

## FCC TEST REPORT (WIFI)

for

YICHEN (SHENZHEN) TECHNOLOGY CO., LTD

Wi-Fi Range Extender

Model Number: JWA-AC2320M

Serial Number: JWA-AC2323M, WRAC1200

FCC ID: 2AJSTJWA-AC2320M

Prepared for : YICHEN (SHENZHEN) TECHNOLOGY CO., LTD  
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Report No. : 17KWE025074F  
Date of Test : Jan. 20 ~ Feb. 15, 2017  
Date of Report : Feb.16, 2017

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# Keyway Testing Technology Co., Ltd.

|  |   |   |                        |
|--|---|---|------------------------|
| <b>Applicant:</b>  | YICHEN (SHENZHEN) TECHNOLOGY CO., LTD   |   |                        |
| <b>Address:</b>  | 23/F, Block C1, Nanshan I Park, No. 1001, Xueyuan Road, Taoyuan Street, Nanshan District, Shenzhen, China |   |                        |
| <b>Manufacturer:</b>   | YICHEN (SHENZHEN) TECHNOLOGY CO., LTD   |   |                        |
| <b>Address:</b>  | 23/F, Block C1, Nanshan I Park, No. 1001, Xueyuan Road, Taoyuan Street, Nanshan District, Shenzhen, China |   |                        |
| <b>E.U.T:</b>  | Wi-Fi Range Extender  |   |                        |
| <b>Model Number:</b>   | JWA-AC2320M   |   |                        |
| <b>Serial Model:</b>   | JWA-AC2323M, WRAC1200   |   |                        |
| <b>Trade Name:</b>   |  JCG                     | <b>Serial No.:</b>  | -----                  |
| <b>Date of Receipt:</b>  | Jan. 18, 2017   | <b>Date of Test:</b>  | Jan. 20 ~ Feb.15, 2017 |
| <b>Test Specification:</b>   | FCC Part 15, Subpart 15.247: Oct. 1, 2016<br>ANSI C63.10:2013<br>KDB558074 D01 DTS Meas Guidance v03r05   |   |                        |
| <b>Test Result:</b>  | The equipment under test was found to be compliance with the requirements of the standards applied.       |   |                        |
| <b>Issue Date: Feb. 16, 2017</b>   |   |   |                        |
| Tested by:   | Reviewed by:  | Approved by:  |                        |
|   |                        |  |                        |
| Keven Wu / Engineer  | Mark Li / Supervisor  | Andy Gao / Supervisor   |                        |
| <b>Other Aspects:</b>  | None.   |   |                        |
| Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested   |   |   |                        |
| This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Keyway Testing Technology Co., Ltd. |   |   |                        |

## 1. TEST SUMMARY

| Test Items                 | Test Requirement           | Result |
|----------------------------|----------------------------|--------|
| Conducted Emissions        | 15.207                     | PASS   |
| Radiated Emissions         | 15.205(a)/15.209/15.247(d) | PASS   |
| 6dB&99% Bandwidth          | 15.247(a)(2)               | PASS   |
| Power density              | 15.247(e)                  | PASS   |
| Maximum Peak Output Power  | 15.247(b)                  | PASS   |
| Duty Cycle                 | 15.207                     | PASS   |
| Emissions from out of band | 15.247(d)                  | PASS   |
| Antenna Requirement        | 15.203                     | PASS   |

## 2. GENERAL PRODUCT INFORMATION

### 2.1. Product Function

Refer to Technical Construction Form and User Manual.

### 2.2. Description of Device (EUT)

|                            |  |
|----------------------------|--|
| Product Name:              | Wi-Fi Range Extender   |
| Model No.:                 | JWA-AC2320M  |
| Serial Model:              | JWA-AC2323M, WRAC1200  |
| Model Difference           | All the models are the same circuit and RF module, except the model names and colour.  |
| Operation Frequency:       | 2412MHz~2462MHz (802.11b/802.11g/802.11n(HT20))<br>2422MHz~2452MHz (802.11n(H40))  |
| Channel numbers:           | 11 for 802.11b/802.11g/802.11n(HT20) ,7 for 802.11n(H40)   |
| Modulation technology:     | Direct Sequence Spread Spectrum (DSSS) for (IEEE 802.11b)<br>Orthogonal Frequency Division Multiplexing(OFDM) for (IEEE 802.11g/802.11n) |
| Data speed (IEEE 802.11b): | 1Mbps, 2Mbps, 5.5Mbps, 11Mbps  |
| Data speed (IEEE 802.11g): | 6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps,<br>36Mbps, 48Mbps, 54Mbps  |
| Data speed (IEEE 802.11n): | Up to 150Mbps  |
| Antenna Type:              | PIFA antenna   |
| Antenna gain:              | 2.86 dBi   |
| Power supply:              | AC 100-240V, 50/60Hz, 0.3A   |

## 2.3. Independent Operation Modes

The basic operation modes are:

### 2.3.1. EUT work WFI TX mode, and frequency as below:

|        |               |           |
|--------|---------------|-----------|
| Mode 1 | 802.11b       | Frequency |
|        |               | 2412MHz   |
|        |               | 2437MHz   |
|        |               | 2462MHz   |
| Mode 2 | 802.11g       | 2412MHz   |
|        |               | 2437MHz   |
|        |               | 2462MHz   |
|        |               | 2412MHz   |
| Mode 3 | 802.11n(HT20) | 2437MHz   |
|        |               | 2462MHz   |
|        |               | 2422MHz   |
|        |               | 2437MHz   |
| Mode 4 | 802.11n(HT40) | 2452MHz   |
|        |               | Link Mode |

Remark: 802.11b mode:1Mbps, 802.11g mode:6Mbps, 802.11n(HT20) mode:MCS0, 802.11n(HT40) mode:MCS0. The software “RFTestTool” was used for testing, which was provided by manufacturer.

## 2.4. Test Supporting System

None.

## 2.5. Test Sites

### 2.5.1. Test Facilities

- Lab Qualifications : Certificated by Industry Canada  
 Registration No.: 9868A  
 Date of registration: December 8, 2011
- Certificated by FCC, USA  
 Registration No.: 370994  
 Date of registration: February 21, 2012
- Certificated by CNAS China  
 Registration No.: CNAS L5783  
 Date of registration: August 8, 2012

## 2.6. List of Test and Measurement Instruments

### 2.6.1. For conducted emission at the mains terminals test

| Equipment                | Manufacturer  | Model No. | Serial No. | Last Cal.  | Next Cal.  |
|--------------------------|---------------|-----------|------------|------------|------------|
| EMI Test Receiver        | Rohde&Schwarz | ESCI      | 101156     | Apr. 09,16 | Apr. 09,17 |
| Artificial Mains Network | Rohde&Schwarz | ENV216    | 101315     | Apr. 09,16 | Apr. 09,17 |
| RF Cable                 | FUJIKURA      | 3D-2W     | 944 Cable  | Apr. 09,16 | Apr. 09,17 |

### 2.6.2. For radiated emission test

| Equipment                             | Manufacturer  | Model No.     | Serial No.   | Last Cal.  | Next Cal.  |
|---------------------------------------|---------------|---------------|--------------|------------|------------|
| EMI Test Receiver                     | Rohde&Schwarz | ESCI          | 101156       | Apr. 09,16 | Apr. 09,17 |
| Bilog Antenna                         | ETS-LINDGREEN | 3142D         | 135452       | Apr. 09,16 | Apr. 09,17 |
| Spectrum Analyzer                     | Agilent       | E4411B        | MY4511304    | Apr. 09,16 | Apr. 09,17 |
| 3m Semi-anechoic Chamber              | ETS-LINDGREEN | 966           | KW01         | Apr. 09,16 | Apr. 09,17 |
| Signal Amplifier                      | SONOMA        | 310           | 187016       | Apr. 09,16 | Apr. 09,17 |
| Signal Amplifier                      | Agilent       | 8449B         | 3008A00251   | Apr. 09,16 | Apr. 09,17 |
| RF Cable                              | IMRO          | IMRO-400      | 966 Cable 1# | N/A        | N/A        |
| MULTI-DEVICE Controller               | ETS-LINDGREEN | 2090          | 126913       | N/A        | N/A        |
| Horn Antenna                          | SCHWARZBECK   | BBHA9170      | 9170-068     | Apr. 09,16 | Apr. 09,17 |
| Spectrum Analyzer                     | Agilent       | E4408B        | MY44211125   | Apr. 09,16 | Apr. 09,17 |
| High Pass filter                      | Micro         | HPM50111      | 324216       | Apr. 09,16 | Apr. 09,17 |
| Constant temperature and humidity box | GF            | GTH-800-40-1P | MAA9906-005  | Apr. 09,16 | Apr. 09,17 |
| Attenuation                           | MCE           | 24-10-34      | BN9258       | Apr. 02,16 | Apr. 02,17 |
| Loop Antenna                          | ARA           | PLA-1030/B    | 1029         | Apr. 02,16 | Apr. 02,17 |
| Power Meter                           | Anritsu       | ML2495A       | 1204003      | Apr. 24,16 | Apr. 24,17 |
| Power Sensor                          | Anritsu       | MA2411B       | 1126150      | Apr. 24,16 | Apr. 24,17 |

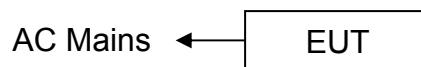
### 3. TEST SET-UP AND OPERATION MODES

#### 3.1. Principle of Configuration Selection

**Emission:** The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the Operating Instructions.

#### 3.2. Block Diagram of Test Set-up

System Diagram of Connections between EUT and Simulators



(*EUT: Wi-Fi Range Extender*)

#### 3.3. Special Accessories and Auxiliary Equipment

None.

#### 3.4. Countermeasures to Achieve EMC Compliance

None.

## 4. EMISSION TEST RESULTS

### 4.1. Conducted Emission at the Mains Terminals Test

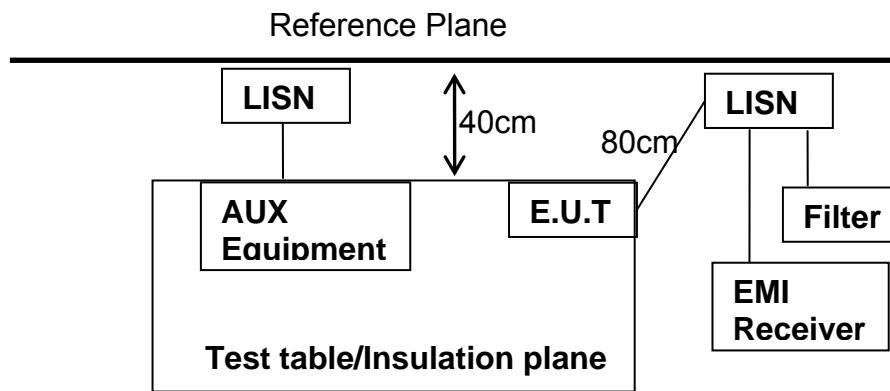
#### 4.1.1. Limit 15.209 limits

| Frequency<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       |

NOTE: 1.The lower limit shall apply at the transition frequencies.  
2.The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.

#### 4.1.2. Test Setup

- 1.The EUT was put on a wooden table which was 0.8 m high above the ground and connected to the AC mains through the Artificial Mains Network (AMN). Where the mains cable supplied by the manufacture was longer than 0.8 m, the excess was folded back and forth parallel to the cable at the center so as to form a bundle no longer than 0.4 m.
- 2.The EUT was kept 0.4 m from any other earthed conducting surface. Both sides of AC line were checked to find out the maximum conducted emission levels according to the test procedure during the conducted emission test.
- 3.The frequency range from 150 kHz to 30 MHz was investigated.
- 4.The bandwidth of the test receiver was set at 9 kHz.
- 5.Pretest for all mode, and the test data of the worst case condition(s) was reported on the following page.

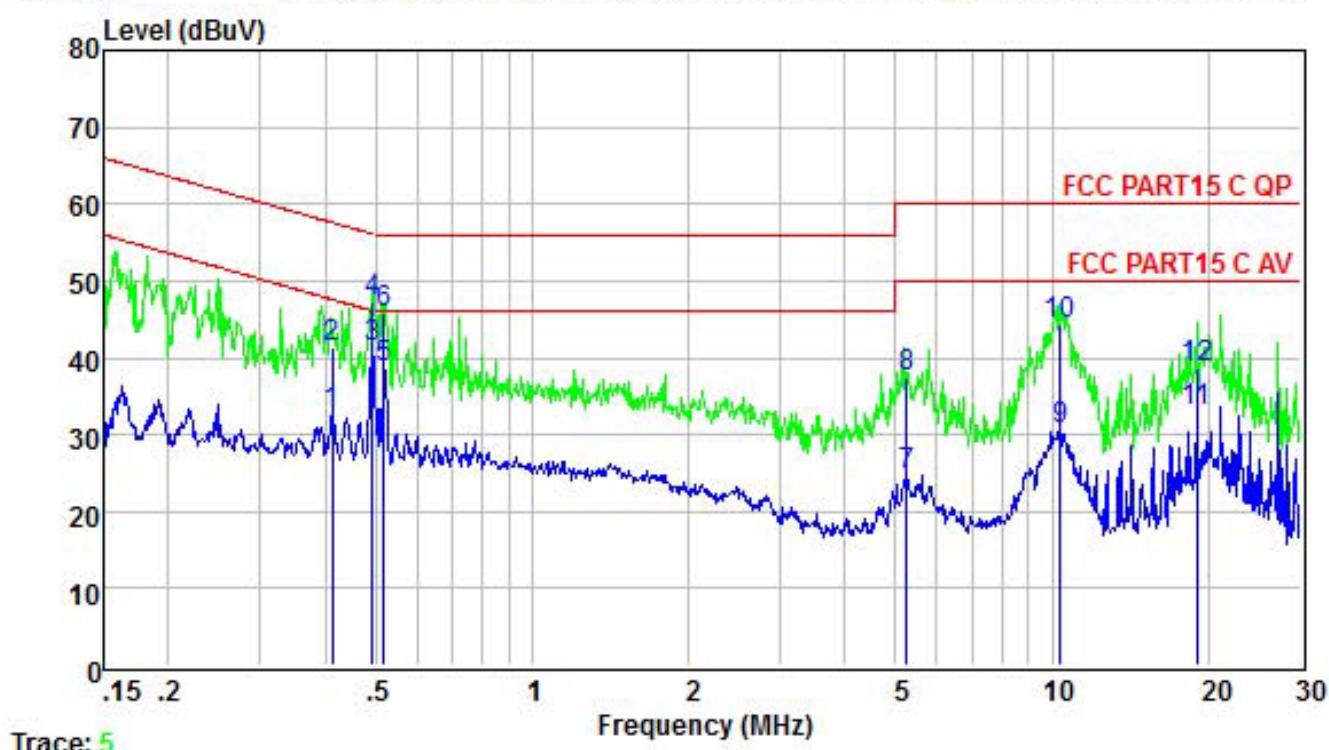


Remark: E.U.T. :Equipment Under Test

LISN: Line Impedance Stabilization Network

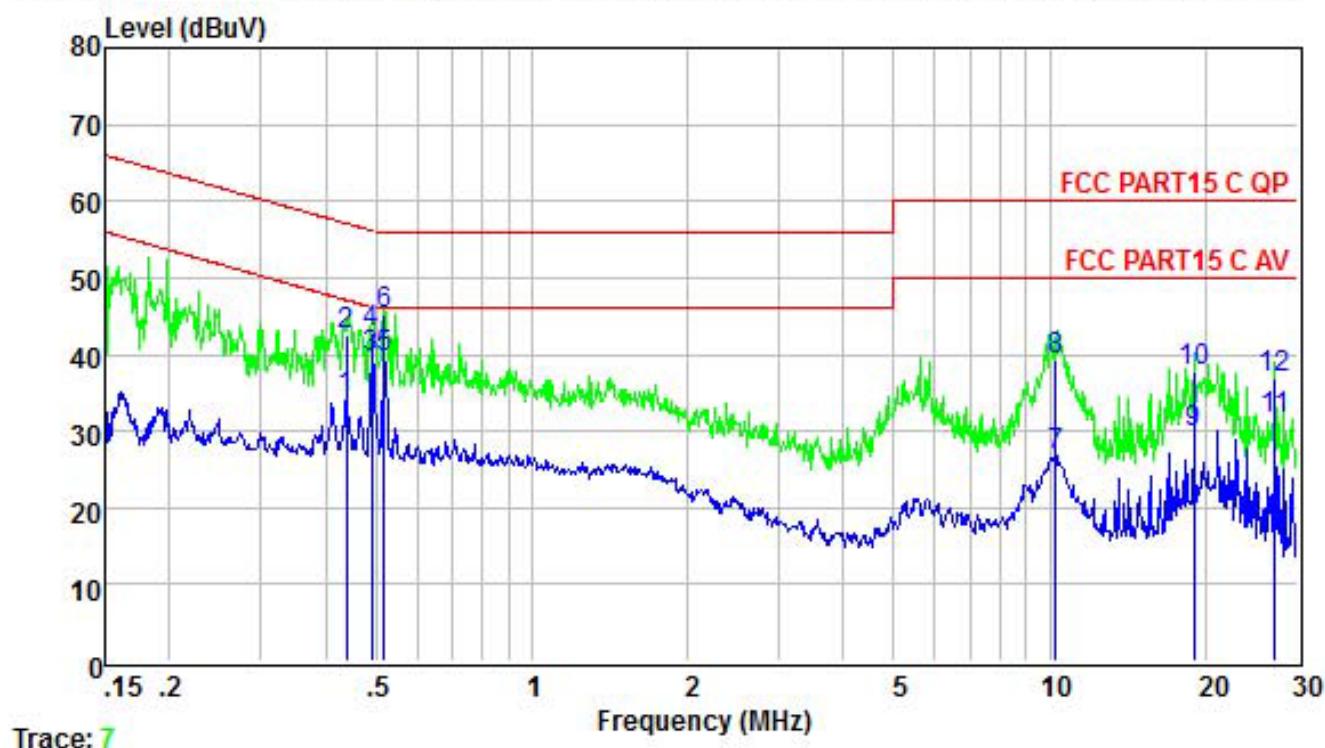
Test table height: 0.8m.

|                |                      |                     |             |
|----------------|----------------------|---------------------|-------------|
| EUT :          | Wi-Fi Range Extender | Model Name :        | JWA-AC2320M |
| Temperature :  | 26 °C                | Relative Humidity : | 54%         |
| Pressure :     | 1010hPa              | Phase :             | L           |
| Test Voltage : | AC 120V/60Hz         | Test Mode :         | Mode 5      |



