# TEST REPORT

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1. Report No : DRTFCC2009-0271
2. Customer
   - Name : LG Electronics USA.
   - Address : 111 Sylvan Avenue North Building, Englewood Cliffs, New Jersey, United States, 07632
3. Use of Report : Class II Permissive Change
4. Product Name / Model Name : Telematics / TCAA19ANANN
   FCC ID : BEJTCAA19ANANN
5. FCC Regulation(s): Part 15.407
   Test Method Used : KDB789033 D02v02r01
6. Date of Test : 2020.08.14 ~ 2020.08.24
7. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing
8. Testing Environment : Refer to appended test report.
8. Test Result : Refer to the attached test result.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

| | | |
|---|---|---|
| Affirmation | Tested by<br>Name : JungWoo Kim (Signature) | Reviewed by<br>Name : JaeJin Lee (Signature) |

**2020. 09. 01.**

**DT&C Co., Ltd.**

Not abided by KS Q ISO / IEC 17025 and KOLAS accreditation.

**If this report is required to confirmation of authenticity, please contact to report@dtnc.net**

# Test Report Version

| Test Report No. | Date | Description | Revised by | Reviewed by |
|---|---|---|---|---|
| DRTFCC2009-0271 | Sep. 01, 2020 | Initial issue | JungWoo Kim | JaeJin Lee |
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# 1. EUT DESCRIPTION

| | |
|---|---|
| **FCC Equipment Class** | Unlicensed National Information Infrastructure (UNII) |
| **Product** | Telematics |
| **Model Name** | TCAA19NANN |
| **Add Model Name** | NA |
| **Power Supply** | DC 12 V |
| **Modulation type** | OFDM |
| **Antenna Specification** | **Antenna type:** External Antenna(2EA)<br>**Antenna gain:** Refer to the clause 7 in test report. |

| 5GHz Band | Mode | Tx frequency (MHz) | Max power(dBm) |
|---|---|---|---|
| **U-NII 1** | 802.11a | 5 180 ~ 5 240 | 13.42 |
| | 802.11n(HT20) | 5 180 ~ 5 240 | 14.22 |
| | 802.11ac(VHT20) | 5 180 ~ 5 240 | **14.23** |
| | 802.11n(HT40) | 5 190 ~ 5 230 | 13.43 |
| | 802.11ac(VHT40) | 5 190 ~ 5 230 | 13.47 |
| | 802.11ac(VHT80) | 5 210 | 8.15 |
| **U-NII 2A** | 802.11a | 5 260 ~ 5 320 | 13.44 |
| | 802.11n(HT20) | 5 260 ~ 5 320 | 14.25 |
| | 802.11ac(VHT20) | 5 260 ~ 5 320 | **14.30** |
| | 802.11n(HT40) | 5 270 ~ 5 310 | 12.94 |
| | 802.11ac(VHT40) | 5 270 ~ 5 310 | 12.98 |
| | 802.11ac(VHT80) | 5 290 | 8.25 |
| **U-NII 2C** | 802.11a | 5 500 ~ 5 720 | 13.29 |
| | 802.11n(HT20) | 5 500 ~ 5 720 | 14.03 |
| | 802.11ac(VHT20) | 5 500 ~ 5 720 | **14.04** |
| | 802.11n(HT40) | 5 510 ~ 5 710 | 12.26 |
| | 802.11ac(VHT40) | 5 510 ~ 5 710 | 12.27 |
| | 802.11ac(VHT80) | 5 530 ~ 5 690 | 12.96 |
| **U-NII 3** | 802.11a | 5 745 ~ 5 825 | 13.16 |
| | 802.11n(HT20) | 5 745 ~ 5 825 | 13.78 |
| | 802.11ac(VHT20) | 5 745 ~ 5 825 | **13.79** |
| | 802.11n(HT40) | 5 755 ~ 5 795 | 13.01 |
| | 802.11ac(VHT40) | 5 755 ~ 5 795 | 13.00 |
| | 802.11ac(VHT80) | 5 775 | 9.87 |

# 2. Information about test items

## 2.1 Transmitting configuration of EUT

| Mode | SISO | | MIMO (CDD) | MIMO (SDM) |
|---|---|---|---|---|
| | Ant 1 | Ant 2 | Ant 1 & 2 | Ant 1 & 2 |
| | Data rate | | | |
| 802.11a | 6~54Mbps | 6~54Mbps | 6~54Mbps | - |
| 802.11n(HT20) | MCS 0 ~ 7 | MCS 0 ~ 7 | MCS 0 ~ 7 | MCS 8 ~ 15 |
| 802.11ac(VHT20) | NSS1 MCS 0 ~ 8 | NSS1 MCS 0 ~ 8 | NSS1 MCS 0 ~ 8 | NSS2 MCS 0 ~ 8 |
| 802.11n(HT40) | MCS 0 ~ 7 | MCS 0 ~ 7 | MCS 0 ~ 7 | MCS 8 ~ 15 |
| 802.11ac(VHT40) | NSS1 MCS 0 ~ 9 | NSS1 MCS 0 ~ 9 | NSS1 MCS 0 ~ 9 | NSS2 MCS 0 ~ 9 |
| 802.11ac(VHT80) | NSS1 MCS 0 ~ 9 | NSS1 MCS 0 ~ 9 | NSS1 MCS 0 ~ 9 | NSS2 MCS 0 ~ 9 |

Note1: SDM = Spatial Diversity Multiplexing, CDD = Cycle Delay Diversity

## 2.2 Tested Channel Information

| 5GHz Band | 802.11a/n(HT20) /802.11ac(VHT20) | | 802.11n(HT40) /802.11ac(VHT40) | | 802.11ac(VHT80) | |
|---|---|---|---|---|---|---|
| | Channel | Frequency [MHz] | Channel | Frequency [MHz] | Channel | Frequency [MHz] |
| U-NII 1 | 36 | 5 180 | 38 | 5 190 | 42 | 5 210 |
| | 40 | 5 200 | - | - | - | - |
| | 48 | 5 240 | 46 | 5 230 | - | - |
| U-NII 2A | 52 | 5 260 | 54 | 5 270 | 58 | 5 290 |
| | 60 | 5 300 | - | - | - | - |
| | 64 | 5 320 | 62 | 5 310 | - | - |
| U-NII 2C | 100 | 5 500 | 102 | 5 510 | 106 | 5 530 |
| | 116 | 5 580 | 110 | 5 550 | - | - |
| | 144 | 5 720 | 142 | 5 710 | 138 | 5 690 |
| U-NII 3 | 149 | 5 745 | 151 | 5 755 | 155 | 5 775 |
| | 157 | 5 785 | - | - | - | - |
| | 165 | 5 825 | 159 | 5 795 | - | - |

## 2.3 Testing Environment

| | | |
|---|---|---|
| **Temperature** | : | +22 ºC ~ +24 ºC |
| **Relative humidity content** | : | +42 % ~ +47 % |
| **Details of power supply** | : | DC 12 V |

## 2.4 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

## 2.5 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C 63.4-2014 and ANSI C 63.10-2013. All measurement uncertainty values are shown with a coverage factor of *k* = 2 to indicate a 95 % level of confidence.

| Test items | Measurement uncertainty |
|---|---|
| Transmitter Output Power | 0.9 dB (The confidence level is about 95 %, k = 2) |
| Radiated spurious emission (1 GHz Below) | 4.9 dB (The confidence level is about 95 %, k = 2) |
| Radiated spurious emission (1 GHz ~ 18 GHz) | 5.1 dB (The confidence level is about 95 %, k = 2) |
| Radiated spurious emission (18 GHz Above) | 5.3 dB (The confidence level is about 95 %, k = 2) |

# 3. SUMMARY OF TESTS

| FCC Part Section(s) | RSS Section(s) | Parameter | Limit | Test Condition | Status Note 1 |
|---|---|---|---|---|---|
| 15.407(a) | RSS-247(6.2) | Emission Bandwidth (26 dB Bandwidth) | N/A | Conducted | NT |
| 15.407(e) | RSS-247(6.2) | Minimum Emission Bandwidth (6 dB Bandwidth) | > 500 kHz in 5 725 ~ 5 850 MHz | | NT |
| 15.407(a) | RSS-247(6.2) | Maximum Conducted Output Power | 5 150 MHz ~ 5 250 MHz : < 23.97 dBm<br><br>5 250 MHz ~ 5 350 MHz & 5 470 MHz ~ 5 725 MHz : < 250 mW or < 11 + 10 log10(B) dBm, whichever power is less. (B is the 26 dB BW.)<br><br>5 725 MHz ~ 5 850 MHz : < 30 dBm | | C |
| 15.407(a) | RSS-247(6.2) | Peak Power Spectral Density | 5 150 MHz ~ 5 250 MHz : 11 dBm/MHz<br>5 250 MHz ~ 5 350 MHz : 11 dBm/MHz<br>5 470 MHz ~ 5 725 MHz : 11 dBm/MHz<br>5 725 MHz ~ 5 850 MHz : 30 dBm/500 kHz | | NT |
| - | RSS GEN[6.7] | Occupied Bandwidth (99 %) | N/A | | NT |
| 15.407(h) | RSS-247(6.3) | Dynamic Frequency Selection | FCC 15.407(h) | | NT |
| 15.407(b) | RSS-247(6.2) | Undesirable Emissions | 5 150 MHz ~ 5 725 MHz: < -27 dBm/MHz EIRP<br>5 725 MHz ~ 5 850 MHz: < -27 dBm/MHz or<br>< 10 dBm/MHz or 15.6 dBm/MHz < 27 dBm/MHz EIRP | Radiated | C Note 3 |
| 15.205<br>15.209<br>15.407(b) | RSS-GEN(8.9)<br>RSS-GEN(8.10)<br>RSS-247(6.2) | General Field Strength Limits(Restricted Bands and Radiated Emission Limits) | Emissions in restricted bands must meet the radiated limits detailed in 15.209 | | C Note 3 |
| 15.207 | RSS-GEN(8.8) | AC Conducted Emissions | FCC 15.207 | AC Line Conducted | NT |
| 15.203 | - | Antenna Requirements | FCC 15.203 | - | C |

Note 1: **C** = Comply **NC** = Not Comply **NT** = Not Tested **NA** = Not Applicable

Note 2: For radiated emission tests below 30 MHz were performed on semi-anechoic chamber which is correlated with OATS.

Note 3: This test item was performed at the worst case based on the original filing.

Note 4: The sample was tested according to the following specification:

**KDB789033 D02v02r01, KDB662911 D01v02r01**

# 4. TEST METHODOLOGY

The measurement procedures described in the ANSI C63.10-2013 and the guidance provided in KDB 7899033 D02v02r01 were used in measurement of the EUT.

The EUT was tested per the guidance of KDB789033 D02v02r01. And ANSI C63.10-2013 was used to reference appropriate EUT setup and maximizing procedures of radiated spurious emission and AC line conducted emission testing.

## 4.1 EUT configuration

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

## 4.2 EUT exercise

The EUT was operated in the test mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.407 under the FCC Rules Part 15 Subpart E.

## 4.3 General test procedures

### Conducted Emissions

The power-line conducted emission test procedure is not described on the KDB789033 D02v02r01. So this test was fulfilled with the requirements in Section 6.2 of ANSI C63.10-2013.

The EUT is placed on the wooden table, which is 0.8 m above ground plane and the conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-peak and Average detector.

### Radiated Emissions

Basically the radiated tests were performed with KDB789033 D02v02r01. But some requirements and procedures like test site requirements, EUT setup and maximizing procedure were fulfilled with the requirements in Section 5 and 6 of the ANSI C63.10-2013 as stated on KDB789033 D02v02r01.

The EUT is placed on a non-conductive table, which is 0.8 m above ground plane. For emission measurements above 1 GHz, the table height is 1.5 m. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 1 m or 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the highest emission, the relative positions of the EUT were rotated through one orthogonal axis.

## 4.4 Description of test modes

The EUT has been tested with all modes of operating conditions to determine the worst case emission characteristics.

A test program is used to control the EUT for staying in continuous transmitting mode with maximum fixed duty cycle.

| Test mode | Worst case data rate |
|---|---|
| 802.11a | 6 Mbps |
| 802.11ac(VHT20) | MCS 0 (SDM) |
| 802.11ac(VHT40) | MCS 0 (SDM) |
| 802.11ac(VHT80) | MCS 0 (SDM) |

# 5. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment , which is traceable to recognized national standards.

# 6. FACILITIES AND ACCREDITATIONS

## 6.1 Facilities

| **DT&C Co., Ltd.** | | |
|---|---|---|
| The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042.<br>The test site complies with the requirements of § 2.948 according to ANSI C63.4-2014.<br>**- FCC & ISED MRA Designation No. : KR0034** | | |
| www.dtnc.net | | |
| Telephone | : | + 82-31-321-2664 |
| FAX | : | + 82-31-321-1664 |

## 6.2 Equipment

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, loop, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and peak, quasi-peak detectors are used to perform radiated measurements.
Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements. All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

# 7. ANTENNA REQUIREMENTS

## According to FCC 47 CFR §15.203:

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

**The antenna is attached on the device by means of unique coupling method.**
**Therefore this E.U.T Complies with the requirement of §15.203**

## Directional antenna gain:

| Bands | SISO | | | | | | MIMO (CDD) Note 2. | MIMO (SDM) Note 3 |
|---|---|---|---|---|---|---|---|---|
| | ANT 1 [dBi] | Cable Loss[dB] | Total 1 [dB]Note1 | ANT 2 [dBi] | Cable Loss[dB] | Total 2 [dB]Note1 | Directional Gain[dBi] | Directional Gain[dBi] |
| **U-NII 1** | **2.60** | **-1.00** | **1.60** | **2.60** | **-1.70** | **0.90** | ***4.27*** | ***1.26*** |
| **U-NII 2A** | **2.40** | **-1.00** | **1.40** | **2.40** | **-1.70** | **0.70** | ***4.07*** | ***1.06*** |
| **U-NII 2C** | **2.60** | **-1.20** | **1.40** | **2.60** | **-2.10** | **0.50** | ***3.97*** | ***0.97*** |
| **U-NII 3** | **2.80** | **-1.20** | **1.60** | **2.80** | **-2.00** | **0.80** | ***4.22*** | ***1.22*** |

**Note 1. The antenna gain was included cable loss.**
**Note 2. Directional gain (Correlated signal with unequal antenna gain and equal transmit power)**
$10 \log [ ( 10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20} )^2 / N_{ANT} ]$ dBi
**Note 3. Directional gain (Completely uncorrelated signal with unequal antenna gain and equal transmit power)**
$10 \log [ ( 10^{G1/10} + 10^{G2/10} + \ldots + 10^{GN/10} ) / N_{ANT} ]$ dBi

# 8. TEST RESULT

## 8.1 Maximum Conducted Output Power

### ▣ Test Requirements

**Part. 15.407(a)**

**(1) For the band 5.15 GHz - 5.25 GHz.**

(i) For an outdoor access point operating in the band 5.15 GHz - 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. 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. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15 GHz - 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. 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.

