



Engineering Solutions & Electromagnetic Compatibility Services

**Certification Application Report  
FCC Part 15.247 & Industry Canada RSS-247**

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<b>FCC/IC ID</b>	IPH-03438 1792A-03438	<b>Test Report Date</b>	April 12, 2018
<b>Platform</b>	N/A	<b>RTL Work Order #</b>	2017241
<b>Model/HVIN</b>	A03438	<b>RTL Quote #</b>	QRTL17-241A
<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>	DTS – Part 15 Digital Transmission System (Wi-Fi, ANT+, BLE portion)		
	DSS - Part 15 Spread Spectrum Transmitter		
<b>FCC Rule Part(s):</b>	FCC Rules Part 15.247: Operation within the bands 920-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz (10/01/17)		
<b>Industry Canada:</b>	RSS-247 Issue 2: Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices RSS-Gen Issue 4: General Requirements for Compliance of Radio Apparatus		
<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>
2412-2462 (Wi-Fi)	0.219	N/A	19M4F1D
2402-2480 (Bluetooth)	0.006	N/A	1M00F1D
2402-2480 (ANT+)	0.005	N/A	1M00F1D
2402-2480 (BLE)	0.005	N/A	1M13F1D

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, ANSI C63.10, and Industry Canada RSS-247 and RSS-Gen.

Signature: 

Date: April 12, 2018

Typed/Printed Name: Desmond A. Fraser

Position: President

*These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANAB.  
Refer to certificate and scope of accreditation AT-1445.*

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

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## 1 General Information

### 1.1 Scope

Applicable Standards:

FCC Rules Part 15.247: Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

Industry Canada RSS-247: Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices

### 1.2 Description of EUT

<b>Equipment Under Test</b>	Body-worn transmitter
<b>Model/HVIN</b>	A03438
<b>Power Supply</b>	Battery operated
<b>Modulation Type</b>	Wi-Fi: CCK, DBPSK; DQPSK; BPSK; QPSK; 16-QAM; 64-QAM ANT+: GFSK BLE: GMSK PRB29, 0x0F, 0x55 Bluetooth: GFSK
<b>Frequency Range</b>	Wi-Fi: 2412–2462 MHz ANT+, BLE and Bluetooth: 2402-2480 MHz
<b>Antenna Connector</b>	Internal

### 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 2013).

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

This is an original certification application for Garmin International Inc. Model/HVIN: A03438, FCC ID: IPH-03438, IC: 1792A-03438.

### 1.5 Modifications

No modifications were required for compliance.

## 2 Test Information

### 2.1 Description of Test Modes

In accordance with FCC 15.31(m), and because the EUT utilizes an operating band greater than 10 MHz, the following frequencies were tested.

**Table 2-1: Channels Tested for Wi-Fi – 802.11b (11 Mbps); 802.11g (54 Mbps); 802.11n (6.5 Mbps)**

Channel	Frequency (MHz)
1	2412
6	2437
11	2462

**Table 2-2: Channels Tested for ANT+**

Channel	Frequency (MHz)
Low	2402
Mid	2441
High	2480

**Table 2-3: Channels Tested for BLE**

Channel	Frequency (MHz)
0	2402
19	2440
39	2480

**Table 2-4: Channels Tested for Bluetooth**

Channel	Frequency (MHz)
2	2402
40	2440
80	2480

### 2.2 Exercising the EUT

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The EUT was provided with software to continuously transmit during testing. The carrier was also checked to verify that information was being transmitted, and all modes were investigated and the worst-case mode was used for final testing. There were no deviations from the test standard(s) and/or methods. The test results reported relate only to the item tested.



**2.3 Test Result Summary**

**Table 2-5: Test Result Summary – FCC Part 15, Subpart C (Section 15.247)**

Standard	Test	Pass/Fail or N/A
FCC 15.209	Radiated Emissions	Pass
FCC 15.247(a)(2)	6 dB Bandwidth	Pass
FCC 15.247(a)(1)	20 dB Bandwidth	Pass
FCC 15.247(a)(1)	Hopping Characteristics	Pass
FCC 15.247(a)(1)	Average Time of Occupancy	Pass
FCC 15.247(b)	Maximum Peak Power Output	Pass
FCC 15.247(d)	Antenna Conducted Spurious Emissions	Pass
FCC 15.247(e)	Power Spectral Density	Pass
FCC 15.247(d)	Band Edge Measurement	Pass

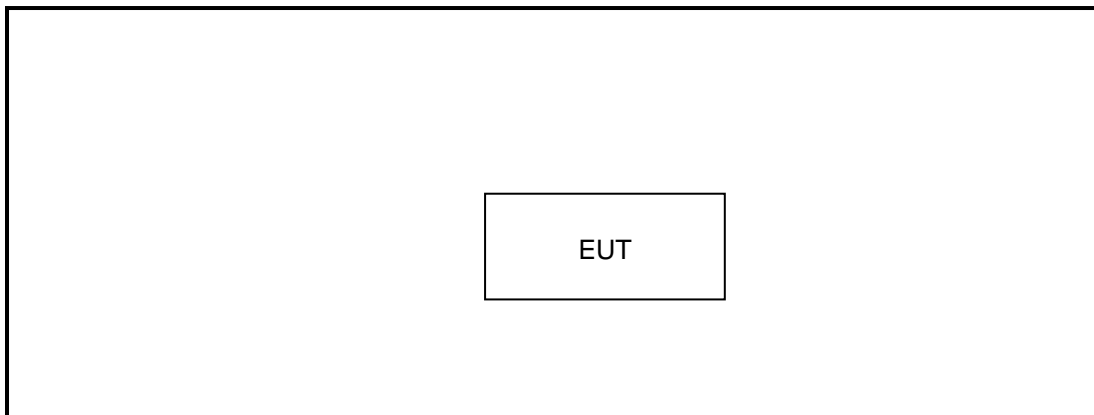
**2.4 Test System Details**

The test sample was received on February 12, 2018. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following tables.

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

Part	Manufacturer	Model/HVIN	Serial Number	FCC ID	Cable Description	RTL Bar Code
Body-worn transmitter (radiated testing)	Garmin International Inc.	A03438	5G5000025	IPH-03438	N/A	22865
Body-worn transmitter (conducted testing)	Garmin International Inc.	A03438	3963228756	IPH-03438	N/A	22733

**2.5 Configuration of Tested System**



**Figure 2-1: Configuration of System Under Test**

### 3 Peak Output Power – FCC 15.247(b); RSS-247 5.4

#### 3.1 Power Output Test Procedure

A conducted power measurement of the EUT was taken using an Agilent N9010A EXA Signal Analyzer with a 50 ohm attenuator.

**Table 3-1: Power Output Test Equipment**

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz-26.5 GHz)	MY51250846	2/6/20
900948	Weinschel Corporation	47-10-43 DC-18GHz	Attenuator, 50W 10dB	BH1487	9/1/18

#### 3.2 Power Output Test Data

**Table 3-2: Power Output Test Data – Bluetooth**

Channel	Frequency (MHz)	Peak Power Conducted Output (dBm)
2	2402	7.5
40	2440	7.1
80	2480	6.1

**Table 3-3: Power Output Test Data – ANT+**

Channel	Frequency (MHz)	Peak Power Conducted Output (dBm)
Low	2402	6.5
Mid	2441	6.1
High	2480	4.6

**Table 3-4: Power Output Test Data – BLE**

Channel	Frequency (MHz)	Peak Power Conducted Output (dBm)
0	2402	6.5
19	2440	5.9
39	2480	4.7

**Table 3-5: Power Output Test Data – 802.11b (11 Mbps)**

Channel	Frequency (MHz)	Peak Power Conducted Output (dBm)
1	2412	22.7
6	2437	23.1
11	2462	21.9

**Table 3-6: Power Output Test Data – 802.11g (54 Mbps)**

Channel	Frequency (MHz)	Peak Power Conducted Output (dBm)
1	2412	23.1
6	2437	22.8
11	2462	22.2

**Table 3-7: Power Output Test Data – 802.11n (6.5 Mbps)**

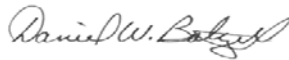
Channel	Frequency (MHz)	Peak Power Conducted Output (dBm)
1	2412	22.8
6	2437	23.4
11	2462	23.2

Measurement uncertainties shown for these tests are expanded Gaussian uncertainties expressed at 95% confidence level using a coverage factor  $k = 1.96$ . Measurement uncertainty = 0.5 dB.

**PASS**

**Test Personnel:**

Daniel W. Baltzell  
 Test Engineer

  
 Signature

February 15, 2018  
 Date of Test

#### 4 Compliance with the Band Edge – FCC 15.247(d); RSS-247 2.2

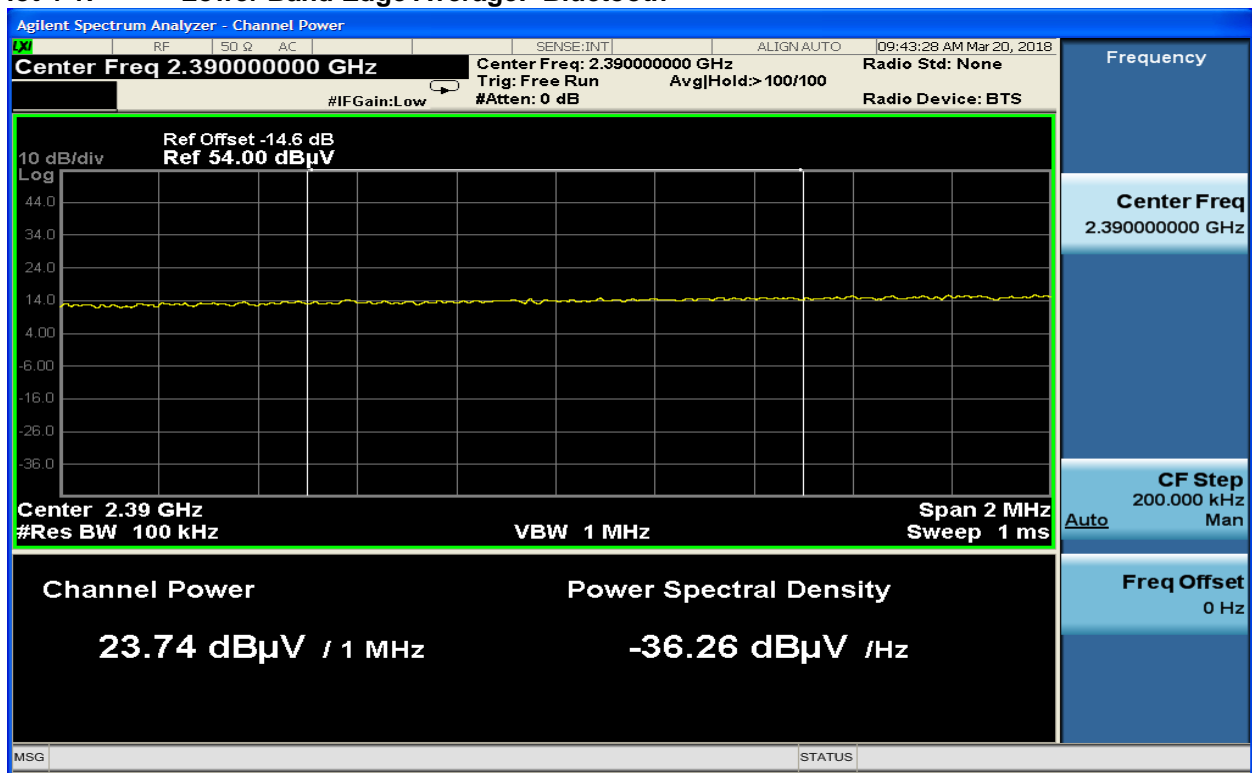
##### 4.1 Band Edge Test Procedure

The transmitter output was connected to its appropriate antenna. 1 MHz integrated peak (100 kHz RBW/1 MHz VBW) and 1 MHz integrated average (100 MHz RBW/1 MHz VBW) corrected measurements were taken within the restricted band to show compliance.

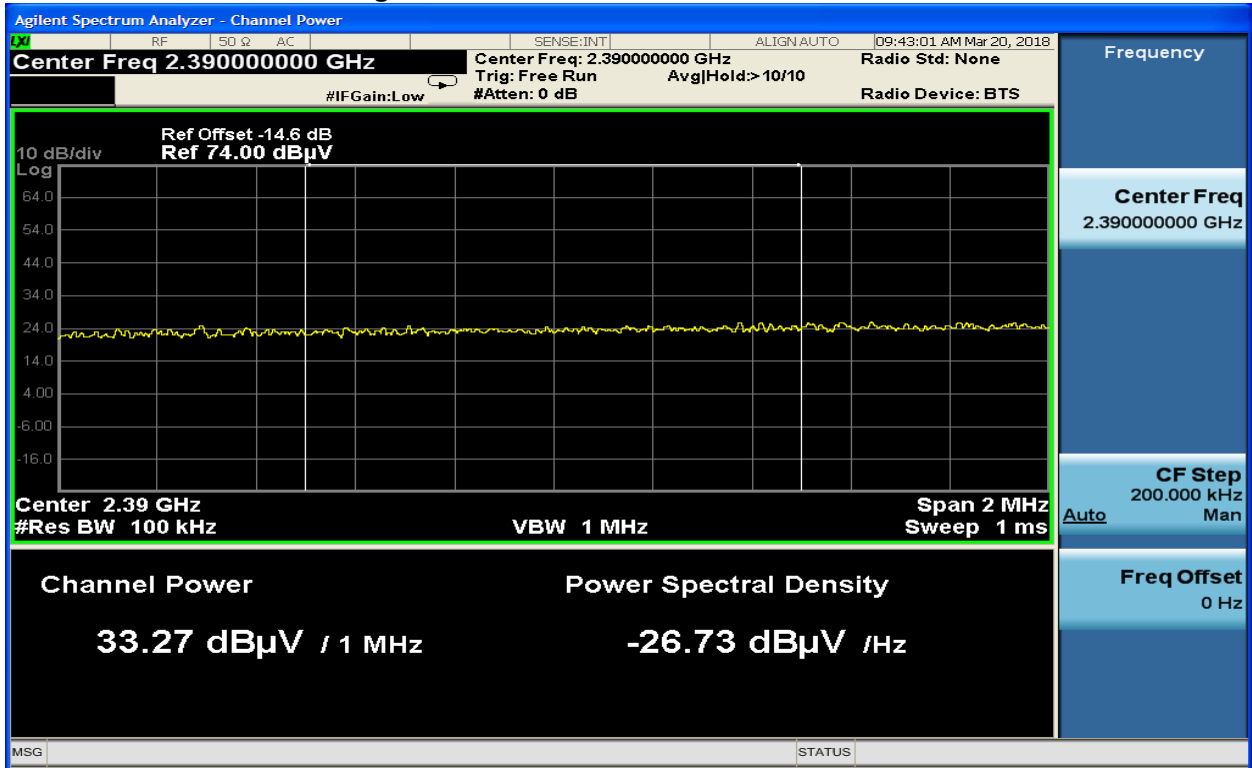
##### 4.2 Restricted Band Edge Test Results

###### 4.2.1 Lower Band Edge

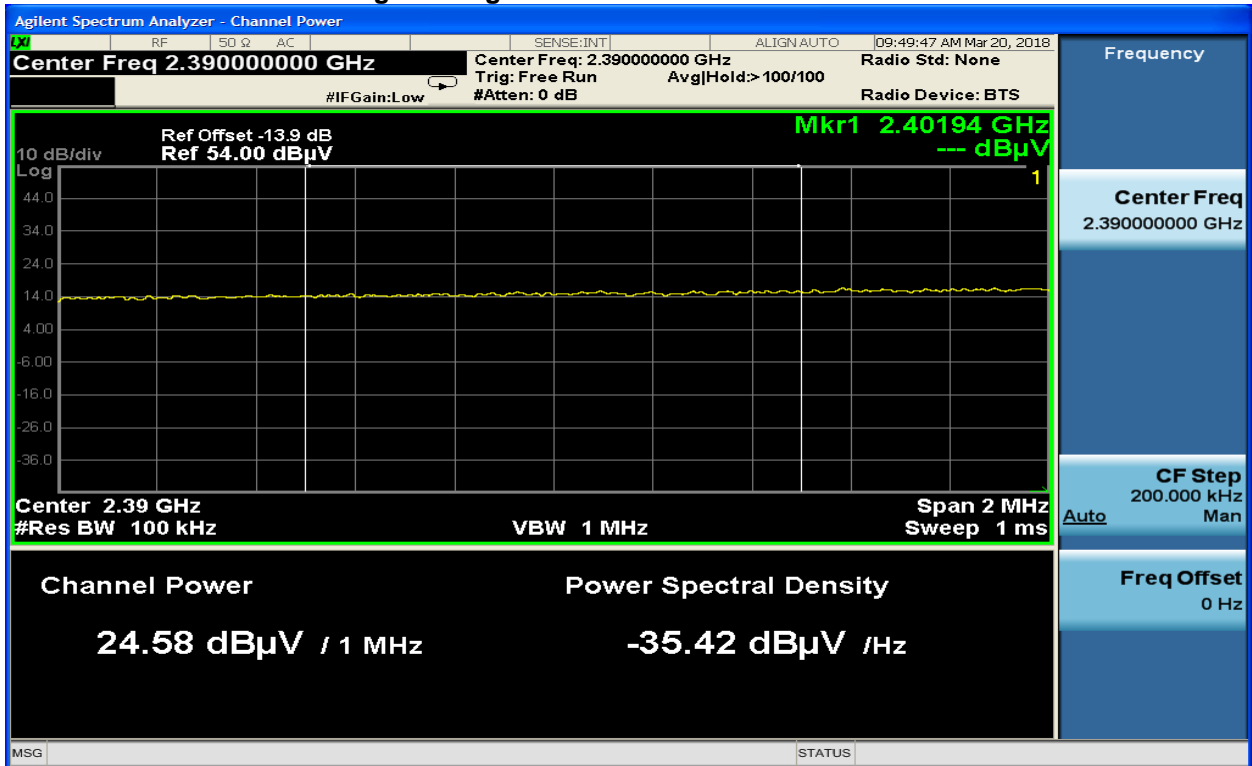
Plot 4-1: Lower Band Edge Average: Bluetooth



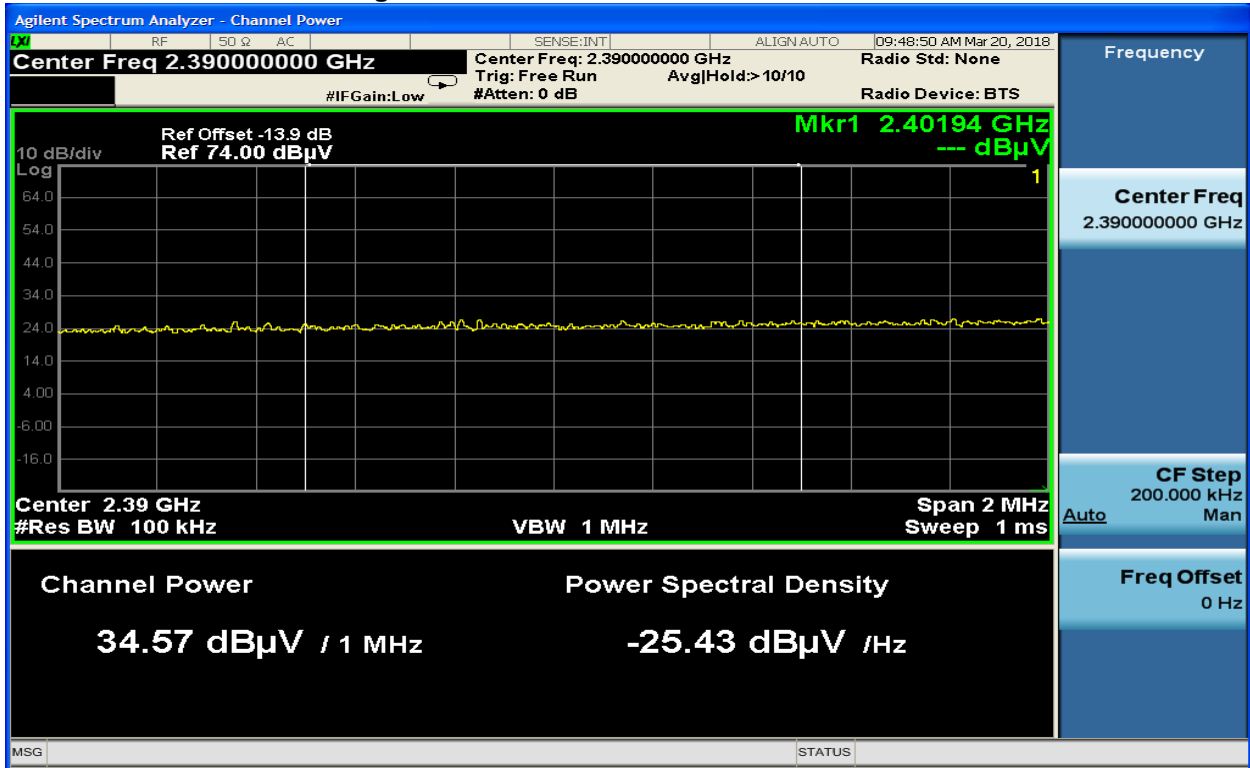
**Plot 4-2: Lower Band Edge Peak: Bluetooth**



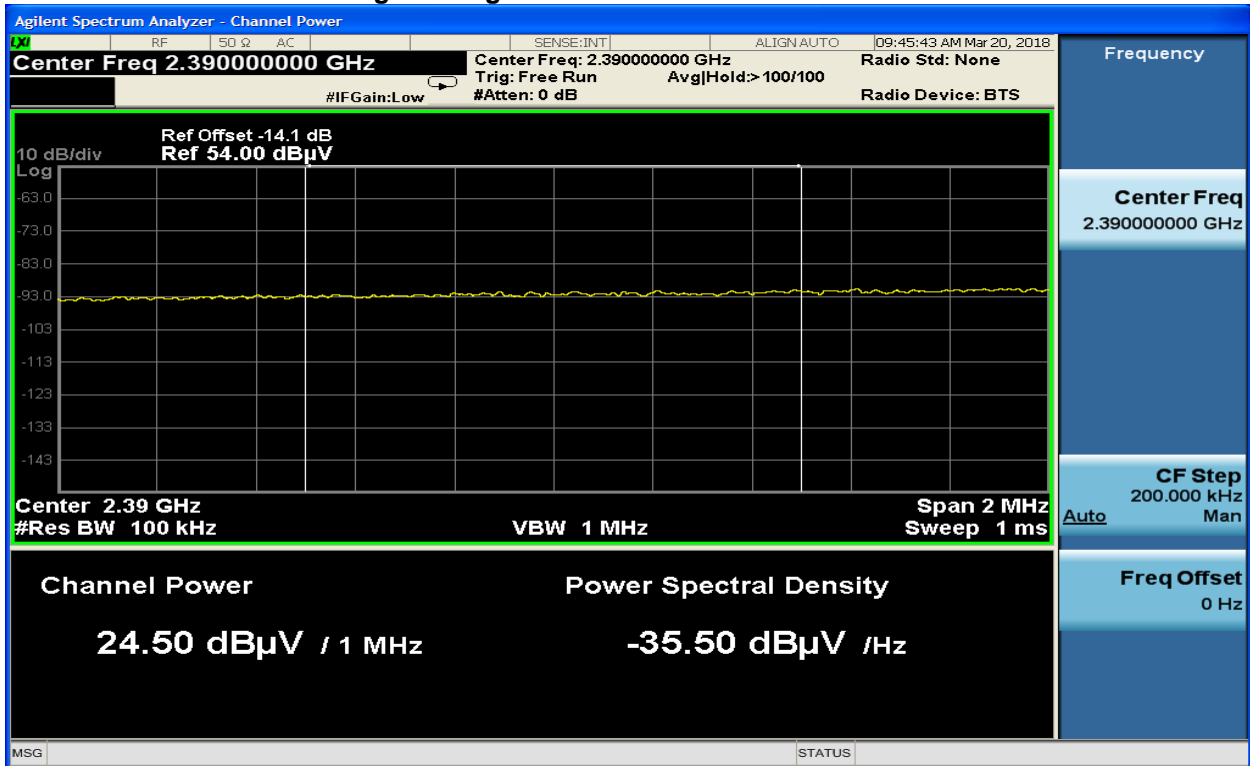
**Plot 4-3: Lower Band Edge Average: ANT+**



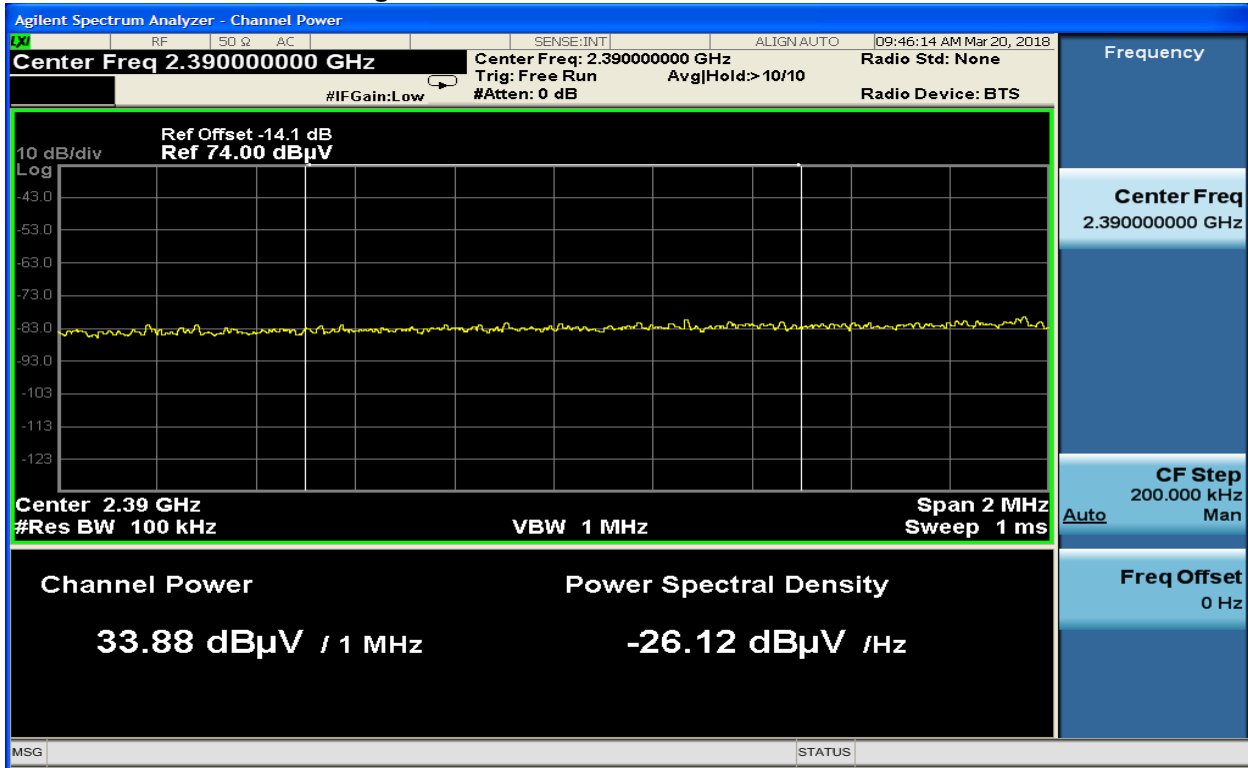
**Plot 4-4: Lower Band Edge Peak: ANT+**



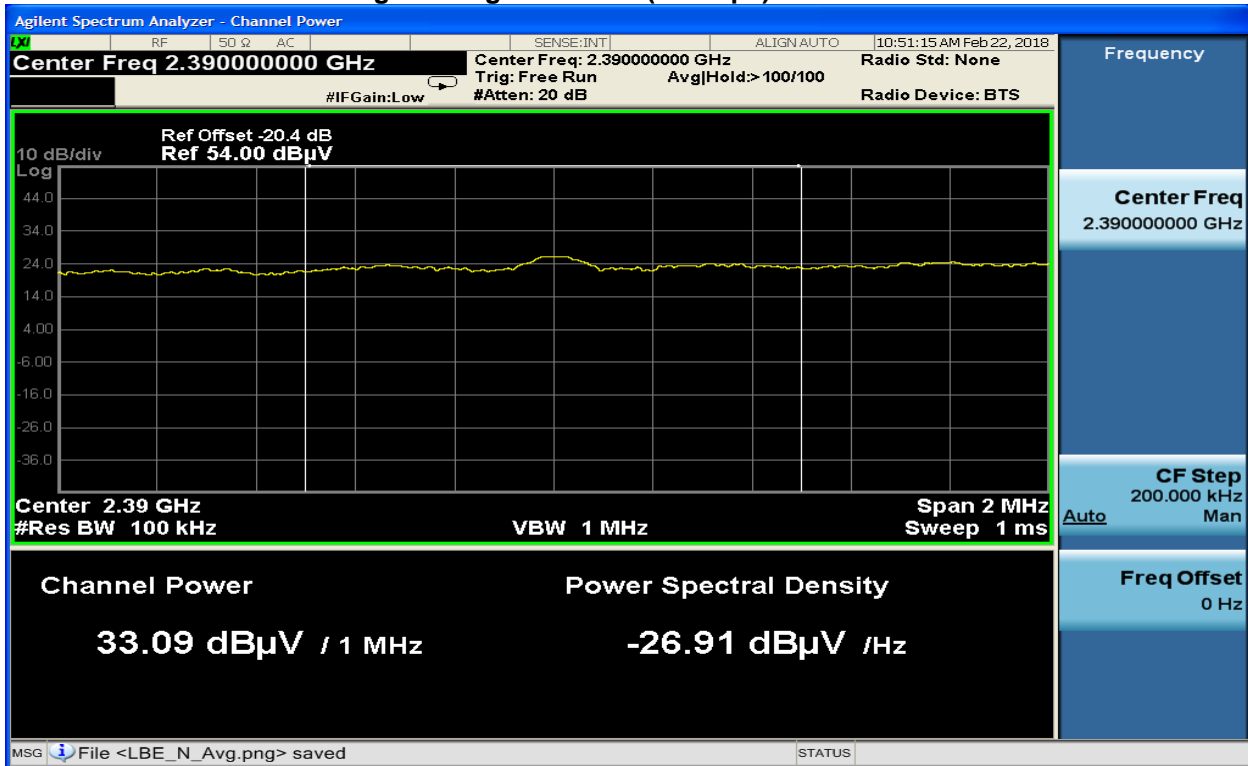
**Plot 4-5: Lower Band Edge Average: BLE**



