# RADIO TEST REPORT

## FCC 47 CFR PART 15 SUBPART C
## INDUSTRY CANADA RSS-247

| | |
|---|---|
| **Test Standard** | **FCC Part 15.247**<br>**RSS-247 issue 2 and RSS-GEN issue 5** |
| **Product name** | **Neat Pad** |
| **Brand Name** | **neat.** |
| **Model No.** | **A1** |
| **Test Result** | **Pass** |
| **Statements of Conformity** | **Determination of compliance is based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.** |

The test Result was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were given in ANSI C63.10: 2013 and compliance standards.

The test results of this report relate only to the tested sample (EUT) identified in this report.
The test Report of full or partial shall not copy. Without written approval of Compliance Certification Services Inc. (Wugu Laboratory).

Approved by:

Kevin Tsai
Deputy Manager

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
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# Revision History

| Rev. | Issue Date | Revisions | Effect Page | Revised By |
|---|---|---|---|---|
| 00 | September 14, 2021 | Initial Issue | ALL | Doris Chu |

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# 1. GENERAL INFORMATION

## 1.1 EUT INFORMATION

| | |
|---|---|
| Applicant | **For FCC**<br>Neatframe AS<br>Martin Linges Vei 25 Fornebu Fornebu 1364 Norway<br>**For IC**<br>Neatframe Limited<br>The Charter Building Charter Place<br>UXBRIDGE United Kingdom UB8 1JG United Kingdom Of Great Britain And Northern Ireland |
| Manufacturer | Neatframe Limited<br>The Charter Building Charter Place<br>UXBRIDGE United Kingdom UB8 1JG United Kingdom Of Great Britain And Northern Ireland |
| Equipment | Neat Pad |
| Model No. | A1 |
| Model Discrepancy | N/A |
| Trade Name | neat. |
| Received Date | August 13, 2021 |
| Date of Test | August 19 ~ September 11, 2021 |
| Power Supply | Power from Power Adapter.<br>1. Model: POE16R-1AFG<br>I/P: 100-240VAC, 50-60Hz, 0.8A, 32-44VA<br>O/P: 56VDC, 0.275A<br>2. Model: POE16R-1AFG6<br>I/P: 100-240VAC, 50-60Hz, 0.8A<br>O/P: 56VDC, 0.275A, 15.4W |
| HW Version | E08WWNFB2M5E.NPADA11 |
| SW Version | V5.12.1.3 |
| EUT Serial # | NA12017000590 |

**Remark:**
1. For more details, please refer to the User's manual of the EUT.
2. Disclaimer: Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

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## 1.2 EUT CHANNEL INFORMATION

| | |
|---|---|
| Frequency Range | 802.11b/g/n HT 20: 2412MHz ~ 2462MHz<br>802.11n HT40: 2422MHz ~ 2452MHz |
| Modulation Type | 1. IEEE 802.11b mode: CCK<br>2. IEEE 802.11g mode: OFDM<br>3. IEEE 802.11n HT 20 MHz mode : OFDM<br>4. IEEE 802.11n HT 40 MHz mode : OFDM |
| Number of channel | 1. IEEE 802.11b mode: 11 Channels<br>2. IEEE 802.11g mode: 11 Channels<br>3. IEEE 802.11n HT 20 MHz mode : 11 Channels<br>4. IEEE 802.11n HT 40 MHz mode : 7 Channels |

**Remark:**
Refer as ANSI C63.10: 2013 clause 5.6.1 Table 4 and RSS-GEN Table A1 for test channels

| Number of frequencies to be tested | | |
|---|---|---|
| **Frequency range in which device operates** | **Number of frequencies** | **Location in frequency range of operation** |
| ☐ 1 MHz or less | 1 | Middle |
| ☐ 1 MHz to 10 MHz | 2 | 1 near top and 1 near bottom |
| ☒ More than 10 MHz | 3 | 1 near top, 1 near middle, and 1 near bottom |

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## 1.3 ANTENNA INFORMATION

| | |
|---|---|
| **Antenna Type** | ☒ FPC ☐ PCB ☐ Dipole ☐ Coils |
| **Antenna Gain** | FPA2927-1A: Gain :0.85 dBi<br>FPA2927-2A: Gain :0.89 dBi<br>Power Directional Gain: 3.88 dBi |
| **Antenna Connector** | i-pex |

Remark:
1.The antenna(s) of the EUT are permanently attached and there are no provisions for connection to an external antenna. So the EUT complies with the requirements of §15.203 and RSS-Gen 6.8.
2. Power Directional Gain = 10*log { [ 10^(Ant1/20) + 10^(Ant2/20) + … + 10^(Ant N /20)]^2 / N ANT} dBi

## 1.4 MEASUREMENT UNCERTAINTY

| PARAMETER | UNCERTAINTY |
|---|---|
| AC Powerline Conducted Emission | +/- 1.2575 |
| Emission bandwidth, 20dB bandwidth | +/- 0.0014 |
| RF output power, conducted | +/- 1.14 |
| Power density, conducted | +/- 1.40 |
| 3M Semi Anechoic Chamber / 30M~200M | +/- 4.12 |
| 3M Semi Anechoic Chamber / 200M~1000M | +/- 4.68 |
| 3M Semi Anechoic Chamber / 1G~8G | +/- 5.18 |
| 3M Semi Anechoic Chamber / 8G~18G | +/- 5.47 |
| 3M Semi Anechoic Chamber / 18G~26G | +/- 3.81 |
| 3M Semi Anechoic Chamber / 26G~40G | +/- 3.87 |

**Remark**:
1.This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2
2. ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report.

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# 1.5 FACILITIES AND TEST LOCATION

All measurement facilities used to collect the measurement data are located at

No.11, Wugong 6th Rd., Wugu Dist., New Taipei City, Taiwan. (R.O.C.)
CAB identifier: TW1309

| Test site | Test Engineer | Remark |
|---|---|---|
| AC Conduction Room | Jack Chen | - |
| Radiation | Ray Li | - |
| RF Conducted | Lance Chen | - |

**Remark:** The lab has been recognized as the FCC accredited lad under the KDB 974614 D01 and is listed in the FCC pubic Access Link (PAL) database, FCC Registration No. :444940, the FCC Designation No.:TW1309

# 1.6 INSTRUMENT CALIBRATION

| RF Conducted Test Site | | | | | |
|---|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Date** | **Calibration Due** |
| Coaxial Cable | Woken | WC12 | CC003 | 06/28/2021 | 06/27/2022 |
| Coaxial Cable | Woken | WC12 | CC001 | 06/28/2021 | 06/27/2022 |
| Power Meter | Anritsu | ML2487A | 6K00003260 | 05/24/2021 | 05/23/2022 |
| Power Seneor | Anritsu | MA2490A | 032910 | 05/24/2021 | 05/23/2022 |
| EXA Signal Analyzer | KEYSIGHT | N9010B | MY55460167 | 09/07/2020 | 09/06/2021 |
| Software | Radio Test Software Ver. 21 | | | | |

| Conducted Emission Room | | | | | |
|---|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Date** | **Calibration Due** |
| CABLE | EMCI | CFD300-NL | CERF | 06/28/2021 | 06/27/2022 |
| EMI Test Receiver | R&S | ESCI | 100064 | 07/05/2021 | 07/04/2022 |
| LISN | SCHAFFNER | NNB 41 | 03/10013 | 02/02/2021 | 02/01/2022 |
| Software | EZ-EMC(CCS-3A1-CE) | | | | |

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| 3M 966 Chamber Test Site | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Cal Date** | **Cal Due** |
| Bilog Antenna | Sunol Sciences | JB3 | A030105 | 07/19/2021 | 07/18/2022 |
| Coaxial Cable | HUBER SUHNER | SUCOFLEX 104PEA | 20995 | 02/24/2021 | 02/23/2022 |
| Coaxial Cable | EMCI | EMC105 | 190914+327109/4 | 09/19/2020 | 09/18/2021 |
| Digital Thermo-Hygro Meter | WISEWIND | 1206 | D07 | 01/06/2021 | 01/05/2022 |
| double Ridged Guide Horn Antenna | ETC | MCTD 1209 | DRH13M02003 | 09/30/2020 | 09/29/2021 |
| High Pass Filters | MICRO TRONICS | HPM13195 | 003 | 02/08/2021 | 02/07/2022 |
| Horn Antenna | ETS LINDGREN | 3116 | 00026370 | 12/11/2020 | 12/10/2021 |
| K Type Cable | Huber+Suhner | SUCOFLEX 102 | 29406/2 | 12/09/2020 | 12/08/2021 |
| K Type Cable | Huber+Suhner | SUCOFLEX 102 | 22470/2 | 12/09/2020 | 12/08/2021 |
| Pre-Amplifier | EMEC | EM330 | 060609 | 02/24/2021 | 02/23/2022 |
| Pre-Amplifier | HP | 8449B | 3008A00965 | 02/25/2021 | 02/24/2022 |
| Pre-Amplifier | MITEQ | AMF-6F-18004000-37-8P | 985646 | 09/02/2020 | 09/01/2021 |
| Signal Analyzer | R&S | FSV 40 | 101073 | 09/17/2020 | 09/16/2021 |
| Antenna Tower | CCS | CC-A-1F | N/A | N.C.R | N.C.R |
| Controller | CCS | CC-C-1F | N/A | N.C.R | N.C.R |
| Turn Table | CCS | CC-T-1F | N/A | N.C.R | N.C.R |
| Software | e3 6.11-20180413 | | | | |

**Remark:** Each piece of equipment is scheduled for calibration once a year.

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## 1.7 SUPPORT AND EUT ACCESSORIES EQUIPMENT

| EUT Accessories Equipment | | | | | |
|---|---|---|---|---|---|
| **No.** | **Equipment** | **Brand** | **Model** | **Series No.** | **FCC ID** |
| | N/A | | | | |

| Support Equipment | | | | | | |
|---|---|---|---|---|---|---|
| **No.** | **Equipment** | **Brand** | **Model** | **Series No.** | **FCC ID** | **IC** |
| 1 | NB(J) | TOSHIBA | PT345T-00L002 | N/A | PD97260H | 1000M-7260H |

## 1.8 TEST METHODOLOGY AND APPLIED STANDARDS

The test methodology, setups and results comply with all requirements in accordance with ANSI C63.10:2013, FCC Part 2, FCC Part 15.247, RSS-247 Issue 2 and RSS-GEN Issue 5.

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# 2. TEST SUMMARY

| FCC Standard Section | IC Standard Section | Report Section | Test Item | Result |
|---|---|---|---|---|
| 15.203 | RSS-Gen 6.8 | 1.3 | Antenna Requirement | Pass |
| 15.207(a) | RSS-GEN 8.8 | 4.1 | AC Conducted Emission | Pass |
| 15.247(a)(2) | RSS-247(5.2)(a) | 4.2 | 6 dB Bandwidth | Pass |
| - | RSS-GEN 6.7 | 4.2 | Occupied Bandwidth (99%) | Pass |
| 15.247(b)(3) | RSS-247(5.4)(d) | 4.3 | Output Power Measurement | Pass |
| 15.247(e) | RSS-247(5.2)(b) | 4.4 | Power Spectral Density | Pass |
| 15.247(d) | RSS-247(5.5) | 4.5 | Conducted Band Edge | Pass |
| 15.247(d) | RSS-247(5.5) | 4.5 | Conducted Emission | Pass |
| 15.247(d) | RSS-GEN 8.9, 8.10 | 4.6 | Radiation Band Edge | Pass |
| 15.247(d) | RSS-GEN 8.9, 8.10 | 4.6 | Radiation Spurious Emission | Pass |

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# 3. DESCRIPTION OF TEST MODES

## 3.1 THE WORST MODE OF OPERATING CONDITION

| | |
|---|---|
| Operation mode | IEEE 802.11b mode :1Mbps<br>IEEE 802.11g mode :6Mbps<br>IEEE 802.11n HT20 mode :MCS8<br>IEEE 802.11n HT40 Mode: MCS8 |
| Test Channel Frequencies | **IEEE 802.11b mode :**<br>1. Lowest Channel : 2412MHz<br>2. Middle Channel : 2437MHz<br>3. Highest Channel : 2462MHz<br>**IEEE 802.11g mode :**<br>1. Lowest Channel : 2412MHz<br>2. Middle Channel : 2437MHz<br>3. Highest Channel : 2462MHz<br>**IEEE 802.11n HT20 mode :**<br>1. Lowest Channel : 2412MHz<br>2. Middle Channel : 2437MHz<br>3. Highest Channel : 2462MHz<br>**IEEE 802.11n HT40 Mode:**<br>1. Lowest Channel: 2422MHz<br>2. Middle Channel: 2437MHz<br>3. Highest Channel: 2452MHz |
| Operation Transmitter | IEEE 802.11b mode : 2T2R<br>IEEE 802.11g mode : 2T2R<br>IEEE 802.11n HT20 mode : 2T2R<br>IEEE 802.11n HT20 mode : 2T2R |

**Remark:**
1. EUT pre-scanned data rate of output power for each mode, the worst data rate were recorded in this report.
2. The worst-case data rates are determined to be as follows for each mode based upon investigations by evaluate the peak power, average power and PSD across all date rates, bandwidths, and modulations. The device supports SISO and MIMO at 802.11 b/g/n mode, per pre-test, MIMO 2TX mode was the worst and reported.

