



# FCC TEST REPORT

**Test report  
On Behalf of  
Lenovo (Beijing) Limited  
For  
Lenovo Smart Projector  
Model No.: LXP200, P200, P200 PLUS  
FCC ID: A5M-LXP200**

**Prepared for :** **Lenovo (Beijing) Limited**  
**201-H2-6, Floor2, Building 2, No. 6 Shangdi West Road, Haidian District, Beijing, China**

**Prepared By :** **Shenzhen HUAKE Testing Technology Co., Ltd.**  
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**Date of Test:** **Sept. 02, 2021 ~ Sept. 09, 2021**

**Date of Report:** **Sept. 15, 2021**

**Report Number:** **HK2109023247-2E**



## TEST RESULT CERTIFICATION

**Applicant's name** .....: Lenovo (Beijing) Limited

**Address** .....: 201-H2-6, Floor2, Building 2, No. 6 Shangdi West Road, Haidian District, Beijing, China

**Manufacture's Name**.....: Lenovo (Beijing) Limited

**Address** .....: 201-H2-6, Floor2, Building 2, No. 6 Shangdi West Road, Haidian District, Beijing, China

**Product description**

**Trade Mark:** Lenovo

**Product name**.....: Lenovo Smart Projector

**Model and/or type reference** : LXP200, P200, P200 PLUS

**Standards** .....: FCC Rules and Regulations Part 15 Subpart C Section 15.247  
ANSI C63.10: 2013

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**Date of Test**.....:

**Date (s) of performance of tests** .....: Sept. 02, 2021 ~ Sept. 15, 2021

**Date of Issue**.....: Sept. 15, 2021

**Test Result**.....: Pass

**Testing Engineer** :

(Gary Qian)

**Technical Manager** :

(Eden Hu)

**Authorized Signatory** :

(Jason Zhou)



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**\*\* Modified History \*\***

| Revision     | Description                 | Issued Data    | Remark     |
|--------------|-----------------------------|----------------|------------|
| Revision 1.0 | Initial Test Report Release | Sept. 15, 2021 | Jason Zhou |
|              |                             |                |            |
|              |                             |                |            |



## 1. TEST RESULT SUMMARY

### 1.1. TEST PROCEDURES AND RESULTS

| Requirement                      | CFR 47 Section      | Result |
|----------------------------------|---------------------|--------|
| Antenna requirement              | §15.203/§15.247b(4) | PASS   |
| AC Power Line Conducted Emission | §15.207             | PASS   |
| Conducted Peak Output Power      | §15.247 (b)(3)      | PASS   |
| 6dB Emission Bandwidth           | §15.247 (a)(2)      | PASS   |
| Power Spectral Density           | §15.247 (e)         | PASS   |
| Band Edge                        | §15.247(d)          | PASS   |
| Spurious Emission                | §15.205/§15.209     | PASS   |

**Note:**

1. PASS: Test item meets the requirement.
2. Fail: Test item does not meet the requirement.
3. N/A: Test case does not apply to the test object.
4. The test result judgment is decided by the limit of test standard.

### 1.2. Information of the Test Laboratory

Shenzhen HUAKE Testing Technology Co., Ltd.

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

Testing Laboratory Authorization :

A2LA Accreditation Code is 4781.01.

FCC Designation Number is CN1229.

Canada IC CAB identifier is CN0045.

CNAS Registration Number is L9589.



### 1.3. MEASUREMENT UNCERTAINTY

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

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



## 2. EUT DESCRIPTION

### 2.1. GENERAL DESCRIPTION OF EUT

|                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Equipment                                                                                                                                                                                                                                                                                                      | Lenovo Smart Projector                                                                                                                                            |
| Model Name                                                                                                                                                                                                                                                                                                     | LXP200                                                                                                                                                            |
| Serial Model                                                                                                                                                                                                                                                                                                   | P200, P200 PLUS                                                                                                                                                   |
| Model Difference                                                                                                                                                                                                                                                                                               | All model's the function, software and electric circuit are the same, only with a product color, appearance and model named different. Test sample model: LXP200. |
| Trade Mark                                                                                                                                                                                                                                                                                                     | Lenovo                                                                                                                                                            |
| FCC ID                                                                                                                                                                                                                                                                                                         | A5M-LXP200                                                                                                                                                        |
| Antenna Type                                                                                                                                                                                                                                                                                                   | Internal Antenna                                                                                                                                                  |
| Antenna Gain                                                                                                                                                                                                                                                                                                   | Antenna 1:1dBi<br>Antenna 2:1dBi<br>MIMO: 4.01dBi                                                                                                                 |
| Operation frequency                                                                                                                                                                                                                                                                                            | 802.11b/g/n 20:2412~2462 MHz<br>802.11n 40: 2422~2452MHz                                                                                                          |
| Number of Channels                                                                                                                                                                                                                                                                                             | 802.11b/g/n20: 11CH<br>802.11n 40: 7CH                                                                                                                            |
| Modulation Type                                                                                                                                                                                                                                                                                                | CCK/OFDM/DBPSK/DAPSK                                                                                                                                              |
| Power Source                                                                                                                                                                                                                                                                                                   | DC 7.6V from battery or DC 12V, 3A from Adapter with AC100-240V 50/60Hz, 1.5A                                                                                     |
| Power Rating                                                                                                                                                                                                                                                                                                   | DC 7.6V from battery or DC 12V, 3A from Adapter with AC100-240V 50/60Hz, 1.5A                                                                                     |
| <b>Note:</b><br>The EUT incorporates a MIMO function. Physically, it provides two completed transmitters and receivers(2T2R), two transmit signals are completely correlated, then, Direction gain= GANT + Array Gain(Array Gain=10 log(2) dB for power spectral density; Array Gain=0 for power measurement). |                                                                                                                                                                   |



## 2.2. CARRIER FREQUENCY OF CHANNELS

| Channel List for 802.11b/802.11g/802.11n (HT20) |                 |         |                 |         |                 |         |                 |
|-------------------------------------------------|-----------------|---------|-----------------|---------|-----------------|---------|-----------------|
| Channel                                         | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 01                                              | 2412            | 04      | 2427            | 07      | 2442            | 10      | 2457            |
| 02                                              | 2417            | 05      | 2432            | 08      | 2447            | 11      | 2462            |
| 03                                              | 2422            | 06      | 2437            | 09      | 2452            |         |                 |

| Channel List For 802.11n (HT40) |                 |         |                 |         |                 |         |                 |
|---------------------------------|-----------------|---------|-----------------|---------|-----------------|---------|-----------------|
| Channel                         | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| --                              | --              | 04      | 2427            | 07      | 2442            | --      | --              |
| --                              | --              | 05      | 2432            | 08      | 2447            | --      | --              |
| 03                              | 2422            | 06      | 2437            | 09      | 2452            |         |                 |

**Note:**

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

## 2.3. OPERATION OF EUT DURING TESTING

**Operating Mode**

The mode is used: Transmitting mode for 802.11b/802.11g/802.11n (HT20)

Low Channel: 2412MHz

Middle Channel: 2437MHz

High Channel: 2462MHz

The mode is used: Transmitting mode for 802.11n (HT40)

Low Channel: 2422MHz

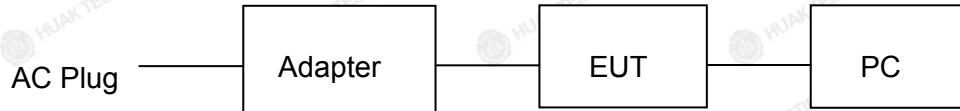
Middle Channel: 2437MHz

High Channel: 2452MHz



## 2.4. DESCRIPTION OF TEST SETUP

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



Operation of EUT during radiation above 1GHz testing:



### Adapter information

Model: S-TR-155DCU

Input: 100-240V, 50/60Hz, 1.5A

Output: 5V 3A 15W, 9V 3A 27W, 12V 3A 36W, 15V 3A 45W, 20V 2.25A 45W, 3.3V-16V 2A 6.6-32W

