# FCC RADIO TEST REPORT
# FCC ID: 2AAA9-RA320

**Product:** Smart Access Point
**Trade Mark:** Relay2
**Model No.:** RA320
**Family Model:** N/A
**Report No.:** S20021801005002
**Issue Date:** 13 Mar. 2020

**Prepared for**

Relay2, Inc.

Suite 209, 1525 McCarthy Blvd., Milpitas, CA 95035

**Prepared by**

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# TEST RESULT CERTIFICATION

**Applicant's name** ..... : Relay2, Inc.

Address ..... : Suite 209, 1525 McCarthy Blvd., Milpitas, CA 95035

**Manufacturer's Name** ..... : Amigo Technology Inc.

Address ..... : 9F.-5, No.266, Sec. 1, Wenhua 2nd Rd., Linkou Dist., New Taipei City 244, Taiwan (R.O.C.)

**Product description**

Product name..... : Smart Access Point

Model and/or type reference : RA320

Family Model..... : N/A

**Standards** ..... : FCC Part15.407

Test procedure..... ANSI C63.10-2013 and KDB 789033 D02 General UNII Test Procedures New Rules v02r01

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

FCC KDB 662911 D02 MIMO With Cross Polarized Antenna V01

This device described above has been tested by NTEK, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements/ the Industry Canada requirements.. And it is applicable only to the tested sample identified in the report.

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**Date of Test** .....

Date (s) of performance of tests..... 18 Feb. 2020 ~ 14 Apr, 2020

Date of Issue..... 14 Apr, 2020

Test Result..... **Pass**

Testing Engineer : Jerry Xie

(Jerry Xie)

Technical Manager : Jason chen

(Jason Chen)

Authorized Signatory : Sam. Chen

(Sam Chen)

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**Revision History**

| Report No. | Version | Description | Issued Date |
|---|---|---|---|
| S20021801005002 | Rev.01 | Initial issue of report | 14 Apr, 2020 |
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## 1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

| FCC Part15 (15.407) , Subpart E | | | |
|---|---|---|---|
| Standard Section | Test Item | Judgment | Remark |
| 15.207 | AC Power Line Conducted Emissions | PASS | |
| 15.209(a),<br>15.407 (b)(1)<br>15.407 (b)(2)<br>15.407 (b)(3)<br>15.407 (b)(4)<br>15.407 (b)(6) | Spurious Radiated Emissions | PASS | |
| 15.407 (a) | 26 dB and 99% Emission Bandwidth | PASS | |
| 15.407(e) | Minimum 6 dB bandwidth | PASS | |
| 15.407 (a) | Maximum Conducted Output Power | PASS | |
| 15.407 (b)(1)<br>15.407 (b)(2)<br>15.407 (b)(3)<br>15.407 (b)(4) | Band Edge | PASS | |
| 15.407 (a) | Power Spectral Density | PASS | |
| 15.407(b) | Spurious Emissions at Antenna Terminals | PASS | |
| 15.407(g) | Frequency Stability Measurement | PASS | |
| 15.407(h) | Dynamic Frequency Selection(DFS) | N/A | |
| 15.203 | Antenna Requirement | PASS | |

NOTE:

(1)" N/A" denotes test is not applicable in this Test Report

(2) This device operates with a duty cycle greater than 99%

## 1.1 FACILITIES AND ACCREDITATIONS

FACILITIES

All measurement facilities used to collect the measurement data are located at
1/F, Building E, Fenda Science Park Sanwei, Xixiang, Bao'an District
Shenzhen, Guangdong, China

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10 and CISPR Publication 22.

LABORATORY ACCREDITATIONS AND LISTINGS

Site Description

| | | |
|---|---|---|
| CNAS-Lab. | : | The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2006 (identical to ISO/IEC 17025:2005)<br>The Certificate Registration Number is L5516. |
| IC-Registration | | The Certificate Registration Number is 9270A.<br>CAB identifier:CN0074 |
| FCC- Accredited | | Test Firm Registration Number: 463705.<br>Designation Number: CN1184 |
| A2LA-Lab. | | The Certificate Registration Number is 4298.01<br>This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories.<br>This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009). |
| Name of Firm | : | Shenzhen NTEK Testing Technology Co., Ltd. |
| Site Location | : | 1/F, Building E, Fenda Science Park Sanwei, Xixiang, Bao'an District<br>Shenzhen, Guangdong, China |

## 1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y±U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

| No. | Item | Uncertainty |
|---|---|---|
| 1 | Conducted Emission Test | ±2.80dB |
| 2 | RF power, conducted | ±0.16dB |
| 3 | Spurious emissions, conducted | ±0.21dB |
| 4 | All emissions, radiated(30MHz~1GHz) | ±2.64dB |
| 5 | All emissions, radiated(1GHz~6GHz) | ±2.40dB |
| 6 | All emissions, radiated(＞6GHz) | ±2.52dB |
| 7 | Temperature | ±0.5°C |
| 8 | Humidity | ±2% |

# 2. GENERAL INFORMATION

## 2.1 GENERAL DESCRIPTION OF EUT

| | |
|---|---|
| Equipment | Smart Access Point |
| Trade Mark | Relay2 |
| Model Name | RA320 |
| Family Model | N/A |
| Model Difference | N/A |
| FCC ID | 2AAA9-RA320 |
| Product Description | |

| | |
|---|---|
| Mode Supported | ☒802.11a<br>☒802.11n(HT20)<br>☒802.11n(HT40)<br>☒802.11ac(HT20)<br>☒802.11ac(HT40)<br>☒802.11ac(HT80) |
| Data Rate | 802.11a: 6,9,12,18,24,36,48,54Mbps;<br>802.11n(HT20/HT40):MCS0-MCS15;<br>802.11ac(VHT20): NSS1, MCS0-MCS8<br>802.11ac(VHT40/VHT80):NSS1, MCS0-MCS9 |
| Modulation | OFDM with BPSK/QPSK/16QAM/64QAM |
| Operating Frequency Range | ☒ U-NII-1: 5180 MHz ~5240MHz<br>☐ U-NII-2A: 5260MHz~5320MHz<br>☐ U-NII-2C: 5500MHz~5700MHz<br>☒ U-NII-3: 5745 MHz ~5825 MHz |
| Function: | ☐Outdoor AP ☒Indoor AP ☐Fixed P2P<br>☐Client |
| Support TPC | ☐YES<br>☒NO |
| Antenna Type | Antenna 3: Embedded Antenna<br>Antenna 4: Embedded Antenna |
| Antenna Gain | Antenna 3: 4.17dBi;<br>Antenna 4: 3.59dBi; |
| Smart system | ☒SISO for 802.11a<br>☒MIMO for 802.11n/ac |

Based on the application, features, or specification exhibited in User's Manual, More details of EUT technical specification, please refer to the User's Manual.

| | |
|---|---|
| Ratings | DC 12V from Adapter |
| Adapter | ☒Adapter supply: |
| Battery | N/A |
| Connecting I/O Port(s) | Please refer to the User's Manual |

| | |
|---|---|
| HW Version | 1.0 |
| SW Version | 2.0.0 |

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2. Frequency and Channel list:

| Band | 20MHz | | 40MHz | | 80MHz | |
|---|---|---|---|---|---|---|
| | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| U-NII-1 | 36 | 5180 MHz | 38 | 5190 MHz | 42 | 5210 MHz |
| | 40 | 5200 MHz | 46 | 5230 MHz | - | - |
| | 44 | 5220 MHz | | | | |
| | 48 | 5240 MHz | | | | |
| U-NII-3 | 149 | 5745 MHz | 151 | 5755 MHz | 155 | 5775 MHz |
| | 153 | 5765 MHz | 159 | 5795 MHz | | |
| | 157 | 5785 MHz | | | | |
| | 161 | 5805 MHz | | | | |
| | 165 | 5825 MHz | | | | |

The module for 5G WIFI has two antennas, and different modes support different transmit mode what describe as Following form:

| Mode | Tx/Rx |
|---|---|
| 802.11a | 1TX, 1RX |
| 802.11n/ac | 1TX/2TX, 1RX/2RX |

For 5GHz mode, Antenna 3,4 are transmitting, each with the same directional gain.
For MIMO mode, Directional gain=$[10\log(10^{G1/20}+10^{G2/20})^2/N_{ANT}]$dBi =6.90 dBi in 5GHz
the 802.11n(20/40) ac(20/40/80) 5GHz has MIMO mode.

Note: G1 means antenna gain for ANT 3 in 4.17dBi.
G2 means antenna gain for ANT 4 in 3.59dBi.
$N_{ANT}$ means the number of Antennas.

## 2.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

| Pretest Mode | Description |
|---|---|
| Mode 1 | Normal Link Mode |
| Mode 2 | 802.11a / n/ ac 20 CH36/ CH40/ CH 48<br>802.11a /n/ ac 20 CH149/ CH157/ CH 165 |
| Mode 3 | 802.11n/ ac40 CH38/ CH 46<br>802.11n/ ac40 CH 151 / CH 159 |
| Mode 4 | 802.11 ac80 CH 42/CH 155 |

| **For Radiated Emission** | |
|---|---|
| Final Test Mode | Description |
| Mode 1 | Normal Link Mode |
| Mode 2 | 802.11a / n/ ac 20 CH36/ CH40/ CH 48<br>802.11a /n/ ac 20 CH149/ CH157/ CH 165 |
| Mode 3 | 802.11n/ ac40 CH38/ CH 46<br>802.11n/ ac40 CH 151 / CH 159 |
| Mode 4 | 802.11 ac80 CH 42/CH 155 |

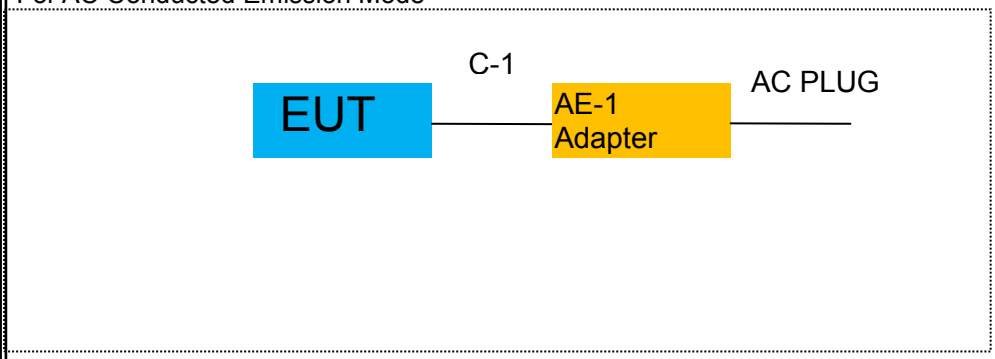
Note:

(1) The measurements are performed at the highest, middle, lowest available channels.

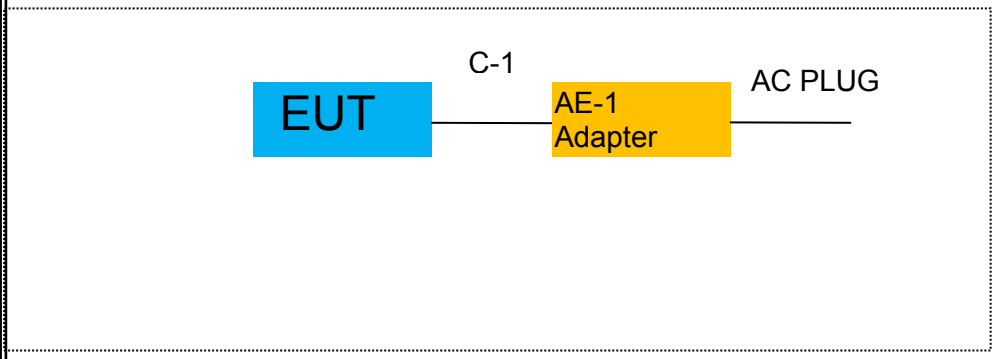
(2) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported

## 2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

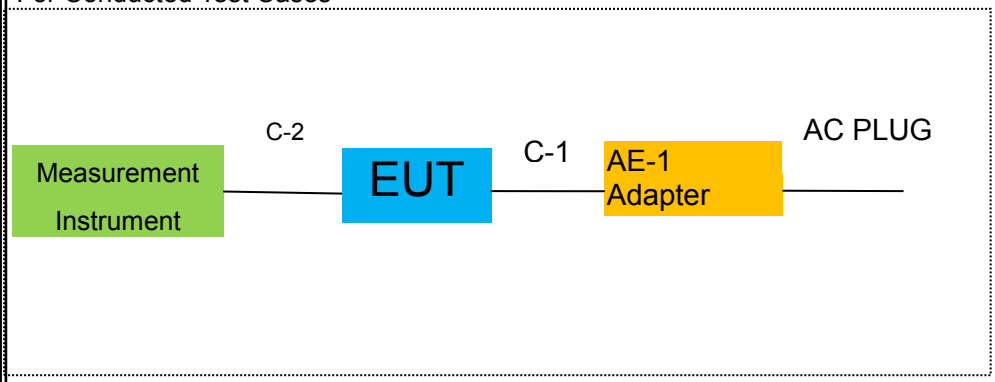
For AC Conducted Emission Mode




For Radiated Test Cases




For Conducted Test Cases




Note: 1. The temporary antenna connector is IPEX on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

## 2.4 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| Item | Equipment | Brand | Model/Type No. | Series No. | Note |
|---|---|---|---|---|---|
| AE-1 | Adapter | N/A | Y48DE-120-3500 | N/A | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

| Item | Cable Type | Shielded Type | Ferrite Core | Length | Note |
|---|---|---|---|---|---|
| C-1 | Power Cable | NO | NO | 1.0m | |
| C-2 | RF Cable | YES | NO | 0.1m | |
| | | | | | |

Note:

(1) The support equipment was authorized by Declaration of Confirmation.
(2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.

## 2.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation& Conducted Test equipment

| Item | Kind of Equipment | Manufacturer | Type No. | Serial No. | Last calibration | Calibrated until | Calibration period |
|---|---|---|---|---|---|---|---|
| 1 | Spectrum Analyzer | Aglient | E4407B | MY45108040 | 2019.05.13 | 2020.05.12 | 1 year |
| 2 | Spectrum Analyzer | Agilent | N9020A | MY49100060 | 2019.08.28 | 2020.08.27 | 1 year |
| 3 | Spectrum Analyzer | R&S | FSV40 | 101417 | 2019.08.28 | 2020.08.27 | 1 year |
| 4 | Test Receiver | R&S | ESPI7 | 101318 | 2019.05.13 | 2020.05.12 | 1 year |
| 5 | Bilog Antenna | TESEQ | CBL6111D | 31216 | 2019.04.15 | 2020.04.14 | 1 year |
| 6 | 50Ω Coaxial Switch | Anritsu | MP59B | 6200983705 | 2018.05.19 | 2020.05.18 | 2 year |
| 7 | Horn Antenna | EM | EM-AH-10180 | 2011071402 | 2019.04.15 | 2020.04.14 | 1 year |
| 8 | Broadband Horn Antenna | SCHWARZBECK | BBHA 9170 | 803 | 2019.12.11 | 2020.12.10 | 1 year |
| 9 | Amplifier | EMC | EMC051835SE | 980246 | 2019.08.06 | 2020.08.05 | 1 year |
| 10 | Active Loop Antenna | SCHWARZBECK | FMZB 1519 B | 055 | 2019.12.11 | 2020.12.10 | 1 year |
| 11 | Power Meter | DARE | RPR3006W | 15I00041SNO84 | 2019.08.06 | 2020.08.05 | 1 year |
| 12 | Test Cable (9KHz-30MHz) | N/A | R-01 | N/A | 2017.04.21 | 2020.04.20 | 3 year |
| 13 | Test Cable (30MHz-1GHz) | N/A | R-02 | N/A | 2017.04.21 | 2020.04.20 | 3 year |
| 14 | High Test Cable(1G-40GHz) | N/A | R-03 | N/A | 2017.04.21 | 2020.04.20 | 3 year |
| 15 | High Test Cable(1G-40GHz) | N/A | R-04 | N/A | 2017.04.21 | 2020.04.20 | 3 year |
| 16 | Filter | TRILTHIC | 2400MHz | 29 | 2017.04.19 | 2020.04.18 | 3 year |
| 17 | temporary antenna connector (Note) | NTS | R001 | N/A | N/A | N/A | N/A |
| 18 | MXG Vector Signal Generator | Agilent | N5182A | MY47070317 | 2019.03.28 | 2020.03.27 | 1 year |

Note:
We will use the temporary antenna connector (soldered on the PCB board) When conducted test
And this temporary antenna connector is listed within the instrument list

AC Conduction Test equipment

| Item | Kind of Equipment | Manufacturer | Type No. | Serial No. | Last calibration | Calibrated until | Calibration period |
|---|---|---|---|---|---|---|---|
| 1 | Test Receiver | R&S | ESCI | 101160 | 2019.05.13 | 2020.05.12 | 1 year |
| 2 | LISN | R&S | ENV216 | 101313 | 2019.04.15 | 2020.04.14 | 1 year |
| 3 | LISN | SCHWARZBECK | NNLK 8129 | 8129245 | 2019.05.13 | 2020.05.12 | 1 year |
| 4 | 50Ω Coaxial Switch | ANRITSU CORP | MP59B | 6200983704 | 2018.05.19 | 2020.05.18 | 2 year |
| 5 | Test Cable (9KHz-30MHz) | N/A | C01 | N/A | 2017.04.21 | 2020.04.20 | 3 year |
| 6 | Test Cable (9KHz-30MHz) | N/A | C02 | N/A | 2017.04.21 | 2020.04.20 | 3 year |
| 7 | Test Cable (9KHz-30MHz) | N/A | C03 | N/A | 2017.04.21 | 2020.04.20 | 3 year |

Note: Each piece of equipment is scheduled for calibration once a year except the Test Cable& Aux Equipment which is scheduled for calibration every 3 years.

# 3. EMC EMISSION TEST

## 3.1 CONDUCTED EMISSION MEASUREMENT

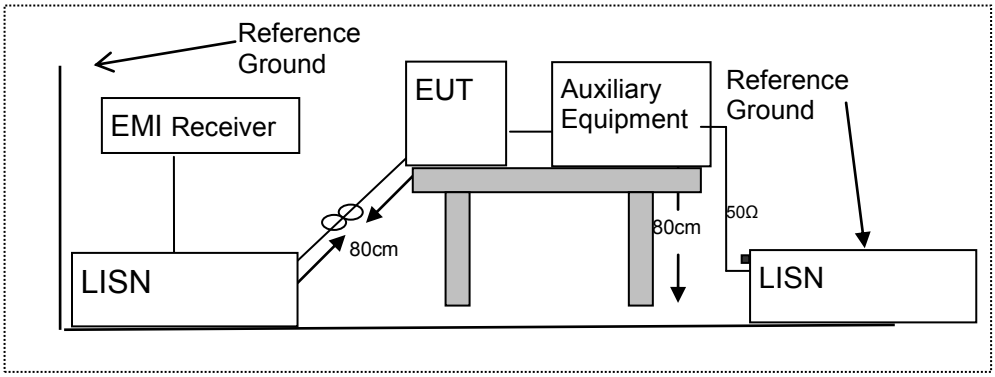
### 3.1.1 APPLICABLE STANDARD

According to FCC Part 15.207(a)

### 3.1.2 CONFORMANCE LIMIT

| Frequency(MHz) | Conducted Emission Limit | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15-0.5 | 66-56* | 56-46* |
| 0.5-5.0 | 56 | 46 |
| 5.0-30.0 | 60 | 50 |
| Note: 1. *Decreases with the logarithm of the frequency<br>2. The lower limit shall apply at the transition frequencies<br>3. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz. | | |

### 3.1.3 TEST CONFIGURATION




### 3.1.4 TEST PROCEDURE

According to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 Conducted emissions the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode.

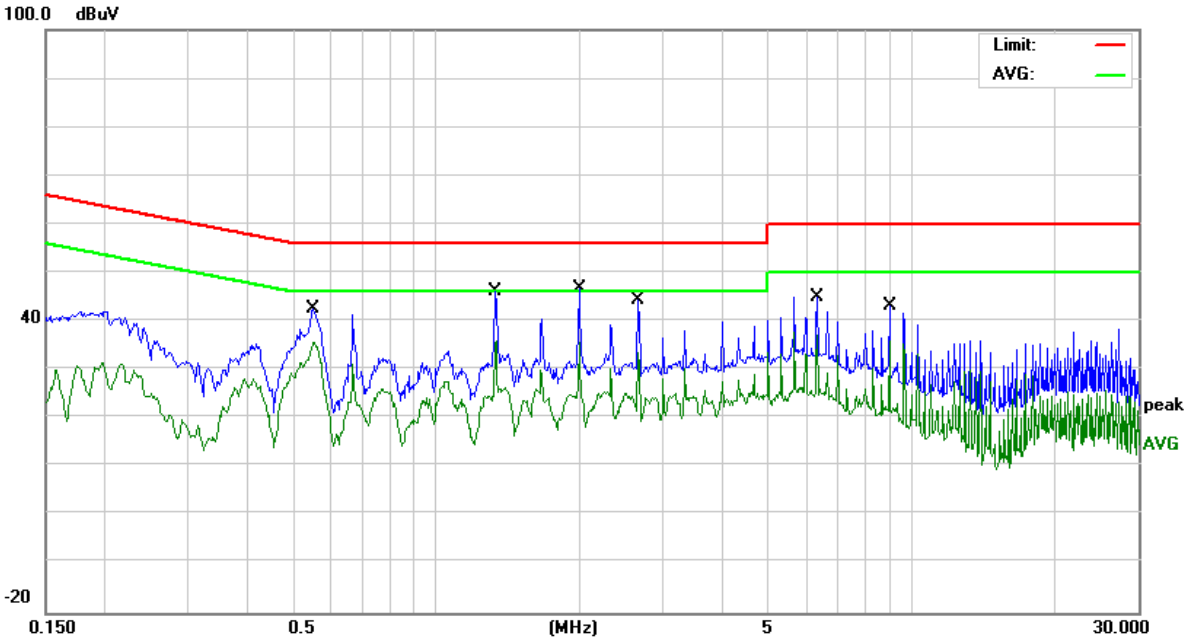
1. The EUT was placed 0.4 meter from the conducting wall of the shielding room.
2. The EUT was placed on a table which is 0.8m above ground plane.
3. Connect EUT to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
4. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40cm long.
5. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
6. LISN at least 80 cm from nearest part of EUT chassis.
7. The frequency range from 150KHz to 30MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth(IF bandwidth=9KHz) with Maximum Hold Mode
9. For the actual test configuration, please refer to the related Item –EUT Test Photos.

| | | | |
|---|---|---|---|
| EUT： | Smart Access Point | Model Name ： | RA320 |
| Temperature： | 26 ℃ | Relative Humidity： | 56% |
| Pressure： | 1010hPa | Phase： | L |
| Test Voltage ： | DC 12V from Adapter | Test Mode： | Mode 1(5.2G) |

| Frequency (MHz) | Reading Level (dBμV) | Correct Factor (dB) | Measure-ment (dBμV) | Limits (dBμV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 0.5463 | 32.76 | 9.74 | 42.50 | 56.00 | -13.50 | QP |
| 0.5463 | 22.15 | 9.74 | 31.89 | 46.00 | -14.11 | AVG |
| 1.3300 | 36.31 | 9.75 | 46.06 | 56.00 | -9.94 | QP |
| 1.3300 | 19.63 | 9.75 | 29.38 | 46.00 | -16.62 | AVG |
| 1.9979 | 37.08 | 9.78 | 46.86 | 56.00 | -9.14 | QP |
| 1.9979 | 18.43 | 9.78 | 28.21 | 46.00 | -17.79 | AVG |
| 2.6619 | 34.65 | 9.80 | 44.45 | 56.00 | -11.55 | QP |
| 2.6619 | 16.55 | 9.80 | 26.35 | 46.00 | -19.65 | AVG |
| 6.3219 | 35.13 | 9.88 | 45.01 | 60.00 | -14.99 | QP |
| 6.3219 | 18.25 | 9.88 | 28.13 | 50.00 | -21.87 | AVG |
| 8.9859 | 33.07 | 9.97 | 43.04 | 60.00 | -16.96 | QP |
| 8.9859 | 14.24 | 9.97 | 24.21 | 50.00 | -25.79 | AVG |

Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

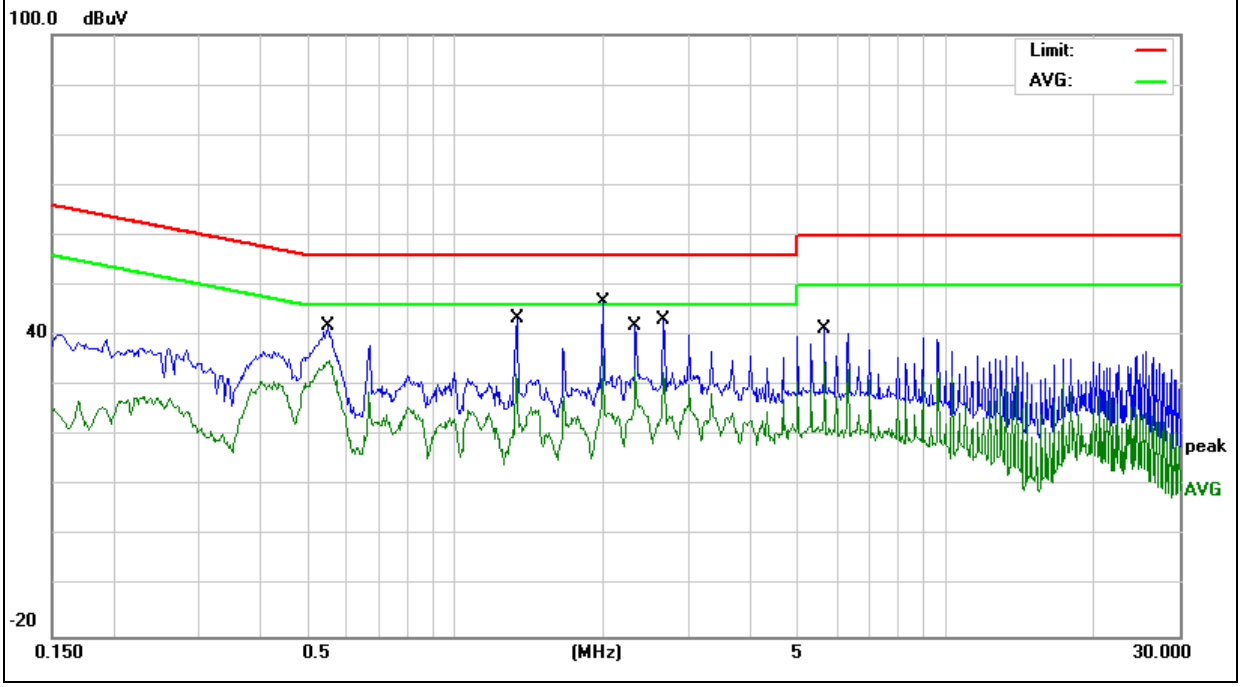


| | | | |
|---|---|---|---|
| EUT： | Smart Access Point | Model Name ： | RA320 |
| Temperature： | 26 ℃ | Relative Humidity： | 56% |
| Pressure： | 1010hPa | Phase： | N |
| Test Voltage ： | DC 12V from Adapter | Test Mode： | Mode 1(5.2G) |

| Frequency (MHz) | Reading Level (dBμV) | Correct Factor (dB) | Measure-ment (dBμV) | Limits (dBμV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 0.5500 | 32.14 | 9.75 | 41.89 | 56.00 | -14.11 | QP |
| 0.5500 | 22.75 | 9.75 | 32.50 | 46.00 | -13.50 | AVG |
| 1.3340 | 33.71 | 9.76 | 43.47 | 56.00 | -12.53 | QP |
| 1.3340 | 16.87 | 9.76 | 26.63 | 46.00 | -19.37 | AVG |
| 1.9979 | 36.95 | 9.79 | 46.74 | 56.00 | -9.26 | QP |
| 1.9979 | 20.06 | 9.79 | 29.85 | 46.00 | -16.15 | AVG |
| 2.3300 | 32.06 | 9.81 | 41.87 | 56.00 | -14.13 | QP |
| 2.3300 | 15.43 | 9.81 | 25.24 | 46.00 | -20.76 | AVG |
| 2.6619 | 33.41 | 9.83 | 43.24 | 56.00 | -12.76 | QP |
| 2.6619 | 17.63 | 9.83 | 27.46 | 46.00 | -18.54 | AVG |
| 5.6577 | 31.42 | 9.95 | 41.37 | 60.00 | -18.63 | QP |
| 5.6577 | 17.33 | 9.95 | 27.28 | 50.00 | -22.72 | AVG |

Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

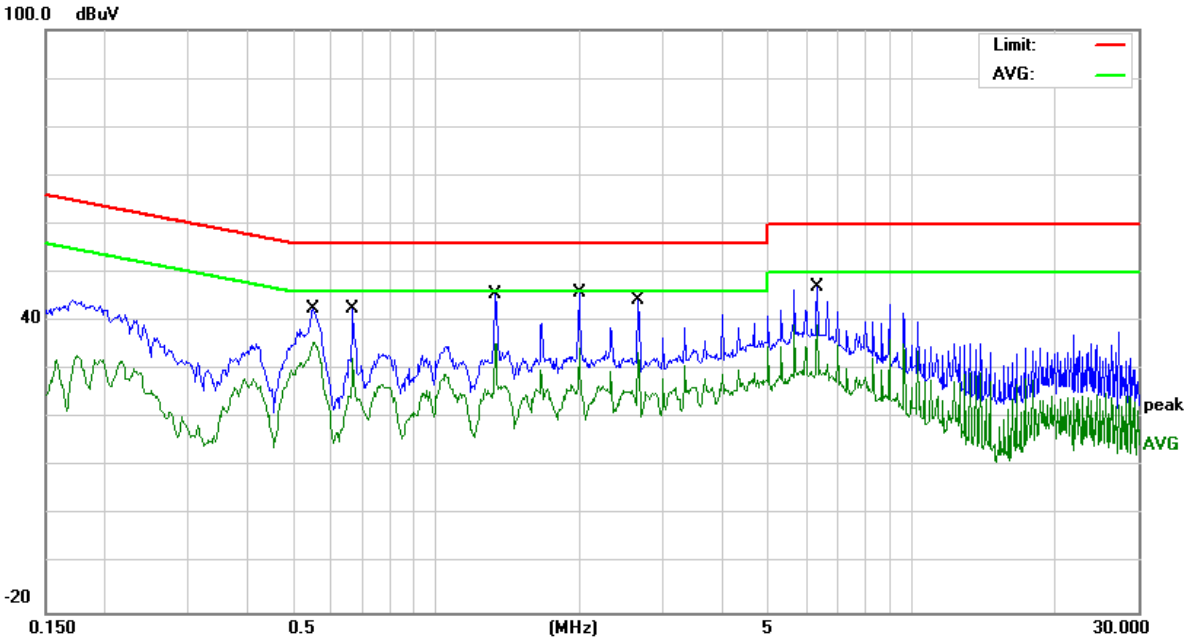


| | | | |
|---|---|---|---|
| EUT： | Smart Access Point | Model Name ： | RA320 |
| Temperature： | 26 ℃ | Relative Humidity： | 56% |
| Pressure： | 1010hPa | Phase： | L |
| Test Voltage ： | DC 12V from Adapter | Test Mode： | Mode 1(5.8G) |

| Frequency (MHz) | Reading Level (dBμV) | Correct Factor (dB) | Measure-ment (dBμV) | Limits (dBμV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 0.5463 | 32.76 | 9.74 | 42.50 | 56.00 | -13.50 | QP |
| 0.5463 | 21.37 | 9.74 | 31.11 | 46.00 | -14.89 | AVG |
| 0.6660 | 32.76 | 9.74 | 42.50 | 56.00 | -13.50 | QP |
| 0.6660 | 18.96 | 9.74 | 28.70 | 46.00 | -17.30 | AVG |
| 1.3300 | 35.81 | 9.75 | 45.56 | 56.00 | -10.44 | QP |
| 1.3300 | 17.64 | 9.75 | 27.39 | 46.00 | -18.61 | AVG |
| 1.9979 | 36.08 | 9.78 | 45.86 | 56.00 | -10.14 | QP |
| 1.9979 | 24.71 | 9.78 | 34.49 | 46.00 | -11.51 | AVG |
| 2.6619 | 34.65 | 9.80 | 44.45 | 56.00 | -11.55 | QP |
| 2.6619 | 20.05 | 9.80 | 29.85 | 46.00 | -16.15 | AVG |
| 6.3219 | 37.13 | 9.88 | 47.01 | 60.00 | -12.99 | QP |
| 6.3219 | 19.43 | 9.88 | 29.31 | 50.00 | -20.69 | AVG |

Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

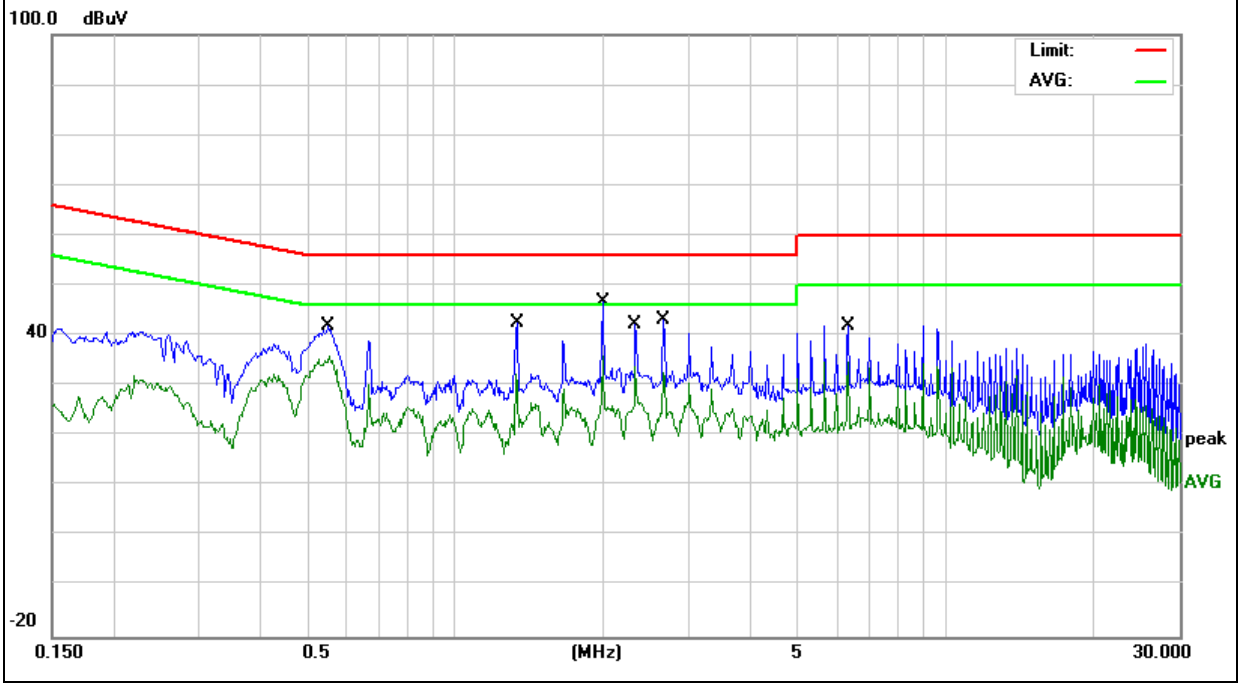


| | | | |
|---|---|---|---|
| EUT： | Smart Access Point | Model Name ： | RA320 |
| Temperature： | 26 ℃ | Relative Humidity： | 56% |
| Pressure： | 1010hPa | Phase： | N |
| Test Voltage ： | DC 12V from Adapter | Test Mode： | Mode 1(5.8G) |

| Frequency (MHz) | Reading Level (dBμV) | Correct Factor (dB) | Measure-ment (dBμV) | Limits (dBμV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 0.5500 | 32.14 | 9.75 | 41.89 | 56.00 | -14.11 | QP |
| 0.5500 | 24.15 | 9.75 | 33.90 | 46.00 | -12.10 | AVG |
| 1.3340 | 32.71 | 9.76 | 42.47 | 56.00 | -13.53 | QP |
| 1.3340 | 20.22 | 9.76 | 29.98 | 46.00 | -16.02 | AVG |
| 1.9979 | 36.95 | 9.79 | 46.74 | 56.00 | -9.26 | QP |
| 1.9979 | 18.94 | 9.79 | 28.73 | 46.00 | -17.27 | AVG |
| 2.3300 | 32.56 | 9.81 | 42.37 | 56.00 | -13.63 | QP |
| 2.3300 | 19.67 | 9.81 | 29.48 | 46.00 | -16.52 | AVG |
| 2.6619 | 33.41 | 9.83 | 43.24 | 56.00 | -12.76 | QP |
| 2.6619 | 18.43 | 9.83 | 28.26 | 46.00 | -17.74 | AVG |
| 6.3219 | 32.10 | 9.95 | 42.05 | 60.00 | -17.95 | QP |
| 6.3219 | 19.71 | 9.95 | 29.66 | 50.00 | -20.34 | AVG |

Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



## 3.2 RADIATED EMISSION MEASUREMENT

### 3.2.1 APPLICABLE STANDARD

According to FCC Part 15.407(d) and 15.209

### 3.2.2 CONFORMANCE LIMIT

According to FCC Part 15.407(b)(7): radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
According to FCC Part15.205, Restricted bands

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090-0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.15 |
| 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 | 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 | | | |

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

| Restricted Frequency(MHz) | Field Strength (μV/m) | Field Strength (dBμV/m) | Measurement Distance |
|---|---|---|---|
| 0.009~0.490 | 2400/F(KHz) | 20 log (uV/m) | 300 |
| 0.490~1.705 | 24000/F(KHz) | 20 log (uV/m) | 30 |
| 1.705~30.0 | 30 | 29.5 | 30 |
| 30-88 | 100 | 40 | 3 |
| 88-216 | 150 | 43.5 | 3 |
| 216-960 | 200 | 46 | 3 |
| Above 960 | 500 | 54 | 3 |

Limits of Radiated Emission Measurement(Above 1000MHz)

| Frequency(MHz) | Class B (dBuV/m) (at 3M) | |
|---|---|---|
| | PEAK | AVERAGE |
| Above 1000 | 74 | 54 |

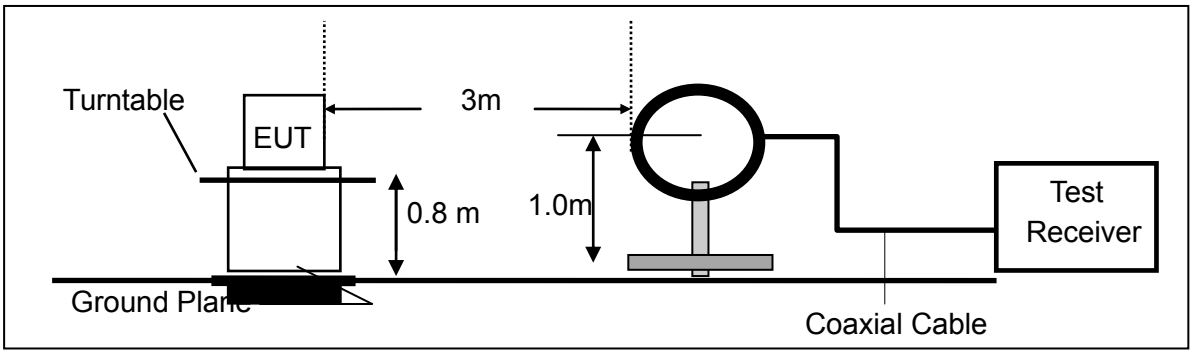
Remark :1. Emission level in dBuV/m=20 log (uV/m)
2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
3. For Frequency 9kHz~30MHz:
Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.
For Frequency above 30MHz:
Distance extrapolation factor =20log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

### 3.2.3 MEASURING INSTRUMENTS

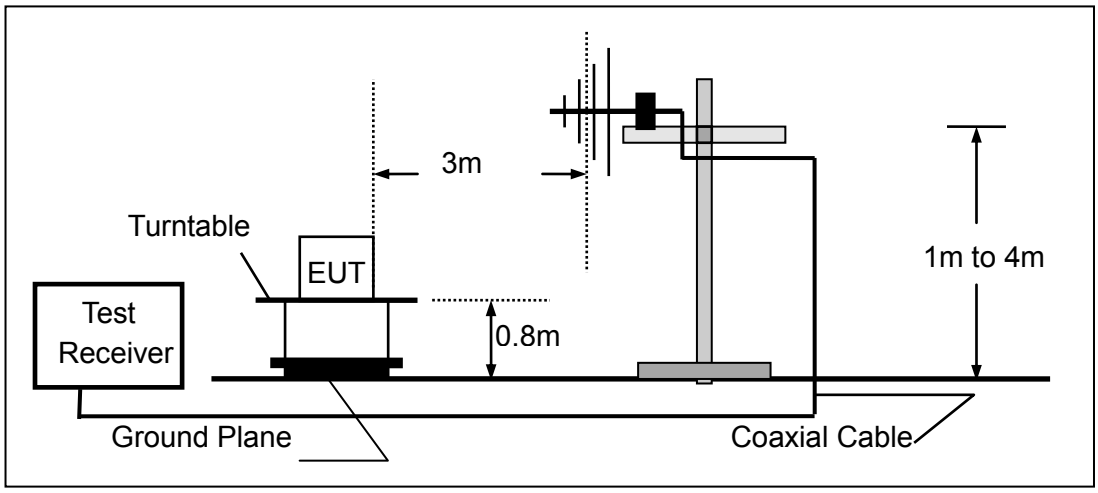
The Measuring equipment is listed in the section 6.3 of this test report.

3.2.4 TEST CONFIGURATION

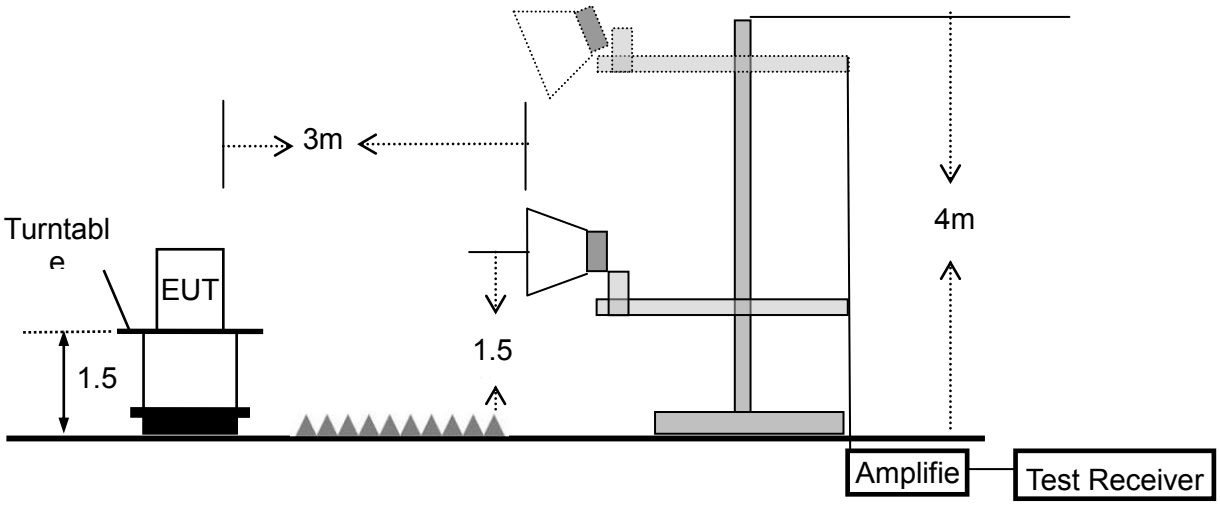
(a)For radiated emissions below 30MHz




(b)For radiated emissions from 30MHz to 1000MHz




(c) For radiated emissions above 1000MHz



### 3.2.5 TEST PROCEDURE

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.10-2013. The test distance is 3m.The setup is according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 and CAN/CSA-CEI/IEC CISPR 22.
This test is required for any spurious emission that falls in a Restricted Band, as defined in Section 15.205.
It must be performed with the highest gain of each type of antenna proposed for use with the EUT.
Use the following spectrum analyzer settings:

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Start Frequency | 1000 MHz |
| Stop Frequency | 10th carrier harmonic |
| RB / VB (emission in restricted band) | 1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average |

| Receiver Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Start ~ Stop Frequency | 9kHz~150kHz / RB 200Hz for QP |
| Start ~ Stop Frequency | 150kHz~30MHz / RB 9kHz for QP |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB 120kHz for QP |

a. The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
b. The EUT was placed on the top of a rotating table 0.8 m for below 1GHz and 1.5m for above 1GHz the ground at a 3 meter. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The height of the equipment or of the substitution antenna shall be 0.8 m for below 1GHz and 1.5m for above 1GHz; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

During the radiated emission test, the Spectrum Analyzer was set with the following configurations:

| Frequency Band (MHz) | Function | Resolution bandwidth | Video Bandwidth |
|---|---|---|---|
| 30 to 1000 | QP | 120 kHz | 300 kHz |
| Above 1000 | Peak | 1 MHz | 1 MHz |
| | Average | 1 MHz | 10 Hz |

Note: for the frequency ranges below 30 MHz, a narrower RBW is used for these ranges but the measured value should add a RBW correction factor (RBWCF) where RBWCF [dB] =10*lg(100 [kHz]/narrower RBW [kHz]). , the narrower RBW is 1 kHz and RBWCF is 20 dB for the frequency 9 kHz to 150 kHz, and the narrower RBW is 10 kHz and RBWCF is 10 dB for the frequency 150 kHz to 30 MHz.

