# FCC Certification Test Report

## SHENZHEN ZERO ZERO INFINITY TECHNOLOGY CO., LTD.

## HOVER CAMERA

## MODEL: HC-6428

## FCC ID: 2AIDWHC-6428

REPORT# **16WS0525027F-03 Rev 0**
**May 18, 2016**

Prepared for:

**Shenzhen Zero Zero Infinity Technology Co., Ltd.**
**1607 Innovation Park, High-Tech Park of Nanshan dist. Shenzhen**

Prepared By:

**Washington International Technology Limited**

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## For the

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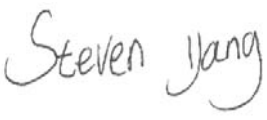
Prepared by:

Henry guo

Reviewed by:



Steven yang

## Abstract

This report has been prepared on behalf of Shenzhen Zero Zero Infinity Technology Co., Ltd. to support the attached Application for Equipment Authorization. The test report and application are submitted for a Spread Spectrum Transceiver under Part 15.407 of the FCC Rules and Regulations. This Federal Communication Commission (FCC) Certification Test Report documents the test configuration and test results for a Shenzhen Zero Zero Infinity Technology Co., Ltd. Hover Camera.

And Testing was performed by Compliance Certification Services (Shenzhen) Inc. has been accepted by the FCC, the FCC Registration Number is 441872.

The Hover Camera is an IEEE 802.11a/802.11b/802.11g/802.11n compliant device and complies with the limits for a Direct Sequence Spread Spectrum Transmitter device under Part 15.407 of the FCC Rules and Regulations.

| Revision History | Reason | Date |
|---|---|---|
| Rev 0 | Initial Release | **May.18, 2016** |
| | | |

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# 1 Introduction

## 1.1 Compliance Statement

After the modifications listed in Section 2.7 were installed:

The Shenzhen Zero Zero Infinity Technology Co., Ltd. Hover Camera complies with the limits for a Spread Spectrum Transceiver device under Part 15.407 of the FCC Rules and Regulations.

## 1.2 Test Scope Summary

Tests for radiated and conducted emissions were performed. All measurements were performed according to the 2013 version of ANSI C63.10

| Test Specification | Specific Description | Result | Modifications (Y/N) | Test Location |
|---|---|---|---|---|
| CFR47 Part 15.407 (b)(6) | Conducted Emissions – AC Power Ports | N/A | Not Applicable | N/A |
| CFR47 Part 15.407(b)(1),(4),(6) | Radiated Emissions and Band Edge Measurement | Complied | No | Compliance Certification Services (Shenzhen) Inc. |
| CFR47 Part 15.407(a)(1),(3) | Max Average Power | Complied | No | Compliance Certification Services (Shenzhen) Inc. |
| CFR47 Part 15.407(a)(1),(3) | Peak Power Spectral Density | Complied | No | Compliance Certification Services (Shenzhen) Inc. |
| CFR47 Part 15.407(e) | 6 dB Bandwidth | Complied | No | Compliance Certification Services (Shenzhen) Inc. |
| CFR47 Part 15.407(g) | Frequency Stability | Complied | No | Compliance Certification Services (Shenzhen) Inc. |
| NOTE: The EUT is also considered as a kind of other class B digital device it has been verified to comply with the requirements of FCC Part 15B Class B(Certification) the test report has been issued by WashingtonTechnology International Limited | | | | |

## 1.3 Contract Information

Customer: Shenzhen Zero Zero Infinity Technology Co., Ltd.

1607 Innovation Park, High-Tech Park of Nanshan dist. Shenzhen

## 1.4 Test and Support Personnel

Paul Pan Compliance Certification Services (Shenzhen) Inc.

No.10-1 Mingkeda Logistics Park, No.18 Huanguan South RD. Guan lan Town, Baoan Distr, Shenzhen, Guangdong, China.

Project Leader

## 1.5 Abbreviations

| | |
|---|---|
| **A** | **A**mpere |
| **ac** | **a**lternating **c**urrent |
| **AM** | Amplitude Modulation |
| **Amps** | **Amp**ere**s** |
| **b/s** | **b**its per **s**econd |
| **BW** | **B**and**W**idth |
| **CE** | **C**onducted **E**mission |
| **cm** | Centi**m**eter |
| **CW** | **C**ontinuous **W**ave |
| **dB** | **decibel** |
| **dc** | **d**irect **c**urrent |
| **EMI** | **E**lectro**m**agnetic **I**nterference |
| **EUT** | **E**quipment **U**nder **T**est |
| **FM** | **F**requency **M**odulation |
| **G** | **g**iga - prefix for $10^9$ multiplier |
| **Hz** | **H**ertz |
| **IF** | **I**ntermediate **F**requency |
| **k** | **k**ilo - prefix for $10^3$ multiplier |
| **LISN** | **L**ine **I**mpedance **S**tabilization **N**etwork |
| **M** | **M**ega - prefix for $10^6$ multiplier |
| **m** | **M**eter |
| **µ** | **m**icro - prefix for $10^{-6}$ multiplier |
| **NB** | **N**arrow**b**and |
| **QP** | **Q**uasi-**P**eak |
| **RE** | **R**adiated **E**missions |
| **RF** | **R**adio **F**requency |
| **rms** | **r**oot-**m**ean-**s**quare |
| **SN** | **S**erial **N**umber |
| **S/A** | **S**pectrum **A**nalyzer |
| **V** | **V**olt |

# 2 Equipment Under Test

## 2.1 EUT Identification

The results obtained relate only to the item(s) tested.

**Table 1: Overview of Hover Camera, Equipment Under Test**

| ITEM | DESCRIPTION |
|---|---|
| Manufacturer: | Shenzhen Zero Zero Infinity Technology Co., Ltd. |
| FCC ID Number | 2AIDWHC-6428 |
| Trade Mark: | Hover Camera |
| EUT Name: | Hover Camera |
| Test Model: | HC-6428 |
| FCC Rule Parts: | §15.407 |
| Frequency Range: | 5180 ~ 5240 MHz, 5745 ~ 5825 MHz |
| Maximum Output Power: | SISO Mode: 10.52 dBm<br>MIMO Mode: 12.89 dBm |
| Modulation: | Direct Sequence Spread Spectrum(DSSS) |
| Necessary Bandwidth: | N/A |
| Keying: | Automatic |
| Type of Information: | IEEE 802.11a: OFDM(64QAM, 16QAM, QPSK, BPSK)<br>IEEE 802.11n HT20, HT40: OFDM (64QAM, 16QAM, QPSK,BPSK) |
| Number of Channels: | 5180 ~ 5240 MHz: 4 for 802.11a, 802.11n (HT20)<br>2 for 802.11n (HT40)<br>5745 ~ 5825 MHz: 5 for 802.11a, 802.11n (HT20)<br>2 for 802.11n (HT40) |
| Antenna Type | Chain 0: PIFA antenna<br>Chain 1: PCB antenna |
| Antenna Gain | Chain 0: -1.21 dBi gain (5180 ~ 5240 MHz),<br>4.46 dBi gain (5745 ~ 5825 MHz);<br>Chain 1: -0.94 dBi gain (5180 ~ 5240 MHz),<br>2.82 dBi gain (5745 ~ 5825 MHz); |
| Frequency Tolerance: | N/A |
| Emission Type(s): | N/A |
| Interface Cables: | None |

| | |
|---|---|
| **Sample Received Date:** | **Apr. 29, 2016** |
| **Sample tested Date:** | **May 06, 2016~ May 18, 2016** |
| **Power Source & Voltage:** | **7.4Vdc (Rechargeable LIPO Battery)**<br>**Battery capacity: 1100mA** |
| **Software Version:** | **V3** |
| **Hardware Version:** | **V0.2** |

## 2.2 EUT Description

The Hover Camera is a small amateur unmanned aerial vehicle. Mobile phone and pad or other equipment by connecting it to Wi-Fi, it can photograph or 4k video recording. The Wi-Fi support IEEE 802.11 a /b/g/n protocol.

Product Name: Hover Camera

Model No. : HC-6428

Tested Model No.: HC-6428

EUT Rated Voltage: 7.4Vdc (Rechargeable LIPO Battery)

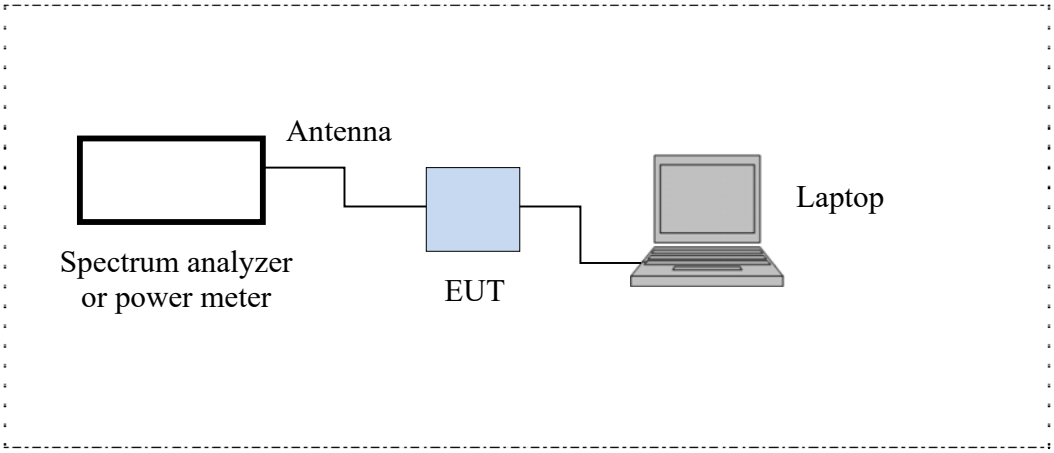
I/O Ports: USB*1;

## 2.3 Test Configuration

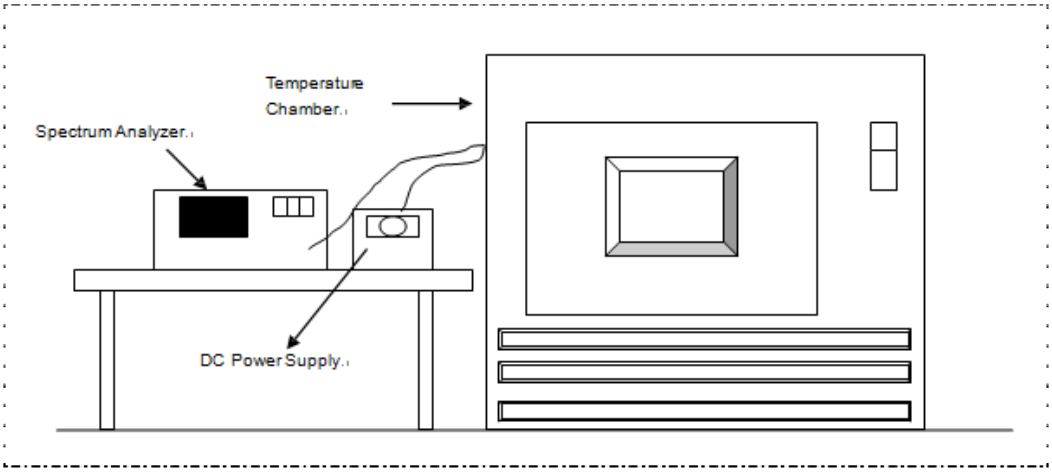
The Shenzhen Zero Zero Infinity Technology Co., Ltd. Hover Camera, Equipment Under Test (EUT), was operated form 7.4Vdc rechargeable LIPO battery Powered.

The EUT was tested connected to a host Laptop via USB cable and to spectrum analyzer or power meter via antenna port. The EUT firmware/software was set up to control power, bit rate, and channel selection.

**RF test setup**






**Conducted test setup:**

**Not Applicable**

**Radiated test setup:**

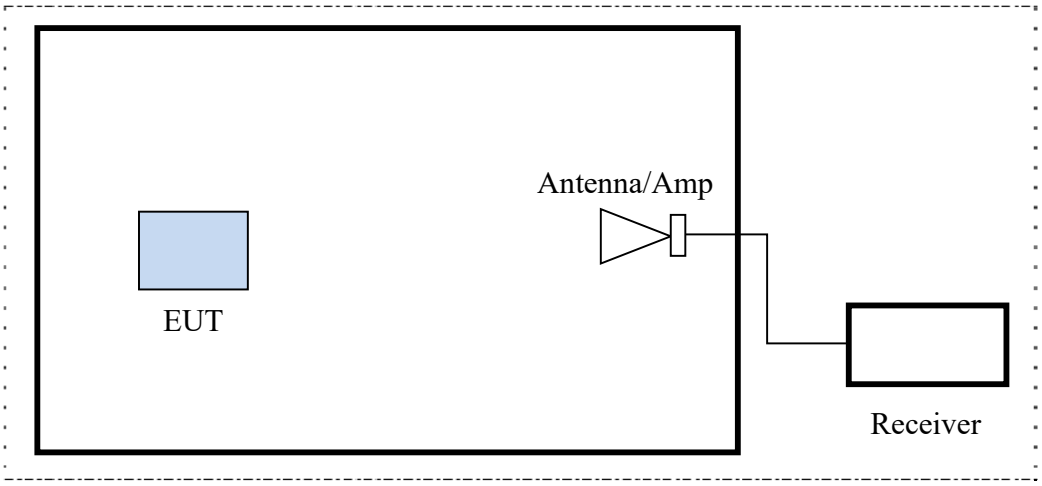



**Figure 1: Test Configuration**

## 2.4 Equipment Configuration

The EUT was set up as outlined in Radiated Emission Test Configuration photo. The EUT was comprised of the following equipment. (All Modules, PCBs, etc. listed were considered as part of the EUT, as tested.)

**Table 2: Equipment Configuration**

| Name / Description | Model Number | Part Number | Serial Number | Revision |
|---|---|---|---|---|
| Hover Camera | HC-6428 | / | FFB2USM380064 | / |
| Hover Camera | HC-6428 | / | FFB2USM380072 | / |

## 2.5 Interface Cables

**Table 3: Interface Cables**

| Port Identification | Connector Type | Cable Length | Shielded (Y/N) | Termination Point |
|---|---|---|---|---|
| Antenna cable | SMA | 0.2m | N | N/A |
| Antenna cable | SMA | 0.2m | N | N/A |
| USB Cable | USB | 1.0 | Y | N/A |

## 2.6 Support Equipment

The following support equipment was used during testing:

| No. | Support Equipment | Model/Part Number | Serial Number |
|---|---|---|---|
| 1 | Laptop | Inspiron 15 5000 series | B3MY362 |

## 2.7 EUT Modifications

No modifications were performed in order to meet the test requirements:

## 2.8 Testing Algorithm

The Hover Camera was operated using and drivers.

## 2.9 Test Location

All measurements herein were performed at And Testing was performed by Compliance Certification Services (Shenzhen) Inc. has been accepted by the FCC, the FCC Registration Number is 441872.

## 2.10 Measurements

### *2.10.1 Measurement Method*

All measurements were performed according to the 2013 version of ANSI C63.10 for testing compliance of a wide variety of unlicensed wireless devices

## 2.11 Measurement Uncertainty

All results reported herein relate only to the equipment tested. The basis for uncertainty calculation uses ANSI/NCSL Z540-2-1997 with a type B evaluation of the standard uncertainty. Elements contributing to the standard uncertainty are combined using the method described in Equation 1 to arrive at the total standard uncertainty. The standard uncertainty is multiplied by the

coverage factor to determine the expanded uncertainty which is generally accepted for use in commercial, industrial, and regulatory applications and when health and safety are concerned (see Equation 2). A coverage factor was selected to yield a 95% confidence in the uncertainty estimation.

**Equation 1: Standard Uncertainty**

$$u_c = \pm\sqrt{\frac{a^2}{div_a{}^2} + \frac{b^2}{div_b{}^2} + \frac{c^2}{div_c{}^2} + .....}$$

where $u_c$ = standard uncertainty

a, b, c,.. = individual uncertainty elements

$div_{a,\ b,\ c}$ = the individual uncertainty element divisor based on the probability distribution

divisor = 1.732 for rectangular distribution

divisor = 2 for normal distribution

divisor = 1.414 for trapezoid distribution

**Equation 2: Expanded Uncertainty**

$$U = ku_c$$

where U = expanded uncertainty

k = coverage factor

k ≤ 2 for 95% coverage (ANSI/NCSL Z540-2 Annex G)

$u_c$ = standard uncertainty

The measurement uncertainty complies with the maximum allowed uncertainty from CISPR 16-4-2. Measurement uncertainty is not used to adjust the measurements to determine compliance. The expanded uncertainty values for the various scopes in the WLL accreditation are provided in Table 4 below.

