FCC Part 15.247 Certification Application Report

Test Lab:		Applicant:	
Rhein Tech Laboratories, Inc. Phone: 703-689-0368 360 Herndon Parkway Fax: 703-689-2056 Suite 1400 www.rheintech.com Herndon, VA 20170 E-Mail: atcbinfo@rheintech.com		Garmin International Inc. 1200 E. 151st Street Olathe, Kansas 66062	
FCC ID	IPH-A3405	**Test Report Date**	August 18, 2018
Platform	N/A	**RTL Work Order #**	2018134
Model #	AA3405	**RTL Quote #**	QRTL18-134A
American National Standard Institute	ANSI C63.10-2013 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
FCC Classification	DSS - Part 15 Spread Spectrum Transmitter		
FCC Rule Part	Part 15.247: Operation within the bands 920-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz (10/01/17)		
Digital Interface Information	Digital Interface was found to be compliant		
Frequency Range (MHz)	**Output Power (W)**	**Frequency Tolerance**	**Emission Designator**
2402-2480	0.013	N/A	N/A

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, and ANSI C63.10.

Signature: _____ Date: August 18, 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.

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1 General Information

1.1 Scope

Applicable Standard:

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

1.2 Description of EUT

Equipment Under Test	Body-worn transmitter
Model #	AA3405
Power Supply	Battery operated
Modulation Type	GFSK
Frequency Range	2402 – 2480 MHz
Antenna Connector Type	Magnet Loop
Antenna Connector	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.

1.4 Related Submittal(s)/Grant(s)

This is an original certification application for Garmin International Inc. Model # AA3405, FCC ID: IPH-A3405.

The following grant note is requested:

The antenna used with this transmitter may transmit simultaneously with module FCC ID: 2AN5Z-001R1.

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 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 BT

Channel	Frequency (MHz)
2 (Low)	2402
40 (Mid)	2440
80 (High)	2480

2.2 Exercising the EUT

The EUT is a watch with touch screen capability and one manual button on the right side. 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 2-2: Test Result Summary

FCC Standard	Test	Pass/Fail or N/A
FCC 15.207	AC Power Conducted Emissions	Pass
FCC 15.209	Radiated Emissions	Pass
FCC 15.247(a)(1)	20 dB Bandwidth	Pass
FCC 15.247(a)(1)	Hopping Characteristics	Pass
FCC 15.247(b)(1)	Maximum Peak Power Output	Pass
FCC 15.247(d)	Antenna Conducted Spurious Emissions	Pass
FCC 15.247(d)	Band Edge Measurement	Pass

2.4 Test System Details

The test sample was received on July 16, 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 2-3: Equipment Under Test

Part	Manufacturer	Model #	Serial Number	FCC ID	Cable Description	RTL Bar Code
Body-worn transmitter (radiated testing)	Garmin International Inc.	AA3405	N/A	IPH-A3405	N/A	23067
Body-worn transmitter (conducted testing)	Garmin International Inc.	AA3405	N/A	IPH-A3405	N/A	23068

2.5 Configuration of Tested System

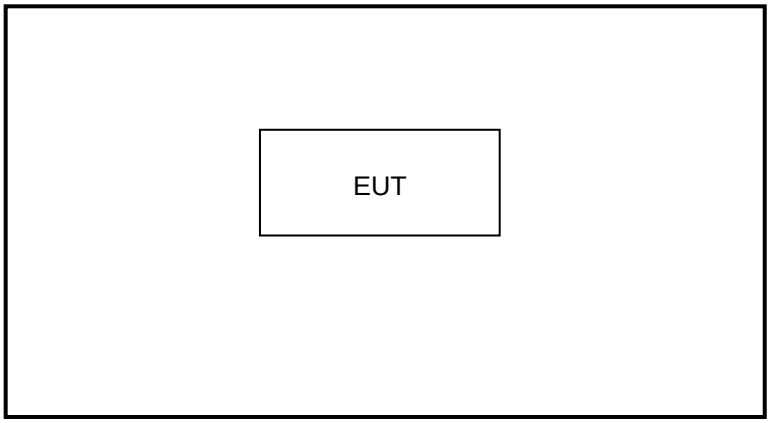


Figure 2-1: Configuration of System Under Test

3 AC Conducted Emissions - FCC 15.207

3.1 Site and Test Description

The power line conducted emissions measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50-ohm/50 microhenry Line Impedance Stabilization Network (LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the AC line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 100 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 100 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable).

The analyzer's 6 dB bandwidth was set to 9 kHz. Video filter less than 10 times the resolution bandwidth is not used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limits were measured and have been recorded.

3.2 Test Limits

Table 3-1: Conducted Emissions Limits

Line-Conducted Emissions		
Limit (dBµV)		
Frequency (MHz)	**Quasi-Peak**	**Average**
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5.00	56	46
5.00 to 30.00	60	50

3.3 Measurement Uncertainty

Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2.

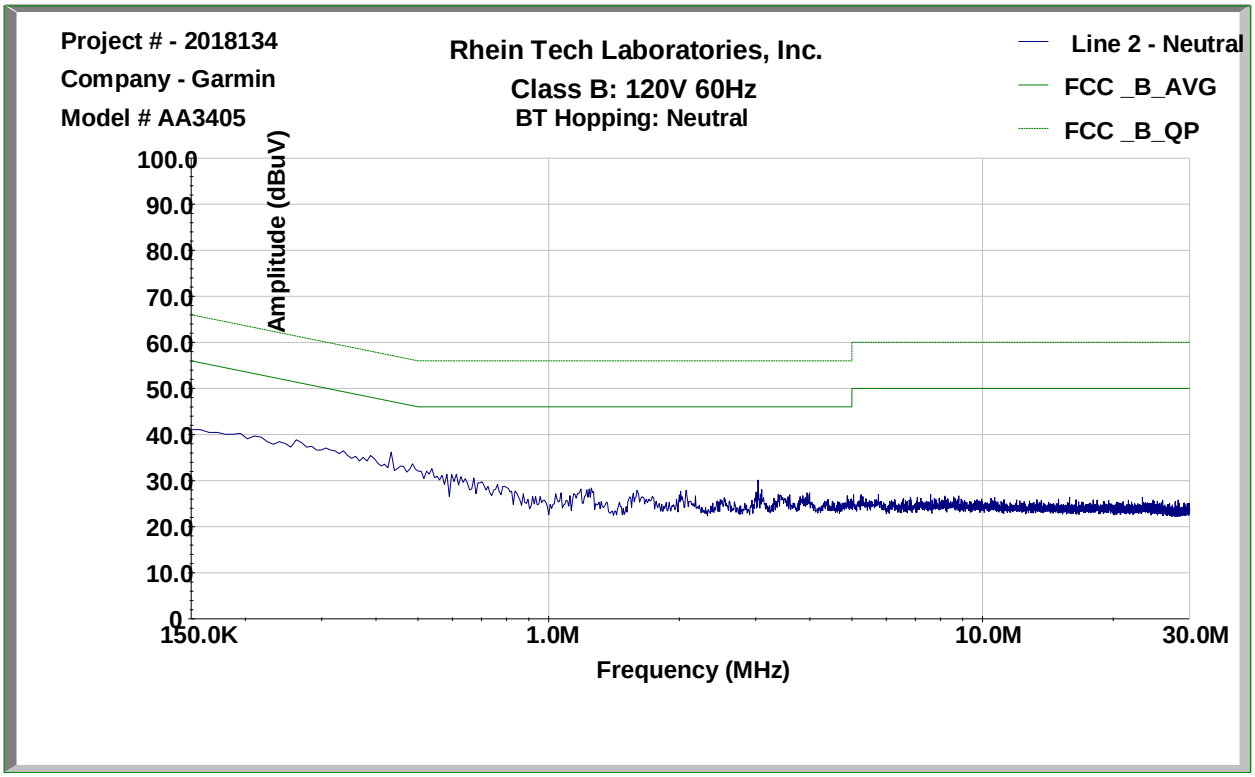
Conducted Emissions: ±2.5 dB

3.4 Conducted Emissions Test Data

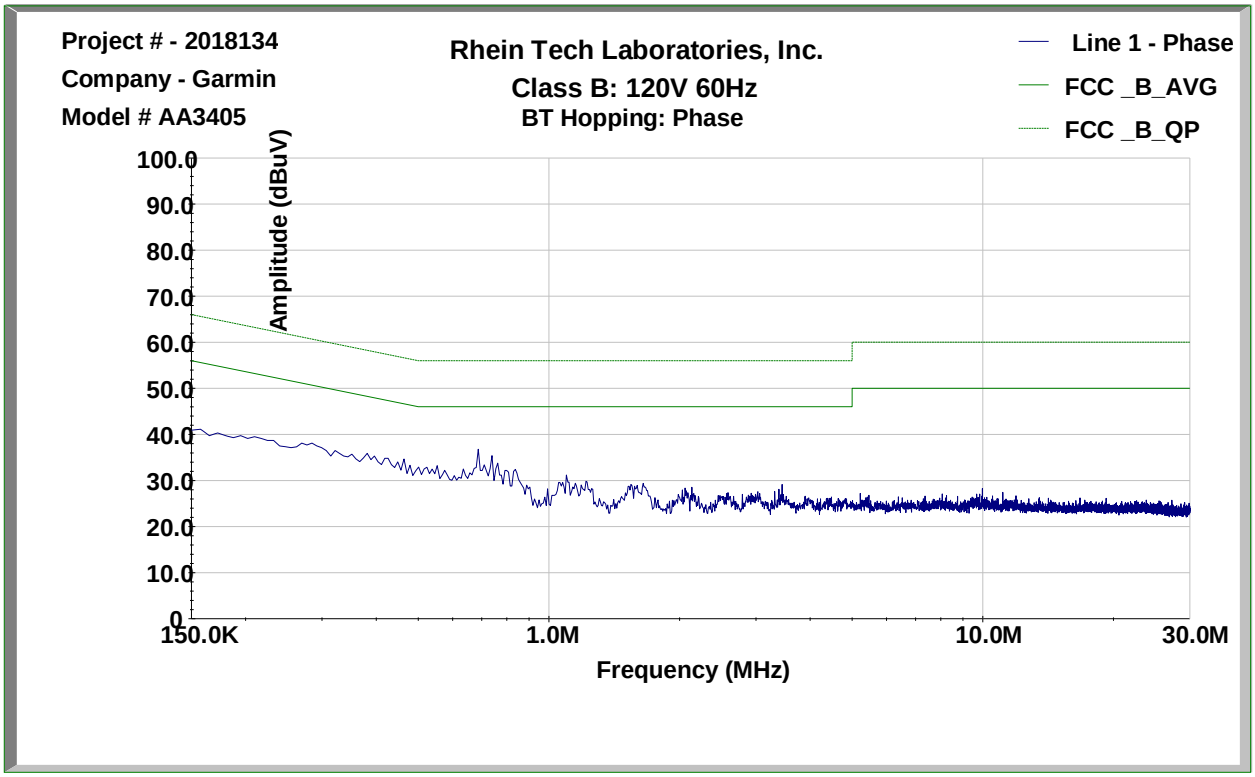
Table 3-2: Conducted Emissions Environmental Condition