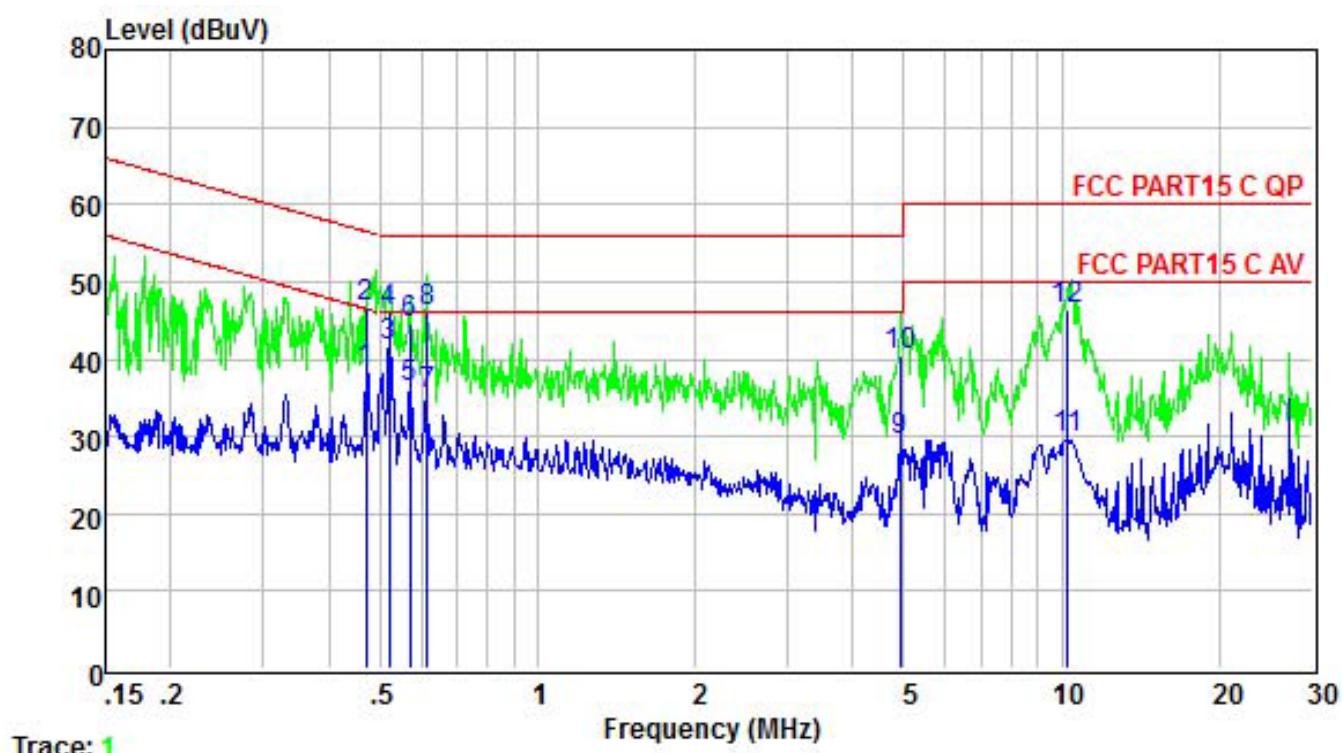
| Freq | Level  | Limit |       | Over   | Remark  |
|------|--------|-------|-------|--------|---------|
|      |        | Line  | dBuV  |        |         |
|      | MHz    |       | dBuV  |        |         |
| 1    | 0.413  | 32.74 | 47.59 | -14.85 | Average |
| 2    | 0.413  | 41.20 | 57.59 | -16.39 | QP      |
| 3    | 0.494  | 41.45 | 46.10 | -4.65  | Average |
| 4    | 0.494  | 47.30 | 56.10 | -8.80  | QP      |
| 5    | 0.518  | 38.70 | 46.00 | -7.30  | Average |
| 6    | 0.518  | 45.90 | 56.00 | -10.10 | QP      |
| 7    | 5.249  | 24.57 | 50.00 | -25.43 | Average |
| 8    | 5.249  | 37.60 | 60.00 | -22.40 | QP      |
| 9    | 10.342 | 30.57 | 50.00 | -19.43 | Average |
| 10   | 10.342 | 44.20 | 60.00 | -15.80 | QP      |
| 11   | 18.920 | 33.14 | 50.00 | -16.86 | Average |
| 12   | 18.920 | 38.60 | 60.00 | -21.40 | QP      |

|                |                      |                     |             |
|----------------|----------------------|---------------------|-------------|
| EUT :          | Wi-Fi Range Extender | Model Name :        | JWA-AC2320M |
| Temperature :  | 26 °C                | Relative Humidity : | 54%         |
| Pressure :     | 1010hPa              | Phase :             | N           |
| Test Voltage : | AC 120V/60Hz         | Test Mode :         | Mode 5      |



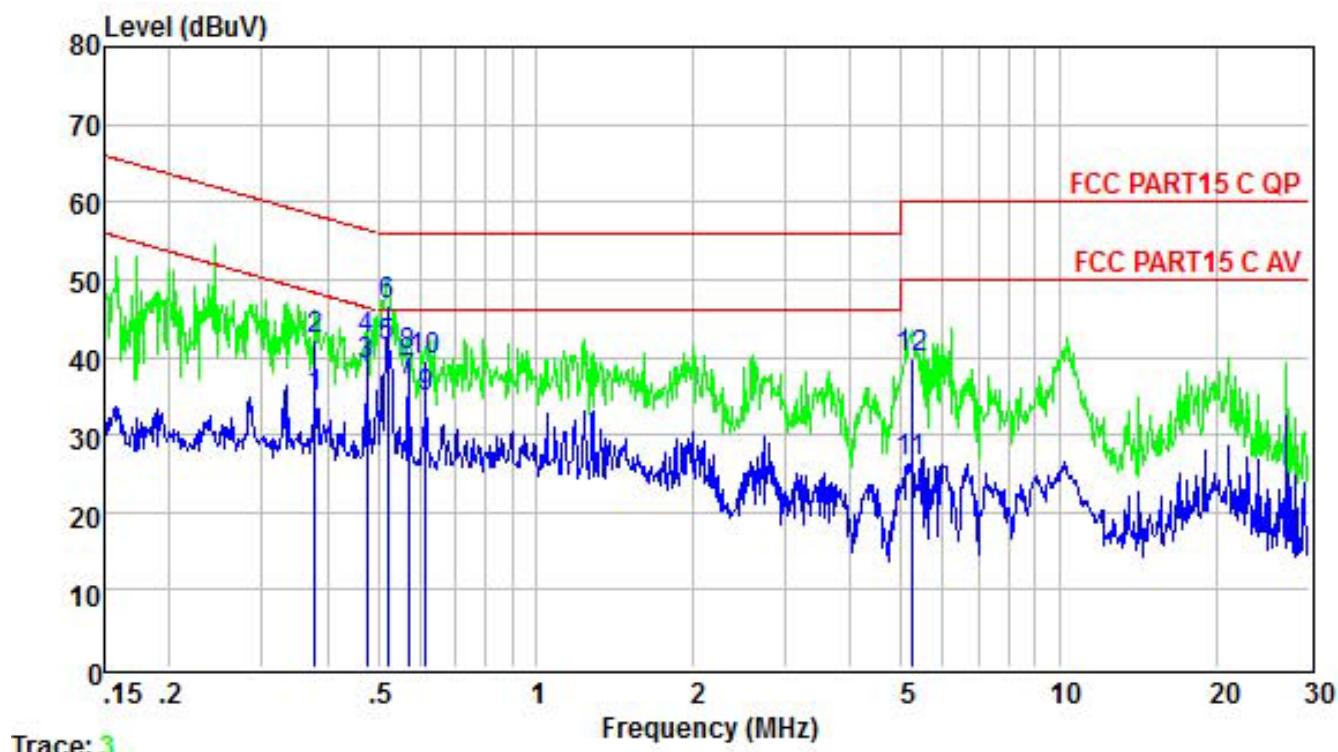
| Freq | Level  | Limit | Over  | Remark         |
|------|--------|-------|-------|----------------|
|      |        | Line  | Limit |                |
| MHz  | dBuV   | dBuV  | dB    |                |
| 1    | 0.440  | 34.16 | 47.07 | -12.91 Average |
| 2    | 0.440  | 42.60 | 57.07 | -14.47 QP      |
| 3    | 0.491  | 39.67 | 46.14 | -6.47 Average  |
| 4    | 0.491  | 42.80 | 56.14 | -13.34 QP      |
| 5    | 0.518  | 39.42 | 46.00 | -6.58 Average  |
| 6    | 0.518  | 45.10 | 56.00 | -10.90 QP      |
| 7    | 10.233 | 26.91 | 50.00 | -23.09 Average |
| 8    | 10.233 | 39.30 | 60.00 | -20.70 QP      |
| 9    | 18.920 | 29.75 | 50.00 | -20.25 Average |
| 10   | 18.920 | 37.70 | 60.00 | -22.30 QP      |
| 11   | 27.127 | 31.61 | 50.00 | -18.39 Average |
| 12   | 27.127 | 36.90 | 60.00 | -23.10 QP      |

|                |                      |                     |             |
|----------------|----------------------|---------------------|-------------|
| EUT :          | Wi-Fi Range Extender | Model Name :        | JWA-AC2320M |
| Temperature :  | 26 °C                | Relative Humidity : | 54%         |
| Pressure :     | 1010hPa              | Phase :             | L           |
| Test Voltage : | AC 240V/60Hz         | Test Mode :         | Mode 5      |



| Freq | Level  | Limit |       | Over Limit | Remark  |
|------|--------|-------|-------|------------|---------|
|      |        | MHz   | dBuV  | dBuV       | dB      |
| 1    | 0.471  | 38.30 | 46.49 | -8.19      | Average |
| 2    | 0.471  | 46.80 | 56.49 | -9.69      | QP      |
| 3    | 0.521  | 41.60 | 46.00 | -4.40      | Average |
| 4    | 0.521  | 46.20 | 56.00 | -9.80      | QP      |
| 5    | 0.570  | 36.20 | 46.00 | -9.80      | Average |
| 6    | 0.570  | 44.70 | 56.00 | -11.30     | QP      |
| 7    | 0.617  | 35.30 | 46.00 | -10.70     | Average |
| 8    | 0.617  | 46.10 | 56.00 | -9.90      | QP      |
| 9    | 4.926  | 29.57 | 46.00 | -16.43     | Average |
| 10   | 4.926  | 40.30 | 56.00 | -15.70     | QP      |
| 11   | 10.233 | 29.89 | 50.00 | -20.11     | Average |
| 12   | 10.233 | 46.30 | 60.00 | -13.70     | QP      |

|                |                      |                     |             |
|----------------|----------------------|---------------------|-------------|
| EUT :          | Wi-Fi Range Extender | Model Name :        | JWA-AC2320M |
| Temperature :  | 26 °C                | Relative Humidity : | 54%         |
| Pressure :     | 1010hPa              | Phase :             | N           |
| Test Voltage : | AC 240V/60Hz         | Test Mode :         | Mode 5      |



| Freq | Level | Limit |       | Over Limit | Remark  |
|------|-------|-------|-------|------------|---------|
|      |       | Line  | dBuV  |            |         |
| MHz  | dBuV  | dBuV  | dB    |            |         |
| 1    | 0.379 | 34.81 | 48.30 | -13.49     | Average |
| 2    | 0.379 | 42.30 | 58.30 | -16.00     | QP      |
| 3    | 0.476 | 39.11 | 46.41 | -7.30      | Average |
| 4    | 0.476 | 42.30 | 56.41 | -14.11     | QP      |
| 5    | 0.521 | 41.30 | 46.00 | -4.70      | Average |
| 6    | 0.521 | 46.80 | 56.00 | -9.20      | QP      |
| 7    | 0.570 | 36.86 | 46.00 | -9.14      | Average |
| 8    | 0.570 | 40.20 | 56.00 | -15.80     | QP      |
| 9    | 0.617 | 34.76 | 46.00 | -11.24     | Average |
| 10   | 0.617 | 39.60 | 56.00 | -16.40     | QP      |
| 11   | 5.221 | 26.60 | 50.00 | -23.40     | Average |
| 12   | 5.221 | 39.80 | 60.00 | -20.20     | QP      |

## 4.2. Radiated Emission Test

### 4.2.1. Limit 15.209 limits

| Frequency<br>MHz | Distance<br>Meters | Filed Strengths Limit                       |          |
|------------------|--------------------|---|----------|
|                  |                    | μV/m  | dB(μV)/m |
| 30~88            | 3                  | 100   | 40.0     |
| 88~216           | 3                  | 150   | 43.5     |
| 216~960          | 3                  | 200   | 46.0     |
| 960~1000         | 3                  | 500   | 54.0     |
| Above 1000       | 3                  | 74.0dB(μV)/m(Peak)<br>54.0dB(μV)/m(Average) |          |

### 4.2.2. Restricted bands of operation

| MHz               | MHz                 | MHz           | GHz         |
|-------------------|---------------------|---------------|-------------|
| 0.009-0.110       | 16.42-16.423        | 399.9-410     | 4.5-5.15    |
| 0.495-0.505       | 16.69475-16.69525   | 608-614       | 5.35-5.46   |
| 2.1735-2.1905     | 16.80425-16.80475   | 960-1240      | 7.25-7.75   |
| 4.125-4.128       | 25.5-25.67          | 1300-1427     | 8.025-8.5   |
| 4.17725-4.17775   | 37.5-38.25          | 1435-1626.5   | 9.0-9.2     |
| 4.20725-4.20775   | 73-74.6             | 1645.5-1646.5 | 9.3-9.5     |
| 6.215-6.218       | 74.8-75.2           | 1660-1710     | 10.6-12.7   |
| 6.26775-6.26825   | 108-121.94          | 1718.8-1722.2 | 13.25-13.4  |
| 6.31175-6.31225   | 123-138             | 2200-2300     | 14.47-14.5  |
| 8.291-8.294       | 149.9-150.05        | 2310-2390     | 15.35-16.2  |
| 8.362-8.366       | 156.52475-156.52525 | 2483.5-2500   | 17.7-21.4   |
| 8.37625-8.38675   | 156.7-156.9         | 2690-2900     | 22.01-23.12 |
| 8.41425-8.41475   | 162.0125-167.17     | 3260-3267     | 23.6-24.0   |
| 12.29-12.293      | 167.72-173.2        | 3332-3339     | 31.2-31.8   |
| 12.51975-12.52025 | 240-285             | 3345.8-3358   | 36.43-36.5  |
| 12.57675-12.57725 | 322-335.4           | 3600-4400     |             |

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

#### 4.2.3. Test setup

The EUT was placed on a turn table which was 0.8 m(above 1GHz, the high was 1.5m) above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

The EUT was tested in the Chamber Site. It was pre-scanned with a Peak detector from the spectrum, and all the final readings from the test receiver were measured with the Quasi-Peak detector.

The bandwidth of the EMI test receiver is set at 120kHz for frequency range from 30MHz to 1000 MHz.

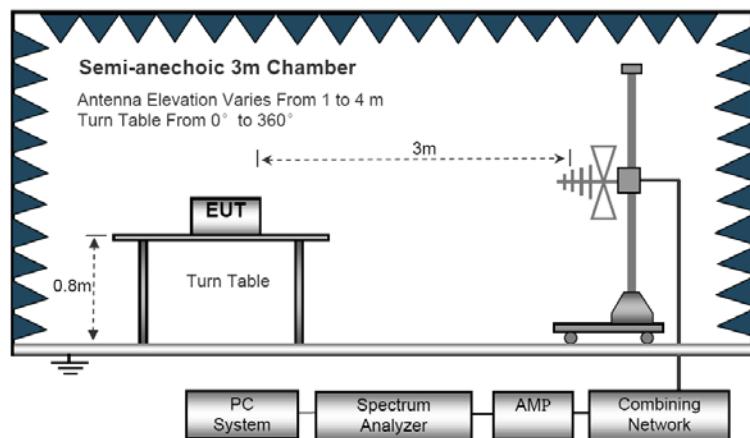
The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz, Both PK and AV measure, PK detector is used.

The frequency range from 30MHz to 10<sup>th</sup> harmonic (25GHz) are checked. And no any emissions were found from 18GHz to 25 GHz, so the radiated emissions from 18GHz to 25GHz were not record.

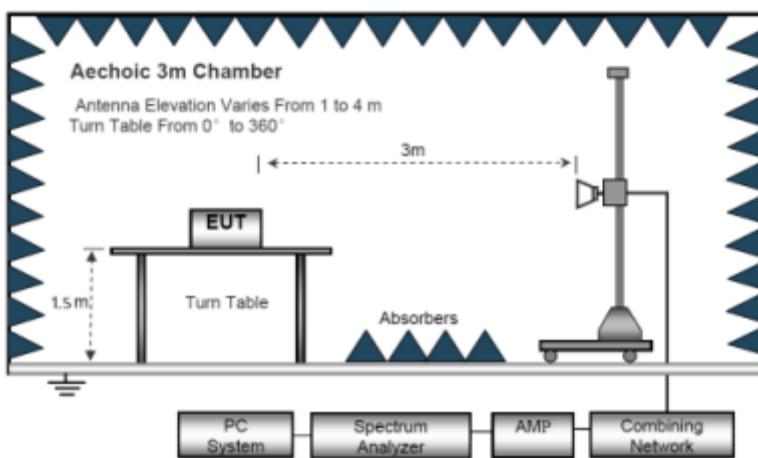
- Notes:
1. Emission Level = Antenna Factor + Cable Loss + Meter Reading+Preamp Factor.
  2. Measurement Uncertainty:  $\pm 3.2$  dB at a level of confidence of 95%.
  3. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.
  4. For emissions below 1GHz, pretest for all mode, The test data of the worst case condition(s) was reported on the following pages.
  5. For Both PK and AV value above 1GHz, PK detector is used.
  6. EUT Pre-scan X/Y/Z orientation, only worst case is presented in the report (Z orientation).

## Radiated Emission Test-Up

### Below 1GHz



### Above 1GHz



|                |                      |                     |             |
|----------------|----------------------|---------------------|-------------|
| EUT :          | Wi-Fi Range Extender | Model Name :        | JWA-AC2320M |
| Temperature :  | 20 °C                | Relative Humidity : | 48%         |
| Pressure :     | 1010hPa              | Test Mode :         | Mode 5      |
| Test Voltage : | AC 120V/60Hz         |                     |             |

**Below 30MHz**

| Freq.<br>(MHz) | Reading<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | State |
|----------------|---------------------|-------------------|----------------|-------|
|                |                     |                   |                | P/F   |
| --             | --                  | --                | --             | P     |
| --             | --                  | --                | --             | P     |

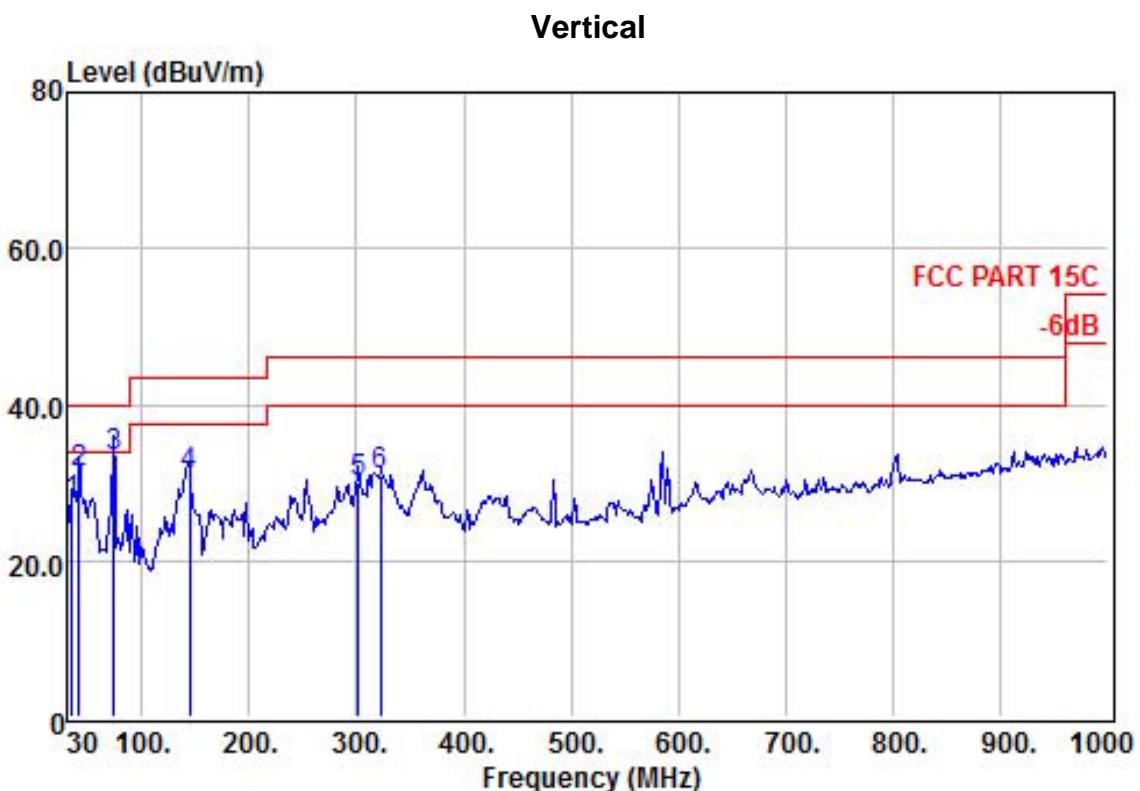
**Note:**

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

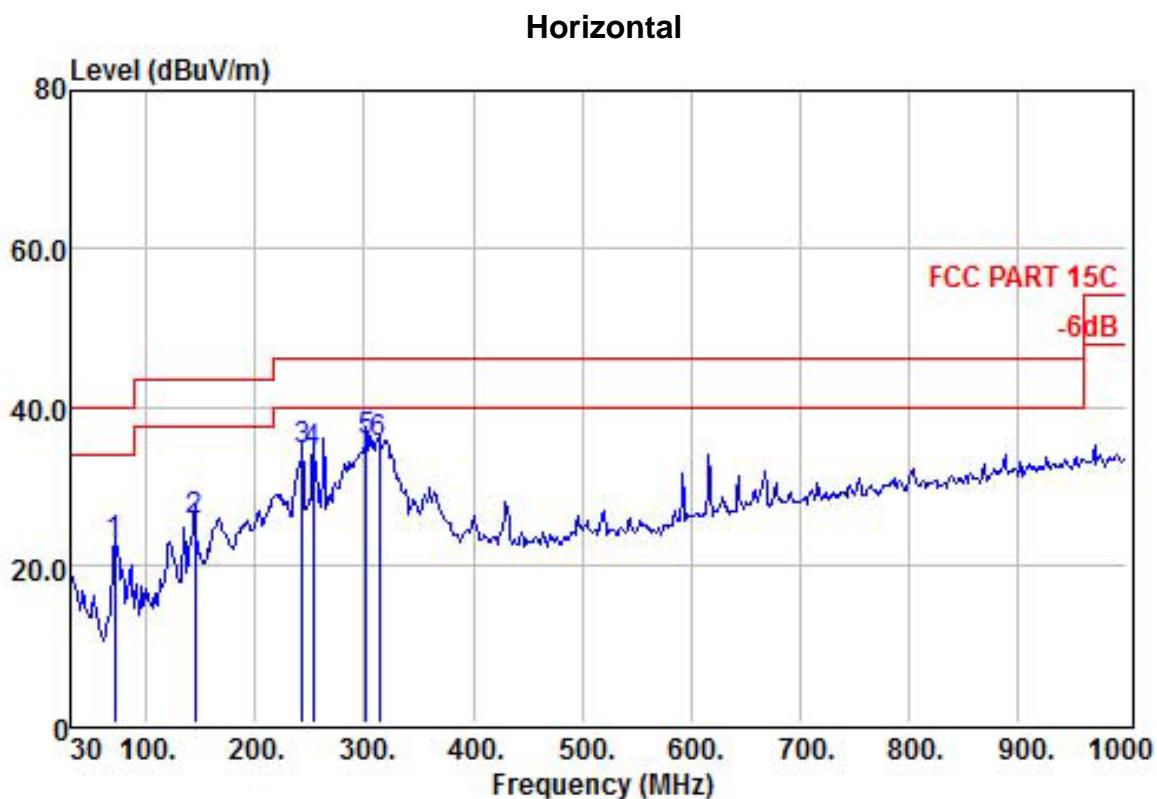
Distance extrapolation factor = $40 \log (\text{specific distance/test distance})$ (dB);

