# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

*OF*

**MAVPSG1**

**Model No.: K140A1, K140A2, K140L1, K140L2**

**FCC ID: 2ATBXK140L1**

**Trademark: MOOD:**

**Report No.: E01A22010552F01303**

**Issue Date: Mar. 30, 2022**

*Prepared for*

**DMX, LLC**

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*Prepared by*

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## VERIFICATION OF COMPLIANCE

| | |
|---|---|
| Applicant: | DMX, LLC<br>2100 South Interstate Highway 35, Suite 200, Austin, TX 78704 U.S.A. |
| Manufacturer: | Sunniwell Co., Ltd.<br>1717 Haitai Building 229# Beisihuan Zhong Road, Bei jing, China |
| Product Description: | MAVPSG1 |
| Trade Mark: | MOOD: |
| Model Number: | K140A1, K140A2, K140L1, K140L2<br>(All models are the same except for the model name, we choose model: K140A1 for all tests.) |

### We hereby certify that:

The above equipment was tested by Dong Guan Anci Electronic Technology Co., Ltd.The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10-2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247(2021).

Date of Test : Jan. 24, 2022 to Mar. 24, 2022

Prepared by : Tomas Yang/Supervisor

Reviewer & Authorized Signer : Alan He/Manager

# Modified Information

| Version | Summary | Revision Date | Report No. |
|---|---|---|---|
| Ver.1.0 | Original Report | / | E01A22010552F01303 |
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# 1. General Information

## 1.1 Product Description

| Characteristics | Description |
|---|---|
| **Product Name** | MAVPSG1 |
| **Model number** | K140A1 |
| **Power Supply** | DC 12V, 1A from adapter |
| **Test Power Supply** | AC 120V/60Hz for adapter |
| **Adapter Information** | Model: GSCU1000S012V18Y<br>Input: 100-240V~50/60Hz 0.5A max<br>Output: DC 12V, 1A |
| **IEEE 802.11 WLAN Mode Supported** | ☒802.11b(20MHz channel bandwidth)<br>☒802.11g(20MHz channel bandwidth)<br>☒802.11n(20MHz channel bandwidth)<br>☒802.11n(40MHz channel bandwidth) |
| **MIMO Mode** | 802.11n(HT20), 802.11n(HT40) |
| **Modulation** | DSSS with DBPSK/DQPSK/CCK for 802.11b;<br>OFDM with BPSK/QPSK/16QAM/64QAM for 802.11g/n; |
| **Operating Frequency Range** | 2412-2462MHz for 802.11b/g;<br>2412-2462MHz for 802.11n(HT20);<br>2422-2452MHz for 802.11n(HT40); |
| **Number of Channels** | 11 channels for 802.11b/g;<br>11 channels for 802.11n(HT20);<br>7 channels for 802.11n(HT40); |
| **Transmit Power Max** | 21.36dBm for 802.11b;<br>24.28dBm for 802.11g;<br>26.95dBm for 802.11n(HT20);<br>27.52 dBm for 802.11n(HT40); |
| **Antenna Type** | 2TX2RX |
| **Antenna Port** | ☒Ant1; ☒Ant2; |
| **Smart system** | ☒SISO for 802.11b/g<br>☒MIMO for 802.11n |
| **Antenna Gain** | 2.17dBi ( for per antenna port Max)<br>5.18dBi for MIMO(Ant1+Ant2 Directional Gain) |
| **Antenna Type** | PIFA antenna |

***Note:*** *for more details, please refer to the User's manual of the EUT.*

# 2. System Test Configuration

## 2.1 EUT Configuration

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

## 2.2 EUT Exercise

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

## 2.3 Test Procedure

### 2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode.

### 2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. Emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013.

## 2.4 Configuration of Tested System

**Fig. 2-1 Configuration of Tested System**

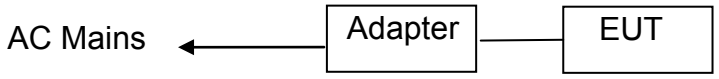


**Table 2-1 Equipment Used in Tested System**

| Item | Equipment | Trademark | Model No. | FCC ID | Note |
|---|---|---|---|---|---|
| 1. | MAVPSG1 | MOOD: | K140A1 | 2ATBXK140L1 | ***EUT*** |
| 2. | Adapter | GSP | Model: GSCU1000S012V 18Y Input: 100-240V~50/60Hz 0.5A max Output: DC 12V, 1A | N/A | ***Support Equipment*** |

**Note:**

(1) Unless otherwise denoted as EUT in『Remark』column, device(s) used in tested system is a support equipment.

# 3. Description of Test Modes

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

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

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

Those data rates (802.11b: 1 Mbps; 802.11g: 6 Mbps; 802.11n (HT20 ): MCS0; 802.11n (HT40 ): MCS0) were used for all test.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting mode is programmed. EUT is connected by com port, and transimit the control instruction via test software(Realtek wlan test tool.apk).

Frequency and Channel list for 802.11 b/g/n (HT20):

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

Frequency and Channel list for 802.11 n (HT40):

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---|---|---|---|---|---|
| 3 | 2422 | 5 | 2432 | 8 | 2447 |
| 4 | 2427 | 6 | 2437 | 9 | 2452 |
| | | 7 | 2442 | | |

Test Frequency and Channel for 802.11 b/g/n (HT20):

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

Test Frequency and channel for 802.11 n (HT40):

| Lowest Frequency | | Middle Frequency | | Highest Frequency | |
|---|---|---|---|---|---|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 3 | 2422 | 6 | 2437 | 9 | 2452 |

Operated Mode for Worst Duty cycle:

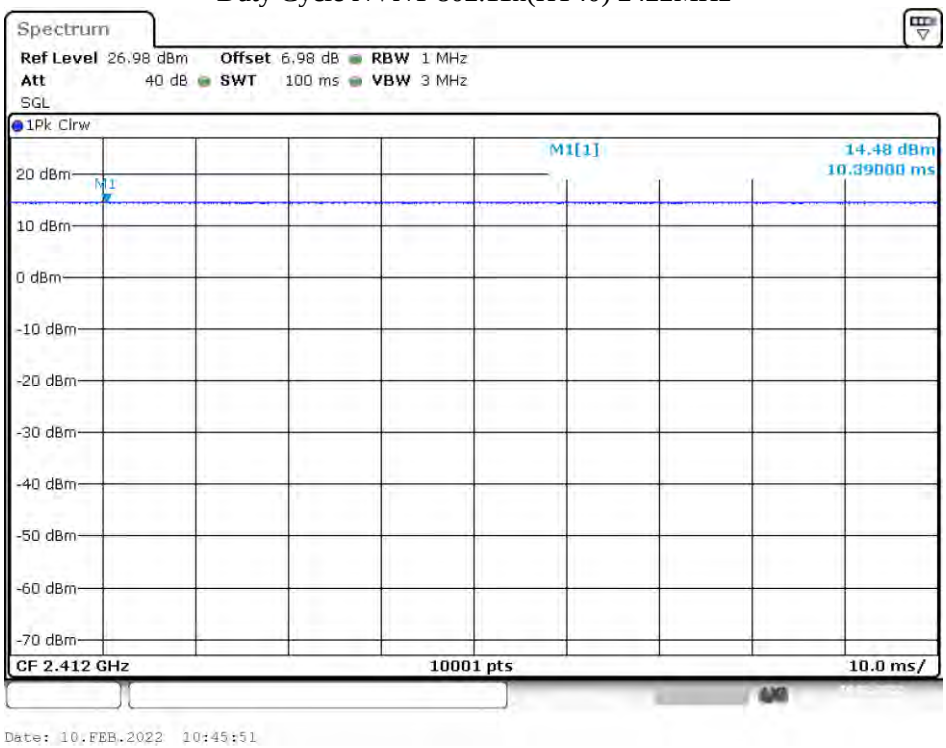
We tested antenna A and antenna B. The test results are similar, the worst test data for Antenna A:

Duty Cycle:

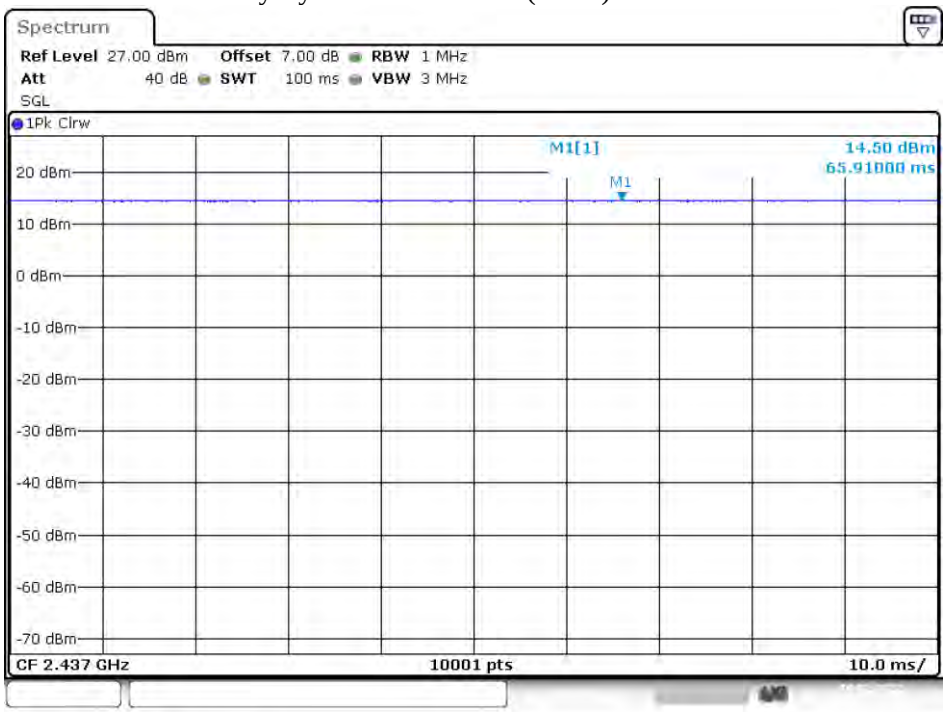
| Mode | Frequency (MHz) | Duty Cycle (%) | Correction Factor (dB) |
|---|---|---|---|
| 802.11b | 2412 | 100 | 0 |
| 802.11b | 2437 | 100 | 0 |
| 802.11b | 2462 | 100 | 0 |
| 802.11g | 2412 | 100 | 0 |
| 802.11g | 2437 | 100 | 0 |
| 802.11g | 2462 | 100 | 0 |
| 802.11n(HT20) | 2412 | 100 | 0 |
| 802.11n(HT20) | 2437 | 100 | 0 |
| 802.11n(HT20) | 2462 | 100 | 0 |
| 802.11n(HT40) | 2422 | 100 | 0 |
| 802.11n(HT40) | 2437 | 100 | 0 |
| 802.11n(HT40) | 2452 | 100 | 0 |

All the modulation modes were tested the data of the worst mode (TX 802.11b) are recorded in the following pages:

Duty Cycle NVNT 802.11n(HT40) 2422MHz



Duty Cycle NVNT 802.11n(HT40) 2437MHz

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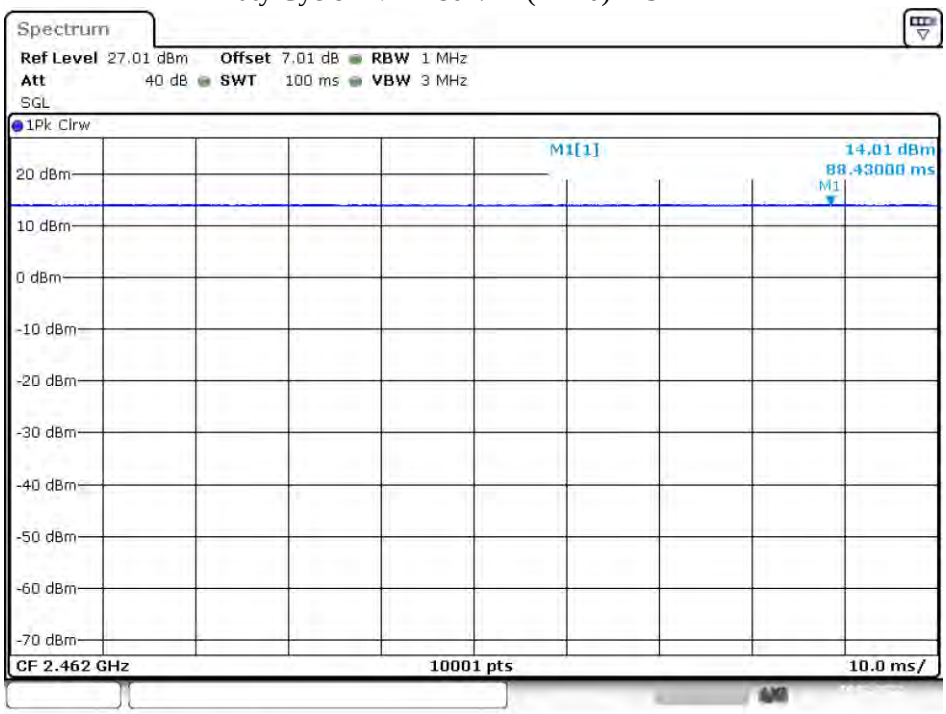
Duty Cycle NVNT 802.11n(HT40) 2452MHz

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# 4. Summary of Test Results

| FCC Rules | Description Of Test | Result |
|---|---|---|
| §15.247(a)(2) | 6dB bandwidth | Pass |
| §15.247(b)(3) | Max Peak output Power test | Pass |
| §15.247(e) | Power density | Pass |
| §15.247(d) | Band edge test | Pass |
| §15.207 | AC Power Conducted Emission | Pass |
| §15.247(d), §15.209 | Radiated Emission | Pass |
| §15.247(d) | Antenna Port Emission | Pass |
| §15.247(b)&§15.203 | Antenna Application | Pass |

RELATED SUBMITTAL(S) / GRANT(S):

This submittal(s) (test report) is intended for FCC ID: 2ATBXK140L1 filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

# 5. Test Methodology

According to its specifications, the EUT must comply with the requirements of the following standards:
FCC 47 CFR Part 2, Subpart J
FCC 47 CFR Part 15, Subpart C
KDB 558074 D01 15.247 Meas Guidance v05r02
FCC KDB 662911 D01 Multiple Transmitter Output v02r01
FCC KDB 662911 D02 MIMO With Cross Polarized Antenna V01

# 6. Test Facility

Site Description

| | | |
|---|---|---|
| EMC Lab | : | Accredited by CNAS, 2017.06.26<br>The certificate is valid until 2022.10.28<br>The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2006 (identical to ISO/IEC 17025:2005)<br>The Certificate Registration Number is L6214.<br><br>Accredited by A2LA, 2018.03.15<br>The Certificate Number is 4422.01.<br>. |
| Name of Firm | : | Dong Guan Anci Electronic Technology Co., Ltd.<br>1-2 Floor, Building A, No.11, Headquarters 2 Road, Songshan, Lake Hi-tech Industrial Development Zone, Dongguan City, Guangdong Pr., China. |

# 7. TEST SYSTEM UNCERTAINTY

The following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| Parameter | Uncertainty |
|---|---|
| Radio Frequency | ±1x10^-5 |
| Maximum Peak Output Power Test | ±1.0dB |
| Conducted Emissions Test | ±2.0dB |
| Radiated Emission Test | ±2.0dB |
| Power Density | ±2.0dB |
| Occupied Bandwidth Test | ±1.0dB |
| Band Edge Test | ±3dB |
| All emission, radiated | ±3dB |
| Antenna Port Emission | ±3dB |
| Temperature | ±0.5℃ |
| Humidity | ±3% |

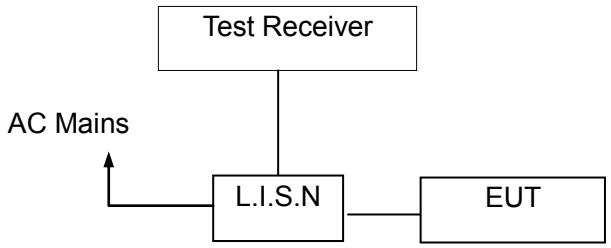
Measurement Uncertainty for a level of Confidence of 95%

# 8. Conducted Emissions Test

## 8.1 Measurement Procedure

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

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




## 8.3 Measurement Equipment Used

| Conducted Emission Test Site | | | | |
|---|---|---|---|---|
| **EQUIPMENT TYPE** | **MFR** | **MODEL NUMBER** | **SERIAL NUMBER** | **Calibrated until** |
| L.I.S.N | SCHWARZBECK | NSLK 8127 | 8127-669 | 2022-05-17 |
| 10 db attenuator | JFW | 50FP-010-H4 | 4360846-427-1 | 2022-05-17 |
| RF Cable | N/A | N/A | 2# | 2022-05-17 |
| EMI Test Receiver | ROHDE&SCHWARZ | ESCI | 101358 | 2022-05-17 |
| Shielded Room | chengyu | 8m*4m*3m | N/A | 2022-05-17 |
| Test Software | Farad | EZ-EMC Ver:ANCI-8A1 | N/A | N/A |

## 8.4 Conducted Emission Limit

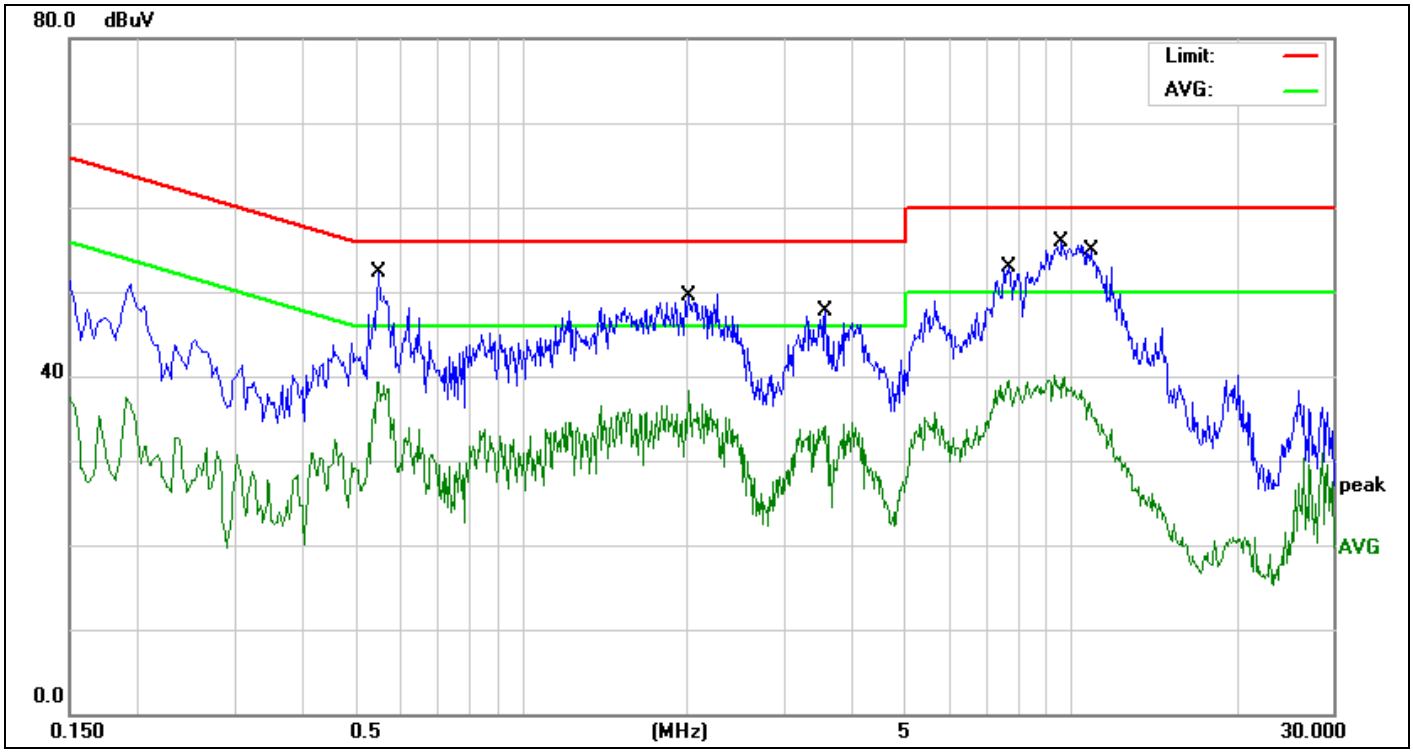
**Conducted Emission**

| **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.

## 8.5 Measurement Result

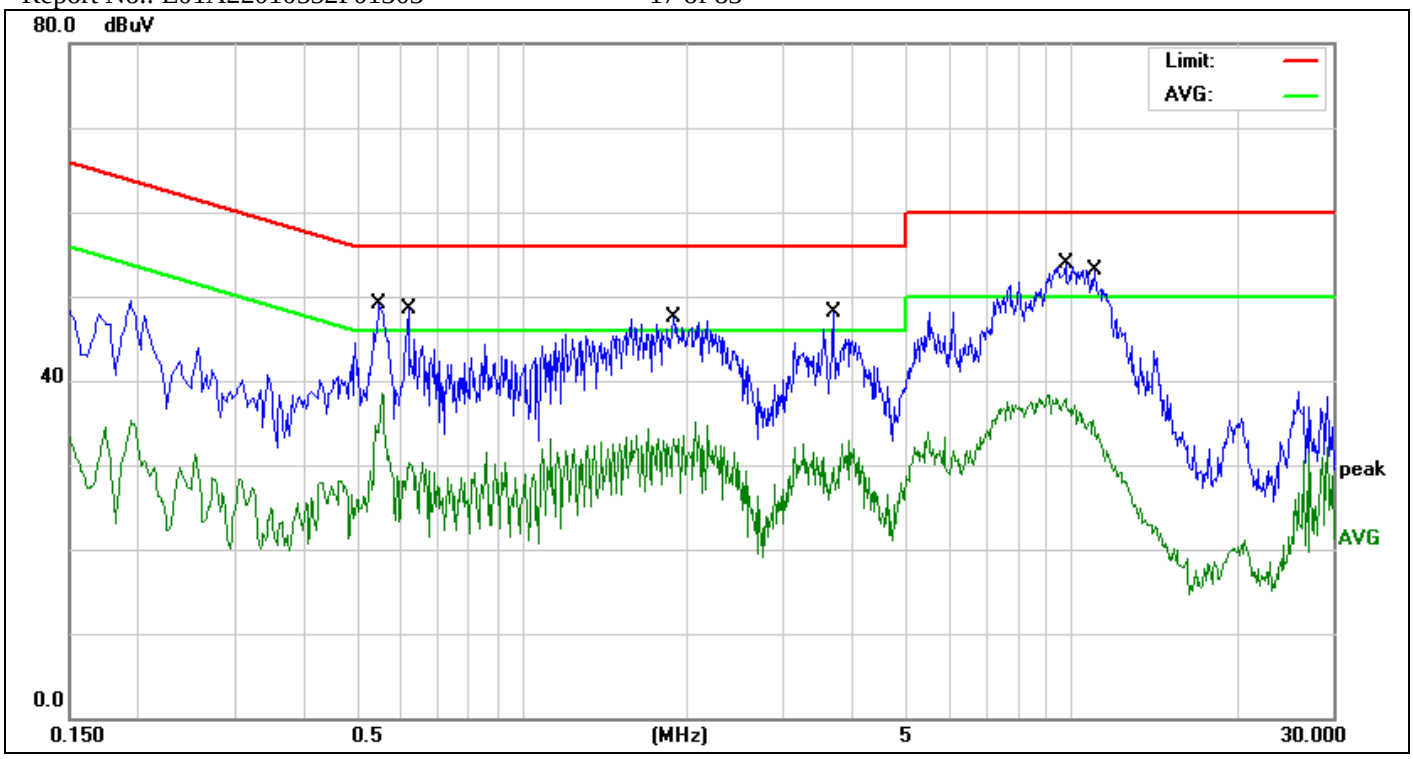
All the modulation modes were tested the data of the worst mode (TX 802.11n HT40 MIMO 2452MHz) are recorded in the following pages and the others modulation methods do not exceed the limits. Please refer to following pages.




| | | | |
|---|---|---|---|
| **Site:** | **843** | **Phase:L1** | **Temperature(C):26(C)** |
| **Limit:** | **FCC PART 15C Conduction(QP)** | | **Humidity(%):60%** |
| **EUT:** | **MAVPSG1** | **Test Time:** | **2022-02-09** |
| **M/N.:** | **K140A1** | **Power Rating:** | **AC 120V/60Hz** |
| **Mode:** | **WIFI TX2452** | **Test Engineer:** | **Sunshine** |
| **Note:** | | | |

| No. | Frequency (MHz) | Reading Level(dBuV) | Factor (dB) | Measure-ment(dBuV) | Limit (dBuV) | Over (dB) | Detector | Comment |
|---|---|---|---|---|---|---|---|---|
| 1 * | 0.5500 | 35.98 | 10.35 | 46.33 | 56.00 | -9.67 | QP | |
| 2 | 0.5500 | 25.58 | 10.35 | 35.93 | 46.00 | -10.07 | AVG | |
| 3 | 2.0220 | 32.16 | 10.41 | 42.57 | 56.00 | -13.43 | QP | |
| 4 | 2.0220 | 21.12 | 10.41 | 31.53 | 46.00 | -14.47 | AVG | |
| 5 | 3.5780 | 29.34 | 10.48 | 39.82 | 56.00 | -16.18 | QP | |
| 6 | 3.5780 | 18.78 | 10.48 | 29.26 | 46.00 | -16.74 | AVG | |
| 7 | 7.6900 | 36.26 | 10.72 | 46.98 | 60.00 | -13.02 | QP | |
| 8 | 7.6900 | 25.31 | 10.72 | 36.03 | 50.00 | -13.97 | AVG | |
| 9 | 9.6220 | 38.19 | 10.87 | 49.06 | 60.00 | -10.94 | QP | |
| 10 | 9.6220 | 25.62 | 10.87 | 36.49 | 50.00 | -13.51 | AVG | |
| 11 | 10.8620 | 36.77 | 10.96 | 47.73 | 60.00 | -12.27 | QP | |
| 12 | 10.8620 | 23.03 | 10.96 | 33.99 | 50.00 | -16.01 | AVG | |

*:Maximum data x:Over limit !:over margin




| | | | |
|---|---|---|---|
| **Site:** | **843** | **Phase:N** | **Temperature(C):26(C)** |
| **Limit:** | **FCC PART 15C Conduction(QP)** | | **Humidity(%):60%** |
| **EUT:** | **MAVPSG1** | **Test Time:** | **2022-02-09** |
| **M/N.:** | **K140A1** | **Power Rating:** | **AC 120V/60Hz** |
| **Mode:** | **WIFI TX2452** | **Test Engineer:** | **Sunshine** |
| **Note:** | | | |

| No. | Frequency (MHz) | Reading Level(dBuV) | Factor (dB) | Measure-ment(dBuV) | Limit (dBuV) | Over (dB) | Detector | Comment |
|---|---|---|---|---|---|---|---|---|
| 1 * | 0.5500 | 33.43 | 10.35 | 43.78 | 56.00 | -12.22 | QP | |
| 2 | 0.5500 | 23.31 | 10.35 | 33.66 | 46.00 | -12.34 | AVG | |
| 3 | 0.6220 | 29.08 | 10.37 | 39.45 | 56.00 | -16.55 | QP | |
| 4 | 0.6220 | 17.69 | 10.37 | 28.06 | 46.00 | -17.94 | AVG | |
| 5 | 1.8940 | 31.01 | 10.41 | 41.42 | 56.00 | -14.58 | QP | |
| 6 | 1.8940 | 20.14 | 10.41 | 30.55 | 46.00 | -15.45 | AVG | |
| 7 | 3.6940 | 25.60 | 10.50 | 36.10 | 56.00 | -19.90 | QP | |
| 8 | 3.6940 | 14.54 | 10.50 | 25.04 | 46.00 | -20.96 | AVG | |
| 9 | 9.7820 | 35.74 | 10.90 | 46.64 | 60.00 | -13.36 | QP | |
| 10 | 9.7820 | 24.09 | 10.90 | 34.99 | 50.00 | -15.01 | AVG | |
| 11 | 11.0219 | 33.35 | 10.97 | 44.32 | 60.00 | -15.68 | QP | |
| 12 | 11.0219 | 21.62 | 10.97 | 32.59 | 50.00 | -17.41 | AVG | |

*:Maximum data x:Over limit !:over margin

# 9. Radiated Emission Test

## 9.1 Measurement Procedure

1. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane, And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measured was complete.

