

# TEST REPORT

of

## FCC Part 15 Subpart C

☒ New Application; ☐ Class I PC; ☐ Class II PC

**Product :** FortiWiFi 61F, FortiWiFi 60F  
**Brand:** FORTINET  
**Model:** FortiWiFi 60Fxxxxxx; FWF-60Fxxxxxx;  
FORTIWIFI-60Fxxxxxx;  
FortiWiFi 61Fxxxxxx; FWF-61Fxxxxxx;  
FORTIWIFI-61Fxxxxxx;  
(where "x" can be used "A-Z", or "0-9", or "-", or  
blank for software purposes or marketing purposes  
only)  
**Model Difference:** 61 series had SSD  
**FCC ID:** TVE-121757A  
**FCC Rule Part:** §15.247, Cat: DTS  
**Applicant:** Fortinet Inc.  
**Address:** 899 KIFER RD SUNNYVALE CA 94086-5301  
UNITED STATES

**Test Performed by:**  
**International Standards Laboratory Corp.**

<LT Lab.>

\*Site Registration No.

BSMI: SL2-IN-E-0013; MRA TW1036; TAF: 0997; IC: IC4067B-4;

\*Address:

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**Report No.: ISL-19LR269FCDS**

**Issue Date : 2020/01/17**

Test results given in this report apply only to the specific sample(s) tested and are traceable to national or international standard through calibration of the equipment and evaluating measurement uncertainty herein.

This report MUST not be used to claim product endorsement by TAF or any agency of the Government.

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## VERIFICATION OF COMPLIANCE

**Applicant:** Fortinet Inc.

**Product Description:** FortiWiFi 61F, FortiWiFi 60F

**Brand Name:** FORTINET

**Model No.:** FortiWiFi 60Fxxxxxx; FWF-60Fxxxxxx;  
FORTIWIFI-60Fxxxxxx; FortiWiFi 61Fxxxxxx;  
FWF-61Fxxxxxx; FORTIWIFI-61Fxxxxxx;  
(where "x" can be used "A-Z", or "0-9", or "-", or blank for software purposes or marketing purposes only)

**Model Difference:** 61 series had SSD

**FCC ID:** TVE-121757A

**Date of test:** 2019/09/09 ~ 2020/01/16

**Date of EUT Received:** 2019/09/09

### We hereby certify that:

All the tests in this report have been performed and recorded in accordance with the standards described above and performed by an independent electromagnetic compatibility consultant, International Standards Laboratory Corp.

The test results contained in this report accurately represent the measurements of the characteristics and the energy generated by sample equipment under test at the time of the test. The sample equipment tested as described in this report is in compliance with the limits of above standards.

Test By:

*Weitin Chen*

Date:

2020/01/17

*Weitin Chen / Senior Engineer*

Prepared By:

*Gigi yeh*

Date:

2020/01/17

*Gigi Yeh / Senior Engineer*

Approved By:

*Jerry Liu*

Date:

2020/01/17

*Jerry Liu / Technical Manager*

## Version

| Version No. | Date       | Description                  |
|-------------|------------|------------------------------|
| 00          | 2020/01/17 | Initial creation of document |
|             |            |                              |
|             |            |                              |

## Uncertainty of Measurement

ISO/IEC 17025 requires that an estimate of measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)).

| Description of Test                   | Uncertainty                                                           |
|---------------------------------------|-----------------------------------------------------------------------|
| Conducted Emission<br>(AC power line) | 2.586 dB                                                              |
| Field Strength of Spurious Radiation  | $\leq 30\text{MHz}$ : 2.96dB<br>30-1GHz: 4.22 dB<br>1-40 GHz: 4.08 dB |
| Conducted Power                       | 2.412 GHz: 1.30 dB<br>5.805 GHz: 1.55 dB                              |
| Power Density                         | 2.412 GHz: 1.30 dB<br>5.805 GHz: 1.67 dB                              |
| Frequency                             | 0.0032%                                                               |
| Time                                  | 0.01%                                                                 |
| DC Voltage                            | 1%                                                                    |

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## 1 General Information

General:

|                  |                                                                                                                                                                                                                                       |                     |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Product Name     | FortiWiFi 61F, FortiWiFi 60F                                                                                                                                                                                                          |                     |
| Brand Name       | FORTINET                                                                                                                                                                                                                              |                     |
| Model Name       | FortiWiFi 60Fxxxxxx; FWF-60Fxxxxxx;<br>FORTIWIFI-60Fxxxxxx; FortiWiFi 61Fxxxxxx;<br>FWF-61Fxxxxxx; FORTIWIFI-61Fxxxxxx;<br>(where “x” can be used “A-Z”, or “0-9”, or “-“, or blank for software purposes or marketing purposes only) |                     |
| Model Difference | 61 series had SSD                                                                                                                                                                                                                     |                     |
| USB Port         | One provided for Data link                                                                                                                                                                                                            |                     |
| Console port     | One provided for Data link                                                                                                                                                                                                            |                     |
| WAN port         | TWO provided for Data link                                                                                                                                                                                                            |                     |
| DMZ Port         | One provided for Data link                                                                                                                                                                                                            |                     |
| LAN Port         | Seven provided for Data link                                                                                                                                                                                                          |                     |
| Power Tolerance: | +/- 1 dB                                                                                                                                                                                                                              |                     |
| Power Supply     | 12Vdc from Adapter                                                                                                                                                                                                                    |                     |
|                  | Adapter: FSP                                                                                                                                                                                                                          | Model: FSP036-RHBN3 |

| Test SoftWare Version             | QSPR Ver5.0-00071 |            |               |
|-----------------------------------|-------------------|------------|---------------|
| RF power setting in TEST SoftWare | Mode              | Freq (MHz) | Power Setting |
|                                   |                   |            | CDD      BF   |
|                                   | 11b               | 2412       | 21            |
|                                   |                   | 2437       | 21            |
|                                   |                   | 2462       | 20            |
|                                   | 11g               | 2412       | 17            |
|                                   |                   | 2437       | 17            |
|                                   |                   | 2462       | 17            |
|                                   | 802.11n HT20      | 2412       | 15      14    |
|                                   |                   | 2437       | 18      14    |
|                                   |                   | 2462       | 16      15    |
|                                   | 802.11n HT40      | 2422       | 15      14    |
|                                   |                   | 2437       | 16      15    |
|                                   |                   | 2452       | 15      14    |

2.4GHz WLAN: 3TX/3RX

| Wi-Fi               | Frequency Range (MHz)    | Channels                                                            | Peak / Average Power | Modulation Technology |
|---------------------|--------------------------|---------------------------------------------------------------------|----------------------|-----------------------|
| 802.11b             | 2412 – 2462(DTS)         | 11                                                                  | 28.48Bm (PK)         | DSSS                  |
| 802.11g             | 2412 – 2462(DTS)         | 11                                                                  | 28.63dBm (PK)        | OFDM                  |
| 802.11n             | HT20<br>2412 – 2462(DTS) | 11                                                                  | 29.24dBm (PK)        |                       |
| 802.11n             | HT40<br>2422 – 2452(DTS) | 7                                                                   | 27.24dBm (PK)        |                       |
| Modulation type     |                          | CCK, DQPSK, DBPSK for DSSS<br>64QAM, 16QAM, QPSK, BPSK for OFDM     |                      |                       |
| Antenna Designation |                          | Dipole Antenna<br>Mode name: W1800R<br>WiFi 2.4G Antenna : 4.16 dBi |                      |                       |

**Antenna Connected Construction:**

The antenna type is Dipole antenna which is designed with detachable attachment and no consideration of replacement. Please see EUT photo for details.

**Remark:** The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

### 1.1 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: TVE-121757A** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

### 1.2 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at an antenna to EUT distance 3 meters.

KDB Document: 558074 D01 15.247 Meas Guidance v05r02

### 1.3 Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of **International Standards Laboratory Corp.** <LT Lab.> No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist., Tao Yuan City 325, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.10: 2013. FCC Registration Number is: 487532; Designation Number is: TW0997, Canada Registration Number: 4067B-4.

### 1.4 Special Accessories

Not available for this EUT intended for grant.

### 1.5 Equipment Modifications

Not available for this EUT intended for grant.

## **2 System Test Configuration**

### **2.1 EUT Configuration**

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

### **2.2 EUT Exercise**

The EUT (Transmitter) was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements.

### **2.3 Test Procedure**

#### **2.3.1 Conducted Emissions**

The EUT is placed on a turn table which is 0.8 m above ground plane. According to the requirements in Section 6 of ANSI C63.10: 2013 and RSS-Gen issue 5 Amendment 1: 2019. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR 16-1-1 Quasi-Peak and Average detector mode.

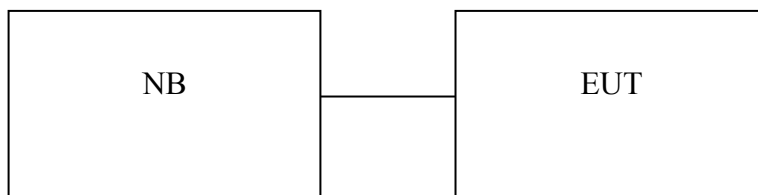
#### **2.3.2 Radiated Emissions**

The EUT is placed on a turn table which is 0.8 m/1.5m (frequency above 1GHz) above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 6 and 11 of ANSI C63.10: 2013.

## 2.4 Configuration of Tested System

**Fig. 2-1 Configuration of Tested System (Fixed channel)**

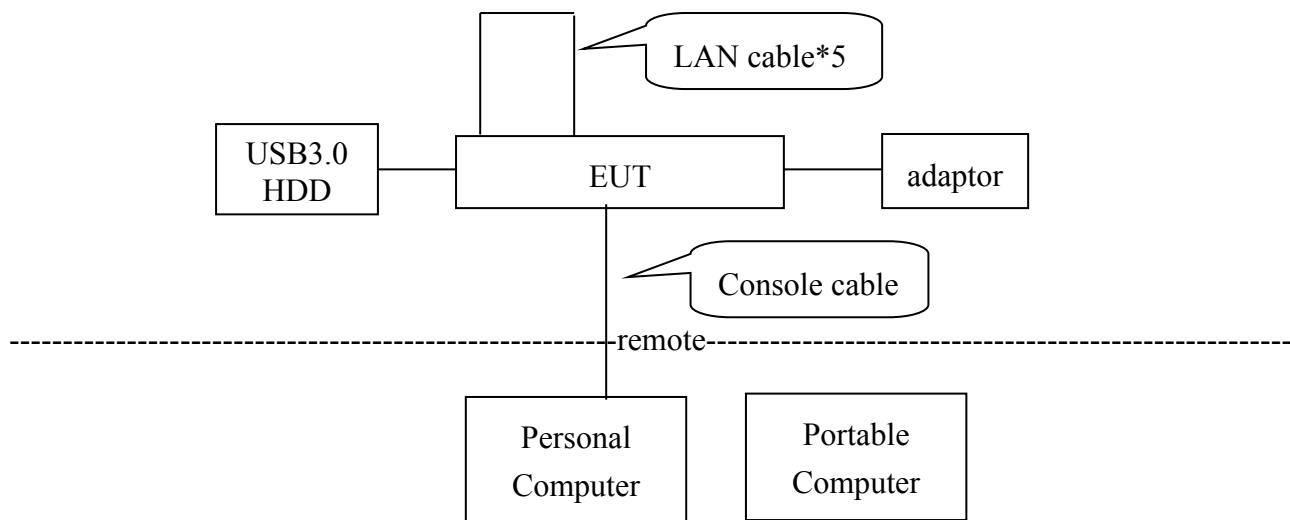
RE



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

| Item | Equip-<br>ment | Mfr/Brand | Model/<br>Type No. | Series No. | Data Cable    | Power Cord    |
|------|----------------|-----------|--------------------|------------|---------------|---------------|
| 1    | NB             | ASUS      | P2420L             | NA         | Non-Shielding | Non-Shielding |

## AC Conduction



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

| Item | Equipment               | Mfr/Brand | Model/<br>Type No. | Series No. | Data Cable         | Power Cord            |
|------|-------------------------|-----------|--------------------|------------|--------------------|-----------------------|
| 1    | USB3.0 HDD              | AKiTiO    | SK2-U31AS-AKT      | N/A        | Shielded<br>/1m    | N/A                   |
| 2    | Portable<br>Computer    | DELL      | P18S               | 6VWSKT1    | N/A                | Non-shielded<br>/1.8m |
| 3    | Personal<br>Computer    | Lenovo    | 5PV                | P834EW3    | N/A                | Non-shield /<br>1.8m  |
| 4    | Traveling<br>Disk (3.0) | Transcend | TS16GJF700         | N/A        | Shielded<br>/1.27m | N/A                   |

### 3 Summary of Test Results

| FCC Rules          | Description Of Test                       | Result    |
|--------------------|-------------------------------------------|-----------|
| §15.207(a)         | AC Power Line Conducted Emission          | Compliant |
| §15.247(b) (3),(4) | Peak Output Power/ EIRP                   | Compliant |
| §15.247(a)(2)      | 6dB & 99% Power Bandwidth                 | Compliant |
| §15.247(d)         | 100 kHz Bandwidth Of Frequency Band Edges | Compliant |
| §15.247(d)         | Spurious Emission                         | Compliant |
| §15.247(e)         | Peak Power Density                        | Compliant |
| §15.203            | Antenna Requirement                       | Compliant |

### 4 Description of Test Modes

The EUT has been tested under engineering operating condition.

Test program used to control the EUT for staying in continuous transmitting mode is programmed.

For 802.11n, CDD mode and Beamforming mode are presented in power output test item. For other test items, CDD mode is the worst case for final tests after pretesting.

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channels were selected for the final test as listed below:

802.11b: Channel low (2412MHz), mid (2437MHz), high (2462MHz) with 1Mbps lowest data rate are chosen for full testing.

802.11g: Channel low (2412MHz), mid (2437MHz), high (2462MHz) with 6Mbps lowest data rate are chosen for full testing.

802.11n HT20: Channel low (2412MHz), mid (2437MHz), high (2462MHz) with 6.5Mbps lowest data rate are chosen for full testing.

802.11n HT40: Channel low (2422MHz), mid (2437MHz), high (2452MHz) with 13.5Mbps lowest data rate are chosen for full testing.

$$\text{Directional gain} = G_{ANT} + 10 \log(N_{ANT}) \text{ dBi}$$

## 5 Conducted Emission Test

### 5.1 Standard Applicable:

According to §15.207 frequency range within 150kHz to 30MHz shall not exceed the Limit table as below.

| Frequency range (MHz)                                                                                                                                                          | Limits (dBuV) |          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------|
|                                                                                                                                                                                | Quasi-peak    | Average  |
| 0.15 to 0.50                                                                                                                                                                   | 66 to 56      | 56 to 46 |
| 0.50 to 5                                                                                                                                                                      | 56            | 46       |
| 5 to 30                                                                                                                                                                        | 60            | 50       |
| Note<br>1. The lower limit shall apply at the transition frequencies<br>2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz. |               |          |

### 5.2 Measurement Equipment Used:

| Location      | Equipment Name           | Brand         | Model      | S/N              | Last Cal. Date | Next Cal. Date |
|---------------|--------------------------|---------------|------------|------------------|----------------|----------------|
| Conduction 02 | LISN 26                  | R&S           | ENV216     | 102378           | 11/21/2018     | 11/21/2019     |
| Conduction 02 | LISN 20                  | R&S           | ENV216     | 101477           | 07/31/2019     | 07/31/2020     |
| Conduction 02 | Conduction 02-1 Cable    | WOKEN         | CFD 300-NL | Conduction 02 -1 | 09/11/2018     | 09/11/2019     |
| Conduction 02 | Conduction 02-1 Cable    | WOKEN         | CFD 300-NL | Conduction 02 -1 | 09/11/2019     | 09/11/2020     |
| Conduction 02 | EMI Receiver 14          | ROHDE&SCHWARZ | ESCI       | 101034           | 05/31/2019     | 05/31/2020     |
| Conduction 02 | ISN T8 10                | Teseq GmbH    | ISN T800   | 42773            | 08/02/2019     | 08/02/2020     |
| Conduction 02 | Capacitive Voltage Probe | FCC           | F-CVP-1    | 68               | 02/19/2019     | 02/19/2020     |
| Conduction 02 | Current Probe            | SCHAFFNER     | SMZ 11     | 18030            | 02/19/2019     | 02/19/2020     |

### 5.3 EUT Setup:

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10-2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

#### **5.4 Measurement Procedure:**

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.
4. Both 120V & 240V have been verified, and 120V/60Hz was defined as the worst-case and record in the report.

#### **5.5 Measurement Result:**

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

Note: Refer to next page for measurement data and plots.

