Certification Application Report
FCC Part 15.247 & ISED RSS-247

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. Phone: 913-440-5471 1200 E. 151st Street Olathe, Kansas 66062 Contact: William Pertner	
FCC ID/ IC	IPH-03524/ 1792A-03524	**Test Report Date**	July 18, 2018
Platform	N/A	**RTL Work Order #**	2018032
Model/HVIN	A03524	**RTL Quote #**	QRTL18-032A
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 (Bluetooth)		
FCC Rule Part(s)	FCC Rules Part 15.247: Operation within the bands 920-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz (10-01-17)		
ISED	RSS-247 Issue 2: Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices RSS-Gen Issue 5: General Requirements for Compliance of Radio Apparatus		
Digital Interface Information	Digital Interface was found to be compliant		
Frequency Range (MHz)	**Output Power (W)**	**Frequency Tolerance**	**Emission Designator**
2402-2480	0.003	N/A	1M37F1D

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 ISED RSS-247 and RSS-Gen.

Signature:  Date: July 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 Standards:

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

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

ISED RSS-Gen Issue 5: General Requirements for Compliance of Radio Apparatus

1.2 Description of EUT

Equipment Under Test	Handheld Satellite Communicator with Bluetooth
Model/HVIN	A03524
Power Supply	Rechargeable Internal Battery
Modulation Type	GFSK, 2-EDR, 3-EDR
Frequency Range	2402-2480 MHz
Antenna Connector	Internal

Note: The EUT contains a modularly approved module (FCC ID: IPH-03302, IC ID: 1792A-03302). SAR testing and radiated spurious emissions testing has been performed to address simultaneous transmissions of it and the Bluetooth transmitter. Please see the SAR report uploaded with this application.

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: A03524, FCC ID: IPH-03524, IC: 1792A-03524.

Requested grant note: The antenna used with this transmitter may transmit simultaneously with module FCC ID: IPH-03302 (IC: 1792A-03302).

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

Channel	Frequency (MHz)
0	2402
39	2441
78	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 2-2: Test Result Summary – FCC Part 15, Subpart C (Section 15.247); ISED RSS-247, RSS-Gen

FCC	ISED	Test	Pass/Fail or N/A
FCC 15.209	RSS-247 5.5; RSS-Gen 8.9, 8.10	Radiated Emissions	Pass
FCC 15.247(a)(1)	RSS-247 5.1; RSS-247 5.1	20 dB Bandwidth	Pass
FCC 15.247(a)(1)	RSS-247 5.1	Hopping Characteristics	Pass
FCC 15.247(a)(1)	RSS-247 5.1(d)	Average Time of Occupancy	Pass
FCC 15.247(b)	RSS-247 5.4	Maximum Peak Power Output	Pass
FCC 15.247(d)	RSS-247 5.5; RSS-Gen 6.13	Antenna Conducted Spurious Emissions	Pass
FCC 15.247(d)	RSS-247 2.2	Band Edge Measurement	Pass
FCC 15.207	RSS-Gen 7.2	AC Conducted Emissions	Pass
N/A	RSS-Gen 6.7	99% Bandwidth	N/A

2.4 Test System Details

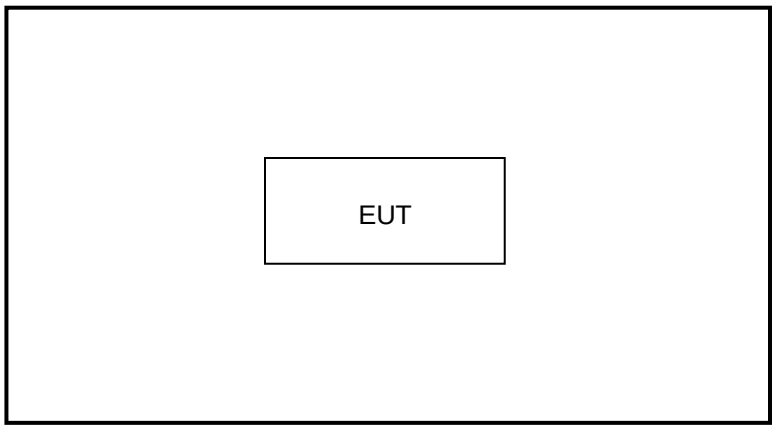
The test sample was received on June 11, 2018. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following table.

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.	A03524	3524 3974137140 01	IPH-03524	N/A	22692
Body-worn transmitter (conducted testing)	Garmin International Inc.	A03524	Test Sample V6	IPH-03524	N/A	22693
5VDC/1A AC Adapter	Garmin International Inc.	ADP-5BW B C.C:A	N/A	N/A	1.0m unshielded	22982
5VDC/2A AC Adapter	Garmin International Inc.	PSAF10R-050Q	P174602697A1	N/A	1.0m unshielded USB	22981
5VDC/1A AC Adapter	Garmin International Inc.	PSAI05R-050Q	P135111416A4	N/A	1.0m unshielded USB	22985
5VDC/2.1A Car Charger Adapter	Garmin International Inc.	RF-279-G021-0	E1813000349	N/A	1.0m unshielded USB	22221

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

3.2 Power Output Test Data

Table 3-2: Power Output Test Data - GFSK

Channel	Frequency (MHz)	Peak Power Conducted Output (dBm)
0	2402	1.6
39	2441	1.7
78	2480	1.7

Table 3-3: Power Output Test Data - 2-EDR

Channel	Frequency (MHz)	Peak Power Conducted Output (dBm)
0	2402	4.2
39	2441	4.2
78	2480	4.3

Table 3-4: Power Output Test Data - 3-EDR

Channel	Frequency (MHz)	Peak Power Conducted Output (dBm)
0	2402	4.9
39	2441	5.0
78	2480	5.0

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:

Khue N. Do		June 21, 2018
Test Engineer	Signature	Date of Test

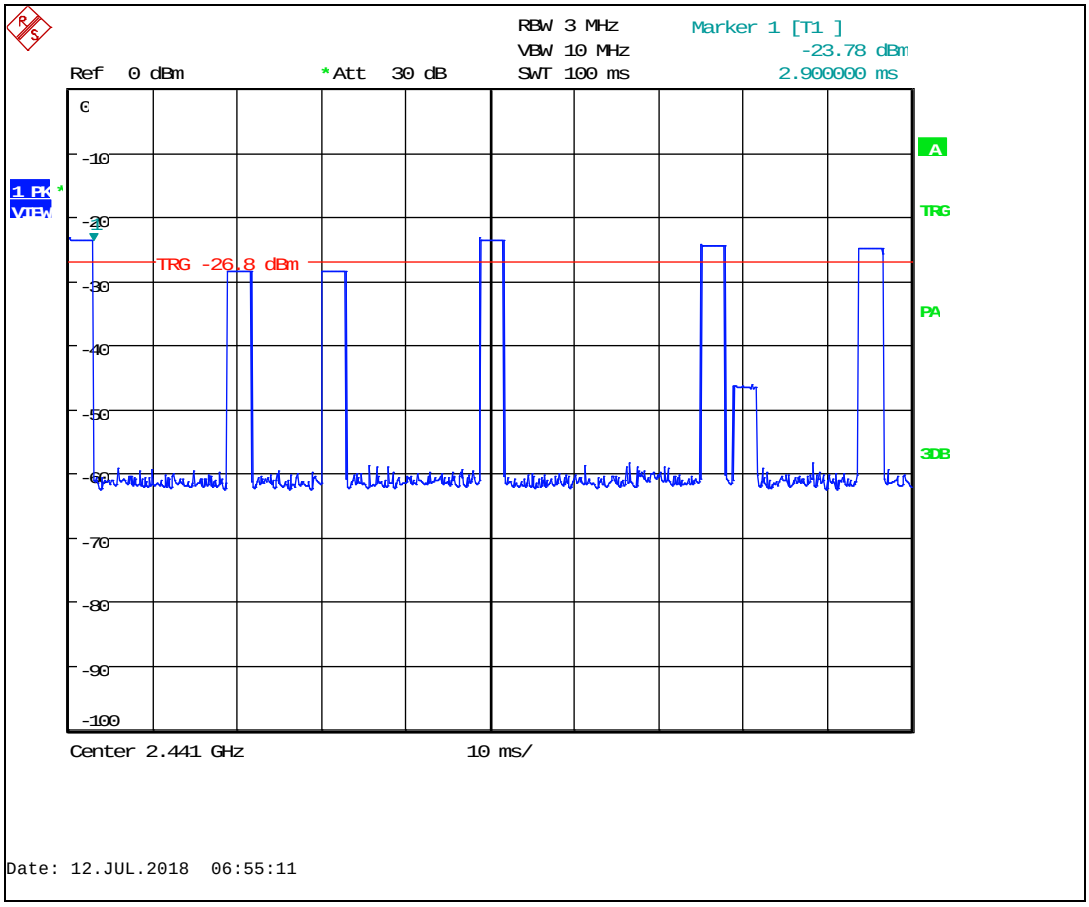
4 Duty Cycle

4.1 Duty Cycle Test Procedure

A Timing plot was taken using a probe near the antenna of the transmitter using a Rohde and Schwarz FSU Spectrum Analyzer.

4.2 Power Output Test Data

Plot 4-1: Duty Cycle



2.9ms (pulse width) x 4 (# of pulses) =11.6ms per 100ms 20*log(11.6%)= -18.7 dB

Measurement uncertainties shown for these tests are expanded uncertainties expressed at the 95% confidence level using a coverage factor K=2. Measurement uncertainty: ±0.5 Hz

Table 4-1: Duty Cycle Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	4/26/19

Test Personnel:

Daniel W. Baltzell		July 12, 2018
Test Engineer	Signature	Date of Test

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

5.1 Band Edge Test Procedure

The transmitter output was connected to its appropriate antenna. 1 MHz peak detector (1 MHz RBW/ 3 MHz VBW) and 1 MHz average detector (1 MHz RBW/3 MHz VBW) measurements were taken within the restricted band to show compliance, converted to field strength at 3m and compared to the limit using:

FS (dBuV/m) = dBm+104.7-20*log(3) or 95.2

5.2 Restricted Band Edge Test Results

5.2.1 Lower Band Edge

Plot 5-1: Lower Band Edge Average – 2-EDR

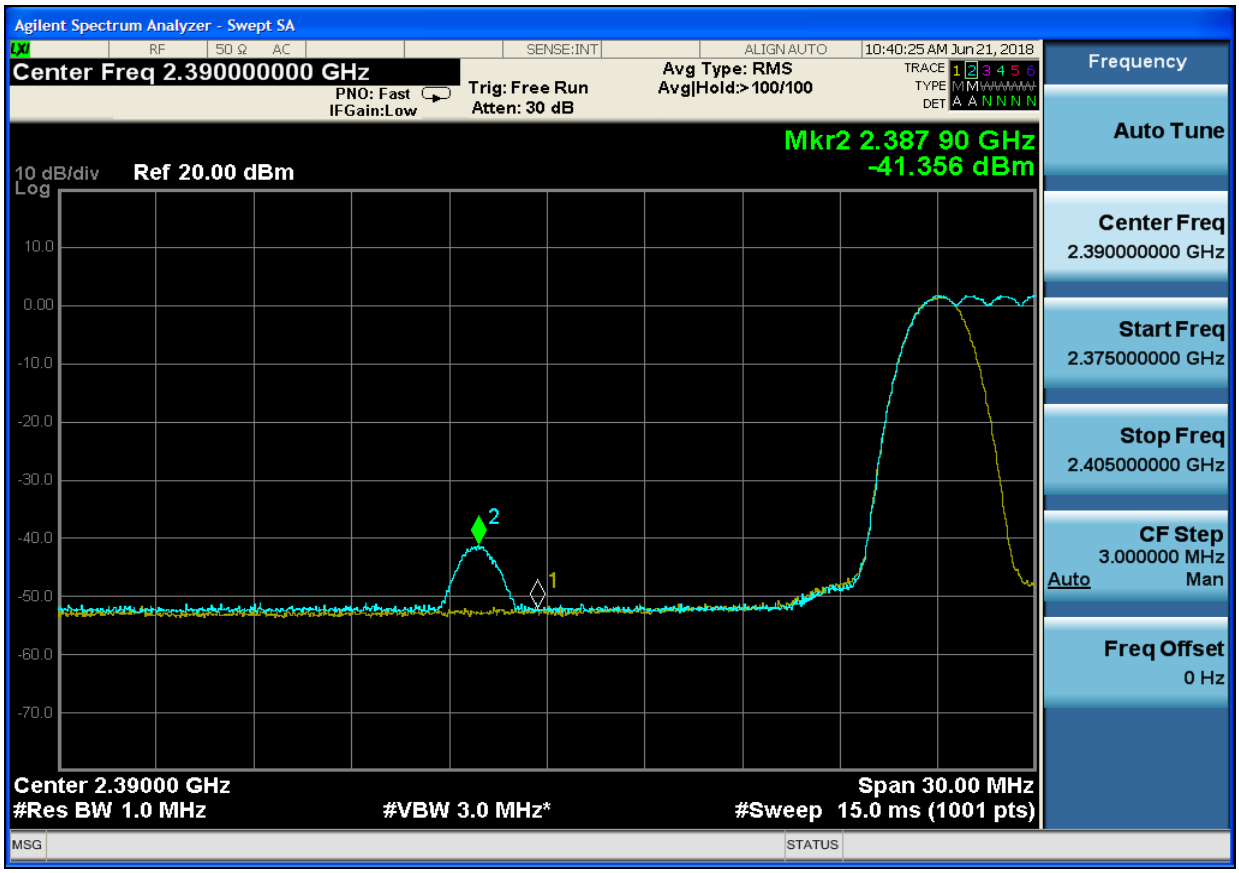


Table 5-1: Lower Band Edge Average – 2-EDR

Frequency (MHz)	Measured Average Level (dBm)	Field Strength Conversion (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
2387.9	-41.4	53.8	54.0	-0.2

Plot 5-2: Lower Band Edge Peak – 2-EDR

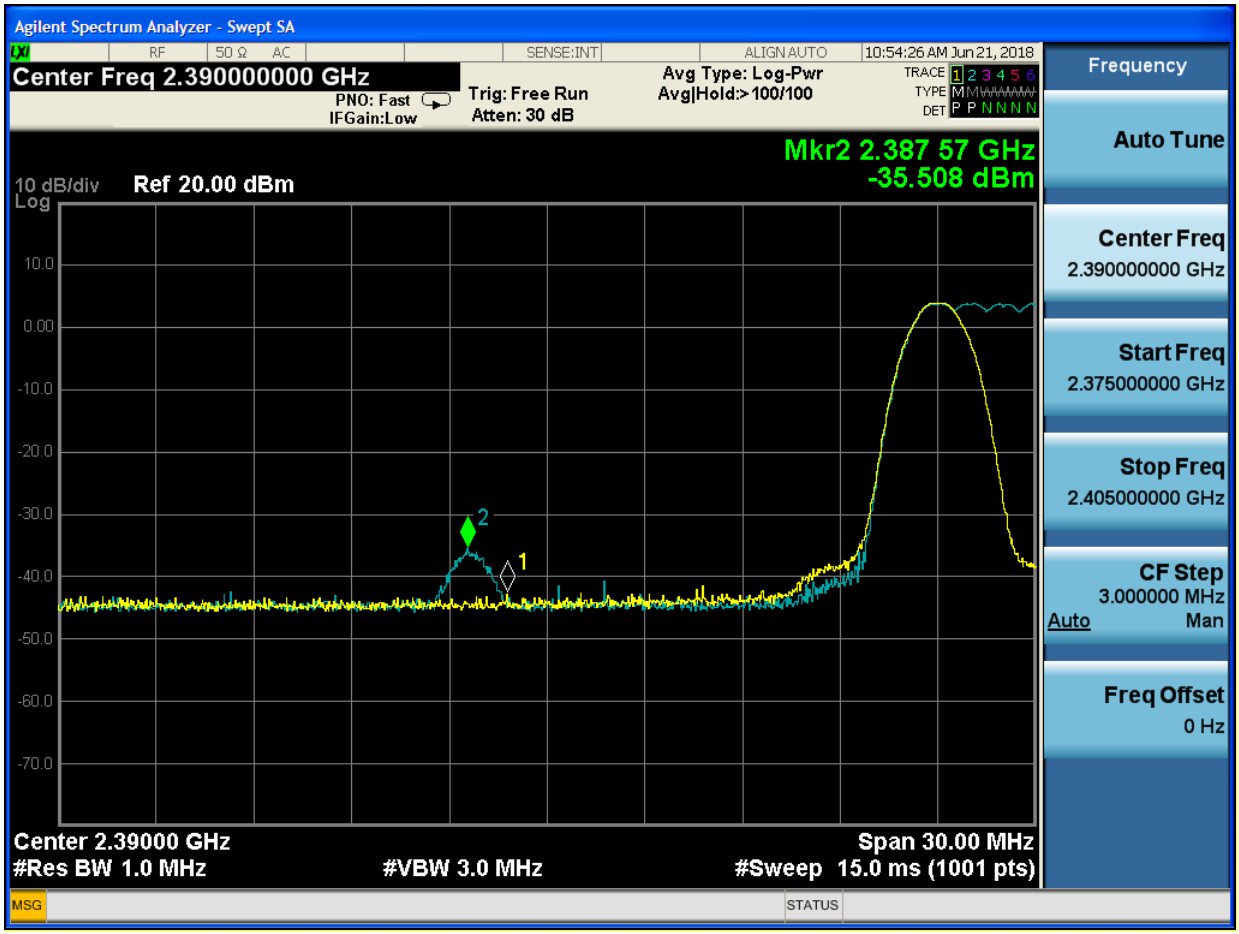


Table 5-2: Lower Band Edge Peak – 2-EDR

Frequency (MHz)	Measured Peak Level (dBm)	Field Strength Conversion (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)
2387.57	-35.5	59.7	74.0	-14.3

Plot 5-3: Lower Band Edge Average - 3-EDR

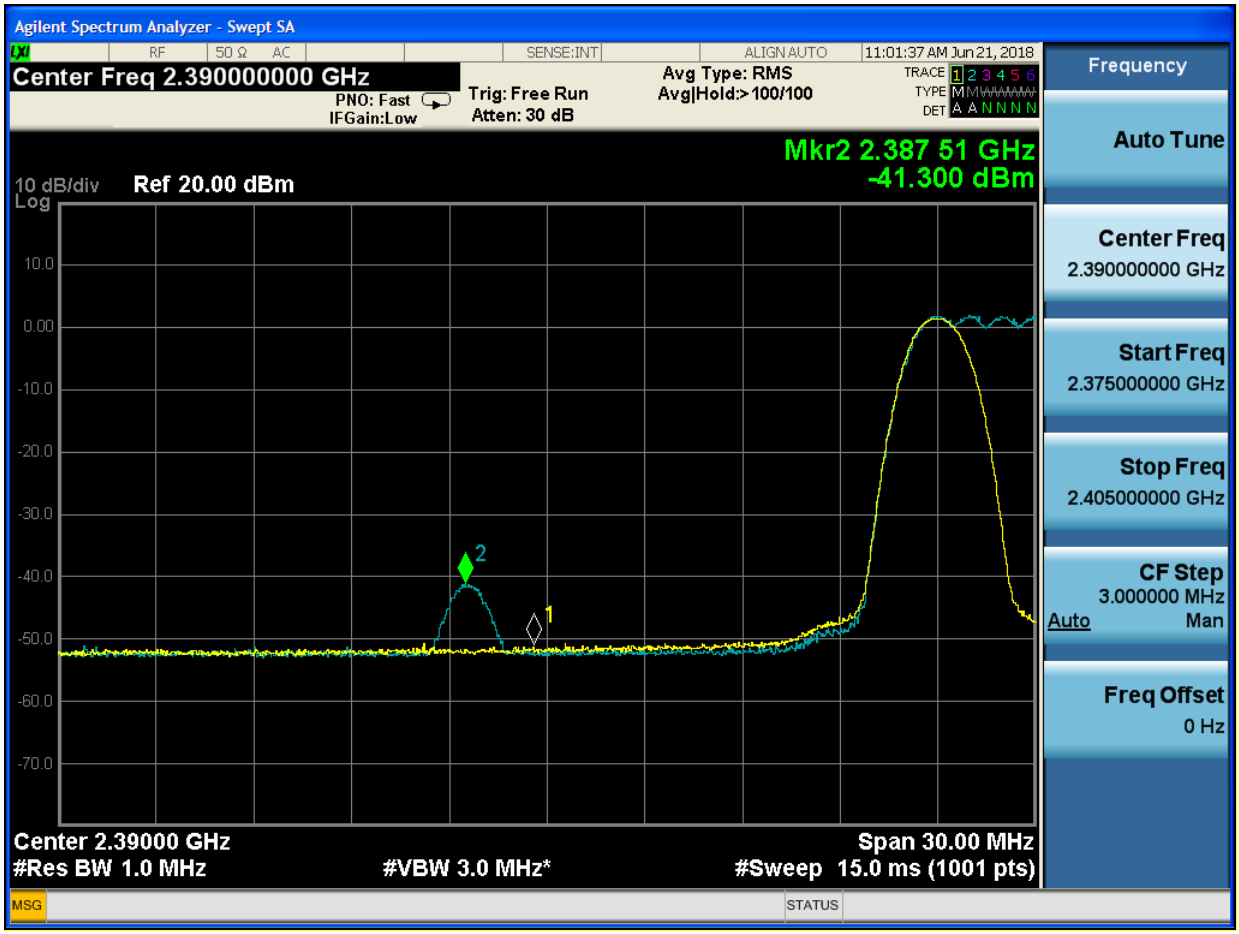


Table 5-3: Lower Band Edge Average - 3-EDR

Frequency (MHz)	Measured Average Level (dBm)	Field Strength Conversion (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
2387.51	-41.3	53.9	54.0	-0.1

