

**COMPLIANCE WORLDWIDE INC.
TEST REPORT 264-17**

**In Accordance with the Requirements of
FCC PART 15.247, SUBPART C
Innovation, Science and Economic Development Canada
RSS-247, ISSUE 2**

**Low Power License-Exempt Radio Communication Devices
Intentional Radiators**

**Issued to
Garmin International, Inc.
1200 E. 151st St.
Olathe, KS 66062-3426**

**for the
Model Number AA3095
802.11b, g, n 2.4 GHz Radio**

**FCC ID: IPH-A3095
IC: 1792A-A3095**

Report Issued on July 21, 2017

Tested by


Brian F. Breault

Reviewed by


Larry K. Stillings

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1. Scope

This test report certifies that the Garmin AA3095, as tested, meets the FCC Part 15, Subpart C and ISSED Canada RSS-247, Issue 2 requirements. The scope of this test report is limited to the test sample provided by the client, only in as much as that sample represents other production units. If any significant changes are made to the unit, the changes shall be evaluated and a retest may be required.

2. Product Details

2.1. Manufacturer:	Garmin International, Inc.
2.2. Model Number:	AA3095
2.3. Serial Number:	Radiated Mode Measurements - 3949088924 Conducted Mode Measurements - 3949088937
2.4. Description:	The Garmin AA3095 is a dive watch with ANT+, BLE, and Wi-Fi communication capabilities
2.5. Power Source:	DC 3.7 Volts lithium rechargeable battery, not user accessible
2.6. Hardware Revision:	V06
2.7. Software Version:	2.0
2.8. Modulation Type:	CCK, OFDM, HT20
2.9. Operating Frequency:	2.4 GHz to 2.4835 Nominal
2.10. EMC Modifications:	None

3. Product Configuration

3.1. Operational Characteristics & Software

Operating Instructions for Test

Start the unit in test mode by pressing and holding the **DOWN** button (bottom left) while pressing and releasing the **PWR/LIGHT** button (top left). Release the **DOWN** button once the main test mode screen is displayed immediately after the Garmin logo screen.



Scroll through the test mode pages by pressing the **BACK/LAP** (bottom right) button.

3. Product Configuration (continued)

3.1. Operational Characteristics & Software (continued)

Operating Instructions for Test (continued)

The first RF test page is the ANT Test Mode page, which will take seven button presses of the **BACK/LAP** button to get to.



- Use the **MENU/UP** (middle left) button to change the frequency (high/low/mid).
- Use the **PWR/LIGHT** (top left) button to change from Carrier to Beacon.
- Use the **START/STOP** (top right) button to turn the test ON or OFF.
- When the test is complete **STOP** the test, then press the **BACK/LAP** (bottom right) to scroll to the next test page.

The next RF test page will be the BLE test page which will take four button presses of the **BACK/LAP** button.



- Use the **MENU/UP** (middle left) button to change the Channel.
- Use the **PWR/LIGHT** (top left) button to change from the TX mode to the RX mode.
- Hold the **MENU/UP** (middle left) button to change between Carrier Wave and data types.
- Use the **DOWN** (bottom left) button to change the TX LEN within data types.
- Use the **START/STOP** (top right) button to turn the test ON or OFF.

When the test is complete use the **START/STOP** (top right) button to STOP the test, then use the **BACK/LAP** button to scroll to the next test page. The next RF test page will be the WIFI test page.



- Use the **DOWN** (bottom left) button to change CHANNEL for test.
- Use the **PWR/LIGHT** (top left) button to change the Data Rate (CW, B-1 MHz, G-6 MHz, N-MCS 0, etc).
- Use the **START/STOP** (top right) button to turn test ON or OFF

When all testing has been completed, press and hold the **PWR/LIGHT** (top left) to power off the unit.

3. Product Configuration (continued)

3.1. Operational Characteristics & Software (continued)

During all radiated emissions measurement testing, the product was mounted on a polystyrene form to facilitate rotating the device through three orthogonal axes, as required by ANSI C63.10, section 5.10.1, for a hand held or body worn device. The three axes were defined as follows:

- X-Axis Horizontal on the left edge with the Garmin logo on the face of the AA3095 pointing to the left. The front of the device was facing the antenna at 0° turntable azimuth.
- Y-Axis Vertical with Garmin logo on the face of the AA3095 pointing up. The front of the device was facing the antenna at 0° turntable azimuth.
- Z-Axis The front of the AA3095 was facing up. The bottom edge of the device was facing the antenna at 0° turntable azimuth. The Garmin logo on the face of the AA3095 is pointing away from the antenna at 0° azimuth.



X-Axis



Y-Axis



Z-Axis

3.2. EUT Hardware

Manufacturer	Model/Part # / Options	Serial Number	Input Voltage	Freq (Hz)	Description/Function
Garmin International, Inc.	AA3095	3949088924 ¹ 3949088937 ²	3.7	DC	Dive Watch

¹ Unit used for radiated test measurements.

² Unit used for conducted test measurements.

3.3. EUT Cables/Transducers

Cable Type	Length	Shield	From	To
See 3.6				

3.4. Miscellaneous EUT Items

Manufacturer	Model/Part #	Qty	Description / Function
None			

3. Product Configuration

3.5. Support Equipment

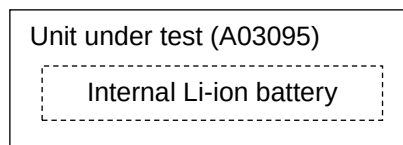
Device	Manufacturer	Model	Serial No.	Comment
AC Adapter	Garmin	ADP-5BW PN 362-00087-00	054W56B018B	5 volts at 1 amp

3.6. Support Equipment Cables

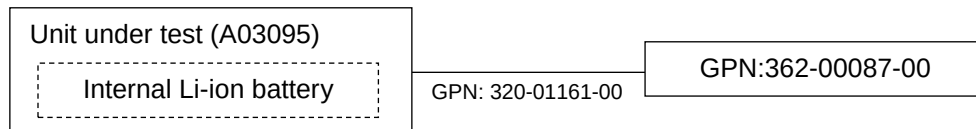
Part #	Shielded Y or N	Length	Description / Function
320-01161-00	Y	1 Meter	Charger cable. USB Type A male to device specific connector.

3.7. Block Diagram

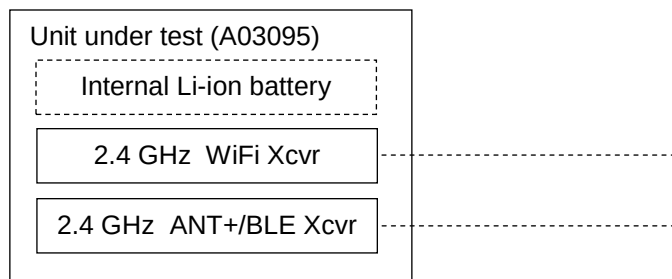
Unit operating off internal battery.



Battery charged via USB cable connected to AC adapter (Part 15.207)



Unit powered by internal battery transmitting ANT+/BLE/Wi-Fi wireless data @ 2.4 GHz



4. Measurements Parameters

4.1. Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due	Interval
EMI Test Receiver, 9kHz - 7GHz ¹	Rohde & Schwarz	ESR7	101156	7/23/2018	3 Years
Spectrum Analyzer 20 Hz – 40 GHz ²	Rohde & Schwarz	FSV40	100899	7/23/2018	3 Years
Spectrum Analyzer, 9 kHz - 40 GHz ³	Rohde & Schwarz	FSVR40	100909	5/3/2019	2 Years
Spectrum Analyzer, 2 Hz - 26 GHz ⁴	Rohde & Schwarz	FSW26	102057	12/7/2018	2 Years
EMI Receiver	Hewlett Packard	8546A	3650A00360	12/6/2018	3 Years
Passive Loop Antenna, 9 kHz to 30 MHz	EMCO	6512	9309-1139	10/26/2018	2 Years
Biconilog Antenna, 30 MHz to 2 GHz	Sunol Sciences	JB1	A050913	6/3/2019	2 Years
Horn Antenna, 960 MHz to 18 GHz	Electro-Metrics	EM-6961	6337	5/2/2018	1 Year
Horn Antenna, 18 GHz to 40 GHz	Com-Power	AH-840	101032	2/24/2018	2 Years
Preamplifier, 1 GHz to 26.5 GHz	Hewlett Packard	8449B	3008A00329	7/22/18	3 Years
LISN 50 ohm 50 µH, 9 kHz to 30 MHz	EMCO	3825/2	9109-1860	11/17/2017	1 Year
2.4 GHz Band Reject Filter	Micro-Tronics	BRM50702	150	6/12/2018	1 Year
EMI Receiver, 9 kHz to 6.5 GHz	Hewlett Packard	8546A	3330A00115	12/4/2018	2 Years
Digital Barometer	Control Company	4195	ID236	10/8/2017	2 Years
Digital Multi-meter	Fluke	187	83030167	11/21/2017	1 Year
Temperature Chamber	Associated Research	E-0029	N/A	NR	---

¹ ESR7 Firmware revision: V3.36, Date installed: 05/16/2017 Previous V2.26 SP2, installed 11/15/2016.
² FSV40 Firmware revision: V2.30 SP4, Date installed: 05/04/2016 Previous V2.30 SP1, installed 10/22/2014.
³ FSVR40 Firmware revision: V2.23 SP1, Date installed: 08/19/2016 Previous V2.23, installed 10/20/2014.
⁴ FSW26 Firmware revision: V2.61 SP1, Date installed: 04/04/2017 Previous V2.40, installed 05/04/2016.

4.2. Measurement Software

Manufacturer	Software Description	Title or Model #	Rev.	Report Sections
Compliance Worldwide	Test Report Generation Software	Test Report Generator	1.0	7.9. Conducted Emissions

4. Measurements Parameters

4.3. Measurement & Equipment Setup

Test Dates:	6/12/2017 – 7/21/2017
Test Engineer:	Brian Breault
Normal Site Temperature (15 - 35°C):	21.2
Relative Humidity (20 -75%RH):	35
Frequency Range:	10 kHz to 25 GHz
Measurement Distance:	3 Meters
	200 Hz - 10 kHz to 150 kHz
EMI Receiver IF Bandwidth:	9 kHz - 150 kHz to 30 MHz
	120 kHz - 30 MHz to 1 GHz
	1 MHz - Above 1 GHz
	1 kHz - 10 kHz to 150 kHz
EMI Receiver Average Bandwidth:	30 kHz - 150 kHz to 30 MHz
	300 kHz - 30 MHz to 1 GHz
	3 MHz - Above 1 GHz
	Peak, QP - 10 kHz to 1 GHz
Detector Function:	Peak, Avg - Above 1 GHz
	Unless otherwise specified.

4.4. Measurement Procedures

Test measurements were made in accordance FCC Part 15.247: Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5850 MHz, and 24.0 - 24.25 GHz and ISED Canada RSS-247 Issue 2: Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.

The measurement procedures in this report are in accordance with ANSI C63.10-2013: *American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices*. FCC OET Publication Number KDB 558074 D01 v03r03: *Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247*, dated April 5, 2017, was also referenced for the test procedures used to generate the data in this report. All references to FCC OET publication number 558074 refer to this version of the publication.

All conducted mode measurements include a 10.25 dB measurement offset value to account for the following:

- 0.047 diameter semi-rigid type cable < 2 inches (approx. loss) 0.024 dB
- Harbor Industries RG142 0.62 meter cable + 10 dB attenuator 10.226 dB

This measurement offset value represents an average of the three test frequencies and represents an absolute worst case error of -0.024 dB.

All radiated emissions measurements include correction factors for antenna, cables, preamp and attenuators, if used.

For spurious emissions testing above 1 GHz only, the device under test was tested in its charge cradle which was connected to a USB +5 volt power supply. This was done to increase the device run time beyond the approximately one hour capability of the built in battery.

4. Measurements Parameters

4.5. Measurement Uncertainty

The following uncertainties are expressed for an expansion/coverage factor of K=2.

RF Frequency	$\pm 1 \times 10^{-8}$
Radiated Emission of Transmitter	± 4.55 dB
Radiated Emission of Receiver	± 4.55 dB
Temperature	$\pm 0.91^{\circ}$ C
Humidity	$\pm 5\%$

5. Choice of Equipment for Test Suits

5.1 Choice of Model

This test report is based on the two test samples supplied by the manufacturer. One sample is unmodified and one has a 0.047 diameter semi-rigid 50 Ω cable attached to an SMA male connector in place of the antenna. These units are reported by the manufacturer to be equivalent to the production units.

5.2 Presentation

The test samples were tested complete with all required ancillary equipment. Refer to Section 3 of this report for product equipment configuration.

5.3 Choice of Operating Frequencies

The AA3095, as tested, operates on 11 channels (USA), from channels 1 to 11 in the 2.4 GHz band.

In accordance with ANSI C63.10-2013, section 5.6, and FCC Part 15.31 (m), the choice of operating frequencies selected for the testing detailed in this report are outlined in the following table:

Channel	Frequency (MHz)	802.11b,g & n (HT20)
1	2412	Tested
2	2417	Not Tested
3	2422	
4	2427	
5	2432	
6	2437	Tested
7	2442	Not Tested
8	2447	
9	2452	
10	2457	
11	2462	Tested

5. Choice of Equipment for Test Suits (continued)

5.4 Modes of Operation

Upon receipt of the Garmin AA3095, the data rates for each of the modulation types supported by the device were evaluated by measuring the maximum conducted power output using each data rate. The following table details the worst case data rate for each of the modes.

2.4 GHz Test Modes

Mode	Modulation	Data Rate
802.11b	CCK	2 Mbps
802.11g	OFDM	6 Mbps
802.11n	HT20	MCS6 (58.5 Mbps)

Detailed Data Rates to Determine Data Rate for Measurement

802.11b	1 Mbps	2 Mbps	5.5 Mbps	11 Mbps	Selected	
Ch 1	7.85	8.18	6.75	6.38	2 Mbps	8.18
Ch 6	7.77	7.81	5.80	5.05	2 Mbps	7.81
Ch 11	7.67	7.70	5.67	5.19	2 Mbps	7.70

802.11g	6 Mbps	9 Mbps	12 Mbps	18 Mbps	24 Mbps	36 Mbps	48 Mbps	54 Mbps	Selected	
Ch 1	10.86	10.86	10.72	10.66	10.61	10.28	10.60	10.43	6 Mbps	10.86
Ch 6	10.48	10.25	9.87	10.16	9.75	9.94	9.91	10.04	6 Mbps	10.48
Ch 11	10.52	10.48	10.02	9.90	9.34	9.28	9.61	9.19	6 Mbps	10.52

802.11n (HT20)	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	Selected	
Ch 1	10.31	9.94	10.65	10.40	10.33	10.14	10.77	10.19	MCS6	10.77
Ch 6	9.75	9.42	9.78	9.79	10.31	10.10	10.46	9.75	MCS6	10.46
Ch 11	9.52	9.54	9.72	9.37	9.84	9.28	10.12	9.62	MCS6	10.12

Notes: Values are peak power measurements using a spectrum analyzer 20 MHz resolution bandwidth and 80 MHz video bandwidth.

For band edge measurements (section 7.6), the DTS bandwidth measurements were taken into consideration for the worst case examples.

6. Measurement Summary

Test Requirement	FCC Rule Reference	Test Report Section	Result
Antenna Requirement	15.203	7.1	Compliant
Minimum DTS Bandwidth	15.247 (a) (2)	7.2	Compliant
Maximum Peak Conducted Output Power	15.247 (b) (1)	7.3	Compliant
Operation with directional antenna gains greater than 6 dBi	15.247 (b) (4)	7.4	Compliant
Spurious Radiated Emissions	15.247 (d)	7.5	Compliant
Spurious Radiated Emissions (> GHz) - Harmonic Measurements	15.247 (d)		Compliant
Lower and Upper Band Edges	15.247 (d)	7.6	Compliant
Emissions in Non-restricted Frequency Bands	15.247(e)	7.7	Compliant
Peak Power Spectral Density	15.247(e)	7.8	Compliant
Conducted Emissions	15.207	7.9	Compliant
Duty Cycle	15.207	7.10	Compliant
Public Exposure to Radio Frequency Energy Levels	1.1307 (b) (1)	7.11	See Note 1 below.

Note 1: The device under test met the 47 CFR §2.1093 10-g extremity SAR exclusion requirements. It did not meet the RSS-102 Issue 5 SAR evaluation limit, however. Separate RF exposure testing, therefore, must be performed to ensure that the device under test meets the RF exposure requirements.

7. Measurement Data

7.1. Antenna Requirement (15.203)

Requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section.

Results: The Garmin AA3095 utilizes an etch antenna which is not user accessible.

7. Measurement Data (continued)

7.2. Minimum DTS Bandwidth

Requirement: (15.247 (a) (2))

Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Procedure: This test was performed in accordance with the procedure detailed in FCC OET publication number 558074, Section 8.1 Option 1, DTS (6 dB) Channel Bandwidth.

Results: The device under test meets the minimum 500 kHz DTS (6 dB) bandwidth requirement.