**Table 4: Expanded Uncertainty List**

| Scope | Expanded Uncertainty |
|---|---|
| Uncertainty for Radiation Emission test in 3m chamber | 2.6dB(30~200MHz, Polarize: H) |
| | 2.6dB(30~200MHz, Polarize: V) |
| | 3.0dB(200M~1GHz, Polarize: H) |
| | 2.8dB(200M~1GHz, Polarize: V) |
| Uncertainty for Radiation Emission test in 3m chamber (1GHz-18GHz) | 6.3dB (1~6GHz, Distance: 3m) |
| | 5.7dB (6~18GHz, Distance: 3m) |
| Uncertainty for Radiated Spurious Emission test in RF chamber | 3.6dB |
| Uncertainty for Conduction Spurious emission test | 2.0dB |
| Uncertainty for Output power test | 0.8dB |
| Uncertainty for Power density test | 2.0dB |
| Uncertainty for Frequency range test | $7x10^{-8}$ |
| Uncertainty for Bandwidth test | 83 kHz |
| Uncertainty for DC power test | 0.1% |
| Uncertainty for test site temperature and humidity | 0.6℃ |
| | 3% |

# 3 Test Equipment

Table 5 shows a list of the test equipment used for measurements along with the calibration information.

**Table 5: Test Equipment List**

Radiation Emission Test

| Item | Instrument | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| 1 | PSA Series Spectrum Analyzer | Agilent | E4446A | US44300399 | Feb.21,16 | 1 Year |
| 2 | Turn Table | N/A | N/A | N/A | N.C.R | N.C.R |
| 3 | Controller | Sunol Sciences | SC104V | 022310-1 | N.C.R | N.C.R |
| 4 | Controller | CT | N/A | N/A | N.C.R | N.C.R |
| 5 | Bilog Antenna | SCHAFFNER | CBL6143 | 5063 | Feb.22,16 | 1 Year |
| 6 | Horn Antenna | SCHWARZBECK | BBHA9120 | D286 | Feb.21,16 | 1 Year |
| 7 | Loop Antenna | COM-POWER | AL-130 | 121044 | Feb.21,16 | 1 Year |
| 8 | High Noise Amplifier | Agilent | 8449B | 3008A01838 | Feb.22,16 | 1 Year |
| 9 | Horn Antenna | Schwarzbeck | BBHA9120 | D286 | Feb.22,16 | 1 Year |
| 10 | Temp. / Humidity Meter | Anymetre | JR913 | N/A | Feb.22,16 | 1 Year |
| 11 | Antenna Tower | SUNOL | TLT2 | N/A | N.C.R | N.C.R |
| 12 | Test S/W | FARAO | LZ-RF / CCS-SZ-3A2 | | | |

RF Test

| Item | Instrument | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| 1 | Spectrum Analyzer | Agilent | N9010A | MY52221469 | Feb.22,16 | 1 Year |
| 2 | Power Meter | Agilent | ML2495A | 1204003 | Feb.22,16 | 1 Year |

# 4 System Test Configuration

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, Radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. It was powered by a 7.4Vdc rechargeable LIPO battery. Only the worst case data were recorded in this test report.

For SISO modes, there are two transmission antennas. The antenna used in any given time can be either Chain 0 or Chain 1. Both antenna ports have different output powers. Therefore, output power and PSD measurement for SISO modes on both antenna ports are reported. For MIMO modes, both Chain 0 and Chain 1 used at the same time.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Therefore, all final radiated testing was performed with the EUT in (see table below) orientation.

| Frequency Band(GHz) | Mode | Antenna Port | Worst-case Orientation |
|---|---|---|---|
| 5.2 and 5.8 | 1TX SISO | Chain 0 | X-Portrait |
| | | Chain 1 | X-Portrait |
| | 2TX MIMO | Chain 0 + Chain 1 | X-Portrait |

Worst-case data rates see table below:

| Mode | Worst-case data rates | | |
|---|---|---|---|
| | SISO Mode | | MIMO Mode: |
| | Chain 0 | Chain 1 | Chain 0+1 |
| 802.11a | 24 Mbps | 24 Mbps | N/A |
| 802.11n HT20 | MCS 6 | MCS 6 | MCS 6 |
| 802.11n HT40 | MCS 12 | MCS 12 | MCS 12 |

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

# 5 Duty Cycle of Test Signal and Measurement Methods

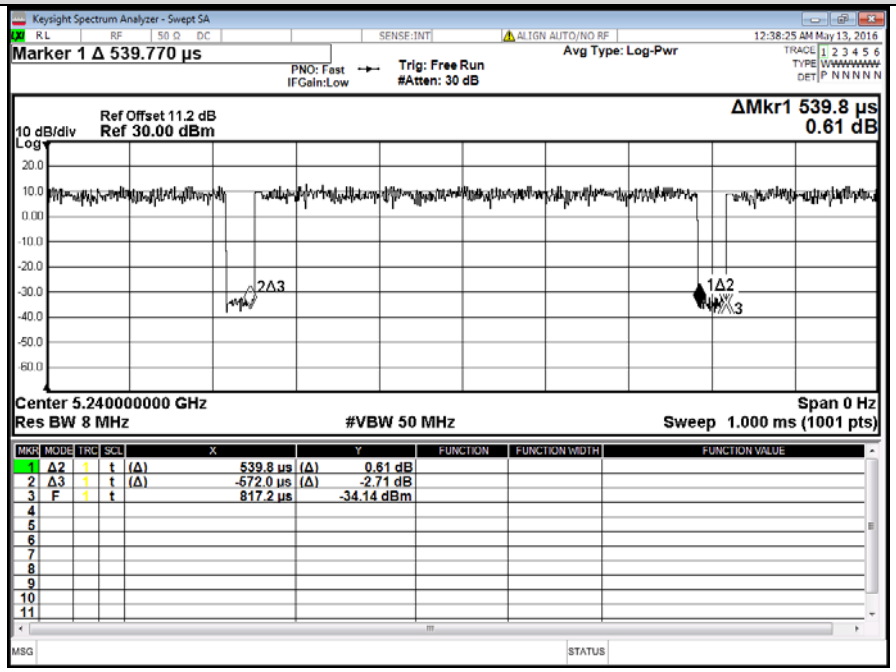
## 5.1 Duty Cycle:

| Mode | Data rates (Mbps) | Transmission Duration T (msec) | Period (msec) | Duty Cycle (linear) | Duty Cycle (%) | Duty Cycle Factor (dB) | 1/ T Minimum VBW (kHz) |
|---|---|---|---|---|---|---|---|
| 802.11a | 24Mbps | 0.5398 | 0.5720 | 0.94 | 94.37 | **0.25** | 1.85 |
| 802.11n(HT20) | MCS6 | 0.2513 | 0.2840 | 0.88 | 88.49 | **0.53** | 3.98 |
| 802.11n(HT40) | MCS12 | 0.1176 | 0.1500 | 0.78 | 78.40 | **1.06** | 8.50 |

Remark:

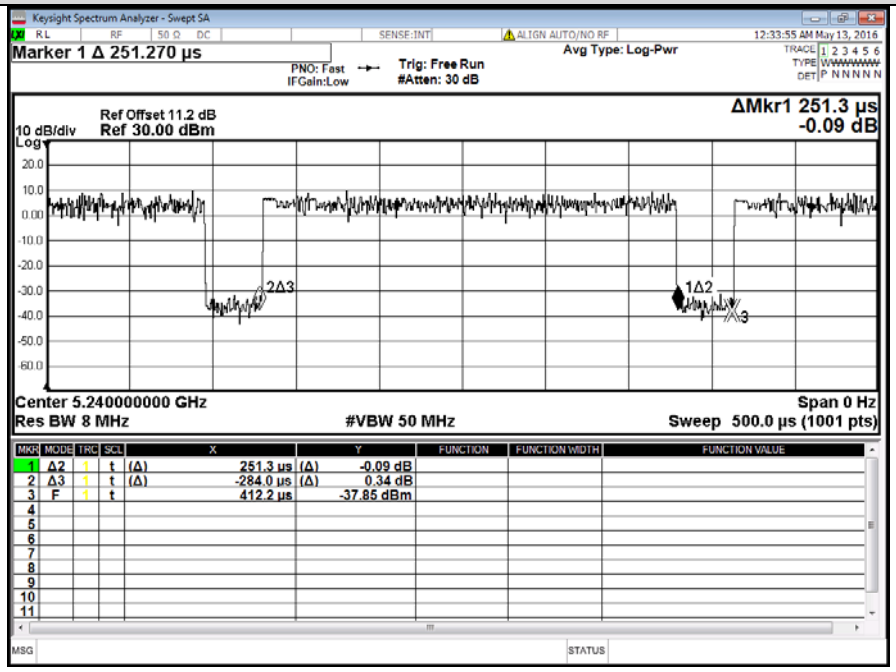
1. Duty cycle= On Time/ Period;
2. Duty Cycle factor = 10 * log(1/ Duty cycle)

**Test Mode: 802.11a_24 Mbps**

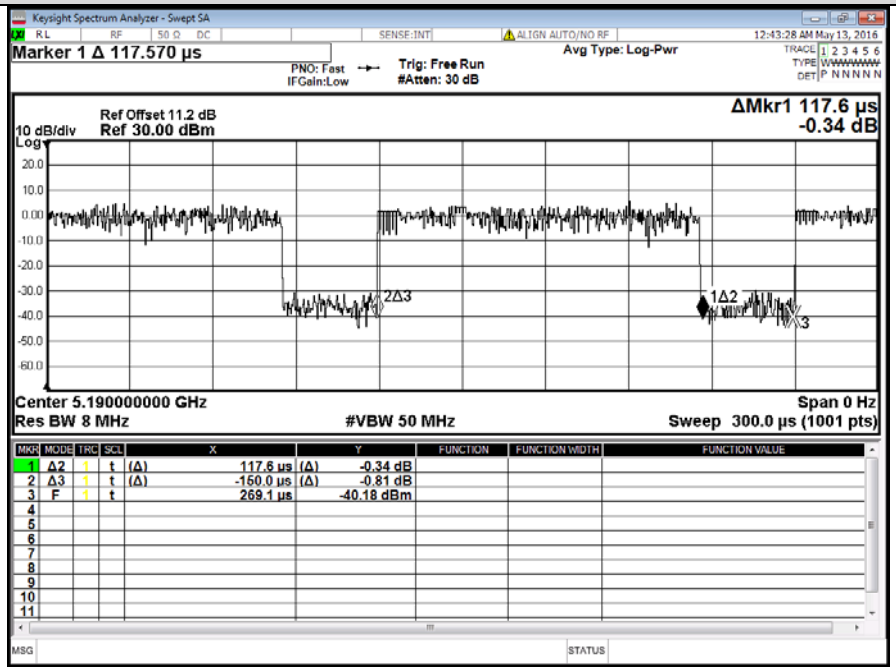


**Test Mode: 802.11n(HT20)_MCS**




**Test Mode: 802.11n(HT40) _MCS**




## 5.2 Measurement Methods:

KDB 789033 D02 General U-NII Test Procedures New Rules v01r02

KDB 662911 D01 Multiple Transmitter Output v02r01

# 6 Test Results

## 6.1 26 dB Bandwidth:

26 dB Bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer.

### 6.1.1 Limit

None; for reporting purposes only.

### 6.1.2 Test Procedure (789033 D02 v01r02 Section C.1)

1) Set RBW = approximately 1 % of the emission bandwidth.

2) Set the VBW > RBW.

3) Detector = Peak.

4) Trace mode = max hold.

5) Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1 %.

### 6.1.3 Test Data

Table 6 provides the test results for RF Power Output. （all the data attached was use the worst case data rate data）

**Table 6: 26 dB Bandwidth**

**SISO Mode-Test Data**

| Mode | Channel Frequency (MHz) | Antenna Port | 26 dB Bandwidth(MHz) | 99% Bandwidth(MHz) |
|---|---|---|---|---|
| 802.11a | 36 (5180) | Chain 0 | 20.67 | 16.484 |
| | | Chain 1 | 20.17 | 16.485 |
| | 40 (5200) | Chain 0 | 20.51 | 16.496 |
| | | Chain 1 | 20.99 | 16.458 |
| | 48 (5240) | Chain 0 | 20.53 | 16.476 |
| | | Chain 1 | 19.98 | 16.493 |

| | | | | |
|---|---|---|---|---|
| 802.11n(HT20) | 36 (5180) | Chain 0 | 21.27 | 17.612 |
| | | Chain 1 | 21.37 | 17.681 |
| | 40 (5200) | Chain 0 | 21.09 | 17.666 |
| | | Chain 1 | 20.74 | 17.555 |
| | 48 (5240) | Chain 0 | 21.12 | 17.608 |
| | | Chain 1 | 21.89 | 17.655 |
| 802.11n(HT40) | 38 (5190) | Chain 0 | 39.44 | 35.824 |
| | | Chain 1 | 39.66 | 35.830 |
| | 46 (5230) | Chain 0 | 39.51 | 36.162 |
| | | Chain 1 | 41.18 | 36.063 |

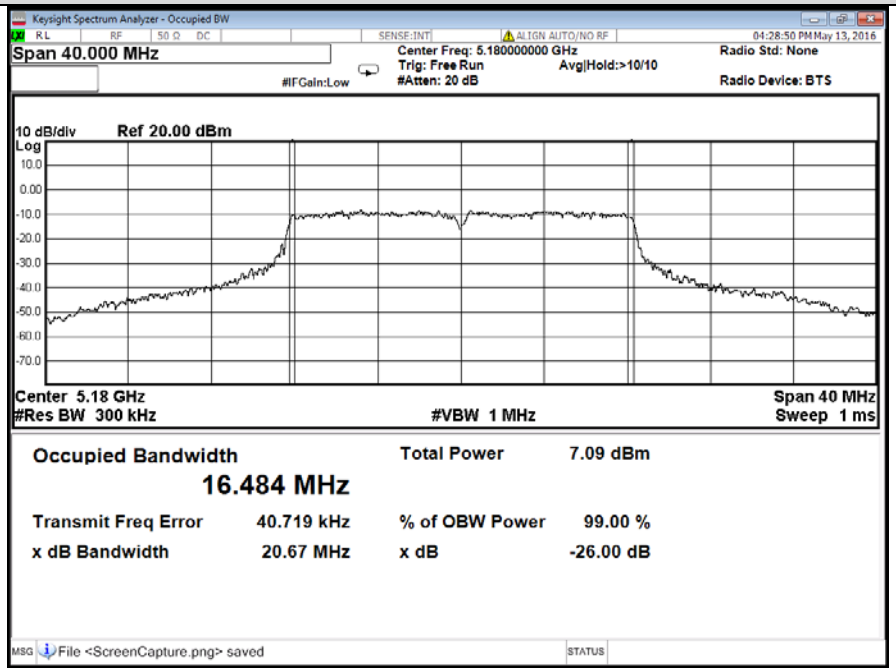
## MIMO Mode-Test Data

| Mode | Channel Frequency (MHz) | Antenna Port | 26 dB Bandwidth(MHz) | 99% Bandwidth(MHz) |
|---|---|---|---|---|
| 802.11n(HT20) | 36 (5180) | Chain 0 | 21.46 | 17.696 |
| | | Chain 1 | 23.71 | 17.887 |
| | 40 (5200) | Chain 0 | 21.50 | 17.671 |
| | | Chain 1 | 22.43 | 17.881 |
| | 48 (5240) | Chain 0 | 22.55 | 17.671 |
| | | Chain 1 | 23.90 | 17.928 |
| 802.11n(HT40) | 38 (5190) | Chain 0 | 40.70 | 36.116 |
| | | Chain 1 | 40.00 | 36.065 |
| | 46 (5230) | Chain 0 | 39.54 | 36.204 |
| | | Chain 1 | 39.97 | 36.066 |

