# FCC PART 15C TEST REPORT FOR CERTIFICATION
On Behalf of

SHENZHEN MODERN BUSINESS TRADING CO.,LTD.

Robotic Vacuum Cleaner

Model Number: D30

Additional Model: D30Max

FCC ID: 2AUTI-DKR30

| | |
|---|---|
| Prepared for: | SHENZHEN MODERN BUSINESS TRADING CO.,LTD. |
| | 302,no.4,lane 3,Yongxiang Road,Wuhe Community,Bantian Street, |
| | Longgang district,Shenzhen |
| | |
| Prepared By: | EST Technology Co., Ltd. |
| | Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China |
| Tel: 86-769-83081888-808 | |

| | |
|---|---|
| Report Number: | ESTE-R2108196 |
| Date of Test: | Aug. 13~20, 2021 |
| Date of Report: | Aug. 21, 2021 |

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# EST Technology Co., Ltd.

| | |
|---|---|
| **Applicant:**<br>**Address:** | SHENZHEN MODERN BUSINESS TRADING CO.,LTD.<br>302,no.4,lane 3,Yongxiang Road,Wuhe Community,Bantian Street,<br>Longgang district,Shenzhen |
| **Manufacturer:**<br>**Address:** | SHENZHEN MODERN BUSINESS TRADING CO.,LTD.<br>302,no.4,lane 3,Yongxiang Road,Wuhe Community,Bantian Street,<br>Longgang district,Shenzhen |
| **Factory:**<br>**Address:** | SHENZHEN MODERN BUSINESS TRADING CO.,LTD.<br>302,no.4,lane 3,Yongxiang Road,Wuhe Community,Bantian Street,<br>Longgang district,Shenzhen |
| **E.U.T:** | Robotic Vacuum Cleaner |
| **Model Number:** | D30 |
| **Additional Model:** | D30Max<br>(Except for the color and model name, the rest is identical.) |
| **Power Supply:** | DC 24V From Adapter Input AC 100-240V, 50/60Hz |
| **Trade Name:** | DEENKEE Serial No.: ------ |
| **Date of Receipt:** | Aug. 13, 2021 Date of Test: Aug. 13~20, 2021 |
| **Test Specification:** | FCC Part 15 Subpart C (15.247)<br>ANSI C63.10:2013<br>FCC KDB 558074 D01 15.247 Meas Guidance v05r02<br>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.<br><br>This report applies to above tested sample only and shall not be reproduced in part without written approval of EST Technology Co., Ltd.<br><br>**Date:** Aug. 21, 2021 |

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

**Other Aspects:**
None.

*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 | : | Robotic Vacuum Cleaner |
| Model Number | : | D30 |
| Software Version | : | N/A |
| Hardware Version | : | N/A |
| Operation frequency | : | 2412MHz~2462MHz |
| Number of channel | : | IEEE 802.11b: 11 Channels<br>IEEE 802.11g: 11 Channels<br>IEEE 802.11n HT20: 11 Channels |
| Max Output Power (PEAK) | : | IEEE 802.11b: 18.38dBm<br>IEEE 802.11g: 20.14dBm<br>IEEE 802.11n HT20: 20.43dBm |
| Modulation Type | : | IEEE 802.11b mode: DSSS(CCK,QPSK, BPSK)<br>IEEE 802.11g mode: OFDM (BPSK/QPSK/16QAM/64QAM)<br>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 | - | - | Internal | - | 2.5 |

# 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<br>15.209<br>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<br>Registration No.: L5288<br>This Certificate is valid until: November 12, 2023<br><br>Certificated by FCC, USA<br>Designation Number: CN1215<br>This Certificate is valid until: January 31, 2022<br><br>Certificated by A2LA, USA<br>Registration No.: 4366.01<br>This Certificate is valid until: January 31, 2022<br><br>Certificated by Industry Canada<br>CAB identifier No.: CN0035<br>This Certificate is valid until: January 31, 2022<br><br>Certificated by VCCI, Japan<br>Registration No.:C-14103; T-20073; R-13663;<br>R-20103; G-20097<br>Date of registration: Apr. 20, 2020<br>This Certificate is valid until: Apr. 19, 2023<br><br>Certificated by TUV Rheinland, Germany<br>Registration No.: UA 50413872 0001<br>Date of registration: July 31, 2018<br><br>Certificated by Intertek<br>Registration No.: 2011-RTL-L2-64<br>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 | $7\times10^{-8}$ |
| Uncertainty for conducted RF Power | 1.08dB |
| 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.

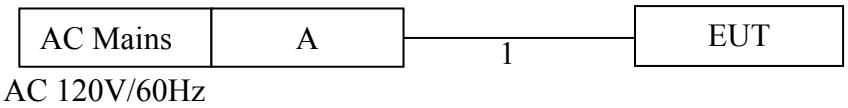
## 2.4. Assistant equipment used for test

| Item | Equipment | Brand | Model Name/Type No. | FCC ID | Series No. |
|---|---|---|---|---|---|
| A | Adapter | - | AS2401A-2401000US | - | - |

| Item | Shielded Type | Ferrite Core | Length | Note |
|---|---|---|---|---|
| 1 | NO | NO | 1.8m | AC 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: Robotic 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 | UI_mp_tool | | |
|---|---|---|---|
| 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 |

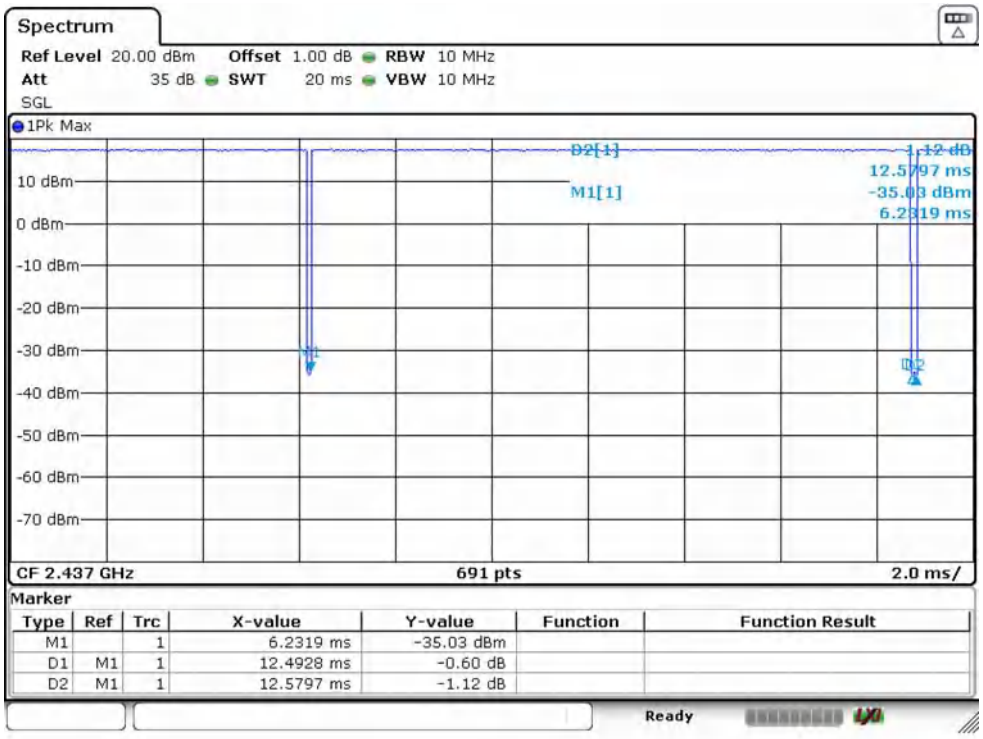
## 2.8. Duty Cycle

| Temperature | 27.2℃ | Relative Humidity | 58% | Test Voltage | AC 120V/60Hz |
|---|---|---|---|---|---|
| Mode | Fre(MHz) | On time(ms) | Total Time(ms) | Duty Cycle | Duty Factor |
| IEEE 802.11b | 2437 | 12.4928 | 12.5797 | 99.31 | 0.00 |
| IEEE 802.11g | 2437 | 2.1014 | 2.2029 | 95.39 | 0.20 |
| IEEE 802.11n HT20 | 2437 | 1.0000 | 1.1159 | 89.61 | 0.48 |

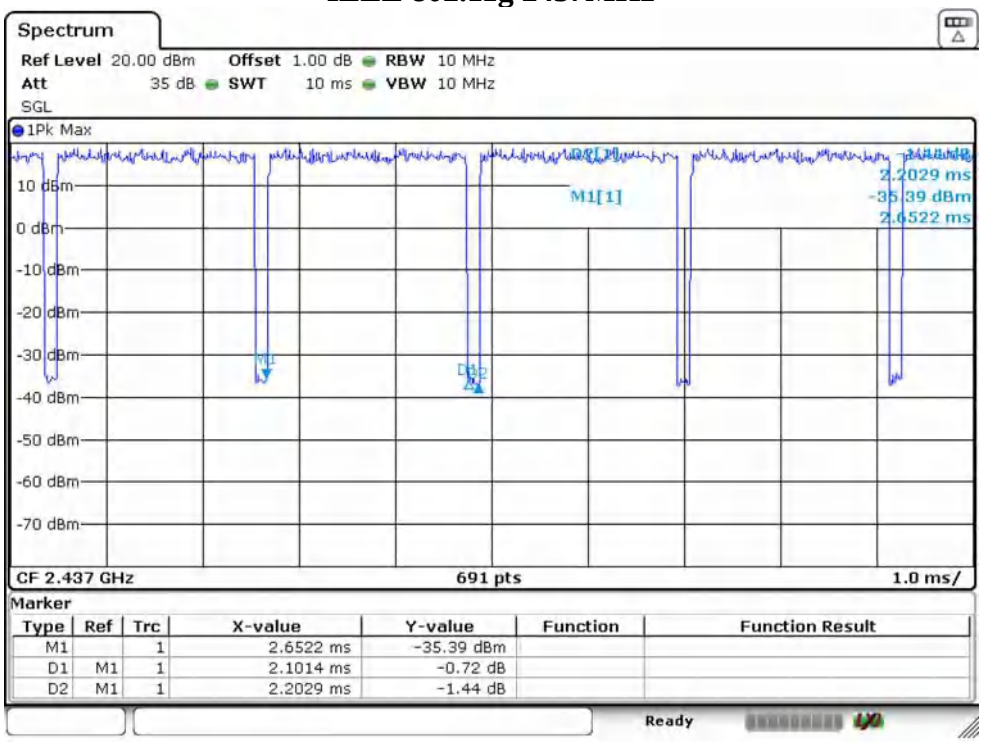
Note:

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).

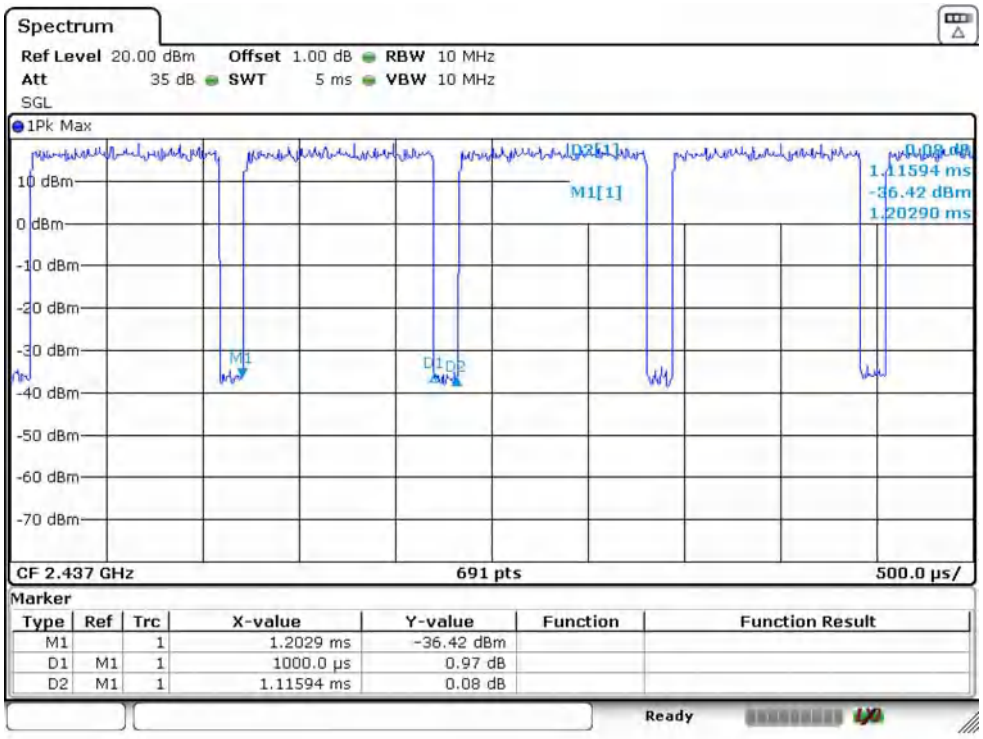
## IEEE 802.11b 2437MHz




## 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 | | |

## 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 13,21 | 1 Year |
| Artificial Mains Network | Rohde & Schwarz | ENV216 | EST-E002 | LISAI | June 13,21 | 1 Year |
| Pulse Limiter | Rohde & Schwarz | ESH3-Z2 | EST-E078 | LISAI | June 13,21 | 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 13,21 | 1 Year |
| Active Loop Antenna | SCHWAREB ECK | FMZB 1519B | EST-E054 | LISAI | June 13,21 | 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 13,21 | 1 Year |
| Bilog Antenna | Teseq | CBL 6111D | EST-E034 | LISAI | June 13,21 | 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 13,21 | 1 Year |
| Signal Amplifier | SCHWARZB ECK | BBV9718 | EST-E032 | LISAI | June 13,21 | 1 Year |
| Spectrum Analyzer | Rohde &Schwarz | FSV40 | EST-E069 | LISAI | July 19,21 | 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 |

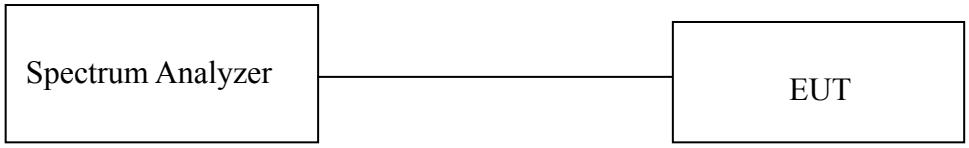
| For connect EUT antenna terminal test | | | | | | |
|---|---|---|---|---|---|---|
| Equipment | Manufacturer | Model No. | Serial No. | Calibration Body | Last Cal. | Next Cal. |
| Spectrum Analyzer | Rohde&Schwarz | FSV40 | EST-E069 | LISAI | July 19,21 | 1 Year |

# 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 |

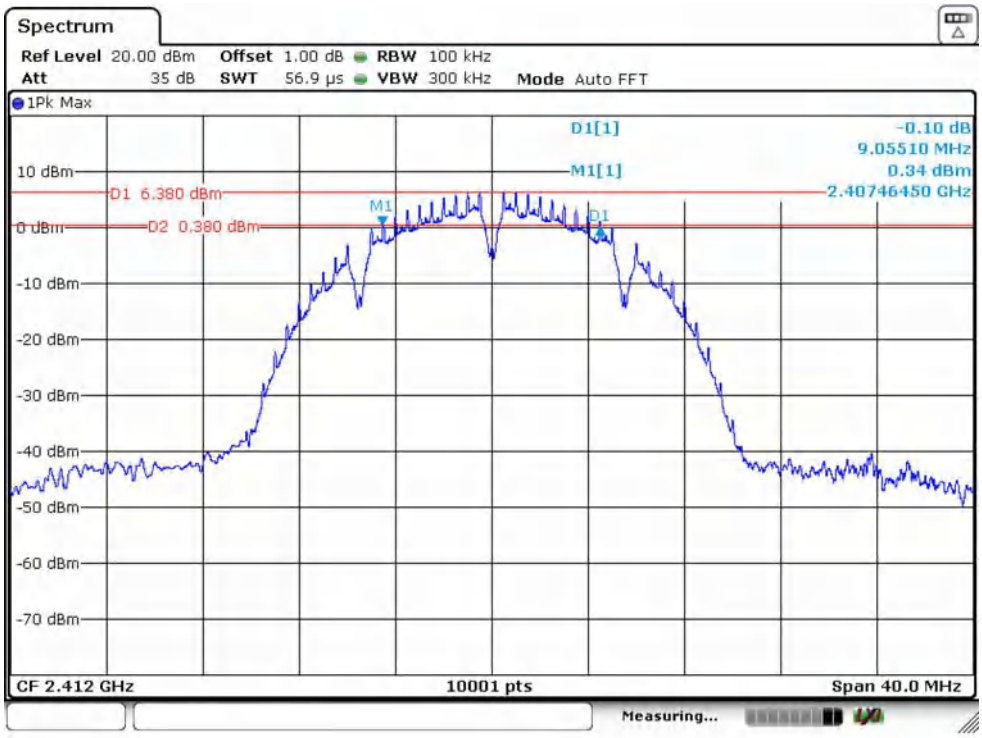
## 3.4. Test Procedure

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.

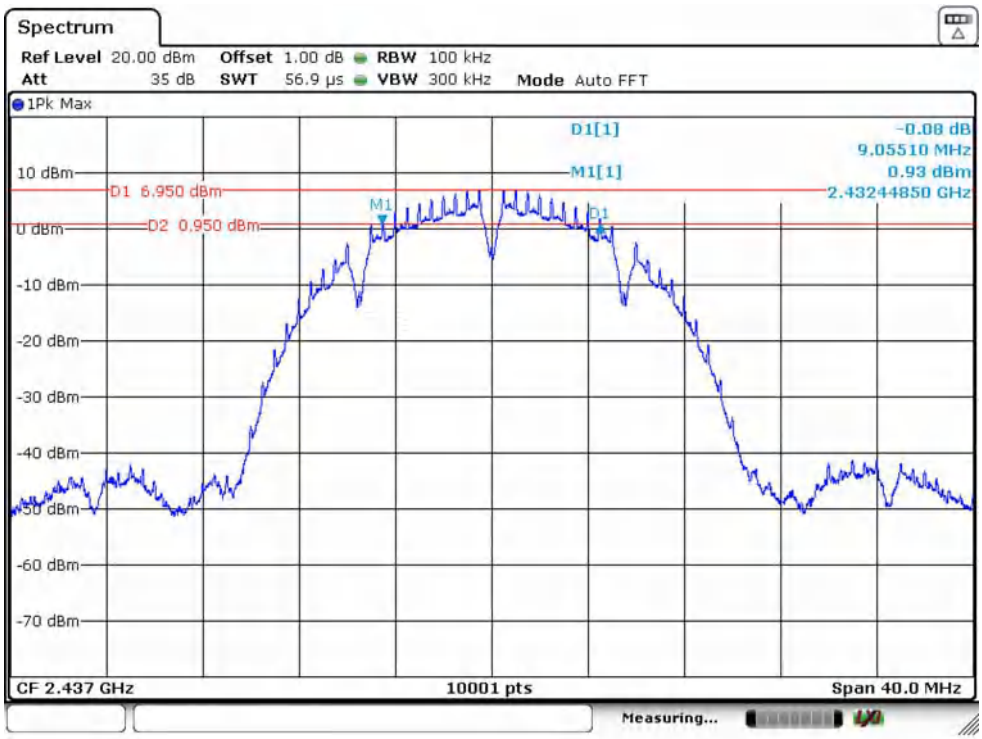
## 3.5. Test Result

| Temperature | 27.2℃ | Relative Humidity | 58% | |
|---|---|---|---|---|
| Test Voltage | AC 120V/60Hz | | | |
| Mode | Freq (MHz) | 6dB Bandwidth (MHz) | Limit (MHz) | Result |
| IEEE 802.11b | 2412 | 9.055 | ≥0.5 | PASS |
| | 2437 | 9.055 | ≥0.5 | PASS |
| | 2462 | 9.055 | ≥0.5 | PASS |
| IEEE 802.11g | 2412 | 16.326 | ≥0.5 | PASS |
| | 2437 | 16.350 | ≥0.5 | PASS |
| | 2462 | 16.338 | ≥0.5 | PASS |
| IEEE 802.11n HT20 | 2412 | 17.550 | ≥0.5 | PASS |
| | 2437 | 17.542 | ≥0.5 | PASS |
| | 2462 | 17.550 | ≥0.5 | PASS |