Date	Temperature (°F)	Humidity (%)	Pressure (kPa)
July 20, 2018	74.8	25	101.2

Plot 3-1: Conducted Emissions – BT – Neutral



Plot 3-2: Conducted Emissions – BT – Phase



Result: Pass

Table 3-3: Conducted Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900339	Hewlett Packard	85650A	Quasi-Peak Adapter (30 Hz – 1 GHz)	2521A00743	4/26/19
900968	Hewlett Packard	8567A	Spectrum Analyzer (10 kHz – 1.5 GHz)	2602A00160	4/26/19
900970	Hewlett Packard	85662A	Spectrum Analyzer Display	2542A11239	4/26/19
901082	AFJ International	LS16	16A LISN	16010020081	2/13/21
Test Software	Quantum Change	TILE!7	TILE! Test Software	7.1.3.20	N/A

Test Personnel:

Khue N. Do		July 20, 2018
EMC Test Engineer	Signature	Date of Test

4 Radiated Emissions – FCC 15.209

4.1 Limits of Radiated Emissions Measurement

Table 4-1: Radiated Emissions Limits

Frequency (MHz)	Field Strength (µV/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.

4.2 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^{th} harmonic of the highest fundamental transmitter frequency (135.6 MHz).

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 MHz 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.

4.3 Measurement Uncertainty

Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2.

Radiated Emissions: ±4.6 dB

4.4 Radiated Emissions Test Data

Based on manufacturer's statement, the maximum duty cycle is 8 %.

Average measurements were corrected from the raw peak measurements with the following formula below:

Average = Peak + (20 * log(Duty Cycle)) Average ≈ Peak – 21.9 dB

Table 4-2: Radiated Emissions Environmental Condition

Date	Temperature (°F)	Humidity (%)	Pressure (kPa)
July 27, 2018	85.2	92	99.8

Table 4-3: Radiated Emissions Harmonics/Spurious – 2402 MHz, BT BR, Peak Detector

Emission Frequency (MHz)	Analyzer Reading (dBµV/m)	Site Correction Factor (dB/m)	Corrected (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
4804	55.7	0.6	56.3	74.0	-17.7	Pass
12010	36.5	8.3	44.8	74.0	-29.2	Pass
19216	28.0	16.7	44.7	74.0	-29.3	Pass

Table 4-4: Radiated Emissions Harmonics/Spurious – 2402 MHz, BT BR, Average Detector

Emission Frequency (MHz)	Calculated Average (dBµV/m)	Site Correction Factor (dB/m)	Corrected (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
4804	33.8	0.6	34.4	54.0	-19.6	Pass
12010	14.6	8.3	22.9	54.0	-31.1	Pass
19216	6.1	16.7	22.8	54.0	-31.2	Pass

Table 4-5: Radiated Emissions Harmonics/Spurious – 2440 MHz, BT BR, Peak Detector

Emission Frequency (MHz)	Analyzer Reading (dBµV/m)	Site Correction Factor (dB/m)	Corrected (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
4880	56.3	0.3	56.6	74.0	-17.4	Pass
7320	56.1	1.7	57.8	74.0	-16.2	Pass
12200	36.5	9.5	46.0	74.0	-28.0	Pass
19520	27.4	16.7	44.1	74.0	-29.9	Pass

Table 4-6: Radiated Emissions Harmonics/Spurious – 2440 MHz, BT BR, Average Detector

Emission Frequency (MHz)	Calculated Average (dBµV/m)	Site Correction Factor (dB/m)	Corrected (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
4880	34.4	0.3	34.7	54.0	-19.3	Pass
7320	34.2	1.7	35.9	54.0	-18.1	Pass
12200	14.6	9.5	24.1	54.0	-29.9	Pass
19520	5.5	16.7	22.2	54.0	-31.8	Pass

Table 4-7: Radiated Emissions Harmonics/Spurious – 2480 MHz, BT BR, Peak Detector

Emission Frequency (MHz)	Analyzer Reading (dBµV/m)	Site Correction Factor (dB/m)	Corrected (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
4960	58.9	0.5	59.4	74.0	-14.6	Pass
7440	52.4	2.1	54.5	74.0	-19.5	Pass
12400	36.4	9.2	45.6	74.0	-28.4	Pass
19840	22.1	16.4	38.5	74.0	-35.5	Pass
22320	22.3	17.3	39.6	74.0	-34.4	Pass

Table 4-8: Radiated Emissions Harmonics/Spurious – 2480 MHz, BT BR, Average Detector

Emission Frequency (MHz)	Calculated Average (dBµV/m)	Site Correction Factor (dB/m)	Corrected (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
4960	37.0	0.5	37.5	54.0	-16.5	Pass
7440	30.5	2.1	32.6	54.0	-21.4	Pass
12400	14.5	9.2	23.7	54.0	-30.3	Pass
19840	0.2	16.4	16.6	54.0	-37.4	Pass
22320	0.4	17.3	17.7	54.0	-36.3	Pass

Table 4-9: Radiated Emissions Harmonics/Spurious – 2402 MHz, BT EDR, Peak Detector

Emission Frequency (MHz)	Analyzer Reading (dBµV/m)	Site Correction Factor (dB/m)	Corrected (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
4804	51.6	0.6	52.2	74.0	-21.8	Pass
12010	36.6	8.3	44.9	74.0	-29.1	Pass
19216	21.8	16.7	38.5	74.0	-35.5	Pass

Table 4-10: Radiated Emissions Harmonics/Spurious – 2402 MHz, BT EDR, Average Detector

Emission Frequency (MHz)	Calculated Average (dBµV/m)	Site Correction Factor (dB/m)	Corrected (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
4804	29.7	0.6	30.3	54.0	-23.7	Pass
12010	14.7	8.3	23.0	54.0	-31.0	Pass
19216	-0.1	16.7	16.6	54.0	-37.4	Pass

Table 4-11: Radiated Emissions Harmonics/Spurious – 2440 MHz, BT EDR, Peak Detector

Emission Frequency (MHz)	Analyzer Reading (dBµV/m)	Site Correction Factor (dB/m)	Corrected (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
4880	50.1	0.3	50.4	74.0	-23.6	Pass
7320	48.4	1.7	50.1	74.0	-23.9	Pass
12200	36.5	9.5	46.0	74.0	-28.0	Pass
19520	20.6	16.7	37.3	74.0	-36.7	Pass

Table 4-12: Radiated Emissions Harmonics/Spurious – 2440 MHz, BT EDR, Average Detector

Emission Frequency (MHz)	Calculated Average (dBµV/m)	Site Correction Factor (dB/m)	Corrected (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
4880	28.2	0.3	28.5	54.0	-25.5	Pass
7320	26.5	1.7	28.2	54.0	-25.8	Pass
12200	14.6	9.5	24.1	54.0	-29.9	Pass
19520	-1.3	16.7	15.4	54.0	-38.6	Pass

Table 4-13: Radiated Emissions Harmonics/Spurious – 2480 MHz, BT EDR, Peak Detector

Emission Frequency (MHz)	Analyzer Reading (dBµV/m)	Site Correction Factor (dB/m)	Corrected (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
4960	50.7	0.5	51.2	74.0	-22.8	Pass
7440	48.3	2.1	50.4	74.0	-23.6	Pass
12400	36.8	9.2	46.0	74.0	-28.0	Pass
19840	21.5	16.4	37.9	74.0	-36.1	Pass
22320	22.9	17.3	40.2	74.0	-33.8	Pass

Table 4-14: Radiated Emissions Harmonics/Spurious – 2480 MHz, BT EDR, Average Detector

Emission Frequency (MHz)	Calculated Average (dBµV/m)	Site Correction Factor (dB/m)	Corrected (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
4960	28.8	0.5	29.3	54.0	-24.7	Pass
7440	26.4	2.1	28.5	54.0	-25.5	Pass
12400	14.9	9.2	24.1	54.0	-29.9	Pass
19840	-0.4	16.4	16.0	54.0	-38.0	Pass
22320	1.0	17.3	18.3	54.0	-35.7	Pass

Result: Pass

Table 4-15: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900321	EMCO	3161-03	Horn Antenna (4.0 – 8.2 GHz)	9508-1020	4/9/19
900323	EMCO	3160-07	Horn Antenna (8.2 – 12.4 GHz)	9605-1054	4/9/19
900356	EMCO	3160-08	Horn Antenna (12.4 – 18.0 GHz)	9607-1044	4/9/19
900772	EMCO	3161-02	Horn Antenna (2 – 4 GHz)	9804-1044	5/17/21
900791	Antenna Research Associates, Inc.	LPB-2520	Bilog Antenna (25 – 1000 MHz)	1037	10/4/20
900811	Rhein Tech Laboratories	PR-1040	Amplifier (10 MHz – 2 GHz)	1003	7/6/19
900878	Rhein Tech Laboratories	AM3-1197-0005	3 meter Antenna mast, polarizing	Outdoor Range 1	Not Required
901242	Rhein Tech Laboratories	WRT-000-0003	Wood rotating table	N/A	Not Required
901218	EMCO	3160-09	Horn Antenna (18 – 26.5 GHz)	960281-003	4/14/19
901583	Agilent Technologies	N9010A	Spectrum Analyzer (10 Hz – 26.5 GHz)	MY51250846	2/6/20
901723	Hewlett Packard	8449B	Amplifier (1 – 26.5 GHz)	3008A00762	5/22/19

Test Personnel:

Khue N. Do		July 27, 2018
EMC Test Engineer	Signature	Date of Test

5 20 dB Bandwidth – FCC 15.247(a)(1)

5.1 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 ≥ 3 x RBW. The device was modulated. The minimum 20 dB bandwidths are presented below.