When spectrum scanned from 30MHz to 1GHz setting resolution bandwidth 120KHz and video bandwidth 300KHz:

| EMI Test Receiver | Setting |
|---|---|
| Attenuation | Auto |
| RBW | 120KHz |
| VBW | 300KHz |
| Detector | QP |
| Trace | Max hold |

When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 3MHz:

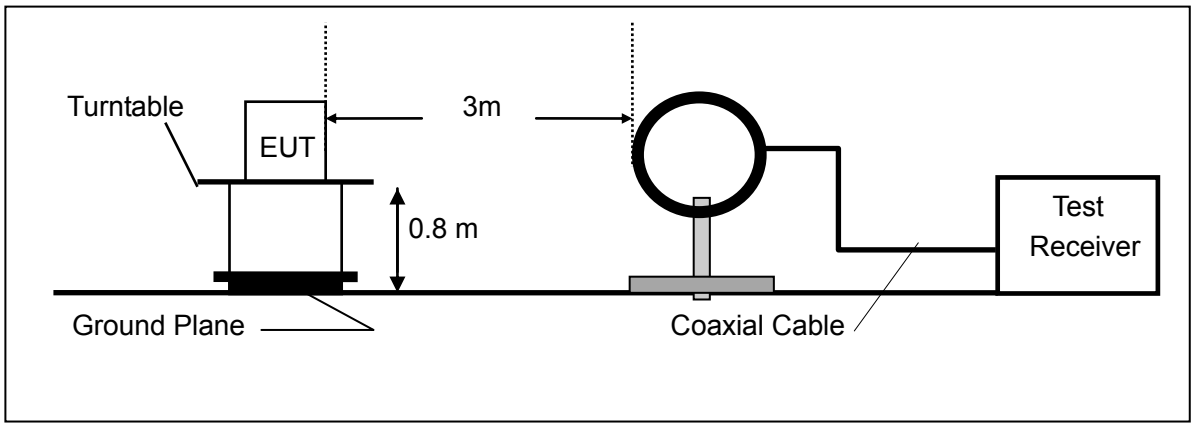
| EMI Test Receiver | Setting |
|---|---|
| Attenuation | Auto |
| RBW | 1MHz |
| VBW | 3MHz |
| Detector | Peak |
| Trace | Max hold |

When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 10Hz:

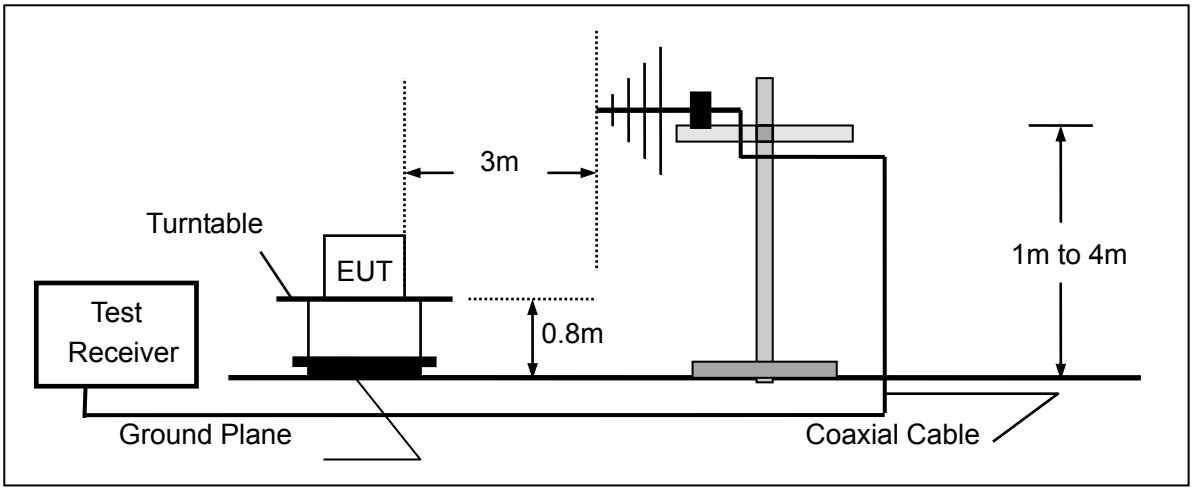
| EMI Test Receiver | Setting |
|---|---|
| Attenuation | Auto |
| RBW | 1MHz |
| VBW | 10Hz |
| Detector | Peak |
| Trace | Max hold |

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

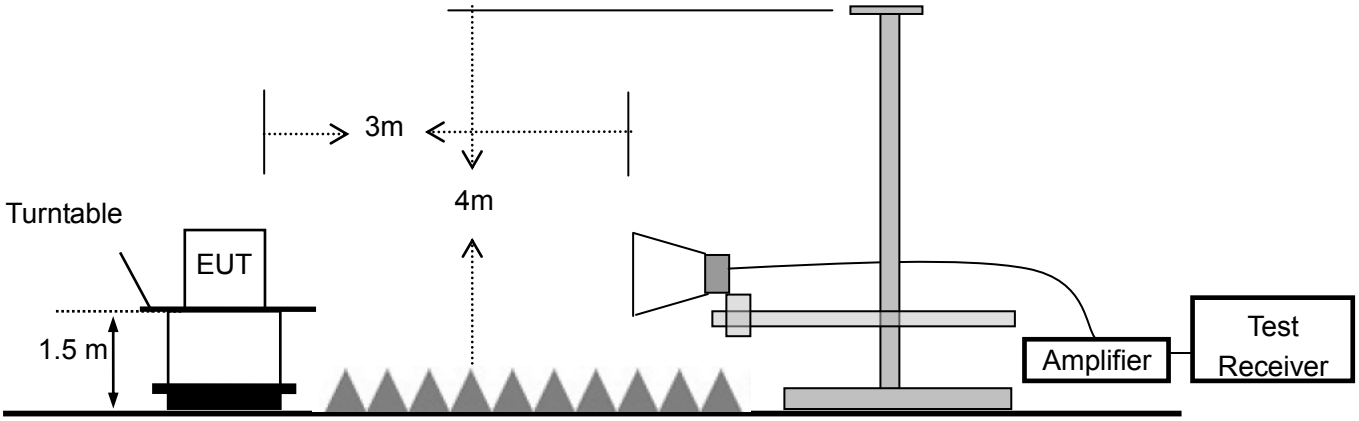
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz




(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz




## 9.3 Measurement Equipment Used

| Item | Equipment | Manufacturer | Model No. | Serial No. | Calibrated until |
|---|---|---|---|---|---|
| 1. | EMI Test Receiver | Rohde & Schwarz | ESPI | 100502 | 2022-11-12 |
| 2. | Pre-Amplifier | HP | 8447D | 2727A06172 | 2022-05-17 |
| 3. | Bilog Antenna | Schwarzbeck | VULB9163 | VULB9163-588 | 2022-05-17 |
| 4. | Loop Antenna | Schwarzbeck | FMZB 1516 | 1516-141 | 2022-11-12 |
| 5. | Spectrum Analyzer | Rohde & Schwarz | FSV40 | US40240623 | 2022-11-12 |
| 6. | Low noise Amplifiers | A-INFO | LA1018N4009 | J1013130524001 | 2022-05-17 |
| 7. | Horn antenna | A-INFO | LB-10180-SF | J2031090612123 | 2022-05-17 |
| 8. | Broadband RF Power Amplifier | AEROFLEX | AEROFLEX100KHz-40GHz | J1013130524001 | 2022-11-12 |
| 9. | DRG Horm Antenna | A.H.SYSTEMS | SAS-574 | J2031090612123 | 2022-11-12 |
| 10. | RF Cable | Gigalink Microwave | ZT40-2.92J-2.92J-2m | N/A | 2022-11-12 |
| 11. | RF Cable | Gigalink Microwave | ZT40-2.92J-2.92J-0.3m | N/A | 2022-11-12 |
| 12. | RF Cable | N/A | N/A | 6# | 2022-05-17 |
| 13. | RF Cable | N/A | N/A | 1-1# | 2022-05-17 |
| 14. | RF Cable | N/A | N/A | 1-2# | 2022-05-17 |
| 15. | RF Cable | N/A | N/A | 7# | 2022-05-17 |
| 16. | 3m Semi-anechoic Chamber | chengyu | 9m*6m*6m | N/A | 2022-05-17 |
| 17. | Test Software | Farad | EZ-EMC Ver:ANCI-3A1 | N/A | N/A |

## 9.4 Radiated Emission Limit

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table15.209(a):

| Frequencies (MHz) | Field Strength (micorvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009~0.490 | 2400/F(KHz) | 300 |
| 0.490~1.705 | 24000/F(KHz) | 30 |
| 1.705~30.0 | 30 | 30 |
| 30~88 | 100 | 3 |
| 88~216 | 150 | 3 |
| 216~960 | 200 | 3 |
| Above 960 | 500 | 3 |

Restricted bands of operation

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

Remark : 1. Emission level in dBuV/m=20 log (uV/m)

2. Measurement was performed at an antenna to the closed point of EUT distance of meters.

3. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of ξ 15.205, and the emissions located in restricted bands also comply with 15.209 limit.

## 9.5 Measurement Result

**Below 30MHz:**

All the modulation modes were tested the data of the test mode are recorded in the following pages.

| | | | |
|---|---|---|---|
| Operation Mode: | TX Mode | Test Date : | 2022-02-08 |
| Frequency Range: | 9KHz~30MHz | Temperature : | 28℃ |
| Test Result: | PASS | Humidity : | 60 % |
| Measured Distance: | 3m | Test By: | Andy |

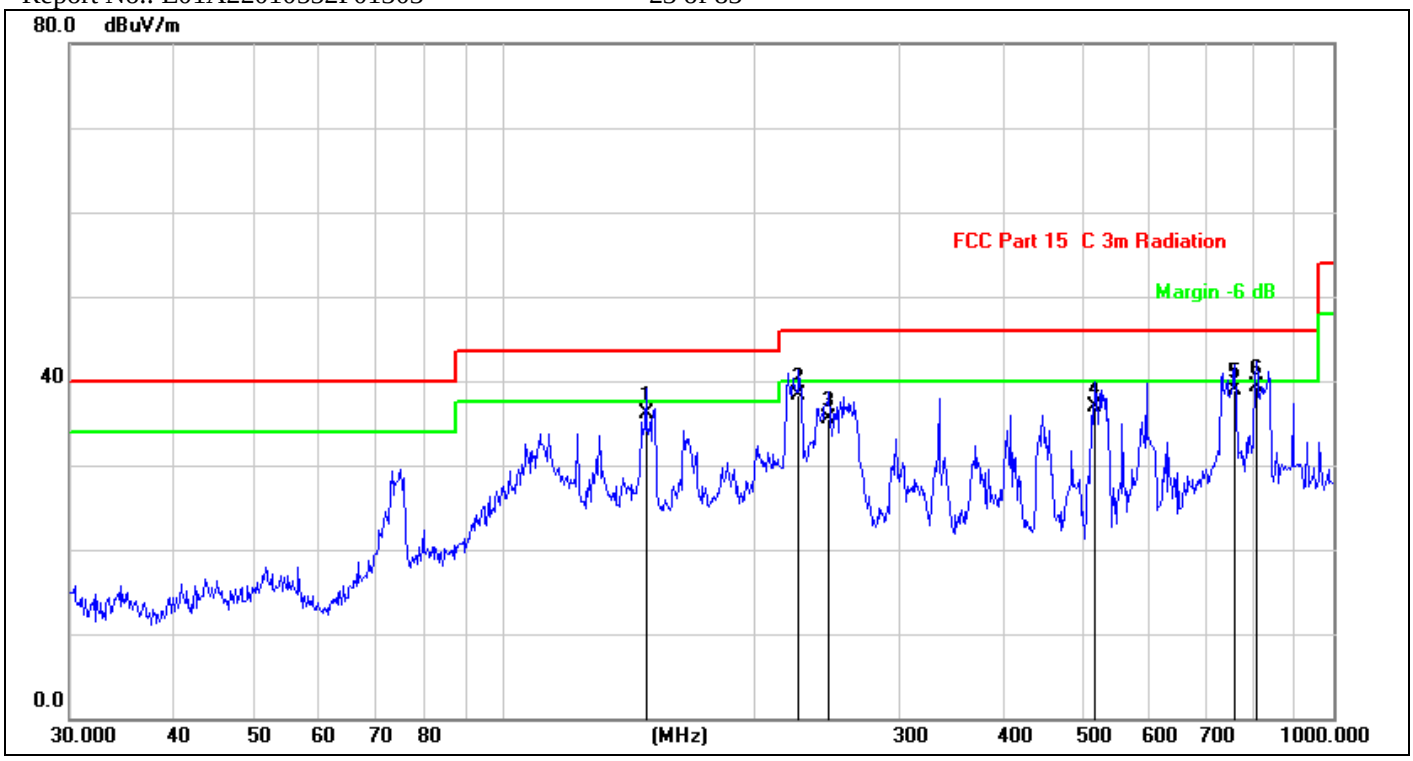
| Freq. (MHz) | Ant.Pol. H/V | Emission Level (dBuV/m) | Limit 3m (dBuV/m) | Over (dB) |
|---|---|---|---|---|
| -- | -- | -- | -- | -- |

Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.
Distance extrapolation factor =40log(Specific distance/ test distance)( dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

**Below 1000MHz:**

All the modulation modes were tested the data of the worst mode (ANT1: 802.11b 2412MHz) are recorded in the following pages and the others modulation methods do not exceed the limits.

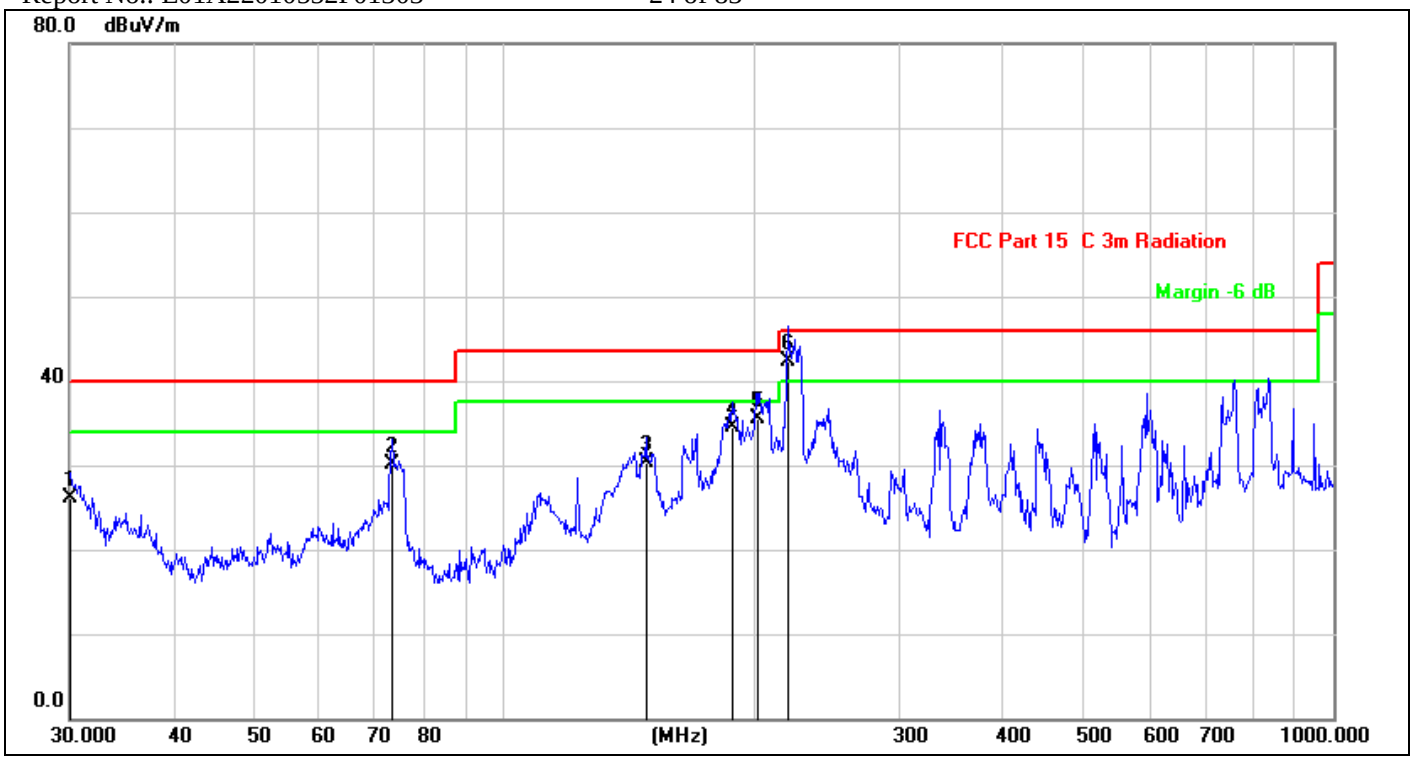
Please refer to the following test plots:




| | | | |
|---|---|---|---|
| **Site:** | **LAB** | **Antenna::Horizontal** | **Temperature(C):26(C)** |
| **Limit:** | **FCC Part 15 C 3m Radiation** | | **Humidity(%):60%** |
| **EUT:** | **MAVPSG1** | **Test Time:** | **2022-02-09** |
| **M/N.:** | **K140A1** | **Power Rating:** | **AC 120V/60Hz** |
| **Mode:** | **TX2412** | **Test Engineer:** | **Dyson** |
| **Note:** | | | |

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Det. | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 148.4410 | 54.81 | -18.70 | 36.11 | 43.50 | -7.39 | QP | |
| 2 | 226.8936 | 53.52 | -15.22 | 38.30 | 46.00 | -7.70 | QP | |
| 3 | 246.8146 | 50.46 | -14.86 | 35.60 | 46.00 | -10.40 | QP | |
| 4 | 515.4374 | 46.95 | -10.04 | 36.91 | 46.00 | -9.09 | QP | |
| 5 | 760.7036 | 44.03 | -5.22 | 38.81 | 46.00 | -7.19 | QP | |
| 6 * | 807.4288 | 44.04 | -4.77 | 39.27 | 46.00 | -6.73 | QP | |

Note: 1. Result Level = Read Level+ Antenna Factor+ Cable Loss- Amp. Factor




| | | | |
|---|---|---|---|
| **Site:** | **LAB** | **Antenna::Vertical** | **Temperature(C):26(C)** |
| **Limit:** | **FCC Part 15 C 3m Radiation** | | **Humidity(%):60%** |
| **EUT:** | **MAVPSG1** | **Test Time:** | **2022-02-09** |
| **M/N.:** | **K140A1** | **Power Rating:** | **AC 120V/60Hz** |
| **Mode:** | **TX2412** | **Test Engineer:** | **Dyson** |
| **Note:** | | | |

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Det. | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 30.1051 | 43.89 | -17.79 | 26.10 | 40.00 | -13.90 | QP | |
| 2 | 73.3593 | 49.54 | -19.41 | 30.13 | 40.00 | -9.87 | QP | |
| 3 | 148.4410 | 49.06 | -18.70 | 30.36 | 43.50 | -13.14 | QP | |
| 4 | 188.4122 | 51.22 | -16.80 | 34.42 | 43.50 | -9.08 | QP | |
| 5 | 202.1005 | 51.24 | -15.68 | 35.56 | 43.50 | -7.94 | QP | |
| 6 * | 219.8449 | 57.65 | -15.35 | 42.30 | 46.00 | -3.70 | QP | |

Note: 1. Result Level = Read Level+ Antenna Factor+ Cable Loss- Amp. Factor

**Above 1000MHz:**

Operation Mode: 802.11b Lowest Test Date : 2022-02-09
Test Voltage: AC 120V/60Hz Test by: Andy

| Freq. | Ant. Pol. | Reading Level(dBuV/m) | | Correct Factor | Emission Level(dBuV/m) | | Limit 3m(dBuV/m | | Margin(dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| (MHz) | H/V | PK | AV | dB | PK | AV | PK | AV | PK | AV |
| 4824 | V | 95.88 | 77.07 | -32.3 | 63.58 | 44.77 | 74 | 54 | -10.42 | -9.23 |
| 7236 | V | 99.69 | 81.32 | -37.2 | 62.49 | 44.12 | 74 | 54 | -11.51 | -9.88 |
| 9648 | V | 103.36 | 83.83 | -39.8 | 63.56 | 44.03 | 74 | 54 | -10.44 | -9.97 |
| 12060 | V | 103.64 | 84.09 | -40.5 | 63.14 | 43.59 | 74 | 54 | -10.86 | -10.41 |
| 14472 | V | 105.75 | 84.82 | -41.7 | 64.05 | 43.12 | 74 | 54 | -9.95 | -10.88 |
| 16884 | V | 102.49 | 83.88 | -40 | 62.49 | 43.88 | 74 | 54 | -11.51 | -10.12 |
| 4824 | H | 93.73 | 74.57 | -31.6 | 62.13 | 42.97 | 74 | 54 | -11.87 | -11.03 |
| 7236 | H | 98.17 | 78.11 | -35.5 | 62.67 | 42.61 | 74 | 54 | -11.33 | -11.39 |
| 9648 | H | 99.85 | 80.77 | -38.3 | 61.55 | 42.47 | 74 | 54 | -12.45 | -11.53 |
| 12060 | H | 100.94 | 80.59 | -39 | 61.94 | 41.59 | 74 | 54 | -12.06 | -12.41 |
| 14472 | H | 102.85 | 83.67 | -42 | 60.85 | 41.67 | 74 | 54 | -13.15 | -12.33 |
| 16884 | H | 100.24 | 79.63 | -39.3 | 60.94 | 40.33 | 74 | 54 | -13.06 | -13.67 |

Operation Mode: 802.11b Middle Test Date : 2022-02-09
Test Voltage: AC 120V/60Hz Test by: Andy

| Freq. | Ant. Pol. | Reading Level(dBuV/m) | | Correct Factor | Emission Level(dBuV/m) | | Limit 3m(dBuV/m) | | Margin(dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| (MHz) | H/V | PK | AV | dB | PK | AV | PK | AV | PK | AV |
| 4874 | V | 96.32 | 75.89 | -32.3 | 64.02 | 43.59 | 74 | 54 | -9.98 | -10.41 |
| 7311 | V | 101.31 | 80.84 | -37.2 | 64.11 | 43.64 | 74 | 54 | -9.89 | -10.36 |
| 9688 | V | 103.39 | 83.01 | -39.8 | 63.59 | 43.21 | 74 | 54 | -10.41 | -10.79 |
| 12185 | V | 103.83 | 82.68 | -40.5 | 63.33 | 42.18 | 74 | 54 | -10.67 | -11.82 |
| 14622 | V | 103.69 | 83.16 | -41 | 62.69 | 42.16 | 74 | 54 | -11.31 | -11.84 |
| 17059 | V | 104.58 | 83.25 | -41.1 | 63.48 | 42.15 | 74 | 54 | -10.52 | -11.85 |
| 4874 | H | 93.74 | 72.17 | -31.6 | 62.14 | 40.57 | 74 | 54 | -11.86 | -13.43 |
| 7311 | H | 96.59 | 75.61 | -35.5 | 61.09 | 40.11 | 74 | 54 | -12.91 | -13.89 |
| 9688 | H | 101.72 | 77.89 | -38.3 | 63.42 | 39.59 | 74 | 54 | -10.58 | -14.41 |
| 12185 | H | 99.34 | 78.87 | -39 | 60.34 | 39.87 | 74 | 54 | -13.66 | -14.13 |
| 14622 | H | 102.59 | 81.12 | -42 | 60.59 | 39.12 | 74 | 54 | -13.41 | -14.88 |
| 17059 | H | 101.37 | 79.66 | -41.5 | 59.87 | 38.16 | 74 | 54 | -14.13 | -15.84 |

Operation Mode: 802.11b Highest

Test Voltage: AC 120V/60Hz

Test Date : 2022-02-09

Test by: Andy

| Freq. | Ant. Pol. | Reading Level(dBuV/m) | | Correct Factor | Emission Level(dBuV/m) | | Limit 3m(dBuV/m) | | Over(dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| (MHz) | H/V | PK | AV | dB | PK | AV | PK | AV | PK | AV |
| 4924 | V | 95.96 | 76.46 | -32.3 | 63.66 | 44.16 | 74 | 54 | -10.34 | -9.84 |
| 7386 | V | 100.35 | 80.84 | -37.2 | 63.15 | 43.64 | 74 | 54 | -10.85 | -10.36 |
| 9848 | V | 103.85 | 82.95 | -39.8 | 64.05 | 43.15 | 74 | 54 | -9.95 | -10.85 |
| 12310 | V | 104.61 | 83.76 | -40.5 | 64.11 | 43.26 | 74 | 54 | -9.89 | -10.74 |
| 14772 | V | 104.94 | 83.55 | -41 | 63.94 | 42.55 | 74 | 54 | -10.06 | -11.45 |
| 17234 | V | 104.22 | 83.26 | -41.1 | 63.12 | 42.16 | 74 | 54 | -10.88 | -11.84 |
| 4924 | H | 91.71 | 73.77 | -31.6 | 60.11 | 42.17 | 74 | 54 | -13.89 | -11.83 |
| 7386 | H | 97.38 | 77.19 | -35.5 | 61.88 | 41.69 | 74 | 54 | -12.12 | -12.31 |
| 9848 | H | 99.43 | 78.64 | -38.3 | 61.13 | 40.34 | 74 | 54 | -12.87 | -13.66 |
| 12310 | H | 99.32 | 79.22 | -39 | 60.32 | 40.22 | 74 | 54 | -13.68 | -13.78 |
| 14772 | H | 101.58 | 83.19 | -42 | 59.58 | 41.19 | 74 | 54 | -14.42 | -12.81 |
| 17234 | H | 100.29 | 82.39 | -41.5 | 58.79 | 40.89 | 74 | 54 | -15.21 | -13.11 |

**All emissions not reported were more than 20dB below the specified limit or in the noise floor.**

**Note:** (1) All Readings are Peak Value and AV.
(2) Emission Level= Reading Level+Probe Factor +Cable Loss.
(3) Data of measurement within this frequency range shown " – " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

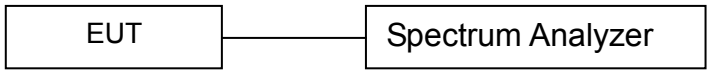
# 10. 6dB Bandwidth Test

## 10.1Measurement Procedure

The EUT was operating in IEEE 802.11b, 802.11g, 802.11n(HT20), 802.11n(HT40) mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

1. Set resolution bandwidth (RBW) = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequency) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

## 10.2Test SET-UP (Block Diagram of Configuration)




## 10.3Measurement Equipment Used

| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | CALIBRATED UNTIL |
|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSV40 | US40240623 | 2022-11-12 |
| Coaxial Cable | Gigalink Microwave | ZT40 | 19022092 | 2022-11-12 |
| Antenna Connector | ARTHUR-YANG | 2244-N1TG1 | N/A | 2022-11-12 |

**Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.**

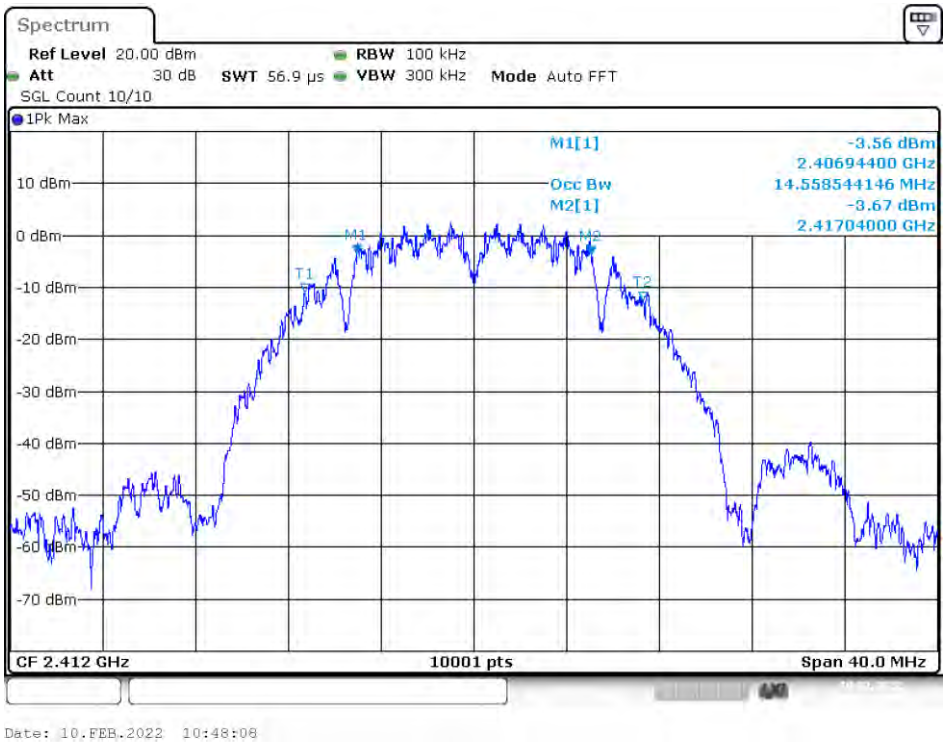
## 10.4Measurement Results

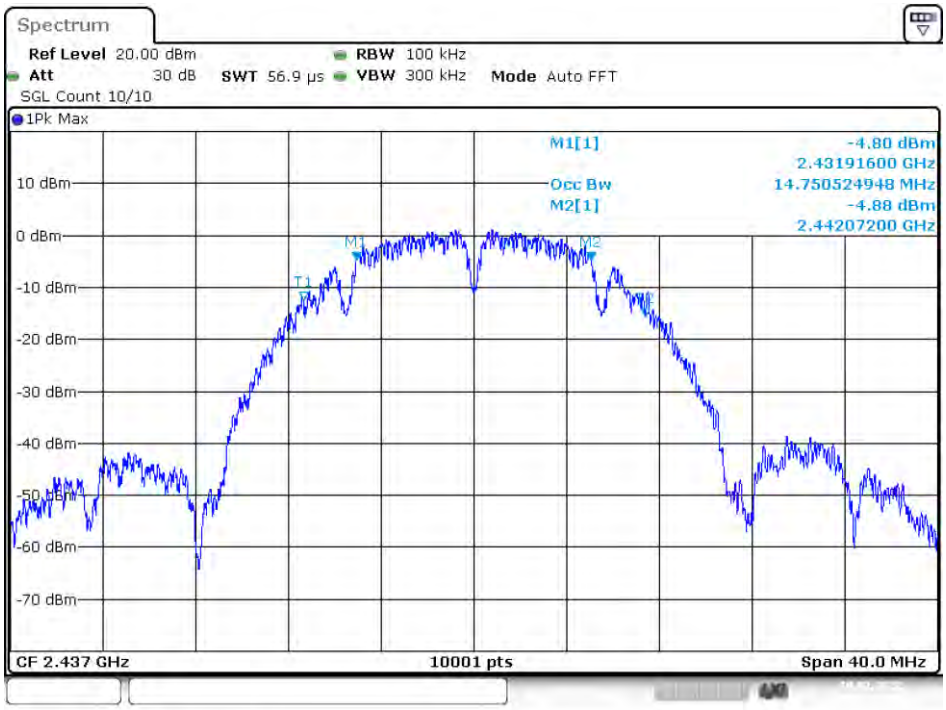
6 Bandwidth Test Data Chart:

Refer to attached data chart.

