# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART E REQUIREMENT

## TEST REPORT

*For*

## Zalpha Series - Autonomous Mobile Robot

## Model No.: Zalpha-MG-S-01, Zalpha-MG-S-03, Zalpha-MG-S-05, Zalpha-MG-E-01, Zalpha-MG-E-03, Zalpha-MG-E-05, Zalpha-MG-L-01, Zalpha-MG-L-03, Zalpha-MG-L-05, Zalpha-TS-S-01, Zalpha-TS-S-03, Zalpha-TS-S-05, Zalpha-TS-E-01, Zalpha-TS-E-03, Zalpha-TS-E-05, Zalpha-TS-L-01, Zalpha-TS-L-03, Zalpha-TS-L-05, Zalpha-TS-SB-01, Zalpha-TS-SB-03, Zalpha-TS-SB-05, Zalpha-TS-EB-01, Zalpha-TS-EB-03, Zalpha-TS-EB-05

## FCC ID: 2AP2R-ZALPHA3-TS

**Trade Mark:** ZALPHA

## Report No.: EA20100455F05002

## Issue Date: September 18, 2021

*Prepared for*

## DF Automation & Robotics Sdn Bhd

## No 5, Jalan Impian Emas 18, Taman Impian Emas, Skudai, 81300, Johor, Malaysia.

*Prepared by*

**Dong Guan Anci Electronic Technology Co., Ltd.**
**1-2 Floor, Building A, No.11, Headquarters 2 Road, Songshan, Lake Hi-tech Industrial Development Zone, Dongguan City, Guangdong Pr., China.**

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# 1 TEST RESULT CERTIFICATION

| | |
|---|---|
| Applicant: | DF Automation & Robotics Sdn Bhd<br>No 5, Jalan Impian Emas 18, Taman lmpian Emas, Skudai, 81300, Johor, Malaysia. |
| Manufacturer: | DF Automation & Robotics Sdn Bhd<br>No 5, Jalan Impian Emas 18, Taman lmpian Emas, Skudai, 81300, Johor, Malaysia. |
| Product Description: | Zalpha Series - Autonomous Mobile Robot |
| Model Number: | Zalpha-MG-S-01, Zalpha-MG-S-03, Zalpha-MG-S-05, Zalpha-MG-E-01, Zalpha-MG-E-03, Zalpha-MG-E-05, Zalpha-MG-L-01, Zalpha-MG-L-03, Zalpha-MG-L-05, Zalpha-TS-S-01, Zalpha-TS-S-03, Zalpha-TS-S-05, Zalpha-TS-E-01, Zalpha-TS-E-03, Zalpha-TS-E-05, Zalpha-TS-L-01, Zalpha-TS-L-03, Zalpha-TS-L-05, Zalpha-TS-SB-01, Zalpha-TS-SB-03, Zalpha-TS-SB-05, Zalpha-TS-EB-01, Zalpha-TS-EB-03, Zalpha-TS-EB-05<br>(Note:1. Zalpha-Mg and Zalpha-TS: MG represent Magnetic Strip Guidance Navigation by using our magnetic sensor board (MSB), while TS represent Laser-based Natural Feature Navigation by using laser sensor to navigate.<br>2. S/E/L/SB/EB: They represent the body size configuration, S (Standard size), E (Extended size), L (Lowbed size), SB (Standard size with bottom sensor), EB (Extended size with bottom sensor)3) Number 01/03/05: They represent the payload. 01 = 100kg, 03 = 300kg, 05 = 500kg. We choose Zalpha-TS-EB-05 for all tests.) |

Measurement Procedure Used:

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULT** |
| FCC 47 CFR Part 2, Subpart J<br>FCC 47 CFR Part 15, Subpart E | **PASS** |

The above equipment was tested by Dong Guan Anci Electronic Technology Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 2 and Part 15.407
The test results of this report relate only to the tested sample identified in this report.

Date of Test : June 21, 2021 to September 02, 2021

Prepared by : Tomas Yang/Supervisor

Reviewer & Authorized Signer : Alan He/Manager

# TABLE OF CONTENTS

# 2 EUT TECHNICAL DESCRIPTION

<table>
<tr><th>Characteristics</th><th colspan="4">Description</th></tr>
<tr><td>IEEE 802.11 WLAN Mode Supported</td><td colspan="4">☒802.11a(20MHz channel bandwidth)<br>☒802.11b(20MHz channel bandwidth)<br>☒802.11g(20MHz channel bandwidth)<br>☒802.11n(20MHz channel bandwidth)<br>☒802.11n(40MHz channel bandwidth)</td></tr>
<tr><td>Data Rate</td><td colspan="4">WIFI:<br>802.11 b:1,2,5.5,11Mbps;<br>802.11 g/a:6,9,12,18,24,36,48,54Mbps;<br>802.11n(HT20): MCS0-MCS15;<br>802.11n(HT40): MCS0-MCS15</td></tr>
<tr><td>Modulation</td><td colspan="4">WIFI:<br>OFDM with BPSK/QPSK/16QAM/64QAM for 802.11a/g/n;<br>DSSS with DBPSK/DQPSK/CCK for 802.11b;</td></tr>
<tr><td rowspan="6">Operating Frequency Range</td><td>WIFI 5G Band</td><td>Mode</td><td>Frequency Range(MHz)</td><td>Number of channels</td></tr>
<tr><td rowspan="2">UNII Band I</td><td>802.11a/n(HT20</td><td>5180-5240</td><td>4</td></tr>
<tr><td>802.11n(HT40)</td><td>5190-5230</td><td>2</td></tr>
<tr><td rowspan="2">UNII Band III</td><td>802.11a/n(HT20)</td><td>5745-5825</td><td>5</td></tr>
<tr><td>802.11n(HT40)</td><td>5755-5795</td><td>2</td></tr>
<tr><td colspan="4">2.4G WIFI:<br>2412-2462MHz for 802.11b/g;<br>2412-2462MHz for 802.11n(HT20);<br>2422-2452MHz for 802.11n(HT40);</td></tr>
<tr><td>Transmit Power Max</td><td colspan="4">21.925 dBm for WIFI 2.4G Band;<br>18.12 dBm for UNII Band I;<br>16.38 dBm for UNII Band III</td></tr>
<tr><td>Antenna Type</td><td colspan="4">External antenna<br>Two antenna for WIFI</td></tr>
<tr><td>Max Antenna Gain</td><td colspan="4">2.0 dBi for WIFI 2.4 Band<br>4.0 dBi for WIFI 5G Band I<br>4.0 dBi for WIFI 5G Band III</td></tr>
<tr><td>Directional Gain</td><td colspan="4">5 dBi for WIFI 2.4G Band<br>7.01 dBi for WIFI 5G Band I<br>7.01 dBi for WIFI 5G Band III</td></tr>
<tr><td>Power supply</td><td colspan="4">DC 28.8V, 12.5A</td></tr>
</table>

***Note:*** *for more details, please refer to the User's manual of the EUT.*

# 3 SUMMARY OF TEST RESULT

| FCC Part Clause | Test Parameter | Verdict | Remark |
|---|---|---|---|
| 15.407 (a)<br>15.407 (e) | 99% , 6dB and 26dB Bandwidth | PASS | |
| 15.407 (a) | Maximum Conducted Output Power | PASS | |
| 15.407 (a) | Peak Power Spectral Density | PASS | |
| 15.407 (b) | Radiated Spurious Emission | PASS | |
| 15.407(g) | Frequency Stability | PASS | |
| 15.407 (b)(6)<br>15.207 | Power Line Conducted Emission | PASS | |
| 15.407(a)<br>15.203 | Antenna Application | PASS | |
| NOTE1: N/A (Not Applicable)<br>NOTE2: According to FCC OET KDB 789033 D2 General UNII Test Procedures New Rules v01r03, In addition, the radiated test is also performed to ensure the emissions emanating from the device cabinet also comply with the applicable limits. | | | |

RELATED SUBMITTAL(S) / GRANT(S):

This submittal(s) (test report) is intended for FCC ID: 2AP2R-ZALPHA3-TS filing to comply with Section 15.247 of the FCC Part 15, Subpart E Rules.

# 4 TEST METHODOLOGY

## 4.1 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to its specifications, the EUT must comply with the requirements of the following standards:
FCC 47 CFR Part 2, Subpart J
FCC 47 CFR Part 15, Subpart E
FCC KDB 789003 D2 General UNII Test Procedures New Rules v01r03
FCC KDB 662911 D01 Multiple Transmitter Output v02r01
FCC KDB 662911 D02 MIMO With Cross Polarized Antenna V01

## 4.2 MEASUREMENT EQUIPMENT USED

4.2.1 Conducted Emission Test Equipment

| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | DUE CAL. |
|---|---|---|---|---|---|
| L.I.S.N | SCHWARZBECK | NSLK 8127 | 8127-669 | 2021-05-23 | 2022-05-22 |
| 10 db attenuator | JFW | 50FP-010-H4 | 4360846-427-1 | 2021-05-23 | 2022-05-22 |
| RF Cable | N/A | N/A | 2# | 2021-05-23 | 2022-05-22 |
| EMI Test Receiver | ROHDE&SCHWARZ | ESCI | 101358 | 2021-05-23 | 2022-05-22 |
| Shielded Room | chengyu | 8m*4m*3m | N/A | 2021-05-23 | 2022-05-22 |
| Test Software | Farad | EZ-EMC Ver:ANCI-8A1 | N/A | N/A | N/A |

4.2.2 Radiated Emission Test Equipment

| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | DUE CAL. |
|---|---|---|---|---|---|
| EMI Test Receiver | Rohde & Schwarz | ESPI | 100502 | 2020-11-20 | 2021-11-19 |
| Pre-Amplifier | HP | 8447D | 2727A06172 | 2021-05-23 | 2022-05-22 |
| Bilog Antenna | Schwarzbeck | VULB9163 | VULB9163-588 | 2021-05-23 | 2022-05-22 |
| Loop Antenna | Schwarzbeck | FMZB 1516 | 1516-141 | 2020-11-20 | 2021-11-19 |
| Spectrum Analyzer | Rohde & Schwarz | FSV40 | US40240623 | 2020-11-20 | 2021-11-19 |
| Low noise Amplifiers | A-INFO | LA1018N4009 | J1013130524001 | 2021-05-23 | 2022-05-22 |
| Horn antenna | A-INFO | LB-10180-SF | J2031090612123 | 2020-11-20 | 2022-05-22 |
| Broadband RF Power Amplifier | AEROFLEX | AEROFLEX100KHz-40GHz | J1013130524001 | 2020-11-20 | 2021-11-19 |
| DRG Horm Antenna | A.H.SYSTEMS | SAS-574 | J2031090612123 | 2020-11-20 | 2021-11-19 |
| RF Cable | Gigalink Microwave | ZT40-2.92J-2.92J-2m | N/A | 2020-11-20 | 2021-11-19 |
| RF Cable | Gigalink Microwave | ZT40-2.92J-2.92J-0.3m | N/A | 2020-11-20 | 2021-11-19 |
| RF Cable | N/A | N/A | 6# | 2021-05-23 | 2022-05-22 |
| RF Cable | N/A | N/A | 1-1# | 2021-05-23 | 2022-05-22 |
| RF Cable | N/A | N/A | 1-2# | 2021-05-23 | 2022-05-22 |
| RF Cable | N/A | N/A | 7# | 2021-05-23 | 2022-05-22 |
| 3m Semi-anechoic Chamber | chengyu | 9m*6m*6m | N/A | 2021-05-23 | 2022-05-22 |

4.2.3 Radio Frequency Test Equipment

| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | DUE CAL. |
|---|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSV40 | US40240623 | 2020-11-20 | 2021-11-19 |

| | | | | | |
|---|---|---|---|---|---|
| Coaxial Cable | Gigalink Microwave | ZT40 | 19022092 | 2020-11-20 | 2021-11-19 |
| Antenna Connector | ARTHUR-YANG | 2244-N1TG1 | N/A | 2020-11-20 | 2021-11-19 |
| USB RF Power sensor | RadiPower | RPR3006W | 17I00015SNO88 | 2020-11-20 | 2021-11-19 |
| RF Test Software | MAIWEI | MTS 8310 | N/A | N/A | N/A |

***Remark:*** *Each piece of equipment is scheduled for calibration once a year.*

## 4.3 DESCRIPTION OF TEST MODES

The EUT has been tested under its typical operating condition.
The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Those data rates (☒802.11a: 6 Mbps; ☒802.11n (HT20): MCS0; ☒802.11n (HT20): MCS15; ☒802.11n (HT40): MCS0; ☒802.11n (HT40): MCS15;) were used for all test.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

☒Wifi 5G with UNII Band I

Frequency and Channel list for 802.11a/n(HT20):

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---|---|---|---|---|---|
| 36 | 5180 | 44 | 5220 | | |
| 40 | 5200 | 48 | 5240 | | |

Frequency and Channel list for 802.11n(HT40):

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---|---|---|---|---|---|
| 38 | 5190 | | | | |
| 46 | 5230 | | | | |

Test Frequency and Channel for 802.11a/n(HT20)):

| Lowest Frequency | | Middle Frequency | | Highest Frequency | |
|---|---|---|---|---|---|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 36 | 5180 | 40 | 5200 | 48 | 5240 |

Test Frequency and channel for 802.11n(VHT40):

| Lowest Frequency | | Middle Frequency | | Highest Frequency | |
|---|---|---|---|---|---|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 38 | 5190 | N/A | N/A | 46 | 5230 |

☒ Wifi 5G with UNII Band III

Frequency and Channel list for 802.11a/n(HT20):

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---|---|---|---|---|---|
| 149 | 5745 | 157 | 5785 | 165 | 5825 |
| 153 | 5765 | 161 | 5805 | | |

Frequency and Channel list for 802.11n(HT40):

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---|---|---|---|---|---|
| 151 | 5755 | | | | |
| 159 | 5795 | | | | |

Fr

Test Frequency and Channel for 802.11a/n(HT20):

| Lowest Frequency | | Middle Frequency | | Highest Frequency | |
|---|---|---|---|---|---|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 149 | 5745 | 157 | 5785 | 165 | 5825 |

Test Frequency and channel for 802.11n(HT40):

| Lowest Frequency | | Middle Frequency | | Highest Frequency | |
|---|---|---|---|---|---|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 151 | 5755 | N/A | N/A | 159 | 5795 |

# 5 FACILITIES AND ACCREDITATIONS

## 5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

1-2 Floor, Building A, No.11, Headquarters 2 Road, Songshan, Lake Hi-tech Industrial Development Zone, Dongguan City, Guangdong Pr., China.
The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10 and CISPR Publication 22.

## 5.2 LABORATORY ACCREDITATIONS AND LISTINGS

Site Description

| | | |
|---|---|---|
| EMC Lab | : | Accredited by CNAS, 2017.06.26<br>The certificate is valid until 2022.10.28<br>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 L6214.<br><br>Accredited by A2LA, 2018.03.15<br>The Certificate Number is 4422.01.<br>. |
| Name of Firm | : | Dong Guan Anci Electronic Technology Co., Ltd.<br>1-2 Floor, Building A, No.11, Headquarters 2 Road, Songshan, Lake Hi-tech Industrial Development Zone, Dongguan City, Guangdong Pr., China. |

# 6 TEST SYSTEM UNCERTAINTY

The following measurement uncertainty levels have been estimated for tests performed on the apparatus:

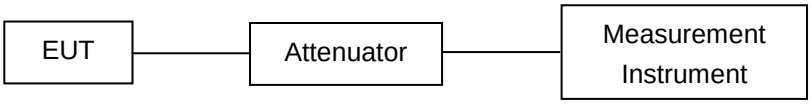
| Parameter | Uncertainty |
|---|---|
| Radio Frequency | ±1x10^-5 |
| Maximum Peak Output Power Test | ±1.0dB |
| Conducted Emissions Test | ±2.0dB |
| Radiated Emission Test | ±2.0dB |
| Power Density | ±2.0dB |
| Occupied Bandwidth Test | ±1.0dB |
| Band Edge Test | ±3dB |
| All emission, radiated | ±3dB |
| Antenna Port Emission | ±3dB |
| Temperature | ±0.5℃ |
| Humidity | ±3% |

Measurement Uncertainty for a level of Confidence of 95%

# 7 SETUP OF EQUIPMENT UNDER TEST

## 7.1 RADIO FREQUENCY TEST SETUP

The WLAN component's antenna ports(s) of the EUT are connected to the measurement instrument per an appropriate attenuator. The EUT is controlled by PC/software to emit the specified signals for the purpose of measurements.




## 7.2 RADIO FREQUENCY TEST SETUP

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.10. 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.

Below 30MHz：

The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna (loop antenna). The Antenna should be positioned with its plane vertical at the specified distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. The center of the loop shall be 1 m above the ground. For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT.

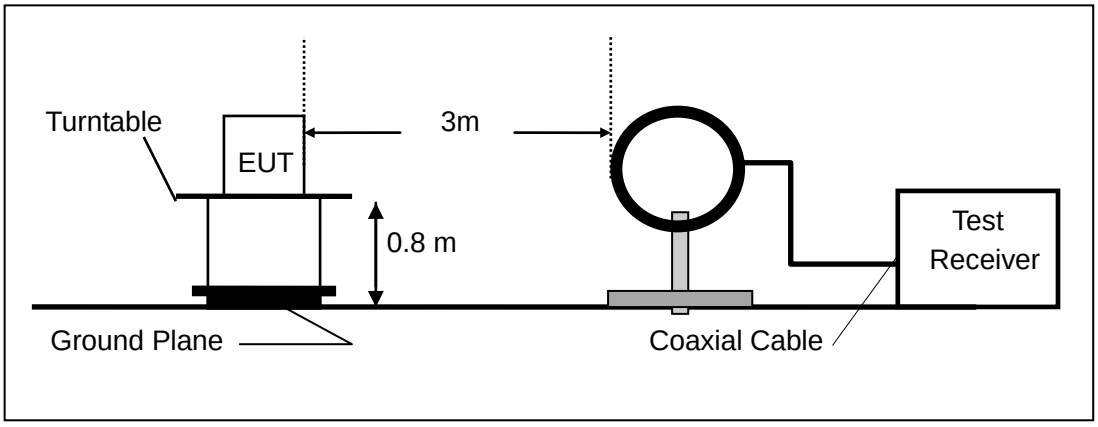
Above 30MHz：

The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

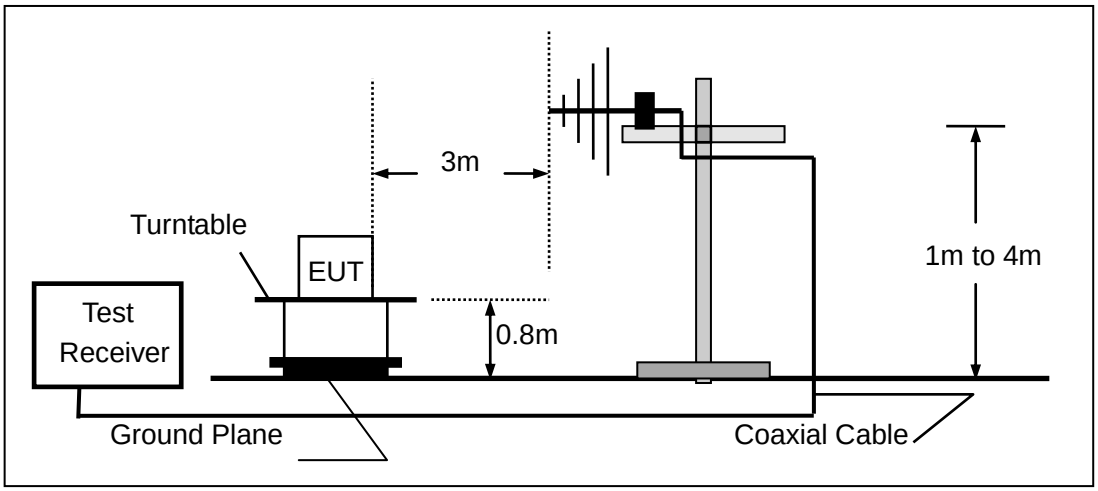
Above 1GHz：

(Note: the FCC's permission to use 1.5m as an alternative per TCBC Conf call of Dec. 2, 2014.)
The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

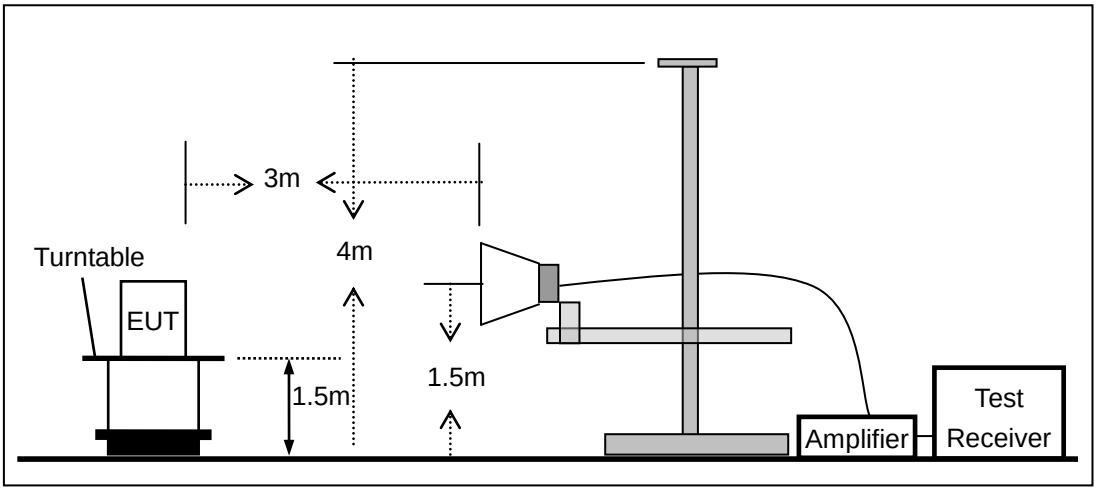
(a) Radiated Emission Test Set-Up, Frequency Below 30MHz



(b) Radiated Emission Test Set-Up, Frequency Below 1000MHz

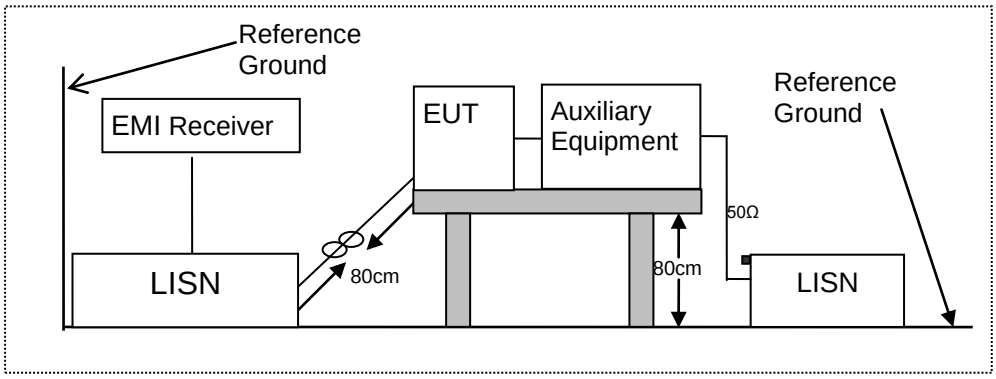



(c) Radiated Emission Test Set-Up, Frequency above 1000MHz

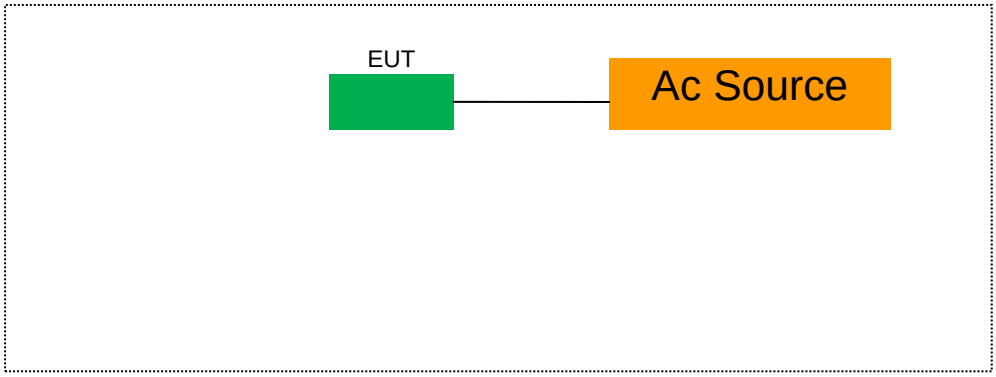


## 7.3 CONDUCTED EMISSION TEST SETUP

The mains cable of the EUT must be connected to LISN. The LISN shall be placed 0.8 m from the boundary of EUT and bonded to a ground reference plane for LISN mounted on top of the ground reference plane. This distance is between the closest points of the LISN and the EUT. All other units of the EUT and associated equipment shall be at least 0.8m from the LISN.
Ground connections, where required for safety purposes, shall be connected to the reference ground point of the LISN and, where not otherwise provided or specified by the manufacturer, shall be of same length as the mains cable and run parallel to the mains connection at a separation distance of not more than 0.1 m.
According to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode.



## 7.4 BLOCK DIAGRAM CONFIGURATION OF TEST SYSTEM




## 7.5 SUPPORT EQUIPMENT

| Item | Equipment | Mfr/Brand | Model/Type No. | FCC ID | Series No. | Note |
|---|---|---|---|---|---|---|
| N/A | N/A | N/A | N/A | N/A | N/A | N/A |

***Notes:***

1. *All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
2. *Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*

# 8 TEST REQUIREMENTS

## 8.1 BANDWIDTH MEASUREMENT

### 8.1.1 Applicable Standard

According to FCC Part 15.407(a)(1) for UNII Band I
According to FCC Part 15.407(e) for UNII Band III

### 8.1.2 Conformance Limit

No limit requirement.
The minimum 6 dB emission bandwidth of at least 500 KHz for the UNII Band III.

### 8.1.3 Test Configuration

Test according to clause 6.1 radio frequency test setup

### 8.1.4 Test Procedure

Connect the antenna port(s) to the spectrum analyzer input. Using the spectrum analyzer Channel Bandwidth mode, configure the spectrum analyzer as shown below

- The following procedure shall be used for measuring (26 dB) power bandwidth:

Center Frequency: test Frequency
Set RBW = approximately 1% of the emission bandwidth.
Set the VBW > RBW.
Detector = Peak.
Trace mode = max hold.
X dB Bandwidth: 26 dB
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%.

- Minimum Emission Bandwidth for the UNII Band III

Center Frequency: test Frequency
Set RBW = 100 kHz
Set VBW ≥ 3 · RBW
Detector = Peak
Trace mode = max hold
Sweep = auto couple
X dB Bandwidth: 6 dB
Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

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

Set center frequency to the nominal EUT channel center frequency.
Set span = 1.5 times to 5.0 times the OBW.
Set RBW = 1 % to 5 % of the OBW
Set VBW ≥ 3 · RBW
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.
Use the 99 % power bandwidth function of the instrument (if available).
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.

8.1.5 Test Results

We tested antenna A and antenna B. The test results are similar, the worst test data for Antenna A:

☒ 802.11a mode

Temperature : 28℃ Test Date : June 27, 2021
Humidity : 65 % Test By: Jack

| Band | Channel Number | Channel Freq. (MHz) | 26dB EBW | 99% OBW | Limit (MHz) | Verdict |
|---|---|---|---|---|---|---|
| UNII Band I | CH36 | 5180 | 19.78 | 16.66 | N/A | N/A |
| | CH40 | 5200 | 19.90 | 16.70 | N/A | N/A |
| | CH48 | 5240 | 19.70 | 16.66 | N/A | N/A |
| UNII Band III | CH149 | 5745 | 19.94 | 16.66 | N/A | N/A |
| | CH157 | 5785 | 19.74 | 16.66 | N/A | N/A |
| | CH165 | 5825 | 19.94 | 16.66 | N/A | N/A |
| Note: N/A (Not Applicable) | | | | | | |

☒ 802.11n(VHT20) mode

Temperature : 28℃ Test Date : June 27, 2021
Humidity : 65 % Test By: Jack

| Band | Channel Number | Channel Freq. (MHz) | 26dB EBW | 99% OBW | Limit (MHz) | Verdict |
|---|---|---|---|---|---|---|
| UNII Band I | CH36 | 5180 | 20.14 | 17.74 | N/A | N/A |
| | CH40 | 5200 | 20.38 | 17.70 | N/A | N/A |
| | CH48 | 5240 | 20.34 | 17.70 | N/A | N/A |
| UNII Band III | CH149 | 5745 | 20.22 | 17.74 | N/A | N/A |
| | CH157 | 5785 | 20.46 | 17.74 | N/A | N/A |
| | CH165 | 5825 | 20.14 | 17.74 | N/A | N/A |
| Note: N/A (Not Applicable) | | | | | | |

☒ 802.11n(VHT40) mode

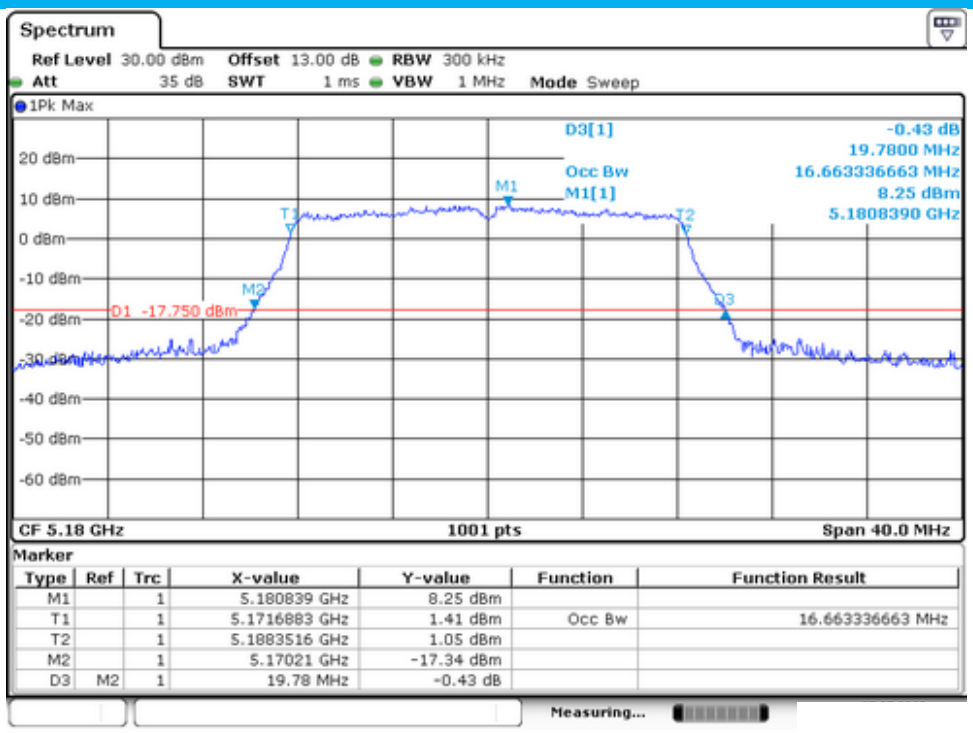
Temperature : 28℃ Test Date : June 27, 2021
Humidity : 65 % Test By: Jack

| Band | Channel Number | Channel Freq. (MHz) | 26dB EBW | 99% OBW | Limit (MHz) | Verdict |
|---|---|---|---|---|---|---|
| UNII Band I | CH38 | 5190 | 40.70 | 36.20 | N/A | N/A |
| | CH46 | 5230 | 40.68 | 36.20 | N/A | N/A |
| UNII Band III | CH151 | 5755 | 40.68 | 36.12 | N/A | N/A |
| | CH159 | 5795 | 40.84 | 36.20 | N/A | N/A |
| Note: N/A (Not Applicable) | | | | | | |

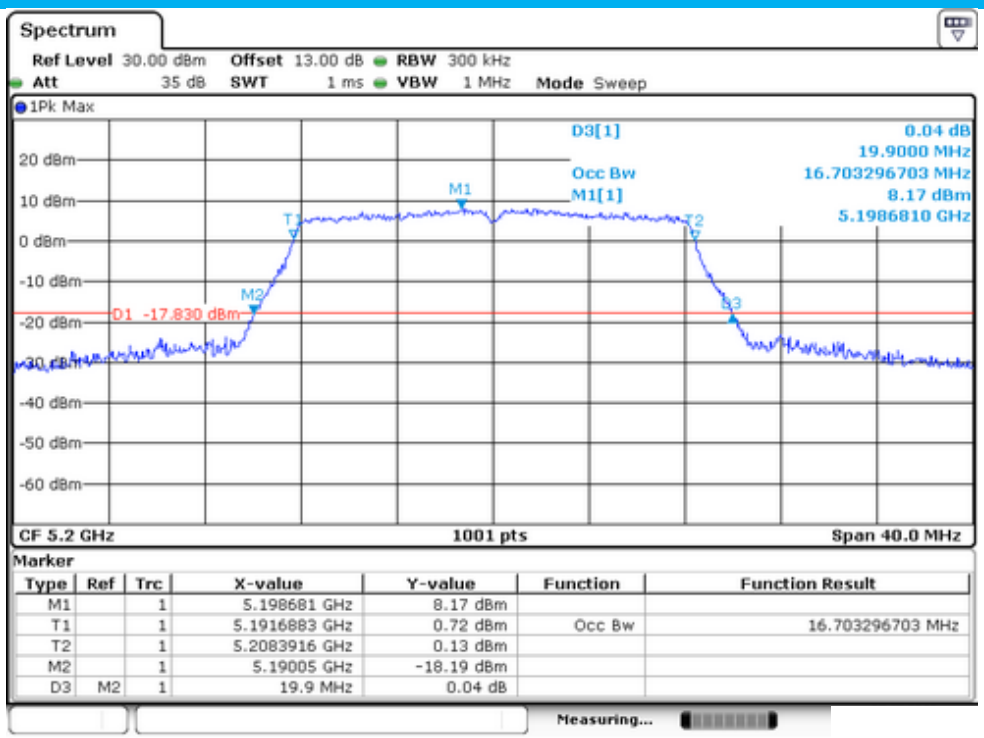
| | | | |
|---|---|---|---|
| | | ☒ UNII Band III | |
| Temperature : | 28℃ | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |

| Operation Mode | Channel Number | Channel Freq. (MHz) | 6dB EBW | Limit (MHz) | Verdict |
|---|---|---|---|---|---|
| 802.11a | CH149 | 5745 | 16.34 | 500 | PASS |
| | CH157 | 5785 | 16.30 | 500 | PASS |
| | CH165 | 5825 | 16.30 | 500 | PASS |
| 802.11n (VHT20) | CH149 | 5745 | 16.90 | 500 | PASS |
| | CH157 | 5785 | 17.38 | 500 | PASS |
| | CH165 | 5825 | 17.06 | 500 | PASS |
| 802.11n (VHT40) | CH151 | 5755 | 35.64 | 500 | PASS |
| | CH159 | 5795 | 35.72 | 500 | PASS |
| Note:<br>N/A (Not Applicable) | | | | | |

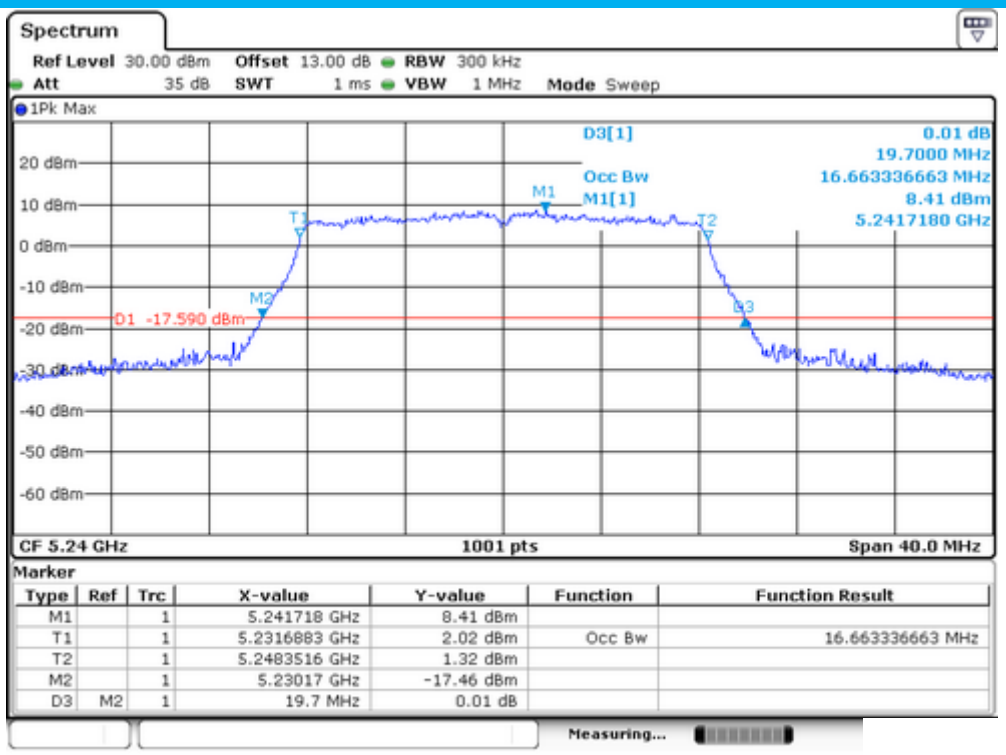
| Emission Bandwidth&99% Occupied Bandwidth | | UNII Band I | |
|---|---|---|---|
| Test Model | 802.11a | Frequency(MHz) | 5180 |



