



FCC TEST REPORT

**Test report
On Behalf of
Zhongshan Sanzang Electronic Technology Co., Ltd.
For
SEABIRD 4K ACTION CAMERA
Model No.: Seabird2.0**

FCC ID: 2ATET-SEABIRD

Prepared for : Zhongshan Sanzang Electronic Technology Co., Ltd.
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Date of Test: Apr. 29, 2019 ~ May 09, 2019

Date of Report: May 09, 2019

Report Number: HK1904290900-1E



TEST RESULT CERTIFICATION

Applicant's name: Zhongshan Sanzang Electronic Technology Co., Ltd.
Address: Zone B, 2nd Floor, No. 81 Zhenxiang New Street, Yonger Village,
Tanzhou Town, Zhongshan, China

Manufacture's Name.....: Zhongshan Sanzang Electronic Technology Co., Ltd.
Address: Zone B, 2nd Floor, No. 81 Zhenxiang New Street, Yonger Village,
Tanzhou Town, Zhongshan, China

Product description

Trade Mark: SEABIRD
Product name.....: SEABIRD 4K ACTION CAMERA
Model and/or type reference : Seabird2.0
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: Apr. 29, 2019 ~ May 09, 2019
Date of Issue.....: May 09, 2019
Test Result.....: **Pass**

Testing Engineer :

(Gary Qian)

Technical Manager :

(Eden Hu)

Authorized Signatory :

(Jason Zhou)



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1. Test Result Summary

1.1. TEST PROCEDURES AND RESULTS

| Requirement | CFR 47 Section | Result |
|----------------------------------|-------------------------------------|--------|
| Antenna requirement | §15.203/§15.247 (c) | PASS |
| AC Power Line Conducted Emission | §15.207 | PASS |
| Conducted Peak Output Power | §15.247 (b)(3) §2.1046 | PASS |
| 6dB Emission Bandwidth | §15.247 (a)(2) §2.1049 | PASS |
| Power Spectral Density | §15.247 (e) | PASS |
| Band Edge | §15.247(d) §2.1051, §2.1057 | PASS |
| Spurious Emission | §15.205/§15.209 §2.1053, §2.1057 | 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. TEST FACILITY

| | | |
|--------------------|---|---|
| Test Firm | : | Shenzhen HUAK Testing Technology Co., Ltd. |
| | | |
| Address | | 1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China |
| | | |
| Designation Number | : | CN1229 |



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 | $\pm 2.56\text{dB}$ |
| 2 | RF power, conducted | $\pm 0.12\text{dB}$ |
| 3 | Spurious emissions, conducted | $\pm 0.11\text{dB}$ |
| 4 | All emissions, radiated(<1G) | $\pm 3.92\text{dB}$ |
| 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 | SEABIRD 4K ACTION CAMERA |
| Model Name | Seabird2.0 |
| Serial No. | N/A |
| Model Difference | N/A |
| Trade Mark | SEABIRD |
| FCC ID | 2ATET-SEABIRD |
| Antenna Type | Internal Antenna |
| Antenna Gain | 1dBi |
| Operation frequency | 802.11b/g/n 20: 2412~2462 MHz 802.11n 40: 2422~2452MHz |
| Number of Channels | 802.11b/g/n20: 11CH 802.11n 40: 7CH |
| Modulation Type | CCK/OFDM/DBPSK/DAPSK |
| Power Source | 3.8VDC By Battery or 5VDC From Micro USB |
| Power Rating | 3.8VDC By Battery or 5VDC From Micro USB |



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

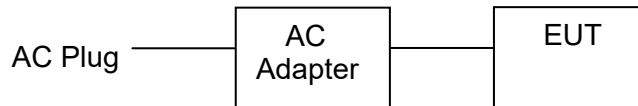
Middle Channel: 2437MHz

High Channel: 2452MHz

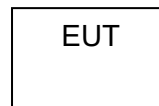


2.4. DESCRIPTION OF TEST SETUP

Operation of EUT during conducted and Radiation testing:



Operation of EUT Above 1GHz Radiation testing:



- Adapter information

Model: HW-050500DFQ

Input: 100-240V~, 50/60Hz, 0.5A

Output: 5VDC

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&Z 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%) |
| <p>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.</p> | |

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 |
| <p>1. For WIFI function, the engineering test program was provided and enabled to make EUT continuous transmit/receive.</p> <p>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.</p> | |



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

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 (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 (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 (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>40cm 80cm</p><p>E.U.T AC power</p><p>Test table/Insulation plane</p><p>LISN Filter AC power</p><p>EMI Receiver</p><p>Remark E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network 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 | | | | | | | | | | | | | | |

**Test Instruments**

| Conducted Emission Shielding Room Test Site (843) | | | | |
|---|--------------|-----------------|---------------|-----------------|
| Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| Receiver | R&S | ESCI 7 | HKE-010 | Dec. 27, 2019 |
| LISN | R&S | ENV216 | HKE-002 | Dec. 27, 2019 |
| 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).

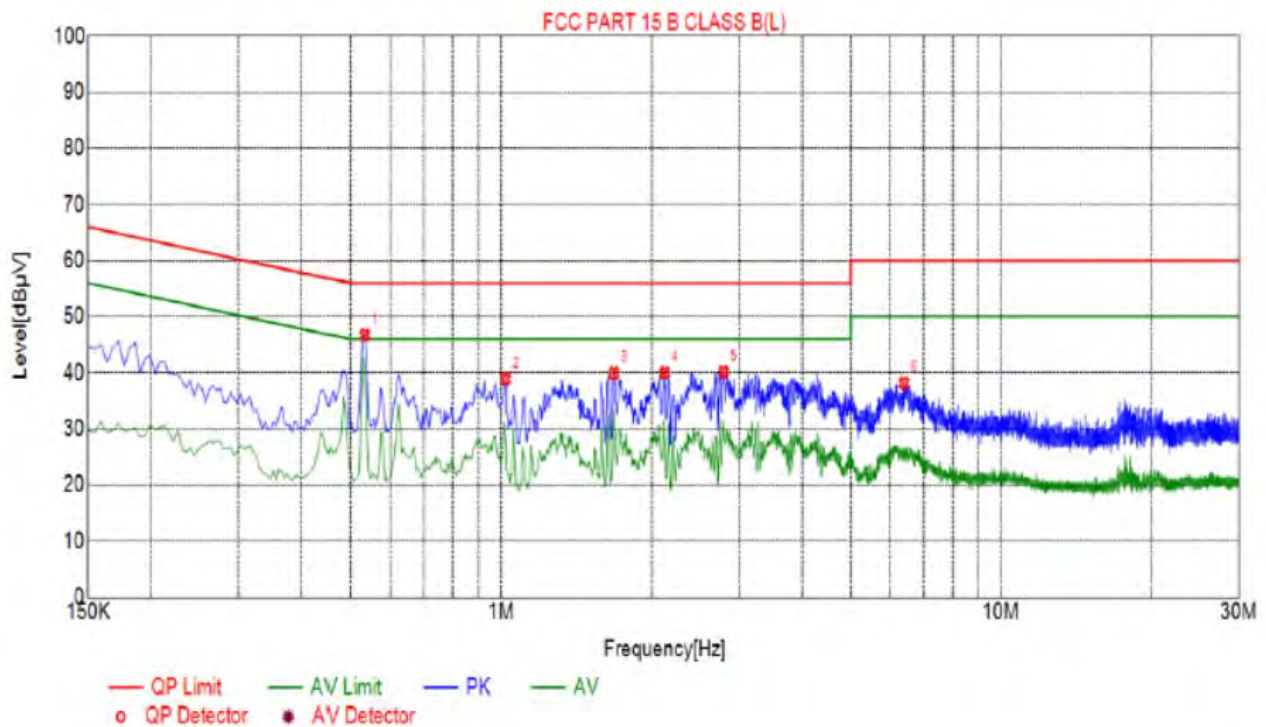


Test data

All the test modes completed for test. only the worst result of
5VDC From Micro USB (802.11b at 2412MHz) was reported

as below:

Test Specification: Line



| Suspected List | | | | | | |
|----------------|----------------|-----------------|----------------|-----------------|----------------|----------|
| NO. | Freq. [MHz] | Level [dBμV] | Factor [dB] | Limit [dBμV] | Margin [dB] | Detector |
| 1 | 0.5325 | 46.70 | 10.05 | 56.00 | 9.30 | PK |
| 2 | 1.0185 | 38.91 | 10.07 | 56.00 | 17.09 | PK |
| 3 | 1.6800 | 39.94 | 10.13 | 56.00 | 16.06 | PK |
| 4 | 2.1255 | 40.02 | 10.16 | 56.00 | 15.98 | PK |
| 5 | 2.7825 | 40.17 | 10.21 | 56.00 | 15.83 | PK |
| 6 | 6.4005 | 38.19 | 10.22 | 60.00 | 21.81 | PK |

