# FCC TEST REPORT

**Test report**
**On Behalf of**
**Advanced Electronic Solutions Global Ltd.**
**For**
**Opyn**
**Model No.: OPYN-IP-IBK**

**FCC ID: 2ALPX-OPYNIPIBK**

| | |
|---|---|
| **Prepared For :** | **Advanced Electronic Solutions Global Ltd.**<br>**Unit 4C Kilcronagh Business Park, Cookstown, County Tyrone, United Kingdom** |
| **Prepared By :** | **Shenzhen HUAK Testing Technology Co., Ltd.**<br>**1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China** |
| **Date of Test:** | **Jun. 14, 2024 ~ Jul. 10, 2024** |
| **Date of Report:** | **Jul. 10, 2024** |
| **Report Number:** | **HK2406143128-2E** |

# TEST RESULT CERTIFICATION

| | | |
|---|---|---|
| **Applicant's name** | : | Advanced Electronic Solutions Global Ltd. |
| Address | : | Unit 4C Kilcronagh Business Park, Cookstown, County Tyrone, United Kingdom |
| **Manufacturer's Name** | : | Advanced Electronic Solutions Global Ltd. |
| Address | : | Unit 4C Kilcronagh Business Park, Cookstown, County Tyrone, United Kingdom |
| **Product description** | | |
| Trade Mark | : | AES |
| Product name | : | Opyn |
| Model and/or type reference | : | OPYN-IP-IBK |
| **Standards** | : | FCC Rules and Regulations Part 15 Subpart E Section 15.407<br>ANSI C63.10: 2013 |



| | | |
|---|---|---|
| **Date of Test** | : | |
| Date (s) of performance of tests | : | **Jun. 14, 2024 ~ Jul. 10, 2024** |
| Date of Issue | : | **Jul. 10, 2024** |
| Test Result | : | **Pass** |

Testing Engineer : Len Liao
(Len Liao)

Technical Manager : Sliver Wan
(Sliver Wan)

Authorized Signatory : Jason Zhou
(Jason Zhou)

# TABLE OF CONTENTS

## ** Modified History **

| Revision | Description | Issued Data | Remark |
|---|---|---|---|
| Revision 1.0 | Initial Test Report Release | Jul. 10, 2024 | Jason Zhou |
| | | | |
| | | | |



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Add: 1-2F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

# 1. TEST RESULT SUMMARY

## 1.1. TEST PROCEDURES AND RESULTS

| Requirement | CFR 47 Section | Result |
|---|---|---|
| Antenna requirement | §15.203 | PASS |
| AC Power Line Conducted Emission | §15.207 | PASS |
| Maximum Conducted Output Power | §15.407(a) | PASS |
| 6dB Emission Bandwidth | §15.407(e) | N/A |
| 26dB Emission Bandwidth& 99% Occupied Bandwidth | §15.407(a) | PASS |
| Power Spectral Density | §15.407(a) | PASS |
| Band edge | §15.407(b)/15.209/15.205 | PASS |
| Radiated Emission | §15.407(b)/15.209/15.205 | PASS |
| Frequency Stability | §15.407(g) | PASS |

***Note:***

*1. PASS: Test item meets the requirement.*

*2. Fail: Test item does not meet the requirement.*

*3. N/A: Test case does not apply to the test object.*

*4. The test result judgment is decided by the limit of test standard.*

## 1.2. INFORMATION OF THE TEST LABORATORY

Shenzhen HUAK Testing Technology Co., Ltd.
Add.: 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Testing Laboratory Authorization：

A2LA Accreditation Code is 4781.01.
FCC Designation Number is CN1229.
Canada IC CAB identifier is CN0045.
CNAS Registration Number is L9589.

## 1.3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

| No. | Item | MU |
|---|---|---|
| 1 | Conducted Emission | ±2.71dB |
| 2 | RF power, conducted | ±0.37dB |
| 3 | Spurious emissions, conducted | ±0.11dB |
| 4 | All emissions, radiated(<1G) | ±3.90dB |
| 5 | All emissions, radiated(>1G) | ±4.28dB |
| 6 | Temperature | ±0.1°C |
| 7 | Humidity | ±1.0% |

# 2. EUT DESCRIPTION

## 2.1. GENERAL DESCRIPTION OF EUT

| | |
|---|---|
| Equipment: | Opyn |
| Model Name: | OPYN-IP-IBK |
| Series Model: | N/A |
| Model Difference: | N/A |
| Trade Mark: | AES |
| FCC ID: | 2ALPX-OPYNIPIBK |
| Operation Frequency: | IEEE 802.11a/n/ac(HT20) 5.180GHz-5.240GHz<br>IEEE 802.11n/ac(HT40) 5.190GHz-5.230GHz<br>IEEE 802.11ac(HT80) 5.210GHz |
| Modulation Technology: | IEEE 802.11a/n/ac |
| Modulation Type: | 256QAM, 64QAM,16QAM, QPSK, BPSK for OFDM |
| Antenna Type: | External Antenna |
| Antenna Gain: | 3.7dBi |
| Power Source: | DC 24V From Adapter |
| Power Supply: | DC 24V From Adapter |
| Software Version: | V1.0 |
| Hardware Version: | V1.0 |

## 2.2. OPERATION FREQUENCY EACH OF CHANNEL

| 802.11a/802.11n/802.11ac (HT20) | | 802.11n/802.11ac (HT40) | | 802.11ac(HT80) | |
|---|---|---|---|---|---|
| Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 36 | 5180 | 38 | 5190 | 42 | 5210 |
| 40 | 5200 | 46 | 5230 | | |
| 44 | 5220 | | | | |
| 48 | 5240 | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

***Note:***

*In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:*

## 2.3. OPERATION OF EUT DURING TESTING

For 802.11a/n/ac(HT20)

| Band I (5150 - 5250 MHz) | | |
|---|---|---|
| Channel Number | Channel | Frequency (MHz) |
| 36 | Low | 5180 |
| 40 | Mid | 5200 |
| 48 | High | 5240 |

For 802.11n/ac(HT40)

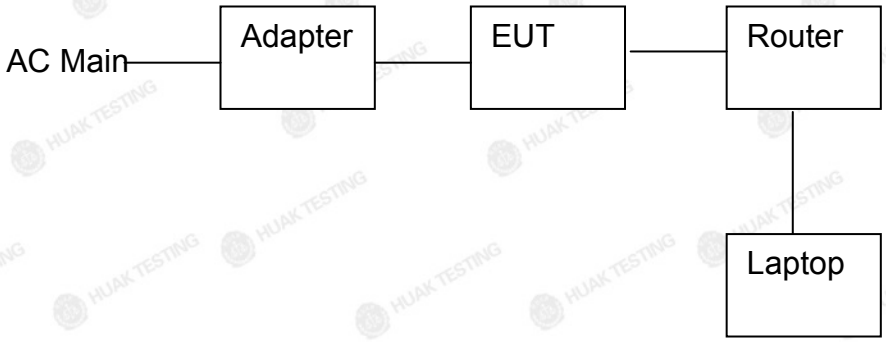
| Band I (5150 - 5250 MHz) | | |
|---|---|---|
| Channel Number | Channel | Frequency (MHz) |
| 38 | Low | 5190 |
| 46 | High | 5230 |

For 802.11ac(HT80)

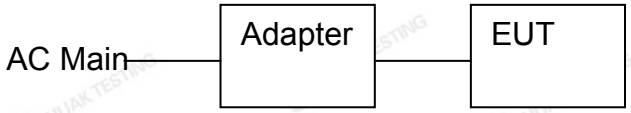
| Band I (5150 - 5250 MHz) | |
|---|---|
| Channel Number | Frequency (MHz) |
| 42 | 5210 |

## 2.4. DESCRIPTION OF TEST SETUP

Operation of EUT during conducted testing and below 1GHz radiation testing:




Operation of EUT during above1GHz radiation testing:




The sample was placed 0.8m/1.5m for blow/above 1GHz above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

## 2.5. 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. | Specification | Note |
|---|---|---|---|---|---|
| 1 | Opyn | AES | OPYN-IP-IBK | N/A | EUT |
| 2 | Adapter | N/A | AS2401A-2401000DM | Input: 100-240V, 50/60Hz, 0.8A MAX<br>Output: 24V 1.0A 24.0W | Peripheral |
| 3 | Laptop | Lenovo | Thinkpad E450 | Input: 20V 2.25A/3.25A | Accessory |
| 4 | Router | N/A | N/A | N/A | Accessory |
| | | | | | |