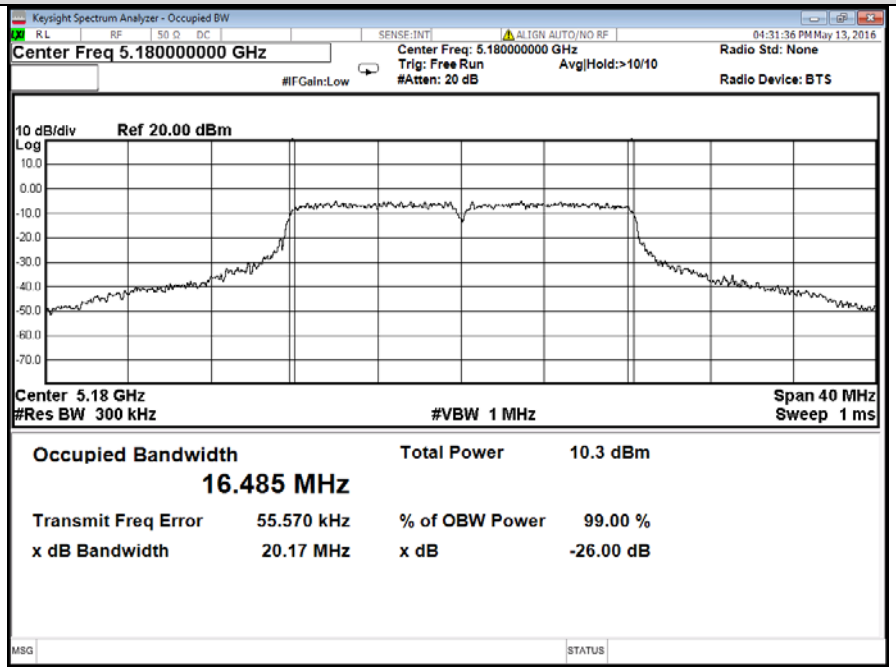
 

## SISO Mode-Test Data

| Test Mode: 802.11a_5180MHz |
|---|
| Chain 0 |

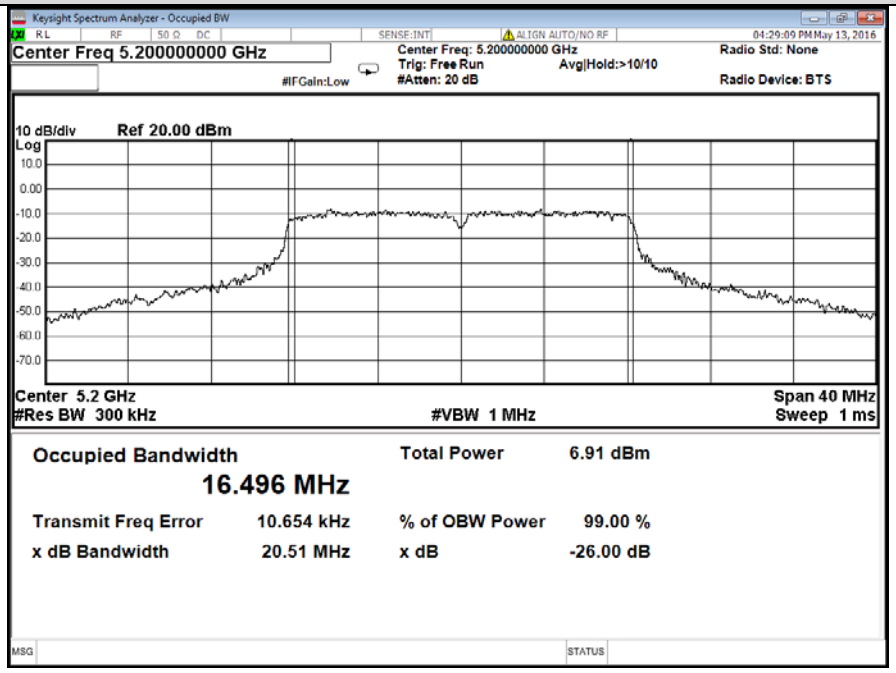



| Chain 1 |
|---|

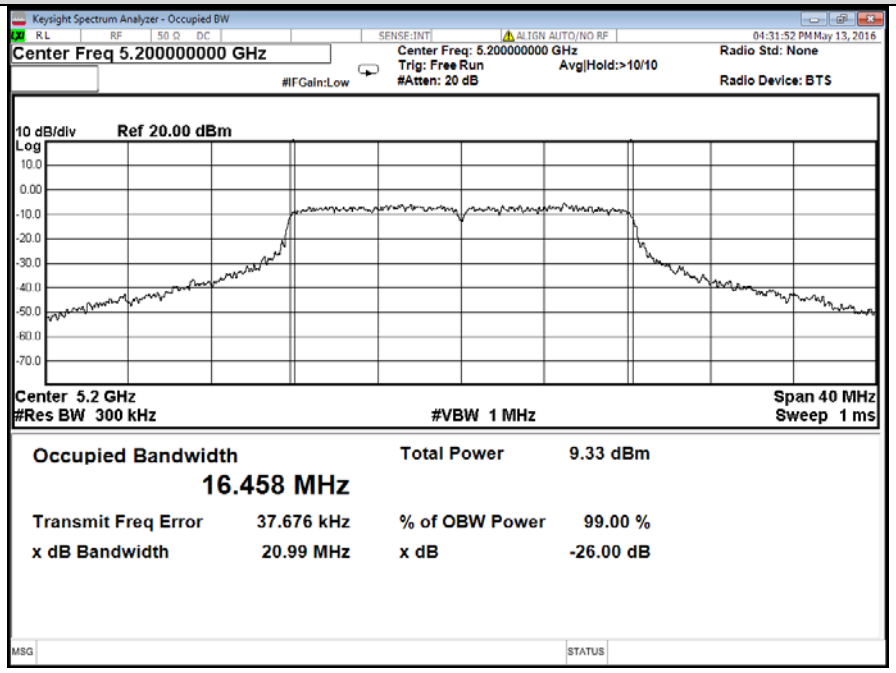


| Test Mode: 802.11a_5200MHz |
|---|
| Chain 0 |

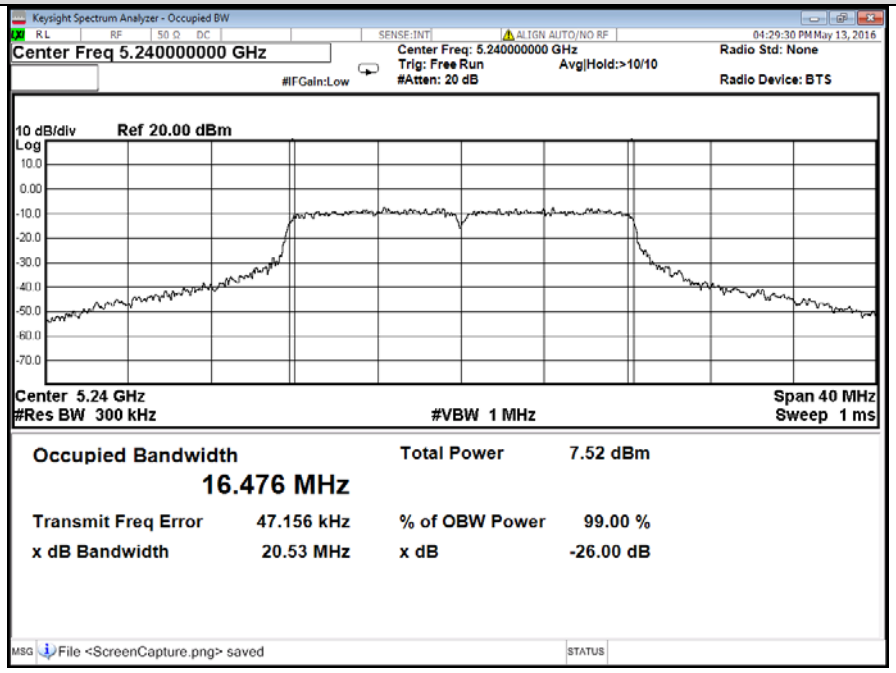



| Chain 1 |
|---|

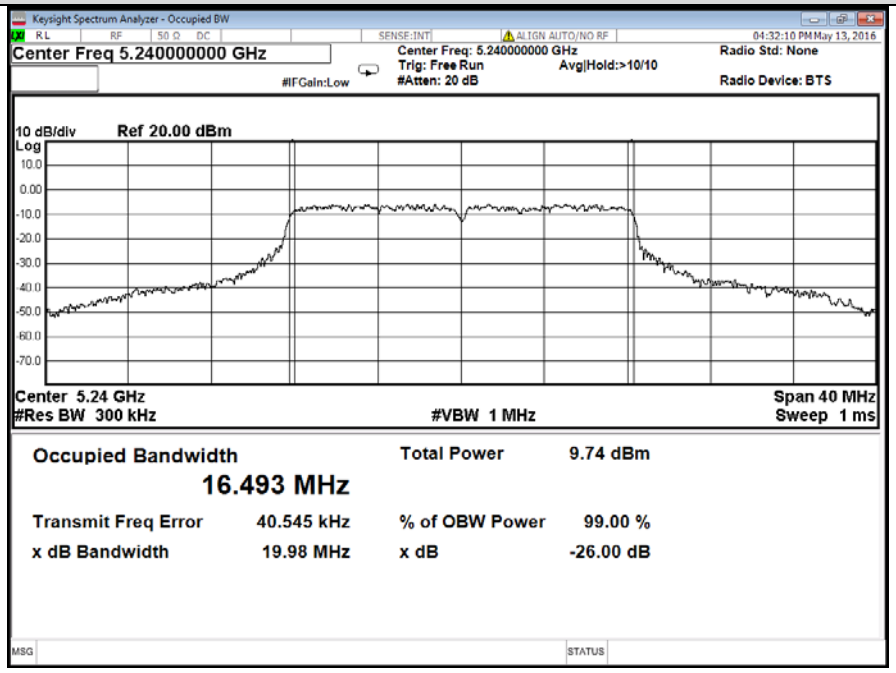


| Test Mode: 802.11a_5240MHz |
|---|
| Chain 0 |

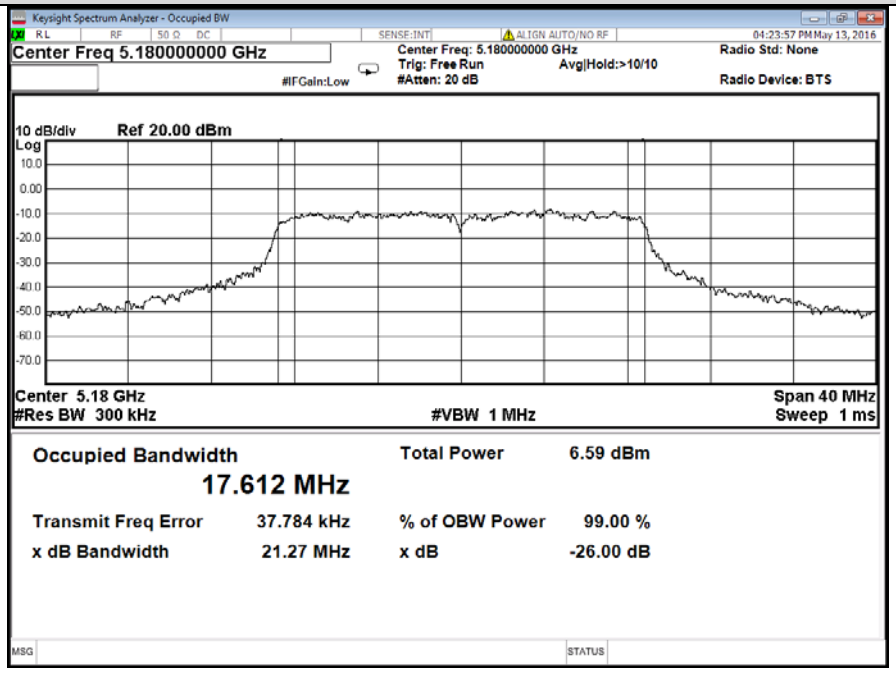



| Chain 1 |
|---|

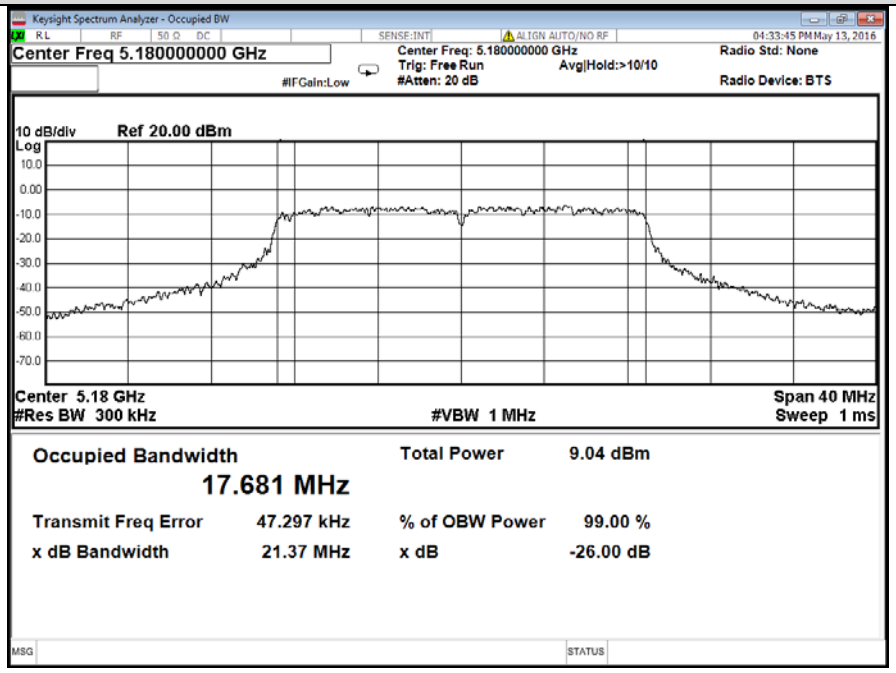


| Test Mode: 802.11n(HT20)_5180MHz |
|---|
| Chain 0 |

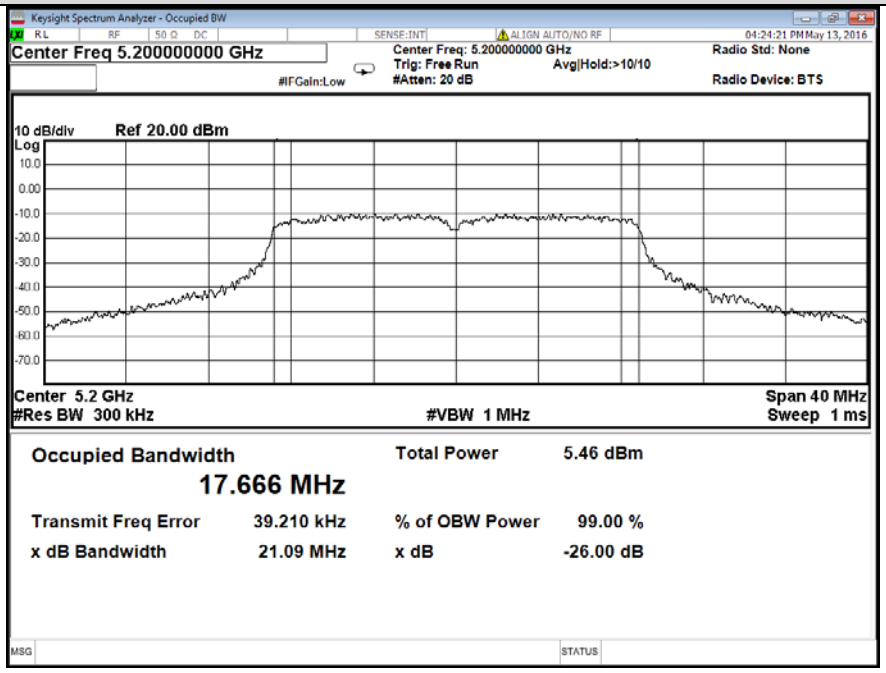



| Chain 1 |
|---|