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## 3.2 THE WORST MODE OF MEASUREMENT

| AC Power Line Conducted Emission | |
|---|---|
| Test Condition | AC Power line conducted emission for line and neutral |
| Power supply Mode | Mode 1: EUT power by Adapter (POE16R-1AFG)<br>Mode 2: EUT power by Adapter (POE16R-1AFG6) |
| Worst Mode | ☒ Mode 1 ☒ Mode 2 ☐ Mode 3 ☐ Mode 4 |

| Radiated Emission Measurement Above 1G | |
|---|---|
| Test Condition | Radiated Emission Above 1G |
| Power supply Mode | Mode 1: EUT Power by Adapter (POE16R-1AFG)<br>Mode 2: EUT Power by Adapter (POE16R-1AFG6) |
| Worst Mode | ☒ Mode 1 ☐ Mode 2 ☐ Mode 3 ☐ Mode 4 |
| Worst Position | ☐ Placed in fixed position.<br>☒ Placed in fixed position at X-Plane (E2-Plane)<br>☐ Placed in fixed position at Y-Plane (E1-Plane)<br>☐ Placed in fixed position at Z-Plane (H-Plane) |

| Radiated Emission Measurement Below 1G | |
|---|---|
| Test Condition | Radiated Emission Below 1G |
| Power supply Mode | Mode 1: EUT Power by Adapter (POE16R-1AFG)<br>Mode 2: EUT Power by Adapter (POE16R-1AFG6) |
| Worst Mode | ☒ Mode 1 ☐ Mode 2 ☐ Mode 3 ☐ Mode 4 |

*Remark:*
*1. The worst mode was record in this test report.*
*2. EUT pre-scanned in three axis ,X,Y, Z and two polarity, for radiated measurement. The worst case(X-Plane) were recorded in this report*
*3. AC power line conducted emission and for below 1G radiation emission were performed the EUT transmit at the highest output power channel as worse case.*

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# 4. EUT DUTY CYCLE

**Temperature:** 20.3 ~ 26.8℃ **Humidity:** 54 ~ 62% RH

**Tested by:** Lance Chen **Test date:** August 19 ~ 31, 2021

| Duty Cycle | | | | |
|---|---|---|---|---|
| Configuration | Duty Cycle (%) | Duty Factor (dB) =10*log (1/Duty Cycle) | 1/T (kHz) | VBW setting (kHz) |
| 802.11b | 96.35 | 0.16 | 0.08 | 1.00 |
| 802.11g | 94.38 | 0.25 | 0.48 | 1.00 |
| 802.11n HT20 | 49.89 | 3.02 | 4.37 | 5.00 |
| 802.11n HT40 | 49.62 | 3.04 | 7.75 | 8.00 |

802.11b

802.11g

802.11n HT20

802.11n HT40

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# 5. TEST RESULT

## 5.1 AC POWER LINE CONDUCTED EMISSION

### 5.1.1 Test Limit

According to §15.207(a)(2) and RSS-GEN section 8.8,

| Frequency Range (MHz) | Limits(dBμV) | |
|---|---|---|
| | 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 |

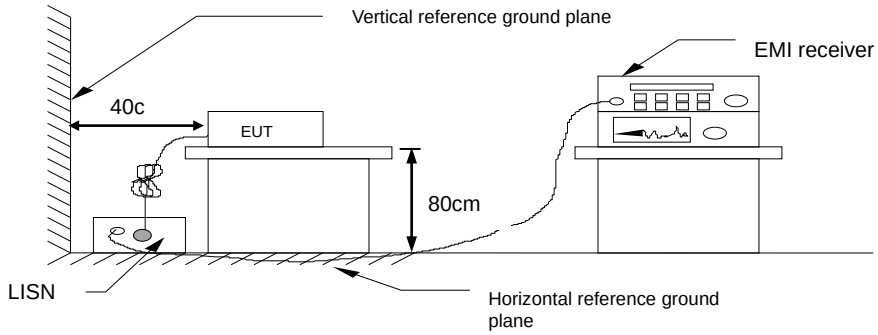
* Decreases with the logarithm of the frequency.

### 5.1.2 Test Procedure

Test method Refer as ANSI C63.10: 2013 clause 6.2,

1. The EUT was placed on a non-conducted table, which is 0.8m above horizontal ground plane and 0.4m above vertical ground plane.
2. EUT connected to the line impedance stabilization network (LISN)
3. Receiver set RBW of 9kHz and Detector Peak, and note as quasi-peak and average.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. Recorded Line for Neutral and Line.

### 5.1.3 Test Setup




### 5.1.4 Test Result

**PASS**

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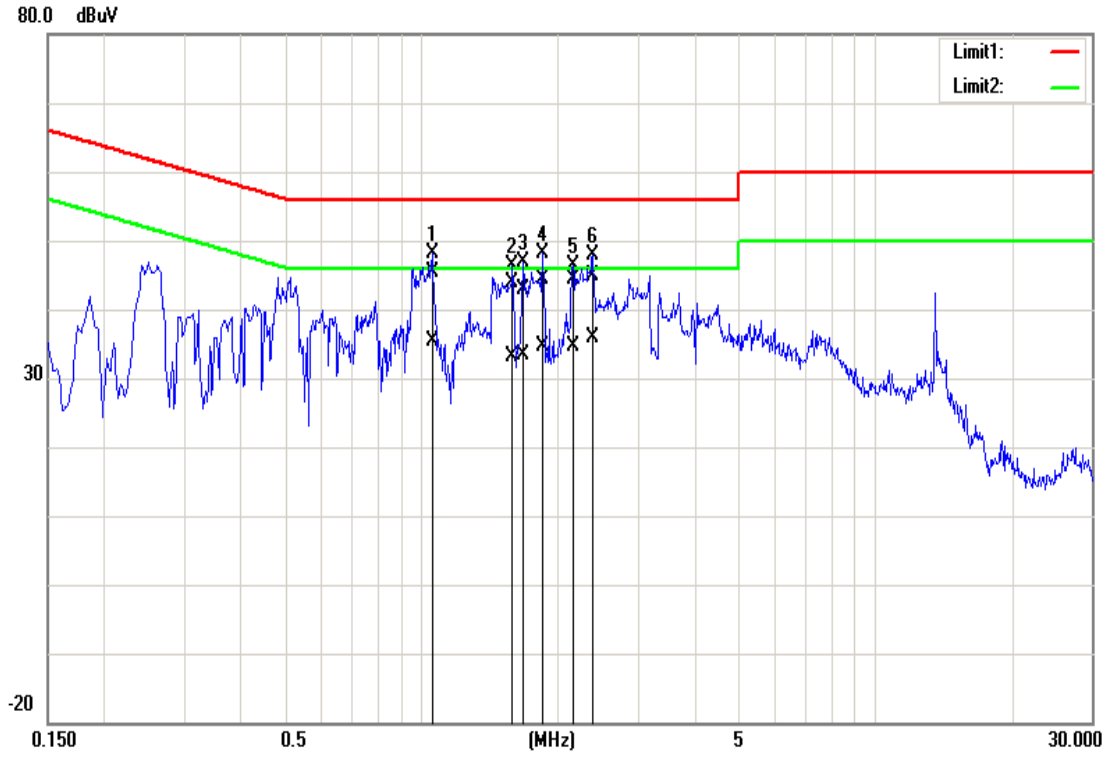
## Test Data

| Test Mode: | Mode 1 | Temp/Hum | 27.3(℃)/ 48%RH |
|---|---|---|---|
| Phase: | Line | Test Date | August 20, 2021 |
| | | Test Engineer | Jack Chen |




| Frequency (MHz) | Quasi Peak reading (dBuV) | Average reading (dBuV) | Correction factor (dB) | Quasi Peak result (dBuV) | Average result (dBuV) | Quasi Peak limit (dBuV) | Average limit (dBuV) | Quasi Peak margin (dB) | Average margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.0580 | 35.06 | 24.99 | 10.31 | 45.37 | 35.30 | 56.00 | 46.00 | -10.63 | -10.70 | Pass |
| 1.5860 | 33.62 | 22.85 | 10.33 | 43.95 | 33.18 | 56.00 | 46.00 | -12.05 | -12.82 | Pass |
| 1.6780 | 32.64 | 23.02 | 10.33 | 42.97 | 33.35 | 56.00 | 46.00 | -13.03 | -12.65 | Pass |
| 1.8500 | 34.05 | 24.41 | 10.34 | 44.39 | 34.75 | 56.00 | 46.00 | -11.61 | -11.25 | Pass |
| 2.1580 | 33.93 | 24.32 | 10.34 | 44.27 | 34.66 | 56.00 | 46.00 | -11.73 | -11.34 | Pass |
| 2.3860 | 34.61 | 25.48 | 10.34 | 44.95 | 35.82 | 56.00 | 46.00 | -11.05 | -10.18 | Pass |

Note: Correction factor = LISN loss + Cable loss.

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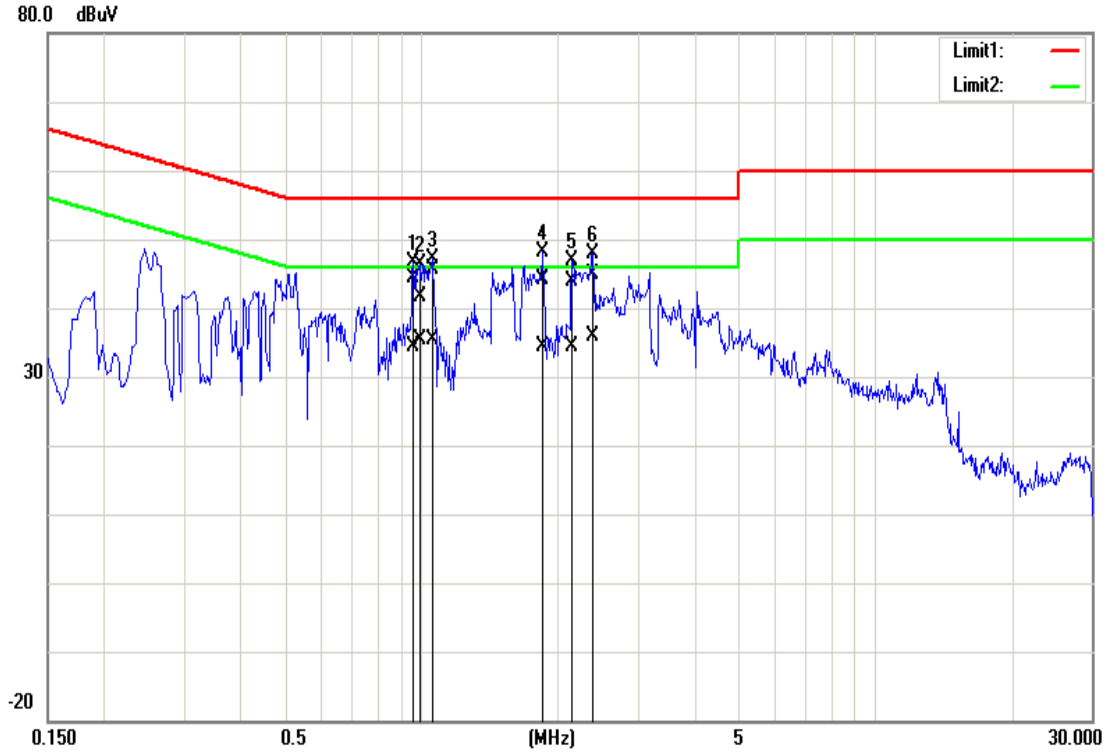
| Test Mode: | Mode 1 | Temp/Hum | 27.3(℃)/ 48%RH |
|---|---|---|---|
| Phase: | Neutral | Test Date | August 20, 2021 |
| | | Test Engineer | Jack Chen |




| Frequency (MHz) | Quasi Peak reading (dBuV) | Average reading (dBuV) | Correction factor (dB) | Quasi Peak result (dBuV) | Average result (dBuV) | Quasi Peak limit (dBuV) | Average limit (dBuV) | Quasi Peak margin (dB) | Average margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.9620 | 34.00 | 24.17 | 10.31 | 44.31 | 34.48 | 56.00 | 46.00 | -11.69 | -11.52 | Pass |
| 0.9900 | 31.41 | 25.06 | 10.31 | 41.72 | 35.37 | 56.00 | 46.00 | -14.28 | -10.63 | Pass |
| 1.0580 | 35.21 | 24.99 | 10.31 | 45.52 | 35.30 | 56.00 | 46.00 | -10.48 | -10.70 | Pass |
| 1.8540 | 33.88 | 24.00 | 10.34 | 44.22 | 34.34 | 56.00 | 46.00 | -11.78 | -11.66 | Pass |
| 2.1540 | 33.63 | 24.07 | 10.34 | 43.97 | 34.41 | 56.00 | 46.00 | -12.03 | -11.59 | Pass |
| 2.3860 | 34.52 | 25.55 | 10.34 | 44.86 | 35.89 | 56.00 | 46.00 | -11.14 | -10.11 | Pass |