(iii) For fixed point-to-point access points operating in the band 5.15 GHz - 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

**(iv) For mobile and portable client devices in the 5.15 GHz - 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. 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.**

**(2) For the 5.25 GHz - 5.35 GHz**
**(3) and 5.47 GHz - 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. 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.**

**(4) For the band 5.725 GHz - 5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. 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. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.**

## ▣ Test Configuration


Method PM-G

## ▣ Test Procedure

### Method PM-G of KDB789033 D02

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

▣ **Test Results: Comply**

**- Summed Output Power: CDD**

| Mode | CH | Freq.[MHz] | Test Result [dBm] | | |
|---|---|---|---|---|---|
| | | | ANT 1 | ANT 2 | ANT1+ANT2 (CDD) |
| 802.11a | 36 | 5 180 | 10.55 | 10.26 | 13.42 |
| | 40 | 5 200 | 10.60 | 9.96 | 13.30 |
| | 48 | 5 240 | 10.40 | 9.93 | 13.18 |
| | 52 | 5 260 | 10.62 | 10.23 | 13.44 |
| | 60 | 5 300 | 10.46 | 10.09 | 13.29 |
| | 64 | 5 320 | 10.62 | 10.12 | 13.39 |
| | 100 | 5 500 | 8.48 | 8.08 | 11.29 |
| | 116 | 5 580 | 10.48 | 10.08 | 13.29 |
| | 144 | 5 720 | 10.19 | 9.91 | 13.06 |
| | 149 | 5 745 | 10.21 | 9.86 | 13.05 |
| | 157 | 5 785 | 10.23 | 10.02 | 13.14 |
| | 165 | 5 825 | 10.08 | 10.22 | 13.16 |

| Mode | CH | Freq.[MHz] | Test Result [dBm] | | |
|---|---|---|---|---|---|
| | | | ANT 1 | ANT 2 | ANT1+ANT2 (CDD) |
| 802.11n(HT20) | 36 | 5 180 | 11.14 | 10.52 | 13.85 |
| | 40 | 5 200 | 11.09 | 11.32 | 14.22 |
| | 48 | 5 240 | 10.76 | 11.25 | 14.02 |
| | 52 | 5 260 | 11.08 | 11.37 | 14.24 |
| | 60 | 5 300 | 10.95 | 11.08 | 14.03 |
| | 64 | 5 320 | 10.59 | 10.46 | 13.54 |
| | 100 | 5 500 | 7.11 | 6.99 | 10.06 |
| | 116 | 5 580 | 11.22 | 10.80 | 14.03 |
| | 144 | 5 720 | 10.65 | 10.64 | 13.66 |
| | 149 | 5 745 | 10.74 | 10.59 | 13.68 |
| | 157 | 5 785 | 10.62 | 10.91 | 13.78 |
| | 165 | 5 825 | 10.55 | 10.50 | 13.54 |

| Mode | CH | Freq.[MHz] | Test Result[dBm] | | |
|---|---|---|---|---|---|
| | | | ANT 1 | ANT 2 | ANT1+ANT2 (CDD) |
| 802.11n (HT40) | 38 | 5 190 | 7.05 | 6.48 | 9.78 |
| | 46 | 5 230 | 10.39 | 10.39 | 13.40 |
| | 54 | 5 270 | 10.26 | 7.68 | 12.17 |
| | 62 | 5 310 | 7.98 | 7.51 | 10.76 |
| | 102 | 5 510 | 6.46 | 6.14 | 9.31 |
| | 110 | 5 550 | 9.44 | 8.91 | 12.19 |
| | 142 | 5 710 | 9.34 | 8.95 | 12.16 |
| | 151 | 5 755 | 9.21 | 8.89 | 12.06 |
| | 159 | 5 795 | 10.15 | 9.84 | 13.01 |

| Mode | CH | Freq.[MHz] | Test Result[dBm] | | |
|---|---|---|---|---|---|
| | | | ANT 1 | ANT 2 | ANT1+ANT2 (CDD) |
| 802.11ac (VHT20) | 36 | 5 180 | 11.06 | 10.51 | 13.80 |
| | 40 | 5 200 | 10.94 | 11.27 | 14.12 |
| | 48 | 5 240 | 10.85 | 11.28 | 14.08 |
| | 52 | 5 260 | 11.07 | 11.39 | 14.24 |
| | 60 | 5 300 | 10.96 | 11.05 | 14.02 |
| | 64 | 5 320 | 10.61 | 10.52 | 13.58 |
| | 100 | 5 500 | 7.02 | 7.10 | 10.07 |
| | 116 | 5 580 | 11.27 | 10.78 | 14.04 |
| | 144 | 5 720 | 10.84 | 10.61 | 13.74 |
| | 149 | 5 745 | 10.80 | 10.55 | 13.69 |
| | 157 | 5 785 | 10.62 | 10.90 | 13.77 |
| | 165 | 5 825 | 10.45 | 10.43 | 13.45 |

| Mode | CH | Freq.[MHz] | Test Result[dBm] | | |
|---|---|---|---|---|---|
| | | | ANT 1 | ANT 2 | ANT1+ANT2 (CDD) |
| 802.11ac (VHT40) | 38 | 5 190 | 7.04 | 6.53 | 9.80 |
| | 46 | 5 230 | 10.46 | 10.45 | 13.47 |
| | 54 | 5 270 | 10.17 | 7.49 | 12.04 |
| | 62 | 5 310 | 8.05 | 7.55 | 10.82 |
| | 102 | 5 510 | 6.66 | 6.08 | 9.39 |
| | 110 | 5 550 | 9.51 | 8.99 | 12.27 |
| | 142 | 5 710 | 9.35 | 8.95 | 12.16 |
| | 151 | 5 755 | 9.18 | 8.81 | 12.01 |
| | 159 | 5 795 | 10.09 | 9.86 | 12.99 |

| Mode | CH | Freq.[MHz] | Test Result[dBm] | | |
|---|---|---|---|---|---|
| | | | ANT 1 | ANT 2 | ANT1+ANT2 (CDD) |
| 802.11ac (VHT80) | 42 | 5 210 | 5.40 | 4.73 | 8.09 |
| | 58 | 5 290 | 5.46 | 4.92 | 8.21 |
| | 106 | 5 530 | 6.86 | 6.63 | 9.76 |
| | 138 | 5 690 | 10.15 | 9.68 | 12.93 |
| | 155 | 5 775 | 7.07 | 6.49 | 9.80 |

**- Summed Output Power: SDM**

| Mode | CH | Freq. [MHz] | Test Result [dBm] | | |
|---|---|---|---|---|---|
| | | | ANT 1 | ANT 2 | ANT1+ANT2 (SDM) |
| 802.11n (HT20) | 36 | 5 180 | 11.04 | 10.55 | 13.81 |
| | 40 | 5 200 | 10.99 | 11.31 | 14.16 |
| | 48 | 5 240 | 10.84 | 11.22 | 14.04 |
| | 52 | 5 260 | 11.08 | 11.39 | 14.25 |
| | 60 | 5 300 | 10.94 | 10.95 | 13.96 |
| | 64 | 5 320 | 10.49 | 10.42 | 13.47 |
| | 100 | 5 500 | 7.02 | 6.86 | 9.95 |
| | 116 | 5 580 | 11.25 | 10.77 | 14.03 |
| | 144 | 5 720 | 10.48 | 10.62 | 13.56 |
| | 149 | 5 745 | 10.69 | 10.65 | 13.68 |
| | 157 | 5 785 | 10.62 | 10.87 | 13.76 |
| | 165 | 5 825 | 10.48 | 10.49 | 13.50 |

| Mode | CH | Freq.[MHz] | Test Result[dBm] | | |
|---|---|---|---|---|---|
| | | | ANT 1 | ANT 2 | ANT1+ANT2 (SDM) |
| 802.11n (HT40) | 38 | 5 190 | 7.05 | 6.54 | 9.81 |
| | 46 | 5 230 | 10.45 | 10.38 | 13.43 |
| | 54 | 5 270 | 10.19 | 9.65 | 12.94 |
| | 62 | 5 310 | 8.13 | 7.56 | 10.86 |
| | 102 | 5 510 | 6.52 | 6.08 | 9.32 |
| | 110 | 5 550 | 9.49 | 8.99 | 12.26 |
| | 142 | 5 710 | 9.35 | 8.93 | 12.16 |
| | 151 | 5 755 | 9.11 | 8.75 | 11.94 |
| | 159 | 5 795 | 10.04 | 9.79 | 12.93 |

| Mode | CH | Freq.[MHz] | Test Result[dBm] | | |
|---|---|---|---|---|---|
| | | | ANT 1 | ANT 2 | ANT1+ANT2 (SDM) |
| 802.11ac (VHT20) | 36 | 5 180 | 11.06 | 10.87 | 13.98 |
| | 40 | 5 200 | 11.04 | 11.40 | 14.23 |
| | 48 | 5 240 | 10.90 | 11.19 | 14.06 |
| | 52 | 5 260 | 11.14 | 11.43 | 14.30 |
| | 60 | 5 300 | 10.98 | 11.04 | 14.02 |
| | 64 | 5 320 | 10.53 | 10.43 | 13.49 |
| | 100 | 5 500 | 7.06 | 6.94 | 10.01 |
| | 116 | 5 580 | 11.19 | 10.83 | 14.02 |
| | 144 | 5 720 | 10.72 | 10.70 | 13.72 |
| | 149 | 5 745 | 10.84 | 10.68 | 13.77 |
| | 157 | 5 785 | 10.64 | 10.92 | 13.79 |
| | 165 | 5 825 | 10.56 | 10.51 | 13.55 |

| Mode | CH | Freq.[MHz] | Test Result[dBm] | | |
|---|---|---|---|---|---|
| | | | ANT 1 | ANT 2 | ANT1+ANT2 (SDM) |
| 802.11ac (VHT40) | 38 | 5 190 | 7.13 | 6.56 | 9.86 |
| | 46 | 5 230 | 10.48 | 10.44 | 13.47 |
| | 54 | 5 270 | 10.21 | 9.71 | 12.98 |
| | 62 | 5 310 | 8.15 | 7.55 | 10.87 |
| | 102 | 5 510 | 6.55 | 6.08 | 9.33 |
| | 110 | 5 550 | 9.52 | 8.95 | 12.25 |
| | 142 | 5 710 | 9.41 | 8.94 | 12.19 |
| | 151 | 5 755 | 9.25 | 8.81 | 12.05 |
| | 159 | 5 795 | 10.13 | 9.85 | 13.00 |

| Mode | CH | Freq.[MHz] | Test Result[dBm] | | |
|---|---|---|---|---|---|
| | | | ANT 1 | ANT 2 | ANT1+ANT2 (SDM) |
| 802.11ac (VHT80) | 42 | 5 210 | 5.45 | 4.80 | 8.15 |
| | 58 | 5 290 | 5.41 | 5.07 | 8.25 |
| | 106 | 5 530 | 6.92 | 6.71 | 9.83 |
| | 138 | 5 690 | 10.18 | 9.71 | 12.96 |
| | 155 | 5 775 | 7.05 | 6.66 | 9.87 |

## 8.2 Radiated Spurious Emission Measurements

### ▣ Test Requirements

▪ **FCC Part 15.209(a) and (b)**

| Frequency (MHz) | Limit (uV/m) | Measurement Distance (meter) |
|---|---|---|
| 0.009 – 0.490 | 2400/F(KHz) | 300 |
| 0.490 – 1.705 | 24000/F(KHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |
| 30 ~ 88 | 100 ** | 3 |
| 88 ~ 216 | 150 ** | 3 |
| 216 ~ 960 | 200 ** | 3 |
| Above 960 | 500 | 3 |

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 MHz - 72 MHz, 76 MHz - 88 MHz, 174 MHz - 216 MHz or 470 MHz - 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

▪ **FCC Part 15.205 (a):** Only spurious emissions are permitted in any of the frequency bands listed below:

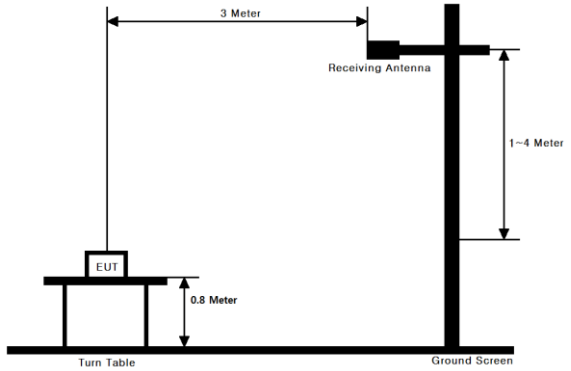
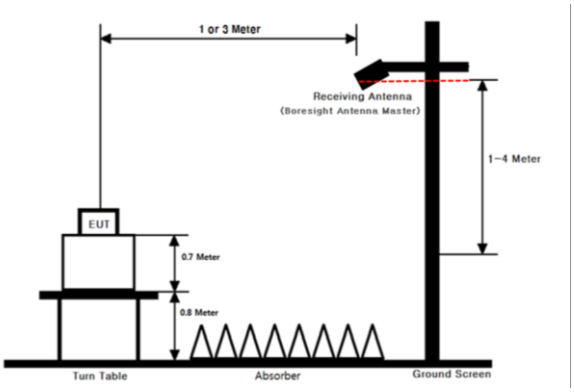
| MHz | MHz | MHz | MHz | GHz | GHz |
|---|---|---|---|---|---|
| 0.009 ~ 0.110 | 8.41425 ~ 8.41475 | 108 ~ 121.94 | 1300 ~ 1427 | 4.5 ~ 5.15 | 14.47 ~ 14.5 |
| 0.495 ~ 0.505 | 12.29 ~ 12.293 | 123 ~ 138 | 1435 ~ 1626.5 | 5.35 ~ 5.46 | 15.35 ~ 16.2 |
| 2.1735 ~ 2.1905 | 12.51975 ~ | 149.9 ~ 150.05 | 1645.5 ~ 1646.5 | 7.25 ~ 7.75 | 17.7 ~ 21.4 |
| 4.125 ~ 4.128 | 12.52025 | 160.52475 ~ | 1660 ~ 1710 | 8.025 ~ 8.5 | 22.01 ~ 23.12 |
| 4.17725 ~ 4.17775 | 12.57675 ~ | 160.52525 | 1718.8 ~ 1722.2 | 9.0 ~ 9.2 | 23.6 ~ 24.0 |
| 4.20725 ~ 4.20775 | 12.57725 | 160.7 ~ 160.9 | 2200 ~ 2300 | 9.3 ~ 9.5 | 31.2 ~ 31.8 |
| 6.215 ~ 6.218 | 13.36 ~ 13.41 | 162.0125 ~ 167.17 | 2310 ~ 2390 | 10.6 ~ 12.7 | 36.43 ~ 36.5 |
| 6.26775 ~ 6.26825 | 16.42 ~ 16.423 | 167.72 ~ 173.2 | 2483.5 ~ 2500 | 13.25 ~ 13.4 | Above 38.6 |
| 6.31175 ~ 6.31225 | 16.69475 ~ | 240 ~ 285 | 2655 ~ 2900 | | |
| 8.291 ~ 8.294 | 16.69525 | 322 ~ 335.4 | 3260 ~ 3267 | | |
| 8.362 ~ 8.366 | 16.80425 ~ | 399.90 ~ 410 | 3332 ~ 3339 | | |
| 8.37625 ~ 8.38675 | 16.80475 | 608 ~ 614 | 3345.8 ~ 3358 | | |
| | 25.5 ~ 25.67 | 960 ~ 1240 | 3600 ~ 4000 | | |
| | 37.5 ~ 38.25 | | | | |
| | 73 ~ 74.6 | | | | |
| | 74.8 ~ 75.2 | | | | |

▪ **FCC Part 15.205(b):** The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1 000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

▪ **FCC Part 15.407 (b):** Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the **5.15 GHz - 5.25 GHz band**: all emissions outside of the **5.15 GHz - 5.35 GHz band** shall not exceed an **EIRP of -27 dBm/MHz**.
(2) For transmitters operating in the **5.25 GHz - 5.35 GHz band**: all emissions outside of the **5.15 GHz - 5.35 GHz band** shall not exceed an **EIRP of -27 dBm/MHz**.
(3) For transmitters operating in the **5.47 GHz - 5.725 GHz band**: all emissions outside of the **5.47 GHz - 5.725 GHz band** shall not exceed an **EIRP of -27 dBm/MHz.**
(4) For transmitters operating in the **5.725 GHz - 5.85 GHz 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.
(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
(6) Unwanted emissions **below 1 GHz** must comply with the general field strength limits set forth in **Section 15.209**. Further, any U-NII devices using an **AC power line** are required to comply also with the conducted limits set forth in **Section 15.207**.
(7) The provisions of §15.205 apply to intentional radiators operating under this section
(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

## ▣ Test Configuration

| Below 1 GHz | Above 1 GHz |
|---|---|
|  |  |



## ▣ Test Procedure

1. The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m.
2. The turn table shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 1 m or 3 m away from the receiving antenna, which is varied from 1 m to 4 m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.

Radiated spurious emission measured using following Measurement Procedure **of KDB789033 D02v02r01**

### ► General Requirements for Unwanted Emissions Measurements

The following requirements apply to all unwanted emissions measurements, both in and outside of the restricted bands:

- EUT Duty Cycle

(1) The EUT shall be configured or modified to **transmit continuously** except as stated in (ii), below. The intent is to test at 100 percent duty cycle; however a small reduction in duty cycle (**to no lower than 98 percent**) is permitted if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.

(2) If **continuous transmission (or at least 98 percent duty cycle) cannot be achieved** due to hardware limitations of the EUT (e.g., overheating), the following additions to the measurement and reporting procedures are required:

- The EUT shall be configured to operate at the maximum achievable duty cycle.
- Measure the duty cycle, x, of the transmitter output signal.
- Adjustments to measurement procedures (e.g., increasing test time and number of traces averaged) shall be performed as described in the procedures below.
- The test report shall include the following additional information:
  - The reason for the duty cycle limitation.
  - The duty cycle achieved for testing and the associated transmit duration and interval between transmissions.
  - The sweep time and the amount of time used for trace stabilization during max-hold measurements for peak emission measurements.

(3) Reduction of the measured emission amplitude levels to account for operational duty factor is not permitted. Compliance is based on emission levels occurring during transmission - not on an average across on and off times of the transmitter.

► **Measurements below 1 000 MHz**

a) Follow the requirements in section II.G.3, “General Requirements for Unwanted Emissions Measurements”.

b) Compliance shall be demonstrated using **CISPR quasi-peak detection**; however, **peak detection** is permitted as an alternative to quasi-peak detection.

► **Measurements Above 1 000 MHz (Peak)**

a) Follow the requirements in section II.G.3, “General Requirements for Unwanted Emissions Measurements”.

b) Peak emission levels are measured by setting the analyzer as follows:

(i) **RBW = 1 MHz.**

(ii) **VBW ≥ 3 MHz.**

(iii) **Detector = Peak.**

(iv) Sweep time = Auto.

(v) Trace mode = Max hold.

