# RF TEST REPORT

| | |
|---|---|
| **Applicant** | Alcatel-Lucent Shanghai Bell CO. Ltd. |
| **FCC ID** | 2ADZRHA030WB |
| **Product** | 7368 Intelligent Services Access Manager CPE |
| **Brand** | NOKIA |
| **Model** | HA-030W-B |
| **Report No.** | RBA1712-0148RF04R1 |
| **Issue Date** | March 22, 2018 |

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15E (2018)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Xianqing Li

*Performed by: Xianqing Li*

Kai Xu

*Approved by: Kai Xu*


## TA Technology (Shanghai) Co., Ltd.

*No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China*

*TEL: +86-021-50791141/2/3*

*FAX: +86-021-50791141/2/3-8000*

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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 18, 2017 ~ March 7, 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.

## 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. |
| Address: | No.145, Jintang Rd, Tangzhen Industry Park, Pudong |
| City: | Shanghai |
| Post code: | 201201 |
| Country: | P. R. China |
| Contact: | Xu Kai |
| Telephone: | +86-021-50791141/2/3 |
| Fax: | +86-021-50791141/2/3-8000 |
| Website: | http://www.ta-shanghai.com |
| E-mail: | xukai@ta-shanghai.com |

# 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** | TAICANG T&W ELECTRONICS CO.,LTD |
| **Manufacturer address** | 89# Jiang Nan RD, Lu Du, Taicang, Jiangsu, China |

**General information**

| **EUT Description** | |
|---|---|
| Model | HA-030W-B |
| SN | / |
| Hardware Version | PEM2 |
| Software Version | Null |
| Power Supply | AC adapter |
| Antenna Type | Internal Antenna |
| Antenna Gain | Antenna 1: 4.0 dBi<br>Antenna 2: 4.0 dBi<br>Antenna 3: 4.0 dBi<br>Antenna 4: 4.0 dBi |
| Directional Gain | 10.02 dBi |
| additional beamforming gain | 6 dB |
| Test Mode(s) | U-NII-1(5150MHz-5250MHz)<br>U-NII-3(5725MHz-5850MHz) |
| Modulation Type | 802.11a/n (HT20/HT40) : OFDM<br>802.11ac (HT20.HT40/HT80): OFDM |
| Max. Conducted Power | 29.50dBm |
| Operating Frequency Range(s) | U-NII-1: 5150-5250MHz<br>U-NII-3: 5725-5850MHz |
| **EUT Accessory** | |
| Adapter 1 | Manufacturer: Dongguan Shilong Fuhua Electronic Co., Ltd<br>Model: 1AF31249AAAA |
| Adapter 2 | Manufacturer:RUIDE<br>Model: RD1202000-C55-80MG |
| Note: The information of the EUT is declared by the manufacturer.<br>2. There is more than one Adapter, each one should be applied throughout the compliance test respectively, and however, only the worst case (Adapter 1 for Radiated Emission, Adapter 2 for Conducted Emission) will be recorded in this report. | |

**EUT Configuration**

| No. | Name | Model/Code No. | Edition | Serial No. or Quantity |
|---|---|---|---|---|
| 1 | EMA-HA-030W-B | 3FE47429AA | PEM2 | PEM 1 |
| 2 | EMA-HA-030W-B | 3FE47429AB | PEM2 | PEM 1 |
| 3 | Power adapter | 1AF31249AAAA | A/0 | UE171030GWAD01 - R 1 |
| 4 | Power adapter | RD1202000-C55-80MG | A/0 | PEM 1 |

| ONT Mnemonic | Kit Code | EMA Code | Part Description | Power Adapter | |
|---|---|---|---|---|---|
| HA-030W-B | 3FE47357AA | 3FE47429AA | Wi-Fi Access Point and range extender, 3xGE UNI, 3x3 11n+4x4 11ac, US plug | 1AF31249 AAAA | RD1202000-C55-80MG |
| HA-030W-B | 3FE47357AB | 3FE47429AB | Wi-Fi Access Point and range extender, 3xGE UNI, 3x3 11n+4x4 11ac, Telmex spec | | |

**Auxiliary Equipment**

| No. | Name | Brand name | Model | ASB code | Valid Until |
|---|---|---|---|---|---|
| 1 | SmartBits 600B | Sprient | DE7853 | - | No Cal. Required |
| 2 | PC | HP | N.A | - | No Cal. Required |
| 3 | PC | DELL | N.A | - | No Cal. Required |
| 4 | PC | Thinkpad | N.A | - | No Cal. Required |

**Ports**

| No. | Port name | Number | Shielded or unshielded | Cable type (optic, twisted pair, etc.) | Max. Cable length |
|---|---|---|---|---|---|
| 1 | AC port | 1 | Unshielded | - | - |
| 2 | GE | 4 | Unshielded | - | - |

# 3. Applied Standards

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

**FCC CFR47 Part 15E (2018)** Unlicensed National Information Infrastructure Devices

**ANSI C63.10 (2013)**

**KDB 789033 D02 General UNII Test Procedures New Rules v02**

**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** |
| 802.11a | 6 | 6 | 6 | 6 |
| 802.11n HT20 | MCS0 | MCS0 | MCS0 | MCS0 |
| 802.11n HT40 | MCS0 | MCS0 | MCS0 | MCS0 |
| 802.11ac HT20 | MCS0 | MCS0 | MCS0 | MCS0 |
| 802.11ac HT40 | MCS0 | MCS0 | MCS0 | MCS0 |
| 802.11ac HT80 | MCS0 | MCS0 | MCS0 | MCS0 |

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

| **Test Cases** | MIMO Antenna 1 | MIMO Antenna 2 | MIMO Antenna 3 | MIMO Antenna 4 |
|---|---|---|---|---|
| Average conducted output power | O | O | O | O |
| Occupied bandwidth | O | O | O | O |
| Frequency stability | O | O | O | O |
| Power Spectral Density | O | O | O | O |
| Unwanted Emissions | O | O | O | O |
| Conducted Emissions | O | O | O | O |
| 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 |
| | | 80 MHz | 42 | 5210MHz |
| | U-NII-3 | 20 MHz | 149 | 5745MHz |
| | | | 157 | 5785MHz |
| | | | 165 | 5825MHz |
| | | 40 MHz | 151 | 5755MHz |
| | | | 159 | 5795MHz |
| | | 80 MHz | 155 | 5775MHz |
| Does this device support TPC Function? ☐Yes ☒No | | | | |
| Does this device support TDWR Band? ☐Yes ☒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.

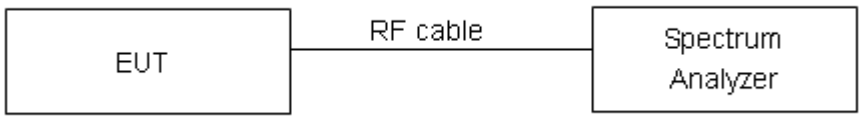
For U-NII-1, set RBW ≈1% OCB kHz, VBW ≥ 3 × RBW, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 26 dB relative to the maximum level measured in the fundamental emission.

For U-NII-3, Set RBW = 100 kHz, VBW ≥ 3 × 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:**

**U-NII-1**

| Network Standards | Carrier frequency (MHz) | 99% bandwidth (MHz) | Minimum 26 dB bandwidth (MHz) | Conclusion |
|---|---|---|---|---|
| 802.11a | 5180 | 16.779 | 21.38 | PASS |
| | 5200 | 16.768 | 21.25 | PASS |
| | 5240 | 16.728 | 21.22 | PASS |
| 802.11n HT20 | 5180 | 18.067 | 28.90 | PASS |
| | 5200 | 19.959 | 30.00 | PASS |
| | 5240 | 21.182 | 30.00 | PASS |
| 802.11n HT40 | 5190 | 36.326 | 40.03 | PASS |
| | 5230 | 40.026 | 60.00 | PASS |
| 802.11ac HT20 | 5180 | 18.093 | 29.77 | PASS |
| | 5200 | 20.733 | 30.00 | PASS |
| | 5240 | 20.472 | 30.00 | PASS |
| 802.11ac HT40 | 5190 | 36.306 | 39.95 | PASS |
| | 5230 | 39.271 | 60.00 | PASS |
| 802.11ac HT80 | 5210 | 74.997 | 81.27 | PASS |

**U-NII-3**

| Network Standards | Carrier frequency (MHz) | 99% bandwidth (MHz) | Minimum 6 dB bandwidth (MHz) | Limit (kHz) | Conclusion |
|---|---|---|---|---|---|
| 802.11a | 5745 | 18.135 | 16.39 | 500 | PASS |
| | 5785 | 19.371 | 16.36 | 500 | PASS |
| | 5825 | 21.662 | 16.32 | 500 | PASS |
| 802.11n HT20 | 5745 | 18.291 | 17.62 | 500 | PASS |
| | 5785 | 18.197 | 17.60 | 500 | PASS |
| | 5825 | 19.334 | 17.63 | 500 | PASS |
| 802.11n HT40 | 5755 | 36.732 | 36.35 | 500 | PASS |
| | 5795 | 37.221 | 36.42 | 500 | PASS |
| 802.11ac HT20 | 5745 | 18.356 | 17.64 | 500 | PASS |
| | 5785 | 18.643 | 17.59 | 500 | PASS |
| | 5825 | 20.040 | 17.59 | 500 | PASS |
| 802.11ac HT40 | 5755 | 36.811 | 36.38 | 500 | PASS |
| | 5795 | 37.378 | 36.41 | 500 | PASS |
| 802.11ac HT80 | 5775 | 76.054 | 75.83 | 500 | PASS |

**U-NII-1**

U-NII-1, 802.11a
Carrier frequency (MHz): 5180


U-NII-1, 802.11n HT20
Carrier frequency (MHz): 5180


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


U-NII-1, 802.11n HT20
Carrier frequency (MHz): 5200


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

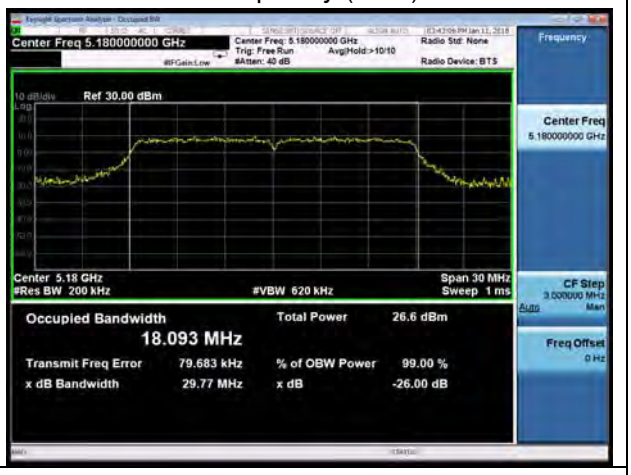

U-NII-1, 802.11n HT20
Carrier frequency (MHz):5240

U-NII-1, 802.11n HT40

Carrier frequency (MHz): 5190


U-NII-1, 802.11ac HT20

Carrier frequency (MHz): 5180




U-NII-1, 802.11n HT40

Carrier frequency (MHz): 5230


U-NII-1, 802.11ac HT20

Carrier frequency (MHz): 5200


U-NII-1, 802.11ac HT20

Carrier frequency (MHz):5240

U-NII-1, 802.11ac HT40
Carrier frequency (MHz): 5190


U-NII-1, 802.11ac HT80
Carrier frequency (MHz): 5210


U-NII-1, 802.11ac HT40
Carrier frequency (MHz): 5230

## U-NII-3 99% bandwidth

U-NII-3, 802.11a

Carrier frequency (MHz): 5745


U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5745


U-NII-3, 802.11a

Carrier frequency (MHz): 5785


U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5785


U-NII-3, 802.11a

Carrier frequency (MHz): 5825


U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5825

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 HT20

Carrier frequency (MHz): 5825

U-NII-3, 802.11ac HT40
Carrier frequency (MHz): 5755


U-NII-3, 802.11ac HT80
Carrier frequency (MHz): 5775


U-NII-3, 802.11ac HT40
Carrier frequency (MHz): 5795

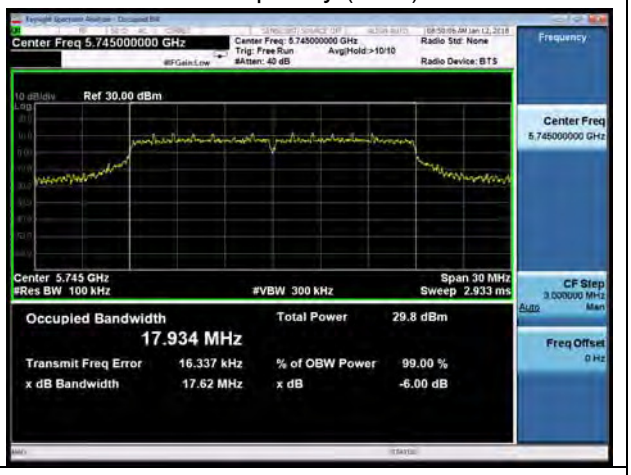
## U-NII-3 Minimum 6 dB bandwidth

U-NII-3, 802.11a

Carrier frequency (MHz): 5745


U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5745




U-NII-3, 802.11a

Carrier frequency (MHz): 5785


U-NII-3, 802.11n HT20

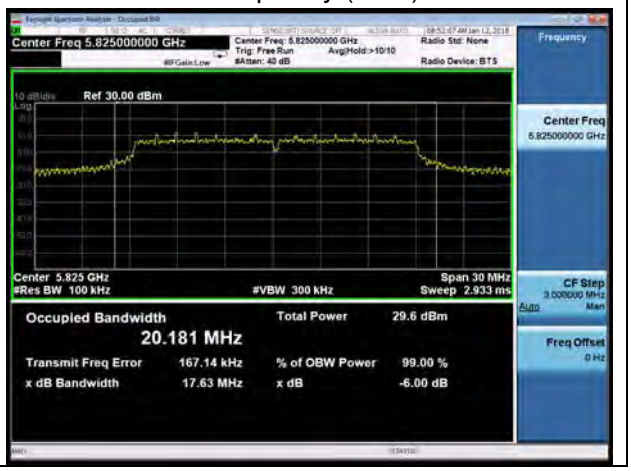
Carrier frequency (MHz): 5785


U-NII-3, 802.11a

Carrier frequency (MHz): 5825


U-NII-3, 802.11n HT20

Carrier frequency (MHz): 5825

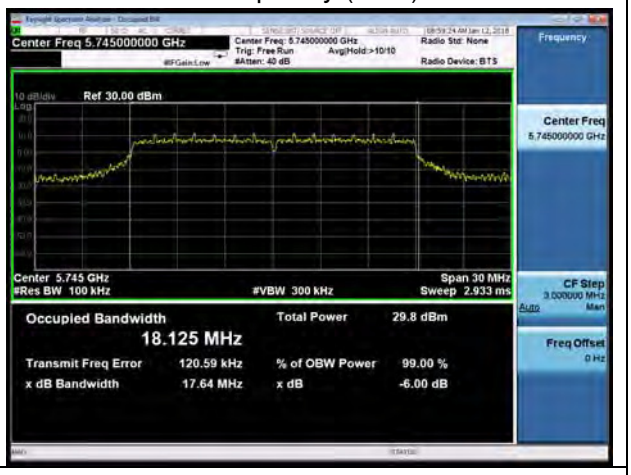


U-NII-3, 802.11n HT40

Carrier frequency (MHz): 5755


U-NII-3, 802.11ac HT20

Carrier frequency (MHz): 5745




U-NII-3, 802.11n HT40

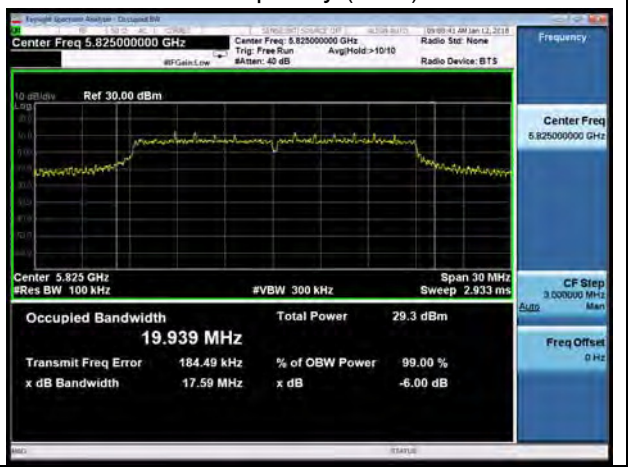
Carrier frequency (MHz): 5795


U-NII-3, 802.11ac HT20

Carrier frequency (MHz): 5785

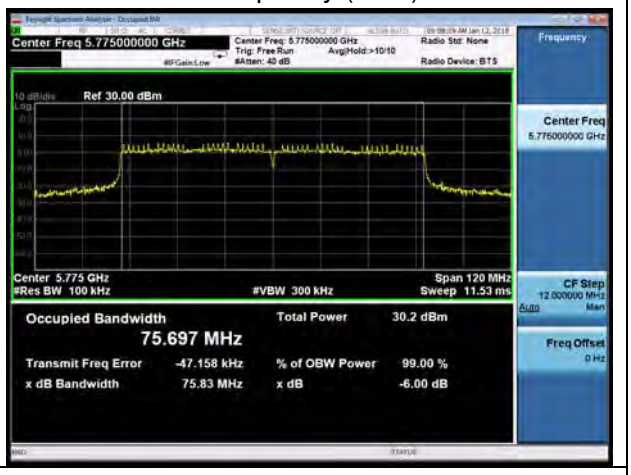

U-NII-3, 802.11ac HT20

Carrier frequency (MHz): 5825



U-NII-3, 802.11ac HT40
Carrier frequency (MHz): 5755


U-NII-3, 802.11ac HT80
Carrier frequency (MHz): 5775




U-NII-3, 802.11ac HT40
Carrier frequency (MHz): 5795

## 5.2. Average Power Output –Conducted

**Ambient condition**

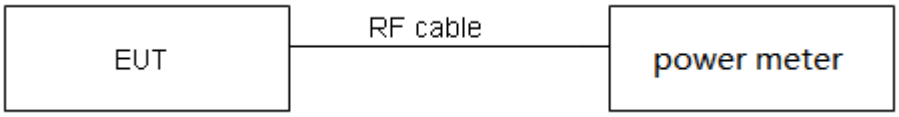
| Temperature | Relative humidity | Pressure |
|---|---|---|
| 23°C ~25°C | 45%~50% | 101.5kPa |

**Methods of Measurement**

During the process of the testing, The EUT was connected to 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

| Band | $T_{on}$ (ms) | $T_{(on+off)}$ (ms) | Duty cycle | Duty cycle correction Factor(dB) |
|---|---|---|---|---|
| 802.11a | 2.06 | 2.17 | 0.95 | 0.21 |
| 802.11n HT20 | 1.92 | 2.02 | 0.95 | 0.23 |
| 802.11n HT40 | 0.94 | 1.04 | 0.90 | 0.44 |
| 802.11ac HT20 | 1.93 | 1.97 | 0.98 | NA |
| 802.11ac HT40 | 0.95 | 0.98 | 0.97 | 0.13 |
| 802.11ac HT80 | 0.95 | 0.98 | 0.97 | 0.14 |
| Note: when Duty cycle>0.98, Duty cycle correction Factor not required. | | | | |

## Test results

### U-NII-1

### MIMO without Beamforming

| Network Standards | Channel/ Frequency (MHz) | Output Power | | | | | | | | Total Power (dBm) | Limit (dBm) | Conclusion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Antenna 1 | | Antenna 2 | | Antenna 3 | | Antenna 4 | | | | |
| | | Read Value (dBm) | Output Power (dBm) | Read Value (dBm) | Output Power (dBm) | Read Value (dBm) | Output Power (dBm) | Read Value (dBm) | Output Power (dBm) | | | |
| 802.11a | 36/5180 | 18.61 | 18.82 | 17.95 | 18.16 | 18.28 | 18.49 | 17.65 | 17.86 | 24.37 | 30.00 | PASS |
| | 40/5200 | 18.53 | 18.74 | 17.63 | 17.84 | 18.10 | 18.31 | 17.42 | 17.63 | 24.18 | 30.00 | PASS |
| | 48/5240 | 18.17 | 18.38 | 17.84 | 18.05 | 18.28 | 18.49 | 17.71 | 17.92 | 24.24 | 30.00 | PASS |
| 802.11n HT20 | 36/5180 | 18.82 | 19.05 | 18.01 | 18.24 | 18.53 | 18.76 | 17.45 | 17.68 | 24.48 | 30.00 | PASS |
| | 40/5200 | 16.30 | 16.53 | 16.20 | 16.43 | 16.37 | 16.60 | 15.32 | 15.55 | 22.32 | 30.00 | PASS |
| | 48/5240 | 18.08 | 18.31 | 17.75 | 17.98 | 18.20 | 18.43 | 17.34 | 17.57 | 24.11 | 30.00 | PASS |
| 802.11n HT40 | 38/5190 | 15.03 | 15.48 | 14.81 | 15.26 | 14.55 | 15.00 | 13.83 | 14.28 | 21.05 | 30.00 | PASS |
| | 46/5230 | 21.19 | 21.64 | 20.75 | 21.20 | 21.21 | 21.66 | 20.64 | 21.09 | 27.43 | 30.00 | PASS |
| 802.11ac HT20 | 36/5180 | 18.65 | 18.65 | 17.91 | 17.91 | 18.26 | 18.26 | 17.29 | 17.29 | 24.08 | 30.00 | PASS |
| | 40/5200 | 18.67 | 18.67 | 17.72 | 17.72 | 18.32 | 18.32 | 17.30 | 17.30 | 24.06 | 30.00 | PASS |
| | 48/5240 | 18.26 | 18.26 | 17.86 | 17.86 | 18.21 | 18.21 | 17.67 | 17.67 | 24.03 | 30.00 | PASS |
| 802.11ac HT40 | 38/5190 | 17.88 | 18.02 | 16.55 | 16.69 | 17.64 | 17.78 | 16.61 | 16.75 | 23.38 | 30.00 | PASS |
| | 46/5230 | 21.59 | 21.73 | 21.11 | 21.25 | 21.49 | 21.63 | 20.94 | 21.08 | 27.45 | 30.00 | PASS |
| 802.11ac HT80 | 42/5210 | 17.48 | 17.62 | 16.93 | 17.07 | 17.07 | 17.21 | 16.24 | 16.38 | 23.12 | 30.00 | PASS |

Note: 1. For Total Power, according to KDB 662911 D01 Multiple Transmitter Output v02r01 1),

The Total Power $=10\log(10^{(\text{Power antenna1 in dBm}/10)}+10^{(\text{Power antenna2 in dBm}/10)}+10^{(\text{Power antenna3 in dBm}/10)}) +10^{(\text{PSD antenna4 in dBm}/10)})$.