***Note:***

*1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*

*2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*

*3. For conducted measurements (Output Power, 6dB Emission Bandwidth, Power Spectral Density, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.*

# 3. GENERA INFORMATION

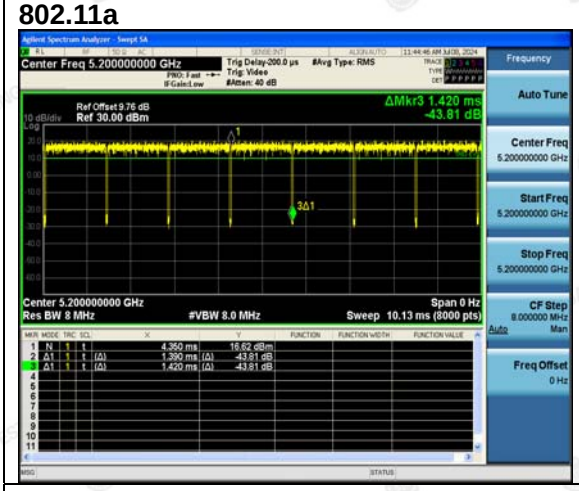
## 3.1. TEST ENVIRONMENT AND MODE

| | |
|---|---|
| **Operating Environment:** | |
| Temperature: | 25.0 °C |
| Humidity: | 56 % RH |
| Atmospheric Pressure: | 1010 mbar |
| **Test Mode:** | |
| Engineering mode: | Keep the EUT in continuous transmitting by select channel and modulations(The value of duty cycle is 100%) |
| We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows: | |
| **Per-scan all kind of data rate in lowest channel, and found the follow list which it was worst case.** | |
| Mode | Data rate |
| 802.11a | 6 Mbps |
| 802.11n(HT20) | MCS0 |
| 802.11n(HT40) | MCS0 |
| 802.11ac(HT20)/ac(HT40)/ac(HT80) | MCS0 |
| **Final Test Mode:** | |
| Operation mode: | Keep the EUT in continuous transmitting with modulation |

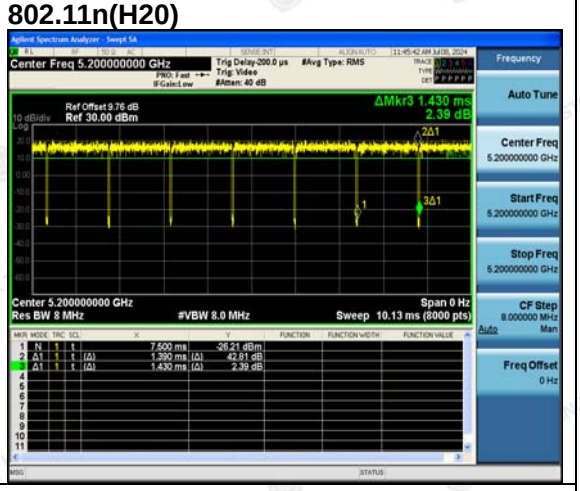
Mode Test Duty Cycle

| Mode | Duty Cycle | Duty Cycle Factor(dB) |
|---|---|---|
| 802.11a | 0.979 | -0.093 |
| 802.11n(H20) | 0.972 | -0.123 |
| 802.11n(H40) | 0.942 | -0.259 |
| 802.11ac(H20) | 0.970 | -0.132 |
| 802.11ac(H40) | 0.941 | -0.263 |
| 802.11ac(H80) | 0.981 | -0.081 |

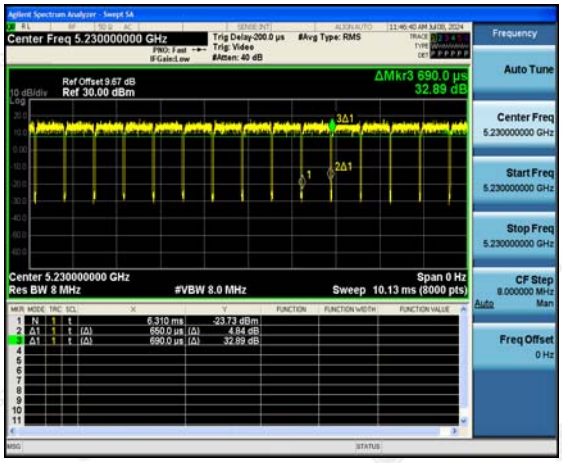
**802.11a**



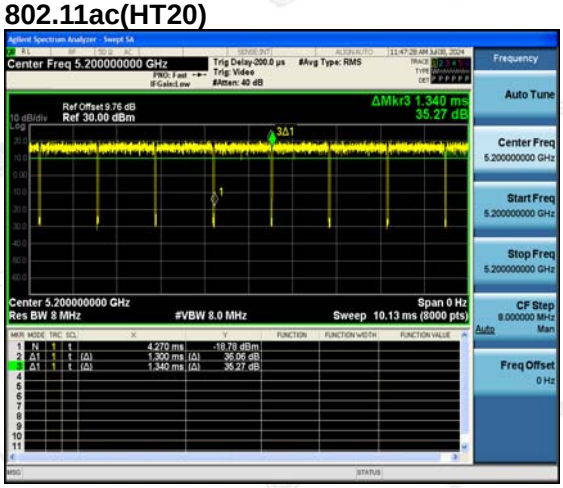

**802.11n(H20)**



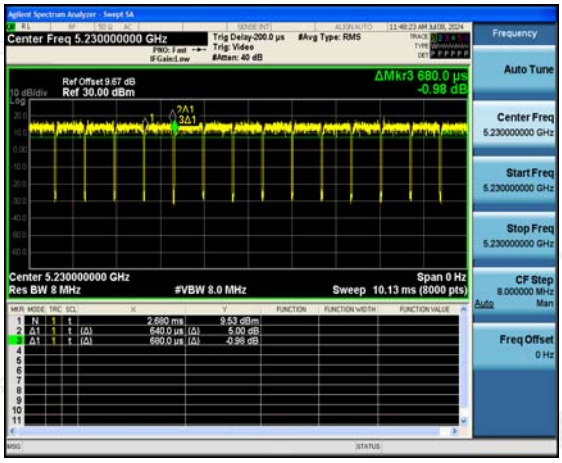

**802.11n(H40)**



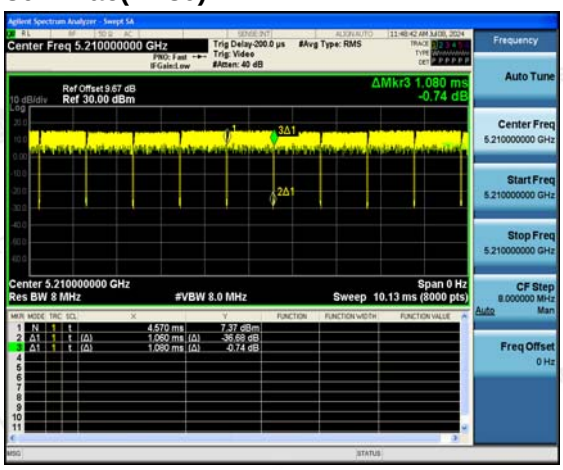

**802.11ac(HT20)**




**802.11ac(HT40)**



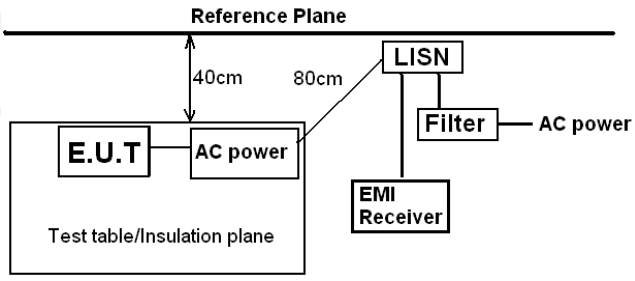

**802.11ac(HT80)**



# 4. TEST RESULTS AND MEASUREMENT DATA

## 4.1. CONDUCTED EMISSION

### 4.1.1. Test Specification

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.207</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Frequency Range:</td><td>150 kHz to 30 MHz</td></tr>
<tr><td>Receiver setup:</td><td>RBW=9 kHz, VBW=30 kHz, Sweep time=auto</td></tr>
<tr><td>Limits:</td><td>
<table>
<tr><td rowspan="2">Frequency range (MHz)</td><td colspan="2">Limit (dBuV)</td></tr>
<tr><td>Quasi-peak</td><td>Average</td></tr>
<tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr>
<tr><td>0.5-5</td><td>56</td><td>46</td></tr>
<tr><td>5-30</td><td>60</td><td>50</td></tr>
</table>
</td></tr>
<tr><td>Test Setup:</td><td> 