Note: Correction factor = LISN loss + Cable loss.

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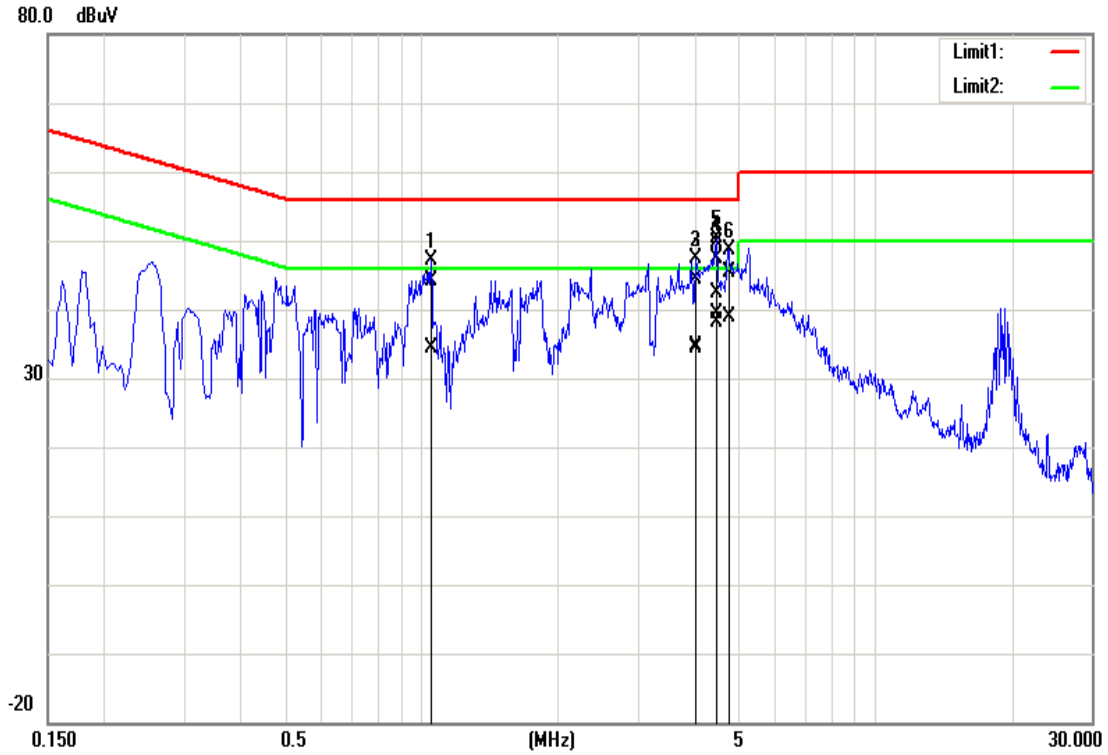
| Test Mode: | Mode 2 | Temp/Hum | 26.1(℃)/ 47%RH |
|---|---|---|---|
| Phase: | Line | Test Date | September 11, 2021 |
| | | Test Engineer | Jack Chen |




| Frequency (MHz) | Quasi Peak reading (dBuV) | Average reading (dBuV) | Correction factor (dB) | Quasi Peak result (dBuV) | Average result (dBuV) | Quasi Peak limit (dBuV) | Average limit (dBuV) | Quasi Peak margin (dB) | Average margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.0500 | 33.82 | 24.05 | 10.31 | 44.13 | 34.36 | 56.00 | 46.00 | -11.87 | -11.64 | Pass |
| 3.9500 | 34.01 | 23.98 | 10.38 | 44.39 | 34.36 | 56.00 | 46.00 | -11.61 | -11.64 | Pass |
| 4.0260 | 34.03 | 24.34 | 10.38 | 44.41 | 34.72 | 56.00 | 46.00 | -11.59 | -11.28 | Pass |
| 4.3900 | 32.05 | 27.87 | 10.38 | 42.43 | 38.25 | 56.00 | 46.00 | -13.57 | -7.75 | Pass |
| 4.4780 | 36.94 | 29.05 | 10.38 | 47.32 | 39.43 | 56.00 | 46.00 | -8.68 | -6.57 | Pass |
| 4.7580 | 35.01 | 28.37 | 10.39 | 45.40 | 38.76 | 56.00 | 46.00 | -10.60 | -7.24 | Pass |

Note: Correction factor = LISN loss + Cable loss.

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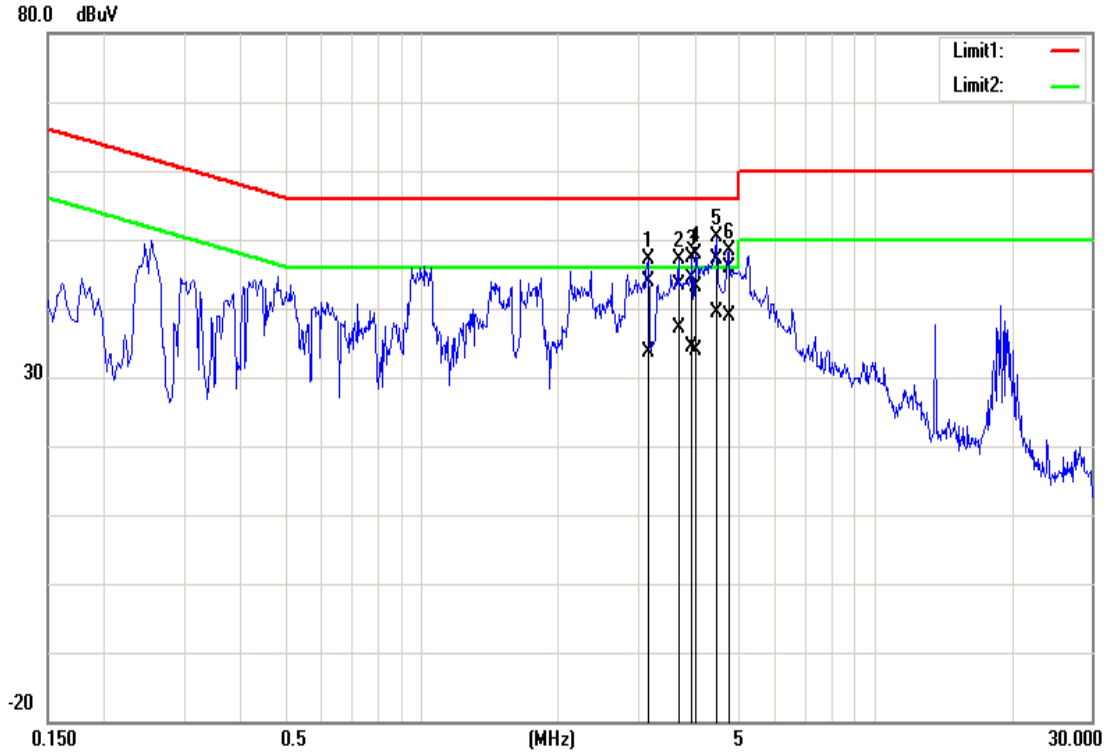
| Test Mode: | Mode 2 | Temp/Hum | 26.1(℃)/ 47%RH |
|---|---|---|---|
| Phase: | Neutral | Test Date | September 11, 2021 |
| | | Test Engineer | Jack Chen |




| Frequency (MHz) | Quasi Peak reading (dBuV) | Average reading (dBuV) | Correction factor (dB) | Quasi Peak result (dBuV) | Average result (dBuV) | Quasi Peak limit (dBuV) | Average limit (dBuV) | Quasi Peak margin (dB) | Average margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 3.1580 | 33.40 | 23.25 | 10.36 | 43.76 | 33.61 | 56.00 | 46.00 | -12.24 | -12.39 | Pass |
| 3.6860 | 32.90 | 26.85 | 10.38 | 43.28 | 37.23 | 56.00 | 46.00 | -12.72 | -8.77 | Pass |
| 3.9460 | 34.00 | 23.96 | 10.38 | 44.38 | 34.34 | 56.00 | 46.00 | -11.62 | -11.66 | Pass |
| 4.0300 | 32.78 | 23.53 | 10.38 | 43.16 | 33.91 | 56.00 | 46.00 | -12.84 | -12.09 | Pass |
| 4.4780 | 36.81 | 29.08 | 10.38 | 47.19 | 39.46 | 56.00 | 46.00 | -8.81 | -6.54 | Pass |
| 4.7580 | 35.41 | 28.60 | 10.39 | 45.80 | 38.99 | 56.00 | 46.00 | -10.20 | -7.01 | Pass |

Note: Correction factor = LISN loss + Cable loss.

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# 5.2 6dB BANDWIDTH AND OCCUPIED BANDWIDTH (99%)

## 5.2.1 Test Limit

According to §15.247(a)(2) and RSS-247 section 5.2(a),

**6 dB Bandwidth** ：

| | |
|---|---|
| Limit | Shall be at least 500kHz |

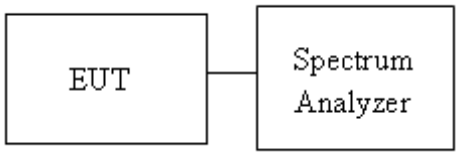
**Occupied Bandwidth(99%)** ： For reporting purposes only.

## 5.2.2 Test Procedure

Test method Refer as ANSI C63.10: 2013,

1. The EUT RF output connected to the spectrum analyzer by RF cable.
2. Setting maximum power transmit of EUT
3. SA set RBW = 100kHz, VBW = 300kHz and Detector = Peak, to measurement 6 dB Bandwidth.
4. SA set RBW = 1% ~ 5% OBW, VBW = three times the RBW and Detector = Peak, to measurement 99% Bandwidth
5. Measure and record the result of 6 dB Bandwidth and 99% Bandwidth. in the test report.

