# FCC TEST REPORT

# FCC ID: 2AQRL-ARID

| | | |
|---|---|---|
| **Product** | : | AquaRID |
| **Model Name** | : | A-RID, A-RID+ |
| **Brand** | : | SwellPro |
| **Report No.** | : | NCT24003267E-1 |

**Prepared for**

**Shenzhen SwellPro Technology CO., LTD**

**5 Floor 2 Building ZhuoLin Industrial Park LiaoKeng Third Industrial park LangXin Community ShiYan Street Baoan District Shenzhen Guangdong, China**

**Prepared by**

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# 1 TEST RESULT CERTIFICATION

| | | |
|---|---|---|
| Applicant | : | Shenzhen SwellPro Technology CO., LTD |
| Address | : | 5 Floor 2 Building ZhuoLin Industrial Park LiaoKeng Third Industrial park LangXin Community ShiYan Street Baoan District Shenzhen Guangdong, China |
| Manufacturer | : | Shenzhen SwellPro Technology CO., LTD |
| Address | : | 5 Floor 2 Building ZhuoLin Industrial Park LiaoKeng Third Industrial park LangXin Community ShiYan Street Baoan District Shenzhen Guangdong, China |
| Product name | : | AquaRID |
| Model name | : | A-RID, A-RID+ |
| Standards | : | FCC CFR47 Part 15 Section 15.247 |
| Test procedure | : | ANSI C63.10:2013 |
| Date of test | : | Jan. 18, 2024-Feb. 05, 2024 |
| Date of Issue | : | Feb. 06, 2024 |

This device described above has been tested by NCT, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Test Engineer:

Keven Wu / Engineer

Technical Manager:

Henry Wang / Manager

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Shenzhen NCT Testing Technology Co., Ltd.
2008

## 2 Test Summary

| Test Items | Test Requirement | Result |
|---|---|---|
| Conduct Emission | FCC part 15.207 | PASS |
| Radiated Spurious Emissions | FCC part 15.205/15.209 | PASS |
| Conducted Spurious Emission | FCC part 15.205/15.209 | PASS |
| Band edge | FCC part 15.247(d) | PASS |
| 6dB&99% Bandwidth | FCC part 15.247 (a)(2) | PASS |
| Maximum Peak Output Power | FCC part 15.247 (b)(3) | PASS |
| Power Spectral Density | FCC part 15.247 (e) | PASS |
| Antenna Requirement | FCC part 15.203/15.247 (c) | PASS |

Remark:

"N/A" denotes test is not applicable in this Test Report.

# 3 General Information

## 3.1 General Description of E.U.T.

| | | |
|---|---|---|
| Product Name | : | AquaRID |
| Model Name | : | A-RID |
| Sample ID | : | 24003267-001# |
| Sample(s) Status: | : | Engineer sample |
| Series Model | : | A-RID+ |
| Model Different.: | : | All the same except the model number. |
| Specification | : | 802.11b |
| Operation Frequency | : | 2412-2462MHz for 802.11b |
| Number of Channel | : | 11 channels for 802.11b |
| Type of Modulation | : | DSSS with DBPSK/DQPSK/CCK for 802.11b |
| Antenna installation | : | Internal Antenna |
| Antenna Gain | : | 2.98dBi |
| Power supply | : | DC 3.7V by battery (500mAh); Charging input: DC 5V |
| Hardware Version | : | V2.0 |
| Software Version | : | V2.0 |
| Remark: the Antenna gain is provided by customer from Antenna spec. and the laboratory will not be responsible for the accumulated calculation results which covers the information provided by the applicant. | | |

## 3.2 Channel List

The EUT has been tested under its typical operating condition.

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Those data rates (802.11b: 1 Mbps): MCS0;were used for all test.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Frequency and Channel list for 802.11 b:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---|---|---|---|---|---|
| 1 | 2412 | 5 | 2432 | 9 | 2452 |
| 2 | 2417 | 6 | 2437 | 10 | 2457 |
| 3 | 2422 | 7 | 2442 | 11 | 2462 |
| 4 | 2427 | 8 | 2447 | | |

Test Frequency and Channel for 802.11 b:

| Lowest Frequency | | Middle Frequency | | Highest Frequency | |
|---|---|---|---|---|---|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 1 | 2412 | 6 | 2437 | 11 | 2462 |

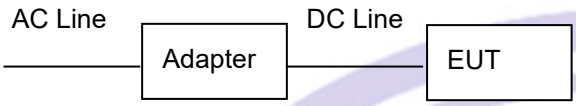
## 3.3 Test Site

Site Description

| | | |
|---|---|---|
| EMC Lab. | : | Accredited by CNAS, 2022-09-27 |
| | | The certificate is valid until 2028.01.07 |
| | | The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2006 (identical to ISO/IEC 17025:2017) |
| | | The Certificate Registration Number is L8251 |
| | | Designation Number: CN1347 |
| | | Test Firm Registration Number: 894804 |
| | | Accredited by A2LA, June 14, 2023 |
| | | The Certificate Registration Number is 6837.01 |
| | | Accredited by Industry Canada, November 09, 2018 |
| | | The Conformity Assessment Body Identifier is CN0150 |
| | | Company Number: 30806 |
| Name of Firm | : | Shenzhen NCT Testing Technology Co., Ltd. |
| Site Location | : | A101&2F B2, Fuqiao 6th Area, Xintian Community, Fuhai Street, Baoan District, Shenzhen, People's Republic of China |

## 3.4 Test Setup Configuration

Conducted Emission




Radiated Emission (30MHz-1GHz)

Radiated Emission(above 1GHz)

Conducted Spurious

## 3.5 Test Mode

| | |
|---|---|
| Transmitting mode | Keep the EUT in continuously transmitting mode. |
| Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data. | |

| | |
|---|---|
| Test Software | Tera Term |
| Power level setup | 13 |

# 4 Equipment During Test

## 4.1 Equipments List

Conducted emission Test Equipment

| Name | Model No. | Serial No. | Manufacturer | Date of Cal. | Due Date |
|---|---|---|---|---|---|
| 944 Shielded Room | 944 Room | / | EMToni | 2022/5/31 | 2025/5/30 |
| EMI Test Receiver | ESPI | 101604 | Rohde & Schwarz | 2023/6/21 | 2024/6/20 |
| LISN | ENV 216 | 102796 | Rohde & Schwarz | 2023/6/21 | 2024/6/20 |
| LISN | VN1-13S | 004023 | CRANAGE | 2023/6/21 | 2024/6/20 |
| Cable | RG223-1500MM | NA | RG | 2023/6/21 | 2024/6/20 |