5.2 Measurement Uncertainty

Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2.

20 dB BW: ±1.0 dB

5.3 20 dB Bandwidth Test Data

Table 5-1: 20 dB BW Environmental Condition

Date	Temperature (°F)	Humidity (%)	Pressure (kPa)
July 24, 2018	75.1	25	101.1

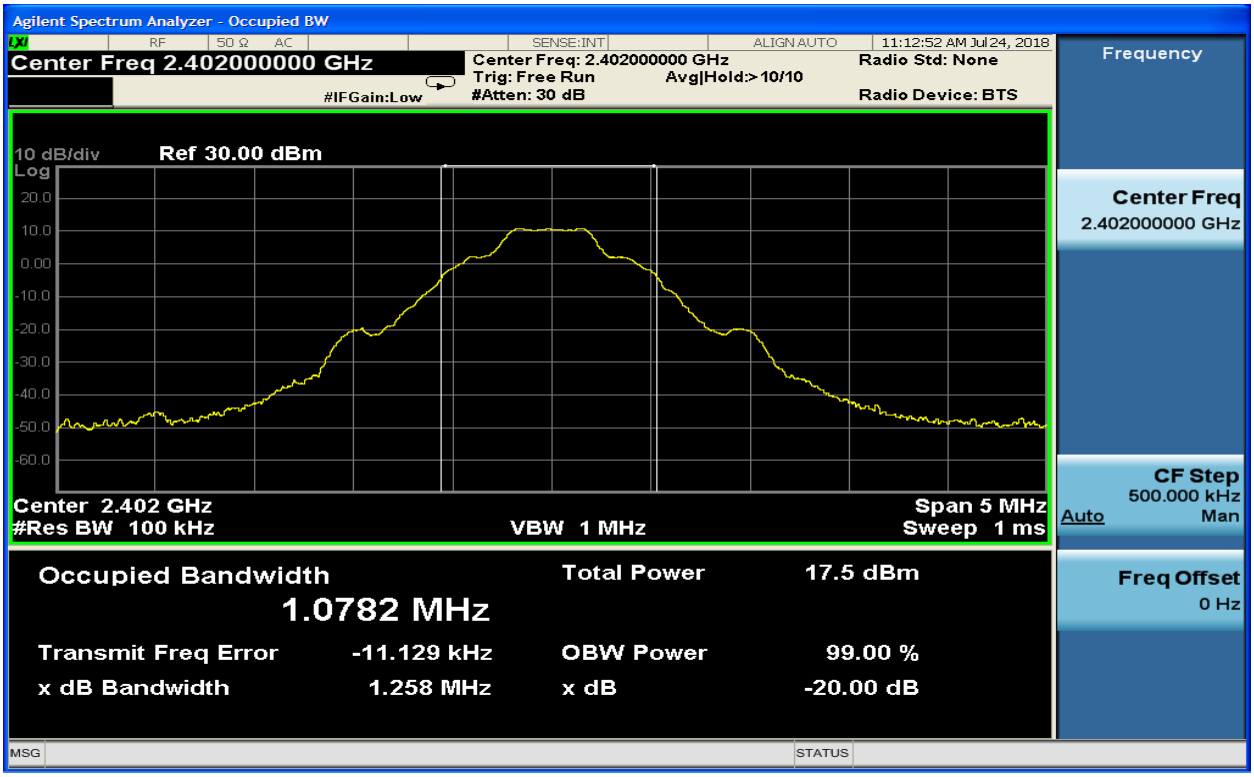
Table 5-2: 20 dB BW – BT BR

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)
2	2402	1258
40	2440	1129
80	2480	1125

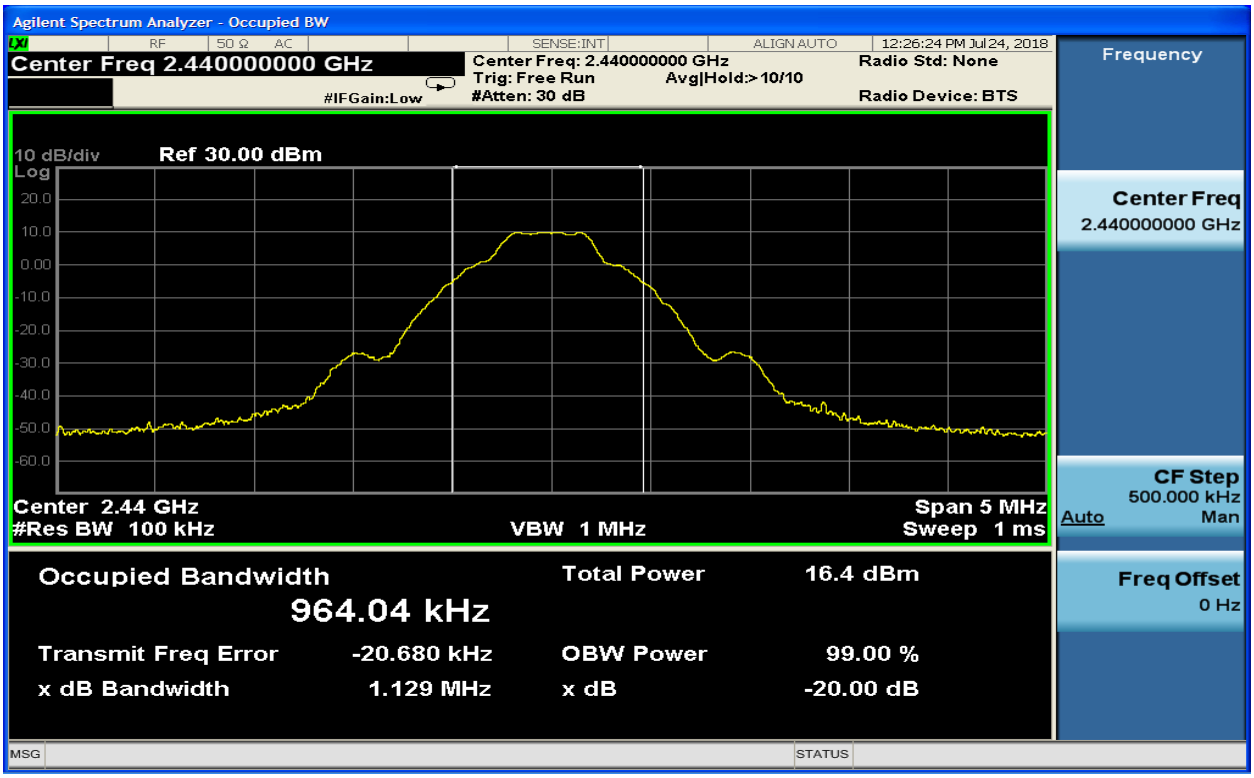
Table 5-3: 20 dB BW – BT EDR

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)
2	2402	1477
40	2440	1464
80	2480	1451