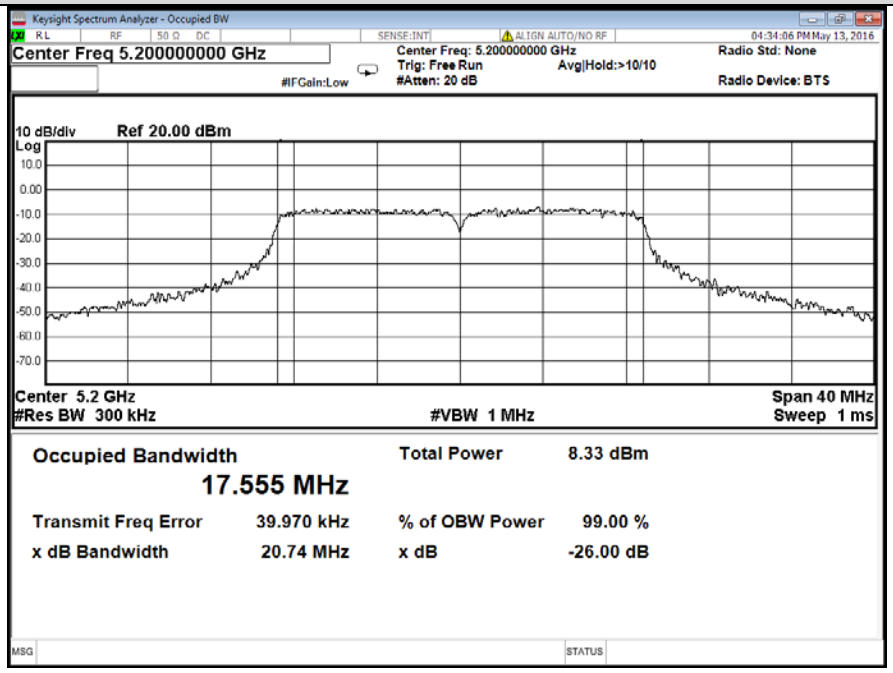


| Test Mode: 802.11n(HT20)_5200MHz |
|---|
| Chain 0 |

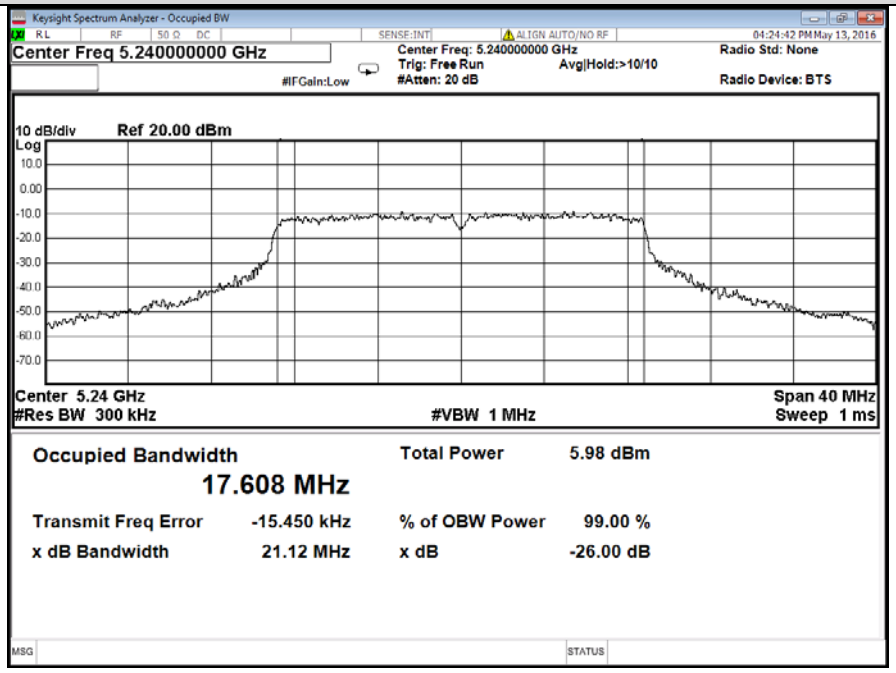



| Chain 1 |
|---|

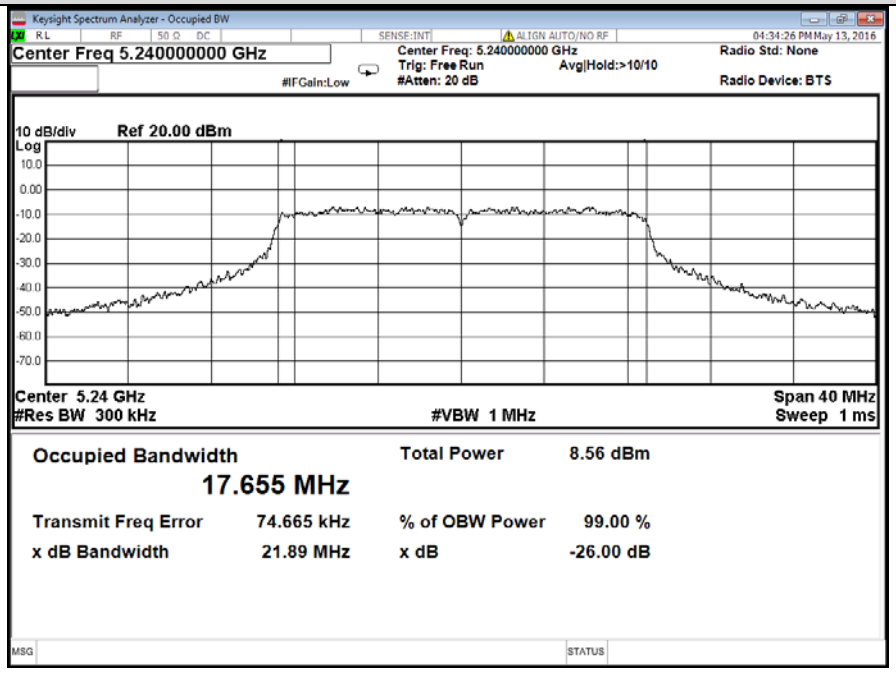


| Test Mode: 802.11n(HT20)_5240MHz |
|---|
| Chain 0 |

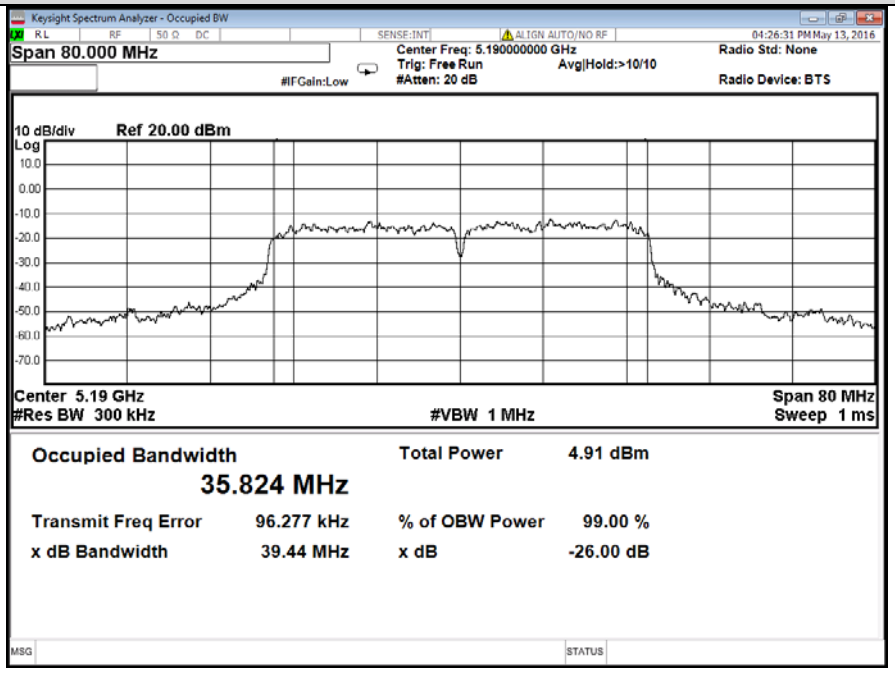



| Chain 1 |
|---|

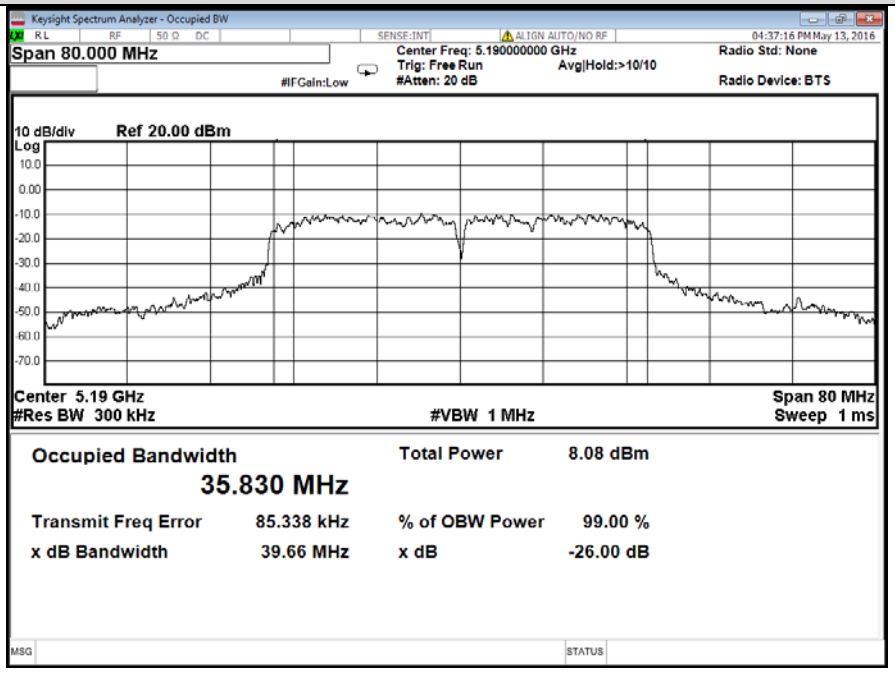


| Test Mode: 802.11n(HT40)_5190MHz |
|---|
| Chain 0 |



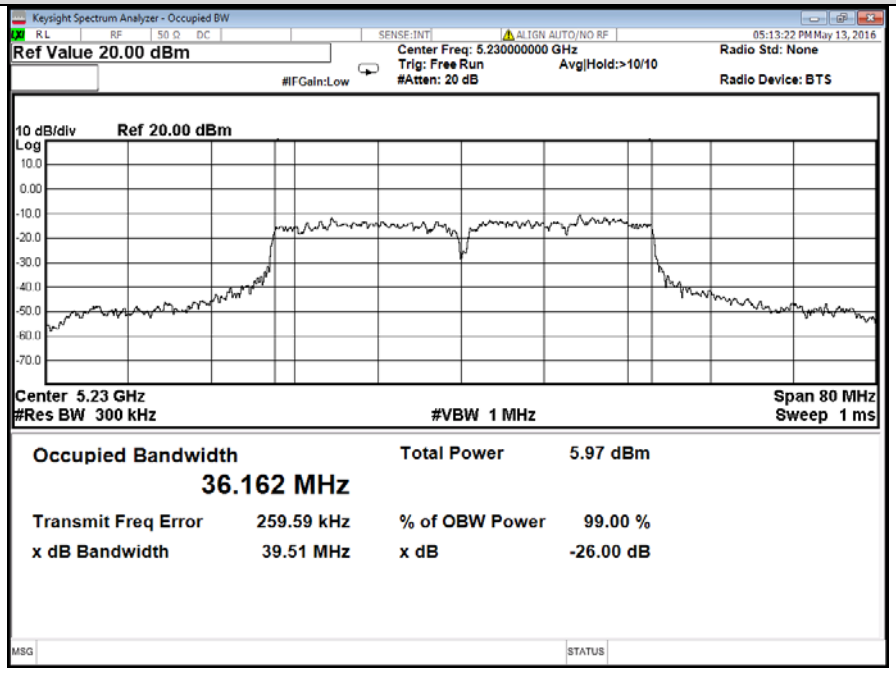

| Chain 1 |
|---|



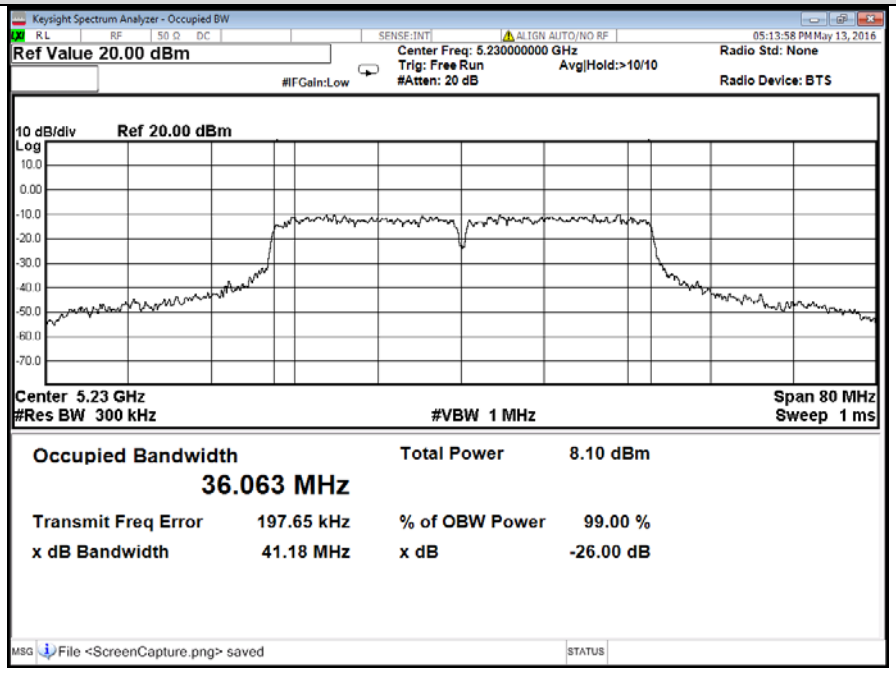

 

## Test Mode: 802.11n(HT40)_5230MHz

### Chain 0



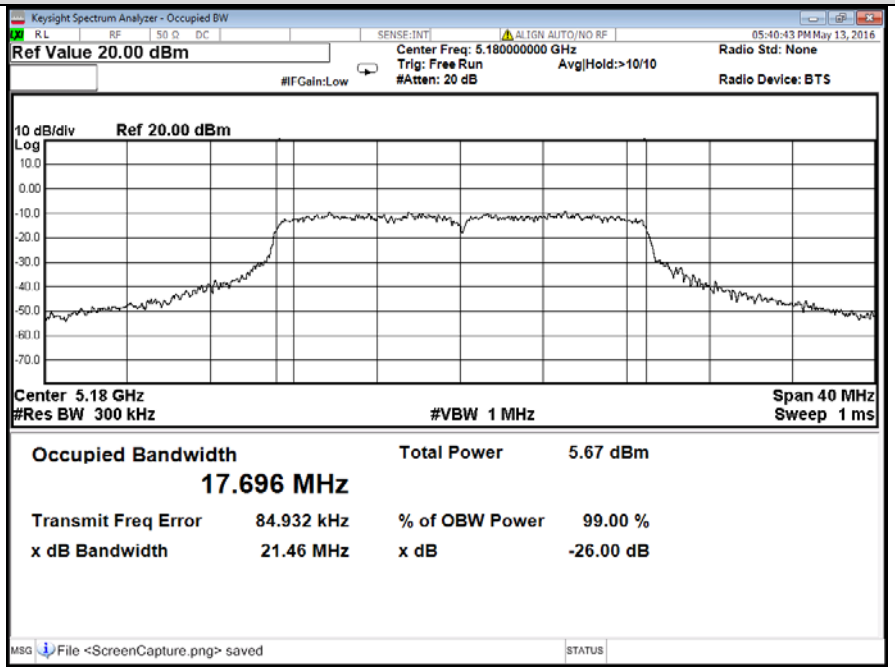

### Chain 1



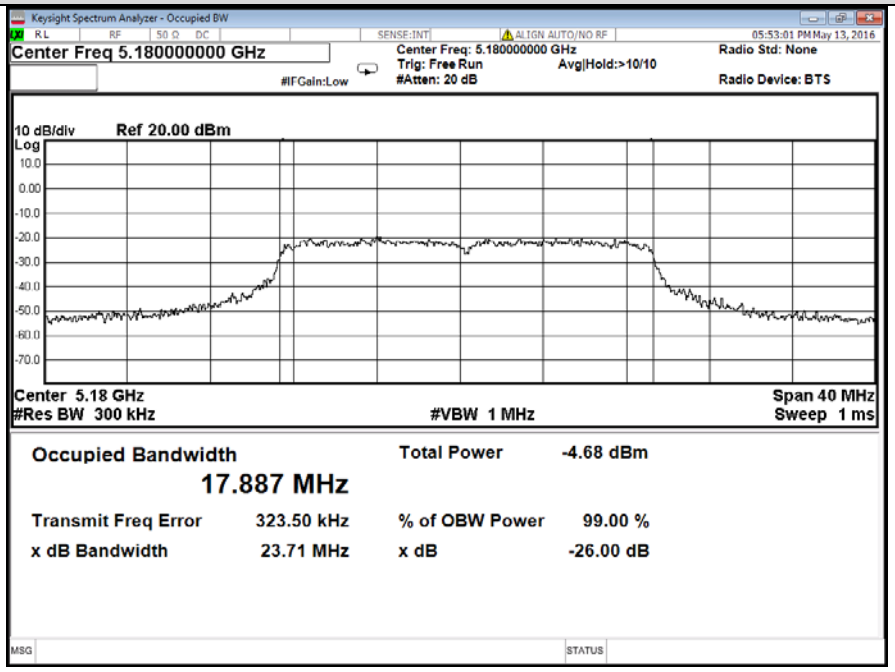

 