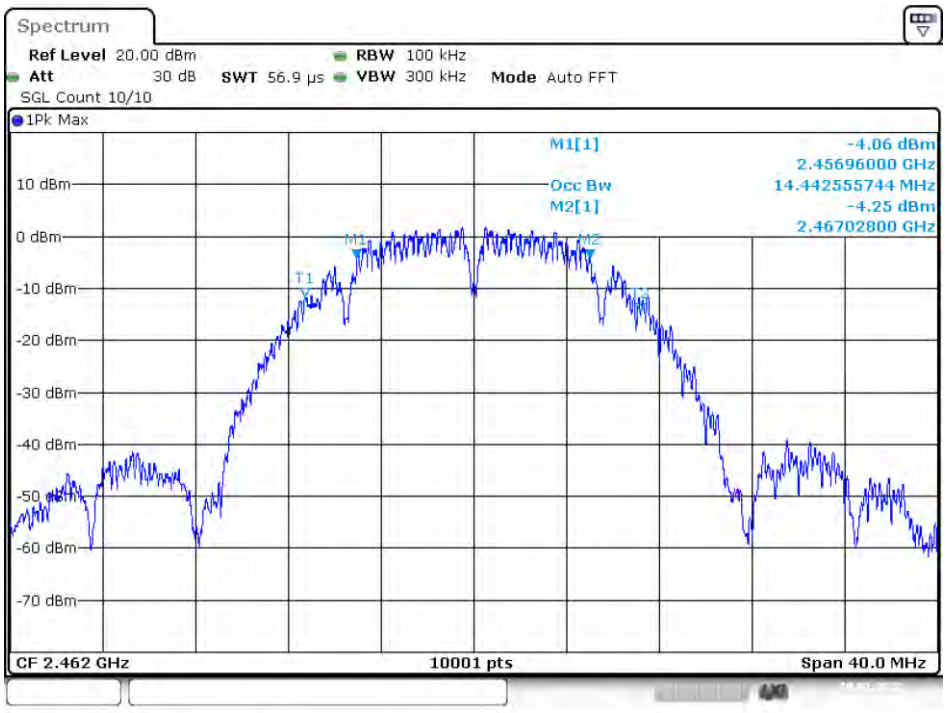
| | | | |
|---|---|---|---|
| Spectrum Detector: | PK | Test Date : | Feb. 10, 2022 |
| Test By: | Andy | Temperature : | 28℃ |
| Humidity : | 60% | | |

| IEEE 802.11b SISO Ant1 | | | |
|---|---|---|---|
| Channel frequency (MHz) | Measurement level (MHz) | Required Limit (KHz) | Result |
| 2412 | 10.096 | >500 | Pass |
| 2437 | 10.156 | >500 | |
| 2462 | 10.068 | >500 | |



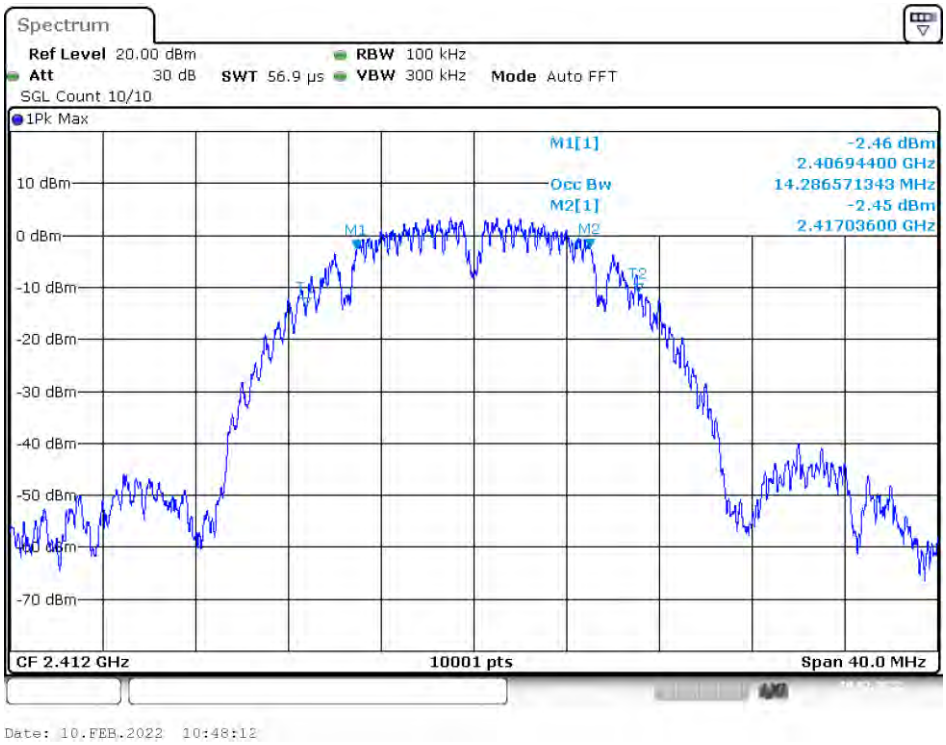



Date: 10.FEB.2022 10:57:30

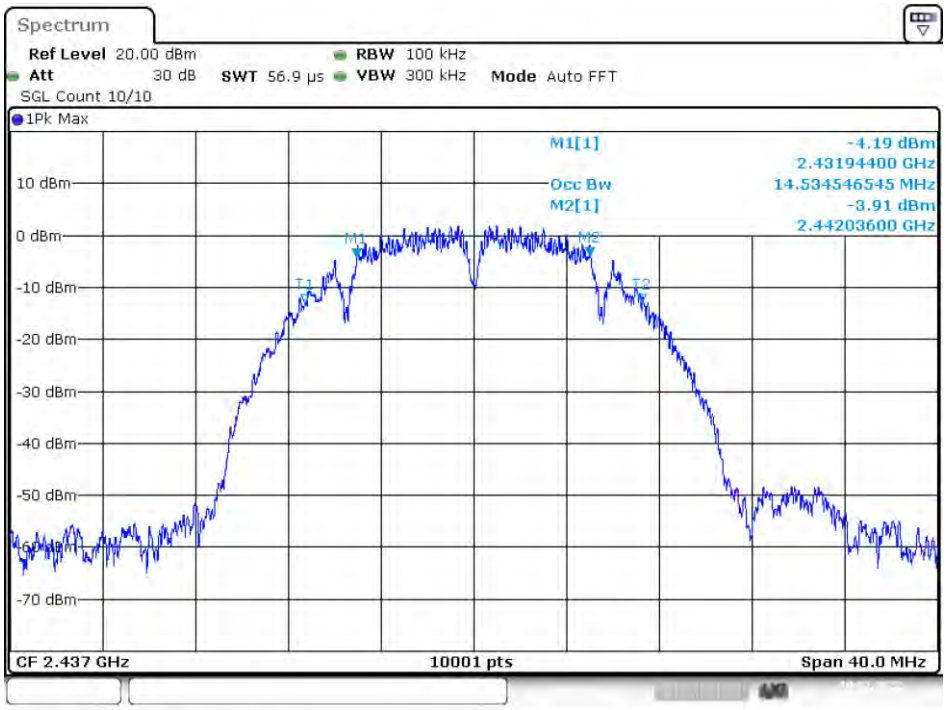



Date: 10.FEB.2022 13:40:49

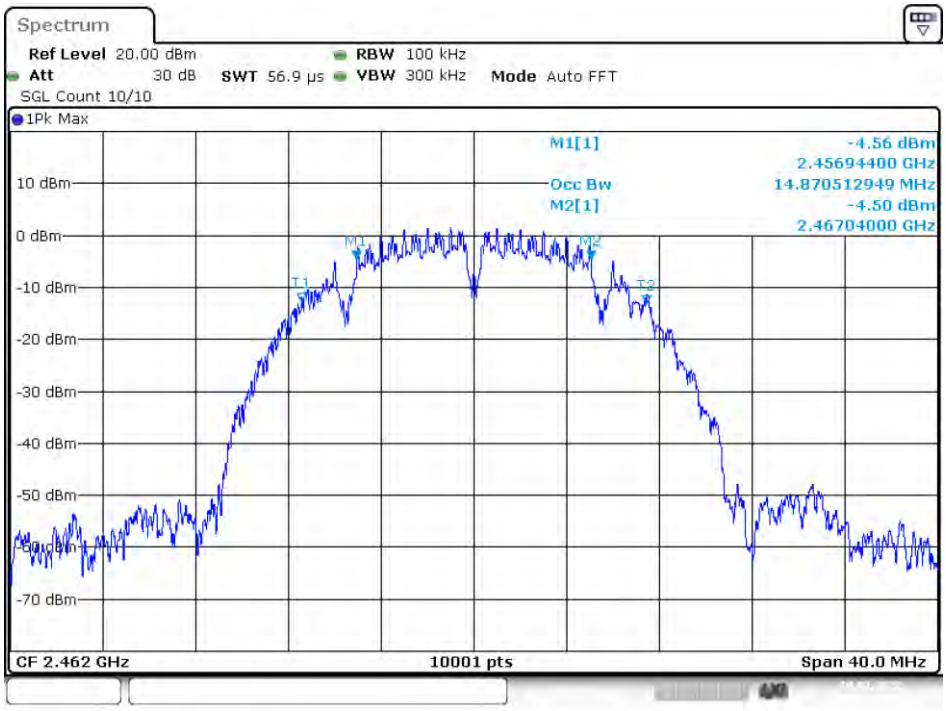
| IEEE 802.11b SISO Ant2 | | | |
|---|---|---|---|
| Channel frequency (MHz) | Measurement level (MHz) | Required Limit (KHz) | Result |
| 2412 | 10.092 | >500 | Pass |
| 2437 | 10.092 | >500 | |
| 2462 | 10.096 | >500 | |




Date: 10.FEB.2022 10:48:12

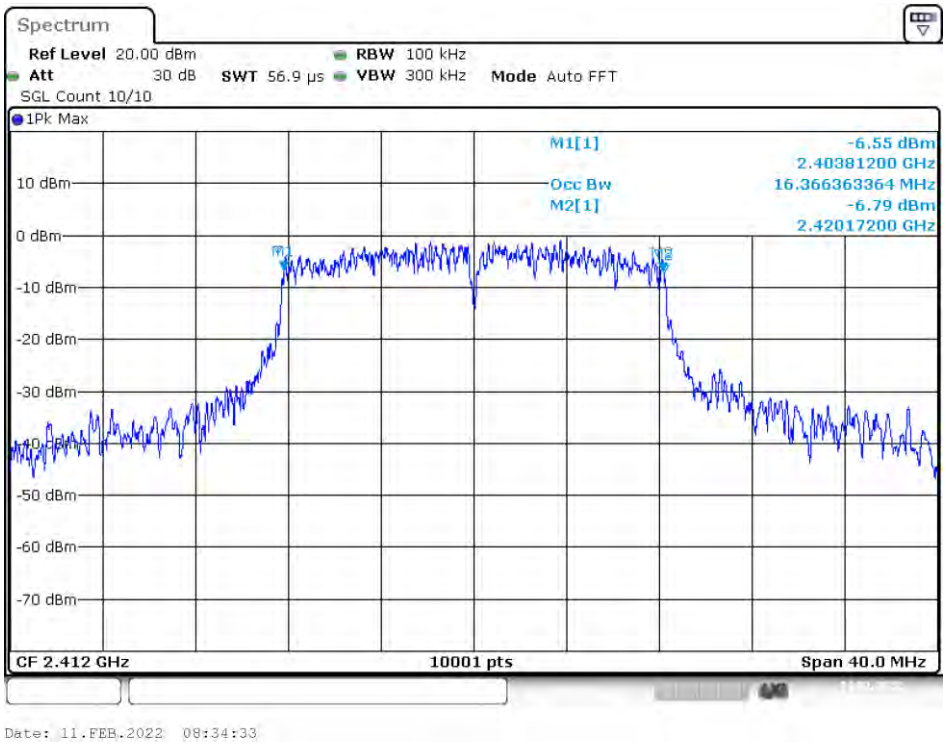


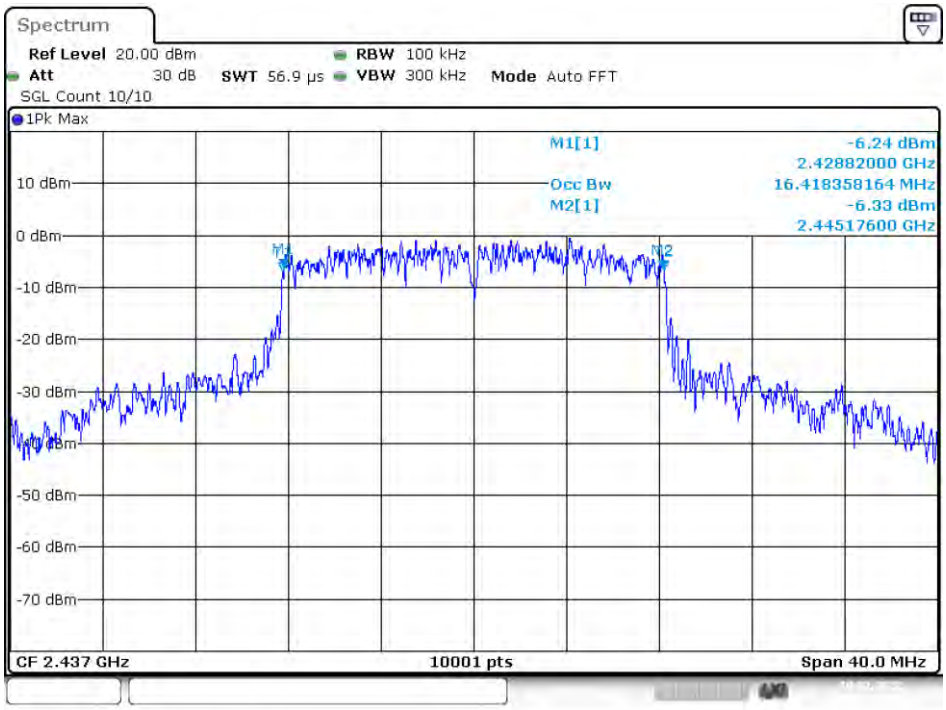

Date: 10.FEB.2022 10:57:34



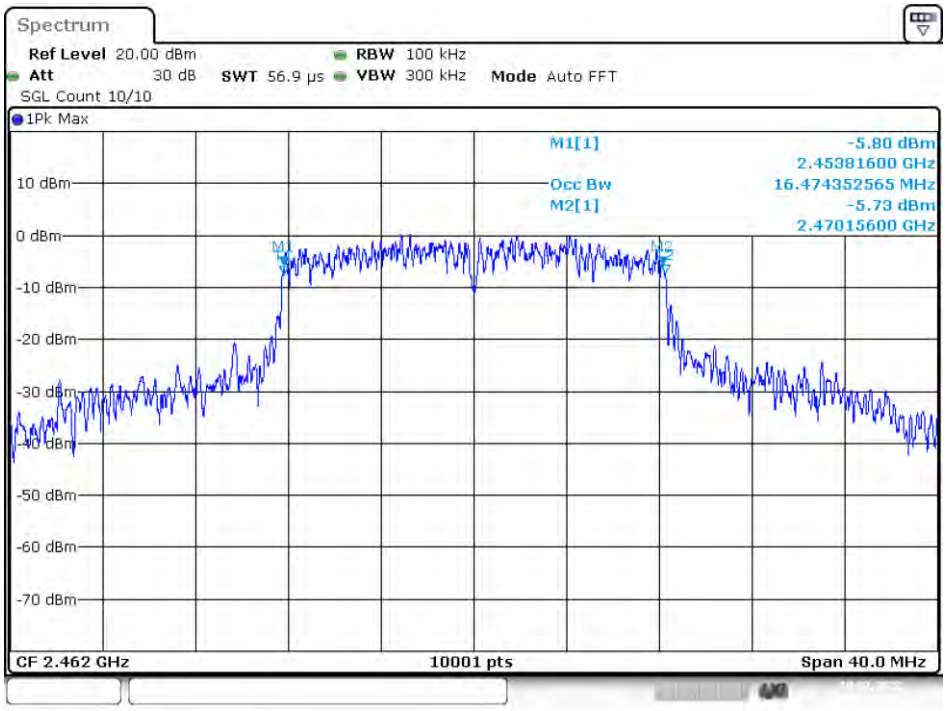

Date: 10.FEB.2022 13:40:53

| IEEE 802.11g SISO Ant1 | | | |
|---|---|---|---|
| Channel frequency (MHz) | Measurement level (MHz) | Required Limit (KHz) | Result |
| 2412 | 16.36 | >500 | Pass |
| 2437 | 16.356 | >500 | |
| 2462 | 16.34 | >500 | |



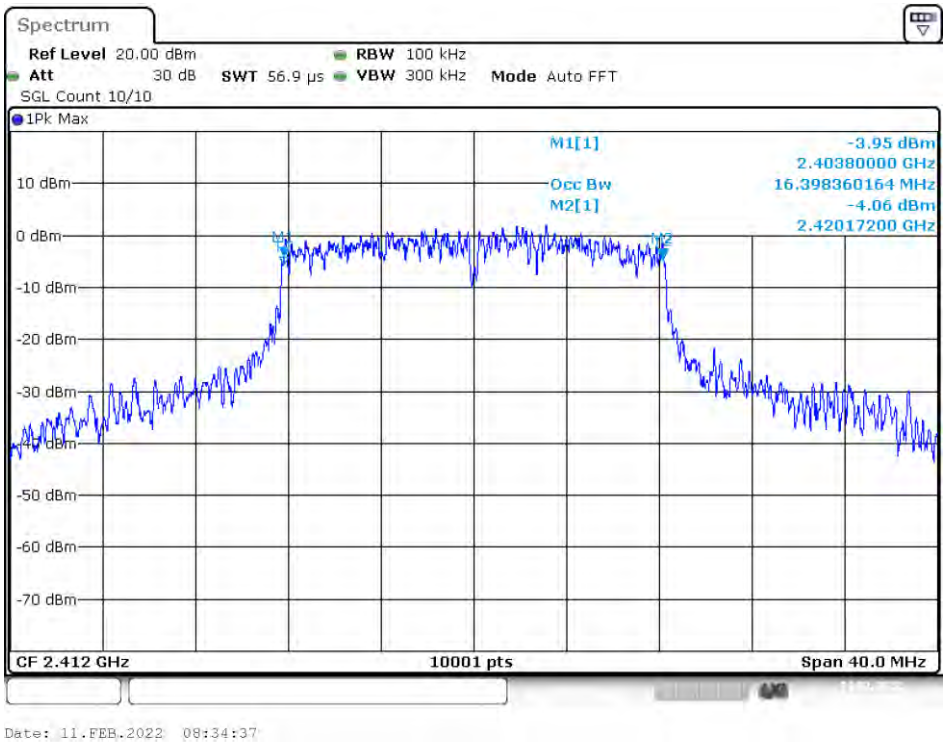



Date: 10.FEB.2022 13:59:57

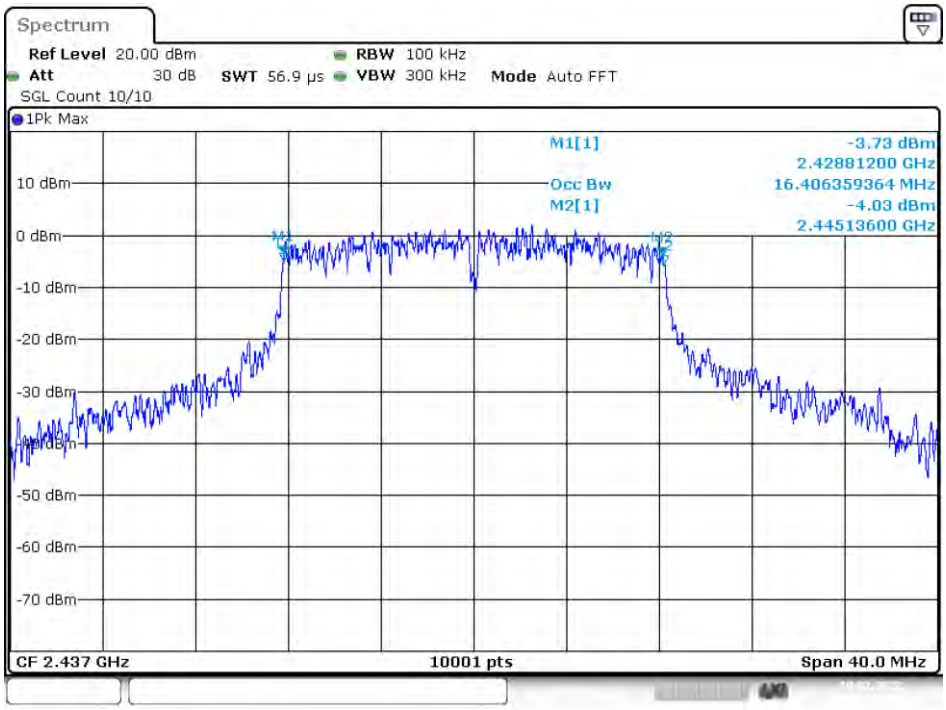



Date: 10.FEB.2022 14:06:42

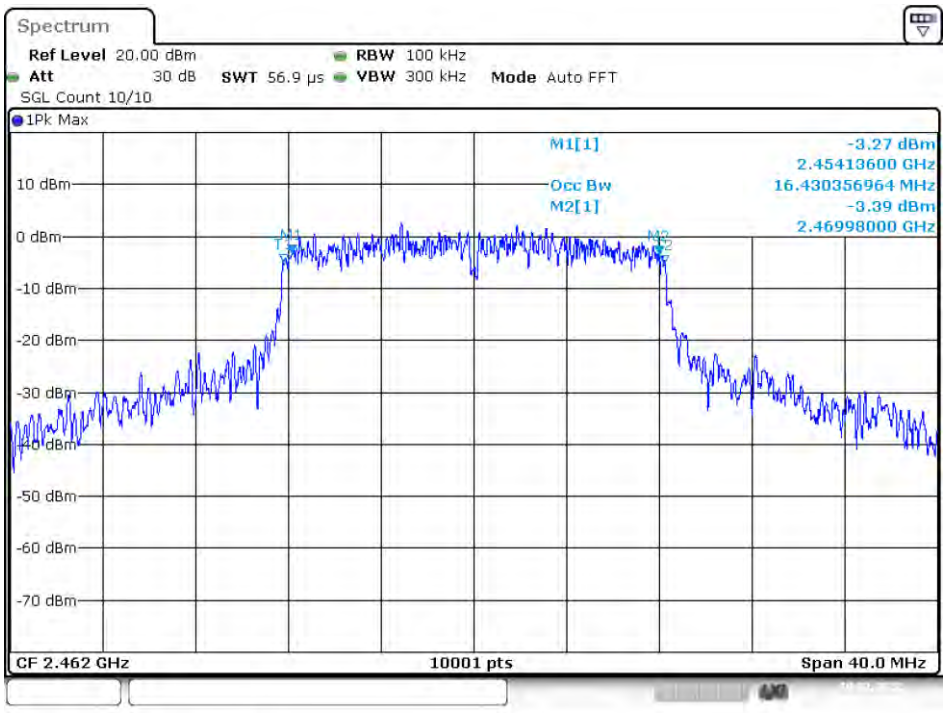
| IEEE 802.11g SISO Ant2 | | | |
|---|---|---|---|
| Channel frequency (MHz) | Measurement level (MHz) | Required Limit (KHz) | Result |
| 2412 | 16.372 | >500 | Pass |
| 2437 | 16.324 | >500 | |
| 2462 | 15.844 | >500 | |




Date: 11.FEB.2022 08:34:37



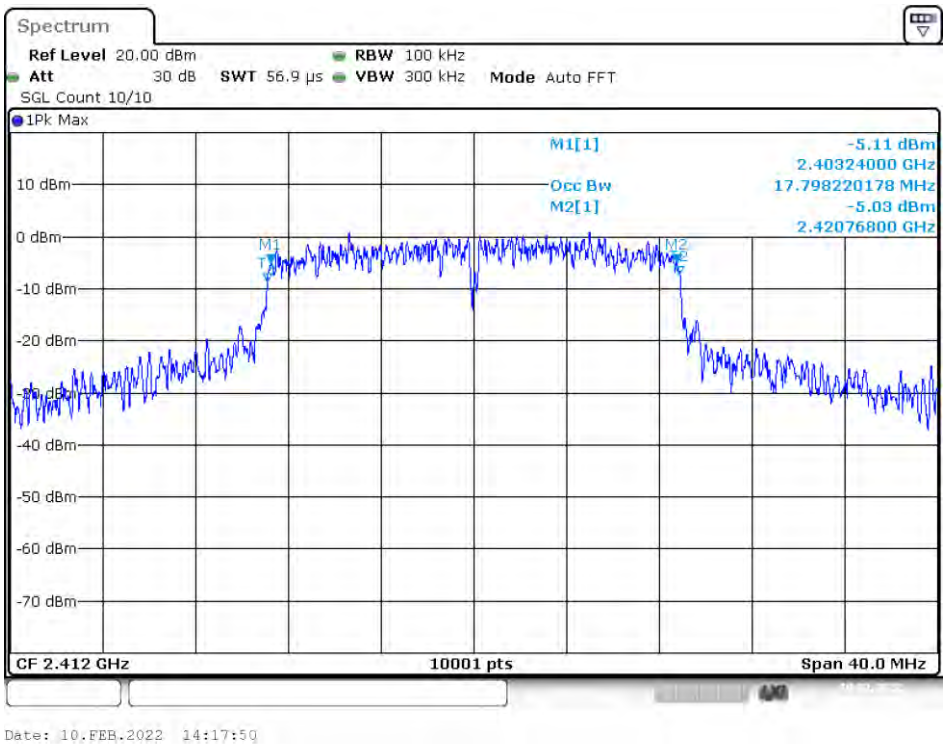

Date: 10.FEB.2022 14:00:01

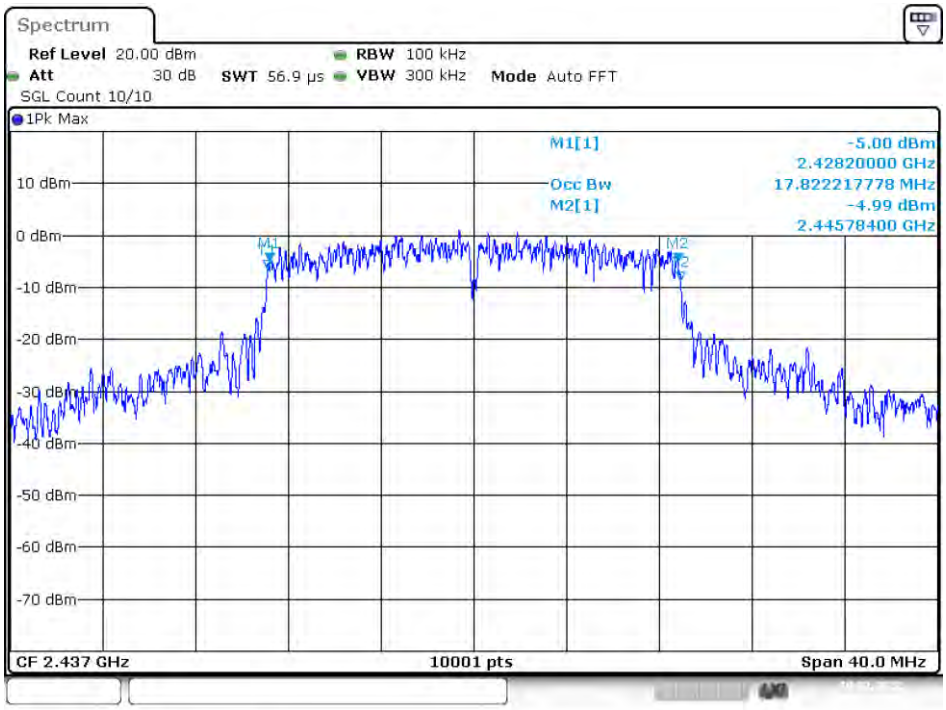



Date: 10.FEB.2022 14:06:46

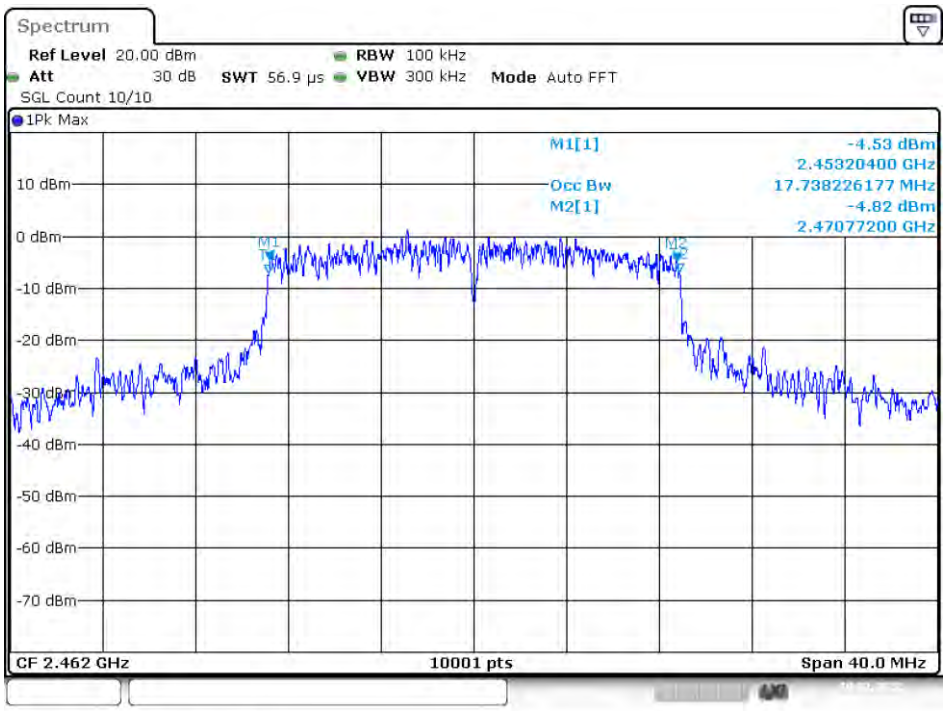
| IEEE 802.11n(HT20) MIMO | | | | |
|---|---|---|---|---|
| Channel frequency (MHz) | Measurement level (MHz) | | Required Limit (KHz) | Result |
| | Ant1 | Ant2 | | |
| 2412 | 17.528 | 17.588 | >500 | Pass |
| 2437 | 17.584 | 17.604 | >500 | |
| 2462 | 17.568 | 17.52 | >500 | |

