



Engineering Solutions & Electromagnetic Compatibility Services

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

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

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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.

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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

Equipment Under Test	Transceiver
Model	45-1637
Power Supply	2 AAA batteries
Modulation Type	FSK
Frequency Range	2405-2480 MHz
Antenna Type	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 2nd 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

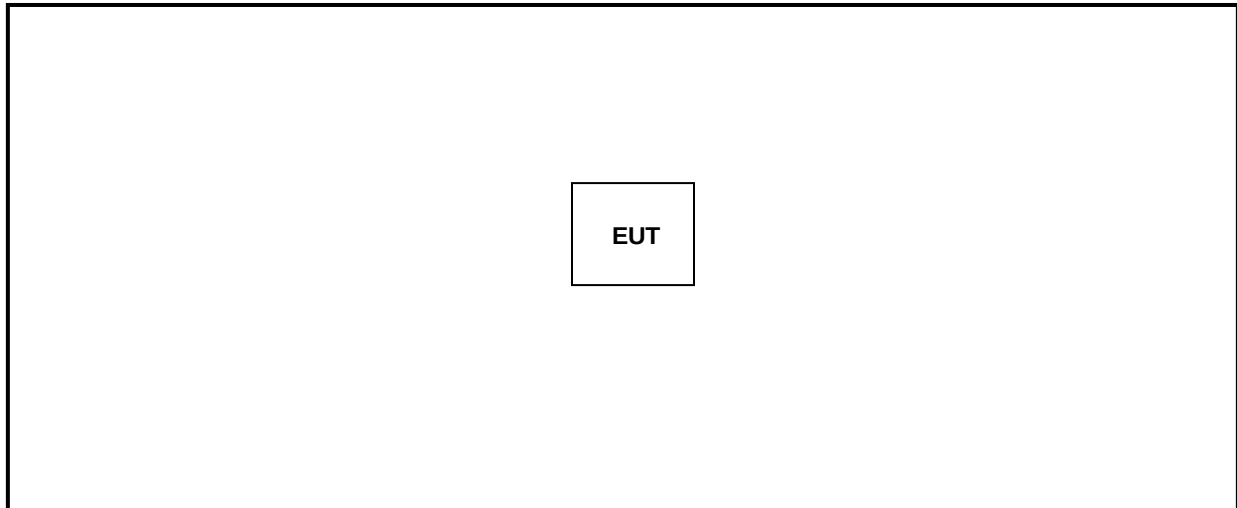


Figure 2-1: Worst Case Configuration of System under Test

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

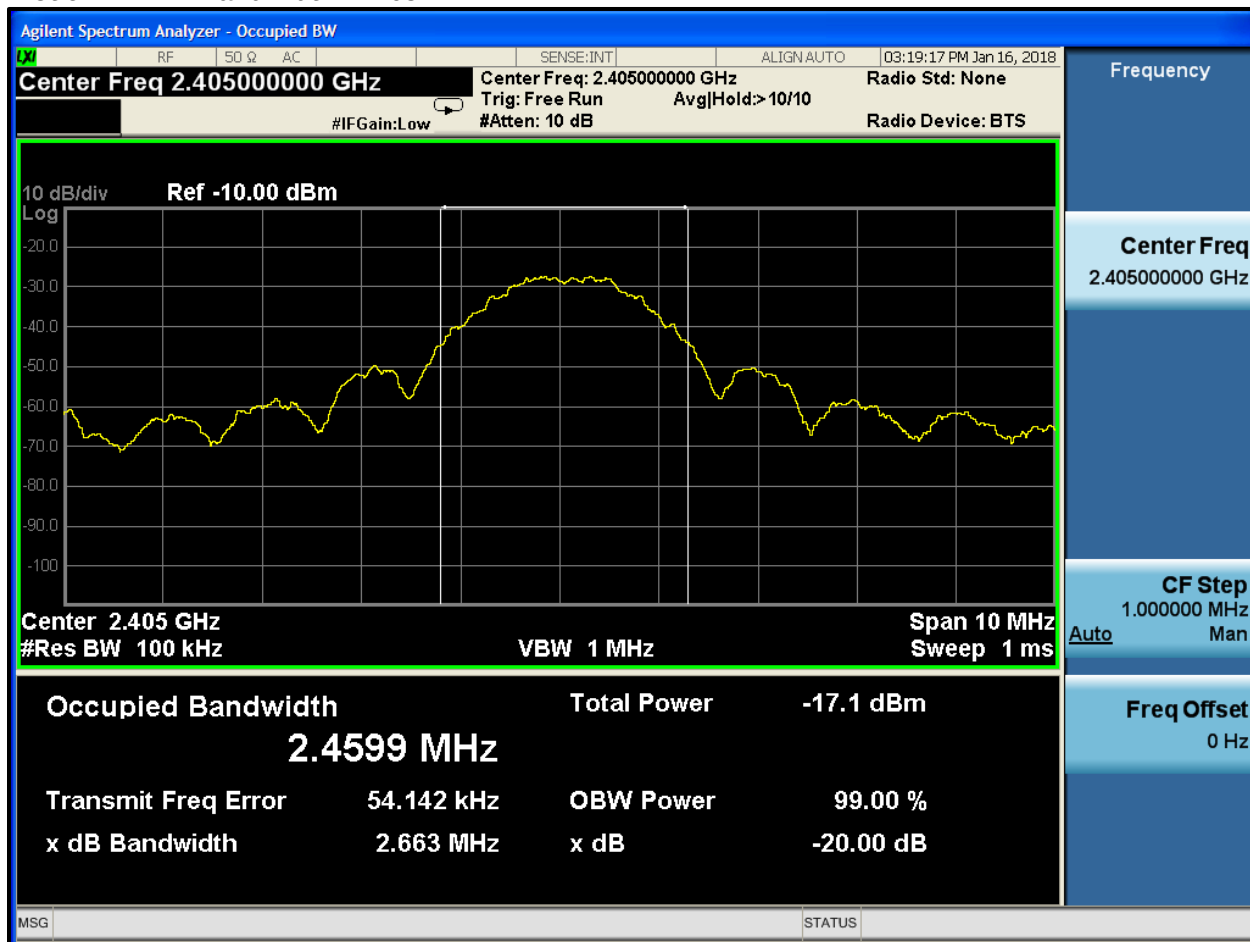
The 20 dB bandwidth was measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz (1% of span), and the video bandwidth set at 1 MHz. The spectrum analyzer's automated display was set to -20 dBc using max hold until the spectrum was filled and a plot taken.

