Class 2 & Class 3 Permissive Change Report
FCC Part 15.247 & Industry Canada RSS-247

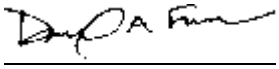
Test Lab:	Applicant:
Rhein Tech Laboratories, Inc. Tel: 703-689-0368 360 Herndon Parkway Fax: 703-689-2056 Suite 1400 www.rheintech.com Herndon, VA 20170 E-Mail: atcbinfo@rheintech.com	Garmin International Inc. Tel: (913) 440-5471 1200 E. 151st Street Olathe, Kansas 66062

FCC ID **IC**	IPH-A3119-00 1792A-A311900	**Test Report Date**	December 6, 2017
Platform	N/A	**RTL Work Order #**	2017209
Model/HVIN	AA3119-00	**RTL Quote #**	QRTL17-209B
American National Standard Institute	ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
FCC Classification	DTS – Digital Transmission System		
FCC Rule Part(s)/Guidance	FCC Rules Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz Direct Sequence System (10/01/2016)		
ISED	RSS-247 Issue 2 Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices		
Digital Interface Information	Digital Interface was found to be compliant		

Frequency Range (MHz)	**Output Power (W)***	**Frequency Tolerance**	**Emission Designator**
2412 – 2462	0.224	N/A	18M8G1D

** power is maximum conducted as stated on original grant*

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, ISED RSS-247, RSS-Gen, and ANSI C63.10.

Signature: 

Date: December 6, 2017

Typed/Printed Name: Desmond A. Fraser

Position: President

Table of Contents

Figure Index

Table Index

Plot Index

Appendix Index

Photograph Index

1 General Information

1.1 Scope

This is an FCC Class 2 permissive change and ISED Class 3 permissive change report.

1.2 Description of EUT

Equipment Under Test	Watch
Model/HVIN	AA3119-00
Power Supply	Internal rechargeable battery
Modulation Type	BPSK
Frequency Range	2412-2462 MHz
Antenna Type	Sheet metal inverted F

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 a Class 2/Class 3 permissive change application for Garmin International Inc. Model/HVIN: AA3119-00, FCC ID: IPH-A3119-00, IC: 1792A-A311900 to add a new antenna.

1.5 Modifications

No modifications were made to the equipment during testing.

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
Low	2412
Middle	2436
High	2462

2.2 Exercising the EUT

The EUT was supplied with a switch to change channels to a high, mid, and low channel for testing, and to switch between all modulations. All modulations were investigated and the worst-case data is presented in this report. The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The EUT was provided with ability to continuously transmit during testing. The carrier was also checked to verify that information was being transmitted. 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) & IC

Test	FCC Reference	ISED Reference	Result
Radiated Emissions	FCC 15.209	RSS-247 5.5; RSS-Gen 6.13/7.1	Pass
Maximum Peak Power Output	FCC 15.247(b)(3)	RSS-247 5.4 RSS-Gen 6.12	Pass
Band Edge Measurement	FCC 15.247(d)	RSS-247 5.5	Pass

2.4 Test System Details

The test samples were received on November 1, 2017. 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/ HVIN	Serial Number	FCC ID	Cable Description	RTL Bar Code
Transceiver (conducted emissions)	Garmin International Inc.	AA3119-00	3953653078u	IPH-A3119-00	N/A	22526
Transceiver (radiated emissions)	Garmin International Inc.	AA3119-00	3953653087u	IPH-A3119-00	N/A	22527