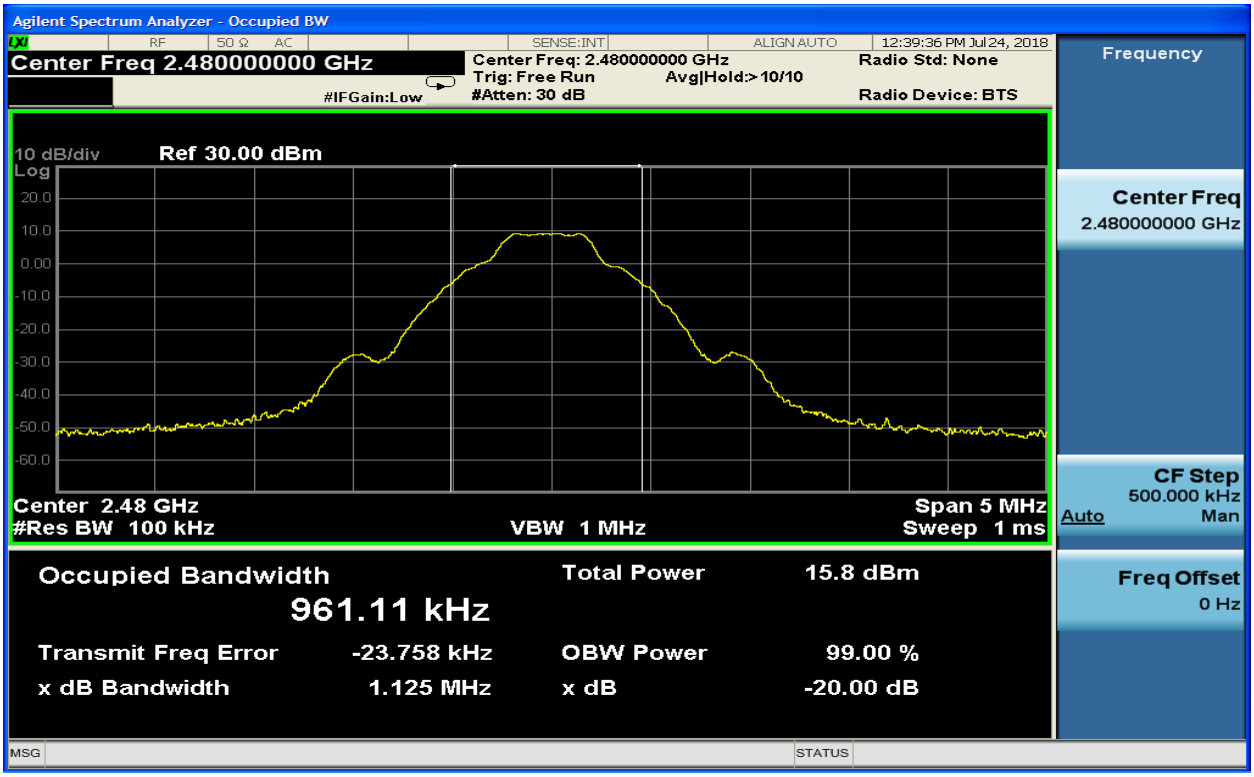
Plot 5-1: 20 dB BW – BT BR – 2402 MHz



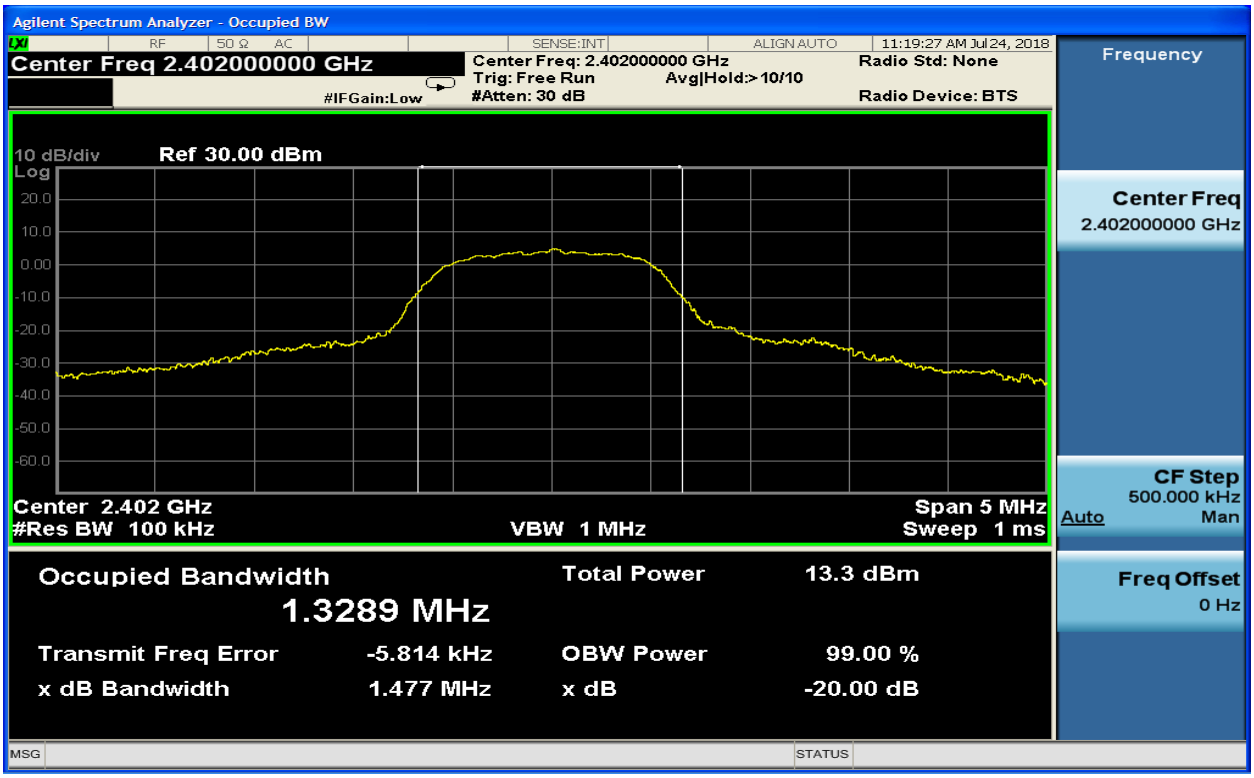
Plot 5-2: 20 dB BW – BT BR – 2440 MHz



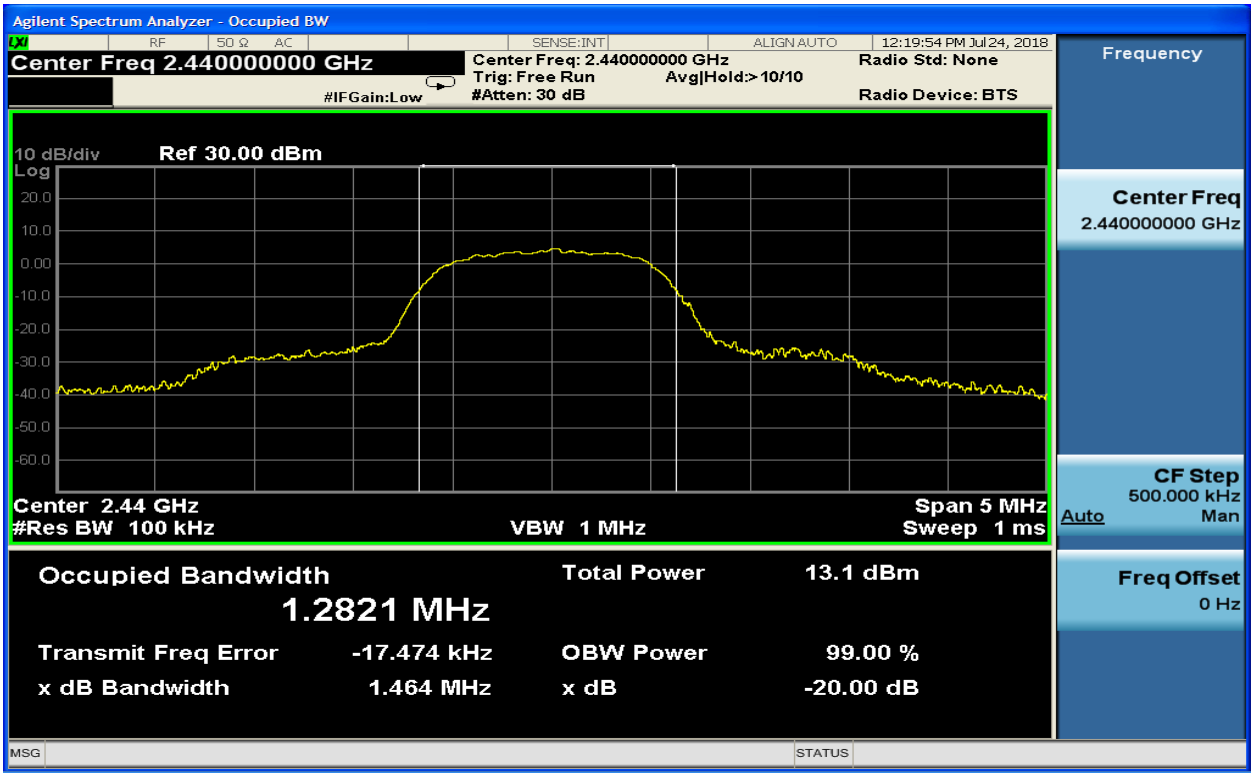
Plot 5-3: 20 dB BW – BT BR – 2480 MHz



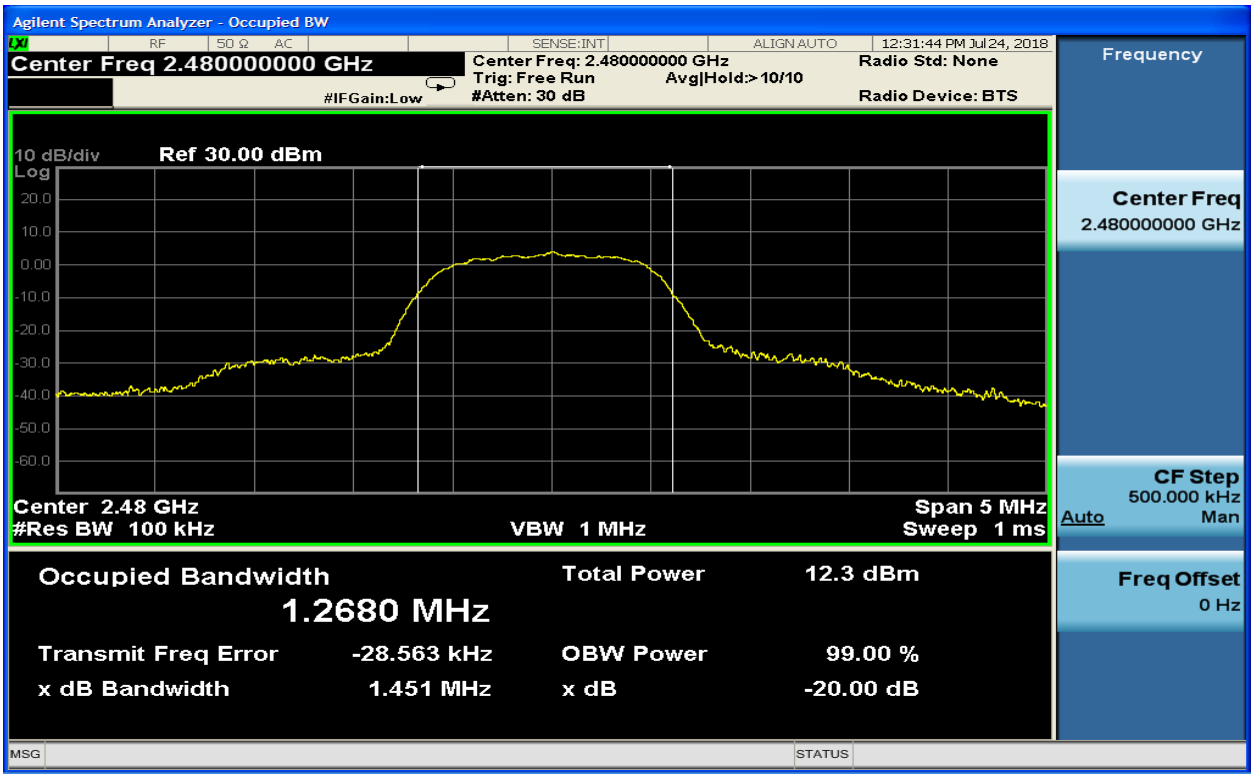
Plot 5-4: 20 dB BW – BT EDR – 2402 MHz



Plot 5-5: 20 dB BW – BT EDR – 2440 MHz



Plot 5-6: 20 dB BW – BT EDR – 2480 MHz



Result: Pass

Table 5-4: 20 dB BW Test Equipment

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

Test Personnel:

Khue N. Do		July 24, 2018
EMC Test Engineer	Signature	Date of Test

6 Hopping Characteristics – FCC 15.247(a)(1)

6.1 Hopping Characteristics Test Procedure

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.

6.2 Test Limits

Table 6-1: Hopping Characteristics Limit

Channel Separation	≈ 1 MHz
# Channel Use	≥ 15 Channels
Average Time of Occupancy (ATO)	< 0.4 s

6.3 Measurement Uncertainty

Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2.