Total Output: 45W Max

### PC information

Model: TP00067A

Input: DC20V, 2.25-3.25A

Output: 5VDC, 0.5A

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



### 3. General Information

#### 3.1. Test environment and mode

| Operating Environment:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Temperature:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 25.0 °C                                                                                                      |
| Humidity:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 56 % RH                                                                                                      |
| Atmospheric Pressure:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1010 mbar                                                                                                    |
| Test Mode:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                              |
| Engineering mode:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Keep the EUT in continuous transmitting by select channel and modulations(The value of duty cycle is 98.46%) |
| The sample was placed (0.8m below 1GHz, 1.5m above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages. For the full battery state and The output power to the maximum state. |                                                                                                              |

We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:

**Per-scan all kind of data rate in lowest channel, and found the follow list which it was worst case.**

| Mode         | Data rate |
|--------------|-----------|
| 802.11b      | 1Mbps     |
| 802.11g      | 6Mbps     |
| 802.11n(H20) | 6.5Mbps   |
| 802.11n(H40) | 13.5Mbps  |

#### Final Test Mode:

|                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| Operation mode:                                                                                                                                                                                                                                                                                                                                                                                                           | Keep the EUT in continuous transmitting with modulation |
| 1. For WIFI function, the engineering test program was provided and enabled to make EUT continuous transmit/receive.<br>2. According to ANSI C63.10 standards, the test results are both the "worst case" and "worst setup" 1Mbps for 802.11b, 6Mbps for 802.11g, 6.5Mbps for 802.11n(H20), 13.5Mbps for 802.11(H40). Duty cycle setting during the transmission is 98.5% with maximum power setting for all modulations. |                                                         |



### 3.2. DESCRIPTION OF SUPPORT UNITS

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

| Equipment | Model No. | Serial No. | FCC ID | Trade Name |
|-----------|-----------|------------|--------|------------|
| /         | /         | /          | /      | /          |

**Note:**

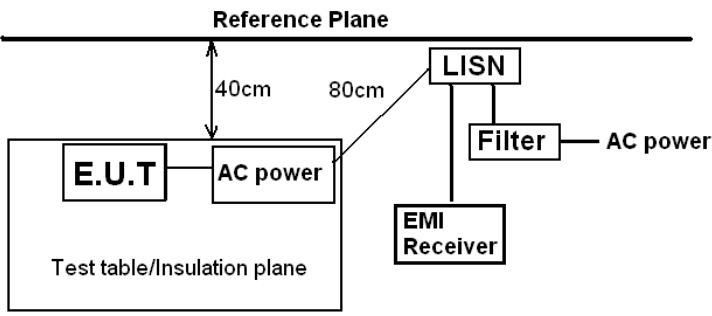
1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.
3. For conducted measurements (Output Power, 6dB Emission Bandwidth, Power Spectral Density, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.



## 4. TEST RESULTS AND MEASUREMENT DATA

### 4.1. CONDUCTED EMISSION

#### 4.1.1. Test Specification

| Test Requirement:        | FCC Part15 C Section 15.207                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                          |              |  |            |         |          |           |           |       |    |    |      |    |    |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------|--|------------|---------|----------|-----------|-----------|-------|----|----|------|----|----|
| Test Method:             | ANSI C63.10:2013                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                          |              |  |            |         |          |           |           |       |    |    |      |    |    |
| Frequency Range:         | 150 kHz to 30 MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                          |              |  |            |         |          |           |           |       |    |    |      |    |    |
| Receiver setup:          | RBW=9 kHz, VBW=30 kHz, Sweep time=auto                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |              |  |            |         |          |           |           |       |    |    |      |    |    |
| Limits:                  | <table><tr><th rowspan="2">Frequency range<br/>(MHz)</th><th colspan="2">Limit (dBuV)</th></tr><tr><th>Quasi-peak</th><th>Average</th></tr><tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr><tr><td>0.5-5</td><td>56</td><td>46</td></tr><tr><td>5-30</td><td>60</td><td>50</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                            | Frequency range<br>(MHz) | Limit (dBuV) |  | Quasi-peak | Average | 0.15-0.5 | 66 to 56* | 56 to 46* | 0.5-5 | 56 | 46 | 5-30 | 60 | 50 |
| Frequency range<br>(MHz) | Limit (dBuV)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                          |              |  |            |         |          |           |           |       |    |    |      |    |    |
|                          | Quasi-peak                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Average                  |              |  |            |         |          |           |           |       |    |    |      |    |    |
| 0.15-0.5                 | 66 to 56*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 56 to 46*                |              |  |            |         |          |           |           |       |    |    |      |    |    |
| 0.5-5                    | 56                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 46                       |              |  |            |         |          |           |           |       |    |    |      |    |    |
| 5-30                     | 60                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 50                       |              |  |            |         |          |           |           |       |    |    |      |    |    |
| Test Setup:              | <div><p>Reference Plane</p><p>Remark<br/>E.U.T: Equipment Under Test<br/>LISN: Line Impedance Stabilization Network<br/>Test table height=0.8m</p></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                          |              |  |            |         |          |           |           |       |    |    |      |    |    |
| Test Mode:               | Charging + transmitting with modulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                          |              |  |            |         |          |           |           |       |    |    |      |    |    |
| Test Procedure:          | <div><div>1. The E.U.T is connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.</div><div>2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).</div><div>3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.</div></div> |                          |              |  |            |         |          |           |           |       |    |    |      |    |    |
| Test Result:             | PASS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                          |              |  |            |         |          |           |           |       |    |    |      |    |    |



#### 4.1.2. Test Instruments

| Conducted Emission Shielding Room Test Site (843) |              |                 |               |                 |
|---------------------------------------------------|--------------|-----------------|---------------|-----------------|
| Equipment                                         | Manufacturer | Model           | Serial Number | Calibration Due |
| Receiver                                          | R&S          | ESCI 7          | HKE-010       | Dec. 09, 2021   |
| LISN                                              | R&S          | ENV216          | HKE-002       | Dec. 09, 2021   |
| Conducted test software                           | Tonscend     | TS+ Rev 2.5.0.0 | HKE-081       | N/A             |

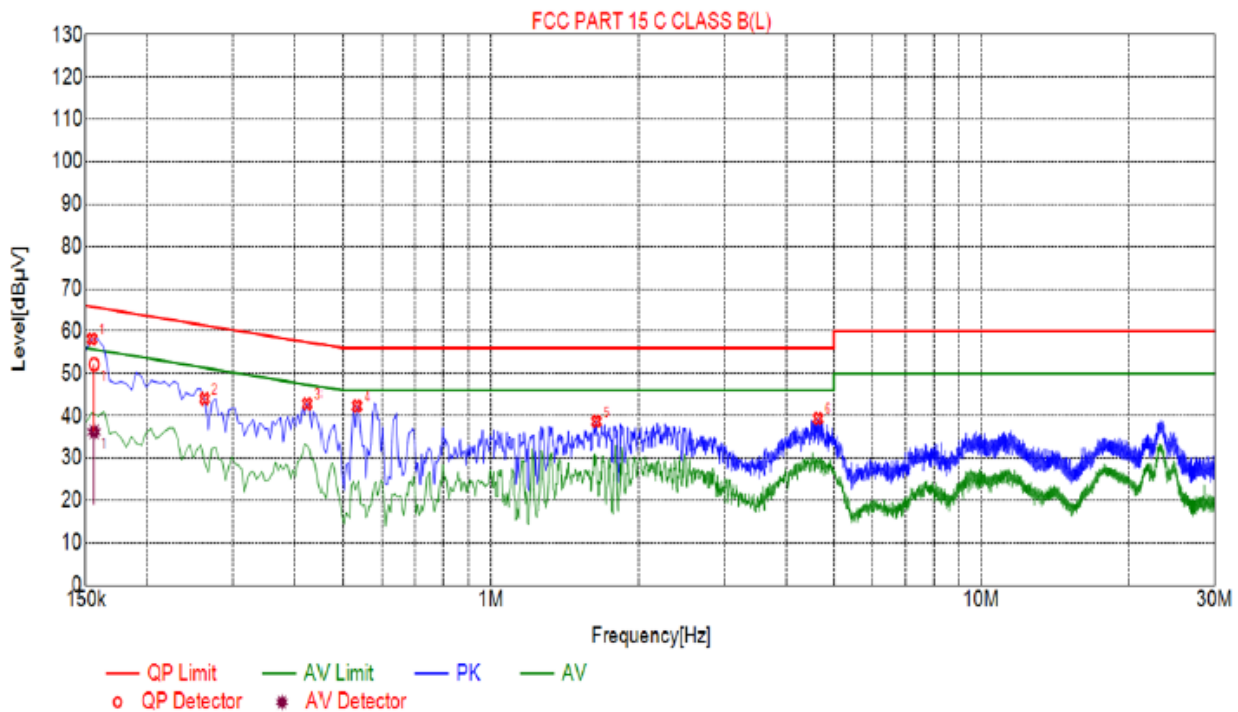
**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).



