



RF TEST REPORT

Applicant Alcatel-Lucent Shanghai Bell Co.,Ltd.
FCC ID 2ADZRXS250WXAB
Product XGSPON ONU
Brand NOKIA
Model XS-250WX-A/XS-240W-A
Report No. RBA1709-0095RF03R2
Issue Date January 11, 2018

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15E (2017)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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Summary of measurement results

| Number | Summary of measurements of results | Clause in FCC rules | Verdict |
|--|------------------------------------|---------------------|---------|
| 1 | Average conducted output power | 15.407(a) | PASS |
| 2 | Occupied bandwidth | 15.407(e) | PASS |
| 3 | Frequency stability | 15.407(g) | PASS |
| 4 | Maximum power spectral density | 15.407(a) | PASS |
| 5 | Unwanted Emissions | 15.407(b) | PASS |
| 6 | Conducted Emissions | 15.207 | PASS |
| Date of Testing: December 20, 2016 ~ February 4, 2017 and September 18, 2017~ January 4, 2018 | | | |



1. Test Laboratory

1.1. Notes of the test report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above. This report must not be used by the client to claim product certification, approval, or endorsement by any government agencies.

1.2. Test facility

CNAS (accreditation number: L2264)

TA Technology (Shanghai) Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

IC (recognition number is 8510A)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Canada to perform electromagnetic emission measurement.

VCCI (recognition number is C-4595, T-2154, R-4113, G-10766)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Japan to perform electromagnetic emission measurement.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.



1.3. Testing Location

Company: TA Technology (Shanghai) Co., Ltd.
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2. General Description of Equipment under Test

Client Information

| | |
|-----------------------------|---|
| Applicant | Alcatel-Lucent Shanghai Bell CO. Ltd. |
| Applicant address | 388-389#,Ningqiao Road,Pudong Jinqiao, Shanghai, P.R. China |
| Manufacturer | Alcatel-Lucent Shanghai Bell CO. Ltd. |
| Manufacturer address | 388-389#,Ningqiao Road,Pudong Jinqiao, Shanghai, P.R. China |

General information

| EUT Description | |
|---|--|
| Model | XS-250WX-A/XS-240W-A |
| SN: | / |
| Hardware Version | 3FE 48307 AA /3FE 48631 AA |
| Software Version | 3FE47059 |
| Power Supply | AC adapter |
| Antenna Type | Internal Antenna |
| Antenna Gain | Antenna 1: 3.0 dBi Antenna 2: 3.0 dBi Antenna 3: 3.0 dBi Antenna 4: 3.0 dBi |
| additional beamforming gain | 6 dB |
| Test Mode(s) | U-NII-1(5150MHz-5250MHz) U-NII-3(5725MHz-5850MHz) |
| Modulation Type | 802.11a/n (HT20/HT40) : OFDM 802.11ac (HT20.HT40/HT80): OFDM |
| Max. Conducted Power | 28.17 dBm |
| Operating Frequency Range(s) | U-NII-1: 5150-5250MHz U-NII-3: 5725-5850MHz |
| EUT Accessory | |
| Adapter | Manufacturer: DELTA electronics, INC. Model: ADP-66CR BC |
| Note: The information of the EUT is declared by the manufacturer. | |



| | |
|---|-------------------|
| XS-250WX-A | XS-240W-A |
| With 10GE port | Without 10GE port |
| Note: Customer declaration, two models is the same except 10GE port. During the test, both of two models are evaluated, XS-250WX-A selected as the worst condition, but only the worst case is recorded in this report. | |

| | Model | ONU Part number | Kit Part number |
|--------|------------|-----------------|-----------------|
| US ONU | XS-250WX-A | 3FE 48307 AA | - |
| US Kit | XS-250WX-A | 3FE 48307 AA | 3FE 48439 AA |
| US ONU | XS-240W-A | 3FE 48631 AA | - |
| US Kit | XS-240W-A | 3FE 48631 AA | 3FE 48626 AA |



3. Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC CFR47 Part 15E (2017) Unlicensed National Information Infrastructure Devices

ANSI C63.10 (2013)

KDB 789033 D02 General UNII Test Procedures New Rules v01r04

KDB 662911 D01 Multiple Transmitter Output v02r01



4. Test Configuration

Test Mode

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the worst case was recorded.

In order to find the worst case condition, Pre-tests are needed at the presence of different data rate. Preliminary tests have been done on all the configuration for confirming worst case. Data rate below means worst-case rate of each test item.

Worst-case data rates are shown as following table.

| Band | Data Rate | | | | |
|---------------|-----------|-----------|-----------|-----------|--------------|
| | Antenna 1 | Antenna 2 | Antenna 3 | Antenna 4 | Antenna type |
| 802.11a | 6 Mbps | 6 Mbps | 6 Mbps | 6 Mbps | SISO |
| 802.11n HT20 | MCS24 | MCS24 | MCS24 | MCS24 | MIMO |
| 802.11n HT40 | MCS24 | MCS24 | MCS24 | MCS24 | |
| 802.11ac HT20 | MCS0NSS4 | MCS0NSS4 | MCS0NSS4 | MCS0NSS4 | |
| 802.11ac HT40 | MCS0NSS4 | MCS0NSS4 | MCS0NSS4 | MCS0NSS4 | |
| 802.11ac HT80 | MCS0NSS4 | MCS0NSS4 | MCS0NSS4 | MCS0NSS4 | |

The device supports non-beamforming and beamforming function in 802.11n/ac, after pre-testing, beamforming mode has the worst emission value, so the worst case was recorded.

The worst case Antenna mode for each of the following tests for Wi-Fi:

| Test Cases | Antenna 1 | Antenna 2 | Antenna 3 | Antenna 4 | MIMO |
|--------------------------------|-----------|-----------|-----------|-----------|--|
| Average conducted output power | 802.11a | 802.11a | 802.11a | 802.11a | 802.11n HT20/40 802.11ac HT20/40/80 |
| Occupied bandwidth | -- | -- | -- | -- | 802.11n HT20/40 802.11ac HT20/40/80 |
| Frequency stability | -- | -- | -- | 802.11a | -- |
| Power Spectral Density | 802.11a | 802.11a | 802.11a | 802.11a | 802.11n HT20/40 802.11ac HT20/40/80 |
| Unwanted Emissions | -- | 802.11a | -- | -- | 802.11n HT20/40 802.11ac HT20/40/80 |
| Conducted Emissions | -- | 802.11a | -- | -- | 802.11n HT20/40 802.11ac HT20/40/80 |
| Note: "O": test all bands | | | | | |



Wireless Technology and Frequency Range

| Wireless Technology | | Bandwidth | Channel | Frequency | |
|--|---------|-----------|---------|-----------|--|
| Wi-Fi | U-NII-1 | 20 MHz | 36 | 5180MHz | |
| | | | 40 | 5200MHz | |
| | | | 44 | 5220MHz | |
| | | | 48 | 5240MHz | |
| | | 40 MHz | 38 | 5190MHz | |
| | | | 46 | 5230MHz | |
| | U-NII-3 | 80 MHz | 42 | 5210MHz | |
| | | 20 MHz | 149 | 5745MHz | |
| | | | 157 | 5785MHz | |
| | | | 165 | 5825MHz | |
| | | 40 MHz | 151 | 5755MHz | |
| | | | 159 | 5795MHz | |
| | | 80 MHz | 155 | 5775MHz | |
| Does this device support TPC Function? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | | | | |
| Does this device support TDWR Band? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | | | | |



5. Test Case Results

5.1. Occupied Bandwidth

Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C | 45%~50% | 101.5kPa |

Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable.

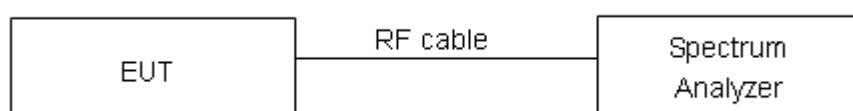
For U-NII-1, set RBW \approx 1% OCB kHz, VBW \geq 3 \times RBW, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 26 dB relative to the maximum level measured in the fundamental emission.

For U-NII-3, Set RBW = 100 kHz, VBW \geq 3 \times RBW, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

Use the 99 % power bandwidth function of the instrument

Test Setup



Limits

Rule FCC Part §15.407(e)

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

Measurement Uncertainty

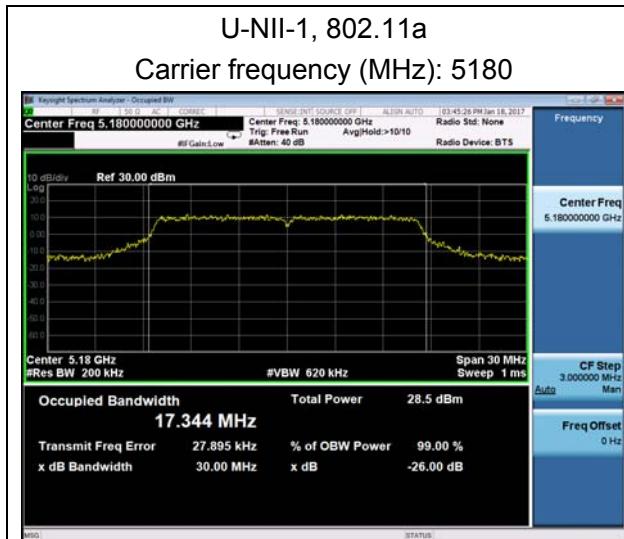
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 936$ Hz.

**Test Results:****SISO Antenna 4 U-NII-1**

| Network Standards | Carrier frequency (MHz) | 99% bandwidth (MHz) | Minimum 26 dB bandwidth (MHz) | Limit(kHz) | Conclusion |
|-------------------|-------------------------|---------------------|-------------------------------|------------|------------|
| 802.11a | 5180 | 17.344 | 30.00 | 500 | PASS |
| | 5200 | 17.208 | 29.79 | 500 | PASS |
| | 5240 | 17.263 | 29.26 | 500 | PASS |

SISO Antenna 4 U-NII-3

| Network Standards | Carrier frequency (MHz) | 99% bandwidth (MHz) | Minimum 6 dB bandwidth (MHz) | Limit(kHz) | Conclusion |
|-------------------|-------------------------|---------------------|------------------------------|------------|------------|
| 802.11a | 5745 | 16.570 | 16.40 | 500 | PASS |
| | 5785 | 16.554 | 16.41 | 500 | PASS |
| | 5825 | 16.551 | 16.37 | 500 | PASS |



U-NII-1, 802.11a
Carrier frequency (MHz): 5200



U-NII-3, 802.11a
Carrier frequency (MHz): 5785



U-NII-1, 802.11a
Carrier frequency (MHz):5240



U-NII-3, 802.11a
Carrier frequency (MHz): 5825



10.000-10.000





MIMO Antenna 3 U-NII-1

| Network Standards | Carrier frequency (MHz) | 99% bandwidth (MHz) | Minimum 26 dB bandwidth (MHz) | Limit(kHz) | Conclusion |
|-------------------|-------------------------|---------------------|-------------------------------|------------|------------|
| 802.11n HT20 | 5180 | 17.963 | 27.24 | 500 | PASS |
| | 5200 | 17.905 | 26.77 | 500 | PASS |
| | 5240 | 17.939 | 25.93 | 500 | PASS |
| 802.11n HT40 | 5190 | 36.240 | 39.40 | 500 | PASS |
| | 5230 | 36.261 | 39.59 | 500 | PASS |
| 802.11ac HT20 | 5180 | 17.966 | 29.55 | 500 | PASS |
| | 5200 | 17.967 | 26.69 | 500 | PASS |
| | 5240 | 17.959 | 26.96 | 500 | PASS |
| 802.11ac HT40 | 5190 | 36.275 | 39.73 | 500 | PASS |
| | 5230 | 36.304 | 39.57 | 500 | PASS |
| 802.11ac HT80 | 5210 | 74.873 | 78.06 | 500 | PASS |

MIMO Antenna 3 U-NII-3

| Network Standards | Carrier frequency (MHz) | 99% bandwidth (MHz) | Minimum 6 dB bandwidth (MHz) | Limit(kHz) | Conclusion |
|-------------------|-------------------------|---------------------|------------------------------|------------|------------|
| 802.11n HT20 | 5745 | 17.707 | 17.62 | 500 | PASS |
| | 5785 | 17.707 | 17.65 | 500 | PASS |
| | 5825 | 17.738 | 17.64 | 500 | PASS |
| 802.11n HT40 | 5755 | 36.179 | 36.09 | 500 | PASS |
| | 5795 | 36.230 | 36.42 | 500 | PASS |
| 802.11ac HT20 | 5745 | 17.715 | 17.63 | 500 | PASS |
| | 5785 | 17.701 | 17.63 | 500 | PASS |
| | 5825 | 17.756 | 17.63 | 500 | PASS |
| 802.11ac HT40 | 5755 | 36.175 | 36.09 | 500 | PASS |
| | 5795 | 36.219 | 36.41 | 500 | PASS |
| 802.11ac HT80 | 5775 | 75.490 | 75.87 | 500 | PASS |