## 5.2.3 Test Setup

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## 5.2.4 Test Result

| | | | |
|---|---|---|---|
| **Temperature:** | 20.3 ~ 26.8℃ | **Humidity:** | 54 ~ 62% RH |
| **Tested by:** | Lance Chen | **Test date:** | August 19 ~ 31, 2021 |

| Test mode: IEEE 802.11b mode / 2412-2462 MHz | | | | | | |
|---|---|---|---|---|---|---|
| **Channel** | **Frequency (MHz)** | **Chain 0 OBW(99%) (MHz)** | **Chain 1 OBW(99%) (MHz)** | **Chain 0 6dB BW (MHz)** | **Chain 1 6dB BW (MHz)** | **6dB limit (kHz)** |
| Low | 2412 | 14.785 | 14.611 | 10.13 | 10.13 | ≥500 |
| Mid | 2437 | 14.820 | 14.824 | 10.13 | 10.14 | |
| High | 2462 | 14.805 | 14.659 | 10.14 | 10.13 | |

| Test mode: IEEE 802.11g mode / 2412-2462 MHz | | | | | | |
|---|---|---|---|---|---|---|
| **Channel** | **Frequency (MHz)** | **Chain 0 OBW(99%) (MHz)** | **Chain 1 OBW(99%) (MHz)** | **Chain 0 6dB BW (MHz)** | **Chain 1 6dB BW (MHz)** | **6dB limit (kHz)** |
| Low | 2412 | 16.574 | 16.457 | 15.69 | 15.79 | ≥500 |
| Mid | 2437 | 16.656 | 16.657 | 15.75 | 15.71 | |
| High | 2462 | 16.546 | 16.463 | 16.31 | 15.68 | |

| Test mode: IEEE 802.11n HT 20 MHz mode / 2412-2462 MHz | | | | | | |
|---|---|---|---|---|---|---|
| **Channel** | **Frequency (MHz)** | **Chain 0 OBW(99%) (MHz)** | **Chain 1 OBW(99%) (MHz)** | **Chain 0 6dB BW (MHz)** | **Chain 1 6dB BW (MHz)** | **6dB limit (kHz)** |
| Low | 2412 | 17.749 | 17.566 | 17.27 | 16.38 | ≥500 |
| Mid | 2437 | 17.853 | 17.854 | 16.43 | 16.43 | |
| High | 2462 | 17.864 | 17.836 | 16.41 | 17.34 | |

| Test mode: IEEE 802.11n HT40 Mode / 2422-2452 MHz | | | | | | |
|---|---|---|---|---|---|---|
| **Channel** | **Frequency (MHz)** | **Chain 0 OBW(99%) (MHz)** | **Chain1 OBW(99%) (MHz)** | **Chain 0 6dB BW (MHz)** | **Chain 1 6dB BW (MHz)** | **6dB limit (kHz)** |
| Low | 2422 | 36.151 | 36.417 | 35.48 | 35.47 | ≥500 |
| Mid | 2437 | 36.128 | 36.127 | 35.49 | 35.50 | |
| High | 2452 | 36.157 | 34.65 | 35.78 | 35.20 | |

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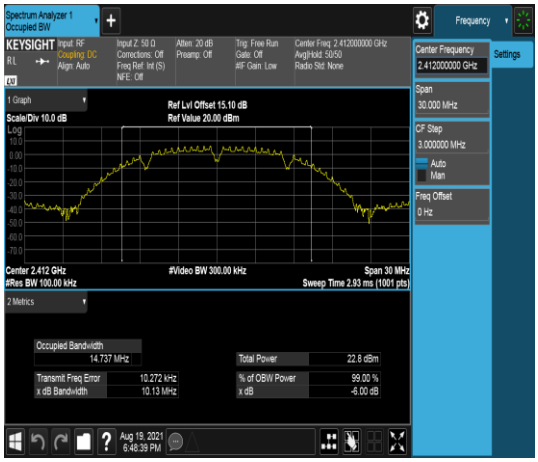
## Test Data

## 6dB BANDWIDTH

| IEEE 802.11b mode-Chain 0 | |
|---|---|
| **Low CH** | **Mid CH** |
|  | |
| **High CH** | |
| | |

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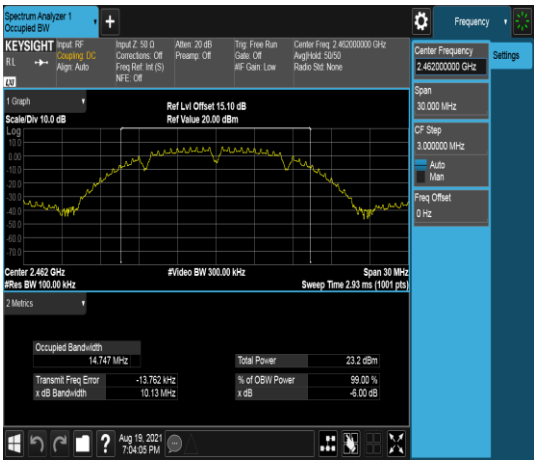
| IEEE 802.11b mode-Chain 1 | |
|---|---|
| **Low CH** | **Mid CH** |
| | |
| **High CH** | |
|  | |

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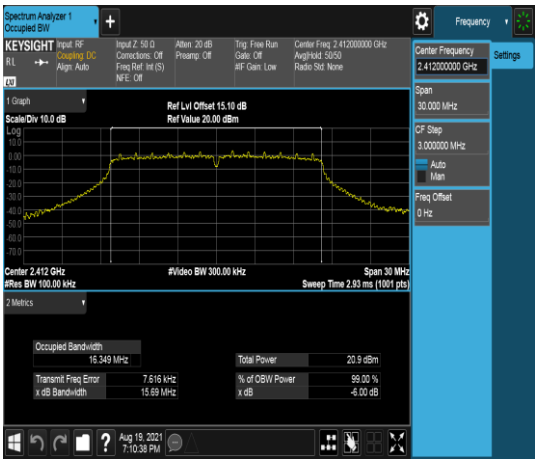
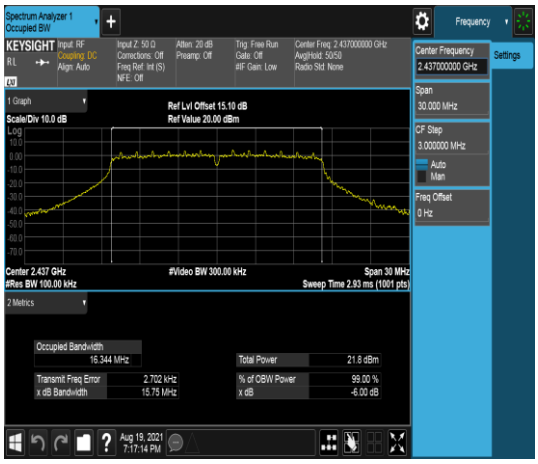
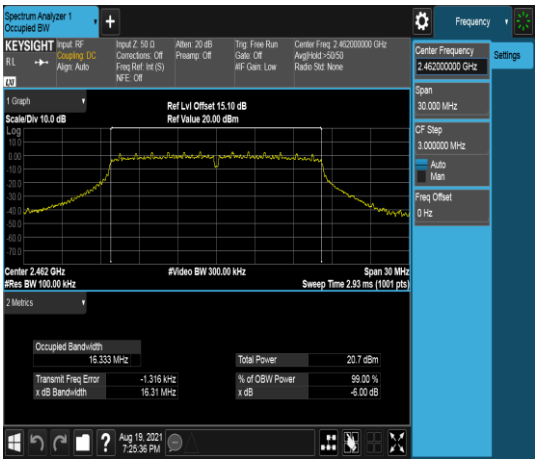
| IEEE 802.11g mode-Chain 0 | |
|---|---|
| **Low CH** | **Mid CH** |
|  |  |
| **High CH** | |
|  | |

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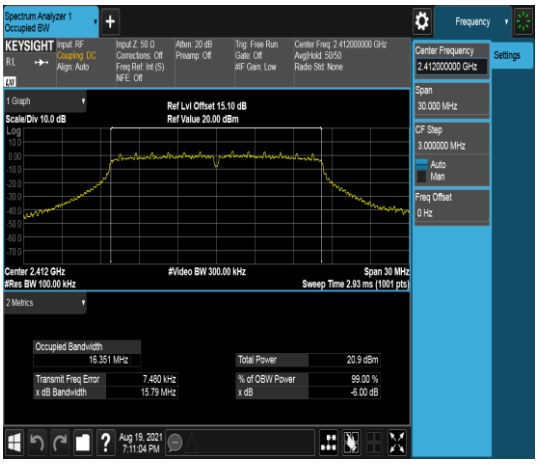
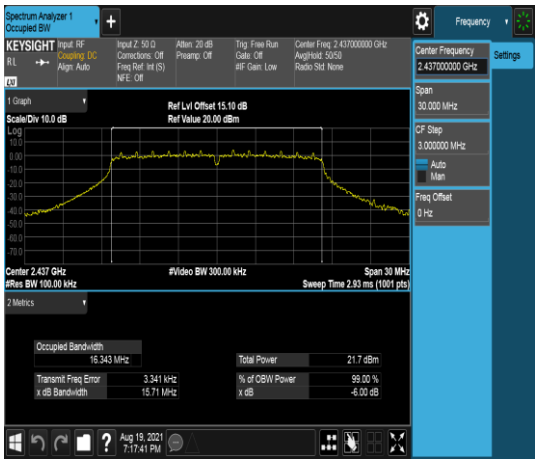
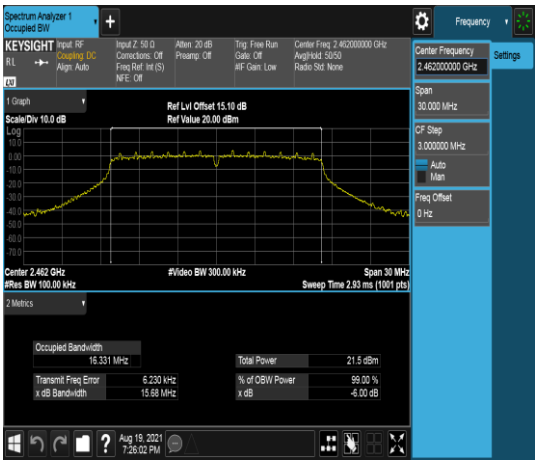
| IEEE 802.11g mode-Chain 1 | |
|---|---|
| **Low CH** | **Mid CH** |
|  |  |
| **High CH** | |
|  | |

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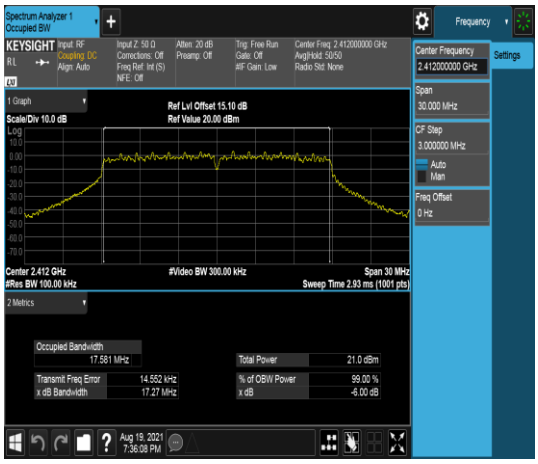
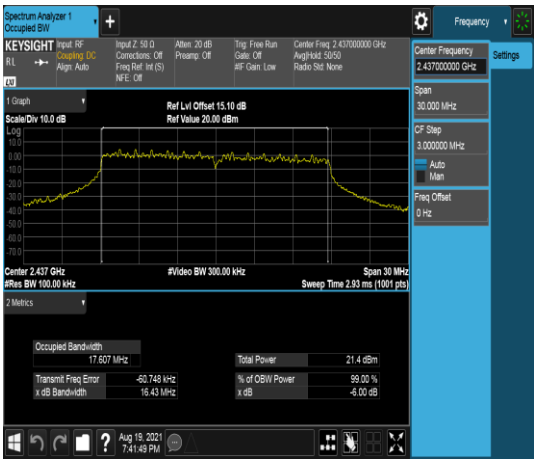
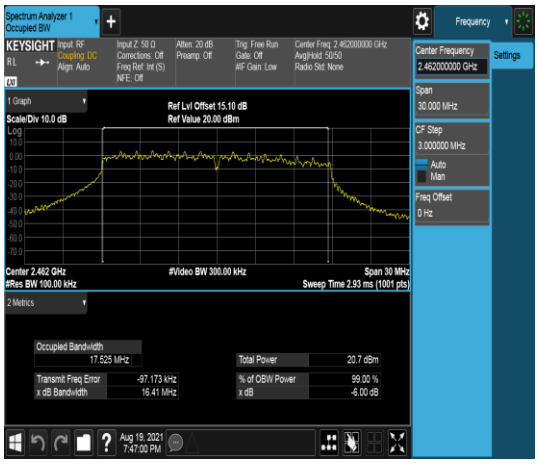
| IEEE 802.11n HT20 mode-Chain 0 | |
|---|---|
| **Low CH** | **Mid CH** |
|  |  |
| **High CH** | |
|  | |