## AC POWER LINE CONDUCTED EMISSION TEST DATA

|                 |                        |            |            |
|-----------------|------------------------|------------|------------|
| Operation Mode: | Full mode (Worst data) | Test Date: | 2019/09/10 |
|-----------------|------------------------|------------|------------|



Address: No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist.,  
Tao Yuan City 325, Taiwan.  
Tel: 03-4071718

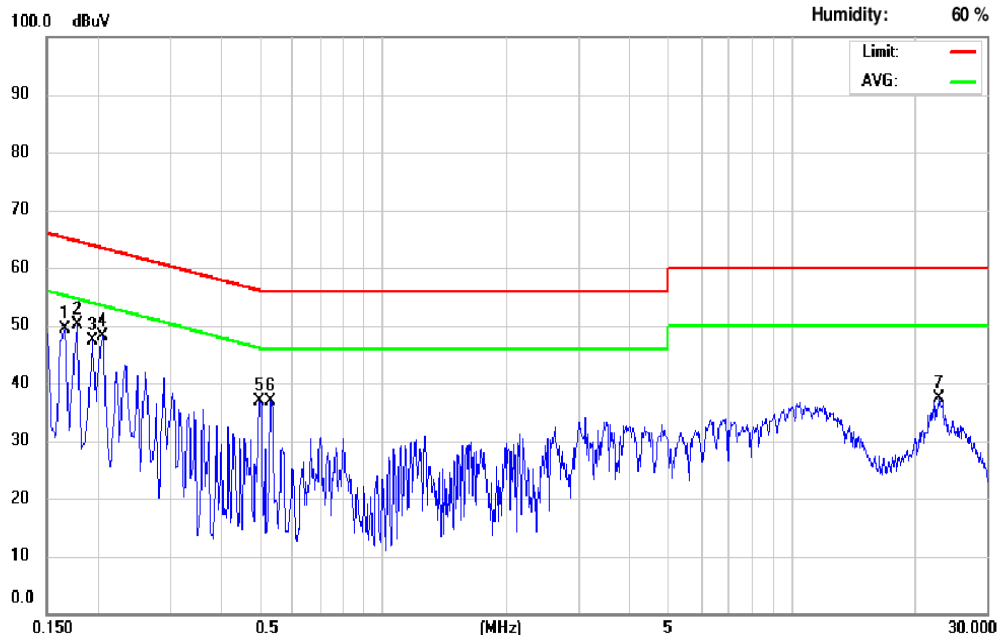
### Conducted Emission Measurement

Date: 2019/9/10

operator: James Kuo

Temperature: 26 °C

Humidity: 60 %



Site: Conduction 02

Phase: L1

| No. | Frequency<br>(MHz) | QP_R<br>(dBuV) | AVG_R<br>(dBuV) | Correct<br>Factor<br>(dB) | QP<br>Emission<br>(dBuV) | QP<br>Limit<br>(dBuV) | QP<br>Margin<br>(dB) | AVG<br>Emission<br>(dBuV) | AVG<br>Limit<br>(dBuV) | AVG<br>Margin<br>(dB) |
|-----|--------------------|----------------|-----------------|---------------------------|--------------------------|-----------------------|----------------------|---------------------------|------------------------|-----------------------|
| 1   | 0.166              | 40.49          | 27.38           | 9.63                      | 50.12                    | 65.16                 | -15.04               | 37.01                     | 55.16                  | -18.15                |
| 2   | 0.178              | 33.15          | 16.37           | 9.62                      | 42.77                    | 64.58                 | -21.81               | 25.99                     | 54.58                  | -28.59                |
| 3   | 0.194              | 33.89          | 22.60           | 9.62                      | 43.51                    | 63.86                 | -20.35               | 32.22                     | 53.86                  | -21.64                |
| 4   | 0.206              | 33.03          | 21.89           | 9.62                      | 42.65                    | 63.37                 | -20.72               | 31.51                     | 53.37                  | -21.86                |
| 5   | 0.498              | 26.98          | 26.82           | 9.64                      | 36.62                    | 56.03                 | -19.41               | 36.46                     | 46.03                  | -9.57                 |
| 6   | 0.530              | 26.90          | 25.49           | 9.64                      | 36.54                    | 56.00                 | -19.46               | 35.13                     | 46.00                  | -10.87                |
| 7   | 22.938             | 21.57          | 14.19           | 9.90                      | 31.47                    | 60.00                 | -28.53               | 24.09                     | 50.00                  | -25.91                |



Address: No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist.,  
Tao Yuan City 325, Taiwan.  
Tel: 03-4071718

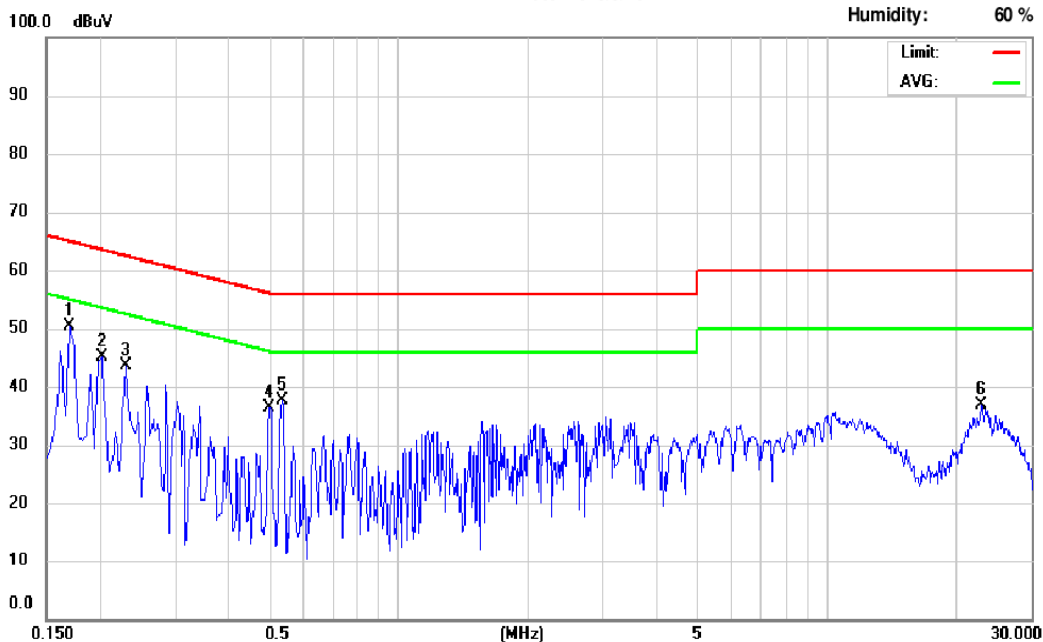
### Conducted Emission Measurement

Date: 2019/9/10

operator: James Kuo

Temperature: 26 °C

Humidity: 60 %



Site: Conduction 02

Phase: **N**

| No. | Frequency<br>(MHz) | QP_R<br>(dBuV) | AVG_R<br>(dBuV) | Correct<br>Factor<br>(dB) | QP<br>Emission<br>(dBuV) | QP<br>Limit<br>(dBuV) | QP<br>Margin<br>(dB) | AVG<br>Emission<br>(dBuV) | AVG<br>Limit<br>(dBuV) | AVG<br>Margin<br>(dB) |
|-----|--------------------|----------------|-----------------|---------------------------|--------------------------|-----------------------|----------------------|---------------------------|------------------------|-----------------------|
| 1   | 0.170              | 39.09          | 26.71           | 9.64                      | 48.73                    | 64.96                 | -16.23               | 36.35                     | 54.96                  | -18.61                |
| 2   | 0.202              | 36.33          | 26.28           | 9.64                      | 45.97                    | 63.53                 | -17.56               | 35.92                     | 53.53                  | -17.61                |
| 3   | 0.230              | 32.25          | 23.08           | 9.64                      | 41.89                    | 62.45                 | -20.56               | 32.72                     | 52.45                  | -19.73                |
| 4   | 0.498              | 26.00          | 25.89           | 9.65                      | 35.65                    | 56.03                 | -20.38               | 35.54                     | 46.03                  | -10.49                |
| 5   | 0.534              | 27.09          | 26.59           | 9.65                      | 36.74                    | 56.00                 | -19.26               | 36.24                     | 46.00                  | -9.76                 |
| 6   | 22.934             | 20.90          | 13.42           | 10.02                     | 30.92                    | 60.00                 | -29.08               | 23.44                     | 50.00                  | -26.56                |

## 6 Peak Output Power Measurement

### 6.1 Standard Applicable:

According to §15.247(b)(3), (b)(4), (c)

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(c) Operation with directional antenna gains greater than 6 dBi.

(1) Fixed point-to-point operation:

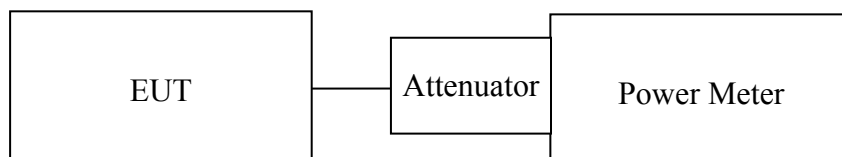
(i) Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.

## 6.2 Measurement Equipment Used:

| Location Conducted | Equipment Name               | Brand       | Model                      | S/N                      | Last Cal. Date | Next Cal. Date |
|--------------------|------------------------------|-------------|----------------------------|--------------------------|----------------|----------------|
| Conducted          | Power Meter                  | Anritsu     | ML2495A                    | 1116010                  | 10/04/2019     | 10/04/2020     |
| Conducted          | Power Sensor                 | Anritsu     | MA2411B                    | 34NKF50                  | 10/04/2019     | 10/04/2020     |
| Conducted          | Power Sensor                 | DARE        | RPR3006W                   | 13I00030SNO33            | 01/11/2019     | 01/11/2020     |
| Conducted          | Power Sensor                 | DARE        | RPR3006W                   | 14I00889SNO35            | 06/27/2019     | 06/27/2020     |
| Conducted          | Power Sensor                 | DARE        | RPR3006W                   | 14I00889SNO36            | 06/27/2019     | 06/27/2020     |
| Conducted          | Temperature Chamber          | KSON        | THS-B4H100                 | 2287                     | 02/19/2019     | 02/19/2020     |
| Conducted          | DC Power supply              | ABM         | 8185D                      | N/A                      | 01/10/2019     | 01/10/2020     |
| Conducted          | AC Power supply              | EXTECH      | CFC105W                    | NA                       | N/A            | N/A            |
| Conducted          | Spectrum analyzer            | Keysight    | N9010A                     | MY56070257               | 10/05/2019     | 10/05/2020     |
| Conducted          | Spectrum analyzer            | R&S         | FSP40                      | 100116                   | 01/10/2019     | 01/10/2020     |
| Conducted          | Test Software                | DARE        | Radiation<br>Ver:2013.1.23 | NA                       | NA             | NA             |
| Conducted          | Test Software                | R&S         | CMUGO<br>Ver:2.0.0         | N/A                      | N/A            | N/A            |
| Conducted          | Radio Communication Analyzer | R&S         | CMU200                     | 111968                   | 10/29/2019     | 10/29/2020     |
| Conducted          | Radio Communication Analyzer | R&S         | CMW500                     | 1201.002K50108<br>793-JG | 10/11/2019     | 10/11/2020     |
| Conducted          | BT Simulator                 | Agilent     | N4010A                     | MY48100200               | NA             | NA             |
| Conducted          | GPS Simulator                | Welnavigate | GS-50                      | 701523                   | NA             | NA             |

## 6.3 Test Set-up:



## 6.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter
3. Record the max. reading.
4. Repeat above procedures until all frequency measured were complete.

## 6.5 Measurement Result:

### CDD mode

#### Peak Output Power

| Channel      |      | Output Power (dBm) |         |         | Combined Output Power (dBm) | Limit (dBm) | Result |
|--------------|------|--------------------|---------|---------|-----------------------------|-------------|--------|
|              |      | Chain 0            | chain 1 | Chain 2 |                             |             |        |
| 802.11b      | Low  | 22.86              | 23.51   | 23.96   | 28.24                       | 30.00       | Pass   |
|              | Mid  | 23.39              | 23.71   | 24.00   | 28.48                       | 30.00       |        |
|              | High | 22.30              | 22.81   | 23.09   | 27.52                       | 30.00       |        |
| 802.11g      | Low  | 23.69              | 24.21   | 23.57   | 28.60                       | 30.00       |        |
|              | Mid  | 23.38              | 23.95   | 24.21   | 28.63                       | 30.00       |        |
|              | High | 23.36              | 23.94   | 23.89   | 28.51                       | 30.00       |        |
| 802.11n HT20 | Low  | 21.46              | 22.83   | 22.96   | 27.24                       | 30.00       |        |
|              | Mid  | 23.68              | 25.07   | 24.54   | 29.24                       | 30.00       |        |
|              | High | 21.39              | 22.48   | 22.70   | 27.00                       | 30.00       |        |
| 802.11n HT40 | Low  | 21.66              | 22.69   | 22.71   | 27.15                       | 30.00       |        |
|              | Mid  | 21.86              | 22.73   | 22.76   | 27.24                       | 30.00       |        |
|              | High | 21.40              | 22.75   | 22.72   | 27.11                       | 30.00       |        |

#### Average Output Power (MIMO 3TX)

| Channel      |      | Output Power (dBm) |         |         | Combined Output Power (dBm) | Limit (dBm) | Result |
|--------------|------|--------------------|---------|---------|-----------------------------|-------------|--------|
|              |      | Chain 0            | chain 1 | Chain 2 |                             |             |        |
| 802.11b      | Low  | 21.12              | 21.66   | 21.98   | 26.37                       | 30.00       | Pass   |
|              | Mid  | 21.24              | 21.69   | 21.98   | 26.42                       | 30.00       |        |
|              | High | 19.99              | 20.37   | 20.84   | 25.19                       | 30.00       |        |
| 802.11g      | Low  | 17.03              | 17.76   | 18.11   | 22.43                       | 30.00       |        |
|              | Mid  | 17.38              | 17.95   | 18.12   | 22.60                       | 30.00       |        |
|              | High | 16.97              | 17.55   | 17.67   | 22.18                       | 30.00       |        |
| 802.11n HT20 | Low  | 14.61              | 15.31   | 15.77   | 20.03                       | 30.00       |        |
|              | Mid  | 17.38              | 18.96   | 18.65   | 23.15                       | 30.00       |        |
|              | High | 14.95              | 15.23   | 15.79   | 20.11                       | 30.00       |        |
| 802.11n HT40 | Low  | 14.15              | 15.57   | 15.62   | 19.94                       | 30.00       |        |
|              | Mid  | 14.91              | 15.69   | 15.37   | 20.11                       | 30.00       |        |
|              | High | 14.17              | 15.73   | 15.22   | 19.86                       | 30.00       |        |

### Beamforming mode

#### Peak Output Power

| Channel      |      | Output Power (dBm) |         |         | Combined Output Power (dBm) | Limit (dBm) | Result |
|--------------|------|--------------------|---------|---------|-----------------------------|-------------|--------|
|              |      | Chain 0            | chain 1 | Chain 2 |                             |             |        |
| 802.11n HT20 | Low  | 19.87              | 20.13   | 20.40   | 24.91                       | 27.07       | Pass   |
|              | Mid  | 20.01              | 20.47   | 20.86   | 25.23                       | 27.07       |        |
|              | High | 20.12              | 20.27   | 20.72   | 25.15                       | 27.07       |        |
| 802.11n HT40 | Low  | 20.36              | 20.78   | 21.08   | 25.52                       | 27.07       |        |
|              | Mid  | 21.86              | 22.02   | 22.42   | 26.88                       | 27.07       |        |
|              | High | 20.72              | 20.97   | 21.17   | 25.73                       | 27.07       |        |

#### Average Output Power

| Channel      |      | Output Power (dBm) |         |         | Combined Output Power (dBm) | Limit(dBm) | Result |
|--------------|------|--------------------|---------|---------|-----------------------------|------------|--------|
|              |      | Chain 0            | chain 1 | Chain 2 |                             |            |        |
| 802.11n HT20 | Low  | 12.98              | 13.21   | 13.61   | 18.05                       | 27.07      | Pass   |
|              | Mid  | 13.12              | 13.55   | 14.03   | 18.35                       | 27.07      |        |
|              | High | 12.99              | 13.24   | 14.01   | 18.21                       | 27.07      |        |
| 802.11n HT40 | Low  | 13.21              | 13.62   | 13.79   | 18.32                       | 27.07      |        |
|              | Mid  | 14.21              | 14.69   | 15.00   | 19.42                       | 27.07      |        |
|              | High | 13.32              | 13.75   | 13.80   | 18.40                       | 27.07      |        |

## 7 6dB Bandwidth & 99% Bandwidth

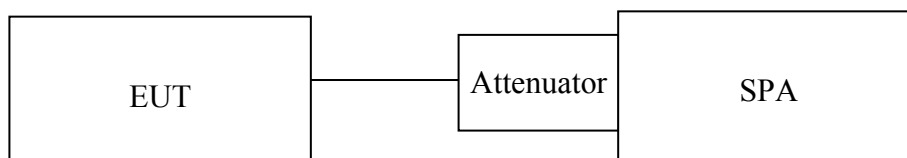
### 7.1 Standard Applicable:

According to §15.247(a)(2), Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500kHz.

### 7.2 Measurement Equipment Used:

Refer to section 6.2 for details.