U-NII-1, 802.11n HT20

Carrier frequency (MHz): 5180



U-NII-1, 802.11n HT40

Carrier frequency (MHz): 5190



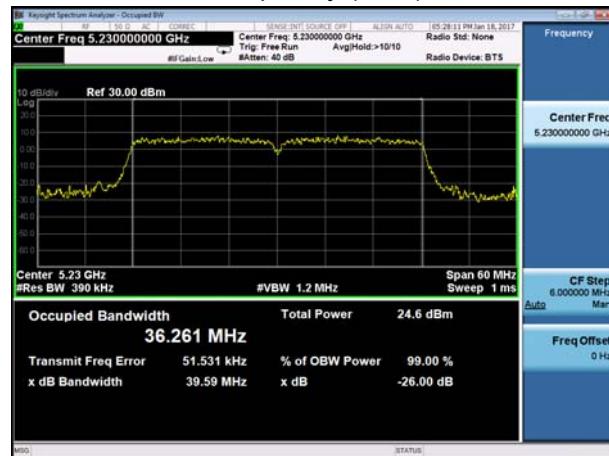
U-NII-1, 802.11n HT20

Carrier frequency (MHz): 5200



U-NII-1, 802.11n HT40

Carrier frequency (MHz): 5230



U-NII-1, 802.11n HT20

Carrier frequency (MHz): 5240



U-NII-1, 802.11ac HT40

Carrier frequency (MHz): 5190





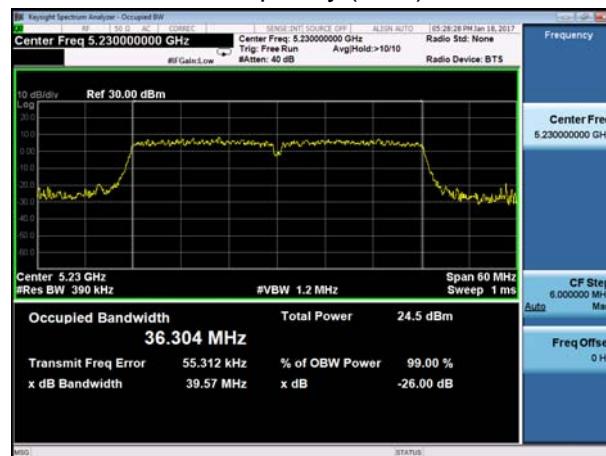
U-NII-1, 802.11ac HT20

Carrier frequency (MHz): 5180



U-NII-1, 802.11ac HT40

Carrier frequency (MHz): 5230



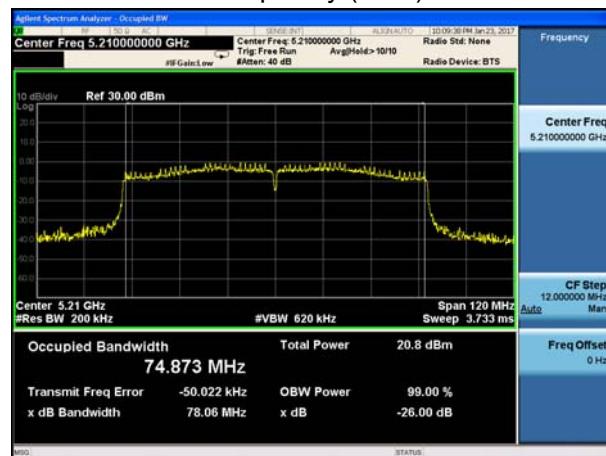
U-NII-1, 802.11ac HT20

Carrier frequency (MHz): 5200



U-NII-1, 802.11ac HT80

Carrier frequency (MHz): 5210



U-NII-1, 802.11ac HT20

Carrier frequency (MHz): 5240





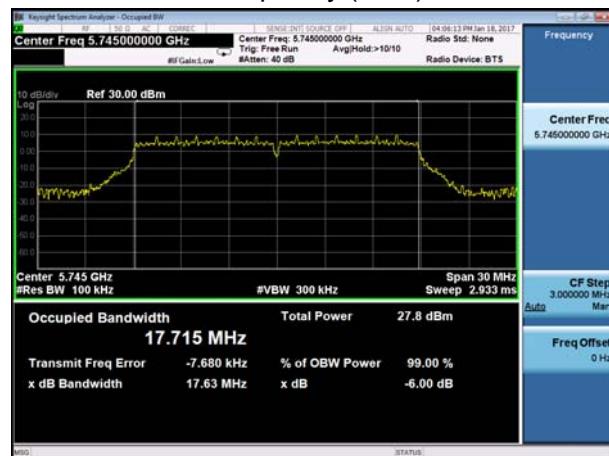
U-NII-3, 802.11n HT40

Carrier frequency (MHz): 5755



U-NII-3, 802.11ac HT20

Carrier frequency (MHz): 5745



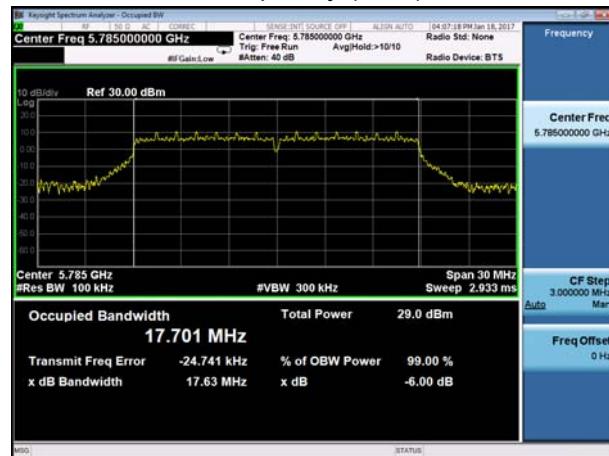
U-NII-3, 802.11n HT40

Carrier frequency (MHz): 5795



U-NII-3, 802.11ac HT20

Carrier frequency (MHz): 5785





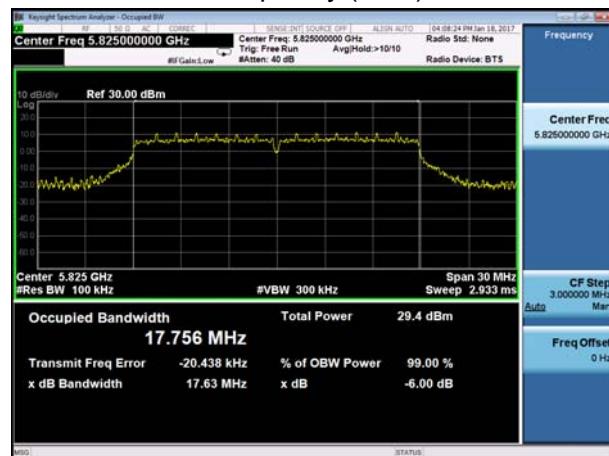
U-NII-3, 802.11ac HT40

Carrier frequency (MHz): 5755



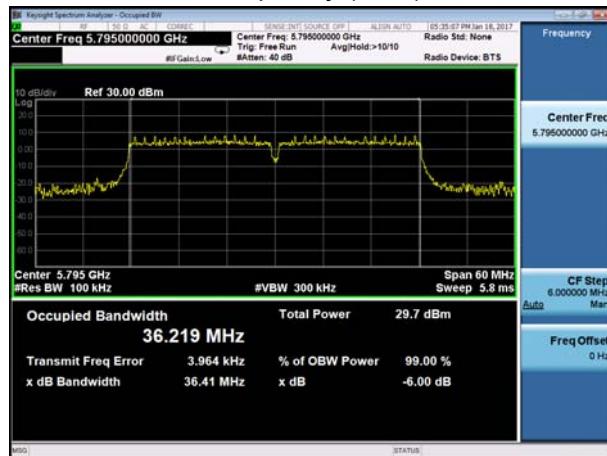
U-NII-3, 802.11ac HT20

Carrier frequency (MHz): 5825



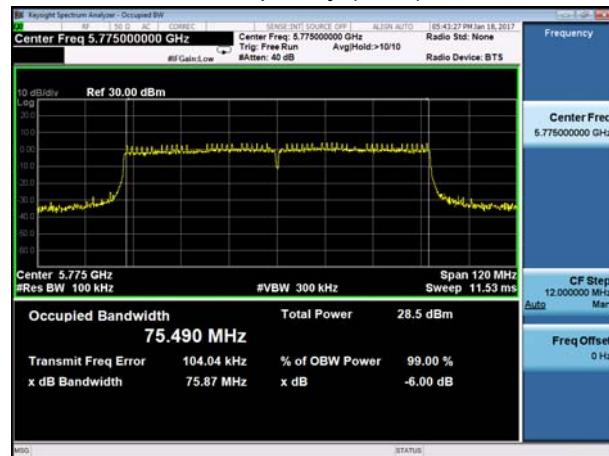
U-NII-3, 802.11ac HT40

Carrier frequency (MHz): 5795



U-NII-3, 802.11ac HT80

Carrier frequency (MHz): 5775





5.2. Average Power Output –Conducted

Ambient condition

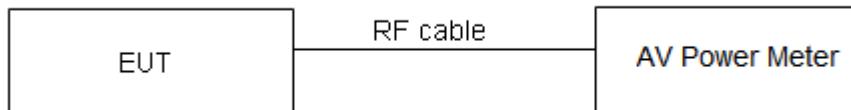
| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C | 45%~50% | 101.5kPa |

Methods of Measurement

During the process of the testing, The EUT was connected to AV Power Meter through an external attenuator and a known loss cable. The EUT is max power transmission with proper modulation. We use Maximum average Conducted Output Power Level Method in KDB789033 for this test

The conducted Power is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically.

Test Setup



Limits

Rule FCC Part 15.407(a)(1)(2)(3)

For 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 provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.44$ dB.

**Test Results**

| Single Antenna 1&2&3&4 Power Index (U-NII-1) | | | | Single Antenna 1&2&3&4 Power Index (U-NII-3) | | |
|---|------|------|------|--|-------|-------|
| Packet Type | CH36 | CH40 | CH48 | CH149 | CH157 | CH165 |
| 802.11a | 88 | 88 | 88 | 92 | 92 | 92 |

| MIMO Antenna 1&2&3&4 Power Index (U-NII-1) | | | | MIMO Antenna 1&2&3&4 Power Index (U-NII-3) | | | |
|---|------|------|------|---|-------|-------|-------|
| Packet Type | CH36 | CH40 | CH48 | Packet Type | CH149 | CH157 | CH165 |
| 802.11n HT20 | 84 | 84 | 84 | 802.11n HT20 | 84 | 84 | 84 |
| 802.11ac HT20 | 84 | 84 | 84 | 802.11ac HT20 | 84 | 84 | 84 |
| Packet Type | CH38 | CH46 | / | Packet Type | CH151 | CH159 | / |
| 802.11n HT40 | 72 | 72 | / | 802.11n HT40 | 84 | 84 | / |
| 802.11ac HT40 | 72 | 72 | / | 802.11ac HT40 | 84 | 84 | / |
| Packet Type | CH42 | / | / | Packet Type | CH155 | / | / |
| 802.11ac HT80 | 72 | / | / | 802.11ac HT80 | 84 | / | / |

**SISO Antenna 1 U-NII-1**

| Network Standards | Channel/ Frequency (MHz) | Average Output Power (dBm) | Limit (dBm) | Conclusion |
|-------------------|--------------------------|----------------------------|-------------|------------|
| 802.11a | 36/5180 | 22.12 | 30 | PASS |
| | 40/5200 | 23.08 | 30 | PASS |
| | 48/5240 | 22.08 | 30 | PASS |

SISO Antenna 2 U-NII-1

| Network Standards | Channel/ Frequency (MHz) | Average Output Power (dBm) | Limit (dBm) | Conclusion |
|-------------------|--------------------------|----------------------------|-------------|------------|
| 802.11a | 36/5180 | 23.19 | 30 | PASS |
| | 40/5200 | 23.96 | 30 | PASS |
| | 48/5240 | 22.74 | 30 | PASS |

SISO Antenna 3 U-NII-1

| Network Standards | Channel/ Frequency (MHz) | Average Output Power (dBm) | Limit (dBm) | Conclusion |
|-------------------|--------------------------|----------------------------|-------------|------------|
| 802.11a | 36/5180 | 22.51 | 30 | PASS |
| | 40/5200 | 23.24 | 30 | PASS |
| | 48/5240 | 22.36 | 30 | PASS |

SISO Antenna 4 U-NII-1

| Network Standards | Channel/ Frequency (MHz) | Average Output Power (dBm) | Limit (dBm) | Conclusion |
|-------------------|--------------------------|----------------------------|-------------|------------|
| 802.11a | 36/5180 | 23.91 | 30 | PASS |
| | 40/5200 | 24.81 | 30 | PASS |
| | 48/5240 | 23.92 | 30 | PASS |

**SISO Antenna 1 U-NII-3**

| Network Standards | Channel/ Frequency (MHz) | Average Output Power (dBm) | Limit (dBm) | Conclusion |
|-------------------|--------------------------|----------------------------|-------------|------------|
| 802.11a | 149/5745 | 22.76 | 30 | PASS |
| | 157/5785 | 23.22 | 30 | PASS |
| | 165/5825 | 22.90 | 30 | PASS |

SISO Antenna 2 U-NII-3

| Network Standards | Channel/ Frequency (MHz) | Average Output Power (dBm) | Limit (dBm) | Conclusion |
|-------------------|--------------------------|----------------------------|-------------|------------|
| 802.11a | 149/5745 | 23.20 | 30 | PASS |
| | 157/5785 | 23.41 | 30 | PASS |
| | 165/5825 | 23.14 | 30 | PASS |

SISO Antenna 3 U-NII-3

| Network Standards | Channel/ Frequency (MHz) | Average Output Power (dBm) | Limit (dBm) | Conclusion |
|-------------------|--------------------------|----------------------------|-------------|------------|
| 802.11a | 149/5745 | 25.18 | 30 | PASS |
| | 157/5785 | 26.02 | 30 | PASS |
| | 165/5825 | 25.53 | 30 | PASS |

SISO Antenna 4 U-NII-3

| Network Standards | Channel/ Frequency (MHz) | Average Output Power (dBm) | Limit (dBm) | Conclusion |
|-------------------|--------------------------|----------------------------|-------------|------------|
| 802.11a | 149/5745 | 22.31 | 30 | PASS |
| | 157/5785 | 22.77 | 30 | PASS |
| | 165/5825 | 22.40 | 30 | PASS |



MIMO without beamforming

U-NII-1

| Network Standards | | Channel/ Frequency (MHz) | Average Output Power (dBm) | | | | | Limit (dBm) | Conclusion |
|-------------------|---------|--------------------------------|----------------------------|-------|-------|-------|-------|----------------|------------|
| MIMO Antenna | | | ANT1 | ANT2 | ANT3 | ANT4 | MIMO | | |
| 802.11n HT20 | U-NII-1 | 36/5180 | 20.36 | 21.59 | 21.18 | 22.44 | 27.48 | 30 | PASS |
| | | 40/5200 | 21.40 | 22.26 | 21.78 | 23.00 | 28.17 | 30 | PASS |
| | | 48/5240 | 20.74 | 21.83 | 21.27 | 22.37 | 27.62 | 30 | PASS |
| 802.11n HT40 | U-NII-1 | 38/5190 | 17.41 | 18.25 | 17.73 | 18.79 | 24.10 | 30 | PASS |
| | | 46/5230 | 17.51 | 18.55 | 17.98 | 19.06 | 24.33 | 30 | PASS |
| 802.11ac HT20 | U-NII-1 | 36/5180 | 20.73 | 21.63 | 21.22 | 22.37 | 27.55 | 30 | PASS |
| | | 40/5200 | 21.31 | 22.03 | 21.85 | 22.82 | 28.06 | 30 | PASS |
| | | 48/5240 | 21.01 | 21.78 | 21.13 | 22.56 | 27.69 | 30 | PASS |
| 802.11ac HT40 | U-NII-1 | 38/5190 | 17.45 | 18.31 | 17.82 | 18.75 | 24.13 | 30 | PASS |
| | | 46/5230 | 17.49 | 18.61 | 18.07 | 19.00 | 24.35 | 30 | PASS |
| 802.11ac HT80 | U-NII-1 | 42/5210 | 17.51 | 18.25 | 17.91 | 19.09 | 24.25 | 30 | PASS |

Note: According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = GANT + Array Gain,
For power measurements on IEEE 802.11 devices,
Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4 ;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any NANT;
Array Gain = $5 \log(NANT/NSS)$ dB or 3 dB, whichever is less, for 20-MHz channel widths with NANT ≥ 5 .
So directional gain = GANT + Array Gain = 3 dB < 6 dB. So the power limit is 30 dBm.



U-NII-3

| Network Standards | | Channel/ Frequency (MHz) | Average Output Power (dBm) | | | | | Limit (dBm) | Conclusion |
|-------------------|---------|--------------------------------|----------------------------|-------|-------|-------|-------|----------------|------------|
| | | | ANT1 | ANT2 | ANT3 | ANT4 | MIMO | | |
| 802.11n HT20 | U-NII-3 | 149/5745 | 20.38 | 20.81 | 22.62 | 19.62 | 27.02 | 30 | PASS |
| | | 157/5785 | 21.21 | 21.43 | 23.48 | 20.34 | 27.80 | 30 | PASS |
| | | 165/5825 | 20.49 | 20.76 | 22.83 | 19.90 | 27.17 | 30 | PASS |
| 802.11n HT40 | U-NII-3 | 151/5755 | 20.88 | 21.07 | 23.29 | 20.25 | 27.56 | 30 | PASS |
| | | 159/5795 | 20.79 | 20.92 | 23.07 | 20.22 | 27.42 | 30 | PASS |
| 802.11ac HT20 | U-NII-3 | 149/5745 | 20.24 | 20.76 | 22.7 | 19.68 | 27.02 | 30 | PASS |
| | | 157/5785 | 20.81 | 21.38 | 23.31 | 20.46 | 27.66 | 30 | PASS |
| | | 165/5825 | 20.62 | 20.63 | 23.05 | 19.81 | 27.23 | 30 | PASS |
| 802.11ac HT40 | U-NII-3 | 151/5755 | 20.94 | 21.05 | 23.23 | 20.31 | 27.55 | 30 | PASS |
| | | 159/5795 | 20.83 | 20.89 | 23.14 | 20.33 | 27.46 | 30 | PASS |
| 802.11ac HT80 | U-NII-3 | 155/5775 | 19.35 | 19.87 | 22.26 | 19.05 | 26.35 | 30 | PASS |

Note: According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = GANT + Array Gain,
For power measurements on IEEE 802.11 devices,
Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4 ;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any NANT;
Array Gain = $5 \log(NANT/NSS)$ dB or 3 dB, whichever is less, for 20-MHz channel widths with NANT ≥ 5 .
So directional gain = GANT + Array Gain = 3 dBi < 6dBi. So the power limit is 30dBm.

