



Engineering Solutions & Electromagnetic Compatibility Services

**Certification Application Report for Full Modular Approval  
FCC Part 15.249 & ISED RSS-210**

|  |  |   |                            |
|--|--|---|----------------------------|
| <b>Test Lab:</b><br><br>Rhein Tech Laboratories, Inc.      Tel: 703-689-0368<br>360 Herndon Parkway              Fax: 703-689-2056<br>Suite 1400                              www.rheintech.com<br>Herndon, VA 20170<br>E-Mail: atcbinfo@rheintech.com |  | <b>Applicant:</b><br><br>Hunter Engineering Company<br>11250 Hunter Drive<br>Bridgeton, Missouri 63044 (USA)<br>Contact: Jim McClenahan |                            |
|  |  |   |                            |
| <b>ID's</b>  | LS3-45-1637/<br>2938A-451637   | <b>Test Report Date</b>   | April 12, 2018             |
| <b>Platform</b>  | PCB  | <b>RTL Work Order #</b>   | 2017285                    |
| <b>Model</b>   | 45-1637  | <b>RTL Quote #</b>  | QRTL17-285A                |
| <b>American National Standard Institute:</b>   | ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices     |   |                            |
| <b>FCC Classification:</b>   | DXX – Part 15 Low Power Communication Device Transmitter   |   |                            |
| <b>FCC Rule Part(s)/Guidance:</b>  | Part 15.249: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz, and 24.0-24.25 GHz (10-01-2017) |   |                            |
| <b>ISED</b>  | RSS-210 Issue 9 (Aug 2016): Licence-Exempt Radio Apparatus: Category I Equipment                                     |   |                            |
| <b>Digital Interface Information:</b>  | Digital Interface was found to be compliant  |   |                            |
|  |  |   |                            |
| <b>Frequency Range (MHz)</b>   | <b>Output Power (W)</b>  | <b>Frequency Tolerance</b>  | <b>Emission Designator</b> |
| 2405-2480  | N/A  | N/A   | 2M46F1D                    |

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the applicable parts of FCC Part 2, FCC Part 15, IC RSS-210 and ANSI C63.10.

Signature: 

Date: April 12, 2018

Typed/Printed Name: Desmond A. Fraser

Position: President

*This report may not be reproduced, except in full, without the written approval of Rhein Tech Laboratories, Inc. and Hunter Engineering Company. The test results relate only to the item(s) tested.*

*These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANSI-ASQ National Accreditation Board/ACLASS. Refer to certificate and scope of accreditation AT-1445.*

## Table of Contents

|     |   |    |
|-----|---|----|
| 1   | General Information.....  | 5  |
| 1.1 | Scope .....   | 5  |
| 1.2 | Description of EUT .....  | 5  |
| 1.3 | Test Facility.....  | 5  |
| 1.4 | Related Submittal(s)/Grant(s) .....   | 5  |
| 1.5 | Modifications .....   | 5  |
| 2   | Test Information .....  | 6  |
| 2.1 | Test Justification .....  | 6  |
| 2.2 | Exercising the EUT.....   | 6  |
| 2.3 | Test Result Summary.....  | 6  |
| 2.4 | Test System Details .....   | 6  |
| 2.5 | Configuration of Tested System.....   | 7  |
| 3   | Conducted AC Emissions – FCC 15.207: Conducted Limits; RSS-Gen 8.8: AC Power Line<br>Conducted Emission Limits for Licence-Exempt Radio Apparatus ..... | 7  |
| 4   | Radiated Emissions Limits Fundamental Emissions – FCC 15.249; RSS-210 B.10 .....  | 8  |
| 4.1 | Radiated Emissions Limits Test Procedure .....  | 8  |
| 4.2 | Radiated Emissions Test Data.....   | 8  |
| 5   | Radiated Emission Limits Radiated Harmonics – FCC 15.249; RSS-210 B.10 .....  | 9  |
| 5.1 | Radiated Emission Limits Test Procedure.....  | 9  |
| 6   | In-Band Emissions Requirement – FCC 15.215(c); Occupied Bandwidth - RSS-Gen 6.6.....  | 11 |
| 6.1 | Modulated Bandwidth Test Procedure .....  | 11 |
| 6.2 | Test Procedure 20 dB Bandwidth .....  | 11 |
| 6.3 | FCC 15.215(c) Requirement.....  | 11 |
| 6.4 | Test Data .....   | 12 |
| 7   | Conclusion .....  | 15 |