## MIMO Mode-Test Data

| Test Mode: 802.11n(HT20)_5180MHz |
|---|
| Chain 0 |

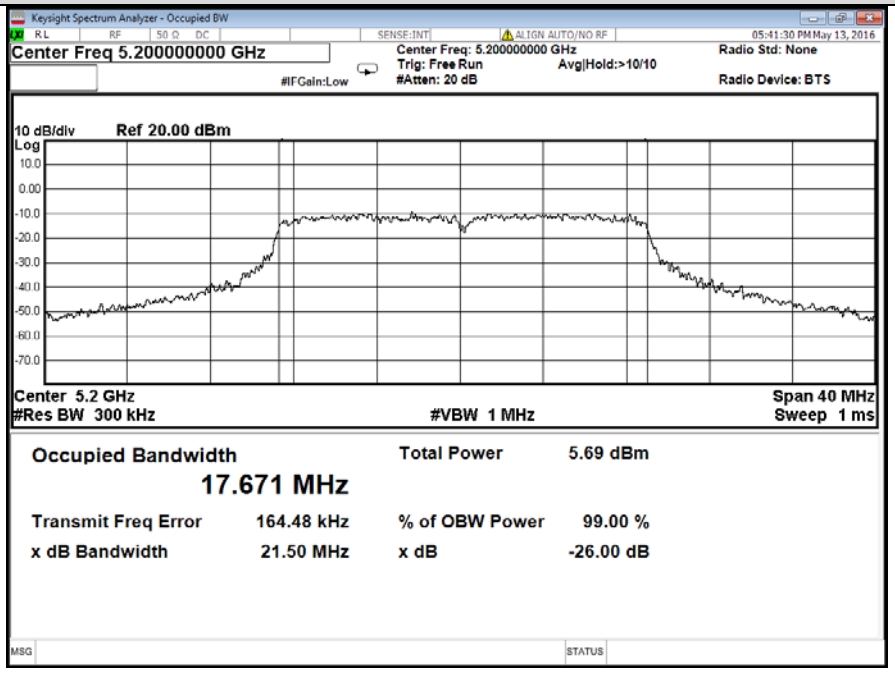



| Chain 1 |
|---|

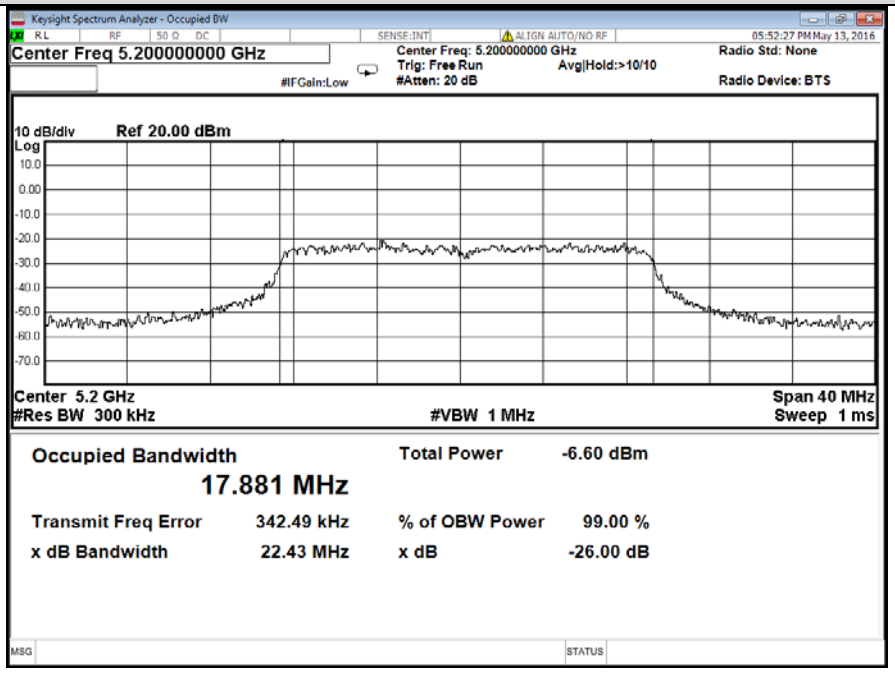


| Test Mode: 802.11n(HT20)_5200MHz |
|---|
| Chain 0 |

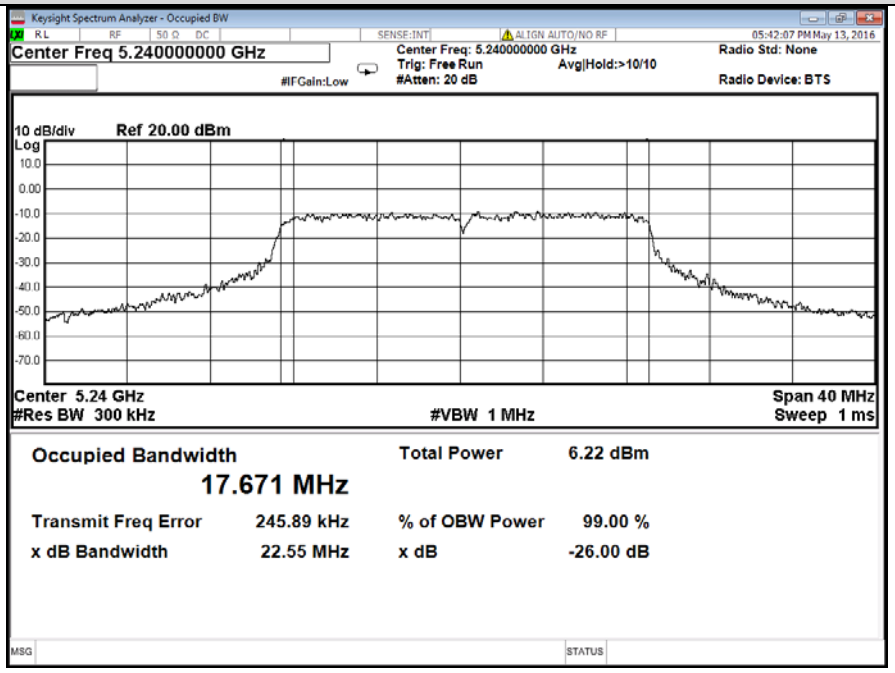



| Chain 1 |
|---|

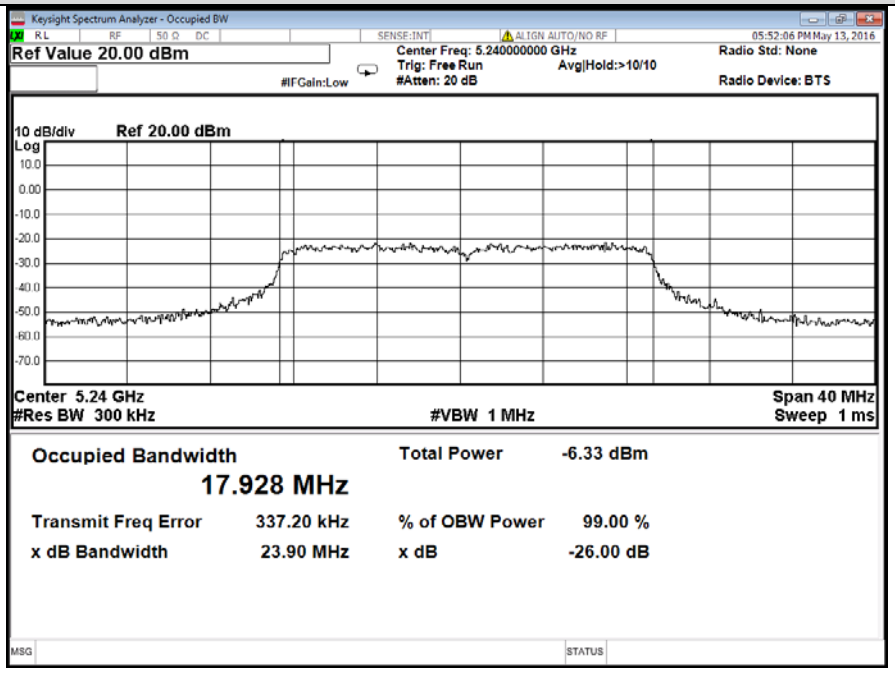


| Test Mode: 802.11n(HT20)_5240MHz |
|---|
| Chain 0 |

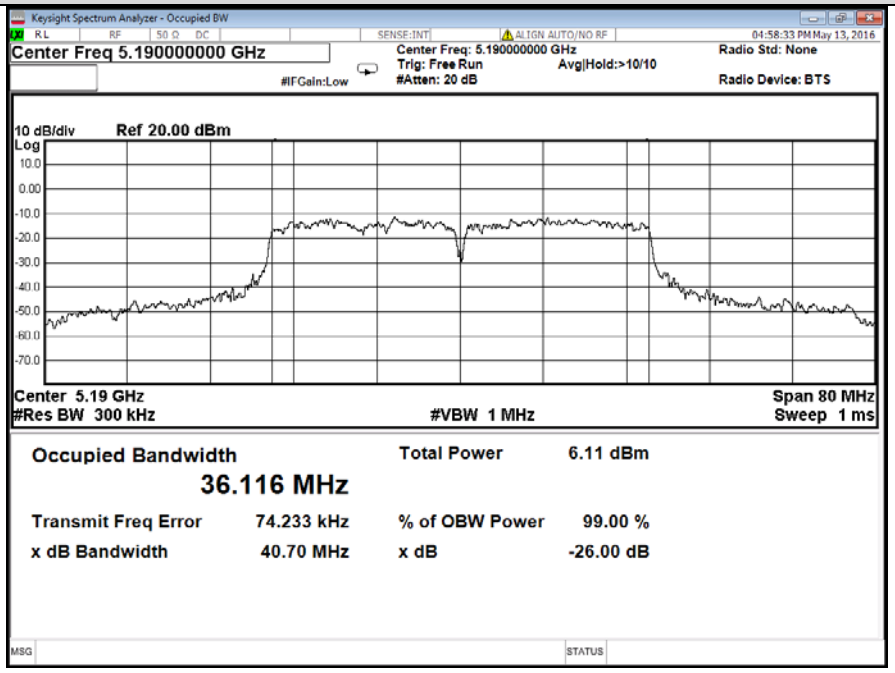



| Chain 1 |
|---|

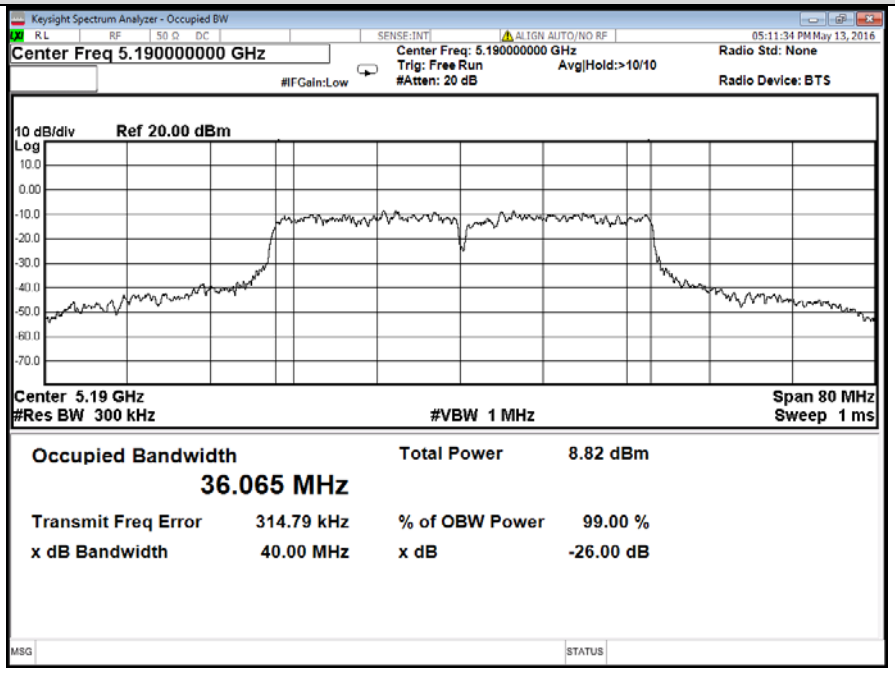


| Test Mode: 802.11n(HT40)_5190MHz |
|---|
| Chain 0 |

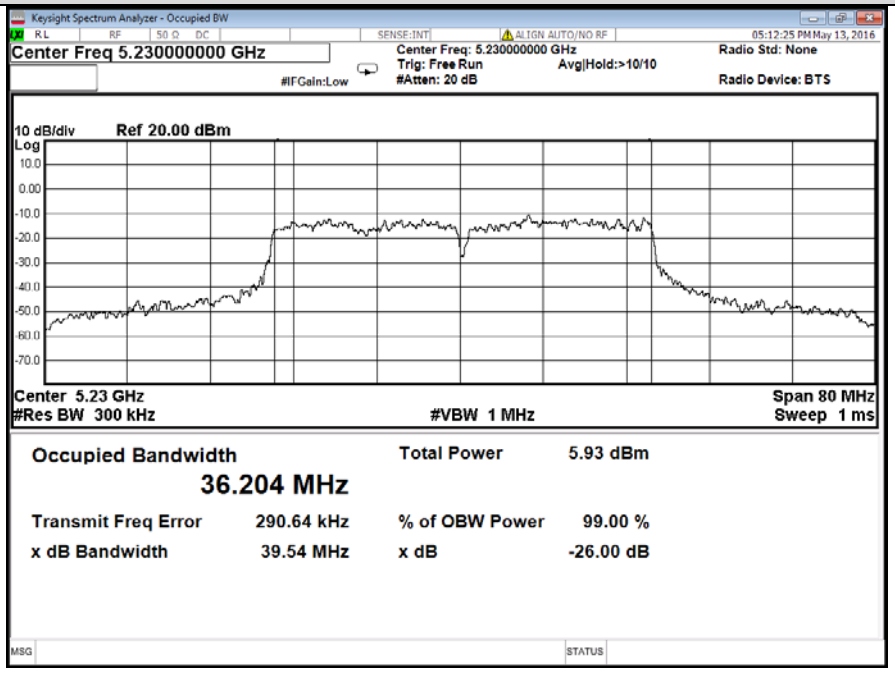



| Chain 1 |
|---|

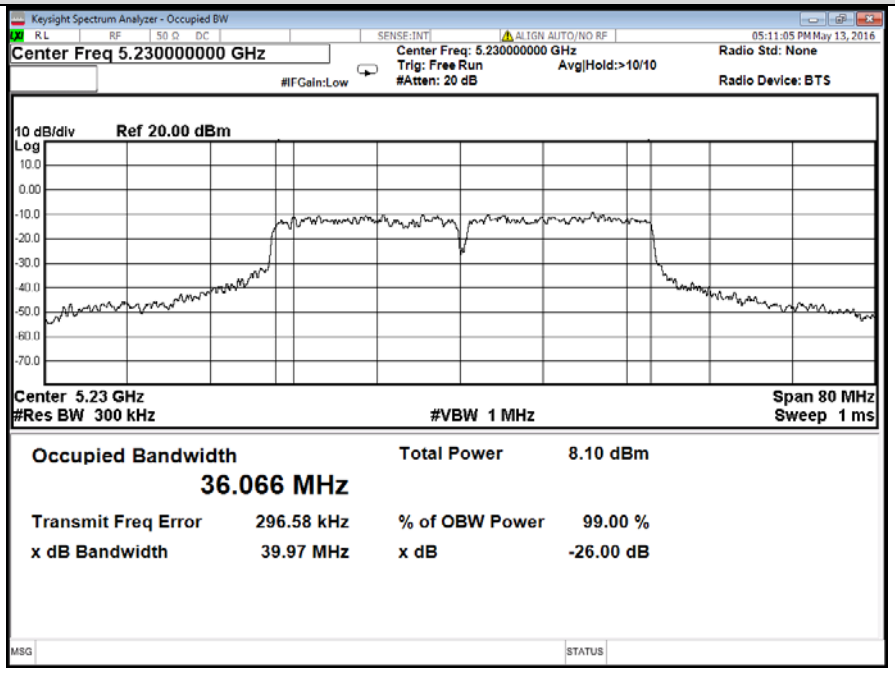


| Test Mode: 802.11n(HT40)_5230MHz |
|---|
| Chain 0 |




| Chain 1 |
|---|



## 6.2 Max Average Power:

To measure the output power the unit was set to transmit on a low, high and middle channel. The output from the transmitter was connected to an attenuator and then to the input of a detector diode. The output of the detector diode was displayed on an oscilloscope. The trace deflection was recorded and the transmitter was replaced with a signal generator at the same frequency. The output of the signal generator was increased until the trace deflection was the same as it was with the transmitter. The signal from the generator was then connected to a power meter and the level was taken.

### 6.2.1 Limit

1. For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW(24 dBm)
2. For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W(30dBm).

### 6.2.2 Test Procedure (789033 D02 v01r02 Section E.3.a(Method PM))

**Average Power Measurement**

1. Connected the EUT's antenna port to measure device by 10dB attenuator.
2. Method PM is used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst.

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

### 6.2.3 Test Data

The EUT complied with the FCC Part 15.407 RF Power Output requirements.

Table 7 provides the test results for RF Power Output. （all the data attached was use the worst case data rate data）

### 6.2.4 Areas of Concern

None.