2. The manufacturer declared the transmitter output signals is CDD mode And $N_{ss}=1$. According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = $G_{ANT}$ + Array Gain,

For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any $N_{ANT}$;

Array Gain = $5 \log(N_{ANT}/N_{SS})$ dB or 3 dB, whichever is less, for 20-MHz channel widths with $N_{ANT} \geq 5$.

So directional gain = $G_{ANT}$ + Array Gain =4+0=4 dBi<6dBi. So the power limt is 30dBm.

**U-NII-3**

**MIMO without Beamforming**

| Network Standards | Channel/ Frequency (MHz) | Output Power | | | | | | | | | Limit (dBm) | Conclusion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Antenna 1 | | Antenna 2 | | Antenna 3 | | Antenna 4 | | Total Power (dBm) | | |
| | | Read Value (dBm) | Output Power (dBm) | Read Value (dBm) | Output Power (dBm) | Read Value (dBm) | Output Power (dBm) | Read Value (dBm) | Output Power (dBm) | | | |
| 802.11a | 149/5745 | 23.67 | 23.88 | 23.42 | 23.63 | 22.90 | 23.11 | 22.17 | 22.38 | 29.31 | 30.00 | PASS |
| | 157/5785 | 23.49 | 23.70 | 23.32 | 23.53 | 22.68 | 22.89 | 22.27 | 22.48 | 29.20 | 30.00 | PASS |
| | 165/5825 | 23.38 | 23.59 | 23.09 | 23.30 | 22.77 | 22.98 | 22.58 | 22.79 | 29.20 | 30.00 | PASS |
| 802.11n HT20 | 149/5745 | 23.52 | 23.75 | 22.44 | 22.67 | 22.02 | 22.25 | 21.28 | 21.51 | 28.64 | 30.00 | PASS |
| | 157/5785 | 23.43 | 23.66 | 23.33 | 23.56 | 22.66 | 22.89 | 22.22 | 22.45 | 29.19 | 30.00 | PASS |
| | 165/5825 | 23.55 | 23.78 | 23.79 | 24.02 | 22.84 | 23.07 | 22.74 | 22.97 | 29.50 | 30.00 | PASS |
| 802.11n HT40 | 151/5755 | 22.29 | 22.74 | 22.12 | 22.57 | 22.45 | 22.90 | 21.47 | 21.92 | 28.57 | 30.00 | PASS |
| | 159/5795 | 22.67 | 23.12 | 22.39 | 22.84 | 22.75 | 23.20 | 21.86 | 22.31 | 28.91 | 30.00 | PASS |
| 802.11ac HT20 | 149/5745 | 23.51 | 23.51 | 22.65 | 22.65 | 22.01 | 22.01 | 21.63 | 21.63 | 28.53 | 30.00 | PASS |
| | 157/5785 | 23.53 | 23.53 | 23.40 | 23.40 | 22.59 | 22.59 | 22.28 | 22.28 | 29.00 | 30.00 | PASS |
| | 165/5825 | 23.57 | 23.57 | 23.46 | 23.46 | 22.69 | 22.69 | 22.66 | 22.66 | 29.14 | 30.00 | PASS |
| 802.11ac HT40 | 151/5755 | 22.97 | 23.11 | 22.40 | 22.54 | 22.69 | 22.83 | 21.87 | 22.01 | 28.67 | 30.00 | PASS |
| | 159/5795 | 22.77 | 22.91 | 22.58 | 22.72 | 22.72 | 22.86 | 22.11 | 22.25 | 28.72 | 30.00 | PASS |
| 802.11ac HT80 | 155/5775 | 22.04 | 22.18 | 21.94 | 22.08 | 21.95 | 22.09 | 21.75 | 21.89 | 28.09 | 30.00 | PASS |

Note: 1. For Total Power, according to KDB 662911 D01 Multiple Transmitter Output v02r01 1),

The Total Power $=10\log(10^{(\text{Power antenna1 in dBm/10})}+10^{(\text{Power antenna2 in dBm/10})}+10^{(\text{Power antenna3 in dBm/10})}) +10^{(\text{PSD antenna4 in dBm/10})})$.

2. The manufacturer declared the transmitter output signals is CDD mode And $N_{ss}=1$. According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = $G_{ANT}$ + Array Gain,

For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any $N_{ANT}$;

Array Gain = 5 log($N_{ANT}/N_{SS}$) dB or 3 dB, whichever is less, for 20-MHz channel widths with $N_{ANT} \geq 5$.

So directional gain = $G_{ANT}$ + Array Gain =4+0=4 dBi<6dBi. So the power limt is 30dBm.

**U-NII-1**

**MIMO with Beamforming**

| Network Standards | Channel/ Frequency (MHz) | Output Power | | | | | | | | | Limit (dBm) | Conclusion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Antenna 1 | | Antenna 2 | | Antenna 3 | | Antenna 4 | | Total Power (dBm) | | |
| | | Read Value (dBm) | Output Power (dBm) | Read Value (dBm) | Output Power (dBm) | Read Value (dBm) | Output Power (dBm) | Read Value (dBm) | Output Power (dBm) | | | |
| 802.11n HT20 | 36/5180 | 18.46 | 18.69 | 17.31 | 17.54 | 18.53 | 18.76 | 17.24 | 17.47 | 24.18 | 25.98 | PASS |
| | 40/5200 | 18.11 | 18.34 | 17.19 | 17.42 | 18.17 | 18.40 | 17.02 | 17.25 | 23.90 | 25.98 | PASS |
| | 48/5240 | 17.94 | 18.17 | 17.45 | 17.68 | 18.31 | 18.54 | 17.19 | 17.42 | 23.99 | 25.98 | PASS |
| 802.11n HT40 | 38/5190 | 20.31 | 20.76 | 19.11 | 19.56 | 19.50 | 19.95 | 18.72 | 19.17 | 25.93 | 25.98 | PASS |
| | 46/5230 | 19.63 | 20.08 | 19.19 | 19.64 | 19.73 | 20.18 | 19.09 | 19.54 | 25.89 | 25.98 | PASS |
| 802.11ac HT20 | 36/5180 | 17.61 | 17.61 | 17.42 | 17.42 | 18.08 | 18.08 | 16.87 | 16.87 | 23.54 | 25.98 | PASS |
| | 40/5200 | 18.28 | 18.28 | 17.34 | 17.34 | 18.04 | 18.04 | 17.11 | 17.11 | 23.74 | 25.98 | PASS |
| | 48/5240 | 17.93 | 17.93 | 17.51 | 17.51 | 18.05 | 18.05 | 17.36 | 17.36 | 23.74 | 25.98 | PASS |
| 802.11ac HT40 | 38/5190 | 20.33 | 20.47 | 19.28 | 19.42 | 19.98 | 20.12 | 19.06 | 19.20 | 25.86 | 25.98 | PASS |
| | 46/5230 | 19.80 | 19.94 | 19.45 | 19.59 | 19.87 | 20.01 | 19.31 | 19.45 | 25.78 | 25.98 | PASS |
| 802.11ac HT80 | 42/5210 | 19.94 | 20.08 | 19.33 | 19.47 | 19.41 | 19.55 | 18.72 | 18.86 | 25.54 | 25.98 | PASS |

Note: 1. For Total Power, according to KDB 662911 D01 Multiple Transmitter Output v02r01 1),

The Total Power $=10\log(10^{(\text{Power antenna1 in dBm}/10)}+10^{(\text{Power antenna2 in dBm}/10)}+10^{(\text{Power antenna3 in dBm}/10)}) +10^{(\text{PSD antenna4 in dBm}/10)})$.

2. 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)=4+10log(4/1)=10.02>6 dBi. So the power limt=30-( directional gain-6 dBi)=30-(10.02-6)=25.98 dBm.

**U-NII-3**

**MIMO with Beamforming**

| Network Standards | Channel/ Frequency (MHz) | Output Power | | | | | | | | | Limit (dBm) | Conclusion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Antenna 1 | | Antenna 2 | | Antenna 3 | | Antenna 4 | | Total Power (dBm) | | |
| | | Read Value (dBm) | Output Power (dBm) | Read Value (dBm) | Output Power (dBm) | Read Value (dBm) | Output Power (dBm) | Read Value (dBm) | Output Power (dBm) | | | |
| 802.11n HT20 | 149/5745 | 19.63 | 19.86 | 19.62 | 19.85 | 19.51 | 19.74 | 18.64 | 18.87 | 25.62 | 25.98 | PASS |
| | 157/5785 | 19.76 | 19.99 | 19.78 | 20.01 | 19.76 | 19.99 | 18.81 | 19.04 | 25.80 | 25.98 | PASS |
| | 165/5825 | 19.70 | 19.93 | 19.61 | 19.84 | 19.39 | 19.62 | 18.90 | 19.13 | 25.66 | 25.98 | PASS |
| 802.11n HT40 | 151/5755 | 19.26 | 19.71 | 19.22 | 19.67 | 19.71 | 20.16 | 18.81 | 19.26 | 25.74 | 25.98 | PASS |
| | 159/5795 | 19.40 | 19.85 | 19.15 | 19.60 | 19.64 | 20.09 | 18.78 | 19.23 | 25.73 | 25.98 | PASS |
| 802.11ac HT20 | 149/5745 | 19.65 | 19.65 | 19.66 | 19.66 | 19.79 | 19.79 | 18.77 | 18.77 | 25.51 | 25.98 | PASS |
| | 157/5785 | 19.66 | 19.66 | 19.65 | 19.65 | 19.77 | 19.77 | 18.87 | 18.87 | 25.52 | 25.98 | PASS |
| | 165/5825 | 19.81 | 19.81 | 19.64 | 19.64 | 19.61 | 19.61 | 18.82 | 18.82 | 25.51 | 25.98 | PASS |
| 802.11ac HT40 | 151/5755 | 19.58 | 19.72 | 19.58 | 19.72 | 19.47 | 19.61 | 18.84 | 18.98 | 25.54 | 25.98 | PASS |
| | 159/5795 | 19.60 | 19.74 | 19.54 | 19.68 | 19.54 | 19.68 | 18.90 | 19.04 | 25.57 | 25.98 | PASS |
| 802.11ac HT80 | 155/5775 | 19.28 | 19.42 | 19.26 | 19.40 | 19.13 | 19.27 | 18.46 | 18.60 | 25.21 | 25.98 | PASS |

Note: 1. For Total Power, according to KDB 662911 D01 Multiple Transmitter Output v02r01 1),

The Total Power $=10\log(10^{(\text{Power antenna1 in dBm}/10)}+10^{(\text{Power antenna2 in dBm}/10)}+10^{(\text{Power antenna3 in dBm}/10)}) +10^{(\text{Power antenna4 in dBm}/10)})$.

2. 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)=4+10log(4/1)=10.02>6 dBi. So the power limt=30-( directional gain-6 dBi)=30-(10.02-6)=25.98 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 that 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, $U$= 936Hz

## Test Results

| Voltage (V) | Temperature (°C) | U-NII-1 Test Results | | | |
|---|---|---|---|---|---|
| | | 5200MHz | | | |
| | | 1min | 2min | 5min | 10min |
| 12 | -20 | 5199.997502 | 5199.993261 | 5199.985059 | 5199.982938 |
| 12 | -10 | 5200.001106 | 5199.987446 | 5199.980274 | 5199.976304 |
| 12 | 0 | 5200.000095 | 5199.985562 | 5199.970942 | 5199.968559 |
| 12 | 10 | 5199.996109 | 5199.983594 | 5199.965812 | 5199.959597 |
| 12 | 20 | 5199.990647 | 5199.97896 | 5199.956915 | 5199.950832 |
| 12 | 30 | 5199.989139 | 5199.973689 | 5199.952134 | 5199.949671 |
| 12 | 40 | 5199.984635 | 5199.966926 | 5199.947932 | 5199.948853 |
| 12 | 50 | 5199.975293 | 5199.962228 | 5199.941996 | 5199.947692 |
| 10.2 | 20 | 5199.969414 | 5199.956608 | 5199.940632 | 5199.943189 |
| 13.8 | 20 | 5199.968863 | 5199.95567 | 5199.939728 | 5199.938771 |
| MHz | | -0.031137219 | -0.044329818 | -0.060271583 | -0.061228703 |
| PPM | | -5.987926693 | -8.52496506 | -11.59068908 | -11.77475052 |

| Voltage (V) | Temperature (°C) | U-NII-3 Test Results | | | |
|---|---|---|---|---|---|
| | | 5785MHz | | | |
| | | 1min | 2min | 5min | 10min |
| 12 | -20 | 5784.99667 | 5784.990456 | 5784.981587 | 5784.976913 |
| 12 | -10 | 5784.990582 | 5784.986245 | 5784.979691 | 5784.976098 |
| 12 | 0 | 5784.985479 | 5784.984671 | 5784.976149 | 5784.972778 |
| 12 | 10 | 5784.975511 | 5784.977206 | 5784.970385 | 5784.971088 |
| 12 | 20 | 5784.966127 | 5784.97056 | 5784.969733 | 5784.961242 |
| 12 | 30 | 5784.959831 | 5784.960746 | 5784.963615 | 5784.95718 |
| 12 | 40 | 5784.956327 | 5784.951477 | 5784.962077 | 5784.949226 |
| 12 | 50 | 5784.949497 | 5784.95064 | 5784.95585 | 5784.943344 |
| 10.2 | 20 | 5784.942953 | 5784.94589 | 5784.948871 | 5784.933513 |
| 13.8 | 20 | 5784.93789 | 5784.945689 | 5784.946467 | 5784.933238 |
| MHz | | -0.062110064 | -0.054310829 | -0.053533372 | -0.066762293 |
| PPM | | -10.73639823 | -9.388215892 | -9.253823981 | -11.54058654 |

## 5.4. Power Spectral Density

**Ambient condition**

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

**Method of Measurement**

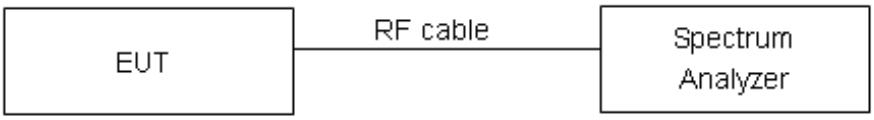
The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable.

Set RBW = 510 kHz, 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 transmittingantennas 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 | 17MHz |
| 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, $U$= 0.75dB.

**Test Results:**

**U-NII-1**

**MIMO without Beamforming**

| Network Standards | Channel/ Frequency (MHz) | Power Spectral Density | | | | | | | | | Limit (dBm/ MHz) | Conclusion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Antenna 1 | | Antenna 2 | | Antenna 3 | | Antenna 4 | | Total Power (dBm /MHz) | | |
| | | Read Value (dBm/ MHz) | PSD (dBm/ MHz) | Read Value (dBm/ MHz) | PSD (dBm/ MHz) | Read Value (dBm/ MHz) | PSD (dBm/ MHz) | Read Value (dBm/ MHz) | PSD (dBm/ MHz) | | | |
| 802.11a | 36/5180 | 6.71 | 6.92 | 6.72 | 6.94 | 7.42 | 7.63 | 5.38 | 5.59 | 12.85 | 12.98 | PASS |
| | 40/5200 | 6.76 | 6.97 | 6.53 | 6.75 | 7.26 | 7.47 | 5.47 | 5.68 | 12.79 | 12.98 | PASS |
| | 48/5240 | 6.43 | 6.65 | 6.66 | 6.88 | 7.11 | 7.32 | 5.45 | 5.66 | 12.69 | 12.98 | PASS |
| 802.11n HT20 | 36/5180 | 6.63 | 6.86 | 6.81 | 7.04 | 7.40 | 7.63 | 5.47 | 5.70 | 12.88 | 12.98 | PASS |
| | 40/5200 | 4.40 | 4.63 | 3.41 | 3.64 | 3.07 | 3.30 | 3.68 | 3.91 | 9.92 | 12.98 | PASS |
| | 48/5240 | 6.32 | 6.55 | 6.49 | 6.72 | 7.21 | 7.44 | 5.48 | 5.71 | 12.67 | 12.98 | PASS |
| 802.11n HT40 | 38/5190 | 0.47 | 0.92 | 0.17 | 0.62 | 0.36 | 0.81 | -0.84 | -0.39 | 6.54 | 12.98 | PASS |
| | 46/5230 | 6.83 | 7.29 | 5.90 | 6.36 | 6.06 | 6.52 | 4.84 | 5.30 | 12.44 | 12.98 | PASS |
| 802.11ac HT20 | 36/5180 | 6.74 | 6.74 | 6.83 | 6.83 | 7.30 | 7.30 | 5.50 | 5.50 | 12.66 | 12.98 | PASS |
| | 40/5200 | 6.53 | 6.53 | 6.53 | 6.53 | 7.07 | 7.07 | 5.48 | 5.48 | 12.46 | 12.98 | PASS |
| | 48/5240 | 6.20 | 6.20 | 6.62 | 6.62 | 7.27 | 7.27 | 5.59 | 5.59 | 12.49 | 12.98 | PASS |
| 802.11ac HT40 | 38/5190 | 3.25 | 3.39 | 2.44 | 2.58 | 2.73 | 2.87 | 2.21 | 2.35 | 8.84 | 12.98 | PASS |
| | 46/5230 | 7.13 | 7.27 | 6.35 | 6.49 | 6.34 | 6.48 | 5.04 | 5.18 | 12.44 | 12.98 | PASS |
| 802.11ac HT80 | 42/5210 | 0.703 | 0.85 | -0.26 | -0.11 | 0.43 | 0.58 | -0.32 | -0.17 | 6.33 | 12.98 | PASS |

Note: 1. Power Spectral Density =Read Value+Duty cycle correction factor

2. For Total PSD, according to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a),the power spectral density=10log($10^{(\text{PSD antenna1 in dBm/10})}$+$10^{(\text{PSD antenna2 in dBm/10})}$+$10^{(\text{PSD antenna3 in dBm/10})}$) +$10^{(\text{PSD antenna4 in dBm/10})}$)

3. The manufacturer declared the transmitter output signals is CDD mode And Nss=1. 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=4+10log（4/1)=10.02>6 dBi. So the PSD limt is 17-(directional gain-6 dBi) =17-(10.02-6) =12.98 dBm.