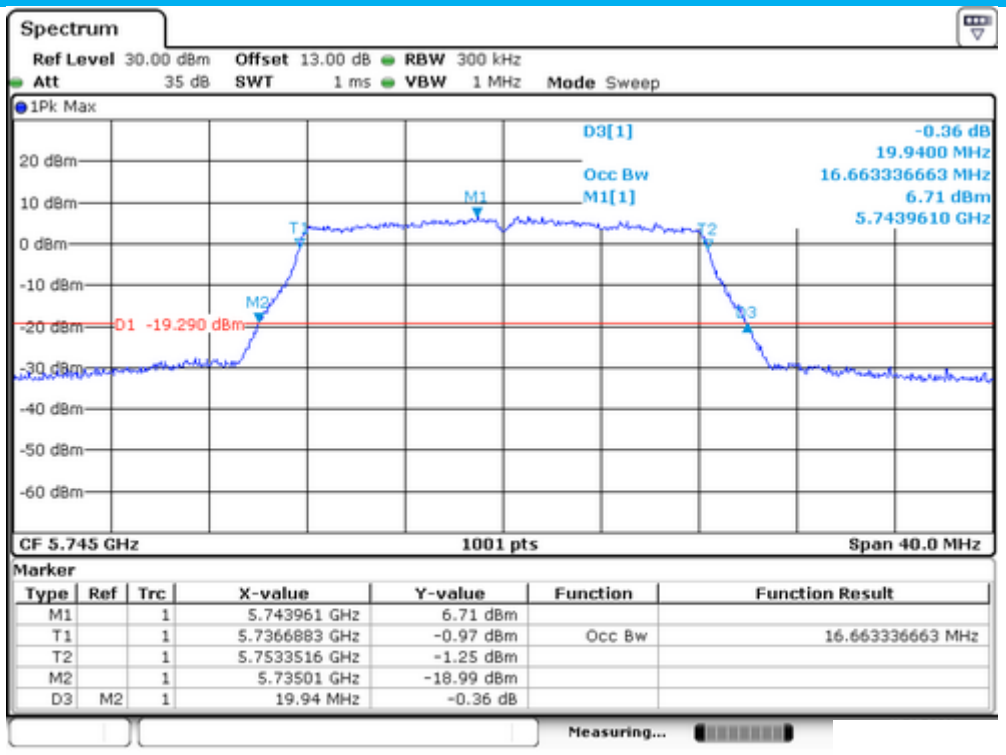

| Emission Bandwidth&99% Occupied Bandwidth | | UNII Band I | |
|---|---|---|---|
| Test Model | 802.11a | Frequency(MHz) | 5200 |



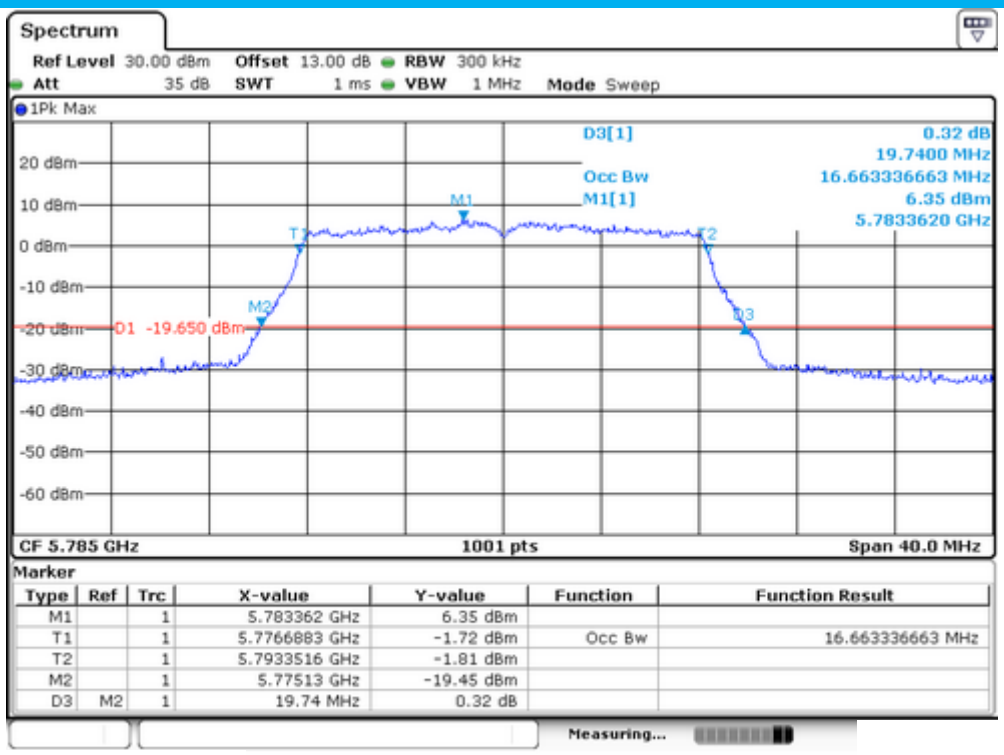
| Emission Bandwidth&99% Occupied Bandwidth | | UNII Band I | |
|---|---|---|---|
| Test Model | 802.11a | Frequency(MHz) | 5240 |



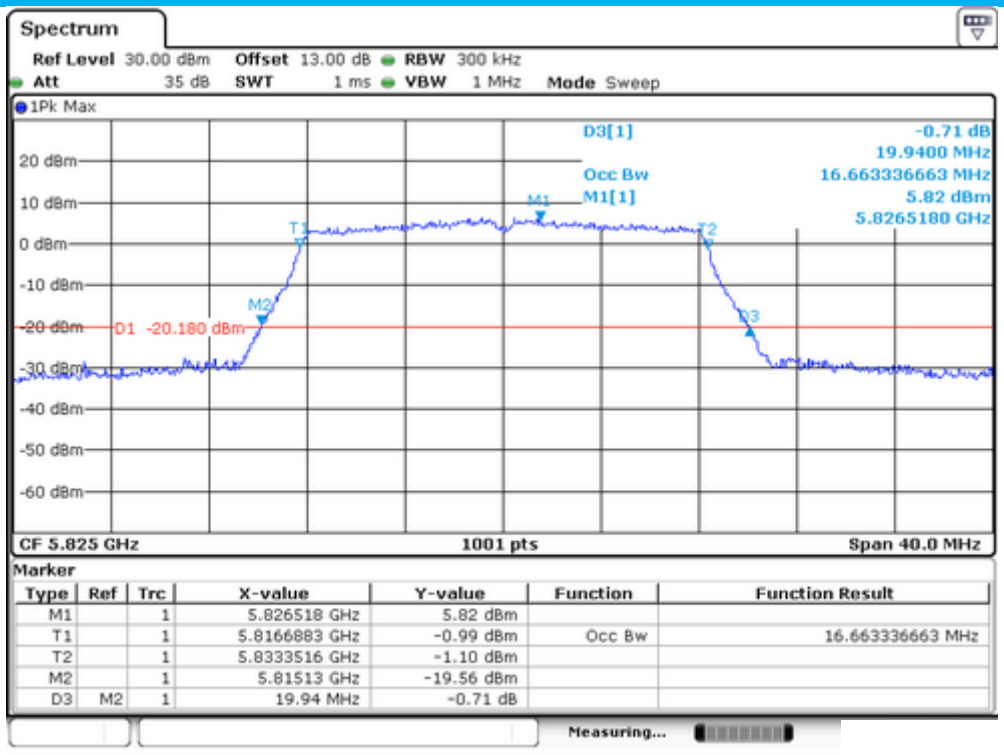

| Emission Bandwidth&99% Occupied Bandwidth | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11a | Frequency(MHz) | 5745 |



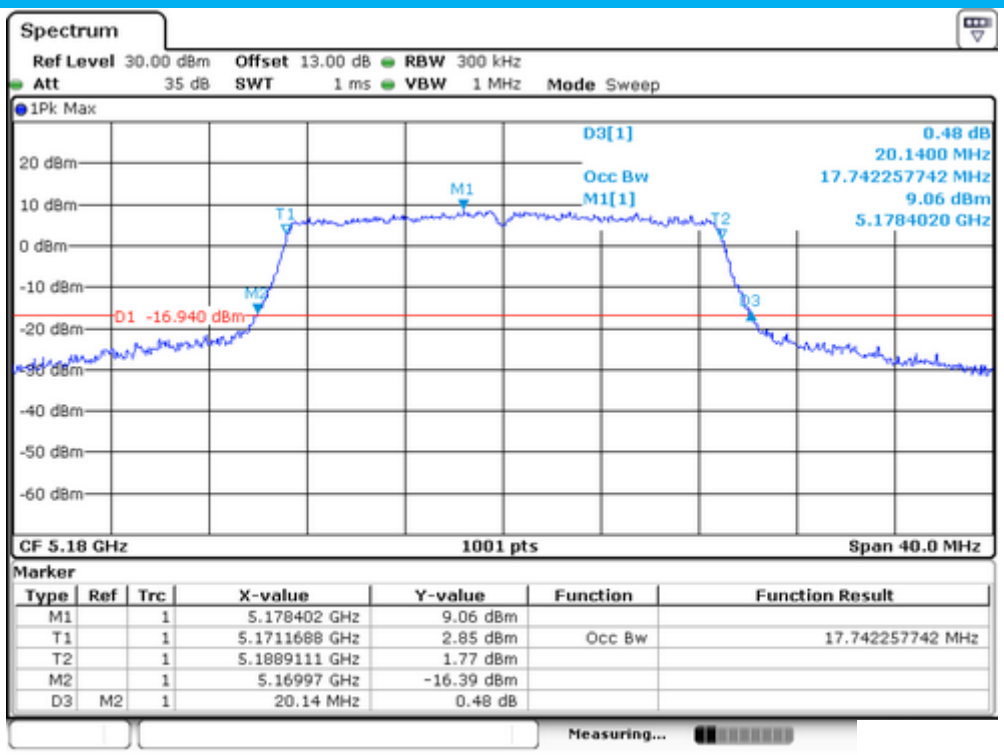
| Emission Bandwidth&99% Occupied Bandwidth | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11a | Frequency(MHz) | 5785 |



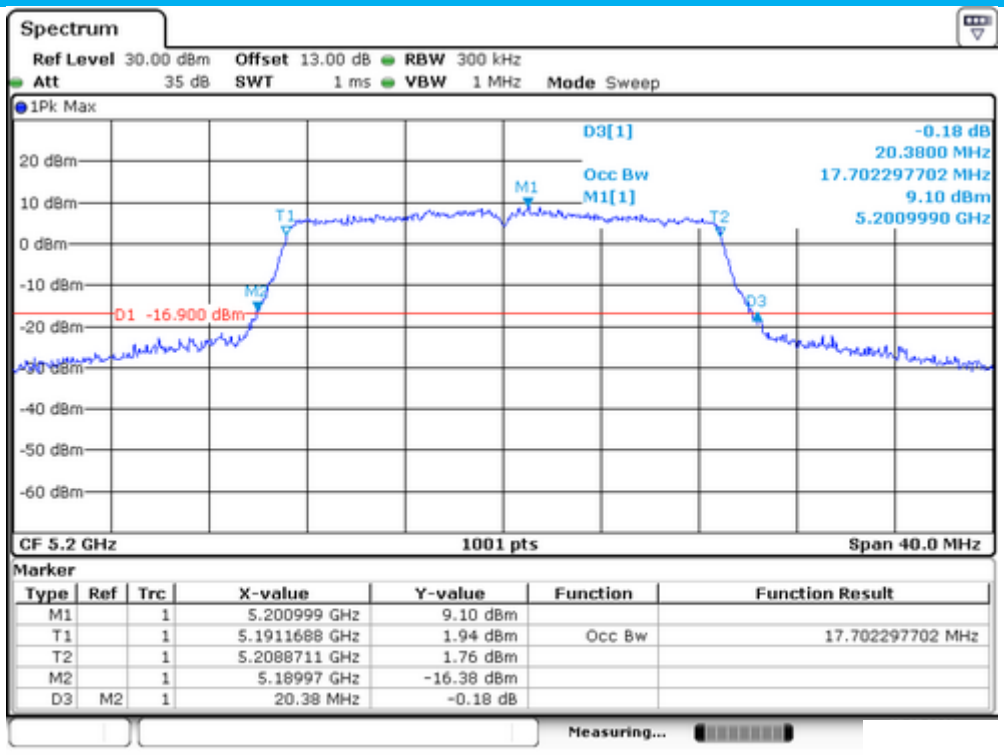

| Emission Bandwidth&99% Occupied Bandwidth | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11a | Frequency(MHz) | 5825 |



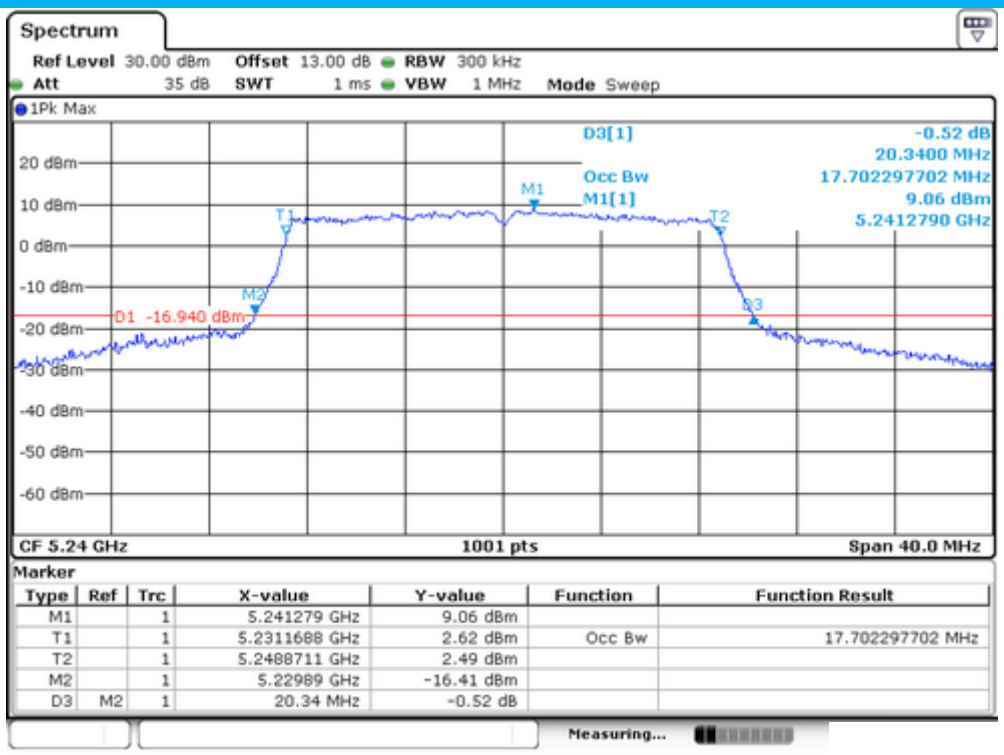
| Emission Bandwidth&99% Occupied Bandwidth | | UNII Band I | |
|---|---|---|---|
| Test Model | 802.11n(VHT20) mode | Frequency(MHz) | 5180 |



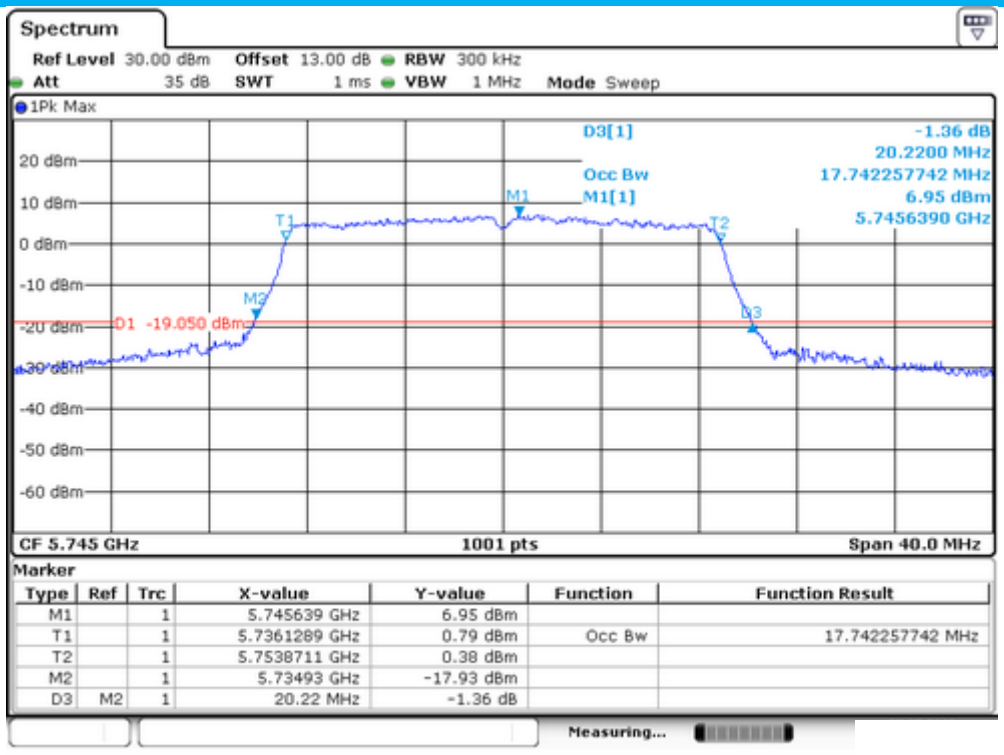

| Emission Bandwidth&99% Occupied Bandwidth | | UNII Band I | |
|---|---|---|---|
| Test Model | 802.11n(VHT20) mode | Frequency(MHz) | 5200 |



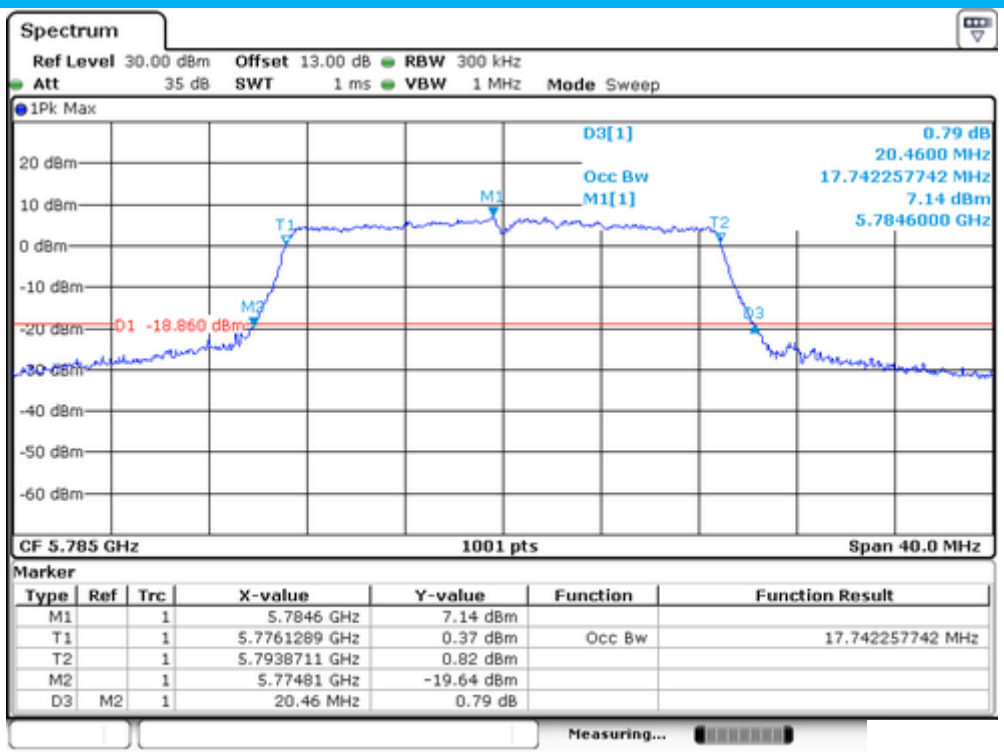
| Emission Bandwidth&99% Occupied Bandwidth | UNII Band I | | |
|---|---|---|---|
| Test Model | 802.11n(VHT20) mode | Frequency(MHz) | 5240 |



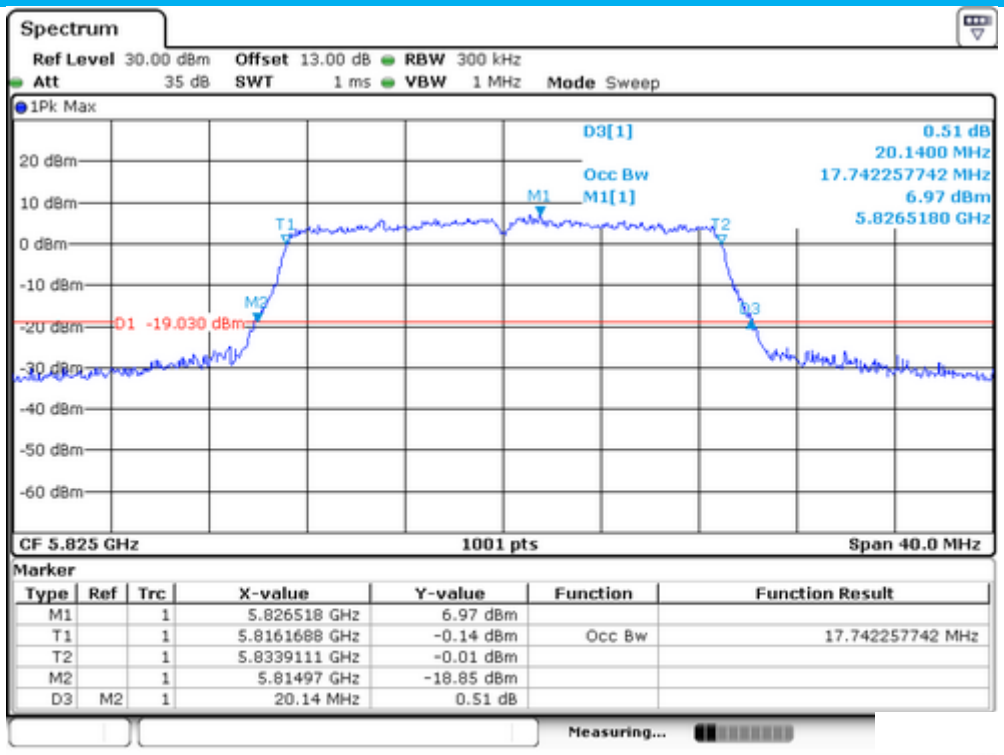

| Emission Bandwidth&99% Occupied Bandwidth | UNII Band III | | |
|---|---|---|---|
| Test Model | 802.11n(VHT20) mode | Frequency(MHz) | 5745 |



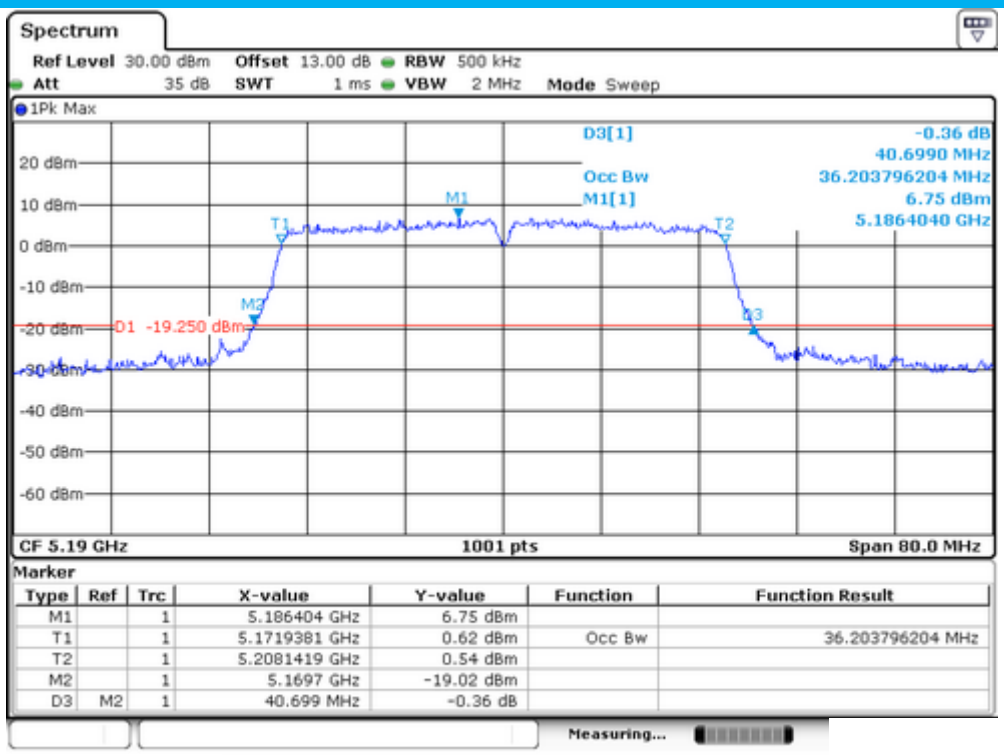
| Emission Bandwidth&99% Occupied Bandwidth | UNII Band III | | |
|---|---|---|---|
| Test Model | 802.11n(VHT20) mode | Frequency(MHz) | 5785 |



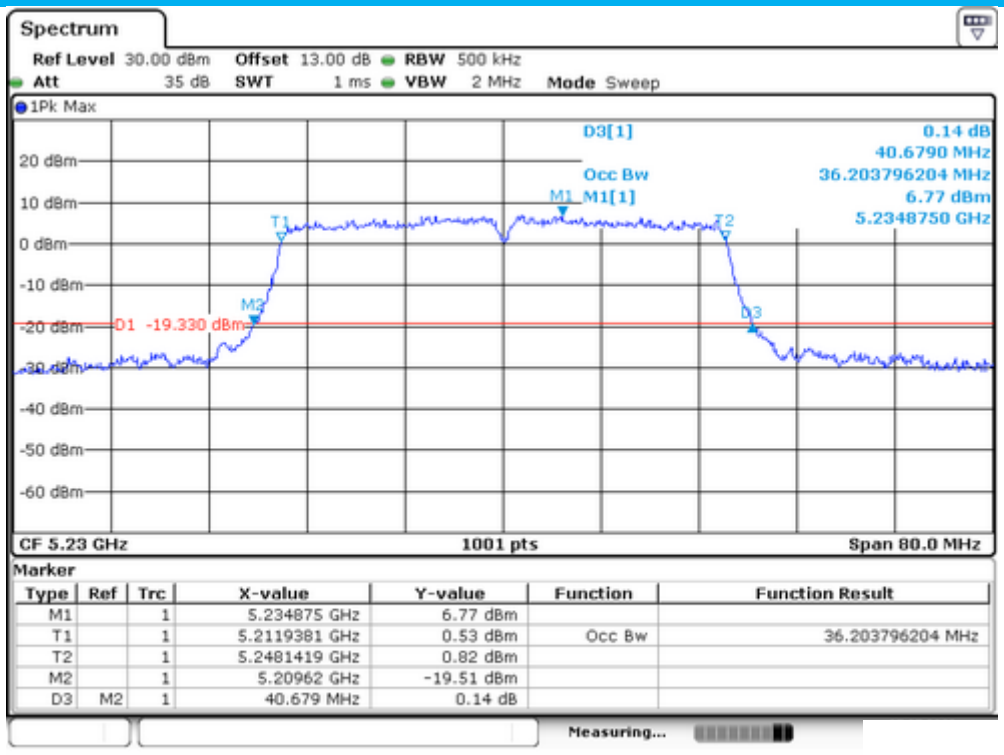

| Emission Bandwidth&99% Occupied Bandwidth | UNII Band III | | |
|---|---|---|---|
| Test Model | 802.11n(VHT20) mode | Frequency(MHz) | 5825 |



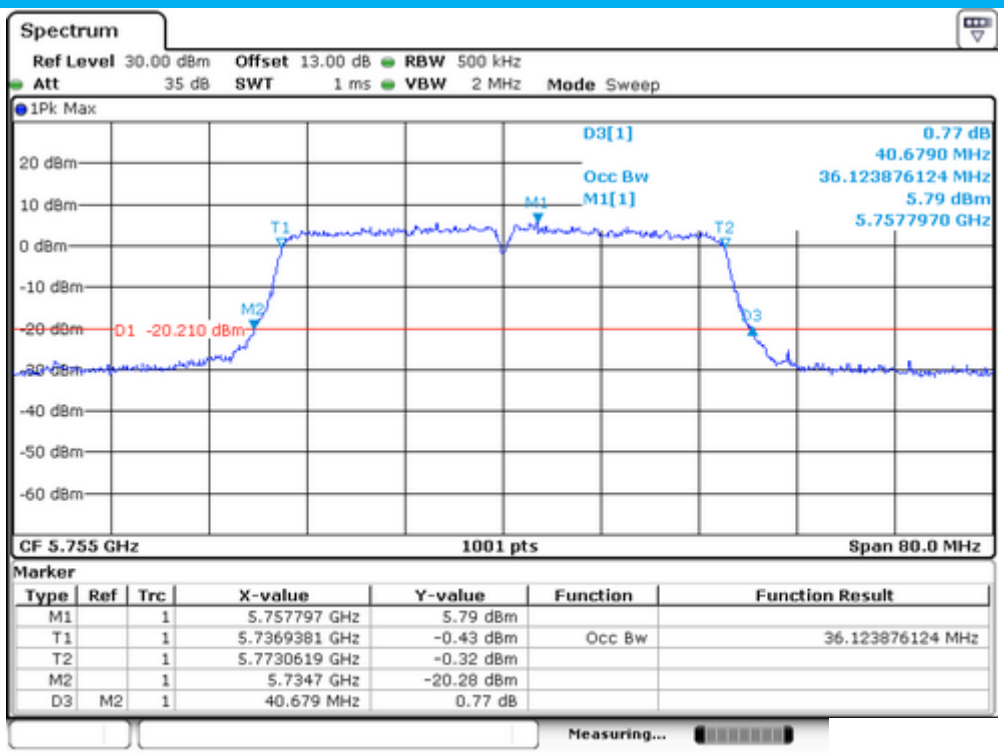
| Emission Bandwidth&99% Occupied Bandwidth | | UNII Band I | |
|---|---|---|---|
| Test Model | 802.11n(VHT40) mode | Frequency(MHz) | 5190 |




| Emission Bandwidth&99% Occupied Bandwidth | | UNII Band I | |
|---|---|---|---|
| Test Model | 802.11n(VHT40) mode | Frequency(MHz) | 5230 |



| Emission Bandwidth&99% Occupied Bandwidth | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11n(VHT40) mode | Frequency(MHz) | 5755 |

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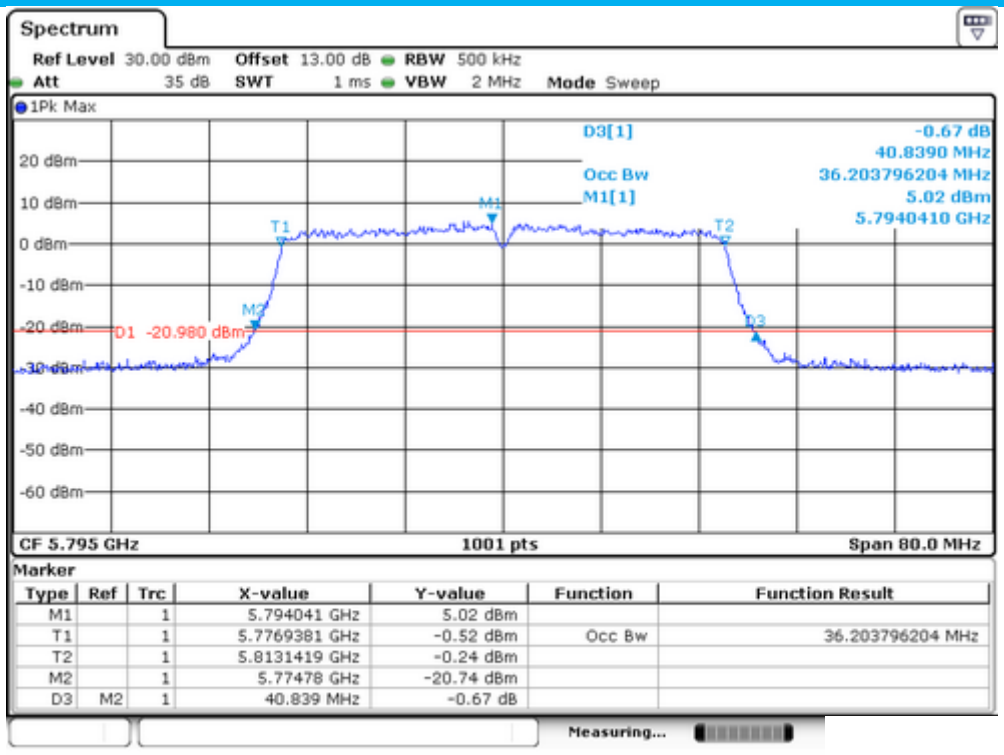
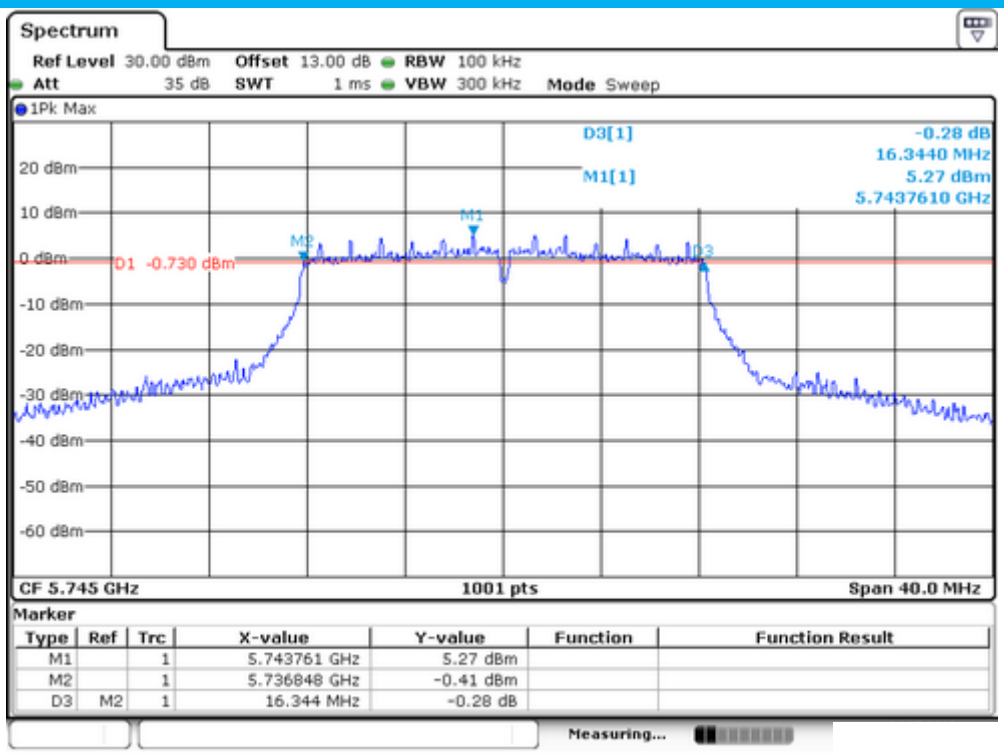
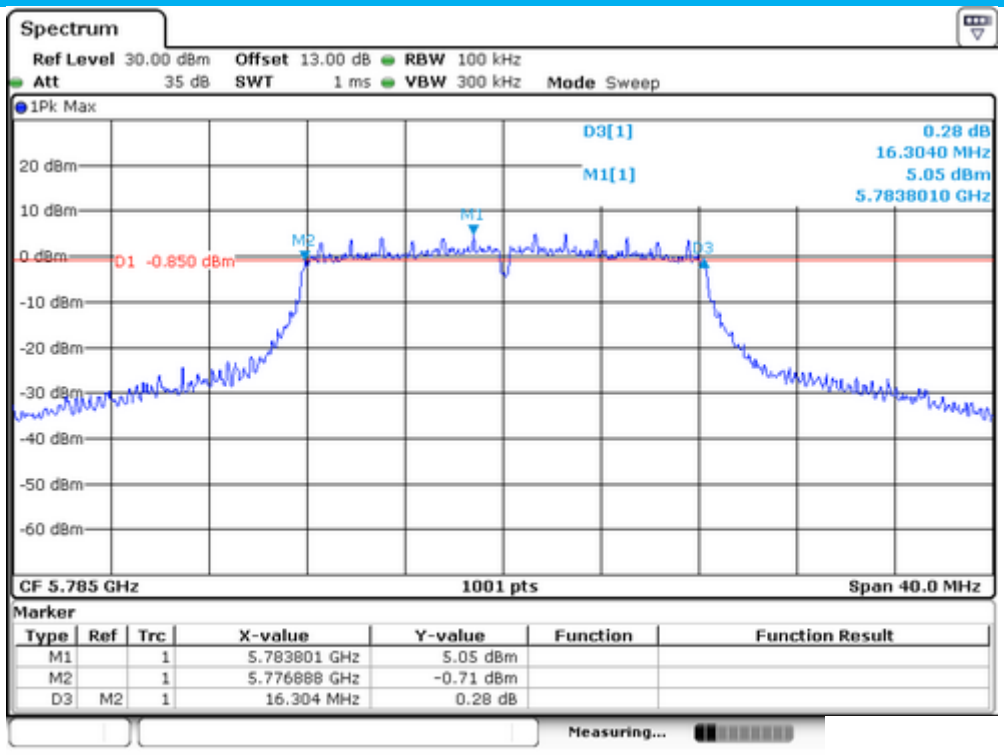
| Emission | ıpied Bandwidth | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11n(VHT40) mode | Frequency(MHz) | 5795 |