#### 4.1.3. Test data

All the test modes completed for test. only the worst result was reported as below:

Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)



| Suspected List |             |              |             |              |             |                |          |      |
|----------------|-------------|--------------|-------------|--------------|-------------|----------------|----------|------|
| NO.            | Freq. [MHz] | Level [dBμV] | Factor [dB] | Limit [dBμV] | Margin [dB] | Reading [dBμV] | Detector | Type |
| 1              | 0.1545      | 59.61        | 20.03       | 65.75        | 6.14        | 39.58          | PK       | L    |
| 2              | 0.2580      | 47.54        | 20.04       | 61.50        | 13.96       | 27.50          | PK       | L    |
| 3              | 0.4200      | 41.65        | 20.04       | 57.45        | 15.80       | 21.61          | PK       | L    |
| 4              | 1.1445      | 37.12        | 20.09       | 56.00        | 18.88       | 17.03          | PK       | L    |
| 5              | 2.1930      | 39.73        | 20.17       | 56.00        | 16.27       | 19.56          | PK       | L    |
| 6              | 4.6455      | 40.87        | 20.26       | 56.00        | 15.13       | 20.61          | PK       | L    |

#### Final Data List

| NO. | Freq. [MHz] | Correction factor [dB] | QP Value [dBμV] | QP Limit [dBμV] | QP Margin [dB] | QP Reading [dBμV] | AV Value [dBμV] | AV Limit [dBμV] | AV Margin [dB] | AV Reading [dBμV] | Type |
|-----|-------------|------------------------|-----------------|-----------------|----------------|-------------------|-----------------|-----------------|----------------|-------------------|------|
| 1   | 0.1560      | 20.02                  | 52.16           | 65.67           | 13.51          | 32.14             | 36.20           | 55.67           | 19.47          | 16.18             | L    |

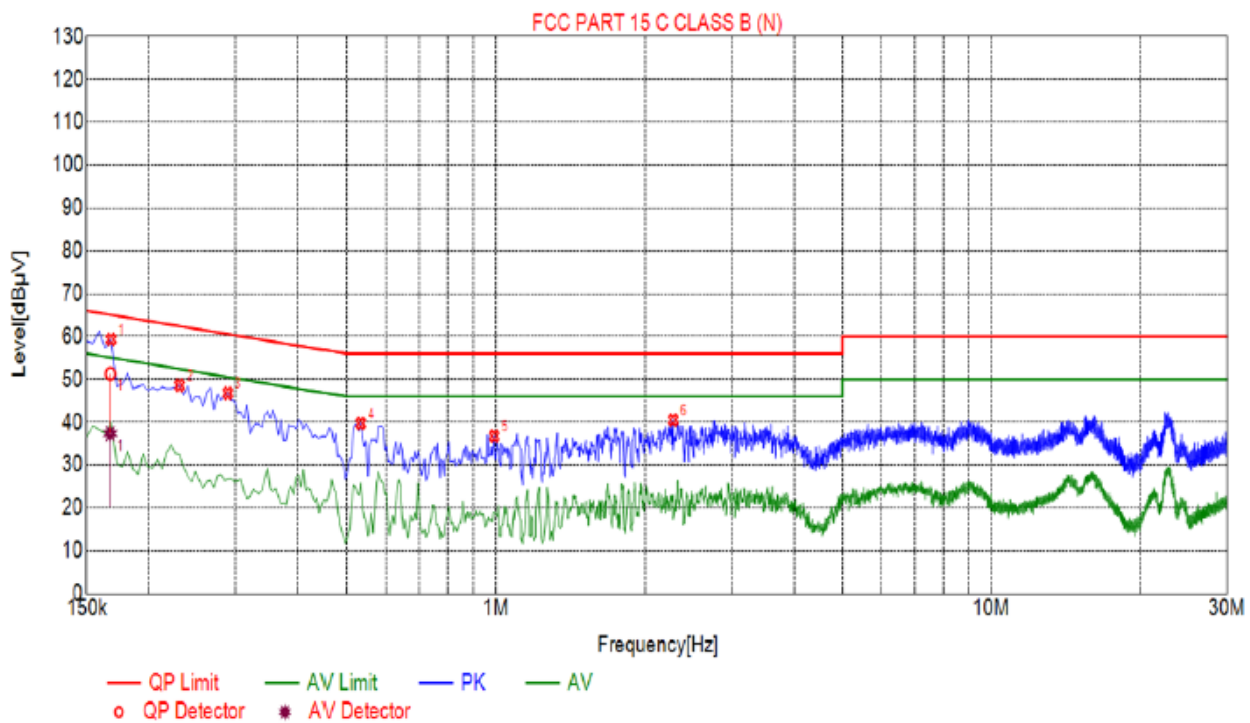
Remark: Margin = Limit – Level

Correction factor = Cable lose + LISN insertion loss

Level=Test receiver reading + correction factor



## Conducted Emission on Neutral Terminal of the power line (150 kHz to 30MHz)



## Suspected List

| NO. | Freq. [MHz] | Level [dBμV] | Factor [dB] | Limit [dBμV] | Margin [dB] | Reading [dBμV] | Detector | Type |
|-----|-------------|--------------|-------------|--------------|-------------|----------------|----------|------|
| 1   | 0.1680      | 59.32        | 20.01       | 65.06        | 5.74        | 39.31          | PK       | N    |
| 2   | 0.2310      | 48.63        | 20.03       | 62.41        | 13.78       | 28.60          | PK       | N    |
| 3   | 0.2895      | 46.80        | 20.03       | 60.54        | 13.74       | 26.77          | PK       | N    |
| 4   | 0.5325      | 39.75        | 20.05       | 56.00        | 16.25       | 19.70          | PK       | N    |
| 5   | 0.9915      | 36.76        | 20.06       | 56.00        | 19.24       | 16.70          | PK       | N    |
| 6   | 2.2785      | 40.54        | 20.18       | 56.00        | 15.46       | 20.36          | PK       | N    |

## Final Data List

| NO. | Freq. [MHz] | Correction factor [dB] | QP Value [dBμV] | QP Limit [dBμV] | QP Margin [dB] | QP Reading [dBμV] | AV Value [dBμV] | AV Limit [dBμV] | AV Margin [dB] | AV Reading [dBμV] | Type |
|-----|-------------|------------------------|-----------------|-----------------|----------------|-------------------|-----------------|-----------------|----------------|-------------------|------|
| 1   | 0.1674      | 20.01                  | 51.31           | 65.09           | 13.78          | 31.30             | 37.38           | 55.09           | 17.71          | 17.37             | N    |

Remark: Margin = Limit – Level

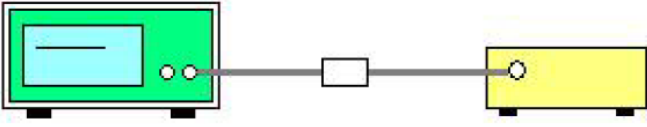
Correction factor = Cable lose + LISN insertion loss

Level = Test receiver reading + correction factor



## 4.2. MAXIMUM CONDUCTED OUTPUT POWER

### 4.2.1. Test Specification

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test Requirement:</b> | FCC Part15 C Section 15.247 (b)(3)                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Test Method:</b>      | KDB 558074                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Limit:</b>            | 30dBm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Test Setup:</b>       | <br><b>Power meter</b> <b>EUT</b>                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Test Mode:</b>        | Transmitting mode with modulation                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Test Procedure:</b>   | <ol style="list-style-type: none"><li>1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 15.247 Meas Guidance v05r02.</li><li>2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.</li><li>3. Set to the maximum power setting and enable the EUT transmit continuously.</li><li>4. Measure the Peak output power and record the results in the test report.</li></ol> |
| <b>Test Result:</b>      | PASS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