**MIMO with beamforming**

| MIMO Antenna 1 Power Index | | | | | | |
|-----------------------------------|-------------|--------------|--------------|--------------|--------------|--------------|
| Packet Type | CH36 | CH40 | CH48 | CH149 | CH157 | CH165 |
| 802.11n HT20 | 85 | 86 | 85 | 100 | 100 | 100 |
| 802.11ac HT20 | 85 | 85 | 85 | 98 | 98 | 100 |
| Packet Type | CH38 | CH46 | CH151 | CH159 | CH102 | CH110 |
| 802.11n HT40 | 87 | 87 | 99 | 99 | / | / |
| 802.11ac HT40 | 86 | 86 | 97 | 97 | / | / |
| Packet Type | CH42 | CH155 | / | / | / | / |
| 802.11ac HT80 | 87 | 106 | / | / | / | / |
| MIMO Antenna 2 Power Index | | | | | | |
| Packet Type | CH36 | CH40 | CH48 | CH149 | CH157 | CH165 |
| 802.11n HT20 | 85 | 86 | 85 | 98 | 98 | 98 |
| 802.11ac HT20 | 85 | 85 | 84 | 96 | 96 | 96 |
| Packet Type | CH38 | CH46 | CH151 | CH159 | / | / |
| 802.11n HT40 | 85 | 85 | 97 | 97 | / | / |
| 802.11ac HT40 | 84 | 83 | 95 | 95 | / | / |
| Packet Type | CH42 | CH155 | / | / | / | / |
| 802.11ac HT80 | 85 | 100 | / | / | / | / |
| MIMO Antenna 3 Power Index | | | | | | |
| Packet Type | CH36 | CH40 | CH48 | CH149 | CH157 | CH165 |
| 802.11n HT20 | 85 | 86 | 85 | 102 | 102 | 102 |
| 802.11ac HT20 | 83 | 83 | 83 | 100 | 100 | 100 |
| Packet Type | CH38 | CH46 | CH151 | CH159 | / | / |
| 802.11n HT40 | 85 | 85 | 100 | 100 | / | / |
| 802.11ac HT40 | 84 | 84 | 99 | 99 | / | / |
| Packet Type | CH42 | CH155 | / | / | / | / |
| 802.11ac HT80 | 85 | 105 | / | / | / | / |
| MIMO Antenna 4 Power Index | | | | | | |
| Packet Type | CH36 | CH40 | CH48 | CH149 | CH157 | CH165 |
| 802.11n HT20 | 83 | 84 | 83 | 100 | 100 | 100 |
| 802.11ac HT20 | 81 | 81 | 81 | 99 | 99 | 99 |
| Packet Type | CH38 | CH46 | CH151 | CH159 | / | / |
| 802.11n HT40 | 84 | 84 | 99 | 99 | / | / |
| 802.11ac HT40 | 83 | 83 | 97 | 97 | / | / |
| Packet Type | CH42 | CH155 | / | / | / | / |
| 802.11ac HT80 | 85 | 105 | / | / | / | / |



MIMO with beamforming

| Network Standards | | Channel/ Frequency (MHz) | Output Power (dBm) | | | | | Limit (dBm) | Conclusion |
|-------------------|---------|--------------------------------|--------------------|-------|-------|-------|-------|----------------|------------|
| MIMO Antenna | | | ANT1 | ANT2 | ANT3 | ANT4 | Total | | |
| 802.11n HT20 | U-NII-1 | 36/5180 | 20.23 | 20.34 | 20.45 | 20.29 | 26.35 | 26.98 | PASS |
| | | 40/5200 | 20.22 | 20.33 | 20.45 | 20.56 | 26.41 | 26.98 | PASS |
| | | 48/5240 | 20.36 | 20.29 | 20.35 | 20.48 | 26.39 | 26.98 | PASS |
| 802.11n HT40 | U-NII-1 | 38/5190 | 20.54 | 20.49 | 20.57 | 20.63 | 26.58 | 26.98 | PASS |
| | | 46/5230 | 20.38 | 20.49 | 20.47 | 20.61 | 26.51 | 26.98 | PASS |
| 802.11ac HT20 | U-NII-1 | 36/5180 | 20.19 | 20.11 | 20.07 | 20.26 | 26.18 | 26.98 | PASS |
| | | 40/5200 | 20.26 | 20.36 | 20.13 | 20.28 | 26.28 | 26.98 | PASS |
| | | 48/5240 | 20.04 | 20.21 | 20.09 | 20.25 | 26.17 | 26.98 | PASS |
| 802.11ac HT40 | U-NII-1 | 38/5190 | 20.32 | 20.26 | 20.26 | 20.46 | 26.35 | 26.98 | PASS |
| | | 46/5230 | 20.31 | 20.44 | 20.34 | 20.38 | 26.39 | 26.98 | PASS |
| 802.11ac HT80 | U-NII-1 | 42/5210 | 20.30 | 20.39 | 20.32 | 20.48 | 26.40 | 26.98 | PASS |

Note: 1. Direction gain calculation according to KDB662911 D01 Multiple Transmitter Output v02r01 F) 2) e) (i), If all antennas have the same gain, directional gain = GANT + 10 log(NANT/NSS)=3+10log (4/1) =9.02 dBi>6dBi.
So the limit= used limit+(6dBi- directional gain) dBm.

| Network Standards | | Channel/ Frequency (MHz) | Output Power (dBm) | | | | | Limit (dBm) | Conclusion |
|-------------------|---------|--------------------------------|--------------------|-------|-------|-------|-------|----------------|------------|
| MIMO Antenna | | | ANT1 | ANT2 | ANT3 | ANT4 | Total | | |
| 802.11n HT20 | U-NII-3 | 149/5745 | 20.26 | 20.37 | 19.99 | 20.07 | 26.20 | 26.98 | PASS |
| | | 157/5785 | 20.13 | 20.25 | 20.27 | 20.20 | 26.23 | 26.98 | PASS |
| | | 165/5825 | 20.22 | 20.35 | 20.27 | 20.04 | 26.24 | 26.98 | PASS |
| 802.11n HT40 | U-NII-3 | 151/5755 | 20.54 | 20.73 | 20.45 | 20.75 | 26.64 | 26.98 | PASS |
| | | 159/5795 | 20.31 | 20.50 | 20.02 | 20.41 | 26.33 | 26.98 | PASS |
| 802.11ac HT20 | U-NII-3 | 149/5745 | 20.20 | 19.96 | 19.89 | 20.17 | 26.08 | 26.98 | PASS |
| | | 157/5785 | 19.77 | 20.01 | 19.94 | 20.08 | 25.97 | 26.98 | PASS |
| | | 165/5825 | 20.03 | 19.81 | 19.70 | 19.88 | 25.88 | 26.98 | PASS |
| 802.11ac HT40 | U-NII-3 | 151/5755 | 20.24 | 20.13 | 20.29 | 20.00 | 26.19 | 26.98 | PASS |
| | | 159/5795 | 20.03 | 20.14 | 20.20 | 19.77 | 26.06 | 26.98 | PASS |
| 802.11ac HT80 | U-NII-3 | 155/5775 | 20.25 | 20.40 | 20.21 | 20.39 | 26.34 | 26.98 | PASS |

Note: 1. Direction gain calculation according to KDB662911 D01 Multiple Transmitter Output v02r01 F) 2) e) (i), If all antennas have the same gain, directional gain = GANT + 10 log(NANT/NSS)=3+10log (4/1) =9.02 dBi>6dBi.
So the limit= used limit+(6dBi- directional gain) dBm.



5.3. Frequency Stability

Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C | 45%~50% | 101.5kPa |

Method of Measurement

1. Frequency stability with respect to ambient temperature

- a) Supply the EUT with a nominal ac voltage or install a new or fully charged battery in the EUT. If possible, a dummy load shall be connected to the EUT because an antenna near the metallic walls of an environmental test chamber could affect the output frequency of the EUT. If the EUT is equipped with a permanently attached, adjustable-length antenna, then the EUT shall be placed in the center of the chamber with the antenna adjusted to the shortest length possible. Turn ON the EUT and tune it to one of the number of frequencies shown in 5.6.
- b) Couple the unlicensed wireless device output to the measuring instrument by connecting an antenna to the measuring instrument with a suitable length of coaxial cable and placing the measuring antenna near the EUT (e.g., 15 cm away), or by connecting a dummy load to the measuring instrument, through an attenuator if necessary.
- c) Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument but is strong enough to allow measurement of the operating or fundamental frequency of the EUT).
- d) Turn the EUT OFF and place it inside the environmental temperature chamber. For devices that have oscillator heaters, energize only the heater circuit.
- e) Set the temperature control on the chamber to the highest specified in the regulatory requirements for the type of device and allow the oscillator heater and the chamber temperature to stabilize.
- f) While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.
- g) Measure the frequency at each of frequencies specified in 5.6.
- h) Switch OFF the EUT but do not switch OFF the oscillator heater.
- i) Lower the chamber temperature by not more than 10 C, and allow the temperature inside the chamber to stabilize.
- j) Repeat step f) through step i) down to the lowest specified temperature.

2. Frequency stability when varying supply voltage

Unless otherwise specified, these tests shall be made at ambient room temperature (+15 C to +25

C). An antenna shall be connected to the antenna output terminals of the EUT if possible. If the EUT is equipped with or uses an adjustable-length antenna, then it shall be fully extended.

- a) Supply the EUT with nominal voltage or install a new or fully charged battery in the EUT. Turn ON the EUT and couple its output to a frequency counter or other frequency-measuring instrument.



- b) Tune the EUT to one of the number of frequencies required in 5.6. Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument but is strong enough to allow measurement of the operating or fundamental frequency of the EUT).
- c) Measure the frequency at each of the frequencies specified in 5.6.
- d) Repeat the above procedure at 85% and 115% of the nominal supply voltage.

Limit

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 936\text{Hz}$



Test Results

| Voltage (V) | Temperature (°C) | U-NII-1 Test Results | | | |
|----------------|---------------------|----------------------|----------|----------|----------|
| | | 5200MHz | | | |
| | | 1min | 2min | 5min | 10min |
| 120 | -20 | 5199.957 | 5199.957 | 5199.952 | 5199.951 |
| 120 | -10 | 5199.952 | 5199.952 | 5199.958 | 5199.955 |
| 120 | 0 | 5199.957 | 5199.957 | 5199.951 | 5199.954 |
| 120 | 10 | 5199.959 | 5199.959 | 5199.951 | 5199.951 |
| 120 | 20 | 5199.954 | 5199.954 | 5199.960 | 5199.951 |
| 120 | 30 | 5199.955 | 5199.955 | 5199.958 | 5199.958 |
| 120 | 40 | 5199.958 | 5199.958 | 5199.958 | 5199.958 |
| 120 | 50 | 5199.956 | 5199.956 | 5199.958 | 5199.958 |
| 90 | 20 | 5199.952 | 5199.952 | 5199.960 | 5199.955 |
| 264 | 20 | 5199.951 | 5199.951 | 5199.959 | 5199.952 |
| MHz | | 0.049 | 0.050 | 0.049 | 0.049 |
| PPM | | 0.001 | 0.001 | 0.001 | 0.001 |



| Voltage (V) | Temperature (°C) | U-NII-3 Test Results | | | |
|----------------|---------------------|----------------------|----------|----------|----------|
| | | 5785MHz | | | |
| | | 1min | 2min | 5min | 10min |
| 120 | -20 | 5784.954 | 5784.955 | 5784.952 | 5784.954 |
| 120 | -10 | 5784.957 | 5784.953 | 5784.953 | 5784.951 |
| 120 | 0 | 5784.952 | 5784.954 | 5784.954 | 5784.959 |
| 120 | 10 | 5784.955 | 5784.956 | 5784.958 | 5784.952 |
| 120 | 20 | 5784.951 | 5784.954 | 5784.953 | 5784.950 |
| 120 | 30 | 5784.954 | 5784.957 | 5784.959 | 5784.957 |
| 120 | 40 | 5784.955 | 5784.958 | 5784.956 | 5784.956 |
| 120 | 50 | 5784.952 | 5784.958 | 5784.950 | 5784.958 |
| 90 | 20 | 5784.959 | 5784.957 | 5784.959 | 5784.954 |
| 264 | 20 | 5784.952 | 5784.960 | 5784.958 | 5784.958 |
| MHz | | 0.049 | 0.047 | 0.050 | 0.050 |
| PPM | | 0.00095 | 0.00090 | 0.00096 | 0.00096 |



5.4. Power Spectral Density

Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C | 45%~50% | 101.5kPa |

Method of Measurement

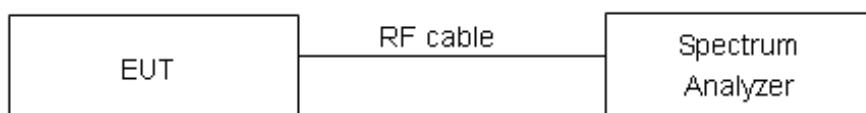
The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable.

Set RBW = 510kHz, VBW =1.5MHz for the band 5.725-5.85 GHz

Set RBW = 1 MHz, VBW =3MHz for the band 5.150-5.250 GHz

The conducted PSD is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically.

Test setup



Limits

Rule FCC Part 15.407(a)(1)/ Part 15.407(a)(2) / Part 15.407(a)(3)

For an indoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

| Frequency Bands/MHz | Limits |
|----------------------------------|--------------|
| 5150-5250 | 17dBm/MHz |
| 5.25-5.35 GHz and 5.47-5.725 GHz | 11dBm/MHz |
| 5725-5850 | 30dBm/500kHz |



Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.75\text{dB}$.

**Test Results:****SISO Antenna 1 U-NII-1**

| Network Standards | Channel Number | Power Spectral Density (dBm /MHz) | Limit (dBm /MHz) | Conclusion |
|-------------------|----------------|-----------------------------------|------------------|------------|
| 802.11a | 36 | 9.507 | 17 | PASS |
| | 40 | 9.408 | 17 | PASS |
| | 48 | 9.399 | 17 | PASS |

SISO Antenna 2 U-NII-1

| Network Standards | Channel Number | Power Spectral Density (dBm /MHz) | Limit (dBm /MHz) | Conclusion |
|-------------------|----------------|-----------------------------------|------------------|------------|
| 802.11a | 36 | 10.193 | 17 | PASS |
| | 40 | 10.334 | 17 | PASS |
| | 48 | 9.522 | 17 | PASS |

SISO Antenna 3 U-NII-1

| Network Standards | Channel Number | Power Spectral Density (dBm /MHz) | Limit (dBm /MHz) | Conclusion |
|-------------------|----------------|-----------------------------------|------------------|------------|
| 802.11a | 36 | 9.594 | 17 | PASS |
| | 40 | 9.480 | 17 | PASS |
| | 48 | 9.338 | 17 | PASS |

SISO Antenna 4 U-NII-1

| Network Standards | Channel Number | Power Spectral Density (dBm /MHz) | Limit (dBm /MHz) | Conclusion |
|-------------------|----------------|-----------------------------------|------------------|------------|
| 802.11a | 36 | 10.830 | 17 | PASS |
| | 40 | 10.534 | 17 | PASS |
| | 48 | 10.166 | 17 | PASS |

**SISO Antenna 1 U-NII-3**

| Network Standards | Channel Number | Power Spectral Density (dBm/500kHz) | Limit (dBm/500kHz) | Conclusion |
|-------------------|----------------|-------------------------------------|--------------------|------------|
| 802.11a | 149 | 5.753 | 30 | PASS |
| | 157 | 5.949 | 30 | PASS |
| | 165 | 6.237 | 30 | PASS |

SISO Antenna 2 U-NII-3

| Network Standards | Channel Number | Power Spectral Density (dBm/500kHz) | Limit (dBm/500kHz) | Conclusion |
|-------------------|----------------|-------------------------------------|--------------------|------------|
| 802.11a | 149 | 6.454 | 30 | PASS |
| | 157 | 7.001 | 30 | PASS |
| | 165 | 7.909 | 30 | PASS |

SISO Antenna 3 U-NII-3

| Network Standards | Channel Number | Power Spectral Density (dBm/500kHz) | Limit (dBm/500kHz) | Conclusion |
|-------------------|----------------|-------------------------------------|--------------------|------------|
| 802.11a | 149 | 7.045 | 30 | PASS |
| | 157 | 7.508 | 30 | PASS |
| | 165 | 8.017 | 30 | PASS |

SISO Antenna 4 U-NII-3

| Network Standards | Channel Number | Power Spectral Density (dBm/500kHz) | Limit (dBm/500kHz) | Conclusion |
|-------------------|----------------|-------------------------------------|--------------------|------------|
| 802.11a | 149 | 5.276 | 30 | PASS |
| | 157 | 5.351 | 30 | PASS |
| | 165 | 5.994 | 30 | PASS |

**MIMO without beamforming****U-NII-1**

| Network Standards | | Channel/ Frequency (MHz) | Power Spectral Density (dBm /MHz) | | | | | Limit (dBm / MHz) | Conclusion |
|-------------------|---------|--------------------------------|--------------------------------------|-------|--------|-------|--------|-------------------------|------------|
| MIMO Antenna | | | ANT1 | ANT2 | ANT3 | ANT4 | MIMO | | |
| 802.11n HT20 | U-NII-1 | 36/5180 | 7.573 | 7.976 | 7.532 | 7.581 | 13.690 | 13.98 | PASS |
| | | 40/5200 | 7.414 | 8.167 | 7.513 | 7.778 | 13.748 | 13.98 | PASS |
| | | 48/5240 | 7.507 | 7.709 | 7.249 | 8.329 | 13.738 | 13.98 | PASS |
| 802.11n HT40 | U-NII-1 | 38/5190 | 1.918 | 2.809 | 1.731 | 2.075 | 8.174 | 13.98 | PASS |
| | | 46/5230 | 1.519 | 1.591 | 0.977 | 2.053 | 7.572 | 13.98 | PASS |
| 802.11ac HT20 | U-NII-1 | 36/5180 | 7.509 | 8.228 | 7.405 | 8.364 | 13.918 | 13.98 | PASS |
| | | 40/5200 | 7.962 | 7.948 | 7.750 | 8.157 | 13.977 | 13.98 | PASS |
| | | 48/5240 | 7.352 | 8.125 | 7.230 | 8.093 | 13.740 | 13.98 | PASS |
| 802.11ac HT40 | U-NII-1 | 38/5190 | 1.494 | 2.605 | 1.702 | 2.180 | 8.037 | 13.98 | PASS |
| | | 46/5230 | 1.029 | 1.951 | 0.853 | 2.299 | 7.596 | 13.98 | PASS |
| 802.11ac HT80 | U-NII-1 | 42/5210 | -0.556 | 0.089 | -0.646 | 0.589 | 5.919 | 13.98 | PASS |

Note: According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i):
If all antennas have the same gain, Directional gain = GANT + Array Gain,
For PSD measurements on all devices,
Array Gain=10log(Nant/Nss)dB,
so directional gain=GANT+Array Gain=3+10log (4/1) =9.02>6dBi.
So the limit=used limit+(6dBi- directional gain) dBm.