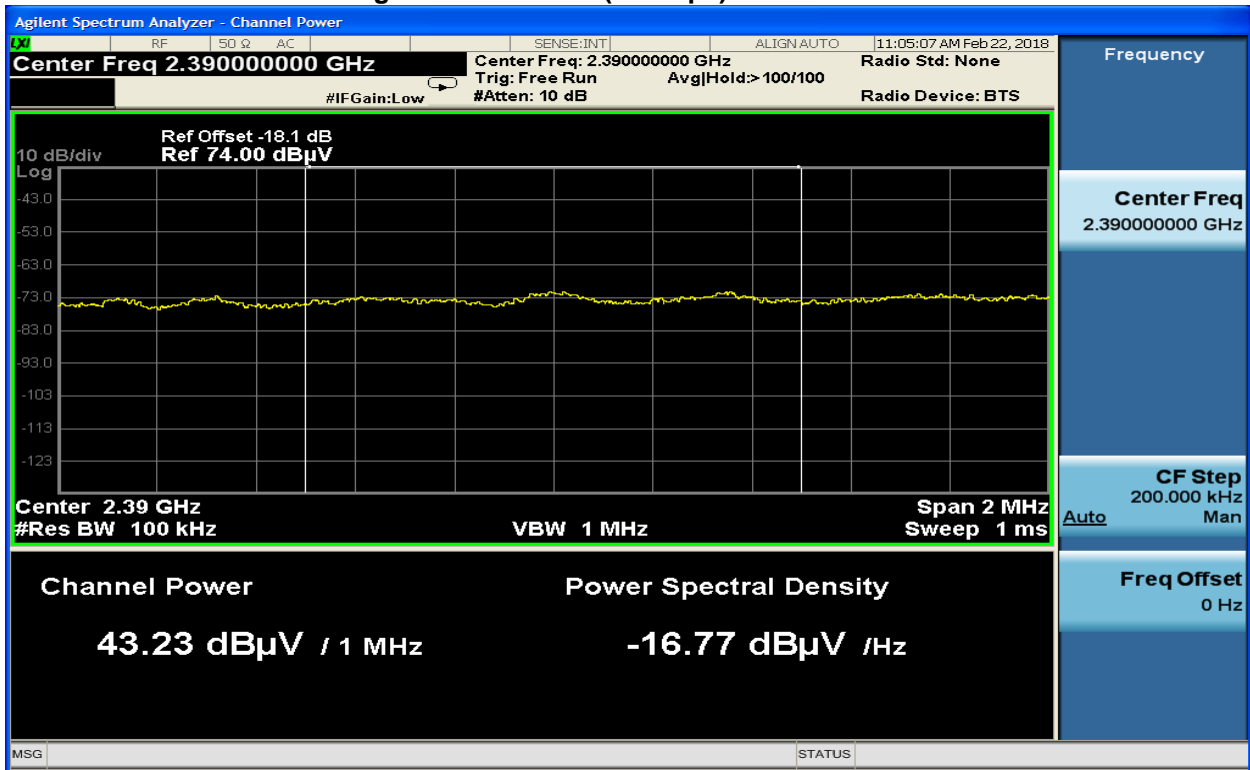
**Plot 4-6: Lower Band Edge Peak: BLE**



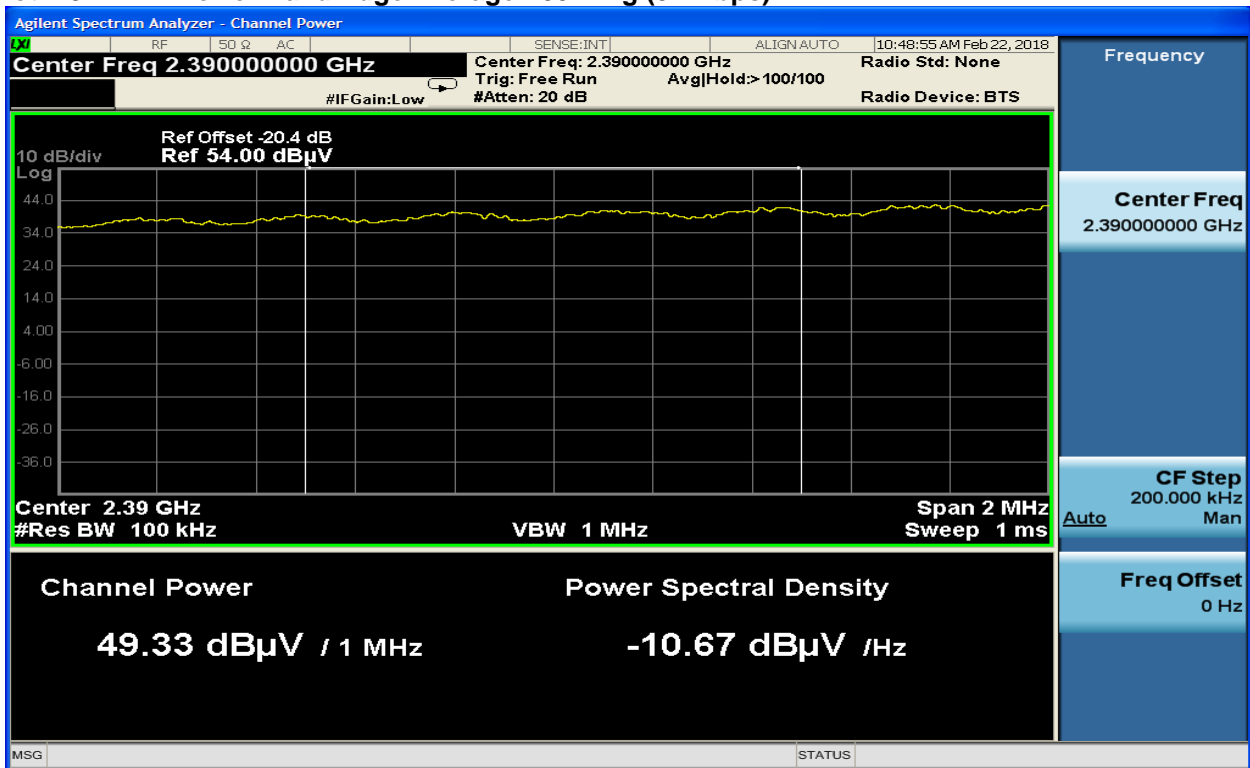
**Plot 4-7: Lower Band Edge Average: 802.11b (11 Mbps)**



**Plot 4-8: Lower Band Edge Peak: 802.11b (11 Mbps)**

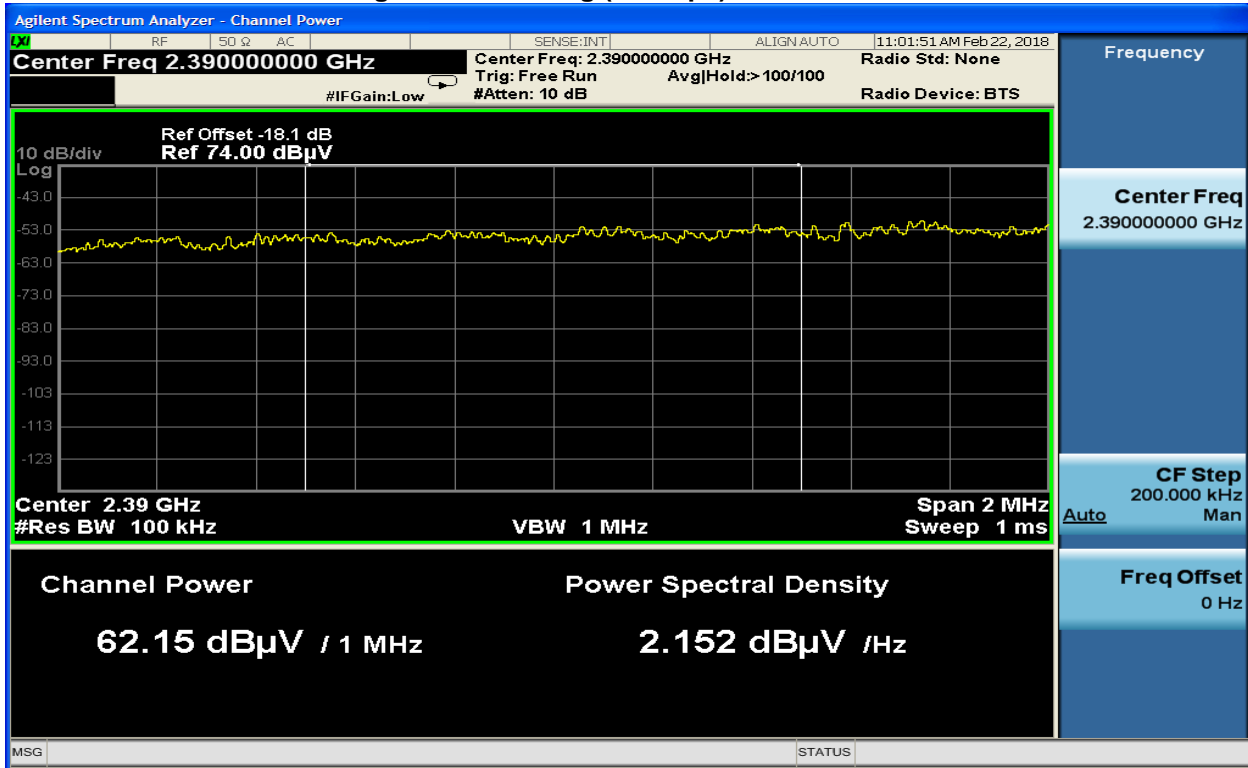


**Plot 4-9: Lower Band Edge Average: 802.11g (54 Mbps)**

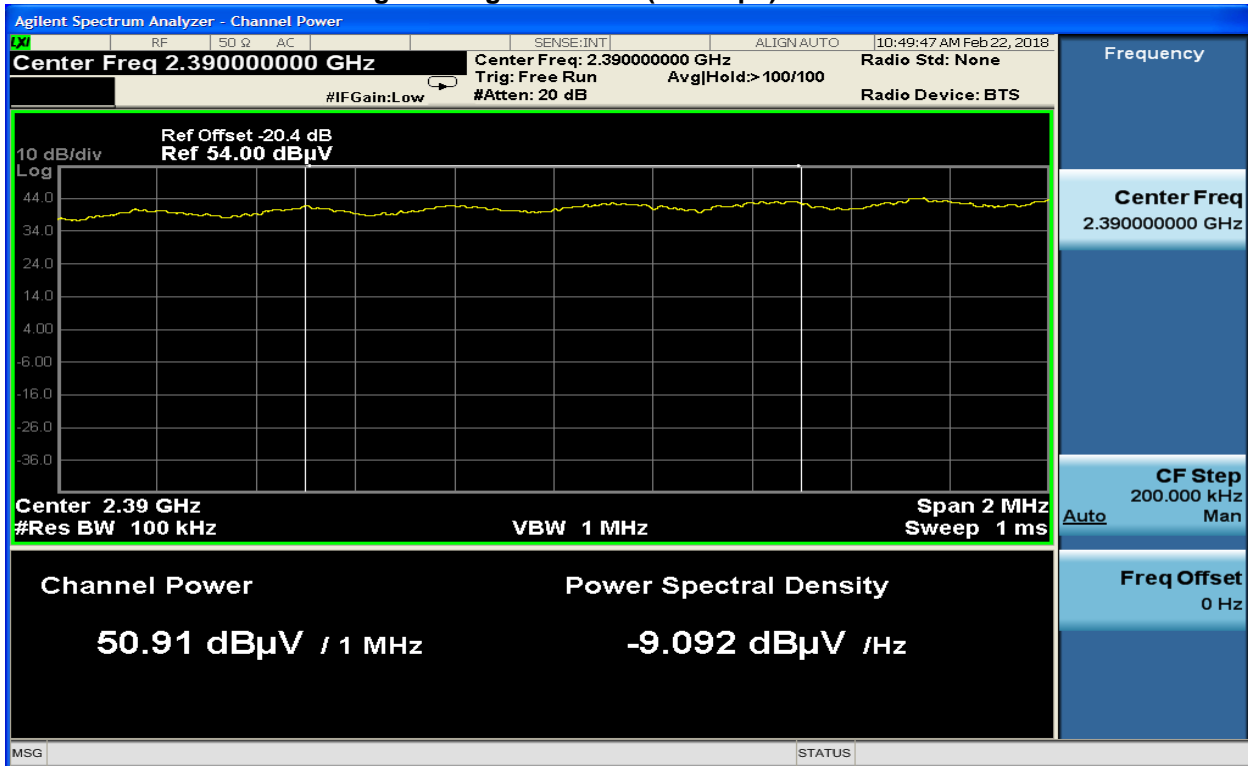




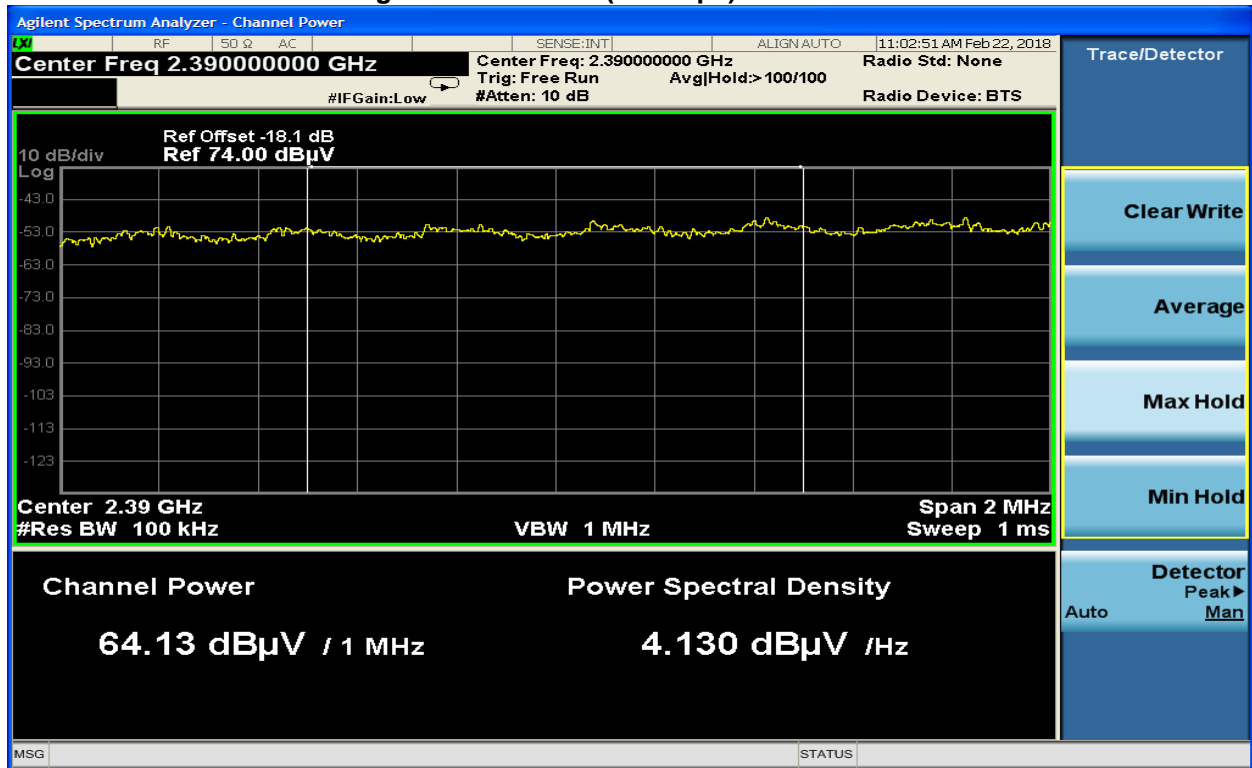
**Plot 4-10: Lower Band Edge Peak: 802.11g (54 Mbps)**



**Plot 4-11: Lower Band Edge Average: 802.11n (6.5 Mbps)**

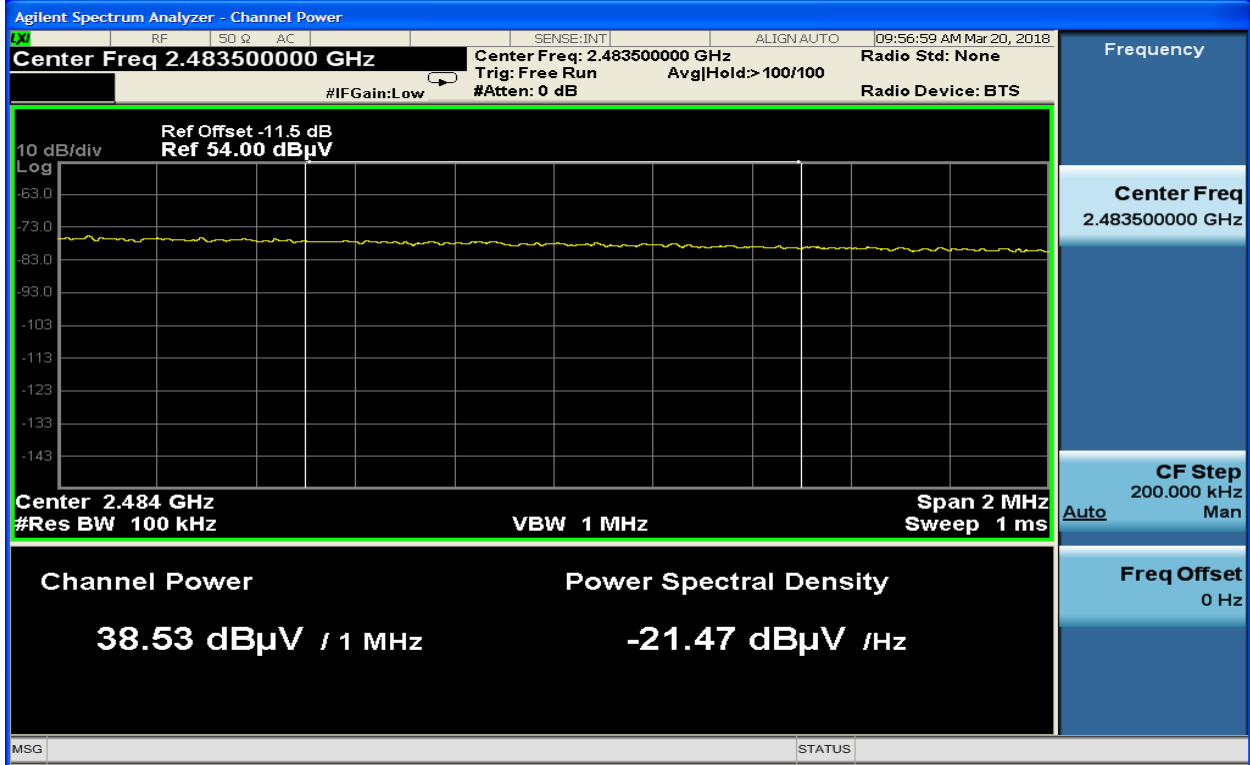


**Plot 4-12: Lower Band Edge Peak: 802.11n (6.5 Mbps)**

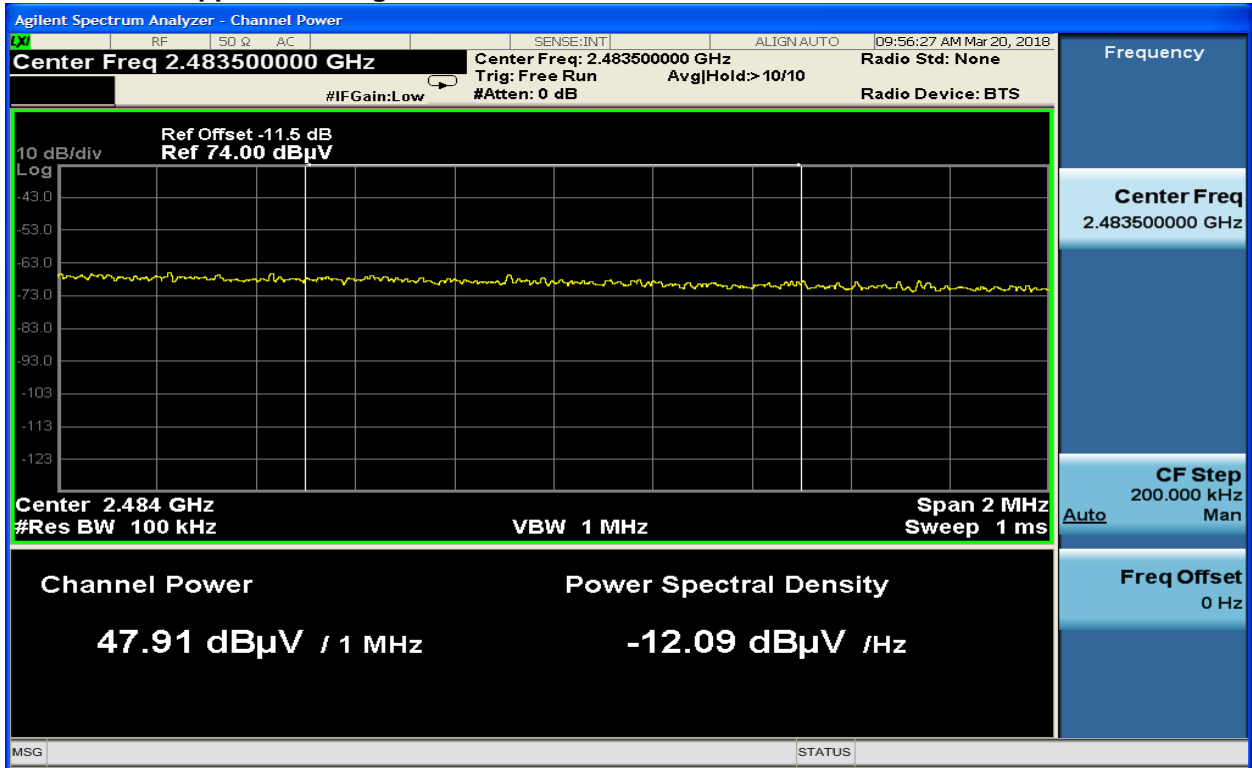


4.2.2 Upper Band Edge

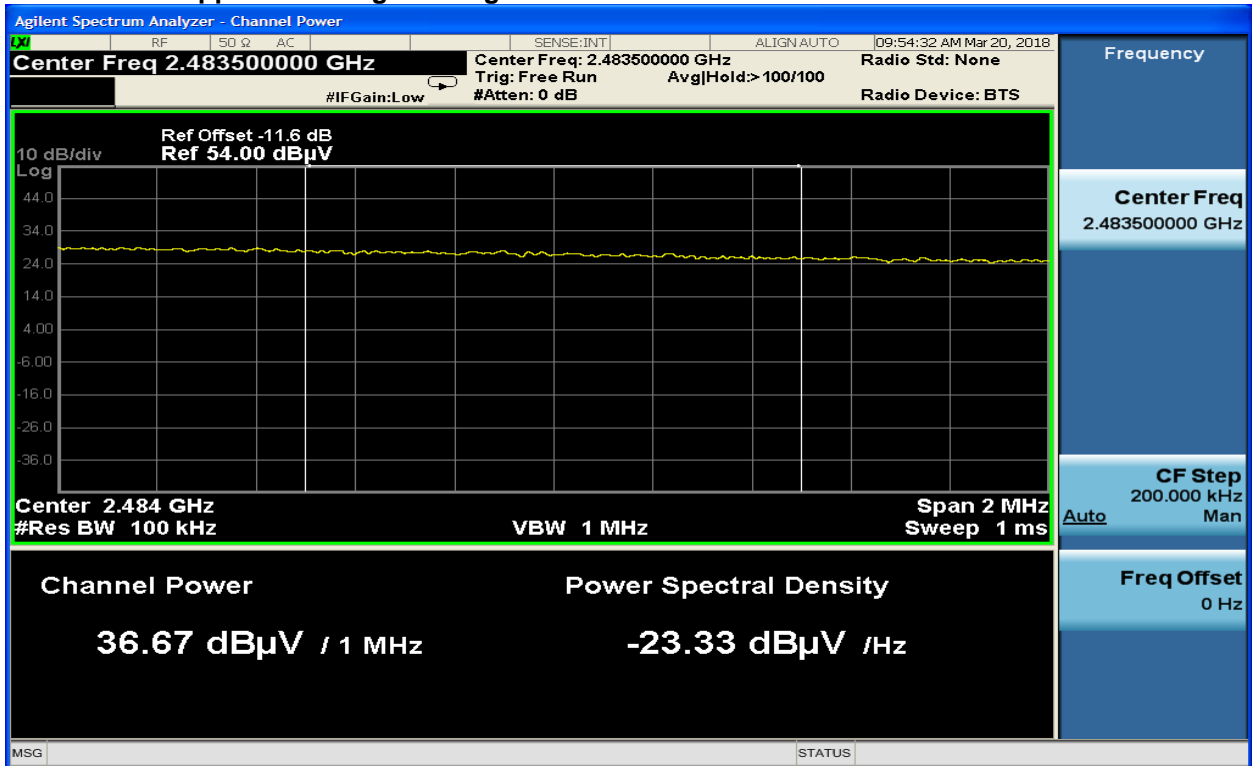
Plot 4-13: Upper Band Edge Average: Bluetooth



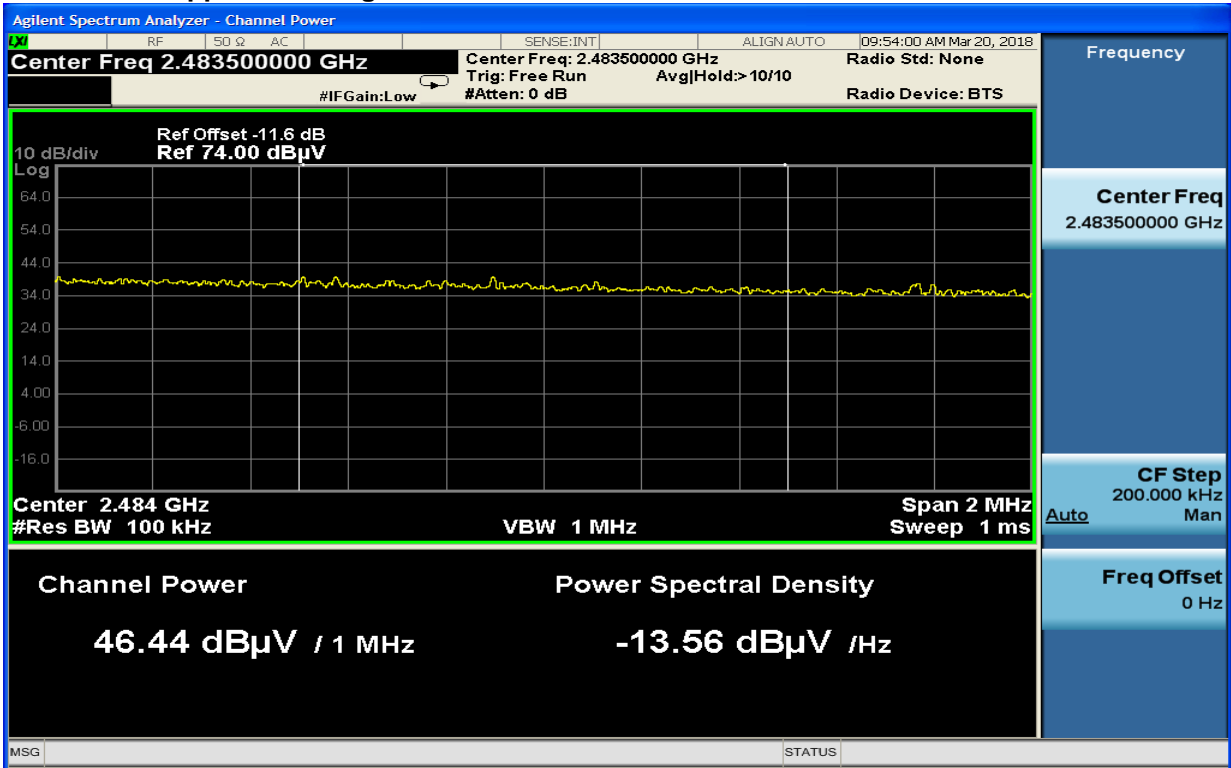
**Plot 4-14: Upper Band Edge Peak: Bluetooth**



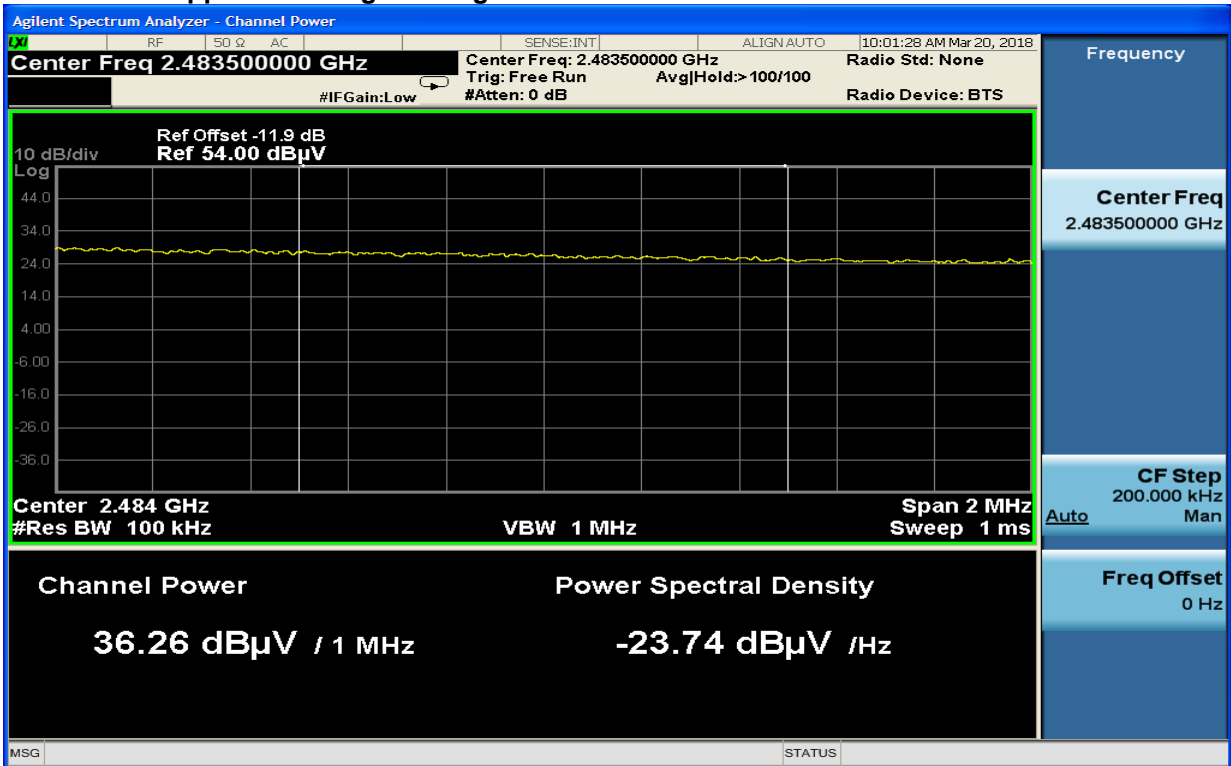
**Plot 4-15: Upper Band Edge Average: ANT+**



