mode	Freq (MHz)	Power Density (dBm/3KHz)		Limit (dBm/3KHz)	Result
IEEE 802.11b	2412	-13.11		8.00	PASS
	2437	-13.58		8.00	PASS
	2462	-14.25		8.00	PASS
IEEE 802.11g	2412	-15.58		8.00	PASS
	2437	-16.22		8.00	PASS
	2462	-16.79		8.00	PASS
IEEE 802.11n HT20	2412	-15.80		8.00	PASS
	2437	-16.45		8.00	PASS
	2462	-17.06		8.00	PASS

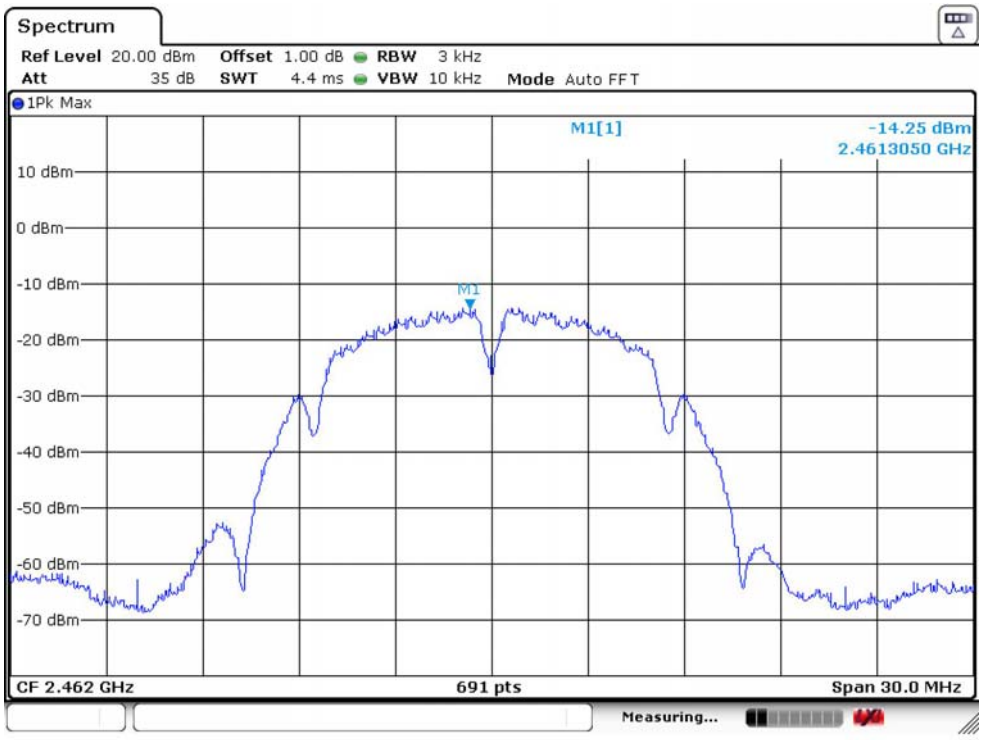
IEEE 802.11b 2412MHz



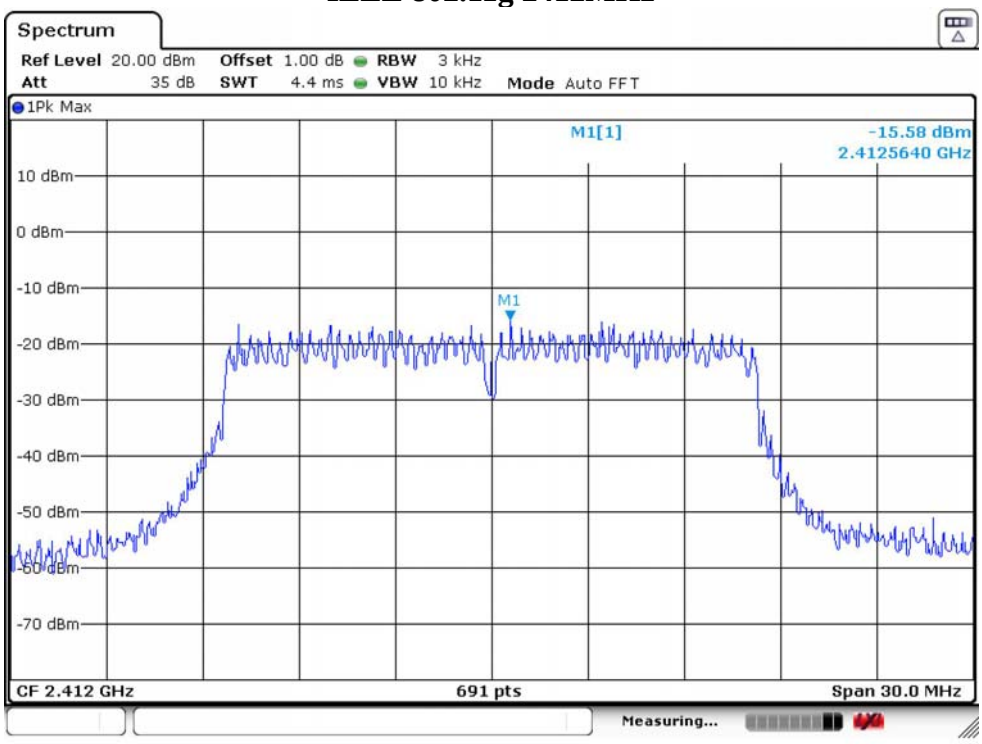
IEEE 802.11b 2437MHz



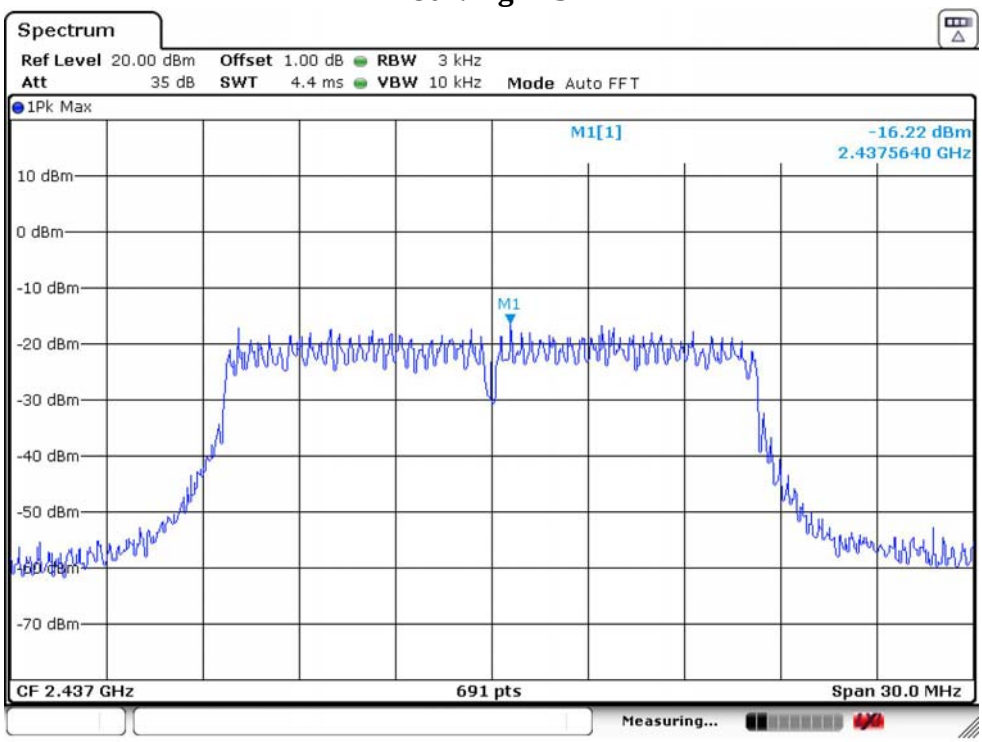
IEEE 802.11b 2462MHz



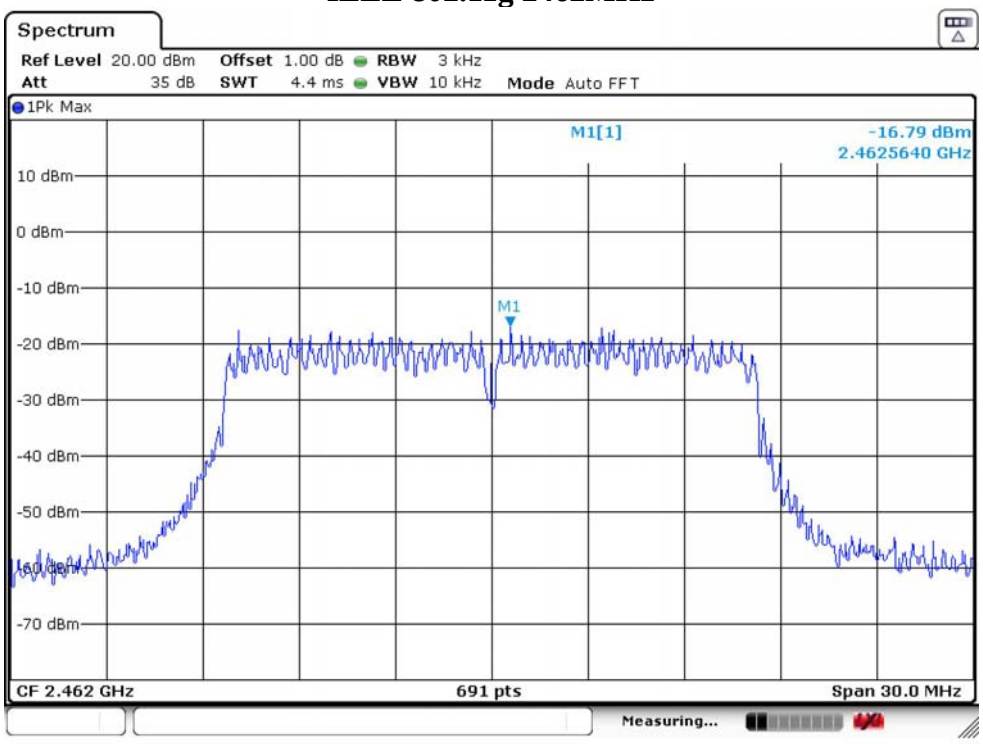
IEEE 802.11g 2412MHz



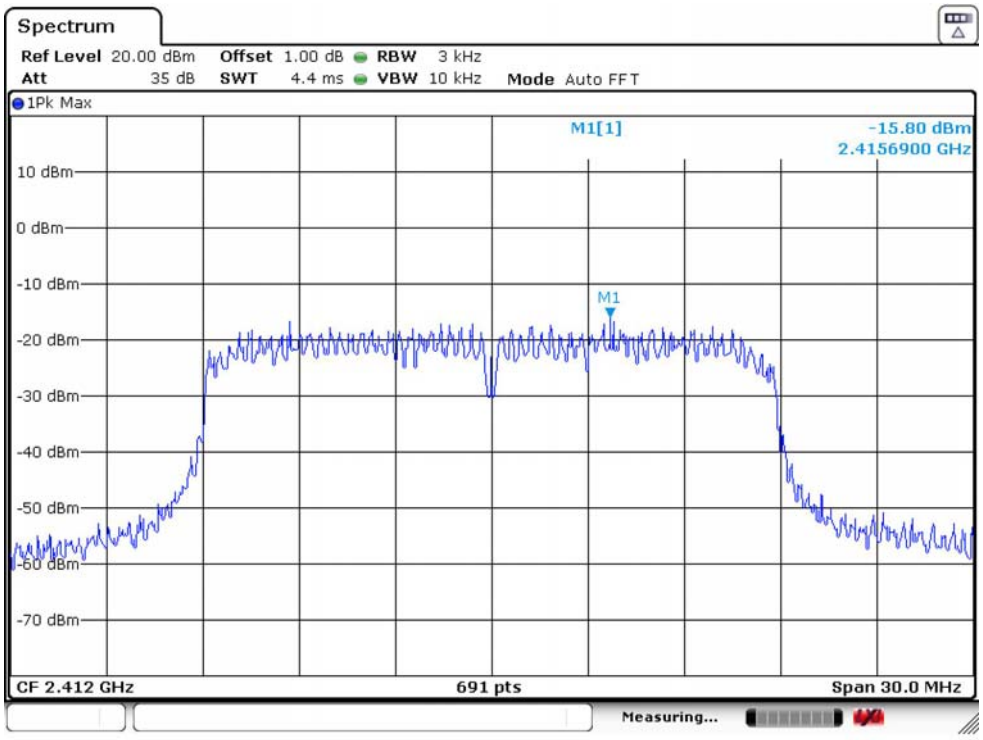
IEEE 802.11g 2437MHz



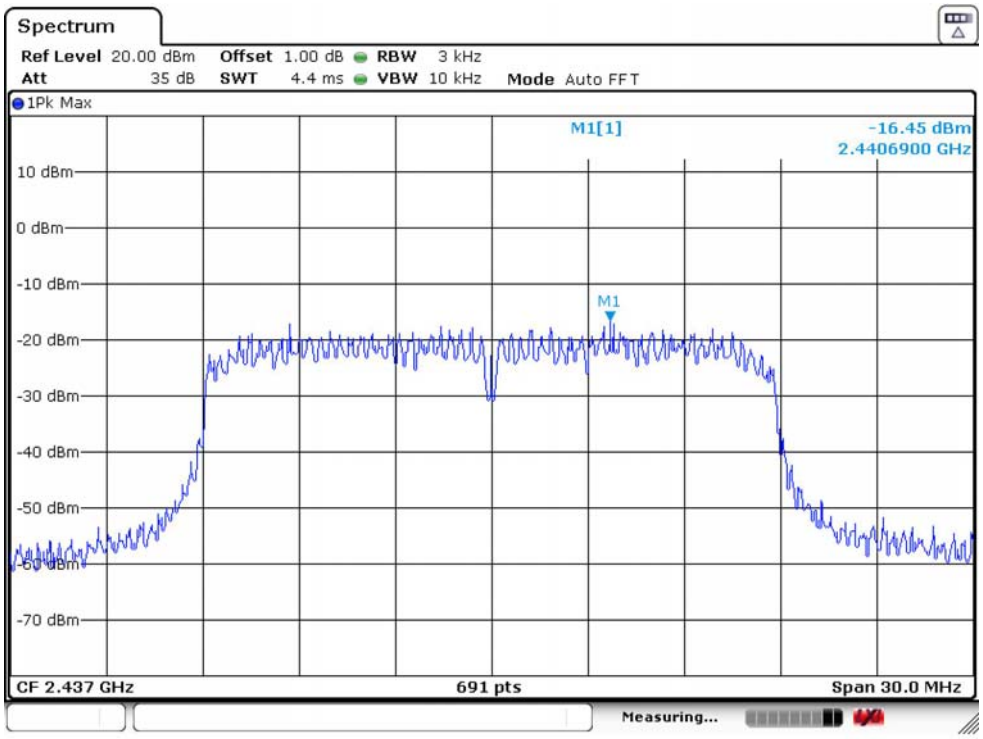
IEEE 802.11g 2462MHz



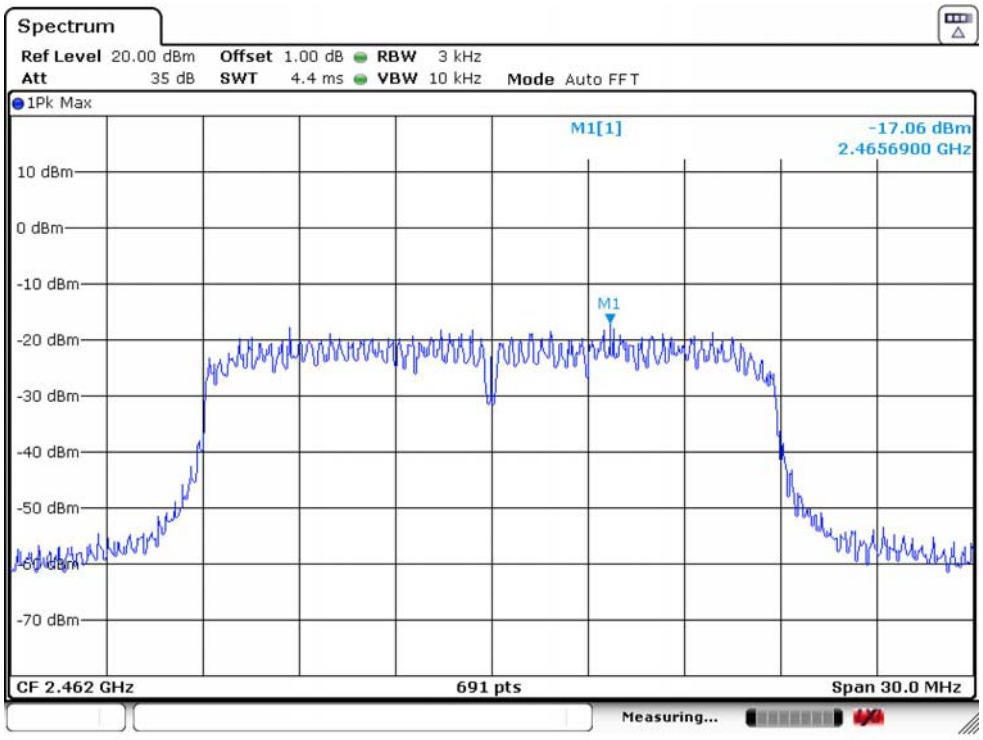
IEEE 802.11n HT20 2412MHz



IEEE 802.11n HT20 2437MHz



IEEE 802.11n HT20 2462MHz

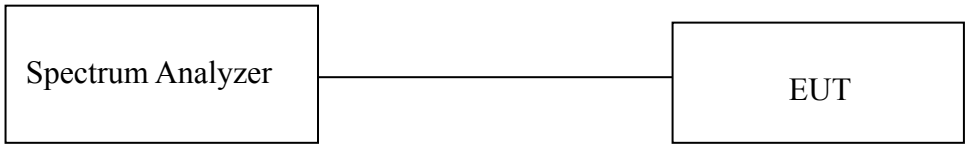


6. CONDUCTED BAND EDGE

6.1. Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

6.2. Test Setup



6.3. Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	100KHz
VBW	300KHz
Span	100MHz(20MHz Bandwidth mode)/200MHz(40MHz Bandwidth mode)
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