Plot 5-4: Lower Band Edge Peak – 3-EDR

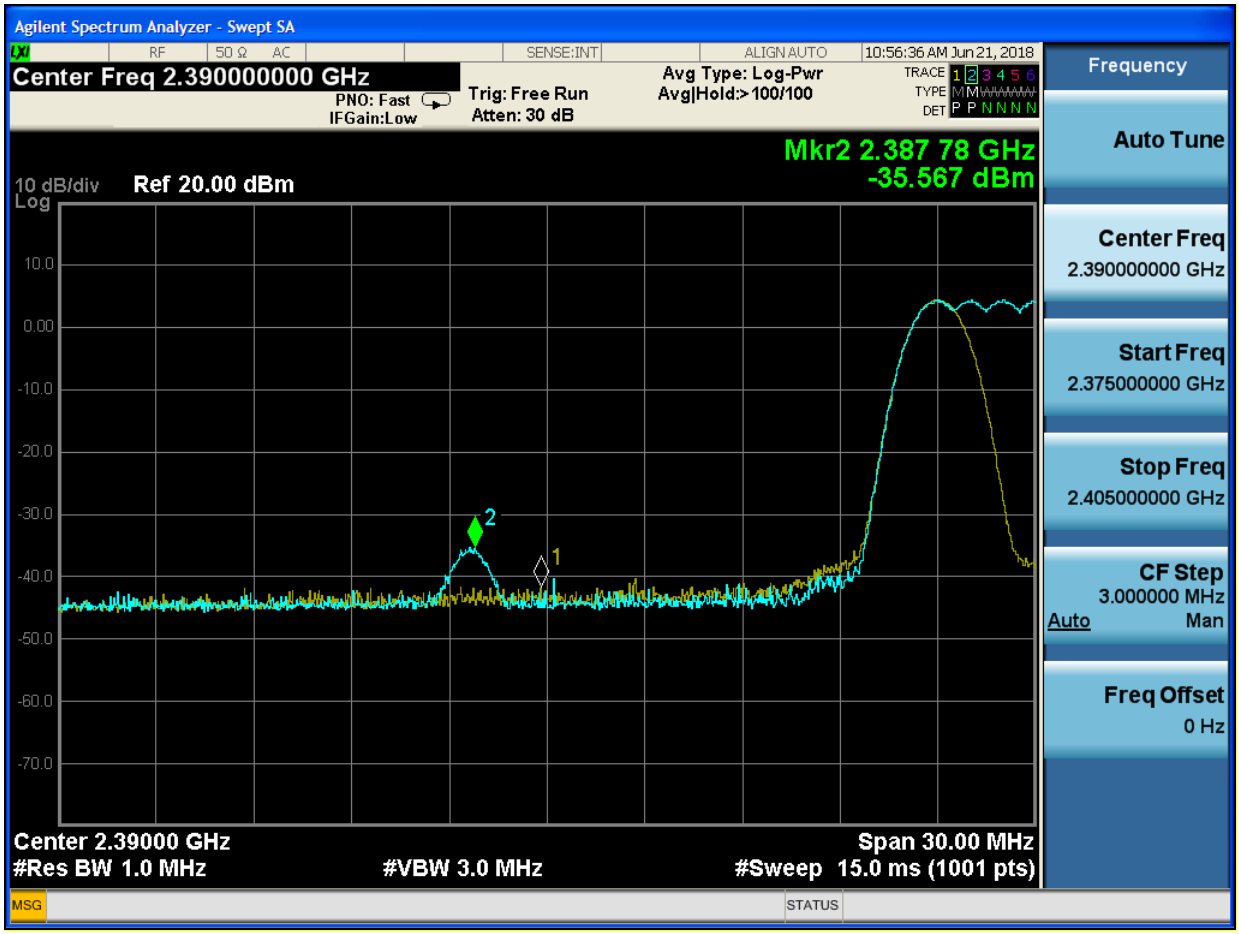


Table 5-4: Lower Band Edge Peak – 3-EDR

Frequency (MHz)	Measured Peak Level (dBm)	Field Strength Conversion (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)
2387.78	-35.6	59.6	74.0	-14.4

Plot 5-5: Lower Band Edge Average - GFSK

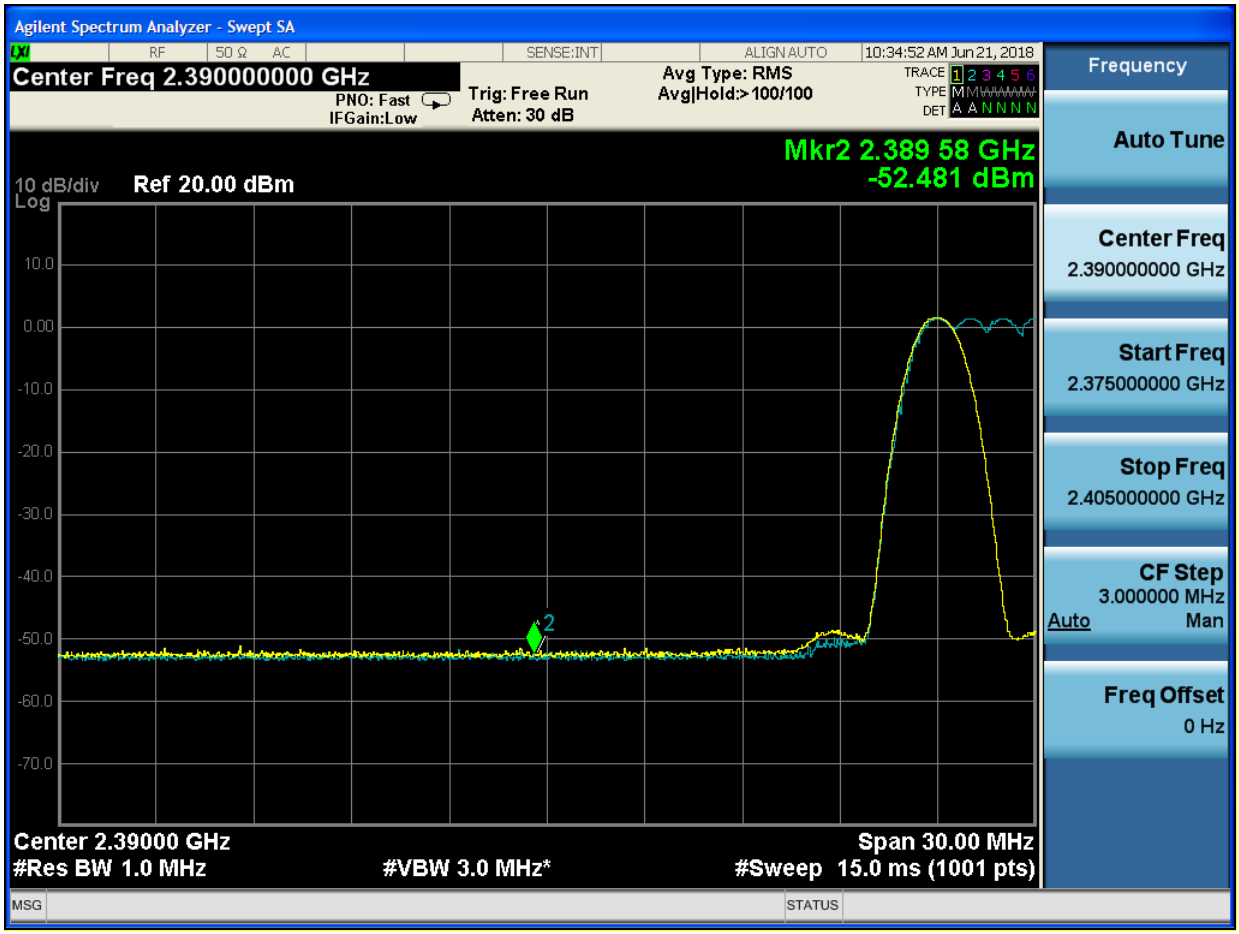


Table 5-5: Lower Band Edge Average - GFSK

Frequency (MHz)	Measured Average Level (dBm)	Field Strength Conversion (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
2389.58	-52.5	42.7	54.0	-11.3

Plot 5-6: Lower Band Edge Peak – GFSK

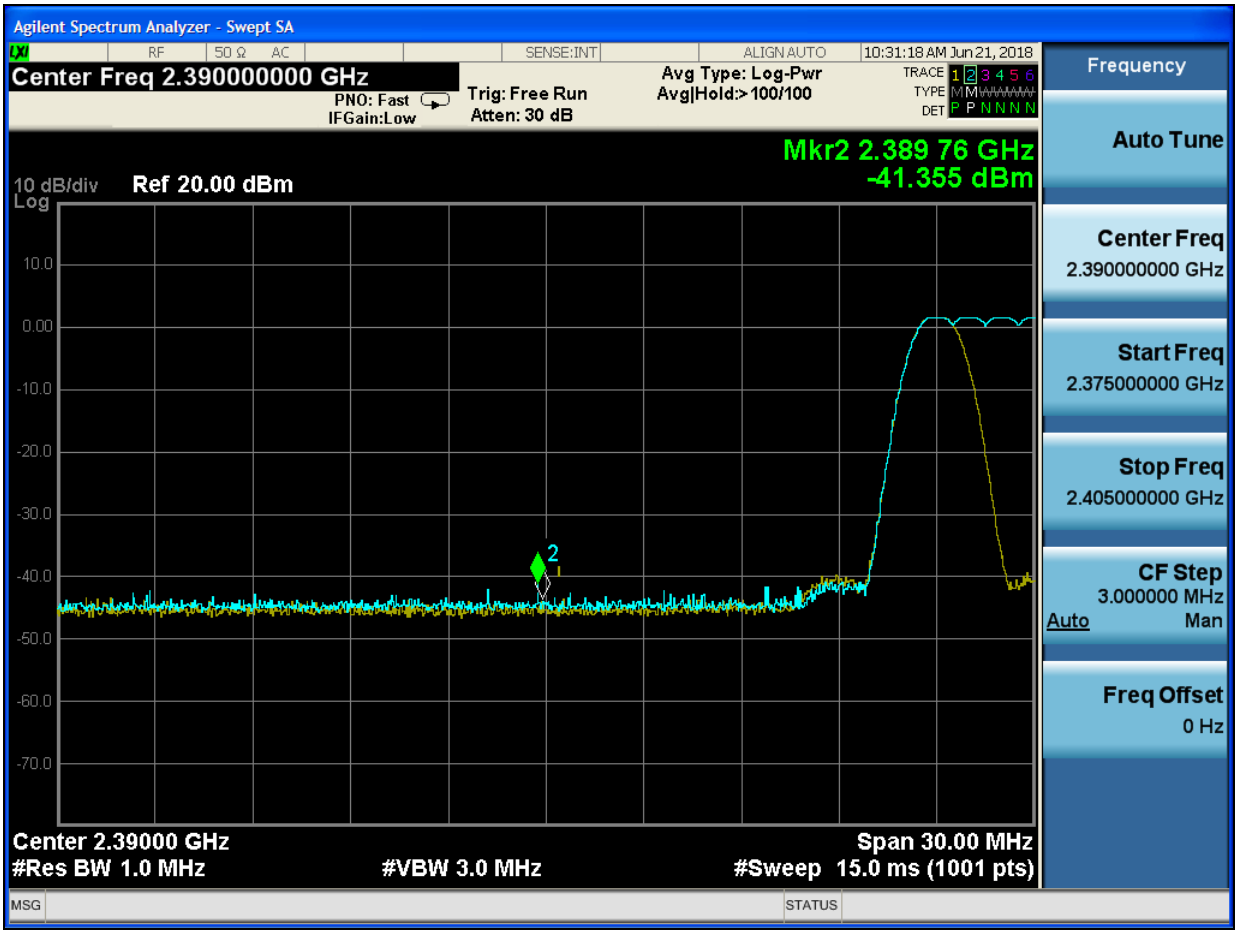


Table 5-6: Lower Band Edge Peak – GFSK

Frequency (MHz)	Measured Peak Level (dBm)	Field Strength Conversion (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)
2389.76	-41.4	53.8	74.0	-20.2

5.2.2 Upper Band Edge

Plot 5-7: Upper Band Edge Average - 2-EDR

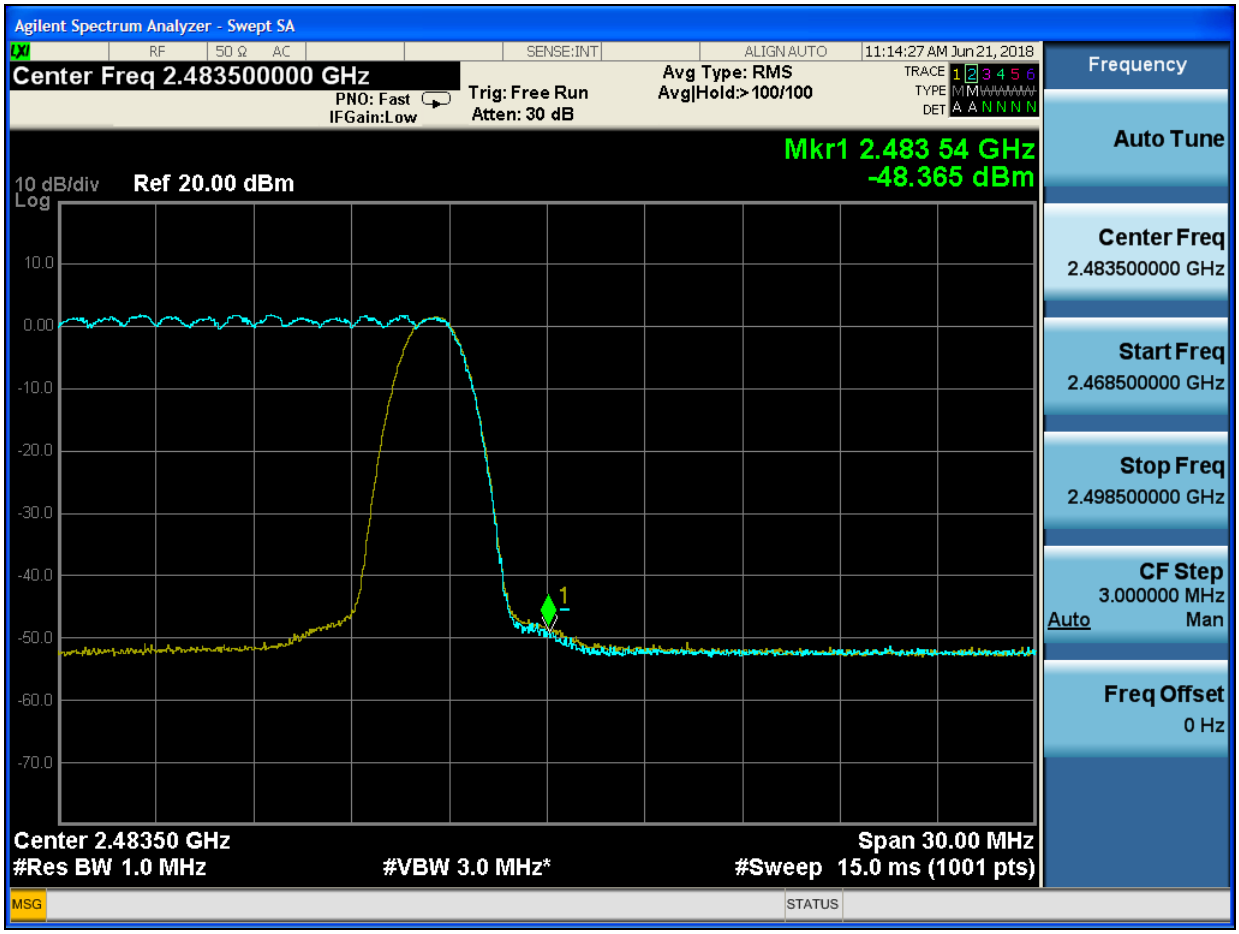


Table 5-7: Upper Band Edge Average – 2-EDR

Frequency (MHz)	Measured Average Level (dBm)	Field Strength Conversion (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
2483.54	-48.4	46.8	54.0	-7.2

Plot 5-8: Upper Band Edge Peak - 2-EDR

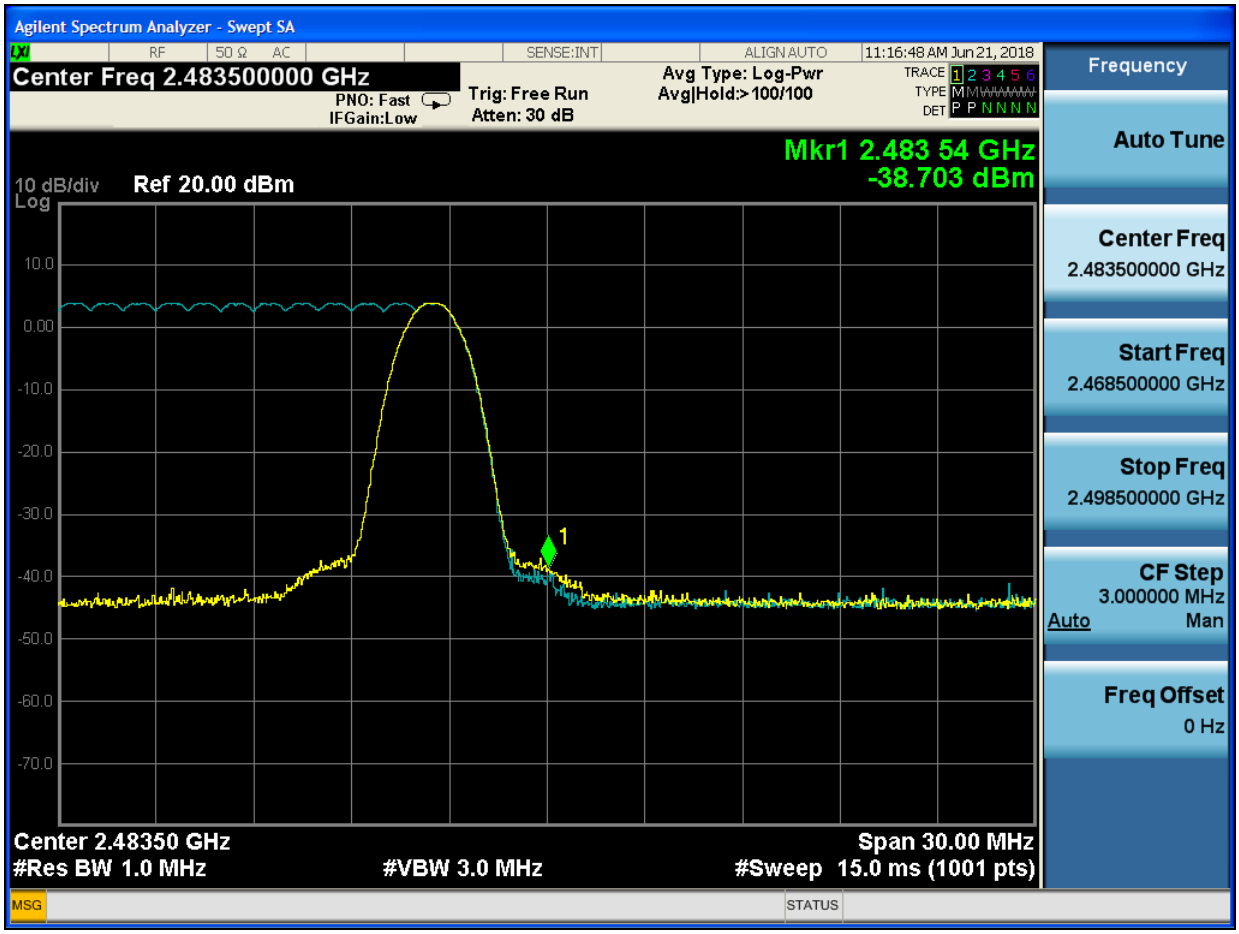


Table 5-8: Upper Band Edge Peak - 2-EDR

Frequency (MHz)	Measured Peak Level (dBm)	Field Strength Conversion (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)
2483.54	-38.7	56.5	74.0	-17.5