Radiated emission & Radio Frequency Test Equipment

| Name | Model No. | Serial No. | Manufacturer | Date of Cal. | Due Date |
|---|---|---|---|---|---|
| 966 Shielded Room | 966 Room | / | EMToni | 2022/5/31 | 2025/5/30 |
| EMI Test Receiver | ESCI | 101178 | Rohde & Schwarz | 2023/6/21 | 2024/6/20 |
| Amplifi（30MHz-1GHz） | BBV 9743 B | 00374 | SCHNWARZBECK | 2023/6/21 | 2024/6/20 |
| Bilog Antenna（30MHz-1GHz） | VULB9162 | 00473 | SCHNWARZBECK | 2023/3/19 | 2025/3/18 |
| Horn antenna（1GHz-18GHz） | BBHA 9120 D | 02622 | SCHNWARZBECK | 2023/3/19 | 2025/3/18 |
| Pream plifier（1GHz-18GHz） | BBV 9718D | 0024 | SCHNWARZBECK | 2023/6/21 | 2024/6/20 |
| Spectrum Analyze（10Hz-40GHz） | FSV 40 | 100952 | Rohde & Schwarz | 2023/6/21 | 2024/6/20 |
| Pream plifier（18GHz-40GHz） | BBV 9721 | 0056 | SCHNWARZBECK | 2023/6/21 | 2024/6/20 |
| Double Ridge Guide Horn Antenna（18GHz-40GHz） | SAS-574 | 588 | A.H.System | 2023/3/19 | 2025/3/18 |
| Loop Antenna (9KHz-30MHz) | FMZB 1513-60 | 00115 | SCHNWARZBECK | 2023/6/21 | 2024/6/20 |
| Amplifier (9KHz-30MHz) | BBV 9745 | 00109 | CHNWARZBECK | 2023/6/21 | 2024/6/20 |

| | | | | | |
|---|---|---|---|---|---|
| MXG Signal Analyzer | N9020A | MY50510202 | Agilent | 2023/6/21 | 2024/6/20 |
| MXG Vector Signal Generator | N5182A | MY50140020 | Agilent | 2023/6/21 | 2024/6/20 |
| MXG Analog Signal Generator | N5181A | MY47420919 | Agilent | 2023/6/21 | 2024/6/20 |
| Power Sensor | TR1029-2 | 512364 | Techoy | 2023/6/21 | 2024/6/20 |
| RF Swith | TR1029-1 | 512364 | Techoy | 2023/6/21 | 2024/6/20 |
| Cable | DA800-4000MM | NA | DA | 2023/6/21 | 2024/6/20 |
| Cable | DA800-11000MM | NA | DA | 2023/6/21 | 2024/6/20 |

Other

| Item | Name | Manufacturer | Model | Software version |
|---|---|---|---|---|
| 1 | EMC Conduction Test System | AUDIX | e3 | 6.120718 |
| 2 | EMC radiation test system | AUDIX | e3 | 6.120718 |
| 3 | RF test system | TACHOY | RFTest | V1.0.0 |
| 4 | RF communication test system | TACHOY | RFTest | V1.0.0 |

## 4.2 Measurement Uncertainty

| Parameter | Uncertainty |
|---|---|
| RF output power, conducted | ±1.0dB |
| Power Spectral Density, conducted | ±2.2dB |
| Radio Frequency | ± 1 x $10^{-6}$ |
| Bandwidth | ± 1.5 x $10^{-6}$ |
| Time | ±2% |
| Duty Cycle | ±2% |
| Temperature | ±1°C |
| Humidity | ±5% |
| DC and low frequency voltages | ±3% |
| Conducted Emissions (150kHz~30MHz) | ±3.64dB |
| Radiated Emission(9KHz~30MHz) | ±4.51dB |
| Radiated Emission(30MHz~1GHz) | ±5.03dB |
| Radiated Emission(1GHz~25GHz) | ±4.74dB |
| Radiated Emission(25GHz~40GHz) | ±3.38dB |
| Remark: The coverage Factor (k=2), and measurement Uncertainty for a level of Confidence of 95% | |

## 4.3 Description of Support Units

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

| Item | Equipment | Mfr/Brand | Model/Type No. | Series No. | Note |
|---|---|---|---|---|---|
| E-1 | AquaRID | SwellPro | A-RID | N/A | EUT |
| E-2 | Adapter | N/A | A18A-050100U-US2 | N/A | Auxiliary |
| | | | | | |

Note:

(1) The support equipment was authorized by Declaration of Confirmation.

(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

# 5 Conducted Emission

| | | |
|---|---|---|
| Test Requirement: | : | FCC CFR 47 Part 15 Section 15.207 |
| Test Method | : | ANSI C63.10: 2013 |
| Test Result | : | PASS |
| Frequency Range | : | 150kHz to 30MHz |
| Class/Severity | : | Class B |

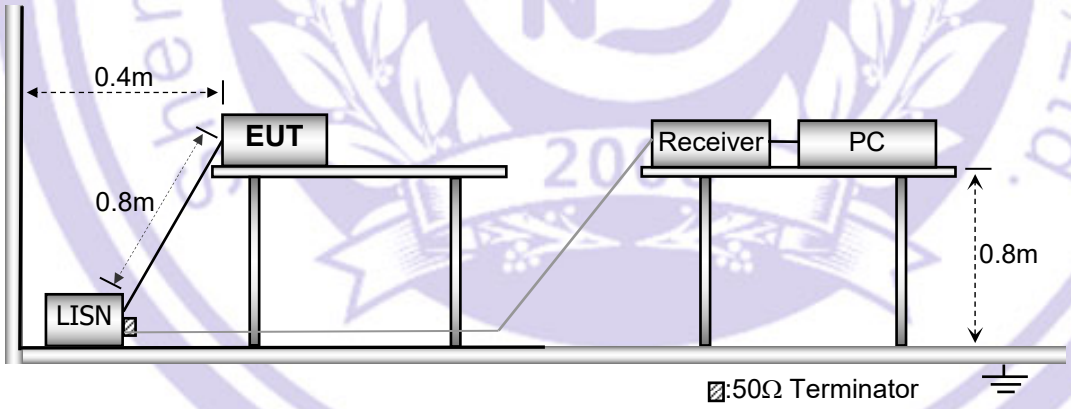
## 5.1 E.U.T. Operation

Operating Environment :

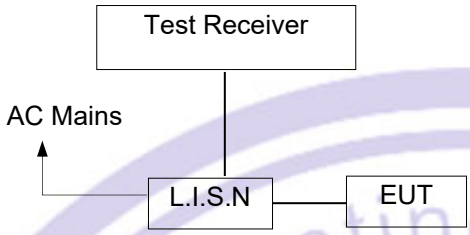
| | | |
|---|---|---|
| Temperature | : | 24.5 °C |
| Humidity | : | 51.3 % RH |
| Atmospheric Pressure | : | 101.11kPa |

## 5.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10:2013.



## 5.3 Test SET-UP (Block Diagram of Configuration)




## 5.4 Measurement Procedure

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured was complete.