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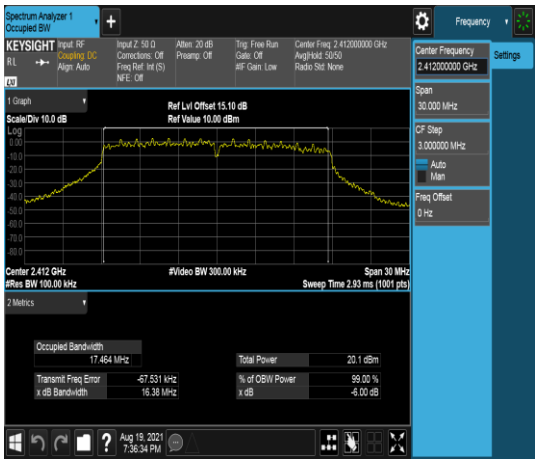
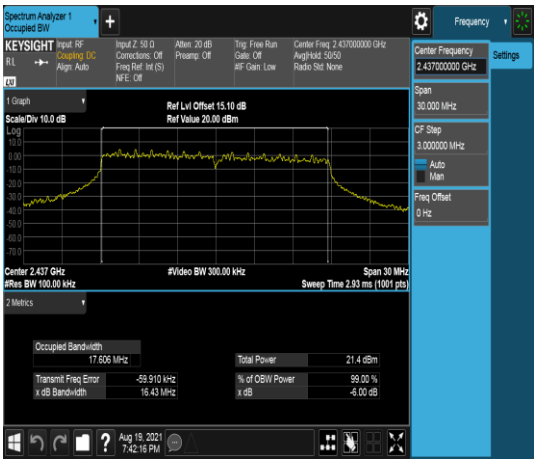
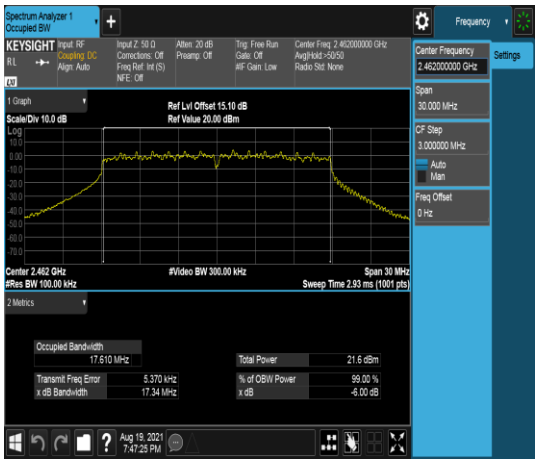
| IEEE 802.11n HT20 mode-Chain 1 | |
|---|---|
| **Low CH** | **Mid CH** |
|  |  |
| **High CH** | |
|  | |

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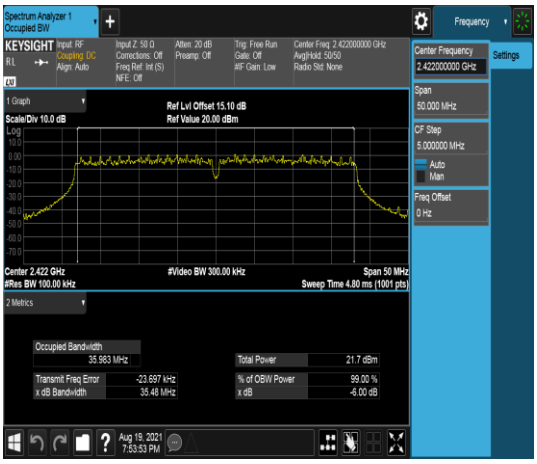
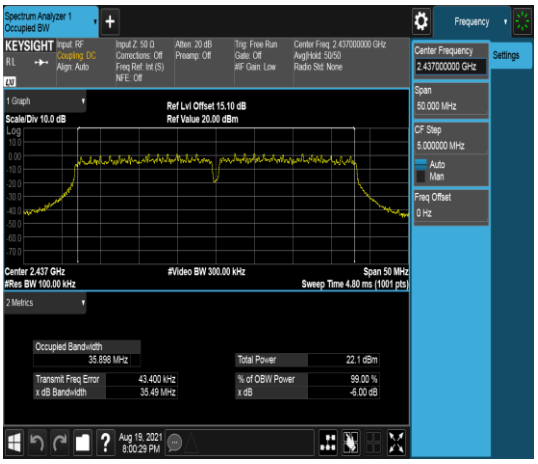
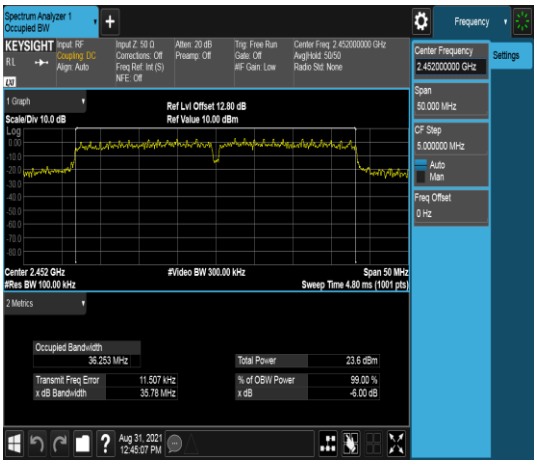
| IEEE 802.11n HT40 mode-Chain 0 | |
|---|---|
| **Low CH** | **Mid CH** |
|  |  |
| **High CH** | |
|  | |

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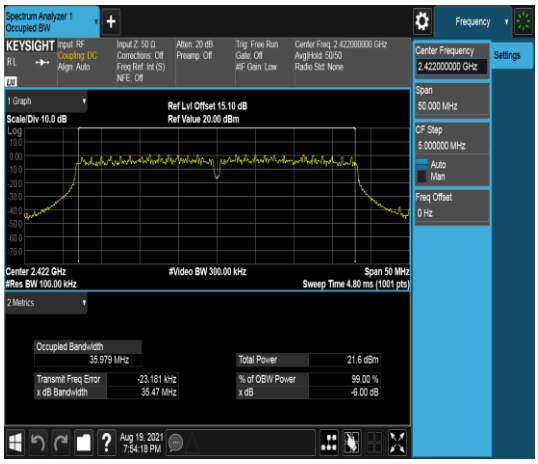
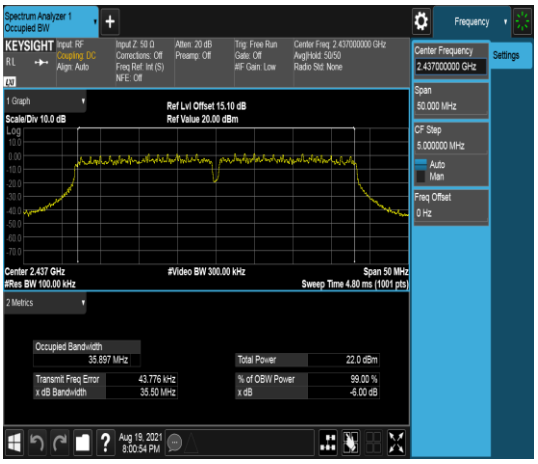
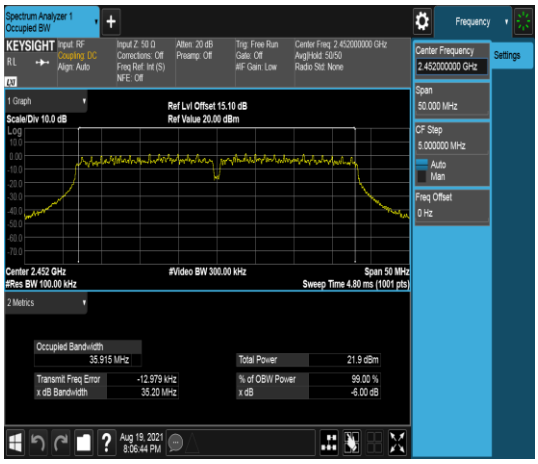
| IEEE 802.11n HT40 mode-Chain 1 | |
|---|---|
| **Low CH** | **Mid CH** |
|  |  |
| **High CH** | |
|  | |

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## Test Data

## BANDWIDTH 99%

| IEEE 802.11b mode-Chain 0 | |
|---|---|
| **Low CH** | **Mid CH** |
| | |
| **High CH** | |
| | |

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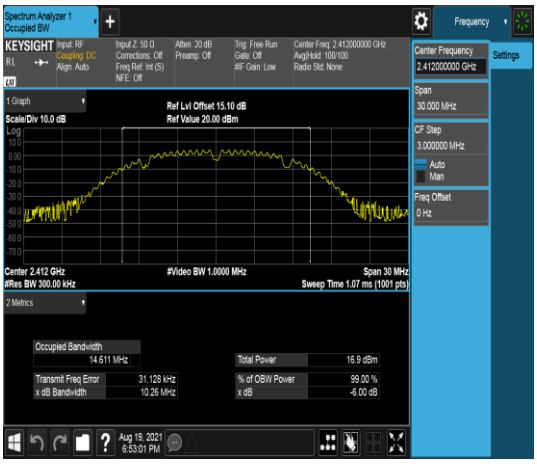
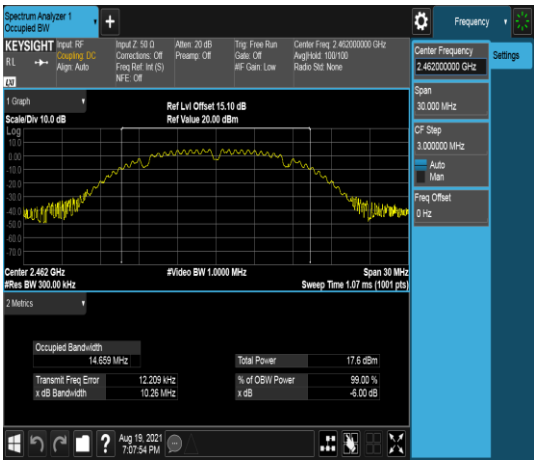
| IEEE 802.11b mode-Chain 1 | |
|---|---|
| **Low CH** | **Mid CH** |
|  | |
| **High CH** | |
|  | |

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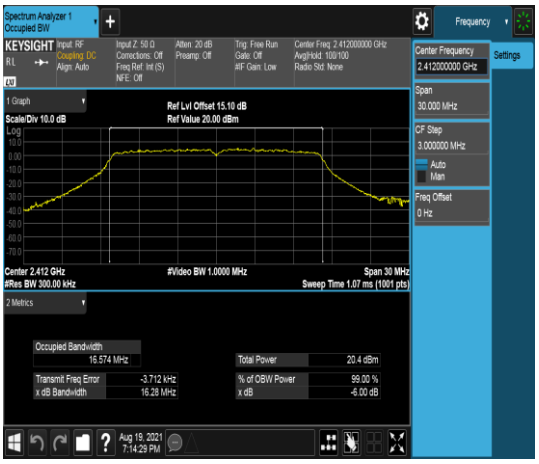
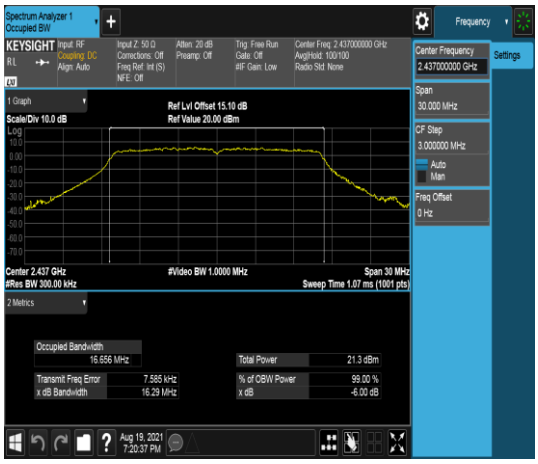
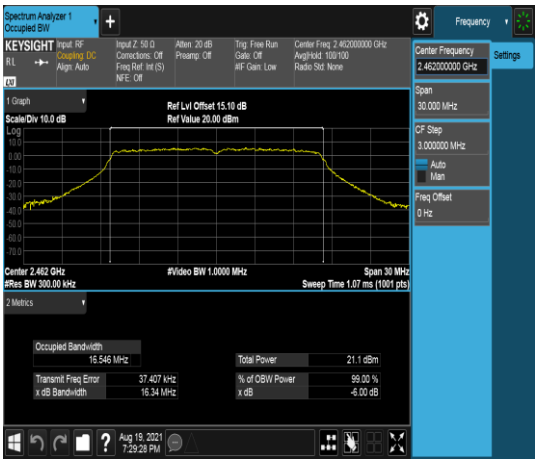
| IEEE 802.11g mode-Chain 0 | |
|---|---|
| **Low CH** | **Mid CH** |
|  |  |
| **High CH** | |
|  | |