Plot 5-9: Upper Band Edge Average - 3-EDR

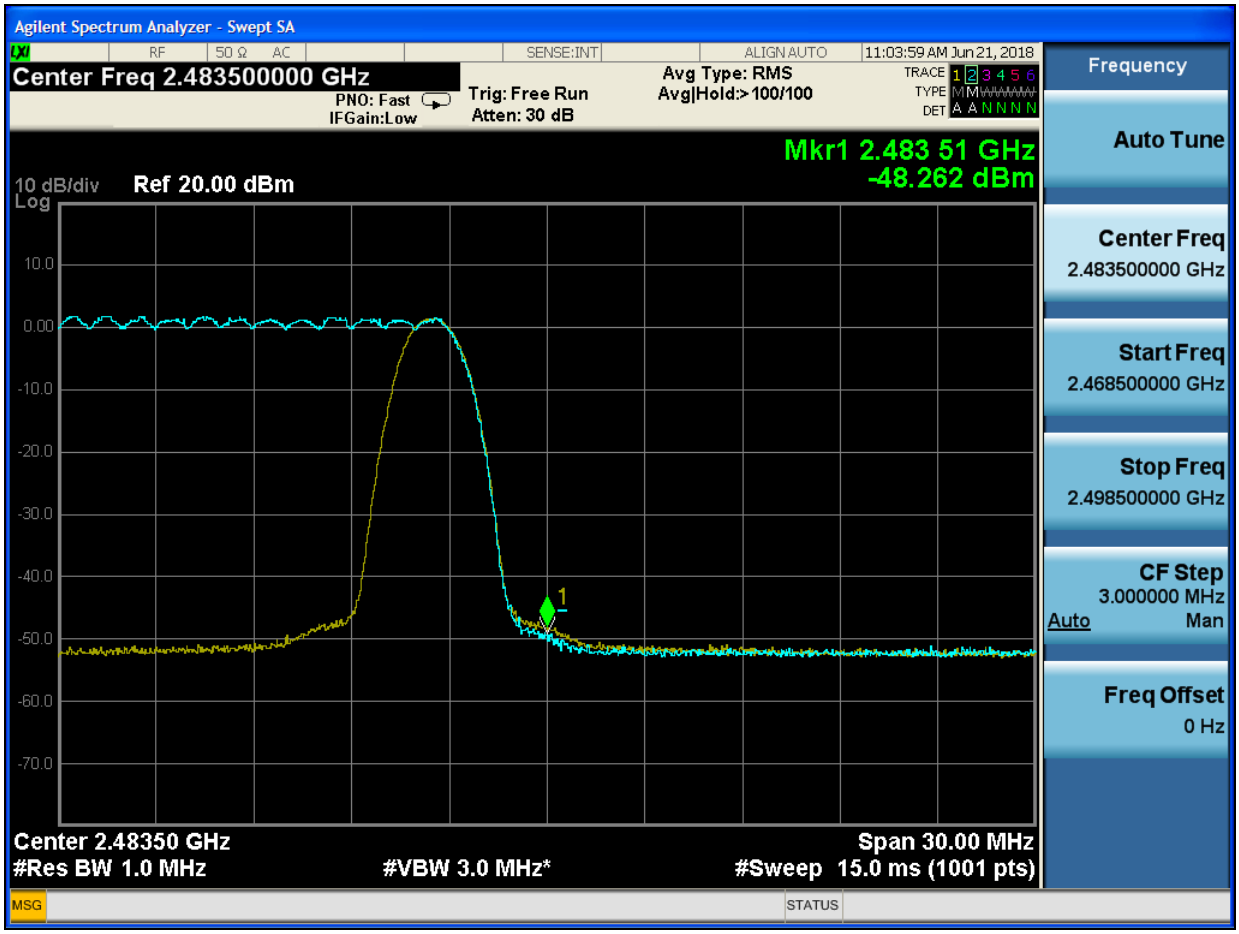


Table 5-9: Upper Band Edge Average - 3-EDR

Frequency (MHz)	Measured Average Level (dBm)	Field Strength Conversion (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
2483.51	-48.3	46.9	54.0	-7.1

Plot 5-10: Upper Band Edge Peak – 3-EDR

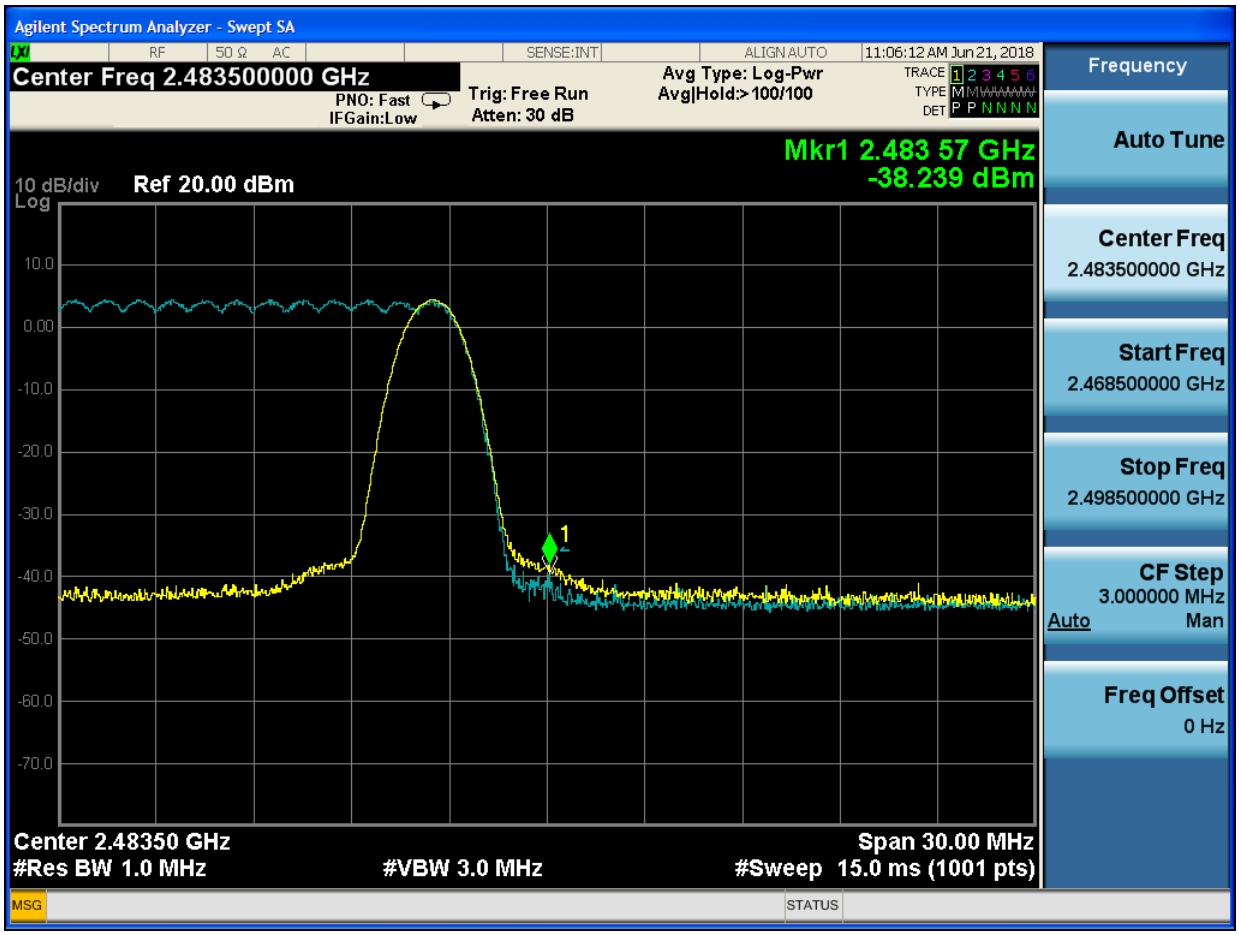


Table 5-10: Upper Band Edge Peak – 3-EDR

Frequency (MHz)	Measured Peak Level (dBm)	Field Strength Conversion (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)
2483.57	-38.2	57.0	74.0	-17.0

Plot 5-11: Upper Band Edge Average - GFSK

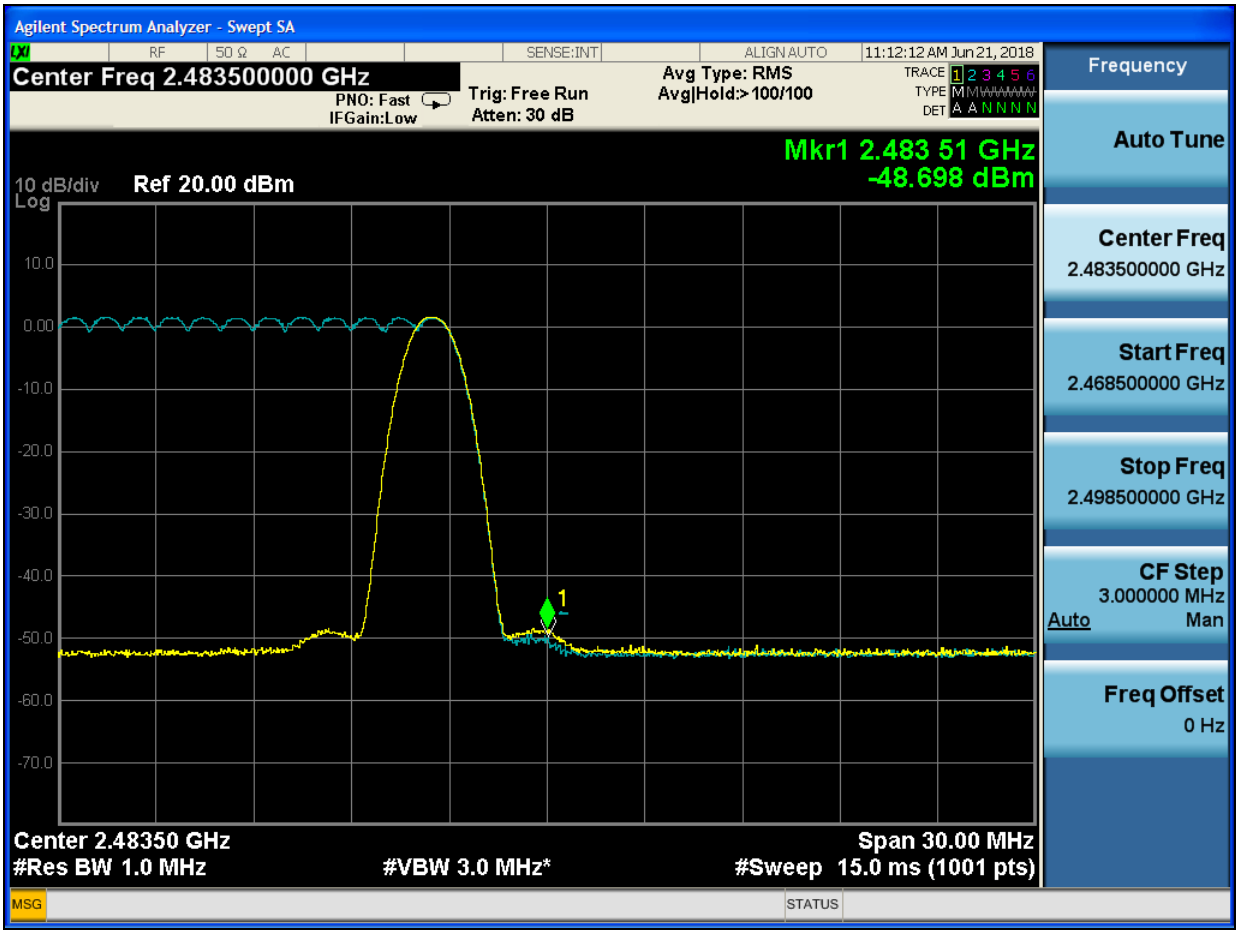


Table 5-11: Upper Band Edge Average - GFSK

Frequency (MHz)	Measured Average Level (dBm)	Field Strength Conversion (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
2483.51	-48.7	46.5	54.0	-7.4

Plot 5-12: Upper Band Edge Peak - GFSK

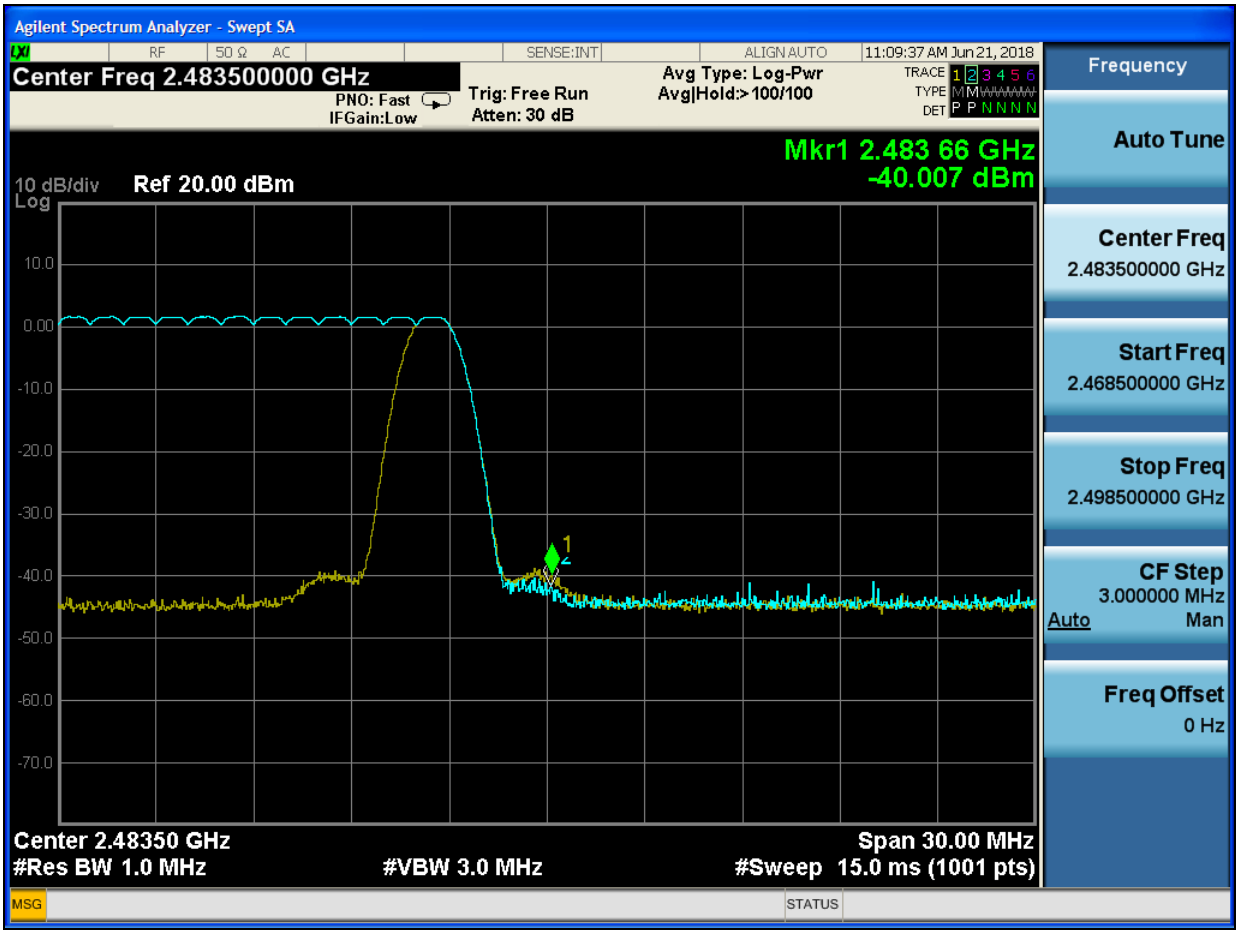


Table 5-12: Upper Band Edge Peak - GFSK

Frequency (MHz)	Measured Peak Level (dBm)	Field Strength Conversion (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)
2483.66	-40.0	55.2	74.0	-18.8

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

Table 5-13: 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:

Khue N. Do		June 21, 2018
Test Engineer	Signature	Date of Test

6 Antenna Conducted Spurious Emissions – FCC 15.247(d); RSS-247 5.5; RSS-Gen 6.13

6.1 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, 2441 MHz, and 2480 MHz.

6.2 Antenna Conducted Spurious Emissions Test Results

The following emission was found to be within 20 dB (note that we are reporting power as peak) of the carrier level. Emissions were measured from the carrier to the 10th harmonic of the carrier frequency. Per FCC 15.31(o), only those within 20 dB of the limit are being reported.

Table 6-1: Antenna Conducted Spurious Emissions – 2480 MHz – 3-EDR

Frequency (MHz)	Emissions Measured (dBm)	Limit (dBm)	Margin (dB)	Pass/ Fail
826.6	-37.7	-18.4	-19.3	Pass

Table 6-2: Antenna Conducted Spurious Emissions 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:

Khue N. Do		June 21, 2018
Test Engineer	Signature	Date of Test

7 Bandwidths – FCC 15.247(a)(1); RSS-247 5.1; RSS-Gen 6.7

7.1 Bandwidth Test Procedure

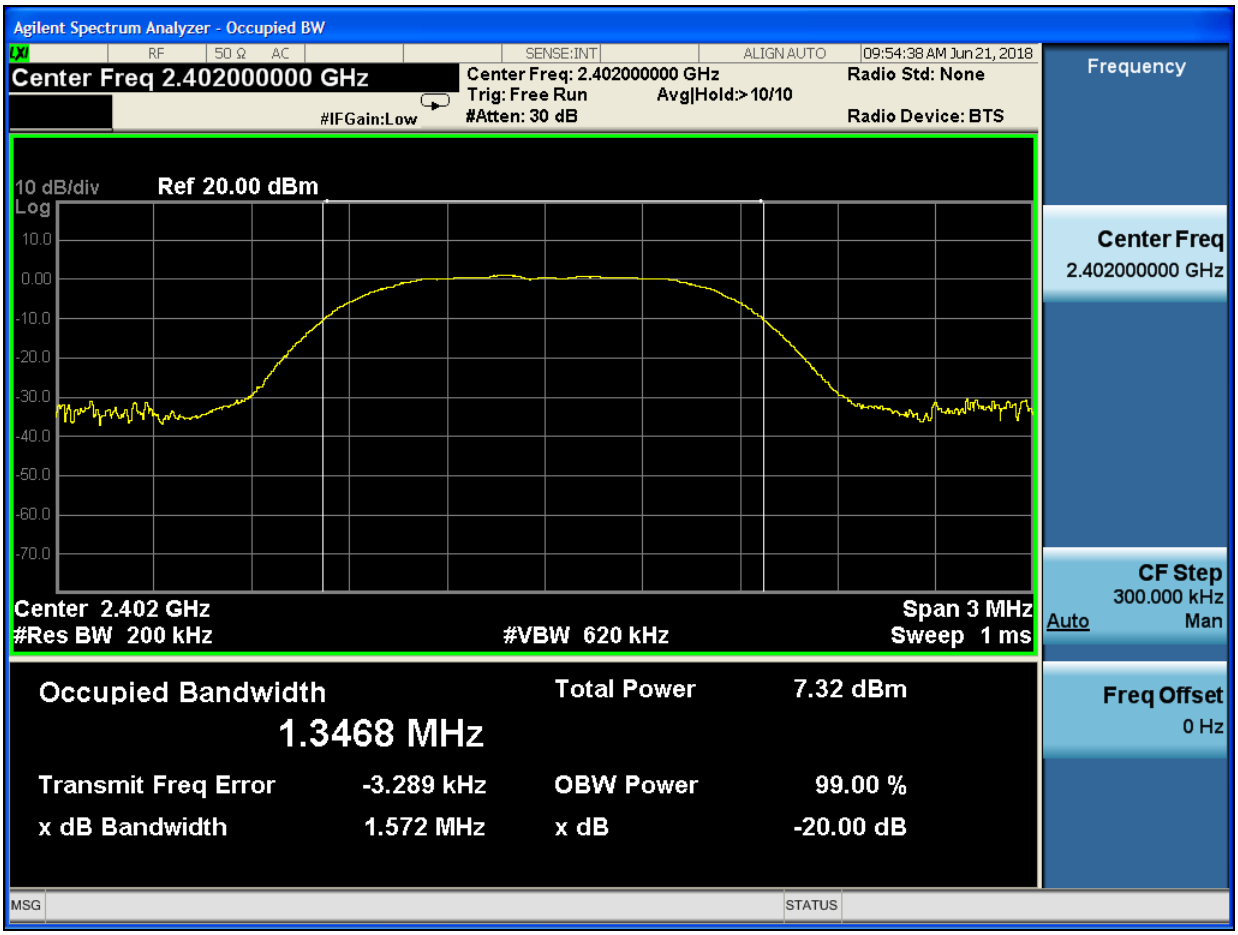
The minimum 20 dB and 99% bandwidths per FCC 15.247(a)(1) and RSS-Gen 6.7 were measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at ≥3xRBW. The device was modulated. The bandwidths are presented below.