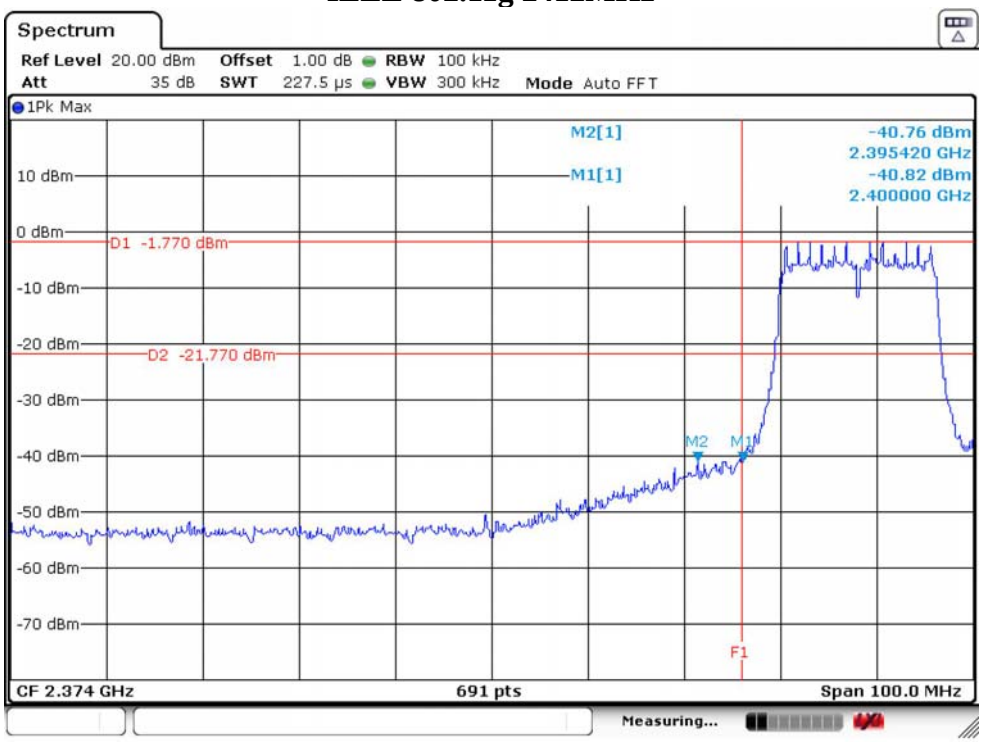
6.4. Test Procedure

a. Connect EUT antenna terminal to the spectrum analyzer with RF cable.
b. Spectrum analyzer setting parameters in accordance with section 6.3.
c. Set the EUT transmit continuously with maximum output power.
d. Allow trace to stabilize, use the marker function to mark the highest emission level outside the authorized band.
e. Repeat above procedures until all modes and channels were measured.
f. Record the results in the test report.
g. IEEE 802.11b, IEEE 802.11g, IEEE 802. 11nH20 all have been tested, only worse case 802.11g is reported.

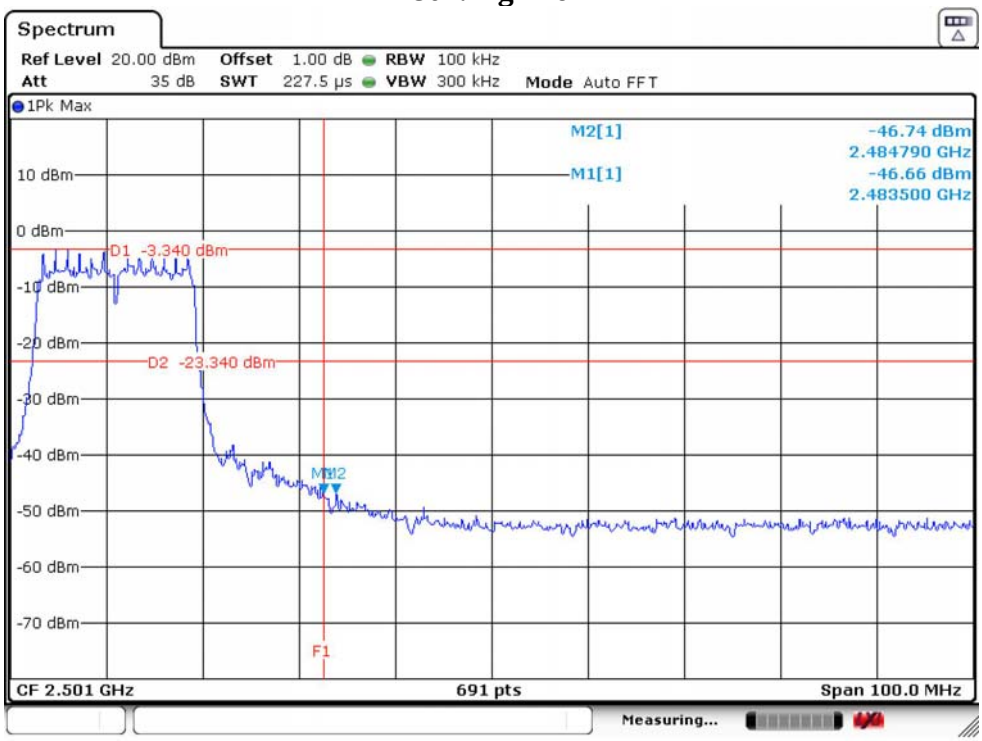
6.5. Test Result

Temperature	21.5℃	Relative Humidity	48%	Test Voltage	AC 120V/60Hz
Result	PASS				

IEEE 802.11g 2412MHz



IEEE 802.11g 2462MHz

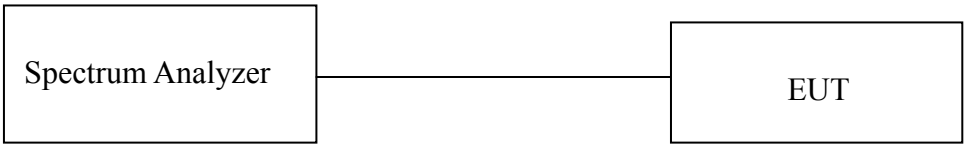


7. CONDUCTED SPURIOUS EMISSIONS

7.1. Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

7.2. Test Setup



7.3. Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	100KHz
VBW	300KHz
Start frequency	30MHz
Stop frequency	25GHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

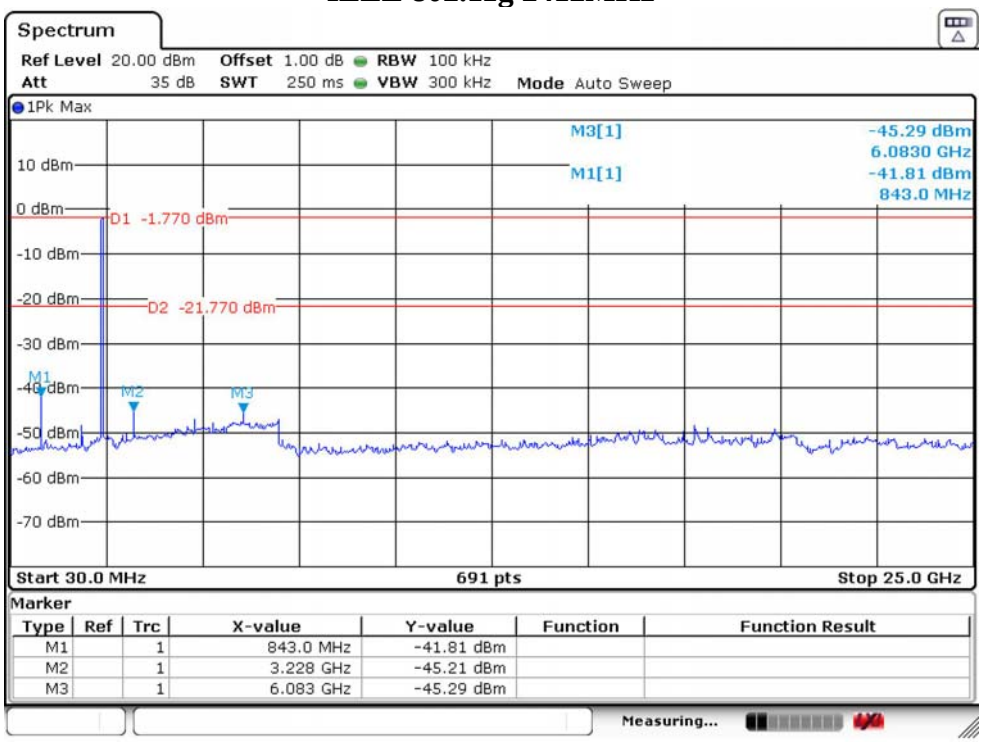
7.4. Test Procedure

a. Connect EUT antenna terminal to the spectrum analyzer with RF cable.
b. Spectrum analyzer setting parameters in accordance with section 7.3.
c. Set the EUT transmit continuously with maximum output power.
d. Allow trace to stabilize, use the marker function to mark the highest emission level outside the authorized band.
e. Repeat above procedures until all modes and channels were measured.
f. Record the results in the test report.
g. IEEE 802.11b, IEEE 802.11g, IEEE 802. 11nH20 all have been tested, only worse case 802.11g is reported.

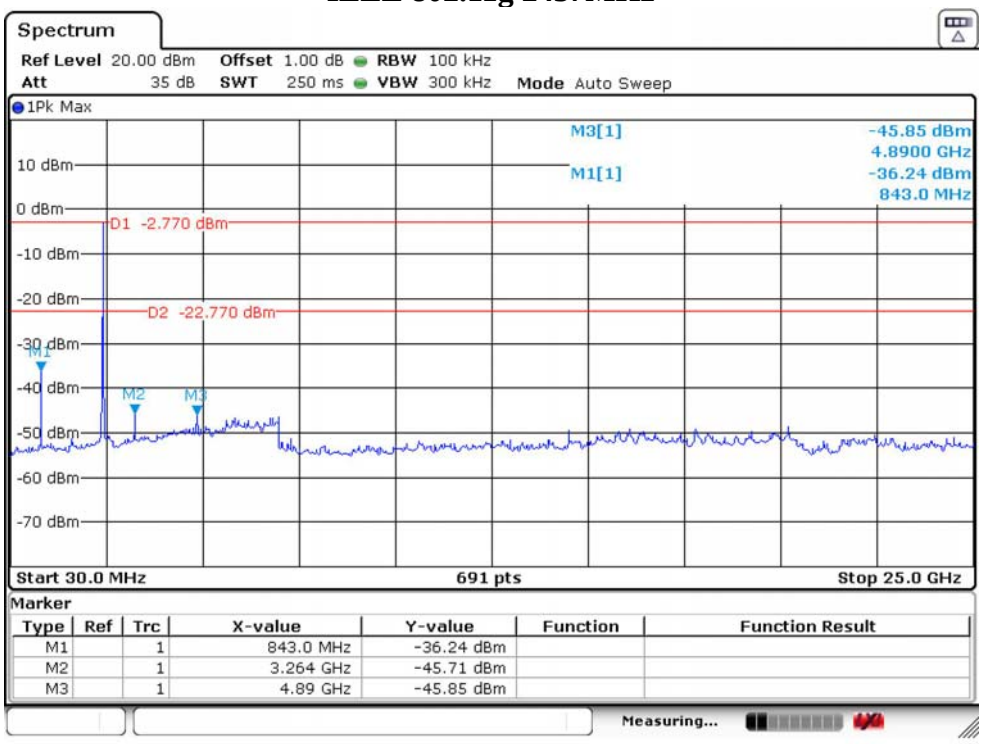
7.5. Test Result

Temperature	21.5℃	Relative Humidity	48%	Test Voltage	AC 120V/60Hz
Result	PASS				

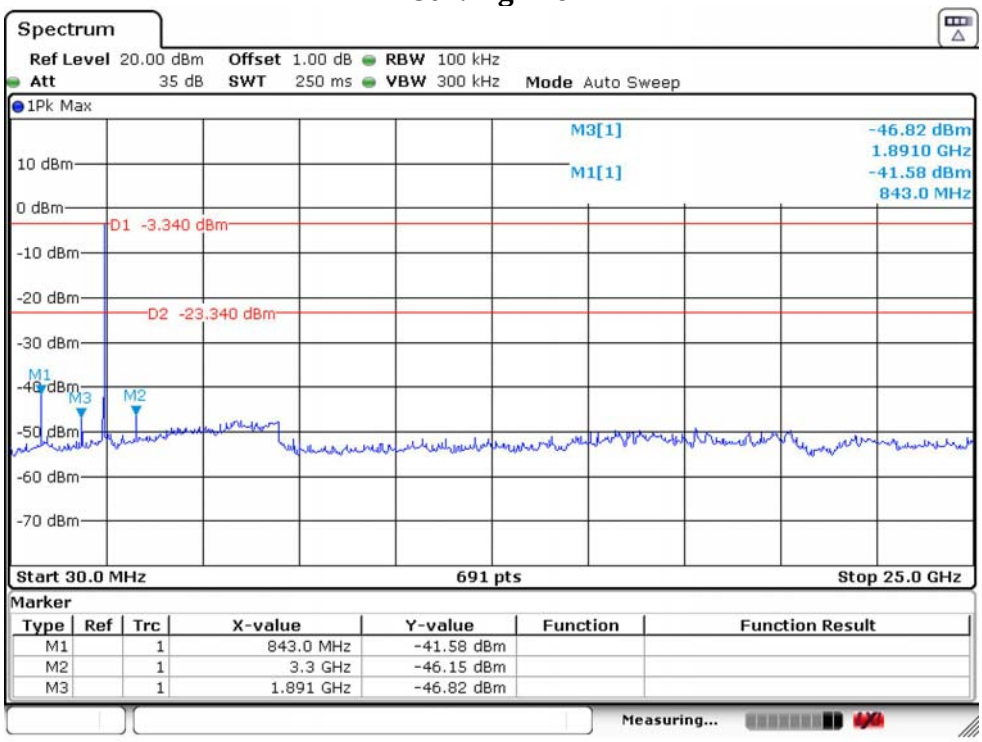
IEEE 802.11g 2412MHz



IEEE 802.11g 2437MHz



IEEE 802.11g 2462MHz



8. RADIATED SPURIOUS EMISSIONS AND BAND EDGE

8.1. Limit

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

15.205 Restricted frequency band

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])

15.209 Limit

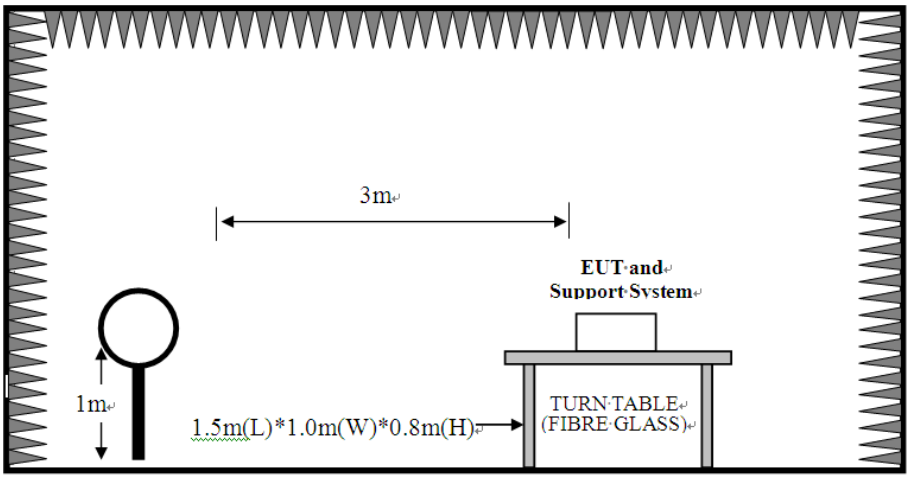
Frequency (MHz)	Field Strength(μV/m)	Distance(m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

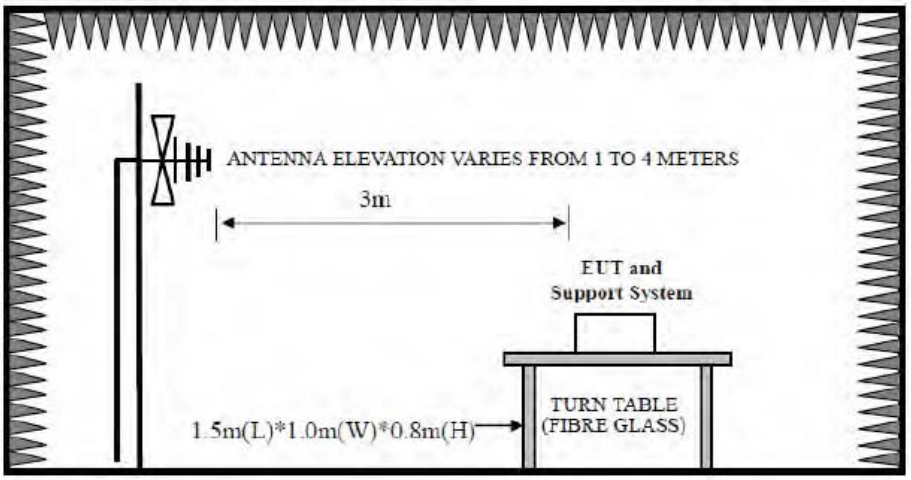
(1) Emission level dBμV = 20 log Emission level μV/m.
(2) The smaller limit shall apply at the cross point between two frequency bands.
(3) Distance is the distance in meters between the measuring instrument,antenna and the closest point of any part of the device or system.