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### Figure Index

---

|             |   |   |
|-------------|---|---|
| Figure 2-1: | Worst Case Configuration of System under Test ..... | 7 |
|-------------|---|---|

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### Table Index

---

|            |  |    |
|------------|--|----|
| Table 2-1: | Test Result Summary with FCC Rules and Regulations .....   | 6  |
| Table 2-2: | Equipment under Test (EUT).....                            | 6  |
| Table 4-1: | Radiated Fundamental Emissions Test Equipment.....         | 8  |
| Table 4-2: | Radiated Emissions - Fundamental Emissions - Peak .....    | 8  |
| Table 4-3: | Radiated Emissions - Fundamental Emissions - Average ..... | 8  |
| Table 5-1: | Radiated Spurious Emissions – Peak.....                    | 9  |
| Table 5-2: | Radiated Spurious Emissions – Average.....                 | 9  |
| Table 5-3: | Radiated Spurious Emissions Test Equipment .....           | 10 |
| Table 6-1: | 20 dB Modulated Bandwidth.....                             | 14 |
| Table 6-2: | Bandwidth Test Equipment .....                             | 14 |

---

### Plot Index

---

|           |                           |    |
|-----------|---------------------------|----|
| Plot 6-1: | Bandwidth - 2405 MHz..... | 12 |
| Plot 6-2: | Bandwidth - 2440 MHz..... | 13 |
| Plot 6-3: | Bandwidth - 2480 MHz..... | 14 |

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### Appendix Index

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|             |   |    |
|-------------|---|----|
| Appendix A: | FCC Part 1.1307, 1.1310, 2.1091, 2.1093; IC RSS-102: RF Exposure..... | 16 |
| Appendix B: | ACB/FCC Agency Authorization Letter .....                             | 17 |
| Appendix C: | ISED Agency Authorization Letter .....                                | 18 |
| Appendix D: | Canadian-based Representative Attestation.....                        | 19 |
| Appendix E: | FCC Modular Approval Attestation .....                                | 20 |
| Appendix F: | ISED Modular Approval Attestation .....                               | 21 |
| Appendix G: | Label and Label Location .....  | 22 |
| Appendix H: | Technical Operational Description.....                                | 24 |
| Appendix I: | Schematics.....   | 25 |
| Appendix J: | Block Diagram .....   | 26 |
| Appendix K: | Manual.....   | 27 |
| Appendix L: | Test Photographs.....   | 28 |
| Appendix M: | External Photographs.....   | 30 |
| Appendix N: | Internal Photographs.....   | 33 |

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### Photograph Index

---

|                |   |    |
|----------------|---|----|
| Photograph 1:  | ID Label Sample on Back of Module.....                      | 22 |
| Photograph 2:  | "Contains FCC ID:.....IC:....." Label Sample .....          | 23 |
| Photograph 3:  | Radiated Emissions Testing – Front View (above 1 GHz) ..... | 28 |
| Photograph 4:  | Radiated Emissions Testing – Side View (above 1 GHz) .....  | 29 |
| Photograph 5:  | Module with Shield – Front View .....                       | 30 |
| Photograph 6:  | Module without Shield - Front View .....                    | 31 |
| Photograph 7:  | Module – Back View.....                                     | 32 |
| Photograph 8:  | Module with Shield – Front View .....                       | 33 |
| Photograph 9:  | Module without Shield - Front View .....                    | 34 |
| Photograph 10: | Module – Back View.....                                     | 35 |

## 1 General Information

### 1.1 Scope

This is an original certification application request for modular approval.

Applicable Standards:

- FCC Rules Part 15.249: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz, and 24.0-24.25
- ISSED RSS-210: Low Power License-Exempt Communications Devices
- ISSED RSS-Gen Issue 4 2014: General Requirements for Compliance of Radio Apparatus

### 1.2 Description of EUT

|                             |                    |
|-----------------------------|--------------------|
| <b>Equipment Under Test</b> | Transceiver        |
| <b>Model</b>                | 45-1637            |
| <b>Power Supply</b>         | 2 AAA batteries    |
| <b>Modulation Type</b>      | FSK                |
| <b>Frequency Range</b>      | 2405-2480 MHz      |
| <b>Antenna Type</b>         | Inverted F Antenna |

The version described above was tested for worst-case spurious, harmonic, and unintentional digital emissions. Worst-case data is presented in this report.