U-NII-3

| Network Standards | | Channel/ Frequency (MHz) | Power Spectral Density (dBm /MHz) | | | | | Limit (dBm / MHz) | Conclusion |
|-------------------|---------|--------------------------------|--------------------------------------|--------|--------|--------|--------|-------------------------|------------|
| MIMO Antenna | | | ANT1 | ANT2 | ANT3 | ANT4 | MIMO | | |
| 802.11n HT20 | U-NII-3 | 149/5745 | 3.049 | 4.235 | 4.263 | 2.840 | 9.667 | 26.98 | PASS |
| | | 157/5785 | 3.385 | 4.144 | 5.094 | 2.898 | 9.981 | 26.98 | PASS |
| | | 165/5825 | 4.284 | 4.679 | 5.497 | 3.355 | 10.542 | 26.98 | PASS |
| 802.11n HT40 | U-NII-3 | 151/5755 | -0.601 | 1.266 | 1.242 | -0.215 | 6.524 | 26.98 | PASS |
| | | 159/5795 | 1.182 | 1.469 | 2.107 | -0.064 | 7.263 | 26.98 | PASS |
| 802.11ac HT20 | U-NII-3 | 149/5745 | 3.133 | 4.233 | 4.566 | 2.478 | 9.703 | 26.98 | PASS |
| | | 157/5785 | 3.815 | 4.442 | 4.691 | 2.786 | 10.014 | 26.98 | PASS |
| | | 165/5825 | 3.902 | 4.823 | 5.660 | 3.079 | 10.494 | 26.98 | PASS |
| 802.11ac HT40 | U-NII-3 | 151/5755 | -0.176 | 1.379 | 1.164 | -0.164 | 6.632 | 26.98 | PASS |
| | | 159/5795 | 0.876 | 0.860 | 2.007 | -0.130 | 6.990 | 26.98 | PASS |
| 802.11ac HT80 | U-NII-3 | 155/5775 | -3.930 | -2.968 | -2.464 | -5.093 | 2.519 | 26.98 | PASS |

Note: According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i):
If all antennas have the same gain, Directional gain = GANT + Array Gain,
For PSD measurements on all devices,
Array Gain=10log(Nant/Nss)dB,
so directional gain=GANT+Array Gain=3+10log (4/1) =9.02>6dBi.
So the limit=used limit+(6dBi- directional gain) dBm.

**MIMO with beamforming****U-NII-1**

| Network Standards | | Channel/ Frequency (MHz) | Power Spectral Density (dBm / MHz) | | | | | Limit (dBm / MHz) | Conclusion |
|-------------------|---------|--------------------------------|---------------------------------------|------|------|------|-------|-------------------------|------------|
| MIMO Antenna | | | ANT1 | ANT2 | ANT3 | ANT4 | Total | | |
| 802.11n HT20 | U-NII-1 | 36/5180 | 5.54 | 6.19 | 6.82 | 6.83 | 12.40 | 13.98 | PASS |
| | | 40/5200 | 5.42 | 5.82 | 6.60 | 6.23 | 12.06 | 13.98 | PASS |
| | | 48/5240 | 6.20 | 6.62 | 7.02 | 6.98 | 12.74 | 13.98 | PASS |
| 802.11n HT40 | U-NII-1 | 38/5190 | 3.41 | 2.75 | 3.95 | 4.03 | 9.58 | 13.98 | PASS |
| | | 46/5230 | 3.30 | 3.75 | 3.66 | 3.43 | 9.56 | 13.98 | PASS |
| 802.11ac HT20 | U-NII-1 | 36/5180 | 5.64 | 6.15 | 5.98 | 6.47 | 12.09 | 13.98 | PASS |
| | | 40/5200 | 5.94 | 5.98 | 5.94 | 5.75 | 11.92 | 13.98 | PASS |
| | | 48/5240 | 5.99 | 6.51 | 6.25 | 6.49 | 12.33 | 13.98 | PASS |
| 802.11ac HT40 | U-NII-1 | 38/5190 | 3.50 | 3.03 | 3.60 | 2.93 | 9.29 | 13.98 | PASS |
| | | 46/5230 | 3.33 | 3.09 | 3.36 | 3.16 | 9.25 | 13.98 | PASS |
| 802.11ac HT80 | U-NII-1 | 42/5210 | 0.86 | 1.48 | 2.22 | 1.44 | 7.55 | 13.98 | PASS |

Note:Direction gain calculation according to KDB662911 D01 Multiple Transmitter Output v02r01 F) 2) e) (i),If all antennas have the same gain, directional gain = GANT + 10 log(NANT/NSS)=3+10log (4/1) =9.02 dBi>6dBi. So the limit=used limit+(6dBi- directional gain) dBm.

U-NII-3

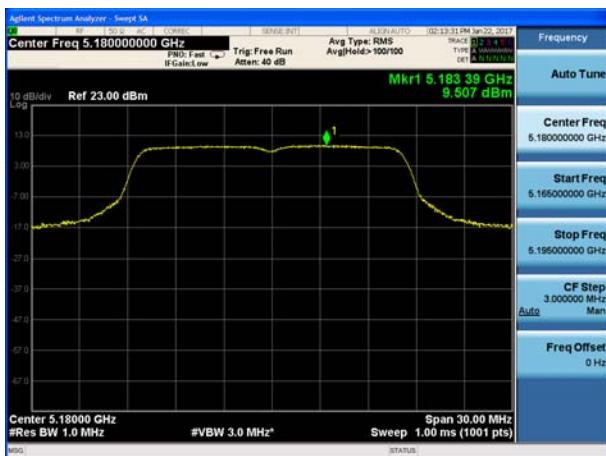
| Network Standards | | Channel/ Frequency (MHz) | Power Spectral Density(dBm / MHz) | | | | | Limit (dBm / MHz) | Conclusion |
|-------------------|----------|--------------------------------|-----------------------------------|--------|--------|--------|-------|-------------------------|------------|
| MIMO Antenna | | | ANT1 | ANT2 | ANT3 | ANT4 | Total | | |
| 802.11n HT20 | U-NII-3 | 149/5745 | 4.96 | 6.54 | 5.15 | 5.56 | 11.62 | 26.98 | PASS |
| | | 157/5785 | 5.54 | 5.83 | 5.85 | 5.62 | 11.73 | 26.98 | PASS |
| | | 165/5825 | 5.66 | 5.91 | 5.74 | 5.59 | 11.75 | 26.98 | PASS |
| 802.11n HT40 | U-NII-3 | 151/5755 | 2.78 | 3.36 | 2.79 | 2.94 | 8.99 | 26.98 | PASS |
| | | 159/5795 | 2.53 | 3.16 | 2.90 | 2.97 | 8.92 | 26.98 | PASS |
| 802.11ac HT20 | U-NvII-3 | 149/5745 | 5.42 | 5.99 | 5.53 | 6.19 | 11.81 | 26.98 | PASS |
| | | 157/5785 | 5.44 | 6.12 | 5.38 | 5.97 | 11.76 | 26.98 | PASS |
| | | 165/5825 | 5.55 | 6.14 | 5.88 | 5.99 | 11.92 | 26.98 | PASS |
| 802.11ac HT40 | U-NII-3 | 151/5755 | 2.54 | 3.17 | 3.71 | 2.99 | 9.14 | 26.98 | PASS |
| | | 159/5795 | 1.90 | 3.32 | 3.42 | 2.81 | 8.92 | 26.98 | PASS |
| 802.11ac HT80 | U-NII-3 | 155/5775 | 0.048 | -0.531 | -0.500 | -0.184 | 5.74 | 26.98 | PASS |

Note:Direction gain calculation according to KDB662911 D01 Multiple Transmitter Output v02r01 F) 2) e) (i),If all antennas have the same gain, directional gain = GANT + 10 log(NANT/NSS)=3+10log (4/1) =9.02 dBi>6dBi. So the limit=used limit+(6dBi- directional gain) dBm.