2.5 Configuration of Tested System

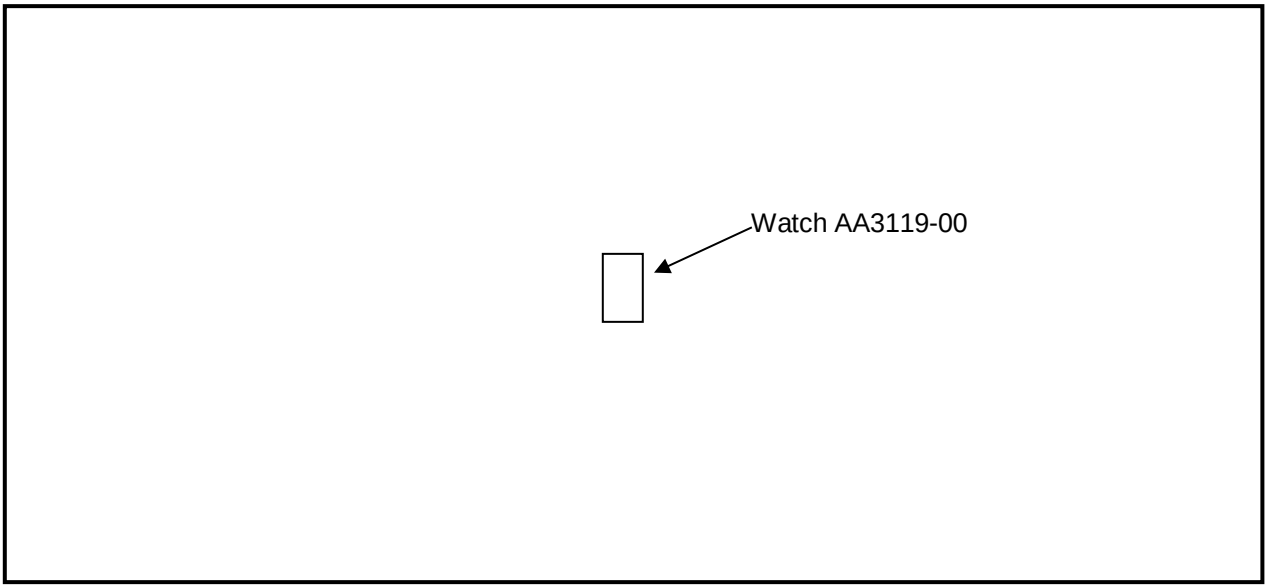


Figure 2-1: Configuration of System Under Test

3 Peak Output Power - 15.247(b)(3); IC RSS-247 5.4(4), RSS-Gen 6.12

3.1 Power Output Test Procedure

A radiated measurement was made with the spectrum analyzer, for the low, mid, and high channels since no antenna port was available and a conversion to dBm and W determined from dBuV/m-104.7* 20Log(3m). The resolution bandwidth used was 3 MHz, and video bandwidth was 10 MHz.

Table 3-1: Peak Power Output Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	3/22/18

3.2 Peak Output Power Test Data

Table 3-2: Peak Output Power Test Data - 802.11b (11 Mbps)

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Peak Emission Level (dBuV/m)	Peak Emission Level (dBm)	Peak Emission Level (W)
2412.0	69.1	25.4	94.5	-0.7	0.001
2437.0	69.1	25.5	94.6	-0.6	0.001
2484.0	71.4	25.7	97.1	1.9	0.002

Table 3-3: Peak Output Power Test Data - 802.11g (9 Mbps)

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Peak Emission Level (dBuV/m)	Peak Emission Level (dBm)	Peak Emission Level (W)
2412.0	69.0	25.4	94.4	-0.8	0.001
2437.0	69.0	25.5	94.5	-0.7	0.001
2462.0	70.5	25.7	96.2	1.0	0.001

Table 3-4: Peak Output Power Test Data - 802.11n (MCS7)

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Peak Emission Level (dBuV/m)	Peak Emission Level (dBm)	Peak Emission Level (W)
2412.0	68.8	25.4	94.2	-1.0	0.001
2437.0	69.1	25.5	94.6	-0.6	0.001
2484.0	70.0	25.7	95.7	0.5	0.001

Measurement uncertainties shown for these tests are expanded Gaussian uncertainties expressed at 95% confidence level using a coverage factor k = 1.96. Measurement uncertainty = ± 4.6 dB.

Test Personnel:

Dan Baltzell		November 7, 2017
Test Engineer	Signature	Date of Test

4 Compliance with the Band Edge – FCC 15.247(d); ISED RSS-247 5.5

4.1 Band Edge Test Procedure

Conducted measurements were taken. The span was set wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation. The spectrum analyzer was set to the following:

RBW > = 1 MHz
VBW > = 3 x RBW
Detector function = peak and average
Trace = max hold