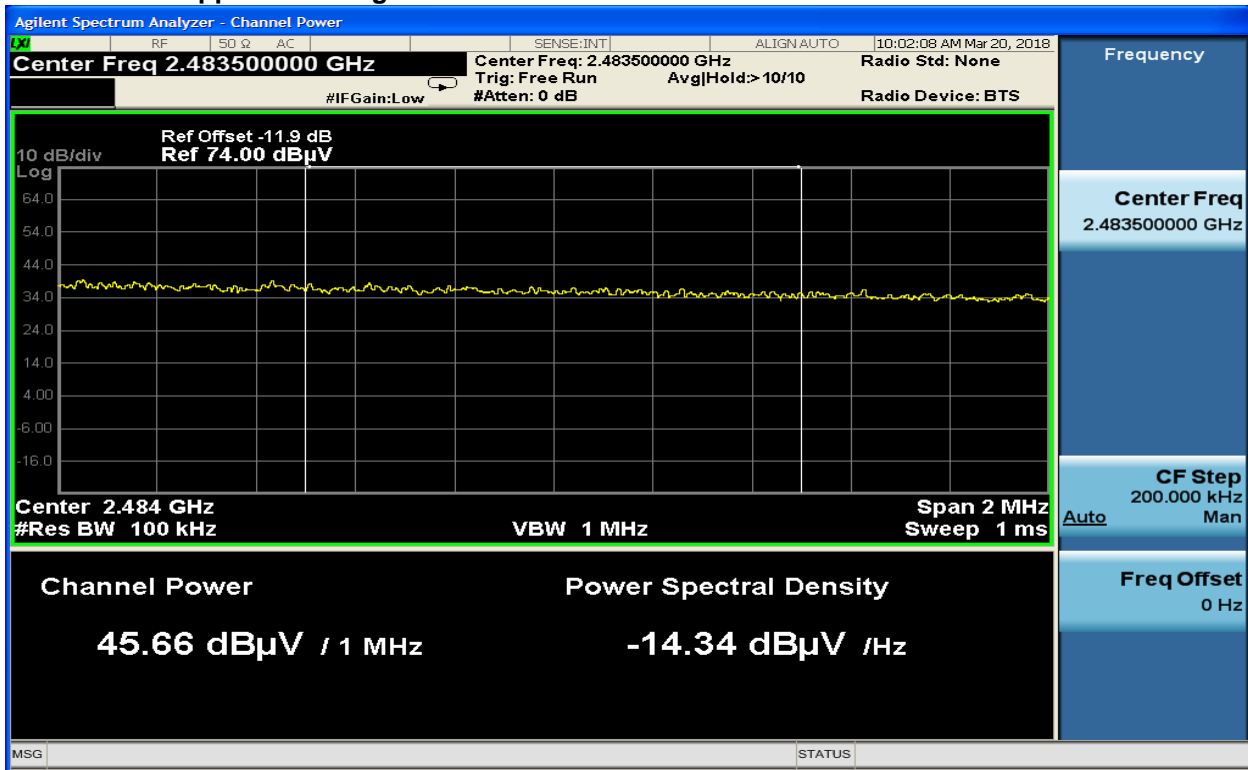
**Plot 4-16: Upper Band Edge Peak: ANT+**



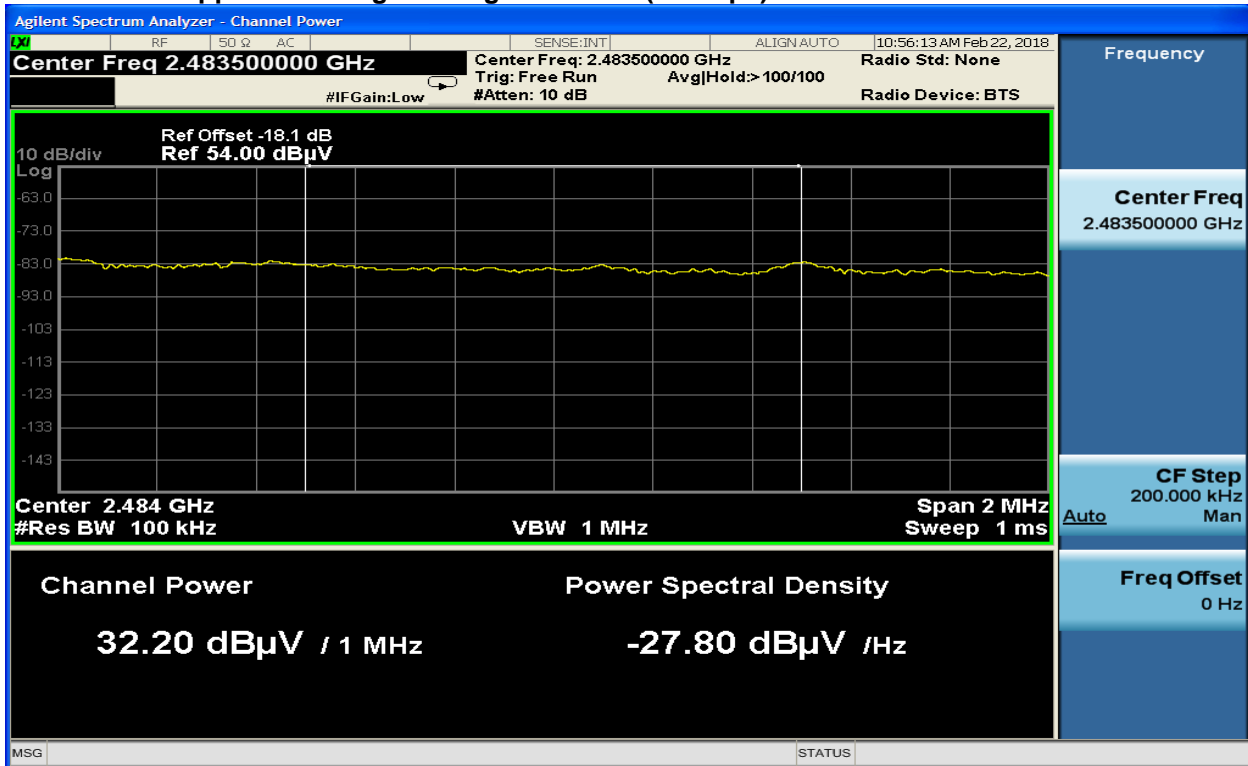
**Plot 4-17: Upper Band Edge Average: BLE**



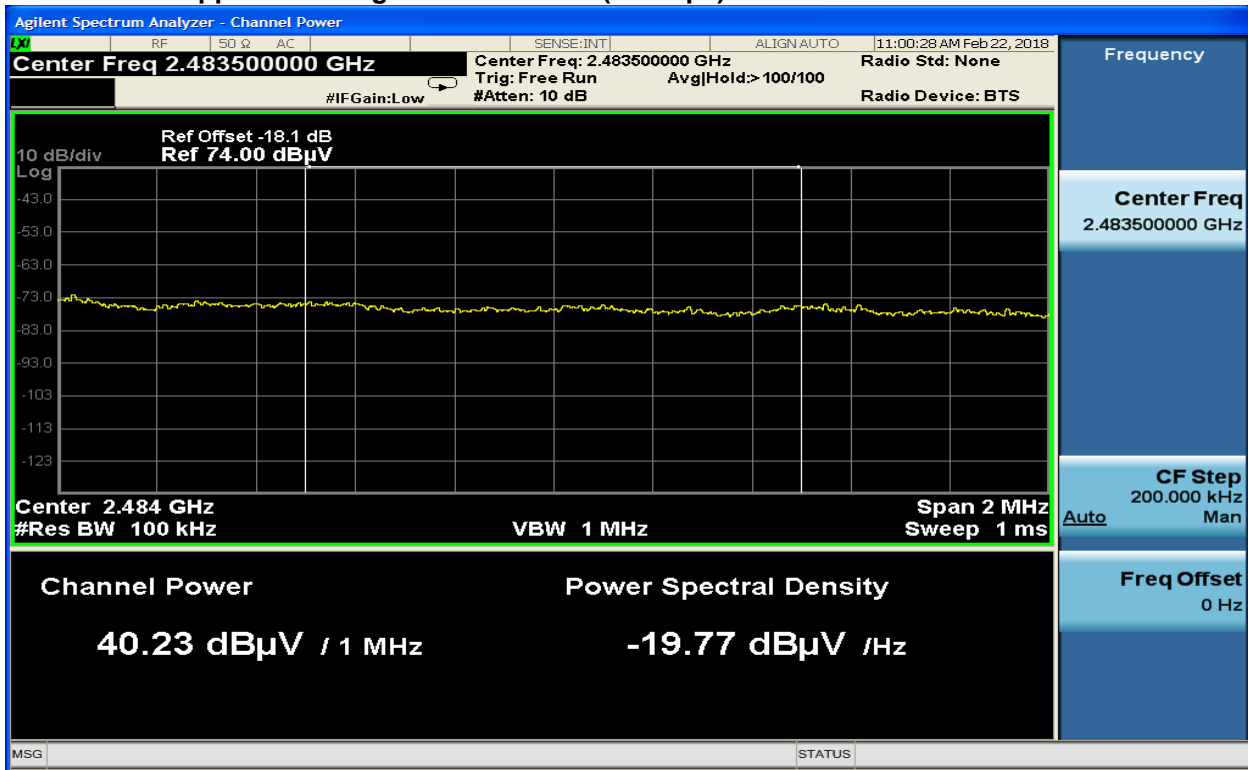
**Plot 4-18: Upper Band Edge Peak: BLE**



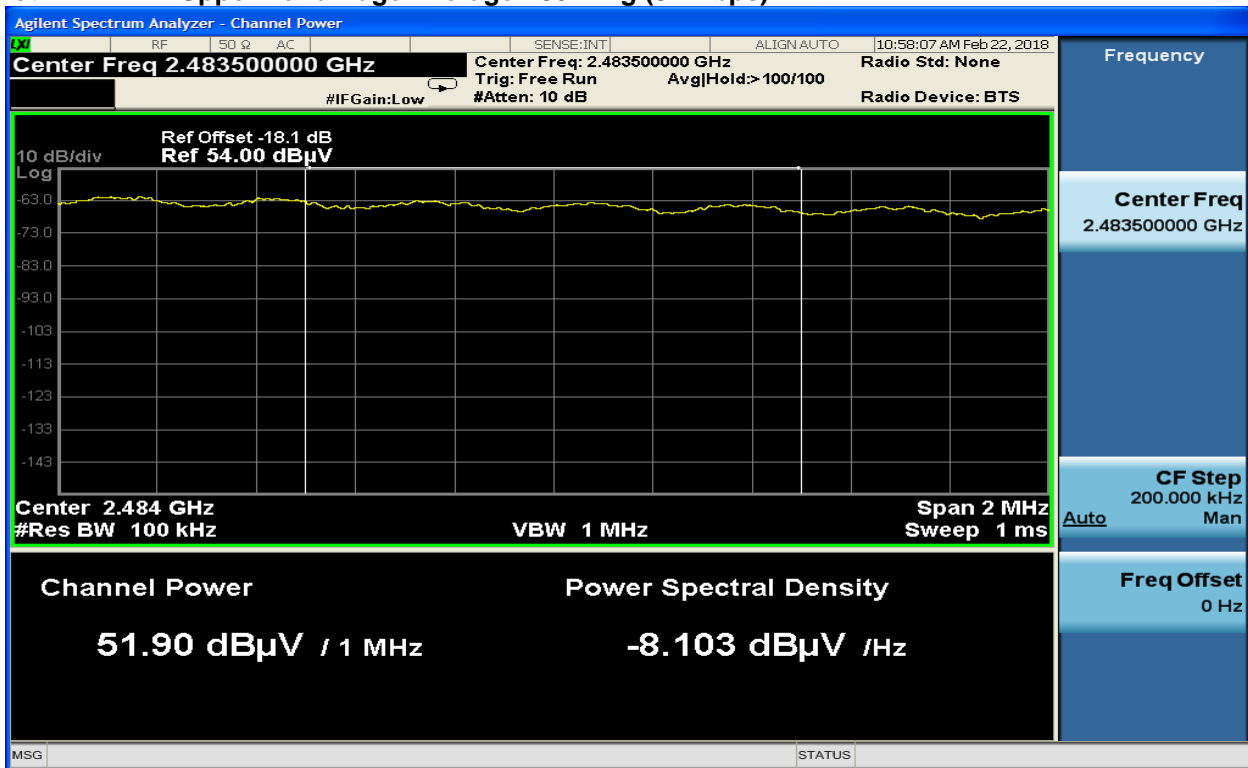
**Plot 4-19: Upper Band Edge Average: 802.11b (11 Mbps)**



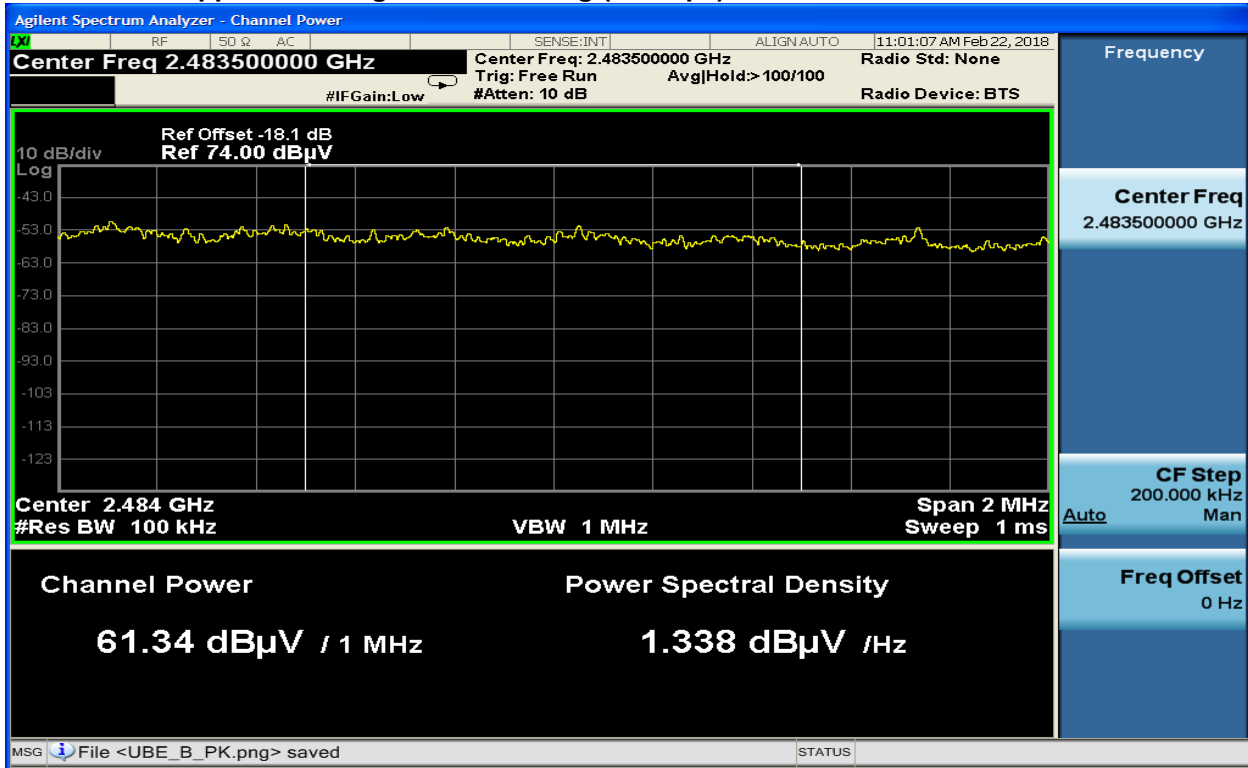
**Plot 4-20: Upper Band Edge Peak: 802.11b (11 Mbps)**



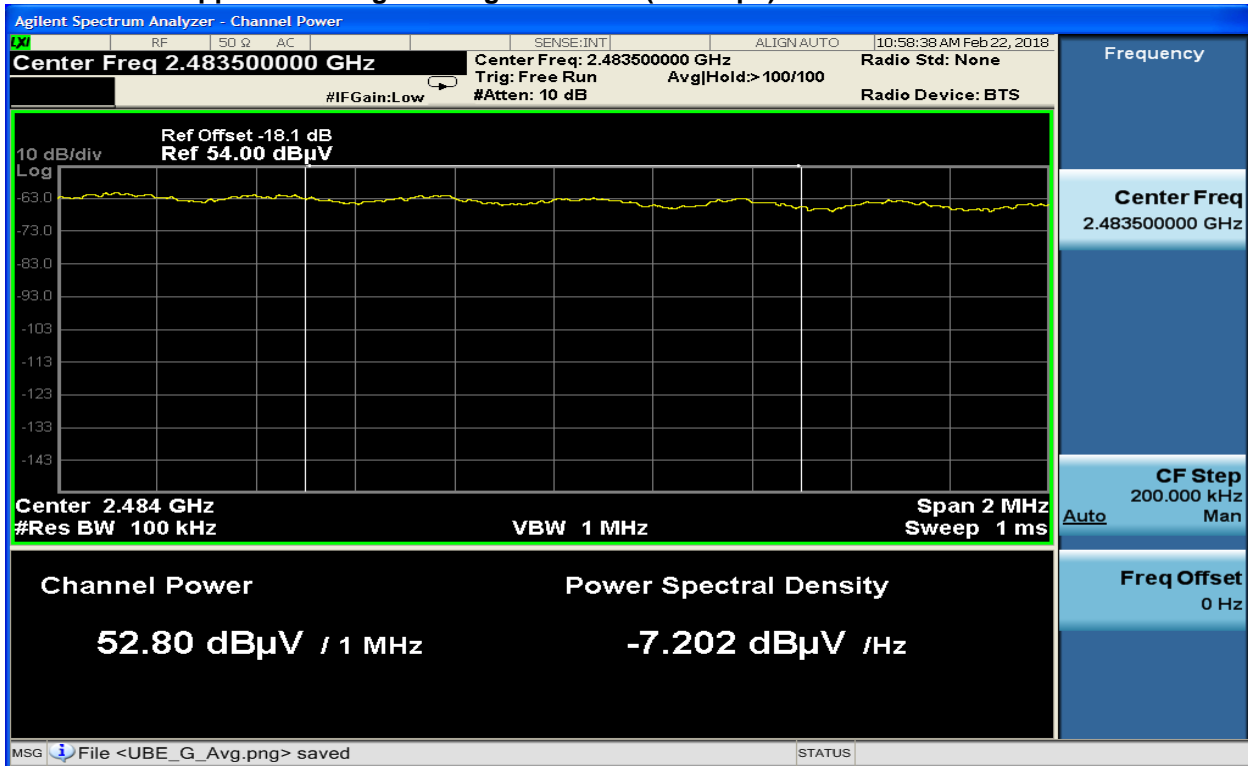
**Plot 4-21: Upper Band Edge Average: 802.11g (54 Mbps)**



**Plot 4-22: Upper Band Edge Peak: 802.11g (54 Mbps)**

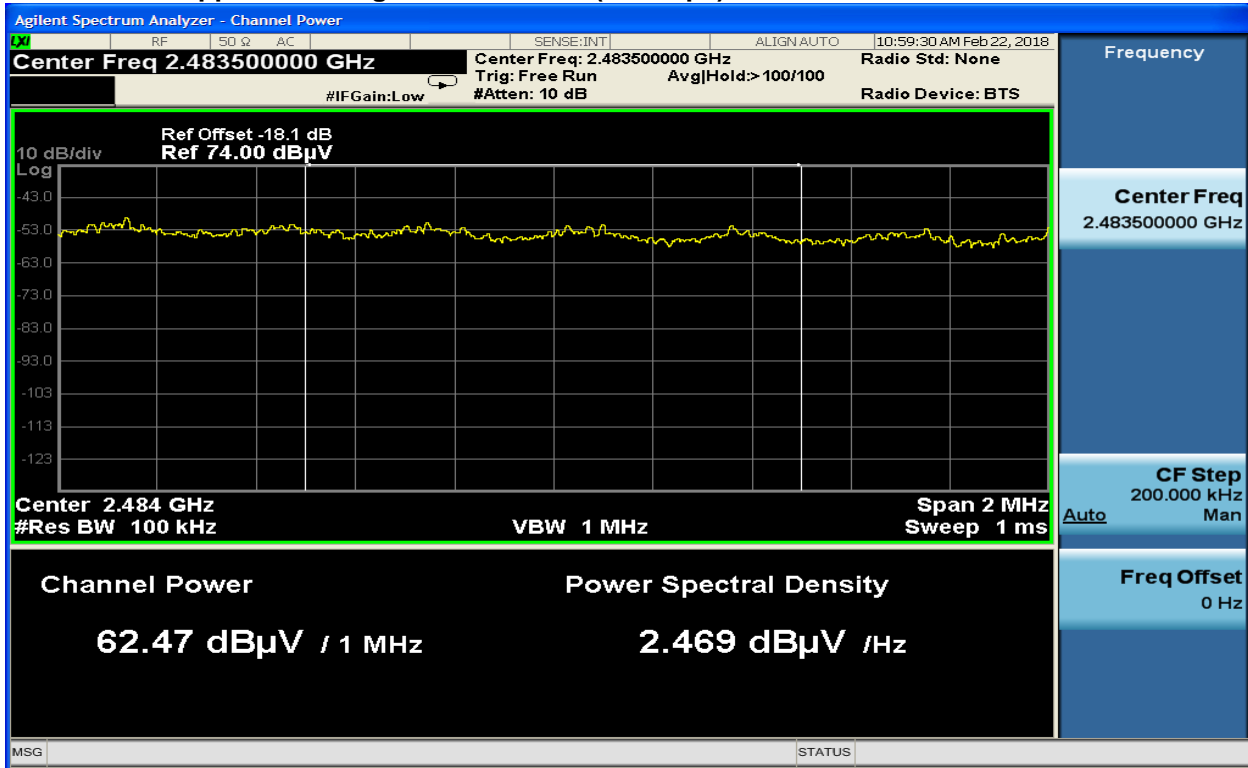


**Plot 4-23: Upper Band Edge Average: 802.11n (6.5 Mbps)**





**Plot 4-24: Upper Band Edge Peak: 802.11n (6.5 Mbps)**



Measurement uncertainty:  $\pm 1.4\%$ . This measurement uncertainty is an expanded uncertainty for 95.45% confidence level received with a coverage factor  $k=2$ .

**Table 4-1: Band Edge Test Equipment**

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz-26.5 GHz)	MY51250846	2/6/20

**PASS**

**Test Personnel:**

Daniel W. Baltzell  
 Test Engineer

*Daniel W. Baltzell*  
 Signature

February 22, 2018  
 Date of Test

**5 Antenna Conducted Spurious Emissions – FCC 15.247(d); RSS-Gen**

**5.1 Antenna Conducted Spurious Emissions Test Procedures**

Antenna spurious emissions per FCC 15.247(d) were measured from the EUT antenna port using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 300 kHz. The modulated carrier was identified at the following frequencies: 2412 MHz, 2437 MHz and 2462 MHz for Wi-Fi; 2402 MHz, 2441 MHz and 2480 MHz for ANT+; 2402 MHz, 2440 MHz and 2480 MHz for BLE and Bluetooth modes.

**5.2 Antenna Conducted Spurious Emissions Test Results**

No harmonics or spurs were found within 20 dB (note that we are reporting power as peak) of the carrier level from the carrier to the 10<sup>th</sup> harmonic of the carrier frequency. Per FCC 15.31(o), no data is being reported.


**Table 5-1: Antenna Conducted Spurious Test Equipment**

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz-26.5 GHz)	MY51250846	2/6/20

Measurement uncertainty: Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2. Measurement uncertainty = -2 dB / +2 dB.

**PASS**

**Test Personnel:**

Daniel W. Baltzell		February 15-March 27, 2018
Test Engineer	Signature	Dates of Test

**6 20 dB Bandwidth – FCC 15.247(a)(1); RSS-247 5.1**

**6.1 20 dB Bandwidth Test Procedure**

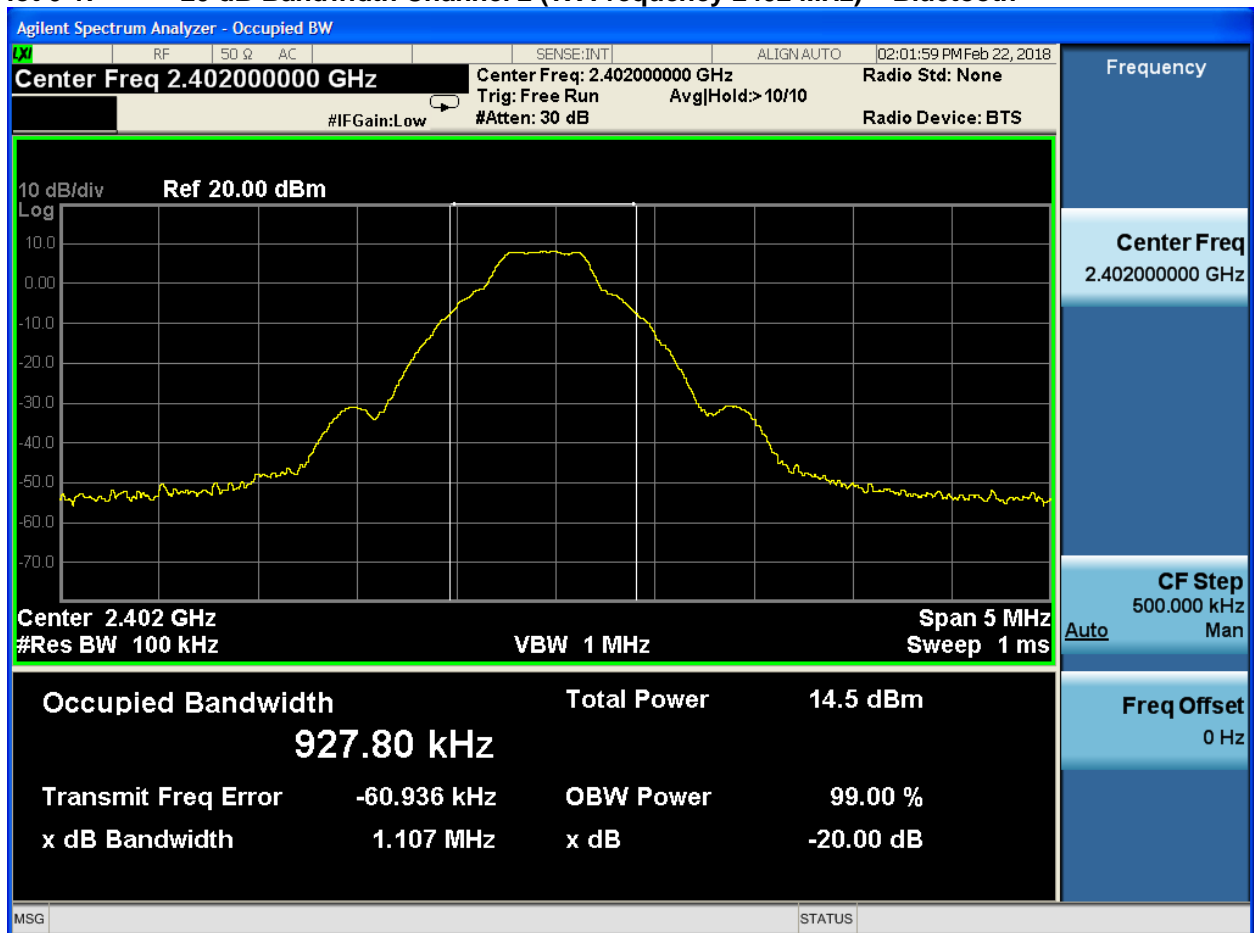
The minimum 20 dB bandwidths per FCC 15.247(a)(1) were measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at  $\geq 3 \times \text{RBW}$ . The device was modulated. The minimum 20 dB bandwidths are presented below.