### 4.2.2. Test Instruments

| RF Test Room              |              |          |               |                 |
|---------------------------|--------------|----------|---------------|-----------------|
| Equipment                 | Manufacturer | Model    | Serial Number | Calibration Due |
| Power meter               | Agilent      | E4419B   | HKE-085       | Dec. 09, 2021   |
| Power Sensor              | Agilent      | E9300A   | HKE-086       | Dec. 09, 2021   |
| RF cable                  | Times        | 1-40G    | HKE-034       | Dec. 09, 2021   |
| RF automatic control unit | Tonscend     | JS0806-2 | HKE-060       | Dec. 09, 2021   |

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



## 4.2.3. Test Data

| Test Channel                                                                                                                                          | Frequency | Maximum Peak Conducted Output Power (dBm) |                |       | LIMIT |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------------------------------------|----------------|-------|-------|
|                                                                                                                                                       | (MHz)     | Antenna port 1                            | Antenna port 2 | MIMO  | dBm   |
| <b>TX 802.11b Mode</b>                                                                                                                                |           |                                           |                |       |       |
| CH01                                                                                                                                                  | 2412      | 14.69                                     | 12.83          | /     | 30    |
| CH06                                                                                                                                                  | 2437      | 13.99                                     | 13.03          | /     | 30    |
| CH11                                                                                                                                                  | 2462      | 13.89                                     | 13.29          | /     | 30    |
| <b>TX 802.11g Mode</b>                                                                                                                                |           |                                           |                |       |       |
| CH01                                                                                                                                                  | 2412      | 13.73                                     | 13.69          | /     | 30    |
| CH06                                                                                                                                                  | 2437      | 13.95                                     | 13.59          | /     | 30    |
| CH11                                                                                                                                                  | 2462      | 14.13                                     | 13.17          | /     | 30    |
| <b>TX 802.11n20 Mode</b>                                                                                                                              |           |                                           |                |       |       |
| CH01                                                                                                                                                  | 2412      | 13.56                                     | 13.00          | 16.30 | 30    |
| CH06                                                                                                                                                  | 2437      | 13.88                                     | 13.25          | 16.59 | 30    |
| CH11                                                                                                                                                  | 2462      | 14.15                                     | 13.82          | 17.00 | 30    |
| <b>TX 802.11n40 Mode</b>                                                                                                                              |           |                                           |                |       |       |
| CH03                                                                                                                                                  | 2422      | 14.02                                     | 13.52          | 16.79 | 30    |
| CH06                                                                                                                                                  | 2437      | 13.84                                     | 13.58          | 16.72 | 30    |
| CH09                                                                                                                                                  | 2452      | 13.97                                     | 13.47          | 16.74 | 30    |
| Note: This product supports antenna 1 and antenna 2 launch, but only support 802.11 n for MIMO mode, not support 802.11 b and 802.11 g for MIMO mode. |           |                                           |                |       |       |



### 4.3. EMISSION BANDWIDTH

#### 4.3.1. Test Specification

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | FCC Part15 C Section 15.247 (a)(2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Test Method:      | KDB 558074                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Limit:            | >500kHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Test Setup:       | <br>Spectrum Analyzer                      EUT                                                                                                                                                                                                                                                                                                                                                                                             |
| Test Mode:        | Transmitting mode with modulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Test Procedure:   | <ol style="list-style-type: none"><li>1. The testing follows FCC KDB Publication 558074 D01 15.247 Meas Guidance v05r02.</li><li>2. Set to the maximum power setting and enable the EUT transmit continuously.</li><li>3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz.</li><li>4. Measure and record the results in the test report.</li></ol> |
| Test Result:      | PASS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

#### 4.3.2. Test Instruments

| RF Test Room                 |              |          |               |                 |
|------------------------------|--------------|----------|---------------|-----------------|
| Equipment                    | Manufacturer | Model    | Serial Number | Calibration Due |
| Spectrum analyzer            | Agilent      | N9020A   | HKE-048       | Dec. 09, 2021   |
| RF Cable<br>(9KHz-26.5GHz)   | Tonscend     | 170660   | N/A           | Dec. 09, 2021   |
| RF automatic<br>control unit | Tonscend     | JS0806-2 | HKE-060       | Dec. 09, 2021   |

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



#### 4.3.3. Test data

##### For antenna port 1

| Test channel | 6dB Emission Bandwidth (MHz) |         |              |              |
|--------------|------------------------------|---------|--------------|--------------|
|              | 802.11b                      | 802.11g | 802.11n(H20) | 802.11n(H40) |
| Lowest       | 8.160                        | 14.880  | 13.960       | 34.000       |
| Middle       | 8.160                        | 15.600  | 15.160       | 34.080       |
| Highest      | 8.160                        | 16.000  | 15.960       | 35.280       |
| Limit:       | >500k                        |         |              |              |
| Test Result: | PASS                         |         |              |              |

Test plots as follows:



## 802.11b Modulation

### Lowest channel



### Middle channel



### Highest channel



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## 802.11g Modulation

### Lowest channel



### Middle channel



### Highest channel



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## 802.11n (HT20) Modulation

### Lowest channel



### Middle channel



### Highest channel



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## 802.11n (HT40) Modulation

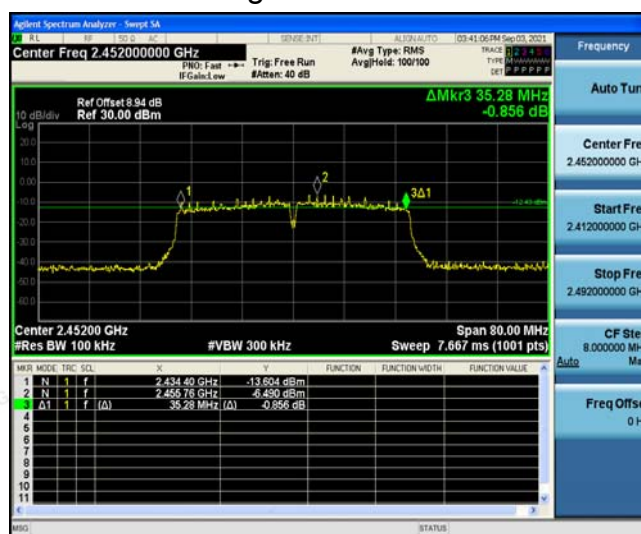
### Lowest channel



### Middle channel



### Highest channel



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**For antenna port 2**

| Test channel | 6dB Emission Bandwidth (MHz) |         |              |              |
|--------------|------------------------------|---------|--------------|--------------|
|              | 802.11b                      | 802.11g | 802.11n(H20) | 802.11n(H40) |
| Lowest       | 7.200                        | 12.840  | 13.960       | 34.000       |
| Middle       | 7.200                        | 15.200  | 13.960       | 35.200       |
| Highest      | 8.120                        | 13.720  | 17.360       | 35.200       |
| Limit:       | ≥500 (kHz)                   |         |              |              |
| Test Result: | PASS                         |         |              |              |

**Test plots as follows:**



## 802.11b Modulation

### Lowest channel



### Middle channel



### Highest channel



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## 802.11g Modulation

### Lowest channel



### Middle channel



### Highest channel



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## 802.11n (HT20) Modulation

### Lowest channel



### Middle channel



### Highest channel



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## 802.11n (HT40) Modulation

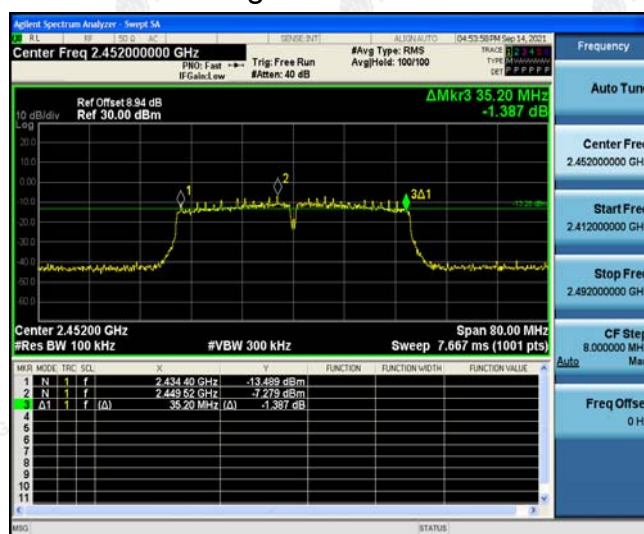
### Lowest channel



### Middle channel



### Highest channel



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## 4.4. Power Spectral Density