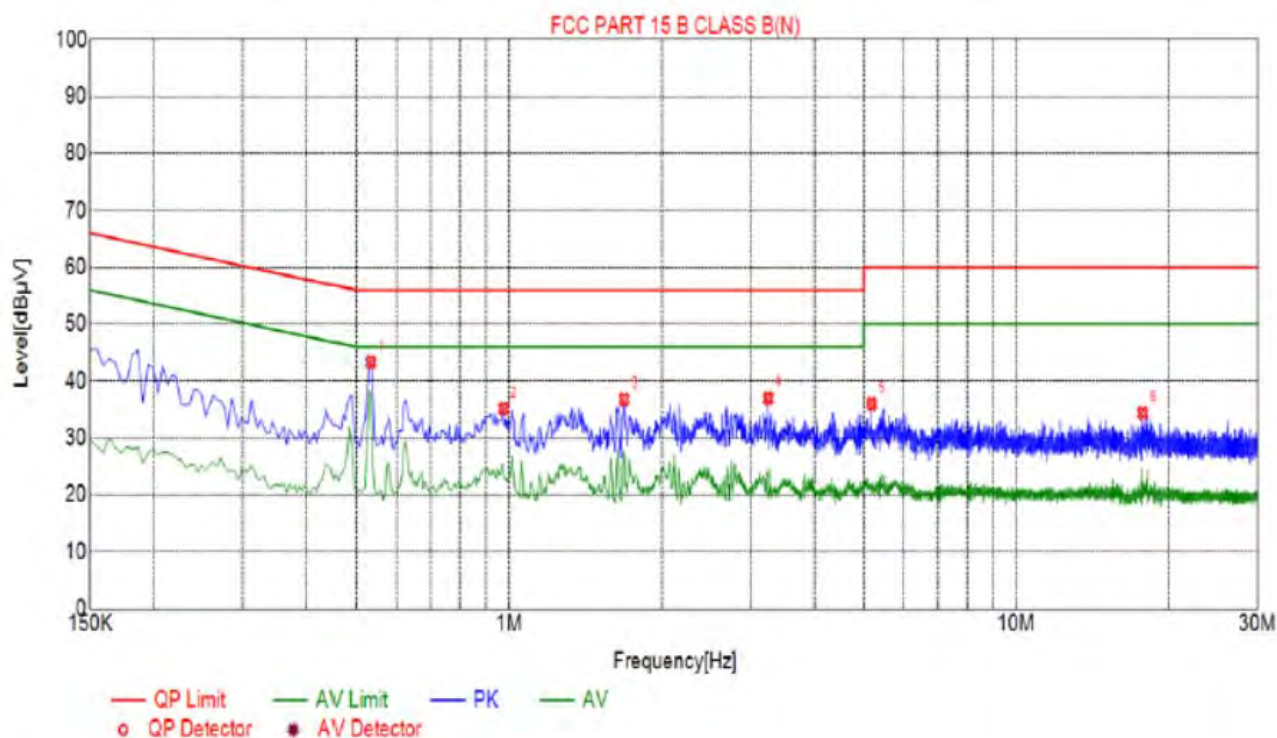
Remark: Margin = Limit – Level

Correction factor = Cable lose + LISN insertion loss

Level=Test receiver reading + correction factor



Test Specification: Neutral



| Suspected List | | | | | | |
|----------------|-------------|--------------|-------------|--------------|-------------|----------|
| NO. | Freq. [MHz] | Level [dBμV] | Factor [dB] | Limit [dBμV] | Margin [dB] | Detector |
| 1 | 0.5325 | 43.36 | 10.05 | 56.00 | 12.64 | PK |
| 2 | 0.9735 | 35.19 | 10.06 | 56.00 | 20.81 | PK |
| 3 | 1.6845 | 36.78 | 10.13 | 56.00 | 19.22 | PK |
| 4 | 3.2415 | 37.01 | 10.23 | 56.00 | 18.99 | PK |
| 5 | 5.1900 | 36.03 | 10.26 | 60.00 | 23.97 | PK |
| 6 | 17.7990 | 34.40 | 10.03 | 60.00 | 25.60 | PK |

Remark: Margin = Limit – Level

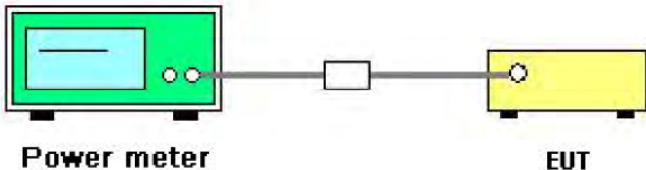
Correction factor = Cable lose + LISN insertion loss

Level=Test receiver reading + correction factor



4.2. Maximum Conducted Output Power

Test Specification

| | |
|--------------------------|--|
| Test Requirement: | FCC Part15 C Section 15.247 (b)(3) |
| Test Method: | KDB 558074 |
| Limit: | 30dBm |
| Test Setup: |  <p>The diagram illustrates the test setup. On the left is a green box labeled 'Power meter'. A cable connects it to a small white box labeled 'Attenuator'. Another cable connects the attenuator to a yellow box labeled 'EUT' (Equipment Under Test).</p> |
| Test Mode: | Transmitting mode with modulation |
| Test Procedure: | <ol style="list-style-type: none">1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v05.2. 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.3. Set to the maximum power setting and enable the EUT transmit continuously.4. Measure the Peak output power and record the results in the test report. |
| Test Result: | PASS |

Test Instruments

| RF Test Room | | | | |
|---------------------------|--------------|----------|---------------|-----------------|
| Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| Power meter | Agilent | E4417B | HKE-107 | Dec. 27, 2019 |
| Power Sensor | Agilent | E9327A | HKE-113 | Dec. 27, 2019 |
| RF cable | Times | 1-40G | HKE-034 | Dec. 27, 2019 |
| RF automatic control unit | Tonscend | JS0806-2 | HKE-060 | Dec. 27, 2019 |

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


**Test Data**

| TX 802.11b Mode | | | |
|--------------------------|-----------|-------------------------------------|-------|
| Test Channe | Frequency | Maximum Peak Conducted Output Power | LIMIT |
| | (MHz) | (dBm) | dBm |
| CH01 | 2412 | 8.57 | 30 |
| CH06 | 2437 | 8.55 | 30 |
| CH11 | 2462 | 8.49 | 30 |
| TX 802.11g Mode | | | |
| CH01 | 2412 | 8.12 | 30 |
| CH06 | 2437 | 8.41 | 30 |
| CH11 | 2462 | 7.79 | 30 |
| TX 802.11n20 Mode | | | |
| CH01 | 2412 | 7.59 | 30 |
| CH06 | 2437 | 7.67 | 30 |
| CH11 | 2462 | 6.86 | 30 |
| TX 802.11n40 Mode | | | |
| CH03 | 2422 | 6.69 | 30 |
| CH06 | 2437 | 6.75 | 30 |
| CH09 | 2452 | 6.36 | 30 |



4.3. Emission Bandwidth

Test Specification

| | |
|--------------------------|---|
| Test Requirement: | FCC Part15 C Section 15.247 (a)(2) |
| Test Method: | KDB 558074 |
| Limit: | >500kHz |
| Test Setup: |  Spectrum Analyzer EUT |
| Test Mode: | Transmitting mode with modulation |
| Test Procedure: | <ol style="list-style-type: none">1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v05.2. Set to the maximum power setting and enable the EUT transmit continuously.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.4. Measure and record the results in the test report. |
| Test Result: | PASS |

Test Instruments

| RF Test Room | | | | |
|------------------------------|--------------|----------|---------------|-----------------|
| Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| Spectrum analyzer | Agilent | N9020A | HKE-048 | Dec. 27, 2019 |
| RF Cable (9KHz-26.5GHz) | Tonscend | 170660 | N/A | Dec. 27, 2019 |
| RF automatic control unit | Tonscend | JS0806-2 | HKE-060 | Dec. 27, 2019 |

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

**Test data**

| Test channel | 6dB Emission Bandwidth (MHz) | | | |
|--------------|------------------------------|---------|--------------|--------------|
| | 802.11b | 802.11g | 802.11n(H20) | 802.11n(H40) |
| Lowest | 10.06 | 16.38 | 17.64 | 35.92 |
| Middle | 10.08 | 16.38 | 17.63 | 36.11 |
| Highest | 10.10 | 16.37 | 17.65 | 36.32 |
| Limit: | >500kHz | | | |
| Test Result: | PASS | | | |

Test plots as follows:



802.11b Modulation

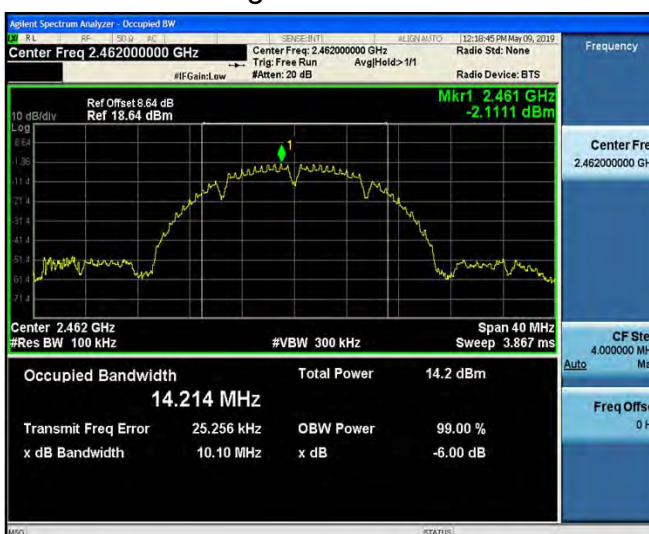
Lowest channel



Middle channel



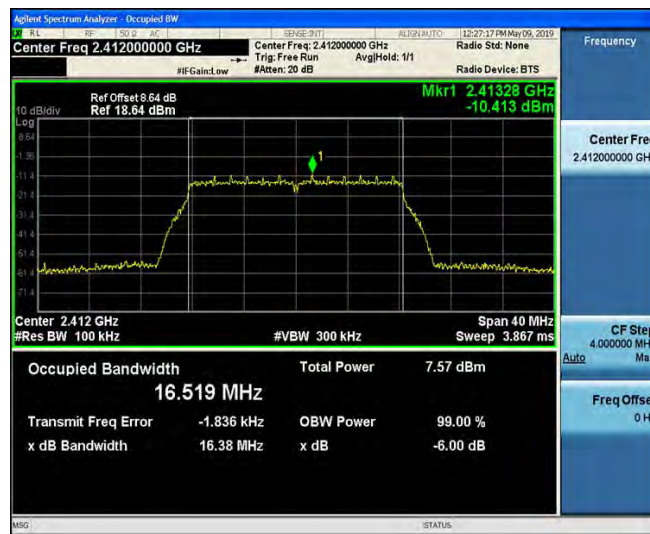
Highest channel



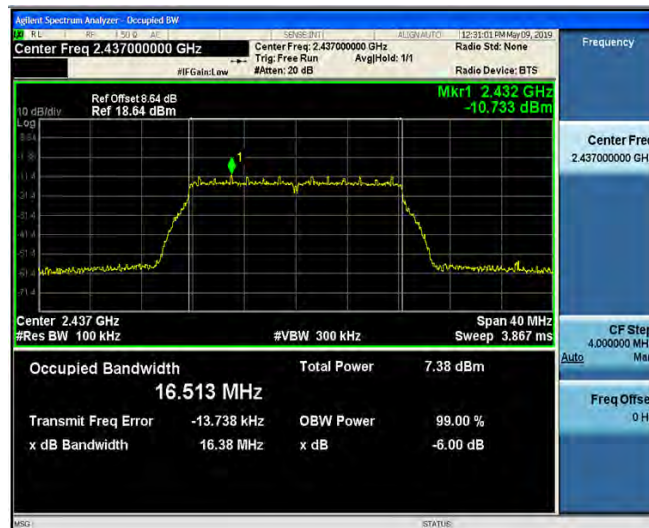


802.11g Modulation

Lowest channel



Middle channel



Highest channel



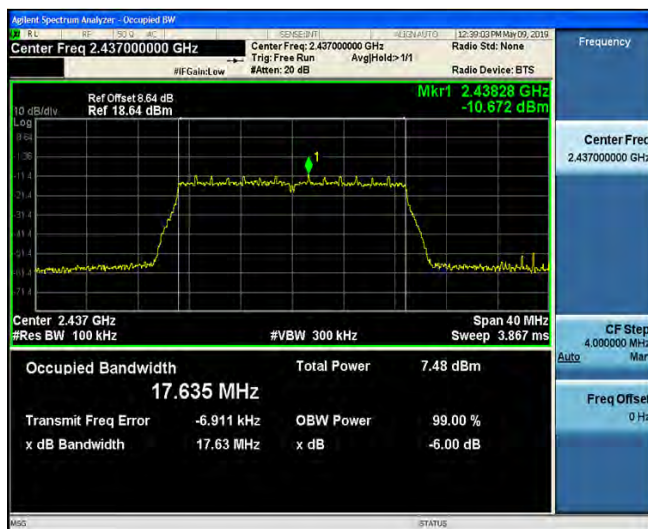


802.11n (HT20) Modulation

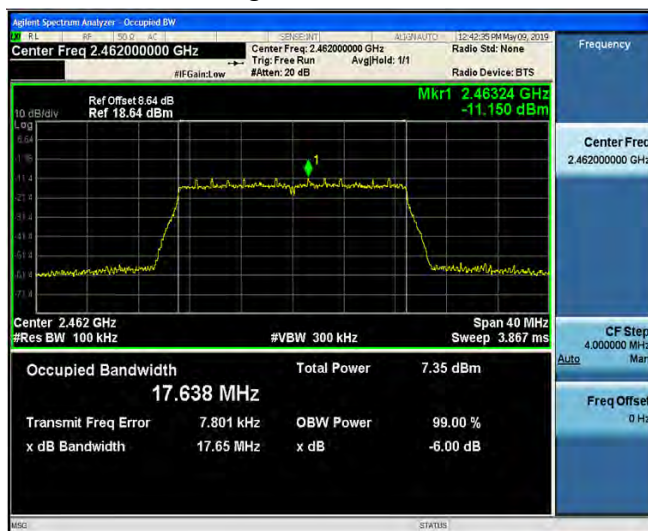
Lowest channel



Middle channel



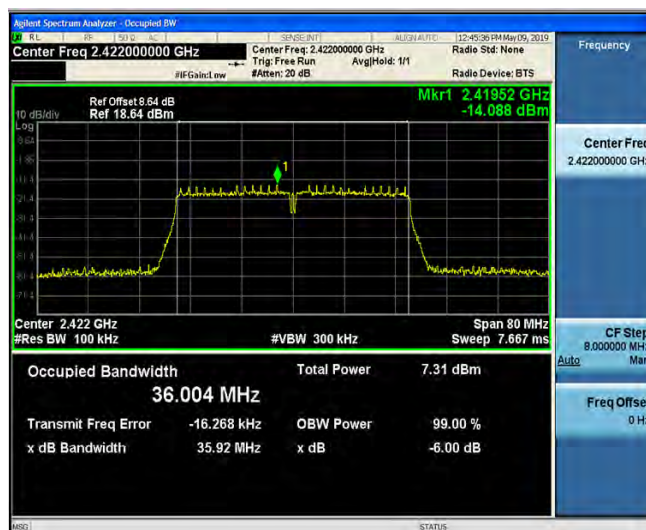
Highest channel



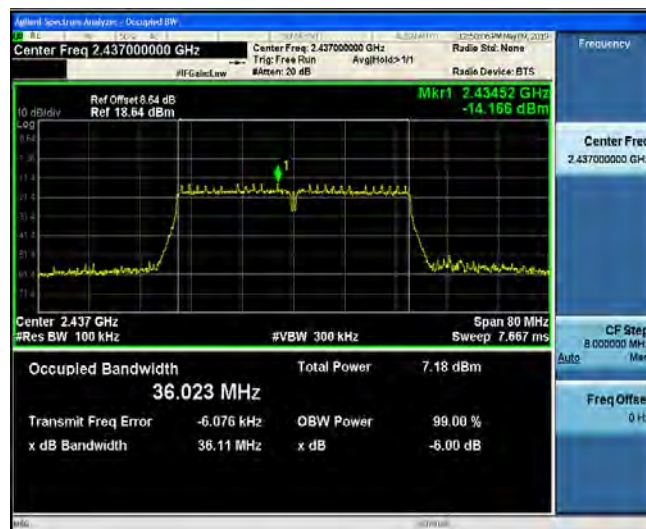


802.11n (HT40) Modulation

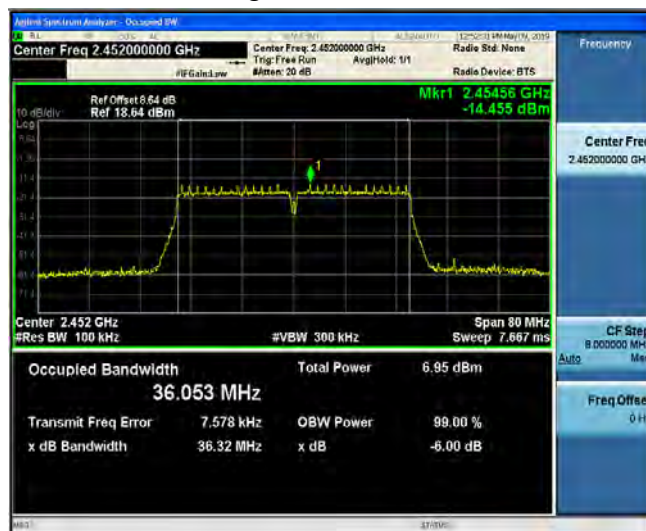
Lowest channel



Middle channel




Highest channel





4.4. Power Spectral Density

Test Specification

| | |
|--------------------------|--|
| Test Requirement: | FCC Part15 C Section 15.247 (e) |
| Test Method: | KDB 558074 |
| Limit: | The average power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission. |
| Test Setup: |  <p style="text-align: center;">Spectrum Analyzer EUT</p> |
| Test Mode: | Transmitting mode with modulation |
| Test Procedure: | <ol style="list-style-type: none"> 1. The testing follows Measurement procedure 10.2 method PKPSD of FCC KDB Publication No.558074 D01 DTS Meas. Guidance v05 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW): $3\text{ kHz} \leq \text{RBW} \leq 100\text{ kHz}$. Video bandwidth VBW $\geq 3 \times \text{RBW}$. Set the span to at least 1.5 times the OBW. 5. Detector = Peak, Sweep time = auto couple. 6. Employ trace averaging (Peak) mode over a minimum of 100 traces. Use the peak marker function to determine the maximum power level. 6. Measure and record the results in the test report. |
| Test Result: | PASS |

Test Instruments

| RF Test Room | | | | |
|---------------------------|--------------|----------|---------------|-----------------|
| Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| Spectrum analyzer | Agilent | N9020A | HKE-048 | Dec. 27, 2019 |
| RF Cable (9KHz-26.5GHz) | Tonscend | 170660 | N/A | Dec. 27, 2019 |
| RF automatic control unit | Tonscend | JS0806-2 | HKE-060 | Dec. 27, 2019 |

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

**Test data**

| EUT Set Mode | Channel | Result (dBm/30kHz) | Result (dBm/3kHz) |
|--|---------|--------------------|-------------------|
| 802.11b | Lowest | -6.49 | -16.49 |
| | Middle | -6.5 | -16.5 |
| | Highest | -2.11 | -12.11 |
| 802.11g | Lowest | -15.67 | -25.67 |
| | Middle | -15.44 | -25.44 |
| | Highest | -15.77 | -25.77 |
| 802.11n(H20) | Lowest | -15.12 | -25.12 |
| | Middle | -15.64 | -25.64 |
| | Highest | -16 | -26 |
| 802.11n(H40) | Lowest | -19.05 | -29.05 |
| | Middle | -19.05 | -29.05 |
| | Highest | -19.91 | -29.91 |
| 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