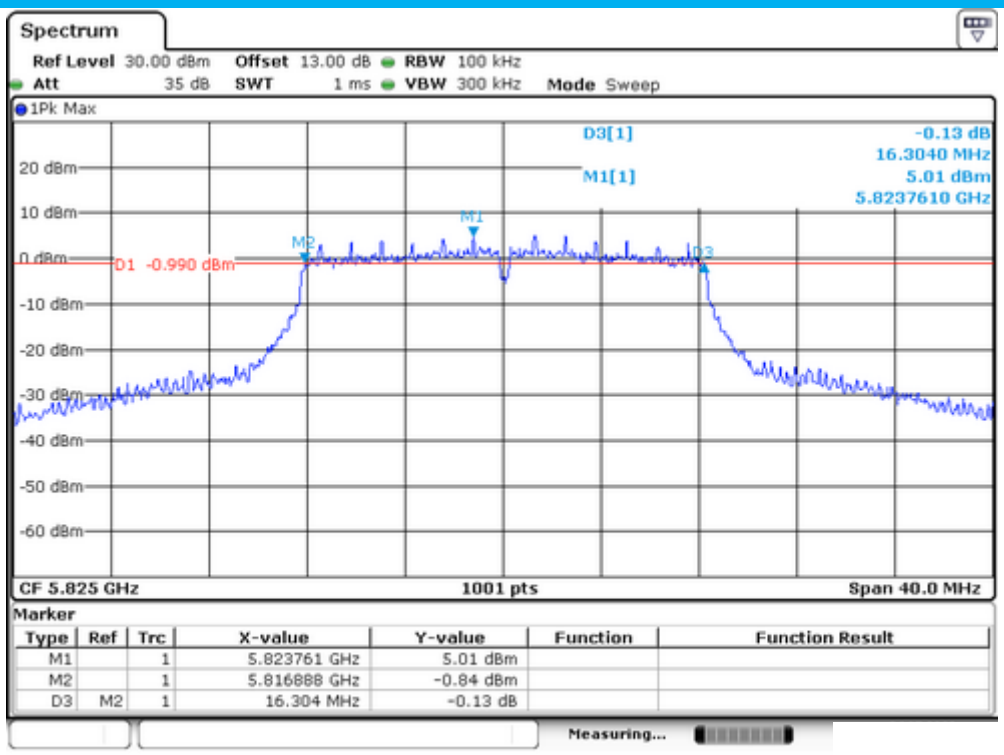
| Minimum Emission Bandwidth | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11a mode | Frequency(MHz) | 5745 |



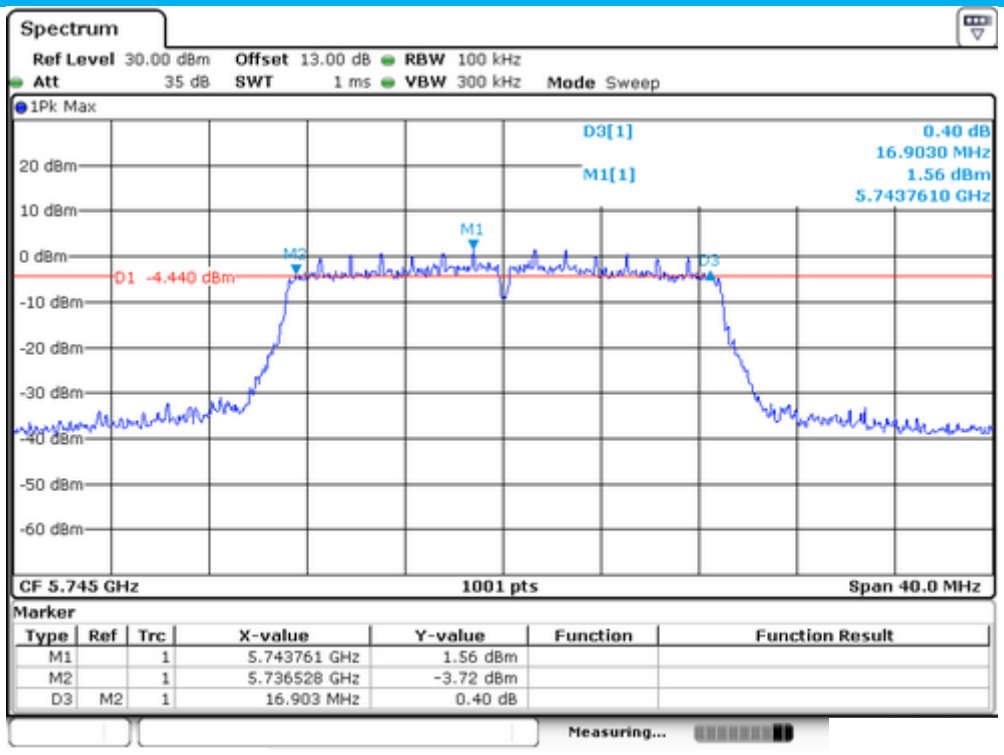

| Minimum Emission Bandwidth | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11a mode | Frequency(MHz) | 5785 |



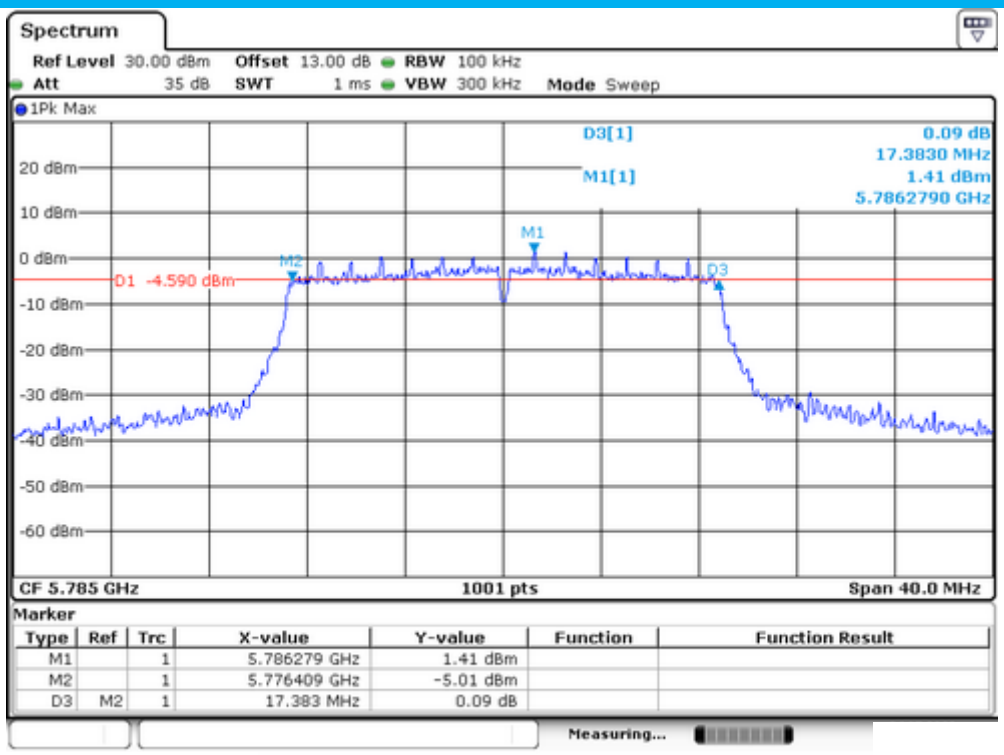
| Minimum Emission Bandwidth | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11a mode | Frequency(MHz) | 5825 |



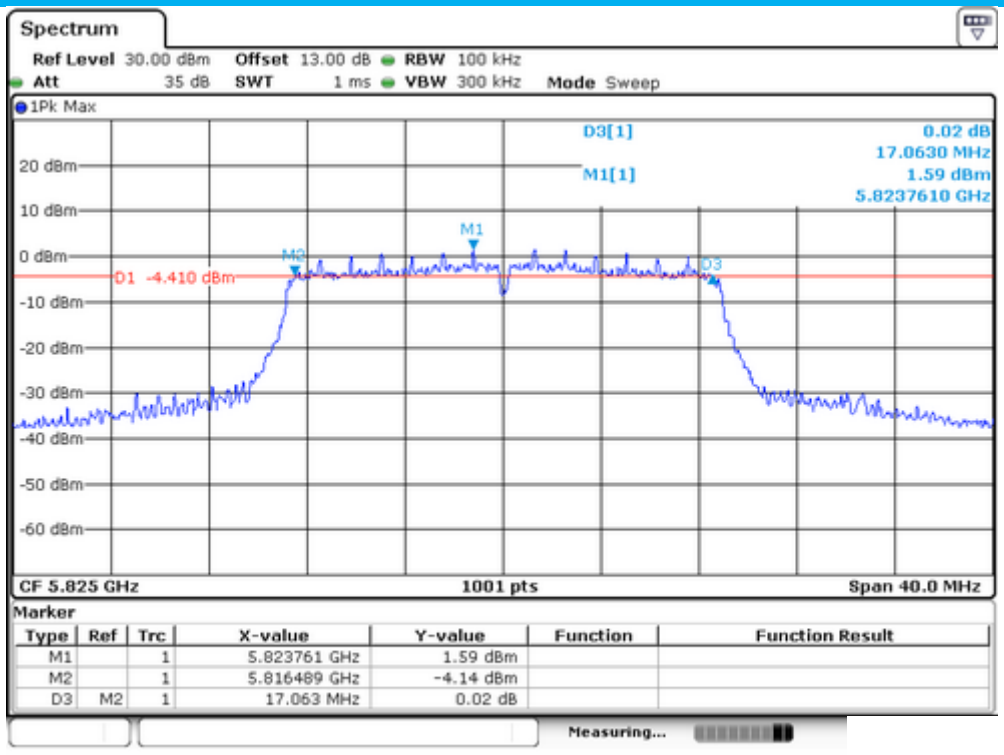

| Minimum Emission Bandwidth | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11n(VHT20) mode | Frequency(MHz) | 5745 |



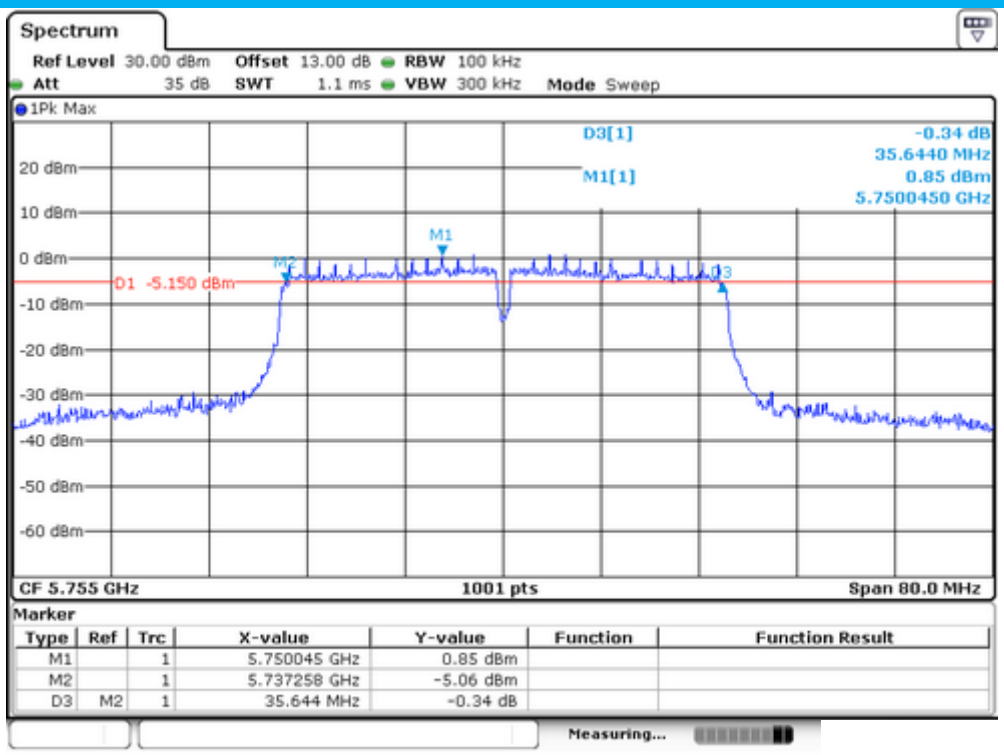
| Minimum Emission Bandwidth | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11n(VHT20) mode | Frequency(MHz) | 5785 |



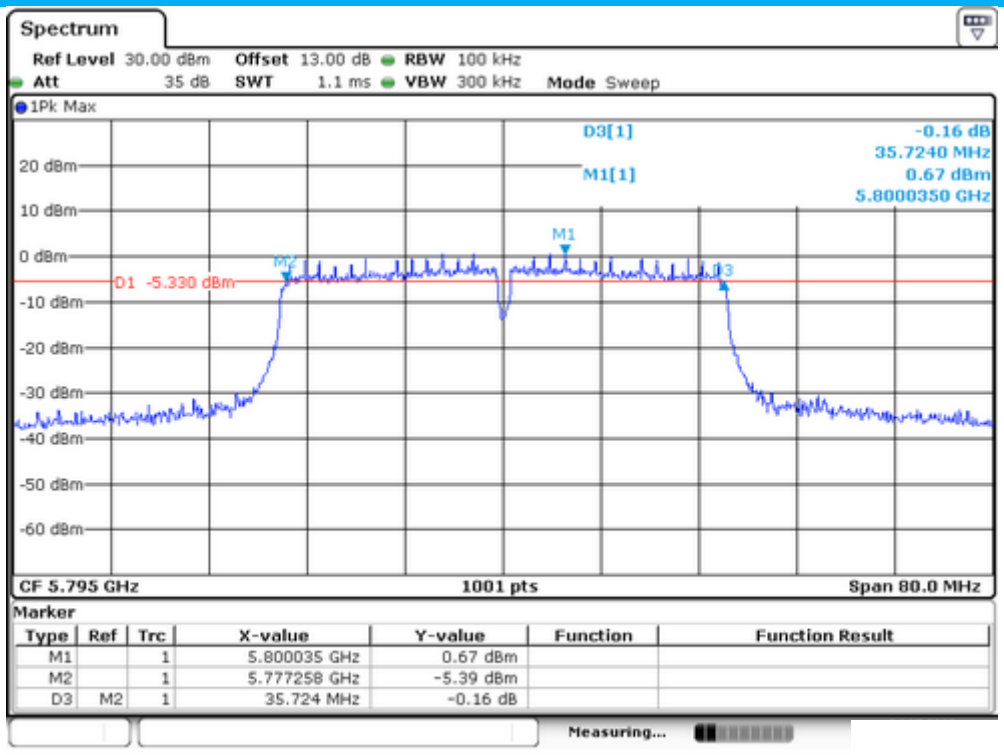

| Minimum Emission Bandwidth | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11n(VHT20) mode | Frequency(MHz) | 5825 |



| Minimum Emission Bandwidth | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11n(VHT40) mode | Frequency(MHz) | 5755 |




| Minimum Emission Bandwidth | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11n(VHT40) mode | Frequency(MHz) | 5795 |



## 8.2 MAXIMUM CONDUCTED OUTPUT POWER

8.2.1 Applicable Standard

According to FCC Part 15.407(a)(1) for UNII Band I
According to FCC Part 15.407(a)(2) for UNII Band II-A and UNII Band II-C
According to FCC Part 15.407(a)(3) for UNII Band III
According to 789033 D02 Section II(E)

8.2.2 Conformance Limit

■ For the band 5.15-5.25 GHz,

(a) (1) (i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(a) (1) (ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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

(a) (1) (iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

■ For the 5.25-5.35 GHz and 5.47-5.725 GHz bands

(a) (2) 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

(a) (3)For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

8.2.3 Test Configuration

Test according to clause 6.1 radio frequency test setup

8.2.4 Test Procedure

The maximum average conducted output power can be measured using Method PM-G (Measurement using a gated RF average power meter):
Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

a. The Transmitter output (antenna port) was connected to the power meter.
b. Turn on the EUT and power meter and then record the power value.
c. Repeat above procedures on all channels needed to be tested.

8.2.5 Test Results

☒ 802.11a mode

Temperature : 28℃ Test Date : June 27, 2021
Humidity : 65 % Test By: Jack

| Band | Channel Number | Channel Freq. (MHz) | Conducted Output Power(dBm) | | Limit (dBm) | Verdict |
|---|---|---|---|---|---|---|
| | | | Ant0 | Ant1 | | |
| UNII Band I | CH36 | 5180 | 17.10 | 16.42 | 24 | Pass |
| | CH40 | 5200 | 17.07 | 16.36 | 24 | Pass |
| | CH48 | 5240 | 16.90 | 16.24 | 24 | Pass |
| UNII Band III | CH149 | 5745 | 14.34 | 14.64 | 30 | Pass |
| | CH157 | 5785 | 14.40 | 15.25 | 30 | Pass |
| | CH165 | 5825 | 13.61 | 14.88 | 30 | Pass |

Note:
N/A (Not Applicable)

☒ 802.11n(VHT20) mode

Temperature : 28℃ Test Date : June 27, 2021
Humidity : 65 % Test By: Jack

| Band | Channel Number | Channel Freq. (MHz) | Conducted Output Power(dBm) | | | Limit (dBm) | Verdict |
|---|---|---|---|---|---|---|---|
| | | | Ant0 | Ant1 | Ant0+1 | | |
| UNII Band I | CH36 | 5180 | 15.42 | 14.77 | 18.12 | 22.99 | Pass |
| | CH40 | 5200 | 15.18 | 14.58 | 17.90 | 22.99 | Pass |
| | CH48 | 5240 | 15.25 | 14.70 | 17.99 | 22.99 | Pass |
| UNII Band III | CH149 | 5745 | 12.67 | 12.89 | 15.79 | 28.99 | Pass |
| | CH157 | 5785 | 13.17 | 13.56 | 16.38 | 28.99 | Pass |
| | CH165 | 5825 | 12.30 | 12.86 | 15.60 | 28.99 | Pass |

Note:
N/A (Not Applicable)

☒ 802.11n(VHT40) mode

Temperature : 28℃ Test Date : June 27, 2021
Humidity : 65 % Test By: Jack

| Band | Channel Number | Channel Freq. (MHz) | Conducted Output Power(dBm) | | | Limit (dBm) | Verdict |
|---|---|---|---|---|---|---|---|
| | | | Ant0 | Ant1 | Ant0+1 | | |
| UNII Band I | CH38 | 5190 | 14.96 | 14.32 | 17.66 | 22.99 | Pass |
| | CH46 | 5230 | 14.75 | 14.09 | 17.44 | 22.99 | Pass |
| UNII Band III | CH151 | 5755 | 12.26 | 12.58 | 15.43 | 28.99 | Pass |
| | CH159 | 5795 | 12.03 | 12.99 | 15.55 | 28.99 | Pass |

Note:
N/A (Not Applicable)

## 8.3 MAXIMUM PEAK POWER DENSITY

8.3.1 Applicable Standard

According to FCC Part 15.407(a)(1) for UNII Band I
According to FCC Part 15.407(a)(2) for UNII Band II-A and UNII Band II-C
According to FCC Part 15.407(a)(3) for UNII Band III
According to 789033 D02 Section II(F)

8.3.2 Conformance Limit

■ For the band 5.15-5.25 GHz,

(a) (1) (i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(a) (1) (ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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

(a) (1) (iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

■ For the 5.25-5.35 GHz and 5.47-5.725 GHz bands

(b) (2) 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

(a) (3)For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

8.3.3 Test Configuration

Test according to clause 6.1 radio frequency test setup

8.3.4 Test Procedure

Methods refer to FCC KDB 789033

1) Create an average power spectrum for the EUT operating mode being tested by following the instructions in section E)2) for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, “Compute power…”.

2) Use the peak search function on the instrument to find the peak of the spectrum.

3) The result is the PPSD.
4) The above procedures make use of 500kHz resolution bandwidth to satisfy the 500kHz measurement bandwidth specified in the 15.407(a)(5). That rule section also permits use of resolution bandwidths less than 1 MHz “provided that the measured power is integrated to show the total power over the measurement bandwidth” (i.e., 1 MHz). If measurements are performed using a reduced resolution bandwidth and integrated over 500kHz bandwidth.

8.3.5 Test Results

☒ 802.11a mode

Temperature : 28℃ Test Date : June 27, 2021
Humidity : 65 % Test By: Jack

| Band | Channel Number | Channel Freq. (MHz) | Power Spectral Density | | Limit | Verdict |
|---|---|---|---|---|---|---|
| | | | Ant0 | Ant1 | | |
| UNII Band I | CH36 | 5180 | 3.13 | 4.13 | ≤11dBm/1MHz | Pass |
| | CH40 | 5200 | 5.12 | 4.12 | ≤11dBm/1MHz | Pass |
| | CH48 | 5240 | 4.48 | 4.61 | ≤11dBm/1MHz | Pass |
| UNII Band III | CH149 | 5745 | -0.92 | -0.66 | ≤30dBm/500KHz | Pass |
| | CH157 | 5785 | -0.27 | -1.49 | ≤30dBm/500KHz | Pass |
| | CH165 | 5825 | 0.35 | -1.35 | ≤30dBm/500KHz | Pass |
| Note:<br>N/A (Not Applicable) | | | | | | |

☒ 802.11n(VHT20) mode

Temperature : 28℃ Test Date : June 27, 2021
Humidity : 65 % Test By: Jack

| Band | Channel Number | Channel Freq. (MHz) | Power Spectral Density | | | Limit | Verdict |
|---|---|---|---|---|---|---|---|
| | | | Ant0 | Ant1 | Ant0+1 | | |
| UNII Band I | CH36 | 5180 | 3.63 | 3.01 | 6.34 | ≤9.99dBm/1MHz | Pass |
| | CH40 | 5200 | 1.66 | 1.84 | 4.76 | ≤9.99dBm/1MHz | Pass |
| | CH48 | 5240 | 1.90 | 1.71 | 4.82 | ≤9.99dBm/1MHz | Pass |
| UNII Band III | CH149 | 5745 | -2.43 | -1.46 | 1.09 | ≤28.99dBm/500KHz | Pass |
| | CH157 | 5785 | -3.80 | -2.52 | -0.10 | ≤28.99dBm/500KHz | Pass |
| | CH165 | 5825 | -2.99 | -4.00 | -0.46 | ≤28.99dBm/500KHz | Pass |
| Note:<br>N/A (Not Applicable) | | | | | | | |

☒ 802.11n(VHT40) mode

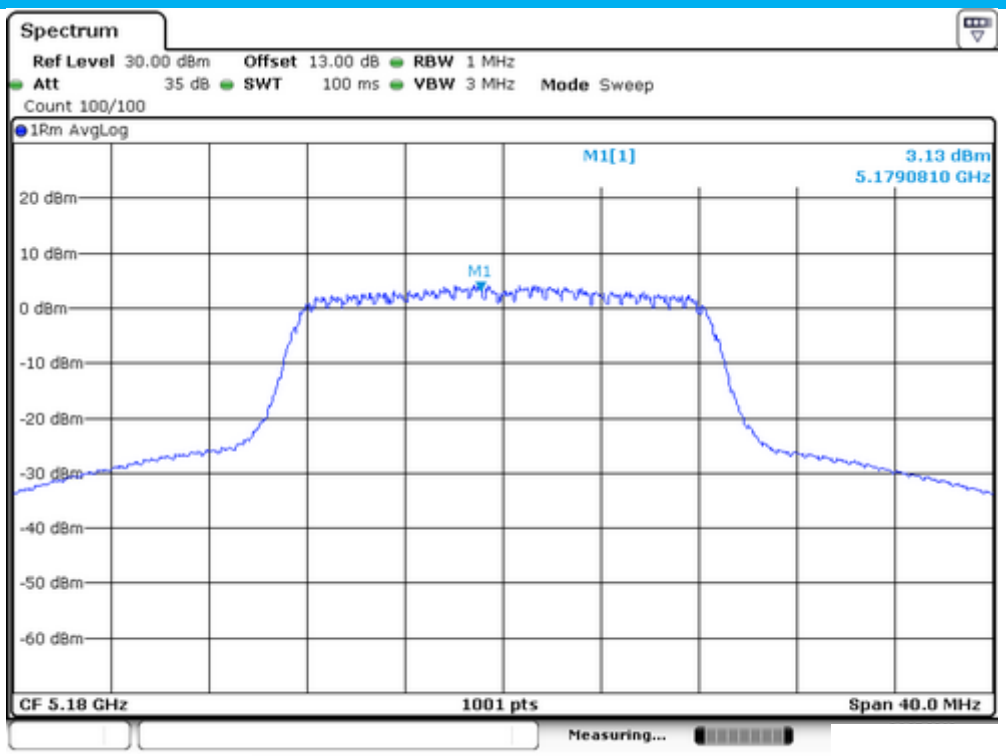
Temperature : 28℃ Test Date : June 27, 2021

Humidity : 65 % Test By: Jack

| Band | Channel Number | Channel Freq. (MHz) | Power Spectral Density | | | Limit | Verdict |
|---|---|---|---|---|---|---|---|
| | | | Ant0 | Ant1 | Ant0+1 | | |
| UNII Band I | CH38 | 5190 | -2.28 | -2.16 | 0.79 | ≤9.99dBm/1MHz | Pass |
| | CH46 | 5230 | -1.67 | -2.89 | 0.77 | ≤9.99dBm/1MHz | Pass |
| UNII Band III | CH151 | 5755 | -7.46 | -7.31 | -4.37 | ≤28.99dBm/500KHz | Pass |
| | CH159 | 5795 | -7.60 | -8.05 | -4.81 | ≤28.99dBm/500KHz | Pass |
| Note:<br>N/A (Not Applicable) | | | | | | | |

| Power Spectral Density | | UNII Band I | |
|---|---|---|---|
| Test Model | 802.11a | Frequency(MHz) | 5180 |

Ant0

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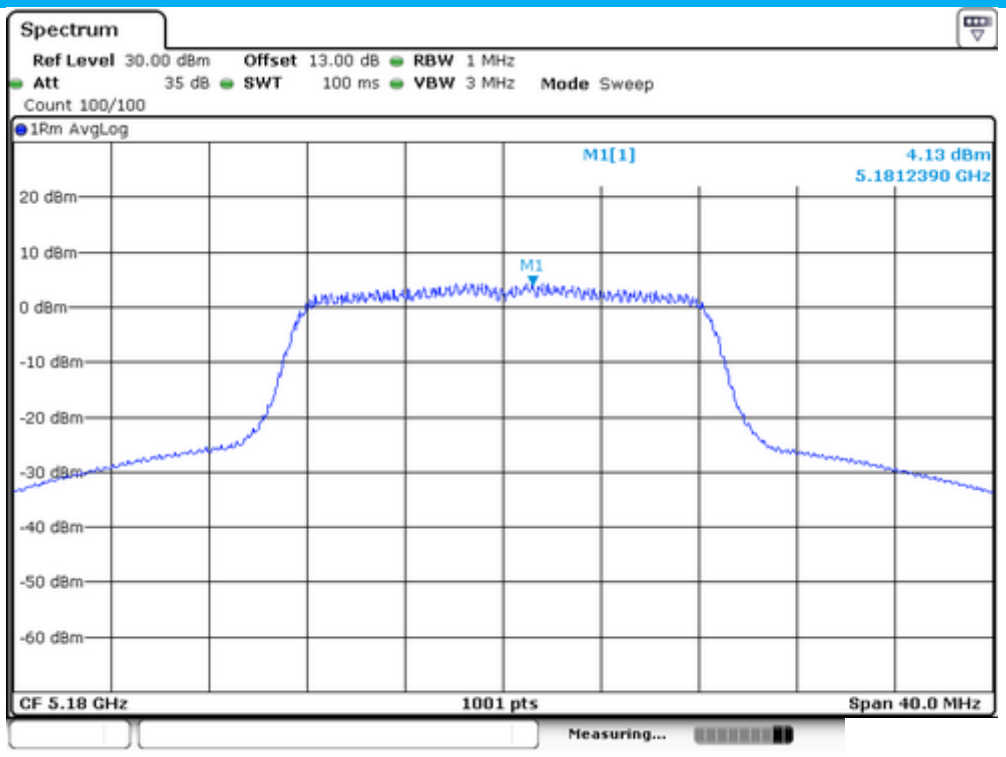
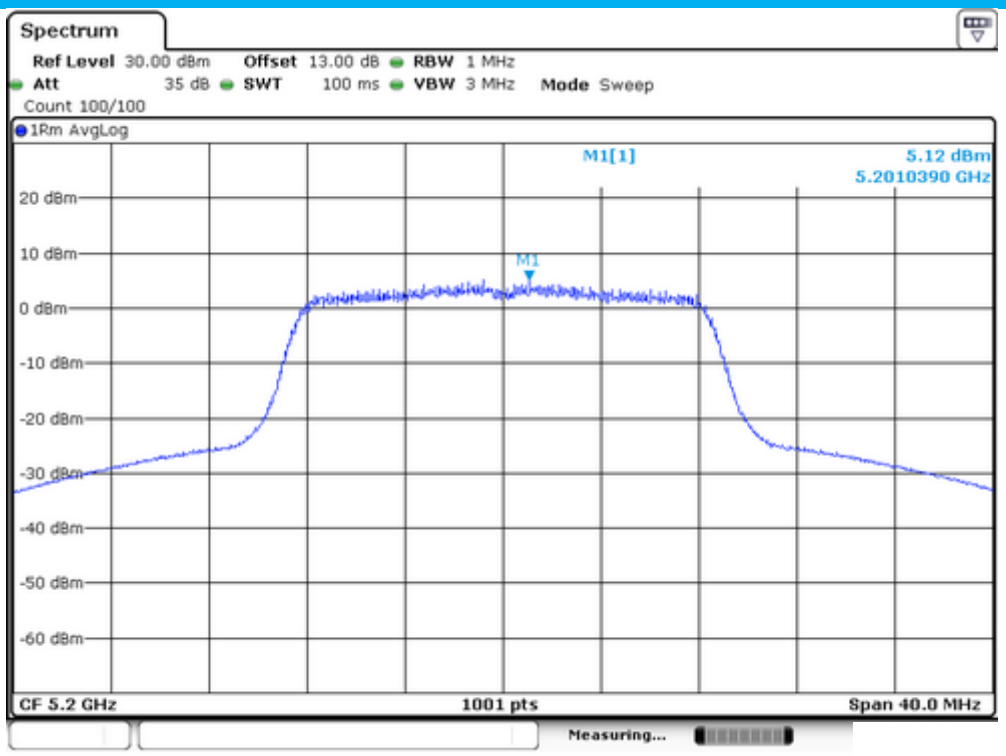


| Power Spectral Density | | UNII Band I | |
|---|---|---|---|
| Test Model | 802.11a | Frequency(MHz) | 5200 |

Ant0

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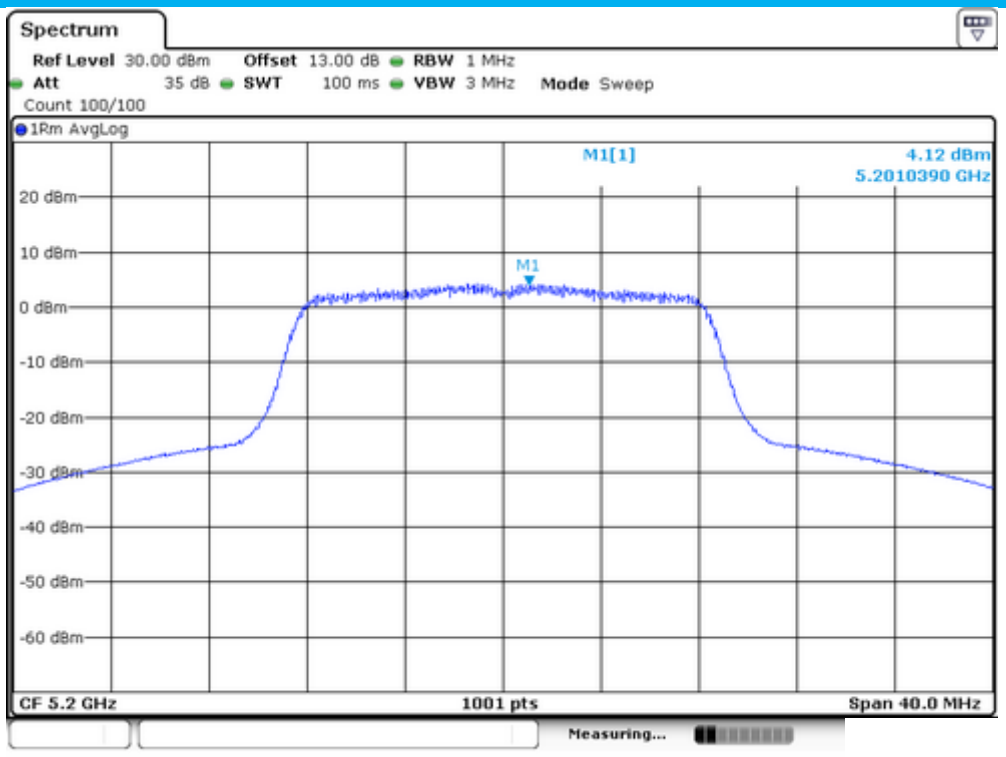
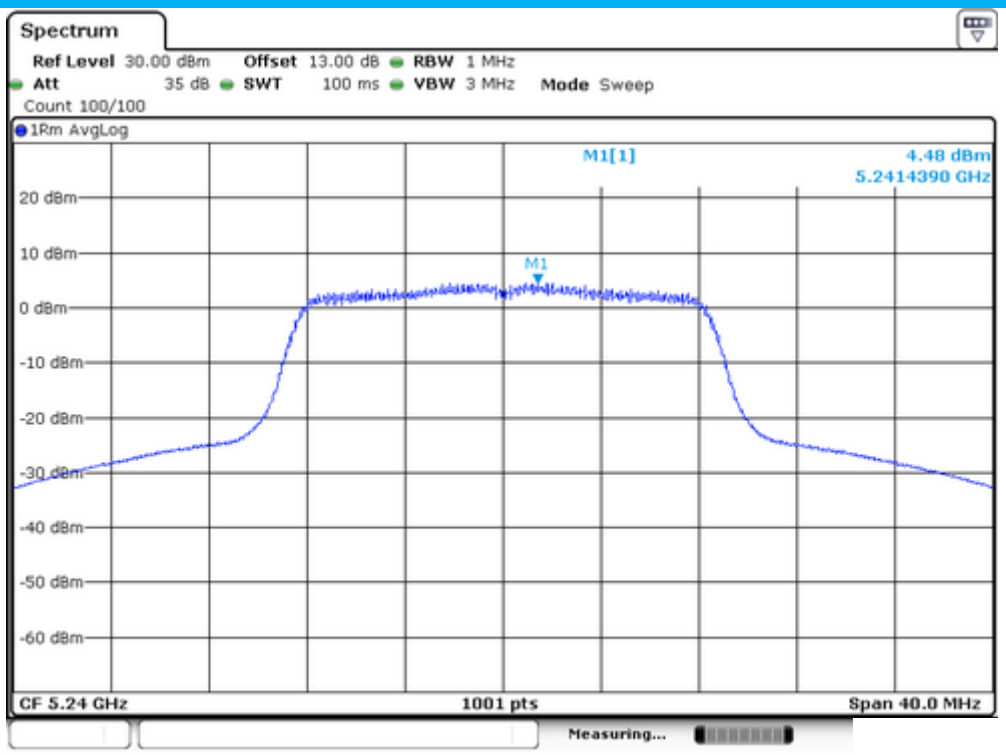


| Power Spectral Density | | UNII Band I | |
|---|---|---|---|
| Test Model | 802.11a | Frequency(MHz) | 5240 |