### 1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.10).

### 1.4 Related Submittal(s)/Grant(s)

This is an original application for full modular approval certification for Hunter Engineering Company Model: 45-1637, FCC ID: LS3-45-1637, IC: 2938A-451637.

### 1.5 Modifications

No modifications were made to the equipment during testing in order to achieve compliance with these standards.

## 2 Test Information

### 2.1 Test Justification

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. 2405, 2440, and 2480 MHz were tested and investigated from 9 kHz to 9 GHz.

### 2.2 Exercising the EUT

The EUT was provided with software to continuously transmit during testing. The carrier was also checked to verify that the information was being transmitted. There were no deviations from the test standard(s) and/or methods. The IF, LO, and up to the 2<sup>nd</sup> LO, were investigated and tested, and found to be compliant.

### 2.3 Test Result Summary

**Table 2-1: Test Result Summary with FCC Rules and Regulations**

| Standard          | Test                        | Pass/Fail or N/A |
|-------------------|-----------------------------|------------------|
| FCC 15.249(a)     | Radiated Emissions          | Pass             |
| FCC 15.207        | AC Line Conducted Emissions | N/A              |
| FCC 15.215        | 20 dB Bandwidth             | Pass             |
| RSS-Gen           | 99% Bandwidth               | Pass             |
| RSS-Gen; ICES-003 | Receiver/Digital Emissions  | Pass             |

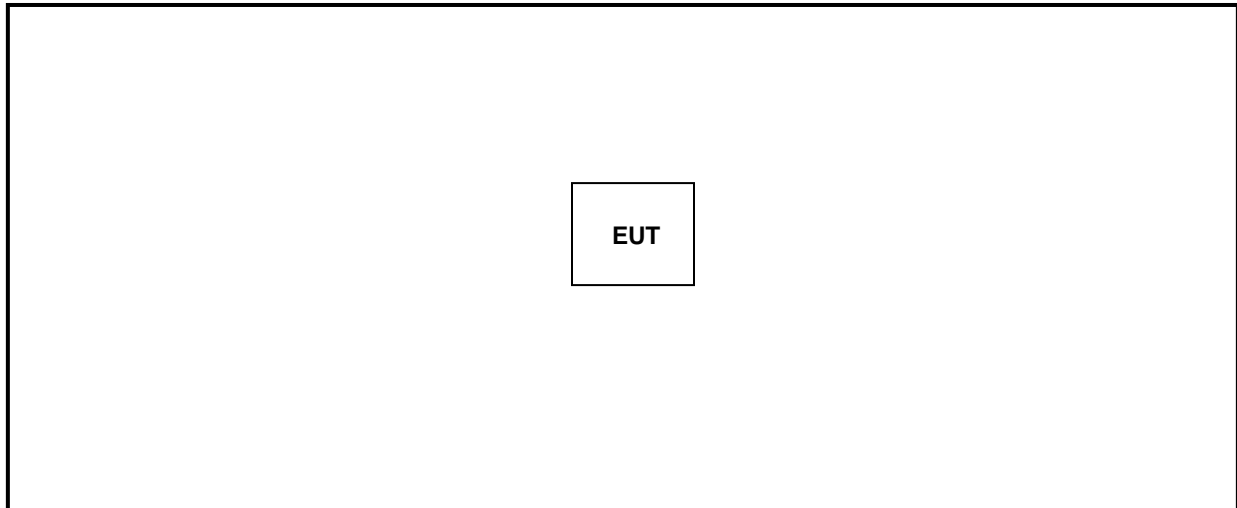
### 2.4 Test System Details

The test samples were received on January 12, 2018. The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system, are in the table below.

**Table 2-2: Equipment under Test (EUT)**

| Part                         | Manufacturer               | Model   | PN/SN | FCC ID | RTL Bar Code |
|------------------------------|----------------------------|---------|-------|--------|--------------|
| Transceiver (Radiated Unit)  | Hunter Engineering Company | 45-1637 | N/A   | XXXX   | 22216        |
| Transceiver (Conducted Unit) | Hunter Engineering Company | 45-1637 | N/A   | XXXX   | 22215        |

## 2.5 Configuration of Tested System



**Figure 2-1: Worst Case Configuration of System under Test**

## 3 Conducted AC Emissions – FCC 15.207: Conducted Limits; RSS-Gen 8.8: AC Power Line Conducted Emission Limits for Licence-Exempt Radio Apparatus

Device is battery operated and not connected to AC lines; therefore, no AC emissions test is required.