Remark:<br>E.U.T: Equipment Under Test<br>LISN: Line Impedence Stabilization Network<br>Test table height=0.8m</td></tr>
<tr><td>Test Mode:</td><td>Tx Mode</td></tr>
<tr><td>Test Procedure:</td><td>1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.<br>2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).<br>3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.</td></tr>
<tr><td>Test Result:</td><td>PASS</td></tr>
</table>

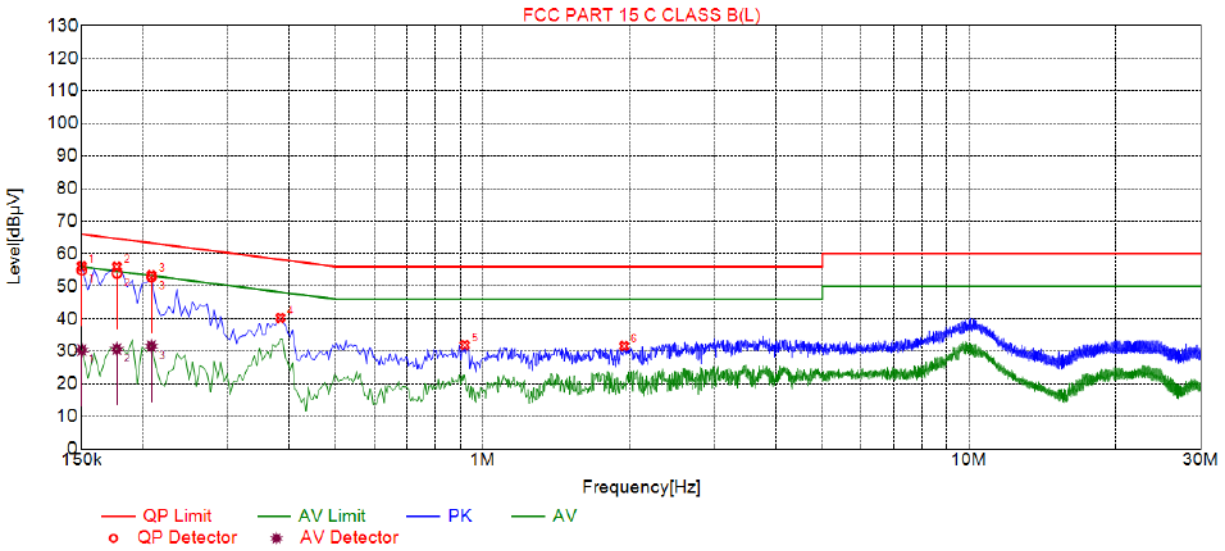
### 4.1.2. Test Instruments

| Conducted Emission Shielding Room Test Site (843) | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Date** | **Calibration Due** |
| Receiver | R&S | ESR | HKE-005 | Feb. 20, 2024 | Feb. 19, 2025 |
| LISN | R&S | ENV216 | HKE-002 | Feb. 20, 2024 | Feb. 19, 2025 |
| LISN | R&S | ENV216 | HKE-059 | Feb. 20, 2024 | Feb. 19, 2025 |
| Coax cable (9KHz-30MHz) | Times | 381806-002 | N/A | Feb. 20, 2024 | Feb. 19, 2025 |
| EMI Test Software | Tonscend | JS32-CE 2.5.0.6 | HKE-081 | N/A | N/A |
| 10dB Attenuator | Schwarzbeck | VTSD9561F | HKE-153 | Feb. 20, 2024 | Feb. 19, 2025 |

***Note:*** *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

**Test data**
**All modes have been tested, only the worst mode of 802.11a is reflected.**

Test Specification: Line




## Suspected List

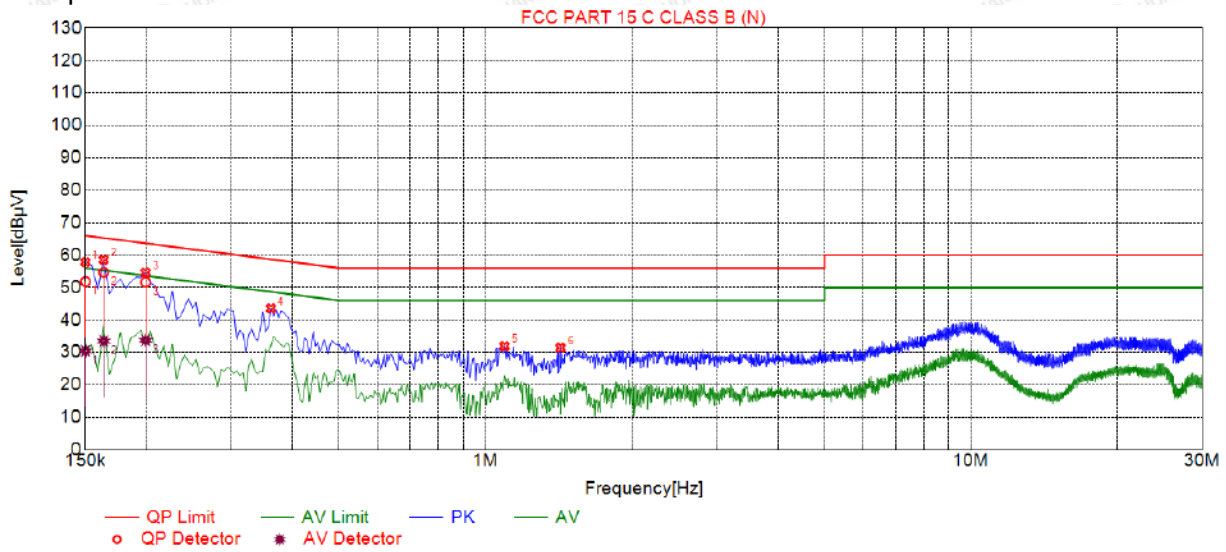
| NO. | Freq. [MHz] | Level [dBµV] | Factor [dB] | Limit [dBµV] | Margin [dB] | Reading [dBµV] | Detector | Type |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.1500 | 56.16 | 19.83 | 66.00 | 9.84 | 36.33 | PK | L |
| 2 | 0.1770 | 55.99 | 19.85 | 64.63 | 8.64 | 36.14 | PK | L |
| 3 | 0.2085 | 53.43 | 19.84 | 63.26 | 9.83 | 33.59 | PK | L |
| 4 | 0.3840 | 40.30 | 19.85 | 58.19 | 17.89 | 20.45 | PK | L |
| 5 | 0.9195 | 31.95 | 19.87 | 56.00 | 24.05 | 12.08 | PK | L |
| 6 | 1.9545 | 31.63 | 19.96 | 56.00 | 24.37 | 11.67 | PK | L |

## Final Data List

| NO. | Freq. [MHz] | Correction factor[dB] | QP Value [dBµV] | QP Limit [dBµV] | QP Margin [dB] | QP Reading [dBµV] | AV Value [dBµV] | AV Limit [dBµV] | AV Margin [dB] | AV Reading [dBµV] | Type |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.1500 | 19.83 | 54.95 | 66.00 | 11.05 | 35.12 | 30.39 | 56.00 | 25.61 | 10.56 | L |
| 2 | 0.1770 | 19.85 | 54.02 | 64.63 | 10.61 | 34.17 | 30.70 | 54.63 | 23.93 | 10.85 | L |
| 3 | 0.2085 | 19.84 | 52.92 | 63.26 | 10.34 | 33.08 | 31.58 | 53.26 | 21.68 | 11.74 | L |

Remark: Margin = Limit – Level
Correction factor = Cable lose + LISN insertion loss
Level=Test receiver reading + correction factor