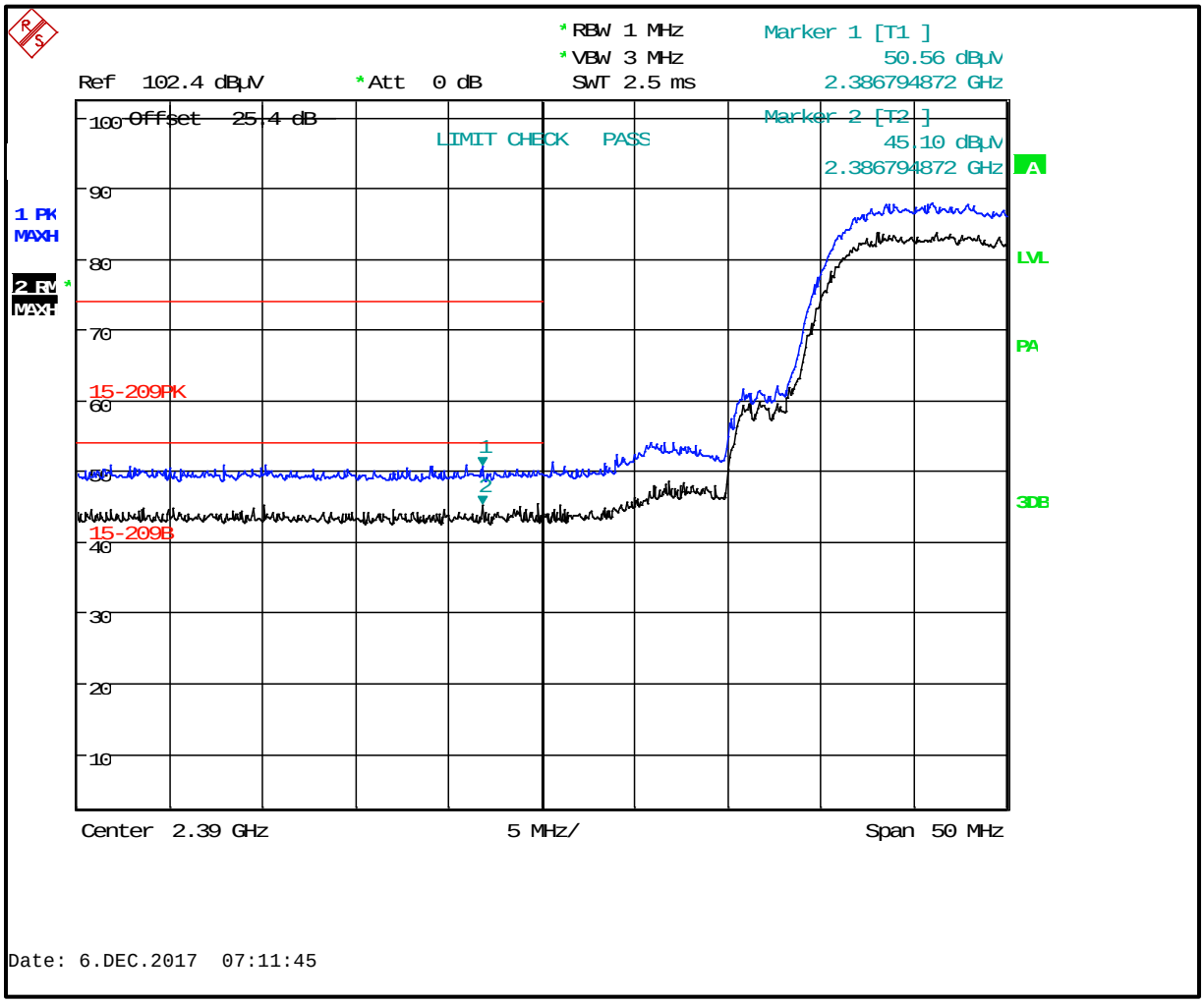
The trace was allowed to stabilize. The marker was set on the emission at the band edge. The maximum restricted-band emission was measured, and was compared to the 20 dBc requirement of 15.247(d) (when using peak emissions) or restricted band.