6.3 FCC 15.215(c) Requirement

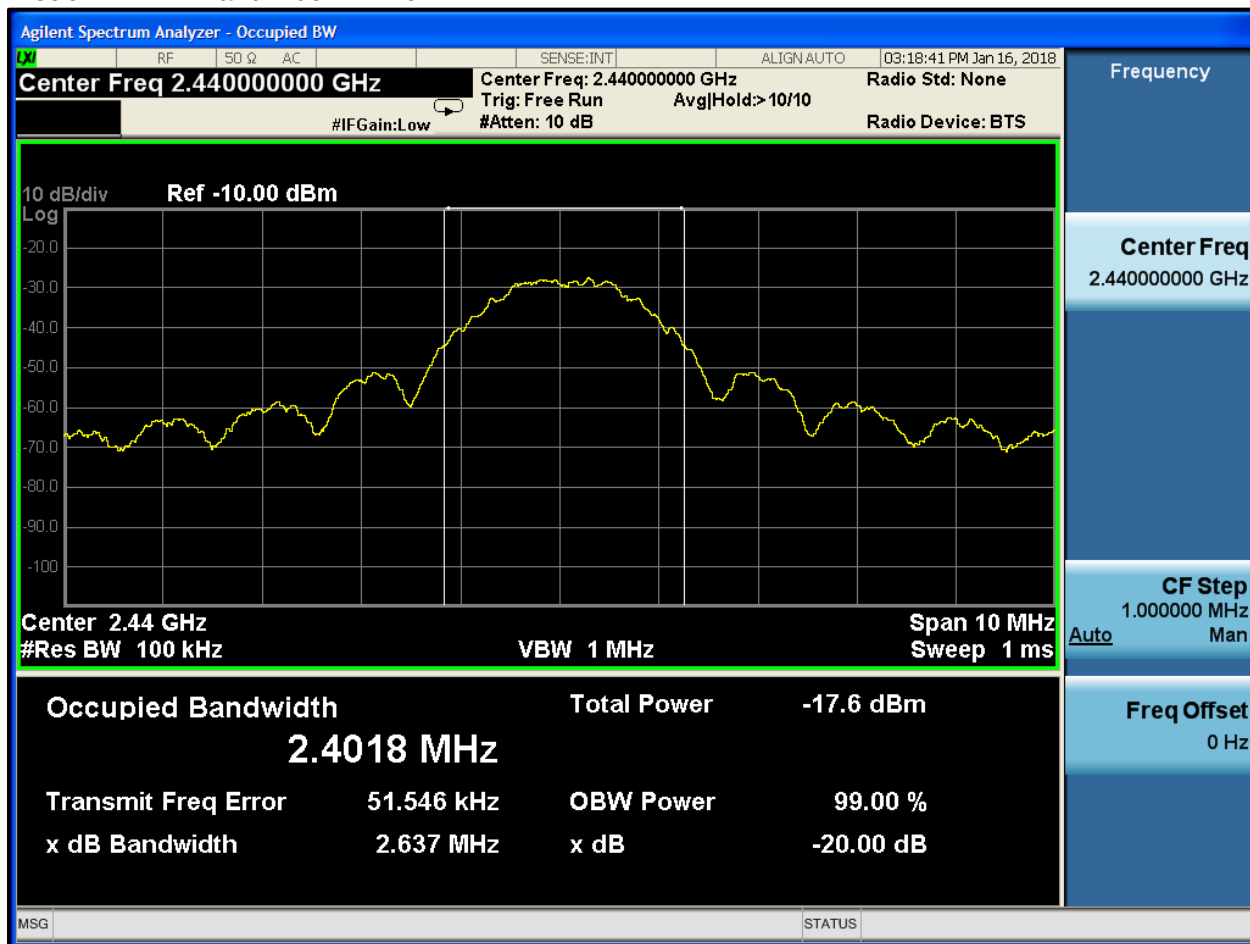
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in FCC 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific 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