Ant0

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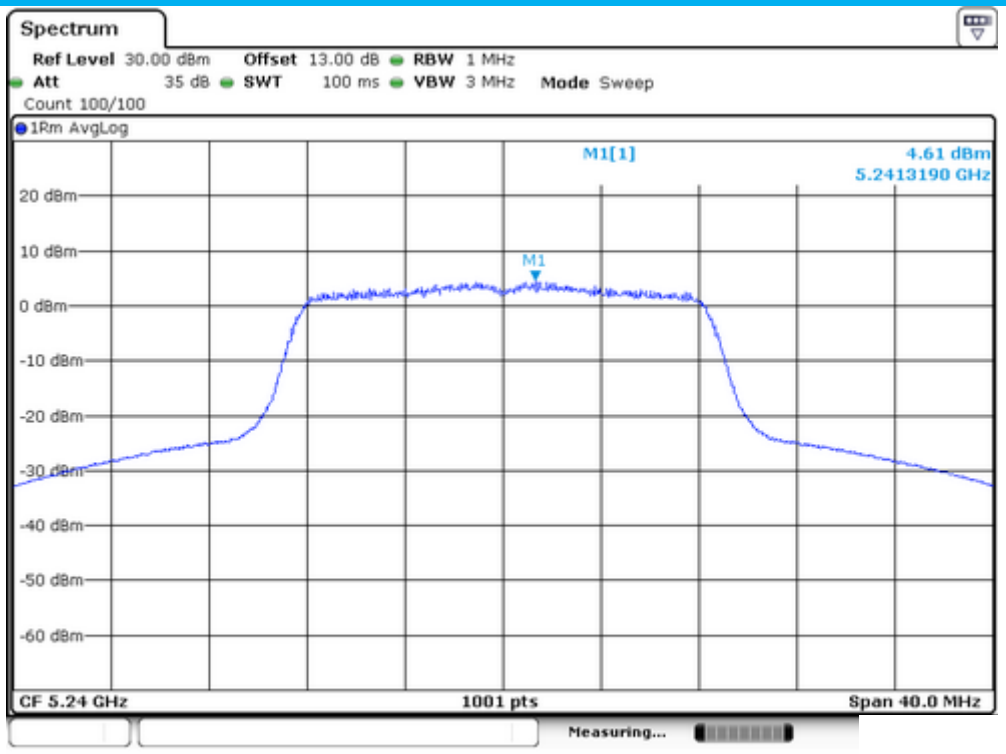
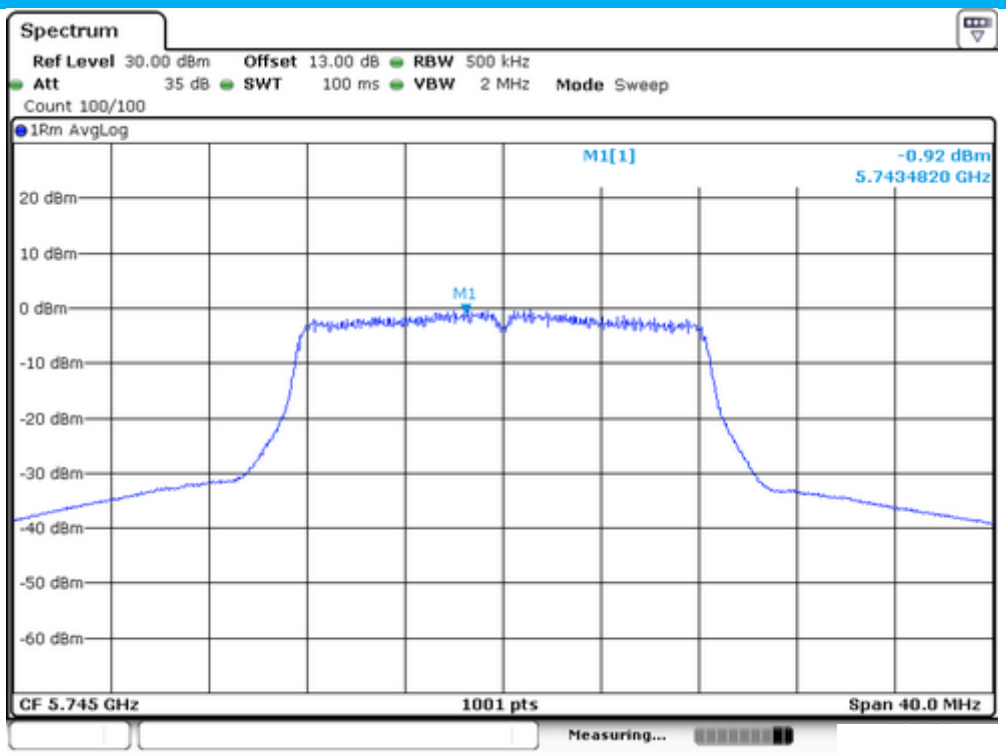


| Power Spectral Density | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11a | Frequency(MHz) | 5745 |

Ant0

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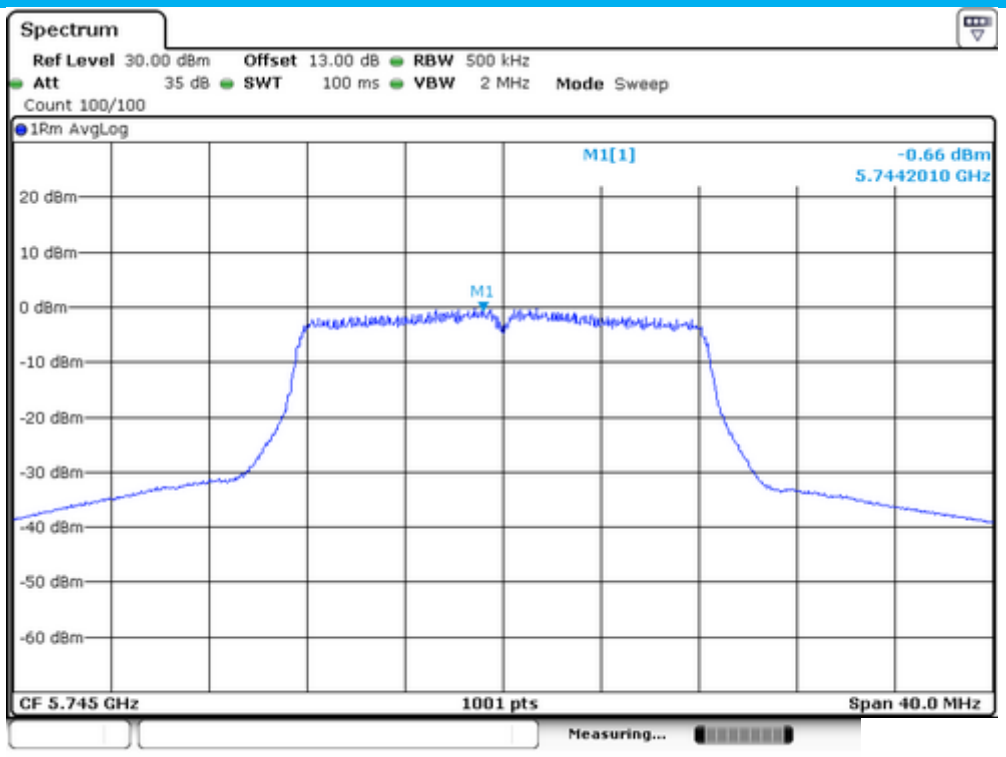
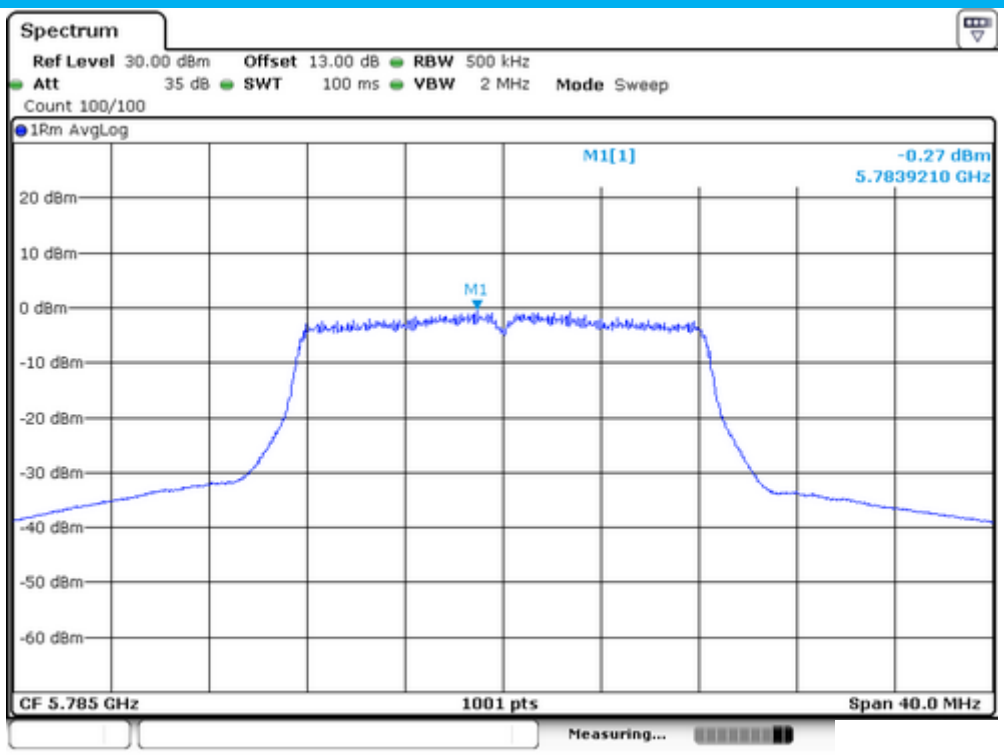


| Power Spectral Density | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11a | Frequency(MHz) | 5785 |

Ant0

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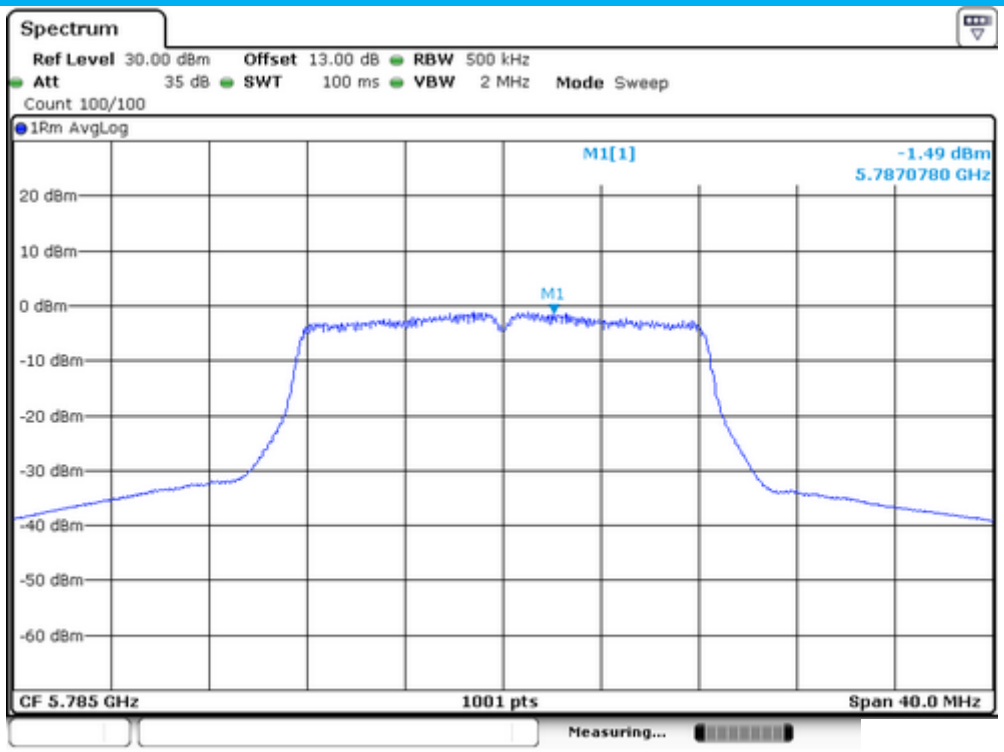
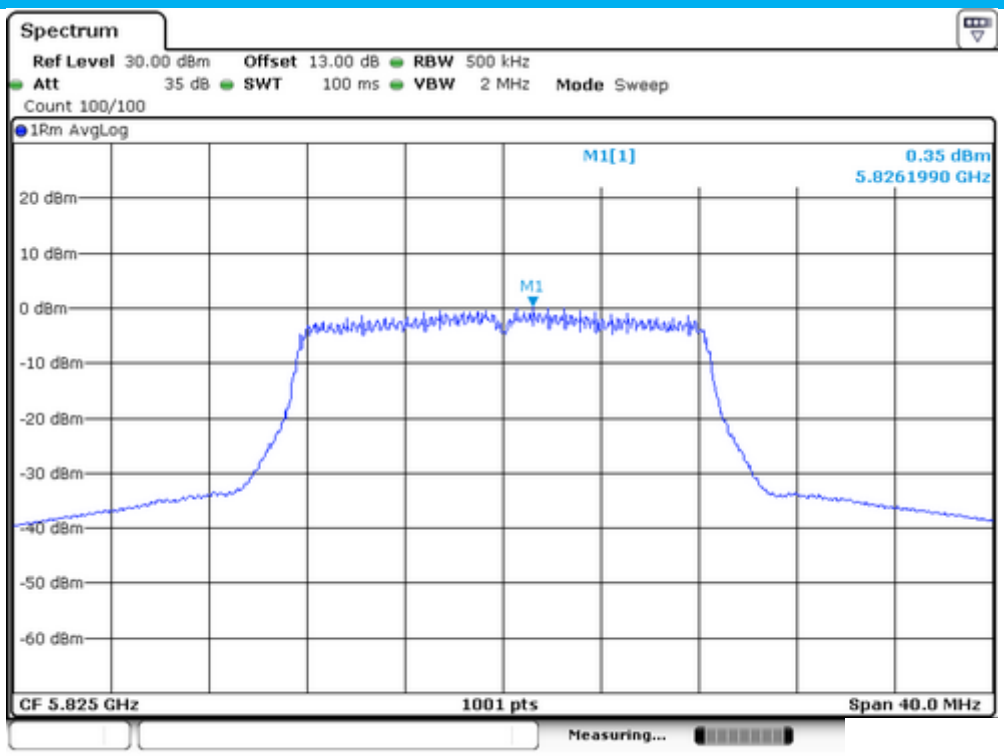


| Power Spectral Density | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11a | Frequency(MHz) | 5825 |

Ant0

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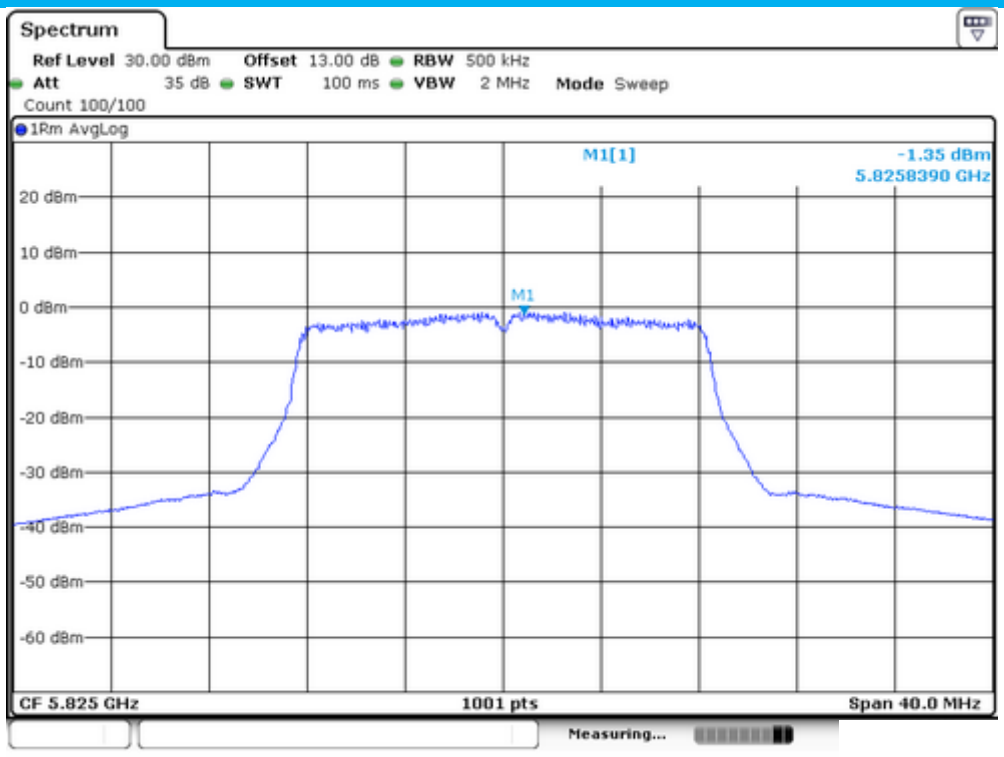
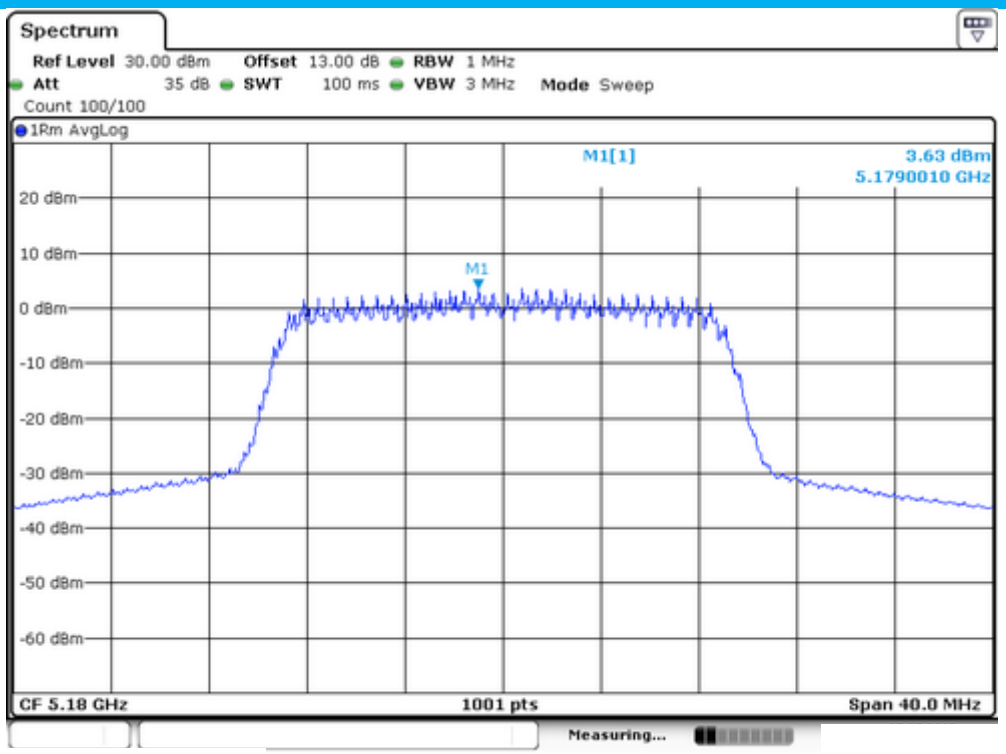


| Power Spectral Density | | UNII Band I | |
|---|---|---|---|
| Test Model | 802.11n(VHT20) mode | Frequency(MHz) | 5180 |

Ant0

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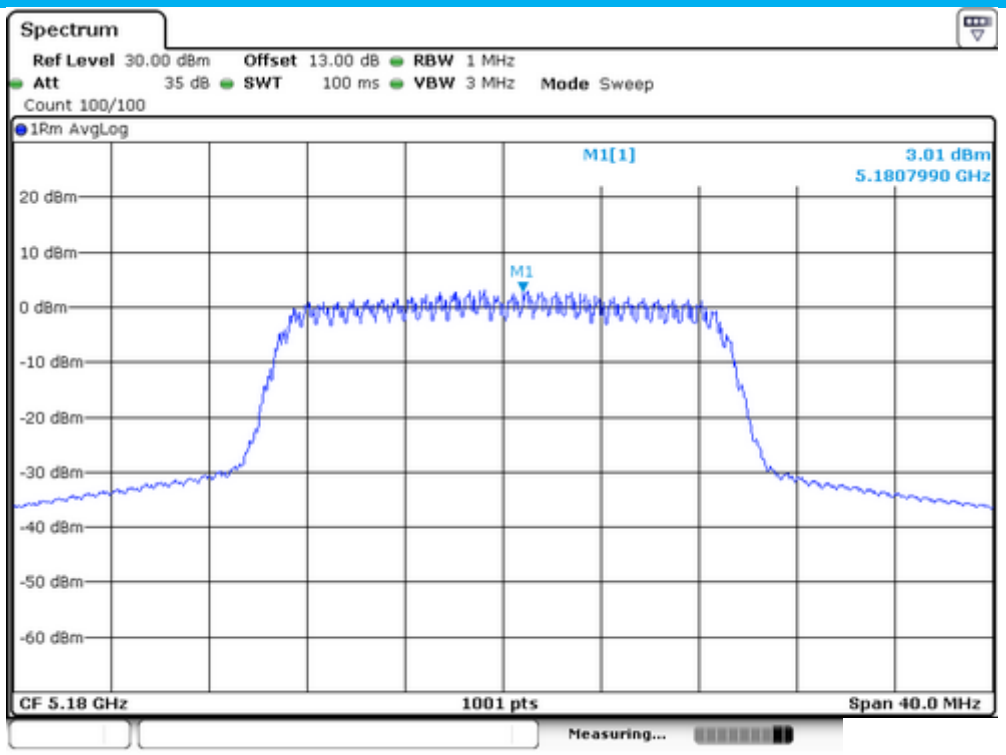
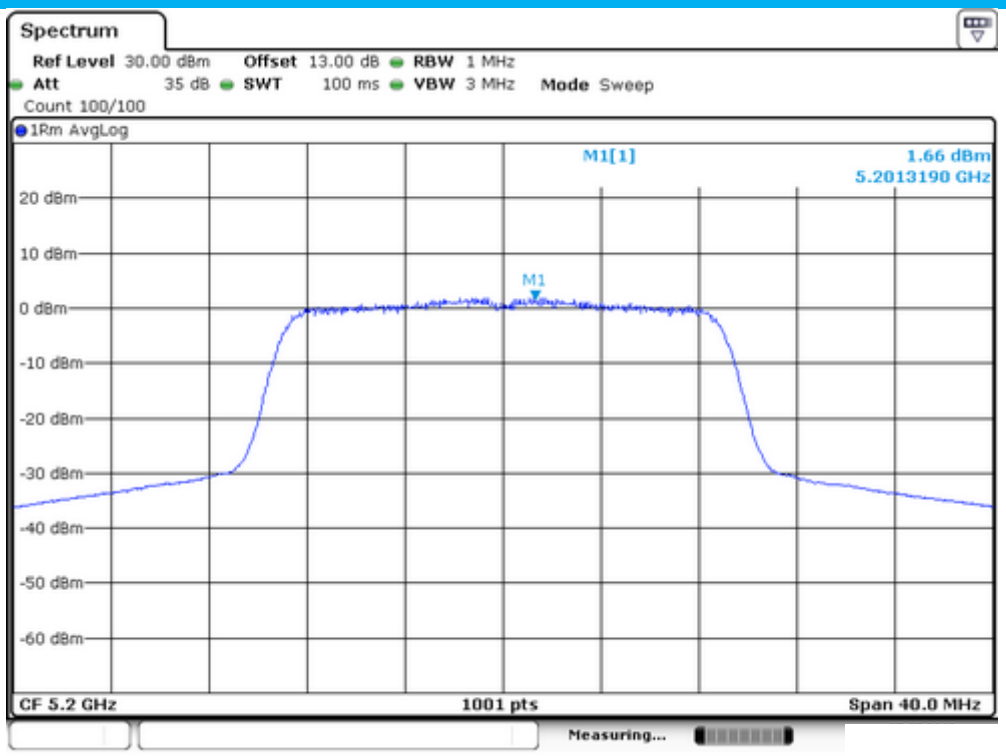


| Power Spectral Density | | UNII Band I | |
|---|---|---|---|
| Test Model | 802.11n(VHT20) mode | Frequency(MHz) | 5200 |

Ant0

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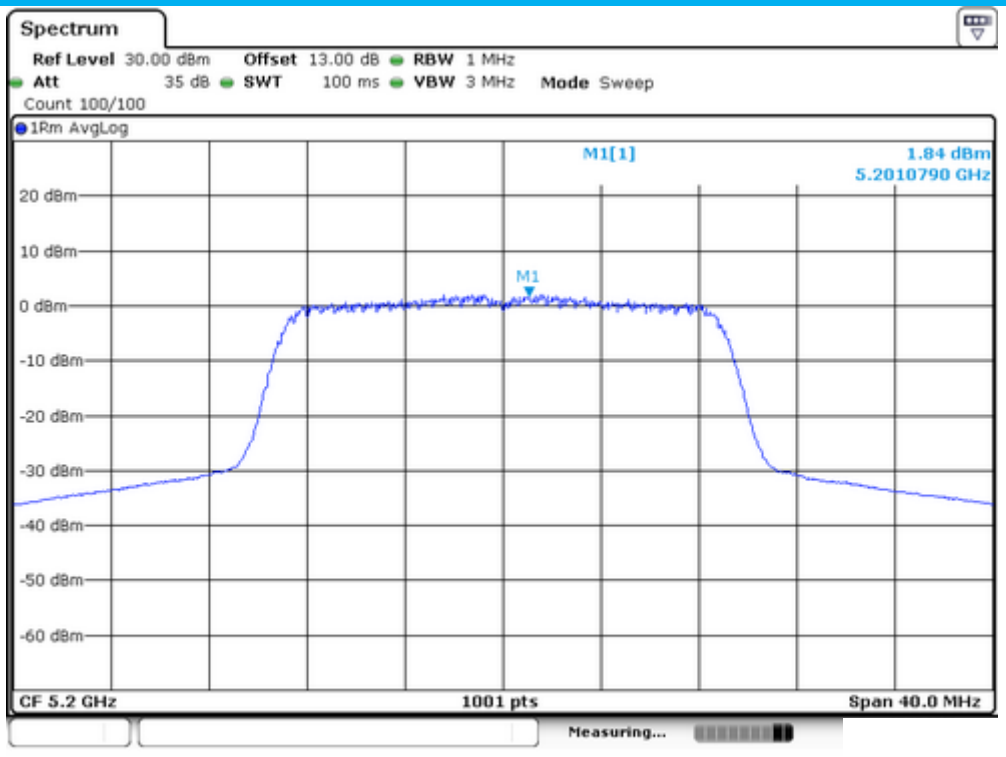
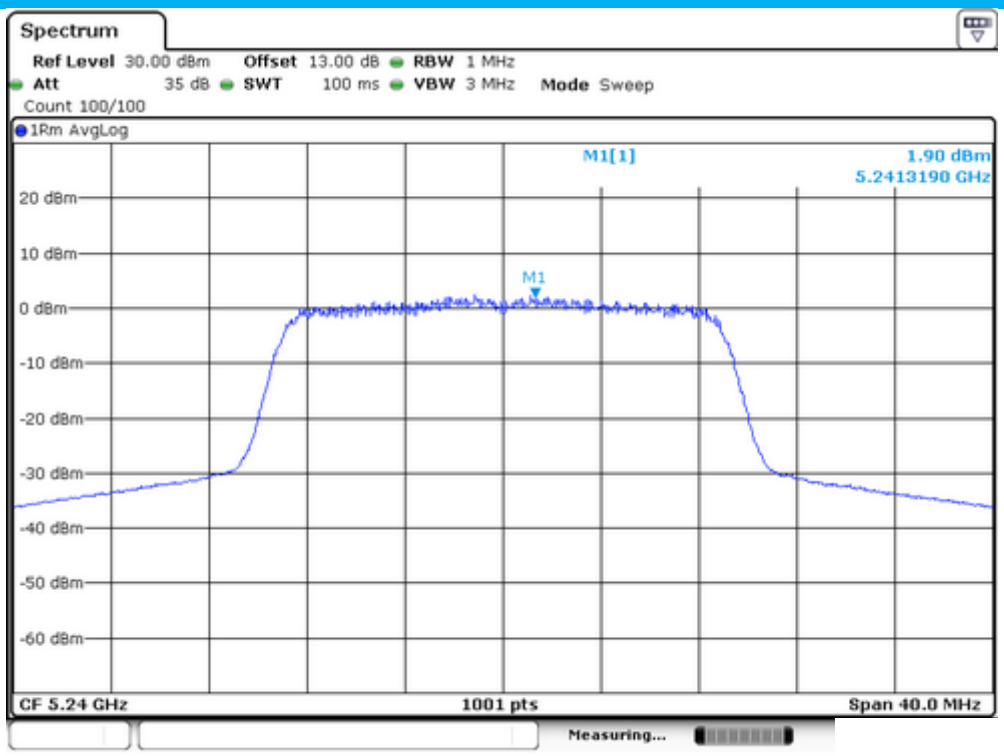


| Power Spectral Density | | UNII Band I | |
|---|---|---|---|
| Test Model | 802.11n(VHT20) mode | Frequency(MHz) | 5240 |

Ant0

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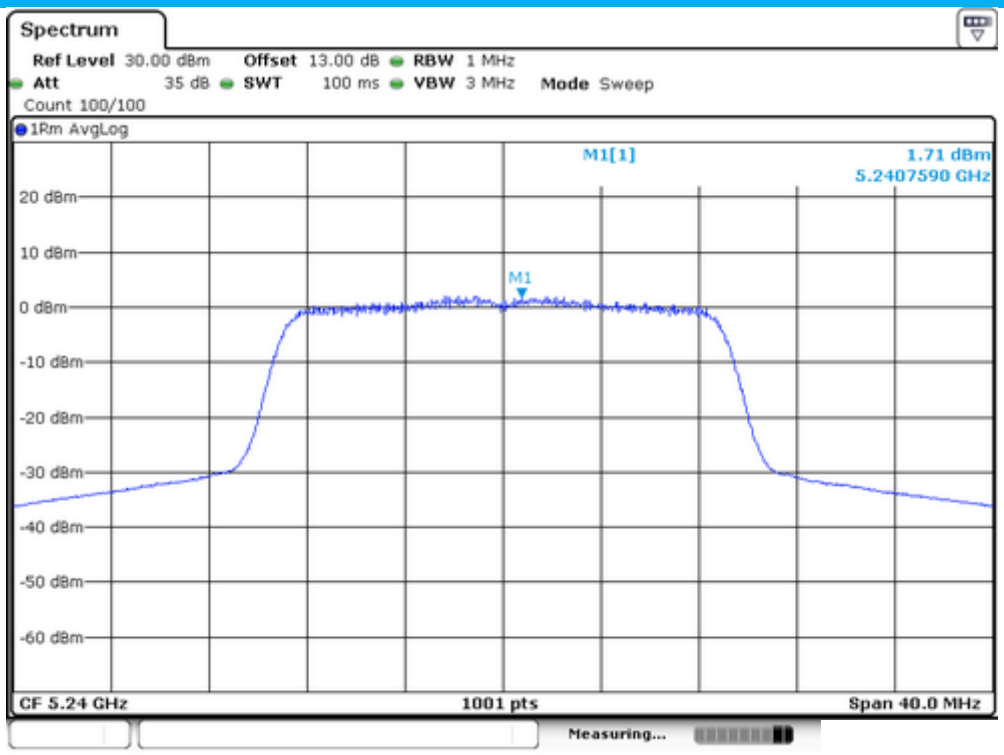
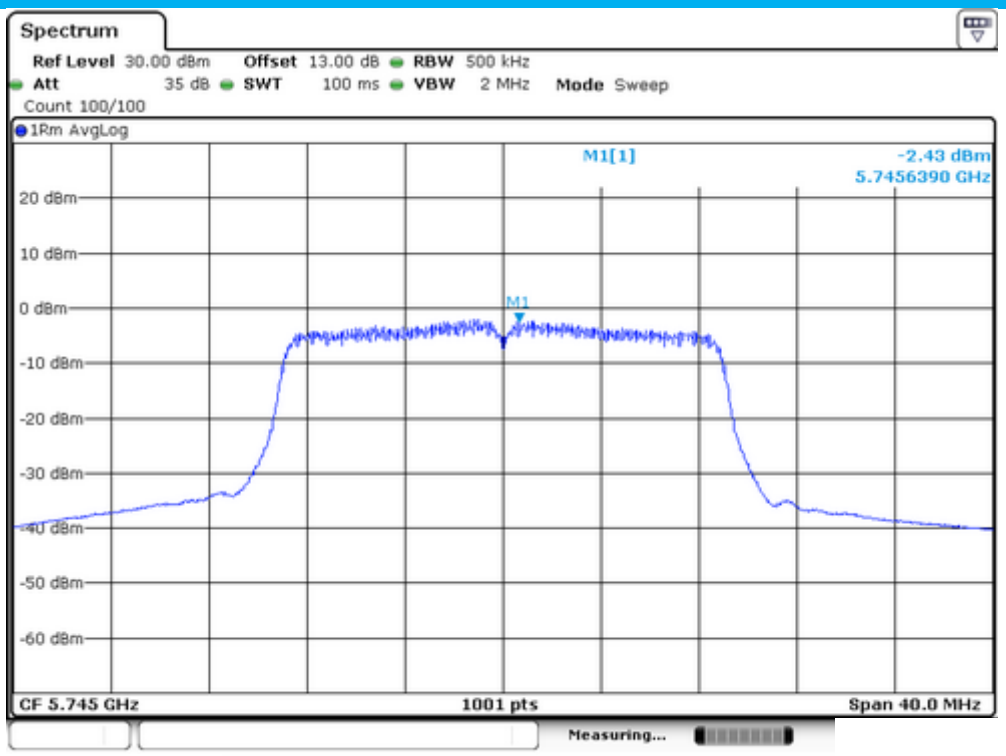


| Power Spectral Density | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11n(VHT20) mode | Frequency(MHz) | 5745 |

Ant0

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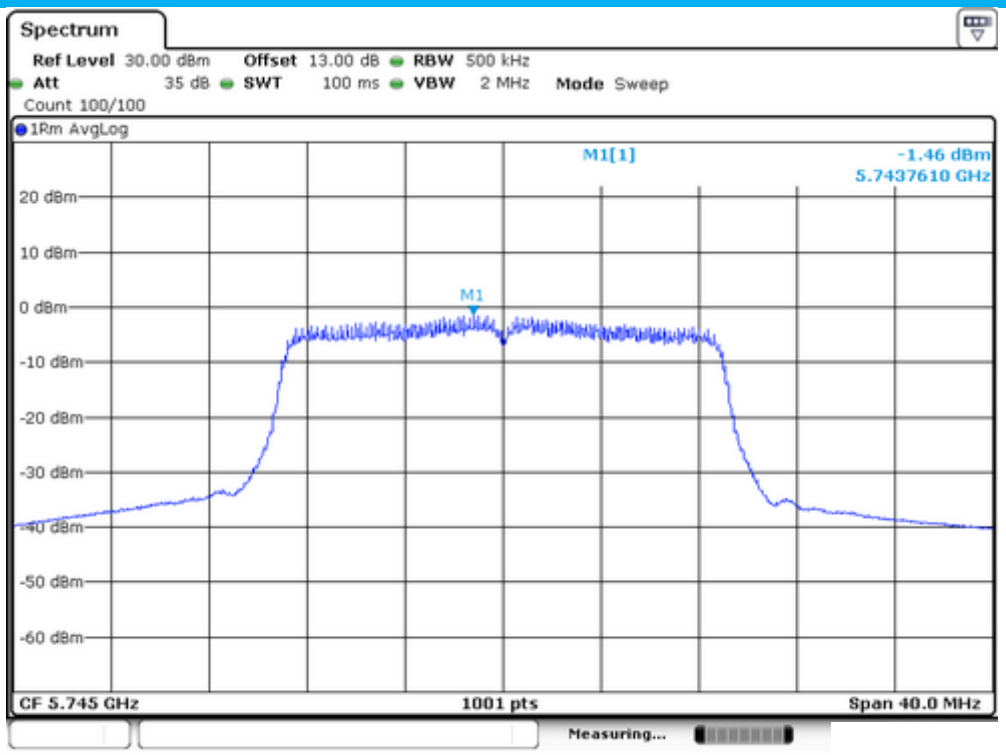
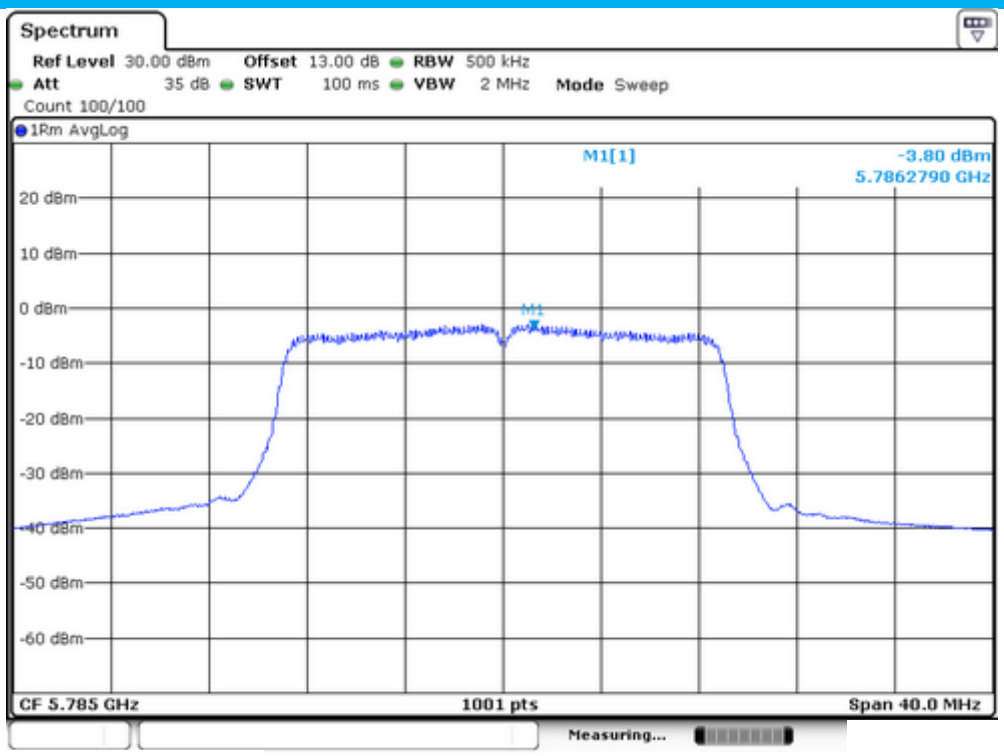


| Power Spectral Density | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11n(VHT20) mode | Frequency(MHz) | 5785 |