Measurement Results

802.11b Mode Channel	Frequency (MHz)	-6 dB Bandwidth (MHz)	Minimum -6 dB Bandwidth (kHz)	Result
Low	2412	11.2631	>500	Compliant
Middle	2437	11.5522	>500	Compliant
High	2462	11.5622	>500	Compliant

802.11g Mode Channel	Frequency (MHz)	-6 dB Bandwidth (MHz)	Minimum -6 dB Bandwidth (kHz)	Result
Low	2412	16.1275	>500	Compliant
Middle	2437	16.1093	>500	Compliant
High	2462	16.1165	>500	Compliant

802.11n HT20 Mode Channel	Frequency (MHz)	-6 dB Bandwidth (MHz)	Minimum -6 dB Bandwidth (kHz)	Result
Low	2412	17.06013	>500	Compliant
Middle	2437	17.53648	>500	Compliant
High	2462	17.62556	>500	Compliant

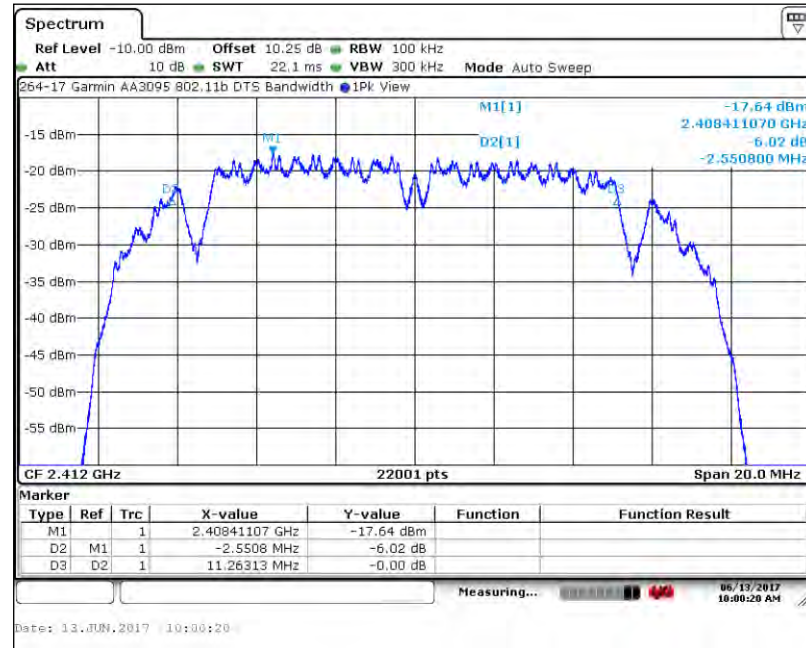
Test Number: 264-17

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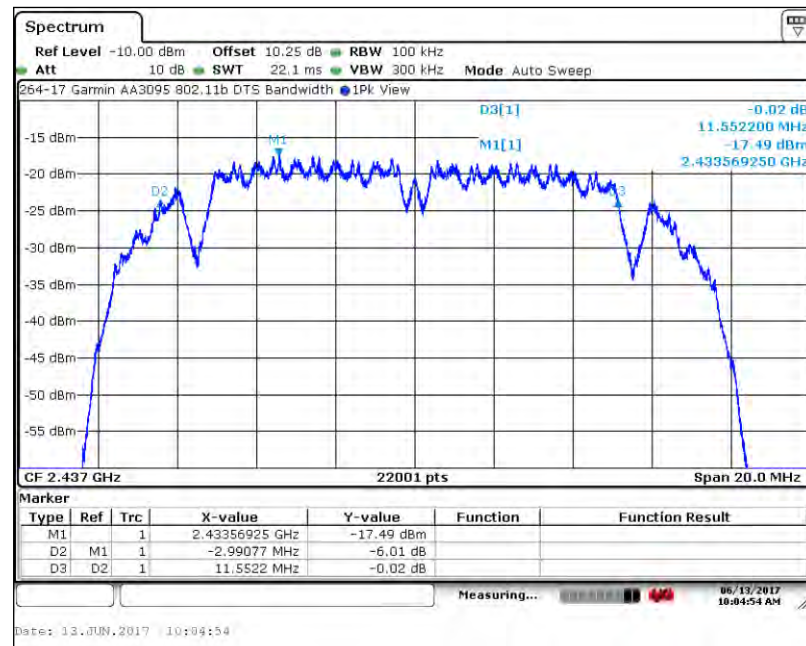
7. Measurement Data (continued)

7.2. Minimum DTS Bandwidth (15.247 (a) (2)) (continued)

7.2.1. 802.11b: Low Channel – 1, 2412 MHz



7.2.2. 802.11b Middle Channel – 6, 2437 MHz



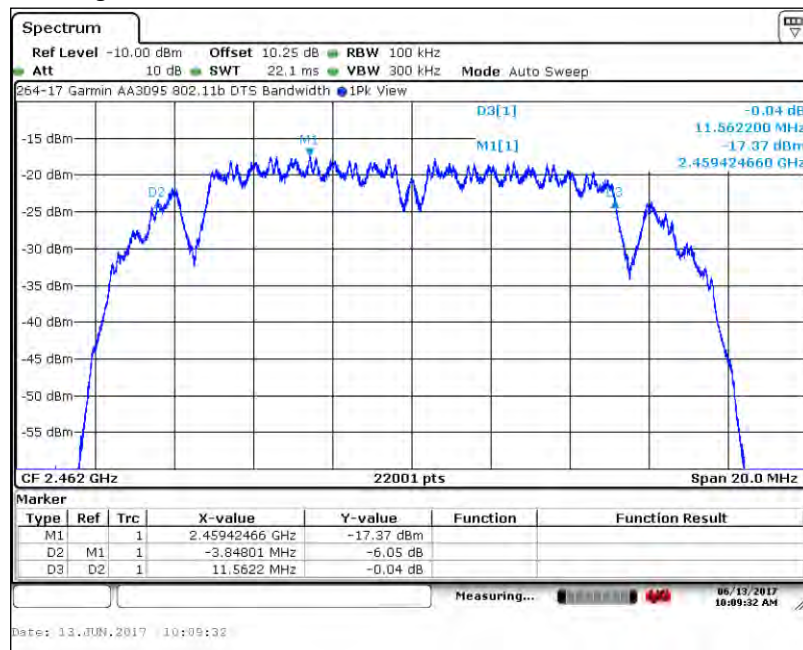
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Issue Date: 7/21/2017

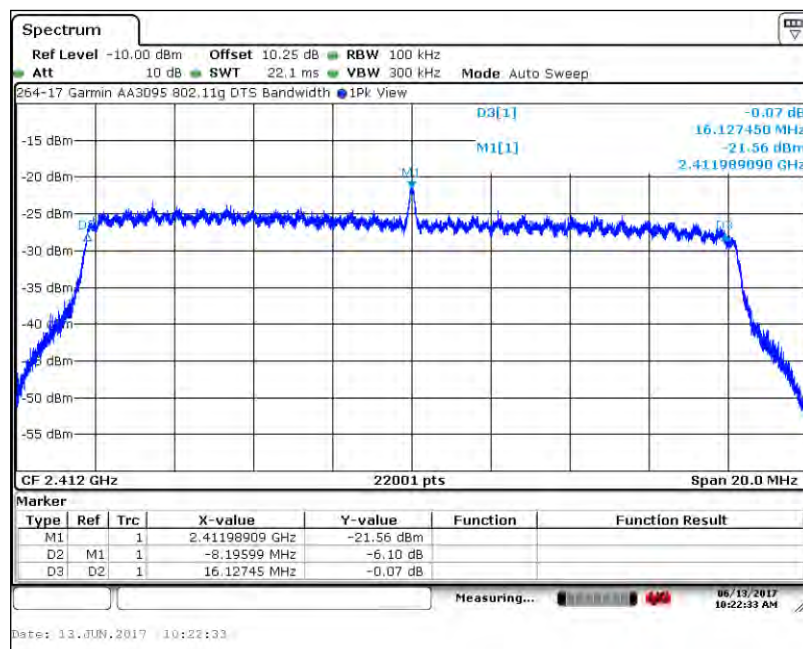
7. Measurement Data (continued)

7.2. Minimum DTS Bandwidth (15.247 (a) (2)) (continued)

7.2.3. 802.11b: High Channel – 11, 2462 MHz



7.2.4. 802.11g: Low Channel – 1, 2412 MHz



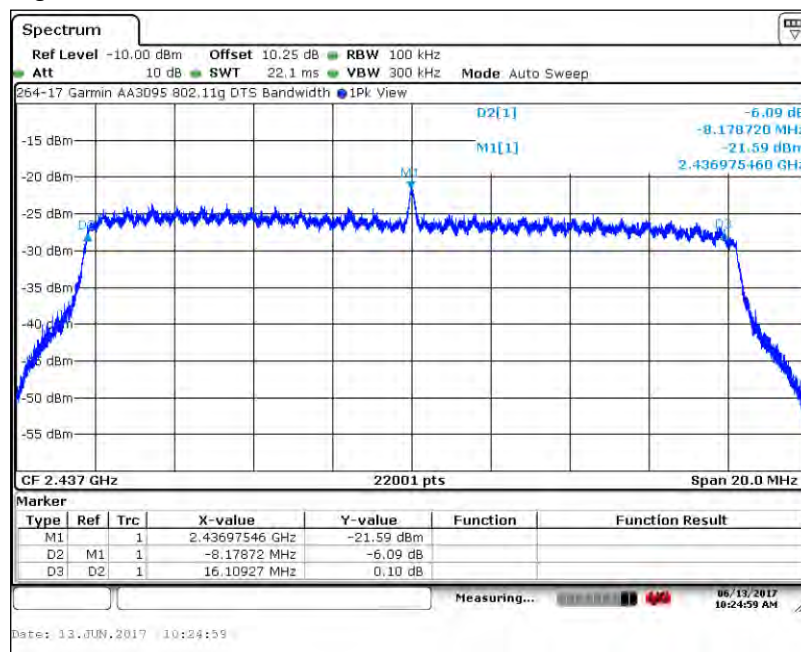
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Issue Date: 7/21/2017

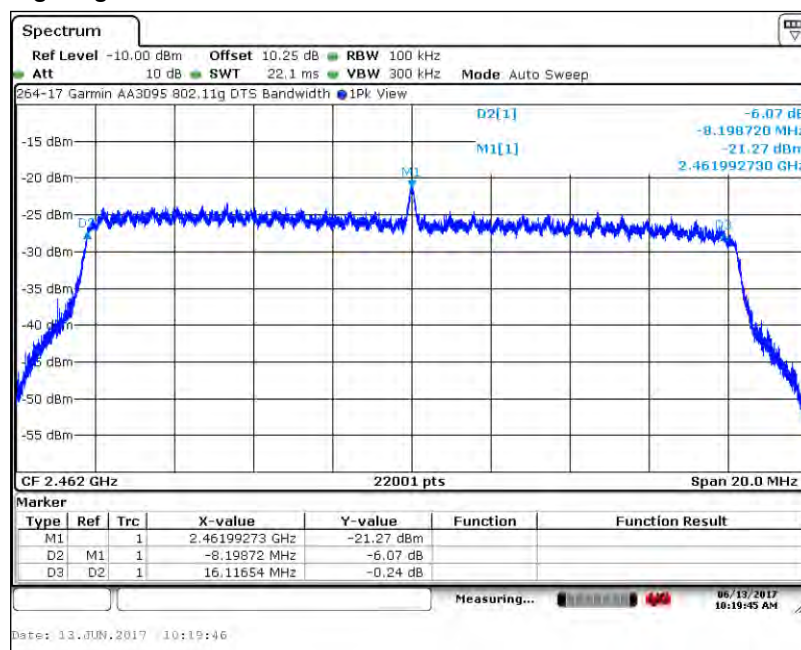
7. Measurement Data (continued)

7.2. Minimum DTS Bandwidth (15.247 (a) (2)) (continued)

7.2.5. 802.11g: Middle Channel – 6, 2437 MHz



7.2.6. 802.11g: High Channel – 11, J2462 MHz



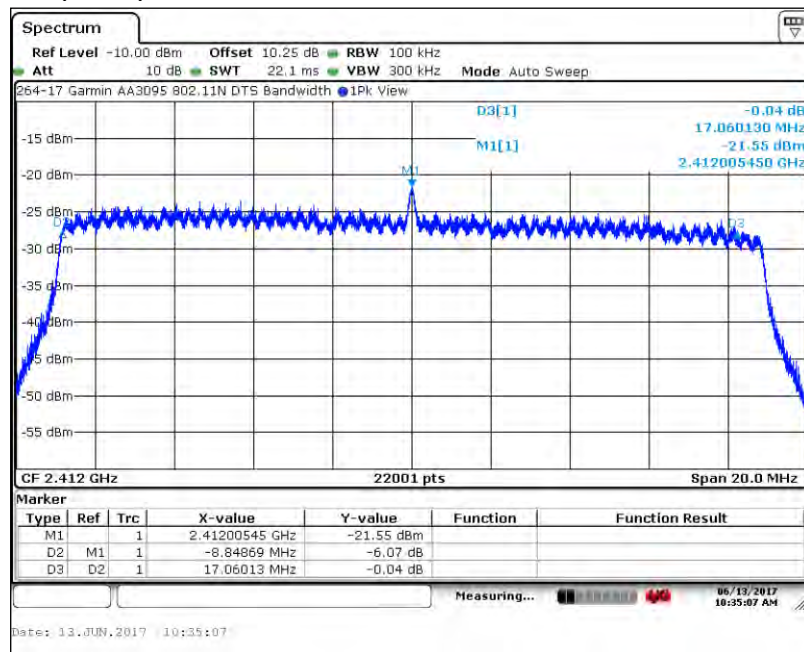
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Issue Date: 7/21/2017

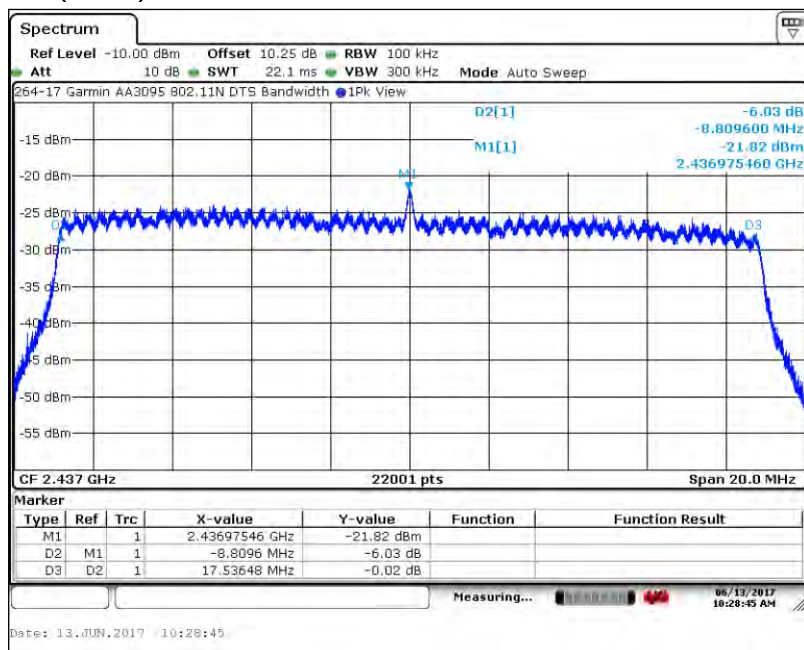
7. Measurement Data (continued)

7.2. Minimum DTS Bandwidth (15.247 (a) (2)) (continued)

7.2.7. 802.11n (HT20): Low Channel – 1, 2412 MHz



7.2.8. 802.11n (HT20): Middle Channel – 11, 2437 MHz



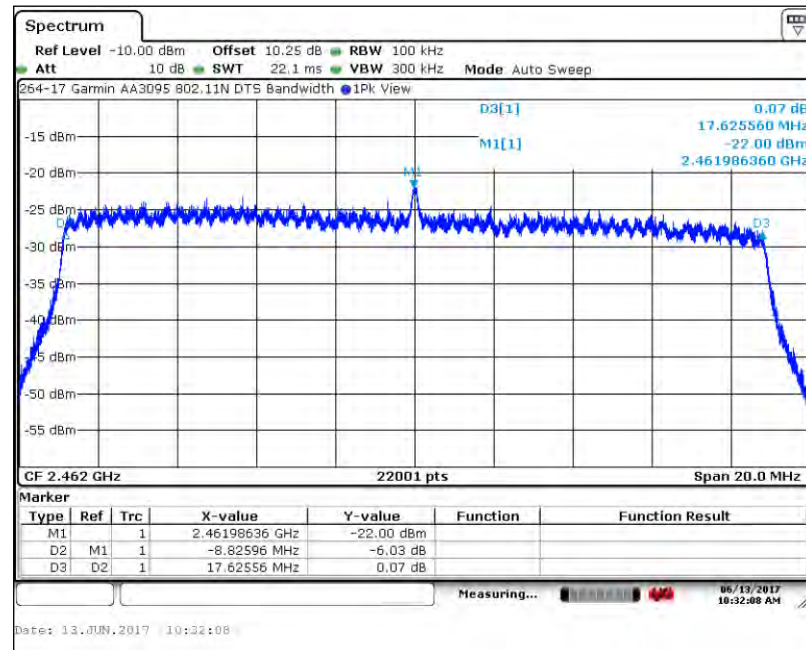
Test Number: 264-17

Issue Date: 7/21/2017

7. Measurement Data (continued)

7.2. Minimum DTS Bandwidth (15.247 (a) (2)) (continued)

7.2.9. 802.11n (HT20): High Channel – 11, 2462 MHz



7. Measurement Data (continued)

7.3. Maximum Peak Conducted Output Power

Requirement: (15.247 (b) (3))

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt (+30 dBm).

Procedure: This test was performed in accordance with the procedure detailed in FCC OET publication number KDB 558074, Section 9.1.1.

Test Note: A spectrum analyzer resolution bandwidth of 20 MHz and a video bandwidth of 80 MHz were used to meet the requirements of FCC OET publication number 558074, Section 9.1.1 and the measured product DTS bandwidth.

Results: The device under test meets the required maximum peak conducted output power level of 1 Watt (+30 dBm).

Measurement Results

802.11b Mode Channel	Frequency	Maximum Peak Conducted Output Power	Peak Limit	Margin	Result
	(MHz)	(dBm)	(dBm)	(dB)	
Low	2412	10.21	30.00	-19.79	Compliant
Middle	2437	10.34	30.00	-19.66	Compliant
High	2462	9.89	30.00	-20.11	Compliant

802.11g Mode Channel	Frequency	Maximum Peak Conducted Output Power	Peak Limit	Margin	Result
	(MHz)	(dBm)	(dBm)	(dB)	
Low	2412	11.73	30.00	-18.27	Compliant
Middle	2437	11.45	30.00	-18.55	Compliant
High	2462	11.18	30.00	-18.82	Compliant

802.11n (HT20) Mode Channel	Frequency	Maximum Peak Conducted Output Power	Peak Limit	Margin	Result
	(MHz)	(dBm)	(dBm)	(dB)	
Low	2412	11.67	30.00	-18.33	Compliant
Middle	2437	11.18	30.00	-18.82	Compliant
High	2462	11.04	30.00	-18.96	Compliant

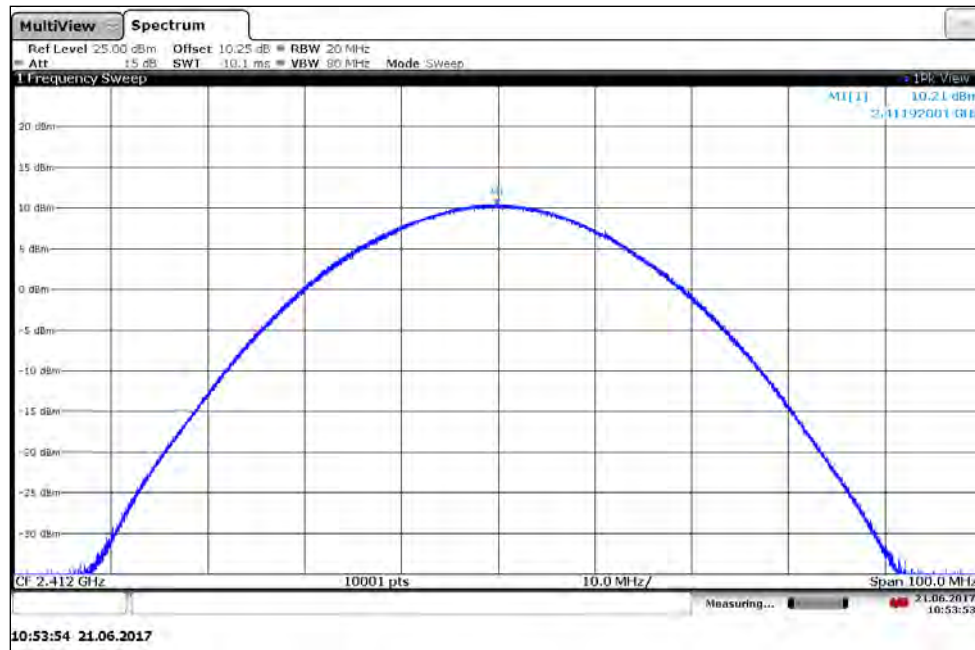
Test Number: 264-17

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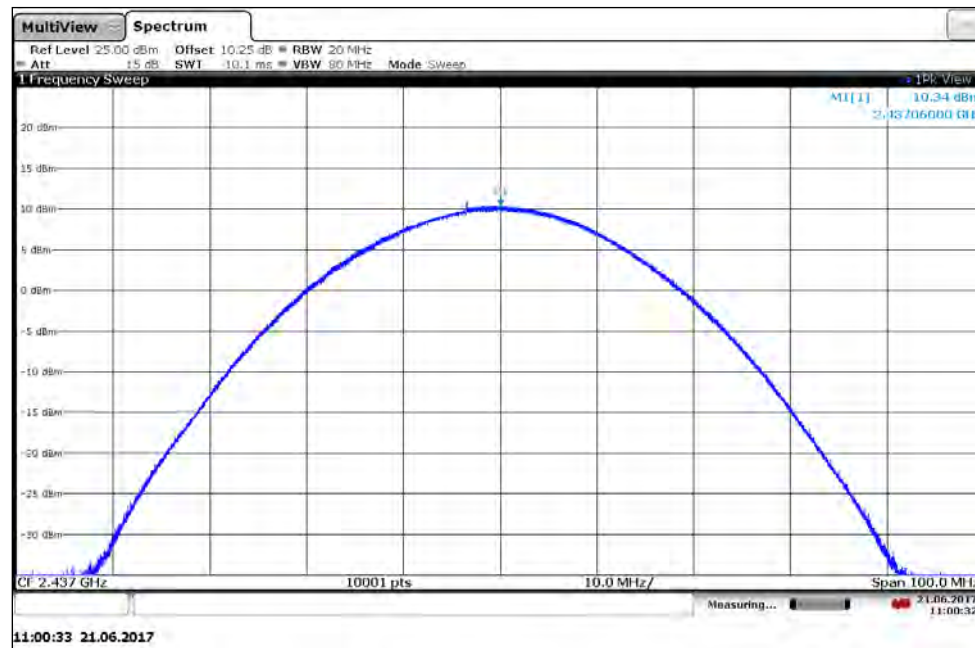
7. Measurement Data (continued)