(vi) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle. For example, at 50 percent duty cycle, the measurement time will increase by a factor of two relative to measurement time for continuous transmission.

► **Measurements Above 1000 MHz (Method AD)**

(i) **RBW = 1 MHz.**

(ii) **VBW ≥ 3 MHz.**

(iii) **Detector = RMS**, if span / (# of points in sweep) ≤ RBW / 2. Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, the detector mode shall be set to peak.

(iv) Averaging type = power (i.e., RMS)

• As an alternative, the detector and averaging type may be set for linear voltage averaging. Some analyzers require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.

(v) Sweep time = Auto.

(vi) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, the number of traces shall be increased by a factor of 1/x, where x is the duty cycle. For example, with 50 percent duty cycle, at least 200 traces shall be averaged.

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

• **If power averaging (RMS) mode was used in step (iv) above, the correction factor is 10 log(1/x), where x is the duty cycle.** For example, if the transmit duty cycle was 50 percent, then 3 dB must be added to the measured emission levels.

• If linear voltage averaging mode was used in step (iv) above, the correction factor is 20 log (1/x), where x is the duty cycle. For example, if the transmit duty cycle was 50 percent, then 6 dB must be added to the measured emission levels.

• If a specific emission is demonstrated to be continuous (100 percent duty cycle) rather than turning on and off with the transmit cycle, no duty cycle correction is required for that emission.

Please refer to Appendix I for the duty correction factor

## ▣ Test Results

**Test Notes**

1. The radiated emissions were tested on the worst-case mode and channel from the original filing.
2. The radiated emissions were investigated 9 kHz to 40 GHz. And no other spurious and harmonic emissions were found below listed frequencies.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F+ DCCF + DCF / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
4. Information of Distance Factor
   For finding emissions, measurements may be performed at a distance closer than that specified in the regulations.
   In this case, the distance factor is applied to the result.
   - Calculation of distance factor
   At frequencies below 30 MHz = 40 log(tested distance / specified distance)
   At frequencies at or above 30 MHz = 20 log(tested distance / specified distance)
   When distance factor is “N/A”, the measurements were performed at the specified distance and distance factor is not applied.
5. The limit is converted to field strength.
   E[dBuV/m] = EIRP[dBm] + 95.2 dB = -27 dBm + 95.2 = 68.2 dBuV/m

### Radiated Spurious Emissions data(9 kHz ~ 40 GHz) : 802.11a_*CDD*

| Band | Tested Channel | Freq. (MHz) | ANT Pol | EUT Position (Axis) | Detector Mode | Reading (dBuV) | T.F (dB/m) | DCCF (dB) | DCF (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U-NII 1 | 36 (5 180 MHz) | 5 149.09 | V | X | PK | 61.93 | 5.04 | N/A | N/A | 66.97 | 74.00 | 7.03 |
| | | 5 149.94 | V | X | AV | 43.40 | 5.04 | 0.20 | N/A | 48.64 | 54.00 | 5.36 |
| | | 10 359.79 | V | X | PK | 44.12 | 11.83 | N/A | N/A | 55.95 | 68.20 | 12.25 |
| U-NII 2A | 64 (5 320 MHz) | 5 350.10 | V | X | PK | 64.25 | 5.50 | N/A | N/A | 69.75 | 74.00 | 4.25 |
| | | 5 351.08 | V | X | AV | 44.20 | 5.50 | 0.20 | N/A | 49.90 | 54.00 | 4.10 |
| | | 10 641.42 | V | X | PK | 43.70 | 12.29 | N/A | N/A | 55.99 | 74.00 | 18.01 |
| | | 10 636.82 | V | X | AV | 33.01 | 12.29 | 0.20 | N/A | 45.50 | 54.00 | 8.50 |
| U-NII 2C | 100 (5 500 MHz) | 5 458.37 | V | X | PK | 52.83 | 5.67 | N/A | N/A | 58.50 | 74.00 | 15.50 |
| | | 5 458.22 | V | X | AV | 41.18 | 5.67 | 0.20 | N/A | 47.05 | 54.00 | 6.95 |
| | | 5 466.18 | V | X | PK | 58.33 | 5.67 | N/A | N/A | 64.00 | 68.20 | 4.20 |
| | | 10 998.73 | V | X | PK | 40.53 | 12.83 | N/A | N/A | 53.36 | 74.00 | 20.64 |
| | | 11 000.00 | V | X | AV | 30.90 | 12.83 | 0.20 | N/A | 43.93 | 54.00 | 10.07 |

### Radiated Spurious Emissions data(9 kHz ~ 40 GHz) : 802.11ac(VHT20)_SDM

| Band | Tested Channel | Freq. (MHz) | ANT Pol | EUT Position (Axis) | Detector Mode | Reading (dBuV) | T.F (dB/m) | DCCF (dB) | DCF (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U-NII 1 | 36 (5 180 MHz) | 5 149.33 | V | X | PK | 66.26 | 5.04 | N/A | N/A | 71.30 | 74.00 | 2.70 |
| | | 5 149.92 | V | X | AV | 45.81 | 5.04 | 0.49 | N/A | 51.34 | 54.00 | 2.66 |
| | | 10 358.76 | V | X | PK | 45.95 | 11.83 | N/A | N/A | 57.78 | 68.20 | 10.42 |
| U-NII 2A | 64 (5 320 MHz) | 5 350.10 | V | X | PK | 65.88 | 5.50 | N/A | N/A | 71.38 | 74.00 | 2.62 |
| | | 5 350.34 | V | X | AV | 45.28 | 5.50 | 0.49 | N/A | 51.27 | 54.00 | 2.73 |
| | | 10 642.14 | V | X | PK` | 43.68 | 12.29 | N/A | N/A | 55.97 | 74.00 | 18.03 |
| | | 10 640.91 | V | X | AV | 32.48 | 12.29 | 0.49 | N/A | 45.26 | 54.00 | 8.74 |
| U-NII 2C | 100 (5 500 MHz) | 5 458.45 | V | X | PK | 55.63 | 5.67 | N/A | N/A | 61.30 | 74.00 | 12.70 |
| | | 5 457.70 | V | X | AV | 41.65 | 5.67 | 0.49 | N/A | 47.81 | 54.00 | 6.19 |
| | | 5 464.19 | V | X | PK | 60.11 | 5.67 | N/A | N/A | 65.78 | 68.20 | 2.42 |
| | | 10 999.85 | V | X | PK | 39.67 | 12.83 | N/A | N/A | 52.50 | 74.00 | 21.50 |
| | | 10 999.74 | V | X | AV | 30.37 | 12.83 | 0.49 | N/A | 43.69 | 54.00 | 10.31 |

### Radiated Spurious Emissions data(9 kHz ~ 40 GHz) : 802.11ac(VHT40)_SDM

| Band | Tested Channel | Freq. (MHz) | ANT Pol | EUT Position (Axis) | Detector Mode | Reading (dBuV) | T.F (dB/m) | DCCF (dB) | DCF (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U-NII 1 | 38 (5 190 MHz) | 5 149.98 | V | X | PK | 62.06 | 5.04 | N/A | N/A | 67.10 | 74.00 | 6.90 |
| | | 5 149.59 | V | X | AV | 43.81 | 5.04 | 0.84 | N/A | 49.69 | 54.00 | 4.31 |
| | | 10 387.74 | V | X | PK | 40.51 | 11.85 | N/A | N/A | 52.36 | 68.20 | 15.84 |
| U-NII 2A | 62 (5 310 MHz) | 5 350.88 | V | X | PK | 65.22 | 5.50 | N/A | N/A | 70.72 | 74.00 | 3.28 |
| | | 5 351.38 | V | X | AV | 44.81 | 5.50 | 0.84 | N/A | 51.15 | 54.00 | 2.85 |
| | | 10 619.95 | V | X | PK | 40.34 | 12.27 | N/A | N/A | 52.61 | 74.00 | 21.39 |
| | | 10 619.60 | V | X | AV | 29.62 | 12.27 | 0.84 | N/A | 42.73 | 54.00 | 11.27 |
| U-NII 2C | 102 (5 510 MHz) | 5 451.06 | V | X | PK | 58.06 | 5.67 | N/A | N/A | 63.73 | 74.00 | 10.27 |
| | | 5 456.54 | V | X | AV | 38.91 | 5.67 | 0.84 | N/A | 45.42 | 54.00 | 8.58 |
| | | 5 463.58 | V | X | PK | 57.84 | 5.67 | N/A | N/A | 63.51 | 68.20 | 4.69 |
| | | 11 019.26 | V | X | PK | 39.50 | 12.83 | N/A | N/A | 52.33 | 74.00 | 21.67 |
| | | 11 019.99 | V | X | AV | 30.69 | 12.83 | 0.84 | N/A | 44.36 | 54.00 | 9.64 |
| U-NII 3 | 151 (5 755 MHz) | 5 647.65 | V | X | PK | 52.68 | 5.83 | N/A | N/A | 58.51 | 68.20 | 9.69 |
| | | 5 720.15 | V | X | PK | 66.63 | 5.94 | N/A | N/A | 72.57 | 111.14 | 38.57 |
| | | 11 510.08 | V | X | PK | 38.80 | 13.34 | N/A | N/A | 52.14 | 74.00 | 21.86 |
| | | 11 510.28 | V | X | AV | 30.05 | 13.34 | 0.84 | N/A | 44.23 | 54.00 | 9.77 |
| | 159 (5 795 MHz) | 5 854.97 | V | X | PK | 50.76 | 6.64 | N/A | N/A | 57.40 | 110.87 | 53.47 |
| | | 5 927.02 | V | X | PK | 43.96 | 6.85 | N/A | N/A | 50.81 | 68.20 | 17.39 |
| | | 11 590.69 | V | X | PK | 39.23 | 13.35 | N/A | N/A | 52.58 | 74.00 | 21.42 |
| | | 11 590.09 | V | X | AV | 29.14 | 13.35 | 0.84 | N/A | 43.33 | 54.00 | 10.67 |

### Radiated Spurious Emissions data(9 kHz ~ 40 GHz) : 802.11ac(VHT80)_SDM

| Band | Tested Channel | Freq. (MHz) | ANT Pol | EUT Position (Axis) | Detector Mode | Reading (dBuV) | T.F (dB/m) | DCCF (dB) | DCF (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U-NII 1 | 42 (5 210 MHz) | 5 148.12 | V | X | PK | 57.88 | 5.04 | N/A | N/A | 62.92 | 74.00 | 11.08 |
| | | 5 148.28 | V | X | AV | 44.95 | 5.04 | 1.40 | N/A | 51.39 | 54.00 | 2.61 |
| | | 10 423.62 | V | X | PK | 40.29 | 11.94 | N/A | N/A | 52.23 | 68.20 | 15.97 |
| U-NII 2A | 58 (5 290 MHz) | 5 352.26 | V | X | PK | 59.56 | 5.50 | N/A | N/A | 65.06 | 74.00 | 8.94 |
| | | 5 351.36 | V | X | AV | 44.65 | 5.50 | 1.40 | N/A | 51.55 | 54.00 | 2.45 |
| | | 10 569.88 | V | X | PK | 39.91 | 12.23 | N/A | N/A | 52.14 | 68.20 | 16.06 |
| U-NII 2C | 106 (5 530 MHz) | 5 459.34 | V | X | PK | 57.94 | 5.67 | N/A | N/A | 63.61 | 74.00 | 10.39 |
| | | 5 459.32 | V | X | AV | 44.09 | 5.67 | 1.40 | N/A | 51.16 | 54.00 | 2.84 |
| | | 5 461.42 | V | X | PK | 58.72 | 5.67 | N/A | N/A | 64.39 | 68.20 | 3.81 |
| | | 11 074.00 | V | X | PK | 39.25 | 12.85 | N/A | N/A | 52.10 | 74.00 | 21.90 |
| | | 11 072.02 | V | X | AV | 29.12 | 12.85 | 1.40 | N/A | 43.37 | 54.00 | 10.63 |

# 9. LIST OF TEST EQUIPMENT

| Type | Manufacturer | Model | Cal.Date (yy/mm/dd) | Next.Cal. Date (yy/mm/dd) | S/N |
|---|---|---|---|---|---|
| Spectrum Analyzer | Agilent Technologies | N9020A | 20/06/24 | 21/06/24 | US47360812 |
| Spectrum Analyzer | Agilent Technologies | N9030A | 19/12/16 | 20/12/16 | MY53310140 |
| DC power supply | SM techno | SDP30-5D | 20/06/24 | 21/06/24 | 305DNF079 |
| Multimeter | FLUKE | 17B+ | 19/12/16 | 20/12/16 | 36390701WS |
| Thermohygrometer | BODYCOM | BJ5478 | 19/12/18 | 20/12/18 | 120612-2 |
| Thermohygrometer | BODYCOM | BJ5478 | 19/12/18 | 20/12/18 | 120612-1 |
| Signal Generator | Rohde Schwarz | SMBV100A | 19/12/16 | 20/12/16 | 255571 |
| Signal Generator | ANRITSU | MG3695C | 19/12/16 | 20/12/16 | 173501 |
| Loop Antenna | ETS-Lindgren | 6502 | 19/09/18 | 21/09/18 | 00226186 |
| Bilog Antenna | Schwarzbeck | VULB 9160 | 19/04/23 | 21/04/23 | 9160-3362 |
| Power Meter & Wide Bandwidth Sensor | Anritsu | ML2496A ML2495A | 20/06/24 | 21/06/24 | 1338004 1306007 |
| HORN ANT | ETS | 3117 | 20/04/24 | 21/04/24 | 00140394 |
| HORN ANT | A.H.Systems | SAS-574 | 20/06/24 | 21/06/24 | 155 |
| PreAmplifier | H.P | 8447D | 19/12/16 | 20/12/16 | 2944A07774 |
| PreAmplifier | Agilent | 8449B | 20/06/24 | 21/06/24 | 3008A02108 |
| PreAmplifier | A.H.Systems Inc. | PAM-1840VH | 20/06/24 | 21/06/24 | 163 |
| High-pass filter | Wainwright | WHKX12-2580-3000-18000-80SS | 20/06/24 | 21/06/24 | 3 |
| High-pass filter | Wainwright | WHNX6-6320-8000-26500-40CC | 20/06/24 | 21/06/24 | 2 |
| Cable | Junkosha | MWX241 | 20/01/13 | 21/01/13 | G-04 |
| Cable | Junkosha | MWX241 | 20/01/13 | 21/01/13 | G-07 |
| Cable | DTNC | Cable | 20/08/03 | 21/08/03 | M-07 |
| Cable | DTNC | Cable | 20/08/03 | 21/08/03 | M-08 |
| Cable | Junkosha | MWX315 | 20/01/16 | 21/01/16 | M-05 |
| Cable | Junkosha | MWX221 | 20/01/16 | 21/01/16 | M-06 |
| Cable | DTNC | Cable | 20/01/16 | 21/01/16 | RF-09 |

Note 1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017
Note 2: The cable is not a regular calibration item, so it has been calibrated by DT & C itself.

# APPENDIX I

## Duty Cycle Information

### ▣ Test Procedure

**Duty Cycle [X = On Time / ( On + Off time )]** is measured using Measurement Procedure **of KDB789033 D02v02r01**

1. Set the center frequency of the spectrum analyzer to the center frequency of the transmission.
2. Set RBW ≥ EBW if possible; otherwise, set RBW to the largest available value.
3. Set VBW ≥ RBW. Set detector = peak.
4. Note : The zero-span measurement method shall not be used unless both **RBW and VBW are > 50 / *T***, where *T* is defined in section II.B.1.a), and **the number of sweep points across duration *T* exceeds 100**. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if *T* ≤ 16.7 microseconds.)

