



中国认可  
国际互认  
检测  
**TESTING**  
**CNAS L6791**

# TEST REPORT

**Applicant:** Ugreen Group Limited  
**Address:** URGEEN Building, Longcheng Industrial Park,  
Longguanxi Road, Longhua, ShenZhen, China  
**Equipment Type:** AC1300 USB High Gain Dual Band Wi-Fi Adapter  
**Model Name:** CM493  
**Brand Name:** **UGREEN**  
**FCC ID:** 2AQI5-50341  
**Test Standard:** 47 CFR Part 15 Subpart C  
(refer to section 3.1)  
**Sample Arrival Date:** Jan. 03, 2025  
**Test Date:** Jan. 06, 2025 - Jan. 09, 2025  
**Date of Issue:** Feb. 28, 2025

**ISSUED BY:**

Shenzhen BALUN Technology Co., Ltd.

**Tested by:** Julie Zhu**Checked by:** Ye Hongji**Approved by:** Sunny Zou  
(Technical Director)

### Revision History

| Version        | Issue Date           | Revisions            |
|----------------|----------------------|----------------------|
| <u>Rev. 01</u> | <u>Feb. 28, 2025</u> | <u>Initial Issue</u> |

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# 1 GENERAL INFORMATION

## 1.1 Test Laboratory

|              |                                                                                                                              |
|--------------|------------------------------------------------------------------------------------------------------------------------------|
| Name         | Shenzhen BALUN Technology Co., Ltd.                                                                                          |
| Address      | Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China |
| Phone Number | +86 755 6685 0100                                                                                                            |

## 1.2 Test Location

|                           |                                                                                                                                                                                                                         |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name                      | Shenzhen BALUN Technology Co., Ltd.                                                                                                                                                                                     |
| Location                  | <input checked="" type="checkbox"/> Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China                                                        |
|                           | <input type="checkbox"/> 1/F, Building B, Ganghongji High-tech Intelligent Industrial Park, No. 1008, Songbai Road, Yangguang Community, Xili Sub-district, Nanshan District, Shenzhen, Guangdong Province, P. R. China |
| Accreditation Certificate | The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196.                                                                                        |

## 2 PRODUCT INFORMATION

### 2.1 Applicant Information

|           |                                                                                       |
|-----------|---------------------------------------------------------------------------------------|
| Applicant | Ugreen Group Limited                                                                  |
| Address   | URGEEN Building, Longcheng Industrial Park, Longguanxi Road, Longhua, ShenZhen, China |

### 2.2 Manufacturer Information

|              |                                                                                       |
|--------------|---------------------------------------------------------------------------------------|
| Manufacturer | Ugreen Group Limited                                                                  |
| Address      | URGEEN Building, Longcheng Industrial Park, Longguanxi Road, Longhua, ShenZhen, China |

### 2.3 Factory Information

|         |                                                                                                                         |
|---------|-------------------------------------------------------------------------------------------------------------------------|
| Factory | Dingnan county Fulong Technology co., Ltd.                                                                              |
| Address | Yingtangindustry park, Qinghua Blvd Liangfu industrydistrict, Lishitown, Dingnan, GanZhou, JiangXi province, P.R. China |

### 2.4 General Description for Equipment under Test (EUT)

|                                           |                                              |
|-------------------------------------------|----------------------------------------------|
| EUT Name                                  | AC1300 USB High Gain Dual Band Wi-Fi Adapter |
| Model Name Under Test                     | CM493                                        |
| Series Model Name                         | N/A                                          |
| Description of Model name differentiation | N/A                                          |
| Hardware Version                          | N/A                                          |
| Software Version                          | N/A                                          |
| Dimensions (Approx.)                      | N/A                                          |
| Weight (Approx.)                          | N/A                                          |

Remark:

- Product Number (P/N) code in the below table, for marketing purpose, will be marked on the marking plate.

|       |         |         |         |         |         |         |        |        |        |        |        |        |
|-------|---------|---------|---------|---------|---------|---------|--------|--------|--------|--------|--------|--------|
| 50341 | 50341EU | 50341UK | 50341US | 50341JP | 50341CN | 50341KC | 50341A | 50341B | 50341C | 50341P | 50341X | 50341U |
|-------|---------|---------|---------|---------|---------|---------|--------|--------|--------|--------|--------|--------|

## 2.5 Technical Information

|                                   |                                                      |
|-----------------------------------|------------------------------------------------------|
| Network and Wireless connectivity | WIFI 802.11a, 802.11b, 802.11g, 802.11n and 802.11ac |
|-----------------------------------|------------------------------------------------------|

The requirement for the following technical information of the EUT was tested in this report:

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                 |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Frequency Range                                         | 802.11b/g/n(20 MHz): 2.412 GHz - 2.462 GHz<br>$f_c = 2412 \text{ MHz} + (N-1)*5 \text{ MHz}$ , where<br>- $f_c$ = "Operating Frequency" in MHz,<br>- $N$ = "Channel Number" with the range from 1 to 11.<br>802.11n(40 MHz): 2.422 GHz - 2.452 GHz<br>$f_c = 2412 \text{ MHz} + (N-1)*5 \text{ MHz}$ , where<br>- $f_c$ = "Operating Frequency" in MHz,<br>- $N$ = "Channel Number" with the range from 3 to 9. |                                                                                                                                                                 |
| Modulation Type                                         | DSSS, OFDM                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                 |
| Product Type                                            | <input type="checkbox"/> Mobile<br><input checked="" type="checkbox"/> Portable<br><input type="checkbox"/> Fix Location                                                                                                                                                                                                                                                                                        |                                                                                                                                                                 |
| Antenna System (eg., MIMO, Smart Antenna)               | Cyclic Delay Diversity (CDD) for 802.11b/g<br>Multi Input Multi Output (MIMO) for 802.11n                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                 |
| Categorization as Correlated or Completely Uncorrelated | Categorization as Correlated for 802.11b/g<br>Categorization as Uncorrelated for 802.11n                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                 |
| Antenna Type                                            | SISO-Antenna A<br>SISO-Antenna B                                                                                                                                                                                                                                                                                                                                                                                | Dipole Antenna                                                                                                                                                  |
| Antenna Gain                                            | SISO-Antenna A<br>SISO-Antenna B                                                                                                                                                                                                                                                                                                                                                                                | 4.67 dBi                                                                                                                                                        |
| Total directional gain                                  | For power spectral density (PSD) measurements                                                                                                                                                                                                                                                                                                                                                                   | Correlated:<br>7.68 dBi<br>Formulas: Directional gain = $G_{ANT} + 10 \log(N_{ANT})$ dBi<br>Uncorrelated:<br>4.67 dBi<br>Formulas: Directional gain = $G_{ANT}$ |
|                                                         | For power measurements                                                                                                                                                                                                                                                                                                                                                                                          | Correlated:<br>7.68 dBi<br>Formulas: Directional gain = $G_{ANT} + 10 \log(N_{ANT})$ dBi<br>Uncorrelated:<br>4.67 dBi<br>Formulas: Directional gain = $G_{ANT}$ |
|                                                         | For Conducted                                                                                                                                                                                                                                                                                                                                                                                                   | Correlated:<br>7.68 dBi                                                                                                                                         |

|                   |                                       |                                                                                                                             |
|-------------------|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
|                   | Out-of-Band and Spurious Measurements | Formulas: Directional gain = $GANT + 10 \log(NANT)$ dBi<br>Uncorrelated:<br>4.67 dBi<br>Formulas: Directional gain = $GANT$ |
| About the Product |                                       | Only the WIFI 802.11b, 802.11g and 802.11n (HT20/40) was tested in this report.                                             |

| Mode                                                                                           | Antenna        |                |      |
|------------------------------------------------------------------------------------------------|----------------|----------------|------|
|                                                                                                | SISO-Antenna A | SISO-Antenna B | MIMO |
| 802.11b                                                                                        | √              | √              | √    |
| 802.11g                                                                                        | √              | √              | √    |
| 802.11n20                                                                                      | √              | √              | √    |
| 802.11n40                                                                                      | √              | √              | √    |
| Note: All the configurations were tested, but only the worst case was reported in this report. |                |                |      |

| Modulation technology | Modulation Type | Transfer Rate (Mbps)(Single RF path) |
|-----------------------|-----------------|--------------------------------------|
| DSSS (802.11b)        | DBPSK           | 1                                    |
|                       | DQPSK           | 2                                    |
|                       | CCK             | 5.5/11                               |
| OFDM (802.11g)        | BPSK            | 6/9                                  |
|                       | QPSK            | 12/18                                |
|                       | 16QAM           | 24/36                                |
|                       | 64QAM           | 48/54                                |
| OFDM (802.11n-20 MHz) | BPSK            | 6.5/7.2                              |
|                       | QPSK            | 13/19.5/14.4/21.7                    |
|                       | 16QAM           | 26/39/28.9/43.3                      |
|                       | 64QAM           | 52/58.5/65/57.8/65/72.2              |
| OFDM (802.11n-40 MHz) | BPSK            | 13.5/15                              |
|                       | QPSK            | 27/40.5/30/45                        |
|                       | 16QAM           | 54/81/60/90                          |
|                       | 64QAM           | 108/121.5/135/120/150                |

Note: Preliminary tests were performed in different data rate in above table to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

| Test Items                   | Mode                | Data Rate         | Channel |       |
|------------------------------|---------------------|-------------------|---------|-------|
| Output Power                 | 11b/11g/11n20/11n40 | 1/6/6.5/13.5 Mbps | 1/6/11  | 3/6/9 |
| Occupied Bandwidth           | 11b/11g/11n20/11n40 | 1/6/6.5/13.5 Mbps | 1/6/11  | 3/6/9 |
| Conducted Spurious Emission  | 11b/11g/11n20/11n40 | 1/6/6.5/13.5 Mbps | 1/6/11  | 3/6/9 |
| Conducted Emission           | 11b/11g/11n20/11n40 | 1/6/6.5/13.5 Mbps | 1/6/11  | 3/6/9 |
| Radiated Spurious Emission   | 11b/11g/11n20/11n40 | 1/6/6.5/13.5 Mbps | 1/6/11  | 3/6/9 |
| Band Edge                    | 11b/11g/11n20/11n40 | 1/6/6.5/13.5 Mbps | 1/6/11  | 3/6/9 |
| Power spectral density (PSD) | 11b/11g/11n20/11n40 | 1/6/6.5/13.5 Mbps | 1/6/11  | 3/6/9 |

Note: The above EUT information in section 2.5 was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

### 3 SUMMARY OF TEST RESULTS

#### 3.1 Test Standards

| No.    | Identity                            | Document Title                                                                                                                                                                           |
|--------|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | 47 CFR Part 15, Subpart C           | Intentional radiators of radio frequency equipment                                                                                                                                       |
| 2<br>☆ | KDB Publication<br>662911 D01v02r01 | Emissions Testing of Transmitters with Multiple Outputs in the Same Band (e.g., MIMO, Smart Antenna, etc)                                                                                |
| 3      | ANSI C63.10-2013                    | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices                                                                                           |
| 4<br>☆ | KDB Publication 558074<br>D01v05r02 | GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES |

#### 3.2 Test Verdict

| No. | Description                          | FCC Part No.       | Test Result | Verdict              |
|-----|--------------------------------------|--------------------|-------------|----------------------|
| 1   | Antenna Requirement                  | 15.203             | N/A         | Pass <sup>Note</sup> |
| 2   | Output Power                         | 15.247 (b)         | 5.2.4       | Pass                 |
| 3   | Occupied Bandwidth                   | 15.247 (a)         | 5.3.4       | Pass                 |
| 4   | Conducted Spurious Emission          | 15.247 (d)         | 5.4.4       | Pass                 |
| 5   | Band Edge(Authorized-band band-edge) | 15.247 (d)         | 5.5.4       | Pass                 |
| 6   | Conducted Emission                   | 15.207             | 5.6.4       | Pass                 |
| 7   | Radiated Spurious Emission           | 15.209; 15.247 (d) | 5.7.4       | Pass                 |
| 8   | Band Edge(Restricted-band band-edge) | 15.209; 15.247 (d) | 5.8.4       | Pass                 |
| 9   | Power spectral density (PSD)         | 15.247 (e)         | 5.9.4       | Pass                 |

Note: The EUT has a permanently and irreplaceable attached antenna, which complies with the requirement FCC 15.203.