**6.2 20 dB Bandwidth Test Data**

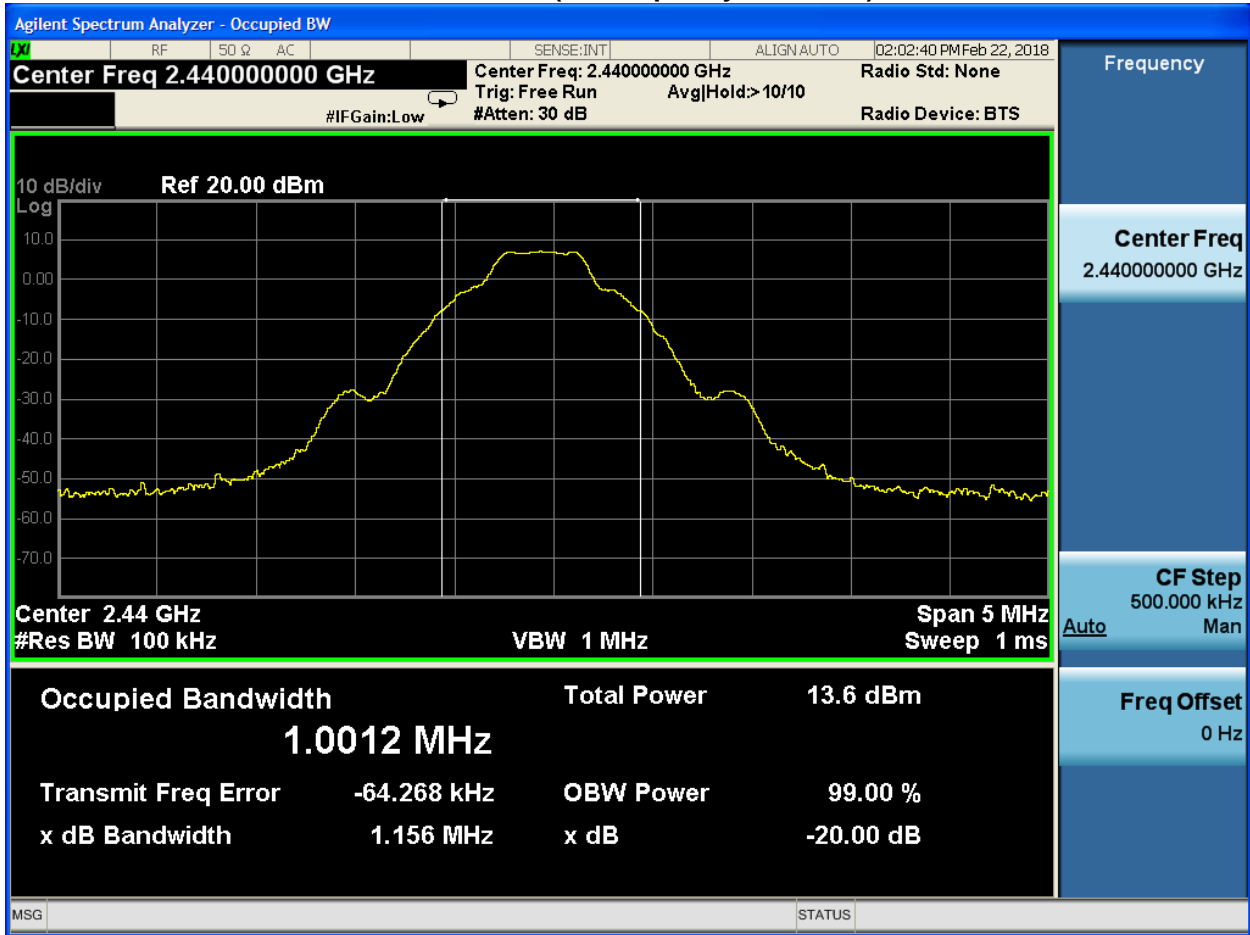
**Table 6-1: 20 dB Bandwidth Test Data – Bluetooth**

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
2	2402	1.107
40	2440	1.156
80	2480	1.144

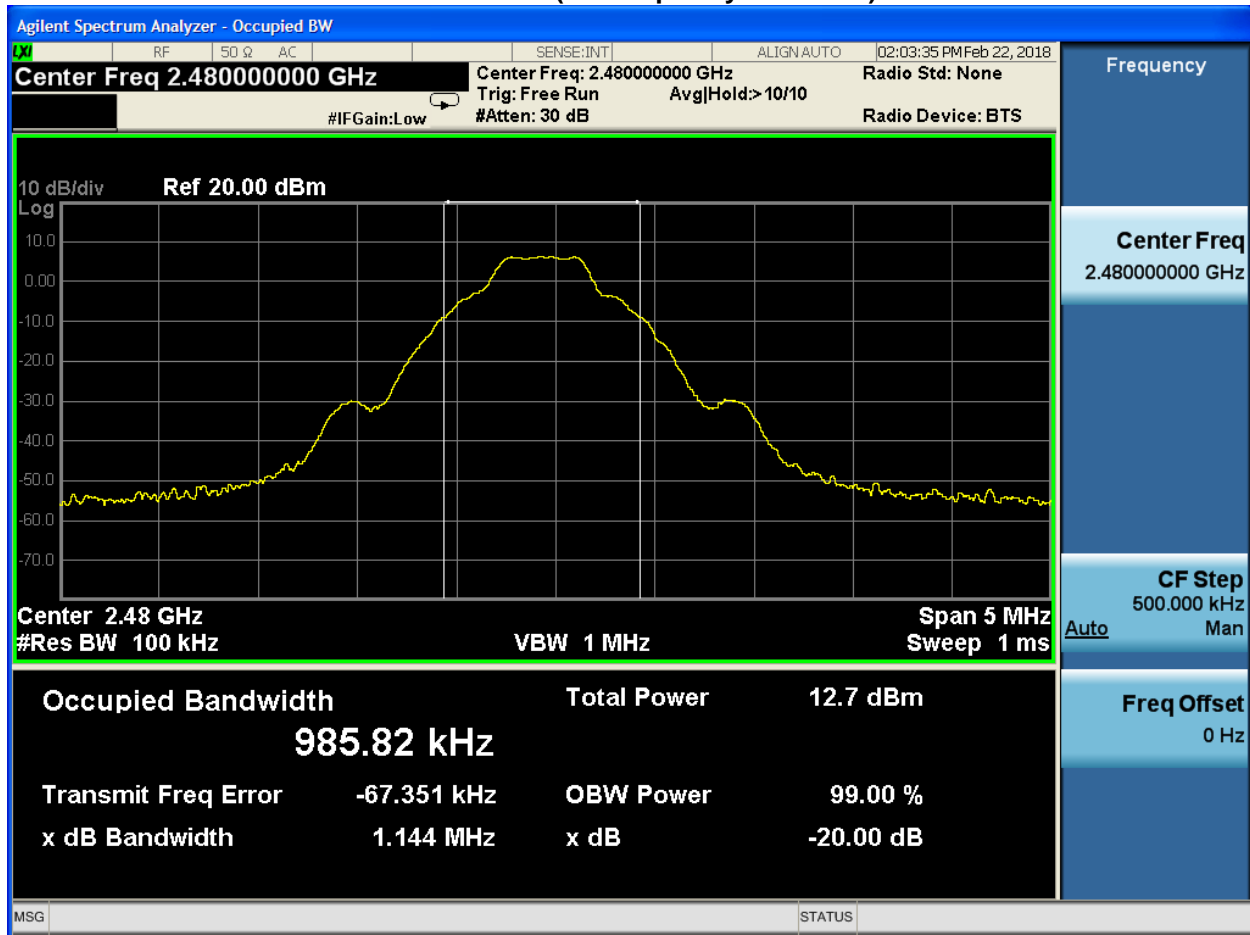
**Plot 6-1: 20 dB Bandwidth Channel 2 (TX Frequency 2402 MHz) – Bluetooth**



**Plot 6-2: 20 dB Bandwidth Channel 40 (TX Frequency 2440 MHz) – Bluetooth**



**Plot 6-3: 20 dB Bandwidth Channel 80 (TX Frequency 2480 MHz) – Bluetooth**



**Table 6-2: 20 dB Bandwidth Test Equipment**

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz-26.5 GHz)	MY51250846	2/6/20

Measurement uncertainty: Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2. Measurement uncertainty = -2 dB/+2 dB.

**PASS**

**Test Personnel:**

Daniel W. Baltzell  
 Test Engineer

*Daniel W. Baltzell*  
 Signature

February 22, 2018  
 Date of Test

**7 6 dB Bandwidth – FCC 15.247(a)(2); RSS-247 5.2**

**7.1 6 dB Bandwidth Test Procedure – Minimum 6 dB Bandwidth**

The minimum 6 dB bandwidths per FCC 15.247(a)(2) were measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at  $\geq 3 \times \text{RBW}$ . The device was modulated. The minimum 6 dB bandwidths are presented below.

**7.2 6 dB Bandwidth Test Results**

**Table 7-1: 6 dB Bandwidth Test Data – ANT+**

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass/Fail
Low	2402	0.519	0.5	Pass
Mid	2441	0.518	0.5	Pass
High	2480	0.520	0.5	Pass

**Table 7-2: 6 dB Bandwidth Test Data – BLE PRB29**

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass/Fail
0	2402	0.564	0.5	Pass
19	2440	0.551	0.5	Pass
39	2480	0.551	0.5	Pass

**Table 7-3: 6 dB Bandwidth Test Data – BLE 0x0F**

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass/Fail
0	2402	0.714	0.5	Pass
19	2440	0.713	0.5	Pass
39	2480	0.713	0.5	Pass

**Table 7-4: 6 dB Bandwidth Test Data – BLE 0x55**

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass/Fail
0	2402	0.605	0.5	Pass
19	2440	0.627	0.5	Pass
39	2480	0.618	0.5	Pass

**Table 7-5: 6 dB Bandwidth Test Data – 802.11b (11 Mbps)**

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass/Fail
1	2412	12.2	0.5	Pass
6	2437	12.4	0.5	Pass
11	2462	12.2	0.5	Pass

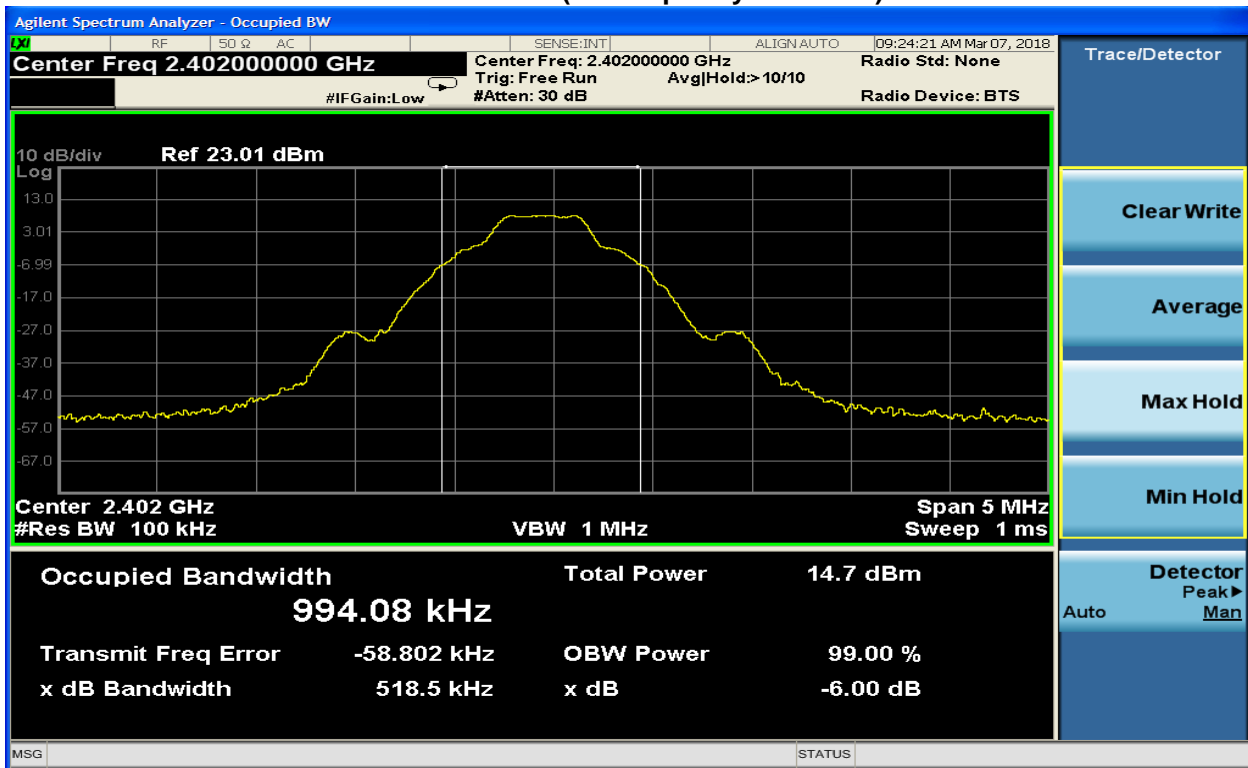
**Table 7-6: 6 dB Bandwidth Test Data – 802.11g (54 Mbps)**

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass/Fail
1	2412	16.7	0.5	Pass
6	2437	17.0	0.5	Pass
11	2462	16.8	0.5	Pass

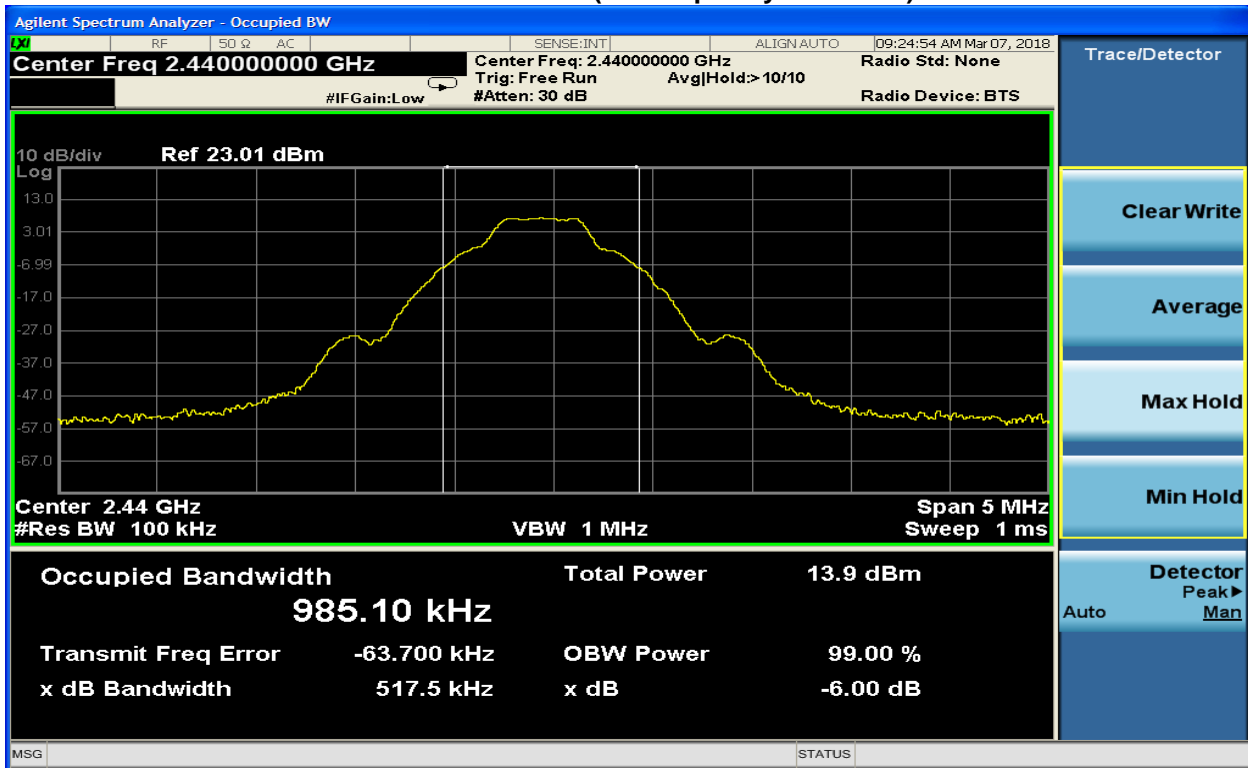
**Table 7-7: 6 dB Bandwidth Test Data – 802.11n (6.5 Mbps)**

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass/Fail
1	2412	17.6	0.5	Pass
6	2437	17.7	0.5	Pass
11	2462	17.6	0.5	Pass

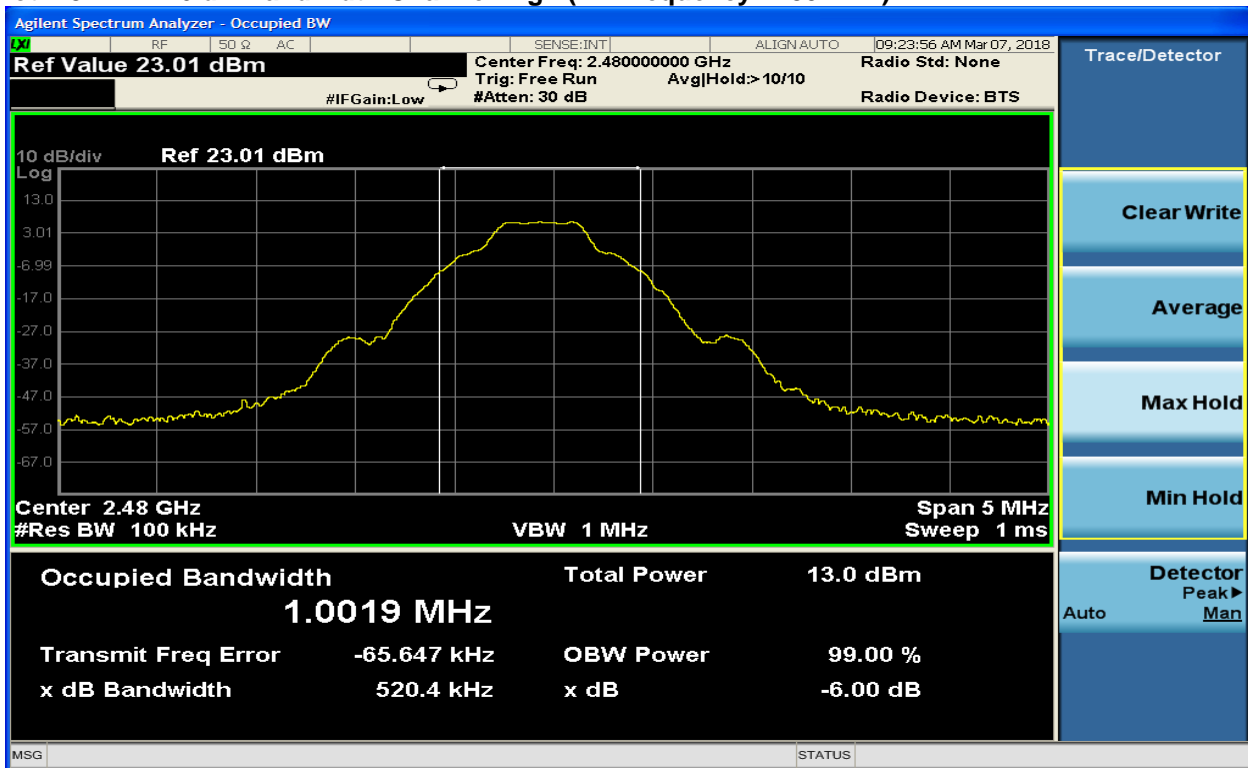
**Plot 7-1: 6 dB Bandwidth Channel Low (TX Frequency 2402 MHz) - ANT+**



**Plot 7-2: 6 dB Bandwidth Channel Middle (TX Frequency 2441 MHz) - ANT+**

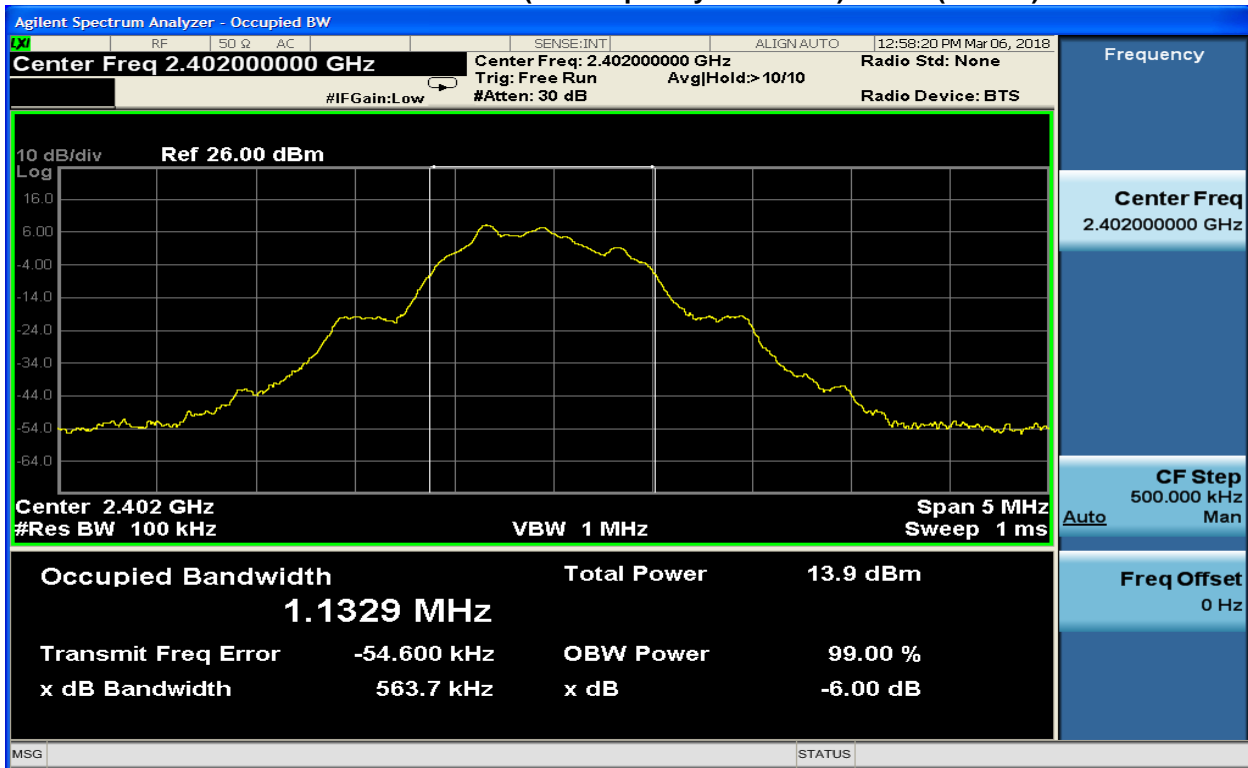


**Plot 7-3: 6 dB Bandwidth Channel High (TX Frequency 2480 MHz) - ANT+**

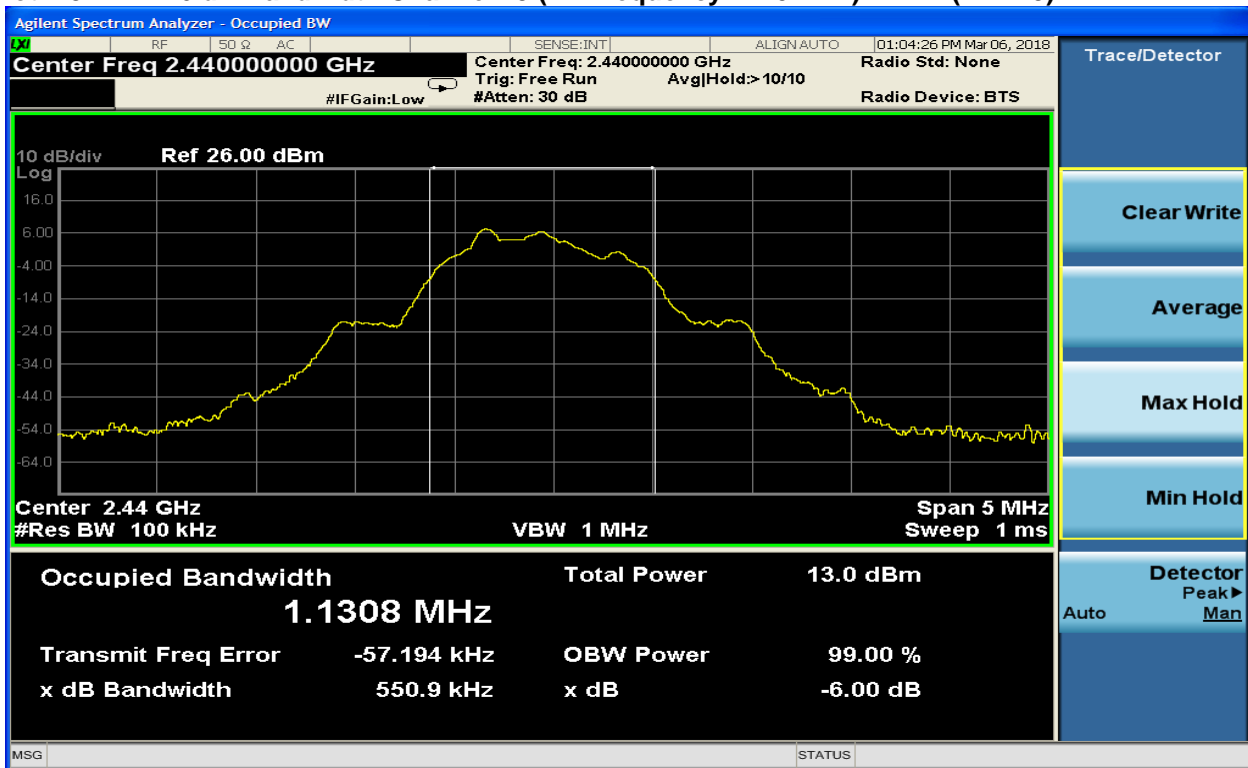




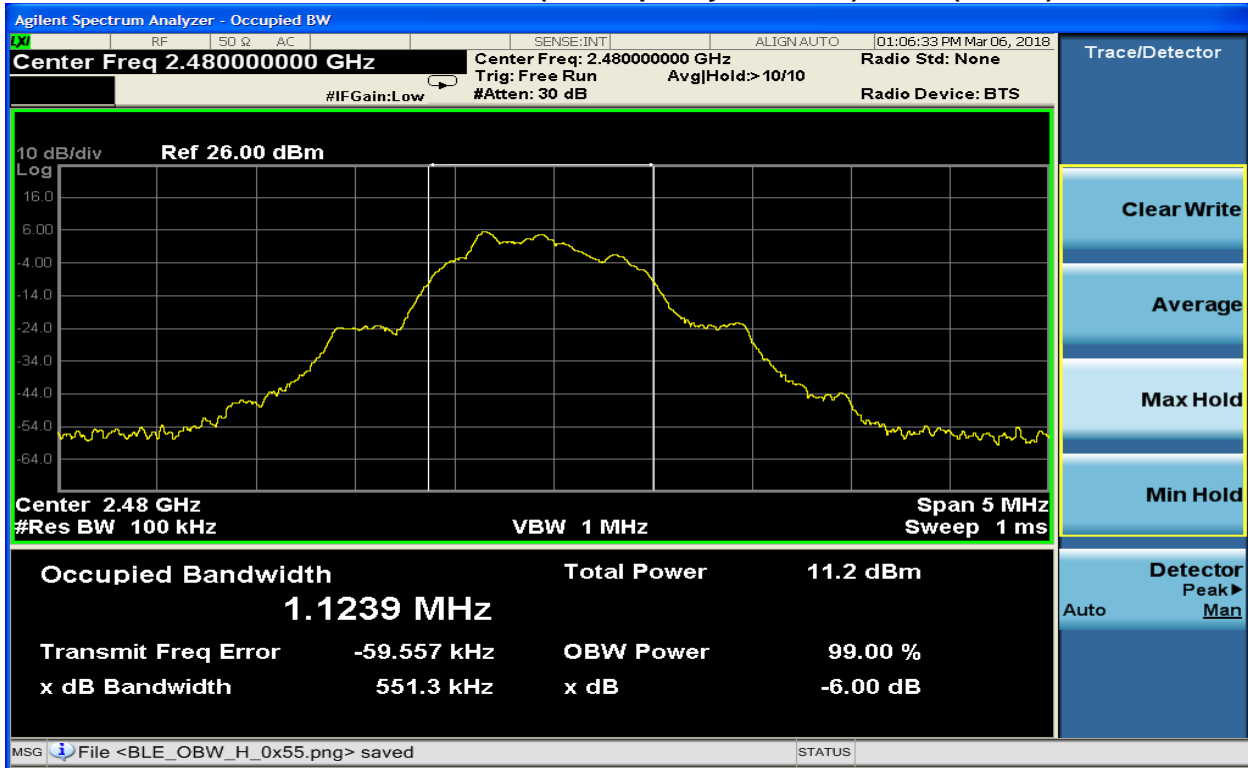
**Plot 7-4: 6 dB Bandwidth Channel 0 (TX Frequency 2402 MHz) – BLE (PRB29)**



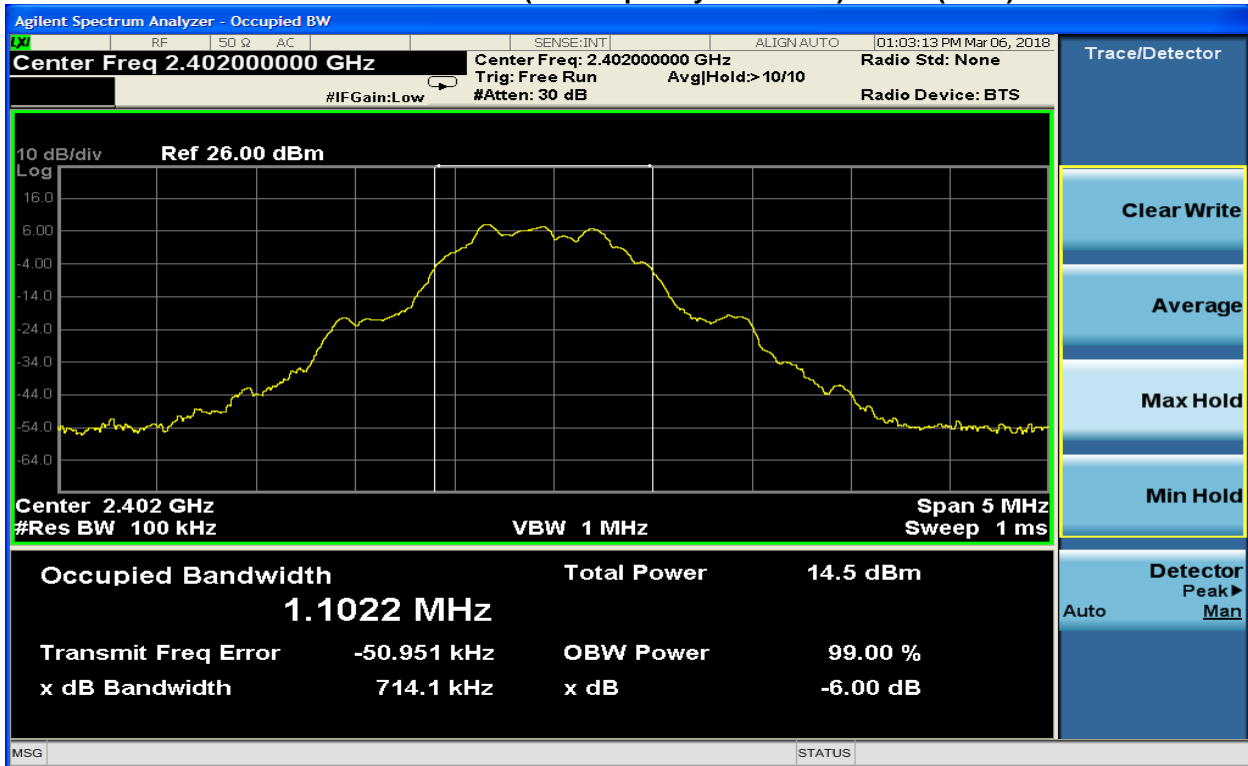
**Plot 7-5: 6 dB Bandwidth Channel 19 (TX Frequency 2440 MHz) – BLE (PRB29)**



