

**EMC Test Report****Application for FCC Grant of Equipment Authorization  
Canada Certification****Innovation, Science and Economic Development Canada  
RSS-Gen Issue 4 / RSS 247 Issue 1  
FCC Part 15 Subpart C****Model: Botvac D3 Connected and Botvac D5 Connected**IC CERTIFICATION #: 12757A-JLTCJ  
FCC ID: 2ABSSJLTCJAPPLICANT: Neato Robotics  
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IC SITE REGISTRATION #: 2845B-3; 2845B-4, 2845B-5, 2845B-7

REPORT DATE: July 27, 2016

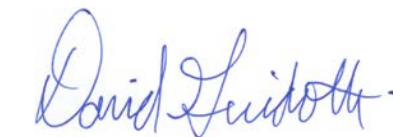
REISSUE DATE: September 8, 2016

FINAL TEST DATES: May 4, 9, 10, 11 and 18, 2016

TOTAL NUMBER OF PAGES: 91

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## REVISION HISTORY

| Rev# | Date              | Comments               | Modified By    |
|------|-------------------|------------------------|----------------|
| -    | July 27, 2016     | First release          |                |
| 1    | August 31, 2016   | Model name is revised. | Deniz Demirci  |
| 2    | September 8, 2016 | Revised Model Name     | David Guidotti |

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## **SCOPE**

An electromagnetic emissions test has been performed on the Neato Robotics model Botvac D5 Connected, pursuant to the following rules:

RSS-Gen Issue 4 “General Requirements for Compliance of Radio Apparatus”

RSS 247 Issue 1 “Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices”

FCC Part 15 Subpart C

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in National Technical Systems - Silicon Valley test procedures:

ANSI C63.10-2013

FCC DTS Measurement Guidance KDB558074

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

**OBJECTIVE**

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA, all unlicensed transmitters and transceivers require certification

Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

**STATEMENT OF COMPLIANCE**

The tested sample of Neato Robotics model Botvac D5 Connected complied with the requirements of the following regulations:

RSS-Gen Issue 4 “General Requirements for Compliance of Radio Apparatus”

RSS 247 Issue 1 “Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices”

FCC Part 15 Subpart C

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

The test results recorded herein are based on a single type test of Neato Robotics model Botvac D5 Connected and therefore apply only to the tested sample. The sample was selected and prepared by Matt Tenuta of Neato Robotics.

Testing performed on model Botvac D5 Connected is considered representative of the model Botvac D3 Connected. The two models are considered electrically identical. The similarities and the differences between models are described in a separate exhibit provided by the manufacturer.

**DEVIATIONS FROM THE STANDARDS**

No deviations were made from the published requirements listed in the scope of this report.

## TEST RESULTS SUMMARY

### DIGITAL TRANSMISSION SYSTEMS (2400 – 2483.5MHz)

| FCC Rule Part                                                                       | RSS Rule Part   | Description                                        | Measured Value / Comments                                   | Limit / Requirement                                                          | Result   |
|-------------------------------------------------------------------------------------|-----------------|----------------------------------------------------|-------------------------------------------------------------|------------------------------------------------------------------------------|----------|
| 15.247(a)                                                                           | RSS 247 5.2     | Digital Modulation                                 | Systems uses OFDM / DSSS techniques                         | System must utilize a digital transmission technology                        | Complies |
| 15.247 (a) (2)                                                                      | RSS 247 5.2 (1) | 6dB Bandwidth                                      | 9.6 MHz                                                     | >500 kHz                                                                     | Complies |
| 15.247 (b) (3)                                                                      | RSS 247 5.4 (4) | Output Power (multipoint systems)                  | Conducted: 16.8 dBm<br>EIRP = 0.026 W <small>Note 1</small> | 1Watt, EIRP limited to 4 Watts.                                              | Complies |
| 15.247(e)                                                                           | RSS 247 5.2 (2) | Power Spectral Density                             | -1.3 dBm/ 10 kHz                                            | 8 dBm/3 kHz                                                                  | Complies |
| 15.247(d)                                                                           | RSS 247 5.5     | Antenna Port Spurious Emissions<br>30 MHz – 25 GHz | > -20 dBc                                                   | < -20 dBc                                                                    | Complies |
| 15.247(d) / 15.209                                                                  | RSS 247 5.5     | Radiated Spurious Emissions<br>30 MHz – 25 GHz     | 73.1 dBμV/m @ 2388.9 MHz (-0.9 dB)                          | Refer to the limits section (p20) for restricted bands, all others < -20 dBc | Complies |
| Note 1: EIRP calculated using antenna gain of -2.7 dBi for the highest EIRP system. |                 |                                                    |                                                             |                                                                              |          |

### GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

| FCC Rule Part         | RSS Rule part          | Description                 | Measured Value / Comments                                                                      | Limit / Requirement                     | Result (margin) |
|-----------------------|------------------------|-----------------------------|------------------------------------------------------------------------------------------------|-----------------------------------------|-----------------|
| 15.203                | -                      | RF Connector                | -                                                                                              | Unique or integral antenna required     | Complies        |
| 15.407 (b) (6)        | RSS-Gen Table 3        | AC Conducted Emissions      | 52.5 dBμV @ 0.178 MHz (-12.1 dB)                                                               | Refer to page 19                        | Complies        |
| 15.109                | RSS GEN Table 2        | Receiver spurious emissions | N/A                                                                                            | N/A                                     | N/A             |
| 15.247 (i) 15.407 (f) | RSS 102                | RF Exposure Requirements    | Refer to MPE calculations in separate exhibit, RSS 102 declaration and User Manual statements. | Refer to OET 65, FCC Part 1 and RSS 102 | Complies        |
| -                     | RSS-Gen 8.3 and 8.4    | User Manual                 |                                                                                                | See user manual as a separate exhibit.  | Complies        |
| -                     | RSP-100<br>RSS-Gen 6.6 | Occupied Bandwidth          | 802.11b: 14.9 MHz<br>802.11g: 17.7 MHz<br>802.11n: 18.3 MHz                                    | Information only                        | N/A             |

**MEASUREMENT UNCERTAINTIES**

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with UKAS document LAB 34.

| Measurement Type                        | Measurement Unit | Frequency Range   | Expanded Uncertainty |
|-----------------------------------------|------------------|-------------------|----------------------|
| RF power, conducted (Power meter)       | dBm              | 25 to 7000 MHz    | $\pm 0.52$ dB        |
| RF power, conducted (Spectrum analyzer) | dBm              | 25 to 7000 MHz    | $\pm 0.7$ dB         |
| Conducted emission of transmitter       | dBm              | 25 to 26500 MHz   | $\pm 0.7$ dB         |
| Radiated emission (Substitution method) | dBm              | 25 to 26500 MHz   | $\pm 2.5$ dB         |
| Radiated emission (Field strength)      | dB $\mu$ V/m     | 25 to 1000 MHz    | $\pm 3.6$ dB         |
|                                         |                  | 1000 to 40000 MHz | $\pm 6.0$ dB         |
| Conducted Emissions (AC Power)          | dB $\mu$ V       | 0.15 to 30 MHz    | $\pm 2.4$ dB         |

**EQUIPMENT UNDER TEST (EUT) DETAILS****GENERAL**

The Neato Robotics model Botvac D5 Connected is a Robotic Vacuum cleaner. It is a floor standing equipment. The EUT is positioned on the table, above the ground plane in order to get accurate measurement results and in conformance with ANSI C63.10-2013 requirement. The electrical rating of the EUT is 100-240 Volts, 50/60 Hz, 0.5 Amps.

The sample was received on May 4, 2016 and tested on May 4, 9, 10, 11 and 18, 2016. The EUT consisted of the following component(s):

| Company        | Model               | Description            | Serial Number | FCC ID     |
|----------------|---------------------|------------------------|---------------|------------|
| Neato Robotics | Botvac D5 Connected | Robotic Vacuum cleaner | -             | 2ABSSJLTCJ |
| Neato Robotics | DELTA Power Charger | Battery Charger        | -             | -          |

**OTHER EUT DETAILS**

The highest internal source of an EUT is defined as the highest frequency generated or used within the EUT or on which the EUT operates or tunes. In some cases, the highest internal source determines the frequency range of test for radiated emissions. The highest internal source of the EUT was declared as 500 MHz.

**ANTENNA SYSTEM**

Internal antenna, -2.7 dBi.

**ENCLOSURE**

The EUT enclosure is primarily constructed of plastic. It measures approximately 34 cm wide by 32 cm deep by 8 cm high.

**MODIFICATIONS**

No modifications were made to the EUT during the time the product was at NTS Silicon Valley.

**SUPPORT EQUIPMENT**

No local support equipment was used during testing.

The following equipment was used as remote support equipment for emissions testing:

| Company | Model           | Description | Serial Number | FCC ID |
|---------|-----------------|-------------|---------------|--------|
| HP      | Pavilion DV6000 | Laptop      | -             | -      |

Note: Laptop was used to configure the EUT. It was not connected to the EUT during the tests

**EUT INTERFACE PORTS**

The I/O cabling configuration during testing was as follows:

| Port | Connected To | Description | Cable(s)               |           |
|------|--------------|-------------|------------------------|-----------|
|      |              |             | Shielded or Unshielded | Length(m) |
| None | -            | -           | --                     |           |

**EUT OPERATION**

During emissions testing the EUT was transmitting in a rated power and modulation specified in the test cases.

## TEST SITE

### GENERAL INFORMATION

Final test measurements were taken at the test sites listed below. Pursuant to section 2.948 of the FCC's Rules and section 3.3 of RSP-100, construction, calibration, and equipment data has been filed with the Commission and with industry Canada.

| Site      | Designation / Registration Numbers |         | Location                                      |
|-----------|------------------------------------|---------|-----------------------------------------------|
|           | FCC                                | Canada  |                                               |
| Chamber 3 | US0027                             | 2845B-3 | 41039 Boyce Road<br>Fremont,<br>CA 94538-2435 |
| Chamber 5 | US0027                             | 2845B-5 |                                               |

ANSI C63.4 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement. The test site(s) contain separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4.

### CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.10. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

### RADIATED EMISSIONS CONSIDERATIONS

Radiated measurements are performed in a semi-anechoic chamber. The test sites are maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines and meet the Normalized Site Attenuation (NSA) requirements of ANSI C63.4.

## **MEASUREMENT INSTRUMENTATION**

### **RECEIVER SYSTEM**

An EMI receiver as specified in CISPR 16-1-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements. If the repetition frequency of the signal being measured is below 20 Hz, peak measurements are made in lieu of Quasi-Peak measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000 MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz, unless the signal is pulsed in which case the average (or video) bandwidth of the measuring instrument is reduced to onset of pulse desensitization and then increased.

### **INSTRUMENT CONTROL COMPUTER**

Software is used to view and convert receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers. The software used for radiated and conducted emissions measurements is NTS EMI Test Software (rev 2.10)

### **LINE IMPEDANCE STABILIZATION NETWORK (LISN)**

Line conducted measurements utilize a 50  $\mu$ H Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250  $\mu$ H CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

**FILTERS/ATTENUATORS**

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

**ANTENNAS**

For the measurement range 30 MHz to 1000 MHz either a combination of a biconical antenna and a log periodic or a bi-log antenna is used. Above 1000 MHz, horn antennas are used. The antenna calibration factors to convert the received voltage to an electric field strength are included with appropriate cable loss and amplifier gain factors to determine an overall site factor, which is then programmed into the test receivers or incorporated into the test software.

**ANTENNA MAST AND EQUIPMENT TURNTABLE**

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height. .

ANSI C63.10 specifies that the test height above ground for transmit antenna shall be 0.80 m for below 1 GHz measurements and 1.5 m for above 1 GHz measurements. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

**INSTRUMENT CALIBRATION**

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

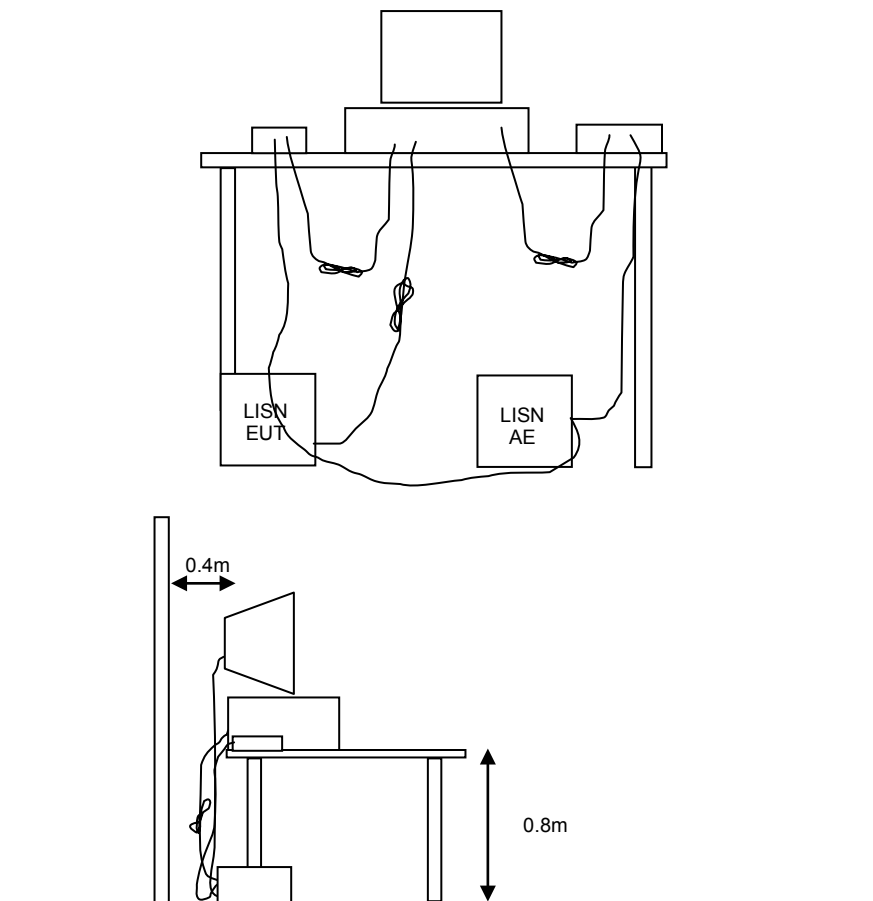
## **TEST PROCEDURES**

### **EUT AND CABLE PLACEMENT**

The regulations require that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.10, and the worst-case orientation is used for final measurements.

### **CONDUCTED EMISSIONS**

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak and Average mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

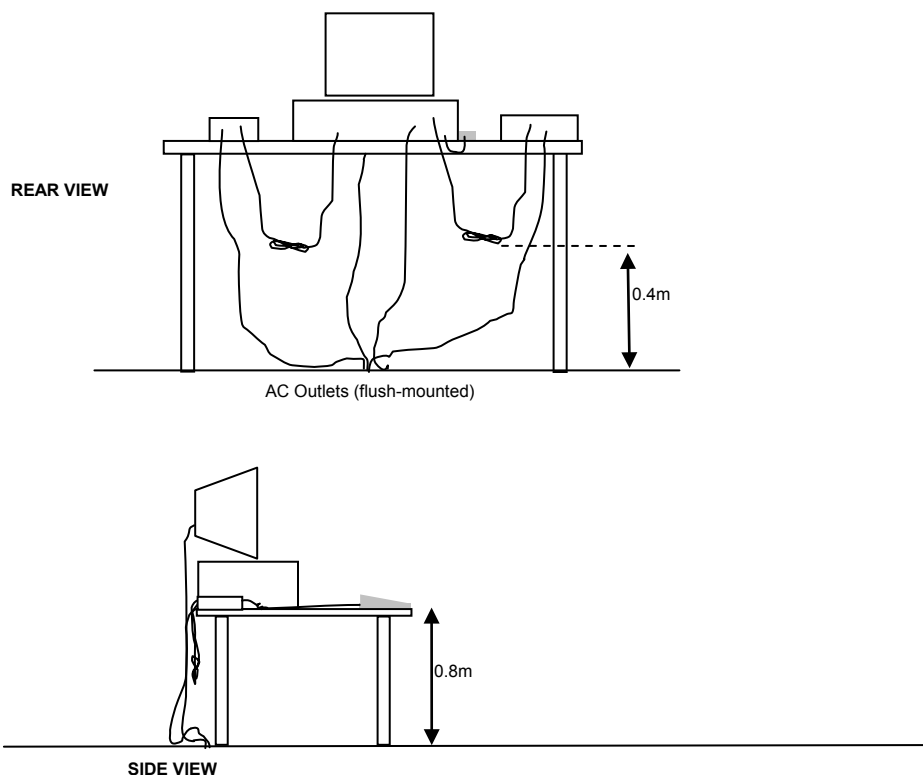


Typical Conducted Emissions Test Configuration

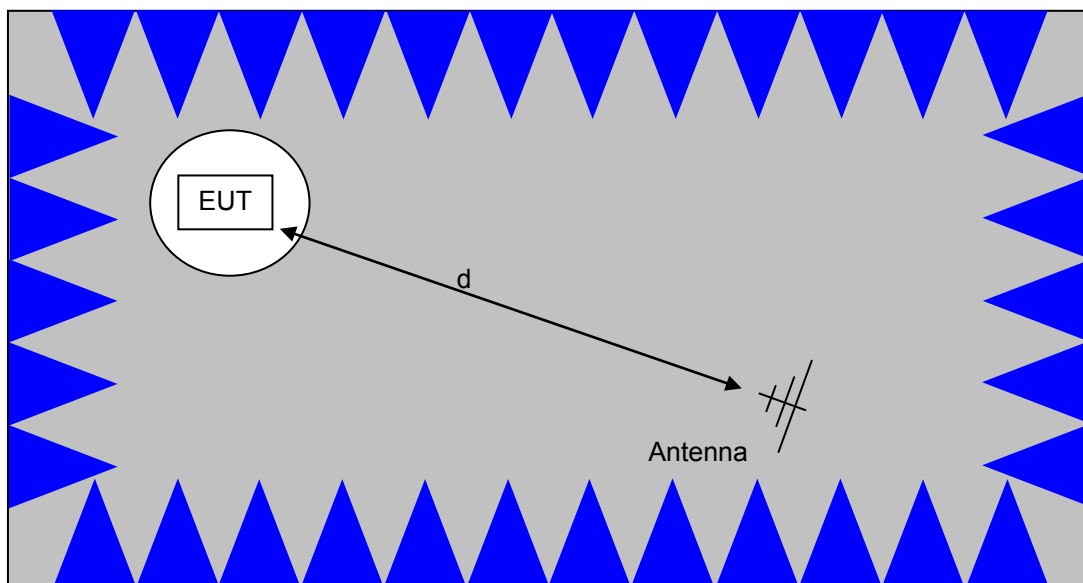
## RADIATED EMISSIONS

A preliminary scan of the radiated emissions is performed in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed, one scan for each antenna polarization (horizontal and vertical to the EUT). During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit. Preliminary scans may be performed in a fully anechoic chamber for the purposes of identifying the frequencies of the highest emissions from the EUT.

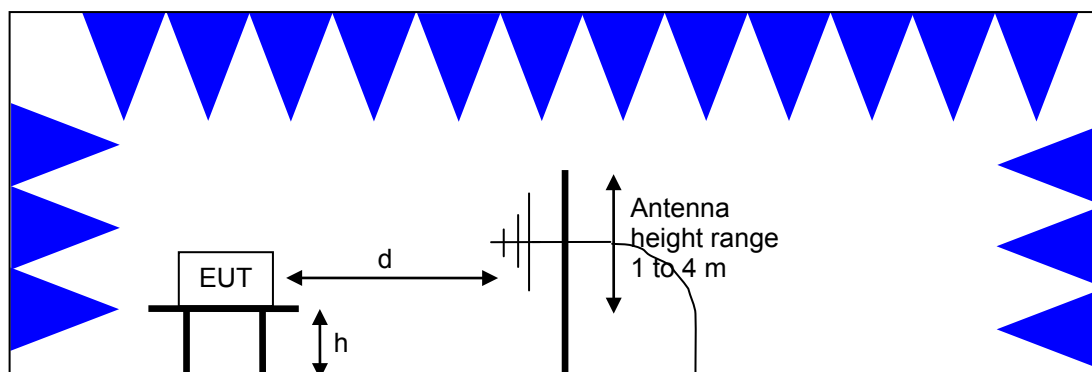
Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain.



Typical Test Configuration for Radiated Field Strength Measurements



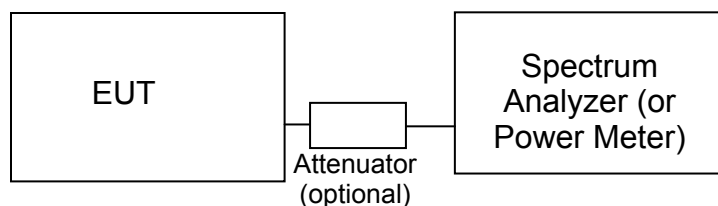
The anechoic materials on the walls and ceiling ensure compliance with the normalized site attenuation requirements of CISPR 16 / CISPR 22 / ANSI C63.4 for an alternate test site at the measurement distances used.



Test Configuration for Radiated Field Strength Measurements  
Semi-Anechoic Chamber, Plan and Side Views

**CONDUCTED EMISSIONS FROM ANTENNA PORT**

Direct measurements of power, bandwidth and power spectral density are performed, where possible, with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.

Test Configuration for Antenna Port Measurements

Measurement bandwidths (video and resolution) are set in accordance with the relevant standards and NTS Silicon Valley's test procedures for the type of radio being tested. When power measurements are made using a resolution bandwidth less than the signal bandwidth the power is calculated by summing the power across the signal bandwidth using either the analyzer channel power function or by capturing the trace data and calculating the power using software. In both cases the summed power is corrected to account for the equivalent noise bandwidth (ENBW) of the resolution bandwidth used.

If power averaging is used (typically for certain digital modulation techniques), the EUT is configured to transmit continuously. Power averaging is performed using either the built-in function of the analyzer or, if the analyzer does not feature power averaging, using external software. In both cases the average power is calculated over a number of sweeps (typically 100). When the EUT cannot be configured to continuously transmit then either the analyzer is configured to perform a gated sweep to ensure that the power is averaged over periods that the device is transmitting or power averaging is disabled and a max-hold feature is used.

If a power meter is used to make output power measurements the sensor head type (peak or average) is stated in the test data table.

**BANDWIDTH MEASUREMENTS**

The 6 dB, 20 dB, 26 dB and/or 99% signal bandwidth are measured using the bandwidths recommended by ANSI C63.10 and RSS GEN.

**SPECIFICATION LIMITS AND SAMPLE CALCULATIONS**

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dB $\mu$ V). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dB $\mu$ V/m). The results are then converted to the linear forms of  $\mu$ V and  $\mu$ V/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

**CONDUCTED EMISSIONS SPECIFICATION LIMITS: FCC 15.207; FCC 15.107(a), RSS GEN**

The table below shows the limits for the emissions on the AC power line from an intentional radiator and a receiver.

| Frequency<br>(MHz) | Average<br>Limit<br>(dB $\mu$ V)                                          | Quasi Peak<br>Limit<br>(dB $\mu$ V)                                       |
|--------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|
| 0.150 to 0.500     | Linear decrease on<br>logarithmic frequency axis<br>between 56.0 and 46.0 | Linear decrease on logarithmic<br>frequency axis between 66.0<br>and 56.0 |
| 0.500 to 5.000     | 46.0                                                                      | 56.0                                                                      |
| 5.000 to 30.000    | 50.0                                                                      | 60.0                                                                      |

### GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands<sup>1</sup>.

| Frequency Range (MHz) | Limit ( $\mu\text{V/m}$ )             | Limit ( $\text{dB}\mu\text{V/m @ 3m}$ )             |
|-----------------------|---------------------------------------|-----------------------------------------------------|
| 0.009-0.490           | $2400/F_{\text{KHz}} @ 300 \text{ m}$ | $67.6-20*\log_{10}(F_{\text{KHz}}) @ 300 \text{ m}$ |
| 0.490-1.705           | $24000/F_{\text{KHz}} @ 30 \text{ m}$ | $87.6-20*\log_{10}(F_{\text{KHz}}) @ 30 \text{ m}$  |
| 1.705 to 30           | $30 @ 30 \text{ m}$                   | $29.5 @ 30 \text{ m}$                               |
| 30 to 88              | $100 @ 3 \text{ m}$                   | $40.0 @ 3 \text{ m}$                                |
| 88 to 216             | $150 @ 3 \text{ m}$                   | $43.5 @ 3 \text{ m}$                                |
| 216 to 960            | $200 @ 3 \text{ m}$                   | $46.0 @ 3 \text{ m}$                                |
| Above 960             | $500 @ 3 \text{ m}$                   | $54.0 @ 3 \text{ m}$                                |

<sup>1</sup> The restricted bands are detailed in FCC 15.205 and RSS-Gen Table 6

**OUTPUT POWER LIMITS – DIGITAL TRANSMISSION SYSTEMS**

The table below shows the limits for output power and output power density. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

| Operating Frequency (MHz) | Output Power    | Power Spectral Density |
|---------------------------|-----------------|------------------------|
| 902 – 928                 | 1 Watt (30 dBm) | 8 dBm/3 kHz            |
| 2400 – 2483.5             | 1 Watt (30 dBm) | 8 dBm/3 kHz            |
| 5725 – 5850               | 1 Watt (30 dBm) | 8 dBm/3 kHz            |

The maximum permitted output power is reduced by 1 dB for every dB the antenna gain exceeds 6dBi. Fixed point-to-point applications using the 5725 – 5850 MHz band are not subject to this restriction.

**TRANSMIT MODE SPURIOUS RADIATED EMISSIONS LIMITS – FHSS and DTS SYSTEMS**

The limits for unwanted (spurious) emissions from the transmitter falling in the restricted bands are those specified in the general limits sections of FCC Part 15 and RSS 210. All other unwanted (spurious) emissions shall be at least 20 dB below the level of the highest in-band signal level (30 dB if the power is measured using the sample detector/power averaging method).