### 4.4.1. Test Specification

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test Requirement:</b> | FCC Part15 C Section 15.247 (e)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Test Method:</b>      | KDB 558074                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Limit:</b>            | The average power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Test Setup:</b>       |  <p style="text-align: center;">Spectrum Analyzer                      EUT</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Test Mode:</b>        | Transmitting mode with modulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Test Procedure:</b>   | <ol style="list-style-type: none"> <li>1. The testing follows Measurement procedure 10.2 method PKPSD of FCC KDB Publication 558074 D01 15.247 Meas Guidance v05r02.</li> <li>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.</li> <li>3. Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW): <math>3\text{ kHz} \leq \text{RBW} \leq 100\text{ kHz}</math>. Video bandwidth VBW <math>\geq 3 \times \text{RBW}</math>. Set the span to at least 1.5 times the OBW.</li> <li>5. Detector = Peak, Sweep time = auto couple.</li> <li>6. Employ trace averaging (Peak) mode over a minimum of 100 traces. Use the peak marker function to determine the maximum power level.</li> <li>6. Measure and record the results in the test report.</li> </ol> |
| <b>Test Result:</b>      | PASS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

### 4.4.2. Test Instruments

| RF Test Room              |              |          |               |                 |
|---------------------------|--------------|----------|---------------|-----------------|
| Equipment                 | Manufacturer | Model    | Serial Number | Calibration Due |
| Spectrum analyzer         | Agilent      | N9020A   | HKE-048       | Dec. 09, 2021   |
| RF Cable (9KHz-26.5GHz)   | Tonscend     | 170660   | N/A           | Dec. 09, 2021   |
| RF automatic control unit | Tonscend     | JS0806-2 | HKE-060       | Dec. 09, 2021   |

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

**4.4.3. Test data****For antenna port 1**

| EUT Set Mode                                               | Channel | Result (dBm/30kHz) | Result (dBm/3kHz) |
|------------------------------------------------------------|---------|--------------------|-------------------|
| 802.11b                                                    | Lowest  | -2.24              | -12.24            |
|                                                            | Middle  | -1.89              | -11.89            |
|                                                            | Highest | -2.58              | -12.58            |
| 802.11g                                                    | Lowest  | -8.64              | -18.64            |
|                                                            | Middle  | -8.9               | -18.9             |
|                                                            | Highest | -9.11              | -19.11            |
| 802.11n(H20)                                               | Lowest  | -8.25              | -18.25            |
|                                                            | Middle  | -8.64              | -18.64            |
|                                                            | Highest | -7.29              | -17.29            |
| 802.11n(H40)                                               | Lowest  | -11.86             | -21.86            |
|                                                            | Middle  | -11.77             | -21.77            |
|                                                            | Highest | -11.83             | -21.83            |
| PSD test result (dBm/3kHz)= PSD test result (dBm/30kHz)-10 |         |                    |                   |
| Limit: 8dBm/3kHz                                           |         |                    |                   |
| Test Result:                                               | PASS    |                    |                   |

**Test plots as follows:**



## 802.11b Modulation

### Lowest channel



### Middle channel



### Highest channel



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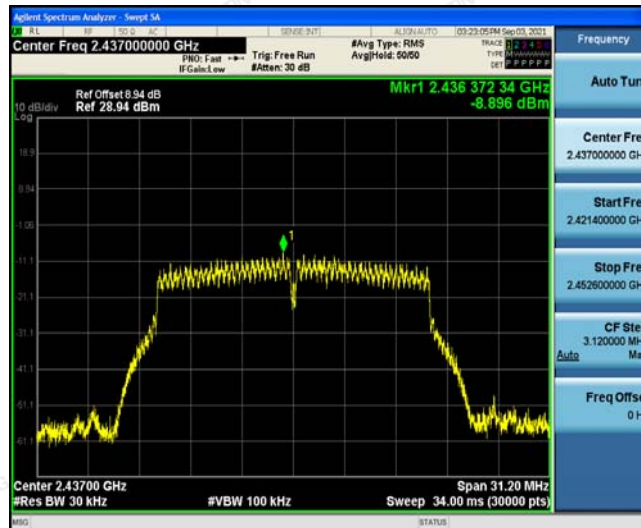


## 802.11g Modulation

### Lowest channel



### Middle channel



### Highest channel



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802.11n (HT20) Modulation

Lowest channel



Middle channel



Highest channel



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## 802.11n (HT40) Modulation

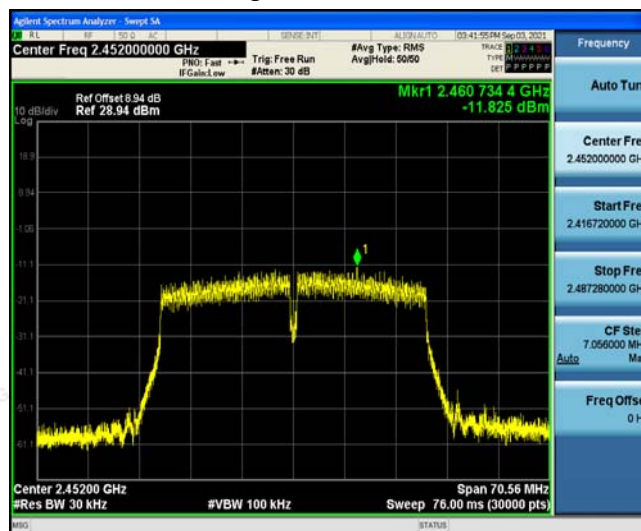
### Lowest channel



### Middle channel



### Highest channel



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**For antenna port 2**

| EUT Set Mode                                               | Channel | Result (dBm/30kHz) | Result (dBm/3kHz) |
|------------------------------------------------------------|---------|--------------------|-------------------|
| 802.11b                                                    | Lowest  | 2.83               | -7.17             |
|                                                            | Middle  | -5.75              | -15.75            |
|                                                            | Highest | 2.87               | -7.13             |
| 802.11g                                                    | Lowest  | -8.88              | -18.88            |
|                                                            | Middle  | -9.47              | -19.47            |
|                                                            | Highest | -9.43              | -19.43            |
| 802.11n(H20)                                               | Lowest  | -9.1               | -19.1             |
|                                                            | Middle  | -8.07              | -18.07            |
|                                                            | Highest | -8.42              | -18.42            |
| 802.11n(H40)                                               | Lowest  | -12.12             | -22.12            |
|                                                            | Middle  | -12.22             | -22.22            |
|                                                            | Highest | -12.16             | -22.16            |
| PSD test result (dBm/3kHz)= PSD test result (dBm/30kHz)-10 |         |                    |                   |
| Limit: 8dBm/3kHz                                           |         |                    |                   |
| Test Result:                                               | PASS    |                    |                   |

**Test plots as follows:**



## 802.11b Modulation

### Lowest channel



### Middle channel



### Highest channel



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## 802.11g Modulation

### Lowest channel



### Middle channel



### Highest channel



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## 802.11n (HT20) Modulation

### Lowest channel



### Middle channel



### Highest channel



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## 802.11n (HT40) Modulation

### Lowest channel



### Middle channel



### Highest channel



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## For MIMO antenna port 1+antenna port 2

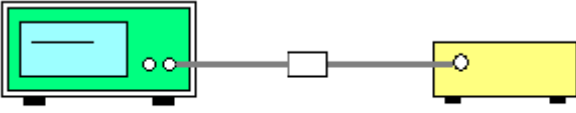
| Frequency                                                                                                                                                                                       | Power Density<br>(dBm/3kHz) | Limit<br>(dBm/3kHz) | Result |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------------|--------|
| TX 802.11n/HT20 Mode                                                                                                                                                                            |                             |                     |        |
| 2412 MHz                                                                                                                                                                                        | -15.64                      | -1                  | PASS   |
| 2437 MHz                                                                                                                                                                                        | -15.34                      | -1                  | PASS   |
| 2462 MHz                                                                                                                                                                                        | -14.81                      | -1                  | PASS   |
| TX 802.11n/HT40 Mode                                                                                                                                                                            |                             |                     |        |
| 2422 MHz                                                                                                                                                                                        | -18.98                      | -1                  | PASS   |
| 2437 MHz                                                                                                                                                                                        | -18.98                      | -1                  | PASS   |
| 2452 MHz                                                                                                                                                                                        | -18.98                      | -1                  | PASS   |
| Note: 1 According to KDB 662911, Result power = $10\log(10^{(\text{ant1}/10)} + 10^{(\text{ant2}/10)})$ .<br>2 Result unit: W, The end result is converted to units of dBm.<br>Limit: 8dBm/3kHz |                             |                     |        |

Note: This product supports antenna 1 and antenna 2 launch, but only support 802.11 n for MIMO mode, not support 802.11 b and 802.11 g for MIMO mode.