Limit line = specific limits(dBuv) + distance extrapolation factor.

| <b>Below 1GHz</b> |                      |                     |             |
|-------------------|----------------------|---------------------|-------------|
| EUT :             | Wi-Fi Range Extender | Model Name :        | JWA-AC2320M |
| Temperature :     | 20 °C                | Relative Humidity : | 48%         |
| Pressure :        | 1010hPa              | Test Mode :         | Mode 1      |
| Test Voltage :    | AC 120V/60Hz         |                     |             |



| Freq | Preamp Factor | Antenna Factor | Read  | Cable | Limit  | Over   | Remark          |
|------|---------------|----------------|-------|-------|--------|--------|-----------------|
|      |               |                | Level | Loss  | Level  | Line   |                 |
| MHz  | dB            | dB/m           | dBuV  | dB    | dBuV/m | dBuV/m | dB              |
| 1    | 34.85         | 31.38          | 15.94 | 42.11 | 0.56   | 27.23  | 40.00 -12.77 QP |
| 2    | 41.64         | 31.38          | 12.23 | 49.77 | 0.56   | 31.18  | 40.00 -8.82 QP  |
| 3    | 73.65         | 31.33          | 7.68  | 56.11 | 0.85   | 33.31  | 40.00 -6.69 QP  |
| 4    | 144.46        | 31.23          | 8.67  | 52.15 | 1.22   | 30.81  | 43.50 -12.69 QP |
| 5    | 301.60        | 30.92          | 13.84 | 45.31 | 1.94   | 30.17  | 46.00 -15.83 QP |
| 6    | 322.94        | 30.83          | 14.44 | 45.21 | 2.02   | 30.84  | 46.00 -15.16 QP |



| Freq | Preamp Factor | Antenna Factor | Read Level | Cable Loss | Limit Line | Over Limit | Remark |        |    |
|------|---------------|----------------|------------|------------|------------|------------|--------|--------|----|
|      |               |                |            |            |            |            |        | MHz    | dB |
| 1    | 70.74         | 31.32          | 7.54       | 45.53      | 0.85       | 22.60      | 40.00  | -17.40 | QP |
| 2    | 144.46        | 31.23          | 8.67       | 46.87      | 1.22       | 25.53      | 43.50  | -17.97 | QP |
| 3    | 243.40        | 30.95          | 12.72      | 51.13      | 1.61       | 34.51      | 46.00  | -11.49 | QP |
| 4    | 253.10        | 30.97          | 12.91      | 50.47      | 1.70       | 34.11      | 46.00  | -11.89 | QP |
| 5    | 301.60        | 30.92          | 13.84      | 50.73      | 1.94       | 35.59      | 46.00  | -10.41 | QP |
| 6    | 313.24        | 30.89          | 14.17      | 50.10      | 1.94       | 35.32      | 46.00  | -10.68 | QP |

Note: 1. Absolute Level= Reading Level + antenna Factor + cable loss - Preamp factor,  
 2. Over Limit= Absolute Level – Limit;  
 3. "802.11b" mode is the worst mode, only the worst case is presented in the report .

| Above 1GHz     |                      |  |                     |             |
|----------------|----------------------|--|---------------------|-------------|
| EUT :          | Wi-Fi Range Extender |  | Model Name :        | JWA-AC2320M |
| Temperature :  | 20 °C                |  | Relative Humidity : | 48%         |
| Pressure :     | 1010hPa              |  | Test Mode :         | Mode 1      |
| Test Voltage : | AC 120V/60HZ         |  |                     |             |

| Polar<br>(H/V) | Frequency | Meter<br>Reading | Antenna<br>Factor | Cable<br>loss | Preamp<br>factor | Emission<br>Level | Limits   | Margin | Remark  |
|----------------|-----------|------------------|-------------------|---------------|------------------|-------------------|----------|--------|---------|
|                | (MHz)     | (dBuV)           | (dB)              | (dB)          | (dB)             | (dBuV/m)          | (dBuV/m) | (dB)   |         |
| <b>TX-2412</b> |           |                  |                   |               |                  |                   |          |        |         |
| V              | 4824      | 31.86            | 31.99             | 12.01         | 27.50            | 48.36             | 54       | -5.64  | Average |
| V              | 4824      | 45.33            | 31.99             | 12.01         | 27.50            | 61.83             | 74       | -12.17 | Peak    |
| V              | 7236      | 36.59            | 25.31             | 16.61         | 27.95            | 50.56             | 74       | -23.44 | Peak    |
| H              | 4824      | 31.39            | 31.99             | 12.01         | 27.50            | 47.89             | 54       | -6.11  | Average |
| H              | 4824      | 43.63            | 31.99             | 12.01         | 27.50            | 60.13             | 74       | -13.87 | Peak    |
| H              | 7236      | 37.68            | 25.31             | 16.61         | 27.95            | 51.65             | 74       | -22.35 | Peak    |
| <b>TX-2437</b> |           |                  |                   |               |                  |                   |          |        |         |
| V              | 4874      | 32.48            | 32.11             | 12.14         | 27.53            | 49.2              | 54       | -4.8   | Average |
| V              | 4874      | 42.79            | 32.11             | 12.14         | 27.53            | 59.51             | 74       | -14.49 | Peak    |
| V              | 7311      | 36.35            | 24.32             | 16.62         | 27.96            | 49.33             | 74       | -24.67 | Peak    |
| H              | 4874      | 32.49            | 32.11             | 12.14         | 27.53            | 49.21             | 54       | -4.79  | Average |
| H              | 4874      | 41.65            | 32.11             | 12.14         | 27.53            | 58.37             | 74       | -15.63 | Peak    |
| H              | 7311      | 36.48            | 24.32             | 16.62         | 27.96            | 49.46             | 74       | -24.54 | Peak    |
| <b>TX-2462</b> |           |                  |                   |               |                  |                   |          |        |         |
| V              | 4924      | 30.29            | 32.23             | 12.28         | 27.56            | 47.24             | 54       | -6.76  | Average |
| V              | 4924      | 42.46            | 32.23             | 12.28         | 27.56            | 59.41             | 74       | -14.59 | Peak    |
| V              | 7386      | 35.65            | 24.36             | 16.62         | 27.98            | 48.65             | 74       | -25.35 | Peak    |
| H              | 4924      | 29.77            | 32.23             | 12.28         | 27.56            | 46.72             | 54       | -7.28  | Average |
| H              | 4924      | 42.96            | 32.23             | 12.28         | 27.56            | 59.91             | 74       | -14.09 | Peak    |
| H              | 7386      | 36.51            | 24.36             | 16.62         | 27.98            | 49.51             | 74       | -24.49 | Peak    |

Note: 1.“802.11b” mode is the worst mode.

2.When PK value is lower than the Average value limit, average didn't record.

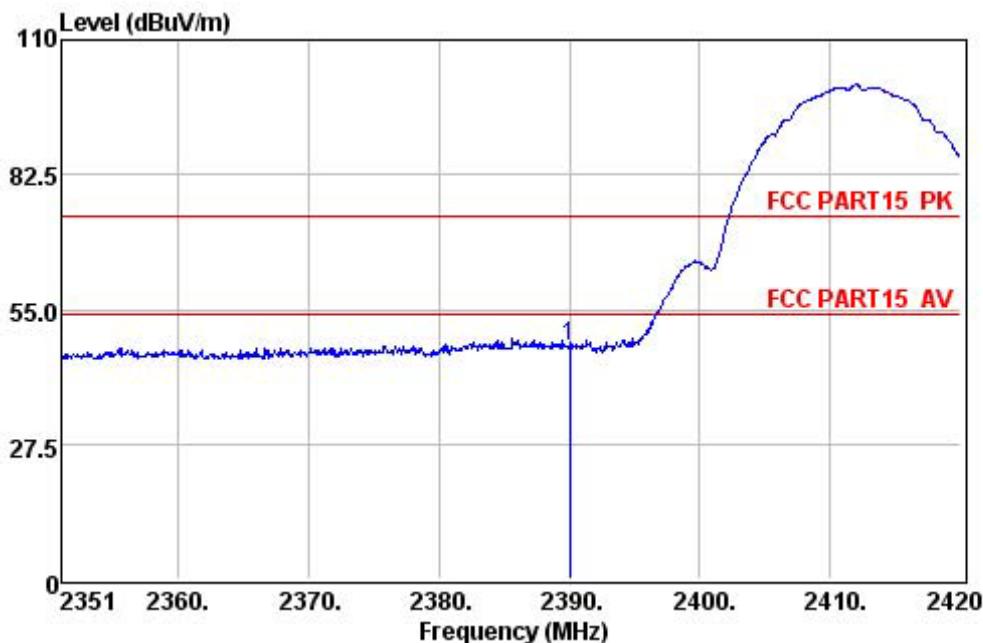
3.The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has not to be reported.

**Spurious Emission in Restricted Band (1-25G) :**

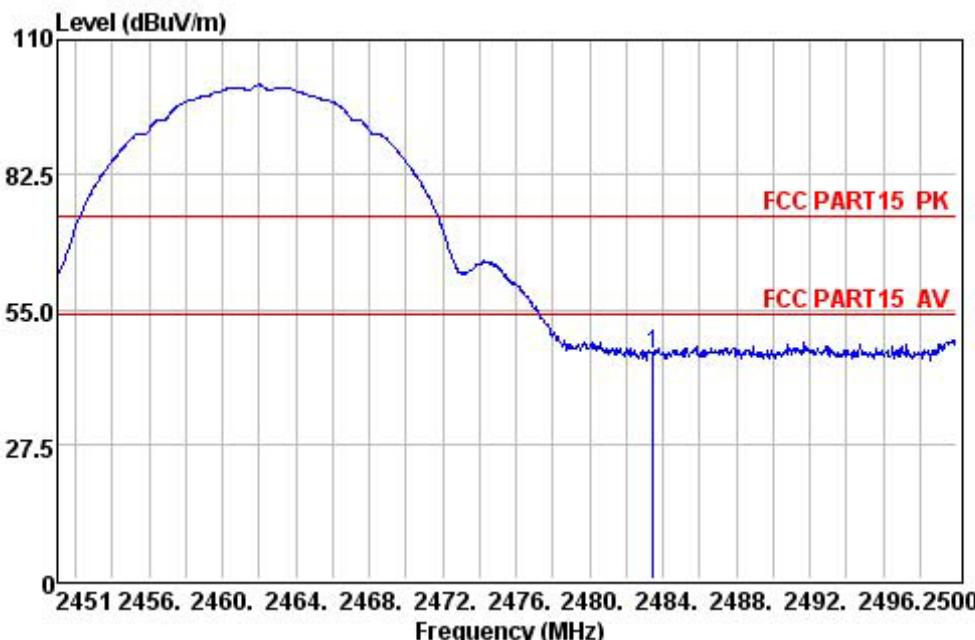
All the modulation modes have been tested and all other emissions more than 20dB below the limit, the worst result was report as below:

| Polar<br>(H/V)     | Frequency<br>(MHz) | Meter<br>Reading | Antenna<br>Factor | Cable<br>loss | Preamp<br>factor | Emission<br>Level | Limits   | Margin | Detector<br>Type |
|--------------------|--------------------|------------------|-------------------|---------------|------------------|-------------------|----------|--------|------------------|
|                    |                    | (dBuV)           | (dB)              | (dB)          | (dB)             | (dBuV/m)          | (dBuV/m) | (dB)   |                  |
| <b>802.11b</b>     |                    |                  |                   |               |                  |                   |          |        |                  |
| V                  | 3264               | 31.39            | 30.26             | 9.96          | 26.63            | 44.98             | 74       | -29.02 | Pk               |
| H                  | 3264               | 32.35            | 30.26             | 9.96          | 26.63            | 45.94             | 74       | -28.06 | PK               |
| V                  | 3336               | 32.13            | 30.33             | 9.96          | 26.66            | 45.76             | 74       | -28.24 | Pk               |
| H                  | 3336               | 31.59            | 30.33             | 9.96          | 26.66            | 45.22             | 74       | -28.78 | PK               |
| V                  | 4100               | 34.72            | 31.64             | 10.61         | 27.06            | 49.91             | 74       | -24.09 | Pk               |
| H                  | 4100               | 33.48            | 31.64             | 10.61         | 27.06            | 48.67             | 74       | -25.33 | PK               |
| V                  | 11764              | 32.68            | 26.64             | 17.32         | 28.98            | 47.66             | 74       | -26.34 | Pk               |
| H                  | 11764              | 33.53            | 26.64             | 17.32         | 28.98            | 48.51             | 74       | -25.49 | PK               |
| V                  | 17732              | 32.44            | 26.27             | 22.01         | 30.39            | 50.33             | 74       | -23.67 | Pk               |
| H                  | 17732              | 32.56            | 26.27             | 22.01         | 30.39            | 50.45             | 74       | -23.55 | PK               |
| <b>802.11g</b>     |                    |                  |                   |               |                  |                   |          |        |                  |
| V                  | 3264               | 33.23            | 30.26             | 9.96          | 26.63            | 46.82             | 74       | -27.18 | Pk               |
| H                  | 3264               | 32.58            | 30.26             | 9.96          | 26.63            | 46.17             | 74       | -27.83 | PK               |
| V                  | 3336               | 32.48            | 30.33             | 9.96          | 26.66            | 46.11             | 74       | -27.89 | Pk               |
| H                  | 3336               | 31.63            | 30.33             | 9.96          | 26.66            | 45.26             | 74       | -28.74 | PK               |
| V                  | 4100               | 34.52            | 31.64             | 10.61         | 27.06            | 49.71             | 74       | -24.29 | Pk               |
| H                  | 4100               | 32.59            | 31.64             | 10.61         | 27.06            | 47.78             | 74       | -26.22 | PK               |
| V                  | 11764              | 31.35            | 26.64             | 17.32         | 28.98            | 46.33             | 74       | -27.67 | Pk               |
| H                  | 11764              | 32.75            | 26.64             | 17.32         | 28.98            | 47.73             | 74       | -26.27 | PK               |
| V                  | 17732              | 31.53            | 26.27             | 22.01         | 30.39            | 49.42             | 74       | -24.58 | Pk               |
| H                  | 17732              | 32.67            | 26.27             | 22.01         | 30.39            | 50.56             | 74       | -23.44 | PK               |
| <b>802.11n(20)</b> |                    |                  |                   |               |                  |                   |          |        |                  |
| V                  | 3264               | 30.53            | 30.26             | 9.96          | 26.63            | 44.12             | 74       | -29.88 | Pk               |
| H                  | 3264               | 30.66            | 30.26             | 9.96          | 26.63            | 44.25             | 74       | -29.75 | PK               |
| V                  | 3336               | 32.85            | 30.33             | 9.96          | 26.66            | 46.48             | 74       | -27.52 | Pk               |
| H                  | 3336               | 32.56            | 30.33             | 9.96          | 26.66            | 46.19             | 74       | -27.81 | PK               |
| V                  | 4100               | 33.83            | 31.64             | 10.61         | 27.06            | 49.02             | 74       | -24.98 | Pk               |
| H                  | 4100               | 31.42            | 31.64             | 10.61         | 27.06            | 46.61             | 74       | -27.39 | PK               |
| V                  | 11764              | 32.85            | 26.64             | 17.32         | 28.98            | 47.83             | 74       | -26.17 | Pk               |
| H                  | 11764              | 32.76            | 26.64             | 17.32         | 28.98            | 47.74             | 74       | -26.26 | PK               |
| V                  | 17732              | 30.36            | 26.27             | 22.01         | 30.39            | 48.25             | 74       | -25.75 | Pk               |
| H                  | 17732              | 30.62            | 26.27             | 22.01         | 30.39            | 48.51             | 74       | -25.49 | PK               |
| <b>802.11n(40)</b> |                    |                  |                   |               |                  |                   |          |        |                  |
| V                  | 3264               | 32.24            | 30.26             | 9.96          | 26.63            | 45.83             | 74       | -28.17 | Pk               |
| H                  | 3264               | 32.59            | 30.26             | 9.96          | 26.63            | 46.18             | 74       | -27.82 | PK               |
| V                  | 3336               | 32.28            | 30.33             | 9.96          | 26.66            | 45.91             | 74       | -28.09 | Pk               |
| H                  | 3336               | 33.65            | 30.33             | 9.96          | 26.66            | 47.28             | 74       | -26.72 | PK               |
| V                  | 4100               | 32.45            | 31.64             | 10.61         | 27.06            | 47.64             | 74       | -26.36 | Pk               |
| H                  | 4100               | 32.75            | 31.64             | 10.61         | 27.06            | 47.94             | 74       | -26.06 | PK               |
| V                  | 11764              | 32.56            | 26.64             | 17.32         | 28.98            | 47.54             | 74       | -26.46 | Pk               |
| H                  | 11764              | 32.46            | 26.64             | 17.32         | 28.98            | 47.44             | 74       | -26.56 | PK               |
| V                  | 17732              | 30.57            | 26.27             | 22.01         | 30.39            | 48.46             | 74       | -25.54 | Pk               |
| H                  | 17732              | 29.19            | 26.27             | 22.01         | 30.39            | 47.08             | 74       | -26.92 | PK               |

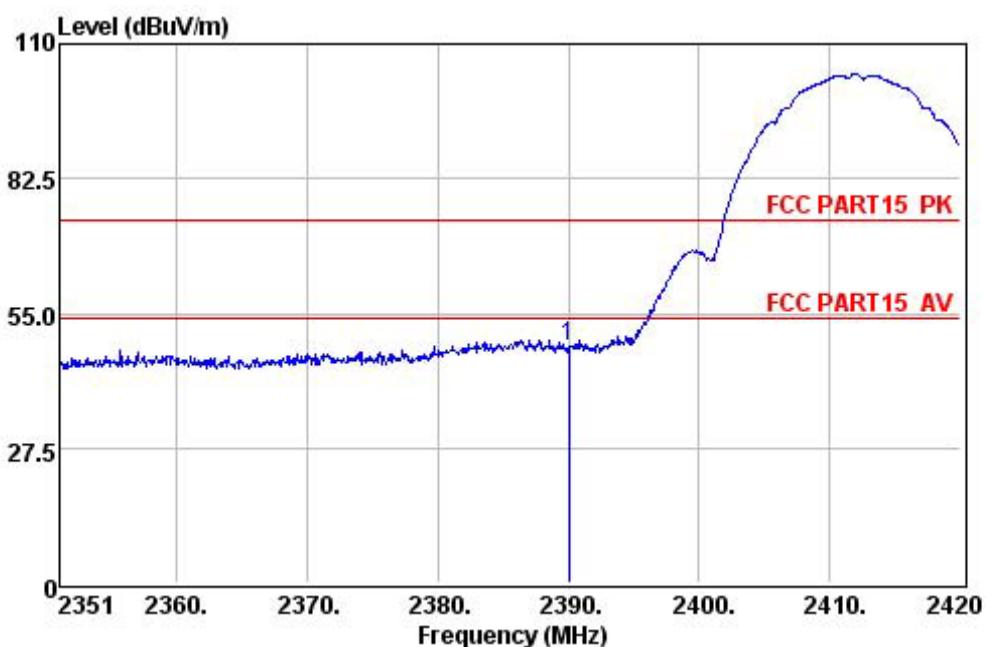
If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