8.2. Test setup

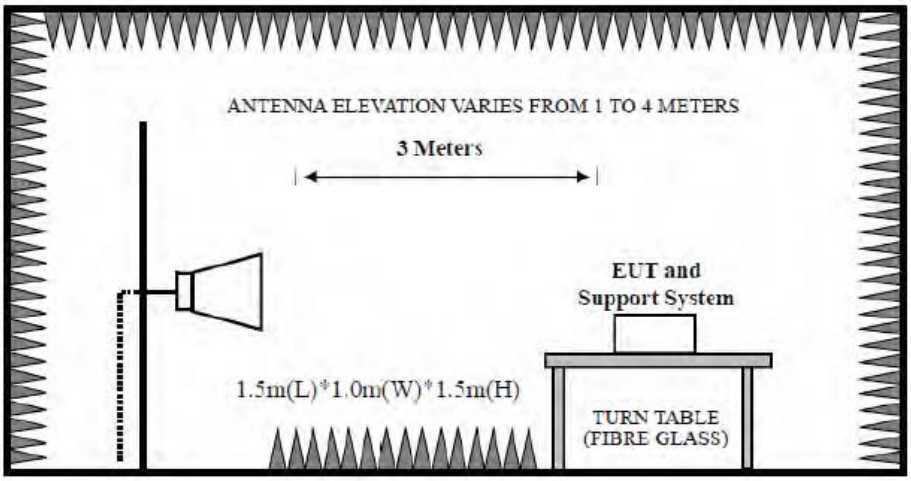
9kHz~30MHz



30~1000MHz



Above 1GHz



8.3. Spectrum Analyzer Setting

For 9KHz-150KHz

Spectrum Parameters	Setting
RBW	300Hz(for Peak&AVG)/CISPR 200Hz(for QP)
VBW	300Hz(for Peak&AVG)/CISPR 200Hz(for QP)
Start frequency	9KHz
Stop frequency	150KHz
Sweep Time	Auto
Detector	PEAK/QP/AVG
Trace Mode	Max Hold

For 150KHz-30MHz

Spectrum Parameters	Setting
RBW	9KHz
VBW	9KHz
Start frequency	150KHz
Stop frequency	30MHz
Sweep Time	Auto
Detector	QP
Trace Mode	Max Hold

For 30MHz-1GHz

Spectrum Parameters	Setting
RBW	120KHz
VBW	300KHz
Start frequency	30MHz
Stop frequency	1GHz
Sweep Time	Auto
Detector	QP
Trace Mode	Max Hold

For Above 1GHz

Spectrum Parameters	Setting	
RBW	1MHz	
VBW	PEAK Measurement	AVG Measurement
	3MHz	Duty cycle≥98%,VBW=10Hz
		Duty cycle＜98%,VBW≥1/T
Start frequency	1GHz	
Stop frequency	25GHz	
Sweep Time	Auto	
Detector	PEAK	
Trace Mode	Max Hold	

Note :

1. T is the on-time time of the duty cycle,when EUT transmit continuously with maximum output power,unit is seconds. reference section 2.8 for the on-time time.

8.4. Test Procedure

a. EUT was placed on a turn table, which is 0.8 meter high above ground for below 1GHz test, and which is 1.5 meter high above ground for above 1GHz test.
b. EUT is set 3 meters away from the receiving antenna, which is mounted on a antenna tower.
c. Set the EUT transmit continuously with maximum output power.
d. The turn table can rotate 360 degrees to determine the position of the maximum emission level.
e. The antenna can be moved up and down between 1 meter and 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna are set on test.
f. Spectrum analyzer setting parameters in accordance with section 8.3.
g. Repeat above procedures until all channels were measured.
h. Record the results in the test report.

Note:

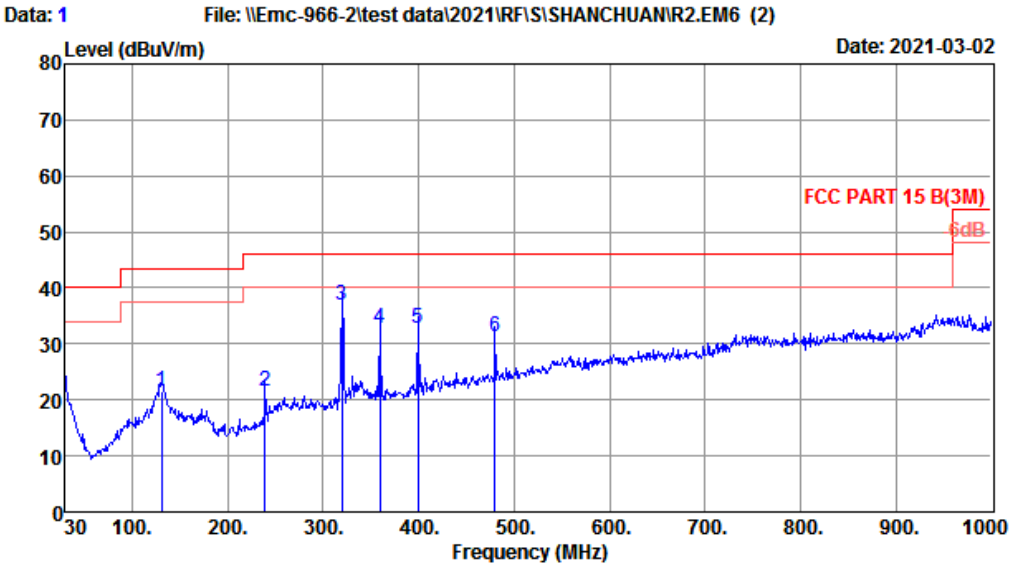
1. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.
2. The frequency 2412MHz/2422MHz/2437MHz/2452MHz/2462MHz are fundamental frequency,which no limit, the limit on plots is automatically generated by the software, it's not fundamental limit, we can't remove it.

8.5. Test Result

Radiated Emissions Below 1GHz

EST Technology

Chilingxiang, Qishantou, Santun,
Houjie, Dongguan,Guangdong,China
Tel:+86-769-83081888
Fax:+86-769-83081878



Site no. : 2# 966 chamber Data no. : 1
Dis. / Ant. : 3m 47018 Ant. pol. : HORIZONTAL
Limit : FCC PART 15 B(3M)
Env. / Ins. : Temp:23.2';Humi:52.5%;Press:101.52kPa
Engineer : Frank
EUT : Robot Vacuum Cleaner
Power : DC 20V From Adapter Input AC 120V/60Hz
M/N : R2
Test Mode : TX Mode

	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	130.88	11.51	0.91	9.00	21.42	43.50	22.08	QP
2	239.52	10.62	1.39	9.44	21.45	46.00	24.55	QP
3	320.03	13.71	1.67	21.65	37.03	46.00	8.97	QP
4	359.80	14.50	1.89	16.42	32.81	46.00	13.19	QP
5	399.57	16.03	1.83	15.04	32.90	46.00	13.10	QP
6	480.08	17.61	2.26	11.34	31.21	46.00	14.79	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

EST Technology

Chilingxiang, Qishantou, Santun,
Houjie, Dongguan,Guangdong,China
Tel:+86-769-83081888
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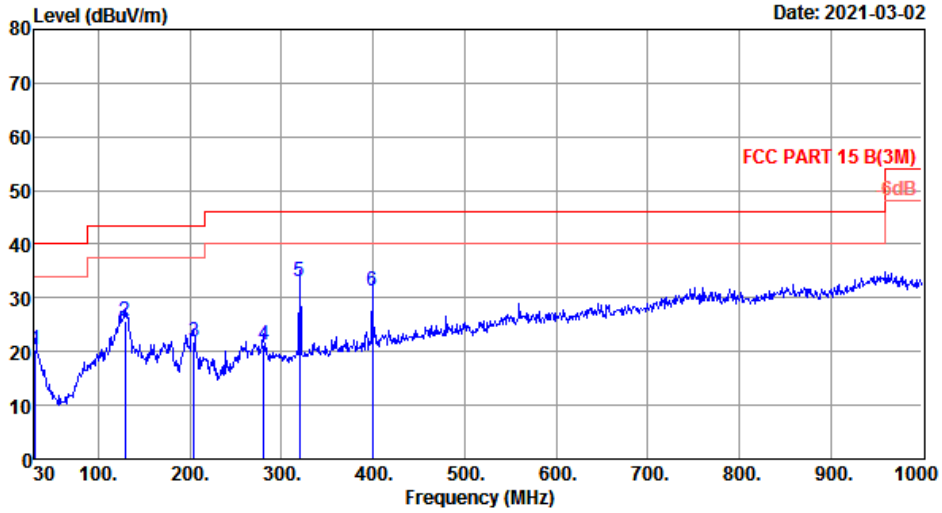
Data: 2 File: \\Emc-966-2\test data\2021\RF\S\SHANCHUAN\R2.EM6 (2)



Site no. : 2# 966 chamber Data no. : 2
Dis. / Ant. : 3m 47018 Ant. pol. : VERTICAL
Limit : FCC PART 15 B(3M)
Env. / Ins. : Temp:23.2';Humi:52.5%;Press:101.52kPa
Engineer : Frank
EUT : Robot Vacuum Cleaner
Power : DC 20V From Adapter Input AC 120V/60Hz
M/N : R2
Test Mode : TX Mode

	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	30.97	17.09	0.20	3.20	20.49	40.00	19.51	QP
2	128.94	11.52	0.93	13.23	25.68	43.50	17.82	QP
3	204.60	8.12	1.13	12.63	21.88	43.50	21.62	QP
4	280.26	12.47	1.53	7.28	21.28	46.00	24.72	QP
5	320.03	13.71	1.67	17.72	33.10	46.00	12.90	QP
6	399.57	16.03	1.83	13.32	31.18	46.00	14.82	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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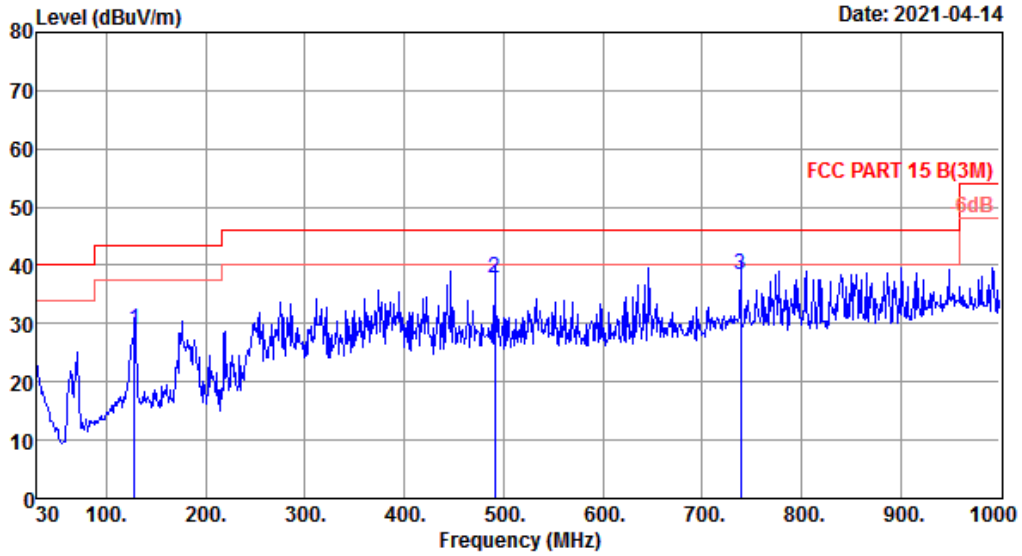
Data: 15 File: \\EMC-966-2\test data\2021\RF\S\SHANCHUAN\R2.EM6 (18)



Site no. : 2# 966 chamber Data no. : 15
Dis. / Ant. : 3m 47018 Ant. pol. : HORIZONTAL
Limit : FCC PART 15 B(3M)
Env. / Ins. : Temp:23.2℃;Humi:52.5%;Press:101.52kPa
Engineer : Frank
EUT : Robot Vacuum Cleaner
Power : DC 14.4V
M/N : R2
Test Mode : TX Mode
S20-DL4516OSF

	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	127.9700	0.00	0.96	28.01	28.97	43.50	14.53	QP
2	490.7500	0.00	2.65	35.15	37.80	46.00	8.20	QP
3	739.0700	0.00	3.59	34.81	38.40	46.00	7.60	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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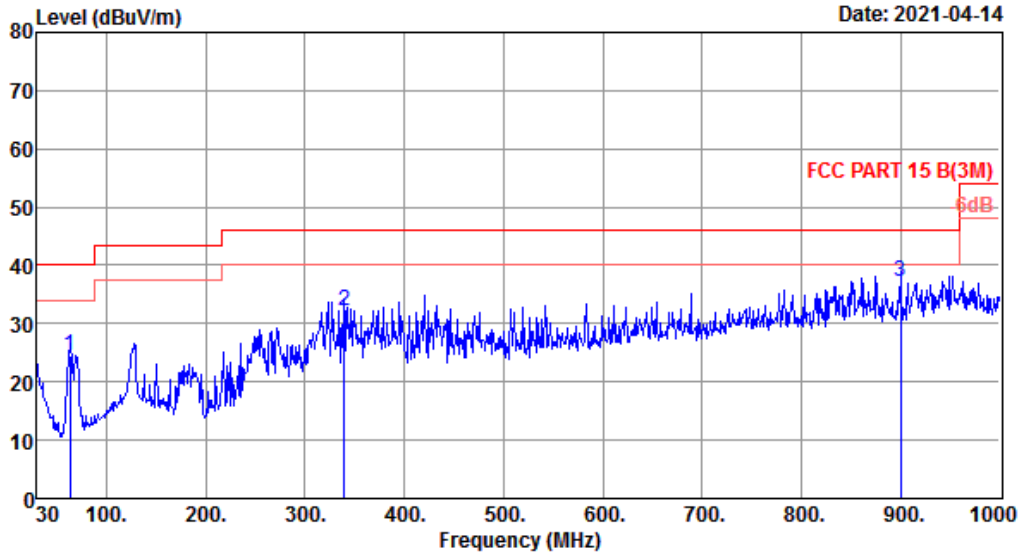
Data: 16 File: \\EMC-966-2\test data\2021\RF\S\SHANCHUAN\R2.EM6 (18)



Site no. : 2# 966 chamber Data no. : 16
Dis. / Ant. : 3m 47018 Ant. pol. : VERTICAL
Limit : FCC PART 15 B(3M)
Env. / Ins. : Temp:23.2℃;Humi:52.5%;Press:101.52kPa
Engineer : Frank
EUT : Robot Vacuum Cleaner
Power : DC 14.4V
M/N : R2
Test Mode : TX Mode
S20-DL4516OSF

	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	62.9800	0.00	0.45	24.09	24.54	40.00	15.46	QP
2	339.4300	0.00	2.05	30.05	32.10	46.00	13.90	QP
3	900.0900	0.00	3.89	33.22	37.11	46.00	8.89	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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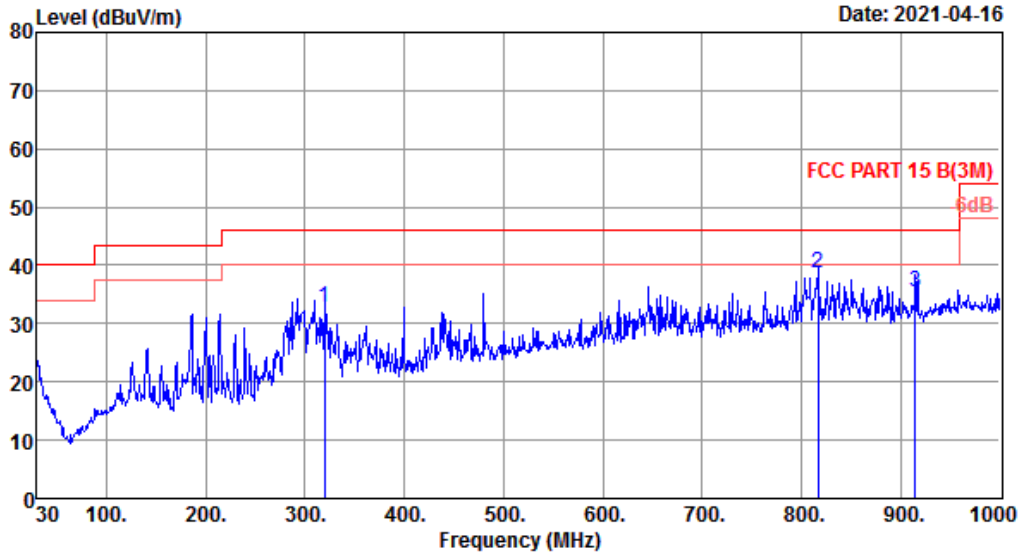
Data: 17 File: \\EMC-966-2\test data\2021\RF\S\SHANCHUAN\R2.EM6 (18)



Site no. : 3# 966 Chamber Data no. : 17
Dis. / Ant. : 3m 47018 Ant. pol. : VERTICAL
Limit : FCC PART 15 B(3M)
Env. / Ins. : Temp:23.2℃;Humi:52.5%;Press:101.52kPa
Engineer : Frank
EUT : Robot Vacuum Cleaner
Power : DC 14.4V
M/N : R2
Test Mode : TX Mode
Saber A2-S