SISO Antenna 1

U-NII-1, 802.11a, Channel No.: 36



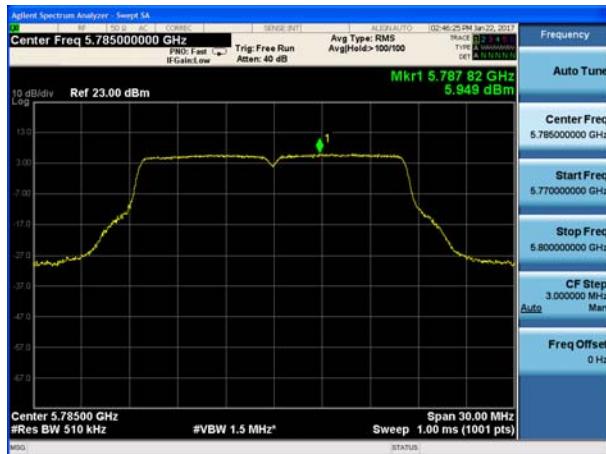
U-NII-3, 802.11a, Channel No.: 149



U-NII-1, 802.11a, Channel No.: 40



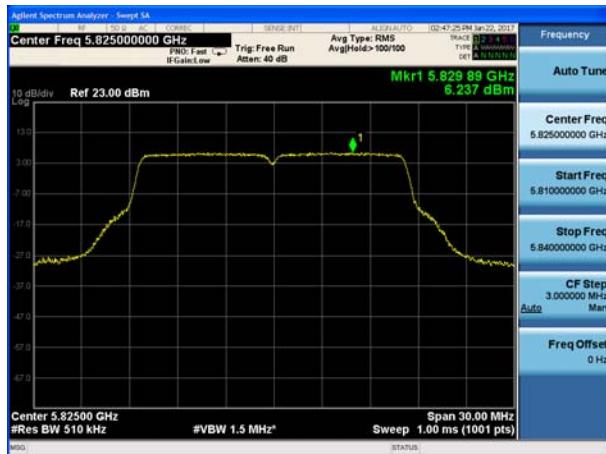
U-NII-3, 802.11a, Channel No.: 157



U-NII-1, 802.11a, Channel No.: 48



U-NII-3, 802.11a, Channel No.: 165



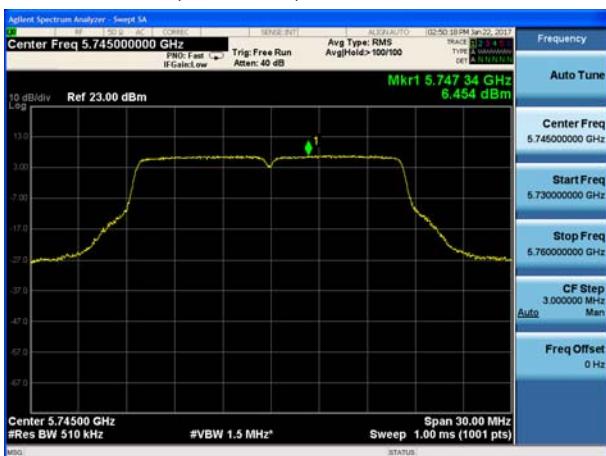


SISO Antenna 2

U-NII-1, 802.11a, Channel No.: 36



U-NII-3, 802.11a, Channel No.: 149



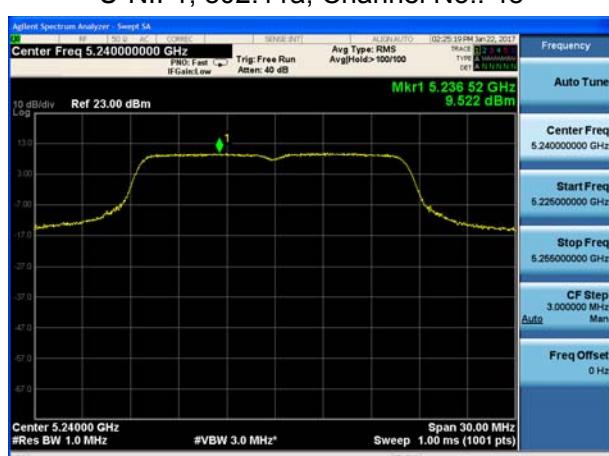
U-NII-1, 802.11a, Channel No.: 40



U-NII-3, 802.11a, Channel No.: 157



U-NII-1, 802.11a, Channel No.: 48



U-NII-3, 802.11a, Channel No.: 165



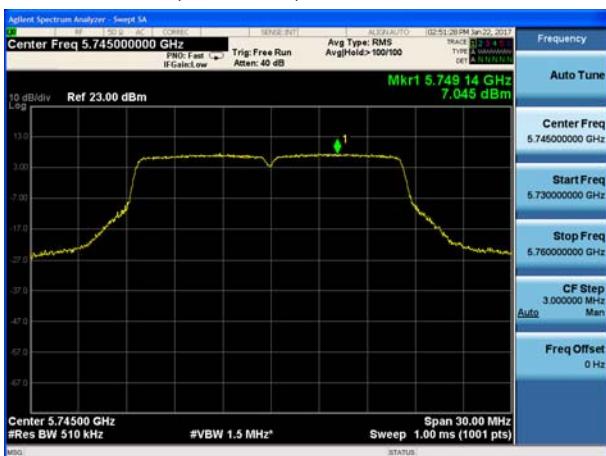


SISO Antenna 3

U-NII-1, 802.11a, Channel No.: 36



U-NII-3, 802.11a, Channel No.: 149



U-NII-1, 802.11a, Channel No.: 40



U-NII-3, 802.11a, Channel No.: 157



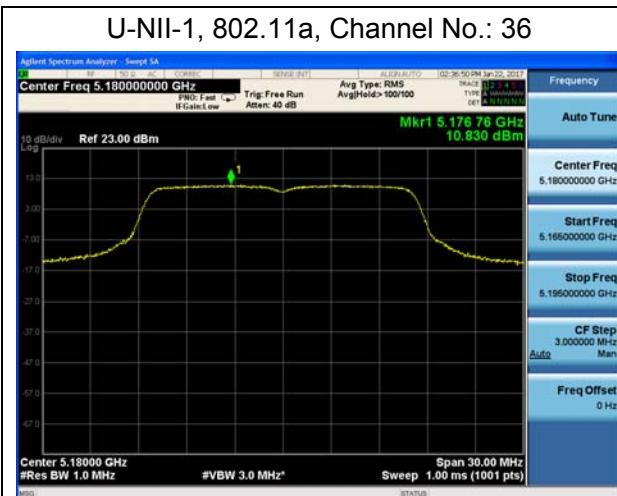
U-NII-1, 802.11a, Channel No.: 48



U-NII-3, 802.11a, Channel No.: 165



SISO Antenna 4



U-NII-1, 802.11a, Channel No.: 40



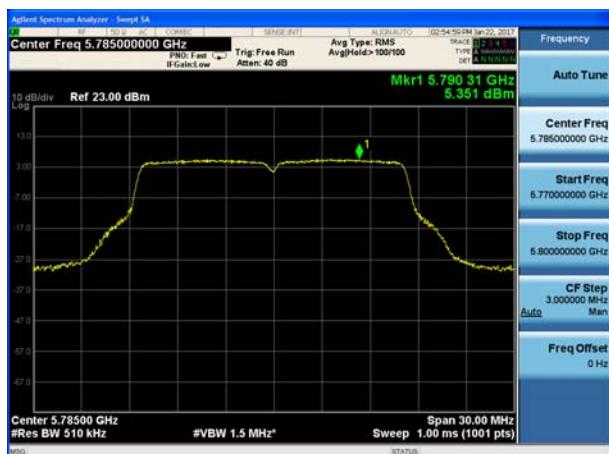
U-NII-1, 802.11a, Channel No.: 48



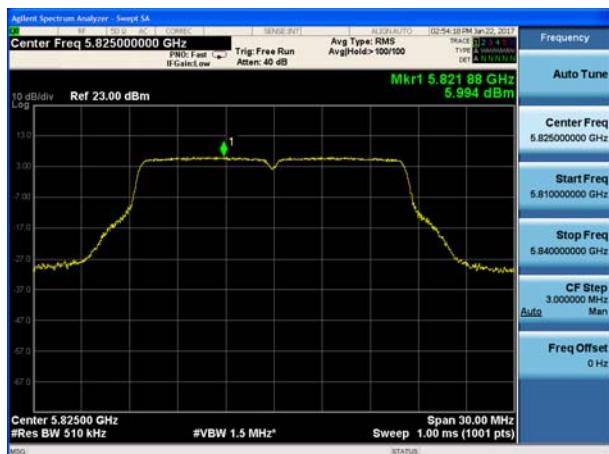
U-NII-3_802.11a_Channel No.: 149



U-NII-3, 802.11a, Channel No.: 157

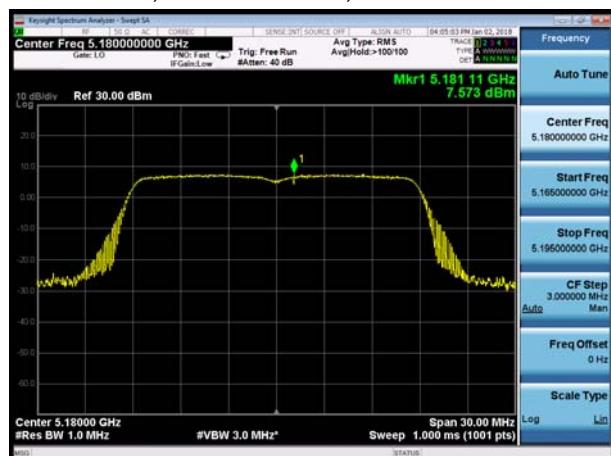


U-NII-3, 802.11a, Channel No.: 165

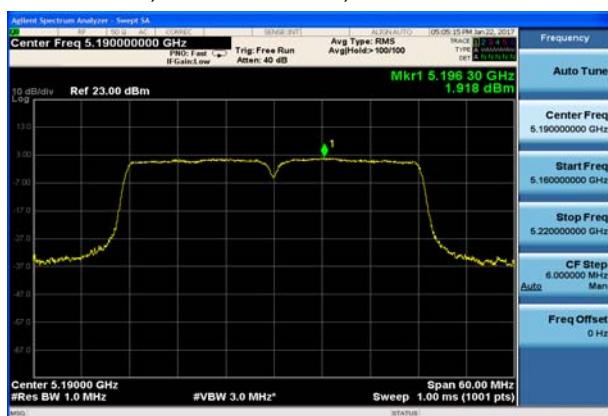


**MIMO without beamforming****MIMO Antenna 1**

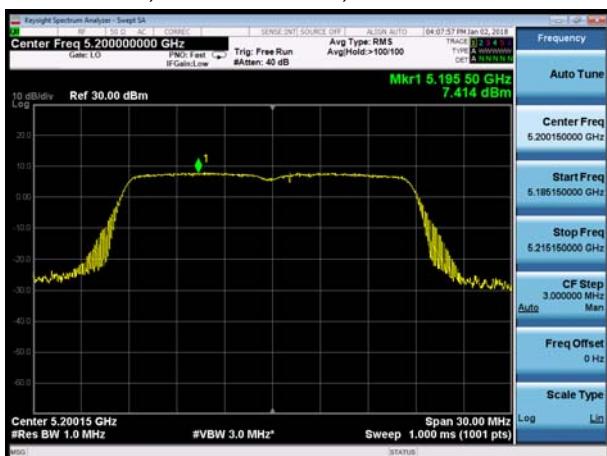
U-NII-1, 802.11n HT20, Channel No.: 36



U-NII-1, 802.11n HT40, Channel No.: 38



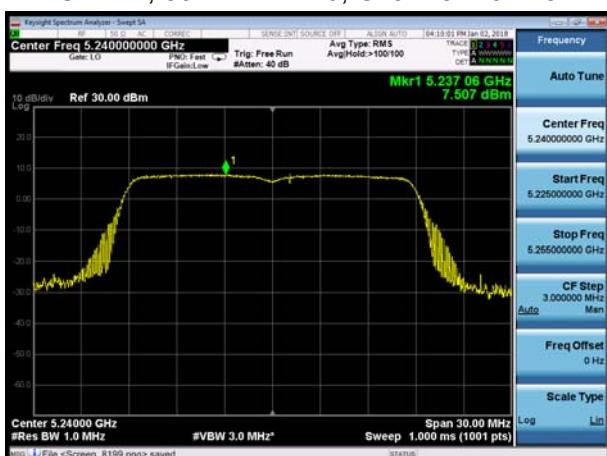
U-NII-1, 802.11n HT20, Channel No.: 40



U-NII-1, 802.11n HT40, Channel No.: 46

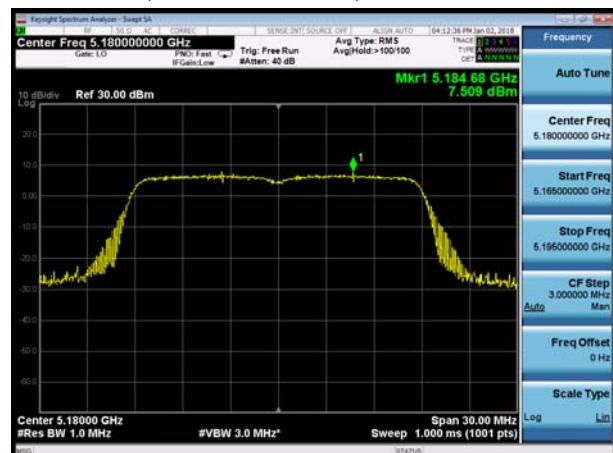


U-NII-1, 802.11n HT20, Channel No.: 48





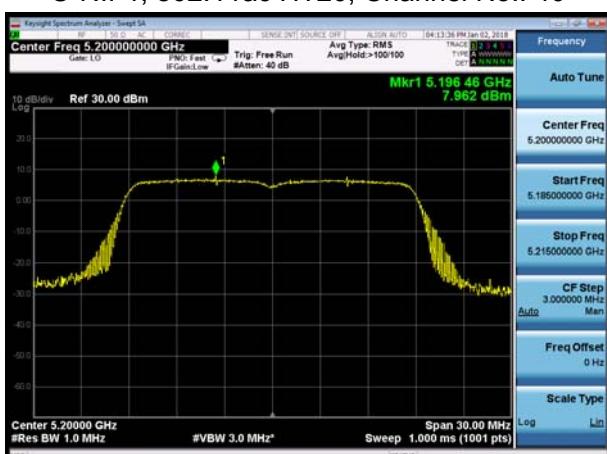
U-NII-1, 802.11ac HT20, Channel No.: 36



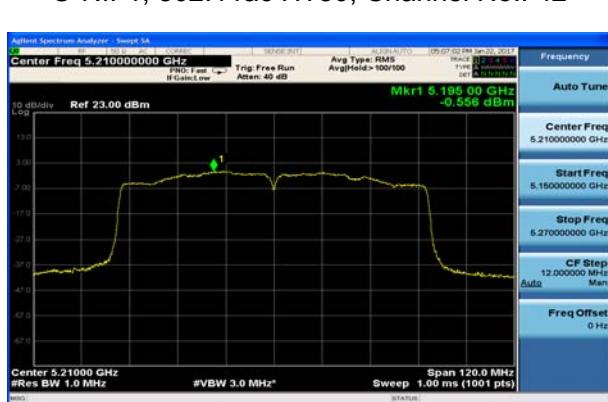
U-NII-1, 802.11ac HT40, Channel No.: 38



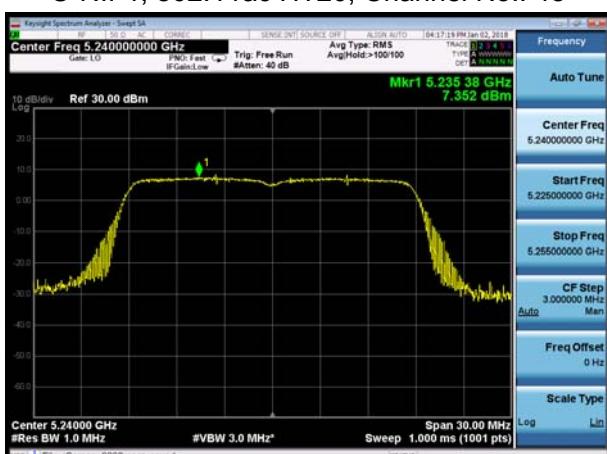
U-NII-1, 802.11ac HT20, Channel No.: 40



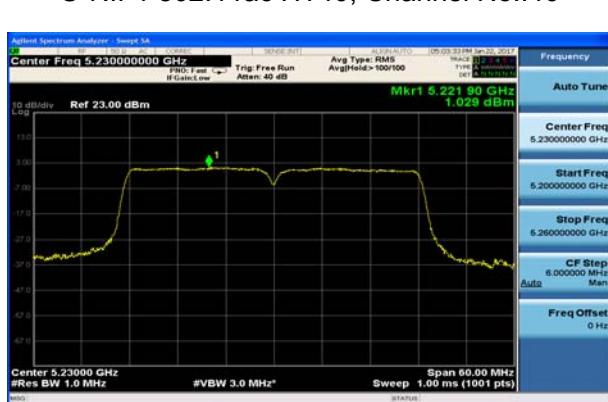
U-NII-1, 802.11ac HT80, Channel No.: 42



U-NII-1, 802.11ac HT20, Channel No.: 48



U-NII-1 802.11ac HT40, Channel No.: 46

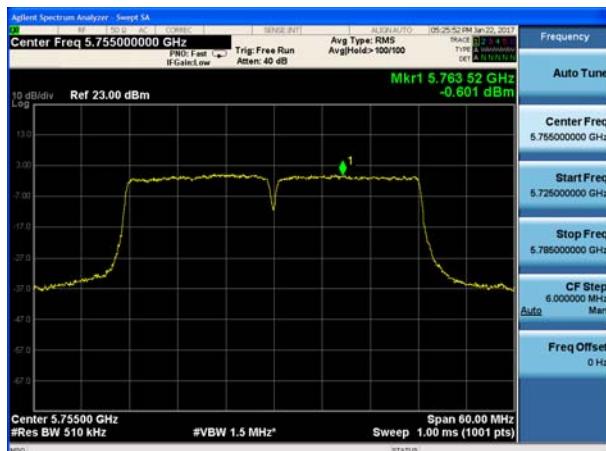




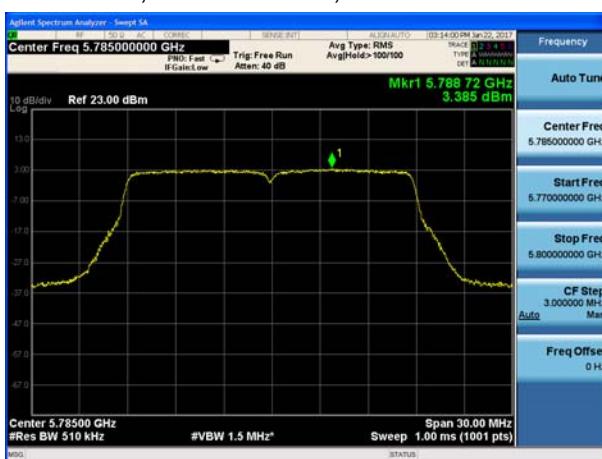
U-NII-3, 802.11n HT20, Channel No.: 149



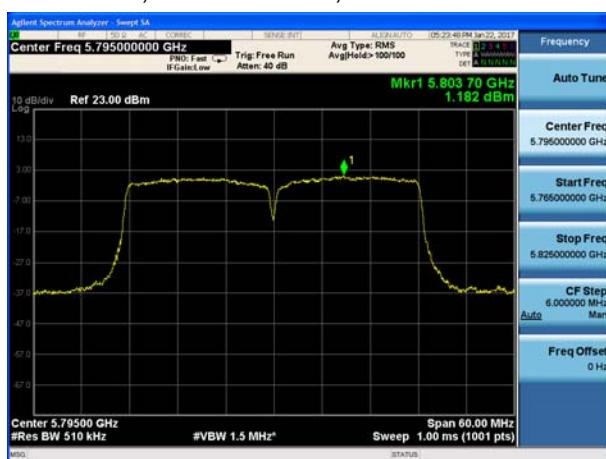
U-NII-3, 802.11n HT40, Channel No.: 151



U-NII-3, 802.11n HT20, Channel No.: 157



U-NII-3, 802.11n HT40, Channel No.: 159



U-NII-3, 802.11n HT20, Channel No.: 165

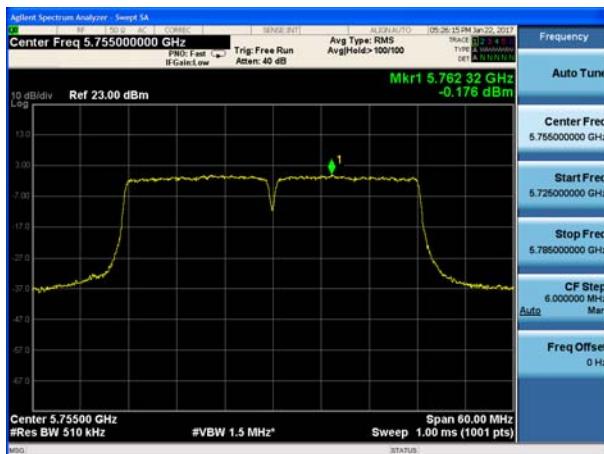




U-NII-3, 802.11ac HT20, Channel No.: 149



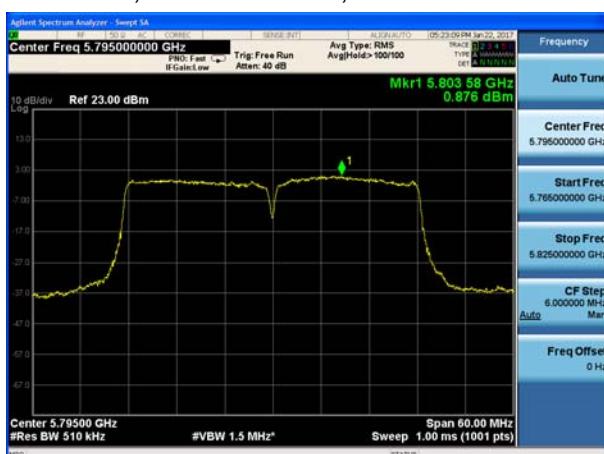
U-NII-3, 802.11ac HT40, Channel No.: 151