**SAMPLE CALCULATIONS - CONDUCTED EMISSIONS**

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - S = M$$

where:

$R_r$  = Receiver Reading in dB $\mu$ V

$S$  = Specification Limit in dB $\mu$ V

$M$  = Margin to Specification in +/- dB

**SAMPLE CALCULATIONS - RADIATED EMISSIONS**

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

A distance factor, when used for electric field measurements above 30MHz, is calculated by using the following formula:

$$F_d = 20 * \text{LOG}_{10} (D_m/D_s)$$

where:

$F_d$  = Distance Factor in dB

$D_m$  = Measurement Distance in meters

$D_s$  = Specification Distance in meters

For electric field measurements below 30MHz the extrapolation factor is either determined by making measurements at multiple distances or a theoretical value is calculated using the formula:

$$F_d = 40 * \text{LOG}_{10} (D_m/D_s)$$

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

$R_r$  = Receiver Reading in dB $\mu$ V/m

$F_d$  = Distance Factor in dB

$R_c$  = Corrected Reading in dB $\mu$ V/m

$L_s$  = Specification Limit in dB $\mu$ V/m

$M$  = Margin in dB Relative to Spec

## Appendix A Test Equipment Calibration Data

| <u>Manufacturer</u>                                      | <u>Description</u>                                                               | <u>Model</u>       | <u>Asset #</u> | <u>Calibrated</u> | <u>Cal Due</u> |
|----------------------------------------------------------|----------------------------------------------------------------------------------|--------------------|----------------|-------------------|----------------|
| <b>Antenna port measurements, 04-May-16</b>              |                                                                                  |                    |                |                   |                |
| NTS                                                      | NTS Capture Analyzer Software (rev 3.8)                                          | N/A                | 0              |                   | N/A            |
| Fluke                                                    | Multimeter, True RMS                                                             | 111                | 1480           | 3/28/2016         | 3/28/2017      |
| Rohde & Schwarz                                          | Power Meter, Dual Channel                                                        | NRVD               | 1539           | 9/24/2015         | 9/24/2016      |
| Agilent Technologies                                     | PSA, Spectrum Analyzer, (installed options, 111, 115, 123, 1DS, B7J, HYX,        | E4446A             | 2139           | 6/22/2015         | 6/22/2016      |
| Agilent Technologies                                     | USB Average Power Sensor                                                         | U2001A             | 2442           | 1/6/2016          | 1/6/2017       |
| Rohde & Schwarz                                          | Peak Power Sensor 100 uW - 2 Watts use with 20dB attenuator sn:1031.6959.00 only | NRV-Z32            | 3225           | 9/24/2015         | 9/24/2016      |
| <b>Radiated Emissions, 1,000 - 18,000 MHz, 09-May-16</b> |                                                                                  |                    |                |                   |                |
| NTS                                                      | NTS EMI Software (rev 2.10)                                                      | N/A                | 0              |                   | N/A            |
| Hewlett Packard                                          | Microwave Preamplifier, 1-26.5GHz                                                | 8449B              | 785            | 10/12/2015        | 10/12/2016     |
| Hewlett Packard                                          | Spectrum Analyzer (SA40) Blue 9 kHz - 40 GHz                                     | 8564E (84125C)     | 1393           | 3/28/2016         | 3/28/2017      |
| EMCO                                                     | Antenna, Horn, 1-18 GHz                                                          | 3115               | 1561           | 6/27/2014         | 6/27/2016      |
| Micro-Tronics                                            | Band Reject Filter, 2400-2500 MHz                                                | BRM50702-02        | 2238           | 9/16/2015         | 9/16/2016      |
| <b>Radiated Emissions, 1,000 - 25,000 MHz, 09-May-16</b> |                                                                                  |                    |                |                   |                |
| NTS                                                      | NTS EMI Software (rev 2.10)                                                      | N/A                | 0              |                   | N/A            |
| Hewlett Packard                                          | High Pass filter, 8.2 GHz                                                        | P/N 84300-80039    | 1152           | 7/10/2015         | 7/10/2016      |
| HP / Miteq                                               | SA40 Head (Blue)                                                                 | TTA1840-45-5P-HG-S | 1620           | 3/8/2016          | 3/8/2017       |
| A. H. Systems                                            | Red System Horn, 18-40GHz                                                        | SAS-574, p/n: 2581 | 2161           | 7/16/2015         | 7/16/2017      |
| Hewlett Packard                                          | Microwave Preamplifier, 1-26.5GHz                                                | 8449B              | 785            | 10/12/2015        | 10/12/2016     |
| Hewlett Packard                                          | Spectrum Analyzer (SA40) Blue 9 kHz - 40 GHz                                     | 8564E (84125C)     | 1393           | 3/28/2016         | 3/28/2017      |
| EMCO                                                     | Antenna, Horn, 1-18 GHz                                                          | 3115               | 1561           | 6/27/2014         | 6/27/2016      |
| Micro-Tronics                                            | Band Reject Filter, 2400-2500 MHz                                                | BRM50702-02        | 2238           | 9/16/2015         | 9/16/2016      |
| <b>Radiated Emissions, 30 - 1,000 MHz, 10-May-16</b>     |                                                                                  |                    |                |                   |                |
| Sunol Sciences                                           | Biconilog, 30-3000 MHz                                                           | JB3                | 1548           | 9/17/2014         | 9/17/2016      |
| Com-Power                                                | Preamplifier, 30-1000 MHz                                                        | PA-103             | 1632           | 6/17/2015         | 6/17/2016      |
| Rohde & Schwarz                                          | EMI Test Receiver, 20 Hz-7 GHz                                                   | ESIB7              | 1756           | 6/20/2015         | 6/20/2016      |
| <b>Antenna port measurements, 11-May-16</b>              |                                                                                  |                    |                |                   |                |
| Rohde & Schwarz                                          | Power Meter, Dual Channel                                                        | NRVD               | 1539           | 9/24/2015         | 9/24/2016      |
| Agilent Technologies                                     | 3Hz -44GHz PSA Spectrum Analyzer                                                 | E4446A             | 2796           | 5/6/2016          | 5/6/2017       |



| <u>Manufacturer</u>                                    | <u>Description</u>                                                                        | <u>Model</u> | <u>Asset #</u> | <u>Calibrated</u> | <u>Cal Due</u> |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------|--------------|----------------|-------------------|----------------|
| Rohde & Schwarz                                        | Peak Power Sensor 100 uW -<br>2 Watts use with 20dB<br>attenuator sn:1031.6959.00<br>only | NRV-Z32      | 3225           | 9/24/2015         | 9/24/2016      |
| <b>Conducted Emissions - AC Power Ports, 18-May-16</b> |                                                                                           |              |                |                   |                |
| EMCO                                                   | LISN, 10 kHz-100 MHz                                                                      | 3825/2       | 1293           | 6/2/2015          | 6/2/2016       |
| Rohde & Schwarz                                        | Pulse Limiter                                                                             | ESH3 Z2      | 1401           | 4/26/2016         | 4/26/2017      |
| Rohde & Schwarz                                        | EMI Test Receiver, 20 Hz-7<br>GHz                                                         | ESIB7        | 1756           | 6/20/2015         | 6/20/2016      |

## **Appendix B Test Data**

T101649 Pages 26 – 90

|                        |                        |                      |                   |
|------------------------|------------------------|----------------------|-------------------|
| Client:                | Neato Robotics         | Job Number:          | JD101609          |
| Product:               | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
|                        |                        | Project Manager:     | Christine Krebill |
| Contact:               | Matt Tenuta            | Project Coordinator: |                   |
| Emissions Standard(s): | FCC 15.247, RSS 247    | Class:               | B                 |
| Immunity Standard(s):  | -                      | Environment:         |                   |

## EMC Test Data

For The

## Neato Robotics

Product

**Botvac D3/D5 Connected**

Date of Last Test: 5/18/2016

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

## Power vs. Data Rate

In normal operating modes the card uses power settings stored on EEPROM to set the output power. For a given nominal output power the actual transmit power normally is reduced as the data rate increases, therefore testing was performed at the data rate in the mode with highest power to determine compliance with the requirements.

The following power measurements were made using an average/peak power meter and with the device configured in a continuous transmit mode on Chain 1 at the various data rates in each mode to verify the highest power mode:

### Sample Notes

#### Sample S/N:

**WLAN Driver:** MCP-8.0.1.47\_Rel

**WLAN Firmware:** PLT 8.9.0.1.38

Date of Test: 5/4/2016

Test Engineer: Deniz Demirci

Test Location: FT Lab #4b

| Mode              | Data Rate | Peak Power (dBm) | Average Power (dBm) | Power setting |
|-------------------|-----------|------------------|---------------------|---------------|
| 802.11b           | 1         | 18.4             | 17.9                | Max           |
|                   | 2         | 18.2             | 17.8                |               |
|                   | 5.5       | <b>18.5</b>      | <b>18.3</b>         |               |
|                   | 11        | 18.3             | 18.0                |               |
| 802.11g           | 6         | <b>16.6</b>      | <b>16.0</b>         | Max           |
|                   | 9         | 16.7             | 16.0                |               |
|                   | 12        | 16.6             | 16.0                |               |
|                   | 18        | 16.6             | 16.0                |               |
|                   | 24        | 16.0             | 15.2                |               |
|                   | 36        | 16.6             | 15.8                |               |
|                   | 48        | 16.6             | 15.8                |               |
|                   | 54        | 16.0             | 14.2                |               |
| 802.11n<br>20 MHz | 6.5       | <b>16.7</b>      | <b>16.1</b>         | Max           |
|                   | 13        | 16.6             | 16.0                |               |
|                   | 19.5      | 16.6             | 16.0                |               |
|                   | 26        | 16.7             | 16.0                |               |
|                   | 39        | 16.6             | 15.8                |               |
|                   | 52        | 16.7             | 15.8                |               |
|                   | 58.5      | 16.1             | 15.0                |               |
|                   | 65        | 16.1             | 15.0                |               |

Note : Power setting - the maximum software power setting used for reference only.

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

## Duty Cycle

Date of Test: 5/4/2016  
 Test Engineer: Deniz Demirci  
 Test Location: FT Lab #4b

Duty cycle measurements performed on the worse case data rate for power.

| Mode | Data Rate | Duty Cycle (x) | Constant DC? | T (ms) | Pwr Cor Factor* | Lin Volt Cor Factor** | Min VBW for FS (Hz) |
|------|-----------|----------------|--------------|--------|-----------------|-----------------------|---------------------|
| 11b  | 5.5       | 0.96           | Yes          | 5.867  | 0.2             | 0.3                   | 170                 |
| 11g  | 6         | 0.99           | Yes          | 5.361  | 0.0             | 0.0                   | 10                  |
| n20  | 6.5       | 0.99           | Yes          | 4.476  | 0.0             | 0.0                   | 10                  |

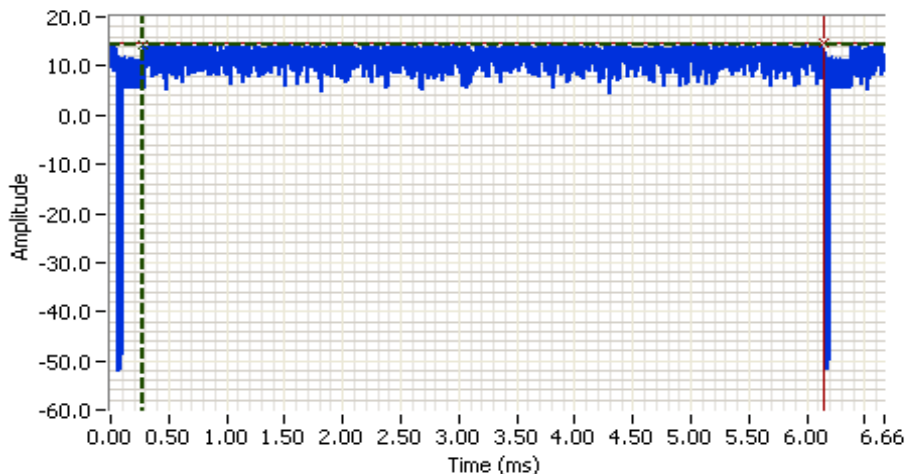
\* Correction factor when using RMS/Power averaging -  $10 \cdot \log(1/x)$

\*\* Correction factor when using linear voltage average -  $20 \cdot \log(1/x)$

T = Minimum transmission duration

|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |

## 802.11b



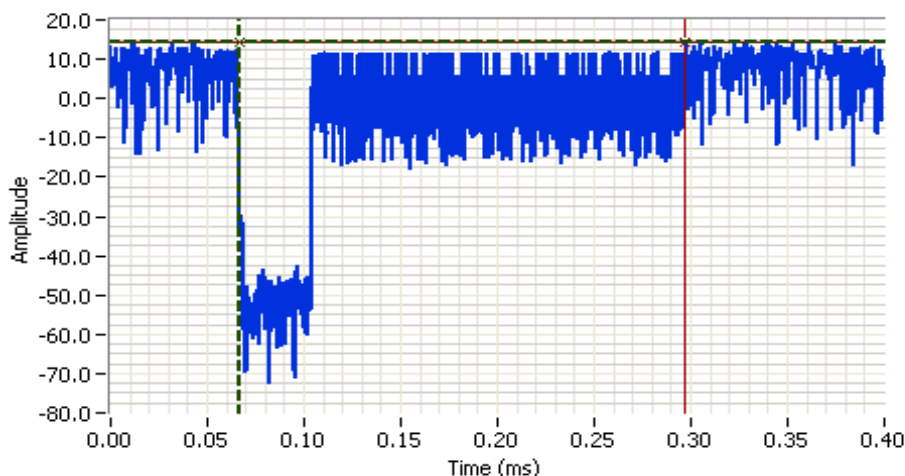
### Analyzer Settings

Agilent Technologies, E4446A  
 CF: 2437.000 MHz  
 SPAN: 0.000 MHz  
 RB: 1.000 MHz  
 VB: 3.000 MHz  
 Detector: POS  
 Attn: 30 DB  
 RL Offset: 10.2 DB  
 Sweep Time: 6.7ms  
 Ref Lvl: 30.0 DBM

### Comments

802.11b, 5.5 Mbps.  
 On time: 5.867 ms

|          |        |      |  |                 |       |
|----------|--------|------|--|-----------------|-------|
| Cursor 1 | 0.2777 | 14.2 |  | Delta Time (ms) | 5.867 |
| Cursor 2 | 6.1443 | 14.7 |  | Delta Amplitude | 0.5   |



### Analyzer Settings

Agilent Technologies, E4446A  
 CF: 2437.000 MHz  
 SPAN: 0.000 MHz  
 RB: 1.000 MHz  
 VB: 3.000 MHz  
 Detector: POS  
 Attn: 30 DB  
 RL Offset: 10.2 DB  
 Sweep Time: 0.4ms  
 Ref Lvl: 30.0 DBM

### Comments

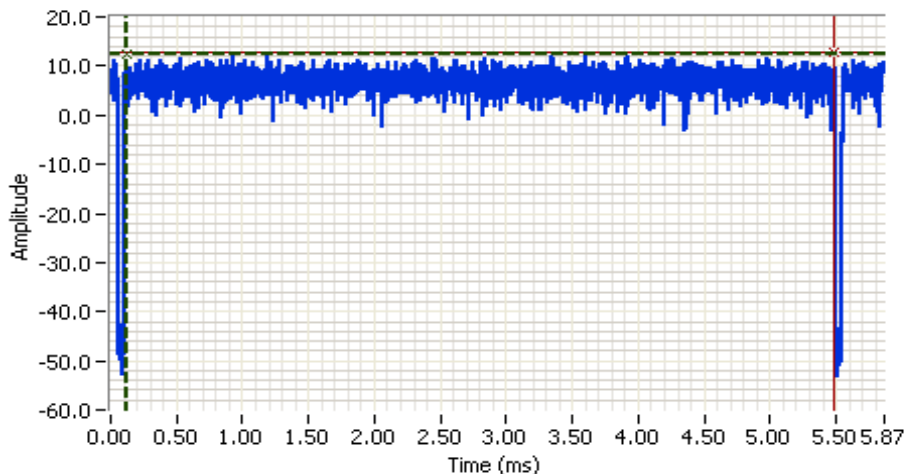
802.11b, 5.5 Mbps.  
 Off time: 0.230 ms

|          |        |      |  |                 |       |
|----------|--------|------|--|-----------------|-------|
| Cursor 1 | 0.0667 | 14.1 |  | Delta Time (ms) | 0.230 |
| Cursor 2 | 0.2969 | 14.3 |  | Delta Amplitude | 0.2   |



|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |

## 802.11g

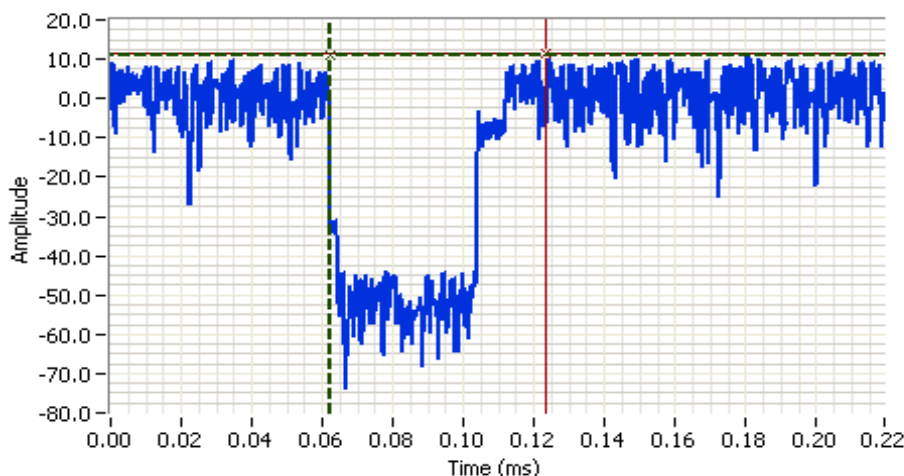


### Analyzer Settings

Agilent Technologies, E4446A  
 CF: 2437.000 MHz  
 SPAN: 0.000 MHz  
 RB: 1.000 MHz  
 VB: 3.000 MHz  
 Detector: POS  
 Attn: 30 DB  
 RL Offset: 10.2 DB  
 Sweep Time: 5.9ms  
 Ref Lvl: 30.0 DBM

### Comments

802.11g, 6 Mbps.  
 On time: 5.361 ms



### Analyzer Settings

Agilent Technologies, E4446A  
 CF: 2437.000 MHz  
 SPAN: 0.000 MHz  
 RB: 1.000 MHz  
 VB: 3.000 MHz  
 Detector: POS  
 Attn: 30 DB  
 RL Offset: 10.2 DB  
 Sweep Time: 219.2us  
 Ref Lvl: 30.0 DBM

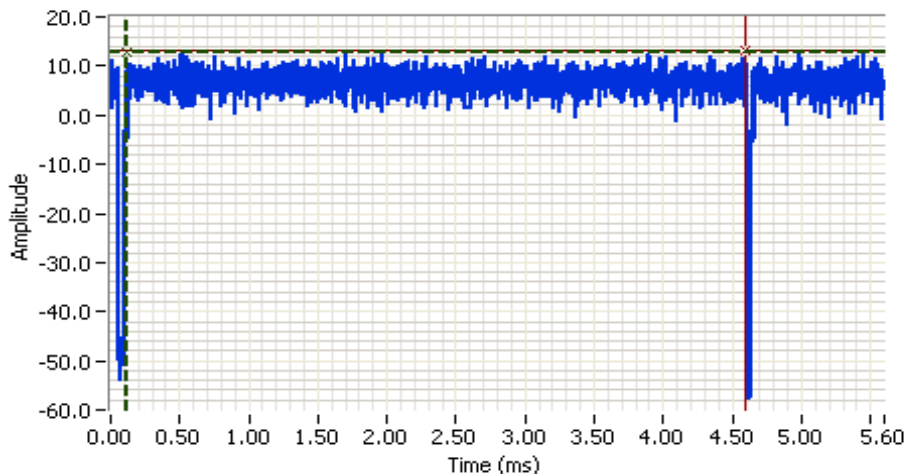
### Comments

802.11g, 6 Mbps.  
 Off time: 0.061 ms



|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |

## 802.11n 20 MHz

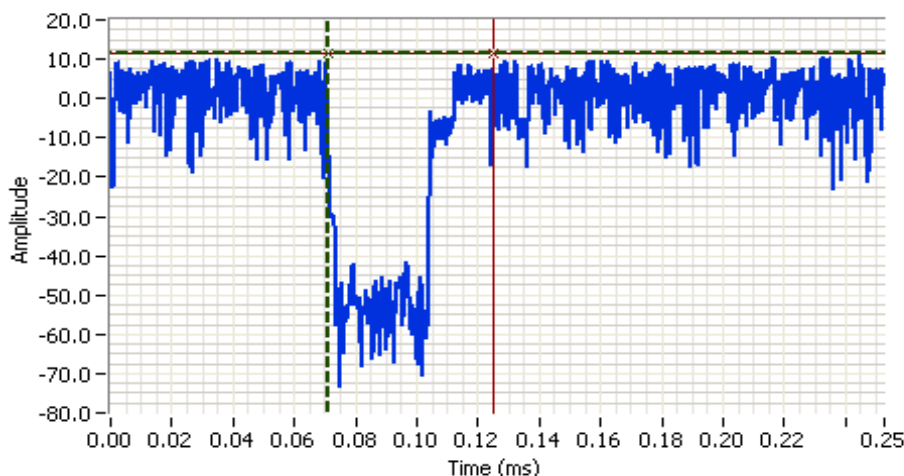


### Analyzer Settings

Agilent Technologies, E4446A  
 CF: 2437.000 MHz  
 SPAN: 0.000 MHz  
 RB: 1.000 MHz  
 VB: 3.000 MHz  
 Detector: POS  
 Attn: 30 DB  
 RL Offset: 10.2 DB  
 Sweep Time: 5.6ms  
 Ref Lvl: 30.0 DBM

### Comments

802.11n20, MCS0  
 On time: 4.476 ms



### Analyzer Settings

Agilent Technologies, E4446A  
 CF: 2437.000 MHz  
 SPAN: 0.000 MHz  
 RB: 1.000 MHz  
 VB: 3.000 MHz  
 Detector: POS  
 Attn: 30 DB  
 RL Offset: 10.2 DB  
 Sweep Time: 252.6us  
 Ref Lvl: 30.0 DBM

### Comments

802.11n20, MCS0  
 Off time: 0.054 ms



|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

## RSS 247 and FCC 15.247 (DTS) Radiated Spurious Emissions

### Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

### General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT, unless otherwise noted.

### Ambient Conditions:

Temperature: 20-22 °C

Rel. Humidity: 30-35 %

### Summary of Results - Device Operating in the 2400-2483.5 MHz Band

| Run # | Mode | Channel       | Target Power | Power Setting | Test Performed                    | Limit                        | Result / Margin                    |
|-------|------|---------------|--------------|---------------|-----------------------------------|------------------------------|------------------------------------|
| 1     | b    | 1 - 2412 MHz  | 17500 debug  | 17500 debug   | Restricted Band Edge (2390 MHz)   | FCC Part 15.209 / 15.247( c) | 51.2 dBµV/m @ 2388.6 MHz (-2.8 dB) |
|       | b    | 11 - 2462 MHz | 17500 debug  | 17500 debug   | Restricted Band Edge (2483.5 MHz) | FCC Part 15.209 / 15.247( c) | 48.5 dBµV/m @ 2485.7 MHz (-5.5 dB) |
| 2     | g    | 1 - 2412 MHz  | 15500 debug  | 15500 debug   | Restricted Band Edge (2390 MHz)   | FCC Part 15.209 / 15.247( c) | 73.1 dBµV/m @ 2388.9 MHz (-0.9 dB) |
|       | g    | 11 - 2462 MHz | 15500 debug  | 15500 debug   | Restricted Band Edge (2483.5 MHz) | FCC Part 15.209 / 15.247( c) | 52.8 dBµV/m @ 2483.5 MHz (-1.2 dB) |
| 3     | n20  | 1 - 2412 MHz  | 14500 debug  | 14500 debug   | Restricted Band Edge (2390 MHz)   | FCC Part 15.209 / 15.247( c) | 73.0 dBµV/m @ 2388.2 MHz (-1.0 dB) |
|       | n20  | 11 - 2462 MHz | 14500 debug  | 14500 debug   | Restricted Band Edge (2483.5 MHz) | FCC Part 15.209 / 15.247( c) | 72.9 dBµV/m @ 2484.0 MHz (-1.1 dB) |

### Modifications Made During Testing

No modifications were made to the EUT during testing

### Deviations From The Standard

No deviations were made from the requirements of the standard.