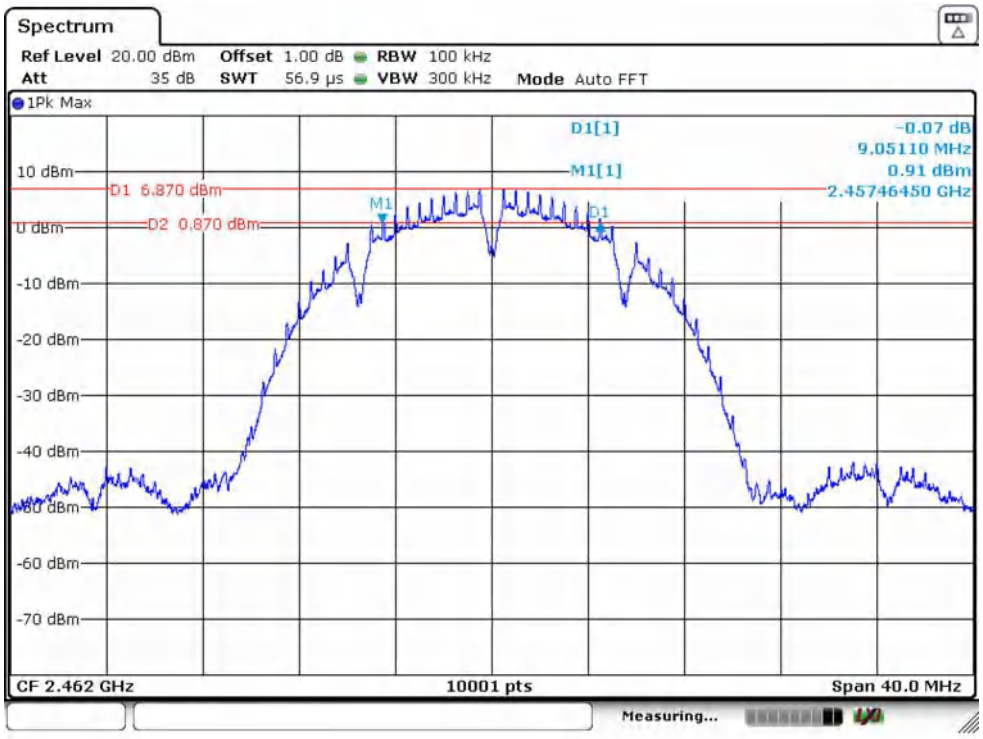
## IEEE 802.11b 2412MHz



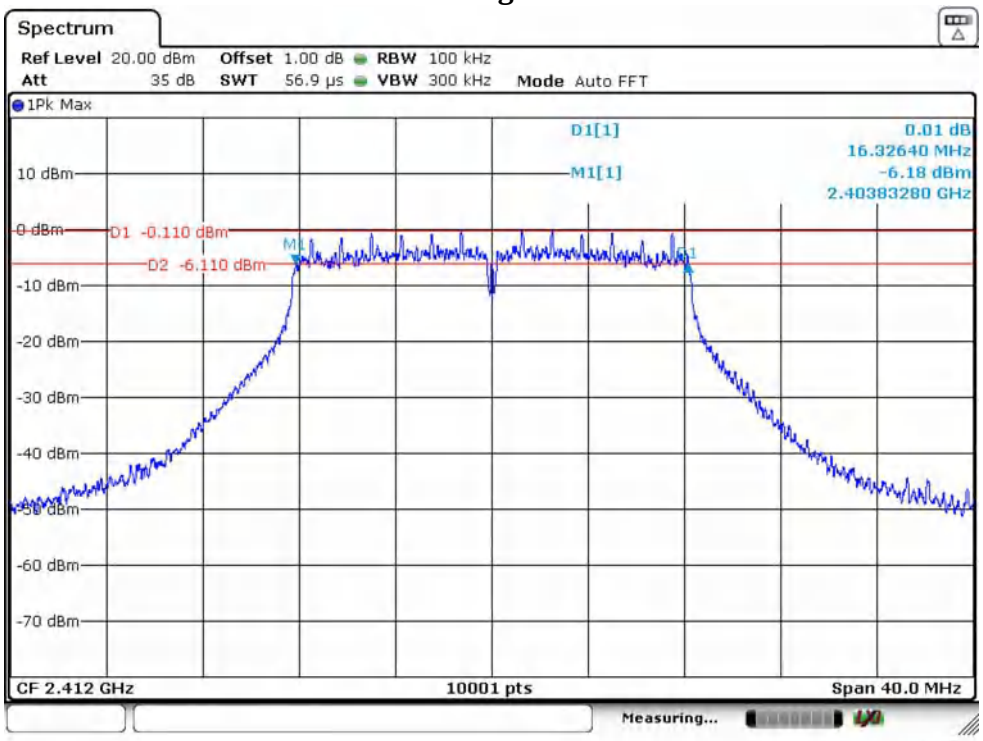

## IEEE 802.11b 2437MHz



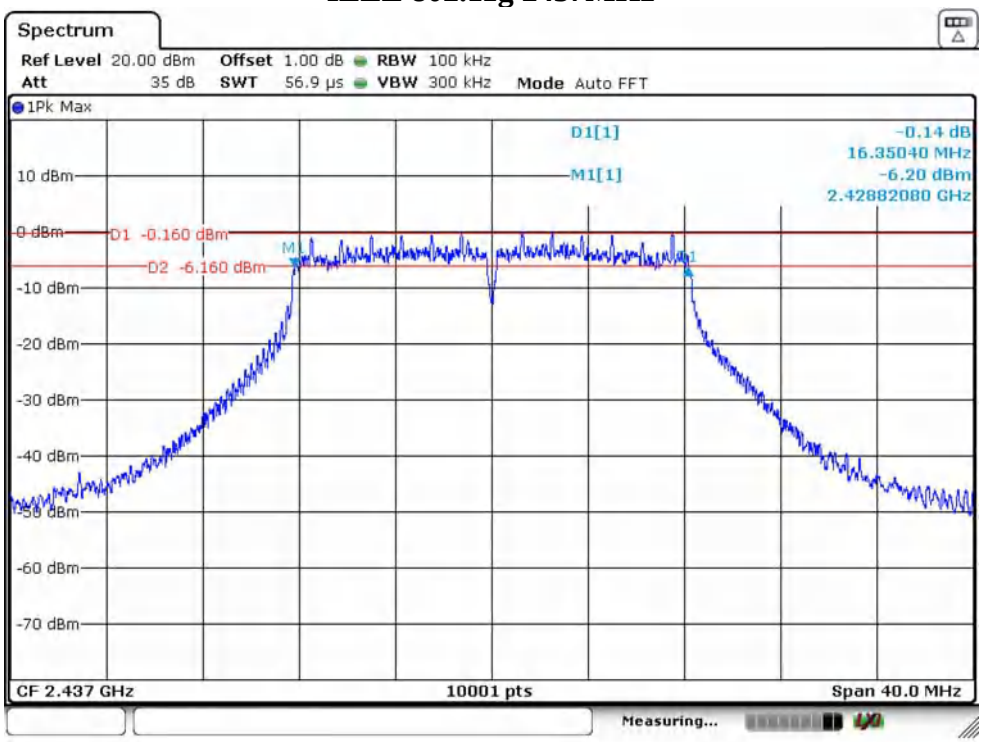
**IEEE 802.11b 2462MHz**



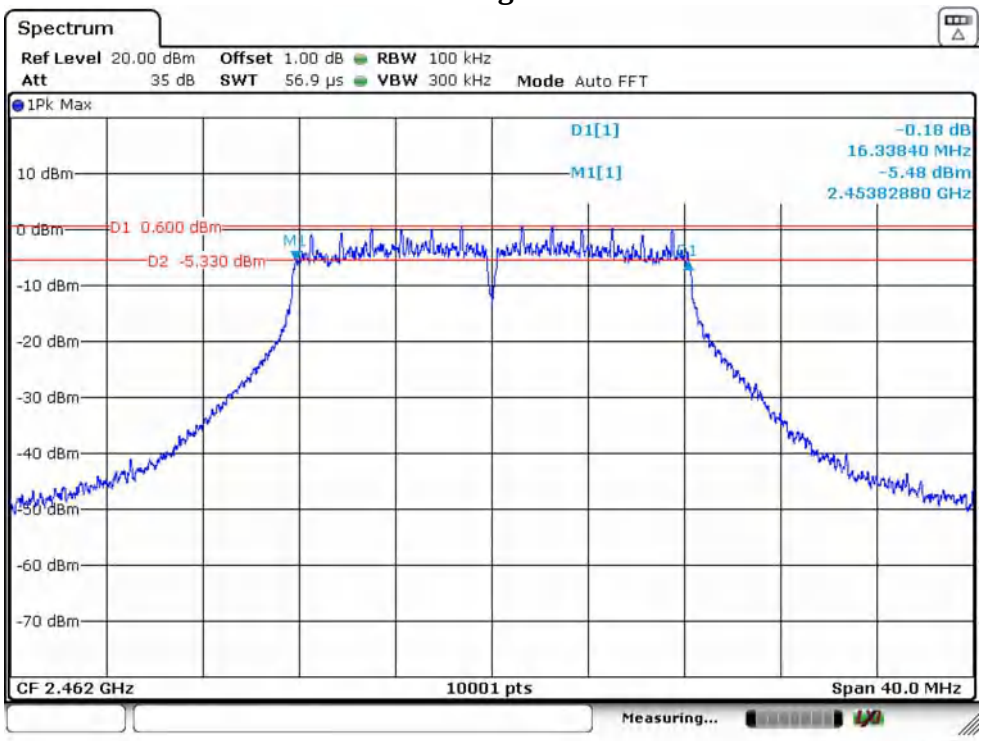
**IEEE 802.11g 2412MHz**



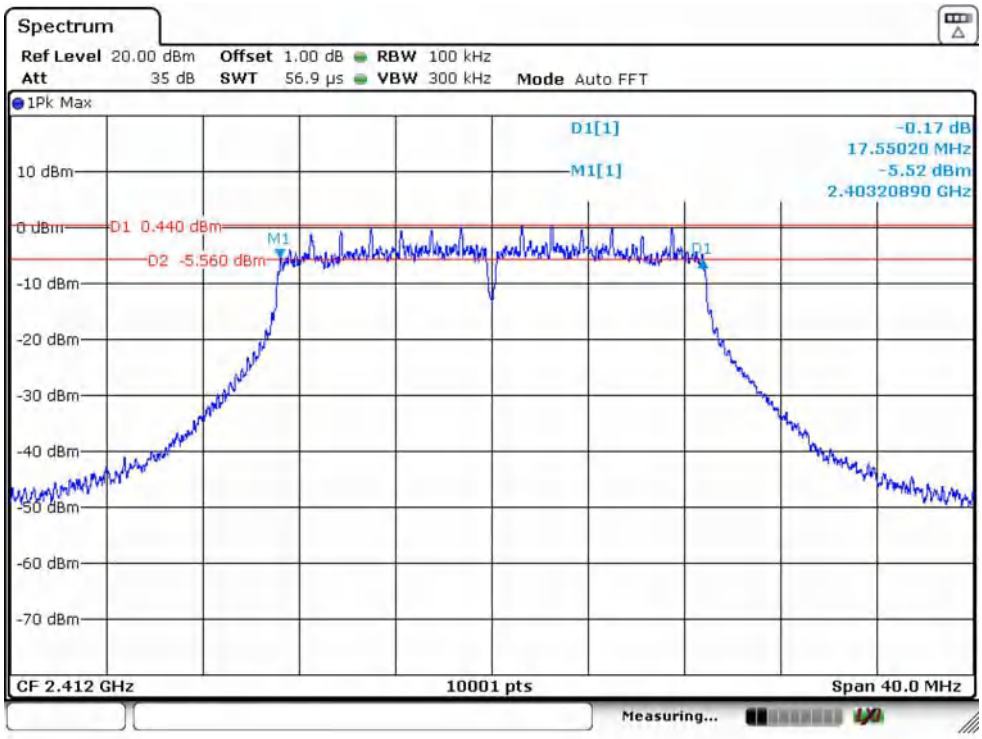

**IEEE 802.11g 2437MHz**



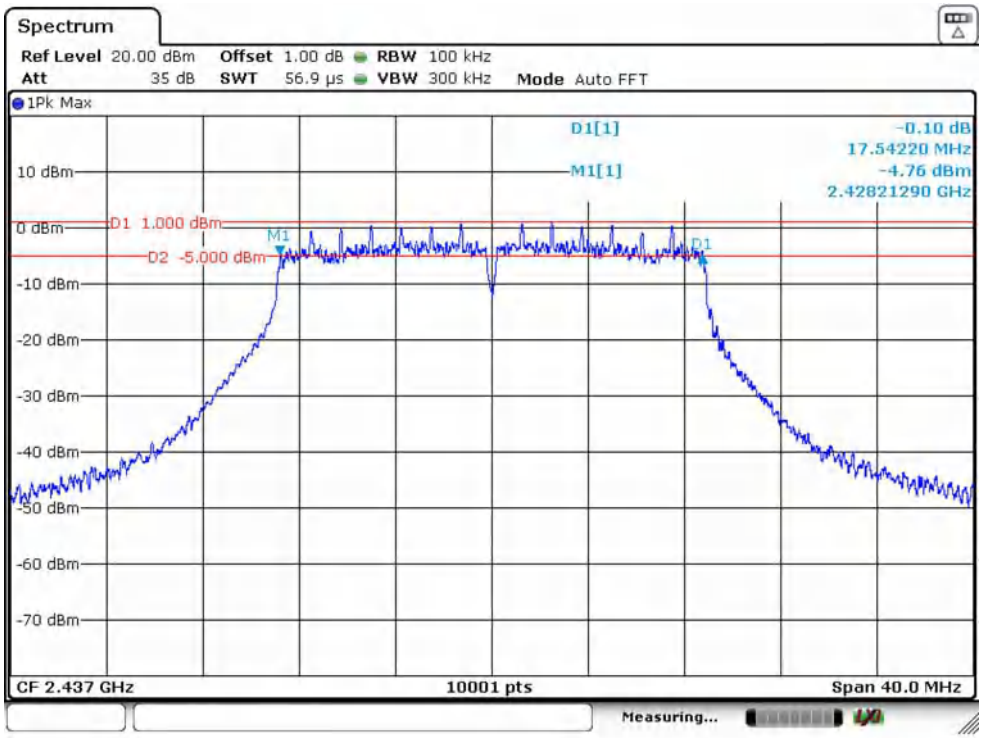
**IEEE 802.11g 2462MHz**



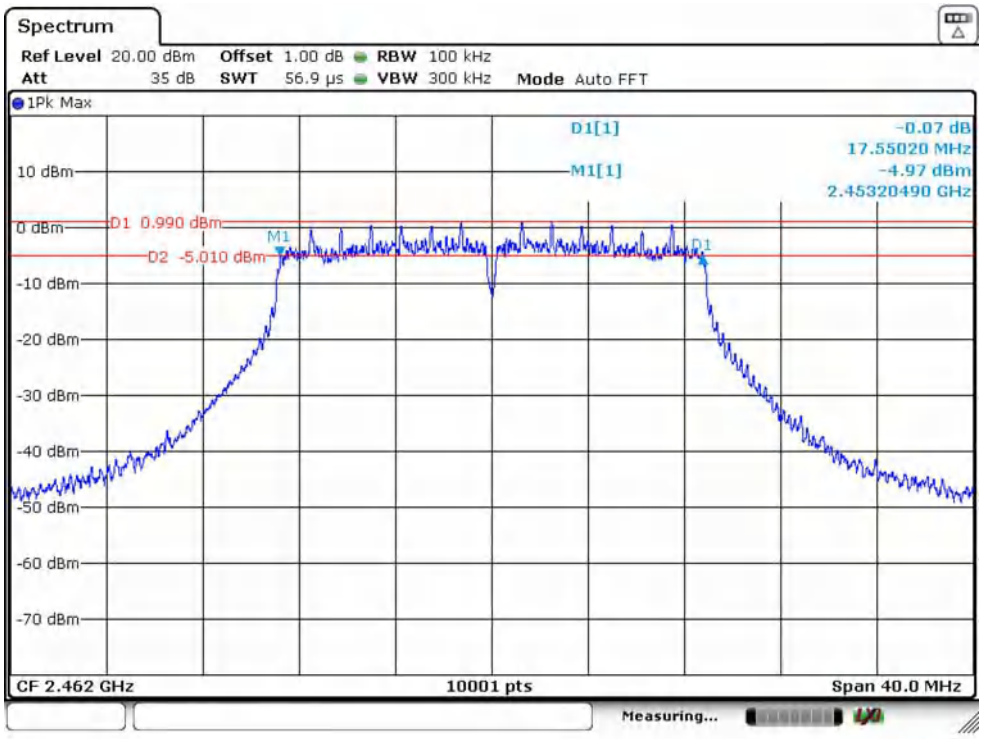
## IEEE 802.11n HT20 2412MHz




## IEEE 802.11n HT20 2437MHz



**IEEE 802.11n HT20 2462MHz**

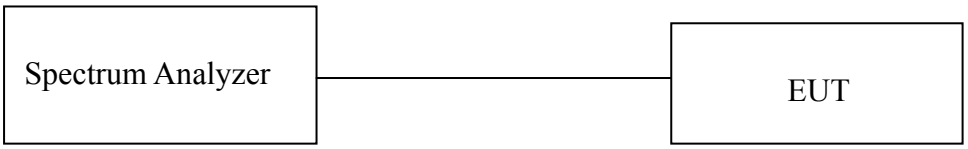


# 4. MAXIMUM PEAK OUTPUT POWER

## 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 |

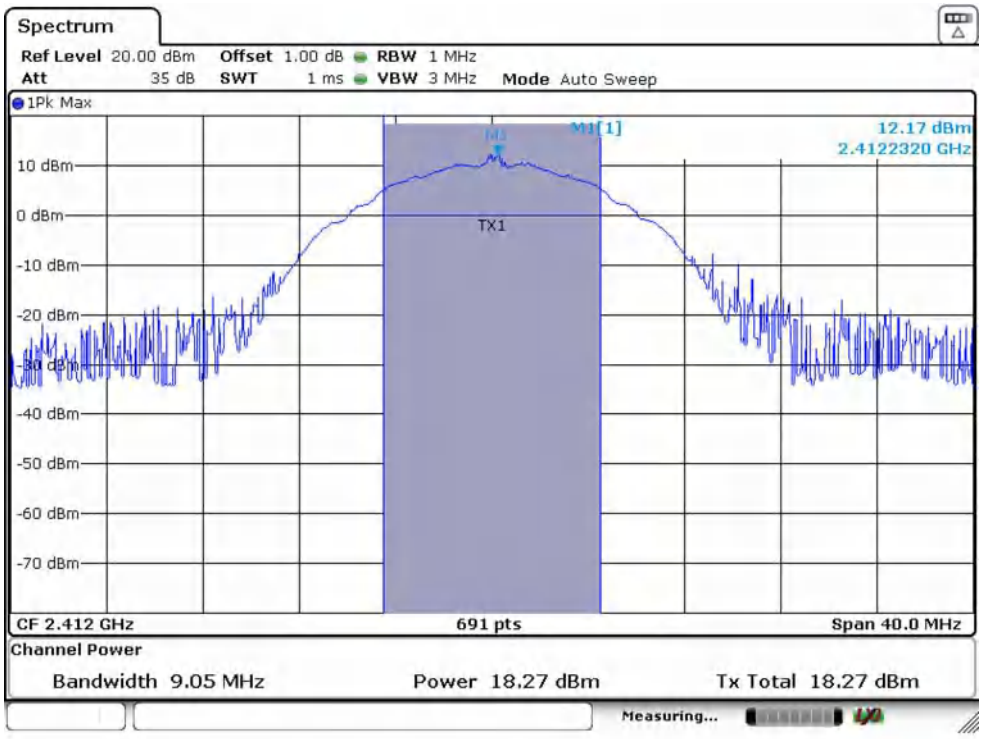
## 4.4. Test Procedure

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.

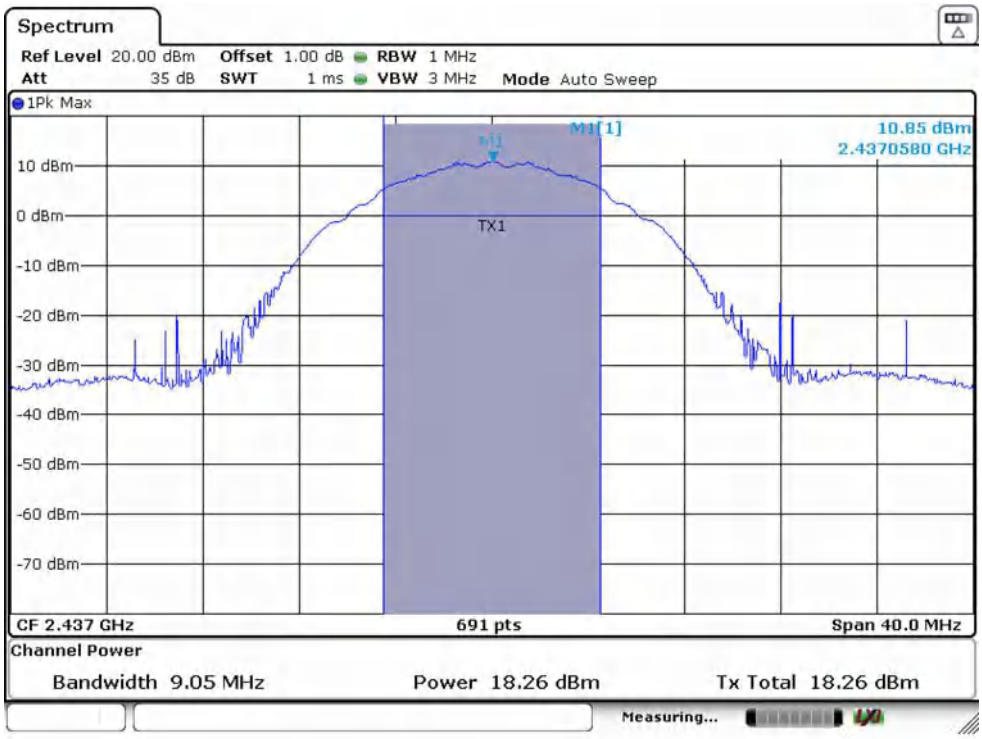
## 4.5. Test Result

| Temperature | 27.2℃ | Relative Humidity | 58% | Test Voltage | | AC 120V/60Hz |
|---|---|---|---|---|---|---|
| Mode | Freq (MHz) | Peak Output Power | | Limit | | Result |
| | | dBm | W | dBm | W | |
| IEEE 802.11b | 2412 | 18.27 | 0.0671 | 30.00 | 1.0000 | PASS |
| | 2437 | 18.26 | 0.0670 | 30.00 | 1.0000 | PASS |
| | 2462 | 18.38 | 0.0689 | 30.00 | 1.0000 | PASS |
| IEEE 802.11g | 2412 | 19.59 | 0.0910 | 30.00 | 1.0000 | PASS |
| | 2437 | 19.95 | 0.0989 | 30.00 | 1.0000 | PASS |
| | 2462 | 20.14 | 0.1033 | 30.00 | 1.0000 | PASS |
| IEEE 802.11n HT20 | 2412 | 19.83 | 0.0962 | 30.00 | 1.0000 | PASS |
| | 2437 | 20.29 | 0.1069 | 30.00 | 1.0000 | PASS |
| | 2462 | 20.43 | 0.1104 | 30.00 | 1.0000 | PASS |