**U-NII-3**

**MIMO without Beamforming**

| Network Standards | Channel/ Frequency (MHz) | Power Spectral Density | | | | | | | | | Limit (dBm/ MHz) | Conclusion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Antenna 1 | | Antenna 2 | | Antenna 3 | | Antenna 4 | | Total Power (dBm /MHz) | | |
| | | Read Value (dBm/ MHz) | PSD (dBm/ MHz) | Read Value (dBm/ MHz) | PSD (dBm/ MHz) | Read Value (dBm/ MHz) | PSD (dBm/ MHz) | Read Value (dBm/ MHz) | PSD (dBm/ MHz) | | | |
| 802.11a | 149/5745 | 9.66 | 9.88 | 9.80 | 10.02 | 8.83 | 9.05 | 8.80 | 9.01 | 15.53 | 25.98 | PASS |
| | 157/5785 | 9.48 | 9.70 | 9.88 | 10.09 | 8.84 | 9.06 | 8.79 | 9.00 | 15.51 | 25.98 | PASS |
| | 165/5825 | 9.41 | 9.63 | 9.50 | 9.71 | 8.76 | 8.97 | 9.17 | 9.38 | 15.45 | 25.98 | PASS |
| 802.11n HT20 | 149/5745 | 9.51 | 9.74 | 9.42 | 9.65 | 9.19 | 9.42 | 8.04 | 8.27 | 15.33 | 25.98 | PASS |
| | 157/5785 | 9.39 | 9.62 | 9.45 | 9.68 | 8.70 | 8.93 | 8.65 | 8.88 | 15.31 | 25.98 | PASS |
| | 165/5825 | 9.62 | 9.85 | 9.79 | 10.02 | 9.09 | 9.32 | 9.15 | 9.38 | 15.67 | 25.98 | PASS |
| 802.11n HT40 | 151/5755 | 5.02 | 5.47 | 4.76 | 5.21 | 5.34 | 5.79 | 4.74 | 5.19 | 11.45 | 25.98 | PASS |
| | 159/5795 | 5.49 | 5.95 | 4.99 | 5.45 | 5.65 | 6.10 | 5.53 | 5.99 | 11.90 | 25.98 | PASS |
| 802.11ac HT20 | 149/5745 | 9.06 | 9.06 | 9.34 | 9.34 | 8.95 | 8.95 | 8.18 | 8.18 | 14.92 | 25.98 | PASS |
| | 157/5785 | 9.35 | 9.35 | 9.50 | 9.50 | 8.64 | 8.64 | 8.47 | 8.47 | 15.03 | 25.98 | PASS |
| | 165/5825 | 9.30 | 9.30 | 9.61 | 9.61 | 8.67 | 8.67 | 8.78 | 8.78 | 15.13 | 25.98 | PASS |
| 802.11ac HT40 | 151/5755 | 5.46 | 5.60 | 4.92 | 5.06 | 5.48 | 5.62 | 4.90 | 5.04 | 11.36 | 25.98 | PASS |
| | 159/5795 | 5.44 | 5.58 | 5.60 | 5.74 | 5.73 | 5.88 | 5.97 | 6.11 | 11.85 | 25.98 | PASS |
| 802.11ac HT80 | 155/5775 | 1.71 | 1.85 | 1.53 | 1.68 | 1.30 | 1.44 | 0.62 | 0.77 | 7.47 | 25.98 | PASS |

Note: 1. Power Spectral Density =Read Value+Duty cycle correction factor

2. For Total PSD, according to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a),the power spectral density=10log($10^{(\text{PSD antenna1 in dBm/10})}$+$10^{(\text{PSD antenna2 in dBm/10})}$+$10^{(\text{PSD antenna3 in dBm/10})}$) +$10^{(\text{PSD antenna4 in dBm/10})}$)

3. The manufacturer declared the transmitter output signals is CDD mode And Nss=1. 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=4+10log（4/1)=10.02>6 dBi. So the PSD limt is 30-(directional gain-6 dBi) =30-(10.02-6)=25.98 dBm.

**U-NII-1**

**MIMO with Beamforming**

| Network Standards | Channel/ Frequency (MHz) | Power Spectral Density | | | | | | | | | Limit (dBm /MHz) | Conclusion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ANT1 | | ANT2 | | ANT3 | | ANT 4 | | Total Power (dBm /MHz) | | |
| | | Read Value (dBm /MHz) | PSD (dBm /MHz) | Read Value (dBm /MHz) | PSD (dBm /MHz) | Read Value (dBm /MHz) | PSD (dBm /MHz) | Read Value (dBm /MHz) | PSD (dBm /MHz) | | | |
| 802.11n HT20 | 36/5180 | 6.87 | 7.10 | 6.21 | 6.44 | 6.91 | 7.14 | 5.82 | 6.05 | 12.73 | 12.98 | PASS |
| | 40/5200 | 6.88 | 7.11 | 6.07 | 6.30 | 6.78 | 7.01 | 5.80 | 6.03 | 12.66 | 12.98 | PASS |
| | 48/5240 | 6.60 | 6.83 | 6.37 | 6.60 | 6.96 | 7.19 | 6.10 | 6.33 | 12.77 | 12.98 | PASS |
| 802.11n HT40 | 38/5190 | 5.82 | 6.27 | 4.89 | 5.35 | 5.17 | 5.62 | 4.39 | 4.84 | 11.57 | 12.98 | PASS |
| | 46/5230 | 5.38 | 5.83 | 5.27 | 5.72 | 3.75 | 4.21 | 4.86 | 5.32 | 11.33 | 12.98 | PASS |
| 802.11ac HT20 | 36/5180 | 6.91 | 6.91 | 6.14 | 6.14 | 6.70 | 6.70 | 5.58 | 5.58 | 12.38 | 12.98 | PASS |
| | 40/5200 | 6.73 | 6.73 | 6.41 | 6.41 | 6.65 | 6.65 | 5.76 | 5.76 | 12.42 | 12.98 | PASS |
| | 48/5240 | 6.90 | 6.90 | 6.69 | 6.69 | 6.95 | 6.95 | 6.07 | 6.07 | 12.69 | 12.98 | PASS |
| 802.11ac HT40 | 38/5190 | 6.03 | 6.17 | 5.08 | 5.23 | 5.58 | 5.72 | 4.78 | 4.93 | 11.56 | 12.98 | PASS |
| | 46/5230 | 5.58 | 5.72 | 5.46 | 5.61 | 5.37 | 5.51 | 4.98 | 5.12 | 11.52 | 12.98 | PASS |
| 802.11ac HT80 | 42/5210 | 3.71 | 3.85 | 3.11 | 3.25 | 3.05 | 3.19 | 2.46 | 2.60 | 9.27 | 12.98 | PASS |

Note: 1. Power Spectral Density =Read Value+Duty cycle correction factor

2. For Total PSD, according to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a),the power spectral density=$10\log(10^{(\text{PSD antenna1 in dBm/10})}+10^{(\text{PSD antenna2 in dBm/10})}+10^{(\text{PSD antenna3 in dBm/10})}) +10^{(\text{PSD antenna4 in dBm/10})}$)

3. 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)=4+10log(4/1)=10.02>6 dBi.

So the PSD limt is 17-(directional gain-6 dBi) =17-(10.02-6) =12.98 dBm.

**U-NII-3**

**MIMO with Beamforming**

| Network Standards | Channel/ Frequency (MHz) | Power Spectral Density | | | | | | | | Total Power (dBm/ 500kHz) | Limit (dBm/ 500kHz) | Conclusion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Antenna 1 | | Antenna 2 | | Antenna 3 | | Antenna 4 | | | | |
| | | Read Value (dBm/ 500kHz) | PSD (dBm/ 500kHz) | Read Value (dBm/ 500kHz) | PSD (dBm/ 500kHz) | Read Value (dBm/ 500kHz) | PSD (dBm/ 500kHz) | Read Value (dBm/ 500kHz) | PSD (dBm/ 500kHz) | | | |
| 802.11n HT20 | 149/5745 | 5.27 | 5.50 | 5.43 | 5.66 | 5.24 | 5.47 | 4.81 | 5.04 | 11.44 | 25.98 | PASS |
| | 157/5785 | 5.42 | 5.65 | 5.47 | 5.70 | 5.46 | 5.69 | 4.98 | 5.21 | 11.59 | 25.98 | PASS |
| | 165/5825 | 5.42 | 5.65 | 5.46 | 5.69 | 4.90 | 5.13 | 5.32 | 5.55 | 11.53 | 25.98 | PASS |
| 802.11n HT40 | 151/5755 | 2.19 | 2.65 | 2.04 | 2.49 | 2.80 | 3.25 | 2.27 | 2.73 | 8.81 | 25.98 | PASS |
| | 159/5795 | 2.74 | 3.20 | 2.19 | 2.64 | 2.47 | 2.92 | 2.57 | 3.02 | 8.97 | 25.98 | PASS |
| 802.11ac HT20 | 149/5745 | 5.34 | 5.34 | 5.52 | 5.52 | 5.55 | 5.55 | 4.82 | 4.82 | 11.34 | 25.98 | PASS |
| | 157/5785 | 5.26 | 5.26 | 5.41 | 5.41 | 5.27 | 5.27 | 5.38 | 5.38 | 11.35 | 25.98 | PASS |
| | 165/5825 | 5.51 | 5.51 | 5.46 | 5.46 | 5.25 | 5.25 | 5.63 | 5.63 | 11.48 | 25.98 | PASS |
| 802.11ac HT40 | 151/5755 | 2.32 | 2.47 | 2.12 | 2.26 | 2.75 | 2.89 | 1.46 | 1.61 | 8.35 | 25.98 | PASS |
| | 159/5795 | 2.49 | 2.63 | 2.34 | 2.49 | 2.60 | 2.74 | 2.70 | 2.84 | 8.70 | 25.98 | PASS |
| 802.11ac HT80 | 155/5775 | -0.98 | -0.83 | -1.11 | -0.96 | -1.12 | -0.98 | -1.42 | -1.28 | 5.01 | 25.98 | PASS |

Note: 1. Power Spectral Density =Read Value+Duty cycle correction factor

2. For Total PSD, according to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a),the power spectral density=$10\log(10^{(\text{PSD antenna1 in dBm/10})}+10^{(\text{PSD antenna2 in dBm/10})}+10^{(\text{PSD antenna3 in dBm/10})}) +10^{(\text{PSD antenna4 in dBm/10})})$

3. 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)=4+10log(4/1)=10.02>6 dBi. So the PSD limt is 30-(directional gain-6 dBi) =30-(10.02-6) =25.98 dBm.

