



**诺检标准**  
NTT STANDARD

# TEST REPORT

## FCC ID: 2BEGI-CC100

Product : Chessnut Companion  
Model Name : CC100  
Brand : Chessnut  
Report No. : SZNTT26017439E1-2

Prepared for

**Shenzhen WISO Technology Co.,Ltd**

**Rm 815, Bld 10, SZ Bay Sci and Tech Ecological Park, No. 10, Gaoxin S.  
9th Rd, Nanshan, Shenzhen, China**

Prepared by

**Shenzhen NTT Testing Technology Co., Ltd.**

**1B, Building 2, Factory Building & 103, Building 3, Factory Building, Dayang  
Industrial Park No.4, Industrial Avenue, Tangwei Community, Fuhai Sub-  
district, Bao 'an District, Shenzhen City, China**

**TEL: 0755-27889935**



## 1 TEST RESULT CERTIFICATION

Applicant's name : Shenzhen WISO Technology Co.,Ltd  
Address : Rm 815, Bld 10, SZ Bay Sci and Tech Ecological Park, No. 10, Gaoxin  
S. 9th Rd, Nanshan, Shenzhen, China  
Manufacture's name : Shenzhen Yilanyi Communication Technology Co., Ltd  
Address : Room A601, Comprehensive Building, Suojia Science and Technology  
Park, Sanwei Community, Hangcheng Subdistrict, Bao'an District,  
Shenzhen.  
Product name : Chessnut Companion  
Model name : CC100  
Additional model : CC101,CC102,CC103,CC104  
Standards : FCC CFR Title 47 Part 15 Subpart C Section 15.407  
ANSI C63.10-2020+Cor 1+2023  
KDB 789033 D02 v02r01  
Test procedure : ANSI C63.10-2020+Cor 1+2023  
Test Date : Apr. 22, 2026 to May. 21, 2026  
Date of Issue : May. 21, 2026  
Test Result : Pass

This device described above has been tested by NTT, 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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Prepared by(Test Engineer):

Zhao Di

Zhao Di

Reviewer(Supervisor):

Ken Wu

Ken Wu

Approved(Manager):

Abel Yu





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## 2 Test Summary

| FCC Part15 (15.407) , Subpart E |                                  |          |        |
|---------------------------------|----------------------------------|----------|--------|
| Standard Section                | Test Item                        | Judgment | Remark |
| 15.407(b), 15.209               | Radiated Spurious Emission       | PASS     |        |
| 15.207                          | AC Power Line conducted emission | PASS     |        |
| 15.407 (a)<br>15.407 (e)        | 99% , 6dB and 26dB Bandwidth     | PASS     |        |
| 15.407 (a)                      | Maximum Conducted Output Power   | PASS     |        |
| 15.407(b)                       | Band Edge                        | PASS     |        |
| 15.407 (a)                      | Power Spectral Density           | PASS     |        |
| 15.407(g)                       | Frequency Stability              | PASS     |        |
| 15.203                          | Antenna Requirement              | PASS     |        |

Remark:

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



### 3 TEST FACILITY

#### Site Description

Designation Number: CN3446

EMC Lab. : Test Firm Registration Number: 129414  
Accredited by ANAB, Dec. 19, 2025  
The Certificate Registration Number is AT-3446

Name of Firm : Shenzhen NTT Testing Technology Co., Ltd.

Site Location : 1B, Building 2, Factory Building & 103, Building 3, Factory Building, Dayang Industrial Park No.4, Industrial Avenue, Tangwei Community, Fuhai Sub-district, Bao'an District, Shenzhen City, China



## 4 General Information

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

|                      |                                                                                                                                                                                                        |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product Name:        | Chessnut Companion                                                                                                                                                                                     |
| Model No.:           | CC100                                                                                                                                                                                                  |
| Sample ID:           | SZNTT26047440E1-001#                                                                                                                                                                                   |
| Sample(s) Status:    | Engineer sample                                                                                                                                                                                        |
| series model:        | CC101,CC102,CC103,CC104                                                                                                                                                                                |
| Model Different.:    | Only the model name and color are different.                                                                                                                                                           |
| Operation Frequency: | UNII-1:<br>5.18GHz-5.24GHz                                                                                                                                                                             |
| Number of Channel:   | Please see next page..                                                                                                                                                                                 |
| Modulation type:     | 802.11a: (64-QAM, 16-QAM, QPSK, BPSK) OFDM<br>802.11n: (64-QAM, 16-QAM, QPSK, BPSK) OFDM<br>802.11ac: (256-QAM, 64-QAM, 16-QAM, QPSK, BPSK) OFDM                                                       |
| Antenna Type:        | FPC Antenna                                                                                                                                                                                            |
| Antenna gain:        | WIFI 5.1G:2.38dBi                                                                                                                                                                                      |
| Power supply:        | DC 3.7V from Battery; Charging input:DC 5V                                                                                                                                                             |
| Hardware Version:    | A733-H60-V3.0                                                                                                                                                                                          |
| Software Version:    | N/A                                                                                                                                                                                                    |
| 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. |



| 802.11a/n/ac( 20MHz) Frequency Channel |                 |         |                 |         |                 |         |                 |
|----------------------------------------|-----------------|---------|-----------------|---------|-----------------|---------|-----------------|
| Channel                                | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 36                                     | 5180            | 40      | 5200            | 44      | 5220            | 48      | 5240            |

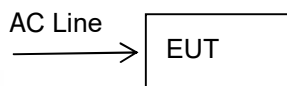
| 802.11/n/ac(40MHz) Frequency Channel |                 |         |                 |         |                 |         |                 |
|--------------------------------------|-----------------|---------|-----------------|---------|-----------------|---------|-----------------|
| Channel                              | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 38                                   | 5190            | 46      | 5230            | -       | -               | -       | -               |

| 802.11/n/ac(80MHz) Frequency Channel |                 |         |                 |         |                 |
|--------------------------------------|-----------------|---------|-----------------|---------|-----------------|
| Channel                              | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 42                                   | 5210            | -       | -               | -       | -               |

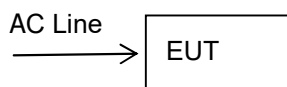


## 4.2 Test Setup Configuration

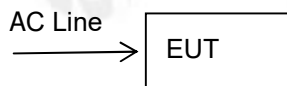
Conducted Emission



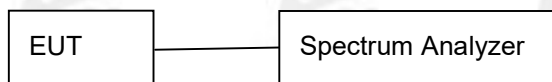
Radiated Emission(30MHz-1GHz)



Radiated Emission(above 1GHz)



RF Conducted Test



## 4.3 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 | 6         |



## 5 Equipment During Test

### 5.1 Equipments List

#### Conducted emission Test Equipment

| Name              | Model No.     | Serial No. | Manufacturer | Date of Cal. | Due Date  |
|-------------------|---------------|------------|--------------|--------------|-----------|
| 944 Shielded Room | HSRCE944      | /          | HTEC         | 2025/4/30    | 2028/4/29 |
| EMI Test Receiver | ESCI          | /          | RS           | 2025/9/8     | 2026/9/7  |
| LISN              | NNLK 8129     | 00603      | Schwarzbeck  | 2025/9/8     | 2026/9/7  |
| LISN              | NNHV 8123-400 | 00694      | Schwarzbeck  | 2025/9/8     | 2026/9/7  |
| LISN              | NNHV 8123-400 | 00680      | Schwarzbeck  | 2025/9/8     | 2026/9/7  |
| Cable             | RG223-1500MM  | NA         | RG           | 2025/9/8     | 2026/9/7  |

#### Radiated emission & Radio Frequency Test Equipment

| Name                                                | Model No.   | Serial No. | Manufacturer    | Date of Cal. | Due Date  |
|-----------------------------------------------------|-------------|------------|-----------------|--------------|-----------|
| 966 Shielded Room                                   | 966 Room    | /          | EMToni          | 2025/7/24    | 2028/7/23 |
| EMI Test Receiver                                   | ESCI        | 101018     | RS              | 2025/9/8     | 2026/9/7  |
| Amplifier<br>(30MHz-1GHz)                           | BBV 9718D   | 00042      | SCHWARZBECK     | 2025/9/8     | 2026/9/7  |
| Bilog Antenna<br>(30MHz-1GHz)                       | VULB9168    | 1858       | SCHWARZBECK     | 2025/9/9     | 2026/9/8  |
| Horn antenna<br>(1GHz-18GHz)                        | BBHA 9120 D | 02622      | SCHWARZBECK     | 2025/9/9     | 2026/9/8  |
| Preamplifier (1GHz-18GHz)                           | BBV 9718D   | 0024       | SCHWARZBECK     | 2025/9/8     | 2026/9/7  |
| Spectrum Analyzer<br>(10Hz-40GHz)                   | FSV 40      | 100952     | Rohde & Schwarz | 2025/9/8     | 2026/9/7  |
| Preamplifier<br>(18GHz-40GHz)                       | BBV 9721    | 0056       | SCHWARZBECK     | 2025/9/8     | 2026/9/7  |
| Double Ridge Guide<br>Horn Antenna<br>(18GHz-40GHz) | SAS-574     | 588        | A.H.System      | 2025/9/8     | 2026/9/7  |



|                                |                   |            |             |            |            |
|--------------------------------|-------------------|------------|-------------|------------|------------|
| Loop Antenna<br>(9KHz-30MHz)   | FMZB1519B         | 014        | SCHWARZBECK | 2025/9/8   | 2026/9/7   |
| Amplifier<br>(9KHz-30MHz)      | CVP 9222 C        | 00109      | SCHWARZBECK | 2025/9/8   | 2026/9/7   |
| MXG Signal Analyzer            | N9020A            | MY50510202 | Agilent     | 2025/9/8   | 2026/9/7   |
| MXG Vector Signal<br>Generator | N5182A            | MY50140020 | Agilent     | 2025/9/8   | 2026/9/7   |
| MXG Analog Signal<br>Generator | N5181A            | MY47420919 | Agilent     | 2025/9/8   | 2026/9/7   |
| Power Sensor                   | TR1029-2          | 512364     | Techoy      | 2025/9/8   | 2026/9/7   |
| RF Swith                       | TR1029-1          | 512364     | Techoy      | 2025/9/8   | 2026/9/7   |
| Cable                          | DA800-<br>4000MM  | NA         | DA          | 2025/9/8   | 2026/9/7   |
| Cable                          | DA800-<br>11000MM | NA         | DA          | 2025/9/8   | 2026/9/7   |
| Oven                           | GX-3020-<br>M150  | NA         | GAOXIN      | 2026/03/10 | 2027/03/09 |

Other

| Item | Name                         | Manufacturer | Model  | Software version   |
|------|------------------------------|--------------|--------|--------------------|
| 1    | EMC Conduction Test System   | FALA         | EZ-EMC | Ver.EMC-CON 3A1.1+ |
| 2    | EMC radiation test system    | FALA         | EZ-EMC | Ver.FA-03A2 RE+    |
| 3    | RF test system               | TACHOY       | RFTest | V1.0.0             |
| 4    | RF communication test system | TACHOY       | RFTest | V1.0.0             |



## 5.2 Measurement Uncertainty

| Parameter                                                                                                                                                                                                                                                 | Uncertainty              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| RF output power, conducted                                                                                                                                                                                                                                | ±1.0dB                   |
| Power Spectral Density, conducted                                                                                                                                                                                                                         | ±2.2dB                   |
| Radio Frequency                                                                                                                                                                                                                                           | ± 1 x 10 <sup>-6</sup>   |
| Bandwidth                                                                                                                                                                                                                                                 | ± 1.5 x 10 <sup>-6</sup> |
| 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)                                                                                                                                                                                                                            | ±5.06dB                  |
| Remark:When making a conformity declaration based on test results for regulations/standards or specifications,the default is to use Clause 4.2.1of ILAC-G8:09/2019 and the guidelines on decision rules and conformity declaration in IEC Guide 115:2023. |                          |

## 5.3 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  | Chessnut Companion | Chessnut  | CC100          | N/A        | EUT  |
|      |                    |           |                |            |      |

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.