#### 4 Radiated Emissions Limits Fundamental Emissions – FCC 15.249; RSS-210 B.10

##### 4.1 Radiated Emissions Limits Test Procedure

Radiated Emissions of the Fundamentals were tested at three meters, and meet the quasi-peak limit of 50 mV/m. The EUT was tested in all three orthogonal planes. Peak measurements were taken and are compared to the quasi-peak limit.

**Table 4-1: Radiated Fundamental Emissions Test Equipment**

| RTL Asset # | Manufacturer                  | Model                     | Part Type                                       | Serial Number | Calibration Due Date |
|-------------|-------------------------------|---------------------------|---|---------------|----------------------|
| 900905      | Rhein Tech Laboratories, Inc. | PR-1040                   | Amplifier<br>(20 MHz - 2 GHz)                   | 900905        | 8/18/18              |
| 900791      | Chase                         | CBL6111B                  | Bilog Antenna<br>(30 MHz – 2000 MHz)            | N/A           | 10/4/20              |
| 900913      | Hewlett Packard               | 85462A                    | EMI Receiver<br>RF Section<br>(9 KHz – 6.5 GHz) | 3325A00159    | 4/4/19               |
| 900914      | Hewlett Packard               | 85460A                    | RF Filter Section<br>(100 kHz - 6.5 GHz)        | 3330A00107    | 4/4/19               |
| N/A         | Rhein Tech Laboratories, Inc. | Automated Emission Tester | Emissions Testing Software                      | Rev. 14.0.2   | N/A                  |

##### 4.2 Radiated Emissions Test Data

**Table 4-2: Radiated Emissions - Fundamental Emissions - Peak**


| Emission Frequency (MHz) | Test Detector | Antenna Polarity (H/V) | Analyzer Reading (dBuV) | Site Correction Factor (dB/m) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Pass/Fail |
|--------------------------|---------------|------------------------|-------------------------|-------------------------------|-------------------------|----------------|-------------|-----------|
| 2405                     | Peak          | V                      | 56.1                    | 25.2                          | 81.3                    | 114.0          | -32.7       | Pass      |
| 2440                     | Peak          | V                      | 55.4                    | 25.2                          | 80.6                    | 114.0          | -33.4       | Pass      |
| 2480                     | Peak          | V                      | 54.9                    | 25.5                          | 80.4                    | 114.0          | -33.6       | Pass      |

**Table 4-3: Radiated Emissions - Fundamental Emissions - Average**

| Emission Frequency (MHz) | Test Detector | Antenna Polarity (H/V) | Analyzer Reading (dBuV) | Site Correction Factor (dB/m) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Pass/Fail |
|--------------------------|---------------|------------------------|-------------------------|-------------------------------|-------------------------|----------------|-------------|-----------|
| 2405                     | Average       | V                      | 54.2                    | 25.2                          | 79.4                    | 94.0           | -14.6       | Pass      |
| 2440                     | Average       | V                      | 52.7                    | 25.2                          | 77.9                    | 94.0           | -16.1       | Pass      |
| 2480                     | Average       | V                      | 52.3                    | 25.5                          | 77.8                    | 94.0           | -16.2       | Pass      |

##### Test Personnel:

Jon Wilson  
Test Engineer

  
Signature

January 12, 2018  
Date of Tests



## 5 Radiated Emission Limits Radiated Harmonics – FCC 15.249; RSS-210 B.10

### 5.1 Radiated Emission Limits Test Procedure

Radiated emissions of the harmonics were tested at three meters. The EUT was tested by rotating through three orthogonal planes, each at 360° rotation with the receive antenna in both vertical and horizontal polarity.