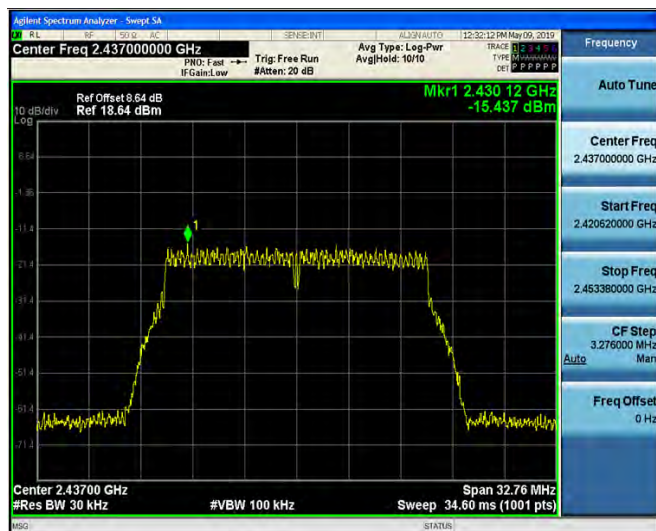


802.11g Modulation

Lowest channel



Middle channel



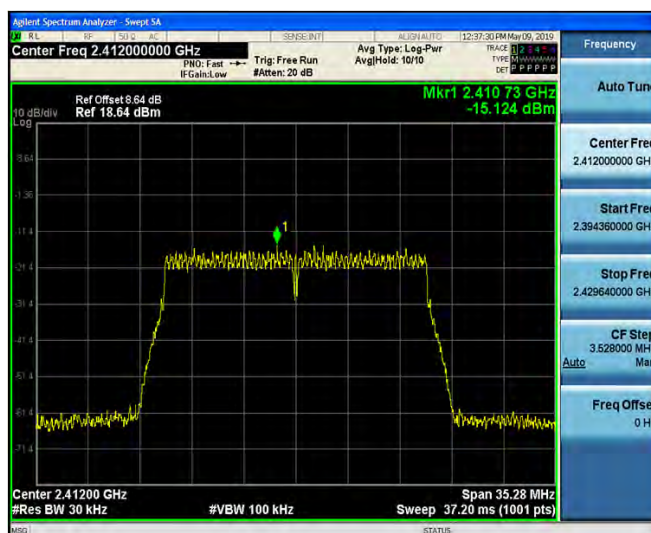
Highest channel





802.11n (HT20) Modulation

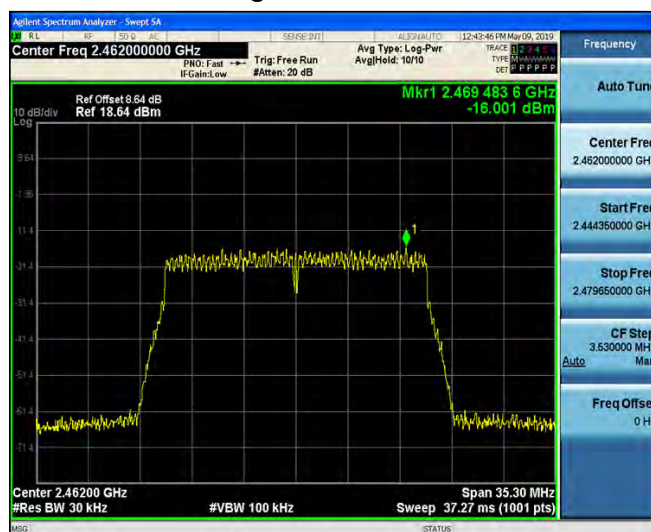
Lowest channel



Middle channel



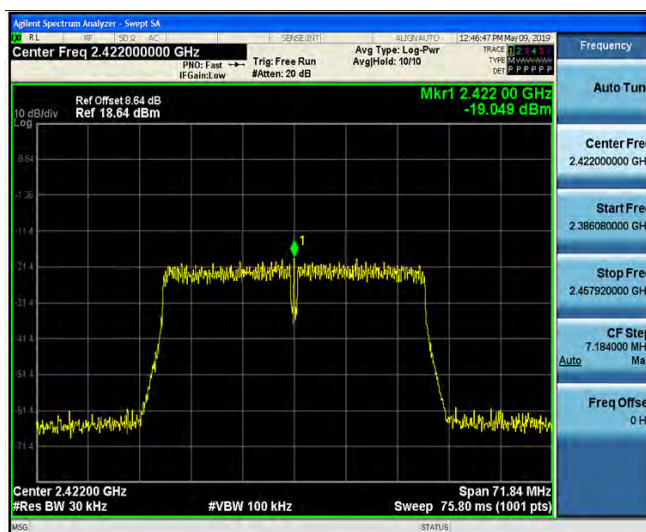
Highest channel



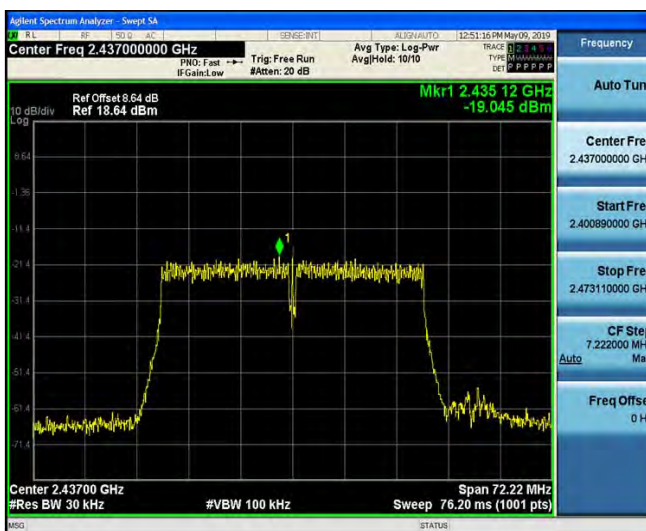


802.11n (HT40) Modulation

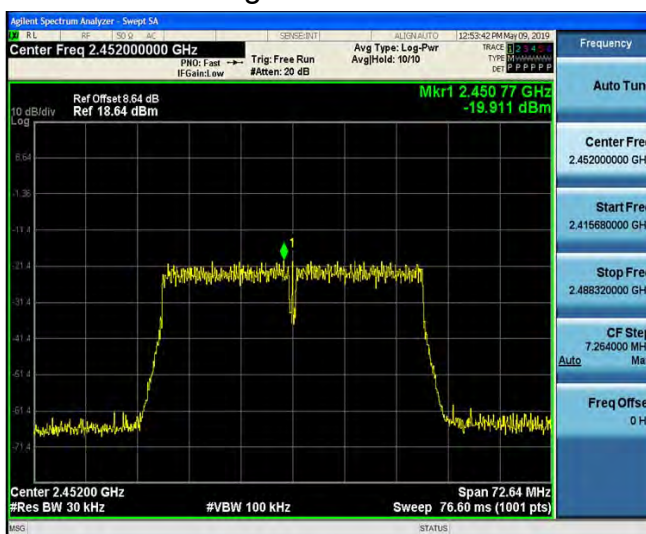
Lowest channel



Middle channel



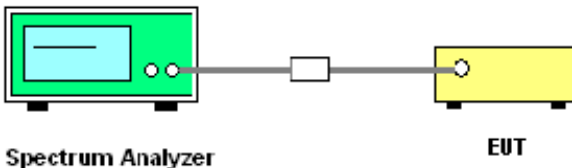
Highest channel





4.5. Conducted Band Edge and Spurious Emission Measurement

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: |  <p>Spectrum Analyzer EUT</p> |
| Test Mode: | Transmitting mode with modulation |
| Test Procedure: | <ol style="list-style-type: none">1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05.2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.3. Set to the maximum power setting and enable the EUT transmit continuously.4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. 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).5. Measure and record the results in the test report.6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band. |
| Test Result: | PASS |

**Test Instruments**

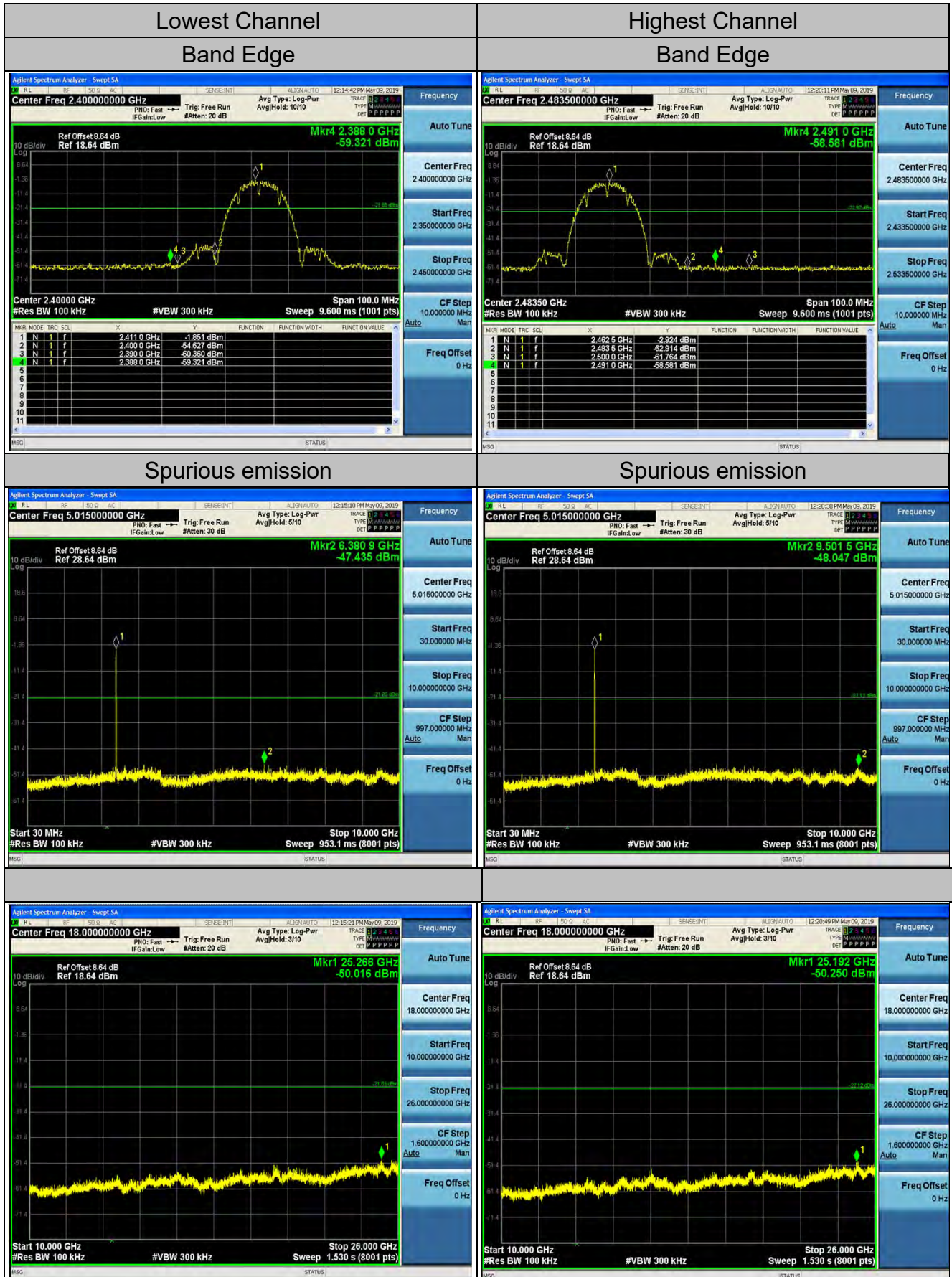
| RF Test Room | | | | |
|------------------------------|--------------|----------|---------------|-----------------|
| Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| Spectrum analyzer | Agilent | N9020A | HKE-048 | Dec. 27, 2019 |
| Signal generator | Agilent | N5183A | HKE-071 | Dec. 27, 2019 |
| RF Cable (9KHz-26.5GHz) | Tonscend | 170660 | N/A | Dec. 27, 2019 |
| RF automatic control unit | Tonscend | JS0806-2 | HKE-060 | Dec. 27, 2019 |