	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	320.0300	0.00	1.92	30.94	32.86	46.00	13.14	QP
2	816.6700	0.00	3.70	34.91	38.61	46.00	7.39	QP
3	914.6400	0.00	3.97	31.47	35.44	46.00	10.56	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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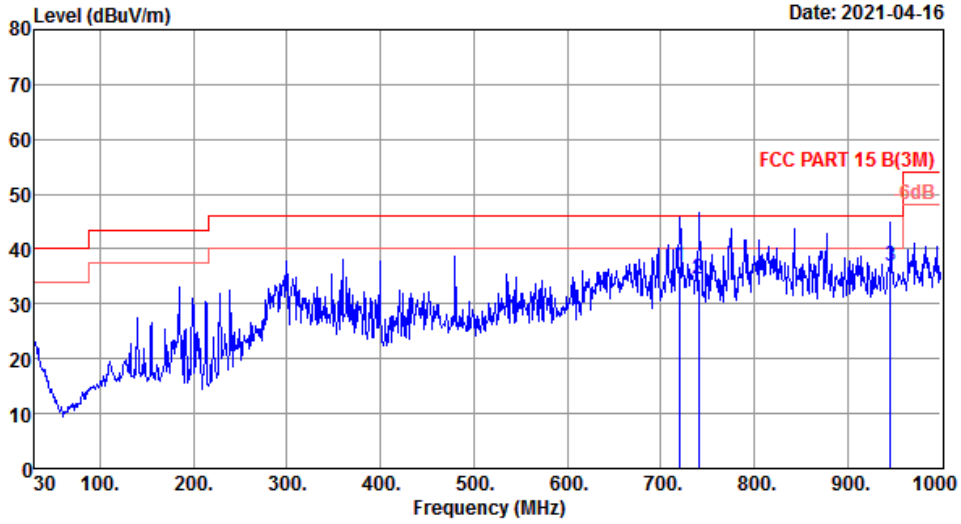
Data: 18 File: \\EMC-966-2\test data\2021\RF\S\SHANCHUAN\R2.EM6 (18)




```
Site no.       : 3# 966 Chamber              Data no.  : 18
Dis. / Ant.    : 3m   47018                  Ant. pol. : HORIZONTAL
Limit          : FCC PART 15 B(3M)
Env. / Ins.    : Temp:23.2℃;Humi:52.5%;Press:101.52kPa
Engineer       : Frank
EUT            : Robot Vacuum Cleaner
Power          : DC 14.4V
M/N            : R2
Test Mode      : TX Mode
                 Saber A2-S
```

	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	720.6400	0.00	3.44	33.43	36.87	46.00	9.13	QP
2	741.0100	0.00	3.61	30.97	34.58	46.00	11.42	QP
3	945.6801	0.00	4.45	32.36	36.81	46.00	9.19	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

Note:

1. The amplitude of 9KHz to 30MHz spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.
2. All channels had been pre-test,only the worst case was reported.

Radiated Emissions Above 1G

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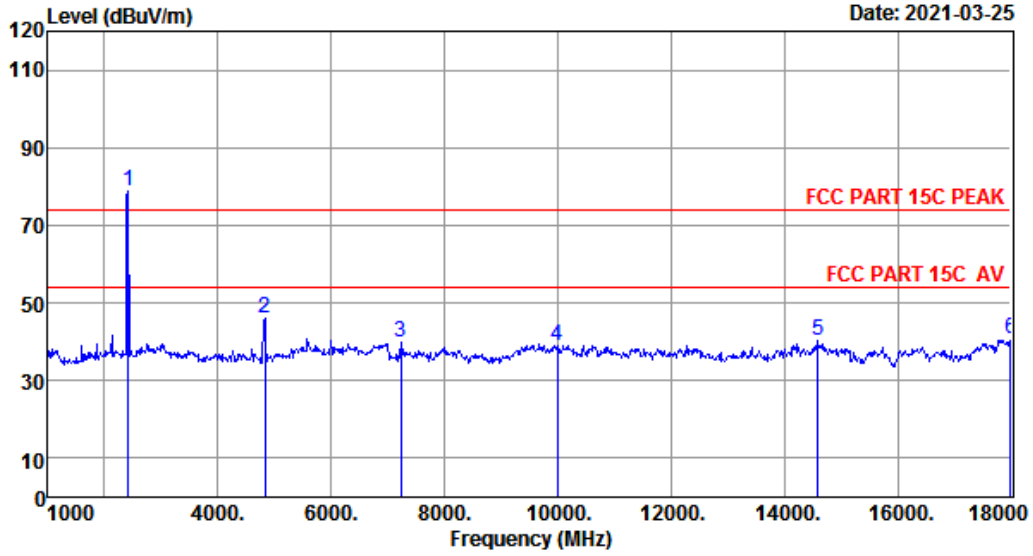
Data: 7 File: \\Emc-966-1\test data\2021\RF\S\Shanchuan\R2.EM6 (16)



Site no. : 1# 966 Chamber Data no. : 7
Dis. / Ant. : 3m ANT9120D 1-18G Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer : DUO
EUT : Robot Vacuum Cleaner
Power : DC 20V From Adapter Input AC 120V/60Hz
M/N : R2
Test Mode : IEEE 802.11b TX 2412MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2412.00	27.28	1.46	34.64	84.81	78.91	74.00	-4.91	Peak
2	4824.00	31.18	3.26	34.67	46.43	46.20	74.00	27.80	Peak
3	7236.00	36.28	5.20	34.82	33.18	39.84	74.00	34.16	Peak
4	9993.00	38.90	5.89	34.20	28.57	39.16	74.00	34.84	Peak
5	14600.00	40.98	6.88	34.48	26.79	40.17	74.00	33.83	Peak
6	18000.00	48.90	8.24	34.30	17.77	40.61	74.00	33.39	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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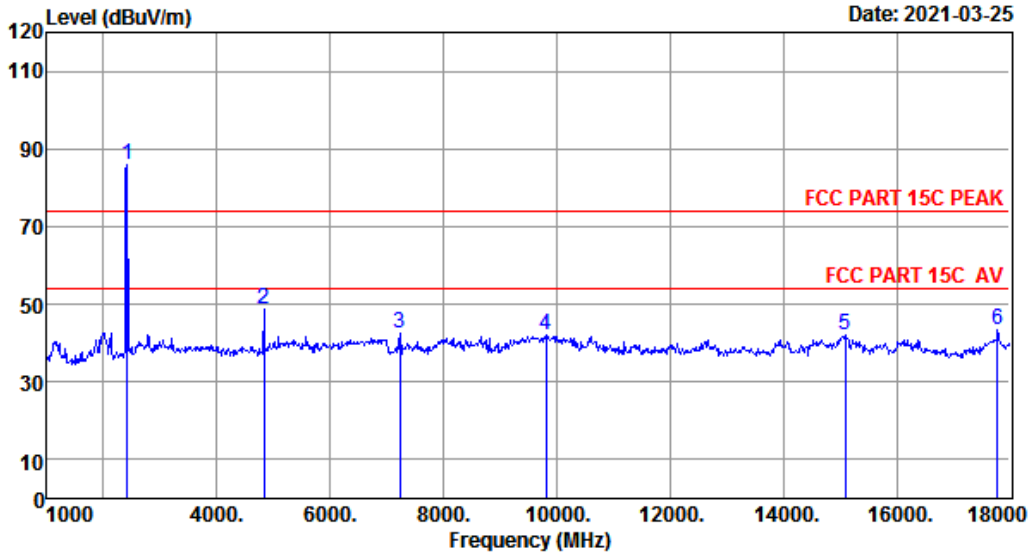
Data: 8 File: \\Emc-966-1\test data\2021\RF\S\Shanchuan\R2.EM6 (16)



Site no. : 1# 966 Chamber Data no. : 8
Dis. / Ant. : 3m ANT9120D 1-18G Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer : DUO
EUT : Robot Vacuum Cleaner
Power : DC 20V From Adapter Input AC 120V/60Hz
M/N : R2
Test Mode : IEEE 802.11b TX 2412MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2412.00	27.28	1.46	34.64	91.78	85.88	74.00	-11.88	Peak
2	4824.00	31.18	3.26	34.67	49.08	48.85	74.00	25.15	Peak
3	7236.00	36.28	5.20	34.82	35.97	42.63	74.00	31.37	Peak
4	9806.00	38.52	5.74	34.24	32.01	42.03	74.00	31.97	Peak
5	15093.00	40.81	6.74	34.57	29.29	42.27	74.00	31.73	Peak
6	17779.00	47.14	8.10	34.32	22.26	43.18	74.00	30.82	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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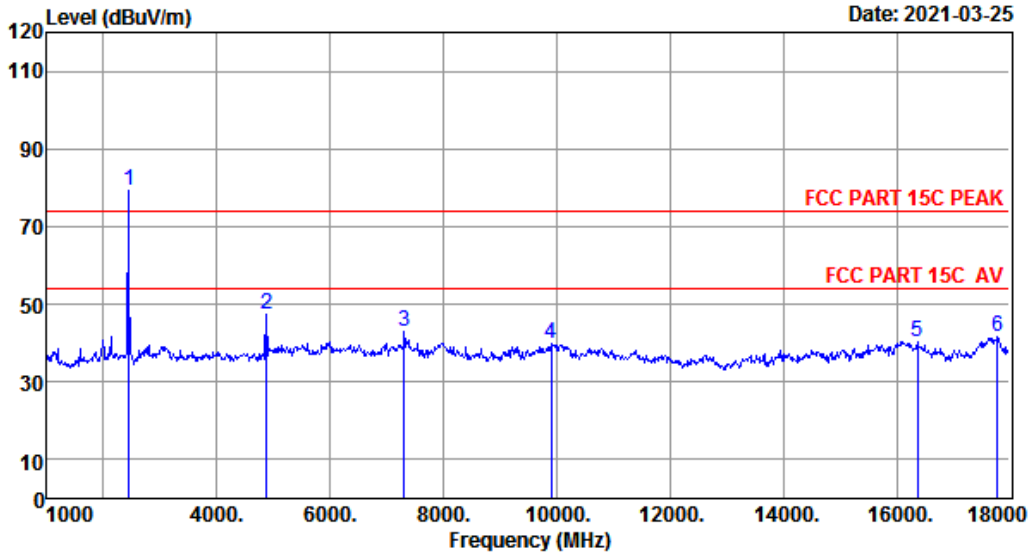
Data: 9 File: \\Emc-966-1\test data\2021\RF\S\Shanchuan\R2.EM6 (16)



Site no. : 1# 966 Chamber Data no. : 9
Dis. / Ant. : 3m ANT9120D 1-18G Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer : DUO
EUT : Robot Vacuum Cleaner
Power : DC 20V From Adapter Input AC 120V/60Hz
M/N : R2
Test Mode : IEEE 802.11b TX 2437MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2441.00	27.33	1.47	34.62	85.07	79.25	74.00	-5.25	Peak
2	4874.00	31.37	3.31	34.68	47.50	47.50	74.00	26.50	Peak
3	7311.00	36.42	5.22	34.83	36.30	43.11	74.00	30.89	Peak
4	9908.00	38.73	5.82	34.22	29.41	39.74	74.00	34.26	Peak
5	16368.00	40.21	7.06	34.27	27.31	40.31	74.00	33.69	Peak
6	17779.00	47.14	8.10	34.32	20.58	41.50	74.00	32.50	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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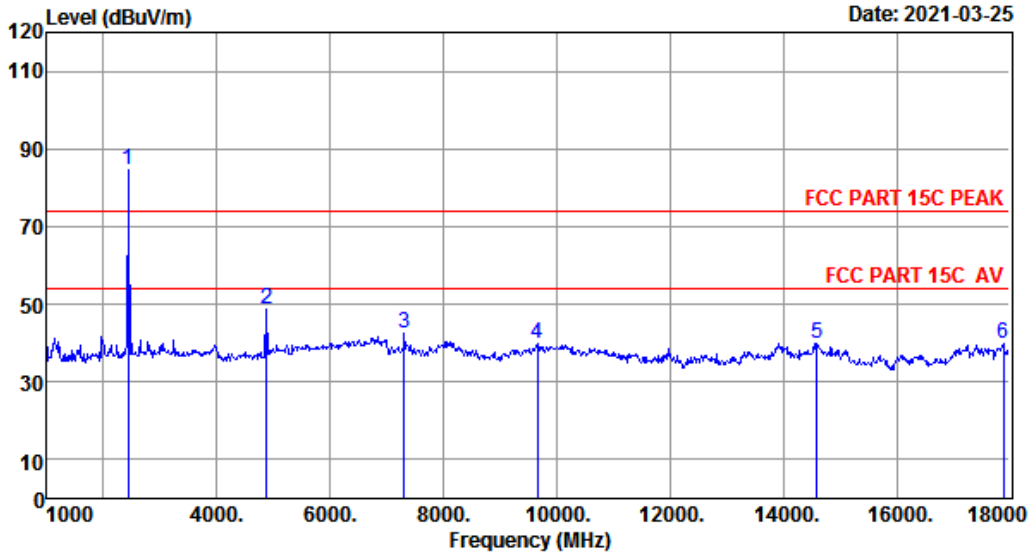
Data: 10 File: \\Emc-966-1\test data\2021\RF\S\Shanchuan\R2.EM6 (16)



Site no. : 1# 966 Chamber Data no. : 10
Dis. / Ant. : 3m ANT9120D 1-18G Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer : DUO
EUT : Robot Vacuum Cleaner
Power : DC 20V From Adapter Input AC 120V/60Hz
M/N : R2
Test Mode : IEEE 802.11b TX 2437MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2437.00	27.33	1.47	34.62	90.28	84.46	74.00	-10.46	Peak
2	4874.00	31.37	3.31	34.68	48.58	48.58	74.00	25.42	Peak
3	7311.00	36.42	5.22	34.83	35.58	42.39	74.00	31.61	Peak
4	9653.00	38.21	5.62	34.27	30.09	39.65	74.00	34.35	Peak
5	14600.00	40.98	6.88	34.48	26.52	39.90	74.00	34.10	Peak
6	17881.00	47.95	8.16	34.31	18.01	39.81	74.00	34.19	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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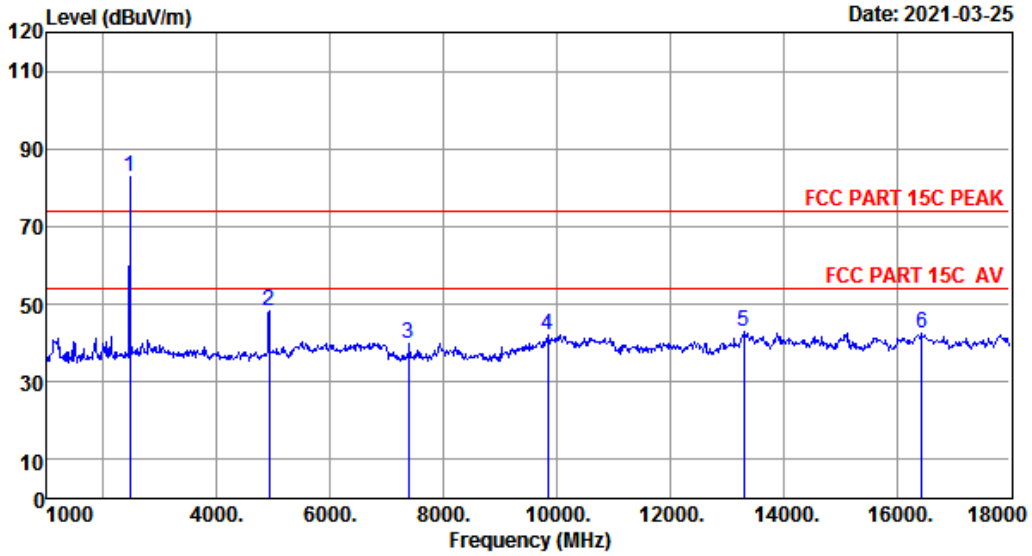
Data: 11 File: \\Emc-966-1\test data\2021\RF\S\Shanchuan\R2.EM6 (16)



Site no. : 1# 966 Chamber Data no. : 11
Dis. / Ant. : 3m ANT9120D 1-18G Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer : DUO
EUT : Robot Vacuum Cleaner
Power : DC 20V From Adapter Input AC 120V/60Hz
M/N : R2
Test Mode : IEEE 802.11b TX 2462MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2462.00	27.35	1.48	34.62	88.62	82.83	74.00	-8.83	Peak
2	4924.00	31.55	3.35	34.69	48.17	48.38	74.00	25.62	Peak
3	7386.00	36.59	5.24	34.84	32.99	39.98	74.00	34.02	Peak
4	9840.00	38.59	5.77	34.23	32.11	42.24	74.00	31.76	Peak
5	13308.00	39.92	6.31	34.37	30.93	42.79	74.00	31.21	Peak
6	16453.00	40.30	7.10	34.29	29.32	42.43	74.00	31.57	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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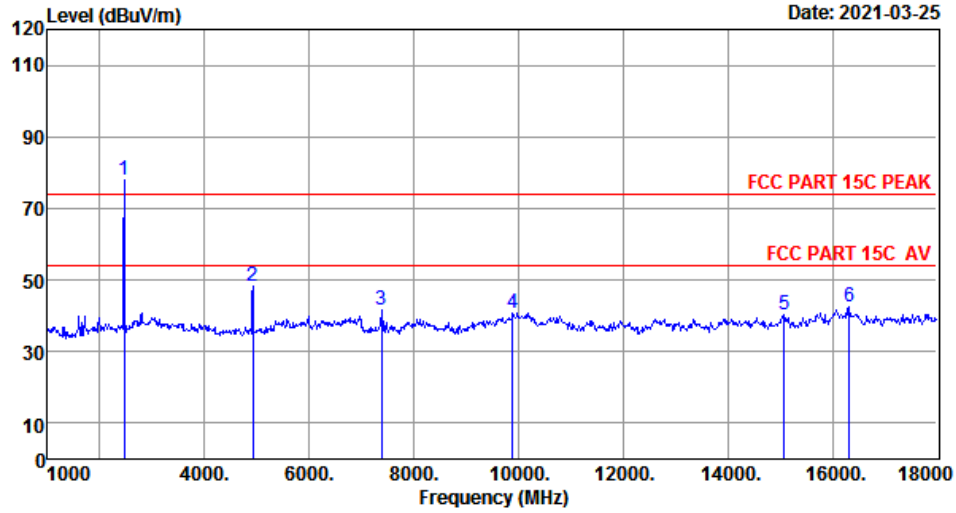
Data: 12 File: \\Emc-966-1\test data\2021\RF\S\Shanchuan\R2.EM6 (16)




```
Site no.       : 1# 966 Chamber              Data no.  : 12
Dis. / Ant.    : 3m   ANT9120D 1-18G         Ant. pol. : HORIZONTAL
Limit          : FCC PART 15C PEAK
Env. / Ins.    : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer       : DUO
EUT            : Robot Vacuum Cleaner
Power          : DC 20V From Adapter Input AC 120V/60Hz
M/N            : R2
Test Mode      : IEEE 802.11b TX 2462MHz
```

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2462.00	27.35	1.48	34.62	83.69	77.90	74.00	-3.90	Peak
2	4924.00	31.55	3.35	34.69	47.85	48.06	74.00	25.94	Peak
3	7386.00	36.59	5.24	34.84	34.65	41.64	74.00	32.36	Peak
4	9891.00	38.69	5.81	34.22	30.63	40.91	74.00	33.09	Peak
5	15076.00	40.82	6.76	34.57	27.10	40.11	74.00	33.89	Peak
6	16317.00	40.15	7.04	34.26	29.50	42.43	74.00	31.57	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

Note:

1. The amplitude of 18GHz to 25GHz spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.
2. IEEE 802.11b, IEEE 802.11g, IEEE 802. 11nH20 all have been tested, only worse case 802.11b is reported.