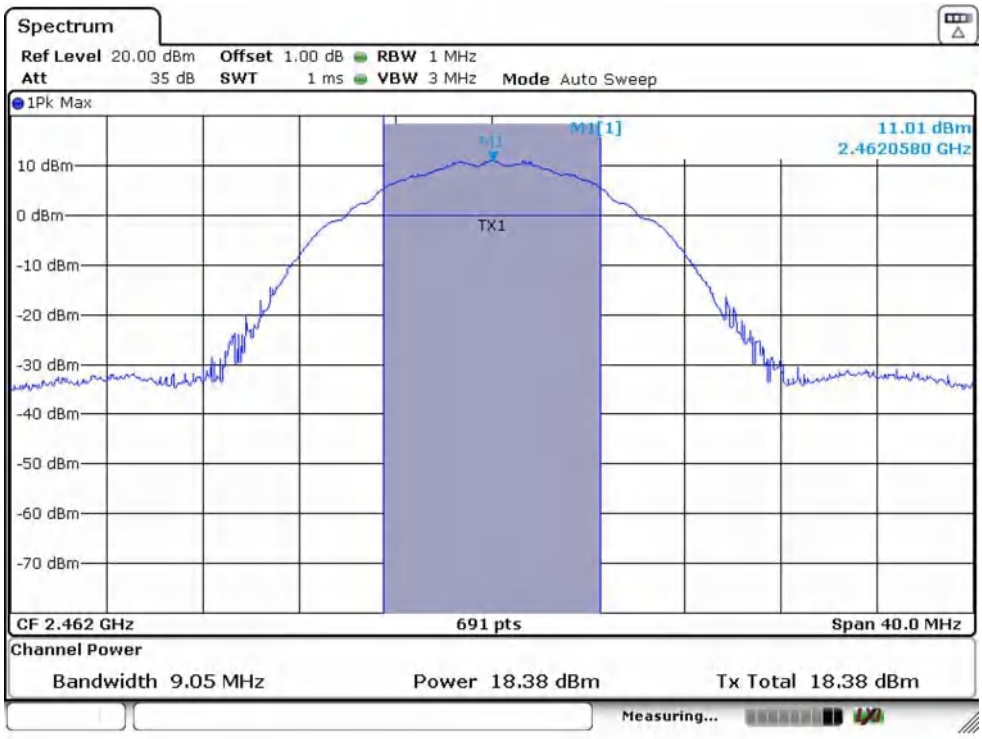
## IEEE 802.11b 2412MHz



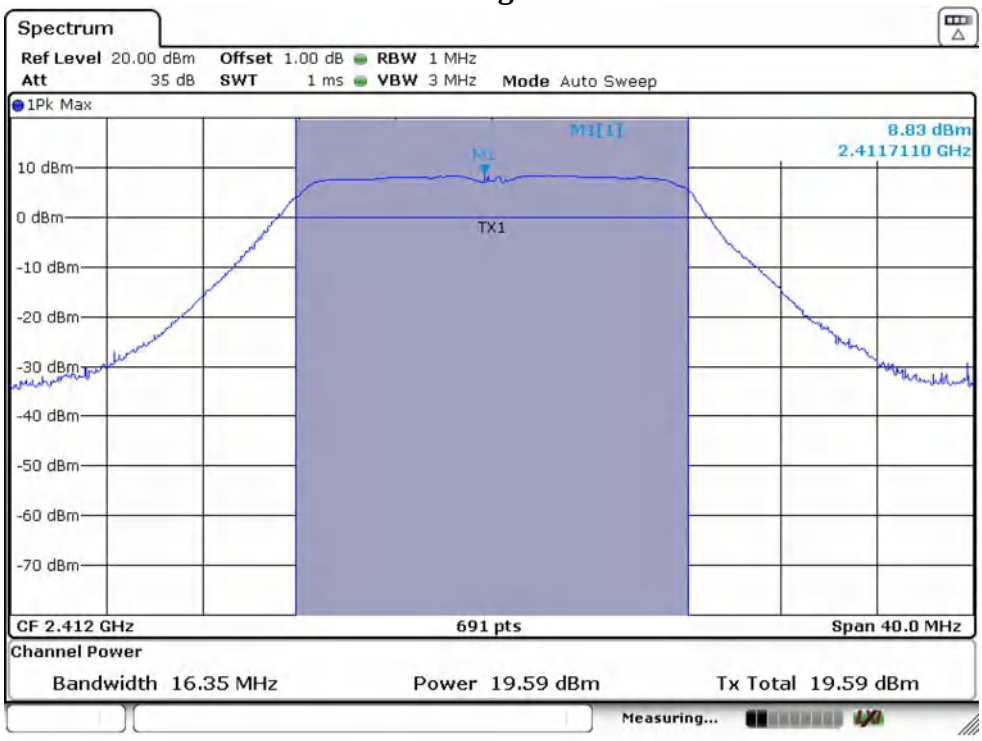

## IEEE 802.11b 2437MHz



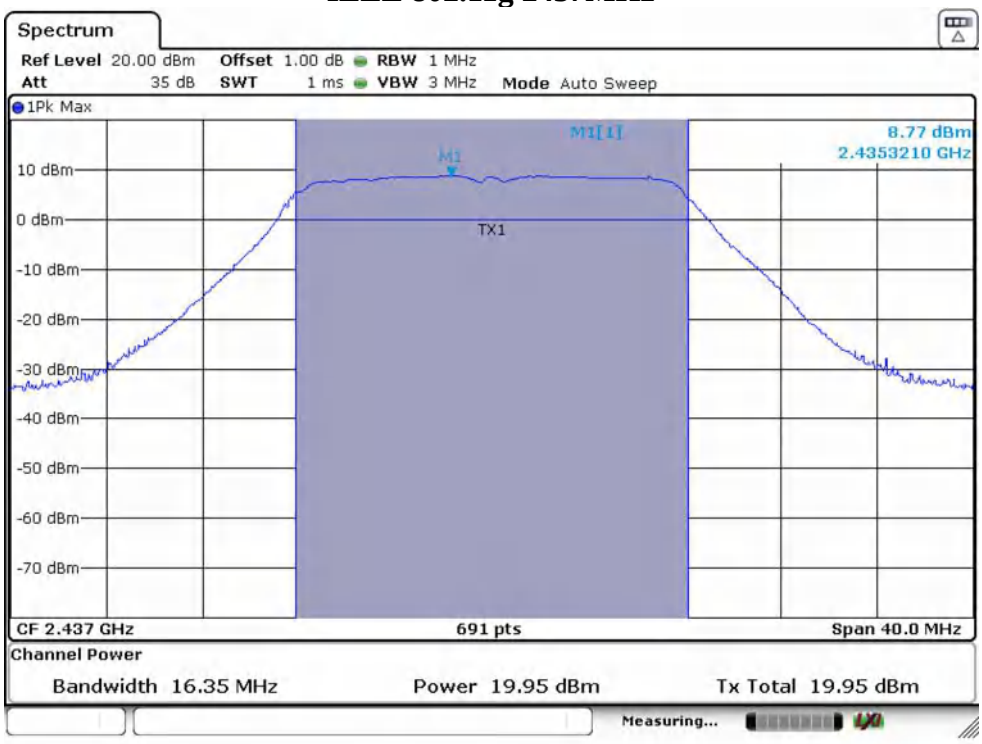
**IEEE 802.11b 2462MHz**



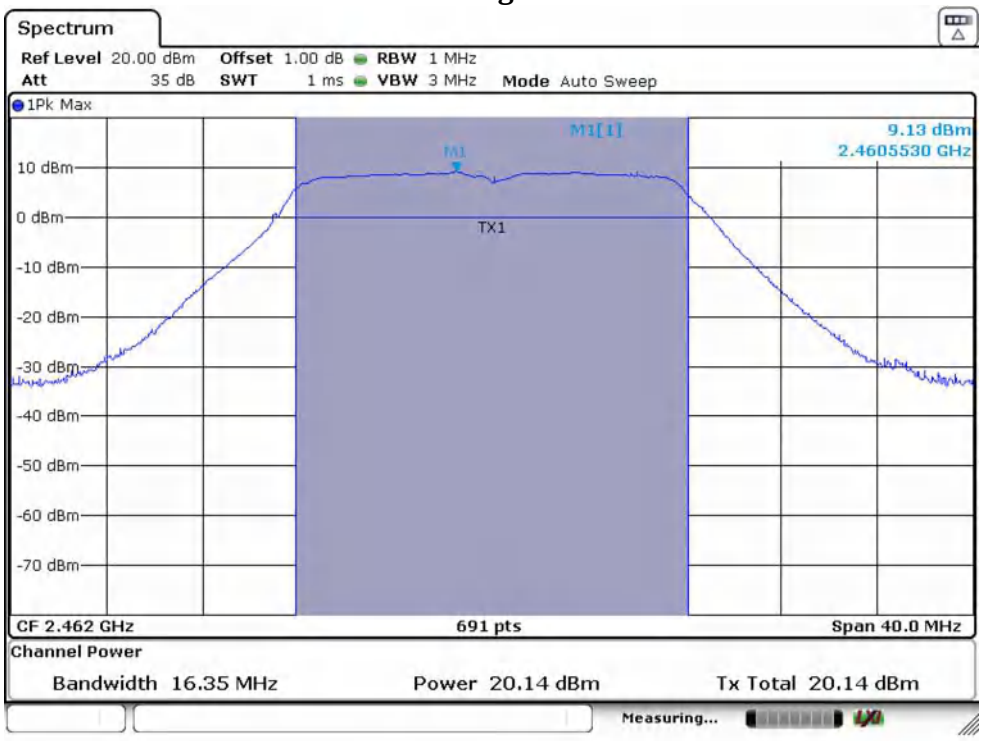
## IEEE 802.11g 2412MHz



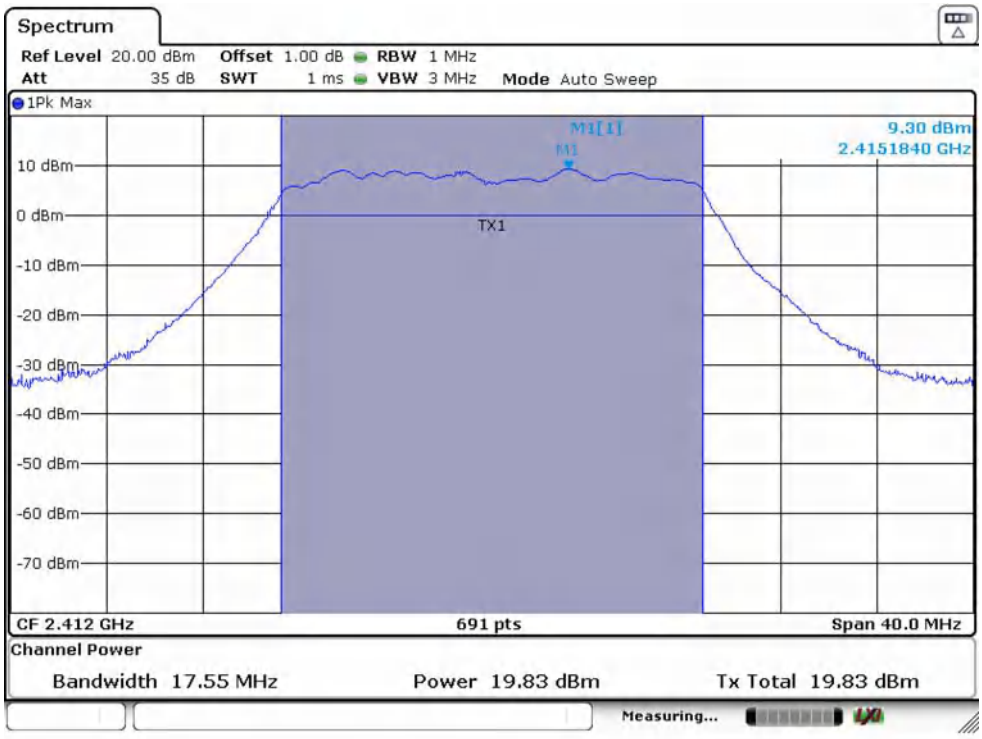

## IEEE 802.11g 2437MHz



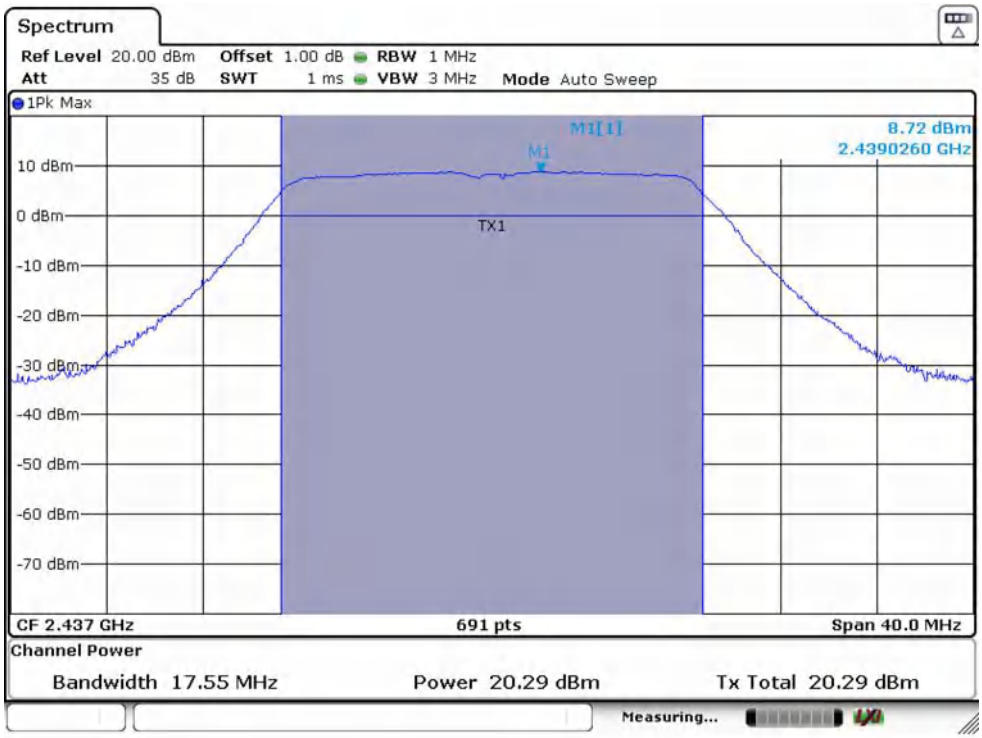
**IEEE 802.11g 2462MHz**



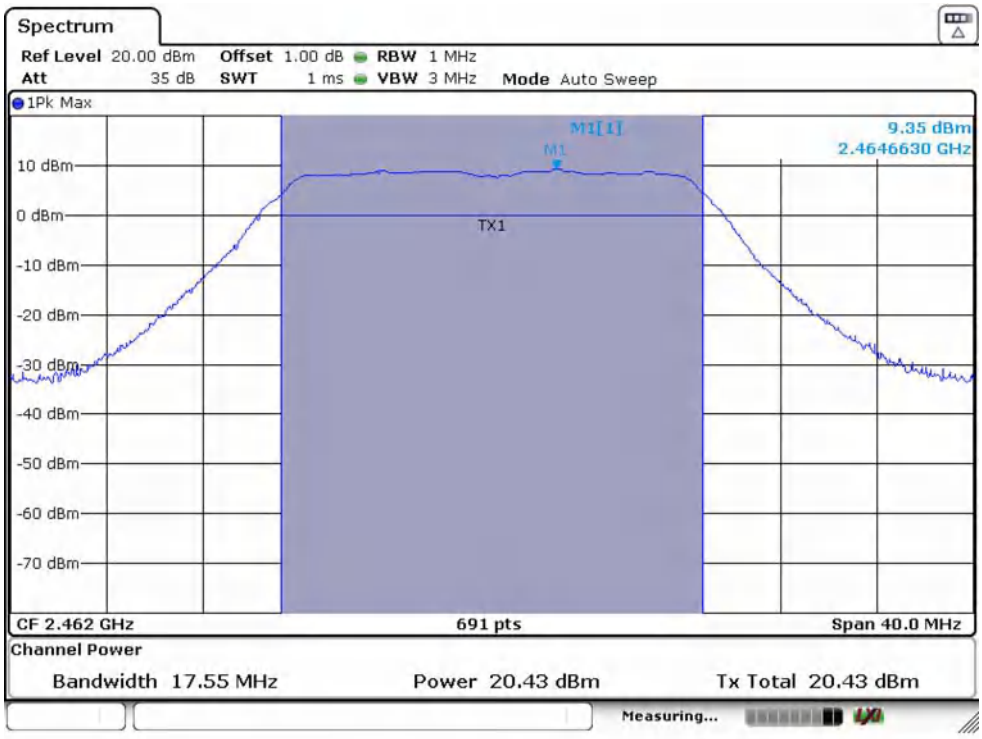
## IEEE 802.11n HT20 2412MHz




## IEEE 802.11n HT20 2437MHz



**IEEE 802.11n HT20 2462MHz**

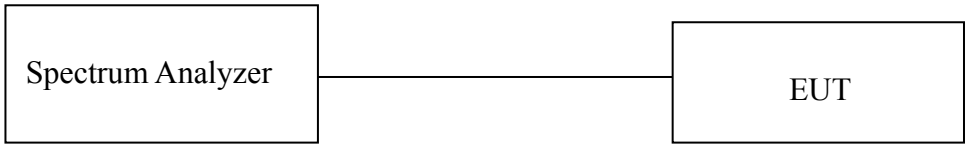


# 5. POWER SPECTRAL DENSITY

## 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 |

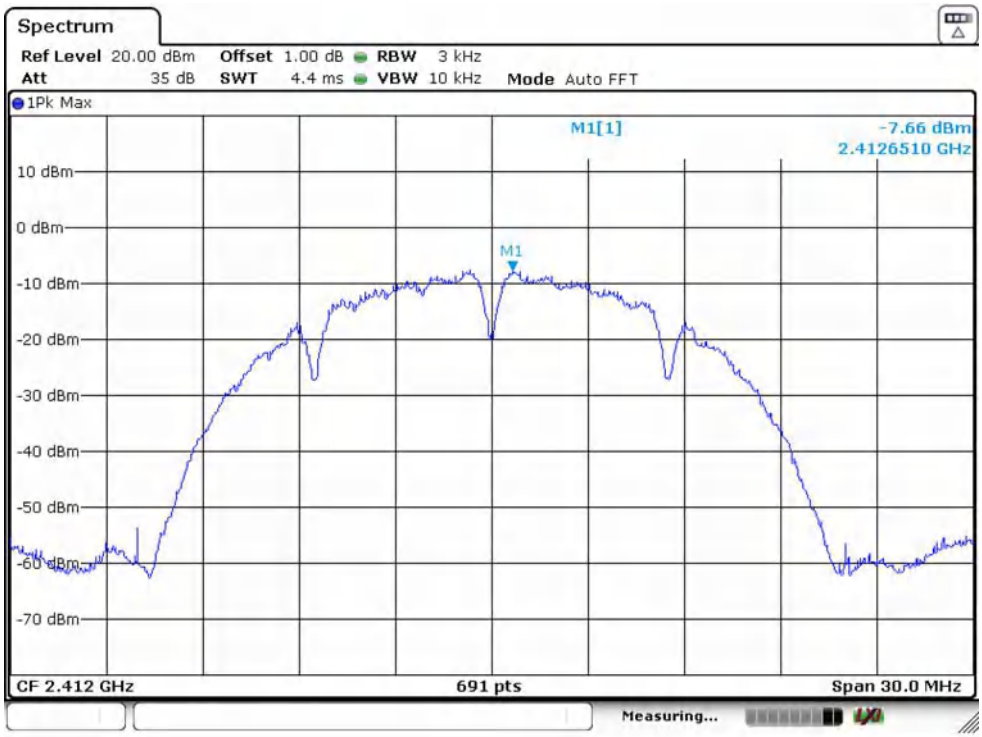
## 5.4. Test Procedure

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.

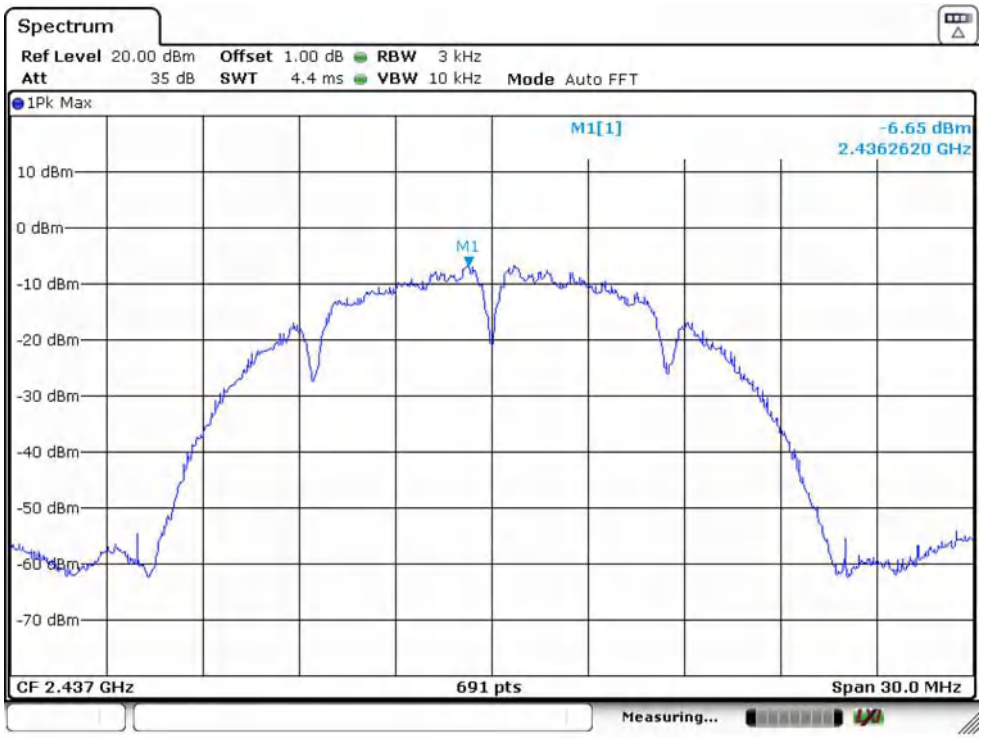
## 5.5. Test Result

| Temperature | 27.2℃ | Relative Humidity | 58% | Test Voltage | AC 120V/60Hz |
|---|---|---|---|---|---|
| Mode | Freq (MHz) | Power Density (dBm/3KHz) | | Limit (dBm/3KHz) | Result |
| IEEE 802.11b | 2412 | -7.66 | | 8.00 | PASS |
| | 2437 | -6.65 | | 8.00 | PASS |
| | 2462 | -7.01 | | 8.00 | PASS |
| IEEE 802.11g | 2412 | -13.51 | | 8.00 | PASS |
| | 2437 | -13.41 | | 8.00 | PASS |
| | 2462 | -13.97 | | 8.00 | PASS |
| IEEE 802.11n HT20 | 2412 | -14.40 | | 8.00 | PASS |
| | 2437 | -13.34 | | 8.00 | PASS |
| | 2462 | -12.73 | | 8.00 | PASS |