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



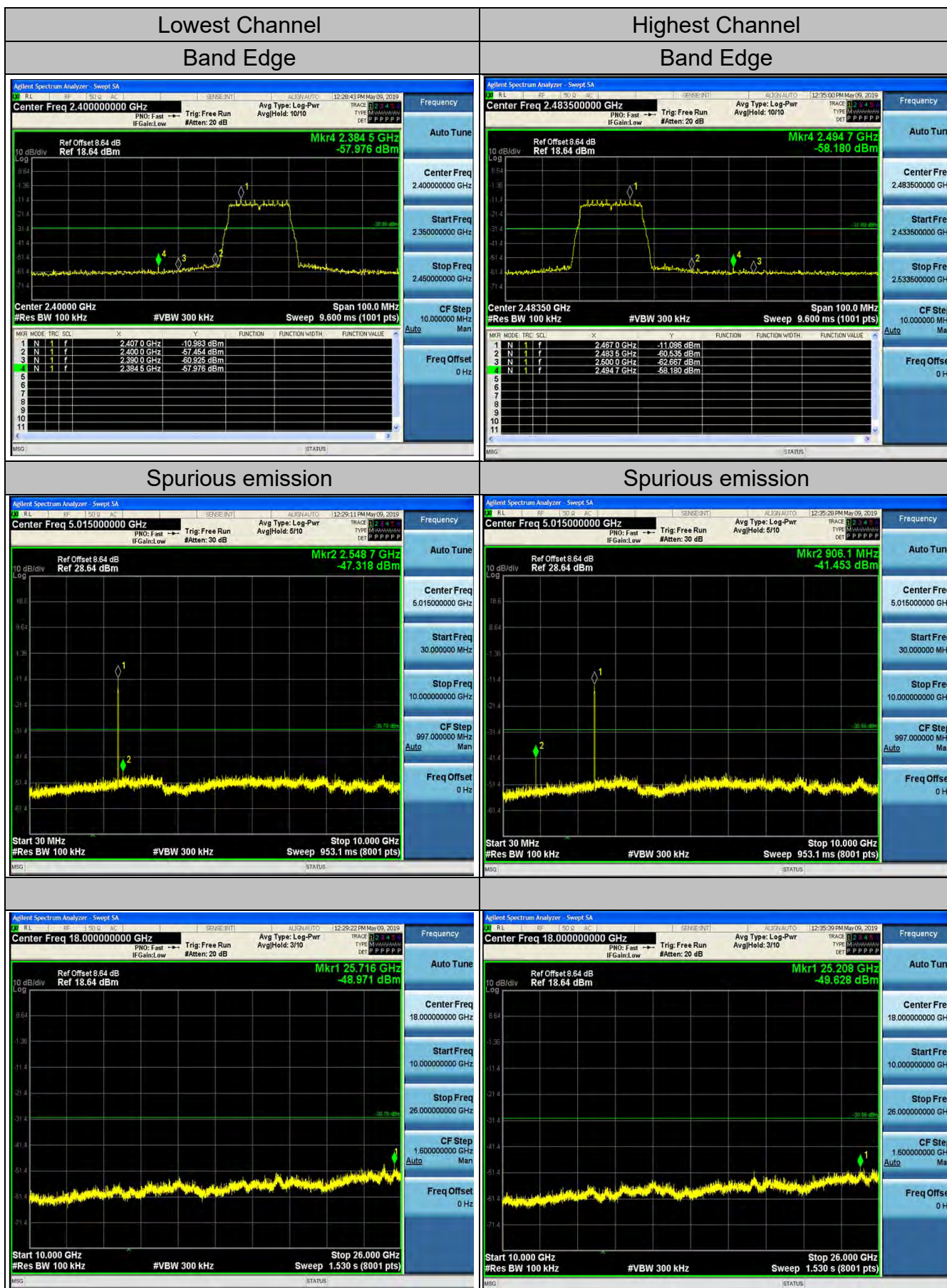
Test Data

802.11b Modulation



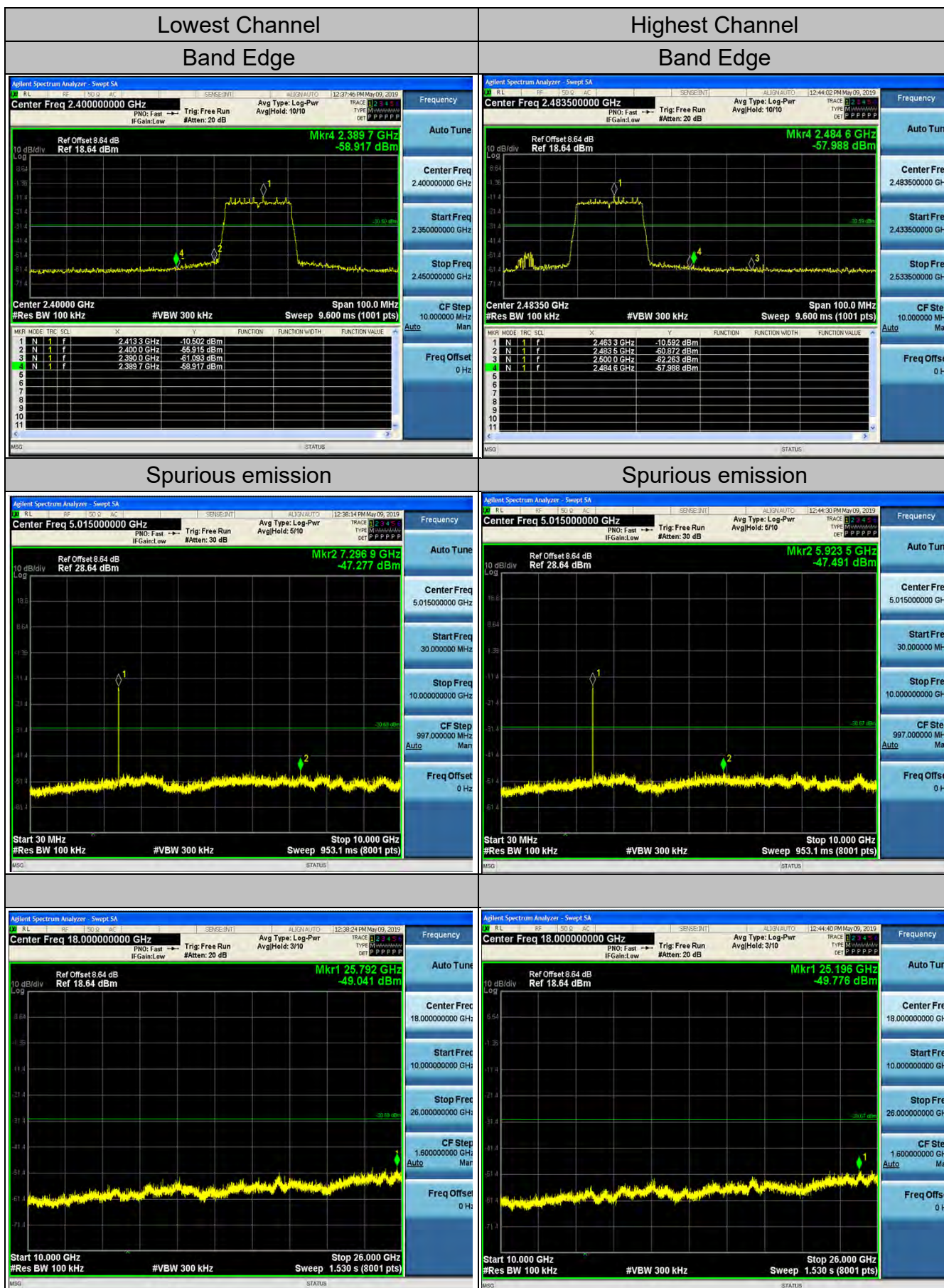


802.11g Modulation



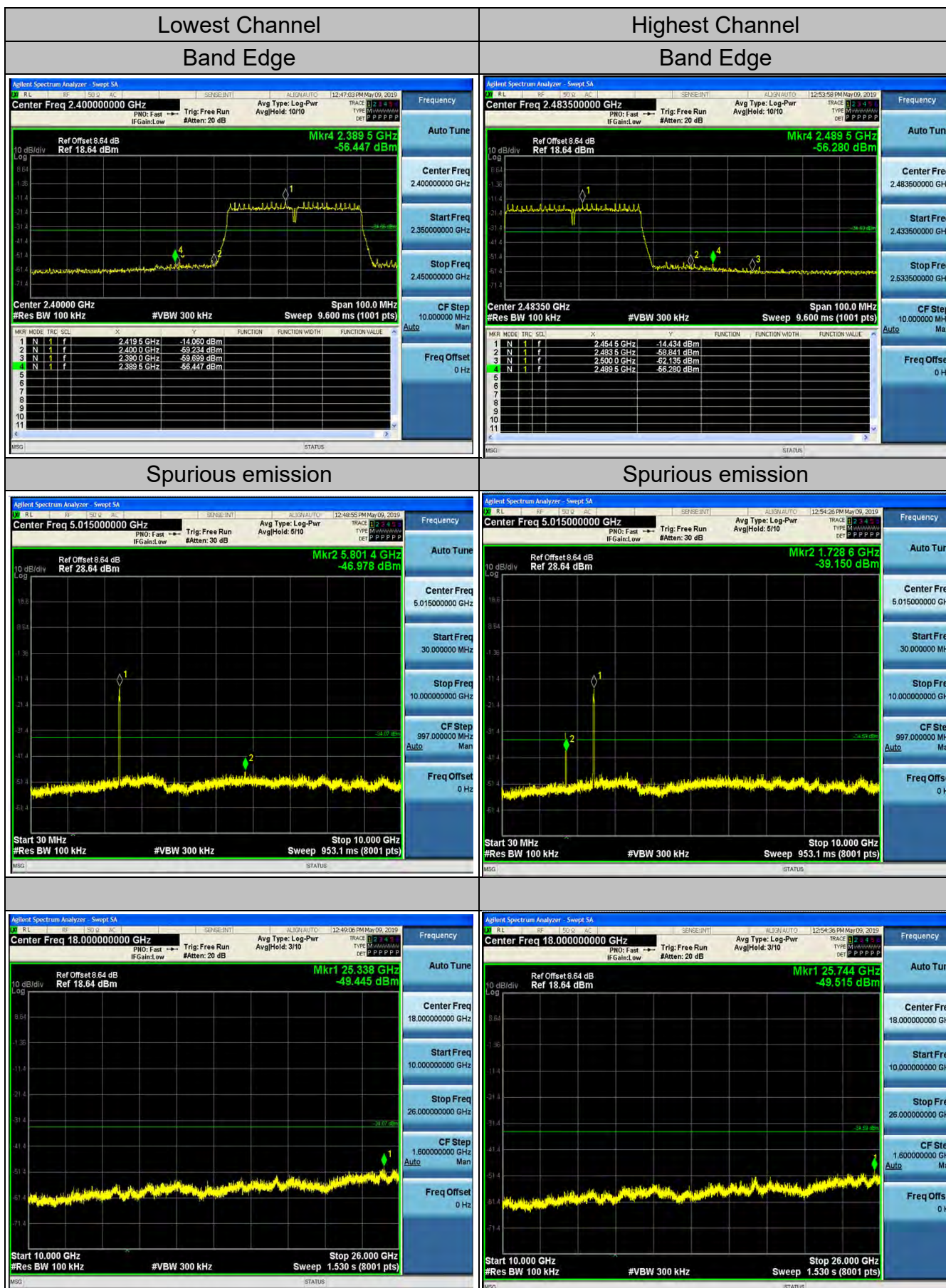


802.11n (HT20) Modulation





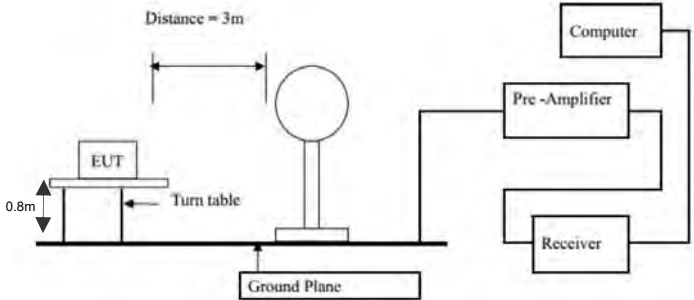
802.11n (HT40) Modulation

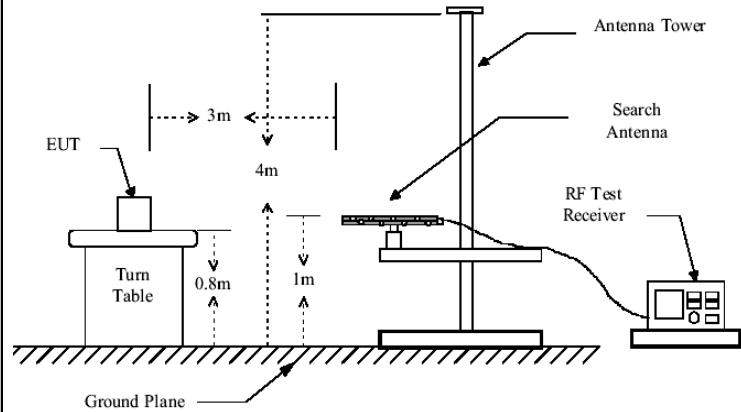




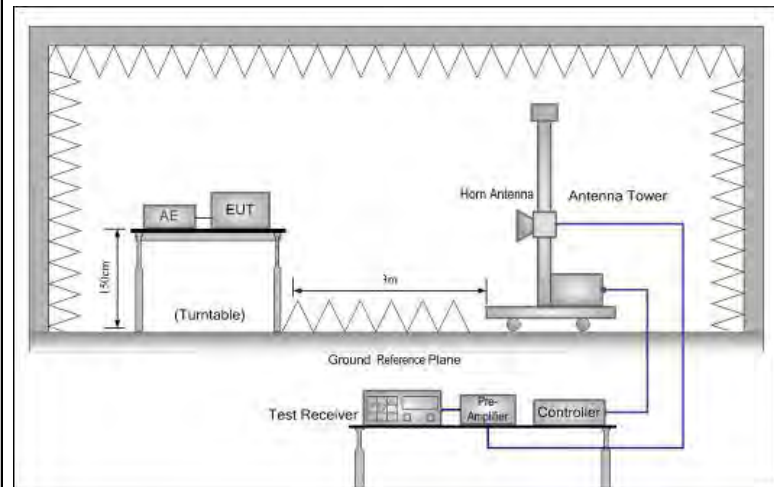
4.6. Radiated Spurious Emission Measurement