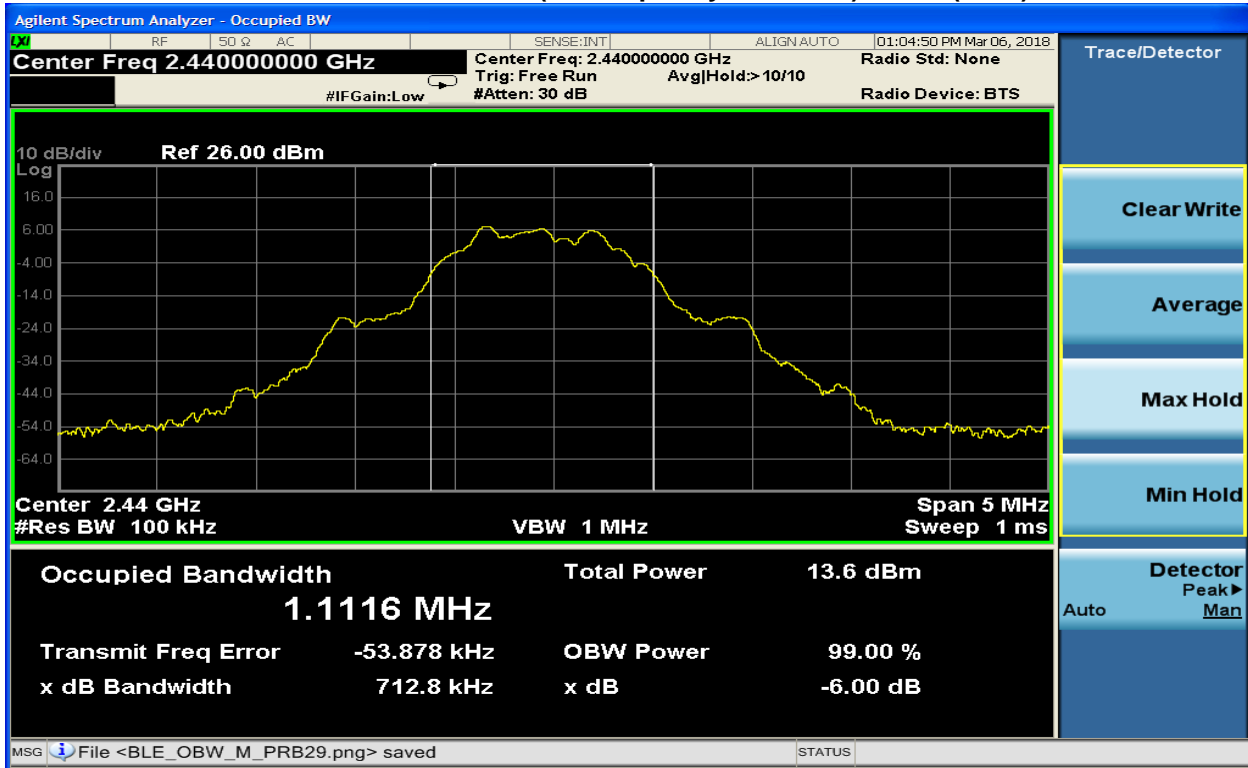
**Plot 7-6: 6 dB Bandwidth Channel 39 (TX Frequency 2480 MHz) – BLE (PRB29)**



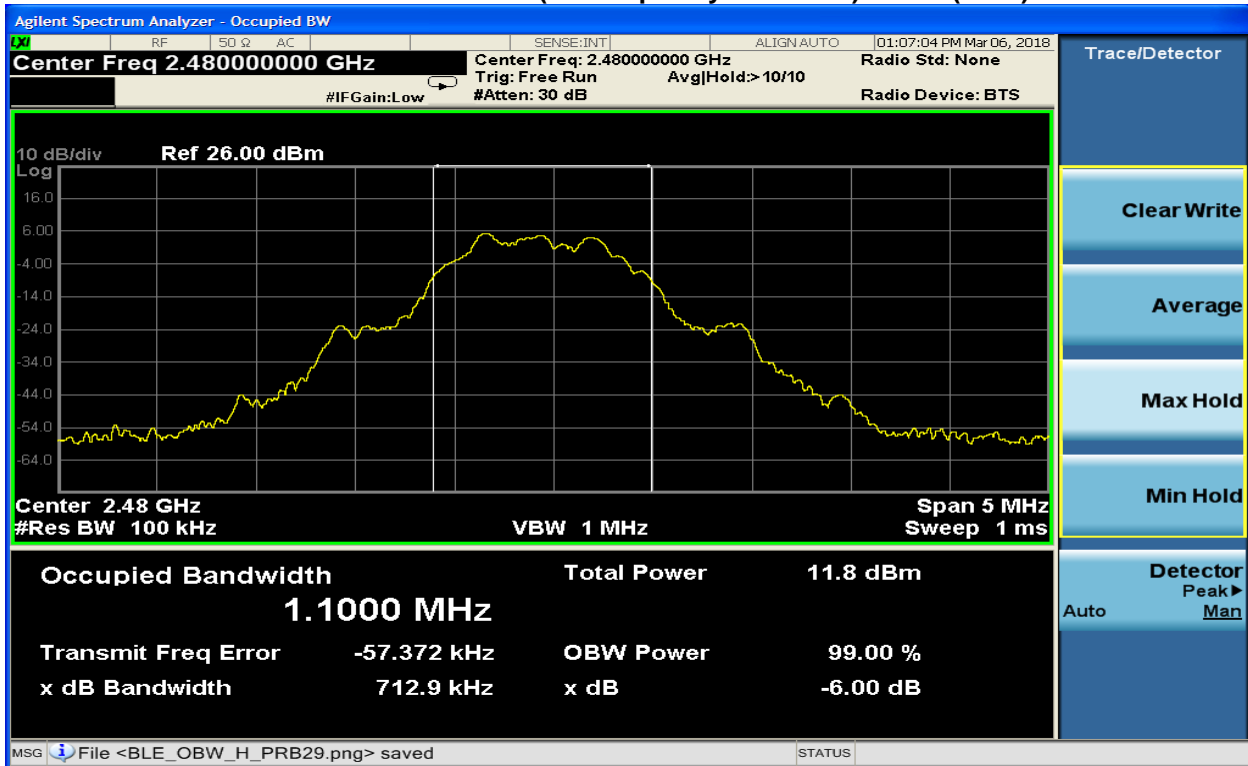
**Plot 7-7: 6 dB Bandwidth Channel 0 (TX Frequency 2402 MHz) – BLE (0x0F)**



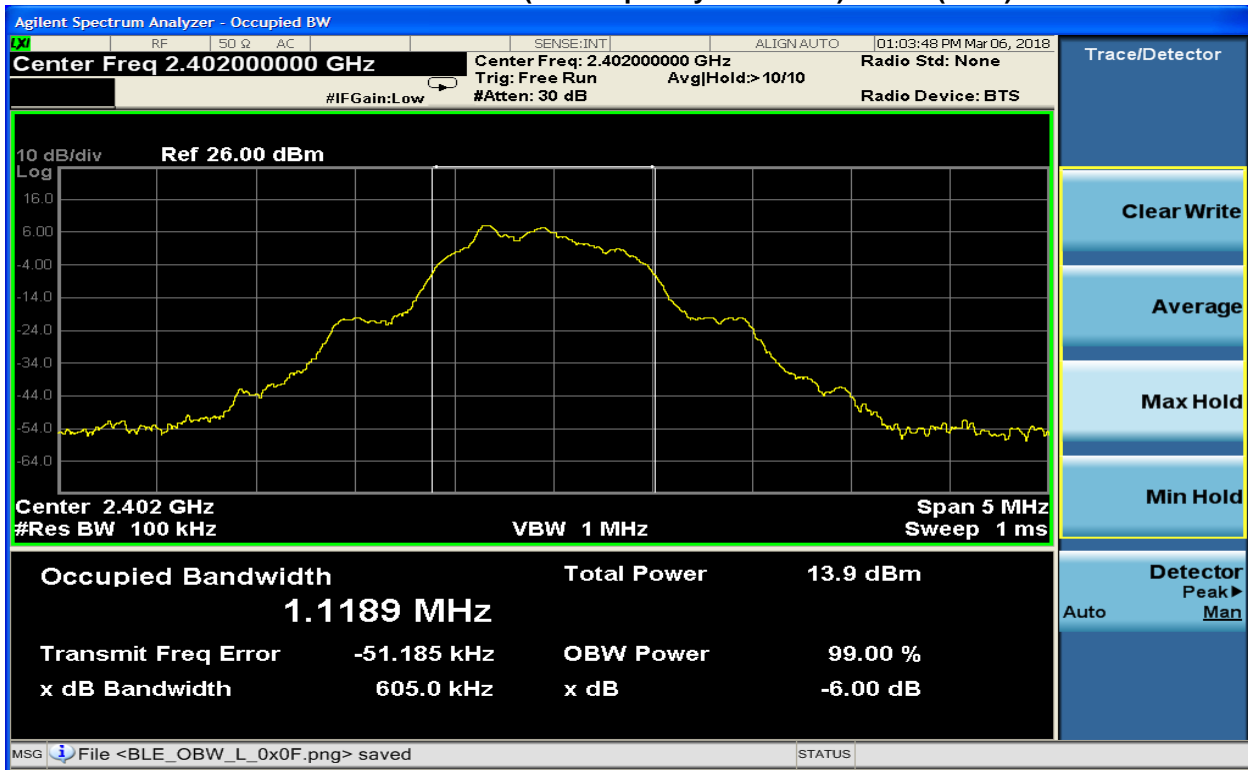
**Plot 7-8: 6 dB Bandwidth Channel 19 (TX Frequency 2440 MHz) – BLE (0x0F)**



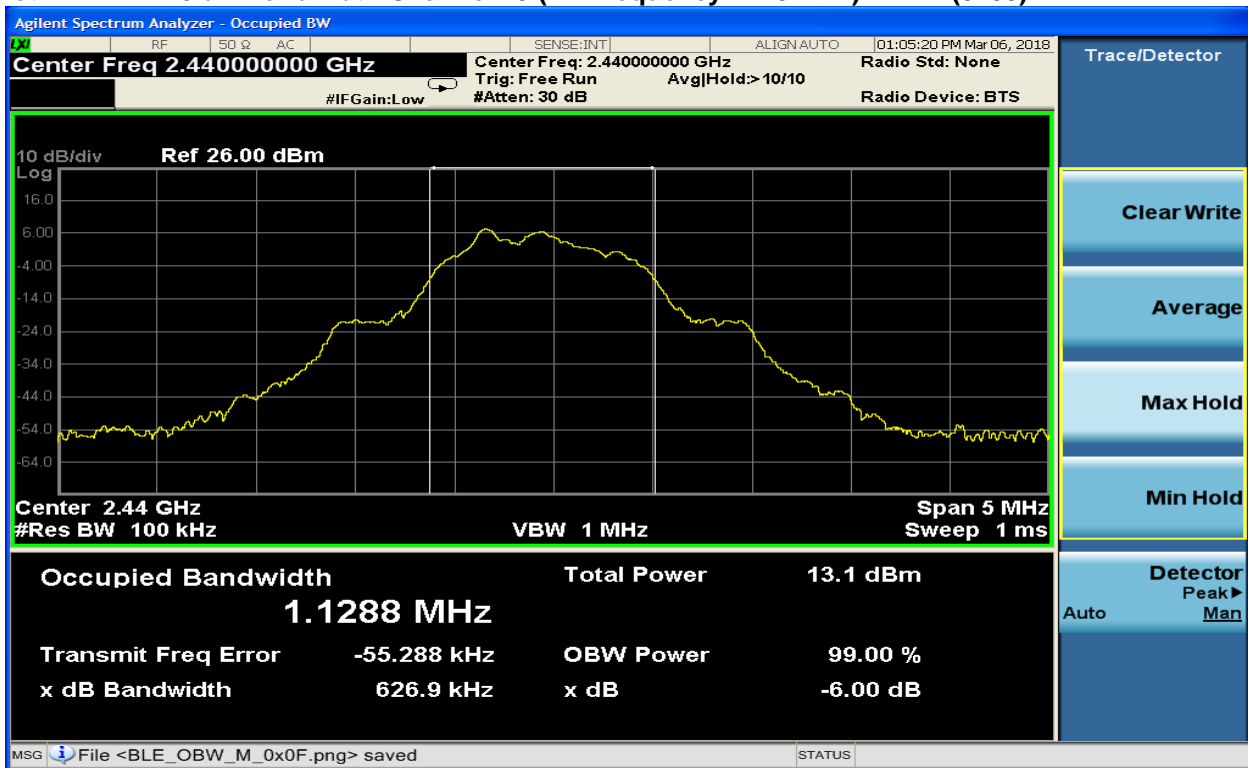
**Plot 7-9: 6 dB Bandwidth Channel 39 (TX Frequency 2480 MHz) – BLE (0x0F)**



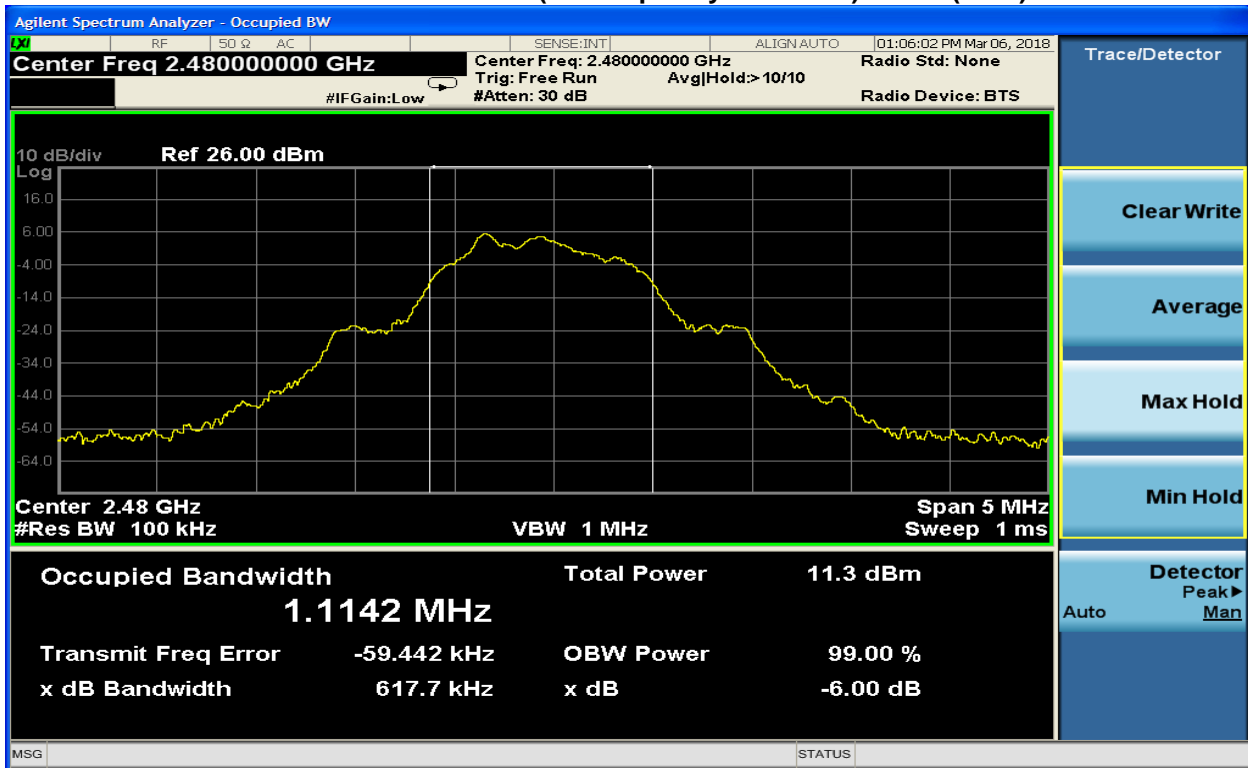
**Plot 7-10: 6 dB Bandwidth Channel 0 (TX Frequency 2402 MHz) – BLE (0x55)**



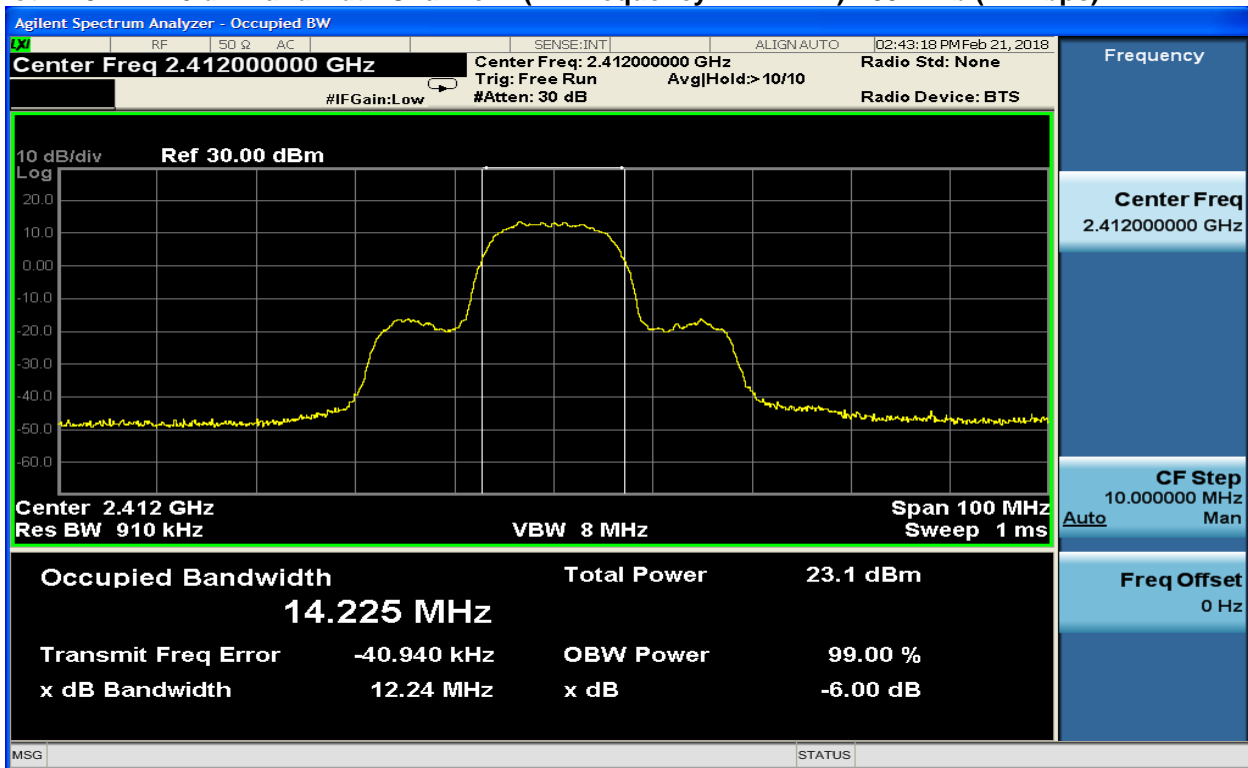
**Plot 7-11: 6 dB Bandwidth Channel 19 (TX Frequency 2440 MHz) – BLE (0x55)**



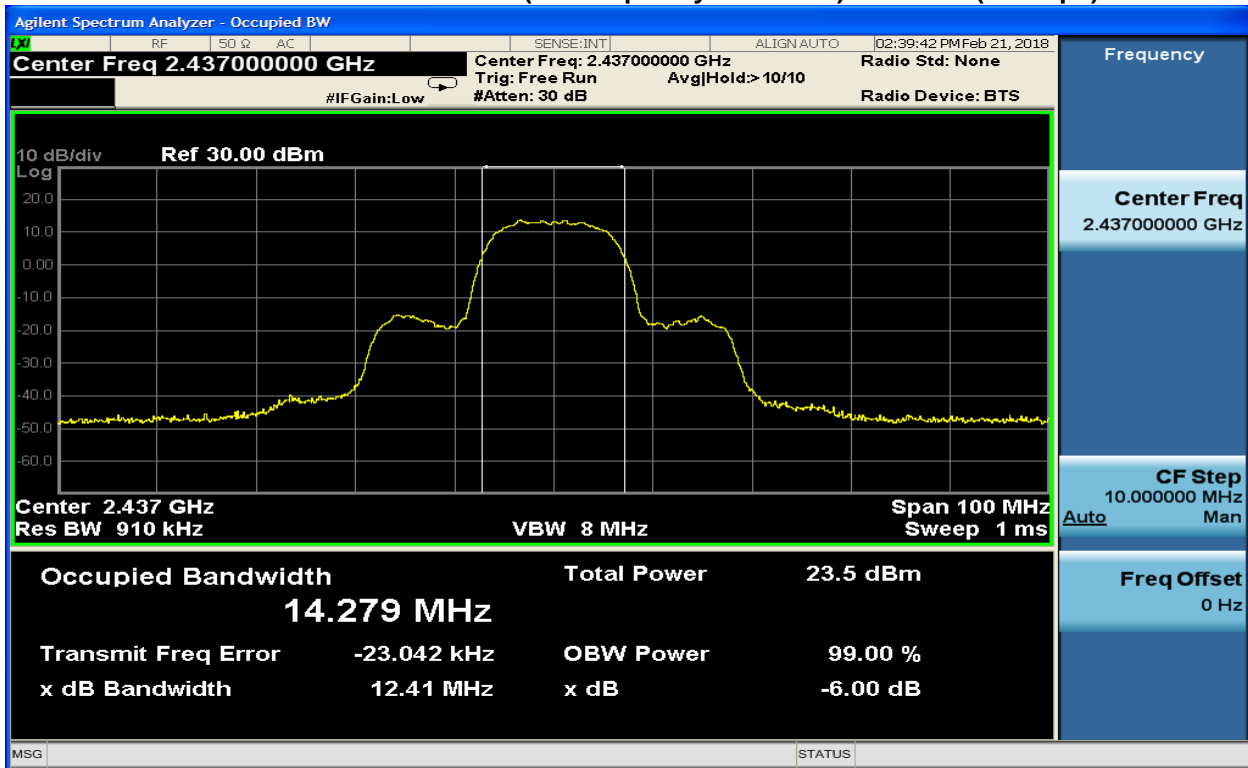
**Plot 7-12: 6 dB Bandwidth Channel 39 (TX Frequency 2480 MHz) – BLE (0x55)**



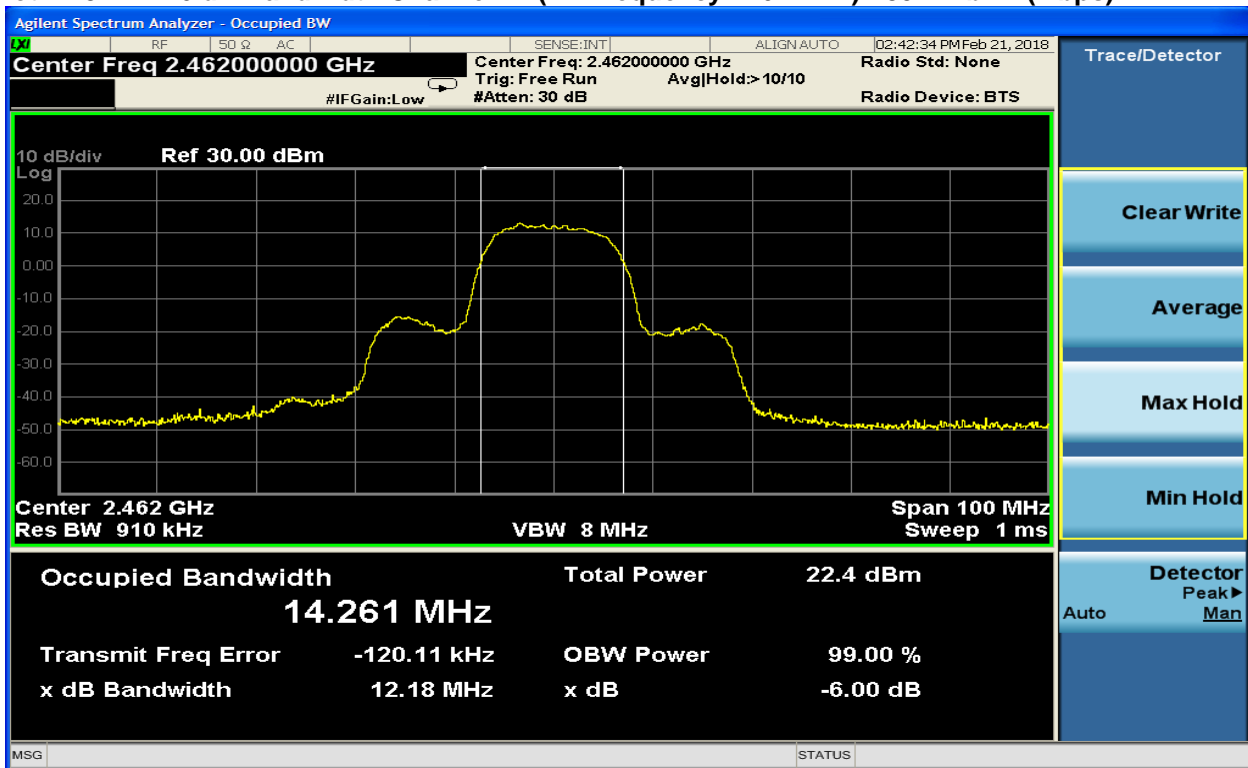
**Plot 7-13: 6 dB Bandwidth Channel 1 (TX Frequency 2412 MHz) - 802.11b (11 Mbps)**



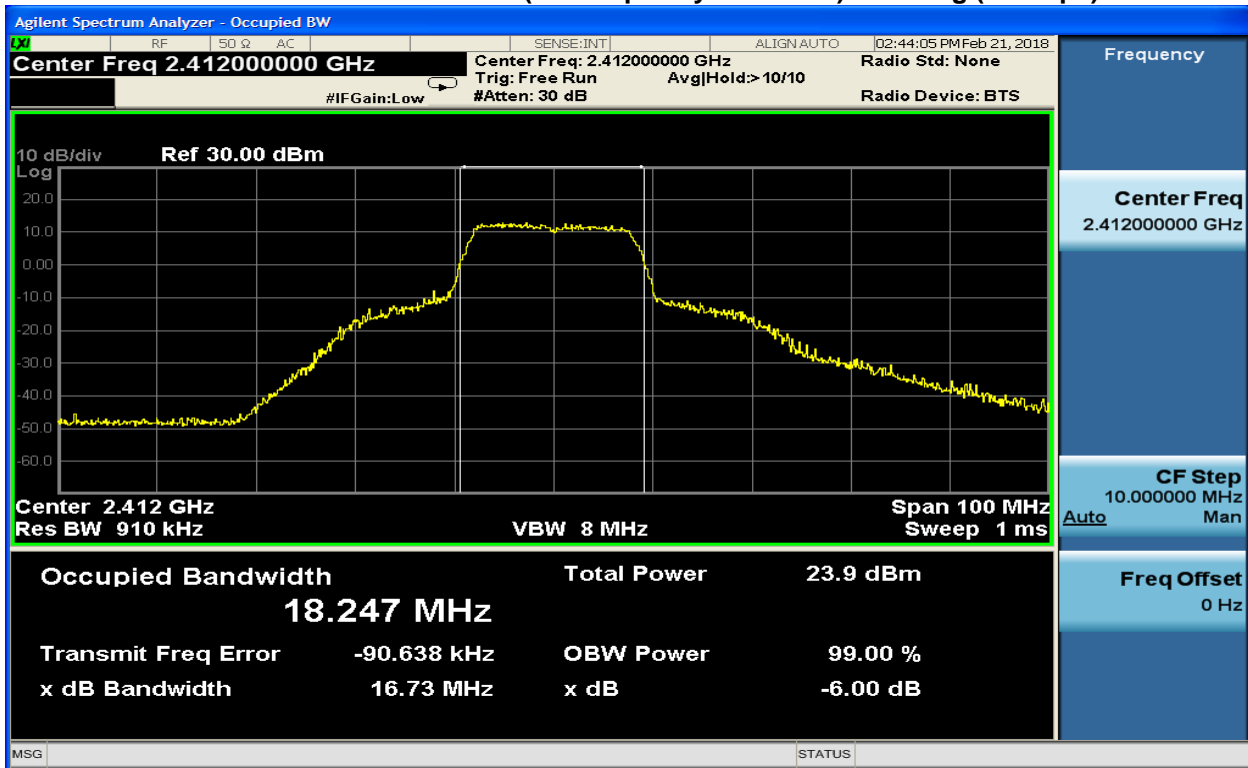
**Plot 7-14: 6 dB Bandwidth Channel 6 (TX Frequency 2437 MHz) - 802.11b (11 Mbps)**