7.2 Bandwidth Test Data

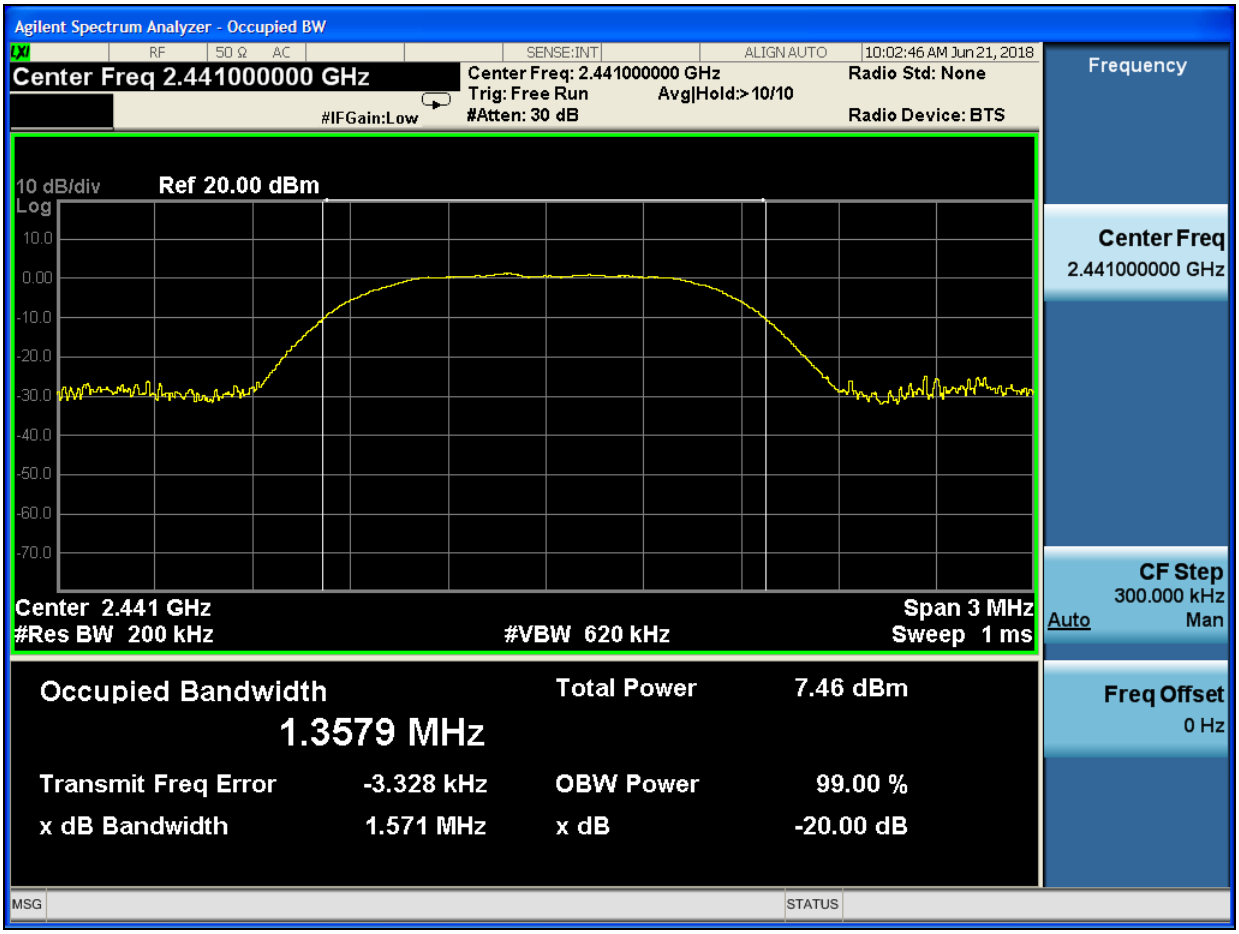
Table 7-1: Bandwidth Test Data – 2-EDR

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99 % Bandwidth (MHz)
0	2402	1.57	1.35
39	2441	1.57	1.36
78	2480	1.57	1.36

Plot 7-1: Bandwidth Channel 0 (TX Frequency 2402 MHz) – 2-EDR



Plot 7-2: Bandwidth Channel 39 (TX Frequency 2441 MHz) – 2-EDR



Plot 7-3: Bandwidth Channel 78 (TX Frequency 2480 MHz) – 2-EDR

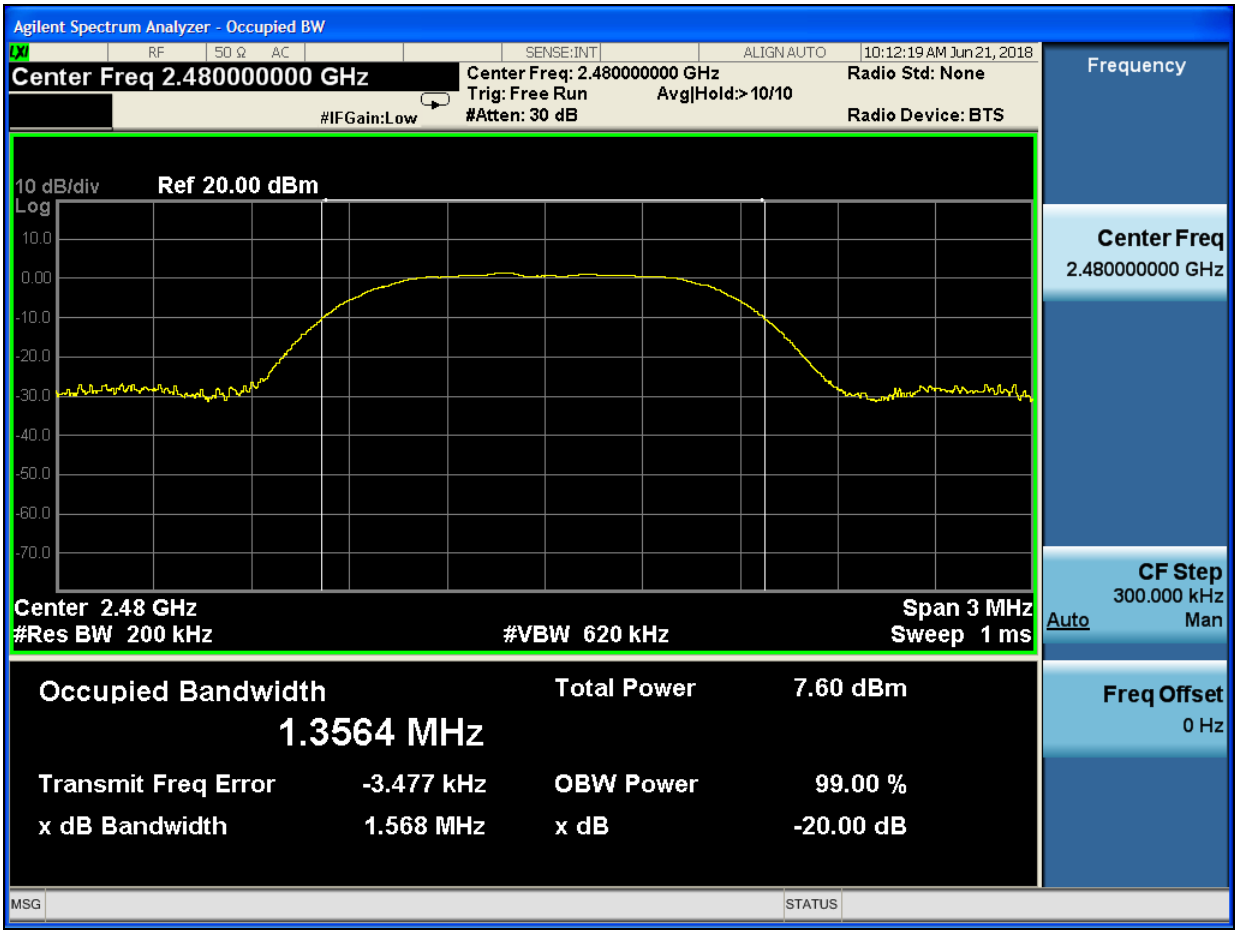
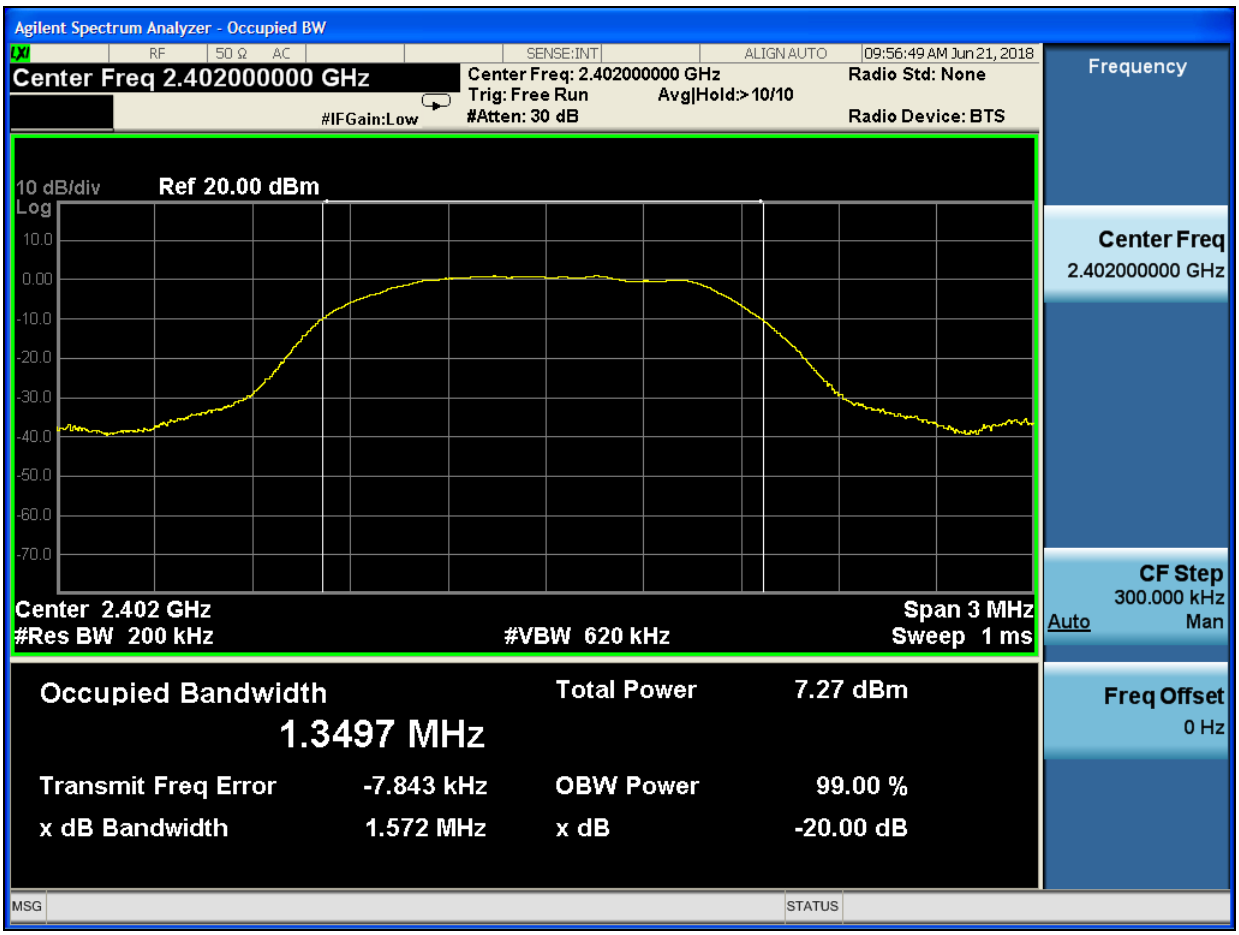


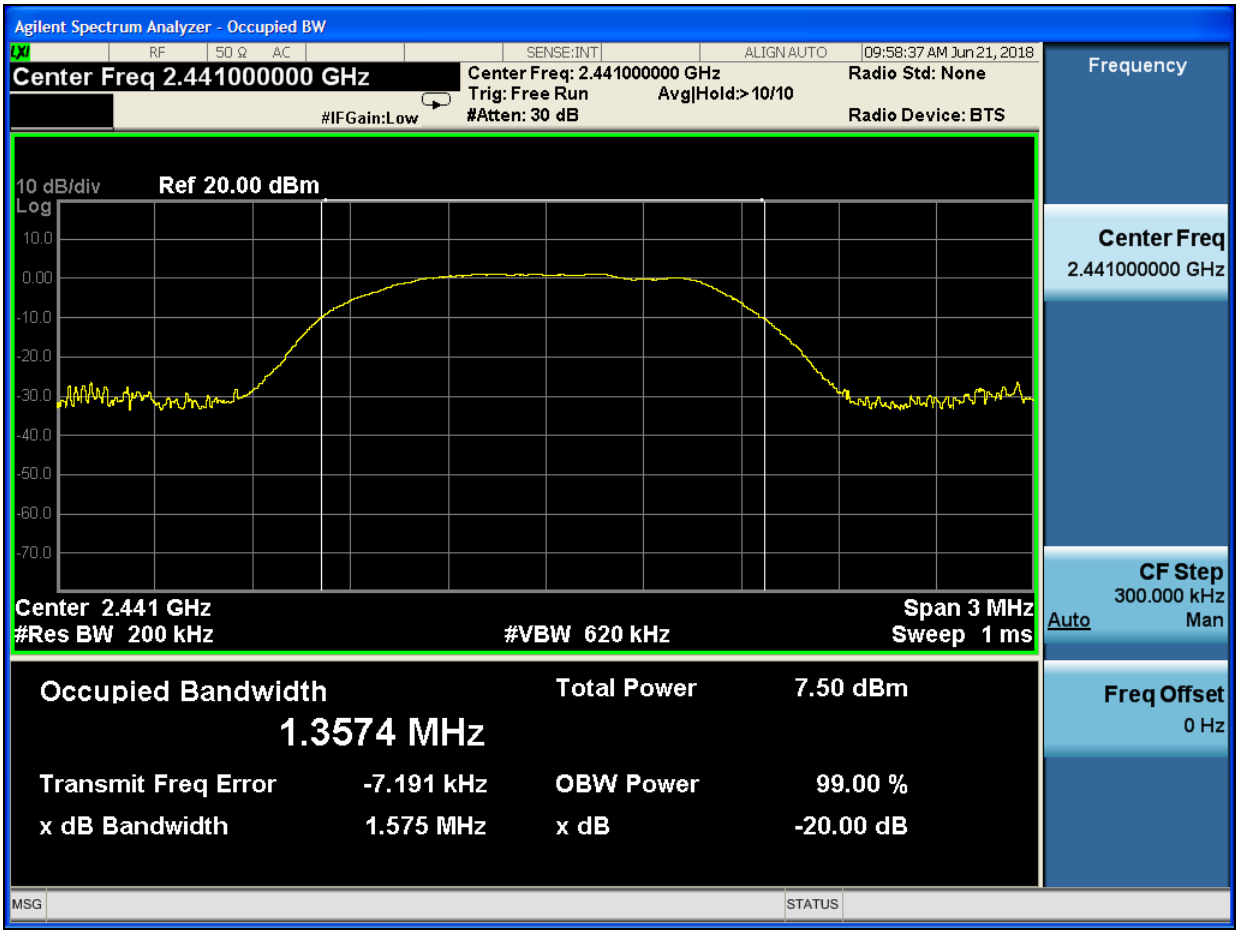
Table 7-2: Bandwidth Test Data – 3-EDR

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
0	2402	1.57	1.35
39	2441	1.58	1.36
79	2480	1.58	1.37

Plot 7-4: Bandwidth Channel 0 (TX Frequency 2402 MHz) – 3-EDR



Plot 7-5: Bandwidth Channel 39 (TX Frequency 2441 MHz) – 3-EDR



Plot 7-6: Bandwidth Channel 78 (TX Frequency 2480 MHz) – 3-EDR

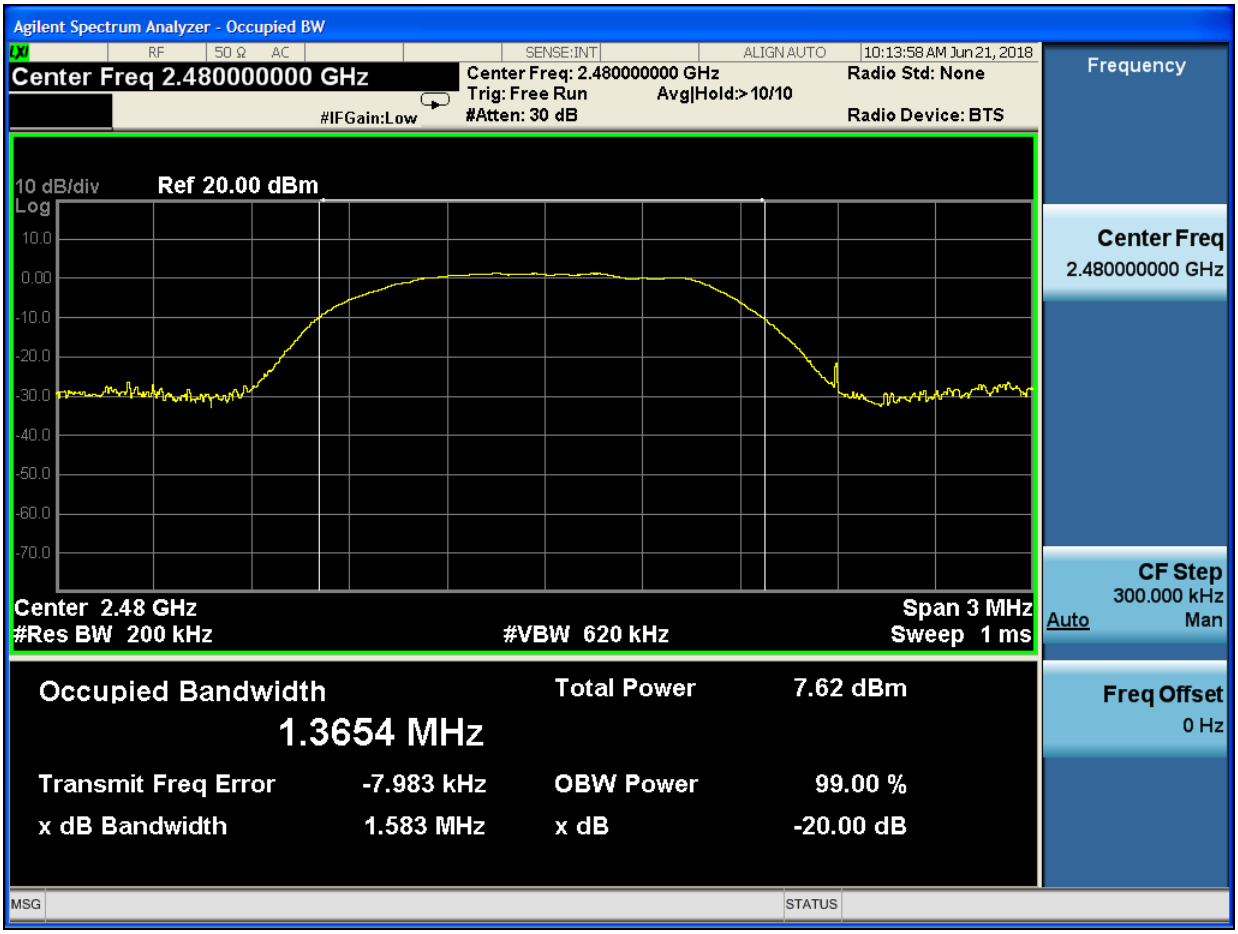
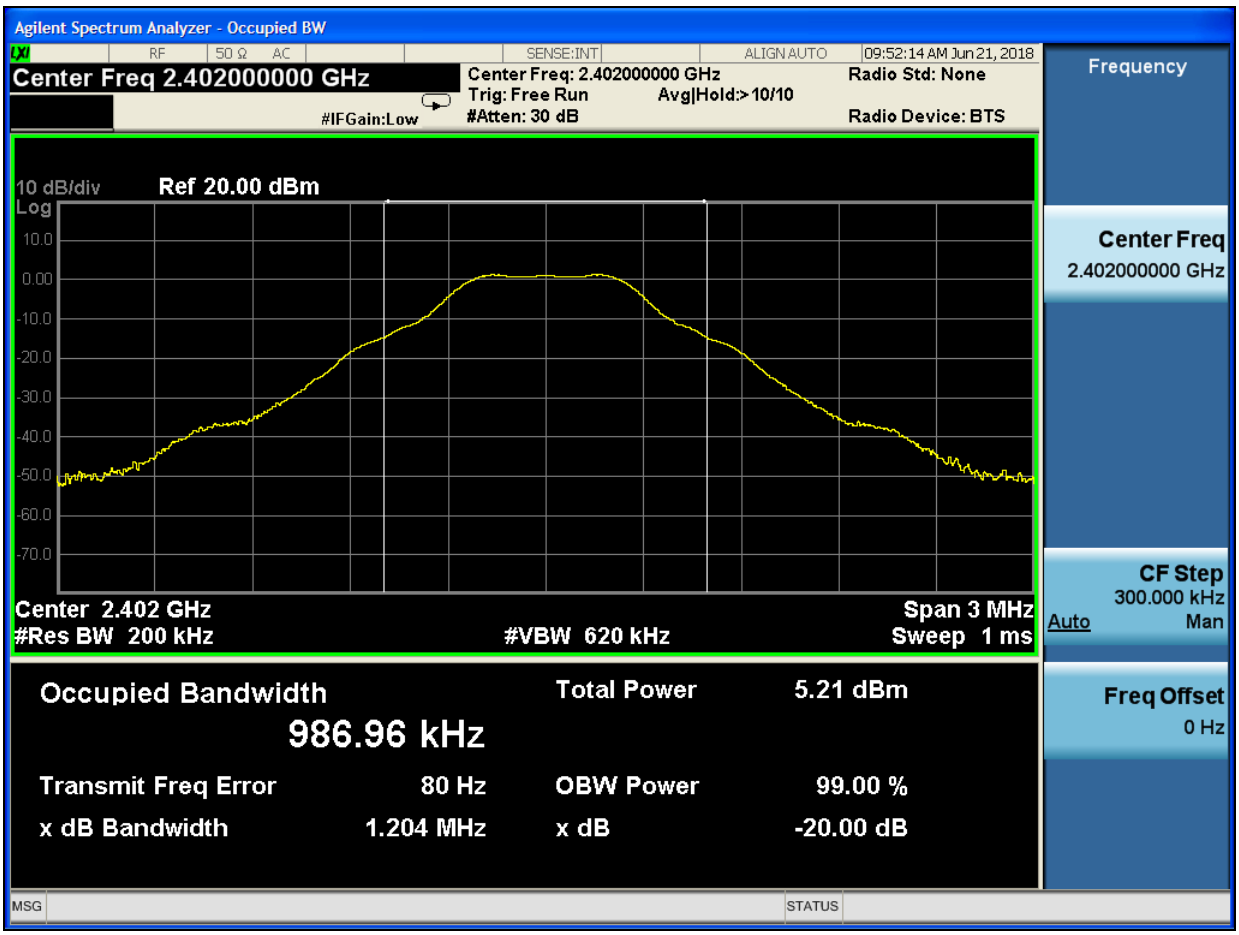