   *T* : The minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
   (***T* = On time** of the above table since the EUT operates with above fixed Duty Cycle and it is the minimum On time)

### ▣ Test Results:

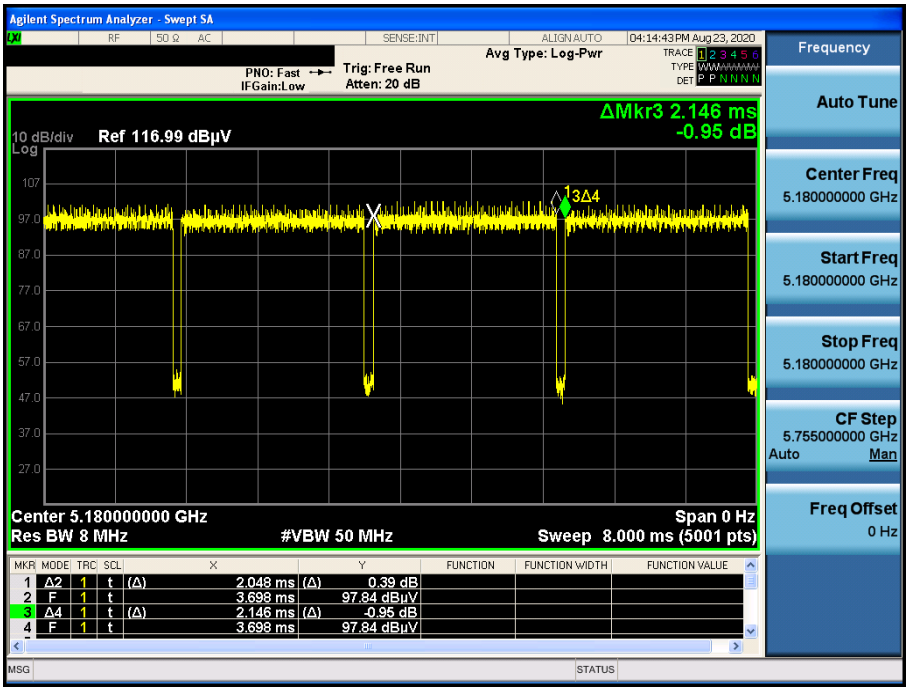
**Duty cycle**

| Mode | Data Rate | Tested Frequency [MHz] | Maximum Achievable Duty Cycle (*x*) = On / (On+Off) | | | DCCF= 10 log(1/x) [dB] | 50/*T* [kHz] |
|---|---|---|---|---|---|---|---|
| | | | T=On Time [ms] | (On+Off) Time [ms] | *x* | | |
| 802.11a | 6Mbps | 5 180 | 2.146 | 2.048 | 0.954 3 | 0.20 | 24.41 |
| 802.11ac (VHT20) | MCS0 | 5 180 | 1.100 | 0.983 | 0.893 6 | 0.49 | 50.86 |
| 802.11ac (VHT40) | MCS0 | 5 190 | 0.602 | 0.496 | 0.823 9 | 0.84 | 100.81 |
| 802.11ac (VHT80) | MCS0 | 5 210 | 0.353 | 0.256 | 0.725 2 | 1.40 | 195.31 |

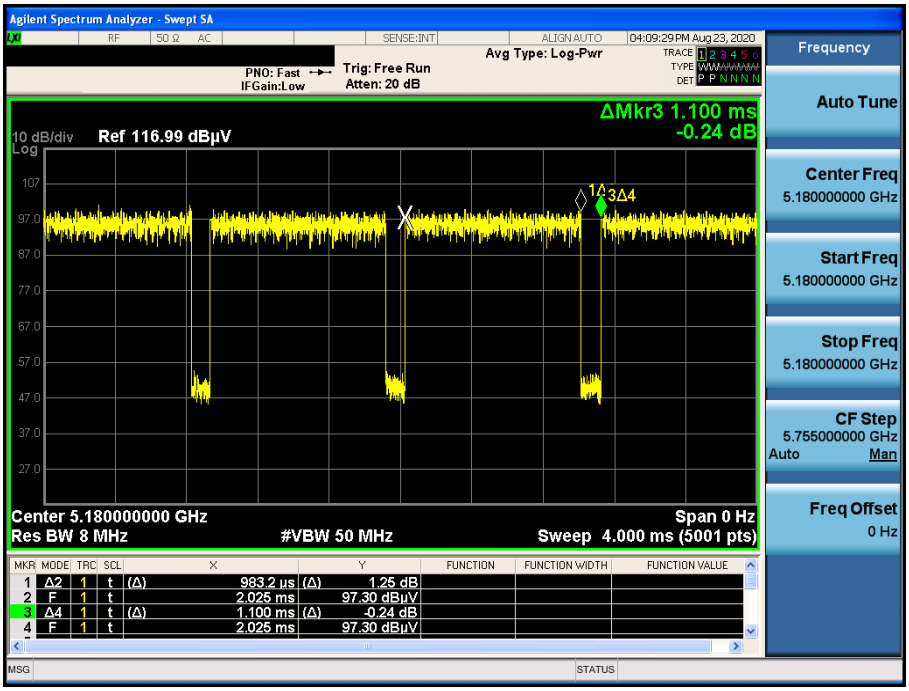
## ▣ Test Plot:

### Single Transmit

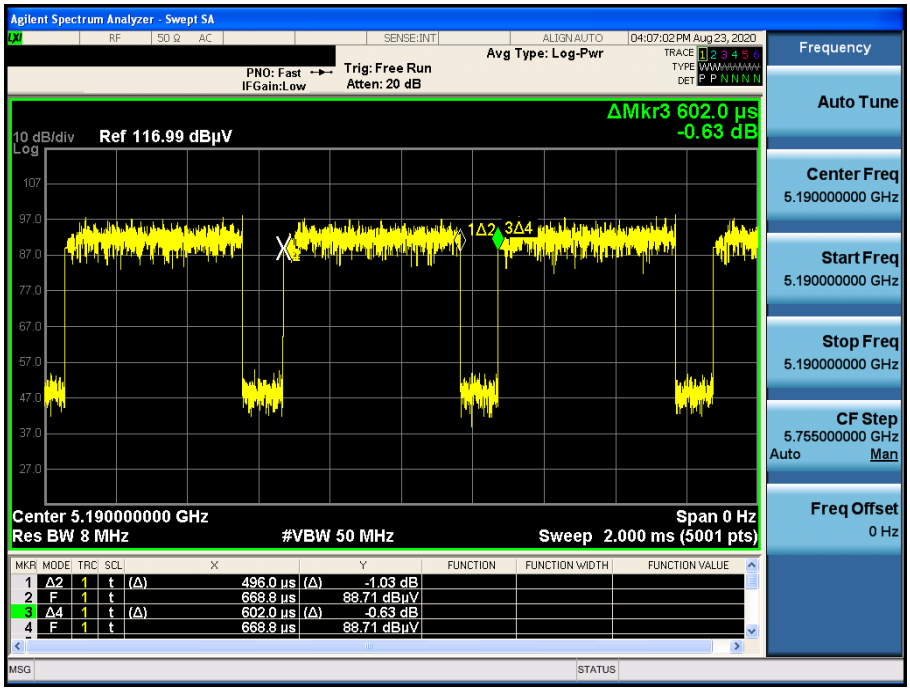
**Duty Cycle** Test Mode: 802.11a & Ch.36



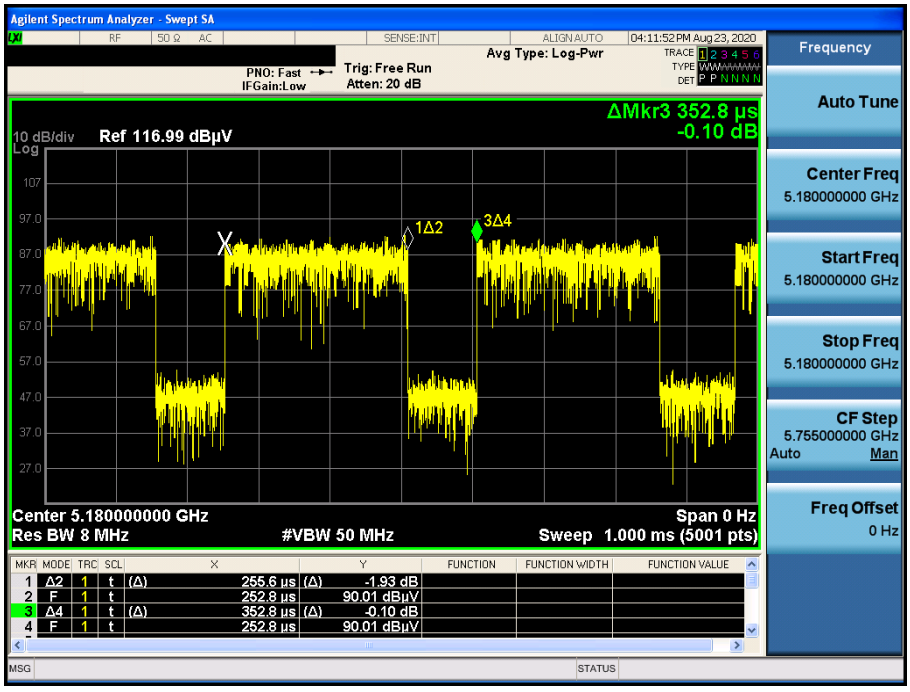

**Duty Cycle** Test Mode: 802.11ac(VHT20) & Ch.36



**Duty Cycle** Test Mode: 802.11ac(VHT40) & Ch.38



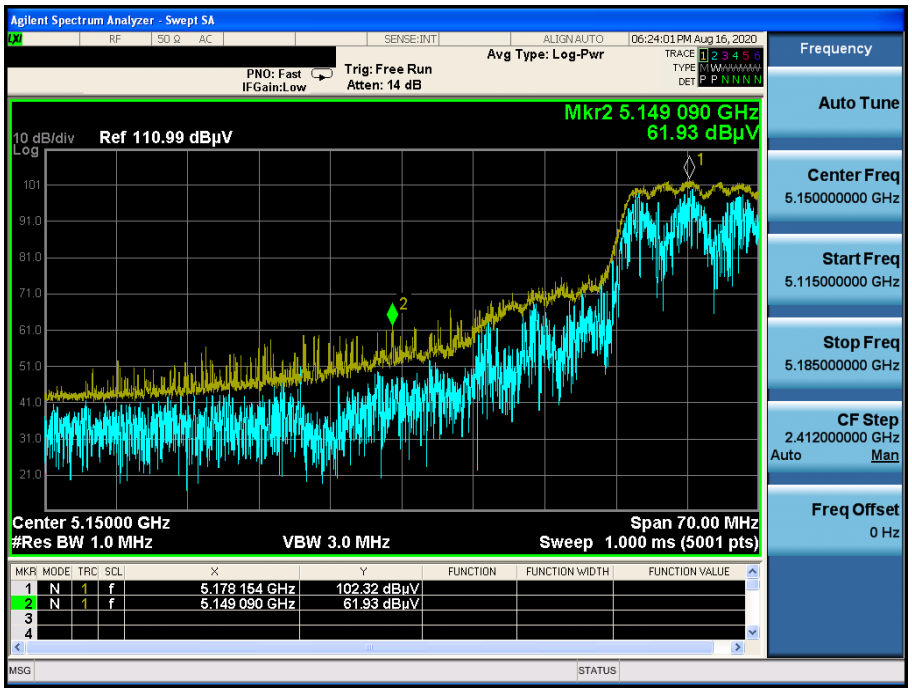

**Duty Cycle** Test Mode: 802.11ac(VHT80) & Ch.42



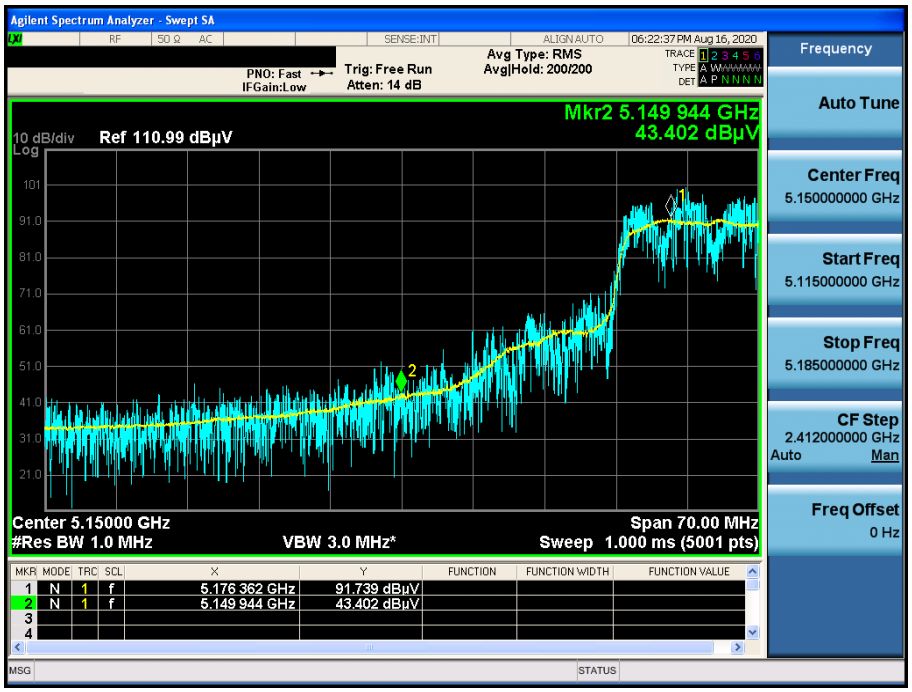
# APPENDIX II

## Unwanted Emissions (Radiated) Test Plot:

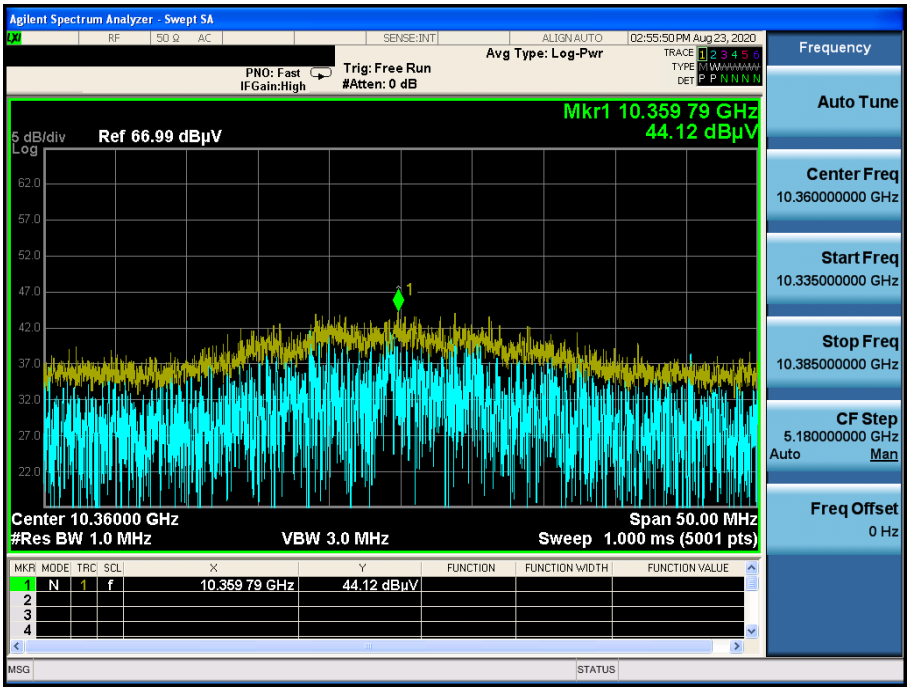
**802.11a & U-NII 1 & Ch.36 & X axis & Ver** **Detector Mode : PK**



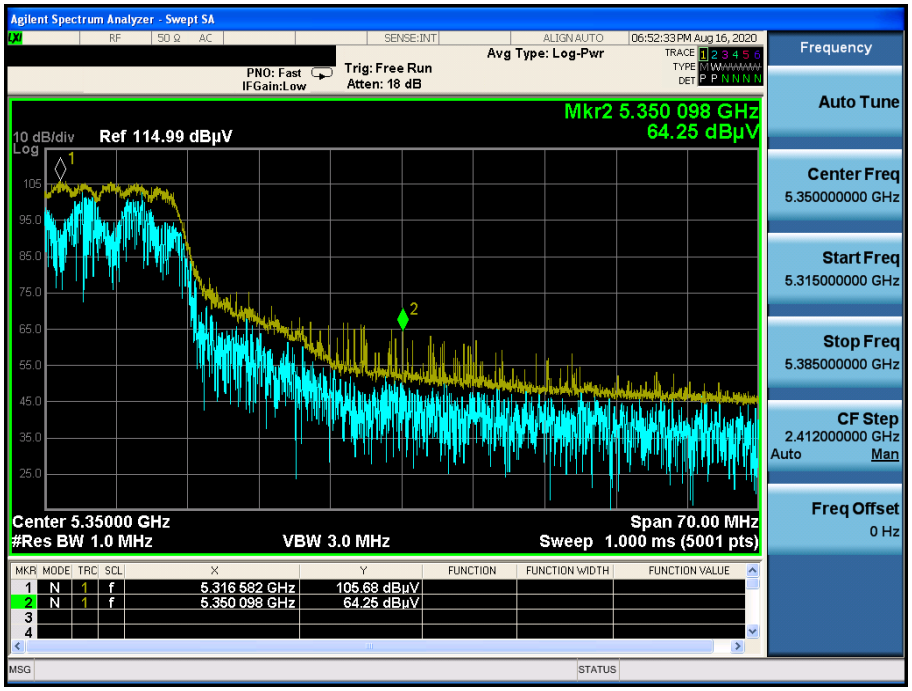

**802.11a & U-NII 1 & Ch.36 & X axis & Ver** **Detector Mode : AV**



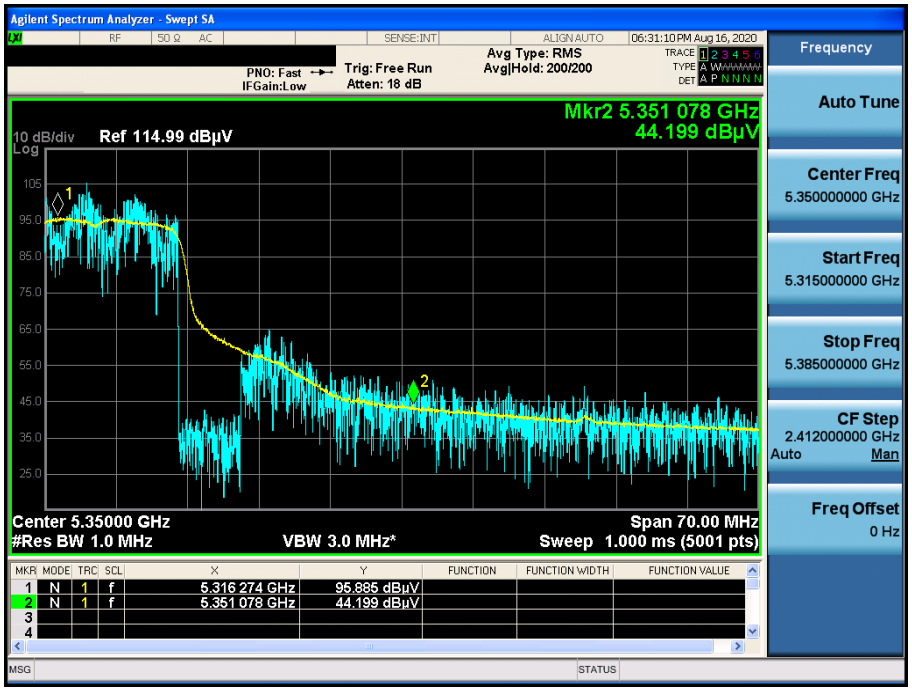
**802.11a & U-NII 1 & Ch.36 & X axis & Ver** **Detector Mode : PK**