## 5.5 Conducted Emission Limit

**Conducted Emission**

| Frequency(MHz) | Quasi-peak | Average |
|---|---|---|
| 0.15-0.5 | 66-56 | 56-46 |
| 0.5-5.0 | 56 | 46 |
| 5.0-30.0 | 60 | 50 |

**Note:**
1. The lower limit shall apply at the transition frequencies
2.The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

## 5.6 Measurement Description

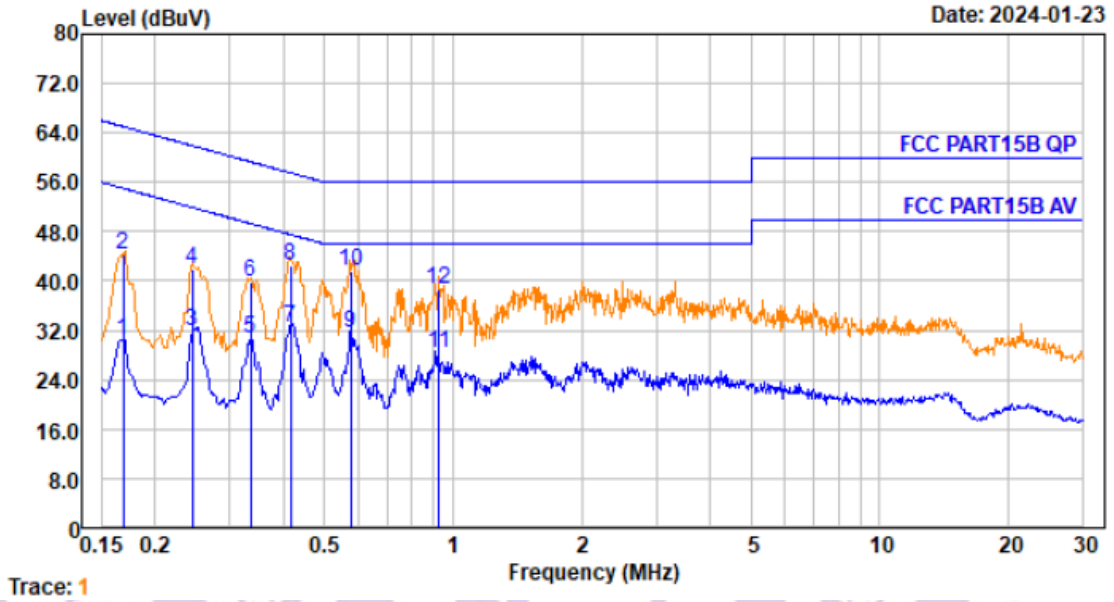
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

## 5.7 Conducted Emission Test Result

Pass.

Please refer to the following pages.

| | | | |
|---|---|---|---|
| Temperature: | 26°C | Relative Humidity: | 54% |
| Pressure: | 101kPa | Phase : | L |
| Test Voltage : | DC 5V from Adapter input AC 120V/60Hz | | |



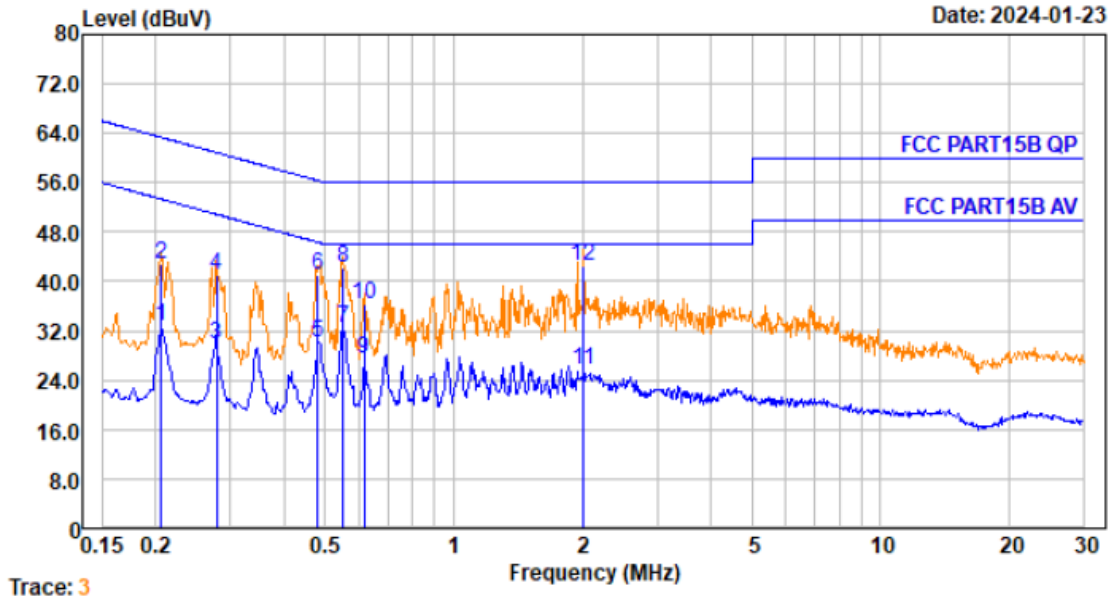

| No. | Freq MHz | Cable Loss dB | LISN Factor dB/m | Receiver Reading dBuV | Emission Level dBuV/m | Limit dBuV/m | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 1. | 0.169 | 0.00 | 9.54 | 10.69 | 30.39 | 55.03 | -24.64 | Average |
| 2. | 0.169 | 0.00 | 9.54 | 24.50 | 44.20 | 65.03 | -20.83 | QP |
| 3. | 0.246 | 0.01 | 9.56 | 12.18 | 31.89 | 51.91 | -20.02 | Average |
| 4. | 0.246 | 0.01 | 9.56 | 22.09 | 41.80 | 61.91 | -20.11 | QP |
| 5. | 0.336 | 0.01 | 9.56 | 10.98 | 30.68 | 49.31 | -18.63 | Average |
| 6. | 0.336 | 0.01 | 9.56 | 20.10 | 39.80 | 59.31 | -19.51 | QP |
| 7. | 0.417 | 0.01 | 9.57 | 12.91 | 32.61 | 47.51 | -14.90 | Average |
| 8. | 0.417 | 0.01 | 9.57 | 22.80 | 42.50 | 57.51 | -15.01 | QP |
| 9. | 0.576 | 0.02 | 9.57 | 11.89 | 31.59 | 46.00 | -14.41 | Average |
| 10. | 0.576 | 0.02 | 9.57 | 21.80 | 41.50 | 56.00 | -14.50 | QP |
| 11. | 0.928 | 0.02 | 9.58 | 8.60 | 28.29 | 46.00 | -17.71 | Average |
| 12. | 0.928 | 0.02 | 9.58 | 19.10 | 38.79 | 56.00 | -17.21 | QP |