Test Specification: Neutral




## Suspected List

| NO. | Freq. [MHz] | Level [dBµV] | Factor [dB] | Limit [dBµV] | Margin [dB] | Reading [dBµV] | Detector | Type |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.1500 | 57.82 | 19.73 | 66.00 | 8.18 | 38.09 | PK | N |
| 2 | 0.1635 | 58.55 | 19.68 | 65.28 | 6.73 | 38.87 | PK | N |
| 3 | 0.1995 | 54.61 | 19.73 | 63.63 | 9.02 | 34.88 | PK | N |
| 4 | 0.3615 | 43.57 | 19.73 | 58.69 | 15.12 | 23.84 | PK | N |
| 5 | 1.0950 | 31.90 | 19.75 | 56.00 | 24.10 | 12.15 | PK | N |
| 6 | 1.4280 | 31.44 | 19.79 | 56.00 | 24.56 | 11.65 | PK | N |

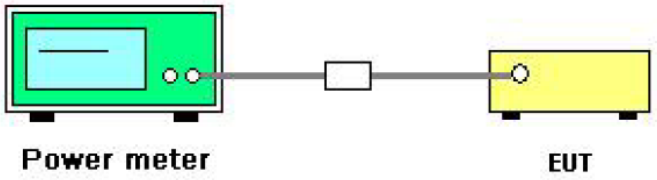
## Final Data List

| NO. | Freq. [MHz] | Correction factor[dB] | QP Value [dBµV] | QP Limit [dBµV] | QP Margin [dB] | QP Reading [dBµV] | AV Value [dBµV] | AV Limit [dBµV] | AV Margin [dB] | AV Reading [dBµV] | Type |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.1500 | 19.73 | 51.85 | 66.00 | 14.15 | 32.12 | 30.47 | 56.00 | 25.53 | 10.74 | N |
| 2 | 0.1635 | 19.68 | 54.72 | 65.28 | 10.56 | 35.04 | 33.53 | 55.28 | 21.75 | 13.85 | N |
| 3 | 0.1995 | 19.73 | 51.69 | 63.63 | 11.94 | 31.96 | 33.72 | 53.63 | 19.91 | 13.99 | N |

Remark: Margin = Limit – Level
Correction factor = Cable lose + LISN insertion loss
Level=Test receiver reading + correction factor

## 4.2. MAXIMUM CONDUCTED OUTPUT POWER

### 4.2.1. Test Specification

| | |
|---|---|
| **Test Requirement:** | FCC Part15 E Section 15.407(a) |
| **Test Method:** | KDB789033 D02 General UNII Test Procedures New Rules v02.r01 Section E |
| **Limit:** | Frequency Band (MHz) / Limit<br>5150-5250 / 250mW for client devices |
| **Test Setup:** |  |
| **Test Mode:** | Transmitting mode with modulation |
| **Test Procedure:** | 1. The testing follows the Measurement Procedure of KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section E, 3, a.<br>2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.<br>3. Set to the maximum power setting and enable the EUT transmit continuously.<br>4. Measure the conducted output power and record the results in the test report. |
| **Test Result:** | PASS |
| **Remark:** | Conducted output power= measurement power +10log(1/x) X is duty cycle=1, so 10log(1/1)=0<br>Conducted output power= measurement power |

### 4.2.2. Test Instruments

| RF Test Room | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Date** | **Calibration Due** |
| Spectrum analyzer | Agilent | N9020A | HKE-048 | Feb. 20, 2024 | Feb. 19, 2025 |
| Power meter | Agilent | E4419B | HKE-085 | Feb. 20, 2024 | Feb. 19, 2025 |
| Power Sensor | Agilent | E9300A | HKE-086 | Feb. 20, 2024 | Feb. 19, 2025 |
| RF cable | Times | 1-40G | HKE-034 | Feb. 20, 2024 | Feb. 19, 2025 |
| RF automatic control unit | Tonscend | JS0806-2 | HKE-060 | Feb. 20, 2024 | Feb. 19, 2025 |
| RF Test Software | Tonscend | JS1120-3 Version 3.3.23 | HKE-083 | N/A | N/A |

***Note:*** *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

**Test Data**

| Configuration Band I (5180 - 5240 MHz ) | | | | |
|---|---|---|---|---|
| Mode | Test channel | Maximum Conducted Output Power (dBm) | FCC Limit (dBm) | Result |
| 11a | CH36 | 9.89 | 24 | PASS |
| 11a | CH40 | 9.76 | 24 | PASS |
| 11a | CH48 | 9.55 | 24 | PASS |
| 11n(HT20) | CH36 | 9.09 | 24 | PASS |
| 11n(HT20) | CH40 | 10.29 | 24 | PASS |
| 11n(HT20) | CH48 | 9.72 | 24 | PASS |
| 11n(HT40) | CH38 | 10.35 | 24 | PASS |
| 11n(HT40) | CH46 | 10.22 | 24 | PASS |
| 11ac(HT20) | CH36 | 9.62 | 24 | PASS |
| 11ac(HT20) | CH40 | 10.14 | 24 | PASS |
| 11ac(HT20) | CH48 | 9.81 | 24 | PASS |
| 11ac(HT40) | CH38 | 10.29 | 24 | PASS |
| 11ac(HT40) | CH46 | 10.31 | 24 | PASS |
| 11ac(HT80) | CH42 | 10.60 | 24 | PASS |
| Note: 1.The test results including the cable lose. | | | | |

## 4.3. 6DB EMISSION BANDWIDTH

### 4.3.1. Test Specification

| | |
|---|---|
| **Test Requirement:** | FCC CFR47 Part 15 Section 15.407(e) |
| **Test Method:** | KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section C |
| **Limit:** | >500kHz |
| **Test Setup:** |  |
| **Test Mode:** | Transmitting mode with modulation |
| **Test Procedure:** | 1. KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section C.<br>2. Set to the maximum power setting and enable the EUT transmit continuously.<br>3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz.<br>4. Measure and record the results in the test report. |
| **Test Result:** | N/A |

### 4.3.2. Test Instruments

| RF Test Room | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Date** | **Calibration Due** |
| Spectrum analyzer | Agilent | N9020A | HKE-048 | Feb. 20, 2024 | Feb. 19, 2025 |
| RF cable | Times | 1-40G | HKE-034 | Feb. 20, 2024 | Feb. 19, 2025 |
| RF automatic control unit | Tonscend | JS0806-2 | HKE-060 | Feb. 20, 2024 | Feb. 19, 2025 |
| RF Test Software | Tonscend | JS1120-3 Version 3.3.23 | HKE-083 | N/A | N/A |

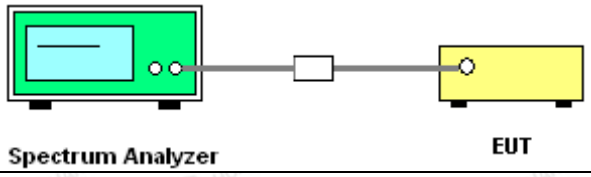
***Note:*** *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

### 4.3.3Test data

N/A

## 4.4. 26DB BANDWIDTH AND 99% OCCUPIED BANDWIDTH

### 4.4.1. Test Specification

| | |
|---|---|
| **Test Requirement:** | 47 CFR Part 15C Section 15.407 |
| **Test Method:** | KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section C |
| **Limit:** | No restriction limits |
| **Test Setup:** |  |
| **Test Mode:** | Transmitting mode with modulation |
| **Test Procedure:** | 1. KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section C.<br>2. Set to the maximum power setting and enable the EUT transmit continuously.<br>3. Make the measurement with the spectrum analyzer's resolution bandwidth RBW = 1% EBW, VBW≥3RBW, In order to make an accurate measurement.<br>4. Measure and record the results in the test report. |
| **Test Result:** | PASS |

### 4.4.2. Test Instruments

| RF Test Room | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Date** | **Calibration Due** |
| Spectrum analyzer | Agilent | N9020A | HKE-048 | Feb. 20, 2024 | Feb. 19, 2025 |
| RF cable | Times | 1-40G | HKE-034 | Feb. 20, 2024 | Feb. 19, 2025 |
| RF automatic control unit | Tonscend | JS0806-2 | HKE-060 | Feb. 20, 2024 | Feb. 19, 2025 |
| RF Test Software | Tonscend | JS1120-3 Version 3.3.23 | HKE-083 | N/A | N/A |