U-NII-3, 802.11ac HT20, Channel No.: 157



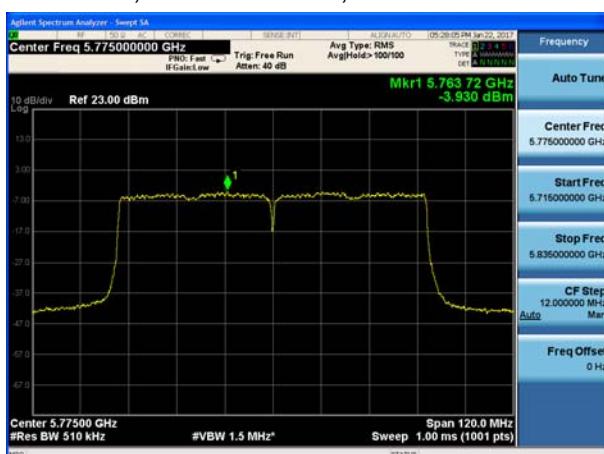
U-NII-3, 802.11ac HT40, Channel No.: 159



U-NII-3, 802.11ac HT20, Channel No.: 165



U-NII-3, 802.11ac HT80, Channel No.: 155



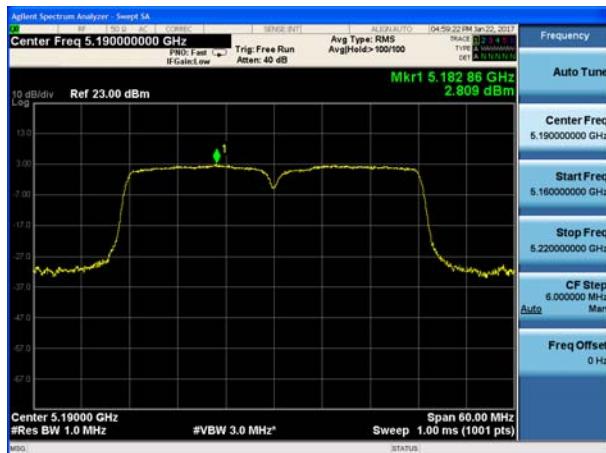


MIMO Antenna 2

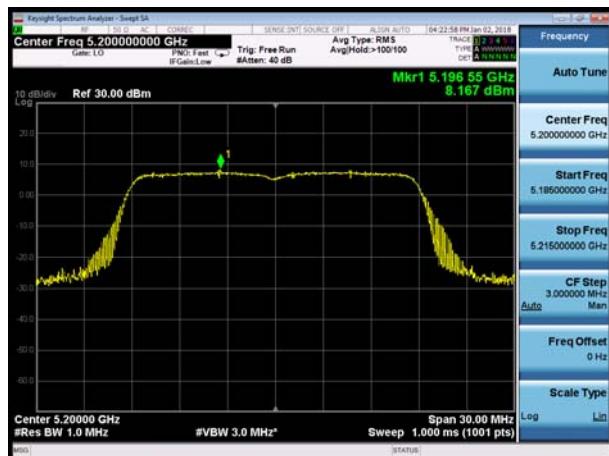
U-NII-1, 802.11n HT20, Channel No.: 36



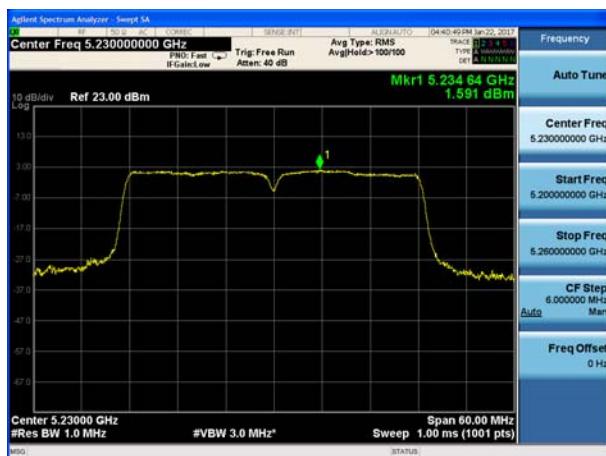
U-NII-1, 802.11n HT40, Channel No.: 38



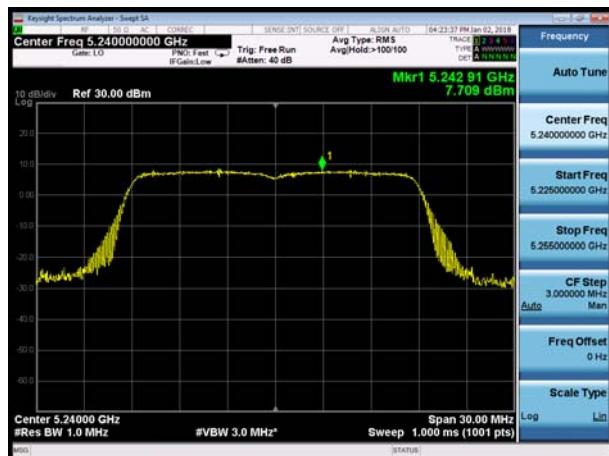
U-NII-1, 802.11n HT20, Channel No.: 40



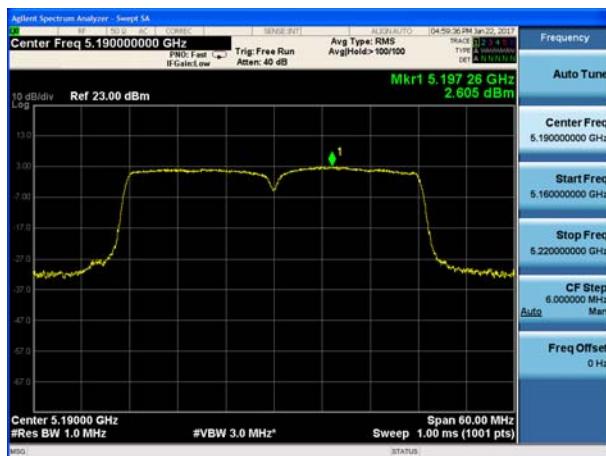
U-NII-1, 802.11n HT40, Channel No.: 46



U-NII-1, 802.11n HT20, Channel No.: 48



U-NII-1, 802.11ac HT40, Channel No.: 38

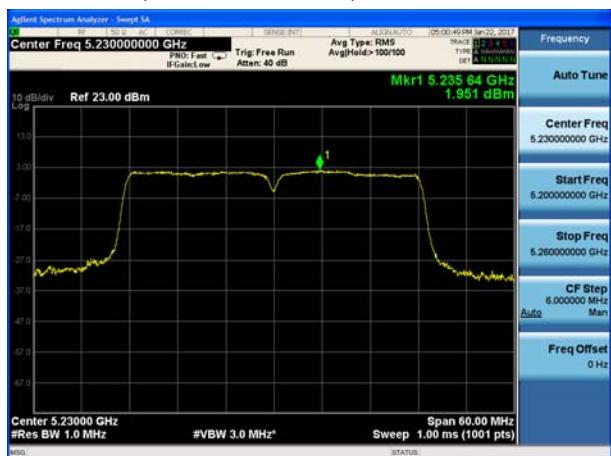




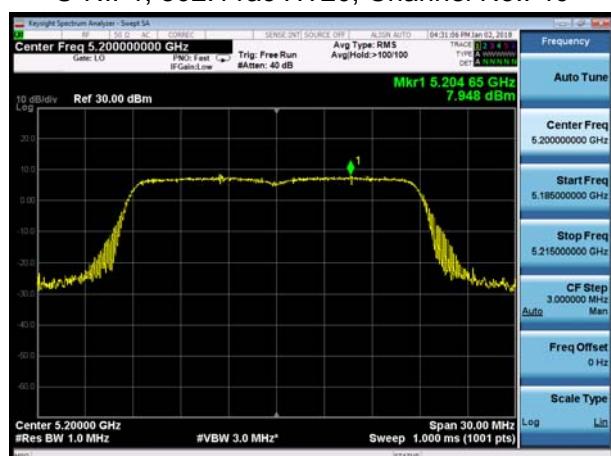
U-NII-1, 802.11ac HT20, Channel No.: 36



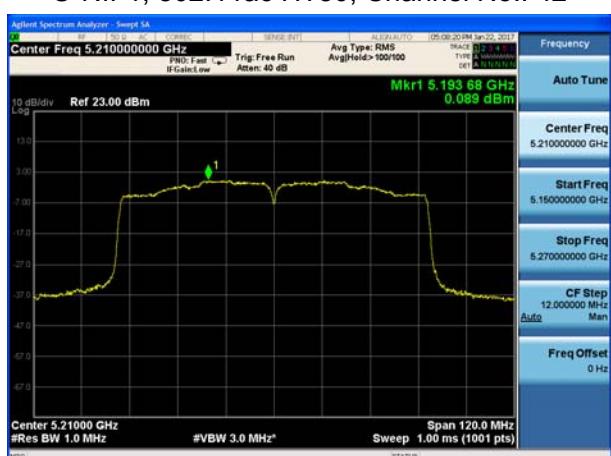
U-NII-1, 802.11ac HT40, Channel No.: 46



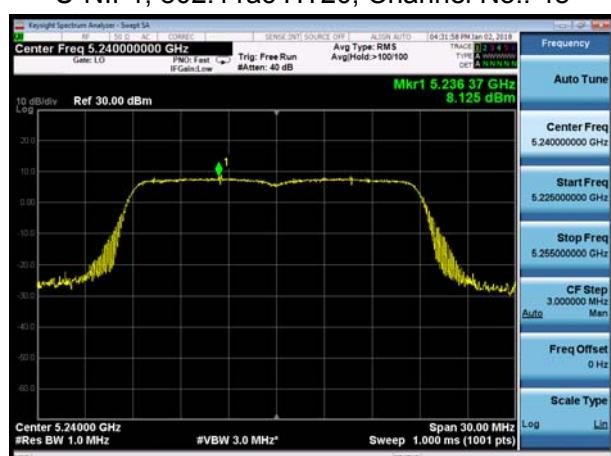
U-NII-1, 802.11ac HT20, Channel No.: 40



U-NII-1, 802.11ac HT80, Channel No.: 42



U-NII-1, 802.11ac HT20, Channel No.: 48

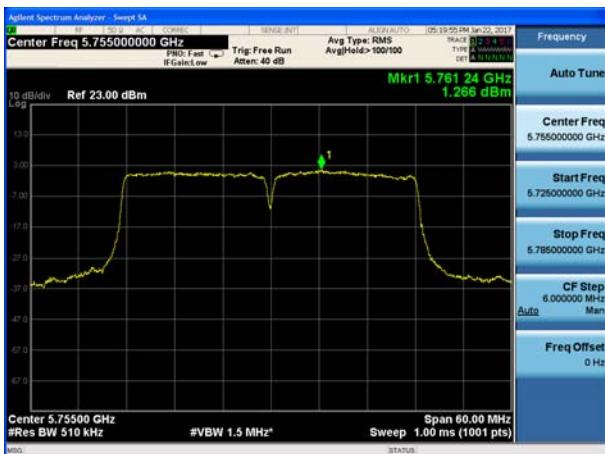




U-NII-3, 802.11n HT20, Channel No.: 149



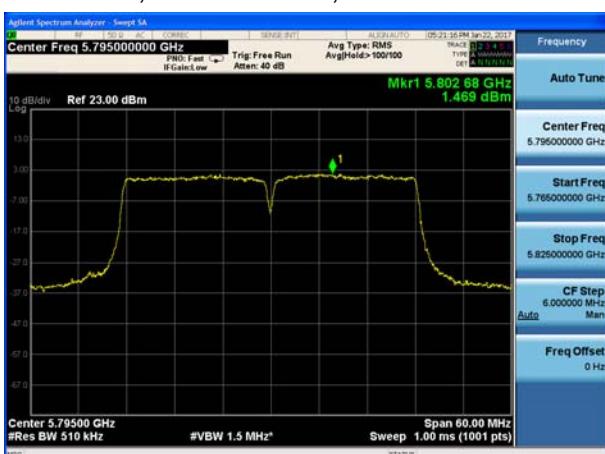
U-NII-3, 802.11n HT40, Channel No.: 151



U-NII-3, 802.11n HT20, Channel No.: 157



U-NII-3, 802.11n HT40, Channel No.: 159

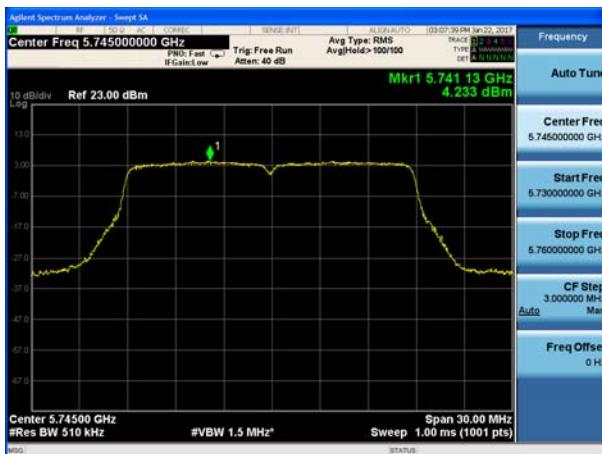


U-NII-3, 802.11n HT20, Channel No.: 165

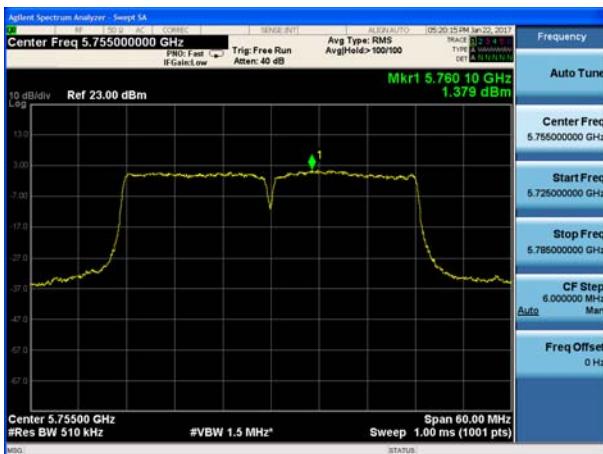




U-NII-3, 802.11ac HT20, Channel No.: 149



U-NII-3, 802.11ac HT40, Channel No.: 151



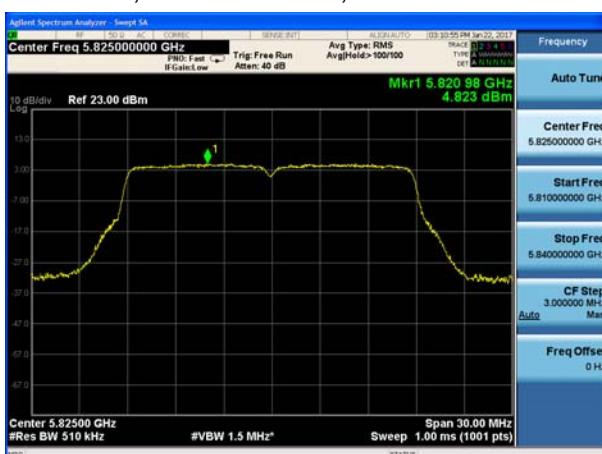
U-NII-3, 802.11ac HT20, Channel No.: 157