Ant0

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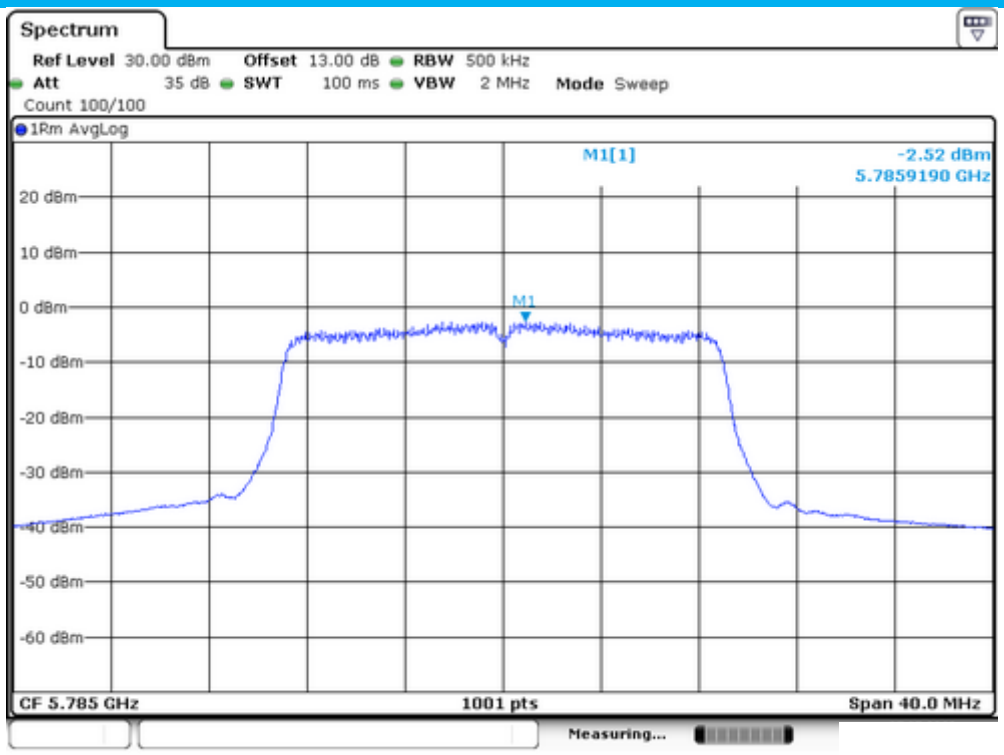
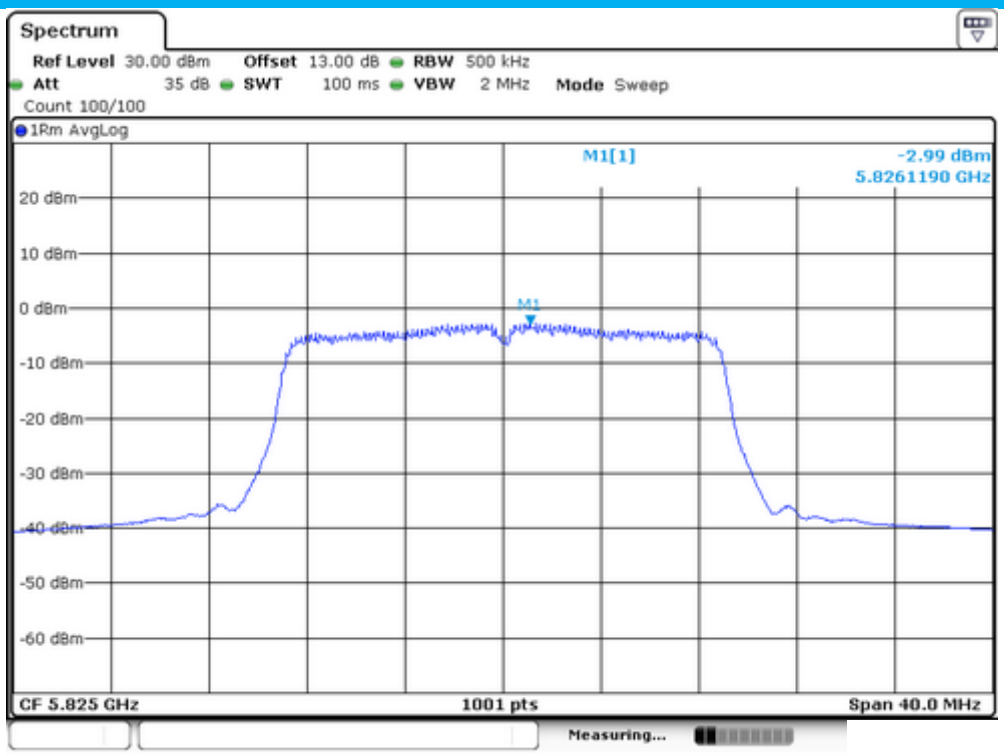


| Power Spectral Density | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11n(VHT20) mode | Frequency(MHz) | 5825 |

Ant0

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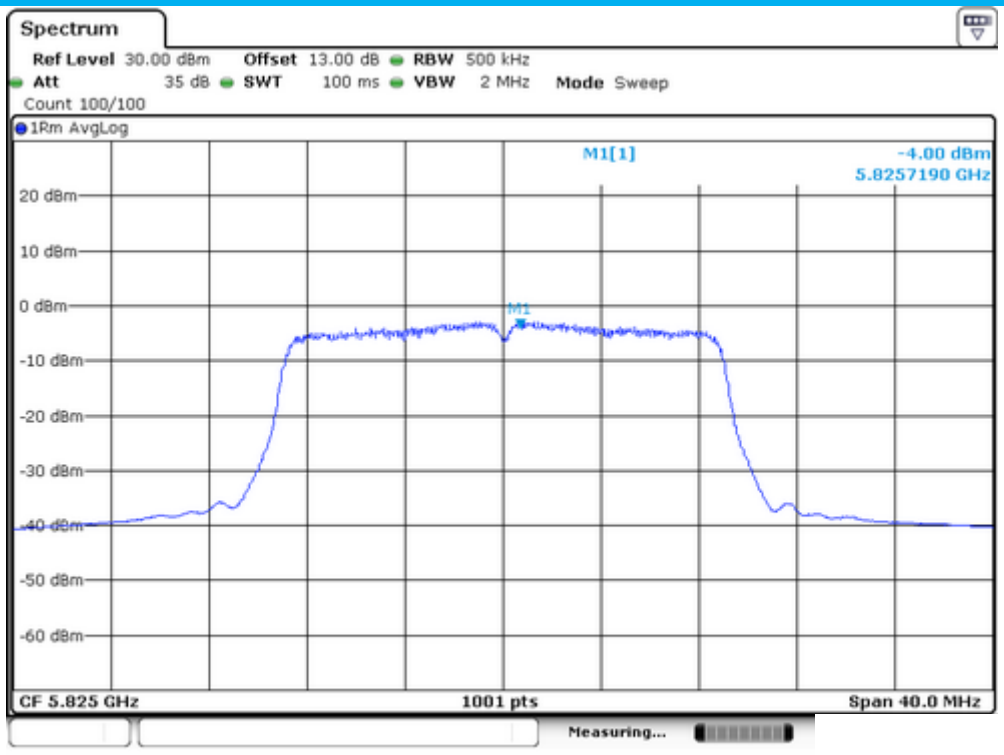
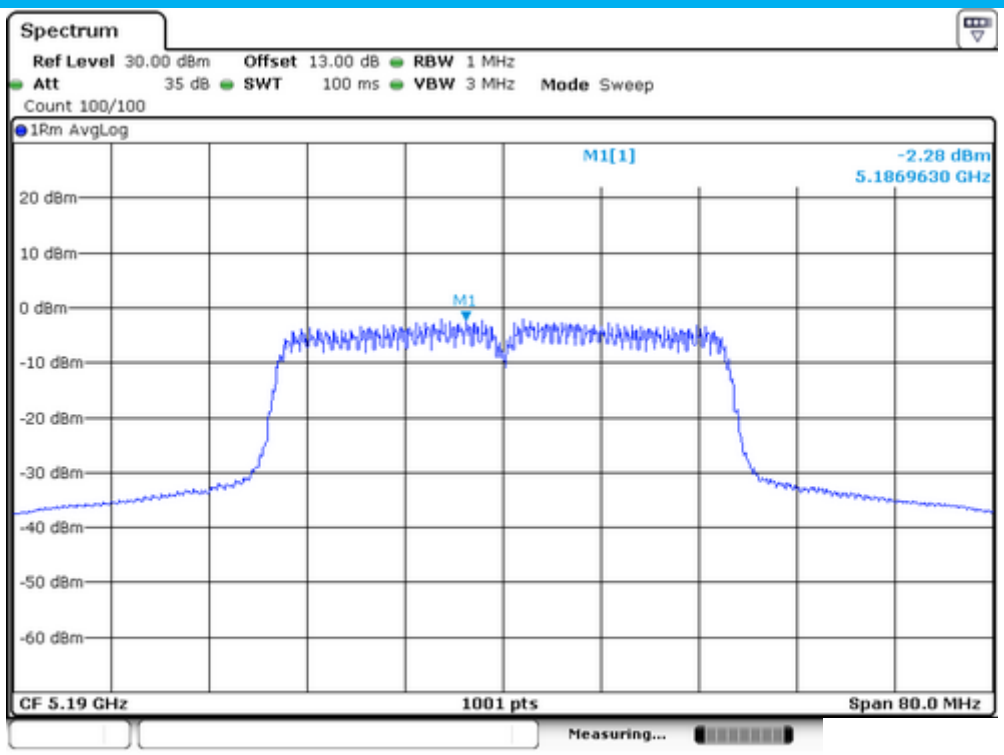


| Power Spectral Density | | UNII Band I | |
|---|---|---|---|
| Test Model | 802.11n(VHT40) mode | Frequency(MHz) | 5190 |

Ant0

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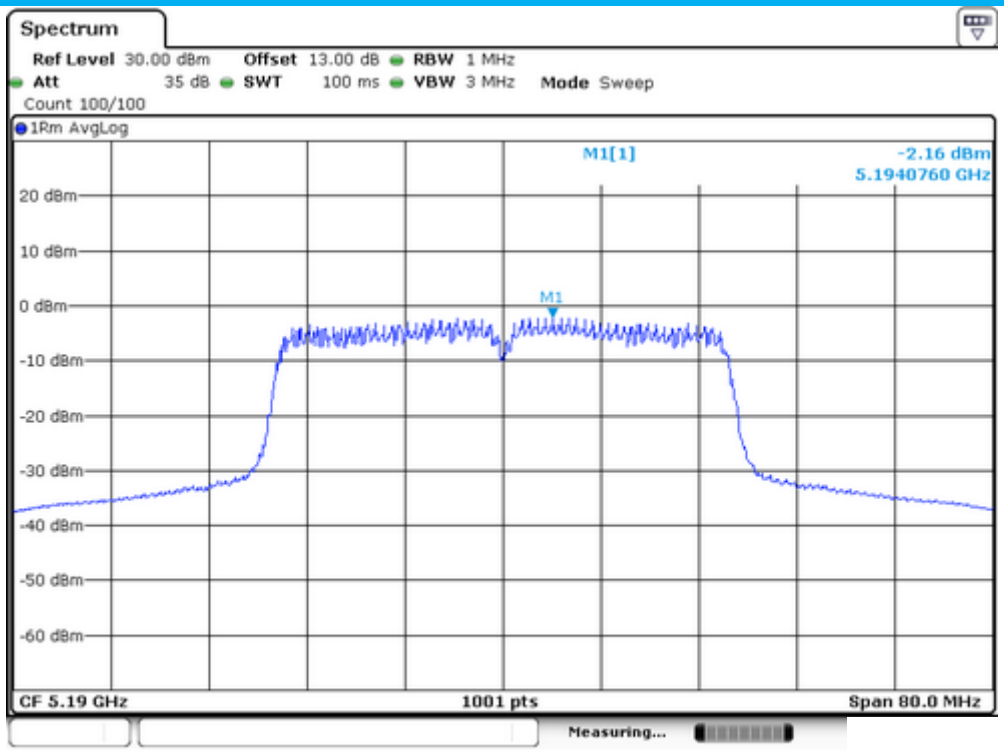
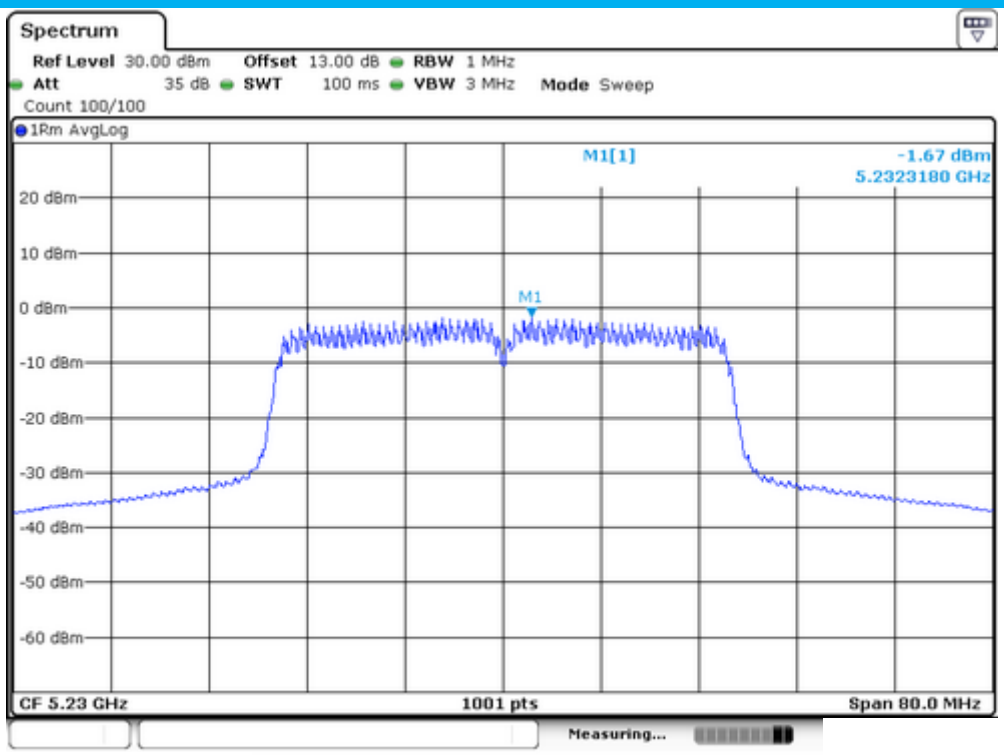


| Power Spectral Density | | UNII Band I | |
|---|---|---|---|
| Test Model | 802.11n(VHT40) mode | Frequency(MHz) | 5230 |

Ant0

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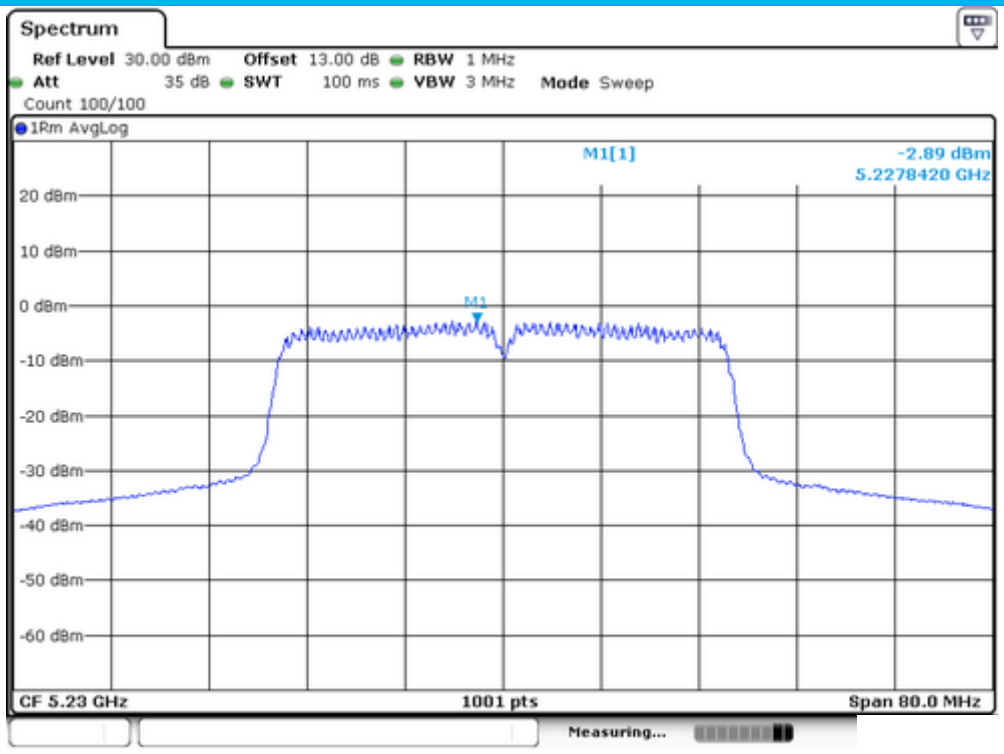
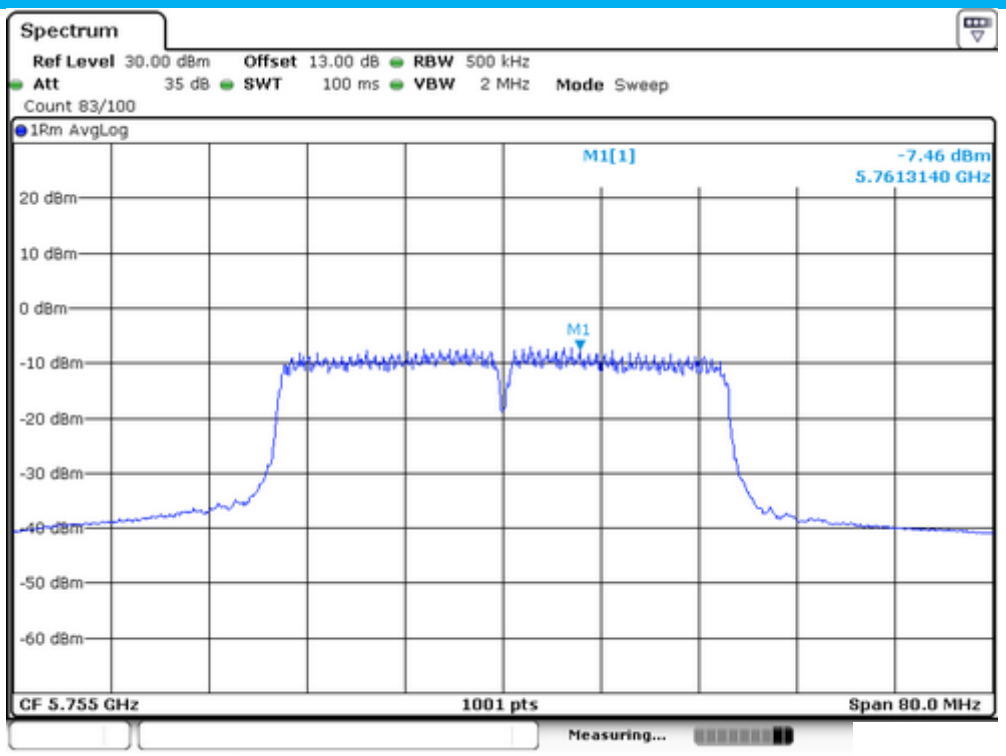


| Power Spectral Density | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11n(VHT40) mode | Frequency(MHz) | 5755 |

Ant0

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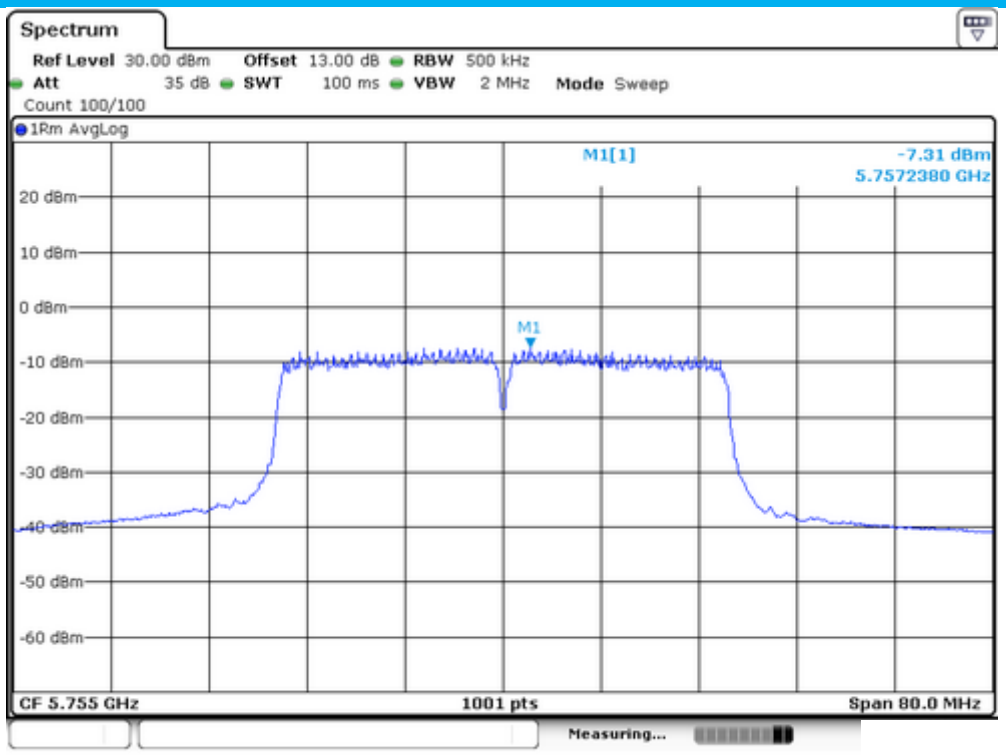
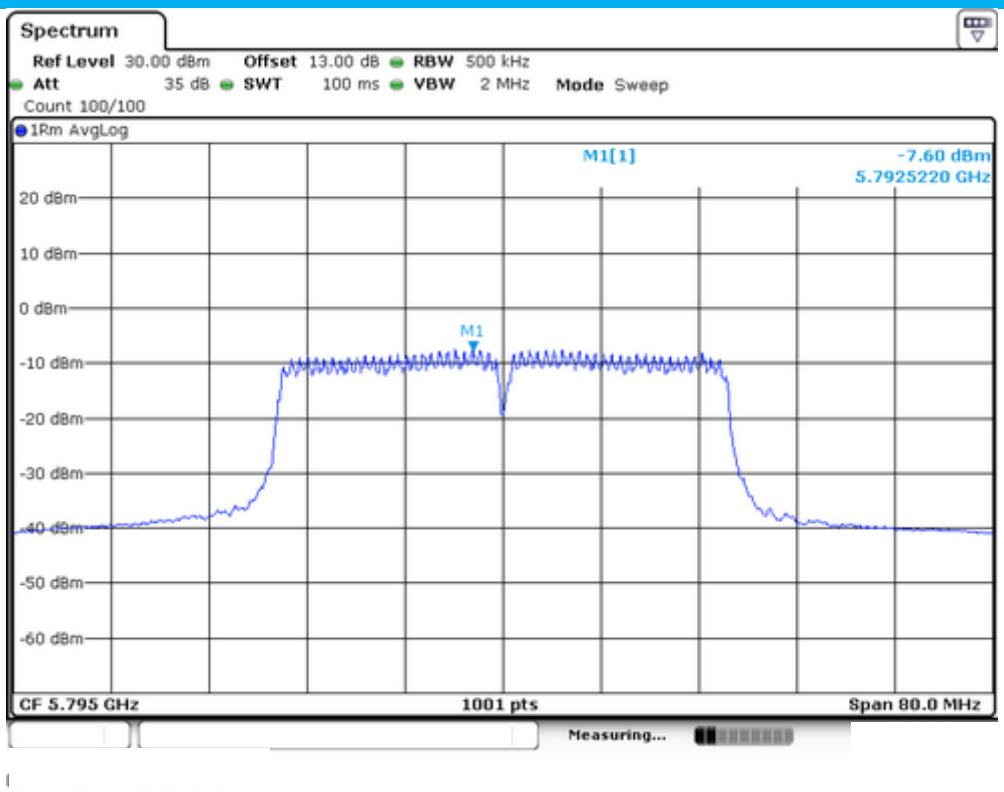


| Power Spectral Density | | UNII Band III | |
|---|---|---|---|
| Test Model | 802.11n(VHT40) mode | Frequency(MHz) | 5795 |

Ant0

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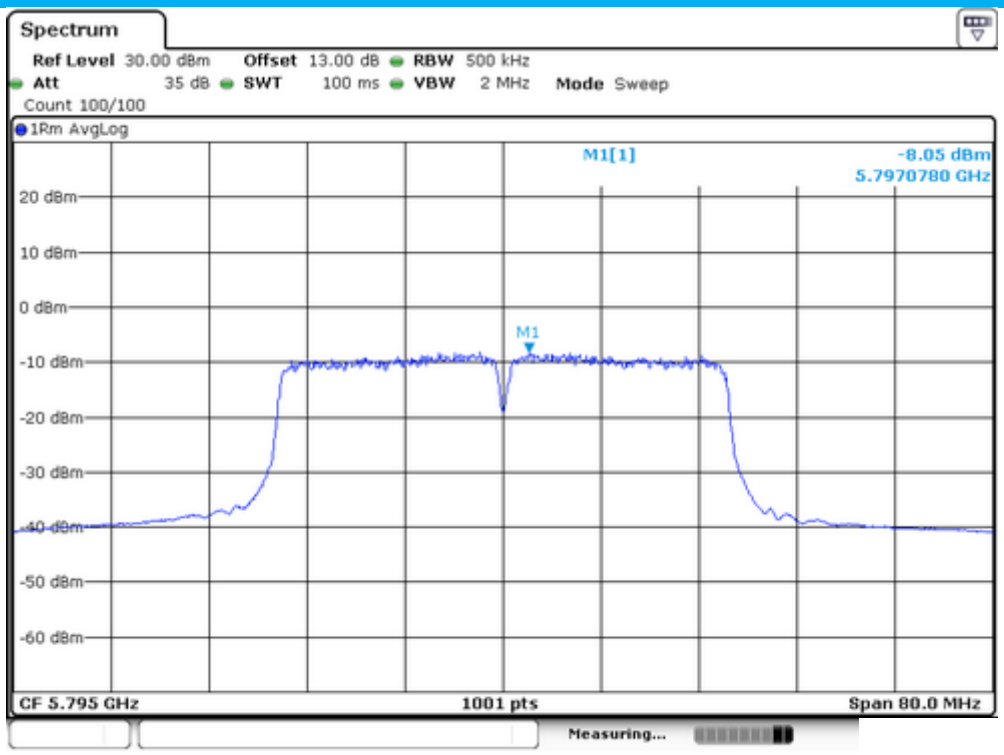


## 8.4 FREQUENCY STABILITY

8.4.1 Applicable Standard

According to FCC Part 15.407(g)
ANSI C63.10 Section 6.8

8.4.2 Conformance Limit

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

8.4.3 Test Configuration

Test according to clause 6.1 radio frequency test setup

8.4.4 Test Procedure

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
Set to the maximum power setting and enable the EUT transmit continuously
Set RBW = 10 kHz.
Set the video bandwidth (VBW) =30 kHz.
Set Span= Entire absence of modulation emissions bandwidth
Set Detector = Peak.
Set Trace mode = max hold.
Set Sweep = auto couple.
Allow the trace to stabilize.
The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value.
Beginning at each temperature level specified in user manual , the frequency shall be measured within one minute after application of primary power to the transmitter and at intervals of no more than one minute thereafter until ten minutes have elapsed or until sufficient measurements are obtained to indicate clearly that the frequency has stabilized within the applicable tolerance, whichever time period is greater. During each test, the ambient temperature shall not be allowed to rise more than 10° centigrade above the respective beginning ambient temperature level
Measure and record the results in the test report.

8.4.5 Test Results

The test data for Antenna A

| 802.11a mode | | 5180 | |
|---|---|---|---|
| Temperature : | -- | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |

| Voltage(V) | Temp(℃) | Test Frequency (MHz) | Max. Deviation (KHz) | Verdict |
|---|---|---|---|---|
| Vnom | -20 | 5179.969548 | -30.452 | Pass |
| | -10 | 5179.969256 | -30.744 | Pass |
| | 0 | 5179.969341 | -30.659 | Pass |
| | 10 | 5179.969596 | -30.404 | Pass |
| | 20 | 5179.969521 | -30.479 | Pass |
| | 30 | 5179.969264 | -30.736 | Pass |
| | 40 | 5179.970336 | -29.664 | Pass |
| | 50 | 5179.969584 | -30.416 | Pass |
| 85% Vnom | 20 | 5179.969774 | -30.226 | Pass |
| 115% Vnom | 20 | 5179.969459 | -30.541 | Pass |

| 802.11a mode | | 5200 | |
|---|---|---|---|
| Temperature : | -- | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |

| Voltage(V) | Temp(℃) | Test Frequency (MHz) | Max. Deviation (KHz) | Verdict |
|---|---|---|---|---|
| Vnom | -20 | 5199.961826 | -38.174 | Pass |
| | -10 | 5199.961694 | -38.306 | Pass |
| | 0 | 5199.961335 | -38.665 | Pass |
| | 10 | 5199.961457 | -38.543 | Pass |
| | 20 | 5200.038558 | 38.558 | Pass |
| | 30 | 5199.961512 | -38.488 | Pass |
| | 40 | 5199.961456 | -38.544 | Pass |
| | 50 | 5199.961159 | -38.841 | Pass |
| 85% Vnom | 20 | 5199.961357 | -38.643 | Pass |
| 115% Vnom | 20 | 5199.961259 | -38.741 | Pass |

| 802.11a mode | | 5240 | |
|---|---|---|---|
| Temperature : | -- | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |

| Voltage(V) | Temp(℃) | Test Frequency (MHz) | Max. Deviation (KHz) | Verdict |
|---|---|---|---|---|
| Vnom | -20 | 5239.977847 | -22.153 | Pass |
| | -10 | 5239.977526 | -22.474 | Pass |
| | 0 | 5239.977224 | -22.776 | Pass |
| | 10 | 5239.977469 | -22.531 | Pass |
| | 20 | 5239.977481 | -22.519 | Pass |
| | 30 | 5239.977742 | -22.258 | Pass |
| | 40 | 5239.977961 | -22.039 | Pass |
| | 50 | 5239.978536 | -21.464 | Pass |
| 85% Vnom | 20 | 5239.977651 | -22.349 | Pass |
| 115% Vnom | 20 | 5239.977123 | -22.877 | Pass |

| | | | |
|---|---|---|---|
| 802.11a mode | | 5745 | |
| Temperature : | -- | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |

| Voltage(V) | Temp(℃) | Test Frequency (MHz) | Max. Deviation (KHz) | Verdict |
|---|---|---|---|---|
| Vnom | -20 | 5744.986774 | -13.226 | Pass |
| | -10 | 5744.986864 | -13.136 | Pass |
| | 0 | 5744.986425 | -13.575 | Pass |
| | 10 | 5744.986639 | -13.361 | Pass |
| | 20 | 5744.986664 | -13.336 | Pass |
| | 30 | 5744.986254 | -13.746 | Pass |
| | 40 | 5744.986265 | -13.735 | Pass |
| | 50 | 5744.986336 | -13.664 | Pass |
| 85% Vnom | 20 | 5744.986694 | -13.306 | Pass |
| 115% Vnom | 20 | 5744.986889 | -13.111 | Pass |

| | | | |
|---|---|---|---|
| 802.11a mode | | 5785 | |
| Temperature : | -- | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |

| Voltage(V) | Temp(℃) | Test Frequency (MHz) | Max. Deviation (KHz) | Verdict |
|---|---|---|---|---|
| Vnom | -20 | 5784.991856 | -8.144 | Pass |
| | -10 | 5784.991241 | -8.759 | Pass |
| | 0 | 5784.991369 | -8.631 | Pass |
| | 10 | 5784.991224 | -8.776 | Pass |
| | 20 | 5784.991585 | -8.415 | Pass |
| | 30 | 5784.991669 | -8.331 | Pass |
| | 40 | 5784.991447 | -8.553 | Pass |
| | 50 | 5784.991451 | -8.549 | Pass |
| 85% Vnom | 20 | 5784.991264 | -8.736 | Pass |
| 115% Vnom | 20 | 5784.991226 | -8.774 | Pass |

| | | | |
|---|---|---|---|
| 802.11a mode | | 5825 | |
| Temperature : | -- | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |

| Voltage(V) | Temp(℃) | Test Frequency (MHz) | Max. Deviation (KHz) | Verdict |
|---|---|---|---|---|
| Vnom | -20 | 5824.982647 | -17.353 | Pass |
| | -10 | 5824.982225 | -17.775 | Pass |
| | 0 | 5824.982451 | -17.549 | Pass |
| | 10 | 5824.982159 | -17.841 | Pass |
| | 20 | 5824.982357 | -17.643 | Pass |
| | 30 | 5824.982456 | -17.544 | Pass |
| | 40 | 5824.982665 | -17.335 | Pass |
| | 50 | 5824.982632 | -17.368 | Pass |
| 85% Vnom | 20 | 5824.982225 | -17.775 | Pass |
| 115% Vnom | 20 | 5824.983856 | -16.144 | Pass |

| 802.11n(VHT20) mode | | 5180 | |
|---|---|---|---|
| Temperature : | -- | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |

| Voltage(V) | Temp(℃) | Test Frequency (MHz) | Max. Deviation (KHz) | Verdict |
|---|---|---|---|---|
| Vnom | -20 | 5180.001485 | 1.485 | Pass |
| | -10 | 5180.001556 | 1.556 | Pass |
| | 0 | 5180.001961 | 1.961 | Pass |
| | 10 | 5180.001745 | 1.745 | Pass |
| | 20 | 5180.001248 | 1.248 | Pass |
| | 30 | 5180.001065 | 1.065 | Pass |
| | 40 | 5180.001336 | 1.336 | Pass |
| | 50 | 5180.001225 | 1.225 | Pass |
| 85% Vnom | 20 | 5180.001167 | 1.167 | Pass |
| 115% Vnom | 20 | 5180.001941 | 1.941 | Pass |

| 802.11n(VHT20) mode | | 5200 | |
|---|---|---|---|
| Temperature : | -- | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |

| Voltage(V) | Temp(℃) | Test Frequency (MHz) | Max. Deviation (KHz) | Verdict |
|---|---|---|---|---|
| Vnom | -20 | 5199.976841 | -23.159 | Pass |
| | -10 | 5199.977751 | -22.249 | Pass |
| | 0 | 5199.975335 | -24.665 | Pass |
| | 10 | 5199.975964 | -24.036 | Pass |
| | 20 | 5199.975581 | -24.419 | Pass |
| | 30 | 5199.975445 | -24.555 | Pass |
| | 40 | 5199.975561 | -24.439 | Pass |
| | 50 | 5199.975852 | -24.148 | Pass |
| 85% Vnom | 20 | 5199.975692 | -24.308 | Pass |
| 115% Vnom | 20 | 5199.976361 | -23.639 | Pass |

| 802.11n(VHT20) mode | | 5240 | |
|---|---|---|---|
| Temperature : | -- | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |

| Voltage(V) | Temp(℃) | Test Frequency (MHz) | Max. Deviation (KHz) | Verdict |
|---|---|---|---|---|
| Vnom | -20 | 5239.982984 | -17.016 | Pass |
| | -10 | 5239.981654 | -18.346 | Pass |
| | 0 | 5239.981452 | -18.548 | Pass |
| | 10 | 5239.981361 | -18.639 | Pass |
| | 20 | 5239.981742 | -18.258 | Pass |
| | 30 | 5239.981564 | -18.436 | Pass |
| | 40 | 5239.981554 | -18.446 | Pass |
| | 50 | 5239.981469 | -18.531 | Pass |
| 85% Vnom | 20 | 5239.981369 | -18.631 | Pass |
| 115% Vnom | 20 | 5239.981157 | -18.843 | Pass |

| 802.11n(VHT20) mode | | 5745 | |
|---|---|---|---|
| Temperature : | -- | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |

| Voltage(V) | Temp(℃) | Test Frequency (MHz) | Max. Deviation (KHz) | Verdict |
|---|---|---|---|---|
| Vnom | -20 | 5744.980889 | -19.111 | Pass |
| | -10 | 5744.980654 | -19.346 | Pass |
| | 0 | 5744.980157 | -19.843 | Pass |
| | 10 | 5744.980225 | -19.775 | Pass |
| | 20 | 5744.980694 | -19.306 | Pass |
| | 30 | 5744.980365 | -19.635 | Pass |
| | 40 | 5744.980745 | -19.255 | Pass |
| | 50 | 5744.980761 | -19.239 | Pass |
| 85% Vnom | 20 | 5744.980715 | -19.285 | Pass |
| 115% Vnom | 20 | 5744.980549 | -19.451 | Pass |

| 802.11n(VHT20) mode | | 5785 | |
|---|---|---|---|
| Temperature : | -- | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |

| Voltage(V) | Temp(℃) | Test Frequency (MHz) | Max. Deviation (KHz) | Verdict |
|---|---|---|---|---|
| Vnom | -20 | 5784.988694 | -11.306 | Pass |
| | -10 | 5784.988264 | -11.736 | Pass |
| | 0 | 5784.988334 | -11.666 | Pass |
| | 10 | 5784.988547 | -11.453 | Pass |
| | 20 | 5784.988841 | -11.159 | Pass |
| | 30 | 5784.988852 | -11.148 | Pass |
| | 40 | 5784.988963 | -11.037 | Pass |
| | 50 | 5784.988751 | -11.249 | Pass |
| 85% Vnom | 20 | 5784.988159 | -11.841 | Pass |
| 115% Vnom | 20 | 5784.988751 | -11.249 | Pass |

| 802.11n(VHT20) mode | | 5825 | |
|---|---|---|---|
| Temperature : | -- | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |

| Voltage(V) | Temp(℃) | Test Frequency (MHz) | Max. Deviation (KHz) | Verdict |
|---|---|---|---|---|
| Vnom | -20 | 5824.991448 | -8.552 | Pass |
| | -10 | 5824.993421 | -6.579 | Pass |
| | 0 | 5824.991549 | -8.451 | Pass |
| | 10 | 5824.991369 | -8.631 | Pass |
| | 20 | 5824.991457 | -8.543 | Pass |
| | 30 | 5824.991861 | -8.139 | Pass |
| | 40 | 5824.991256 | -8.744 | Pass |
| | 50 | 5824.991134 | -8.866 | Pass |
| 85% Vnom | 20 | 5824.991469 | -8.531 | Pass |
| 115% Vnom | 20 | 5824.991357 | -8.643 | Pass |

| 802.11n(VHT40) mode | | 5190 | |
|---|---|---|---|
| Temperature : | -- | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |

| Voltage(V) | Temp(℃) | Test Frequency (MHz) | Max. Deviation (KHz) | Verdict |
|---|---|---|---|---|
| Vnom | -20 | 5189.975645 | -24.355 | Pass |
| | -10 | 5189.976552 | -23.448 | Pass |
| | 0 | 5189.976339 | -23.661 | Pass |
| | 10 | 5189.976458 | -23.542 | Pass |
| | 20 | 5189.975627 | -24.373 | Pass |
| | 30 | 5189.975157 | -24.843 | Pass |
| | 40 | 5189.975852 | -24.148 | Pass |
| | 50 | 5189.975242 | -24.758 | Pass |
| 85% Vnom | 20 | 5189.975364 | -24.636 | Pass |
| 115% Vnom | 20 | 5189.975891 | -24.109 | Pass |

| 802.11n(VHT40) mode | | 5230 | |
|---|---|---|---|
| Temperature : | -- | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |

| Voltage(V) | Temp(℃) | Test Frequency (MHz) | Max. Deviation (KHz) | Verdict |
|---|---|---|---|---|
| Vnom | -20 | 5229.972467 | -27.533 | Pass |
| | -10 | 5229.972521 | -27.479 | Pass |
| | 0 | 5229.972463 | -27.537 | Pass |
| | 10 | 5229.972348 | -27.652 | Pass |
| | 20 | 5229.972578 | -27.422 | Pass |
| | 30 | 5229.972496 | -27.504 | Pass |
| | 40 | 5229.973257 | -26.743 | Pass |
| | 50 | 5229.972856 | -27.144 | Pass |
| 85% Vnom | 20 | 5229.972264 | -27.736 | Pass |
| 115% Vnom | 20 | 5229.972581 | -27.754 | Pass |

| 802.11n(VHT40) mode | | 5755 | |
|---|---|---|---|
| Temperature : | -- | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |

| Voltage(V) | Temp(℃) | Test Frequency (MHz) | Max. Deviation (KHz) | Verdict |
|---|---|---|---|---|
| Vnom | -20 | 5754.994864 | -5.136 | Pass |
| | -10 | 5754.994542 | -5.458 | Pass |
| | 0 | 5754.994364 | -5.636 | Pass |
| | 10 | 5754.994694 | -5.306 | Pass |
| | 20 | 5754.994452 | -5.548 | Pass |
| | 30 | 5754.994426 | -5.574 | Pass |
| | 40 | 5754.994218 | -5.782 | Pass |
| | 50 | 5754.994364 | -5.636 | Pass |
| 85% Vnom | 20 | 5754.994841 | -5.159 | Pass |
| 115% Vnom | 20 | 5754.994352 | -5.648 | Pass |

| 802.11n(VHT40) mode | | 5795 | |
|---|---|---|---|
| Temperature : | -- | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |

| Voltage(V) | Temp(℃) | Test Frequency (MHz) | Max. Deviation (KHz) | Verdict |
|---|---|---|---|---|
| Vnom | -20 | 5794.985456 | -14.544 | Pass |
| | -10 | 5794.985572 | -14.428 | Pass |
| | 0 | 5794.985136 | -14.864 | Pass |
| | 10 | 5794.985956 | -14.044 | Pass |
| | 20 | 5794.985471 | -14.529 | Pass |
| | 30 | 5794.986582 | -13.418 | Pass |
| | 40 | 5794.985642 | -14.358 | Pass |
| | 50 | 5794.985349 | -14.651 | Pass |
| 85% Vnom | 20 | 5794.985334 | -14.666 | Pass |
| 115% Vnom | 20 | 5794.986582 | -13.418 | Pass |

## 8.5 UNDESIRABLE RADIATED SPURIOUS EMISSION

8.5.1 Applicable Standard

According to FCC Part 15.407 (b)
According to 789033 D02 Section II(G)

8.5.2 Conformance Limit

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.
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.
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.
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.
The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209
The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table 15.209(a):

| 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 | 2400/F(KHz) | 20 log (uV/m) | 30 |
| 1.705-30 | 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 |

The provisions of §15.205 apply to intentional radiators operating under this section,15.205 Restricted bands of operation

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090-0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.15 |
| 10.495-0.505 | 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 | | | |

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. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of ξ

15.205, and the emissions located in restricted bands also comply with 15.209 limit.

8.5.3 Test Configuration

Test according to clause 6.2 radio frequency test setup

8.5.4 Test Procedure

■ Unwanted Emissions Measurements below 1000 MHz

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

The EUT was placed on a turn table which is 0.8m above ground plane.

And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

Repeat above procedures until all frequency measured was complete.

We use software control the EUT, Let EUT hopping on and transmit with highest power, All the modes have been tested and the worst result was reported.

Use the following spectrum analyzer settings:

Set RBW=120kHz for f < 1 GHz(30MHz to 1GHz), 200Hz for f<150KHz(9KHz to 150KHz), 9KHz for <30MHz (150KHz to 30KHz).

Set the VBW > RBW.

Detector = Peak.

Trace mode = max hold.

Follow the guidelines in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b). Submit this data.

Repeat above procedures until all frequency measured was complete.

■ Unwanted Maximum peak Emissions Measurements above 1000 MHz

Maximum emission levels are measured by setting the analyzer as follows:

RBW = 1 MHz.

VBW ≥ 3 MHz.

Detector = Peak.

Sweep time = auto.

Trace mode = max hold.

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

■ Unwanted Average Emissions Measurements above 1000 MHz

Method VB (Averaging using reduced video bandwidth): Alternative method.

RBW = 1 MHz.

Video bandwidth. • If the EUT is configured to transmit with duty cycle ≥ 98 percent, set VBW ≤ RBW/100 (i.e., 10 kHz) but not less than 10 Hz.

• If the EUT duty cycle is < 98 percent, set VBW ≥ 1/T, where T is defined in section II.B.1.a).

Video bandwidth mode or display mode • The instrument shall be set to ensure that video filtering is applied in the power domain. Typically, this requires setting the detector mode to RMS and setting the Average-VBW Type to Power (RMS).

• As an alternative, the analyzer may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some analyzers require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to “Voltage” regardless of the display mode.

Detector = Peak.

Sweep time = auto.

Trace mode = max hold.

Allow max hold to run for at least 50 traces if the transmitted signal is continuous or has at least 98 percent duty cycle. For lower duty cycles, increase the minimum number of traces by a factor of 1/x, where x is the

duty cycle. For example, use at least 200 traces if the duty cycle is 25 percent. (If a specific emission is demonstrated to be continuous—i.e., 100 percent duty cycle—rather than turning on and off with the transmit cycle, at least 50 traces shall be averaged.)

■ Band edge measurements.

Unwanted band-edge emissions may be measured using either of the special band-edge measurement techniques (the marker-delta or integration methods) described below. Note that the marker-delta method is primarily a radiated measurement technique that requires the 99% occupied bandwidth edge to be within 2 MHz of the authorized band edge, whereas the integration method can be used in either a radiated or conducted measurement without any special requirement with regards to the displacement of the unwanted emission(s) relative to the authorized bandwidth.

Marker-Delta Method.

The marker-delta method, as described in ANSI C63.10, can be used to perform measurements of the radiated unwanted emissions level of emissions provided that the 99% occupied bandwidth of the fundamental is within 2 MHz of the authorized band-edge.

8.5.5 Test Results

■ ☒For Undesirable radiated Spurious Emission in UNII Band I

The voltage 1240V and the modes 802.11a/n has been tested and the worst result (801.11n(VHT20)) recorded as below:

- ☒Undesirable radiated Spurious Emission Above 1GHz (1GHz to 40GHz)

| | | | |
|---|---|---|---|
| Temperature : | 28℃ | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |
| Test mode: | 801.11n(VHT20) | Frequency(MHz): | 5180 |

| Freq. (MHz) | Ant.Pol. H/V | Field Strength (dBuV/m) | E.I.R.P (dBm) | Limit (dBm) | Over(dB) |
|---|---|---|---|---|---|
| 7090.32 | V | 52.18 | -43.05 | -27 | -16.05 |
| 9778.73 | V | 59.85 | -35.38 | -27 | -8.38 |
| 13159.31 | V | 60.12 | -35.11 | -27 | -8.11 |
| 6954.23 | H | 56.73 | -38.5 | -27 | -11.5 |
| 10322.76 | H | 60.69 | -34.54 | -27 | -7.54 |
| 13346.24 | H | 62.77 | -32.46 | -27 | -5.46 |

| | | | |
|---|---|---|---|
| Temperature : | 28℃ | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |
| Test mode: | 801.11n(VHT20) | Frequency(MHz): | 5220 |

| Freq. (MHz) | Ant.Pol. H/V | Field Strength (dBuV/m) | E.I.R.P (dBm) | Limit (dBm) | Over(dB) |
|---|---|---|---|---|---|
| 7088.95 | V | 54.16 | -41.07 | -27 | -14.07 |
| 8120.73 | V | 54.85 | -40.38 | -27 | -13.38 |
| 13160.36 | V | 59.38 | -35.85 | -27 | -8.85 |
| 6952.89 | H | 55.66 | -39.57 | -27 | -12.57 |
| 10323.82 | H | 60.27 | -34.96 | -27 | -7.96 |
| 13344.89 | H | 59.96 | -35.27 | -27 | -8.27 |

| | | | |
|---|---|---|---|
| Temperature : | 28℃ | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |
| Test mode: | 801.11n(VHT20) | Frequency(MHz): | 5240 |

| Freq. (MHz) | Ant.Pol. H/V | Field Strength (dBuV/m) | E.I.R.P (dBm) | Limit (dBm) | Over(dB) |
|---|---|---|---|---|---|
| 7087.43 | V | 53.49 | -41.74 | -27 | -14.74 |
| 9780.78 | V | 59.85 | -35.38 | -27 | -8.38 |
| 13158.85 | V | 57.46 | -37.77 | -27 | -10.77 |
| 6951.43 | H | 56.77 | -38.46 | -27 | -11.46 |
| 10324.8 | H | 60.18 | -35.05 | -27 | -8.05 |
| 13343.45 | H | 60.32 | -34.91 | -27 | -7.91 |

**Note:** (1) All Readings are Peak Value (VBW=3MHz) and Peak Value (VBW=10Hz).
(2) Emission Level= Reading Level+Probe Factor +Cable Loss.
(3)EIRP[dBm] = E[dBμV/m] + 20 log(d[meters]) - 104.77
d is the measurement distance in 3 meters

- ☒Undesirable radiated Undesirable radiated Spurious Emission in Band Edge

| | | | |
|---|---|---|---|
| Temperature : | 28℃ | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |
| Test mode: | 801.11n(VHT20) | Frequency(MHz): | 5180 |

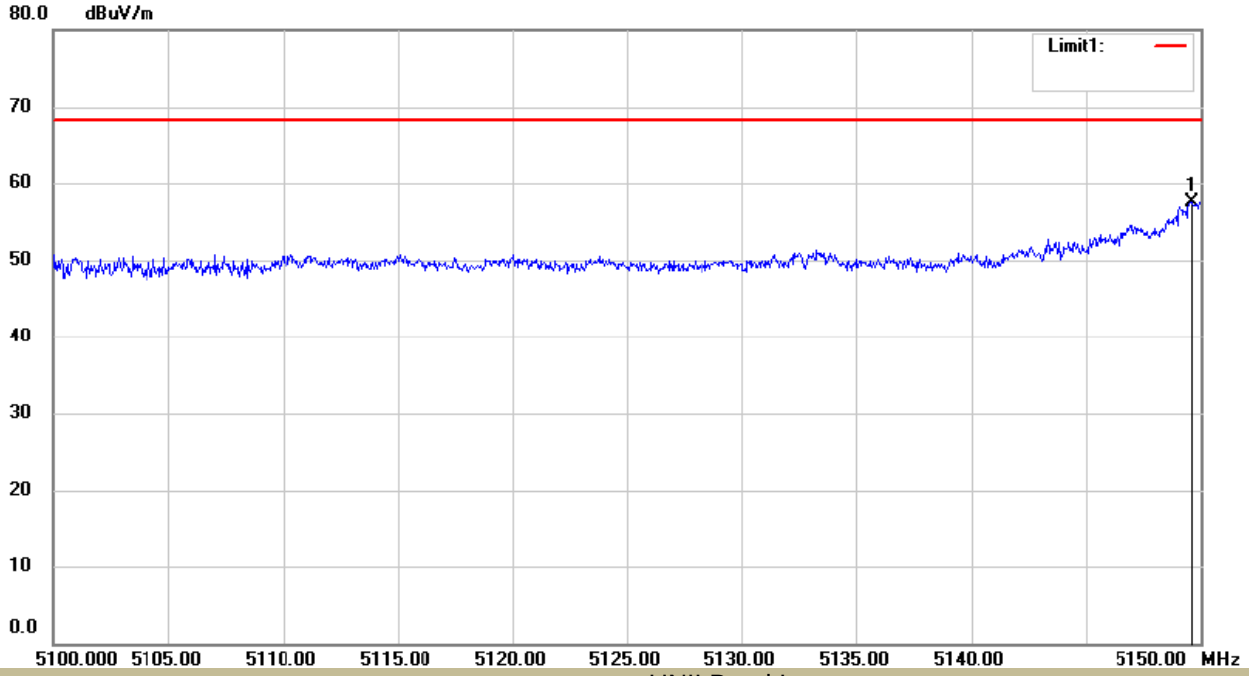
| Freq. (MHz) | Ant.Pol. H/V | Field Strength (RBW=100KHz) (dBuV/m) | E.I.R.P (dBm) | Limit (dBm) | Verdict |
|---|---|---|---|---|---|
| 5149.05 | H | 68.16 | -27.07 | -27 | Pass |
| 5138.55 | V | 67.33 | -27.9 | -27 | Pass |

| | | | |
|---|---|---|---|
| Temperature : | 28℃ | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |
| Test mode: | 801.11n(VHT20) | Frequency(MHz): | 5240 |

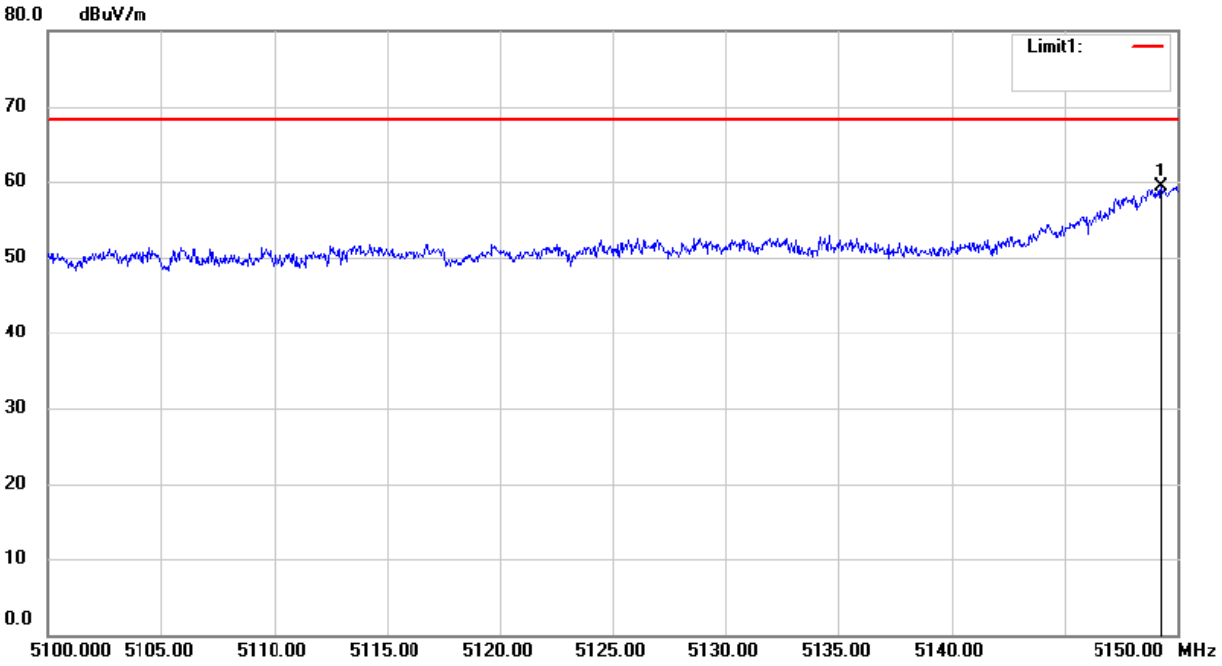
| Freq. (MHz) | Ant.Pol. H/V | Field Strength (RBW=100KHz) (dBuV/m) | E.I.R.P (dBm) | Limit (dBm) | Verdict |
|---|---|---|---|---|---|
| 5352.15 | V | 68.53 | -26.70 | -27 | Pass |
| 5359.05 | H | 69.17 | -26.06 | -27 | Pass |

**Note:** (1) All Readings are Peak Value (VBW=3MHz) and AV Value (VBW=10Hz).
(2) Emission Level= Reading Level+Probe Factor +Cable Loss.
(3)EIRP[dBm] = E[dBμV/m] + 20 log(d[meters]) - 104.77
d is the measurement distance in 3 meters

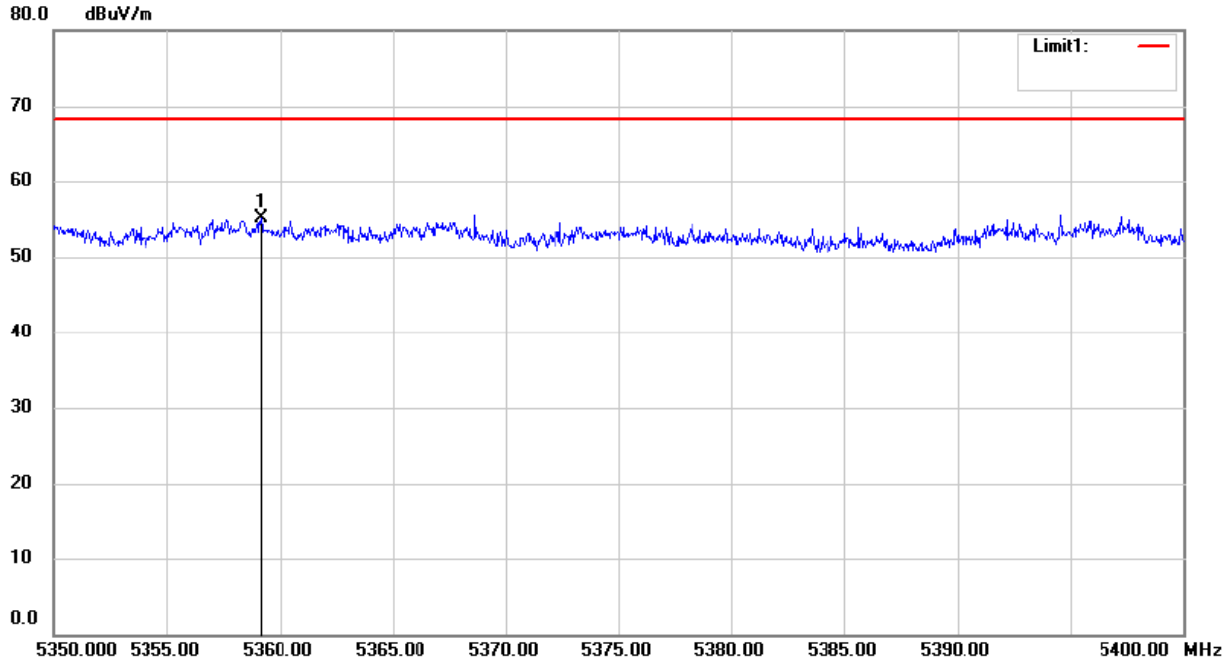
| Test Model | UNII Band I<br>Undesirable radiated Spurious Emission in Restricted Band (5100-5150MHz)<br>☐802.11a ☒802.11n(HT20) ☐802.11n(HT40)<br>☒5180 ☐5200 ☐5240 Ant.Pol H |
|---|---|



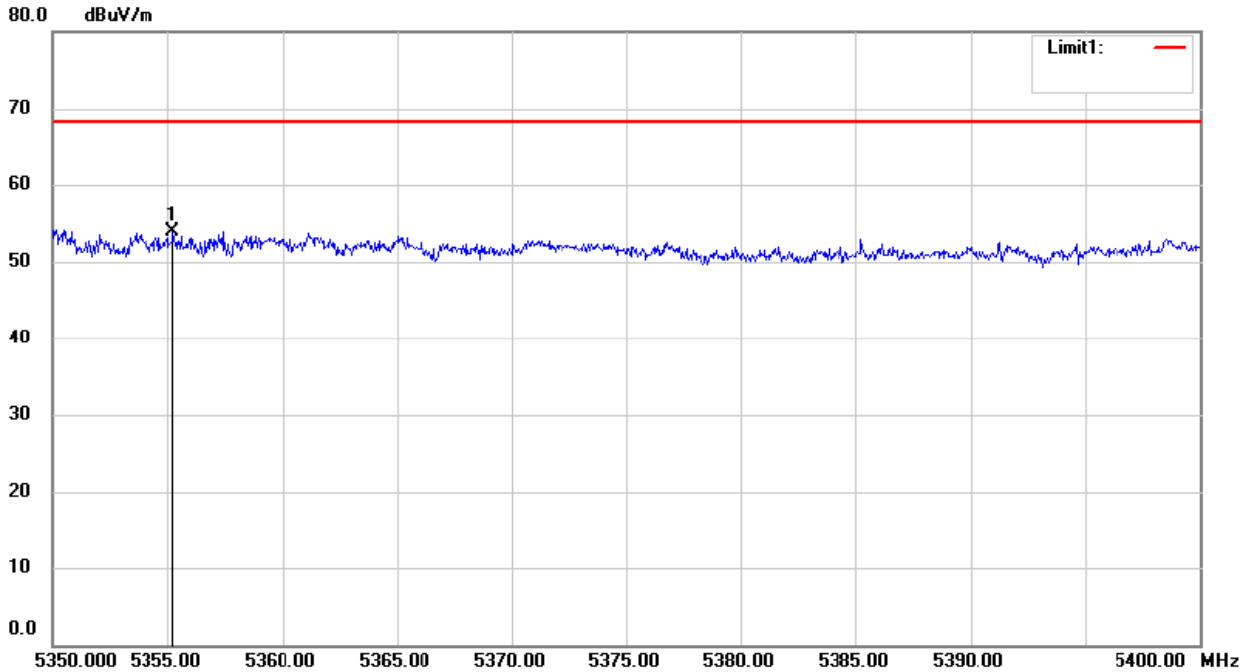

| Test Model | UNII Band I<br>Undesirable radiated Spurious Emission in Restricted Band (5100-5150MHz)<br>☐802.11a ☒802.11n(HT20) ☐802.11n(HT40)<br>☒5180 ☐5200 ☐5240 Ant.Pol V |
|---|---|



| Test Model | UNII Band I<br>Undesirable radiated Spurious Emission in Restricted Band (5350-5400MHz ) |
|---|---|
| | ☐802.11a ☒802.11n(HT20) ☐802.11n(HT40) |
| | ☐5180 ☐5200 ☒5240 Ant.Pol H |




| Test Model | UNII Band I<br>Undesirable radiated Spurious Emission in Restricted Band (5350-5400MHz ) |
|---|---|
| | ☐802.11a ☒802.11n(HT20) ☐802.11n(HT40) |
| | ☐5180 ☐5200 ☒5240 Ant.Pol V |



■ ☒For Undesirable radiated Spurious Emission in UNII Band III

All the modes 802.11a/n has been tested and the worst result 802.11(HT20) recorded as below:

- ☒Undesirable radiated Spurious Emission Above 1GHz (1GHz to 40GHz)

| | | | |
|---|---|---|---|
| Temperature : | 28℃ | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |
| Test mode: | 802.11(HT20) | Frequency(MHz): | 5745 |

| Freq. (MHz) | Ant.Pol. H/V | Field Strength (dBuV/m) | E.I.R.P (dBm) | Limit (dBm) | Over(dB) |
|---|---|---|---|---|---|
| 7142.69 | V | 51.69 | -43.54 | -27.00 | -16.54 |
| 9838.38 | V | 50.48 | -44.75 | -27.00 | -17.75 |
| 13214.11 | V | 67.26 | -27.97 | -27.00 | -0.97 |
| 7004.02 | H | 56.63 | -38.6 | -27.00 | -11.6 |
| 10382.46 | H | 60.79 | -34.44 | -27.00 | -7.44 |
| 13398.47 | H | 61.54 | -33.69 | -27.00 | -6.69 |

| | | | |
|---|---|---|---|
| Temperature : | 28℃ | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |
| Test mode: | 802.11(HT20) | Frequency(MHz): | 5785 |

| Freq. (MHz) | Ant.Pol. H/V | Field Strength (dBuV/m) | E.I.R.P (dBm) | Limit (dBm) | Over(dB) |
|---|---|---|---|---|---|
| 7141.34 | V | 46.72 | -48.51 | -27.00 | -21.51 |
| 9837 | V | 44.18 | -51.05 | -27.00 | -24.05 |
| 13215.18 | V | 59.69 | -35.54 | -27.00 | -8.54 |
| 7005.12 | H | 49.35 | -45.88 | -27.00 | -18.88 |
| 10381.03 | H | 51.44 | -43.79 | -27.00 | -16.79 |
| 13399.45 | H | 52.87 | -42.36 | -27.00 | -15.36 |

| | | | |
|---|---|---|---|
| Temperature : | 28℃ | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |
| Test mode: | 802.11(HT20) | Frequency(MHz): | 5825 |

| Freq. (MHz) | Ant.Pol. H/V | Field Strength (dBuV/m) | E.I.R.P (dBm) | Limit (dBm) | Over(dB) |
|---|---|---|---|---|---|
| 7142.41 | V | 46.85 | -48.38 | -27.00 | -21.38 |
| 9835.63 | V | 43.94 | -51.29 | -27.00 | -24.29 |
| 13216.22 | V | 60.05 | -35.18 | -27.00 | -8.18 |
| 7006.17 | H | 47.64 | -47.59 | -27.00 | -20.59 |
| 10379.69 | H | 51.26 | -43.97 | -27.00 | -16.97 |
| 13400.51 | H | 54.34 | -40.89 | -27.00 | -13.89 |

**Note:** (1) All Readings are Peak Value (VBW=3MHz) and Peak Value (VBW=10Hz).
(2) Emission Level= Reading Level+Probe Factor +Cable Loss.
(3)EIRP[dBm] = E[dBμV/m] + 20 log(d[meters]) - 104.77
d is the measurement distance in 3 meters

- ☒Undesirable radiated Spurious Emission in band edge

| | | | |
|---|---|---|---|
| Temperature : | 28℃ | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |
| Test mode: | 802.11a | Frequency: | 5745 |

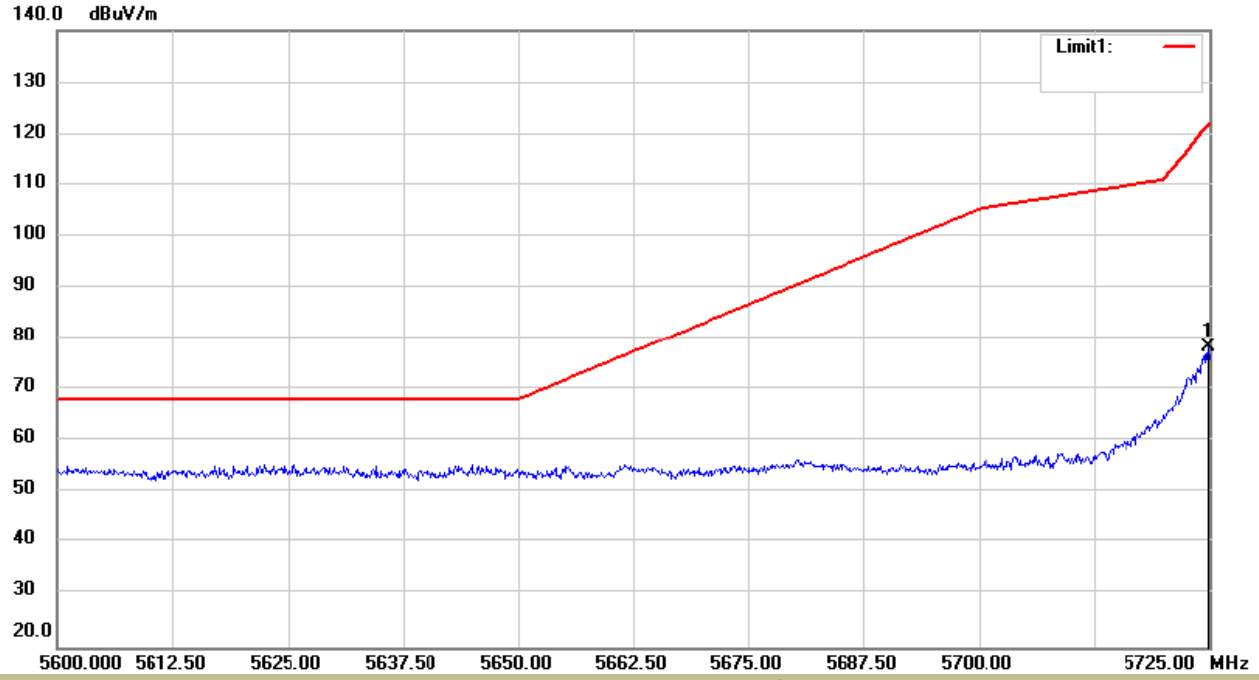
| Freq. (MHz) | Ant.Pol. H/V | Field Strength (RBW=100KHz) (dBuV/m) | E.I.R.P (dBm) | Limit (dBm) | Verdict |
|---|---|---|---|---|---|
| 5725.00 | H | 52.33 | -42.90 | -17 | PASS |
| 5724.75 | V | 50.84 | -44.39 | -17 | PASS |

| | | | |
|---|---|---|---|
| Temperature : | 28℃ | Test Date : | June 27, 2021 |
| Humidity : | 65 % | Test By: | Jack |
| Test mode: | 802.11a | Frequency: | 5825 |

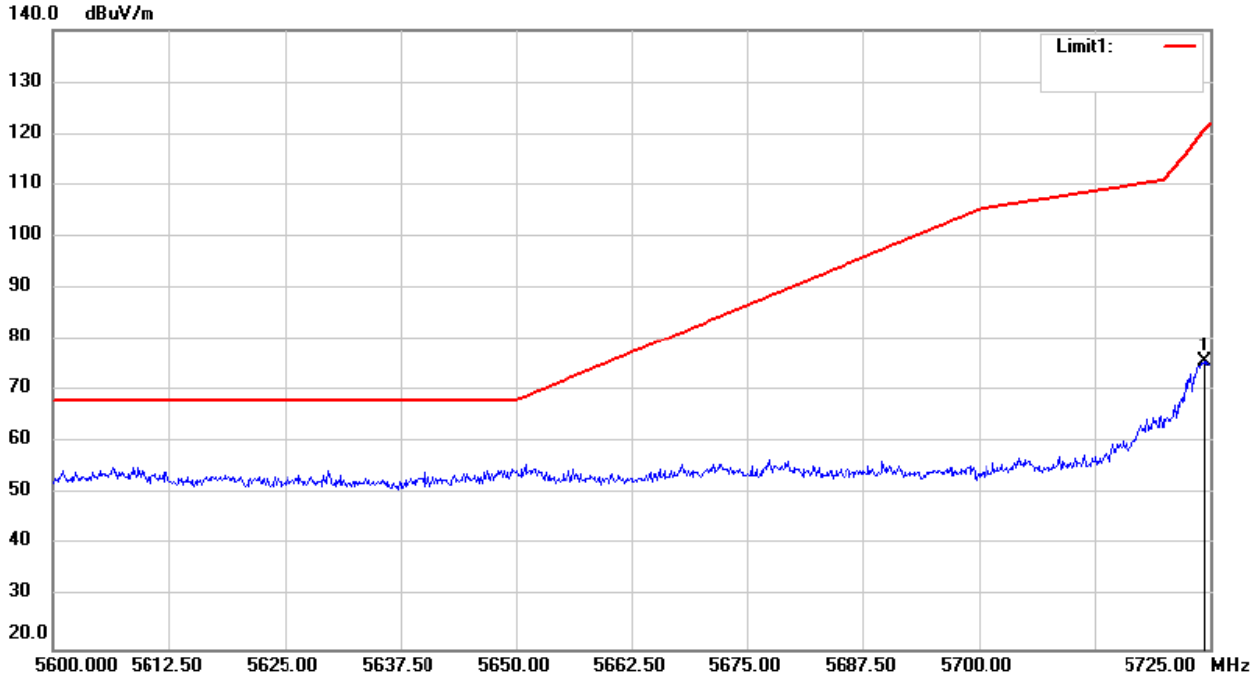
| Freq. (MHz) | Ant.Pol. H/V | Field Strength (RBW=100KHz) (dBuV/m) | E.I.R.P (dBm) | Limit (dBm) | Verdict |
|---|---|---|---|---|---|
| 5881.75 | H | 51.75 | -43.48 | -17 | PASS |
| 5874.87 | V | 49.62 | -45.61 | -17 | PASS |

**Note:** (1) All Readings are Peak Value (VBW=3MHz) and AV Value (VBW=10Hz).
(2) Emission Level= Reading Level+Probe Factor +Cable Loss.
(3)EIRP[dBm] = E[dBμV/m] + 20 log(d[meters]) - 104.77
d is the measurement distance in 3 meters