## 6 Conducted Emission

Test Requirement: : FCC CFR 47 Part 15 Section 15.207  
Test Method: : ANSI C63.10-2020+Cor 1+2023  
Test Result: : PASS  
Frequency Range: : 150kHz to 30MHz  
Class/Severity: : Class B  
Detector: : Peak for pre-scan (9kHz Resolution Bandwidth)

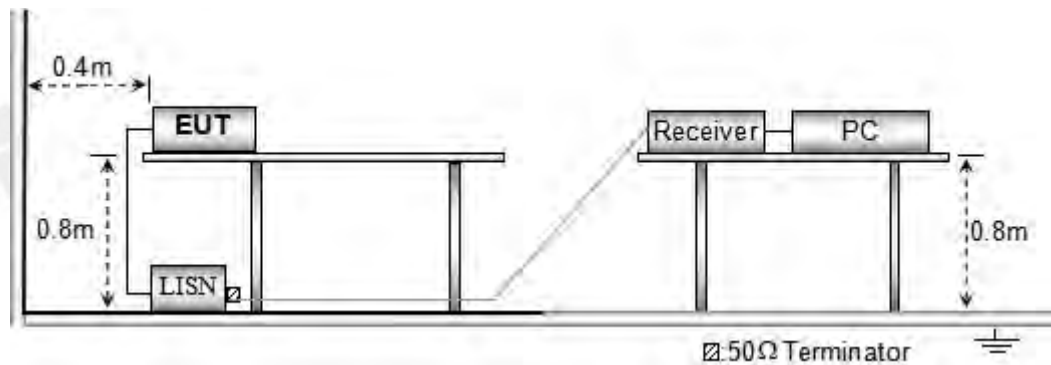
### 6.1 E.U.T. Operation

Operating Environment :

Temperature: : 26°C  
Humidity: : 54 % RH  
Atmospheric Pressure: : 101.12 kPa  
Test Voltage : AC 120V/60Hz

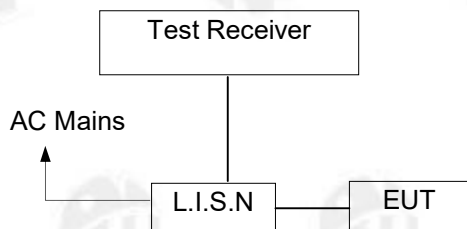
### 6.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10-2020+Cor 1+2023.





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



### 6.4 Measurement Procedure:

1. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
2. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
3. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
4. LISN at least 80 cm from nearest part of EUT chassis.
5. For the actual test configuration, please refer to the related Item - EUT Test Photos.

### 6.5 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.



## 6.6 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.

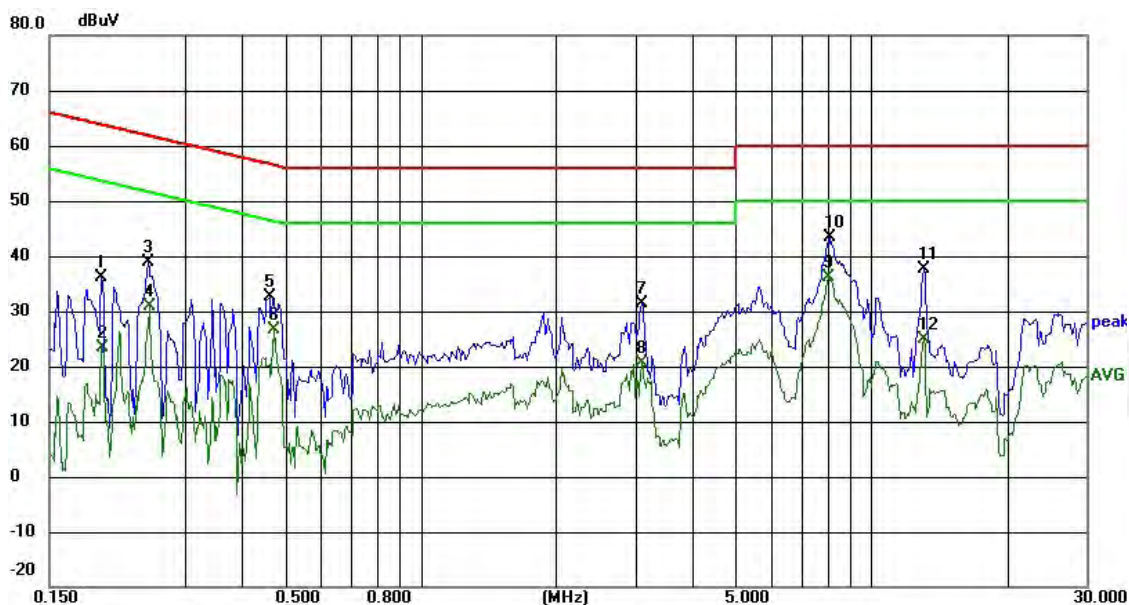
## 6.7 Conducted Emission Test Result

Pass

Conducted emission at both 120V & 240V is assessed, and emission at 120V represents the worst case. All the modulation modes were tested the data of the worst mode (802.11a, Lowest channel) are recorded in the following pages and the others modulation methods do not exceed the limits.



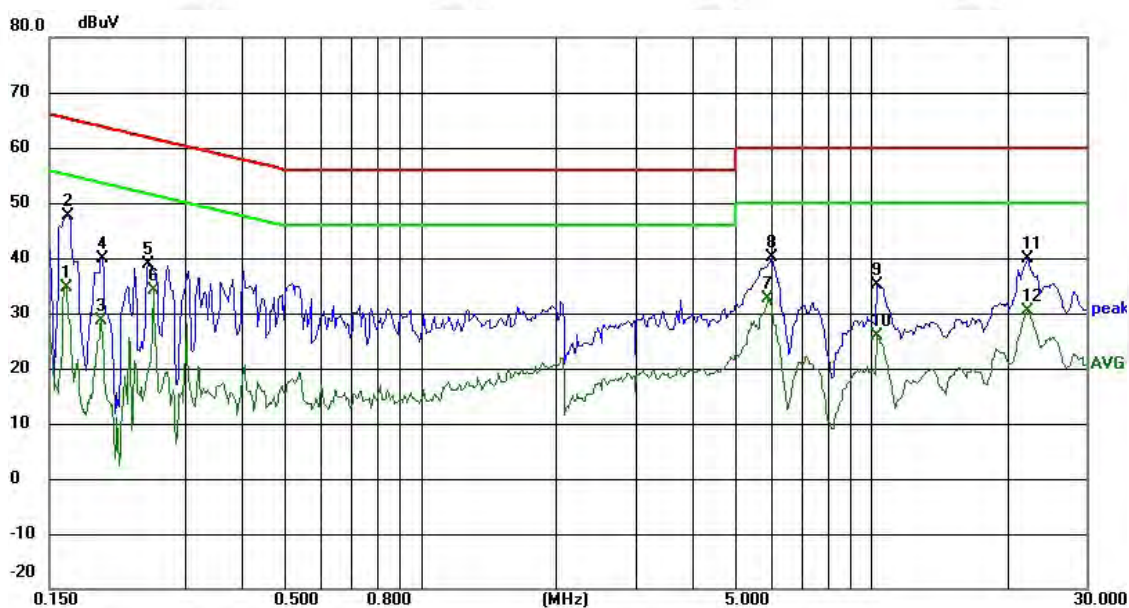
|                |                                       |                    |     |
|----------------|---------------------------------------|--------------------|-----|
| Temperature:   | 26°C                                  | Relative Humidity: | 54% |
| Pressure:      | 101kPa                 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



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | P/F |
|-----|-----------------|----------------|-------------|--------------|--------------|-------------|----------|-----|
| 1   | 0.1952          | 25.93          | 10.12       | 36.05        | 63.81        | -27.76      | peak     | P   |
| 2   | 0.1968          | 13.20          | 10.12       | 23.32        | 53.74        | -30.42      | AVG      | P   |
| 3   | 0.2479          | 28.66          | 10.16       | 38.82        | 61.83        | -23.01      | peak     | P   |
| 4   | 0.2494          | 20.73          | 10.16       | 30.89        | 51.78        | -20.89      | AVG      | P   |
| 5   | 0.4620          | 22.25          | 10.35       | 32.60        | 56.66        | -24.06      | peak     | P   |
| 6   | 0.4736          | 16.26          | 10.36       | 26.62        | 46.45        | -19.83      | AVG      | P   |
| 7   | 3.1013          | 21.20          | 10.29       | 31.49        | 56.00        | -24.51      | peak     | P   |
| 8   | 3.1013          | 10.26          | 10.29       | 20.55        | 46.00        | -25.45      | AVG      | P   |
| 9 * | 8.0198          | 17.74          | 18.28       | 36.02        | 50.00        | -13.98      | AVG      | P   |
| 10  | 8.0891          | 25.07          | 18.35       | 43.42        | 60.00        | -16.58      | peak     | P   |
| 11  | 13.0571         | 14.24          | 23.46       | 37.70        | 60.00        | -22.30      | peak     | P   |
| 12  | 13.0571         | 1.45           | 23.46       | 24.91        | 50.00        | -25.09      | AVG      | P   |



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



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | P/F |
|-----|-----------------|----------------|-------------|--------------|--------------|-------------|----------|-----|
| 1   | 0.1640          | 24.48          | 10.15       | 34.63        | 55.26        | -20.63      | AVG      | P   |
| 2   | 0.1655          | 37.56          | 10.15       | 47.71        | 65.18        | -17.47      | peak     | P   |
| 3   | 0.1952          | 18.56          | 10.12       | 28.68        | 53.81        | -25.13      | AVG      | P   |
| 4   | 0.1968          | 29.87          | 10.12       | 39.99        | 63.74        | -23.75      | peak     | P   |
| 5   | 0.2479          | 28.62          | 10.16       | 38.78        | 61.83        | -23.05      | peak     | P   |
| 6   | 0.2553          | 23.93          | 10.17       | 34.10        | 51.58        | -17.48      | AVG      | P   |
| 7 * | 5.8978          | 22.45          | 10.22       | 32.67        | 50.00        | -17.33      | AVG      | P   |
| 8   | 6.0224          | 29.80          | 10.22       | 40.02        | 60.00        | -19.98      | peak     | P   |
| 9   | 10.2873         | 14.35          | 20.66       | 35.01        | 60.00        | -24.99      | peak     | P   |
| 10  | 10.2873         | 5.17           | 20.66       | 25.83        | 50.00        | -24.17      | AVG      | P   |
| 11  | 22.2500         | 7.09           | 32.71       | 39.80        | 60.00        | -20.20      | peak     | P   |
| 12  | 22.2500         | -2.26          | 32.71       | 30.45        | 50.00        | -19.55      | AVG      | P   |

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. Measurement Level = Reading level + Correct Factor  
Correct Factor = Insertion loss of LISN + Cable loss.
4. Margin = Measurement Level - Limit



## 7 Radiated Spurious Emissions

Test Requirement : FCC CFR47 Part 15 Section 15.209 & 15.407  
 Test Method : ANSI C63.10-2020+Cor 1+2023  
 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   | $2400/F(\text{kHz})$  | 300          | $10000 * 2400/F(\text{kHz})$                | $20\log^{(2400/F(\text{kHz}))} + 80$  |
| 0.490 ~ 1.705   | $24000/F(\text{kHz})$ | 30           | $100 * 24000/F(\text{kHz})$                 | $20\log^{(24000/F(\text{kHz}))} + 40$ |
| 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                                         | $20\log^{(500)}$                      |

| FREQUENCY (MHz) | Limit (dBuV/m) (at 3M) |         |
|-----------------|------------------------|---------|
|                 | PEAK                   | AVERAGE |
| Above 1000      | 74                     | 54      |



### Undesirable emission limits

The maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (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.
- (2) For transmitters operating in the 5.25-5.35 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.
- (3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (4) For transmitters operating in the 5.725-5.85 GHz band: 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

| Requirement  | Limit(EIRP)     | Limit (Field strength at 3m) |
|--------------|-----------------|------------------------------|
| 15.407(b)(1) | PK:-27(dBm/MHz) | PK:68.2(dB $\mu$ V/m)        |
| 15.407(b)(2) |                 |                              |
| 15.407(b)(3) |                 |                              |
| 15.407(b)(4) |                 |                              |

### 7.1 EUT Operation

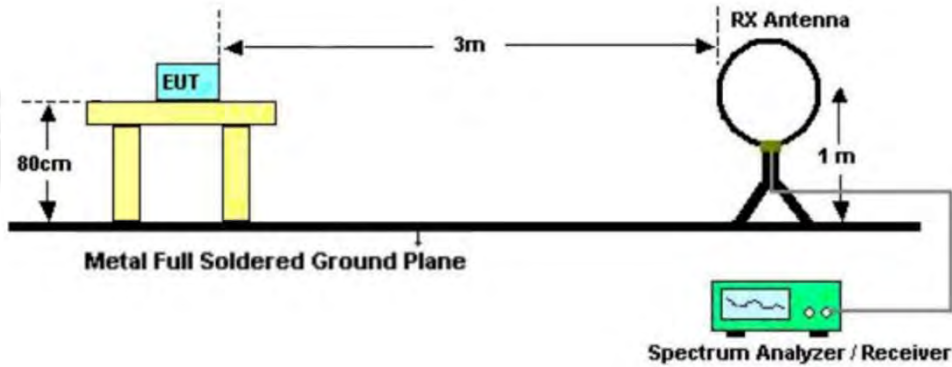
Operating Environment :

|                      |               |
|----------------------|---------------|
| Temperature          | : 26 °C       |
| Humidity             | : 54% RH      |
| Atmospheric Pressure | : 101.3kPa    |
| Test Voltage         | : AC 120V60Hz |