## 4 GENERAL TEST CONFIGURATIONS

### 4.1 Test Environments

During the measurement, the normal environmental conditions were within the listed ranges:

|                            |                         |                    |
|----------------------------|-------------------------|--------------------|
| Relative Humidity          | 35% to 54%              |                    |
| Atmospheric Pressure       | 100 kPa to 102 kPa      |                    |
| Temperature                | NT (Normal Temperature) | +16.8°C to +24.6°C |
| Working Voltage of the EUT | NV (Normal Voltage)     | 5.0 V              |

### 4.2 Test Equipment List

| Description         | Manufacturer               | Model             | Serial No.  | Cal. Date  | Cal. Due   |
|---------------------|----------------------------|-------------------|-------------|------------|------------|
| Spectrum Analyzer   | KEYSIGHT                   | N9020A            | MY56060183  | 2024.08.01 | 2025.07.31 |
| Power Sensor        | KEYSIGHT                   | U2063XA           | MY58000251  | 2024.07.04 | 2025.07.03 |
| Spectrum Analyzer   | KEYSIGHT                   | N9020A            | MY52510065  | 2024.08.01 | 2025.07.31 |
| Test Antenna-Horn   | SCHWARZBECK                | BBHA 9120D        | 01631       | 2022.02.23 | 2025.02.22 |
| Test Antenna-Horn   | A-INFO                     | LB-180400KF       | J211060273  | 2024.06.15 | 2027.06.14 |
| Anechoic Chamber    | RAINFORD                   | 9m*6m*6m          | 144         | 2022.02.19 | 2025.09.03 |
| Amplifier           | COM-MV                     | LSCX_LNA1-12G-01  | 180602      | 2024.08.01 | 2025.07.31 |
| Amplifier           | COM-MV                     | XKu_LNA7-18G-01   | 180601      | 2024.08.01 | 2025.07.31 |
| Amplifier           | COM-MV                     | KA LNA18 40G-01   | 18050001    | 2024.12.05 | 2025.12.04 |
| EMI Receiver        | ROHDE&SCHWARZ              | ESRP              | 101036      | 2024.08.01 | 2025.07.31 |
| Test Antenna-Bi-Log | SCHWARZBECK                | VULB 9168         | 9168-01162  | 2023.08.04 | 2026.08.03 |
| Test Antenna-Loop   | SCHWARZBECK                | FMZB 1519         | 1519-037    | 2024.01.23 | 2025.01.22 |
| Amplifier           | COM-MV                     | ZT30-1000M        | B2018054558 | 2024.11.28 | 2025.11.27 |
| Anechoic Chamber    | EMC Electronic Co., Ltd    | 20.10*11.60*7.35m | 130         | 2024.07.13 | 2027.07.12 |
| EMI Receiver        | KEYSIGHT                   | N9010B            | MY57110309  | 2024.08.01 | 2025.07.31 |
| LISN                | SCHWARZBECK                | NSLK 8127         | 8127-687    | 2024.05.09 | 2025.05.08 |
| Shielded Enclosure  | YiHeng Electronic Co., Ltd | 3.5m*3.1m*2.8m    | 112         | 2022.02.19 | 2025.02.18 |

### 4.3 Test Software List

| Description | Manufacturer | Software Version | Serial No. | Applicable test Setup               |
|-------------|--------------|------------------|------------|-------------------------------------|
| BL410R      | BALUN        | V2.1.1.488       | N/A        | The section 4.5.1                   |
| BL410E      | BALUN        | V22.930          | N/A        | The section 4.5.2&4.5.3&4.5.4&4.5.5 |

## 4.4 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

| Parameters                        | Uncertainty |
|-----------------------------------|-------------|
| Occupied Channel Bandwidth        | 2.8%        |
| RF output power, conducted        | 1.28 dB     |
| Power Spectral Density, conducted | 1.30 dB     |
| Unwanted Emissions, conducted     | 1.84 dB     |
| All emissions, radiated           | 5.36 dB     |
| Temperature                       | 0.8℃        |
| Humidity                          | 4%          |

## 4.5 Description of Test Setup

### 4.5.1 For Antenna Port Test

Conducted value (dBm) = Measurement value (dBm) + cable loss (dB)

For example: the measurement value is 10 dBm and the cable 0.5dBm used, then the final result of EUT:

Conducted value (dBm) = 10 dBm + 0.5 dB = 10.5 dBm



(Diagram 1)

#### 4.5.2 For AC Power Supply Port Test



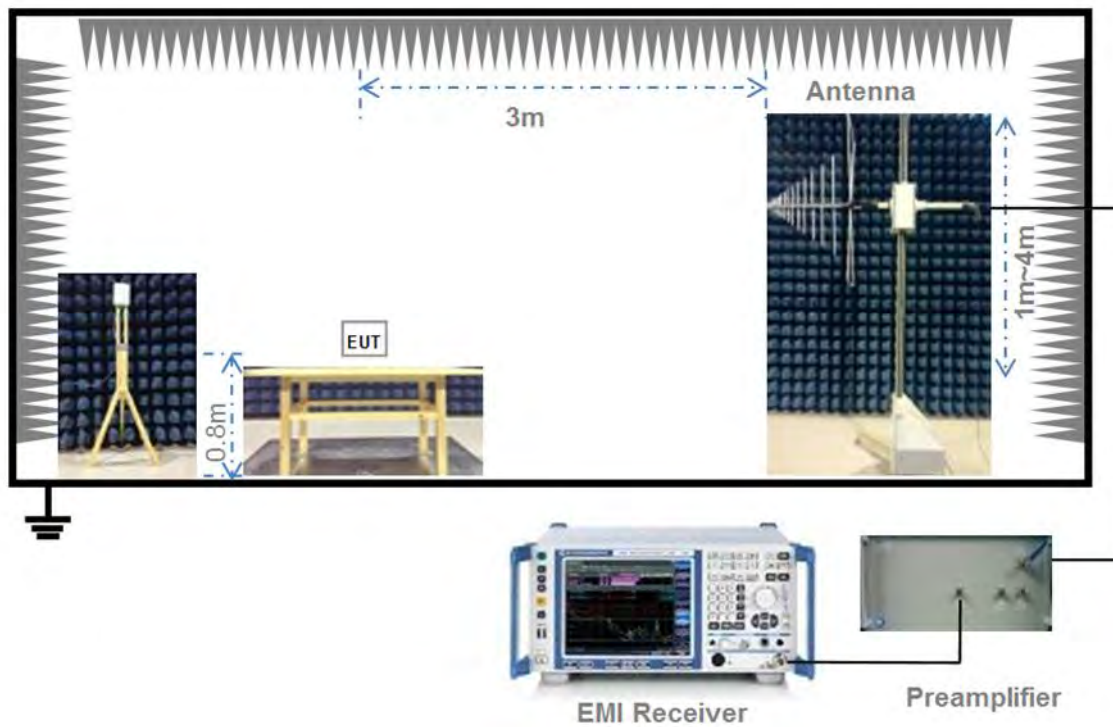
(Diagram 2)

#### 4.5.3 For Radiated Test (Below 30 MHz)



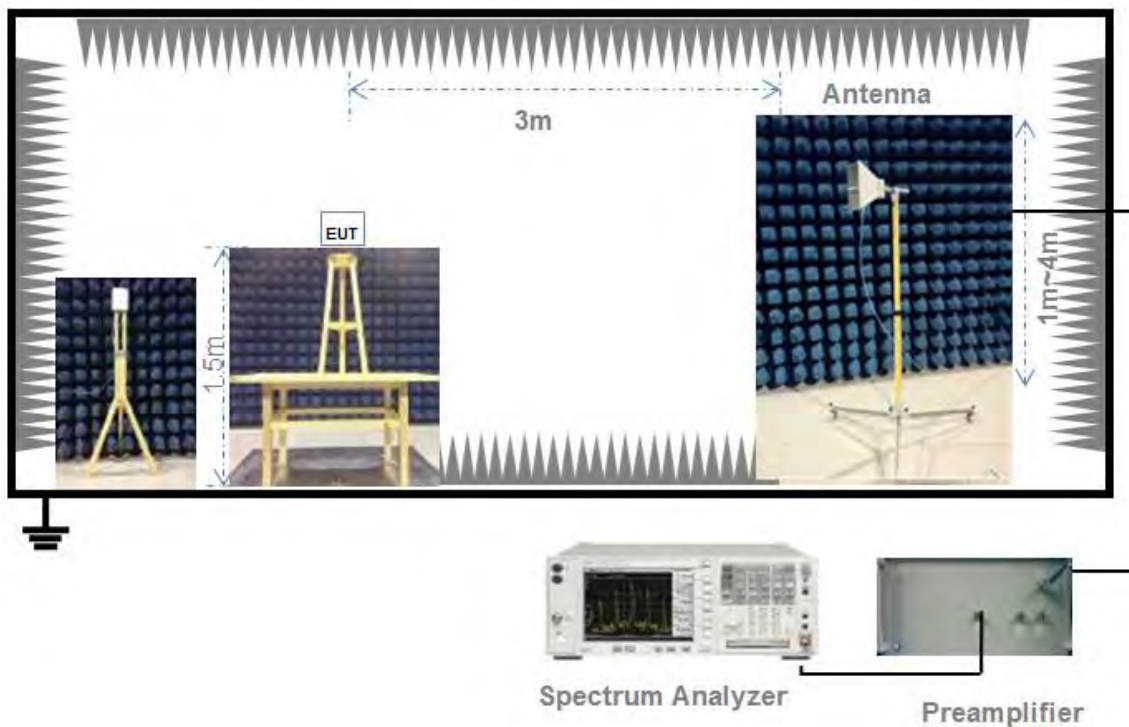
(Diagram 3)

#### 4.5.4 For Radiated Test (30 MHz-1 GHz)



(Diagram 4)

#### 4.5.5 For Radiated Test (Above 1 GHz)



(Diagram 5)

## 4.6 Measurement Results Explanation Example

### 4.6.1 For conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

### 4.6.2 For radiated band edges and spurious emission test:

$$E = \text{EIRP} - 20\log D + 104.8$$

where:

E = electric field strength in dB $\mu$ V/m,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

EIRP = Measure Conducted output power Value (dBm) + Maximum transmit antenna gain (dBi) + the appropriate maximum ground reflection factor (dB)

## 5 TEST ITEMS

### 5.1 Antenna Requirements

#### 5.1.1 Relevant Standards

##### FCC §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

#### 5.1.2 Antenna Anti-Replacement Construction

The Antenna Anti-Replacement as following method:

| Protected Method                        | Description                            |
|-----------------------------------------|----------------------------------------|
| The antenna is embedded in the product. | An embedded-in antenna design is used. |

| Reference Documents | Item                                     |
|---------------------|------------------------------------------|
| Photo               | Please refer to the EUT Photo documents. |

#### 5.1.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

## 5.2 Output Power

### 5.2.1 Test Limit

#### FCC § 15.247(b)

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements.

### 5.2.2 Test Setup

See section 4.5.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX A.

### 5.2.3 Test Procedure

#### Maximum peak conducted output power

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 EUT shall be transmitted at its maximum power control level.

#### Maximum conducted (average) output power (Reporting Only)

a) As an alternative to spectrum analyzer or EMI receiver measurements, measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.

- 1) The EUT is configured to transmit continuously, or to transmit with a constant duty factor.
- 2) At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
- 3) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

b) If the transmitter does not transmit continuously, measure the duty cycle (x) of the transmitter output signal.

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

d) Adjust the measurement in dBm by adding  $10\log(1/x)$ , where x is the duty cycle.

### Measurements of duty cycle

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  $\geq$  OBW 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  $> 50/T$  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.)