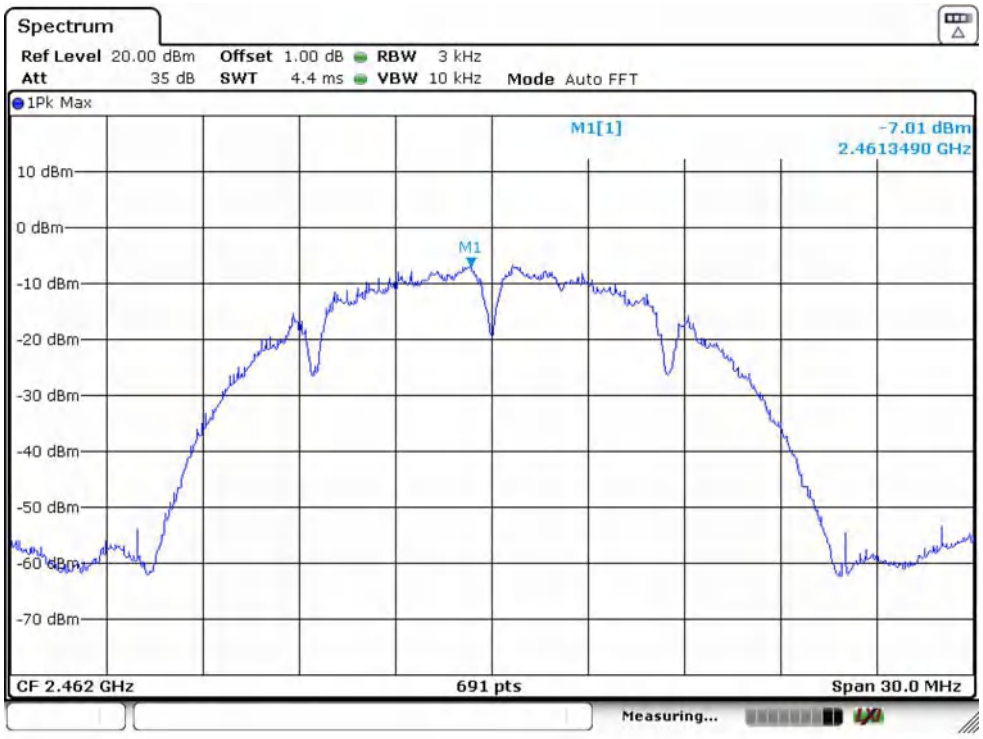
**IEEE 802.11b 2412MHz**



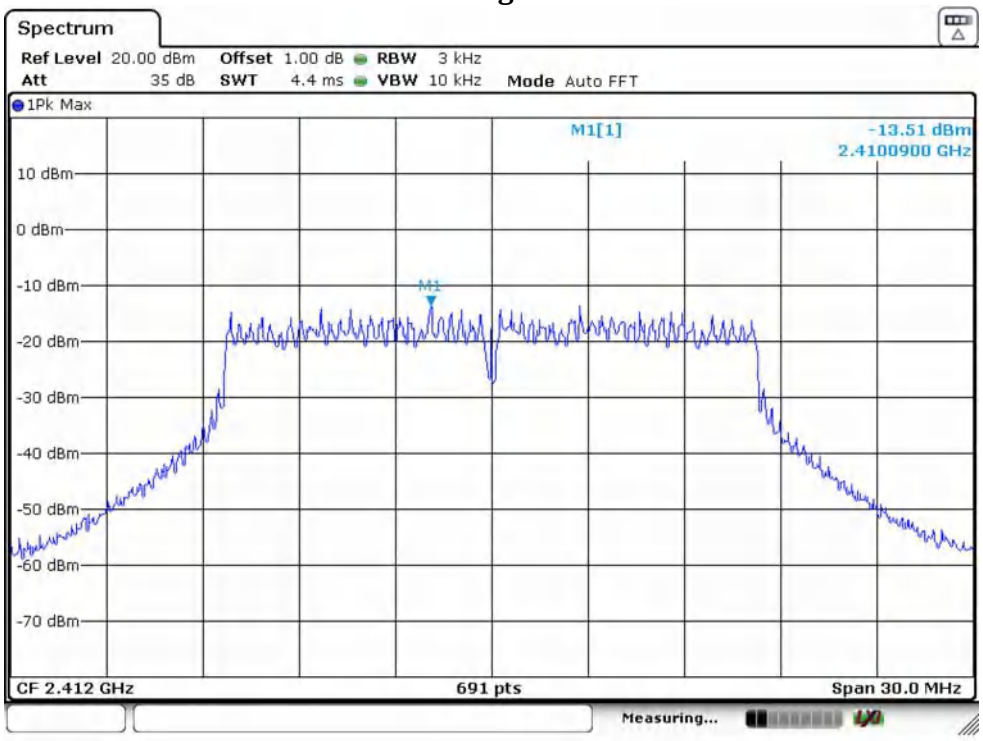

**IEEE 802.11b 2437MHz**



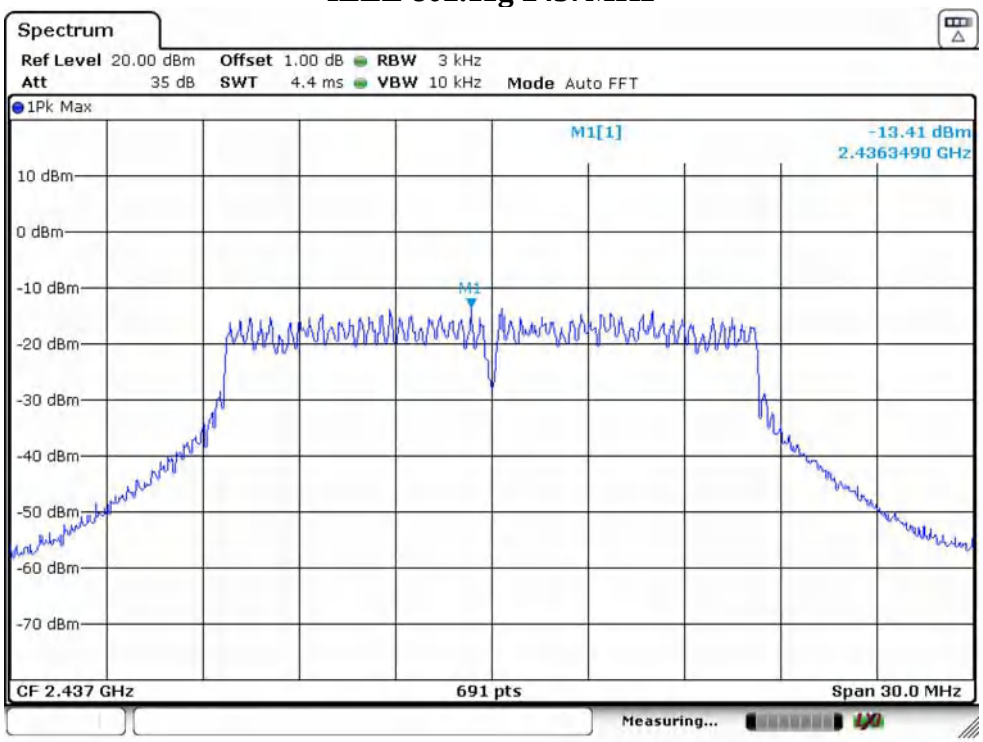
**IEEE 802.11b 2462MHz**



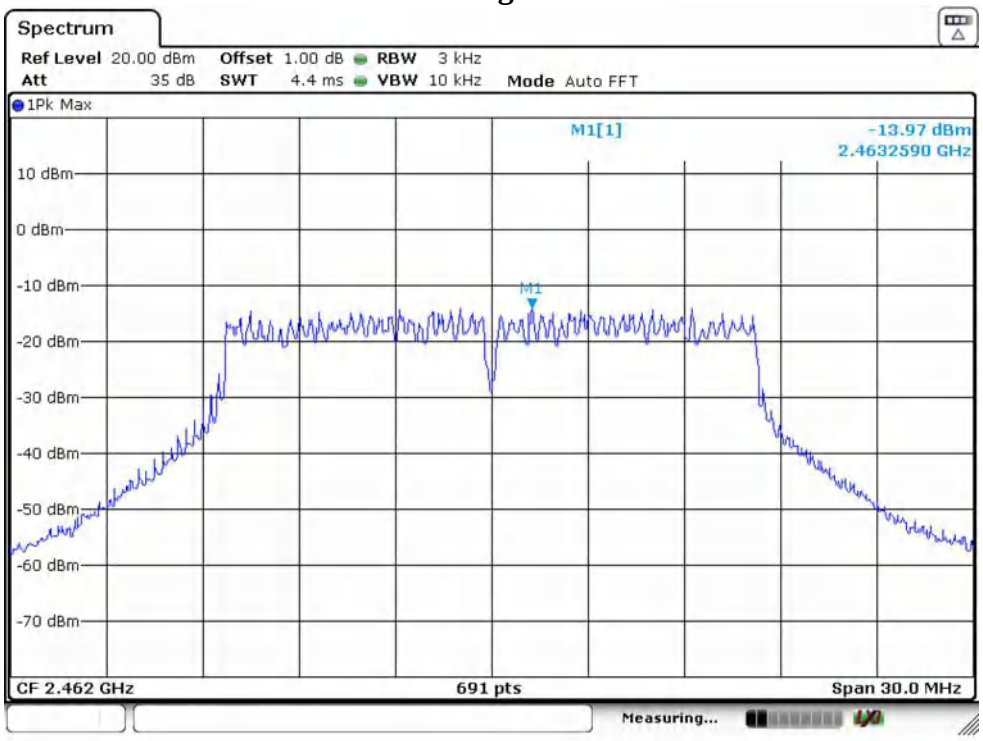
**IEEE 802.11g 2412MHz**



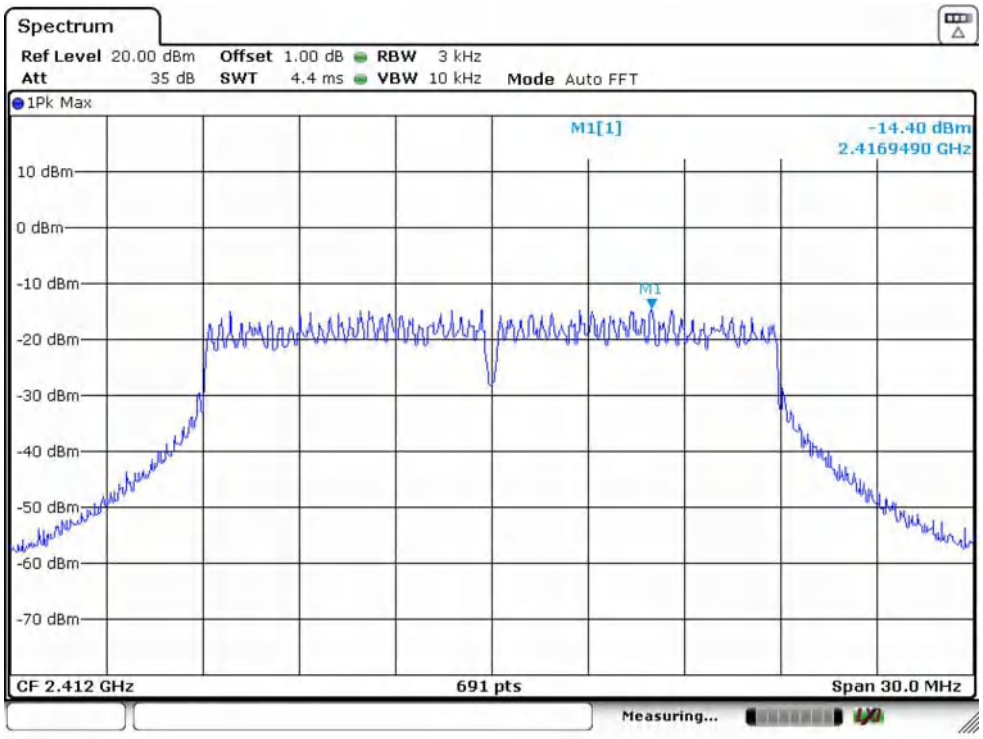

**IEEE 802.11g 2437MHz**



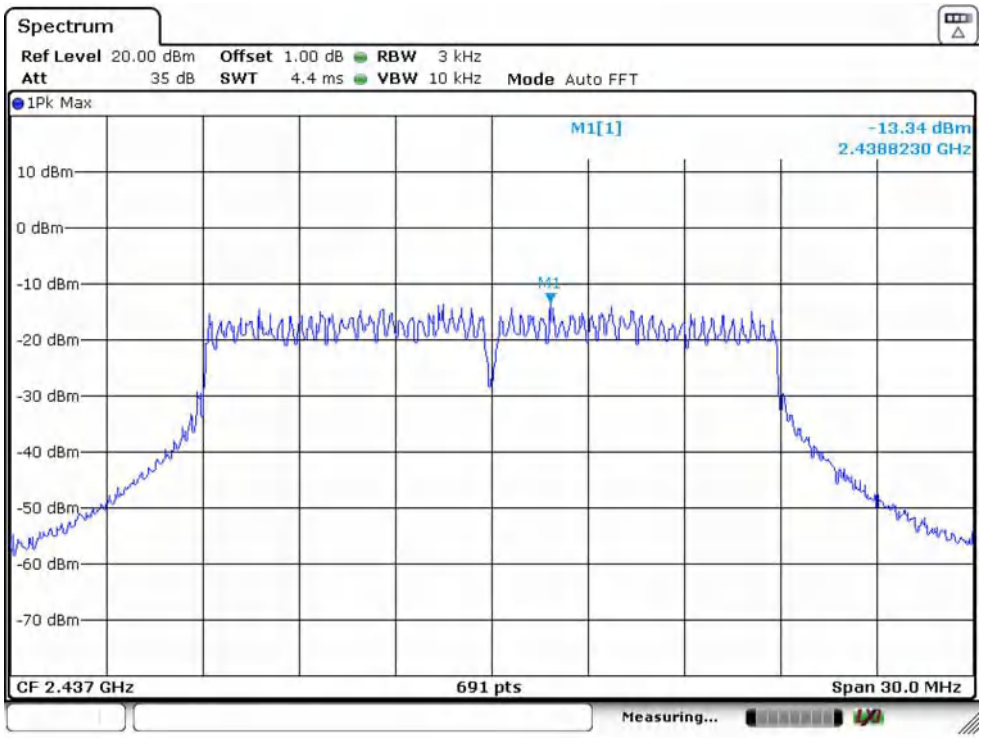
**IEEE 802.11g 2462MHz**



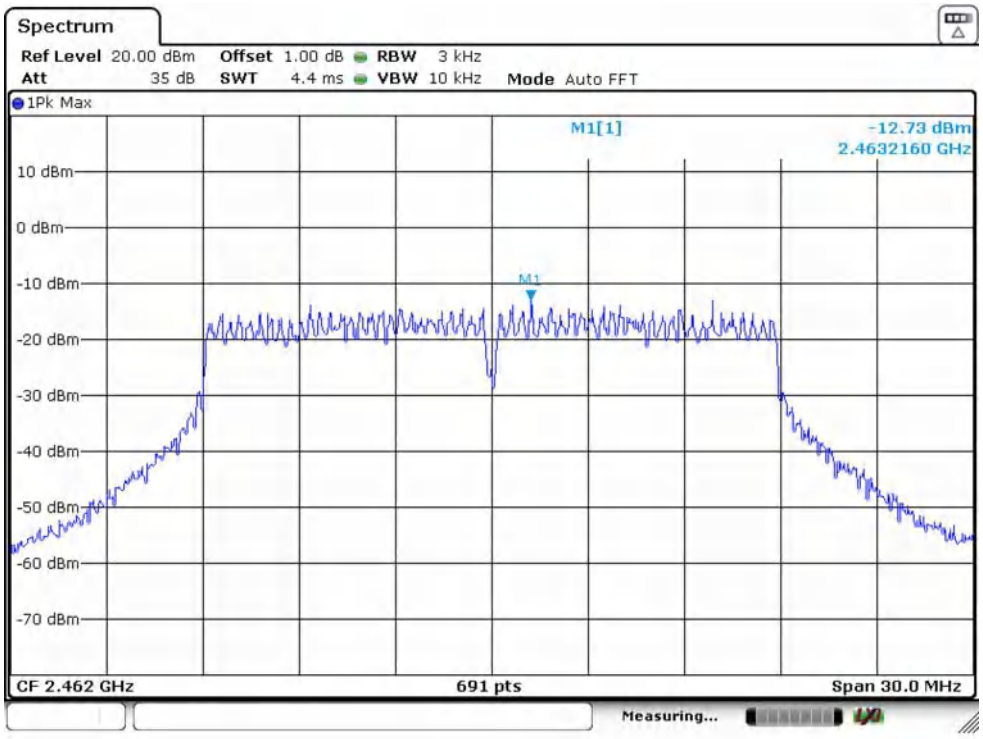
**IEEE 802.11n HT20 2412MHz**




**IEEE 802.11n HT20 2437MHz**



**IEEE 802.11n HT20 2462MHz**

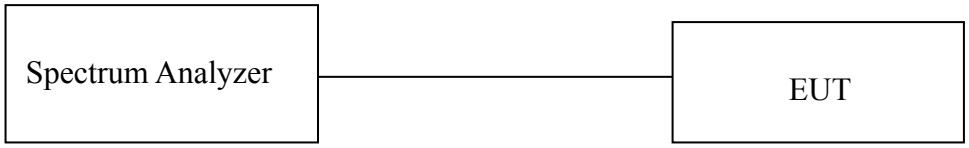


# 6. CONDUCTED BAND EDGE

## 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 |

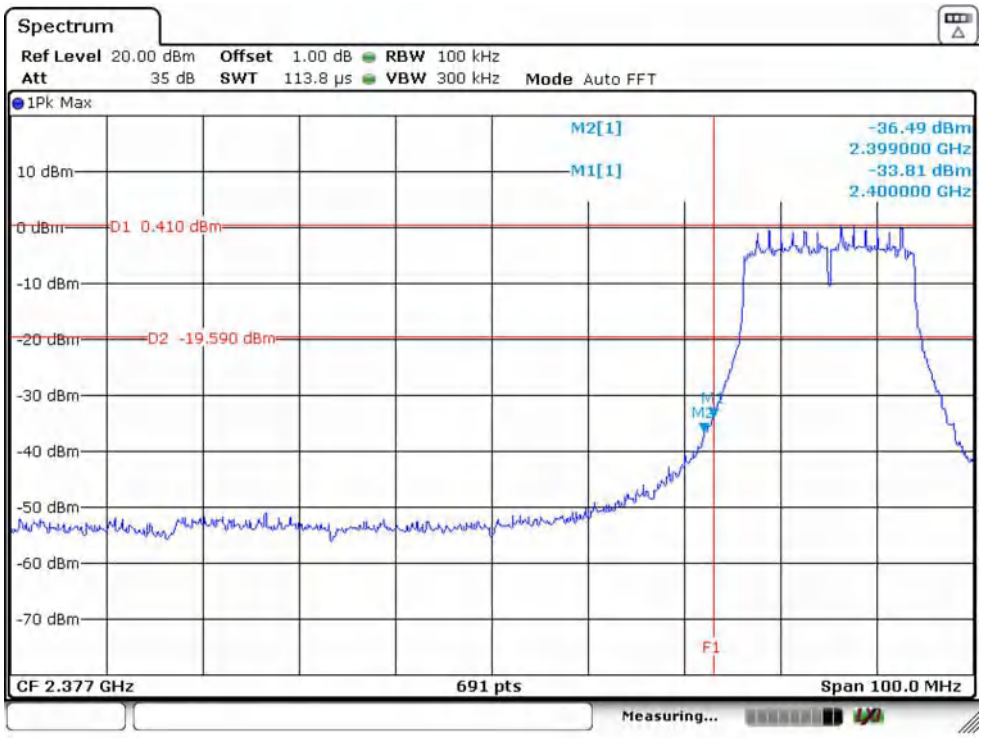
## 6.4. Test Procedure

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, IEEE 802 11nH40 all have been tested, only worse case 802. 11nH20 is reported.

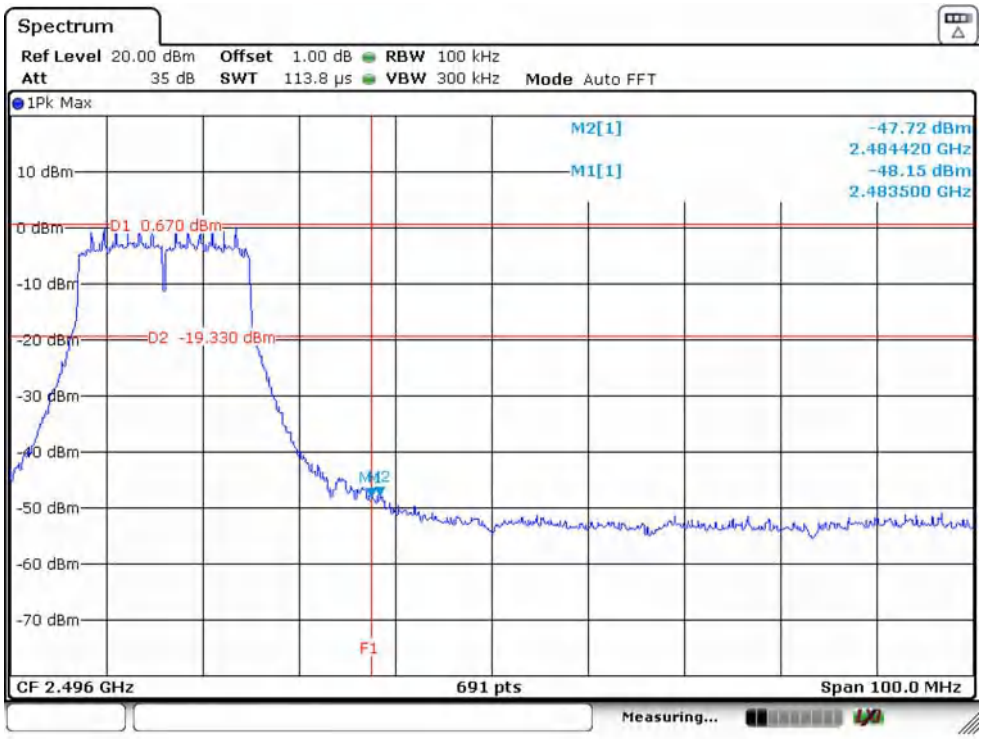
## 6.5. Test Result

| Temperature | 27.2℃ | Relative Humidity | 58% | Test Voltage | AC 120V/60Hz |
|---|---|---|---|---|---|
| Result | PASS | | | | |

**IEEE 802.11n HT20 2412MHz**




**IEEE 802.11n HT20 2462MHz**



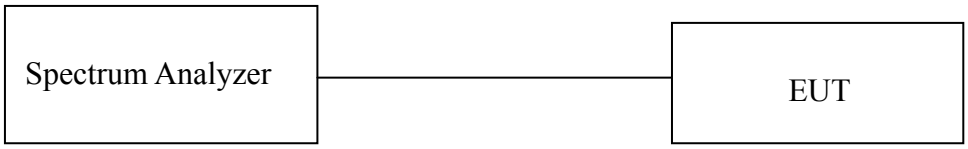

All modulations are all tested ,only worse case is reported

# 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 |

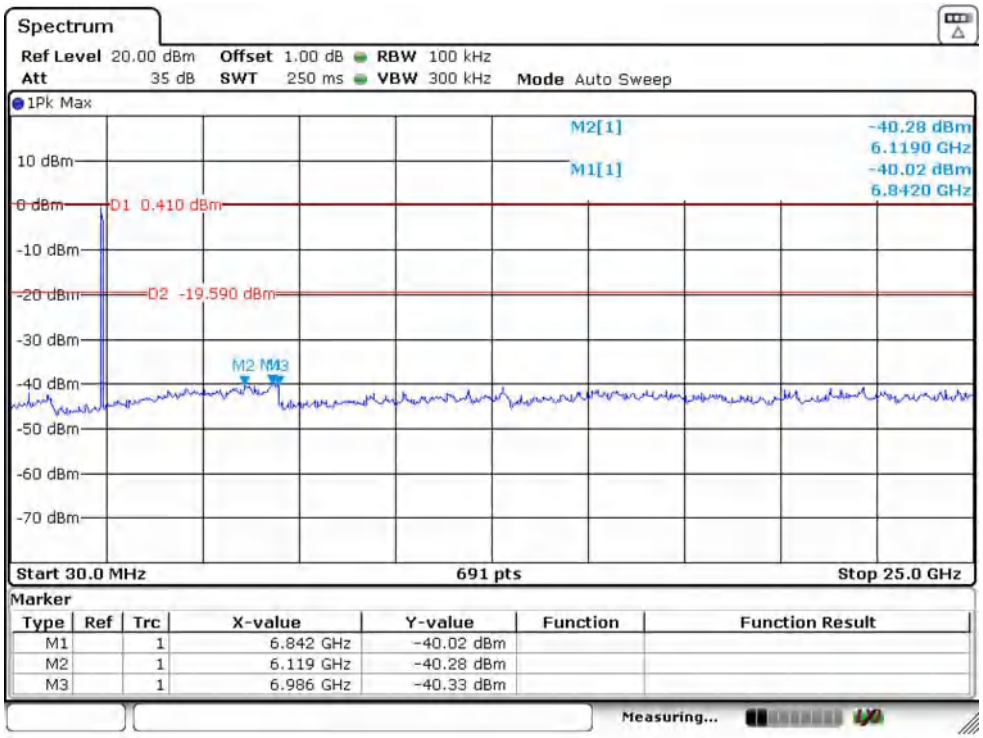
## 7.4. Test Procedure

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, IEEE 802 11nH40 all have been tested, only worse case 802. 11nH20 is reported.

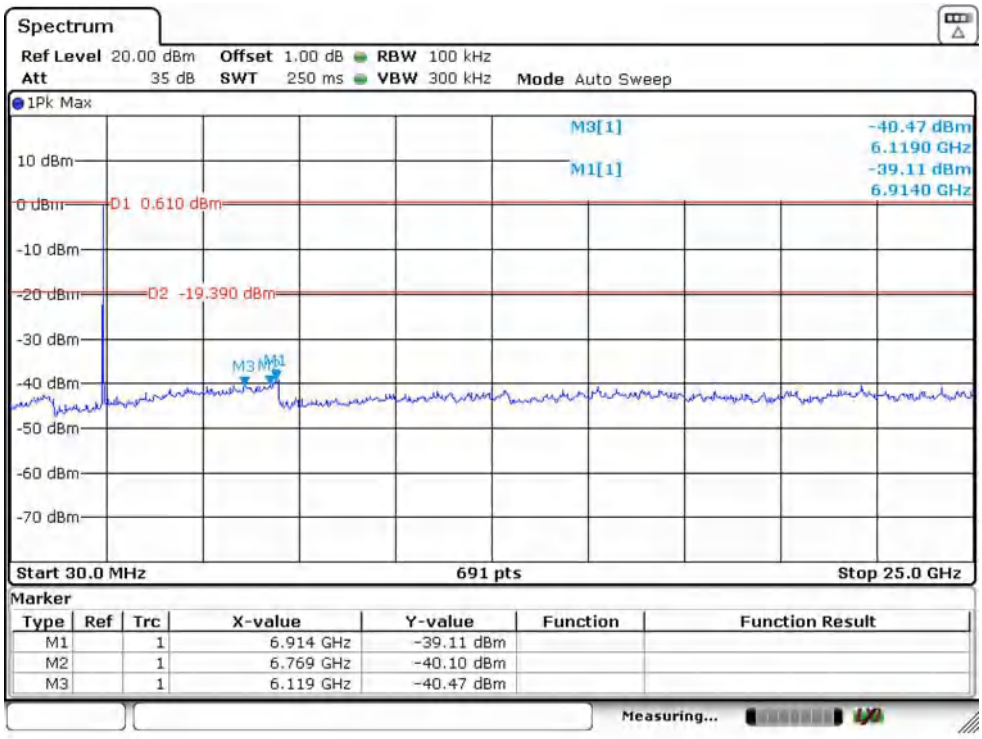
## 7.5. Test Result

| Temperature | 27.2℃ | Relative Humidity | 58% | Test Voltage | AC 120V/60Hz |
|---|---|---|---|---|---|
| Result | PASS | | | | |

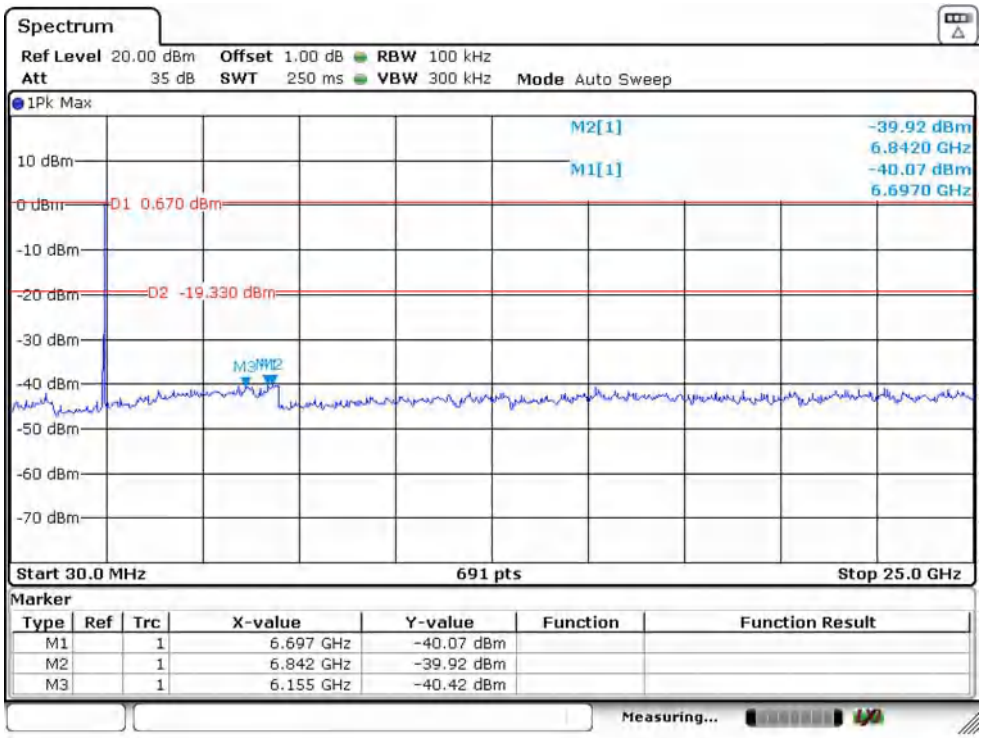
**IEEE 802.11n HT20 2412MHz**



**IEEE 802.11n HT20 2437MHz**




**IEEE 802.11n HT20 2462MHz**




All modulations are all tested ,only worse case is reported

# 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

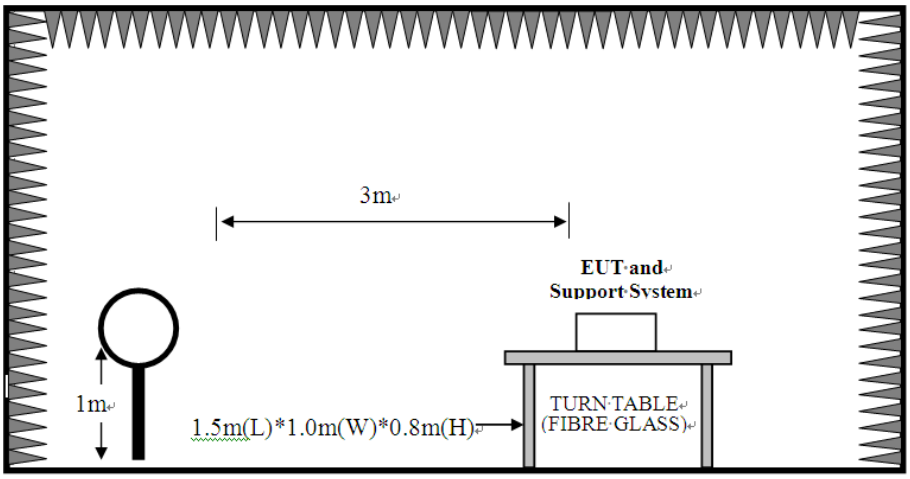
| Frequency (MHz) | Field Strength(μV/m) | Distance(m) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

Note:

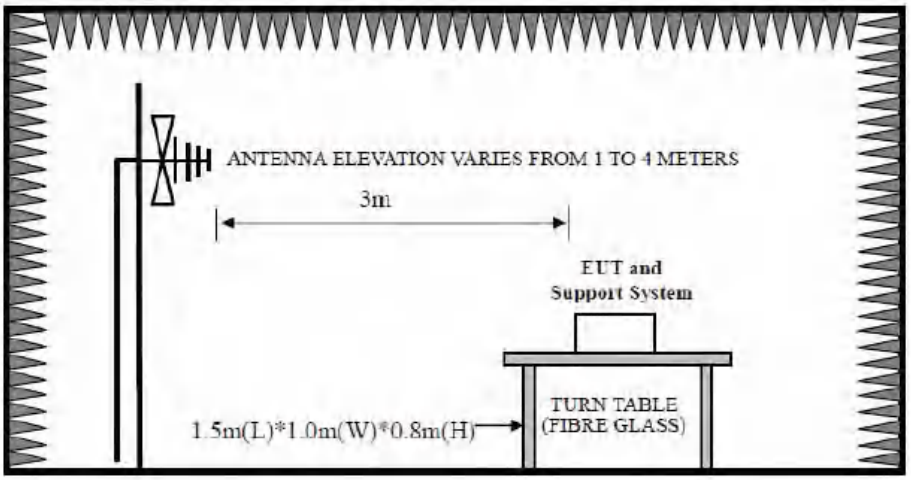
(1) Emission level dBμV = 20 log Emission level μV/m.
(2) The smaller limit shall apply at the cross point between two frequency bands.
(3) Distance is the distance in meters between the measuring instrument,antenna and the closest point of any part of the device or system.

## 8.2. Test setup

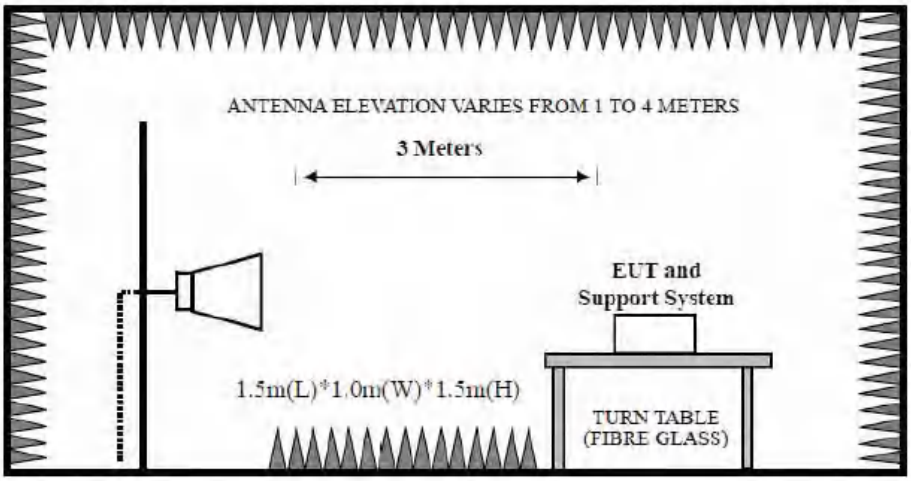
9kHz~30MHz




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**

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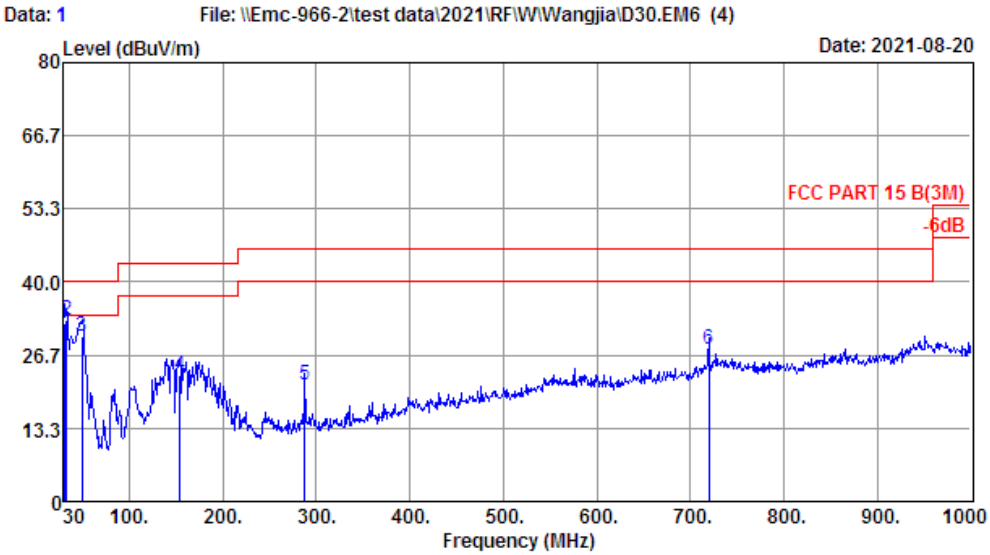


```
Site no.       : 2# 966 chamber              Data no.  : 1
Dis. / Ant.    : 3m   47018                  Ant. pol. : VERTICAL
Limit          : FCC PART 15 B(3M)
Env. / Ins.    : Temp:23.6';Humi:56%;Press:101.52kPa
Engineer       : Frank
EUT            : Robot Vacuum Cleaner
Power          : DC 24V From Adapter Input AC 120V/60Hz
M/N            : D30
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 | 30.00 | 18.80 | 0.19 | 13.57 | 32.56 | 40.00 | 7.44 | QP |
| 2 | 32.91 | 16.35 | 0.22 | 16.42 | 32.99 | 40.00 | 7.01 | QP |
| 3 | 49.40 | 9.05 | 0.28 | 20.82 | 30.15 | 40.00 | 9.85 | QP |
| 4 | 154.16 | 11.54 | 1.02 | 10.54 | 23.10 | 43.50 | 20.40 | QP |
| 5 | 288.02 | 13.56 | 1.57 | 6.23 | 21.36 | 46.00 | 24.64 | QP |
| 6 | 719.67 | 21.80 | 2.92 | 3.07 | 27.79 | 46.00 | 18.21 | 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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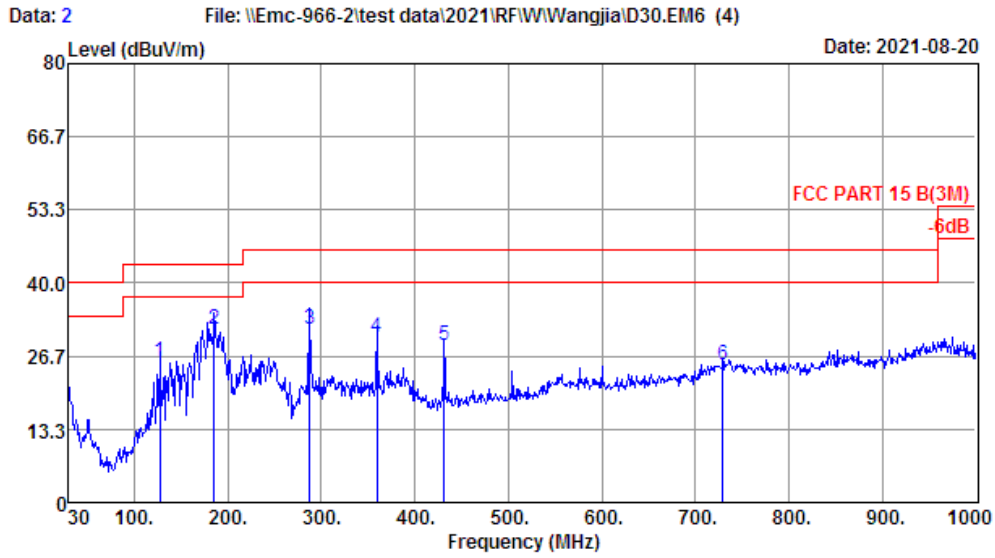