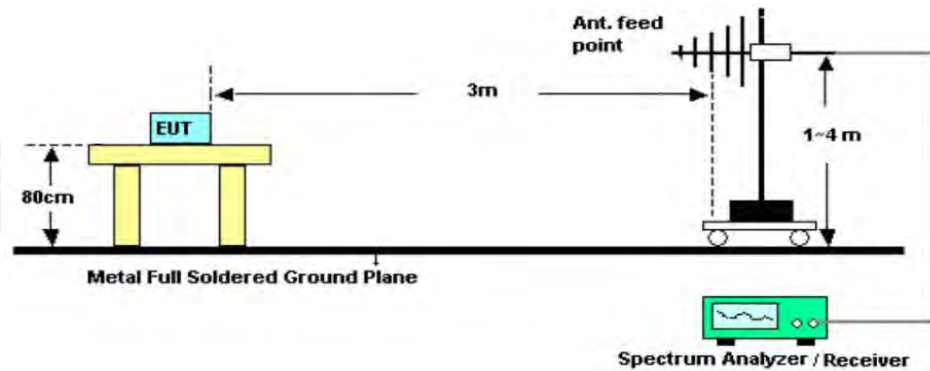
## 7.2 Test Setup

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

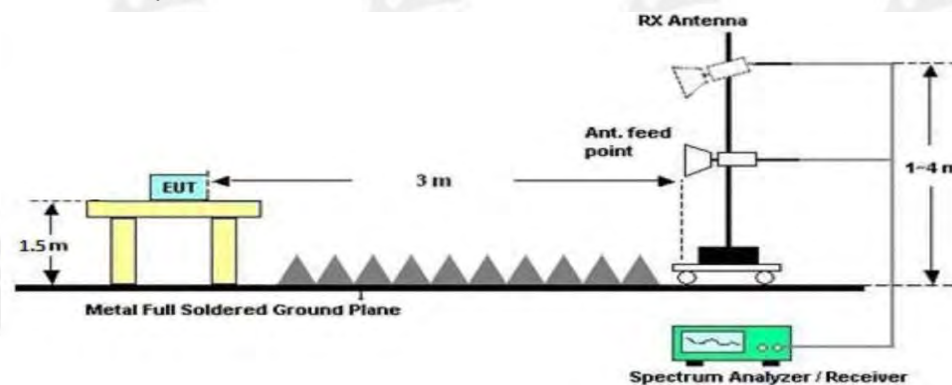
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.





### 7.3 Spectrum Analyzer Setup

| Spectrum Parameter                    | Setting                                          |
|---------------------------------------|--------------------------------------------------|
| Attenuation                           | Auto                                             |
| Start Frequency                       | 1000 MHz                                         |
| Stop Frequency                        | 10th carrier harmonic                            |
| RB / VB (emission in restricted band) | 1 MHz / 3 MHz for Peak, 1 MHz / 10Hz for Average |

| Receiver Parameter     | Setting                          |
|------------------------|----------------------------------|
| Attenuation            | Auto                             |
| Start ~ Stop Frequency | 9kHz~150kHz / RB 200Hz for QP    |
| Start ~ Stop Frequency | 150kHz~30MHz / RB 9kHz for QP    |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB 120kHz for QP |



## 7.4 Test Procedure

1. The testing follows the guidelines in Spurious Radiated Emissions of ANSI C63.10-2020+Cor 1+2023.
2. 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.
3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (From 1m to 4m) and turntable (from 0 degree to 360 degree) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Final measurement (Above 1GHz): The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1MHz. The measurement will be performed in horizontal and vertical polarization of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 degree to 360 degree in order to have the antenna inside the cone of radiation.
7. Test Procedure of measurement (For Above 1GHz):
  - 1) Monitor the frequency range at horizontal polarization and move the antenna over all sides of the EUT(if necessary move the EUT to another orthogonal axis).
  - 2) Change the antenna polarization and repeat 1) with vertical polarization.
  - 3) Make a hardcopy of the spectrum.
  - 4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
  - 5) Change the analyser mode to Clear/ Write and found the cone of emission.
  - 6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3m and the antenna will be still inside the cone of emission.
  - 7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarization and azimuth and the peak and average detector, which causes the maximum emission.
  - 8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.
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.



## 7.5 Summary of Test Results

### Test Frequency: 9KHz-30MHz

| Freq.<br>(MHz) | Ant. Pol.<br>H/V | Emission Level<br>(dBuV/m) | Limit 3m<br>(dBuV/m) | Over<br>(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 =  $40\log(\text{Specific distance} / \text{test distance})$  (dB);

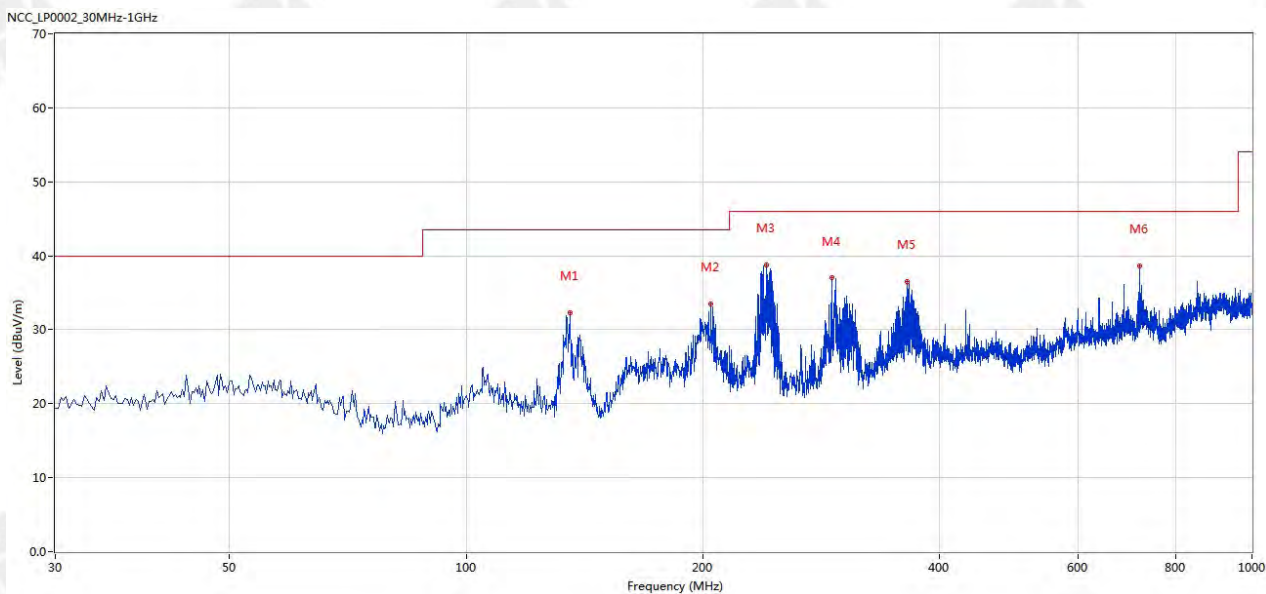
Limit line = Specific limits (dBuV) + distance extrapolation factor.

### Test Frequency: 30MHz ~ 1GHz

Please refer to the following test plots, Low Channel Worst case 802.11a for record:



|               |                                       |                    |            |
|---------------|---------------------------------------|--------------------|------------|
| Temperature:  | 26℃                                   | Relative Humidity: | 54%        |
| Pressure:     | 101kPa                                | Polarization:      | Horizontal |
| Test Voltage: | DC 5V from Adapter Input AC 120V/60Hz |                    |            |



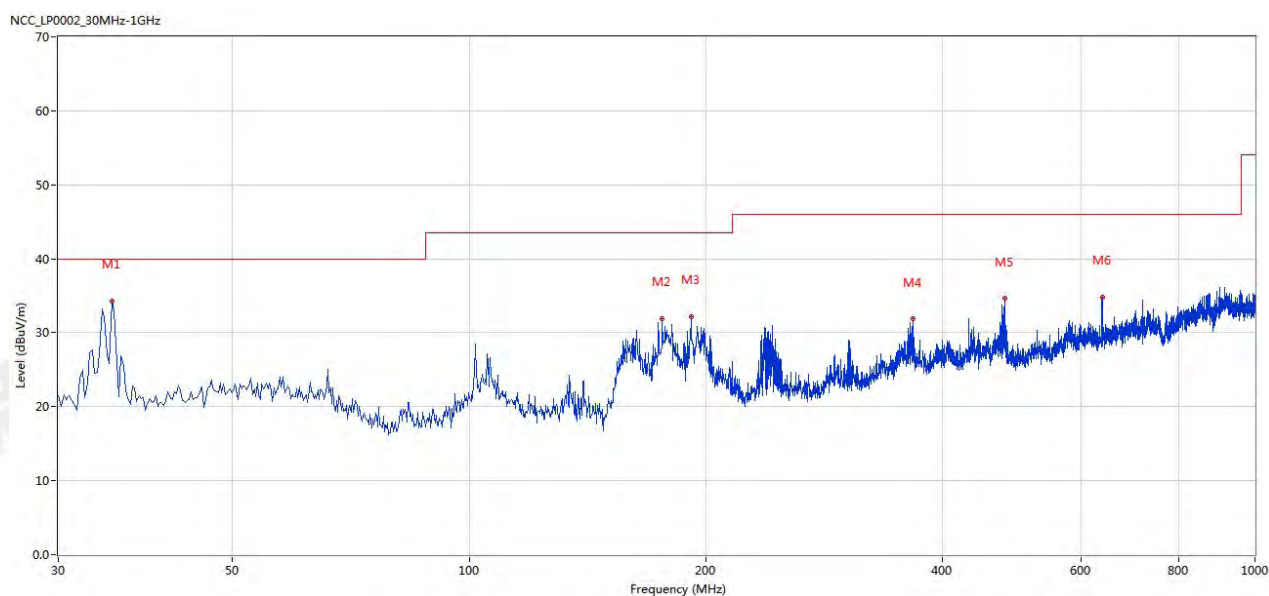
| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Antenna    | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|------------|---------|
| 1   | 135.704         | 32.27            | -13.17      | 43.5           | 11.23       | Peak     | Horizontal | Pass    |
| 2   | 204.799         | 33.54            | -10.73      | 43.5           | 9.96        | Peak     | Horizontal | Pass    |
| 3   | 240.922         | 38.74            | -8.92       | 46.0           | 7.26        | Peak     | Horizontal | Pass    |
| 4   | 291.835         | 36.98            | -7.69       | 46.0           | 9.02        | Peak     | Horizontal | Pass    |
| 5   | 364.081         | 36.52            | -4.95       | 46.0           | 9.48        | Peak     | Horizontal | Pass    |
| 6   | 719.740         | 38.67            | -1.06       | 46.0           | 7.33        | Peak     | Horizontal | Pass    |

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

Margin= Emission Level - Limit



|               |                                       |                    |          |
|---------------|---------------------------------------|--------------------|----------|
| Temperature:  | 26℃                                   | Relative Humidity: | 54%      |
| Pressure:     | 101 kPa                               | Polarization:      | Vertical |
| Test Voltage: | DC 5V from Adapter Input AC 120V/60Hz |                    |          |



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Antenna  | Verdict |
|-----|-----------------|------------------|-------------|----------------|-------------|----------|----------|---------|
| 1   | 35.091          | 34.34            | -9.86       | 40.0           | 5.66        | Peak     | Vertical | Pass    |
| 2   | 176.191         | 31.86            | -11.39      | 43.5           | 11.64       | Peak     | Vertical | Pass    |
| 3   | 191.465         | 32.12            | -11.11      | 43.5           | 11.38       | Peak     | Vertical | Pass    |
| 4   | 367.233         | 31.85            | -4.95       | 46.0           | 14.15       | Peak     | Vertical | Pass    |
| 5   | 479.968         | 34.61            | -4.15       | 46.0           | 11.39       | Peak     | Vertical | Pass    |
| 6   | 639.008         | 34.80            | -1.64       | 46.0           | 11.20       | Peak     | Vertical | Pass    |