Notes: 1.An initial pre-scan was performed on the line and neutral lines with peak detector.

2.Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.

3.Mesurement Level = Reading level + Correct Factor

| | | | |
|---|---|---|---|
| Temperature: | 26°C | Relative Humidity: | 54% |
| Pressure: | 101kPa | Phase : | N |
| Test Voltage : | DC 5V from Adapter input AC 120V/60Hz | | |




| No. | Freq MHz | Cable Loss dB | LISN Factor dB/m | Receiver Reading dBuV | Emission Level dBuV/m | Limit dBuV/m | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 1. | 0.206 | 0.01 | 9.55 | 13.13 | 32.84 | 53.36 | -20.52 | Average |
| 2. | 0.206 | 0.01 | 9.55 | 23.10 | 42.81 | 63.36 | -20.55 | QP |
| 3. | 0.279 | 0.01 | 9.56 | 10.25 | 29.96 | 50.85 | -20.89 | Average |
| 4. | 0.279 | 0.01 | 9.56 | 21.19 | 40.90 | 60.85 | -19.95 | QP |
| 5. | 0.481 | 0.01 | 9.58 | 10.46 | 30.17 | 46.32 | -16.15 | Average |
| 6. | 0.481 | 0.01 | 9.58 | 21.40 | 41.11 | 56.32 | -15.21 | QP |
| 7. | 0.552 | 0.01 | 9.58 | 12.63 | 32.33 | 46.00 | -13.67 | Average |
| 8. | 0.552 | 0.01 | 9.58 | 22.61 | 42.31 | 56.00 | -13.69 | QP |
| 9. | 0.617 | 0.02 | 9.58 | 7.77 | 27.48 | 46.00 | -18.52 | Average |
| 10. | 0.617 | 0.02 | 9.58 | 16.69 | 36.40 | 56.00 | -19.60 | QP |
| 11. | 2.012 | 0.04 | 9.58 | 5.88 | 25.56 | 46.00 | -20.44 | Average |
| 12. | 2.012 | 0.04 | 9.58 | 22.81 | 42.49 | 56.00 | -13.51 | QP |

Notes: 1.An initial pre-scan was performed on the line and neutral lines with peak detector.

2.Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.

3.Mesurement Level = Reading level + Correct Factor

# 6 Radiated Spurious Emissions

Test Requirement : FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method : ANSI C63.10:2013

Test Result : PASS

Measurement Distance : 3m

Limit : See the follow table

| Frequency (MHz) | Field Strength | | Field Strength Limit at 3m Measurement Dist | |
|---|---|---|---|---|
| | uV/m | Distance (m) | uV/m | dBuV/m |
| 0.009 ~ 0.490 | 2400/F(kHz) | 300 | 10000 * 2400/F(kHz) | $20\log^{(2400/F(kHz))} + 80$ |
| 0.490 ~ 1.705 | 24000/F(kHz) | 30 | 100 * 24000/F(kHz) | $20\log^{(24000/F(kHz))} + 40$ |
| 1.705 ~ 30 | 30 | 30 | 100 * 30 | $20\log^{(30)} + 40$ |
| 30 ~ 88 | 100 | 3 | 100 | $20\log^{(100)}$ |
| 88 ~ 216 | 150 | 3 | 150 | $20\log^{(150)}$ |
| 216 ~ 960 | 200 | 3 | 200 | $20\log^{(200)}$ |
| Above 960 | 500 | 3 | 500 | $20\log^{(500)}$ |

## 6.1 EUT Operation

Operating Environment :