### 3.2.6 TEST RESULTS (9KHZ – 30 MHZ)

| | | | |
|---|---|---|---|
| EUT： | Smart Access Point | Model Name ： | RA320 |
| Temperature： | 26 ℃ | Relative Humidity： | 54% |
| Pressure: | 1010 hPa | Test Voltage ： | DC 12V from Adapter |
| Test Mode ： | TX | Polarization : | -- |

| Freq. | Reading | Limit | Margin | State |
|---|---|---|---|---|
| (MHz) | (dBuV/m) | (dBuV/m) | (dB) | P/F |
| -- | -- | -- | -- | N/A |
| -- | -- | -- | -- | N/A |

**NOTE:**

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

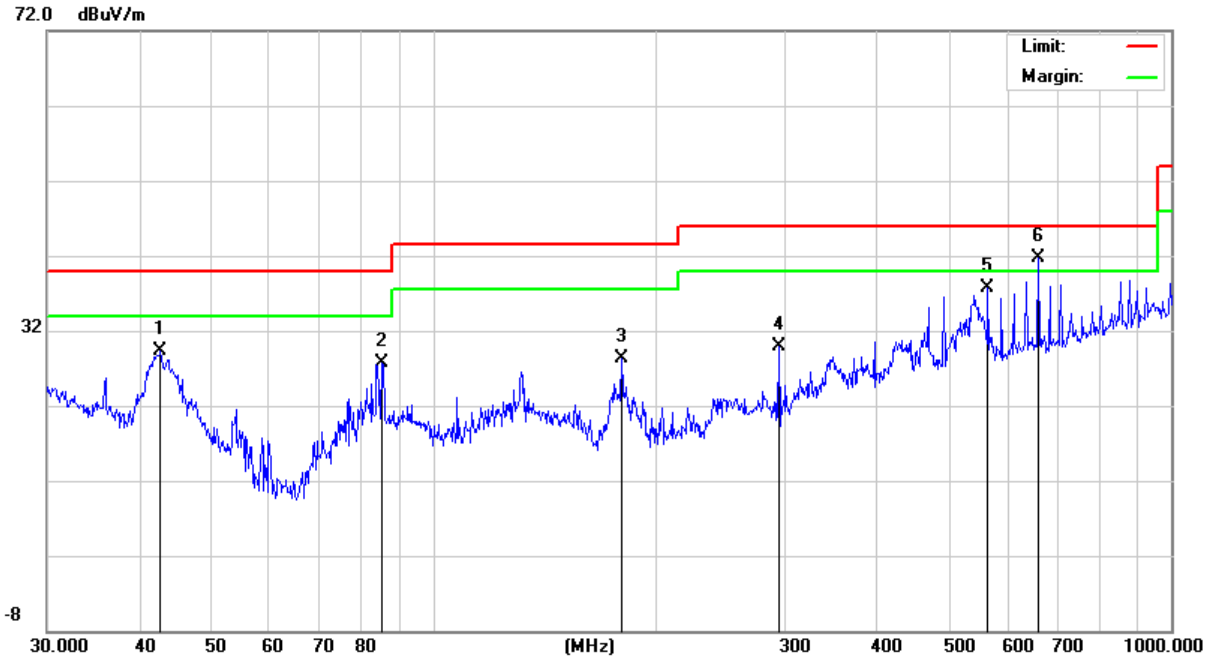
### 3.2.7 TEST RESULTS (30MHZ – 1GHZ)

| | | | |
|---|---|---|---|
| EUT： | Smart Access Point | Model Name ： | RA320 |
| Temperature： | 26 ℃ | Relative Humidity： | 54% |
| Pressure： | 1010 hPa | Test Voltage ： | DC 12V from Adapter |
| Test Mode ： | TX(5.2G)- 802.11a (High CH) | | |

| Polar (H/V) | Frequency (MHz) | Meter Reading (dBuV) | Factor (dB) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| V | 42.7496 | 16.86 | 12.42 | 29.28 | 40.00 | -10.72 | QP |
| V | 85.2980 | 18.62 | 9.07 | 27.69 | 40.00 | -12.31 | QP |
| V | 180.0165 | 18.22 | 10.05 | 28.27 | 43.50 | -15.23 | QP |
| V | 294.1136 | 15.71 | 14.25 | 29.96 | 46.00 | -16.04 | QP |
| V | 564.6389 | 15.53 | 22.12 | 37.65 | 46.00 | -8.35 | QP |
| V | 661.1503 | 19.15 | 22.58 | 41.73 | 46.00 | -4.27 | QP |

**Remark:**

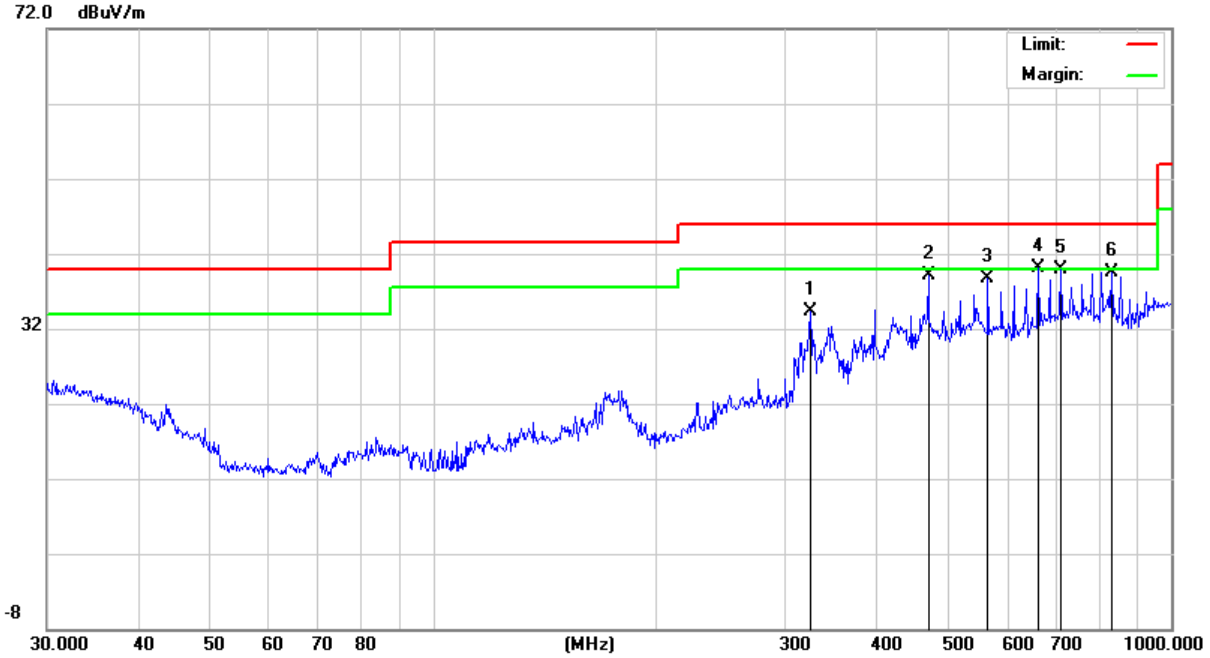
Absolute Level= ReadingLevel+ Factor, Margin= Absolute Level - Limit



| Polar (H/V) | Frequency (MHz) | Meter Reading (dBuV) | Factor (dB) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| H | 324.4560 | 19.06 | 15.17 | 34.23 | 46.00 | -11.77 | QP |
| H | 468.8761 | 20.00 | 19.08 | 39.08 | 46.00 | -6.92 | QP |
| H | 564.6389 | 16.50 | 22.12 | 38.62 | 46.00 | -7.38 | QP |
| H | 661.1503 | 17.54 | 22.58 | 40.12 | 46.00 | -5.88 | QP |
| H | 709.1823 | 16.55 | 23.41 | 39.96 | 46.00 | -6.04 | QP |
| H | 830.4002 | 13.89 | 25.65 | 39.54 | 46.00 | -6.46 | QP |

**Remark:**

Absolute Level= ReadingLevel+ Factor, Margin= Absolute Level - Limit

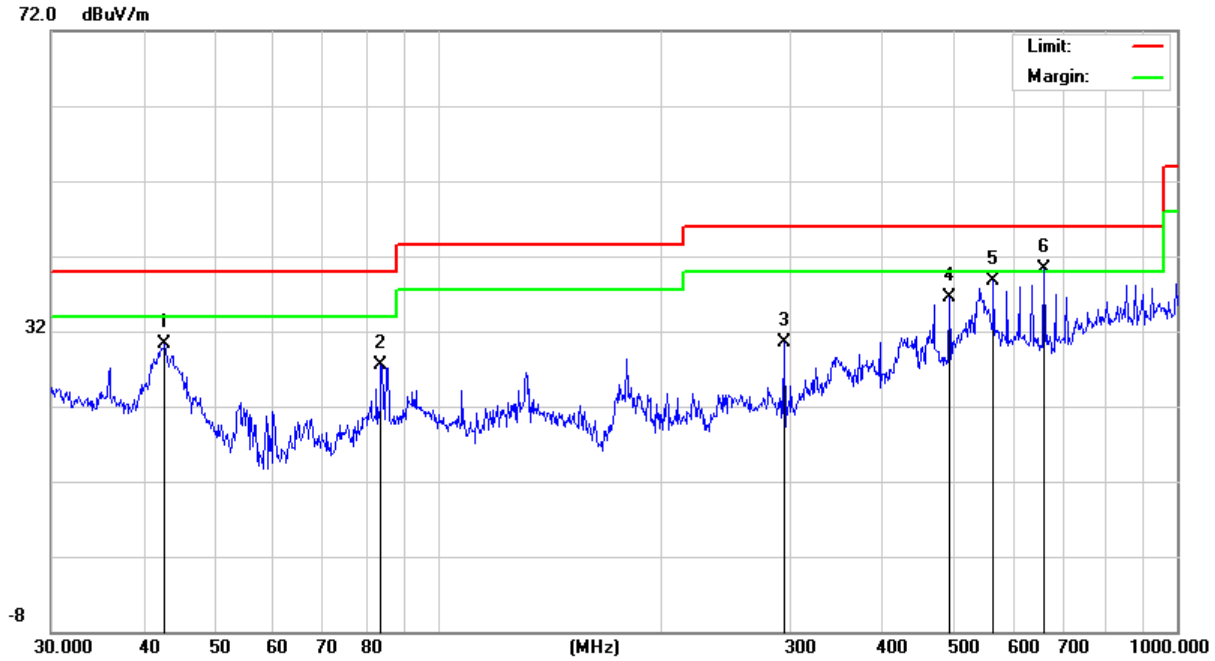


| | | | |
|---|---|---|---|
| EUT： | Smart Access Point | Model Name ： | RA320 |
| Temperature： | 26 ℃ | Relative Humidity： | 54% |
| Pressure： | 1010 hPa | Test Voltage ： | DC 12V from Adapter |
| Test Mode ： | TX(5.8G) - 802.11a (High CH) | | |

| Polar (H/V) | Frequency (MHz) | Meter Reading (dBuV) | Factor (dB) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| V | 42.7496 | 17.86 | 12.42 | 30.28 | 40.00 | -9.72 | QP |
| V | 83.8156 | 18.88 | 8.57 | 27.45 | 40.00 | -12.55 | QP |
| V | 294.1136 | 16.21 | 14.25 | 30.46 | 46.00 | -15.54 | QP |
| V | 492.4685 | 16.60 | 19.94 | 36.54 | 46.00 | -9.46 | QP |
| V | 564.6389 | 16.53 | 22.12 | 38.65 | 46.00 | -7.35 | QP |
| V | 661.1503 | 17.65 | 22.58 | 40.23 | 46.00 | -5.77 | QP |

**Remark:**

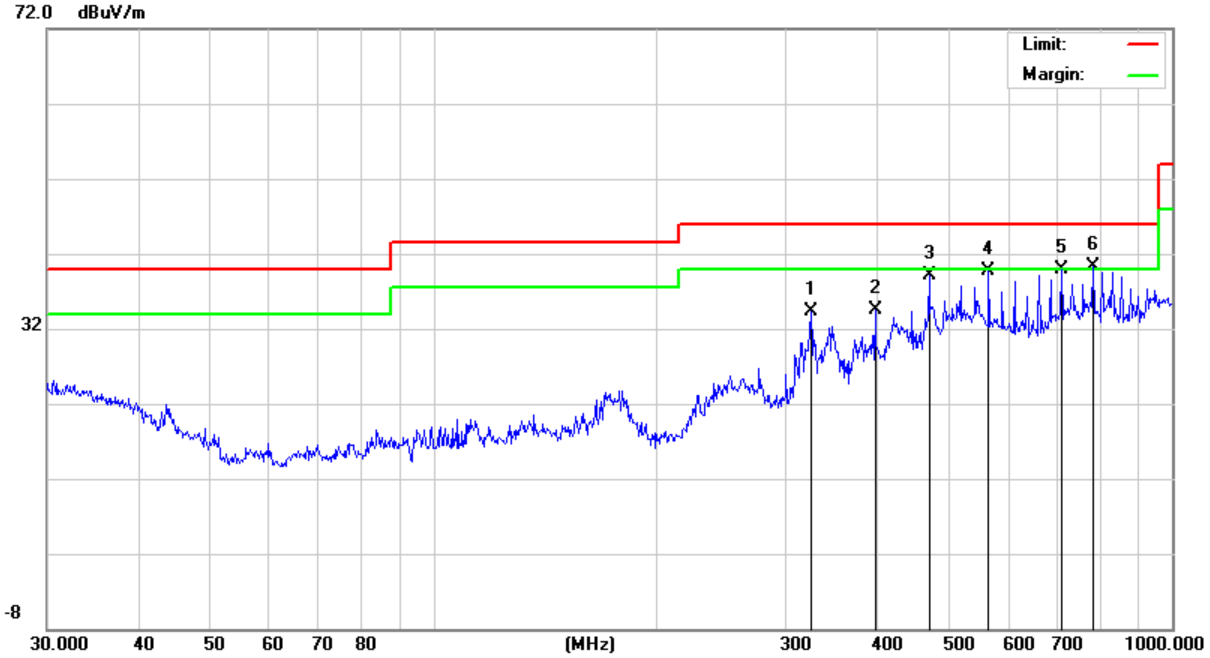
Absolute Level= ReadingLevel+ Factor, Margin= Absolute Level - Limit



| Polar (H/V) | Frequency (MHz) | Meter Reading (dBuV) | Factor (dB) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| H | 324.4560 | 19.06 | 15.17 | 34.23 | 46.00 | -11.77 | QP |
| H | 396.2412 | 16.91 | 17.68 | 34.59 | 46.00 | -11.41 | QP |
| H | 468.8761 | 20.00 | 19.08 | 39.08 | 46.00 | -6.92 | QP |
| H | 564.6389 | 17.50 | 22.12 | 39.62 | 46.00 | -6.38 | QP |
| H | 709.1823 | 16.55 | 23.41 | 39.96 | 46.00 | -6.04 | QP |
| H | 782.3451 | 15.37 | 24.95 | 40.32 | 46.00 | -5.68 | QP |

**Remark:**

Absolute Level= ReadingLevel+ Factor, Margin= Absolute Level - Limit



### 3.2.8 TEST RESULTS (1GHz-18GHz)

| | | | |
|---|---|---|---|
| EUT： | Smart Access Point | Model Name ： | RA320 |
| Temperature： | 26 ℃ | Relative Humidity： | 54% |
| Pressure： | 1010 hPa | Test Voltage ： | DC 12V from Adapter |
| Test Mode ： | TX(5.2G) - 802.11n20 _5180~5240MHz | | |

| Polar | Frequency | Meter Reading | Cable loss | Antenna Factor | Preamp Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|---|---|---|
| (H/V) | (MHz) | (dBuV) | (dB) | dB/m | (dB) | (dBuV/m) | (dBuV/m) | (dB) | |
| Low Channel (5180 MHz)-Above 1G | | | | | | | | | |
| Vertical | 5150.00 | 54.80 | 5.94 | 35.40 | 44.00 | 52.14 | 74.00 | -21.86 | Pk |
| Vertical | 10360.75 | 50.50 | 8.46 | 39.75 | 44.50 | 54.21 | 68.20 | -13.99 | Pk |
| Vertical | 15540.35 | 60.54 | 10.12 | 38.80 | 44.10 | 65.36 | 74.00 | -8.64 | Pk |
| Horizontal | 5150.00 | 57.87 | 5.94 | 35.18 | 44.00 | 54.99 | 74.00 | -19.01 | Pk |
| Horizontal | 10360.00 | 51.10 | 8.46 | 38.71 | 44.50 | 53.77 | 68.20 | -14.43 | Pk |
| Horizontal | 15540.17 | 55.24 | 10.12 | 38.38 | 44.10 | 59.64 | 74.00 | -14.36 | Pk |
| middle Channel (5200 MHz)-Above 1G | | | | | | | | | |
| Vertical | 10400.72 | 52.18 | 8.47 | 37.88 | 44.51 | 54.02 | 68.20 | -14.18 | Pk |
| Vertical | 15600.05 | 60.43 | 10.12 | 38.80 | 44.10 | 65.25 | 74.00 | -8.75 | Pk |
| Horizontal | 10400.46 | 54.02 | 8.47 | 38.64 | 44.50 | 56.63 | 68.20 | -11.57 | Pk |
| Horizontal | 15600.97 | 58.71 | 10.12 | 38.38 | 44.10 | 63.11 | 74.00 | -10.89 | Pk |
| High Channel (5240 MHz)-Above 1G | | | | | | | | | |
| Vertical | 5350.00 | 58.38 | 7.10 | 37.24 | 43.50 | 59.22 | 74.00 | -14.78 | Pk |
| Vertical | 10480.73 | 52.15 | 8.46 | 37.68 | 44.50 | 53.79 | 68.20 | -14.41 | Pk |
| Vertical | 15720.06 | 53.80 | 10.12 | 38.80 | 44.10 | 58.62 | 74.00 | -15.38 | Pk |
| Horizontal | 5350.00 | 60.14 | 7.10 | 37.24 | 43.50 | 60.98 | 74.00 | -13.02 | Pk |
| Horizontal | 10480.37 | 54.54 | 8.46 | 38.57 | 44.50 | 57.07 | 68.20 | -11.13 | Pk |
| Horizontal | 15720.19 | 58.79 | 10.12 | 38.38 | 44.10 | 63.19 | 74.00 | -10.81 | Pk |

Note:"802.11n20(5G)" mode is the worst mode. PK value is lower than the Average value limit, So average didn't record.

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value

has no need to be reported.

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

| | | | |
|---|---|---|---|
| EUT： | Smart Access Point | Model Name ： | RA320 |
| Temperature： | 26 ℃ | Relative Humidity： | 54% |
| Pressure： | 1010 hPa | Test Voltage ： | DC 12V from Adapter |
| Test Mode ： | TX (5.8G) -- 802.11n20 _5745~5825MHz | | |

| Polar | Frequency | Meter Reading | Cable loss | Antenna Factor | Preamp Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|---|---|---|
| (H/V) | (MHz) | (dBuV) | (dB) | dB/m | (dB) | (dBuV/m) | (dBuV/m) | (dB) | |
| Low Channel (5745 MHz)-Above 1G | | | | | | | | | |
| Vertical | 5460.00 | 62.99 | 5.94 | 35.40 | 44.00 | 60.33 | 74.00 | -13.67 | Pk |
| Vertical | 11490.00 | 51.95 | 8.46 | 39.75 | 44.50 | 55.66 | 74.00 | -18.34 | Pk |
| Vertical | 17235.00 | 55.32 | 10.12 | 38.80 | 44.10 | 60.14 | 68.20 | -8.06 | Pk |
| Horizontal | 5460.00 | 60.52 | 5.94 | 35.18 | 44.00 | 57.64 | 74.00 | -16.36 | Pk |
| Horizontal | 11490.00 | 58.98 | 8.46 | 38.71 | 44.50 | 61.65 | 74.00 | -12.35 | Pk |
| Horizontal | 17235.00 | 55.18 | 10.12 | 38.38 | 44.10 | 59.58 | 68.20 | -8.62 | Pk |
| middle Channel (5785 MHz)-Above 1G | | | | | | | | | |
| Vertical | 11570.00 | 54.19 | 8.47 | 37.88 | 44.51 | 56.03 | 74.00 | -17.97 | Pk |
| Vertical | 17355.00 | 51.80 | 10.12 | 38.8 | 44.10 | 56.62 | 68.20 | -11.58 | Pk |
| Horizontal | 11570.00 | 58.18 | 8.47 | 38.64 | 44.50 | 60.79 | 74.00 | -13.21 | Pk |
| Horizontal | 17355.00 | 63.28 | 10.12 | 38.38 | 44.10 | 67.68 | 74.00 | -6.32 | Pk |
| High Channel (5825 MHz)-Above 1G | | | | | | | | | |
| Vertical | 11650.00 | 64.95 | 8.46 | 37.68 | 44.50 | 66.59 | 74.00 | -7.41 | Pk |
| Vertical | 17475.00 | 59.95 | 10.12 | 38.8 | 44.10 | 64.77 | 68.20 | -3.43 | Pk |
| Horizontal | 11650.00 | 59.42 | 8.46 | 38.57 | 44.50 | 61.95 | 74.00 | -12.05 | Pk |
| Horizontal | 17475.00 | 58.09 | 10.12 | 38.38 | 44.10 | 62.49 | 68.20 | -5.71 | Pk |

Note:"802.11n20(5G)" mode is the worst mode. PK value is lower than the Average value limit, So average didn't record.

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value

has no need to be reported.

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

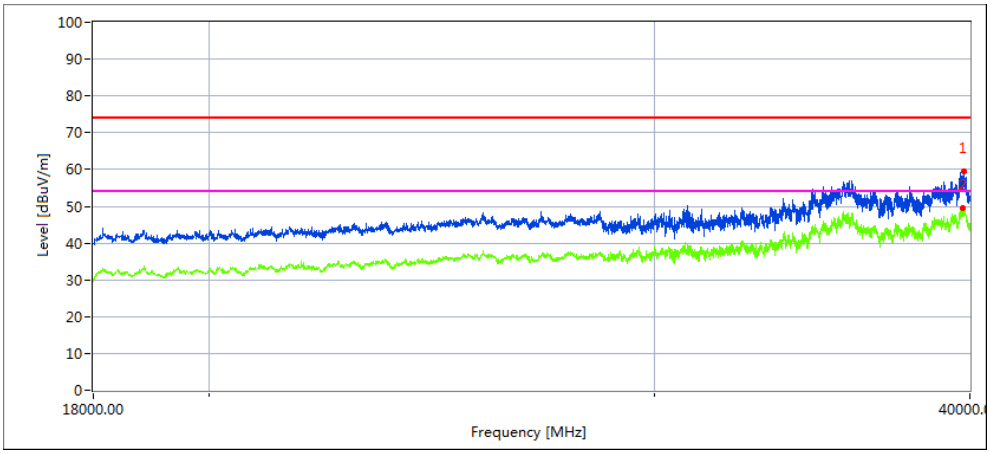
### 3.2.9 TEST RESULTS (18GHz-40GHz)

| | | | |
|---|---|---|---|
| EUT： | Smart Access Point | Model Name ： | RA320 |
| Temperature： | 26 ℃ | Relative Humidity： | 54% |
| Pressure： | 1010 hPa | Test Voltage ： | DC 12V from Adapter |
| Test Mode ： | TX (5.2G)-802.11a 5180MHz~5240MHz;<br>TX (5.8G)-802.11a 5745MHz~5825MHz | | |

All the modulation modes have been tested, and the worst result was report as below:

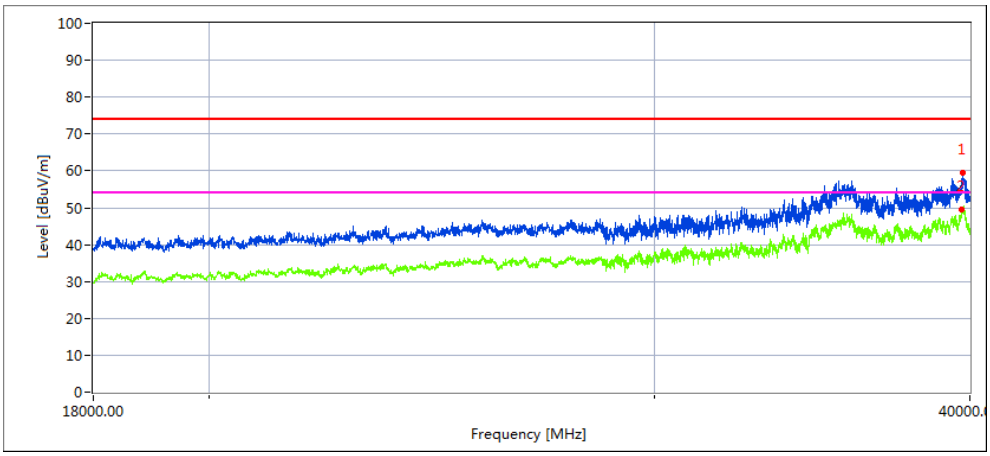
Low Channel (5180 MHz)-Above 1G

Horizontal




| Frequency | Meter Reading | Cable loss | Antenna Factor | Preamp Factor | Emission Level | Limits | Margin dB | Detector Type |
|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBuV) | (dB) | dB/m | (dB) | (dBuV/m) | (dBuV/m) | (dB) | |
| 39755.62 | 38.56 | 20.09 | 44.07 | 43.48 | 58.81 | 68.2 | 9.39 | Peak |

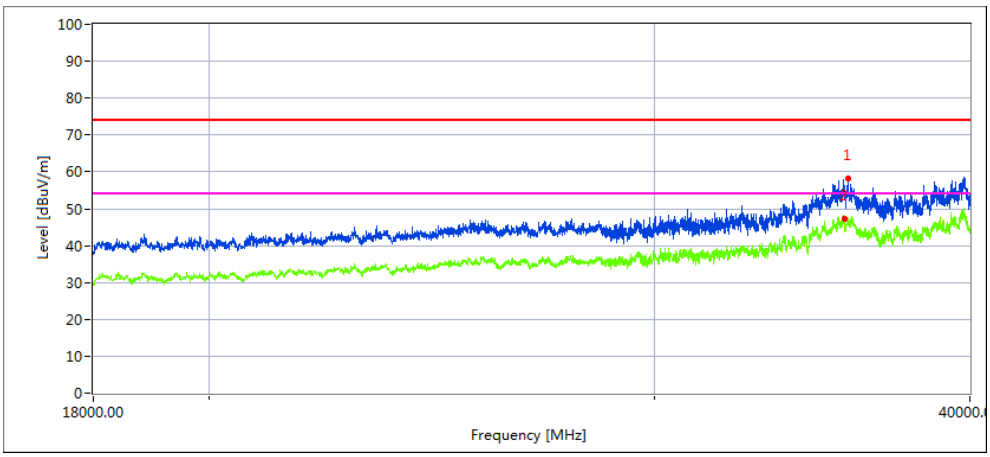
Vertical




| Frequency | Meter Reading | Cable loss | Antenna Factor | Preamp Factor | Emission Level | Limits | Margin dB | Detector Type |
|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBuV) | (dB) | dB/m | (dB) | (dBuV/m) | (dBuV/m) | (dB) | |
| 39769.433 | 34.16 | 20.09 | 44.07 | 43.48 | 54.84 | 68.2 | 13.36 | Peak |

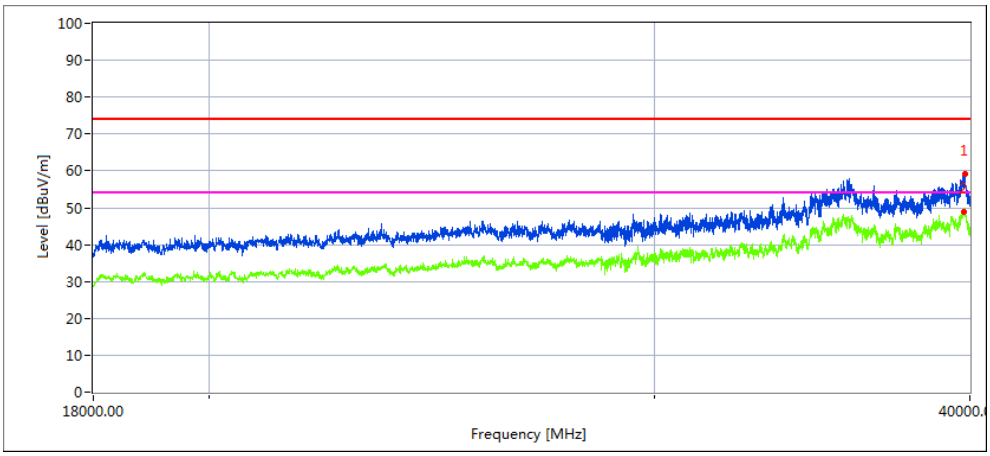
## High Channel (5240 MHz)-Above 1G

Horizontal




| Frequency | Meter Reading | Cable loss | Antenna Factor | Preamp Factor | Emission Level | Limits | Margin dB | Detector Type |
|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBuV) | (dB) | dB/m | (dB) | (dBuV/m) | (dBuV/m) | (dB) | |
| 35628.298 | 39.54 | 19.11 | 42.73 | 44.61 | 56.77 | 68.2 | 11.43 | Peak |

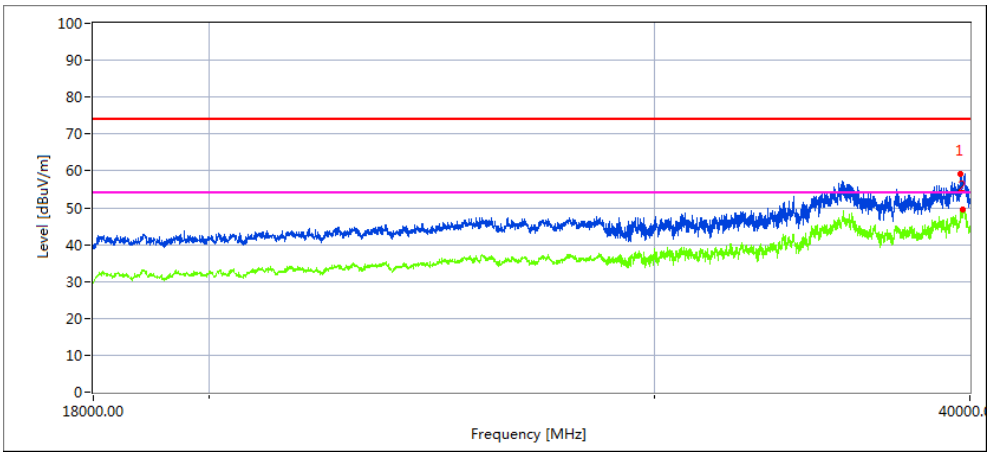
Vertical




| Frequency | Meter Reading | Cable loss | Antenna Factor | Preamp Factor | Emission Level | Limits | Margin dB | Detector Type |
|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBuV) | (dB) | dB/m | (dB) | (dBuV/m) | (dBuV/m) | (dB) | |
| 39693.17 | 37.09 | 20.09 | 44.07 | 43.48 | 57.77 | 68.2 | 10.43 | Peak |

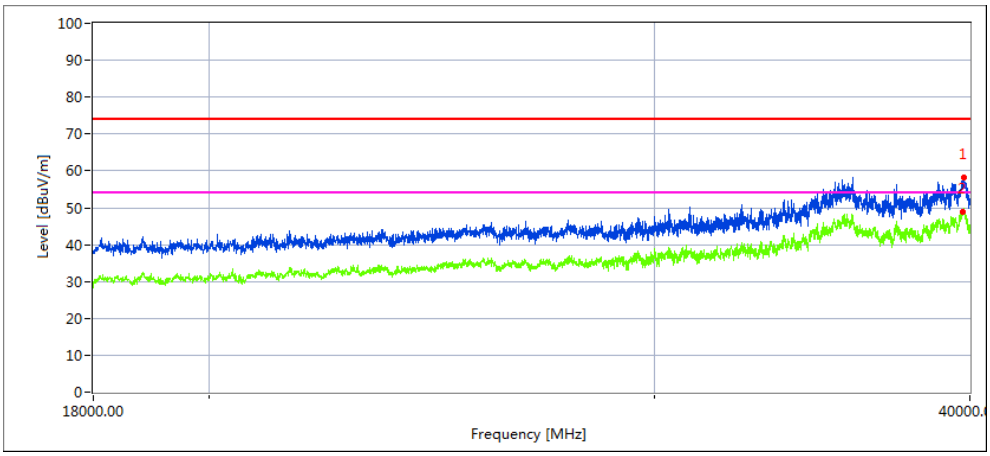
## Low Channel (5745 MHz)-Above 1G

Horizontal




| Frequency | Meter Reading | Cable loss | Antenna Factor | Preamp Factor | Emission Level | Limits | Margin dB | Detector Type |
|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBuV) | (dB) | dB/m | (dB) | (dBuV/m) | (dBuV/m) | (dB) | |
| 39461.17 | 39.55 | 20.09 | 44.16 | 43.48 | 60.32 | 68.2 | 7.88 | Peak |

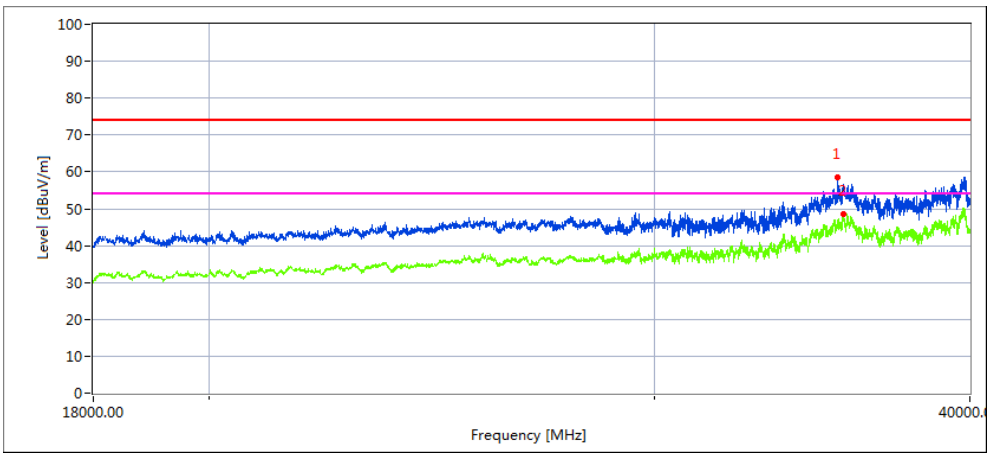
Vertical




| Frequency | Meter Reading | Cable loss | Antenna Factor | Preamp Factor | Emission Level | Limits | Margin dB | Detector Type |
|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBuV) | (dB) | dB/m | (dB) | (dBuV/m) | (dBuV/m) | (dB) | |
| 39744.51 | 36.76 | 20.06 | 44.07 | 43.21 | 57.68 | 68.2 | 10.52 | Peak |

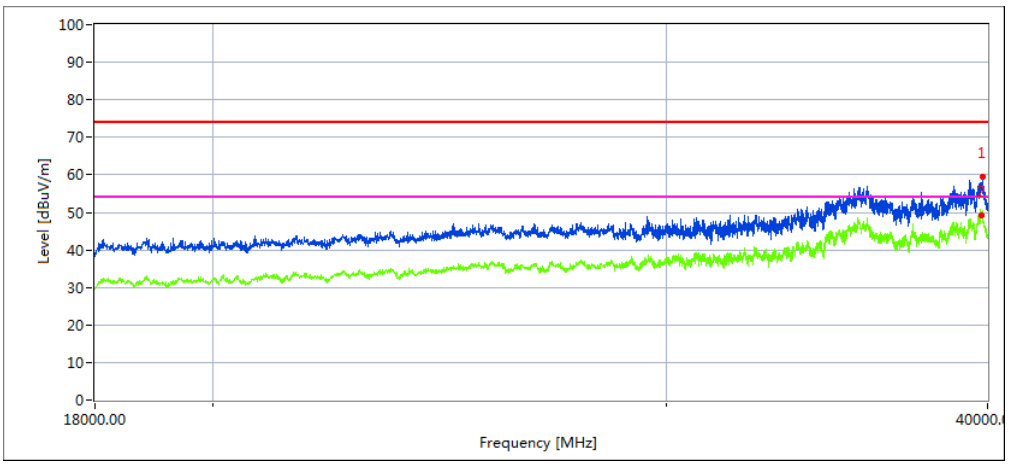
## High Channel (5825 MHz)-Above 1G

Horizontal




| Frequency | Meter Reading | Cable loss | Antenna Factor | Preamp Factor | Emission Level | Limits | Margin dB | Detector Type |
|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBuV) | (dB) | dB/m | (dB) | (dBuV/m) | (dBuV/m) | (dB) | |
| 35629.24 | 39.81 | 19.11 | 42.63 | 43.48 | 58.07 | 68.2 | 10.13 | Peak |

Vertical




| Frequency | Meter Reading | Cable loss | Antenna Factor | Preamp Factor | Emission Level | Limits | Margin dB | Detector Type |
|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBuV) | (dB) | dB/m | (dB) | (dBuV/m) | (dBuV/m) | (dB) | |
| 39815.11 | 36.76 | 20.1 | 44.1 | 43.22 | 57.74 | 68.2 | 10.46 | Peak |

# 4. POWER SPECTRAL DENSITY TEST

## 4.1 APPLIED PROCEDURES / LIMIT

**According to FCC §15.407(a)**

For the band 5.15-5.25 GHz,

(i) For an outdoor 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. 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 5.15-5.25 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.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. 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 client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. 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

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

,

## 4.2 TEST PROCEDURE

For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, "provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 KHz bandwidth, the following adjustments to the procedures apply:

a) Set RBW ≥ 1/T, where T is defined in section II.B.I.a).

b) Set VBW ≥ 3 RBW.

c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10log(500kHz/RBW) to the measured result, whereas RBW (< 500 KHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10log(1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.

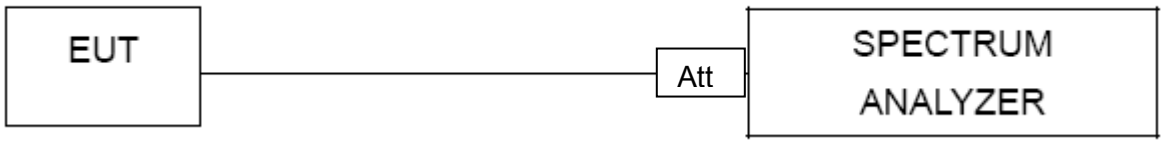
e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 KHz for the sections 5.c) and 5.d) above, since RBW=100 KHZ is available on nearly all spectrum analyzers.

## 4.3 DEVIATION FROM STANDARD

No deviation.

## 4.4 TEST SETUP




## 4.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.1 Unless otherwise a special operating condition is specified in the follows during the testing.

## 4.6 TEST RESULTS

| | | | |
|---|---|---|---|
| EUT： | Smart Access Point | Model Name ： | RA320 |
| Temperature： | 26 ℃ | Relative Humidity： | 54% |
| Pressure： | 1010 hPa | Test Voltage ： | DC 12V from Adapter |
| Test Mode ： | TX Frequency Band 1 (5150-5250MHz), Band 3 (5745-5825MHz) | | |

Note: Band1 For 802.11n/ac 5GHz has MIMO mode.Directional gain=6.90dbi
6.90dbi>6.0dbi so power density limit= 11-(6.90-6)=10.1 in dBm
Band3 For 802.11n/ac 5GHz has MIMO mode.Directional gain=6.90dbi
6.90dbi>6.0dbi so power density limit= 30-(6.90-6)=29.1 in dBm

Test data reference attachment.

# 5. 26DB & 99% EMISSION BANDWIDTH

## 5.1 APPLIED PROCEDURES / LIMIT

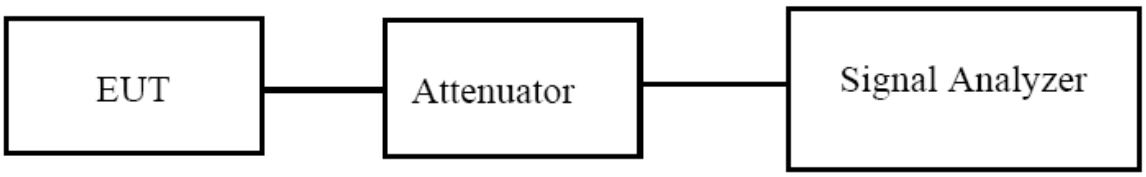
The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

## 5.2 TEST PROCEDURE

a) Set RBW = approximately 1% of the emission bandwidth.
b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

The following procedure shall be used for measuring (99 %) power bandwidth:

1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW ≥ 3 · RBW
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99 % power bandwidth function of the instrument (if available).
7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.



## 5.3 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

## 5.4 TEST RESULTS

| | | | |
|---|---|---|---|
| EUT： | Smart Access Point | Model Name ： | RA320 |
| Temperature： | 26 ℃ | Relative Humidity： | 54% |
| Pressure： | 1010 hPa | Test Voltage ： | DC 12V from Adapter |
| Test Mode ： | TX Frequency Band 1 (5150-5250MHz), Band 3(5725-5850MHz) | | |

Test data reference attachment.

# 6. MINIMUM 6 DB BANDWIDTH

## 6.1 APPLIED PROCEDURES / LIMIT

**According to FCC §15.407(e)**

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

## 6.2 TEST PROCEDURE

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

a) Set RBW = 100 kHz.

b) Set the video bandwidth (VBW) ≥ 3 × RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Sweep = auto couple.

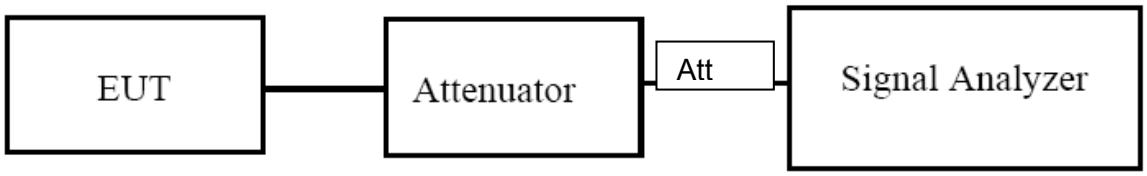
f) Allow the trace to stabilize.

g) 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.

## 6.3 DEVIATION FROM STANDARD

No deviation.

## 6.4 TEST SETUP




## 6.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

## 6.6 TEST RESULTS

| | | | |
|---|---|---|---|
| EUT： | Smart Access Point | Model Name ： | RA320 |
| Temperature： | 26 ℃ | Relative Humidity： | 54% |
| Pressure： | 1010 hPa | Test Voltage ： | DC 12V from Adapter |
| Test Mode ： | TX (5G) Mode Frequency Band 3 (5725-5850MHz) | | |

Test data reference attachment.

# 7. MAXIMUM CONDUCTED OUTPUT POWER

## 7.1 PPLIED PROCEDURES / LIMIT

**According to FCC §15.407**

The maximum conduced output power should not exceed:

| Frequency Band(MHz) | Limit |
|---|---|
| 5150~5250 | 250mW |
| 5250~5350 | 250mW |
| 5470~5725 | 250mW |
| 5725~5850 | 1W |

6.2 TEST PROCEDURE

· Method PM is Measurement using an RF average power meter. The procedure for this method is as follows:

a) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the following conditions are satisfied:

1) The EUT is configured to transmit continuously, or to transmit with a constant duty cycle.

2) At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.

3) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

b) If the transmitter does not transmit continuously, measure the duty cycle D of the transmitter output signal as described in 12.2.

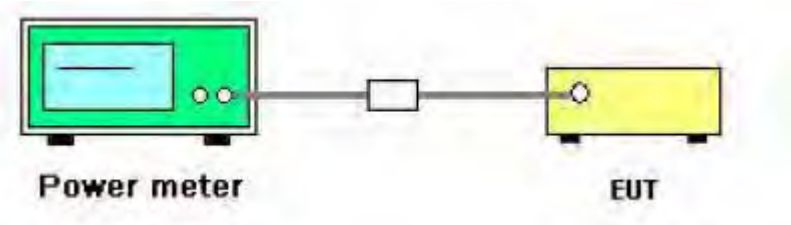
c) Measure the average power of the transmitter. This measurement is an average over both the ON and OFF periods of the transmitter.

d) Adjust the measurement in dBm by adding [10 log (1 / D)], where D is the duty cycle {e.g., [10 log (1 / 0.25)], if the duty cycle is 25%}.

6.3 DEVIATION FROM STANDARD

No deviation.

6.4 TEST SETUP




6.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

## 7.2 TEST RESULTS

| | | | |
|---|---|---|---|
| EUT： | Smart Access Point | Model Name ： | RA320 |
| Temperature： | 26 ℃ | Relative Humidity： | 54% |
| Pressure： | 1010 hPa | Test Voltage ： | DC 12V from Adapter |
| Test Mode ： | TX (5G) Mode Frequency Band 1 (5150-5250MHz), Band 3 (5725-5850MHz) | | |

Note: Band1&Band2A&Band2C For 802.11n/ac 5GHz has MIMO mode. Directional gain=6.90dbi
6.90dbi>6.0dbi so power limit= 24-(6.90-6)=23.1 in dBm
Band3 For 802.11n/ac 5GHz has MIMO mode. Directional gain=6.90dbi
6.90dbi>6.0dbi so power limit= 30-(6.90-6)=29.1 in dBm

Test data reference attachment.

# 8. OUT OF BAND EMISSIONS

## 8.1 APPLICABLE STANDARD

**According to FCC §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 5.15-5.25 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.

(2) 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.

(3) 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.

(4) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz.

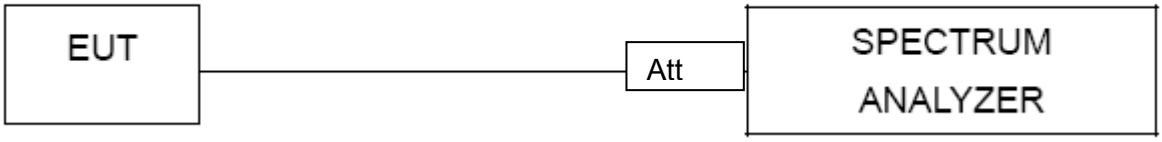
## 8.2 TEST PROCEDURE

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 1 MHz with a convenient frequency span.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

## 8.3 DEVIATION FROM STANDARD

No deviation.

## 8.4 TEST SETUP




**8.5 EUT OPERATION CONDITIONS**

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

## 8.6 TEST RESULTS

| | | | |
|---|---|---|---|
| EUT： | Smart Access Point | Model Name ： | RA320 |
| Temperature： | 26 ℃ | Relative Humidity： | 54% |
| Pressure： | 1010 hPa | Test Voltage ： | DC 12V from Adapter |

Test data reference attachment.

# 8. Frequency Stability Measurement

## 8.1 LIMIT

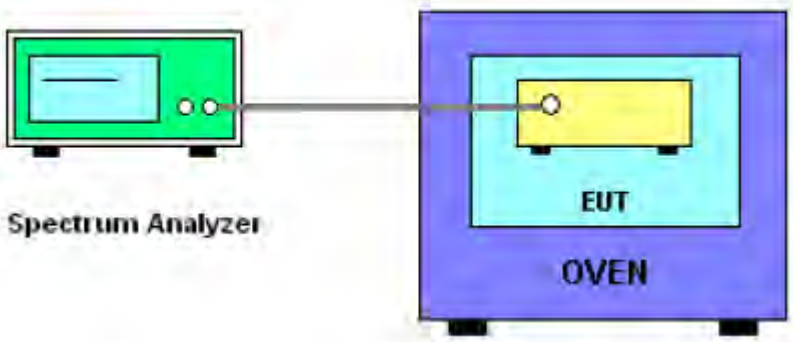
Manufactures of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

The transmitter center frequency tolerance shall be ± 20 ppm maximum for the 5 GHz band (IEEE 802.11n specification).

## 8.2 TEST PROCEDURES

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. EUT have transmitted absence of modulation signal and fixed channelize.
3. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth.
4. Set RBW = 10 kHz, VBW = 10 kHz with peak detector and maxhold settings.
5. fc is declaring of channel frequency. Then the frequency error formula is (fc-f)/fc × $10_6$ ppm and the limit is less than ±20ppm (IEEE 802.11nspecification).
6. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value
7. Extreme temperature is -30°C~80°C.

## 8.3 TEST SETUP LAYOUT




## 8.4 EUT OPERATION DURING TEST

1. The EUT was programmed to be in continuously un-modulation transmitting mode.
2. The module has two antennas, and the worst data is Antenna 3, only shown Antenna 3 Plot.