```
Site no.      : 2# 966 chamber              Data no.  : 2
Dis. / Ant.   : 3m   47018                  Ant. pol. : HORIZONTAL
Limit         : FCC PART 15 B(3M)
Env. / Ins.   : Temp:23.6';Humi:56%;Press:101.52kPa
Engineer      : Frank
EUT           : Robot Vacuum Cleaner
Power         : DC 24V From Adapter Input AC 120V/60Hz
M/N           : D30
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 | 127.00 | 11.78 | 0.87 | 12.94 | 25.59 | 43.50 | 17.91 | QP |
| 2 | 185.20 | 9.40 | 1.12 | 20.95 | 31.47 | 43.50 | 12.03 | QP |
| 3 | 288.02 | 13.56 | 1.57 | 16.38 | 31.51 | 46.00 | 14.49 | QP |
| 4 | 359.80 | 15.60 | 1.89 | 12.54 | 30.03 | 46.00 | 15.97 | QP |
| 5 | 431.58 | 16.92 | 1.98 | 9.61 | 28.51 | 46.00 | 17.49 | QP |
| 6 | 729.37 | 21.80 | 3.01 | 0.42 | 25.23 | 46.00 | 20.77 | 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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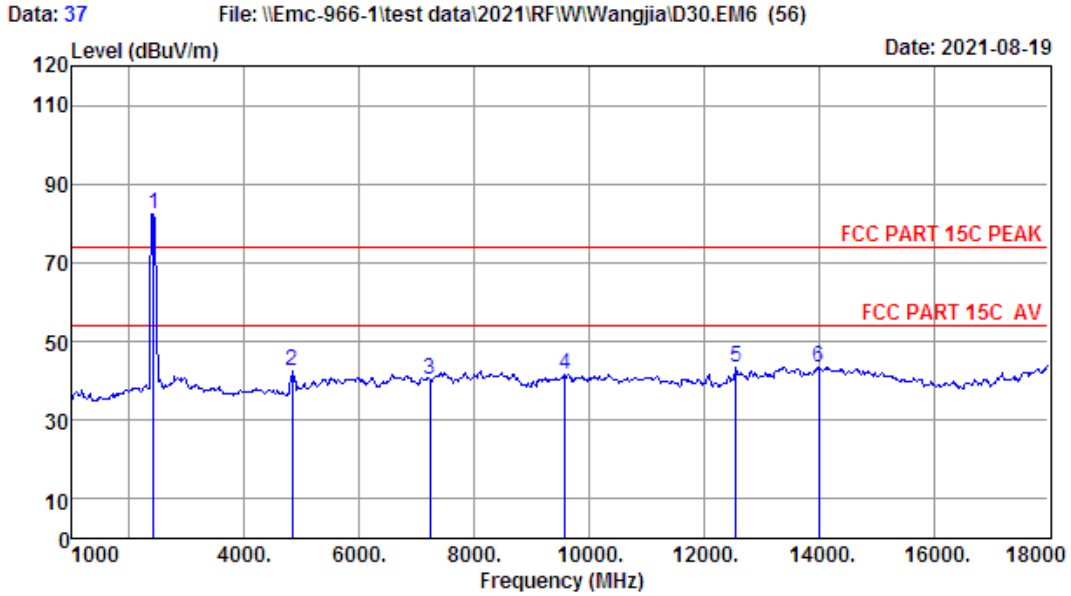


```
Site no.       : 1# 966 Chamber              Data no.  : 37
Dis. / Ant.    : 3m   ANT9120D 1-18G         Ant. pol. : HORIZONTAL
Limit          : FCC PART 15C PEAK
Env. / Ins.    : Temp:25.8';Humi:68%;Press:101.52kPa
Engineer       : Pablo
EUT            : Robotic Vacuum Cleaner
Power          : DC 24V From Adapter Input AC 120V/60Hz
M/N            : D30
Test Mode      : IEEE 802.11g 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 | 88.21 | 82.31 | 74.00 | -8.31 | Peak |
| 2 | 4824.00 | 31.18 | 3.26 | 34.67 | 42.53 | 42.30 | 74.00 | 31.70 | Peak |
| 3 | 7236.00 | 36.28 | 5.20 | 34.82 | 33.66 | 40.32 | 74.00 | 33.68 | Peak |
| 4 | 9585.00 | 38.07 | 5.57 | 34.28 | 32.26 | 41.62 | 74.00 | 32.38 | Peak |
| 5 | 12560.00 | 39.62 | 6.22 | 34.58 | 32.30 | 43.56 | 74.00 | 30.44 | Peak |
| 6 | 14005.00 | 41.10 | 6.53 | 34.30 | 30.19 | 43.52 | 74.00 | 30.48 | 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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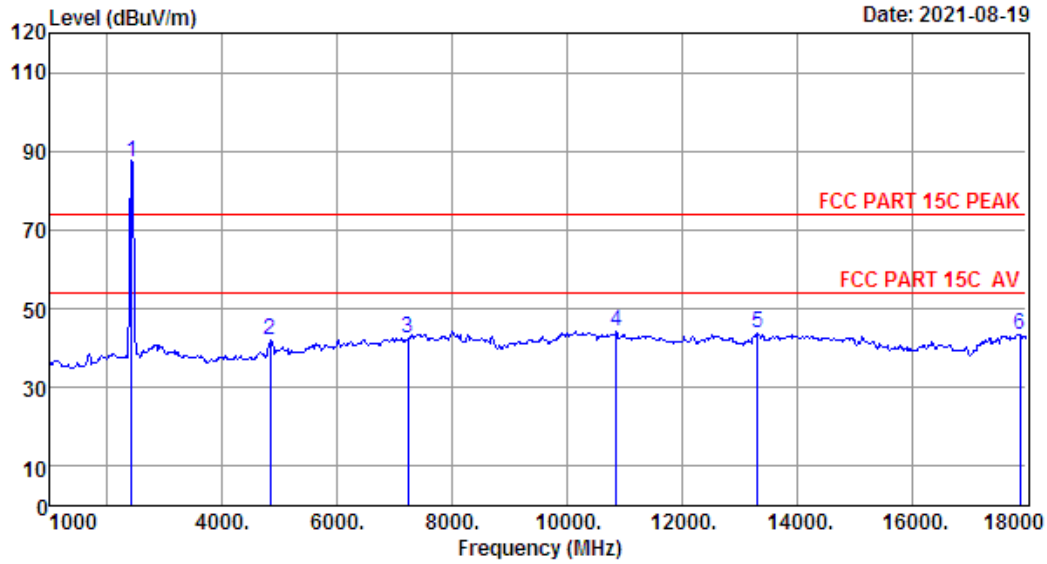
Data: 38 File: \\Emc-966-1\test data\2021\RF\W\Wangjia\D30.EM6 (56)




Site no. : 1# 966 Chamber Data no. : 38
Dis. / Ant. : 3m ANT9120D 1-18G Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:25.8';Humi:68%;Press:101.52kPa
Engineer : Pablo
EUT : Robotic Vacuum Cleaner
Power : DC 24V From Adapter Input AC 120V/60Hz
M/N : D30
Test Mode : IEEE 802.11g 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 | 93.33 | 87.43 | 74.00 | -13.43 | Peak |
| 2 | 4824.00 | 31.18 | 3.26 | 34.67 | 42.18 | 41.95 | 74.00 | 32.05 | Peak |
| 3 | 7236.00 | 36.28 | 5.20 | 34.82 | 35.68 | 42.34 | 74.00 | 31.66 | Peak |
| 4 | 10860.00 | 39.76 | 6.09 | 34.46 | 33.03 | 44.42 | 74.00 | 29.58 | Peak |
| 5 | 13325.00 | 39.95 | 6.31 | 34.37 | 32.05 | 43.94 | 74.00 | 30.06 | Peak |
| 6 | 17881.00 | 47.95 | 8.16 | 34.31 | 21.77 | 43.57 | 74.00 | 30.43 | 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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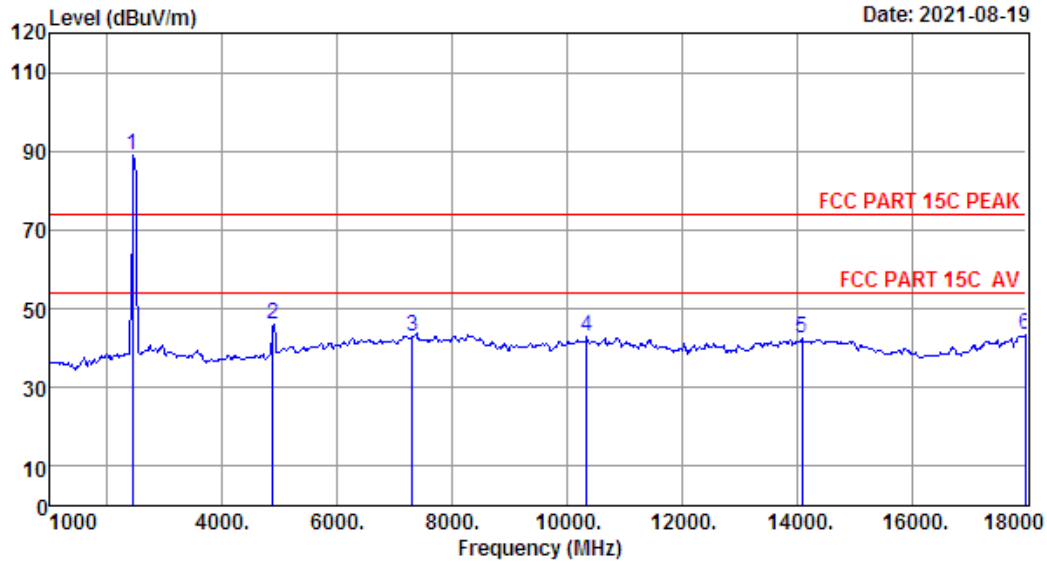
Data: 39 File: \\Emc-966-1\test data\2021\RF\W\Wangjia\D30.EM6 (56)




Site no. : 1# 966 Chamber Data no. : 39
Dis. / Ant. : 3m ANT9120D 1-18G Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:25.8';Humi:68%;Press:101.52kPa
Engineer : Pablo
EUT : Robotic Vacuum Cleaner
Power : DC 24V From Adapter Input AC 120V/60Hz
M/N : D30
Test Mode : IEEE 802.11g 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 | 94.85 | 89.03 | 74.00 | -15.03 | Peak |
| 2 | 4874.00 | 31.37 | 3.31 | 34.68 | 46.26 | 46.26 | 74.00 | 27.74 | Peak |
| 3 | 7311.00 | 36.42 | 5.22 | 34.83 | 35.95 | 42.76 | 74.00 | 31.24 | Peak |
| 4 | 10350.00 | 39.26 | 5.98 | 34.31 | 31.90 | 42.83 | 74.00 | 31.17 | Peak |
| 5 | 14090.00 | 41.08 | 6.59 | 34.33 | 28.96 | 42.30 | 74.00 | 31.70 | Peak |
| 6 | 17983.00 | 48.76 | 8.23 | 34.30 | 20.63 | 43.32 | 74.00 | 30.68 | 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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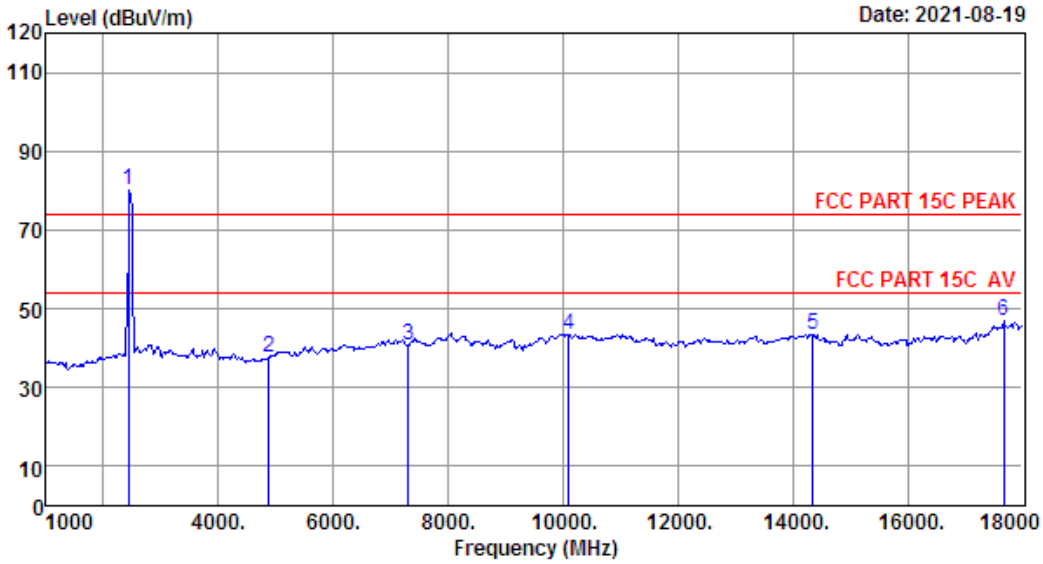
Data: 40 File: \\Emc-966-1\test data\2021\RF\W\Wangjia\D30.EM6 (56)




Site no. : 1# 966 Chamber Data no. : 40
Dis. / Ant. : 3m ANT9120D 1-18G Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:25.8';Humi:68%;Press:101.52kPa
Engineer : Pablo
EUT : Robotic Vacuum Cleaner
Power : DC 24V From Adapter Input AC 120V/60Hz
M/N : D30
Test Mode : IEEE 802.11g 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 | 85.92 | 80.10 | 74.00 | -6.10 | Peak |
| 2 | 4874.00 | 31.37 | 3.31 | 34.68 | 37.56 | 37.56 | 74.00 | 36.44 | Peak |
| 3 | 7311.00 | 36.42 | 5.22 | 34.83 | 34.00 | 40.81 | 74.00 | 33.19 | Peak |
| 4 | 10095.00 | 39.00 | 5.92 | 34.23 | 32.89 | 43.58 | 74.00 | 30.42 | Peak |
| 5 | 14345.00 | 41.03 | 6.79 | 34.40 | 30.14 | 43.56 | 74.00 | 30.44 | Peak |
| 6 | 17677.00 | 46.32 | 8.03 | 34.33 | 27.11 | 47.13 | 74.00 | 26.87 | 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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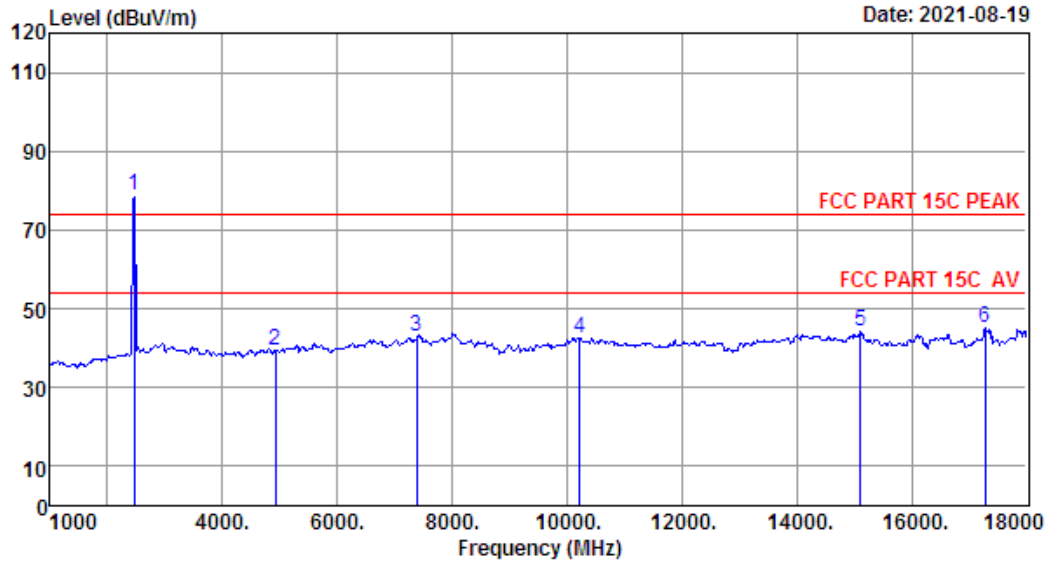
Data: 41 File: \\Emc-966-1\test data\2021\RF\W\Wangjia\D30.EM6 (56)




Site no. : 1# 966 Chamber Data no. : 41
Dis. / Ant. : 3m ANT9120D 1-18G Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:25.8';Humi:68%;Press:101.52kPa
Engineer : Pablo
EUT : Robotic Vacuum Cleaner
Power : DC 24V From Adapter Input AC 120V/60Hz
M/N : D30
Test Mode : IEEE 802.11g 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 | 84.39 | 78.60 | 74.00 | -4.60 | Peak |
| 2 | 4924.00 | 31.55 | 3.35 | 34.69 | 39.27 | 39.48 | 74.00 | 34.52 | Peak |
| 3 | 7386.00 | 36.59 | 5.24 | 34.84 | 35.75 | 42.74 | 74.00 | 31.26 | Peak |
| 4 | 10214.00 | 39.12 | 5.95 | 34.27 | 31.90 | 42.70 | 74.00 | 31.30 | Peak |
| 5 | 15110.00 | 40.79 | 6.73 | 34.56 | 31.13 | 44.09 | 74.00 | 29.91 | Peak |
| 6 | 17286.00 | 43.21 | 7.70 | 34.37 | 28.70 | 45.24 | 74.00 | 28.76 | 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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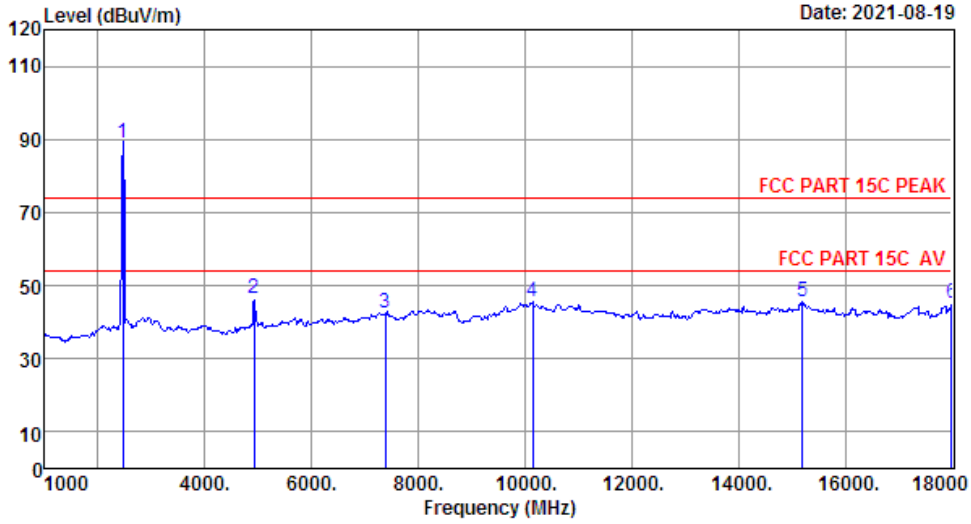
Data: 42 File: \\Emc-966-1\test data\2021\RF\W\Wangjia\D30.EM6 (56)




```
Site no.      : 1# 966 Chamber              Data no.  : 42
Dis. / Ant.   : 3m   ANT9120D 1-18G         Ant. pol. : VERTICAL
Limit         : FCC PART 15C PEAK
Env. / Ins.   : Temp:25.8';Humi:68%;Press:101.52kPa
Engineer      : Pablo
EUT           : Robotic Vacuum Cleaner
Power         : DC 24V From Adapter Input AC 120V/60Hz
M/N           : D30
Test Mode     : IEEE 802.11g 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 | 94.77 | 88.98 | 74.00 | -14.98 | Peak |
| 2 | 4924.00 | 31.55 | 3.35 | 34.69 | 46.38 | 46.59 | 74.00 | 27.41 | Peak |
| 3 | 7386.00 | 36.59 | 5.24 | 34.84 | 35.57 | 42.56 | 74.00 | 31.44 | Peak |
| 4 | 10146.00 | 39.05 | 5.93 | 34.25 | 34.68 | 45.41 | 74.00 | 28.59 | Peak |
| 5 | 15195.00 | 40.69 | 6.67 | 34.52 | 32.61 | 45.45 | 74.00 | 28.55 | Peak |
| 6 | 18000.00 | 48.90 | 8.24 | 34.30 | 22.23 | 45.07 | 74.00 | 28.93 | 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.

# Radiated Band Edge

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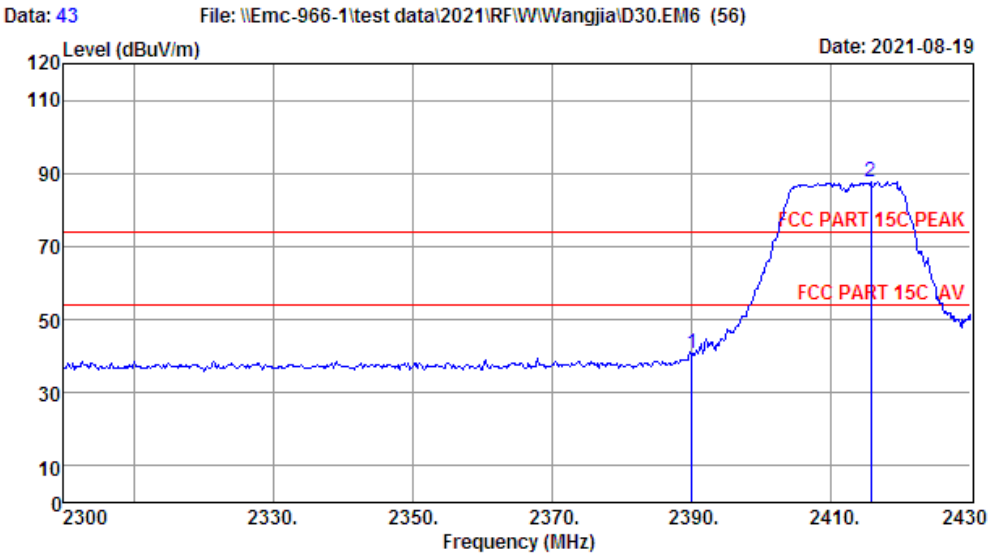


```
Site no.      : 1# 966 Chamber              Data no.  : 43
Dis. / Ant.   : 3m   ANT9120D 1-18G         Ant. pol. : VERTICAL
Limit         : FCC PART 15C PEAK
Env. / Ins.   : Temp:25.8';Humi:68%;Press:101.52kPa
Engineer      : Pablo
EUT           : Robotic Vacuum Cleaner
Power         : DC 24V From Adapter Input AC 120V/60Hz
M/N           : D30
Test Mode     : IEEE 802.11g 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 | 46.56 | 40.63 | 74.00 | 33.37 | Peak |
| 2 | 2415.70 | 27.28 | 1.46 | 34.64 | 93.71 | 87.81 | 74.00 | -13.81 | 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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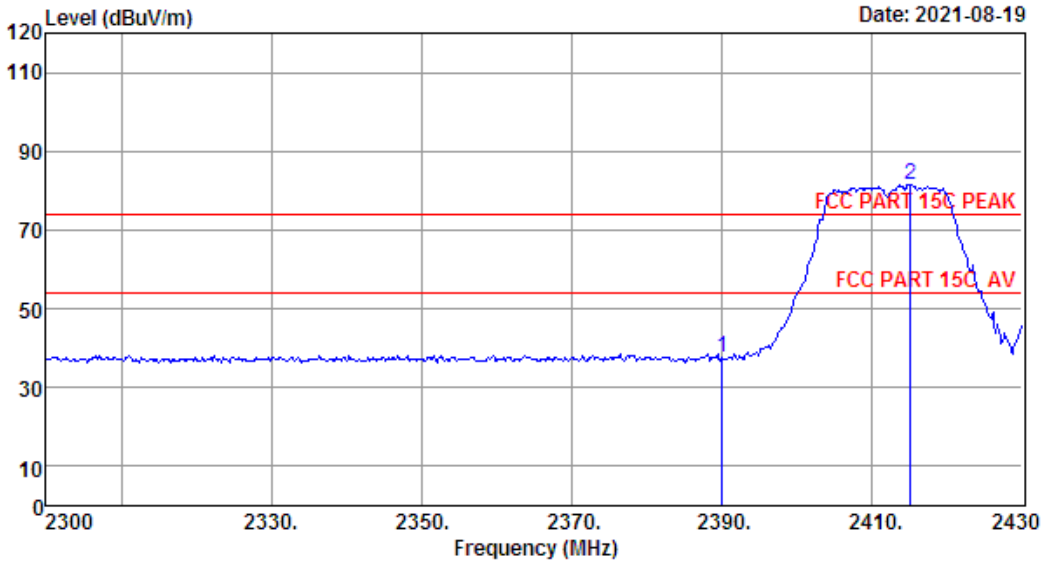
Data: 44 File: \\Emc-966-1\test data\2021\RF\W\Wangjia\D30.EM6 (56)




Site no. : 1# 966 Chamber Data no. : 44
Dis. / Ant. : 3m ANT9120D 1-18G Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:25.8';Humi:68%;Press:101.52kPa
Engineer : Pablo
EUT : Robotic Vacuum Cleaner
Power : DC 24V From Adapter Input AC 120V/60Hz
M/N : D30
Test Mode : IEEE 802.11g 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 | 43.37 | 37.44 | 74.00 | 36.56 | Peak |
| 2 | 2415.05 | 27.28 | 1.46 | 34.64 | 87.57 | 81.67 | 74.00 | -7.67 | 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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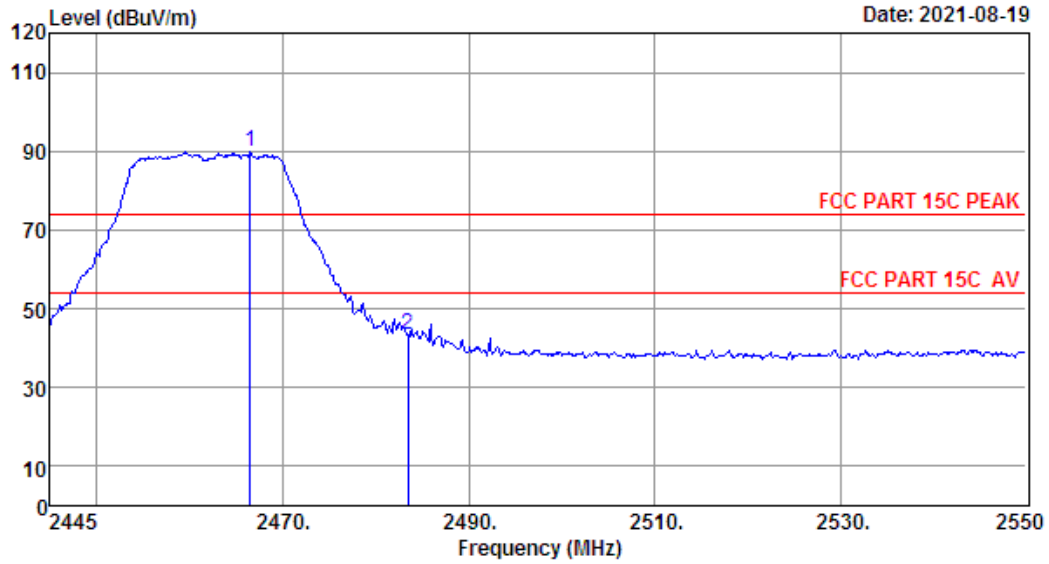
Data: 45 File: \\Emc-966-1\test data\2021\RF\W\Wangjia\D30.EM6 (56)




```
Site no.      : 1# 966 Chamber              Data no.  : 45
Dis. / Ant.   : 3m   ANT9120D 1-18G         Ant. pol. : VERTICAL
Limit         : FCC PART 15C PEAK
Env. / Ins.   : Temp:25.8';Humi:68%;Press:101.52kPa
Engineer      : Pablo
EUT           : Robotic Vacuum Cleaner
Power         : DC 24V From Adapter Input AC 120V/60Hz
M/N           : D30
Test Mode     : IEEE 802.11g 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 | 2466.53 | 27.35 | 1.48 | 34.62 | 95.71 | 89.92 | 74.00 | -15.92 | Peak |
| 2 | 2483.50 | 27.38 | 1.48 | 34.61 | 49.13 | 43.38 | 74.00 | 30.62 | 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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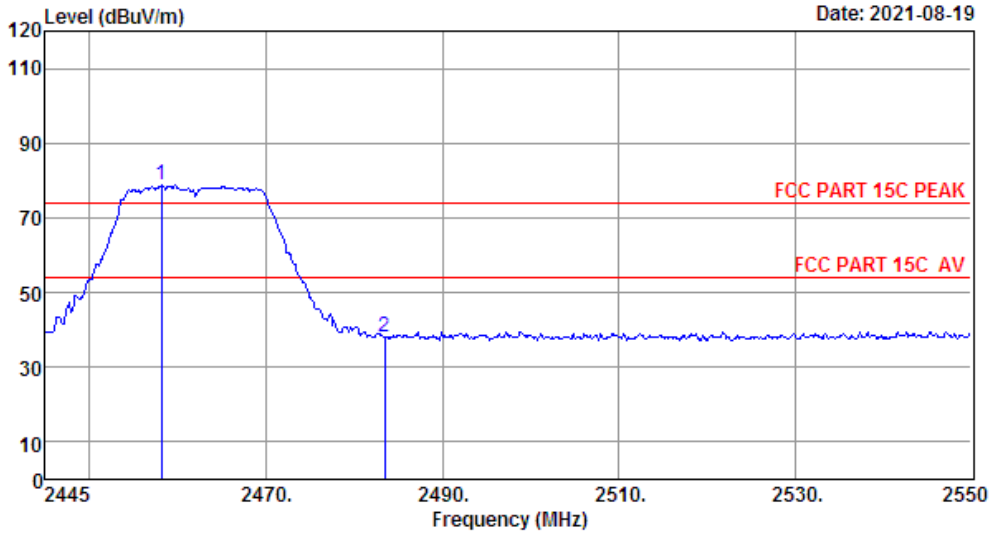
Data: 46 File: \\Emc-966-1\test data\2021\RF\W\Wangjia\D30.EM6 (56)




Site no. : 1# 966 Chamber Data no. : 46
Dis. / Ant. : 3m ANT9120D 1-18G Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:25.8';Humi:68%;Press:101.52kPa
Engineer : Pablo
EUT : Robotic Vacuum Cleaner
Power : DC 24V From Adapter Input AC 120V/60Hz
M/N : D30
Test Mode : IEEE 802.11g 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 | 2458.13 | 27.35 | 1.48 | 34.62 | 84.54 | 78.75 | 74.00 | -4.75 | Peak |
| 2 | 2483.50 | 27.38 | 1.48 | 34.61 | 43.89 | 38.14 | 74.00 | 35.86 | 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 modulations are all tested ,only worse case is reported.