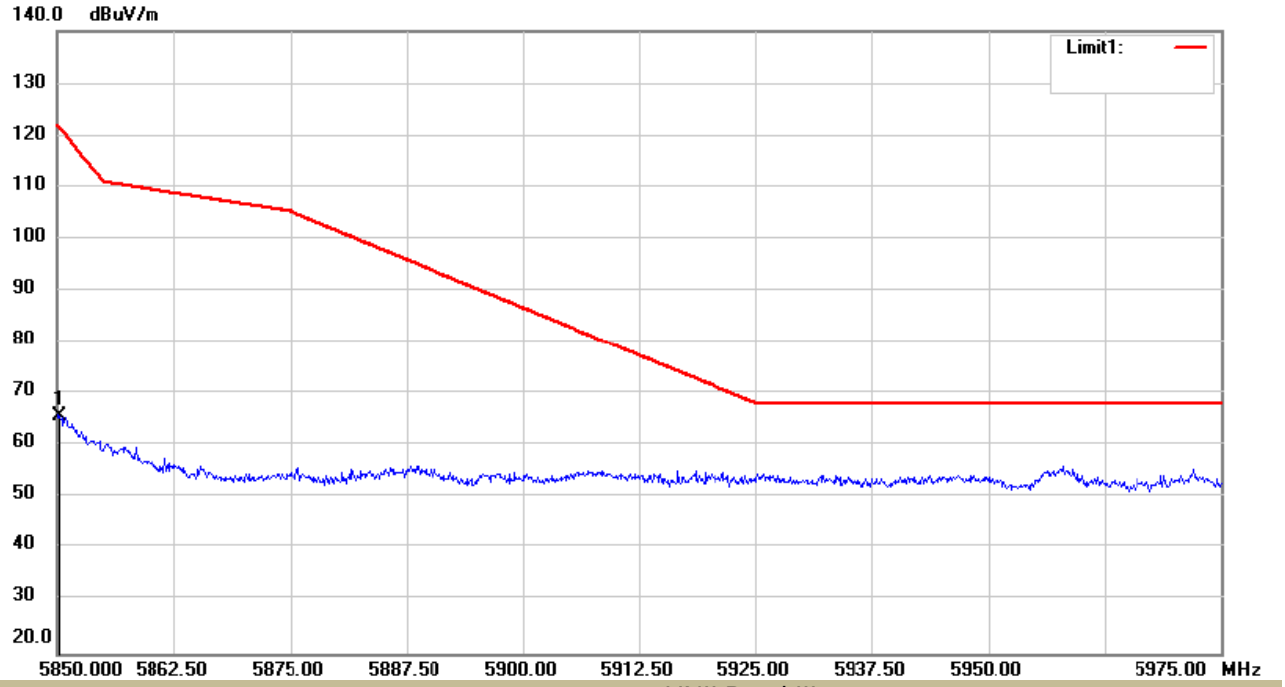
| Test Model | UNII Band III<br>Undesirable radiated Undesirable radiated Spurious Emission in Band Edge<br>☐802.11a ☒802.11n(HT20) ☐802.11n(HT40)<br>☒5745 Ant.Pol H |
|---|---|



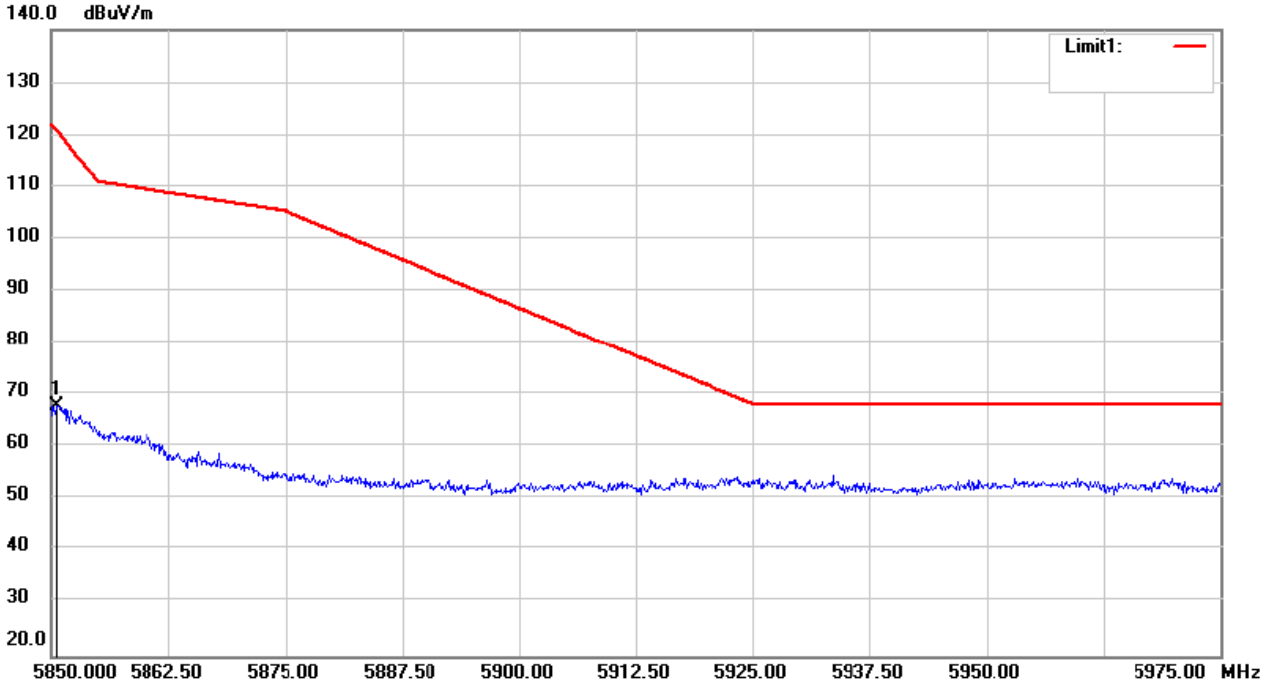

| Test Model | UNII Band III<br>Undesirable radiated Undesirable radiated Spurious Emission in Band Edge<br>☐802.11a ☒802.11n(HT20) ☐802.11n(HT40)<br>☒5745 Ant.Pol V |
|---|---|



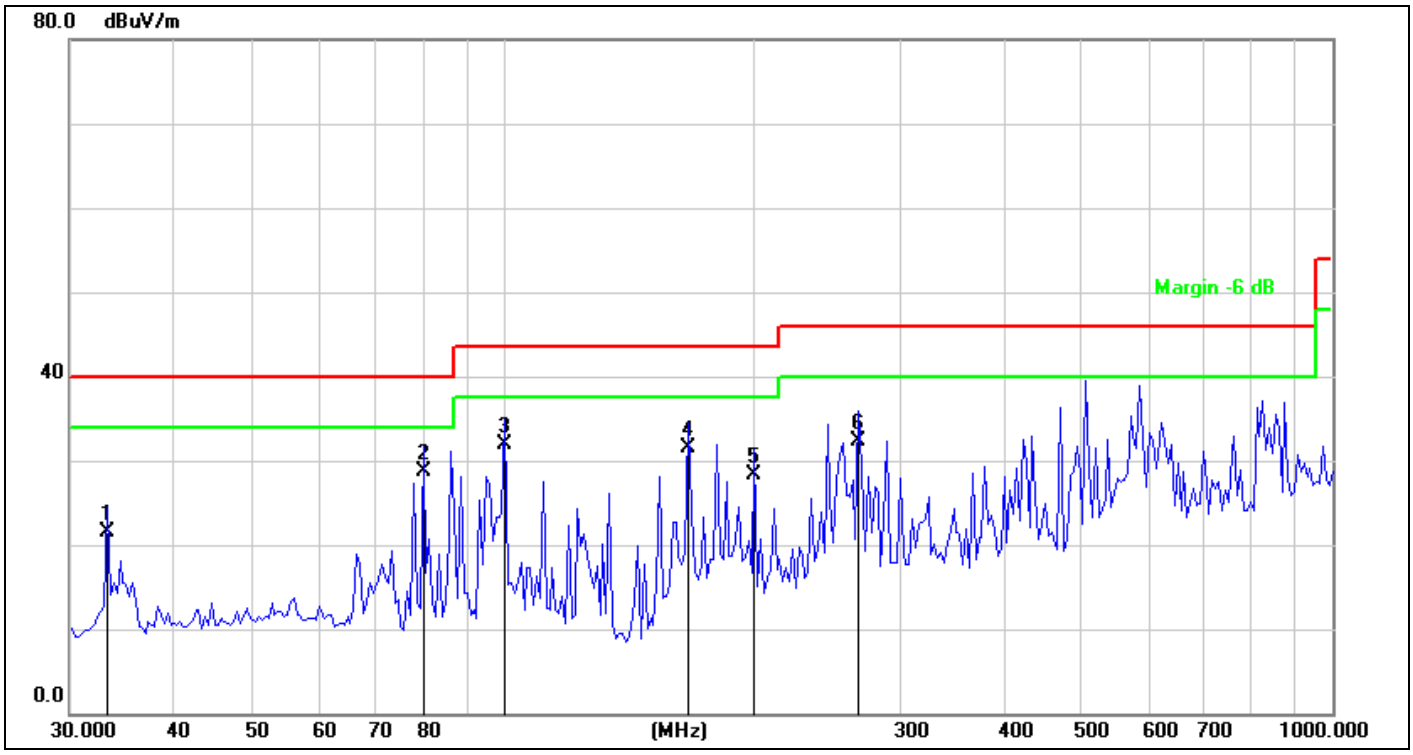
| Test Model | UNII Band III<br>Undesirable radiated Undesirable radiated Spurious Emission in Band Edge<br>☐802.11a ☒802.11n(HT20) ☐802.11n(HT40)<br>☒5825 Ant.Pol H |
|---|---|




| Test Model | UNII Band III<br>Undesirable radiated Undesirable radiated Spurious Emission in Band Edge<br>☐802.11a ☒802.11n(HT20) ☐802.11n(HT40)<br>☒5825 Ant.Pol V |
|---|---|



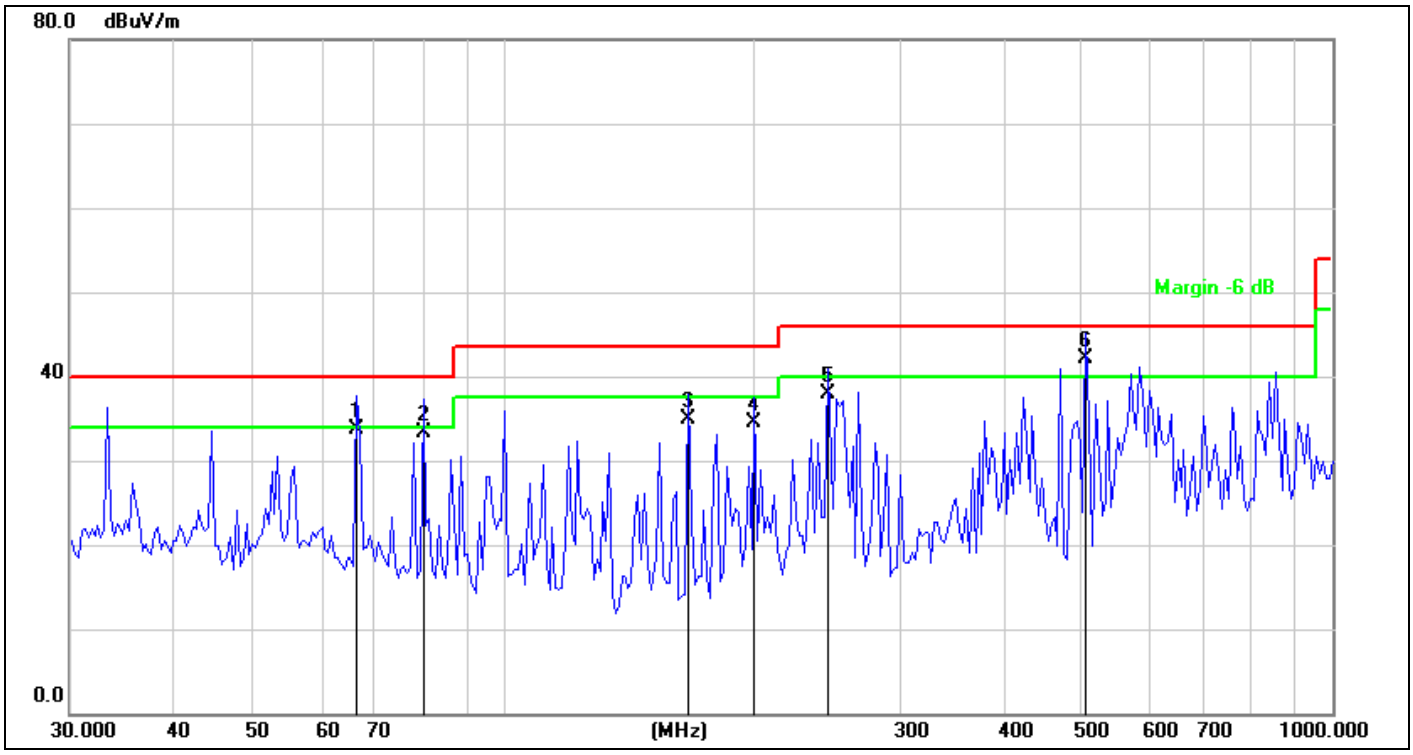
- Undesirable radiated Spurious Emission below 1GHz (30MHz to 1GHz)




| | | | |
|---|---|---|---|
| **Site:** | **LAB** | **Antenna::Horizontal** | **Temperature(C):26(C)** |
| **Limit:** | **FCC Part 15 C 3m Radiation** | | **Humidity(%):60%** |
| **EUT:** | **Zalpha Series - Autonomous Mobile Robot** | **Test Time:** | **2021-07-02** |
| **M/N.:** | **Zalpha-TS-EB-05** | **Power Rating:** | **Battery 25.6V** |
| **Mode:** | **TX5180** | **Test Engineer:** | **Dyson** |
| **Note:** | | | |

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Det. | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 33.3279 | 39.63 | -18.07 | 21.56 | 40.00 | -18.44 | QP | |
| 2 * | 80.0806 | 46.97 | -18.35 | 28.62 | 40.00 | -11.38 | QP | |
| 3 | 100.5806 | 49.14 | -17.19 | 31.95 | 43.50 | -11.55 | QP | |
| 4 | 167.2368 | 49.41 | -17.83 | 31.58 | 43.50 | -11.92 | QP | |
| 5 | 201.0401 | 44.55 | -16.26 | 28.29 | 43.50 | -15.21 | QP | |
| 6 | 268.4853 | 46.19 | -13.83 | 32.36 | 46.00 | -13.64 | QP | |

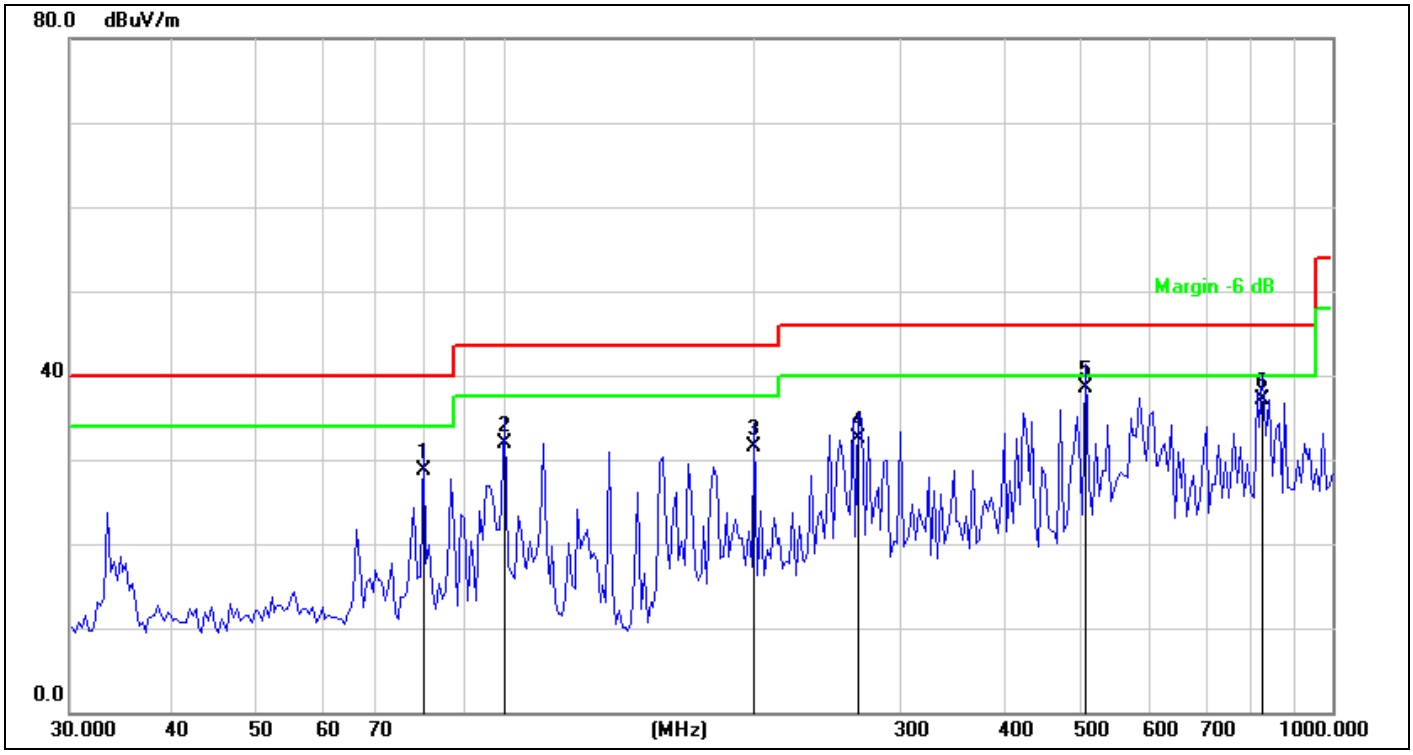
Note: 1. Result Level = Read Level+ Antenna Factor+ Cable Loss- Amp. Factor




| | | | |
|---|---|---|---|
| **Site:** | **LAB** | **Antenna::Vertical** | **Temperature(C):26(C)** |
| **Limit:** | **FCC Part 15 C 3m Radiation** | | **Humidity(%):60%** |
| **EUT:** | **Zalpha Series - Autonomous Mobile Robot** | **Test Time:** | **2021-07-02** |
| **M/N.:** | **Zalpha-TS-EB-05** | **Power Rating:** | **Battery 25.6V** |
| **Mode:** | **TX5180** | **Test Engineer:** | **Dyson** |
| **Note:** | | | |

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Det. | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 66.6156 | 50.98 | -17.34 | 33.64 | 40.00 | -6.36 | QP | |
| 2 | 80.0806 | 51.60 | -18.35 | 33.25 | 40.00 | -6.75 | QP | |
| 3 | 167.2366 | 52.71 | -17.83 | 34.88 | 43.50 | -8.62 | QP | |
| 4 | 201.0401 | 50.69 | -16.26 | 34.43 | 43.50 | -9.07 | QP | |
| 5 | 245.9508 | 52.57 | -14.60 | 37.97 | 46.00 | -8.03 | QP | |
| 6 * | 504.7062 | 51.05 | -8.95 | 42.10 | 46.00 | -3.90 | QP | |

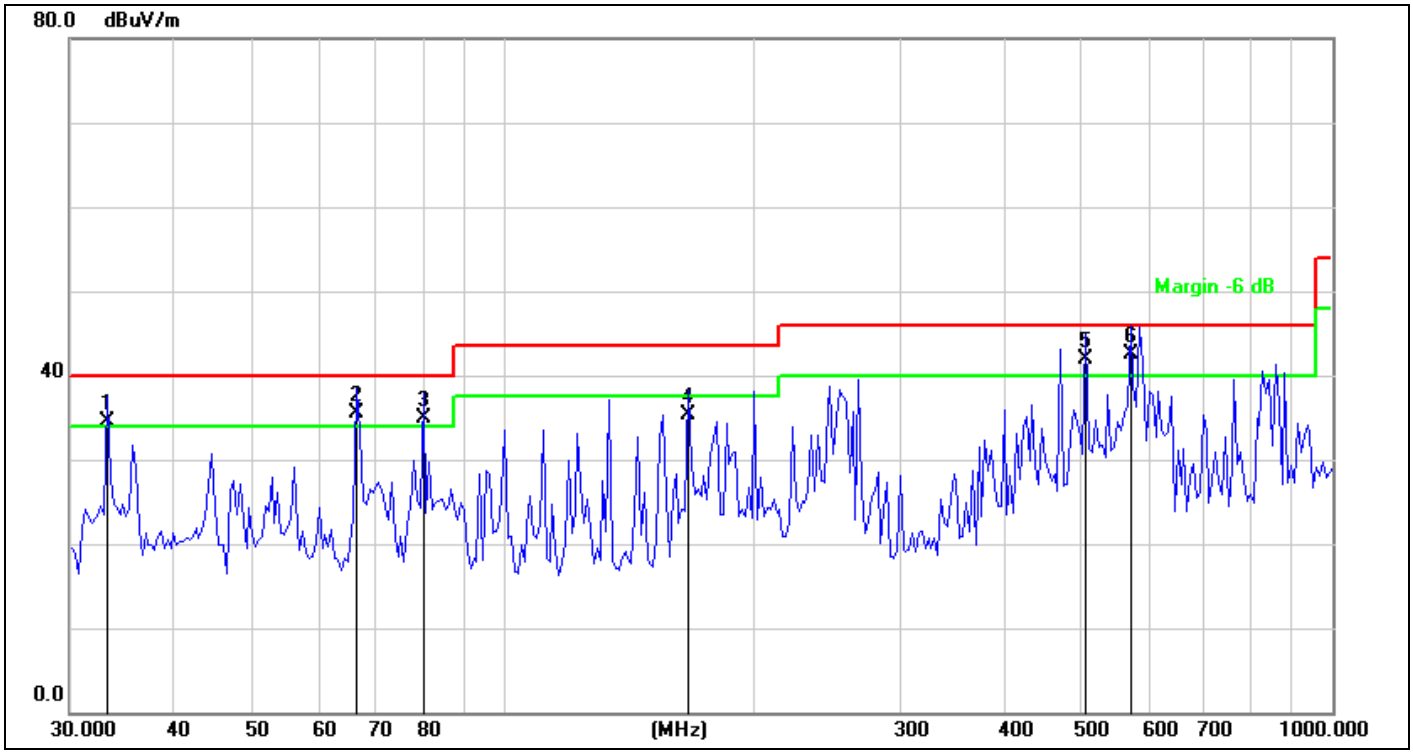
Note: 1. Result Level = Read Level+ Antenna Factor+ Cable Loss- Amp. Factor




| | | | |
|---|---|---|---|
| **Site:** | **LAB** | **Antenna::Horizontal** | **Temperature(C):26(C)** |
| **Limit:** | **FCC Part 15 C 3m Radiation** | | **Humidity(%):60%** |
| **EUT:** | **Zalpha Series - Autonomous Mobile Robot** | **Test Time:** | **2021-07-02** |
| **M/N.:** | **Zalpha-TS-EB-05** | **Power Rating:** | **Battery 25.6V** |
| **Mode:** | **TX5200** | **Test Engineer:** | **Dyson** |
| **Note:** | | | |

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Det. | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 80.0806 | 47.14 | -18.35 | 28.79 | 40.00 | -11.21 | QP | |
| 2 | 100.5806 | 49.06 | -17.19 | 31.87 | 43.50 | -11.63 | QP | |
| 3 | 201.0402 | 47.71 | -16.26 | 31.45 | 43.50 | -12.05 | QP | |
| 4 | 268.4853 | 46.36 | -13.83 | 32.53 | 46.00 | -13.47 | QP | |
| 5 * | 504.7062 | 47.37 | -8.95 | 38.42 | 46.00 | -7.58 | QP | |
| 6 | 824.5968 | 41.06 | -4.01 | 37.05 | 46.00 | -8.95 | QP | |

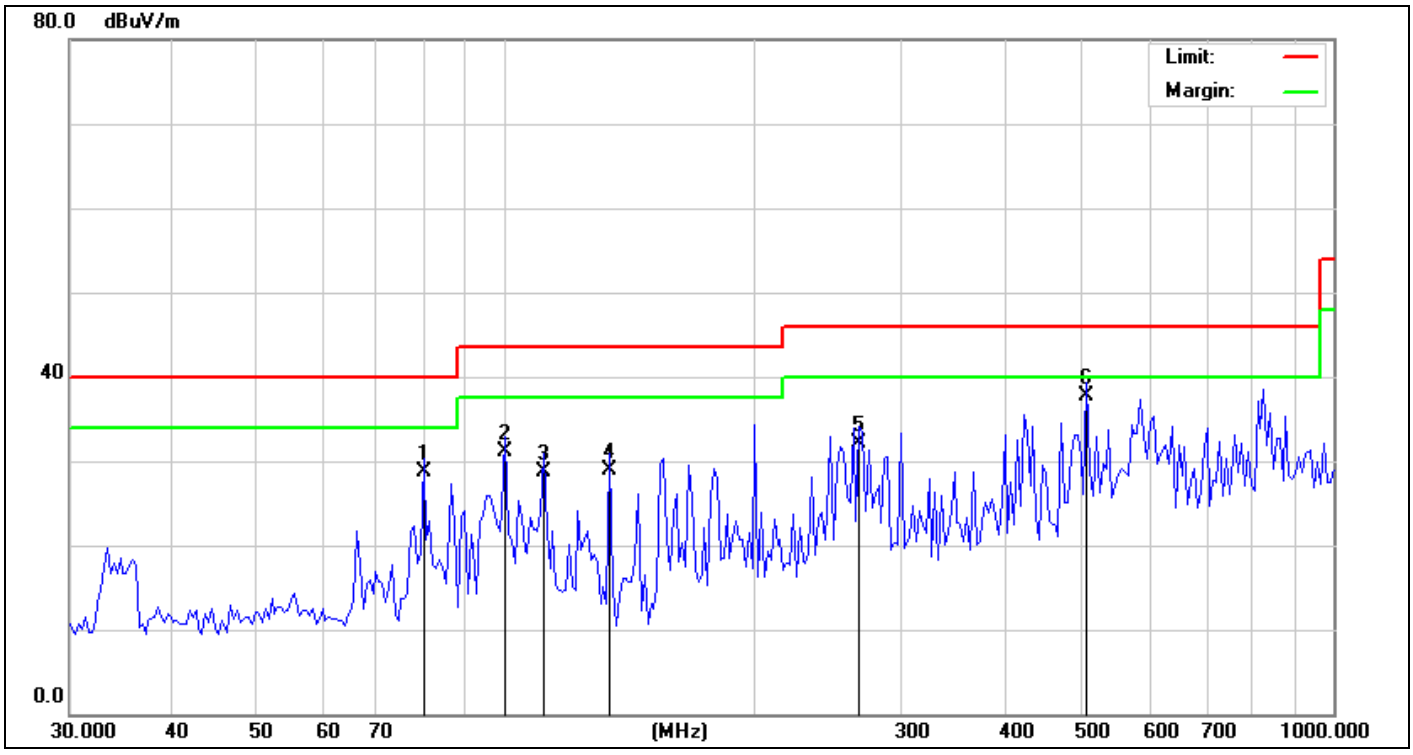
Note: 1. Result Level = Read Level+ Antenna Factor+ Cable Loss- Amp. Factor




| | | | |
|---|---|---|---|
| **Site:** | **LAB** | **Antenna::Vertical** | **Temperature(C):26(C)** |
| **Limit:** | **FCC Part 15 C 3m Radiation** | | **Humidity(%):60%** |
| **EUT:** | **Zalpha Series - Autonomous Mobile Robot** | **Test Time:** | **2021-07-02** |
| **M/N.:** | **Zalpha-TS-EB-05** | **Power Rating:** | **Battery 25.6V** |
| **Mode:** | **TX5200** | **Test Engineer:** | **Dyson** |
| **Note:** | | | |

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Det. | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 ! | 33.3278 | 52.66 | -18.07 | 34.59 | 40.00 | -5.41 | QP | |
| 2 ! | 66.6156 | 52.92 | -17.34 | 35.58 | 40.00 | -4.42 | QP | |
| 3 ! | 80.0806 | 53.31 | -18.35 | 34.96 | 40.00 | -5.04 | QP | |
| 4 | 167.2366 | 53.21 | -17.83 | 35.38 | 43.50 | -8.12 | QP | |
| 5 ! | 504.7062 | 50.94 | -8.95 | 41.99 | 46.00 | -4.01 | QP | |
| 6 * | 570.6100 | 49.56 | -7.02 | 42.54 | 46.00 | -3.46 | QP | |

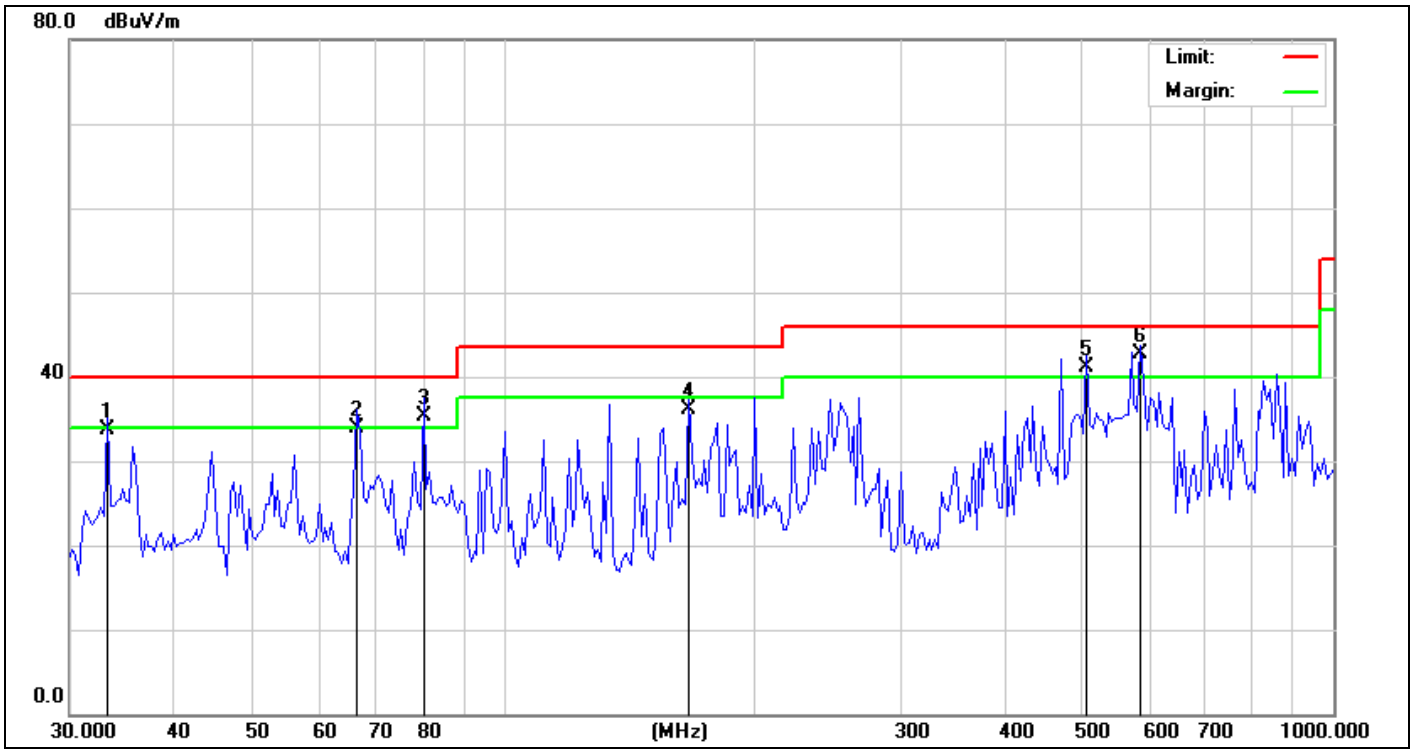
Note: 1. Result Level = Read Level+ Antenna Factor+ Cable Loss- Amp. Factor




| | | | |
|---|---|---|---|
| **Site:** | **LAB** | **Antenna::Horizontal** | **Temperature(C):26(C)** |
| **Limit:** | **FCC Part 15 C 3m Radiation** | | **Humidity(%):60%** |
| **EUT:** | **Zalpha Series - Autonomous Mobile Robot** | **Test Time:** | **2021-07-02** |
| **M/N.:** | **Zalpha-TS-EB-05** | **Power Rating:** | **Battery 25.6V** |
| **Mode:** | **TX5240** | **Test Engineer:** | **Dyson** |
| **Note:** | | | |

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Det. | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 80.0806 | 47.00 | -18.35 | 28.65 | 40.00 | -11.35 | QP | |
| 2 | 100.5806 | 48.32 | -17.19 | 31.13 | 43.50 | -12.37 | QP | |
| 3 | 111.7377 | 45.36 | -16.57 | 28.79 | 43.50 | -14.71 | QP | |
| 4 | 134.3232 | 47.58 | -18.64 | 28.94 | 43.50 | -14.56 | QP | |
| 5 | 268.4852 | 45.96 | -13.83 | 32.13 | 46.00 | -13.87 | QP | |
| 6 * | 504.7062 | 46.58 | -8.95 | 37.63 | 46.00 | -8.37 | QP | |

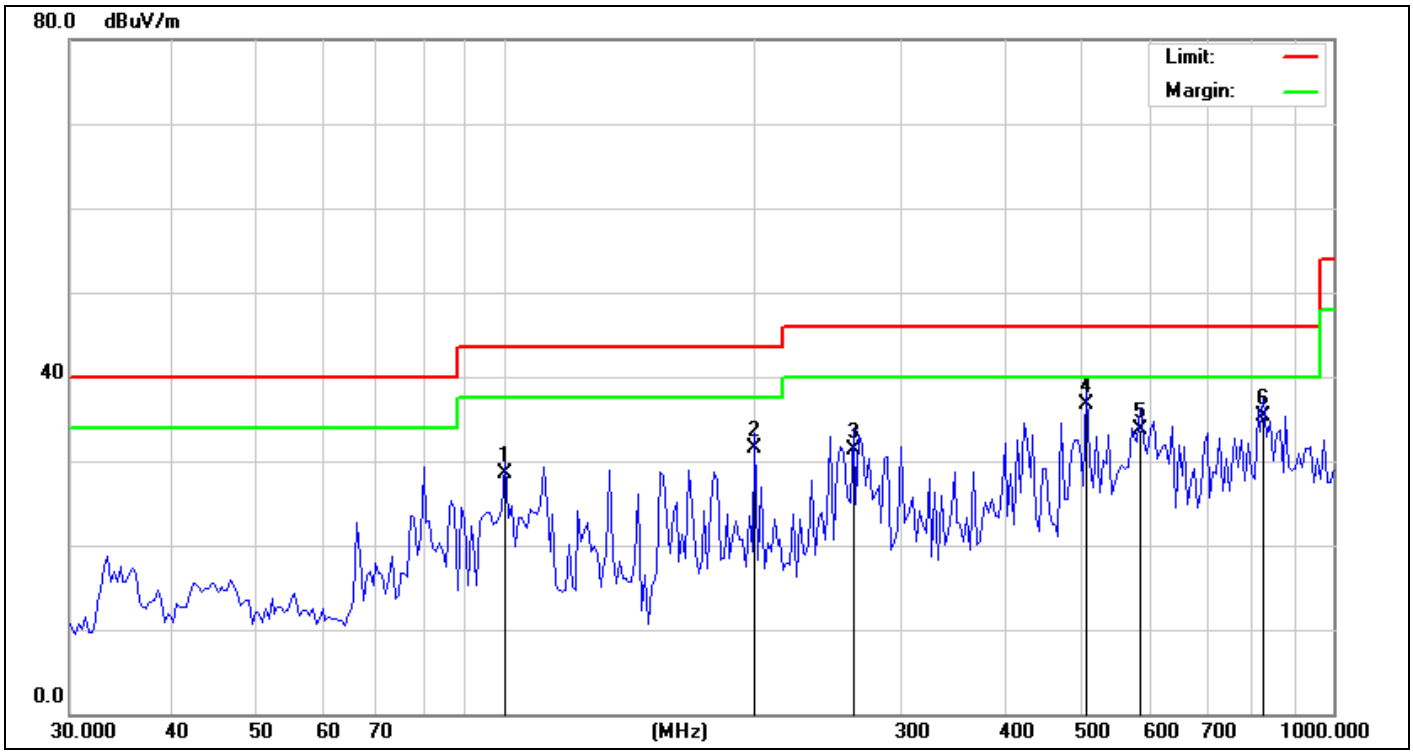
Note: 1. Result Level = Read Level+ Antenna Factor+ Cable Loss- Amp. Factor




| | | | |
|---|---|---|---|
| **Site:** | **LAB** | **Antenna::Vertical** | **Temperature(C):26(C)** |
| **Limit:** | **FCC Part 15 C 3m Radiation** | | **Humidity(%):60%** |
| **EUT:** | **Zalpha Series - Autonomous Mobile Robot** | **Test Time:** | **2021-07-02** |
| **M/N.:** | **Zalpha-TS-EB-05** | **Power Rating:** | **Battery 25.6V** |
| **Mode:** | **TX5240** | **Test Engineer:** | **Dyson** |
| **Note:** | | | |

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Det. | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 33.3278 | 51.69 | -18.07 | 33.62 | 40.00 | -6.38 | QP | |
| 2 | 66.6156 | 51.32 | -17.34 | 33.98 | 40.00 | -6.02 | QP | |
| 3 ! | 80.0806 | 53.69 | -18.35 | 35.34 | 40.00 | -4.66 | QP | |
| 4 | 167.2366 | 53.96 | -17.83 | 36.13 | 43.50 | -7.37 | QP | |
| 5 ! | 504.7062 | 50.01 | -8.95 | 41.06 | 46.00 | -4.94 | QP | |
| 6 * | 585.8156 | 49.25 | -6.47 | 42.78 | 46.00 | -3.22 | QP | |