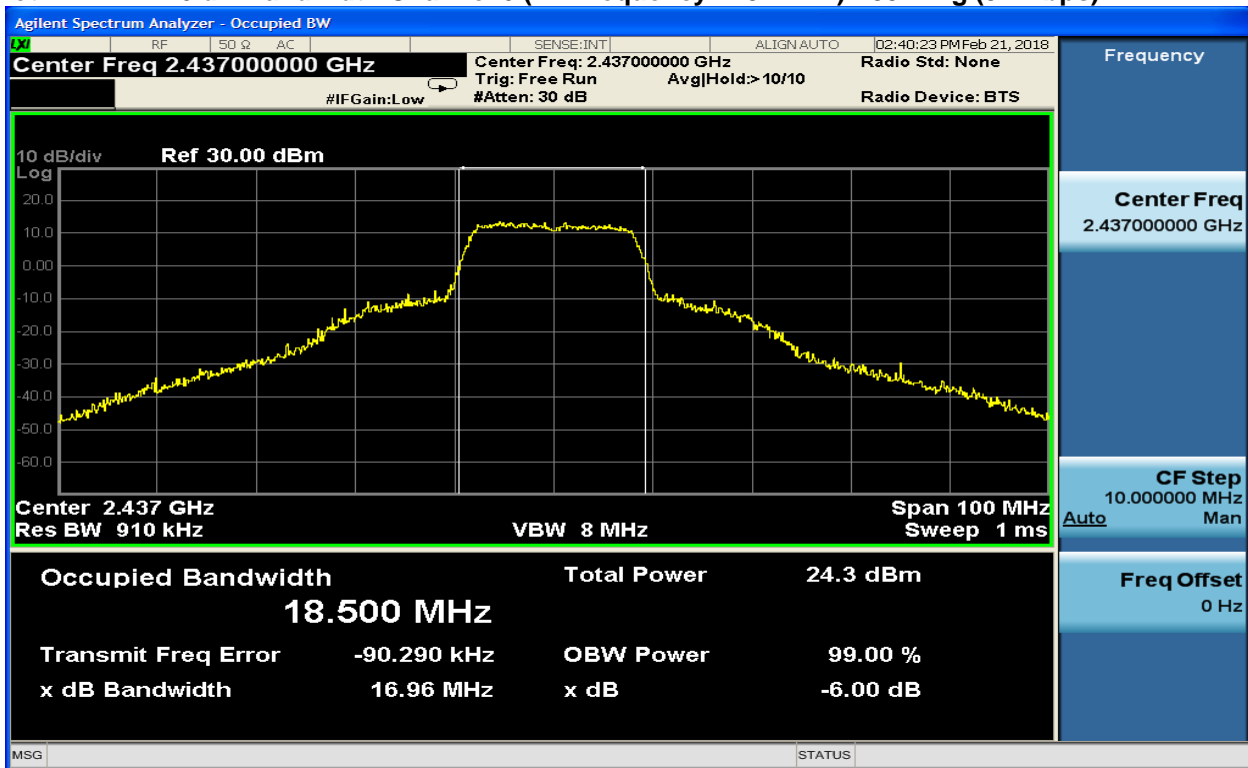
**Plot 7-15: 6 dB Bandwidth Channel 11 (TX Frequency 2462 MHz) - 802.11b 11 (Mbps)**



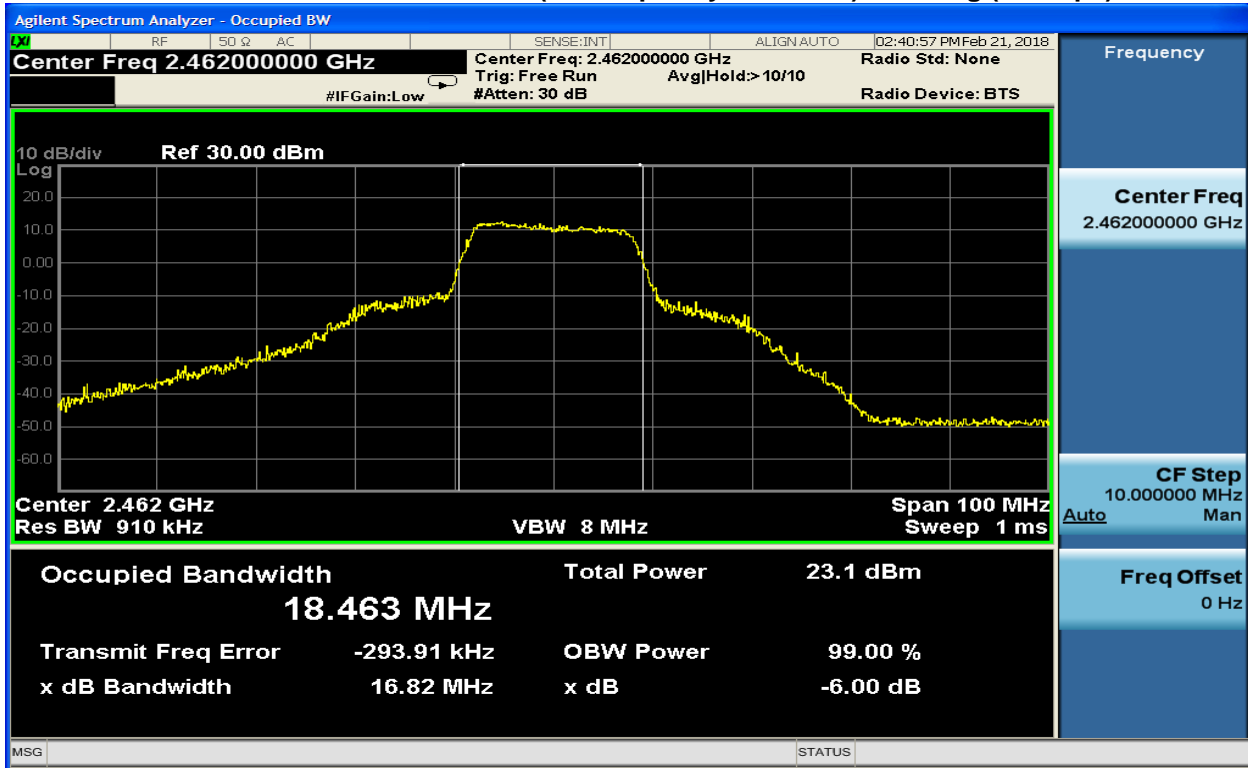
**Plot 7-16: 6 dB Bandwidth Channel 1 (TX Frequency 2412 MHz) - 802.11g (54 Mbps)**



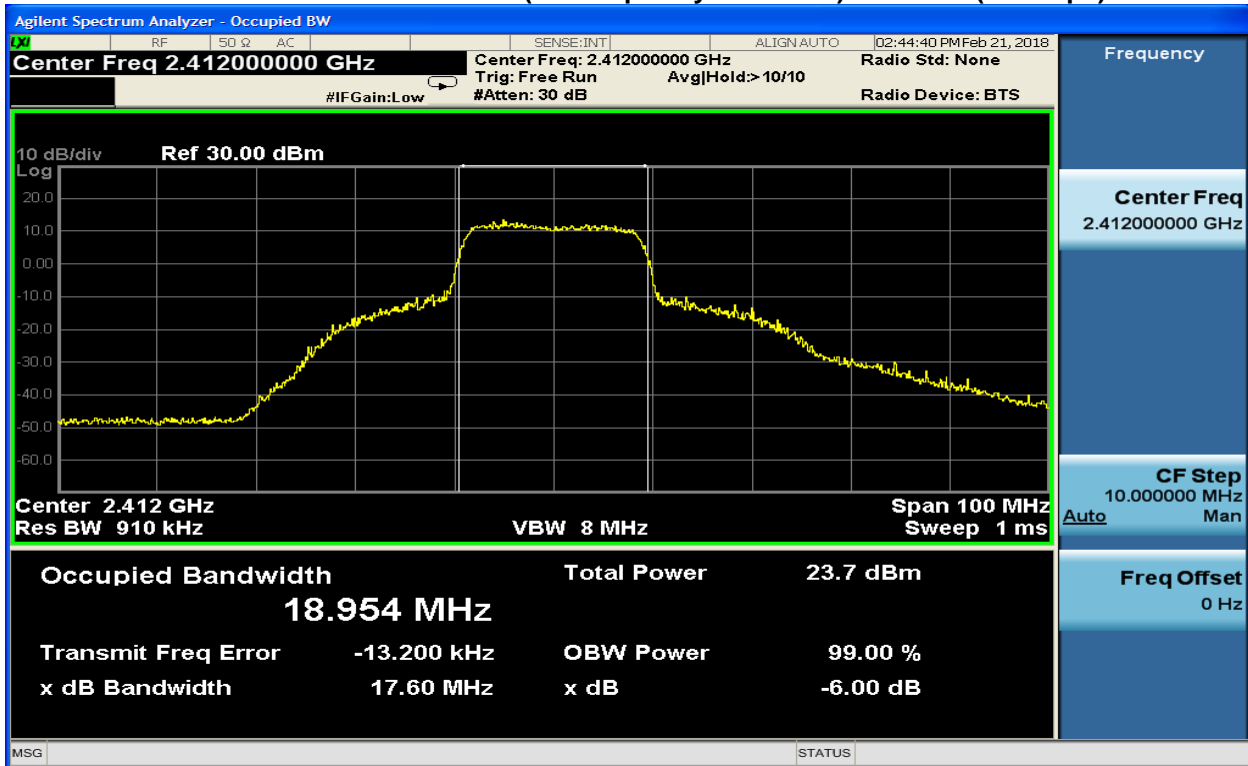
**Plot 7-17: 6 dB Bandwidth Channel 6 (TX Frequency 2437 MHz) - 802.11g (54 Mbps)**



**Plot 7-18: 6 dB Bandwidth Channel 11 (TX Frequency 2462 MHz) - 802.11g (54 Mbps)**

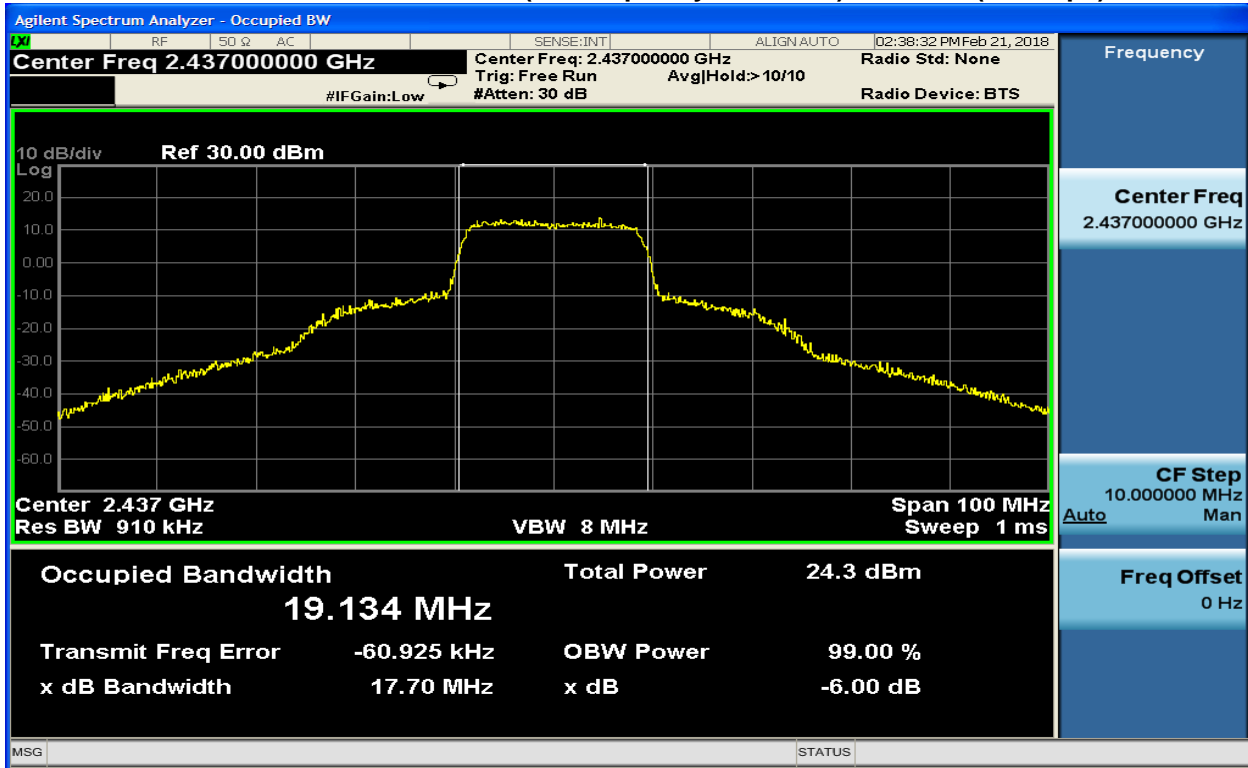


**Plot 7-19: 6 dB Bandwidth Channel 1 (TX Frequency 2412 MHz) - 802.11n (6.5 Mbps)**

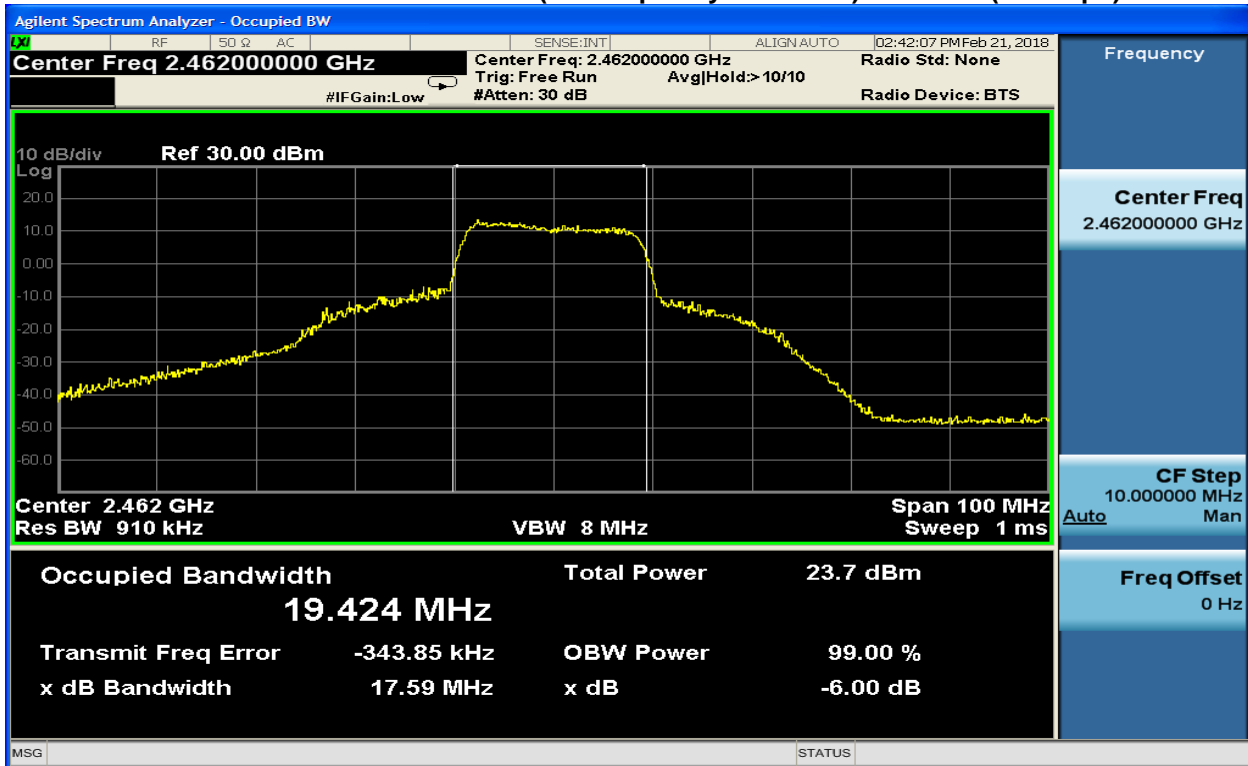




**Plot 7-20: 6 dB Bandwidth Channel 6 (TX Frequency 2437 MHz) - 802.11n (6.5 Mbps)**



**Plot 7-21: 6 dB Bandwidth Channel 11 (TX Frequency 2462 MHz) - 802.11n (6.5 Mbps)**



Measurement uncertainty: Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor  $k = 2$ . Measurement uncertainty =  $-2 \text{ dB}/+2 \text{ dB}$ .

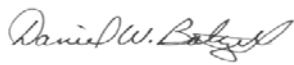
**Table 7-8: 6 dB Bandwidth Test Equipment**

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz-26.5 GHz)	MY51250846	2/6/20

**PASS**

**Test Personnel:**

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Daniel W. Baltzell Test Engineer	 Signature	February 21, 2018 Date of Test
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## 8 Power Spectral Density – FCC 15.247(e); RSS-247 5.2(b)

### 8.1 Power Spectral Density Test Procedure

The power spectral density per FCC 15.247(e) was measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 3 kHz, the video bandwidth set at 30 kHz, and the auto sweep time. The spectral lines were resolved for the modulated carriers at 2412 MHz, 2437 MHz and 2462 MHz. These levels are below the +8 dBm limit. See the power spectral density table and plots.

### 8.2 Power Spectral Density Test Data

**Table 8-1: Power Spectral Density Test Data – ANT+**

Channel	Frequency (MHz)	RF Power Level (dBm)	Maximum Limit +8dBm	Pass/Fail
Low	2402	-3.3	8	Pass
Mid	2441	-4.3	8	Pass
High	2480	-5.1	8	Pass

**Table 8-2: Power Spectral Density Test Data – BLE PRB29**

Channel	Frequency (MHz)	RF Power Level (dBm)	Maximum Limit +8dBm	Pass/Fail
0	2402	-10.7	8	Pass
19	2440	-11.8	8	Pass
39	2480	-13.4	8	Pass

**Table 8-3: Power Spectral Density Test Data – BLE 0x0F**

Channel	Frequency (MHz)	RF Power Level (dBm)	Maximum Limit +8dBm	Pass/Fail
0	2402	-9.0	8	Pass
19	2440	-10.0	8	Pass
39	2480	-11.5	8	Pass

**Table 8-4: Power Spectral Density Test Data – BLE 0x55**

Channel	Frequency (MHz)	RF Power Level (dBm)	Maximum Limit +8dBm	Pass/Fail
0	2402	-10.9	8	Pass
19	2440	-11.8	8	Pass
39	2480	-13.5	8	Pass

**Table 8-5: Power Spectral Density Test Data – 802.11b (11 Mbps)**

Channel	Frequency (MHz)	RF Power Level (dBm)	Maximum Limit +8dBm	Pass/Fail
1	2412	-6.7	8	Pass
6	2437	-6.4	8	Pass
11	2462	-7.5	8	Pass

**Table 8-6: Power Spectral Density Test Data – 802.11g (54 Mbps)**

Channel	Frequency (MHz)	RF Power Level (dBm)	Maximum Limit +8dBm	Pass/Fail
1	2412	-8.9	8	Pass
6	2437	-8.1	8	Pass
11	2462	-7.4	8	Pass

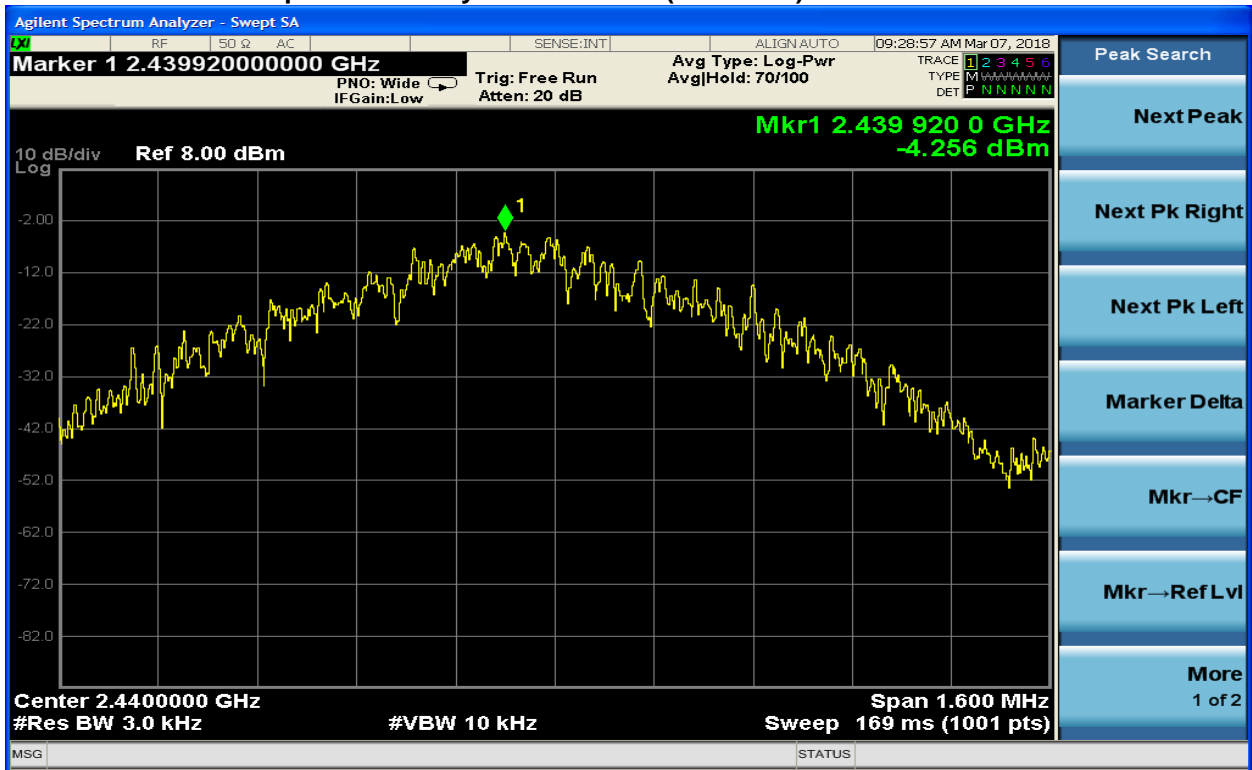
**Table 8-7: Power Spectral Density Test Data – 802.11n (6.5 Mbps)**

Channel	Frequency (MHz)	RF Power Level (dBm)	Maximum Limit +8dBm	Pass/Fail
1	2412	-9.9	8	Pass
6	2437	-9.5	8	Pass
11	2462	-9.7	8	Pass

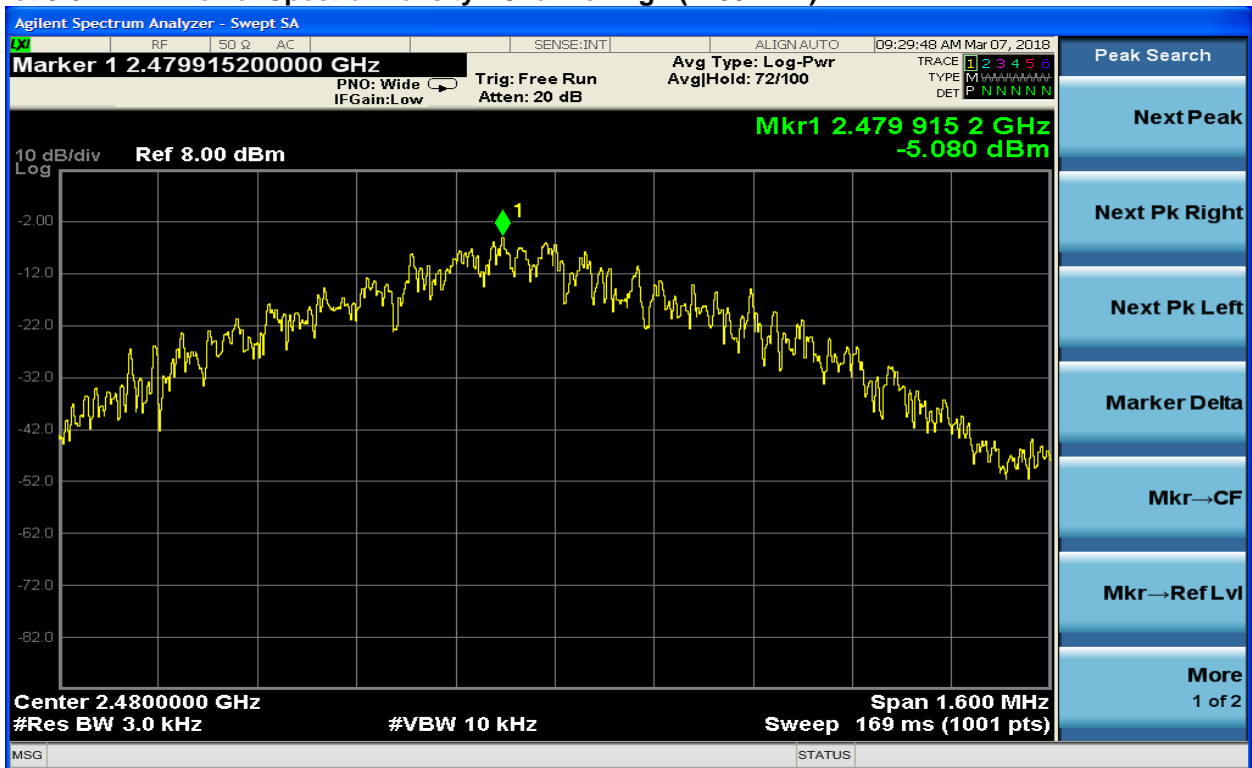
**Plot 8-1: Power Spectral Density: Channel Low (2402 MHz) - ANT+**



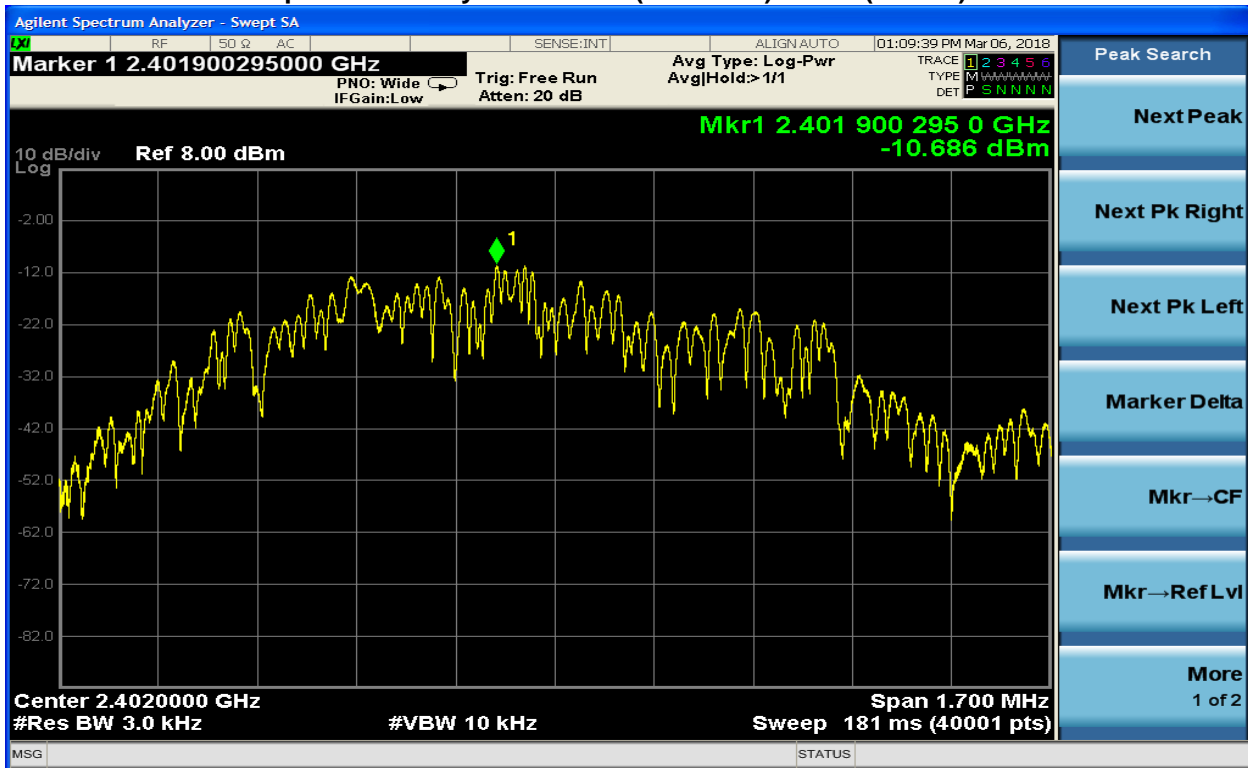
**Plot 8-2: Power Spectral Density: Channel Mid (2441 MHz) - ANT+**



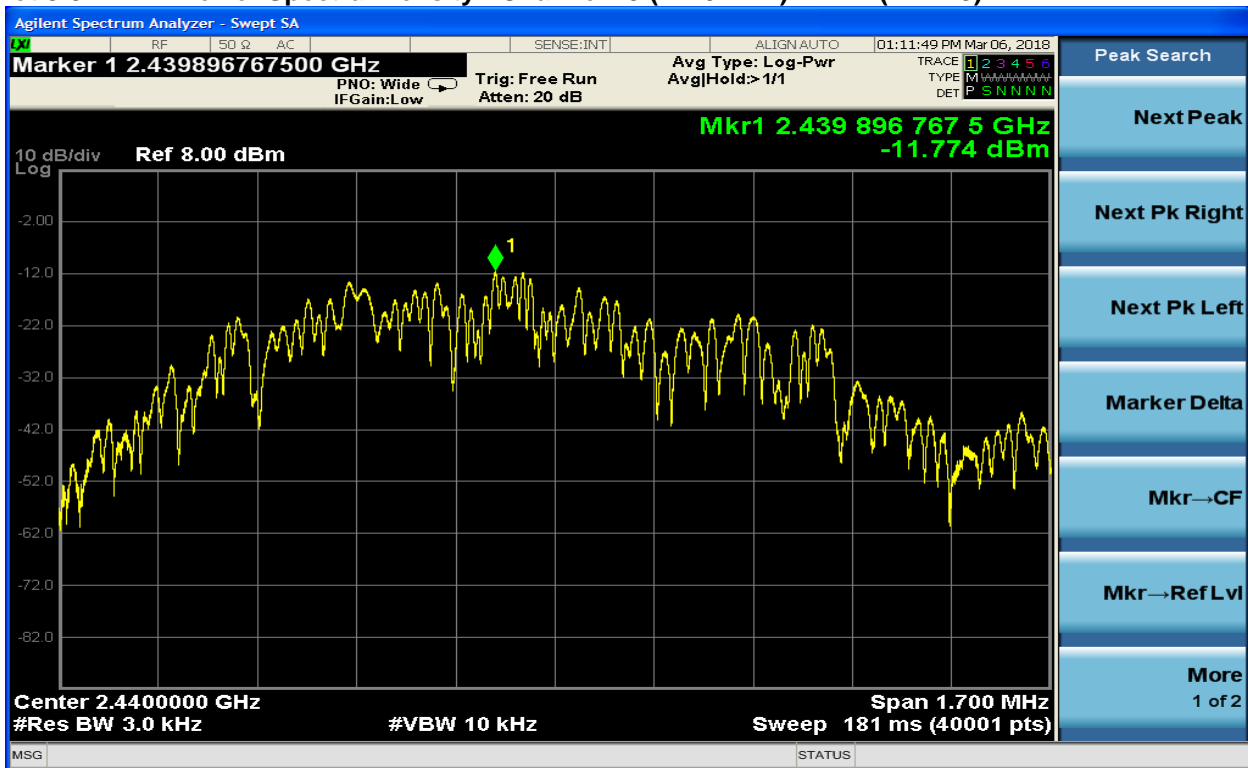
**Plot 8-3: Power Spectral Density: Channel High (2480 MHz) - ANT+**