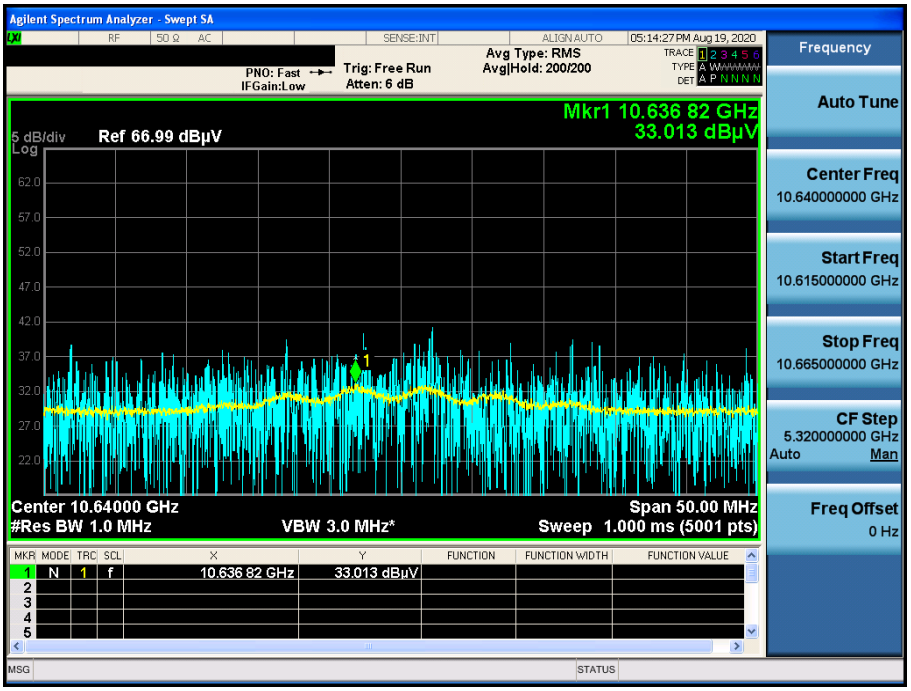
**802.11a & U-NII 2A & Ch.64 & X axis & Ver** **Detector Mode : PK**



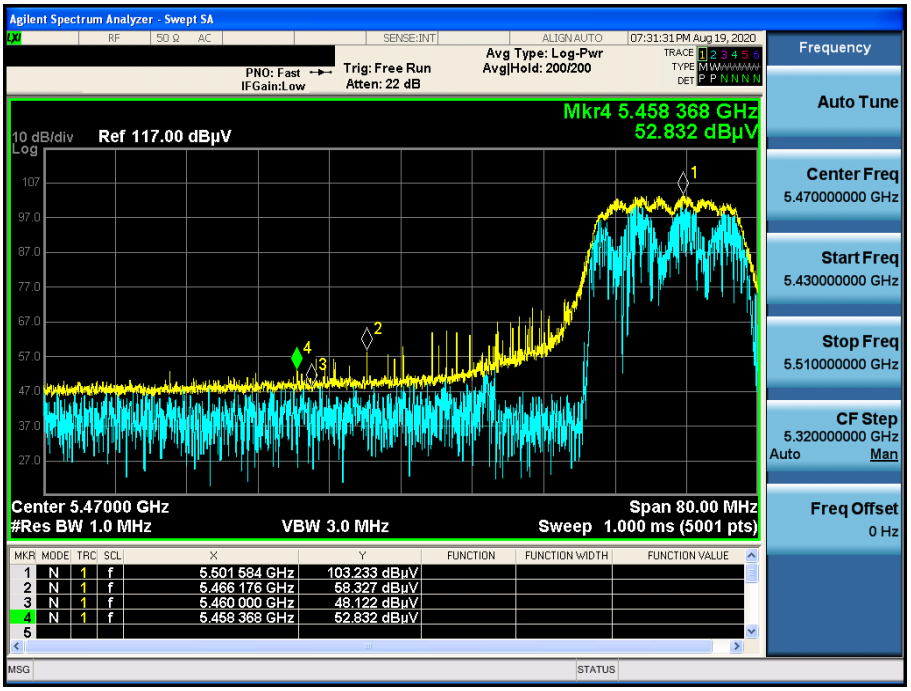

**802.11a & U-NII 2A & Ch.64 & X axis & Ver** **Detector Mode : AV**



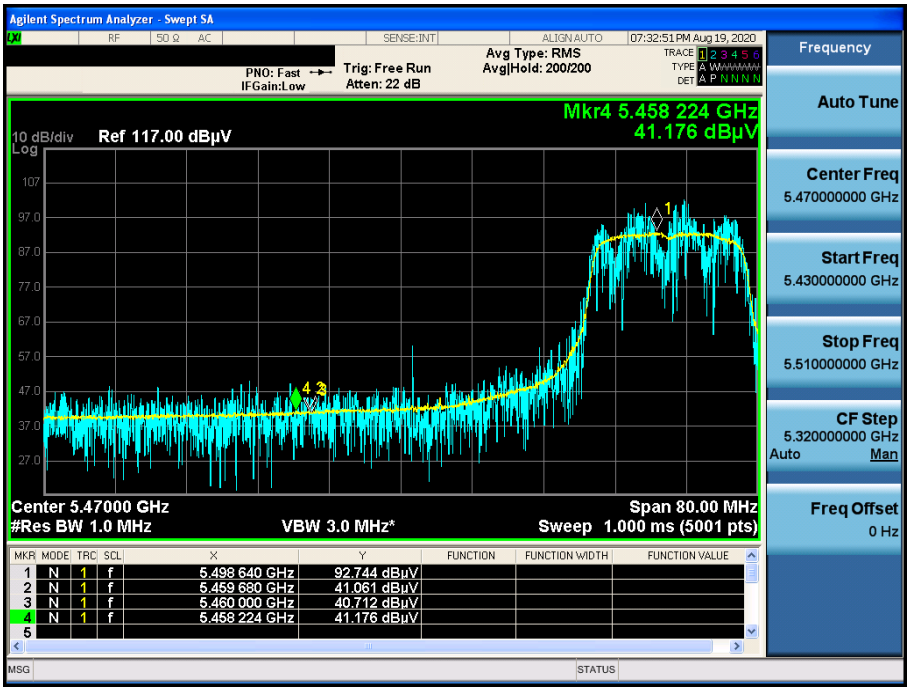
**802.11a & U-NII 2A & Ch.64 & X axis & Ver** **Detector Mode : AV**



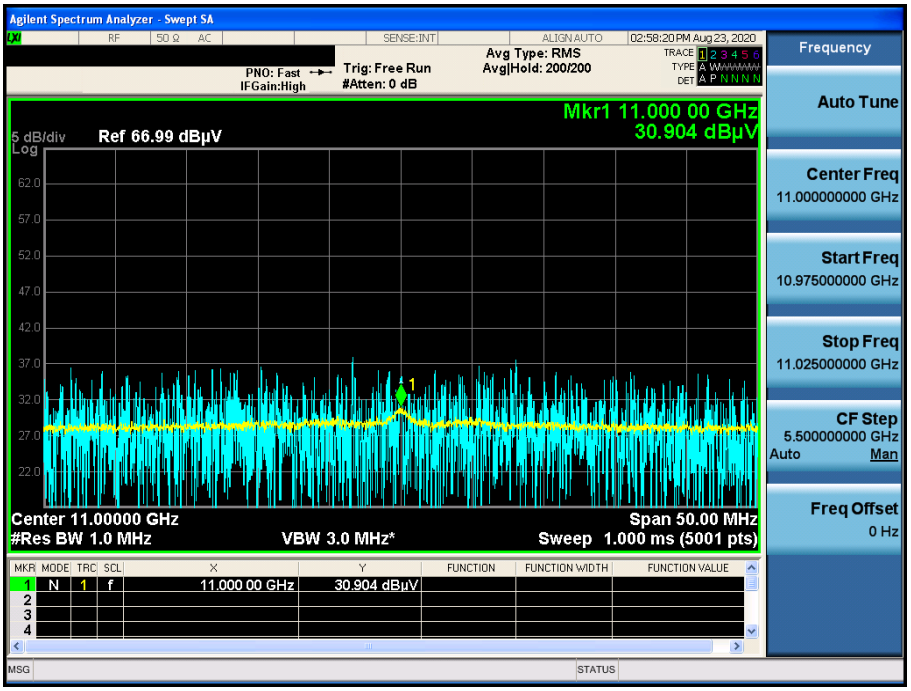
**802.11a & U-NII 2C & Ch.100 & X axis & Ver** **Detector Mode : PK**



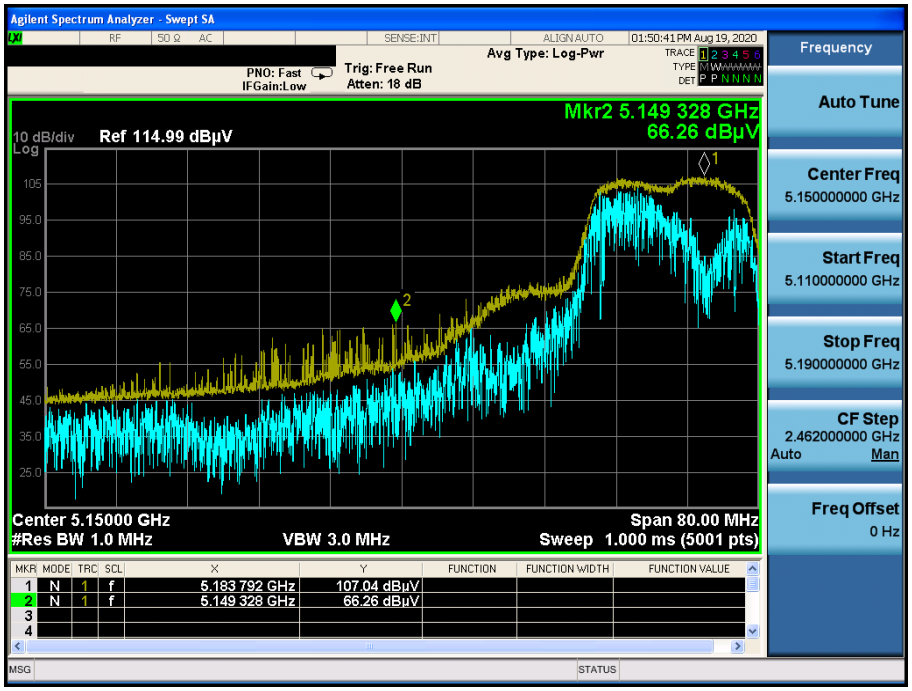

**802.11a & U-NII 2C & Ch.100 & X axis & Ver** **Detector Mode : AV**



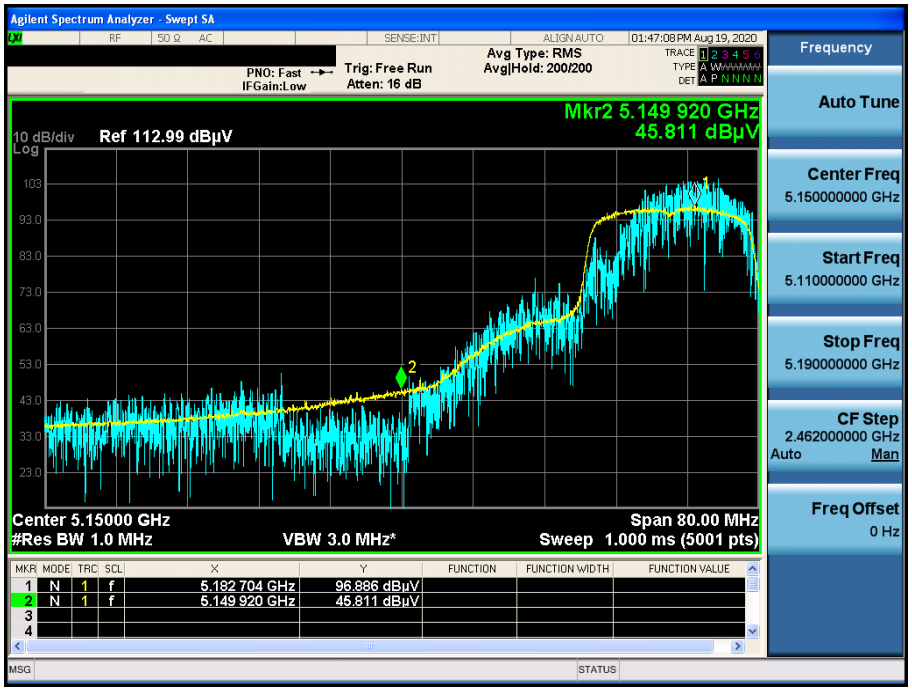
**802.11a & U-NII 2C & Ch.100 & X axis & Ver** **Detector Mode : AV**



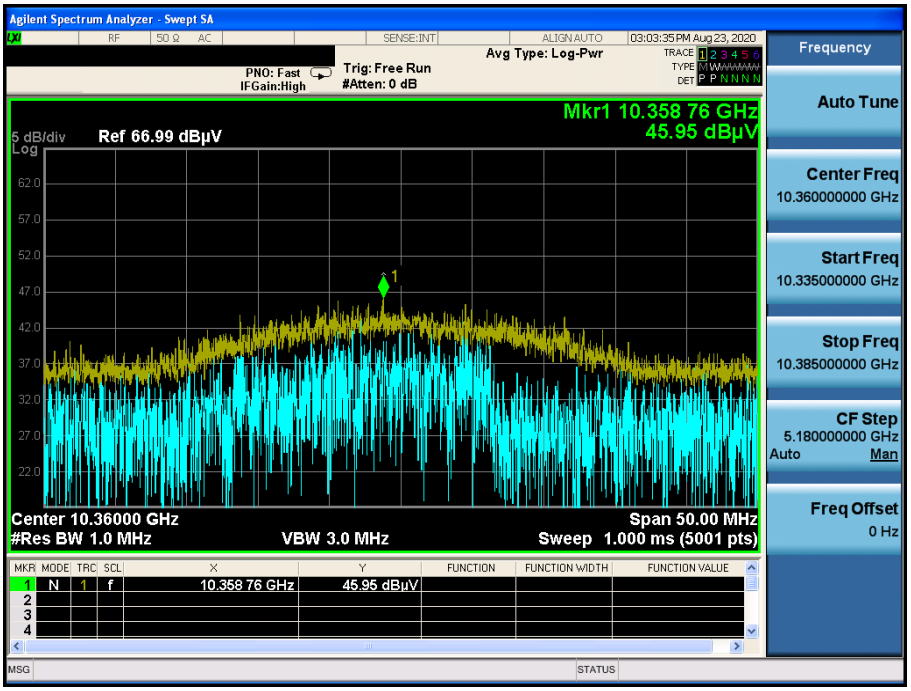
**802.11ac(VHT20) & U-NII 1 & Ch.36 & X axis & Ver Detector Mode : PK**