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

Margin= Emission Level - Limit



## Test Frequency 1GHz-40GHz

802.11a

| Polar<br>(H/V)      | Frequency<br>(MHz) | Meter<br>Reading<br>(dBuV) | Pre-<br>amplifier<br>(dB) | Cable<br>Loss<br>(dB) | Antenna<br>Factor<br>(dB) | Emission<br>Level<br>(dBuV/m) | Limits<br>(dBuV/<br>m) | Margin<br>(dB) | Detect<br>or<br>Type |
|---------------------|--------------------|----------------------------|---------------------------|-----------------------|---------------------------|-------------------------------|------------------------|----------------|----------------------|
| Low Channel:5180MHz |                    |                            |                           |                       |                           |                               |                        |                |                      |
| V                   | 10360              | 43.17                      | 32.29                     | 8.39                  | 38.9                      | 58.17                         | 74                     | -15.83         | PK                   |
| V                   | 10360              | 22.31                      | 32.29                     | 8.39                  | 38.9                      | 37.31                         | 54                     | -16.69         | AV                   |
| V                   | 15540              | 39.22                      | 31.19                     | 9.62                  | 40.37                     | 58.02                         | 74                     | -15.98         | PK                   |
| V                   | 15540              | 21.88                      | 31.19                     | 9.62                  | 40.37                     | 40.68                         | 54                     | -13.32         | AV                   |
| V                   | 20720              | 40.08                      | 27.02                     | 7.2                   | 38.98                     | 59.24                         | 74                     | -14.76         | PK                   |
| V                   | 20720              | 20.45                      | 27.02                     | 7.2                   | 38.98                     | 39.61                         | 54                     | -14.39         | AV                   |
| H                   | 10360              | 43.90                      | 32.29                     | 8.39                  | 38.9                      | 58.90                         | 74                     | -15.10         | PK                   |
| H                   | 10360              | 23.11                      | 32.29                     | 8.39                  | 38.9                      | 38.11                         | 54                     | -15.89         | AV                   |
| H                   | 15540              | 40.47                      | 31.19                     | 9.62                  | 40.37                     | 59.27                         | 74                     | -14.73         | PK                   |
| H                   | 15540              | 19.66                      | 31.19                     | 9.62                  | 40.37                     | 38.46                         | 54                     | -15.54         | AV                   |
| H                   | 20720              | 38.13                      | 27.02                     | 7.2                   | 38.98                     | 57.29                         | 74                     | -16.71         | PK                   |
| H                   | 20720              | 21.38                      | 27.02                     | 7.2                   | 38.98                     | 40.54                         | 54                     | -13.46         | AV                   |



| Polar                  | Frequency | Meter Reading | Pre-amplifier | Cable Loss | Antenna Factor | Emission Level | Limits   | Margin | Detect or Type |
|------------------------|-----------|---------------|---------------|------------|----------------|----------------|----------|--------|----------------|
| (H/V)                  | (MHz)     | (dBuV)        | (dB)          | (dB)       | (dB)           | (dBuV/m)       | (dBuV/m) | (dB)   |                |
| Middle Channel:5200MHz |           |               |               |            |                |                |          |        |                |
| V                      | 10400     | 43.44         | 32.26         | 8.48       | 38.9           | 58.56          | 74       | -15.44 | PK             |
| V                      | 10400     | 18.87         | 32.26         | 8.48       | 38.9           | 33.99          | 54       | -20.01 | AV             |
| V                      | 15600     | 38.56         | 31.08         | 9.67       | 40.61          | 57.76          | 74       | -16.24 | PK             |
| V                      | 15600     | 16.41         | 31.08         | 9.67       | 40.61          | 35.61          | 54       | -18.39 | AV             |
| V                      | 20800     | 37.15         | 27.03         | 7.24       | 39.03          | 56.39          | 74       | -17.61 | PK             |
| V                      | 20800     | 16.94         | 27.03         | 7.24       | 39.03          | 36.18          | 54       | -17.82 | AV             |
| H                      | 10400     | 38.20         | 32.26         | 8.48       | 38.9           | 53.32          | 74       | -20.68 | PK             |
| H                      | 10400     | 20.69         | 32.26         | 8.48       | 38.9           | 35.81          | 54       | -18.19 | AV             |
| H                      | 15600     | 36.09         | 31.08         | 9.67       | 40.61          | 55.29          | 74       | -18.71 | PK             |
| H                      | 15600     | 16.30         | 31.08         | 9.67       | 40.61          | 35.50          | 54       | -18.50 | AV             |
| H                      | 20800     | 35.93         | 27.03         | 7.24       | 39.03          | 55.17          | 74       | -18.83 | PK             |
| H                      | 20800     | 17.36         | 27.03         | 7.24       | 39.03          | 36.60          | 54       | -17.40 | AV             |



| Polar                | Frequency | Meter Reading | Pre-amplifier | Cable Loss | Antenna Factor | Emission Level | Limits   | Margin | Detect or Type |
|----------------------|-----------|---------------|---------------|------------|----------------|----------------|----------|--------|----------------|
| (H/V)                | (MHz)     | (dBuV)        | (dB)          | (dB)       | (dB)           | (dBuV/m)       | (dBuV/m) | (dB)   |                |
| High Channel:5240MHz |           |               |               |            |                |                |          |        |                |
| V                    | 10480     | 46.08         | 32.23         | 8.56       | 38.9           | 61.31          | 74       | -12.69 | PK             |
| V                    | 10480     | 33.12         | 32.23         | 8.56       | 38.9           | 48.35          | 54       | -5.65  | AV             |
| V                    | 15720     | 44.07         | 30.97         | 9.73       | 40.85          | 63.68          | 74       | -10.32 | PK             |
| V                    | 15720     | 28.94         | 30.97         | 9.73       | 40.85          | 48.55          | 54       | -5.45  | AV             |
| V                    | 20960     | 43.03         | 27.03         | 7.26       | 39.06          | 62.32          | 74       | -11.68 | PK             |
| V                    | 20960     | 25.33         | 27.03         | 7.26       | 39.06          | 44.62          | 54       | -9.38  | AV             |
| H                    | 10480     | 45.53         | 32.23         | 8.56       | 38.9           | 60.76          | 74       | -13.24 | PK             |
| H                    | 10480     | 31.45         | 32.23         | 8.56       | 38.9           | 46.68          | 54       | -7.32  | AV             |
| H                    | 15720     | 45.24         | 30.97         | 9.73       | 40.85          | 64.85          | 74       | -9.15  | PK             |
| H                    | 15720     | 28.90         | 30.97         | 9.73       | 40.85          | 48.51          | 54       | -5.49  | AV             |
| H                    | 20960     | 45.43         | 27.03         | 7.26       | 39.06          | 64.72          | 74       | -9.28  | PK             |
| H                    | 20960     | 24.19         | 27.03         | 7.26       | 39.06          | 43.48          | 54       | -10.52 | AV             |

Remark:

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.
4. The worst mode is 802.11a, only the worst data is recorded.

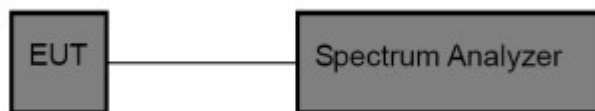


## 8 Duty cycle

### 8.1 Limit

Test Requirement: FCC CFR Title 47 Part 15 Subpart C Section 15.407  
Test Method: ANSI C63.10-2020+Cor 1+2023  
KDB 789033 D02 v02r01  
Test Result: PASS

### 8.2 Test Setup



### 8.3 Test Procedure

The zero-span mode on a spectrum analyzer or EMI receiver, if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW  $\geq$  EBW if possible; otherwise, set RBW to the largest available value. Set VBW  $\geq$  RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are  $> 50/T$ , where T is defined in IILB.1.a), and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if  $T \leq 16.7$  microseconds.)

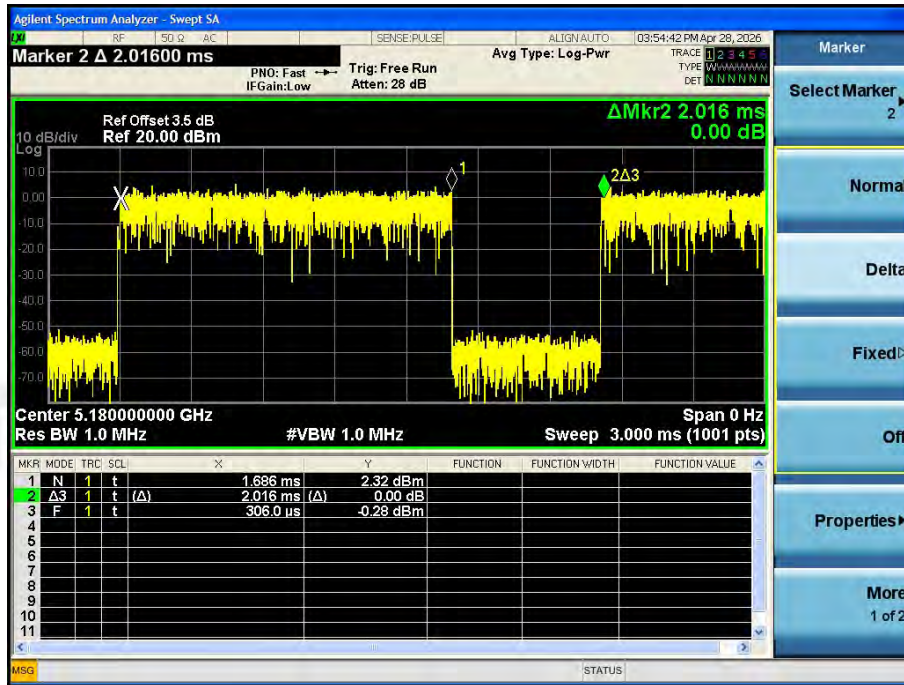
### 8.4 Test Result



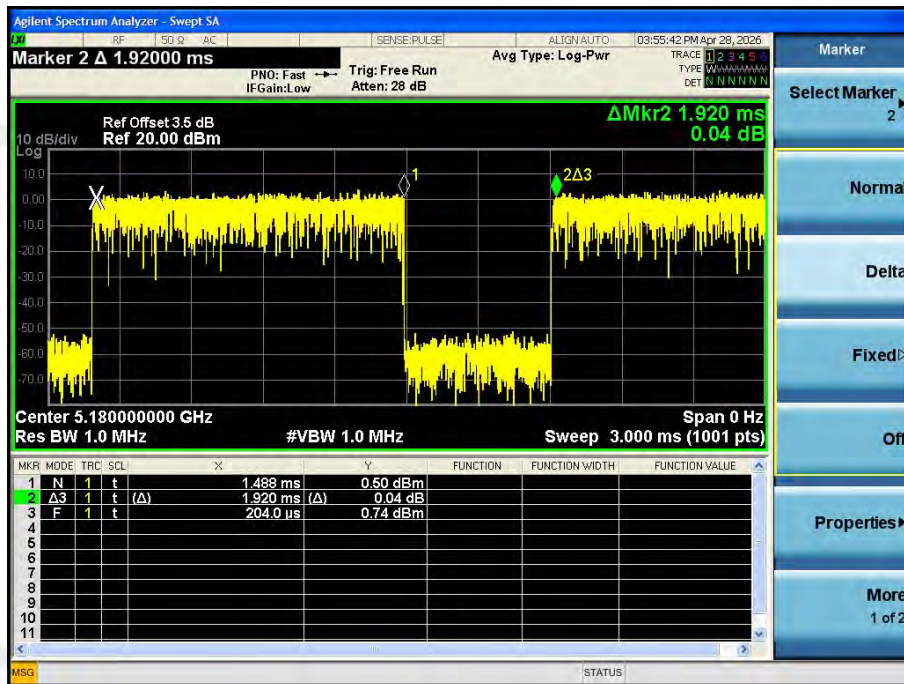
| Mode            | ON Time<br>B<br>(msec) | Period<br>(msec) | Duty Cycle<br>x<br>(linear) | Duty Cycle<br>(%) | $10\log(1/x)$ Duty<br>Cycle<br>Correction<br>Factor<br>(dB) | 1/B<br>Minimum<br>VBW<br>(kHz) |
|-----------------|------------------------|------------------|-----------------------------|-------------------|-------------------------------------------------------------|--------------------------------|
| 802.11a         | 1.380                  | 2.016            | 0.685                       | 68.45%            | 1.646                                                       | 0.725                          |
| 802.11N20(MHz)  | 1.284                  | 1.920            | 0.669                       | 66.88%            | 1.747                                                       | 0.779                          |
| 802.11AC20(MHz) | 0.664                  | 1.280            | 0.519                       | 51.88%            | 2.850                                                       | 1.506                          |
| 802.11N40(MHz)  | 0.300                  | 0.952            | 0.315                       | 31.51%            | 5.016                                                       | 3.333                          |
| 802.11AC40(MHz) | 0.172                  | 0.824            | 0.209                       | 20.87%            | 6.805                                                       | 5.814                          |
| 802.11AC80(MHz) | 0.132                  | 0.812            | 0.163                       | 16.26%            | 7.889                                                       | 7.576                          |



802.11a

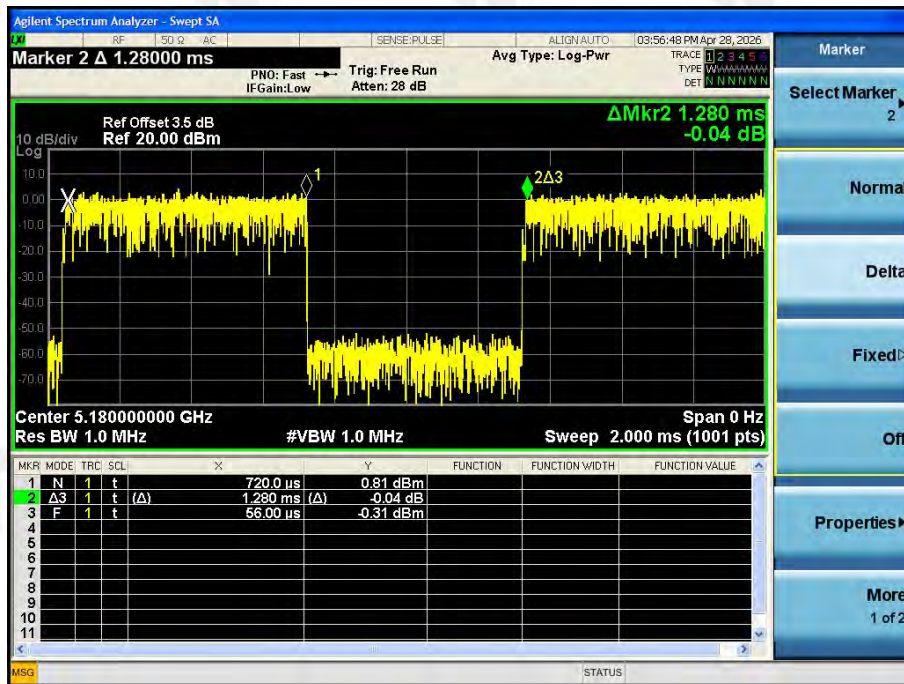


802.11N20(MHz)