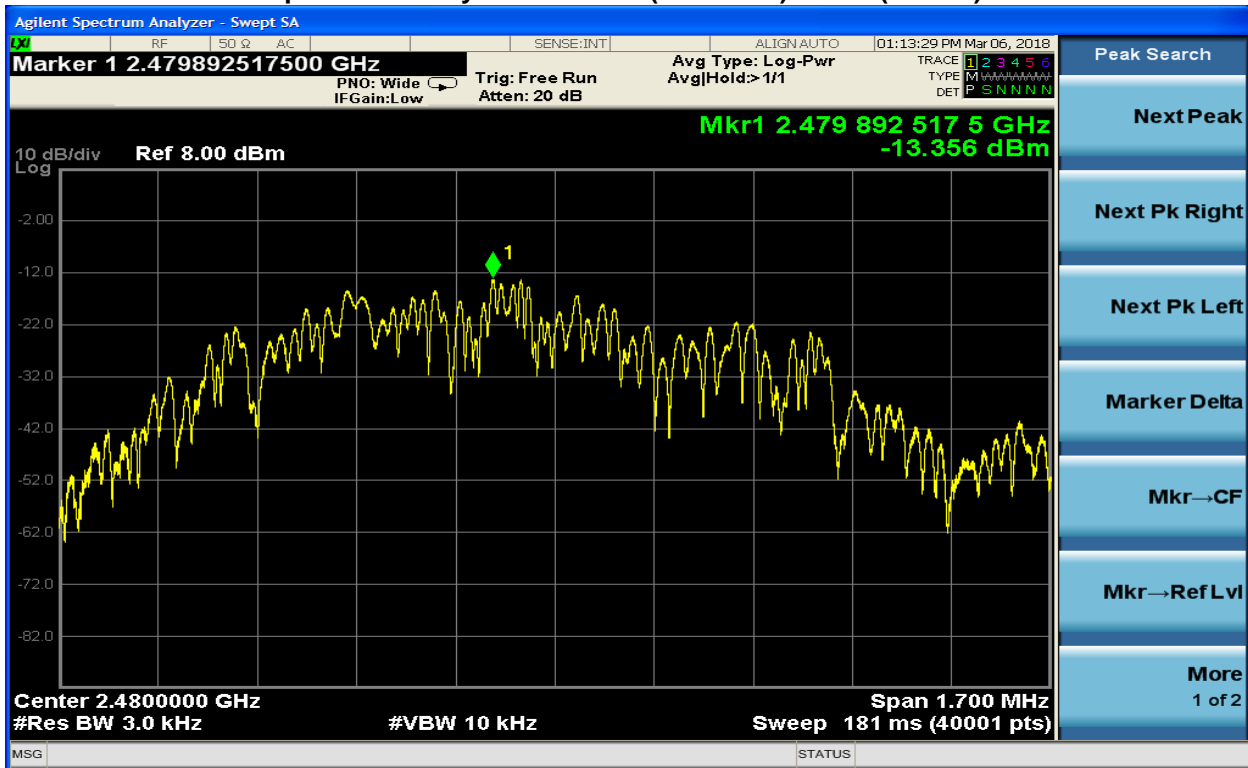
**Plot 8-4: Power Spectral Density: Channel 0 (2402 MHz) – BLE (PRB29)**



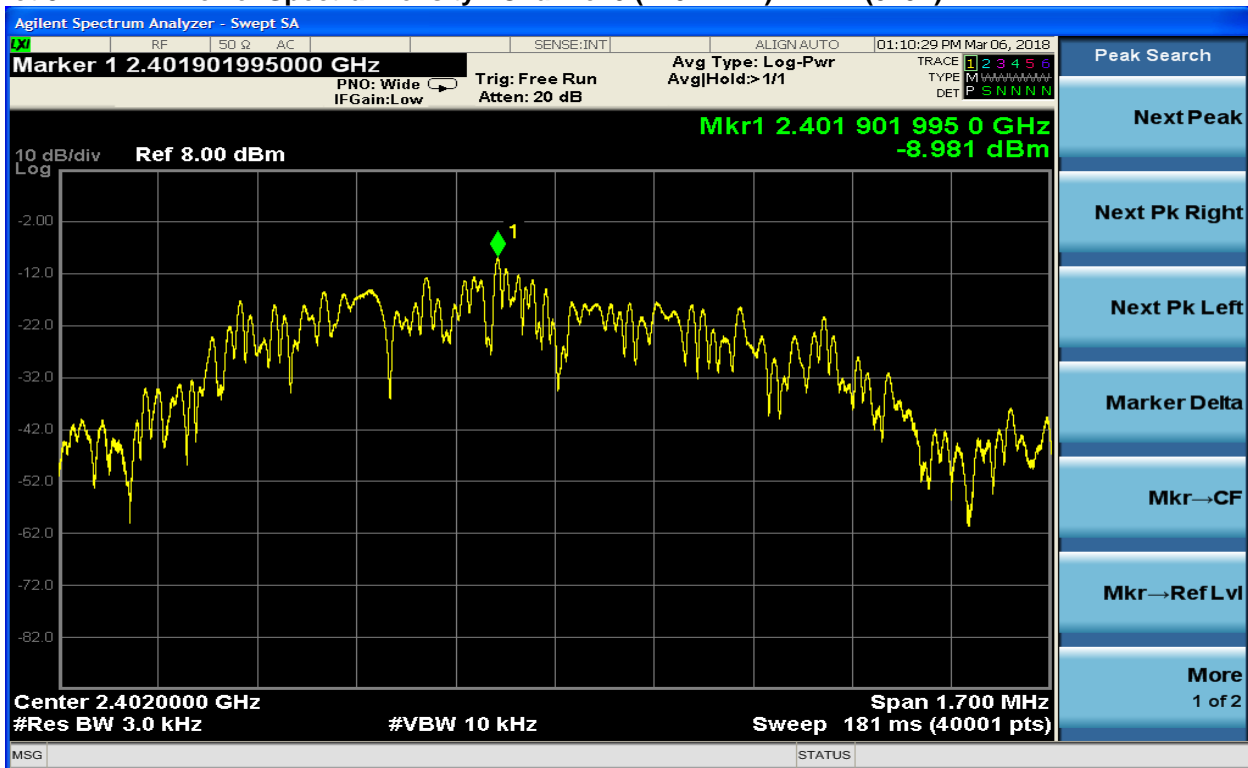
**Plot 8-5: Power Spectral Density: Channel 19 (2440 MHz) – BLE (PRB29)**



**Plot 8-6: Power Spectral Density: Channel 39 (2480 MHz) – BLE (PRB29)**



**Plot 8-7: Power Spectral Density: Channel 0 (2402 MHz) – BLE (0x0F)**



**Plot 8-8: Power Spectral Density: Channel 19 (2440 MHz) – BLE (0x0F)**



**Plot 8-9: Power Spectral Density: Channel 39 (2480 MHz) – BLE (0x0F)**





**Plot 8-10: Power Spectral Density: Channel 0 (2402 MHz) – BLE (0x55)**



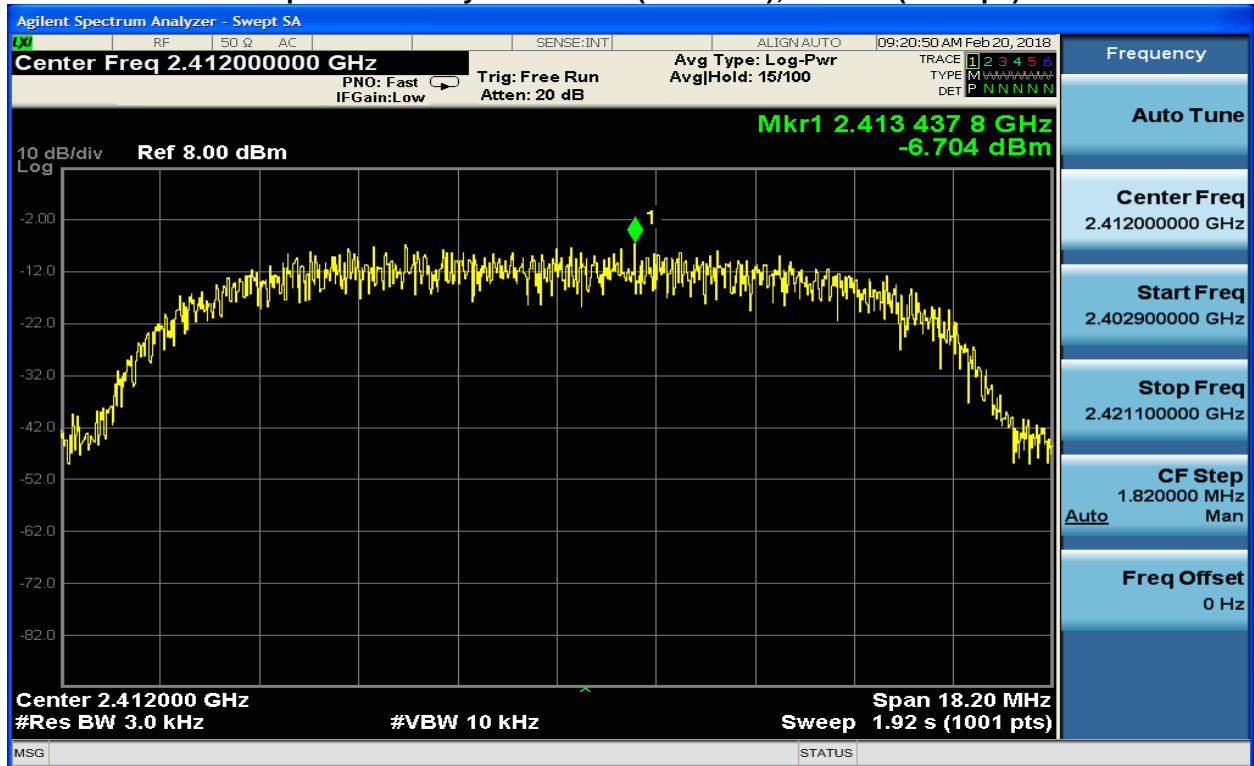
**Plot 8-11: Power Spectral Density: Channel 19 (2440 MHz) – BLE (0x55)**



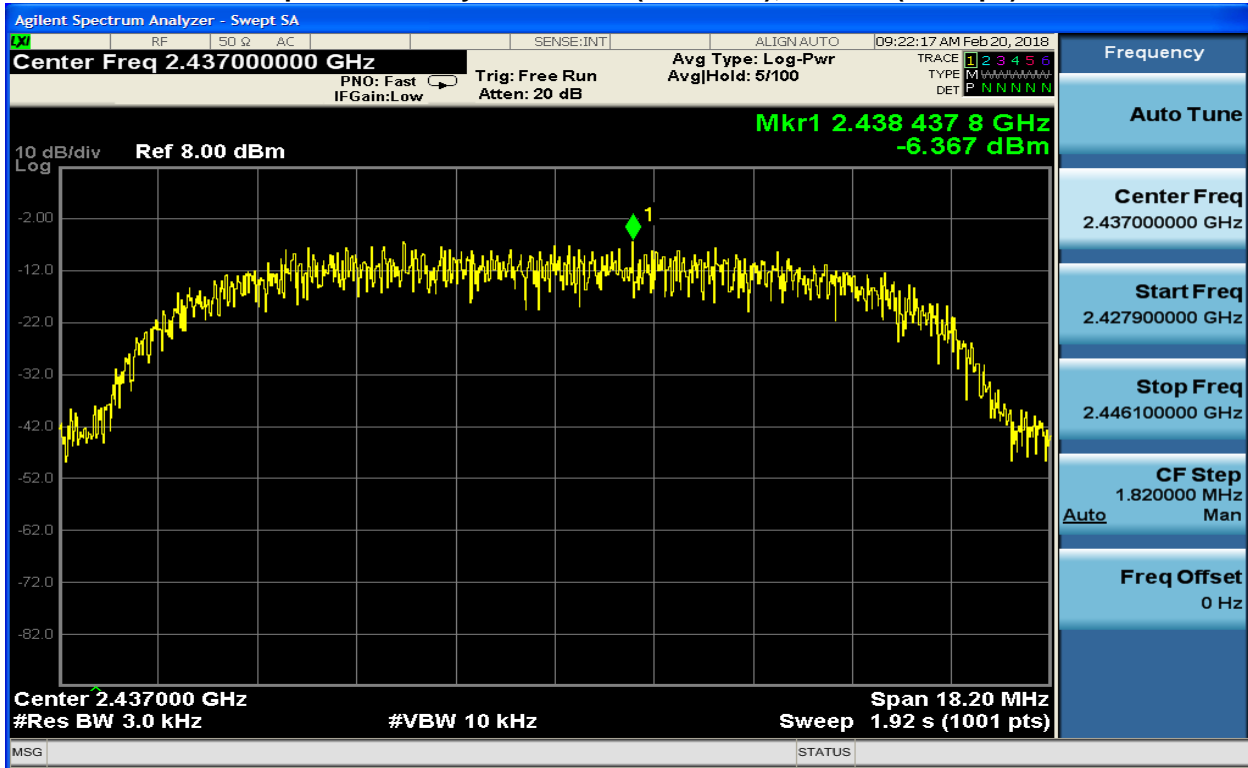
**Plot 8-12: Power Spectral Density: Channel 39 (2480 MHz) – BLE (0x55)**



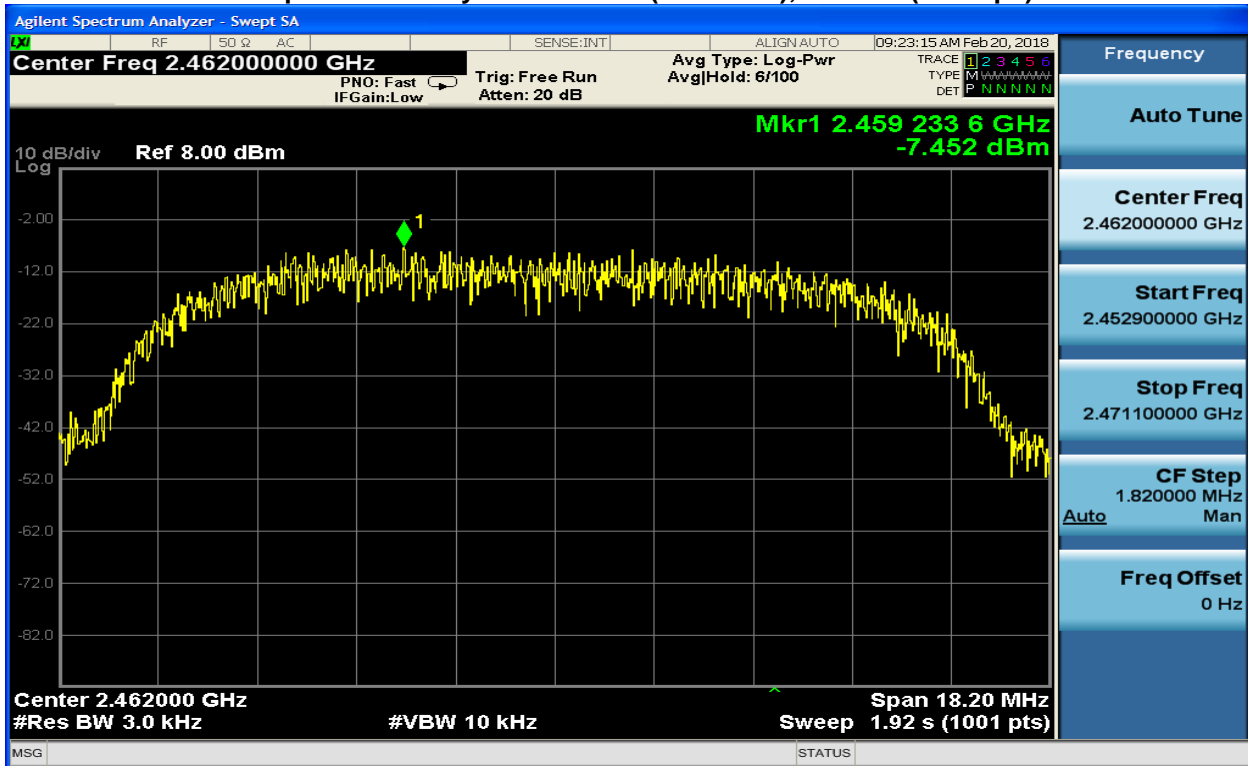
**Plot 8-13: Power Spectral Density: Channel 1 (2412 MHz); 802.11b (11 Mbps)**



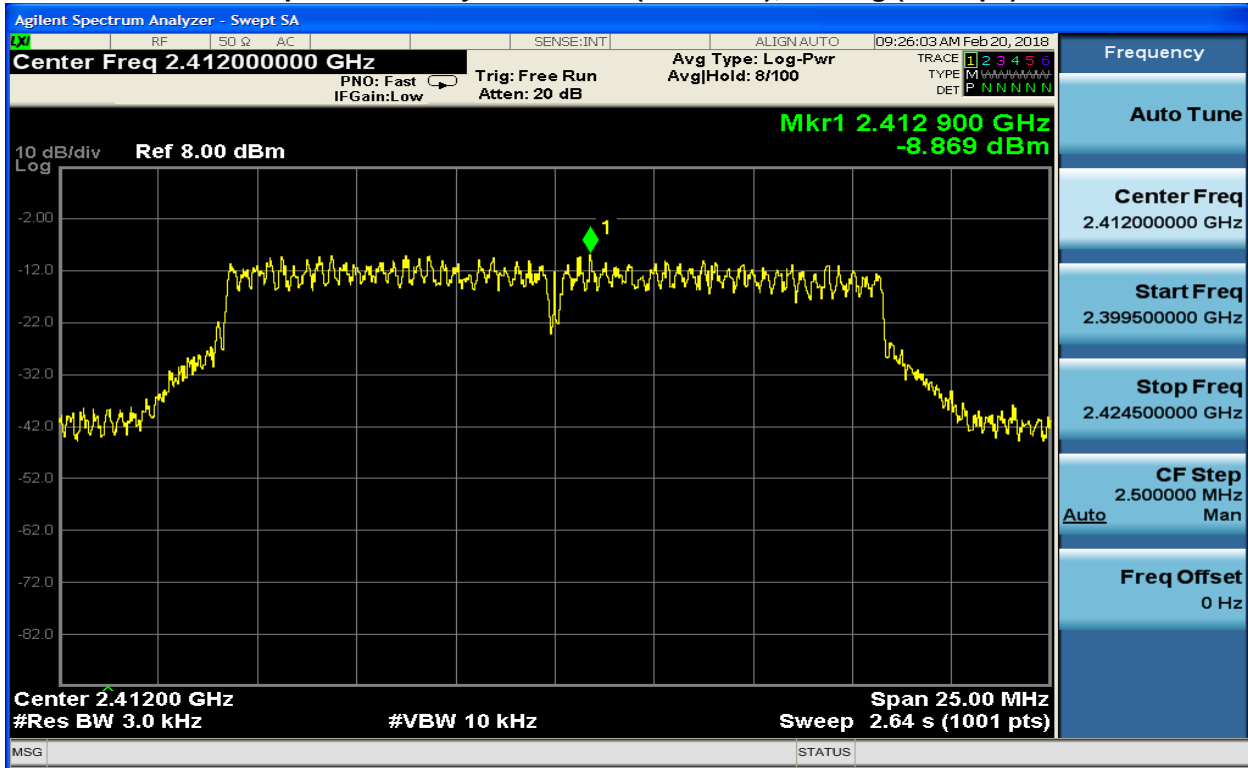
**Plot 8-14: Power Spectral Density: Channel 6 (2437 MHz); 802.11b (11 Mbps)**



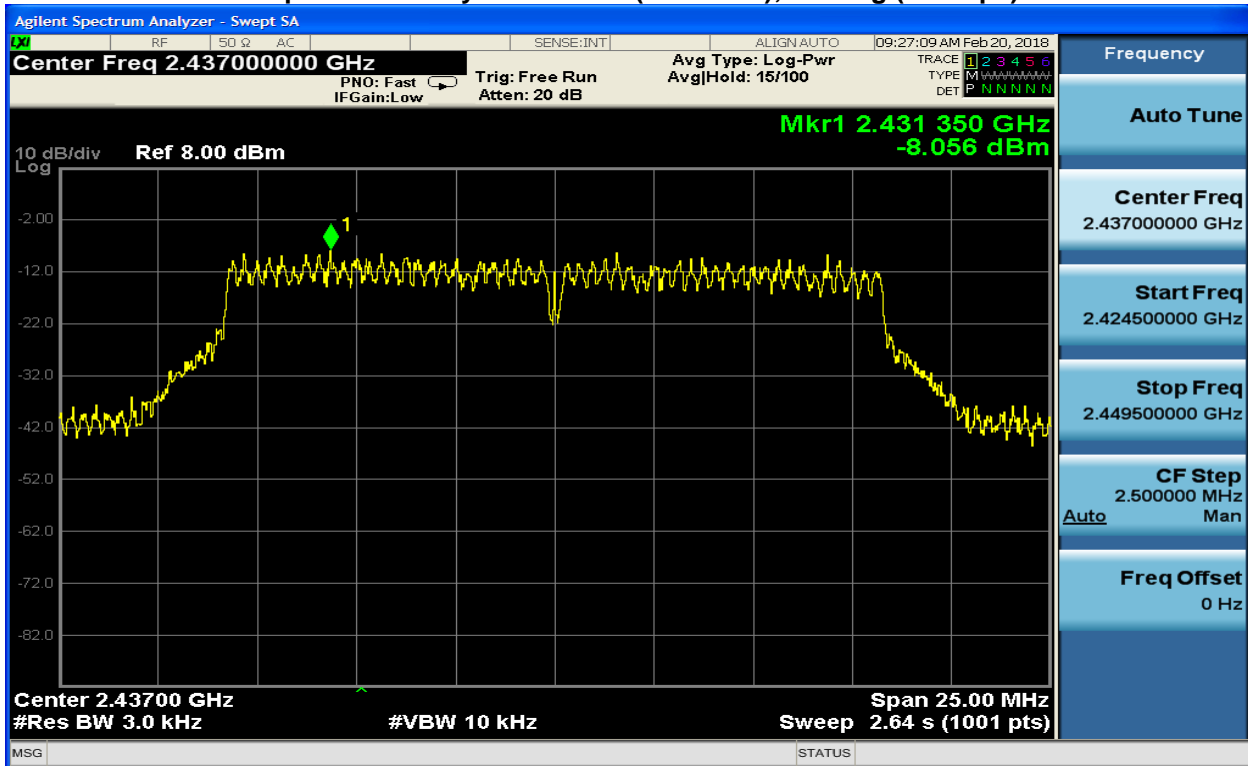
**Plot 8-15: Power Spectral Density: Channel 11 (2462 MHz); 802.11b (11 Mbps)**



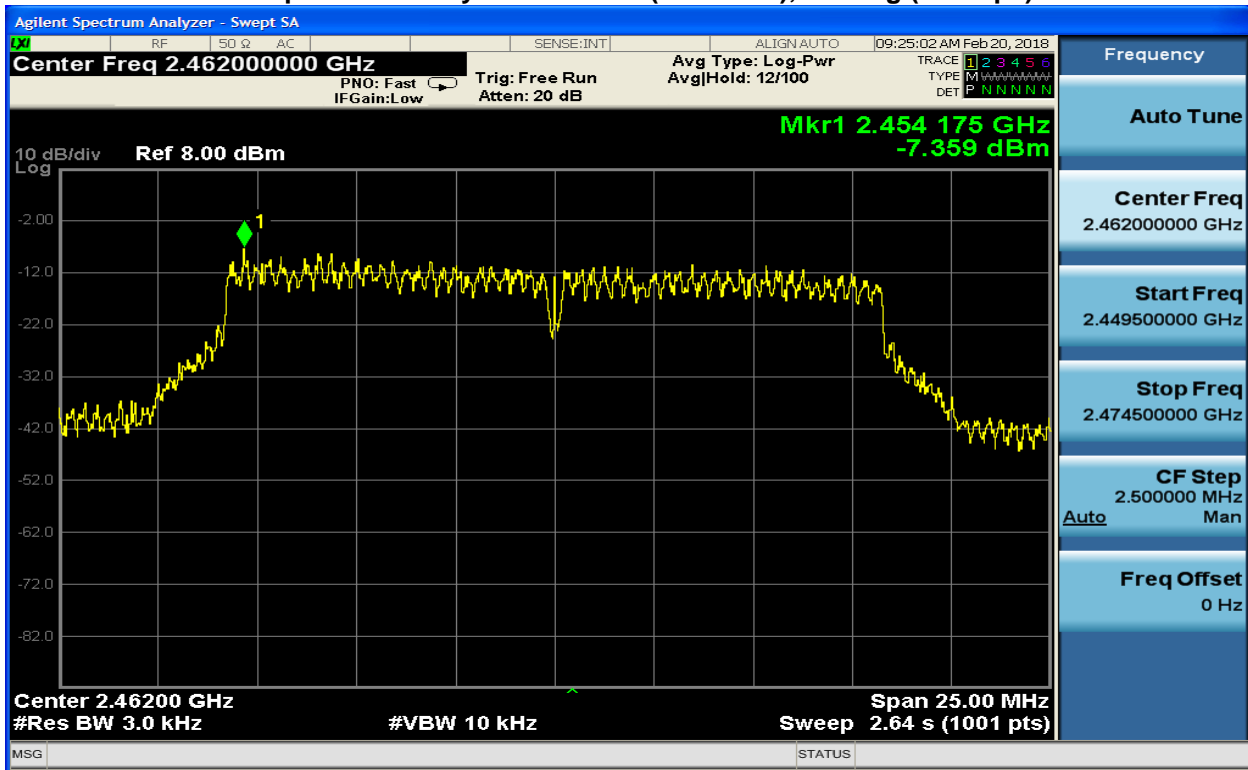
**Plot 8-16: Power Spectral Density: Channel 1 (2412 MHz); 802.11g (54 Mbps)**



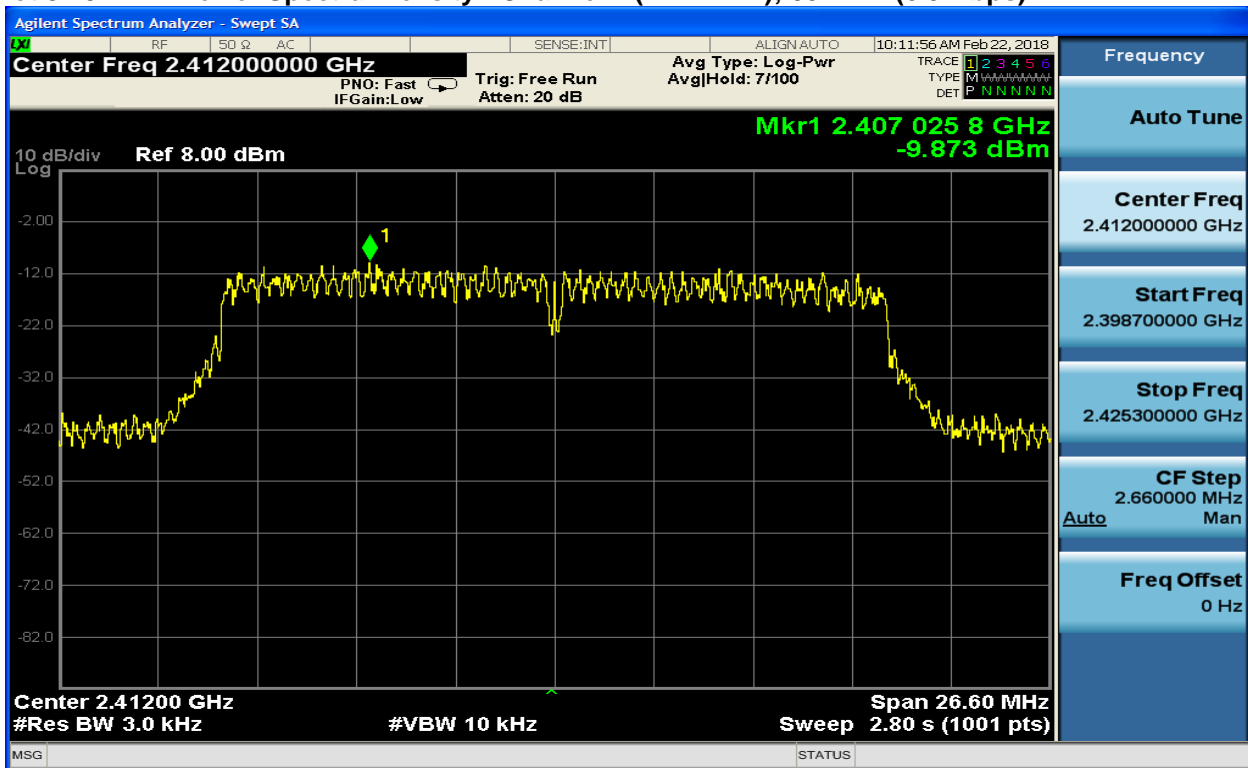
**Plot 8-17: Power Spectral Density: Channel 6 (2437 MHz); 802.11g (54 Mbps)**