### 5.2.4 Test Result

#### Duty Cycle

| Test Mode      | On Time (ms) | On+Off time (ms) | Duty Cycle | Duty Factor |
|----------------|--------------|------------------|------------|-------------|
| 802.11b        | 8.174        | 8.242            | 99.17%     | 0.04        |
| 802.11g        | 1.355        | 1.415            | 95.76%     | 0.19        |
| 802.11n-20 MHz | 1.265        | 1.325            | 95.47%     | 0.20        |
| 802.11n-40 MHz | 0.628        | 0.684            | 91.86%     | 0.37        |

SISO-Antenna APeak Power Test Data

## 802.11b Mode:

| Channel | Measured Output Peak Power |       | Limit |      | Verdict |
|---------|----------------------------|-------|-------|------|---------|
|         | dBm                        | mW    | dBm   | mW   |         |
| Low     | 17.15                      | 51.88 | 30    | 1000 | Pass    |
| Middle  | 16.95                      | 49.55 |       |      | Pass    |
| High    | 16.93                      | 49.32 |       |      | Pass    |

## 802.11g Mode:

| Channel | Measured Output Peak Power |        | Limit |      | Verdict |
|---------|----------------------------|--------|-------|------|---------|
|         | dBm                        | mW     | dBm   | mW   |         |
| Low     | 19.89                      | 97.50  | 30    | 1000 | Pass    |
| Middle  | 20.23                      | 105.44 |       |      | Pass    |
| High    | 20.24                      | 105.68 |       |      | Pass    |

## 802.11n-20 MHz Mode:

| Channel | Measured Output Peak Power |       | Limit |      | Verdict |
|---------|----------------------------|-------|-------|------|---------|
|         | dBm                        | mW    | dBm   | mW   |         |
| Low     | 19.13                      | 81.85 | 30    | 1000 | Pass    |
| Middle  | 18.98                      | 79.07 |       |      | Pass    |
| High    | 19.09                      | 81.10 |       |      | Pass    |

## 802.11n-40 MHz Mode:

| Channel | Measured Output Peak Power |       | Limit |      | Verdict |
|---------|----------------------------|-------|-------|------|---------|
|         | dBm                        | mW    | dBm   | mW   |         |
| Low     | 18.85                      | 76.74 | 30    | 1000 | Pass    |
| Middle  | 19.13                      | 81.85 |       |      | Pass    |
| High    | 19.01                      | 79.62 |       |      | Pass    |

Average Power Test Data

## 802.11b Mode:

| Channel | Measured Output Average Power |       | Limit |      | Verdict |
|---------|-------------------------------|-------|-------|------|---------|
|         | dBm                           | mW    | dBm   | mW   |         |
| Low     | 13.90                         | 24.55 | 30    | 1000 | Pass    |
| Middle  | 13.68                         | 23.33 |       |      | Pass    |
| High    | 13.65                         | 23.17 |       |      | Pass    |

## 802.11g Mode:

| Channel | Measured Output Average Power |       | Limit |      | Verdict |
|---------|-------------------------------|-------|-------|------|---------|
|         | dBm                           | mW    | dBm   | mW   |         |
| Low     | 13.56                         | 22.70 | 30    | 1000 | Pass    |
| Middle  | 13.91                         | 24.60 |       |      | Pass    |
| High    | 13.91                         | 24.60 |       |      | Pass    |

## 802.11n-20 MHz Mode:

| Channel | Measured Output Average Power |       | Limit |      | Verdict |
|---------|-------------------------------|-------|-------|------|---------|
|         | dBm                           | mW    | dBm   | mW   |         |
| Low     | 12.94                         | 19.68 | 30    | 1000 | Pass    |
| Middle  | 12.84                         | 19.23 |       |      | Pass    |
| High    | 12.94                         | 19.68 |       |      | Pass    |

## 802.11n-40 MHz Mode:

| Channel | Measured Output Average Power |       | Limit |      | Verdict |
|---------|-------------------------------|-------|-------|------|---------|
|         | dBm                           | mW    | dBm   | mW   |         |
| Low     | 12.44                         | 17.54 | 30    | 1000 | Pass    |
| Middle  | 12.84                         | 19.23 |       |      | Pass    |
| High    | 12.73                         | 18.75 |       |      | Pass    |

SISO-Antenna BPeak Power Test Data

## 802.11b Mode:

| Channel | Measured Output Peak Power |       | Limit |      | Verdict |
|---------|----------------------------|-------|-------|------|---------|
|         | dBm                        | mW    | dBm   | mW   |         |
| Low     | 17.35                      | 54.33 | 30    | 1000 | Pass    |
| Middle  | 17.05                      | 50.70 |       |      | Pass    |
| High    | 16.63                      | 46.03 |       |      | Pass    |

## 802.11g Mode:

| Channel | Measured Output Peak Power |        | Limit |      | Verdict |
|---------|----------------------------|--------|-------|------|---------|
|         | dBm                        | mW     | dBm   | mW   |         |
| Low     | 19.69                      | 93.11  | 30    | 1000 | Pass    |
| Middle  | 20.33                      | 107.89 |       |      | Pass    |
| High    | 19.84                      | 96.38  |       |      | Pass    |

## 802.11n-20 MHz Mode:

| Channel | Measured Output Peak Power |       | Limit |      | Verdict |
|---------|----------------------------|-------|-------|------|---------|
|         | dBm                        | mW    | dBm   | mW   |         |
| Low     | 19.03                      | 79.98 | 30    | 1000 | Pass    |
| Middle  | 18.58                      | 72.11 |       |      | Pass    |
| High    | 19.19                      | 82.99 |       |      | Pass    |

## 802.11n-40 MHz Mode:

| Channel | Measured Output Peak Power |       | Limit |      | Verdict |
|---------|----------------------------|-------|-------|------|---------|
|         | dBm                        | mW    | dBm   | mW   |         |
| Low     | 18.78                      | 75.51 | 30    | 1000 | Pass    |
| Middle  | 19.03                      | 79.98 |       |      | Pass    |
| High    | 18.71                      | 74.30 |       |      | Pass    |

Average Power Test Data

## 802.11b Mode:

| Channel | Measured Output Average Power |       | Limit |      | Verdict |
|---------|-------------------------------|-------|-------|------|---------|
|         | dBm                           | mW    | dBm   | mW   |         |
| Low     | 13.83                         | 24.15 | 30    | 1000 | Pass    |
| Middle  | 13.81                         | 24.04 |       |      | Pass    |
| High    | 13.98                         | 25.00 |       |      | Pass    |

## 802.11g Mode:

| Channel | Measured Output Average Power |       | Limit |      | Verdict |
|---------|-------------------------------|-------|-------|------|---------|
|         | dBm                           | mW    | dBm   | mW   |         |
| Low     | 13.57                         | 22.75 | 30    | 1000 | Pass    |
| Middle  | 13.61                         | 22.96 |       |      | Pass    |
| High    | 13.63                         | 23.07 |       |      | Pass    |

## 802.11n-20 MHz Mode:

| Channel | Measured Output Average Power |       | Limit |      | Verdict |
|---------|-------------------------------|-------|-------|------|---------|
|         | dBm                           | mW    | dBm   | mW   |         |
| Low     | 12.95                         | 19.72 | 30    | 1000 | Pass    |
| Middle  | 12.78                         | 18.97 |       |      | Pass    |
| High    | 12.61                         | 18.24 |       |      | Pass    |

## 802.11n-40 MHz Mode:

| Channel | Measured Output Average Power |       | Limit |      | Verdict |
|---------|-------------------------------|-------|-------|------|---------|
|         | dBm                           | mW    | dBm   | mW   |         |
| Low     | 12.91                         | 19.54 | 30    | 1000 | Pass    |
| Middle  | 12.84                         | 19.23 |       |      | Pass    |
| High    | 12.77                         | 18.92 |       |      | Pass    |

MIMO-Antenna APeak Power Test Data

## 802.11b Mode:

| Channel | Measured Output Peak Power |       | Limit |         | Verdict |
|---------|----------------------------|-------|-------|---------|---------|
|         | dBm                        | mW    | dBm   | mW      |         |
| Low     | 14.45                      | 27.86 | 28.32 | 679.204 | Pass    |
| Middle  | 13.95                      | 24.83 |       |         | Pass    |
| High    | 13.93                      | 24.72 |       |         | Pass    |

## 802.11g Mode:

| Channel | Measured Output Peak Power |       | Limit |         | Verdict |
|---------|----------------------------|-------|-------|---------|---------|
|         | dBm                        | mW    | dBm   | mW      |         |
| Low     | 16.59                      | 45.60 | 28.32 | 679.204 | Pass    |
| Middle  | 17.33                      | 54.08 |       |         | Pass    |
| High    | 16.94                      | 49.43 |       |         | Pass    |

## 802.11n-20 MHz Mode:

| Channel | Measured Output Peak Power |       | Limit |      | Verdict |
|---------|----------------------------|-------|-------|------|---------|
|         | dBm                        | mW    | dBm   | mW   |         |
| Low     | 16.33                      | 42.95 | 30    | 1000 | Pass    |
| Middle  | 16.18                      | 41.50 |       |      | Pass    |
| High    | 15.79                      | 37.93 |       |      | Pass    |

## 802.11n-40 MHz Mode:

| Channel | Measured Output Peak Power |       | Limit |      | Verdict |
|---------|----------------------------|-------|-------|------|---------|
|         | dBm                        | mW    | dBm   | mW   |         |
| Low     | 15.68                      | 36.98 | 30    | 1000 | Pass    |
| Middle  | 15.83                      | 38.28 |       |      | Pass    |
| High    | 16.21                      | 41.78 |       |      | Pass    |

Average Power Test Data

## 802.11b Mode:

| Channel | Measured Output Average Power |       | Limit |         | Verdict |
|---------|-------------------------------|-------|-------|---------|---------|
|         | dBm                           | mW    | dBm   | mW      |         |
| Low     | 10.87                         | 12.22 | 28.32 | 679.204 | Pass    |
| Middle  | 10.61                         | 11.51 |       |         | Pass    |
| High    | 10.84                         | 12.13 |       |         | Pass    |

## 802.11g Mode:

| Channel | Measured Output Average Power |       | Limit |         | Verdict |
|---------|-------------------------------|-------|-------|---------|---------|
|         | dBm                           | mW    | dBm   | mW      |         |
| Low     | 10.80                         | 12.02 | 28.32 | 679.204 | Pass    |
| Middle  | 10.84                         | 12.13 |       |         | Pass    |
| High    | 10.94                         | 12.42 |       |         | Pass    |

## 802.11n-20 MHz Mode:

| Channel | Measured Output Average Power |      | Limit |      | Verdict |
|---------|-------------------------------|------|-------|------|---------|
|         | dBm                           | mW   | dBm   | mW   |         |
| Low     | 9.90                          | 9.77 | 30    | 1000 | Pass    |
| Middle  | 9.71                          | 9.35 |       |      | Pass    |
| High    | 9.94                          | 9.86 |       |      | Pass    |

## 802.11n-40 MHz Mode:

| Channel | Measured Output Average Power |      | Limit |      | Verdict |
|---------|-------------------------------|------|-------|------|---------|
|         | dBm                           | mW   | dBm   | mW   |         |
| Low     | 9.87                          | 9.71 | 30    | 1000 | Pass    |
| Middle  | 9.99                          | 9.98 |       |      | Pass    |
| High    | 9.89                          | 9.75 |       |      | Pass    |

MIMO-Antenna BPeak Power Test Data

## 802.11b Mode:

| Channel | Measured Output Peak Power |       | Limit |         | Verdict |
|---------|----------------------------|-------|-------|---------|---------|
|         | dBm                        | mW    | dBm   | mW      |         |
| Low     | 14.23                      | 26.49 | 28.32 | 679.204 | Pass    |
| Middle  | 13.65                      | 23.17 |       |         | Pass    |
| High    | 13.63                      | 23.07 |       |         | Pass    |

## 802.11g Mode:

| Channel | Measured Output Peak Power |       | Limit |         | Verdict |
|---------|----------------------------|-------|-------|---------|---------|
|         | dBm                        | mW    | dBm   | mW      |         |
| Low     | 16.69                      | 46.67 | 28.32 | 679.204 | Pass    |
| Middle  | 17.43                      | 55.34 |       |         | Pass    |
| High    | 17.04                      | 50.58 |       |         | Pass    |

## 802.11n-20 MHz Mode:

| Channel | Measured Output Peak Power |       | Limit |      | Verdict |
|---------|----------------------------|-------|-------|------|---------|
|         | dBm                        | mW    | dBm   | mW   |         |
| Low     | 16.13                      | 41.02 | 30    | 1000 | Pass    |
| Middle  | 15.18                      | 32.96 |       |      | Pass    |
| High    | 16.19                      | 41.59 |       |      | Pass    |

## 802.11n-40 MHz Mode:

| Channel | Measured Output Peak Power |       | Limit |      | Verdict |
|---------|----------------------------|-------|-------|------|---------|
|         | dBm                        | mW    | dBm   | mW   |         |
| Low     | 15.98                      | 39.63 | 30    | 1000 | Pass    |
| Middle  | 15.93                      | 39.17 |       |      | Pass    |
| High    | 15.41                      | 34.75 |       |      | Pass    |

Average Power Test Data

## 802.11b Mode:

| Channel | Measured Output Average Power |       | Limit |         | Verdict |
|---------|-------------------------------|-------|-------|---------|---------|
|         | dBm                           | mW    | dBm   | mW      |         |
| Low     | 10.84                         | 12.13 | 28.32 | 679.204 | Pass    |
| Middle  | 10.56                         | 11.38 |       |         | Pass    |
| High    | 10.39                         | 10.94 |       |         | Pass    |