***Note:*** *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

## Test data

### Band I

| Mode | Test channel | Frequency (MHz) | 26 dB Bandwidth (MHz) | Verdict |
|---|---|---|---|---|
| 11a | CH36 | 5180 | 20.440 | PASS |
| 11a | CH40 | 5200 | 20.520 | PASS |
| 11a | CH48 | 5240 | 20.560 | PASS |
| 11n(HT20) | CH36 | 5180 | 20.840 | PASS |
| 11n(HT20) | CH40 | 5200 | 20.680 | PASS |
| 11n(HT20) | CH48 | 5240 | 20.720 | PASS |
| 11n(HT40) | CH38 | 5190 | 41.520 | PASS |
| 11n(HT40) | CH46 | 5230 | 41.760 | PASS |
| 11ac(HT20) | CH36 | 5180 | 20.760 | PASS |
| 11ac(HT20) | CH40 | 5200 | 20.640 | PASS |
| 11ac(HT20) | CH48 | 5240 | 21.000 | PASS |
| 11ac(HT40) | CH38 | 5190 | 41.680 | PASS |
| 11ac(HT40) | CH46 | 5230 | 41.600 | PASS |
| 11ac(HT80) | CH42 | 5210 | 81.280 | PASS |

**Test plots as follows:**

**Band I （5150 – 5250 MHz）**

| 802.11a |
| --- |
|  |
| Low |
|  |
| Mid |
|  |
| High |

| 802.11n(HT20) |
| --- |
|  |
| Low |
|  |
| Mid |
|  |
| High |

| 802.11n(HT40) |
|---|
|  |
| Low |
|  |
| High |
| 802.11ac(HT20) |
|  |
| Low |


Mid


High

802.11ac(HT40)

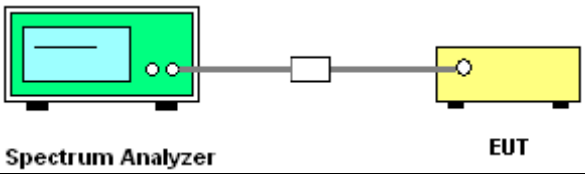

Low


High

802.11ac(HT80)

## 4.5. POWER SPECTRAL DENSITY

### 4.5.1. Test Specification

| | |
|---|---|
| **Test Requirement:** | FCC Part15 E Section 15.407 (a) |
| **Test Method:** | KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section F |
| **Limit:** | ≤11.00dBm/MHz for Band I 5150MHz-5250MHz |
| **Test Setup:** |  |
| **Test Mode:** | Transmitting mode with modulation |
| **Test Procedure:** | 1. Set the spectrum analyzer or EMI receiver span to view the entire emission bandwidth.<br>2. Set RBW = 1 MHz, VBW ≥ 3*RBW, Sweep time = Auto, Detector = RMS.<br>3. Allow the sweeps to continue until the trace stabilizes.<br>4. Use the peak marker function to determine the maximum amplitude level.<br>5. The E.I.R.P spectral density used radiated test method. At a test site that has been validated using the procedures of ANSI C63.4 or the latest CISPR 16-1-4 for measurements above 1 GHz, so as to simulate a near free-space environment. |
| **Test Result:** | PASS |

### 4.5.2. Test Instruments

| RF Test Room | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Date** | **Calibration Due** |
| Spectrum analyzer | Agilent | N9020A | HKE-048 | Feb. 20, 2024 | Feb. 19, 2025 |
| RF cable | Times | 1-40G | HKE-034 | Feb. 20, 2024 | Feb. 19, 2025 |
| RF automatic control unit | Tonscend | JS0806-2 | HKE-060 | Feb. 20, 2024 | Feb. 19, 2025 |
| RF Test Software | Tonscend | JS1120-3 Version 3.3.23 | HKE-083 | N/A | N/A |

***Note:*** *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

### 4.5.3. Test data

| Configuration Band I (5180 - 5240 MHz ) | | | | |
|---|---|---|---|---|
| Mode | Test channel | Level [dBm/MHz] | Limit (dBm/MHz) | Result |
| 11a | CH36 | 6.66 | 11 | PASS |
| 11a | CH40 | 7.07 | 11 | PASS |
| 11a | CH48 | 6.47 | 11 | PASS |
| 11n(HT20) | CH36 | 4.09 | 11 | PASS |
| 11n(HT20) | CH40 | 7.00 | 11 | PASS |
| 11n(HT20) | CH48 | 5.90 | 11 | PASS |
| 11n(HT40) | CH38 | 5.54 | 11 | PASS |
| 11n(HT40) | CH46 | 5.65 | 11 | PASS |
| 11ac(HT20) | CH36 | 6.29 | 11 | PASS |
| 11ac(HT20) | CH40 | 6.85 | 11 | PASS |
| 11ac(HT20) | CH48 | 5.97 | 11 | PASS |
| 11ac(HT40) | CH38 | 5.44 | 11 | PASS |
| 11ac(HT40) | CH46 | 5.28 | 11 | PASS |
| 11ac(HT80) | CH42 | 6.22 | 11 | PASS |
| Note: 1. Instrument attenuation and cable loss See test diagram | | | | |

**Band I （5150 – 5250 MHz）**

| 802.11a |
|---|
|  |
| Low |
|  |
| Mid |
|  |
| High |

802.11n(HT20)


Low


Mid


High

| 802.11n(HT40) |
| --- |
|  |
| Low |
|  |
| High |
| 802.11ac(HT20) |
|  |
| Low |


Mid


High

802.11ac(HT40)

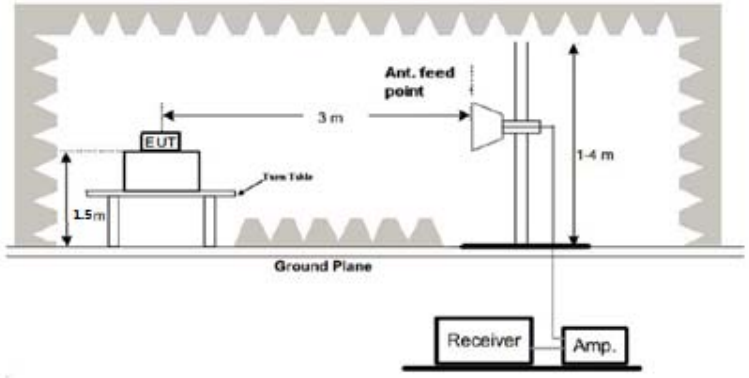

Low


High

802.11ac(HT80)

## 4.6. BAND EDGE

### 4.6.1. Test Specification

| | |
|---|---|
| **Test Requirement:** | FCC CFR47 Part 15E Section 15.407 |
| **Test Method:** | ANSI C63.10 2013 |
| **Limit:** | For band I&II&III: E[dBμV/m] = EIRP[dBm] + 95.2=68.2 dBμV/m, for EIRP(dBm)= **-27dBm**<br><br>For transmitters operating in the 5.725-5.85 GHz band:<br><br>All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.<br><br>For band IV(5715-5725MHz&5850-5860MHz): E[dBμV/m] = EIRP[dBm] + 95.2=78.2 dBμV/m, for EIRP(dBm)= **-27dBm**;<br><br>For band IV(other un-restricted band):E[dBμV/m] = EIRP[dBm] + 95.2=68.2 dBμV/m, for EIRP(dBm)= **-27dBm** |
| **Test Setup:** |  |
| **Test Mode:** | Transmitting mode with modulation |
| **Test Procedure:** | 1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.<br>2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.<br>3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. |

| | |
|---|---|
| **Test Procedure:** | 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.<br>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.<br>6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi peak or average method as specified and then reported in a data sheet. |
| **Test Result:** | PASS |

### 4.6.2. Test Instruments

| Radiated Emission Test Site (966) | | | | | |
|---|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Date** | **Calibration Due** |
| Spectrum analyzer | Agilent | N9020A | HKE-048 | Feb. 20, 2024 | Feb. 19, 2025 |
| Spectrum analyzer | R&S | FSV3044 | HKE-126 | Feb. 20, 2024 | Feb. 19, 2025 |
| Preamplifier | EMCI | EMC051845S | HKE-006 | Feb. 20, 2024 | Feb. 19, 2025 |
| Preamplifier | Schwarzbeck | BBV 9743 | HKE-016 | Feb. 20, 2024 | Feb. 19, 2025 |
| Preamplifier | A.H. Systems | SAS-574 | HKE-182 | Feb. 21, 2024 | Feb. 20, 2026 |
| 6d Attenuator | Pasternack | 6db | HKE-184 | Feb. 21, 2024 | Feb. 20, 2026 |
| EMI Test Receiver | Rohde & Schwarz | ESR-7 | HKE-010 | Feb. 21, 2024 | Feb. 20, 2026 |
| Broadband Antenna | Schwarzbeck | VULB9168 | HKE-167 | Feb. 21, 2024 | Feb. 20, 2026 |
| Loop Antenna | COM-POWER | AL-130R | HKE-014 | Feb. 20, 2024 | Feb. 19, 2025 |
| Horn Antenna | Schewarzbeck | 9120D | HKE-013 | Feb. 21, 2024 | Feb. 20, 2026 |
| EMI Test Software | Tonscend | JS32-RE 5.0.0 | HKE-082 | N/A | N/A |
| RSE Test Software | Tonscend | JS36-RSE | HKE-184 | N/A | N/A |