U-NII-3, 802.11ac HT40, Channel No.: 159



U-NII-3, 802.11ac HT20, Channel No.: 165



U-NII-3, 802.11ac HT80, Channel No.: 155





MIMO Antenna 3

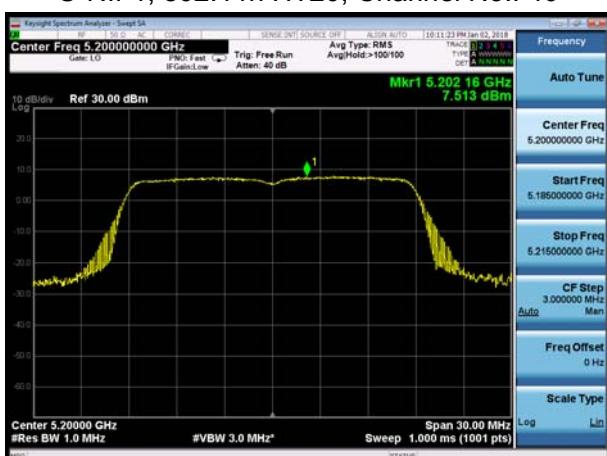
U-NII-1, 802.11n HT20, Channel No.: 36



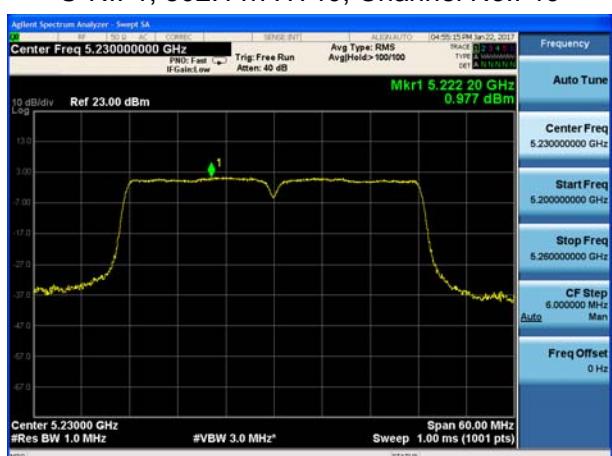
U-NII-1, 802.11n HT40, Channel No.: 38



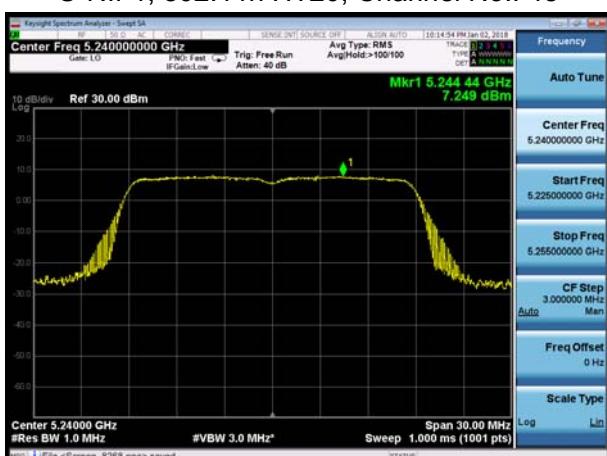
U-NII-1, 802.11n HT20, Channel No.: 40



U-NII-1, 802.11n HT40, Channel No.: 46



U-NII-1, 802.11n HT20, Channel No.: 48

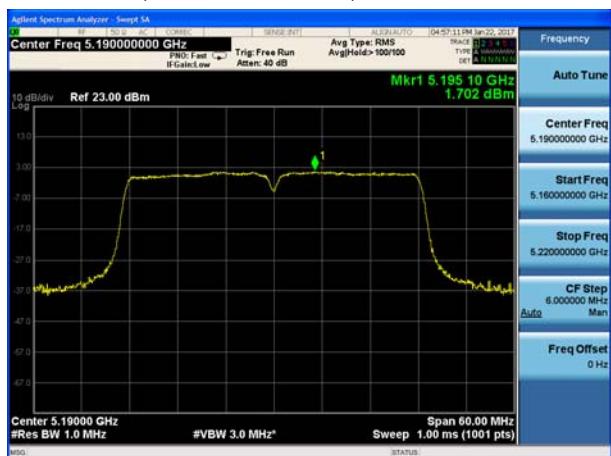




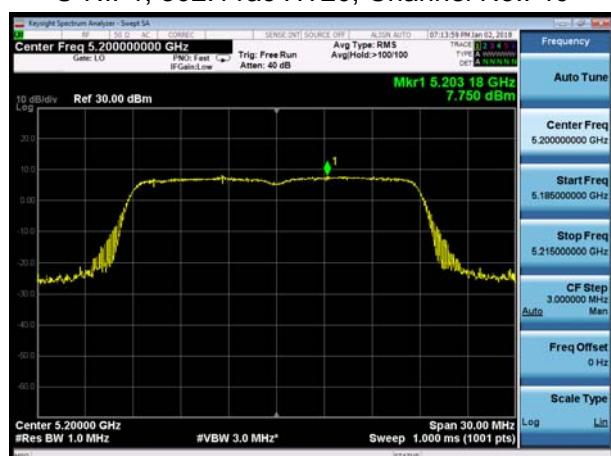
U-NII-1, 802.11ac HT20, Channel No.: 36



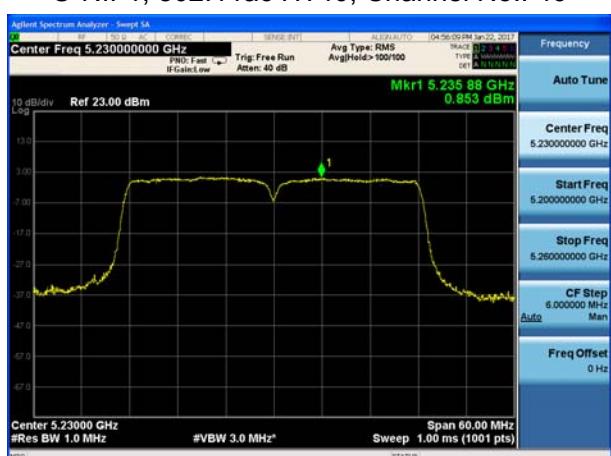
U-NII-1, 802.11ac HT40, Channel No.: 38



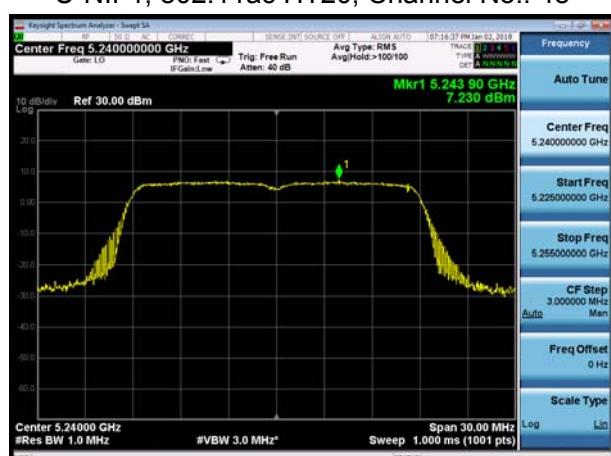
U-NII-1, 802.11ac HT20, Channel No.: 40



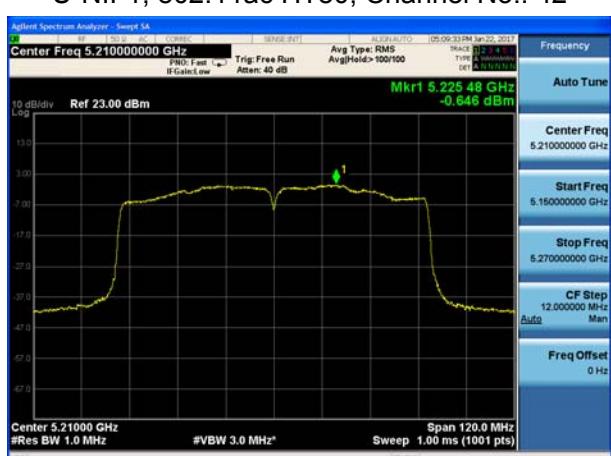
U-NII-1, 802.11ac HT40, Channel No.: 46



U-NII-1, 802.11ac HT20, Channel No.: 48



U-NII-1, 802.11ac HT80, Channel No.: 42

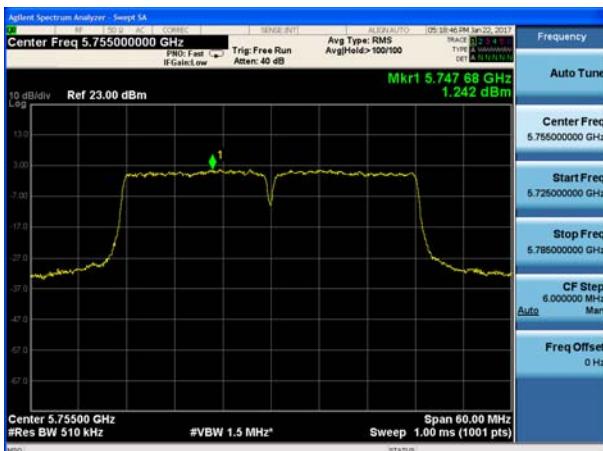




U-NII-3, 802.11n HT20, Channel No.: 149



U-NII-3, 802.11n HT40, Channel No.: 151



U-NII-3, 802.11n HT20, Channel No.: 157



U-NII-3, 802.11n HT40, Channel No.: 159

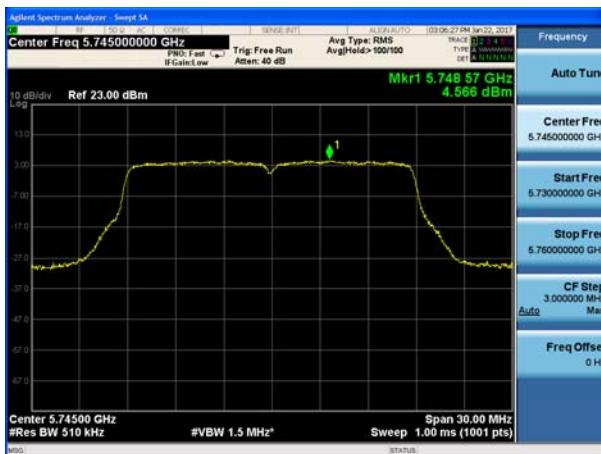


U-NII-3, 802.11n HT20, Channel No.: 165

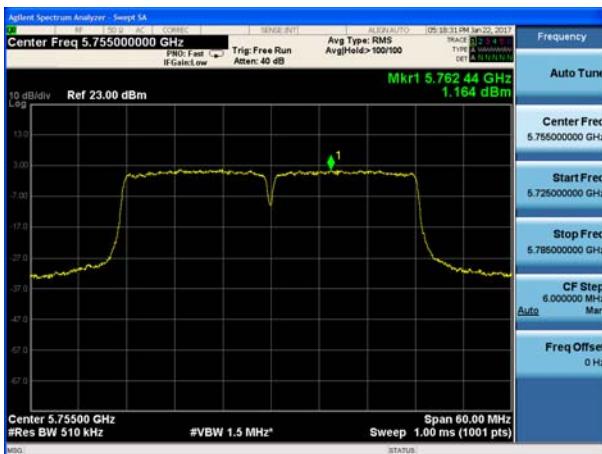




U-NII-3, 802.11ac HT20, Channel No.: 149



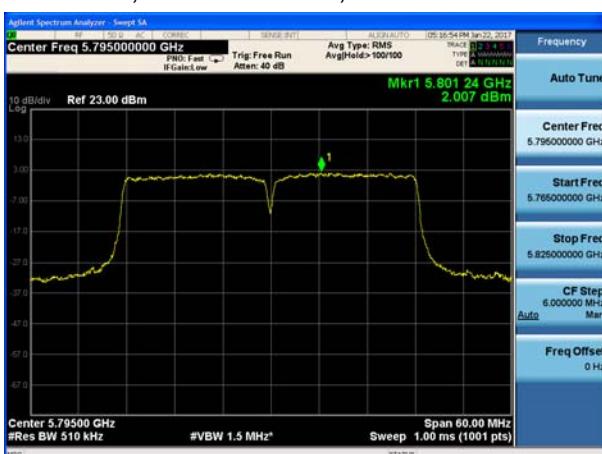
U-NII-3, 802.11ac HT40, Channel No.: 151



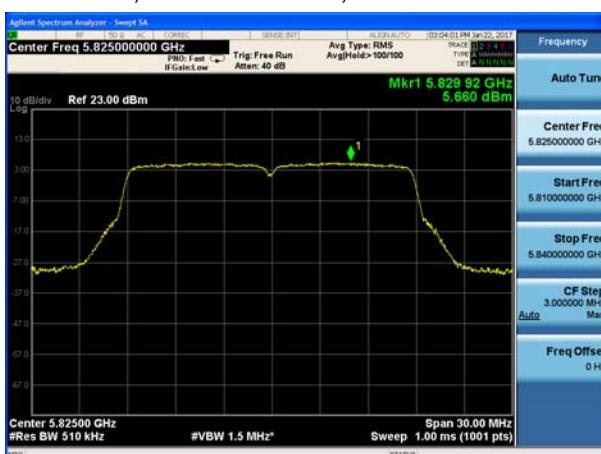
U-NII-3, 802.11ac HT20, Channel No.: 157



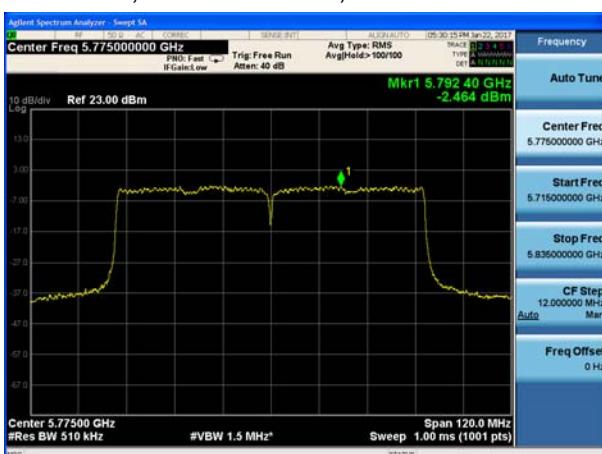
U-NII-3, 802.11ac HT40, Channel No.: 159



U-NII-3, 802.11ac HT20, Channel No.: 165



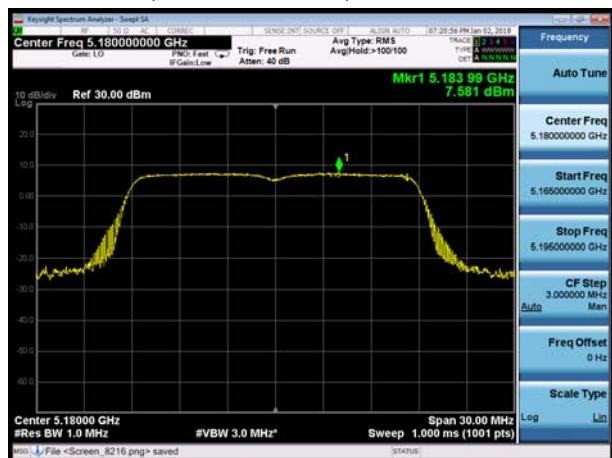
U-NII-3, 802.11ac HT80, Channel No.: 155