# 9. AC POWER LINE CONDUCTED EMISSIONS

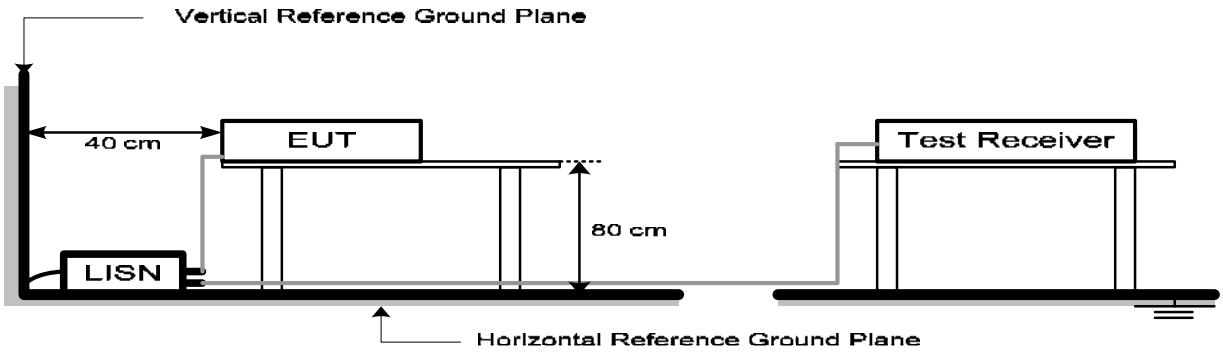
## 9.1. Limit

| 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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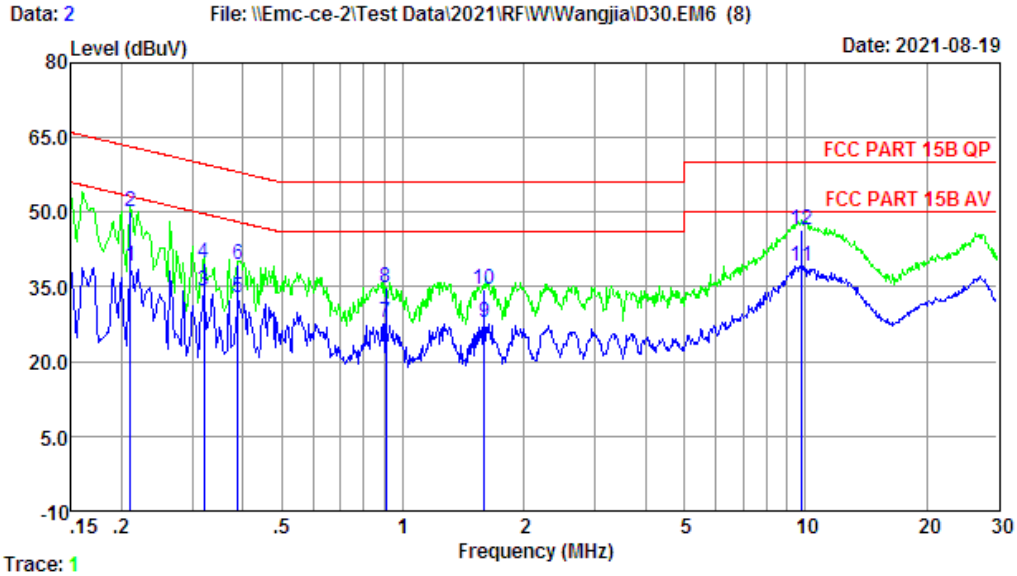


Site no : 2#CE Shield Room Data no. : 2
Env. / Ins. : Temp:25.8℃ Humi:57% Press:101.50kPa LINE Phase : NEUTRAL
Limit : FCC PART 15B QP
Engineer : YYB
EUT : Robotic Vacuum Cleaner
Power : DC 24V From Adapter Input AC 240V/60Hz
M/N : D30
Test Mode : TX Mode

| | Freq. (MHz) | LISN Factor (dB) | Cable Loss (dB) | Reading (dBuV) | Emission Level (dBuv) | Limits (dBuv) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.21 | 9.78 | 9.84 | 19.59 | 39.21 | 53.18 | 13.97 | Average |
| 2 | 0.21 | 9.78 | 9.84 | 30.35 | 49.97 | 63.18 | 13.21 | QP |
| 3 | 0.32 | 9.83 | 9.92 | 14.32 | 34.07 | 49.71 | 15.64 | Average |
| 4 | 0.32 | 9.83 | 9.92 | 20.18 | 39.93 | 59.71 | 19.78 | QP |
| 5 | 0.39 | 9.72 | 9.92 | 13.31 | 32.95 | 48.08 | 15.13 | Average |
| 6 | 0.39 | 9.72 | 9.92 | 19.80 | 39.44 | 58.08 | 18.64 | QP |
| 7 | 0.91 | 9.86 | 9.94 | 8.20 | 28.00 | 46.00 | 18.00 | Average |
| 8 | 0.91 | 9.86 | 9.94 | 14.99 | 34.79 | 56.00 | 21.21 | QP |
| 9 | 1.59 | 9.88 | 9.95 | 8.15 | 27.98 | 46.00 | 18.02 | Average |
| 10 | 1.59 | 9.88 | 9.95 | 14.55 | 34.38 | 56.00 | 21.62 | QP |
| 11 | 9.76 | 10.09 | 10.07 | 19.11 | 39.27 | 50.00 | 10.73 | Average |
| 12 | 9.76 | 10.09 | 10.07 | 26.31 | 46.47 | 60.00 | 13.53 | QP |

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

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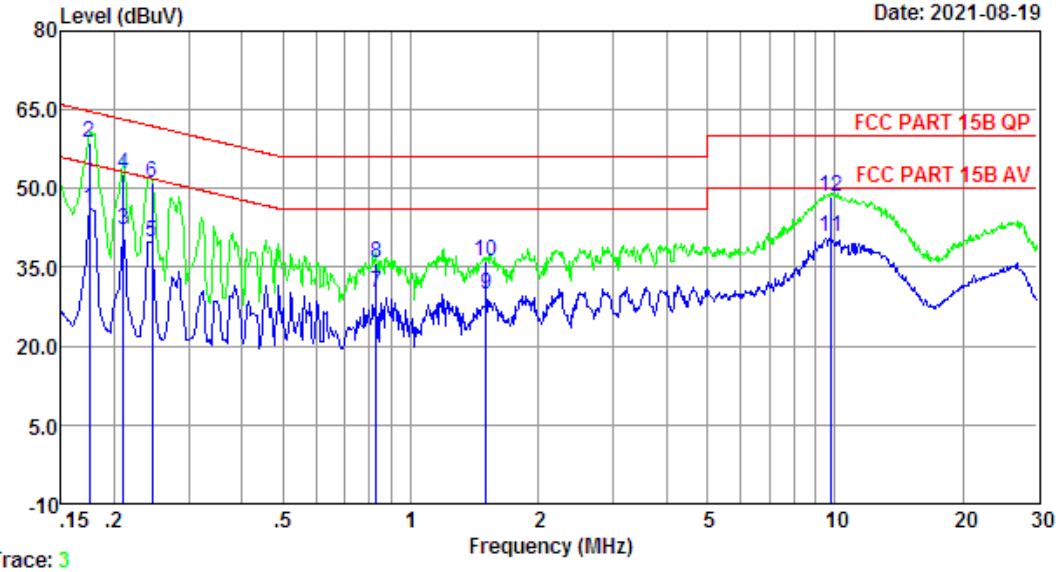
Data: 4 File: \\Emc-ce-2\Test Data\2021\RF\W\Wangjia\D30.EM6 (8)




Trace: 3

Site no : 2#CE Shield Room Data no. : 4
Env. / Ins. : Temp:25.8℃ Humi:57% Press:101.50kPa LINE Phase : LINE
Limit : FCC PART 15B QP
Engineer : YYB
EUT : Robotic Vacuum Cleaner
Power : DC 24V From Adapter Input AC 240V/60Hz
M/N : D30
Test Mode : TX Mode

| | Freq. (MHz) | LISN Factor (dB) | Cable Loss (dB) | Reading (dBuV) | Emission Level (dBuv) | Limits (dBuv) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.17 | 9.84 | 9.77 | 26.65 | 46.26 | 54.72 | 8.46 | Average |
| 2 | 0.17 | 9.84 | 9.77 | 39.24 | 58.85 | 64.72 | 5.87 | QP |
| 3 | 0.21 | 9.78 | 9.84 | 22.56 | 42.18 | 53.18 | 11.00 | Average |
| 4 | 0.21 | 9.78 | 9.84 | 33.20 | 52.82 | 63.18 | 10.36 | QP |
| 5 | 0.25 | 9.73 | 9.92 | 20.26 | 39.91 | 51.91 | 12.00 | Average |
| 6 | 0.25 | 9.73 | 9.92 | 31.53 | 51.18 | 61.91 | 10.73 | QP |
| 7 | 0.83 | 9.88 | 9.93 | 10.30 | 30.11 | 46.00 | 15.89 | Average |
| 8 | 0.83 | 9.88 | 9.93 | 16.00 | 35.81 | 56.00 | 20.19 | QP |
| 9 | 1.50 | 9.85 | 9.96 | 10.10 | 29.91 | 46.00 | 16.09 | Average |
| 10 | 1.50 | 9.85 | 9.96 | 16.44 | 36.25 | 56.00 | 19.75 | QP |
| 11 | 9.76 | 9.85 | 10.07 | 20.93 | 40.85 | 50.00 | 9.15 | Average |
| 12 | 9.76 | 9.85 | 10.07 | 28.36 | 48.28 | 60.00 | 11.72 | QP |

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

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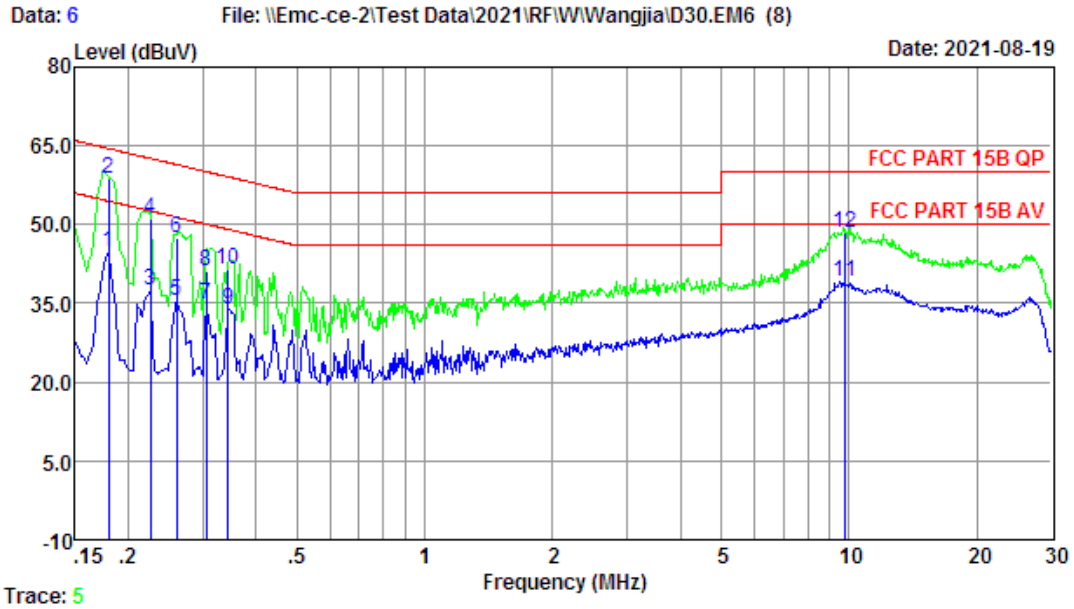


Site no : 2#CE Shield Room Data no. : 6
Env. / Ins. : Temp:25.8℃ Humi:57% Press:101.50kPa LINE Phase : LINE
Limit : FCC PART 15B QP
Engineer : YYB
EUT : Robotic Vacuum Cleaner
Power : DC 24V From Adapter Input AC 120V/60Hz
M/N : D30
Test Mode : TX Mode

| | Freq. (MHz) | LISN Factor (dB) | Cable Loss (dB) | Reading (dBuV) | Emission Level (dBuv) | Limits (dBuv) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.18 | 9.84 | 9.77 | 25.20 | 44.81 | 54.50 | 9.69 | Average |
| 2 | 0.18 | 9.84 | 9.77 | 39.05 | 58.66 | 64.50 | 5.84 | QP |
| 3 | 0.23 | 9.78 | 9.84 | 17.81 | 37.43 | 52.61 | 15.18 | Average |
| 4 | 0.23 | 9.78 | 9.84 | 31.38 | 51.00 | 62.61 | 11.61 | QP |
| 5 | 0.26 | 9.73 | 9.92 | 16.00 | 35.65 | 51.42 | 15.77 | Average |
| 6 | 0.26 | 9.73 | 9.92 | 27.83 | 47.48 | 61.42 | 13.94 | QP |
| 7 | 0.31 | 9.81 | 9.92 | 15.02 | 34.75 | 50.10 | 15.35 | Average |
| 8 | 0.31 | 9.81 | 9.92 | 21.53 | 41.26 | 60.10 | 18.84 | QP |
| 9 | 0.34 | 9.76 | 9.92 | 14.29 | 33.97 | 49.09 | 15.12 | Average |
| 10 | 0.34 | 9.76 | 9.92 | 21.95 | 41.63 | 59.09 | 17.46 | QP |
| 11 | 9.76 | 9.85 | 10.07 | 19.36 | 39.28 | 50.00 | 10.72 | Average |
| 12 | 9.76 | 9.85 | 10.07 | 28.65 | 48.57 | 60.00 | 11.43 | QP |

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

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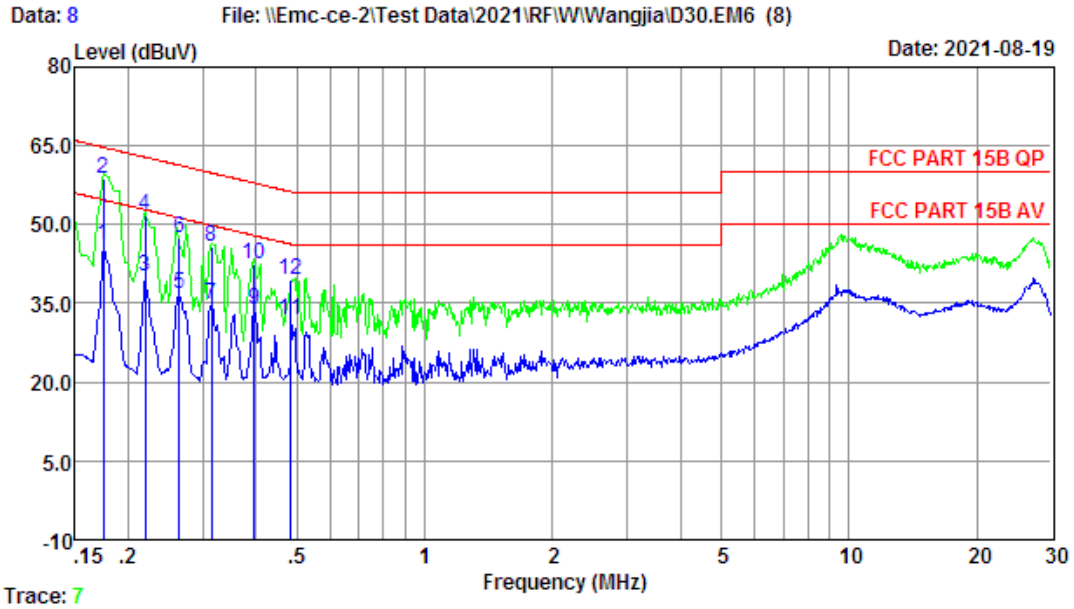



Site no : 2#CE Shield Room Data no. : 8
Env. / Ins. : Temp:25.8℃ Humi:57% Press:101.50kPa LINE Phase : NEUTRAL
Limit : FCC PART 15B QP
Engineer : YYB
EUT : Robotic Vacuum Cleaner
Power : DC 24V From Adapter Input AC 120V/60Hz
M/N : D30
Test Mode : TX Mode

| | Freq. (MHz) | LISN Factor (dB) | Cable Loss (dB) | Reading (dBuV) | Emission Level (dBuv) | Limits (dBuv) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.17 | 9.72 | 9.77 | 26.51 | 46.00 | 54.72 | 8.72 | Average |
| 2 | 0.17 | 9.72 | 9.77 | 39.16 | 58.65 | 64.72 | 6.07 | QP |
| 3 | 0.22 | 9.78 | 9.84 | 20.62 | 40.24 | 52.83 | 12.59 | Average |
| 4 | 0.22 | 9.78 | 9.84 | 32.16 | 51.78 | 62.83 | 11.05 | QP |
| 5 | 0.26 | 9.84 | 9.92 | 16.97 | 36.73 | 51.29 | 14.56 | Average |
| 6 | 0.26 | 9.84 | 9.92 | 27.66 | 47.42 | 61.29 | 13.87 | QP |
| 7 | 0.31 | 9.83 | 9.92 | 15.21 | 34.96 | 49.84 | 14.88 | Average |
| 8 | 0.31 | 9.83 | 9.92 | 25.91 | 45.66 | 59.84 | 14.18 | QP |
| 9 | 0.40 | 9.72 | 9.92 | 14.08 | 33.72 | 47.95 | 14.23 | Average |
| 10 | 0.40 | 9.72 | 9.92 | 22.82 | 42.46 | 57.95 | 15.49 | QP |
| 11 | 0.48 | 9.76 | 9.92 | 12.12 | 31.80 | 46.27 | 14.47 | Average |
| 12 | 0.48 | 9.76 | 9.92 | 19.71 | 39.39 | 56.27 | 16.88 | QP |

Remarks: 1. Emission Level= LISN Factor + Cable Loss + Reading.
2. Margin= Limit - Emission Level.
3. If the average limit is met when useing 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

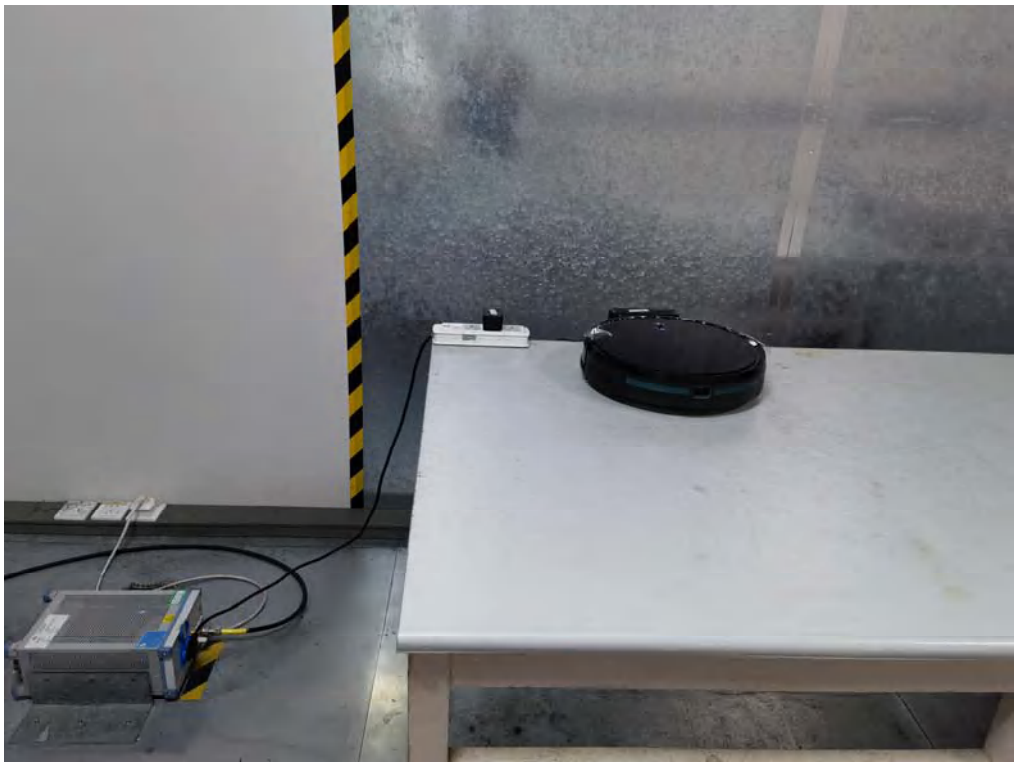
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply 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

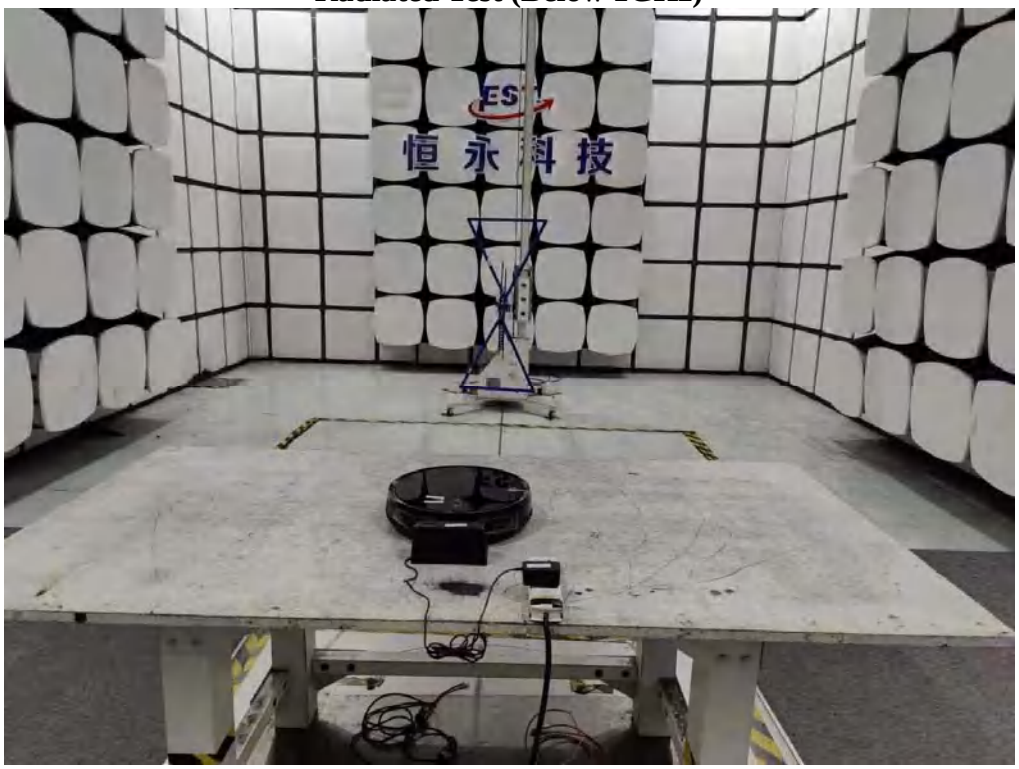
The antennas used for this product is internal antenna ,so compliance with antenna requirements.
( Please refer to the EUT photo for details)