8.5 TEST RESULTS

| | | | |
|---|---|---|---|
| EUT： | Smart Access Point | Model Name ： | RA320 |
| Temperature： | 26 ℃ | Relative Humidity： | 54% |
| Pressure： | 1010 hPa | Test Voltage ： | DC 12V from Adapter |
| Test Mode ： | TX Frequency Band I (5150-5250MHz) | | |

Voltage vs. Frequency Stability

| TEST CONDITIONS | | | | Reference Frequency：5180MHz | | | |
|---|---|---|---|---|---|---|---|
| | | | | f | fc | Max. Deviation (MHz) | Max. Deviation (ppm) |
| T nom (°C) | 20 | V nom (V) | 12.00 | 5179.9707 | 5180 | -0.0293 | -5.6658 |
| | | V max (V) | 13.80 | 5179.9000 | 5180 | -0.1000 | -19.3050 |
| | | V min (V) | 10.20 | 5179.9981 | 5180 | -0.0019 | -0.3758 |
| Limits | | | | Within 5150-5250MHz | | | |
| Result | | | | Complies | | | |

Temperature vs. Frequency Stability

| TEST CONDITIONS | | | | Reference Frequency：5180MHz | | | |
|---|---|---|---|---|---|---|---|
| | | | | f | fc | Max. Deviation (MHz) | Max. Deviation (ppm) |
| V nom (V) | 12 | T (°C) | -30 | 5179.9032 | 5180 | -0.0968 | -18.690 |
| | | T (°C) | -20 | 5180.0227 | 5180 | 0.0227 | 4.384 |
| | | T (°C) | -10 | 5179.9843 | 5180 | -0.0157 | -3.033 |
| | | T (°C) | 0 | 5180.0367 | 5180 | 0.0367 | 7.089 |
| | | T (°C) | 10 | 5180.0342 | 5180 | 0.0342 | 6.596 |
| | | T (°C) | 20 | 5180.0142 | 5180 | 0.0142 | 2.744 |
| | | T (°C) | 30 | 5179.9690 | 5180 | -0.0310 | -5.985 |
| | | T (°C) | 40 | 5180.0282 | 5180 | 0.0282 | 5.448 |
| | | T (°C) | 50 | 5179.9810 | 5180 | -0.0190 | -3.668 |
| | | T (°C) | 60 | 5180.0104 | 5180 | 0.0104 | 2.011 |
| | | T (°C) | 70 | 5180.0001 | 5180 | 0.0001 | 0.024 |
| | | T (°C) | 80 | 5179.9757 | 5180 | -0.0243 | -4.694 |
| Limits | | | | Within 5150-5250MHz | | | |
| Result | | | | Complies | | | |

Voltage vs. Frequency Stability

| TEST CONDITIONS | | | | Reference Frequency：5200MHz | | | |
|---|---|---|---|---|---|---|---|
| | | | | f | fc | Max. Deviation (MHz) | Max. Deviation (ppm) |
| T nom (°C) | 20 | V nom (V) | 12.00 | 5199.9949 | 5200 | -0.0051 | -0.971 |
| | | V max (V) | 13.80 | 5199.9795 | 5200 | -0.0205 | -3.943 |
| | | V min (V) | 10.20 | 5199.9809 | 5200 | -0.0191 | -3.672 |
| Limits | | | | Within 5150-5250MHz | | | |
| Result | | | | Complies | | | |

Temperature vs. Frequency Stability

| TEST CONDITIONS | | | | Reference Frequency：5200MHz | | | |
|---|---|---|---|---|---|---|---|
| | | | | f | fc | Max. Deviation (MHz) | Max. Deviation (ppm) |
| V nom (V) | 12 | T (°C) | -30 | 5200.0238 | 5200 | 0.0238 | 4.581 |
| | | T (°C) | -20 | 5199.9776 | 5200 | -0.0224 | -4.304 |
| | | T (°C) | -10 | 5199.9491 | 5200 | -0.0509 | -9.798 |
| | | T (°C) | 0 | 5200.0426 | 5200 | 0.0426 | 8.189 |
| | | T (°C) | 10 | 5200.0139 | 5200 | 0.0139 | 2.669 |
| | | T (°C) | 20 | 5200.0183 | 5200 | 0.0183 | 3.510 |
| | | T (°C) | 30 | 5199.9953 | 5200 | -0.0047 | -0.913 |
| | | T (°C) | 40 | 5200.0355 | 5200 | 0.0355 | 6.828 |
| | | T (°C) | 50 | 5199.9859 | 5200 | -0.0141 | -2.703 |
| | | T (°C) | 60 | 5199.9637 | 5200 | -0.0364 | -6.990 |
| | | T (°C) | 70 | 5200.0230 | 5200 | 0.0230 | 4.418 |
| | | T (°C) | 80 | 5199.9882 | 5200 | -0.0118 | -2.272 |
| Limits | | | | Within 5150-5250MHz | | | |
| Result | | | | Complies | | | |

Voltage vs. Frequency Stability

| TEST CONDITIONS | | | | Reference Frequency：5240MHz | | | |
|---|---|---|---|---|---|---|---|
| | | | | f | fc | Max. Deviation (MHz) | Max. Deviation (ppm) |
| T nom (°C) | 20 | V nom (V) | 12.00 | 5239.9912 | 5240 | -0.0088 | -1.679 |
| | | V max (V) | 13.80 | 5240.0133 | 5240 | 0.0133 | 2.538 |
| | | V min (V) | 10.20 | 5239.9884 | 5240 | -0.0116 | -2.210 |
| Limits | | | | Within 5150-5250MHz | | | |
| Result | | | | Complies | | | |

Temperature vs. Frequency Stability

| TEST CONDITIONS | | | | Reference Frequency：5240MHz | | | |
|---|---|---|---|---|---|---|---|
| | | | | f | fc | Max. Deviation (MHz) | Max. Deviation (ppm) |
| V nom (V) | 12 | T (°C) | -30 | 5239.9724 | 5240 | -0.0276 | -5.266 |
| | | T (°C) | -20 | 5240.0298 | 5240 | 0.0298 | 5.685 |
| | | T (°C) | -10 | 5239.9722 | 5240 | -0.0278 | -5.308 |
| | | T (°C) | 0 | 5240.0164 | 5240 | 0.0164 | 3.130 |
| | | T (°C) | 10 | 5239.9807 | 5240 | -0.0193 | -3.677 |
| | | T (°C) | 20 | 5240.0185 | 5240 | 0.0185 | 3.538 |
| | | T (°C) | 30 | 5239.9548 | 5240 | -0.0452 | -8.621 |
| | | T (°C) | 40 | 5239.9871 | 5240 | -0.0129 | -2.471 |
| | | T (°C) | 50 | 5239.9561 | 5240 | -0.0439 | -8.385 |
| | | T (°C) | 60 | 5239.9603 | 5240 | -0.0397 | -7.583 |
| | | T (°C) | 70 | 5239.9621 | 5240 | -0.0379 | -7.224 |
| | | T (°C) | 80 | 5239.9530 | 5240 | -0.0470 | -8.963 |
| Limits | | | | Within 5150-5250MHz | | | |
| Result | | | | Complies | | | |

| | | | |
|---|---|---|---|
| EUT： | Panoramic Camera | Model Name. ： | PIONA1925/A |
| Temperature： | 25 ℃ | Relative Humidity： | 56% |
| Pressure： | 1012 hPa | Test Voltage ： | DC 3.8V |
| Test Mode ： | TX Frequency(5745-5850MHz) | | |

| TEST CONDITIONS | | | | Reference Frequency：5745MHz | | | |
|---|---|---|---|---|---|---|---|
| | | | | f | fc | Max. Deviation (MHz) | Max. Deviation (ppm) |
| T nom (° C) | 20 | V nom (V) | 12.00 | 5744.9763 | 5745 | -0.0237 | -4.125 |
| | | V max (V) | 13.80 | 5744.9956 | 5745 | -0.0044 | -0.774 |
| | | V min (V) | 10.20 | 5744.9851 | 5745 | -0.0149 | -2.598 |
| Limits | | | | Within 5745-5850MHz | | | |
| Result | | | | Complies | | | |

Voltage vs. Frequency Stability

Temperature vs. Frequency Stability

| TEST CONDITIONS | | | | Reference Frequency：5745MHz | | | |
|---|---|---|---|---|---|---|---|
| | | | | f | fc | Max. Deviation (MHz) | Max. Deviation (ppm) |
| V nom (V) | 12 | T (°C) | -30 | 5745.0127 | 5745 | 0.0127 | 2.205 |
| | | T (°C) | -20 | 5744.9976 | 5745 | -0.0024 | -0.417 |
| | | T (°C) | -10 | 5745.0294 | 5745 | 0.0294 | 5.117 |
| | | T (°C) | 0 | 5744.9521 | 5745 | -0.0479 | -8.331 |
| | | T (°C) | 10 | 5745.0354 | 5745 | 0.0354 | 6.158 |
| | | T (°C) | 20 | 5744.9754 | 5745 | -0.0246 | -4.282 |
| | | T (°C) | 30 | 5744.9464 | 5745 | -0.0536 | -9.326 |
| | | T (°C) | 40 | 5744.9823 | 5745 | -0.0177 | -3.088 |
| | | T (°C) | 50 | 5745.0170 | 5745 | 0.0170 | 2.955 |
| | | T (°C) | 60 | 5744.9850 | 5745 | -0.0150 | -2.613 |
| | | T (°C) | 70 | 5744.9825 | 5745 | -0.0175 | -3.052 |
| | | T (°C) | 80 | 5745.0357 | 5745 | 0.0357 | 6.222 |
| Limits | | | | Within 5745-5850MHz | | | |
| Result | | | | Complies | | | |

Voltage vs. Frequency Stability

| TEST CONDITIONS | | | | Reference Frequency：5785MHz | | | |
|---|---|---|---|---|---|---|---|
| | | | | f | fc | Max. Deviation (MHz) | Max. Deviation (ppm) |
| T nom (°C) | 20 | V nom (V) | 12.00 | 5784.9804 | 5785 | -0.0196 | -3.380 |
| | | V max (V) | 13.80 | 5784.9717 | 5785 | -0.0283 | -4.887 |
| | | V min (V) | 10.20 | 5784.9701 | 5785 | -0.0299 | -5.169 |
| Limits | | | | Within 5745-5850MHz | | | |
| Result | | | | Complies | | | |

Temperature vs. Frequency Stability

| TEST CONDITIONS | | | | Reference Frequency：5785MHz | | | |
|---|---|---|---|---|---|---|---|
| | | | | f | fc | Max. Deviation (MHz) | Max. Deviation (ppm) |
| V nom (V) | 12 | T (°C) | -30 | 5784.9947 | 5785 | -0.0053 | -0.920 |
| | | T (°C) | -20 | 5784.9702 | 5785 | -0.0298 | -5.147 |
| | | T (°C) | -10 | 5785.0040 | 5785 | 0.0040 | 0.697 |
| | | T (°C) | 0 | 5785.0128 | 5785 | 0.0128 | 2.206 |
| | | T (°C) | 10 | 5784.9747 | 5785 | -0.0253 | -4.377 |
| | | T (°C) | 20 | 5784.9954 | 5785 | -0.0046 | -0.790 |
| | | T (°C) | 30 | 5784.9969 | 5785 | -0.0031 | -0.534 |
| | | T (°C) | 40 | 5785.0373 | 5785 | 0.0373 | 6.447 |
| | | T (°C) | 50 | 5784.9805 | 5785 | -0.0195 | -3.378 |
| | | T (°C) | 60 | 5784.9770 | 5785 | -0.0230 | -3.969 |
| | | T (°C) | 70 | 5785.0491 | 5785 | 0.0491 | 8.492 |
| | | T (°C) | 80 | 5784.9854 | 5785 | -0.0146 | -2.531 |
| Limits | | | | Within 5745-5850MHz | | | |
| Result | | | | Complies | | | |

Voltage vs. Frequency Stability

| TEST CONDITIONS | | | | Reference Frequency：5825MHz | | | |
|---|---|---|---|---|---|---|---|
| | | | | f | fc | Max. Deviation (MHz) | Max. Deviation (ppm) |
| T nom (°C) | 20 | V nom (V) | 12.00 | 5824.9880 | 5825 | -0.0120 | -2.056 |
| | | V max (V) | 13.80 | 5824.9798 | 5825 | -0.0202 | -3.464 |
| | | V min (V) | 10.20 | 5824.9989 | 5825 | -0.0011 | -0.186 |
| Limits | | | | Within 5745-5850MHz | | | |
| Result | | | | Complies | | | |

Temperature vs. Frequency Stability

| TEST CONDITIONS | | | | Reference Frequency：5825MHz | | | |
|---|---|---|---|---|---|---|---|
| | | | | f | fc | Max. Deviation (MHz) | Max. Deviation (ppm) |
| V nom (V) | 19 | T (°C) | -30 | 5824.9975 | 5825 | -0.0025 | -0.429 |
| | | T (°C) | -20 | 5824.9773 | 5825 | -0.0227 | -3.902 |
| | | T (°C) | -10 | 5825.0118 | 5825 | 0.0118 | 2.023 |
| | | T (°C) | 0 | 5824.9864 | 5825 | -0.0136 | -2.335 |
| | | T (°C) | 10 | 5825.0191 | 5825 | 0.0191 | 3.279 |
| | | T (°C) | 20 | 5824.9845 | 5825 | -0.0155 | -2.655 |
| | | T (°C) | 30 | 5824.9840 | 5825 | -0.0160 | -2.752 |
| | | T (°C) | 40 | 5824.9693 | 5825 | -0.0307 | -5.278 |
| | | T (°C) | 50 | 5824.9806 | 5825 | -0.0194 | -3.327 |
| | | T (°C) | 60 | 5825.0278 | 5825 | 0.0278 | 4.779 |
| | | T (°C) | 70 | 5824.9884 | 5825 | -0.0116 | -1.985 |
| | | T (°C) | 80 | 5824.9816 | 5825 | -0.0184 | -3.159 |
| Limits | | | | Within 5745-5850MHz | | | |
| Result | | | | Complies | | | |

# 9. DYNAMIC FREQUENCY SELECTION(DFS)

## 9.1 APPLICABILITY OF DFS REQUIREMENTS

EUT is client and operates as client without radar detection function.

Table 1: Applicability of DFS Requirements Prior to Use of a Channel

| Requirement | Operational Mode | | |
|---|---|---|---|
| | Master | Client Without Radar Detection | Client With Radar Detection |
| Non-Occupancy Period | Yes | Not required | Yes |
| DFS Detection Threshold | Yes | Not required | Yes |
| Channel Availability Check Time | Yes | Not required | Not required |
| U-NII Detection Bandwidth | Yes | Not required | Yes |

Table 2: Applicability of DFS requirements during normal operation

| Requirement | Operational Mode | | |
|---|---|---|---|
| | Master | Client Without Radar Detection | Client With Radar Detection |
| DFS Detection Threshold | Yes | Not required | Yes |
| Channel Closing Transmission Time | Yes | Yes | Yes |
| Channel Move Time | Yes | Yes | Yes |
| U-NII Detection Bandwidth | Yes | Not required | Yes |
| Client Beacon Test | N/A | Yes | Yes |

| Additional requirements for devices with multiple bandwidth modes | Operational Mode | |
|---|---|---|
| | Master or Client With Radar Detection | Client Without Radar Detection |
| U-NII Detection Bandwidth and Statistical Performance Check | All BW modes must be tested | Not required |
| Channel Move Time and Channel Closing Transmission Time | Test using widest BW mode available | Test using the widest BW mode available for the link |
| All other tests | Any single BW mode | Not required |

**Note**
Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.

## 9.2 INTERFERENCE THRESHOLD VALUES, MASTER OR CLIENT INCORPORATING IN-SERVICE MONITORING

| Maximum Transmit Power | Value (see notes 1, 2, and 3) |
|---|---|
| EIRP ≥ 200 milliwatt | -64 dBm |
| EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz | -62 dBm |
| EIRP < 200 milliwatt that do not meet the power spectral density requirement | -64 dBm |

**Note 1:** This is the level at the input of the receiver assuming a 0 dBi receive antenna.
**Note 2:** Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.
**Note 3:** EIRP is based on the highest antenna gain.

## 9.3 DFS RESPONSE REQUIREMENT VALUES

| Parameter | Value |
|---|---|
| Non-occupancy period | Minimum 30 minutes |
| Channel Availability Check Time | 60 seconds |
| Channel Move Time | 10 seconds See Note 1. |
| Channel Closing Transmission Time | 200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2. |
| U-NII Detection Bandwidth | Minimum 100% of the 99% power bandwidth See Note 3. |

**Note 1**: The instant that the Channel Move Time and the Channel Closing Transmission Time begins is as follows:
• For the Short pulse radar Test Signals this instant is the end of the Burst.
• For the Frequency Hopping radar Test Signal, this instant is the end of the last radar Burst generated.
• For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission.
**Note 2**: The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate Channel changes (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.
**Note 3**: During the U-NII Detection Bandwidth detection test, radar type 0 is used and for each frequency step the minimum percentage of detection is 90%. Measurements are performed with no data traffic.

## 9.4 SHORT PULSE RADAR TEST WAVEFORMS

As the EUT is a Client Device with no Radar Detection, only one type radar pulse is required for the testing. Radar Pulse type 0 was used in the evaluation of the Client device for the purpose of measuring the Channel Move Time and the Channel Closing Transmission Time.

| Radar Type | Pulse Width (μsec) | PRI (μsec) | Number of Pulses | Minimum Percentage of Successful Detection | Minimum Trials |
|---|---|---|---|---|---|
| 0 | 1 | 1428 | 18 | 60% | 30 |
| 1 | 1 | Test A<br>Test B | $\mathrm{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{\mathrm{PRI}_{\mu sec}}\right)\right\}$ | 60% | 30 |
| 2 | 1-5 | 150-230 | 23-29 | 60% | 30 |
| 3 | 6-10 | 200-500 | 16-18 | 60% | 30 |
| 4 | 11-20 | 200-500 | 12-16 | 60% | 30 |
| Aggregate (Radar Types 1-4) | | | | 80% | 120 |

Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a
Test B: 15 unique PRI values randomly selected within the range of 518-3066 μsec, with a minimum increment of 1 μsec, excluding PRI values selected in Test A

A minimum of 30 unique waveforms are required for each of the short pulse radar types 2 through 4. For short pulse radar type 1, the same waveform is used a minimum of 30 times. If more than 30 waveforms are used for short pulse radar types 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms.
If more than 30 waveforms are used for Short Pulse Radar Type 1, then each additional waveform is generated with Test B and must also be unique and not repeated from the previous waveforms in Tests A or B. The aggregate is the average of the percentage of successful detections of short pulse radar types 1-4.

## 9.5 CALIBRATION SETUP AND DFS TEST RESULTS

Radar Waveform Calibration Procedure

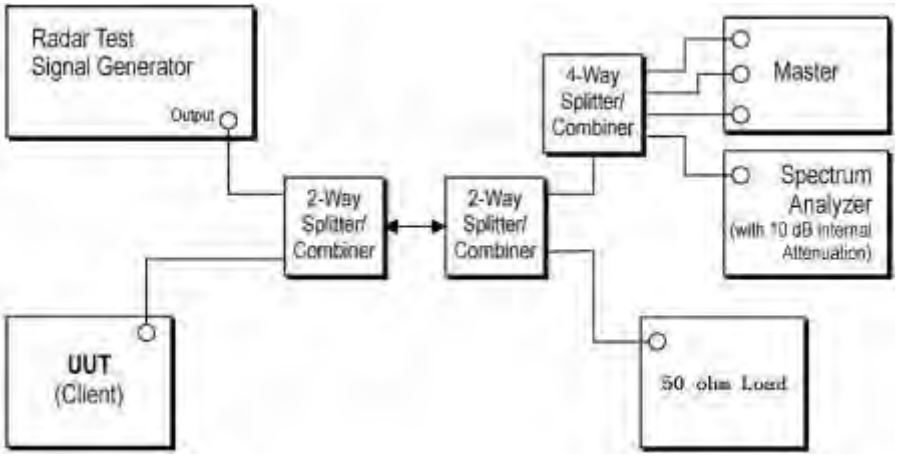
1) A 50 ohm load is connected in place of the spectrum analyzer, and the spectrum analyzer is connected to place of the master

2) The interference Radar Detection Threshold Level is -62dBm + 0dBi +1dB = -61dBm that had been taken into account the output power range and antenna gain.

3) The following equipment setup was used to calibrate the conducted radar waveform. A vector signal generator was utilized to establish the test signal level for radar type 0. During this process there were no transmissions by either the master or client device. The spectrum analyzer was switched to the zero spans (time domain) at the frequency of the radar waveform generator. Peak detection was used. The spectrum analyzer resolution bandwidth (RBW) and video bandwidth (VBW) were set to 3 MHz. The spectrum analyzer had offset -1.0dB to compensate RF cable loss 1.0dB.

4) The vector signal generator amplitude was set so that the power level measured at the spectrum analyzer was - -62dBm + 0dBi +1dB = -61dBm. Capture the spectrum analyzer plots on short pulse radar waveform.

## 9.6 CONDUCTED CALIBRATION SETUP




| | | |
|---|---|---|
| Wireless AP | Manufacturer | LINKSYS LLC |
| | Model NO. | WRT32X |
| | FCC ID | Q87-WRT3200ACM |

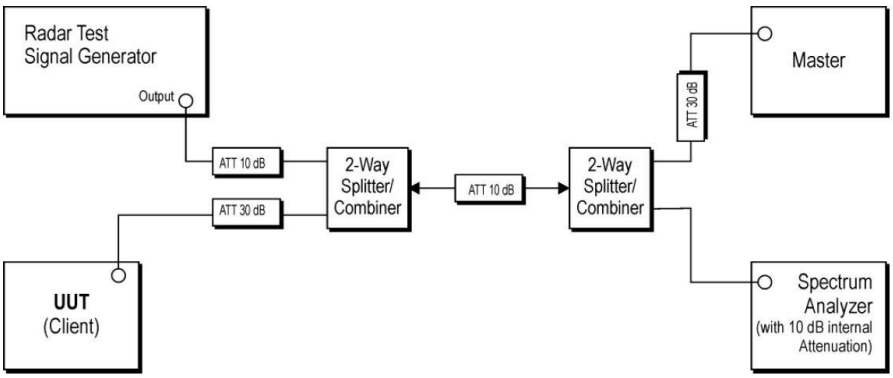
## 9.7 RADAR WAVEFORM CALIBRATION RESULT

Not applicable.

## 9.8 IN-SERVICE MONITORING: CHANNEL MOVE TIME, CHANNEL CLOSING TRANSMISSION TIME AND NON-OCCUPANCY PERIOD

TEST CONFIGURATION:

Setup for Client with injection at the Master




TEST PROCEDURE:

1. The radar pulse generator is setup to provide a pulse at frequency that the master and client are operating. A type 0 radar pulse with a 1us pulse width and a 1428us PRI is used for the testing.
2. The vector signal generator is adjusted to provide the radar burst (18 pulses) at the level of approximately -61dBm at the antenna port of the master device
3. A trigger is provided from the pulse generator to the DFS monitoring system in order to capture the traffic and the occurrence of the radar pulse.
4. EUT will associate with the master at channel. The file “iperf.exe” specified by the FCC is Streamed from the PC 2 through the master and the client device to the PC 1 and played in full motion video using Media Player Classic Ver. 6.4.8.6 in order to properly load the network for the entire period of the test.
5. When radar burst with a level equal to the DFS Detection Threshold +1dB is generated on the operating channel of the U-NII device. At time T0 the radar waveform generator sends a burst of pulse of the radar waveform at Detection Threshold +1dB.
6. Observe the transmissions of the EUT at the end of the radar Burst on the Operating Channel Measure and record the transmissions from the UUT during the observation time (Channel Move Time). One 15 seconds plot is reported for the Short Pulse Radar Type 0. The plot for the Short Pulse Radar Types start at the end of the radar burst. The Channel Move Time will be calculated based on the zoom In 600ms plot of the Short Pulse Radar Type
7. Measurement of the aggregate duration of the Channel Closed Transmission Time method. With the spectrum analyzer set to zero span tuned to the center frequency of the EUT operating channel at the radar simulated frequency, peak detection, and max hold, the dwell time per bin is given by: Dwell (0.3ms) =S (12000ms) / B (4000); where Dwell is the dwell time per spectrum analyzer sampling bin, S is sweep time and B is the number of spectrum analyzer sampling bins. An upper bound of the aggregate duration of the intermittent control signals of Channel Closing Transmission Time is calculated by: C (ms)= N X Dwell (0.3ms); where C is the Closing Time, N is the number of spectrum analyzer sampling bins (intermittent control signals) showing a U-NII transmission and Dwell is the dwell time per bin.
8. Measurement the EUT for more than 30 minutes following the channel move time to verify that no transmission or beacons occur on this channel.

TEST MODE:

Please refer to the clause 2.2

## 9.9 RESULT OF CHANNEL MOVE TIME, CHANNEL CLOSING TRANSMISSION TIME AND NON-OCCUPANCY PERIOD FOR CLIENT BEACON TEST

Not applicable.

# 10. ANTENNA REQUIREMENT

## 10.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

## 10.2 EUT ANTENNA

The EUT antenna is permanent attached Embedded antenna(antenna gain: 4.17dBi (Antenna3); 3.39 dBi (Antenna4)). It comply with the standard requirement.

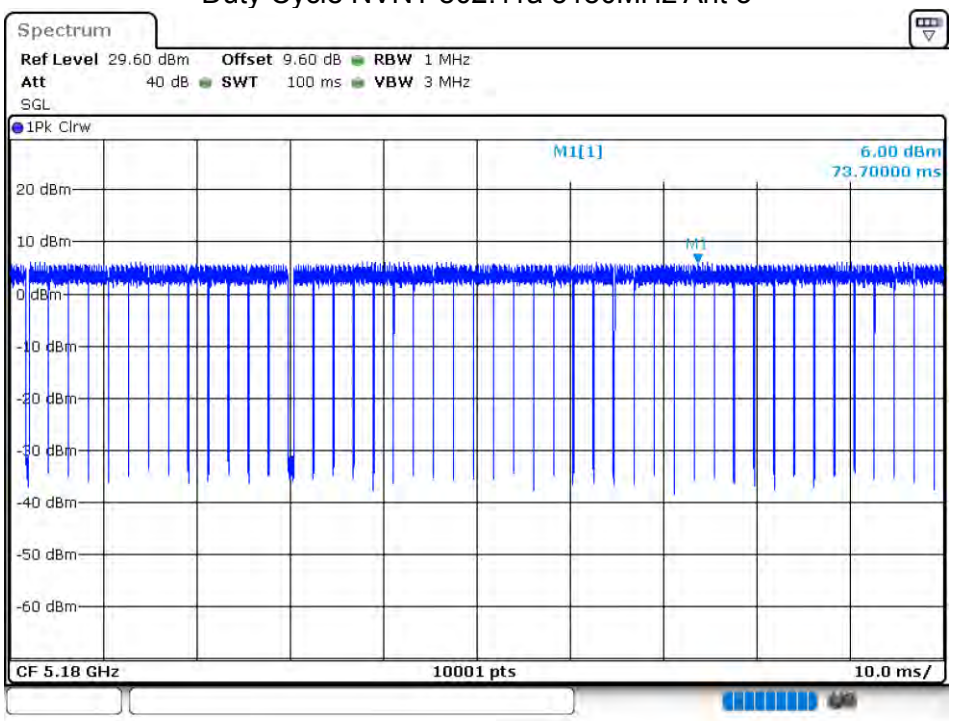
# 11. TEST RESULTS

## 11.1 DUTY CYCLE

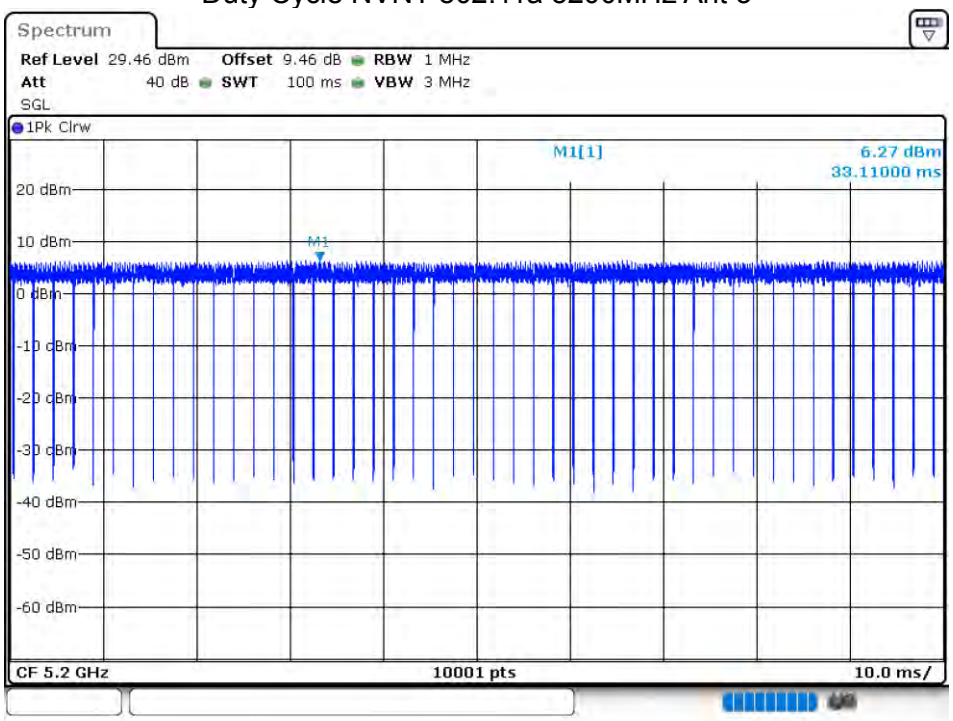
5.2G:

| Antenna | Condition | Mode | Frequency (MHz) | Duty Cycle (%) | Correction Factor (dB) |
|---|---|---|---|---|---|
| Ant 3 | NVNT | 802.11a | 5180 | 100 | 0 |
| Ant 3 | NVNT | 802.11a | 5200 | 100 | 0 |
| Ant 3 | NVNT | 802.11a | 5240 | 100 | 0 |
| Ant 4 | NVNT | 802.11a | 5180 | 100 | 0 |
| Ant 4 | NVNT | 802.11a | 5200 | 100 | 0 |
| Ant 4 | NVNT | 802.11a | 5240 | 100 | 0 |
| Ant 3 | NVNT | 802.11ac20 | 5180 | 100 | 0 |
| Ant 3 | NVNT | 802.11ac20 | 5200 | 100 | 0 |
| Ant 3 | NVNT | 802.11ac20 | 5240 | 100 | 0 |
| Ant 4 | NVNT | 802.11ac20 | 5180 | 100 | 0 |
| Ant 4 | NVNT | 802.11ac20 | 5200 | 100 | 0 |
| Ant 4 | NVNT | 802.11ac20 | 5240 | 100 | 0 |
| Ant 3 | NVNT | 802.11ac40 | 5190 | 100 | 0 |
| Ant 3 | NVNT | 802.11ac40 | 5230 | 99.96 | 0 |
| Ant 4 | NVNT | 802.11ac40 | 5190 | 100 | 0 |
| Ant 4 | NVNT | 802.11ac40 | 5230 | 99.99 | 0 |
| Ant 3 | NVNT | 802.11ac80 | 5210 | 100 | 0 |
| Ant 4 | NVNT | 802.11ac80 | 5210 | 100 | 0 |
| Ant 3 | NVNT | 802.11n(HT20) | 5180 | 100 | 0 |
| Ant 3 | NVNT | 802.11n(HT20) | 5200 | 100 | 0 |
| Ant 3 | NVNT | 802.11n(HT20) | 5240 | 100 | 0 |
| Ant 4 | NVNT | 802.11n(HT20) | 5180 | 100 | 0 |
| Ant 4 | NVNT | 802.11n(HT20) | 5200 | 100 | 0 |
| Ant 4 | NVNT | 802.11n(HT20) | 5240 | 100 | 0 |
| Ant 3 | NVNT | 802.11n(HT40) | 5190 | 100 | 0 |
| Ant 3 | NVNT | 802.11n(HT40) | 5230 | 100 | 0 |
| Ant 4 | NVNT | 802.11n(HT40) | 5190 | 100 | 0 |
| Ant 4 | NVNT | 802.11n(HT40) | 5230 | 100 | 0 |

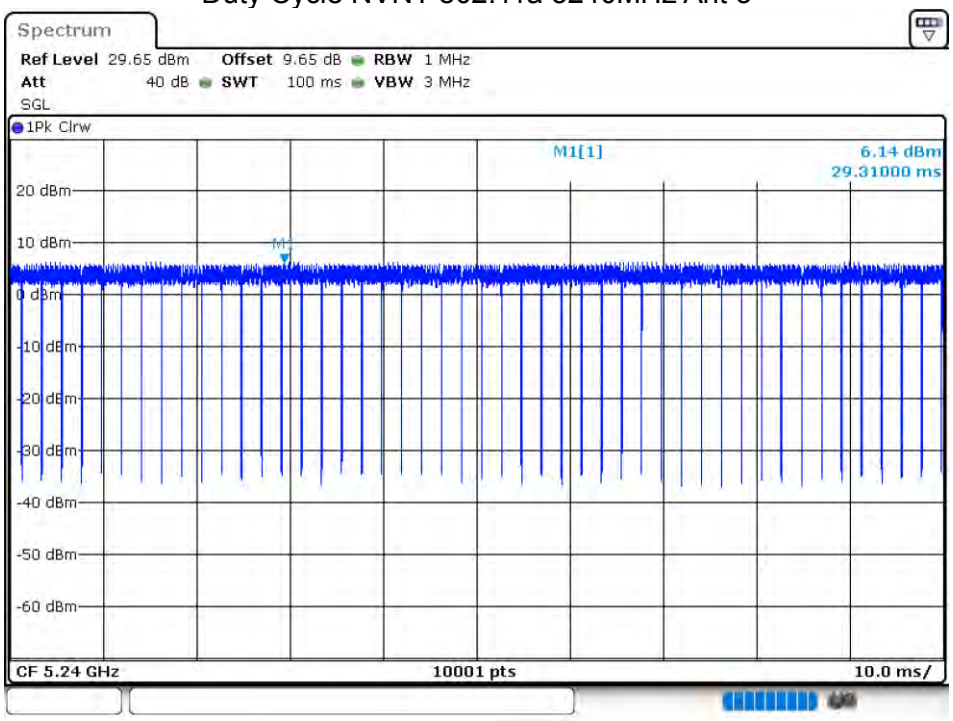
Duty Cycle NVNT 802.11a 5180MHz Ant 3



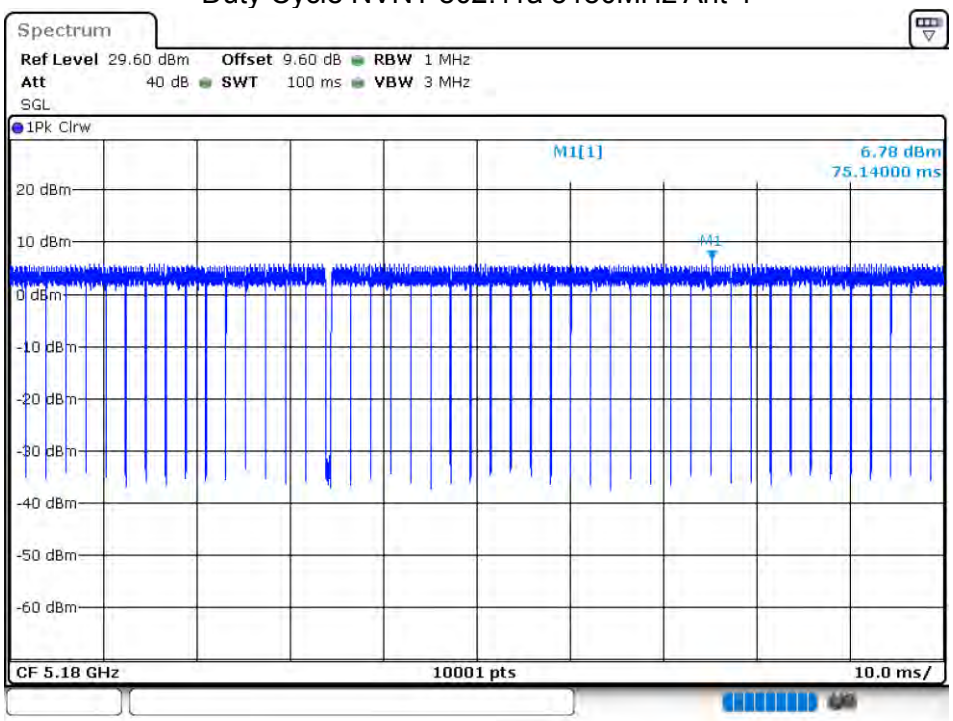

Duty Cycle NVNT 802.11a 5200MHz Ant 3



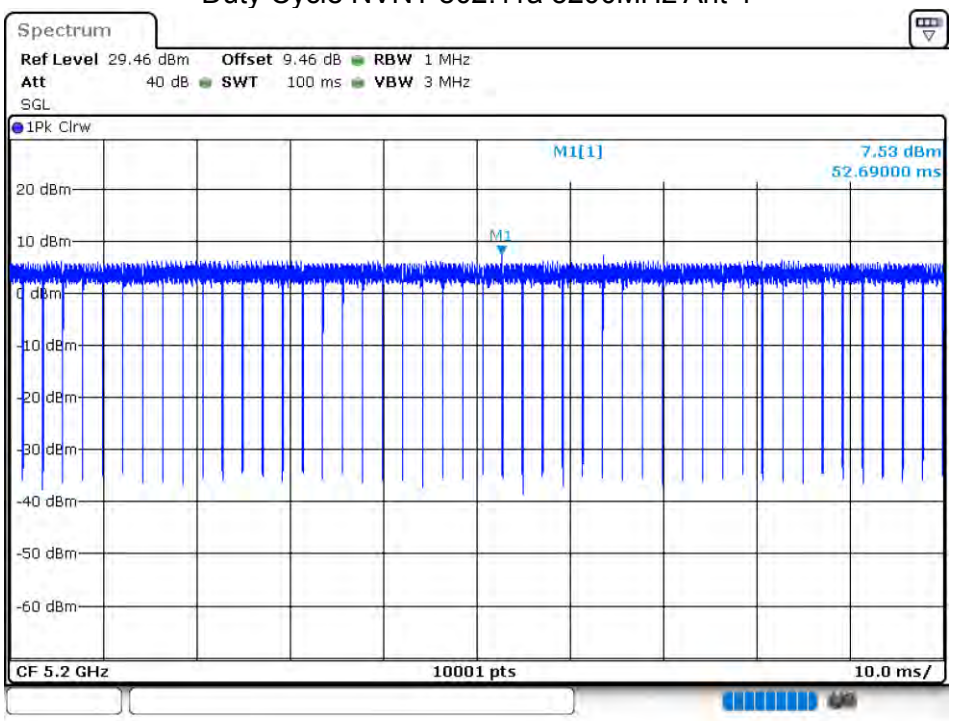
Duty Cycle NVNT 802.11a 5240MHz Ant 3



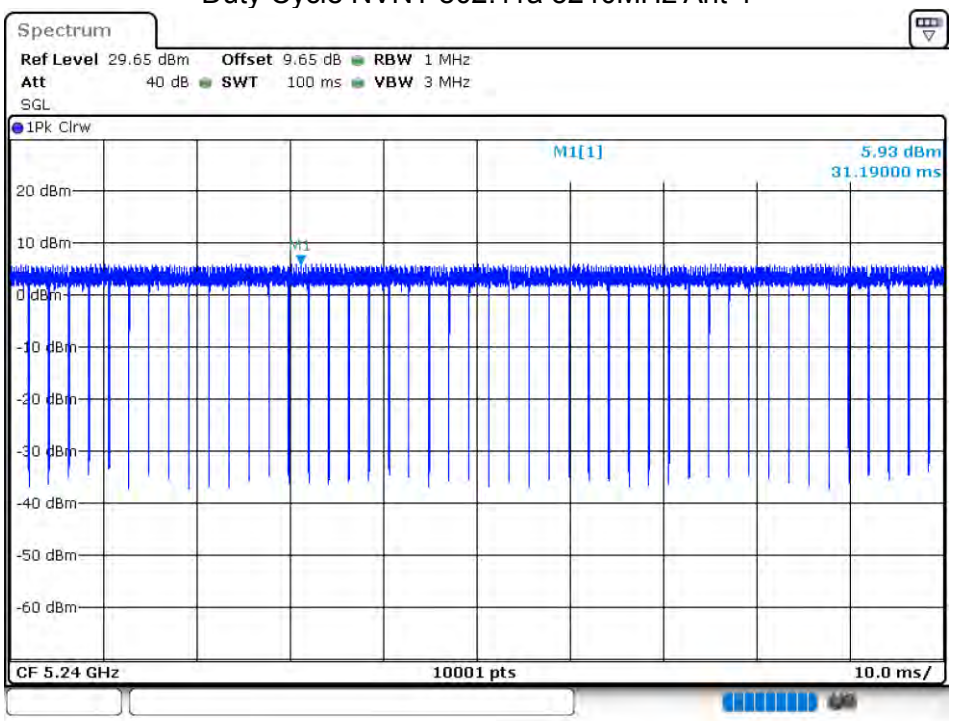

Duty Cycle NVNT 802.11a 5180MHz Ant 4



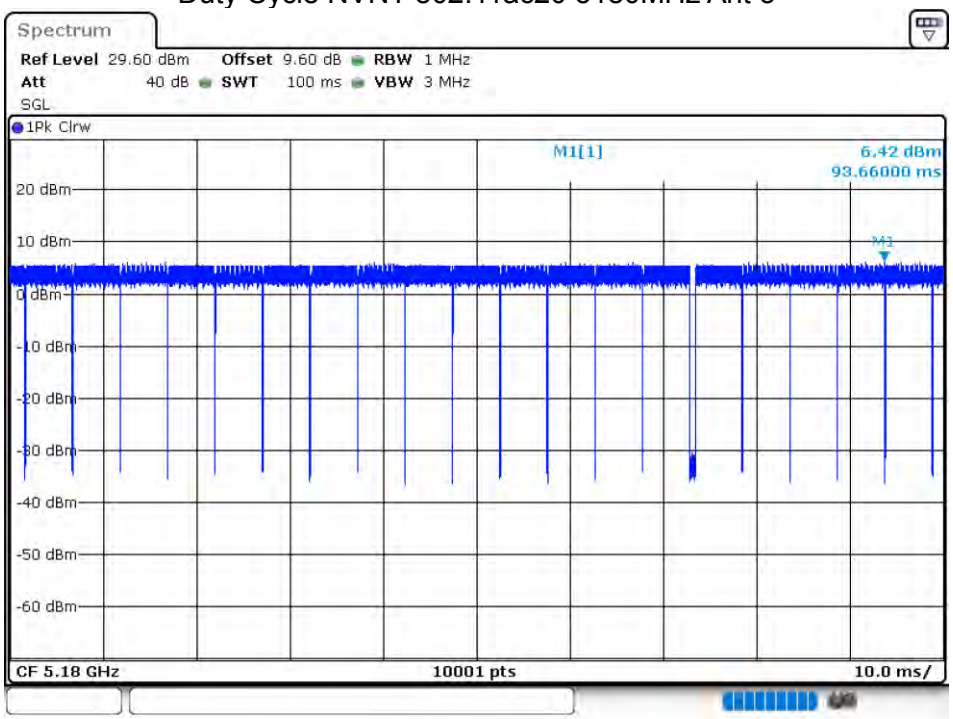
Duty Cycle NVNT 802.11a 5200MHz Ant 4



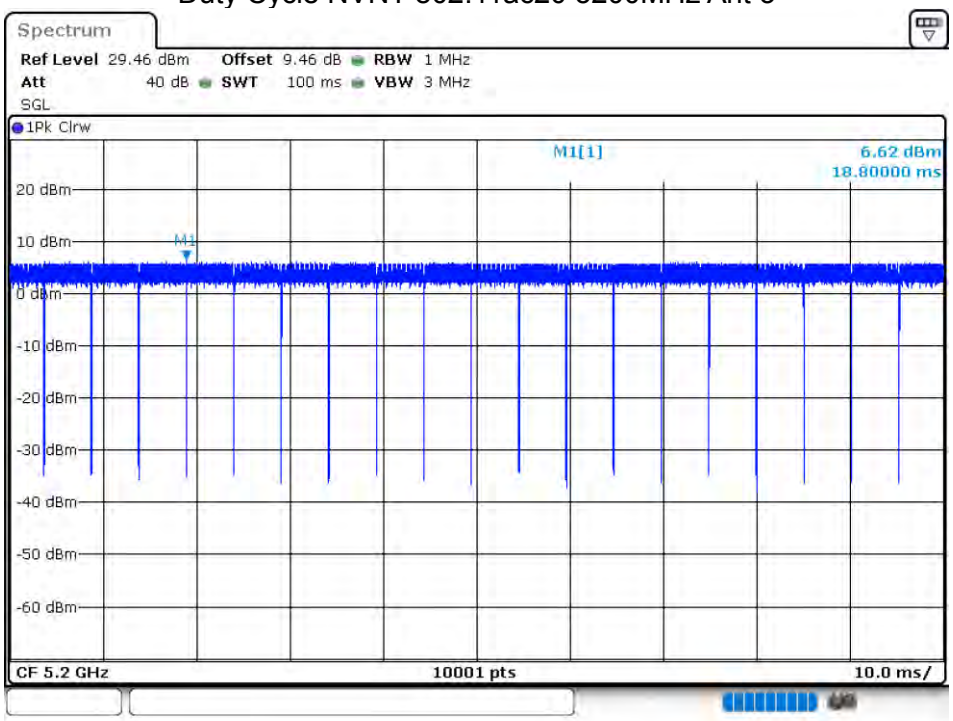

Duty Cycle NVNT 802.11a 5240MHz Ant 4



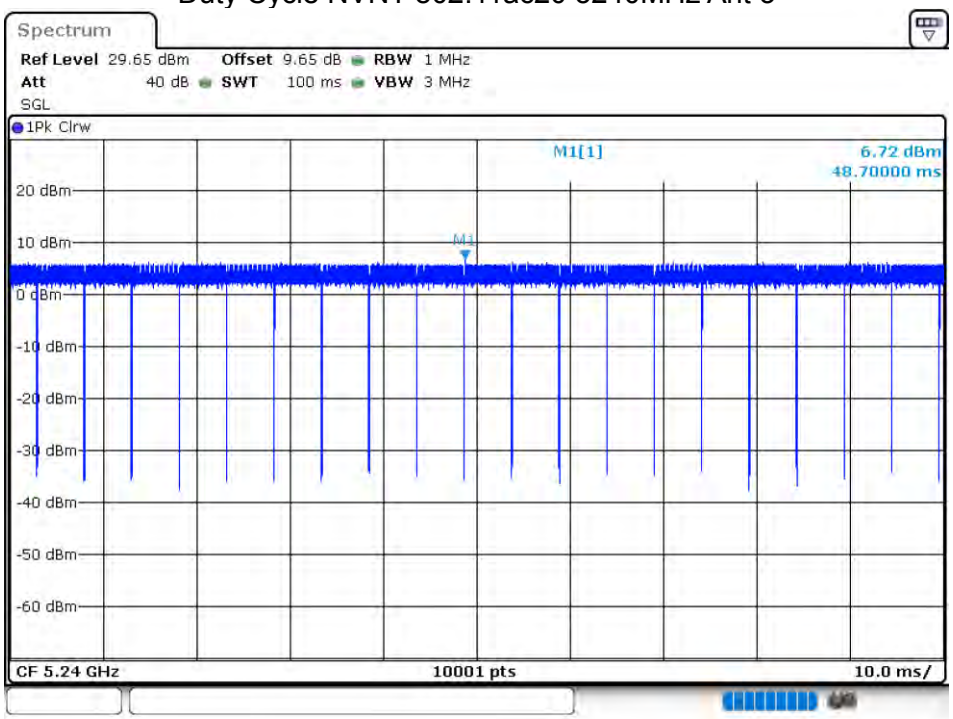
Duty Cycle NVNT 802.11ac20 5180MHz Ant 3



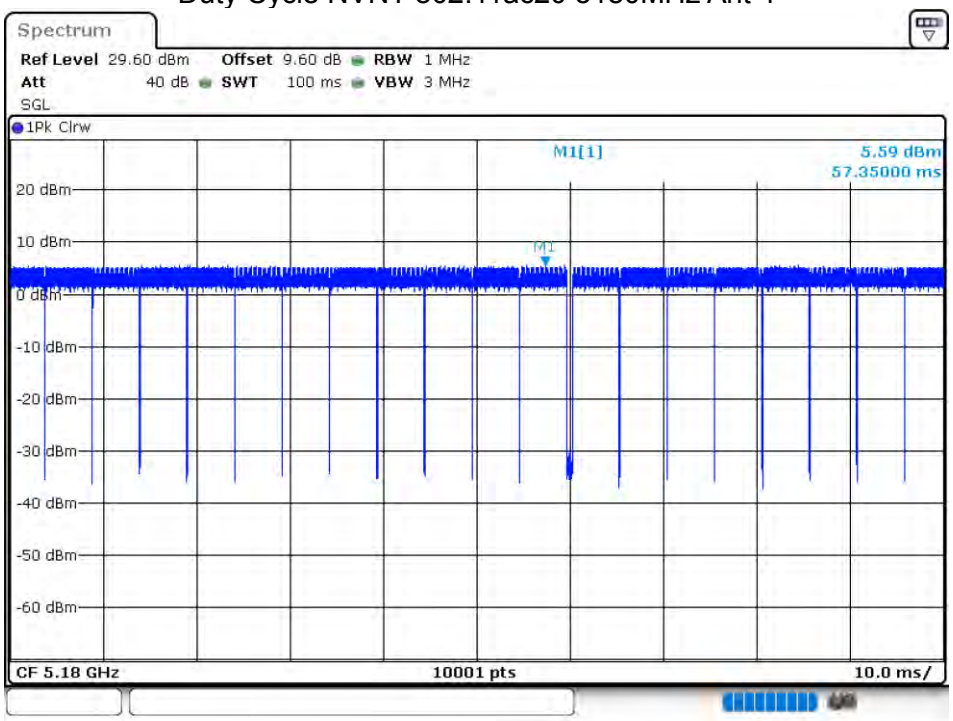

Duty Cycle NVNT 802.11ac20 5200MHz Ant 3



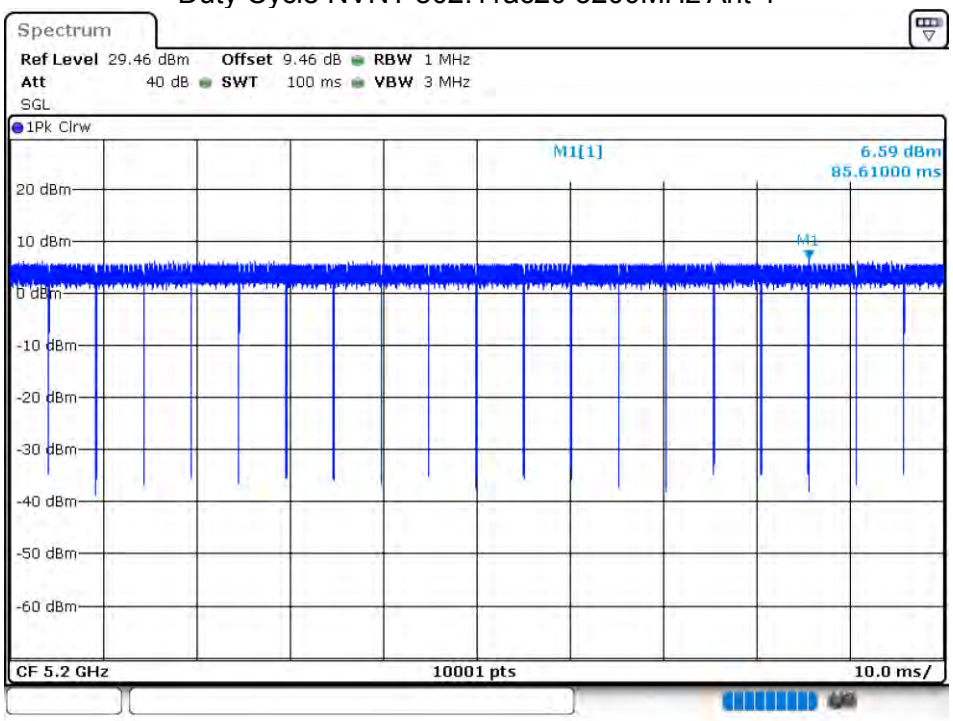
Duty Cycle NVNT 802.11ac20 5240MHz Ant 3