### Sample Notes

Sample S/N: DVT2\_022

WLAN Driver: MCP-8.0.1.47\_Rel

WLAN Firmware: PLT 8.9.0.1.38

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

## Procedure Comments:

Measurements performed in accordance with FCC KDB 558074

Peak measurements performed with: RBW = 1 MHz, VBW = 3 MHz, peak detector, max hold, auto sweep time

Unless otherwise stated/noted, emission has duty cycle  $\geq 98\%$  and was measured using RBW = 1 MHz, VBW = 10 Hz, peak detector, linear average mode, auto sweep time, max hold.

| Mode | Data Rate | Duty Cycle (x) | Constant DC? | T (ms) | Pwr Cor Factor* | Lin Volt Cor Factor** | Min VBW for FS (Hz) |
|------|-----------|----------------|--------------|--------|-----------------|-----------------------|---------------------|
| 11b  | 5.5       | 0.96           | Yes          | 5.867  | 0.2             | 0.3                   | 170                 |
| 11g  | 6.0       | 0.99           | Yes          | 5.361  | 0.0             | 0.0                   | 10                  |
| n20  | 6.5       | 0.99           | Yes          | 4.476  | 0.0             | 0.0                   | 10                  |

## Measurement Specific Notes:

|         |                                                                                                                                                                                           |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Note 1: | Emission has duty cycle $\geq 98\%$ , average measurement performed: RBW = 1 MHz, VBW = 10 Hz, peak detector, linear averaging, auto sweep,                                               |
| Note 2: | Emission has constant duty cycle $< 98\%$ , average measurement performed: RBW=1MHz, VBW>1/T but not less than 10Hz, peak detector, linear averaging, auto sweep,max hold 50*1/DC traces. |

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

Date of Test: 05/09/16  
 Test Engineer: Deniz Demirci

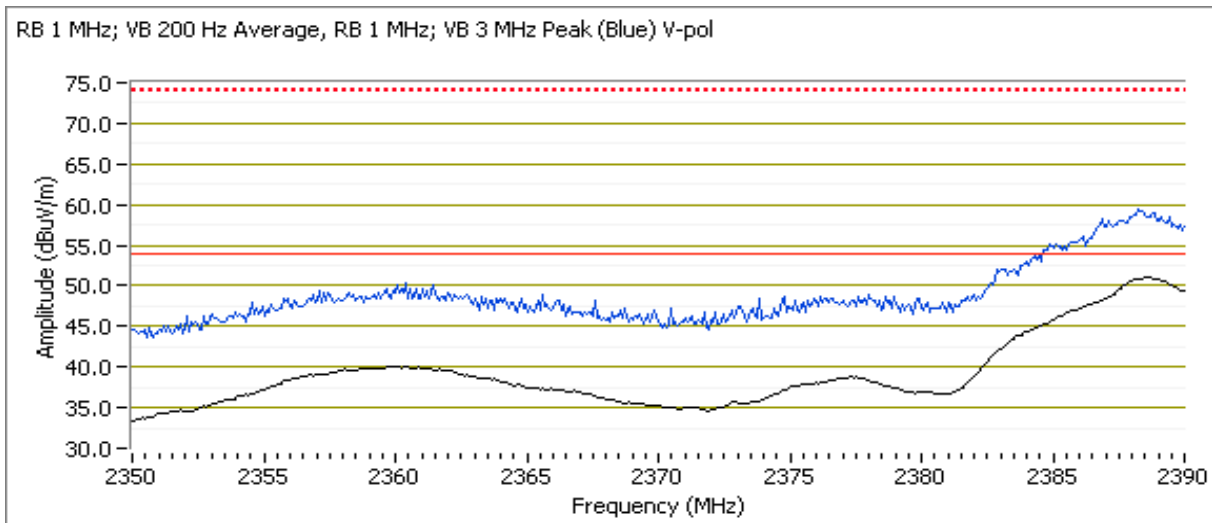
Config. Used: 1  
 Test Location: FT CH #3

## Run #1: Radiated Bandedge Measurements

Channel: 1                      Mode: b                      Power: 17500 (debug)  
 Tx Chain: Main                      Data Rate: 5.5 Mbps

## Band Edge Signal Field Strength - Direct measurement of field strength

| Frequency | Level        | Pol | 15.209 / 15.247 |        | Detector  | Azimuth | Height | Comments                          |
|-----------|--------------|-----|-----------------|--------|-----------|---------|--------|-----------------------------------|
| MHz       | dB $\mu$ V/m | V/H | Limit           | Margin | Pk/QP/Avg | degrees | meters |                                   |
| 2388.640  | 51.2         | V   | 54.0            | -2.8   | AVG       | 132     | 2.1    | Note 2.POS; RB 1 MHz; VB: 200 Hz  |
| 2388.960  | 59.5         | V   | 74.0            | -14.5  | PK        | 132     | 2.1    | POS; RB 1 MHz; VB: 3 MHz          |
| 2388.640  | 50.3         | H   | 54.0            | -3.7   | AVG       | 50      | 2.5    | Note 2. POS; RB 1 MHz; VB: 200 Hz |
| 2388.640  | 58.3         | H   | 74.0            | -15.7  | PK        | 50      | 2.5    | POS; RB 1 MHz; VB: 3 MHz          |



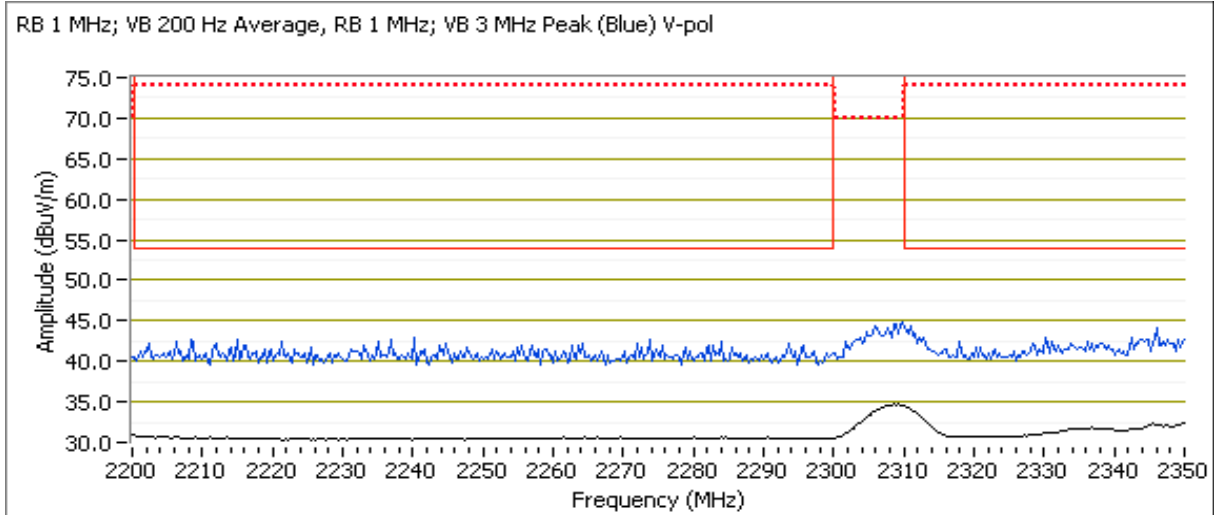


**NTS**

WE ENGINEER SUCCESS

## EMC Test Data

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

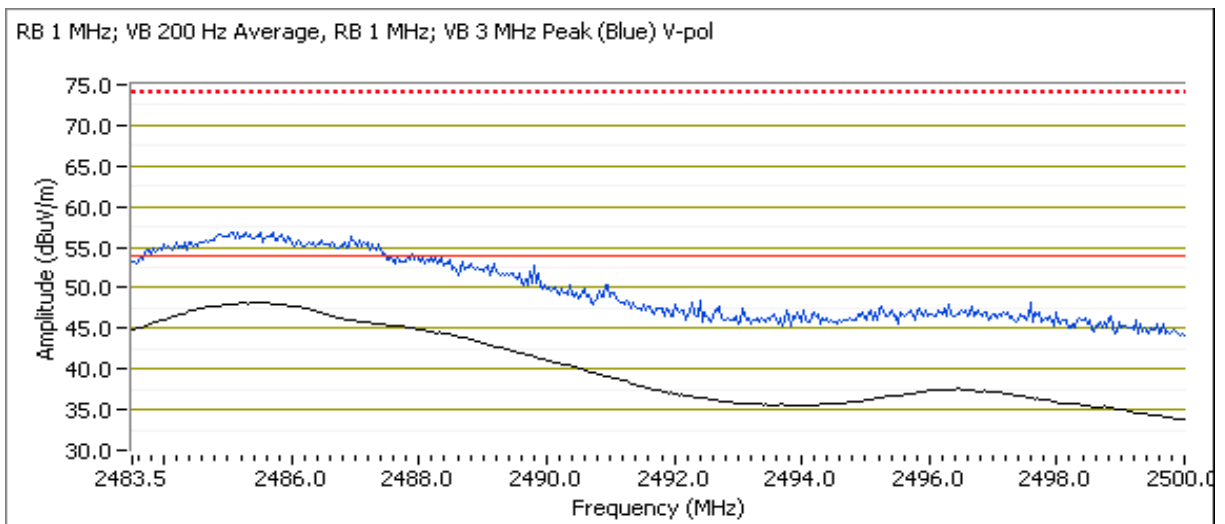


|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

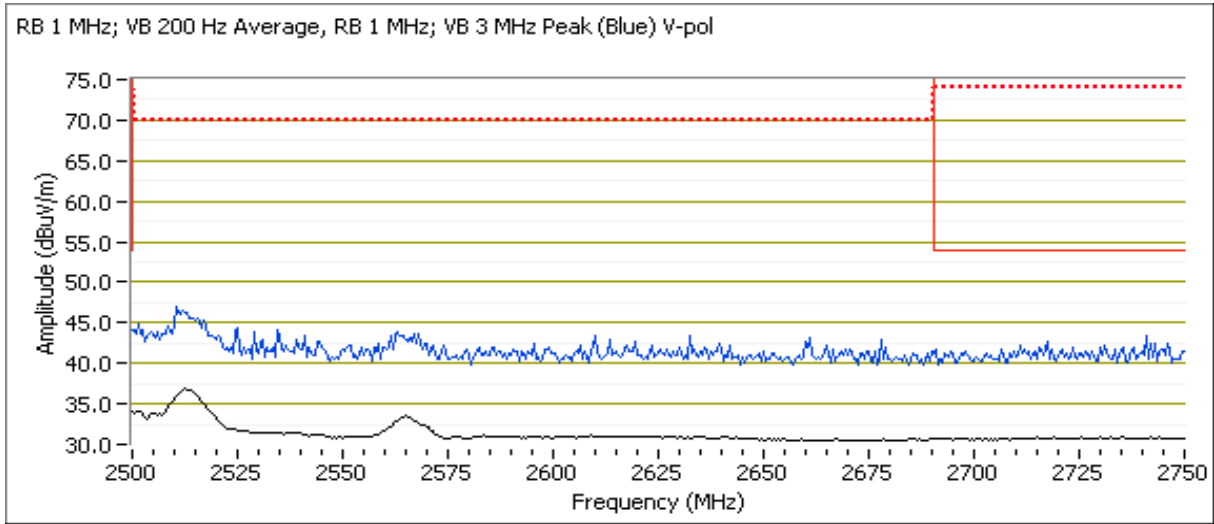
Channel: 11                      Mode: b                      Power: 17500 (debug)  
 Tx Chain: Main                      Data Rate: 5.5 Mbps

## Band Edge Signal Field Strength - Direct measurement of field strength

| Frequency       | Level        | Pol | 15.209 / 15.247 |             | Detector  | Azimuth | Height | Comments                         |
|-----------------|--------------|-----|-----------------|-------------|-----------|---------|--------|----------------------------------|
| MHz             | dB $\mu$ V/m | V/H | Limit           | Margin      | Pk/QP/Avg | degrees | meters |                                  |
| <b>2485.650</b> | <b>48.5</b>  | V   | 54.0            | <b>-5.5</b> | AVG       | 132     | 2.2    | Note 2 POS; RB 1 MHz; VB: 200 Hz |
| 2485.020        | 56.9         | V   | 74.0            | -17.1       | PK        | 132     | 2.2    | POS; RB 1 MHz; VB: 3 MHz         |
| 2485.190        | 48.1         | H   | 54.0            | -5.9        | AVG       | 53      | 2.4    | Note 2 POS; RB 1 MHz; VB: 200 Hz |
| 2485.720        | 56.8         | H   | 74.0            | -17.2       | PK        | 53      | 2.4    | POS; RB 1 MHz; VB: 3 MHz         |



|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |



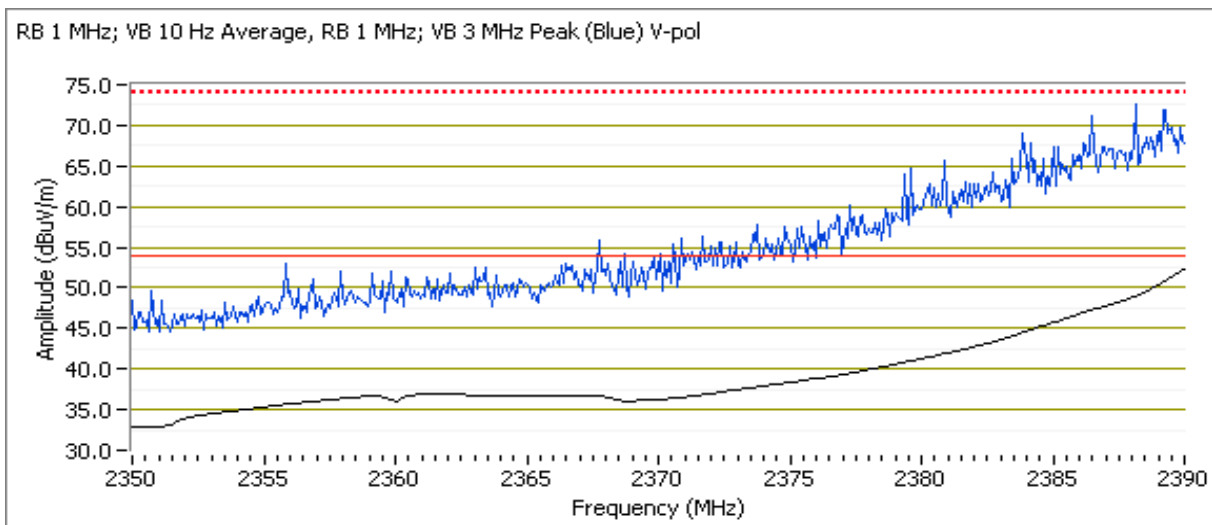
|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

## Run #2: Radiated Bandedge Measurements

Channel: 1                      Mode: g                      Power: 15500 (debug)  
 Tx Chain: Main                      Data Rate: 6 Mbps

## Band Edge Signal Field Strength - Direct measurement of field strength

| Frequency       | Level        | Pol | 15.209 / 15.247 |             | Detector  | Azimuth | Height | Comments                         |
|-----------------|--------------|-----|-----------------|-------------|-----------|---------|--------|----------------------------------|
| MHz             | dB $\mu$ V/m | V/H | Limit           | Margin      | Pk/QP/Avg | degrees | meters |                                  |
| <b>2388.940</b> | <b>73.1</b>  | V   | 74.0            | <b>-0.9</b> | PK        | 131     | 2.3    | POS; RB 1 MHz; VB: 3 MHz         |
| 2390.000        | 52.2         | V   | 54.0            | -1.8        | AVG       | 131     | 2.3    | Note 1, POS; RB 1 MHz; VB: 10 Hz |
| 2385.670        | 72.6         | H   | 74.0            | -1.4        | PK        | 56      | 2.5    | POS; RB 1 MHz; VB: 3 MHz         |
| 2390.000        | 51.8         | H   | 54.0            | -2.2        | AVG       | 56      | 2.5    | Note 1, POS; RB 1 MHz; VB: 10 Hz |

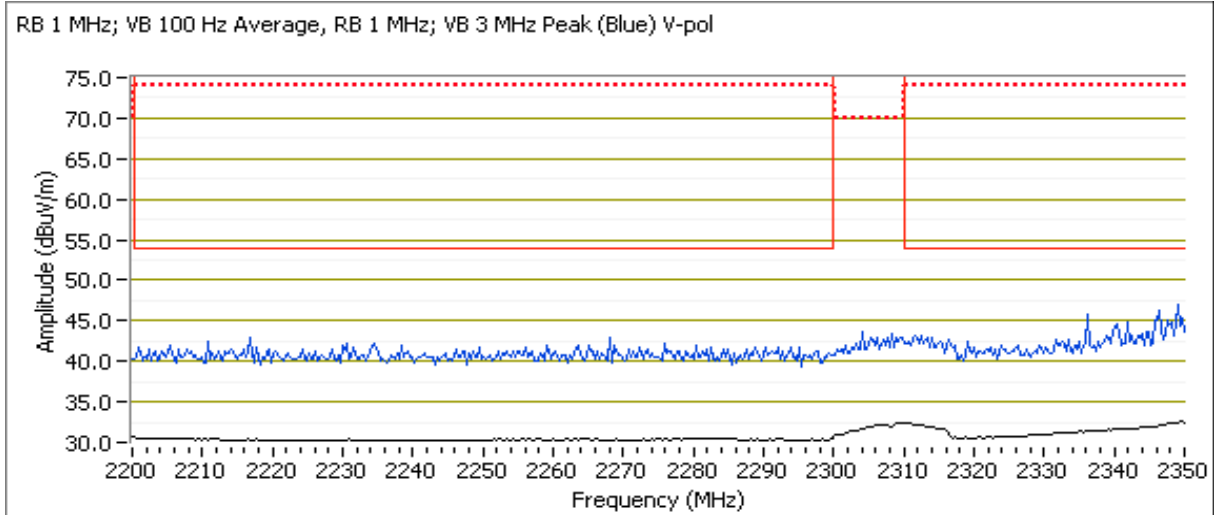


**NTS**

WE ENGINEER SUCCESS

## EMC Test Data

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

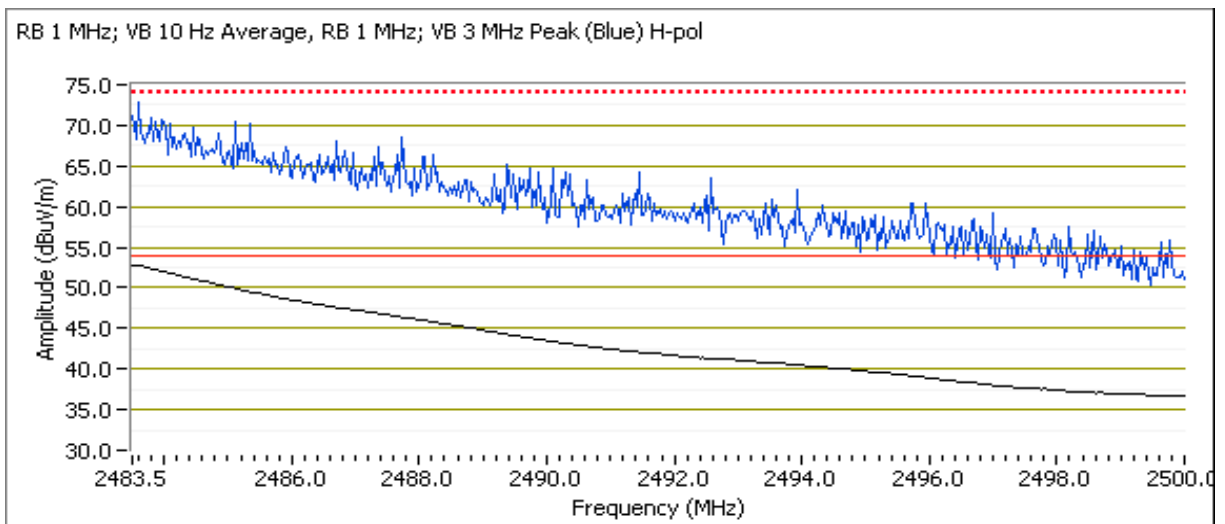


|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

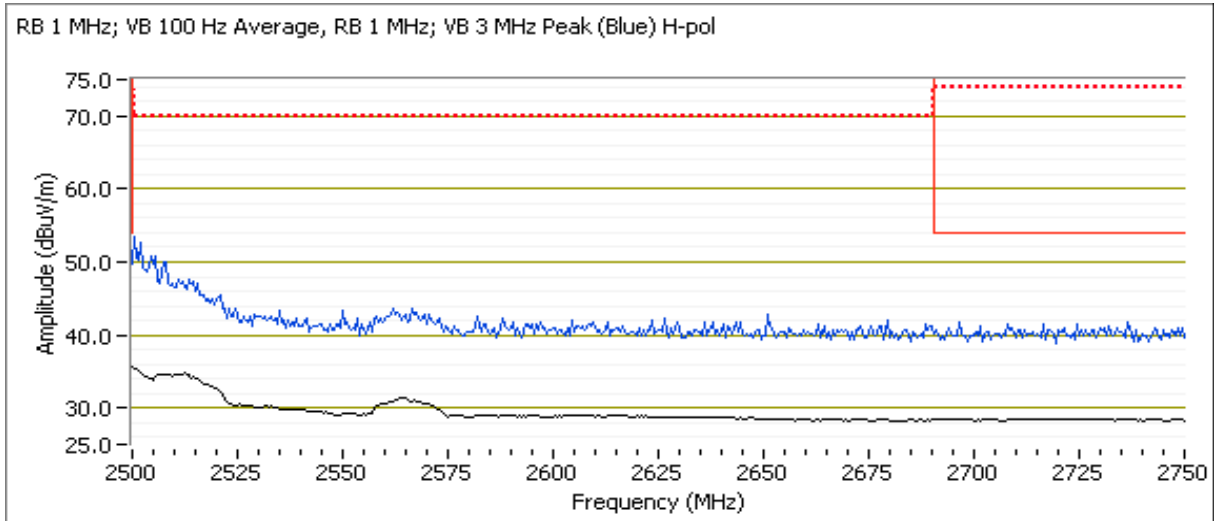
Channel: 11                      Mode: g                      Power: 15500 (debug)  
 Tx Chain: Main                  Data Rate: 6 Mbps

## Band Edge Signal Field Strength - Direct measurement of field strength

| Frequency | Level        | Pol | 15.209 / 15.247 |        | Detector  | Azimuth | Height | Comments                         |
|-----------|--------------|-----|-----------------|--------|-----------|---------|--------|----------------------------------|
| MHz       | dB $\mu$ V/m | V/H | Limit           | Margin | Pk/QP/Avg | degrees | meters |                                  |
| 2483.500  | 52.8         | H   | 54.0            | -1.2   | AVG       | 79      | 1.5    | Note 1, POS; RB 1 MHz; VB: 10 Hz |
| 2483.500  | 52.4         | V   | 54.0            | -1.6   | AVG       | 135     | 2.2    | Note 1, POS; RB 1 MHz; VB: 10 Hz |
| 2483.670  | 72.0         | H   | 74.0            | -2.0   | PK        | 79      | 1.5    | POS; RB 1 MHz; VB: 3 MHz         |
| 2484.190  | 71.0         | V   | 74.0            | -3.0   | PK        | 135     | 2.2    | POS; RB 1 MHz; VB: 3 MHz         |



|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |



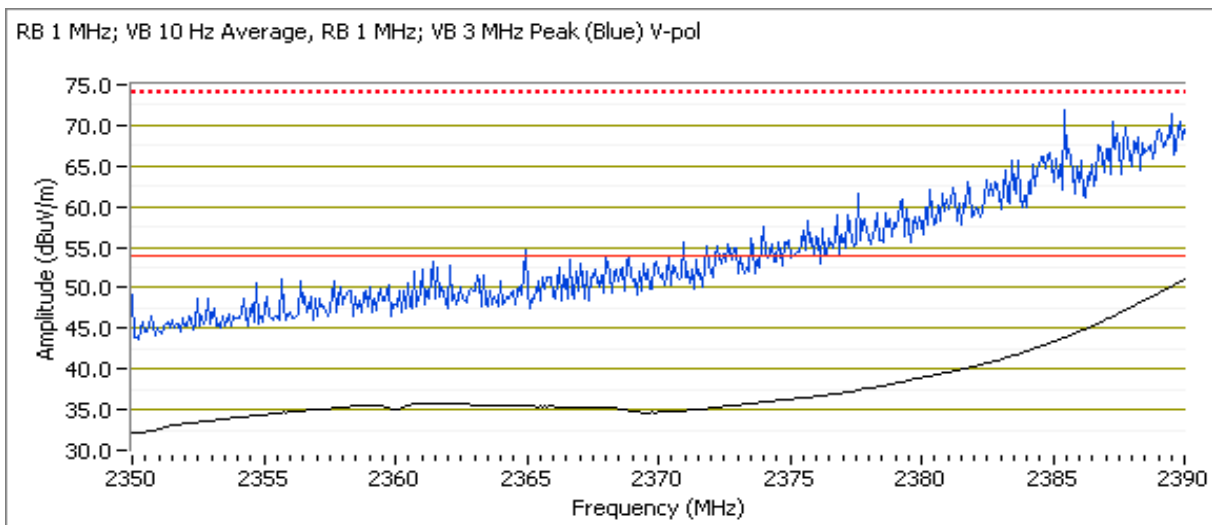
|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

## Run #3: Radiated Bandedge Measurements

Channel: 1      Mode: n20      Power: 14500 (debug)  
 Tx Chain: Main      Data Rate: MCS0

## Band Edge Signal Field Strength - Direct measurement of field strength

| Frequency       | Level        | Pol | 15.209 / 15.247 |             | Detector  | Azimuth | Height | Comments                         |
|-----------------|--------------|-----|-----------------|-------------|-----------|---------|--------|----------------------------------|
| MHz             | dB $\mu$ V/m | V/H | Limit           | Margin      | Pk/QP/Avg | degrees | meters |                                  |
| <b>2388.160</b> | <b>73.0</b>  | V   | 74.0            | <b>-1.0</b> | PK        | 131     | 2.3    | POS; RB 1 MHz; VB: 3 MHz         |
| 2389.360        | 72.7         | H   | 74.0            | -1.3        | PK        | 64      | 1.1    | POS; RB 1 MHz; VB: 3 MHz         |
| 2390.000        | 50.9         | V   | 54.0            | -3.1        | AVG       | 131     | 2.3    | Note 1, POS; RB 1 MHz; VB: 10 Hz |
| 2390.000        | 50.7         | H   | 54.0            | -3.3        | AVG       | 64      | 1.1    | Note 1, POS; RB 1 MHz; VB: 10 Hz |

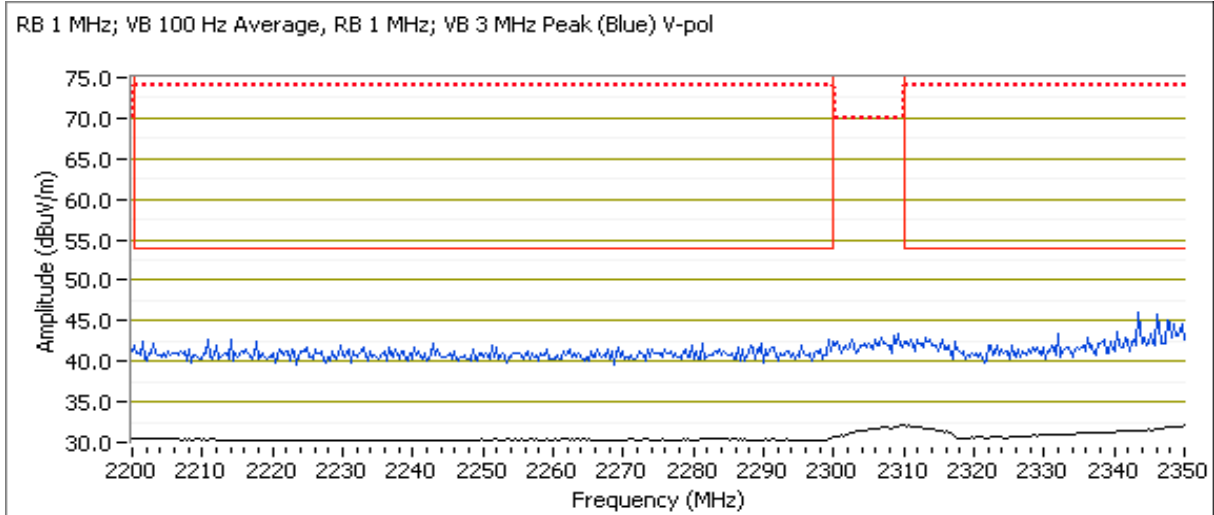


**NTS**

WE ENGINEER SUCCESS

## EMC Test Data

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

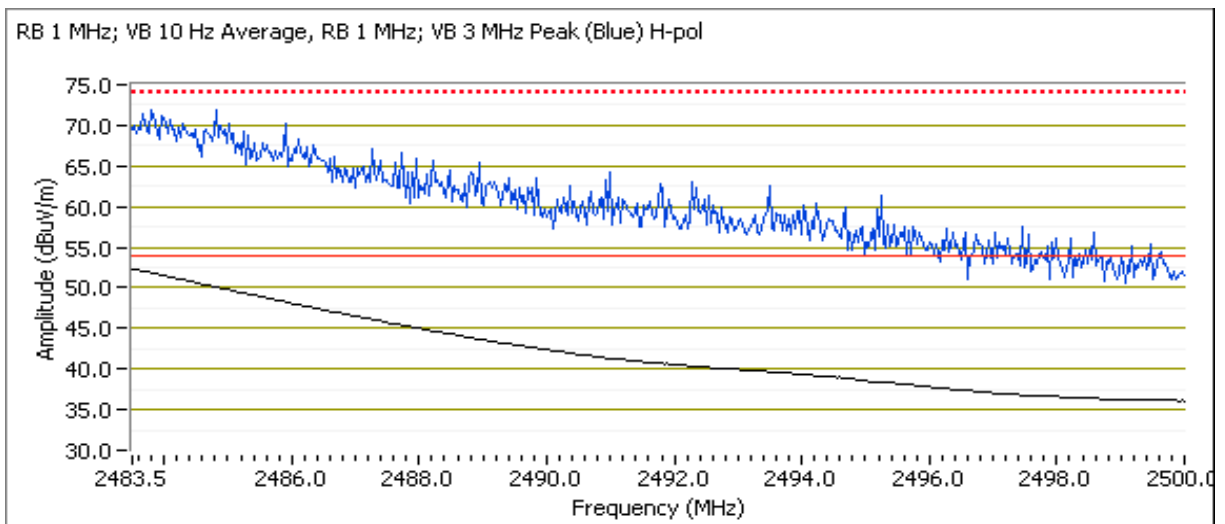


|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

Channel: 11                      Mode: n20                      Power: 14500 (debug)  
 Tx Chain: Main                      Data Rate: MCS0