## Table 7: Max Conducted Output Power

### SISO Mode-Test Data

### Chain 0:

| Mode | Channel Frequency (MHz) | Maximum Conducted Average Power (dBm) | | Power Limit (dBm) | Result (Pass / Fail) |
|---|---|---|---|---|---|
| | | Chain 0 Measured Power | Power with Duty Factor | | |
| 802.11a | 36 (5180) | 6.56 | 6.81 | 24 | Pass |
| | 40 (5200) | 7.26 | 7.51 | 24 | Pass |
| | 48 (5240) | 7.43 | 7.68 | 24 | Pass |
| | 149 (5745) | 7.20 | 7.45 | 30 | Pass |
| | 157 (5785) | 6.63 | 6.88 | 30 | Pass |
| | 165 (5825) | 8.86 | **9.11** | 30 | Pass |
| 802.11n (HT20) | 36 (5180) | 6.51 | 7.04 | 24 | Pass |
| | 40 (5200) | 6.37 | 6.90 | 24 | Pass |
| | 48 (5240) | 7.22 | 7.75 | 24 | Pass |
| | 149 (5745) | 6.06 | 6.59 | 30 | Pass |
| | 157 (5785) | 5.71 | 6.24 | 30 | Pass |
| | 165 (5825) | 8.05 | 8.58 | 30 | Pass |
| 802.11n (HT40) | 38 (5190) | 5.77 | 6.83 | 24 | Pass |
| | 46 (5230) | 6.67 | 7.73 | 24 | Pass |
| | 151 (5755) | 5.74 | 6.80 | 30 | Pass |
| | 159 (5795) | 6.50 | 7.56 | 30 | Pass |

**Chain 1:**

| Mode | Channel Frequency (MHz) | Maximum Conducted Average Power (dBm) | | Power Limit (dBm) | Result (Pass / Fail) |
|---|---|---|---|---|---|
| | | Chain 0 Measured Power | Power with Duty Factor | | |
| 802.11a | 36 (5180) | 9.76 | 10.01 | 24 | Pass |
| | 40 (5200) | 8.84 | 9.09 | 24 | Pass |
| | 48 (5240) | 9.83 | 10.08 | 24 | Pass |
| | 149 (5745) | 8.97 | 9.22 | 30 | Pass |
| | 157 (5785) | 9.16 | 9.41 | 30 | Pass |
| | 165 (5825) | 7.83 | 8.08 | 30 | Pass |
| 802.11n (HT20) | 36 (5180) | 8.98 | 9.51 | 24 | Pass |
| | 40 (5200) | 8.15 | 8.68 | 24 | Pass |
| | 48 (5240) | 8.89 | 9.42 | 24 | Pass |
| | 149 (5745) | 9.99 | **10.52** | 30 | Pass |
| | 157 (5785) | 8.08 | 8.61 | 30 | Pass |
| | 165 (5825) | 6.80 | 7.33 | 30 | Pass |
| 802.11n (HT40) | 38 (5190) | 8.26 | 9.32 | 24 | Pass |
| | 46 (5230) | 7.51 | 8.57 | 24 | Pass |
| | 151 (5755) | 7.84 | 8.90 | 30 | Pass |
| | 159 (5795) | 7.86 | 8.92 | 30 | Pass |

## MIMO Mode-Test Data

| Mode | Channel Frequency (MHz) | Maximum Conducted Average Power (dBm) | | | | | Power Limit (dBm) | Result (Pass / Fail) |
|---|---|---|---|---|---|---|---|---|
| | | Chain 0 Measured Power | Power with Duty Factor | Chain 1 Measured Power | Power with Duty Factor | Total | | |
| 802.11n (HT20) | 36 (5180) | 6.44 | 6.97 | 8.96 | **9.49** | 11.42 | 24 | Pass |
| | 40 (5200) | 6.24 | 6.77 | 8.28 | 8.81 | 10.92 | 24 | Pass |
| | 48 (5240) | 7.06 | 7.59 | 8.69 | 9.22 | 11.49 | 24 | Pass |
| | 149 (5745) | 6.84 | 7.37 | 10.07 | 10.60 | 12.29 | 29.31 | Pass |
| | 157 (5785) | 6.22 | 6.75 | 7.99 | 8.52 | 10.73 | 29.31 | Pass |
| | 165 (5825) | 8.96 | 9.49 | 7.01 | 7.54 | 11.63 | 29.31 | Pass |
| 802.11n (HT40) | 38 (5190) | 5.39 | 6.45 | 8.10 | 9.16 | 11.02 | 24 | Pass |
| | 46 (5230) | 6.90 | 7.96 | 8.02 | 9.08 | 11.57 | 24 | Pass |
| | 151 (5755) | 5.73 | 6.79 | 10.61 | **11.67** | 12.89 | 29.31 | Pass |
| | 159 (5795) | 6.65 | 7.71 | 8.86 | 9.92 | 11.96 | 29.31 | Pass |

Note.1: According exploratory test, EUT will have maximum output power as above bolded data rate, so those data rate were used for all test.

Note2. The TX chains are correlated and the antenna gain is unequal among the chains.
The directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2$ /NANT] dBi

Directional gain and the maximum conducted output power and the maximum power spectral density see table below:

| Frequency | Chain 0 Antenna Gain (dBi) | Chain 1 Antenna Gain (dBi) | Correlated chains directional gain (dBi) | Power Limits (dBm) | PSD Limits (dBm) |
|---|---|---|---|---|---|
| U-NII-1 | -1.21 | -0.94 | 1.94 | 24 | 11 |
| U-NII-3 | 4.46 | 2.82 | 6.69 | 29.31 | 29.31 |

## 6.3 Peak Power Spectral Density

The output from the transmitter was connected to an attenuator and then to the input of the RF Spectrum Analyzer. The analyzer offset was adjusted to compensate for the attenuator and other losses in the system.

### 6.3.1 Limit

1. For mobile and portable client devices in the 5.15-5.25 GHz band, The maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.
2. For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

### 6.3.2 Test Procedure(789033 D02 v01r02 Section F)

**1. 5.15-5.25 GHz band：**

Using method SA-2

a) Set span to encompass the entire emission bandwidth (EBW) of the signal.

b) Set RBW = 1 MHz, Set VBW ⩾ 3 RBW, Detector = RMS

c) Sweep time = auto, trigger set to “free run”.

d) Trace average at least 100 traces in power averaging mode.

e) Record the max value and add 10 log (1/duty cycle)

**2. 5.725-5.85 GHz band：**

a) Set span to encompass the entire emission bandwidth (EBW) of the signal.

b) Set RBW = 500 kHz, Set VBW ≥ 3 RBW, Detector = RMS

c) Use the peak marker function to determine the maximum power level in any 500 kHz band segment within the fundamental EBW.

d) Sweep time = auto, trigger set to “free run”.

e) Trace average at least 100 traces in power averaging mode.

f) Record the max value and add 10 log (1/duty cycle)

### 6.3.3 Test Data

The EUT complied with the FCC Part 15.407 Peak Power Spectral Density requirements. Table 8 provides the test results for RF Power Spectral Density. (all the data attached was use the worst case data rate data）

### 6.3.4 Areas of Concern

None.

## Table 8: Peak Power Spectral Density

### SISO Mode-Test Data

| Mode | Channel Frequency (MHz) | Antenna Port | PSD w/o Duty Factor (dBm) | PSD with Duty Factor (dBm) | Maximum Limit (dBm) | Result (Pass / Fail) |
|---|---|---|---|---|---|---|
| 802.11a | 36 (5180) | Chain 0 | -5.3131 | -5.06 | 11 | Pass |
| | | Chain 1 | -2.6828 | **-2.43** | 11 | Pass |
| | 40 (5200) | Chain 0 | -4.9917 | -4.74 | 11 | Pass |
| | | Chain 1 | -4.6519 | -4.40 | 11 | Pass |
| | 48 (5240) | Chain 0 | -4.5272 | -4.28 | 11 | Pass |
| | | Chain 1 | -3.5053 | -3.26 | 11 | Pass |
| | 149 (5745) | Chain 0 | -8.8825 | -8.63 | 30 | Pass |
| | | Chain 1 | -3.7845 | -3.53 | 30 | Pass |
| | 157 (5785) | Chain 0 | -9.0122 | -8.76 | 30 | Pass |
| | | Chain 1 | -6.5891 | -6.34 | 30 | Pass |
| | 165 (5825) | Chain 0 | -7.1335 | -6.88 | 30 | Pass |
| | | Chain 1 | -8.1507 | -7.90 | 30 | Pass |
| 802.11n (HT20) | 36 (5180) | Chain 0 | -6.4039 | -5.87 | 11 | Pass |
| | | Chain 1 | -4.5628 | -4.03 | 11 | Pass |
| | 40 (5200) | Chain 0 | -5.7128 | -5.18 | 11 | Pass |
| | | Chain 1 | -5.0770 | -4.55 | 11 | Pass |
| | 48 (5240) | Chain 0 | -5.5636 | -5.03 | 11 | Pass |
| | | Chain 1 | -5.1307 | -4.60 | 11 | Pass |
| | 149 (5745) | Chain 0 | -10.360 | -9.83 | 30 | Pass |
| | | Chain 1 | -5.5110 | -4.98 | 30 | Pass |
| | 157 (5785) | Chain 0 | -10.978 | -10.45 | 30 | Pass |
| | | Chain 1 | -7.3939 | -6.86 | 30 | Pass |
| | 165 (5825) | Chain 0 | -8.1720 | -7.64 | 30 | Pass |
| | | Chain 1 | -7.9932 | -7.46 | 30 | Pass |

| Mode | Channel Frequency (MHz) | Antenna Port | PSD w/o Duty Factor (dBm) | PSD with Duty Factor (dBm) | Maximum Limit (dBm) | Result (Pass / Fail) |
|---|---|---|---|---|---|---|
| 802.11n (HT40) | 38 (5190) | Chain 0 | -10.770 | -9.71 | 11 | Pass |
| | | Chain 1 | -8.6705 | -7.61 | 11 | Pass |
| | 46 (5230) | Chain 0 | -9.6016 | -8.54 | 11 | Pass |
| | | Chain 1 | -7.3102 | -6.25 | 11 | Pass |
| | 151 (5755) | Chain 0 | -14.355 | -13.30 | 30 | Pass |
| | | Chain 1 | -9.9844 | -8.92 | 30 | Pass |
| | 159 (5795) | Chain 0 | -12.249 | -11.19 | 30 | Pass |
| | | Chain 1 | -11.806 | -10.75 | 30 | Pass |

**MIMO Mode-Test Data**

**5.15-5.25 GHz band**

| Mode | Channel Frequency (MHz) | Antenna Port | PSD w/o Duty Factor (dBm) | PSD with Duty Factor (dBm) | Maximum Limit (dBm) | Result (Pass / Fail) |
|---|---|---|---|---|---|---|
| 802.11n (HT20) | 36 (5180) | Chain 0 | -7.9442 | -7.41 | 11 | Pass |
| | | Chain 1 | -4.2070 | -3.68 | 11 | Pass |
| | 40 (5200) | Chain 0 | -8.7924 | -8.26 | 11 | Pass |
| | | Chain 1 | -5.3581 | -4.83 | 11 | Pass |
| | 48 (5240) | Chain 0 | -7.8905 | -7.36 | 11 | Pass |
| | | Chain 1 | -5.4994 | -4.97 | 11 | Pass |
| | 149 (5745) | Chain 0 | -8.4355 | -7.91 | 29.31 | Pass |
| | | Chain 1 | -5.0164 | -4.49 | 29.31 | Pass |
| | 157 (5785) | Chain 0 | -11.128 | -10.60 | 29.31 | Pass |
| | | Chain 1 | -9.3236 | -8.79 | 29.31 | Pass |
| | 165 (5825) | Chain 0 | -9.1477 | -8.62 | 29.31 | Pass |
| | | Chain 1 | -8.3982 | -7.87 | 29.31 | Pass |

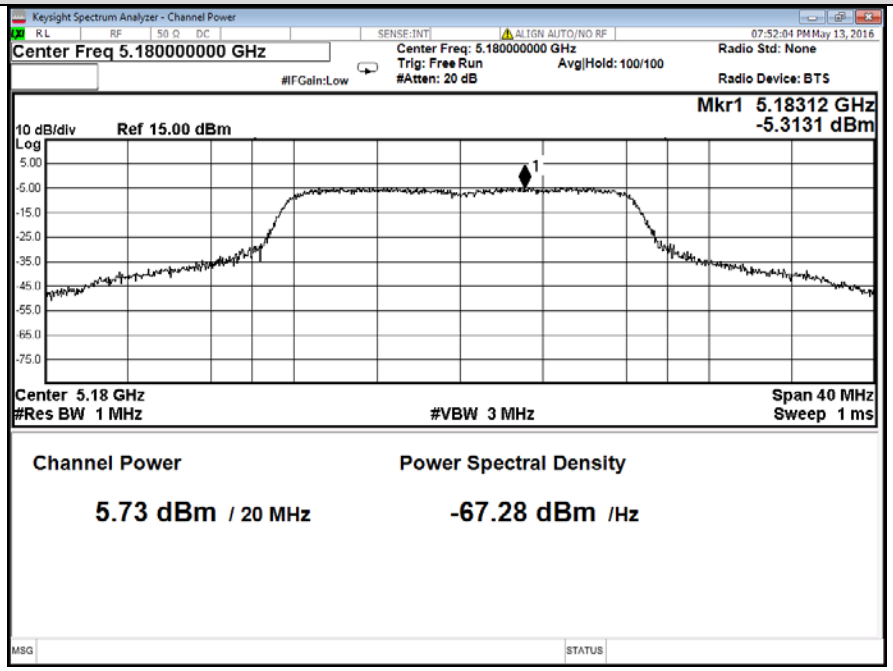
| Mode | Channel Frequency (MHz) | Antenna Port | PSD w/o Duty Factor (dBm) | PSD with Duty Factor (dBm) | Maximum Limit (dBm) | Result (Pass / Fail) |
|---|---|---|---|---|---|---|
| 802.11n (HT40) | 38 (5190) | Chain 0 | -11.125 | -10.07 | 11 | Pass |
| | | Chain 1 | -7.8140 | -6.75 | 11 | Pass |
| | 46 (5230) | Chain 0 | -9.5157 | -8.46 | 11 | Pass |
| | | Chain 1 | -8.2878 | -7.23 | 11 | Pass |
| | 151 (5755) | Chain 0 | -13.940 | -12.88 | 30 | Pass |
| | | Chain 1 | -10.351 | -9.29 | 30 | Pass |
| | 159 (5795) | Chain 0 | -13.433 | -12.37 | 30 | Pass |
| | | Chain 1 | -10.746 | -9.69 | 30 | Pass |

| Mode | Channel Frequency (MHz) | PSD with Duty Factor (dBm) | | | Maximum Limit (dBm) | Result (Pass / Fail) |
|---|---|---|---|---|---|---|
| | | Chain 0 PSD with Duty Factor | Chain 1 PSD with Duty Factor | Total | | |
| 802.1n (HT20) | 36 (5180) | -7.41 | -3.68 | **-2.15** | 11 | Pass |
| | 40 (5200) | -8.26 | -4.83 | -3.20 | 11 | Pass |
| | 48 (5240) | -7.36 | -4.97 | -2.99 | 11 | Pass |
| | 149 (5745) | -7.91 | -4.49 | -2.86 | 30 | Pass |
| | 157 (5785) | -10.60 | -8.79 | -6.59 | 30 | Pass |
| | 165 (5825) | -8.62 | -7.87 | -5.22 | 30 | Pass |
| 802.1n (HT40) | 38 (5190) | -10.07 | -6.75 | -5.09 | 11 | Pass |
| | 46 (5230) | -8.46 | -7.23 | -4.79 | 11 | Pass |
| | 151 (5755) | -12.88 | -9.29 | -7.71 | 30 | Pass |
| | 159 (5795) | -12.37 | -9.69 | -7.82 | 30 | Pass |