7.3. Maximum Peak Conducted Output Power (continued)

7.3.1. 802.11b: Low Channel – 1, 2412 MHz



7.3.2. 802.11b: Middle Channel – 6, 2437 MHz



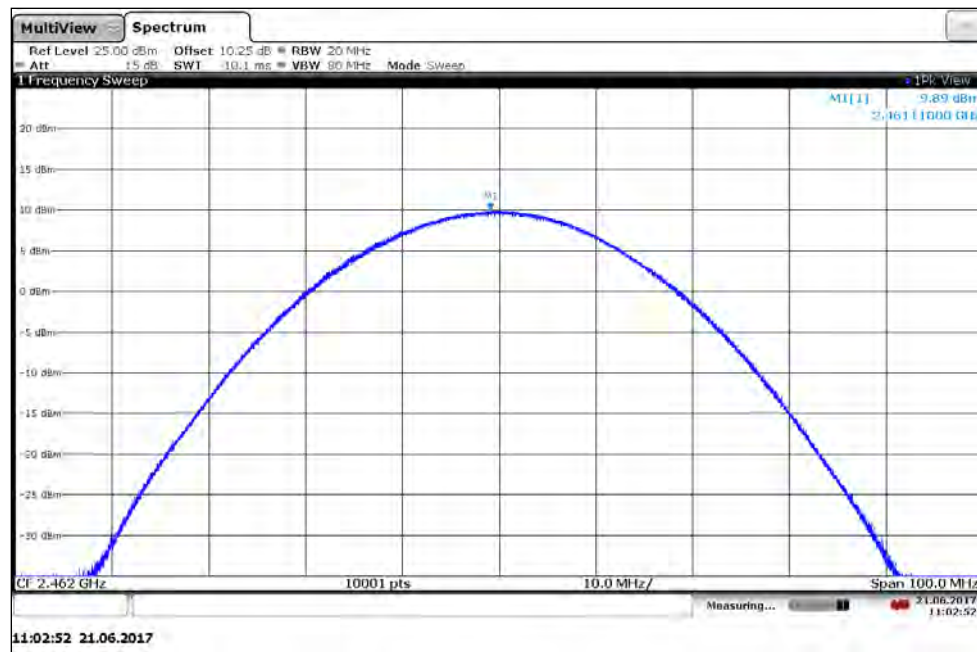
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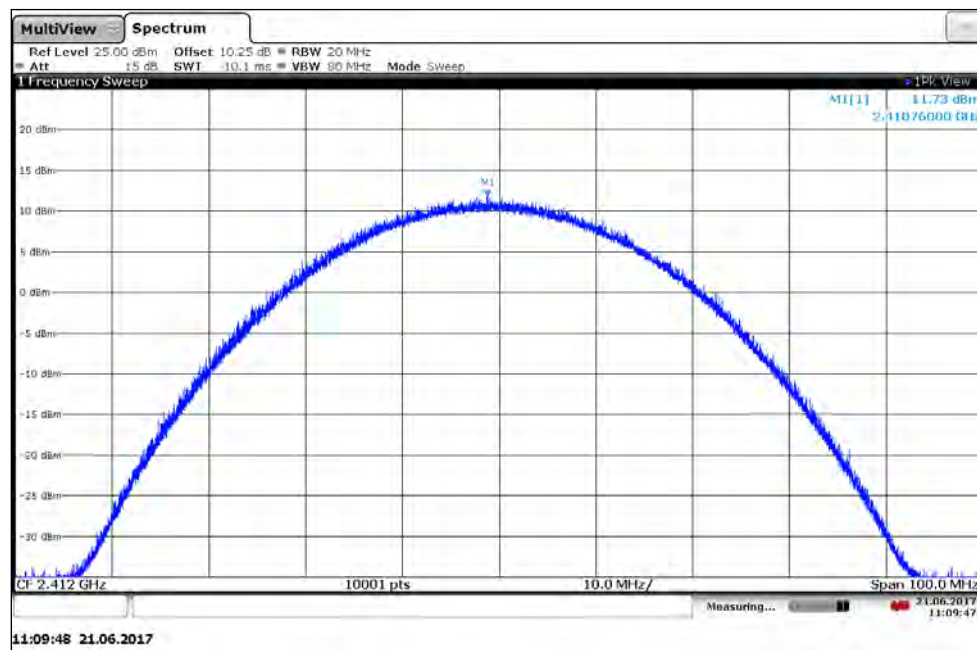
7. Measurement Data (continued)

7.3. Maximum Peak Conducted Output Power (continued)

7.3.3. 802.11b: High Channel – 11, 2462 MHz



7.3.4. 802.11g: Low Channel – 1, 2412 MHz



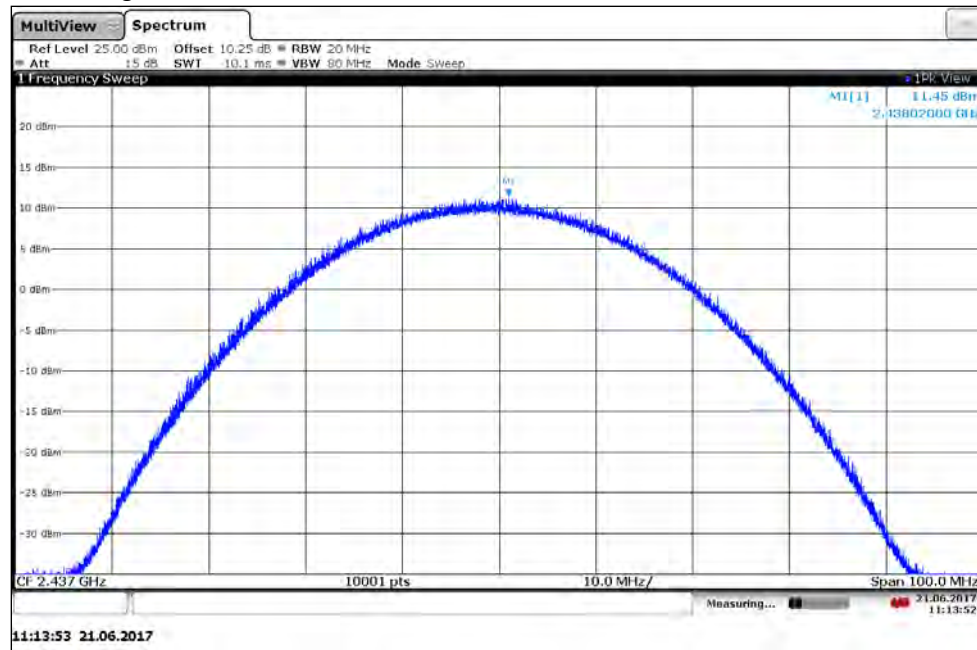
Test Number: 264-17

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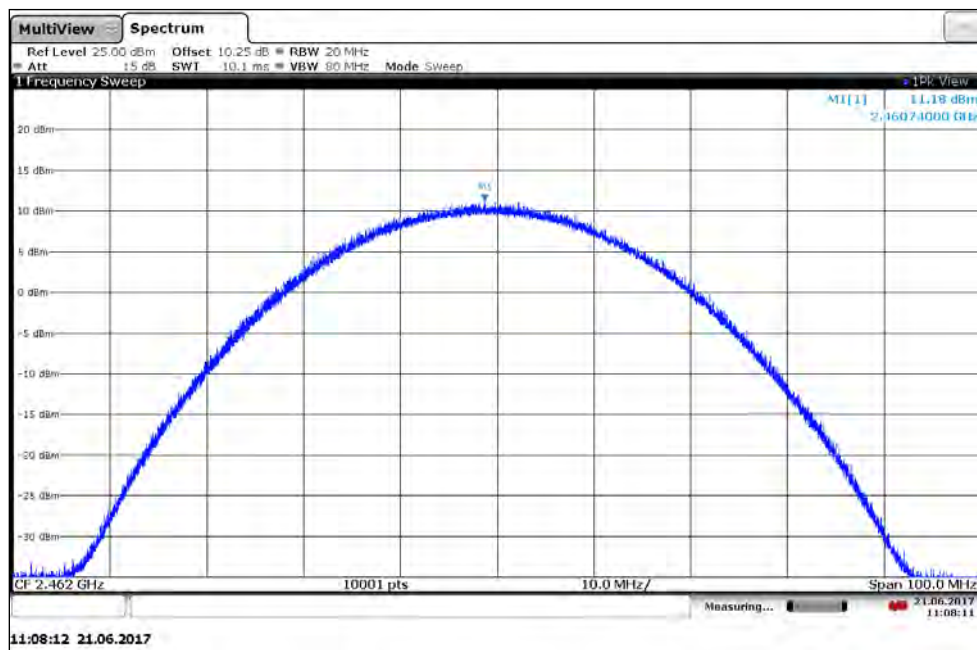
7. Measurement Data (continued)

7.3. Maximum Peak Conducted Output Power (continued)

7.3.5. 802.11g: Middle Channel – 6, 2437 MHz



7.3.6. 802.11g: High Channel – 11, 2462 MHz



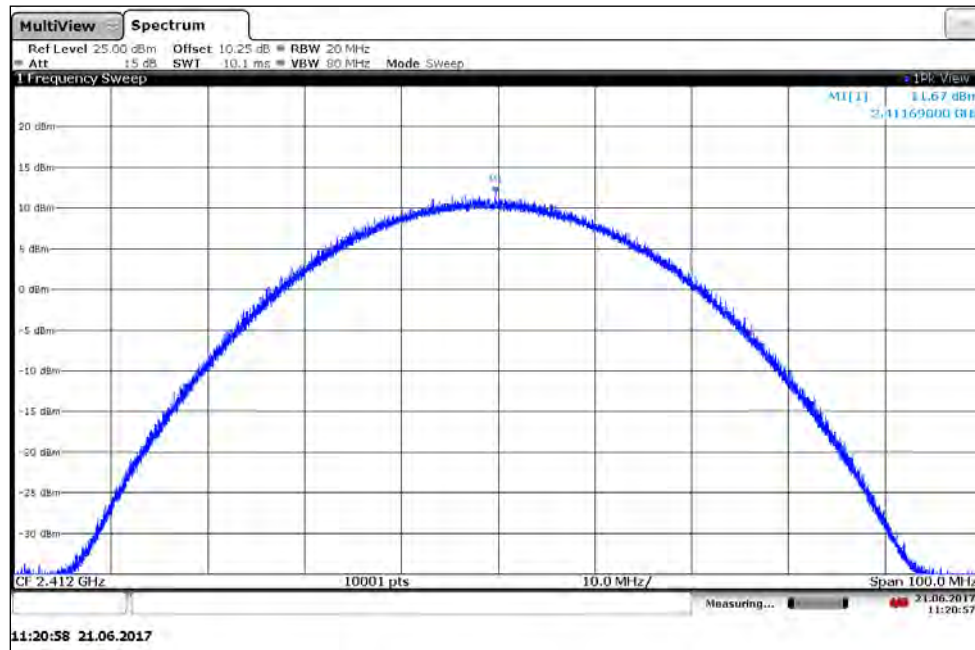
Test Number: 264-17

Issue Date: 7/21/2017

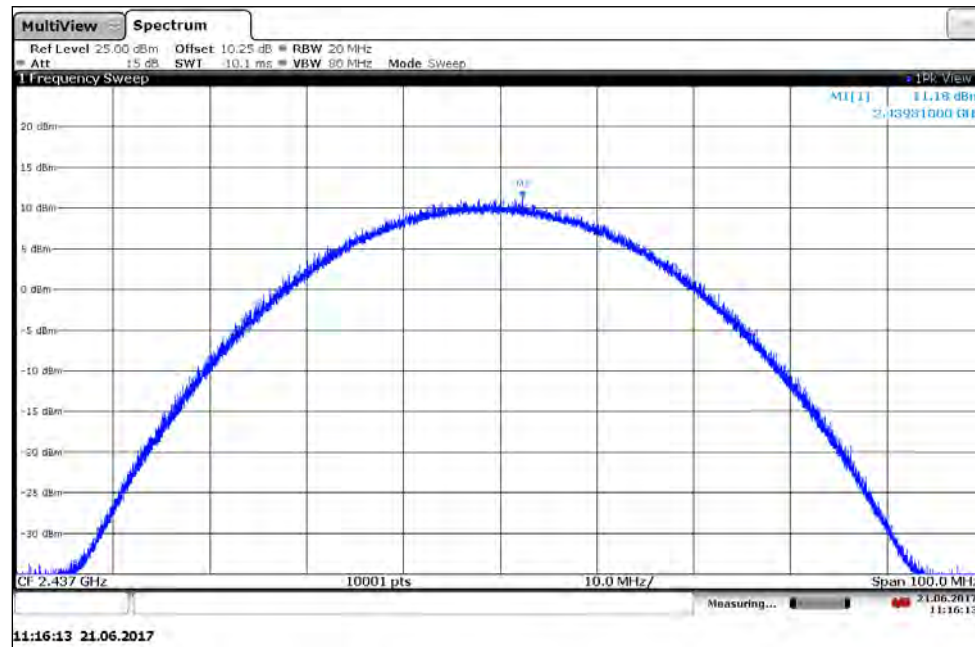
7. Measurement Data (continued)

7.3. Maximum Peak Conducted Output Power (continued)

7.3.7. 802.11n: Low Channel – 1, 2412 MHz



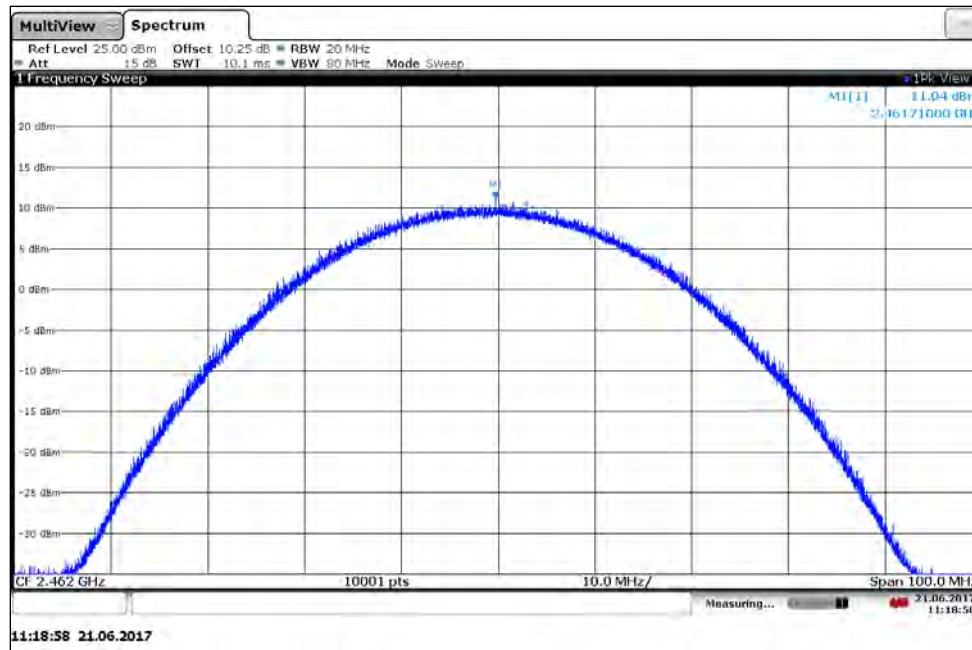
7.3.8. 802.11n: Middle Channel – 6, 2437 MHz



7. Measurement Data (continued)

7.3. Maximum Peak Conducted Output Power (continued)

7.3.9. 802.11n: High Channel – 11, 2462 MHz



7.4. Operation with directional antenna gains greater than 6 dBi (15.247 (b)(4))

Requirement: If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of FCC Part 15.247, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400 – 2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Procedure: Not applicable for the device under test.

DUT Status: The DUT utilizes an antenna with a -1.7 dBi gain and therefore is exempt from this requirement.

7. Measurement Data (continued)

7.5. Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz)

7.5.1 Transmitter Spurious Radiated Emissions

Requirement: (15.209) The Emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency Range (MHz)	Distance (Meters)	Limit (dBμV/m) ¹
0.009 to 0.490	3	128.5 to 93.8
0.490 to 1.705	3	73.8 to 63.0
1.705 to 30	3	69.5
30 to 88	3	40.0
88 to 216	3	43.5
216 to 960	3	46.0
>960	3	54.0

¹Measurements in the 9 to 90 kHz, 110 to 490 kHz and above 1000 MHz ranges employ an average detector. Otherwise a quasi-peak detector is used.

Procedure: This test was performed in accordance with the procedure detailed in FCC OET publication number 558074, Section 12.0: Emissions in restricted frequency bands and FCC 47CFRPart 15.209: Radiated Emission Limits; General Requirements.

The test methods used to generate the data in this test report is in accordance with ANSI C63.10:2013, American National Standard for Testing Unlicensed Wireless Devices.

Test Notes: Measurements were made from the lowest oscillator frequency as stated by the manufacturer (32.768 kHz) to the 10th harmonic of the highest transmitter frequency or 40 MHz, whichever is lower.

Reference FCC Part 15.33(a) and FCC Part 15.33(a)(1).

Each of the test modes documented within the test report were evaluated and the worst case of each of the test modes is detailed in this section. A full set of measurement scans are presented in Appendix A of this test report.

Results: The Emissions from the DUT did not exceed the field strength levels specified in the above table.