### 7.3 Test Set-up:



### 7.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=100kHz, VBW = 3\*RBW, Span= cover the complete power envelope of the signal of the UUT Sweep=auto
4. Mark the peak frequency and -6dB (upper and lower) frequency.
5. Repeat above procedures until all frequency measured were complete.

## 7.5 Measurement Result:

### 802.11b

| Frequency (MHz) | 6dB Bandwidth (MHz) | 99% Bandwidth (MHz) | Limit (kHz) | Result |
|-----------------|---------------------|---------------------|-------------|--------|
| Low             | 8.10                | 12.78               | > 500       | PASS   |
| Mid             | 8.09                | 12.86               | > 500       | PASS   |
| High            | 8.10                | 12.79               | > 500       | PASS   |

### 802.11g

| Frequency (MHz) | 6dB Bandwidth (MHz) | 99% Bandwidth (MHz) | Limit (kHz) | Result |
|-----------------|---------------------|---------------------|-------------|--------|
| Low             | 16.35               | 16.37               | > 500       | PASS   |
| Mid             | 16.34               | 16.38               | > 500       | PASS   |
| High            | 16.36               | 16.38               | > 500       | PASS   |

### 802.11n HT20

| Frequency (MHz) | 6dB Bandwidth (MHz) | 99% Bandwidth (MHz) | Limit (kHz) | Result |
|-----------------|---------------------|---------------------|-------------|--------|
| Low             | 17.54               | 17.55               | > 500       | PASS   |
| Mid             | 17.29               | 17.56               | > 500       | PASS   |
| High            | 17.53               | 17.56               | > 500       | PASS   |

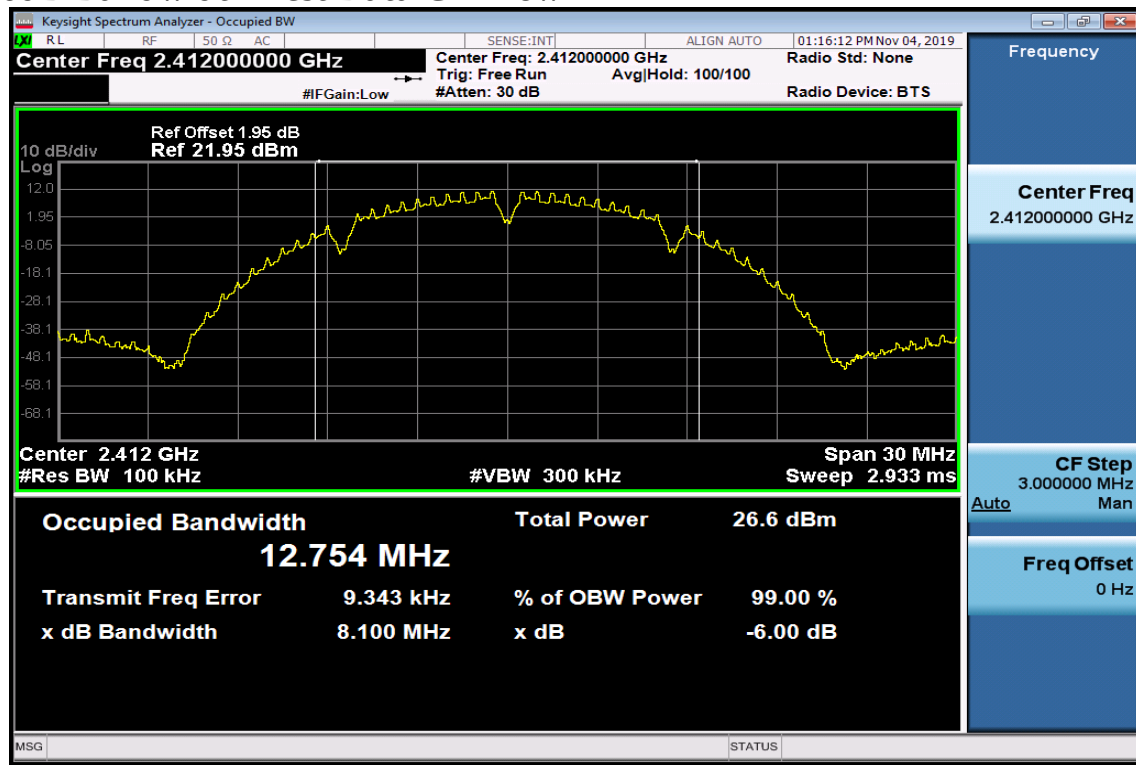
### 802.11n HT40

| Frequency (MHz) | 6dB Bandwidth (MHz) | 99% Bandwidth (MHz) | Limit (kHz) | Result |
|-----------------|---------------------|---------------------|-------------|--------|
| Low             | 36.12               | 36.35               | > 500       | PASS   |
| Mid             | 35.10               | 35.83               | > 500       | PASS   |
| High            | 35.15               | 35.83               | > 500       | PASS   |

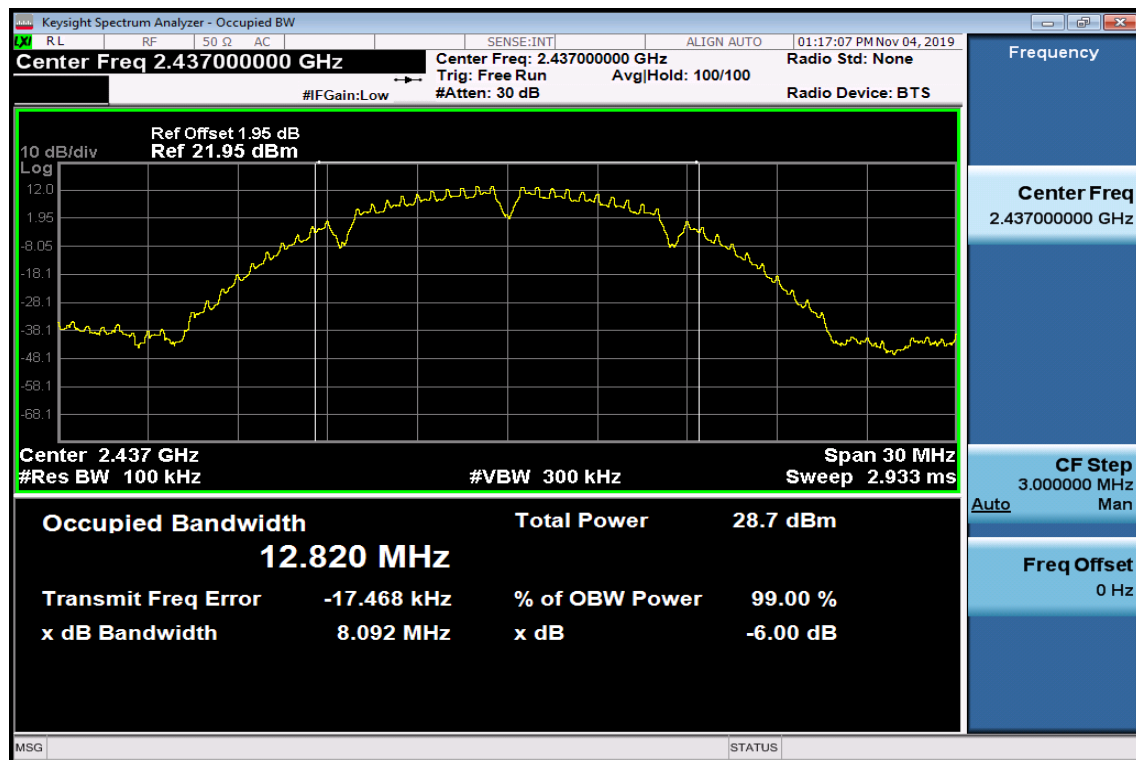
Note: Refer to next page for plots.