Temperature: : 24.5°C

Humidity: : 52 % RH

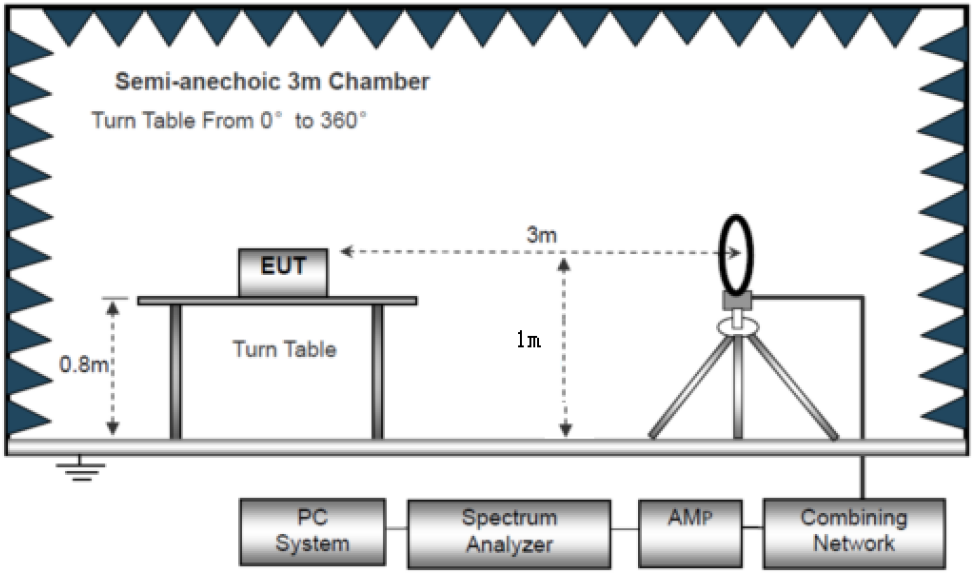
Atmospheric Pressure: : 101.11kPa

Test Voltage : DC 5V from Adapter input AC 120V/60Hz

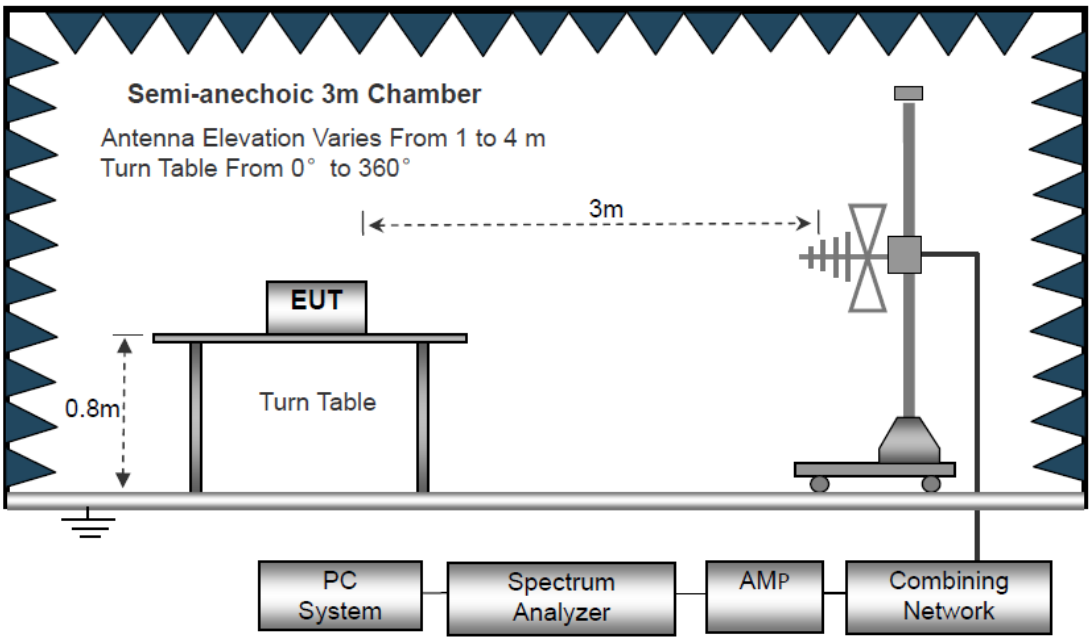
## 6.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site

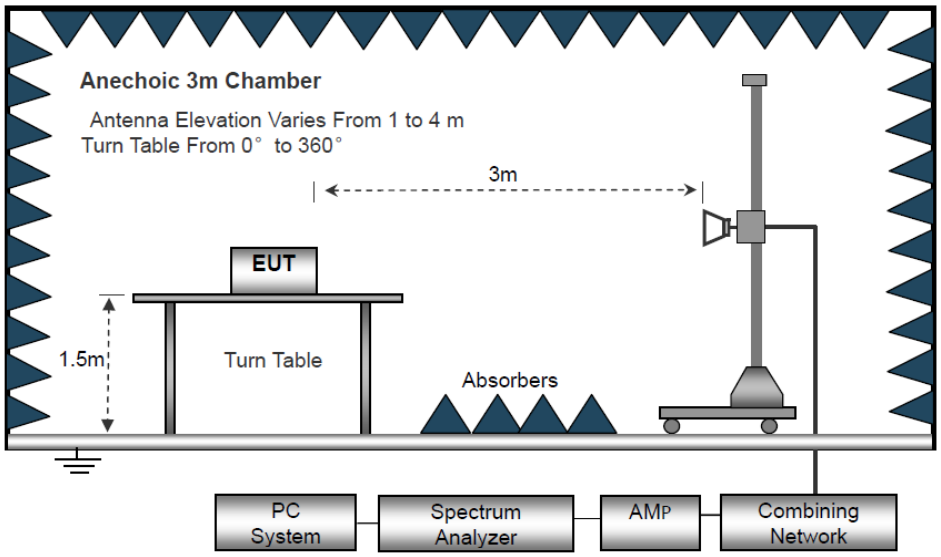
The test setup for emission measurement below 30MHz




The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz




## 6.3 Spectrum Analyzer Setup

| | | | |
|---|---|---|---|
| Below 30MHz | | | |
| IF Bandwidth | : | 10kHz | |
| Resolution Bandwidth | : | 10kHz | |
| Video Bandwidth | : | 10kHz | |
| 30MHz ~ 1GHz | | | |
| Detector | : | PK | QP |
| Resolution Bandwidth | : | 100kHz | 120kHz |
| Video Bandwidth | : | 300kHz | 300kHz |
| Above 1GHz | | | |
| Detector | : | PK | AV |
| Resolution Bandwidth | : | 1MHz | 1MHz |
| Video Bandwidth | : | 3MHz | 10Hz |

## 6.4 Test Procedure

1. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane, And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m above ground plane.

2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.

3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.

5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

6. Repeat above procedures until the measurements for all frequencies are complete.

7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

8. The test above 1GHz must be use the fully anechoic room, and the test below 1GHz use the half anechoic room

## 6.5 Summary of Test Results

**Test Frequency: 9KHz-30MHz**

| Freq. (MHz) | Ant.Pol. H/V | Emission Level (dBuV/m) | Limit 3m (dBuV/m) | Over (dB) |
|---|---|---|---|---|
| -- | -- | -- | -- | >20 |

Note:

The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

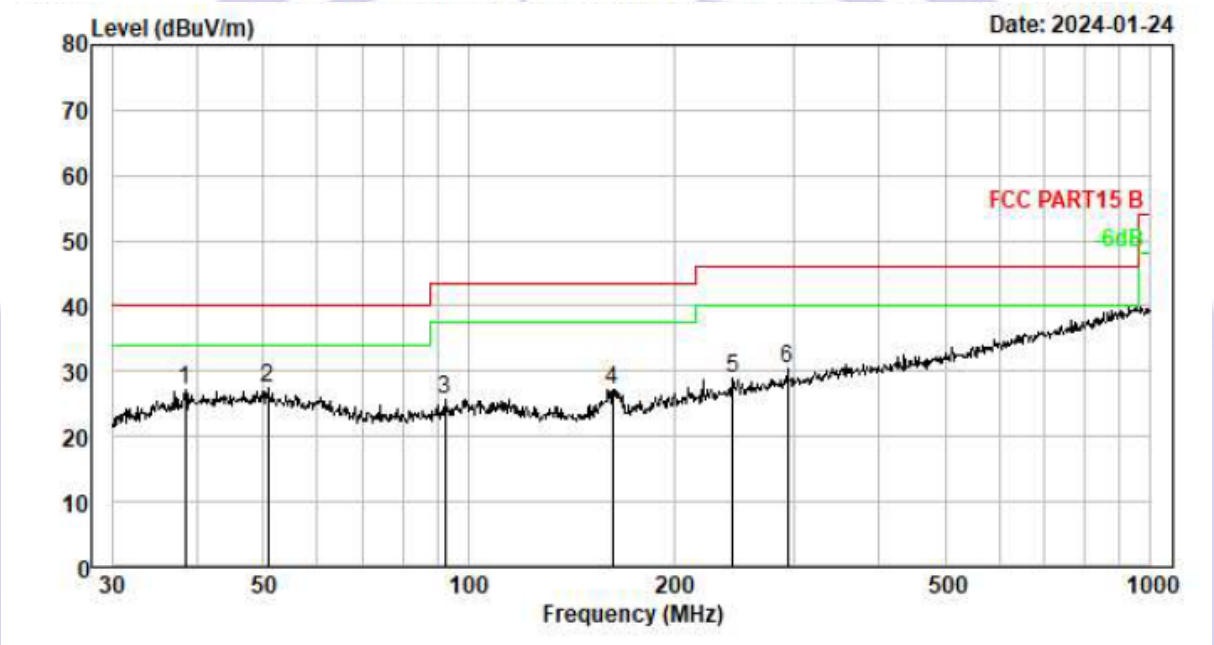
Distance extrapolation factor =40log(Specific distance/ test distance)( dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

**Test Frequency: 30MHz ~ 1GHz**

All the modulation modes were tested the data of the worst mode (TX 802.11b Low Channel) are recorded in the following pages and the others modulation methods do not exceed the limits.

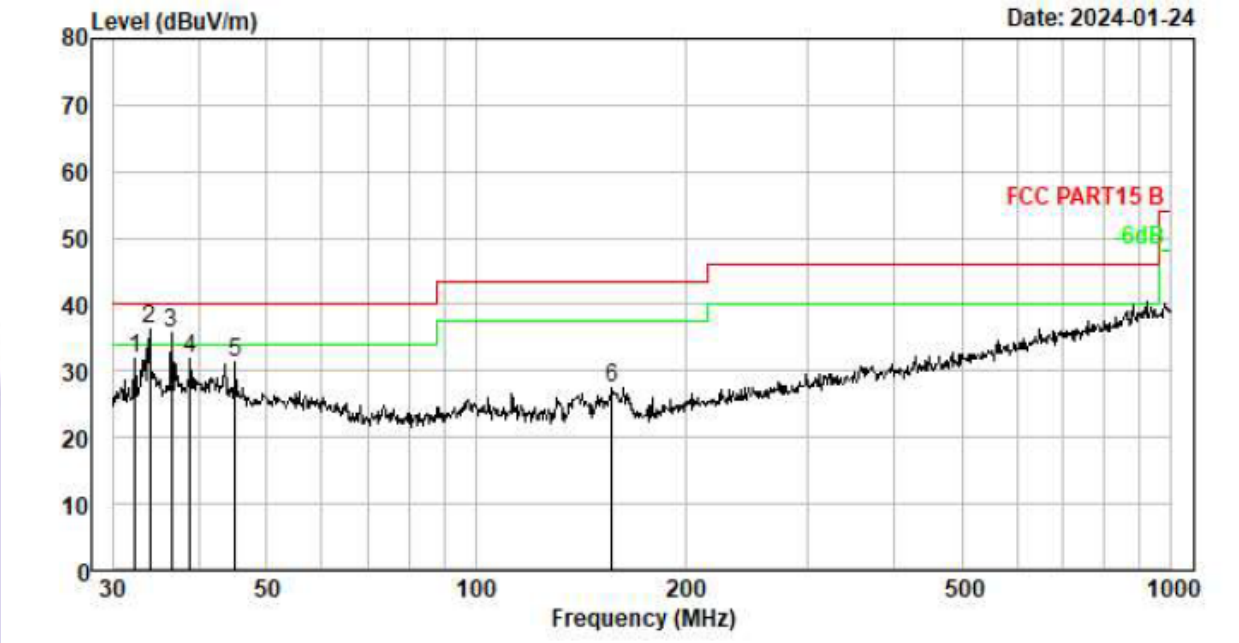
Please refer to the following test plots:

| | | | |
|---|---|---|---|
| Temperature: | 26℃ | Relative Humidity: | 54% |
| Pressure: | 101 kPa | Polarization: | Horizontal |
| Test Voltage: | DC 3.7V by battery | | |




| No. | Freq MHz | Cable Loss dB | ANT Factor dB/m | Preamp Gain dB | Receiver Reading dBμV | Emission Level dBμV/m | Limit dBμV/m | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 38.346 | 0.33 | 12.07 | 0.00 | 14.81 | 27.21 | 40.00 | -12.79 | QP |
| 2 | 50.764 | 0.44 | 12.62 | 0.00 | 14.36 | 27.42 | 40.00 | -12.58 | QP |
| 3 | 92.462 | 0.66 | 10.21 | 0.00 | 14.95 | 25.82 | 43.50 | -17.68 | QP |
| 4 | 162.611 | 0.95 | 8.93 | 0.00 | 17.37 | 27.25 | 43.50 | -16.25 | QP |
| 5 | 244.232 | 1.17 | 12.83 | 0.00 | 14.95 | 28.95 | 46.00 | -17.05 | QP |
| 6 | 294.114 | 1.27 | 14.16 | 0.00 | 14.90 | 30.33 | 46.00 | -15.67 | QP |

| | | | |
|---|---|---|---|
| Temperature: | 26℃ | Relative Humidity: | 54% |
| Pressure: | 101kPa | Polarization: | Vertical |
| Test Voltage: | DC 3.7V by battery | | |




| No. | Freq MHz | Cable Loss dB | ANT Factor dB/m | Preamp Gain dB | Receiver Reading dBμV | Emission Level dBμV/m | Limit dBμV/m | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 32.293 | 0.27 | 10.34 | 0.00 | 21.27 | 31.88 | 40.00 | -8.12 | QP |
| 2 | 33.917 | 0.29 | 10.84 | 0.00 | 25.15 | 36.28 | 40.00 | -3.72 | QP |
| 3 | 36.509 | 0.31 | 11.58 | 0.00 | 23.85 | 35.74 | 40.00 | -4.26 | QP |
| 4 | 38.752 | 0.34 | 12.18 | 0.00 | 19.23 | 31.75 | 40.00 | -8.25 | QP |
| 5 | 45.058 | 0.39 | 12.61 | 0.00 | 18.30 | 31.30 | 40.00 | -8.70 | QP |
| 6 | 157.007 | 0.93 | 8.65 | 0.00 | 17.78 | 27.36 | 43.50 | -16.14 | QP |