## MIMO without Beamforming

### Antenna 1

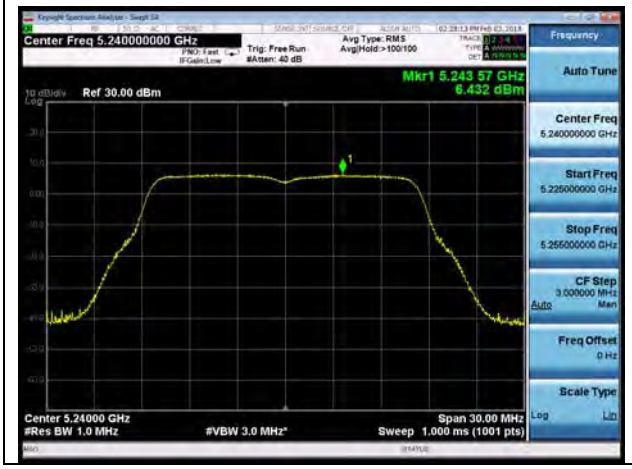
U-NII-1, 802.11a, Channel No.: 36


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


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

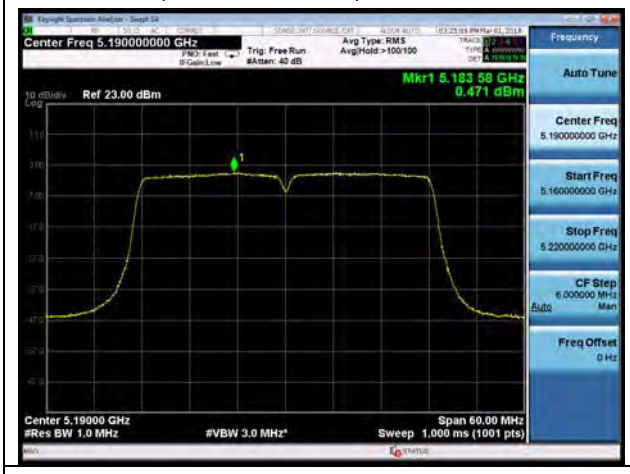

U-NII-1, 802.11n HT20, Channel No.: 40


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



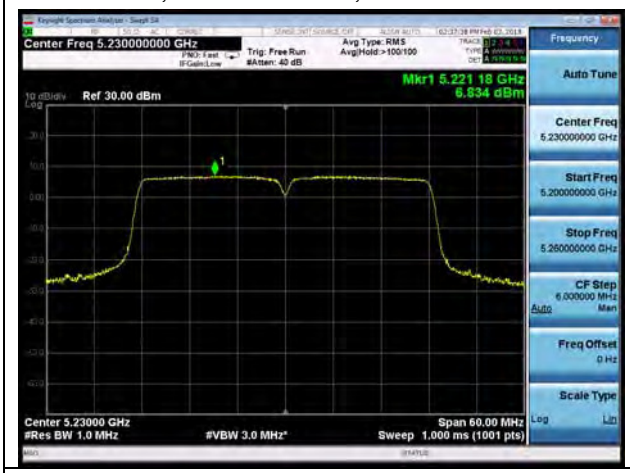

U-NII-1, 802.11n HT20, Channel No.: 48

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




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


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



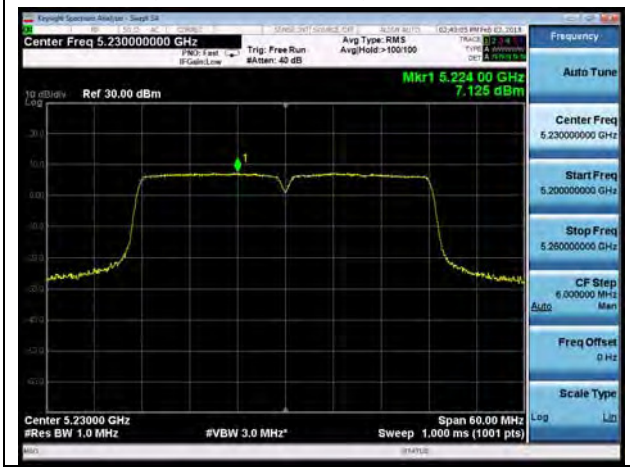

U-NII-1, 802.11ac HT20, Channel No.: 40


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

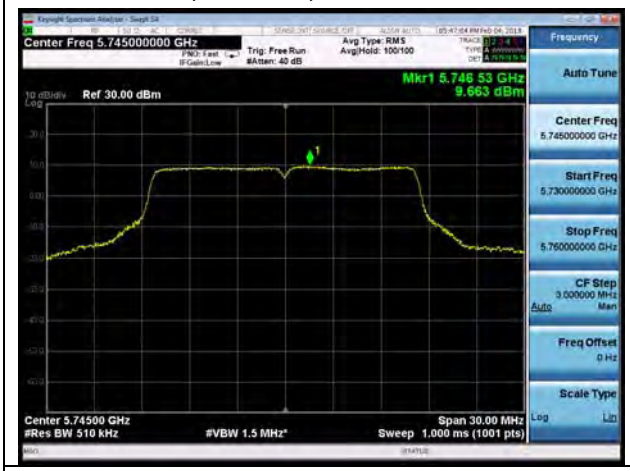
U-NII-1, 802.11ac HT40, Channel No.: 38


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


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

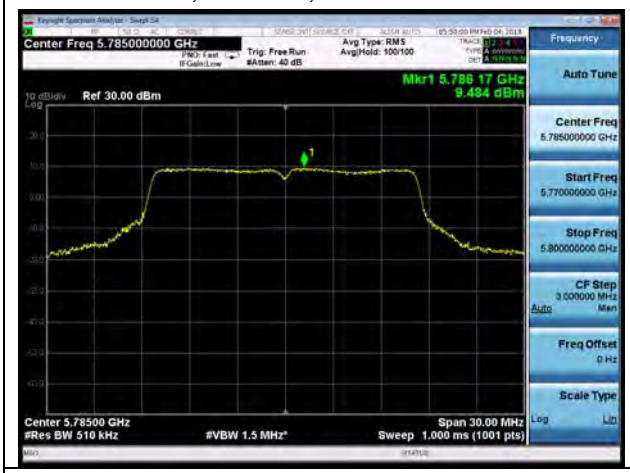


U-NII-3, 802.11a, Channel No.: 149



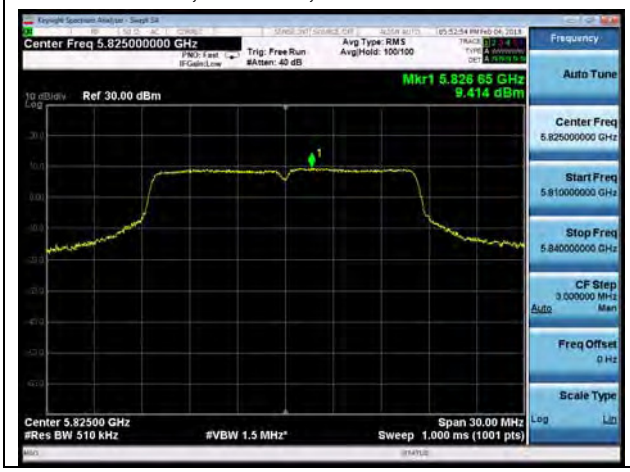

U-NII-3, 802.11n HT20, Channel No.: 149


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



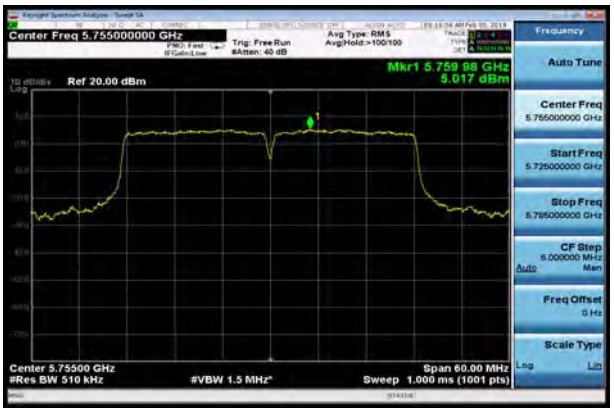

U-NII-3, 802.11n HT20, Channel No.: 157


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




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

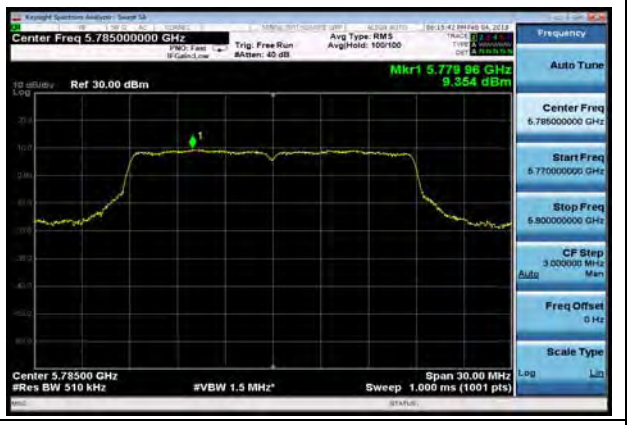
U-NII-3, 802.11n HT40, Channel No.: 151




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

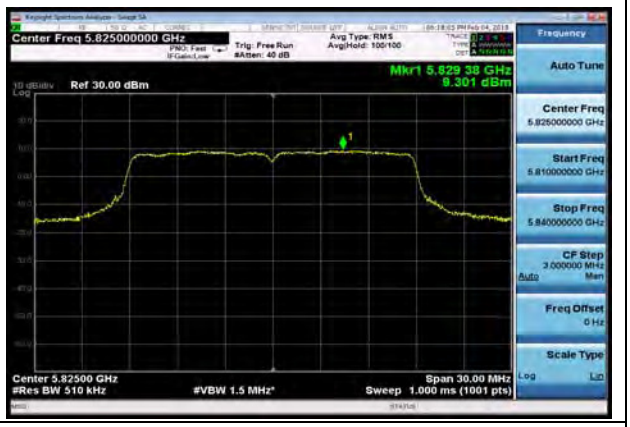

U-NII-3, 802.11n HT40, Channel No.: 159


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




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


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

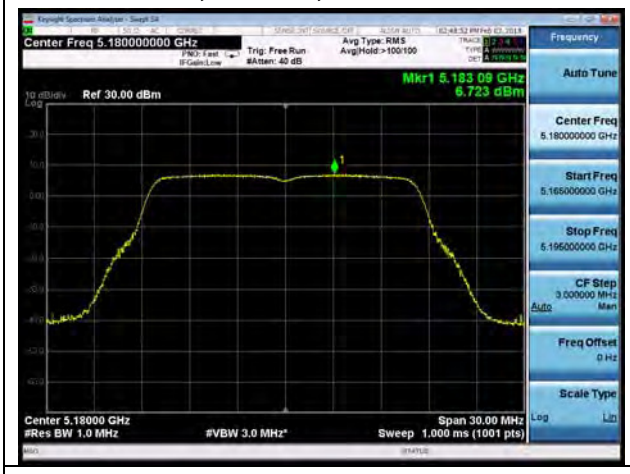



U-NII-3, 802.11ac HT40, Channel No.: 159


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

## Antenna 2

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

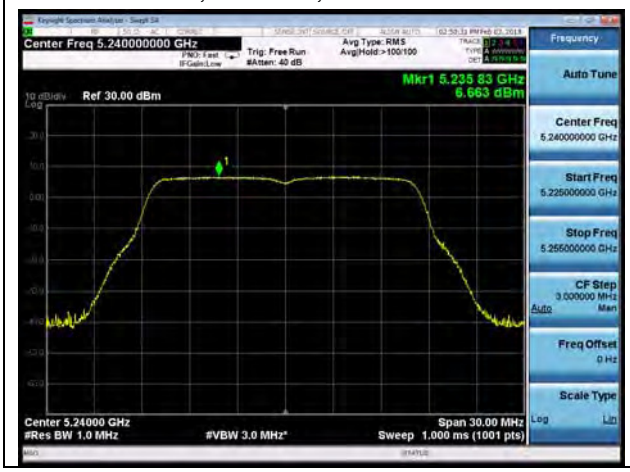



U-NII-1, 802.11n HT20, Channel No.: 36


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

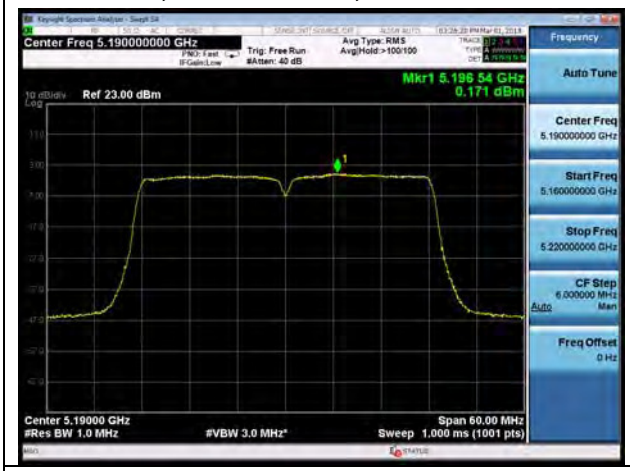

U-NII-1, 802.11n HT20, Channel No.: 40


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



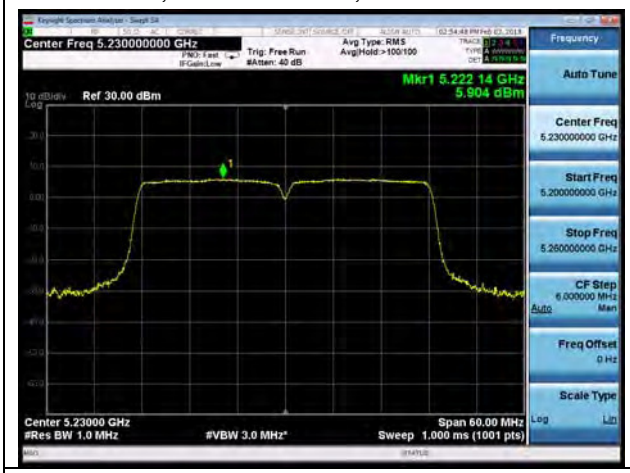

U-NII-1, 802.11n HT20, Channel No.: 48

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




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

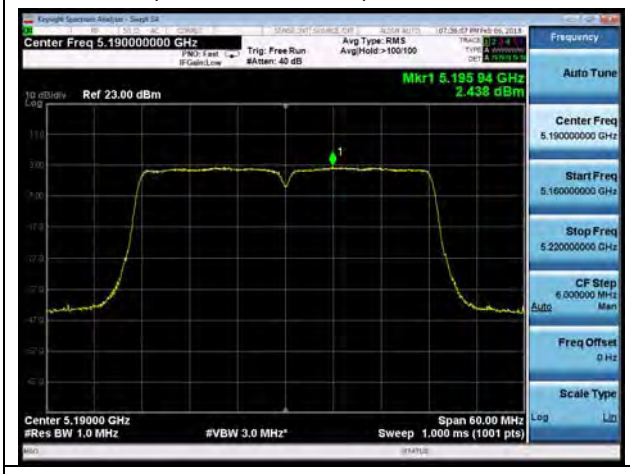

U-NII-1, 802.11n HT40, Channel No.: 46




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

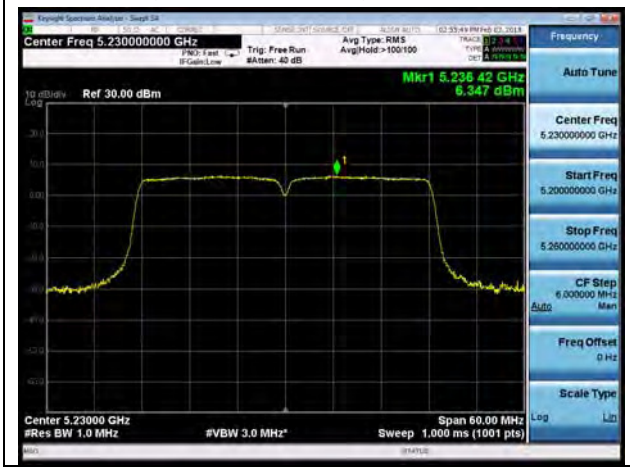

U-NII-1, 802.11ac HT20, Channel No.: 48

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

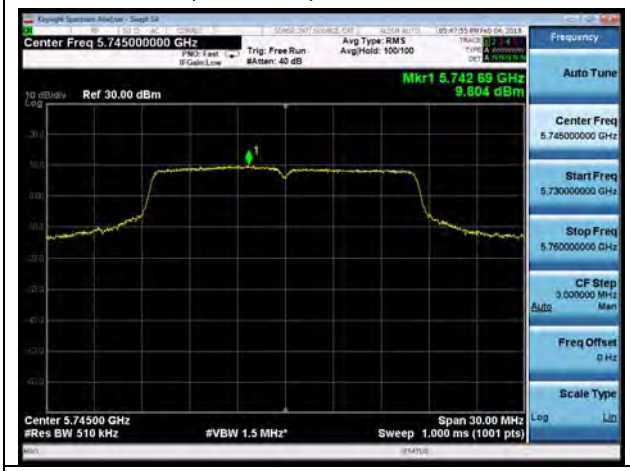



U-NII-1, 802.11ac HT80, Channel No.: 42


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

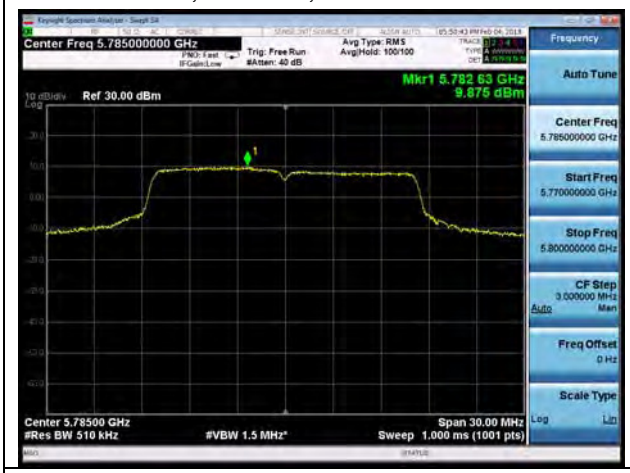


U-NII-3, 802.11a, Channel No.: 149



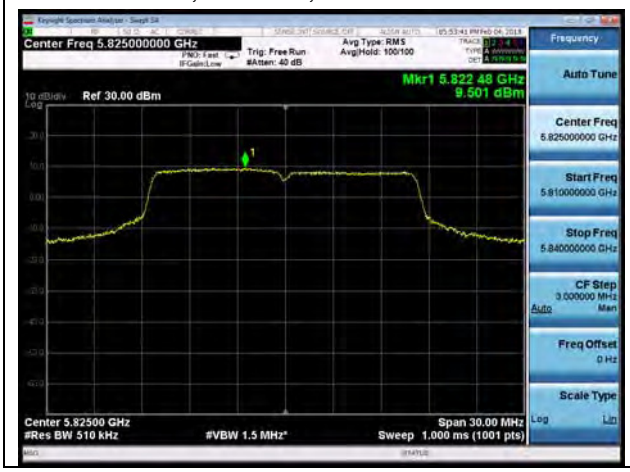

U-NII-3, 802.11n HT20, Channel No.: 149


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




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


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




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

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

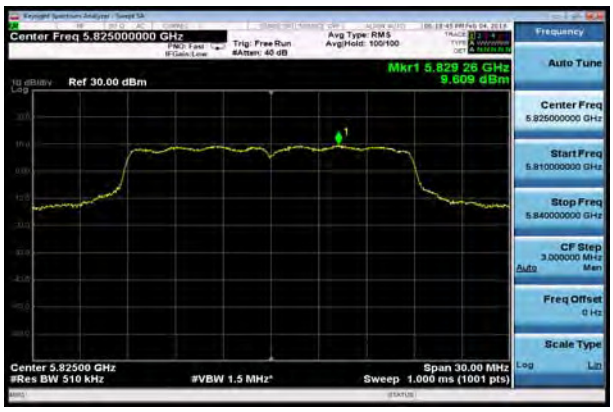

U-NII-3, 802.11ac HT20, Channel No.: 149


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


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


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


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




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

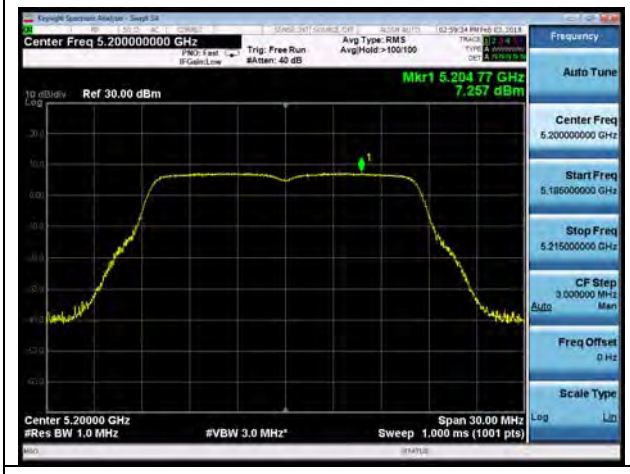

U-NII-3, 802.11ac HT80, Channel No.: 155

## Antenna 3

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

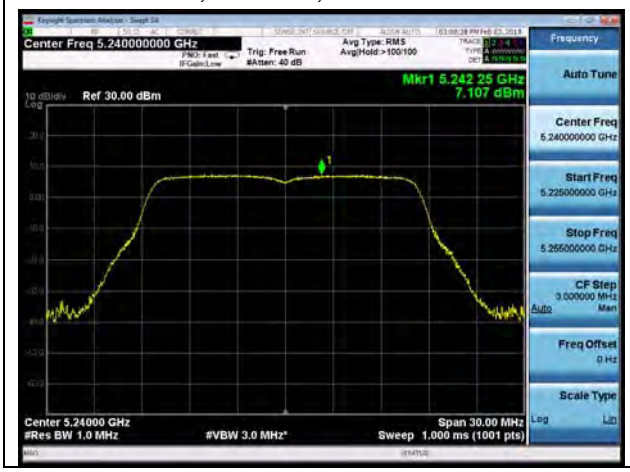

U-NII-1, 802.11n HT20, Channel No.: 36


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



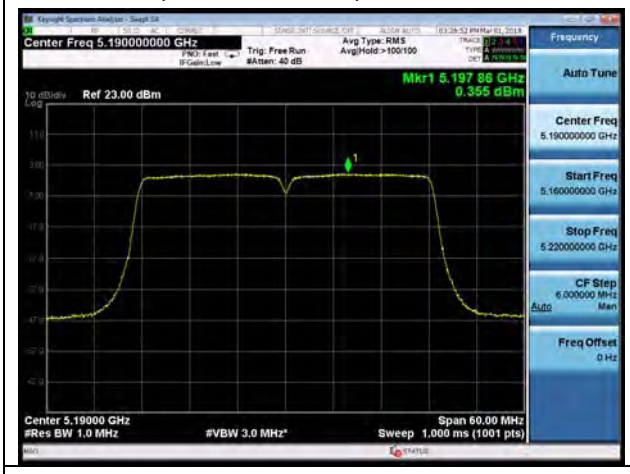

U-NII-1, 802.11n HT20, Channel No.: 40


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



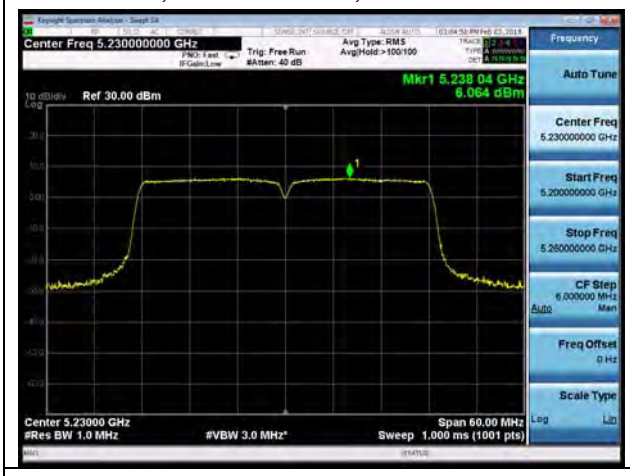

U-NII-1, 802.11n HT20, Channel No.: 48

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




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

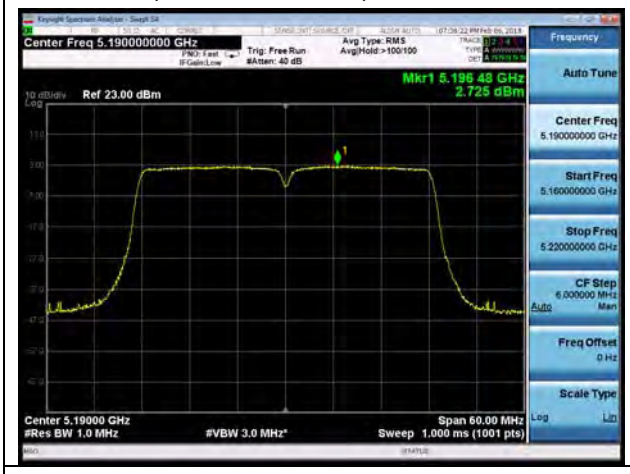

U-NII-1, 802.11n HT40, Channel No.: 46




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

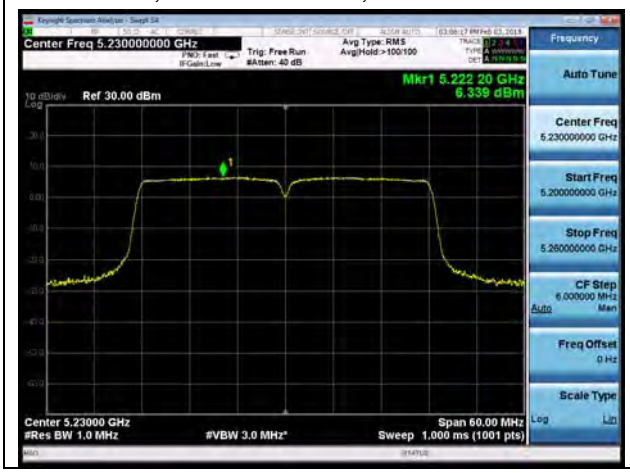

U-NII-1, 802.11ac HT20, Channel No.: 48

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




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


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



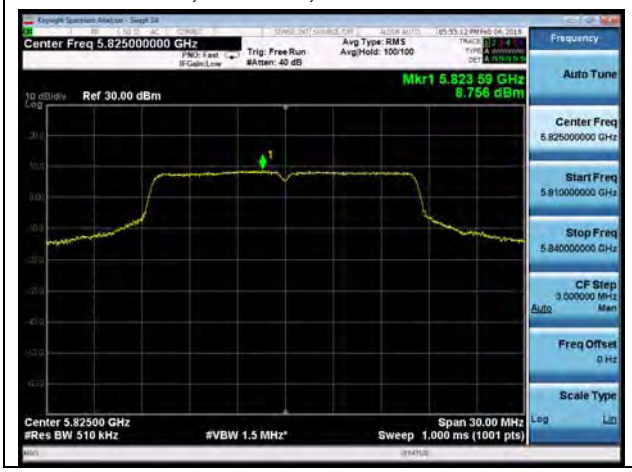
U-NII-3, 802.11a, Channel No.: 149


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


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

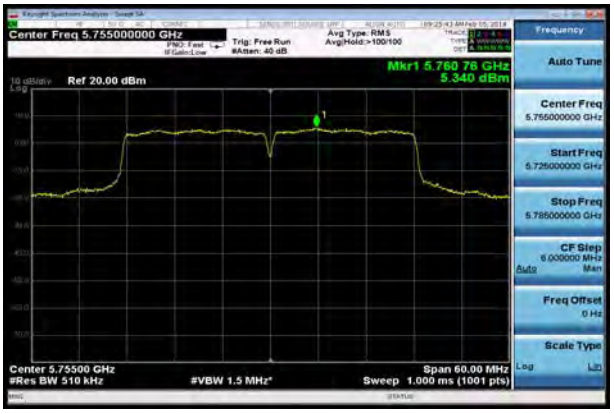

U-NII-3, 802.11n HT20, Channel No.: 157


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




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

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

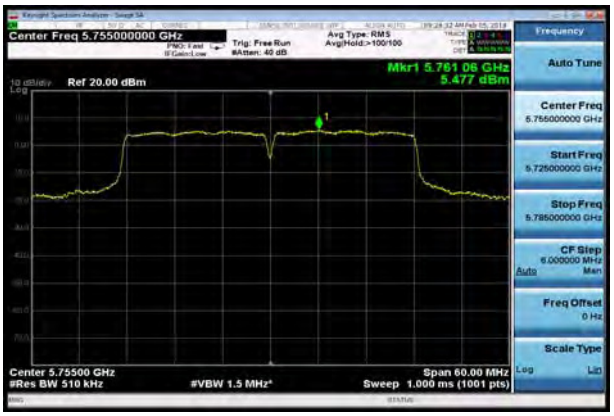