## 802.11b

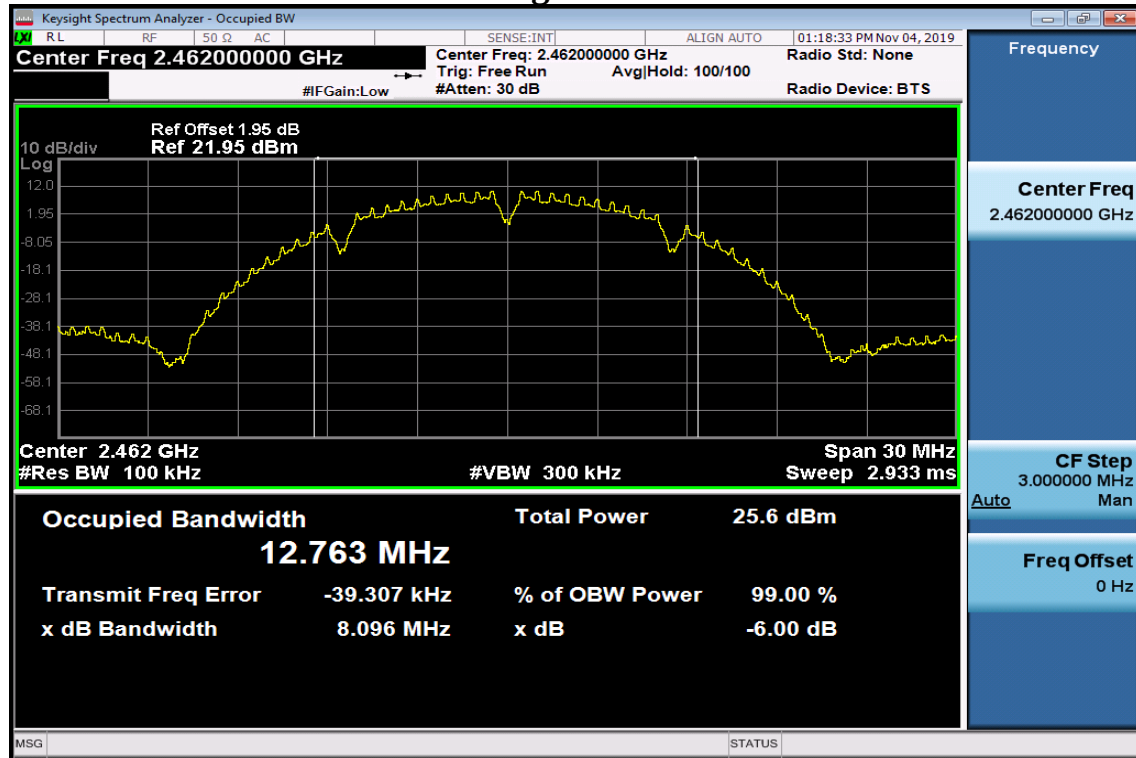
### 6dB Bandwidth Test Data CH-Low



### 6dB Bandwidth Test Data CH-Mid

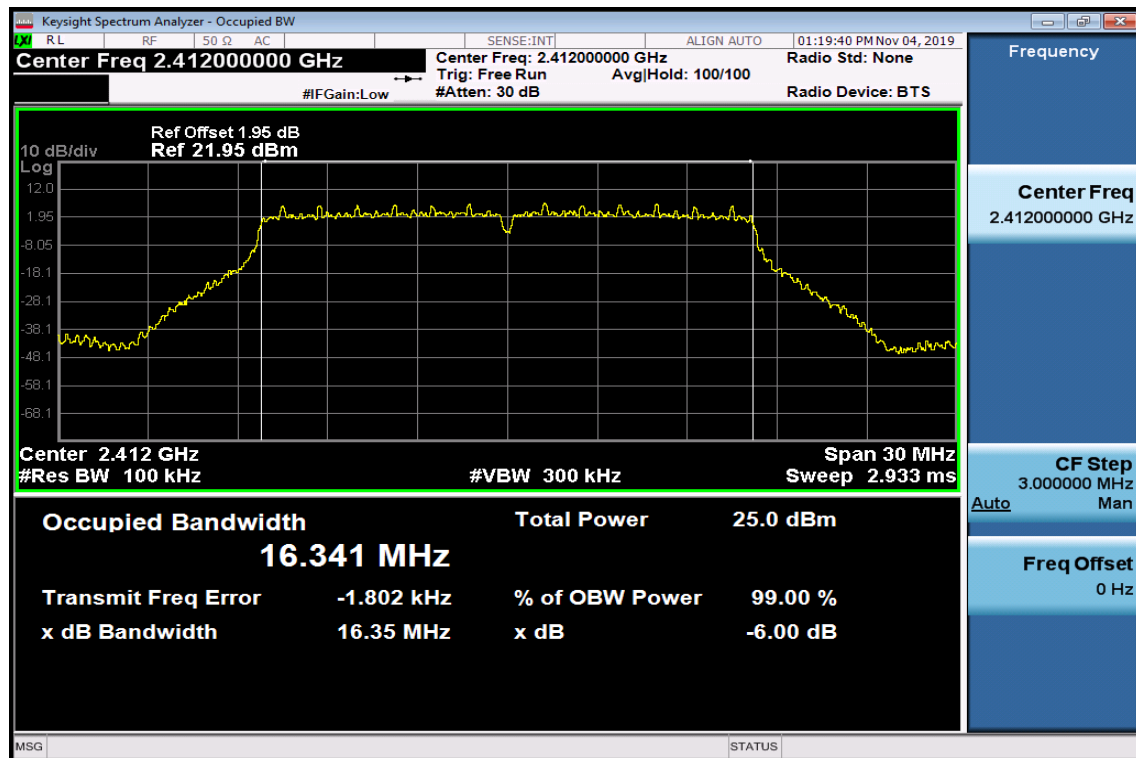


## 6dB Bandwidth Test Data CH-High

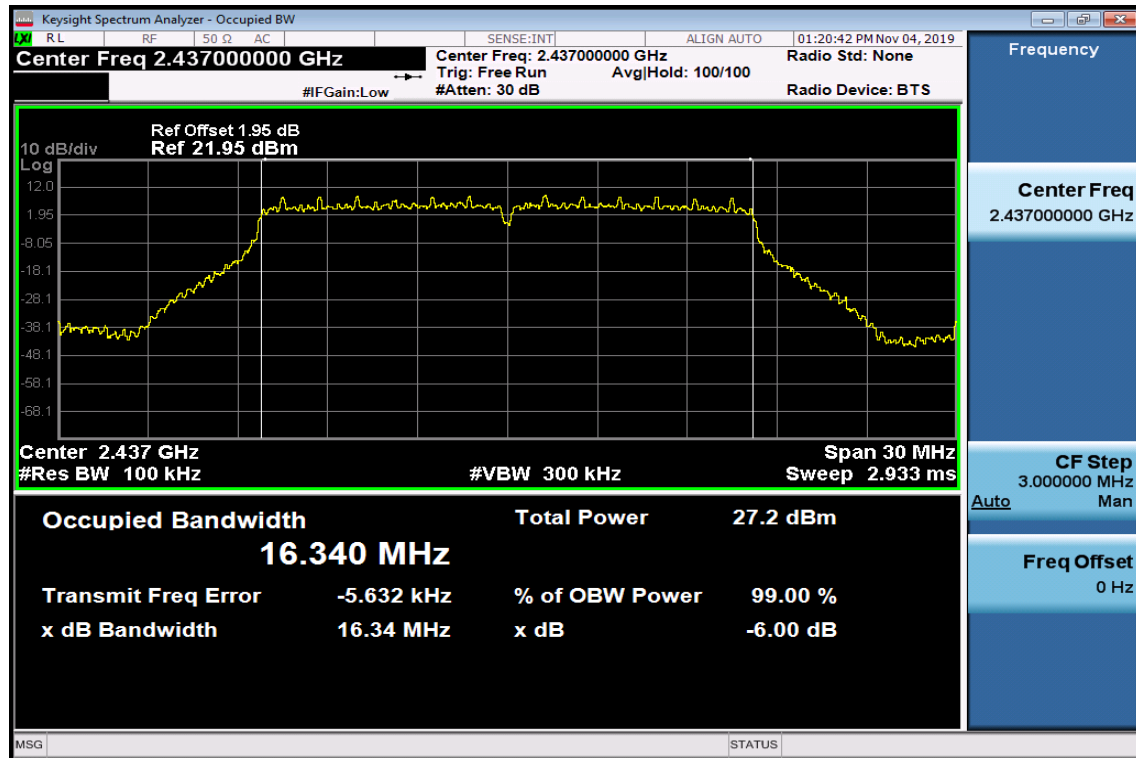


## 802.11g

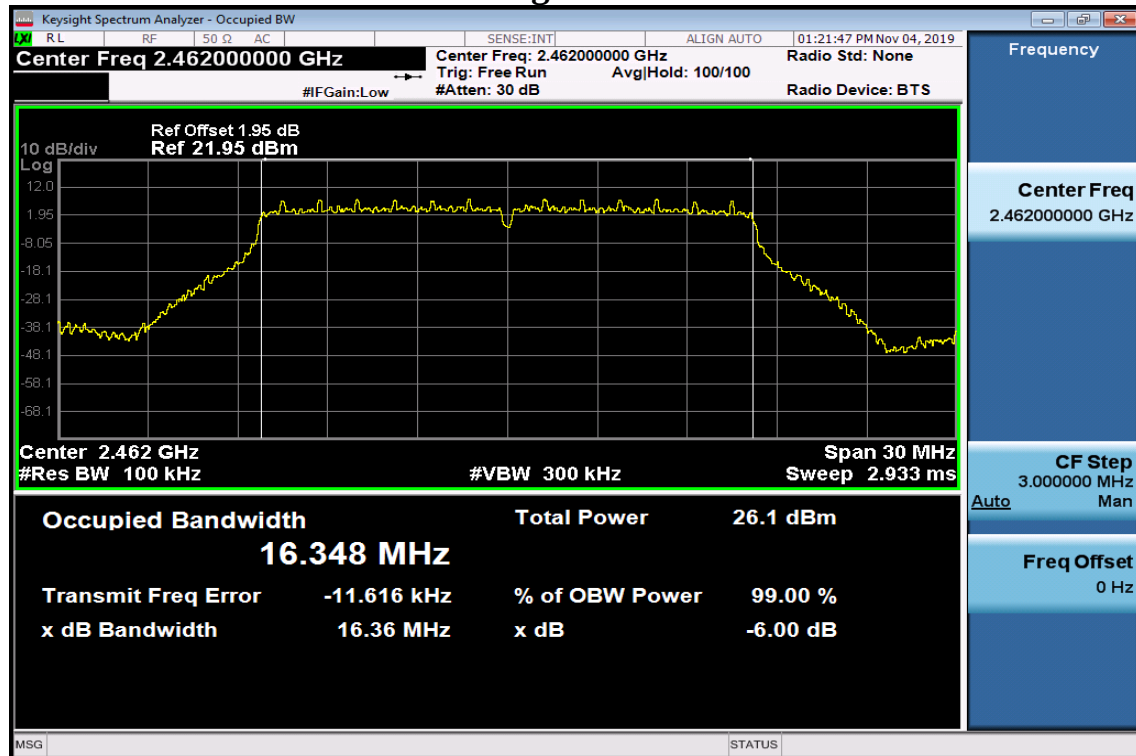
## 6dB Bandwidth Test Data CH-Low



## 6dB Bandwidth Test Data CH-Mid

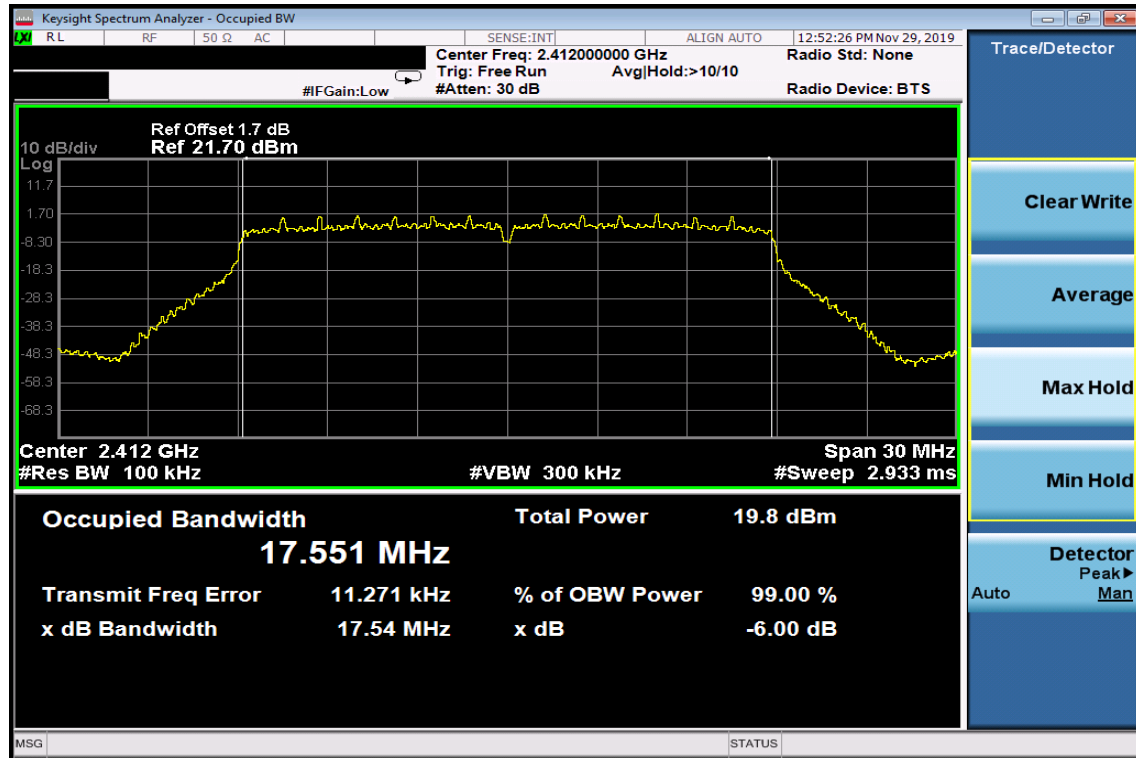


## 6dB Bandwidth Test Data CH-High

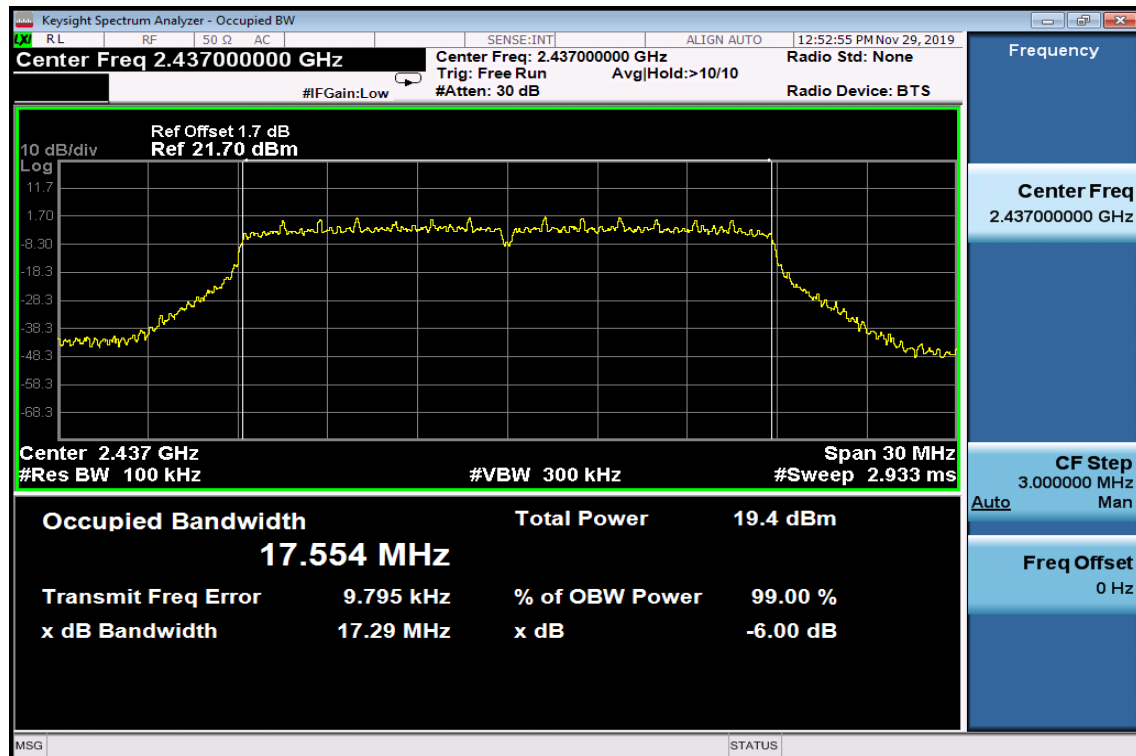


## 802.11n\_HT20

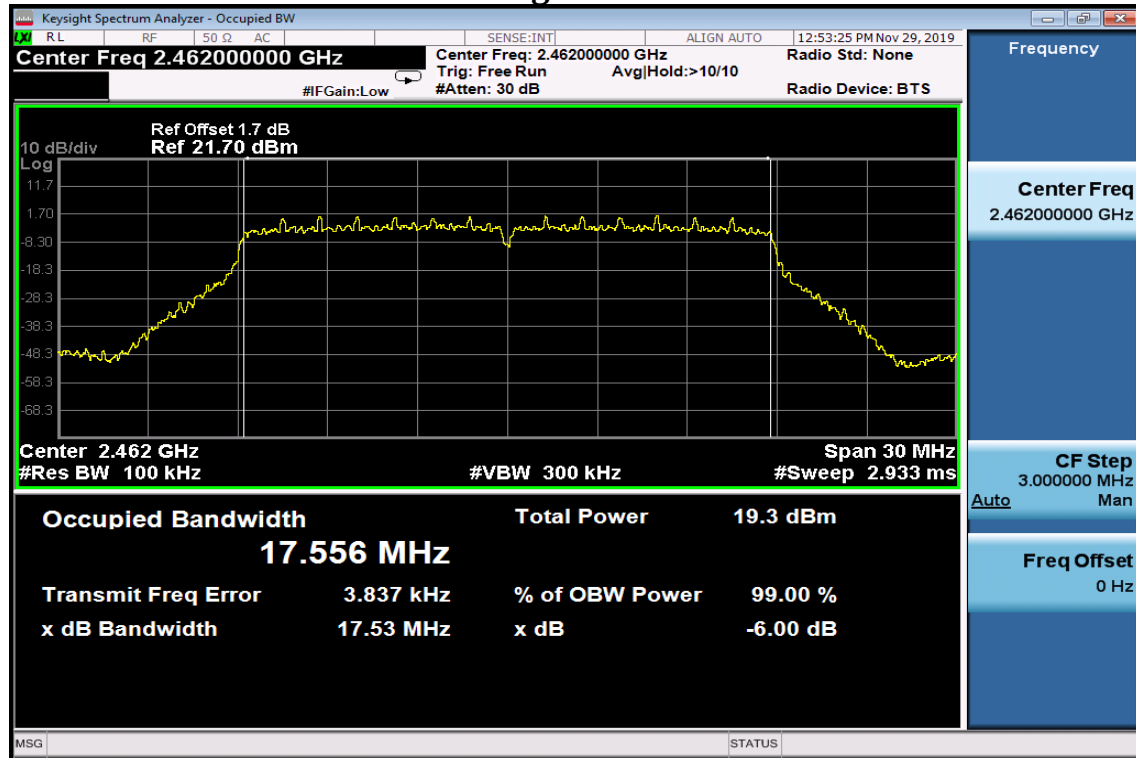
### 6dB Bandwidth Test Data CH-Low



### 6dB Bandwidth Test Data CH-Mid

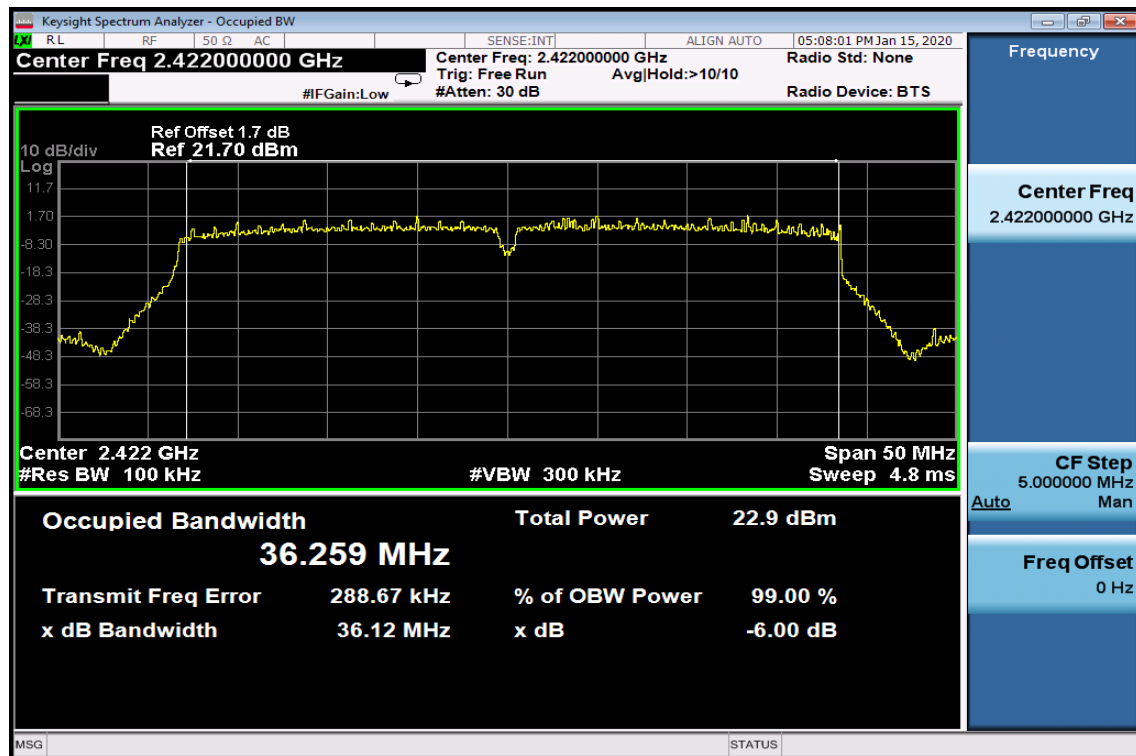