# 11. TEST SETUP PHOTO

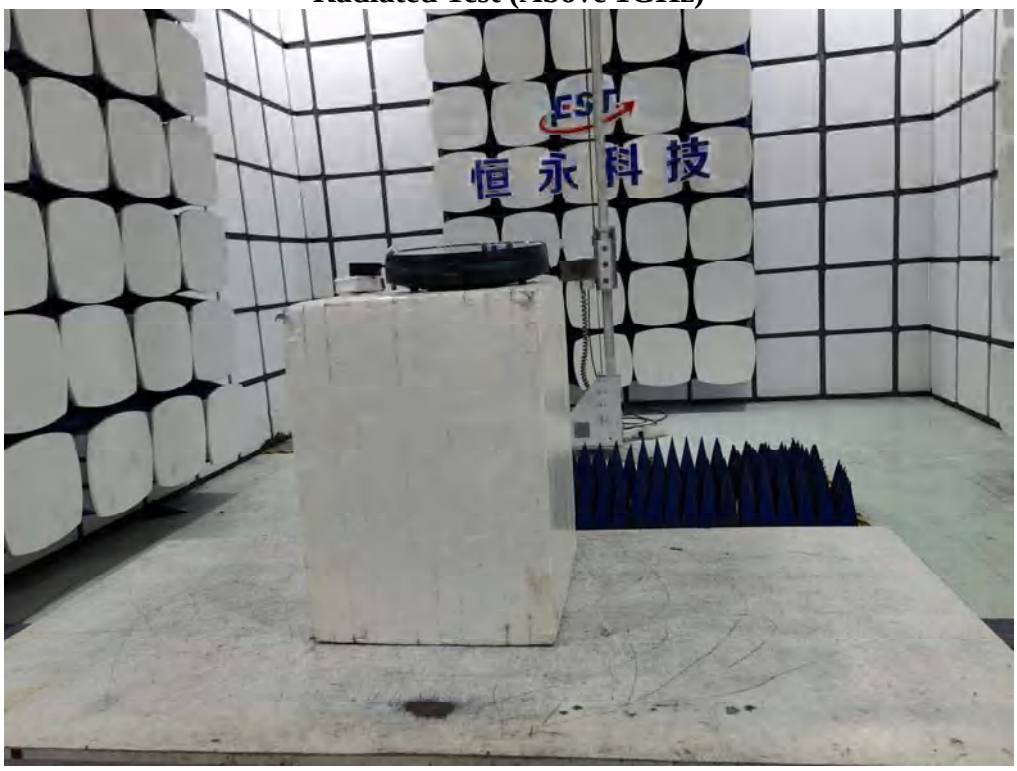
**Conducted Test**



**Radiated Test (Below 1GHz)**



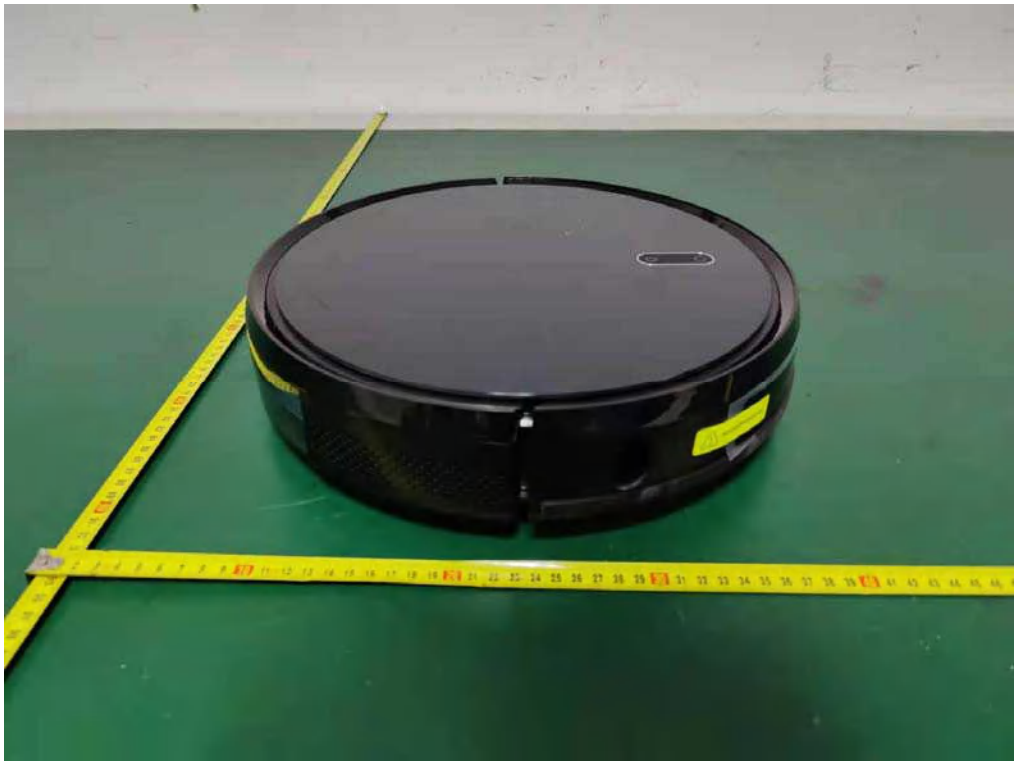

**Radiated Test (Above 1GHz)**



# 12. EUT PHOTO

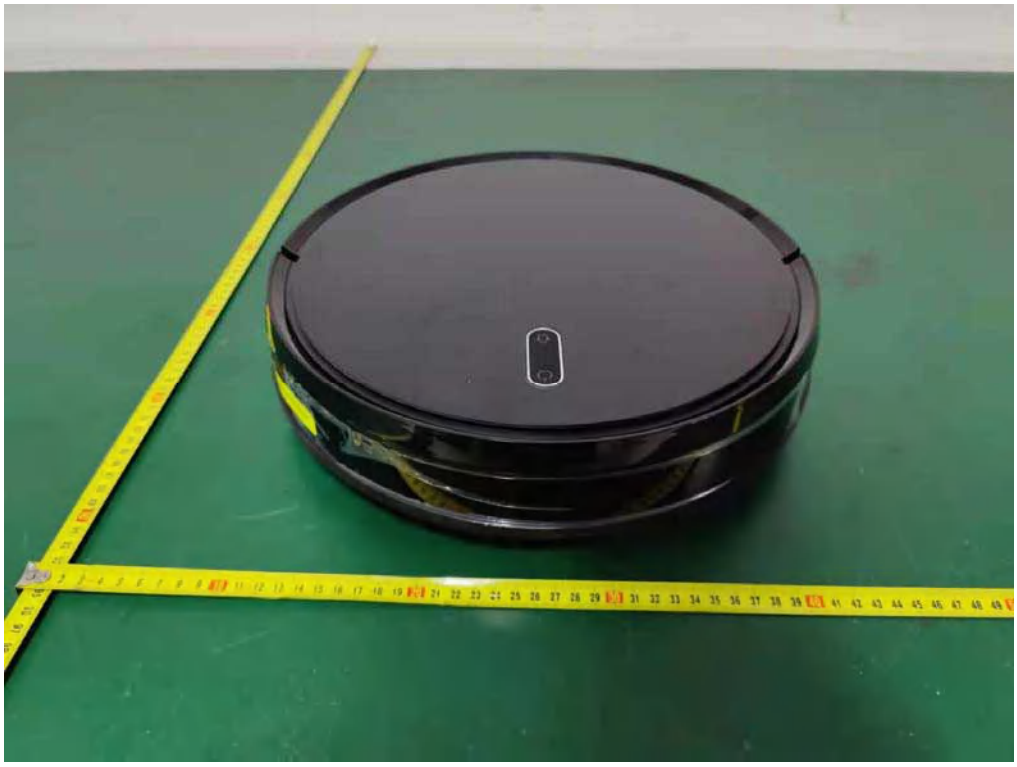
**External Photos**

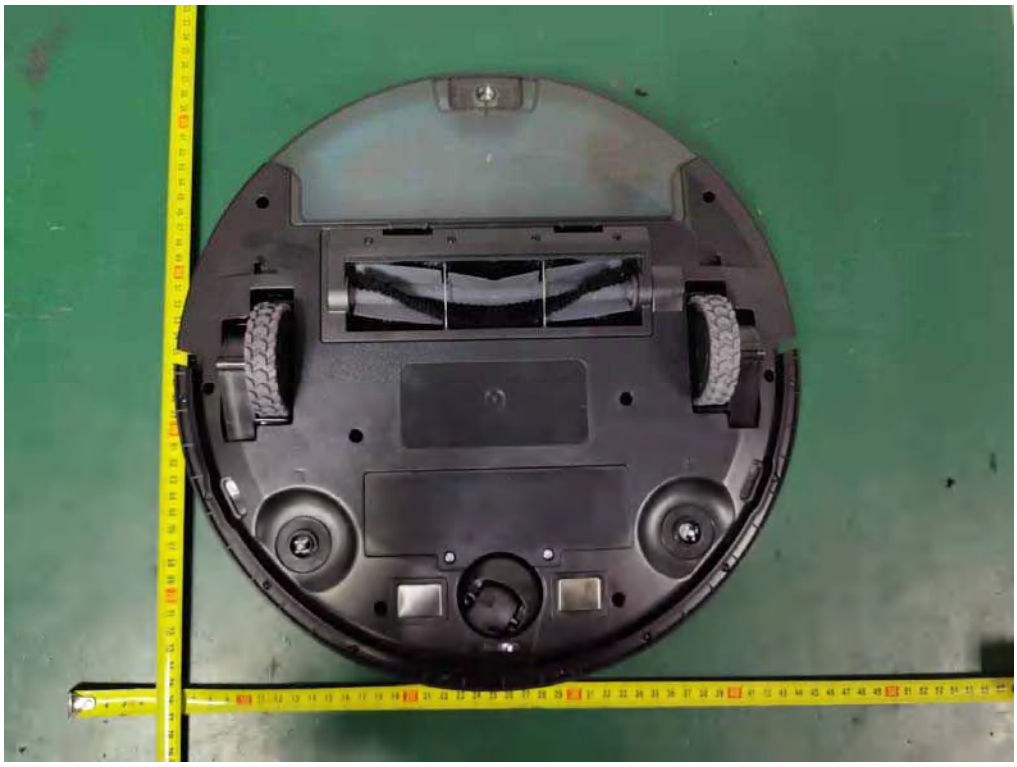
M/N: D30



**External Photos**

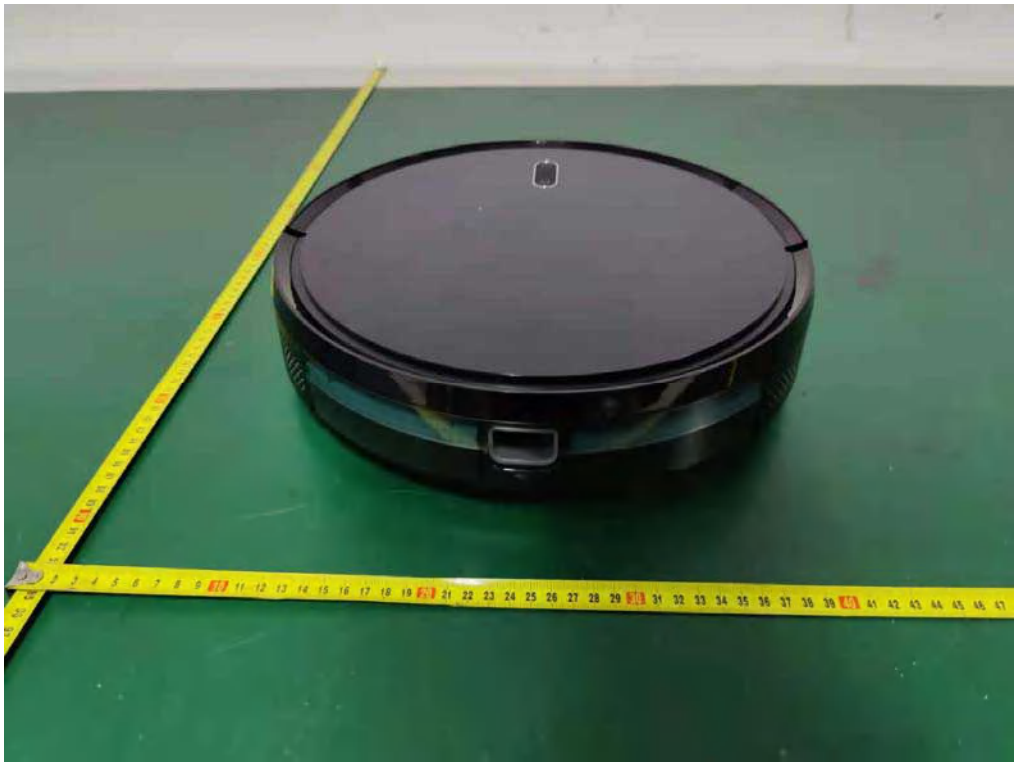
M/N: D30

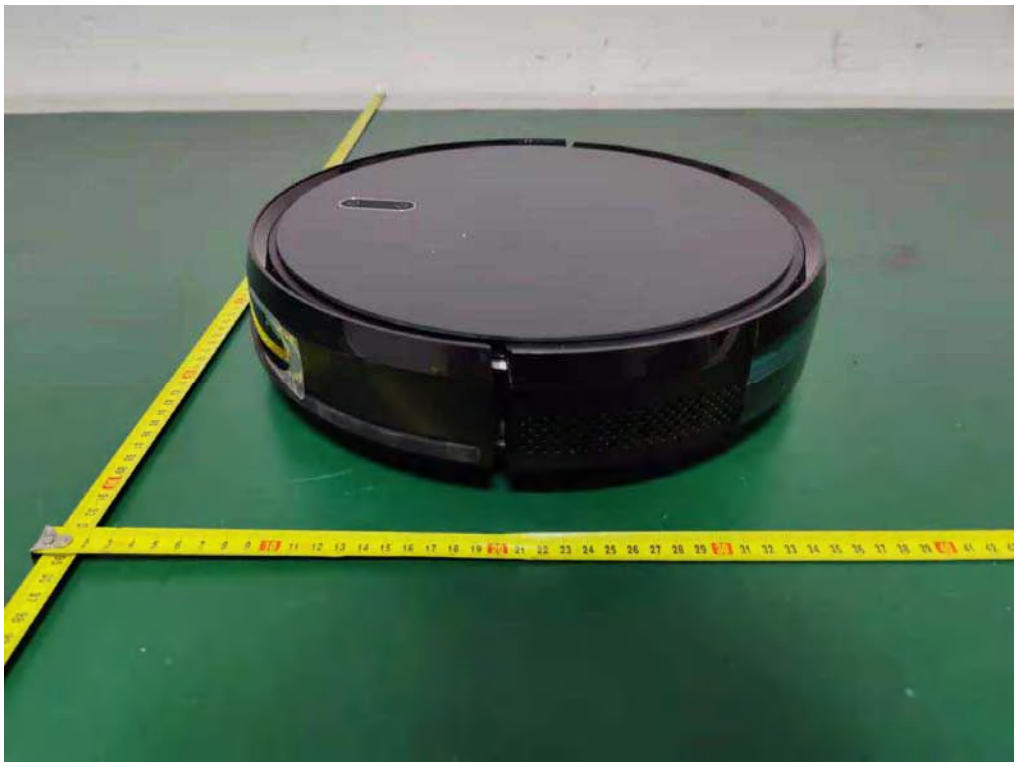




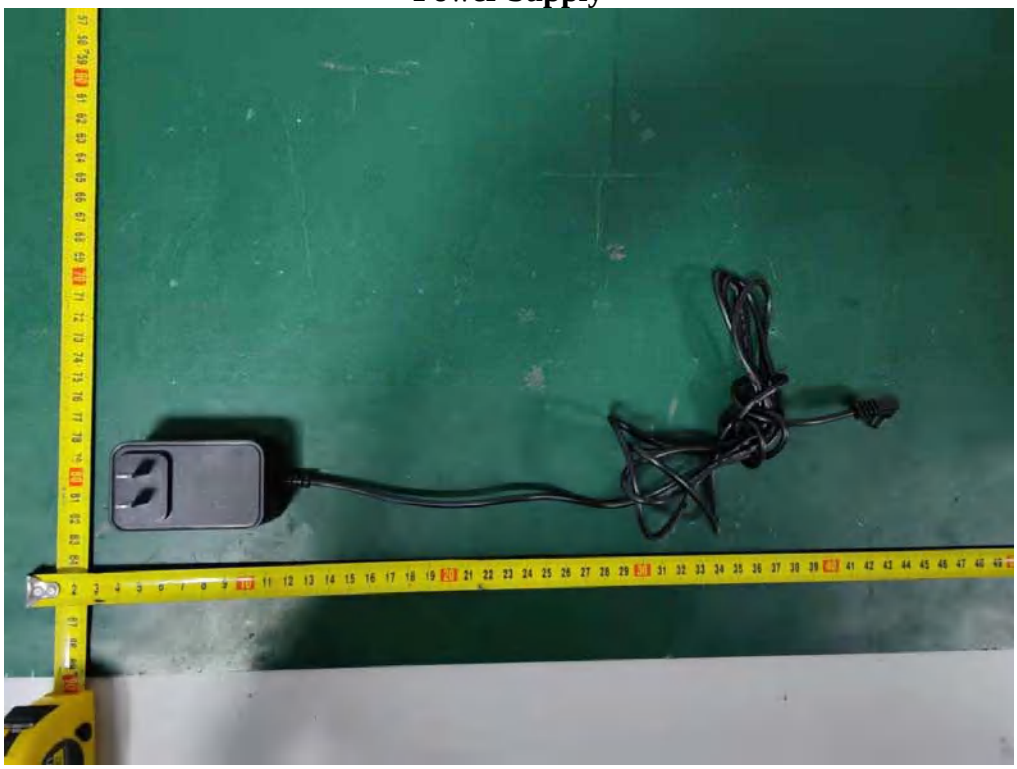
**External Photos**

M/N: D30



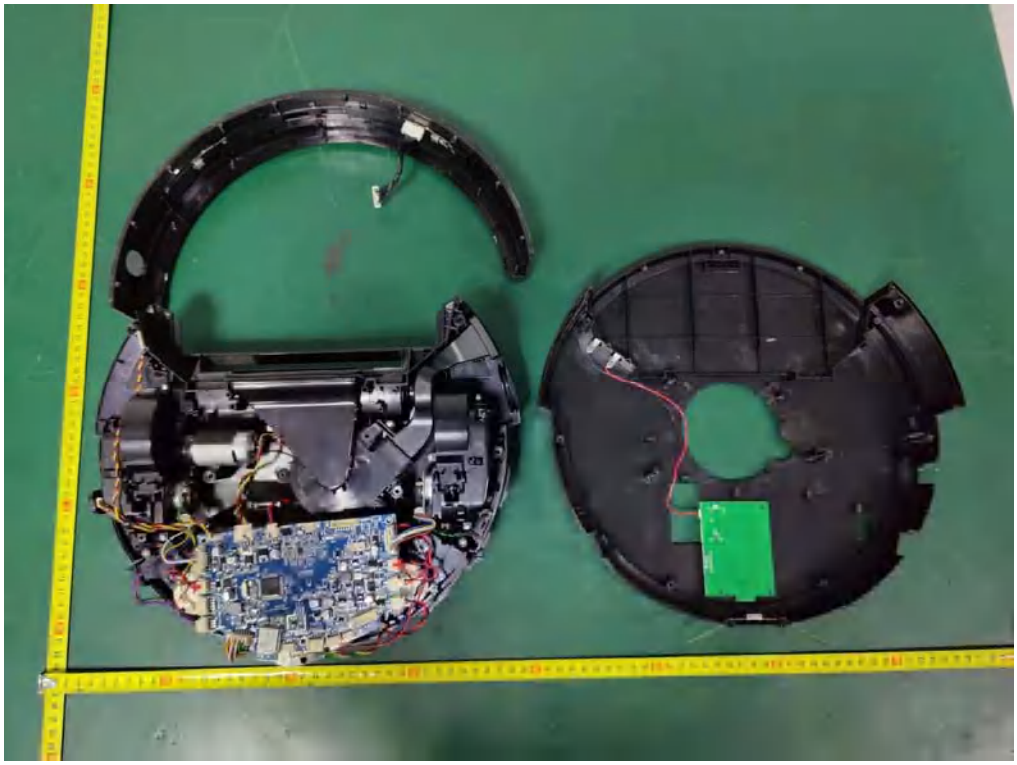


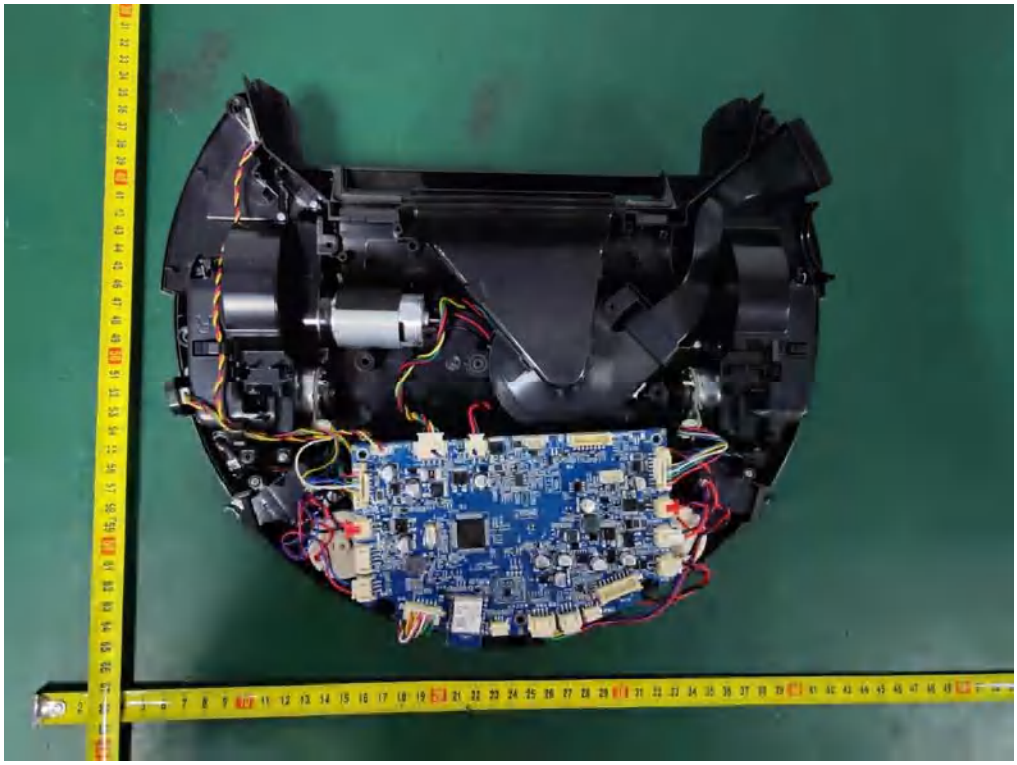
**Power Supply**



**Internal Photos**

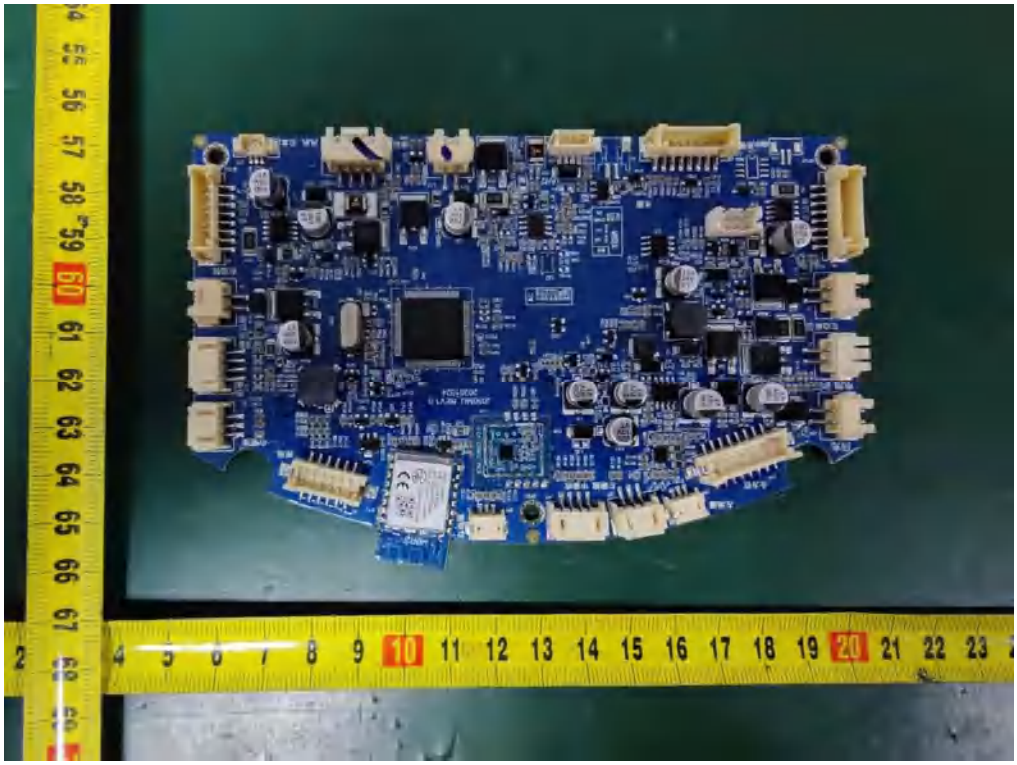
M/N: D30

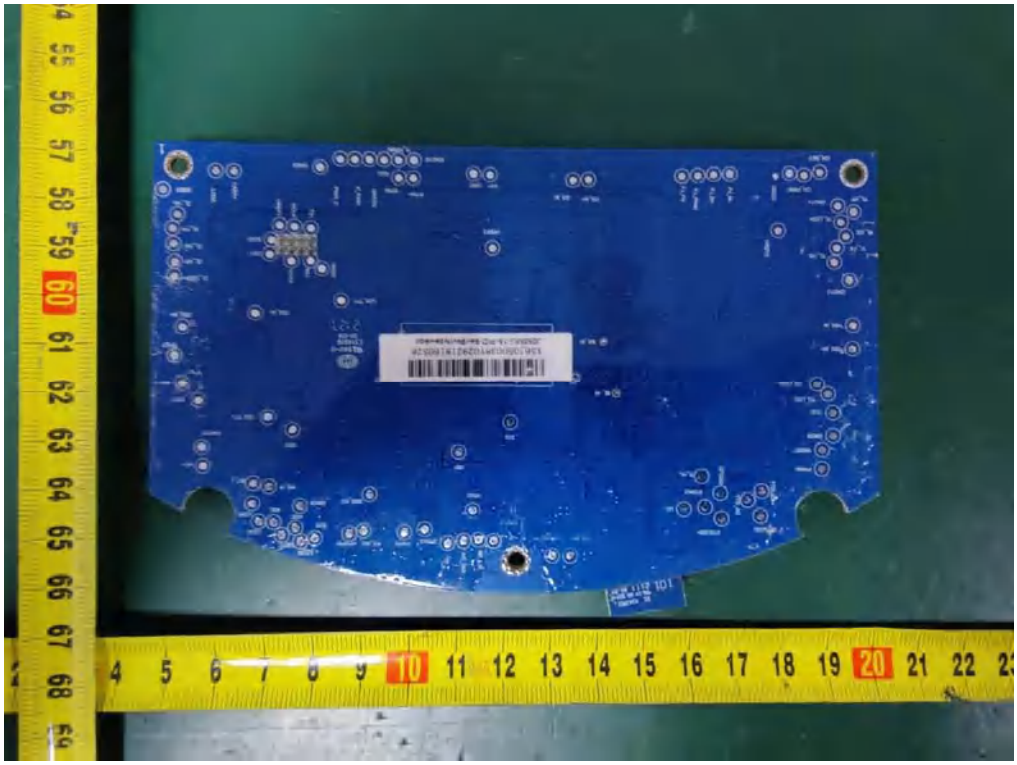