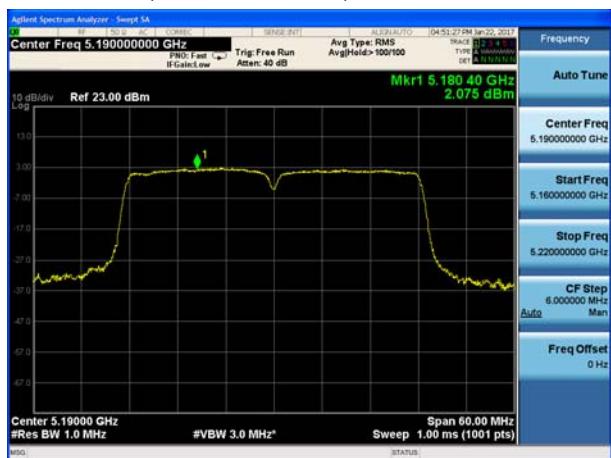


MIMO Antenna 4

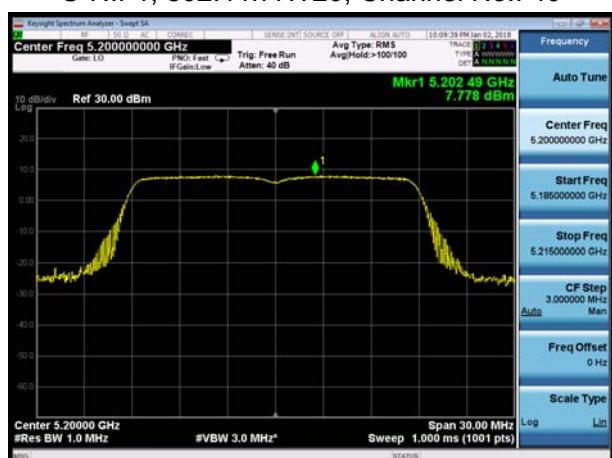
U-NII-1, 802.11n HT20, Channel No.: 36



U-NII-1, 802.11n HT40, Channel No.: 38



U-NII-1, 802.11n HT20, Channel No.: 40



U-NII-1, 802.11n HT40, Channel No.: 46



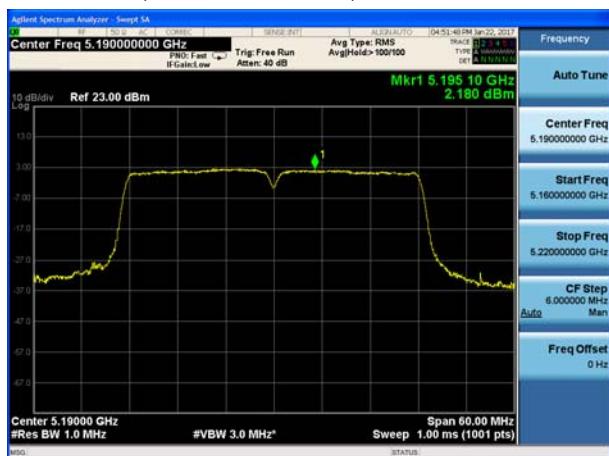
U-NII-1, 802.11n HT20, Channel No.: 48



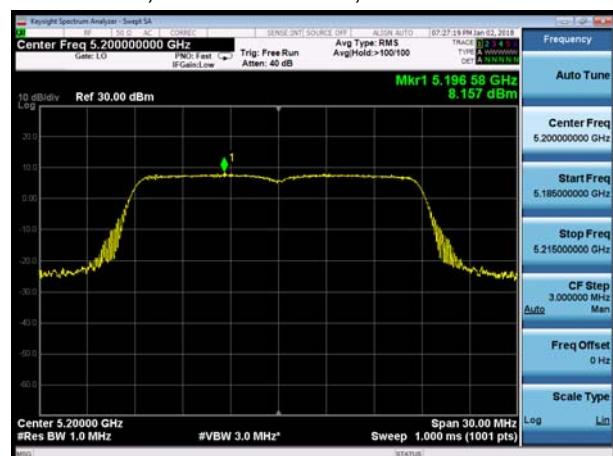
U-NII-1, 802.11ac HT20, Channel No.: 36



U-NII-1, 802.11ac HT40, Channel No.: 38



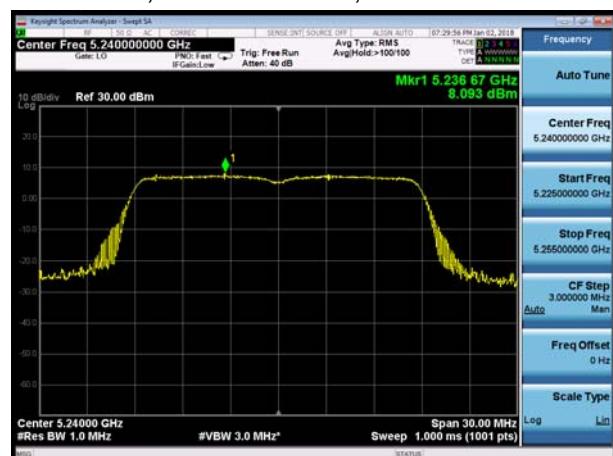
U-NII-1, 802.11ac HT20, Channel No.: 40



U-NII-1, 802.11ac HT40, Channel No.: 46



U-NII-1, 802.11ac HT20, Channel No.: 48

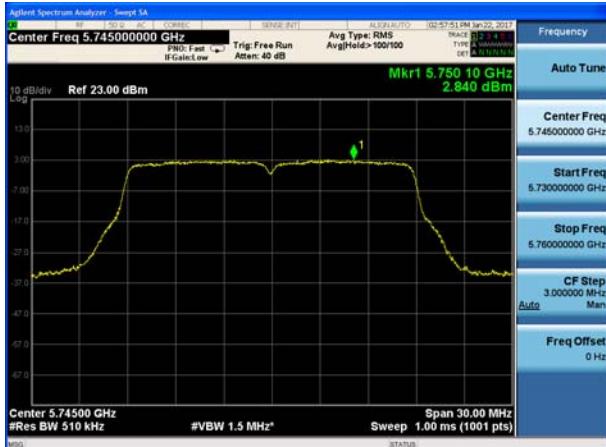


U-NII-1, 802.11ac HT80, Channel No.: 42





U-NII-3, 802.11n HT20, Channel No.: 149



U-NII-3, 802.11n HT40, Channel No.: 151



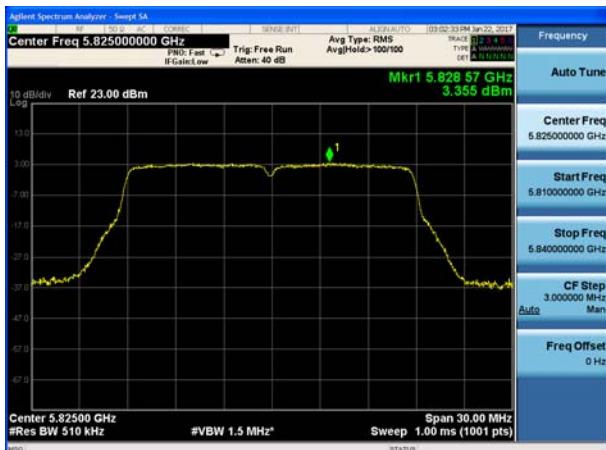
U-NII-3, 802.11n HT20, Channel No.: 157



U-NII-3, 802.11n HT40, Channel No.: 159



U-NII-3, 802.11n HT20, Channel No.: 165





U-NII-3, 802.11ac HT20, Channel No.: 149



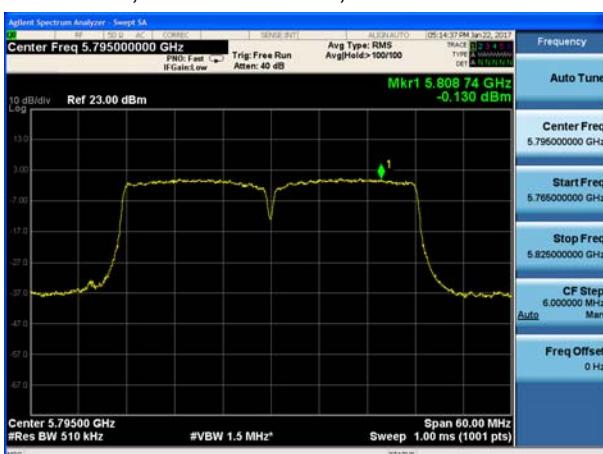
U-NII-3, 802.11ac HT40, Channel No.: 151



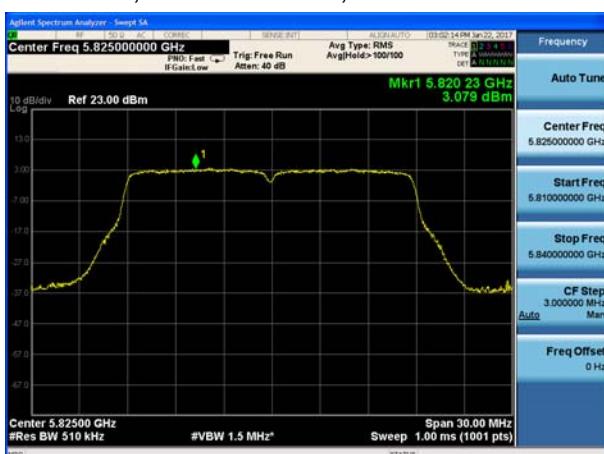
U-NII-3, 802.11ac HT20, Channel No.: 157



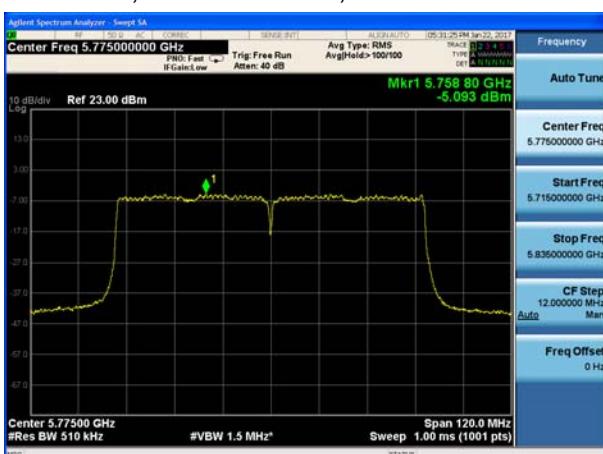
U-NII-3, 802.11ac HT40, Channel No.: 159



U-NII-3, 802.11ac HT20, Channel No.: 165

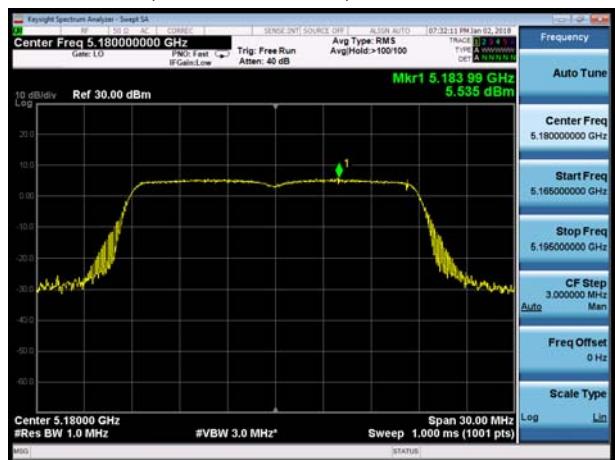


U-NII-3, 802.11ac HT80, Channel No.: 155

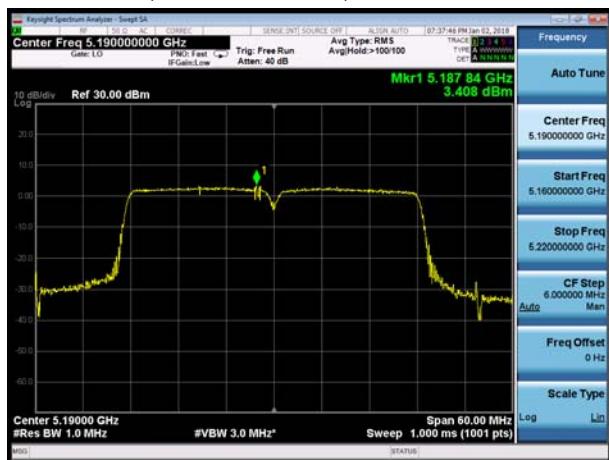


**MIMO with beamforming****MIMO Antenna 1**

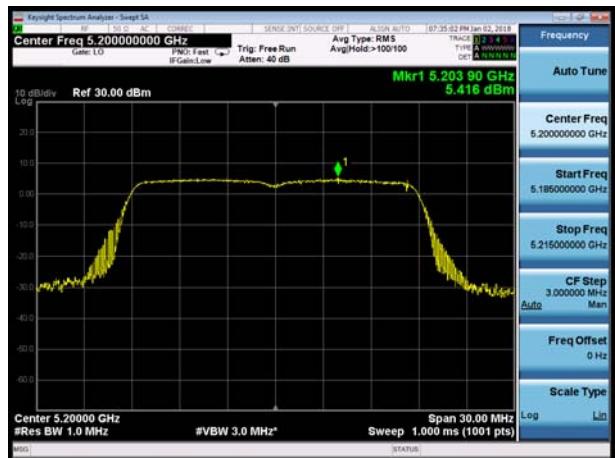
U-NII-1, 802.11n HT20, Channel No.: 36



U-NII-1, 802.11n HT40, Channel No.: 38



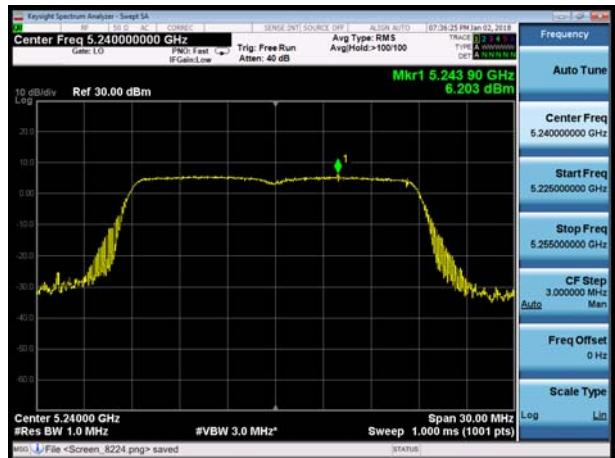
U-NII-1, 802.11n HT20, Channel No.: 40



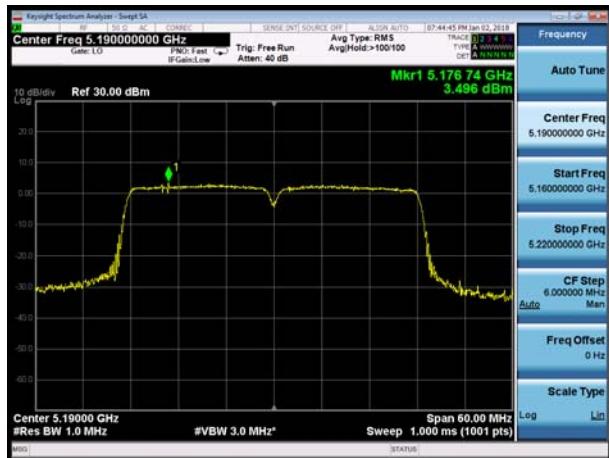
U-NII-1, 802.11n HT40, Channel No.: 46



U-NII-1, 802.11n HT20, Channel No.: 48

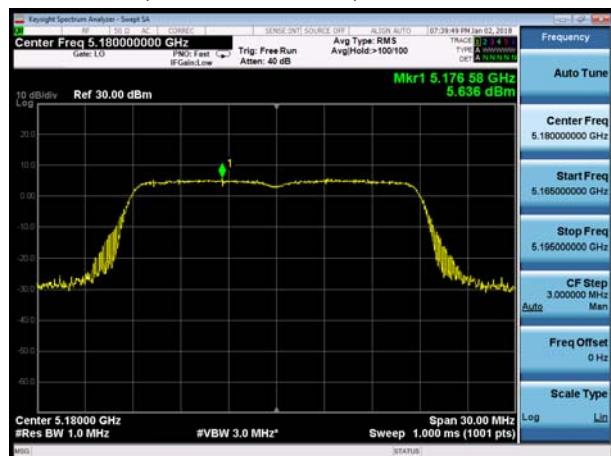


U-NII-1, 802.11ac HT40, Channel No.: 38

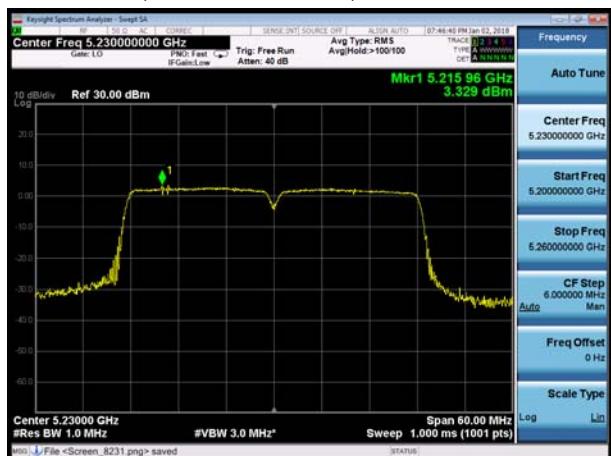




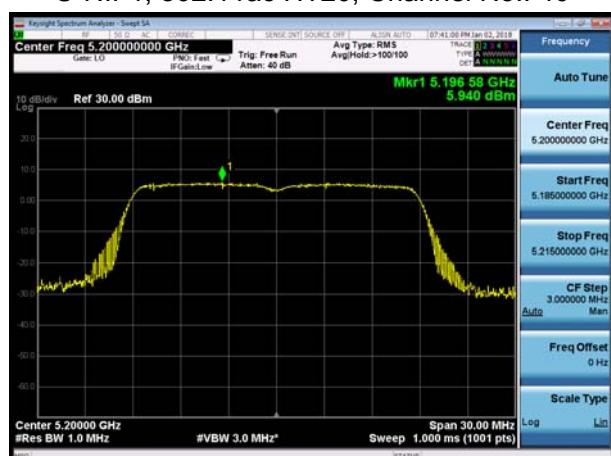
U-NII-1, 802.11ac HT20, Channel No.: 36



U-NII-1, 802.11ac HT40, Channel No.: 46



U-NII-1, 802.11ac HT20, Channel No.: 40



U-NII-1, 802.11ac HT80, Channel No.: 42



U-NII-1, 802.11ac HT20, Channel No.: 48