U-NII-3, 802.11ac HT20, Channel No.: 149


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


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


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




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


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


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

## Antenna 4

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


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

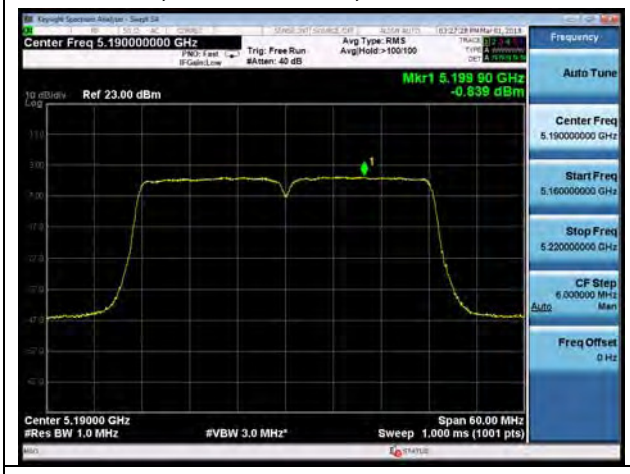

U-NII-1, 802.11a, Channel No.: 40


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


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

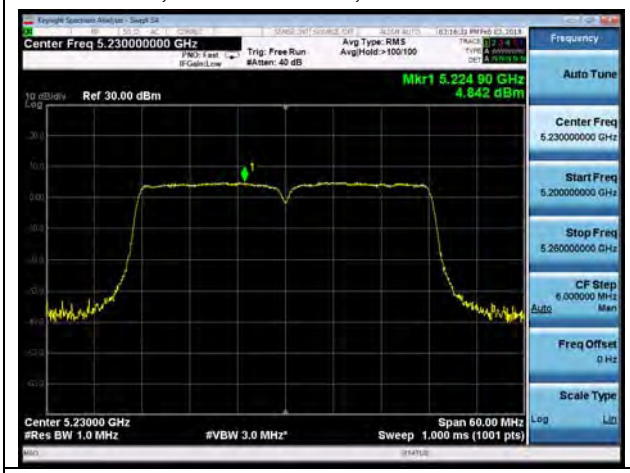

U-NII-1, 802.11n HT20, Channel No.: 48

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




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

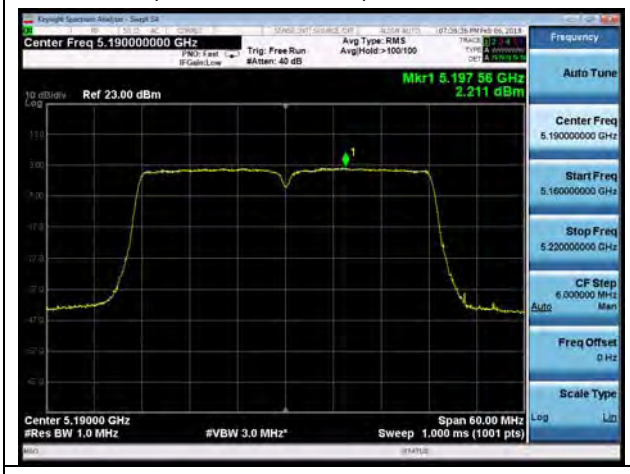

U-NII-1, 802.11n HT40, Channel No.: 46




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

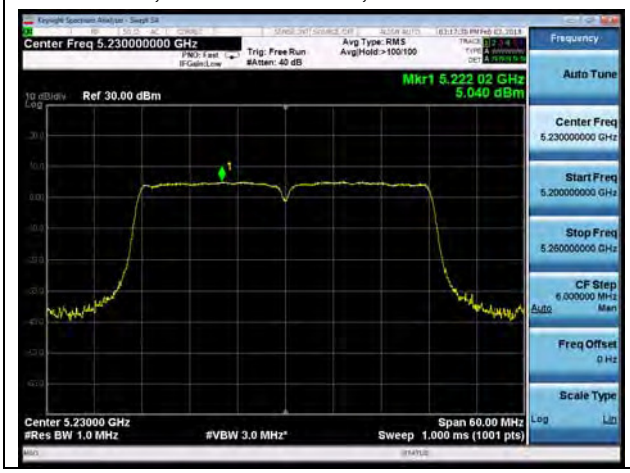

U-NII-1, 802.11ac HT20, Channel No.: 48

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

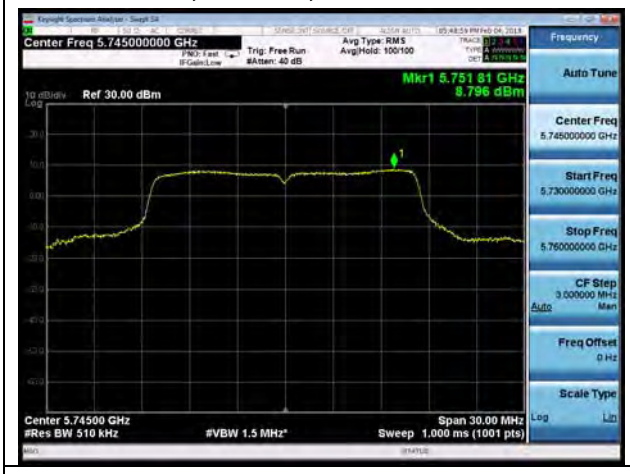



U-NII-1, 802.11ac HT80, Channel No.: 42


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

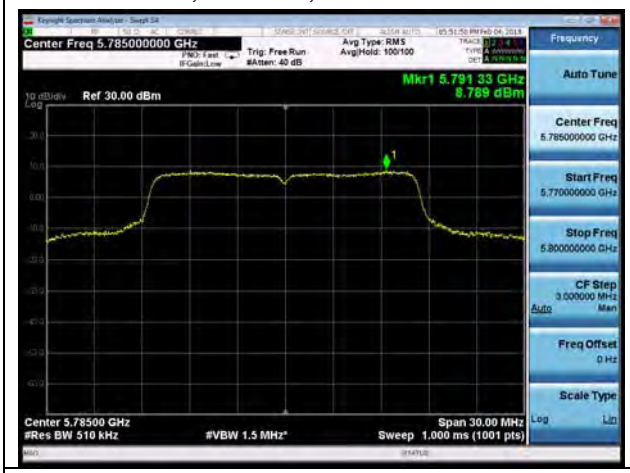


U-NII-3, 802.11a, Channel No.: 149



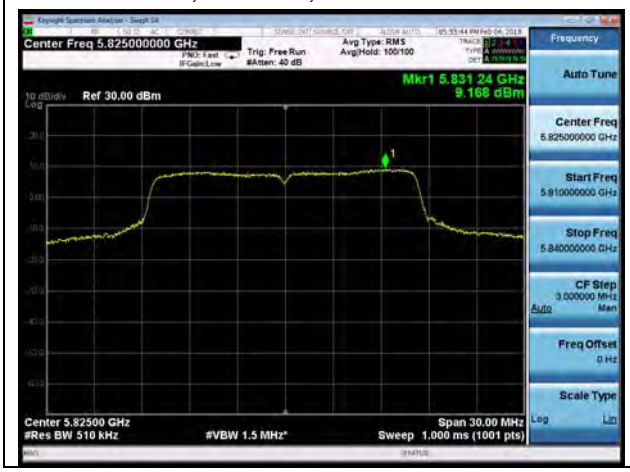

U-NII-3, 802.11n HT20, Channel No.: 149


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




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


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



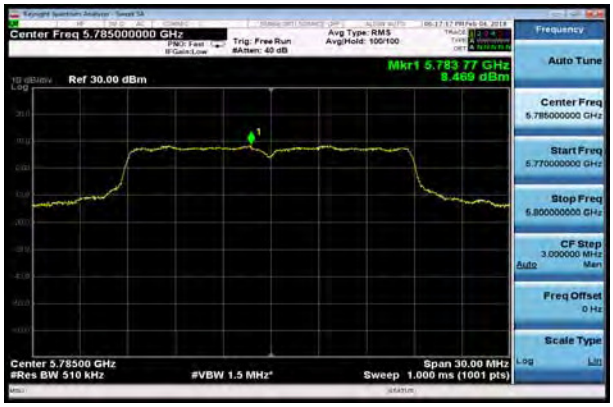

U-NII-3, 802.11n HT20, Channel No.: 165

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


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


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


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




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


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


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


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

## MIMO with Beamforming

### 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 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

## 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

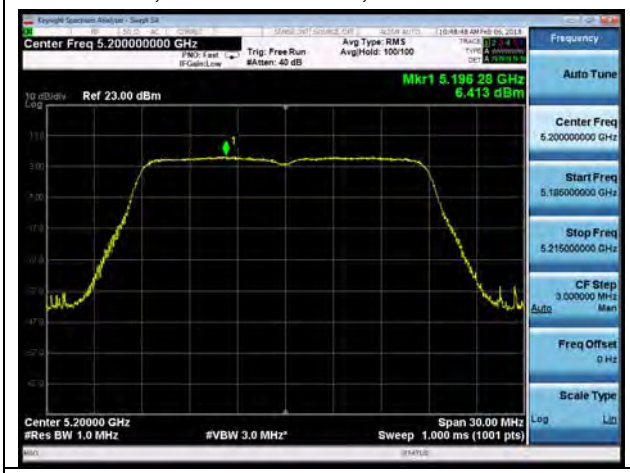

U-NII-1, 802.11n HT40, Channel No.: 46


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

U-NII-1, 802.11ac 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

## 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

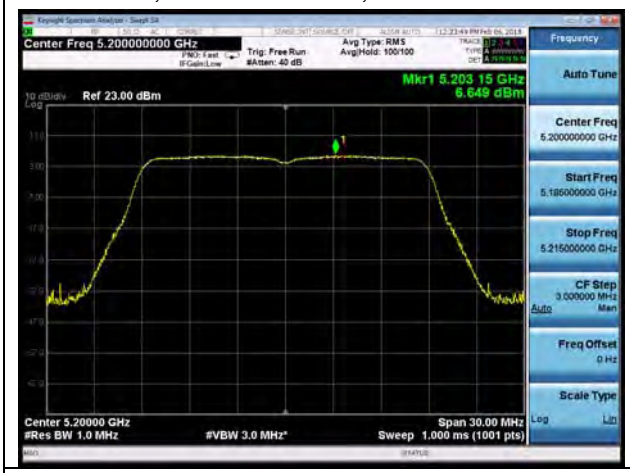

U-NII-1, 802.11n HT40, Channel No.: 46


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

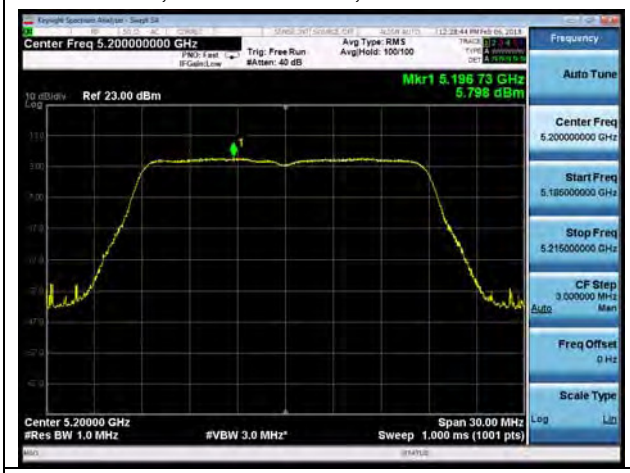

U-NII-3, 802.11ac HT80, Channel No.: 155

## 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



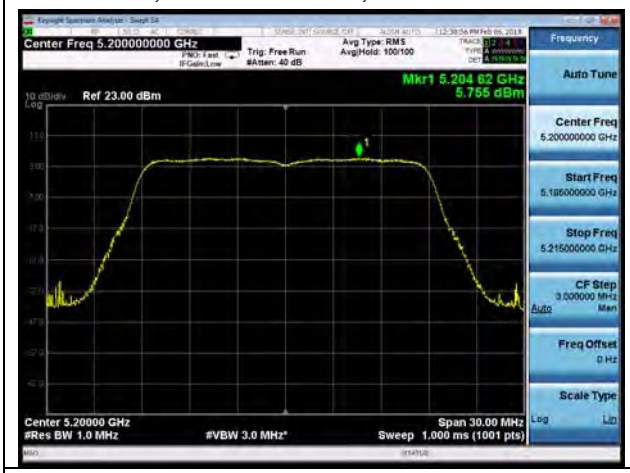

U-NII-1, 802.11n HT40, Channel No.: 46


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

## 5.5. Unwanted Emission

**Ambient condition**

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

**Method of Measurement**

The test set-up was made in accordance to the general provisions of ANSI C63.10-2013. The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna. The radiated emissions measurements were made in a typical installation configuration.
Sweep the whole frequency band range from 9kHz to the 10th harmonic of the carrier, and the emissions less than 20 dB below the permissible value are reported.

During the test, the height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. The turntable shall be rotated from 0 to 360 degrees for detecting the maximum of radiated spurious signal level. The measurements shall be repeated with orthogonal polarization of the test antenna. The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing.
Set the spectrum analyzer in the following:
Below 1GHz (detector: Peak and Quasi-Peak)
RBW=100kHz / VBW=300kHz / Sweep=AUTO
Above 1GHz (detector: Peak):
I) Peak emission levels are measured by setting the instrument as follows:
1) RBW = 1 MHz.
2) VBW ≥ [3 × RBW]
3) Detector = peak.
4) Sweep time = auto.
5) Trace mode = max hold.
6) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, then the time required for the trace to stabilize will increase by a factor of approximately 1 / D, where D is the duty cycle.

II) Average emission levels are measured by setting the instrument as follows:
a) RBW = 1 MHz.
b) VBW ≥ [3 × RBW].
c) Detector = RMS (power averaging), if [span / (# of points in sweep)] ≤ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)

e) Sweep time = auto.

f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)

g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.

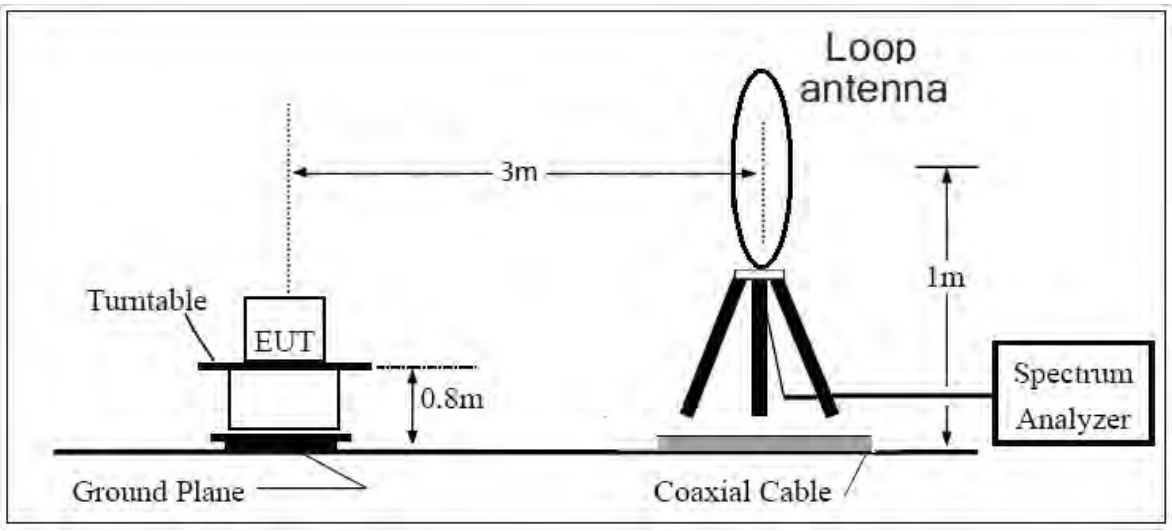
2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.

3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

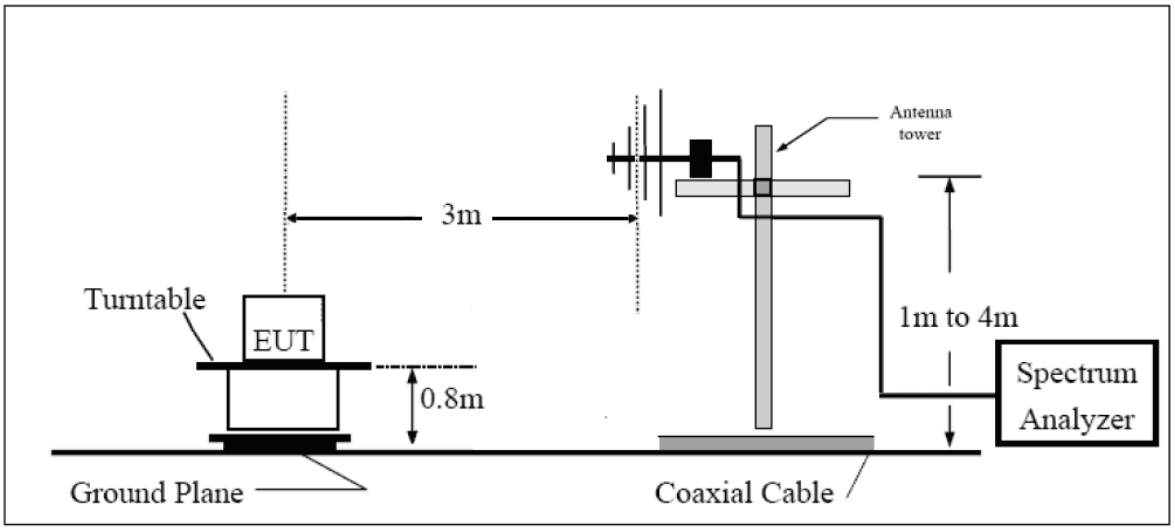
The field strength of spurious emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the antenna is vertical.

The test is in transmitting mode.