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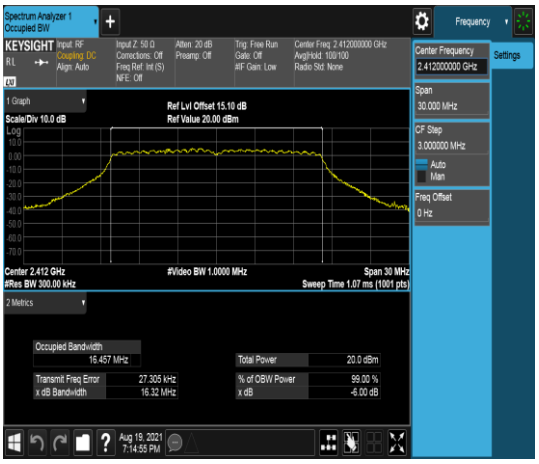
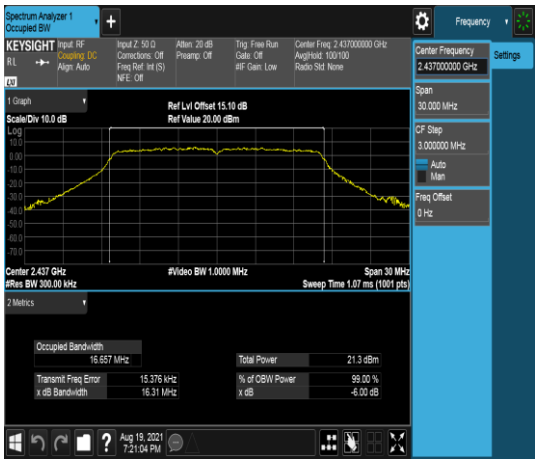
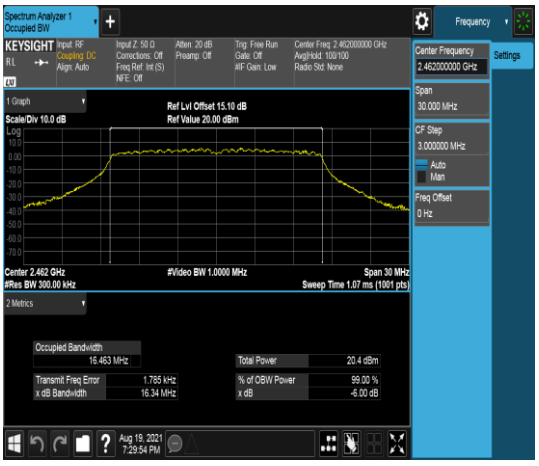
| IEEE 802.11g mode-Chain 1 | |
|---|---|
| **Low CH** | **Mid CH** |
|  |  |
| **High CH** | |
|  | |

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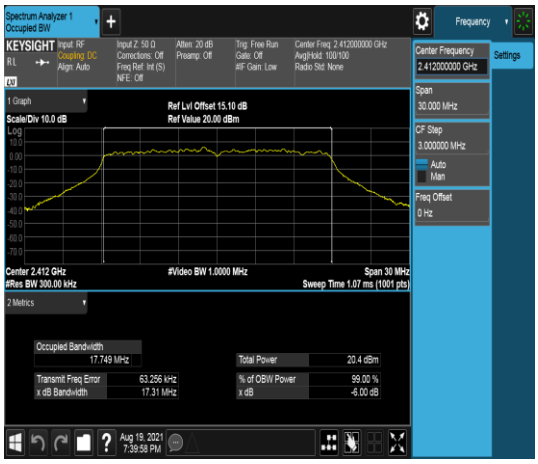
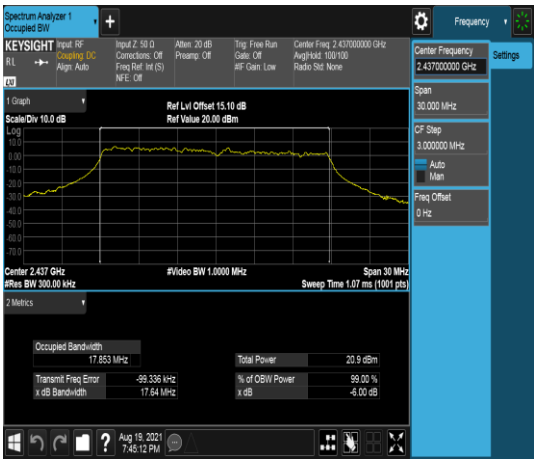
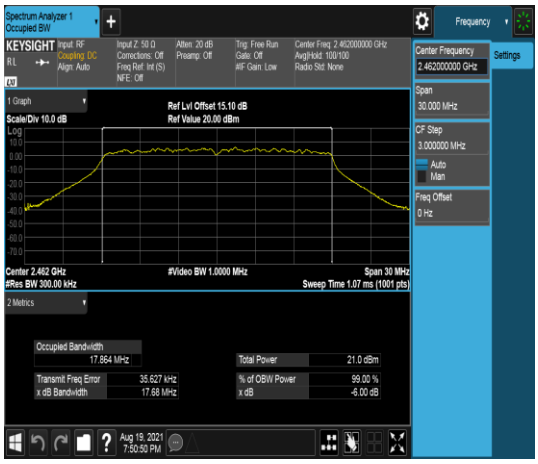
| IEEE 802.11n HT20 mode-Chain 0 | |
|---|---|
| **Low CH** | **Mid CH** |
|  |  |
| **High CH** | |
|  | |

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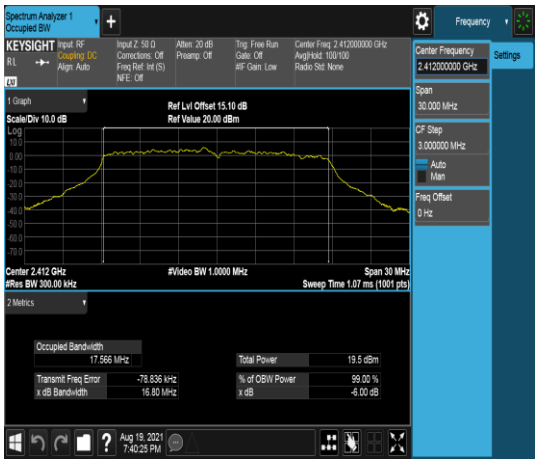
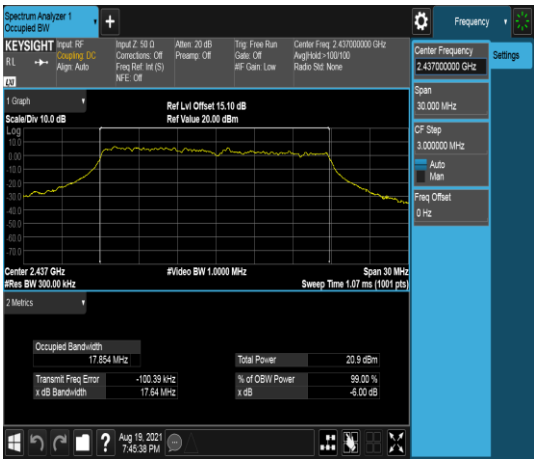
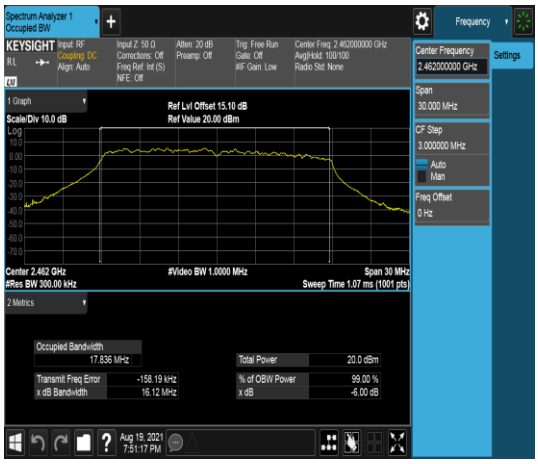
| IEEE 802.11n HT20 mode-Chain 1 | |
|---|---|
| **Low CH** | **Mid CH** |
|  |  |
| **High CH** | |
|  | |

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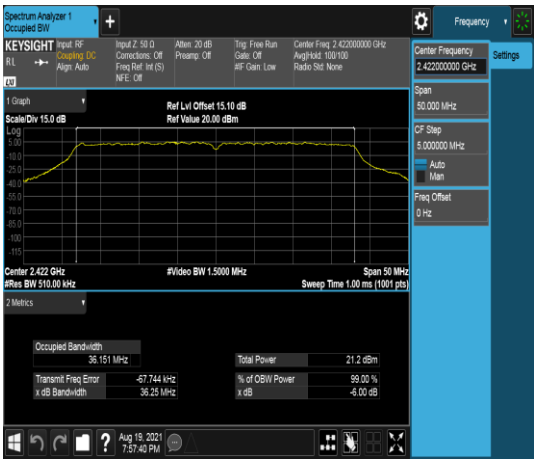
| IEEE 802.11n HT40 mode-Chain 0 | |
|---|---|
| **Low CH** | **Mid CH** |
|  | |
| **High CH** | |
| | |

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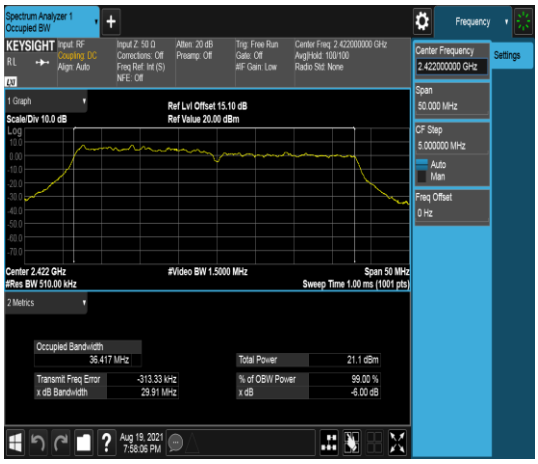
| IEEE 802.11n HT40 mode-Chain 1 | |
|---|---|
| **Low CH** | **Mid CH** |
|  | |
| **High CH** | |
| | |

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# 5.3 OUTPUT POWER MEASUREMENT

## 5.3.1 Test Limit

According to §15.247(b) and RSS-247 section 5.4(d),

**Peak output power**：

**FCC:**

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,

**IC:**

For systems using digital modulation in the 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt(30 dBm) and the e.i.r.p. shall not exceed 4Watt(36 dBm), base on the use of antennas with directional gain not exceed 6 dBi If transmitting antennas of directional gain greater than 6dBi are used the peak output power the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

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,

| | |
|---|---|
| Limit | ☒ Antenna not exceed 6 dBi：30dBm<br>☐ Antenna with DG greater than 6 dBi：<br>[Limit = 30 – (DG – 6)]<br>☐ Point-to-point operation： |

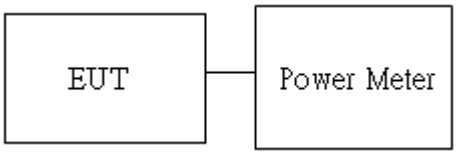
**Average output power**：For reporting purposes only.

## 5.3.2 Test Procedure

Test method Refer as ANSI C63.10:2013.

1. The EUT RF output connected to the power meter by RF cable.
2. Setting maximum power transmit of EUT.
3. The path loss was compensated to the results for each measurement.
4. Measure and record the result of Peak output power and Average output power. in the test report.