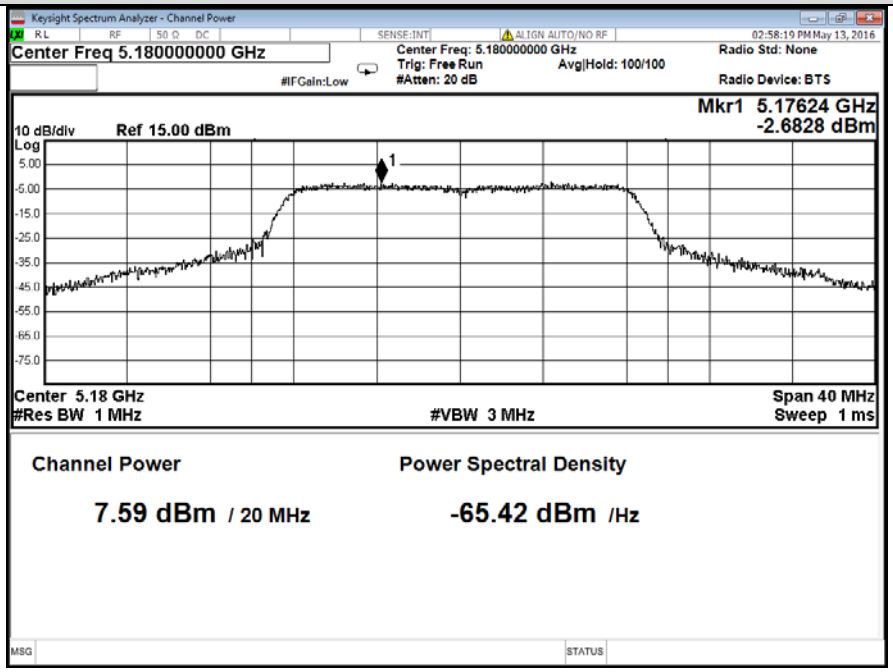
 

## SISO Mode-Test Data

| Test Mode: 802.11a_5180MHz |
|---|
| Chain 0 |



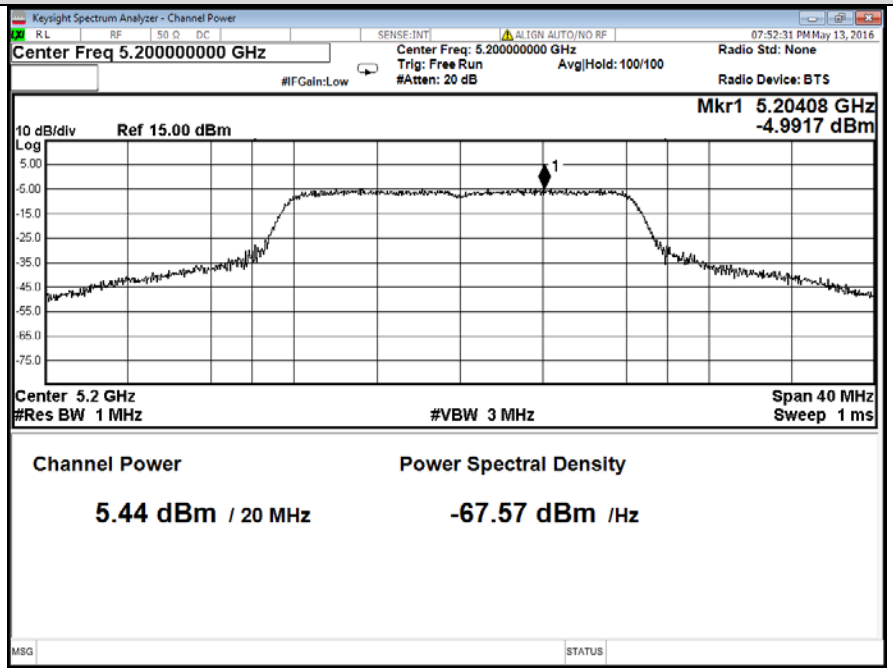

| Chain 1 |
|---|



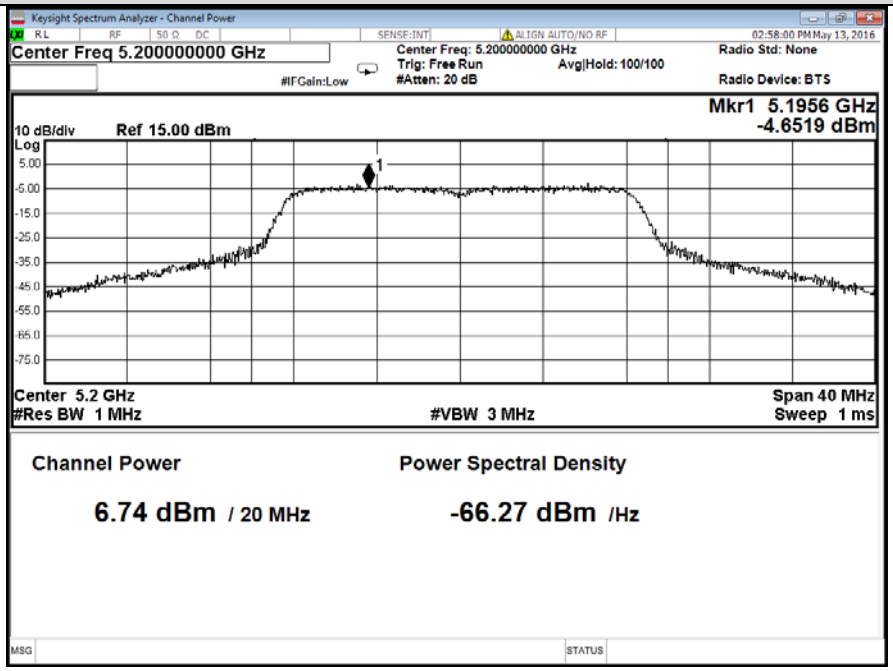

 

## Test Mode: 802.11a_5200MHz

### Chain 0



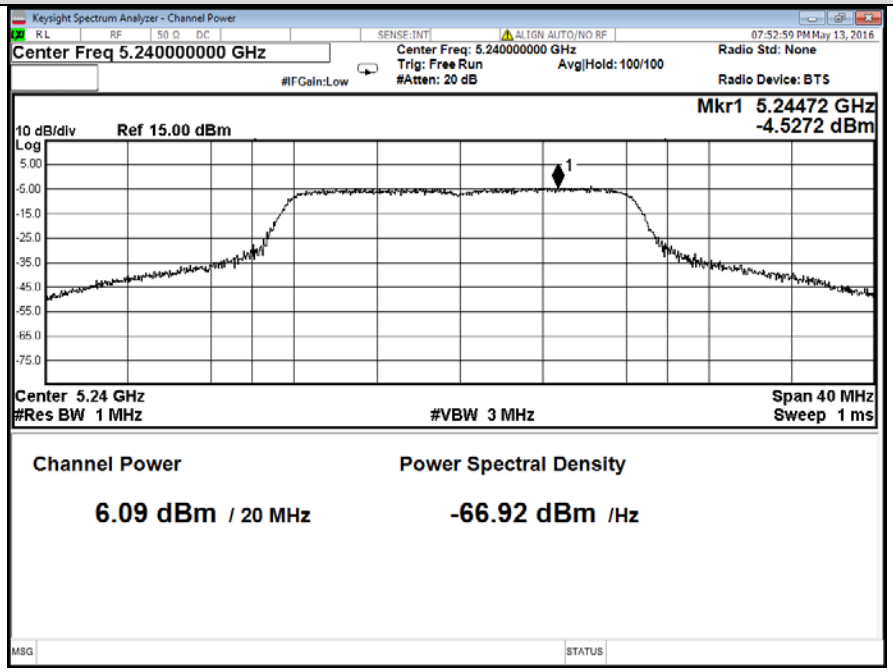

### Chain 1



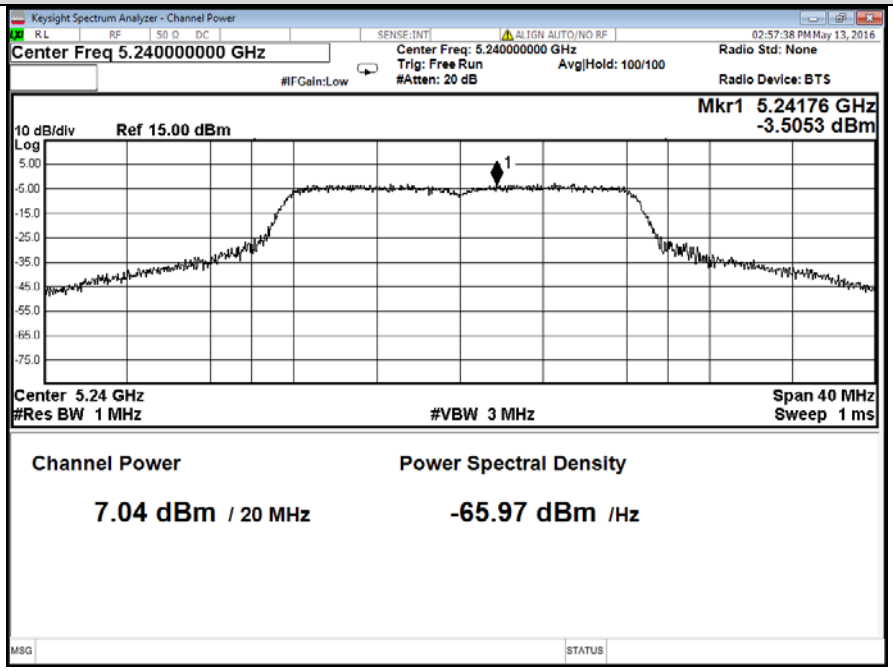

 

## Test Mode: 802.11a_5240MHz

### Chain 0



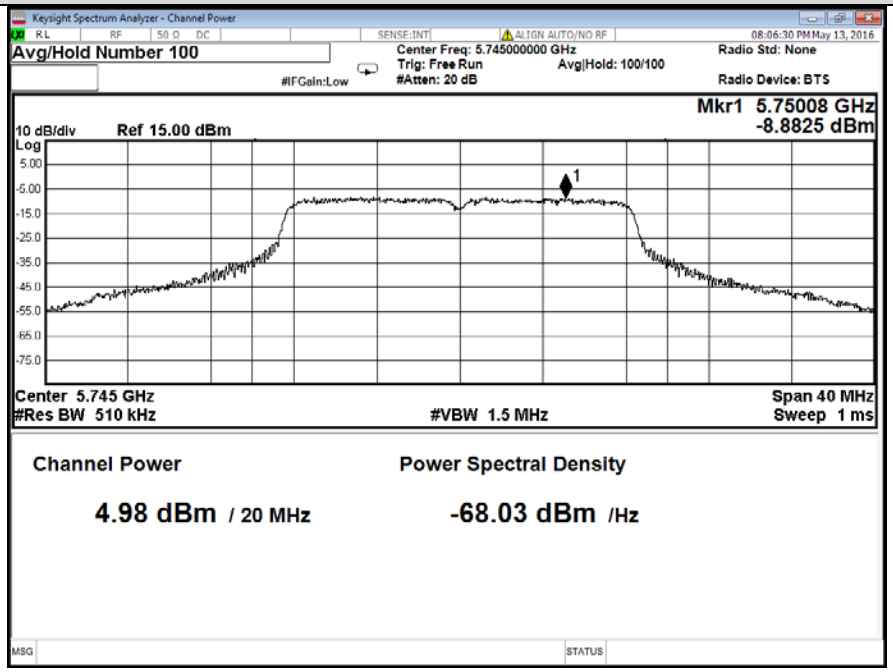

### Chain 1



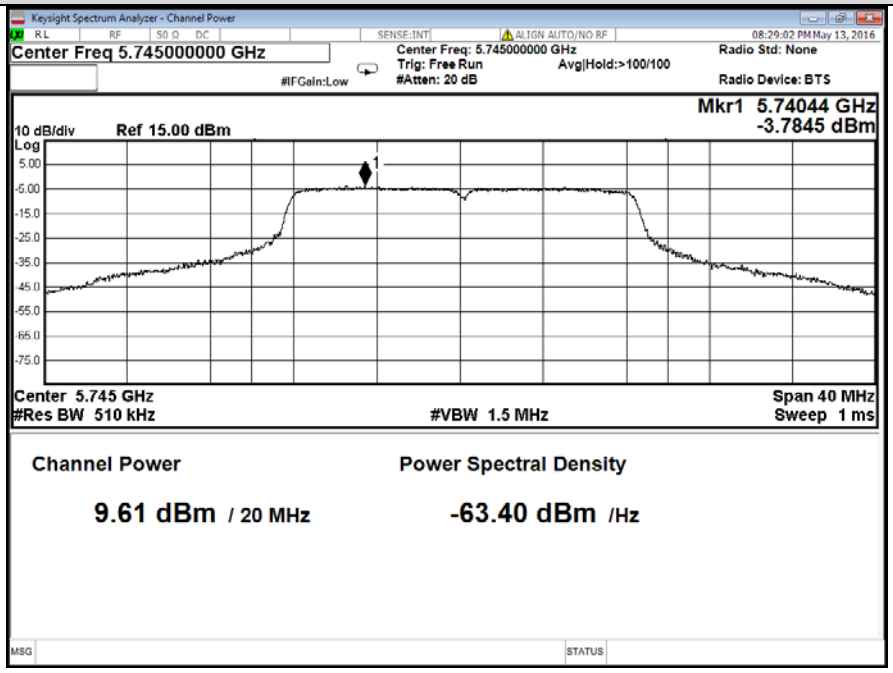

 

## Test Mode: 802.11a_5745MHz

### Chain 0



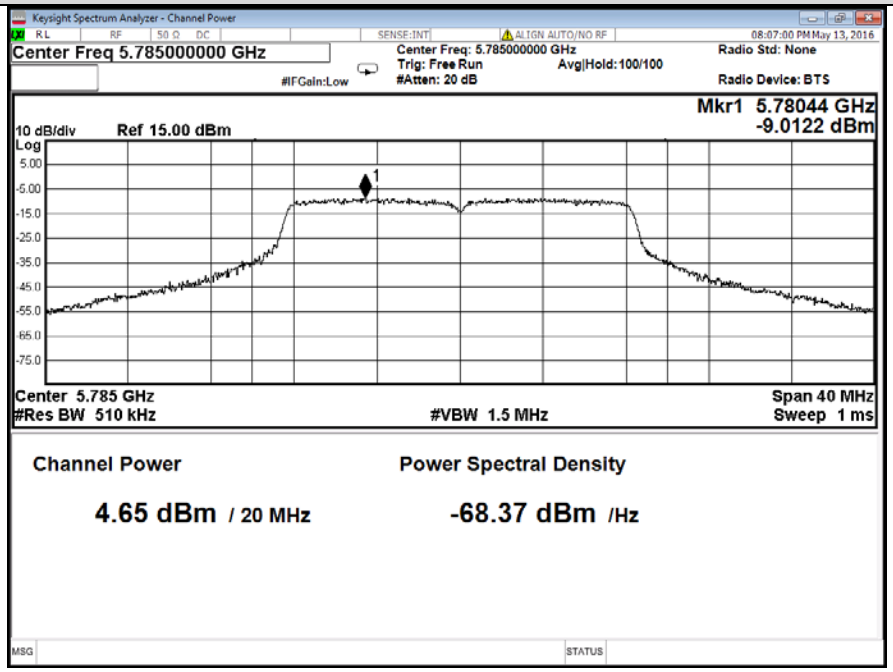

### Chain 1



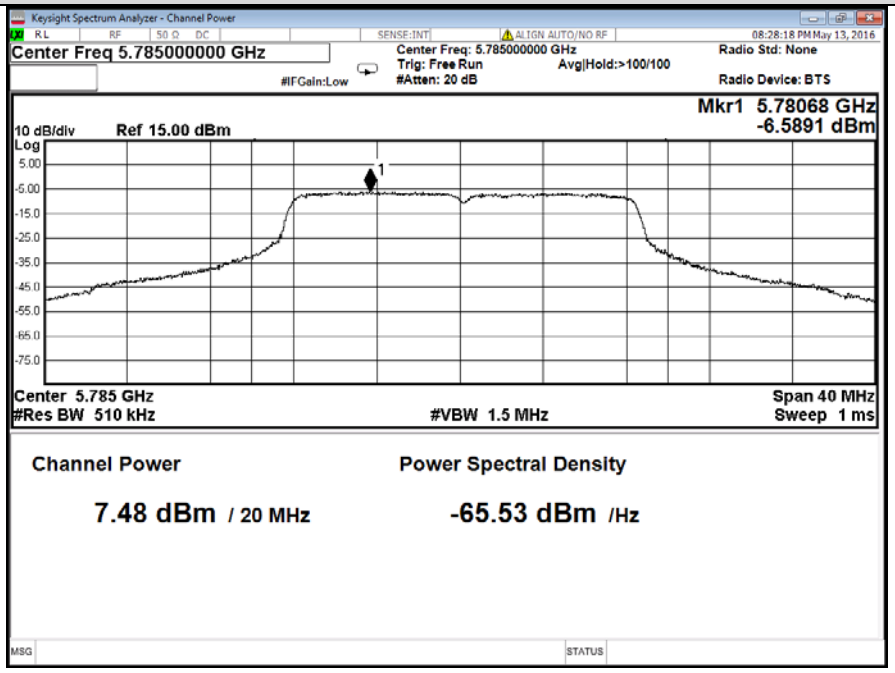

 