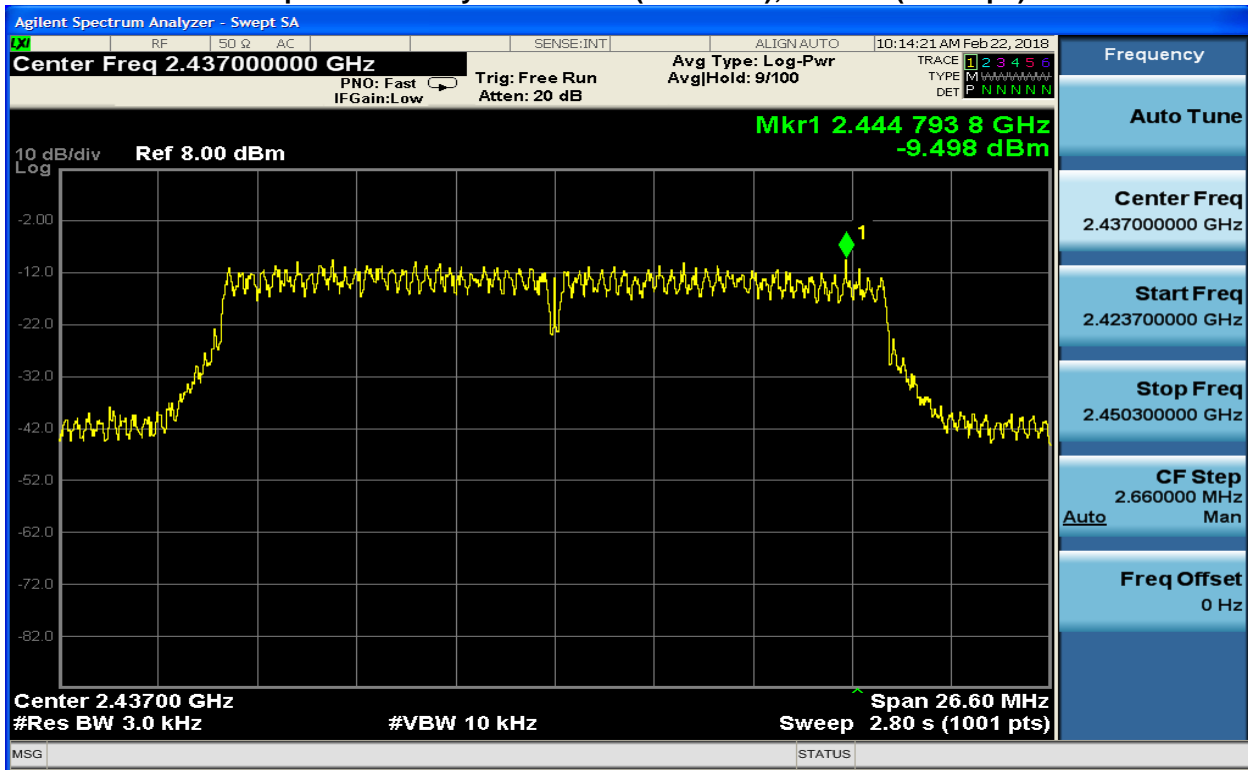
**Plot 8-18: Power Spectral Density: Channel 11 (2462 MHz); 802.11g (54 Mbps)**



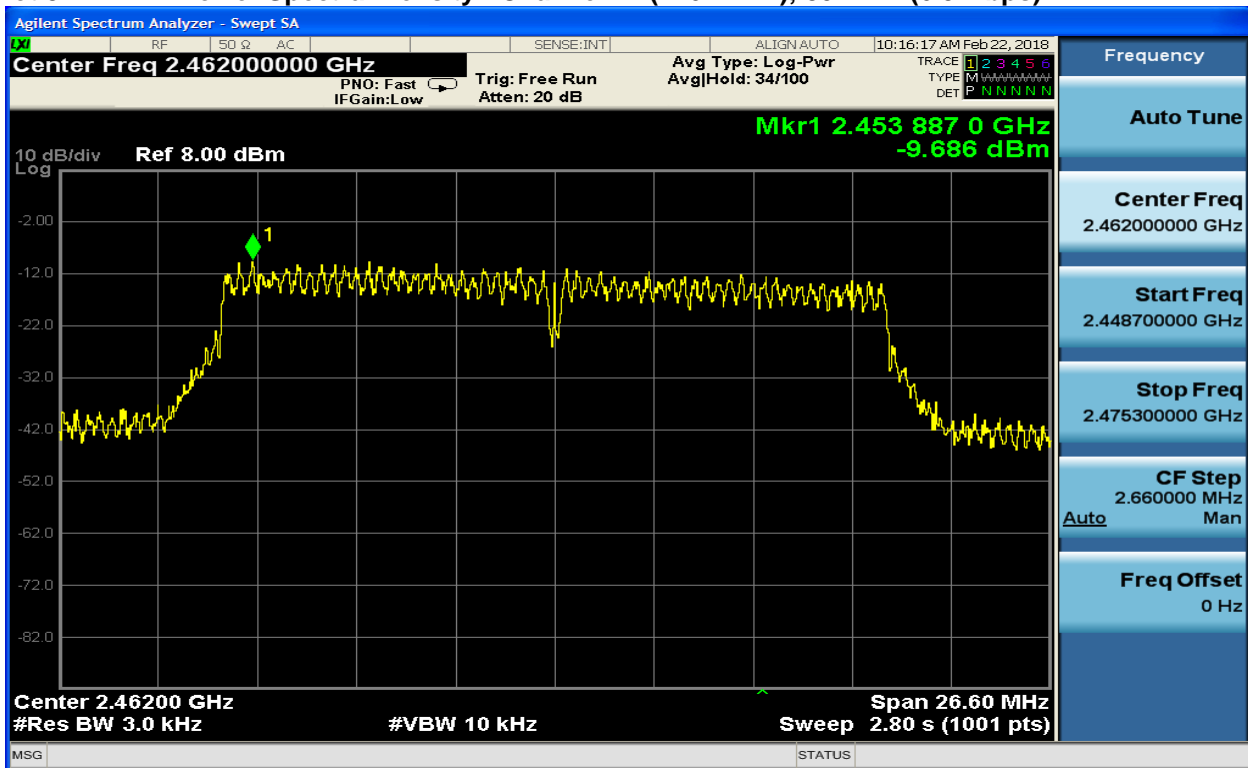
**Plot 8-19: Power Spectral Density: Channel 1 (2412 MHz); 802.11n (6.5 Mbps)**



**Plot 8-20: Power Spectral Density: Channel 6 (2437 MHz); 802.11n (6.5 Mbps)**



**Plot 8-21: Power Spectral Density: Channel 11 (2462 MHz); 802.11n (6.5 Mbps)**



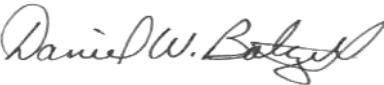

Measurement uncertainties shown for these tests are expanded Gaussian uncertainties expressed at 95% confidence level using a coverage factor  $k = 1.96$ . Measurement uncertainty = 0.5 dB.

**PASS**

**Table 8-8: Power Spectral Density Test Equipment**

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz-26.5 GHz)	MY51250846	2/6/20

**Test Personnel:**

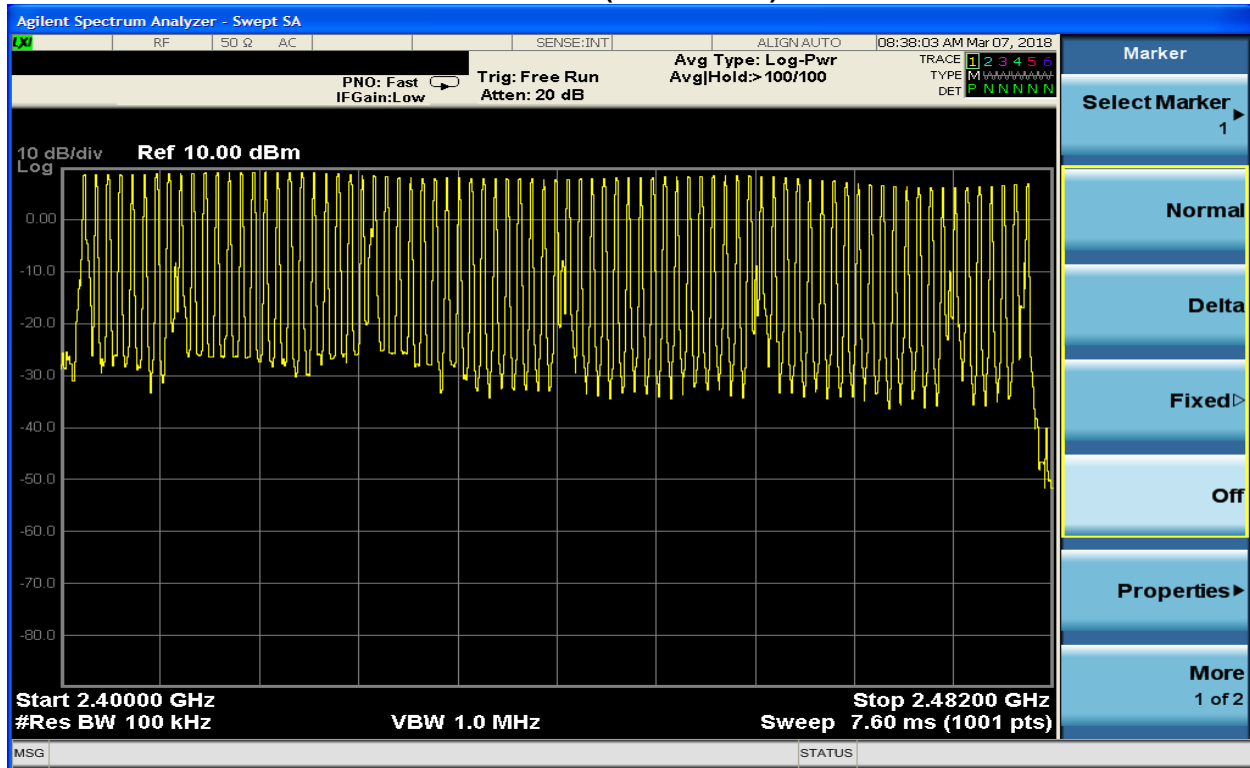
Daniel W. Baltzell Test Engineer	 Signature	February 20, 2018 Date of Test
Khue Do Test Engineer	 Signature	March 6-7, 2018 Dates of Test

### 9 Hopping Characteristics – FCC 15.247(a)(1); RSS-247 5.1

15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter.

15.247(a)(1)(iii) Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

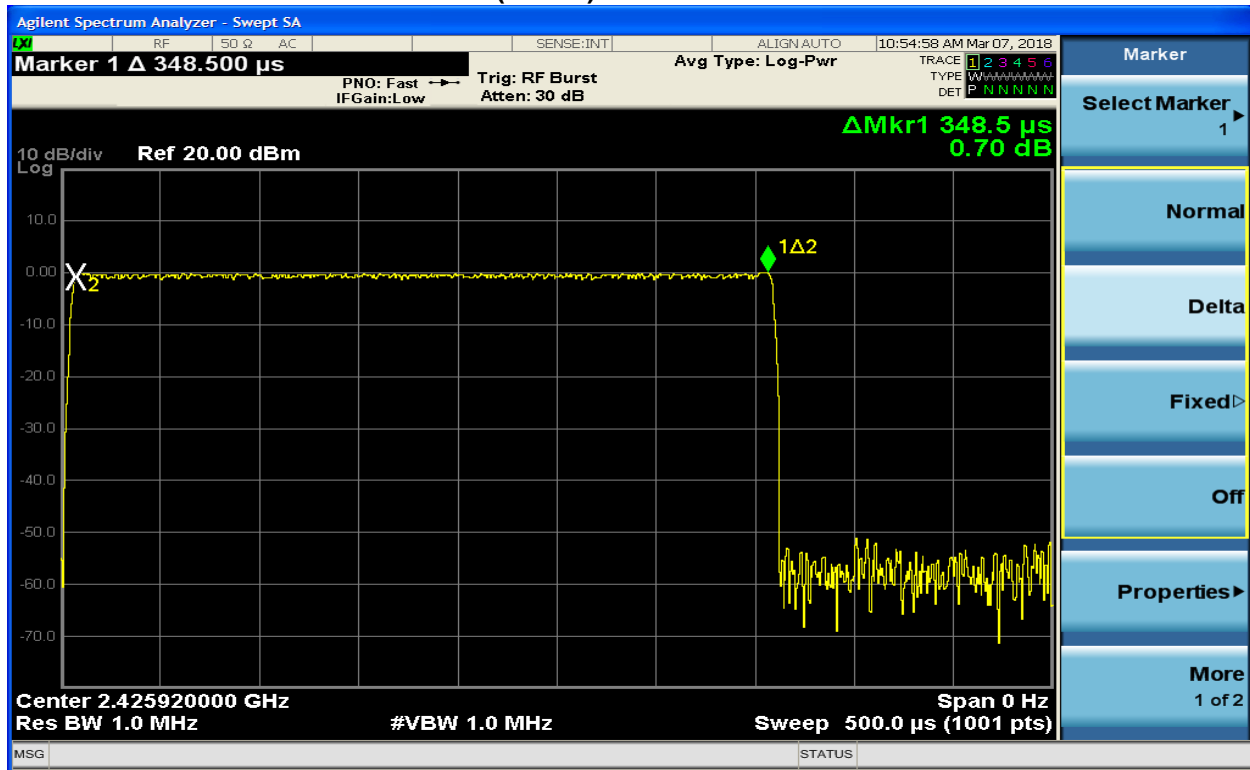
**Plot 9-1: Number of Channels – Bluetooth (79 Channels)**







**Plot 9-4: Pulse Width – Bluetooth (349 us)**



Number of pulses in 79 \* 0.4 (31.6) seconds = 30  
 Pulse width 349 us x 30 = 0.011 s which is less than 0.400s (limit)

Measurement uncertainty: ±1.4%. This measurement uncertainty is an expanded uncertainty for 95.45% confidence level received with a coverage factor k=2.

**Pass**

**Table 9-1: Hopping Mode Characteristics Test Equipment**

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz-26.5 GHz)	MY51250846	2/6/20

**PASS**

Test Personnel:

Khue Do  
 Test Engineer

*[Handwritten Signature]*  
 Signature

March 7, 2018  
 Date of Test

**10 Radiated Emissions – FCC 15.209; RSS-247 6.2 and RSS-Gen**

**10.1 Limits of Radiated Emissions Measurement**

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009-0.490	2400/f (kHz)	300
0.490-1.705	2400/f (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

As shown in 15.35(b), for frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any circumstances of modulation.

**10.2 Radiated Emissions Measurement Test Procedure**

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to the 10<sup>th</sup> harmonic of the highest fundamental transmitter frequency (24.8 GHz) for the 2.4 GHz band.

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

**10.3 Radiated Emissions Test Results**

**Table 10-1: Radiated Emissions Harmonics/Spurious - 2412 MHz, 802.11b, Peak Detector**

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4824.0	56.1	0.2	56.3	74.0	-17.7
12060.0	38.9	3.2	42.1	74.0	-31.9
14472.0	35.6	8.6	44.2	74.0	-29.8
19296.0	33.9	13.2	47.1	74.0	-26.9

**Table 10-2: Radiated Emissions Harmonics/Spurious - 2412 MHz, 802.11b, Average Detector**

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4824.0	48.5	0.2	48.7	54.0	-5.3
12060.0	31.9	3.2	35.1	54.0	-18.9
14472.0	30.6	8.6	39.2	54.0	-14.8
19296.0	30.4	13.2	43.6	54.0	-10.4

**Table 10-3: Radiated Emissions Harmonics/Spurious- 2412 MHz, 802.11g, Peak Detector**

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4824.0	53.2	0.2	53.4	74.0	-20.6
7236.0	41.2	-1.5	39.7	74.0	-34.3
12060.0	38.0	3.2	41.2	74.0	-32.8
14472.0	35.5	8.6	44.1	74.0	-29.9

**Table 10-4: Radiated Emissions Harmonics/Spurious - 2412 MHz, 802.11g, Average Detector**

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4824.0	45.1	0.2	45.3	54.0	-8.7
7236.0	33.6	-1.5	32.1	54.0	-21.9
12060.0	30.7	3.2	33.9	54.0	-20.1
14472.0	31.5	8.6	40.1	54.0	-13.9

**Table 10-5: Radiated Emissions Harmonics/Spurious - 2412 MHz, 802.11n, Peak Detector**

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4824.0	53.9	0.2	54.1	74.0	-19.9
7236.0	42.2	-1.5	40.7	74.0	-33.3
12060.0	37.7	3.2	40.9	74.0	-33.1
14472.0	35.1	8.6	43.7	74.0	-30.3

**Table 10-6: Radiated Emissions Harmonics/Spurious - 2412 MHz, 802.11n, Average Detector**

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4824.0	45.6	0.2	45.8	54.0	-8.2
7236.0	34.6	-1.5	33.1	54.0	-20.9
12060.0	30.6	3.2	33.8	54.0	-20.2
14472.0	30.8	8.6	39.4	54.0	-14.6

**Table 10-7: Radiated Emissions Harmonics/Spurious - 2437 MHz, 802.11b, Peak Detector**

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4874.0	55.0	0.2	55.2	74.0	-18.8
7311.0	41.1	-1.5	39.6	74.0	-34.4
12185.0	37.6	3.2	40.8	74.0	-33.2
19496.0	32.1	13.2	45.3	74.0	-28.7

**Table 10-8: Radiated Emissions Harmonics/Spurious - 2437 MHz, 802.11b, Average Detector**

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4874.0	47.2	0.2	47.4	54.0	-6.6
7311.0	32.0	-1.5	30.5	54.0	-23.5
12185.0	30.4	3.2	33.6	54.0	-20.4
19496.0	29.0	13.2	42.2	54.0	-11.8

**Table 10-9: Radiated Emissions Harmonics/Spurious - 2437 MHz, 802.11g, Peak Detector**

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4874.0	53.1	0.2	53.3	74.0	-20.7
7311.0	40.7	-1.5	39.2	74.0	-34.8
12185.0	36.7	3.2	39.9	74.0	-34.1
19496.0	32.3	13.2	45.5	74.0	-28.5

**Table 10-10: Radiated Emissions Harmonics/Spurious - 2437 MHz, 802.11g, Average Detector**

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4874.0	45.8	0.2	46.0	54.0	-8.0
7311.0	33.1	-1.5	31.6	54.0	-22.4
12185.0	30.0	3.2	33.2	54.0	-20.8
19496.0	29.2	13.2	42.4	54.0	-11.6

**Table 10-11: Radiated Emissions Harmonics/Spurious - 2437 MHz, 802.11n, Peak Detector**

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4874.0	51.9	0.2	52.1	74.0	-21.9
7311.0	41.1	-1.5	39.6	74.0	-34.4
12185.0	36.3	3.2	39.5	74.0	-34.5
19496.0	32.5	13.2	45.7	74.0	-28.3

**Table 10-12: Radiated Emissions Harmonics/Spurious - 2437 MHz, 802.11n, Average Detector**

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4874.0	44.4	0.2	44.6	54.0	-9.4
7311.0	33.3	-1.5	31.8	54.0	-22.2
12185.0	30.2	3.2	33.4	54.0	-20.6
19496.0	29.9	13.2	43.1	54.0	-10.9

**Table 10-13: Radiated Emissions Harmonics/Spurious - 2462 MHz, 802.11b, Peak Detector**

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4924.0	54.5	0.2	54.7	74.0	-19.3
7386.0	41.5	-1.5	40.0	74.0	-34.0
12310.0	36.5	3.2	39.7	74.0	-34.3
19696.0	31.1	13.2	44.3	74.0	-29.7
22158.0	17.5	12.0	29.5	74.0	-44.5

**Table 10-14: Radiated Emissions Harmonics/Spurious - 2462 MHz, 802.11b, Average Detector**

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4924.0	47.3	0.2	47.5	54.0	-6.5
7386.0	34.4	-1.5	32.9	54.0	-21.1
12310.0	30.6	3.2	33.8	54.0	-20.2
19696.0	28.8	13.2	42.0	54.0	-12.0
22158.0	9.0	12.0	21.0	54.0	-33.0

**Table 10-15: Radiated Emissions Harmonics/Spurious - 2462 MHz, 802.11g, Peak Detector**

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4924.0	54.2	0.2	54.4	74.0	-19.6
7386.0	40.6	-1.5	39.1	74.0	-34.9
12310.0	36.2	3.2	39.4	74.0	-34.6
19696.0	31.7	13.2	44.9	74.0	-29.1
22158.0	17.2	12.0	29.2	74.0	-44.8

**Table 10-16: Radiated Emissions Harmonics/Spurious - 2462 MHz, 802.11g, Average Detector**

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4924.0	45.9	0.2	46.1	54.0	-7.9
7386.0	32.4	-1.5	30.9	54.0	-23.1
12310.0	29.9	3.2	33.1	54.0	-20.9
19696.0	28.2	13.2	41.4	54.0	-12.6
22158.0	9.2	12.0	21.2	54.0	-32.8

**Table 10-17: Radiated Emissions Harmonics/Spurious - 2462 MHz, 802.11n, Peak Detector**

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4924.0	52.5	0.2	52.7	74.0	-21.3
7386.0	41.1	-1.5	39.6	74.0	-34.4
12310.0	36.6	3.2	39.8	74.0	-34.2
19696.0	30.3	13.2	43.5	74.0	-30.5
22158.0	16.9	12.0	28.9	74.0	-45.1

**Table 10-18: Radiated Emissions Harmonics/Spurious - 2462 MHz, 802.11n, Average Detector**

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4924.0	44.7	0.2	44.9	54.0	-9.1
7386.0	33.0	-1.5	31.5	54.0	-22.5
12310.0	30.8	3.2	34.0	54.0	-20.0
19696.0	26.9	13.2	40.1	54.0	-13.9
22158.0	9.4	12.0	21.4	54.0	-32.6



**Table 10-19: Radiated Emissions Harmonics/Spurious - 2402 MHz, ANT+, Peak Detector**

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4804.0	47.6	0.2	47.8	74.0	-26.2
12010.0	37.0	3.2	40.2	74.0	-33.8
19216.0	36.4	13.2	49.6	74.0	-24.4

**Table 10-20: Radiated Emissions Harmonics/Spurious - 2402 MHz, ANT+, Average Detector**

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4804.0	45.7	0.2	45.9	54.0	-8.1
12010.0	31.1	3.2	34.3	54.0	-19.7
19216.0	32.8	13.2	46.0	54.0	-8.0

**Table 10-21: Radiated Emissions Harmonics/Spurious - 2441 MHz, ANT+, Peak Detector**

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4882.0	46.6	0.6	47.2	74.0	-26.8
7323.0	40.7	-2.3	38.4	74.0	-35.6
12205.0	32.5	3.4	35.9	74.0	-38.1
19528.0	31.2	13.3	44.5	74.0	-29.5

**Table 10-22: Radiated Emissions Harmonics/Spurious - 2441 MHz, ANT+, Average Detector**

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4882.0	44.3	0.6	44.9	54.0	-9.1
7323.0	38.4	-2.3	36.1	54.0	-17.9
12205.0	27.6	3.4	31.0	54.0	-23.0
19528.0	26.4	13.3	39.7	54.0	-14.3

**Table 10-23: Radiated Emissions Harmonics/Spurious - 2480 MHz, ANT+, Peak Detector**

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4960.0	47.6	0.8	48.4	74.0	-25.6
7440.0	37.5	-2.4	35.1	74.0	-38.9
12400.0	25.6	3.7	29.3	74.0	-44.7
19840.0	24.2	13.1	37.3	74.0	-36.7
22320.0	23.5	12.0	35.5	74.0	-38.5

**Table 10-24: Radiated Emissions Harmonics/Spurious - 2480 MHz, ANT+, Average Detector**

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4960.0	44.3	0.8	45.1	54.0	-8.9
7440.0	34.3	-2.4	31.9	54.0	-22.1
12400.0	19.6	3.7	23.3	54.0	-30.7
19840.0	15.5	13.1	28.6	54.0	-25.4
22320.0	15.1	12.0	27.1	54.0	-26.9

**Table 10-25: Radiated Emissions Harmonics/Spurious - 2402 MHz, BLE, Peak Detector**

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4804.0	46.7	0.2	46.9	74.0	-27.1
12010.0	44.1	3.2	47.3	74.0	-26.7
19216.0	33.8	13.2	47.0	74.0	-27.0

**Table 10-26: Radiated Emissions Harmonics/Spurious - 2402 MHz, BLE, Average Detector**

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4804.0	45.0	0.2	45.2	54.0	-8.8
12010.0	42.0	3.2	45.2	54.0	-8.8
19216.0	31.4	13.2	44.6	54.0	-9.4

**Table 10-27: Radiated Emissions Harmonics/Spurious - 2440 MHz, BLE, Peak Detector**

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4880.0	46.2	0.6	46.8	74.0	-27.2
7320.0	43.1	-2.3	40.8	74.0	-33.2
12200.0	38.5	3.4	41.9	74.0	-32.1
19520.0	26.6	13.3	39.9	74.0	-34.1

**Table 10-28: Radiated Emissions Harmonics/Spurious - 2440 MHz, BLE, Average Detector**

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4880.0	44.7	0.6	45.3	54.0	-8.7
7320.0	41.0	-2.3	38.7	54.0	-15.3
12200.0	35.0	3.4	38.4	54.0	-15.6
19520.0	21.5	13.3	34.8	54.0	-19.2

**Table 10-29: Radiated Emissions Harmonics/Spurious - 2480 MHz, BLE, Peak Detector**

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4960.0	46.8	0.8	47.6	74.0	-26.4
7440.0	37.5	-2.4	35.1	74.0	-38.9
12400.0	27.2	3.7	30.9	74.0	-43.1
19840.0	17.3	13.1	30.4	74.0	-43.6
22320.0	16.9	12.0	28.9	74.0	-45.1

**Table 10-30: Radiated Emissions Harmonics/Spurious - 2480 MHz, BLE, Average Detector**

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4960.0	44.8	0.8	45.6	54.0	-8.4
7440.0	33.9	-2.4	31.5	54.0	-22.5
12400.0	18.0	3.7	21.7	54.0	-32.3
19840.0	8.9	13.1	22.0	54.0	-32.0
22320.0	8.8	12.0	20.8	54.0	-33.2

**Table 10-31: Radiated Emissions Harmonics/Spurious - 2402 MHz, Bluetooth, Peak Detector**

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4804.0	47.7	0.2	47.9	74.0	-26.1
12010.0	44.3	3.2	47.5	74.0	-26.5
19216.0	29.6	13.2	42.8	74.0	-31.2

**Table 10-32: Radiated Emissions Harmonics/Spurious - 2402 MHz, Bluetooth, Average Detector**

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4804.0	44.5	0.2	44.7	54.0	-9.3
12010.0	42.3	3.2	45.5	54.0	-8.5
19216.0	24.4	13.2	37.6	54.0	-16.4

**Table 10-33: Radiated Emissions Harmonics/Spurious - 2440 MHz, Bluetooth, Peak Detector**

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4880.0	46.1	0.6	46.7	74.0	-27.3
7320.0	42.3	-2.3	40.0	74.0	-34.0
12200.0	22.0	3.4	25.4	74.0	-48.6
19520.0	27.5	13.3	40.8	74.0	-33.2

**Table 10-34: Radiated Emissions Harmonics/Spurious - 2440 MHz, Bluetooth, Average Detector**

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4880.0	43.9	0.6	44.5	54.0	-9.5
7320.0	38.9	-2.3	36.6	54.0	-17.4
12200.0	14.0	3.4	17.4	54.0	-36.6
19520.0	26.0	13.3	39.3	54.0	-14.7

**Table 10-35: Radiated Emissions Harmonics/Spurious - 2480 MHz, Bluetooth, Peak Detector**

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4960.0	46.3	0.8	47.1	74.0	-26.9
7440.0	39.7	-2.4	37.3	74.0	-36.7
12400.0	21.6	3.7	25.3	74.0	-48.7
19840.0	26.3	13.1	39.4	74.0	-34.6
22320.0	23.4	12.0	35.4	74.0	-38.6

**Table 10-36: Radiated Emissions Harmonics/Spurious - 2480 MHz, Bluetooth, Average Detector**

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4960.0	44.3	0.8	45.1	54.0	-8.9
7440.0	35.9	-2.4	33.5	54.0	-20.5
12400.0	15.2	3.7	18.9	54.0	-35.1
19840.0	18.4	13.1	31.5	54.0	-22.5
22320.0	16.5	12.0	28.5	54.0	-25.5

Measurement uncertainty: Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor  $k = 2$ . +4.0 dB/-2.65 dB

**Table 10-37: Radiated Emissions Test Equipment**

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901663	Rohde and Schwarz	HFH2-Z2	Loop Antenna (9 kHz-30 MHz)	827525/019	5/1/19
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1-26.5 GHz)	3008A00505	8/18/18
900905	Rhein Tech Laboratories	PR-1040	OATS 1 Preamplifier 40dB (30 MHz-2 GHz)	1006	8/18/18
900878	Rhein Tech Laboratories	AM3-1197-0005	3 meter Antenna mast, polarizing	Outdoor Range 1	Not Required
901592	Insulated Wire Inc.	KPS-1503-3600-KPR	SMK RF Cables 20'	NA	8/21/18
901593	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36"	NA	8/18/18
901242	Rhein Tech Laboratories	WRT-000-0003	Wood rotating table	N/A	Not Required
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
900772	EMCO	3161-02	Horn Antenna (2-4 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	4/4/18
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	3/22/18
900791	Antenna Research Associates, Inc.	LPB-2520	BiLog Antenna (25-1000 MHz)	1037	10/4/20

**PASS**

**Test Personnel:**

Khue N. Do  
 Test Engineer



Signature

February 15-27, 2018  
 Dates of Test

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

Client: Garmin Int'l Inc.  
Model/HVIN: A03438  
Standards: FCC 15.247/IC RSS-247  
ID's: IPH-03438/1792A-03438  
Report #: 2017241

## **11 Conclusion**

The data in this measurement report shows that the EUT as tested, Garmin International Inc. Model/HVIN A03438, FCC ID: IPH-03438, IC: 1792A-03438, complies with all the applicable requirements of Parts 2 and 15 of the FCC Rules and Regulations, and IC RSS-247 and RSS-Gen.