## 802.11g Mode:

| Channel | Measured Output Average Power |       | Limit |         | Verdict |
|---------|-------------------------------|-------|-------|---------|---------|
|         | dBm                           | mW    | dBm   | mW      |         |
| Low     | 10.92                         | 12.36 | 28.32 | 679.204 | Pass    |
| Middle  | 10.73                         | 11.83 |       |         | Pass    |
| High    | 10.69                         | 11.72 |       |         | Pass    |

## 802.11n-20 MHz Mode:

| Channel | Measured Output Average Power |      | Limit |      | Verdict |
|---------|-------------------------------|------|-------|------|---------|
|         | dBm                           | mW   | dBm   | mW   |         |
| Low     | 9.84                          | 9.64 | 30    | 1000 | Pass    |
| Middle  | 9.70                          | 9.33 |       |      | Pass    |
| High    | 9.66                          | 9.25 |       |      | Pass    |

## 802.11n-40 MHz Mode:

| Channel | Measured Output Average Power |      | Limit |      | Verdict |
|---------|-------------------------------|------|-------|------|---------|
|         | dBm                           | mW   | dBm   | mW   |         |
| Low     | 9.79                          | 9.53 | 30    | 1000 | Pass    |
| Middle  | 9.71                          | 9.35 |       |      | Pass    |
| High    | 9.62                          | 9.16 |       |      | Pass    |

MIMOPeak Power Test Data

## 802.11b Mode:

| Channel | Measured Output Peak Power |       | Limit |         | Verdict |
|---------|----------------------------|-------|-------|---------|---------|
|         | dBm                        | mW    | dBm   | mW      |         |
| Low     | 17.35                      | 54.35 | 28.32 | 679.204 | Pass    |
| Middle  | 16.81                      | 48.01 |       |         | Pass    |
| High    | 16.79                      | 47.78 |       |         | Pass    |

## 802.11g Mode:

| Channel | Measured Output Peak Power |        | Limit |         | Verdict |
|---------|----------------------------|--------|-------|---------|---------|
|         | dBm                        | mW     | dBm   | mW      |         |
| Low     | 19.65                      | 92.27  | 28.32 | 679.204 | Pass    |
| Middle  | 20.39                      | 109.41 |       |         | Pass    |
| High    | 20.00                      | 100.01 |       |         | Pass    |

## 802.11n-20 MHz Mode:

| Channel | Measured Output Peak Power |       | Limit |      | Verdict |
|---------|----------------------------|-------|-------|------|---------|
|         | dBm                        | mW    | dBm   | mW   |         |
| Low     | 19.24                      | 83.97 | 30    | 1000 | Pass    |
| Middle  | 18.72                      | 74.46 |       |      | Pass    |
| High    | 19.00                      | 79.52 |       |      | Pass    |

## 802.11n-40 MHz Mode:

| Channel | Measured Output Peak Power |       | Limit |      | Verdict |
|---------|----------------------------|-------|-------|------|---------|
|         | dBm                        | mW    | dBm   | mW   |         |
| Low     | 18.84                      | 76.61 | 30    | 1000 | Pass    |
| Middle  | 18.89                      | 77.46 |       |      | Pass    |
| High    | 18.84                      | 76.54 |       |      | Pass    |

Average Power Test Data

## 802.11b Mode:

| Channel | Measured Output Average Power |       | Limit |         | Verdict |
|---------|-------------------------------|-------|-------|---------|---------|
|         | dBm                           | mW    | dBm   | mW      |         |
| Low     | 13.87                         | 24.35 | 28.32 | 679.204 | Pass    |
| Middle  | 13.60                         | 22.88 |       |         | Pass    |
| High    | 13.63                         | 23.07 |       |         | Pass    |

## 802.11g Mode:

| Channel | Measured Output Average Power |       | Limit |         | Verdict |
|---------|-------------------------------|-------|-------|---------|---------|
|         | dBm                           | mW    | dBm   | mW      |         |
| Low     | 13.87                         | 24.38 | 28.32 | 679.204 | Pass    |
| Middle  | 13.80                         | 23.96 |       |         | Pass    |
| High    | 13.83                         | 24.14 |       |         | Pass    |

## 802.11n-20 MHz Mode:

| Channel | Measured Output Average Power |       | Limit |      | Verdict |
|---------|-------------------------------|-------|-------|------|---------|
|         | dBm                           | mW    | dBm   | mW   |         |
| Low     | 12.88                         | 19.41 | 30    | 1000 | Pass    |
| Middle  | 12.72                         | 18.69 |       |      | Pass    |
| High    | 12.81                         | 19.11 |       |      | Pass    |

## 802.11n-40 MHz Mode:

| Channel | Measured Output Average Power |       | Limit |      | Verdict |
|---------|-------------------------------|-------|-------|------|---------|
|         | dBm                           | mW    | dBm   | mW   |         |
| Low     | 12.84                         | 19.23 | 30    | 1000 | Pass    |
| Middle  | 12.86                         | 19.33 |       |      | Pass    |
| High    | 12.77                         | 18.91 |       |      | Pass    |

## 5.3 Occupied Bandwidth

### 5.3.1 Limit

FCC §15.247(a)

Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW. The 6 dB bandwidth must be greater than 500 kHz.

### 5.3.2 Test Setup

See section 4.5.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX A.

### 5.3.3 Test Procedure

Use the following spectrum analyzer settings:

Set RBW = 100 kHz.

Set the video bandwidth (VBW)  $\geq 3$  RBW.

Detector = Peak.

Trace mode = max hold.

Sweep = auto couple.

Allow the trace to stabilize.

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### 5.3.4 Test Result

#### Test Data

Note: All antenna were tested, but only the worst case has been reported in this report.

#### SISO-Antenna A

##### 802.11b Mode:

| Channel | 6 dB Bandwidth<br>(MHz) | 99% Bandwidth<br>(MHz) | 6 dB Bandwidth<br>Limits (kHz) |
|---------|-------------------------|------------------------|--------------------------------|
| Low     | 9.700000                | 13.601000              | $\geq 500$                     |
| Middle  | 9.200000                | 13.549000              | $\geq 500$                     |
| High    | 9.200000                | 13.583000              | $\geq 500$                     |

##### 802.11g Mode:

| Channel | 6 dB Bandwidth<br>(MHz) | 99% Bandwidth<br>(MHz) | 6 dB Bandwidth<br>Limits (kHz) |
|---------|-------------------------|------------------------|--------------------------------|
| Low     | 16.600000               | 17.254000              | $\geq 500$                     |
| Middle  | 16.500000               | 17.294000              | $\geq 500$                     |
| High    | 16.500000               | 17.272000              | $\geq 500$                     |

##### 802.11n-20MHz Mode:

| Channel | 6 dB Bandwidth<br>(MHz) | 99% Bandwidth<br>(MHz) | 6 dB Bandwidth<br>Limits (kHz) |
|---------|-------------------------|------------------------|--------------------------------|
| Low     | 17.500000               | 18.243000              | $\geq 500$                     |
| Middle  | 17.500000               | 18.191000              | $\geq 500$                     |
| High    | 17.200000               | 18.233000              | $\geq 500$                     |

##### 802.11n-40MHz Mode:

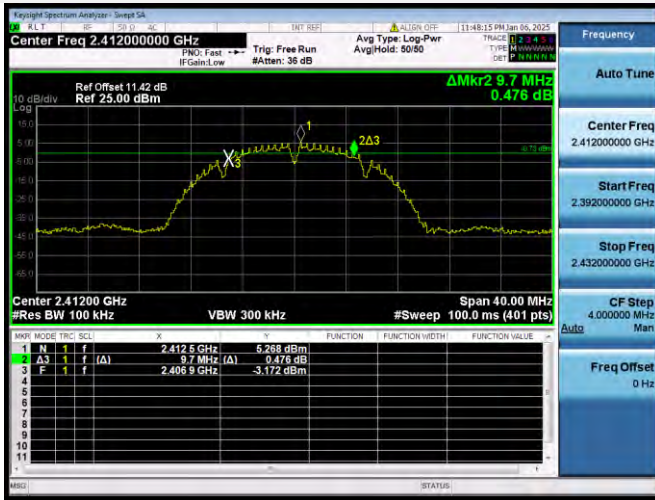
| Channel | 6 dB Bandwidth<br>(MHz) | 99% Bandwidth<br>(MHz) | 6 dB Bandwidth<br>Limits (kHz) |
|---------|-------------------------|------------------------|--------------------------------|
| Low     | 36.200000               | 36.901000              | $\geq 500$                     |
| Middle  | 36.200000               | 36.914000              | $\geq 500$                     |
| High    | 36.200000               | 36.900000              | $\geq 500$                     |