**Table 5-1: Radiated Spurious Emissions – Peak**

| Fundamental Frequency (MHz) | Emission Frequency (MHz) | Test Detector | Antenna Polarity (H/V) | Analyzer Reading (dBuV) | Site Correction Factor (dB/m) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Pass/Fail |
|-----------------------------|--------------------------|---------------|------------------------|-------------------------|-------------------------------|-------------------------|----------------|-------------|-----------|
| 2405.0                      | 4810.0                   | Peak          | H                      | 57.3                    | -1.8                          | 55.5                    | 74.0           | -18.5       | Pass      |
| 2440.0                      | 4880.0                   | Peak          | H                      | 56.2                    | -1.5                          | 54.7                    | 74.0           | -19.3       | Pass      |
| 2480.0                      | 4960.0                   | Peak          | H                      | 55.9                    | -1.3                          | 54.6                    | 74.0           | -19.4       | Pass      |

**Table 5-2: Radiated Spurious Emissions – Average**


| Fundamental Frequency (MHz) | Emission Frequency (MHz) | Test Detector | Antenna Polarity (H/V) | Analyzer Reading (dBuV) | Site Correction Factor (dB/m) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Pass/Fail |
|-----------------------------|--------------------------|---------------|------------------------|-------------------------|-------------------------------|-------------------------|----------------|-------------|-----------|
| 2405.0                      | 4810.0                   | RMS           | H                      | 51.3                    | -1.8                          | 49.5                    | 54.0           | -4.5        | Pass      |
| 2440.0                      | 4880.0                   | RMS           | H                      | 50.0                    | -1.5                          | 48.5                    | 54.0           | -5.5        | Pass      |
| 2480.0                      | 4960.0                   | RMS           | H                      | 50.0                    | -1.3                          | 48.7                    | 54.0           | -5.3        | Pass      |

**Table 5-3: Radiated Spurious Emissions Test Equipment**

| RTL Asset # | Manufacturer                  | Model                           | Part Type                                       | Serial Number | Calibration Due Date |
|-------------|-------------------------------|---------------------------------|---|---------------|----------------------|
| 900905      | Rhein Tech Laboratories, Inc. | PR-1040                         | Amplifier<br>(20 MHz - 2 GHz)                   | 900905        | 8/18/18              |
| 900791      | Chase                         | CBL6111B                        | Bilog Antenna<br>(30 MHz – 2000 MHz)            | N/A           | 10/4/20              |
| 900913      | Hewlett Packard               | 85462A                          | EMI Receiver<br>RF Section<br>(9 KHz – 6.5 GHz) | 3325A00159    | 4/4/19               |
| 900914      | Hewlett Packard               | 85460A                          | RF Filter Section<br>(100 kHz - 6.5 GHz)        | 3330A00107    | 4/4/19               |
| 901583      | Agilent Technologies          | N9010A                          | EXA Signal Analyzer<br>(10 Hz - 26.5 GHz)       | MY51250846    | 2/06/20              |
| 900932      | Hewlett Packard               | 8449B OPT<br>H02                | Preamplifier<br>(1 - 26.5 GHz)                  | 3008A00505    | 8/18/18              |
| 900772      | EMCO                          | 3161-02                         | Horn Antenna<br>(2.0 - 4.0 GHz)                 | 9804-1044     | 4/9/18               |
| 900321      | EMCO                          | 3161-03                         | Horn Antenna<br>(4.0 - 8.2 GHz)                 | 9508-1020     | 4/9/18               |
| 900323      | EMCO                          | 3160-07                         | Horn Antenna<br>(8.2 - 12.4 GHz)                | 9605-1054     | 4/9/18               |
| 900356      | EMCO                          | 3160-08                         | Horn Antenna<br>(12.4 - 18 GHz)                 | 9607-1044     | 4/9/18               |
| 901218      | EMCO                          | 3160-09                         | Horn Antenna<br>(18 - 26.5 GHz)                 | 960281-003    | 4/14/18              |
| N/A         | Rhein Tech Laboratories, Inc. | Automated<br>Emission<br>Tester | Emissions<br>Testing Software                   | Rev. 14.0.2   | N/A                  |

**Test Personnel:**

Jon Wilson  
Test Engineer

  
Signature

January 12, 2018  
Date of Tests

## **6 In-Band Emissions Requirement – FCC 15.215(c); Occupied Bandwidth - RSS-Gen 6.6**

### **6.1 Modulated Bandwidth Test Procedure**

The 99% bandwidth was measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz (1% of span), and the video bandwidth set at 1 MHz.