Hopping Characteristics: ±1.0 dB

6.4 Hopping Characteristics Test Data

Table 6-2: Hopping Characteristics Environmental Condition

Date	Temperature (°F)	Humidity (%)	Pressure (kPa)
July 20, 2018	75.5	24	101.2

Table 6-3: Hopping Characteristics – Channel Separation

Rate	Separation (MHz)	Limit (MHz)	Result (Pass / Fail)
BT BR	1	≈ 1	Pass

Table 6-4: Hopping Characteristics – Channel Use

Rate	# of Channel Use	Limit	Result (Pass / Fail)
BT BR	79	≥ 15	Pass

Table 6-5: Hopping Characteristics – ATO

Rate	Pulse Width (ms)	# of Pulses within Period	Average Time of Occupancy (ms)	Limit (ms)	Result (Pass / Fail)
BT BR	0.15	325	48.75	400	Pass

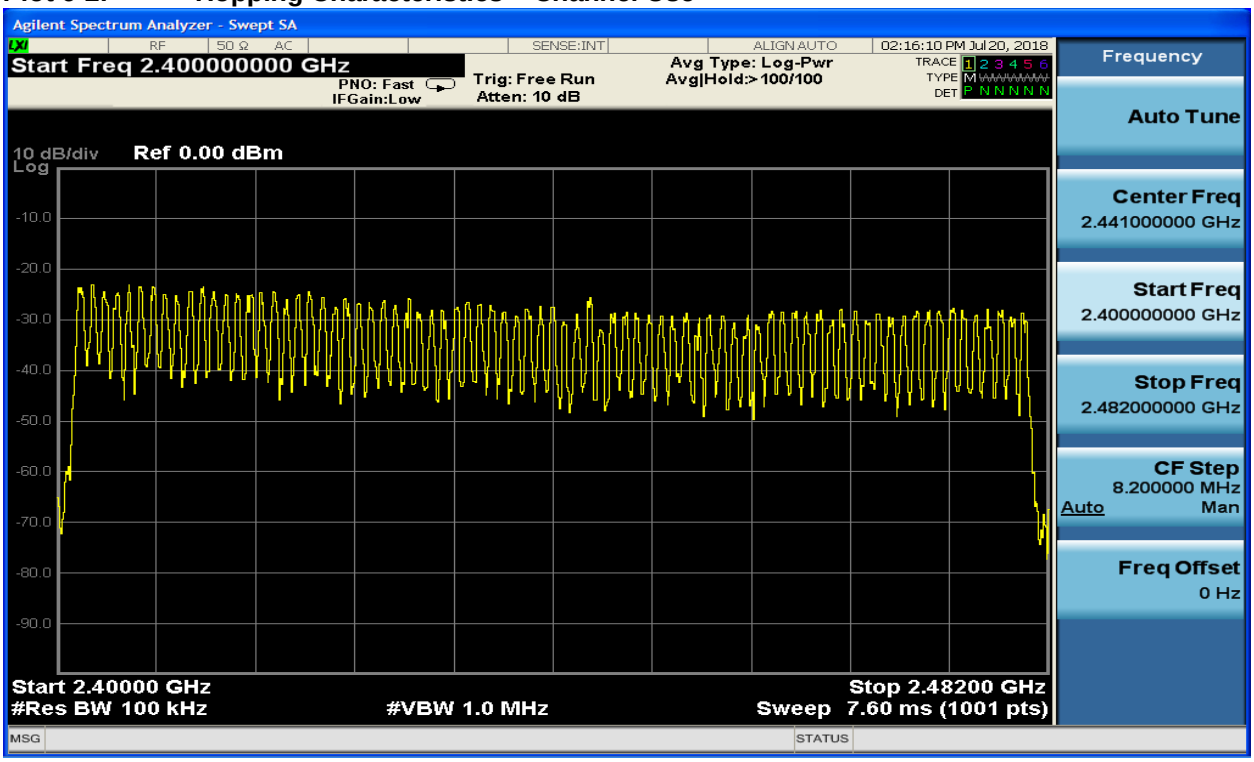
ATO: Period = 0.4 s * # of Channels Employed

Period = 0.4 s * 79 = 31.6 s

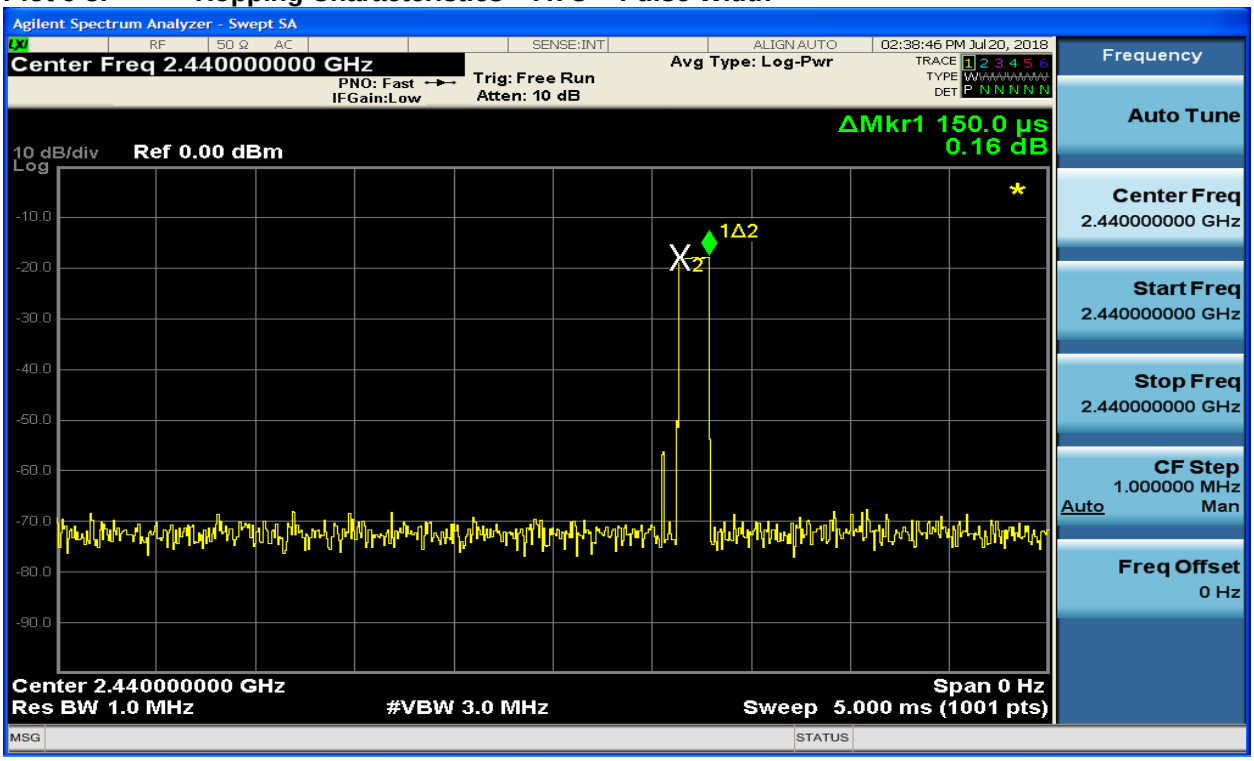
ATO = Pulse Width * # of Pulses within Period

Plot 6-1: Hopping Characteristics – Channel Separation

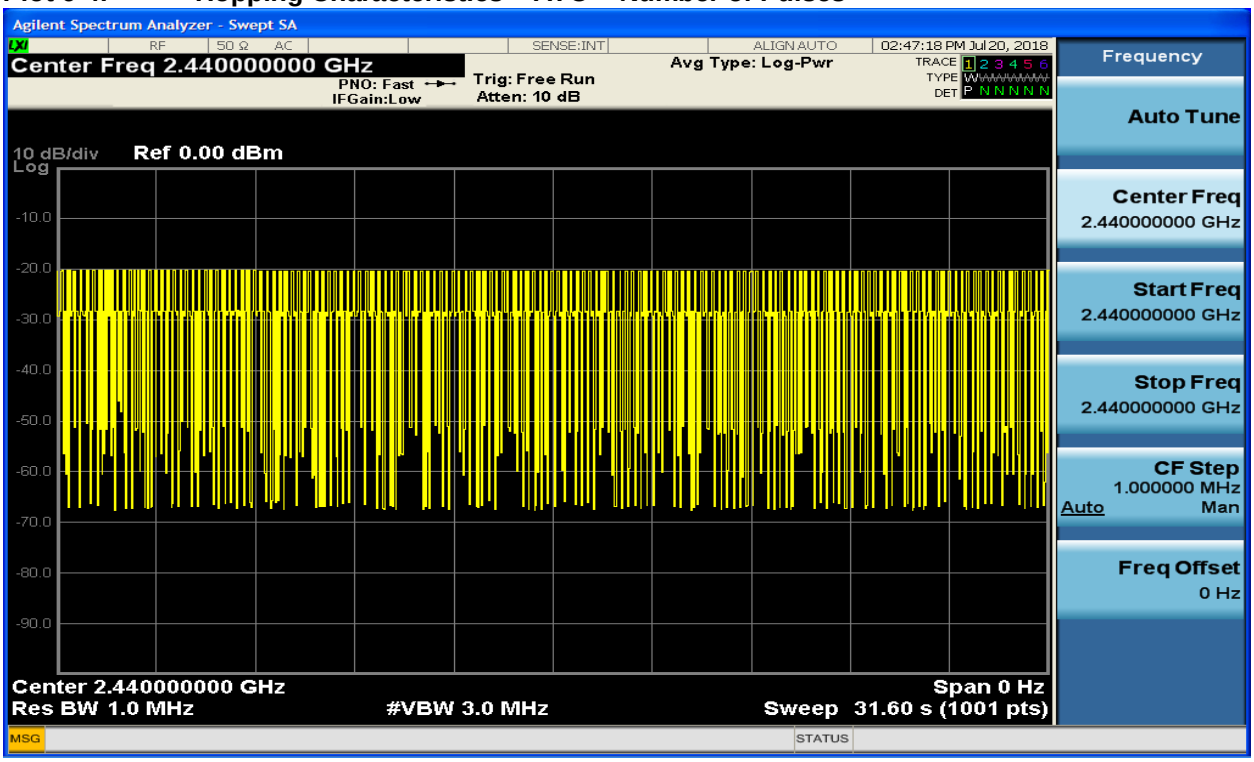
Plot 6-2: Hopping Characteristics – Channel Use



Plot 6-3: Hopping Characteristics – ATO – Pulse Width



Plot 6-4: Hopping Characteristics – ATO – Number of Pulses



Result: Pass

Table 6-6: Hopping Characteristics Test Equipment

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

Test Personnel:

Khue N. Do		July 20, 2018
EMC Test Engineer	Signature	Date of Test

7 Maximum Peak Output Power – FCC 15.247(b)(1)

7.1 Max Peak OP Test Procedure

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

7.2 Test Limits

Table 7-1: Max Peak OP Limit

Maximum Peak Output Power Limit	0.125 W

7.3 Measurement Uncertainty

Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2.