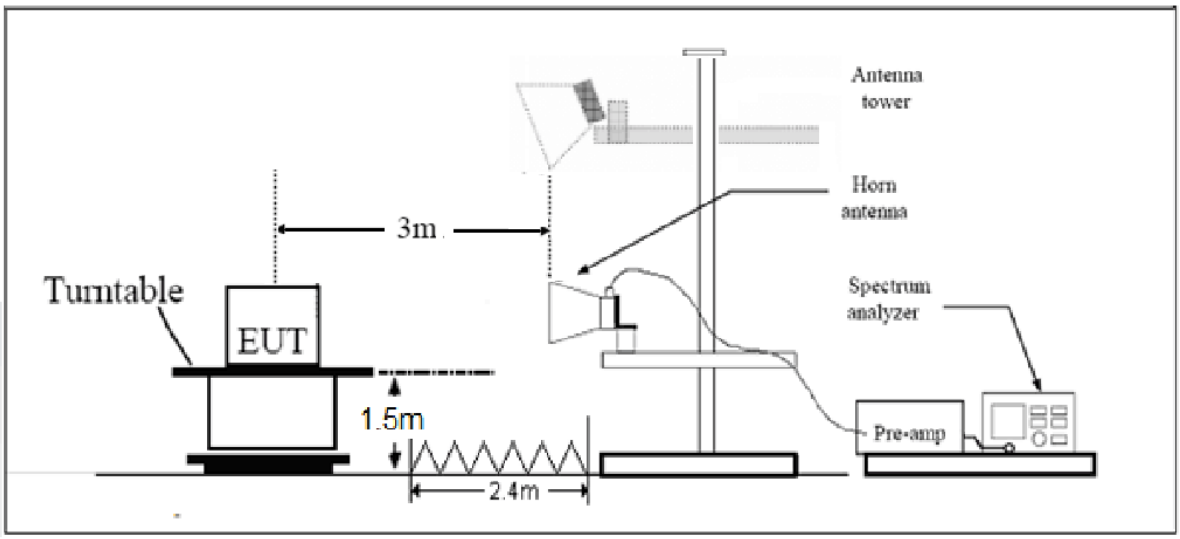
**9KHz~~~30MHz**




**30MHz~~~ 1GHz**




**Above 1GHz**




Note: Area side:2.4mX3.6m

**Limits**

(1) For transmitters operating in the 5725-5850 MHz band: All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(2) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz(68.2dBμV/m).

(3) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz(68.2dBμV/m).

(4) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz(68.2dBμV/m).

Note: the following formula is used to convert the EIRP to field strength

§1、E[dBμV/m] = EIRP[dBm] - 20 log(d[meters]) + 104.77, where E = field strength and

d = distance at which field strength limit is specified in the rules;

§2、E[dBμV/m] = EIRP[dBm] + 95.2, for d = 3 meters

(5) Unwanted spurious emissions fallen in restricted bands per FCC Part15.205 shall comply with the general field strength limits set forth in § 15.209 as below table.

| Frequency of emission (MHz) | Field strength(uV/m) | Field strength(dBuV/m) |
|---|---|---|
| 0.009–0.490 | 2400/F(kHz) | / |
| 0.490–1.705 | 24000/F(kHz) | / |
| 1.705–30.0 | 30 | / |
| 30-88 | 100 | 40 |
| 88-216 | 150 | 43.5 |
| 216-960 | 200 | 46 |
| Above960 | 500 | 54 |

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090 - 0.110 | 16.42 - 16.423 | 399.9 - 410 | 4.5 - 5.15 |
| [1]0.495 - 0.505 | 16.69475 - 16.69525 | 608 - 614 | 5.35 - 5.46 |
| 2.1735 - 2.1905 | 16.80425 - 16.80475 | 960 - 1240 | 7.25 - 7.75 |
| 4.125 - 4.128 | 25.5 - 25.67 | 1300 - 1427 | 8.025 - 8.5 |
| 4.17725 - 4.17775 | 37.5 - 38.25 | 1435 - 1626.5 | 9.0 - 9.2 |
| 4.20725 - 4.20775 | 73 - 74.6 | 1645.5 - 1646.5 | 9.3 - 9.5 |
| 6.215 - 6.218 | 74.8 - 75.2 | 1660 - 1710 | 10.6 - 12.7 |
| 6.26775 - 6.26825 | 108 - 121.94 | 1718.8 - 1722.2 | 13.25 - 13.4 |
| 6.31175 - 6.31225 | 123 - 138 | 2200 - 2300 | 14.47 - 14.5 |
| 8.291 - 8.294 | 149.9 - 150.05 | 2310 - 2390 | 15.35 - 16.2 |
| 8.362 - 8.366 | 156.52475 - 156.52525 | 2483.5 - 2500 | 17.7 - 21.4 |
| 8.37625 - 8.38675 | 156.7 - 156.9 | 2690 - 2900 | 22.01 - 23.12 |
| 8.41425 - 8.41475 | 162.0125 - 167.17 | 3260 - 3267 | 23.6 - 24.0 |
| 12.29 - 12.293 | 167.72 - 173.2 | 3332 - 3339 | 31.2 - 31.8 |
| 12.51975 - 12.52025 | 240 - 285 | 3345.8 - 3358 | 36.43 - 36.5 |
| 12.57675 - 12.57725 | 322 - 335.4 | 3600 - 4400 | ([2]) |
| 13.36 - 13.41 | | | |

**Measurement Uncertainty**

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k$ = 1.96.

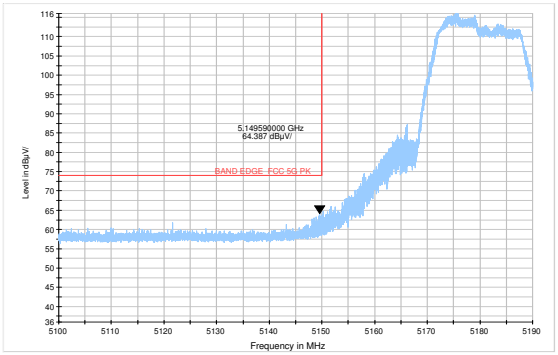
| Frequency | Uncertainty |
|---|---|
| 9KHz-30MHz | 3.55 dB |
| 30MHz-200MHz | 4.19 dB |
| 200MHz-1GHz | 3.63 dB |
| 1GHz-26.5G | 3.68 dB |
| 26.5G-40GHz | 4.76dB |

## Test Results:

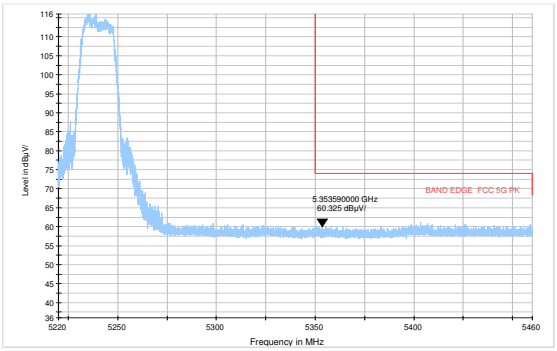
**The signal beyond the limit is carrier.**