### **6.2 Test Procedure 20 dB Bandwidth**

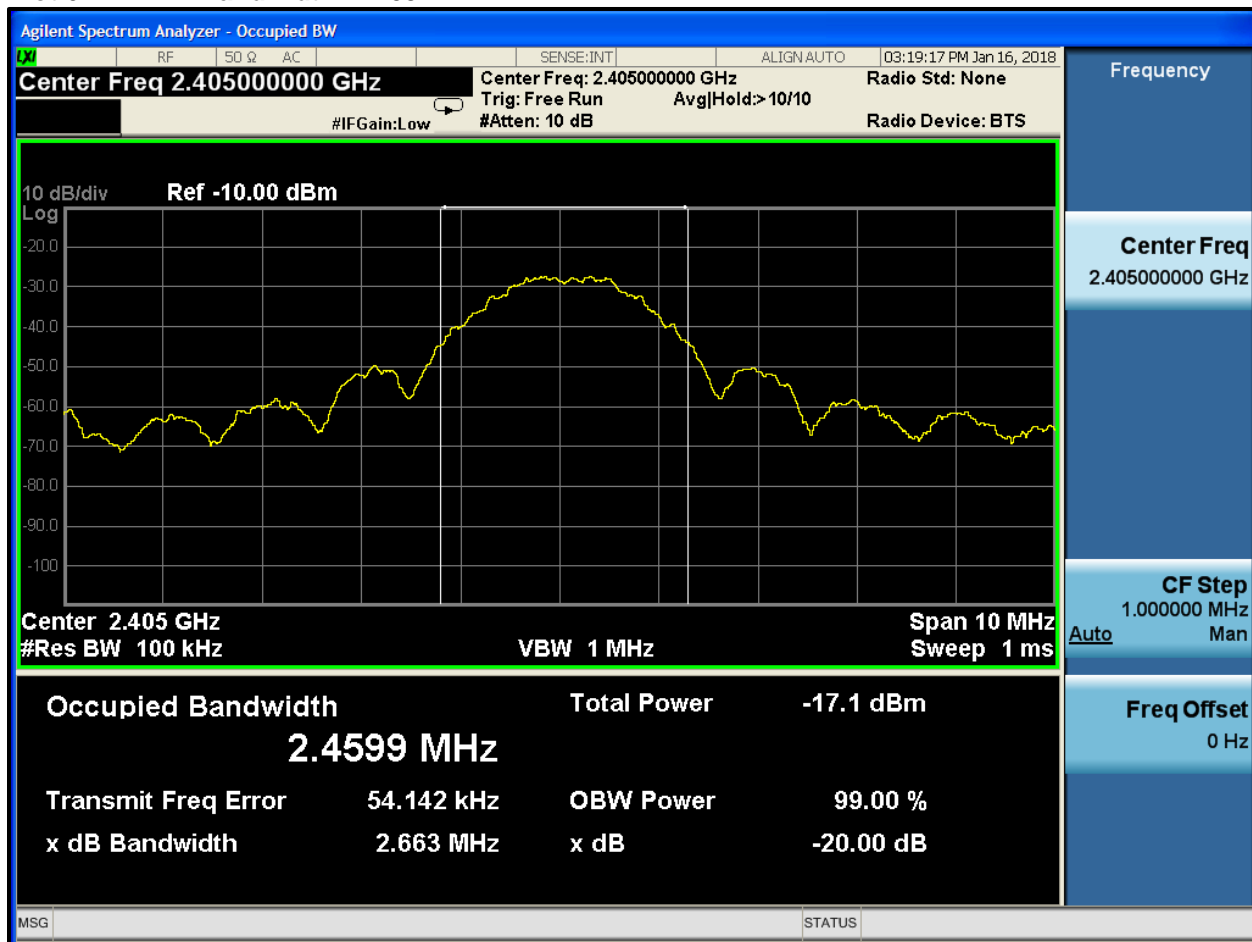
The 20 dB bandwidth was measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz (1% of span), and the video bandwidth set at 1 MHz. The spectrum analyzer's automated display was set to -20 dBc using max hold until the spectrum was filled and a plot taken.