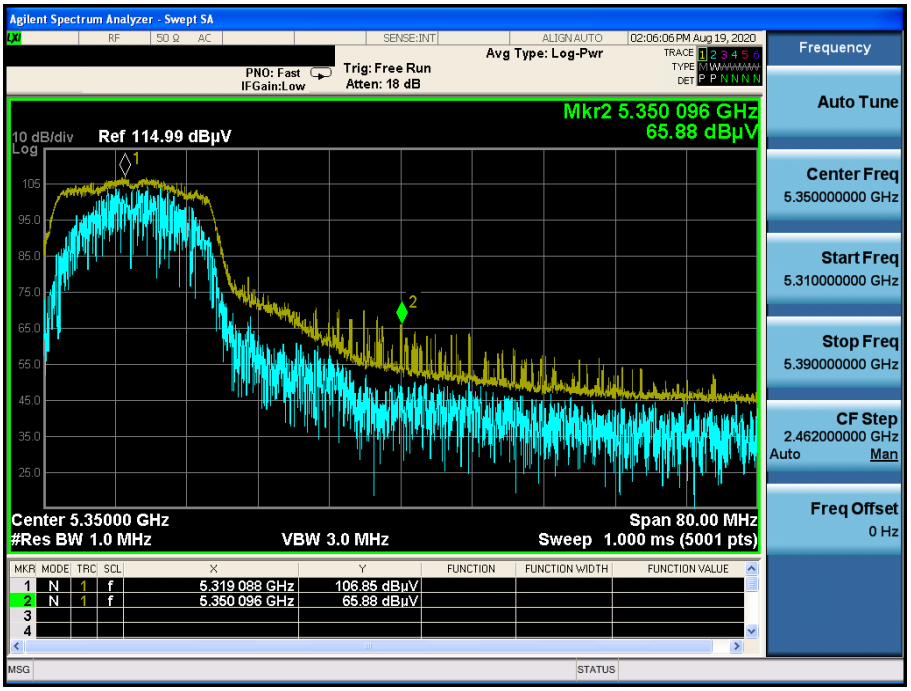

**802.11ac(VHT20) & U-NII 1 & Ch.36 & X axis & Ver Detector Mode : AV**



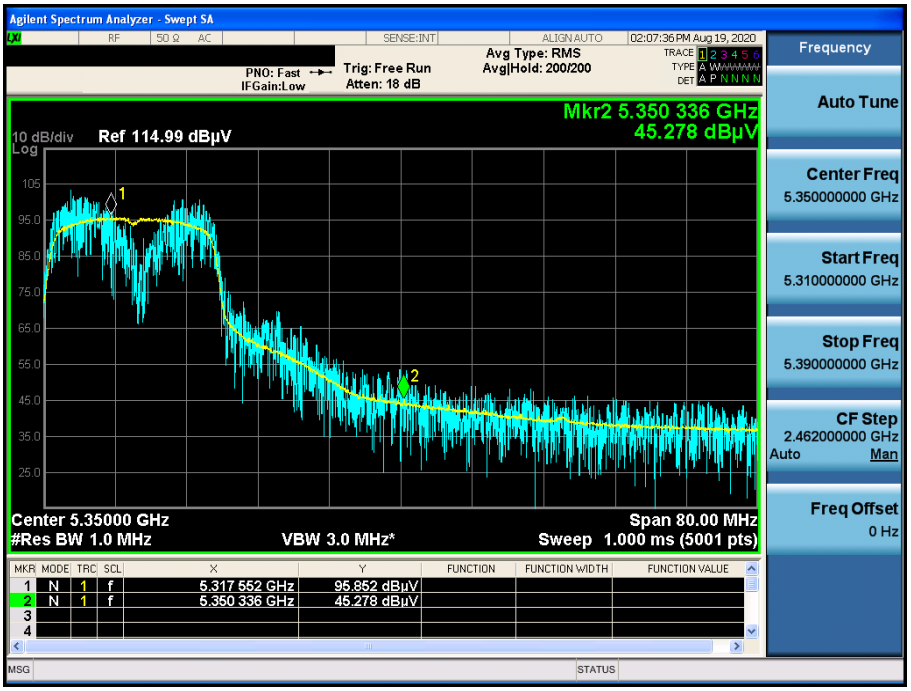
**802.11ac(VHT20) & U-NII 1 & Ch.36 & X axis & Ver Detector Mode : PK**



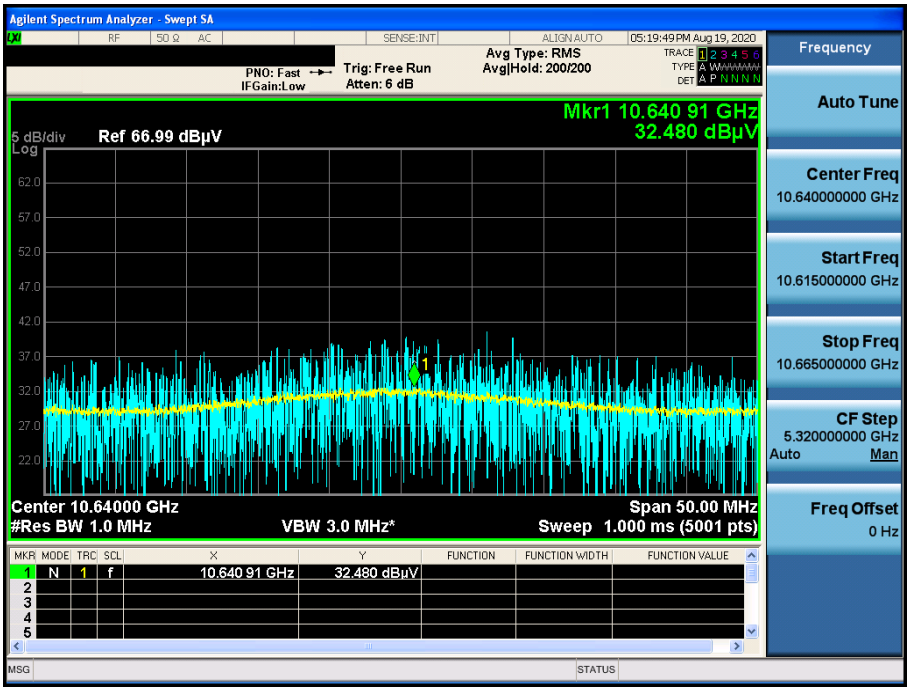
**802.11ac(VHT20) & U-NII 2A & Ch.64 & X axis & Ver Detector Mode : PK**



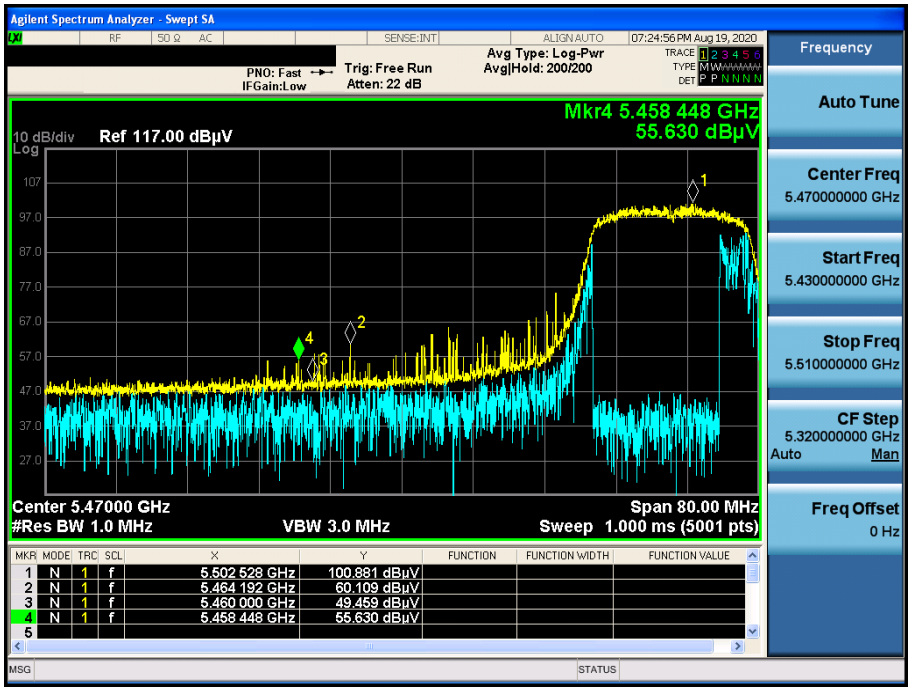

**802.11ac(VHT20) & U-NII 2A & Ch.64 & X axis & Ver Detector Mode : AV**



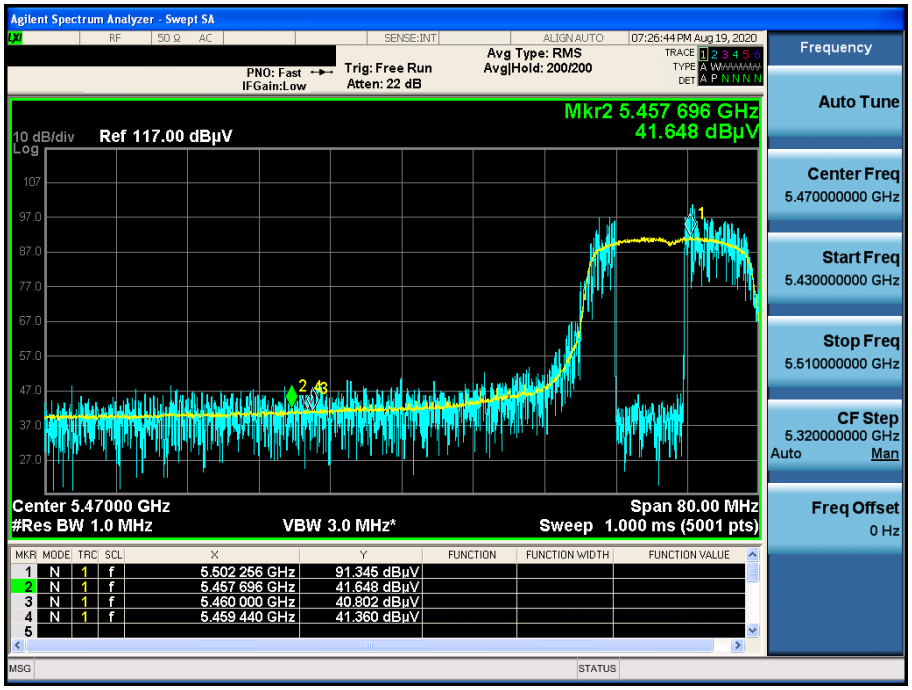
**802.11ac(VHT20) & U-NII 2A & Ch.64 & X axis & Ver Detector Mode : AV**



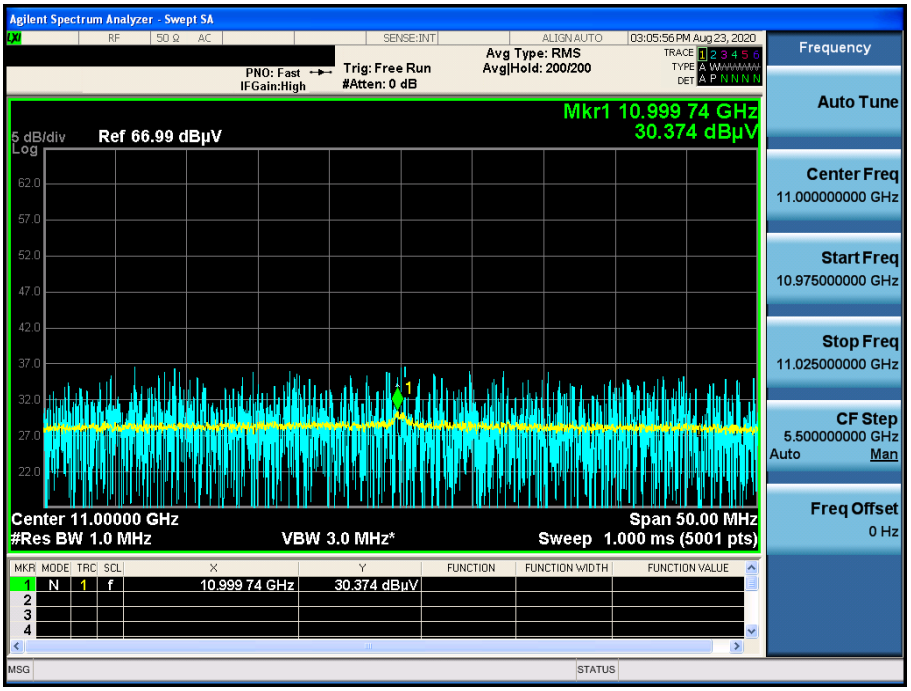
**802.11ac(VHT20) & U-NII 2C & Ch.100 & X axis & Ver Detector Mode : PK**



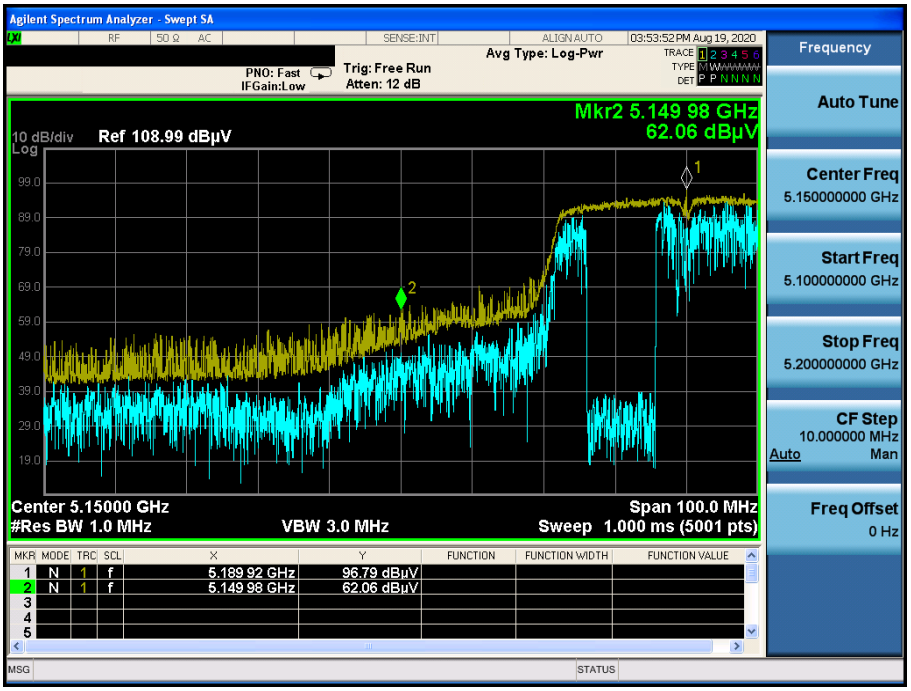

**802.11ac(VHT20) & U-NII 2C & Ch.100 & X axis & Ver Detector Mode : AV**



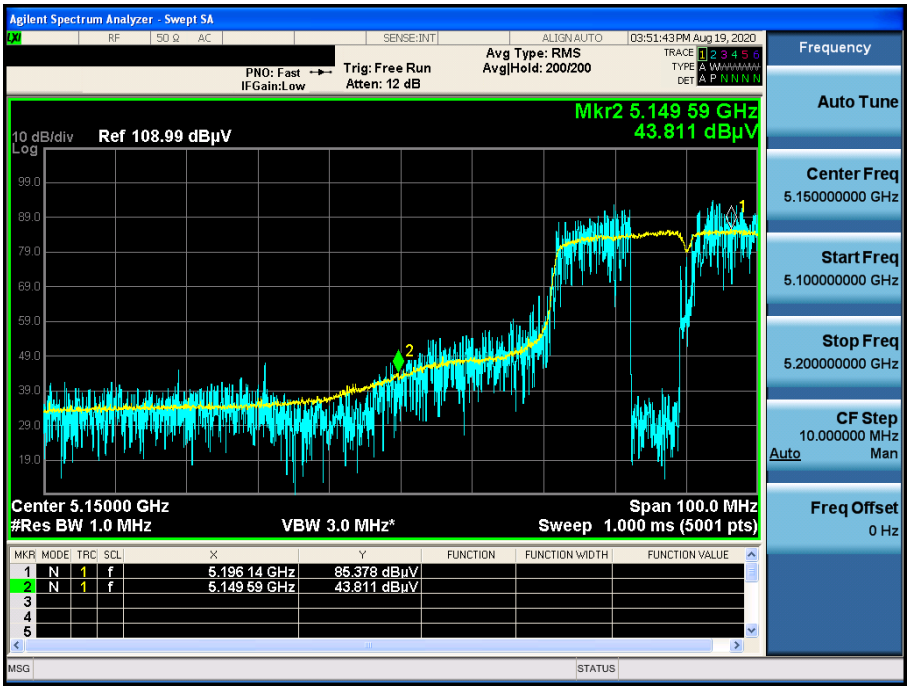
**802.11ac(VHT20) & U-NII 2C & Ch.100 & X axis & Ver Detector Mode : AV**