Radiated Band Edge

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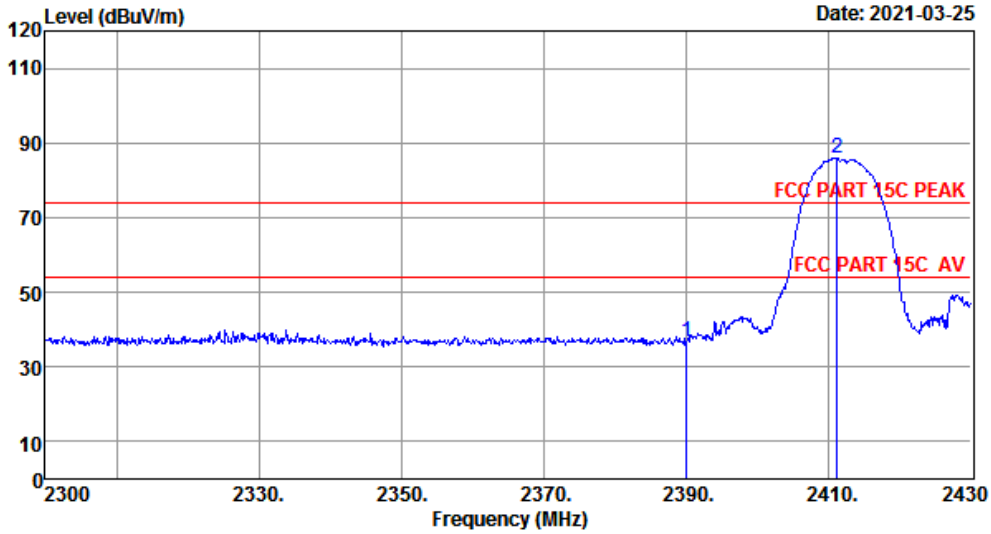
Data: 13 File: \\Emc-966-1\test data\2021\RF\S\Shanchuan\R2.EM6 (16)



Site no. : 1# 966 Chamber Data no. : 13
Dis. / Ant. : 3m ANT9120D 1-18G Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer : DUO
EUT : Robot Vacuum Cleaner
Power : DC 20V From Adapter Input AC 120V/60Hz
M/N : R2
Test Mode : IEEE 802.11b TX 2412MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.26	1.45	34.64	42.80	36.87	74.00	37.13	Peak
2	2411.15	27.28	1.46	34.64	91.85	85.95	74.00	-11.95	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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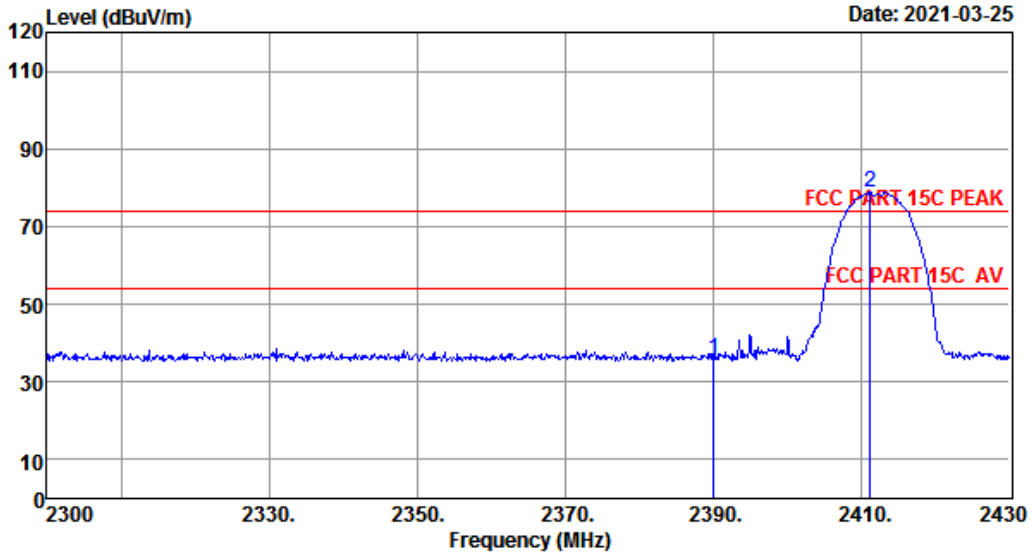
Data: 14 File: \\Emc-966-1\test data\2021\RF\S\Shanchuan\R2.EM6 (16)



Site no. : 1# 966 Chamber Data no. : 14
Dis. / Ant. : 3m ANT9120D 1-18G Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer : DUO
EUT : Robot Vacuum Cleaner
Power : DC 20V From Adapter Input AC 120V/60Hz
M/N : R2
Test Mode : IEEE 802.11b TX 2412MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.26	1.45	34.64	41.95	36.02	74.00	37.98	Peak
2	2411.15	27.28	1.46	34.64	84.67	78.77	74.00	-4.77	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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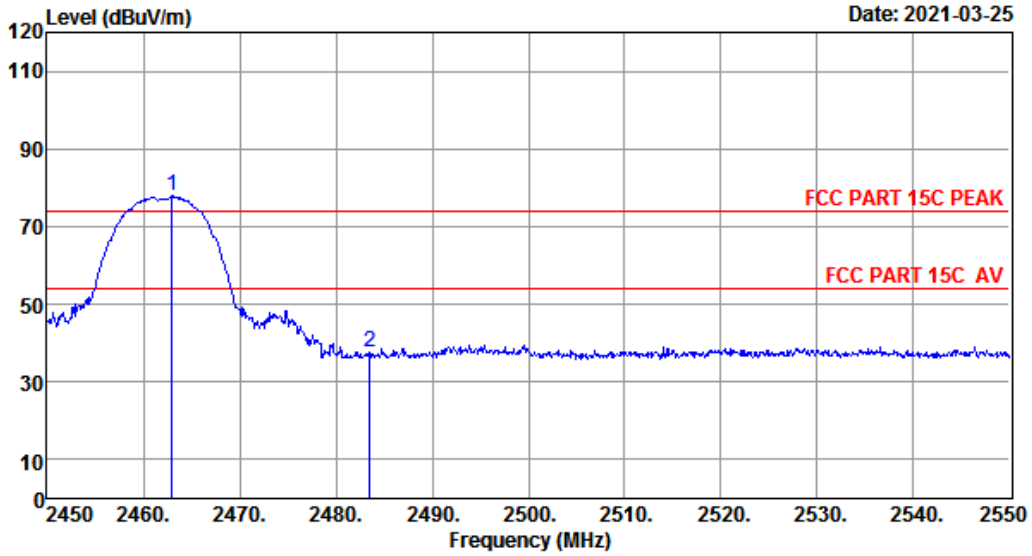
Data: 15 File: \\Emc-966-1\test data\2021\RF\S\Shanchuan\R2.EM6 (16)



Site no. : 1# 966 Chamber Data no. : 15
Dis. / Ant. : 3m ANT9120D 1-18G Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer : DUO
EUT : Robot Vacuum Cleaner
Power : DC 20V From Adapter Input AC 120V/60Hz
M/N : R2
Test Mode : IEEE 802.11b TX 2462MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2463.00	27.35	1.48	34.62	83.54	77.75	74.00	-3.75	Peak
2	2483.50	27.38	1.48	34.61	43.48	37.73	74.00	36.27	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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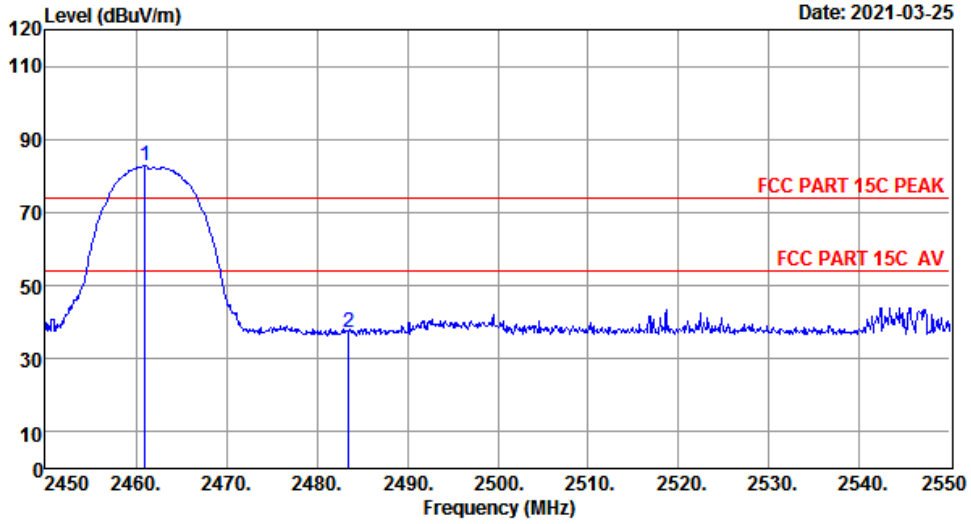
Data: 16 File: \\Emc-966-1\test data\2021\RF\S\Shanchuan\R2.EM6 (16)



Site no. : 1# 966 Chamber Data no. : 16
Dis. / Ant. : 3m ANT9120D 1-18G Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:27.3';Humi:54%;Press:101.52kPa
Engineer : DUO
EUT : Robot Vacuum Cleaner
Power : DC 20V From Adapter Input AC 120V/60Hz
M/N : R2
Test Mode : IEEE 802.11b TX 2462MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2461.00	27.35	1.48	34.62	88.52	82.73	74.00	-8.73	Peak
2	2483.50	27.38	1.48	34.61	42.84	37.09	74.00	36.91	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

Note:

1. All channels had been pre-test,only of the worst case channels were reported.
2. IEEE 802.11b, IEEE 802.11g, IEEE 802. 11nH20 all have been tested, only worse case 802.11b is reported.

9. AC POWER LINE CONDUCTED EMISSIONS

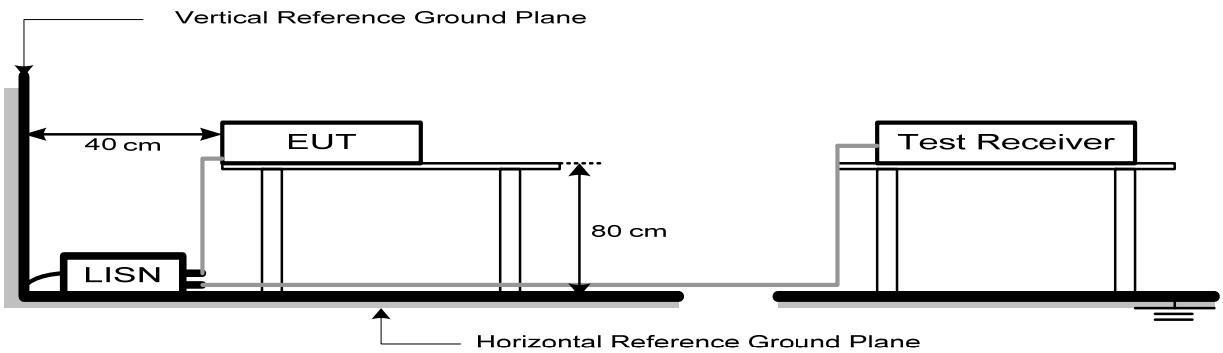
9.1. Limit

Frequency			Maximum RF Line Voltage	
			Quasi-Peak Level dB(μV)	Average Level dB(μV)
150kHz	~	500kHz	66 ~ 56*	56 ~ 46*
500kHz	~	5MHz	56	46
5MHz	~	30MHz	60	50

Note:

1. * Decreasing linearly with logarithm of frequency.
2. The lower limit shall apply at the transition frequencies.

9.2. Test Setup



9.3. Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	9KHz
VBW	9KHz
Start frequency	150KHz
Stop frequency	30MHz
Sweep Time	Auto
Detector	QP/AVG
Trace Mode	Max Hold

9.4. Test Procedure

a. The EUT was placed on a non-metallic table, 80cm above the ground plane.
b. The EUT Power connected to the power mains through a line impedance stabilization network.
c. Provides a 50 ohm coupling impedance for the EUT (Please refer the block diagram of the test setup and photographs).
d. Set the EUT transmit continuously with maximum output power.
e. Spectrum analyzer setting parameters in accordance with section 9.3.
f. The AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to ANSI C63.10: 2013 on Conducted Emission Test.
g. Record the results in the test report.

9.5. Test Result

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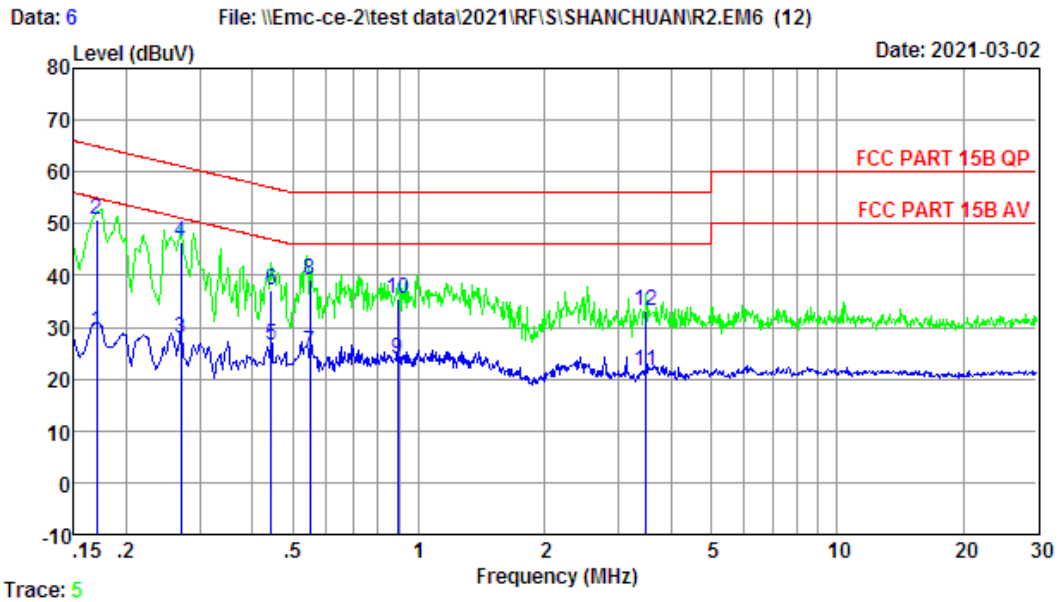

Site no : 2#CE Shield Room Data no. : 6
Env. / Ins. : Temp:22.8℃ Humi:49% Press:101.40kPa LINE Phase : LINE
Limit : FCC PART 15B QP
Engineer : ZSX
EUT : Robot Vacuum Cleaner
Power : DC 20V From Adapter Input AC 120V/60Hz
M/N : R2
Test Mode : TX Mode

	Freq. (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuv)	Limits (dBuv)	Margin (dB)	Remark
1	0.1703	9.68	9.69	9.79	29.16	54.94	25.78	Average
2	0.1703	9.68	9.69	31.34	50.71	64.94	14.23	QP
3	0.2701	9.72	9.92	8.36	28.00	51.12	23.12	Average
4	0.2701	9.72	9.92	26.92	46.56	61.12	14.56	QP
5	0.4444	9.77	9.92	6.76	26.45	46.98	20.53	Average
6	0.4444	9.77	9.92	17.55	37.24	56.98	19.74	QP
7	0.5493	9.80	9.92	5.65	25.37	46.00	20.63	Average
8	0.5493	9.80	9.92	19.42	39.14	56.00	16.86	QP
9	0.8897	9.87	9.93	4.00	23.80	46.00	22.20	Average
10	0.8897	9.87	9.93	15.63	35.43	56.00	20.57	QP
11	3.4906	9.92	9.98	1.62	21.52	46.00	24.48	Average
12	3.4906	9.92	9.98	13.44	33.34	56.00	22.66	QP