Table 4-1: Band Edge Test Equipment

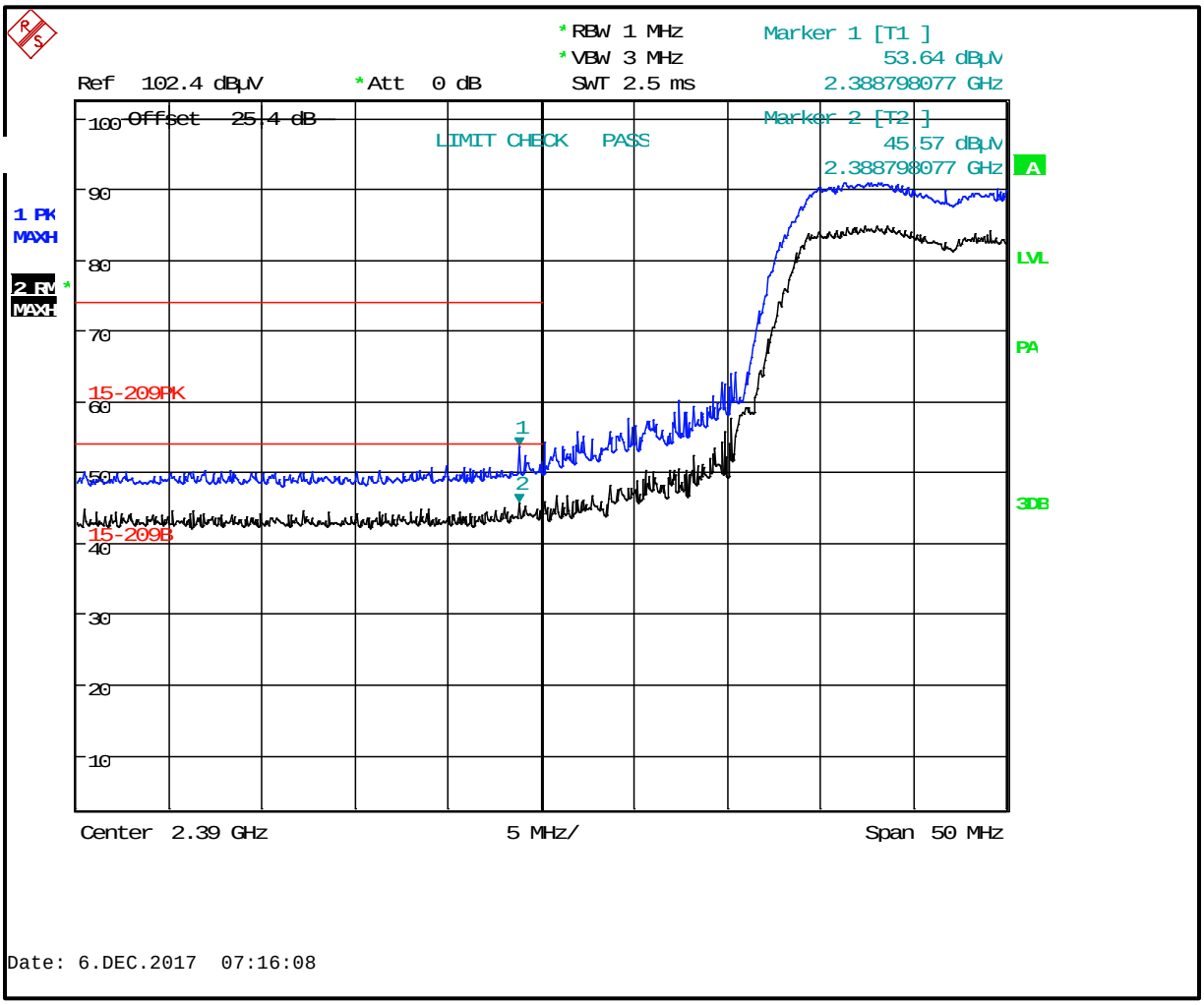
RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	3/22/18

4.2 Band Edge Test Results

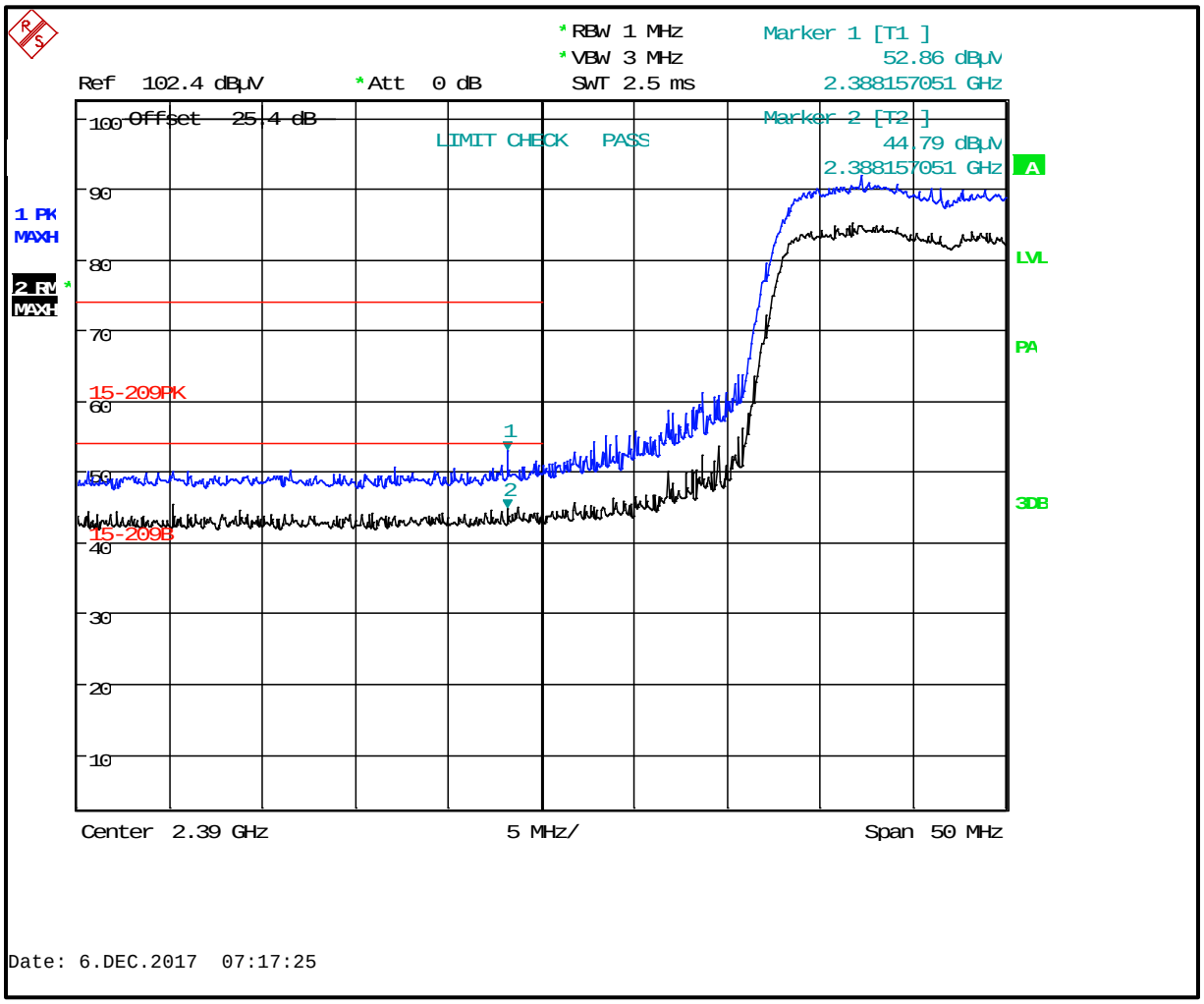
Plot 4-1: Lower Band Edge – Peak-Average Detector - 802.11b (11 Mbps)