## Test Plots

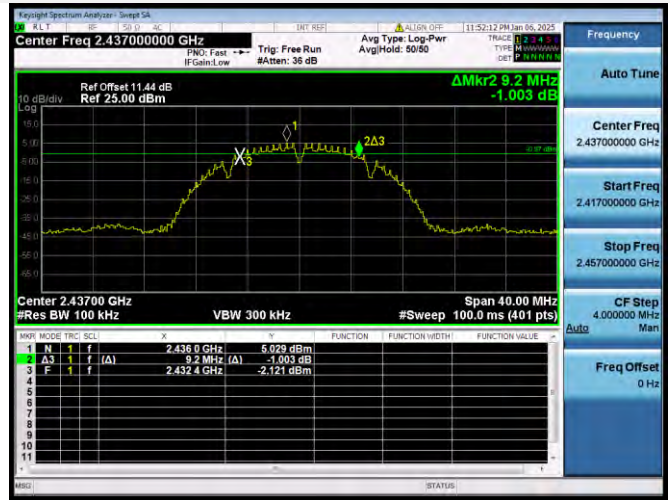
## SISO-Antenna A

## 6 dB Bandwidth

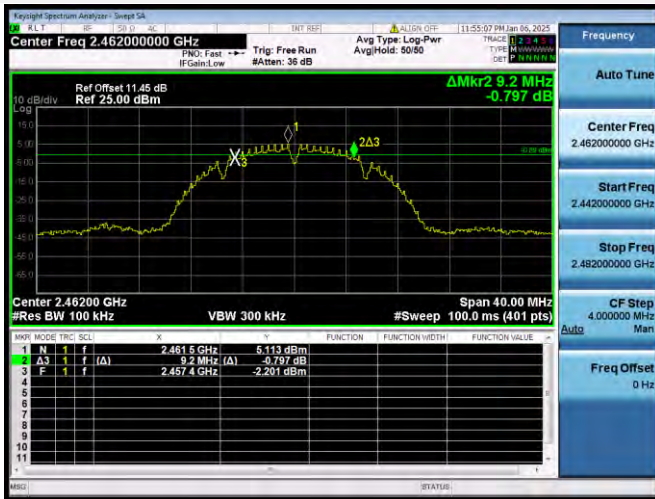
## 802.11b LOW CHANNEL



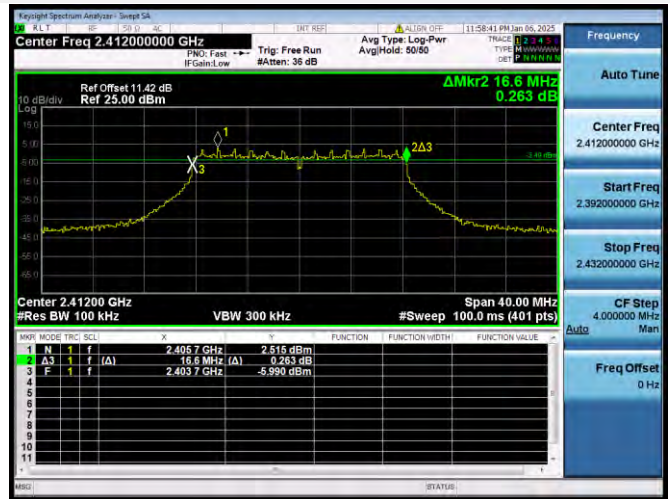
## 802.11b MIDDLE CHANNEL



## 802.11b HIGH CHANNEL



## 802.11g LOW CHANNEL



## 802.11g MIDDLE CHANNEL



## 802.11g HIGH CHANNEL



## 802.11n-20 MHz LOW CHANNEL



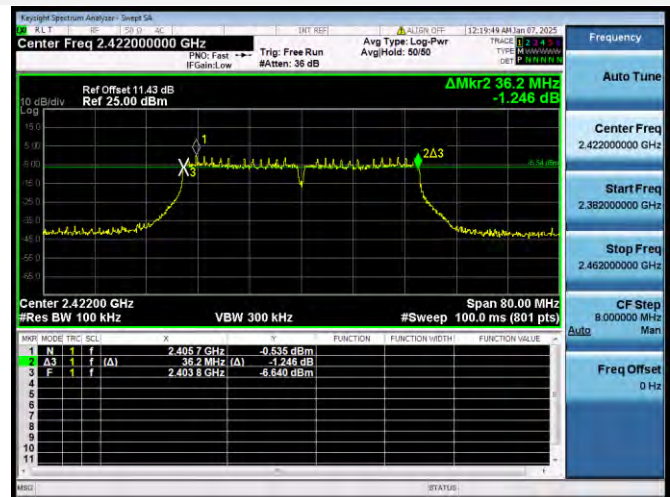
## 802.11n-20 MHz MIDDLE CHANNEL



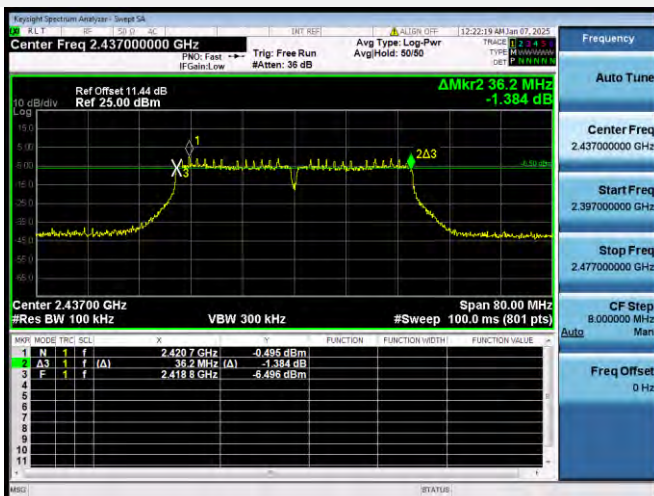
## 802.11n-20 MHz HIGH CHANNEL



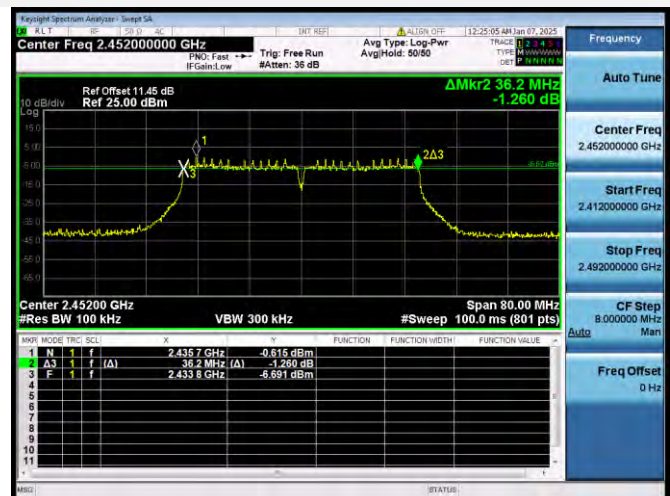
## 802.11n-40 MHz LOW CHANNEL



## 802.11n-40 MHz MIDDLE CHANNEL



## 802.11n-40 MHz HIGH CHANNEL

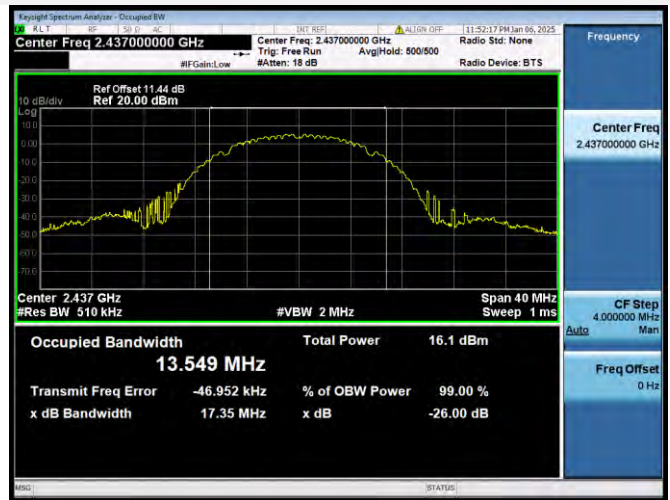


## 99% Bandwidth

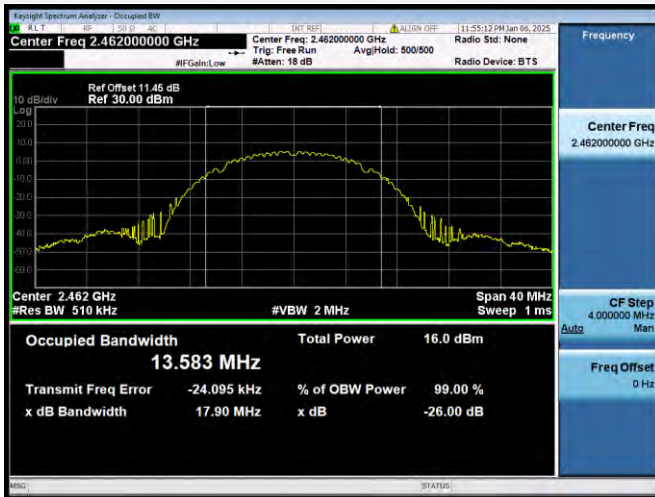
## 802.11b LOW CHANNEL



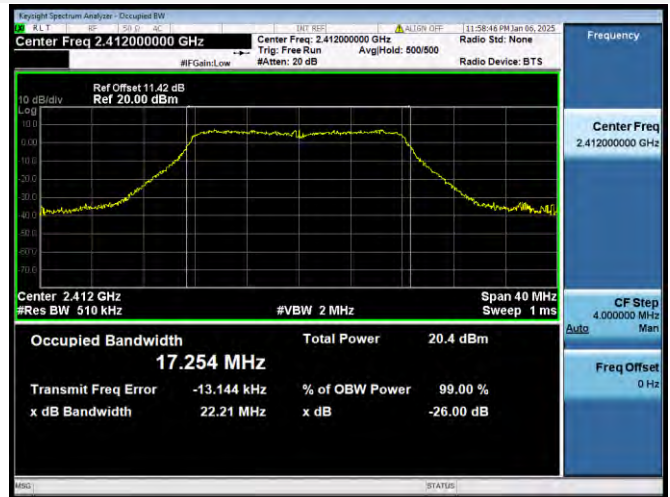
## 802.11b MIDDLE CHANNEL



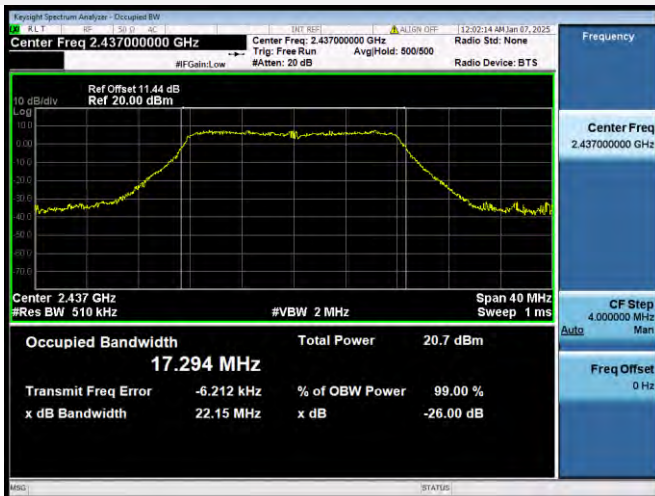
## 802.11b HIGH CHANNEL



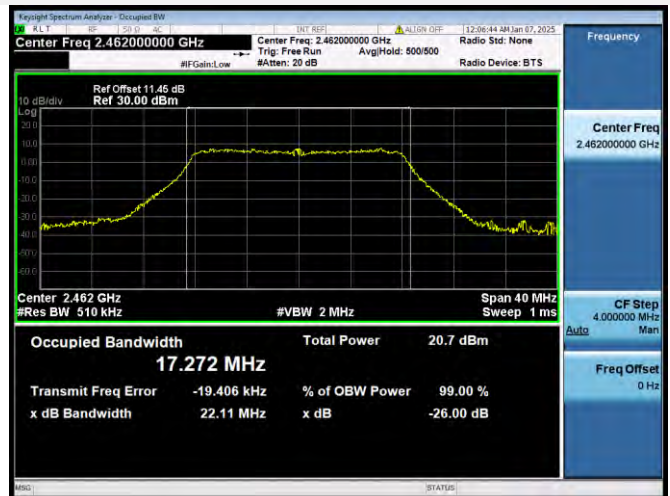
## 802.11g LOW CHANNEL



## 802.11g MIDDLE CHANNEL



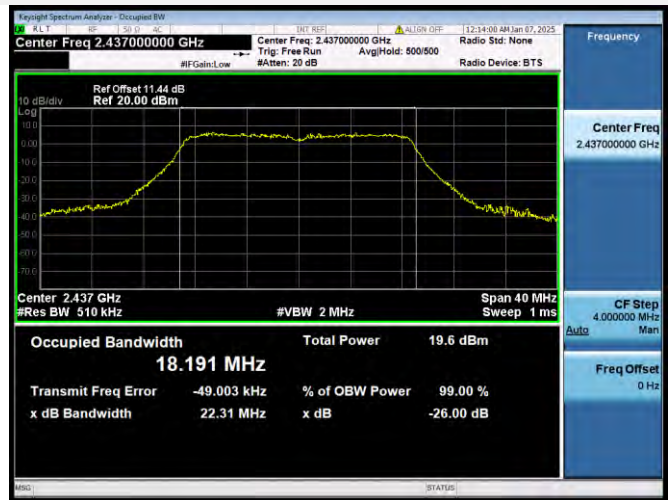
## 802.11g HIGH CHANNEL



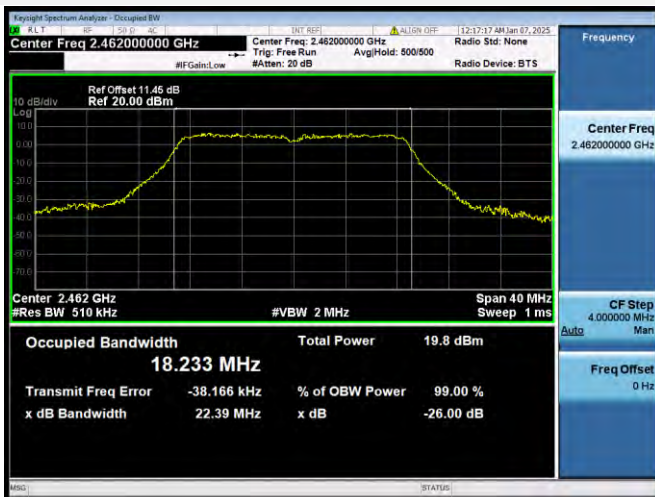
## 802.11n-20 MHz LOW CHANNEL



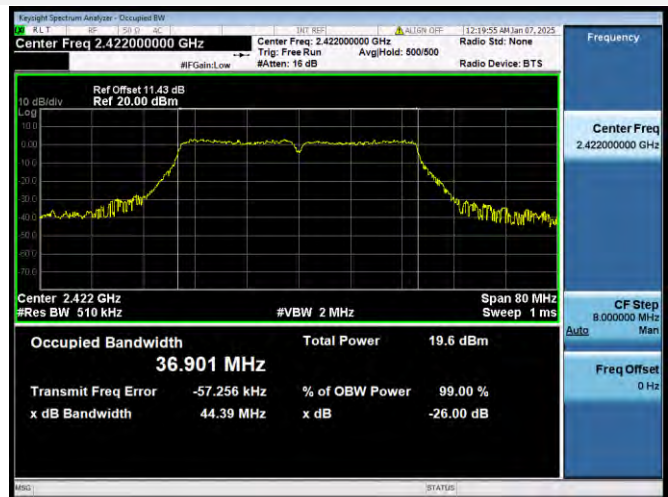
## 802.11n-20 MHz MIDDLE CHANNEL



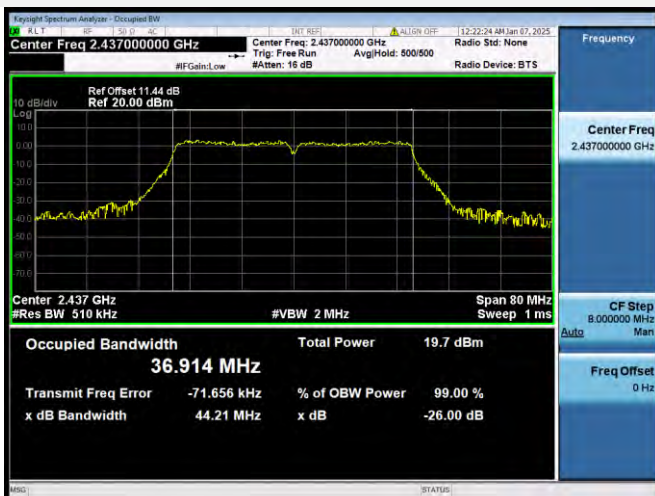
## 802.11n-20 MHz HIGH CHANNEL



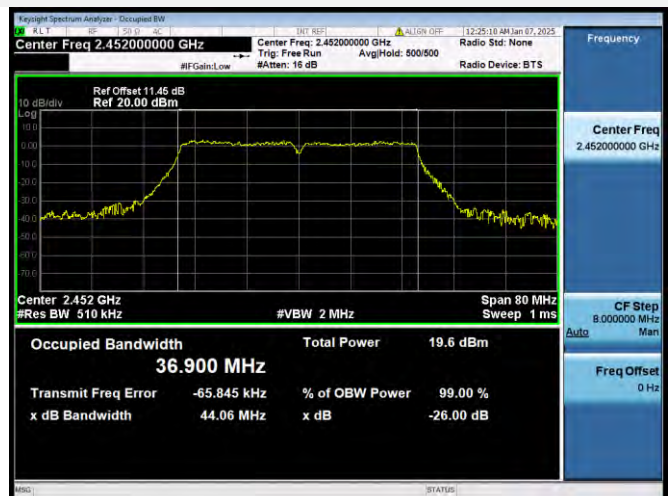
## 802.11n-40 MHz LOW CHANNEL



## 802.11n-40 MHz MIDDLE CHANNEL



## 802.11n-40 MHz HIGH CHANNEL



## 5.4 Conducted Spurious Emission

### 5.4.1 Limit

#### FCC §15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

### 5.4.2 Test Setup

See section 4.5.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX A.

### 5.4.3 Test Procedure

The DTS rules specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:

- a) If the maximum peak conducted output power procedure was used to demonstrate compliance as described in 9.1, then the peak output power 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 (i.e., 20 dBc).
- b) If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc).
- c) In either case, attenuation to levels below the 15.209 general radiated emissions limits is not required.

The following procedures shall be used to demonstrate compliance to these limits. Note that these procedures can be used in either an antenna-port conducted or radiated test set-up. Radiated tests must conform to the test site requirements and utilize maximization procedures defined herein.

#### Reference level measurement

Establish a reference level by using the following procedure:

Set instrument center frequency to DTS channel center frequency.

Set the span to  $\geq 1.5$  times the DTS bandwidth.

Set the RBW = 100 kHz.

Set the VBW  $\geq 3 \times$  RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum PSD level.

### Emission level measurement

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

Set the RBW = 100 kHz.

Set the VBW  $\geq 3 \times$  RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

#### 5.4.4 Test Result

##### Test Data

Note: All antenna were tested, but only the worst case has been reported in this report.

##### SISO-Antenna A

##### 802.11b Mode:

| Channel | Measured Max.<br>Out of Band<br>Emission (dBm) | Limit (dBm)   |                            | Verdict |
|---------|------------------------------------------------|---------------|----------------------------|---------|