Ant1



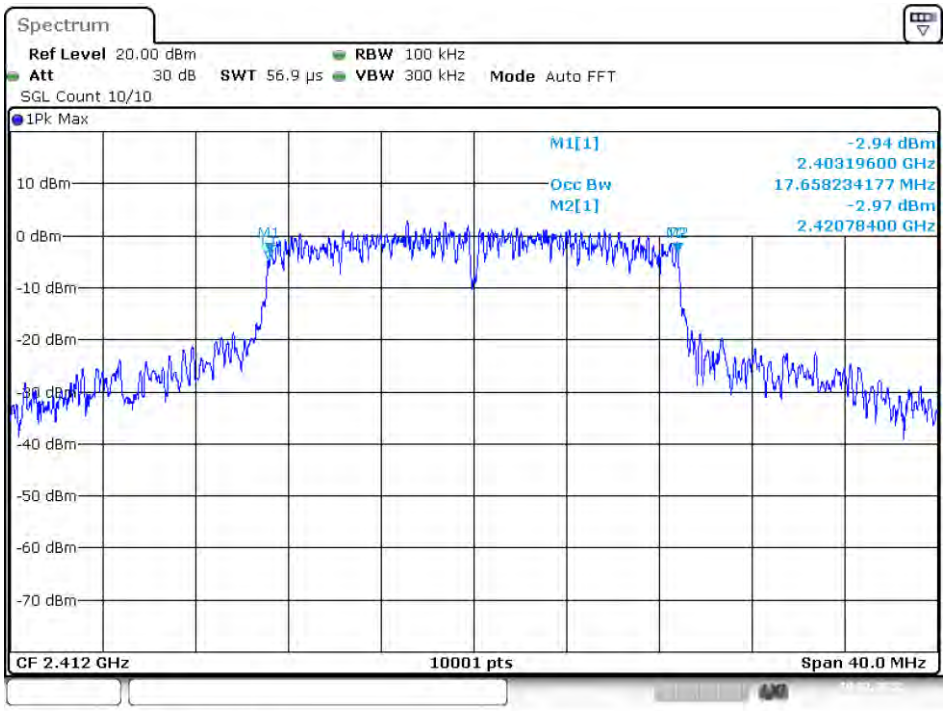



Date: 10.FEB.2022 14:24:04

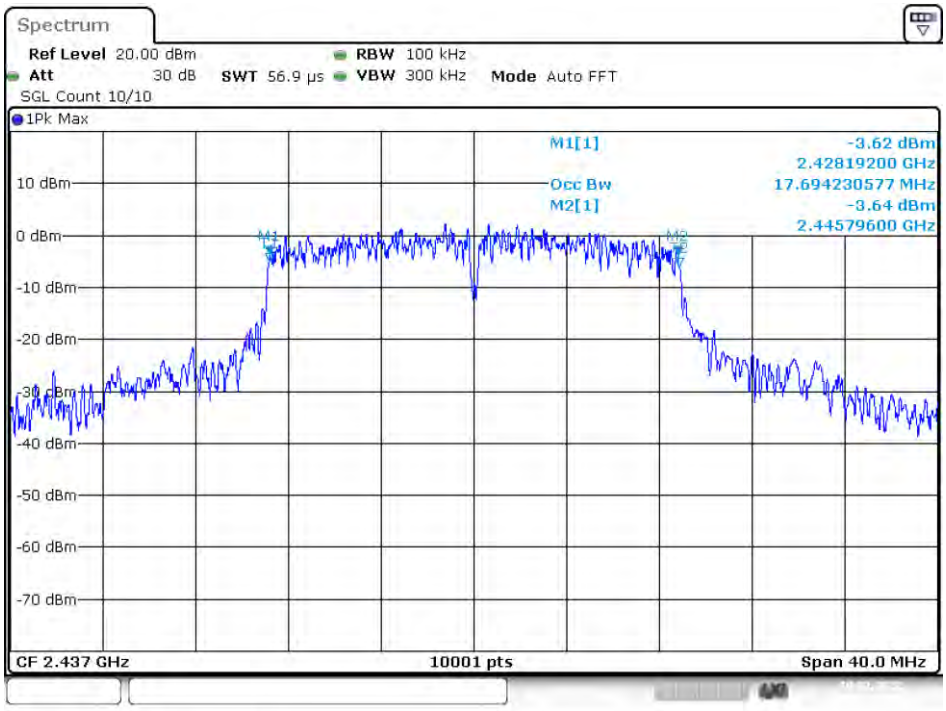



Date: 10.FEB.2022 14:28:28

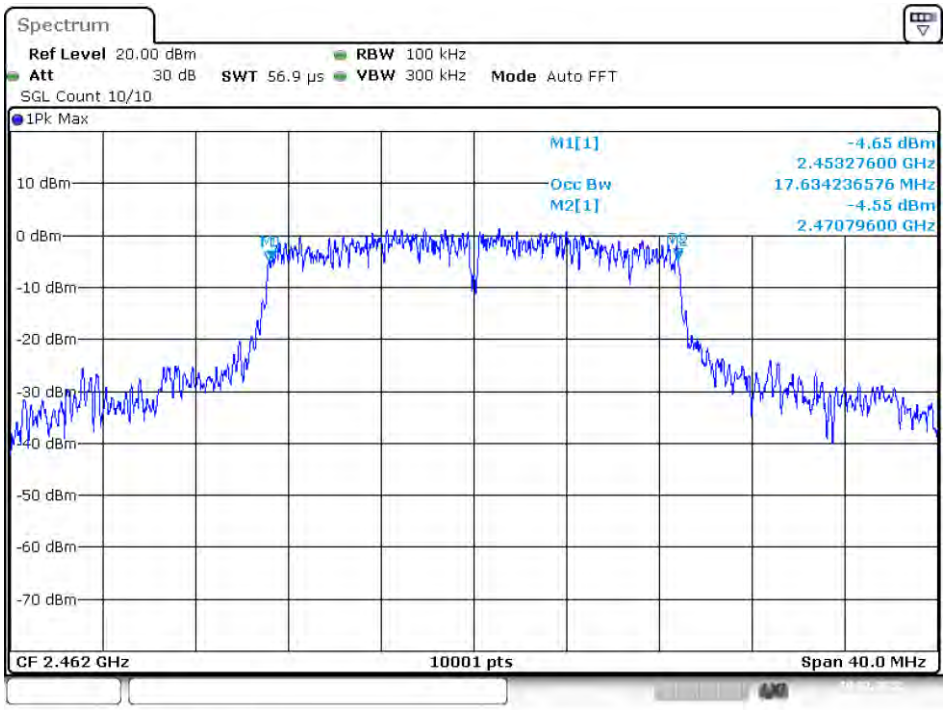
Ant2




Date: 10.FEB.2022 14:17:54

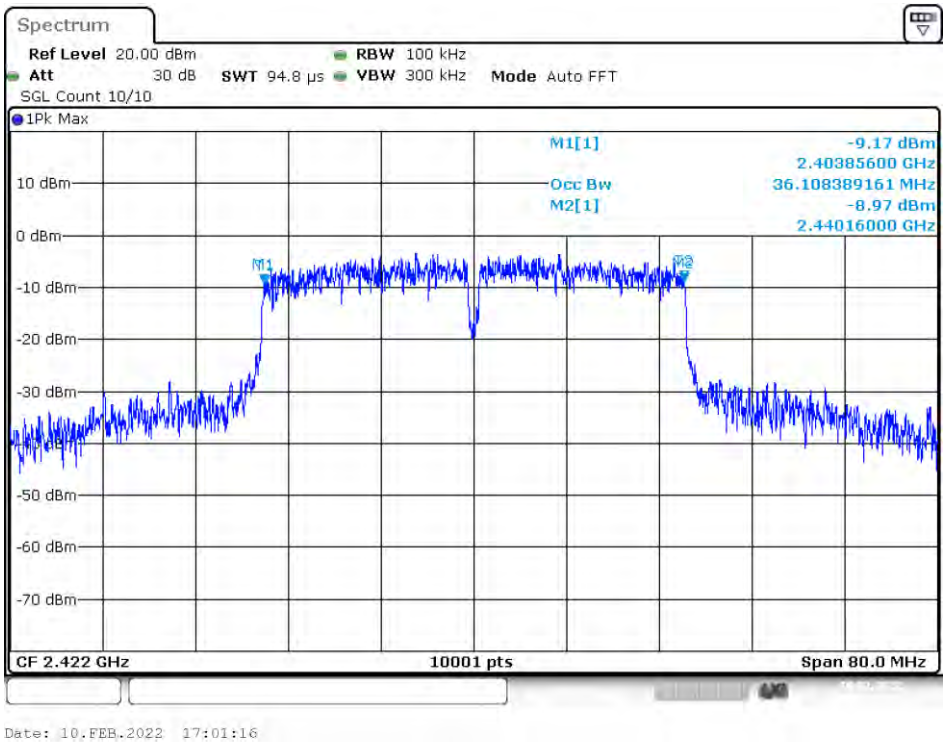


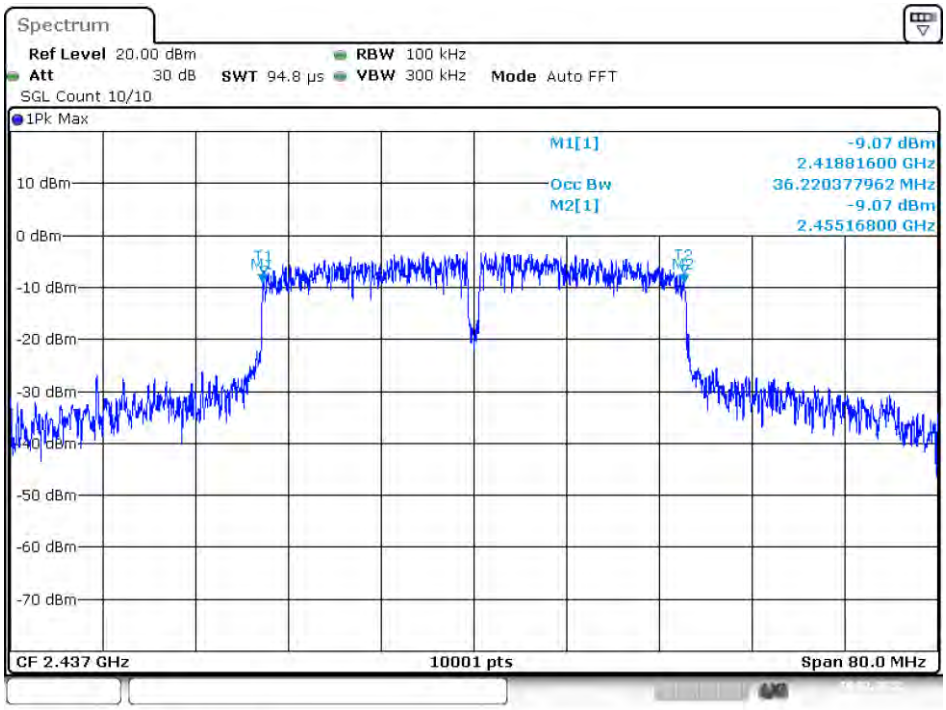

Date: 10.FEB.2022 14:24:08


Spectrum
Ref Level 20.00 dBm
RBW 100 kHz
Att 30 dB
SWT 56.9 µs
VBW 300 kHz
Mode Auto FFT
SGL Count 10/10
1Pk Max
M1[1] -4.65 dBm
2.45327600 GHz
Occ Bw 17.634236576 MHz
M2[1] -4.55 dBm
2.47079600 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.462 GHz
10001 pts
Span 40.0 MHz
Date: 10.FEB.2022 14:28:31

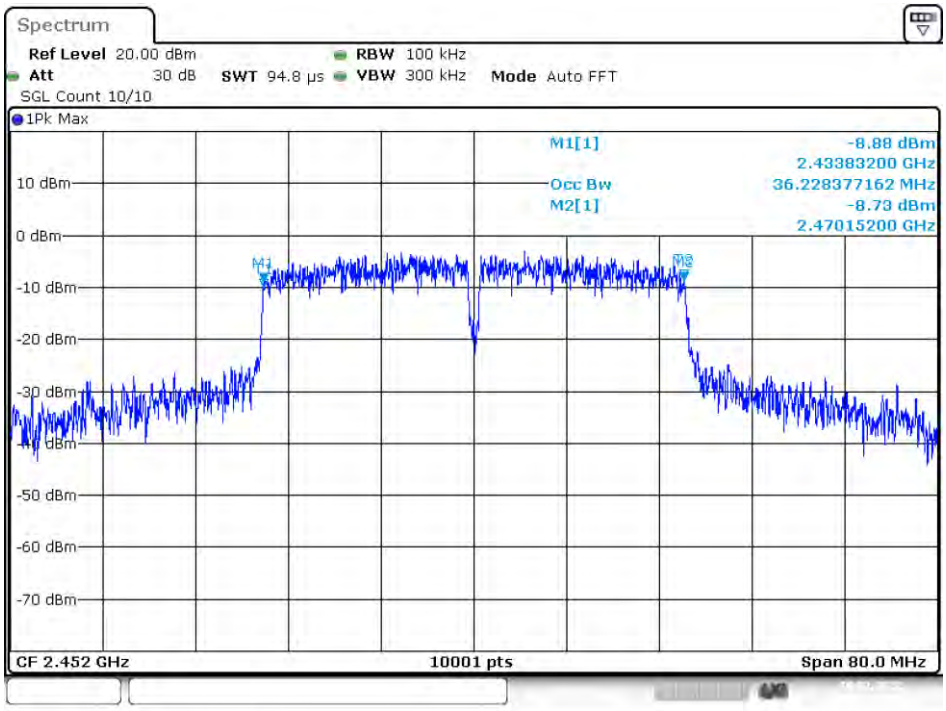
| IEEE 802.11n (HT40) MIMO | | | | |
|---|---|---|---|---|
| Channel frequency (MHz) | Measurement level (MHz) | | Required Limit (KHz) | Result |
| | Ant1 | Ant2 | | |
| 2422 | 36.304 | 36.176 | >500 | Pass |
| 2437 | 36.352 | 36.048 | >500 | |
| 2452 | 36.32 | 36.304 | >500 | |

Ant1



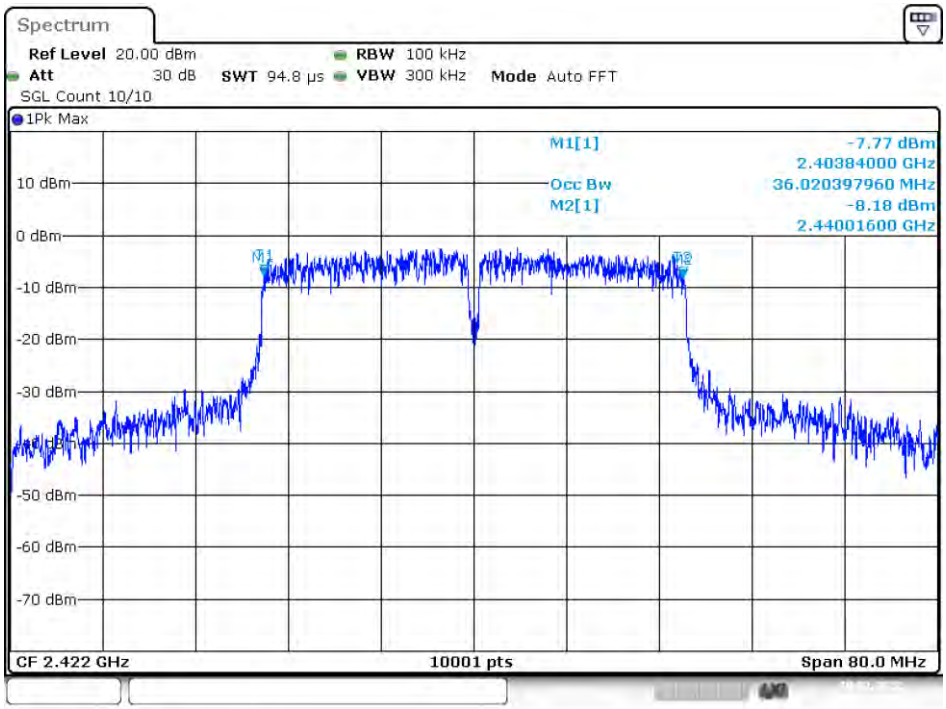



Date: 10.FEB.2022 17:34:22

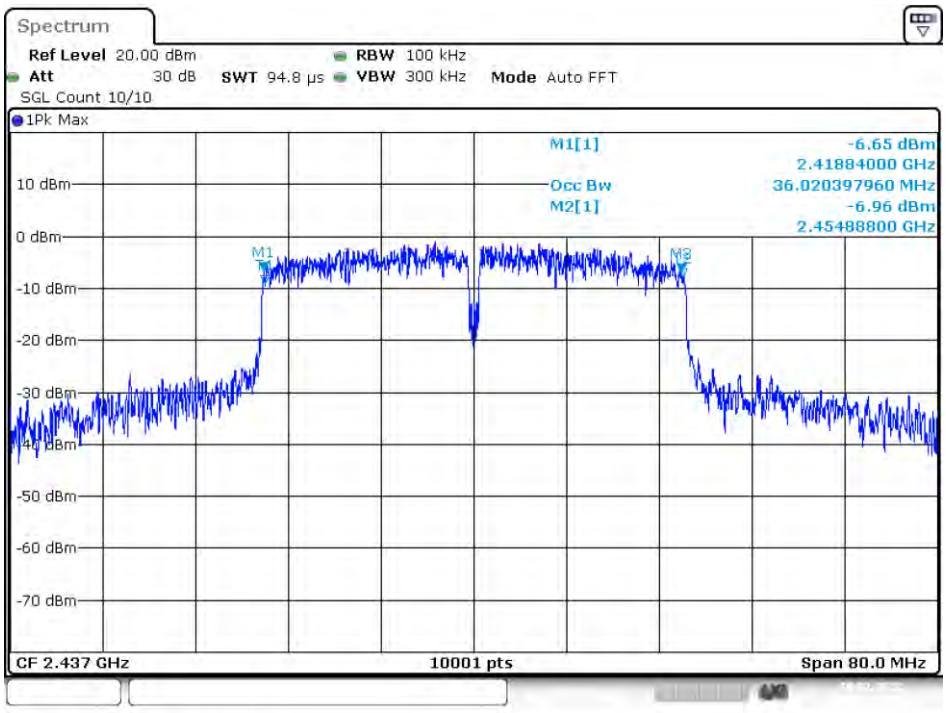



Date: 10.FEB.2022 17:36:35

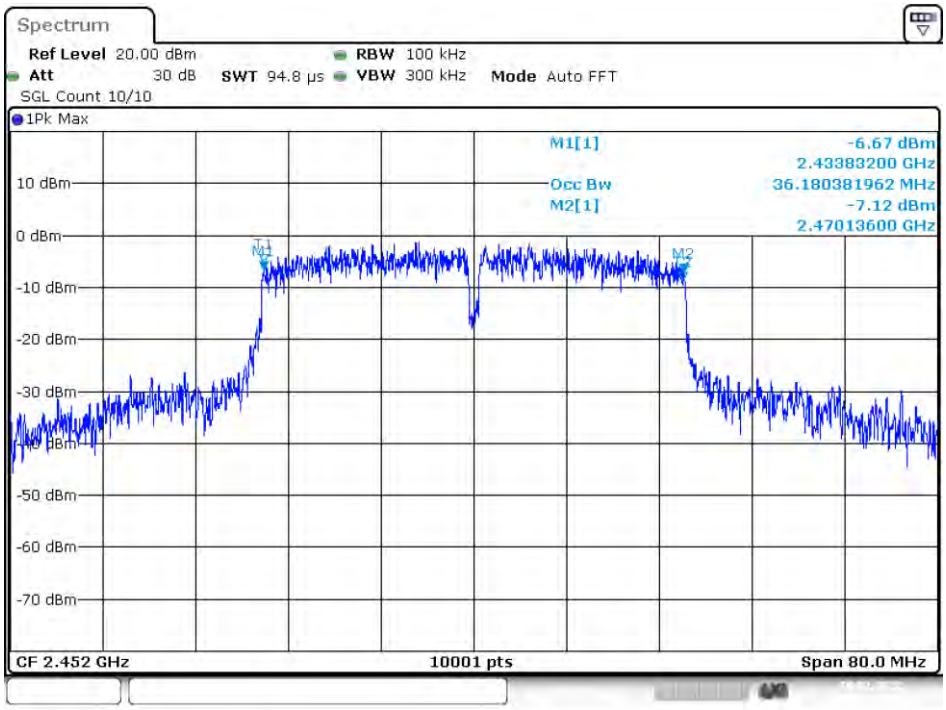
Ant2




Date: 10.FEB.2022 17:01:20




Date: 10.FEB.2022 17:34:26


Spectrum
Ref Level 20.00 dBm
RBW 100 kHz
Att 30 dB
SWT 94.8 µs
VBW 300 kHz
Mode Auto FFT
SGL Count 10/10
1Pk Max
M1[1] -6.67 dBm
2.43383200 GHz
Occ Bw 36.180381962 MHz
M2[1] -7.12 dBm
2.47013600 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-50 dBm
-60 dBm
-70 dBm
M1
M2
CF 2.452 GHz
10001 pts
Span 80.0 MHz
Date: 10.FEB.2022 17:36:39

# 11. Maximum Peak Output Power Test

## 11.1 Measurement Procedure

(1) According to FCC Part15.247(b)(3)

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

The testing follows FCC public Notice DA 00-705 Measurement Guidelines.

The RF output of EUT was connected to the power meter by RF cable and attnuator. The path loss was compensated to the results for each measurement.

Set to the maximum output power setting and enable the EUT transmit continuously.

Measure the conducted output power with cable loss and record the results in the test report.

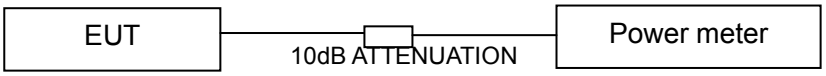
Measure and record the results in the report.

(2) According to FCC Part 15.247(b)(4):

Conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note: If antenna Gain exceeds 6 dBi, then Output power Limit=30-(Gain - 6)

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




## 11.3 Measurement Equipment Used

| EQUIPMENT TYPE | Manufacturer | Model No. | Serial Number | Calibrated until. |
|---|---|---|---|---|
| USB RF Power sensor | RadiPower | RPR3006W | 17I00015SNO88 | 2022-11-12 |
| RF Test Software | MAIWEI | MTS 8310 | N/A | N/A |

## 11.4 Peak Power output limit

The maximum peak conducted output power of the intentional radiator for systems using digital modulation in the 2400 - 2483.5 MHz bands shall not exceed: 1 Watt (30dBm).

## 11.5Measurement Results

| | | | |
|---|---|---|---|
| Spectrum Detector: | PK | Test Date : | Feb. 10, 2022 |
| Test By: | Andy | Temperature : | 28℃ |
| Test Result: | PASS | Humidity : | 60% |

| Operation Mode | Channel Number | Channel Frequency (MHz) | Measurement Level (dBm) | | | Limit (dBm) | Verdict |
|---|---|---|---|---|---|---|---|
| | | | Ant1 | Ant2 | Sum | | |
| 802.11b | 1 | 2412 | 21.36 | 18.19 | -- | 30 | PASS |
| | 6 | 2437 | 20.53 | 17.13 | -- | 30 | PASS |
| | 11 | 2462 | 20.32 | 17.22 | -- | 30 | PASS |
| 802.11g | 1 | 2412 | 23.30 | 21.96 | -- | 30 | PASS |
| | 6 | 2437 | 23.90 | 21.46 | -- | 30 | PASS |
| | 11 | 2462 | 24.28 | 21.72 | -- | 30 | PASS |
| 802.11n (HT20) | 1 | 2412 | 24.54 | 22.26 | 26.56 | 30 | PASS |
| | 6 | 2437 | 24.92 | 22.66 | 26.95 | 30 | PASS |
| | 11 | 2462 | 22.13 | 21.96 | 25.06 | 30 | PASS |
| 802.11n (HT40) | 3 | 2422 | 24.53 | 24.49 | 27.52 | 30 | PASS |
| | 6 | 2437 | 23.67 | 23.58 | 26.64 | 30 | PASS |
| | 9 | 2452 | 24.32 | 22.09 | 26.36 | 30 | PASS |

Note:
1. For MIMO System of 802.11n(HT20) and 802.11n(HT40), total power is calculated by combining the output power of each antenna according to KDB662911.
2. Antenna 1 Gain: 2.17dBi, Antenna 2 Gain: 2.17dBi. For antennas with gains of 6dBi or less, maximum allowed Transmitter output watt(+30dBm)
3. In MIMO, Ant1+Ant2 Directional Gain=$G_{ANT}$+10Log(N)dBi=2.17+10log(2)=5.18dBi.

# 12. Band Edge Test

## 12.1 Measurement Procedure

### For Conducted Test

1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v04.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. Measure and record the results in the test report.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

### For Radiated emission Test

1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v04.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) 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.
3. The EUT was placed on a turntable with 0.8 meter above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.
6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. Repeat above procedures until all frequency measured were complete.

When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 3MHz.

| EMI Test Receiver | Setting |
|---|---|
| Attenuation | Auto |
| RBW | 1MHz |
| VBW | 3MHz |
| Detector | Peak |
| Trace | Max hold |

When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 10Hz.

| EMI Test Receiver | Setting |
|---|---|
| Attenuation | Auto |
| RBW | 1MHz |
| VBW | 10Hz |
| Detector | Peak |
| Trace | Max hold |

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

EUT ——— Spectrum Analyzer

## 12.3 Measurement Equipment Used

| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | CALIBRATED UNTIL |
|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSV40 | US40240623 | 2022-11-12 |
| Coaxial Cable | Gigalink Microwave | ZT40 | 19022092 | 2022-11-12 |
| Antenna Connector | ARTHUR-YANG | 2244-N1TG1 | N/A | 2022-11-12 |

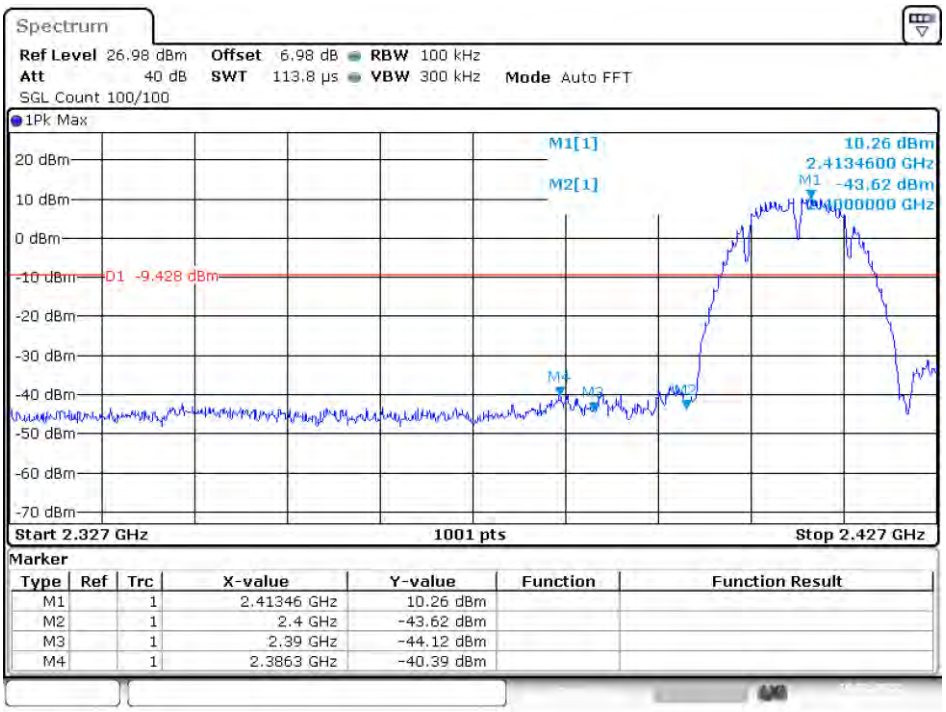
**Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.**

## 12.4 Measurement Results

1. Conducted Test

Please refer to the following pages.

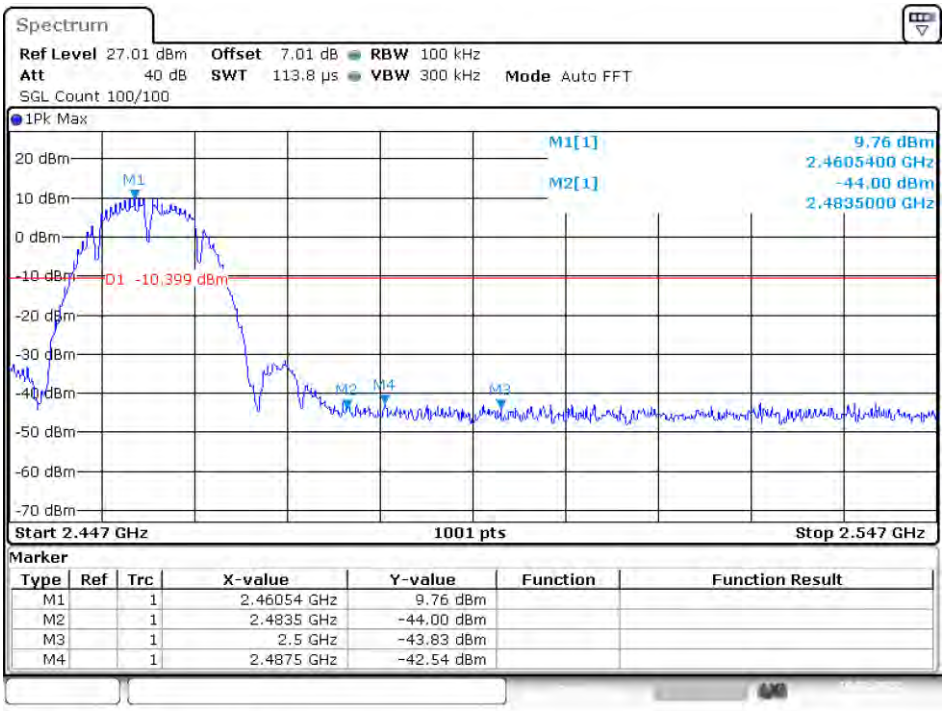
## Test Mode: IEEE 802.11b SISO Ant1




Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 2.41346 GHz | 10.26 dBm | | |
| M2 | | 1 | 2.4 GHz | -43.62 dBm | | |
| M3 | | 1 | 2.39 GHz | -44.12 dBm | | |
| M4 | | 1 | 2.3863 GHz | -40.39 dBm | | |

Date: 10.FEB.2022 10:49:09

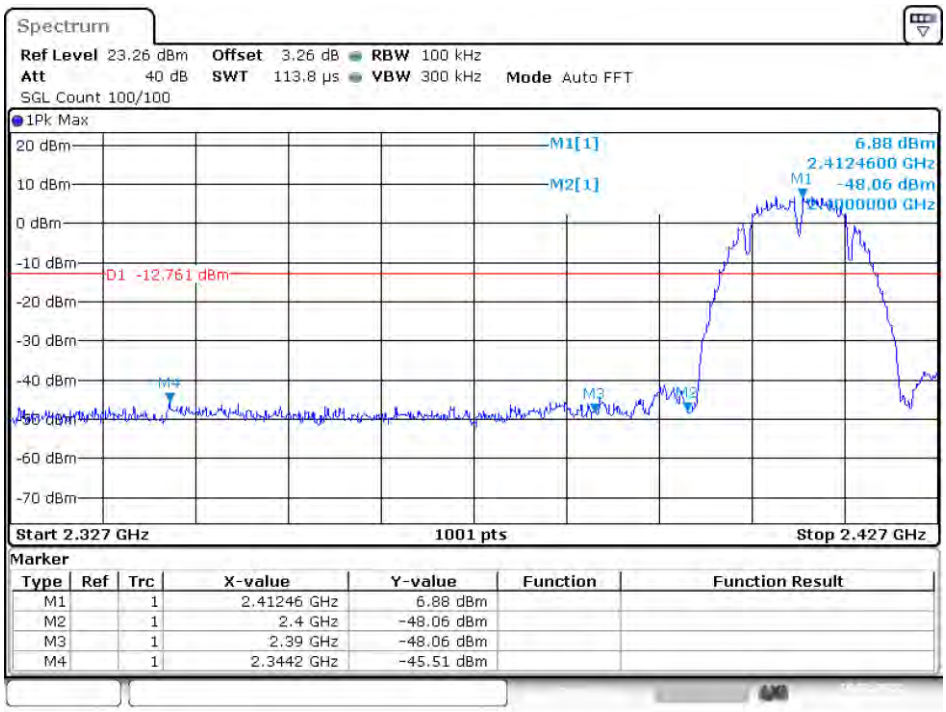



Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 2.46054 GHz | 9.76 dBm | | |
| M2 | | 1 | 2.4835 GHz | -44.00 dBm | | |
| M3 | | 1 | 2.5 GHz | -43.83 dBm | | |
| M4 | | 1 | 2.4875 GHz | -42.54 dBm | | |