***Note:*** *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

### 4.6.3. Test Data

Radiated Band Edge Test:

Operation Mode: 802.11a Mode with 5.2G TX CH Low

Horizontal

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 5150 | 52.69 | -2.49 | 50.2 | 74 | -23.8 | peak |
| 5150 | / | -2.49 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Vertical:

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 5150 | 54.21 | -2.49 | 51.72 | 74 | -22.28 | peak |
| 5150 | / | -2.49 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Operation Mode: TX CH High with 5.2G

Horizontal

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 5350 | 55.02 | -2.11 | 52.91 | 74 | -21.09 | peak |
| 5350 | / | -2.11 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Vertical:

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 5350 | 54.95 | -2.11 | 52.84 | 74 | -21.16 | peak |
| 5350 | / | -2.11 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Operation Mode: 802.11n20 Mode with 5.2G TX CH Low

Horizontal

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 5150 | 53.77 | -2.49 | 51.28 | 74 | -22.72 | peak |
| 5150 | / | -2.49 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Vertical:

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 5150 | 53.06 | -2.49 | 50.57 | 74 | -23.43 | peak |
| 5150 | / | -2.49 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Operation Mode: TX CH High with 5.2G

Horizontal

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 5350 | 54.16 | -2.11 | 52.05 | 74 | -21.95 | peak |
| 5350 | / | -2.11 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Vertical:

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 5350 | 54.28 | -2.11 | 52.17 | 74 | -21.83 | peak |
| 5350 | / | -2.11 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Operation Mode: 802.11 n40 Mode with 5.2G TX CH Low

Horizontal

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 5150 | 53.66 | -2.49 | 51.17 | 74 | -22.83 | peak |
| 5150 | / | -2.49 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Vertical:

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 5150 | 53.16 | -2.49 | 50.67 | 74 | -23.33 | peak |
| 5150 | / | -2.49 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Operation Mode: TX CH High with 5.2G

Horizontal

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 5350 | 54.77 | -2.11 | 52.66 | 74 | -21.34 | peak |
| 5350 | / | -2.11 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

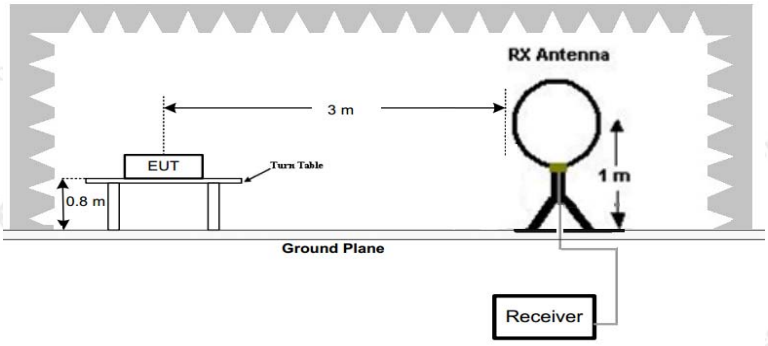
Vertical:

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 5350 | 55.02 | -2.11 | 52.91 | 74 | -21.09 | peak |
| 5350 | / | -2.11 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

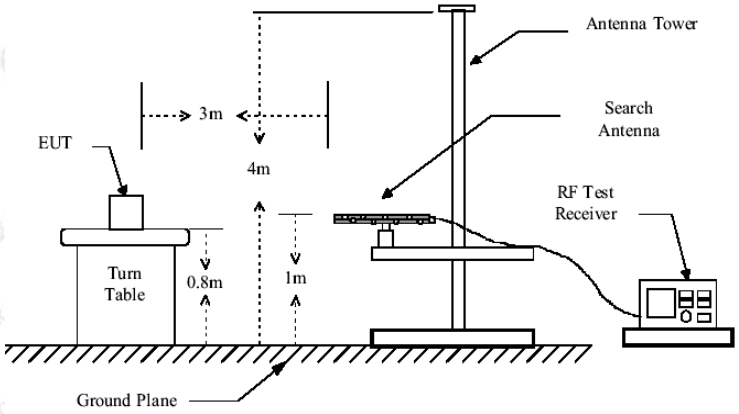
Remark:
1. If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.
2. In restricted bands of operation, the spurious emissions below the permissible value more than 20dB.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

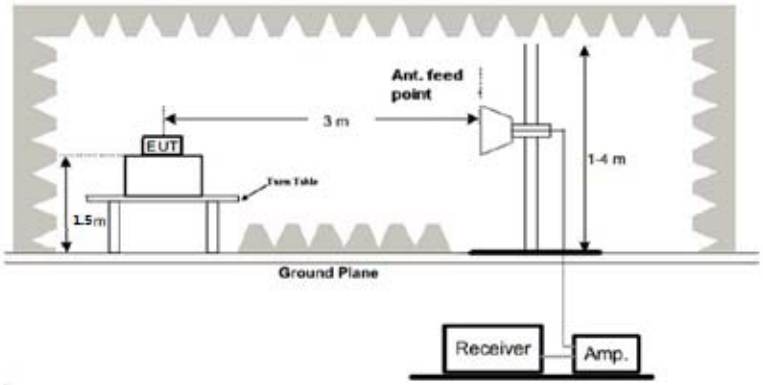
## 4.7. SPURIOUS EMISSION

### 4.7.1.1. Test Specification

<table>
<tr><td>Test Requirement:</td><td>FCC CFR47 Part 15 Section 15.407</td></tr>
<tr><td>Test Method:</td><td>KDB 789033 D02 v02r01</td></tr>
<tr><td>Frequency Range:</td><td>9kHz to 40GHz</td></tr>
<tr><td>Measurement Distance:</td><td>3 m</td></tr>
<tr><td>Antenna Polarization:</td><td>Horizontal & Vertical</td></tr>
<tr><td>Operation mode:</td><td>Transmitting mode with modulation</td></tr>
<tr><td>Receiver Setup:</td><td>
<table>
<tr><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Remark</td></tr>
<tr><td>9kHz- 150kHz</td><td>Quasi-peak</td><td>200Hz</td><td>1kHz</td><td>Quasi-peak Value</td></tr>
<tr><td>150kHz-30MHz</td><td>Quasi-peak</td><td>9kHz</td><td>30kHz</td><td>Quasi-peak Value</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>120KHz</td><td>300KHz</td><td>Quasi-peak Value</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak Value</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average Value</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.<br>(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.<br>The limit of frequency below 1GHz and which fall in rest ricted bands should complies 15.209.</td></tr>
<tr><td>Test setup:</td><td>For radiated emissions below 30MHz<br> 