### **6.3 FCC 15.215(c) Requirement**

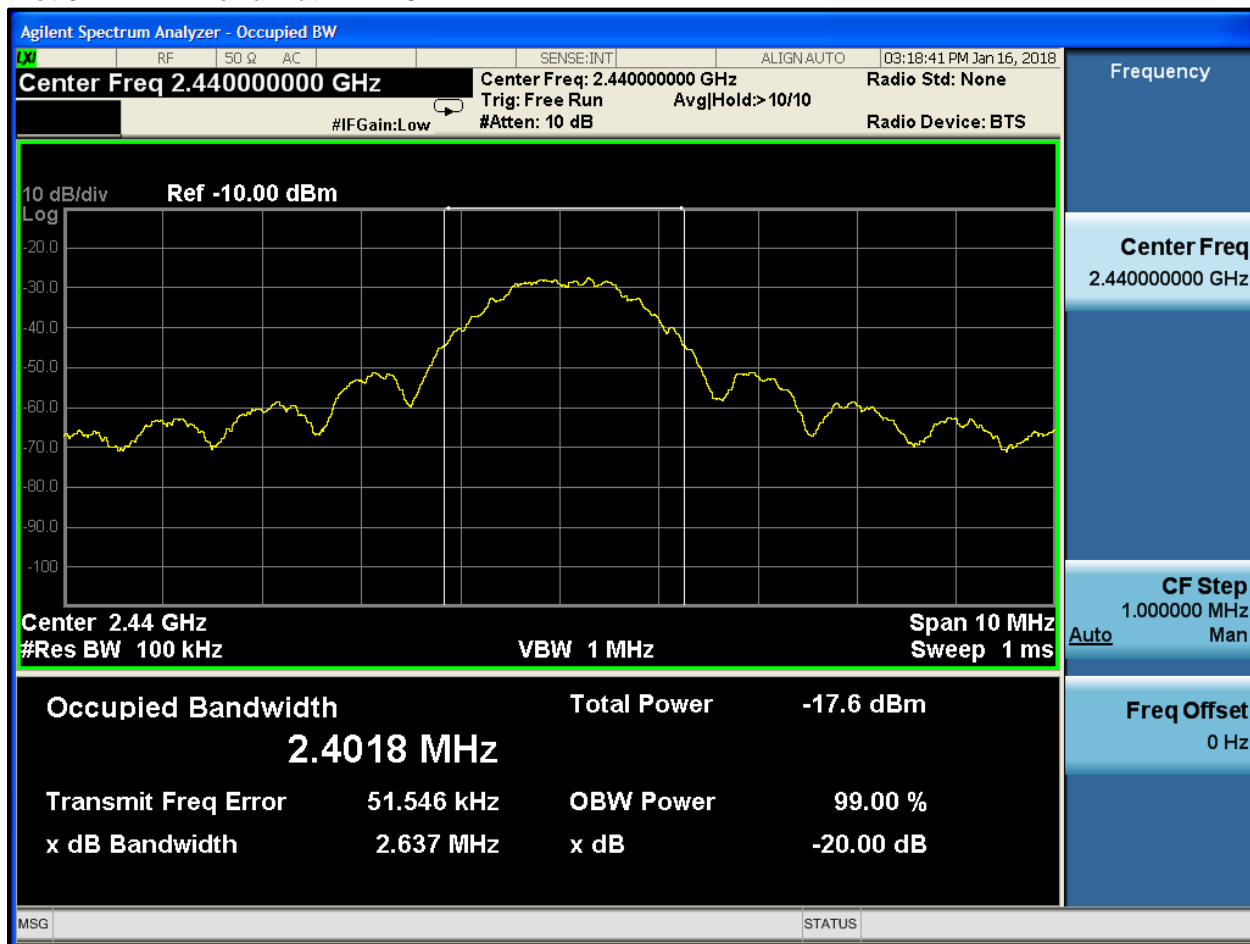
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in FCC 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