Date: 10.FEB.2022 13:44:26

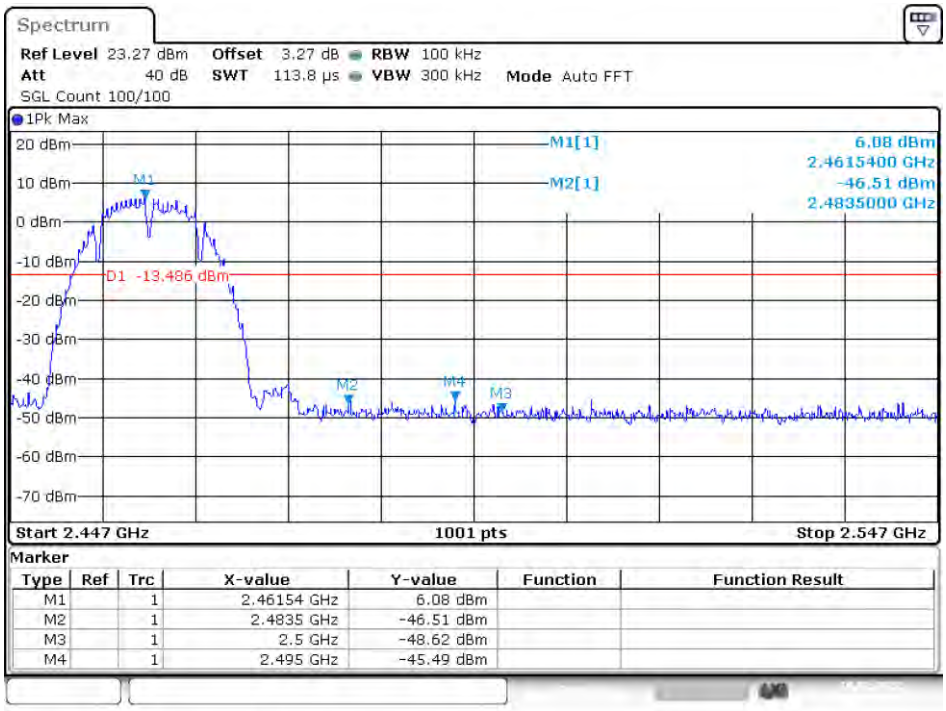
Test Mode: IEEE 802.11b SISO Ant2




Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 2.41246 GHz | 6.88 dBm | | |
| M2 | | 1 | 2.4 GHz | -48.06 dBm | | |
| M3 | | 1 | 2.39 GHz | -48.06 dBm | | |
| M4 | | 1 | 2.3442 GHz | -45.51 dBm | | |

Date: 10.FEB.2022 10:49:19

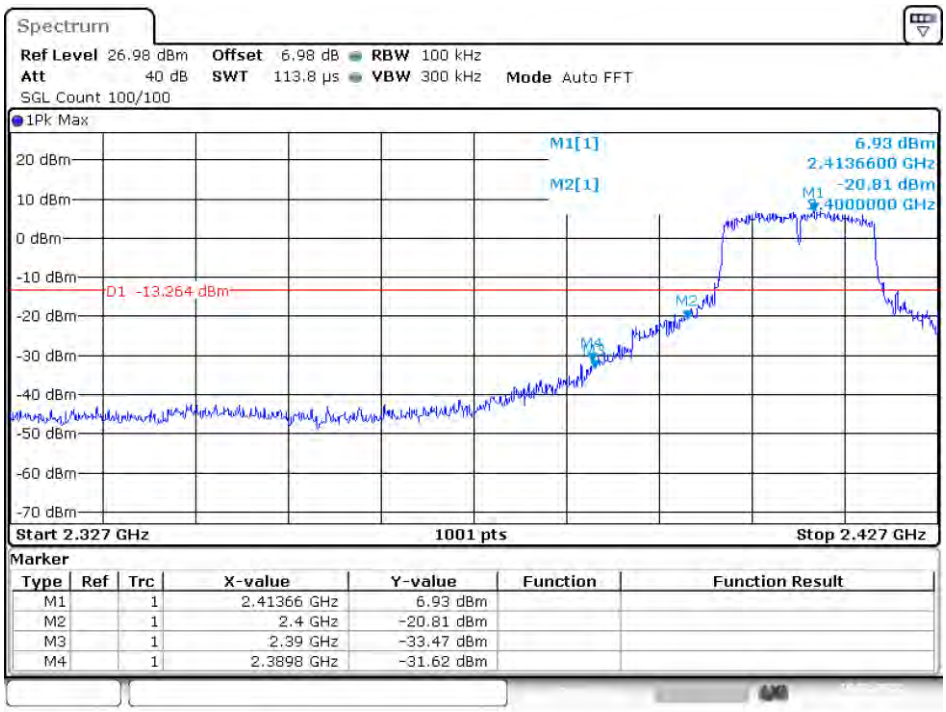



Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 2.46154 GHz | 6.08 dBm | | |
| M2 | | 1 | 2.4835 GHz | -46.51 dBm | | |
| M3 | | 1 | 2.5 GHz | -48.62 dBm | | |
| M4 | | 1 | 2.495 GHz | -45.49 dBm | | |

Date: 10.FEB.2022 13:44:36

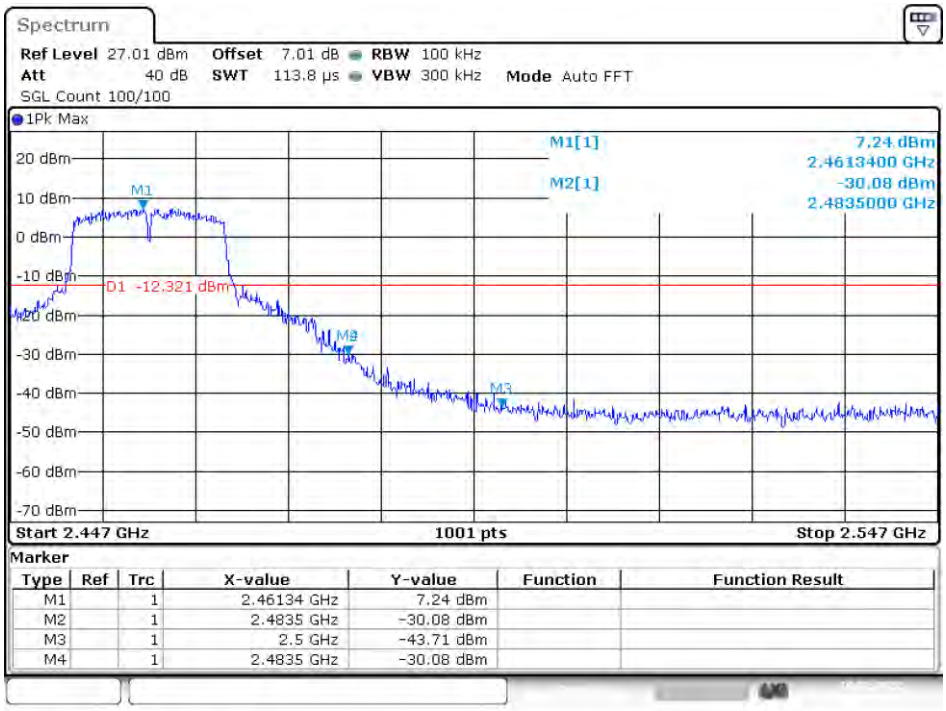
Test Mode: IEEE 802.11g SISO Ant1




Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 2.41366 GHz | 6.93 dBm | | |
| M2 | | 1 | 2.4 GHz | -20.81 dBm | | |
| M3 | | 1 | 2.39 GHz | -33.47 dBm | | |
| M4 | | 1 | 2.3898 GHz | -31.62 dBm | | |

Date: 10.FEB.2022 13:51:37

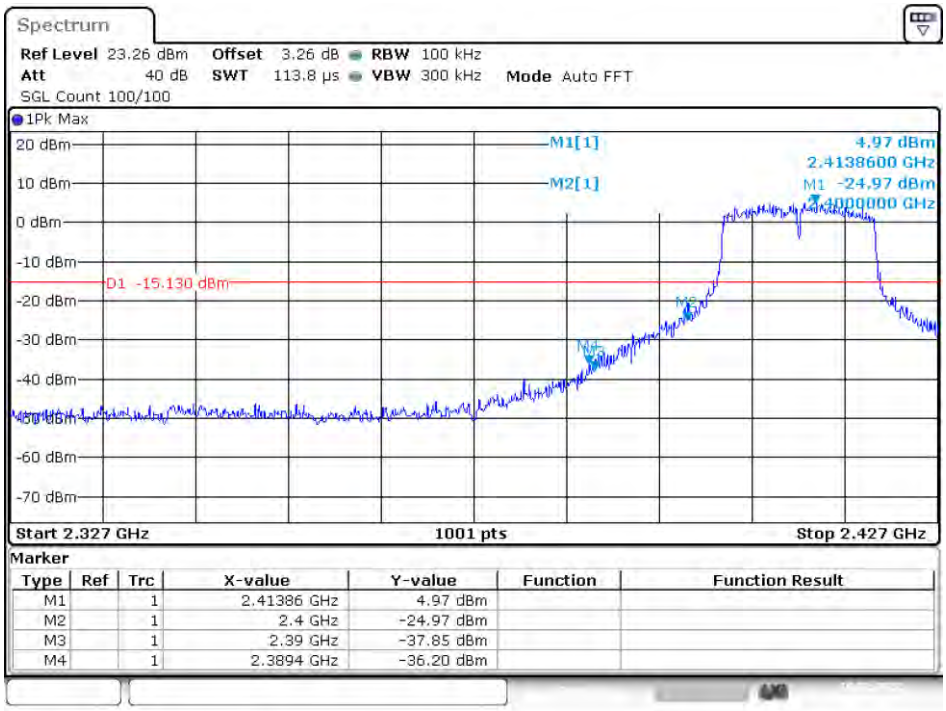


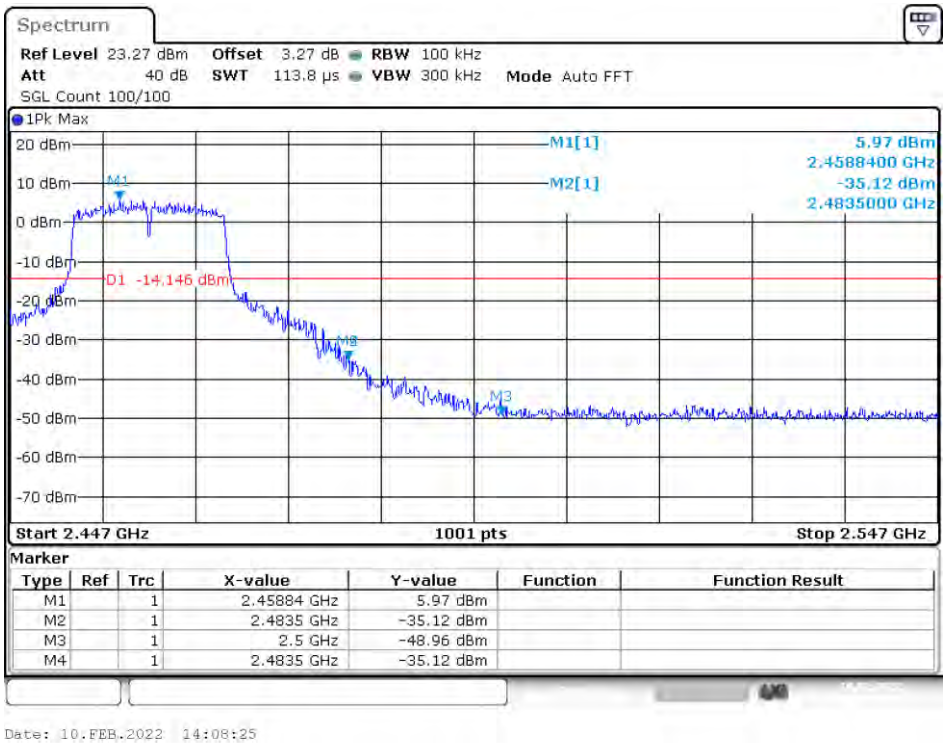

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 2.46134 GHz | 7.24 dBm | | |
| M2 | | 1 | 2.4835 GHz | -30.08 dBm | | |
| M3 | | 1 | 2.5 GHz | -43.71 dBm | | |
| M4 | | 1 | 2.4835 GHz | -30.08 dBm | | |

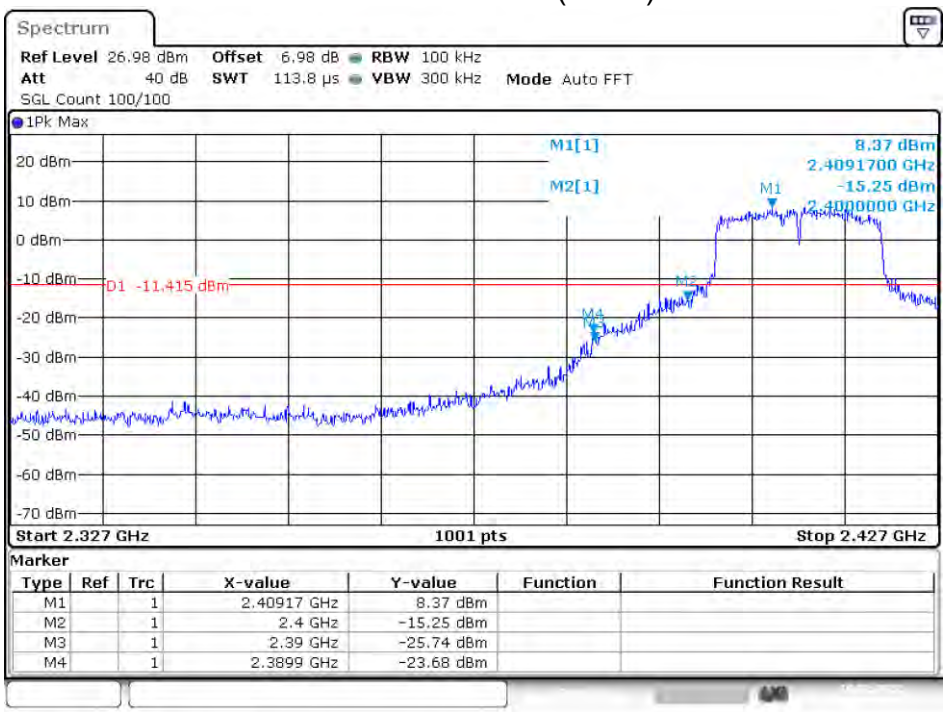
Date: 10.FEB.2022 14:08:15

Test Mode: IEEE 802.11g SISO Ant2



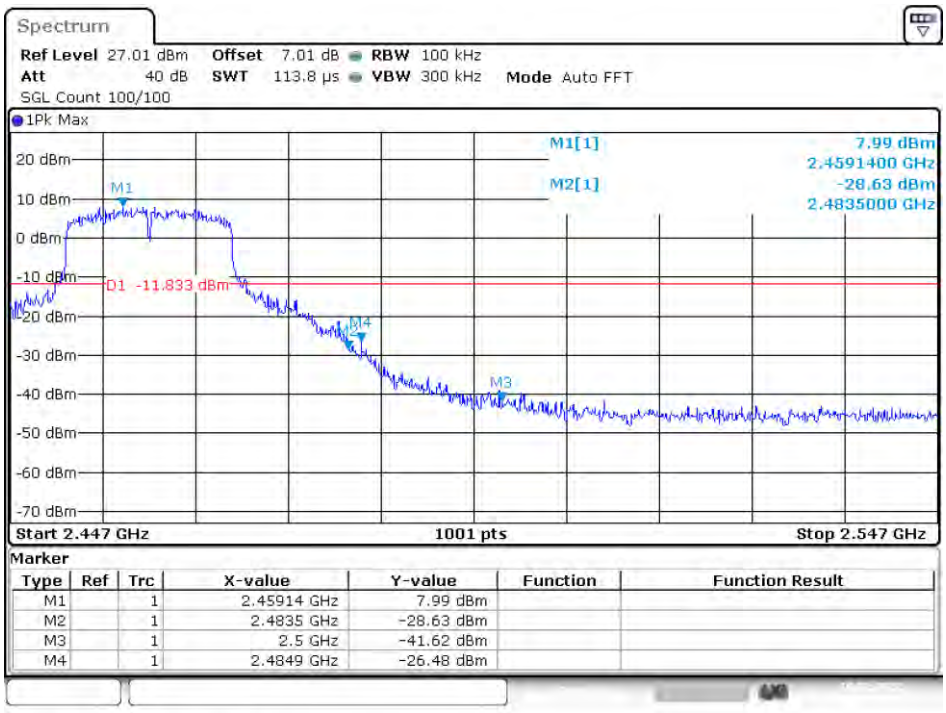
Test Mode: IEEE 802.11n(HT20) MIMO




Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 2.40917 GHz | 8.37 dBm | | |
| M2 | | 1 | 2.4 GHz | -15.25 dBm | | |
| M3 | | 1 | 2.39 GHz | -25.74 dBm | | |
| M4 | | 1 | 2.3899 GHz | -23.68 dBm | | |

Date: 10.FEB.2022 14:20:12

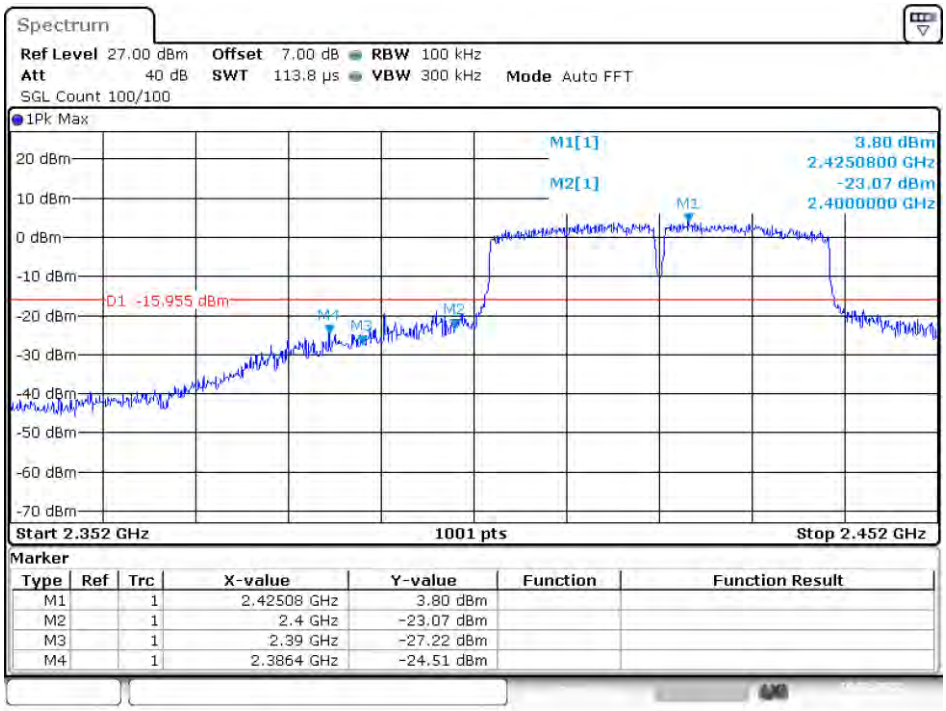



Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 2.45914 GHz | 7.99 dBm | | |
| M2 | | 1 | 2.4835 GHz | -28.63 dBm | | |
| M3 | | 1 | 2.5 GHz | -41.62 dBm | | |
| M4 | | 1 | 2.4849 GHz | -26.48 dBm | | |

Date: 10.FEB.2022 14:29:46

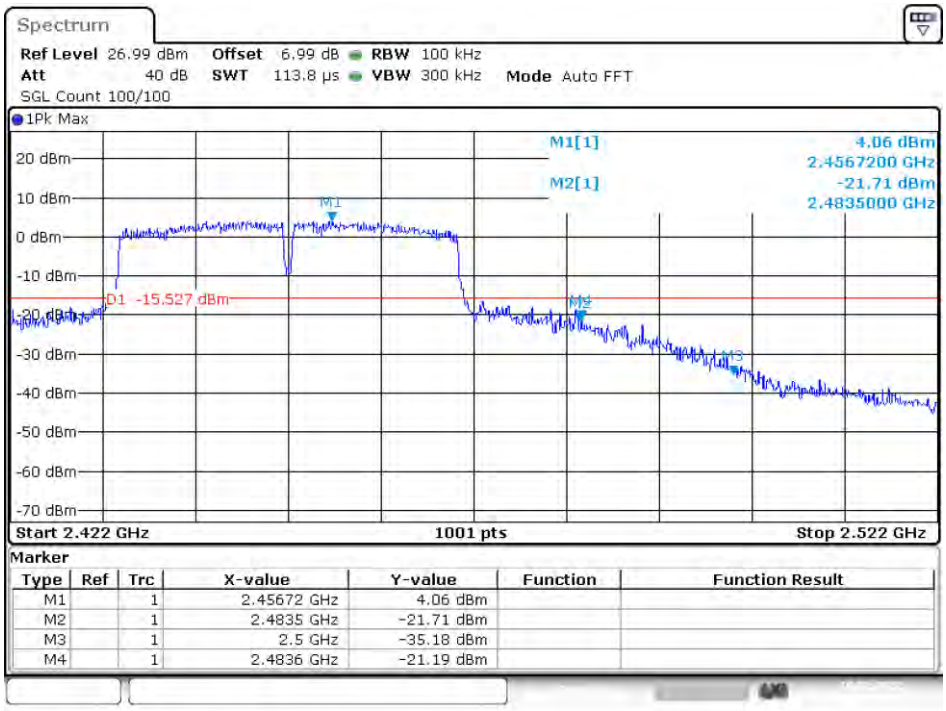
Test Mode: IEEE 802.11n(HT40) MIMO




Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 2.42508 GHz | 3.80 dBm | | |
| M2 | | 1 | 2.4 GHz | -23.07 dBm | | |
| M3 | | 1 | 2.39 GHz | -27.22 dBm | | |
| M4 | | 1 | 2.3864 GHz | -24.51 dBm | | |

Date: 10.FEB.2022 17:01:57




Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 2.45672 GHz | 4.06 dBm | | |
| M2 | | 1 | 2.4835 GHz | -21.71 dBm | | |
| M3 | | 1 | 2.5 GHz | -35.18 dBm | | |
| M4 | | 1 | 2.4836 GHz | -21.19 dBm | | |

Date: 10.FEB.2022 17:37:07

2. Radiated emission Test

| | | | |
|---|---|---|---|
| Spectrum Detector: | PK/AV | Test Date : | 2022-02-09 |
| Test By: | Andy | Temperature : | 28 ℃ |
| Humidity : | 65 % | | |

| IEEE 802.11b SISO Ant1 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Freq. | Ant. Pol. | Reading Level(dBuV/m) | | Correct Factor | Emission Level(dBuV/m) | | Limit 3m(dBuV/m | | Margin(dB) | |
| (MHz) | H/V | PK | AV | dB | PK | AV | PK | AV | PK | AV |
| <2400 | H | 86.65 | 68.41 | -26.3 | 60.35 | 42.11 | 74 | 54 | -13.65 | -11.89 |
| <2400 | V | 85.65 | 65.59 | -26.1 | 59.55 | 39.49 | 74 | 54 | -14.45 | -14.51 |
| >2483.5 | H | 88.09 | 67.52 | -26.3 | 61.79 | 41.22 | 74 | 54 | -12.21 | -12.78 |
| >2483.5 | V | 86.46 | 65.18 | -26.1 | 60.36 | 39.08 | 74 | 54 | -13.64 | -14.92 |

| IEEE 802.11b SISO Ant2 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Freq. | Ant. Pol. | Reading Level(dBuV/m) | | Correct Factor | Emission Level(dBuV/m) | | Limit 3m(dBuV/m | | Margin(dB) | |
| (MHz) | H/V | PK | AV | dB | PK | AV | PK | AV | PK | AV |
| <2400 | H | 89.84 | 69.84 | -26.3 | 63.54 | 43.54 | 74 | 54 | -10.46 | -10.46 |
| <2400 | V | 88.21 | 68.29 | -26.1 | 62.11 | 42.19 | 74 | 54 | -11.89 | -11.81 |
| >2483.5 | H | 88.35 | 68.99 | -26.3 | 62.05 | 42.69 | 74 | 54 | -11.95 | -11.31 |
| >2483.5 | V | 86.79 | 65.99 | -26.1 | 60.69 | 39.89 | 74 | 54 | -13.31 | -14.11 |

| IEEE 802.11g SISO Ant1 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Freq. | Ant. Pol. | Reading Level(dBuV/m) | | Correct Factor | Emission Level(dBuV/m) | | Limit 3m(dBuV/m | | Margin(dB) | |
| (MHz) | H/V | PK | AV | dB | PK | AV | PK | AV | PK | AV |
| <2400 | H | 90.45 | 70.55 | -26.3 | 64.15 | 44.25 | 74 | 54 | -9.85 | -9.75 |
| <2400 | V | 86.79 | 66.79 | -26.1 | 60.69 | 40.69 | 74 | 54 | -13.31 | -13.31 |
| >2483.5 | H | 87.89 | 67.78 | -26.3 | 61.59 | 41.48 | 74 | 54 | -12.41 | -12.52 |
| >2483.5 | V | 86.43 | 68.89 | -26.1 | 60.33 | 42.79 | 74 | 54 | -13.67 | -11.21 |

| IEEE 802.11g SISO Ant2 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Freq. | Ant. Pol. | Reading Level(dBuV/m) | | Correct Factor | Emission Level(dBuV/m) | | Limit 3m(dBuV/m | | Margin(dB) | |
| (MHz) | H/V | PK | AV | dB | PK | AV | PK | AV | PK | AV |
| <2400 | H | 90.88 | 68.79 | -26.3 | 64.58 | 42.49 | 74 | 54 | -9.42 | -11.51 |
| <2400 | V | 88.21 | 65.97 | -26.1 | 62.11 | 39.87 | 74 | 54 | -11.89 | -14.13 |
| >2483.5 | H | 86.89 | 67.88 | -26.3 | 60.59 | 41.58 | 74 | 54 | -13.41 | -12.42 |
| >2483.5 | V | 85.97 | 66.74 | -26.1 | 59.87 | 40.64 | 74 | 54 | -14.13 | -13.36 |

| IEEE 802.11n(HT20)MIMO | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Freq. | Ant. Pol. | Reading Level(dBuV/m) | | Correct Factor | Emission Level(dBuV/m) | | Limit 3m(dBuV/m | | Margin(dB) | |
| (MHz) | H/V | PK | AV | dB | PK | AV | PK | AV | PK | AV |
| <2400 | H | 89.27 | 70.32 | -26.3 | 62.97 | 44.02 | 74 | 54 | -11.03 | -9.98 |
| <2400 | V | 86.21 | 68.25 | -26.1 | 60.11 | 42.15 | 74 | 54 | -13.89 | -11.85 |
| >2483.5 | H | 88.76 | 68.64 | -26.3 | 62.46 | 42.34 | 74 | 54 | -11.54 | -11.66 |
| >2483.5 | V | 87.46 | 67.74 | -26.1 | 61.36 | 41.64 | 74 | 54 | -12.64 | -12.36 |

| IEEE 802.11n(HT40)MIMO | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Freq. | Ant. Pol. | Reading Level(dBuV/m) | | Correct Factor | Emission Level(dBuV/m) | | Limit 3m(dBuV/m | | Margin(dB) | |
| (MHz) | H/V | PK | AV | dB | PK | AV | PK | AV | PK | AV |
| <2400 | H | 89.99 | 69.84 | -26.3 | 63.69 | 43.54 | 74 | 54 | -10.31 | -10.46 |
| <2400 | V | 86.26 | 68.21 | -26.1 | 60.16 | 42.11 | 74 | 54 | -13.84 | -11.89 |
| >2483.5 | H | 87.25 | 66.99 | -26.3 | 60.95 | 40.69 | 74 | 54 | -13.05 | -13.31 |
| >2483.5 | V | 85.98 | 66.35 | -26.1 | 59.88 | 40.25 | 74 | 54 | -14.12 | -13.75 |

# 13. Maxiumum Power Spectral Density

## 13.1 Test Equipment

| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | CALIBRATED UNTIL |
|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSV40 | US40240623 | 2022-11-12 |
| Coaxial Cable | Gigalink Microwave | ZT40 | 19022092 | 2022-11-12 |
| Antenna Connector | ARTHUR-YANG | 2244-N1TG1 | N/A | 2022-11-12 |

**Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.**

## 13.2 Measuring Instruments and Setting

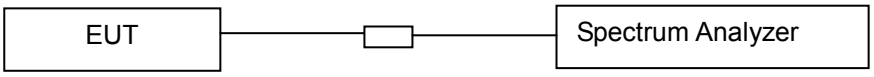
The following table is the setting of spectrum analyzer.

| Spectrum analyzer | Setting |
|---|---|
| Attenuation | Auto |
| Span Frequency | Set the span to 1.5 times the DTS bandwidth. |
| RBW | 3KHz |
| VBW | 10KHz |
| Detector | Peak |
| Trace | Max hold |
| Sweep Time | Automatic |

## 13.3 Test Procedures

a. The transmitter output (antenna port) was connected to the spectrum analyzer.
b. Set analyzer center frequency to DTS channel center frequency.
c. Set the analyzer span to a minimum of 1.5 times the DTS bandwidth.
d. Set the RBW=3KHz. Set the VBW=10KHz
e. Detector = peak.
f. Sweep time = auto couple.
g. Trace mode = max hold.
h. Allow trace to fully stabilize.
i. Use the peak marker function to determine the maximum amplitude level.