**Spurious Emission in Band Edge:****802.11b- Vertical**

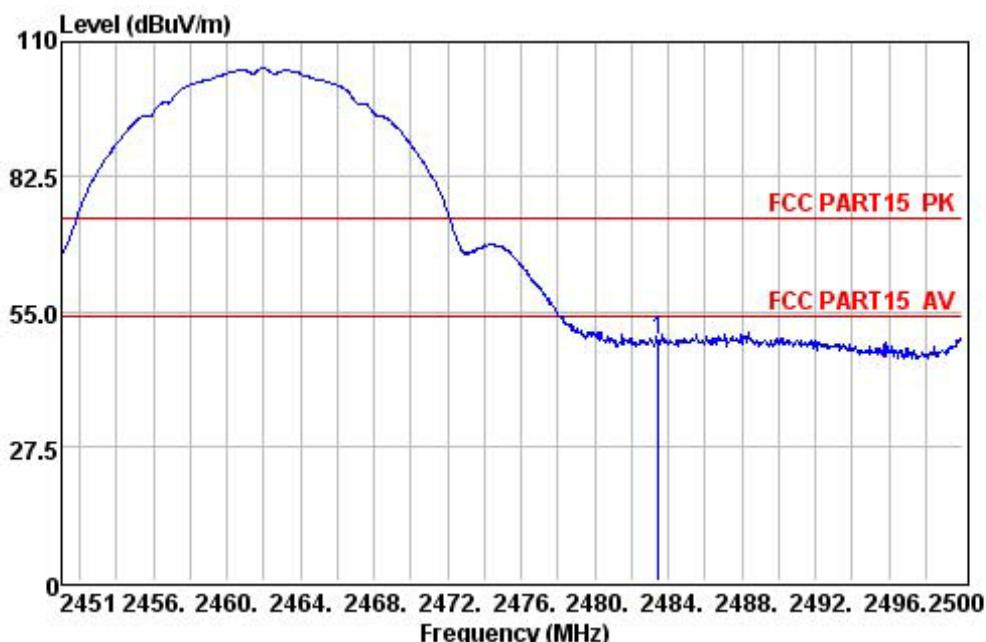
|   | Antenna<br>Freq | Preamp<br>Factor | Read<br>Level | Cable<br>Loss | Limit<br>Level | Line<br>Level | Over<br>Limit | Remark      |
|---|-----------------|------------------|---------------|---------------|----------------|---------------|---------------|-------------|
|   | MHz             | dB/m             | dB            | dBuV          | dB             | dBuV/m        | dBuV/m        | dB          |
| 1 | 2390.00         | 28.72            | 26.32         | 45.20         | 0.00           | 47.60         | 74.00         | -26.40 Peak |



|   | Antenna<br>Freq | Preamp<br>Factor | Read<br>Level | Cable<br>Loss | Limit<br>Level | Line<br>Level | Over<br>Limit | Remark      |
|---|-----------------|------------------|---------------|---------------|----------------|---------------|---------------|-------------|
|   | MHz             | dB/m             | dB            | dBuV          | dB             | dBuV/m        | dBuV/m        | dB          |
| 1 | 2483.50         | 28.79            | 26.34         | 43.53         | 0.00           | 45.98         | 74.00         | -28.02 Peak |

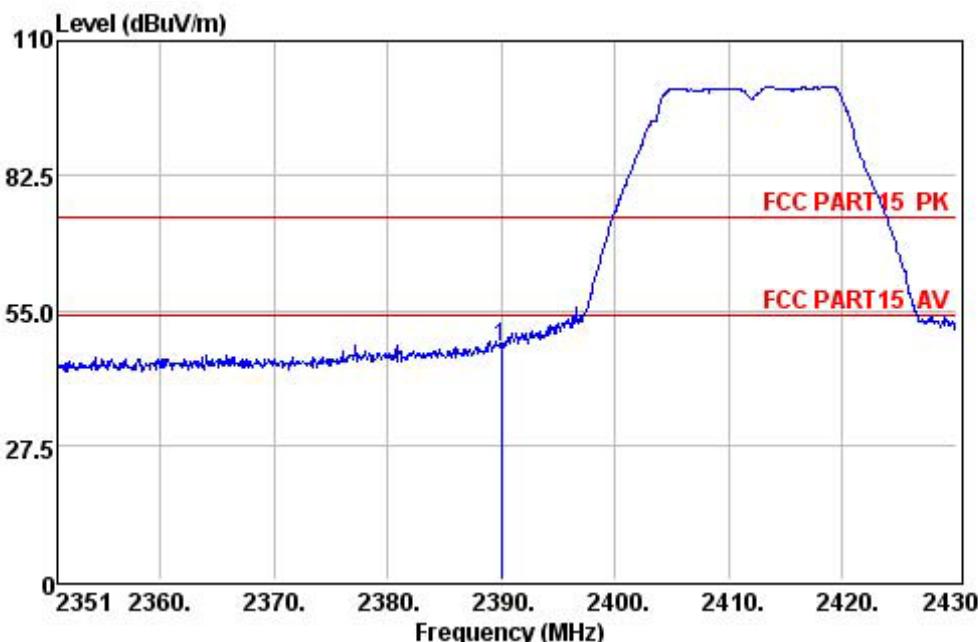
**802.11b- Horizontal**

|   | Antenna<br>Freq | Preamp<br>Factor | Read<br>Level | Cable<br>Loss | Limit<br>Level | Line<br>Limit | Over<br>Limit | Remark      |
|---|-----------------|------------------|---------------|---------------|----------------|---------------|---------------|-------------|
|   | MHz             | dB/m             | dB            | dBuV          | dB             | dBuV/m        | dBuV/m        | dB          |
| 1 | 2390.00         | 28.72            | 26.32         | 45.74         | 0.00           | 48.14         | 74.00         | -25.86 Peak |

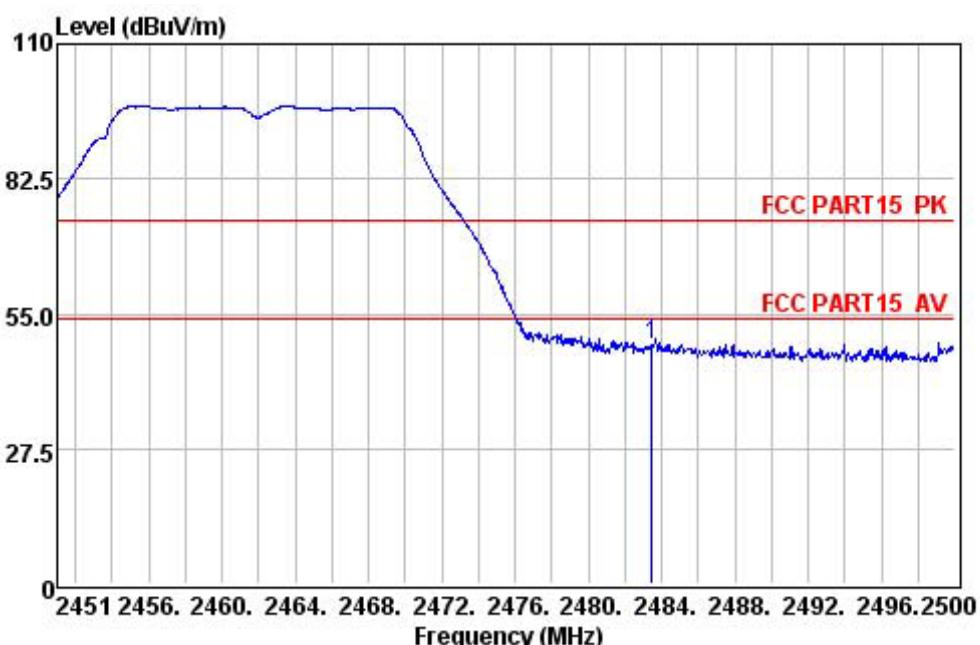


|   | Antenna<br>Freq | Preamp<br>Factor | Read<br>Level | Cable<br>Loss | Limit<br>Level | Line<br>Limit | Over<br>Limit | Remark      |
|---|-----------------|------------------|---------------|---------------|----------------|---------------|---------------|-------------|
|   | MHz             | dB/m             | dB            | dBuV          | dB             | dBuV/m        | dBuV/m        | dB          |
| 1 | 2483.50         | 28.79            | 26.34         | 46.81         | 0.00           | 49.26         | 74.00         | -24.74 Peak |

## 802.11g- Vertical

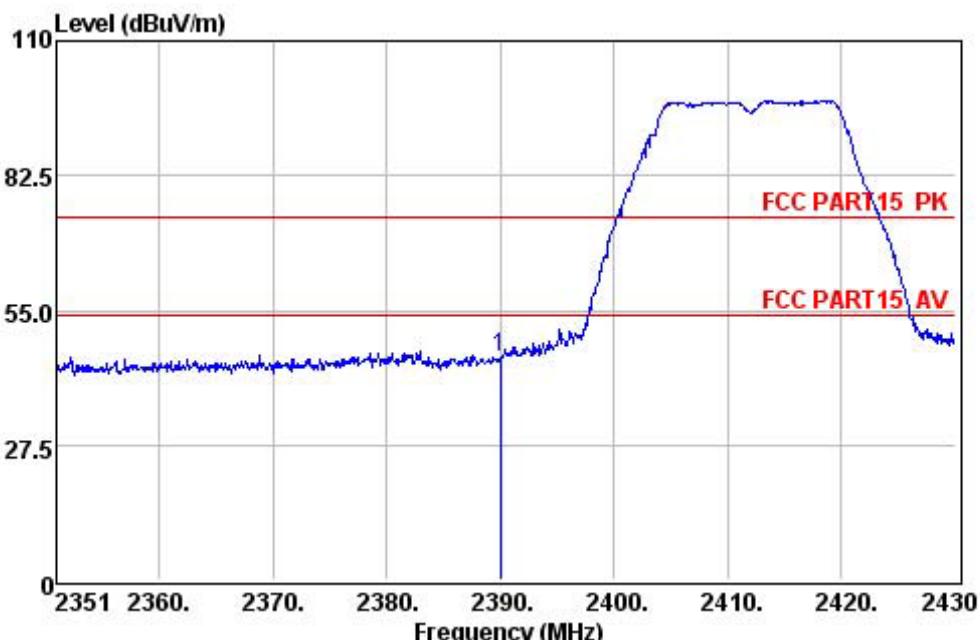


|   | Antenna<br>Freq | Preamp<br>Factor | Read<br>Level | Cable<br>Loss | Limit<br>Level | Line<br>Limit | Over<br>Limit | Remark      |
|---|-----------------|------------------|---------------|---------------|----------------|---------------|---------------|-------------|
|   | MHz             | dB/m             | dB            | dBuV          | dB             | dBuV/m        | dBuV/m        | dB          |
| 1 | 2390.00         | 28.72            | 26.32         | 44.88         | 0.00           | 47.28         | 74.00         | -26.72 Peak |

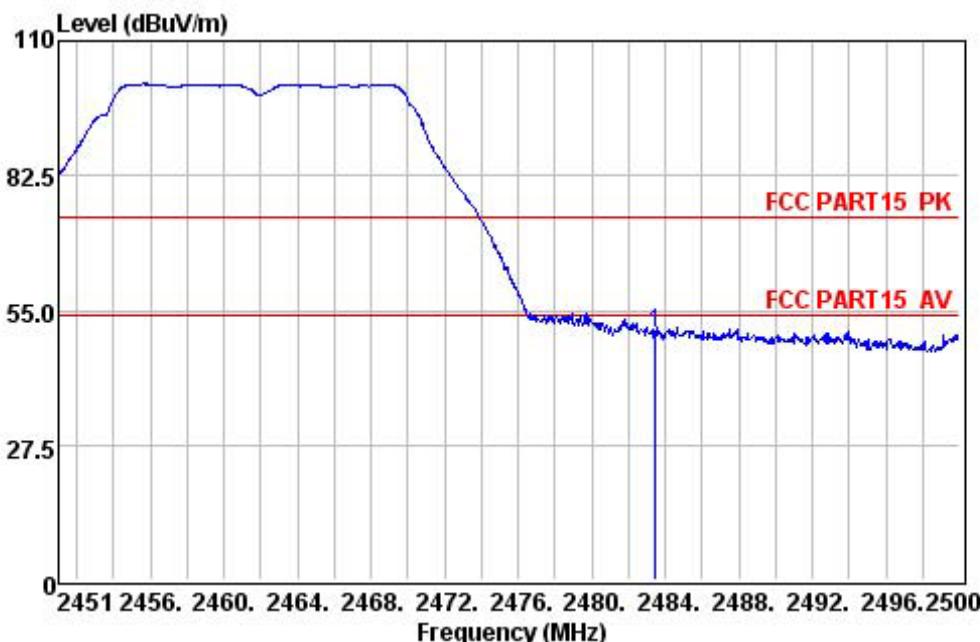


|   | Antenna<br>Freq | Preamp<br>Factor | Read<br>Level | Cable<br>Loss | Limit<br>Level | Line<br>Limit | Over<br>Limit | Remark      |
|---|-----------------|------------------|---------------|---------------|----------------|---------------|---------------|-------------|
|   | MHz             | dB/m             | dB            | dBuV          | dB             | dBuV/m        | dBuV/m        | dB          |
| 1 | 2483.50         | 28.79            | 26.34         | 46.11         | 0.00           | 48.56         | 74.00         | -25.44 Peak |

## 802.11g- Horizontal

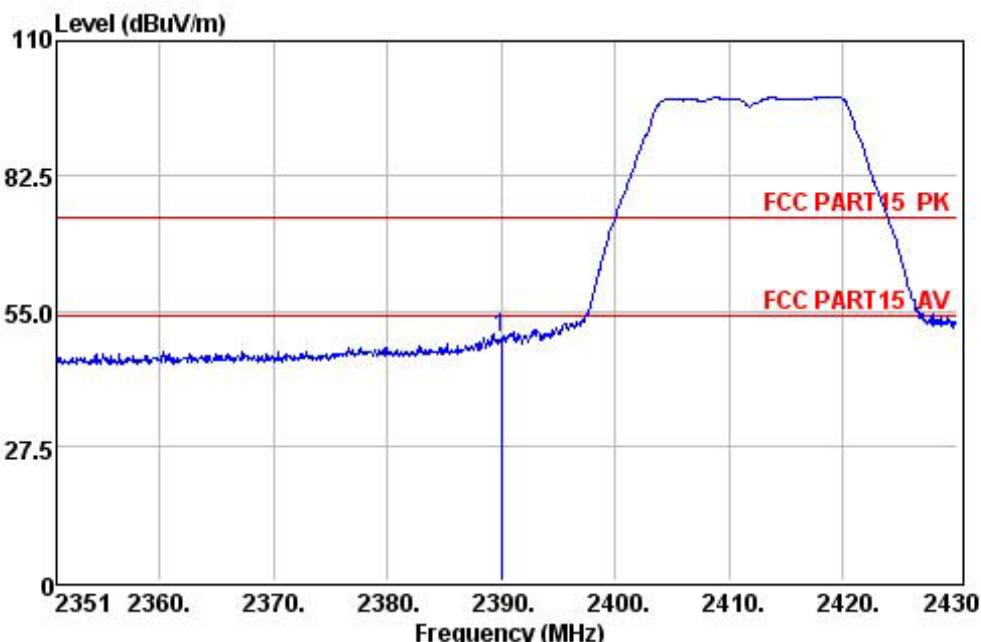


|   | Antenna<br>Freq | Preamp<br>Factor | Read<br>Level | Cable<br>Loss | Limit<br>Level | Line<br>Limit | Over<br>Limit | Remark      |
|---|-----------------|------------------|---------------|---------------|----------------|---------------|---------------|-------------|
|   | MHz             | dB/m             | dB            | dBuV          | dB             | dBuV/m        | dBuV/m        | dB          |
| 1 | 2390.00         | 28.72            | 26.32         | 42.98         | 0.00           | 45.38         | 74.00         | -28.62 Peak |

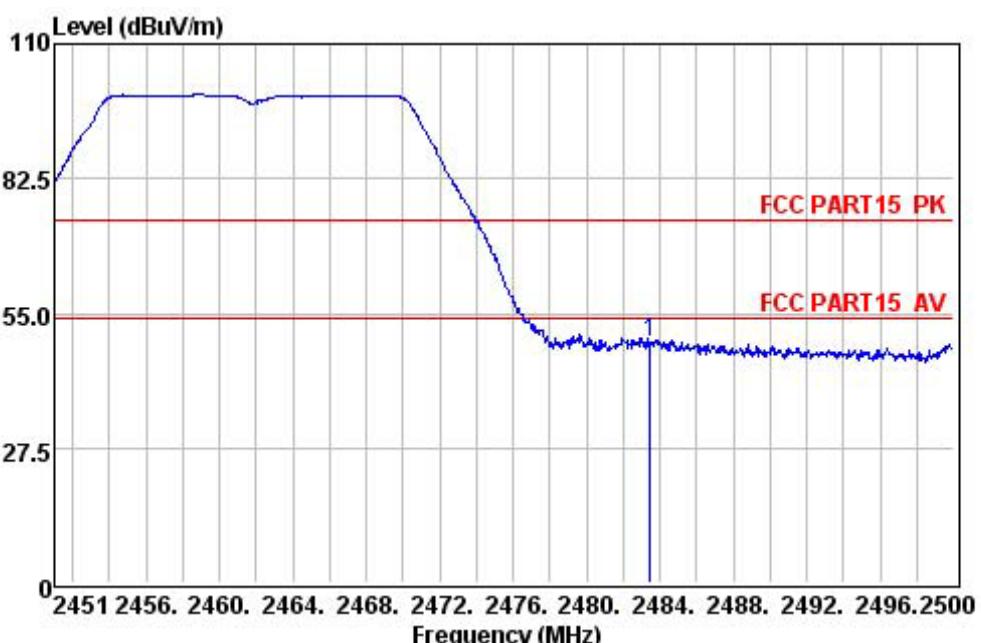


|   | Antenna<br>Freq | Preamp<br>Factor | Read<br>Level | Cable<br>Loss | Limit<br>Level | Line<br>Limit | Over<br>Limit | Remark      |
|---|-----------------|------------------|---------------|---------------|----------------|---------------|---------------|-------------|
|   | MHz             | dB/m             | dB            | dBuV          | dB             | dBuV/m        | dBuV/m        | dB          |
| 1 | 2483.50         | 28.79            | 26.34         | 47.73         | 0.00           | 50.18         | 74.00         | -23.82 Peak |

## 802.11n(20)- Vertical

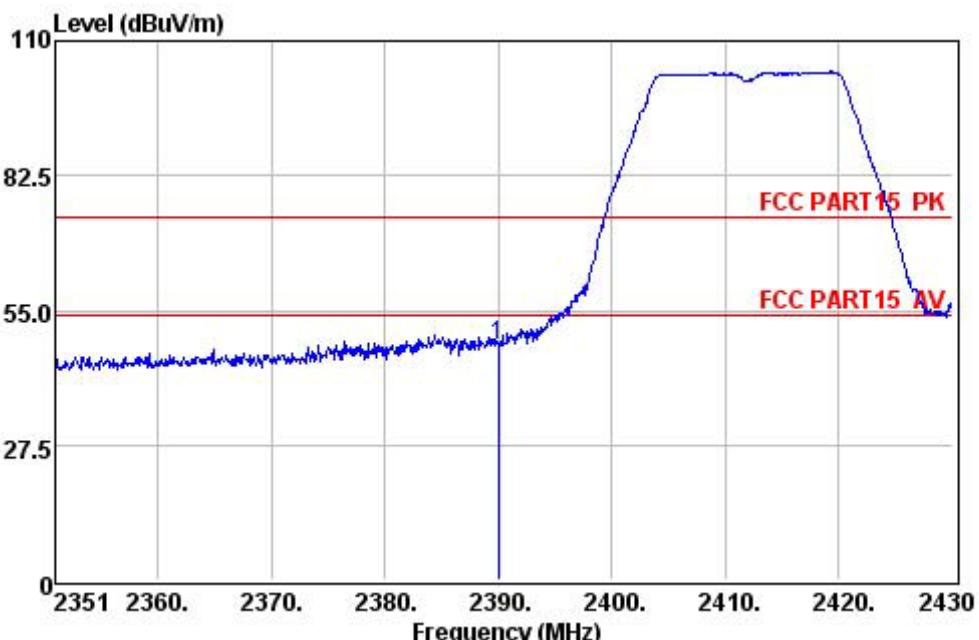


|   | Antenna<br>Freq | Preamp<br>Factor | Read<br>Level | Cable<br>Loss | Limit<br>Level | Limit<br>Line | Over<br>Limit | Remark      |
|---|-----------------|------------------|---------------|---------------|----------------|---------------|---------------|-------------|
|   | MHz             | dB/m             | dB            | dBuV          | dB             | dBuV/m        | dBuV/m        | dB          |
| 1 | 2390.00         | 28.72            | 26.32         | 46.97         | 0.00           | 49.37         | 74.00         | -24.63 Peak |