## Band Edge Signal Field Strength - Direct measurement of field strength

| Frequency       | Level        | Pol | 15.209 / 15.247 |             | Detector  | Azimuth | Height | Comments                         |
|-----------------|--------------|-----|-----------------|-------------|-----------|---------|--------|----------------------------------|
| MHz             | dB $\mu$ V/m | V/H | Limit           | Margin      | Pk/QP/Avg | degrees | meters |                                  |
| <b>2483.970</b> | <b>72.9</b>  | H   | 74.0            | <b>-1.1</b> | PK        | 82      | 1.0    | POS; RB 1 MHz; VB: 3 MHz         |
| 2484.330        | 72.7         | V   | 74.0            | -1.3        | PK        | 127     | 2.0    | POS; RB 1 MHz; VB: 3 MHz         |
| 2483.550        | 52.2         | H   | 54.0            | -1.8        | AVG       | 82      | 1.0    | Note 1, POS; RB 1 MHz; VB: 10 Hz |
| 2483.500        | 51.7         | V   | 54.0            | -2.3        | AVG       | 127     | 2.0    | Note 1, POS; RB 1 MHz; VB: 10 Hz |

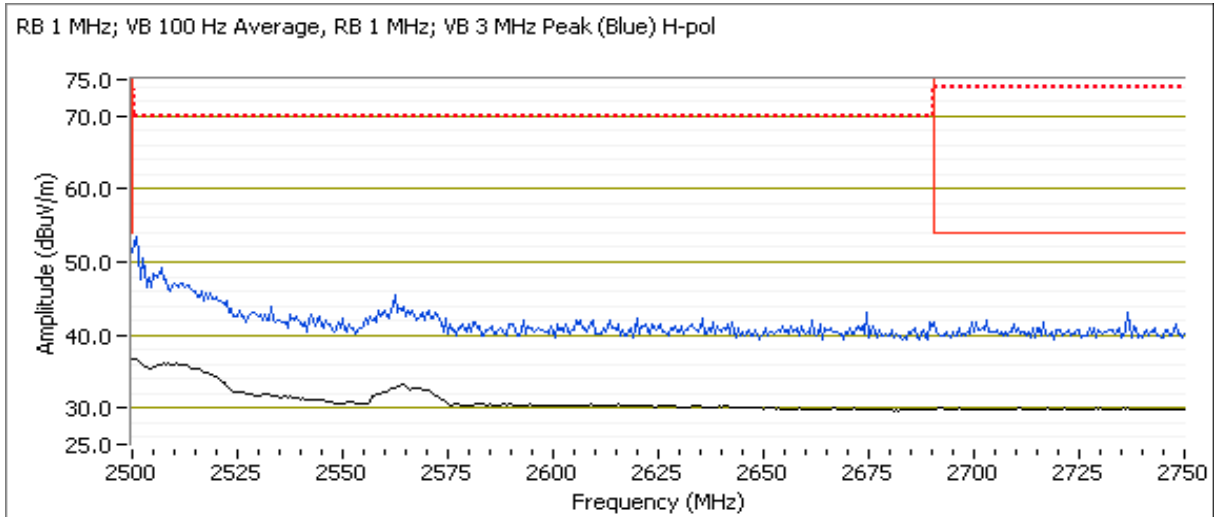


**NTS**

WE ENGINEER SUCCESS

## EMC Test Data

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |



|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

## RSS 247 and FCC 15.247 (DTS) Radiated Spurious Emissions

### Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

### General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT, unless otherwise noted.

### Ambient Conditions:

Temperature: 20-22 °C  
 Rel. Humidity: 30-35 %

### Summary of Results - Device Operating in the 2400-2483.5 MHz Band

| Run #                                                                       | Mode | Channel       | Target Power | Power Setting | Test Performed                      | Limit                        | Result / Margin                     |
|-----------------------------------------------------------------------------|------|---------------|--------------|---------------|-------------------------------------|------------------------------|-------------------------------------|
| 1                                                                           | b    | 1 - 2412 MHz  | 17500 debug  | 17500 debug   | Radiated Emissions, 30 MHz - 25 GHz | FCC Part 15.209 / 15.247( c) | 42.2 dBμV/m @ 4818.7 MHz (-11.8 dB) |
|                                                                             | b    | 6 - 2437 MHz  | 17500 debug  | 17500 debug   | Radiated Emissions, 30 MHz - 25 GHz | FCC Part 15.209 / 15.247( c) | 43.7 dBμV/m @ 4879.2 MHz (-10.3 dB) |
|                                                                             | b    | 11 - 2462 MHz | 17500 debug  | 17500 debug   | Radiated Emissions, 30 MHz - 25 GHz | FCC Part 15.209 / 15.247( c) | 41.1 dBμV/m @ 4929.2 MHz (-12.9 dB) |
| Scans on center channel in two OFDM modes to determine the worst case mode. |      |               |              |               |                                     |                              |                                     |
| 2                                                                           | g    | 6 - 2437 MHz  | 15500 debug  | 15500 debug   | Radiated Emissions, 30 MHz - 25 GHz | FCC Part 15.209 / 15.247( c) | 34.8 dBμV/m @ 4878.3 MHz (-19.2 dB) |
|                                                                             | n20  | 6 - 2437 MHz  | 14500 debug  | 14500 debug   | Radiated Emissions, 30 MHz - 25 GHz | FCC Part 15.209 / 15.247( c) | 34.1 dBμV/m @ 4874.1 MHz (-19.9 dB) |
| Measurements on low and high channels in worst-case OFDM mode.              |      |               |              |               |                                     |                              |                                     |
| 3                                                                           | g    | 1 - 2412 MHz  | 15500 debug  | 15500 debug   | Radiated Emissions, 30 MHz - 25 GHz | FCC Part 15.209 / 15.247( c) | 35.0 dBμV/m @ 4821.7 MHz (-19.0 dB) |
|                                                                             | g    | 11 - 2462 MHz | 15500 debug  | 15500 debug   | Radiated Emissions, 30 MHz - 25 GHz | FCC Part 15.209 / 15.247( c) | 35.1 dBμV/m @ 4924.2 MHz (-18.9 dB) |

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

## Modifications Made During Testing

No modifications were made to the EUT during testing

## Deviations From The Standard

No deviations were made from the requirements of the standard.

## Sample Notes

**Sample S/N:** DVT2\_022

**WLAN Driver:** MCP-8.0.1.47\_Rel

**WLAN Firmware:** PLT 8.9.0.1.38

## Procedure Comments:

Measurements performed in accordance with FCC KDB 558074

Peak measurements performed with: RBW=1 MHz, VBW=3 MHz, peak detector, max hold, auto sweep time

Unless otherwise stated/noted, emission has duty cycle  $\geq 98\%$  and was measured using RBW=1 MHz, VBW=10 Hz, peak detector, linear average mode, auto sweep time, max hold.

2.4GHz band reject filter used

| Mode | Data Rate | Duty Cycle (x) | Constant DC? | T (ms) | Pwr Cor Factor* | Lin Volt Cor Factor** | Min VBW for FS (Hz) |
|------|-----------|----------------|--------------|--------|-----------------|-----------------------|---------------------|
| 11b  | 5.5       | 0.96           | Yes          | 5.867  | 0.2             | 0.3                   | 170                 |
| 11g  | 6.0       | 0.99           | Yes          | 5.361  | 0.0             | 0.0                   | 10                  |
| n20  | 6.5       | 0.99           | Yes          | 4.476  | 0.0             | 0.0                   | 10                  |

## Measurement Specific Notes:

|         |                                                                                                                                                                                           |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Note 1: | Emission in non-restricted band, but limit of 15.209 used.                                                                                                                                |
| Note 2: | Emission in non-restricted band, the limit was set 20 dB below the level of the fundamental and measured in 100 kHz.                                                                      |
| Note 3: | Emission has duty cycle $\geq 98\%$ , average measurement performed: RBW = 1 MHz, VBW = 10 Hz, peak detector, linear averaging, auto sweep,                                               |
| Note 4: | Emission has constant duty cycle $< 98\%$ , average measurement performed: RBW=1MHz, VBW>1/T but not less than 10Hz, peak detector, linear averaging, auto sweep,max hold 50*1/DC traces. |



## EMC Test Data

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

Date of Test: 5/9/2016, 5/10/2016  
Test Engineer: Deniz Demirci / R. Varelas

Config. Used: 1  
Test Location: FT CH #3, #5

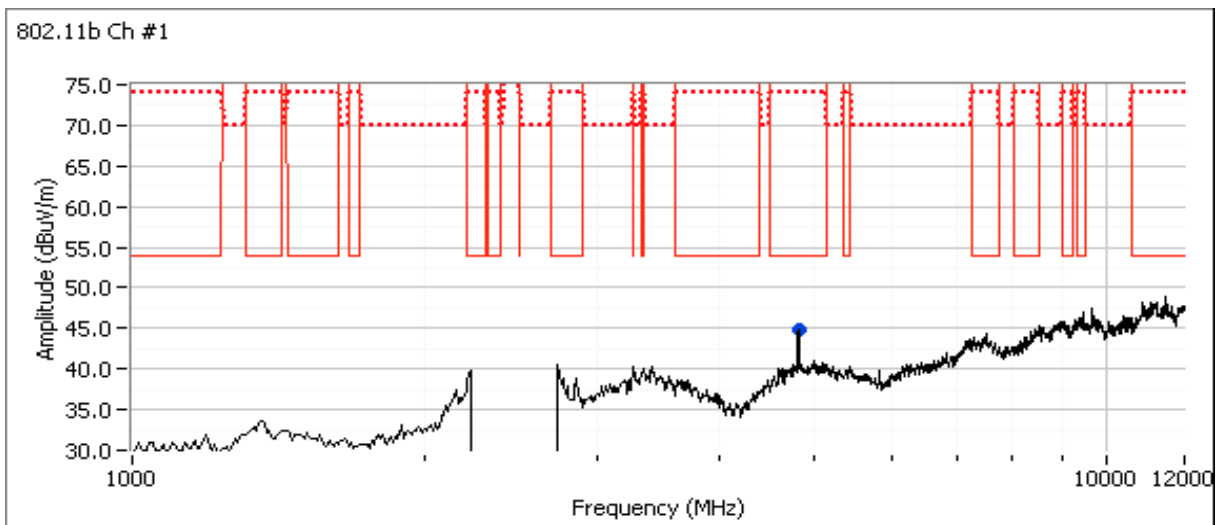
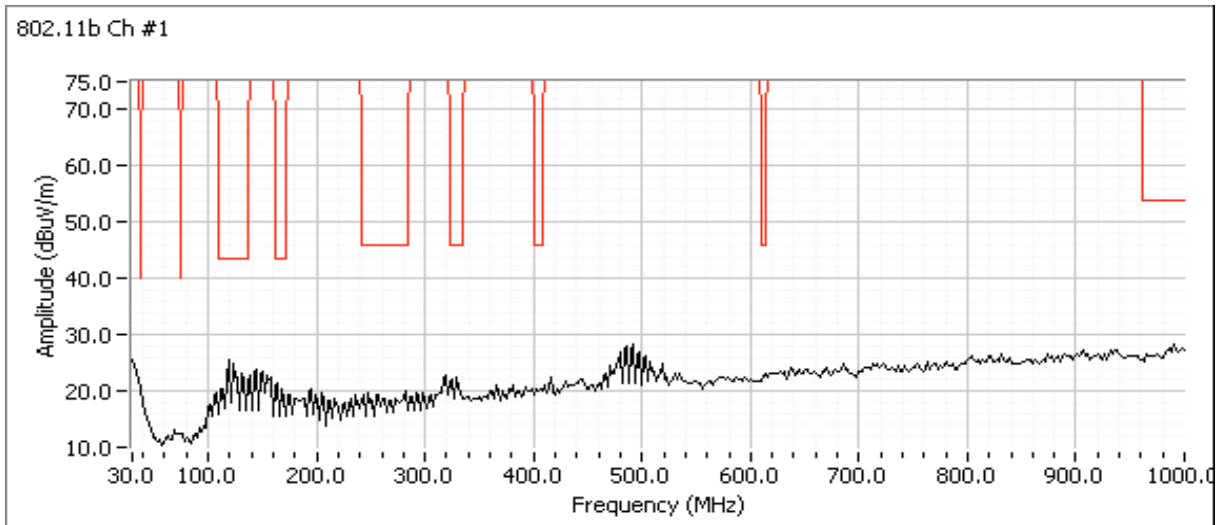
### Run #1: Radiated Spurious Emissions, 30 - 25000 MHz. Operating Mode: 802.11b

#### Run #1a: Low Channel

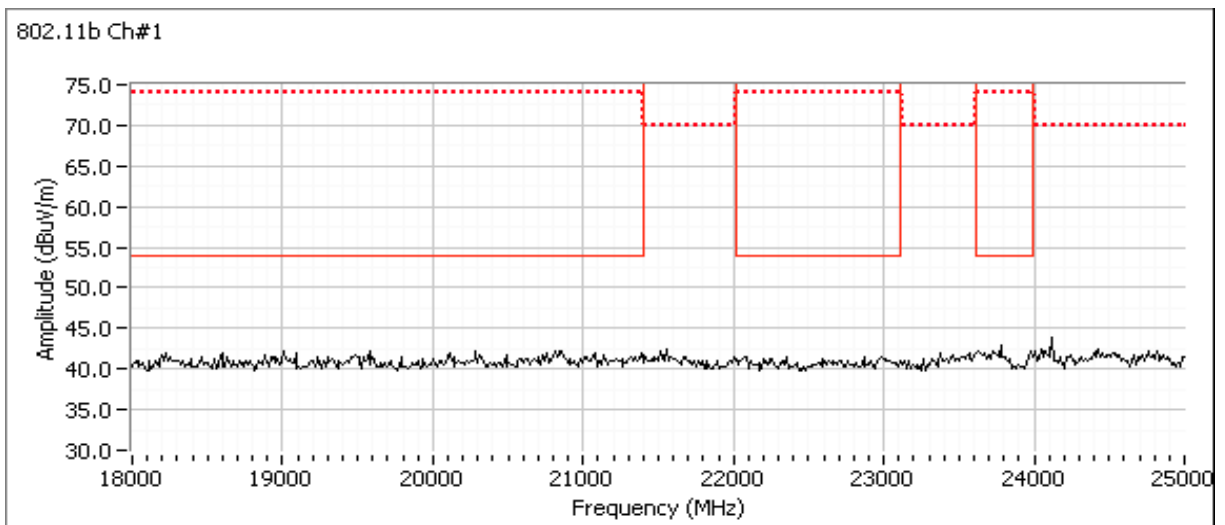
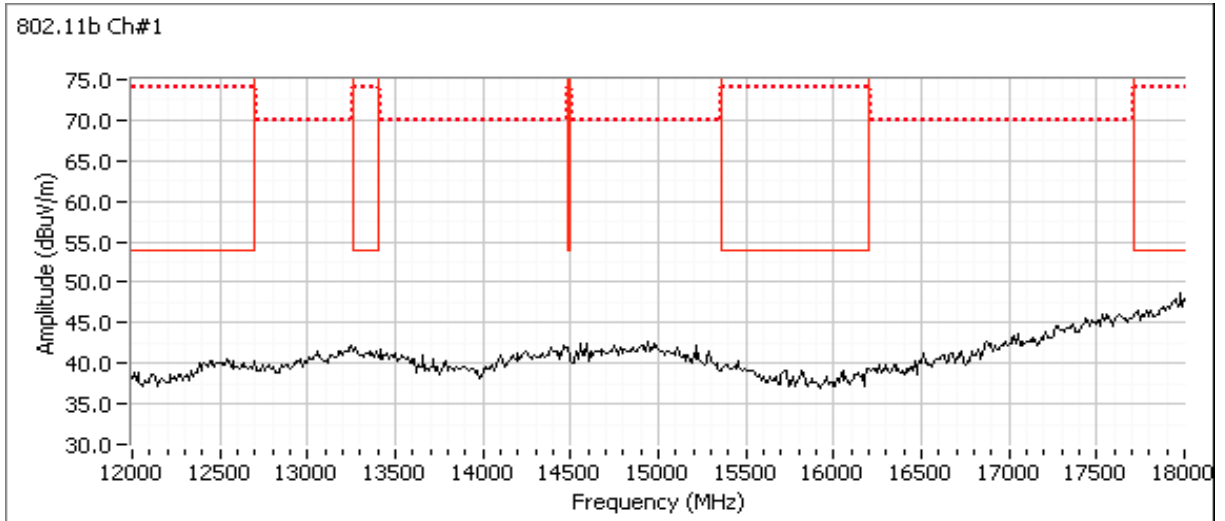
Channel: 1                      Mode: b                      Power: 17500 (debug)  
Tx Chain: Main              Data Rate: 1 Mbps

| Frequency | Level  | Pol | 15.209 / 15.247 |        | Detector  | Azimuth | Height | Comments                        |
|-----------|--------|-----|-----------------|--------|-----------|---------|--------|---------------------------------|
| MHz       | dBμV/m | v/h | Limit           | Margin | Pk/QP/Avg | degrees | meters |                                 |
| 4818.700  | 42.2   | V   | 54.0            | -11.8  | AVG       | 331     | 1.7    | Note 4, RB 1 MHz;VB 300 Hz;Peak |
| 4818.700  | 50.8   | V   | 74.0            | -23.2  | PK        | 331     | 1.7    | RB 1 MHz;VB 3 MHz;Peak          |

|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |



|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |





## EMC Test Data

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

### Run #1b: Center Channel

Channel: 6

Mode: b

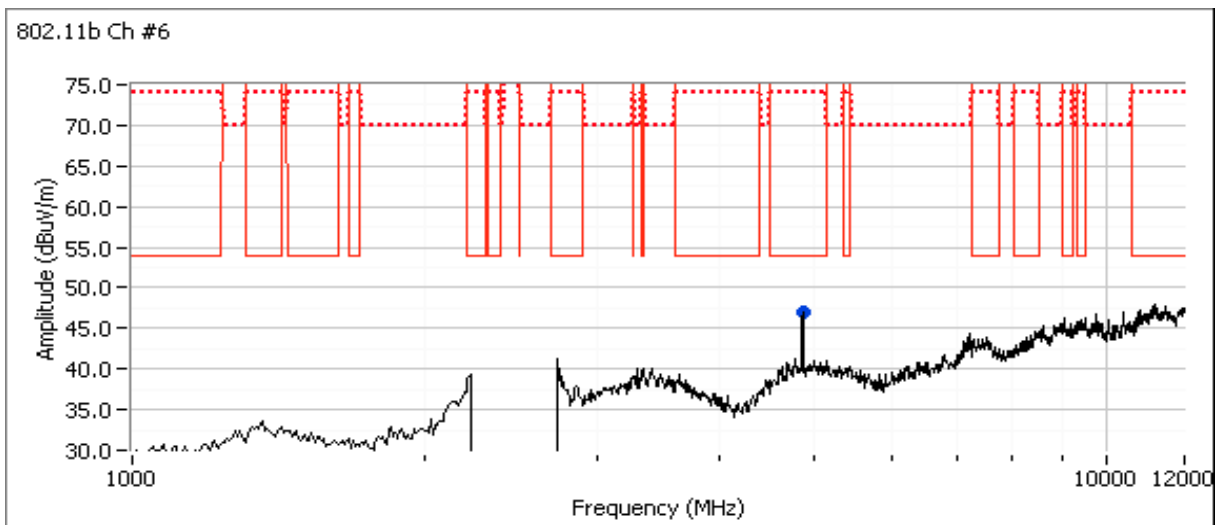
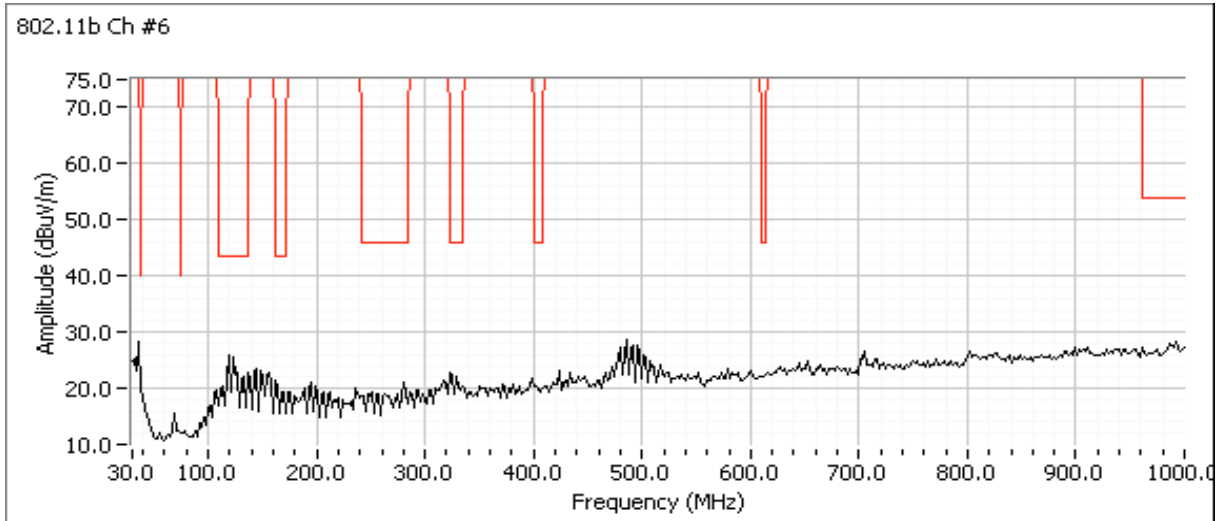
Power: 17500 (debug)

Tx Chain: Main

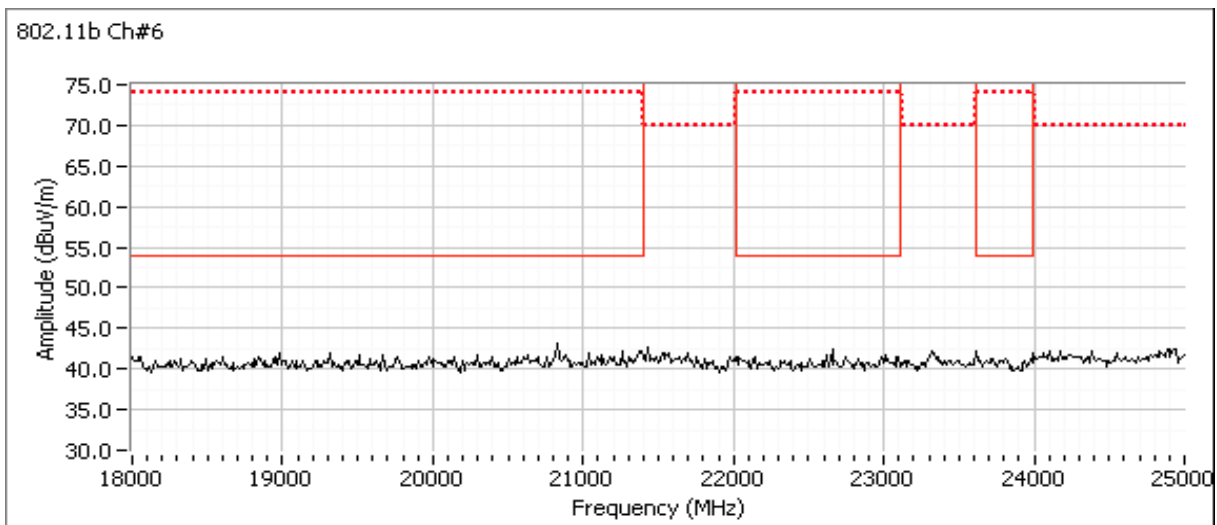
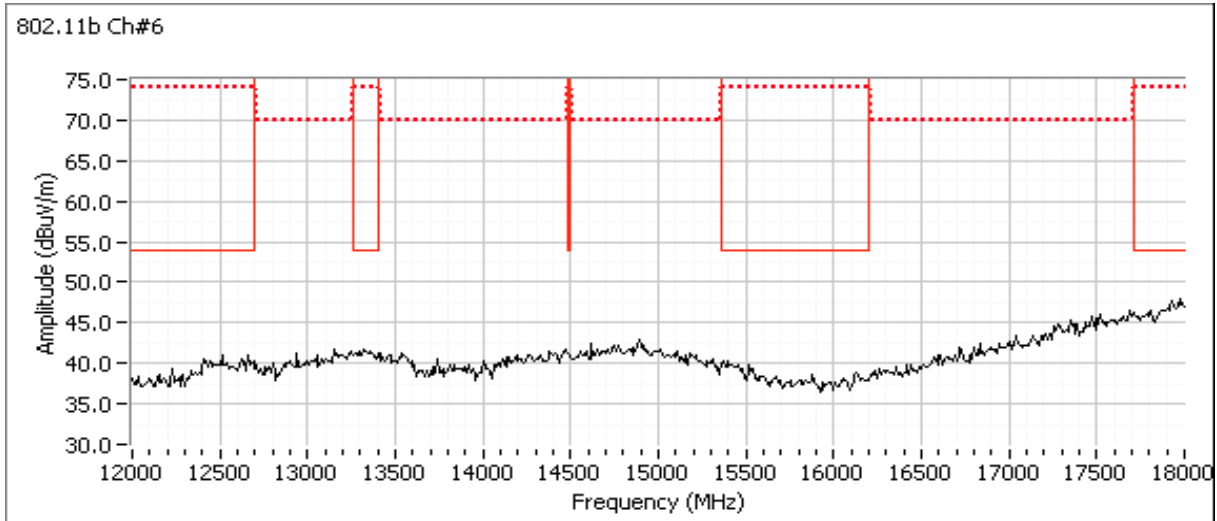
Data Rate: 1 Mbps

| Frequency       | Level        | Pol | 15.209 / 15.247 |              | Detector  | Azimuth | Height | Comments                        |
|-----------------|--------------|-----|-----------------|--------------|-----------|---------|--------|---------------------------------|
| MHz             | dB $\mu$ V/m | v/h | Limit           | Margin       | Pk/QP/Avg | degrees | meters |                                 |
| <b>4879.200</b> | <b>43.7</b>  | V   | 54.0            | <b>-10.3</b> | AVG       | 334     | 1.7    | Note 4, RB 1 MHz;VB 300 Hz;Peak |
| 4879.670        | 51.8         | V   | 74.0            | -22.2        | PK        | 334     | 1.7    | RB 1 MHz;VB 3 MHz;Peak          |

|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |



|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |





## EMC Test Data

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

### Run #1c: High Channel

Channel: 11

Mode: b

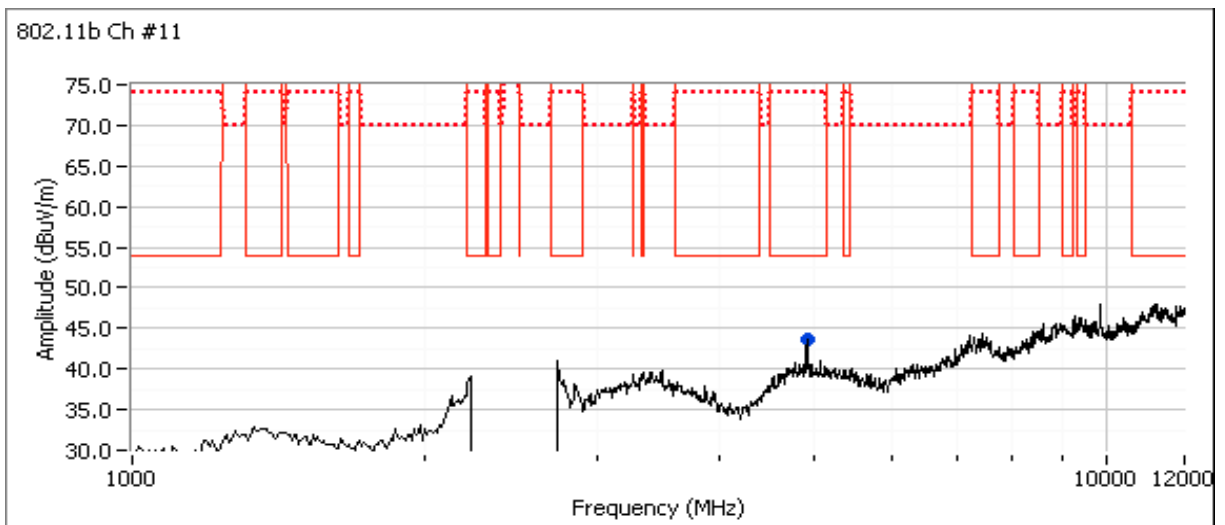
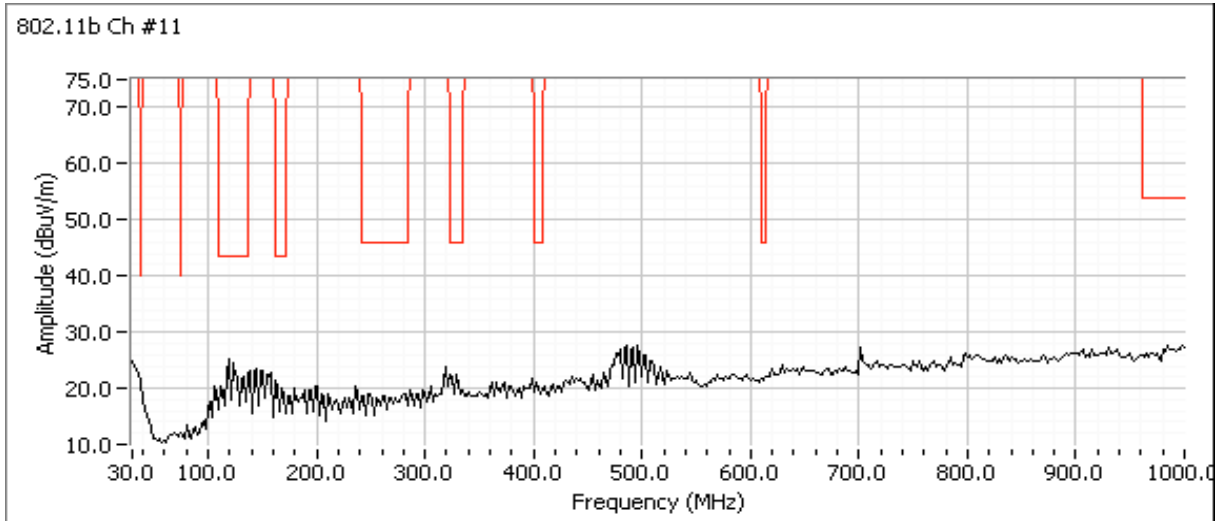
Power: 17500 (debug)