## 13.4 Block Diagram of Test Setup



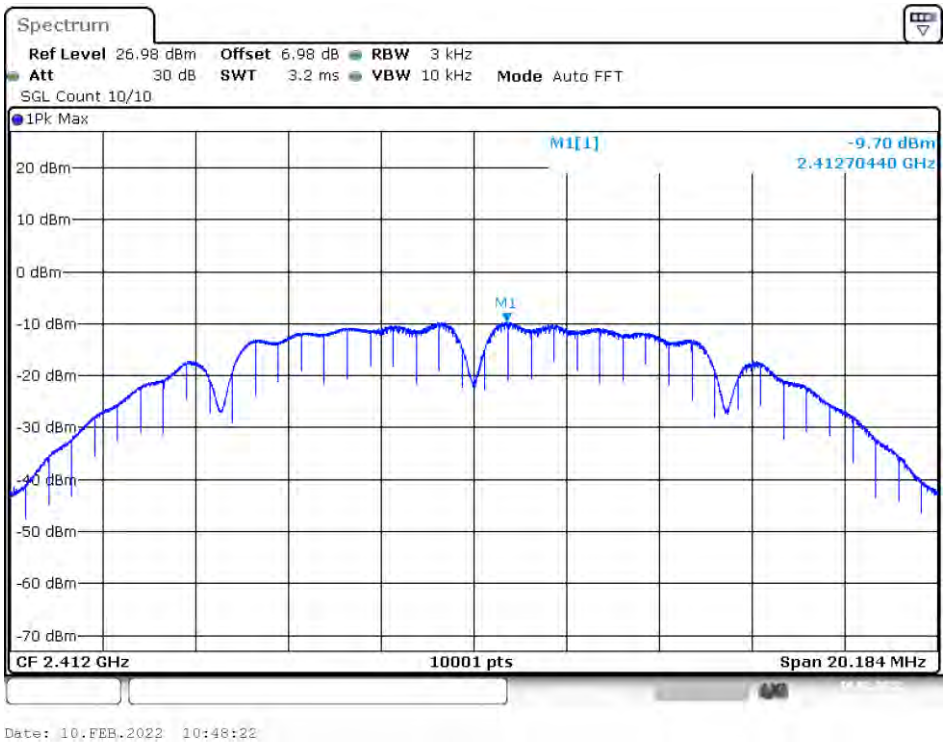
## 13.5Limit

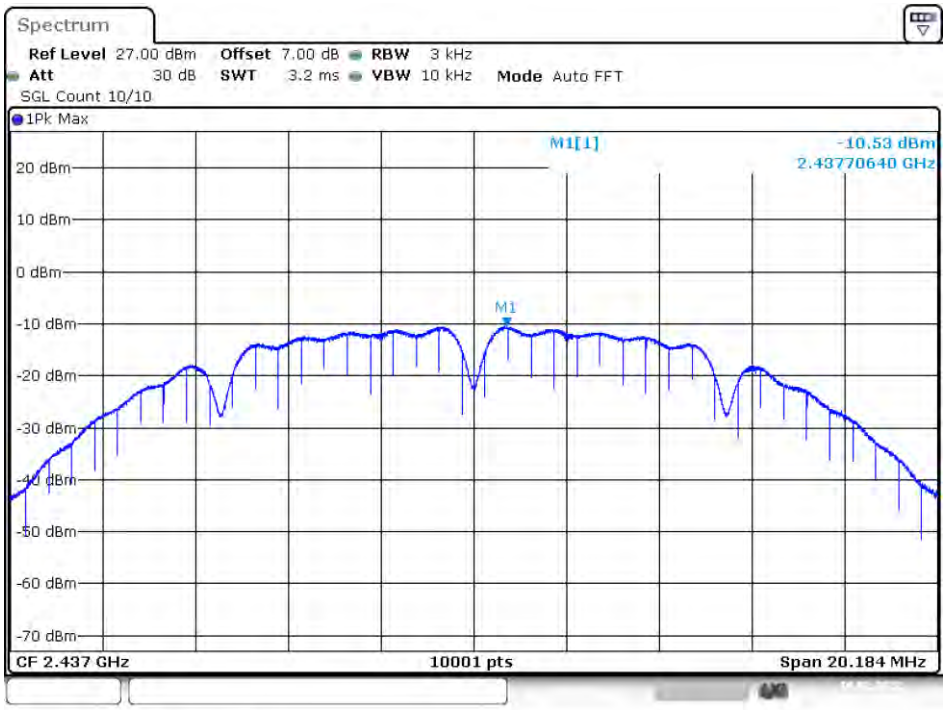
The transmitted power density averaged over any 1 second interval shall not be greater +8dBm in any 3 kHz bandwidth.

## 13.6Test Result

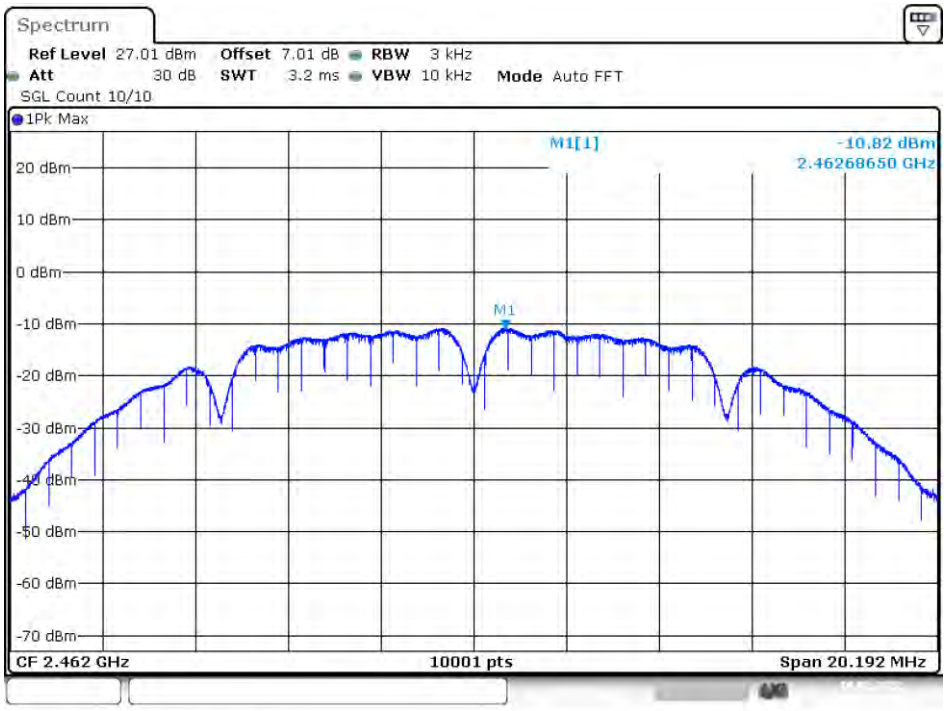
| | | | |
|---|---|---|---|
| Spectrum Detector: | PK | Test Date : | Feb. 10, 2022 |
| Test By: | Andy | Temperature : | 28℃ |
| Humidity : | 60% | | |

| IEEE 802.11b SISO Ant1 | | | |
|---|---|---|---|
| Channel frequency (MHz) | Power Density (dBm/3kHz) | Power Density Limit (dBm/3kHz) | Result |
| 2412 | -9.70 | 8 | Pass |
| 2437 | -10.53 | | |
| 2462 | -10.82 | | |



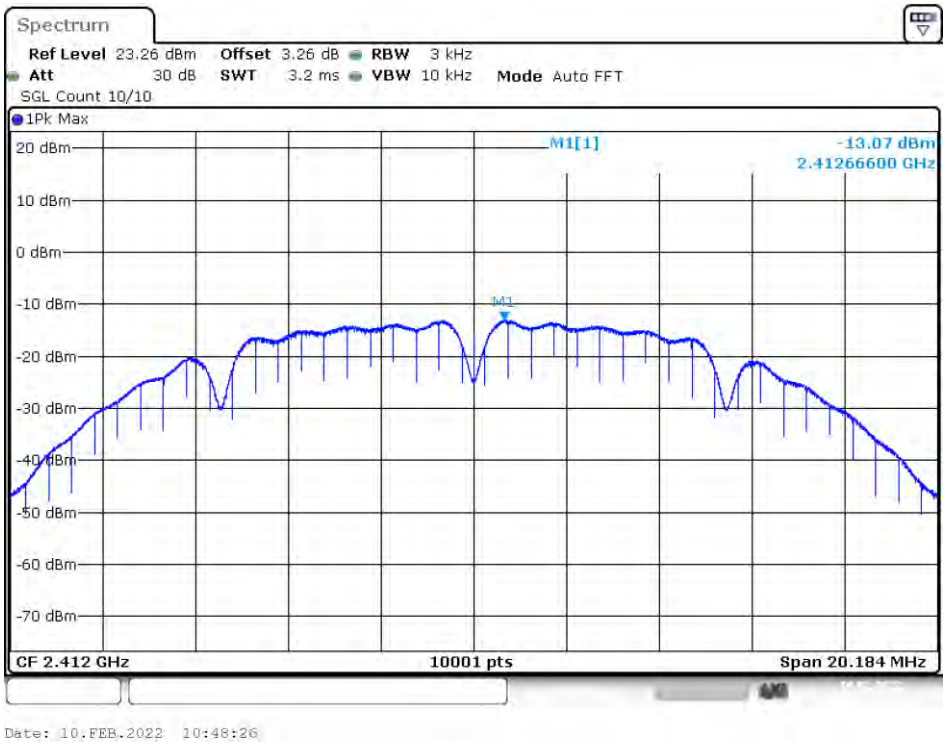


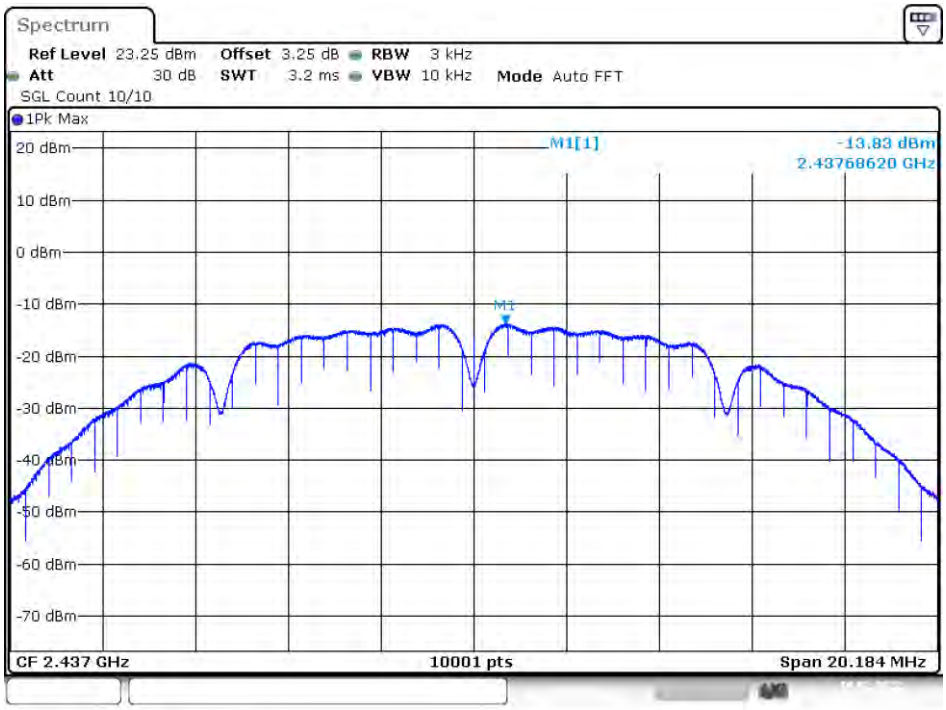

Date: 10.FEB.2022 10:57:46



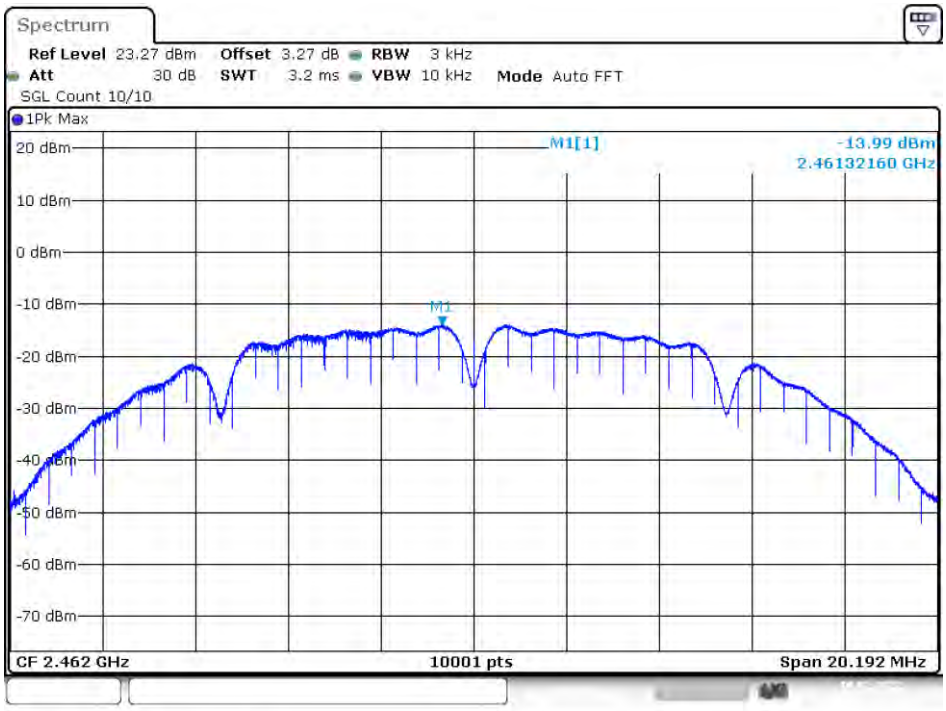

Date: 10.FEB.2022 13:43:19

| IEEE 802.11b SISO Ant2 | | | |
|---|---|---|---|
| Channel frequency (MHz) | Power Density (dBm/3kHz) | Power Density Limit (dBm/3kHz) | Result |
| 2412 | -13.07 | 8 | Pass |
| 2437 | -13.83 | | |
| 2462 | -13.99 | | |



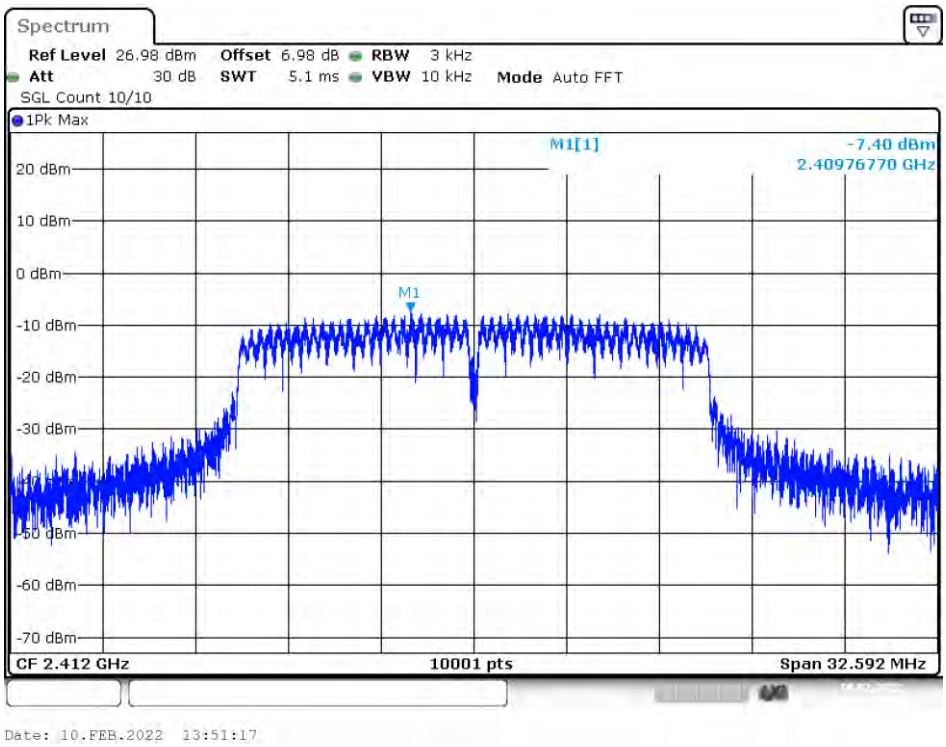



Date: 10.FEB.2022 10:57:49

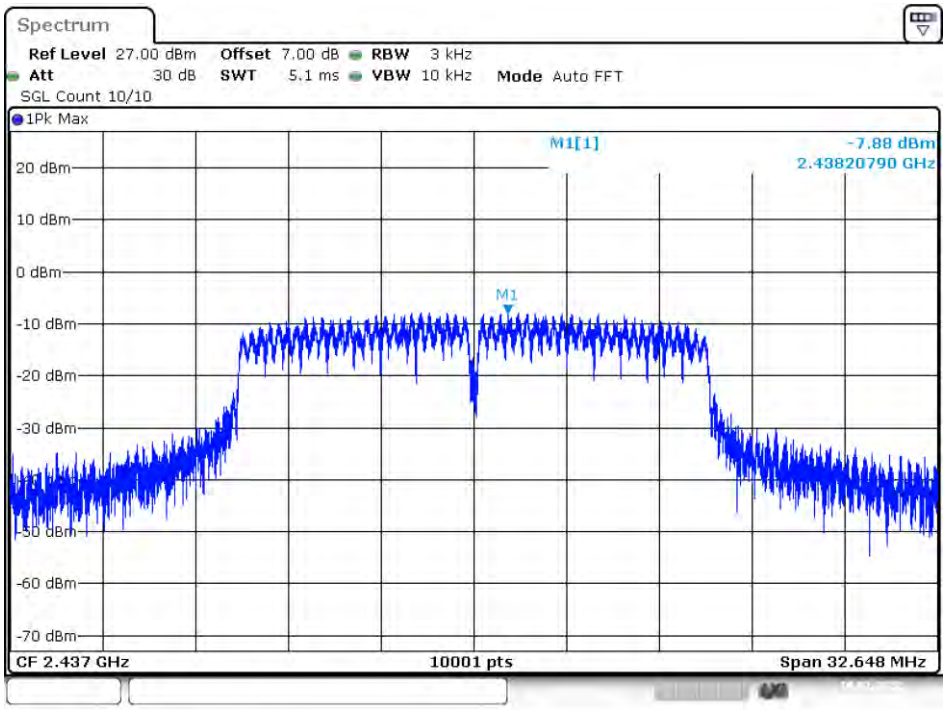



Date: 10.FEB.2022 13:43:23

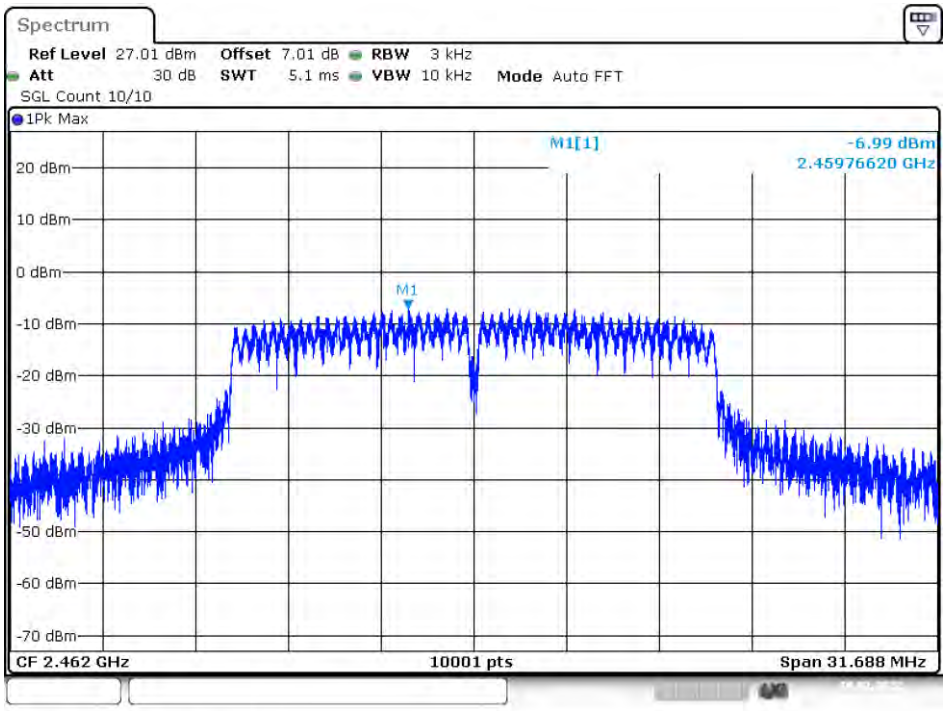
| IEEE 802.11g(SISO) Ant 1 | | | |
|---|---|---|---|
| Channel frequency (MHz) | Power Density (dBm/3kHz) | Power Density Limit (dBm/3kHz) | Result |
| 2412 | -7.40 | 8 | Pass |
| 2437 | -7.88 | | |
| 2462 | -6.99 | | |




Date: 10.FEB.2022 13:51:17

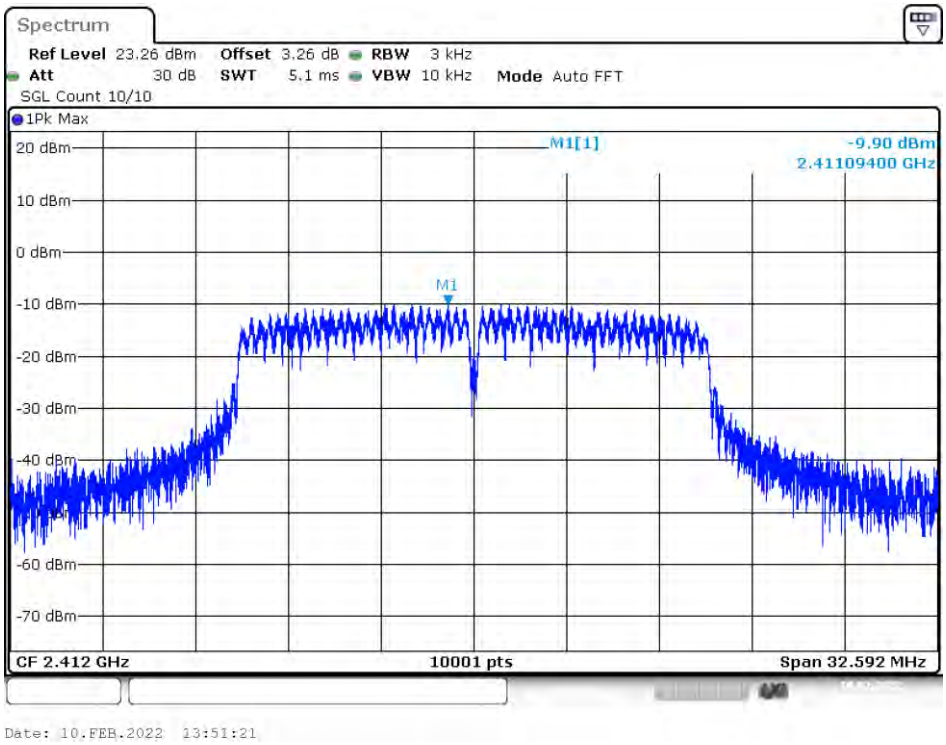


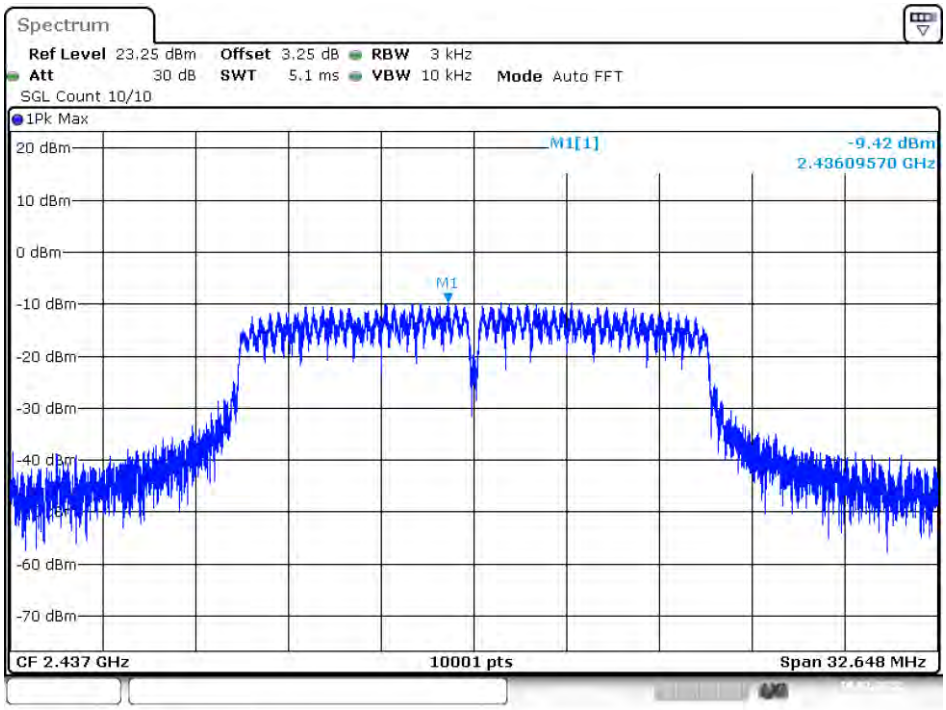

Date: 10.FEB.2022 14:00:57



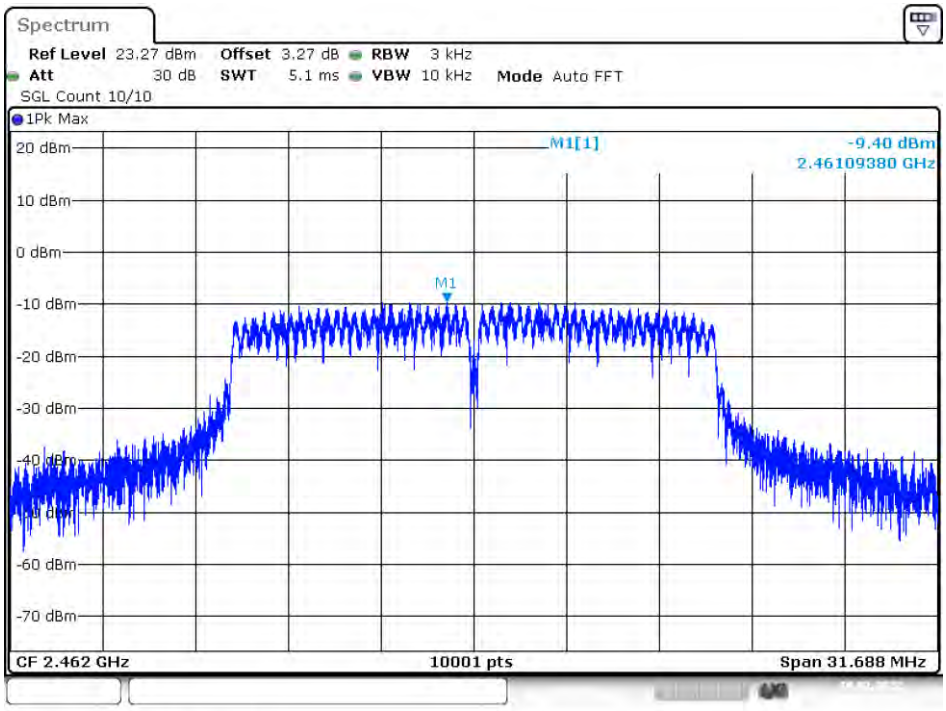

Date: 10.FEB.2022 14:07:15

| IEEE 802.11g(SISO) Ant2 | | | |
|---|---|---|---|
| Channel frequency (MHz) | Power Density (dBm/3kHz) | Power Density Limit (dBm/3kHz) | Result |
| 2412 | -9.90 | 8 | Pass |
| 2437 | -9.42 | | |
| 2462 | -9.40 | | |





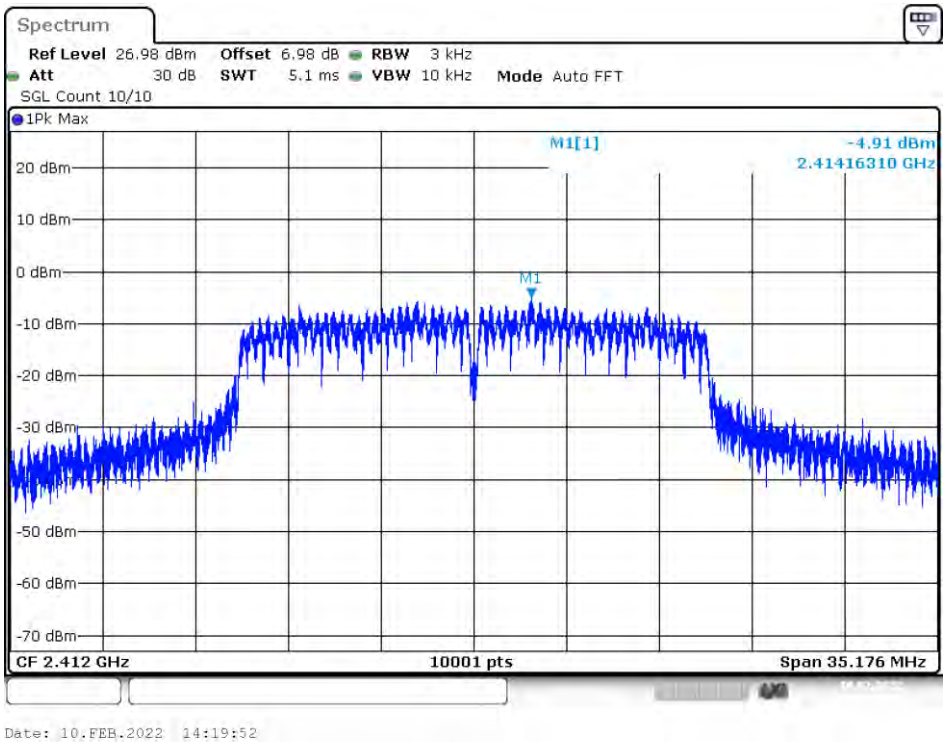

Date: 10.FEB.2022 14:01:01

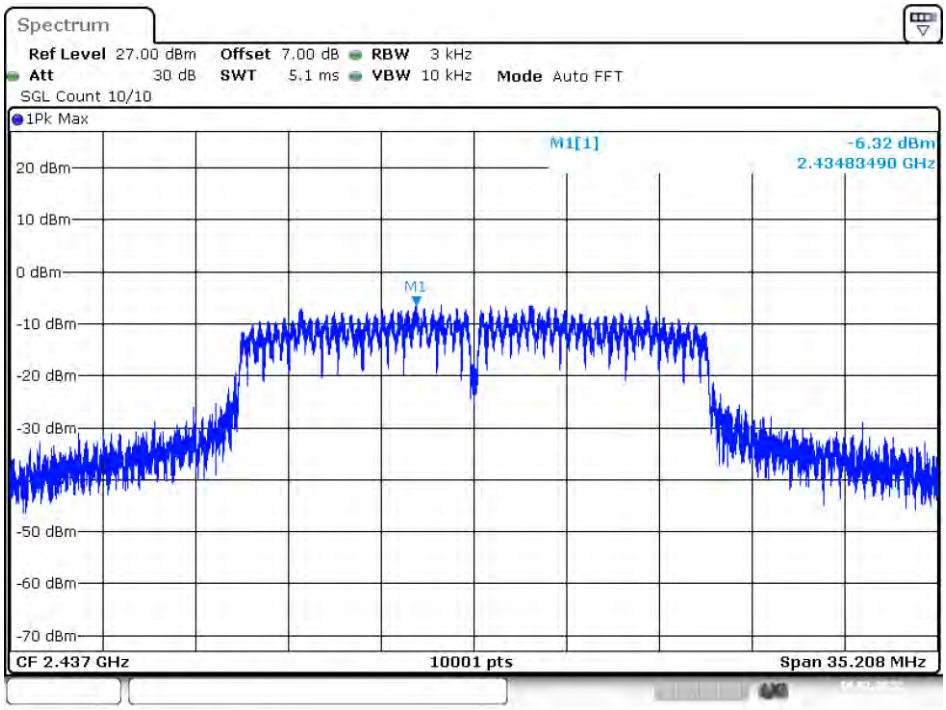



Date: 10.FEB.2022 14:07:19

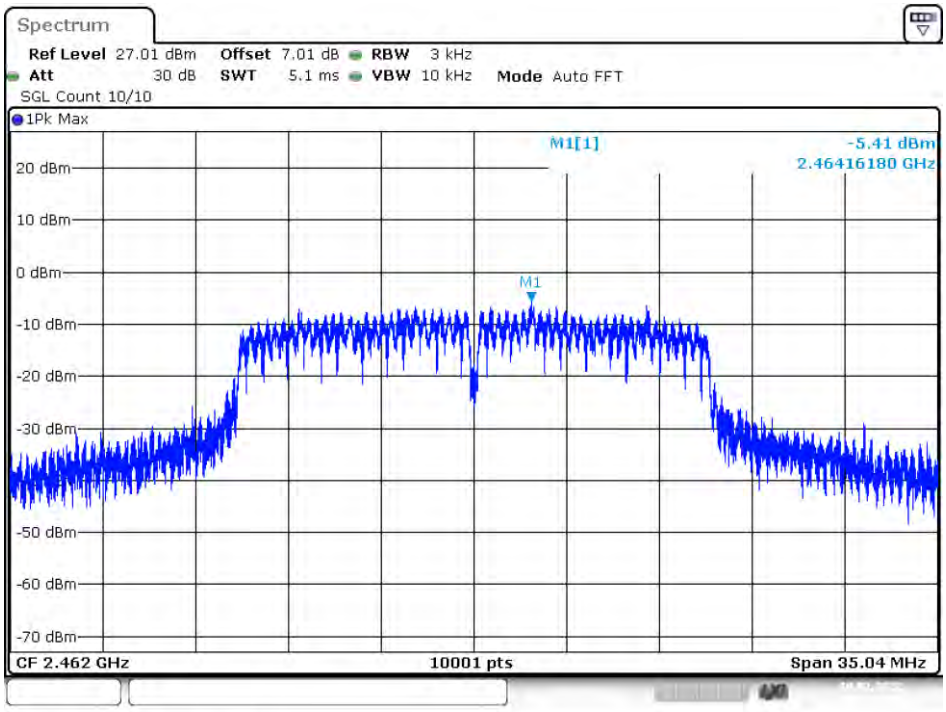
| IEEE 802.11n(HT20) MIMO(Antenna Gain=5.18dBi) | | | | | |
|---|---|---|---|---|---|
| Channel frequency (MHz) | Power Density (dBm/3kHz) | | | Power Density Limit (dBm/3kHz) | Result |
| | Ant1 | Ant2 | Total | | |
| 2412 | -4.91 | -7.42 | -2.98 | 8 | Pass |
| 2437 | -6.32 | -7.69 | -3.94 | | |
| 2462 | -5.41 | -8.71 | -3.74 | | |
| Remark: In MIMO, Ant1+Ant2 Directional Gain=$G_{ant}$+10Log(N)dBi=2.17+10Log(2)=5.18dBi. Directional Gain was according to KDB662911. | | | | | |