## 6dB Bandwidth Test Data CH-High

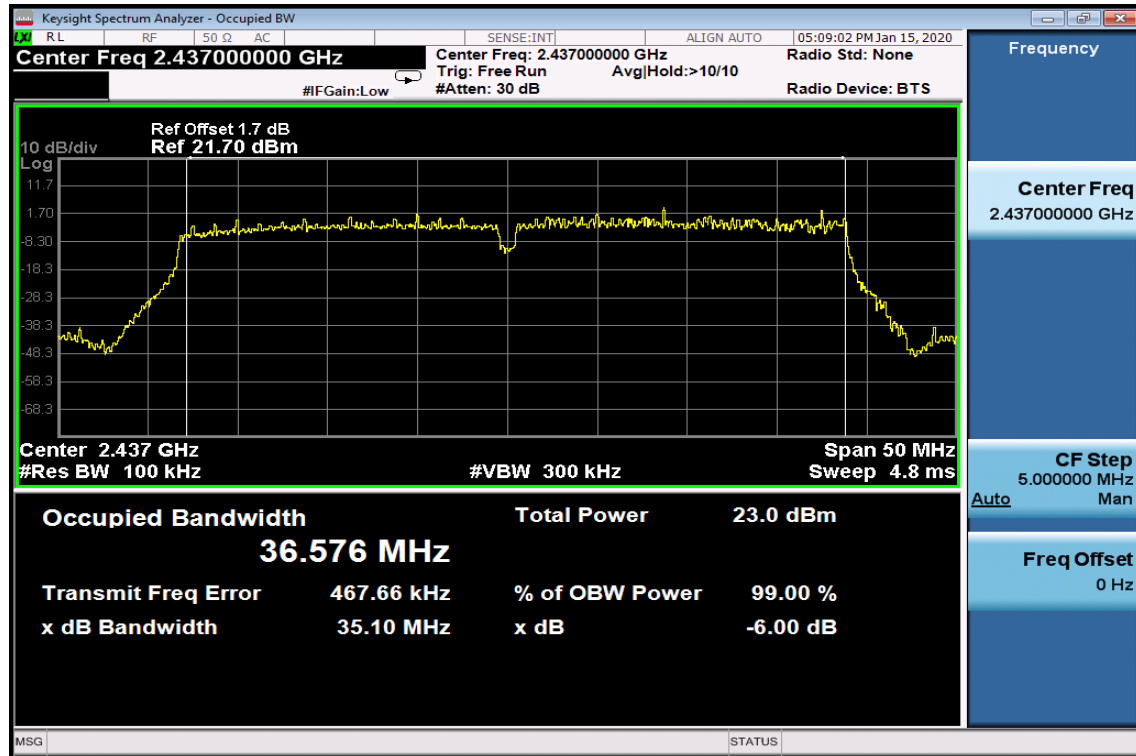


## 802.11n\_HT40

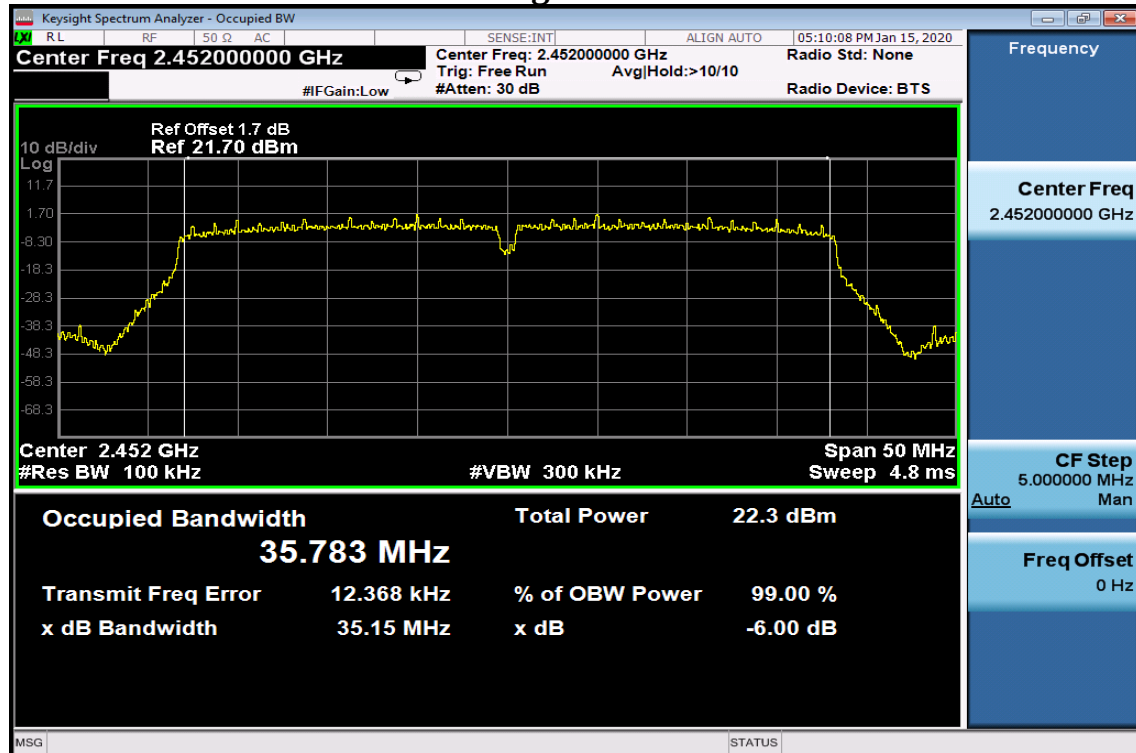
## 6dB Bandwidth Test Data CH-Low



## 6dB Bandwidth Test Data CH-Mid

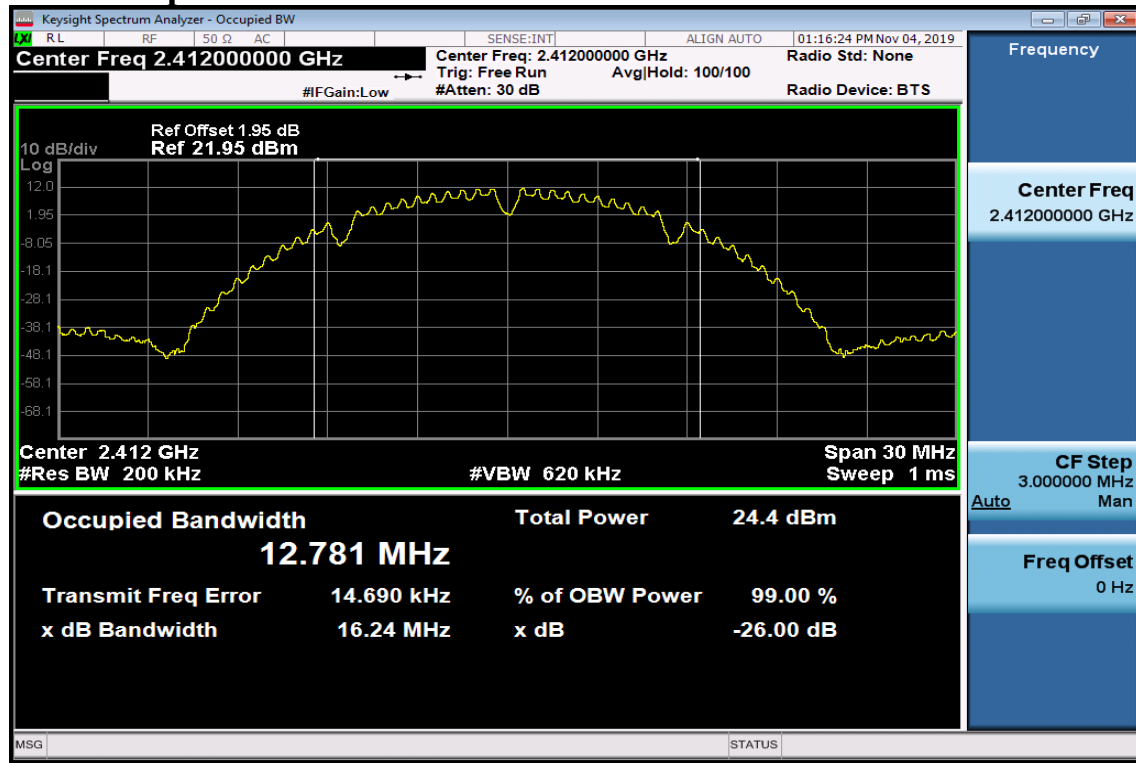


## 6dB Bandwidth Test Data CH-High

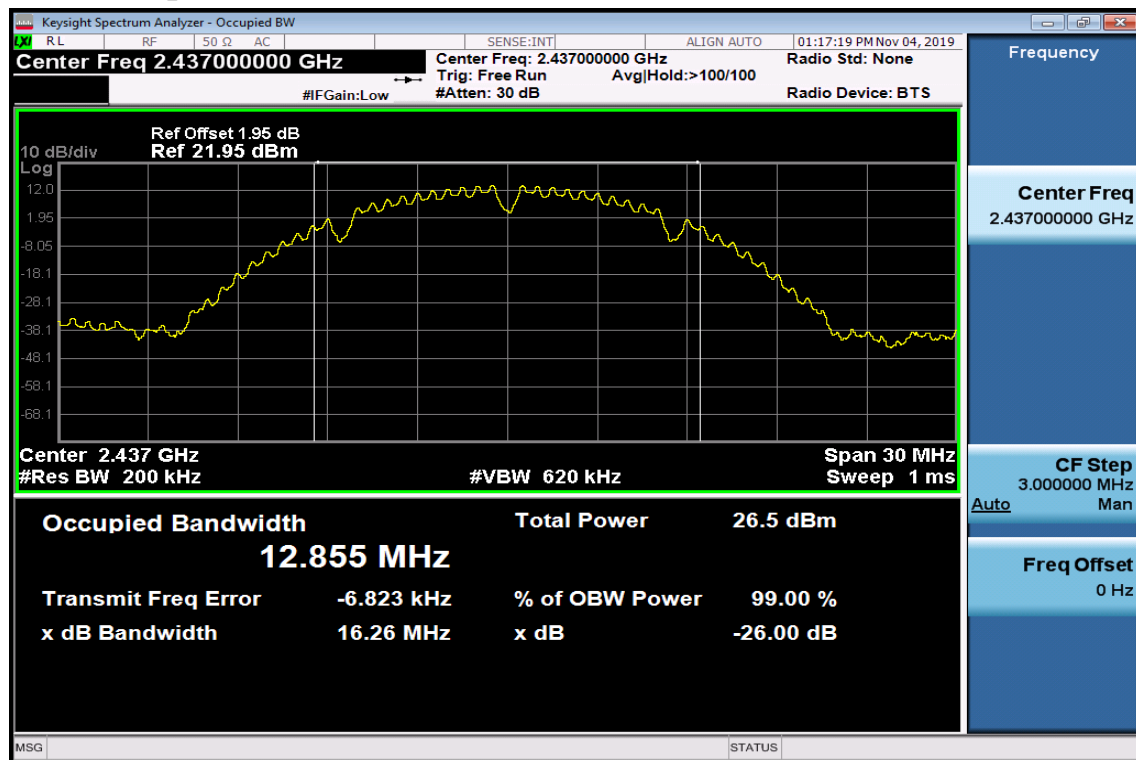


802.11b

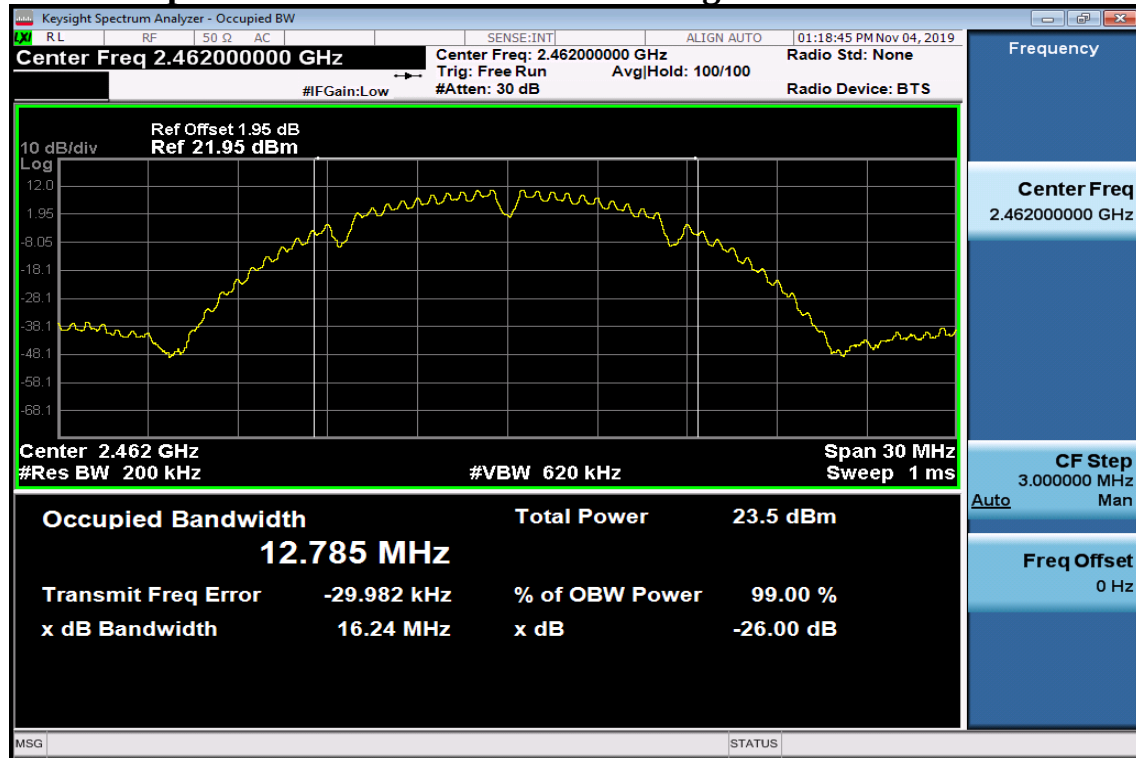
### 99% Occupied Bandwidth Test Data CH-Low



### 99% Occupied Bandwidth Test Data CH-Mid

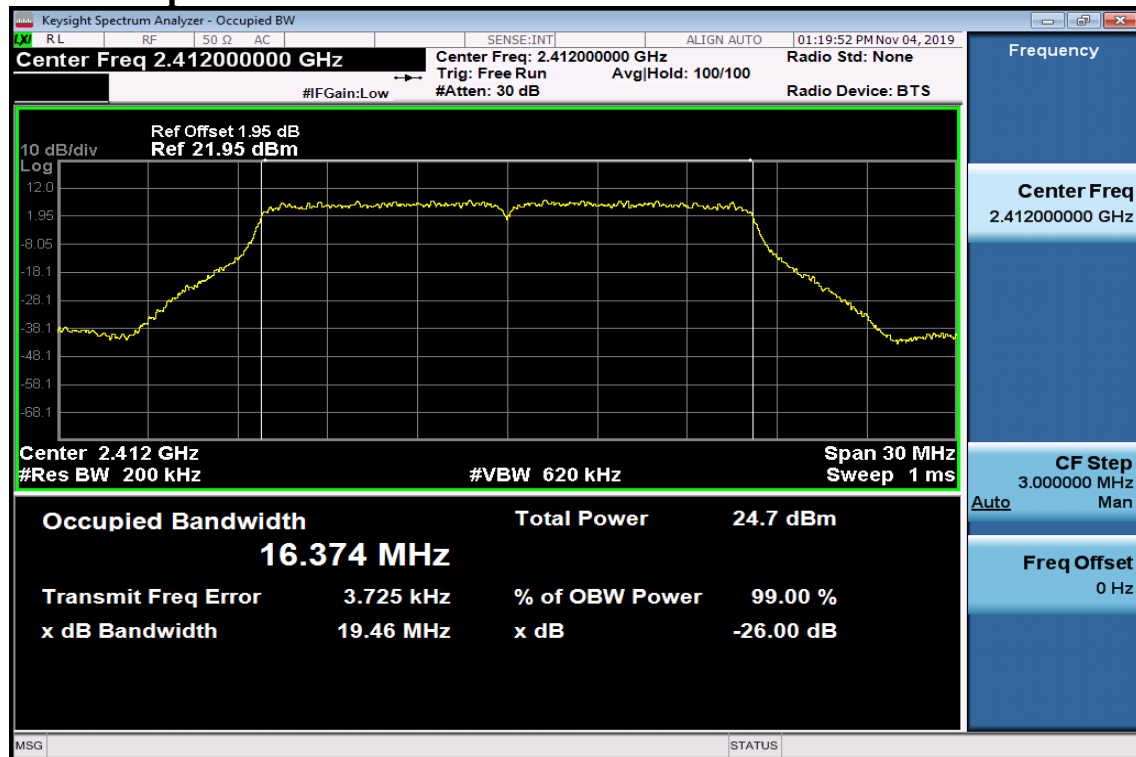


## 99% Occupied Bandwidth Test Data CH-High

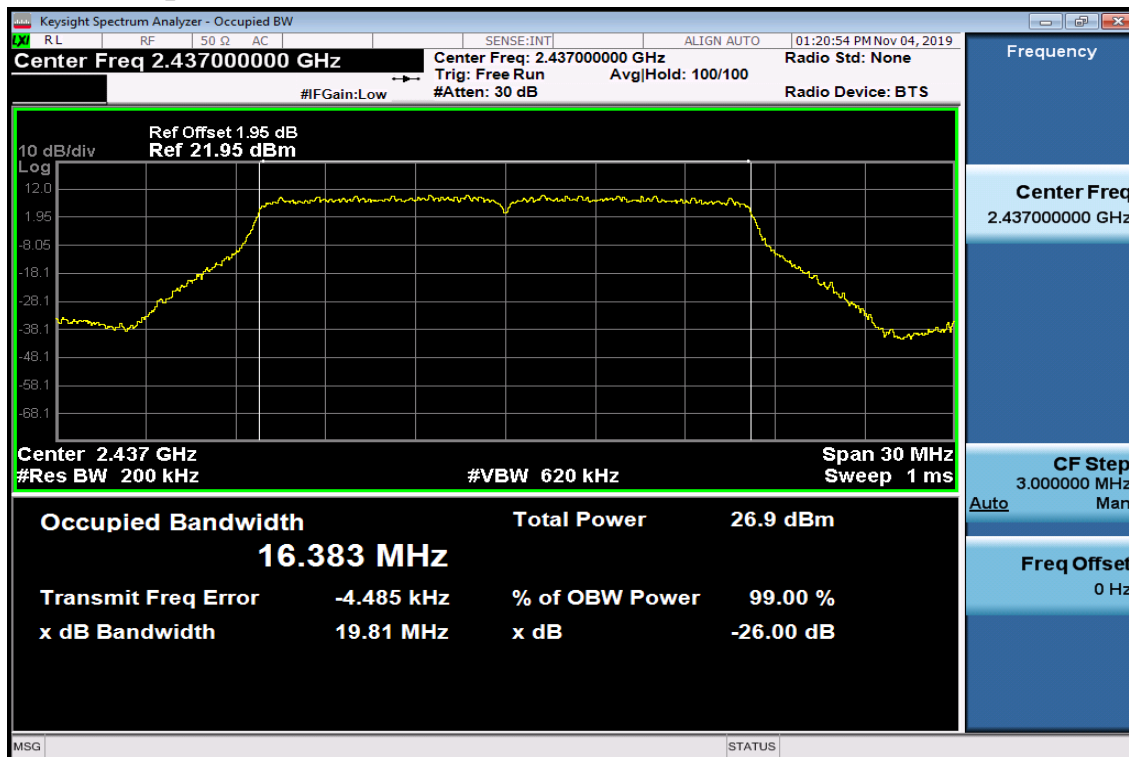


802.11g

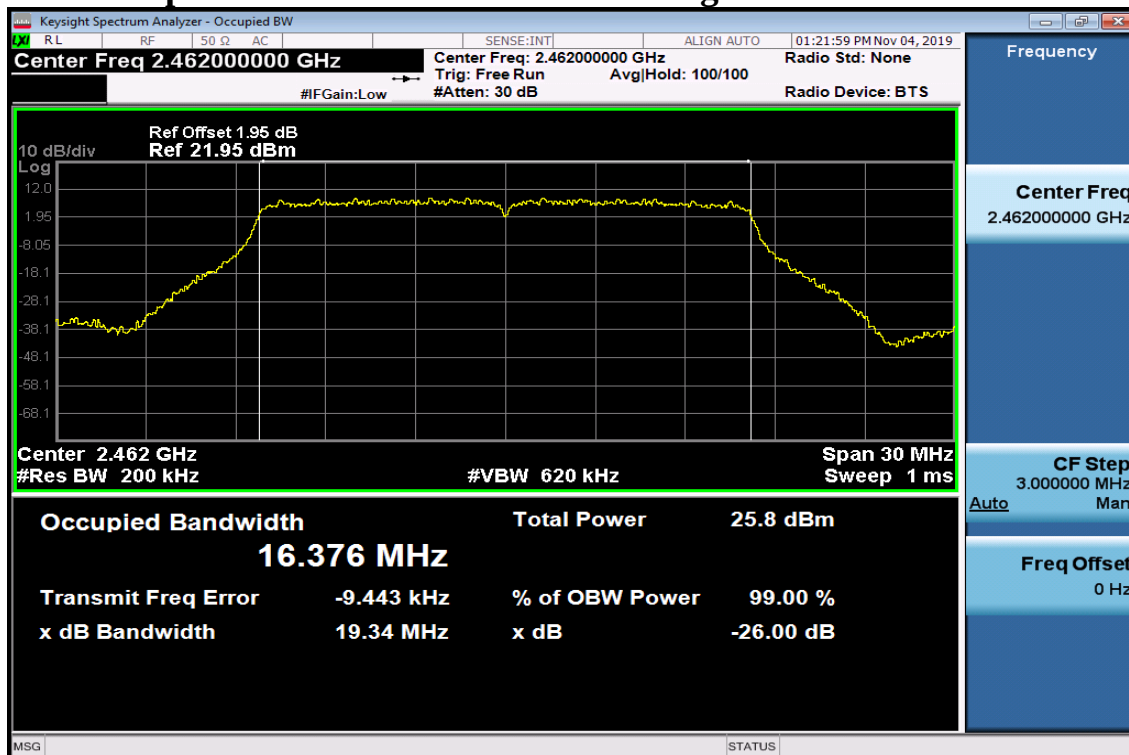
## 99% Occupied Bandwidth Test Data CH-Low