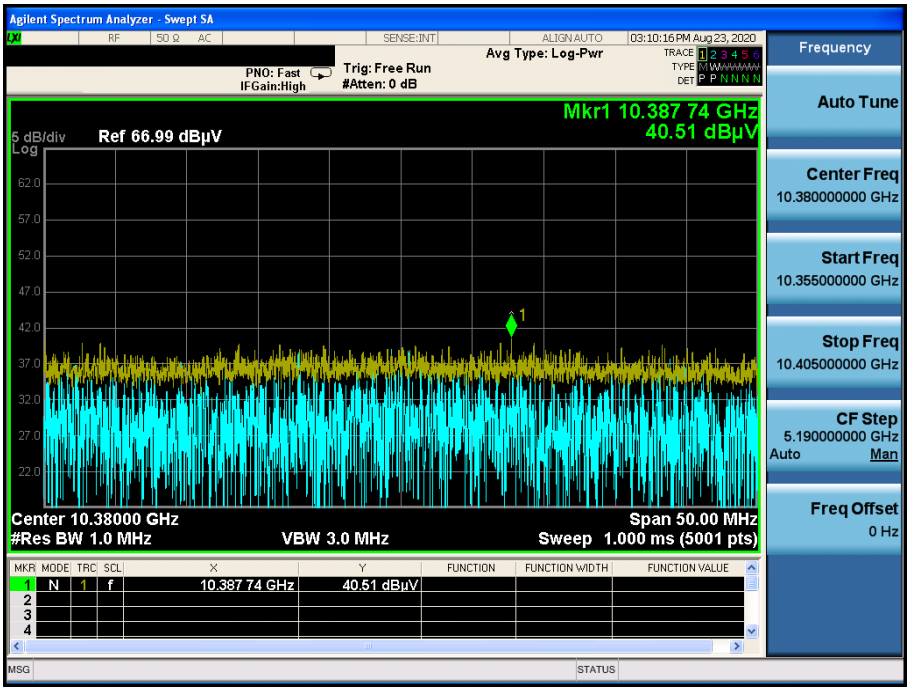
**802.11ac(VHT40) & U-NII 1 & Ch.38 & X axis & Ver Detector Mode : PK**



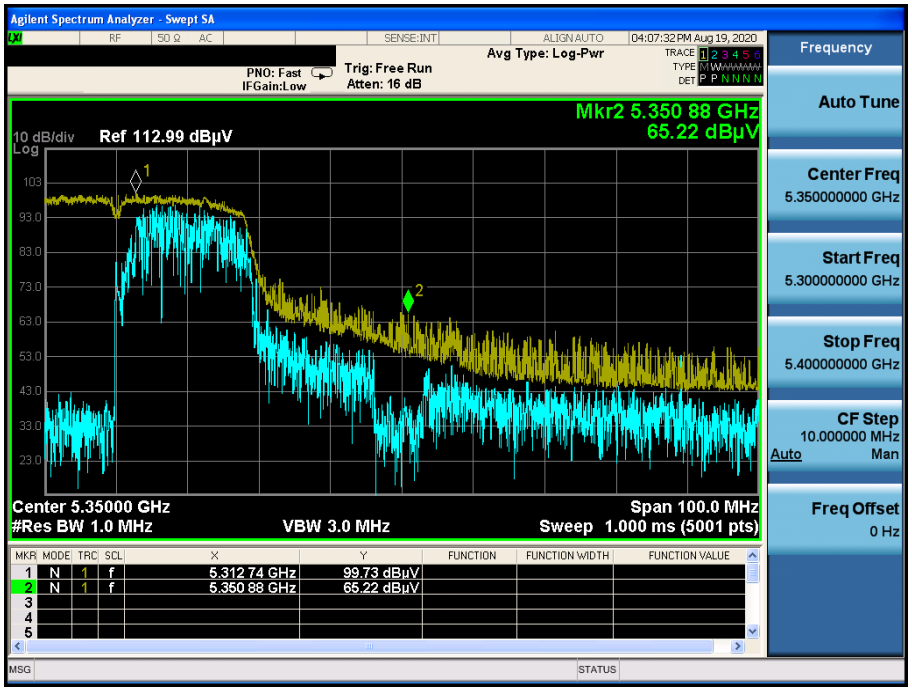

**802.11ac(VHT40) & U-NII 1 & Ch.38 & X axis & Ver Detector Mode : AV**



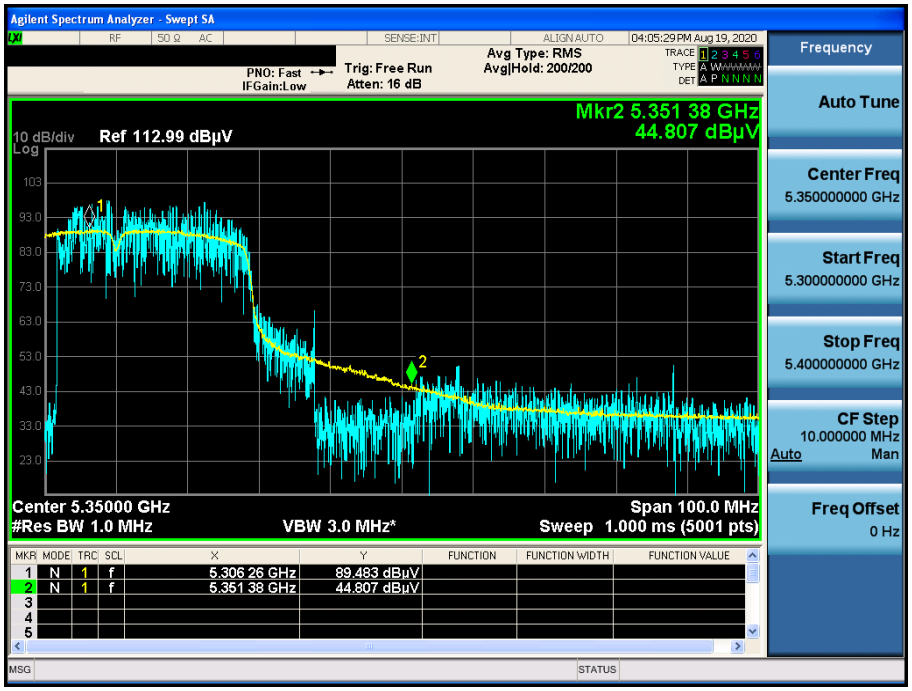
**802.11ac(VHT40) & U-NII 1 & Ch.38 & X axis & Ver Detector Mode : PK**



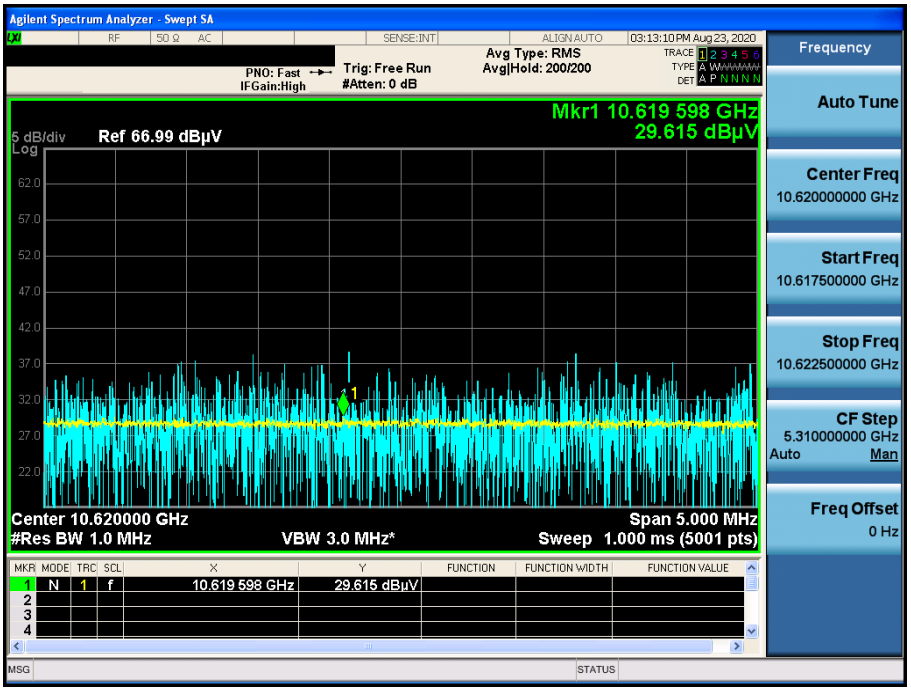
**802.11ac(VHT40) & U-NII 2A & Ch.62 & X axis & Ver Detector Mode : PK**



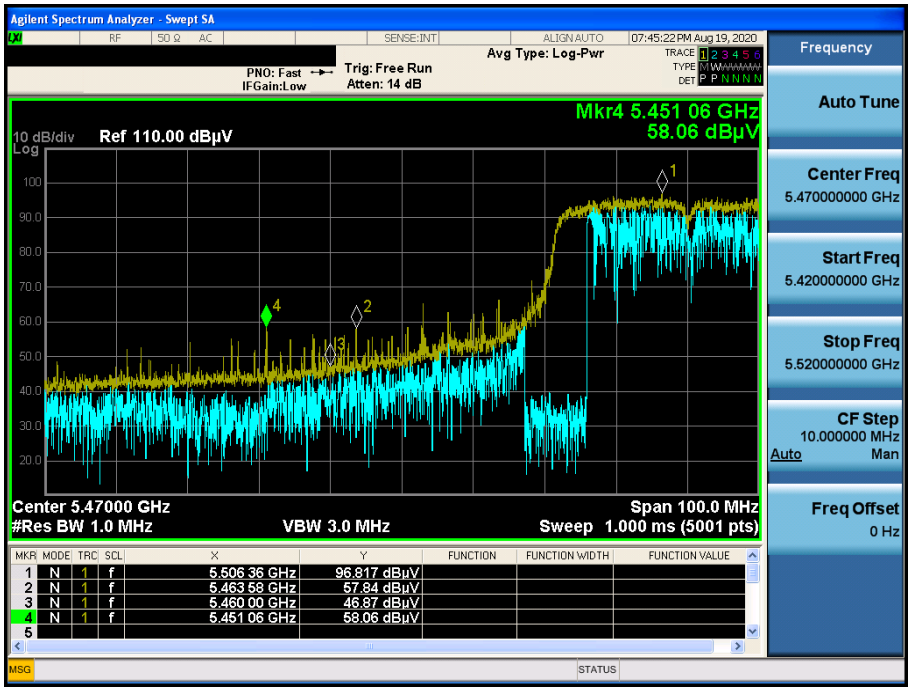

**802.11ac(VHT40) & U-NII 2A & Ch.62 & X axis & Ver Detector Mode : AV**



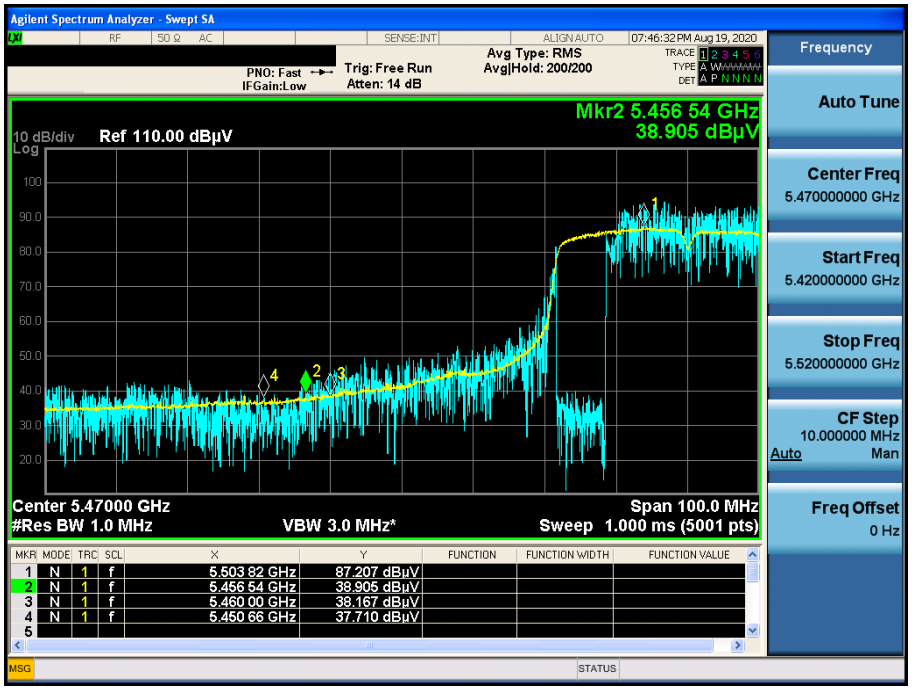
**802.11ac(VHT40) & U-NII 2A & Ch.62 & X axis & Ver Detector Mode : AV**



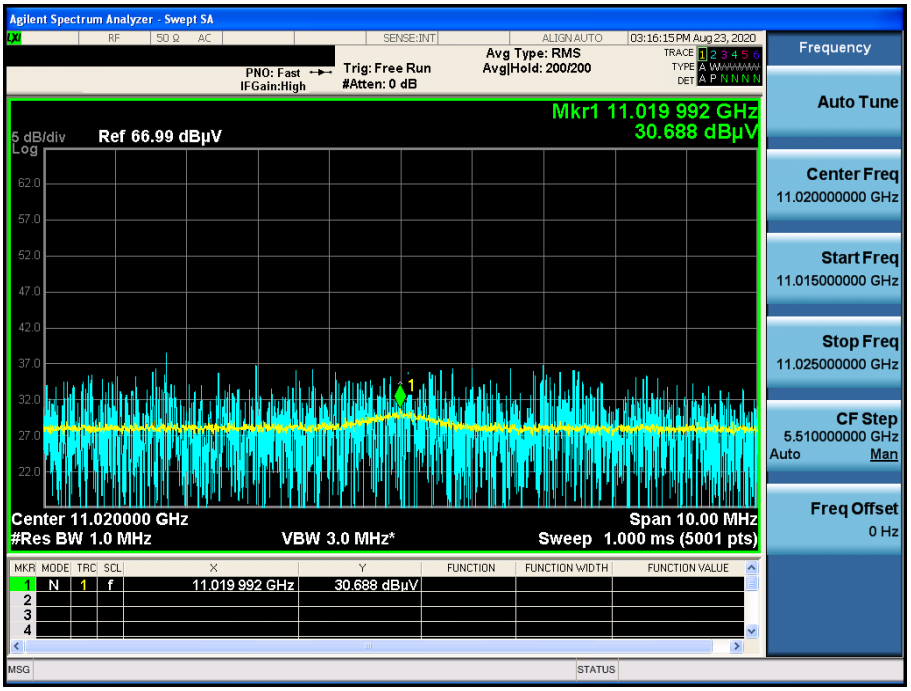
**802.11ac(VHT40) & U-NII 2C & Ch.102 & X axis & Ver Detector Mode : PK**



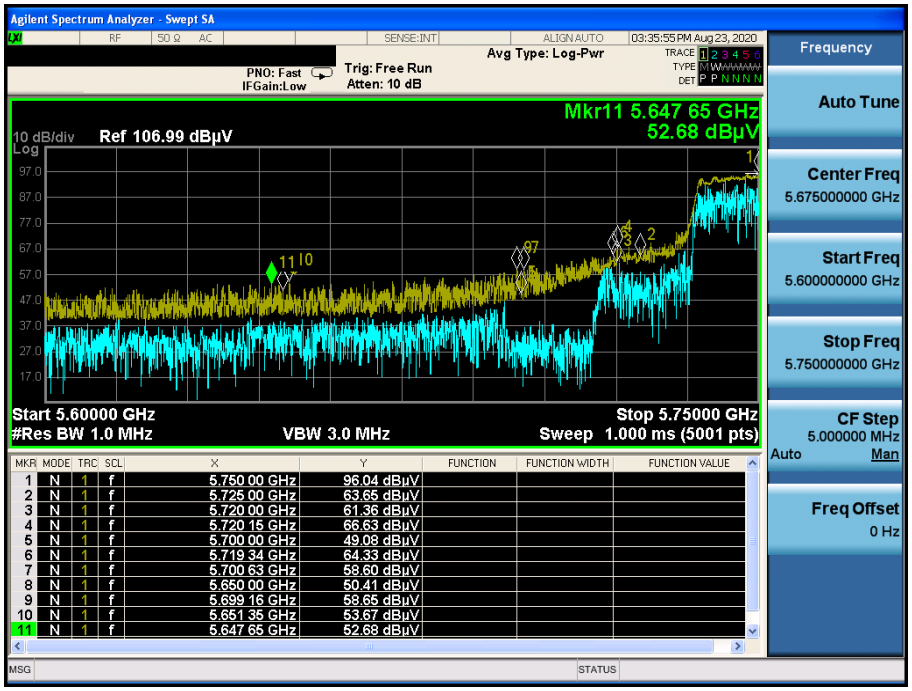

**802.11ac(VHT40) & U-NII 2C & Ch.102 & X axis & Ver Detector Mode : AV**



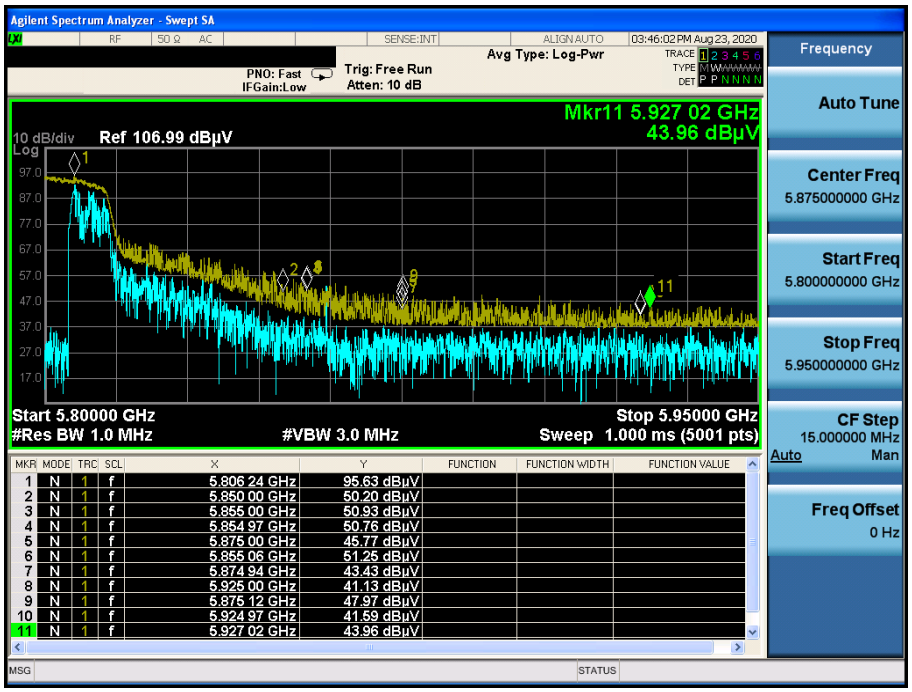
**802.11ac(VHT40) & U-NII 2C & Ch.102 & X axis & Ver Detector Mode : AV**