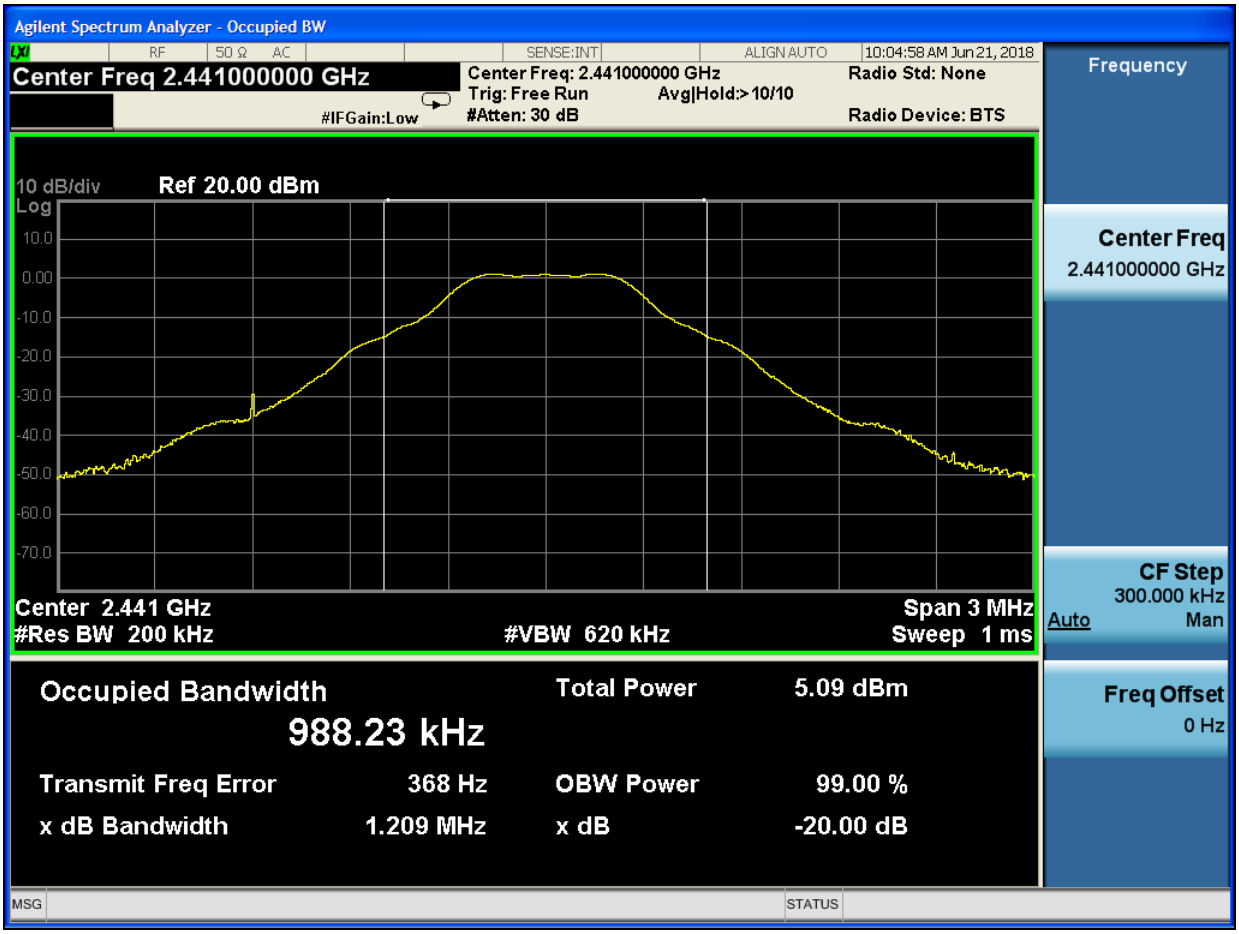
Table 7-3: Bandwidth Test Data – GFSK

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
0	2402	1.20	0.99
39	2441	1.21	0.99
78	2480	1.21	0.99

Plot 7-7: Bandwidth Channel 0 (TX Frequency 2402 MHz) – GFSK



Plot 7-8: Bandwidth Channel 39 (TX Frequency 2441 MHz) – GFSK



Plot 7-9: Bandwidth Channel 78 (TX Frequency 2480 MHz) – GFSK

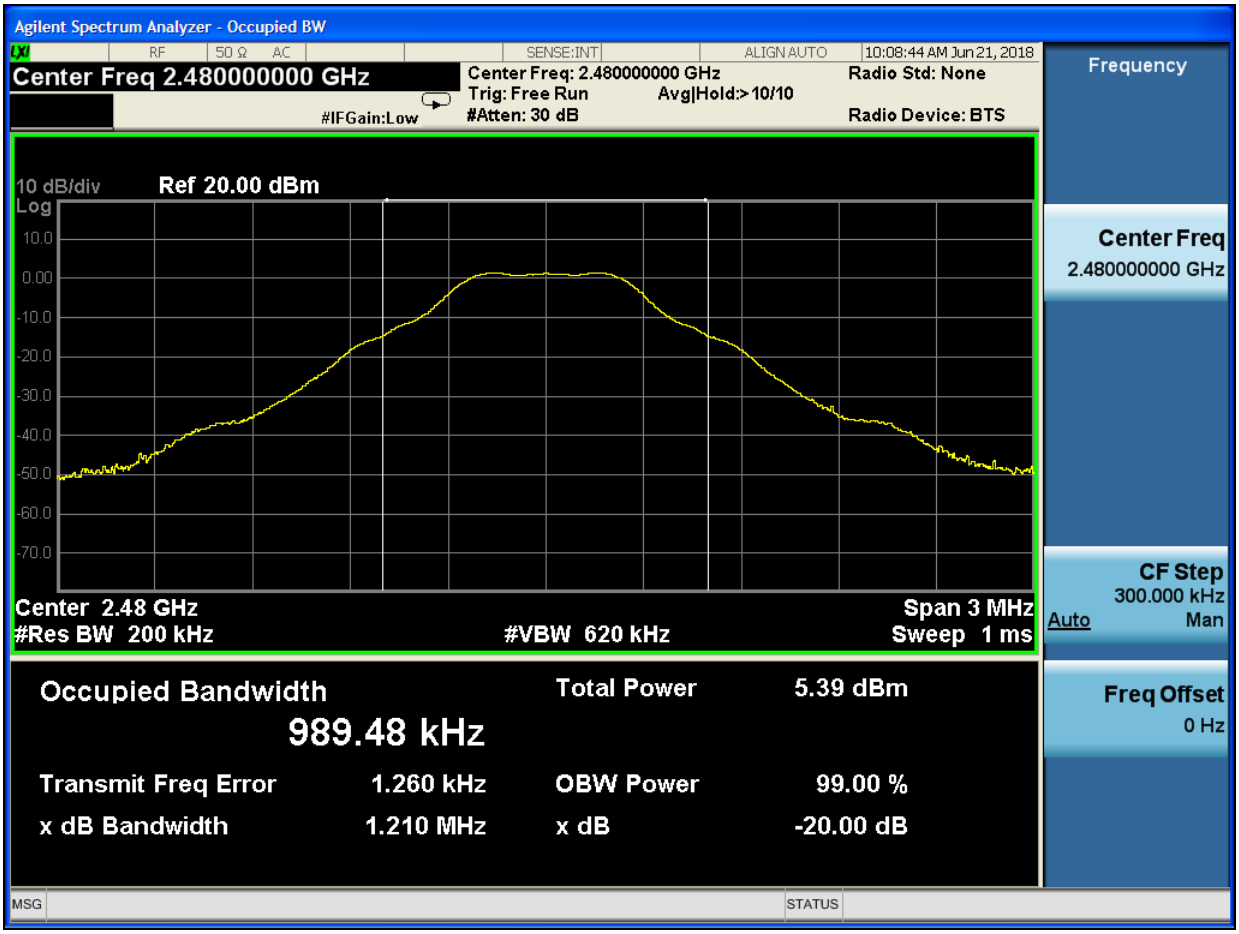


Table 7-4: 20 dB Bandwidth Test Equipment

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:

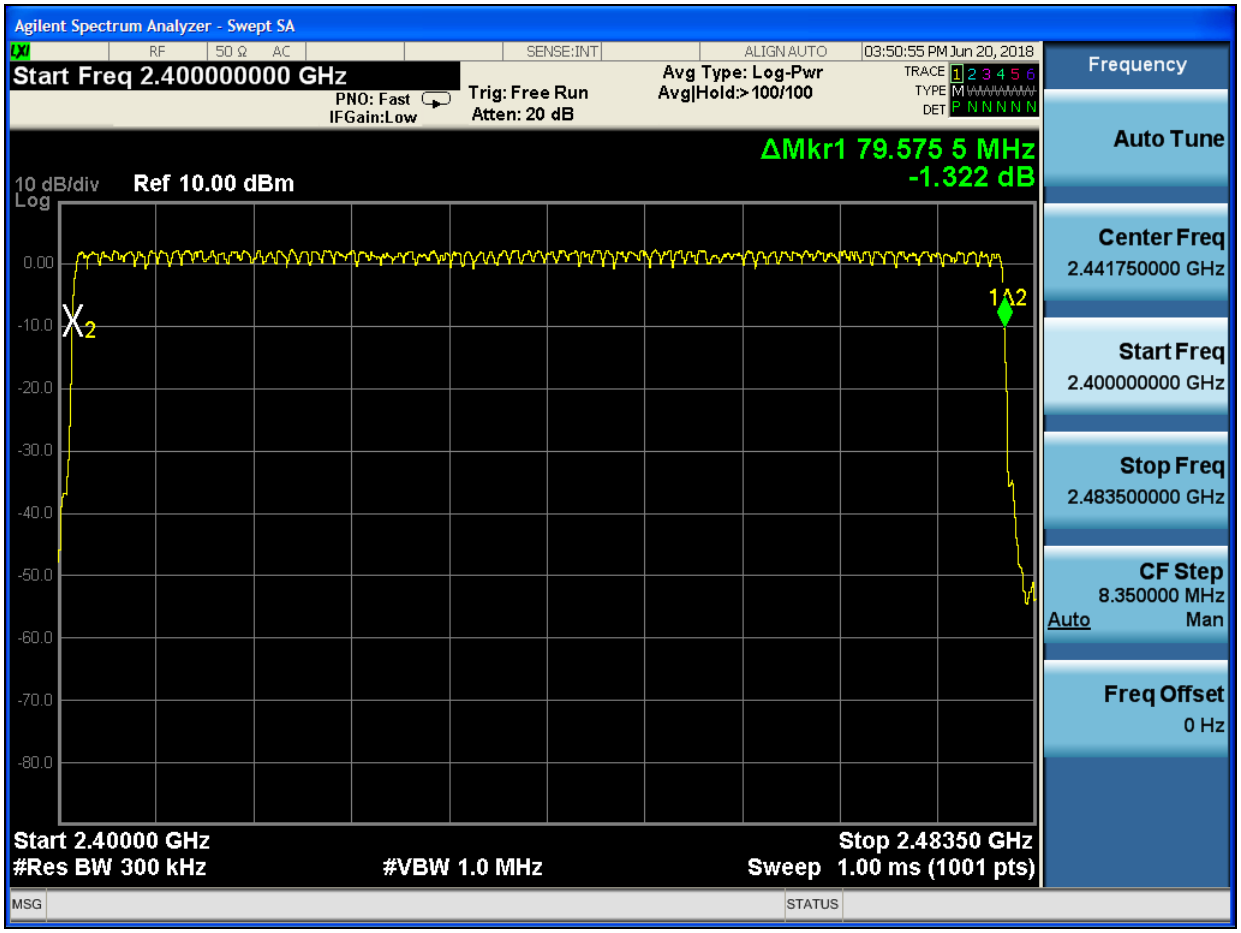
Khue N. Do		June 21, 2018
Test Engineer	Signature	Date of Test

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

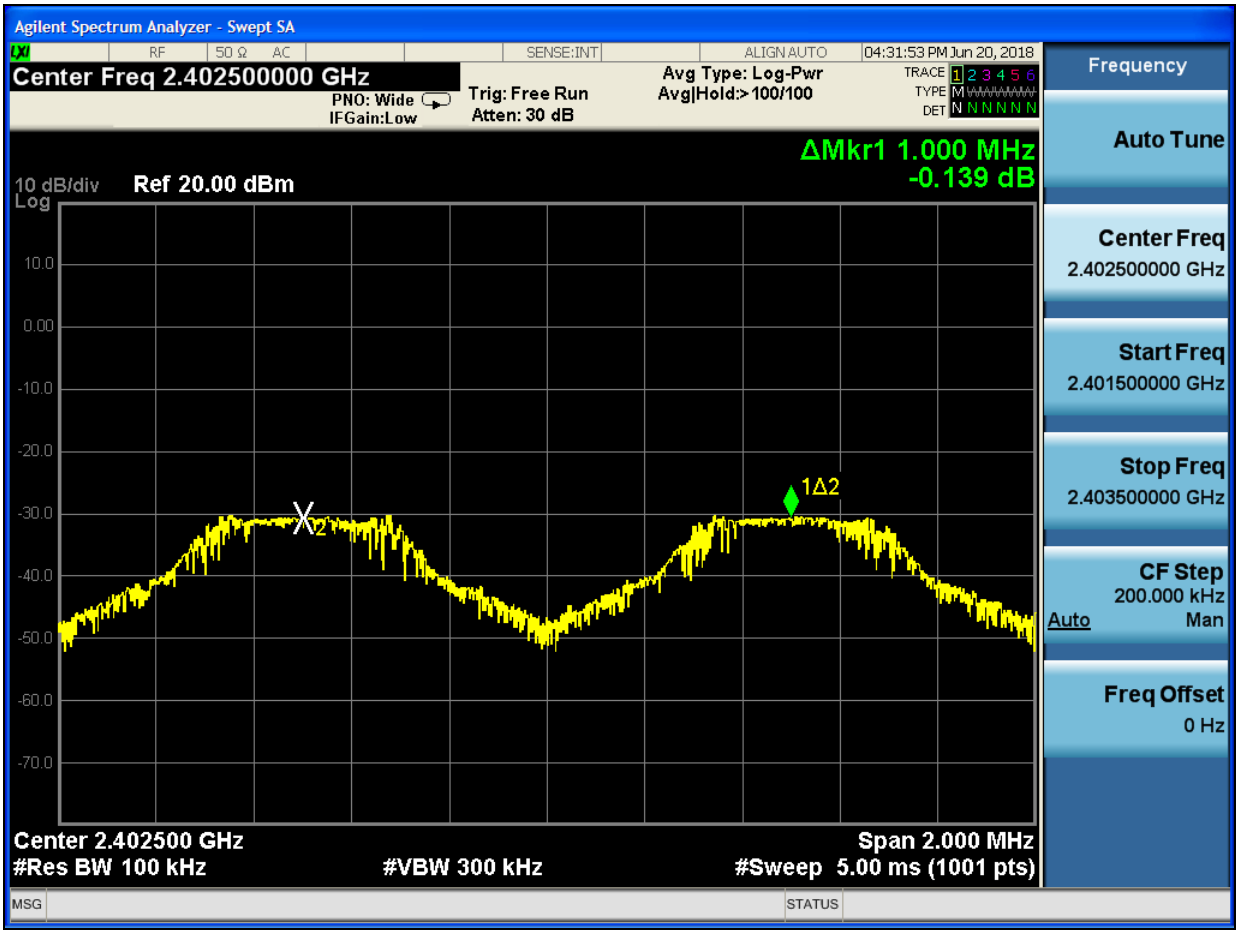
15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies 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.

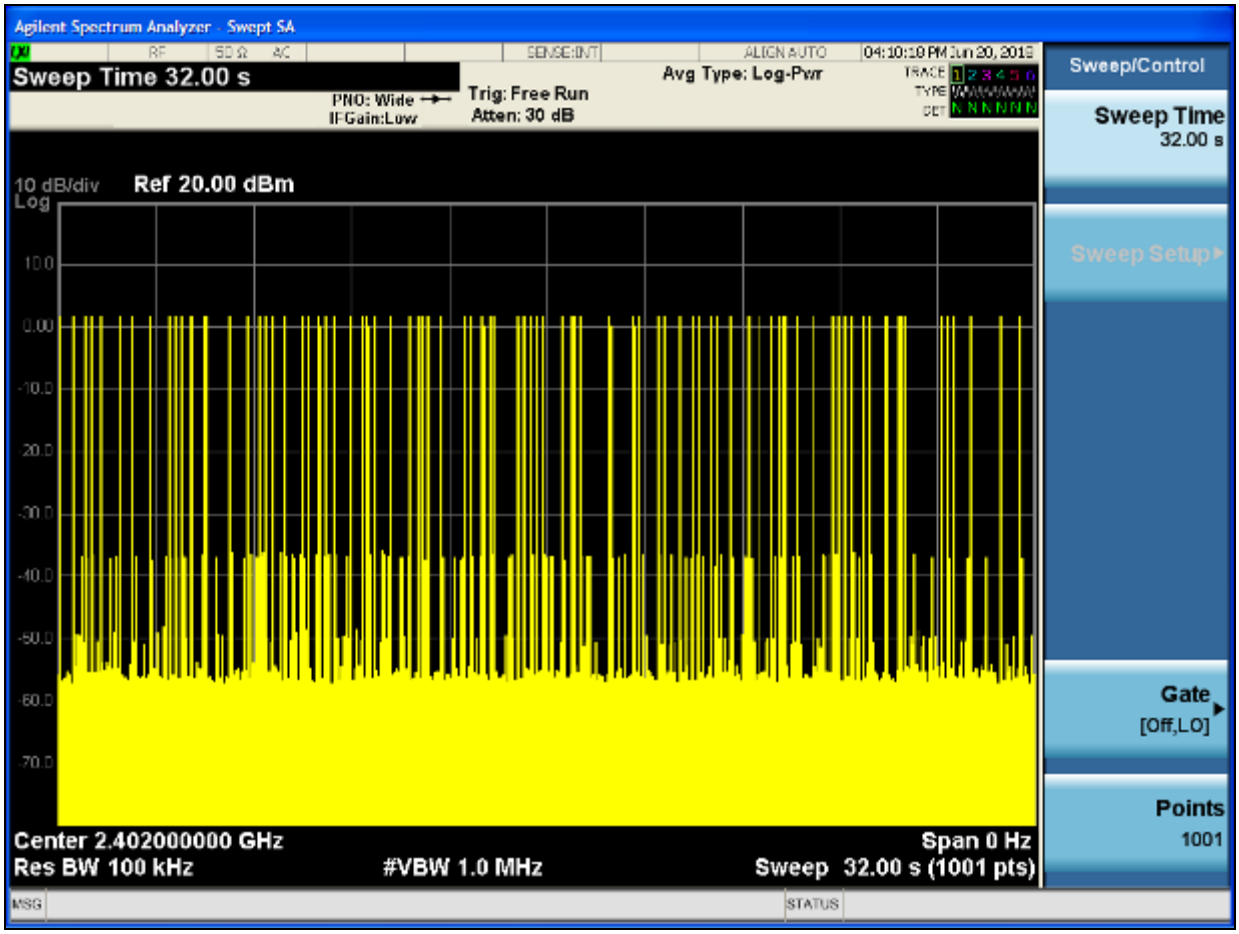
Plot 8-1: Number of Channels – Bluetooth (79 Channels)