Test Specification

| | | | | |
|------------------------------|--|-----------------------------------|-------------------------------|------------------|
| Test Requirement: | FCC Part15 C Section 15.209 | | | |
| Test Method: | ANSI C63.10: 2013 | | | |
| Frequency Range: | 9 kHz to 25 GHz | | | |
| Measurement Distance: | 3 m | | | |
| Antenna Polarization: | Horizontal & Vertical | | | |
| Operation mode: | Transmitting mode with modulation | | | |
| Receiver Setup: | Frequency | Detector | RBW | VBW |
| | 9kHz- 150kHz | Quasi-peak | 200Hz | 1kHz |
| | 150kHz- 30MHz | Quasi-peak | 9kHz | 30kHz |
| | 30MHz-1GHz | Quasi-peak | 100KHz | 300KHz |
| | Above 1GHz | Peak | 1MHz | 3MHz |
| Limit: | | | | Remark |
| | | | | Quasi-peak Value |
| | | | | Quasi-peak Value |
| | | | | Quasi-peak Value |
| | | | | Peak Value |
| | | | | Average Value |
| | Frequency | Field Strength (microvolts/meter) | Measurement Distance (meters) | |
| | 0.009-0.490 | 2400/F(KHz) | 300 | |
| | 0.490-1.705 | 24000/F(KHz) | 30 | |
| | 1.705-30 | 30 | 30 | |
| Test setup: | Frequency | Field Strength (microvolts/meter) | Measurement Distance (meters) | Detector |
| | Above 1GHz | 500 | 3 | Average |
| | | 5000 | 3 | Peak |
| | For radiated emissions below 30MHz | | | |
| |  | | | |
| | 30MHz to 1GHz | | | |



Above 1GHz



Test Procedure:

- For the radiated emission test below 1GHz:
The EUT was placed on a turntable with 0.8 meter above ground. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high PASS filter are used for the test in order to get better signal level.
For the radiated emission test above 1GHz:
Place the measurement antenna on a turntable with 1.5 meter above ground, which is away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which



| | |
|---------------|--|
| | <p>maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.</p> <p>3. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level</p> <p>4. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.</p> <p>5. Use the following spectrum analyzer settings:</p> <ul style="list-style-type: none">(1) Span shall wide enough to fully capture the emission being measured;(2) Set RBW=100 kHz for $f < 1$ GHz; VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold;(3) Set RBW = 1 MHz, VBW= 3MHz for $f \geq 1$ GHz for peak measurement. <p>For average measurement: VBW = 10 Hz, when duty cycle is no less than 98 percent. VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.</p> |
| Test results: | PASS |

**Test Instruments**

| Radiated Emission Test Site (966) | | | | |
|--|---------------------|-----------------|----------------------|------------------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| Receiver | R&S | ESCI-7 | HKE-010 | Dec. 27, 2019 |
| Spectrum analyzer | Agilent | N9020A | HKE-048 | Dec. 27, 2019 |
| Preamplifier | EMCI | EMC051845 SE | HKE-015 | Dec. 27, 2019 |
| Preamplifier | Agilent | 83051A | HKE-016 | Dec. 27, 2019 |
| Loop antenna | Schwarzbeck | FMZB 1519 B | HKE-014 | Dec. 26, 2019 |
| Broadband antenna | Schwarzbeck | VULB 9163 | HKE-012 | Dec. 26, 2019 |
| Horn antenna | Schwarzbeck | 9120D | HKE-013 | Dec. 26, 2019 |
| Antenna Mast | Keleto | CC-A-4M | N/A | N/A |
| Position controller | Taiwan MF | MF7802 | HKE-011 | Dec. 27, 2019 |
| Radiated test software | Tonscend | TS+ Rev 2.5.0.0 | HKE-082 | N/A |
| RF cable (9KHz-1GHz) | Times | 381806-001 | N/A | N/A |
| RF cable | Times | 1-40G | HKE-034 | Dec. 27, 2019 |

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

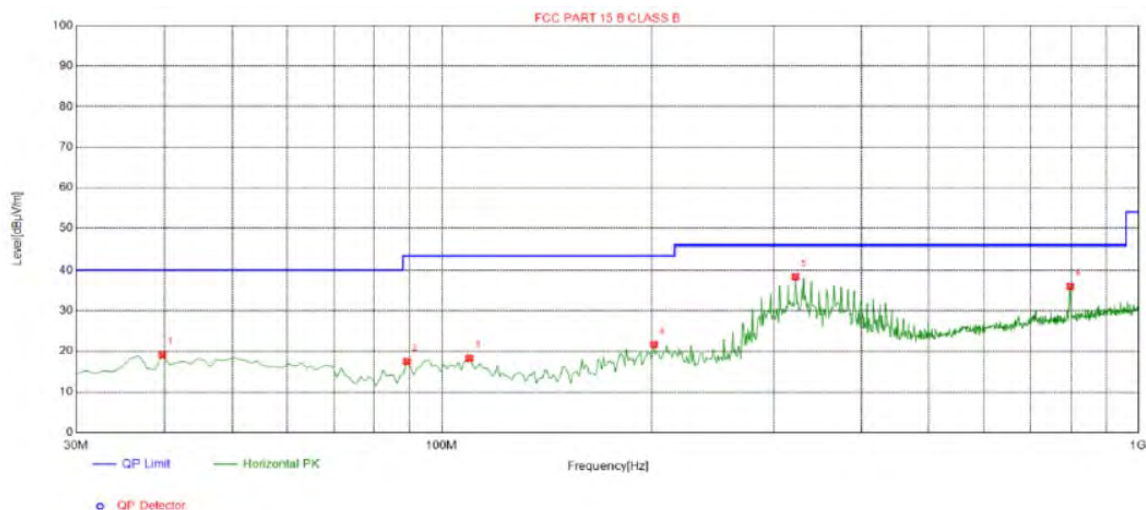


Test Data

All the test modes completed for test. only the worst result of
5VDC From Micro USB (802.11b at 2412MHz) was reported

Below 1GHz

Horizontal



Suspected List

| NO. | Freq. [MHz] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity |
|-----|----------------|-------------------|----------------|-------------------|----------------|----------------|--------------|------------|
| 1 | 39.7000 | 19.15 | -14.64 | 40.00 | 20.85 | 100 | 359 | Horizontal |
| 2 | 89.1700 | 17.51 | -17.27 | 43.50 | 25.99 | 100 | 12 | Horizontal |
| 3 | 109.540 | 18.28 | -15.43 | 43.50 | 25.22 | 100 | 12 | Horizontal |
| 4 | 201.690 | 21.68 | -15.02 | 43.50 | 21.82 | 100 | 262 | Horizontal |
| 5 | 321.970 | 38.41 | -12.00 | 46.00 | 7.59 | 100 | 238 | Horizontal |
| 6 | 799.210 | 35.96 | -3.13 | 46.00 | 10.04 | 100 | 94 | Horizontal |

Remark:

Margin = Limit – Level

Level=Test receiver reading + factor

Factor= Antenna factor + cable loss- Amp factor

**Vertical****Suspected List**

| NO. | Freq. [MHz] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity |
|-----|-------------|----------------|-------------|----------------|-------------|-------------|-----------|----------|
| 1 | 35.8200 | 28.30 | -15.88 | 40.00 | 11.70 | 100 | 106 | Vertical |
| 2 | 67.8300 | 25.38 | -17.13 | 40.00 | 14.62 | 100 | 146 | Vertical |
| 3 | 89.1700 | 24.23 | -17.27 | 43.50 | 19.27 | 100 | 347 | Vertical |
| 4 | 201.690 | 27.47 | -15.02 | 43.50 | 16.03 | 100 | 347 | Vertical |
| 5 | 365.620 | 35.04 | -11.15 | 46.00 | 10.96 | 100 | 172 | Vertical |
| 6 | 710.940 | 31.10 | -4.86 | 46.00 | 14.90 | 100 | 146 | Vertical |

Remark:

Margin = Limit – Level

Level=Test receiver reading + factor

Factor= Antenna factor + cable loss- Amp factor

Harmonics and Spurious Emissions**Frequency Range (9 kHz-30MHz)**

| Frequency (MHz) | Level@3m (dBμV/m) | Limit@3m (dBμV/m) |
|-----------------|-------------------|-------------------|
| -- | -- | -- |
| -- | -- | -- |
| -- | -- | -- |
| -- | -- | -- |

Note: 1. Emission Level=Reading+ Cable loss+ Antenna factor-Amp factor

2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement

**Above 1GHz****RADIATED EMISSION TEST**

LOW CH1 (802.11b Mode)/2412

Horizontal:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4824 | 61.54 | -3.64 | 57.9 | 74 | -16.1 | peak |
| 4824 | 48.27 | -3.64 | 44.63 | 54 | -9.37 | AVG |
| 7236 | 56.42 | -0.95 | 55.47 | 74 | -18.53 | peak |
| 7236 | 41.89 | -0.95 | 40.94 | 54 | -13.06 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4824 | 64.64 | -3.64 | 61 | 74 | -13 | peak |
| 4824 | 48.52 | -3.64 | 44.88 | 54 | -9.12 | AVG |
| 7236 | 55.65 | -0.95 | 54.7 | 74 | -19.3 | peak |
| 7236 | 42.46 | -0.95 | 41.51 | 54 | -12.49 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |



MID CH6 (802.11b Mode)/2437

Horizontal:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4874 | 62.32 | -3.51 | 58.81 | 74 | -15.19 | peak |
| 4874 | 48.04 | -3.51 | 44.53 | 54 | -9.47 | AVG |
| 7311 | 59.27 | -0.82 | 58.45 | 74 | -15.55 | peak |
| 7311 | 38.94 | -0.82 | 38.12 | 54 | -15.88 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4874 | 58.56 | -3.51 | 55.05 | 74 | -18.95 | peak |
| 4874 | 44.99 | -3.51 | 41.48 | 54 | -12.52 | AVG |
| 7311 | 53.65 | -0.82 | 52.83 | 74 | -21.17 | peak |
| 7311 | 41.56 | -0.82 | 40.74 | 54 | -13.26 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |



HIGH CH11 (802.11b Mode)/2462

Horizontal:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4924 | 59.81 | -3.43 | 56.38 | 74 | -17.62 | peak |
| 4924 | 48.35 | -3.43 | 44.92 | 54 | -9.08 | AVG |
| 7386 | 55.62 | -0.75 | 54.87 | 74 | -19.13 | peak |
| 7386 | 38.09 | -0.75 | 37.34 | 54 | -16.66 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4924 | 63.18 | -3.43 | 59.75 | 74 | -14.25 | peak |
| 4924 | 44.03 | -3.43 | 40.6 | 54 | -13.4 | AVG |
| 7386 | 52.97 | -0.75 | 52.22 | 74 | -21.78 | peak |
| 7386 | 40.06 | -0.75 | 39.31 | 54 | -14.69 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Remark :

- (1) Measuring frequencies from 1 GHz to the 25 GHz.
- (2) "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency.
- (3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
- (4) Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 9KHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
- (6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.