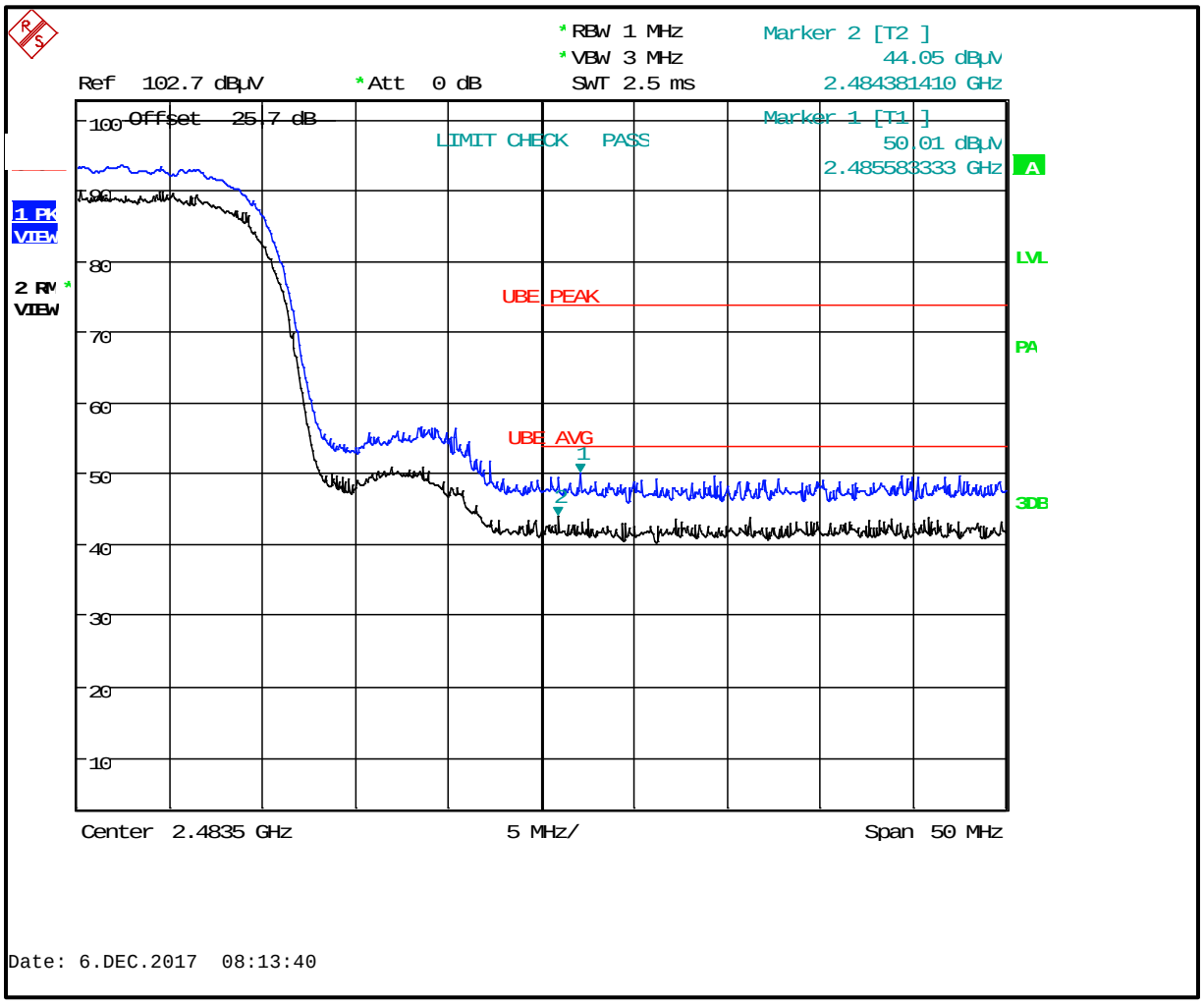
Plot 4-2: Lower Band Edge – Peak-Average Detector - 802.11g (9 Mbps)