Remarks: 1. Emission Level= LISN Factor + Cable Loss + Reading.
2. Margin=Limit - Emission Level.
3. If the average limit is met when using a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

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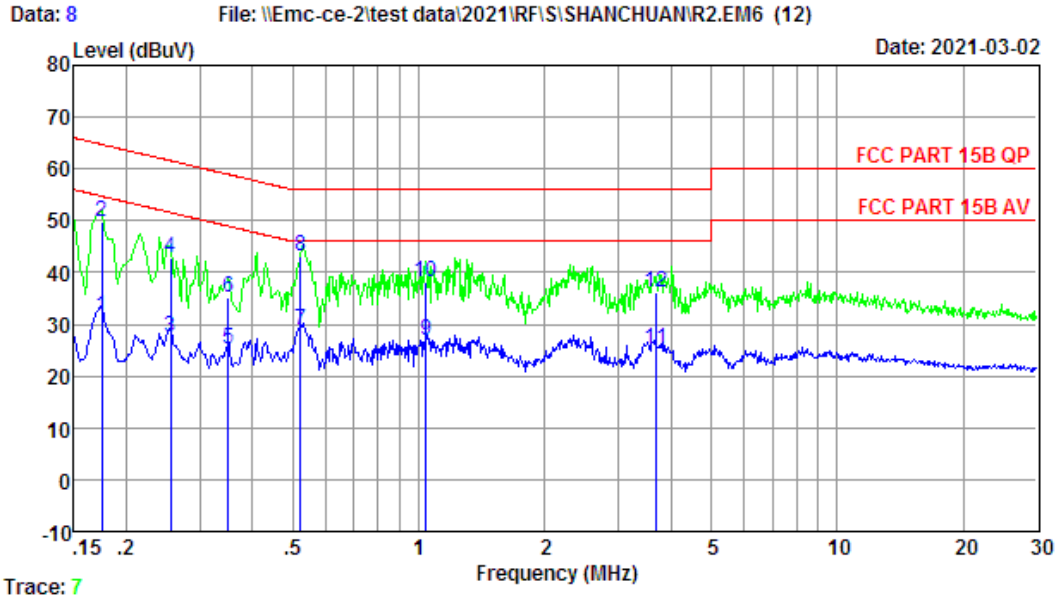

Site no : 2#CE Shield Room Data no. : 8
Env. / Ins. : Temp:22.8℃ Humi:49% Press:101.40kPa LINE Phase : NEUTRAL
Limit : FCC PART 15B QP
Engineer : ZSX
EUT : Robot Vacuum Cleaner
Power : DC 20V From Adapter Input AC 120V/60Hz
M/N : R2
Test Mode : TX Mode

	Freq. (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuv)	Limits (dBuv)	Margin (dB)	Remark
1	0.1749	9.65	9.77	12.24	31.66	54.72	23.06	Average
2	0.1749	9.65	9.77	30.32	49.74	64.72	14.98	QP
3	0.2548	9.65	9.92	7.89	27.46	51.60	24.14	Average
4	0.2548	9.65	9.92	23.38	42.95	61.60	18.65	QP
5	0.3502	9.67	9.92	5.63	25.22	48.96	23.74	Average
6	0.3502	9.67	9.92	15.71	35.30	58.96	23.66	QP
7	0.5210	9.70	9.92	9.25	28.87	46.00	17.13	Average
8	0.5210	9.70	9.92	23.48	43.10	56.00	12.90	QP
9	1.0430	9.76	9.94	7.17	26.87	46.00	19.13	Average
10	1.0430	9.76	9.94	18.52	38.22	56.00	17.78	QP
11	3.6806	9.92	9.99	5.19	25.10	46.00	20.90	Average
12	3.6806	9.92	9.99	16.32	36.23	56.00	19.77	QP

Remarks: 1. Emission Level= LISN Factor + Cable Loss + Reading.
2. Margin=Limit - Emission Level.
3. If the average limit is met when using a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

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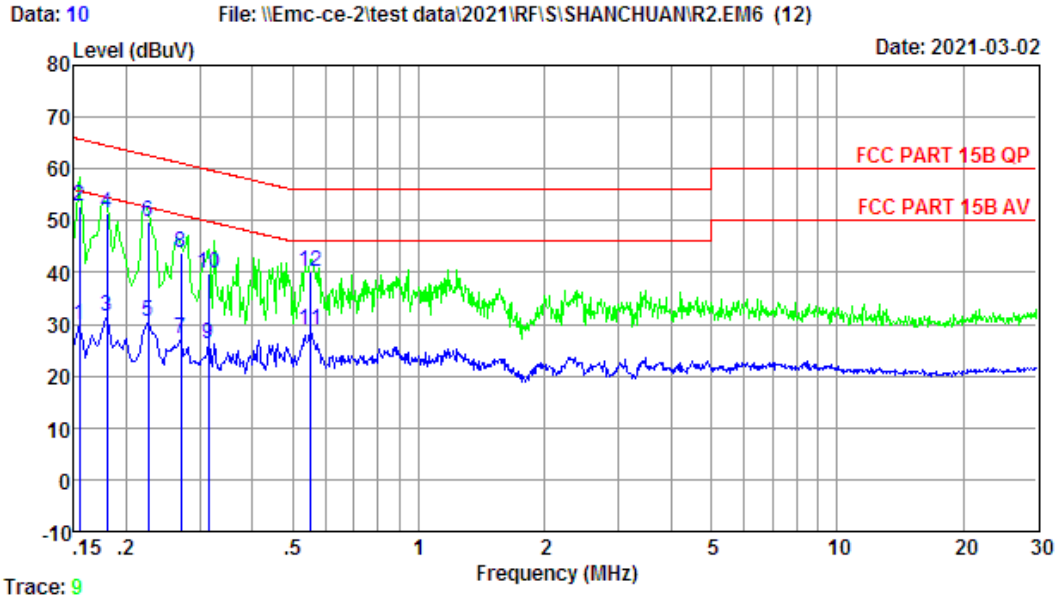

Site no : 2#CE Shield Room Data no. : 10
Env. / Ins. : Temp:22.8℃ Humi:49% Press:101.40kPa LINE Phase : LINE
Limit : FCC PART 15B QP
Engineer : ZSX
EUT : Robot Vacuum Cleaner
Power : DC 20V From Adapter Input AC 240V/60Hz
M/N : R2
Test Mode : TX Mode

	Freq. (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuv)	Limits (dBuv)	Margin (dB)	Remark
1	0.1548	9.68	9.69	10.52	29.89	55.74	25.85	Average
2	0.1548	9.68	9.69	33.32	52.69	65.74	13.05	QP
3	0.1796	9.69	9.77	12.08	31.54	54.50	22.96	Average
4	0.1796	9.69	9.77	32.11	51.57	64.50	12.93	QP
5	0.2256	9.70	9.84	11.10	30.64	52.61	21.97	Average
6	0.2256	9.70	9.84	30.23	49.77	62.61	12.84	QP
7	0.2701	9.72	9.92	7.53	27.17	51.12	23.95	Average
8	0.2701	9.72	9.92	24.32	43.96	61.12	17.16	QP
9	0.3149	9.73	9.92	6.64	26.29	49.84	23.55	Average
10	0.3149	9.73	9.92	20.15	39.80	59.84	20.04	QP
11	0.5493	9.80	9.92	9.23	28.95	46.00	17.05	Average
12	0.5493	9.80	9.92	20.33	40.05	56.00	15.95	QP

Remarks: 1. Emission Level= LISN Factor + Cable Loss + Reading.
2. Margin=Limit - Emission Level.
3. If the average limit is met when using a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

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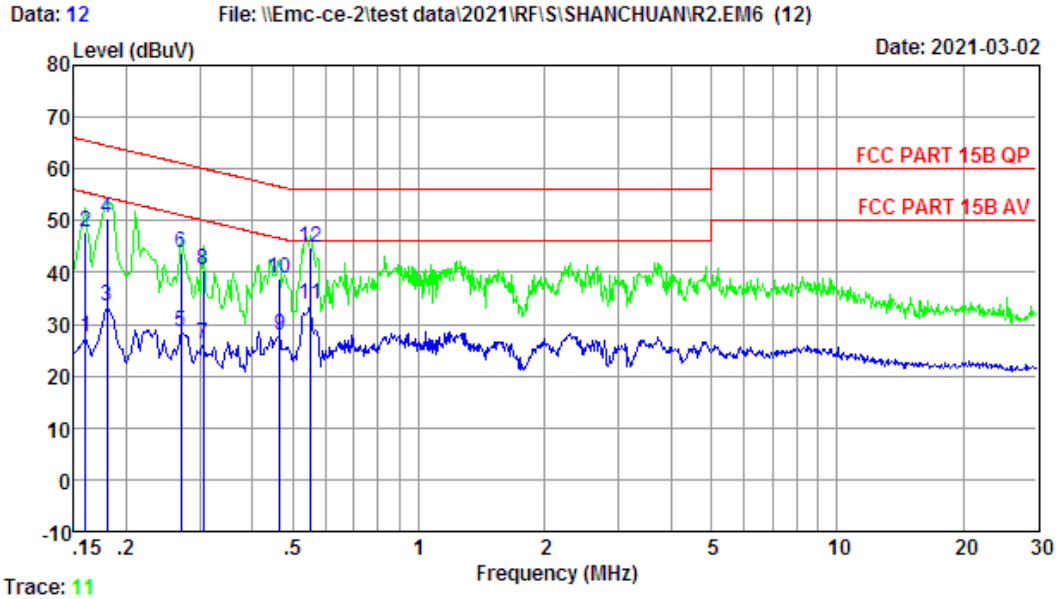


Site no : 2#CE Shield Room Data no. : 12
Env. / Ins. : Temp:22.8℃ Humi:49% Press:101.40kPa LINE Phase : NEUTRAL
Limit : FCC PART 15B QP
Engineer : ZSX
EUT : Robot Vacuum Cleaner
Power : DC 20V From Adapter Input AC 240V/60Hz
M/N : R2
Test Mode : TX Mode

	Freq. (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuv)	Limits (dBuv)	Margin (dB)	Remark
1	0.1598	9.64	9.69	8.07	27.40	55.47	28.07	Average
2	0.1598	9.64	9.69	28.32	47.65	65.47	17.82	QP
3	0.1796	9.65	9.77	14.05	33.47	54.50	21.03	Average
4	0.1796	9.65	9.77	31.11	50.53	64.50	13.97	QP
5	0.2701	9.66	9.92	9.05	28.63	51.12	22.49	Average
6	0.2701	9.66	9.92	24.32	43.90	61.12	17.22	QP
7	0.3051	9.66	9.92	6.53	26.11	50.10	23.99	Average
8	0.3051	9.66	9.92	20.75	40.33	60.10	19.77	QP
9	0.4661	9.69	9.92	8.24	27.85	46.58	18.73	Average
10	0.4661	9.69	9.92	19.33	38.94	56.58	17.64	QP
11	0.5493	9.70	9.92	14.28	33.90	46.00	12.10	Average
12	0.5493	9.70	9.92	25.21	44.83	56.00	11.17	QP

Remarks: 1. Emission Level= LISN Factor + Cable Loss + Reading.
2. Margin=Limit - Emission Level.
3. If the average limit is met when using a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

10. ANTENNA REQUIREMENTS

10.1. Limit

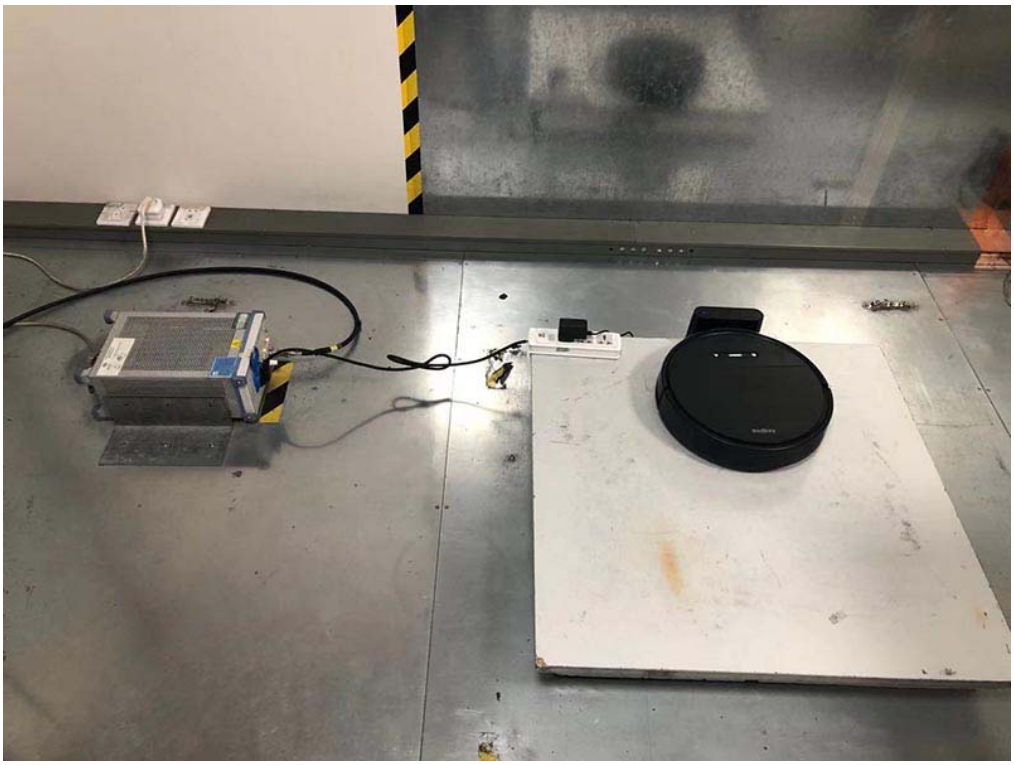
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

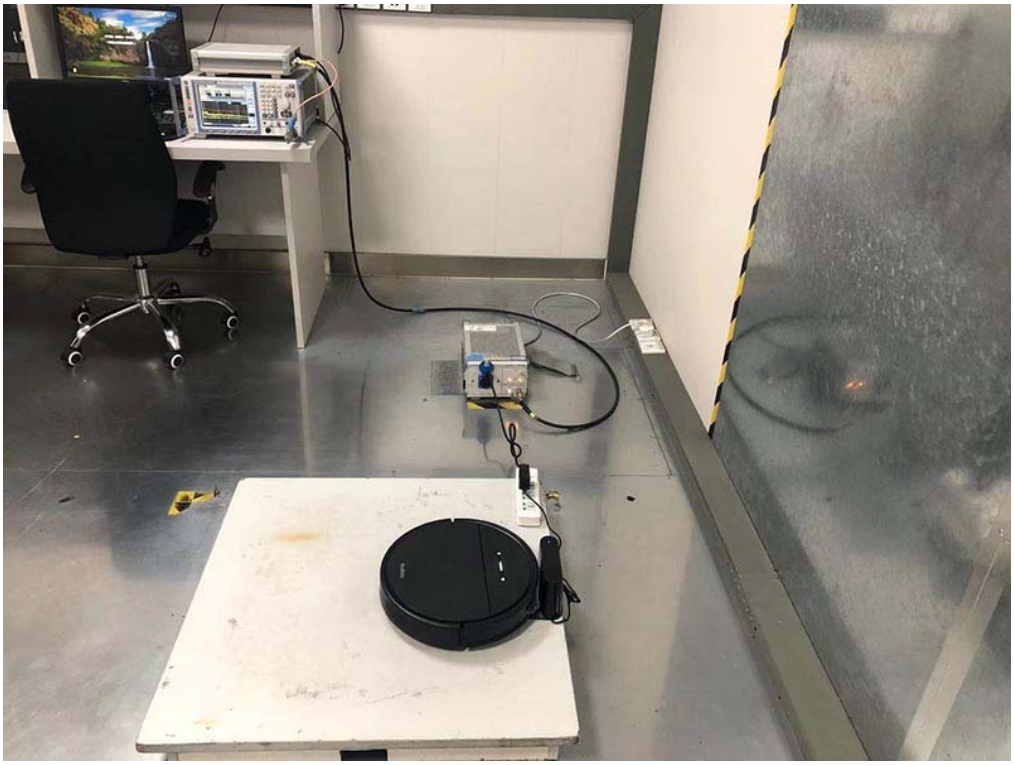
10.2. Test Result

The antennas used for this product is internal antenna ,so compliance with antenna requirements.
(Please refer to the EUT photo for details)