## 5.3.3 Test Setup

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## 5.3.4 Test Result

**Temperature:** 20.3 ~ 26.8℃ **Humidity:** 54 ~ 62% RH

**Tested by:** Lance Chen **Test date:** August 19 ~ 31, 2021

**Peak output power**：

| 802.11b_2TX | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CH | Freq. (MHz) | Data Rate | Power set | Peak Output Power (dBm) | | Total Peak Output Power (dBm) | Limit (dBm) | RESULT |
| | | | | CH 0 | CH 1 | | | |
| 1 | 2412 | 1 | default | 18.45 | 16.71 | 20.68 | 30.00 | PASS |
| 6 | 2437 | 1 | default | 18.40 | 17.06 | 20.79 | 30.00 | PASS |
| 11 | 2462 | 1 | default | 18.65 | 17.09 | **20.95** | 30.00 | PASS |

| 802.11g_2TX | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CH | Freq. (MHz) | Data Rate | Power set | Peak Output Power (dBm) | | Total Peak Output Power (dBm) | Limit (dBm) | RESULT |
| | | | | CH 0 | CH 1 | | | |
| 1 | 2412 | 6 | default | 18.12 | 16.25 | 20.30 | 30.00 | PASS |
| 6 | 2437 | 6 | default | 18.36 | 17.11 | 20.79 | 30.00 | PASS |
| 11 | 2462 | 6 | default | 18.64 | 17.12 | **20.96** | 30.00 | PASS |

| 802.11n_HT20M MIMO | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CH | Freq. (MHz) | Data Rate | Power set | Peak Output Power (dBm) | | Total Peak Output Power (dBm) | Limit (dBm) | RESULT |
| | | | | CH 0 | CH 1 | | | |
| 1 | 2412 | MCS8 | default | 25.09 | 24.21 | **27.68** | 30.00 | PASS |
| 6 | 2437 | MCS8 | default | 24.78 | 23.59 | 27.24 | 30.00 | PASS |
| 11 | 2462 | MCS8 | default | 24.03 | 22.52 | 26.35 | 30.00 | PASS |

| 802.11n_HT40M MIMO | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CH | Freq. (MHz) | Data Rate | Power set | Peak Output Power (dBm) | | Total Peak Output Power (dBm) | Limit (dBm) | RESULT |
| | | | | CH 0 | CH 1 | | | |
| 3 | 2422 | MCS8 | default | 24.22 | 23.58 | 26.92 | 30.00 | PASS |
| 6 | 2437 | MCS8 | default | 25.58 | 25.11 | **28.36** | 30.00 | PASS |
| 9 | 2452 | MCS8 | default | 25.47 | 24.56 | 28.05 | 30.00 | PASS |

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**Average output power：**

| 802.11b_2TX | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CH | Freq. (MHz) | Data Rate | Power set | Avg. Output Power (dBm) | | Max. Avg. Output include tune up tolerance Power (dBm) | Limit (dBm) | RESULT |
| | | | | CH 0 | CH 1 | | | |
| 1 | 2412 | 1 | default | 16.45 | 14.61 | 18.80 | 30.00 | PASS |
| 6 | 2437 | 1 | default | 16.31 | 14.99 | 18.87 | 30.00 | PASS |
| 11 | 2462 | 1 | default | 17.02 | 14.98 | **19.29** | 30.00 | PASS |

| 802.11g_2TX | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CH | Freq. (MHz) | Data Rate | Power set | Avg. Output Power (dBm) | | Max. Avg. Output include tune up tolerance Power (dBm) | Limit (dBm) | RESULT |
| | | | | CH 0 | CH 1 | | | |
| 1 | 2412 | 6 | default | 16.03 | 14.37 | 18.54 | 30.00 | PASS |
| 6 | 2437 | 6 | default | 16.39 | 14.97 | 19.00 | 30.00 | PASS |
| 11 | 2462 | 6 | default | 16.53 | 15.14 | **19.15** | 30.00 | PASS |

| 802.11n_HT20M MIMO | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CH | Freq. (MHz) | Data Rate | Power set | Avg. Output Power (dBm) | | Max. Avg. Output include tune up tolerance Power (dBm) | Limit (dBm) | RESULT |
| | | | | CH 0 | CH 1 | | | |
| 1 | 2412 | MCS8 | default | 12.74 | 12.06 | 18.44 | 30.00 | PASS |
| 6 | 2437 | MCS8 | default | 13.16 | 11.97 | **18.64** | 30.00 | PASS |
| 11 | 2462 | MCS8 | default | 13.05 | 12.07 | 18.62 | 30.00 | PASS |

| 802.11n_HT40M MIMO | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CH | Freq. (MHz) | Data Rate | Power set | Avg. Output Power (dBm) | | Max. Avg. Output include tune up tolerance Power (dBm) | Limit (dBm) | RESULT |
| | | | | CH 0 | CH 1 | | | |
| 3 | 2422 | MCS8 | default | 11.05 | 10.97 | 17.06 | 30.00 | PASS |
| 6 | 2437 | MCS8 | default | 13.07 | 12.55 | **18.87** | 30.00 | PASS |
| 9 | 2452 | MCS8 | default | 12.89 | 11.35 | 18.24 | 30.00 | PASS |

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**EIRP power：**

| 802.11b_2TX | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CH | Freq. (MHz) | Data Rate | Avg. Output Power (dBm) | | Total Avg. Output Power (dBm) | Antenna Gain (dBi) | EIRP (dBm) | Limit (dBm) | RESULT |
| | | | CH 0 | CH 1 | | | | | |
| 1 | 2412 | 1 | 16.45 | 14.61 | 18.80 | 3.88 | 22.68 | 36 | PASS |
| 6 | 2437 | 1 | 16.31 | 14.99 | 18.87 | 3.88 | 22.75 | 36 | PASS |
| 11 | 2462 | 1 | 17.02 | 14.98 | 19.29 | 3.88 | **23.17** | 36 | PASS |

| 802.11g_2TX | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CH | Freq. (MHz) | Data Rate | Avg. Output Power (dBm) | | Total Avg. Output Power (dBm) | Antenna Gain (dBi) | EIRP (dBm) | Limit (dBm) | RESULT |
| | | | CH 0 | CH 1 | | | | | |
| 1 | 2412 | 6 | 16.03 | 14.37 | 18.54 | 3.88 | 22.42 | 36 | PASS |
| 6 | 2437 | 6 | 16.39 | 14.97 | 19.00 | 3.88 | 22.88 | 36 | PASS |
| 11 | 2462 | 6 | 16.53 | 15.14 | 19.15 | 3.88 | **23.03** | 36 | PASS |

| 802.11n_HT20M MIMO | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CH | Freq. (MHz) | Data Rate | Avg. Output Power (dBm) | | Total Avg. Output Power (dBm) | Antenna Gain (dBi) | EIRP (dBm) | Limit (dBm) | RESULT |
| | | | CH 0 | CH 1 | | | | | |
| 1 | 2412 | MCS8 | 12.74 | 12.06 | 18.44 | 3.88 | 22.32 | 36 | PASS |
| 6 | 2437 | MCS8 | 13.16 | 11.97 | 18.64 | 3.88 | **22.52** | 36 | PASS |
| 11 | 2462 | MCS8 | 13.05 | 12.07 | 18.62 | 3.88 | 22.50 | 36 | PASS |

| 802.11n_HT40M MIMO | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CH | Freq. (MHz) | Data Rate | Avg. Output Power (dBm) | | Total Avg. Output Power (dBm) | Antenna Gain (dBi) | EIRP (dBm) | Limit (dBm) | RESULT |
| | | | CH 0 | CH 1 | | | | | |
| 3 | 2422 | MCS8 | 11.05 | 10.97 | 17.06 | 3.88 | 20.94 | 36 | PASS |
| 6 | 2437 | MCS8 | 13.07 | 12.55 | 18.87 | 3.88 | **22.75** | 36 | PASS |
| 9 | 2452 | MCS8 | 12.89 | 11.35 | 18.24 | 3.88 | 22.12 | 36 | PASS |

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# 5.4 POWER SPECTRAL DENSITY

## 5.4.1 Test Limit

According to §15.247(e) and RSS-247 section 5.2(b),

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

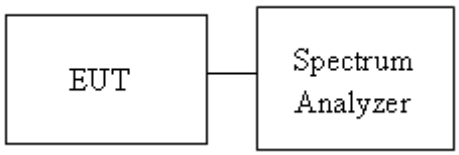
| | |
|---|---|
| Limit | ☒ Antenna not exceed 6 dBi：8dBm<br>☐ Antenna with DG greater than 6 dBi：<br>[ Limit = 8 – (DG – 6) ]<br>☐ Point-to-point operation： |

## 5.4.2 Test Procedure

Test method Refer as ANSI C63.10:2013

1. The EUT RF output connected to the spectrum analyzer by RF cable.
2. Setting maximum power transmit of EUT
3. SA set RBW = 3kHz, VBW = 10kHz, Span = 1.5 times DTS Bandwidth (6 dB BW), Detector = Peak, Sweep Time = Auto and Trace = Max hold.
4. The path loss and Duty Factor were compensated to the results for each measurement by SA.
5. Mark the maximum level.
6. Measure and record the result of power spectral density. in the test report.

## 5.4.3 Test Setup

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### 5.4.4 Test Result

| | | | |
|---|---|---|---|
| **Temperature:** | 20.3 ~ 26.8℃ | **Humidity:** | 54 ~ 62% RH |
| **Tested by:** | Lance Chen | **Test date:** | August 19 ~ 31, 2021 |

| POWER DENSITY 802.11b | | | | | |
|---|---|---|---|---|---|
| Freq. (MHz) | Ch0 PSD | Ch1 PSD | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Result |
| 2412 | -8.39 | -7.61 | -4.97 | 8.00 | PASS |
| 2437 | -7.87 | -8.07 | -4.96 | 8.00 | PASS |
| 2462 | -8.38 | -7.41 | -4.85 | 8.00 | PASS |

| POWER DENSITY 802.11g | | | | | |
|---|---|---|---|---|---|
| Freq. (MHz) | Ch0 PSD | Ch1 PSD | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Result |
| 2412 | -10.94 | -10.51 | -7.71 | 8.00 | PASS |
| 2437 | -9.68 | -10.38 | -7.01 | 8.00 | PASS |
| 2462 | -11.8 | -10.57 | -8.13 | 8.00 | PASS |

| POWER DENSITY 802.11n HT20 | | | | | |
|---|---|---|---|---|---|
| Freq. (MHz) | Ch0 PSD | Ch1 PSD | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Result |
| 2412 | -12.15 | -12.83 | -9.47 | 8.00 | PASS |
| 2437 | -12.52 | -12.29 | -9.39 | 8.00 | PASS |
| 2462 | -13.08 | -10.82 | -8.79 | 8.00 | PASS |

| POWER DENSITY 802.11n HT40 | | | | | |
|---|---|---|---|---|---|
| Freq. (MHz) | Ch0 PSD | Ch1 PSD | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Result |
| 2422 | -16.36 | -16.21 | -13.27 | 8.00 | PASS |
| 2437 | -15.01 | -15.54 | -12.26 | 8.00 | PASS |
| 2452 | -17.45 | -16.20 | -13.77 | 8.00 | PASS |