7. Measurement Data (continued)

7.5. Transmitter Spurious Radiated Emissions (30 kHz to 25 GHz) (continued)

7.5.1. Transmitter Spurious Radiated Emissions (continued)

7.5.1.1. 802.11b

Frequency Range	Worst-Case Measured Frequency	Field Strength	FCC Part 15.209 Limit	Margin	Reference	Receive Antenna Polarity
	(MHz)	(dBμV/m)	(dBμV/m)	(dB)	Appendix A	(H/V)
10 kHz - 150 kHz	0.0105	104.01	127.18	-23.17	A1.1.3.2	Perpendicular
.150 kHz - 30 MHz	1.4028	51.95	64.69	-12.74	A2.1.2.1	Parallel
30 MHz - 1000 MHz	955.8204	34.03	46.00	-11.97	A3.1.1.3	H
1000 MHz - 10000 MHz	9900.1000	48.97	54.00	-5.03	A4.1.1.2	V
10000 MHz - 18000 MHz	17735.3000	47.67	54.00	-6.33	A5.1.3.1	H
18000 MHz - 25000 MHz	24922.3000	47.35	54.00	-6.65	A6.1.2.1	H

7.5.1.2. 802.11g

Frequency Range	Worst-Case Measured Frequency	Field Strength	FCC Part 15.209 Limit	Margin	Reference	Receive Antenna Polarity
	(MHz)	(dBμV/m)	(dBμV/m)	(dB)	Appendix A	(H/V)
10 kHz - 150 kHz	0.0121	102.40	125.93	-23.53	A1.2.3.2	Perpendicular
.150 kHz - 30 MHz	1.5828	51.17	63.64	-12.47	A2.2.2.6	Perpendicular
30 MHz - 1000 MHz	921.3826	33.80	46.00	-12.20	A3.1.1.3	H
1000 MHz - 10000 MHz	9648.2000	49.55	54.00	-4.45	A4.2.1.3	H
10000 MHz - 18000 MHz	16620.3000	48.21	54.00	-5.79	A5.2.2.1	H
18000 MHz - 25000 MHz	24163.0000	46.88	54.00	-7.12	A6.2.3.4	V

7.5.1.3. 802.11n

Frequency Range	Worst-Case Measured Frequency	Field Strength	FCC Part 15.209 Limit	Margin	Reference	Receive Antenna Polarity
	(MHz)	(dBμV/m)	(dBμV/m)	(dB)	Appendix A	(H/V)
10 kHz - 150 kHz	0.0116	102.62	126.27	-23.65	A1.3.3.1	Parallel
.150 kHz - 30 MHz	0.5946	60.16	72.12	-11.96	A2.3.1.3	Parallel
30 MHz - 1000 MHz	973.4276	33.57	46.00	-12.43	A3.3.2.6	V
1000 MHz - 10000 MHz	9847.9000	48.44	54.00	-5.56	A4.3.3.4	V
10000 MHz - 18000 MHz	16714.7000	47.58	54.00	-6.42	A5.3.3.1	H
18000 MHz - 25000 MHz	24177.7000	47.05	54.00	-6.95	A6.3.1.4	V

7. Measurement Data (continued)

7.5. Transmitter Spurious Radiated Emissions (150 kHz to 40 GHz)

7.5.2. Transmitter Spurious Radiated Emissions (Harmonic Meas.) Test Results

Worst case measurements of Harmonics that fall into the restricted bands.

7.5.2.1. 2.4 GHz, 802.11b

802.11b Freq. (MHz)	Field Strength (dB μ V/m) ¹		Limit (dB μ V/m)		Margin (dB μ V/m)		Antenna Polarity (H/V)	Result
	Peak	Average	Peak	Average	Peak	Average		
4824	49.06	34.84	74.00	54.00	-24.94	-19.16	V	Compliant
4874	50.26	36.89	74.00	54.00	-23.74	-17.11	H	Compliant
4924	49.16	35.24	74.00	54.00	-24.84	-18.76	V	Compliant
7311	52.49	38.06	74.00	54.00	-21.51	-15.94	H	Compliant
7386	51.44	37.44	74.00	54.00	-22.56	-16.56	V	Compliant
12060	58.21	44.18	74.00	54.00	-15.79	-9.82	V	Compliant
12185	58.82	44.53	74.00	54.00	-15.18	-9.47	V	Compliant
12310	58.81	45.50	74.00	54.00	-15.19	-8.50	V	Compliant
14472	59.84	46.21	74.00	54.00	-14.16	-7.79	V	Compliant
19296	59.97	46.87	74.00	54.00	-14.03	-7.13	V	Compliant
19496	59.97	46.87	74.00	54.00	-14.03	-7.13	V	Compliant
19696	60.05	46.82	74.00	54.00	-13.95	-7.18	H	Compliant
22158	61.89	48.57	74.00	54.00	-12.11	-5.43	H	Compliant

¹ All correction factors are stored in the spectrum analyzer and applied to this column entry.

7.5.2.2. 2.4 GHz, 802.11g

802.11b Freq. (MHz)	Field Strength (dB μ V/m) ¹		Limit (dB μ V/m)		Margin (dB μ V/m)		Antenna Polarity (H/V)	Result
	Peak	Average	Peak	Average	Peak	Average		
4824	50.64	35.84	74.00	54.00	-23.36	-18.16	H	Compliant
4874	49.30	35.38	74.00	54.00	-24.70	-18.62	H	Compliant
4924	49.12	35.20	74.00	54.00	-24.88	-18.80	H	Compliant
7311	51.26	37.72	74.00	54.00	-22.74	-16.28	V	Compliant
7386	50.70	37.43	74.00	54.00	-23.30	-16.57	H	Compliant
12060	58.66	45.21	74.00	54.00	-15.34	-8.79	H	Compliant
12185	59.24	44.57	74.00	54.00	-14.76	-9.43	H	Compliant
12310	58.44	44.59	74.00	54.00	-15.56	-9.41	V	Compliant
14472	60.42	46.96	74.00	54.00	-13.58	-7.04	H	Compliant
19296	60.82	46.18	74.00	54.00	-13.18	-7.82	H	Compliant
19496	60.37	46.29	74.00	54.00	-13.63	-7.71	H	Compliant
19696	60.82	46.55	74.00	54.00	-13.18	-7.45	H	Compliant
22158	62.22	48.15	74.00	54.00	-11.78	-5.85	H	Compliant

¹ All correction factors are stored in the spectrum analyzer and applied to this column entry.

7. Measurement Data (continued)

7.5. Transmitter Spurious Radiated Emissions (150 kHz to 40 GHz) (continued)

7.5.2. Transmitter Spurious Radiated Emissions (Harmonic Meas.) Test Results

Worst case measurements of Harmonics that fall into the restricted bands.

7.5.2.3. 2.4 GHz, 802.11n

802.11b Freq. (MHz)	Field Strength (dBμV/m) ¹		Limit (dBμV/m)		Margin (dBμV/m)		Antenna Polarity (H/V)	Result
	Peak	Average	Peak	Average	Peak	Average		
4824	48.53	35.31	74.00	54.00	-25.47	-18.69	V	Compliant
4874	49.30	35.23	74.00	54.00	-24.70	-18.77	V	Compliant
4924	49.53	35.61	74.00	54.00	-24.47	-18.39	H	Compliant
7311	50.83	37.48	74.00	54.00	-23.17	-16.52	V	Compliant
7386	51.08	37.55	74.00	54.00	-22.92	-16.45	V	Compliant
12060	57.60	44.22	74.00	54.00	-16.40	-9.78	V	Compliant
12185	58.25	44.53	74.00	54.00	-15.75	-9.47	V	Compliant
12310	59.10	45.04	74.00	54.00	-14.90	-8.96	H	Compliant
14472	60.61	46.36	74.00	54.00	-13.39	-7.64	H	Compliant
19296	59.99	45.93	74.00	54.00	-14.01	-8.07	H	Compliant
19496	60.23	46.02	74.00	54.00	-13.77	-7.98	V	Compliant
19696	60.83	46.36	74.00	54.00	-13.17	-7.64	H	Compliant
22158	62.10	48.13	74.00	54.00	-11.90	-5.87	H	Compliant

¹ All correction factors are stored in the spectrum analyzer and applied to this column entry.

7. Measurement Data (continued)

7.6. Band Edge and Out of Band Measurements

Requirement: 15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Procedure: For the lower band edge, this measurement was performed in accordance with the procedure detailed in FCC OET publication number 558074, Section 11: Emissions in non-restricted frequency bands.

For the upper band edge, this measurement was performed as a typical restricted band radiated emissions measurement above 1 GHz. Peak and CISPR average detectors and a 1 MHz resolution and 3 MHz video bandwidth were utilized.

Test Note: The radiated band edge and worst case out of band measurements in this report represent the measurements made with the worst case receive antenna polarity and product orthogonal position. In addition, the DTS bandwidth measurements were taken into consideration for the worst case examples.

Results: The DUT met the 20 dB requirement at the lower band edge and the Part 15.209 requirements at the upper band edge.

7.6.1. Lower Band Edge

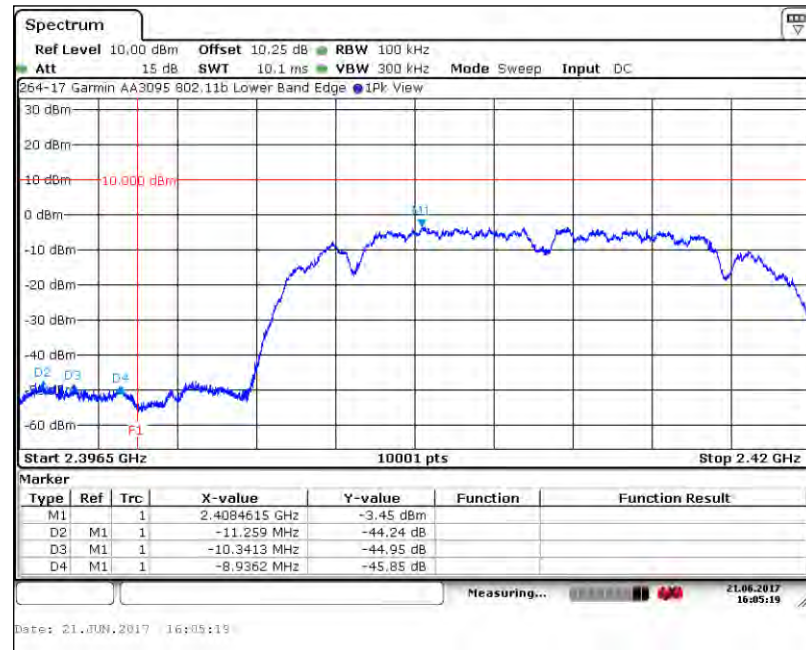
Band Edge Frequency	Mode of Operation	Lowest Transmitter Frequency	Maximum PSD (100 kHz)	Band Edge Delta to Max PSD (100 kHz)	Minimum Required Delta	Result
(MHz)		(MHz)	(dBm)	(dBm)	(dB)	
2400	802.11b	2412	-3.45	-45.85	-20	Compliant
	802.11g		-10.70	-33.15	-20	Compliant
	802.11n		-11.08	-30.38	-20	Compliant

7. Measurement Data (continued)

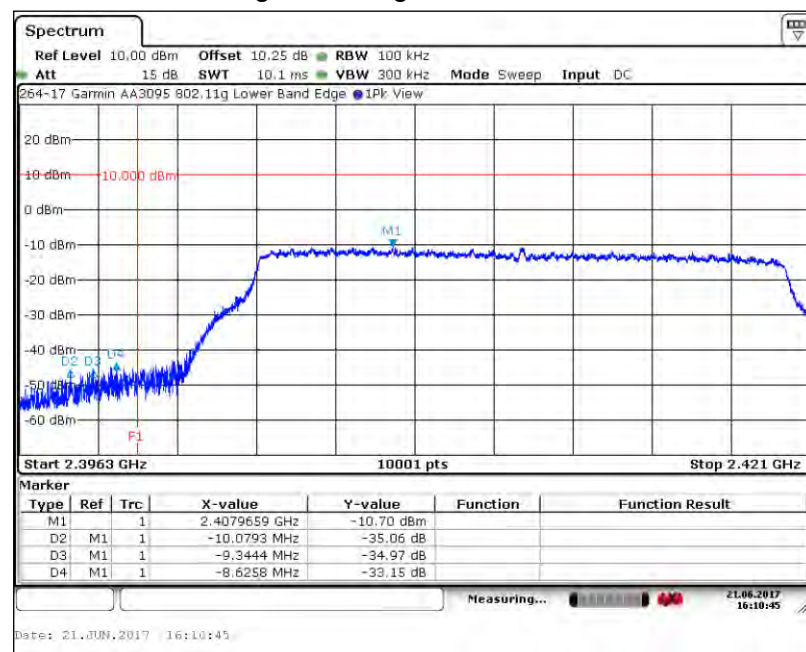
7.6. Band Edge and Out of Band Measurements (continued)

7.6.1. Lower Band Edge

7.6.1.1. Lower Band Edge, 802.11b



7.6.1.2. Lower Band Edge, 802.11g

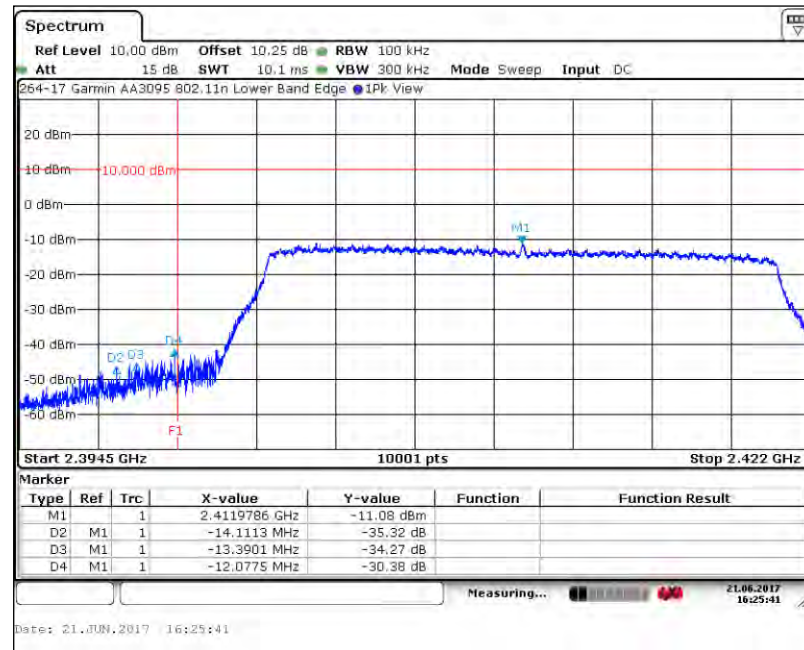


7. Measurement Data (continued)

7.6. Band Edge and Out of Band Measurements (continued)

7.6.1. Lower Band Edge

7.6.1.3. Lower Band Edge, 802.11n (HT20)



7.6.2. Upper Band Edge and Worst Case Out of Band

Upper Band Edge

Band Edge Frequency (MHz)	Mode of Operation	Field Strength (dBμV/m)		Limit (dBμV/m)		Margin (dB)		Result
		Peak	Average	Peak	Average	Peak	Average	
2483.5	802.11b	40.94	30.30	74	54	-33.06	-23.70	Compliant
	802.11g	44.60	32.89	74	54	-29.40	-21.11	Compliant
	802.11n	43.98	32.45	74	54	-30.02	-21.55	Compliant

Worst Case Out of Band

Band Edge Frequency (MHz)	Mode of Operation	Out of Band Frequency (MHz)	Field Strength (dBμV/m)		Limit (dBμV/m)		Margin (dB)		Result
			Peak	Average	Peak	Average	Peak	Average	
2483.5	802.11b	2488.2466	41.69	30.74	74	54	-32.31	-23.26	Compliant
	802.11g	2488.3305	44.41	33.19	74	54	-29.59	-20.81	Compliant
	802.11n	2486.8371	44.63	32.50	74	54	-29.37	-21.50	Compliant

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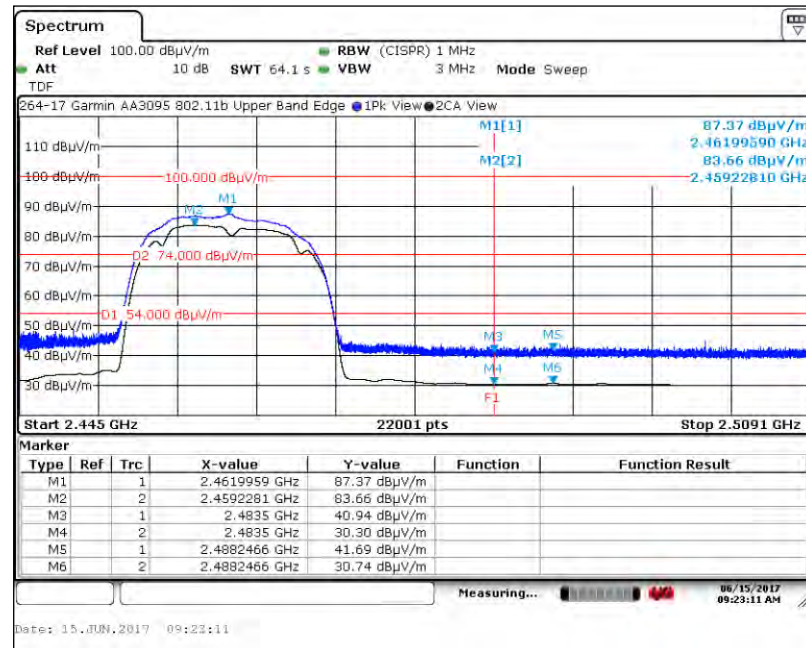
Issue Date: 7/21/2017

7. Measurement Data (continued)

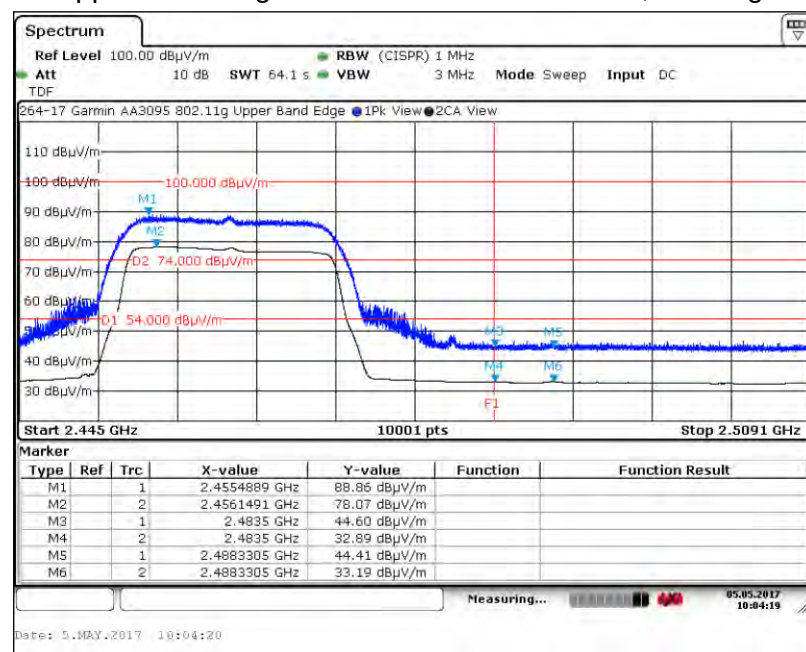
7.6. Band Edge and Out of Band Measurements (continued)