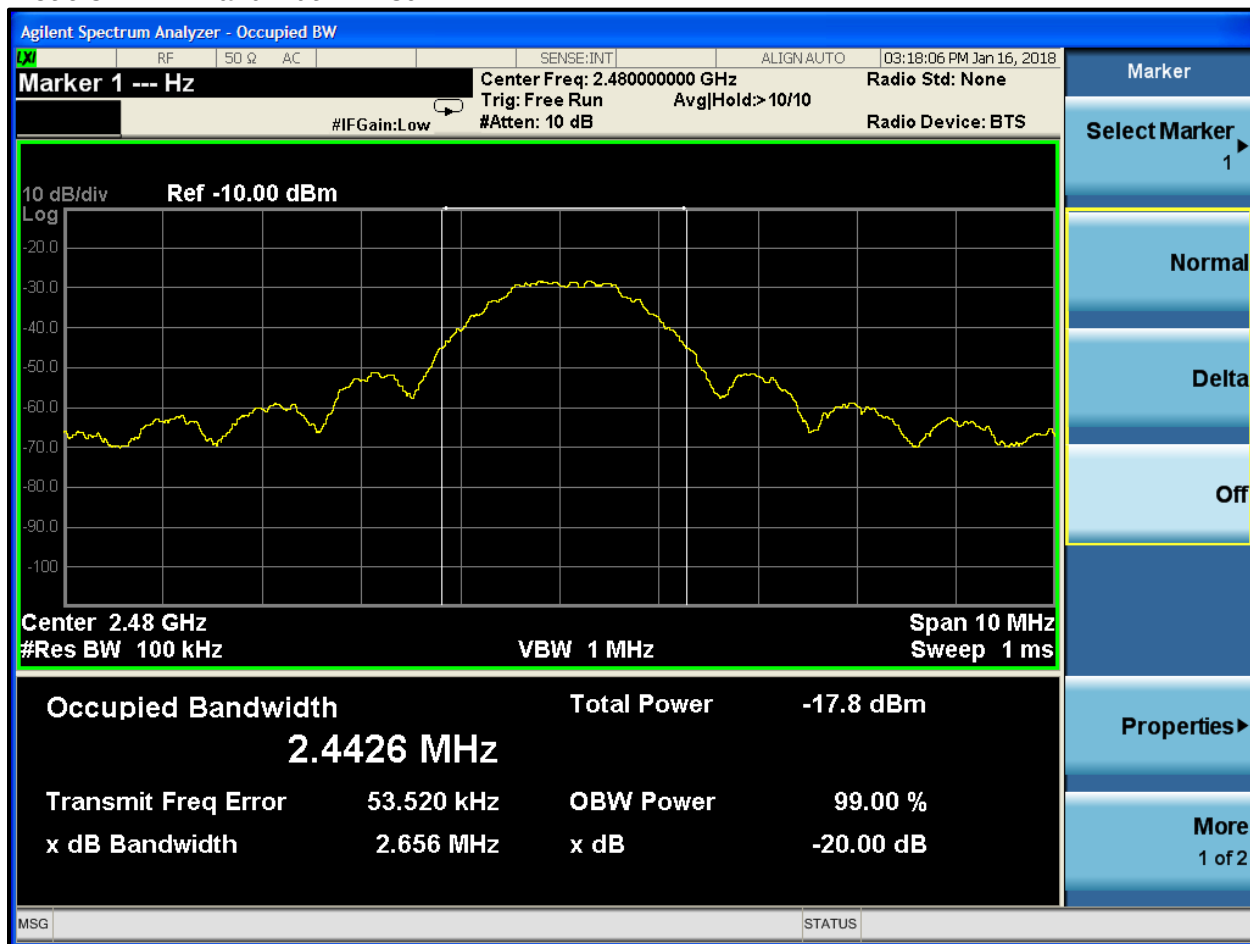


Table 6-1: 20 dB Modulated Bandwidth

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 (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.