## 99% Occupied Bandwidth Test Data CH-Mid

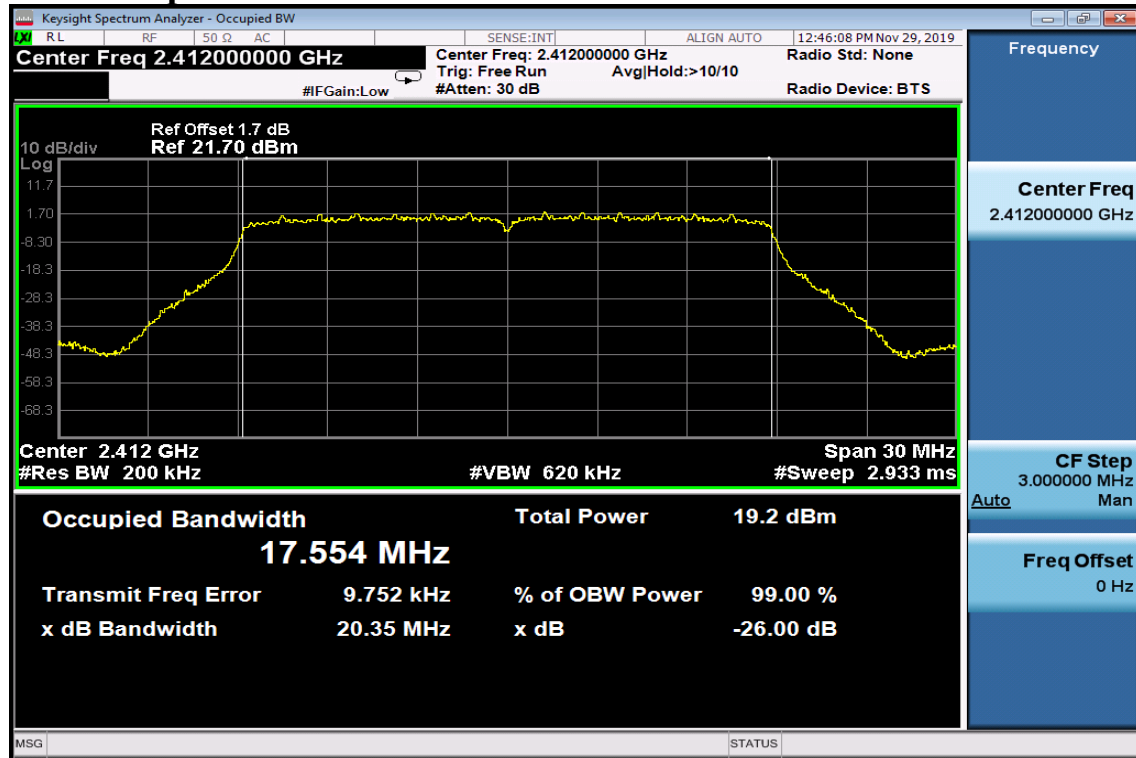


## 99% Occupied Bandwidth Test Data CH-High

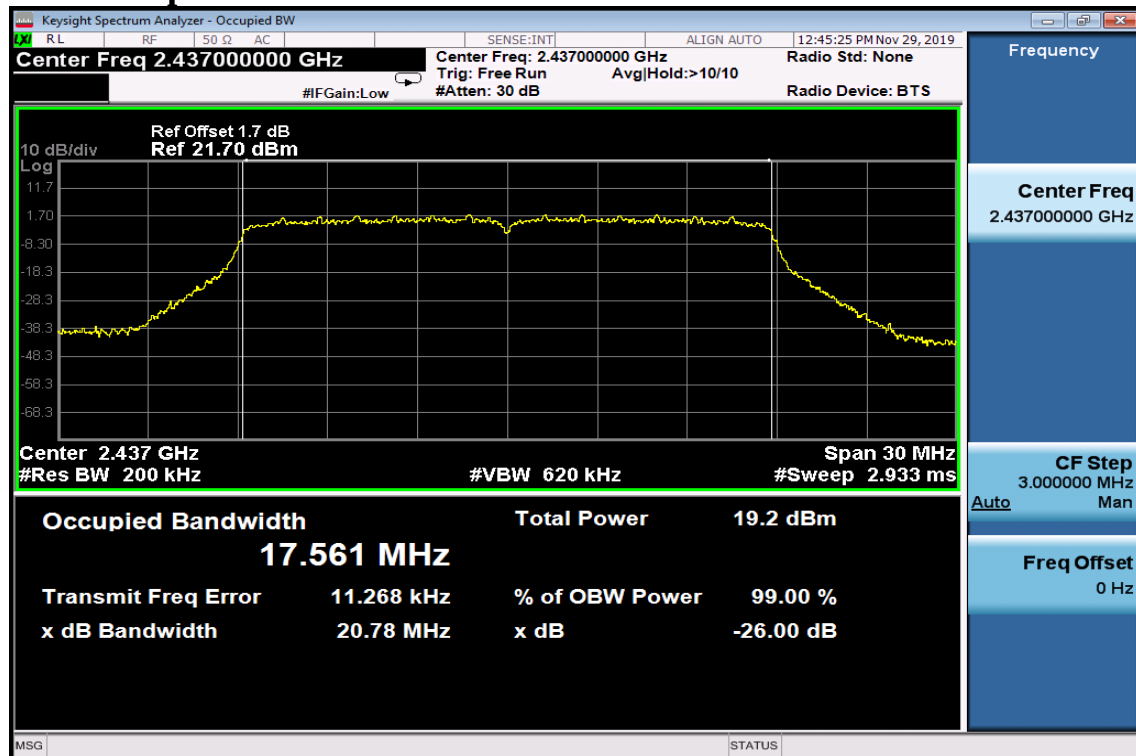


## 802.11n\_HT20

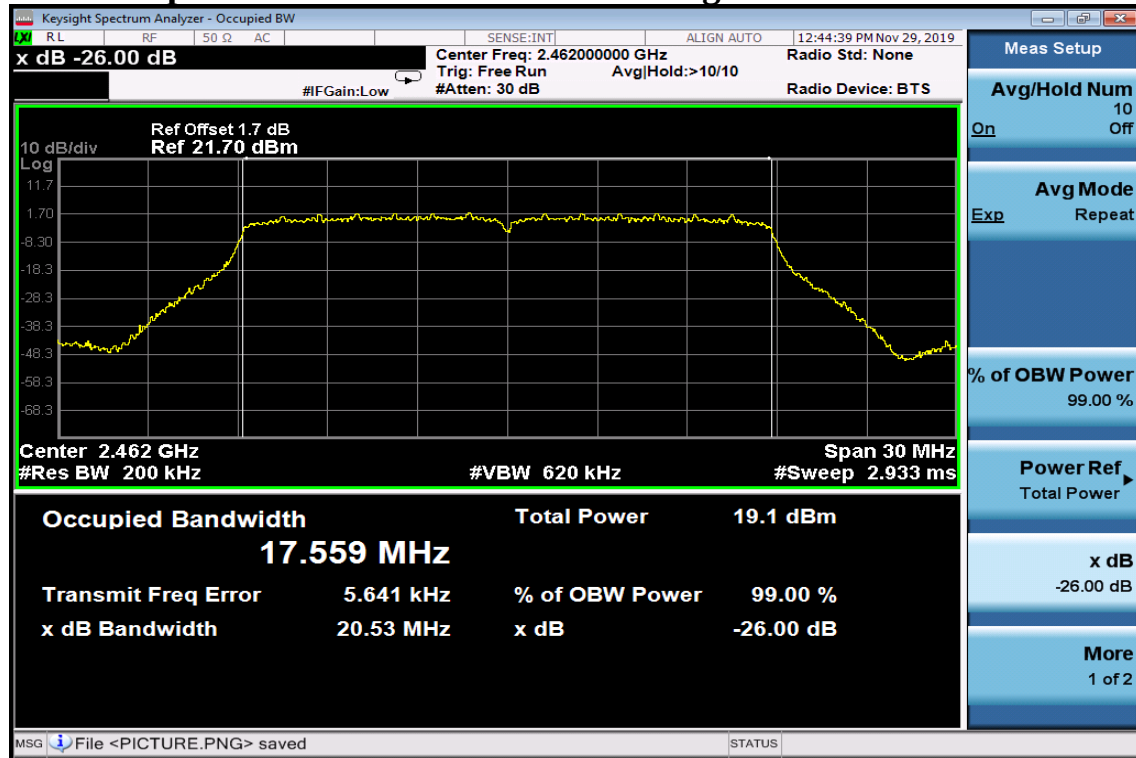
### 99% Occupied Bandwidth Test Data CH-Low



### 99% Occupied Bandwidth Test Data CH-Mid

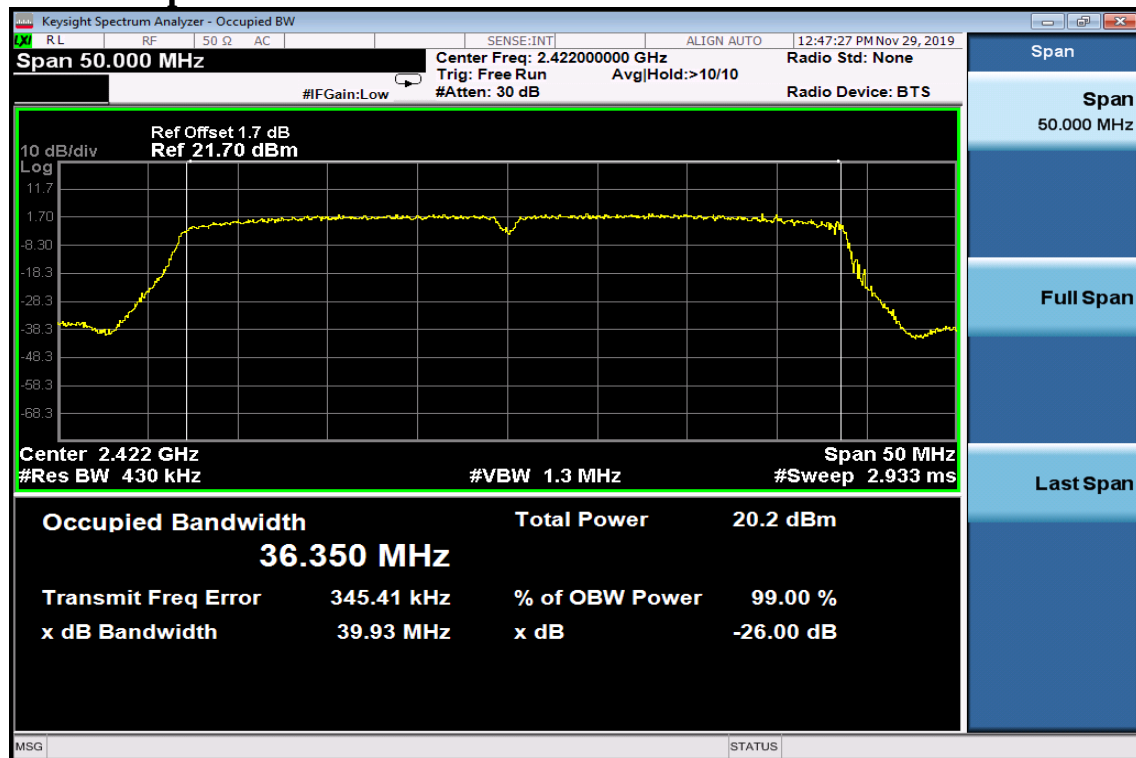


## 99% Occupied Bandwidth Test Data CH-High

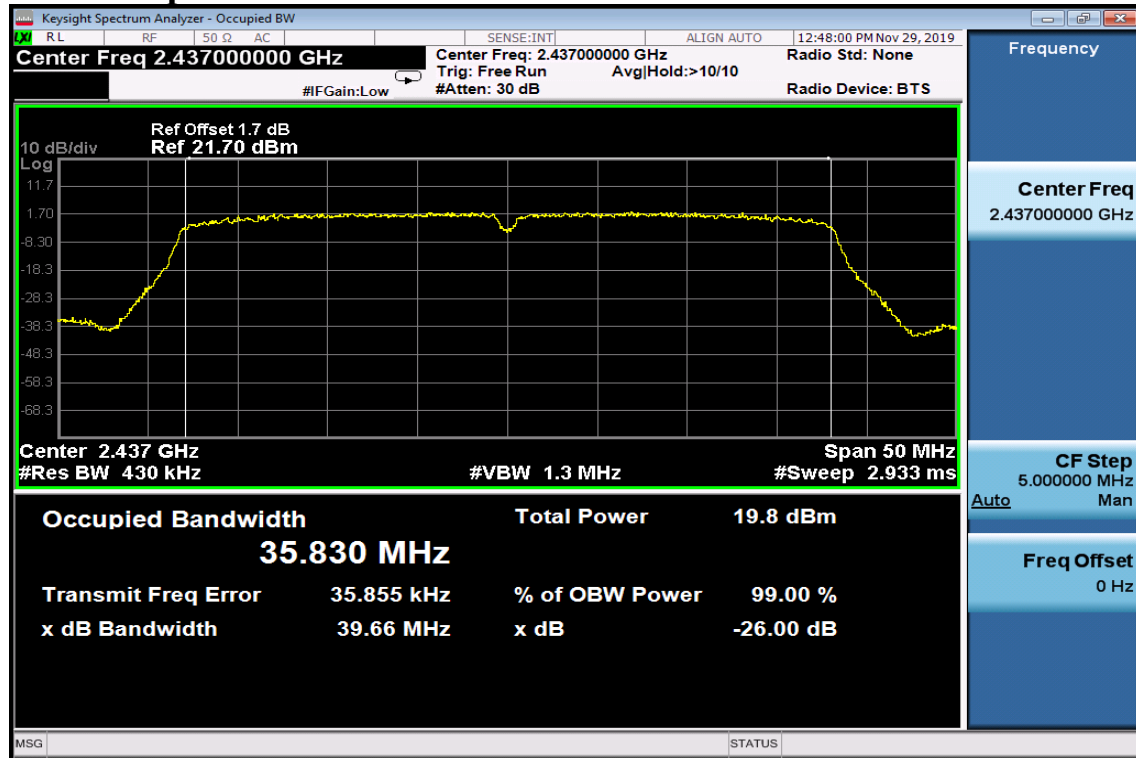


## 802.11n\_HT40

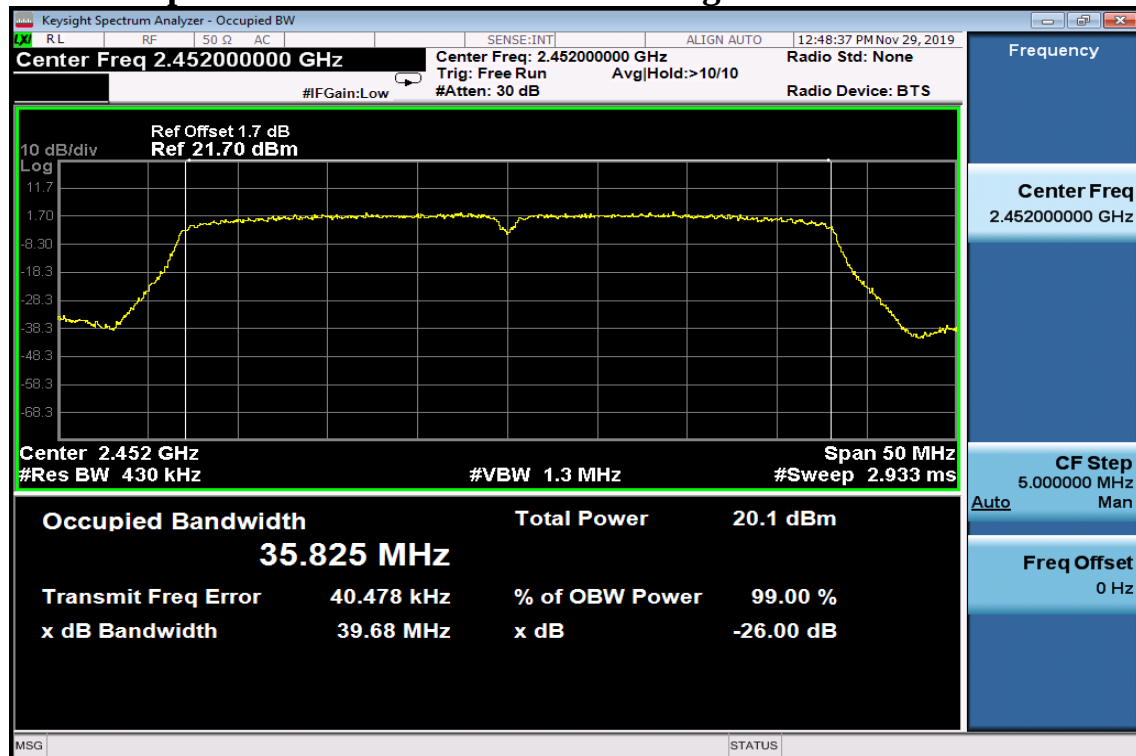
## 99% Occupied Bandwidth Test Data CH-Low