## Test Mode: 802.11a_5785MHz

### Chain 0



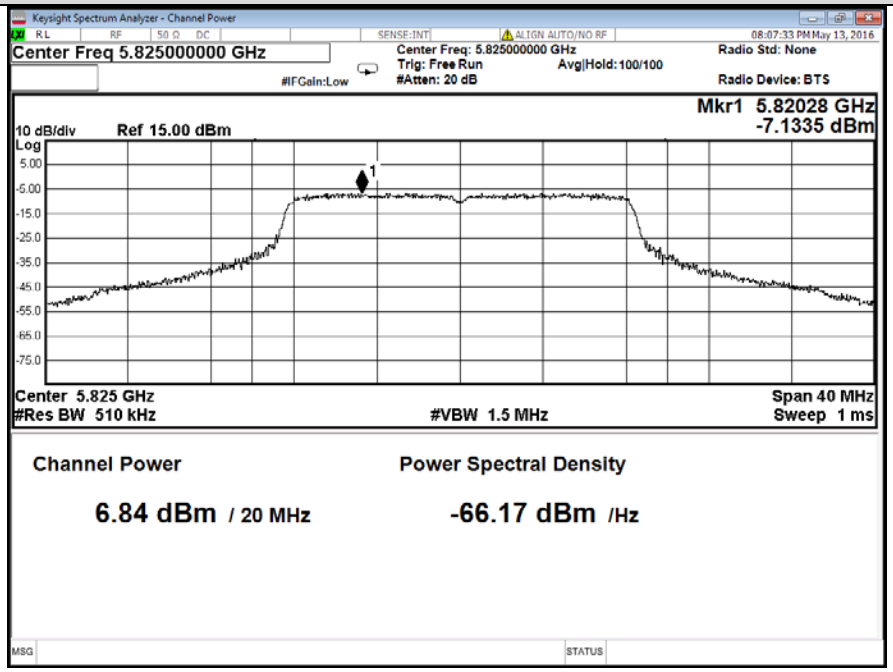

### Chain 1



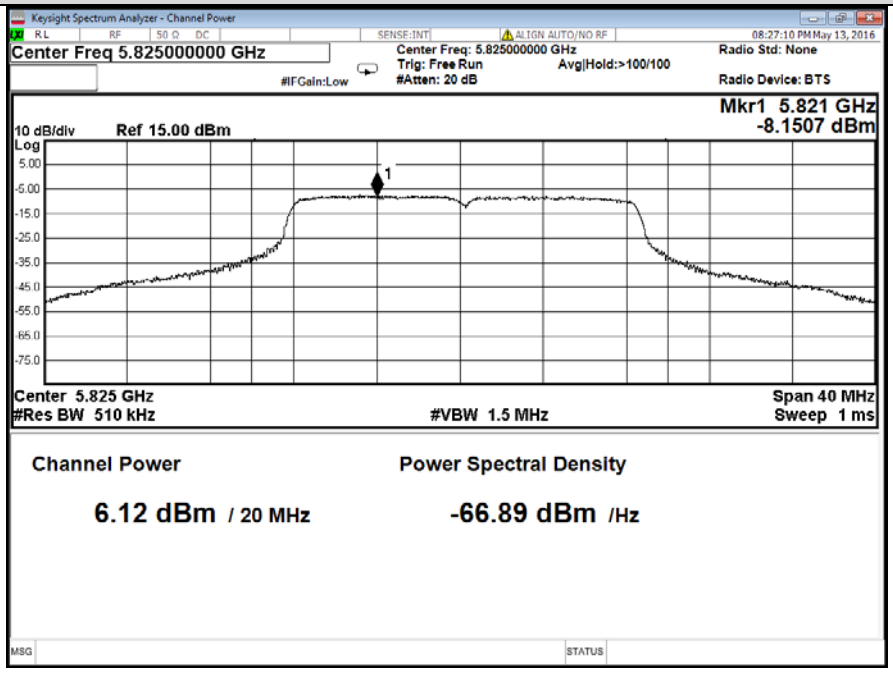

 

## Test Mode: 802.11a_5825MHz

### Chain 0



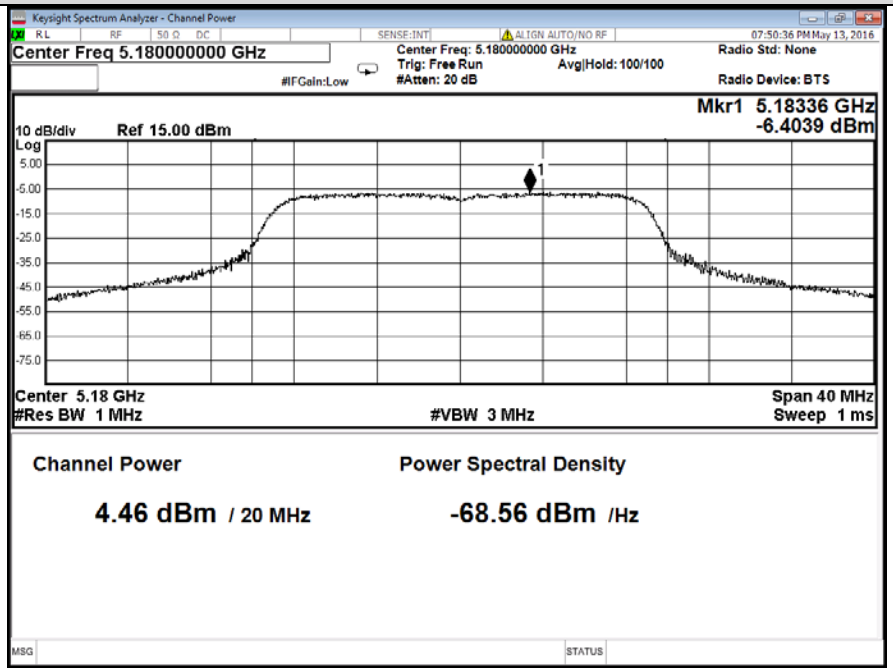

### Chain 1



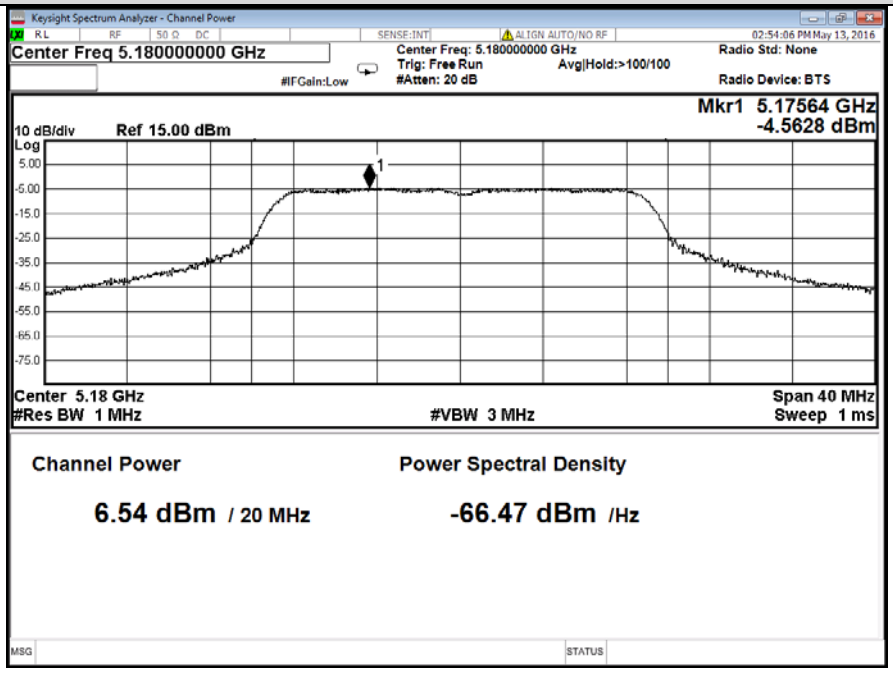

 

## Test Mode: 802.11n(HT20)_5180MHz

### Chain 0



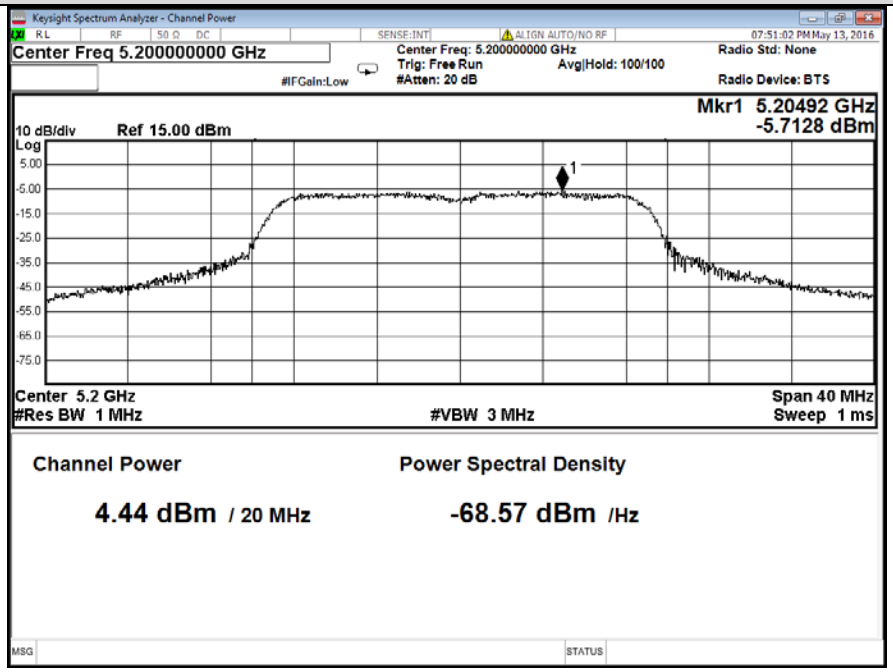

### Chain 1



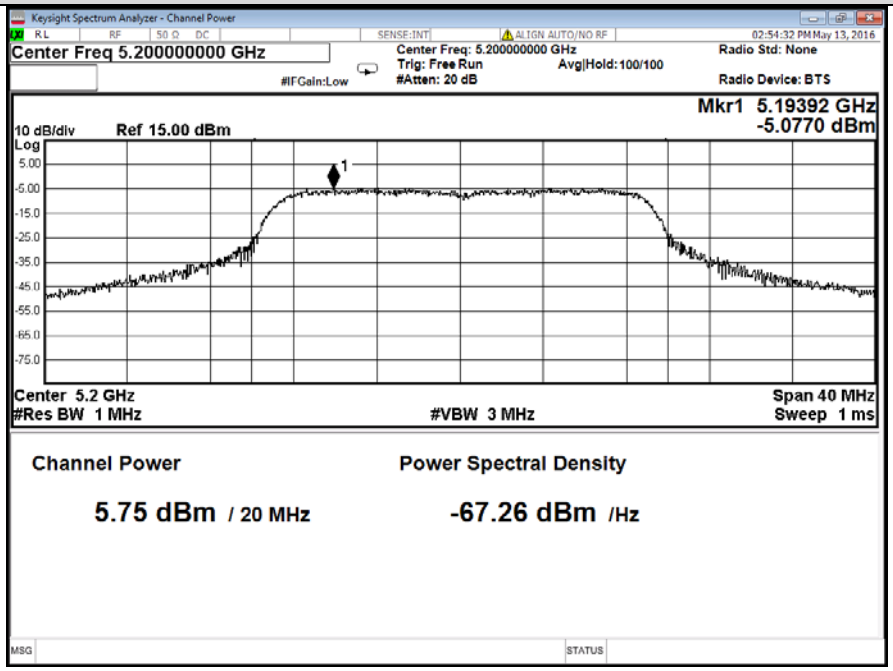

 

## Test Mode: 802.11n(HT20)_5200MHz

### Chain 0



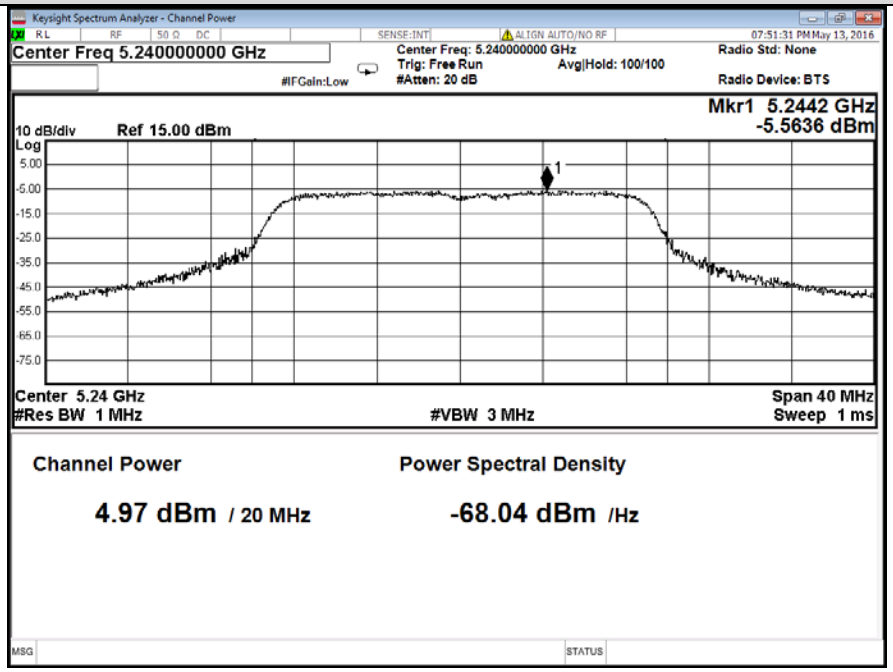

### Chain 1



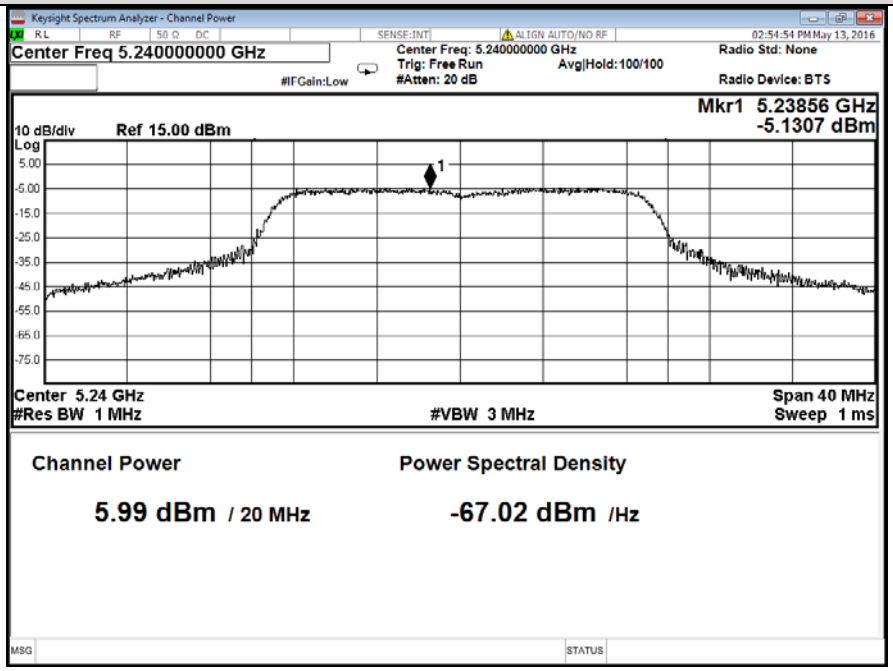

 

## Test Mode: 802.11n(HT20)_5240MHz

### Chain 0



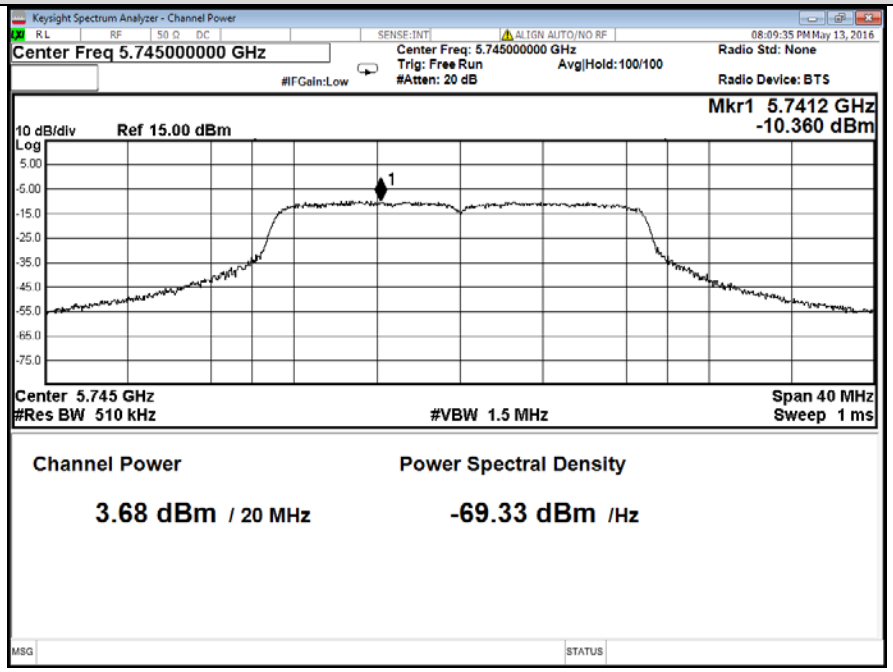

### Chain 1



## Test Mode: 802.11n(HT20)_5745MHz

### Chain 0




### Chain 1