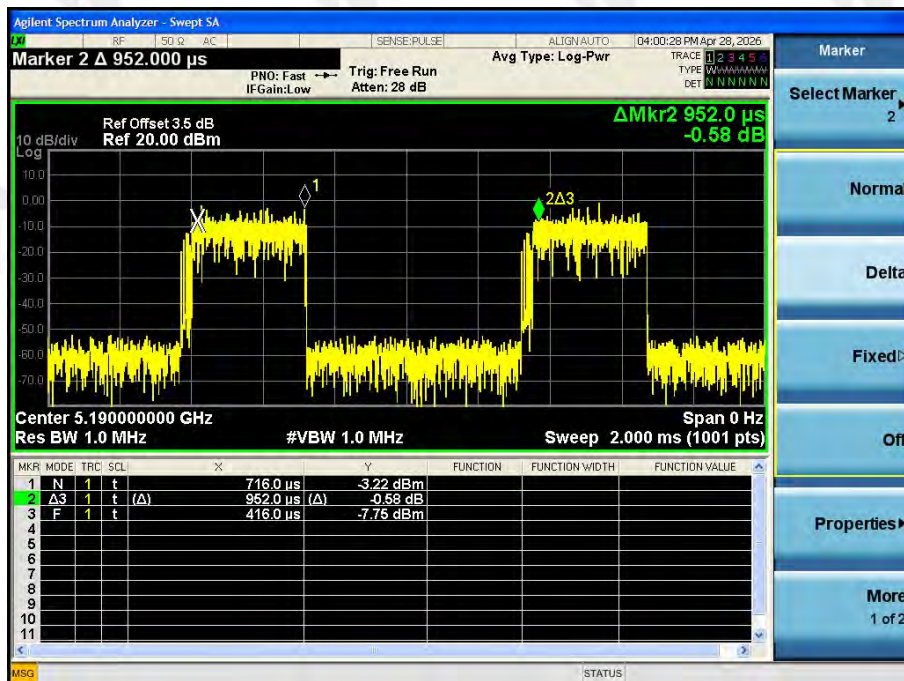




802.11AC20(MHz)

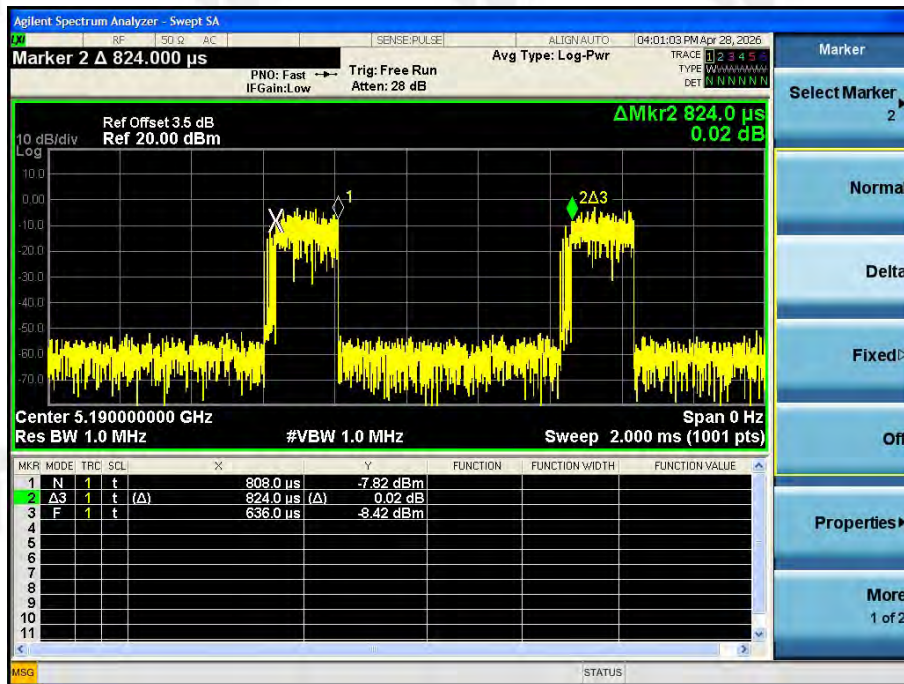


802.11N40(MHz)

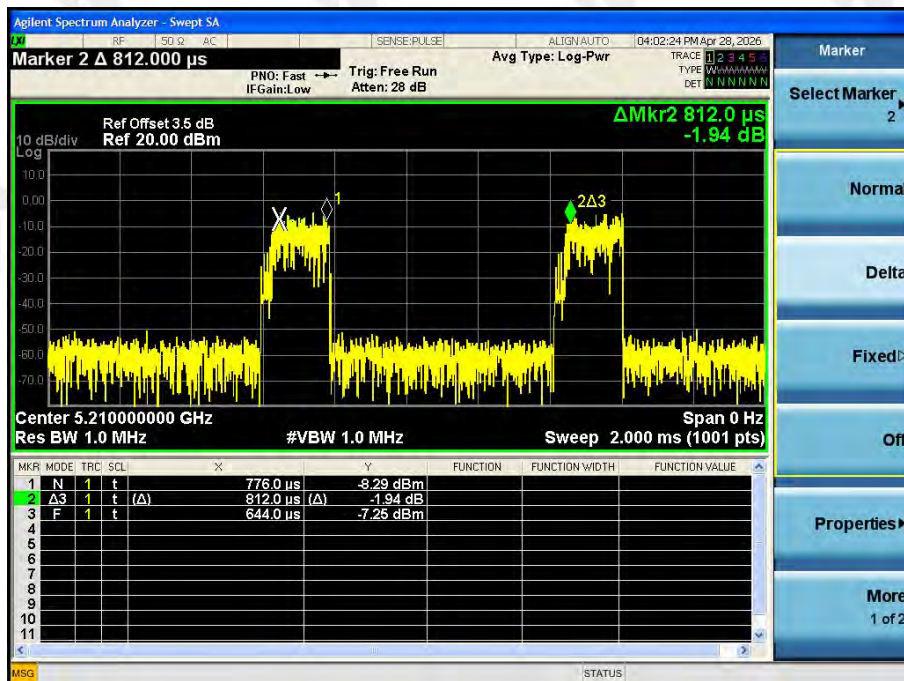




802.11AC40(MHz)



802.11AC80(MHz)





## 9 POWER SPECTRAL DENSITY TEST

### 9.1 Test Standard and Limit

#### According to FCC §15.407(3)

(1) For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum

power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

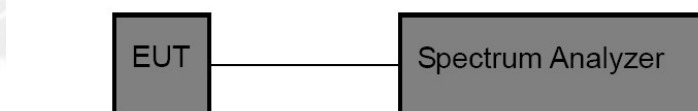
(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII



devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

## 9.2 Test Setup



## 9.3 Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above,
2. The testing follows FCC KDB 789033 D02.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to Spectrum.
4. For U-NII1, U-NII-2A, U-NII-2C Band:

Set RBW=1MHz, VBW=3MHz, where span is enough to capture the entire bandwidth, Sweep time = Auto (601 pts), detector = sample, traces 100 sweeps of video averaging. (SA-2 with the omission of procedure x, the integration with 26dB EBW bandwidth)

For U-NII-3 Band:

Set RBW=510 kHz, VBW=3\*RBW, where span is enough to capture the entire bandwidth, Sweep time = Auto (601 pts), detector = sample, traces 100 sweeps of video averaging. (SA-2 with the omission of procedure x, the integration with 26dB EBW bandwidth)

5. Use the cursor on spectrum to peak search the highest level of trace
6. Record the max. reading and add  $10 \log(1/\text{duty cycle})$ .

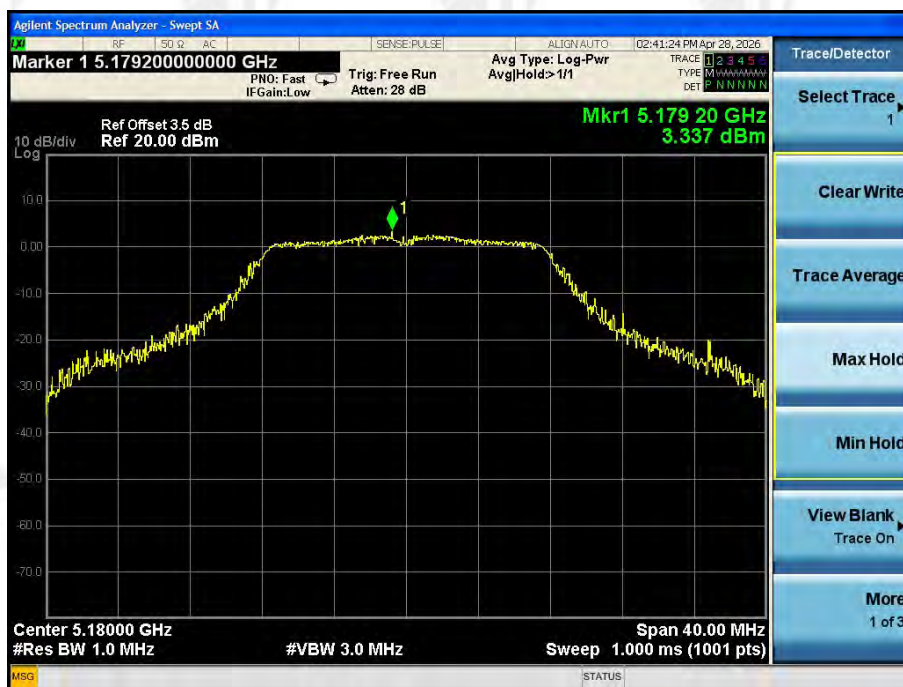
## 9.4 Test Data



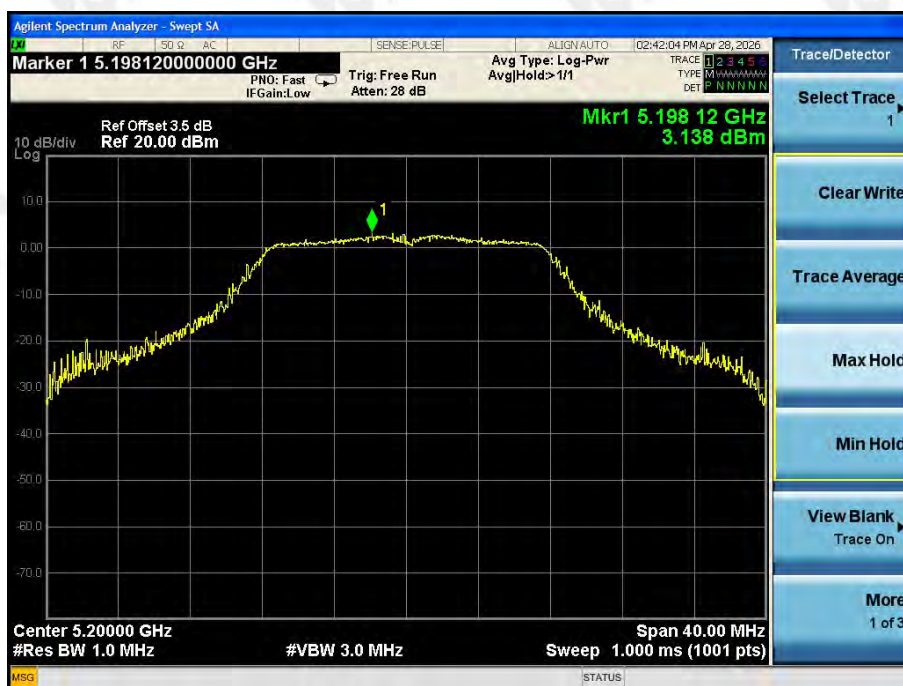
| Test Mode                                                | Channel | Channel Frequency (MHz) | Power Density (MHz)<br>ANT 1 | Limit (dBm) | Result |
|----------------------------------------------------------|---------|-------------------------|------------------------------|-------------|--------|
| 802.11a<br>(5.18GHz-5.24GHz)<br>Data rate 6Mbps          | Low     | 5180                    | 3.337                        | 11          | Pass   |
|                                                          | Middle  | 5200                    | 3.138                        | 11          | Pass   |
|                                                          | Highest | 5240                    | 4.124                        | 11          | Pass   |
| 802.11n(20M)<br>(5.18GHz-5.24GHz)<br>Data rate 13Mbps    | Low     | 5180                    | 1.569                        | 11          | Pass   |
|                                                          | Middle  | 5200                    | 1.457                        | 11          | Pass   |
|                                                          | Highest | 5240                    | 1.135                        | 11          | Pass   |
| 802.11ac(20M)<br>(5.18GHz-5.24GHz)<br>Data rate 13Mbps   | Low     | 5180                    | 0.857                        | 11          | Pass   |
|                                                          | Middle  | 5200                    | 1.497                        | 11          | Pass   |
|                                                          | Highest | 5240                    | 0.940                        | 11          | Pass   |
| 802.11n(40M)<br>(5.18GHz-5.24GHz)<br>Data rate 27Mbps    | Low     | 5190                    | -1.758                       | 11          | Pass   |
|                                                          | Highest | 5230                    | -1.289                       | 11          | Pass   |
| 802.11ac(40M)<br>(5.18GHz-5.24GHz)<br>Data rate 27Mbps   | Low     | 5190                    | -2.272                       | 11          | Pass   |
|                                                          | Highest | 5230                    | -1.783                       | 11          | Pass   |
| 802.11ac(80M)<br>(5.18GHz-5.24GHz)<br>Data rate 58.6Mbps | ---     | 5210                    | -5.252                       | 11          | Pass   |