Tx Chain: Main

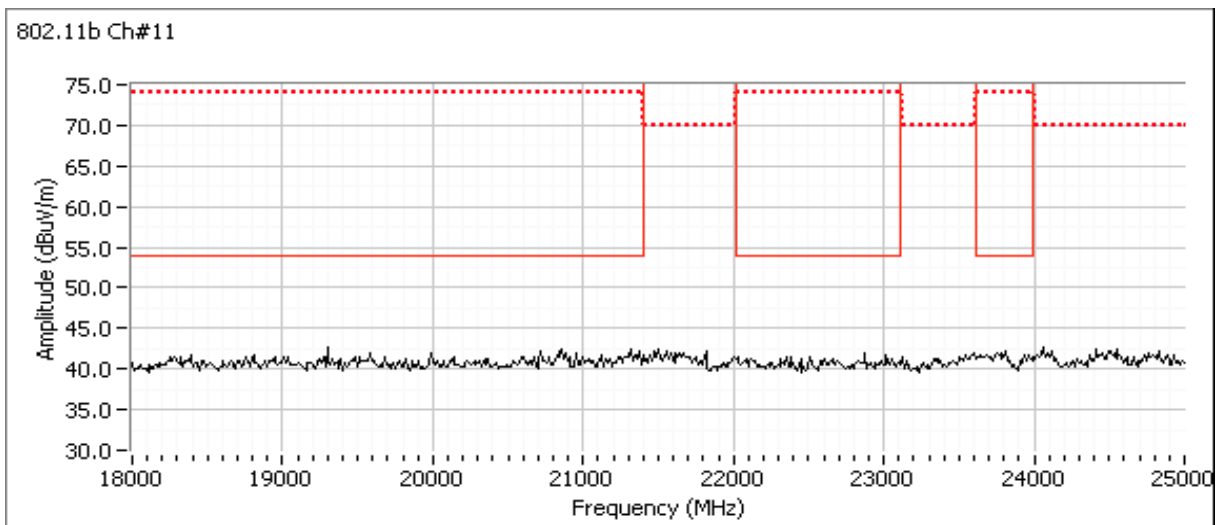
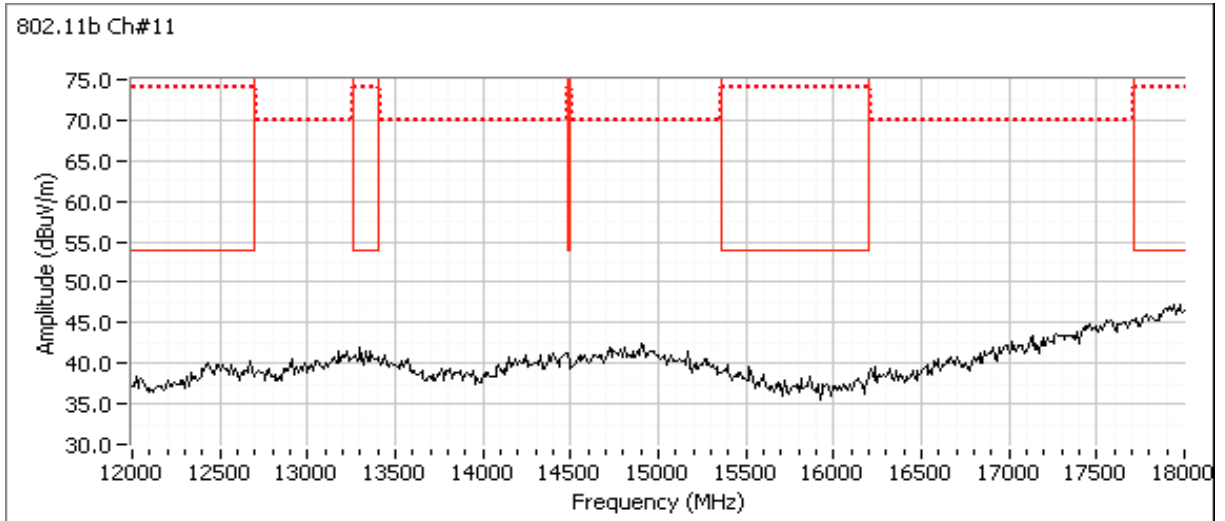
Data Rate: 1 Mbps

| Frequency       | Level        | Pol | 15.209 / 15.247 |              | Detector  | Azimuth | Height | Comments                        |
|-----------------|--------------|-----|-----------------|--------------|-----------|---------|--------|---------------------------------|
| MHz             | dB $\mu$ V/m | v/h | Limit           | Margin       | Pk/QP/Avg | degrees | meters |                                 |
| <b>4929.200</b> | <b>41.1</b>  | V   | 54.0            | <b>-12.9</b> | AVG       | 310     | 1.6    | Note 4, RB 1 MHz;VB 300 Hz;Peak |
| 4918.800        | 50.1         | V   | 74.0            | -23.9        | PK        | 310     | 1.6    | RB 1 MHz;VB 3 MHz;Peak          |

|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |



|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |





## EMC Test Data

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

### Run #2: Radiated Spurious Emissions, 30 - 25000 MHz. Operating Mode: OFDM

#### Run #2a: Center Channel

Channel: 6

Mode: g

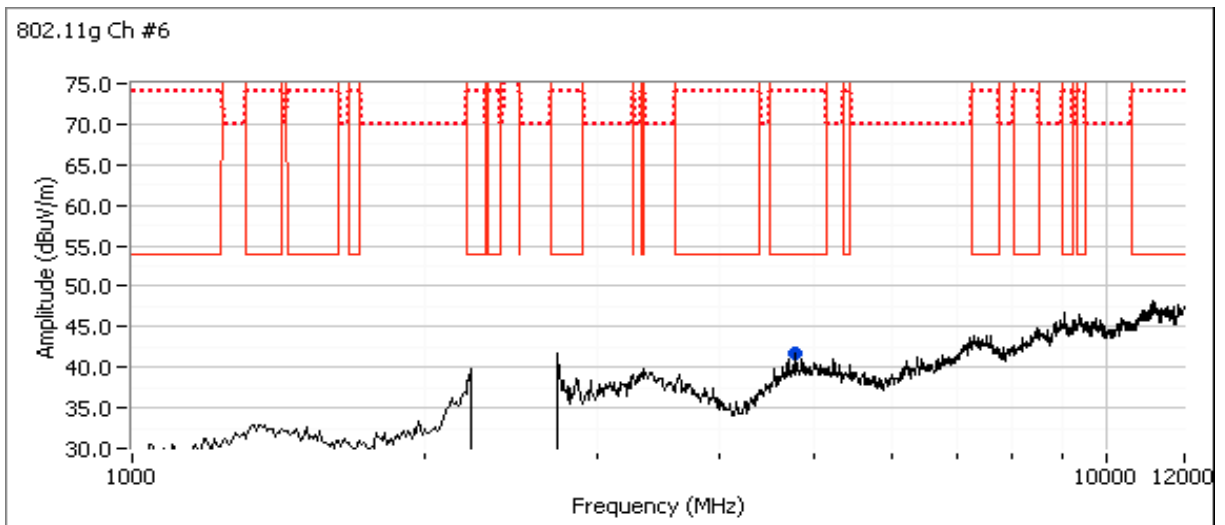
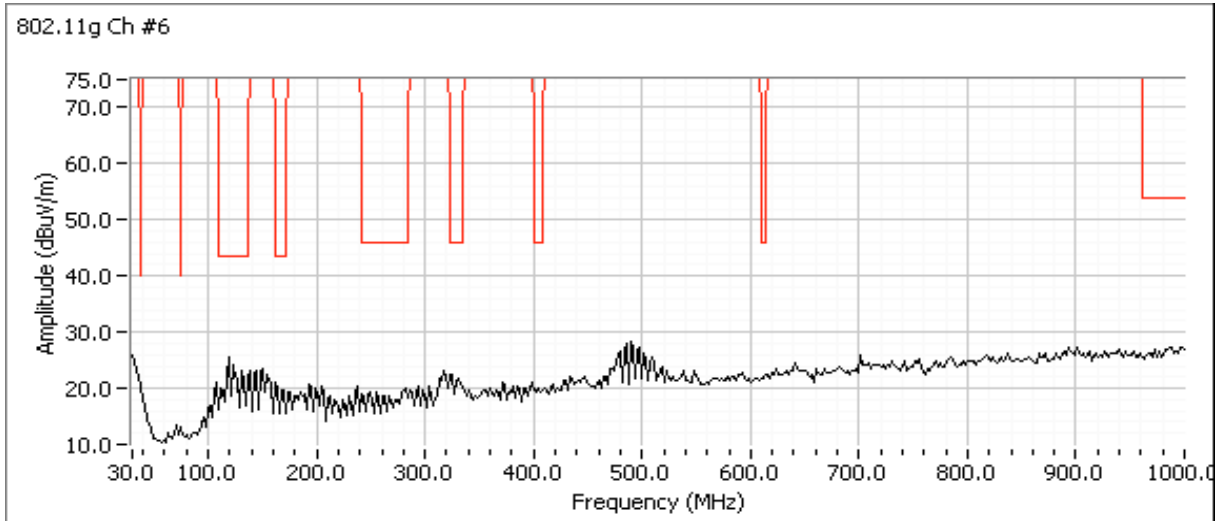
Power: 15500 (debug)

Tx Chain: Main

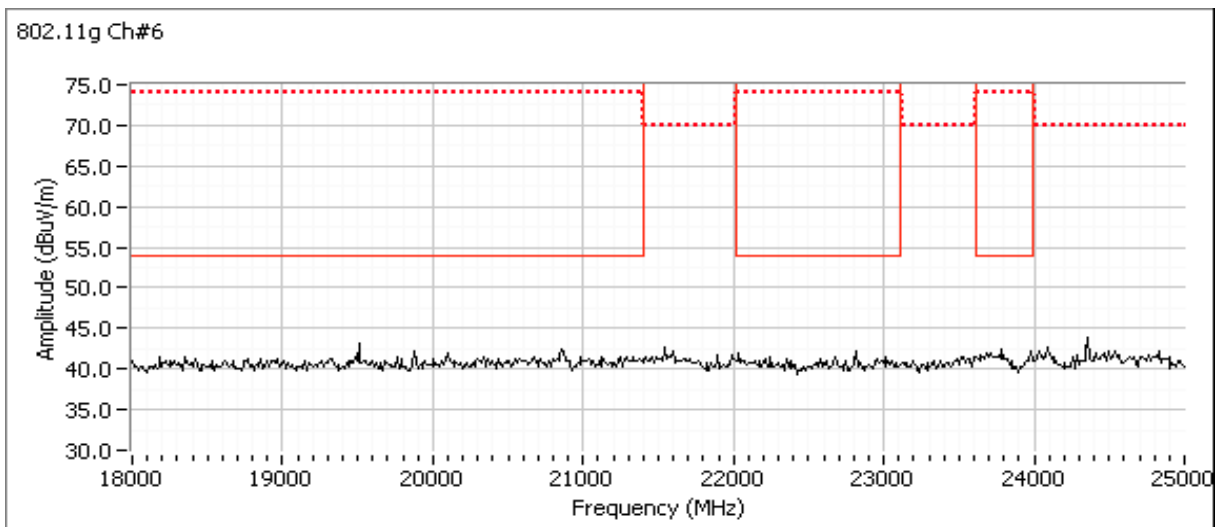
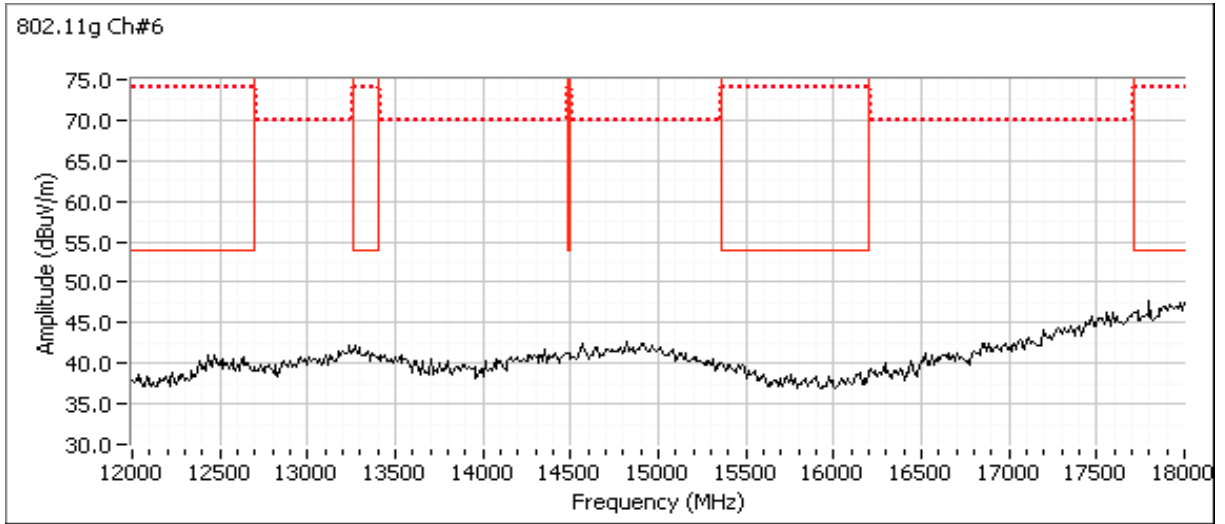
Data Rate: 6 Mbps

| Frequency | Level  | Pol | 15.209 / 15.247 |        | Detector  | Azimuth | Height | Comments                       |
|-----------|--------|-----|-----------------|--------|-----------|---------|--------|--------------------------------|
| MHz       | dBμV/m | v/h | Limit           | Margin | Pk/QP/Avg | degrees | meters |                                |
| 4878.340  | 34.8   | V   | 54.0            | -19.2  | AVG       | 257     | 1.7    | Note 3, RB 1 MHz;VB 10 Hz;Peak |
| 4889.240  | 47.3   | V   | 74.0            | -26.7  | PK        | 257     | 1.7    | RB 1 MHz;VB 3 MHz;Peak         |

|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |



|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |





## EMC Test Data

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

### Run #2b: Center Channel

Channel: 6

Mode: n20

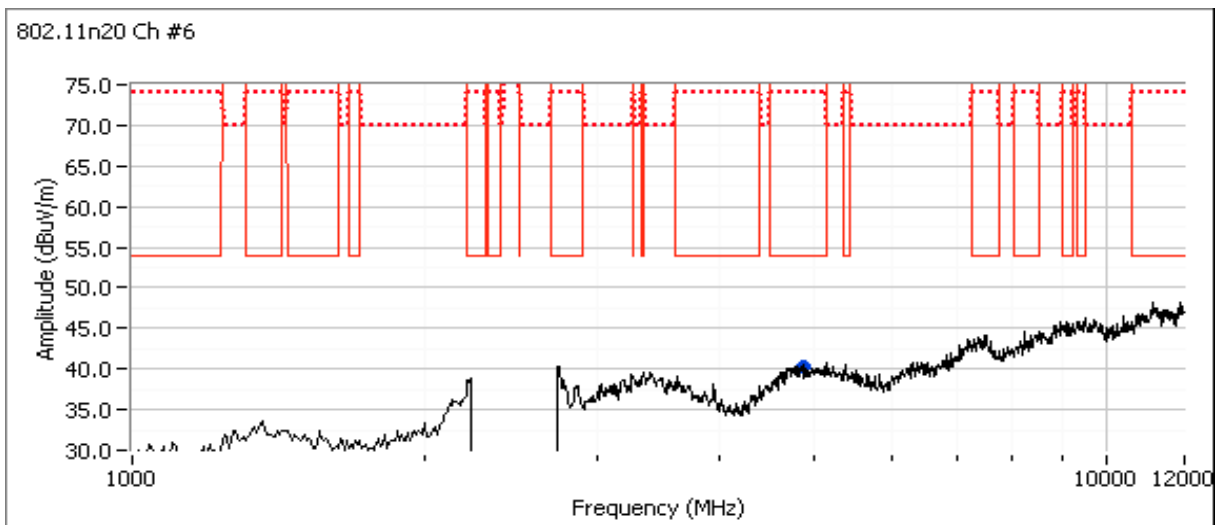
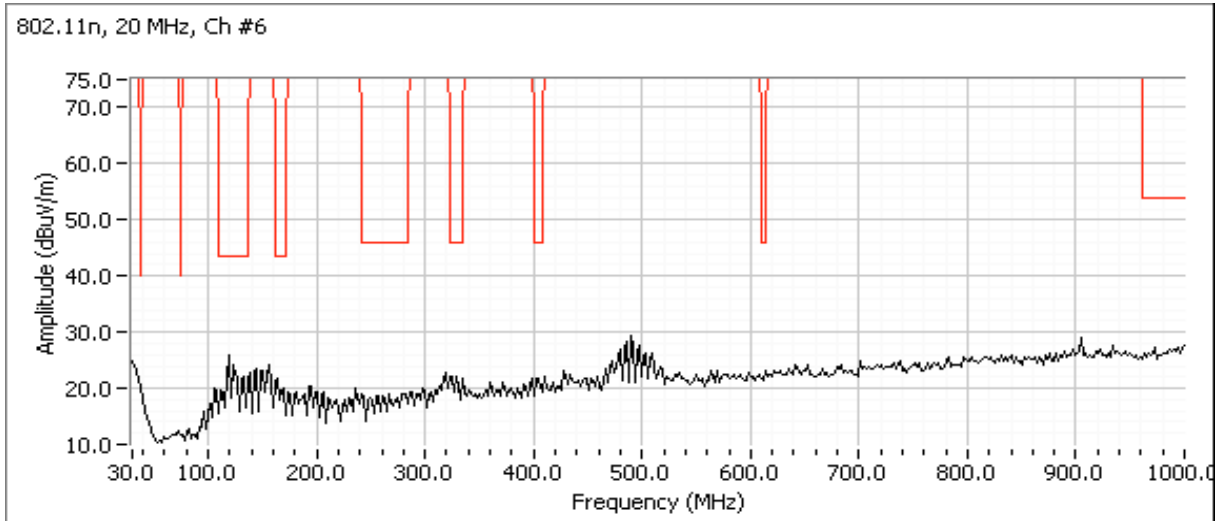
Power: 14500 (debug)

Tx Chain: Main

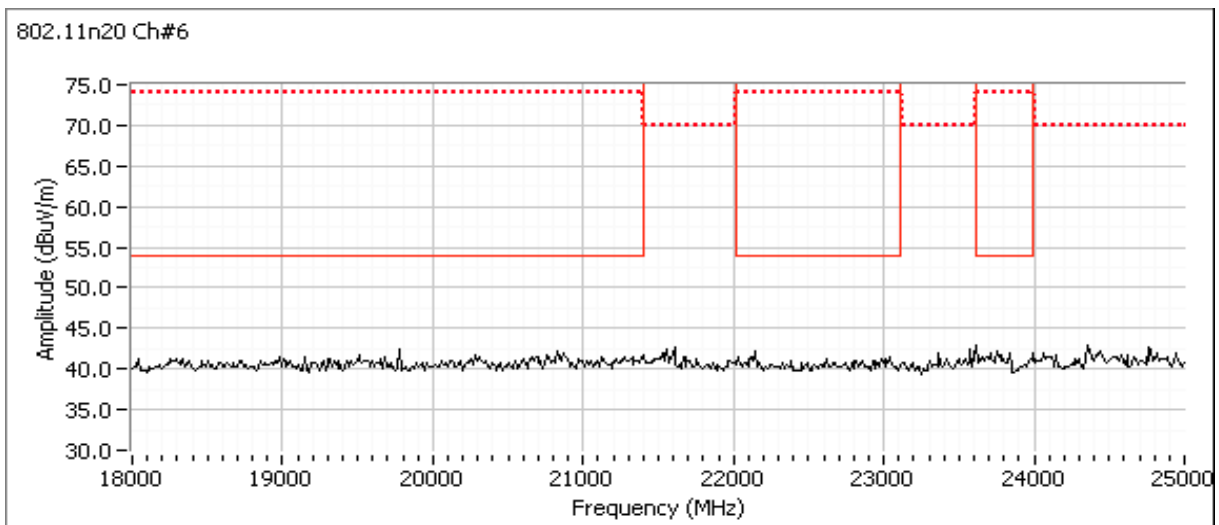
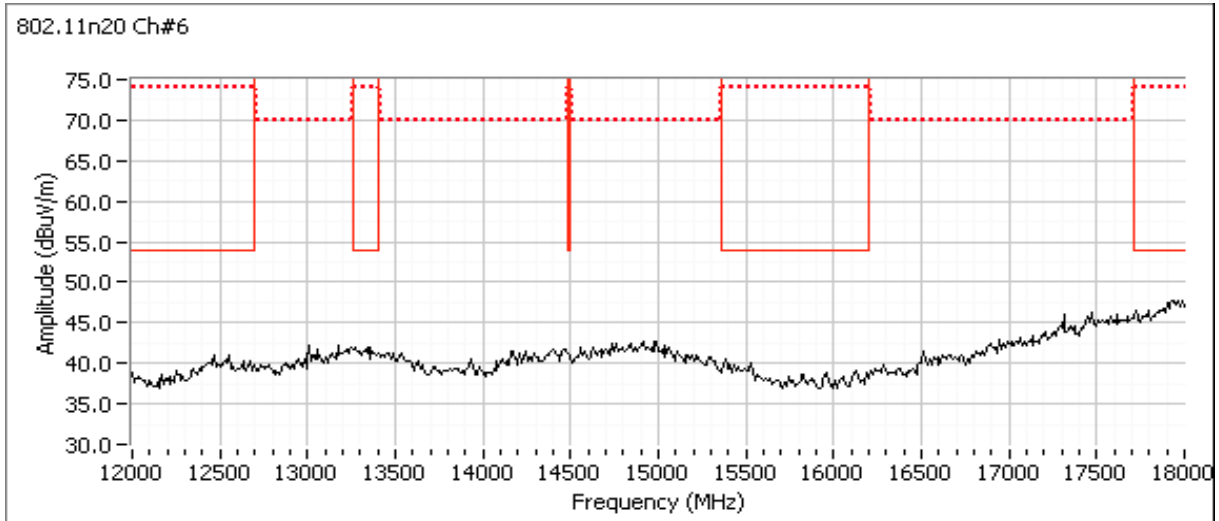
Data Rate: MCS0

| Frequency       | Level        | Pol | 15.209 / 15.247 |              | Detector  | Azimuth | Height | Comments                       |
|-----------------|--------------|-----|-----------------|--------------|-----------|---------|--------|--------------------------------|
| MHz             | dB $\mu$ V/m | v/h | Limit           | Margin       | Pk/QP/Avg | degrees | meters |                                |
| <b>4874.100</b> | <b>34.1</b>  | H   | 54.0            | <b>-19.9</b> | AVG       | 96      | 2.1    | Note 3, RB 1 MHz;VB 10 Hz;Peak |
| 4876.600        | 47.1         | H   | 74.0            | -26.9        | PK        | 96      | 2.1    | RB 1 MHz;VB 3 MHz;Peak         |