|         |                                                | Carrier Level | Calculated 20<br>dBc Limit |         |
| Low     | -34.15                                         | 5.31          | -14.70                     | Pass    |
| Middle  | -34.93                                         | 4.72          | -15.28                     | Pass    |
| High    | -35.12                                         | 5.13          | -14.87                     | Pass    |

##### 802.11g Mode:

| Channel | Measured Max.<br>Out of Band<br>Emission (dBm) | Limit (dBm)   |                            | Verdict |
|---------|------------------------------------------------|---------------|----------------------------|---------|
|         |                                                | Carrier Level | Calculated 20<br>dBc Limit |         |
| Low     | -33.41                                         | 2.60          | -17.40                     | Pass    |
| Middle  | -34.48                                         | 3.16          | -16.84                     | Pass    |
| High    | -33.75                                         | 3.12          | -16.88                     | Pass    |

##### 802.11n-20MHz Mode:

| Channel | Measured Max.<br>Out of Band<br>Emission (dBm) | Limit (dBm)   |                            | Verdict |
|---------|------------------------------------------------|---------------|----------------------------|---------|
|         |                                                | Carrier Level | Calculated 20<br>dBc Limit |         |
| Low     | -34.39                                         | 2.34          | -17.66                     | Pass    |
| Middle  | -33.47                                         | 2.14          | -17.86                     | Pass    |
| High    | -34.09                                         | 2.11          | -17.89                     | Pass    |

##### 802.11n-40MHz Mode:

| Channel | Measured Max.<br>Out of Band<br>Emission (dBm) | Limit (dBm)   |                            | Verdict |
|---------|------------------------------------------------|---------------|----------------------------|---------|
|         |                                                | Carrier Level | Calculated 20<br>dBc Limit |         |
| Low     | -34.68                                         | -0.55         | -20.55                     | Pass    |
| Middle  | -35.46                                         | -0.39         | -20.39                     | Pass    |
| High    | -34.41                                         | -0.53         | -20.53                     | Pass    |

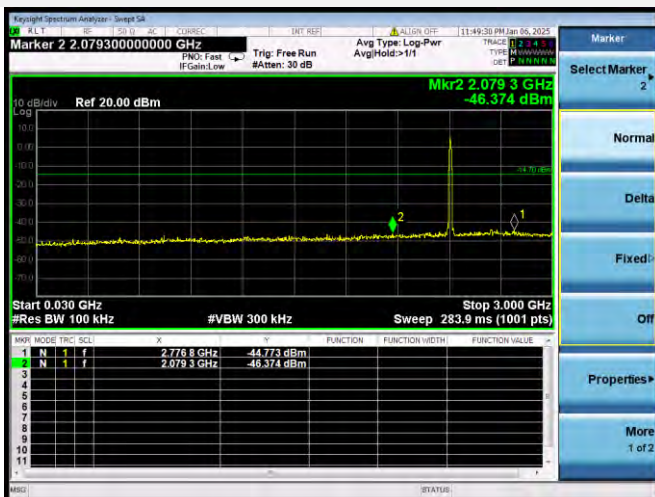
## Test Plots

## SISO-Antenna A

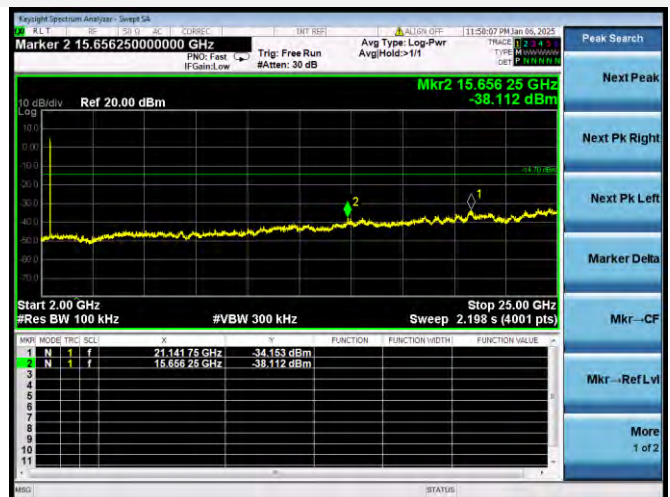
## 802.11b LOW CHANNEL CARRIER LEVEL



## 802.11b LOW CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



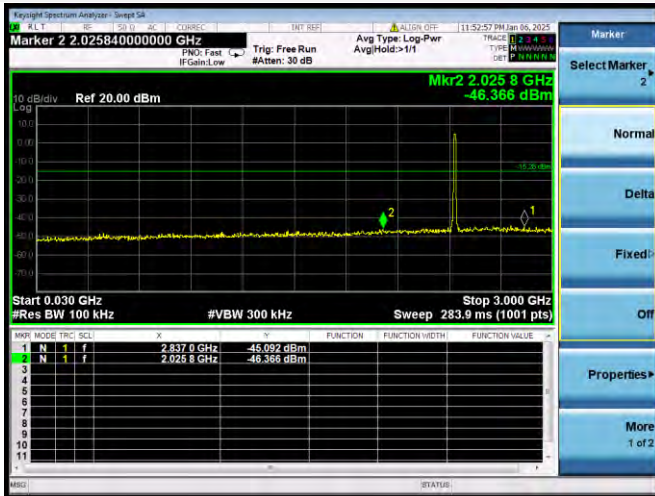
## 802.11b LOW CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



## 802.11b MIDDLE CHANNEL CARRIER LEVEL



### 802.11b MIDDLE CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



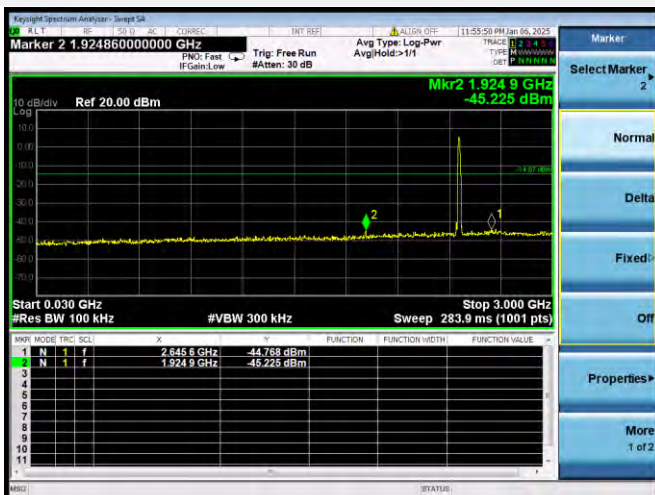
### 802.11b MIDDLE CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



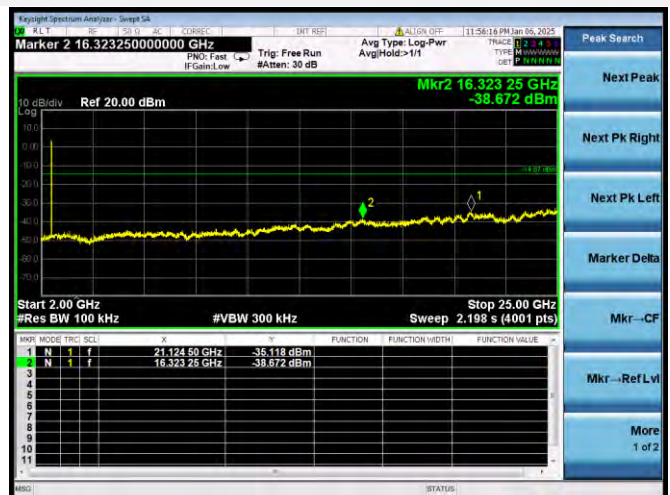
### 802.11b HIGH CHANNEL CARRIER LEVEL



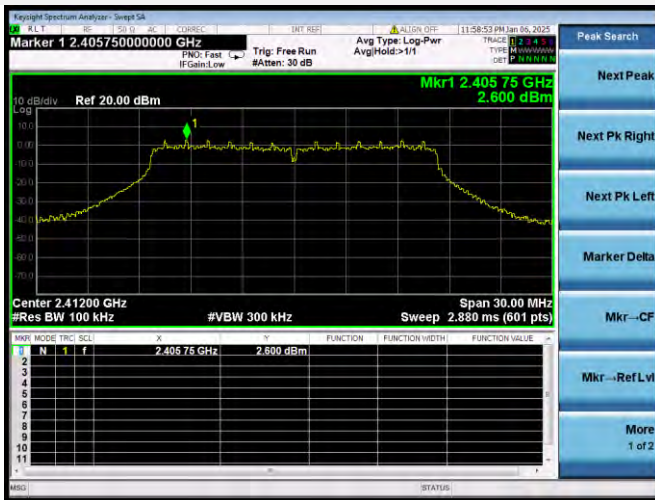
### 802.11b HIGH CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