**U-NII-1**

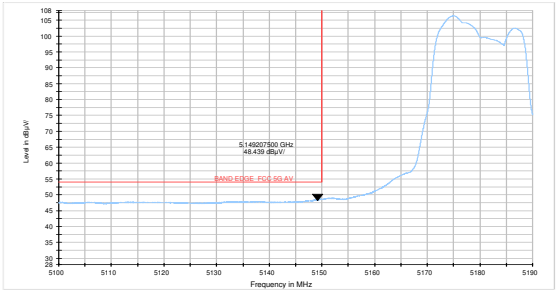
### 802.11a-Channel 36: Peak



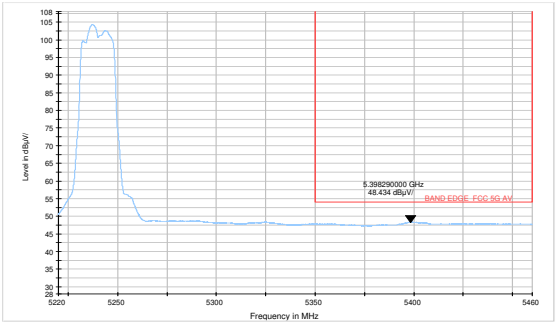

### 802.11a-Channel 48: Peak



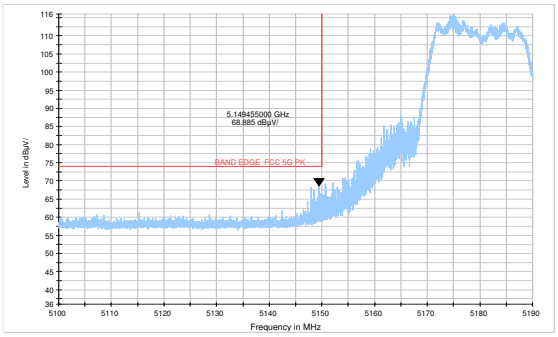

### 802.11a-Channel 36: Average



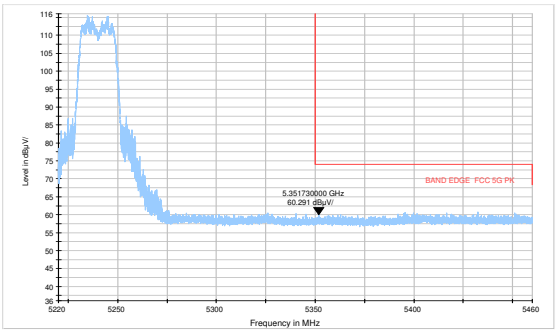

### 802.11a-Channel 48: Average



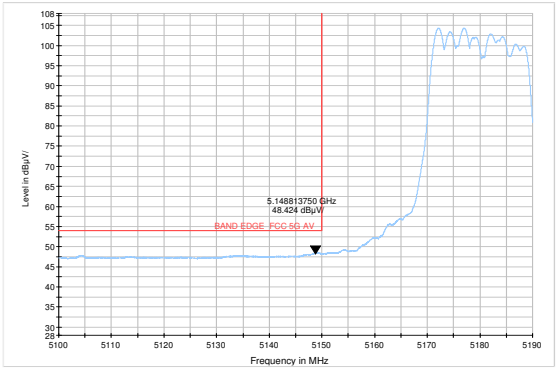

### 802.11n HT20-Channel 36: Peak



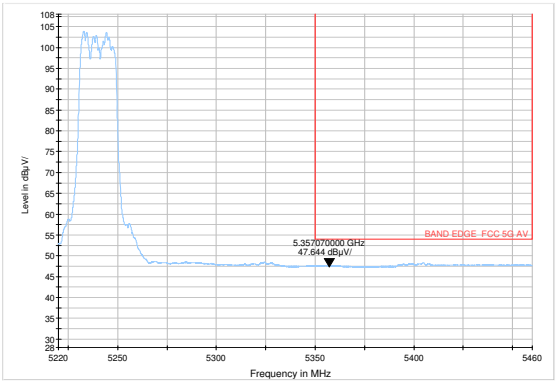

### 802.11n HT20-Channel 48: Peak



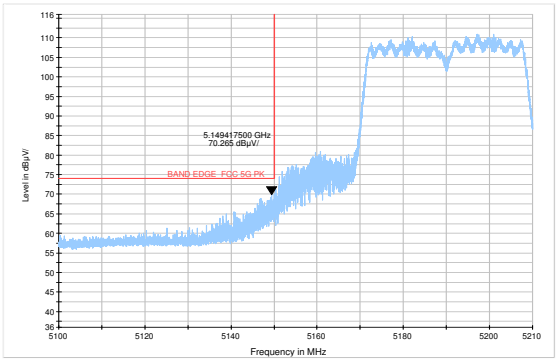

### 802.11n HT20-Channel 36: Average



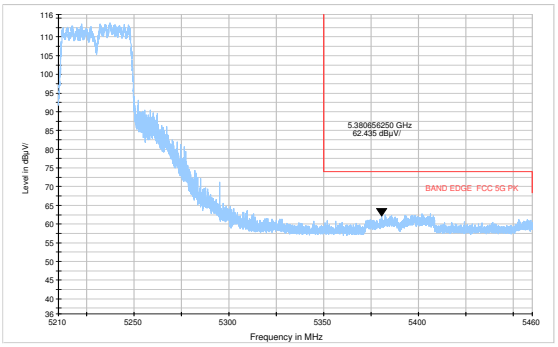

### 802.11n HT20-Channel 48: Average



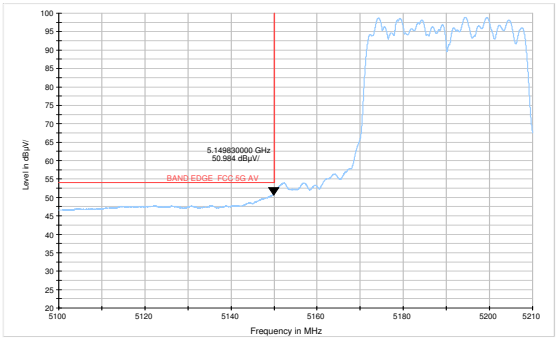
## 802.11n HT40-Channel 38: Peak



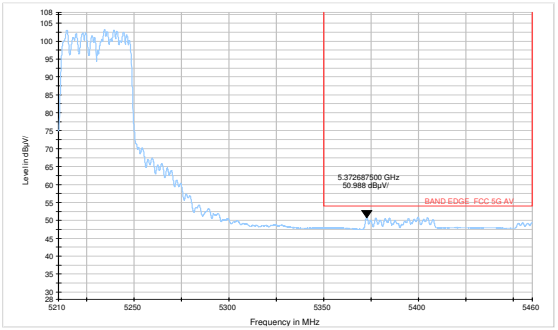

## 802.11n HT40-Channel 46: Peak



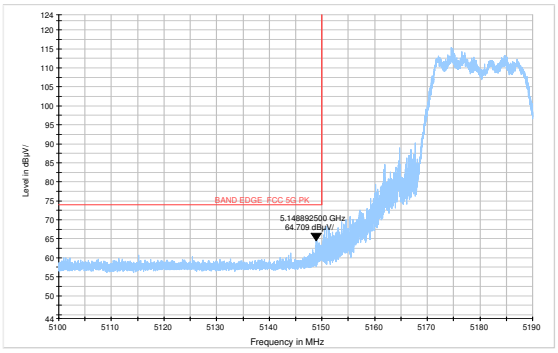

## 802.11n HT40-Channel 38: Average



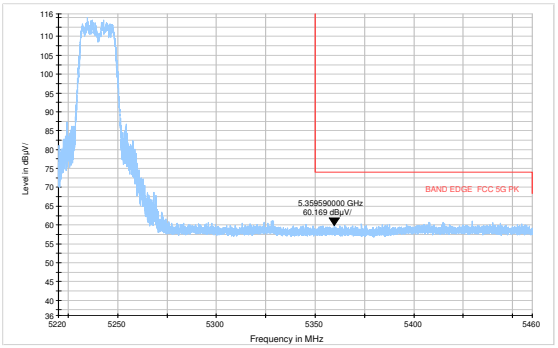

## 802.11n HT40-Channel 46: Average



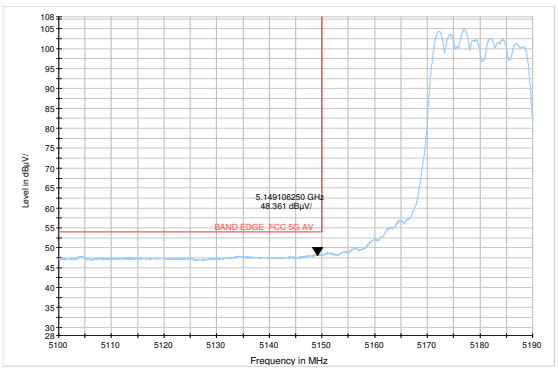

## 802.11ac HT20 -Channel 36: Peak



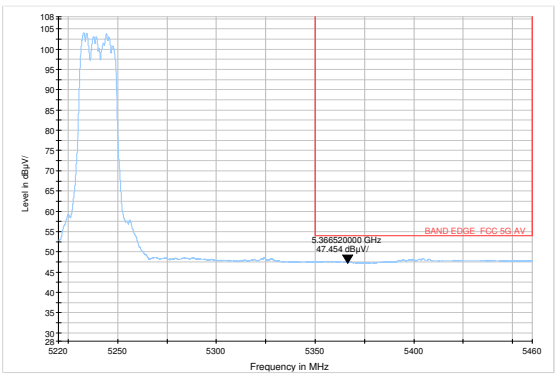

## 802.11ac HT20 -Channel 48: Peak



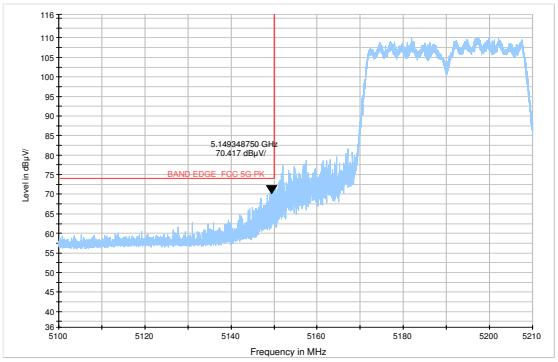

## 802.11ac HT20-Channel 36: Average



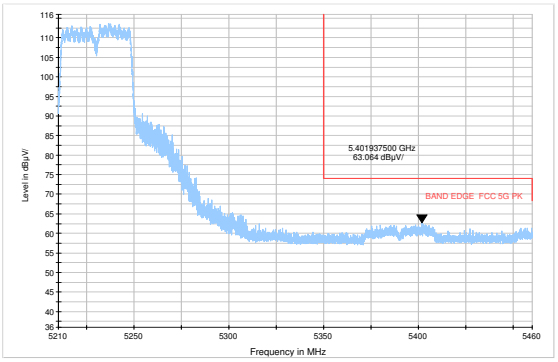

## 802.11ac HT20 -Channel 48: Average



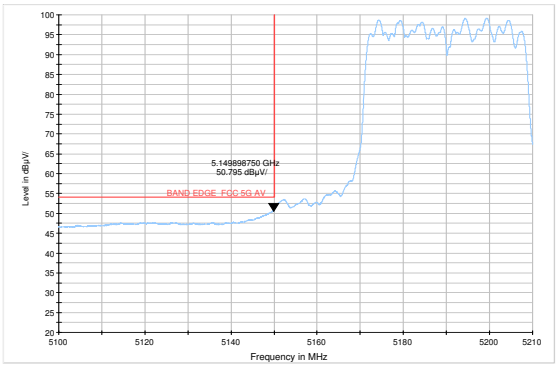
## 802.11ac HT40-Channel 38: Peak



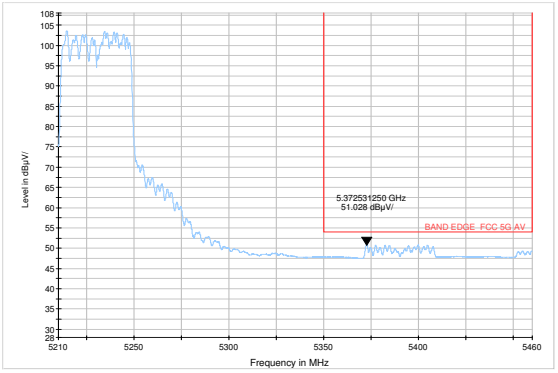

## 802.11ac HT40-Channel 46: Peak



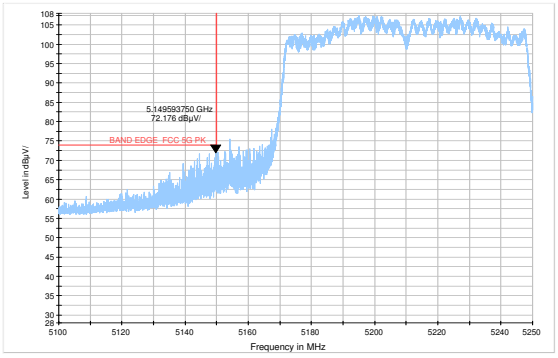

## 802.11ac HT40-Channel 38: Average



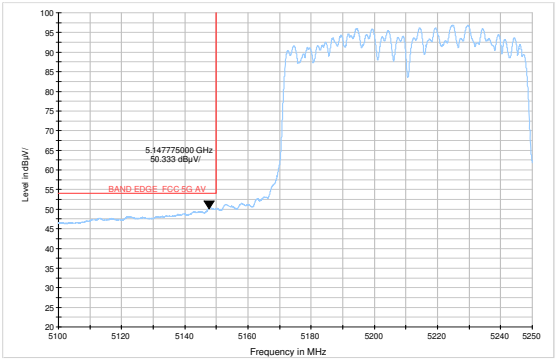

## 802.11ac HT40-Channel 46: Average




## 802.11ac HT80 –Channel 42: Peak

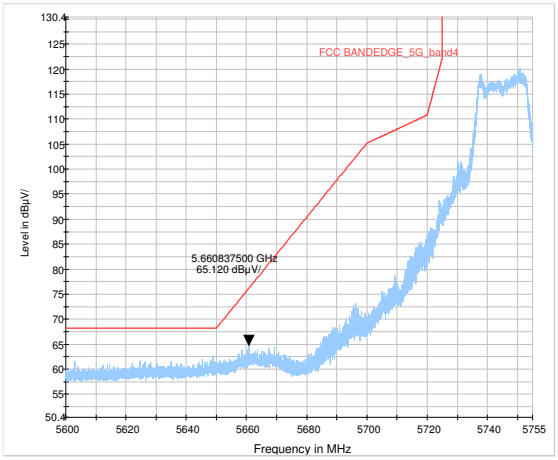



## 802.11ac HT80- Channel 42: Average

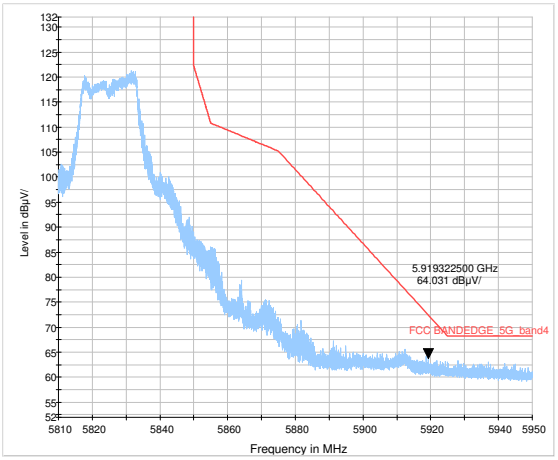


## U-NII-3

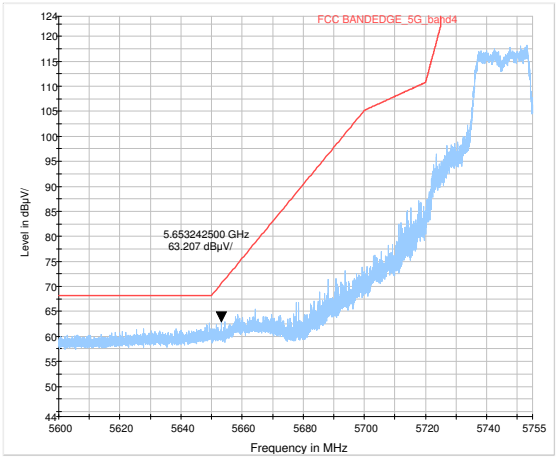
### 802.11a-Channel 149: Peak



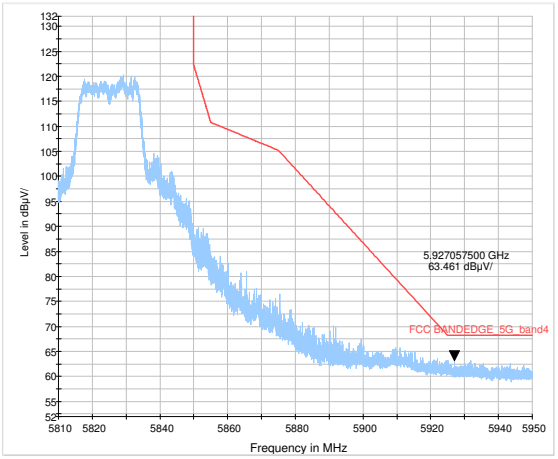

### 802.11a-Channel 165: Peak



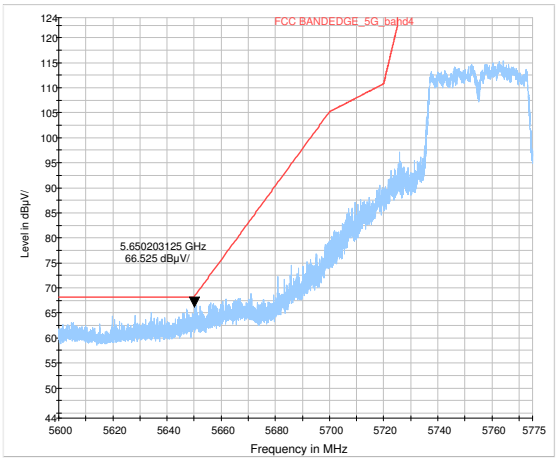

### 802.11n HT20-Channel 149: Peak



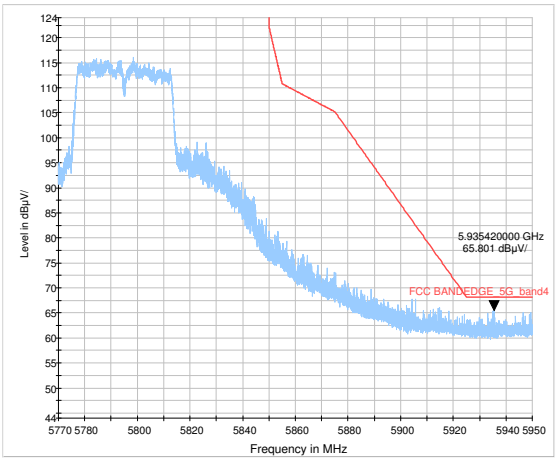

### 802.11n HT20-Channel 165: Peak



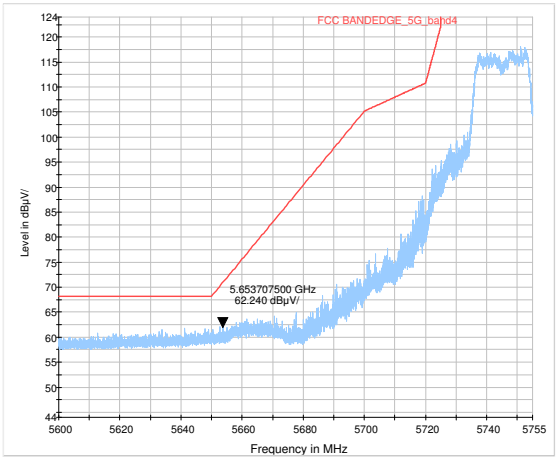

### 802.11n HT40-Channel 151: Peak



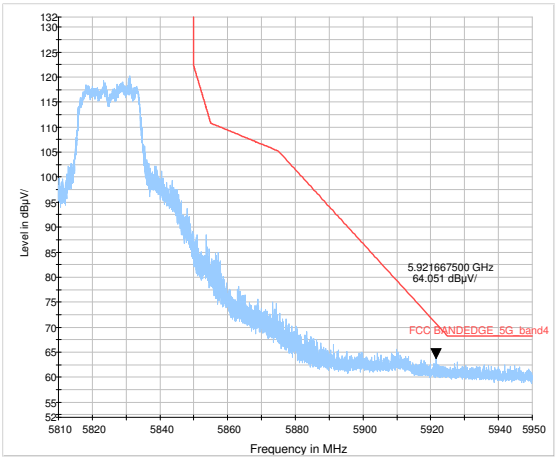

### 802.11n HT40-Channel 159: Peak



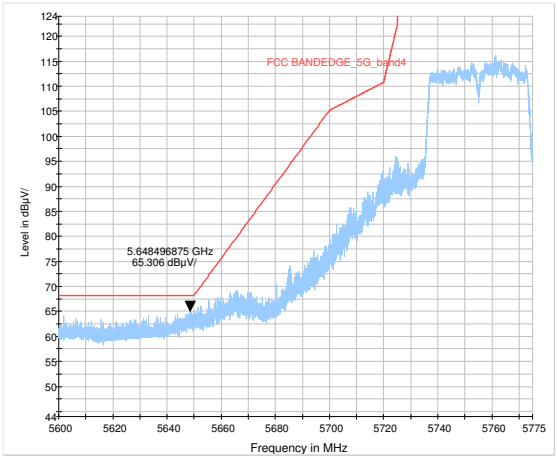
## 802.11ac HT20-Channel 149: Peak



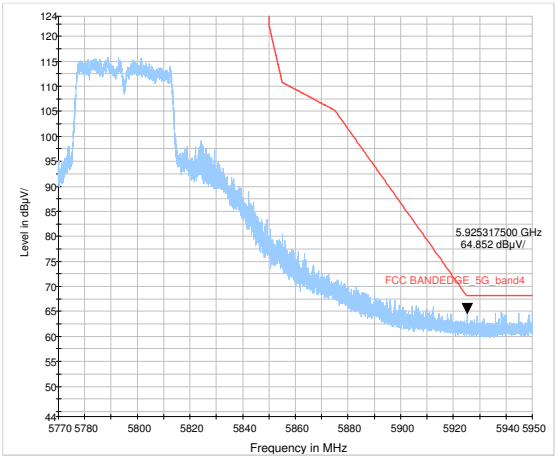

## 802.11ac HT20-Channel 165: Peak



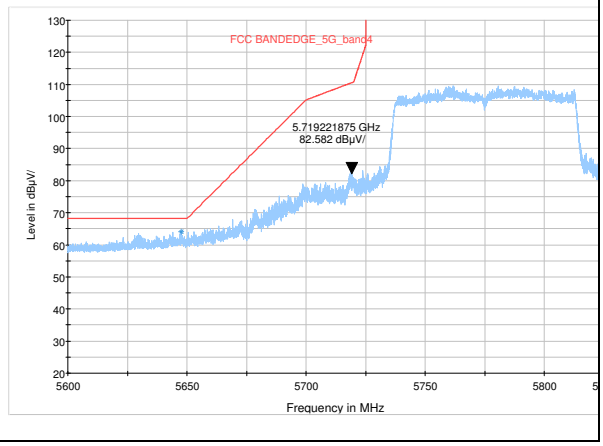

## 802.11ac HT40-Channel 151: Peak




## 802.11ac HT40-Channel 159: Peak




## 802.11ac HT80- Channel 155: Peak



**Result of RE**

**Test result**

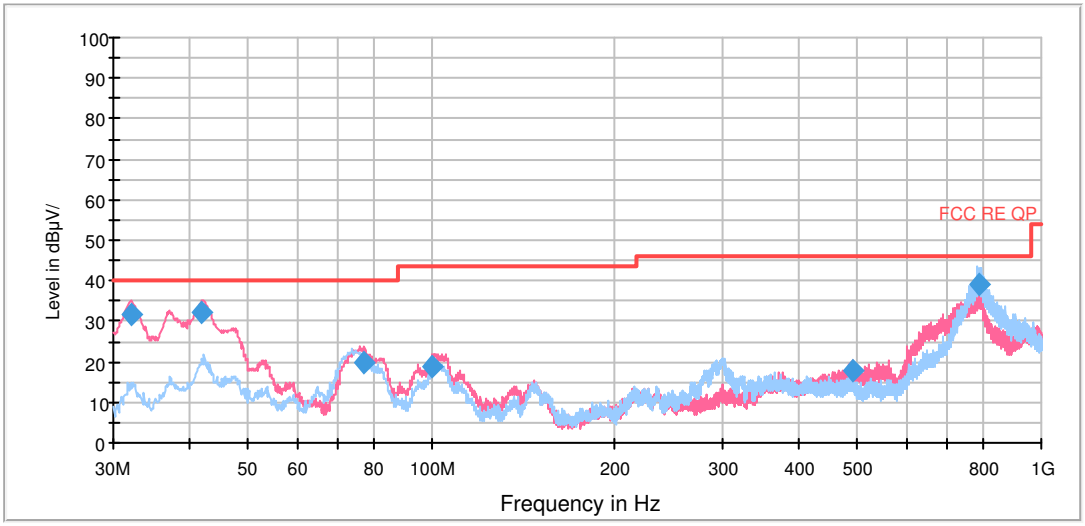
Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, and 9KHz-30MHz, the emissions more than 20 dB below the permissible value are not reported.

**After the pre test, Antenna 1 was selected as the worst antenna.**

During the test, the Radiates Emission from 30MHz to 1GHz was performed in all modes with all channels, 802.11n (HT40), Channel 38 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

**Continuous TX mode:**

RE 30M-1GHz QP




Radiates Emission from 30MHz to 1GHz

| Frequency (MHz) | Quasi-Peak (dBuV/m) | Reading value (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|---|---|---|---|---|---|---|---|---|
| 32.141097 | 31.8 | 50.9 | 100.0 | V | 317.0 | -19.1 | 8.2 | 40.0 |
| 41.977794 | 32.0 | 50.1 | 100.0 | V | 34.0 | -18.1 | 8.0 | 40.0 |
| 77.376175 | 20.0 | 46.7 | 100.0 | V | 149.0 | -26.7 | 20.0 | 40.0 |
| 100.393240 | 19.0 | 43.0 | 100.0 | V | 33.0 | -24.0 | 24.5 | 43.5 |
| 489.992750 | 17.6 | 37.4 | 100.0 | V | 295.0 | -19.8 | 28.4 | 46.0 |
| 787.882250 | 39.0 | 55.6 | 121.0 | H | 73.0 | -16.6 | 7.0 | 46.0 |

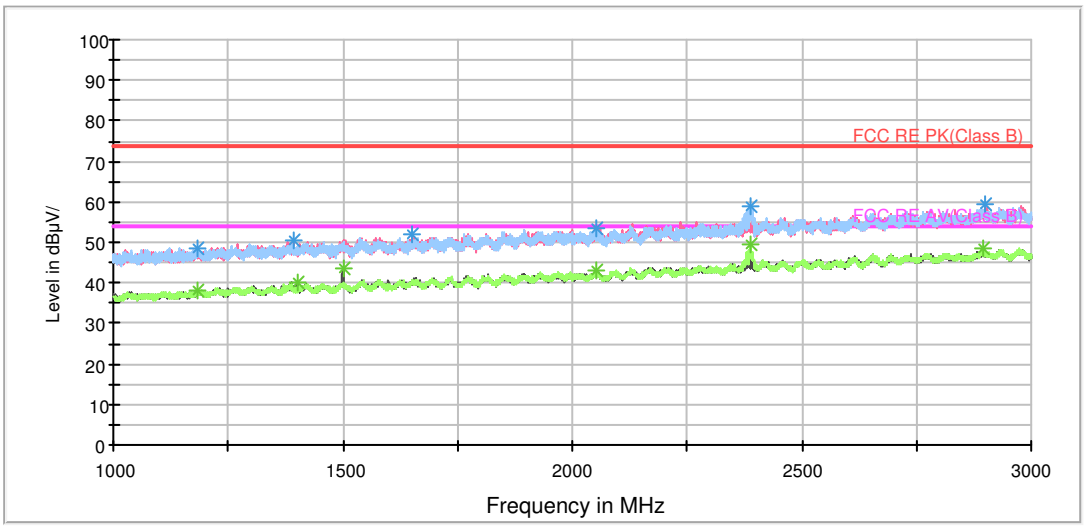
**Remark: 1. Quasi-Peak = Reading value + Correction factor**

**2. Correction Factor = Antenna factor+ Insertion loss(cable loss+amplifier gain)**

**3. Margin = Limit – Quasi-Peak**

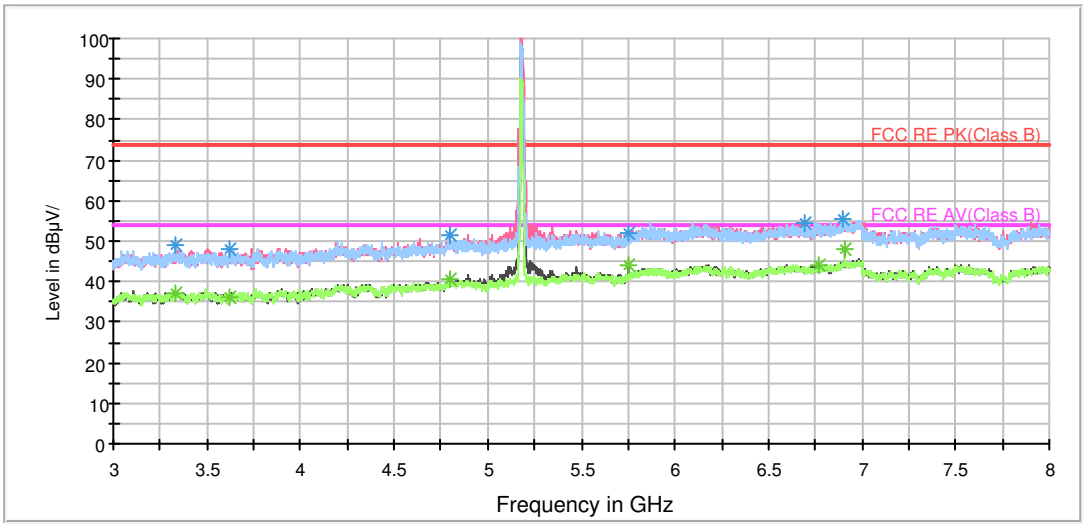
**802.11a CH36**

RE 1G-3GHz PK+AV




Radiates Emission from 1GHz to 3GHz

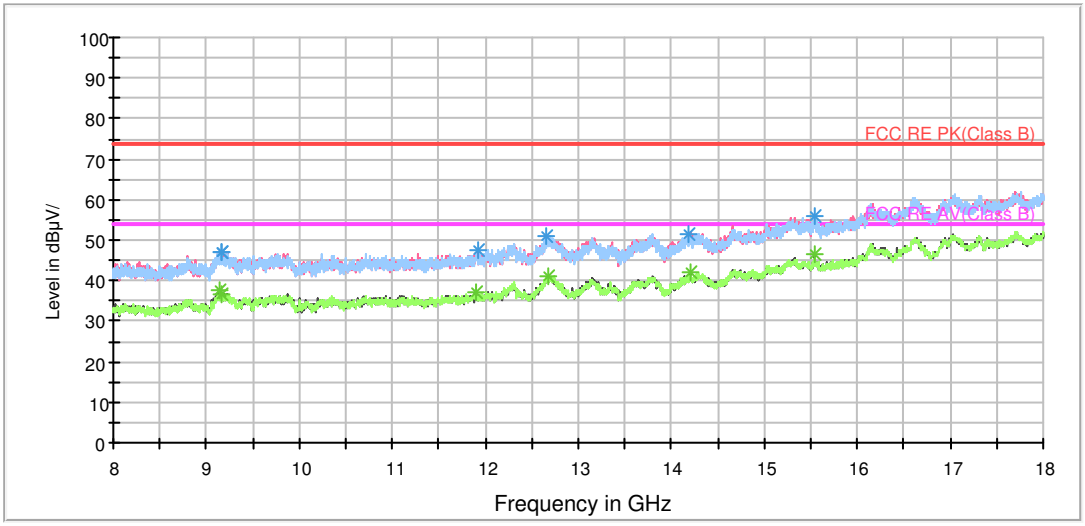
RE 3-18GHz PK+AV




Note: The signal beyond the limit is carrier.