7.6.2. Upper Band Edge and Worst Case Out of Band

7.6.2.1. Upper Band Edge & Worst Case Out of Band, 802.11b



7.6.2.2. Upper Band Edge & Worst Case Out of Band, 802.11g

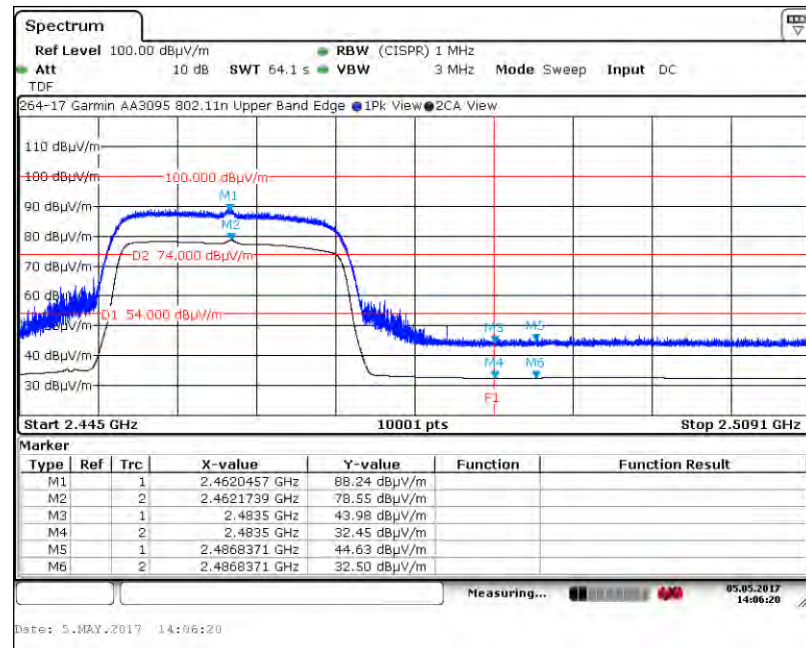


7. Measurement Data (continued)

7.6. Band Edge and Out of Band Measurements (continued)

7.6.2. Upper Band Edge and Worst Case Out of Band

7.6.2.3. Upper Band Edge & Worst Case Out of Band, 802.11n (HT20)



7.6.3. Lower Restricted Band, 2.310 MHz to 2390 MHz

Mode of Operation	Freq. (MHz)	Field Strength (dBμV/m)		Limit (dBμV/m)		Margin (dBμV/m)		Result
		Peak	Average	Peak	Average	Peak	Average	
802.11b	2321.8595	46.89	37.13	74	54	-27.11	-16.87	Compliant
802.11g	2323.8186	46.98	33.66	74	54	-27.02	-20.34	Compliant
802.11n	2323.3627	47.99	36.52	74	54	-26.01	-17.48	Compliant

Test Number: 264-17

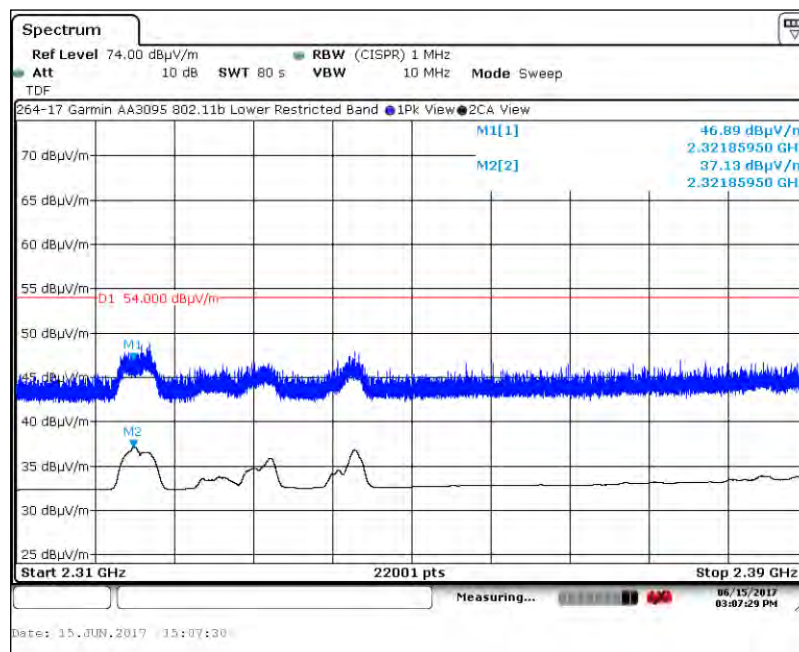
Issue Date: 7/21/2017

7. Measurement Data (continued)

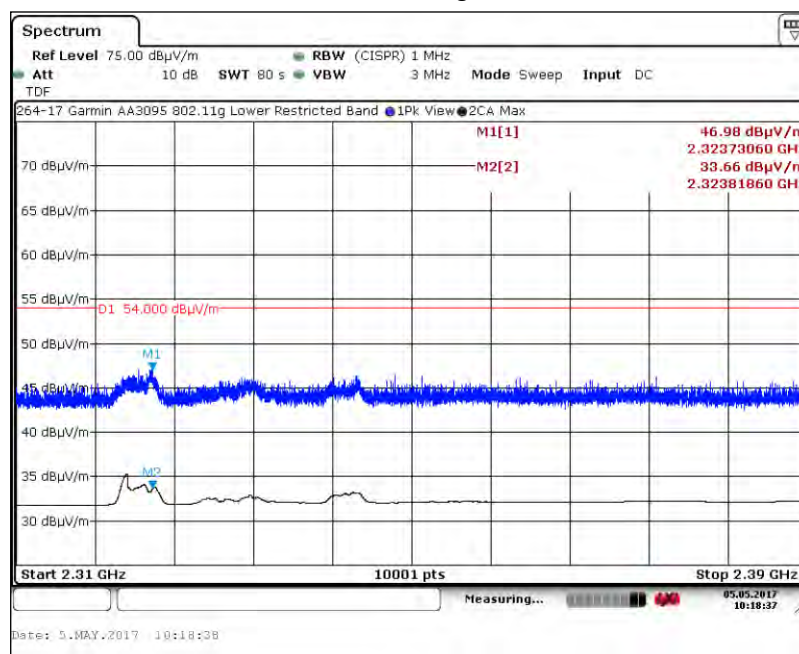
7.6. Band Edge and Out of Band Measurements (continued)

7.6.3. Lower Restricted Band, 2.310 MHz, to 2390 MHz

7.6.3.1. Lower Restricted Band, 802.11b



7.6.3.2. Lower Restricted Band, 802.11g



Test Number: 264-17

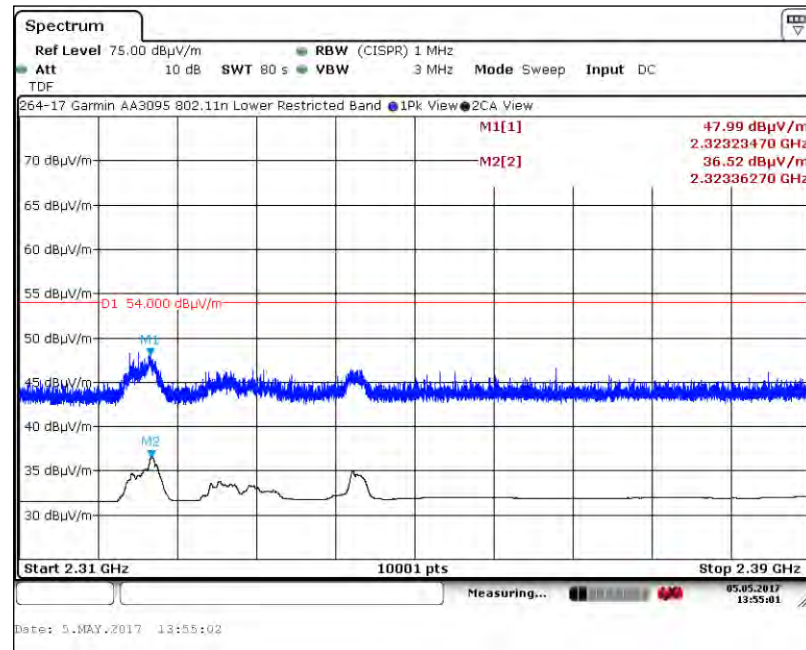
Issue Date: 7/21/2017

7. Measurement Data (continued)

7.6. Band Edge and Out of Band Measurements (continued)

7.6.3. Lower Restricted Band, 2.310 MHz, to 2390 MHz

7.6.3.3. Lower Restricted Band, 802.11Nn (HT20)



7.6.4. Upper Restricted Band, 2483.5 MHz to 2500 MHz

Mode of Operation	Freq. (MHz)	Field Strength (dBμV/m)		Limit (dBμV/m)		Margin (dBμV/m)		Result
		Peak	Average	Peak	Average	Peak	Average	
802.11b	2488.2094	41.68	29.53	74	54	-32.32	-24.47	Compliant
802.11g	2488.1468	46.17	33.11	74	54	-27.83	-20.89	Compliant
802.11n	2488.1567	45.24	32.98	74	54	-28.76	-21.02	Compliant

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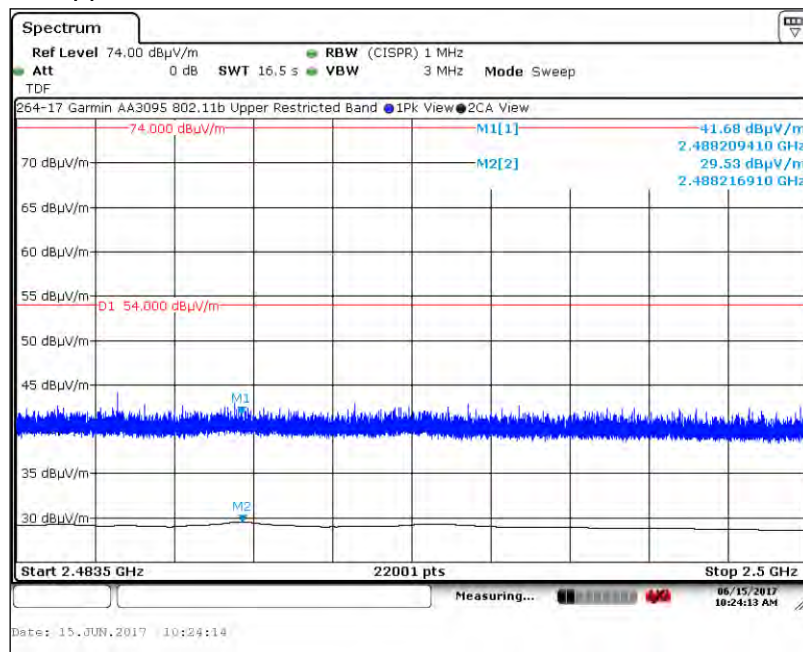
Issue Date: 7/21/2017

7. Measurement Data (continued)

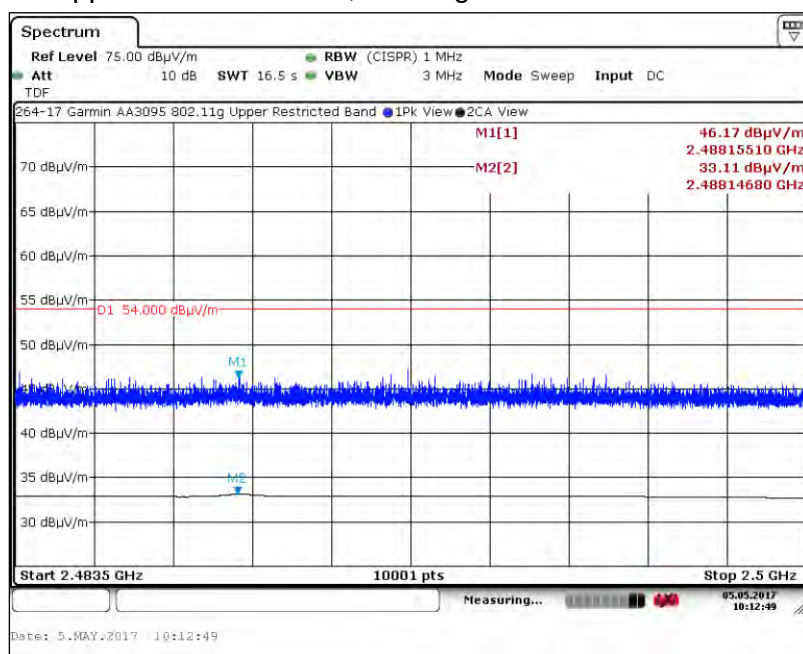
7.6. Band Edge and Out of Band Measurements (continued)

7.6.4. Upper Restricted Band, 2483.5 MHz, to 2500 MHz

7.6.4.1. Upper Restricted Band, 802.11b



7.6.4.2. Upper Restricted Band, 802.11g



Test Number: 264-17

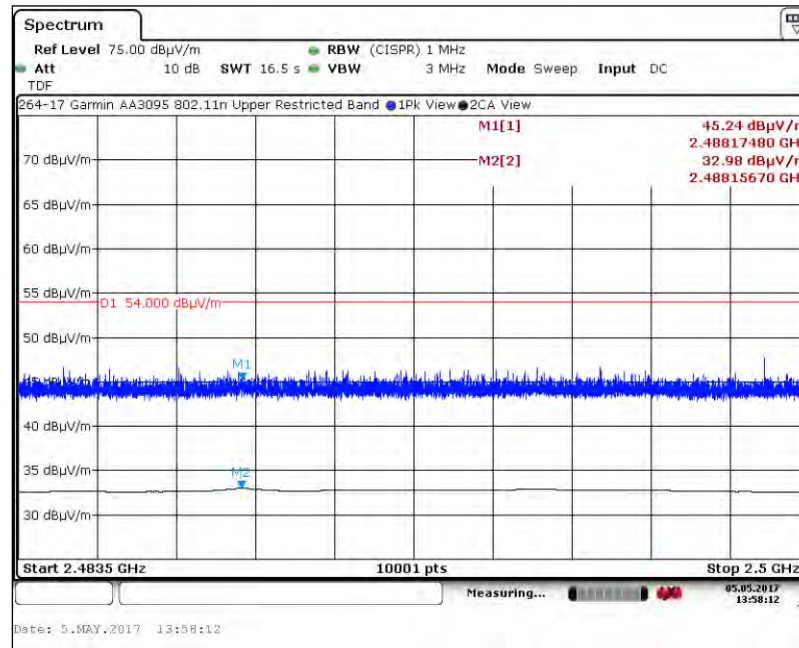
Issue Date: 7/21/2017

7. Measurement Data (continued)

7.6. Band Edge and Out of Band Measurements (continued)

7.6.4. Upper Restricted Band, 2483.5 MHz, to 2500 MHz

7.6.4.3. Upper Restricted Band, 802.11n (HT20)



7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands

Requirement: 15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Test Notes: Conducted mode measurements were taken for the data detailed in this section.

Peak in-band measurements were taken at the time the DTS (-6 dB) bandwidth measurements were made. These values were used as the reference levels for the following measurements. Refer to section 7.2 of this report for these values.

Results: The DUT met the 20 dB requirement emission level delta requirement in the non restricted frequency bands.

Emissions in Non-restricted Frequency Bands

Mode of Operation	Maximum PSD (100 kHz) In-Band ¹ (dBm)	Worst Case Out-of-Band Frequency (MHz)	Maximum PSD (100 kHz) Out-of-Band (dBm)	Delta to Maximum PSD (dB)	Minimum Required Delta	Result
802.11b	-17.37	2170.868	-51.54	-34.17	-20 dB	Compliant
802.11g	-21.27	2170.868	-48.98	-27.71	-20 dB	Compliant
802.11n	-21.55	2398.381	-48.38	-26.83	-20 dB	Compliant

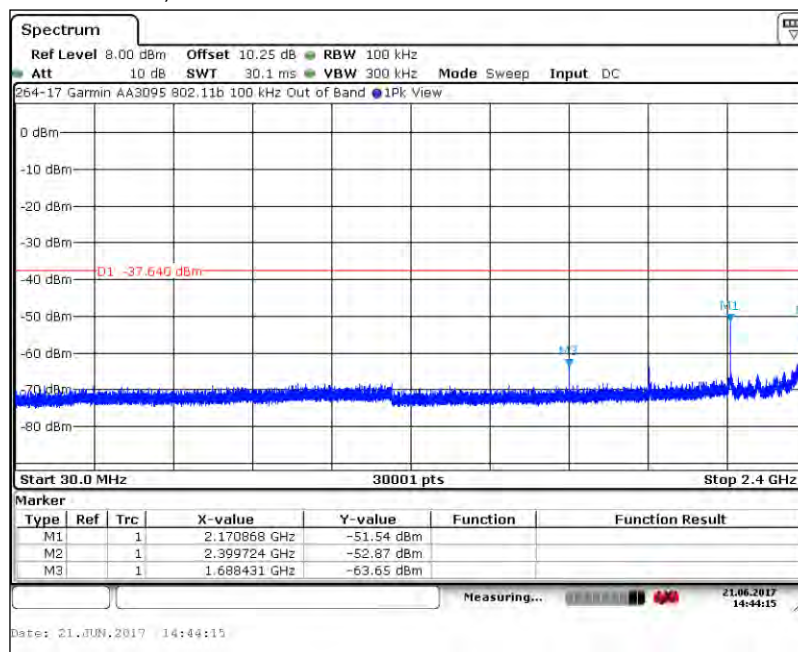
¹Taken from Section 7.2 - DTS Bandwidth

7. Measurement Data (continued)

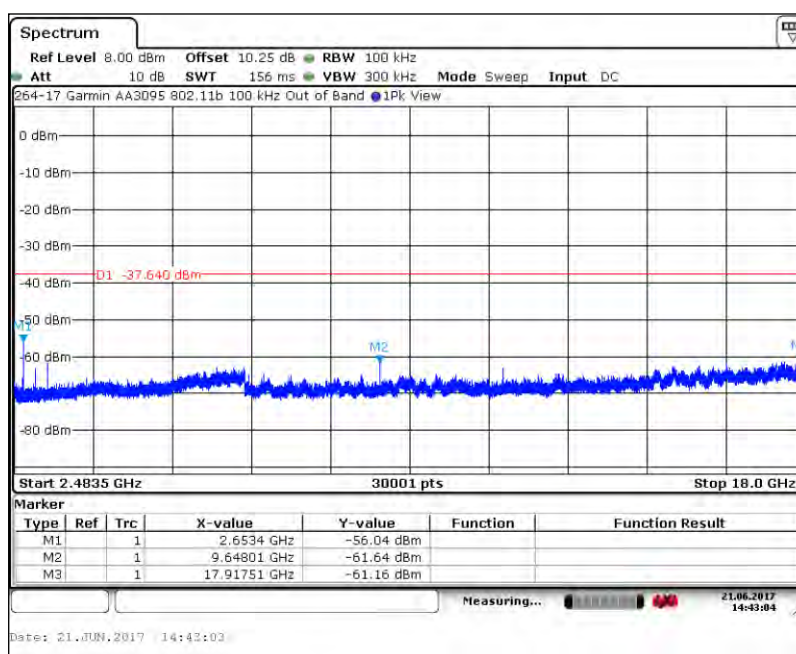
7.7. Emissions in Non-restricted Frequency Bands (continued)

7.7.1. 802.11b

7.7.1.1. 802.11b, 30 MHz to 2.4 GHz



7.7.1.2. 802.11b, 2.4835 GHz to 18 GHz



Test Number: 264-17

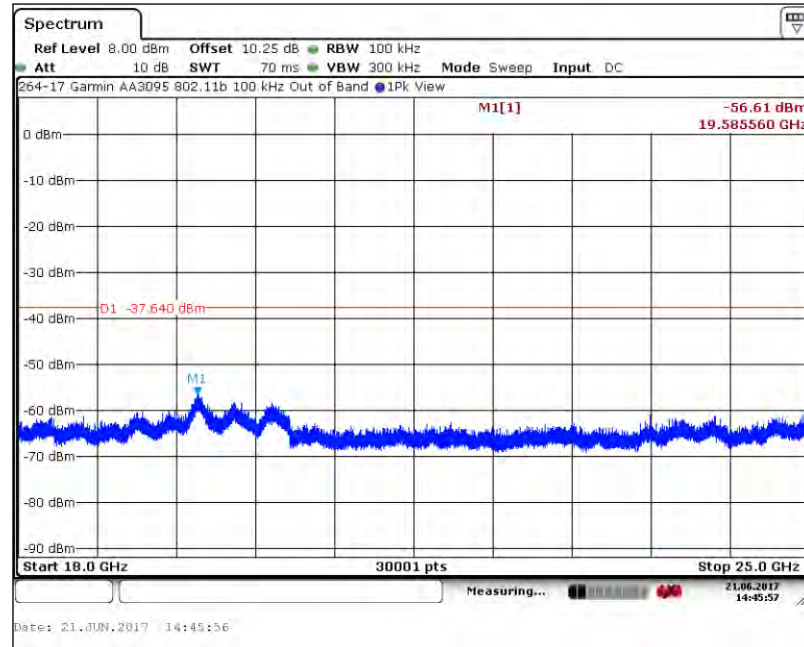
Issue Date: 7/21/2017

7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands (continued)