Maximum Peak OP: ±1.0 dB

7.4 Max Peak OP Test Data

Table 7-2: Max Peak OP Environmental Condition

Date	Temperature (°F)	Humidity (%)	Pressure (kPa)
July 24, 2018	75.0	25	101.1

Table 7-3: Max Peak OP – BT BR

Channel	Frequency (MHz)	Peak (dBm)	Limit (dBm)	Margin (dB)	Result (Pass / Fail)
2	2402	11.2	21.0	-9.8	Pass
40	2440	10.6	21.0	-10.4	Pass
80	2480	9.5	21.0	-11.5	Pass

Table 7-4: Max Peak OP – BT EDR

Channel	Frequency (MHz)	Peak (dBm)	Limit (dBm)	Margin (dB)	Result (Pass / Fail)
2	2402	8.7	21.0	-12.3	Pass
40	2440	8.1	21.0	-12.9	Pass
80	2480	7.5	21.0	-13.5	Pass

Note 1: 1.0 W ≈ 30.0 dBm 11.2 dBm ≈ 0.013 W

Note 2: The 10 dB attenuator has been added back into the peak.

Result: Pass

Table 7-5: Max Peak OP Test Equipment

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

Test Personnel:

Khue N. Do		July 24, 2018
EMC Test Engineer	Signature	Date of Test

8 Antenna Conducted Spurious Emissions – FCC 15.247(d)

8.1 Antenna Conducted Spurious Emissions Test Procedures

Antenna conducted 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: 2402 MHz, 2440 MHz and 2480 MHz for BT BR and BT EDR modes.

8.2 Measurement Uncertainty

Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2.

Antenna Conducted Spurious: ±1.0 dB

8.3 Antenna Conducted Spurious Emissions Test Data

Table 8-1: Antenna Conducted Spurious Environmental Condition

Date	Temperature (°F)	Humidity (%)	Pressure (kPa)
July 25, 2018	75.0	25	101.1

No harmonics or spurs were found within 20 dB (note that powers are reported as peaks) of the carrier level from the carrier to the 10th harmonic of the carrier frequency for BT BR and BT EDR modes. Per FCC 15.31(o), no data is being reported.

Result: Pass

Table 8-2: Antenna Conducted Spurious Test Equipment

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

Test Personnel:

Khue N. Do		July 25, 2018
EMC Test Engineer	Signature	Date of Test

9 Compliance with the Band Edge – FCC 15.247(d)

9.1 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.

9.2 Test Limits

Table 9-1: Band Edge Limits

Band Edge Average Limit	54.0 dBµV/m
Band Edge Peak Limit	74.0 dBµV/m

9.3 Measurement Uncertainty

Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2.

Band Edge: ±1.0 dB

9.4 Restricted Band Edge Test Data

Note: Measurements were conducted. A conversion was used to compare the measurements to radiated at 3 m.

dBm to dBµV/m at 3 m conversion:

EIRP [dBm] = E[dBµV/m] + (20 * log(d)) – 104.77 where d is 3 m

E[dBµV/m] = EIRP [dBm] + 95.23

Table 9-2: Band Edge Environmental Condition

Date	Temperature (°F)	Humidity (%)	Pressure (kPa)
July 25, 2018	75.3	25	101.1

Table 9-3: Band Edge Test Data – BT BR – Average

Band Edge	Channel Power (dBm)	Channel Power (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
Lower	-47.7	47.5	54.0	-6.5	Pass
Upper	-43.5	51.7	54.0	-2.3	Pass

Table 9-4: Band Edge Test Data – BT BR – Peak

Band Edge	Channel Power (dBm)	Channel Power (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
Lower	-44.7	50.5	74.0	-23.5	Pass
Upper	-40.9	54.3	74.0	-19.7	Pass

Table 9-5: Band Edge Test Data – BT EDR – Average

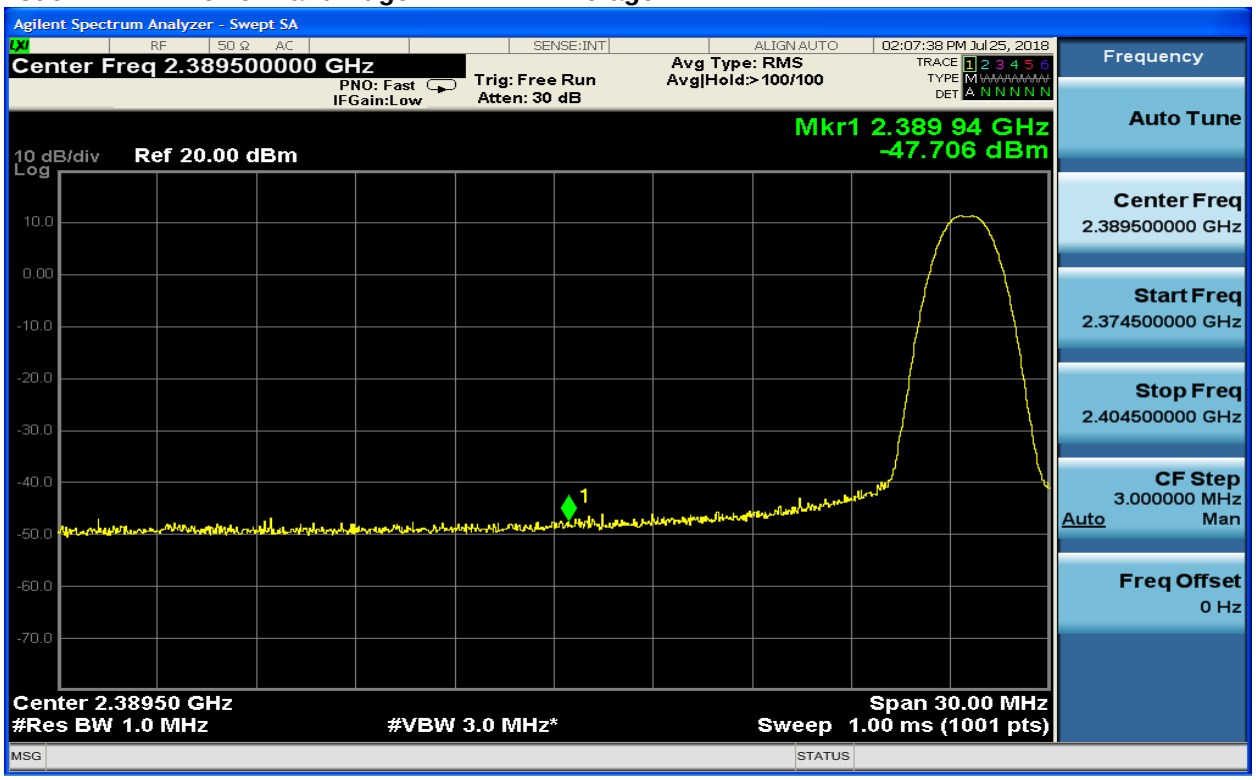
Band Edge	Channel Power (dBm)	Channel Power (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
Lower	-48.1	47.1	54.0	-6.9	Pass
Upper	-44.3	50.9	54.0	-3.1	Pass

Table 9-6: Band Edge Test Data – BT EDR – Peak

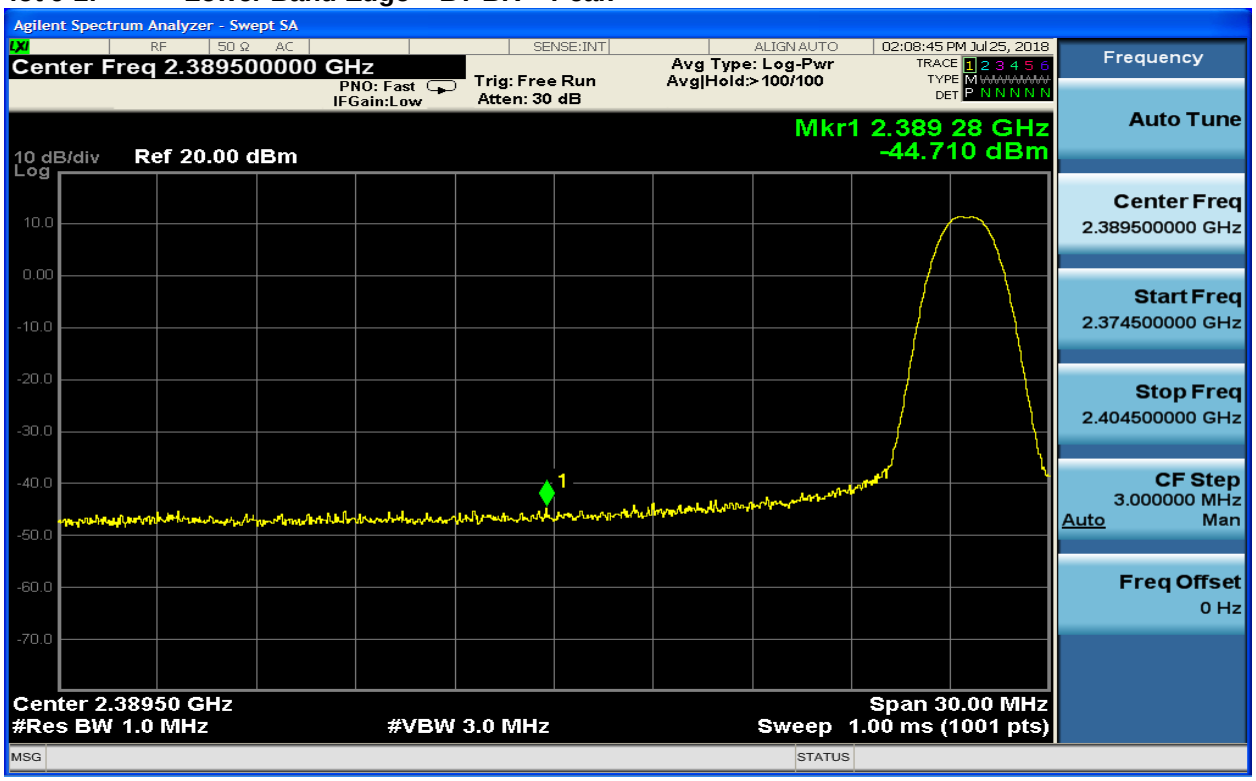
Band Edge	Channel Power (dBm)	Channel Power (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
Lower	-45.7	49.5	74.0	-24.5	Pass
Upper	-31.3	63.9	74.0	-10.1	Pass