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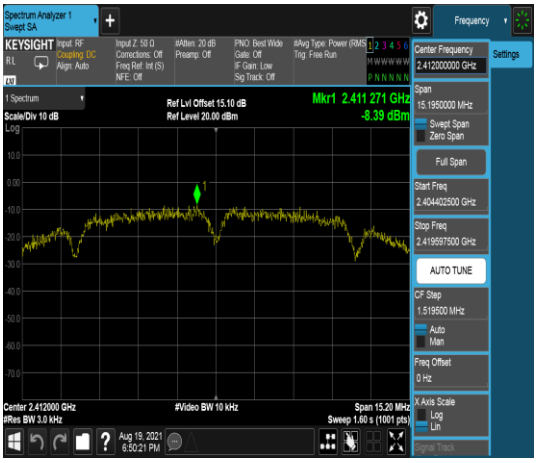
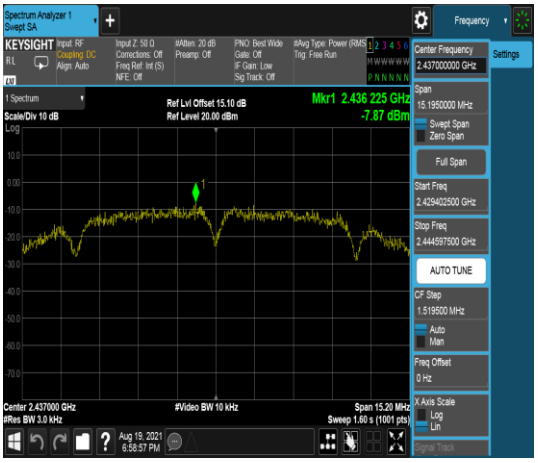
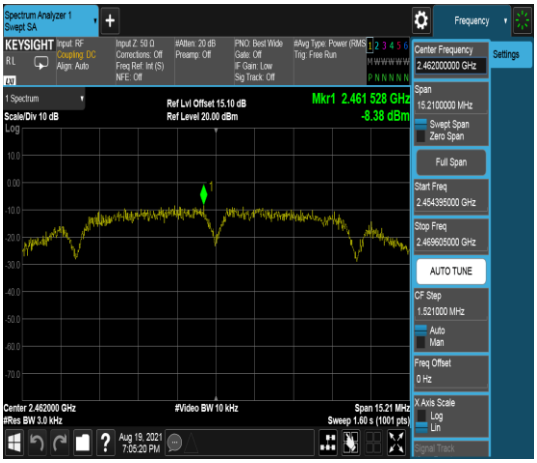
## Test Data

| IEEE 802.11b mode- chain 0 | |
|---|---|
| **Low CH** | **Mid CH** |
|  |  |
| **High CH** | |
|  | |

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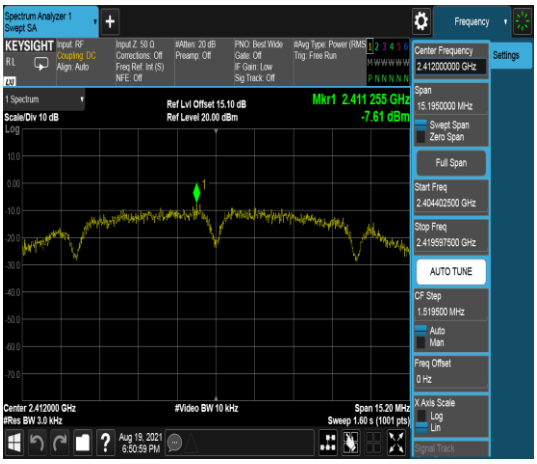
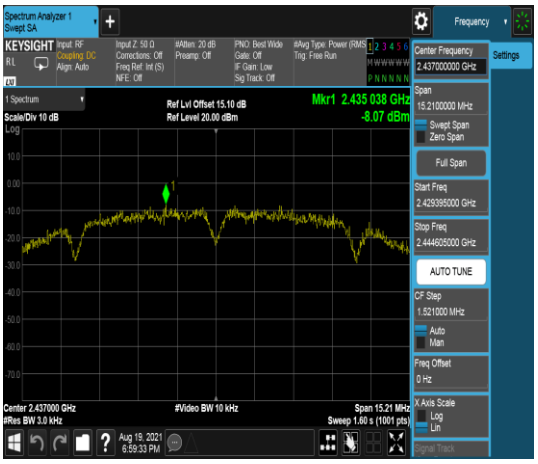
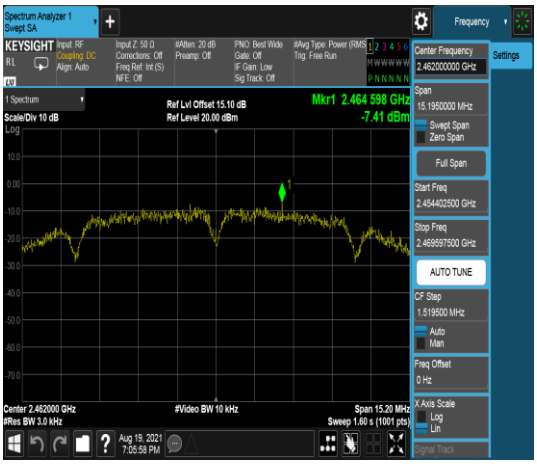
| IEEE 802.11b mode- chain 1 | |
|---|---|
| **Low CH** | **Mid CH** |
|  |  |
| **High CH** | |
|  | |

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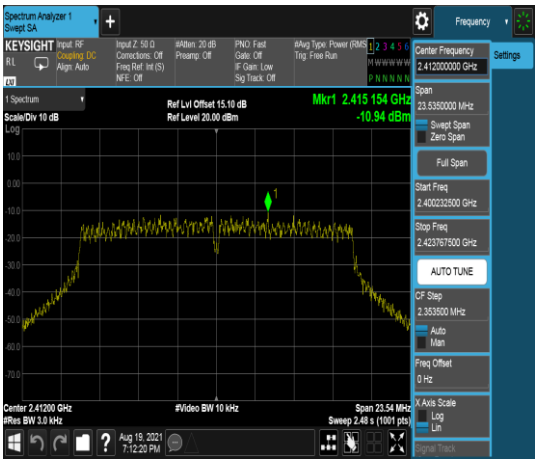
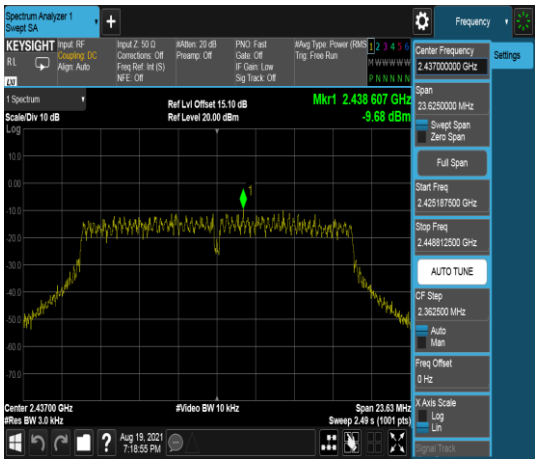
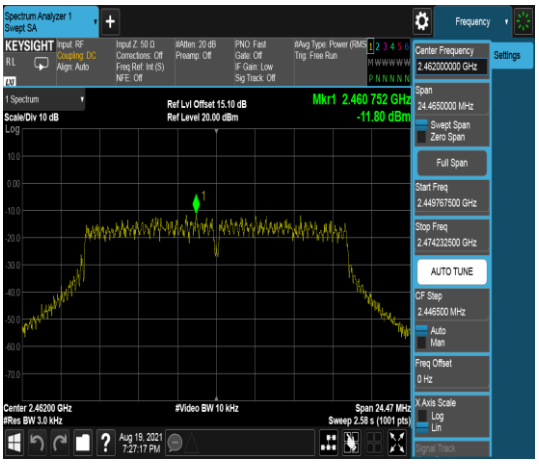
| IEEE 802.11g mode- chain 0 | |
|---|---|
| **Low CH** | **Mid CH** |
|  |  |
| **High CH** | |
|  | |

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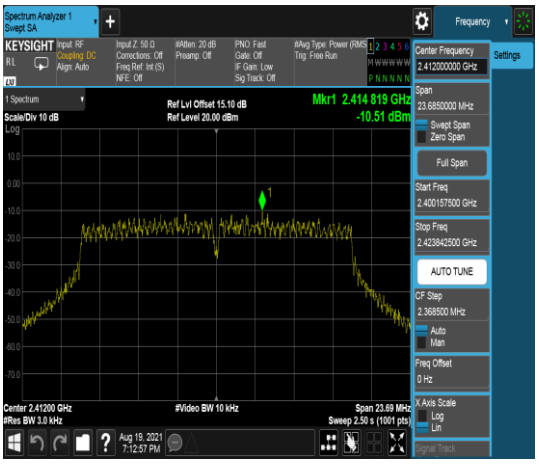
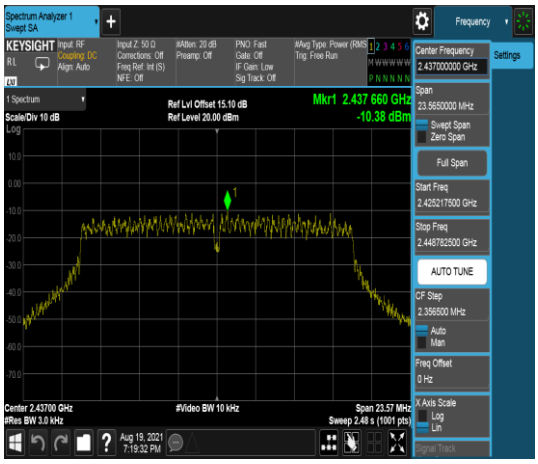
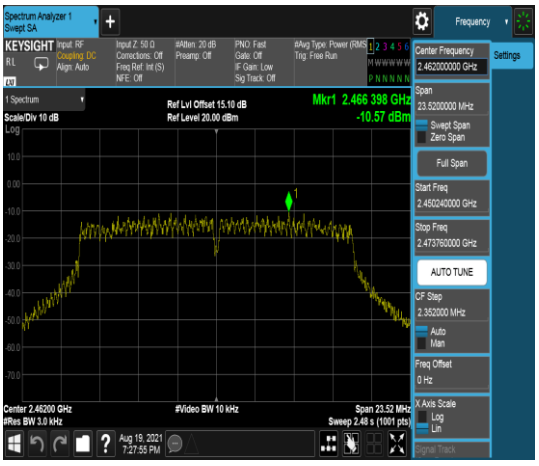
| IEEE 802.11g mode- chain 1 | |
|---|---|
| **Low CH** | **Mid CH** |
|  |  |
| **High CH** | |
|  | |

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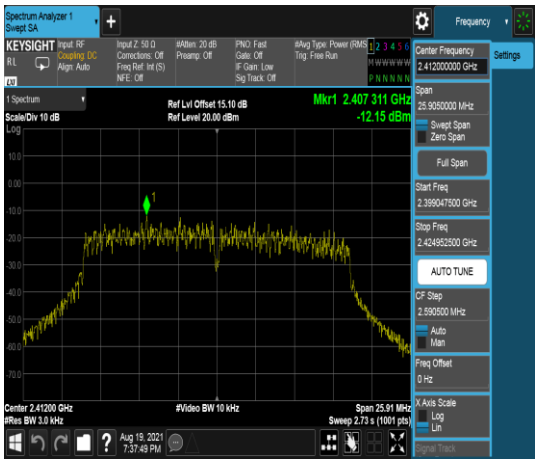
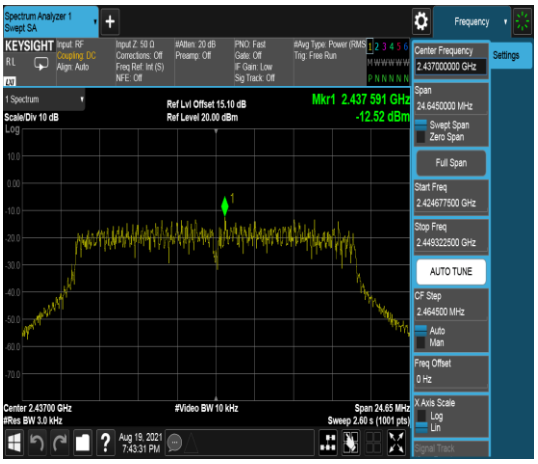
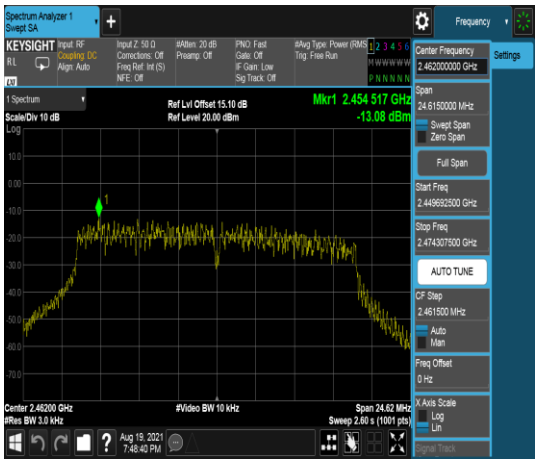
| IEEE 802.11n HT20 mode- chain 0 | |
|---|---|
| **Low CH** | **Mid CH** |
|  |  |
| **High CH** | |
|  | |

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