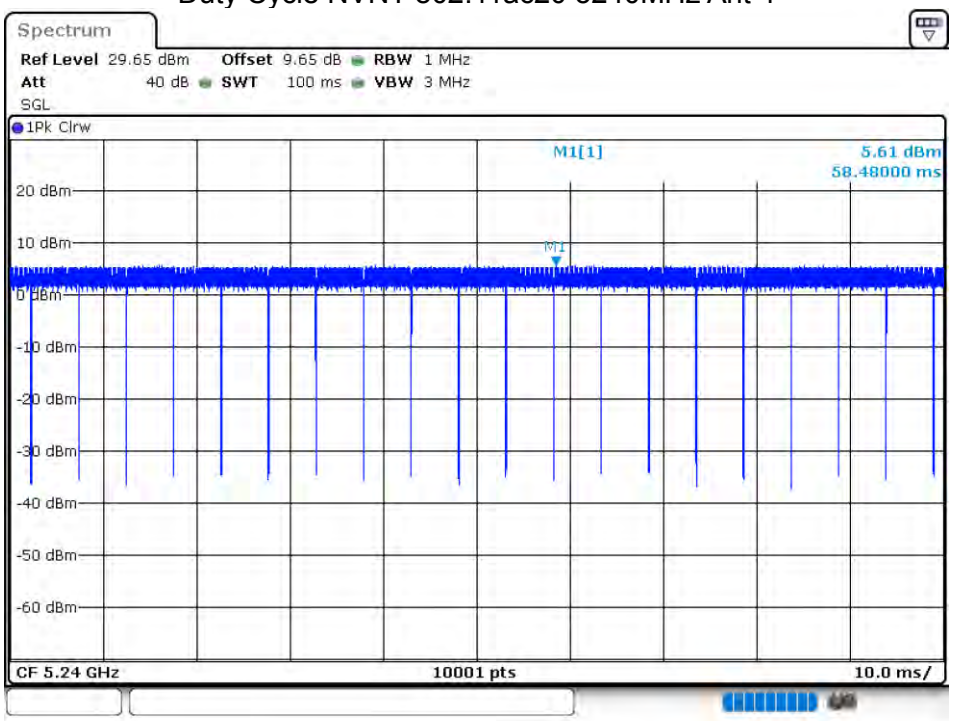

Duty Cycle NVNT 802.11ac20 5180MHz Ant 4



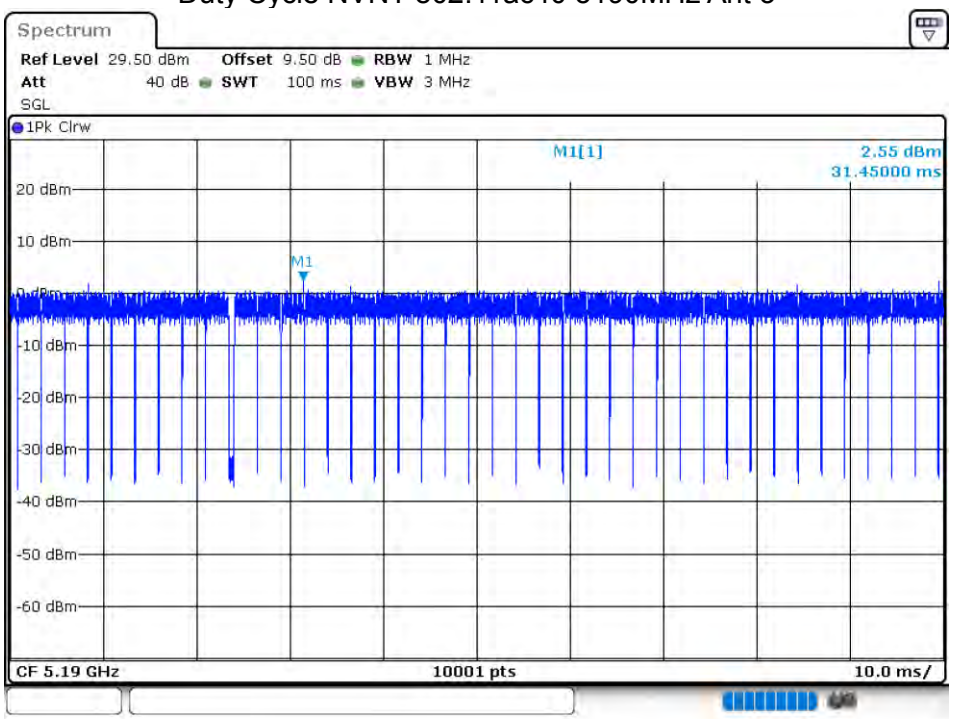
Duty Cycle NVNT 802.11ac20 5200MHz Ant 4



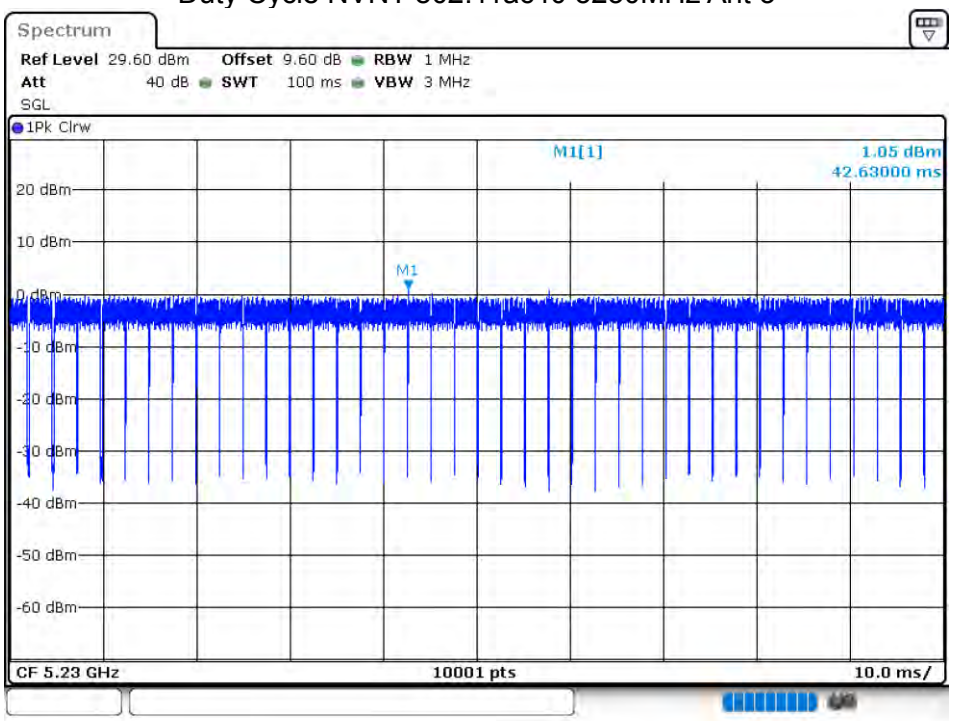

Duty Cycle NVNT 802.11ac20 5240MHz Ant 4



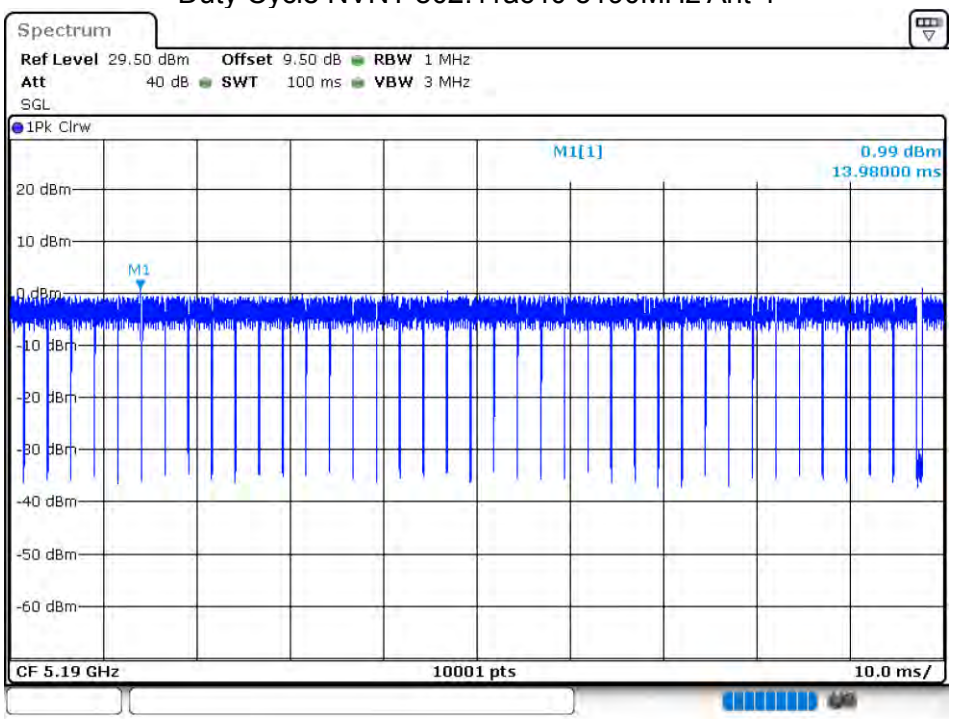
Duty Cycle NVNT 802.11ac40 5190MHz Ant 3



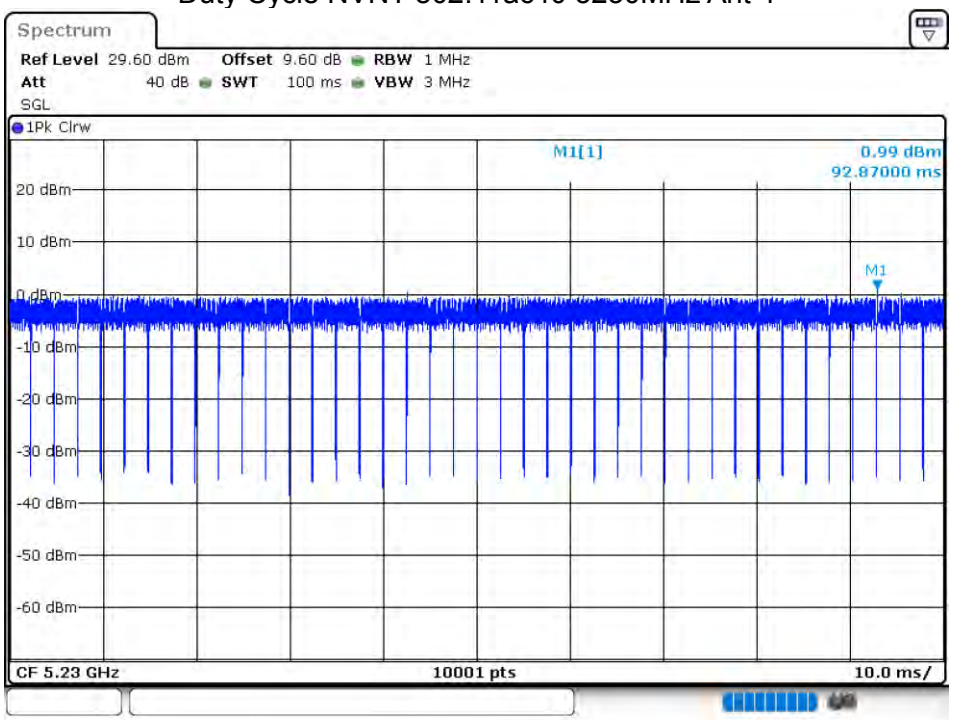

Duty Cycle NVNT 802.11ac40 5230MHz Ant 3



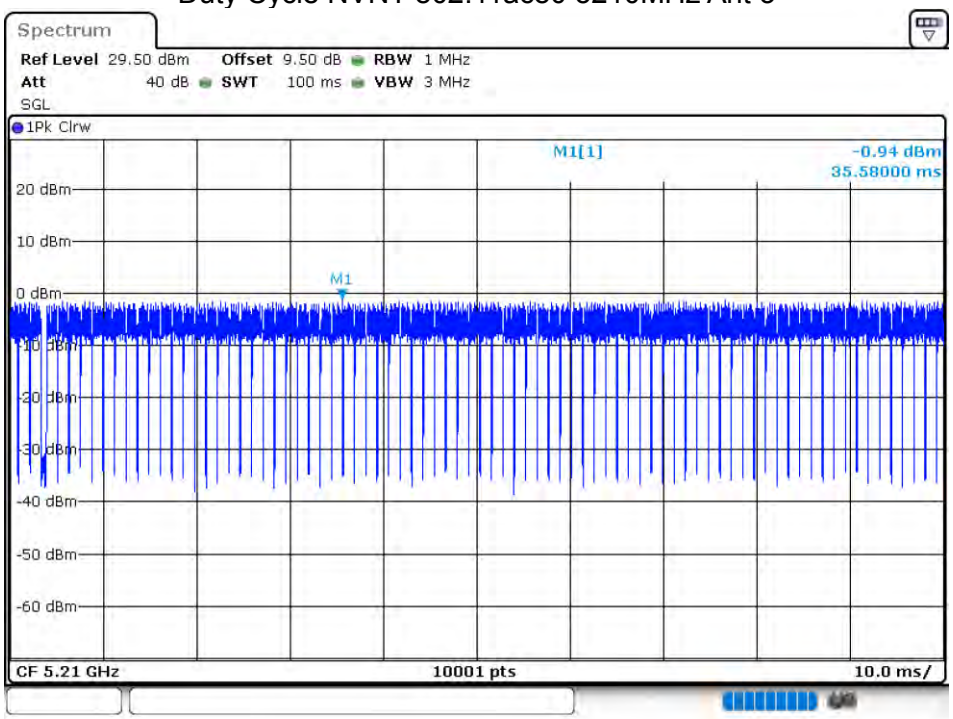
Duty Cycle NVNT 802.11ac40 5190MHz Ant 4



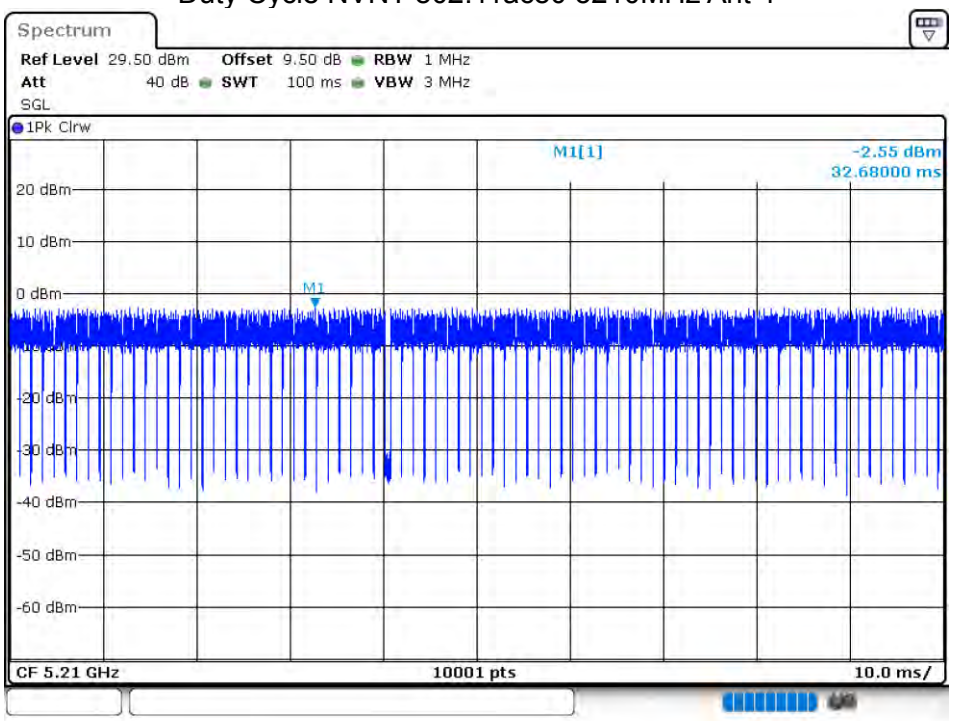

Duty Cycle NVNT 802.11ac40 5230MHz Ant 4



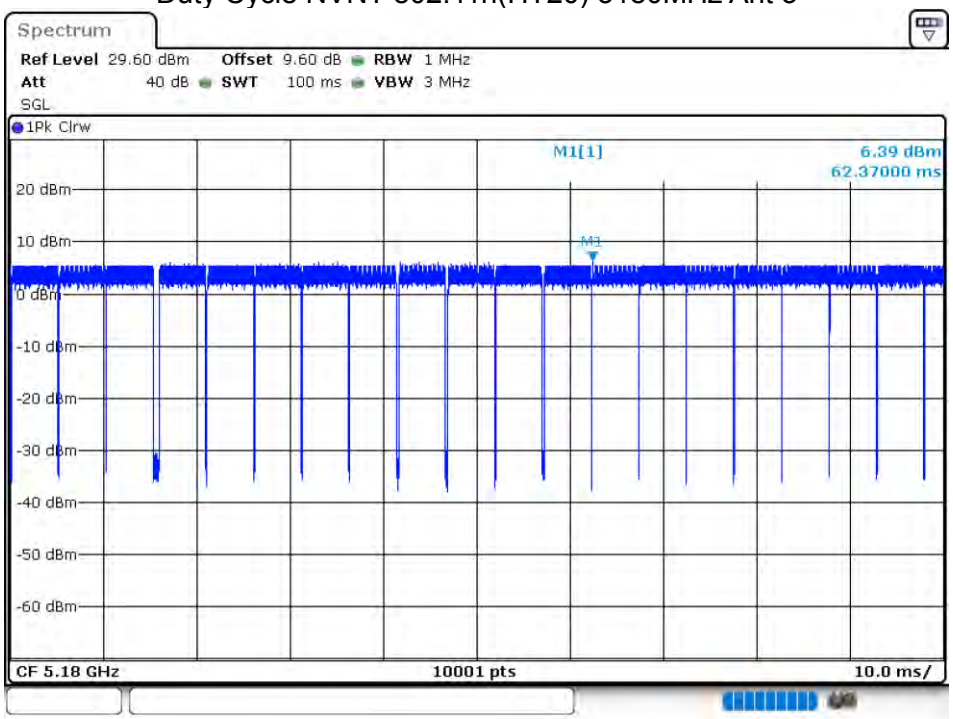
Duty Cycle NVNT 802.11ac80 5210MHz Ant 3



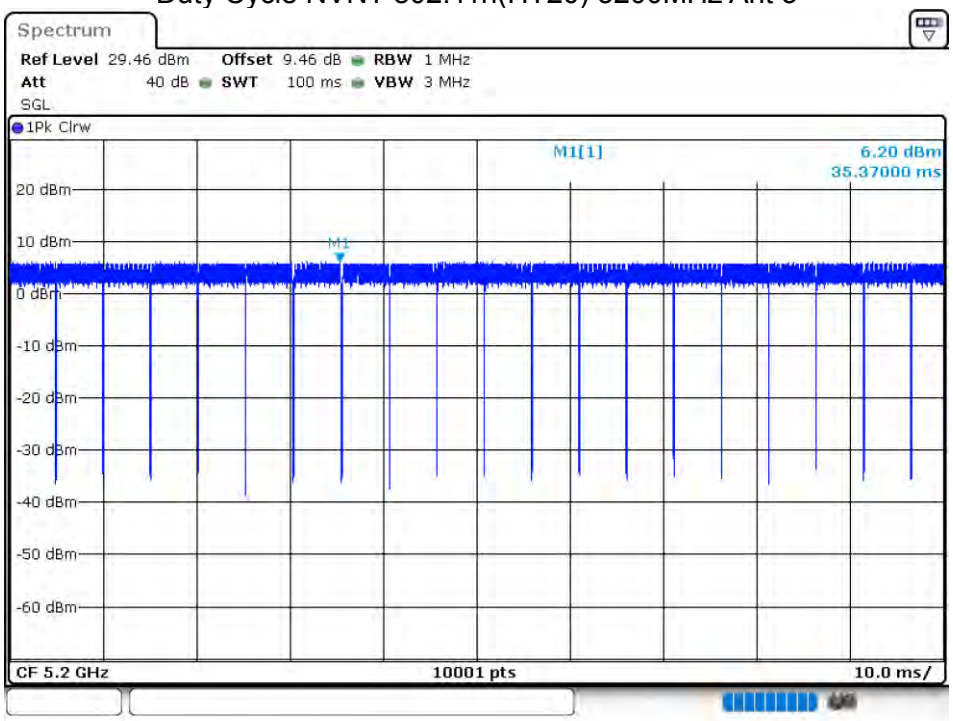

Duty Cycle NVNT 802.11ac80 5210MHz Ant 4



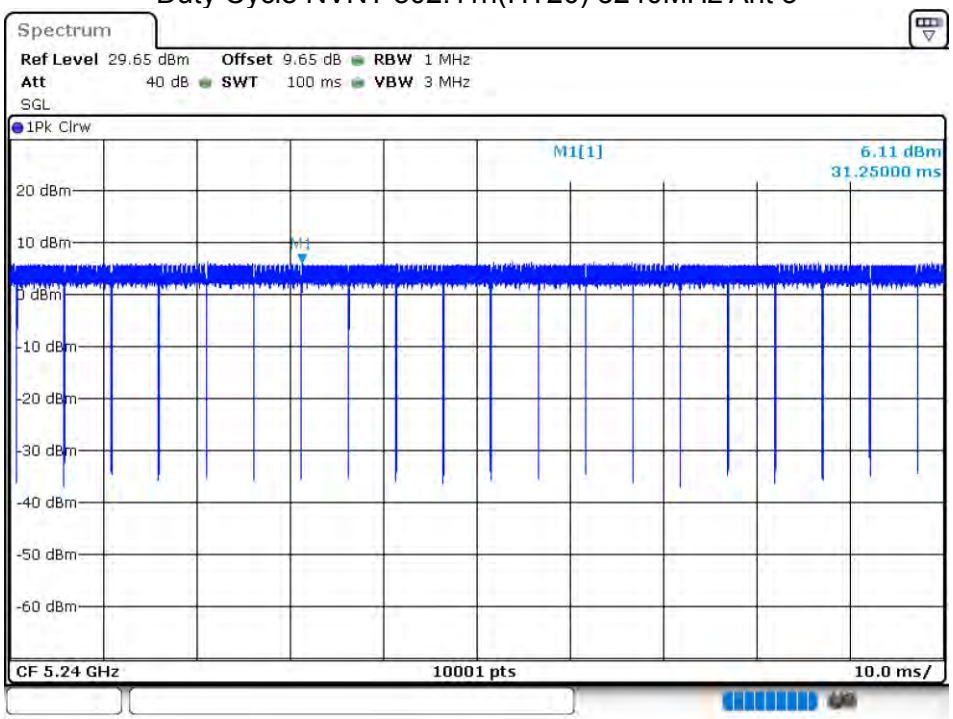
Duty Cycle NVNT 802.11n(HT20) 5180MHz Ant 3



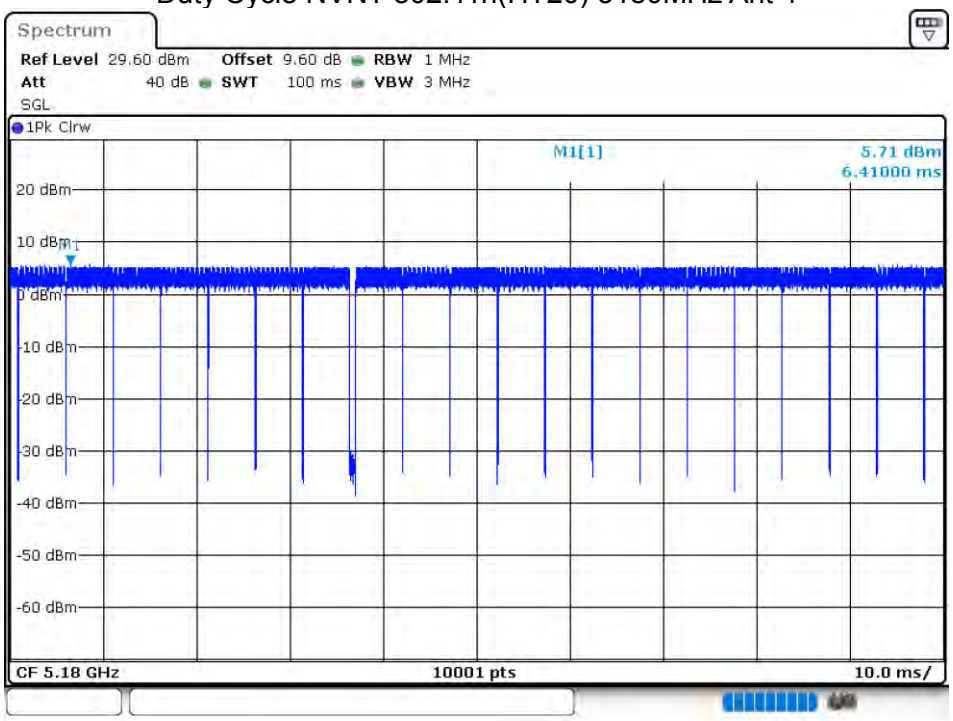

Duty Cycle NVNT 802.11n(HT20) 5200MHz Ant 3



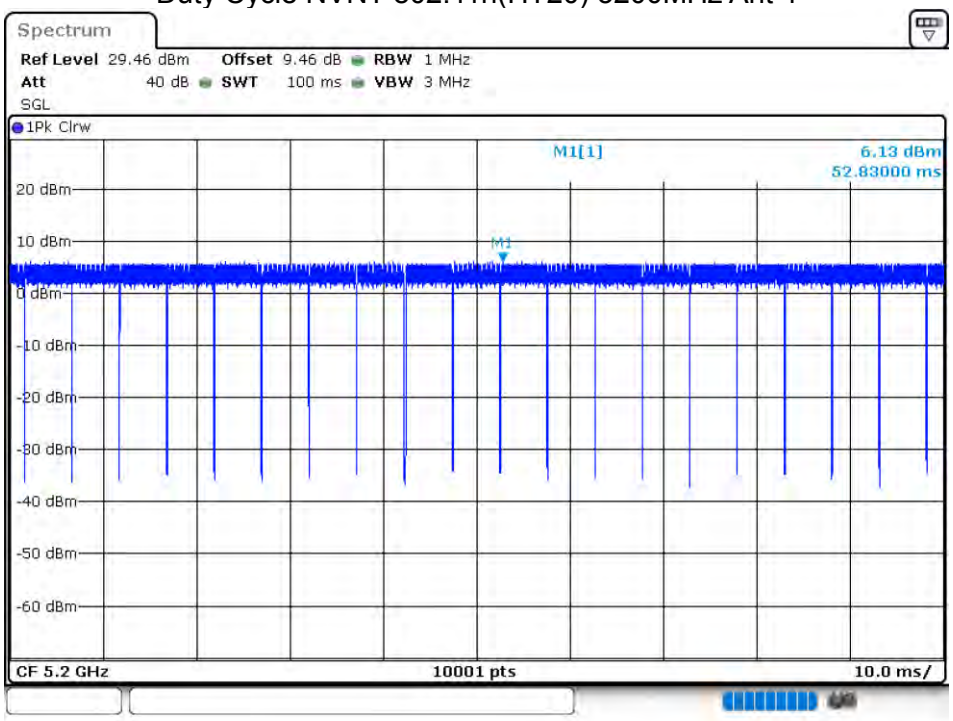
Duty Cycle NVNT 802.11n(HT20) 5240MHz Ant 3



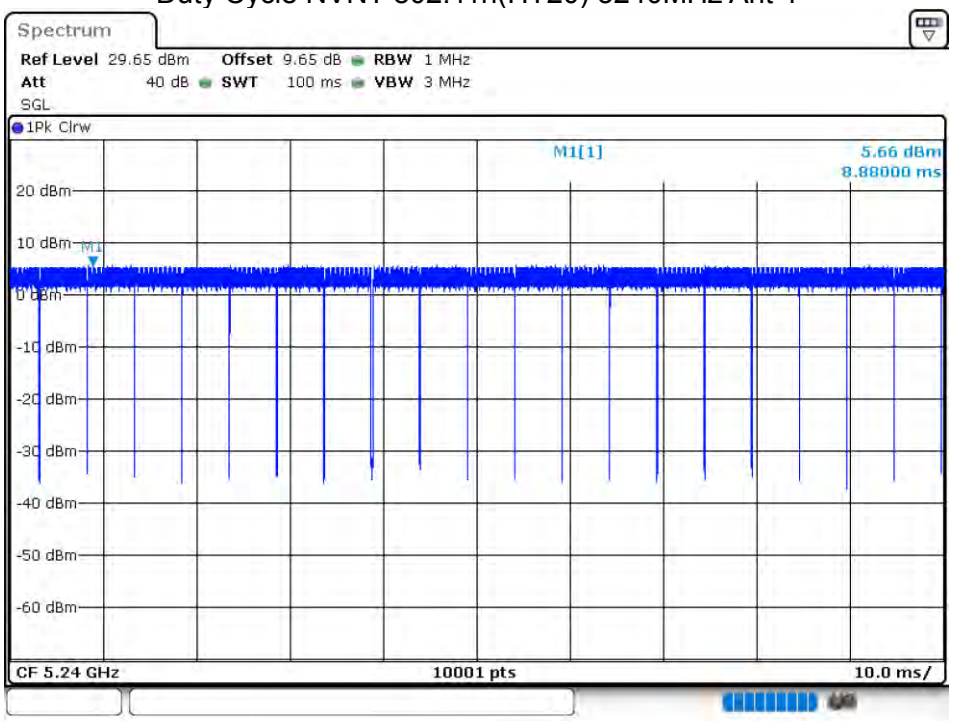

Duty Cycle NVNT 802.11n(HT20) 5180MHz Ant 4



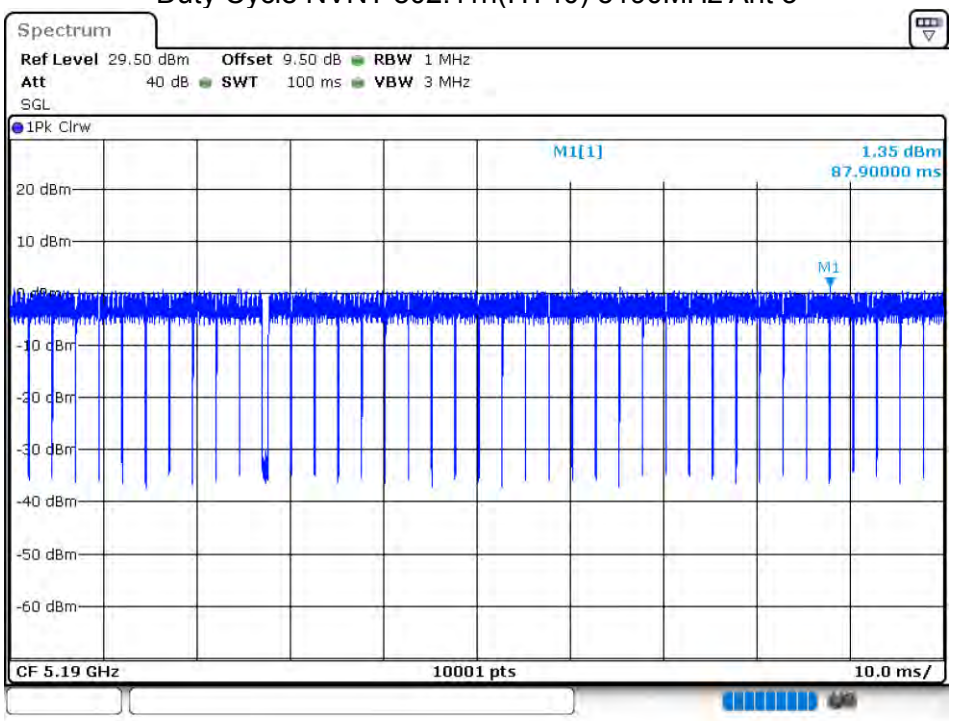
Duty Cycle NVNT 802.11n(HT20) 5200MHz Ant 4



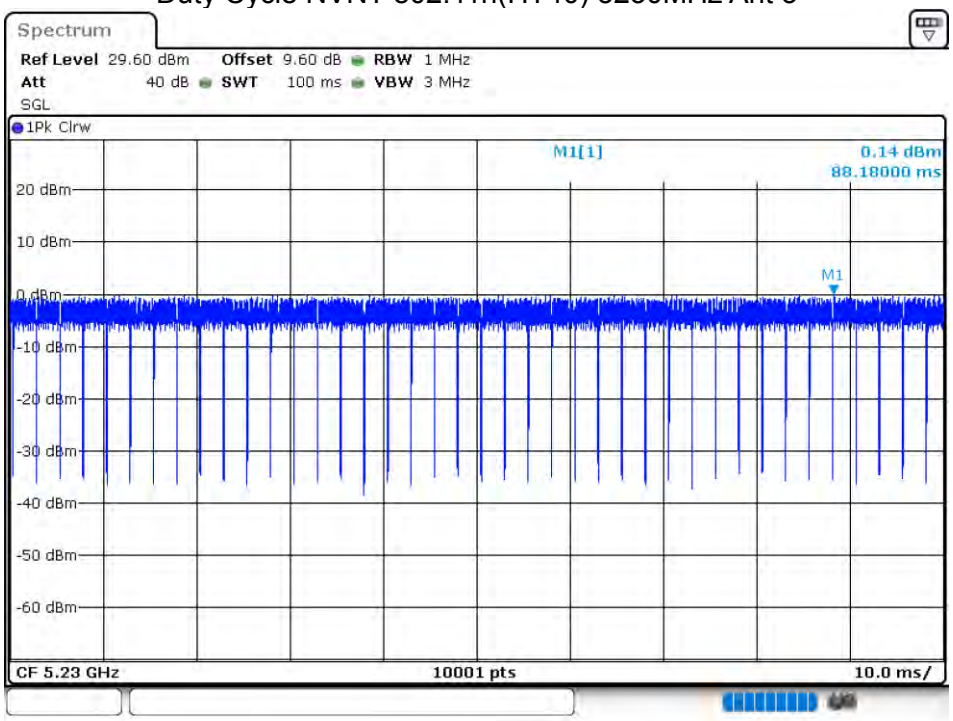

Duty Cycle NVNT 802.11n(HT20) 5240MHz Ant 4



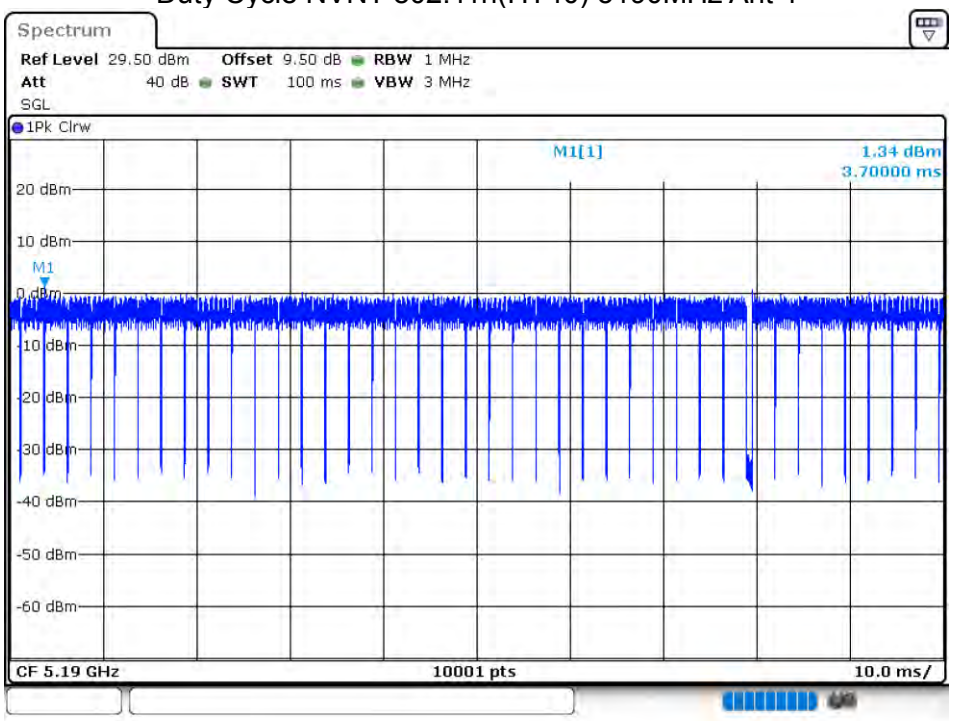
Duty Cycle NVNT 802.11n(HT40) 5190MHz Ant 3



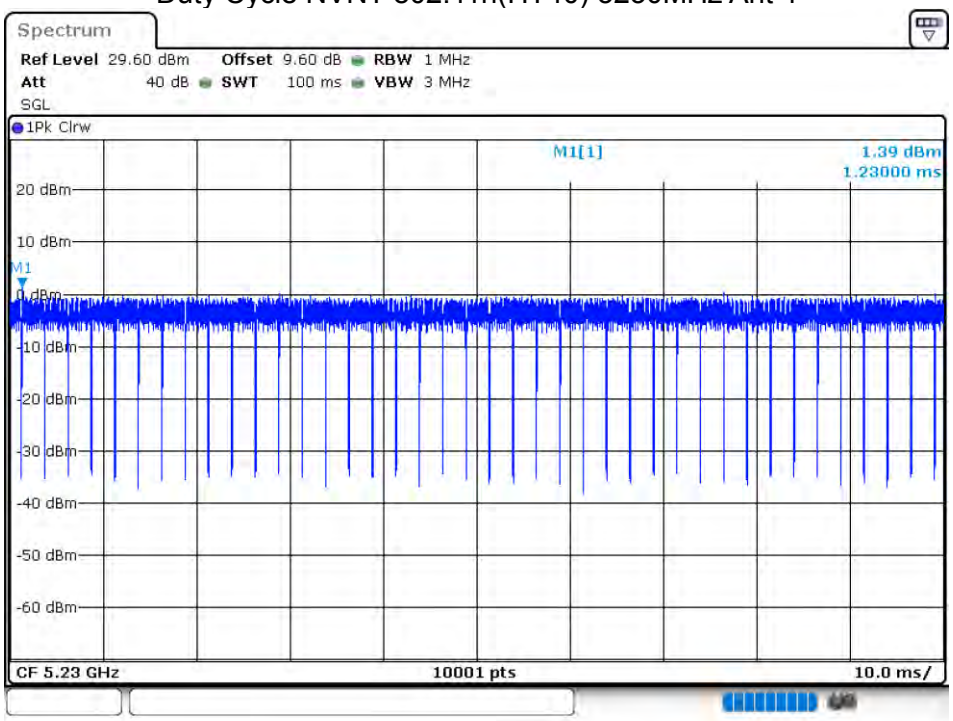

Duty Cycle NVNT 802.11n(HT40) 5230MHz Ant 3



Duty Cycle NVNT 802.11n(HT40) 5190MHz Ant 4




Duty Cycle NVNT 802.11n(HT40) 5230MHz Ant 4



5.8G:

| Antenna | Condition | Mode | Frequency (MHz) | Duty Cycle (%) | Correction Factor (dB) |
|---|---|---|---|---|---|
| Ant 3 | NVNT | 802.11a | 5745 | 100 | 0 |
| Ant 3 | NVNT | 802.11a | 5785 | 100 | 0 |
| Ant 3 | NVNT | 802.11a | 5825 | 100 | 0 |
| Ant 4 | NVNT | 802.11a | 5745 | 100 | 0 |
| Ant 4 | NVNT | 802.11a | 5785 | 100 | 0 |
| Ant 4 | NVNT | 802.11a | 5825 | 100 | 0 |
| Ant 3 | NVNT | 802.11ac20 | 5745 | 100 | 0 |
| Ant 3 | NVNT | 802.11ac20 | 5785 | 100 | 0 |
| Ant 3 | NVNT | 802.11ac20 | 5825 | 100 | 0 |
| Ant 4 | NVNT | 802.11ac20 | 5745 | 100 | 0 |
| Ant 4 | NVNT | 802.11ac20 | 5785 | 100 | 0 |
| Ant 4 | NVNT | 802.11ac20 | 5825 | 100 | 0 |
| Ant 3 | NVNT | 802.11ac40 | 5755 | 100 | 0 |
| Ant 3 | NVNT | 802.11ac40 | 5795 | 100 | 0 |
| Ant 4 | NVNT | 802.11ac40 | 5755 | 100 | 0 |
| Ant 4 | NVNT | 802.11ac40 | 5795 | 100 | 0 |
| Ant 3 | NVNT | 802.11ac80 | 5775 | 100 | 0 |
| Ant 4 | NVNT | 802.11ac80 | 5775 | 100 | 0 |
| Ant 3 | NVNT | 802.11n(HT20) | 5745 | 100 | 0 |
| Ant 3 | NVNT | 802.11n(HT20) | 5785 | 100 | 0 |
| Ant 3 | NVNT | 802.11n(HT20) | 5825 | 100 | 0 |
| Ant 4 | NVNT | 802.11n(HT20) | 5745 | 100 | 0 |
| Ant 4 | NVNT | 802.11n(HT20) | 5785 | 100 | 0 |
| Ant 4 | NVNT | 802.11n(HT20) | 5825 | 100 | 0 |
| Ant 3 | NVNT | 802.11n(HT40) | 5755 | 100 | 0 |
| Ant 3 | NVNT | 802.11n(HT40) | 5795 | 100 | 0 |
| Ant 4 | NVNT | 802.11n(HT40) | 5755 | 100 | 0 |
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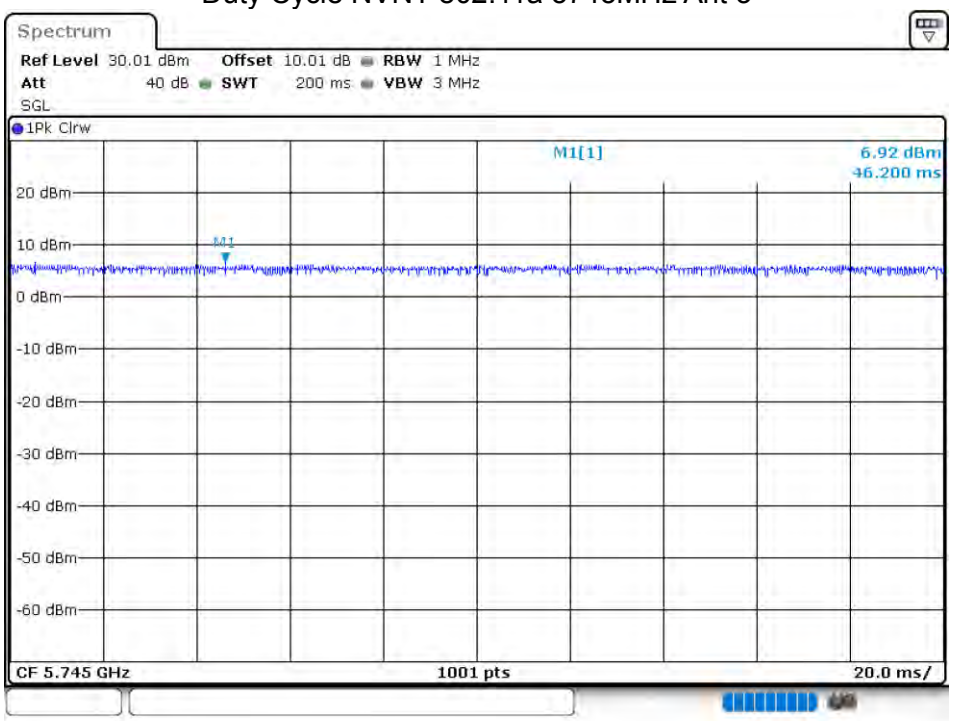
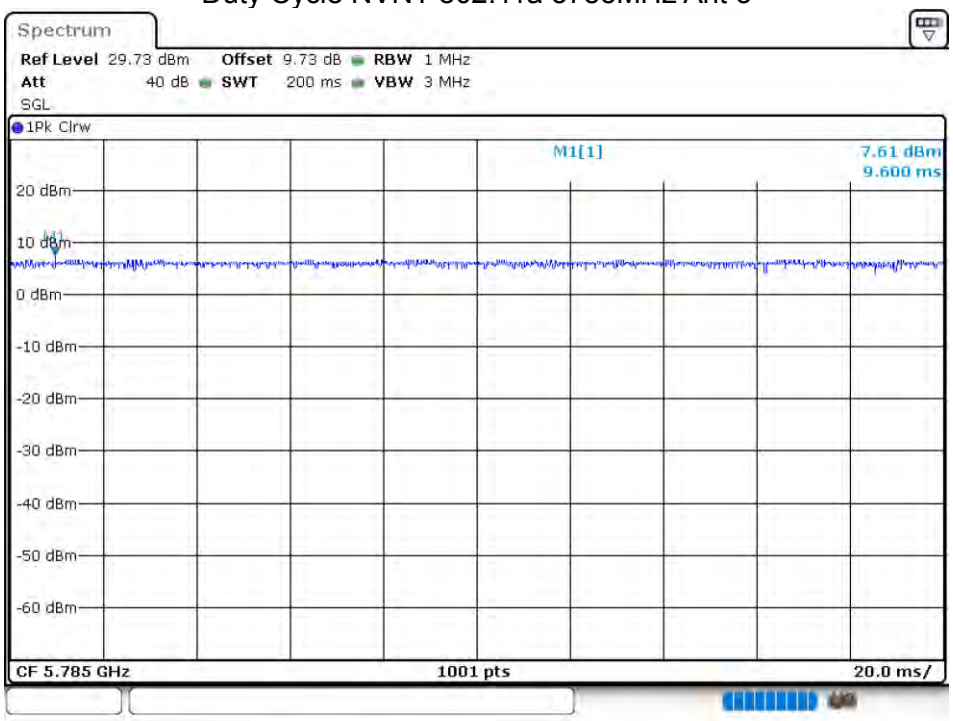
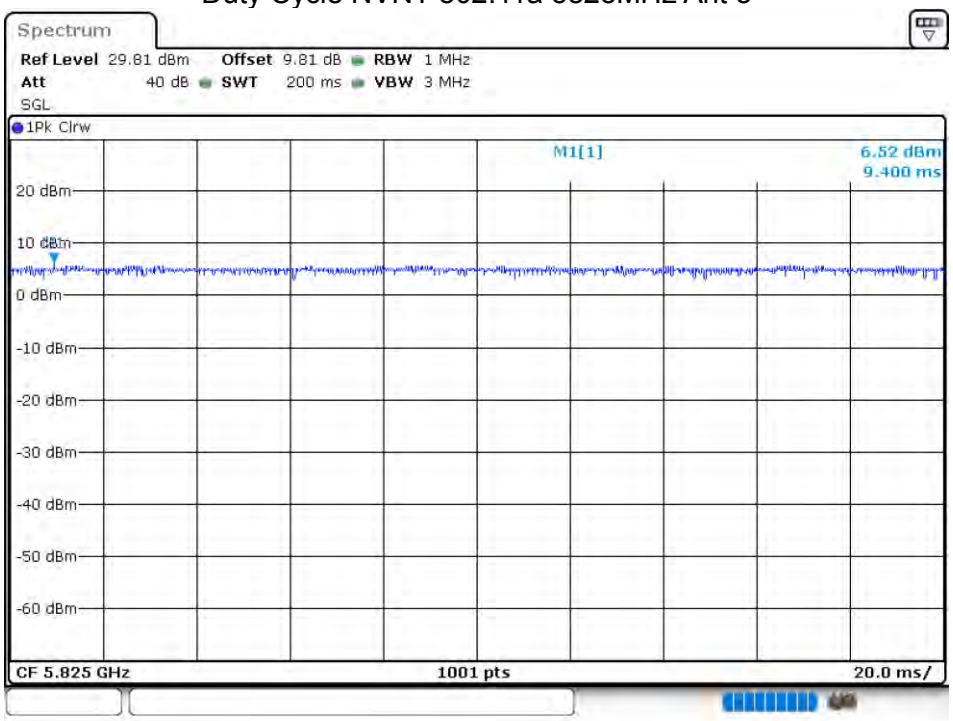
Duty Cycle NVNT 802.11a 5745MHz Ant 3