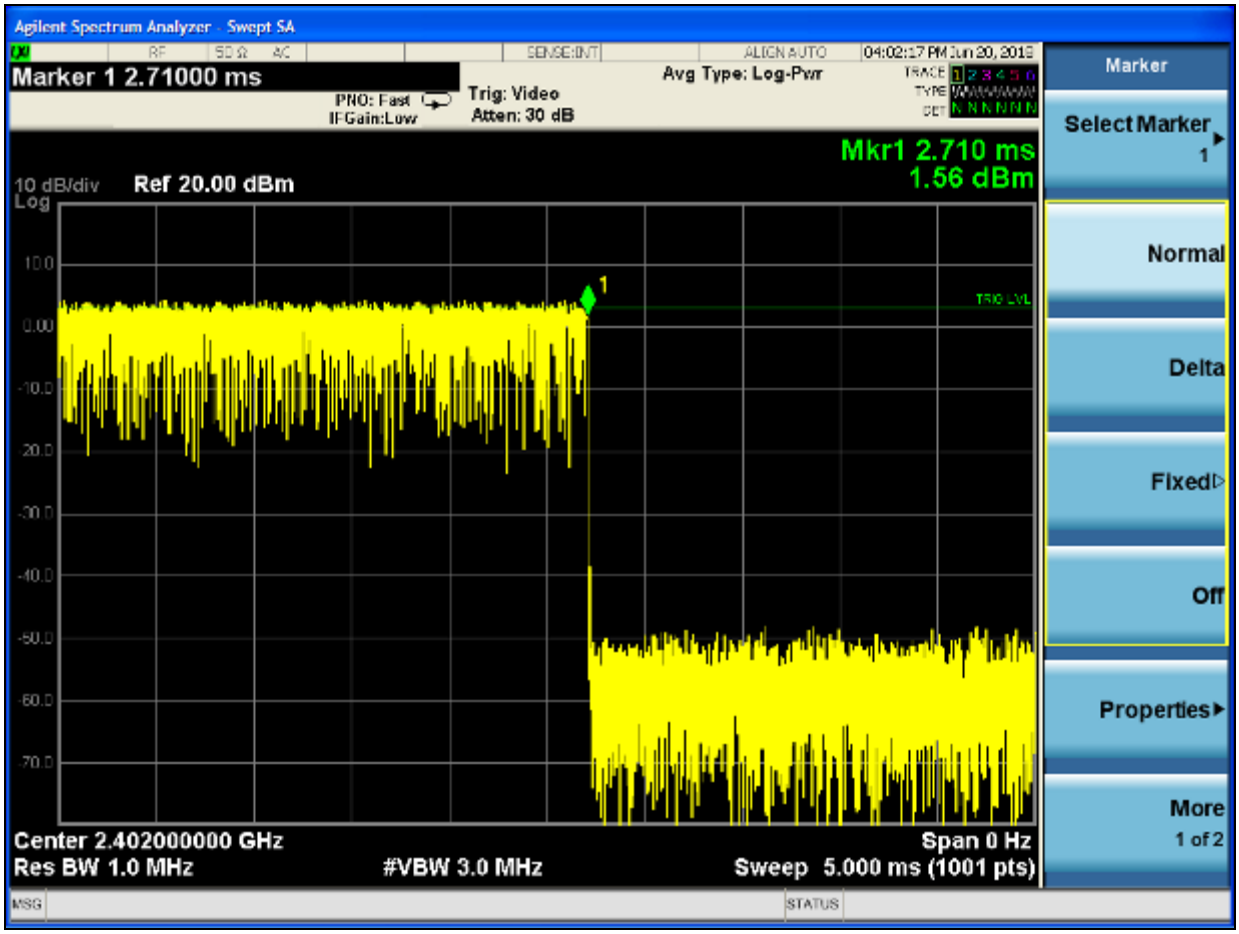
Plot 8-2: Channel Separation – Bluetooth (1 MHz)



Plot 8-3: Number of Pulses – Bluetooth (93)



Plot 8-4: Pulse Width – Bluetooth (2.71 ms)



Number of pulses in 79 * 0.4 (31.6) seconds = 93
Pulse width 2.71 ms x 93 = 0.252 s which is less than 0.400s (limit)

Measurement uncertainty: ±1.4%. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Pass

Table 8-1: 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		June 20, 2018
Test Engineer	Signature	Date of Test

9 Radiated Emissions – FCC 15.209; RSS-247 5.5; RSS-Gen 8.9, 8.10

9.1 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.

9.2 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 (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.

9.3 Radiated Emissions Test Results

Table 9-1: Radiated Emissions Harmonics/Spurious - 2402 MHz, 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	15.1	33.5	48.6	74.0	-25.4
12010.0	15.3	44.0	59.3	74.0	-14.7
19216.0	4.4	52.9	57.3	74.0	-16.7

Table 9-2: Radiated Emissions Harmonics/Spurious - 2402 MHz, Average

Frequency (MHz)	Peak (dBuV/m) -18.7 dB Duty Cycle Correction	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4804.0	-3.6	33.5	29.9	54.0	-24.1
12010.0	-3.4	44.0	40.6	54.0	-13.4
19216.0	-14.3	52.9	38.6	54.0	-15.4

Table 9-3: Radiated Emissions Harmonics/Spurious - 2441 MHz, 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	18.6	33.6	52.2	74.0	-21.8
7323.0	16.7	35.7	52.4	74.0	-21.6
12205.0	16.7	44.0	60.7	74.0	-13.3
19528.0	7.3	53.0	60.3	74.0	-13.7

Table 9-4: Radiated Emissions Harmonics/Spurious - 2441 MHz, Average

Frequency (MHz)	Peak (dBuV/m) - 18.7 dB Duty Cycle Correction	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4880.0	-0.1	33.6	33.5	54.0	-20.5
7320.0	-2.0	35.7	33.7	54.0	-20.3
12200.0	-2.0	44.0	42.0	54.0	-12.0
19520.0	-11.4	53.0	41.6	54.0	-12.4

Table 9-5: Radiated Emissions Harmonics/Spurious - 2480 MHz, 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	21.7	33.8	55.5	74.0	-18.5
7440.0	14.2	35.8	50.0	74.0	-24.0
12400.0	16.1	44.0	60.1	74.0	-13.9
19840.0	7.2	53.2	60.4	74.0	-13.6
22320.0	6.8	54.2	61.0	74.0	-13.0

Table 9-6: Radiated Emissions Harmonics/Spurious - 2480 MHz, Average

Frequency (MHz)	Peak (dBuV/m) - 18.7 dB Duty Cycle Correction	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4960.0	3.0	33.8	36.8	54.0	-17.2
7440.0	-4.5	35.8	31.3	54.0	-22.7
12400.0	-2.6	44.0	41.4	54.0	-12.6
19840.0	-11.5	53.2	41.7	54.0	-12.3
22320.0	-11.9	54.2	42.3	54.0	-11.7

Table 9-7: Unintentional Radiated Emissions

Frequency (MHz)	Quasi-Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Quasi-Peak Corrected (dBuV/m)	Limit (dBuV/m)	Margin (dB)
19.391	-7.4	0.2	-7.2	49.5	-56.7
32.532	4.0	17.8	21.8	40.0	-18.2
35.737	5.6	16.0	21.6	40.0	-18.4
52.083	11.8	8.4	20.2	40.0	-19.8
68.750	11.7	6.7	18.4	40.0	-21.6
155.930	3.2	11.3	14.5	43.5	-29.0
259.936	-2.0	15.2	13.2	46.0	-32.8
337.179	-2.3	15.5	13.2	46.0	-32.8

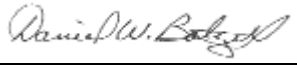
Measurement uncertainty: ±4.7 dB. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Table 9-8: 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
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
900772	EMCO	3161-02	Horn Antenna (2-4 GHz)	9804-1044	4/9/19
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 GHz)	9607-1044	4/9/19
901218	EMCO	3160-09	Horn Antenna (18-26.5 GHz)	960281-003	4/9/19
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	4/26/19
900791	Antenna Research Associates, Inc.	LPB-2520	BiLog Antenna (25-1000 MHz)	1037	10/4/20

PASS

Test Personnel:

Daniel W. Baltzell		July 11, 2018
Test Engineer	Signature	Date of Test

10 AC Conducted Emissions - FCC 15.207; RSS-Gen 7.2

10.1 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).

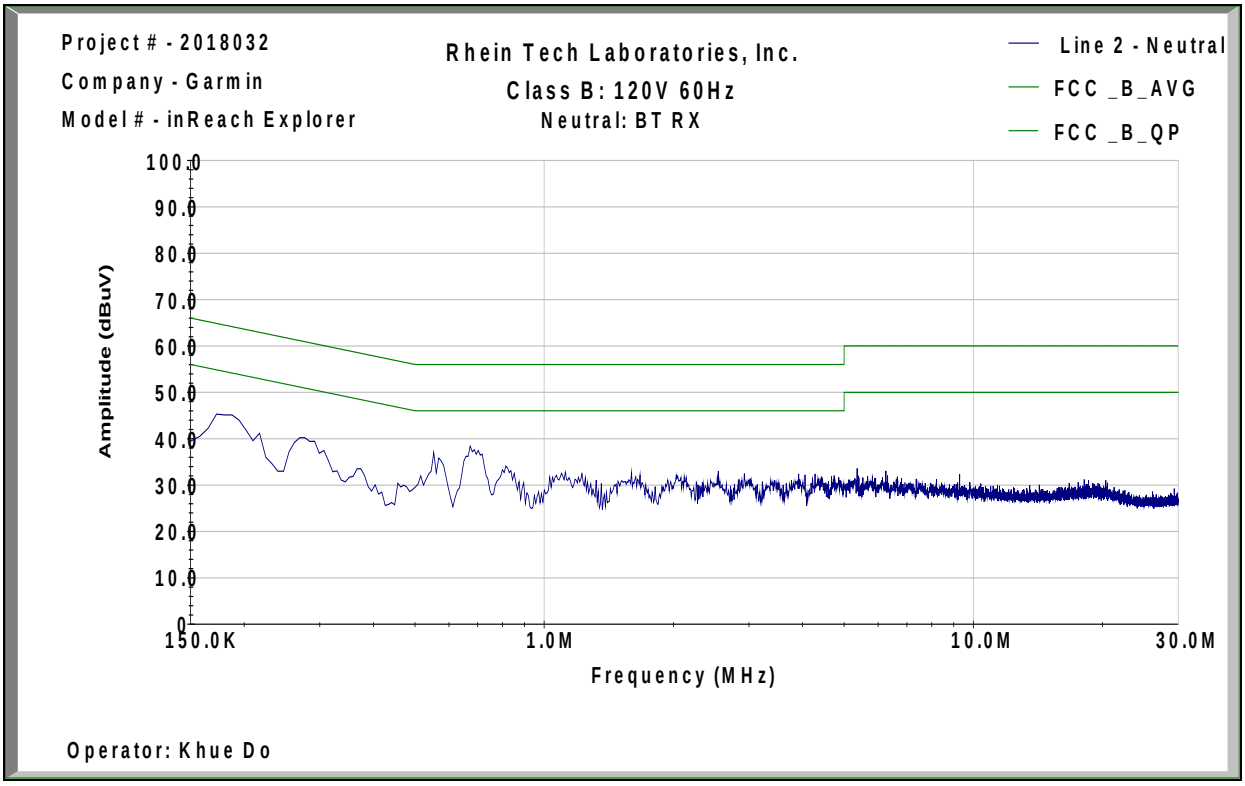
The analyzer's 6 dB bandwidth was set to 9 kHz. Video filter less than 10 times the resolution bandwidth is not used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. 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.

10.2 Test Limits

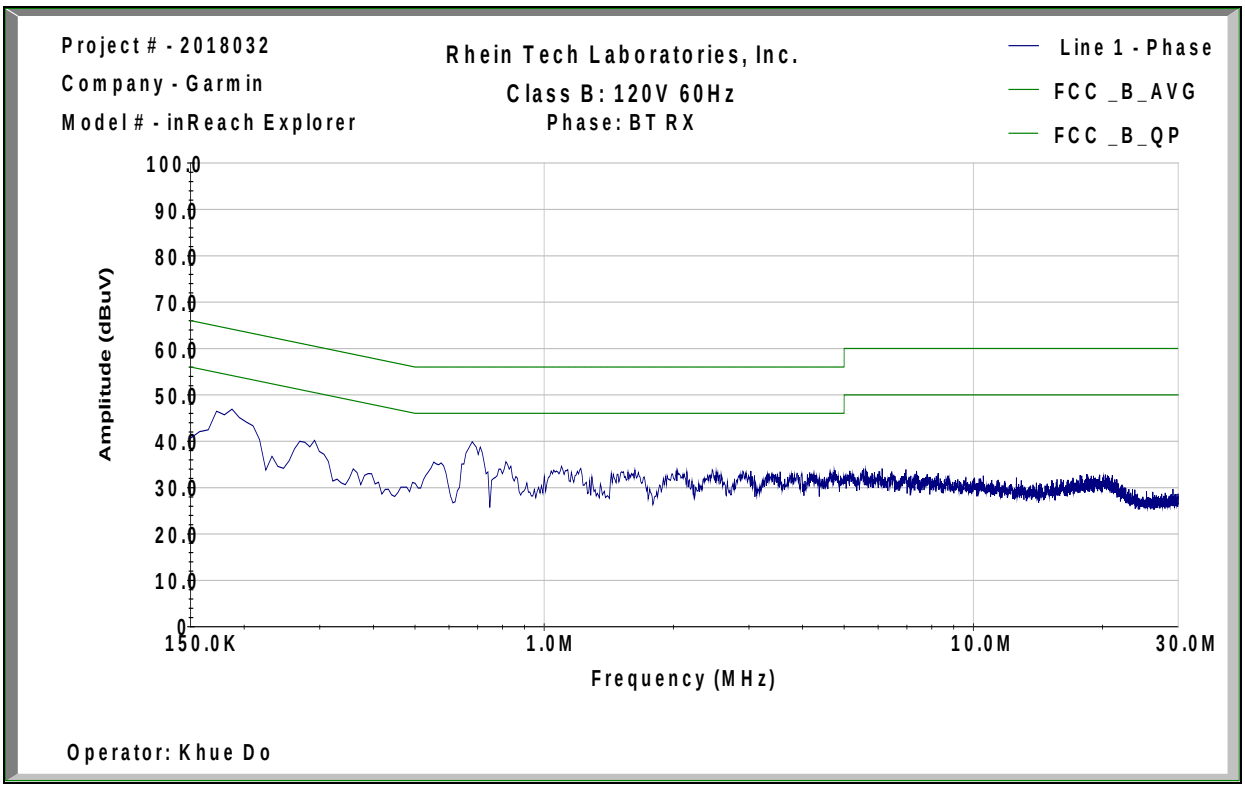
Line-Conducted Emissions		
Limit (dBµV)		
Frequency (MHz)	**Quasi-Peak**	**Average**
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5.00	56	46
5.00 to 30.00	60	50

10.3 Conducted Emissions Test Data

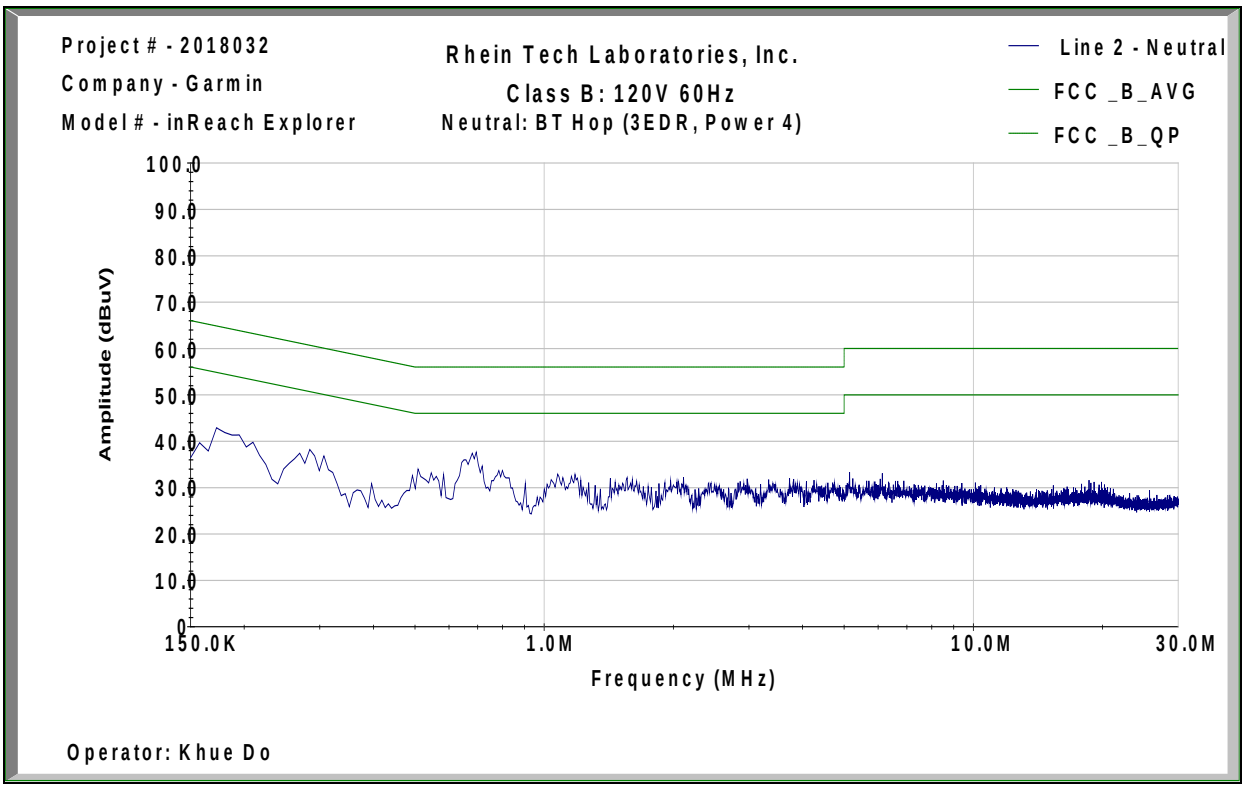
Plot 10-1: Conducted Emissions - Neutral Side – Standby – AC Adapter ADP-5BW B C.C:A



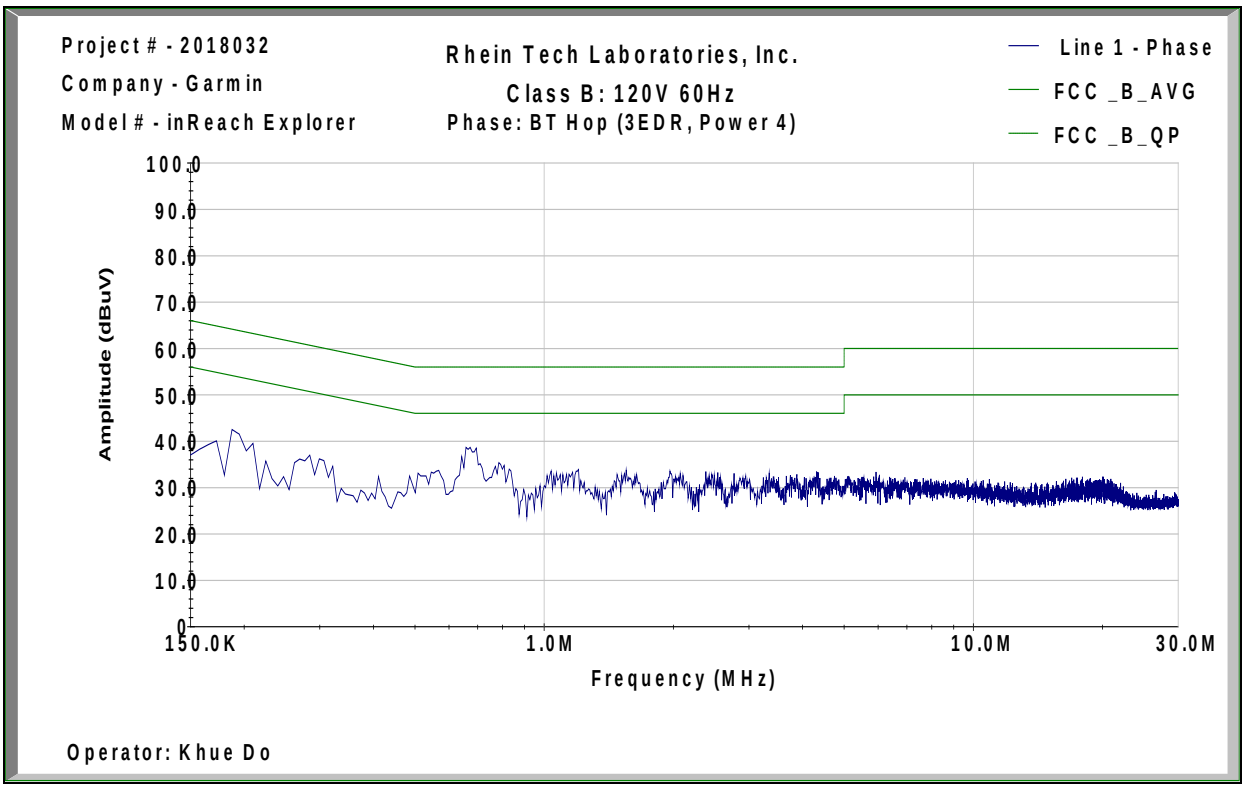
Plot 10-2: Conducted Emissions - Phase Side – Standby – AC Adapter ADP-5BW B C.C:A