802.11a (5.18GHz-5.24GHz) The Lowest Channel 36: 5180MHz

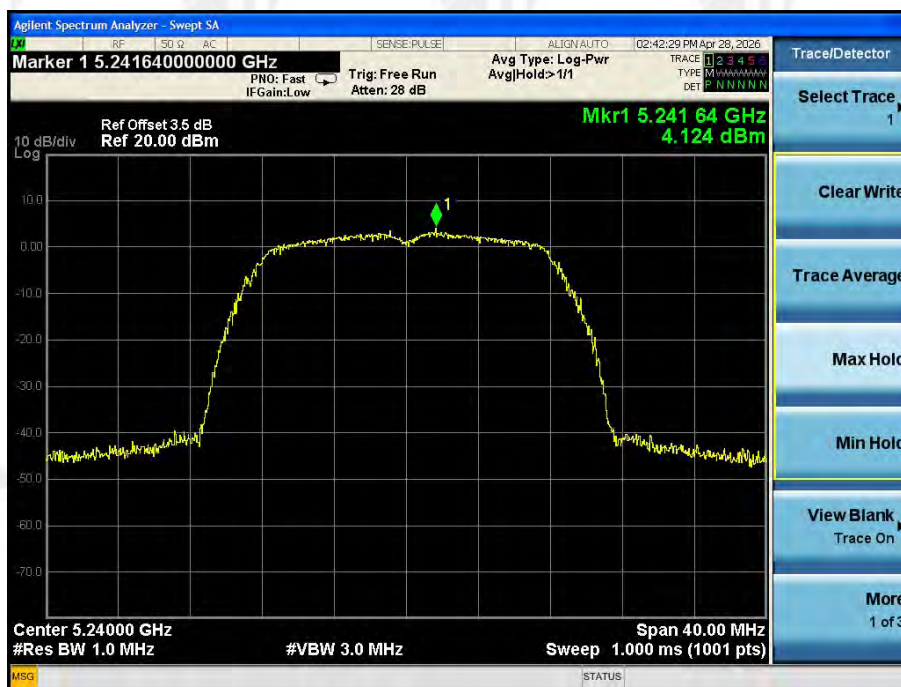


802.11a (5.18GHz-5.24GHz) The Middle Channel 40: 5200MHz

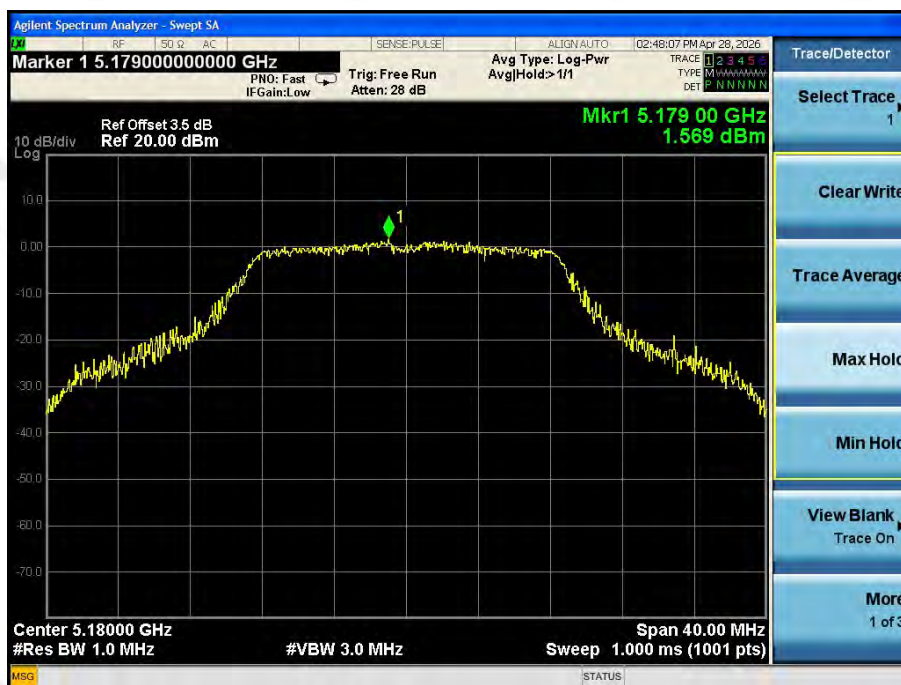




802.11a (5.18GHz-5.24GHz) The Highest Channel 48: 5240MHz



802.11n(20M) (5.18GHz-5.24GHz) The Lowest Channel 36: 5180MHz

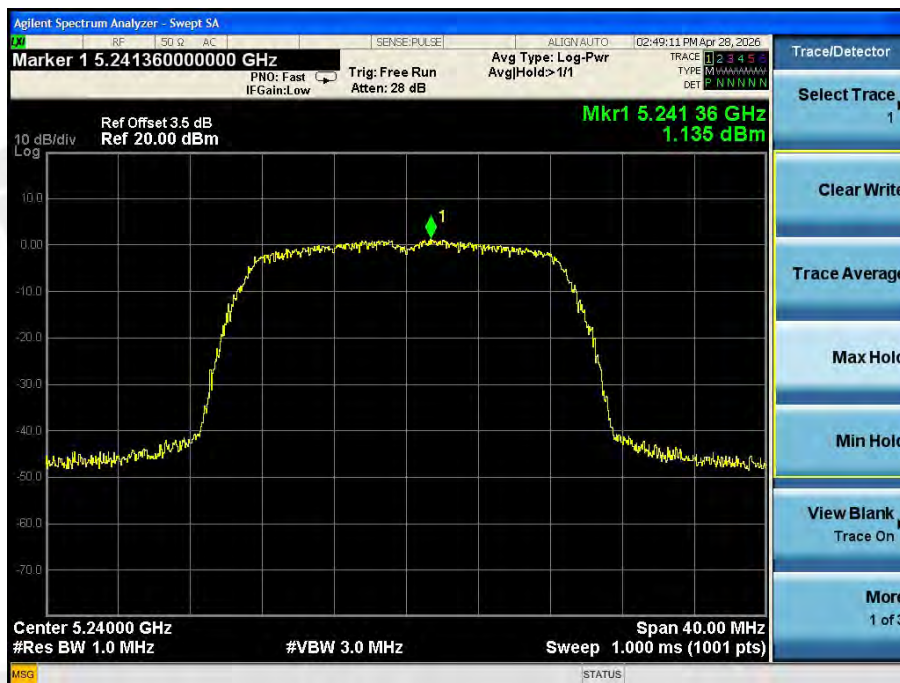




802.11n(20M) (5.18GHz-5.24GHz) The Middle Channel 40: 5200MHz



802.11n(20M) (5.18GHz-5.24GHz) The Highest Channel 48: 5240MHz





802.11ac(20M) (5.18GHz-5.24GHz) The Lowest Channel 36: 5180MHz

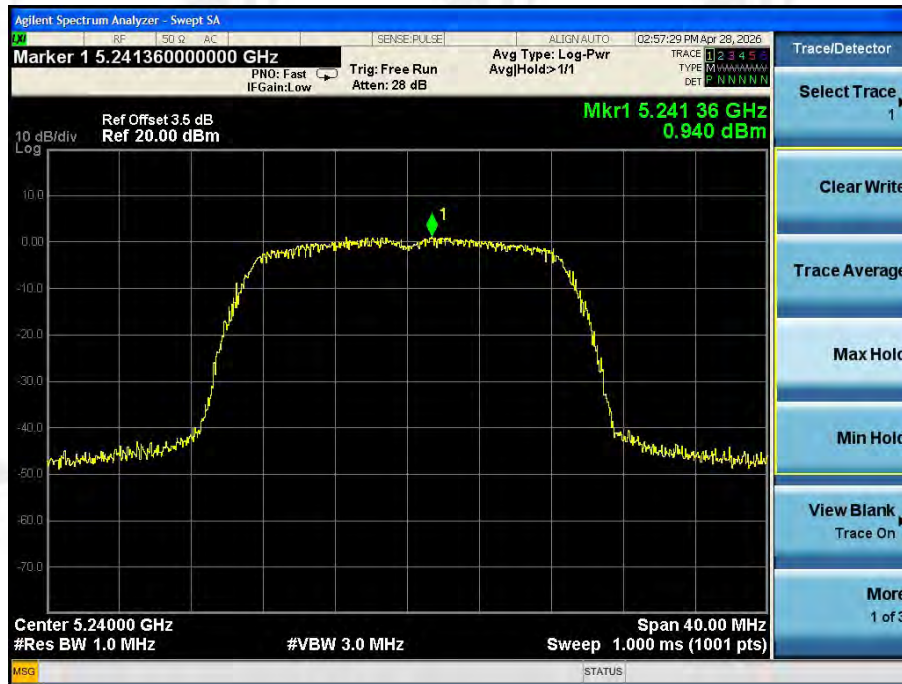


802.11ac(20M) (5.18GHz-5.24GHz) The Middle Channel 40: 5200MHz





802.11ac(20M) (5.18GHz-5.24GHz) The Highest Channel 48: 5240MHz





802.11n(40M) (5.18GHz-5.24GHz) The Lowest Channel 38: 5190MHz

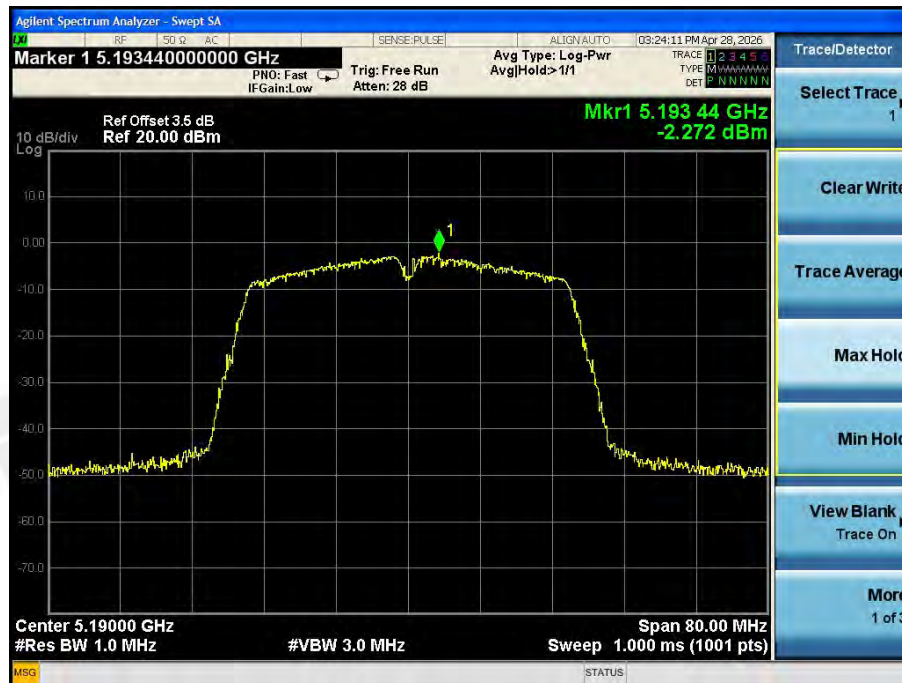


802.11n(40M) (5.18GHz-5.24GHz) The Highest Channel 46: 5230MHz

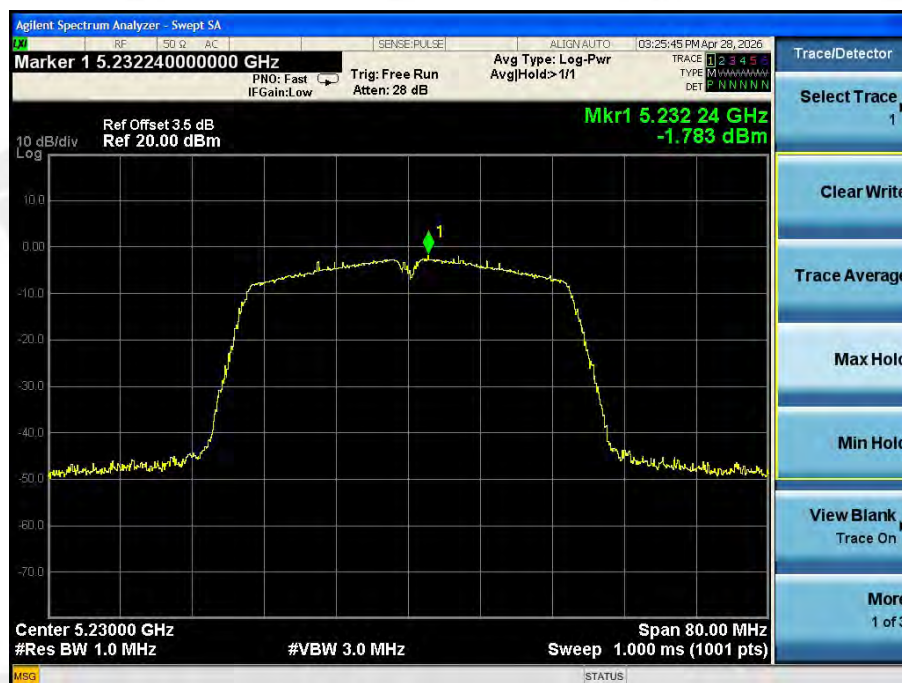




802.11ac(40M) (5.18GHz-5.24GHz) The Lowest Channel 38: 5190MHz



802.11ac(40M) (5.18GHz-5.24GHz) The Highest Channel 46: 5230MHz





802.11ac(80M) (5.18GHz-5.24GHz) The Lowest Channel 42: 5210MHz



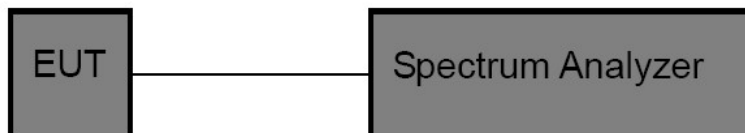


## 10 26DB & 6DB & 99% Emission Bandwidth Test

### 10.1 Test Standard

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Standard | FCC Part15 C Section 15.407                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|               | The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band, the minimum bandwidth 6 dB bandwidth of U-NII devices shall be at least 500KHz. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth. |

### 10.2 Test Setup



### 10.3 Test Procedure

- Spectrum Setting: RBW= 300kHz(802.11a/n20/ac20), RBW=510kHz(802.11n40/ac40), RBW=1MHz(802.11ac80), VBW  $\geq$  RBW, Sweep time = Auto.
- Set the VBW > RBW.
- Detector = Peak.
- Trace mode = max hold.
- 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.



The following procedure shall be used for measuring (99 %) power bandwidth:

1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 3.3 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW  $\geq 3 \cdot$  RBW
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99 % power bandwidth fuNCTion of the instrument (if available).
7. If the instrument does not have a 99 % power bandwidth fuNCTion, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

#### 10.4 Test Data



| Test Mode                                                | Test Channel | Frequency<br>(MHz) | 26 dB Bandwidth<br>(MHz)ANT 1 |
|----------------------------------------------------------|--------------|--------------------|-------------------------------|
| 802.11a<br>(5.18GHz-5.24GHz)<br>Data rate 6Mbps          | CH36         | 5180               | 26.15                         |
|                                                          | CH40         | 5200               | 26.37                         |
|                                                          | CH48         | 5240               | 20.15                         |
| 802.11n(20M)<br>(5.18GHz-5.24GHz)<br>Data rate 13Mbps    | CH36         | 5180               | 27.72                         |
|                                                          | CH40         | 5200               | 25.37                         |
|                                                          | CH48         | 5240               | 20.38                         |
| 802.11ac(20M)<br>(5.18GHz-5.24GHz)<br>Data rate 13Mbps   | CH36         | 5180               | 25.68                         |
|                                                          | CH40         | 5200               | 27.39                         |