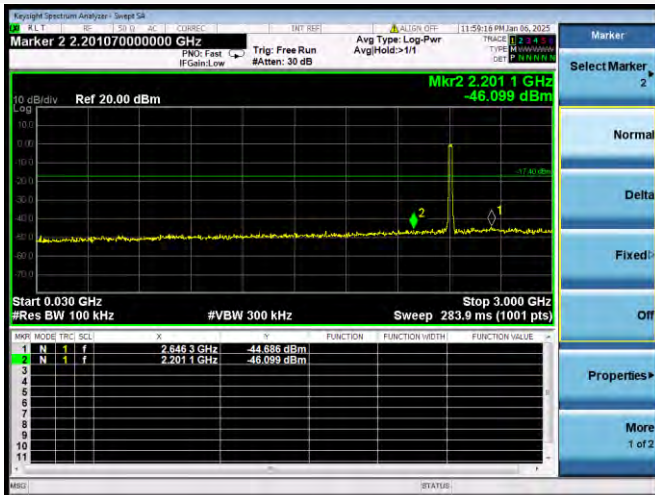
### 802.11b HIGH CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



## 802.11g LOW CHANNEL CARRIER LEVEL



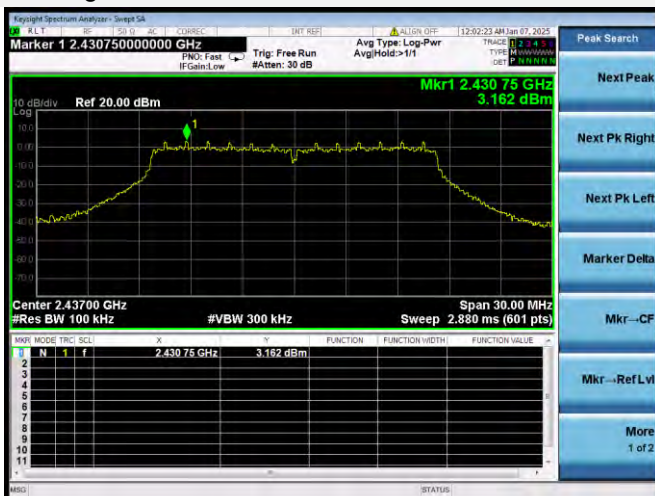
## 802.11g LOW CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



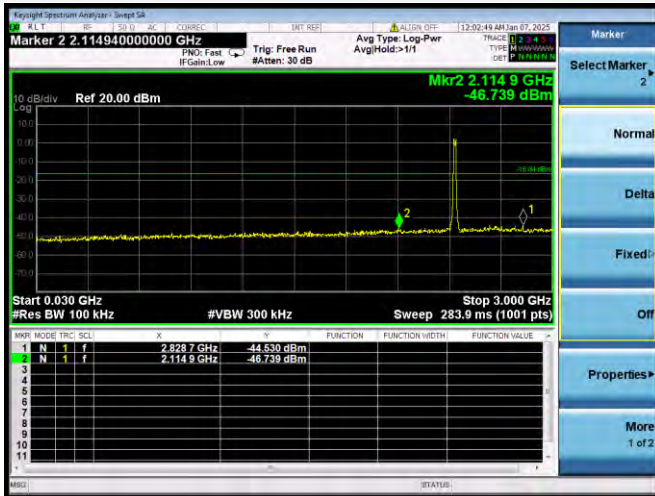
## 802.11g LOW CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



## 802.11g MIDDLE CHANNEL CARRIER LEVEL



### 802.11g MIDDLE CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



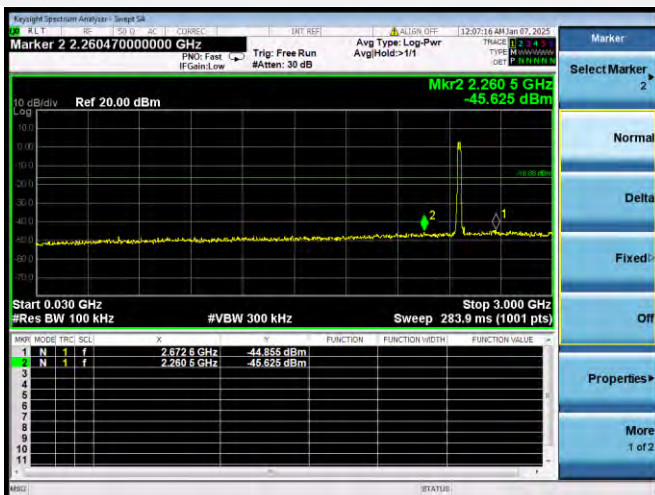
### 802.11g MIDDLE CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



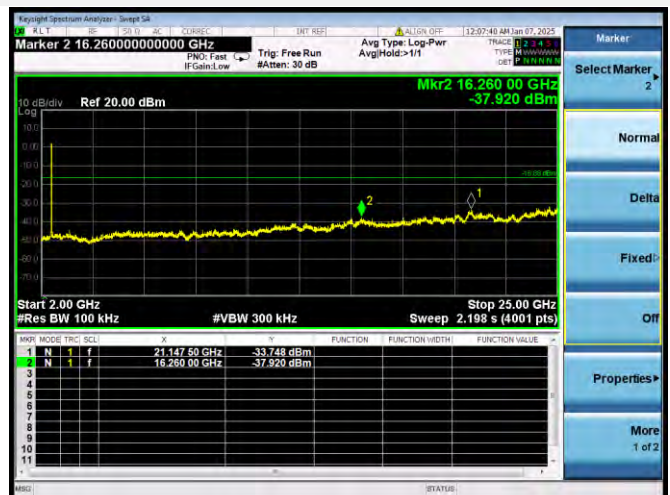
### 802.11g HIGH CHANNEL CARRIER LEVEL



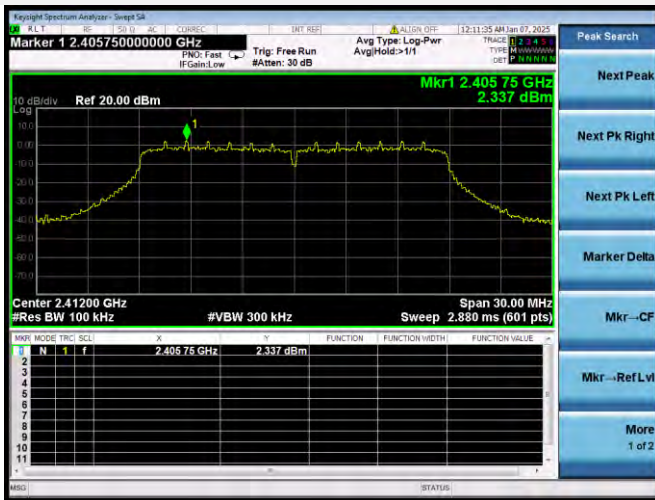
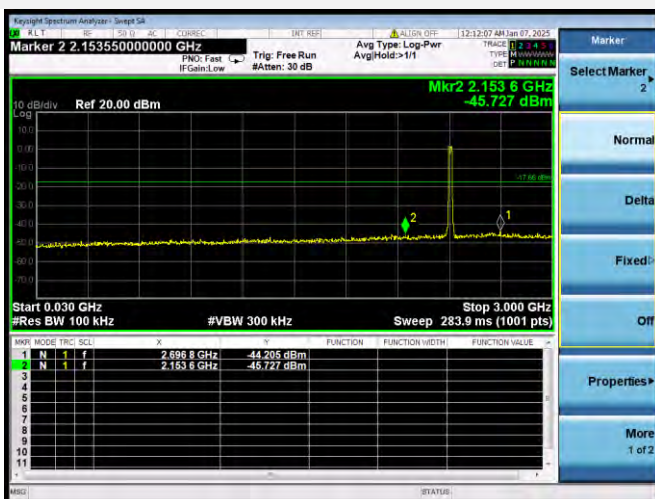
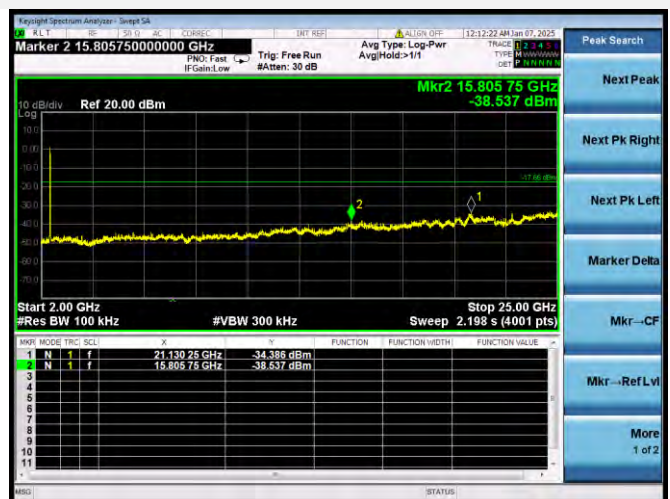
### 802.11g HIGH CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



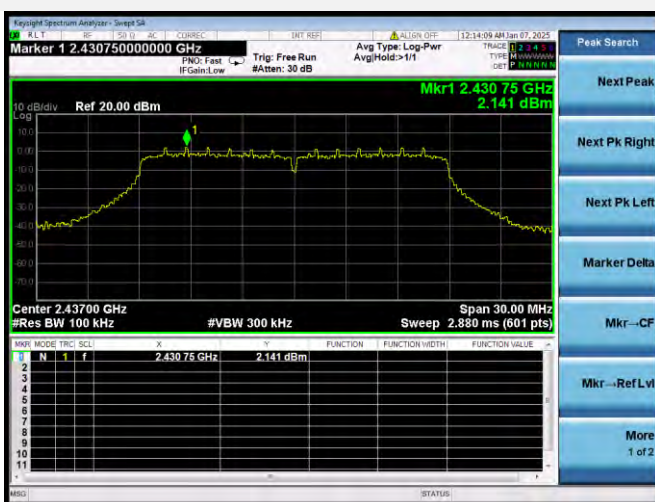
### 802.11g HIGH CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



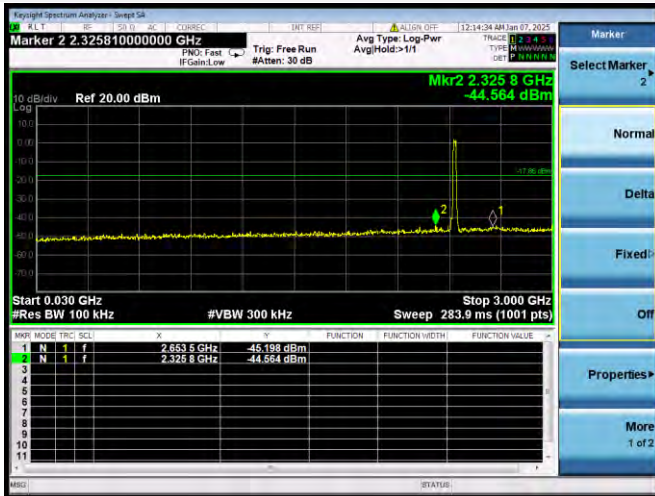
## 802.11n-20 MHz LOW CHANNEL CARRIER LEVEL

802.11n-20 MHz LOW CHANNEL, SPURIOUS  
30 MHz ~ 3 GHz802.11n-20 MHz LOW CHANNEL, SPURIOUS  
2 GHz ~ 25 GHz

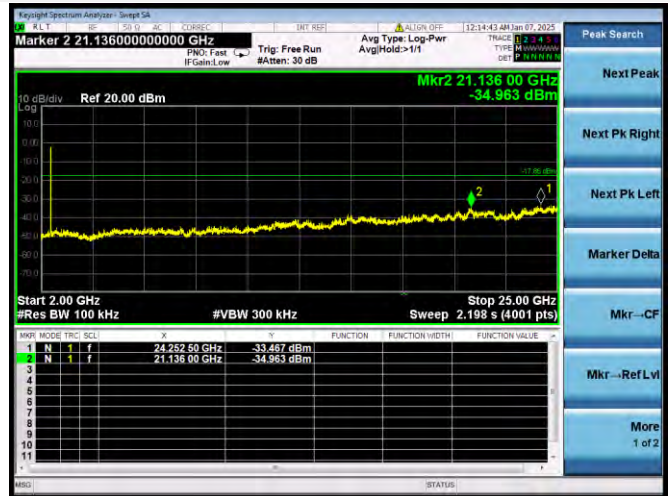
## 802.11n-20 MHz MIDDLE CHANNEL CARRIER LEVEL