<br>30MHz to 1GHz</td></tr>
</table>

<table>
<tr>
<td></td>
<td>


<br>Above 1GHz<br>


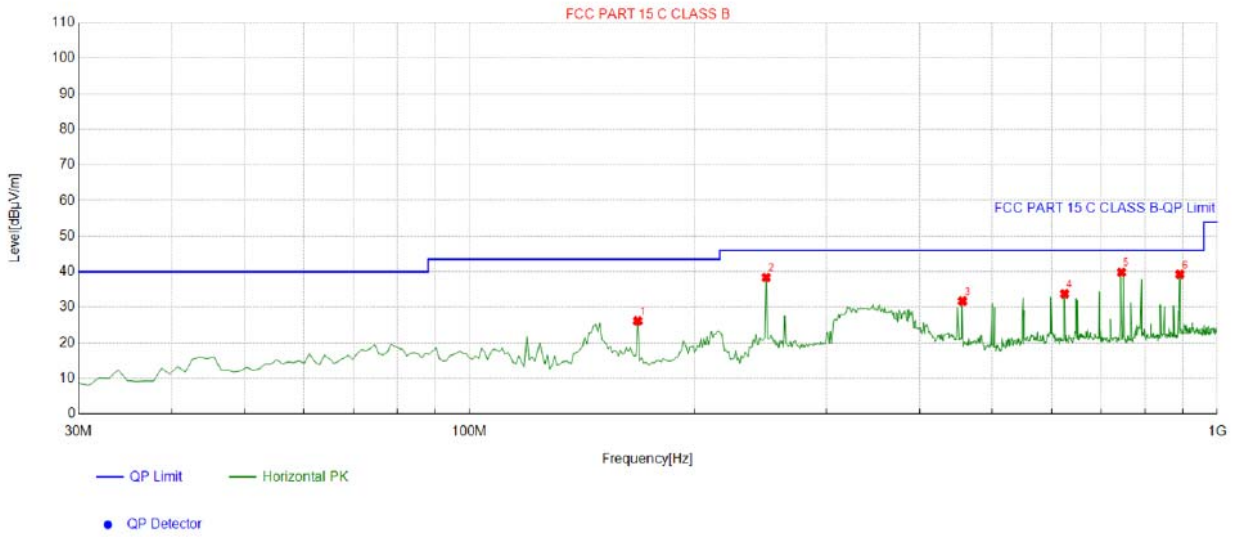
</td>
</tr>
<tr>
<td>Test Procedure:</td>
<td>1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.<br>2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.<br>3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.<br>4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable was turned from 0 degrees to 360 degrees to find the maximum reading.<br>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</td>
</tr>
</table>

| | |
|---|---|
| **Test Procedure:** | 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would bere-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. |
| **Test results:** | PASS |

## 4.7.2. Test Data

**All the test modes completed for test. only the worst result of 802.11a**
**Below 1GHz**

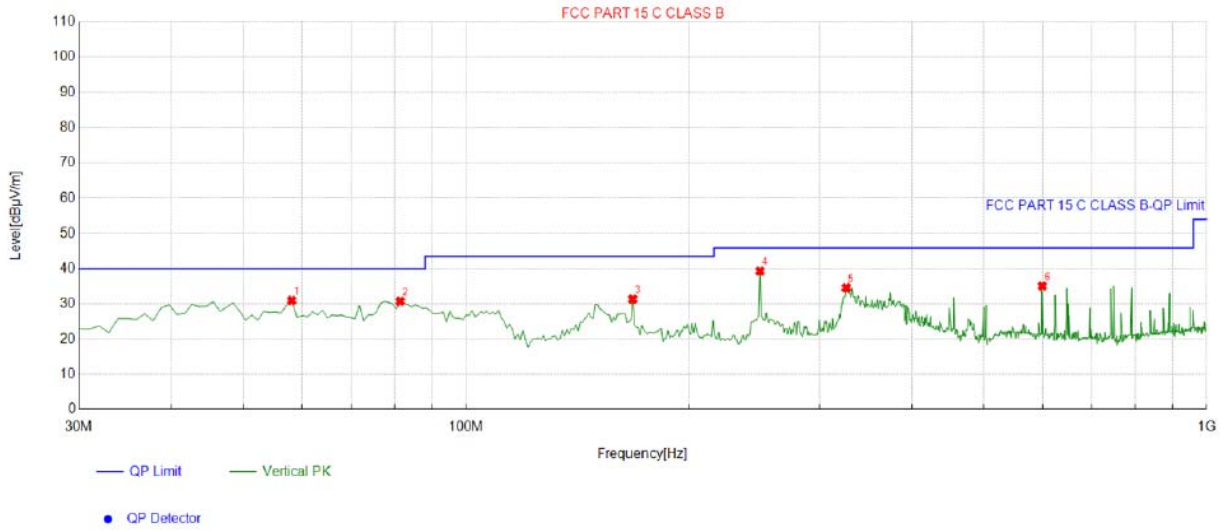
**Horizontal**




| Suspected List | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| NO. | Freq. [MHz] | Factor [dB] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity |
| 1 | 167.87787 | -17.31 | 43.48 | 26.17 | 43.50 | 17.33 | 100 | 259 | Horizontal |
| 2 | 249.43943 | -13.41 | 51.80 | 38.39 | 46.00 | 7.61 | 100 | 58 | Horizontal |
| 3 | 456.25625 | -8.87 | 40.61 | 31.74 | 46.00 | 14.26 | 100 | 225 | Horizontal |
| 4 | 625.20520 | -5.45 | 39.22 | 33.77 | 46.00 | 12.23 | 100 | 66 | Horizontal |
| 5 | 744.63463 | -3.42 | 43.25 | 39.83 | 46.00 | 6.17 | 100 | 186 | Horizontal |
| 6 | 891.25125 | -1.49 | 40.77 | 39.28 | 46.00 | 6.72 | 100 | 36 | Horizontal |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

**Vertical**




| Suspected List | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| NO. | Freq. [MHz] | Factor [dB] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity |
| 1 | 58.158158 | -14.00 | 45.02 | 31.02 | 40.00 | 8.98 | 100 | 187 | Vertical |
| 2 | 81.461461 | -18.34 | 49.14 | 30.80 | 40.00 | 9.20 | 100 | 20 | Vertical |
| 3 | 167.87787 | -17.31 | 48.71 | 31.40 | 43.50 | 12.10 | 100 | 6 | Vertical |
| 4 | 249.43943 | -13.41 | 52.78 | 39.37 | 46.00 | 6.63 | 100 | 106 | Vertical |
| 5 | 326.14614 | -10.98 | 45.62 | 34.64 | 46.00 | 11.36 | 100 | 326 | Vertical |
| 6 | 599.95996 | -5.33 | 40.46 | 35.13 | 46.00 | 10.87 | 100 | 335 | Vertical |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

**Above 1GHz**

LOW CH 36 (802.11 a Mode with 5.2G)/5180

Horizontal:

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 3647 | 49.74 | -4.59 | 45.15 | 74 | -28.85 | peak |
| 3647 | 42.33 | -4.59 | 37.74 | 54 | -16.26 | AVG |
| 10360 | 49.08 | 3.74 | 52.82 | 74 | -21.18 | peak |
| 10360 | 35.55 | 3.74 | 39.29 | 54 | -14.71 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Vertical:

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 3647 | 49.74 | -4.59 | 45.15 | 74 | -28.85 | peak |
| 3647 | 42.33 | -4.59 | 37.74 | 54 | -16.26 | AVG |
| 10360 | 49.08 | 3.74 | 52.82 | 74 | -21.18 | peak |
| 10360 | 35.55 | 3.74 | 39.29 | 54 | -14.71 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

MID CH40 (802.11 a Mode with 5.2G)/5200

Horizontal:

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 3647 | 49.82 | -4.59 | 45.23 | 74 | -28.77 | peak |
| 3647 | 41.45 | -4.59 | 36.86 | 54 | -17.14 | AVG |
| 10400 | 49.81 | 3.74 | 53.55 | 74 | -20.45 | peak |
| 10400 | 37.59 | 3.74 | 41.33 | 54 | -12.67 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Vertical:

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 3647 | 49.82 | -4.59 | 45.23 | 74 | -28.77 | peak |
| 3647 | 41.45 | -4.59 | 36.86 | 54 | -17.14 | AVG |
| 10400 | 49.81 | 3.74 | 53.55 | 74 | -20.45 | peak |
| 10400 | 37.59 | 3.74 | 41.33 | 54 | -12.67 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

HIGH CH 48 (802.11a Mode with 5.2G)/5240

Horizontal:

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 3647 | 49.46 | -4.59 | 44.87 | 74 | -29.13 | peak |
| 3647 | 43.17 | -4.59 | 38.58 | 54 | -15.42 | AVG |
| 10480 | 50 | 3.75 | 53.75 | 74 | -20.25 | peak |
| 10480 | 38.29 | 3.75 | 42.04 | 54 | -11.96 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

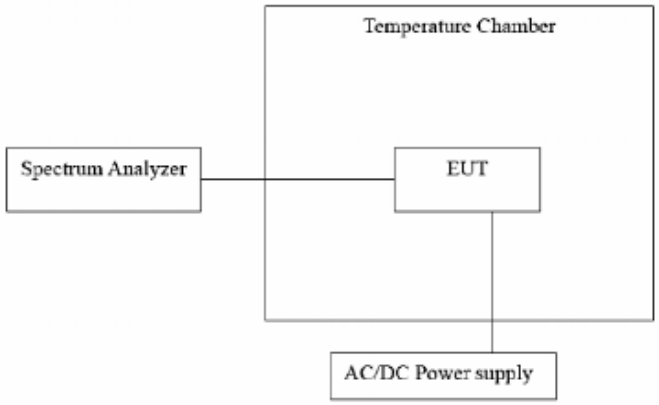
Vertical:

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 3647 | 50.51 | -4.59 | 45.92 | 74 | -28.08 | peak |
| 3647 | 41.68 | -4.59 | 37.09 | 54 | -16.91 | AVG |
| 10480 | 49.93 | 3.75 | 53.68 | 74 | -20.32 | peak |
| 10480 | 36.15 | 3.75 | 39.9 | 54 | -14.1 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Remark：
(1) Measuring frequencies from 1 GHz to the 40 GHz.
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency; “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) The emissions are attenuated more than 20dB below the permissible limits are not recorded in the report.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.
(7) All the test modes completed for test. only the worst result of Mode 1(802.11a Mode )

## 4.8. FREQUENCY STABILITY MEASUREMENT

### 4.8.1. Test Specification

| | |
|---|---|
| **Test Requirement:** | FCC Part15 Section 15.407(g) |
| **Test Method:** | ANSI C63.10: 2013 |
| **Limit:** | The frequency tolerance shall be maintained within the band of operation frequency over a temperature variation of 0 degrees to 35 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. |
| **Test Setup:** |  |
| **Test Procedure:** | The EUT was placed inside the environmental test chamber and powered by nominal AC/DC voltage. b. Turn the EUT on and couple its output to a spectrum analyzer. c. Turn the EUT off and set the chamber to the highest temperature specified. d. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. e. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature. f. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record. |
| **Test Result:** | PASS |
| **Remark:** | N/A |

### 4.8.2. Test Instruments

| RF Test Room | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Date** | **Calibration Due** |
| RF Automatic control unit | Tonscend | JS 0806-2 | HKE-060 | Feb. 20, 2024 | Feb. 19, 2025 |
| Spectrum analyzer | Agilent | N9020A | HKE-048 | Feb. 20, 2024 | Feb. 19, 2025 |
| Temperature and humidity meter | Boyang | HTC-1 | HKE-077 | Feb. 20, 2024 | Feb. 19, 2025 |
| programmable power supply | Agilent | E3646A | HKE-092 | Feb. 20, 2024 | Feb. 19, 2025 |
| RF Test Software | Tonscend | JS1120-3 Version 3.3.23 | HKE-083 | N/A | N/A |

***Note:*** *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

**Test Result as follows:**

| Mode | Voltage (V) | FHL (5180MHz) | Deviation (KHz) | FHH (5240MHz) | Deviation (KHz) |
|---|---|---|---|---|---|
| 5.2G Band | 108V | 5180.027 | 27 | 5240.008 | 8 |
| | 120V | 5180.045 | 45 | 5240.020 | 20 |
| | 132V | 5179.980 | -20 | 5240.004 | 4 |

| Mode | Temperature (℃) | FHL (5180MHz) | Deviation (KHz) | FHH (5240MHz) | Deviation (KHz) |
|---|---|---|---|---|---|
| 5.2G Band | -30 | 5180.044 | 44 | 5239.997 | -3 |
| | -20 | 5180.035 | 35 | 5239.986 | -14 |
| | -10 | 5180.038 | 38 | 5239.993 | -7 |
| | 0 | 5180.040 | 40 | 5240.009 | 9 |
| | 10 | 5179.994 | -6 | 5240.019 | 19 |
| | 20 | 5179.992 | -8 | 5239.994 | -6 |
| | 30 | 5180.039 | 39 | 5239.963 | -37 |
| | 40 | 5180.002 | 2 | 5239.980 | -20 |
| | 50 | 5180.007 | 7 | 5240.028 | 28 |

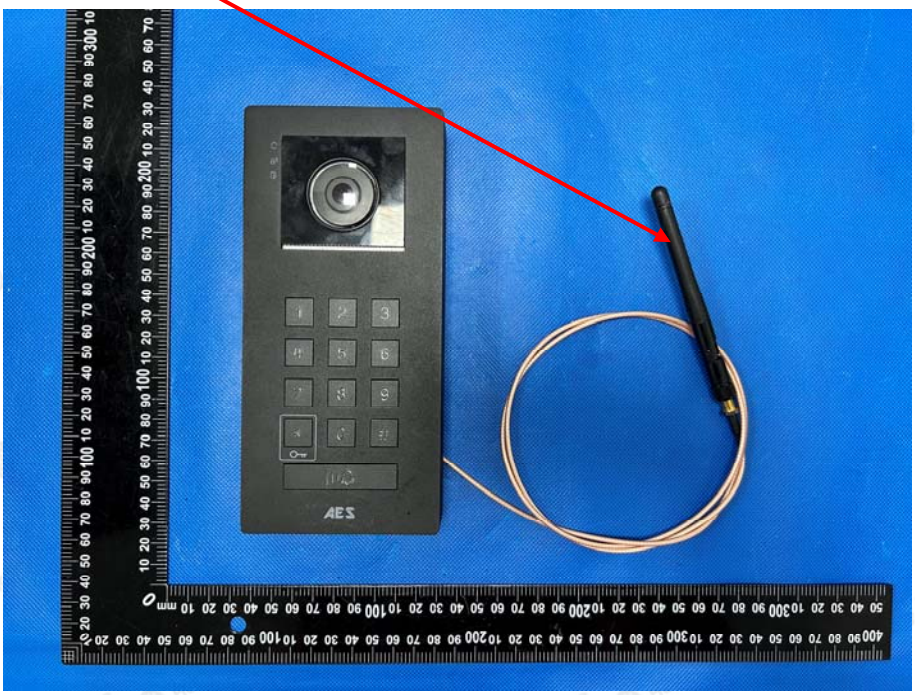
## 4.9. ANTENNA REQUIREMENT

**Standard Applicable**
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.

**Refer to statement below for compliance.**
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

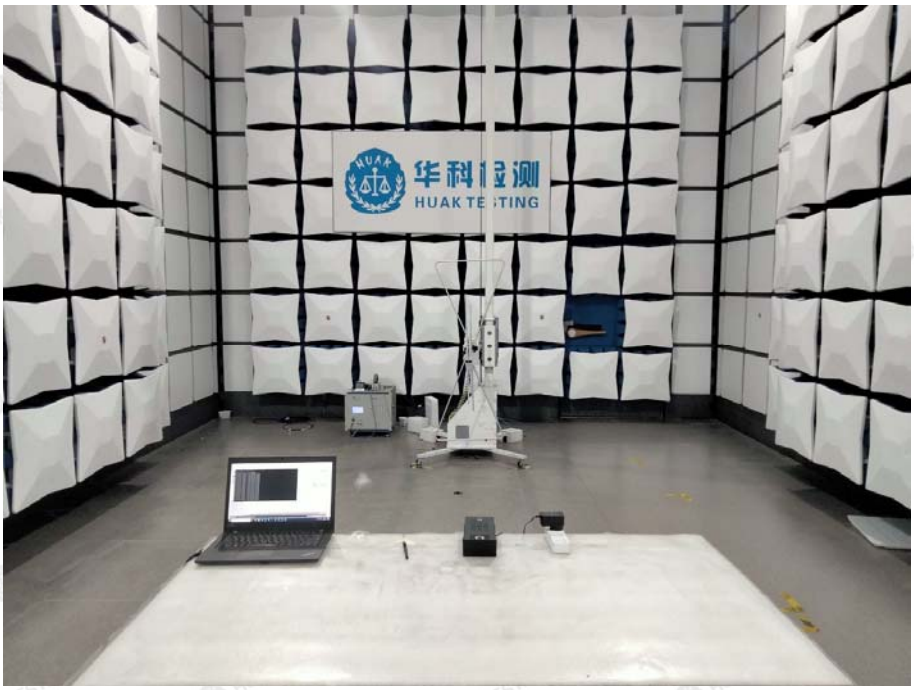
**Antenna Connected Construction**
The antenna used in this product is a External Antenna. It conforms to the standard requirements. The directional gains of antenna used for transmitting is 3.7dBi.

WIFI ANTENNA



# 5. PHOTOGRAPHS OF TEST SETUP

Radiated Emissions




Conducted Emission



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Add: 1-2F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

# 6. PHOTOS OF THE EUT

Reference to the report: ANNEX A of external photos and ANNEX B of internal photos.

---------End of test report---------



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