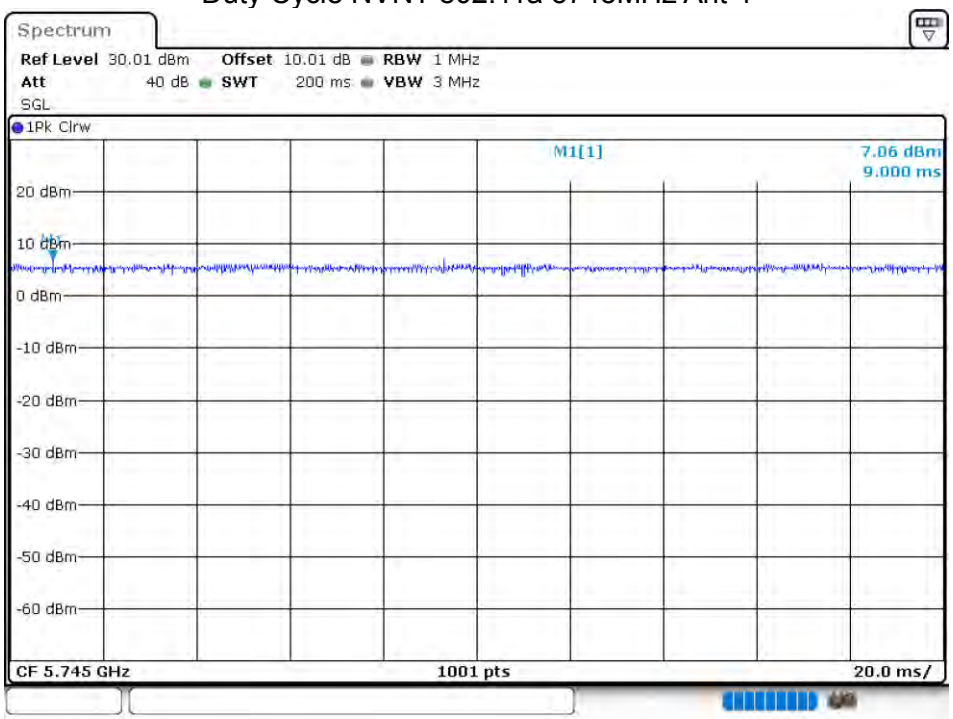
Duty Cycle NVNT 802.11a 5785MHz Ant 3



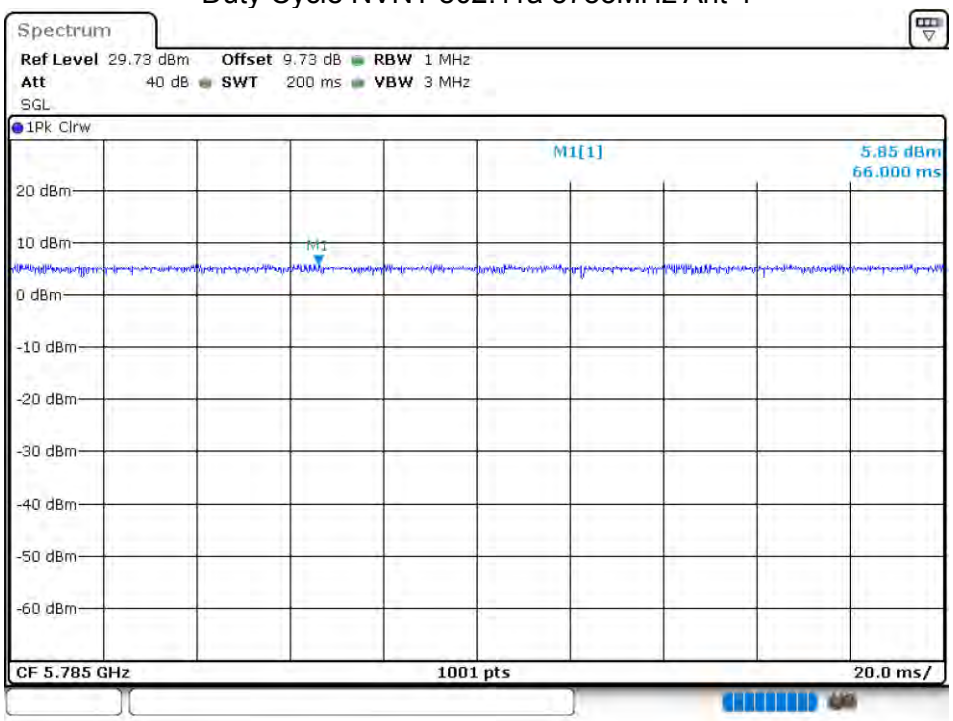

Duty Cycle NVNT 802.11a 5825MHz Ant 3



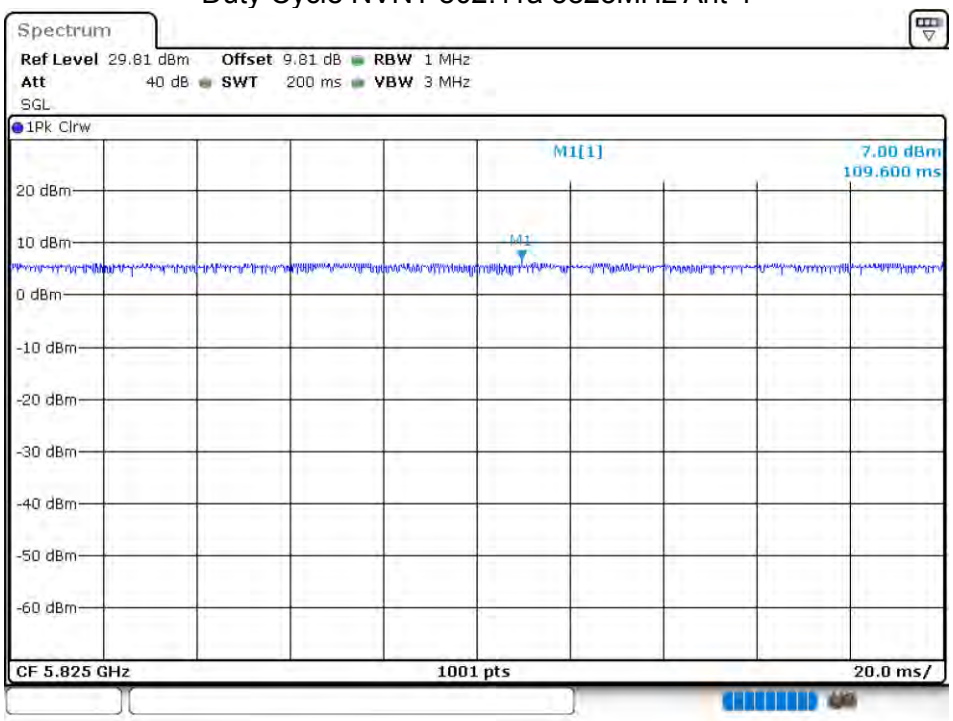
Duty Cycle NVNT 802.11a 5745MHz Ant 4



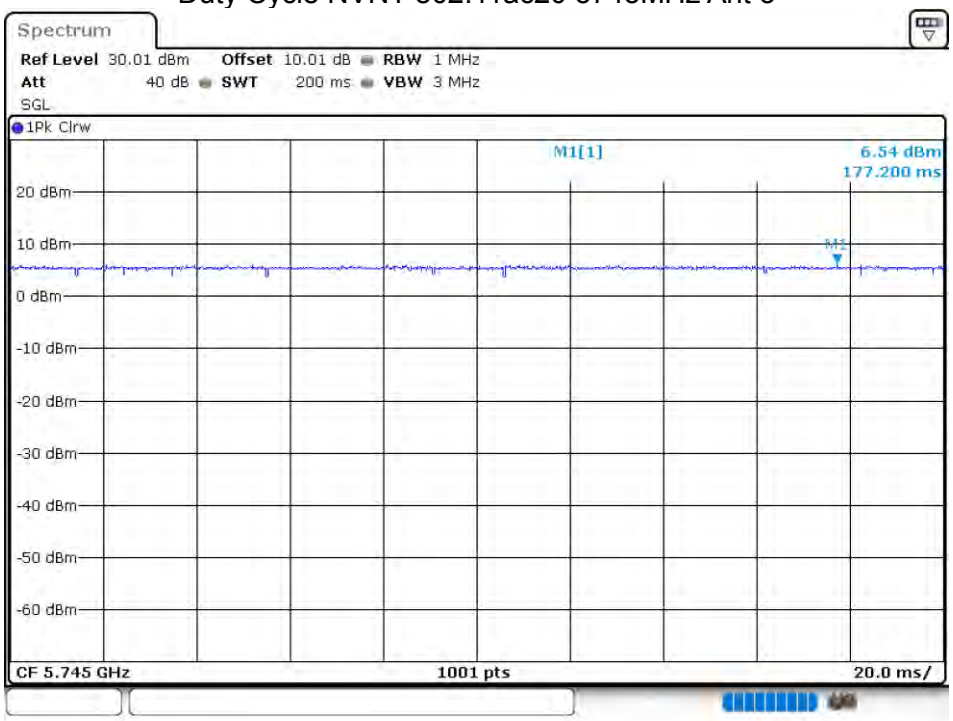

Duty Cycle NVNT 802.11a 5785MHz Ant 4



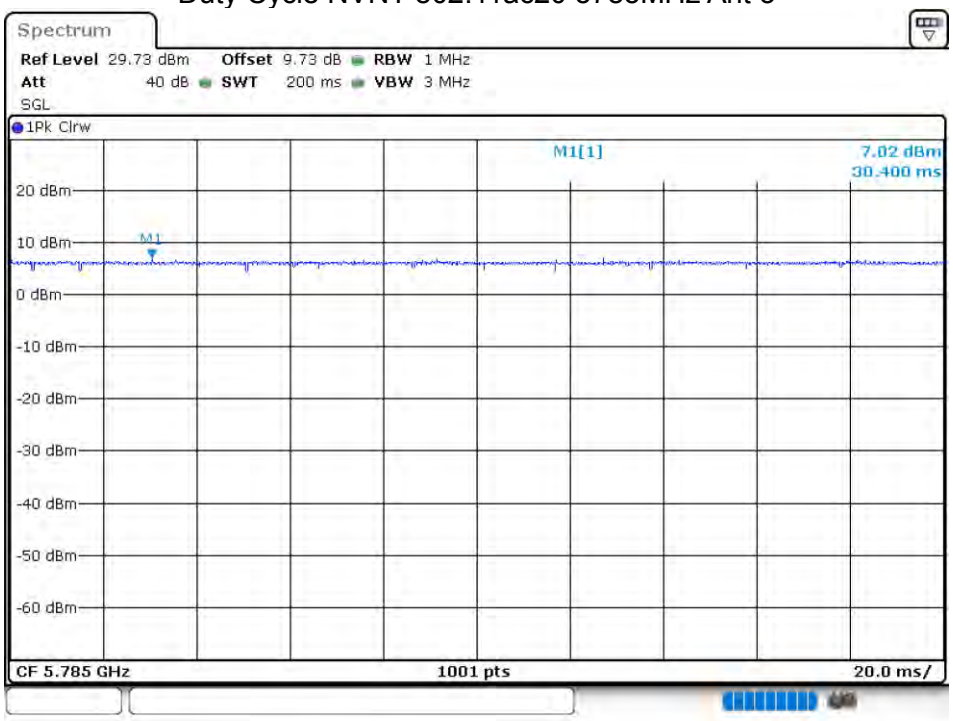
Duty Cycle NVNT 802.11a 5825MHz Ant 4



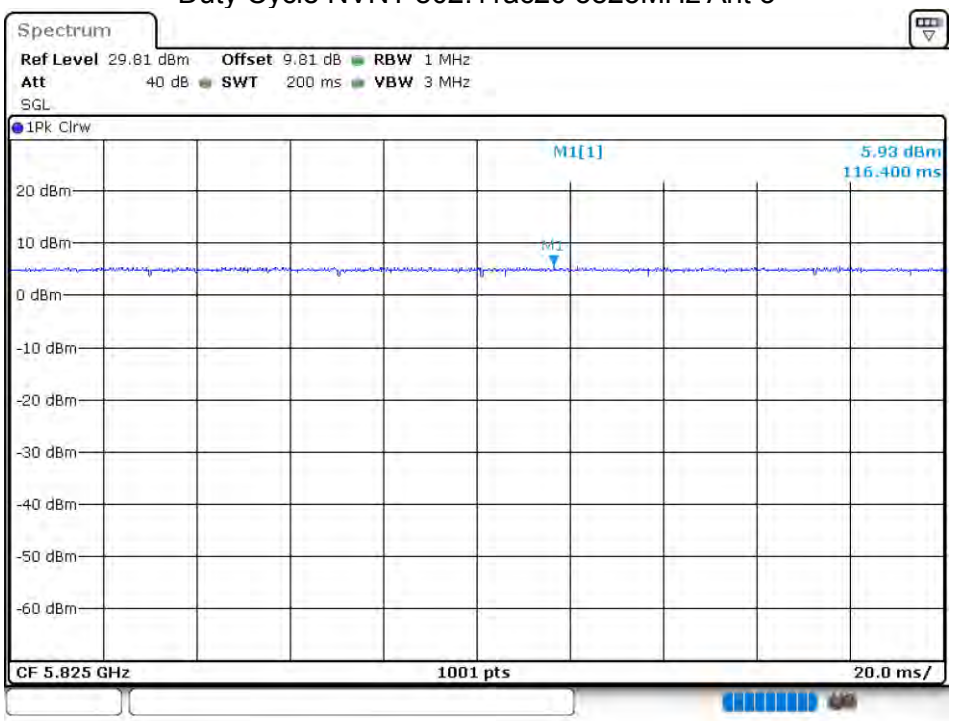

Duty Cycle NVNT 802.11ac20 5745MHz Ant 3



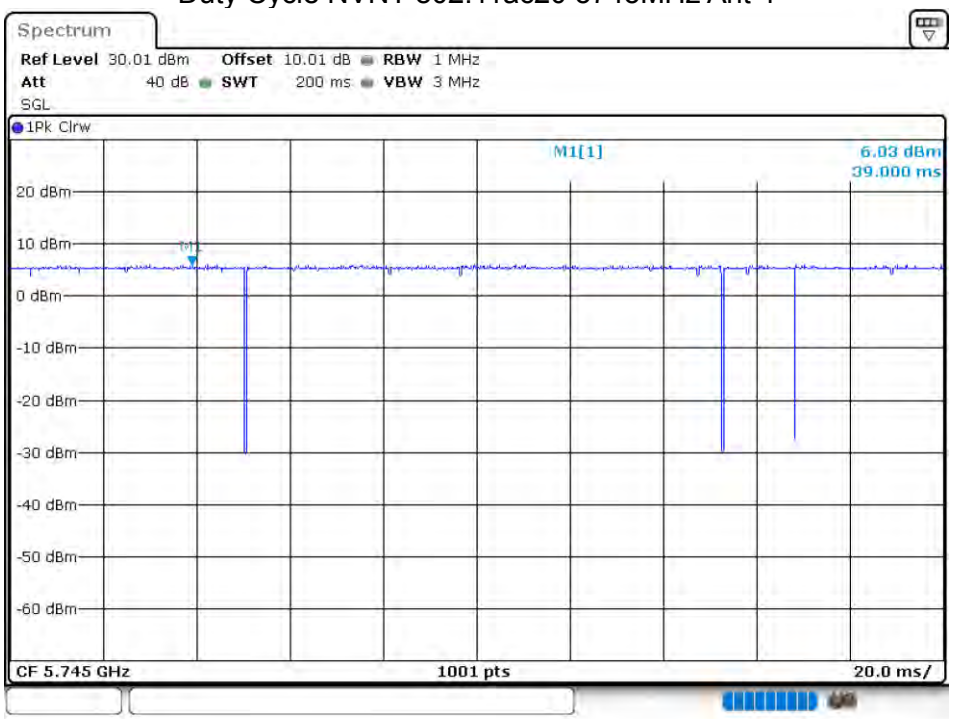
Duty Cycle NVNT 802.11ac20 5785MHz Ant 3



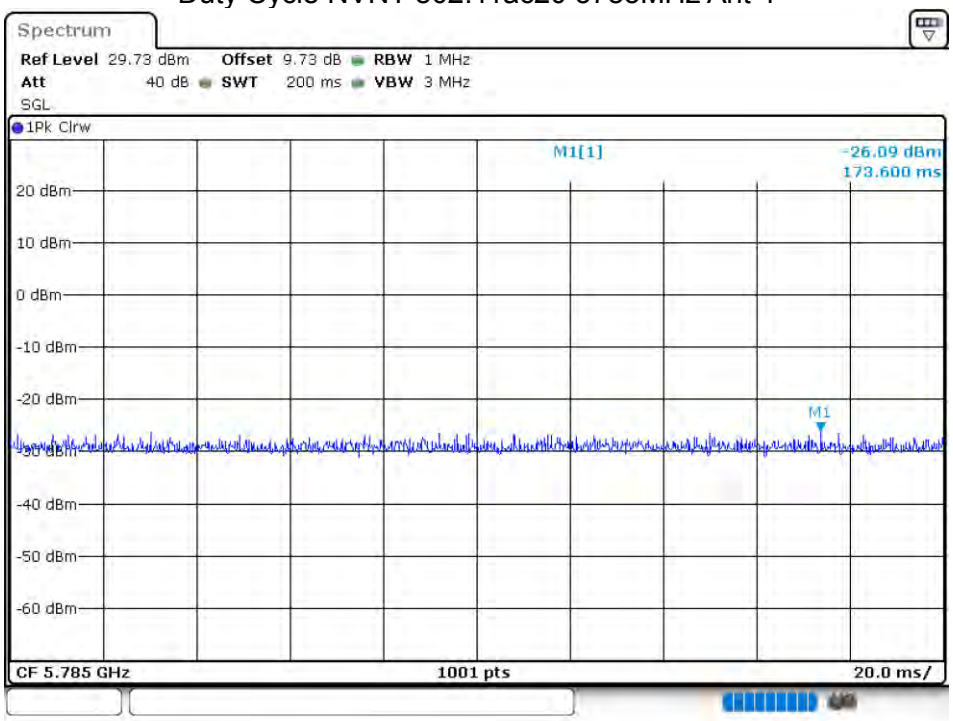

Duty Cycle NVNT 802.11ac20 5825MHz Ant 3



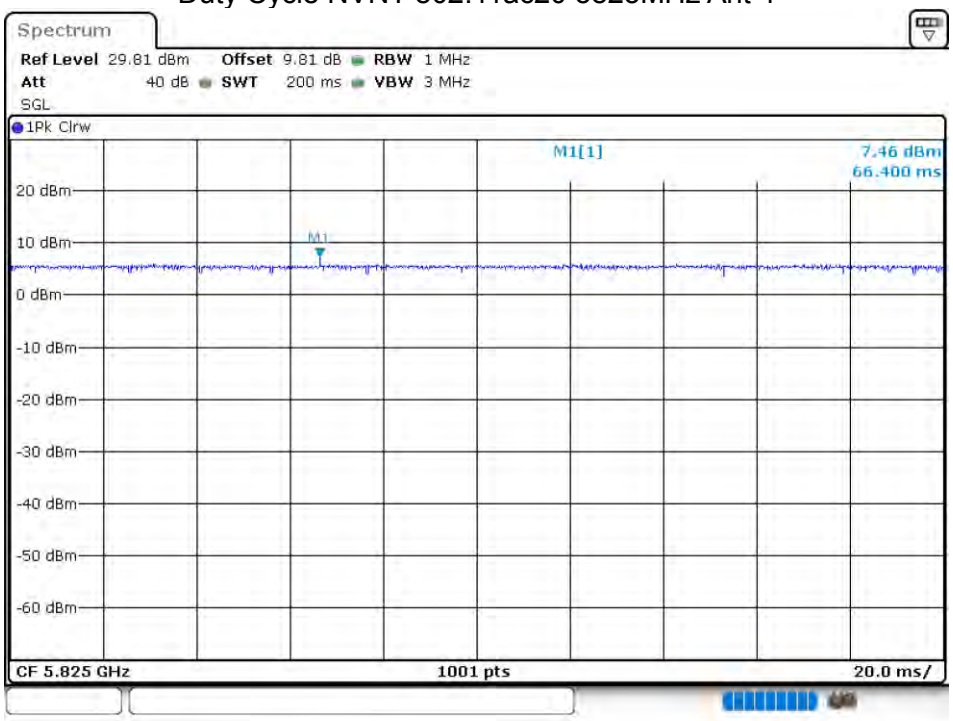
Duty Cycle NVNT 802.11ac20 5745MHz Ant 4



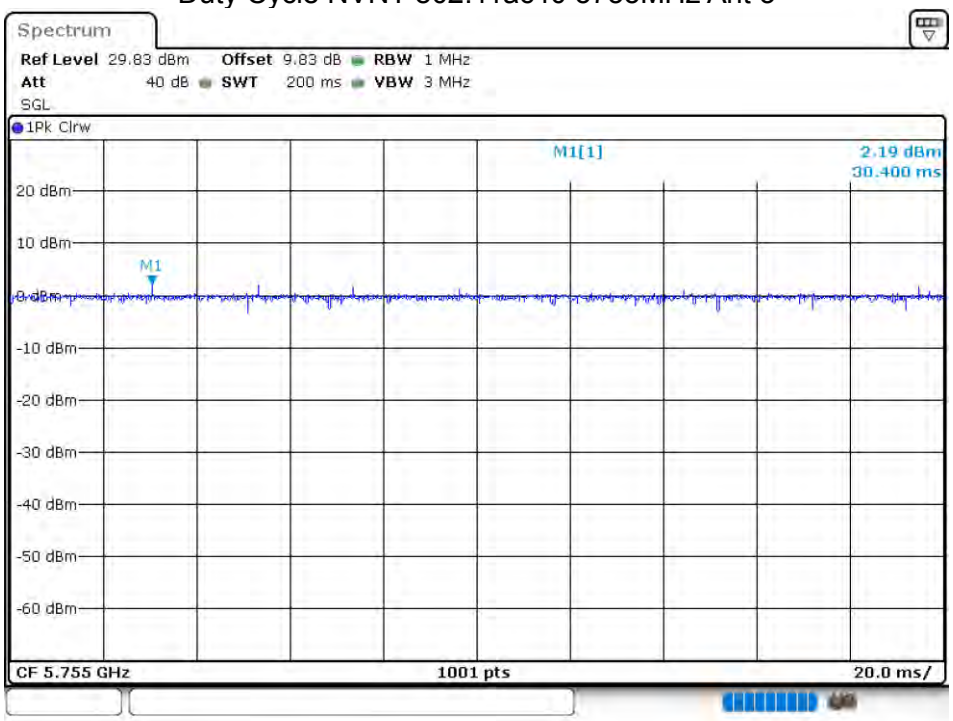

Duty Cycle NVNT 802.11ac20 5785MHz Ant 4



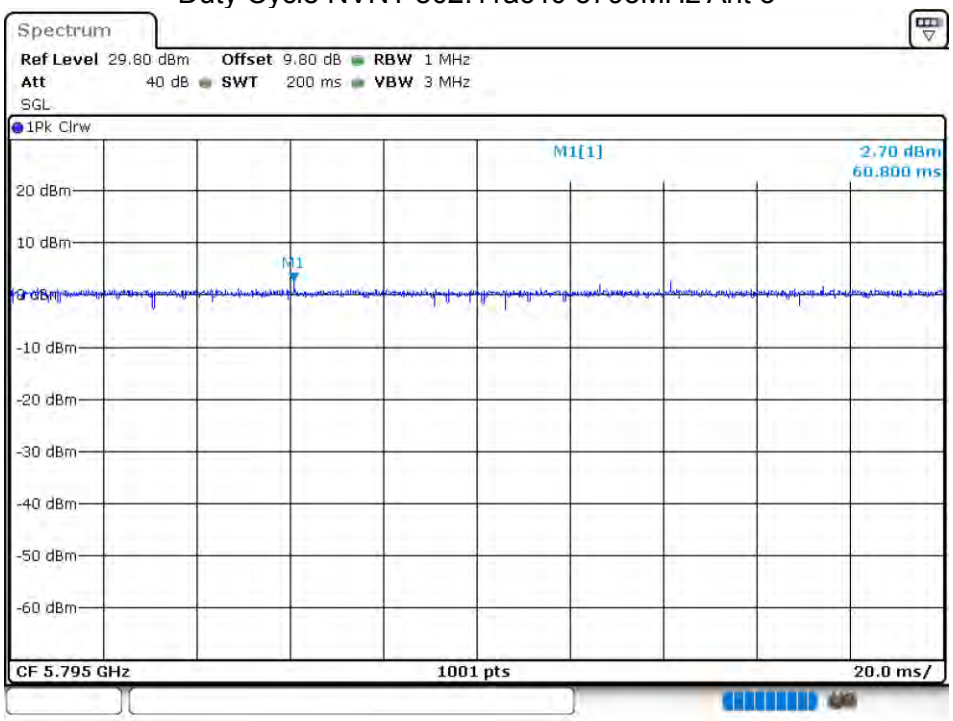
Duty Cycle NVNT 802.11ac20 5825MHz Ant 4



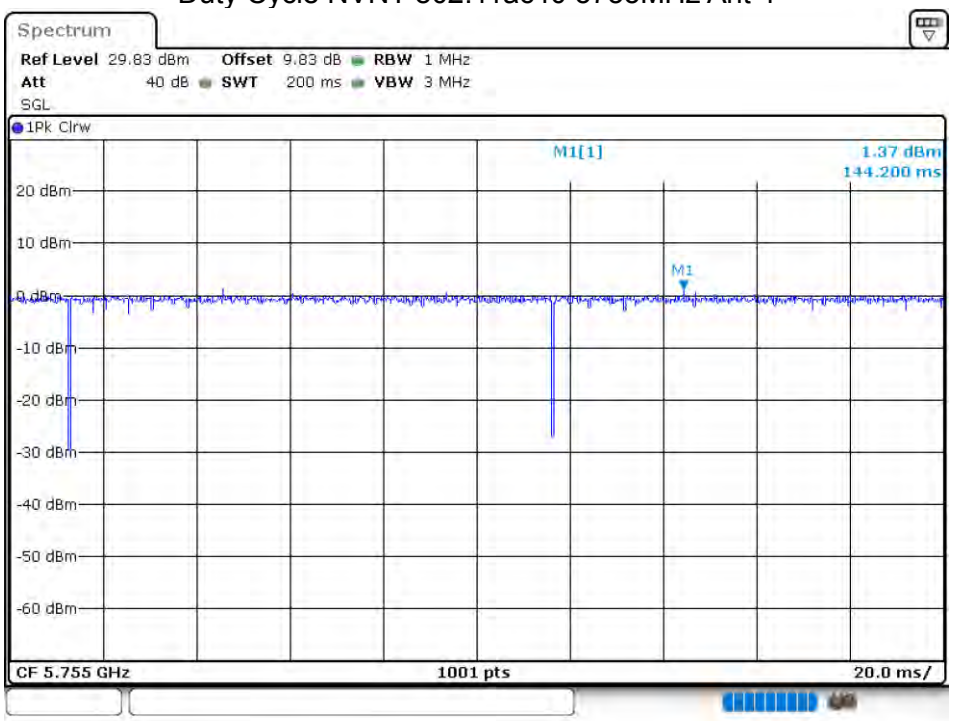

Duty Cycle NVNT 802.11ac40 5755MHz Ant 3



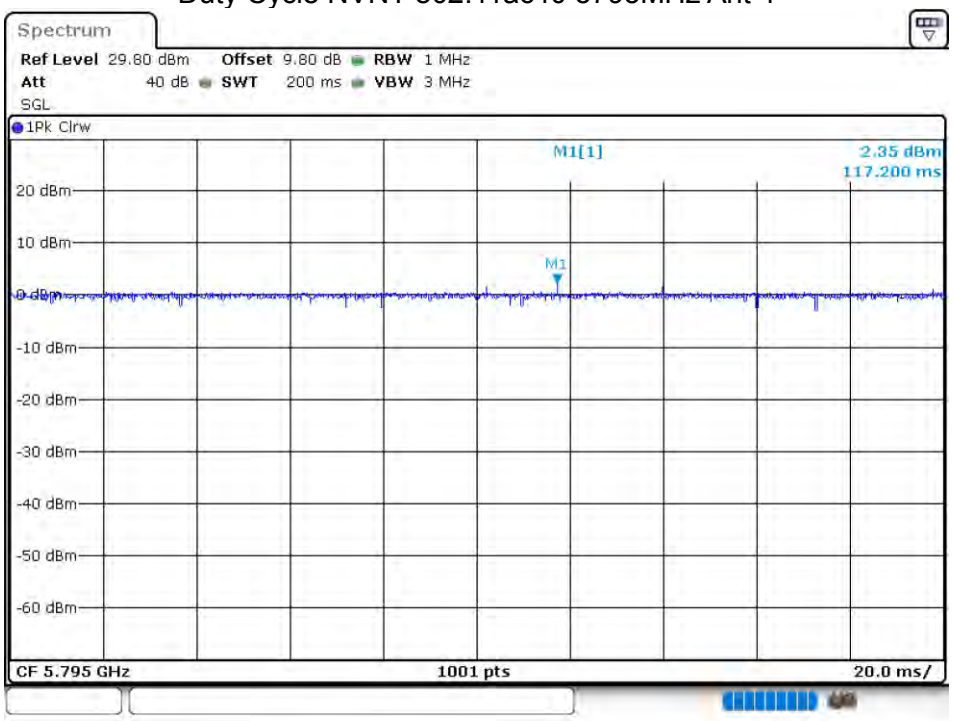
Duty Cycle NVNT 802.11ac40 5795MHz Ant 3



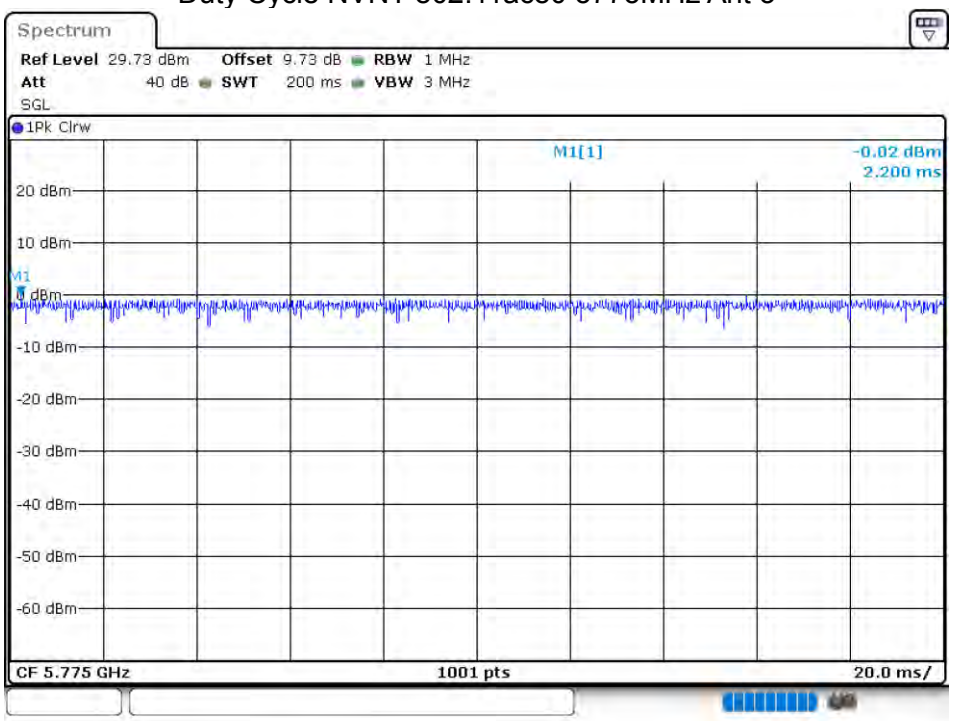

Duty Cycle NVNT 802.11ac40 5755MHz Ant 4



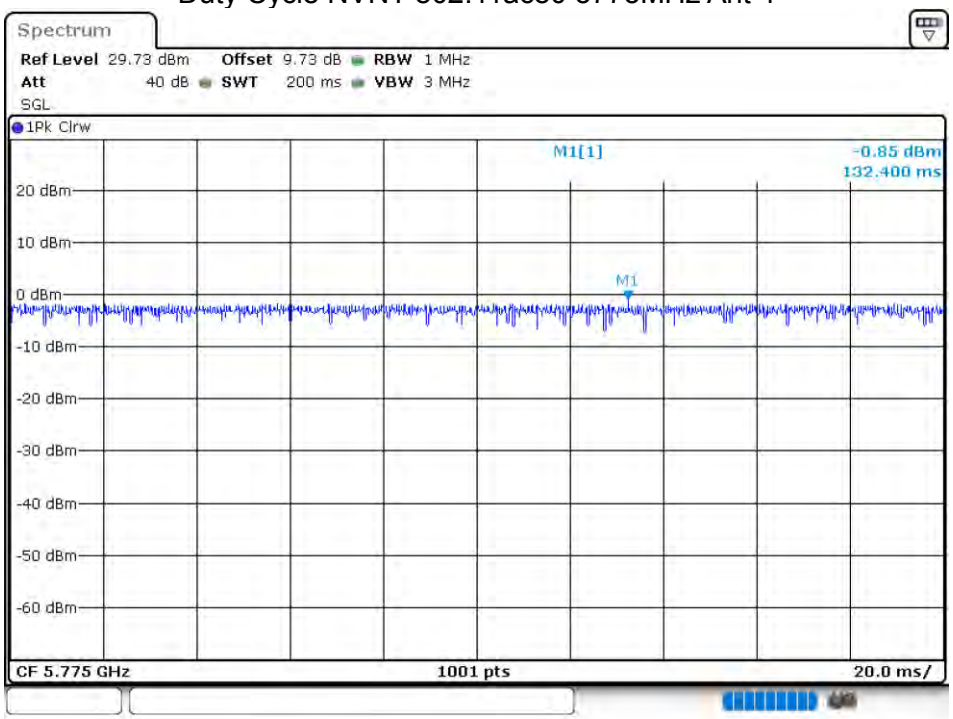
Duty Cycle NVNT 802.11ac40 5795MHz Ant 4



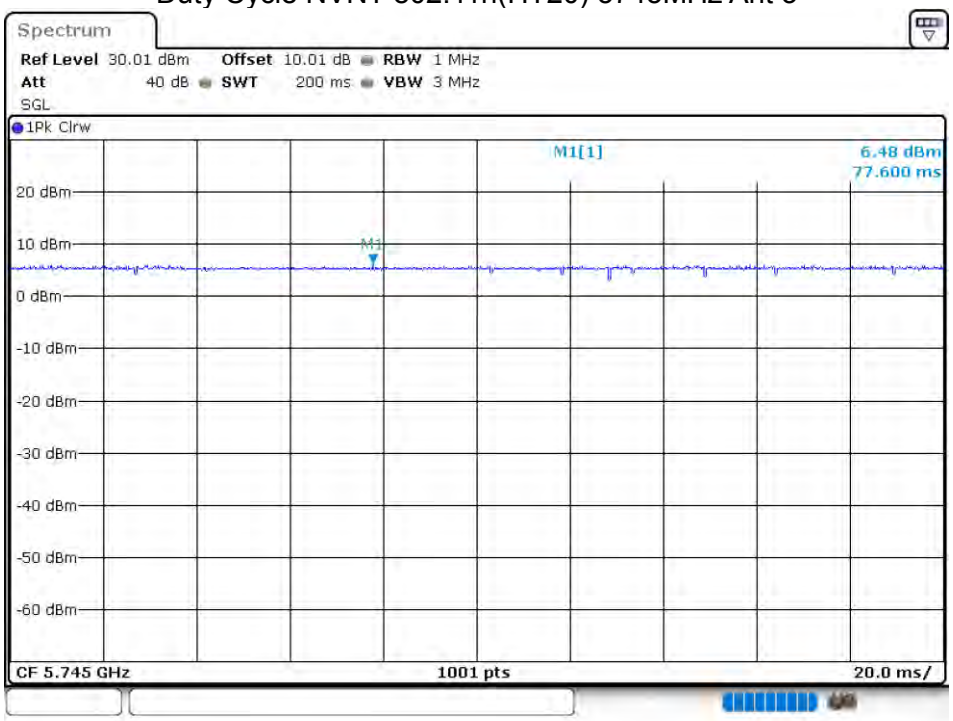

Duty Cycle NVNT 802.11ac80 5775MHz Ant 3



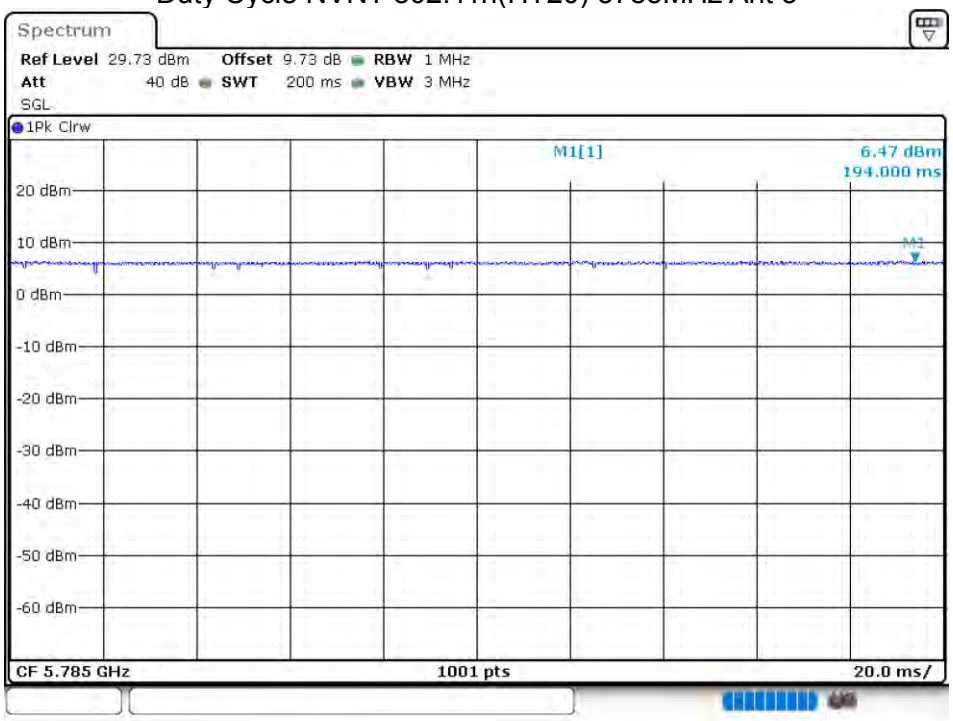
Duty Cycle NVNT 802.11ac80 5775MHz Ant 4



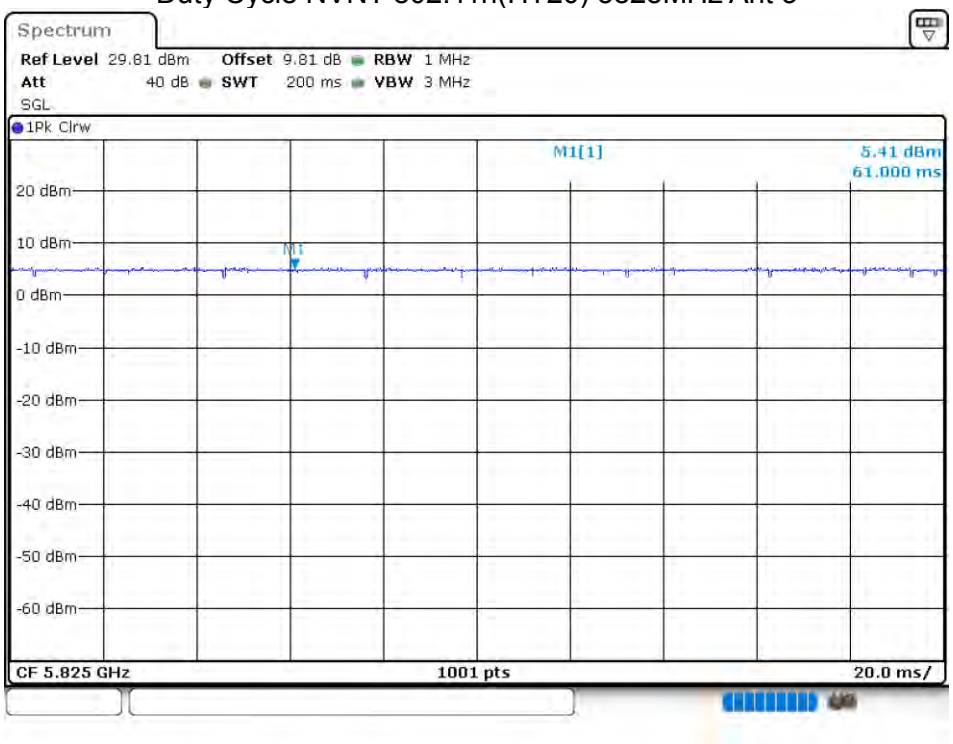

Duty Cycle NVNT 802.11n(HT20) 5745MHz Ant 3



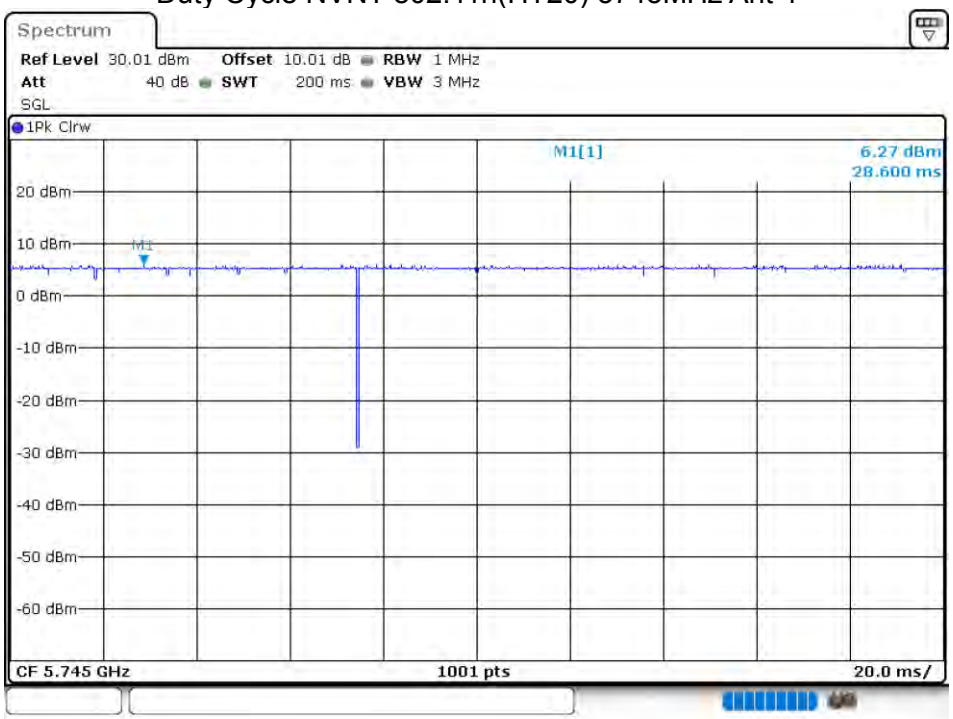
Duty Cycle NVNT 802.11n(HT20) 5785MHz Ant 3



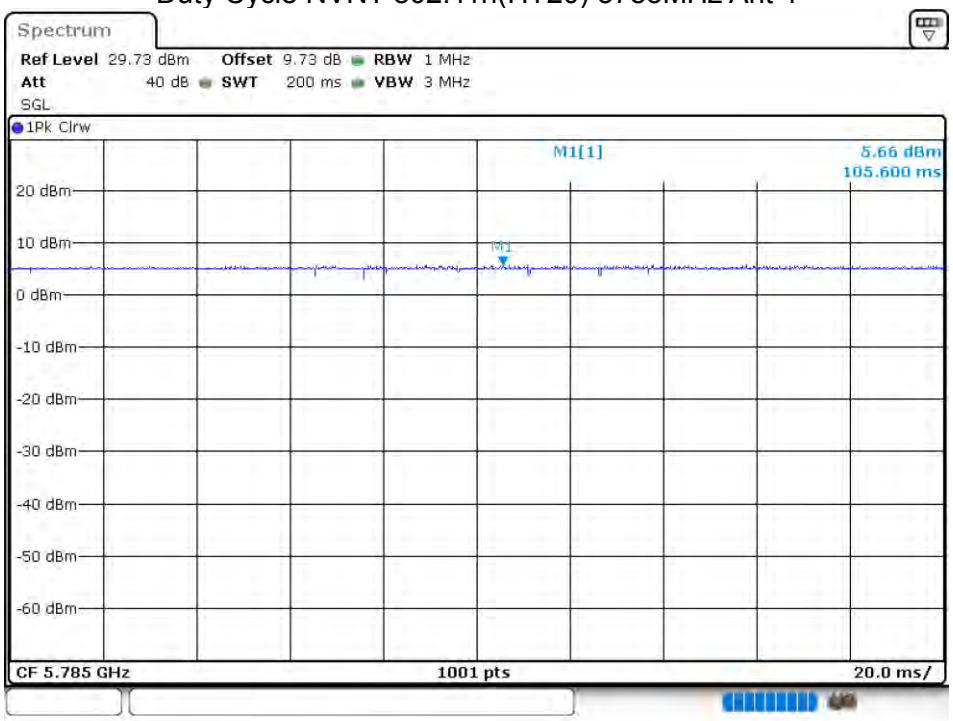

Duty Cycle NVNT 802.11n(HT20) 5825MHz Ant 3



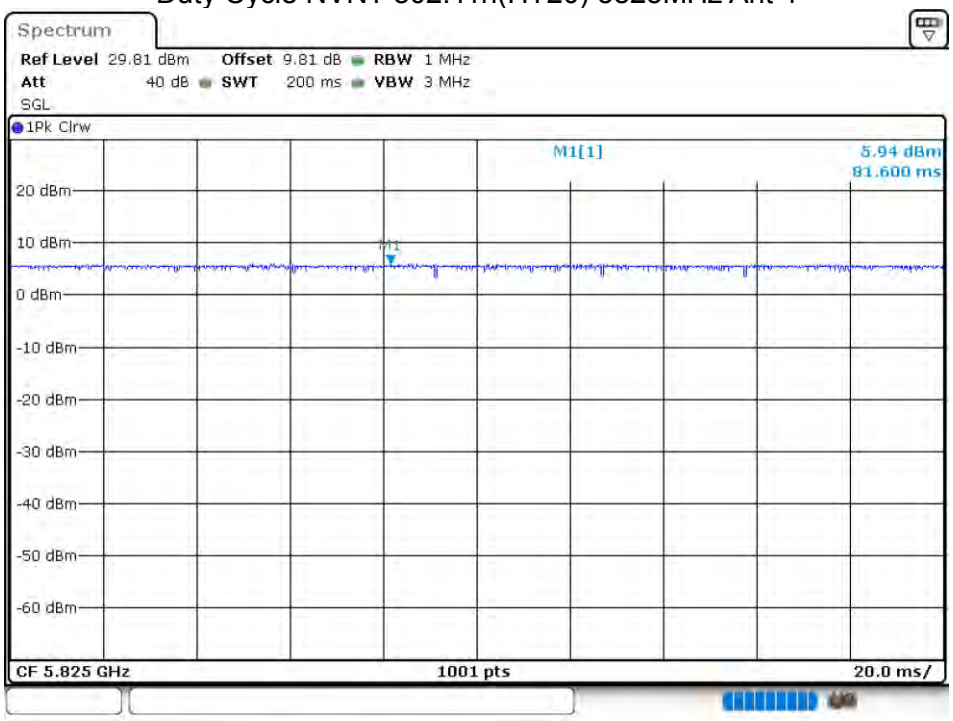
Duty Cycle NVNT 802.11n(HT20) 5745MHz Ant 4