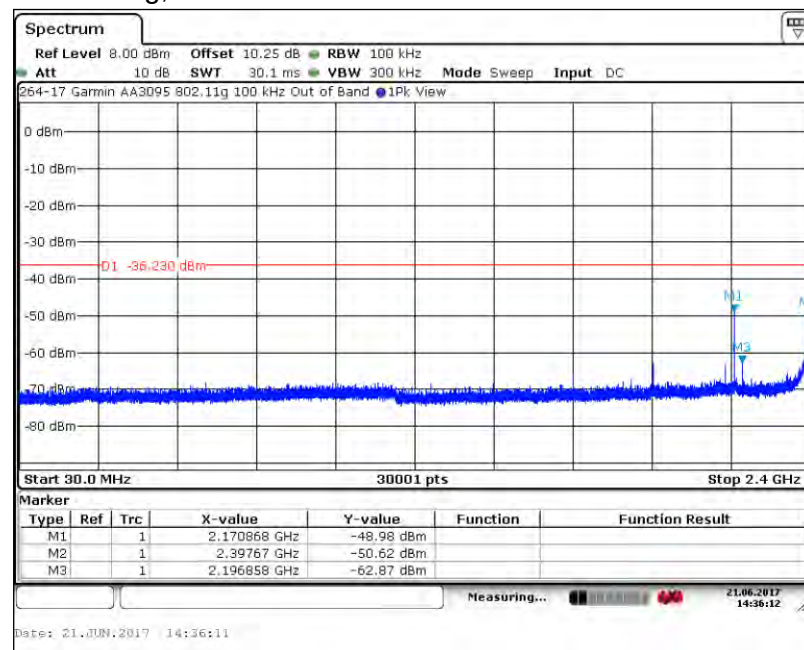
7.7.1. 802.11b

7.7.1.3. 802.11b, 18 GHz to 25 GHz



7.7.2. 802.11g

7.7.2.1. 802.11g, 30 MHz to 2.4 GHz



Test Number: 264-17

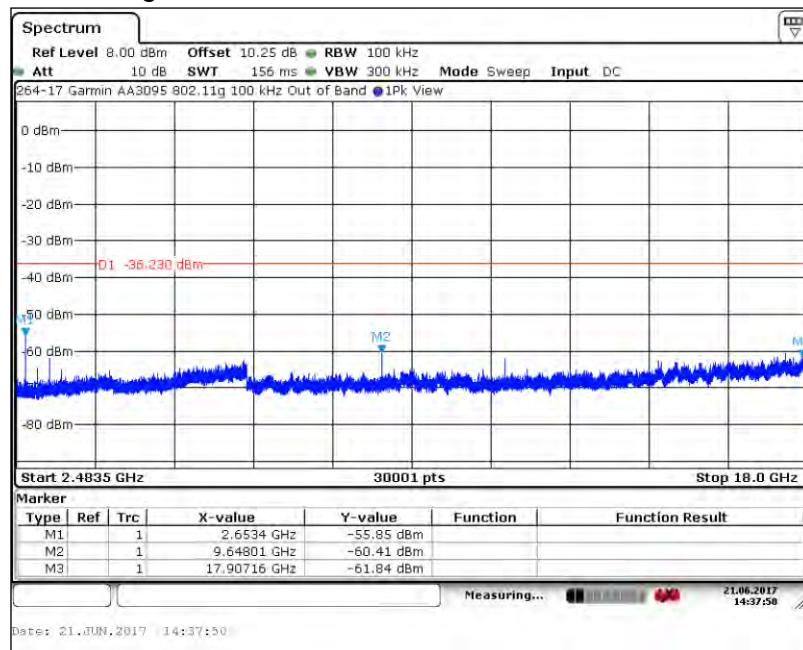
Issue Date: 7/21/2017

7. Measurement Data (continued)

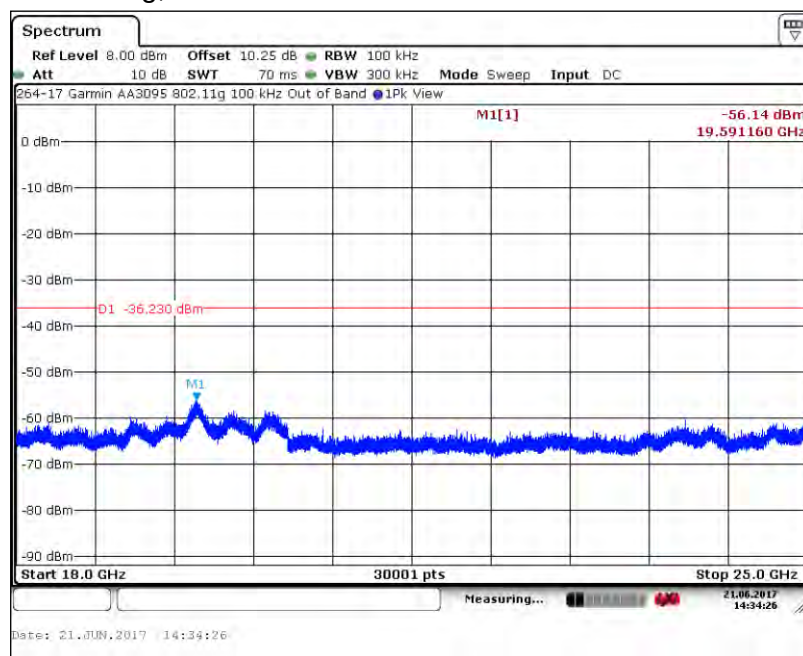
7.7. Emissions in Non-restricted Frequency Bands (continued)

7.7.2. 802.11g

7.7.2.2. 802.11g, 2.4835 GHz to 18 GHz



7.7.2.3. 802.11g, 18 GHz to 25 GHz



Test Number: 264-17

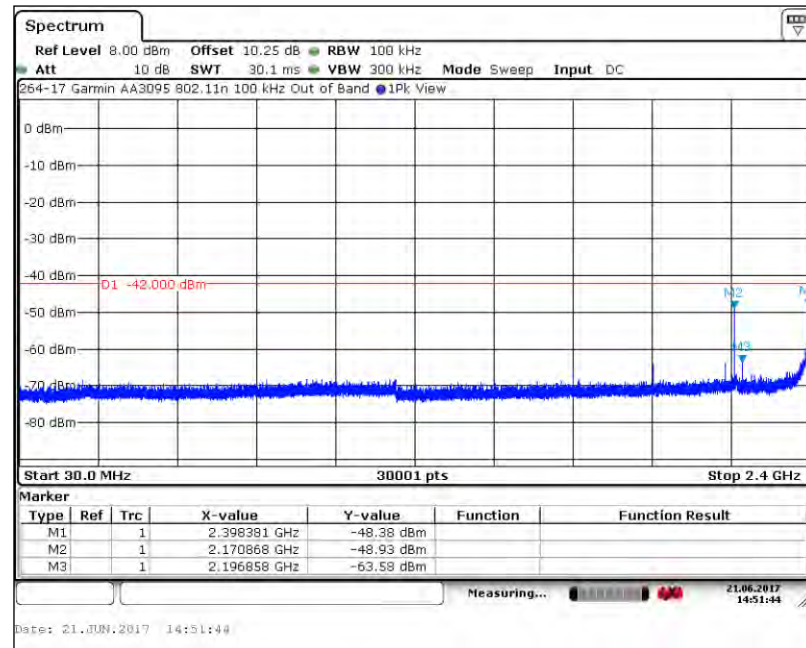
Issue Date: 7/21/2017

7. Measurement Data (continued)

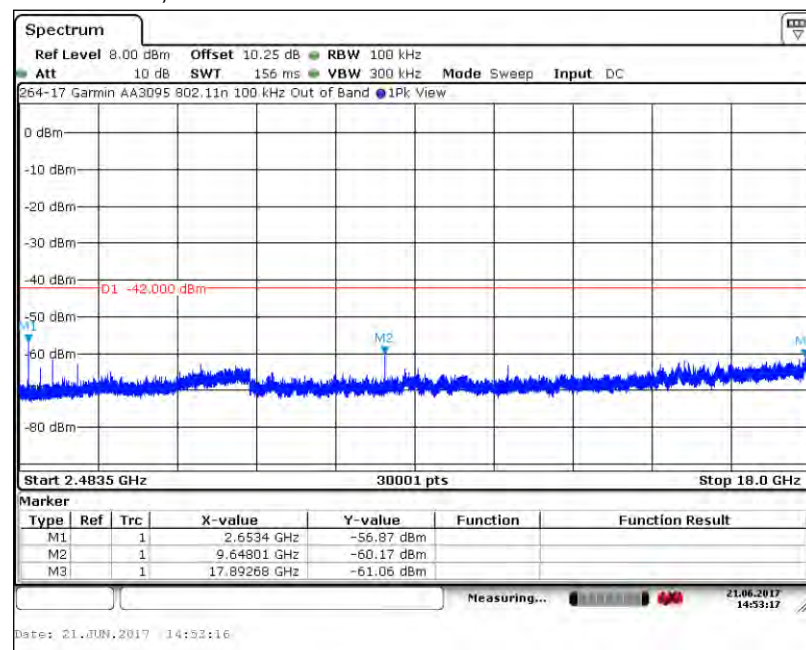
7.7. Emissions in Non-restricted Frequency Bands (continued)

7.7.3. 802.11n

7.7.3.1. 802.11n, 30 MHz to 2.4 GHz



7.7.3.2. 802.11n, 2.4835 GHz to 18 GHz



Test Number: 264-17

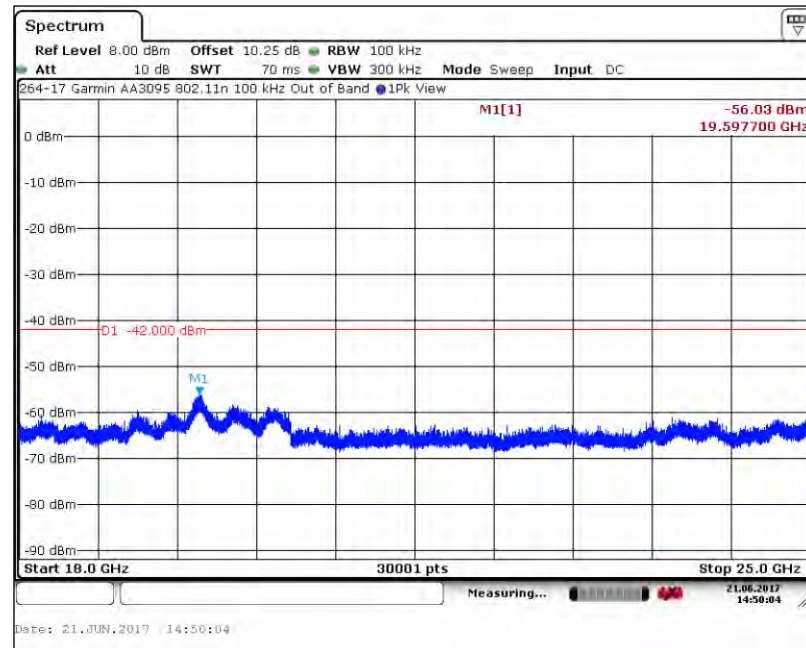
Issue Date: 7/21/2017

7. Measurement Data (continued)

7.7. Emissions in Non-restricted Frequency Bands (continued)

7.7.3. 802.11n

7.7.3.3. 802.11n, 18 GHz to 25 GHz



7. Measurement Data (continued)

7.8. Peak Power Spectral Density (15.247(e))

Requirement: For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of FCC Part 15.247. The same method of determining the conducted output power shall be used to determine the power spectral density.

Procedure: FCC OET publication number 558074, Section 10.2: Method PKPSD (peak PSD). FCC OET 662911 was referenced to determine the procedure for measuring in-band power spectral density of transmitters with multiple outputs in the same band.

Results: The DUT MEETS the required power spectral density limit at the tested frequencies.

Measurement Results in 2400 MHz to 2483.5 MHz Band

802.11b Mode Channel	Frequency	Maximum PSD Frequency	Maximum Power Spectral Density	Limit	Margin	Result
	(MHz)	(MHz)	(dBm)	(dBm)	(dB)	
Low	2412	2412.0000	-13.07	8	-21.07	Compliant
Middle	2437	2437.0000	-14.29	8	-22.29	Compliant
High	2462	2461.9987	-16.23	8	-24.23	Compliant

802.11g Mode Channel	Frequency	Maximum PSD Frequency	Maximum Power Spectral Density	Limit	Margin	Result
	(MHz)	(MHz)	(dBm)	(dBm)	(dB)	
Low	2412	2411.9983	-15.31	8	-23.31	Compliant
Middle	2437	2437.0000	-15.02	8	-23.02	Compliant
High	2462	2461.9983	-16.49	8	-24.49	Compliant

802.11n Mode Channel	Frequency	Maximum PSD Frequency	Maximum Power Spectral Density	Limit	Margin	Result
	(MHz)	(MHz)	(dBm)	(dBm)	(dB)	
Low	2412	2411.9980	-15.64	8	-23.64	Compliant
Middle	2437	2437.0000	-15.63	8	-23.63	Compliant
High	2462	2461.9980	-16.05	8	-24.05	Compliant

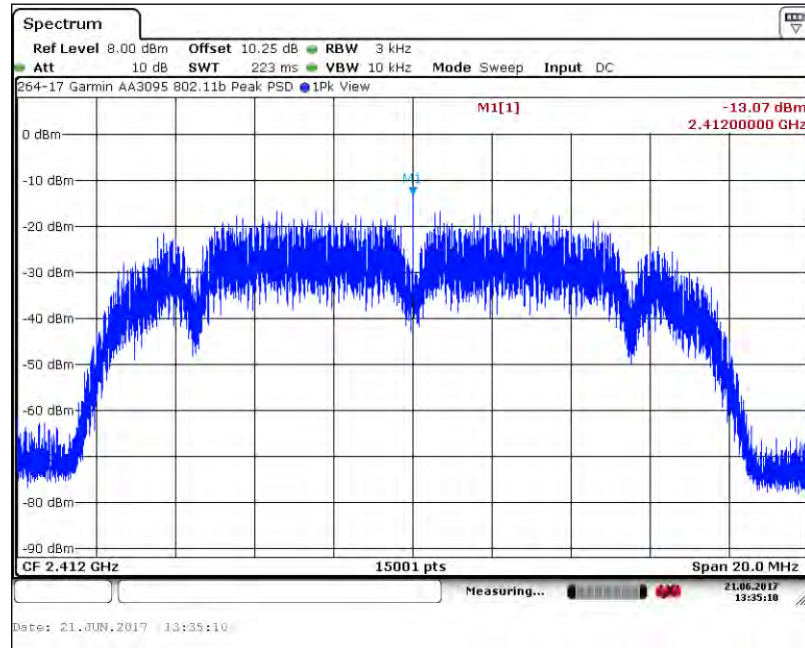
Test Number: 264-17

Issue Date: 7/21/2017

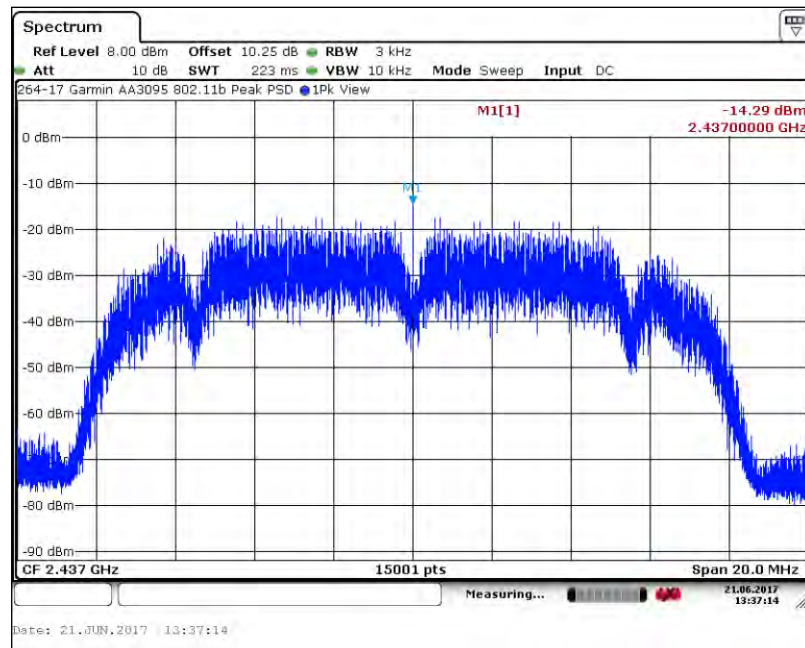
7. Measurement Data (continued)

7.8. Peak Power Spectral Density (15.247(e)) (continued)

7.8.1. 802.11b: Low Channel – 1, 2412 MHz



7.8.2. 802.11b: Middle Channel – 6, 2437 MHz



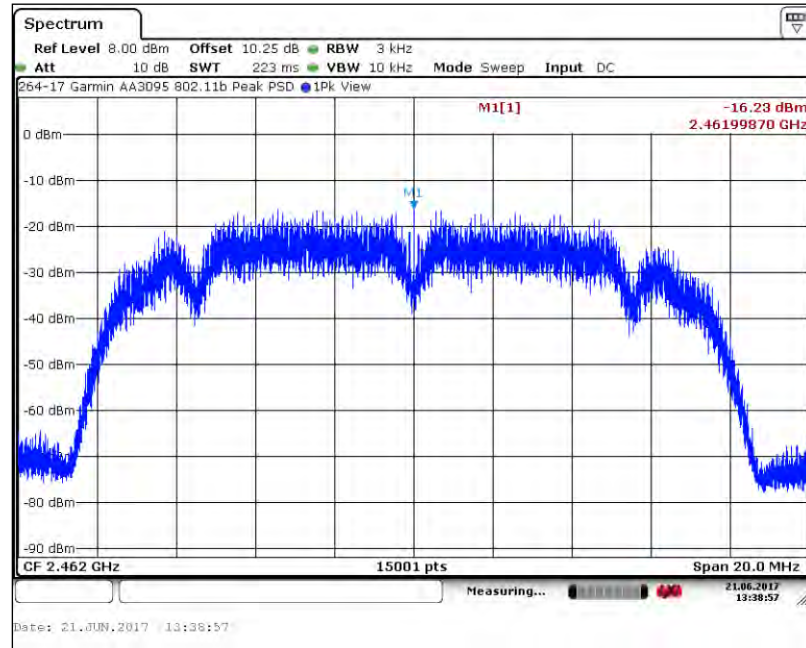
Test Number: 264-17

Issue Date: 7/21/2017

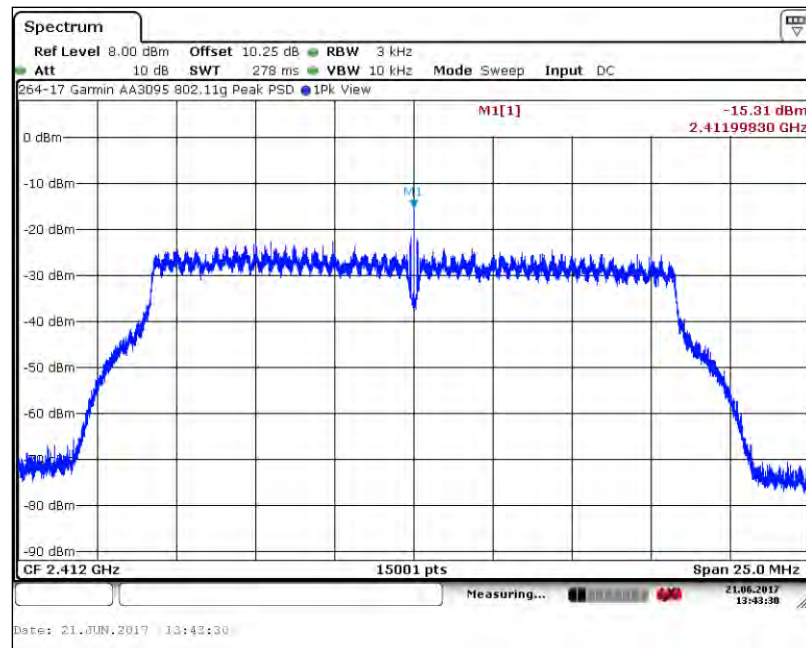
7. Measurement Data (continued)