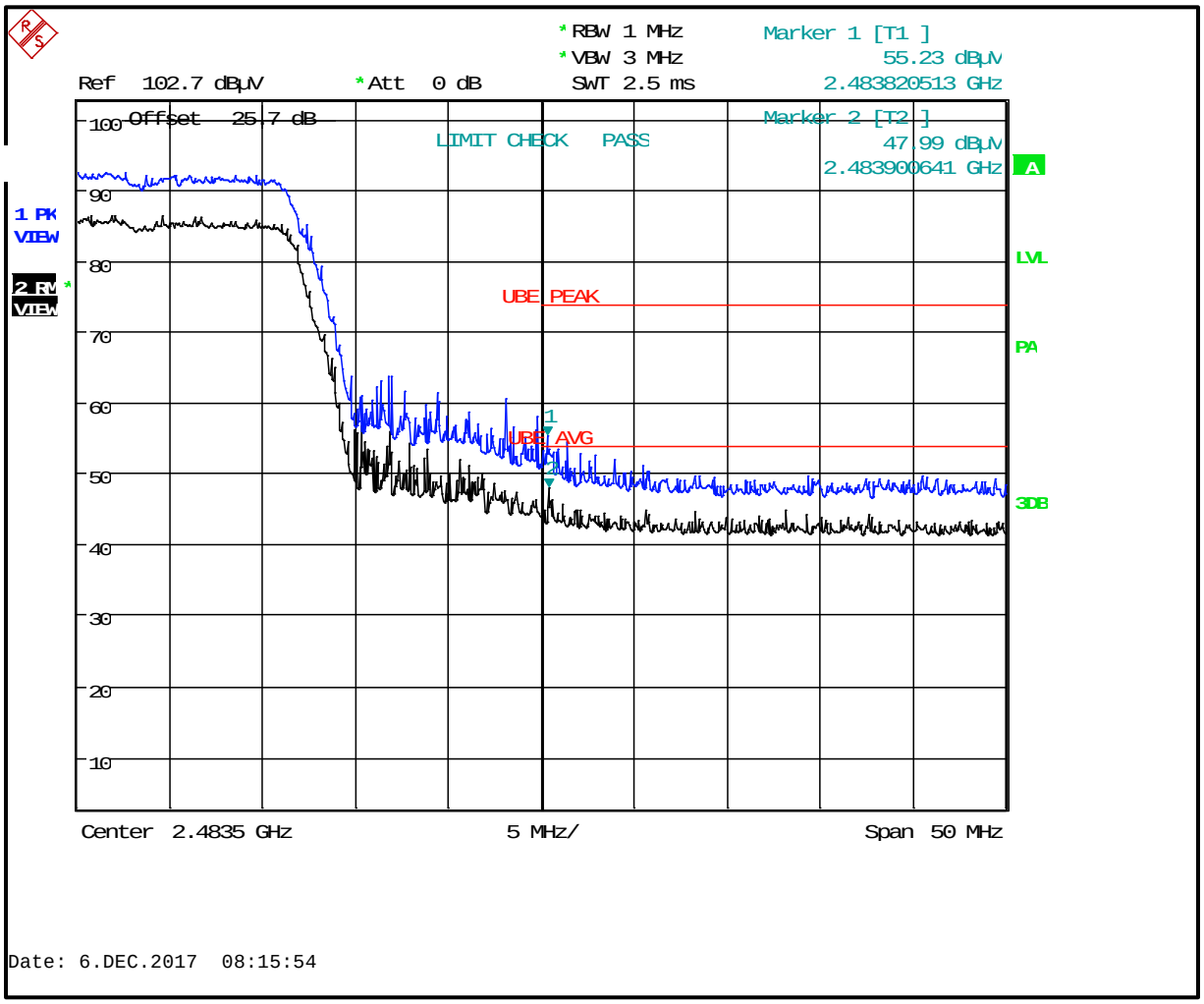
Plot 4-3: Lower Band Edge – Peak-Average Detector - 802.11n (MCS7)