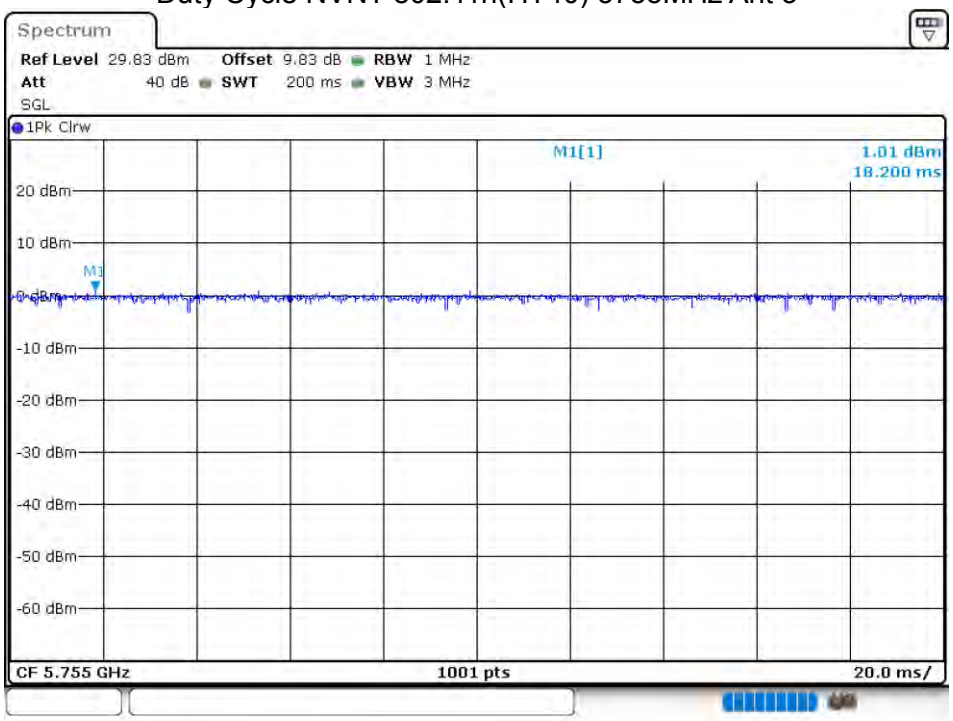

Duty Cycle NVNT 802.11n(HT20) 5785MHz Ant 4



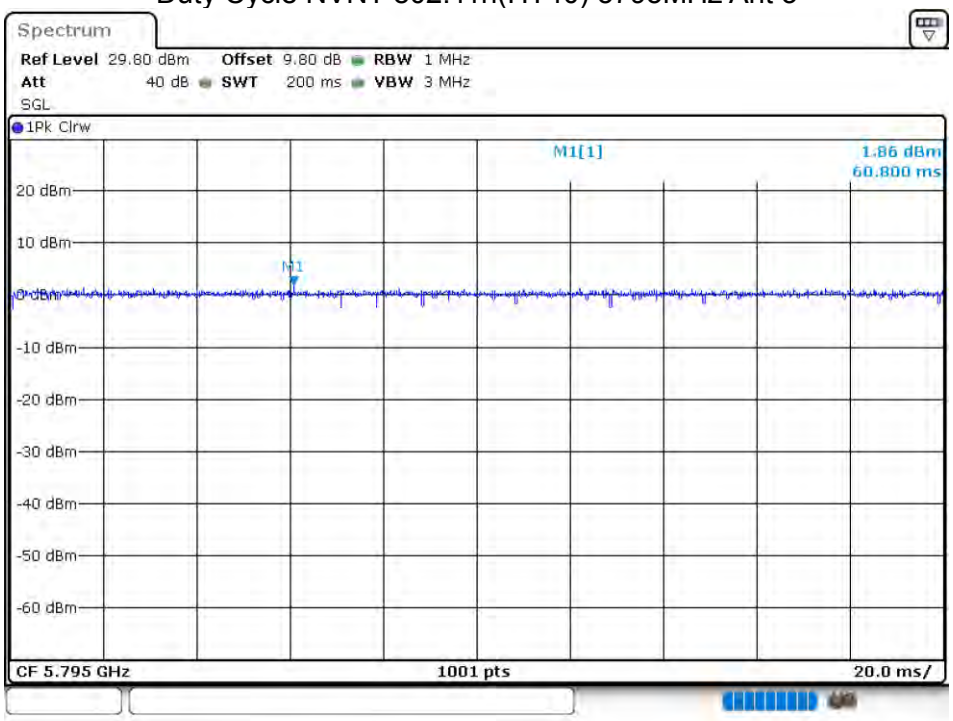
Duty Cycle NVNT 802.11n(HT20) 5825MHz Ant 4



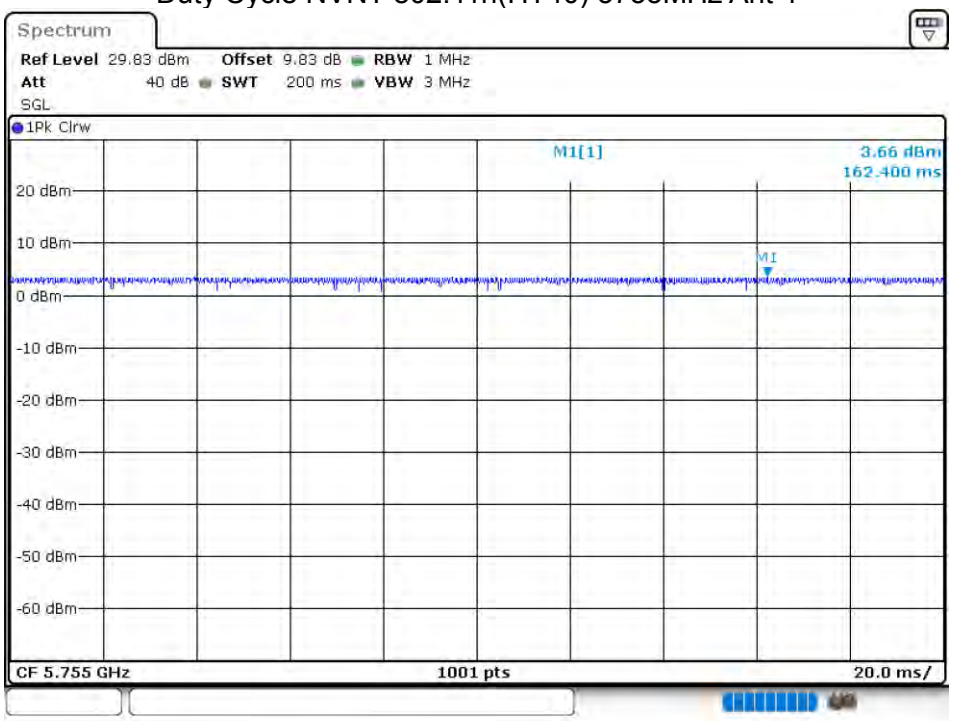

Duty Cycle NVNT 802.11n(HT40) 5755MHz Ant 3



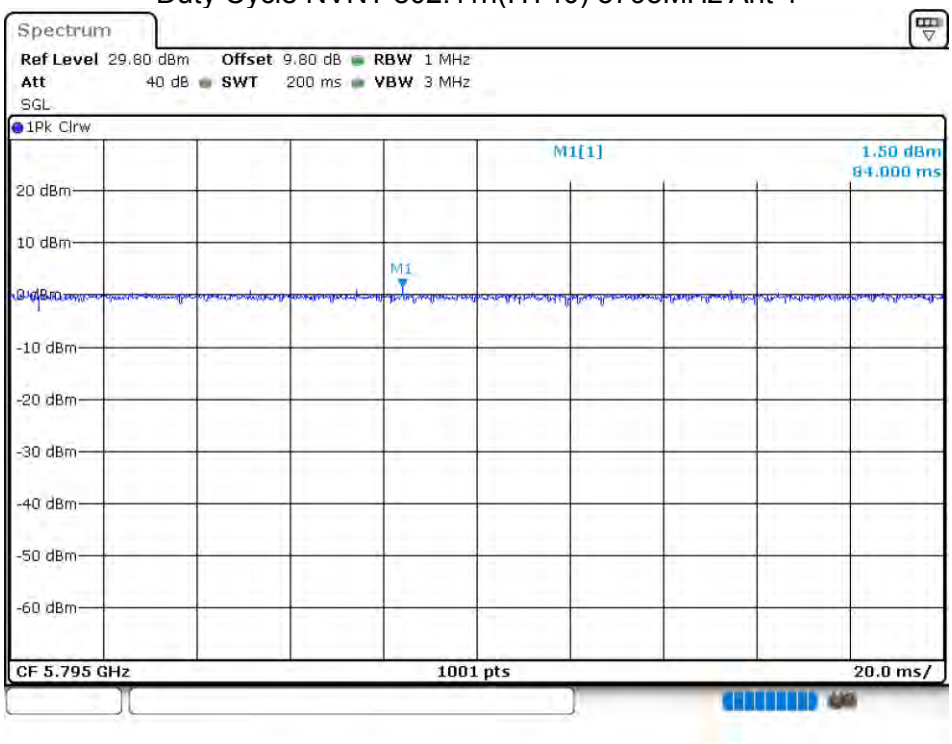
Duty Cycle NVNT 802.11n(HT40) 5795MHz Ant 3




Duty Cycle NVNT 802.11n(HT40) 5755MHz Ant 4



Duty Cycle NVNT 802.11n(HT40) 5795MHz Ant 4



## 11.2 MAXIMUM CONDUCTED OUTPUT POWER

5.2G

| Condition | Mode | Frequency (MHz) | Antenna | Conducted Power (dBm) | Duty Factor (dB) | Total Power (dBm) | Limit (dBm) | Verdict |
|---|---|---|---|---|---|---|---|---|
| NVNT | 802.11a | 5180 | Ant 3 | 10.42 | 0 | -- | 24 | Pass |
| NVNT | 802.11a | 5200 | Ant 3 | 10.66 | 0 | -- | 24 | Pass |
| NVNT | 802.11a | 5240 | Ant 3 | 10.42 | 0 | -- | 24 | Pass |
| NVNT | 802.11a | 5180 | Ant 4 | 10.24 | 0 | -- | 24 | Pass |
| NVNT | 802.11a | 5200 | Ant 4 | 10.56 | 0 | -- | 24 | Pass |
| NVNT | 802.11a | 5240 | Ant 4 | 10.08 | 0 | -- | 24 | Pass |
| NVNT | 802.11ac20 | 5180 | Ant 3 | 10.71 | 0 | 13.50 | 23.1 | Pass |
| NVNT | 802.11ac20 | 5180 | Ant 4 | 10.25 | 0 | | 23.1 | Pass |
| NVNT | 802.11ac20 | 5200 | Ant 3 | 10.85 | 0 | 13.77 | 23.1 | Pass |
| NVNT | 802.11ac20 | 5200 | Ant 4 | 10.67 | 0 | | 23.1 | Pass |
| NVNT | 802.11ac20 | 5240 | Ant 3 | 10.66 | 0 | 13.46 | 23.1 | Pass |
| NVNT | 802.11ac20 | 5240 | Ant 4 | 10.22 | 0 | | 23.1 | Pass |
| NVNT | 802.11ac40 | 5190 | Ant 3 | 10.35 | 0 | 12.99 | 23.1 | Pass |
| NVNT | 802.11ac40 | 5190 | Ant 4 | 9.57 | 0 | | 23.1 | Pass |
| NVNT | 802.11ac40 | 5230 | Ant 3 | 9.31 | 0 | 12.48 | 23.1 | Pass |
| NVNT | 802.11ac40 | 5230 | Ant 4 | 9.63 | 0 | | 23.1 | Pass |
| NVNT | 802.11ac80 | 5210 | Ant 3 | 9.93 | 0 | 12.52 | 23.1 | Pass |
| NVNT | 802.11ac80 | 5210 | Ant 4 | 9.04 | 0 | | 23.1 | Pass |
| NVNT | 802.11n(HT20) | 5180 | Ant 3 | 10.63 | 0 | 13.49 | 23.1 | Pass |
| NVNT | 802.11n(HT20) | 5180 | Ant 4 | 10.32 | 0 | | 23.1 | Pass |
| NVNT | 802.11n(HT20) | 5200 | Ant 3 | 10.88 | 0 | 13.81 | 23.1 | Pass |
| NVNT | 802.11n(HT20) | 5200 | Ant 4 | 10.72 | 0 | | 23.1 | Pass |
| NVNT | 802.11n(HT20) | 5240 | Ant 3 | 10.63 | 0 | 13.44 | 23.1 | Pass |
| NVNT | 802.11n(HT20) | 5240 | Ant 4 | 10.21 | 0 | | 23.1 | Pass |
| NVNT | 802.11n(HT40) | 5190 | Ant 3 | 10.33 | 0 | 12.98 | 23.1 | Pass |
| NVNT | 802.11n(HT40) | 5190 | Ant 4 | 9.57 | 0 | | 23.1 | Pass |
| NVNT | 802.11n(HT40) | 5230 | Ant 3 | 9.29 | 0 | 12.48 | 23.1 | Pass |
| NVNT | 802.11n(HT40) | 5230 | Ant 4 | 9.65 | 0 | | 23.1 | Pass |

5.8G:

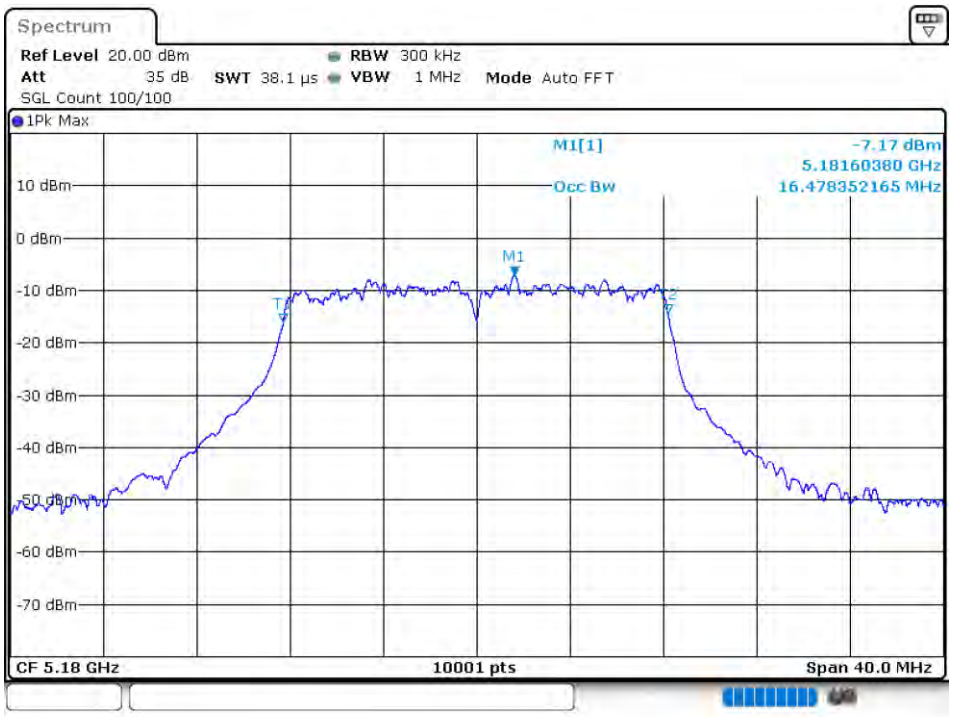
| Condition | Mode | Frequency (MHz) | Antenna | Conducted Power (dBm) | Duty Factor (dB) | Total Power (dBm) | Limit (dBm) | Verdict |
|---|---|---|---|---|---|---|---|---|
| NVNT | 802.11a | 5745 | Ant 3 | 10.08 | 0 | -- | 30 | Pass |
| NVNT | 802.11a | 5785 | Ant 3 | 10.83 | 0 | -- | 30 | Pass |
| NVNT | 802.11a | 5825 | Ant 3 | 9.74 | 0 | -- | 30 | Pass |
| NVNT | 802.11a | 5745 | Ant 4 | 10.2 | 0 | -- | 30 | Pass |
| NVNT | 802.11a | 5785 | Ant 4 | 10.07 | 0 | -- | 30 | Pass |
| NVNT | 802.11a | 5825 | Ant 4 | 10.32 | 0 | -- | 30 | Pass |
| NVNT | 802.11ac20 | 5745 | Ant 3 | 10.46 | 0 | 13.47 | 29.1 | Pass |
| NVNT | 802.11ac20 | 5745 | Ant 4 | 10.46 | 0 | | 29.1 | Pass |
| NVNT | 802.11ac20 | 5785 | Ant 3 | 10.93 | 0 | 13.45 | 29.1 | Pass |
| NVNT | 802.11ac20 | 5785 | Ant 4 | 9.89 | 0 | | 29.1 | Pass |
| NVNT | 802.11ac20 | 5825 | Ant 3 | 9.77 | 0 | 13.05 | 29.1 | Pass |
| NVNT | 802.11ac20 | 5825 | Ant 4 | 10.29 | 0 | | 29.1 | Pass |
| NVNT | 802.11ac40 | 5755 | Ant 3 | 10.33 | 0 | 13.18 | 29.1 | Pass |
| NVNT | 802.11ac40 | 5755 | Ant 4 | 10.01 | 0 | | 29.1 | Pass |
| NVNT | 802.11ac40 | 5795 | Ant 3 | 10.78 | 0 | 13.54 | 29.1 | Pass |
| NVNT | 802.11ac40 | 5795 | Ant 4 | 10.27 | 0 | | 29.1 | Pass |
| NVNT | 802.11ac80 | 5775 | Ant 3 | 10.13 | 0 | 12.76 | 29.1 | Pass |
| NVNT | 802.11ac80 | 5775 | Ant 4 | 9.33 | 0 | | 29.1 | Pass |
| NVNT | 802.11n(HT20) | 5745 | Ant 3 | 10.12 | 0 | 13.22 | 29.1 | Pass |
| NVNT | 802.11n(HT20) | 5745 | Ant 4 | 10.29 | 0 | | 29.1 | Pass |
| NVNT | 802.11n(HT20) | 5785 | Ant 3 | 10.89 | 0 | 13.48 | 29.1 | Pass |
| NVNT | 802.11n(HT20) | 5785 | Ant 4 | 10.01 | 0 | | 29.1 | Pass |
| NVNT | 802.11n(HT20) | 5825 | Ant 3 | 9.79 | 0 | 13.19 | 29.1 | Pass |
| NVNT | 802.11n(HT20) | 5825 | Ant 4 | 10.53 | 0 | | 29.1 | Pass |
| NVNT | 802.11n(HT40) | 5755 | Ant 3 | 10.42 | 0 | 13.29 | 29.1 | Pass |
| NVNT | 802.11n(HT40) | 5755 | Ant 4 | 10.13 | 0 | | 29.1 | Pass |
| NVNT | 802.11n(HT40) | 5795 | Ant 3 | 10.78 | 0 | 13.51 | 29.1 | Pass |
| NVNT | 802.11n(HT40) | 5795 | Ant 4 | 10.19 | 0 | | 29.1 | Pass |

**11.3 OCCUPIED CHANNEL BANDWIDTH**

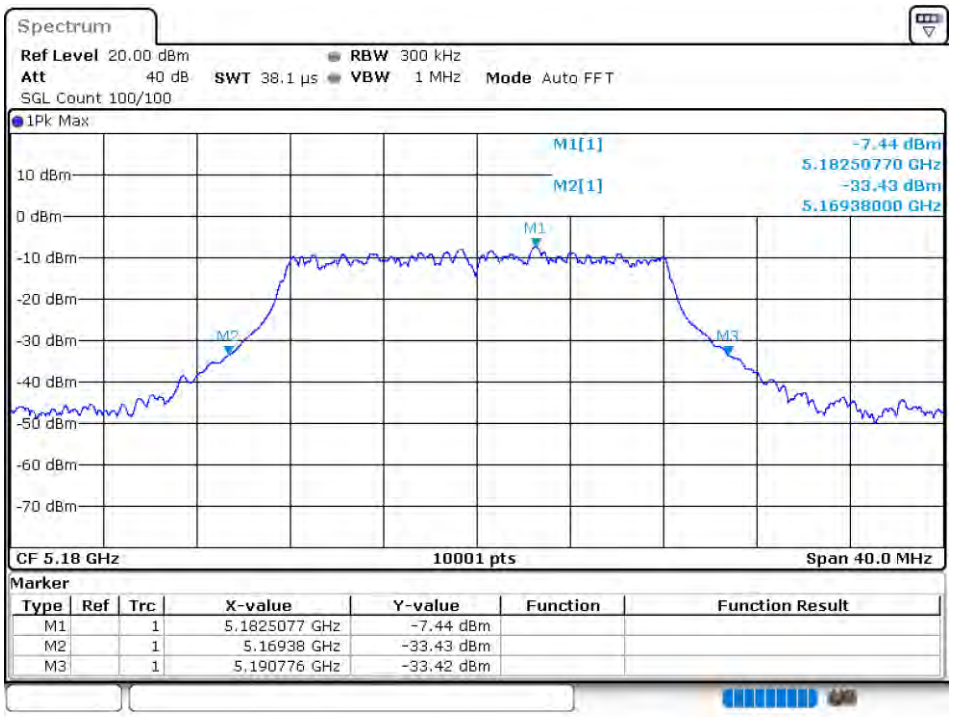
5.2G:

| Condition | Mode | Frequency (MHz) | Antenna | 99% OBW (MHz) | -26 dB Bandwidth (MHz) | Verdict |
|---|---|---|---|---|---|---|
| NVNT | 802.11a | 5180 | Ant 3 | 16.4784 | 21.396 | Pass |
| NVNT | 802.11a | 5200 | Ant 3 | 16.6343 | 22.188 | Pass |
| NVNT | 802.11a | 5240 | Ant 3 | 16.8503 | 21.716 | Pass |
| NVNT | 802.11a | 5180 | Ant 4 | 16.7383 | 20.628 | Pass |
| NVNT | 802.11a | 5200 | Ant 4 | 16.7383 | 21.7 | Pass |
| NVNT | 802.11a | 5240 | Ant 4 | 16.6143 | 22.008 | Pass |
| NVNT | 802.11ac20 | 5180 | Ant 3 | 17.8342 | 22.78 | Pass |
| NVNT | 802.11ac20 | 5200 | Ant 3 | 17.9462 | 23.024 | Pass |
| NVNT | 802.11ac20 | 5240 | Ant 3 | 17.8622 | 22.008 | Pass |
| NVNT | 802.11ac20 | 5180 | Ant 4 | 17.8182 | 22.624 | Pass |
| NVNT | 802.11ac20 | 5200 | Ant 4 | 17.7902 | 22.564 | Pass |
| NVNT | 802.11ac20 | 5240 | Ant 4 | 18.0302 | 23.084 | Pass |
| NVNT | 802.11ac40 | 5190 | Ant 3 | 36.4604 | 44.264 | Pass |
| NVNT | 802.11ac40 | 5230 | Ant 3 | 36.4684 | 45.816 | Pass |
| NVNT | 802.11ac40 | 5190 | Ant 4 | 36.4604 | 44.712 | Pass |
| NVNT | 802.11ac40 | 5230 | Ant 4 | 36.5723 | 45.056 | Pass |
| NVNT | 802.11ac80 | 5210 | Ant 3 | 76.1524 | 91.456 | Pass |
| NVNT | 802.11ac80 | 5210 | Ant 4 | 76.4724 | 92.4 | Pass |
| NVNT | 802.11n(HT20) | 5180 | Ant 3 | 18.0662 | 22.036 | Pass |
| NVNT | 802.11n(HT20) | 5200 | Ant 3 | 17.8102 | 22.38 | Pass |
| NVNT | 802.11n(HT20) | 5240 | Ant 3 | 17.8982 | 22.696 | Pass |
| NVNT | 802.11n(HT20) | 5180 | Ant 4 | 17.8622 | 21.912 | Pass |
| NVNT | 802.11n(HT20) | 5200 | Ant 4 | 18.1262 | 22.74 | Pass |
| NVNT | 802.11n(HT20) | 5240 | Ant 4 | 17.9542 | 22.3 | Pass |
| NVNT | 802.11n(HT40) | 5190 | Ant 3 | 36.4684 | 45.392 | Pass |
| NVNT | 802.11n(HT40) | 5230 | Ant 3 | 36.4924 | 45.872 | Pass |
| NVNT | 802.11n(HT40) | 5190 | Ant 4 | 36.4444 | 44.864 | Pass |
| NVNT | 802.11n(HT40) | 5230 | Ant 4 | 36.5803 | 46.088 | Pass |

OBW NVNT 802.11a 5180MHz Ant 3



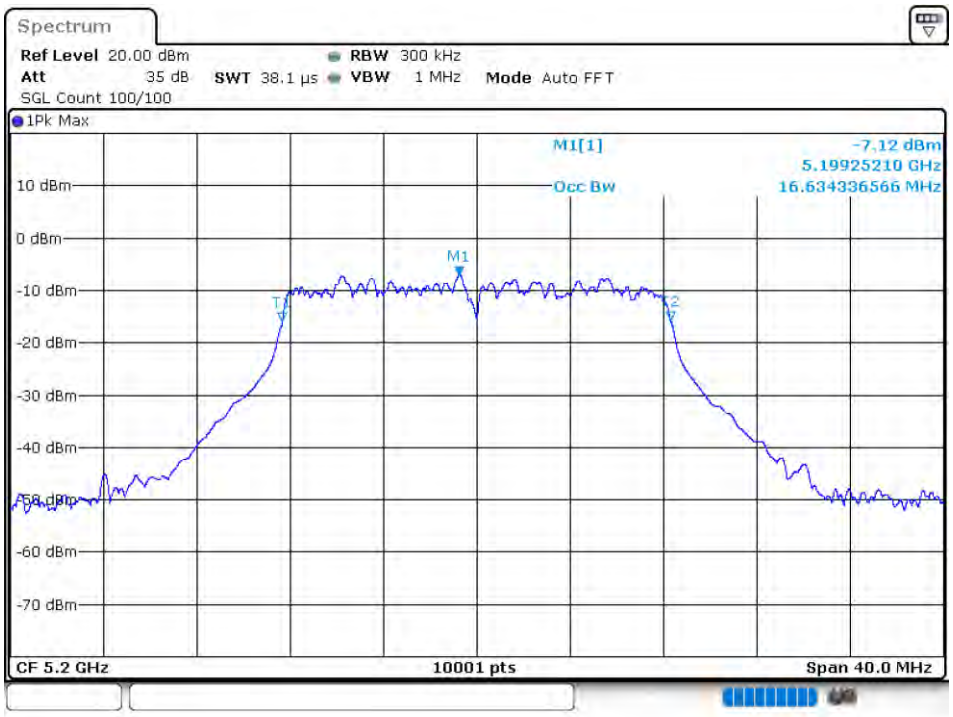

-26 dB BW NVNT 802.11a 5180MHz Ant 3



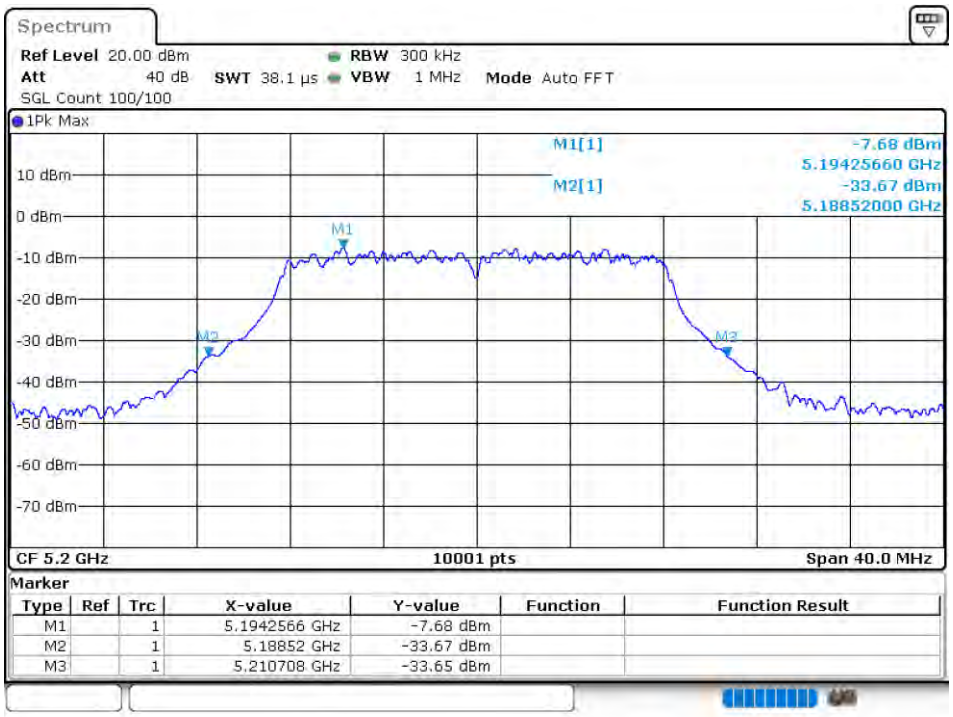

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.1825077 GHz | -7.44 dBm | | |
| M2 | | 1 | 5.16938 GHz | -33.43 dBm | | |
| M3 | | 1 | 5.190776 GHz | -33.42 dBm | | |

OBW NVNT 802.11a 5200MHz Ant 3



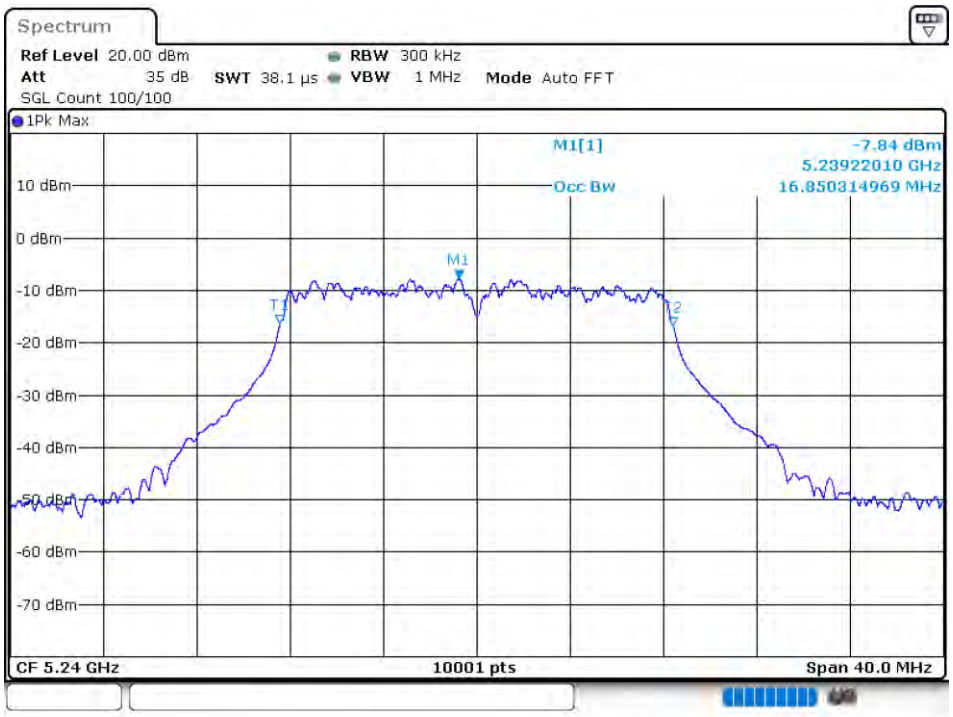

-26 dB BW NVNT 802.11a 5200MHz Ant 3



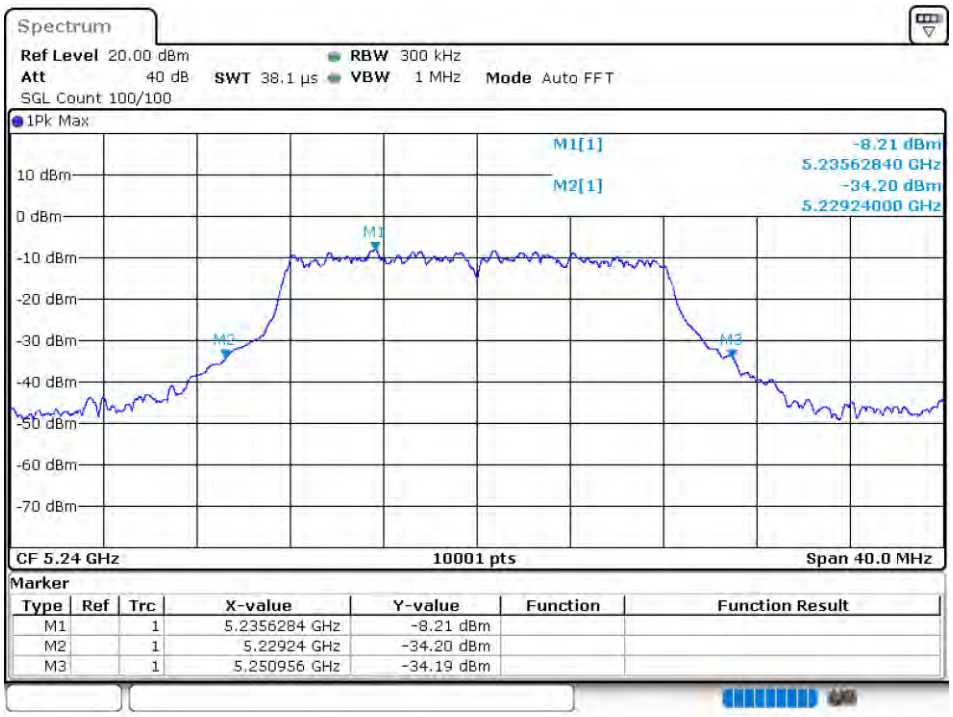

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.1942566 GHz | -7.68 dBm | | |
| M2 | | 1 | 5.18852 GHz | -33.67 dBm | | |
| M3 | | 1 | 5.210708 GHz | -33.65 dBm | | |

OBW NVNT 802.11a 5240MHz Ant 3



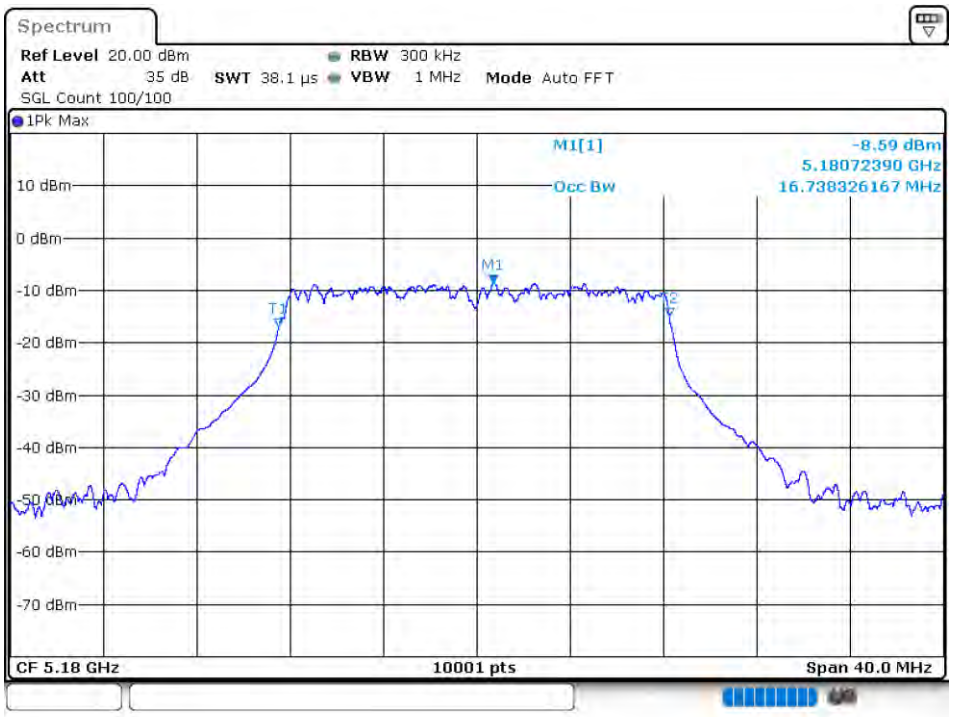

-26 dB BW NVNT 802.11a 5240MHz Ant 3



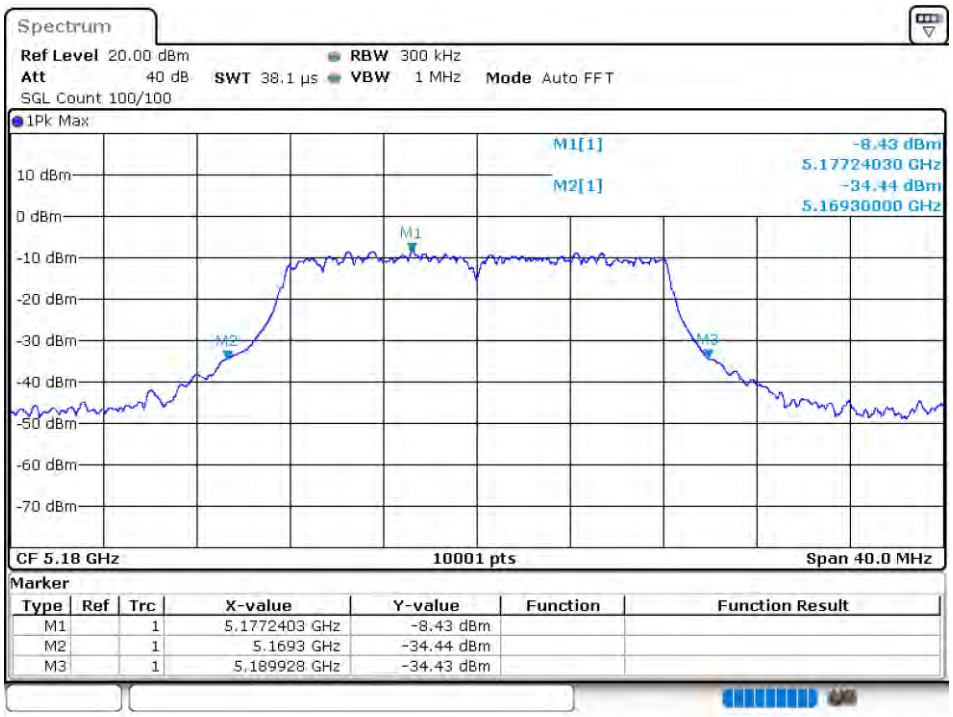

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.2356284 GHz | -8.21 dBm | | |
| M2 | | 1 | 5.22924 GHz | -34.20 dBm | | |
| M3 | | 1 | 5.250956 GHz | -34.19 dBm | | |

OBW NVNT 802.11a 5180MHz Ant 4



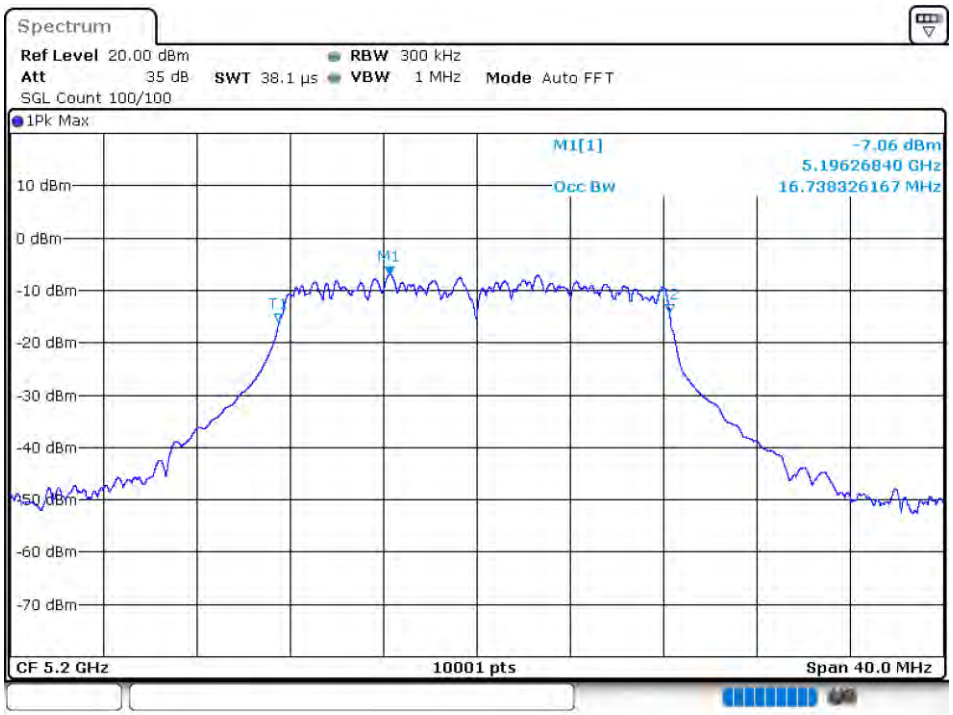

-26 dB BW NVNT 802.11a 5180MHz Ant 4



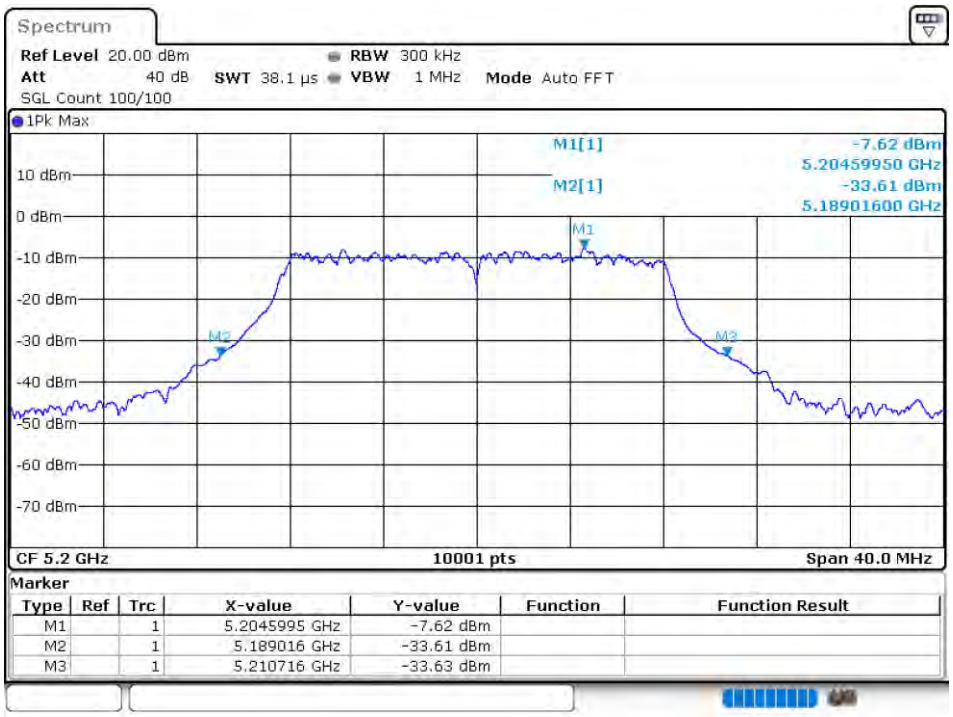

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.1772403 GHz | -8.43 dBm | | |
| M2 | | 1 | 5.1693 GHz | -34.44 dBm | | |
| M3 | | 1 | 5.189928 GHz | -34.43 dBm | | |