|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |



|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |





## EMC Test Data

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

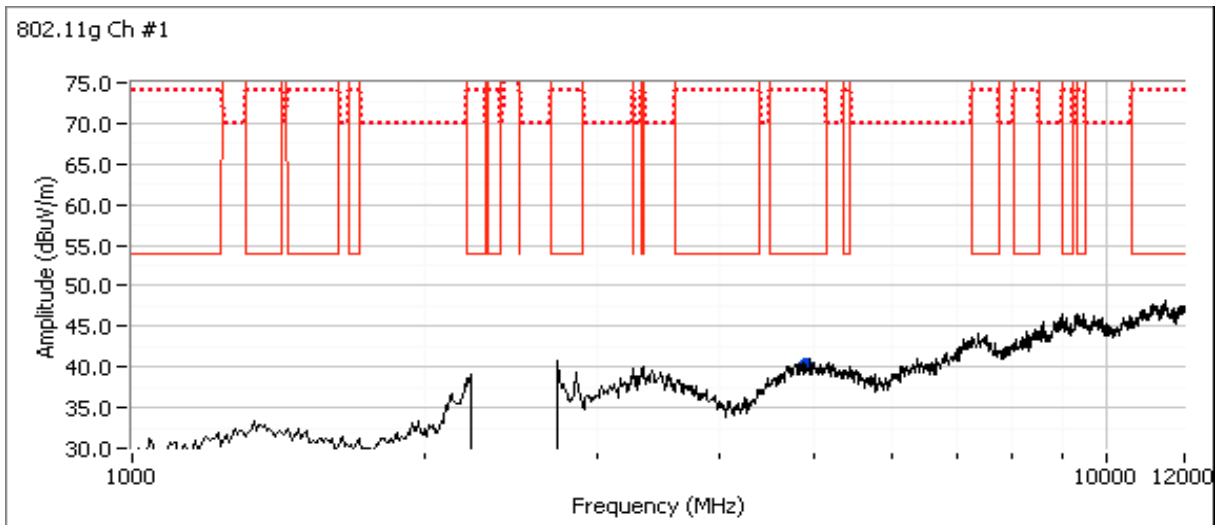
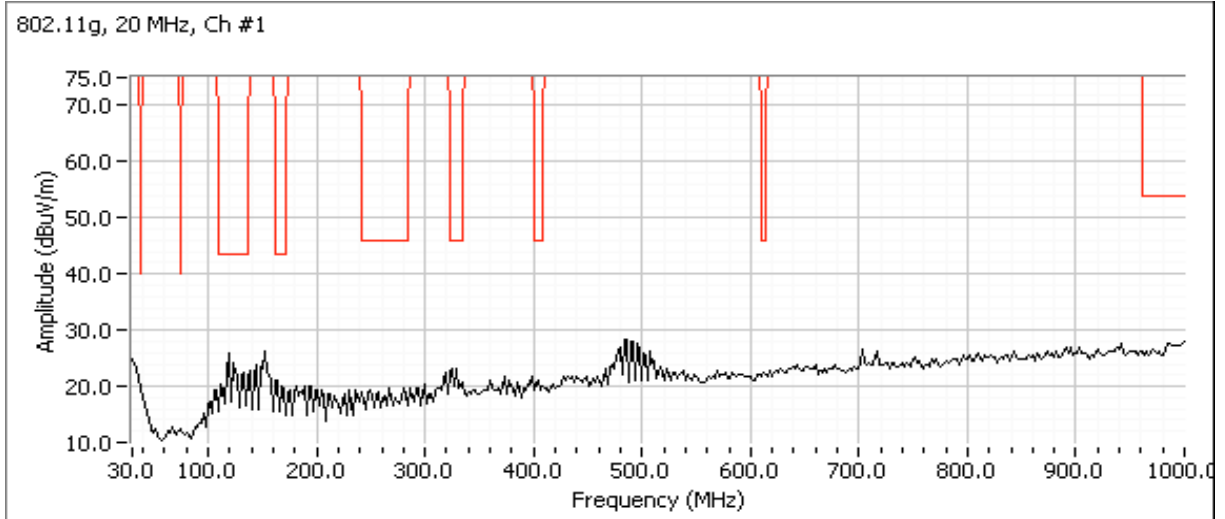
**Run #3: Radiated Spurious Emissions, 30 - 25000 MHz. Operating Mode: Worse case from Run #2**

**Run #3a: Low Channel**

Channel: 1                                      Mode: g                                      Power: 15500 (debug)  
Tx Chain: Main                                      Data Rate: 6 Mbps

| Frequency       | Level       | Pol | 15.209 / 15.247 |              | Detector  | Azimuth | Height | Comments                       |
|-----------------|-------------|-----|-----------------|--------------|-----------|---------|--------|--------------------------------|
| MHz             | dBμV/m      | v/h | Limit           | Margin       | Pk/QP/Avg | degrees | meters |                                |
| <b>4821.670</b> | <b>35.0</b> | V   | 54.0            | <b>-19.0</b> | AVG       | 98      | 1.0    | Note 3, RB 1 MHz;VB 10 Hz;Peak |
| 4831.310        | 47.3        | V   | 74.0            | -26.7        | PK        | 98      | 1.0    | RB 1 MHz;VB 3 MHz;Peak         |

|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |

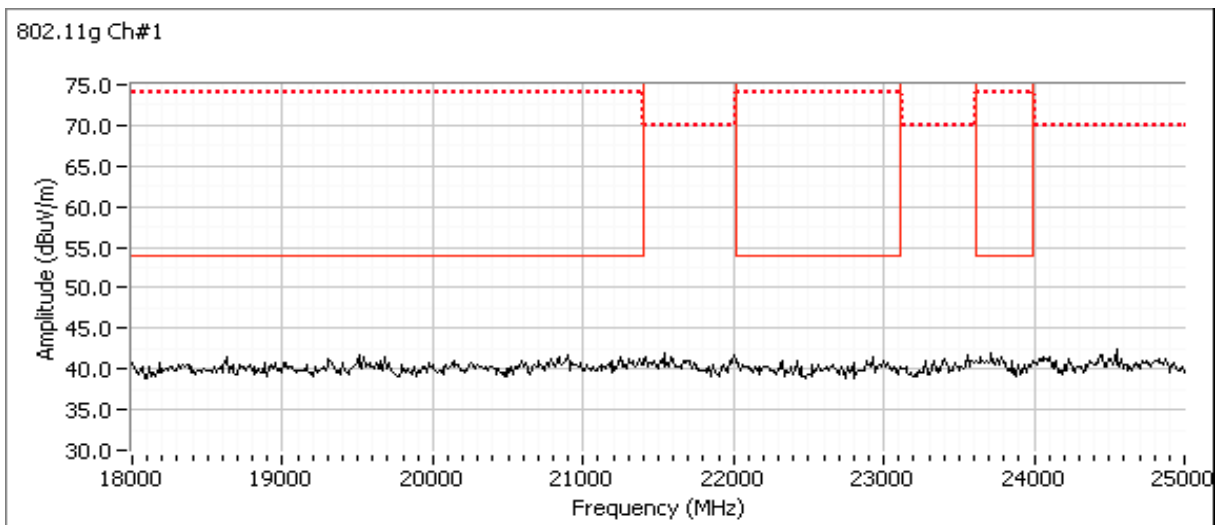
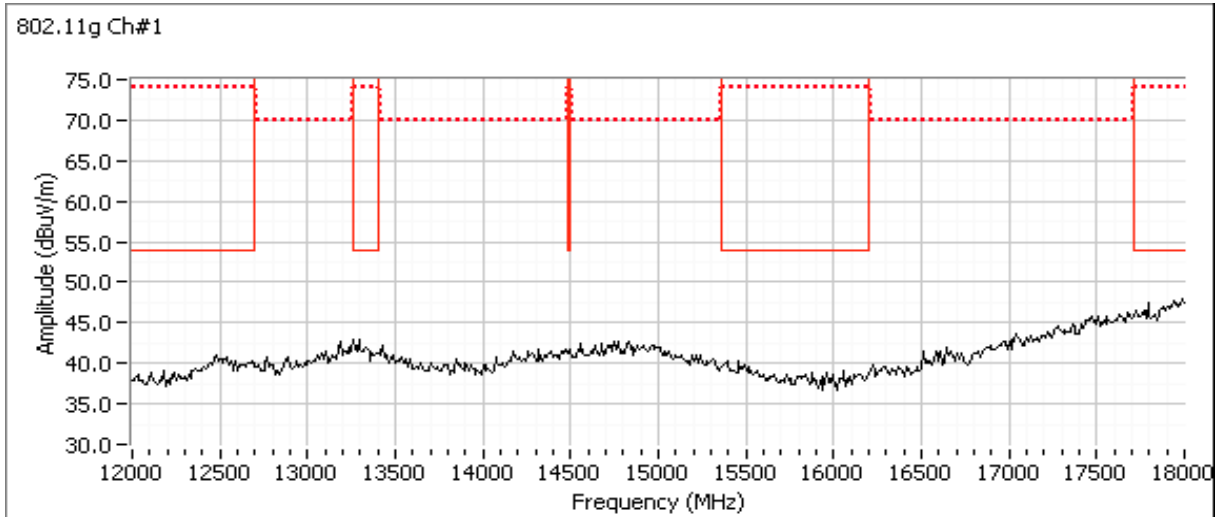


**NTS**

WE ENGINEER SUCCESS

## EMC Test Data

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |





## EMC Test Data

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

### Run #3b: High Channel

Channel: 11

Mode: g

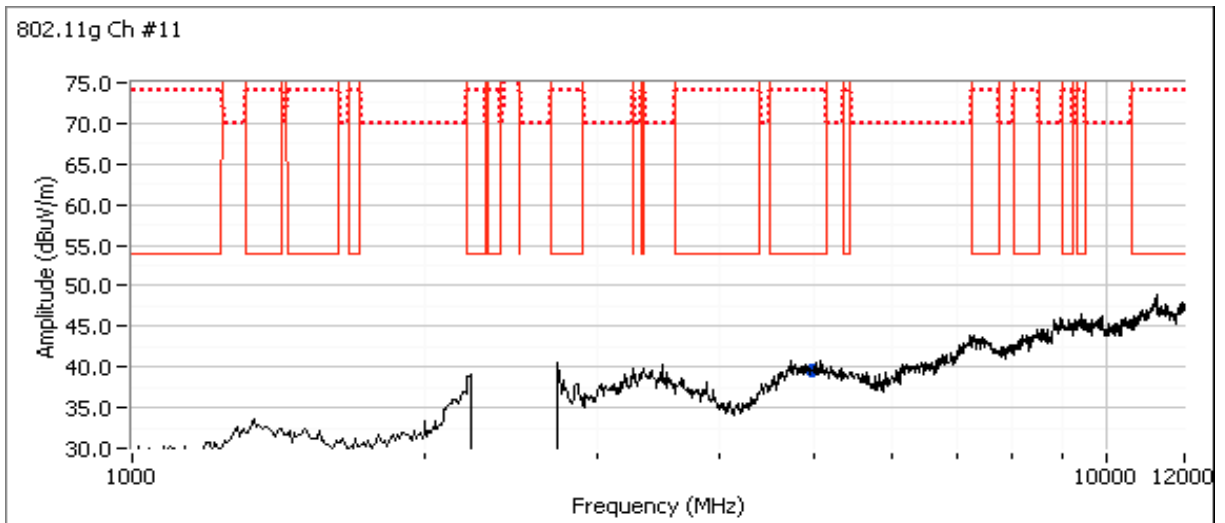
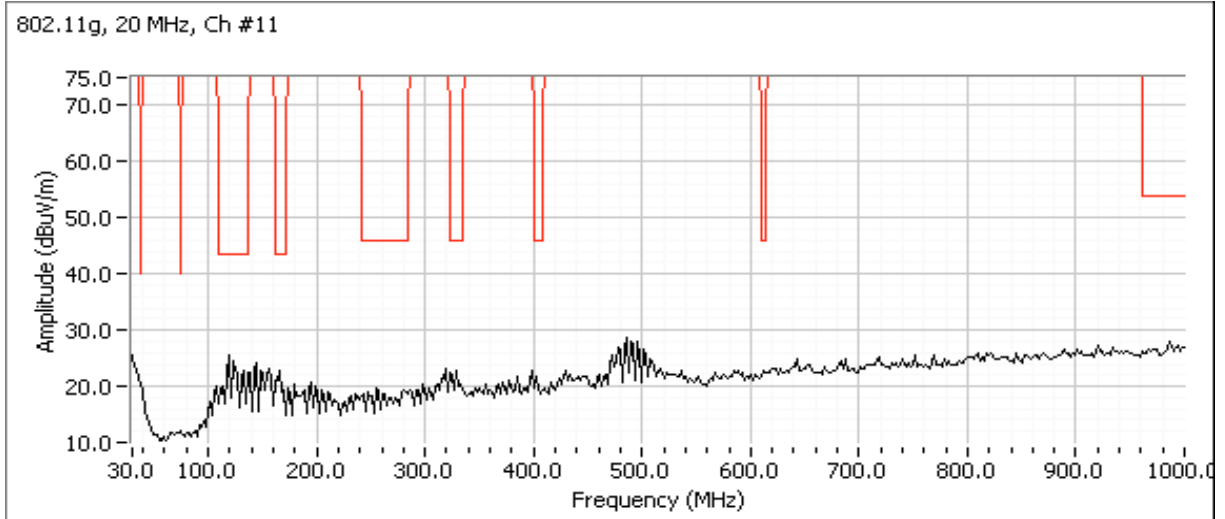
Power: 15500 (debug)

Tx Chain: Main

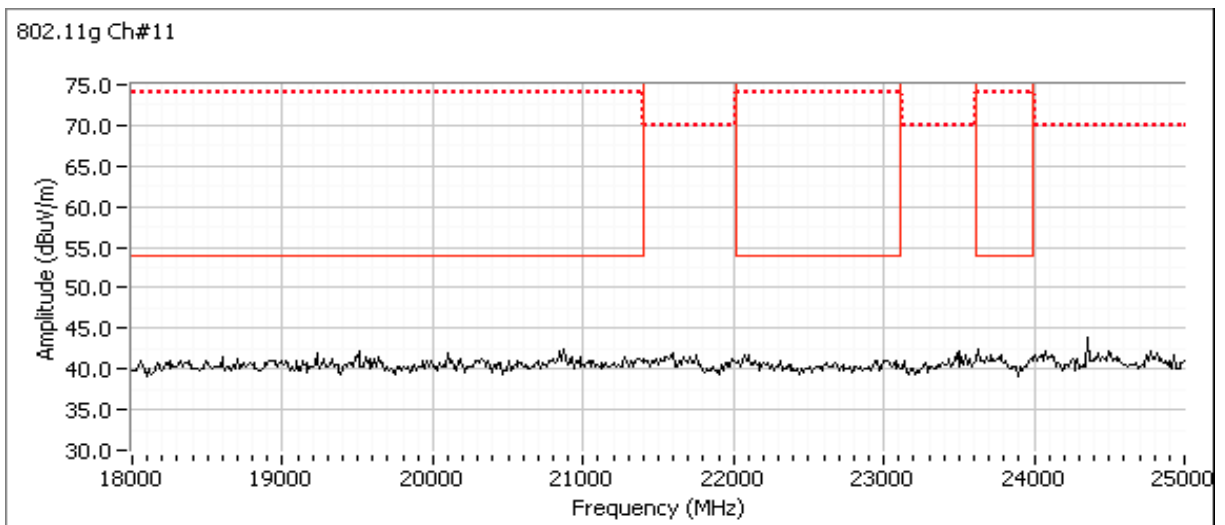
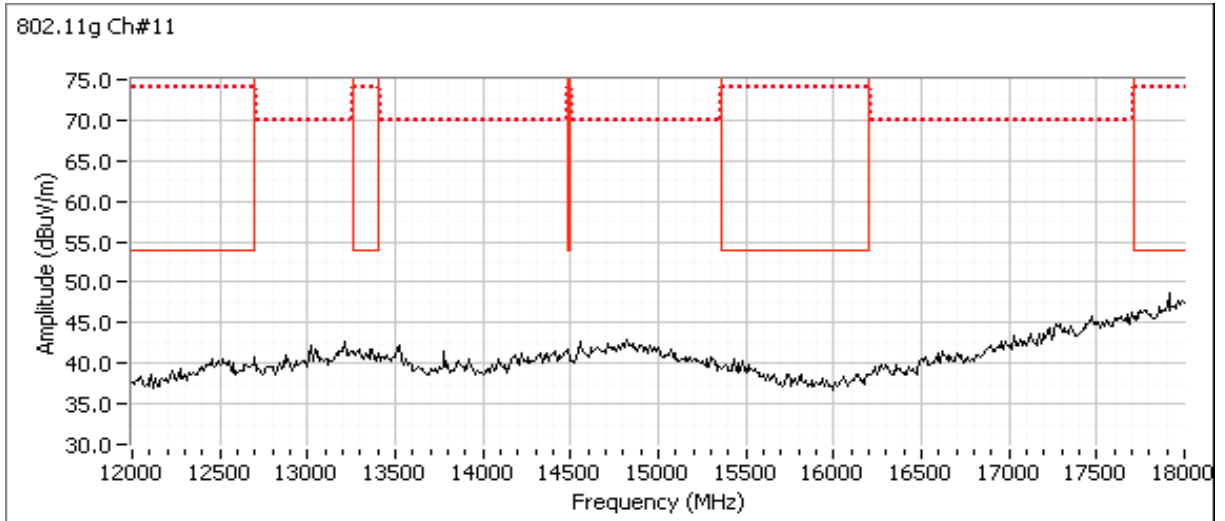
Data Rate: 6 Mbps

| Frequency | Level        | Pol | 15.209 / 15.247 |        | Detector  | Azimuth | Height | Comments                       |
|-----------|--------------|-----|-----------------|--------|-----------|---------|--------|--------------------------------|
| MHz       | dB $\mu$ V/m | v/h | Limit           | Margin | Pk/QP/Avg | degrees | meters |                                |
| 4924.150  | 35.1         | V   | 54.0            | -18.9  | AVG       | 146     | 1.0    | Note 3, RB 1 MHz;VB 10 Hz;Peak |
| 4922.860  | 46.9         | V   | 74.0            | -27.1  | PK        | 146     | 1.0    | RB 1 MHz;VB 3 MHz;Peak         |

|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |



|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |



|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

## RSS 247 and FCC 15.247 (DTS) Antenna Port Measurements Power, PSD, Bandwidth and Spurious Emissions

### Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

### General Test Configuration

The EUT was connected to the spectrum analyzer or power meter via a suitable attenuator. All measurements were made on a single chain.

All measurements have been corrected to allow for the external attenuators used.

### Ambient Conditions:

Temperature: 20-22 °C  
Rel. Humidity: 30-45 %

### Summary of Results

| Run # | Pwr setting | Avg Pwr | Test Performed               | Limit     | Pass / Fail | Result / Margin                                             |
|-------|-------------|---------|------------------------------|-----------|-------------|-------------------------------------------------------------|
| 1     | -           | -       | Output Power                 | 15.247(b) | Pass        | 16.8 dBm                                                    |
| 2     | -           | -       | Power spectral Density (PSD) | 15.247(d) | Pass        | -1.3 dBm/ 10 kHz                                            |
| 3     | -           | -       | Minimum 6 dB Bandwidth       | 15.247(a) | Pass        | 9.6 MHz                                                     |
| 3     | -           | -       | 99% Bandwidth                | RSS Gen   | -           | 802.11b: 14.9 MHz<br>802.11g: 17.7 MHz<br>802.11n: 18.3 MHz |
| 4     | -           | -       | Spurious emissions           | 15.247(b) | Pass        | > -20 dBc                                                   |

### Modifications Made During Testing

No modifications were made to the EUT during testing

### Deviations From The Standard

No deviations were made from the requirements of the standard.

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

## Procedure Comments:

Measurements performed in accordance with FCC KDB 558074, ANSI C63.10 and RSS-Gen

| Mode | Data Rate | Duty Cycle (x) | Constant DC? | T (ms) | Pwr Cor Factor* | Lin Volt Cor Factor** | Min VBW for FS (Hz) |
|------|-----------|----------------|--------------|--------|-----------------|-----------------------|---------------------|
| 11b  | 5.5       | 0.96           | Yes          | 5.867  | 0.2             | 0.3                   | 170                 |
| 11g  | 6.0       | 0.99           | Yes          | 5.361  | 0.0             | 0.0                   | 10                  |
| n20  | 6.5       | 0.99           | Yes          | 4.476  | 0.0             | 0.0                   | 10                  |

## Sample Notes

**Sample S/N:** 001

**WLAN Driver:** MCP-8.0.1.47\_Rel

**WLAN Firmware:** PLT 8.9.0.1.38

# EMC Test Data

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

## Run #1: Output Power

Date of Test: 5/11/2016  
 Test Engineer: Deniz Demirci  
 Test Location: FT Lab #4a

Config. Used: 1  
 Config Change: None  
 EUT Voltage: 14.4

### Mode: 11b

| Power Setting <sup>2</sup> | Frequency (MHz) | Output Power       |      | Antenna Gain (dBi) | Result | EIRP |       | Output Power       |    |
|----------------------------|-----------------|--------------------|------|--------------------|--------|------|-------|--------------------|----|
|                            |                 | (dBm) <sup>1</sup> | mW   |                    |        | dBm  | W     | (dBm) <sup>3</sup> | mW |
| 17500                      | 2412            | 16.8               | 47.9 | -2.7               | Pass   | 14.1 | 0.026 |                    |    |
| 17500                      | 2437            | 16.8               | 47.9 | -2.7               | Pass   | 14.1 | 0.026 |                    |    |
| 17500                      | 2462            | 16.8               | 47.9 | -2.7               | Pass   | 14.1 | 0.026 |                    |    |

### Mode: 11g

| Power Setting <sup>2</sup> | Frequency (MHz) | Output Power       |      | Antenna Gain (dBi) | Result | EIRP |       | Output Power       |    |
|----------------------------|-----------------|--------------------|------|--------------------|--------|------|-------|--------------------|----|
|                            |                 | (dBm) <sup>1</sup> | mW   |                    |        | dBm  | W     | (dBm) <sup>3</sup> | mW |
| 15500                      | 2412            | 14.1               | 25.7 | -2.7               | Pass   | 11.4 | 0.014 |                    |    |
| 15500                      | 2437            | 14.1               | 25.7 | -2.7               | Pass   | 11.4 | 0.014 |                    |    |
| 15500                      | 2462            | 14.1               | 25.7 | -2.7               | Pass   | 11.4 | 0.014 |                    |    |

### Mode: n20

| Power Setting <sup>2</sup> | Frequency (MHz) | Output Power       |      | Antenna Gain (dBi) | Result | EIRP |       | Output Power       |    |
|----------------------------|-----------------|--------------------|------|--------------------|--------|------|-------|--------------------|----|
|                            |                 | (dBm) <sup>1</sup> | mW   |                    |        | dBm  | W     | (dBm) <sup>3</sup> | mW |
| 14500                      | 2412            | 13.1               | 20.4 | -2.7               | Pass   | 10.4 | 0.011 |                    |    |
| 14500                      | 2437            | 13.1               | 20.4 | -2.7               | Pass   | 10.4 | 0.011 |                    |    |
| 14500                      | 2462            | 13.1               | 20.4 | -2.7               | Pass   | 10.4 | 0.011 |                    |    |

Note 1: Output power measured using a peak power meter, spurious limit is **-20 dBc**.

Note 2: Power setting - the software power setting used during testing, included for reference only.