## 99% Occupied Bandwidth Test Data CH-Mid



## 99% Occupied Bandwidth Test Data CH-High



## **8 Spurious Radiated Emission Test**

### **8.1 Standard Applicable**

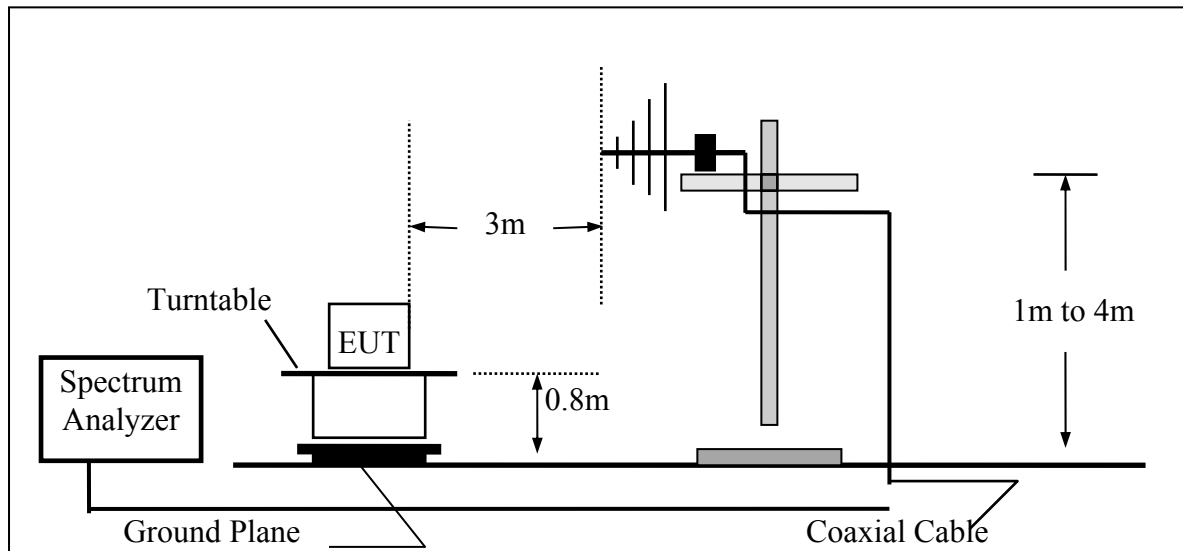
According to §15.247(c), all other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). And according to §15.33(a)(1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

## 8.2 Measurement Equipment Used:

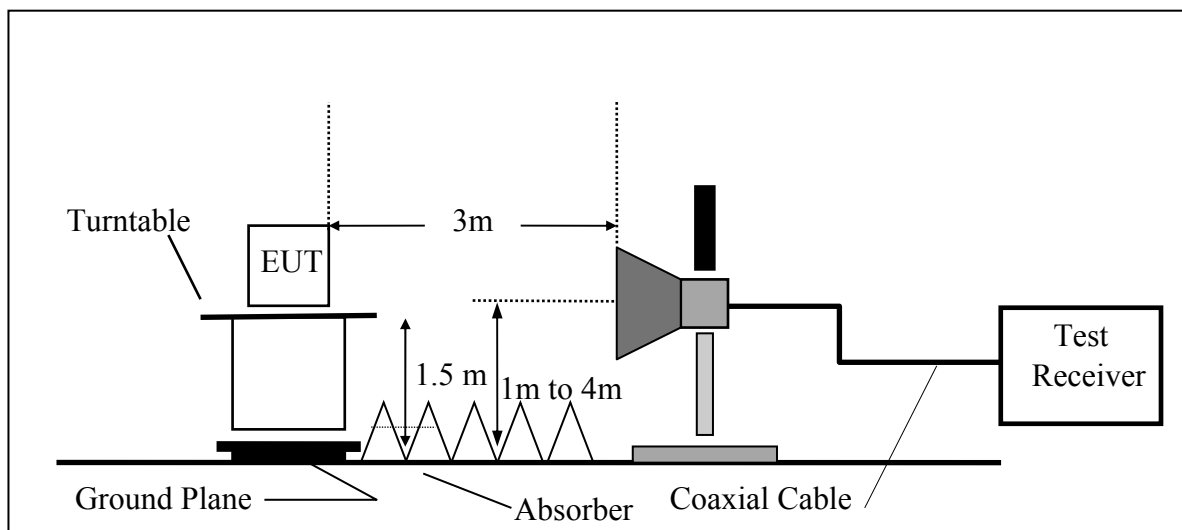
| Chamber 19(966)               |                                |                        |                     |            |            |
|-------------------------------|--------------------------------|------------------------|---------------------|------------|------------|
| Equipment Type                | Manufacturer                   | Model Number           | Serial Number       | Last Cal.  | Cal Due.   |
| Spectrum analyzer             | R&S                            | FSP40                  | 100116              | 01/10/2019 | 01/10/2020 |
| EMI Receiver                  | R&S                            | ESR3                   | 102461              | 08/08/2018 | 08/08/2020 |
| Loop Antenna                  | EM                             | EM-6879                | 271                 | 05/31/2019 | 05/31/2020 |
| Bilog Antenna<br>(30MHz-1GHz) | Schwarzbeck                    | VULB9168 w<br>5dB Att. | 736                 | 01/29/2019 | 01/29/2020 |
| Horn antenna<br>(1GHz-18GHz)  | Schwarzbeck                    | 9120D                  | 9120D-1627          | 06/17/2019 | 06/17/2020 |
| Horn antenna<br>(18GHz-26GHz) | Com-power                      | AH-826                 | 081001              | 11/21/2019 | 11/21/2020 |
| Horn antenna<br>(26GHz-40GHz) | Com-power                      | AH-640                 | 100A                | 03/29/2019 | 03/29/2021 |
| Preamplifier<br>(9kHz-1GHz)   | HP                             | 8447F                  | 3113A06362          | 01/14/2019 | 01/14/2020 |
| Preamplifier<br>(1GHz-26GHz)  | Agilent                        | 8449B                  | 3008A02471          | 10/05/2019 | 10/05/2020 |
| Preamplifier<br>(26GHz-40GHz) | MITEQ                          | JS4-26004000-27-<br>5A | 818471              | 05/06/2019 | 05/06/2020 |
| RF Cable<br>(9kHz-18GHz)      | HUBER SUHNER                   | Sucoflex 104A          | MY1397/4A           | 01/17/2019 | 01/17/2020 |
| RF Cable<br>(18GHz-40GHz)     | HUBER SUHNER                   | Sucoflex 102           | 27963/2&37421/<br>2 | 11/27/2017 | 11/27/2019 |
| RF Cable<br>(18GHz-40GHz)     | HUBER SUHNER                   | Sucoflex 102           | 27963/2&37421/<br>2 | 11/27/2019 | 11/27/2021 |
| Signal Generator              | Anritsu                        | MG3692A                | 20311               | 01/09/2019 | 01/09/2020 |
| Test Software                 | Audix                          | E3<br>Ver:6.12023      | N/A                 | N/A        | N/A        |
| Magnetic Field Meter          | Combinova                      | MFM-10                 | 645                 | 10/16/2019 | 10/16/2020 |
| Magnetic Field Meter          | Combinova                      | MFM-1000               | 619                 | 12/06/2019 | 12/06/2020 |
| Electric Field Meter          | Combinova                      | EFM-200                | 402                 | 10/16/2019 | 10/16/2020 |
| E-field probe                 | Narda / Wandel &<br>Goltermann | EF-0691 +<br>NBM-520   | D-0135 + D-0526     | 03/02/2019 | 03/02/2020 |

### 8.3 Test SET-UP:

(A) Radiated Emission Test Setup for frequency below 1000MHz



(B) Radiated Emission Test Setup Frequency above 1 GHz



#### 8.4 Measurement Procedure:

- 1 According 414788 section 2, Either OATS or chamber for radiated emission below 30MHz, the test was done at 966 chamber, the test site was evaluated with OATS and the Chamber has test signals level greater than OATS's.
- 2 The EUT was placed on a turn table which is 0.8m/1.5m above ground plane in 966 chamber.
- 3 The turn table shall rotate 360 degrees to determine the position of maximum emission level.
- 4 EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
- 5 When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
- 6 Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 7 And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 8 Repeat above procedures until all frequency measured were complete.

Test receiver setting : Blew 1GHz  
 Detector : Average(9kHz – 90kHz, 110kHz – 90kHz), Quasi-Peak  
 Bandwidth : 200Hz, 120kHz  
 Test spectrum setting : Above 1GHz  
 Peak : RBW=1MHz, VBW=3MHz, Sweep=auto  
 Average (for Wi-Fi) : RBW=1MHz, VBW=10Hz, Sweep=auto

#### Average Measurement Setting (VBW)

| Mode           | Duty Cycle (%) | T <sub>on</sub> (us) | T <sub>off</sub> (us) | 1/T <sub>on</sub> (kHz) | Determined VBW Setting  |
|----------------|----------------|----------------------|-----------------------|-------------------------|-------------------------|
| 802.11b        | 100            | -                    | -                     | -                       | 10Hz (Duty cycle ≥ 98%) |
| 802.11g        | 100            | -                    | -                     | -                       | 10Hz (Duty cycle ≥ 98%) |
| 802.11n (HT20) | 100            | -                    | -                     | -                       | 10Hz (Duty cycle ≥ 98%) |
| 802.11n (HT40) | 100            | -                    | -                     | -                       | 10Hz (Duty cycle ≥ 98%) |

## 8.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

|       |                        |                                            |
|-------|------------------------|--------------------------------------------|
| Where | FS = Field Strength    | CL = Cable Attenuation Factor (Cable Loss) |
|       | RA = Reading Amplitude | AG = Amplifier Gain                        |
|       | AF = Antenna Factor    |                                            |

## 8.6 Measurement Result:

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

### Radiated Spurious Emission Measurement Result (below 1GHz)

|                |                 |           |            |
|----------------|-----------------|-----------|------------|
| Operation Mode | 802.11b TX mode | Test Date | 2019/11/25 |
| Channel number | CH Low          | Test By   | Weitin     |
| Temperature    | 25 °C           | Pol       | Ver./Hor   |
| Humidity       | 60 %            |           |            |

| No | Freq<br>MHz | Reading<br>dBuV | Factor<br>dB | Level<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|--------------|-----------------|-----------------|--------------|--------|------------|
| 1  | 62.98       | 35.82           | -6.13        | 29.69           | 40.00           | -10.31       | Peak   | VERTICAL   |
| 2  | 191.02      | 33.10           | -7.08        | 26.02           | 43.50           | -17.48       | Peak   | VERTICAL   |
| 3  | 250.19      | 33.91           | -5.51        | 28.40           | 46.00           | -17.60       | Peak   | VERTICAL   |
| 4  | 399.57      | 33.95           | -2.02        | 31.93           | 46.00           | -14.07       | Peak   | VERTICAL   |
| 5  | 496.57      | 33.07           | -0.67        | 32.40           | 46.00           | -13.60       | Peak   | VERTICAL   |
| 6  | 833.16      | 33.99           | 5.18         | 39.17           | 46.00           | -6.83        | Peak   | VERTICAL   |
|    |             |                 |              |                 |                 |              |        |            |
| 1  | 98.87       | 41.36           | -10.39       | 30.97           | 43.50           | -12.53       | Peak   | HORIZONTAL |
| 2  | 250.19      | 40.52           | -5.51        | 35.01           | 46.00           | -10.99       | Peak   | HORIZONTAL |
| 3  | 298.69      | 33.33           | -3.85        | 29.48           | 46.00           | -16.52       | Peak   | HORIZONTAL |
| 4  | 497.54      | 31.71           | -0.67        | 31.04           | 46.00           | -14.96       | Peak   | HORIZONTAL |
| 5  | 520.82      | 33.84           | 0.08         | 33.92           | 46.00           | -12.08       | Peak   | HORIZONTAL |
| 6  | 833.16      | 30.89           | 5.18         | 36.07           | 46.00           | -9.93        | Peak   | HORIZONTAL |

#### Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 9kHz to 1000MHz were made with an instrument detector setting 9-90kHz/110-490kHz using PK/AV and other Frequency Band using PK/QP
- 4 Measurement result 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.

### Radiated Spurious Emission Measurement Result (below 1GHz)

|                |                 |           |            |
|----------------|-----------------|-----------|------------|
| Operation Mode | 802.11b TX mode | Test Date | 2019/11/25 |
| Channel number | CH Mid          | Test By   | Weitin     |
| Temperature    | 25 °C           | Pol       | Ver./Hor   |
| Humidity       | 60 %            |           |            |

| No | Freq<br>MHz | Reading<br>dBuV | Factor<br>dB | Level<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|--------------|-----------------|-----------------|--------------|--------|------------|
| 1  | 40.67       | 37.30           | -5.65        | 31.65           | 40.00           | -8.35        | Peak   | VERTICAL   |
| 2  | 125.06      | 32.37           | -7.47        | 24.90           | 43.50           | -18.60       | Peak   | VERTICAL   |
| 3  | 250.19      | 33.00           | -5.51        | 27.49           | 46.00           | -18.51       | Peak   | VERTICAL   |
| 4  | 298.69      | 31.48           | -3.85        | 27.63           | 46.00           | -18.37       | Peak   | VERTICAL   |
| 5  | 422.85      | 32.58           | -1.60        | 30.98           | 46.00           | -15.02       | Peak   | VERTICAL   |
| 6  | 833.16      | 32.78           | 5.18         | 37.96           | 46.00           | -8.04        | Peak   | VERTICAL   |
|    |             |                 |              |                 |                 |              |        |            |
| 1  | 94.99       | 41.62           | -11.09       | 30.53           | 43.50           | -12.97       | Peak   | HORIZONTAL |
| 2  | 188.11      | 39.18           | -6.87        | 32.31           | 43.50           | -11.19       | Peak   | HORIZONTAL |
| 3  | 250.19      | 41.56           | -5.51        | 36.05           | 46.00           | -9.95        | Peak   | HORIZONTAL |
| 4  | 299.66      | 33.22           | -3.82        | 29.40           | 46.00           | -16.60       | Peak   | HORIZONTAL |
| 5  | 518.88      | 28.54           | 0.02         | 28.56           | 46.00           | -17.44       | Peak   | HORIZONTAL |
| 6  | 833.16      | 30.29           | 5.18         | 35.47           | 46.00           | -10.53       | Peak   | HORIZONTAL |

#### Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 9MHz to 1000MHz were made with an instrument detector setting 9-90kHz/110-490kHz using PK/AV and other Frequency Band using PK/QP
- 4 Measurement result 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 SPA between 9kHz to 30MHz was 10kHz, VBW= 30kHz; between 30MHz to 1GHz was 100kHz, VBW=300kHz.