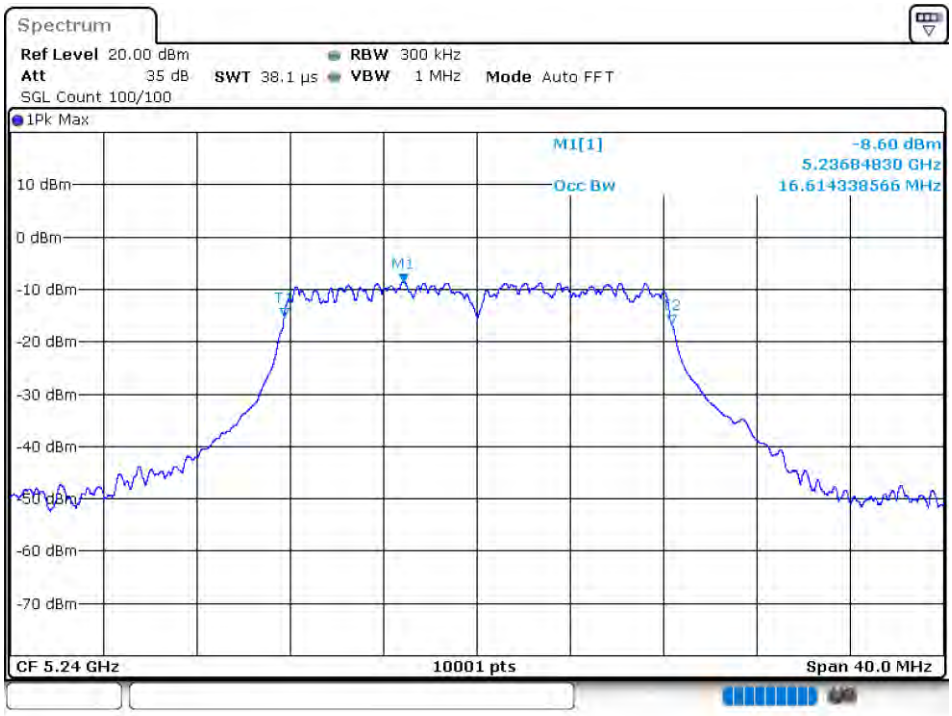
OBW NVNT 802.11a 5200MHz Ant 4



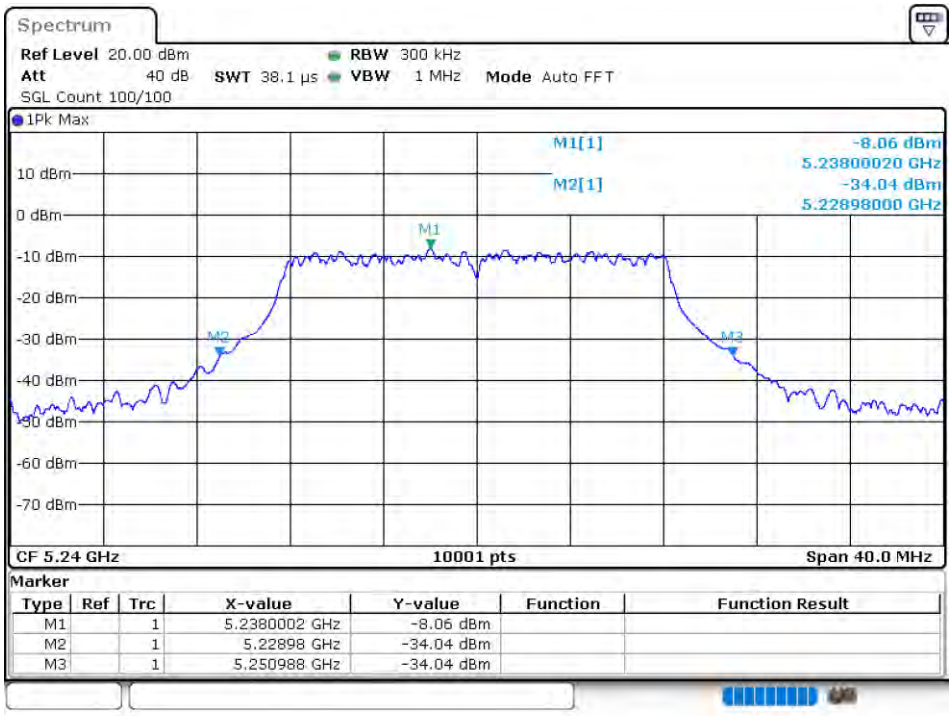

-26 dB BW NVNT 802.11a 5200MHz Ant 4



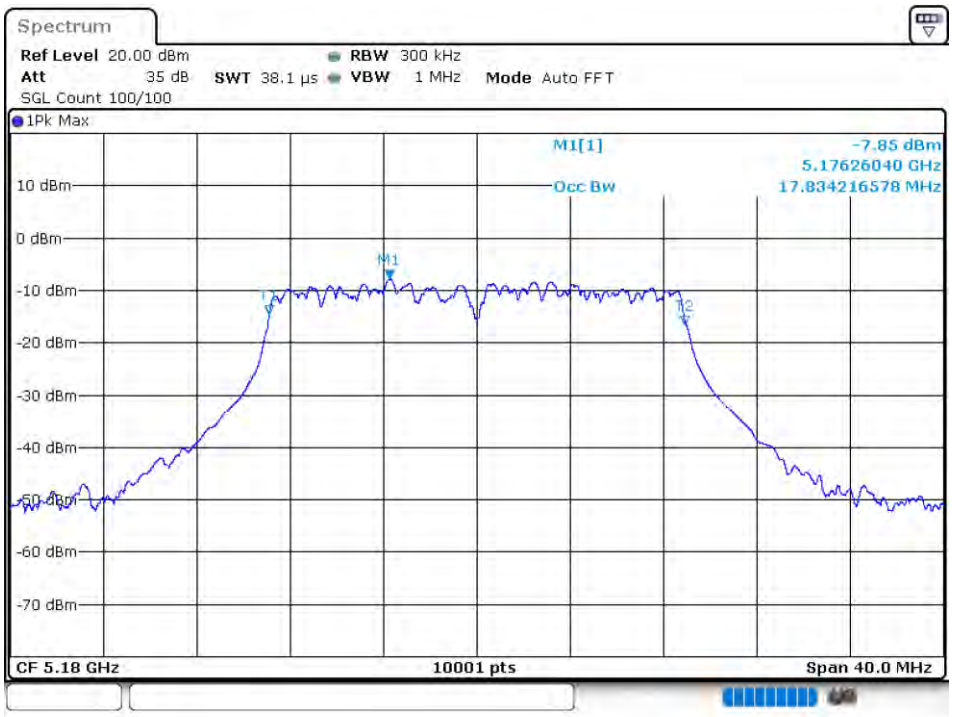
OBW NVNT 802.11a 5240MHz Ant 4



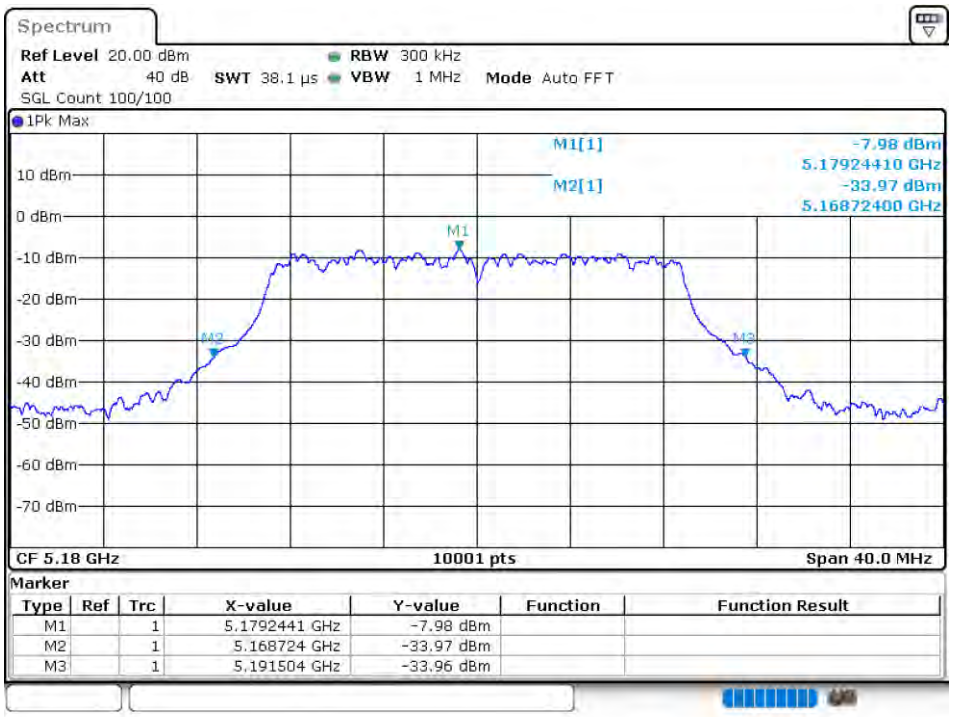

-26 dB BW NVNT 802.11a 5240MHz Ant 4



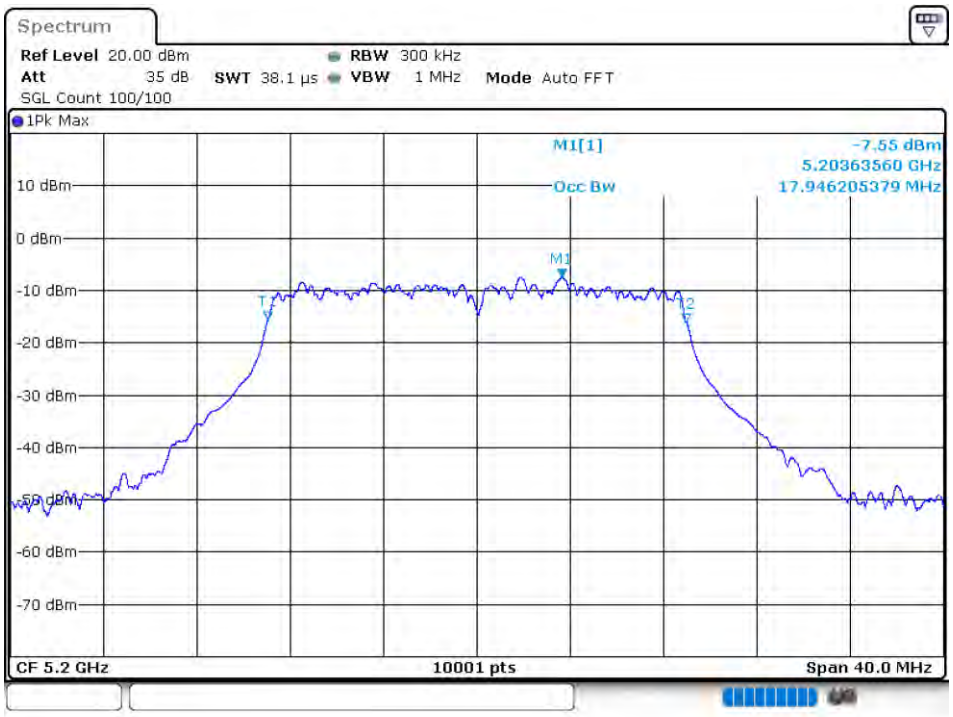
OBW NVNT 802.11ac20 5180MHz Ant 3



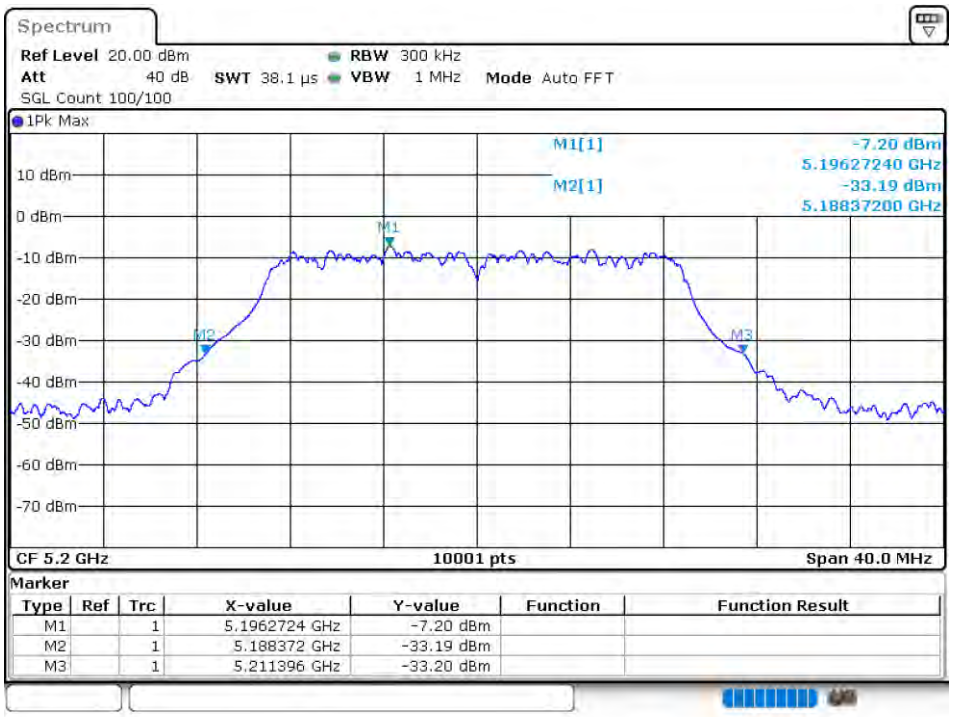

-26 dB BW NVNT 802.11ac20 5180MHz Ant 3



OBW NVNT 802.11ac20 5200MHz Ant 3



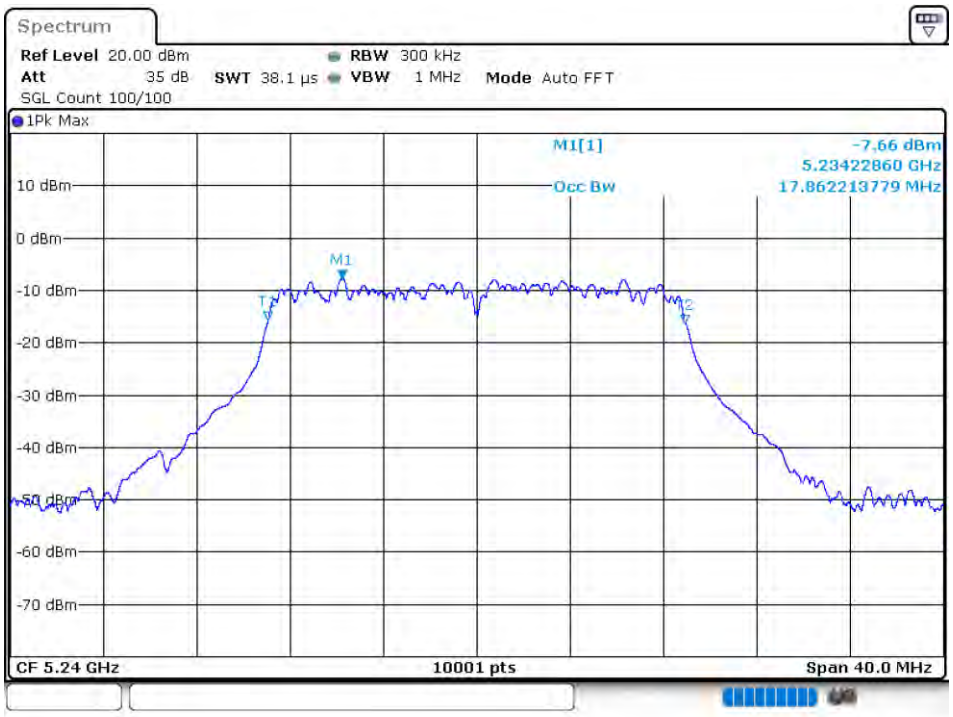

-26 dB BW NVNT 802.11ac20 5200MHz Ant 3



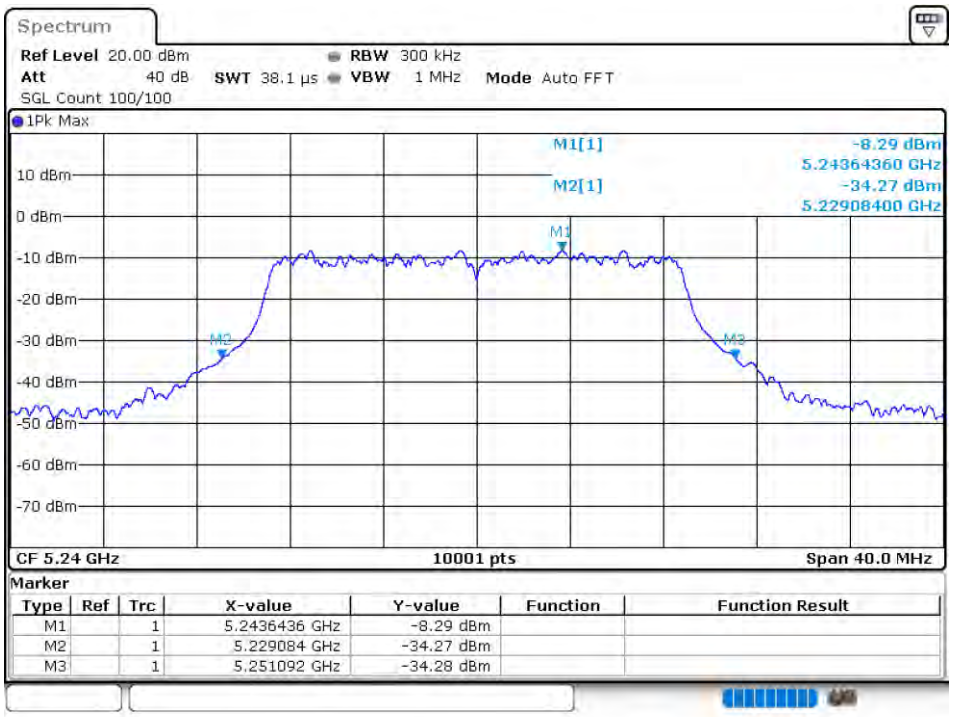

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.1962724 GHz | -7.20 dBm | | |
| M2 | | 1 | 5.188372 GHz | -33.19 dBm | | |
| M3 | | 1 | 5.211396 GHz | -33.20 dBm | | |

OBW NVNT 802.11ac20 5240MHz Ant 3



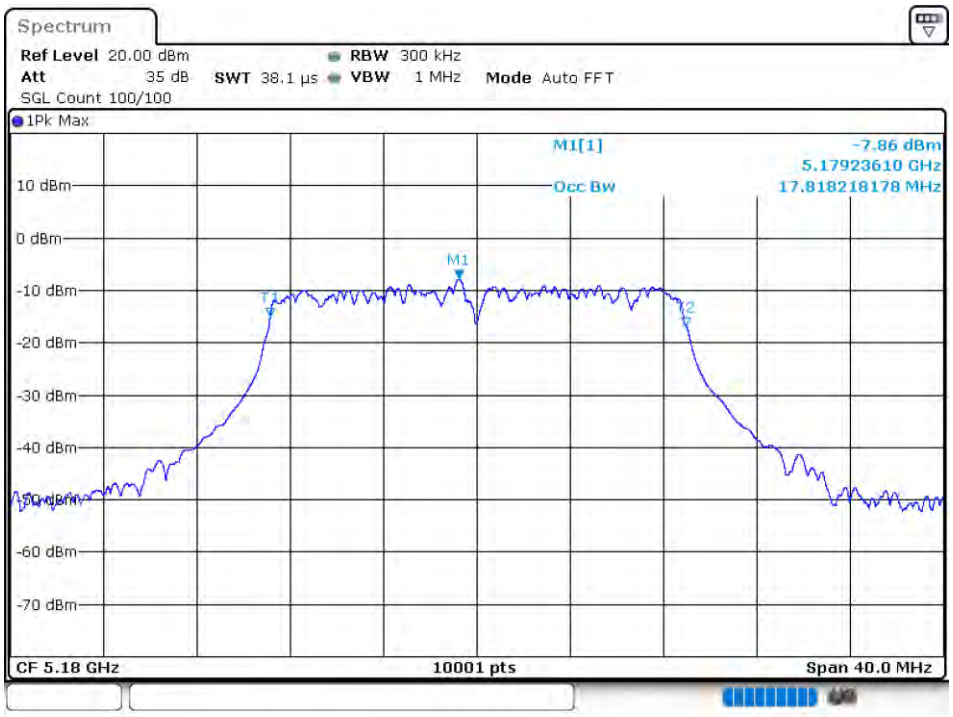

-26 dB BW NVNT 802.11ac20 5240MHz Ant 3



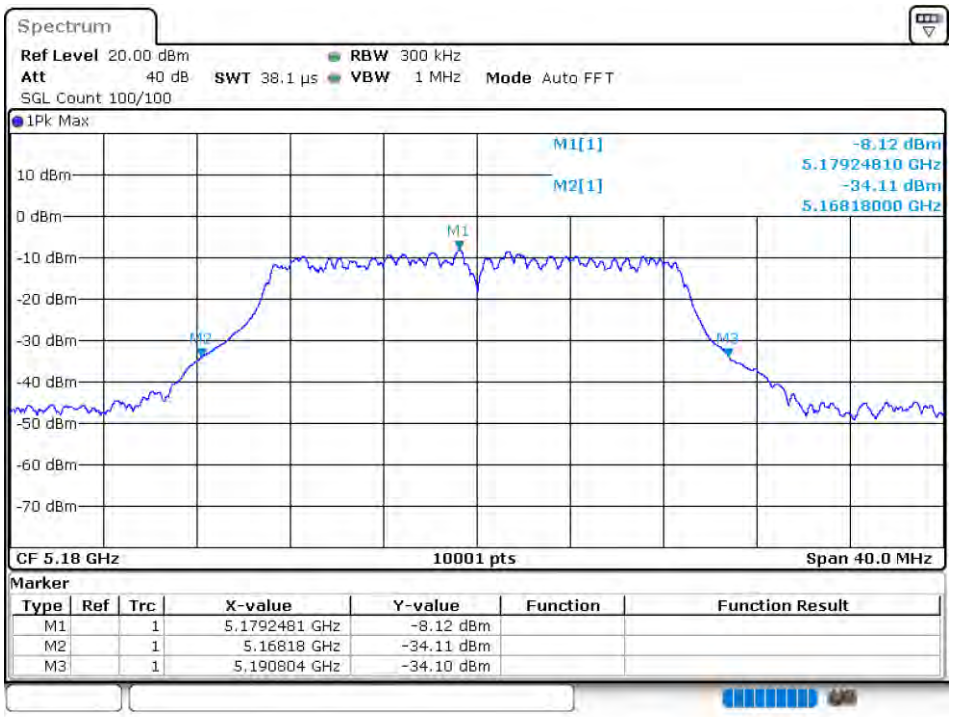

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.2436436 GHz | -8.29 dBm | | |
| M2 | | 1 | 5.229084 GHz | -34.27 dBm | | |
| M3 | | 1 | 5.251092 GHz | -34.28 dBm | | |

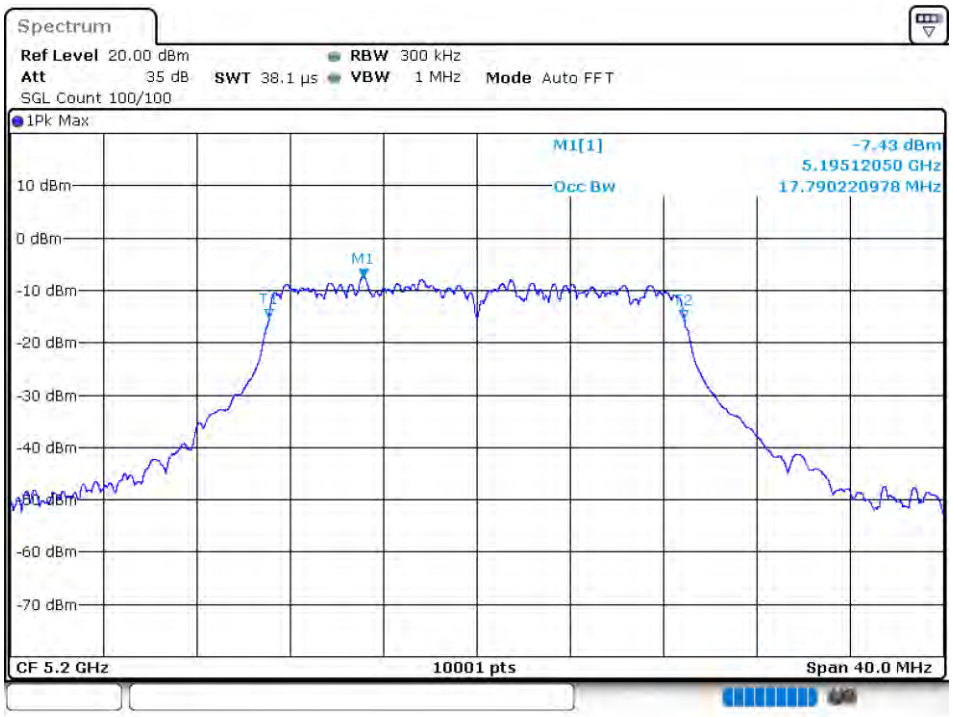
OBW NVNT 802.11ac20 5180MHz Ant 4



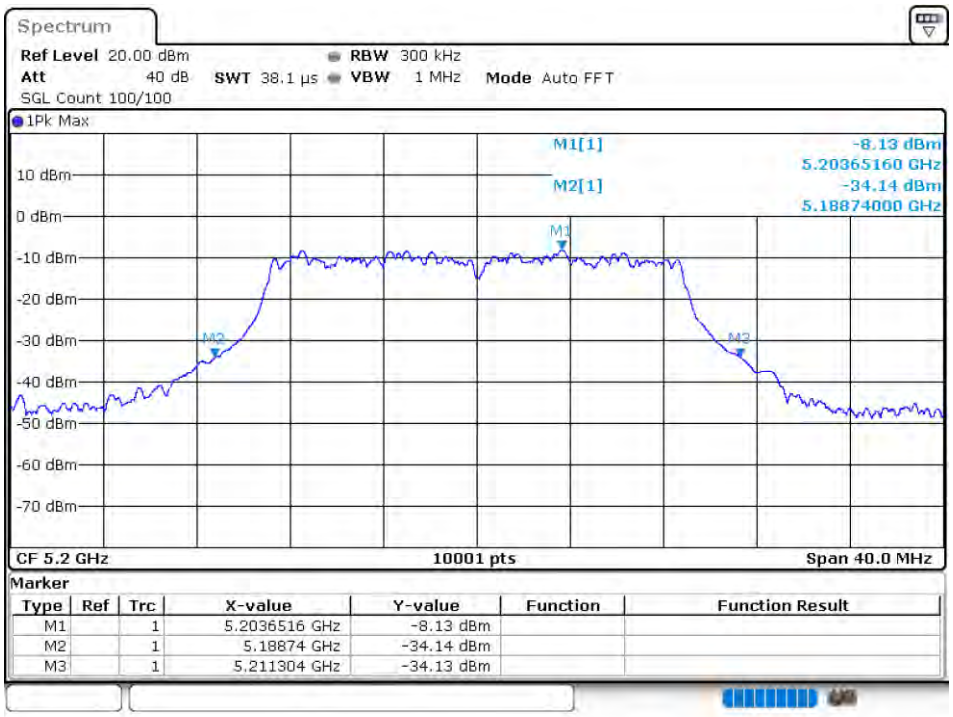

-26 dB BW NVNT 802.11ac20 5180MHz Ant 4



OBW NVNT 802.11ac20 5200MHz Ant 4



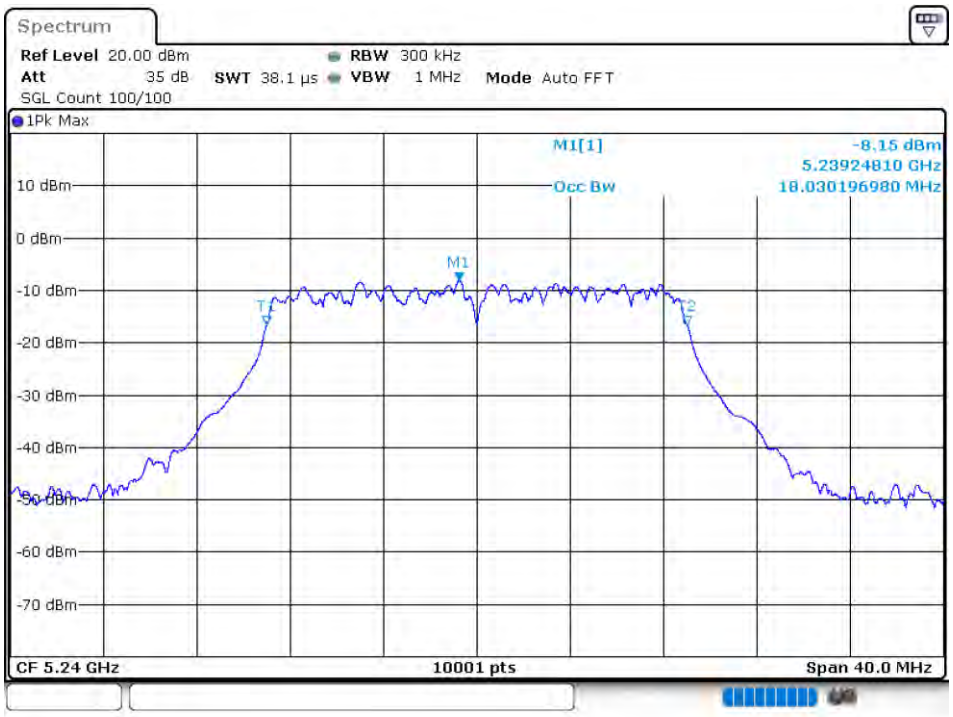

-26 dB BW NVNT 802.11ac20 5200MHz Ant 4



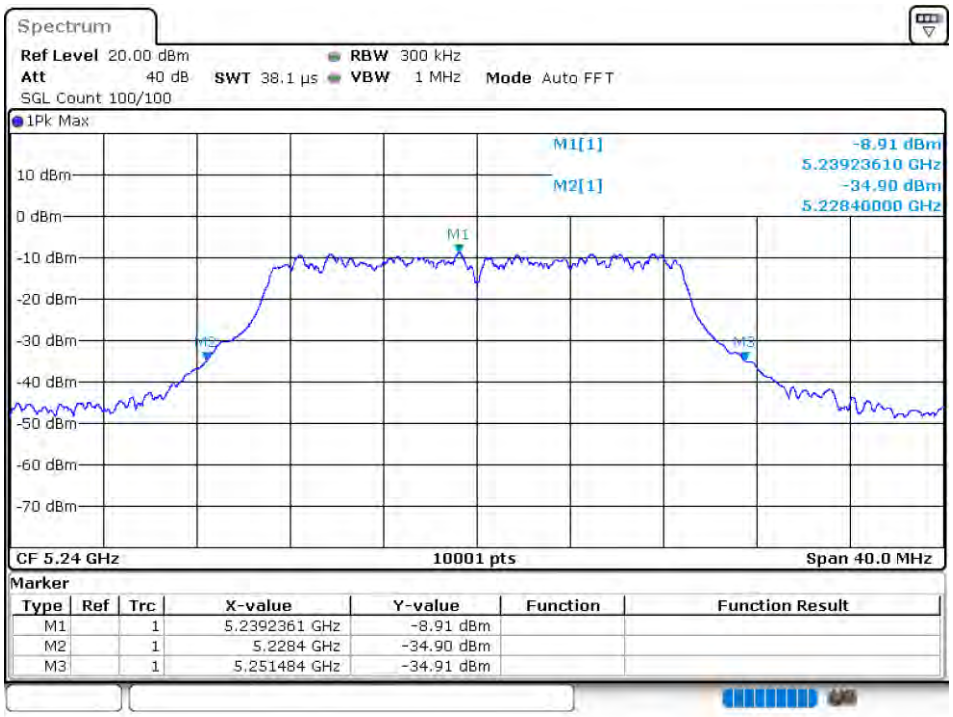

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.2036516 GHz | -8.13 dBm | | |
| M2 | | 1 | 5.18874 GHz | -34.14 dBm | | |
| M3 | | 1 | 5.211304 GHz | -34.13 dBm | | |

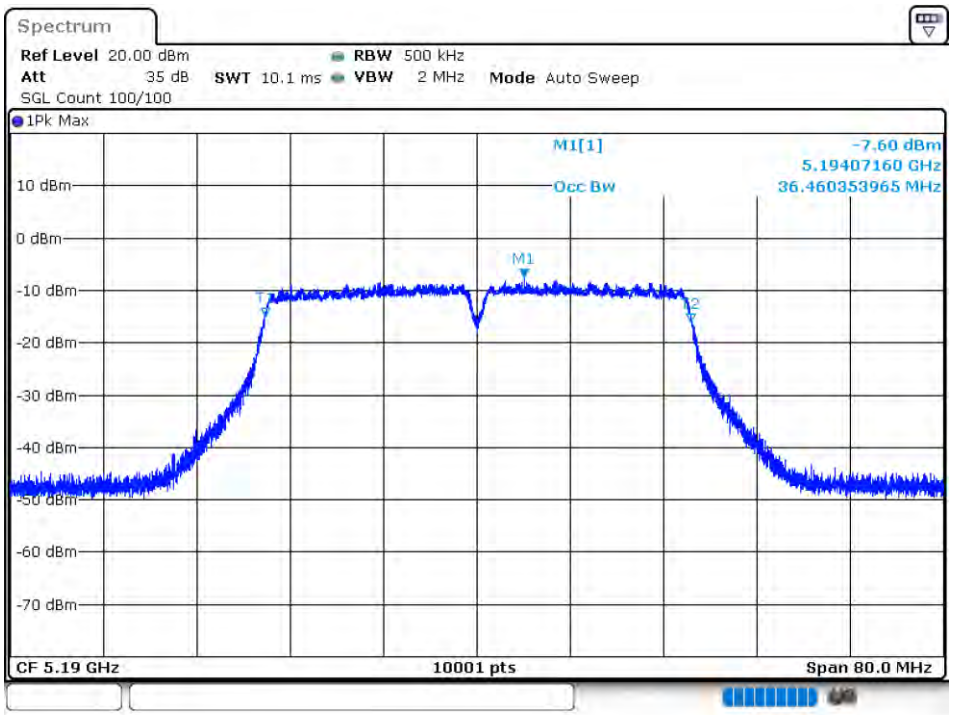
OBW NVNT 802.11ac20 5240MHz Ant 4



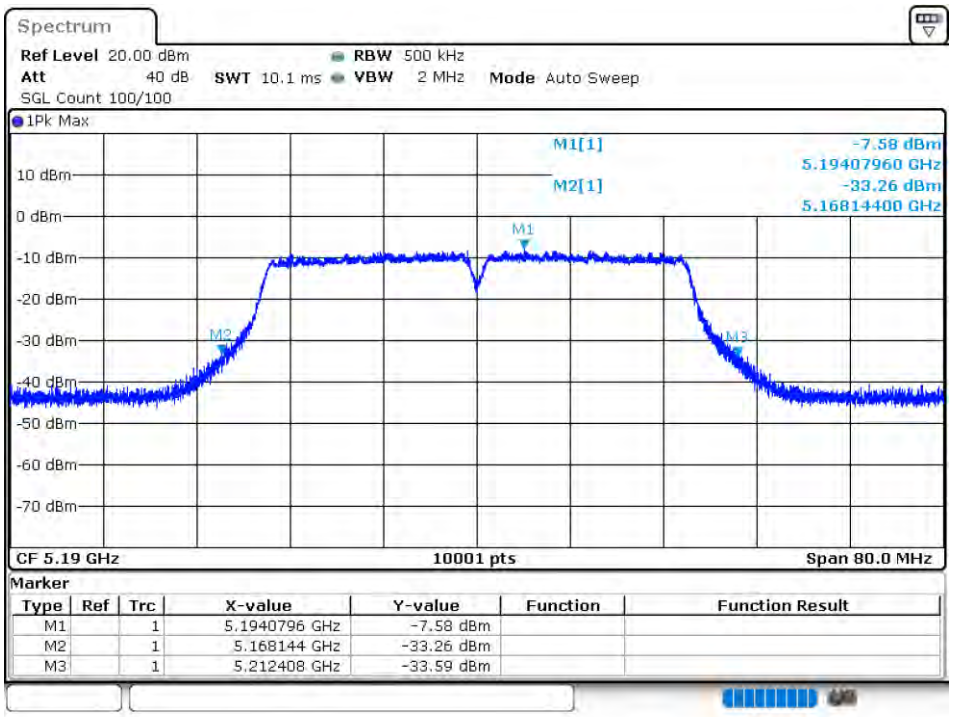

-26 dB BW NVNT 802.11ac20 5240MHz Ant 4



OBW NVNT 802.11ac40 5190MHz Ant 3



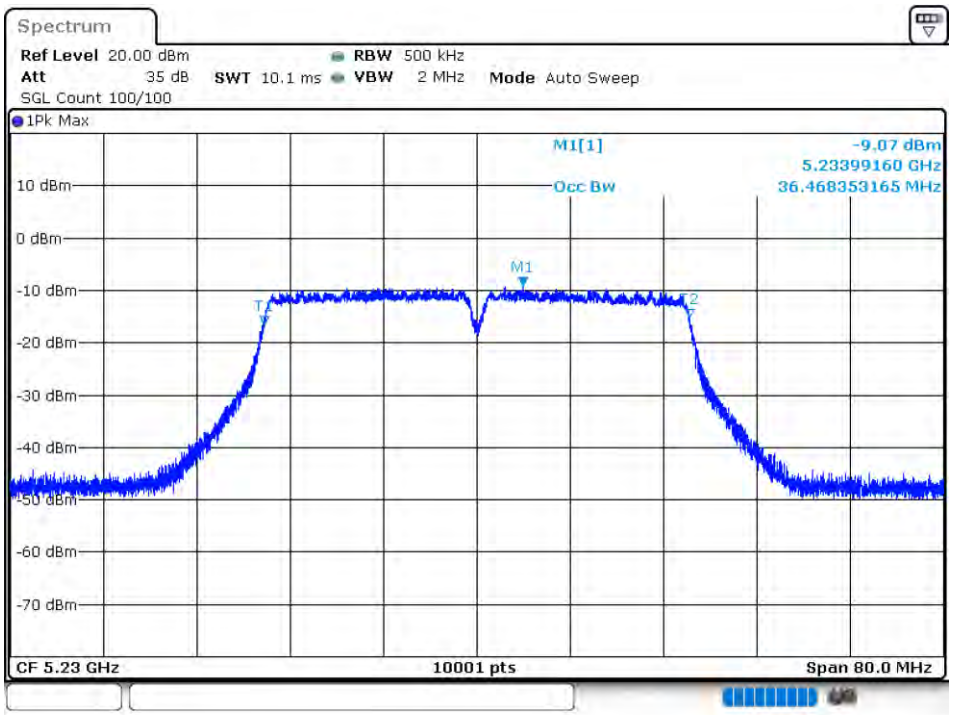

-26 dB BW NVNT 802.11ac40 5190MHz Ant 3



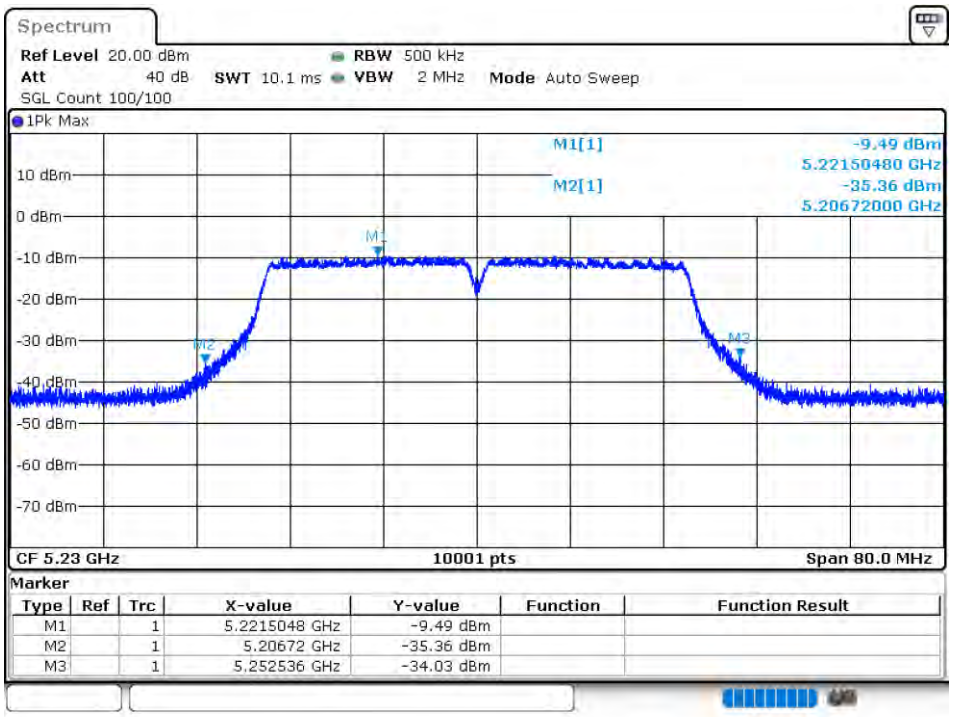

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.1940796 GHz | -7.58 dBm | | |
| M2 | | 1 | 5.168144 GHz | -33.26 dBm | | |
| M3 | | 1 | 5.212408 GHz | -33.59 dBm | | |

OBW NVNT 802.11ac40 5230MHz Ant 3



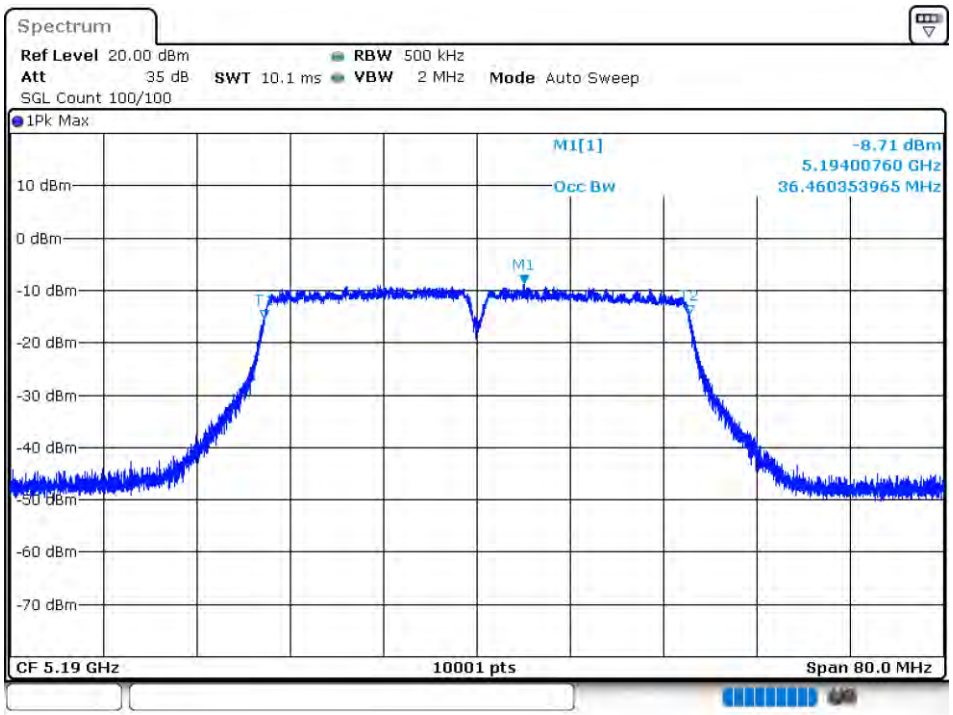

-26 dB BW NVNT 802.11ac40 5230MHz Ant 3



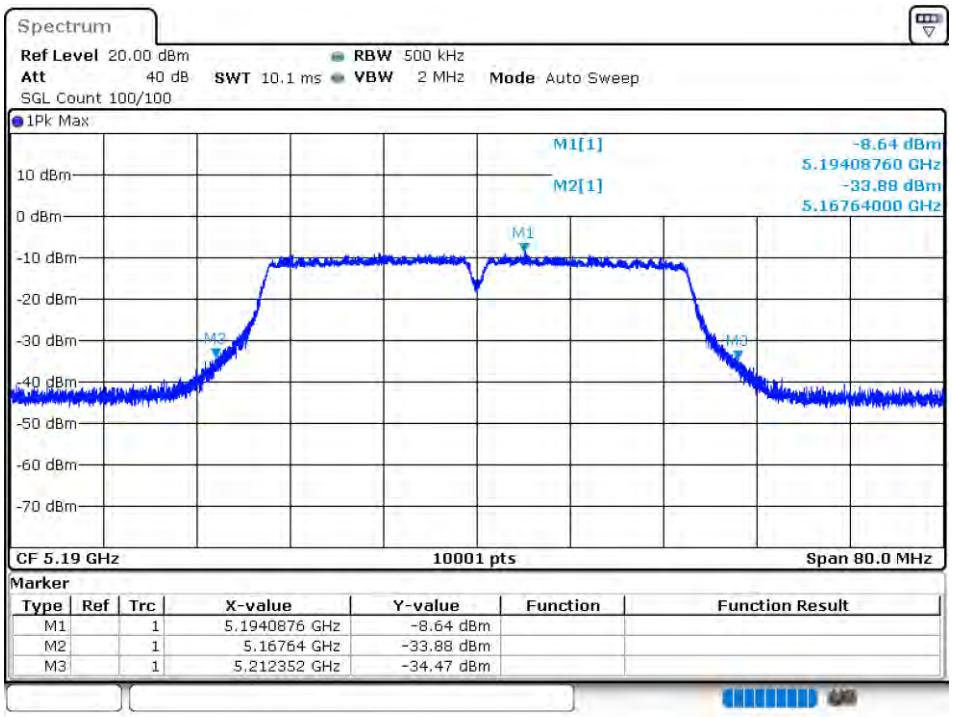

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.2215048 GHz | -9.49 dBm | | |
| M2 | | 1 | 5.20672 GHz | -35.36 dBm | | |
| M3 | | 1 | 5.252536 GHz | -34.03 dBm | | |

OBW NVNT 802.11ac40 5190MHz Ant 4



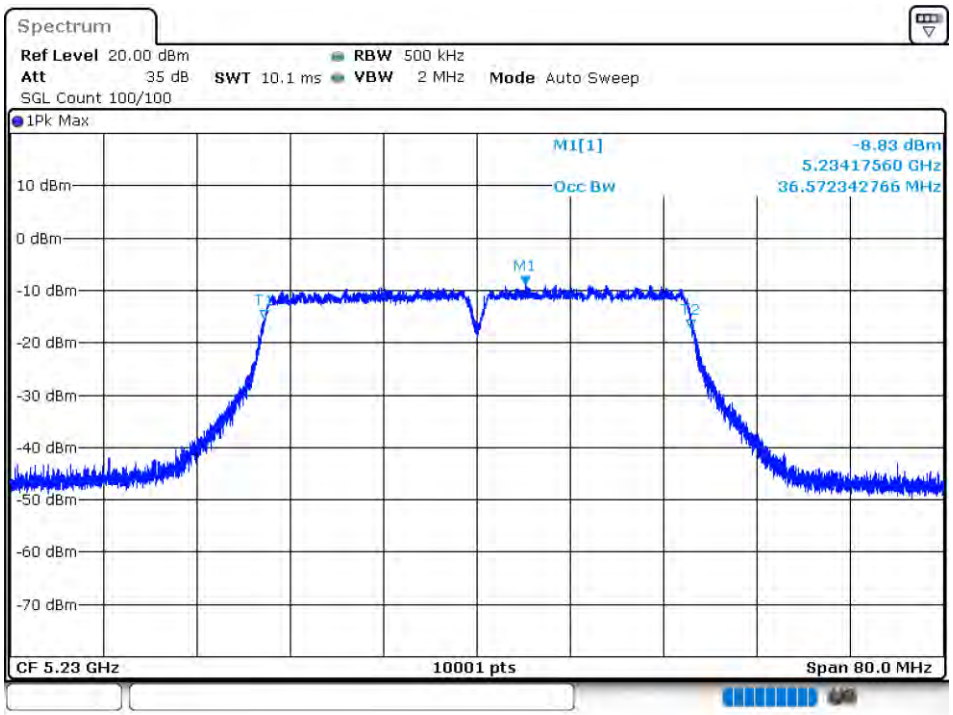

-26 dB BW NVNT 802.11ac40 5190MHz Ant 4



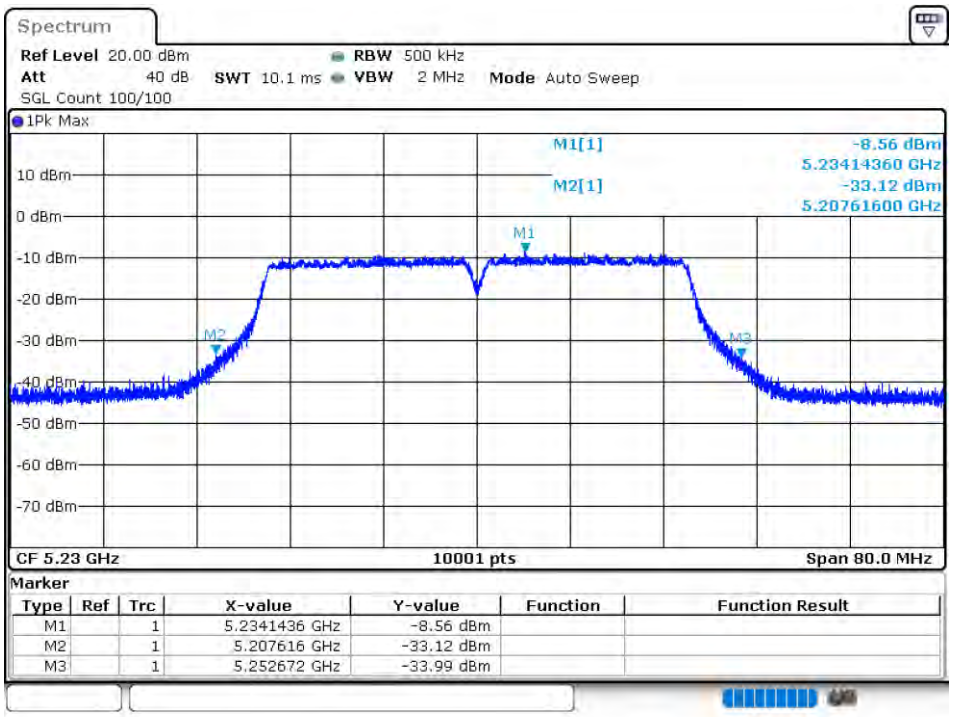

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.1940876 GHz | -8.64 dBm | | |
| M2 | | 1 | 5.16764 GHz | -33.88 dBm | | |
| M3 | | 1 | 5.212352 GHz | -34.47 dBm | | |