|                                                          | CH48         | 5240               | 20.44                         |
| 802.11n(40M)<br>(5.18GHz-5.24GHz)<br>Data rate 27Mbps    | CH38         | 5190               | 39.96                         |
|                                                          | CH46         | 5230               | 40.33                         |
| 802.11ac(40M)<br>(5.18GHz-5.24GHz)<br>Data rate 27Mbps   | CH38         | 5190               | 39.95                         |
|                                                          | CH46         | 5230               | 40.36                         |
| 802.11ac(80M)<br>(5.18GHz-5.24GHz)<br>Data rate 58.6Mbps | CH42         | 5210               | 79.71                         |



802.11a (5.18GHz-5.24GHz) The Low Channel 36: 5180MHz



802.11a (5.18GHz-5.24GHz) The Middle Channel 40: 5200MHz





802.11a (5.18GHz-5.24GHz) The High Channel 48: 5240MHz

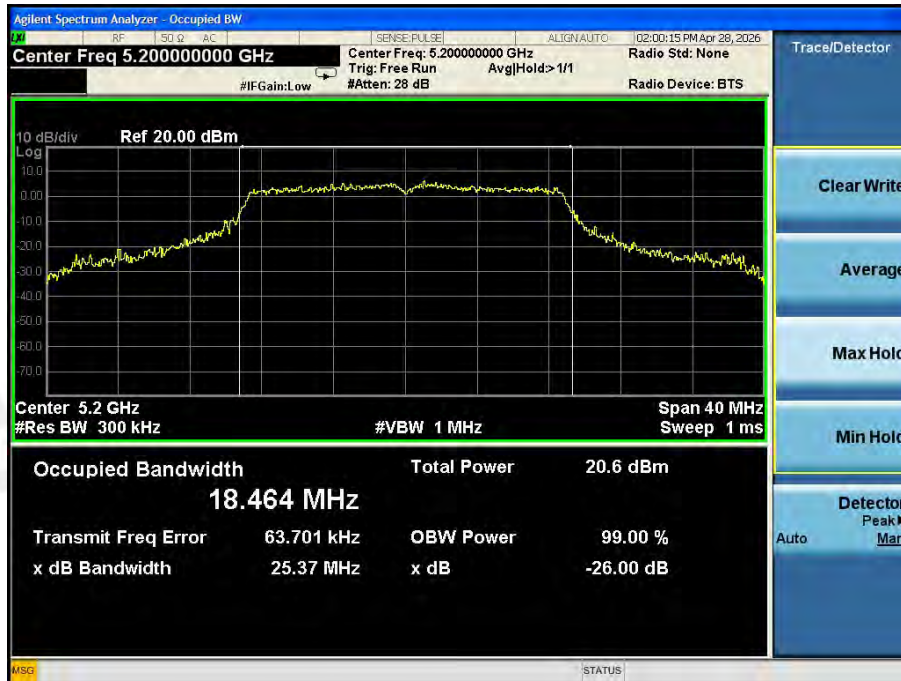


802.11n(20M) (5.18GHz-5.24GHz) The Lowest Channel 36: 5180MHz





802.11n(20M) (5.18GHz-5.24GHz) The Middle Channel 40: 5200MHz



802.11n(20M) (5.18GHz-5.24GHz) The High Channel 48: 5240MHz





802.11ac(20M) (5.18GHz-5.24GHz) The Middle Channel 36: 5180MHz

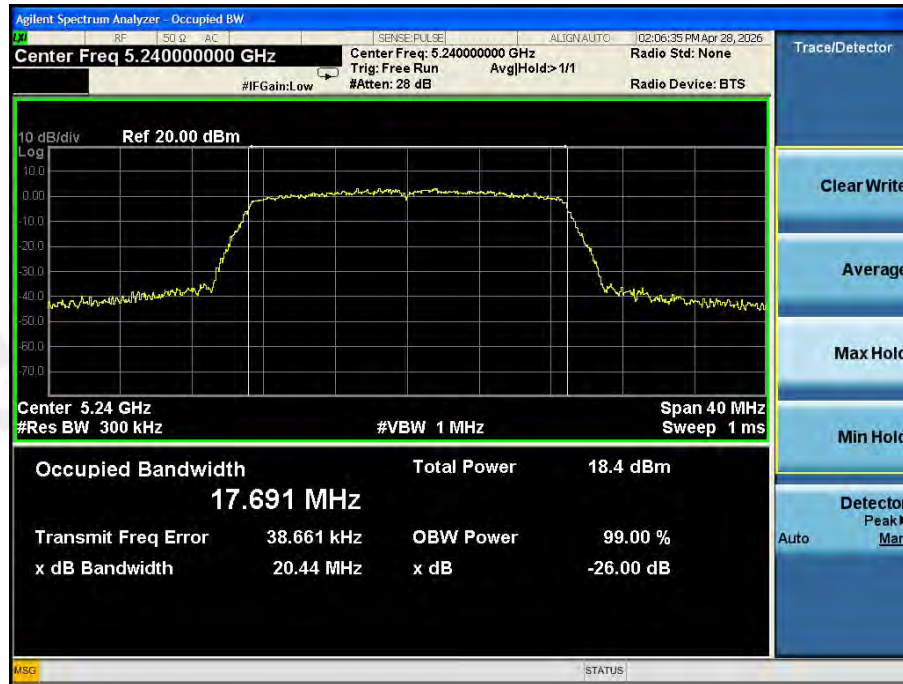


802.11 ac(20M) (5.18GHz-5.24GHz) The High Channel 40: 5200MHz





802.11ac(20M) (5.18GHz-5.24GHz) The Middle Channel 48: 5240MHz





802.11n(40M) (5.18GHz-5.24GHz) The Lowest Channel 38: 5190MHz



802.11n(40M) (5.18GHz-5.24GHz) The High Channel 46: 5230MHz





802.11ac(40M) (5.18GHz-5.24GHz) The Lowest Channel 38: 5190MHz

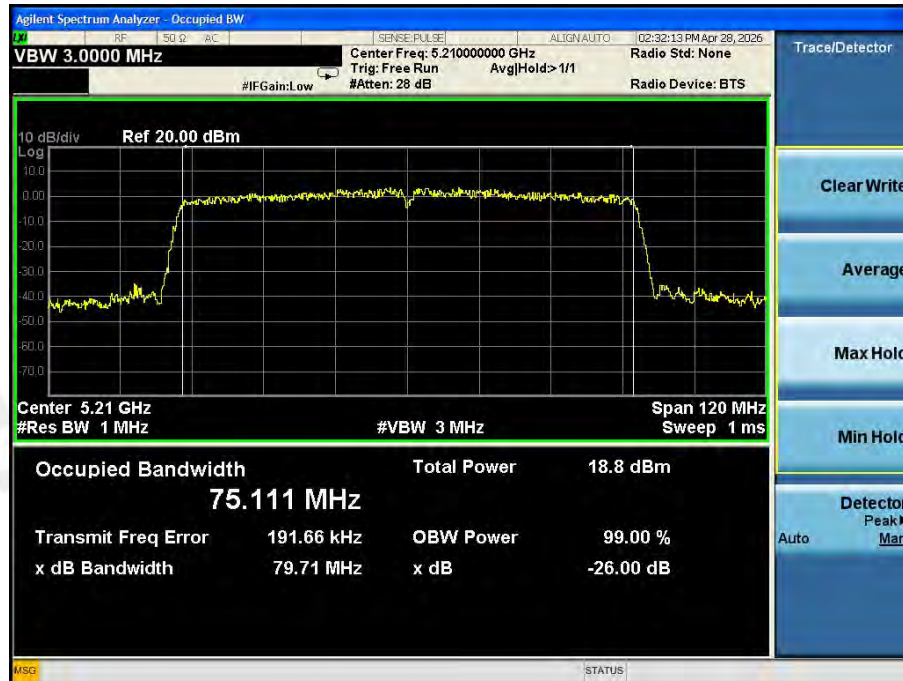


802.11ac(40M) (5.18GHz-5.24GHz) The High Channel 46: 5230MHz





802.11ac(80M) (5.18GHz-5.24GHz) The Lowest Channel 42: 5210MHz





## 11 Maximum Conducted Output Power

### 11.1 Test Standard and Limit

According to FCC §15.407

For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power.

For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi.

If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26 dB emission bandwidth in megahertz.

If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the band 5.725-5.850 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power.

Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications,



and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

## 11.2 Test Setup



## 11.3 Test Procedure

The EUT was directly connected to the Power meter

### 1. Device Configuration

If possible, configure or modify the operation of the EUT so that it transmits continuously at its maximum power control level (see section II.B.).

The intent is to test at 100 percent duty cycle; however a small reduction in duty cycle (to no lower than 98 percent) is permitted if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.

b) If continuous transmission (or at least 98 percent duty cycle) cannot be achieved due to hardware limitations (e.g., overheating), the EUT shall be operated at its maximum power control level with the transmit duration as long as possible and the duty cycle as high as possible.

Measurement using a Power Meter(PM)

a) Method PM (Measurement using an RF average power meter):

(i) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the following conditions are satisfied:

- The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
- At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.

- The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

(i) If the transmitter does not transmit continuously, measure the duty cycle,  $x$ , of the transmitter output signal as described in IIL.B.