Remark:Emission Level=Reading+Cable Loss+ANT Factor

**Test Frequency: From 1GHz to 25GHz**

| Polar (H/V) | Frequency (MHz) | Meter Reading (dBuV) | Pre-amplifier (dB) | Cable Loss (dB) | Antenna Factor (dB) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|---|---|---|
| Low Channel:2412MHz | | | | | | | | | |
| V | 4824.00 | 50.81 | 34.12 | 5.03 | 32.39 | 53.57 | 74.00 | -20.43 | PK |
| V | 4824.00 | 40.85 | 34.12 | 5.03 | 32.39 | 43.66 | 54.00 | -10.34 | AV |
| V | 7236.00 | 44.61 | 32.54 | 6.29 | 35.86 | 53.79 | 74.00 | -20.21 | PK |
| V | 7236.00 | 33.86 | 32.54 | 6.29 | 35.86 | 43.93 | 54.00 | -10.07 | AV |
| V | 9648.00 | 47.85 | 32.98 | 7.55 | 38.4 | 54.45 | 74.00 | -19.55 | PK |
| V | 9648.00 | 34.63 | 32.98 | 7.55 | 38.4 | 43.44 | 54.00 | -10.56 | AV |
| V | 12060.00 | 42.34 | 32.09 | 8.93 | 39 | 56.81 | 74.00 | -17.19 | PK |
| V | 12060.00 | 31.77 | 32.09 | 8.93 | 39 | 45.89 | 54.00 | -8.11 | AV |
| H | 4824.00 | 49.50 | 34.12 | 5.03 | 32.39 | 52.99 | 74.00 | -21.01 | PK |
| H | 4824.00 | 37.57 | 34.12 | 5.03 | 32.39 | 42.97 | 54.00 | -11.03 | AV |
| H | 7236.00 | 47.34 | 32.54 | 6.29 | 35.86 | 53.79 | 74.00 | -20.21 | PK |
| H | 7236.00 | 36.39 | 32.54 | 6.29 | 35.86 | 42.83 | 54.00 | -11.17 | AV |
| H | 9648.00 | 44.75 | 32.98 | 7.55 | 38.4 | 54.87 | 74.00 | -19.13 | PK |
| H | 9648.00 | 33.74 | 32.98 | 7.55 | 38.4 | 44.65 | 54.00 | -9.35 | AV |
| H | 12060.00 | 39.00 | 32.09 | 8.93 | 39 | 55.11 | 74.00 | -18.89 | PK |
| H | 12060.00 | 31.40 | 32.09 | 8.93 | 39 | 45.73 | 54.00 | -8.27 | AV |

| Polar (H/V) | Frequency (MHz) | Meter Reading (dBuV) | Pre-amplifier (dB) | Cable Loss (dB) | Antenna Factor (dB) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|---|---|---|
| Middle Channel:2437MHz | | | | | | | | | |
| V | 4874.00 | 47.86 | 34.07 | 5.09 | 32.59 | 51.47 | 74.00 | -22.53 | PK |
| V | 4874.00 | 36.77 | 34.07 | 5.09 | 32.59 | 40.38 | 54.00 | -13.62 | AV |
| V | 7311.00 | 45.52 | 32.63 | 6.34 | 35.96 | 55.19 | 74.00 | -18.81 | PK |
| V | 7311.00 | 33.47 | 32.63 | 6.34 | 35.96 | 43.14 | 54.00 | -10.86 | AV |
| V | 9748.00 | 40.52 | 32.92 | 7.59 | 38.4 | 53.59 | 74.00 | -20.41 | PK |
| V | 9748.00 | 28.91 | 32.92 | 7.59 | 38.4 | 41.98 | 54.00 | -12.02 | AV |
| V | 12185.00 | 38.41 | 31.96 | 8.88 | 39.04 | 54.37 | 74.00 | -19.63 | PK |
| V | 12185.00 | 25.75 | 31.96 | 8.88 | 39.04 | 41.71 | 54.00 | -12.29 | AV |
| H | 4874.00 | 49.69 | 34.07 | 5.09 | 32.59 | 53.3 | 74.00 | -20.7 | PK |
| H | 4874.00 | 36.81 | 34.07 | 5.09 | 32.59 | 40.42 | 54.00 | -13.58 | AV |
| H | 7311.00 | 44.49 | 32.63 | 6.34 | 35.96 | 54.16 | 74.00 | -19.84 | PK |
| H | 7311.00 | 32.64 | 32.63 | 6.34 | 35.96 | 42.31 | 54.00 | -11.69 | AV |
| H | 9748.00 | 38.75 | 32.92 | 7.59 | 38.4 | 51.82 | 74.00 | -22.18 | PK |
| H | 9748.00 | 28.67 | 32.92 | 7.59 | 38.4 | 41.74 | 54.00 | -12.26 | AV |
| H | 12185.00 | 39.48 | 31.96 | 8.88 | 39.04 | 55.44 | 74.00 | -18.56 | PK |
| H | 12185.00 | 29.86 | 31.96 | 8.88 | 39.04 | 45.82 | 54.00 | -8.18 | AV |