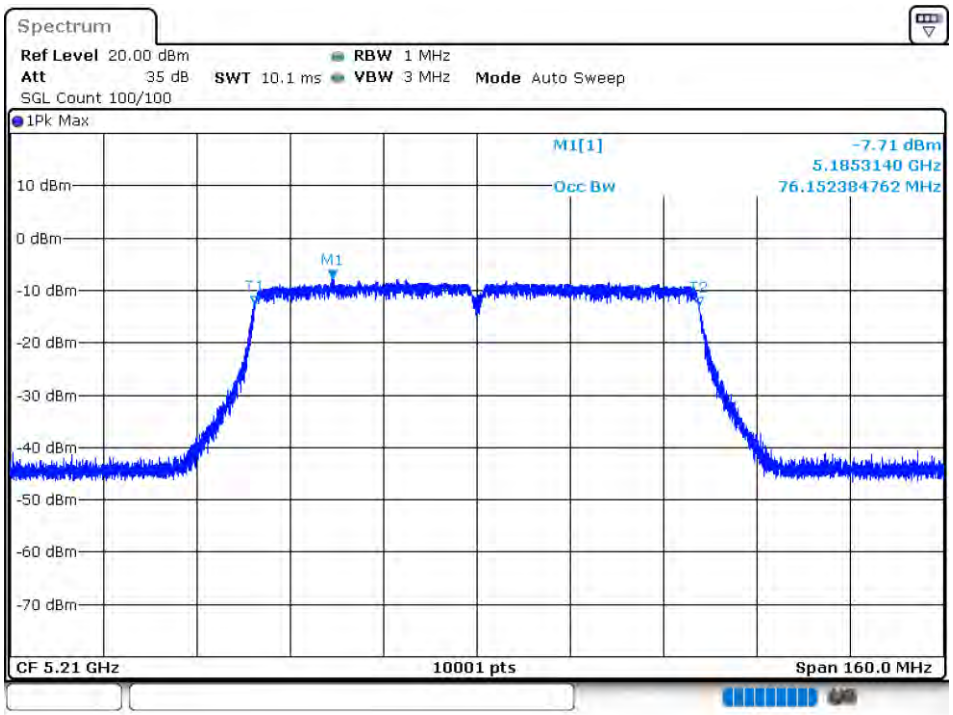
OBW NVNT 802.11ac40 5230MHz Ant 4



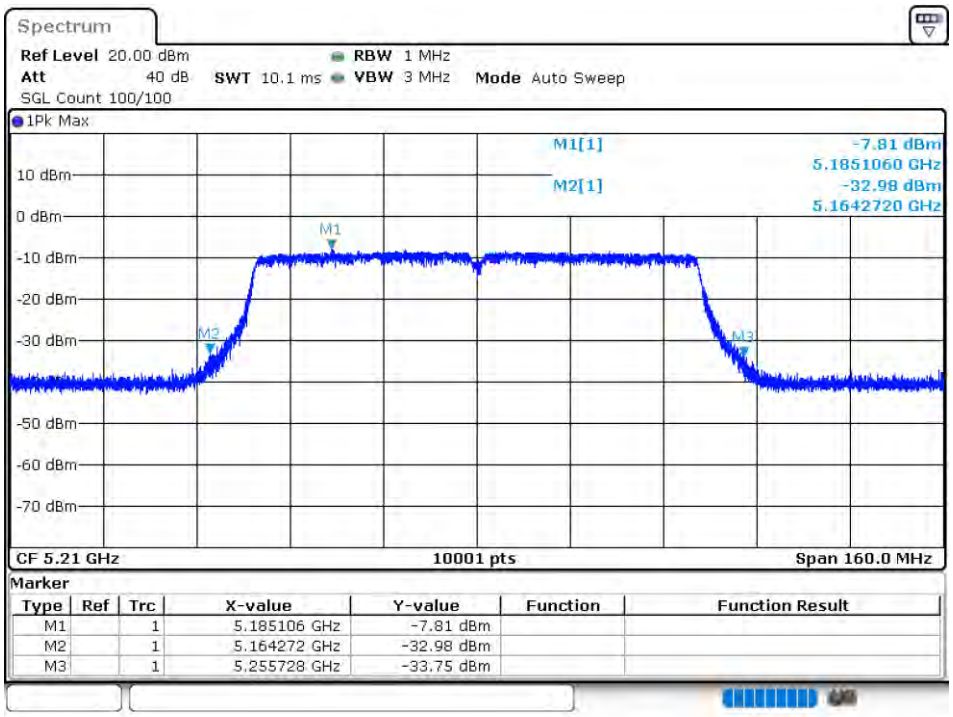

-26 dB BW NVNT 802.11ac40 5230MHz Ant 4



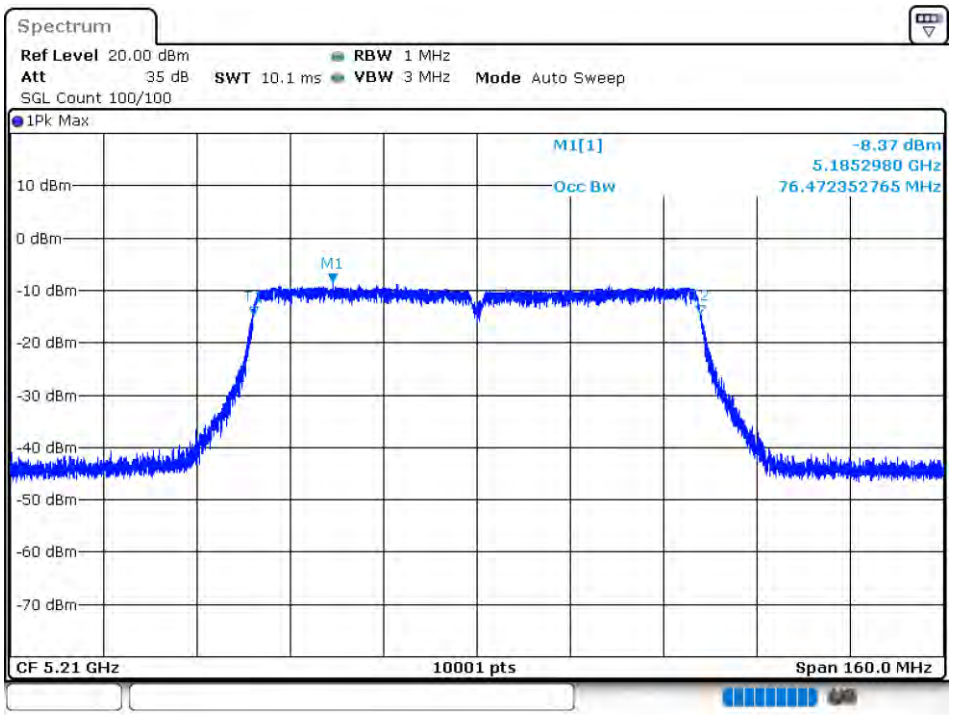
OBW NVNT 802.11ac80 5210MHz Ant 3



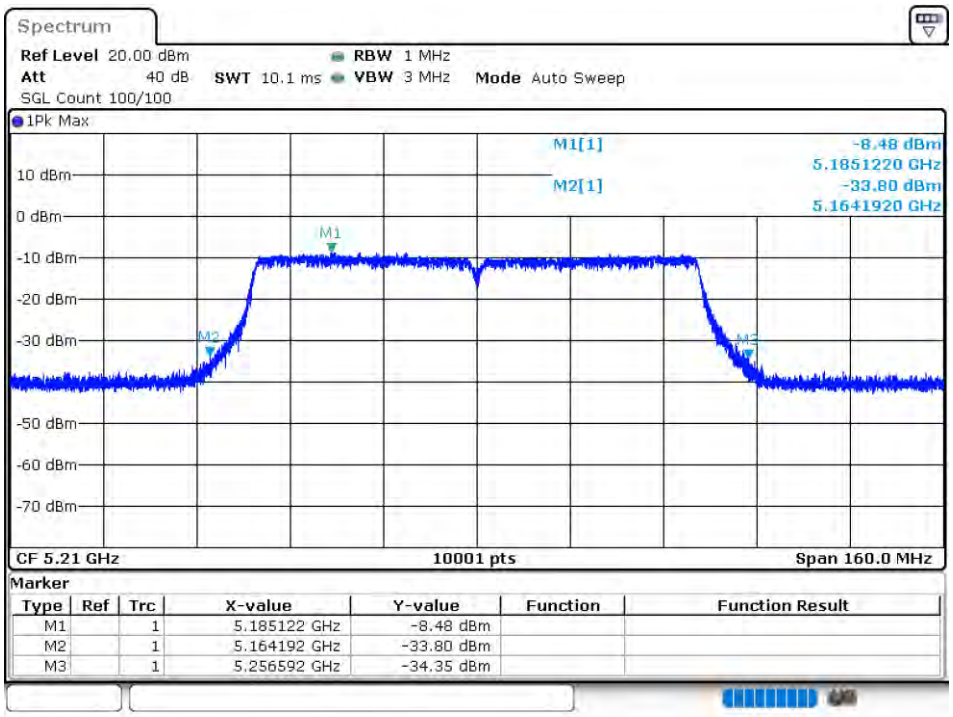

-26 dB BW NVNT 802.11ac80 5210MHz Ant 3



OBW NVNT 802.11ac80 5210MHz Ant 4



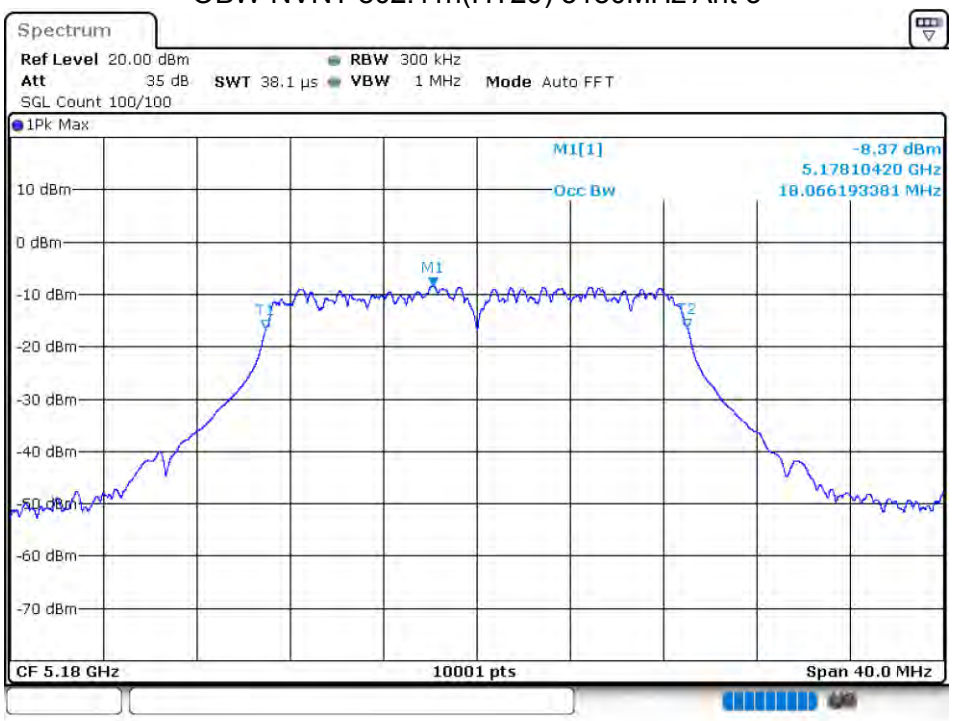

-26 dB BW NVNT 802.11ac80 5210MHz Ant 4



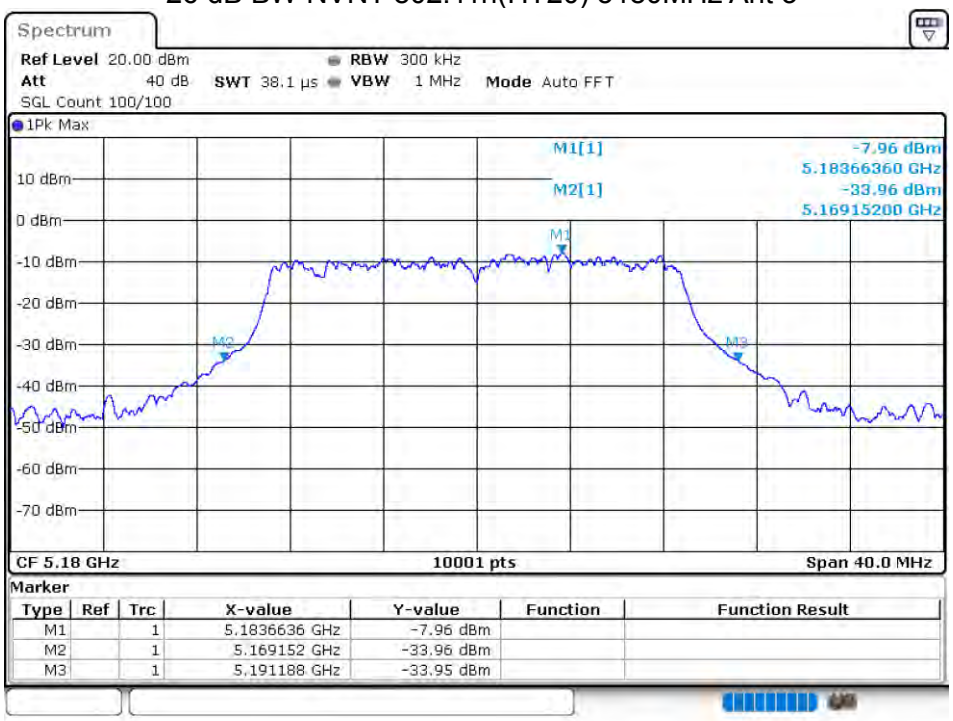

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.185122 GHz | -8.48 dBm | | |
| M2 | | 1 | 5.164192 GHz | -33.80 dBm | | |
| M3 | | 1 | 5.256592 GHz | -34.35 dBm | | |

OBW NVNT 802.11n(HT20) 5180MHz Ant 3



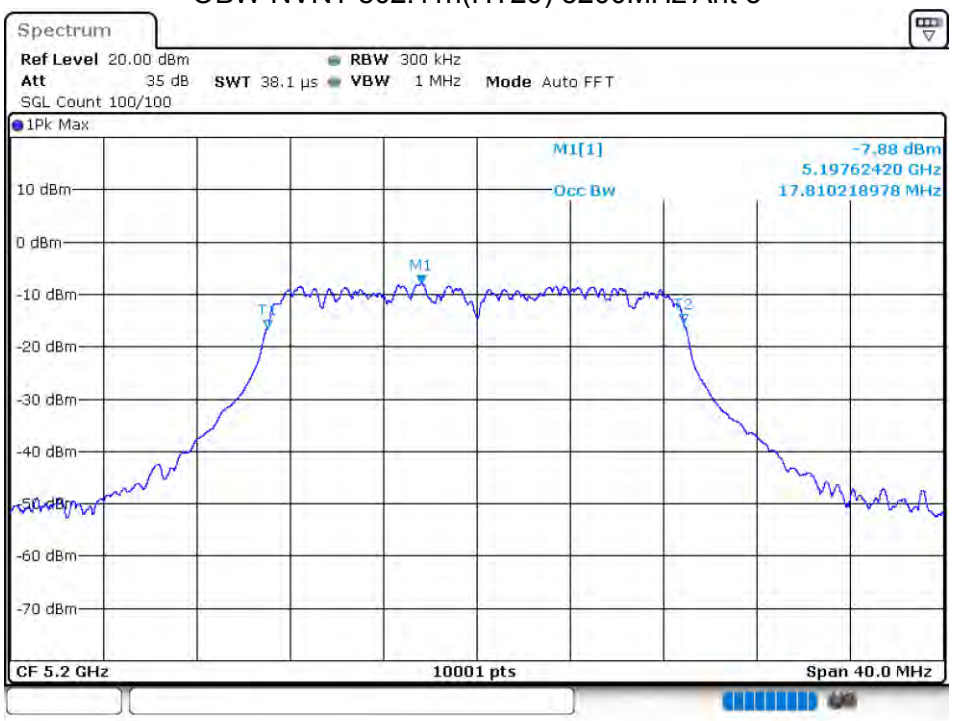

-26 dB BW NVNT 802.11n(HT20) 5180MHz Ant 3



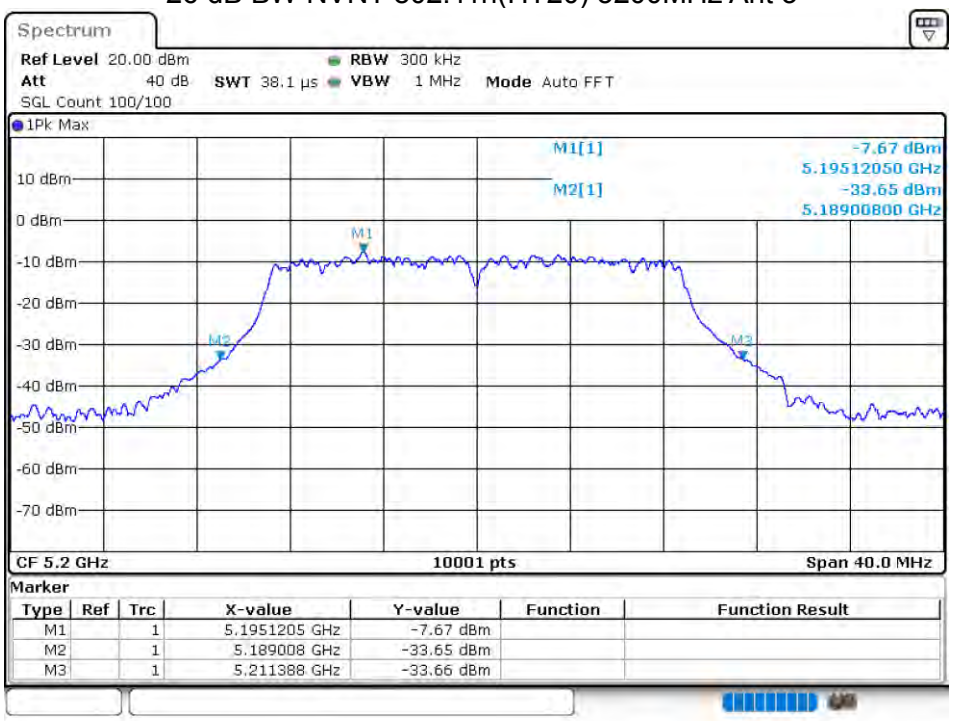

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.1836636 GHz | -7.96 dBm | | |
| M2 | | 1 | 5.169152 GHz | -33.96 dBm | | |
| M3 | | 1 | 5.191188 GHz | -33.95 dBm | | |

OBW NVNT 802.11n(HT20) 5200MHz Ant 3




-26 dB BW NVNT 802.11n(HT20) 5200MHz Ant 3

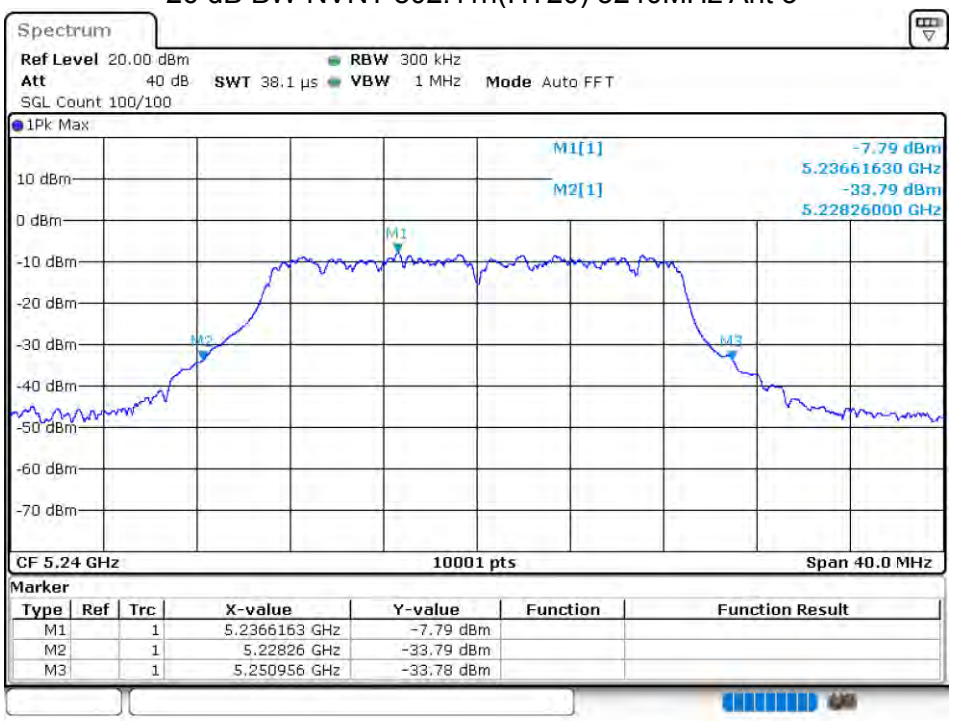



Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.1951205 GHz | -7.67 dBm | | |
| M2 | | 1 | 5.189008 GHz | -33.65 dBm | | |
| M3 | | 1 | 5.211388 GHz | -33.66 dBm | | |

OBW NVNT 802.11n(HT20) 5240MHz Ant 3

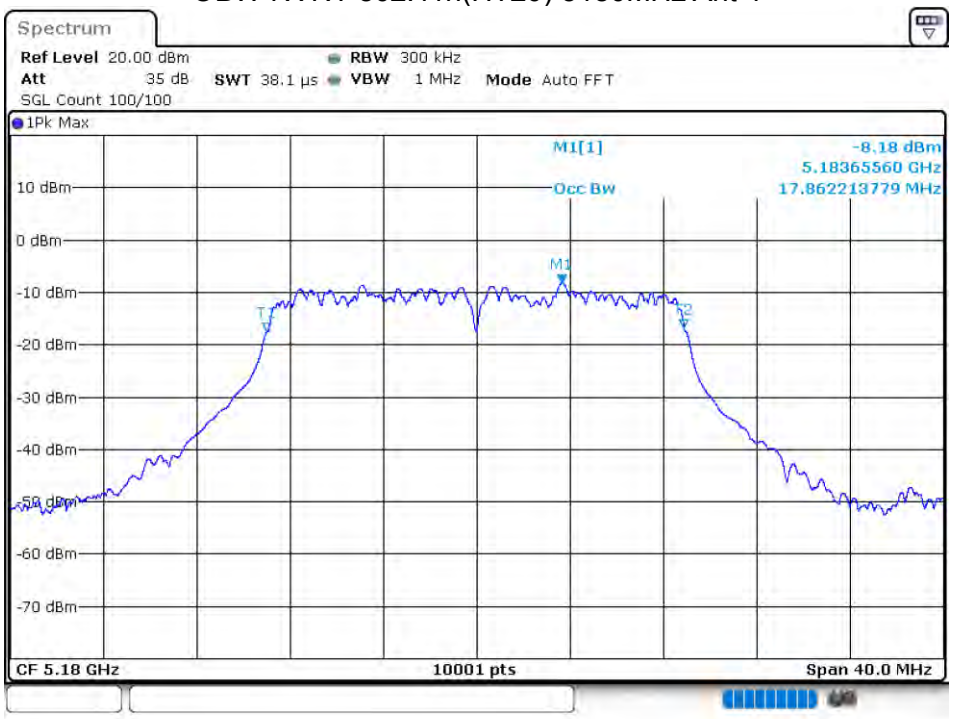
-26 dB BW NVNT 802.11n(HT20) 5240MHz Ant 3



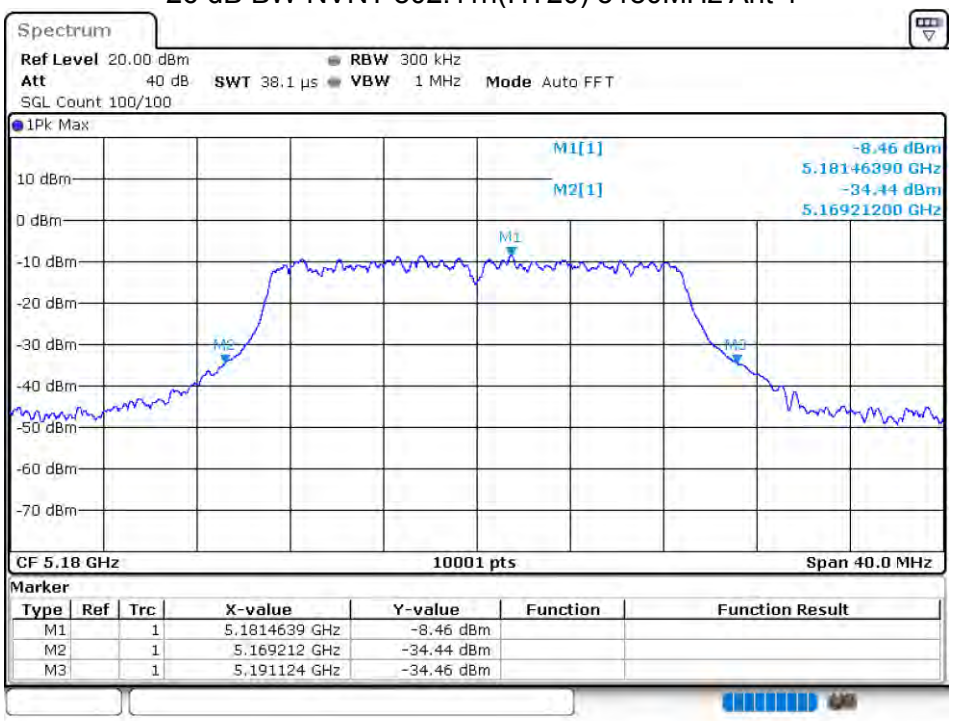

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.2366163 GHz | -7.79 dBm | | |
| M2 | | 1 | 5.22826 GHz | -33.79 dBm | | |
| M3 | | 1 | 5.250956 GHz | -33.78 dBm | | |

OBW NVNT 802.11n(HT20) 5180MHz Ant 4




-26 dB BW NVNT 802.11n(HT20) 5180MHz Ant 4

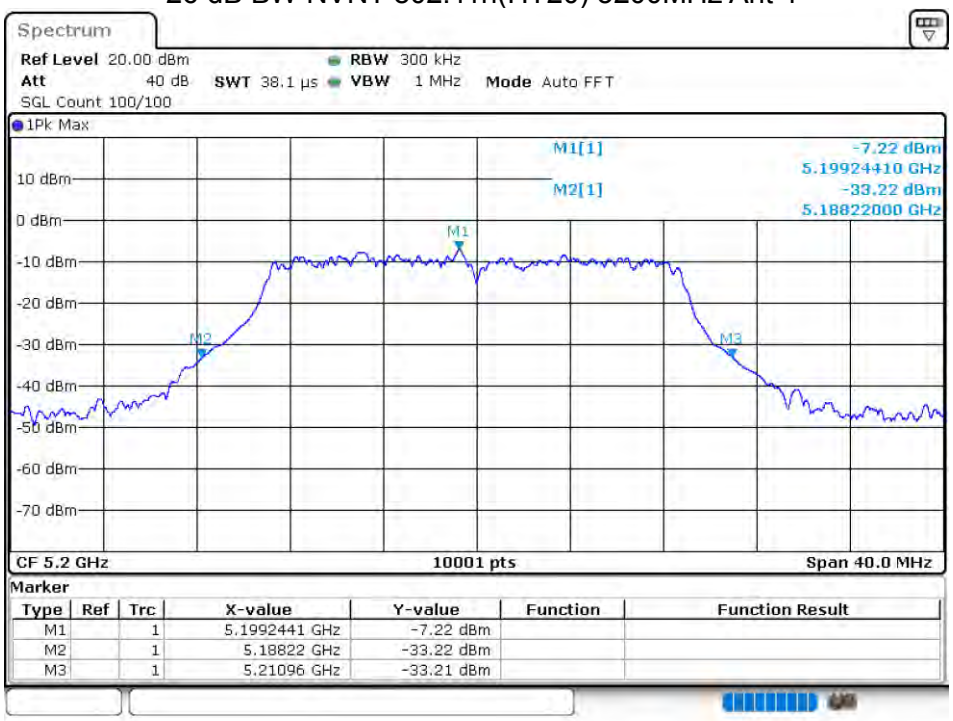



Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.1814639 GHz | -8.46 dBm | | |
| M2 | | 1 | 5.169212 GHz | -34.44 dBm | | |
| M3 | | 1 | 5.191124 GHz | -34.46 dBm | | |

OBW NVNT 802.11n(HT20) 5200MHz Ant 4

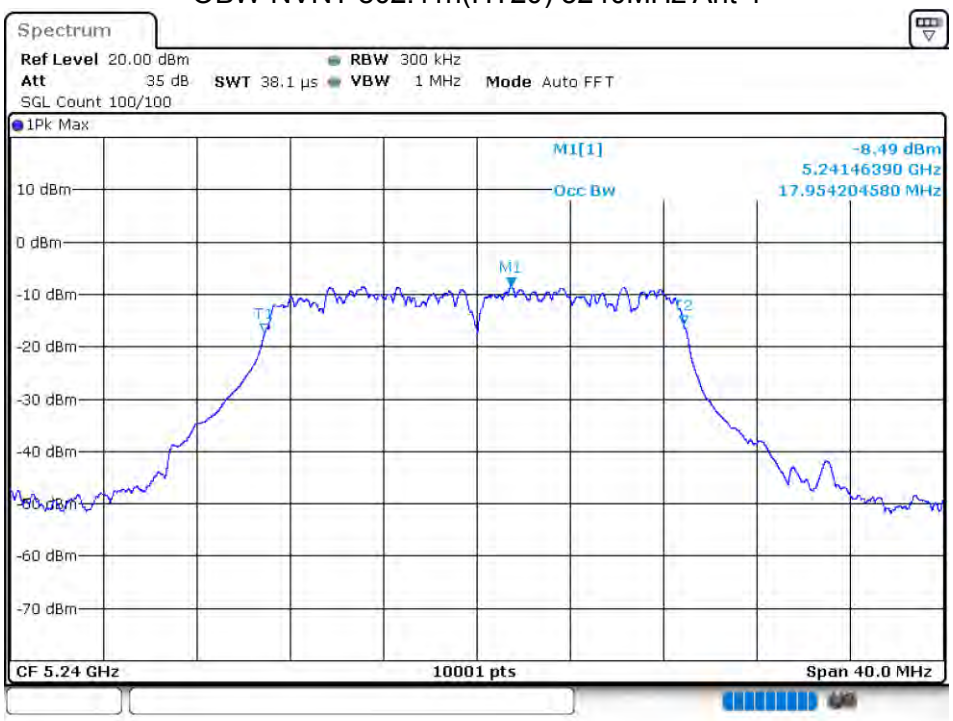
-26 dB BW NVNT 802.11n(HT20) 5200MHz Ant 4



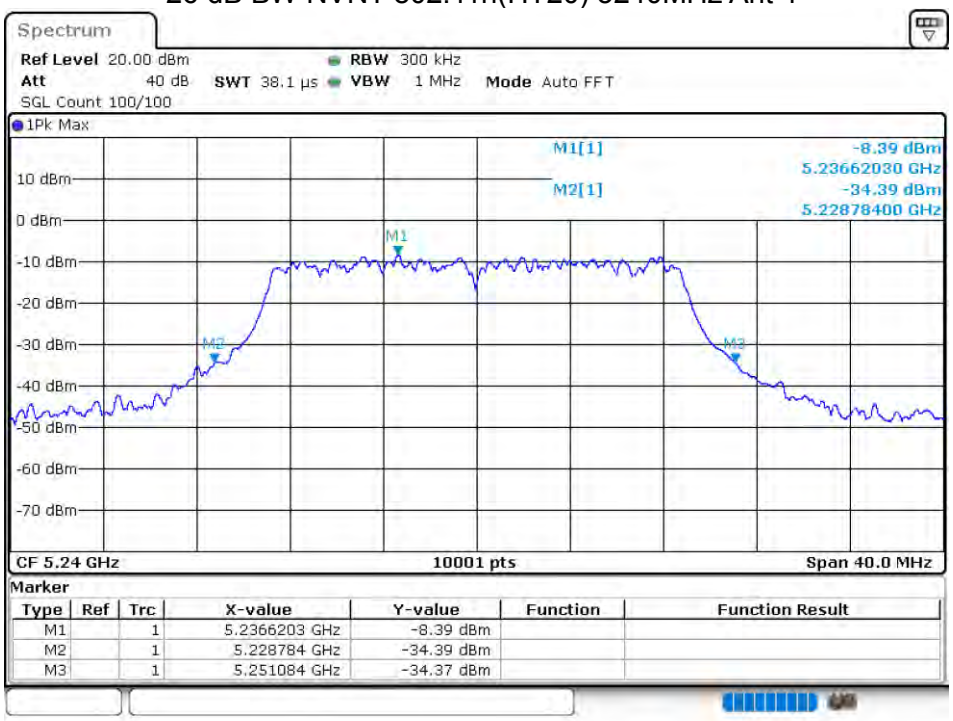

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.1992441 GHz | -7.22 dBm | | |
| M2 | | 1 | 5.18822 GHz | -33.22 dBm | | |
| M3 | | 1 | 5.21096 GHz | -33.21 dBm | | |

OBW NVNT 802.11n(HT20) 5240MHz Ant 4



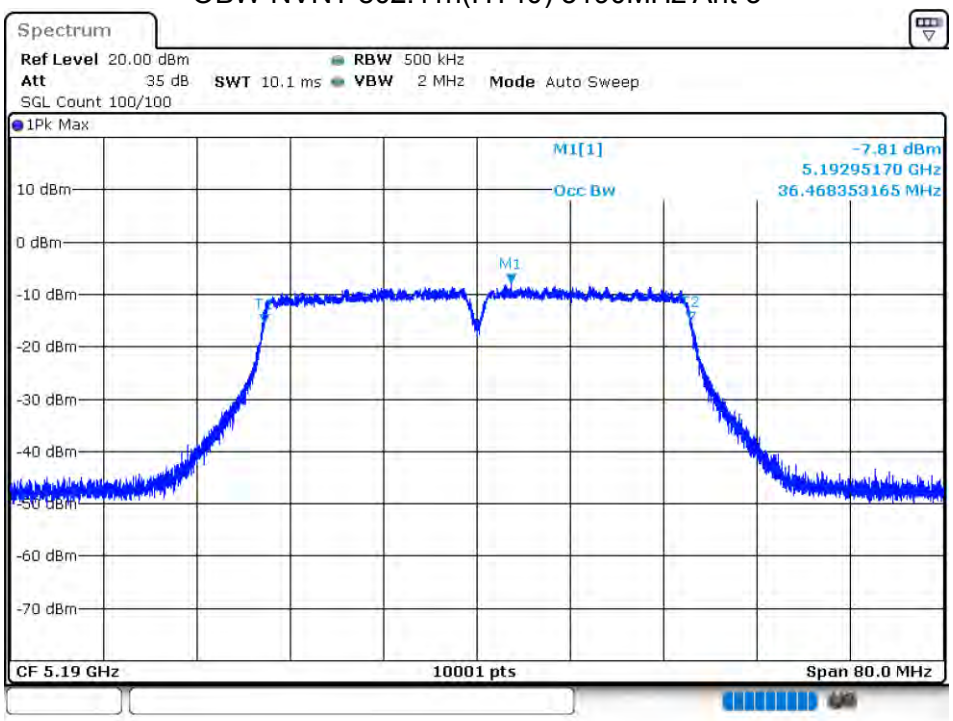

-26 dB BW NVNT 802.11n(HT20) 5240MHz Ant 4



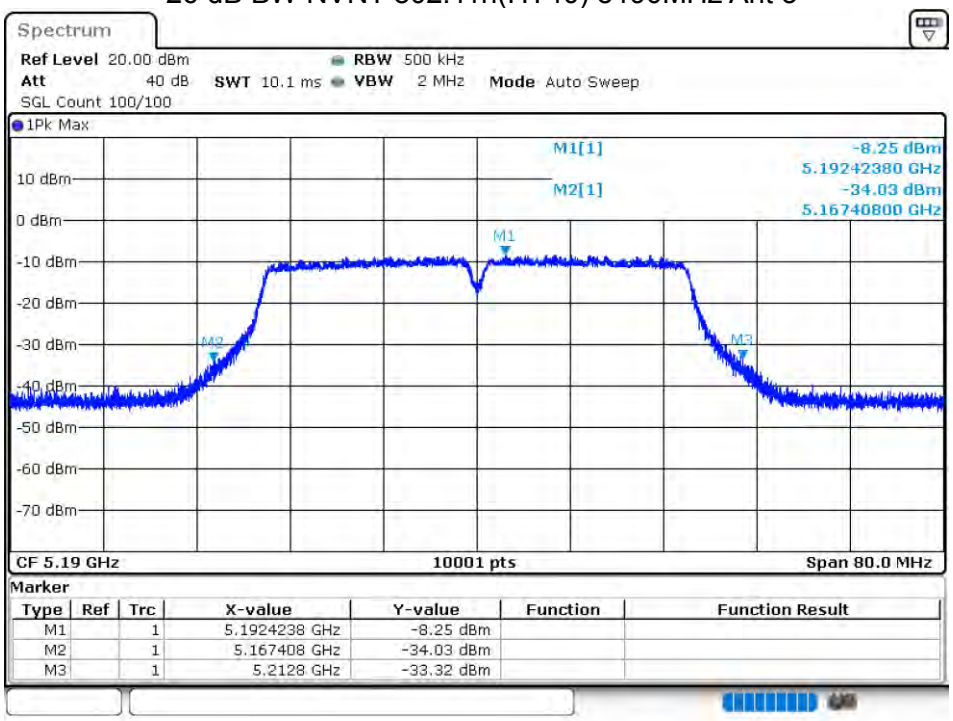

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.2366203 GHz | -8.39 dBm | | |
| M2 | | 1 | 5.228784 GHz | -34.39 dBm | | |
| M3 | | 1 | 5.251084 GHz | -34.37 dBm | | |

OBW NVNT 802.11n(HT40) 5190MHz Ant 3



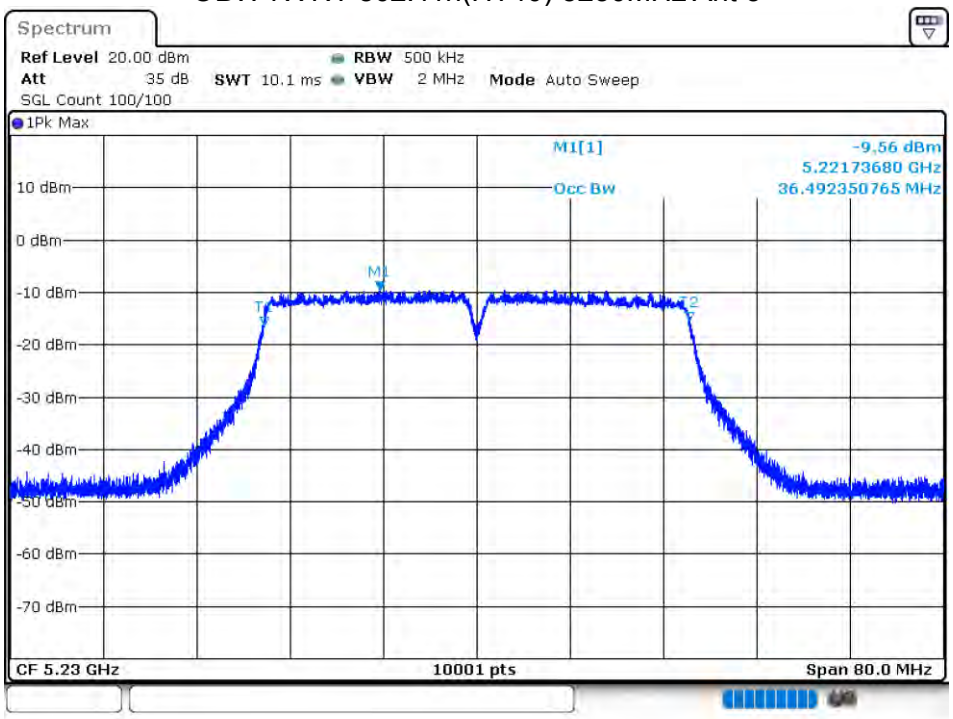

-26 dB BW NVNT 802.11n(HT40) 5190MHz Ant 3



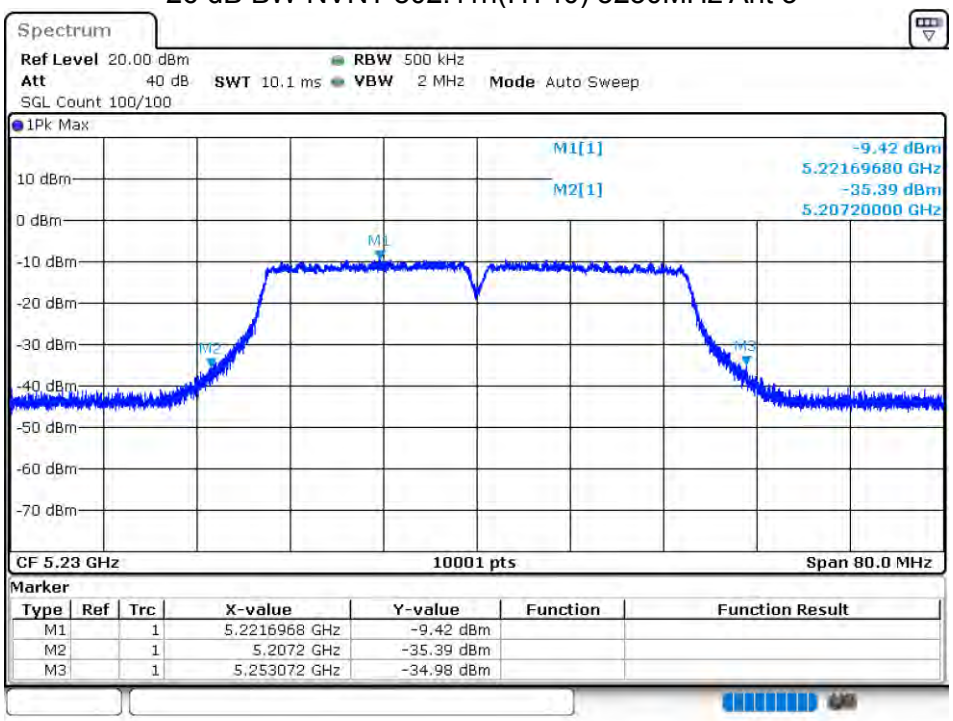

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.1924238 GHz | -8.25 dBm | | |
| M2 | | 1 | 5.167408 GHz | -34.03 dBm | | |
| M3 | | 1 | 5.2128 GHz | -33.32 dBm | | |

OBW NVNT 802.11n(HT40) 5230MHz Ant 3



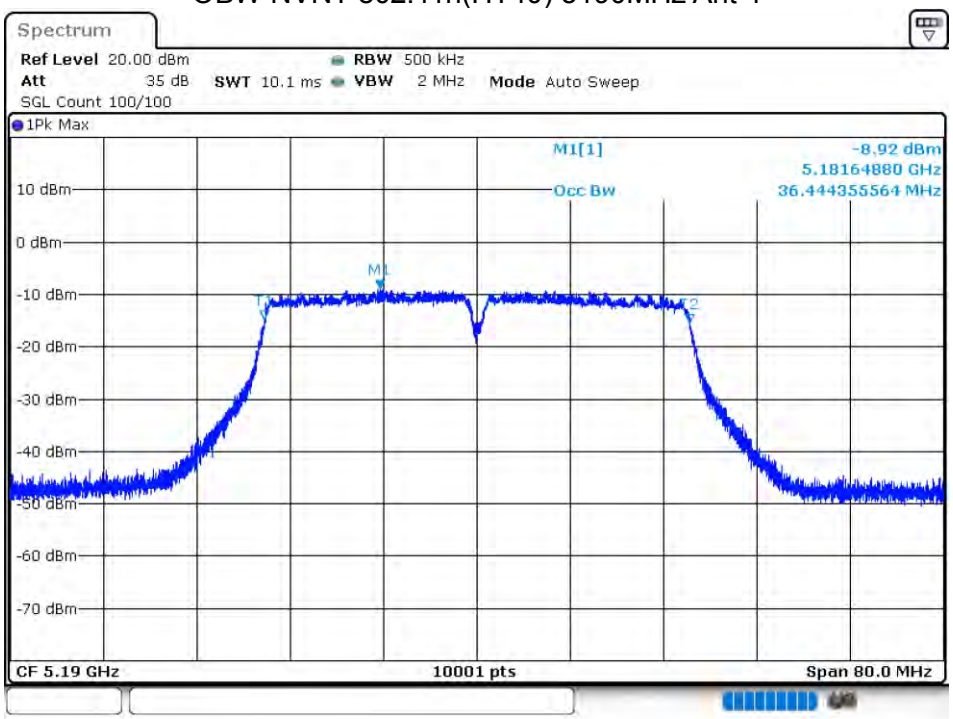

-26 dB BW NVNT 802.11n(HT40) 5230MHz Ant 3



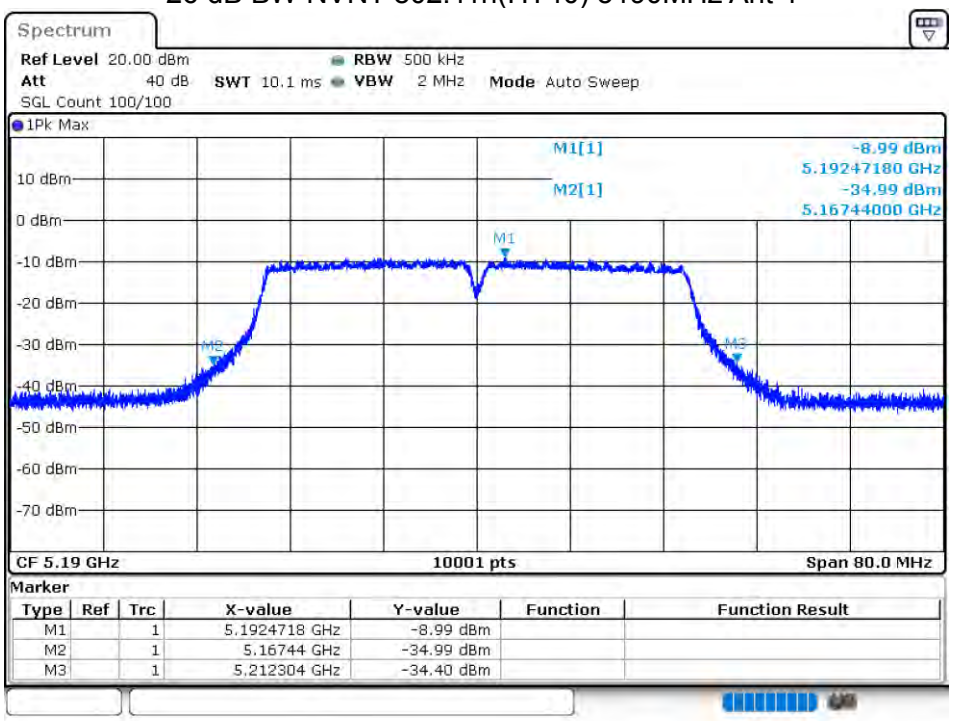

Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.2216968 GHz | -9.42 dBm | | |
| M2 | | 1 | 5.2072 GHz | -35.39 dBm | | |
| M3 | | 1 | 5.253072 GHz | -34.98 dBm | | |

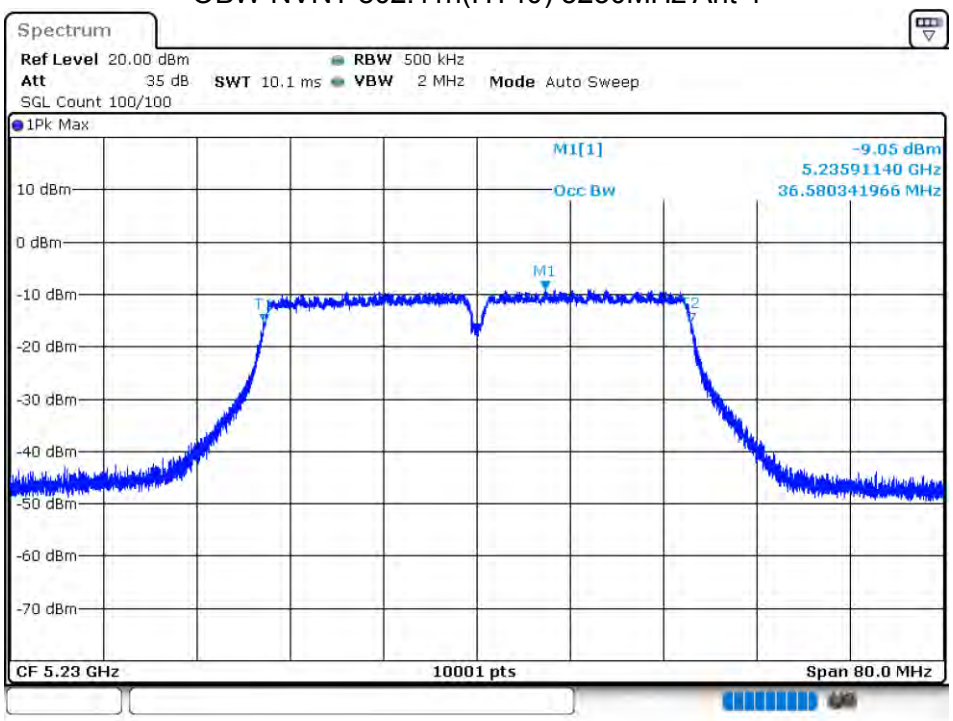
OBW NVNT 802.11n(HT40) 5190MHz Ant 4



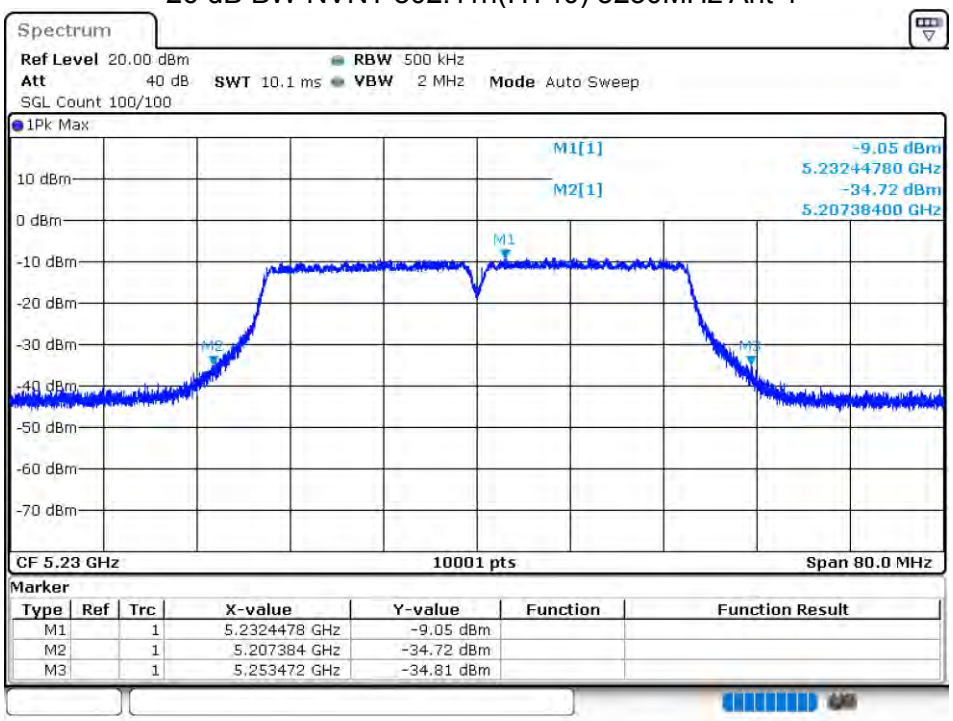

-26 dB BW NVNT 802.11n(HT40) 5190MHz Ant 4



OBW NVNT 802.11n(HT40) 5230MHz Ant 4




-26 dB BW NVNT 802.11n(HT40) 5230MHz Ant 4




Marker

| Type | Ref | Trc | X-value | Y-value | Function | Function Result |
|---|---|---|---|---|---|---|
| M1 | | 1 | 5.2324478 GHz | -9.05 dBm | | |
| M2 | | 1 | 5.207384 GHz | -34.72 dBm | | |
| M3 | | 1 | 5.253472 GHz | -34.81 dBm | | |