(ii) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.



(iv) Adjust the measurement in dBm by adding  $10 \log (1/x)$  where x is the duty cycle (e.g.  $10 \log (1/0.25)$  if the duty cycle is 25%).

b) Method PM-G (Measurement using a gated RF average power meter):

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

#### 11.4 Test Data

| Test Mode                                             | Channel | Channel Frequency (MHz) | Output Power A (dBm) | Limit (dBm) | Result |
|-------------------------------------------------------|---------|-------------------------|----------------------|-------------|--------|
| 802.11a<br>(5.18GHz-5.24GHz)<br>Data rate 6Mbps       | CH36    | 5180                    | 14.97                | 24          | Pass   |
|                                                       | CH40    | 5200                    | 14.73                | 24          | Pass   |
|                                                       | CH48    | 5240                    | 14.45                | 24          | Pass   |
| 802.11n(20M)<br>(5.18GHz-5.24GHz)<br>Data rate 13Mbps | CH36    | 5180                    | 14.85                | 24          | Pass   |
|                                                       | CH40    | 5200                    | 14.65                | 24          | Pass   |
|                                                       | CH48    | 5240                    | 14.43                | 24          | Pass   |
| 802.11ac(20M)<br>(5.18GHz-5.24GHz)                    | CH36    | 5180                    | 14.55                | 24          | Pass   |
|                                                       | CH40    | 5200                    | 14.32                | 24          | Pass   |
|                                                       | CH48    | 5240                    | 14.13                | 24          | Pass   |
| 802.11n(40M)<br>(5.18GHz-5.24GHz)<br>Data rate 27Mbps | CH38    | 5190                    | 14.33                | 24          | Pass   |
|                                                       | CH46    | 5230                    | 13.65                | 24          | Pass   |
| 802.11ac(40M)<br>(5.18GHz-5.24GHz)                    | CH38    | 5190                    | 14.15                | 24          | Pass   |
|                                                       | CH46    | 5230                    | 13.57                | 24          | Pass   |



|                                                          |      |      |       |    |      |
|----------------------------------------------------------|------|------|-------|----|------|
| Data rate 27Mbps                                         |      |      |       |    |      |
| 802.11ac(80M)<br>(5.18GHz-5.24GHz)<br>Data rate 58.6Mbps | CH42 | 5210 | 13.58 | 24 | Pass |

## 12 Out of Band Emissions and Spurious Emission

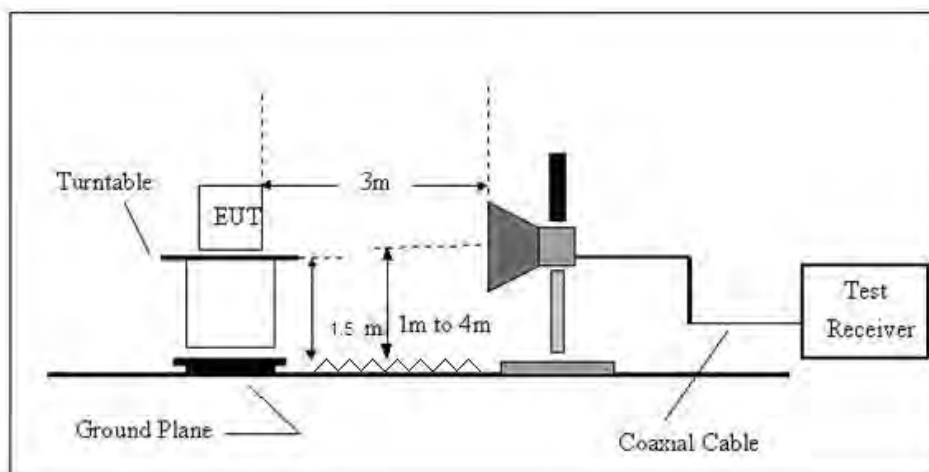
### 12.1 Test Standard and Limit

According to FCC §15.407(b)

Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (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.
- (2) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of  $-17$  dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of  $-27$  dBm/MHz.

### 12.2 Test Setup



### 12.3 Test Procedure

- a. The Transmitter output of EUT was connected to the spectrum analyzer.  
Equipment mode: Spectrum analyzer  
Detector function: Peak mode  
SPAN: 100MHz  
RBW: 1 MHz  
VBW: 1 MHz  
Sweep time= Auto.
- b. Using Peak Search to read the peak power of Carrier frequencies after Maximum Hold function is completed.



c. Find the next peak frequency outside the operation frequency band.

## 12.4 Test Data

Peak value:

| Test mode:      |                      | 802.11a       |                        |                |                |          |              |
|-----------------|----------------------|---------------|------------------------|----------------|----------------|----------|--------------|
| Frequency (MHz) | Reading Level (dBuV) | Factor (dB/m) | Measure Level (dBuV/m) | Limit (dBuV/m) | Over limit(dB) | Detector | Antenna Pol. |
| 5150            | 44.35                | 7.18          | 51.53                  | 68.2           | -16.67         | PK       | H            |
| 5150            | 43.24                | 7.18          | 50.42                  | 68.2           | -17.78         | PK       | V            |
| 5350            | 43.41                | 7.2           | 50.61                  | 68.2           | -17.59         | PK       | H            |
| 5350            | 49.23                | 7.2           | 56.43                  | 68.2           | -11.77         | PK       | V            |

Peak value:

| Test mode:      |                      | 802.11n(HT20) |                        |                |                |          |              |
|-----------------|----------------------|---------------|------------------------|----------------|----------------|----------|--------------|
| Frequency (MHz) | Reading Level (dBuV) | Factor (dB/m) | Measure Level (dBuV/m) | Limit (dBuV/m) | Over limit(dB) | Detector | Antenna Pol. |
| 5150            | 47.51                | 7.18          | 54.69                  | 68.2           | -13.51         | PK       | H            |
| 5150            | 54.16                | 7.18          | 61.34                  | 68.2           | -6.86          | PK       | V            |
| 5350            | 43.22                | 7.2           | 50.42                  | 68.2           | -17.78         | PK       | H            |
| 5350            | 50.11                | 7.2           | 57.31                  | 68.2           | -10.89         | PK       | V            |

Peak value:

| Test mode:      |               | 802.11n(HT40) |               |                |             |          |              |
|-----------------|---------------|---------------|---------------|----------------|-------------|----------|--------------|
| Frequency (MHz) | Reading Level | Factor        | Measure Level | Limit (dBuV/m) | Margin (dB) | Detector | Antenna Pol. |



|      |       |      |       |      |        |    |   |
|------|-------|------|-------|------|--------|----|---|
| 5150 | 42.81 | 7.18 | 49.99 | 68.2 | -18.21 | PK | H |
| 5150 | 43.16 | 7.18 | 50.34 | 68.2 | -17.86 | PK | V |
| 5350 | 43.88 | 7.2  | 51.08 | 68.2 | -17.12 | PK | H |
| 5350 | 47.14 | 7.2  | 54.34 | 68.2 | -13.86 | PK | V |

Peak value:

| Test mode:      |               | 802.11ac(VHT80) |               |                |             |          |              |
|-----------------|---------------|-----------------|---------------|----------------|-------------|----------|--------------|
| Frequency (MHz) | Reading Level | Factor          | Measure Level | Limit (dBuV/m) | Margin (dB) | Detector | Antenna Pol. |
| 5150            | 45.23         | 7.18            | 52.41         | 68.2           | -15.79      | PK       | H            |
| 5150            | 48.42         | 7.18            | 55.6          | 68.2           | -12.6       | PK       | V            |
| 5350            | 46.06         | 7.2             | 53.26         | 68.2           | -14.94      | PK       | H            |
| 5350            | 48.29         | 7.2             | 55.49         | 68.2           | -12.71      | PK       | V            |

Note:

1. Measure Level = Reading Level + Factor,
2. Factor = Antenna Factor + Cable Loss-Pre-amplifier,



## 13 Frequency Stability Measurement

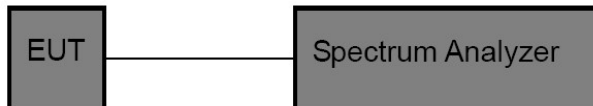
### 13.1 Test Standard and Limit

FCC

Manufactures of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

The transmitter center frequency tolerance shall be  $\pm 20$  ppm maximum for the 5 GHz band (IEEE 802.11n specification).

### 13.2 Test Setup



### 13.3 Test Procedure

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. EUT have transmitted absence of modulation signal and fixed channelize.
3. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth.
4. Set RBW = 10 kHz, VBW = 10 kHz with peak detector and maxhold settings.
5.  $f_c$  is declaring of channel frequency. Then the frequency error formula is  $(f_c - f)/f_c \times 10^6$  ppm and the limit is less than  $\pm 20$  ppm (IEEE 802.11n specification).
6. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value
7. Extreme temperature is  $-20^{\circ}\text{C} \sim 50^{\circ}\text{C}$ .

### 13.4 Test Data



| Temp.<br>(°C) | Operating<br>Frequency<br>(MHz) | 85%* voltage                | 100%* voltage               | 115%* voltage               |
|---------------|---------------------------------|-----------------------------|-----------------------------|-----------------------------|
|               |                                 | Measured Frequency<br>(MHz) | Measured Frequency<br>(MHz) | Measured Frequency<br>(MHz) |
| -20           | 5180                            | 5179.8107                   | 5180.3083                   | 5179.9329                   |
|               | 5200                            | 5199.4925                   | 5200.5183                   | 5199.7750                   |
|               | 5220                            | 5219.4807                   | 5220.4902                   | 5219.6651                   |
|               | 5240                            | 5239.2352                   | 5240.2261                   | 5239.0199                   |
| -10           | 5180                            | 5179.0571                   | 5180.3766                   | 5178.9596                   |
|               | 5200                            | 5199.9289                   | 5200.7507                   | 5199.0634                   |
|               | 5220                            | 5219.6564                   | 5220.6702                   | 5219.5465                   |
|               | 5240                            | 5239.4799                   | 5240.6293                   | 5239.2351                   |
| 0             | 5180                            | 5180.0490                   | 5180.6005                   | 5179.3446                   |
|               | 5200                            | 5199.4503                   | 5200.6680                   | 5199.8630                   |
|               | 5220                            | 5219.1149                   | 5219.9097                   | 5219.9018                   |
|               | 5240                            | 5239.4125                   | 5240.7923                   | 5239.4531                   |
| 10            | 5180                            | 5179.5457                   | 5178.7942                   | 5178.9639                   |
|               | 5200                            | 5200.0149                   | 5199.6529                   | 5199.3279                   |
|               | 5220                            | 5220.1511                   | 5220.0729                   | 5219.6944                   |
|               | 5240                            | 5240.4268                   | 5239.5899                   | 5238.8420                   |
| 20            | 5180                            | 5180.1790                   | 5179.9956                   | 5179.6427                   |
|               | 5200                            | 5199.4948                   | 5199.2463                   | 5198.9936                   |
|               | 5220                            | 5220.1770                   | 5219.6317                   | 5219.1020                   |
|               | 5240                            | 5240.0263                   | 5239.8042                   | 5238.6267                   |
| 20            | 5180                            | 5180.7197                   | 5180.2893                   | 5179.7183                   |
|               | 5200                            | 5199.5461                   | 5199.3938                   | 5199.2718                   |
|               | 5220                            | 5219.4583                   | 5218.5625                   | 5218.3255                   |
|               | 5240                            | 5239.6103                   | 5239.2284                   | 5239.2531                   |



|    |      |           |           |           |
|----|------|-----------|-----------|-----------|
| 30 | 5180 | 5180.1823 | 5179.9403 | 5178.9336 |
|    | 5200 | 5200.5431 | 5200.0937 | 5199.2221 |
|    | 5220 | 5220.3454 | 5219.8350 | 5219.1974 |
|    | 5240 | 5239.9105 | 5239.7707 | 5238.6874 |
| 40 | 5180 | 5180.0484 | 5179.0968 | 5179.2482 |
|    | 5200 | 5200.2703 | 5199.9380 | 5199.8208 |
|    | 5220 | 5219.5492 | 5219.3435 | 5218.6349 |
|    | 5240 | 5239.8076 | 5239.2484 | 5239.5698 |
| 50 | 5180 | 5180.0277 | 5180.0868 | 5179.9272 |
|    | 5200 | 5199.9963 | 5200.8422 | 5199.3159 |
|    | 5220 | 5219.8063 | 5220.3181 | 5220.0618 |
|    | 5240 | 5239.9478 | 5240.6941 | 5239.6616 |



## 14 Antenna Requirement

### 14.1 Test Standard and Requirement

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Standard | FCC Part15 Section 15.203                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Requirement   | <p>1) 15.203 requirement:</p> <p>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, 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.</p> |

### 14.2 Antenna Connected Construction

The antenna is Internal Antenna which permanently attached, and the best case gain of the antenna is 2.38 dBi(WIFI 5.1G),It complies with the standard requirement.



## 15 TEST SETUP & EUT PHOTOGRAPH

Please see the attachment for details.

----- End of Report -----