Ant1



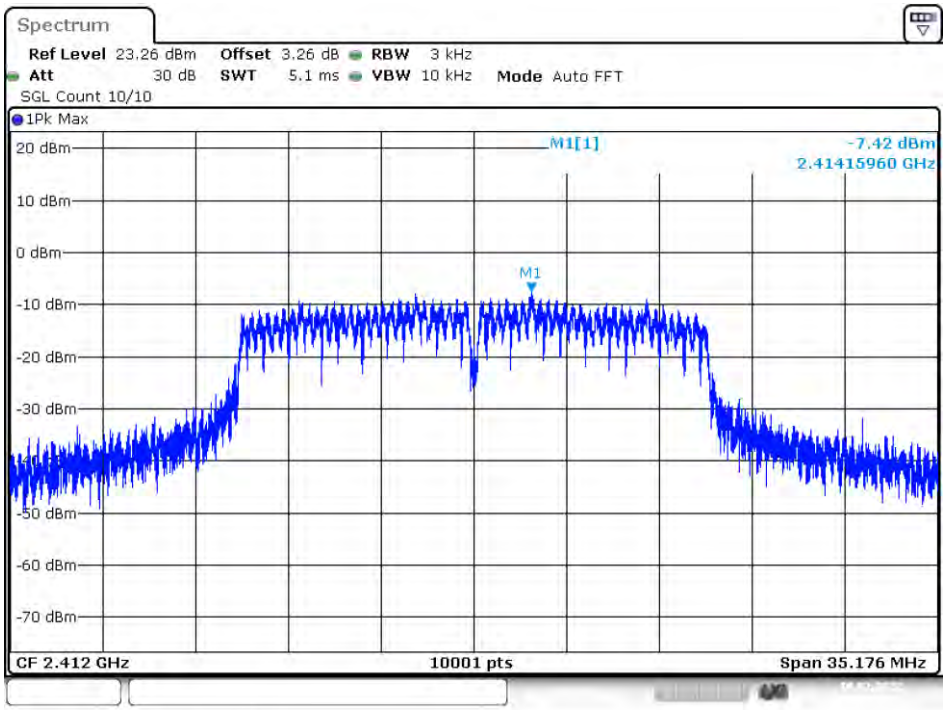



Date: 10.FEB.2022 14:25:07

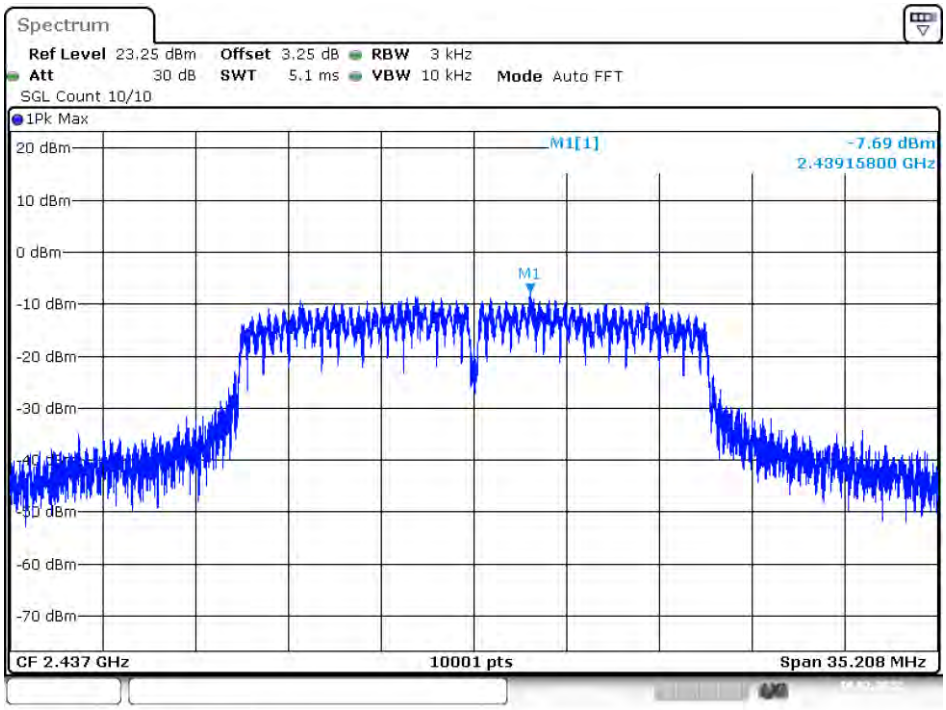



Date: 10.FEB.2022 14:29:16

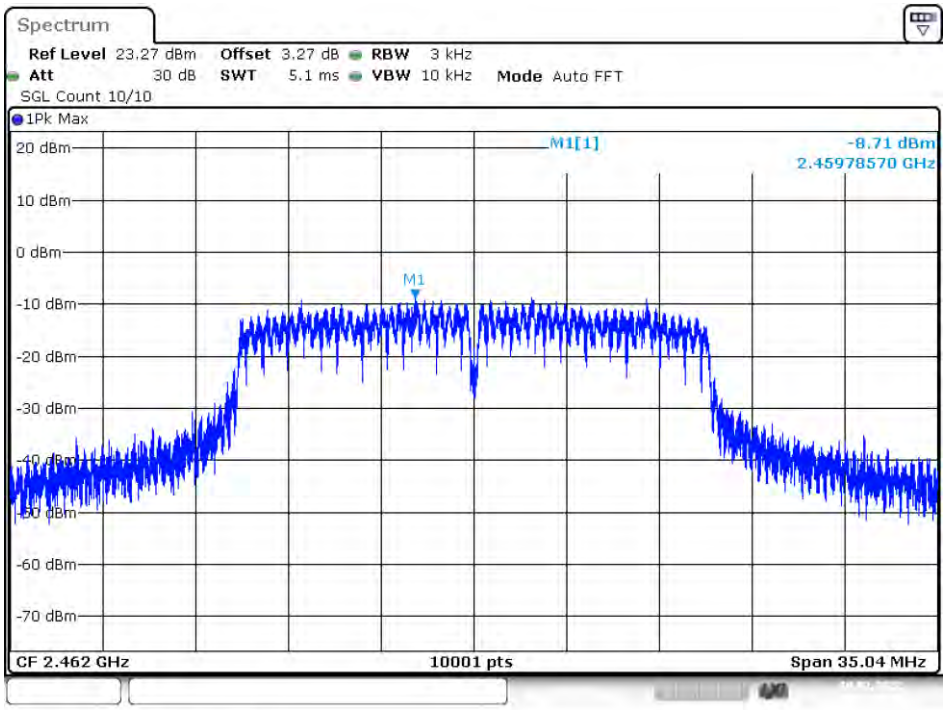
Ant2




Date: 10.FEB.2022 14:19:56



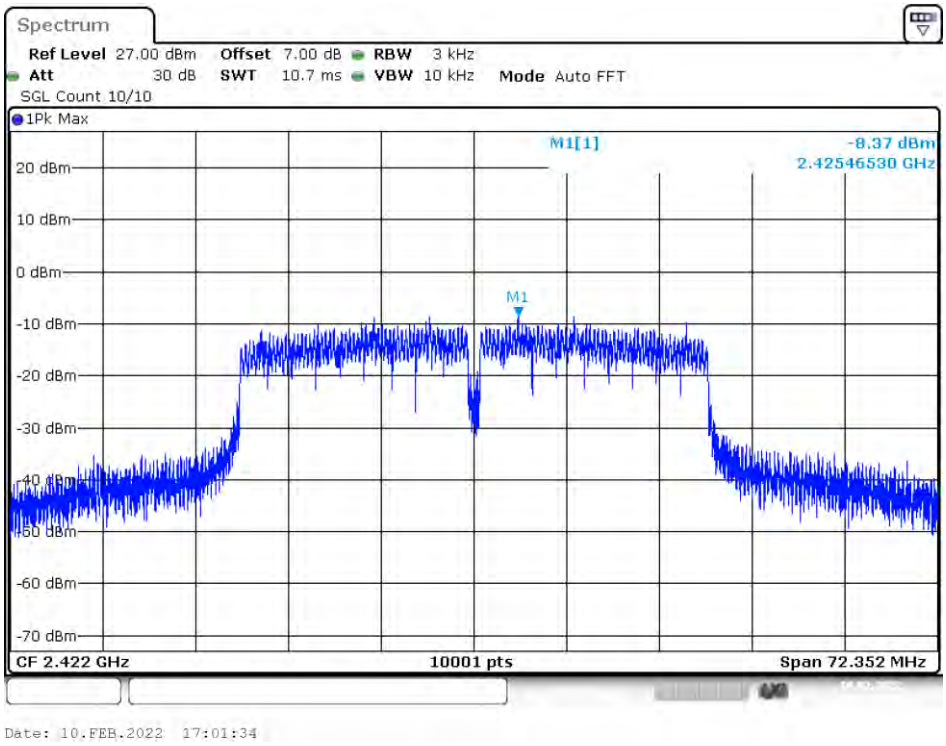

Date: 10.FEB.2022 14:25:11

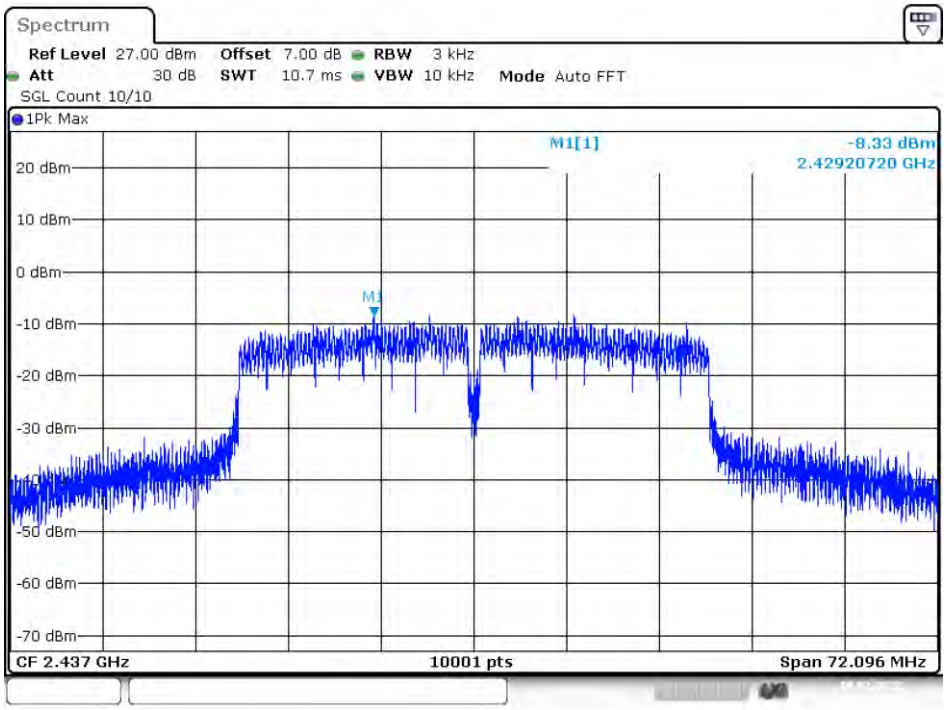



Date: 10.FEB.2022 14:29:19

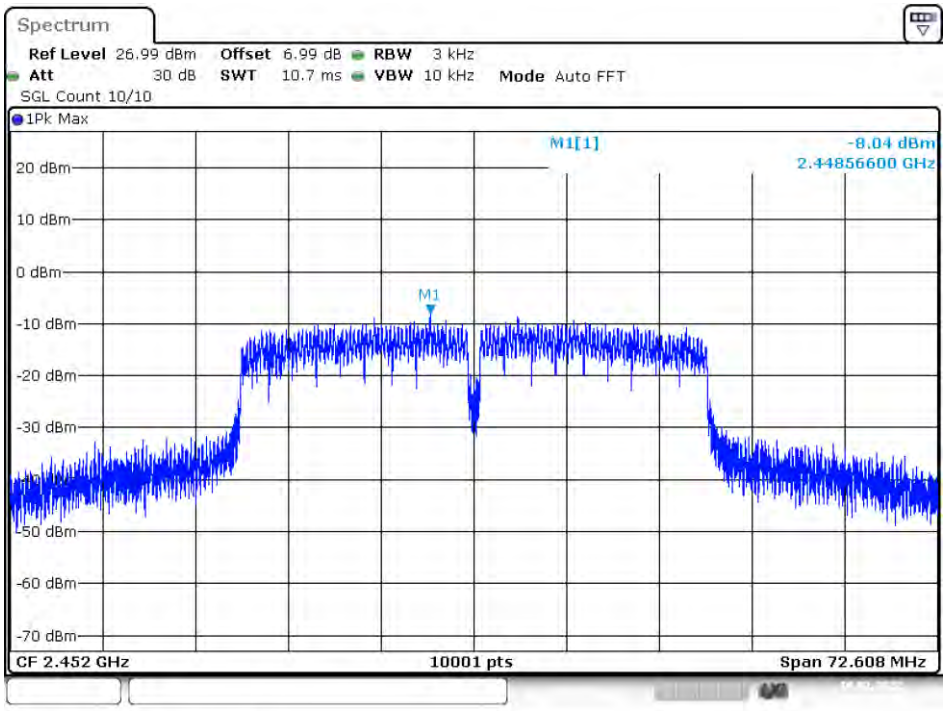
| IEEE 802.11n(HT40) MIMO(Antenna Gain=5.18dBi) | | | | | |
|---|---|---|---|---|---|
| Channel frequency (MHz) | Power Density (dBm/3kHz) | | | Power Density Limit (dBm/3kHz) | Result |
| | Ant 1 | Ant 2 | Total | | |
| 2422 | -8.37 | -9.65 | -5.95 | 8 | Pass |
| 2437 | -8.33 | -9.59 | -5.90 | | |
| 2452 | -8.04 | -10.47 | -6.08 | | |
| Remark: In MIMO, Ant1+Ant2 Directional Gain=$G_{ant}$+10Log(N)dBi=2.17+10Log(2)=5.18dBi. Directional Gain was according to KDB662911. | | | | | |

Ant1



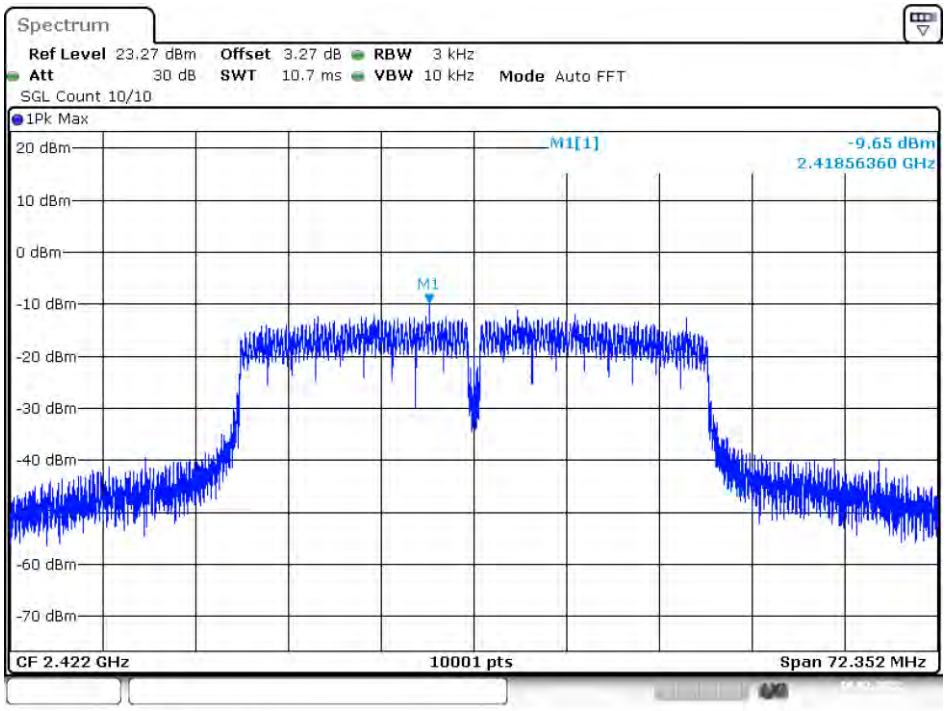



Date: 10.FEB.2022 17:34:35

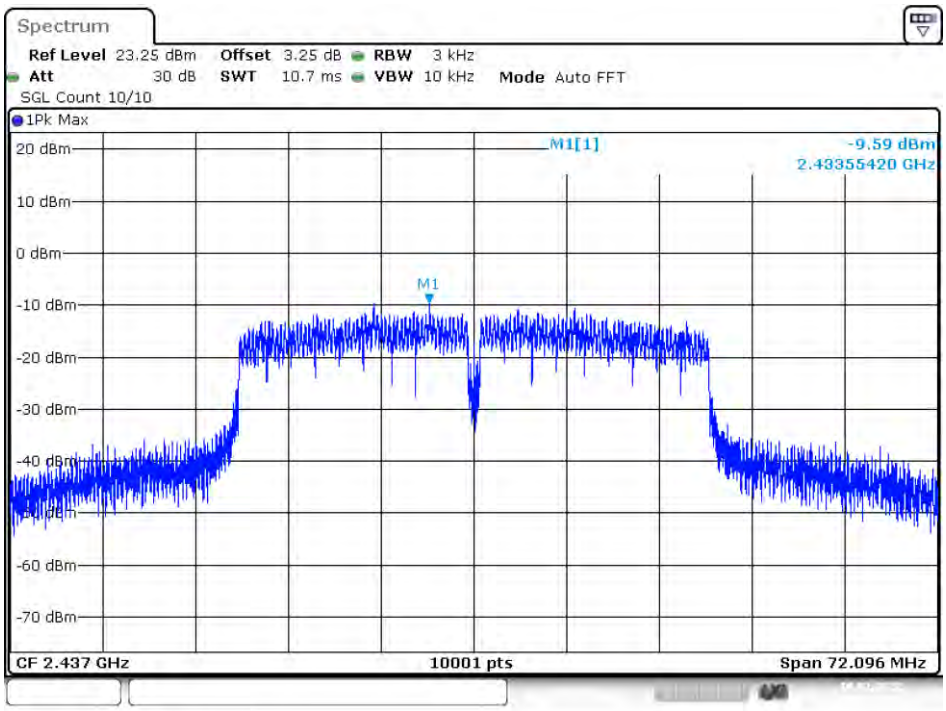



Date: 10.FEB.2022 17:36:48

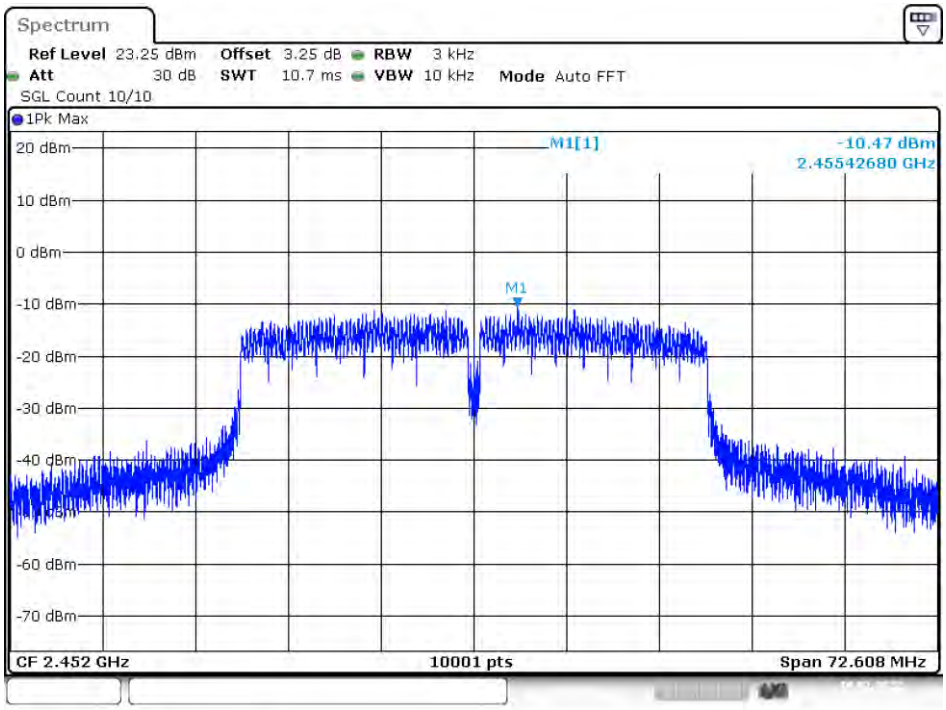
Ant2




Date: 10.FEB.2022 17:01:38




Date: 10.FEB.2022 17:34:39


Spectrum
Ref Level 23.25 dBm Offset 3.25 dB RBW 3 kHz
Att 30 dB SWT 10.7 ms VBW 10 kHz Mode Auto FFT
SGL Count 10/10
1Pk Max
M1[1] -10.47 dBm
2.45542680 GHz
M1
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-60 dBm
-70 dBm
CF 2.452 GHz
10001 pts
Span 72.608 MHz
Date: 10.FEB.2022 17:36:52

# 14. Antenna Port Emission

## 14.1 Test Equipment

| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | CALIBRATED UNTIL |
|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSV40 | US40240623 | 2022-11-12 |
| Coaxial Cable | Gigalink Microwave | ZT40 | 19022092 | 2022-11-12 |
| Antenna Connector | ARTHUR-YANG | 2244-N1TG1 | N/A | 2022-11-12 |

**Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.**

## 14.2 Measuring Instruments and Setting

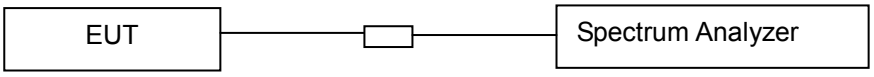
The following table is the setting of spectrum analyzer.

| Spectrum analyzer | Setting |
|---|---|
| Attenuation | Auto |
| RBW | 100kHz |
| VBW | 300kHz |
| Detector | Peak |
| Trace | Max hold |

## 14.3 Test Procedures

The conducted spurious emissions were measured conducted using a spectrum analyzer at low, Middle, and high channels, the limit was determined by attenuation 20dB of the RF peak power output.

## 14.4 Block Diagram of Test setup

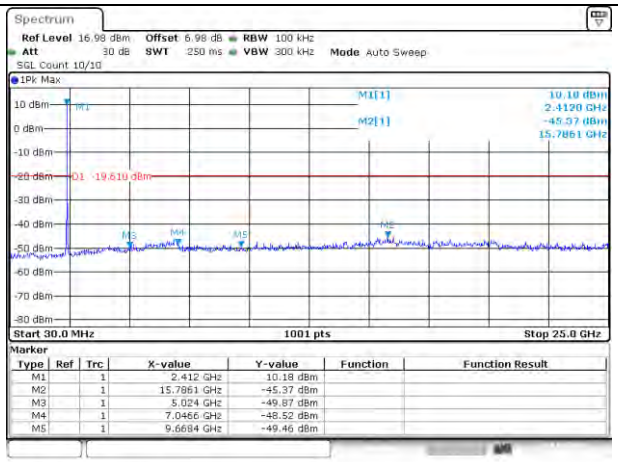



## 14.5 Test Result

**PASS.**

Please refer to the following pages.

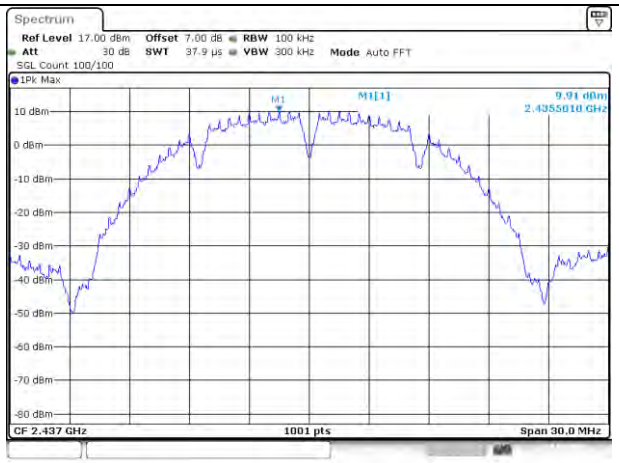
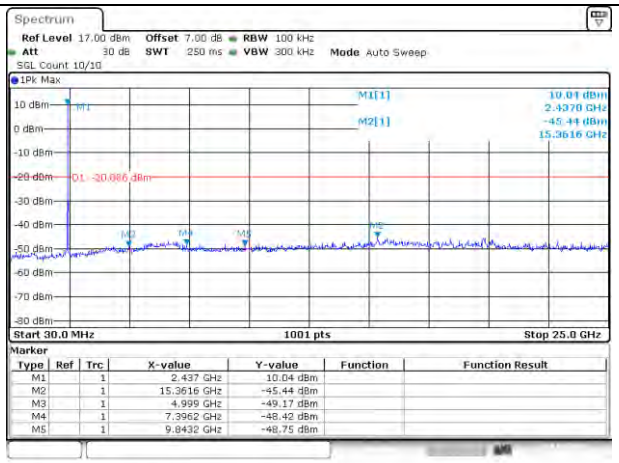
Tx. Spurious 802.11b 2412MHz Ant1 Emission

| Reference | Emission |
|---|---|
| |  |

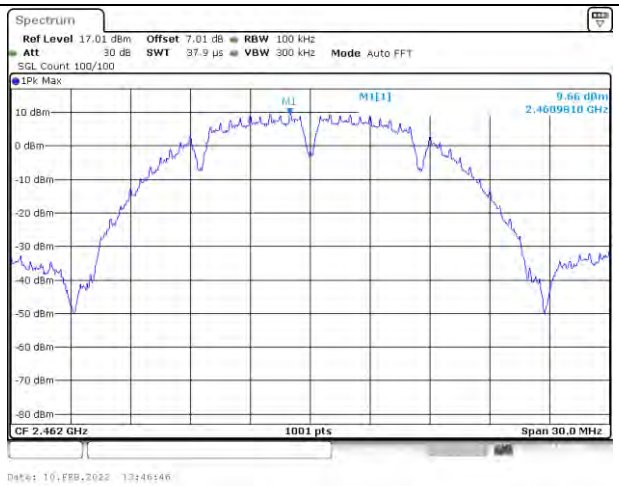
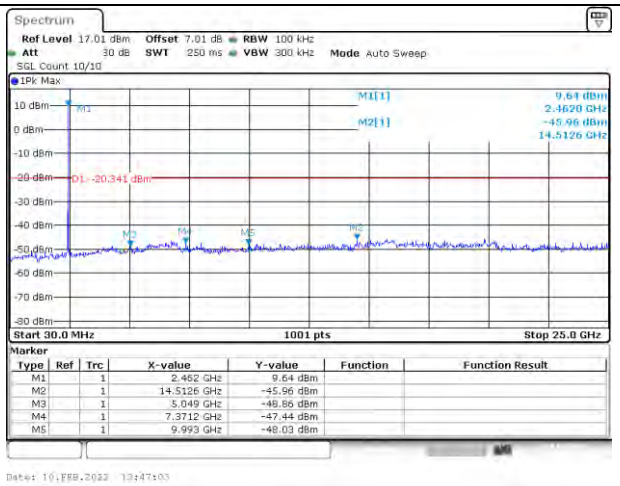