LOW CH1 (802.11g Mode)/2412

Horizontal:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4824 | 62.03 | -3.64 | 58.39 | 74 | -15.61 | peak |
| 4824 | 47.52 | -3.64 | 43.88 | 54 | -10.12 | AVG |
| 7236 | 54.35 | -0.95 | 53.4 | 74 | -20.6 | peak |
| 7236 | 41.46 | -0.95 | 40.51 | 54 | -13.49 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4824 | 60.74 | -3.64 | 57.1 | 74 | -16.9 | peak |
| 4824 | 49.52 | -3.64 | 45.88 | 54 | -8.12 | AVG |
| 7236 | 53.70 | -0.95 | 52.75 | 74 | -21.25 | peak |
| 7236 | 42.94 | -0.95 | 41.99 | 54 | -12.01 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |



MID CH6 (802.11g Mode)/2437

Horizontal:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4874 | 62.07 | -3.51 | 58.56 | 74 | -15.44 | peak |
| 4874 | 44.34 | -3.51 | 40.83 | 54 | -13.17 | AVG |
| 7311 | 60.19 | -0.82 | 59.37 | 74 | -14.63 | peak |
| 7311 | 42.17 | -0.82 | 41.35 | 54 | -12.65 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4874 | 60.86 | -3.51 | 57.35 | 74 | -16.65 | peak |
| 4874 | 48.96 | -3.51 | 45.45 | 54 | -8.55 | AVG |
| 7311 | 53.74 | -0.82 | 52.92 | 74 | -21.08 | peak |
| 7311 | 41.78 | -0.82 | 40.96 | 54 | -13.04 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |



HIGH CH11 (802.11g Mode)/2462

Horizontal:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4924 | 62.75 | -3.43 | 59.32 | 74 | -14.68 | peak |
| 4924 | 44.57 | -3.43 | 41.14 | 54 | -12.86 | AVG |
| 7386 | 57.35 | -0.75 | 56.6 | 74 | -17.4 | peak |
| 7386 | 37.58 | -0.75 | 36.83 | 54 | -17.17 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4924 | 55.64 | -3.43 | 52.21 | 74 | -21.79 | peak |
| 4924 | 46.87 | -3.43 | 43.44 | 54 | -10.56 | AVG |
| 7386 | 58.82 | -0.75 | 58.07 | 74 | -15.93 | peak |
| 7386 | 36.16 | -0.75 | 35.41 | 54 | -18.59 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Remark :

- (1) Measuring frequencies from 1 GHz to the 25 GHz.
- (2) "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency.
- (3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
- (4) Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 9KHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
- (6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.



LOW CH1 (802.11n/H20 Mode)/2412

Horizontal:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4824 | 62.25 | -3.64 | 58.61 | 74 | -15.39 | peak |
| 4824 | 44.96 | -3.64 | 41.32 | 54 | -12.68 | AVG |
| 7236 | 56.67 | -0.95 | 55.72 | 74 | -18.28 | peak |
| 7236 | 41.94 | -0.95 | 40.99 | 54 | -13.01 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4824 | 63.45 | -3.64 | 59.81 | 74 | -14.19 | peak |
| 4824 | 45.74 | -3.64 | 42.1 | 54 | -11.9 | AVG |
| 7236 | 52.43 | -0.95 | 51.48 | 74 | -22.52 | peak |
| 7236 | 43.28 | -0.95 | 42.33 | 54 | -11.67 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |



MID CH6 (802.11n/H20 Mode)/2437

Horizontal:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4874.00 | 66.33 | -3.51 | 62.82 | 74.00 | -11.18 | peak |
| 4874.00 | 49.90 | -3.51 | 46.39 | 54.00 | -7.61 | AVG |
| 7311.00 | 58.14 | -0.82 | 57.32 | 74.00 | -16.68 | peak |
| 7311.00 | 42.37 | -0.82 | 41.55 | 54.00 | -12.45 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4874.00 | 61.27 | -3.51 | 57.76 | 74.00 | -16.24 | peak |
| 4874.00 | 49.32 | -3.51 | 45.81 | 54.00 | -8.19 | AVG |
| 7311.00 | 57.43 | -0.82 | 56.61 | 74.00 | -17.39 | peak |
| 7311.00 | 40.31 | -0.82 | 39.49 | 54.00 | -14.51 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |



HIGH CH11 (802.11n/H20 Mode)/2462

Horizontal:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4924 | 61.47 | -3.43 | 58.04 | 74 | -15.96 | peak |
| 4924 | 48.19 | -3.43 | 44.76 | 54 | -9.24 | AVG |
| 7386 | 54.58 | -0.75 | 53.83 | 74 | -20.17 | peak |
| 7386 | 40.34 | -0.75 | 39.59 | 54 | -14.41 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4924 | 59.55 | -3.43 | 56.12 | 74 | -17.88 | peak |
| 4924 | 46.79 | -3.43 | 43.36 | 54 | -10.64 | AVG |
| 7386 | 56.82 | -0.75 | 56.07 | 74 | -17.93 | peak |
| 7386 | 39.64 | -0.75 | 38.89 | 54 | -15.11 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |



LOW CH3 (802.11n/H40 Mode)/2422

Horizontal:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4844 | 61.57 | -3.63 | 57.94 | 74 | -16.06 | peak |
| 4844 | 45.88 | -3.63 | 42.25 | 54 | -11.75 | AVG |
| 7266 | 58.75 | -0.94 | 57.81 | 74 | -16.19 | peak |
| 7266 | 45.53 | -0.94 | 44.59 | 54 | -9.41 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4844 | 63.28 | -3.63 | 59.65 | 74 | -14.35 | peak |
| 4844 | 45.27 | -3.63 | 41.64 | 54 | -12.36 | AVG |
| 7266 | 59.27 | -0.94 | 58.33 | 74 | -15.67 | peak |
| 7266 | 44.09 | -0.94 | 43.15 | 54 | -10.85 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |



MID CH6 (802.11n/H40 Mode)/2437

Horizontal:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4874 | 59.31 | -3.51 | 55.8 | 74 | -18.2 | peak |
| 4874 | 45.57 | -3.51 | 42.06 | 54 | -11.94 | AVG |
| 7311 | 58.63 | -0.82 | 57.81 | 74 | -16.19 | peak |
| 7311 | 45.39 | -0.82 | 44.57 | 54 | -9.43 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4874 | 58.09 | -3.51 | 54.58 | 74 | -19.42 | peak |
| 4874 | 45.99 | -3.51 | 42.48 | 54 | -11.52 | AVG |
| 7311 | 55.02 | -0.82 | 54.2 | 74 | -19.8 | peak |
| 7311 | 37.93 | -0.82 | 37.11 | 54 | -16.89 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |



HIGH CH9 (802.11n/H40 Mode)/2452

Horizontal:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4904 | 60.23 | -3.43 | 56.8 | 74 | -17.2 | peak |
| 4904 | 43.79 | -3.43 | 40.36 | 54 | -13.64 | AVG |
| 7356 | 54.69 | -0.75 | 53.94 | 74 | -20.06 | peak |
| 7356 | 40.97 | -0.75 | 40.22 | 54 | -13.78 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4904 | 61.71 | -3.43 | 58.28 | 74 | -15.72 | peak |
| 4904 | 45.56 | -3.43 | 42.13 | 54 | -11.87 | AVG |
| 7356 | 52.38 | -0.75 | 51.63 | 74 | -22.37 | peak |
| 7356 | 40.74 | -0.75 | 39.99 | 54 | -14.01 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Remark :

- (1) Measuring frequencies from 1 GHz to the 25 GHz.
- (2) "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency.
- (3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
- (4) Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 9KHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
- (6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.

**Test Result of Radiated Spurious at Band edges**

Operation Mode:
802.11b Mode TX CH Low (2412MHz)

Horizontal

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2310 | 52.62 | -5.81 | 46.81 | 74 | -27.19 | peak |
| 2310 | / | -5.81 | / | 54 | / | AVG |
| 2390 | 52.17 | -5.84 | 46.33 | 74 | -27.67 | peak |
| 2390 | 44.56 | -5.84 | 38.72 | 54 | -15.28 | AVG |
| 2400 | 55.15 | -5.84 | 49.31 | 74 | -24.69 | peak |
| 2400 | 40.75 | -5.84 | 34.91 | 54 | -19.09 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2310 | 54.19 | -5.81 | 48.38 | 74 | -25.62 | peak |
| 2310 | / | -5.81 | / | 54 | / | AVG |
| 2390 | 61.35 | -5.84 | 55.51 | 74 | -18.49 | peak |
| 2390 | 47.44 | -5.84 | 41.6 | 54 | -12.4 | AVG |
| 2400 | 57.35 | -5.84 | 51.51 | 74 | -22.49 | peak |
| 2400 | 45.96 | -5.84 | 40.12 | 54 | -13.88 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |



Operation Mode: TX CH High (2462MHz)

Horizontal

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2483.50 | 57.05 | -5.65 | 51.4 | 74 | -22.6 | peak |
| 2483.50 | / | -5.65 | / | 54 | / | AVG |
| 2500.00 | 53.35 | -5.65 | 47.7 | 74 | -26.3 | peak |
| 2500.00 | / | -5.65 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|--|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2483.50 | 53.89 | -5.65 | 48.24 | 74 | -25.76 | peak |
| 2483.50 | / | -5.65 | / | 54 | / | AVG |
| 2500.00 | 48.39 | -5.65 | 42.74 | 74 | -31.26 | peak |
| 2500.00 | / | -5.65 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |
| Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit. | | | | | | |



Operation Mode: 802.11g Mode TX CH Low (2412MHz)