9.4.1 Lower Band Edge

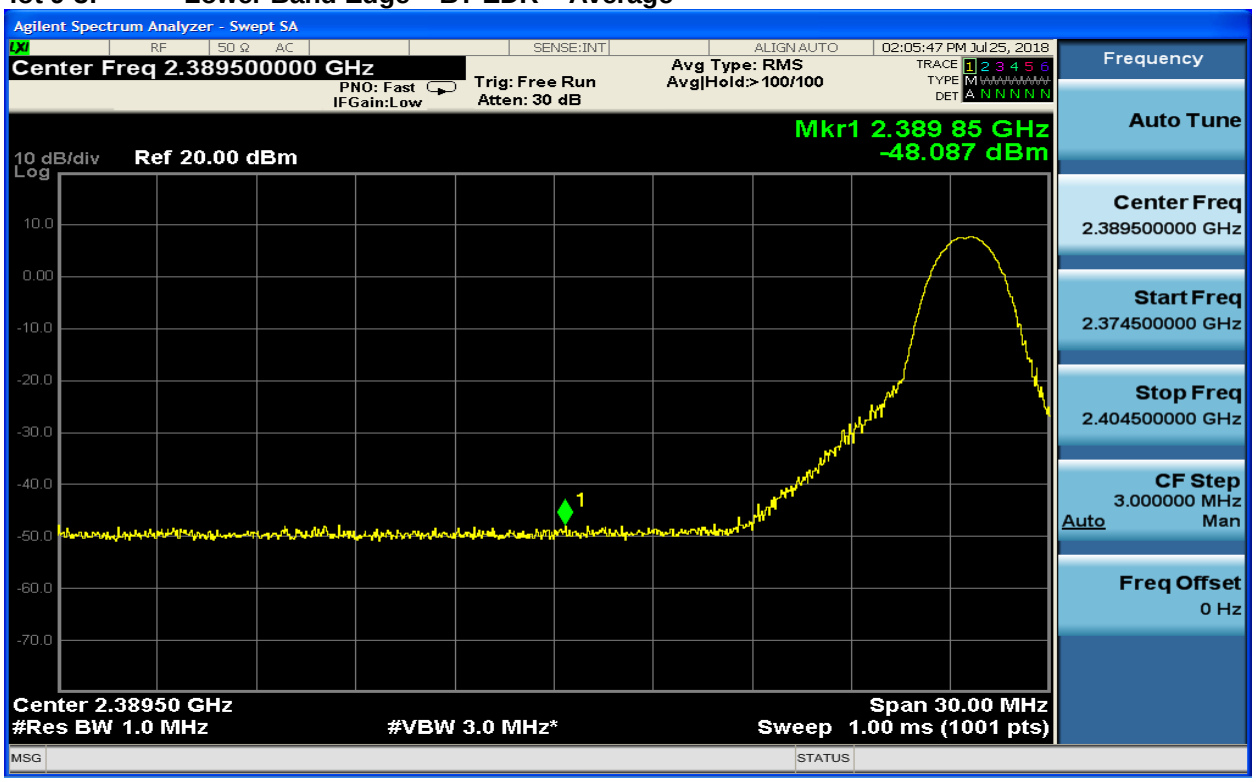
Plot 9-1: Lower Band Edge – BT BR – Average



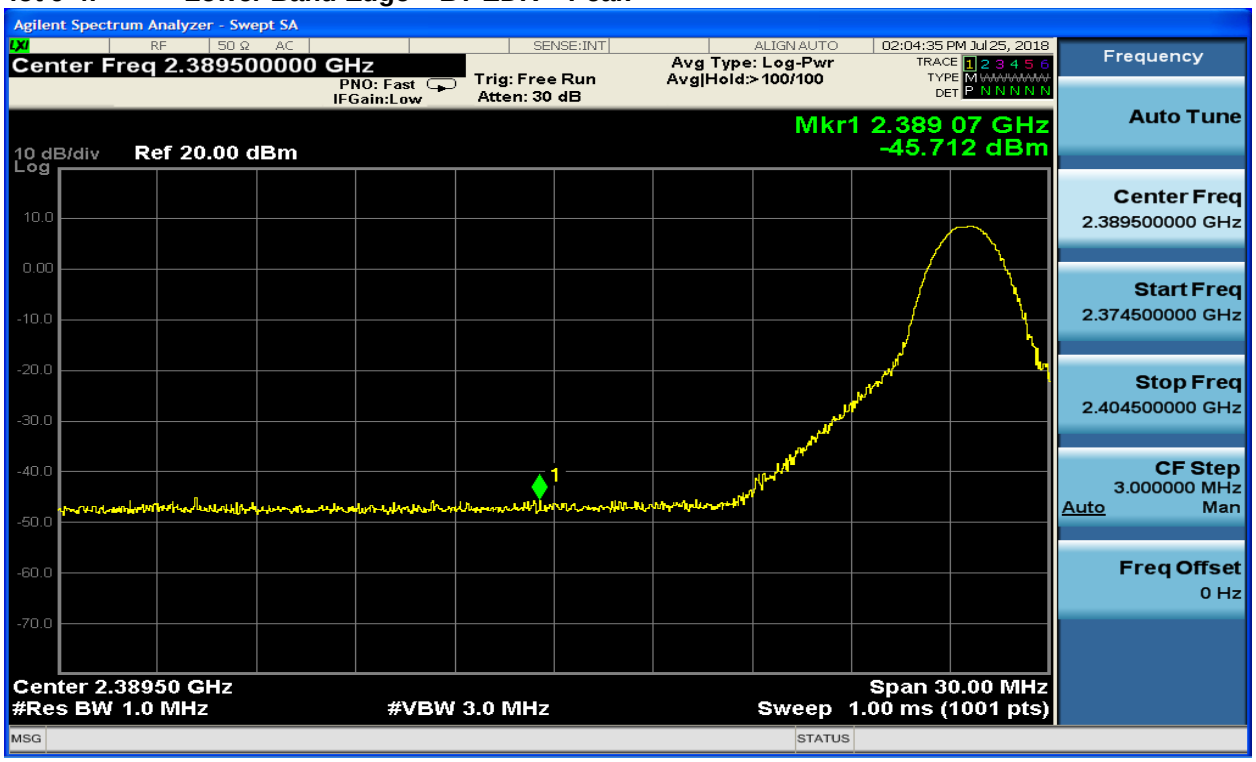
Plot 9-2: Lower Band Edge – BT BR – Peak