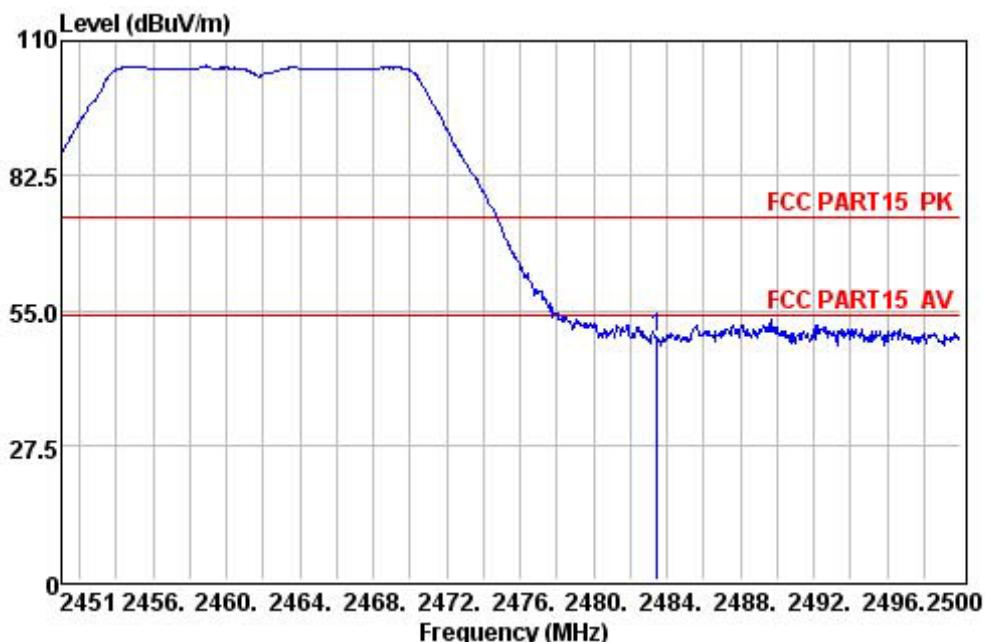


|   | Antenna<br>Freq | Preamp<br>Factor | Read<br>Level | Cable<br>Loss | Limit<br>Level | Limit<br>Line | Over<br>Limit | Remark      |
|---|-----------------|------------------|---------------|---------------|----------------|---------------|---------------|-------------|
|   | MHz             | dB/m             | dB            | dBuV          | dB             | dBuV/m        | dBuV/m        | dB          |
| 1 | 2483.50         | 28.79            | 26.34         | 46.71         | 0.00           | 49.16         | 74.00         | -24.84 Peak |

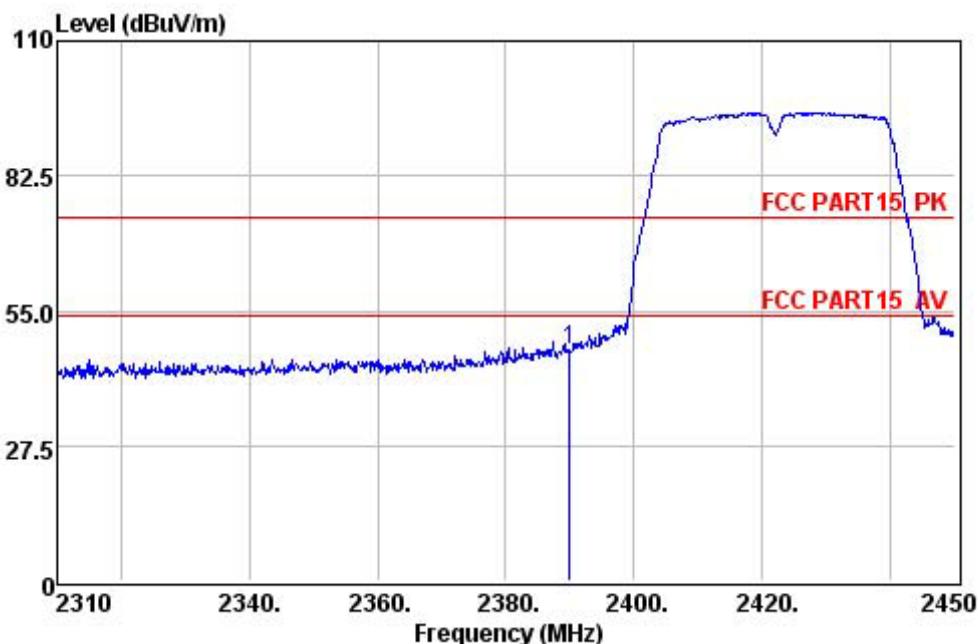
## 802.11n(20)- Horizontal



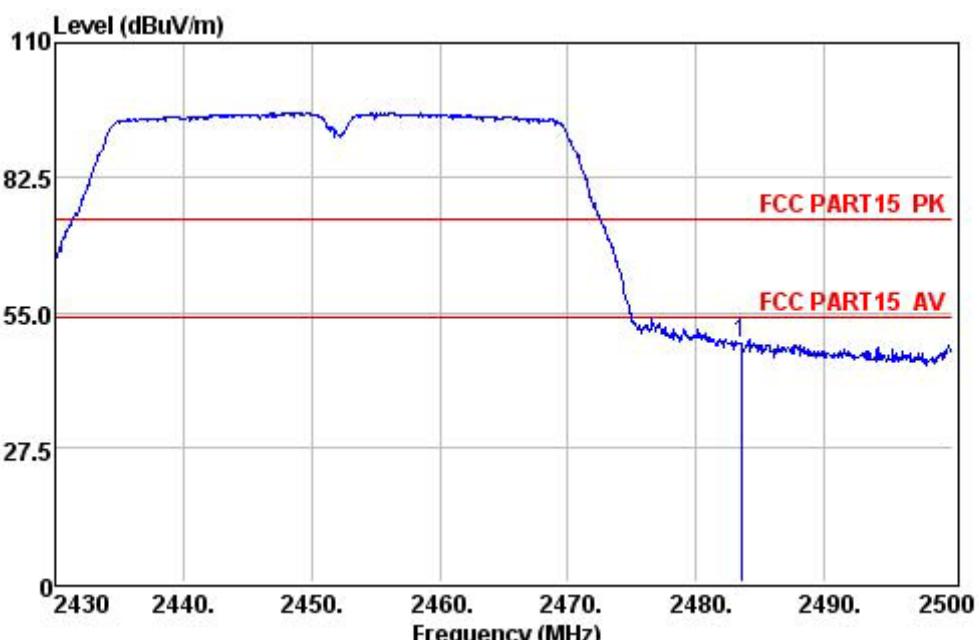
|   | Antenna<br>Freq | Preamp<br>Factor | Read<br>Level | Cable<br>Loss | Limit<br>Level | Limit<br>Line | Over<br>Limit | Remark      |
|---|-----------------|------------------|---------------|---------------|----------------|---------------|---------------|-------------|
|   | MHz             | dB/m             | dB            | dBuV          | dB             | dBuV/m        | dBuV/m        | dB          |
| 1 | 2390.00         | 28.72            | 26.32         | 45.44         | 0.00           | 47.84         | 74.00         | -26.16 Peak |



|   | Antenna<br>Freq | Preamp<br>Factor | Read<br>Level | Cable<br>Loss | Limit<br>Level | Limit<br>Line | Over<br>Limit | Remark      |
|---|-----------------|------------------|---------------|---------------|----------------|---------------|---------------|-------------|
|   | MHz             | dB/m             | dB            | dBuV          | dB             | dBuV/m        | dBuV/m        | dB          |
| 1 | 2483.50         | 28.79            | 26.34         | 46.87         | 0.00           | 49.32         | 74.00         | -24.68 Peak |

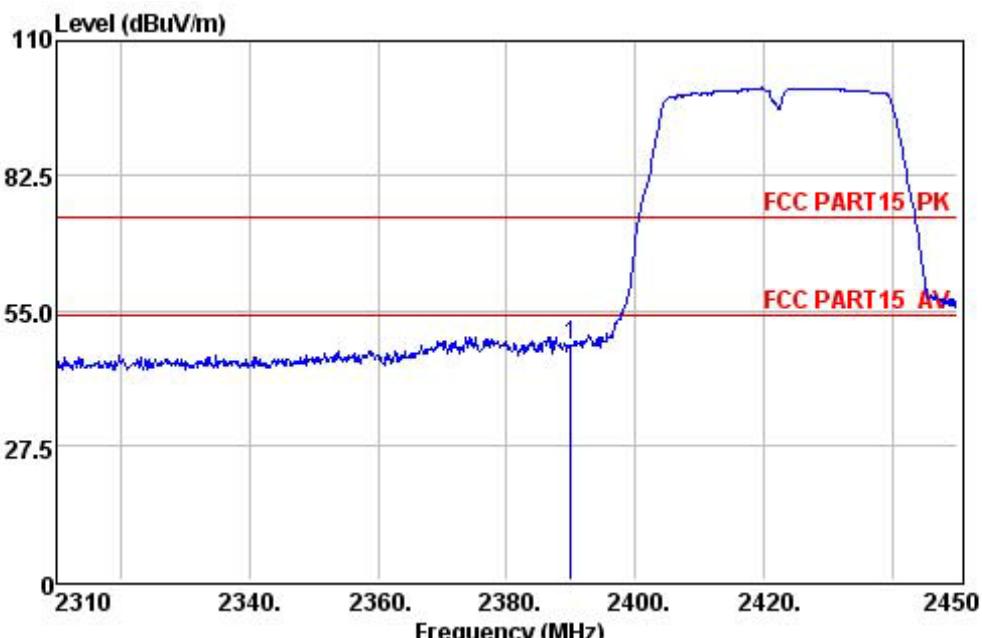
**802.11n(40)- Vertical**

|   | Antenna<br>Freq | Preamp<br>Factor | Read<br>Level | Cable<br>Loss | Limit<br>Level | Line<br>Limit | Over<br>Limit | Remark      |
|---|-----------------|------------------|---------------|---------------|----------------|---------------|---------------|-------------|
|   | MHz             | dB/m             | dB            | dBuV          | dB             | dBuV/m        | dBuV/m        | dB          |
| 1 | 2390.00         | 28.72            | 26.32         | 44.66         | 0.00           | 47.06         | 74.00         | -26.94 Peak |

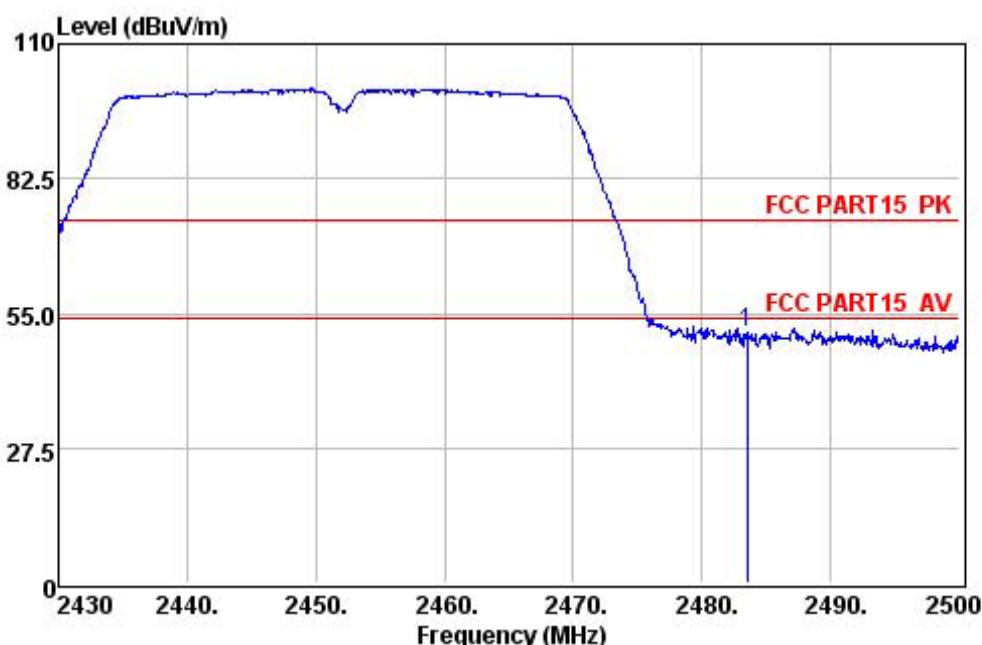


|   | Antenna<br>Freq | Preamp<br>Factor | Read<br>Level | Cable<br>Loss | Limit<br>Level | Line<br>Limit | Over<br>Limit | Remark      |
|---|-----------------|------------------|---------------|---------------|----------------|---------------|---------------|-------------|
|   | MHz             | dB/m             | dB            | dBuV          | dB             | dBuV/m        | dBuV/m        | dB          |
| 1 | 2483.50         | 28.79            | 26.34         | 46.12         | 0.00           | 48.57         | 74.00         | -25.43 Peak |

## 802.11n(40)- Horizontal



|   | Antenna<br>Freq | Preamp<br>Factor | Read<br>Level | Cable<br>Loss | Limit<br>Level | Line<br>Limit | Over<br>Limit | Remark      |
|---|-----------------|------------------|---------------|---------------|----------------|---------------|---------------|-------------|
|   | MHz             | dB/m             | dB            | dBuV          | dB             | dBuV/m        | dBuV/m        | dB          |
| 1 | 2390.00         | 28.72            | 26.32         | 45.24         | 0.00           | 47.64         | 74.00         | -26.36 Peak |



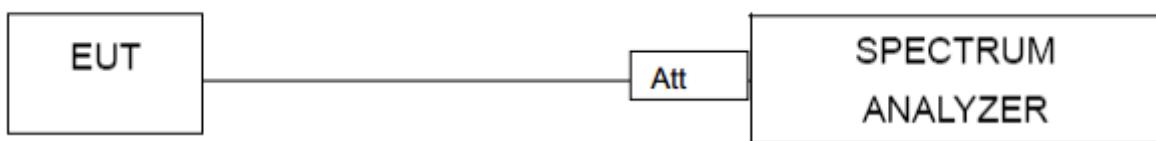
|   | Antenna<br>Freq | Preamp<br>Factor | Read<br>Level | Cable<br>Loss | Limit<br>Level | Line<br>Limit | Over<br>Limit | Remark      |
|---|-----------------|------------------|---------------|---------------|----------------|---------------|---------------|-------------|
|   | MHz             | dB/m             | dB            | dBuV          | dB             | dBuV/m        | dBuV/m        | dB          |
| 1 | 2483.50         | 28.79            | 26.34         | 48.50         | 0.00           | 50.95         | 74.00         | -23.05 Peak |

## 5. BAND EDGE COMPLIANCE TEST

### 5.1. Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

### 5.2. Test setup



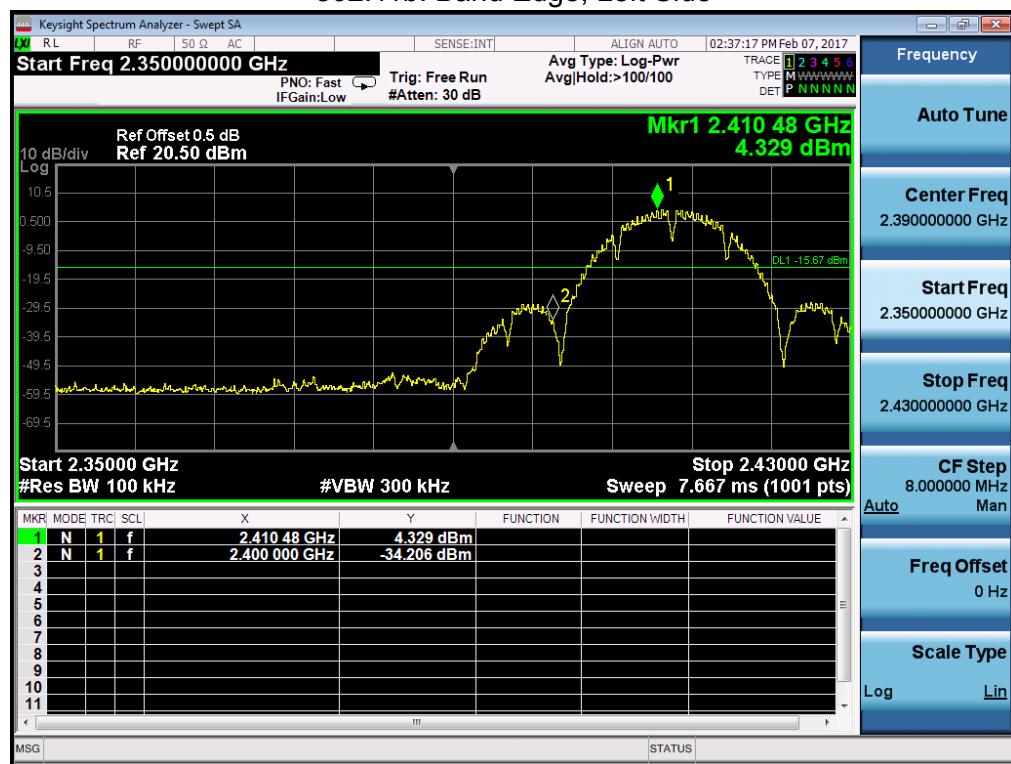
### 5.3. Test Procedure

- a) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
- c) Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
- d) Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
- e) Repeat above procedures until all measured frequencies were complete.