Horizontal

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2310 | 56.56 | -5.81 | 50.75 | 74 | -23.25 | peak |
| 2310 | / | -5.81 | / | 54 | / | AVG |
| 2390 | 63.48 | -5.84 | 57.64 | 74 | -16.36 | peak |
| 2390 | 44.31 | -5.84 | 38.47 | 54 | -15.53 | AVG |
| 2400 | 59.77 | -5.84 | 53.93 | 74 | -20.07 | peak |
| 2400 | 47.03 | -5.84 | 41.19 | 54 | -12.81 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2310 | 55.21 | -5.81 | 49.4 | 74 | -24.6 | peak |
| 2310 | / | -5.81 | / | 54 | / | AVG |
| 2390 | 58.99 | -5.84 | 53.15 | 74 | -20.85 | peak |
| 2390 | 47.88 | -5.84 | 42.04 | 54 | -11.96 | AVG |
| 2400 | 56.85 | -5.84 | 51.01 | 74 | -22.99 | peak |
| 2400 | 47.52 | -5.84 | 41.68 | 54 | -12.32 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |



Operation Mode: TX CH High (2462MHz)

Horizontal

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2483.50 | 57.25 | -5.65 | 51.6 | 74 | -22.4 | peak |
| 2483.50 | / | -5.65 | / | 54 | / | AVG |
| 2500.00 | 49.47 | -5.65 | 43.82 | 74 | -30.18 | peak |
| 2500.00 | / | -5.65 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|--|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2483.50 | 58.11 | -5.65 | 52.46 | 74 | -21.54 | peak |
| 2483.50 | / | -5.65 | / | 54 | / | AVG |
| 2500.00 | 53.02 | -5.65 | 47.37 | 74 | -26.63 | peak |
| 2500.00 | / | -5.65 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |
| Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit. | | | | | | |



Operation Mode: 802.11n/H20 Mode TX CH Low (2412MHz)

Horizontal

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2310 | 58.46 | -5.81 | 52.65 | 74 | -21.35 | peak |
| 2310 | / | -5.81 | / | 54 | / | AVG |
| 2390 | 61.91 | -5.84 | 56.07 | 74 | -17.93 | peak |
| 2390 | 50.49 | -5.84 | 44.65 | 54 | -9.35 | AVG |
| 2400 | 61.51 | -5.84 | 55.67 | 74 | -18.33 | peak |
| 2400 | 40.64 | -5.84 | 34.8 | 54 | -19.2 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2310 | 57.22 | -5.81 | 51.41 | 74 | -22.59 | peak |
| 2310 | / | -5.81 | / | 54 | / | AVG |
| 2390 | 58.83 | -5.84 | 52.99 | 74 | -21.01 | peak |
| 2390 | 49.05 | -5.84 | 43.21 | 54 | -10.79 | AVG |
| 2400 | 64.11 | -5.84 | 58.27 | 74 | -15.73 | peak |
| 2400 | 45.84 | -5.84 | 40 | 54 | -14 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |



Operation Mode: TX CH High (2462MHz)

Horizontal

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2483.50 | 56.18 | -5.65 | 50.53 | 74 | -23.47 | peak |
| 2483.50 | / | -5.65 | / | 54 | / | AVG |
| 2500.00 | 58.88 | -5.65 | 53.23 | 74 | -20.77 | peak |
| 2500.00 | / | -5.65 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|--|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2483.50 | 58.66 | -5.65 | 53.01 | 74 | -20.99 | peak |
| 2483.50 | / | -5.65 | / | 54 | / | AVG |
| 2500.00 | 54.97 | -5.65 | 49.32 | 74 | -24.68 | peak |
| 2500.00 | / | -5.65 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |
| Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit. | | | | | | |



Operation Mode: 802.11n/H40 Mode TX CH Low (2422MHz)

Horizontal

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2310 | 59.43 | -5.81 | 53.62 | 74 | -20.38 | peak |
| 2310 | / | -5.81 | / | 54 | / | AVG |
| 2390 | 60.89 | -5.84 | 55.05 | 74 | -18.95 | peak |
| 2390 | 43.53 | -5.84 | 37.69 | 54 | -16.31 | AVG |
| 2400 | 62.12 | -5.84 | 56.28 | 74 | -17.72 | peak |
| 2400 | 51.34 | -5.84 | 45.5 | 54 | -8.5 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2310 | 55.38 | -5.81 | 49.57 | 74 | -24.43 | peak |
| 2310 | / | -5.81 | / | 54 | / | AVG |
| 2390 | 62.29 | -5.84 | 56.45 | 74 | -17.55 | peak |
| 2390 | 45.53 | -5.84 | 39.69 | 54 | -14.31 | AVG |
| 2400 | 60.93 | -5.84 | 55.09 | 74 | -18.91 | peak |
| 2400 | 46.16 | -5.84 | 40.32 | 54 | -13.68 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |



Operation Mode: TX CH High (2452MHz)

Horizontal

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2483.50 | 55.65 | -5.65 | 50 | 74 | -24 | peak |
| 2483.50 | / | -5.65 | / | 54 | / | AVG |
| 2500.00 | 57.33 | -5.65 | 51.68 | 74 | -22.32 | peak |
| 2500.00 | / | -5.65 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|--|----------------|--------|----------------|----------|--------|---------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2483.50 | 53.06 | -5.65 | 47.41 | 74 | -26.59 | peak |
| 2483.50 | / | -5.65 | / | 54 | / | AVG |
| 2500.00 | 56.35 | -5.65 | 50.7 | 74 | -23.3 | peak |
| 2500.00 | / | -5.65 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |
| Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit. | | | | | | |

4.7. ANTENNA REQUIREMENT

Standard Applicable

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, 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.

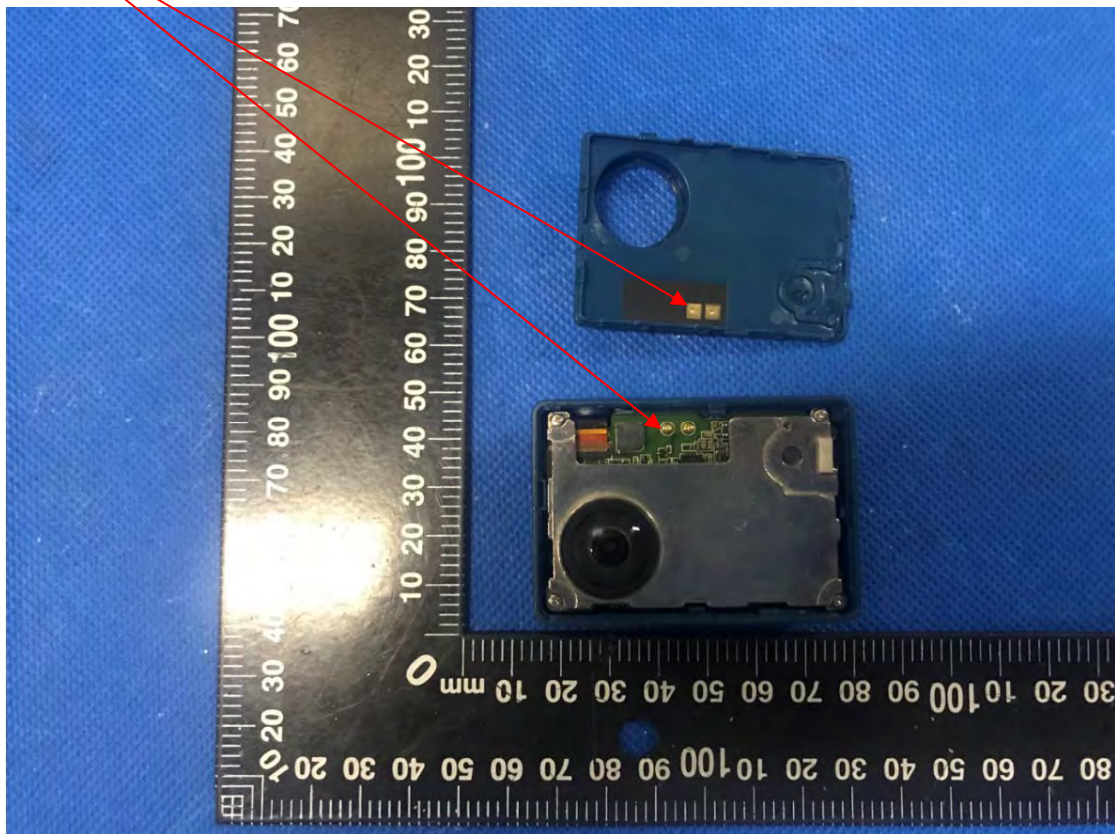
Refer to statement below for compliance.

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction

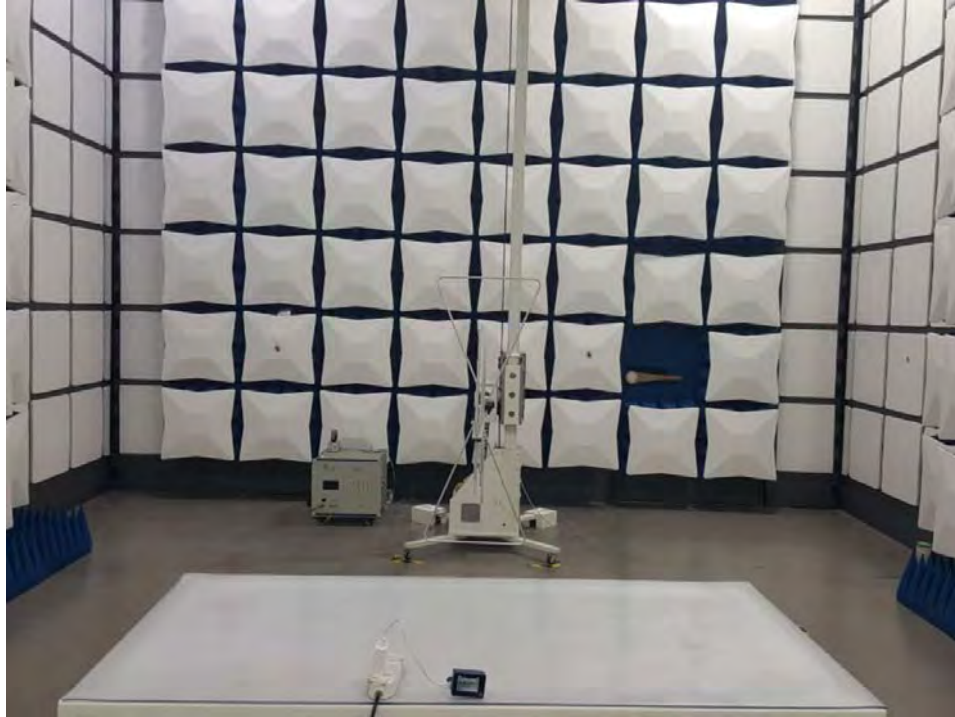
The antenna used in this product is a Internal Antenna, The directional gains of antenna used for transmitting is 1dBi.

WIFI ANTENNA



4.8. PHOTOGRAPH OF TEST

Radiated Emission





Conducted Emission





5. PHOTOGRAPH OF TEST

Reference to the reporter : ANNEX A of external photos and ANNEX B of internal photos

-----End of test report-----