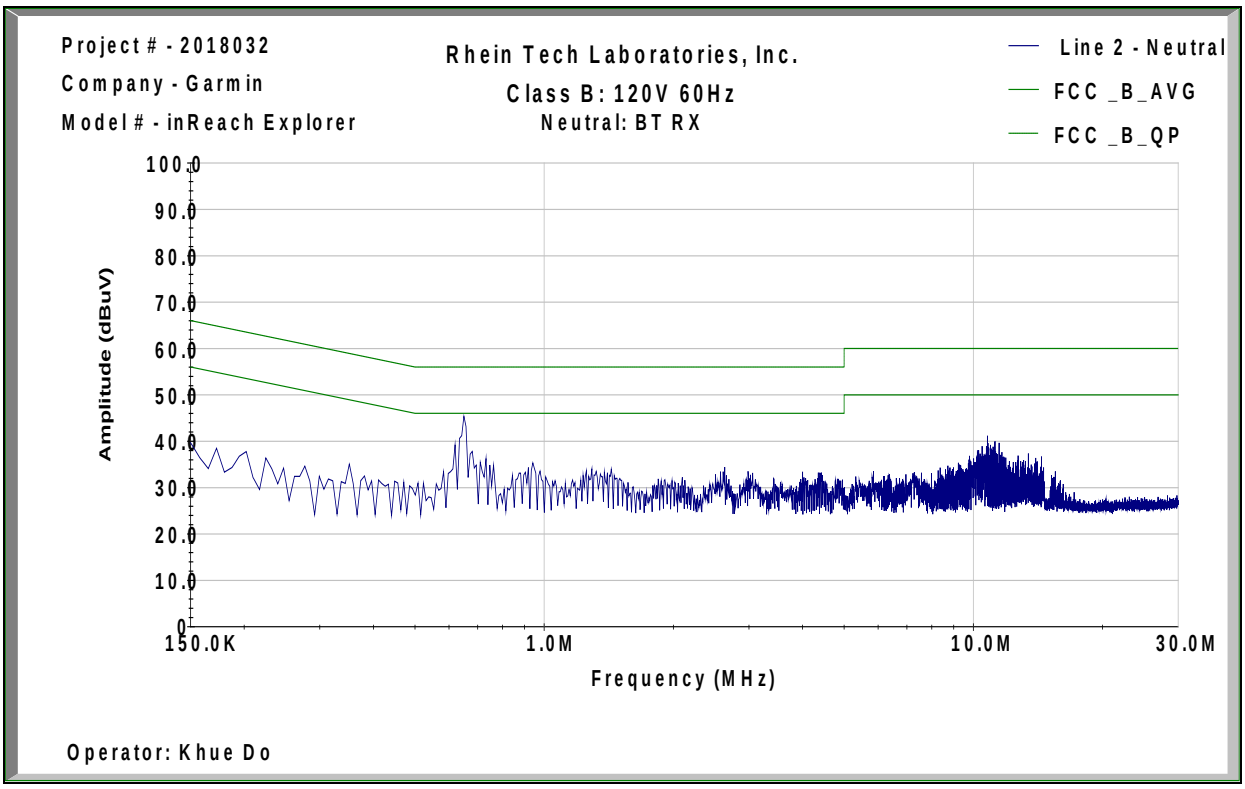
Plot 10-3: Conducted Emissions - Neutral Side – TX – AC Adapter ADP-5BW B C.C:A



Plot 10-4: Conducted Emissions - Phase Side – TX – AC Adapter ADP-5BW B C.C:A



Plot 10-5: Conducted Emissions - Neutral Side – RX – AC Adapter PSAF10R-050Q



Plot 10-6: Conducted Emissions - Phase Side – RX – AC Adapter PSAF10R-050Q

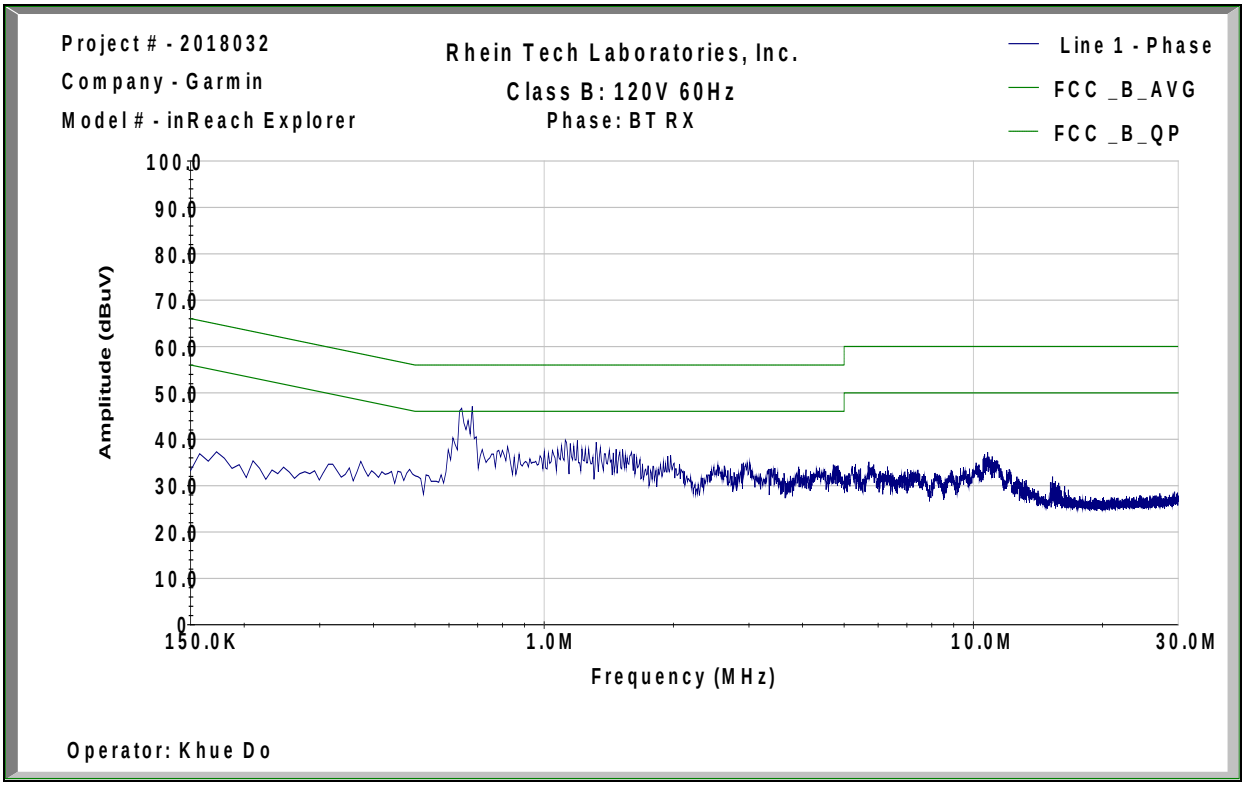
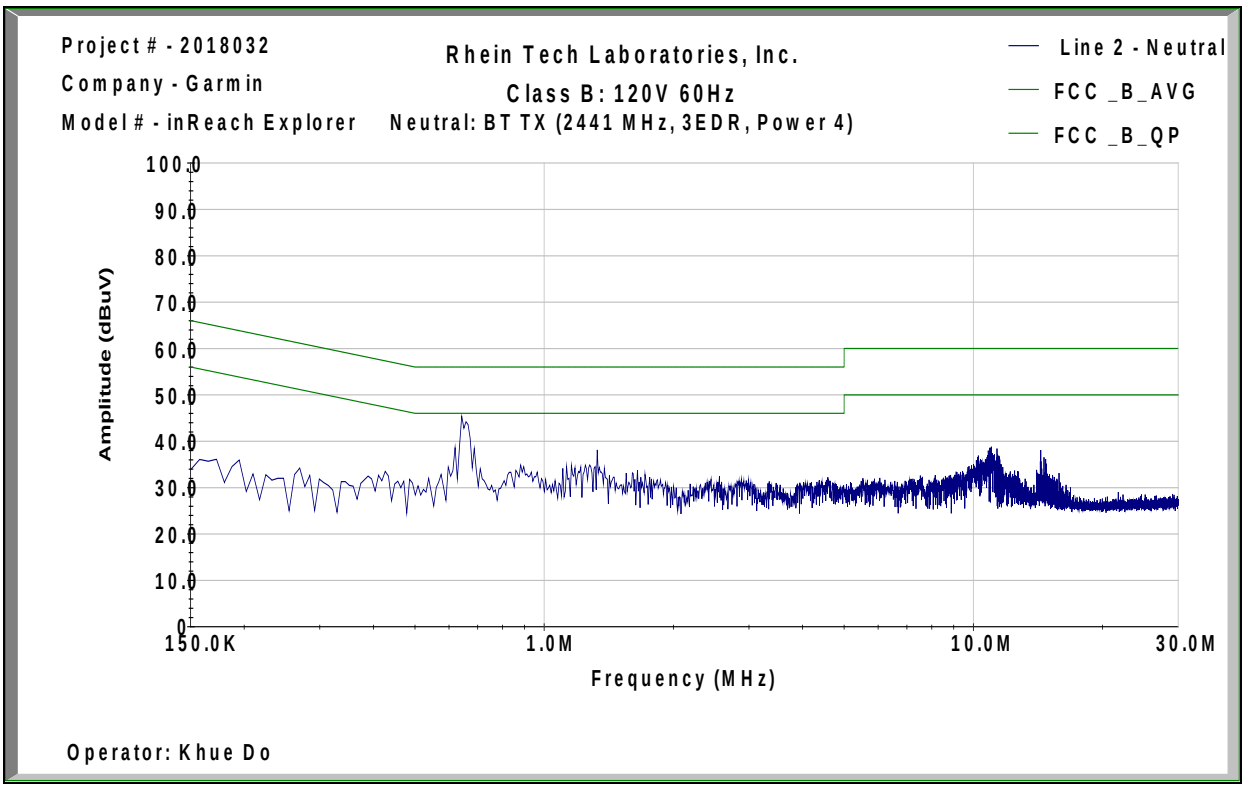


Table 10-1: Conducted Emissions - Phase Side – RX – AC Adapter PSAF10R-050Q

Frequency MHz	Detector AVG / QPK	Level dBuV	SCF dB	Corrected dBuV	Limit dBuV	Margin dB	Result Pass / Fail
0.647	AVG	25.1	0.8	25.9	46.0	-20.1	Pass
0.647	QPK	49.3	0.8	50.1	56.0	-5.9	Pass

Plot 10-7: Conducted Emissions - Neutral Side – TX– AC Adapter PSAF10R-050Q



Plot 10-8: Conducted Emissions - Phase Side – TX – AC Adapter PSAF10R-050Q

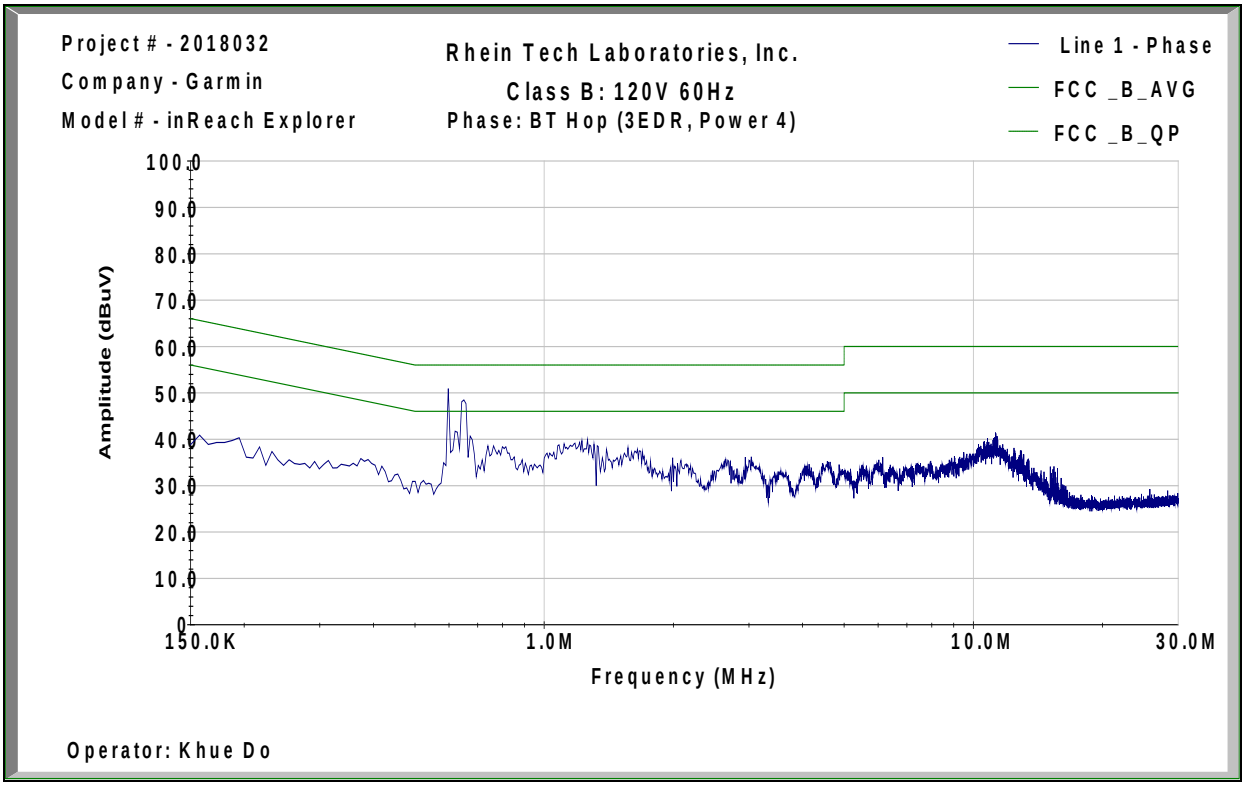
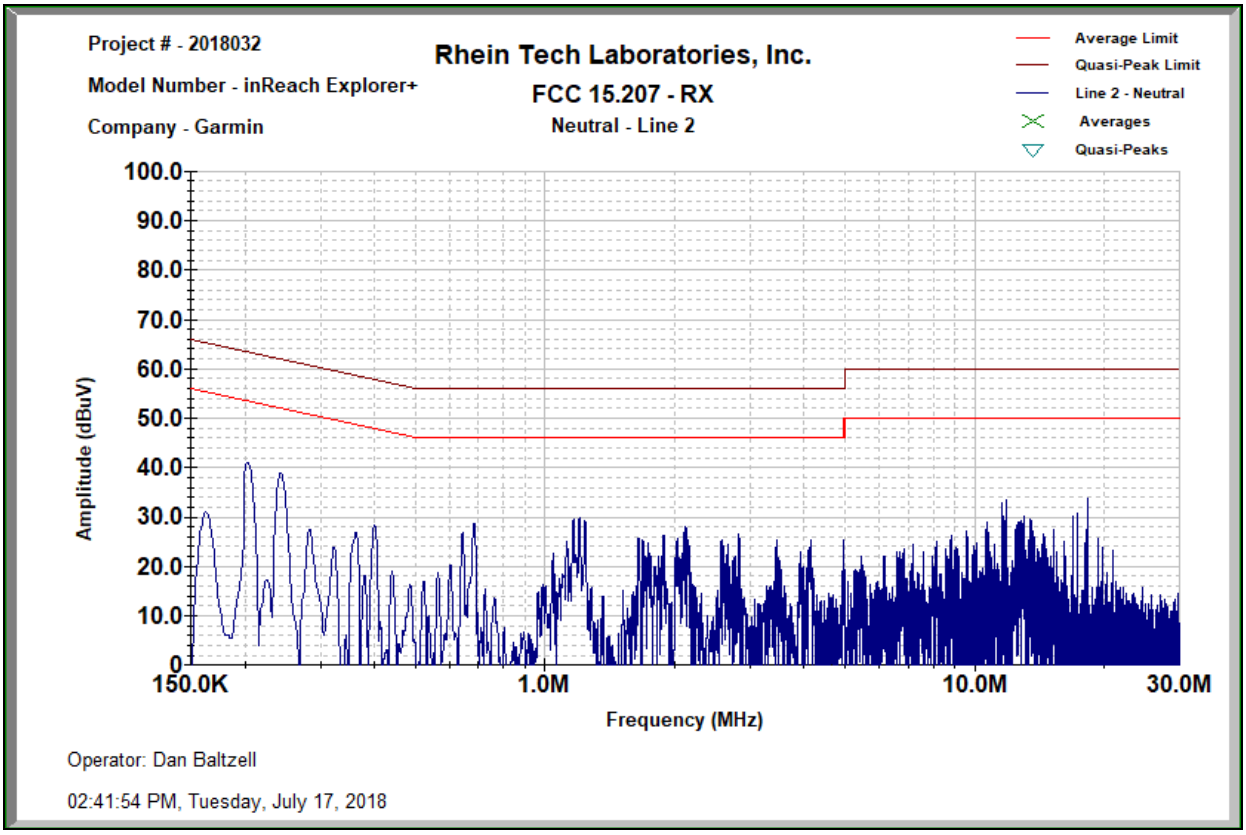


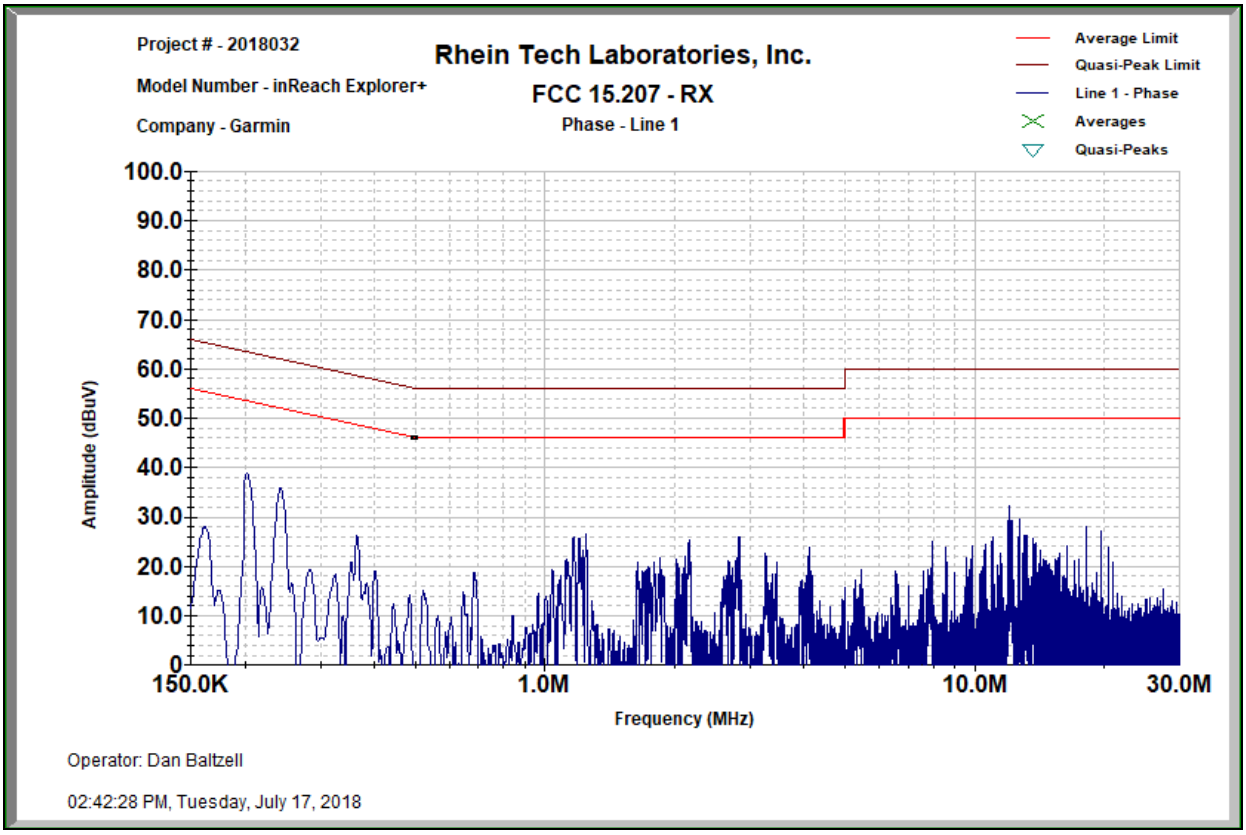
Table 10-2: Conducted Emissions - Phase Side – TX – AC Adapter PSAF10R-050Q