### Radiated Spurious Emission Measurement Result (below 1GHz)

|                |                 |           |            |
|----------------|-----------------|-----------|------------|
| Operation Mode | 802.11b TX mode | Test Date | 2019/11/25 |
| Channel number | CH High         | Test By   | Weitin     |
| Temperature    | 25 °C           | Pol       | Ver./Hor   |
| Humidity       | 60 %            |           |            |

| No | Freq<br>MHz | Reading<br>dBuV | Factor<br>dB | Level<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|--------------|-----------------|-----------------|--------------|--------|------------|
| 1  | 94.99       | 41.62           | -11.09       | 30.53           | 43.50           | -12.97       | Peak   | VERTICAL   |
| 2  | 188.11      | 39.18           | -6.87        | 32.31           | 43.50           | -11.19       | Peak   | VERTICAL   |
| 3  | 250.19      | 41.56           | -5.51        | 36.05           | 46.00           | -9.95        | Peak   | VERTICAL   |
| 4  | 299.66      | 33.22           | -3.82        | 29.40           | 46.00           | -16.60       | Peak   | VERTICAL   |
| 5  | 518.88      | 28.54           | 0.02         | 28.56           | 46.00           | -17.44       | Peak   | VERTICAL   |
| 6  | 833.16      | 30.29           | 5.18         | 35.47           | 46.00           | -10.53       | Peak   | VERTICAL   |
|    |             |                 |              |                 |                 |              |        |            |
| 1  | 98.87       | 41.09           | -10.39       | 30.70           | 43.50           | -12.80       | Peak   | HORIZONTAL |
| 2  | 179.38      | 37.35           | -6.05        | 31.30           | 43.50           | -12.20       | Peak   | HORIZONTAL |
| 3  | 250.19      | 41.41           | -5.51        | 35.90           | 46.00           | -10.10       | Peak   | HORIZONTAL |
| 4  | 299.66      | 34.08           | -3.82        | 30.26           | 46.00           | -15.74       | Peak   | HORIZONTAL |
| 5  | 498.51      | 35.64           | -0.65        | 34.99           | 46.00           | -11.01       | Peak   | HORIZONTAL |
| 6  | 833.16      | 30.35           | 5.18         | 35.53           | 46.00           | -10.47       | Peak   | HORIZONTAL |

#### Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 9kHz to 1000MHz were made with an instrument detector setting 9-90kHz/110-490kHz using PK/AV and other Frequency Band using PK/QP
- 4 Measurement result 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 SPA between 9kHz to 30MHz was 10kHz, VBW= 30kHz; between 30MHz to 1GHz was 100kHz, VBW=300kHz.

### Radiated Spurious Emission Measurement Result (below 1GHz)

|                |                 |           |            |
|----------------|-----------------|-----------|------------|
| Operation Mode | 802.11g TX mode | Test Date | 2019/11/25 |
| Channel number | CH Low          | Test By   | Weitin     |
| Temperature    | 25 °C           | Pol       | Ver./Hor   |
| Humidity       | 60 %            |           |            |

| No | Freq<br>MHz | Reading<br>dBuV | Factor<br>dB | Level<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|--------------|-----------------|-----------------|--------------|--------|------------|
| 1  | 250.19      | 33.14           | -5.51        | 27.63           | 46.00           | -18.37       | Peak   | VERTICAL   |
| 2  | 302.57      | 31.44           | -3.77        | 27.67           | 46.00           | -18.33       | Peak   | VERTICAL   |
| 3  | 399.57      | 33.50           | -2.02        | 31.48           | 46.00           | -14.52       | Peak   | VERTICAL   |
| 4  | 521.79      | 34.63           | 0.11         | 34.74           | 46.00           | -11.26       | Peak   | VERTICAL   |
| 5  | 598.42      | 29.92           | 1.49         | 31.41           | 46.00           | -14.59       | Peak   | VERTICAL   |
| 6  | 833.16      | 34.71           | 5.18         | 39.89           | 46.00           | -6.11        | Peak   | VERTICAL   |
|    |             |                 |              |                 |                 |              |        |            |
| 1  | 100.81      | 41.33           | -10.04       | 31.29           | 43.50           | -12.21       | Peak   | HORIZONTAL |
| 2  | 193.93      | 40.52           | -7.18        | 33.34           | 43.50           | -10.16       | Peak   | HORIZONTAL |
| 3  | 250.19      | 40.56           | -5.51        | 35.05           | 46.00           | -10.95       | Peak   | HORIZONTAL |
| 4  | 298.69      | 33.31           | -3.85        | 29.46           | 46.00           | -16.54       | Peak   | HORIZONTAL |
| 5  | 385.99      | 29.11           | -2.22        | 26.89           | 46.00           | -19.11       | Peak   | HORIZONTAL |
| 6  | 514.03      | 32.08           | -0.18        | 31.90           | 46.00           | -14.10       | Peak   | HORIZONTAL |

#### Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 9kHz to 1000MHz were made with an instrument detector setting 9-90kHz/110-490kHz using PK/AV and other Frequency Band using PK/QP
- 4 Measurement result 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 SPA between 9kHz to 30MHz was 10kHz, VBW= 30kHz; between 30MHz to 1GHz was 100kHz, VBW=300kHz.

### Radiated Spurious Emission Measurement Result (below 1GHz)

|                |                 |           |            |
|----------------|-----------------|-----------|------------|
| Operation Mode | 802.11g TX mode | Test Date | 2019/11/25 |
| Channel number | CH Mid          | Test By   | Weitin     |
| Temperature    | 25 °C           | Pol       | Ver./Hor   |
| Humidity       | 60 %            |           |            |

| No | Freq<br>MHz | Reading<br>dBuV | Factor<br>dB | Level<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|--------------|-----------------|-----------------|--------------|--------|------------|
| 1  | 152.22      | 32.83           | -5.19        | 27.64           | 43.50           | -15.86       | Peak   | VERTICAL   |
| 2  | 250.19      | 33.50           | -5.51        | 27.99           | 46.00           | -18.01       | Peak   | VERTICAL   |
| 3  | 306.45      | 31.15           | -3.72        | 27.43           | 46.00           | -18.57       | Peak   | VERTICAL   |
| 4  | 399.57      | 34.39           | -2.02        | 32.37           | 46.00           | -13.63       | Peak   | VERTICAL   |
| 5  | 518.88      | 31.71           | 0.02         | 31.73           | 46.00           | -14.27       | Peak   | VERTICAL   |
| 6  | 833.16      | 35.18           | 5.18         | 40.36           | 46.00           | -5.64        | Peak   | VERTICAL   |
|    |             |                 |              |                 |                 |              |        |            |
| 1  | 101.78      | 42.39           | -9.91        | 32.48           | 43.50           | -11.02       | Peak   | HORIZONTAL |
| 2  | 191.02      | 39.64           | -7.08        | 32.56           | 43.50           | -10.94       | Peak   | HORIZONTAL |
| 3  | 250.19      | 41.34           | -5.51        | 35.83           | 46.00           | -10.17       | Peak   | HORIZONTAL |
| 4  | 299.66      | 33.12           | -3.82        | 29.30           | 46.00           | -16.70       | Peak   | HORIZONTAL |
| 5  | 497.54      | 31.65           | -0.67        | 30.98           | 46.00           | -15.02       | Peak   | HORIZONTAL |
| 6  | 833.16      | 30.97           | 5.18         | 36.15           | 46.00           | -9.85        | Peak   | HORIZONTAL |

#### Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 9kHz to 1000MHz were made with an instrument detector setting 9-90kHz/110-490kHz using PK/AV and other Frequency Band using PK/QP
- 4 Measurement result 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 SPA between 9kHz to 30MHz was 10kHz, VBW= 30kHz; between 30MHz to 1GHz was 100kHz, VBW=300kHz.

### Radiated Spurious Emission Measurement Result (below 1GHz)

|                |                 |           |            |
|----------------|-----------------|-----------|------------|
| Operation Mode | 802.11g TX mode | Test Date | 2019/11/25 |
| Channel number | CH High         | Test By   | Weitin     |
| Temperature    | 25 °C           | Pol       | Ver./Hor   |
| Humidity       | 60 %            |           |            |

| No | Freq<br>MHz | Reading<br>dBuV | Factor<br>dB | Level<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|--------------|-----------------|-----------------|--------------|--------|------------|
| 1  | 125.06      | 32.97           | -7.47        | 25.50           | 43.50           | -18.00       | Peak   | VERTICAL   |
| 2  | 250.19      | 33.48           | -5.51        | 27.97           | 46.00           | -18.03       | Peak   | VERTICAL   |
| 3  | 299.66      | 31.75           | -3.82        | 27.93           | 46.00           | -18.07       | Peak   | VERTICAL   |
| 4  | 422.85      | 32.90           | -1.60        | 31.30           | 46.00           | -14.70       | Peak   | VERTICAL   |
| 5  | 595.51      | 27.97           | 1.43         | 29.40           | 46.00           | -16.60       | Peak   | VERTICAL   |
| 6  | 850.62      | 28.80           | 5.35         | 34.15           | 46.00           | -11.85       | Peak   | VERTICAL   |
|    |             |                 |              |                 |                 |              |        |            |
| 1  | 98.87       | 41.45           | -10.39       | 31.06           | 43.50           | -12.44       | Peak   | HORIZONTAL |
| 2  | 191.02      | 38.84           | -7.08        | 31.76           | 43.50           | -11.74       | Peak   | HORIZONTAL |
| 3  | 250.19      | 41.52           | -5.51        | 36.01           | 46.00           | -9.99        | Peak   | HORIZONTAL |
| 4  | 299.66      | 33.69           | -3.82        | 29.87           | 46.00           | -16.13       | Peak   | HORIZONTAL |
| 5  | 497.54      | 39.59           | -0.67        | 38.92           | 46.00           | -7.08        | Peak   | HORIZONTAL |
| 6  | 841.89      | 28.30           | 5.29         | 33.59           | 46.00           | -12.41       | Peak   | HORIZONTAL |

#### Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 9kHz to 1000MHz were made with an instrument detector setting 9-90kHz/110-490kHz using PK/AV and other Frequency Band using PK/QP
- 4 Measurement result 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 SPA between 9kHz to 30MHz was 10kHz, VBW= 30kHz; between 30MHz to 1GHz was 100kHz, VBW=300kHz.

### Radiated Spurious Emission Measurement Result (below 1GHz)

|                |                      |           |            |
|----------------|----------------------|-----------|------------|
| Operation Mode | 802.11n HT20 TX mode | Test Date | 2019/11/25 |
| Channel number | CH Low               | Test By   | Weitin     |
| Temperature    | 25 °C                | Pol       | Ver./Hor   |
| Humidity       | 60 %                 |           |            |

| No | Freq<br>MHz | Reading<br>dBuV | Factor<br>dB | Level<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|--------------|-----------------|-----------------|--------------|--------|------------|
| 1  | 125.06      | 33.50           | -7.47        | 26.03           | 43.50           | -17.47       | Peak   | VERTICAL   |
| 2  | 250.19      | 34.22           | -5.51        | 28.71           | 46.00           | -17.29       | Peak   | VERTICAL   |
| 3  | 353.98      | 30.47           | -2.92        | 27.55           | 46.00           | -18.45       | Peak   | VERTICAL   |
| 4  | 398.60      | 33.96           | -2.03        | 31.93           | 46.00           | -14.07       | Peak   | VERTICAL   |
| 5  | 520.82      | 32.51           | 0.08         | 32.59           | 46.00           | -13.41       | Peak   | VERTICAL   |
| 6  | 833.16      | 35.28           | 5.18         | 40.46           | 46.00           | -5.54        | Peak   | VERTICAL   |
|    |             |                 |              |                 |                 |              |        |            |
| 1  | 98.87       | 41.15           | -10.39       | 30.76           | 43.50           | -12.74       | Peak   | HORIZONTAL |
| 2  | 187.14      | 40.48           | -6.78        | 33.70           | 43.50           | -9.80        | Peak   | HORIZONTAL |
| 3  | 250.19      | 41.67           | -5.51        | 36.16           | 46.00           | -9.84        | Peak   | HORIZONTAL |
| 4  | 298.69      | 33.89           | -3.85        | 30.04           | 46.00           | -15.96       | Peak   | HORIZONTAL |
| 5  | 520.82      | 31.62           | 0.08         | 31.70           | 46.00           | -14.30       | Peak   | HORIZONTAL |
| 6  | 833.16      | 30.53           | 5.18         | 35.71           | 46.00           | -10.29       | Peak   | HORIZONTAL |

#### Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 9kHz to 1000MHz were made with an instrument detector setting 9-90kHz/110-490kHz using PK/AV and other Frequency Band using PK/QP
- 4 Measurement result 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 SPA between 9kHz to 30MHz was 10kHz, VBW= 30kHz; between 30MHz to 1GHz was 100kHz, VBW=300kHz.

### Radiated Spurious Emission Measurement Result (below 1GHz)

|                |                      |           |            |
|----------------|----------------------|-----------|------------|
| Operation Mode | 802.11n HT20 TX mode | Test Date | 2019/11/25 |
| Channel number | CH Mid               | Test By   | Weitin     |
| Temperature    | 25 °C                | Pol       | Ver./Hor   |
| Humidity       | 60 %                 |           |            |

| No | Freq<br>MHz | Reading<br>dBuV | Factor<br>dB | Level<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|--------------|-----------------|-----------------|--------------|--------|------------|
| 1  | 250.19      | 33.29           | -5.51        | 27.78           | 46.00           | -18.22       | Peak   | VERTICAL   |
| 2  | 407.33      | 33.36           | -1.89        | 31.47           | 46.00           | -14.53       | Peak   | VERTICAL   |
| 3  | 521.79      | 33.98           | 0.11         | 34.09           | 46.00           | -11.91       | Peak   | VERTICAL   |
| 4  | 607.15      | 28.56           | 1.62         | 30.18           | 46.00           | -15.82       | Peak   | VERTICAL   |
| 5  | 732.28      | 28.52           | 3.57         | 32.09           | 46.00           | -13.91       | Peak   | VERTICAL   |
| 6  | 833.16      | 34.78           | 5.18         | 39.96           | 46.00           | -6.04        | Peak   | VERTICAL   |
|    |             |                 |              |                 |                 |              |        |            |
| 1  | 99.84       | 41.04           | -10.19       | 30.85           | 43.50           | -12.65       | Peak   | HORIZONTAL |
| 2  | 186.17      | 39.34           | -6.69        | 32.65           | 43.50           | -10.85       | Peak   | HORIZONTAL |
| 3  | 250.19      | 41.57           | -5.51        | 36.06           | 46.00           | -9.94        | Peak   | HORIZONTAL |
| 4  | 298.69      | 32.78           | -3.85        | 28.93           | 46.00           | -17.07       | Peak   | HORIZONTAL |
| 5  | 521.79      | 30.58           | 0.11         | 30.69           | 46.00           | -15.31       | Peak   | HORIZONTAL |
| 6  | 833.16      | 31.58           | 5.18         | 36.76           | 46.00           | -9.24        | Peak   | HORIZONTAL |

#### Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 9kHz to 1000MHz were made with an instrument detector setting 9-90kHz/110-490kHz using PK/AV and other Frequency Band using PK/QP
- 4 Measurement result 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 SPA between 9kHz to 30MHz was 10kHz, VBW= 30kHz; between 30MHz to 1GHz was 100kHz, VBW=300kHz.

### Radiated Spurious Emission Measurement Result (below 1GHz)

|                |                      |           |            |
|----------------|----------------------|-----------|------------|
| Operation Mode | 802.11n HT20 TX mode | Test Date | 2019/11/25 |
| Channel number | CH High              | Test By   | Weitin     |
| Temperature    | 25 °C                | Pol       | Ver./Hor   |
| Humidity       | 60 %                 |           |            |

| No | Freq<br>MHz | Reading<br>dBuV | Factor<br>dB | Level<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|--------------|-----------------|-----------------|--------------|--------|------------|
| 1  | 125.06      | 33.43           | -7.47        | 25.96           | 43.50           | -17.54       | Peak   | VERTICAL   |
| 2  | 250.19      | 33.44           | -5.51        | 27.93           | 46.00           | -18.07       | Peak   | VERTICAL   |
| 3  | 298.69      | 31.08           | -3.85        | 27.23           | 46.00           | -18.77       | Peak   | VERTICAL   |
| 4  | 391.81      | 33.61           | -2.13        | 31.48           | 46.00           | -14.52       | Peak   | VERTICAL   |
| 5  | 522.76      | 32.45           | 0.13         | 32.58           | 46.00           | -13.42       | Peak   | VERTICAL   |
| 6  | 833.16      | 34.40           | 5.18         | 39.58           | 46.00           | -6.42        | Peak   | VERTICAL   |
|    |             |                 |              |                 |                 |              |        |            |
| 1  | 100.81      | 41.30           | -10.04       | 31.26           | 43.50           | -12.24       | Peak   | HORIZONTAL |
| 2  | 165.80      | 36.96           | -5.09        | 31.87           | 43.50           | -11.63       | Peak   | HORIZONTAL |
| 3  | 250.19      | 41.17           | -5.51        | 35.66           | 46.00           | -10.34       | Peak   | HORIZONTAL |
| 4  | 298.69      | 34.40           | -3.85        | 30.55           | 46.00           | -15.45       | Peak   | HORIZONTAL |
| 5  | 497.54      | 31.05           | -0.67        | 30.38           | 46.00           | -15.62       | Peak   | HORIZONTAL |
| 6  | 833.16      | 31.02           | 5.18         | 36.20           | 46.00           | -9.80        | Peak   | HORIZONTAL |

#### Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 9kHz to 1000MHz were made with an instrument detector setting 9-90kHz/110-490kHz using PK/AV and other Frequency Band using PK/QP
- 4 Measurement result 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 SPA between 9kHz to 30MHz was 10kHz, VBW= 30kHz; between 30MHz to 1GHz was 100kHz, VBW=300kHz.