## 4.5. CONDUCTED BAND EDGE AND SPURIOUS EMISSION MEASUREMENT

### 4.5.1. Test Specification

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | FCC Part15 C Section 15.247 (d)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Test Method:      | KDB558074                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Limit:            | In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement and radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Test Setup:       | <br>Spectrum Analyzer                      EUT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Test Mode:        | Transmitting mode with modulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Test Procedure:   | <ol style="list-style-type: none"><li>1. The testing follows FCC KDB Publication 558074 D01 15.247 Meas Guidance v05r02.</li><li>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.</li><li>3. Set to the maximum power setting and enable the EUT transmit continuously.</li><li>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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).</li><li>5. Measure and record the results in the test report.</li><li>6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.</li></ol> |
| Test Result:      | PASS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |



#### 4.5.2. Test Instruments

| RF Test Room                 |              |          |               |                 |
|------------------------------|--------------|----------|---------------|-----------------|
| Equipment                    | Manufacturer | Model    | Serial Number | Calibration Due |
| Spectrum analyzer            | Agilent      | N9020A   | HKE-048       | Dec. 09, 2021   |
| Signal generator             | Agilent      | N5183A   | HKE-071       | Dec. 09, 2021   |
| RF Cable<br>(9KHz-26.5GHz)   | Tonscend     | 170660   | N/A           | Dec. 09, 2021   |
| RF automatic<br>control unit | Tonscend     | JS0806-2 | HKE-060       | Dec. 09, 2021   |

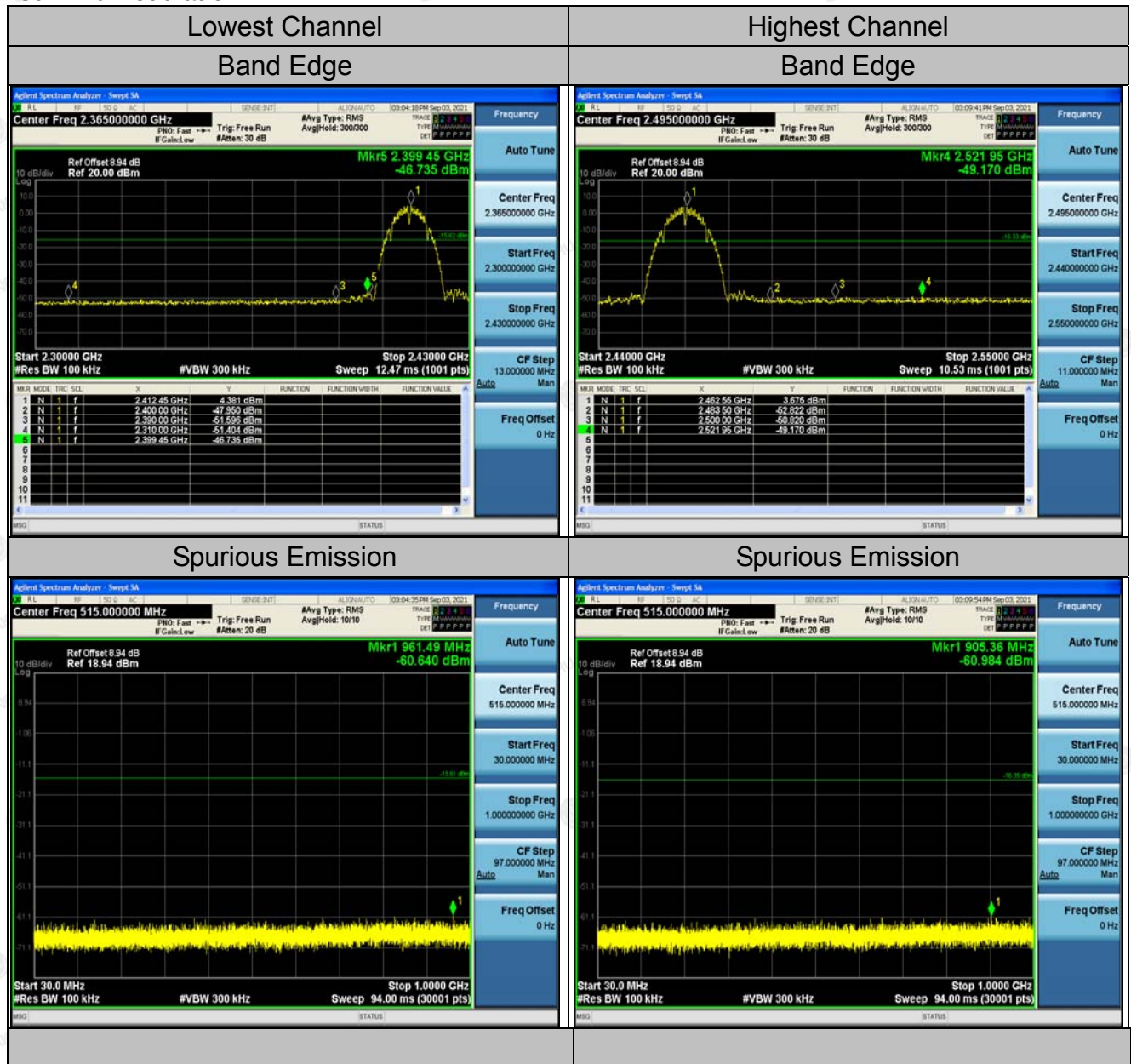
**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