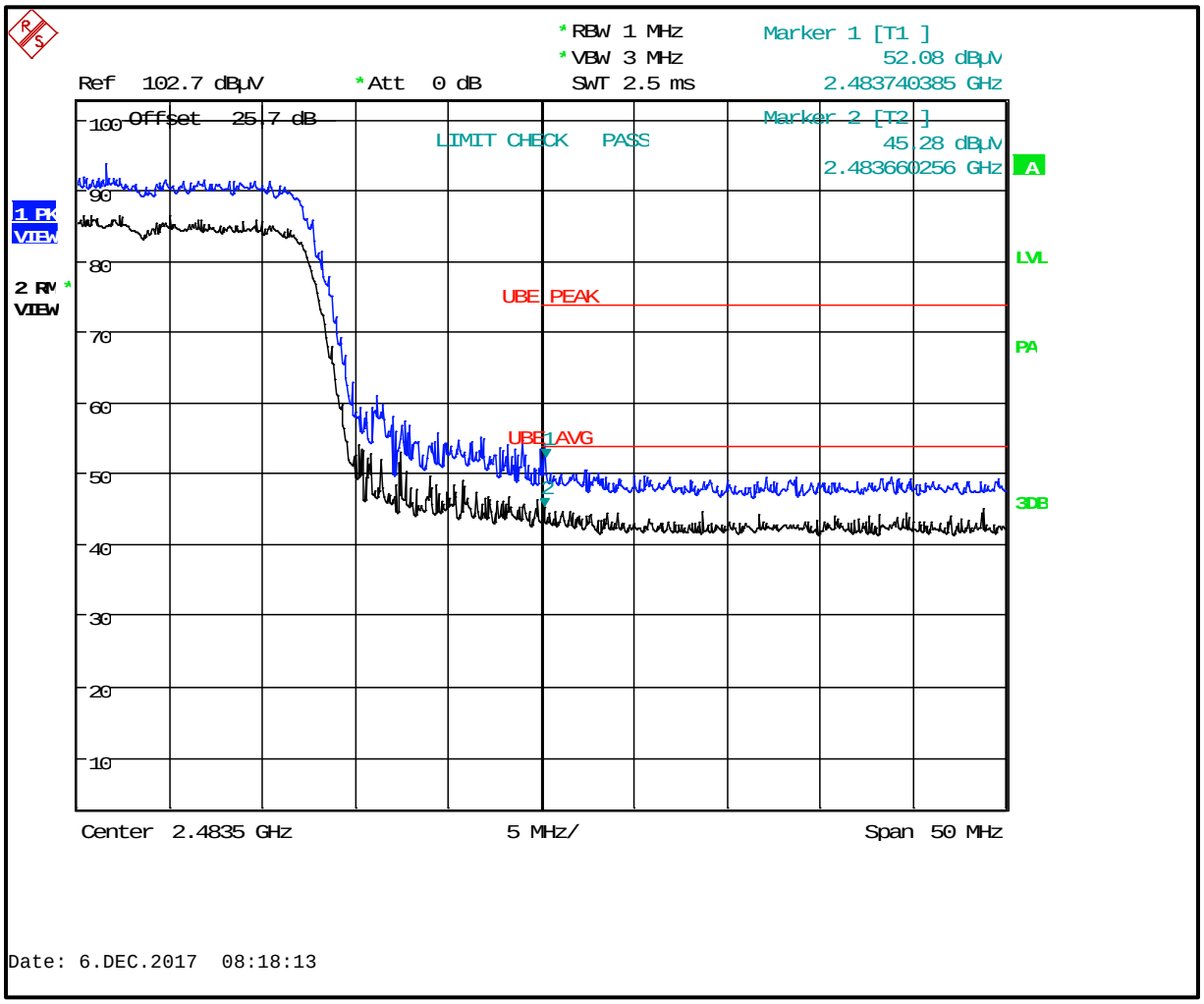
Plot 4-4: Upper Band Edge – Peak-Average Detector - 802.11b (11 Mbps)



Plot 4-5: Upper Band Edge – Peak-Average Detector - 802.11g (9 Mbps)



Plot 4-6: Upper Band Edge – Peak-Average Detector - 802.11n (MCS7)



Measurement uncertainties shown for these tests are expanded Gaussian uncertainties expressed at 95% confidence level using a coverage factor k = 1.96. Measurement uncertainty = 4.5 dB.