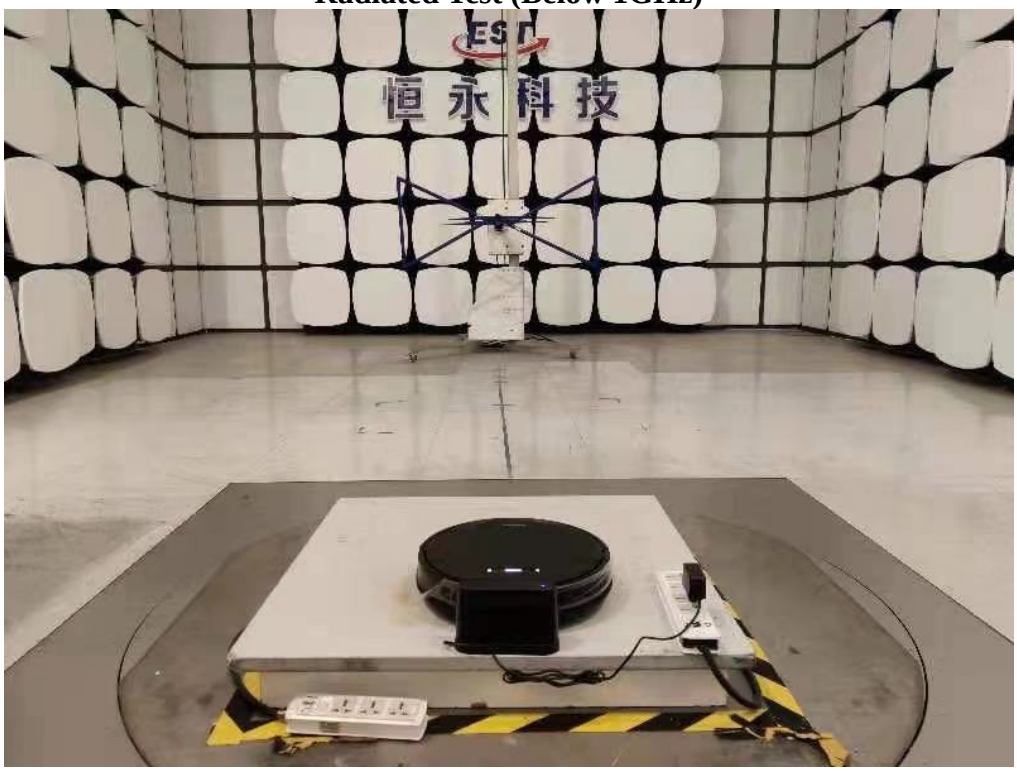
11. TEST SETUP PHOTO

Conducted Test





Radiated Test (Below 1GHz)



Radiated Test (Above 1GHz)