**Internal Photos**

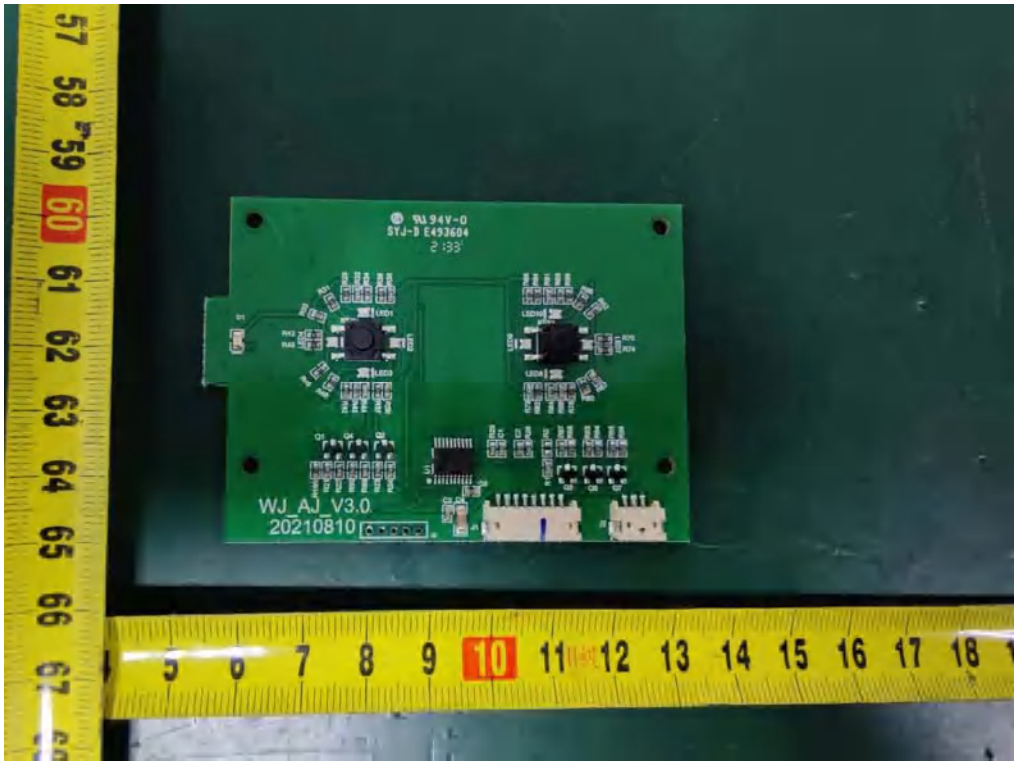
M/N: D30

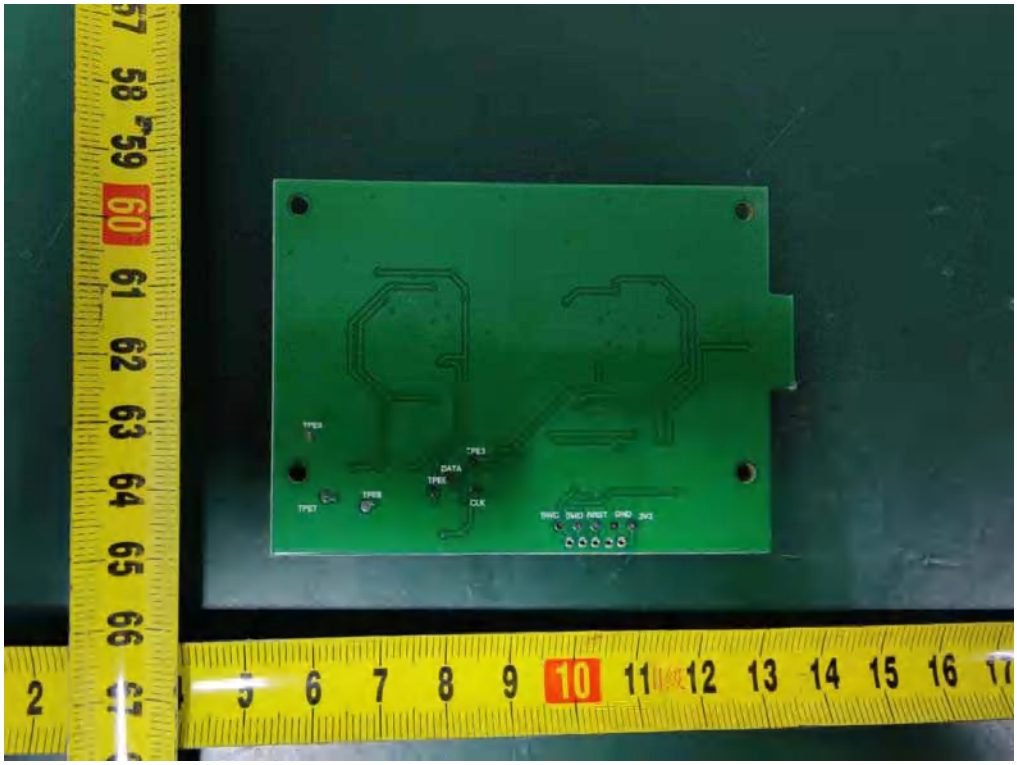




**Internal Photos**

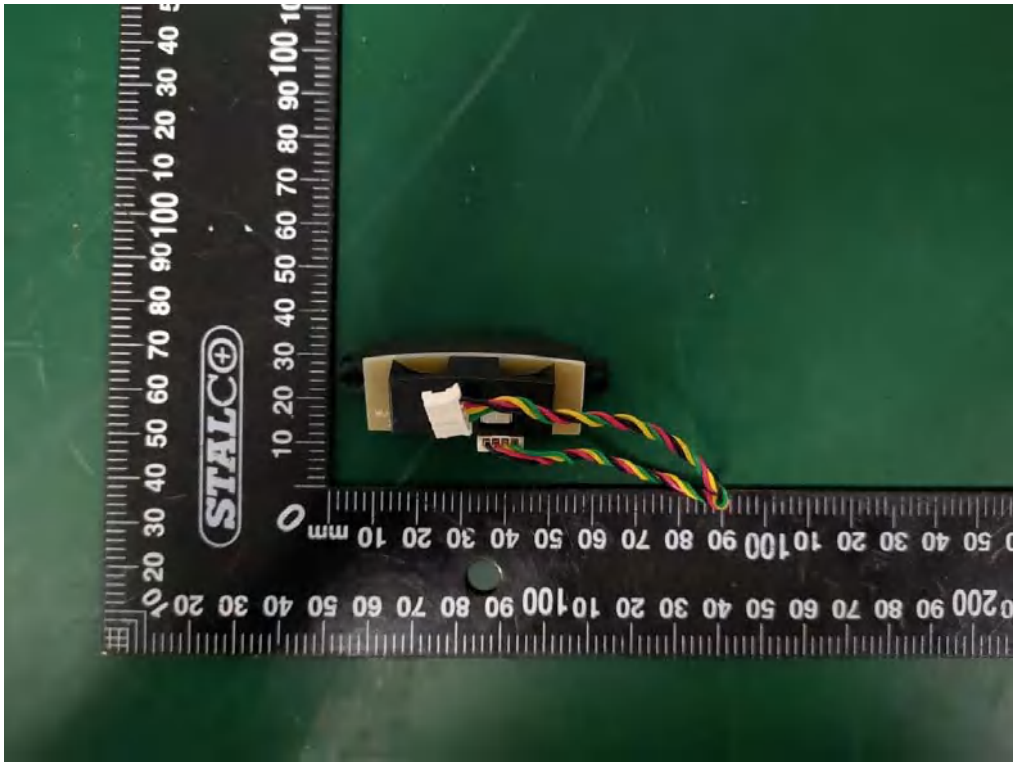
M/N: D30

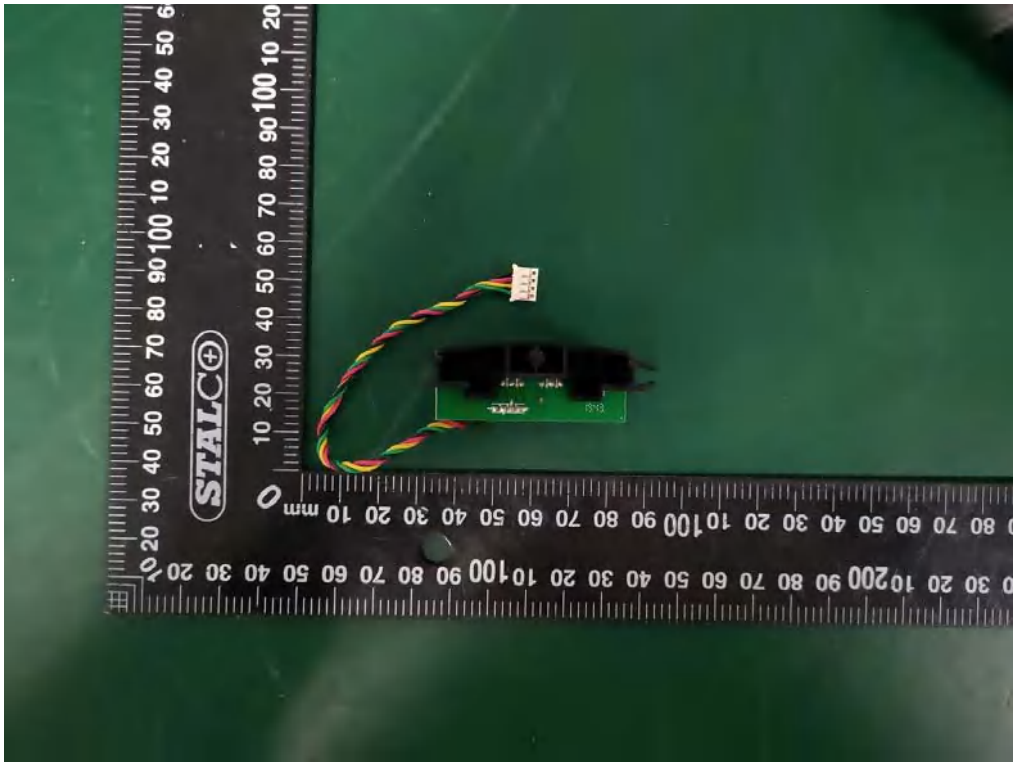


**Internal Photos**

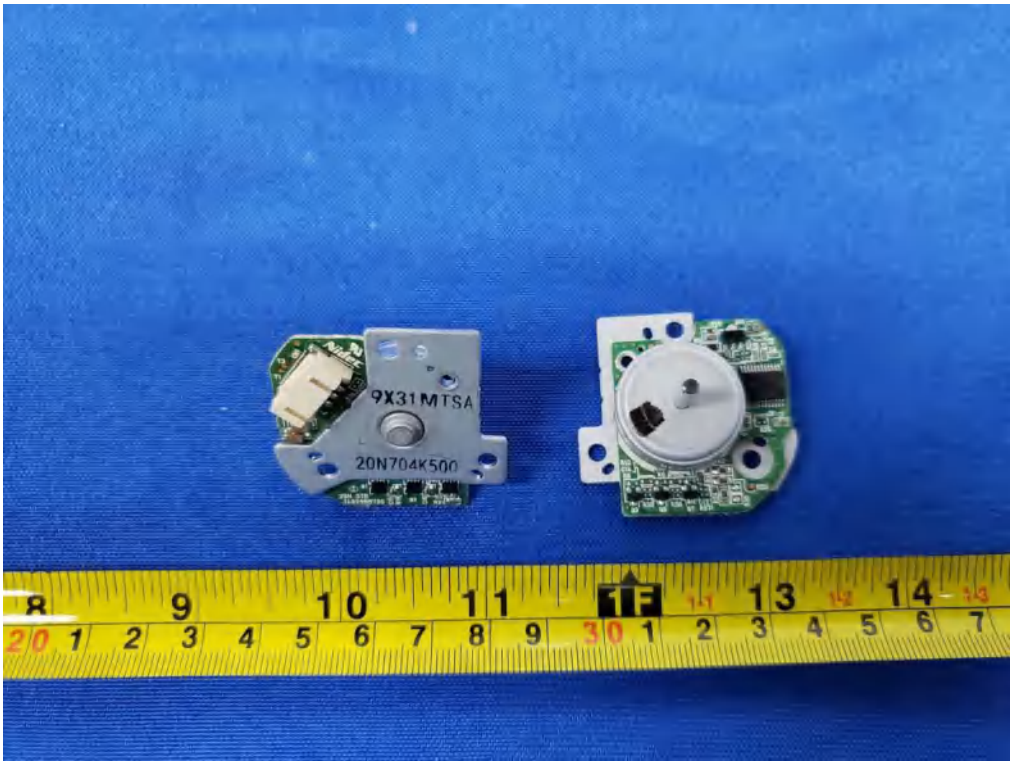
M/N: D30

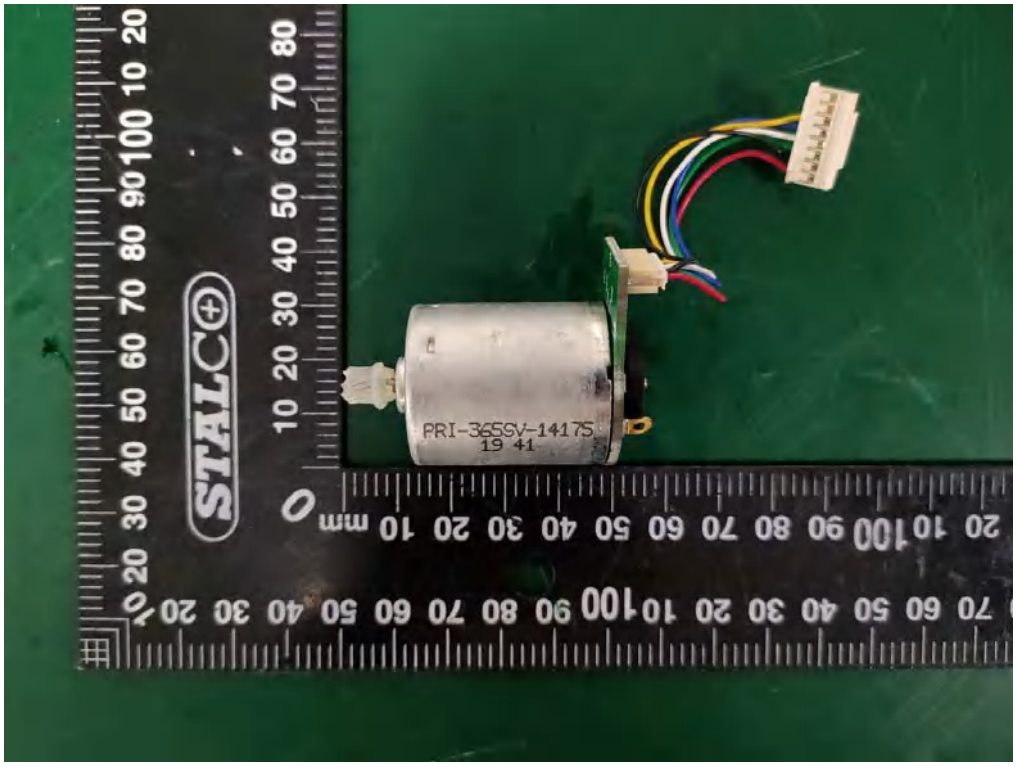


**Internal Photos**

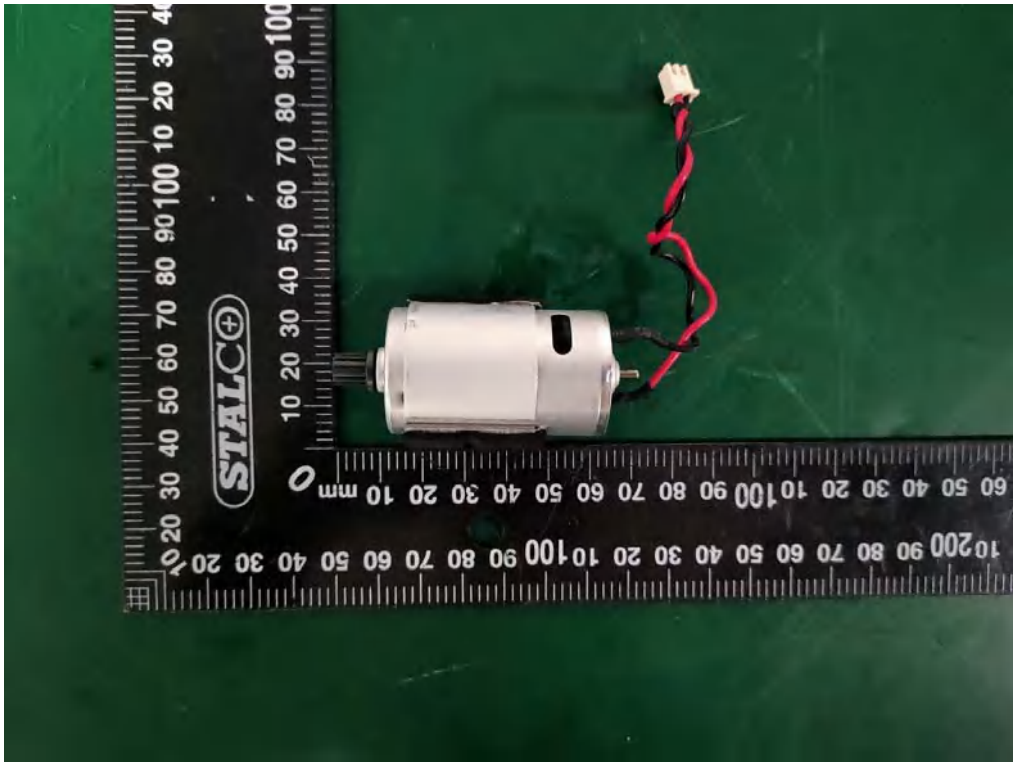
M/N: D30

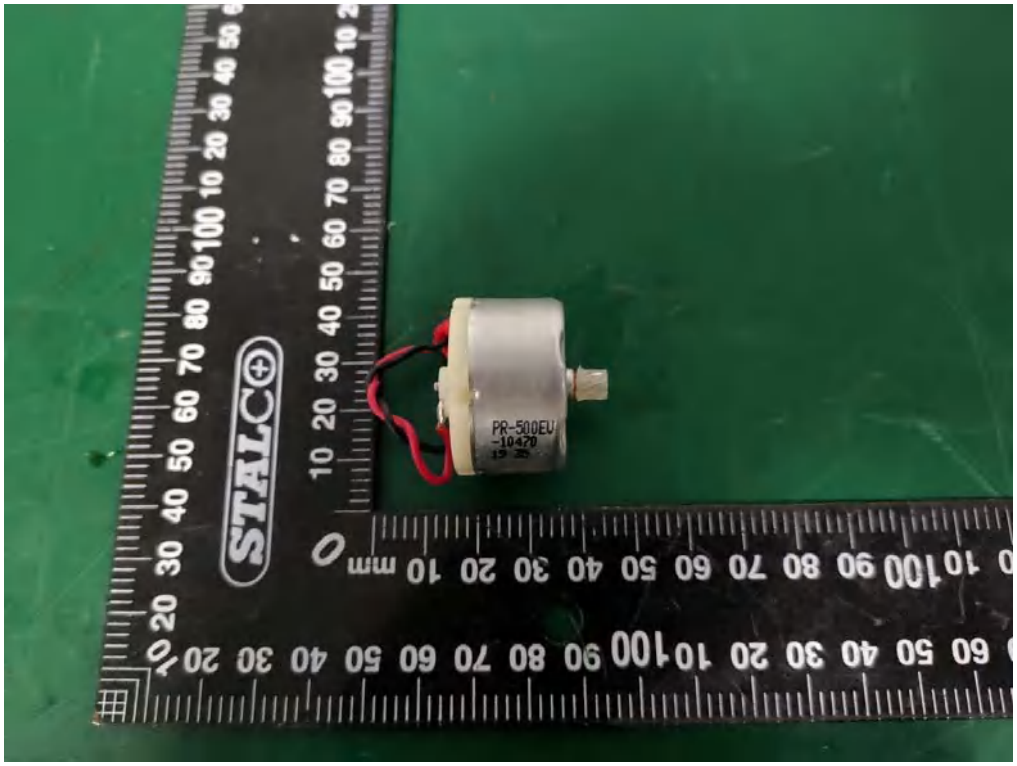


**Internal Photos**

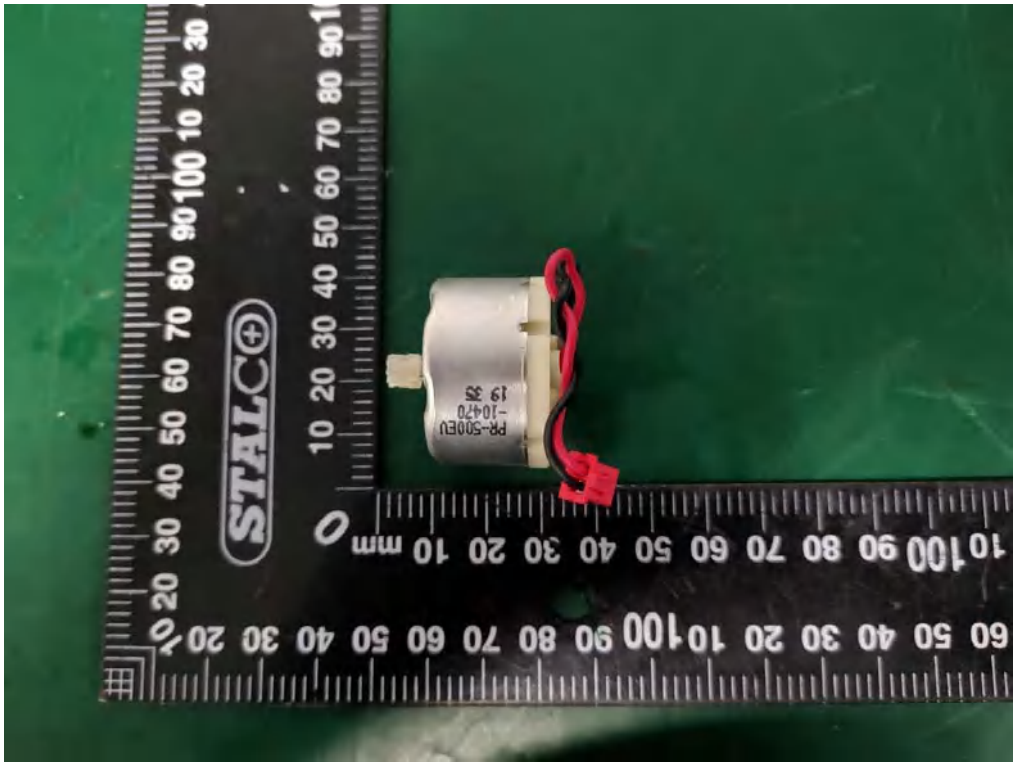
M/N: D30

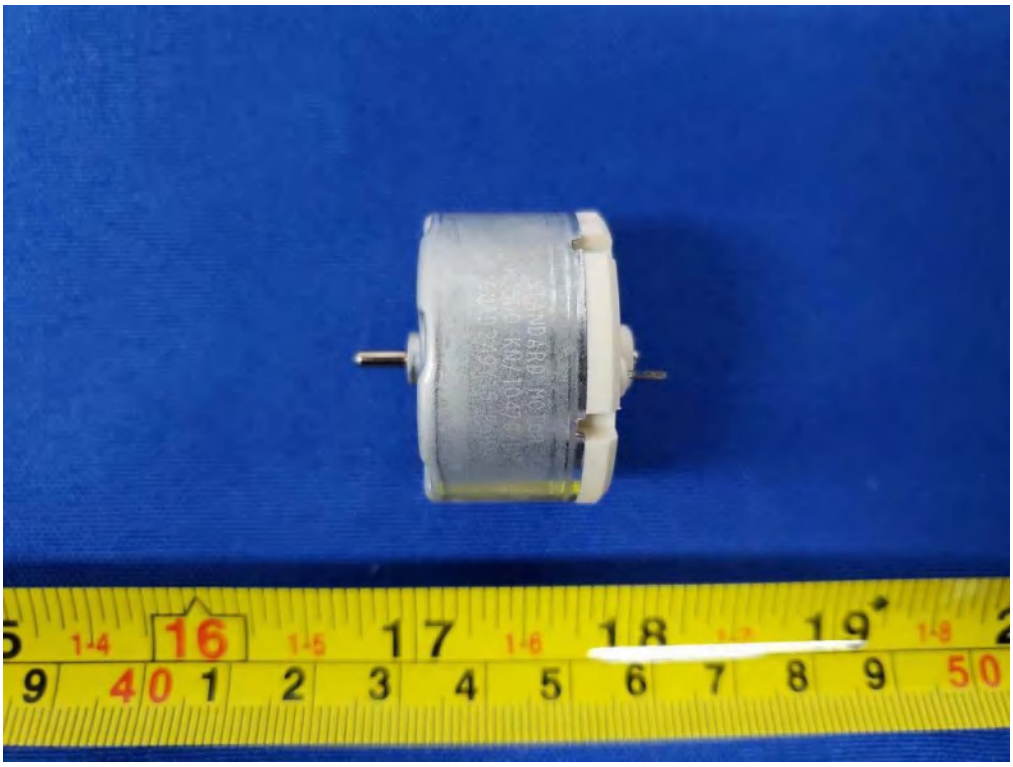


**Internal Photos**

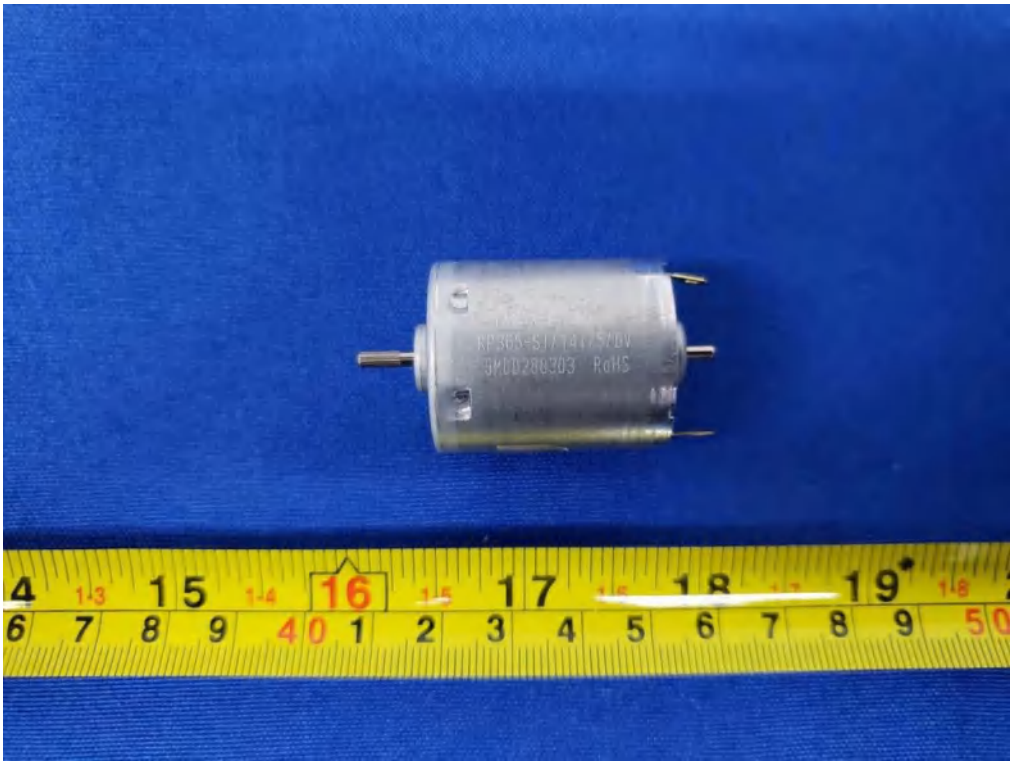
M/N: D30



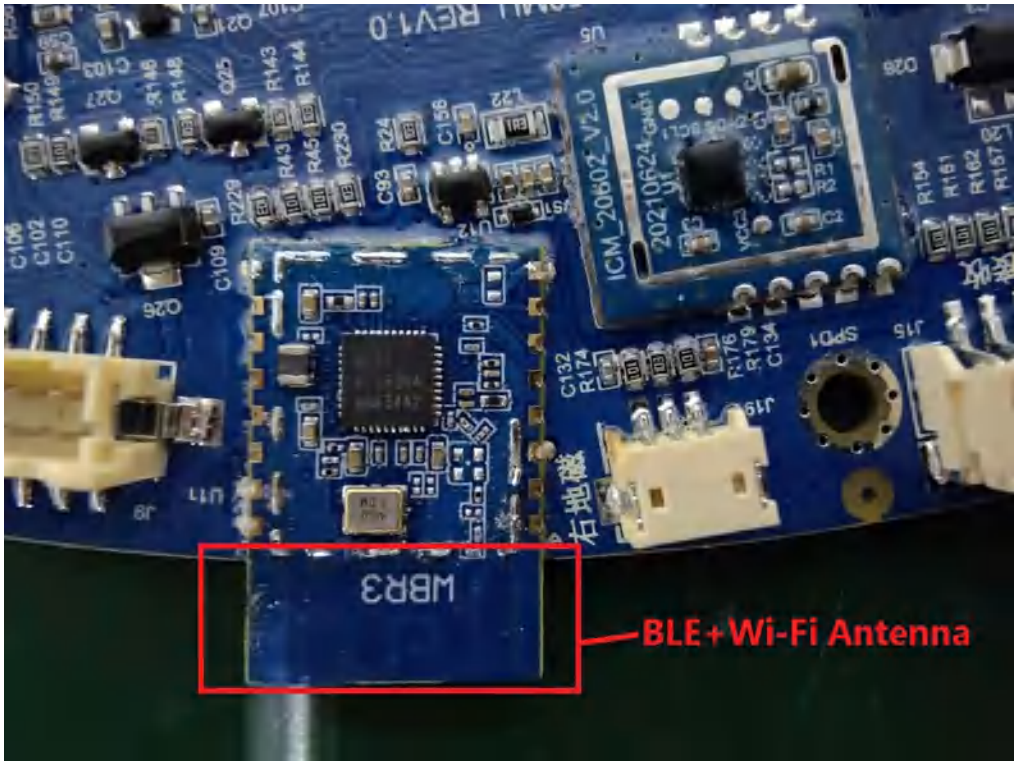
**Internal Photos**

M/N: D30



**Internal Photos**

M/N: D30




**End of Test Report**