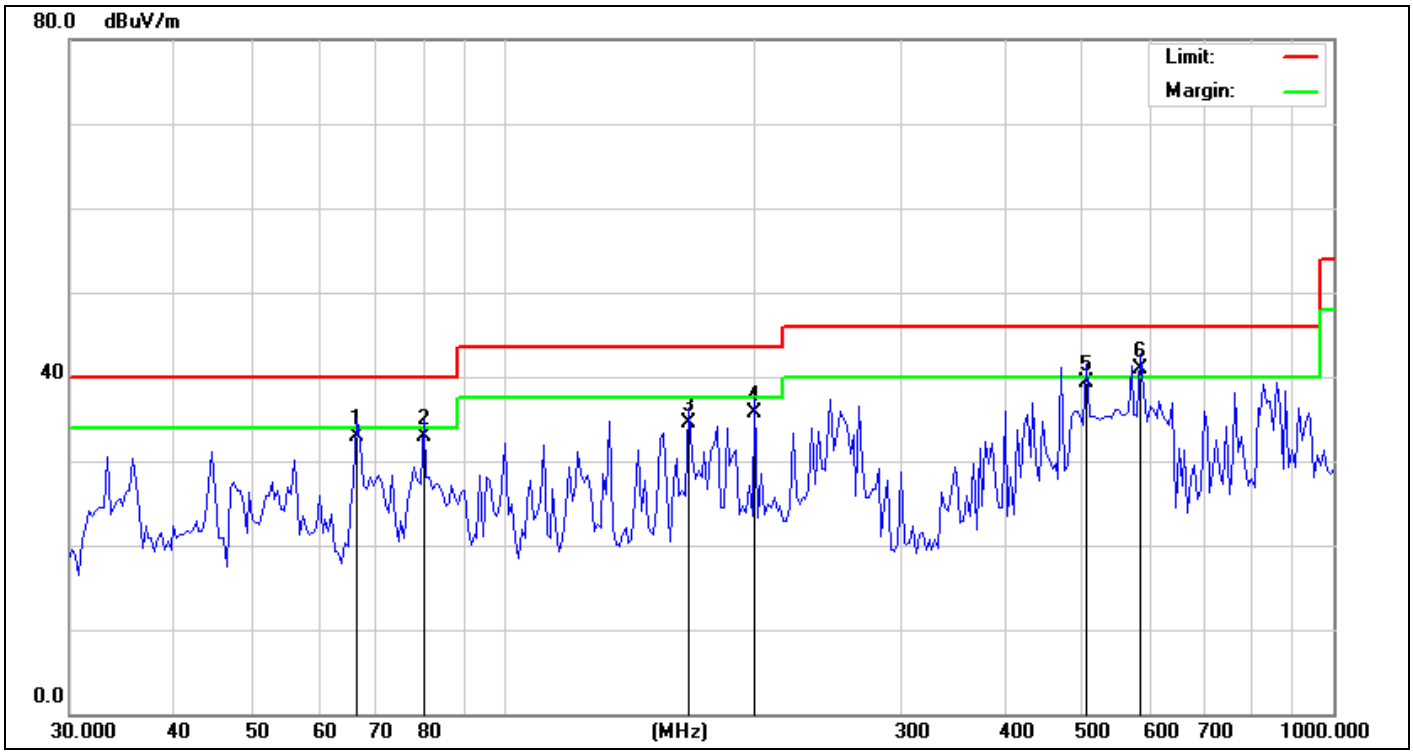
Note: 1. Result Level = Read Level+ Antenna Factor+ Cable Loss- Amp. Factor




| | | | |
|---|---|---|---|
| **Site:** | **LAB** | **Antenna::Horizontal** | **Temperature(C):26(C)** |
| **Limit:** | **FCC Part 15 C 3m Radiation** | | **Humidity(%):60%** |
| **EUT:** | **Zalpha Series - Autonomous Mobile Robot** | **Test Time:** | **2021-07-02** |
| **M/N.:** | **Zalpha-TS-EB-05** | **Power Rating:** | **Battery 25.6V** |
| **Mode:** | **TX5745** | **Test Engineer:** | **Dyson** |
| **Note:** | | | |

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Det. | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 100.5806 | 45.63 | -17.19 | 28.44 | 43.50 | -15.06 | QP | |
| 2 | 201.0398 | 47.85 | -16.26 | 31.59 | 43.50 | -11.91 | QP | |
| 3 | 263.8190 | 45.32 | -14.00 | 31.32 | 46.00 | -14.68 | QP | |
| 4 * | 504.7062 | 45.63 | -8.95 | 36.68 | 46.00 | -9.32 | QP | |
| 5 | 585.8156 | 40.25 | -6.47 | 33.78 | 46.00 | -12.22 | QP | |
| 6 | 824.5968 | 39.25 | -4.01 | 35.24 | 46.00 | -10.76 | QP | |

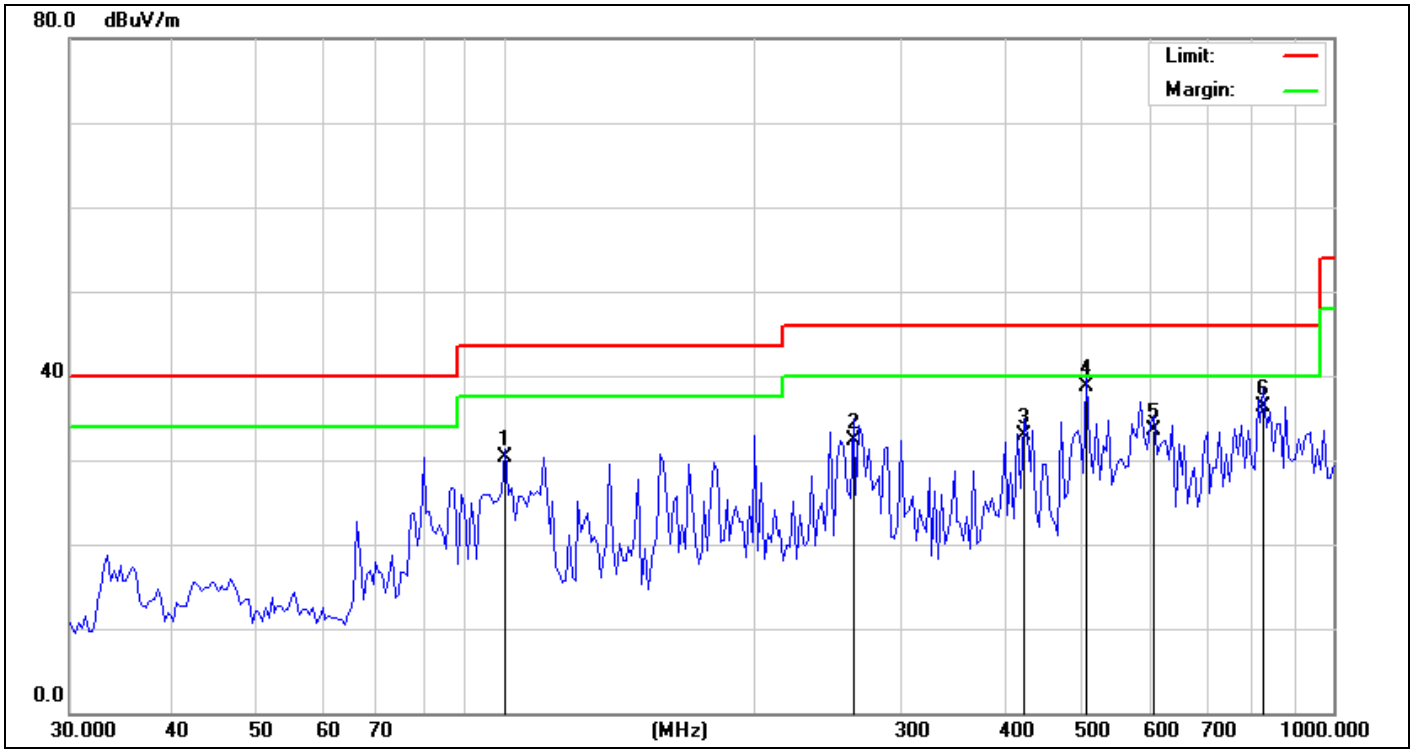
Note: 1. Result Level = Read Level+ Antenna Factor+ Cable Loss- Amp. Factor




| | | | |
|---|---|---|---|
| **Site:** | **LAB** | **Antenna::Vertical** | **Temperature(C):26(C)** |
| **Limit:** | **FCC Part 15 C 3m Radiation** | | **Humidity(%):60%** |
| **EUT:** | **Zalpha Series - Autonomous Mobile Robot** | **Test Time:** | **2021-07-02** |
| **M/N.:** | **Zalpha-TS-EB-05** | **Power Rating:** | **Battery 25.6V** |
| **Mode:** | **TX5745** | **Test Engineer:** | **Dyson** |
| **Note:** | | | |

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Det. | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 66.6156 | 50.32 | -17.34 | 32.98 | 40.00 | -7.02 | QP | |
| 2 | 80.0806 | 51.32 | -18.35 | 32.97 | 40.00 | -7.03 | QP | |
| 3 | 167.2366 | 52.32 | -17.83 | 34.49 | 43.50 | -9.01 | QP | |
| 4 | 201.0398 | 52.01 | -16.26 | 35.75 | 43.50 | -7.75 | QP | |
| 5 | 504.7062 | 48.32 | -8.95 | 39.37 | 46.00 | -6.63 | QP | |
| 6 * | 585.8156 | 47.36 | -6.47 | 40.89 | 46.00 | -5.11 | QP | |

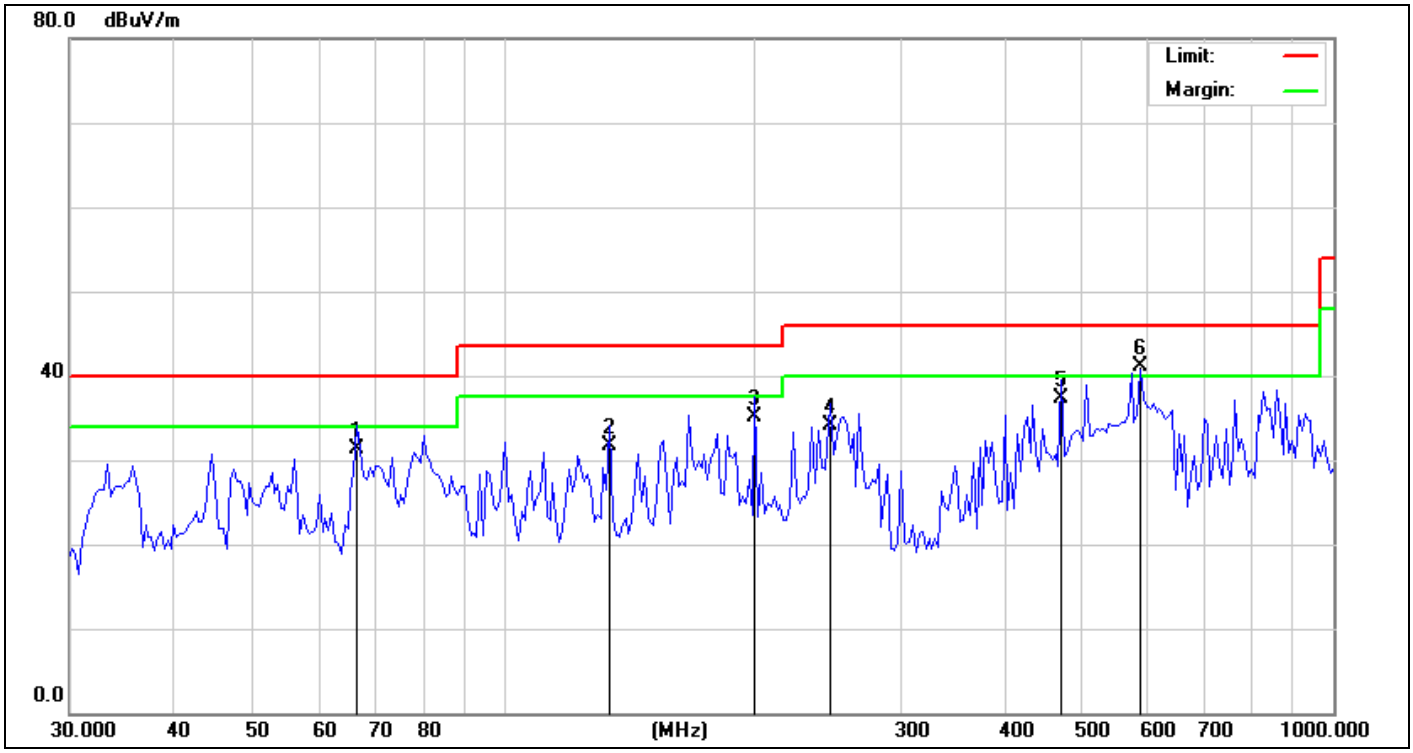
Note: 1. Result Level = Read Level+ Antenna Factor+ Cable Loss- Amp. Factor




| | | | |
|---|---|---|---|
| **Site:** | **LAB** | **Antenna::Horizontal** | **Temperature(C):26(C)** |
| **Limit:** | **FCC Part 15 C 3m Radiation** | | **Humidity(%):60%** |
| **EUT:** | **Zalpha Series - Autonomous Mobile Robot** | **Test Time:** | **2021-07-02** |
| **M/N.:** | **Zalpha-TS-EB-05** | **Power Rating:** | **Battery 25.6V** |
| **Mode:** | **TX5785** | **Test Engineer:** | **Dyson** |
| **Note:** | | | |

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Det. | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 100.5806 | 47.52 | -17.19 | 30.33 | 43.50 | -13.17 | QP | |
| 2 | 263.8190 | 46.35 | -14.00 | 32.35 | 46.00 | -13.65 | QP | |
| 3 | 423.5403 | 43.52 | -10.61 | 32.91 | 46.00 | -13.09 | QP | |
| 4 * | 504.7062 | 47.63 | -8.95 | 38.68 | 46.00 | -7.32 | QP | |
| 5 | 606.7219 | 39.52 | -6.07 | 33.45 | 46.00 | -12.55 | QP | |
| 6 | 824.5968 | 40.32 | -4.01 | 36.31 | 46.00 | -9.69 | QP | |

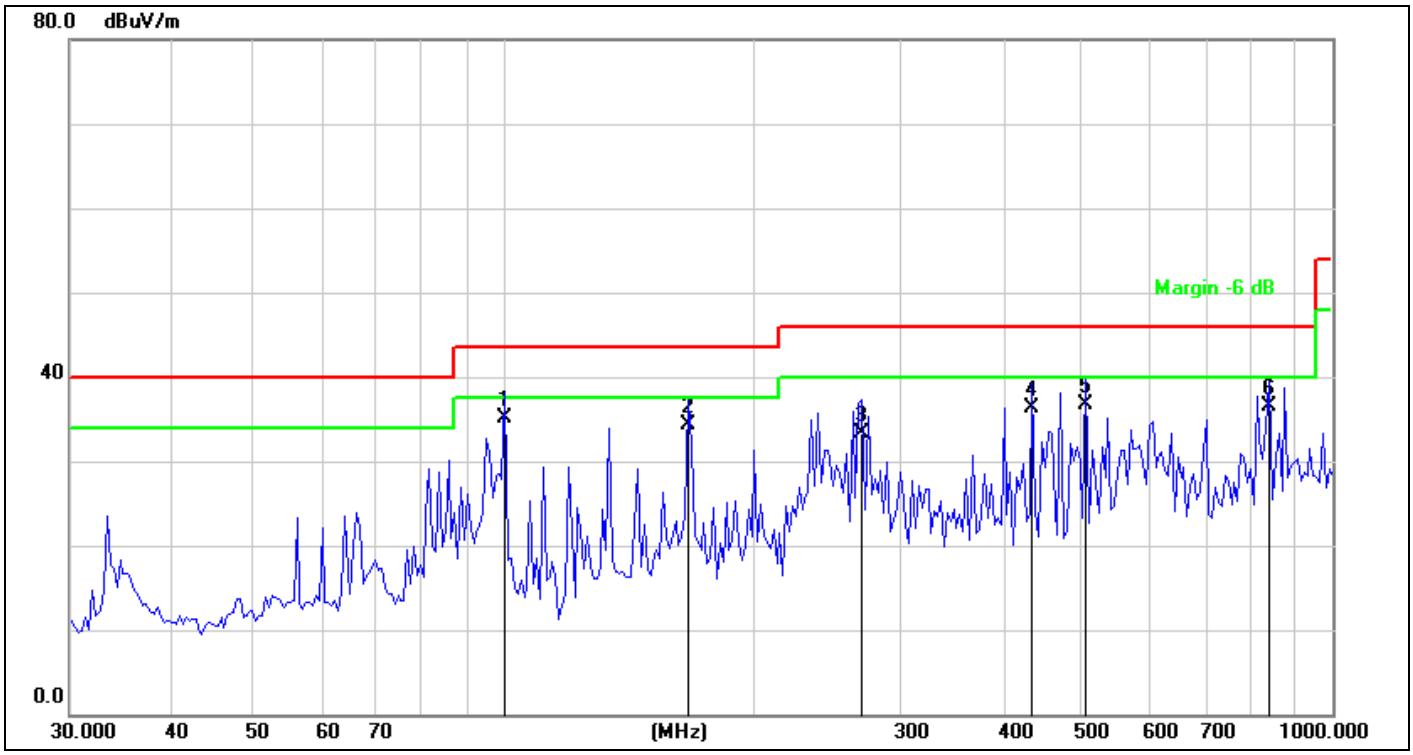
Note: 1. Result Level = Read Level+ Antenna Factor+ Cable Loss- Amp. Factor




| | | | |
|---|---|---|---|
| **Site:** | **LAB** | **Antenna::Vertical** | **Temperature(C):26(C)** |
| **Limit:** | **FCC Part 15 C 3m Radiation** | | **Humidity(%):60%** |
| **EUT:** | **Zalpha Series - Autonomous Mobile Robot** | **Test Time:** | **2021-07-02** |
| **M/N.:** | **Zalpha-TS-EB-05** | **Power Rating:** | **Battery 25.6V** |
| **Mode:** | **TX5785** | **Test Engineer:** | **Dyson** |
| **Note:** | | | |

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Det. | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 66.6156 | 48.63 | -17.34 | 31.29 | 40.00 | -8.71 | QP | |
| 2 | 134.3232 | 50.32 | -18.64 | 31.68 | 43.50 | -11.82 | QP | |
| 3 | 201.0398 | 51.32 | -16.26 | 35.06 | 43.50 | -8.44 | QP | |
| 4 | 248.1165 | 48.60 | -14.55 | 34.05 | 46.00 | -11.95 | QP | |
| 5 | 470.5230 | 47.63 | -10.31 | 37.32 | 46.00 | -8.68 | QP | |
| 6 * | 585.8156 | 47.50 | -6.47 | 41.03 | 46.00 | -4.97 | QP | |

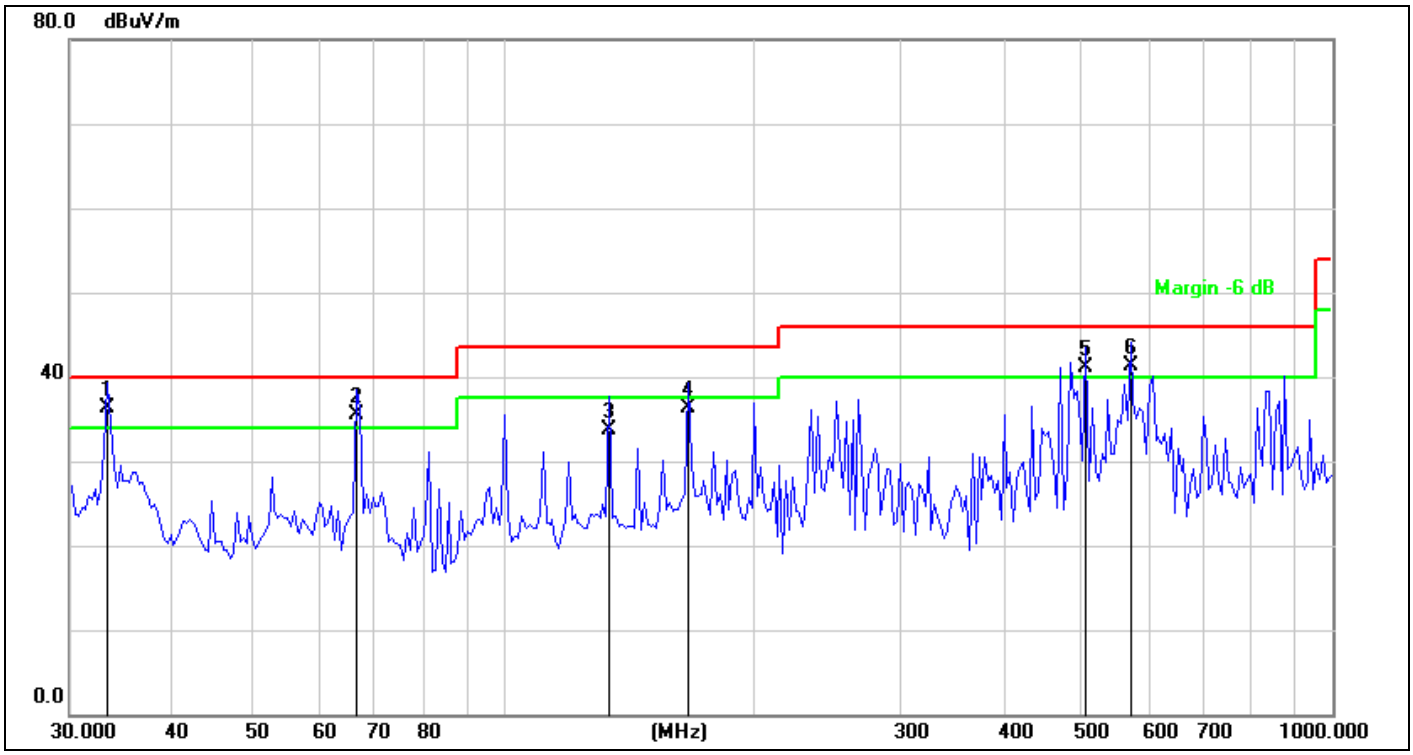
Note: 1. Result Level = Read Level+ Antenna Factor+ Cable Loss- Amp. Factor




| | | | |
|---|---|---|---|
| **Site:** | **LAB** | **Antenna::Horizontal** | **Temperature(C):26(C)** |
| **Limit:** | **FCC Part 15 C 3m Radiation** | | **Humidity(%):60%** |
| **EUT:** | **Zalpha Series - Autonomous Mobile Robot** | **Test Time:** | **2021-07-02** |
| **M/N.:** | **Zalpha-TS-EB-05** | **Power Rating:** | **Battery 25.6V** |
| **Mode:** | **TX5825** | **Test Engineer:** | **Dyson** |
| **Note:** | | | |

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Det. | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 * | 100.5806 | 52.29 | -17.19 | 35.10 | 43.50 | -8.40 | QP | |
| 2 | 167.2368 | 52.07 | -17.83 | 34.24 | 43.50 | -9.26 | QP | |
| 3 | 270.8493 | 47.07 | -13.74 | 33.33 | 46.00 | -12.67 | QP | |
| 4 | 434.8268 | 46.65 | -10.44 | 36.21 | 46.00 | -9.79 | QP | |
| 5 | 504.7062 | 45.56 | -8.95 | 36.61 | 46.00 | -9.39 | QP | |
| 6 | 839.1818 | 40.10 | -3.57 | 36.53 | 46.00 | -9.47 | QP | |

Note: 1. Result Level = Read Level+ Antenna Factor+ Cable Loss- Amp. Factor




| | | | |
|---|---|---|---|
| **Site:** | **LAB** | **Antenna::Vertical** | **Temperature(C):26(C)** |
| **Limit:** | **FCC Part 15 C 3m Radiation** | | **Humidity(%):60%** |
| **EUT:** | **Zalpha Series - Autonomous Mobile Robot** | **Test Time:** | **2021-07-02** |
| **M/N.:** | **Zalpha-TS-EB-05** | **Power Rating:** | **Battery 25.6V** |
| **Mode:** | **TX5825** | **Test Engineer:** | **Dyson** |
| **Note:** | | | |

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Det. | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 * | 33.3278 | 54.29 | -18.07 | 36.22 | 40.00 | -3.78 | QP | |
| 2 ! | 66.6156 | 52.82 | -17.34 | 35.48 | 40.00 | -4.52 | QP | |
| 3 | 134.3234 | 52.25 | -18.64 | 33.61 | 43.50 | -9.89 | QP | |
| 4 | 167.2366 | 54.08 | -17.83 | 36.25 | 43.50 | -7.25 | QP | |
| 5 ! | 504.7062 | 50.15 | -8.95 | 41.20 | 46.00 | -4.80 | QP | |
| 6 ! | 570.6100 | 48.27 | -7.02 | 41.25 | 46.00 | -4.75 | QP | |

Note: 1. Result Level = Read Level+ Antenna Factor+ Cable Loss- Amp. Factor

## 8.6 POWER LINE CONDUCTED EMISSIONS

8.6.1 Applicable Standard

According to FCC Part 15.207(a)

8.6.2 Conformance Limit

| Conducted Emission Limit | | |
|---|---|---|
| Frequency(MHz) | 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. The lower limit shall apply at the transition frequencies
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

8.6.3 Test Configuration

Test according to clause 6.3 conducted emission test setup

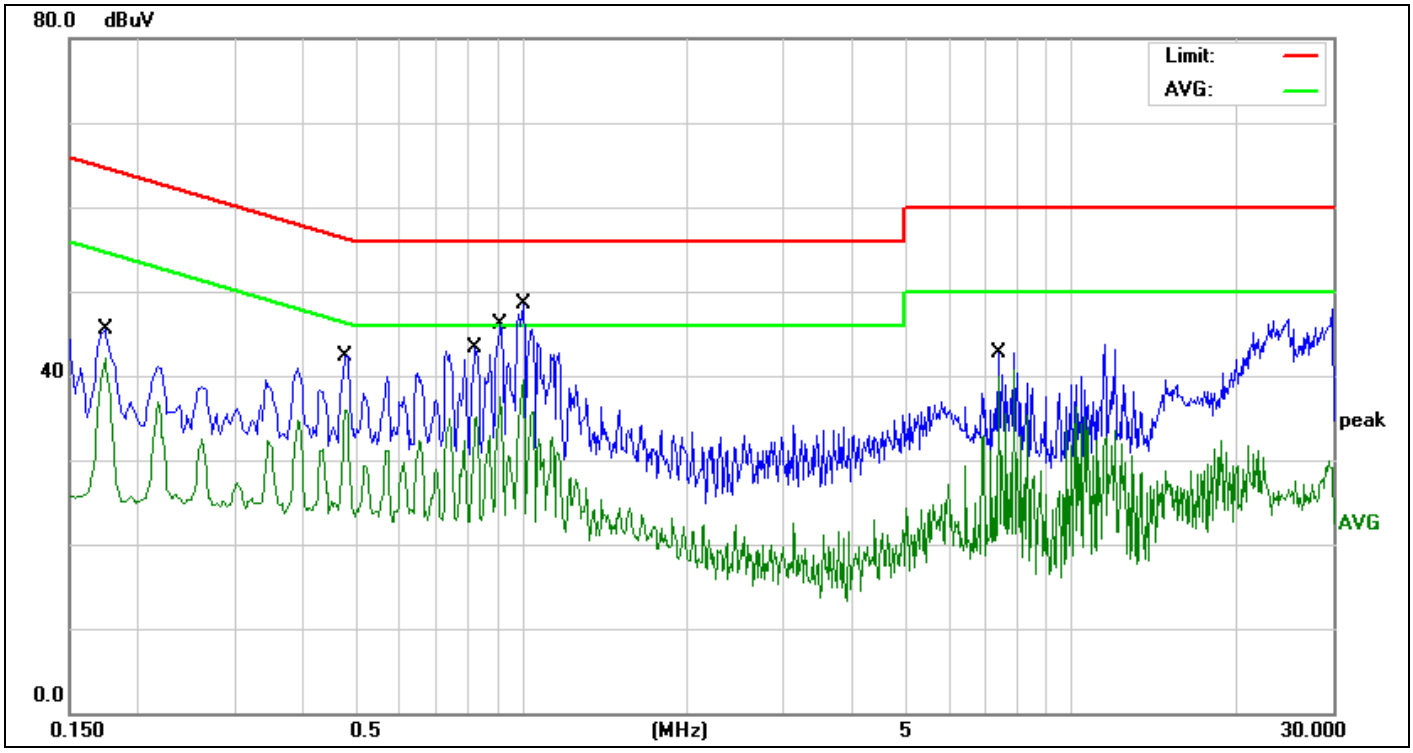
8.6.4 Test Procedure

The EUT was placed on a table which is 0.8m above ground plane.
Maximum procedure was performed on the highest emissions to ensure EUT compliance.
Repeat above procedures until all frequency measured were complete.

8.6.5 Test Results

Pass

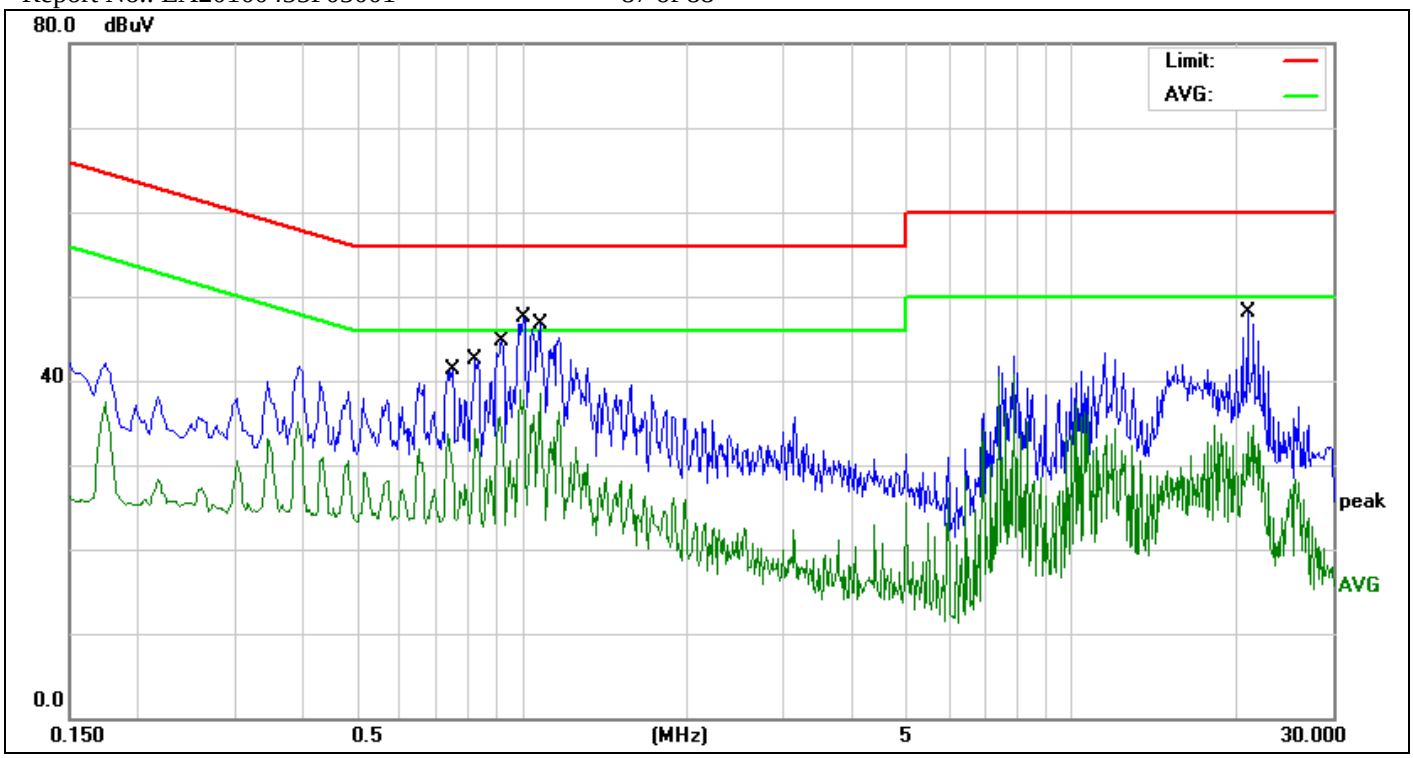
We test the EUT AC 240V, and show the worst result as bellow.




| | | | |
|---|---|---|---|
| **Site:** | **843** | **Phase:L1** | **Temperature(C):26(C)** |
| **Limit:** | **FCC PART 15C Conduction(QP)** | | **Humidity(%):60%** |
| **EUT:** | **Zalpha Series - Autonomous Mobile Robot** | **Test Time:** | **2021-07-02** |
| **M/N.:** | **Zalpha-TS-EB-05** | **Power Rating:** | **AC 240V/60Hz** |
| **Mode:** | **WIFI TX5180** | **Test Engineer:** | **Sunshine** |
| **Note:** | | | |

| No. | Frequency (MHz) | Reading Level(dBuV) | Factor (dB) | Measure-ment(dBuV) | Limit (dBuV) | Over (dB) | Detector | Comment |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.1740 | 33.42 | 9.65 | 43.07 | 64.76 | -21.69 | QP | |
| 2 | 0.1740 | 32.55 | 9.65 | 42.20 | 54.76 | -12.56 | AVG | |
| 3 | 0.4780 | 29.78 | 9.73 | 39.51 | 56.37 | -16.86 | QP | |
| 4 | 0.4780 | 26.03 | 9.73 | 35.76 | 46.37 | -10.61 | AVG | |
| 5 | 0.8260 | 31.52 | 9.80 | 41.32 | 56.00 | -14.68 | QP | |
| 6 | 0.8260 | 24.49 | 9.80 | 34.29 | 46.00 | -11.71 | AVG | |
| 7 | 0.9180 | 34.06 | 9.81 | 43.87 | 56.00 | -12.13 | QP | |
| 8 | 0.9180 | 27.39 | 9.81 | 37.20 | 46.00 | -8.80 | AVG | |
| 9 | 1.0060 | 36.44 | 9.82 | 46.26 | 56.00 | -9.74 | QP | |
| 10 * | 1.0060 | 29.09 | 9.82 | 38.91 | 46.00 | -7.09 | AVG | |
| 11 | 7.3940 | 30.39 | 10.00 | 40.39 | 60.00 | -19.61 | QP | |
| 12 | 7.3940 | 30.14 | 10.00 | 40.14 | 50.00 | -9.86 | AVG | |

*:Maximum data x:Over limit !:over margin




| | | | |
|---|---|---|---|
| **Site:** | **843** | **Phase:N** | **Temperature(C):26(C)** |
| **Limit:** | **FCC PART 15C Conduction(QP)** | | **Humidity(%):60%** |
| **EUT:** | **Zalpha Series - Autonomous Mobile Robot** | **Test Time:** | **2021-07-02** |
| **M/N.:** | **Zalpha-TS-EB-05** | **Power Rating:** | **AC 240V/60Hz** |
| **Mode:** | **WIFI TX5180** | **Test Engineer:** | **Sunshine** |
| **Note:** | | | |

| No. | Frequency (MHz) | Reading Level(dBuV) | Factor (dB) | Measure-ment(dBuV) | Limit (dBuV) | Over (dB) | Detector | Comment |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.7500 | 29.40 | 9.77 | 39.17 | 56.00 | -16.83 | QP | |
| 2 | 0.7500 | 20.18 | 9.77 | 29.95 | 46.00 | -16.05 | AVG | |
| 3 | 0.8220 | 30.39 | 9.80 | 40.19 | 56.00 | -15.81 | QP | |
| 4 | 0.8220 | 25.42 | 9.80 | 35.22 | 46.00 | -10.78 | AVG | |
| 5 | 0.9220 | 32.38 | 9.81 | 42.19 | 56.00 | -13.81 | QP | |
| 6 | 0.9220 | 22.14 | 9.81 | 31.95 | 46.00 | -14.05 | AVG | |
| 7 | 1.0100 | 35.29 | 9.82 | 45.11 | 56.00 | -10.89 | QP | |
| 8 | 1.0100 | 24.42 | 9.82 | 34.24 | 46.00 | -11.76 | AVG | |
| 9 | 1.0820 | 35.62 | 9.84 | 45.46 | 56.00 | -10.54 | QP | |
| 10 * | 1.0820 | 29.15 | 9.84 | 38.99 | 46.00 | -7.01 | AVG | |
| 11 | 21.0020 | 34.31 | 10.15 | 44.46 | 60.00 | -15.54 | QP | |
| 12 | 21.0020 | 24.10 | 10.15 | 34.25 | 50.00 | -15.75 | AVG | |

*:Maximum data x:Over limit !:over margin

## 8.7 ANTENNA APPLICATION

8.7.1 Antenna Requirement

| Standard | Requirement |
|---|---|
| FCC CRF Part 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded. |

For intentional device, according to FCC 47 CFR Section 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. And according to FCC 47 CFR Section 15.407 (a), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

8.7.2 Result

PASS.

The EUT has two Metel antenna for WIFI 2.4 Band, the max gain is 2.0 dBi;
The EUT has two Metel antenna: for WIFI 5G Band, the max gain is 4.0 dBi for WIFI 5G Band I, and the max gain is 4.0dBi for WIFI 5G Band II.

Note: ☒ Antenna use a permanently attached antenna which is not replaceable.
☐ Not using a standard antenna jack or electrical connector for antenna replacement
☐ The antenna has to be professionally installed (please provide method of installation)

which in accordance to section 15.203, please refer to the internal photos.