7.8. Peak Power Spectral Density (15.247(e)) (continued)

7.8.3. 802.11b: High Channel – 11, 2462 MHz



7.8.4. 802.11g: Low Channel – 1, 2412 MHz



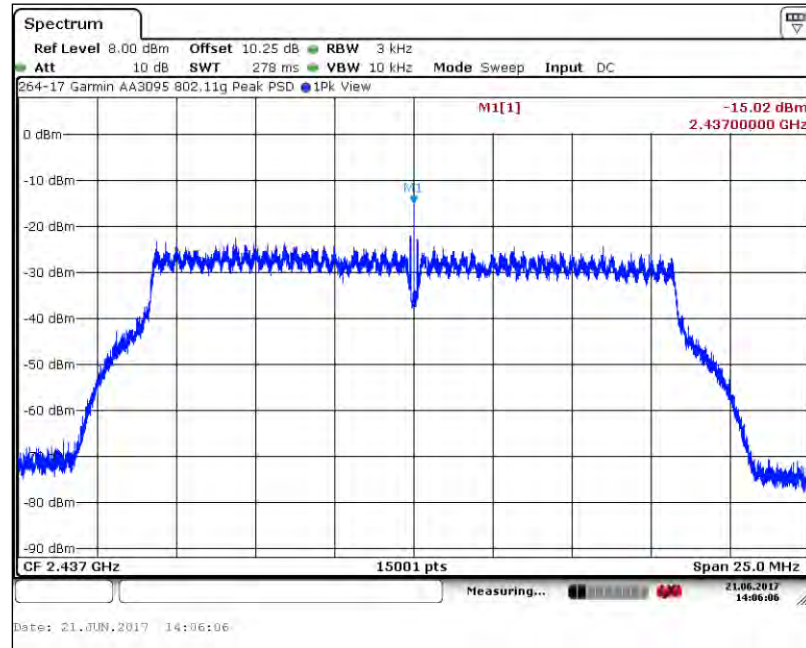
Test Number: 264-17

Issue Date: 7/21/2017

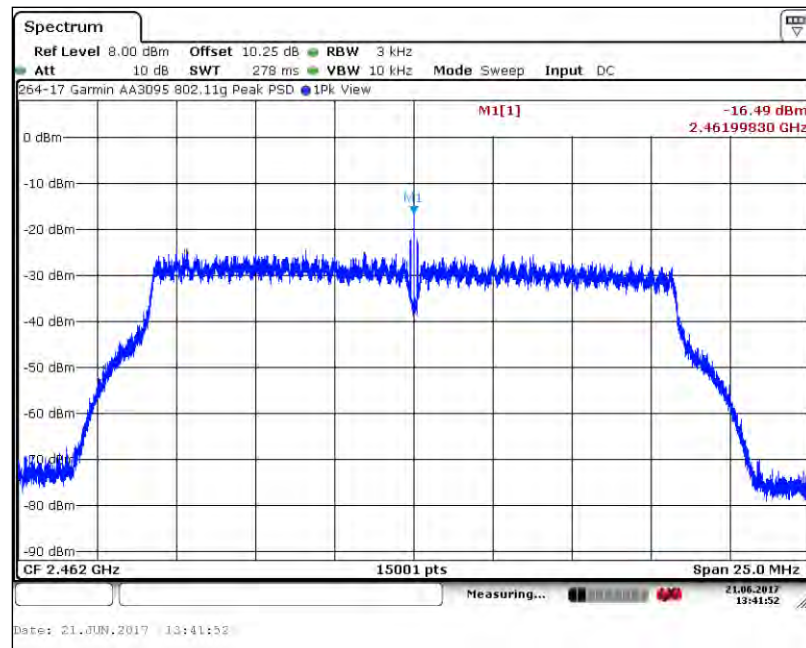
7. Measurement Data

7.8. Peak Power Spectral Density (15.247(e)) (continued)

7.8.5. 802.11g: Middle Channel – 6, 2437 MHz



7.8.6. 802.11g: High Channel – 11, 2462 MHz



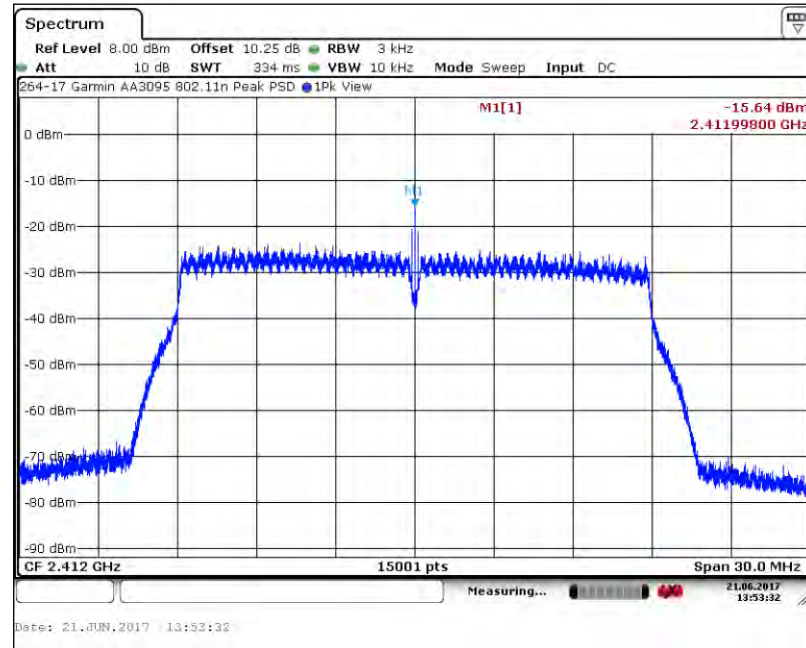
Test Number: 264-17

Issue Date: 7/21/2017

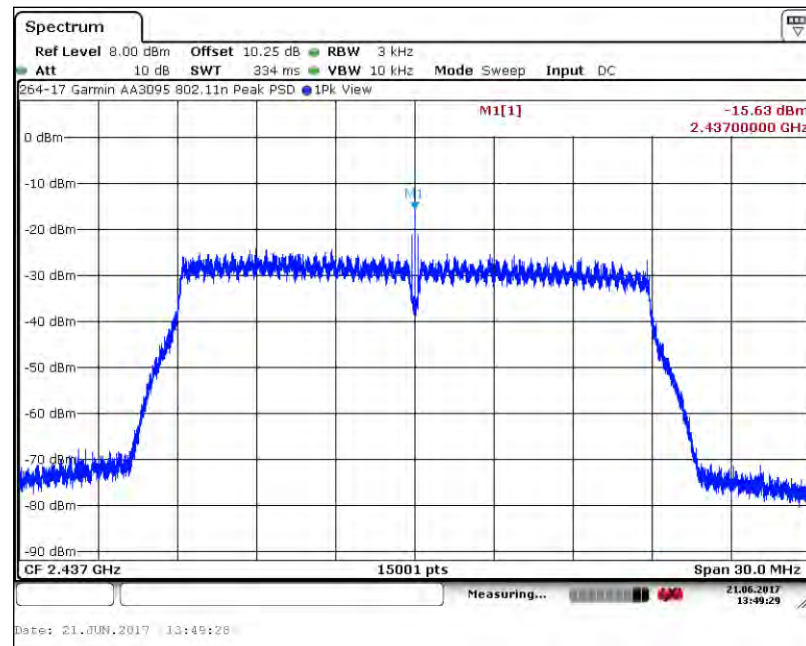
7. Measurement Data

7.8. Peak Power Spectral Density (15.247(e)) (continued)

7.8.7. 802.11n: Low Channel – 1, 2412 MHz



7.8.8. 802.11n: Middle Channel – 6, 2437 MHz



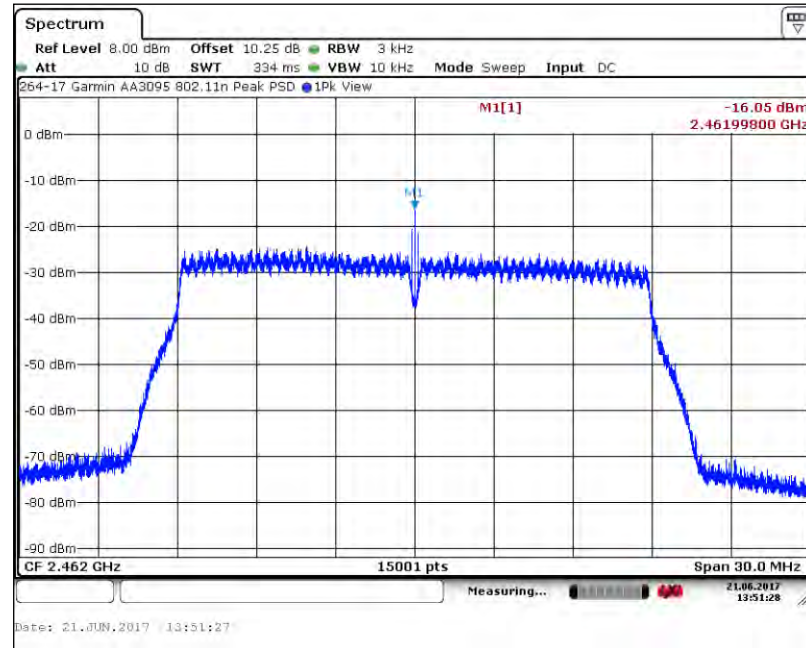
Test Number: 264-17

Issue Date: 7/21/2017

7. Measurement Data

7.8. Peak Power Spectral Density (15.247(e)) (continued)

7.8.9. 802.11n: High Channel – 11, 2462 MHz



7. Measurement Data (continued)

7.9. Conducted Emissions

Requirement: 15.207 With certain exceptions, an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Limits (dB μ V)	
	Quasi-Peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5.0	56	46
5.0 to 30.0	60	50

* Decreases with the logarithm of the frequency.

Procedure: This test was performed in accordance with the procedure detailed in ANSI C63.10-2013, Section 6.2: Standard test method for ac power-line conducted emissions from unlicensed wireless devices.

Test Notes: The portable device was fully discharged and then plugged into the supplied charger.

Results: The device under test meets the FCC Part 15.207 test requirements.

Measurement & Equipment Setup

Test Date:	6/27/2017
Test Engineer:	Brian Breault
Site Temperature (°C):	21
Relative Humidity (%RH):	37
Frequency Range:	0.15 MHz to 30 MHz
EMI Receiver IF Bandwidth:	9 kHz
EMI Receiver Avg Bandwidth:	30 kHz
Detector Functions:	Peak, Quasi-Peak & Average

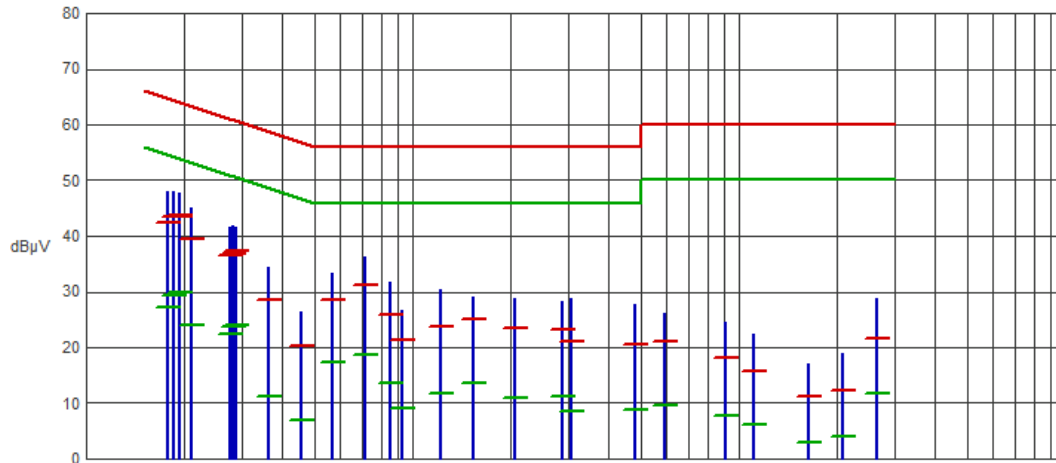
7. Measurement Data (continued)

7.9. Conducted Emissions

7.9.1. 120 Volts, 60 Hz Phase

Test No.: 264-17, 120 Volts, 60 Hz Phase

FCC Part 15.207



Frequency (MHz)	Pk Amp (dBμV)	QP Amp (dBμV)	QP Limit (dBμV)	QP Margin (dB)	Avg Amp (dBμV)	Avg Limit (dBμV)	Avg Margin (dB)	Comments
.1769	48.00	42.46	64.63	-22.17	27.20	54.63	-27.43	
.1861	47.94	43.43	64.21	-20.78	29.22	54.21	-24.99	
.1925	47.70	43.71	63.93	-20.22	29.96	53.93	-23.97	
.1930	47.53	43.52	63.91	-20.39	29.84	53.91	-24.07	
.2105	45.12	39.35	63.19	-23.84	24.01	53.19	-29.18	
.2771	41.72	36.58	60.90	-24.32	22.44	50.90	-28.46	
.2811	41.96	36.77	60.78	-24.01	23.67	50.78	-27.11	
.2880	41.63	37.27	60.58	-23.31	23.97	50.58	-26.61	
.3625	34.42	28.58	58.67	-30.09	11.17	48.67	-37.50	
.4580	26.42	20.40	56.73	-36.33	6.85	46.73	-39.88	
.5704	33.24	28.59	56.00	-27.41	17.42	46.00	-28.58	
.7144	36.31	31.13	56.00	-24.87	18.75	46.00	-27.25	
.8530	31.75	25.95	56.00	-30.05	13.47	46.00	-32.53	
.9255	26.74	21.39	56.00	-34.61	8.97	46.00	-37.03	
1.2162	30.29	23.61	56.00	-32.39	11.60	46.00	-34.40	
1.5302	29.01	24.96	56.00	-31.04	13.56	46.00	-32.44	
2.0682	28.74	23.35	56.00	-32.65	10.83	46.00	-35.17	
2.8793	28.36	23.14	56.00	-32.86	11.17	46.00	-34.83	
3.0775	28.81	21.09	56.00	-34.91	8.46	46.00	-37.54	
4.8278	27.83	20.52	56.00	-35.48	8.87	46.00	-37.13	
5.9457	26.01	20.97	60.00	-39.03	9.73	50.00	-40.27	
9.0879	24.42	18.15	60.00	-41.85	7.86	50.00	-42.14	
11.0568	22.34	15.75	60.00	-44.25	6.16	50.00	-43.84	
16.2994	17.08	11.32	60.00	-48.68	2.92	50.00	-47.08	
20.8074	18.87	12.19	60.00	-47.81	3.92	50.00	-46.08	
26.3606	28.70	21.60	60.00	-38.40	11.65	50.00	-38.35	

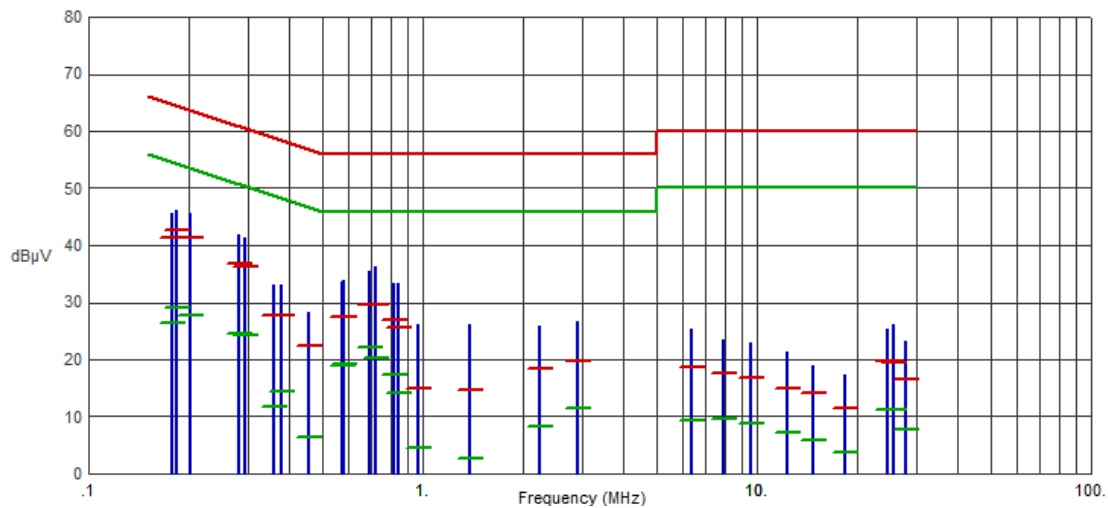
7. Measurement Data (continued)

7.9. Conducted Emissions

7.9.2. 120 Volts, 60 Hz Neutral

Test No.: 264-17, 120 Volts, 60 Hz Neutral

FCC Part 15.207



Frequency (MHz)	Pk Amp (dBμV)	QP Amp (dBμV)	QP Limit (dBμV)	QP Margin (dB)	Avg Amp (dBμV)	Avg Limit (dBμV)	Avg Margin (dB)	Comments
.1781	45.48	41.32	64.57	-23.25	26.45	54.57	-28.12	
.1835	46.15	42.58	64.33	-21.75	29.09	54.33	-25.24	
.2014	45.71	41.23	63.55	-22.32	27.68	53.55	-25.87	
.2823	41.86	36.69	60.75	-24.06	24.62	50.75	-26.13	
.2928	41.30	36.30	60.44	-24.14	24.26	50.44	-26.18	
.3578	33.09	27.78	58.78	-31.00	11.84	48.78	-36.94	
.3788	32.99	27.79	58.31	-30.52	14.49	48.31	-33.82	
.4574	28.40	22.47	56.74	-34.27	6.30	46.74	-40.44	
.5724	33.69	27.47	56.00	-28.53	18.95	46.00	-27.05	
.5815	33.76	27.55	56.00	-28.45	19.13	46.00	-26.87	
.6899	35.55	29.71	56.00	-26.29	22.07	46.00	-23.93	
.7260	36.26	29.47	56.00	-26.53	20.26	46.00	-25.74	
.8235	33.35	26.93	56.00	-29.07	17.33	46.00	-28.67	
.8458	33.31	25.53	56.00	-30.47	14.14	46.00	-31.86	
.9663	26.19	14.81	56.00	-41.19	4.50	46.00	-41.50	
1.3819	26.10	14.71	56.00	-41.29	2.69	46.00	-43.31	
2.2342	25.99	18.33	56.00	-37.67	8.31	46.00	-37.69	
2.9139	26.66	19.67	56.00	-36.33	11.38	46.00	-34.62	
6.3616	25.21	18.58	60.00	-41.42	9.41	50.00	-40.59	
7.9233	23.53	17.55	60.00	-42.45	9.68	50.00	-40.32	
9.5540	22.98	16.77	60.00	-43.23	8.73	50.00	-41.27	
12.2987	21.31	14.85	60.00	-45.15	7.20	50.00	-42.80	
14.7607	18.90	14.24	60.00	-45.76	5.97	50.00	-44.03	
18.3520	17.33	11.37	60.00	-48.63	3.64	50.00	-46.36	
24.5718	25.44	19.71	60.00	-40.29	11.13	50.00	-38.87	
25.5532	26.04	19.54	60.00	-40.46	11.12	50.00	-38.88	
27.8537	23.29	16.49	60.00	-43.51	7.84	50.00	-42.16	