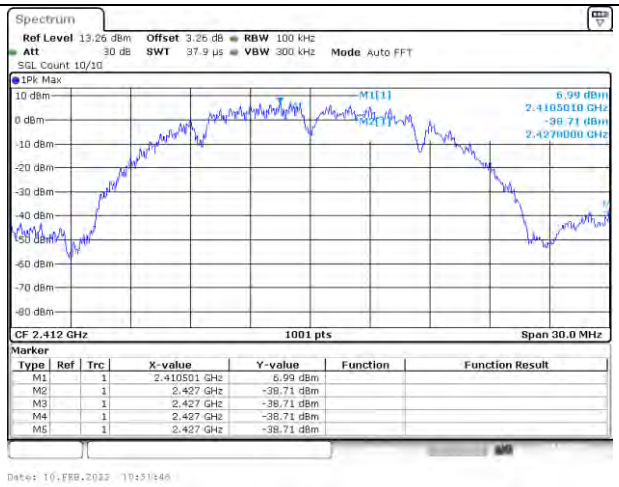
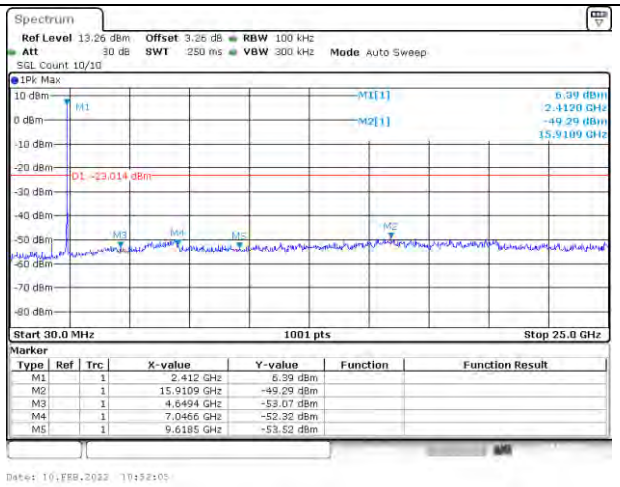
Tx. Spurious 802.11b 2437MHz Ant1 Emission

| Reference | Emission |
|---|---|
|  |  |

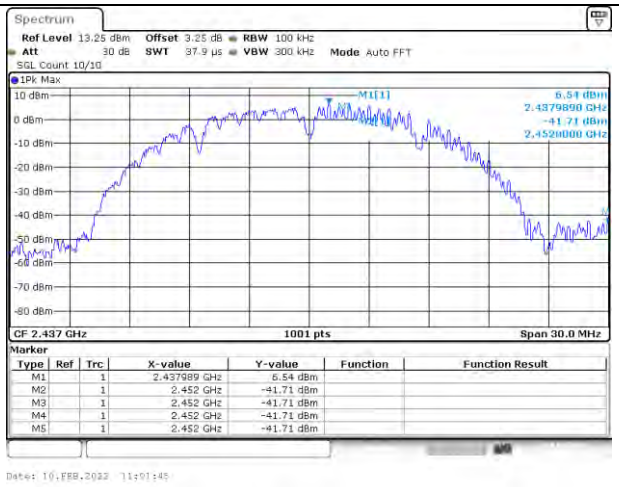
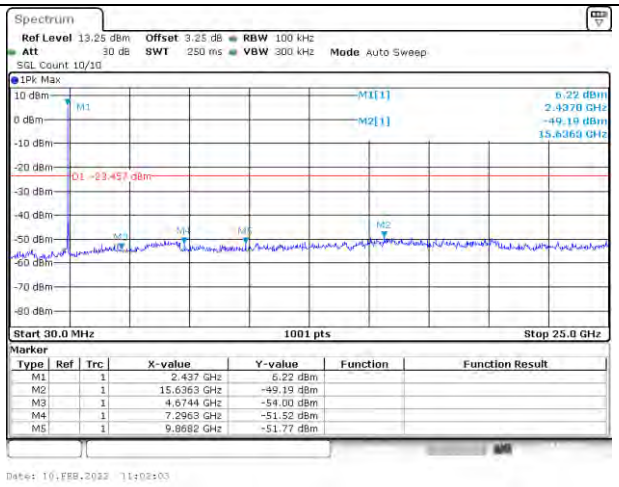
Tx. Spurious 802.11b 2462MHz Ant1 Emission

| Reference | Emission |
|---|---|
|  |  |

Tx. Spurious 802.11b 2412MHz Ant2 Emission

| Reference | Emission |
|---|---|
|  |  |

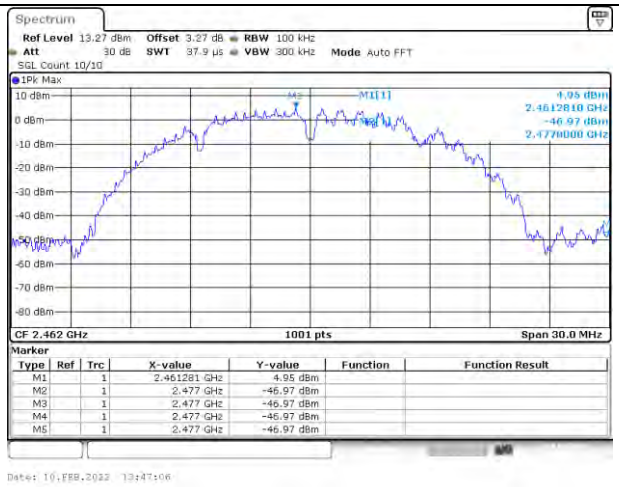
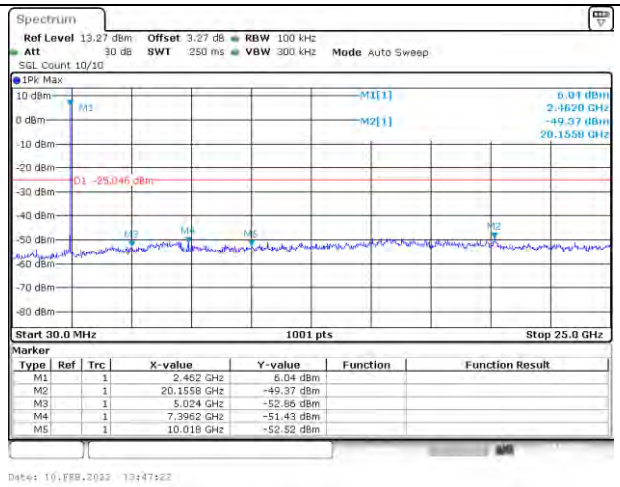
Tx. Spurious 802.11b 2437MHz Ant2 Emission

| Reference | Emission |
|---|---|
|  |  |

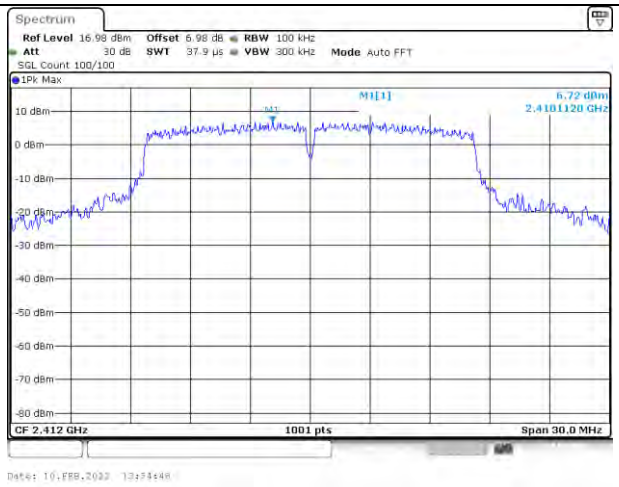
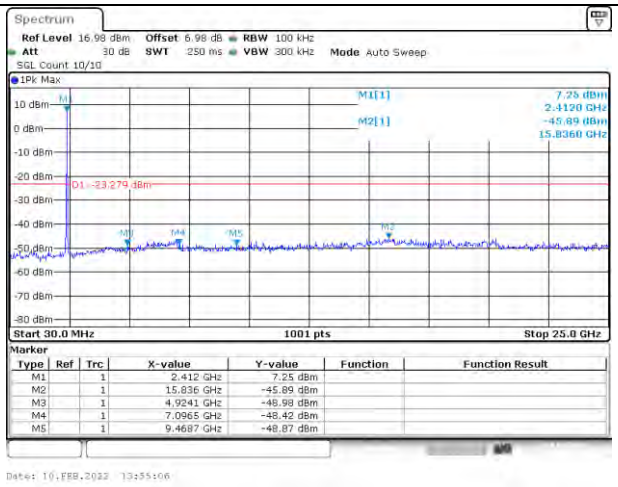




Tx. Spurious 802.11b 2462MHz Ant2 Emission

| Reference | Emission |
|---|---|
|  |  |

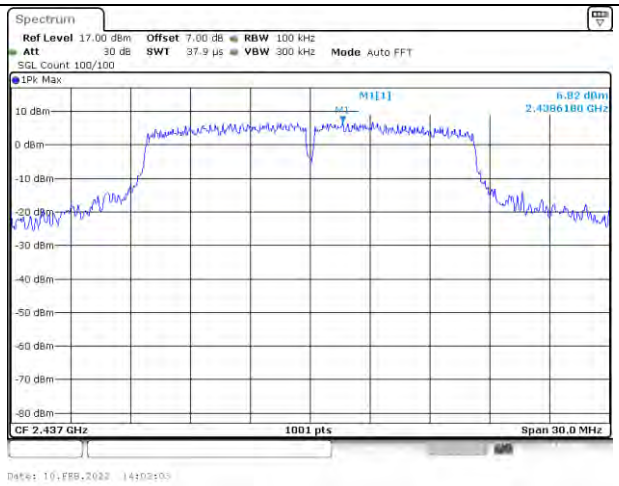
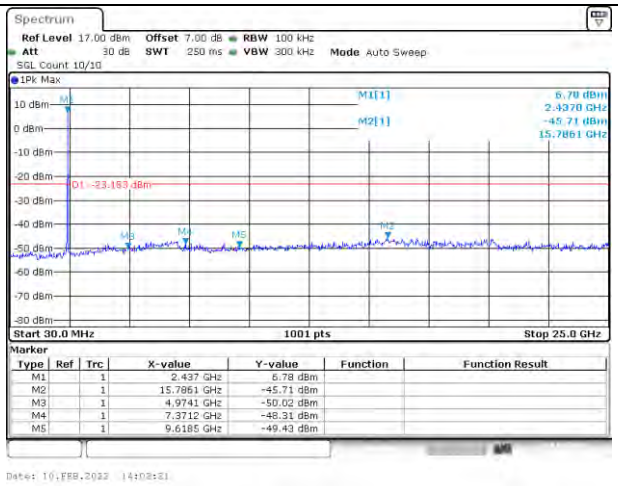
Tx. Spurious 802.11g 2412MHz Ant1 Emission

| Reference | Emission |
|---|---|
|  |  |

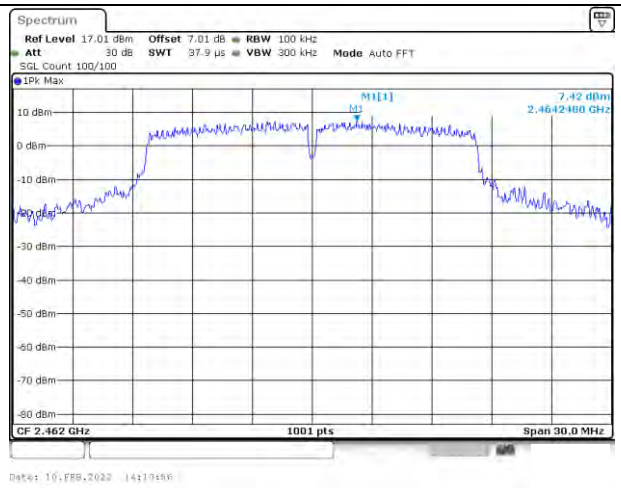
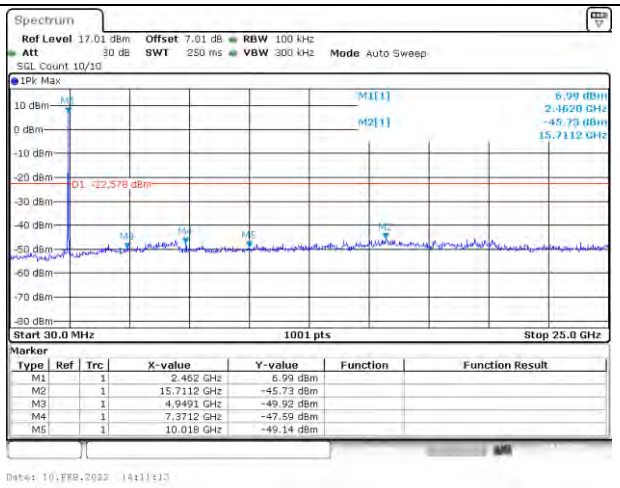




Tx. Spurious 802.11g 2437MHz Ant1 Emission

| Reference | Emission |
|---|---|
|  |  |

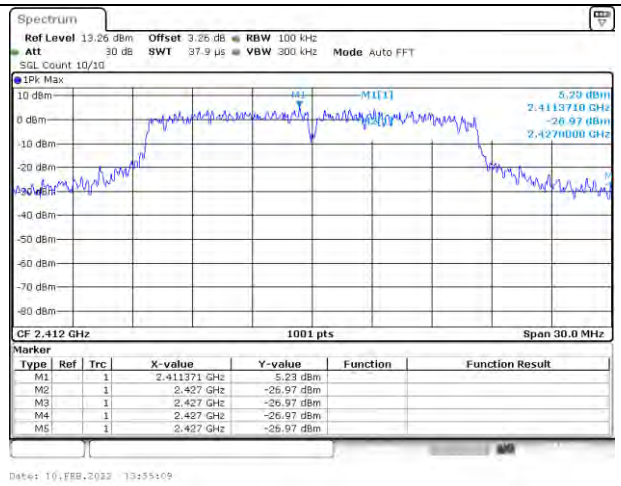
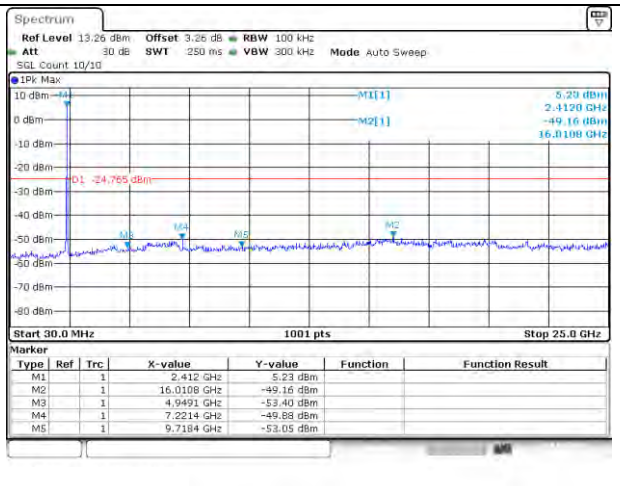
Tx. Spurious 802.11g 2462MHz Ant1 Emission

| Reference | Emission |
|---|---|
|  |  |

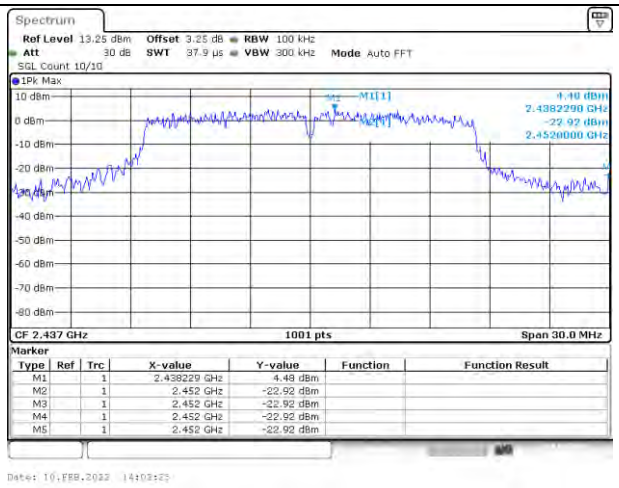
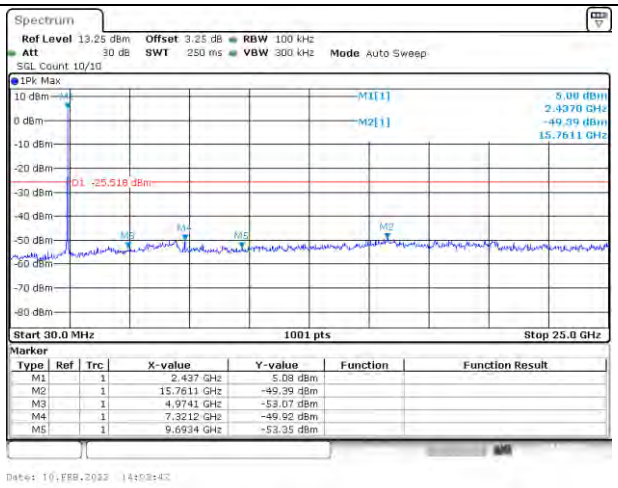




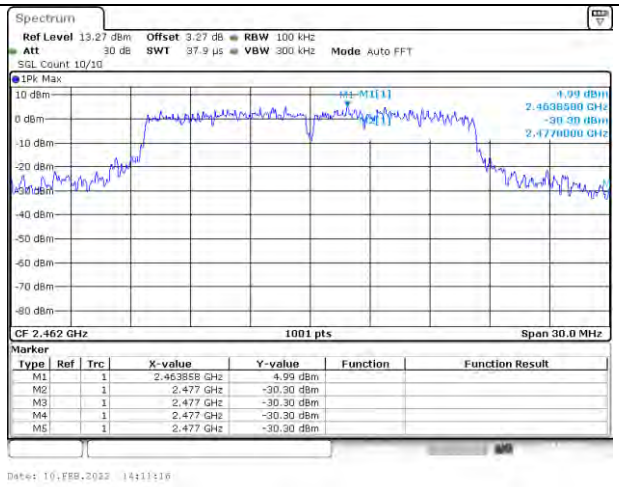
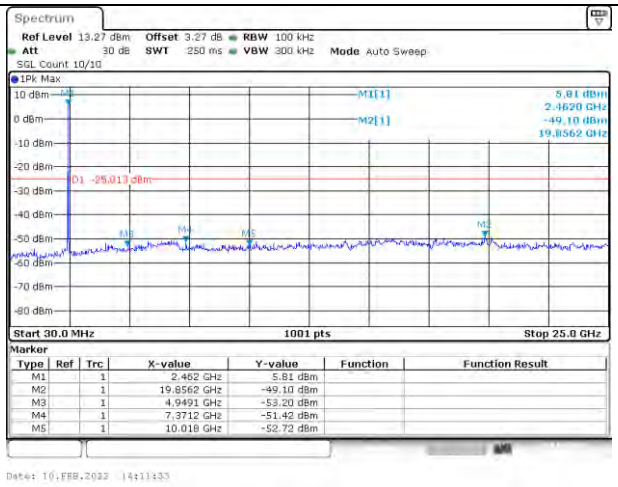
Tx. Spurious 802.11g 2412MHz Ant2 Emission

| Reference | Emission |
|---|---|
|  |  |

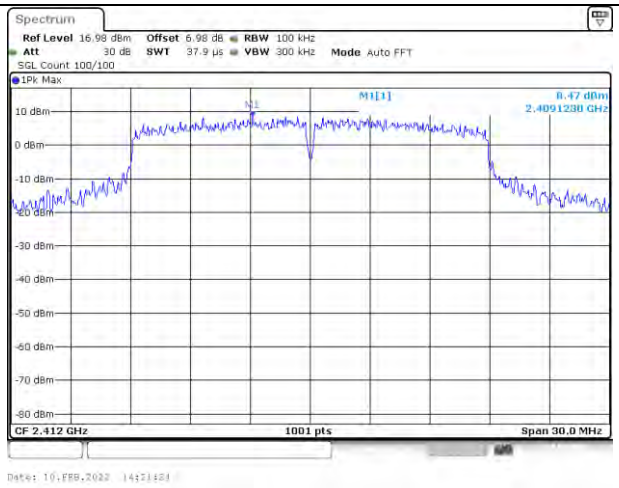
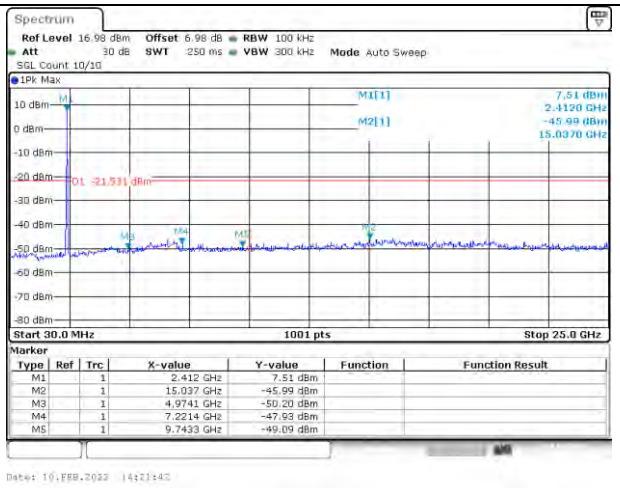
Tx. Spurious 802.11g 2437MHz Ant2 Emission

| Reference | Emission |
|---|---|
|  |  |

Tx. Spurious 802.11g 2462MHz Ant2 Emission

| Reference | Emission |
|---|---|
|  |  |

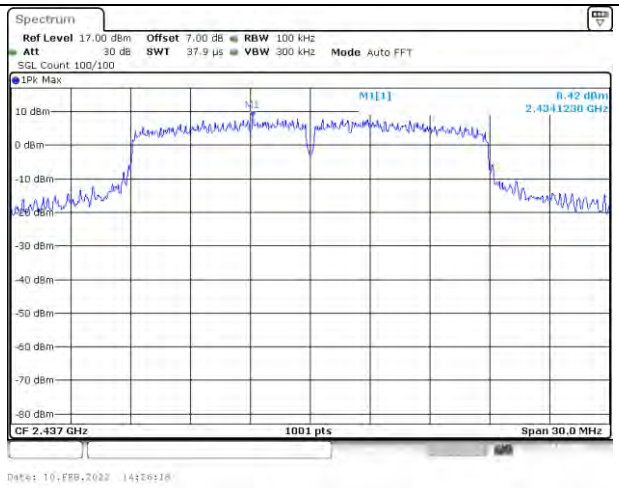
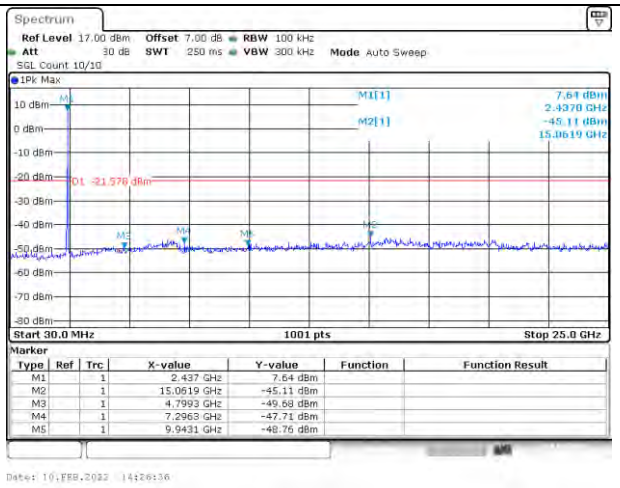
Tx. Spurious 802.11n(HT20) 2412MHz MIMO Emission

| Reference | Emission |
|---|---|
|  |  |

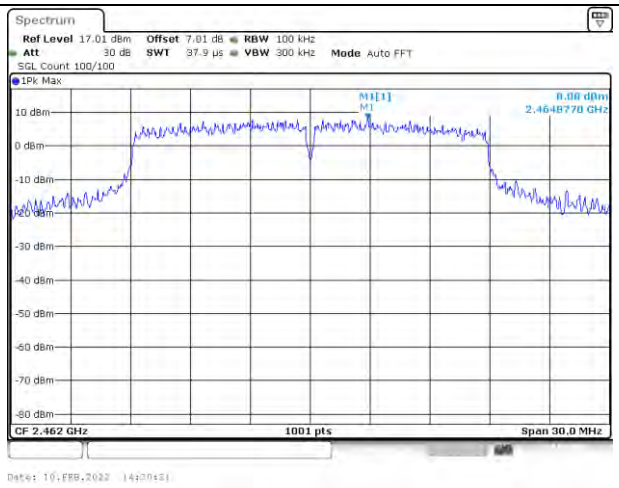
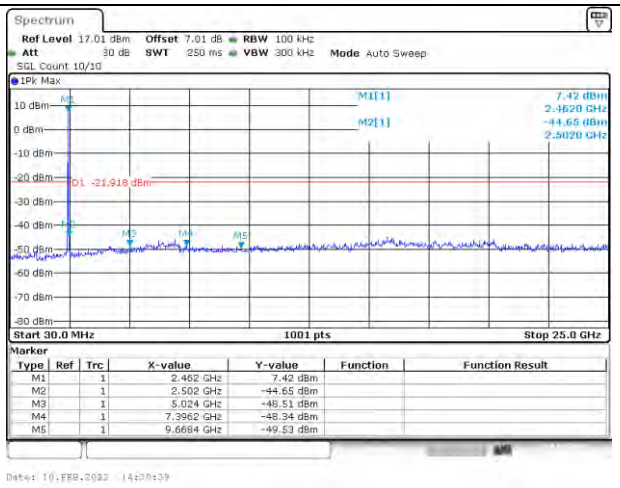




Tx. Spurious 802.11n(HT20) 2437MHz MIMO Emission

| Reference | Emission |
|---|---|
|  |  |

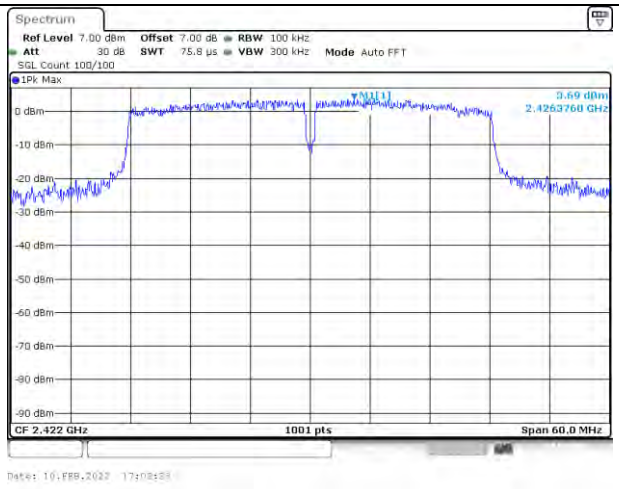
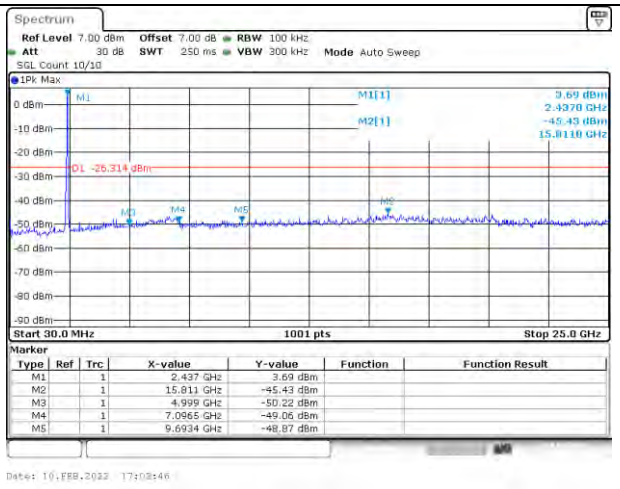
Tx. Spurious 802.11n(HT20) 2462MHz MIMO Emission

| Reference | Emission |
|---|---|
|  |  |

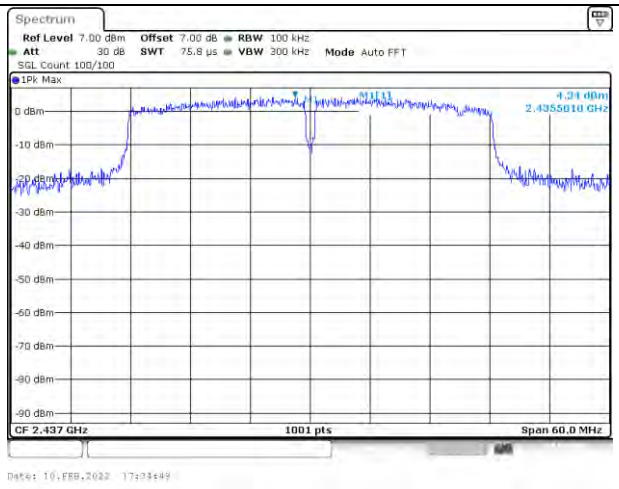
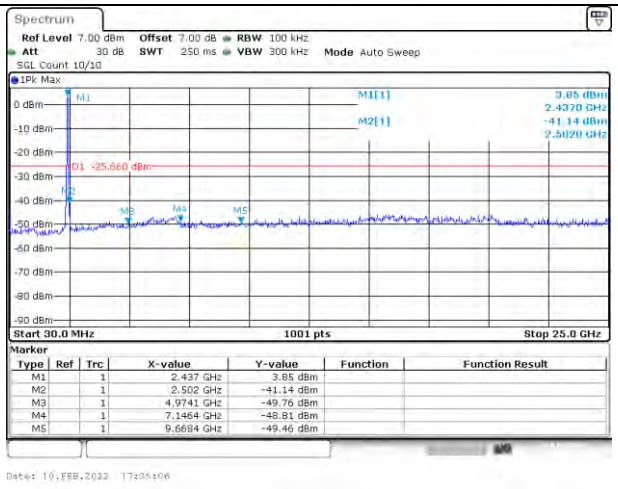




Tx. Spurious 802.11n(HT40) 2422MHz MIMO Emission

| Reference | Emission |
|---|---|
|  |  |

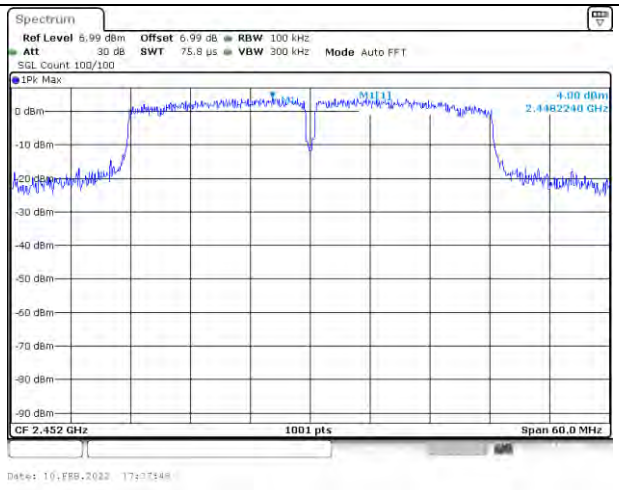
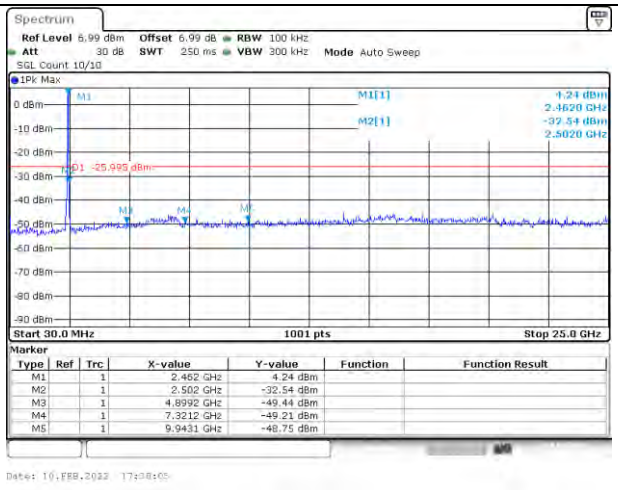
Tx. Spurious 802.11n(HT40) 2437MHz MIMO Emission

| Reference | Emission |
|---|---|
|  |  |





Tx. Spurious 802.11n(HT40) 2452MHz MIMO Emission

| Reference | Emission |
|---|---|
|  |  |

# 15. Antenna Application

## 15.1 Antenna Requirement

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

## 15.2 Result

The EUT'S antenna are internal PIFA antennas and integrated on PCB. The antenna's gain is 2.17dBi and meets the requirement

# 16. Photos of EUT

Please refer to report: E01A22010552F01301.

----------The end of report----------