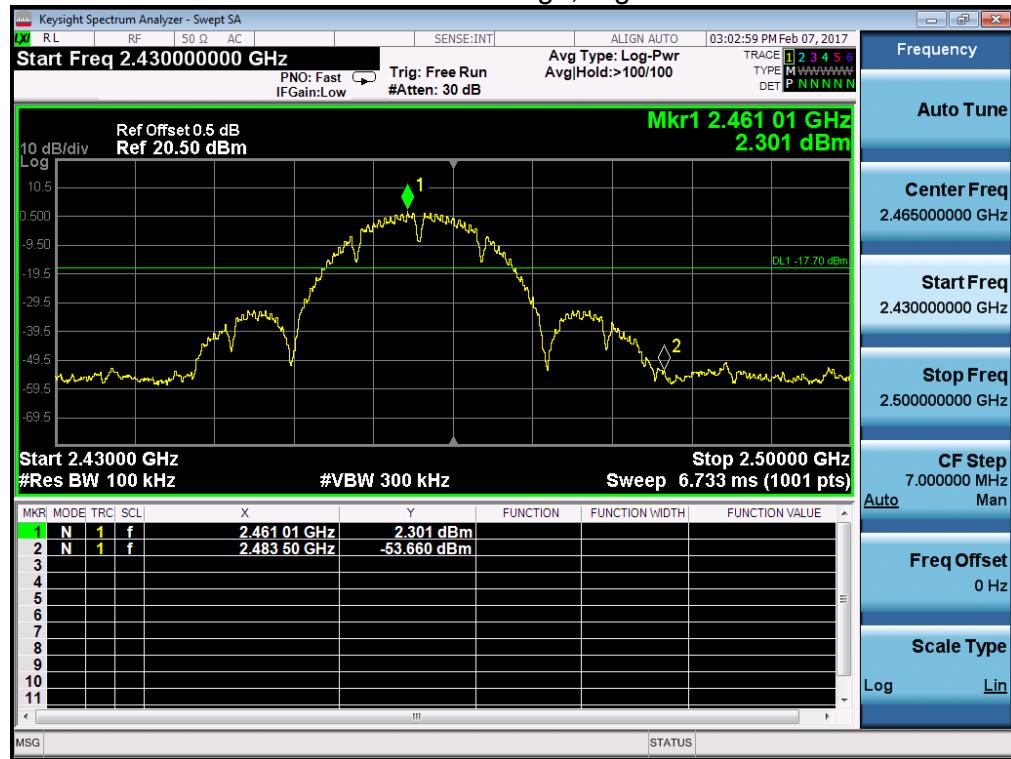
**Conduction band-edge**

| Frequency Band<br>MHz | Delta Peak to band<br>emission (dBc) | > Limit<br>(dBc) | Result |
|-----------------------|--------------------------------------|------------------|--------|
| 802.11b mode          |                                      |                  |        |
| 2400                  | 38.535                               | 20               | Pass   |
| 2483.5                | 55.961                               | 20               | Pass   |
| 802.11g mode          |                                      |                  |        |
| 2400                  | 26.705                               | 20               | Pass   |
| 2483.5                | 39.819                               | 20               | Pass   |
| 802.11n-HT20 mode     |                                      |                  |        |
| 2400                  | 25.509                               | 20               | Pass   |
| 2483.5                | 37.123                               | 20               | Pass   |
| 802.11n-HT40 mode     |                                      |                  |        |
| 2400                  | 27.152                               | 20               | Pass   |
| 2483.5                | 33.247                               | 20               | Pass   |

## 802.11b: Band Edge, Left Side



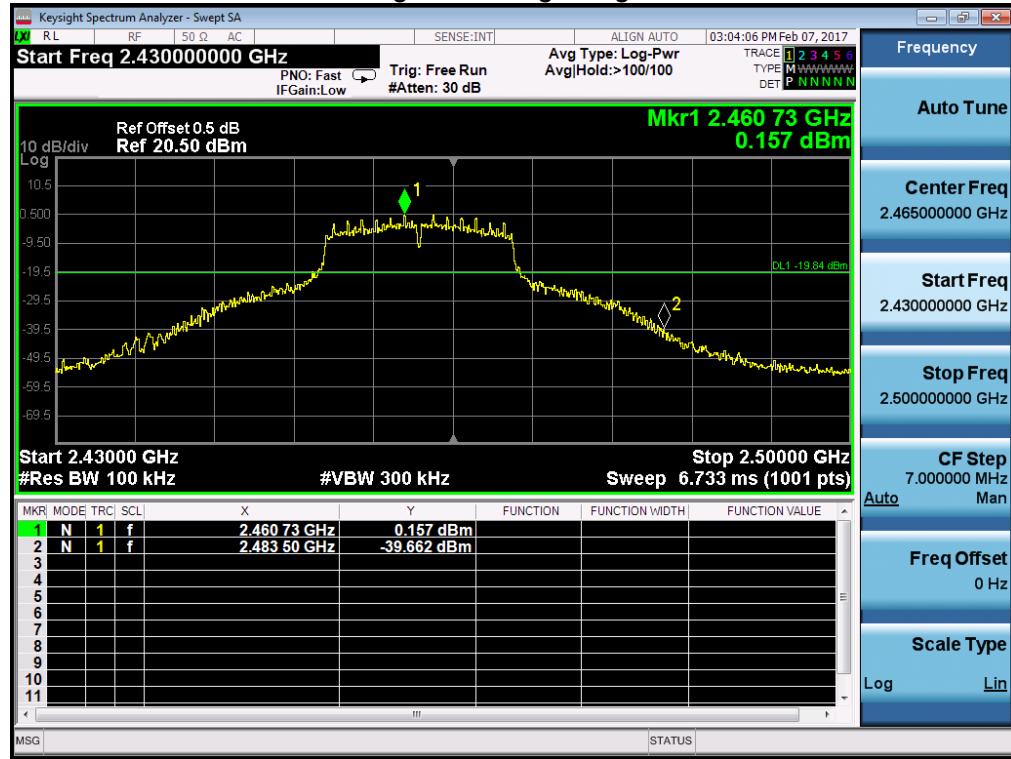
## 802.11b: Band Edge, Right Side



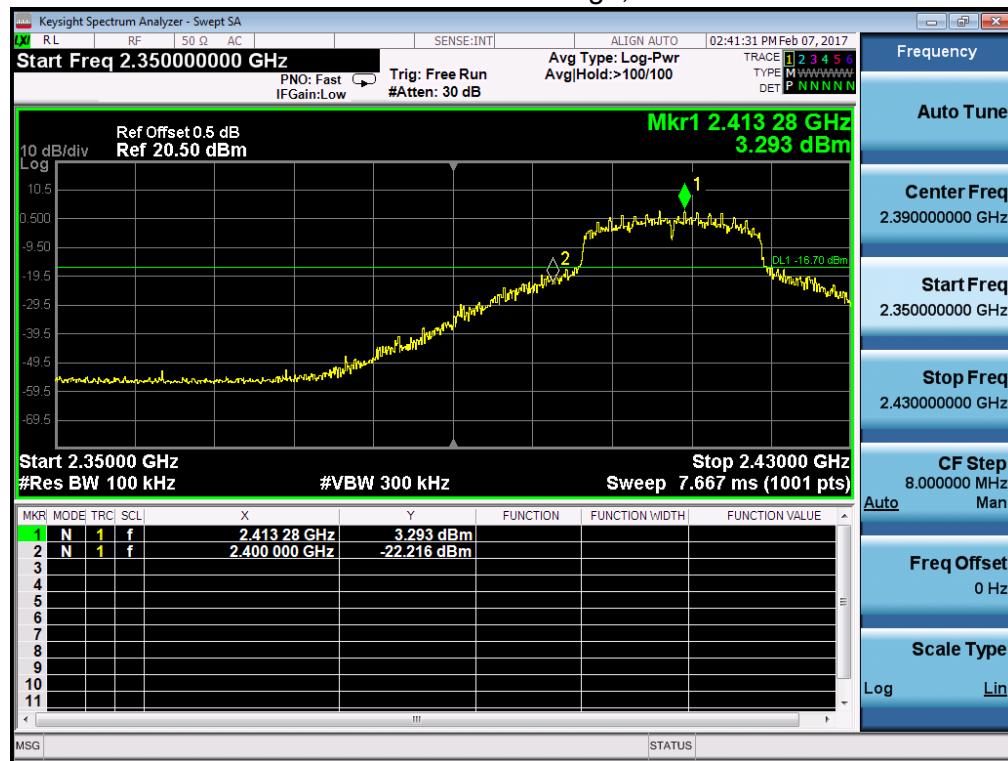
## 802.11g: Band Edge, Left Side



## 802.11g: Band Edge, Right Side



## 802.11n-HT20: Band Edge, Left Side



## 802.11n-HT20: Band Edge, Right Side



## 802.11n-HT40: Band Edge, Left Side



## 802.11n-HT40: Band Edge, Right Side



## 6. BANDWIDTH TEST

### 6.1. Limits

For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz

### 6.2. Test Procedure

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

Test data:

|                   | Frequency<br>(MHz) | 6dB<br>Bandwidth<br>(MHz) | Limit<br>(MHz) | Result |
|-------------------|--------------------|---------------------------|----------------|--------|
| 802.11b           | 2412               | 10.04                     | >0.5           | Pass   |
|                   | 2437               | 9.15                      | >0.5           | Pass   |
|                   | 2462               | 10.05                     | >0.5           | Pass   |
| 802.11g           | 2412               | 15.10                     | >0.5           | Pass   |
|                   | 2437               | 15.29                     | >0.5           | Pass   |
|                   | 2462               | 15.13                     | >0.5           | Pass   |
| 802.11n<br>(HT20) | 2412               | 15.10                     | >0.5           | Pass   |
|                   | 2437               | 16.06                     | >0.5           | Pass   |
|                   | 2462               | 15.72                     | >0.5           | Pass   |
| 802.11n<br>(HT40) | 2422               | 31.28                     | >0.5           | Pass   |
|                   | 2437               | 32.54                     | >0.5           | Pass   |
|                   | 2452               | 35.27                     | >0.5           | Pass   |

Test plot as follows:  
6dB bandwidth

## 802.11b 2412MHz



## 802.11g 2412MHz



## 802.11b 2437MHz



## 802.11g 2437MHz



## 802.11b 2462MHz



## 802.11g 2462MHz



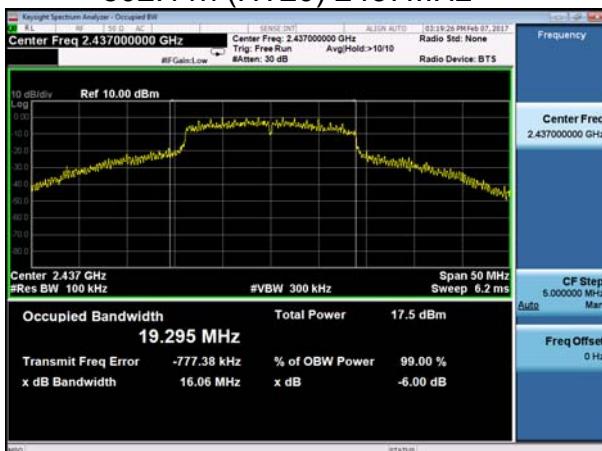
## 802.11n (HT20) 2412MHz



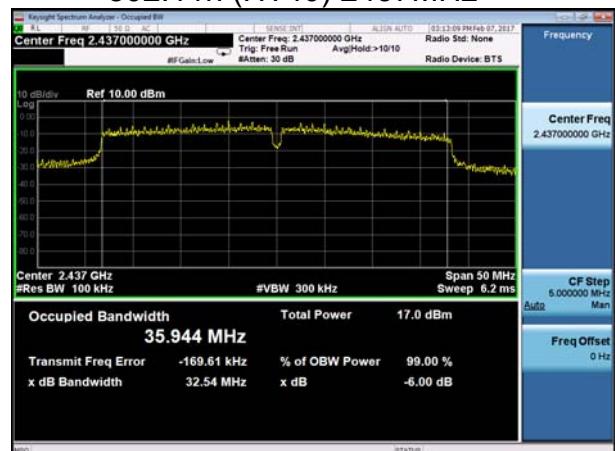
## 802.11n (HT40) 2422MHz



## 802.11n (HT20) 2437MHz



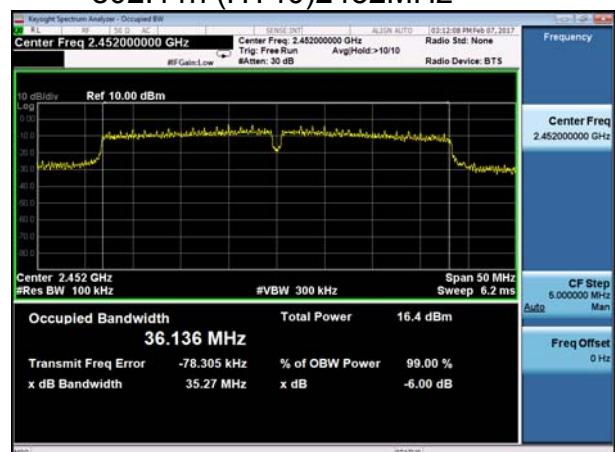
## 802.11n (HT40) 2437MHz



## 802.11n(HT20) 2462MHz



## 802.11n (HT40) 2452MHz



## 7. OUTPUT POWER TEST

### 7.1. Limits

For systems using digital modulation in the 2400~2483.5MHz, The output power shall not exceed 1W (30dBm)

### 7.2. Test setup

1. The Transmitter output (antenna port) was connected to the power meter.
2. Turn on the EUT and power meter and then record the power value.
3. Repeat above procedures on all channels needed to be tested.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.



### 7.3. Test result

| Test Channel               | Frequency | Maximum Conducted Output Power | LIMIT |
|----------------------------|-----------|--------------------------------|-------|
|                            | (MHz)     | (dBm)                          | dBm   |
| <b>TX 802.11b Mode</b>     |           |                                |       |
| CH01                       | 2412      | 11.11                          | 30    |
| CH06                       | 2437      | 11.13                          | 30    |
| CH11                       | 2462      | 11.17                          | 30    |
| <b>TX 802.11g Mode</b>     |           |                                |       |
| CH01                       | 2412      | 10.21                          | 30    |
| CH06                       | 2437      | 10.25                          | 30    |
| CH11                       | 2462      | 10.39                          | 30    |
| <b>TX 802.11n(20) Mode</b> |           |                                |       |
| CH01                       | 2412      | 9.37                           | 30    |
| CH06                       | 2437      | 9.25                           | 30    |
| CH11                       | 2462      | 9.38                           | 30    |
| <b>TX 802.11n(40) Mode</b> |           |                                |       |
| CH03                       | 2422      | 8.28                           | 30    |
| CH06                       | 2437      | 8.27                           | 30    |
| CH09                       | 2452      | 8.14                           | 30    |

Note: For power test the duty cycle is 100% in continuous transmitting mode.

## 8. DUTY CYCLE

### 8.1. Test Procedure

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

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.

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

The EUT was operating in controlled its channel.

Use the following spectrum analyzer settings:

Span = Zero Span

RBW = 8MHz

VBW = 50MHz

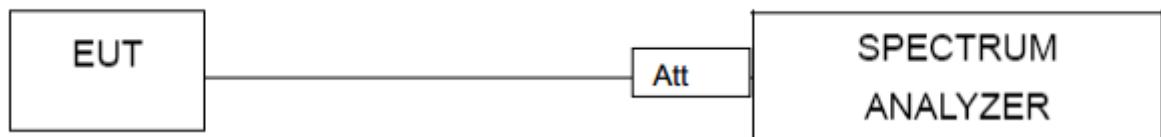
Number of points in Sweep >100

Detector function = peak

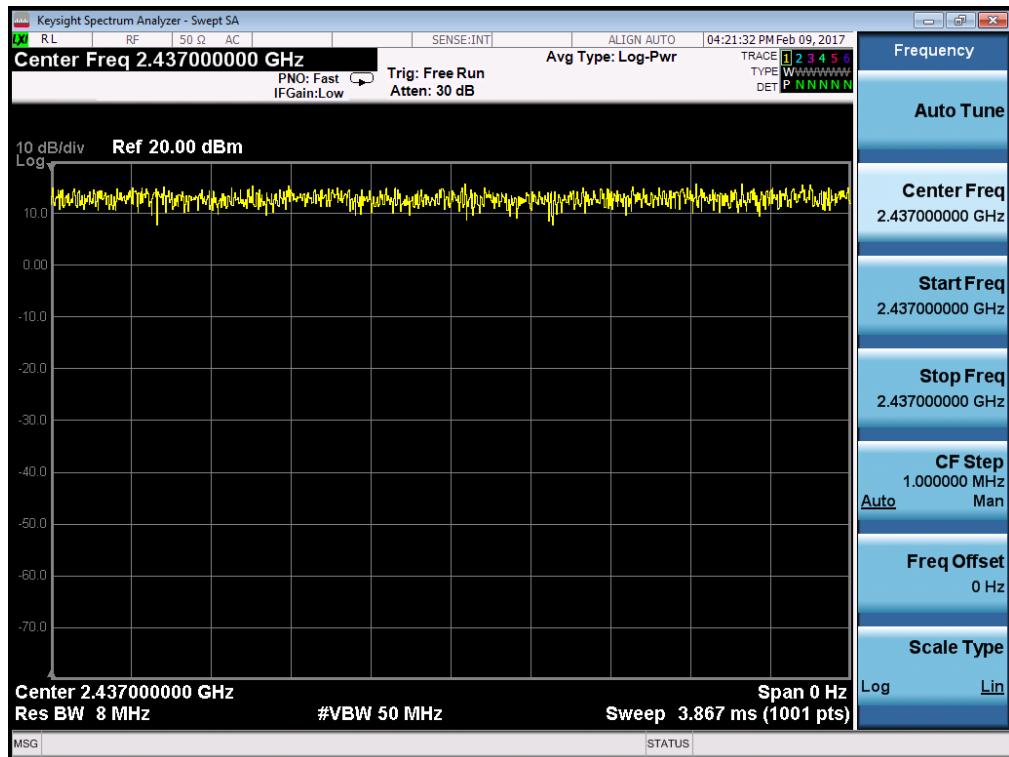
Trace = Clear write Measure  $T_{\text{total}}$  and  $T_{\text{on}}$

Calculate Duty Cycle =  $T_{\text{on}} / T_{\text{total}}$  and Duty Cycle Factor=10\*log(1/Duty Cycle)

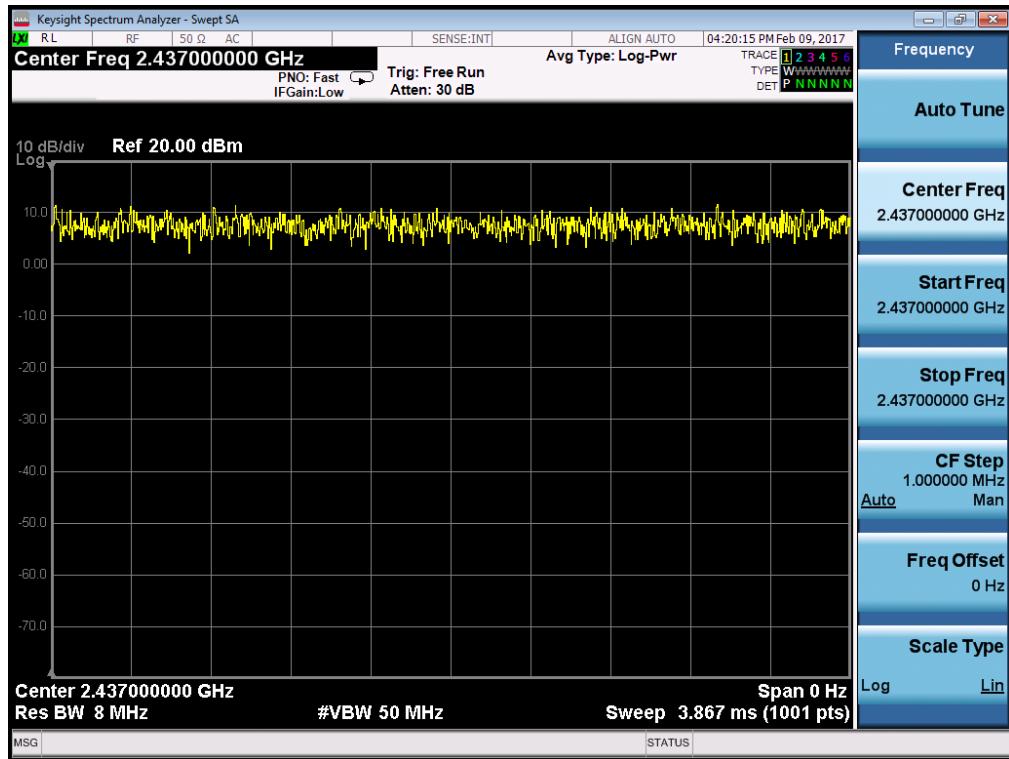
### 8.2. Test Setup



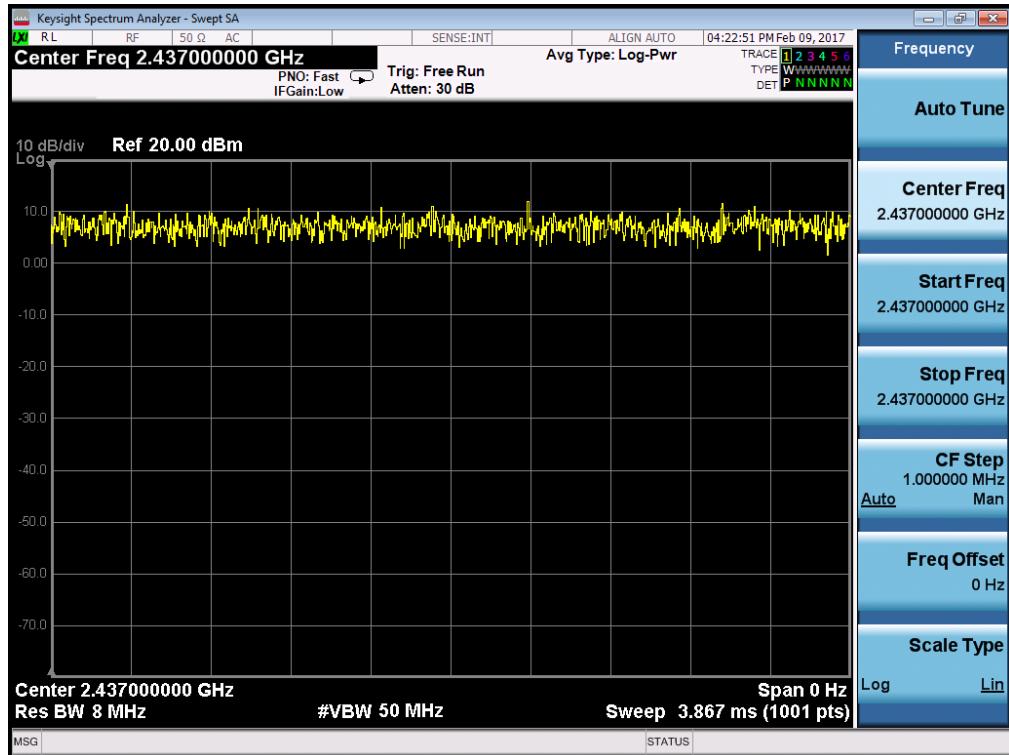
## Test plot of Duty Cycle for 802.11b



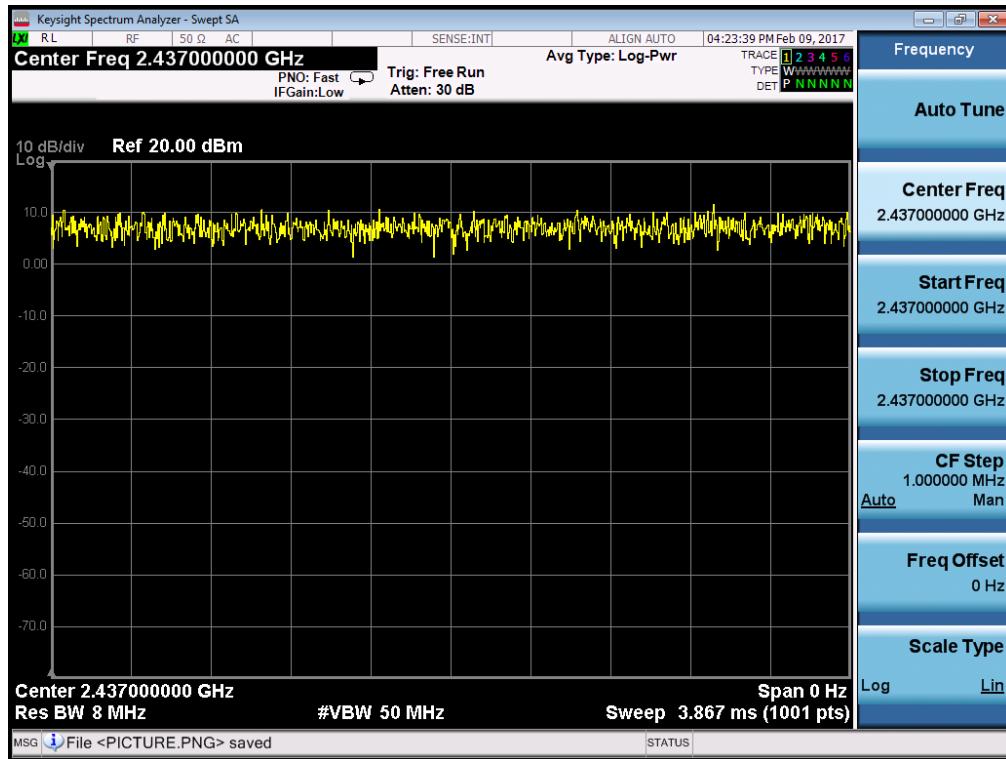
## Test plot of Duty Cycle for 802.11g



## Test plot of Duty Cycle for 802.11n(HT20)



## Test plot of Duty Cycle for 802.11n(HT40)



## 9. POWER SPECTRAL DENSITY TEST

### 9.1. Limits

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

### 9.2. Test setup

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
4. Set the VBW  $\geq 3 \text{ RBW}$ .
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