Plot 9-3: Lower Band Edge – BT EDR – Average

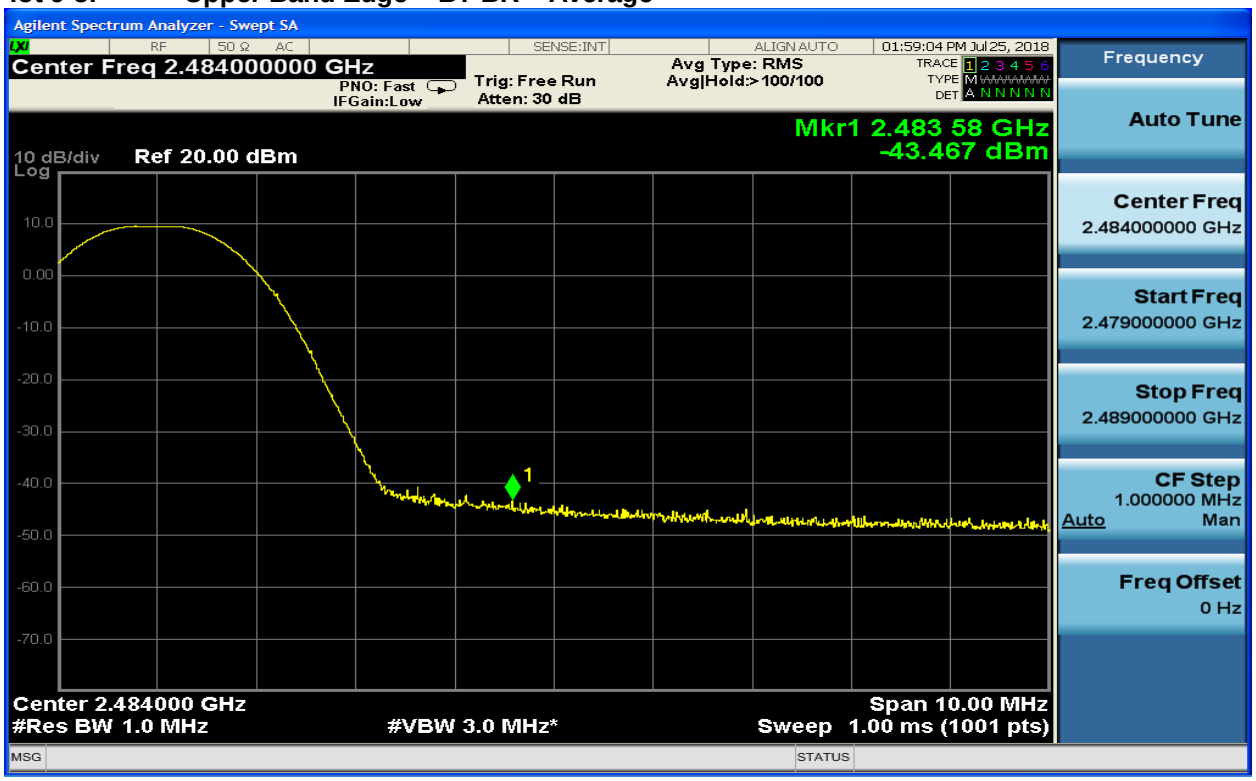


Plot 9-4: Lower Band Edge – BT EDR – Peak

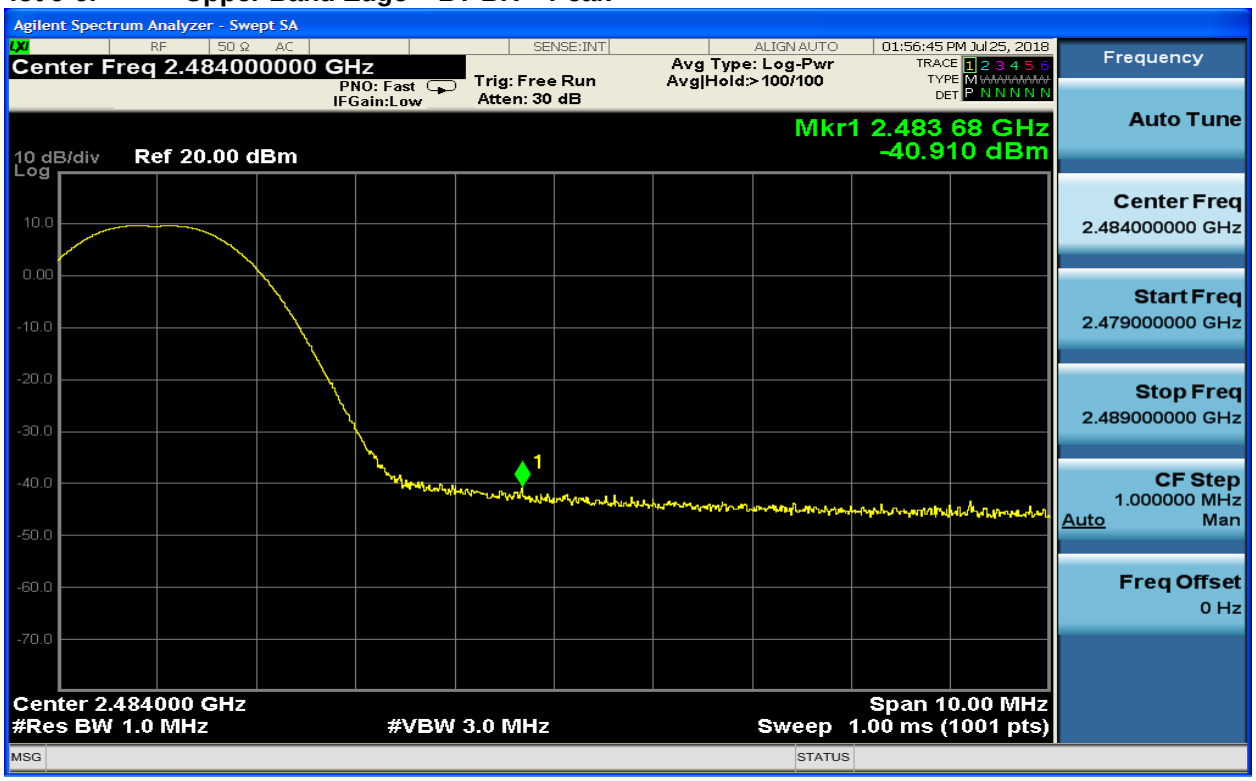


9.4.2 Upper Band Edge

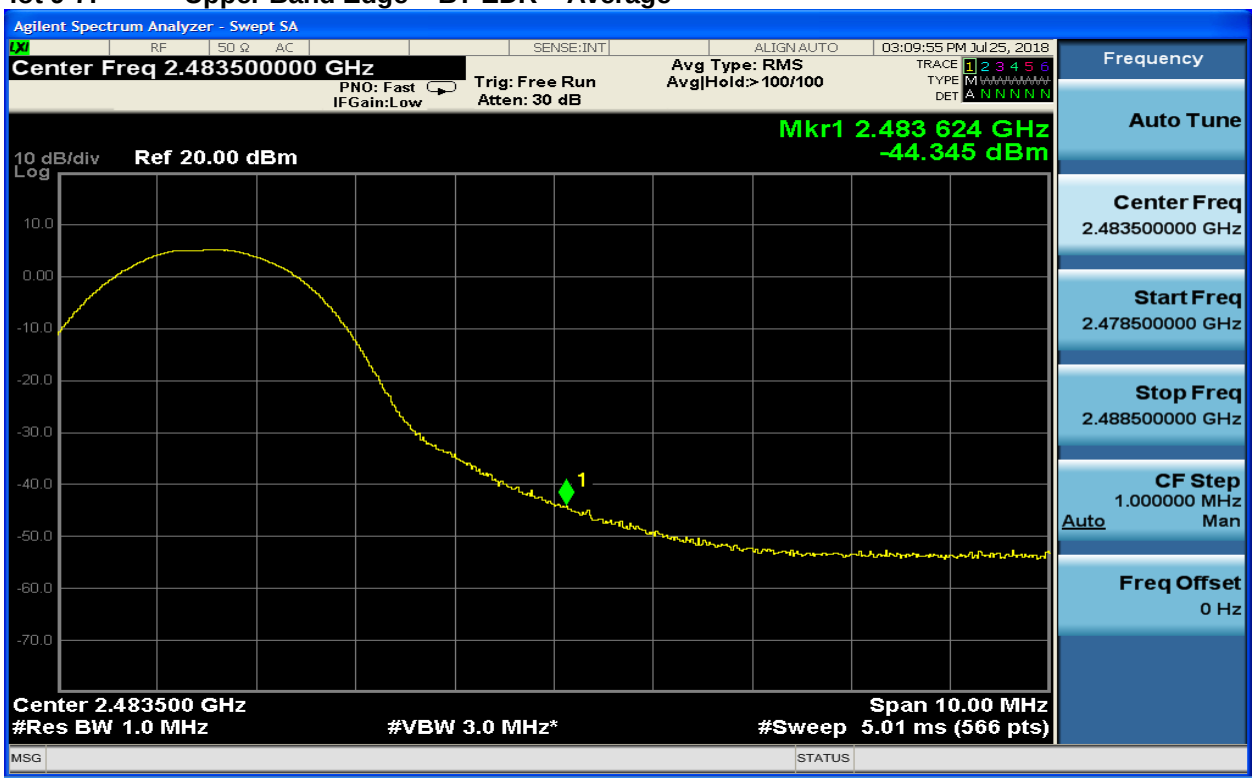
Plot 9-5: Upper Band Edge – BT BR – Average



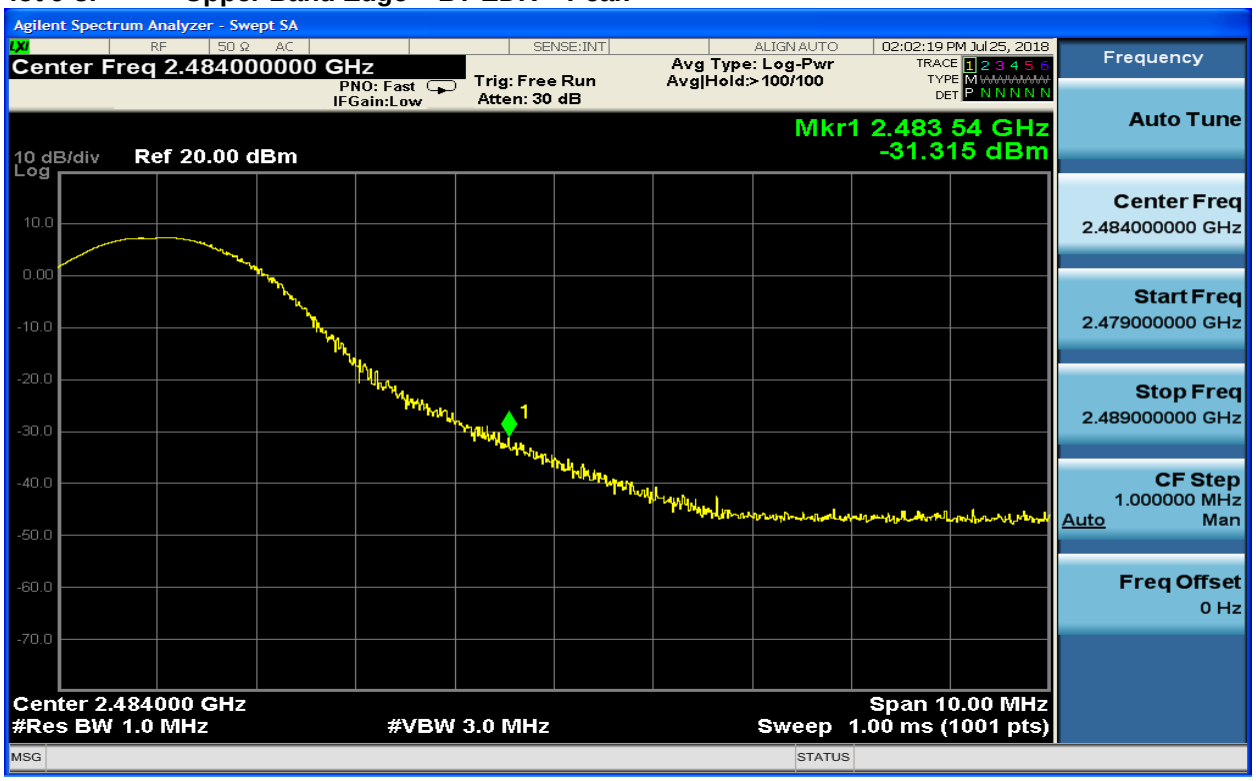
Plot 9-6: Upper Band Edge – BT BR – Peak



Plot 9-7: Upper Band Edge – BT EDR – Average



Plot 9-8: Upper Band Edge – BT EDR – Peak



Result: Pass

Table 9-7: Band Edge Test Equipment

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

Test Personnel:

Khue N. Do		July 25, 2018
EMC Test Engineer	Signature	Date of Test

10 Conclusion

The data in this measurement report shows that the Bluetooth portion of the EUT as tested, Garmin International Inc. Model # AA3405, FCC ID: IPH-A3405, complies with the applicable requirements of Parts 2 and 15 of the FCC Rules and Regulations.