Test Personnel:

Dan Baltzell	Daniel W. Baltzell	December 6, 2017
Test Engineer	Signature	Date of Test

5 Radiated Emissions - 15.209; RSS-247 2.2; RSS-Gen 6.13/7.1

5.1 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.

5.2 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 1.5 meters above the ground plane. The spectrum was examined from 9 kHz to the 10th harmonic of the highest fundamental transmitter frequency (10 GHz). 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 a VBW of 10 Hz, 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.

Table 5-1: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900791	Chase	CBL6112	Antenna (.03 – 2 GHz)	2099	6/11/18
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	4/9/18
900321	EMCO	3161-03	Horn Antenna (4 - 8.2 GHz)	9528-1020	4/9/18
900323	EMCO	3160-07	Horn Antenna (8.2 - 12.4 GHz)	9605-1024	4/9/18
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	3/22/18
901592	Insulated Wire Inc.	KPS-1503-3600-KPR	SMK RF Cables 20'	NA	8/18/18

5.3 Radiated Emissions Test Results

5.3.1 Spurious/Harmonics Radiated Emissions Test Data

Table 5-2: Radiated Emissions Spurious/Harmonics – 2412 MHz – Peak - 802.11g (11 Mbps)

Emission Frequency (MHz)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4824.0	14.7	28.5	43.2	74.0	-30.8
12060.0	11.5	36.9	48.4	74.0	-25.6
14472.0	11.5	40.5	52.0	74.0	-22.0
19296.0	-1.3	45.1	43.8	74.0	-30.2

Table 5-3: Radiated Emissions Spurious/Harmonics – 2412 MHz – Average - 802.11g (11 Mbps)

Emission Frequency (MHz)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4824.0	8.9	28.5	37.4	54.0	-16.6
12060.0	1.9	36.9	38.8	54.0	-15.2
14472.0	1.5	40.5	42.0	54.0	-12.0
19296.0	-8.5	45.1	36.6	54.0	-17.4

Table 5-4: Radiated Emissions Spurious/Harmonics – 2437 MHz – Peak - 802.11g (11 Mbps)

Emission Frequency (MHz)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4874.0	15.0	28.5	43.5	74.0	-30.5
7311.0	17.3	29.8	47.1	74.0	-26.9
12185.0	11.7	36.9	48.6	74.0	-25.4
19496.0	-2.0	45.2	43.1	74.0	-30.9

Table 5-5: Radiated Emissions Spurious/Harmonics – 2437 MHz – Average - 802.11g (11 Mbps)

Emission Frequency (MHz)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4874.0	10.1	28.5	38.6	54.0	-15.4
7311.0	10.9	29.8	40.7	54.0	-13.3
12185.0	2.2	36.9	39.1	54.0	-14.9
19496.0	-8.9	45.2	36.2	54.0	-17.8

Table 5-6: Radiated Emissions Spurious/Harmonics – 2462 MHz – Peak - 802.11g (11 Mbps)

Emission Frequency (MHz)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4924.0	15.9	28.6	44.5	74.0	-29.5
7386.0	18.2	29.8	48.0	74.0	-26.0
12310.0	10.9	36.9	47.8	74.0	-26.2
19696.0	-1.9	45.2	43.3	74.0	-30.7
22158.0	-3.6	46.1	42.4	74.0	-31.6

Table 5-7: Radiated Emissions Spurious/Harmonics – 2462 MHz – Average - 802.11g (11 Mbps)

Emission Frequency (MHz)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4924.0	11.1	28.6	39.7	54.0	-14.3
7386.0	12.9	29.8	42.7	54.0	-11.3
12310.0	1.7	36.9	38.6	54.0	-15.4
19696.0	-10.2	45.2	35.0	54.0	-19.0
22158.0	-13.7	46.1	32.3	54.0	-21.7

Measurement uncertainty: Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2. ± 4.6 dB

Test Personnel:

Dan Baltzell		December 6, 2017
Test Engineer	Signature	Date of Test

6 Conclusion

The data in this measurement report shows that the EUT as tested, Garmin International Inc. Model/HVIN: AA3119-00, FCC ID: IPH-A3119-00, IC: 1792A-A311900, complies with the applicable requirements of Parts 2 and 15 of the FCC Rules and Regulations and Industry Canada RSS-247 and RSS-Gen.