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

## Run #2: Power spectral Density

### Mode: 11b

| Power Setting | Frequency (MHz) | PSD<br>(dBm/10 kHz) <sup>Note 1</sup> | Limit<br>dBm/3 kHz | Result |
|---------------|-----------------|---------------------------------------|--------------------|--------|
| 17500         | 2411.6000       | -1.4                                  | 8.0                | Pass   |
| 17500         | 2436.9500       | -1.3                                  | 8.0                | Pass   |
| 17500         | 2460.8000       | -1.5                                  | 8.0                | Pass   |

### Mode: 11g

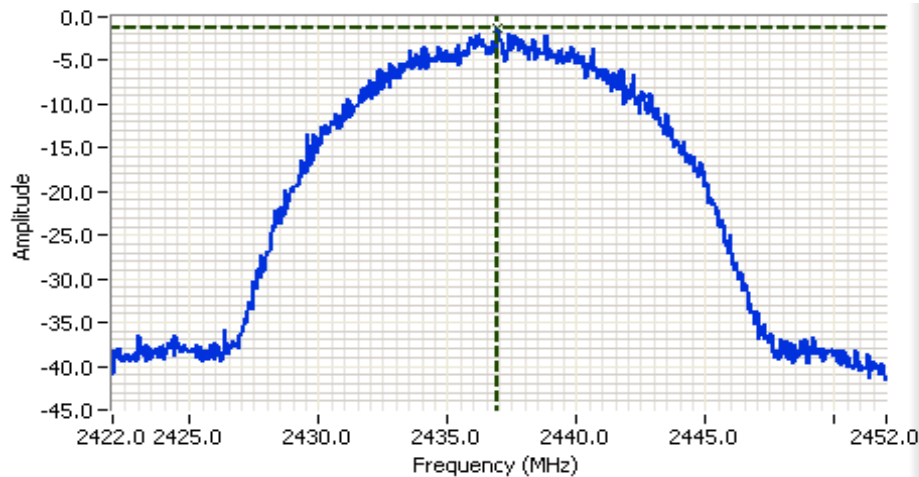
| Power Setting | Frequency (MHz) | PSD<br>(dBm/10 kHz) <sup>Note 1</sup> | Limit<br>dBm/3 kHz | Result |
|---------------|-----------------|---------------------------------------|--------------------|--------|
| 15500         | 2413.8500       | -5.4                                  | 8.0                | Pass   |
| 15500         | 2437.6000       | -4.2                                  | 8.0                | Pass   |
| 15500         | 2462.3500       | -5.1                                  | 8.0                | Pass   |

### Mode: n20

| Power Setting | Frequency (MHz) | PSD<br>(dBm/10 kHz) <sup>Note 1</sup> | Limit<br>dBm/3 kHz | Result |
|---------------|-----------------|---------------------------------------|--------------------|--------|
| 14500         | 2416.7          | -6.0                                  | 8.0                | Pass   |
| 14500         | 2438.5          | -7.0                                  | 8.0                | Pass   |
| 14500         | 2462.95         | -6.1                                  | 8.0                | Pass   |

Note 1: Test performed per method PKSPD, in KDB 558074. Power spectral density measured using:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ ,  $\text{VBW}=3*\text{RBW}$ , peak detector, span =  $1.5*\text{DTS BW}$ , auto sweep time, max hold.

|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |

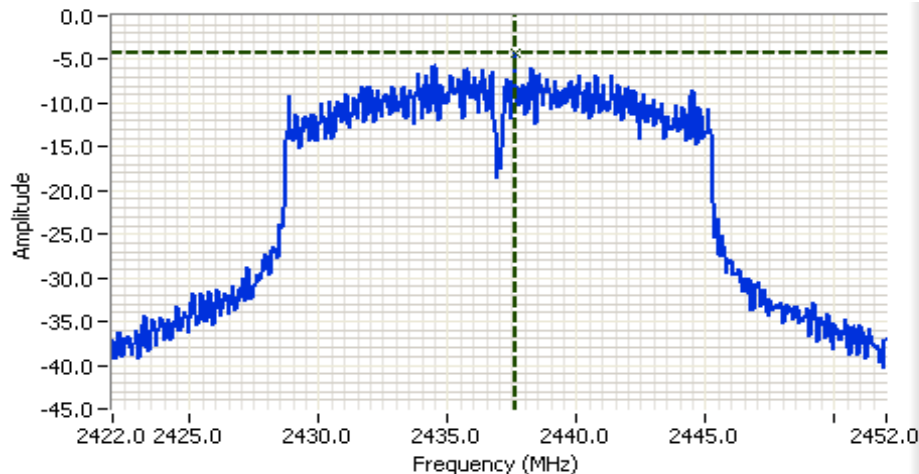
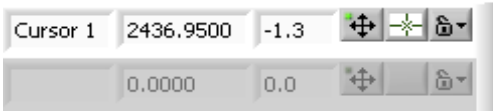


## Analyzer Settings

Agilent Technologies, E4446A  
 CF: 2437.000 MHz  
 SPAN: 30.000 MHz  
 RB: 10.0 kHz  
 VB: 30.0 kHz  
 Detector: POS  
 Attn: 30 DB  
 RL Offset: 10.2 DB  
 Sweep Time: 286.7ms  
 Ref Lvl: 30.0 DBM

## Comments

802.11b  
 PSD: -1.3 dBm/10 kHz

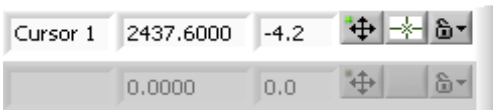


## Analyzer Settings

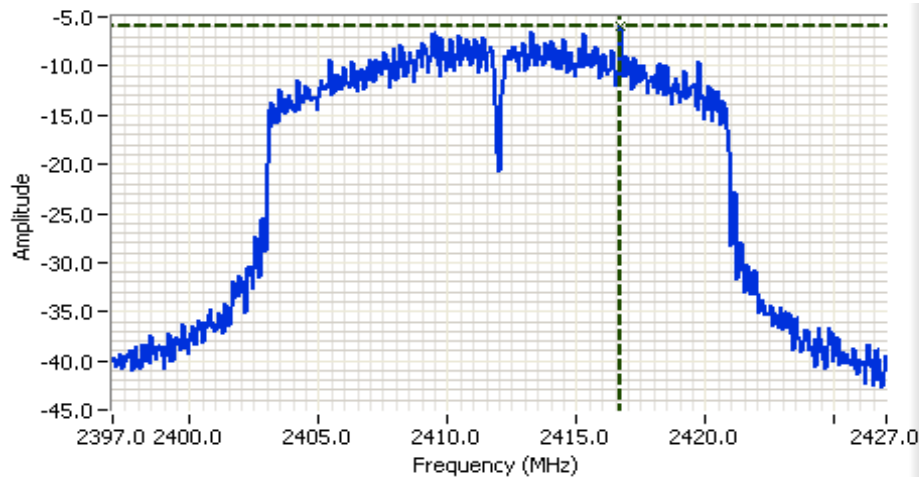
Agilent Technologies, E4446A  
 CF: 2437.000 MHz  
 SPAN: 30.000 MHz  
 RB: 10.0 kHz  
 VB: 30.0 kHz  
 Detector: POS  
 Attn: 30 DB  
 RL Offset: 10.2 DB  
 Sweep Time: 286.7ms  
 Ref Lvl: 30.0 DBM

## Comments

802.11g  
 PSD: -4.2 dBm/10 kHz



|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |

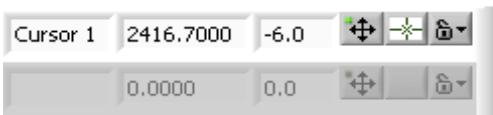


## Analyzer Settings

Agilent Technologies, E4446A  
 CF: 2412.000 MHz  
 SPAN: 30.000 MHz  
 RB: 10.0 kHz  
 VB: 30.0 kHz  
 Detector: POS  
 Attn: 30 DB  
 RL Offset: 10.2 DB  
 Sweep Time: 286.7ms  
 Ref Lvl: 30.0 DBM

## Comments

802.11n 20 MHz  
 PSD: -6.0 dBm/10 kHz



|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | N/A               |

## Run #3: Signal Bandwidth

### Mode: 11b

| Power Setting | Frequency (MHz) | Bandwidth (MHz) |      | RBW Setting (MHz) |     |
|---------------|-----------------|-----------------|------|-------------------|-----|
|               |                 | 6dB             | 99%  | 6dB               | 99% |
| 17500         | 2412            | 10.4            | 14.9 | 0.1               | 0.3 |
| 17500         | 2437            | 9.60            | 14.8 | 0.1               | 0.3 |
| 17500         | 2462            | 9.60            | 14.8 | 0.1               | 0.3 |

### Mode: 11g

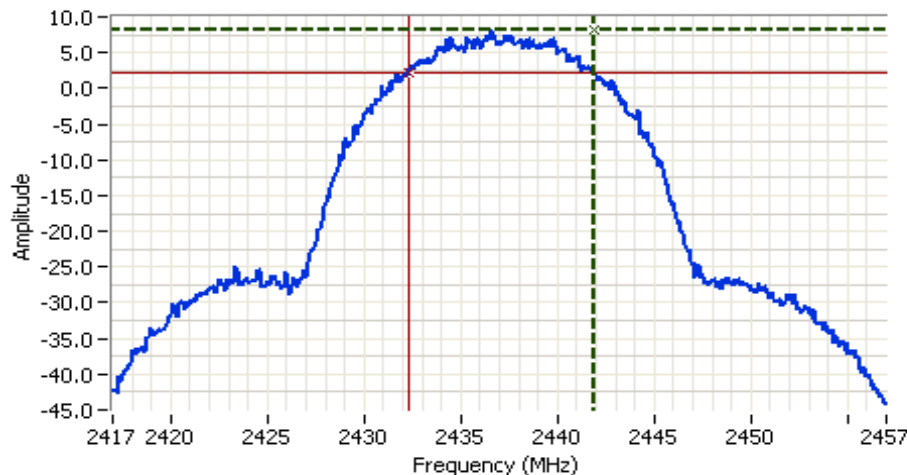
| Power Setting | Frequency (MHz) | Bandwidth (MHz) |      | RBW Setting (MHz) |     |
|---------------|-----------------|-----------------|------|-------------------|-----|
|               |                 | 6dB             | 99%  | 6dB               | 99% |
| 15500         | 2412            | 15.0            | 17.2 | 0.1               | 0.3 |
| 15500         | 2437            | 15.1            | 17.7 | 0.1               | 0.3 |
| 15500         | 2462            | 15.0            | 17.7 | 0.1               | 0.3 |

### Mode: n20

| Power Setting | Frequency (MHz) | Bandwidth (MHz) |      | RBW Setting (MHz) |     |
|---------------|-----------------|-----------------|------|-------------------|-----|
|               |                 | 6dB             | 99%  | 6dB               | 99% |
| 14500         | 2412            | 15.1            | 17.9 | 0.1               | 0.3 |
| 14500         | 2437            | 15.1            | 18.3 | 0.1               | 0.3 |
| 14500         | 2462            | 15.1            | 18.3 | 0.1               | 0.3 |

|         |                                                                                                                                                                                               |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Note 1: | DTS BW: RBW = 100 kHz, VBW $\geq 3 \times$ RBW, peak detector, max hold, auto sweep time.<br>99% BW: RBW = 1-5% of 99% BW, VBW $\geq 3 \times$ RBW, peak detector, max hold, auto sweep time. |
| Note 2: | Graphs indicate worst case results.                                                                                                                                                           |

|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |

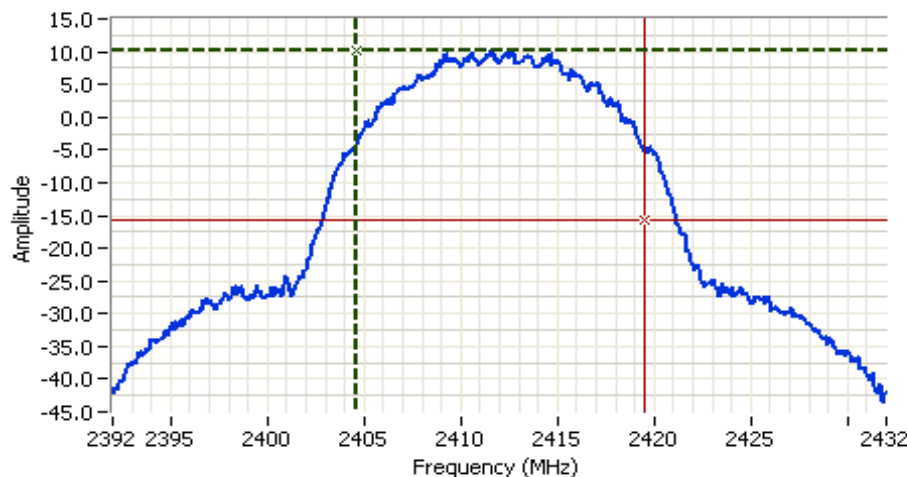


## Analyzer Settings

Agilent Technologies, E4446A  
 CF: 2437.000 MHz  
 SPAN: 40.000 MHz  
 RB: 100 kHz  
 VB: 300 kHz  
 Detector: POS  
 Attn: 20 DB  
 RL Offset: 10.2 DB  
 Sweep Time: 3.8ms  
 Ref Lvl: 20.0 DBM

## Comments

6dB BW: 9.600 MHz  
 802.11b



## Analyzer Settings

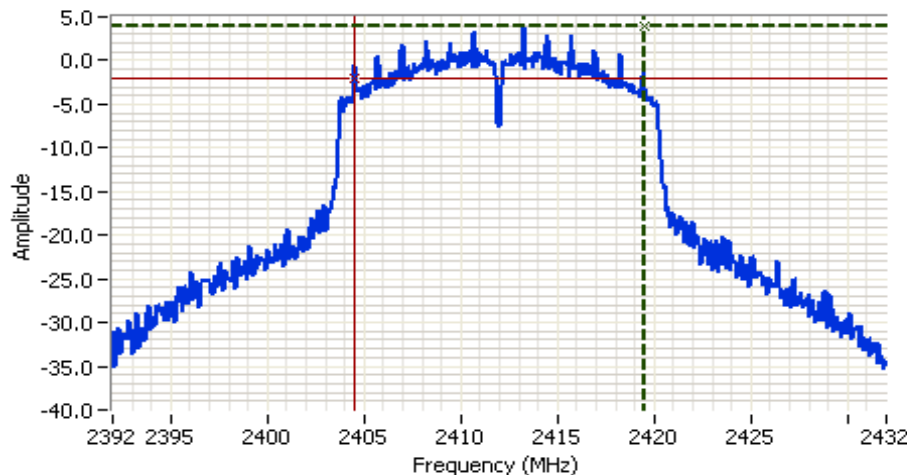
Agilent Technologies, E4446A  
 CF: 2412.000 MHz  
 SPAN: 40.000 MHz  
 RB: 300 kHz  
 VB: 1.000 MHz  
 Detector: POS  
 Attn: 20 DB  
 RL Offset: 10.2 DB  
 Sweep Time: 1.0ms  
 Ref Lvl: 20.0 DBM

## Comments

99% power BW: 14.908 MHz  
 802.11b



|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |



## Analyzer Settings

Agilent Technologies, E4446A  
 CF: 2412.000 MHz  
 SPAN: 40.000 MHz  
 RB: 100 kHz  
 VB: 300 kHz  
 Detector: POS  
 Attn: 20 DB  
 RL Offset: 10.2 DB  
 Sweep Time: 3.8ms  
 Ref Lvl: 20.0 DBM

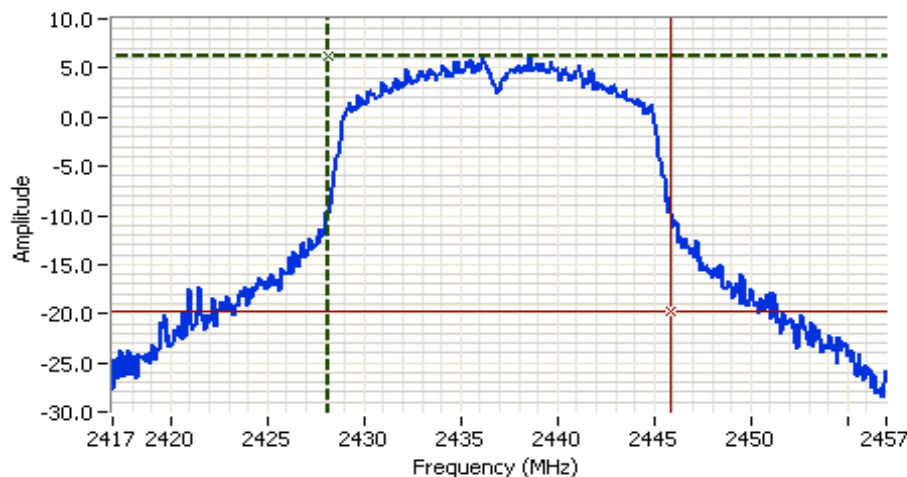
## Comments

6dB BW: 15.000 MHz  
 802.11g

Cursor 1 2419.4667 3.9  
 Cursor 2 2404.4667 -2.1

Delta Freq. 15.000

Delta Amplitude 6.0



## Analyzer Settings

Agilent Technologies, E4446A  
 CF: 2437.000 MHz  
 SPAN: 40.000 MHz  
 RB: 300 kHz  
 VB: 1.000 MHz  
 Detector: POS  
 Attn: 20 DB  
 RL Offset: 10.2 DB  
 Sweep Time: 1.0ms  
 Ref Lvl: 20.0 DBM

## Comments

99% power BW: 17.704 MHz  
 802.11g

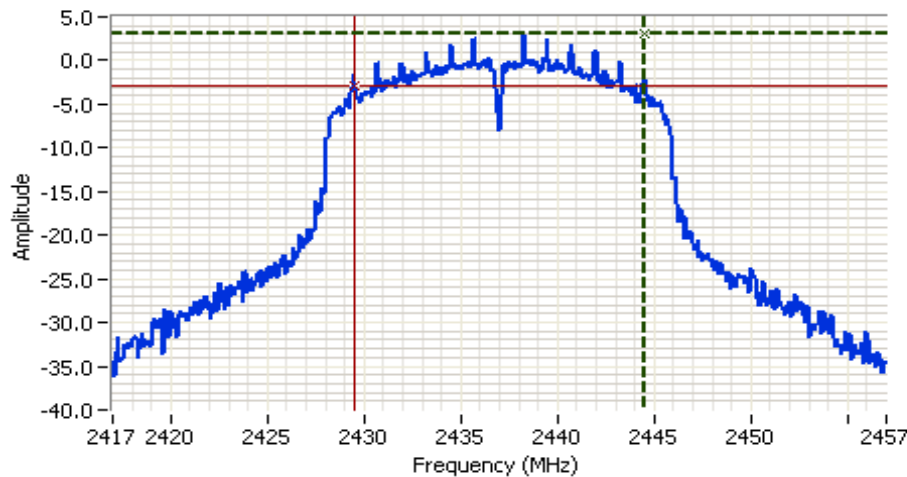
Cursor 1 2428.1148 6.2  
 Cursor 2 2445.8186 -19.8

Delta Freq. 17.704

Delta Amplitude 26.0



|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |



## Analyzer Settings

Agilent Technologies, E4446A  
 CF: 2437.000 MHz  
 SPAN: 40.000 MHz  
 RB: 100 kHz  
 VB: 300 kHz  
 Detector: POS  
 Attn: 20 DB  
 RL Offset: 10.2 DB  
 Sweep Time: 3.8ms  
 Ref Lvl: 20.0 DBM

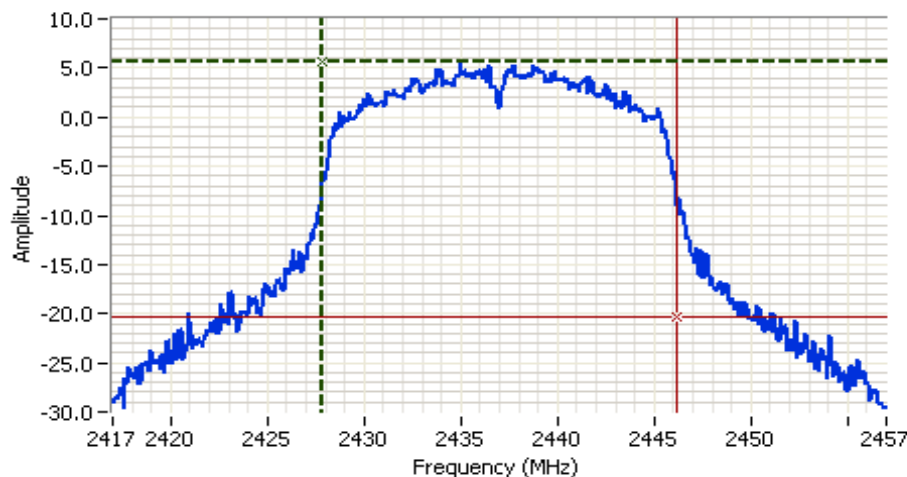
## Comments

6dB BW: 15.067 MHz  
 802.11n, 20 MHz

Cursor 1 2444.5333 3.2  
 Cursor 2 2429.4667 -2.8

Delta Freq. 15.067

Delta Amplitude 6.0



## Analyzer Settings

Agilent Technologies, E4446A  
 CF: 2437.000 MHz  
 SPAN: 40.000 MHz  
 RB: 300 kHz  
 VB: 1.000 MHz  
 Detector: POS  
 Attn: 20 DB  
 RL Offset: 10.2 DB  
 Sweep Time: 1.0ms  
 Ref Lvl: 20.0 DBM

## Comments

99% power BW: 18.303 MHz  
 802.11n, 20 MHz

Cursor 1 2427.8486 5.6  
 Cursor 2 2446.1514 -20.4

Delta Freq. 18.303

Delta Amplitude 26.0



|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |

## Run #4a: Out of Band Spurious Emissions

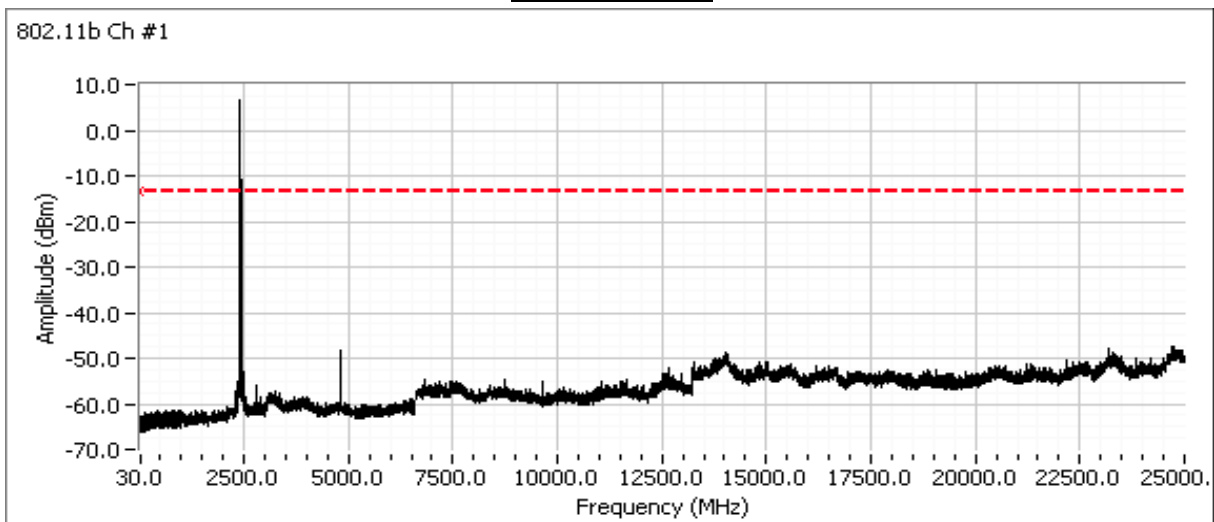
Date of Test: 5/12/2016  
 Test Engineer: Deniz Demirci  
 Test Location: FT Lab #4a

Config. Used: 1  
 Config Change: None  
 EUT Voltage: 14.4

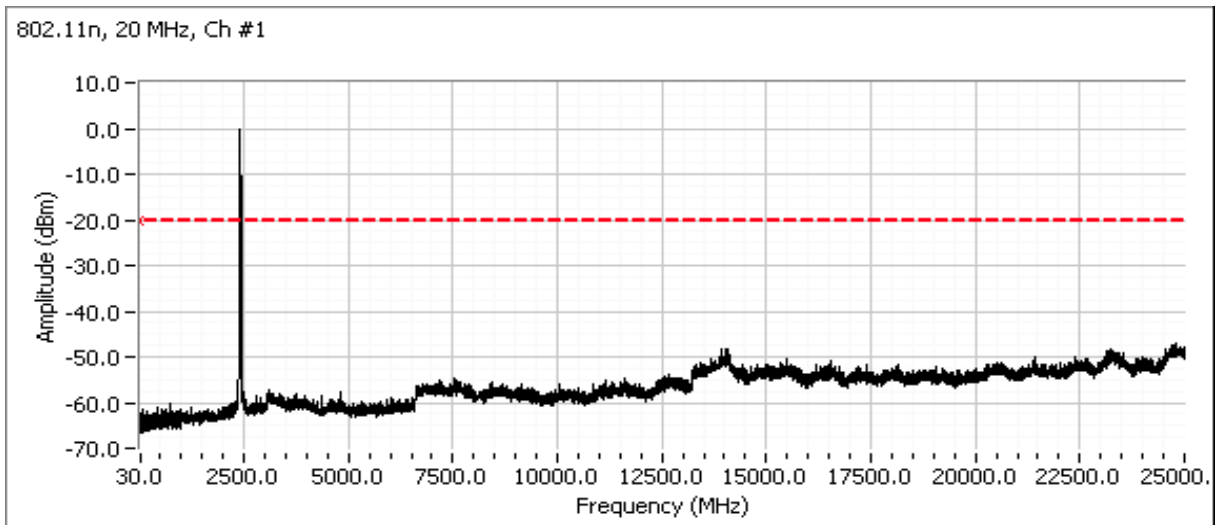
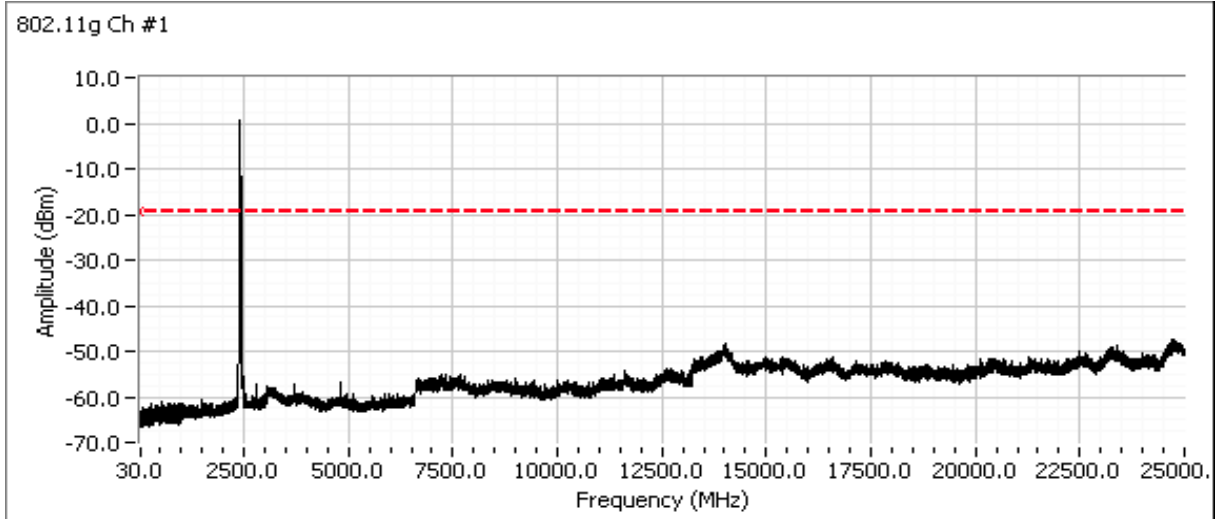
| Frequency (MHz) | Power Setting | Mode  | Limit   | Result |
|-----------------|---------------|-------|---------|--------|
| 2412            | FCC           | b/g/n | -20 dBc | Pass   |
| 2437            | FCC           | b/g/n | -20 dBc | Pass   |
| 2462            | FCC           | b/g/n | -20 dBc | Pass   |

Note 1: Tests performed per KDB 558074 v03r03 section 11.0. with RBW = 100 kHz, VBW = 3xRBW, peak detector.

Plots for low channel

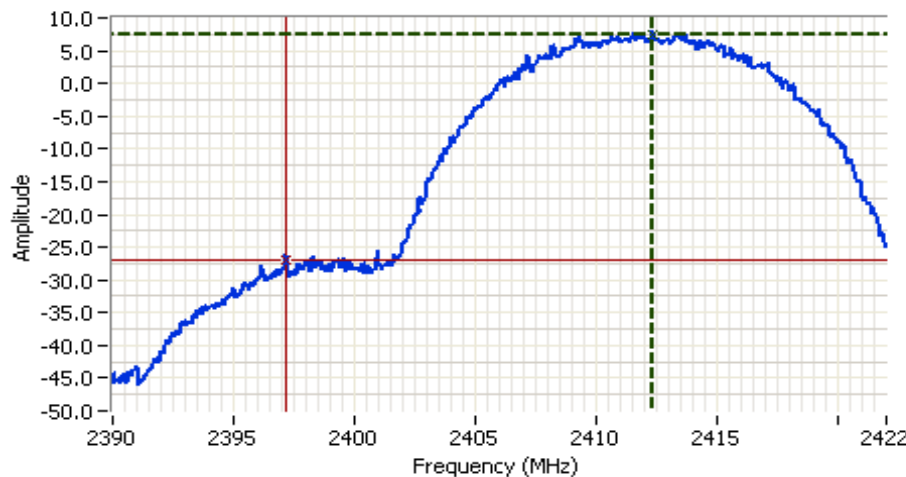


|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |



|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |

Additional plot showing compliance with -20 dBc limit from 2390 MHz to 2400 MHz. Radiated measurements used to show compliance with the limits in the restricted band below 2390 MHz.