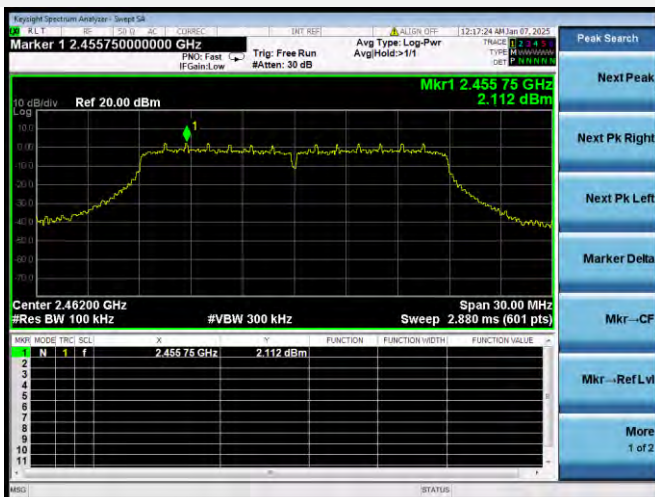
### 802.11n-20 MHz MIDDLE CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



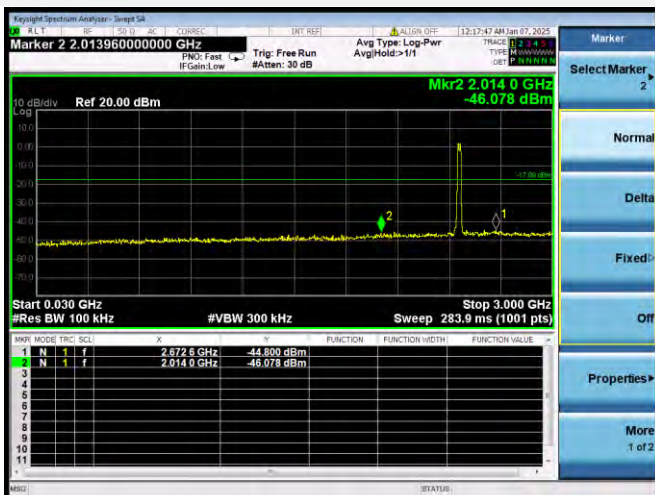
### 802.11n-20 MHz MIDDLE CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



### 802.11n-20 MHz HIGH CHANNEL CARRIER LEVEL



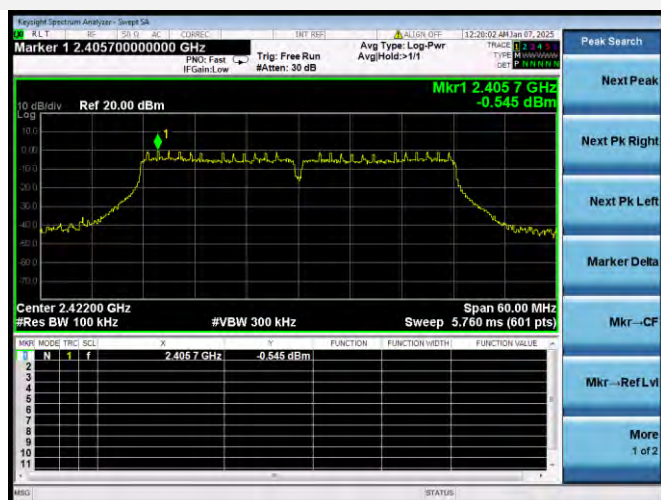
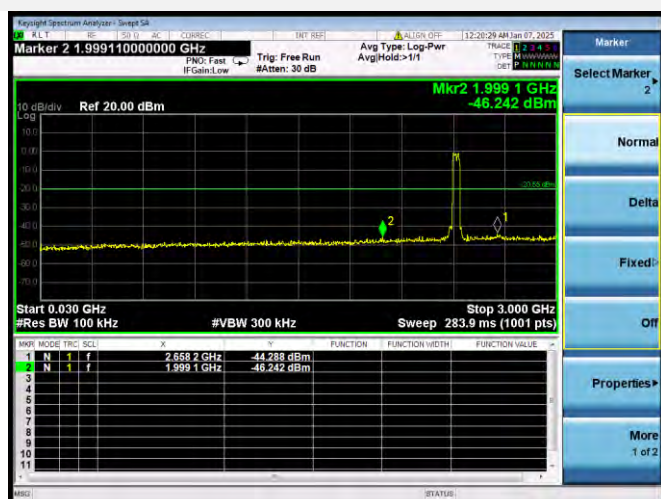
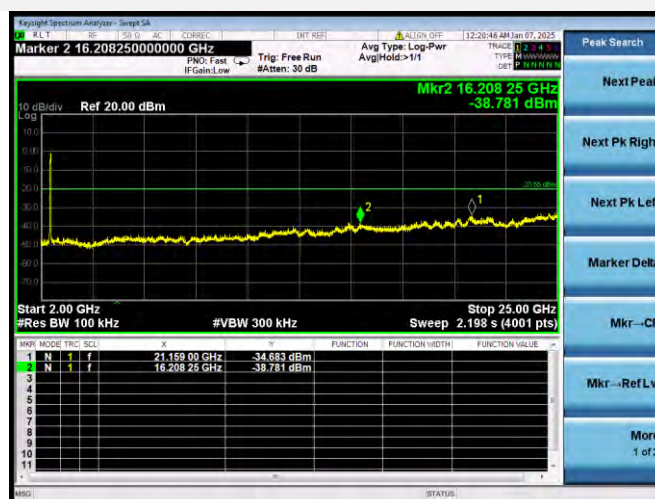
### 802.11n-20 MHz HIGH CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



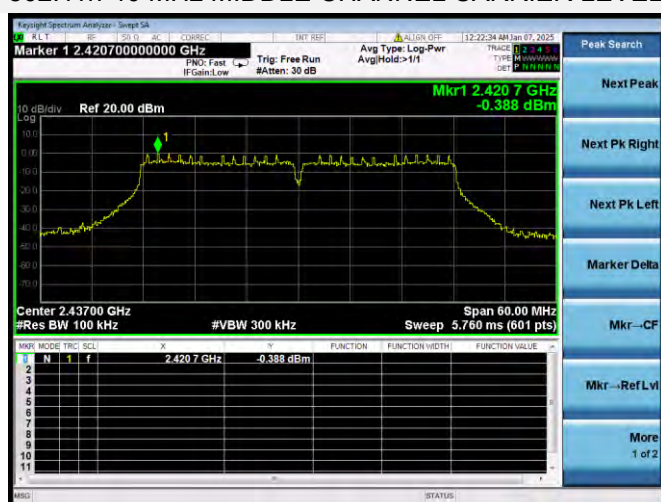
### 802.11n-20 MHz HIGH CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



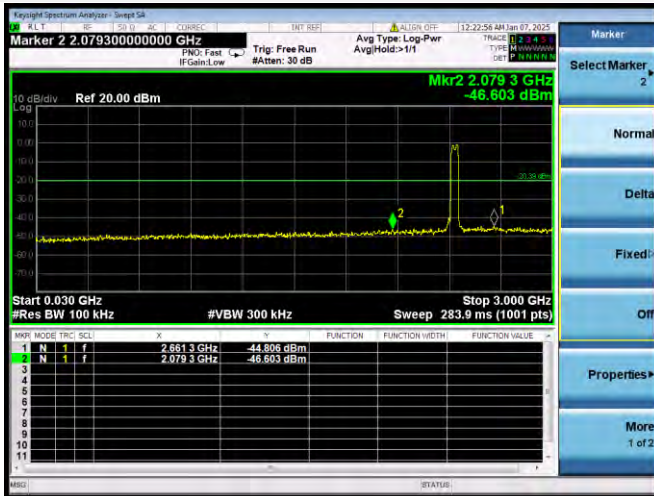
## 802.11n-40 MHz LOW CHANNEL CARRIER LEVEL

802.11n-40 MHz LOW CHANNEL, SPURIOUS  
30 MHz ~ 3 GHz802.11n-40 MHz LOW CHANNEL, SPURIOUS  
2 GHz ~ 25 GHz

## 802.11n-40 MHz MIDDLE CHANNEL CARRIER LEVEL



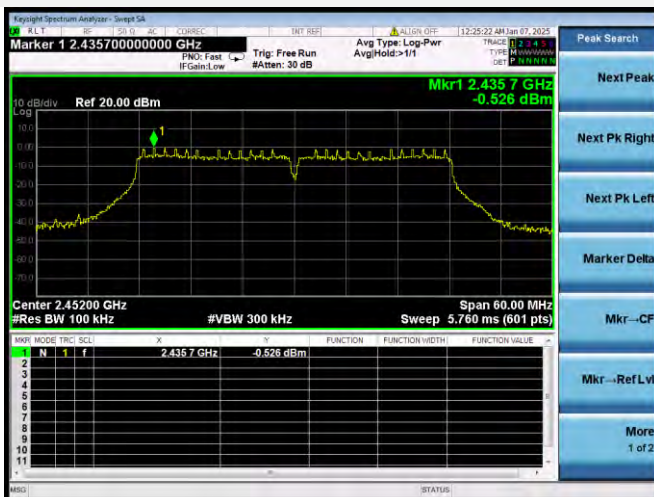
### 802.11n-40 MHz MIDDLE CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



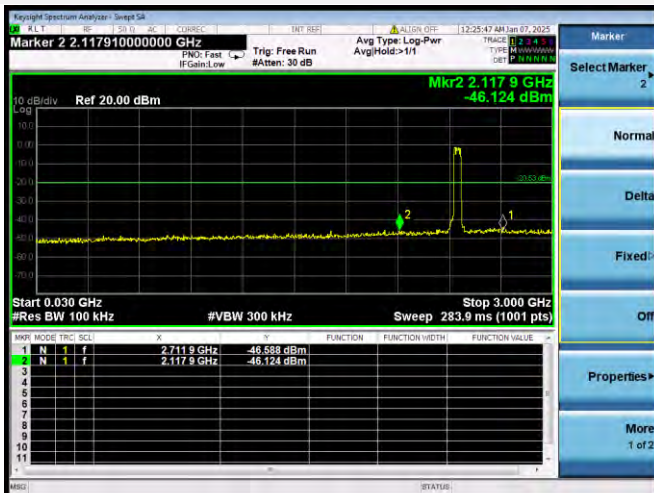
### 802.11n-40 MHz MIDDLE CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



### 802.11n-40 MHz HIGH CHANNEL CARRIER LEVEL



### 802.11n-40 MHz HIGH CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



### 802.11n-40 MHz HIGH CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



## 5.5 Band Edge (Authorized-band band-edge)

### 5.5.1 Limit

#### FCC §15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

### 5.5.2 Test Setup

See section 4.5.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX A.

### 5.5.3 Test Procedure

The following procedures may be used to determine the peak or average field strength or power of an unwanted emission that is within 2 MHz of the authorized band edge. If a peak detector is utilized, use the procedure described in 13.2.1. Use the procedure described in 13.2.2 when using an average detector and the EUT can be configured to transmit continuously (i.e., duty cycle  $\geq 98\%$ ). Use the procedure described in 13.2.3 when using an average detector and the EUT cannot be configured to transmit continuously but the duty cycle is constant (i.e., duty cycle variations are less than  $\pm 2$  percent). Use the procedure described in 13.2.4 when using an average detector for those cases where the EUT cannot be configured to transmit continuously and the duty cycle is not constant (duty cycle variations equal or exceed 2 percent).

When using a peak detector to measure unwanted emissions at or near the band edge (within 2 MHz of the authorized band), the following integration procedure can be used.

Set instrument center frequency to the frequency of the emission to be measured (must be within 2 MHz of the authorized band edge).

Set span to 2 MHz

RBW = 100 kHz.

VBW  $\geq 3 \times$  RBW.

Detector = peak.

Sweep time = auto.

Trace mode = max hold.

Allow sweep to continue until the trace stabilizes (required measurement time may increase for low duty cycle applications)

Compute the power by integrating the spectrum over 1 MHz using the analyzer's band power measurement function with band limits set equal to the emission frequency (femission)  $\pm 0.5$  MHz. If the instrument does not have a band power function, then sum the amplitude levels (in power units) at 100 kHz intervals extending across the 1 MHz spectrum defined by femission  $\pm 0.5$  MHz.

Standard method(The 99% OBW of the fundamental emission is without 2 MHz of the authorized band):

Span: Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products that fall outside of the authorized band of operation.

Reference level: As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than  $[10 \log (\text{OBW/RBW})]$  below the reference level. Specific guidance is given in 4.1.5.2.

Attenuation: Auto (at least 10 dB preferred).

Sweep time: Coupled.

Resolution bandwidth: 100 kHz.

Video bandwidth: 300 kHz.

Detector: Peak.

Trace: Max hold.