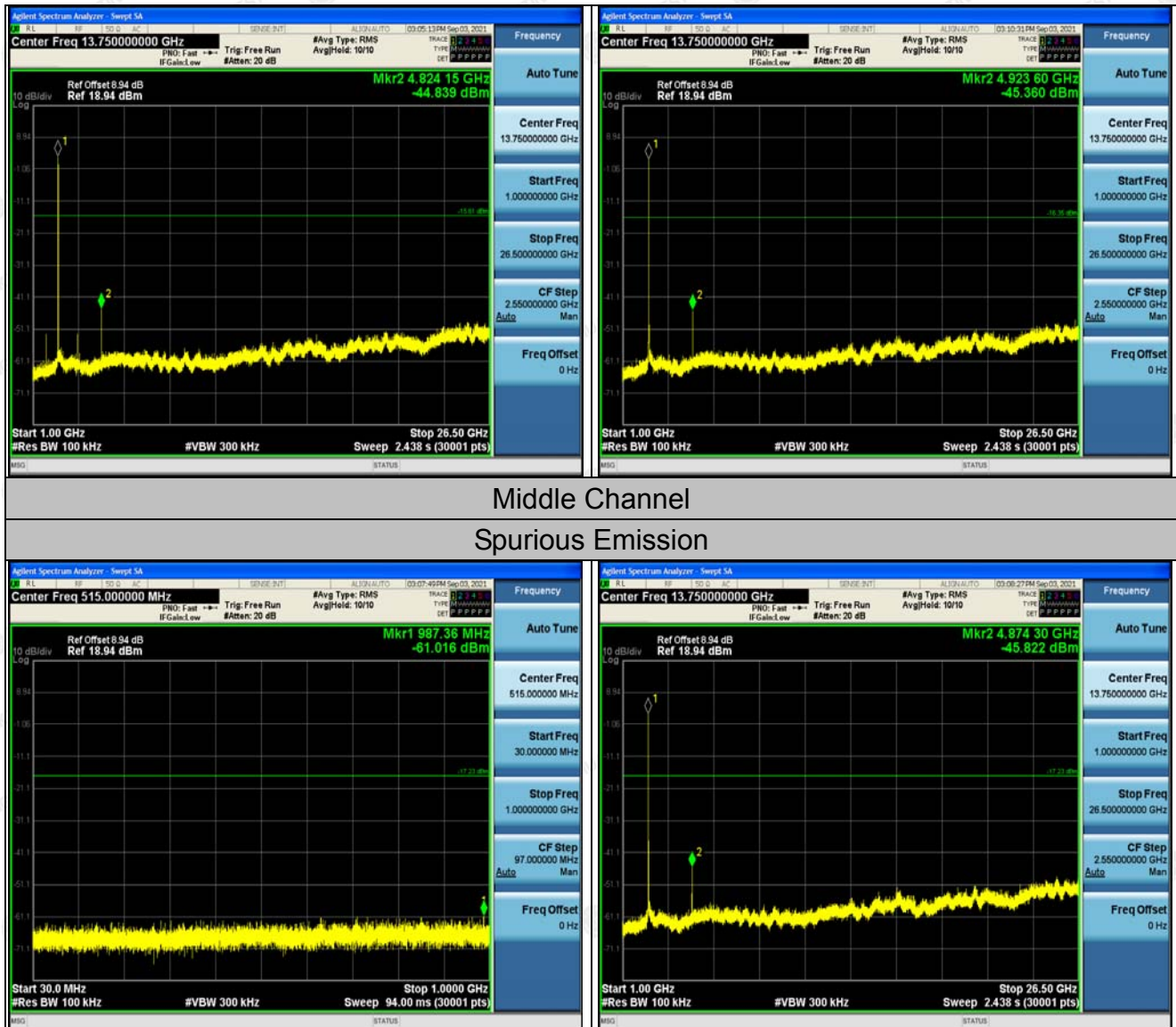


### 4.5.3. Test Data

#### Chain 1

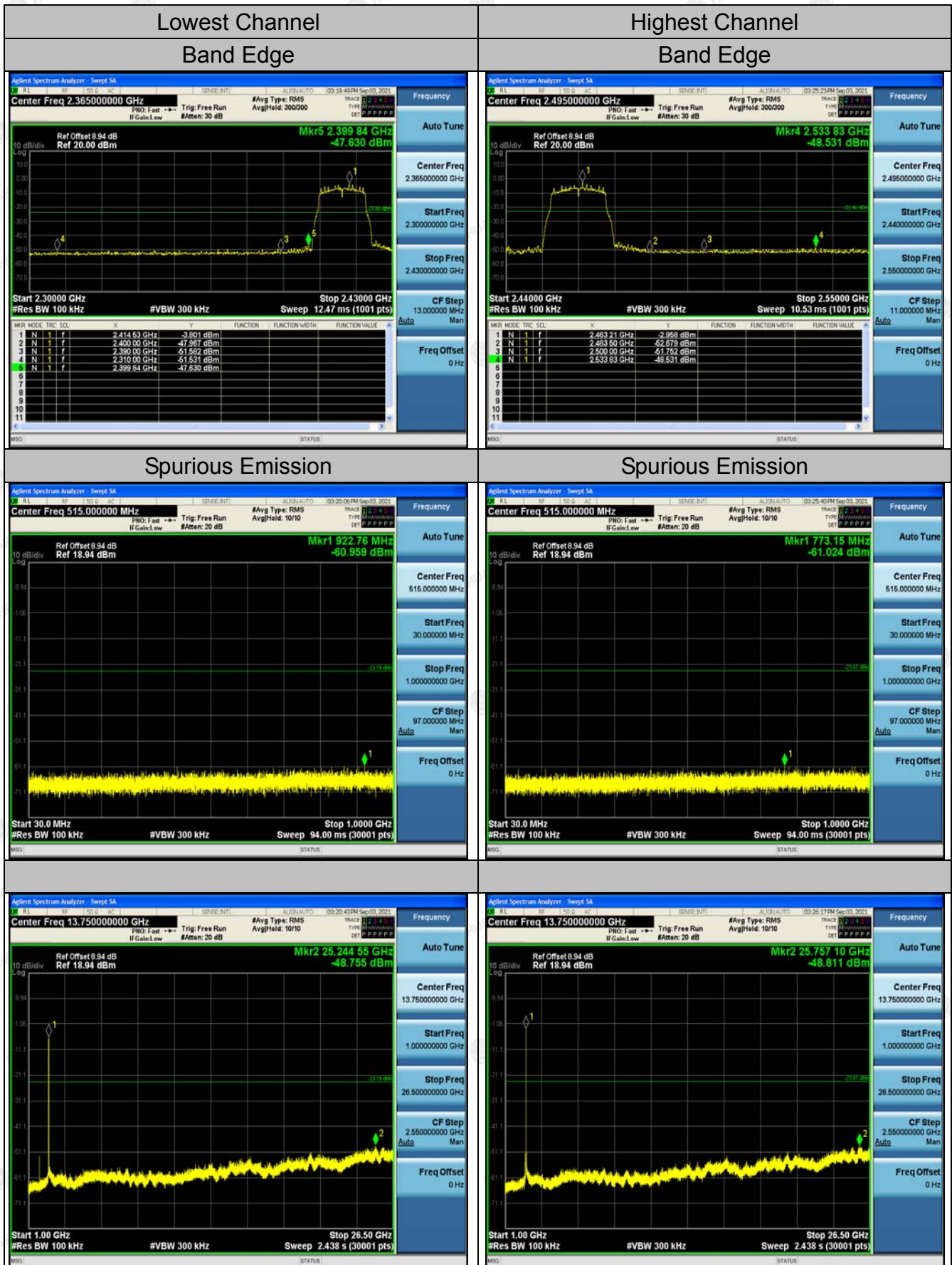
#### 802.11b Modulation







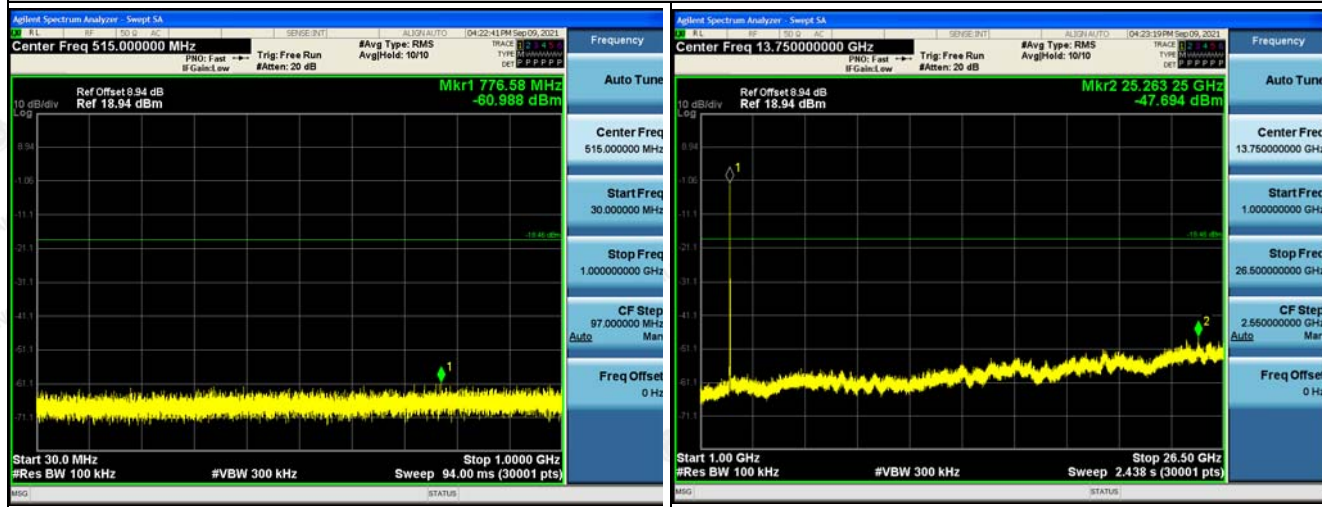
802.11g Modulation



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## Middle Channel Spurious Emission