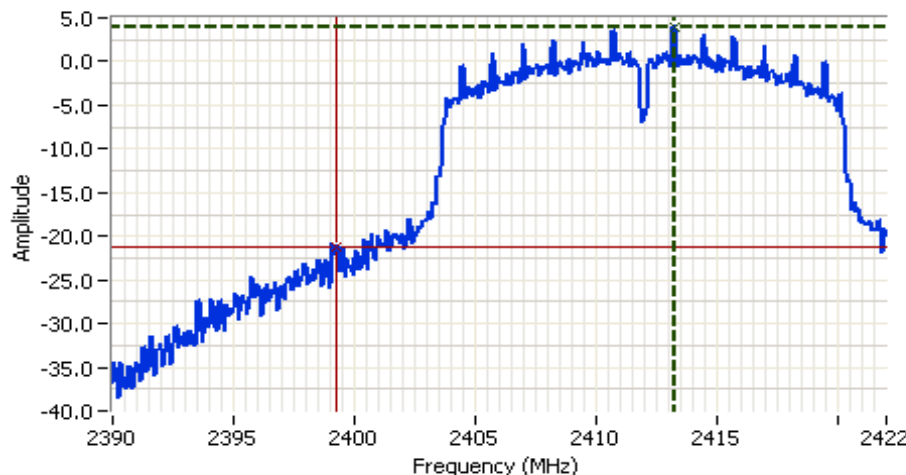


## Analyzer Settings

Agilent Technologies, E4446A  
 CF: 2406.000 MHz  
 SPAN: 32.000 MHz  
 RB: 100 kHz  
 VB: 300 kHz  
 Detector: POS  
 Attn: 20 DB  
 RL Offset: 10.2 DB  
 Sweep Time: 3.1ms  
 Ref Lvl: 20.0 DBM

## Comments

802.11b Ch #1  
 Pass -20 dBc  
 (-34.4 dBc)



## Analyzer Settings

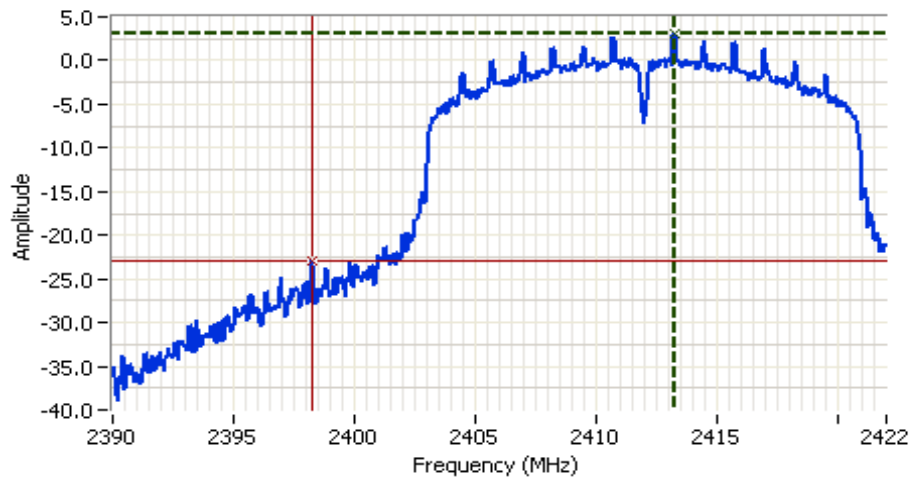
Agilent Technologies, E4446A  
 CF: 2406.000 MHz  
 SPAN: 32.000 MHz  
 RB: 100 kHz  
 VB: 300 kHz  
 Detector: POS  
 Attn: 20 DB  
 RL Offset: 10.2 DB  
 Sweep Time: 3.1ms  
 Ref Lvl: 20.0 DBM

## Comments

802.11g Ch #1  
 Pass -20 dBc  
 (-25.3 dBc)



|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |



## Analyzer Settings

Agilent Technologies, E4446A  
 CF: 2406.000 MHz  
 SPAN: 32.000 MHz  
 RB: 100 kHz  
 VB: 300 kHz  
 Detector: POS  
 Attn: 20 DB  
 RL Offset: 10.2 DB  
 Sweep Time: 3.1ms  
 Ref Lvl: 20.0 DBM

## Comments

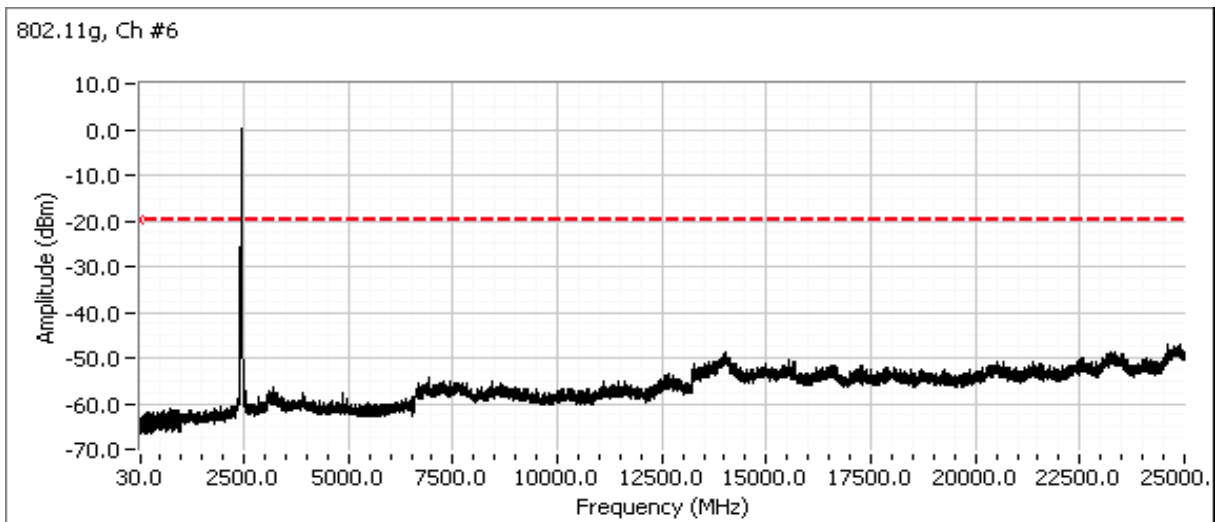
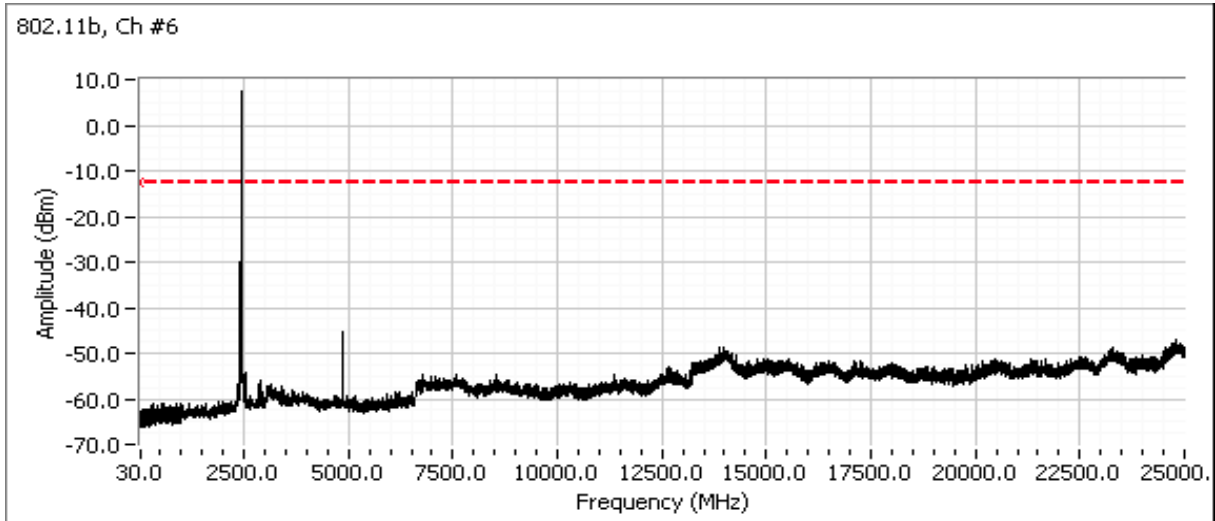
802.11n, 20 MHz, Ch #1  
 Pass -20 dBc  
 (-26.1 dBc)

|          |           |       |                                                                                     |
|----------|-----------|-------|-------------------------------------------------------------------------------------|
| Cursor 1 | 2413.2533 | 3.1   |  |
| Cursor 2 | 2398.2133 | -22.9 |  |

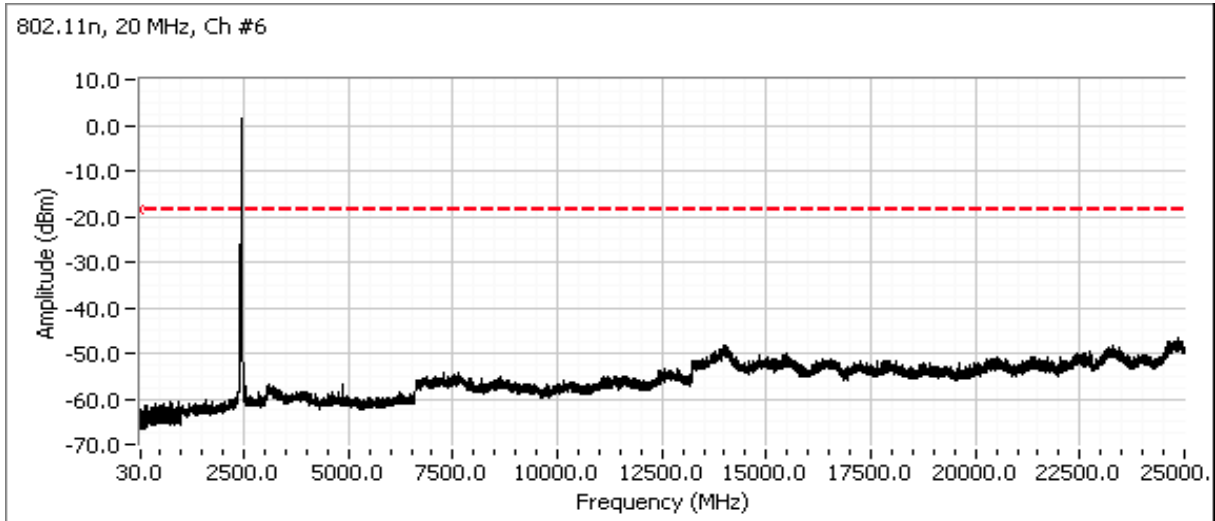
Delta Freq. 15.040  
 Delta Amplitude 26.1

|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |

## Plots for center channel

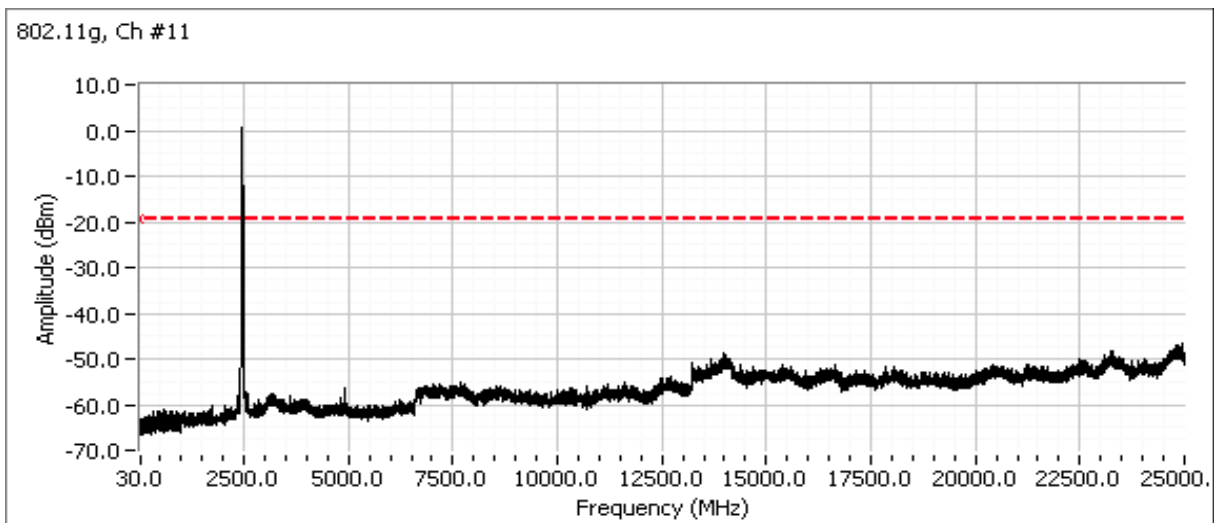
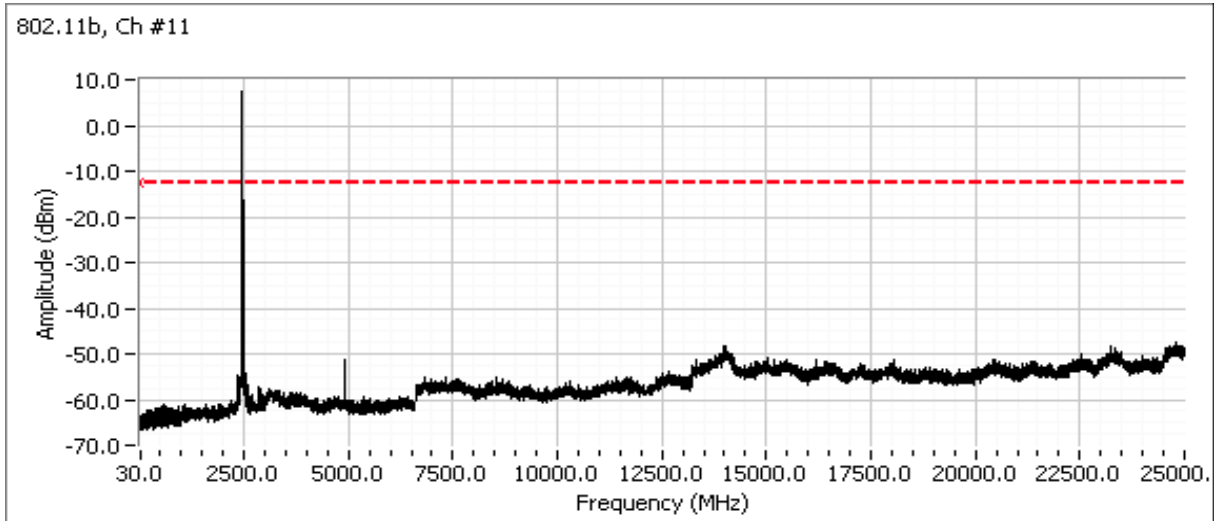


|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |

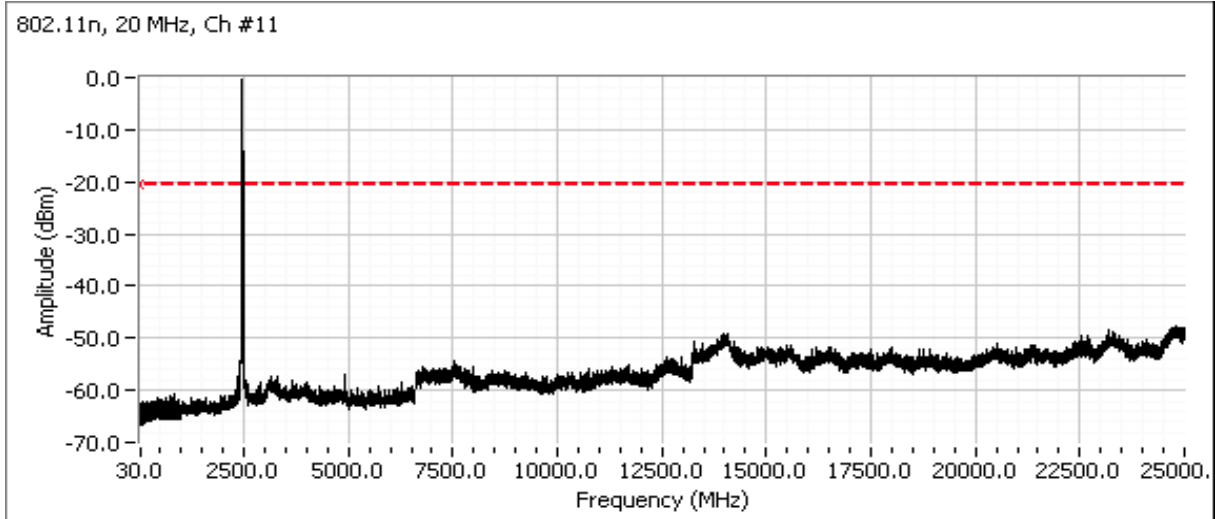


|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |

## Plots for high channel



|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: N/A                         |



|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | B                 |

## Conducted Emissions

*(NTS Silicon Valley, Fremont Facility, Semi-Anechoic Chamber)*

### Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 5/18/2016  
 Test Engineer: Deniz Demirci  
 Test Location: FT Ch #5

Config. Used: 1  
 Config Change: None  
 EUT Voltage: 120 V/60 Hz

### General Test Configuration

The EUT was located on a table inside the semi-anechoic chamber, 40 cm from a vertical coupling plane and 80 cm from the LISN. No remote support equipment was used.

**Ambient Conditions:**

|                |          |
|----------------|----------|
| Temperature:   | 20-22 °C |
| Rel. Humidity: | 30-35 %  |

### Summary of Results

| Run # | Test Performed               | Limit   | Result | Margin                              |
|-------|------------------------------|---------|--------|-------------------------------------|
| 1     | CE, AC Power,<br>120 V/60 Hz | Class B | Pass   | 52.5 dBµV @ 0.178 MHz<br>(-12.1 dB) |

### Modifications Made During Testing

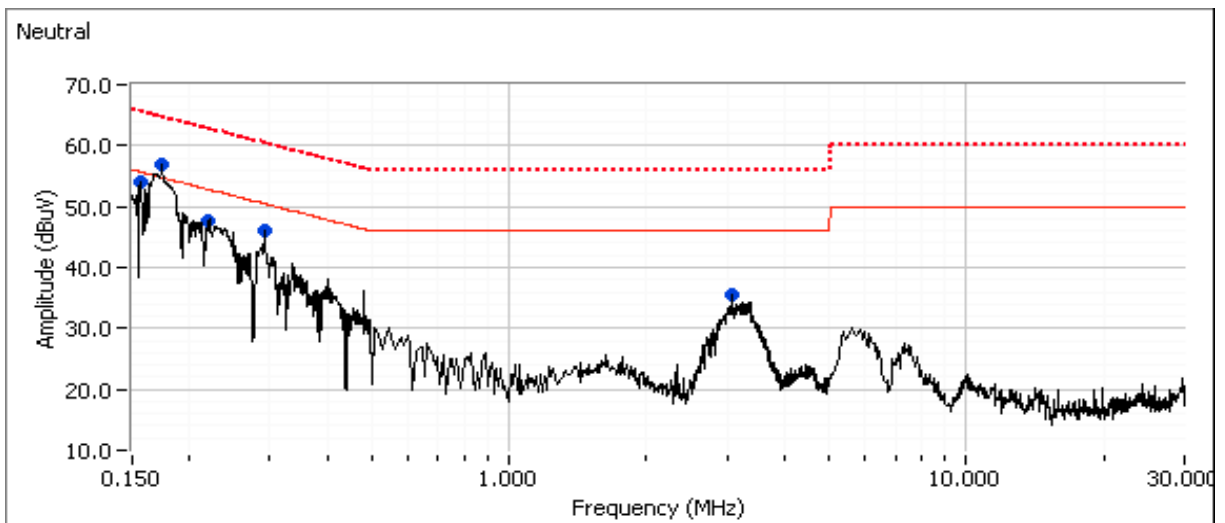
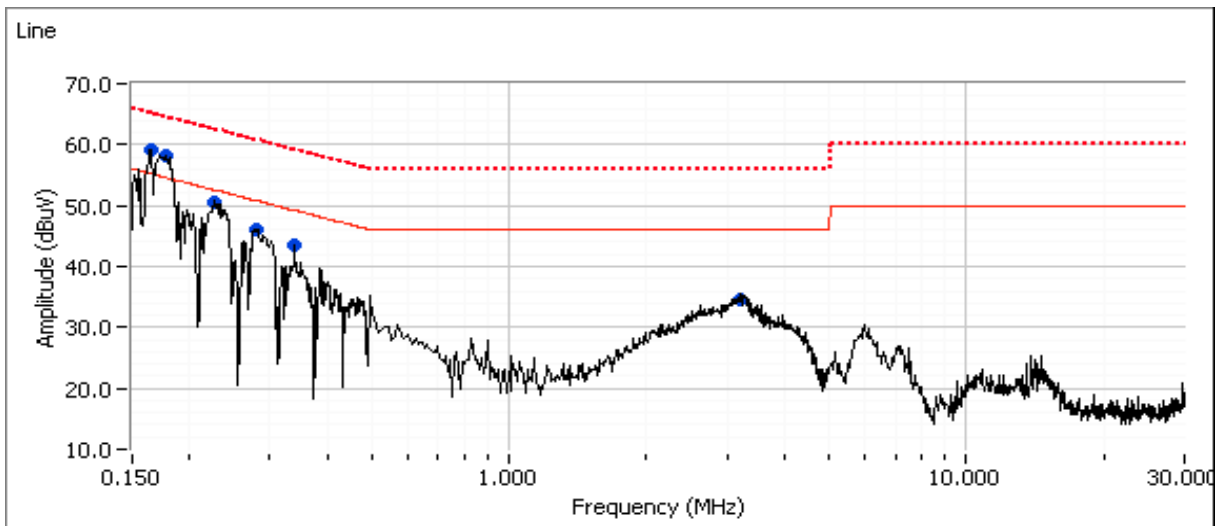
No modifications were made to the EUT during testing

### Deviations From The Standard

No deviations were made from the requirements of the standard.

|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: B                           |

**Run #1: AC Power Port Conducted Emissions, 0.15 - 30 MHz, 120 V/60 Hz**  
**Battery Charging (Delta Power charger w 2 p plug), 802.11b continuously transmitting at Ch #6, at maximum rated power.**



## EMC Test Data

|           |                        |                      |                   |
|-----------|------------------------|----------------------|-------------------|
| Client:   | Neato Robotics         | Job Number:          | JD101609          |
| Model:    | Botvac D3/D5 Connected | T-Log Number:        | T101649           |
| Contact:  | Matt Tenuta            | Project Manager:     | Christine Krebill |
| Standard: | FCC 15.247, RSS 247    | Project Coordinator: | -                 |
|           |                        | Class:               | B                 |

### Preliminary peak readings captured during pre-scan (peak readings vs. average limit)

| Frequency<br>MHz | Level<br>dB $\mu$ V | AC<br>Line | Class B |        | Detector<br>QP/Ave | Comments |
|------------------|---------------------|------------|---------|--------|--------------------|----------|
|                  |                     |            | Limit   | Margin |                    |          |
| 0.165            | 59.2                | Line 1     | 55.2    | 4.0    | Peak               |          |
| 0.178            | 58.1                | Line 1     | 54.6    | 3.5    | Peak               |          |
| 0.228            | 50.4                | Line 1     | 52.5    | -2.1   | Peak               |          |
| 0.279            | 46.1                | Line 1     | 50.8    | -4.7   | Peak               |          |
| 0.339            | 43.5                | Line 1     | 49.2    | -5.7   | Peak               |          |
| 3.223            | 34.5                | Line 1     | 46.0    | -11.5  | Peak               |          |
| 0.174            | 56.8                | Neutral    | 54.8    | 2.0    | Peak               |          |
| 0.220            | 47.7                | Neutral    | 52.8    | -5.1   | Peak               |          |
| 0.292            | 46.0                | Neutral    | 50.5    | -4.5   | Peak               |          |
| 0.156            | 53.9                | Neutral    | 55.7    | -1.8   | Peak               |          |
| 3.070            | 35.5                | Neutral    | 46.0    | -10.5  | Peak               |          |

|                               |                                    |
|-------------------------------|------------------------------------|
| Client: Neato Robotics        | Job Number: JD101609               |
| Model: Botvac D3/D5 Connected | T-Log Number: T101649              |
| Contact: Matt Tenuta          | Project Manager: Christine Krebill |
| Standard: FCC 15.247, RSS 247 | Project Coordinator: -             |
|                               | Class: B                           |

## Final quasi-peak and average readings

| Frequency<br>MHz | Level<br>dB $\mu$ V | AC<br>Line | Class B |        | Detector<br>QP/Ave | Comments    |
|------------------|---------------------|------------|---------|--------|--------------------|-------------|
|                  |                     |            | Limit   | Margin |                    |             |
| 0.178            | 52.5                | Line 1     | 64.6    | -12.1  | QP                 | QP (1.00s)  |
| 0.165            | 52.5                | Line 1     | 65.2    | -12.7  | QP                 | QP (1.00s)  |
| 0.173            | 51.5                | Neutral    | 64.8    | -13.3  | QP                 | QP (1.00s)  |
| 0.228            | 45.4                | Line 1     | 62.5    | -17.1  | QP                 | QP (1.00s)  |
| 0.178            | 36.1                | Line 1     | 54.6    | -18.5  | AVG                | AVG (0.10s) |
| 0.157            | 45.9                | Neutral    | 65.6    | -19.7  | QP                 | QP (1.00s)  |
| 0.280            | 40.3                | Line 1     | 60.8    | -20.5  | QP                 | QP (1.00s)  |
| 0.173            | 33.9                | Neutral    | 54.8    | -20.9  | AVG                | AVG (0.10s) |
| 0.292            | 39.0                | Neutral    | 60.5    | -21.5  | QP                 | QP (1.00s)  |
| 0.220            | 40.6                | Neutral    | 62.8    | -22.2  | QP                 | QP (1.00s)  |
| 0.165            | 30.8                | Line 1     | 55.2    | -24.4  | AVG                | AVG (0.10s) |
| 0.339            | 34.7                | Line 1     | 59.2    | -24.5  | QP                 | QP (1.00s)  |
| 3.214            | 31.1                | Line 1     | 56.0    | -24.9  | QP                 | QP (1.00s)  |
| 0.228            | 26.9                | Line 1     | 52.5    | -25.6  | AVG                | AVG (0.10s) |
| 3.214            | 20.1                | Line 1     | 46.0    | -25.9  | AVG                | AVG (0.10s) |
| 0.292            | 23.8                | Neutral    | 50.5    | -26.7  | AVG                | AVG (0.10s) |
| 3.073            | 27.7                | Neutral    | 56.0    | -28.3  | QP                 | QP (1.00s)  |
| 3.073            | 16.1                | Neutral    | 46.0    | -29.9  | AVG                | AVG (0.10s) |
| 0.280            | 19.7                | Line 1     | 50.8    | -31.1  | AVG                | AVG (0.10s) |
| 0.339            | 16.2                | Line 1     | 49.2    | -33.0  | AVG                | AVG (0.10s) |
| 0.220            | 19.4                | Neutral    | 52.8    | -33.4  | AVG                | AVG (0.10s) |
| 0.157            | 19.6                | Neutral    | 55.6    | -36.0  | AVG                | AVG (0.10s) |

### ***End of Report***

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