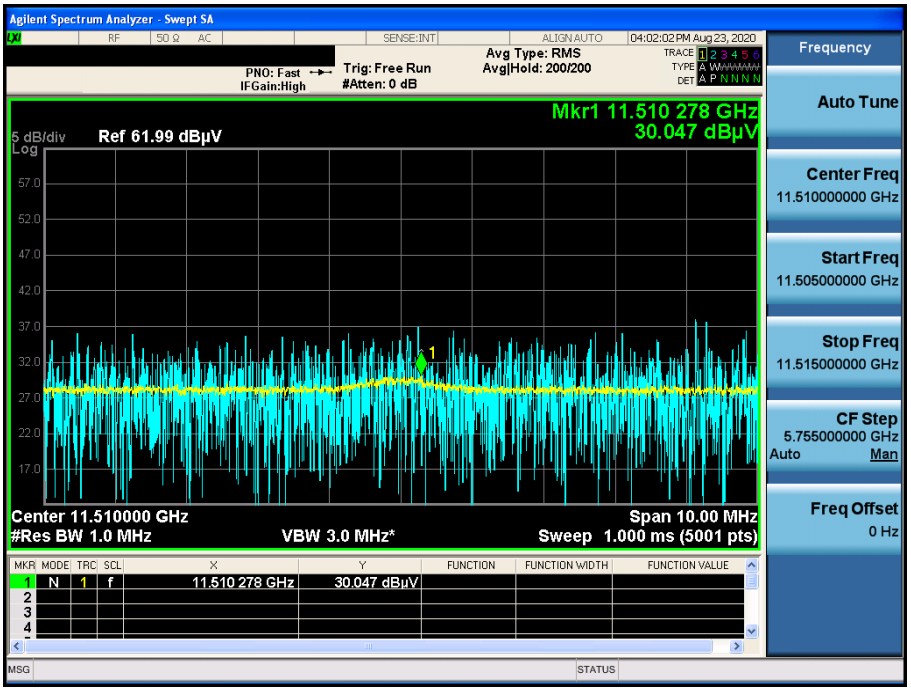
**802.11ac(VHT40) & U-NII 3 & Ch.151 & X axis & Ver Detector Mode : PK**




**802.11ac(VHT40) & U-NII 3 & Ch.159 & X axis & Ver Detector Mode : PK**

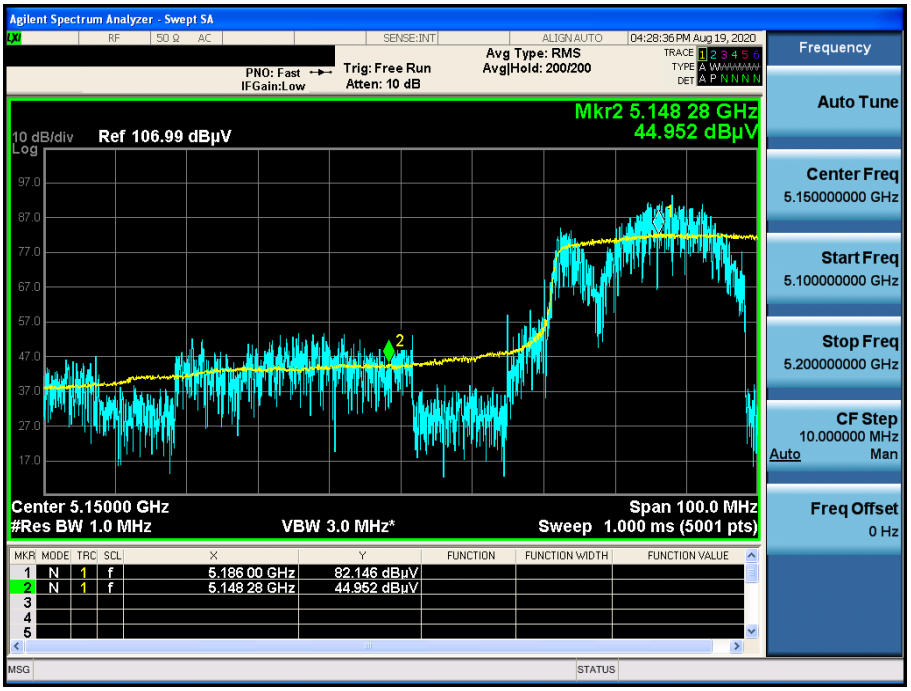


**802.11ac(VHT40) & U-NII 3 & Ch.151 & X axis & Ver Detector Mode : AV**

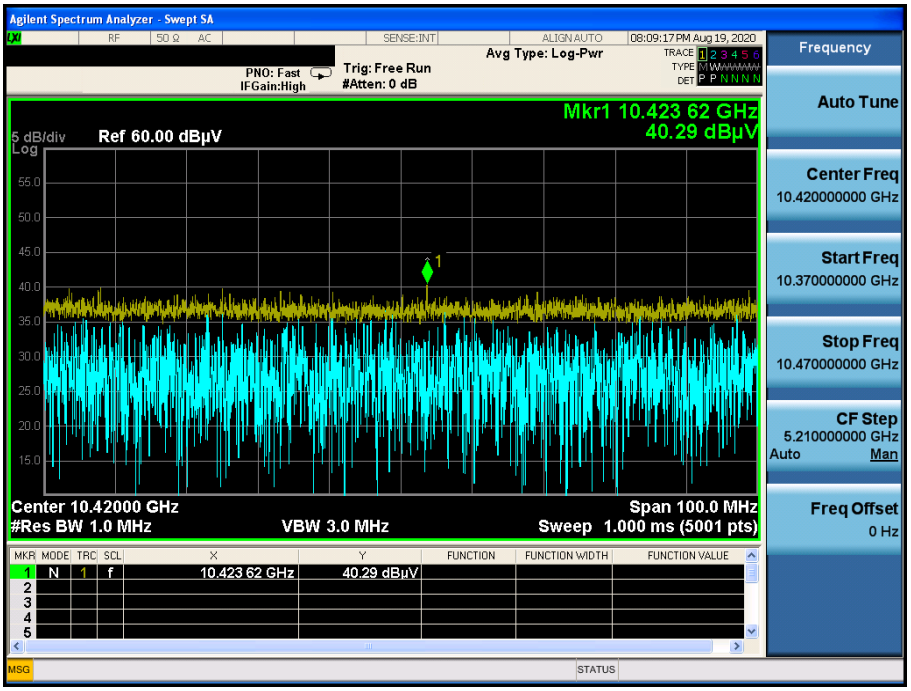


**802.11ac(VHT80) & U-NII 1 & Ch.42 & X axis & Ver Detector Mode : PK**

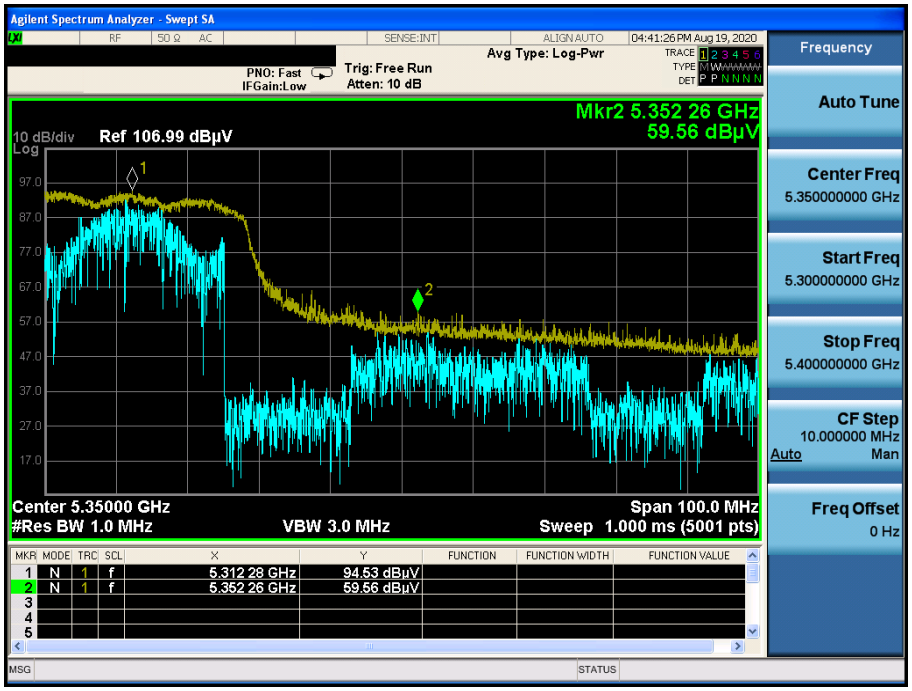

**802.11ac(VHT80) & U-NII 1 & Ch.42 & X axis & Ver Detector Mode : AV**



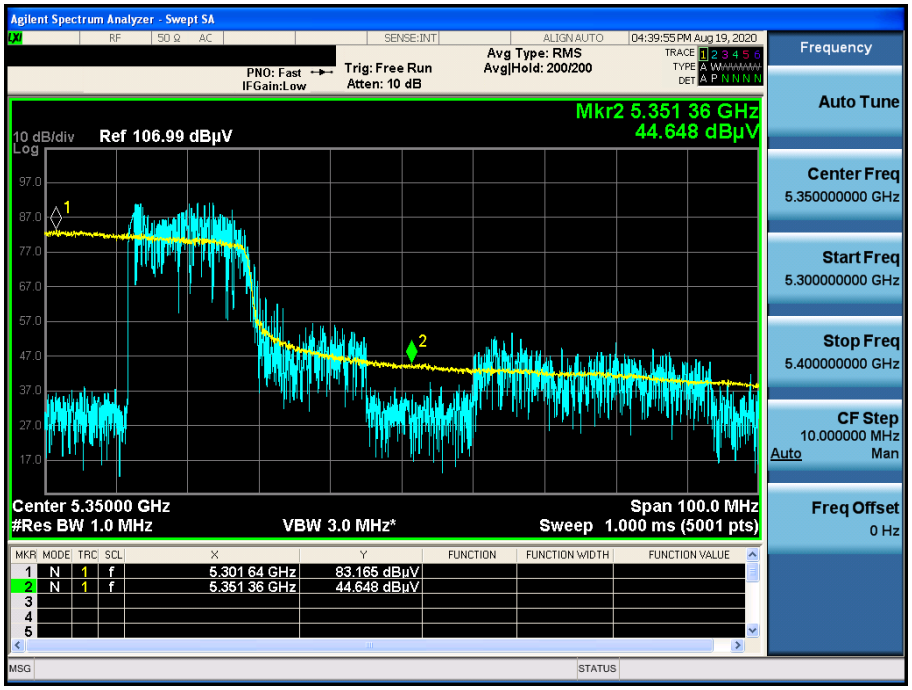
**802.11ac(VHT80) & U-NII 1 & Ch.42 & X axis & Ver Detector Mode : PK**



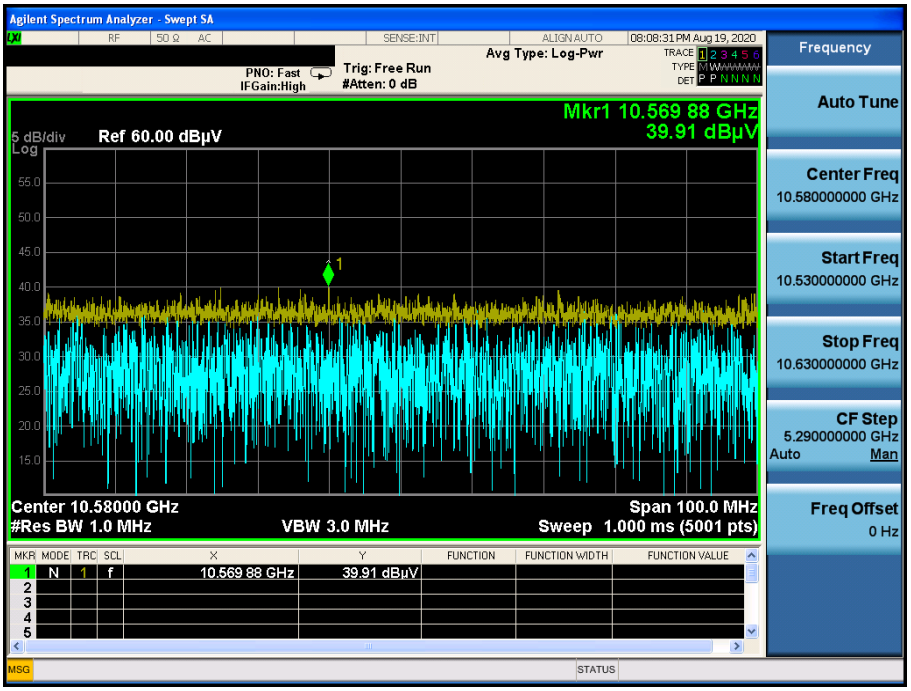
**802.11ac(VHT80) & U-NII 2A & Ch.58 & X axis & Ver Detector Mode : PK**



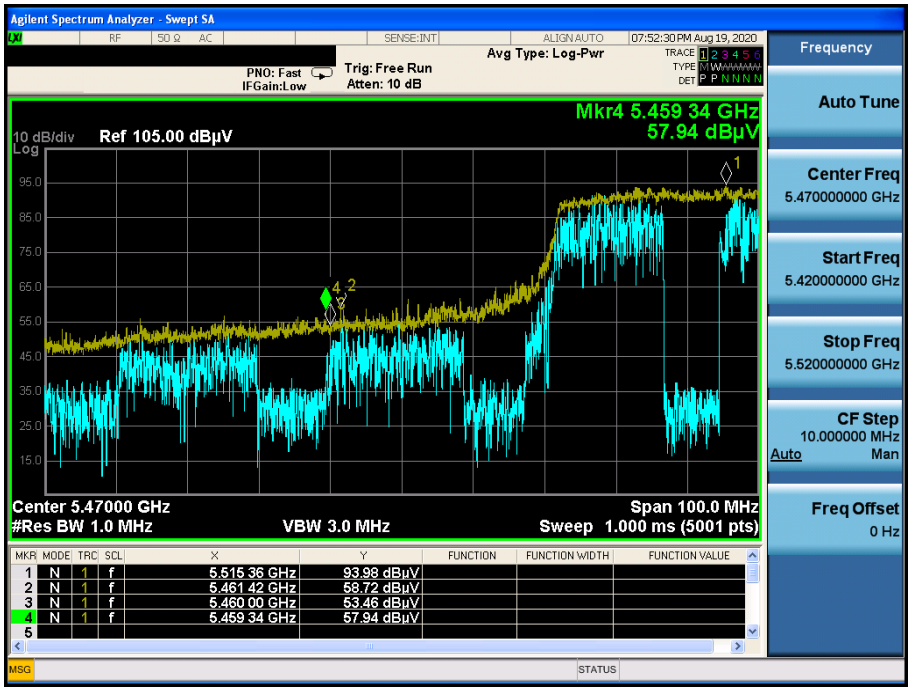

**802.11ac(VHT80) & U-NII 2A & Ch.58 & X axis & Ver Detector Mode : AV**



**802.11ac(VHT80) & U-NII 2A & Ch.58 & X axis & Ver Detector Mode : PK**



**802.11ac(VHT80) & U-NII 2C & Ch.106 & X axis & Ver Detector Mode : PK**




**802.11ac(VHT80) & U-NII 2C & Ch.106 & X axis & Ver Detector Mode : AV**

**802.11ac(VHT80) & U-NII 2C & Ch.106 & X axis & Ver Detector Mode : AV**