12. EUT PHOTO

External Photos

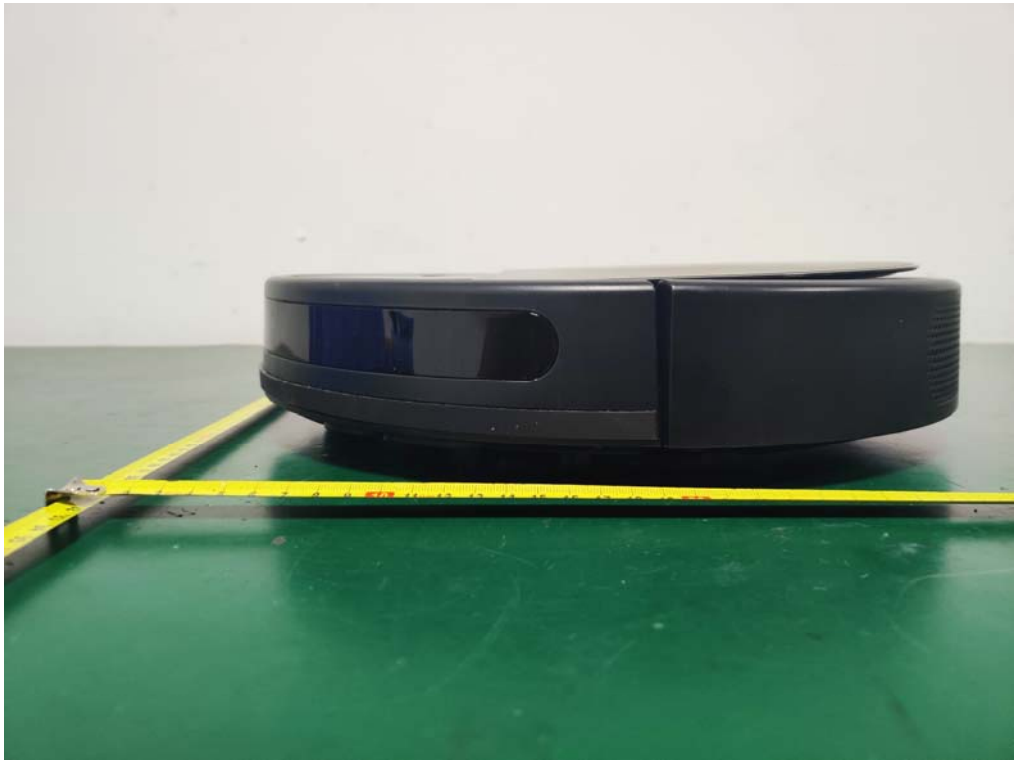
M/N: R2

External Photos

M/N: R2

External Photos

M/N: R2

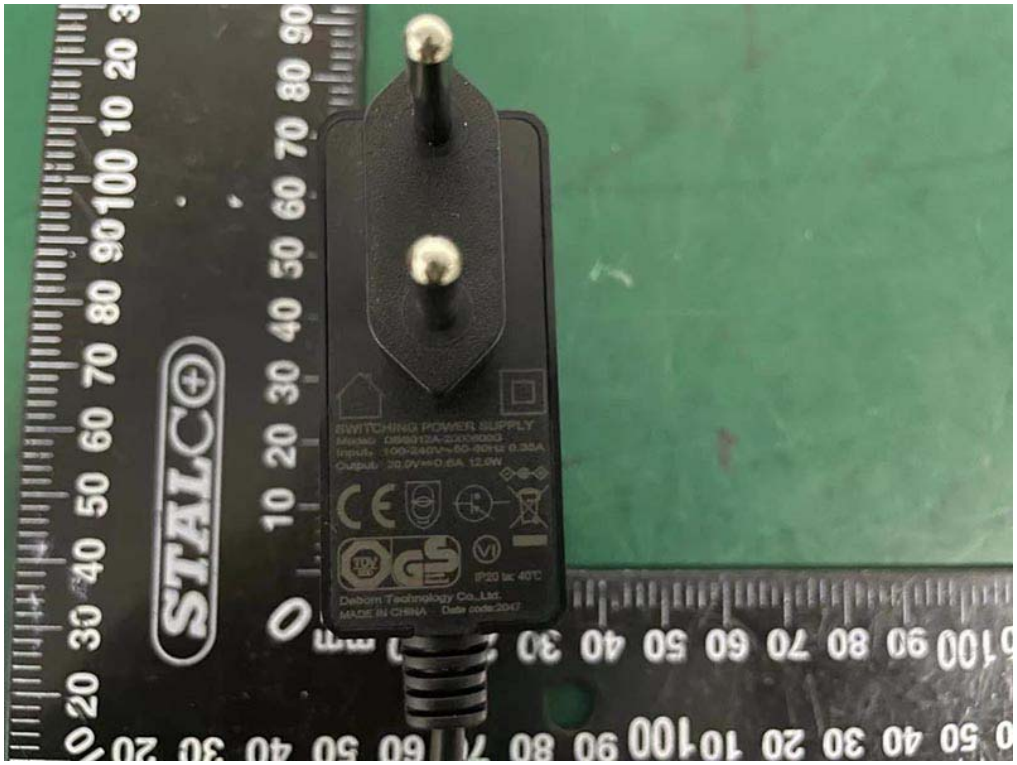


External Photos

M/N: R2

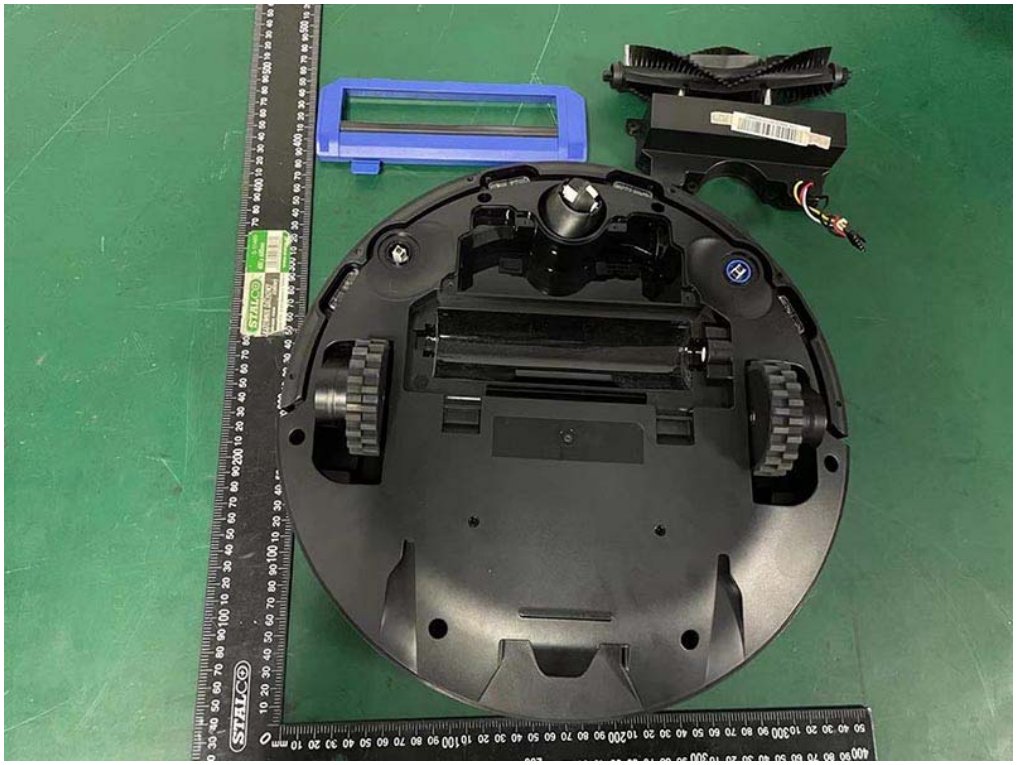
External Photos

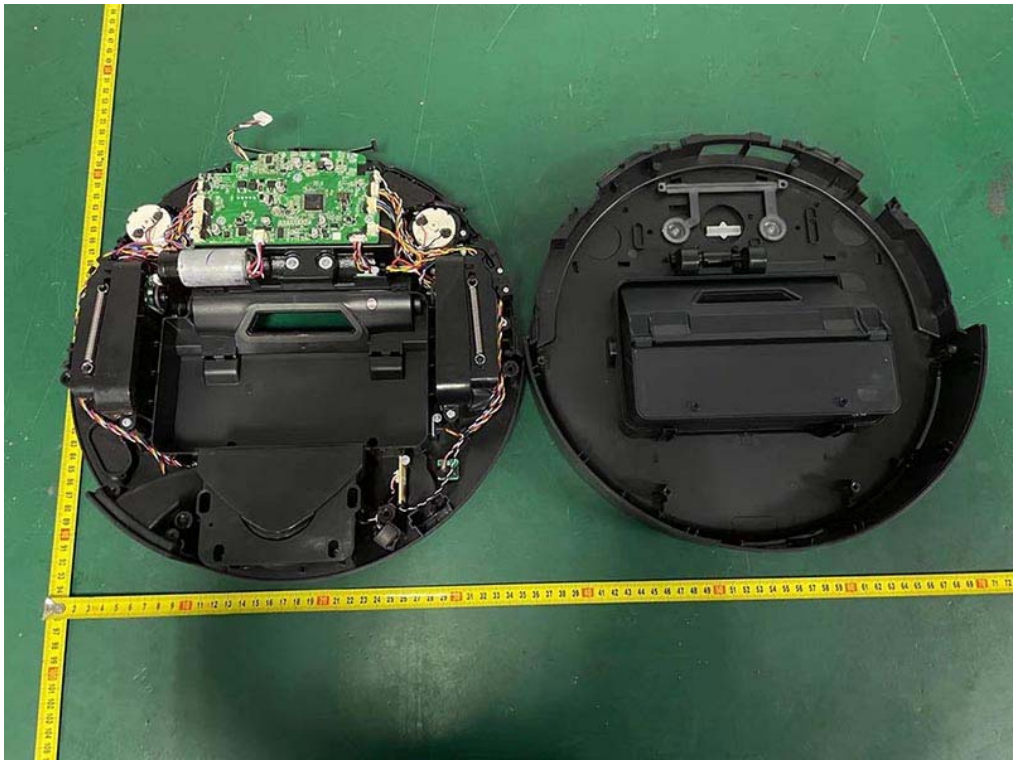
M/N: R2



Internal Photos

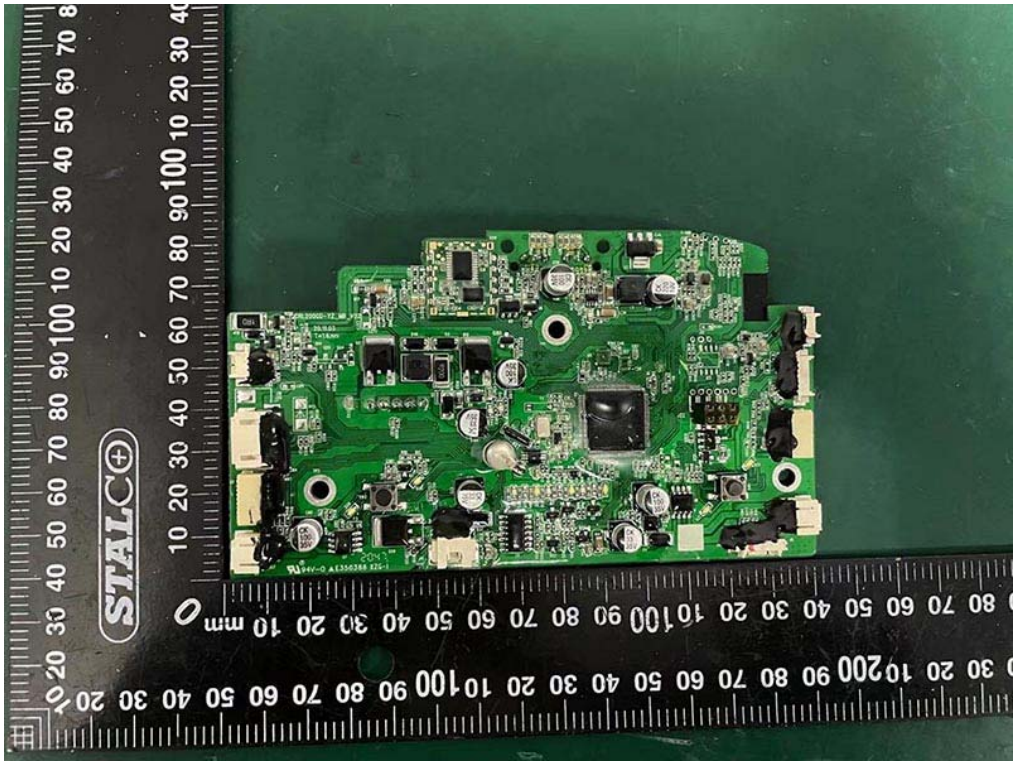
M/N: R2

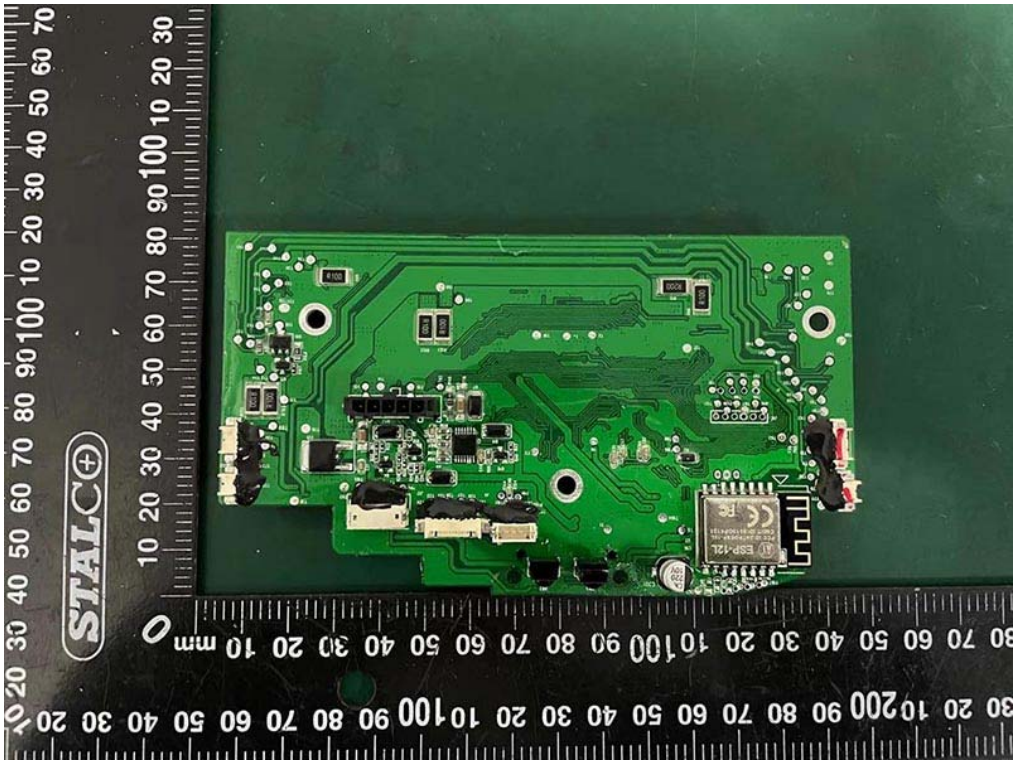




Internal Photos

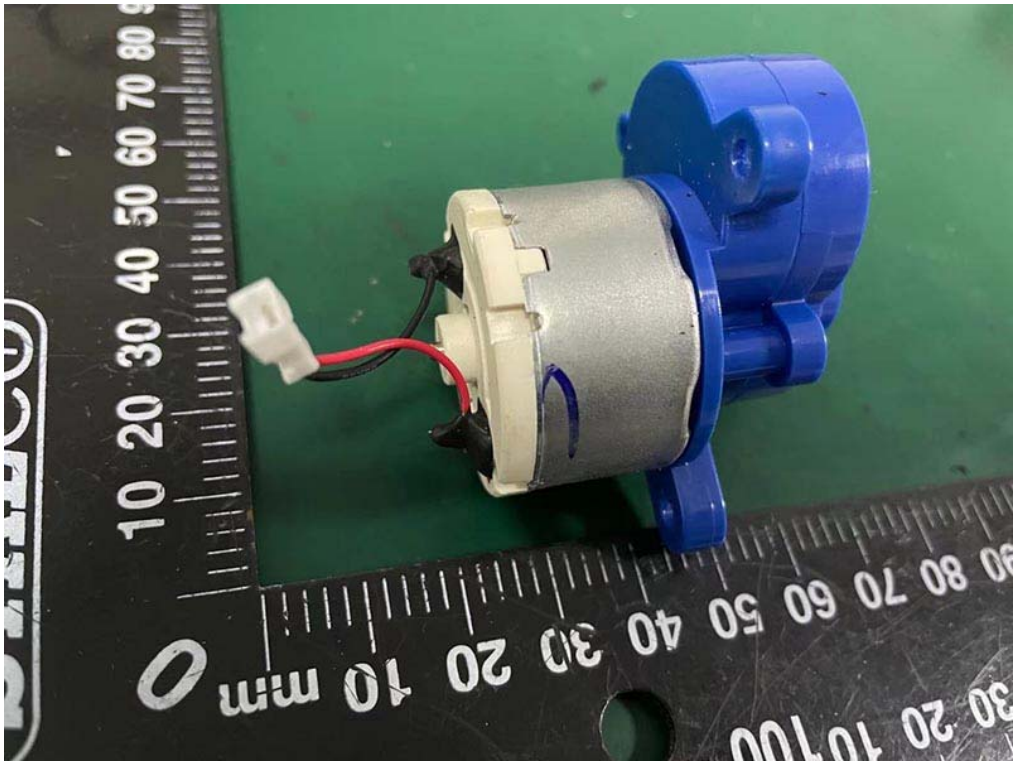
M/N: R2

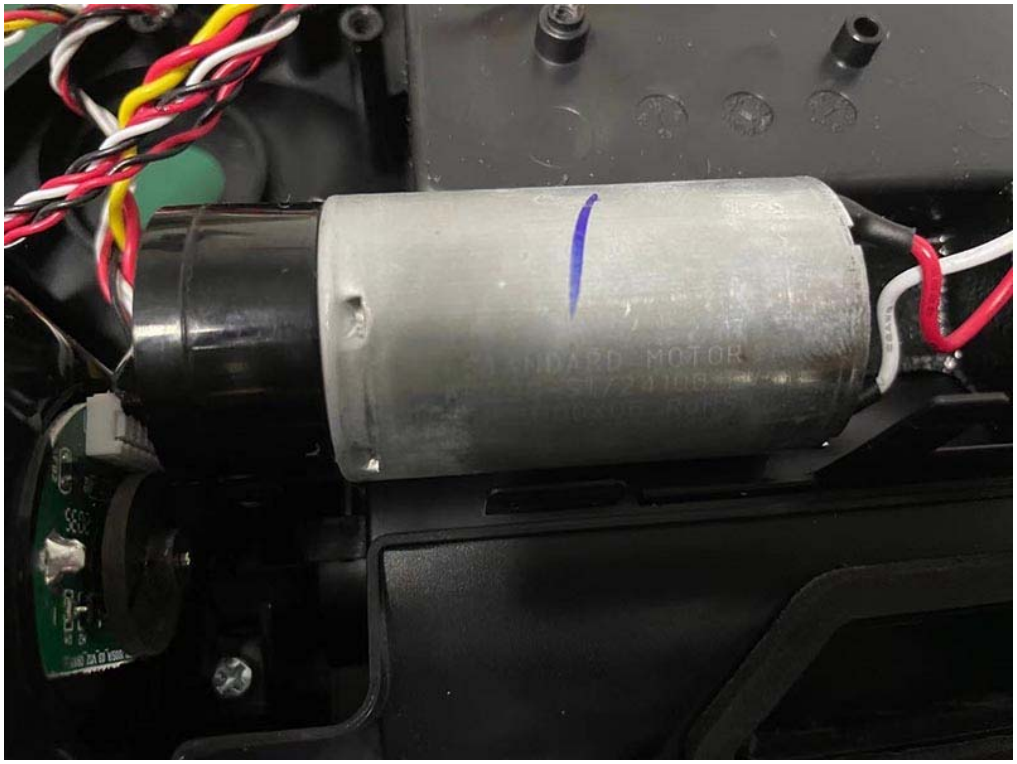




Internal Photos

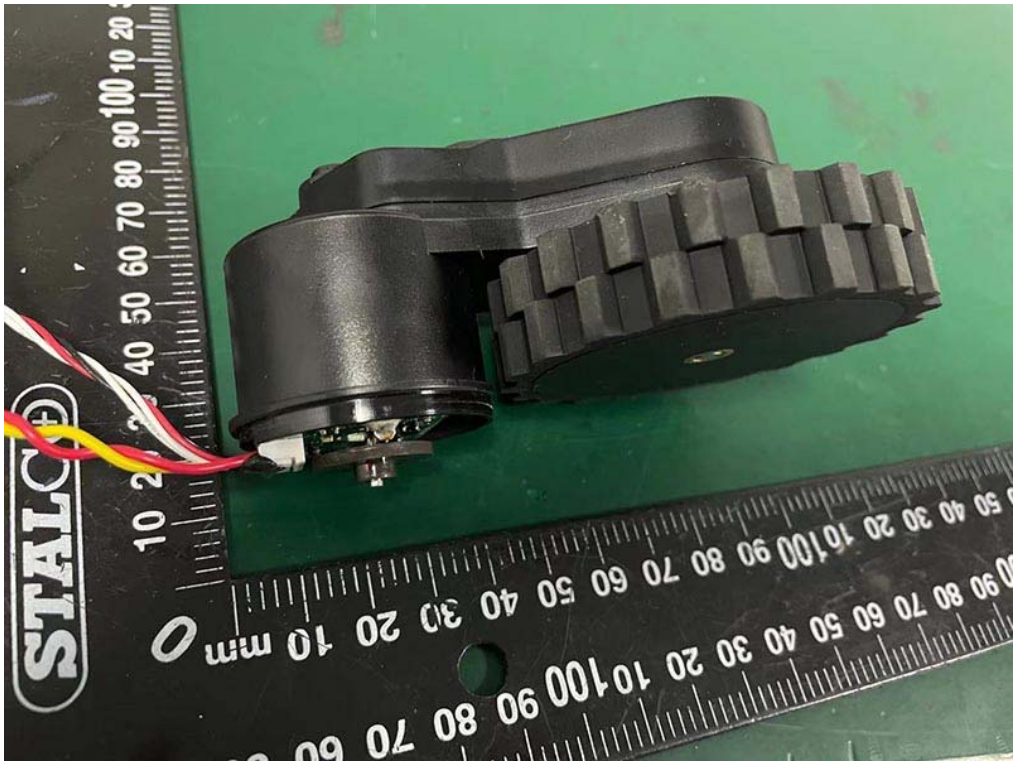
M/N: R2





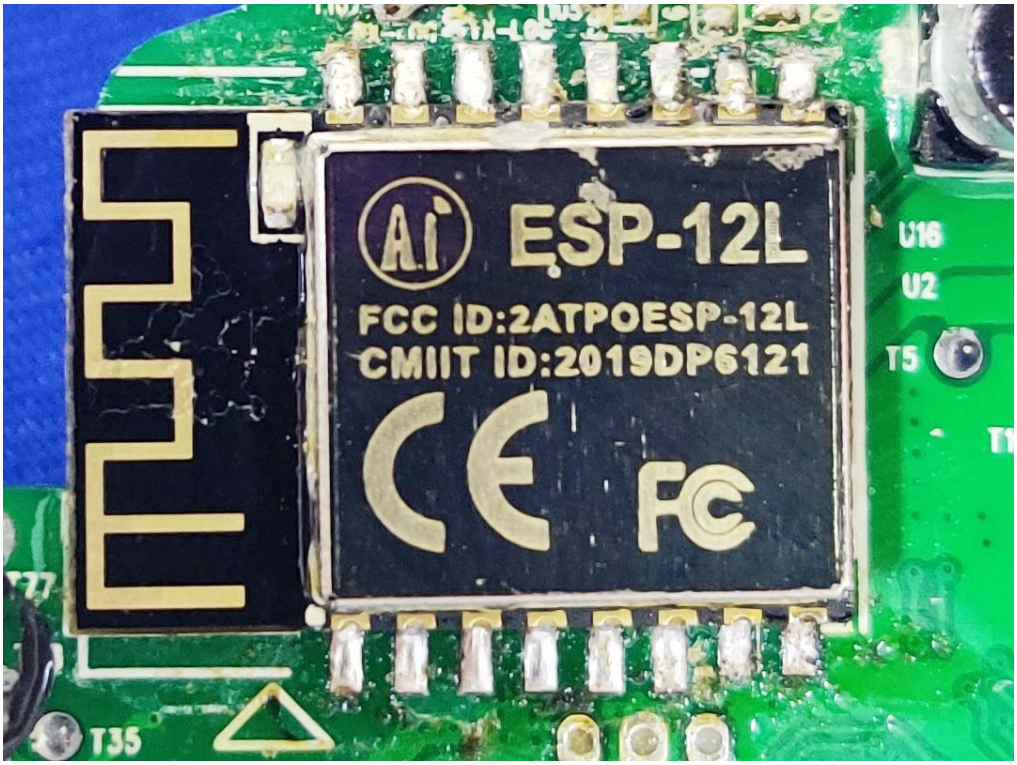
Internal Photos

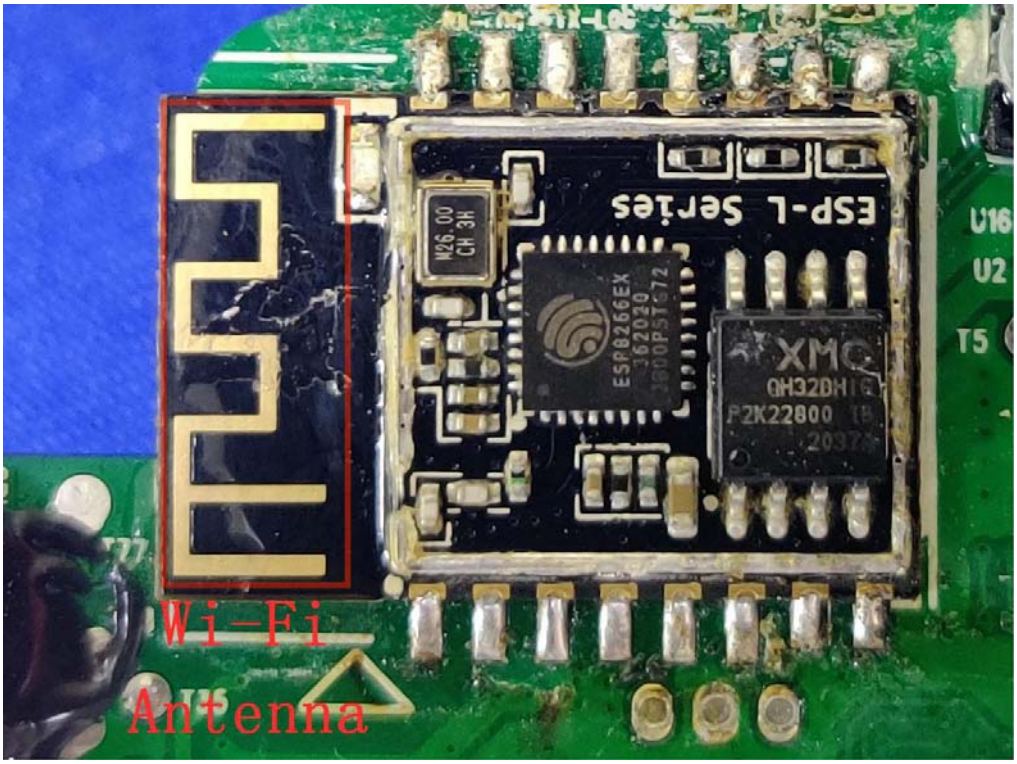
M/N: R2



Internal Photos

M/N: R2

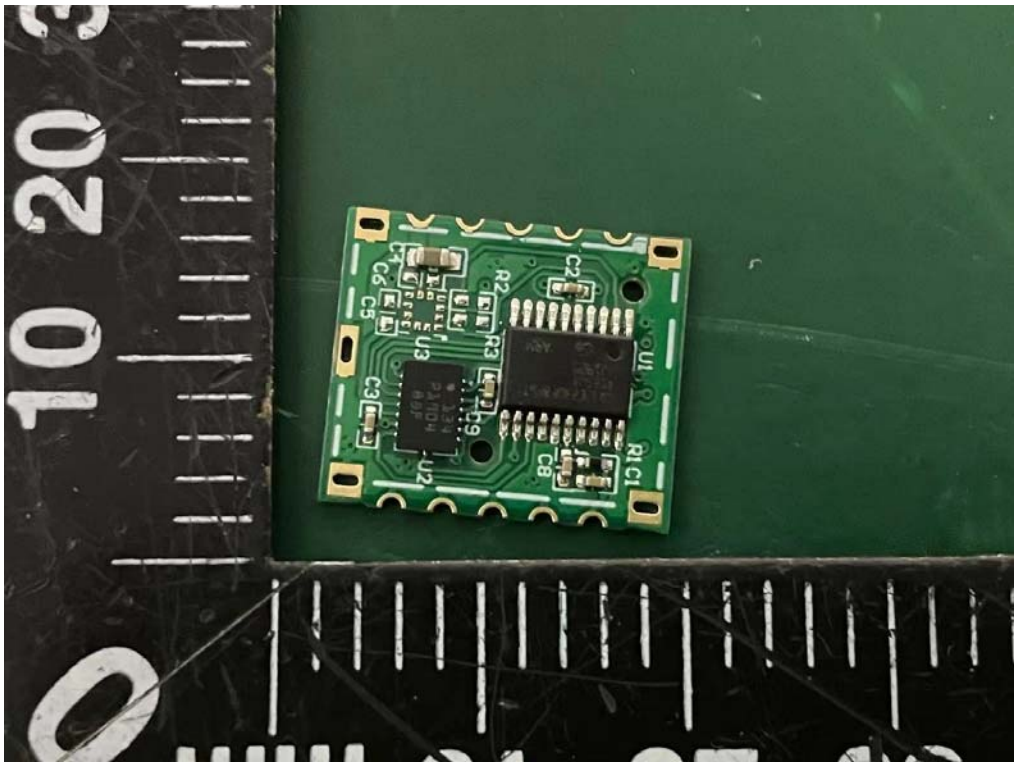


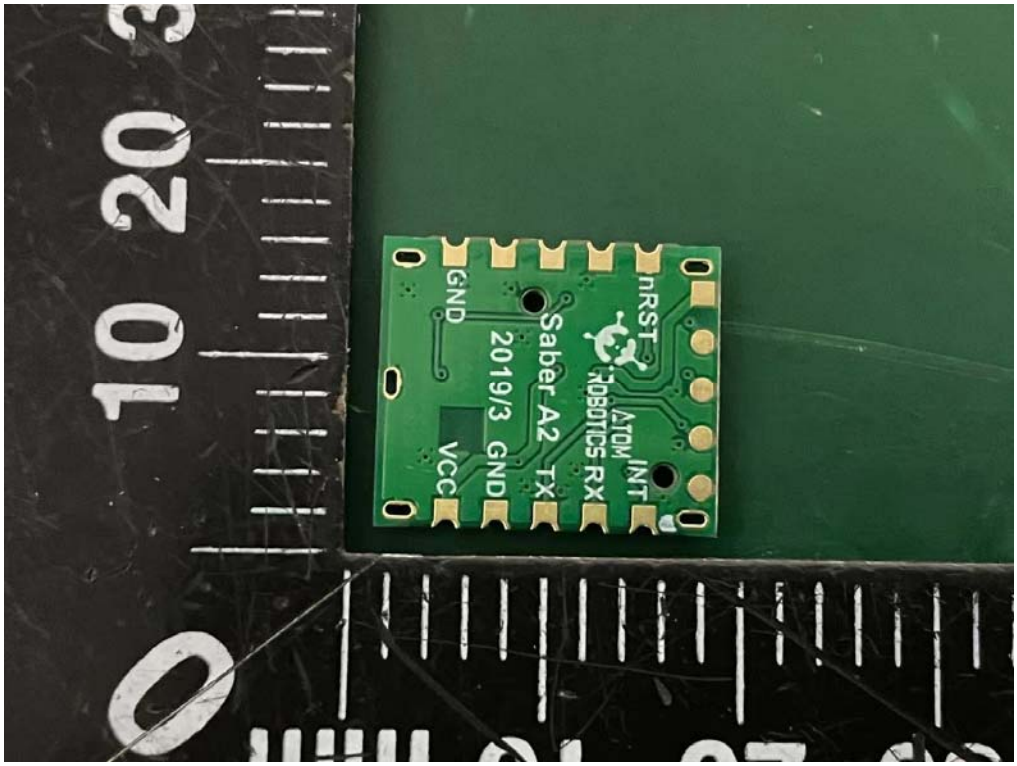


New EUT photo

Internal Photos

M/N: R2





Internal Photos

M/N: R2

End of Test Report