### 9.3. Test result

|                | Channel Frequency (MHz) | Power density (dBm/3kHz) | Limit (dBm/3kHz) | Result |
|----------------|-------------------------|--------------------------|------------------|--------|
| 802.11b        | 2412                    | -11.674                  | 8                | Pass   |
|                | 2437                    | -12.993                  | 8                | Pass   |
|                | 2462                    | -14.188                  | 8                | Pass   |
| 802.11g        | 2412                    | -13.232                  | 8                | Pass   |
|                | 2437                    | -14.744                  | 8                | Pass   |
|                | 2462                    | -16.870                  | 8                | Pass   |
| 802.11n (HT20) | 2412                    | -11.996                  | 8                | Pass   |
|                | 2437                    | -13.546                  | 8                | Pass   |
|                | 2462                    | -14.865                  | 8                | Pass   |
| 802.11n (HT40) | 2422                    | -16.965                  | 8                | Pass   |
|                | 2437                    | -17.440                  | 8                | Pass   |
|                | 2452                    | -18.531                  | 8                | Pass   |

## 802.11b 2412MHz



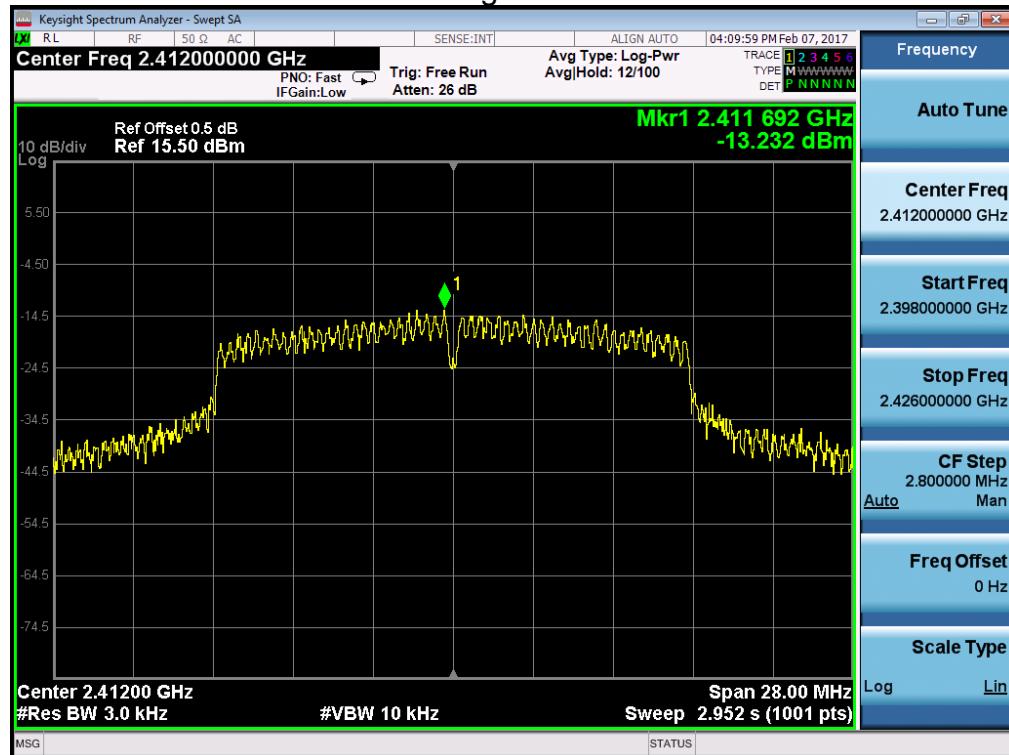
## 802.11b 2437MHz



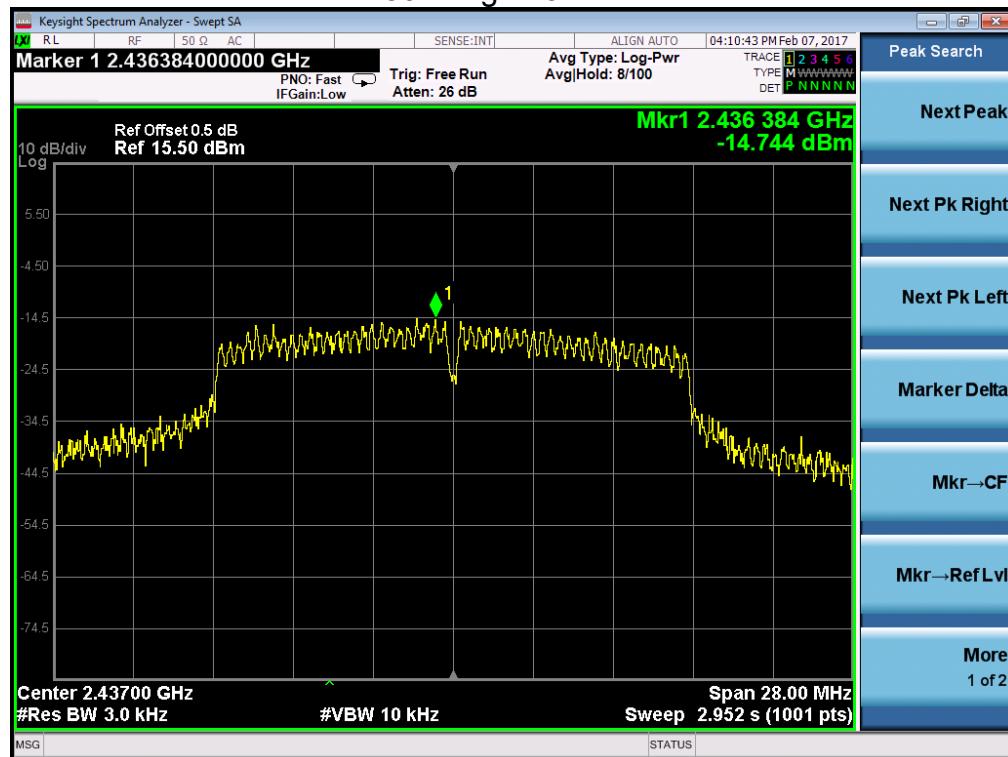
## 802.11b 2462MHz



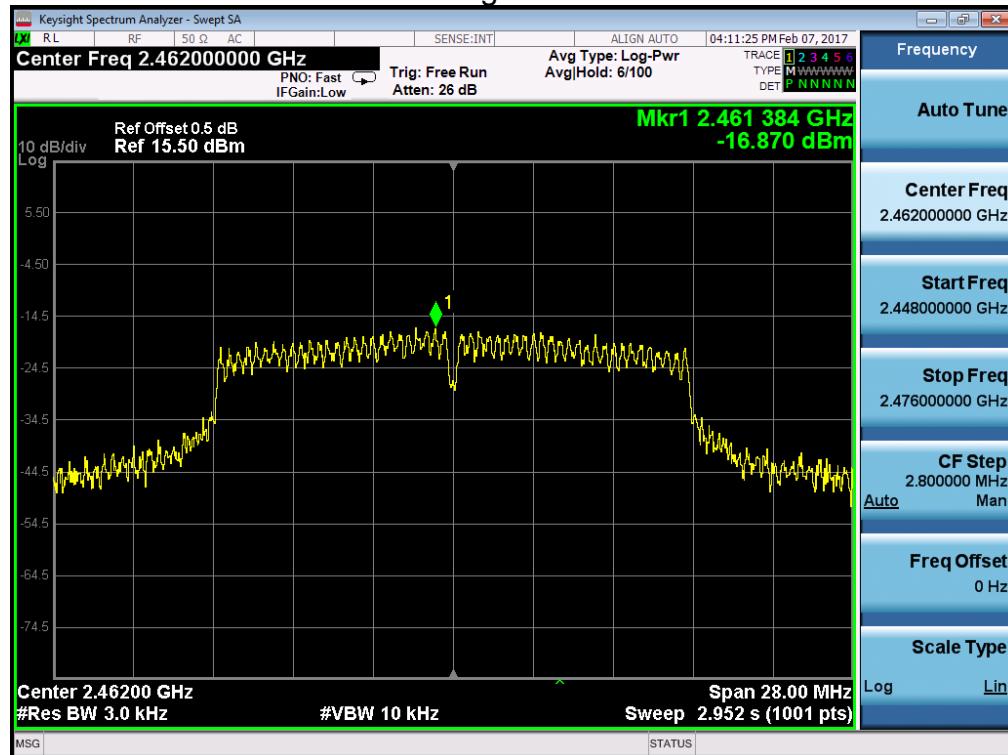
## 802.11g 2412MHz



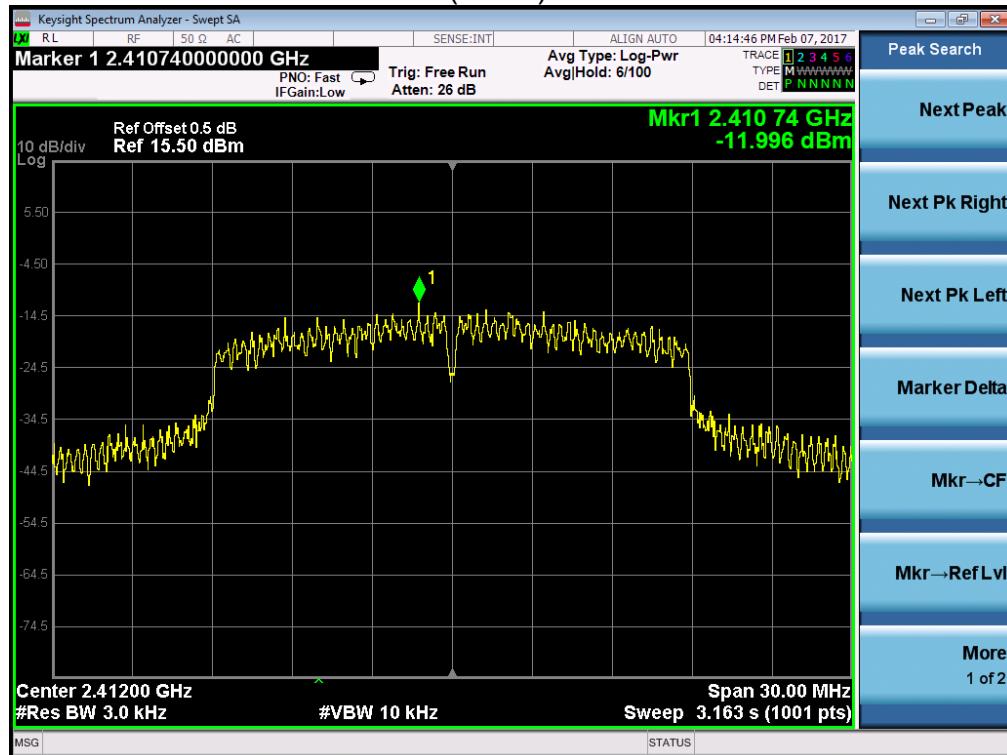
## 802.11g 2437MHz



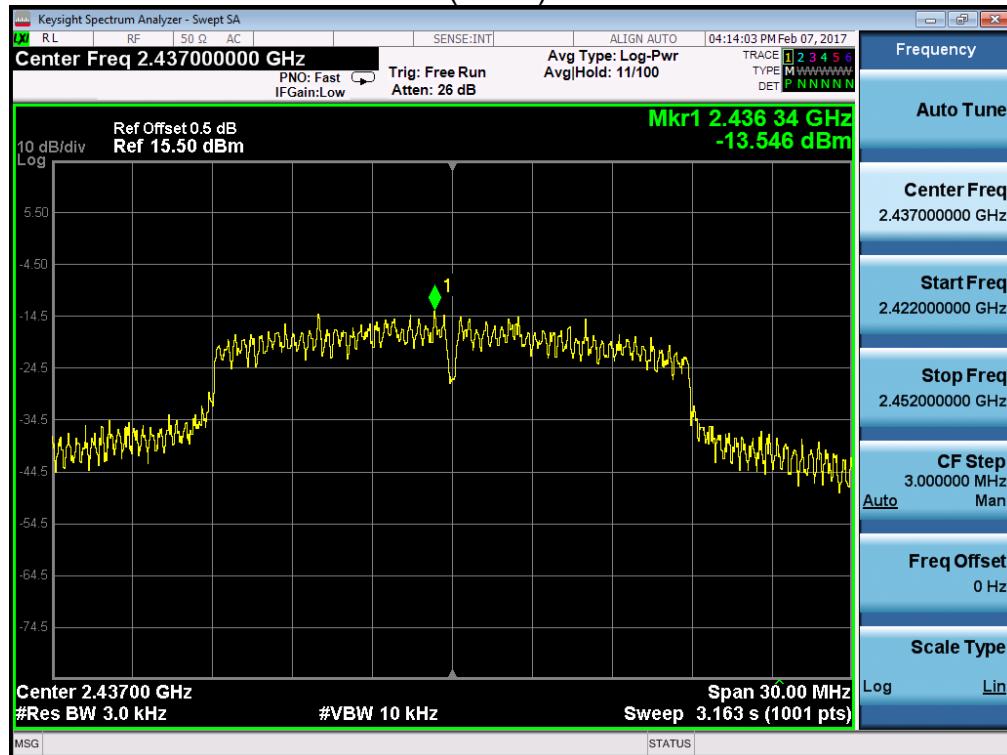
## 802.11g 2462MHz



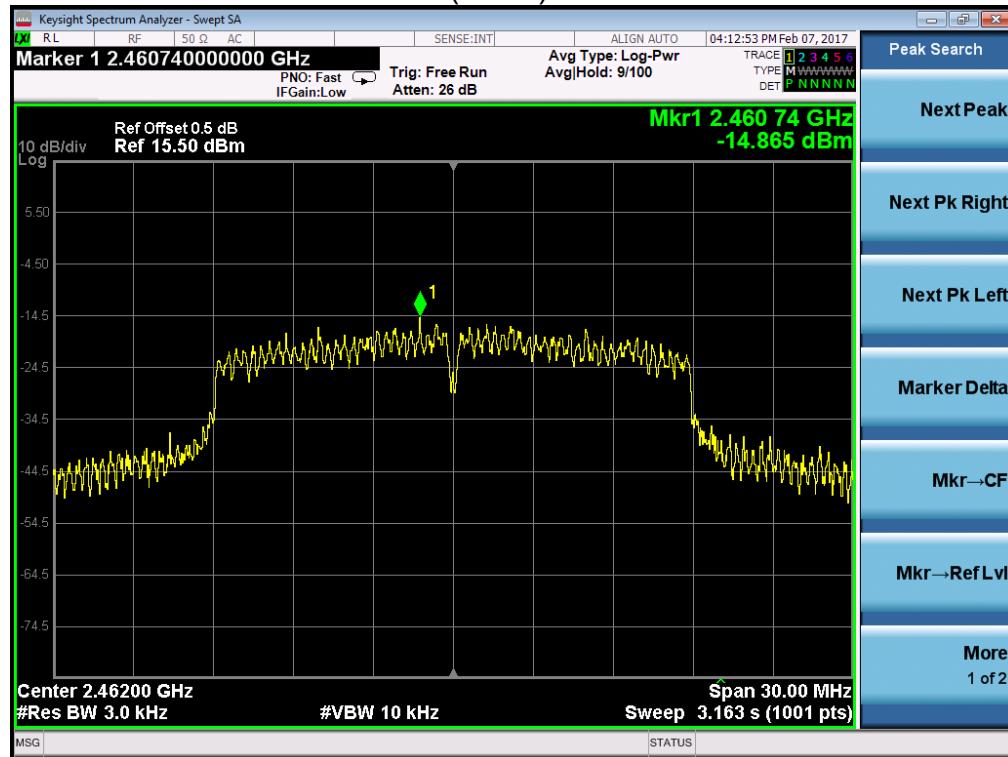
## 802.11n(HT20) 2412MHz



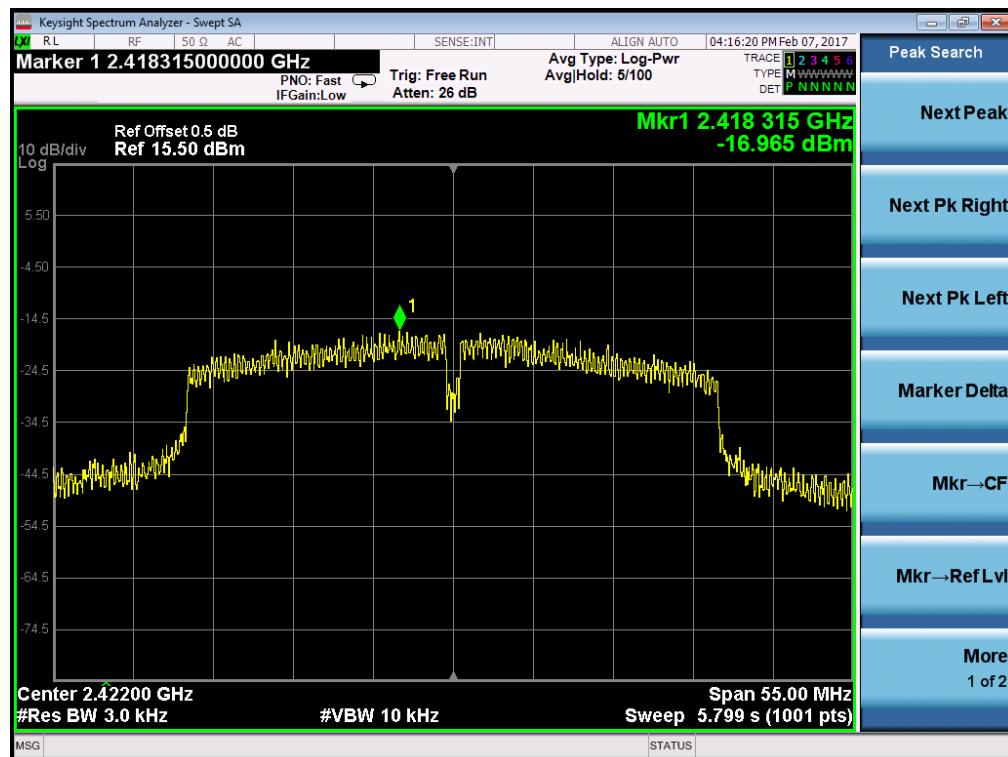
## 802.11n(HT20) 2437MHz



## 802.11n(HT20) 2462MHz



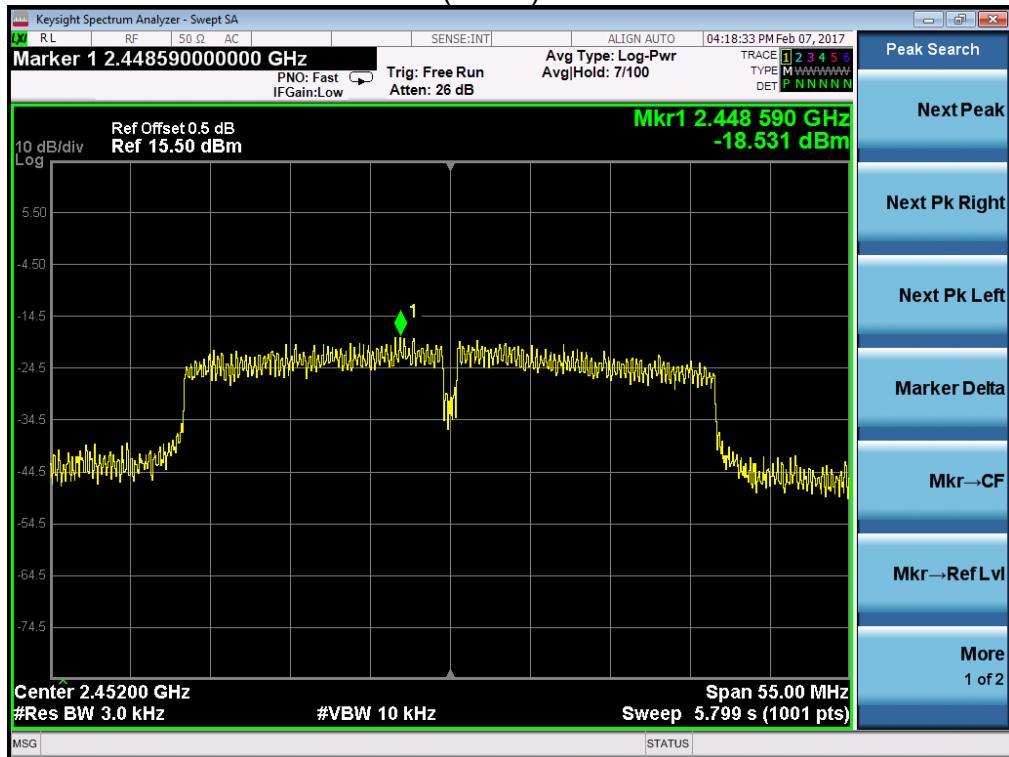
## 802.11n(HT40) 2422MHz



## 802.11n(HT40) 2437MHz



## 802.11n(HT40)2452MHz



## 10. ANTENNA REQUIREMENTS

### 10.1. Limits

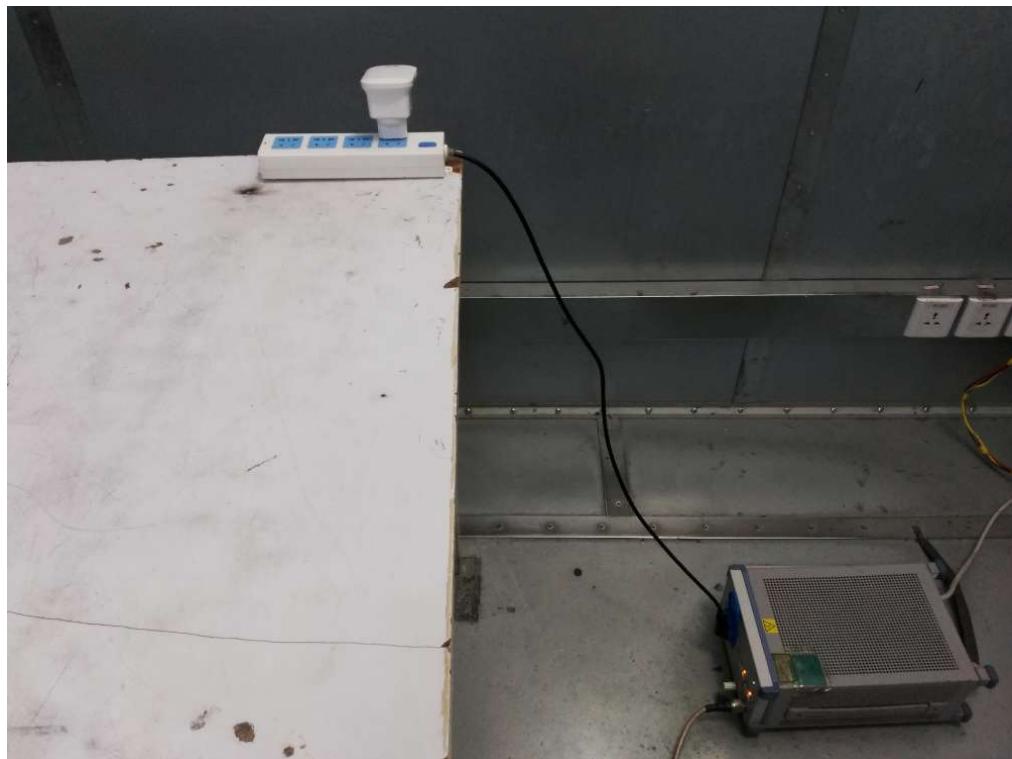
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional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

### 10.2. Result

The antennas used for this product is PIFA antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is 2.86dBi.

## 11. PHOTOGRAPHS OF TEST SET-UP

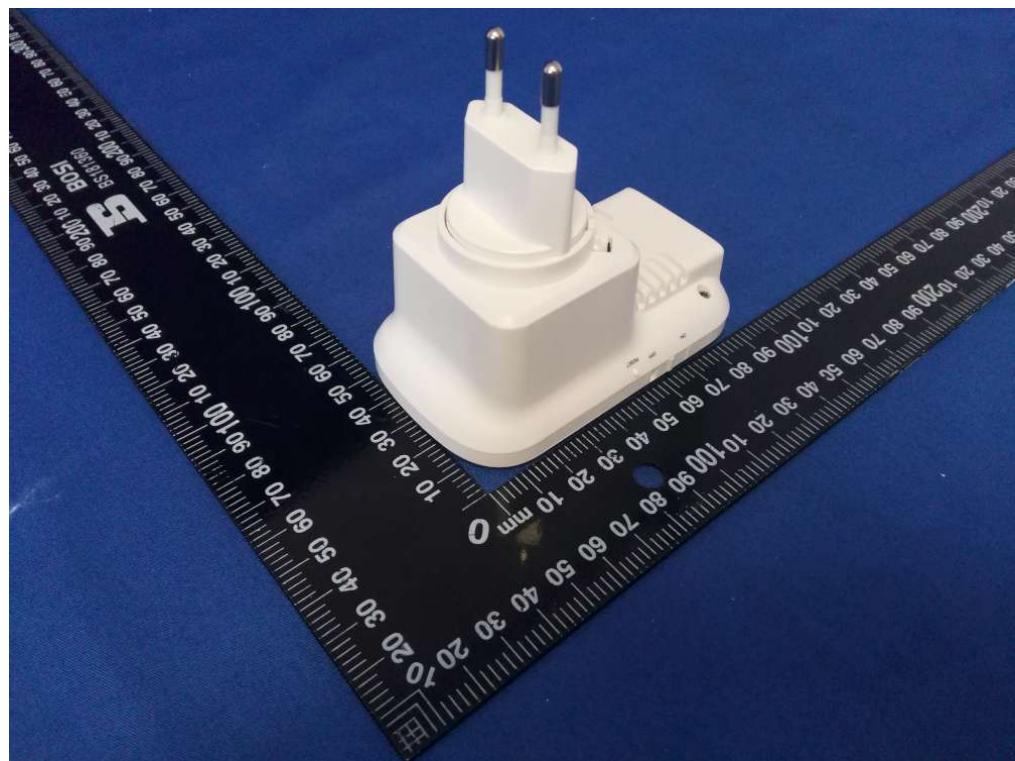
Conducted Emission



### Radiated Emission Test

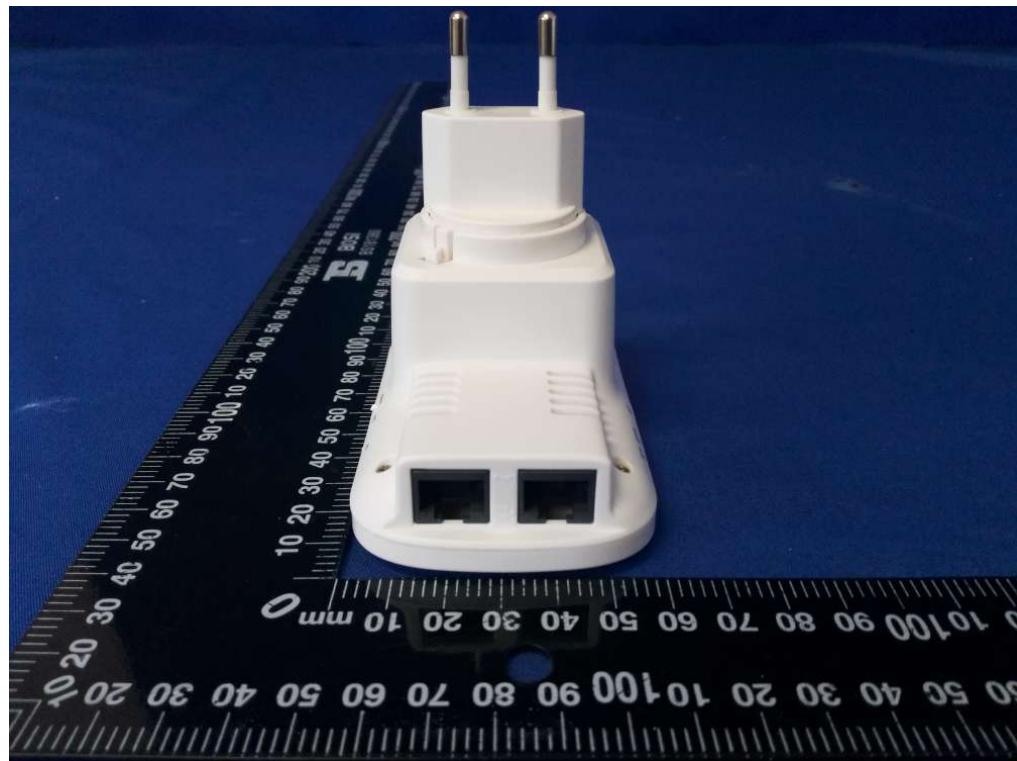


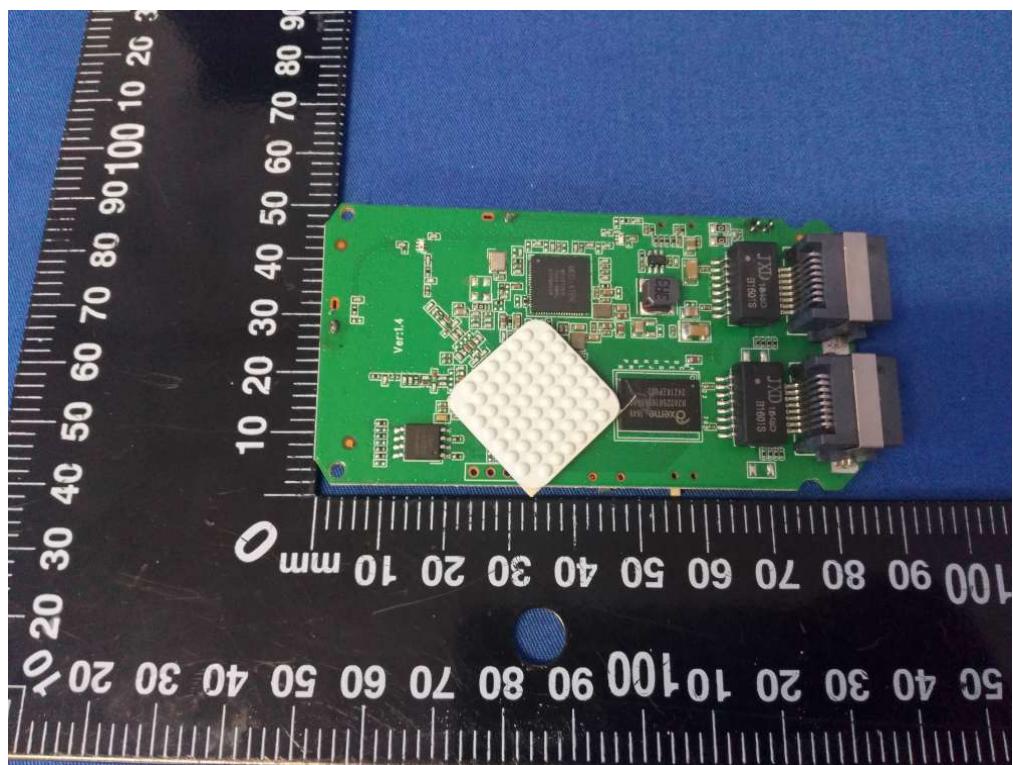
## 12. PHOTOGRAPHS OF THE EUT

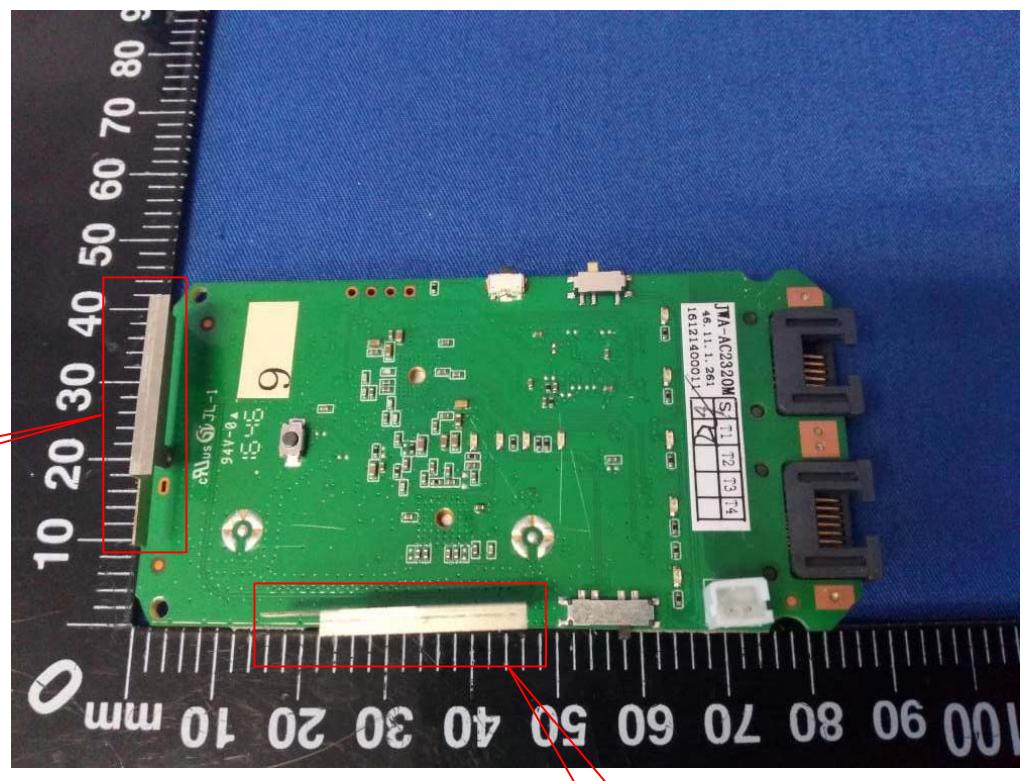




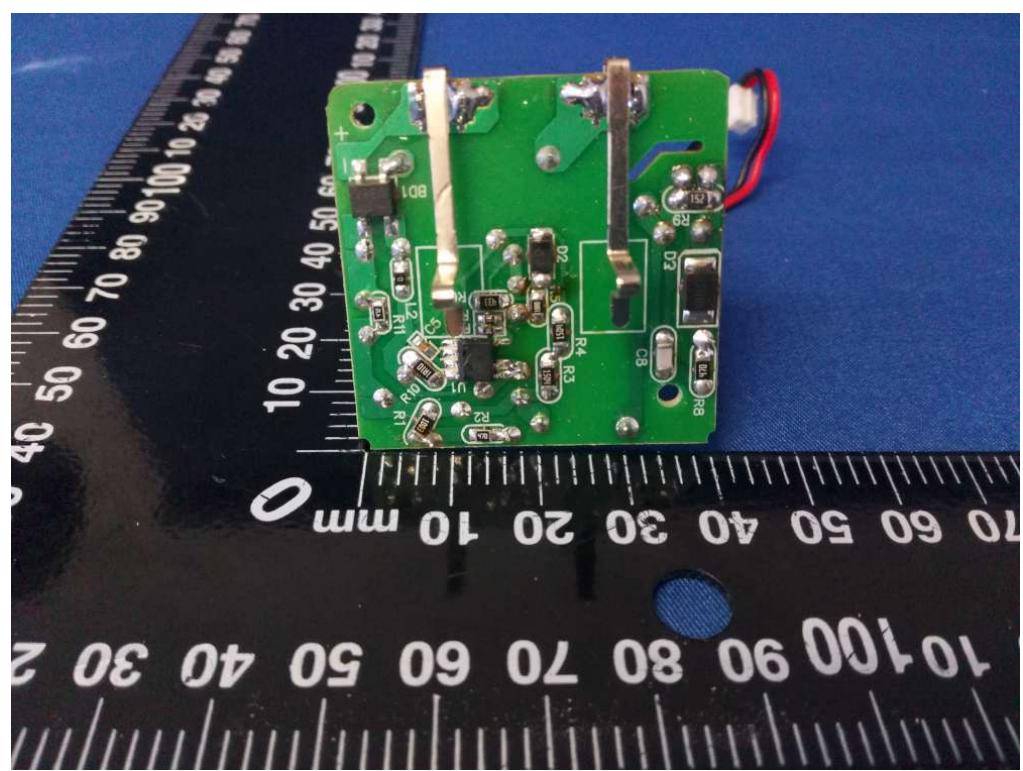
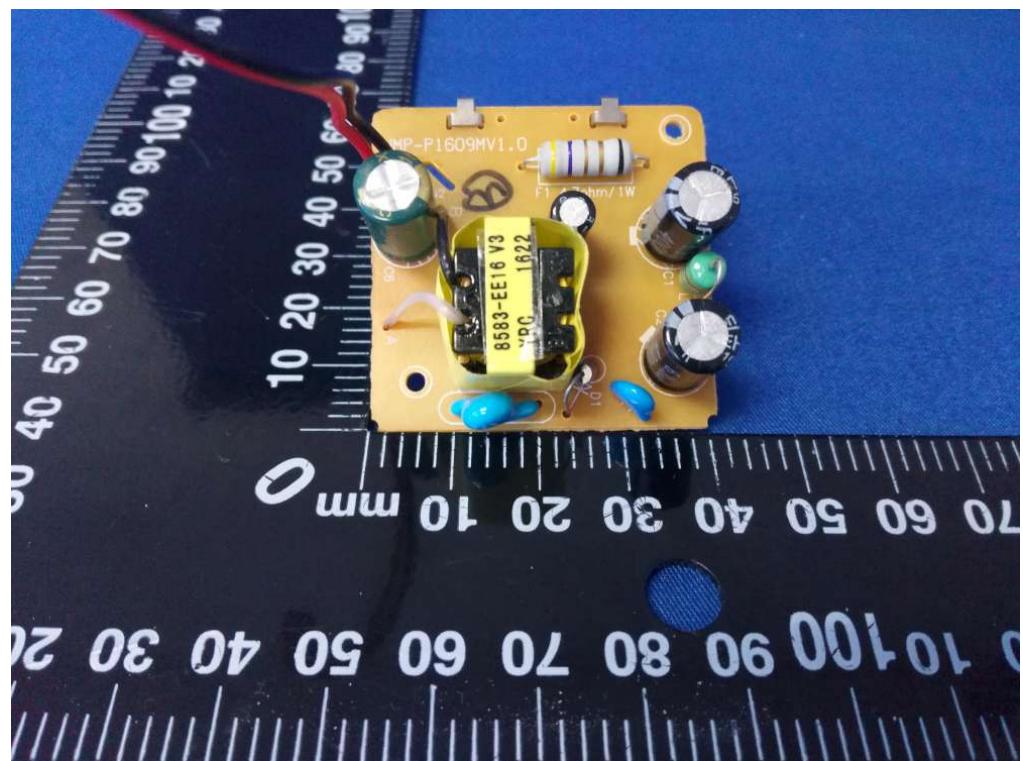








5G Antenna



\*\*\* the end of report \*\*\*