Frequency MHz	Detector AVG / QPK	Level dBuV	SCF dB	Corrected dBuV	Limit dBuV	Margin dB	Result Pass / Fail
0.647	AVG	21.7	0.8	22.5	46.0	-23.5	Pass
0.647	QPK	49.0	0.8	49.8	56.0	-6.2	Pass

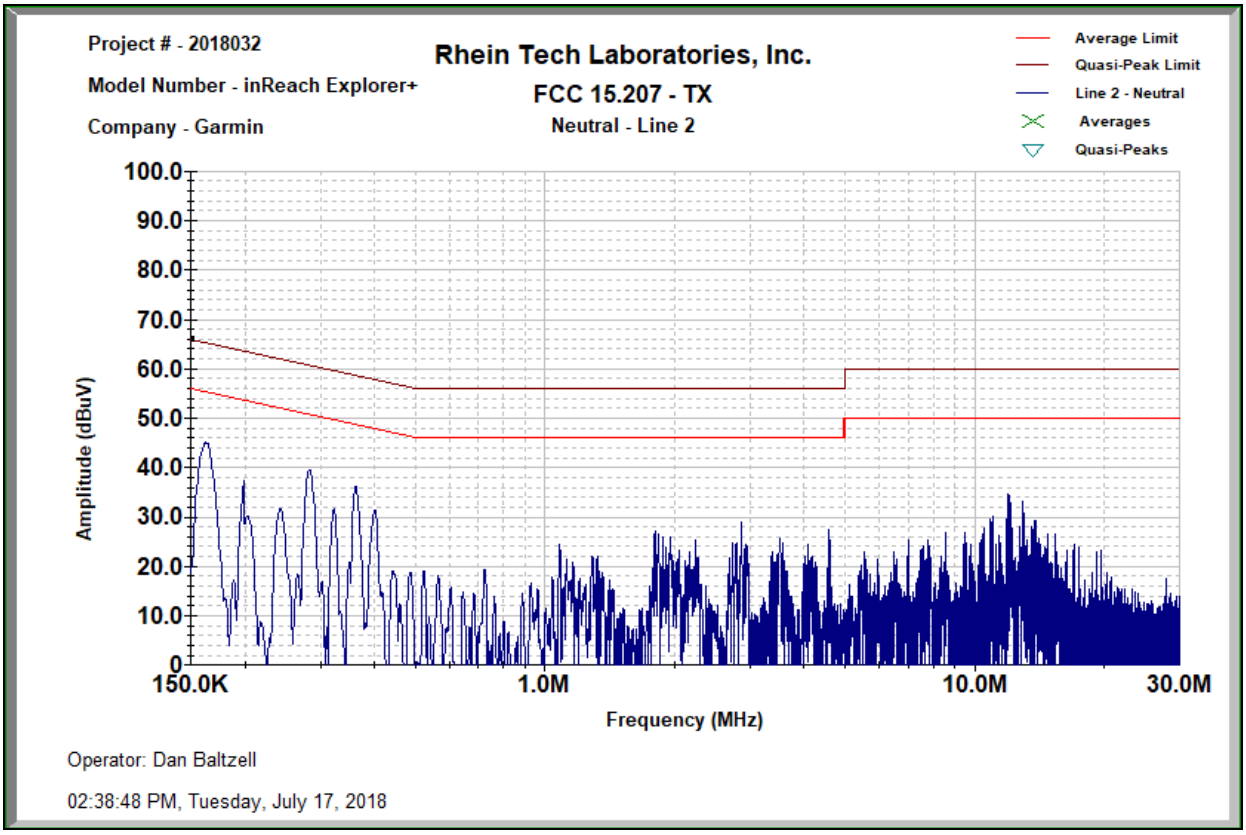
Plot 10-9: Conducted Emissions - Neutral Side – RX – AC Adapter PSAI05R-050Q



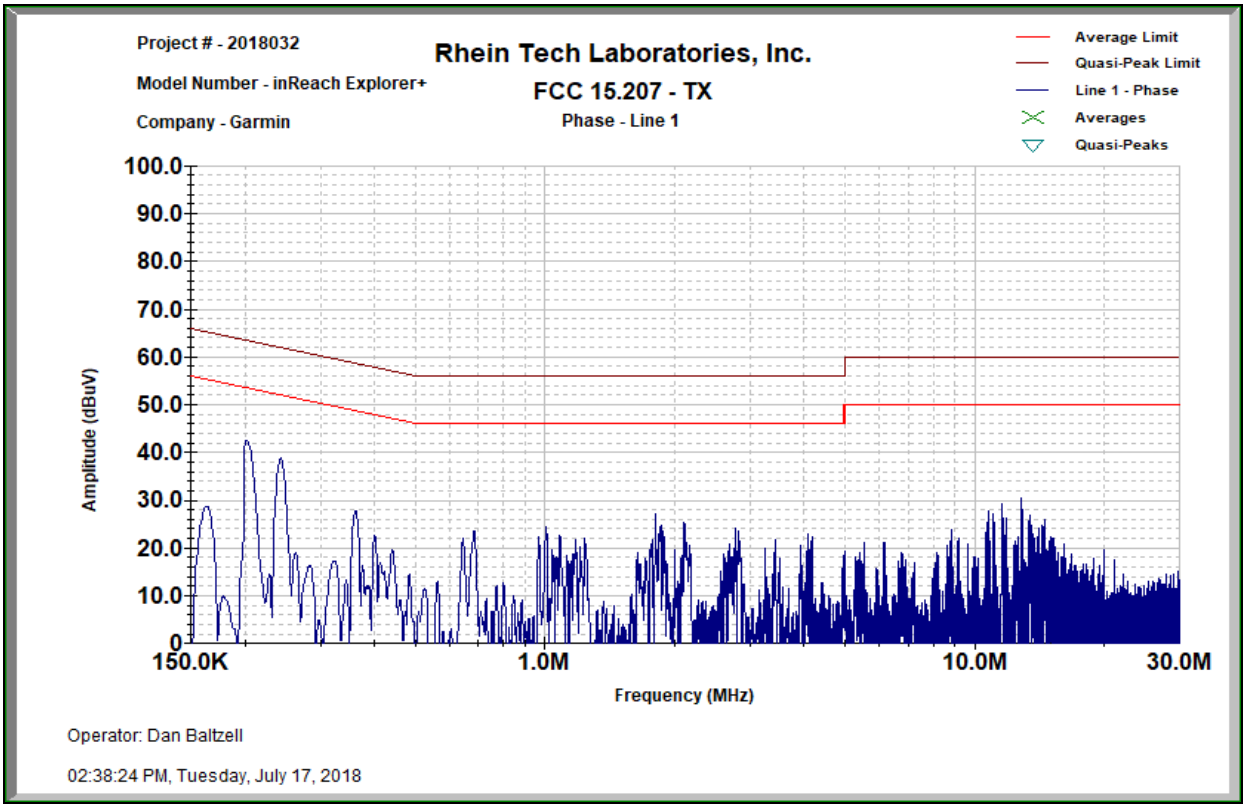
Plot 10-10: Conducted Emissions - Phase Side – RX – AC Adapter PSAI05R-050Q



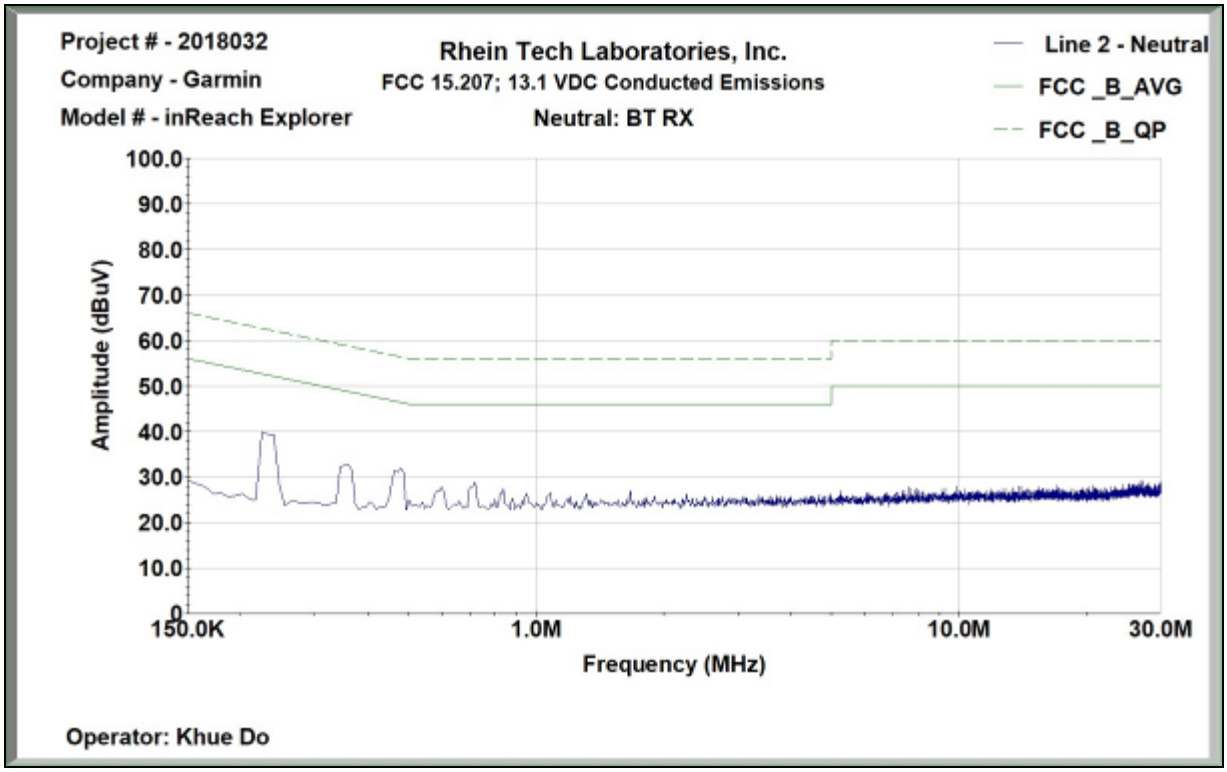
Plot 10-11: Conducted Emissions - Neutral Side – TX – AC Adapter PSAI05R-050Q



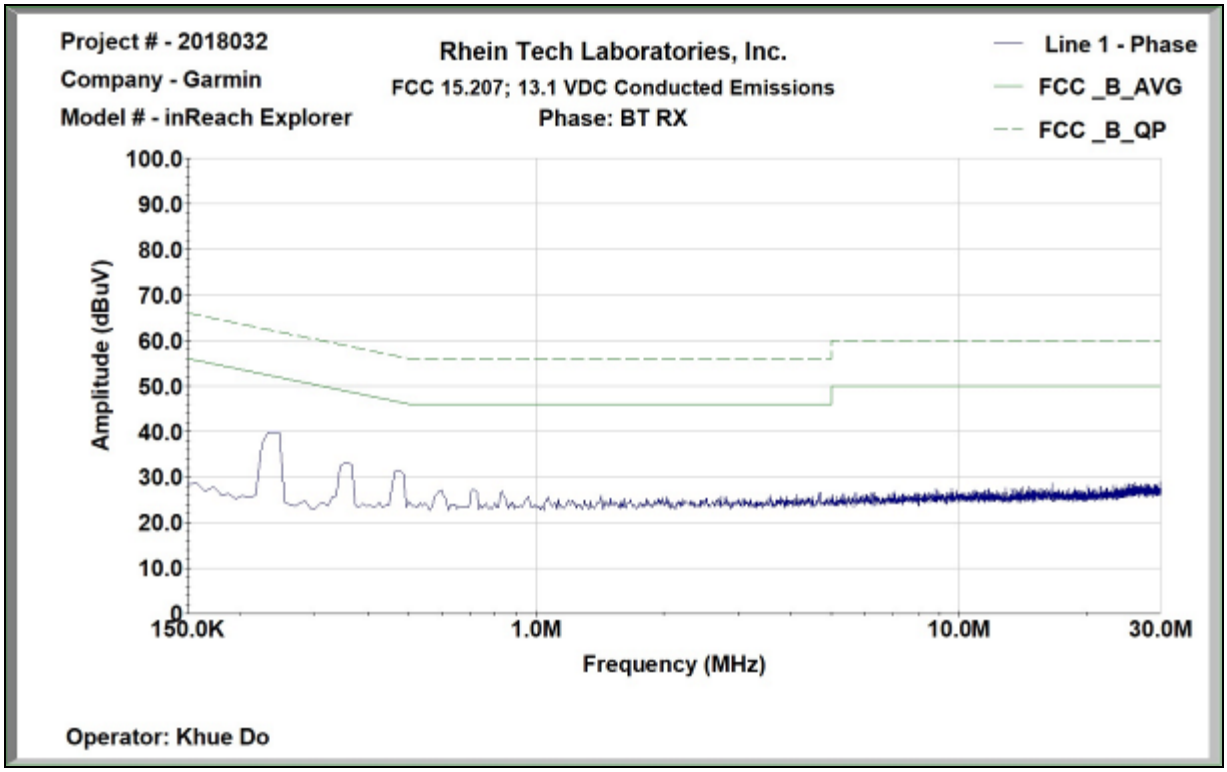
Plot 10-12: Conducted Emissions - Phase Side – TX – AC Adapter PSAI05R-050Q



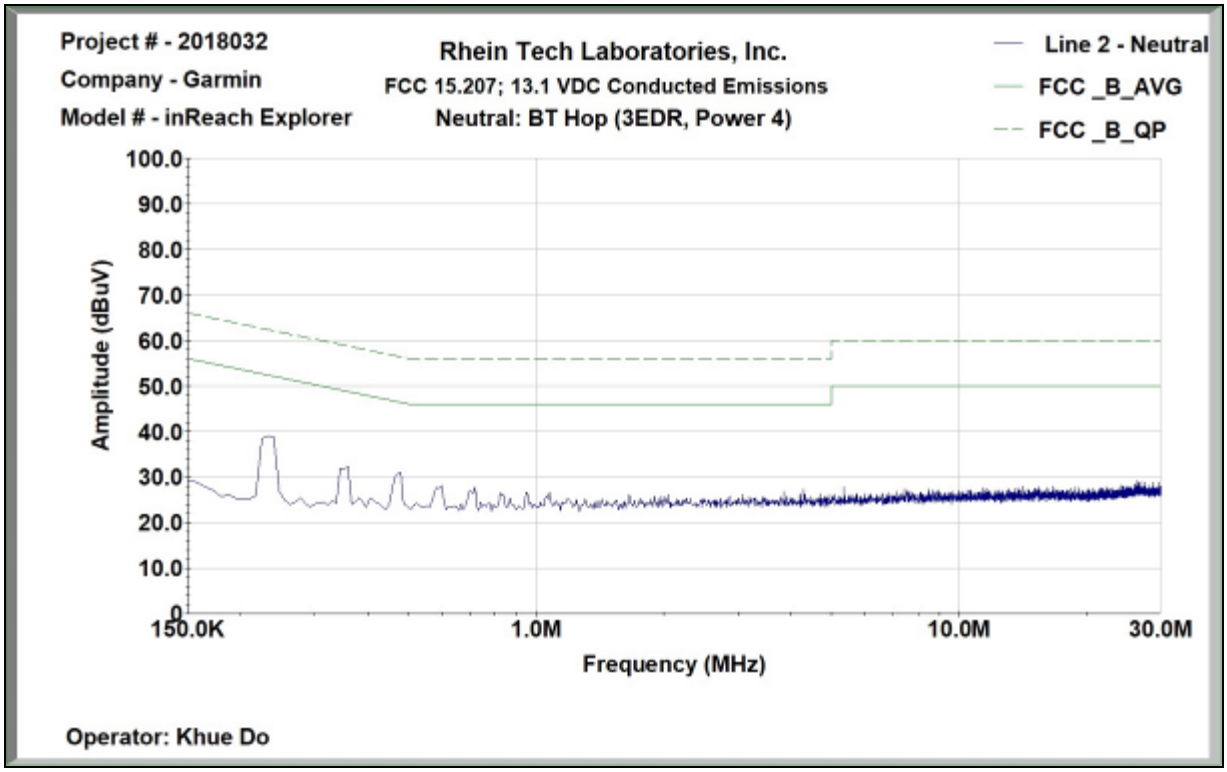
Plot 10-13: Conducted Emissions - Neutral Side – RX – Car Charger Adapter RF-279-G021-0



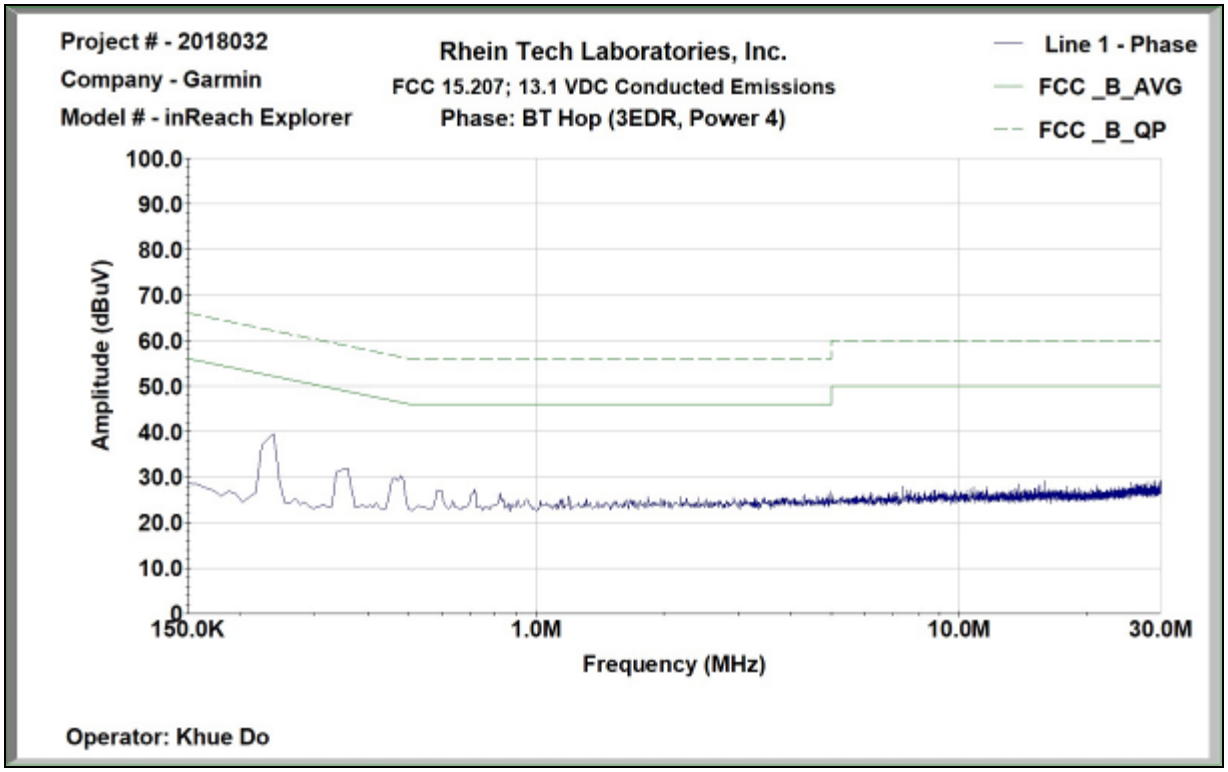
Plot 10-14: Conducted Emissions - Phase Side – RX – Car Charger Adapter RF-279-G021-0



Plot 10-15: Conducted Emissions - Neutral Side – TX – Car Charger Adapter RF-279-G021-0



Plot 10-16: Conducted Emissions - Phase Side – TX – Car Charger Adapter RF-279-G021-0

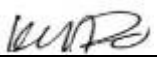
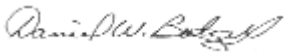


Measurement uncertainty: ±3.6 dB. Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2.

Table 10-3: Conducted Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900968	Hewlett Packard	8567A	Spectrum Analyzer (10 kHz-1.5 GHz)	2602A00160	4/26/19
900339	Hewlett Packard	85650A	Quasi-Peak Adapter (30 Hz-1 GHz)	2521A00743	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!4	TILE! Test Software	4.0.A.8	N/A
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	4/26/19
Test Software	ETS Lindgren	TILE!7	TILE! Test Software	7.0.3.349	N/A

Test Personnel:

Khue Do		June 22, 2018
Daniel W. Baltzell		July 17, 2018
Test Engineer	Signature	Dates of Test

11 Conclusion

The data in this measurement report shows that the EUT as tested, Garmin International Inc. Model/HVIN A03524, FCC ID: IPH-03524, IC: 1792A-03524, complies with the applicable requirements of FCC Parts 2 and 15 and ISED RSS-247 and RSS-Gen.