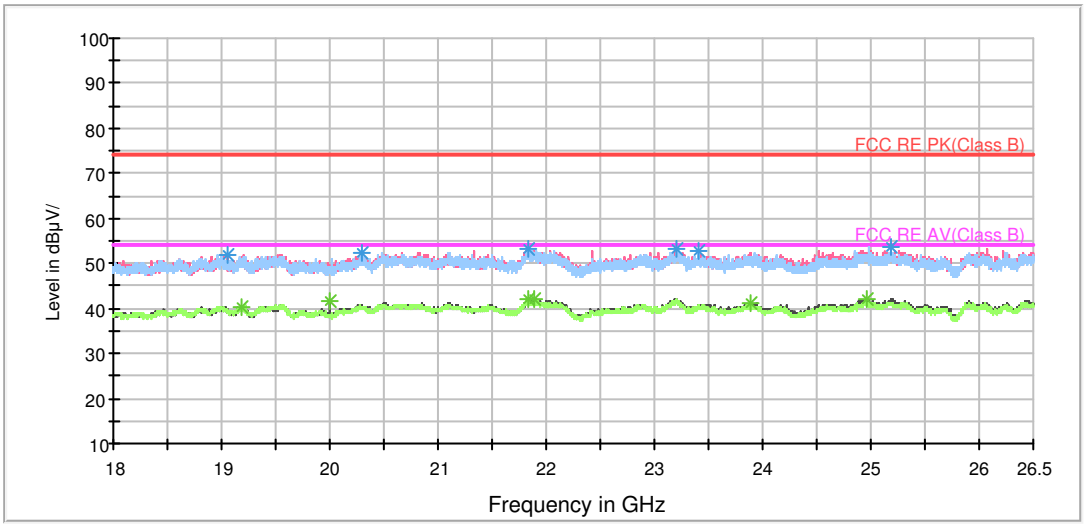
Radiates Emission from 3GHz to 8GHz

RE 3-18GHz PK+AV



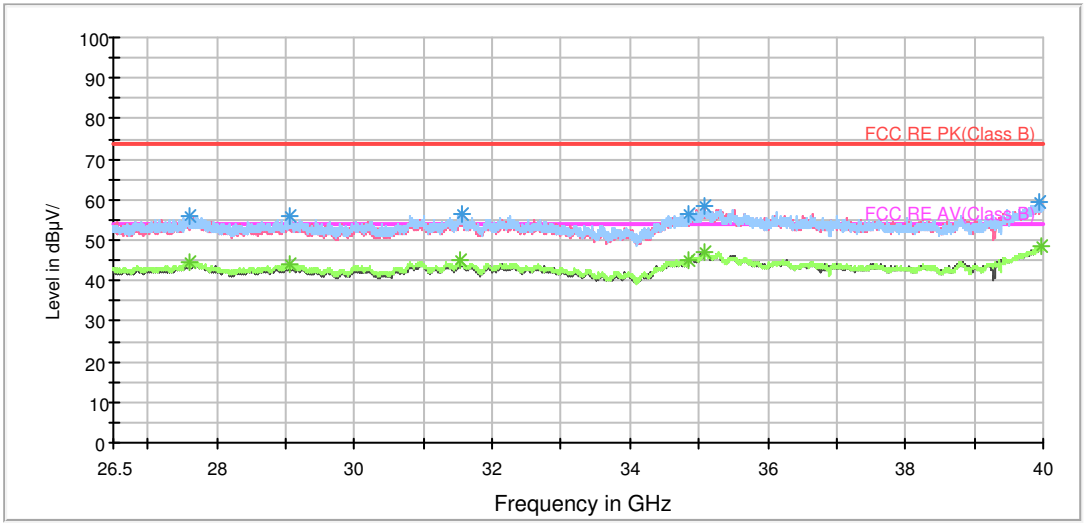

Radiates Emission from 8GHz to 18GHz

BELL_RE 18-26.5GHz PK+AV




Radiates Emission from 18GHz to 26.5GHz

BELL RE 26.5-40GHz PK+AV




Radiates Emission from 26.5GHz to 40GHz

| Frequency (MHz) | Peak (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|---|---|---|---|---|---|---|---|---|
| 3328.750000 | 48.8 | 200.0 | H | 37.0 | 41.0 | 7.8 | 25.2 | 74 |
| 3621.875000 | 48.1 | 200.0 | V | 306.0 | 40.1 | 8.0 | 25.9 | 74 |
| 4793.750000 | 51.3 | 200.0 | H | 205.0 | 40.1 | 11.2 | 22.7 | 74 |
| 5754.375000 | 51.7 | 200.0 | H | 0.0 | 38.1 | 13.6 | 22.3 | 74 |
| 6689.375000 | 54.6 | 200.0 | V | 256.0 | 39.3 | 15.3 | 19.4 | 74 |
| 6892.500000 | 55.4 | 200.0 | H | 329.0 | 39.2 | 16.2 | 18.6 | 74 |

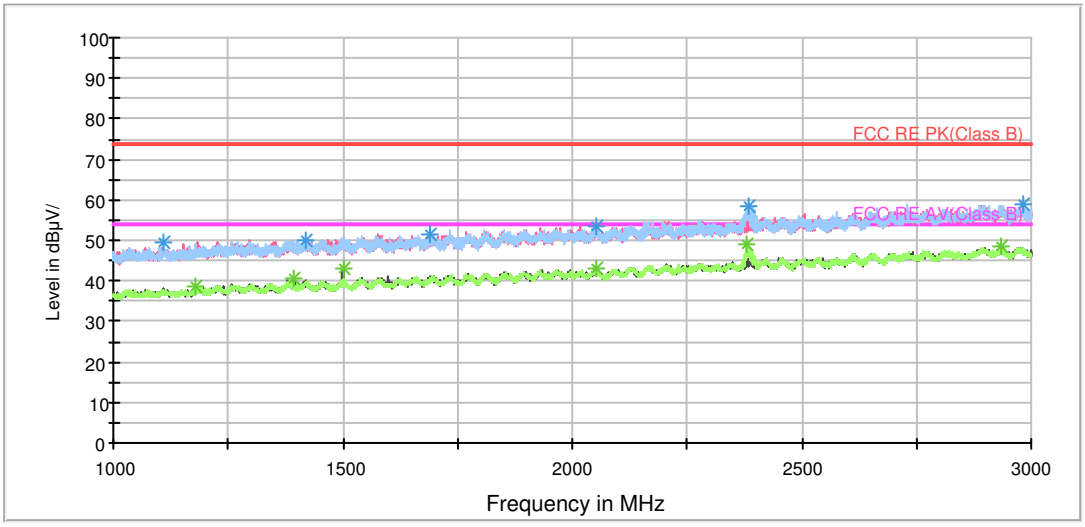
**Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)**

| Frequency (MHz) | Average (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|---|---|---|---|---|---|---|---|---|
| 3328.750000 | 37.2 | 200.0 | H | 37.0 | 29.4 | 7.8 | 16.8 | 54 |
| 3621.875000 | 36.3 | 200.0 | V | 306.0 | 28.3 | 8.0 | 17.7 | 54 |
| 4793.750000 | 40.6 | 200.0 | H | 205.0 | 29.4 | 11.2 | 13.4 | 54 |
| 5755.625000 | 44.0 | 200.0 | V | 216.0 | 30.4 | 13.6 | 10.0 | 54 |
| 6770.000000 | 44.2 | 200.0 | V | 240.0 | 28.7 | 15.5 | 9.8 | 54 |
| 6906.875000 | 48.0 | 200.0 | V | 264.0 | 31.7 | 16.3 | 6.0 | 54 |

**Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)**

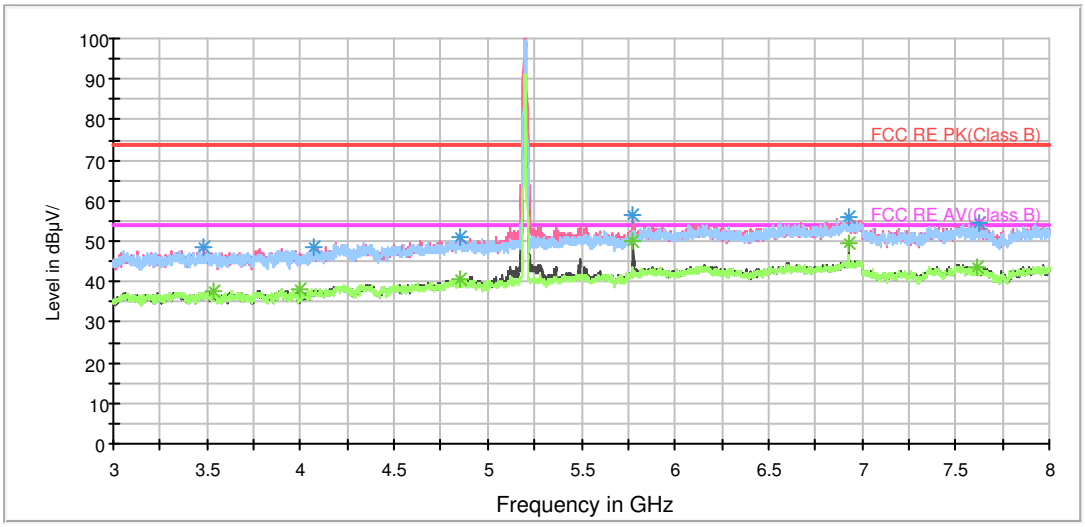
## 802.11a CH40

RE 1G-3GHz PK+AV




Radiates Emission from 1GHz to 3GHz

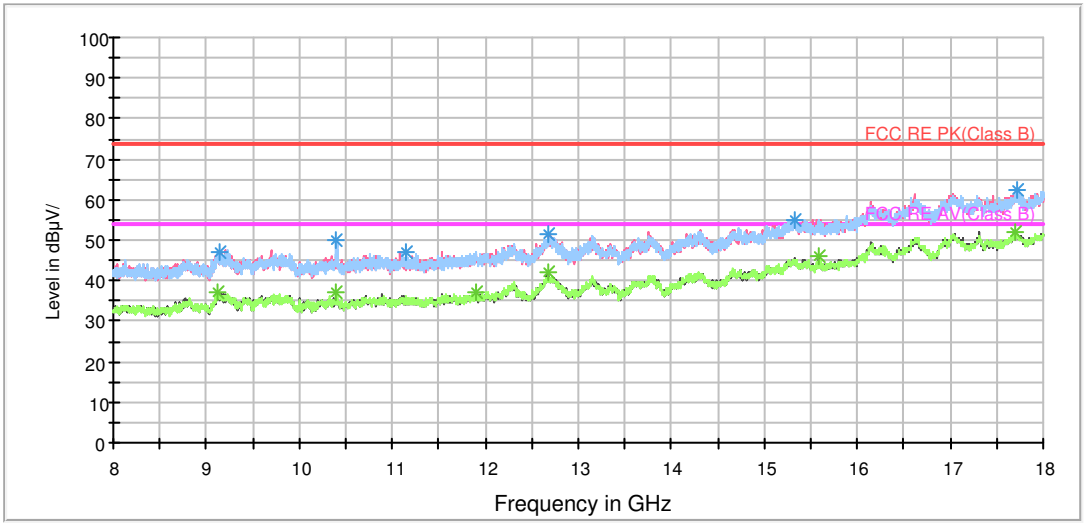
RE 3-18GHz PK+AV




Note: The signal beyond the limit is carrier.

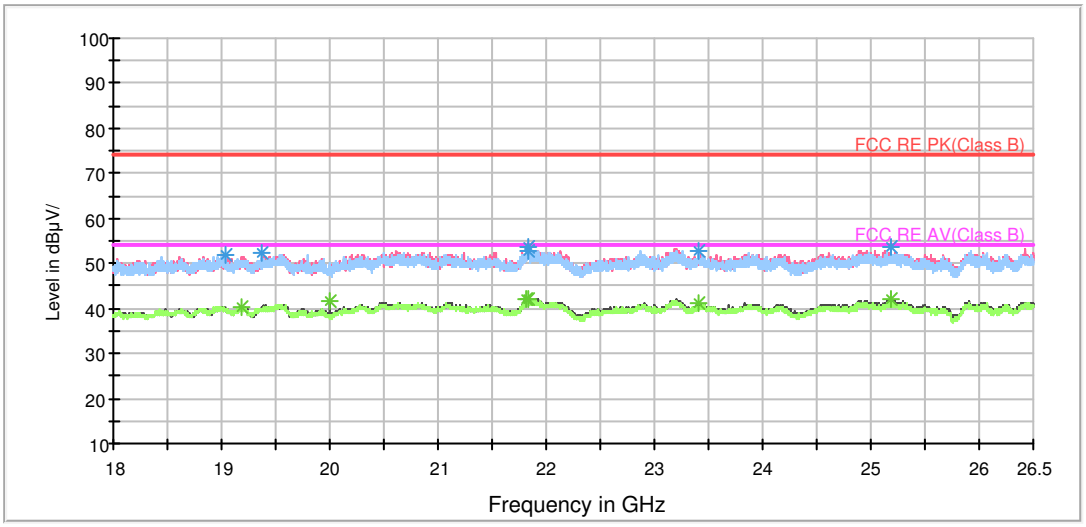
Radiates Emission from 3GHz to 8GHz

RE 3-18GHz PK+AV



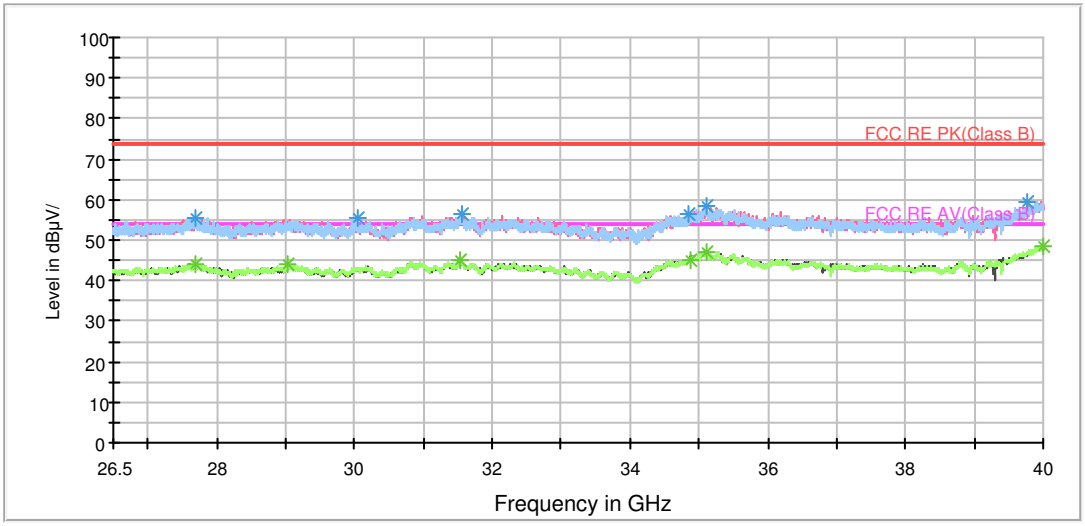

Radiates Emission from 8GHz to 18GHz

BELL_RE 18-26.5GHz PK+AV




Radiates Emission from 18GHz to 26.5GHz

BELL RE 26.5-40GHz PK+AV




Radiates Emission from 26.5GHz to 40GHz

| Frequency (MHz) | Peak (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|---|---|---|---|---|---|---|---|---|
| 3486.875000 | 48.5 | 200.0 | V | 319.0 | 40.5 | 8.0 | 25.5 | 74 |
| 4075.000000 | 48.4 | 200.0 | H | 0.0 | 39.3 | 9.1 | 25.6 | 74 |
| 4847.500000 | 50.9 | 200.0 | H | 0.0 | 39.3 | 11.6 | 23.1 | 74 |
| 5778.125000 | 56.3 | 200.0 | V | 36.0 | 42.4 | 13.9 | 17.7 | 74 |
| 6933.125000 | 56.2 | 200.0 | V | 327.0 | 40.0 | 16.2 | 17.8 | 74 |
| 7620.625000 | 54.5 | 200.0 | H | 246.0 | 37.7 | 16.8 | 19.5 | 74 |

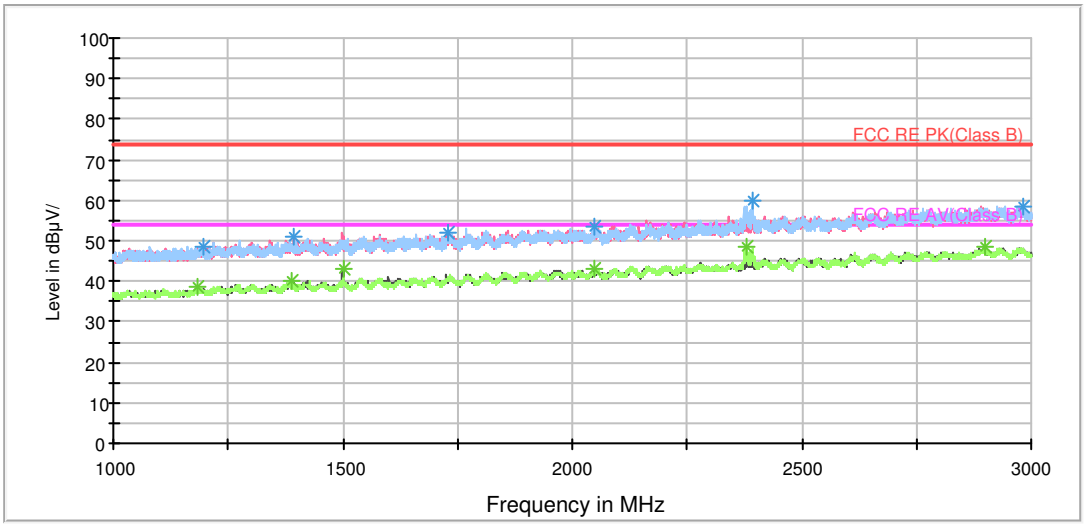
**Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)**

| Frequency (MHz) | Average (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Reading value (dBuV/m) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|---|---|---|---|---|---|---|---|---|
| 3532.500000 | 37.6 | 200.0 | H | 191.0 | 29.7 | 7.9 | 16.4 | 54 |
| 4000.000000 | 38.3 | 200.0 | H | 43.0 | 29.4 | 8.9 | 15.7 | 54 |
| 4848.125000 | 40.4 | 200.0 | H | 182.0 | 28.8 | 11.6 | 13.6 | 54 |
| 5778.125000 | 49.8 | 200.0 | V | 36.0 | 35.9 | 13.9 | 4.2 | 54 |
| 6933.750000 | 49.7 | 200.0 | V | 288.0 | 33.5 | 16.2 | 4.3 | 54 |
| 7611.250000 | 43.3 | 200.0 | V | 311.0 | 26.4 | 16.9 | 10.7 | 54 |

**Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)**

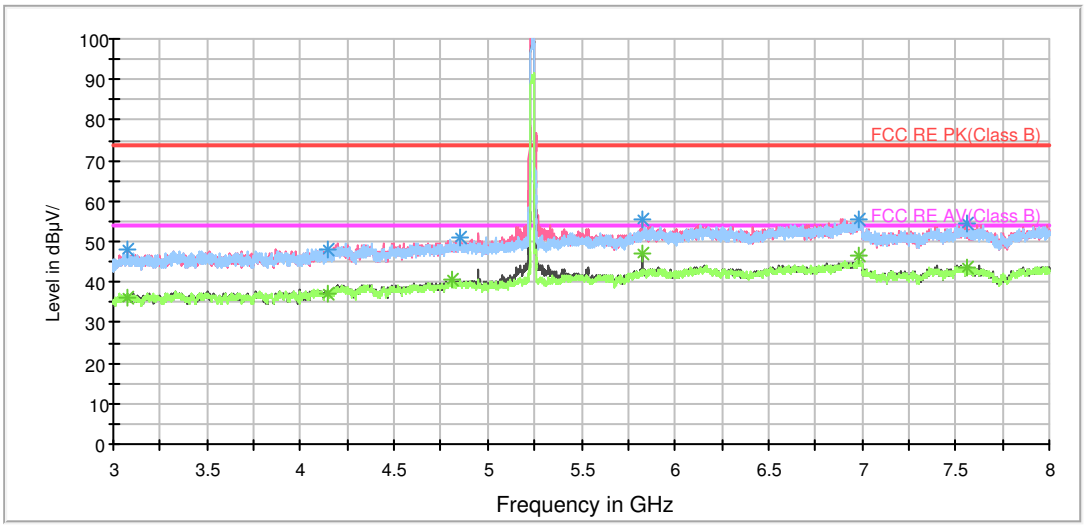
**802.11a CH48**

RE 1G-3GHz PK+AV




Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV




Note: The signal beyond the limit is carrier.

Radiates Emission from 3GHz to 8GHz