| Polar (H/V) | Frequency (MHz) | Meter Reading (dBuV) | Pre-amplifier (dB) | Cable Loss (dB) | Antenna Factor (dB) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|---|---|---|
| High Channel:2462MHz | | | | | | | | | |
| V | 4924.00 | 47.3 | 34.02 | 5.15 | 32.8 | 51.23 | 74.00 | -22.77 | PK |
| V | 4924.00 | 37.75 | 34.02 | 5.15 | 32.8 | 41.68 | 54.00 | -12.32 | AV |
| V | 7386.00 | 43.02 | 32.71 | 6.4 | 36.05 | 52.76 | 74.00 | -21.24 | PK |
| V | 7386.00 | 33.6 | 32.71 | 6.4 | 36.05 | 43.34 | 54.00 | -10.66 | AV |
| V | 9848.00 | 42.61 | 32.86 | 7.62 | 38.4 | 55.77 | 74.00 | -18.23 | PK |
| V | 9848.00 | 29.81 | 32.86 | 7.62 | 38.4 | 42.97 | 54.00 | -11.03 | AV |
| V | 12310.00 | 39.36 | 31.82 | 8.84 | 39.08 | 55.46 | 74.00 | -18.54 | PK |
| V | 12310.00 | 29.79 | 31.82 | 8.84 | 39.08 | 45.89 | 54.00 | -8.11 | AV |
| H | 4924.00 | 48.4 | 34.02 | 5.15 | 32.8 | 52.33 | 74.00 | -21.67 | PK |
| H | 4924.00 | 37.92 | 34.02 | 5.15 | 32.8 | 41.85 | 54.00 | -12.15 | AV |
| H | 7386.00 | 46.57 | 32.71 | 6.4 | 36.05 | 56.31 | 74.00 | -17.69 | PK |
| H | 7386.00 | 32.69 | 32.71 | 6.4 | 36.05 | 42.43 | 54.00 | -11.57 | AV |
| H | 9848.00 | 42.62 | 32.86 | 7.62 | 38.4 | 55.78 | 74.00 | -18.22 | PK |
| H | 9848.00 | 31.05 | 32.86 | 7.62 | 38.4 | 44.21 | 54.00 | -9.79 | AV |
| H | 12310.00 | 40.78 | 31.82 | 8.84 | 39.08 | 56.88 | 74.00 | -17.12 | PK |
| H | 12310.00 | 27.29 | 31.82 | 8.84 | 39.08 | 43.39 | 54.00 | -10.61 | AV |

Note:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier,
Margin= Emission Level - Limit
2. If peak below the average limit, the average emission was no test.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Radiated Band Emission Measuremen:

| | Polar (H/V) | Frequency (MHz) | Meter Reading (dBuV) | Pre-amplifier (dB) | Cable Loss (dB) | Antenna Factor (dB/m) | Emission level (dBuV/m) | Limit (dBuV/m) | Detector Type | Result |
|---|---|---|---|---|---|---|---|---|---|---|
| 802.11b | Low Channel 2412MHz | | | | | | | | | |
| | H | 2390.00 | 58.35 | 35.17 | 3.48 | 27.49 | 54.15 | 74.00 | PK | PASS |
| | H | 2390.00 | 49.77 | 35.17 | 3.48 | 27.49 | 45.57 | 54.00 | AV | PASS |
| | H | 2400.00 | 60.63 | 35.16 | 3.49 | 27.52 | 56.48 | 74.00 | PK | PASS |
| | H | 2400.00 | 50.68 | 35.16 | 3.49 | 27.52 | 46.53 | 54.00 | AV | PASS |
| | V | 2390.00 | 57.85 | 35.17 | 3.48 | 27.49 | 53.65 | 74.00 | PK | PASS |
| | V | 2390.00 | 50.55 | 35.17 | 3.48 | 27.49 | 46.35 | 54.00 | AV | PASS |
| | V | 2400.00 | 60.49 | 35.16 | 3.49 | 27.52 | 56.34 | 74.00 | PK | PASS |
| | V | 2400.00 | 50.79 | 35.16 | 3.49 | 27.52 | 46.64 | 54.00 | AV | PASS |
| | High Channel 2462MHz | | | | | | | | | |
| | H | 2483.50 | 58.86 | 35.11 | 3.56 | 27.75 | 55.06 | 74.00 | PK | PASS |
| | H | 2483.50 | 48.69 | 35.11 | 3.56 | 27.75 | 44.89 | 54.00 | AV | PASS |
| | H | 2500.00 | 59.72 | 35.1 | 3.57 | 27.8 | 55.99 | 74.00 | PK | PASS |
| | H | 2500.00 | 50.15 | 35.1 | 3.57 | 27.8 | 46.42 | 54.00 | AV | PASS |
| | V | 2483.50 | 59.52 | 35.11 | 3.56 | 27.75 | 55.72 | 74.00 | PK | PASS |
| | V | 2483.50 | 50.63 | 35.11 | 3.56 | 27.75 | 46.83 | 54.00 | AV | PASS |
| | V | 2500.00 | 58.87 | 35.1 | 3.57 | 27.8 | 55.14 | 74.00 | PK | PASS |
| | V | 2500.00 | 50.21 | 35.1 | 3.57 | 27.8 | 46.48 | 54.00 | AV | PASS |

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier, Margin= Emission Level - Limit

# 7 Conduct Band Edge And Spurious Emissions Measurement

| | | |
|---|---|---|
| Test Requirement | : | FCC CFR47 Part 15 Section 15.247 |
| Test Method | : | ANSI C63.10:2013 |
| Test Limit | : | Regulation 15.247 (d),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)).<br>RSS-247 § 5.5:<br>In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required. |

## 7.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold

## 7.2 Test Result

Please see the attchment for the data.

# 8 6dB&99% Bandwidth Measurement

| | | |
|---|---|---|
| Test Requirement | : | FCC CFR47 Part 15 Section 15.247 |
| Test Method | : | ANSI C63.10:2013 |
| Test Limit | | Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz. |

## 8.1 Test Procedure

For 6dB Bandwidth Measurement

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

For 99% Bandwidth Measurement

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 1%-5% OBW, VBW ≥ 3RBW

## 8.2 Test Result

Please see the attchment for the data.

# 9 Maximum Peak Output Power

| | | |
|---|---|---|
| Test Requirement | : | FCC CFR47 Part 15 Section 15.247 |
| Test Method | : | ANSI C63.10:2013 |
| Test Limit | : | Regulation 15.247 (b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power.<br>RSS-247 § 5.4 (d)<br>For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e). |

## 9.1 Test Procedure

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

## 9.2 Test Result

Please see the attchment for the data.

# 10 Power Spectral density

| | | |
|---|---|---|
| Test Requirement | : | FCC CFR47 Part 15 Section 15.247 |
| Test Method | : | ANSI C63.10:2013 |
| Test Limit | : | Regulation 15.247(f) The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. |

## 10.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

2. Set the spectrum analyzer: RBW = 3kHz. VBW = 10kHz, Span = 1.5 times the DTS channel bandwidth(6 dB bandwidth). Sweep = auto; Detector Function = Peak. Trace = Max hold.

3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

## 10.2 Test Result

Please see the attchment for the data.

# 11 Antenna Application

## 11.1 Antenna Requirement

For intentional device, according to FCC 47 CFR Section 15.203, 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. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

According to RSS-GEN section 6.8

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

## 11.2 Result

The EUT'S antenna, permanent attached antenna, is Internal Antenna. The antenna's gain is 2.98 dBi and meets the requirement.

## 12 Test Setup and EUT Photos

Reference to the attachment for details.

******THE END REPORT******