## 6.4 Test Data

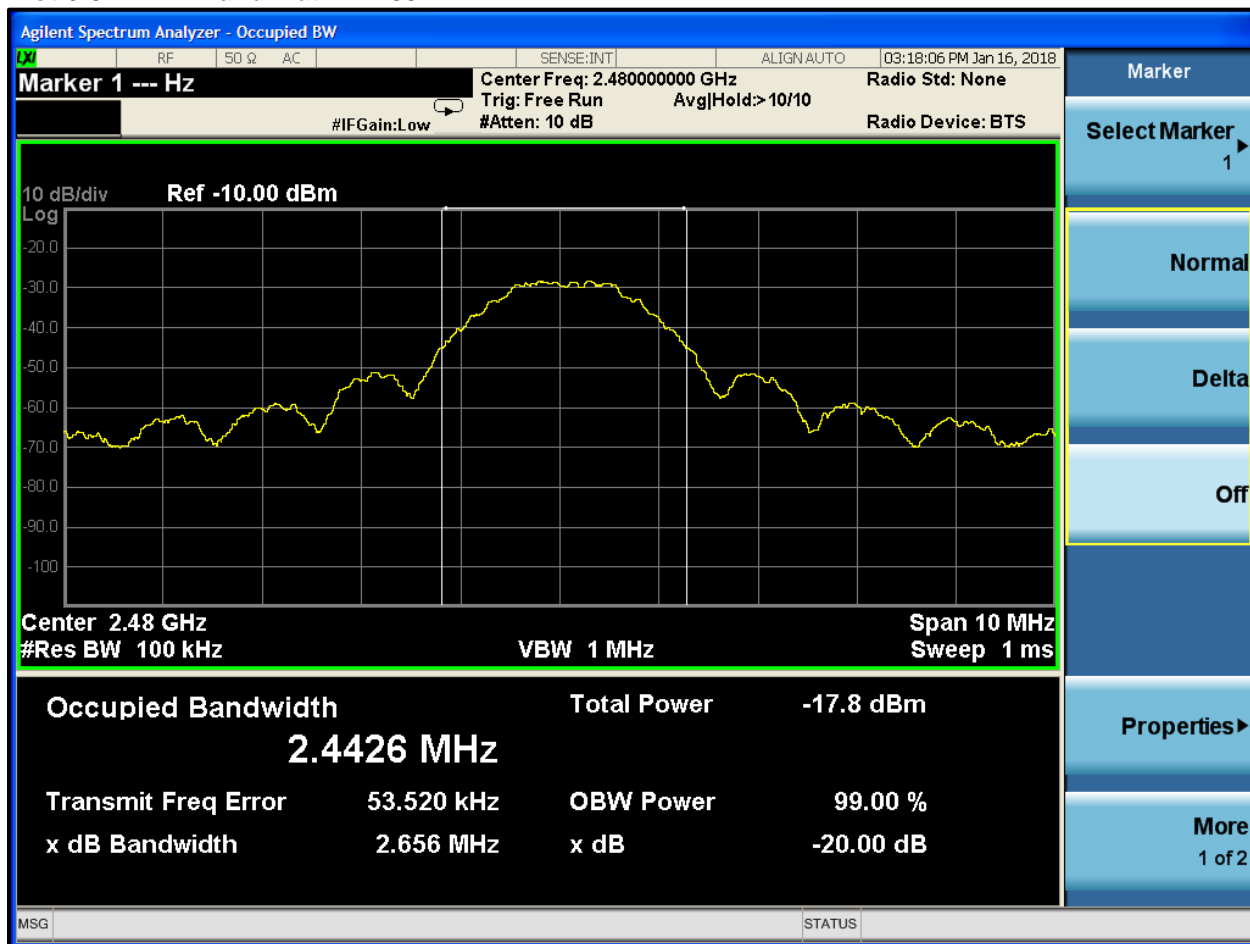
Plot 6-1: Bandwidth - 2405 MHz



**Plot 6-2: Bandwidth - 2440 MHz**



**Plot 6-3: Bandwidth - 2480 MHz**



**Table 6-1: 20 dB Modulated Bandwidth**

| Frequency (MHz) | 20 dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|-----------------|-----------------------|---------------------|
| 2405            | 2.66                  | 2.46                |
| 2440            | 2.64                  | 2.40                |
| 2480            | 2.66                  | 2.44                |

**Table 6-2: Bandwidth Test Equipment**

| RTL Asset # | Manufacturer | Model  | Part Type                                   | Serial Number | Calibration Due Date |
|-------------|--------------|--------|---|---------------|----------------------|
| 901583      | Agilent      | N9010A | EXA Spectrum Analyzer<br>(10 Hz – 26.5 GHz) | MY51250846    | 2/06/20              |

**Test Personnel:**

Dan Baltzell  
Test Engineer

*Daniel W. Baltzell*

Signature

January 16, 2018  
Date of Tests

Rhein Tech Laboratories, Inc.  
360 Herndon Parkway  
Suite 1400  
Herndon, VA 20170  
<http://www.rheintech.com>

Client: Hunter Engineering Company  
Model: 45-1637  
Standards: FCC 15.249/IC RSS-210  
ID's: LS3-45-1637/2938A-451637  
Report #: 2017285

## **7 Conclusion**

The data in this measurement report shows that the EUT as tested, Hunter Engineering Company Model: 45-1637, FCC ID: LS3-45-1637, IC: 2938A-451637, complies with the applicable requirements for modular approval per Parts 2 and 15 of the FCC Rules, and Industry Canada RSS-210 and RSS-Gen.