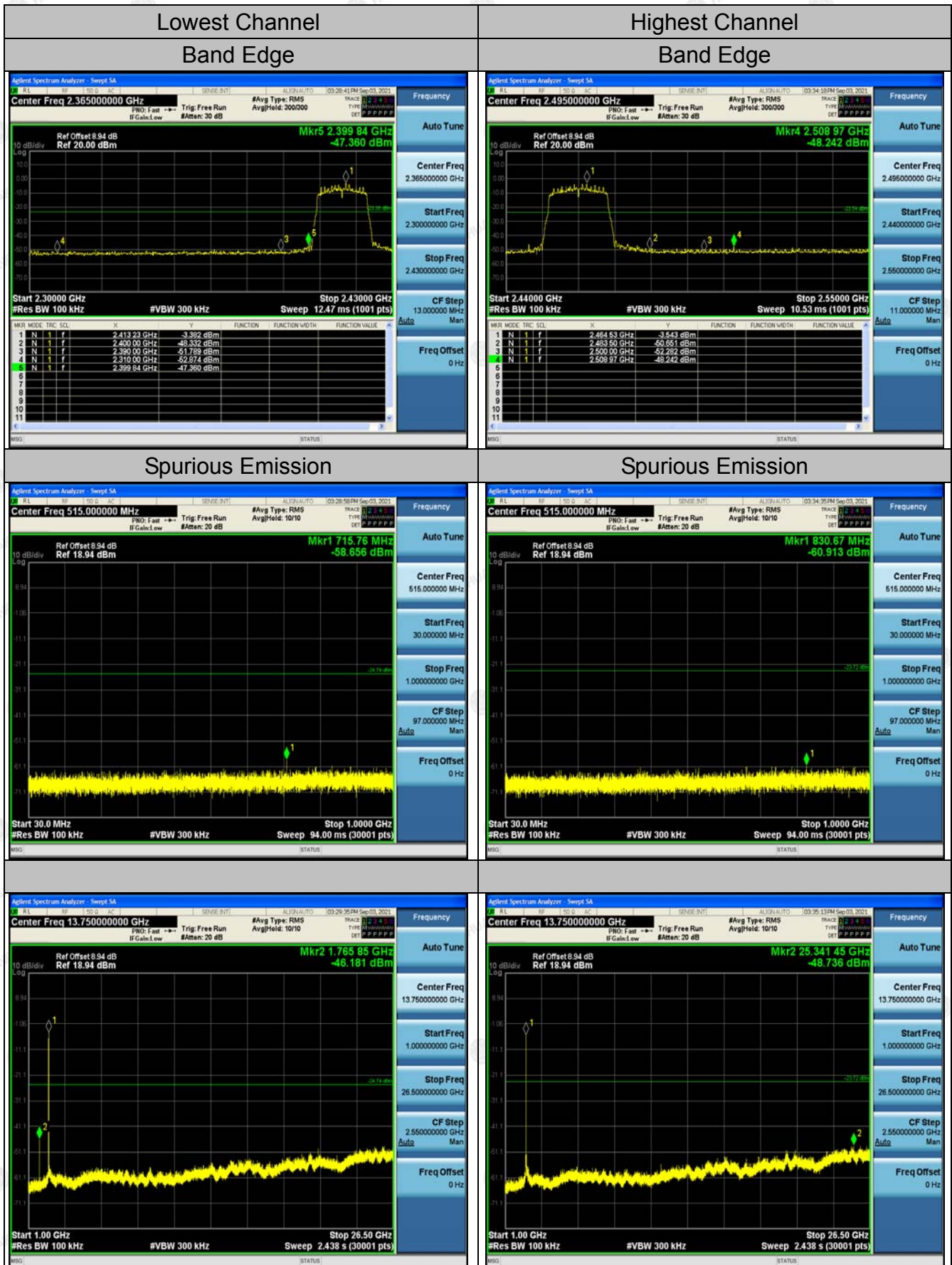
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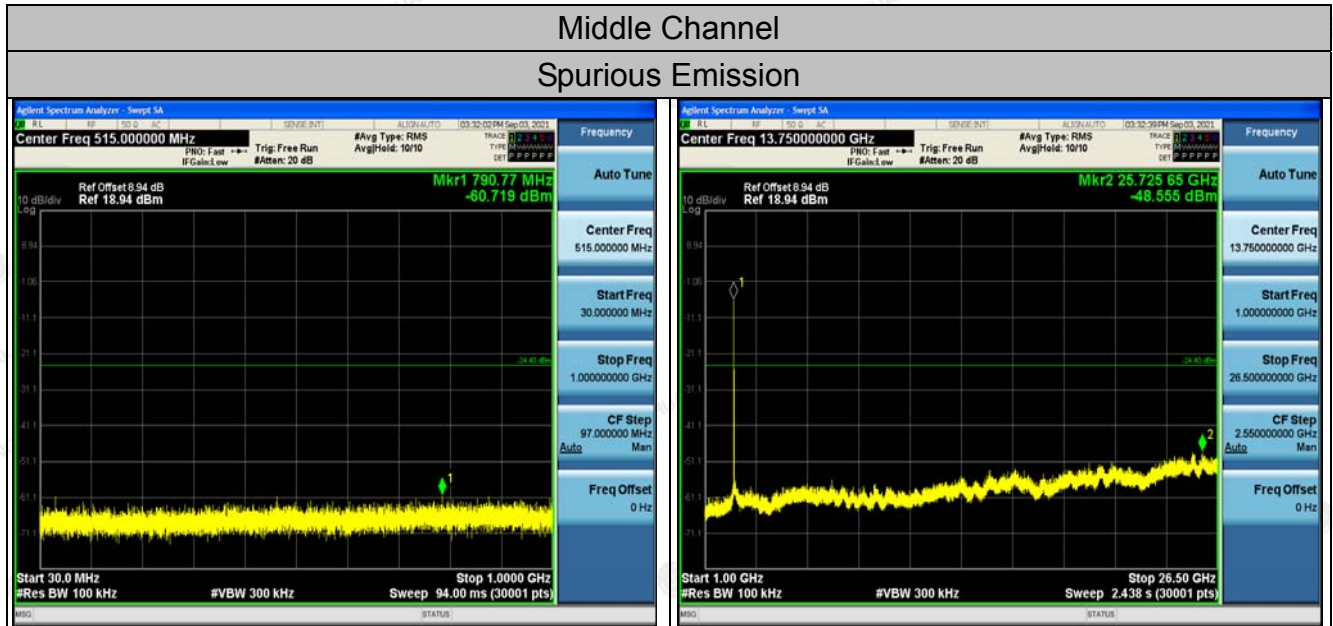
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802.11n (HT20) Modulation



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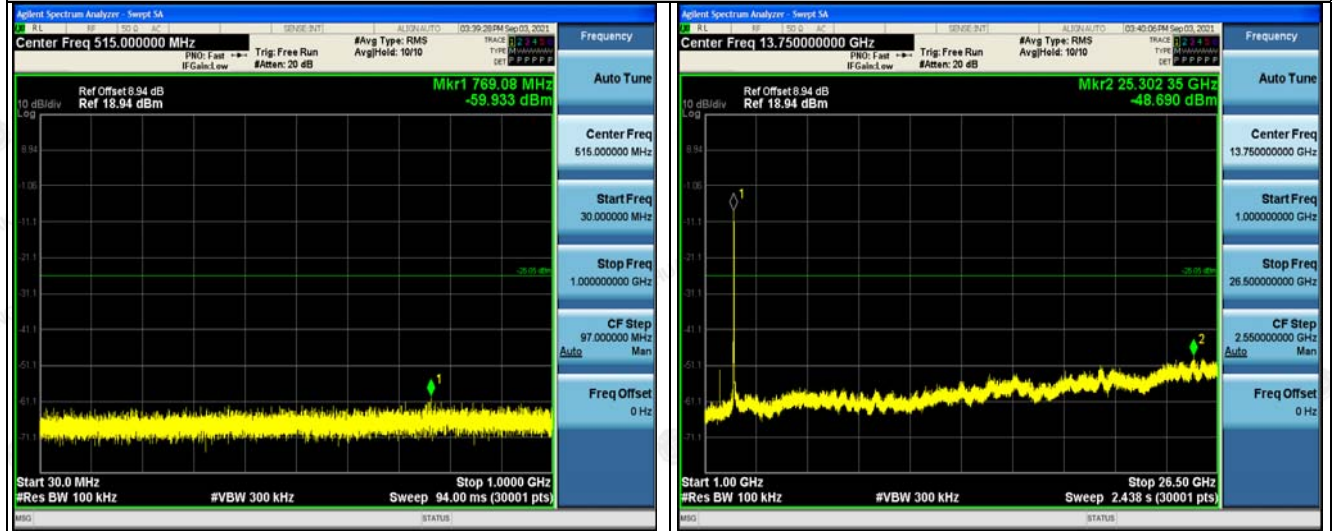
802.11n (HT40) Modulation



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