7. Measurement Data (continued)

7.10. Duty Cycle

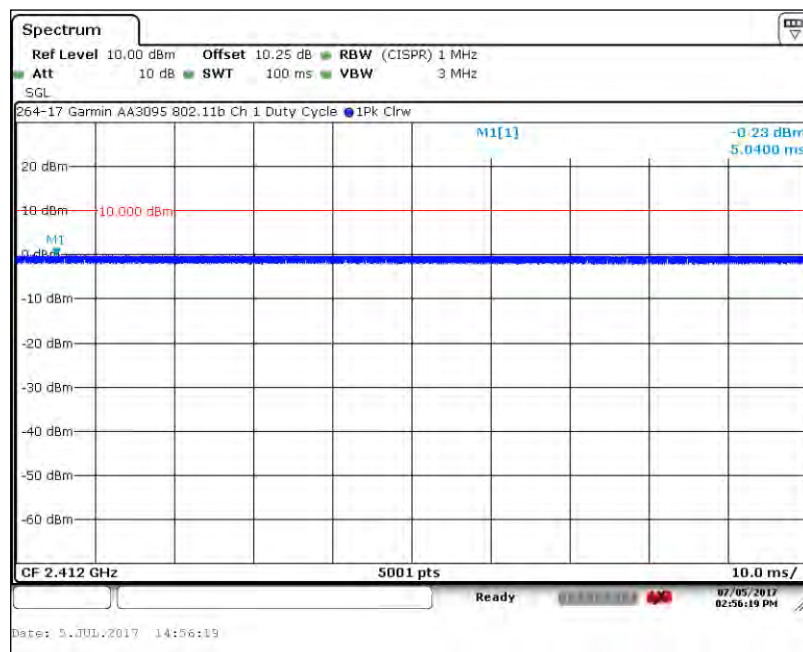
Requirement: (FCC OET publication number 558074)

Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%).

Procedure: Duty cycle measurements were made according to the procedure detailed ANSI C63.10-2013, Section 11.6(b)

Results: All measured duty cycles for the device under test are greater than 98%.

7.10.1. 802.11b: Low Channel – 1, 2412 MHz



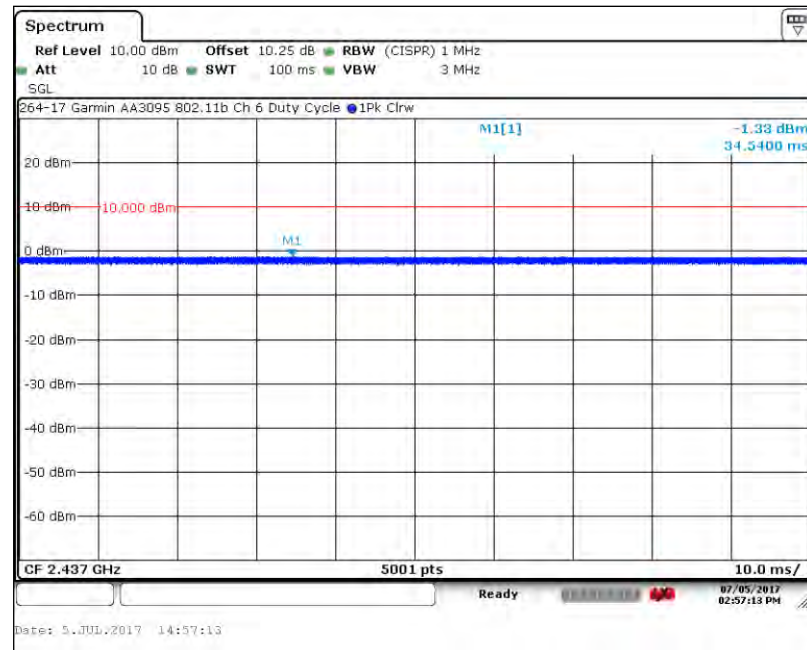
Test Number: 264-17

Issue Date: 7/21/2017

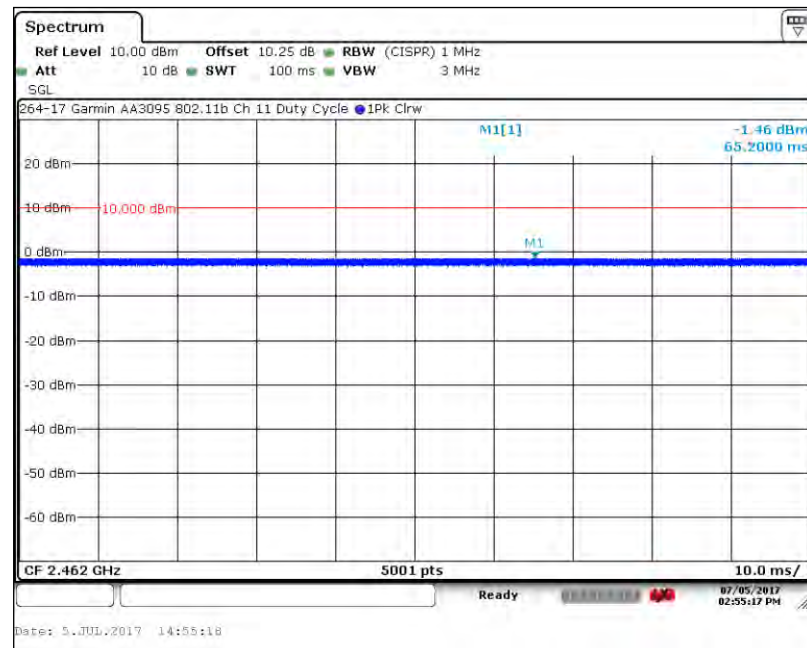
7. Measurement Data (continued)

7.10. Duty Cycle (continued)

7.10.2. 802.11b: Middle Channel – 6, 2437 MHz



7.10.3. 2.4 GHz 802.11b: High Channel – 11, 2462 MHz



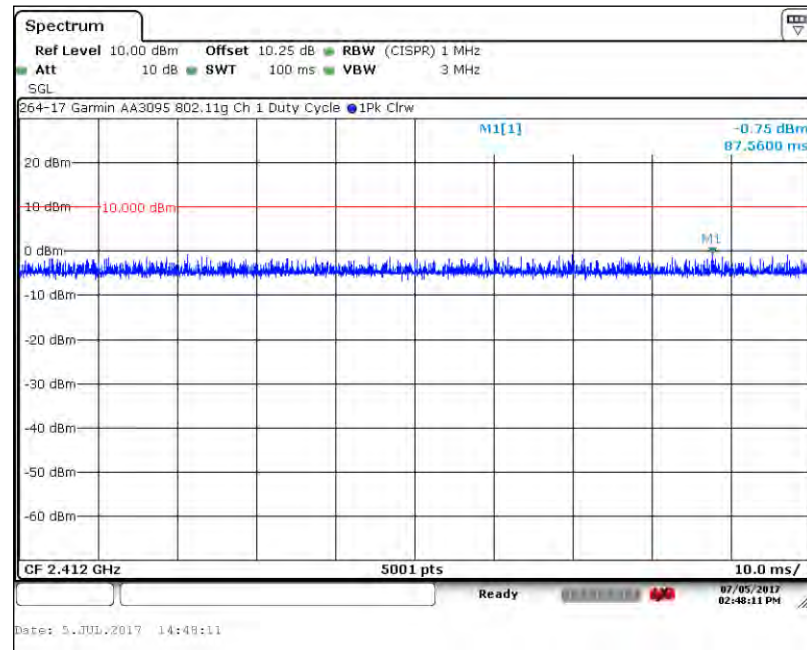
Test Number: 264-17

Issue Date: 7/21/2017

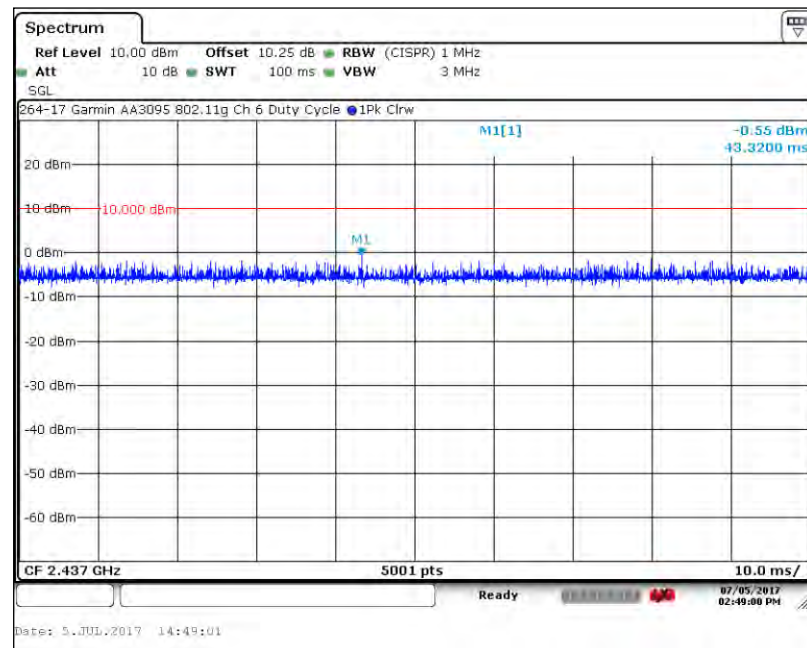
7. Measurement Data (continued)

7.10. Duty Cycle (continued)

7.10.4. 802.11g: Low Channel – 1, 2412 MHz



7.10.5. 802.11g: Middle Channel – 6, 2437 MHz



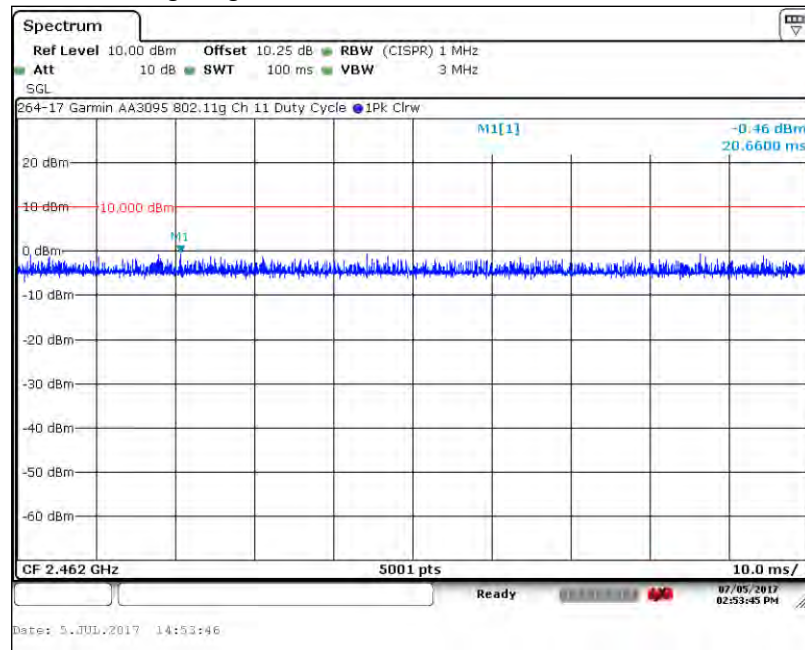
Test Number: 264-17

Issue Date: 7/21/2017

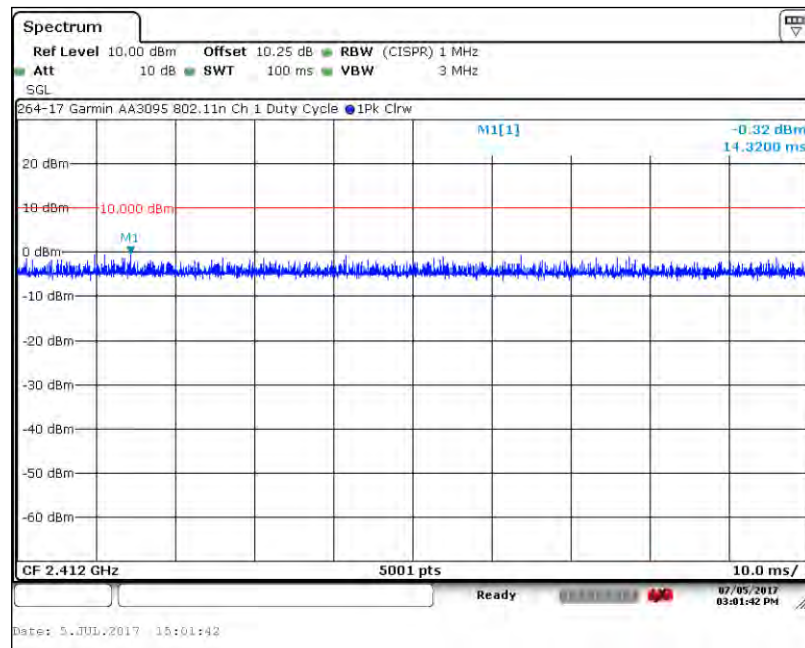
7. Measurement Data (continued)

7.10. Duty Cycle (continued)

7.10.6. 2.4 GHz 802.11g: High Channel – 11, 2462 MHz



7.10.7. 802.11n (HT20): Low Channel – 1, 2412 MHz



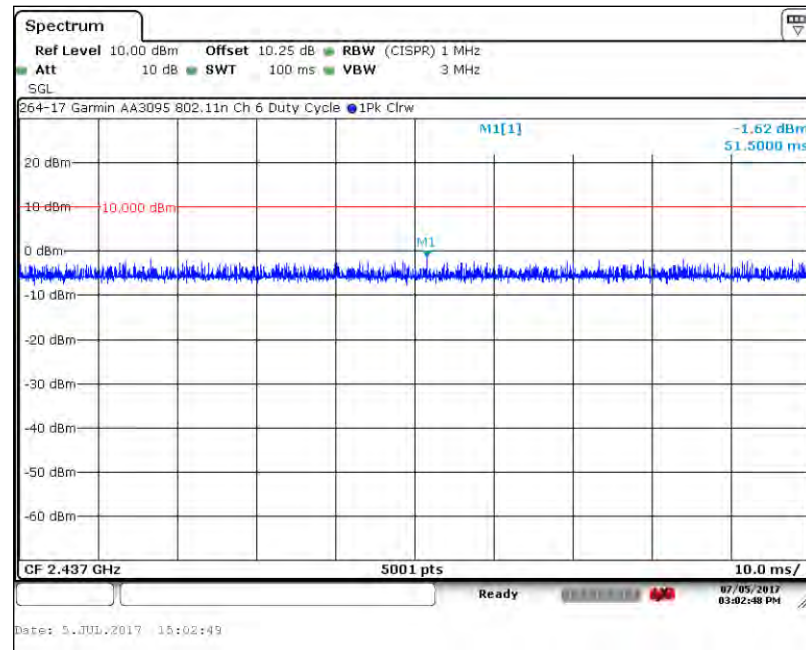
Test Number: 264-17

Issue Date: 7/21/2017

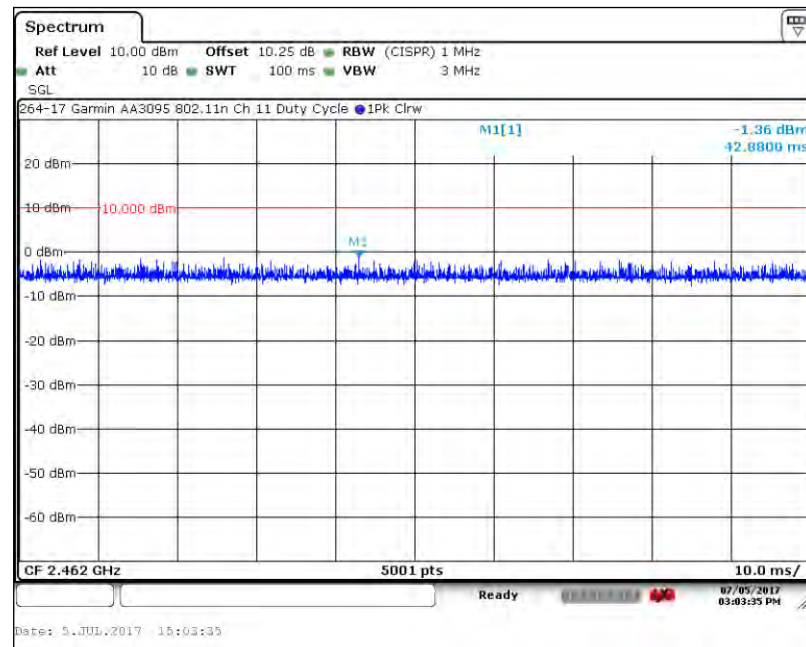
7. Measurement Data (continued)

7.10. Duty Cycle (continued)

7.10.8. 802.11n (HT20): Middle Channel – 6, 2437 MHz



7.10.9. 802.11n (HT20): High Channel – 11, 2462 MHz



7. Measurement Data (continued)

7.11. Public Exposure to Radio Frequency Energy Levels (15.247(i) (1.1307 (b)(1)) RSS-GEN, ISSUE 4 5.5, RSS 102)

7.11.1. 15.247(i) (1.1307 (b)(1)) Requirements

Requirement: Portable devices are subject to radio frequency radiation exposure requirements.

For a 1-g head or body SAR, the test exclusion result must be ≤ 3.0 .

For a 10-g extremity SAR, the test exclusion result must be ≤ 7.5 .

Test Notes: The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by the following formula:

$$\text{SAR Test Exclusion} = \frac{P_{\text{MAX}}}{d_{\text{MIN}}} \times \sqrt{f_{(\text{GHz})}} \quad (1)$$

P_{MAX} mW Maximum power of channel, including tune-up tolerance

d_{MIN} mm Minimum test separation distance, mm (≤ 50 mm)

$f_{(\text{GHz})}$ GHz $f_{(\text{GHz})}$ is the RF channel transmit frequency in GHz (>100 MHz and <6 GHz)

(1) FCC OET 447498 - Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

Results: Passed - The device under test meets the exclusion requirement detailed in FCC OET 447498.

802.11b	Channel:	1	6	11	
	Input¹:	P_{MAX}	10	11	10 mW
		d_{MIN}^2	5.00	5.00	5.00 mm
		$f_{(\text{GHz})}$	2.412	2.437	2.462 GHz
	Test Exclusion:	3.3	3.4	3.06	
	Limit Exemption:	7.5	7.5	7.5	
	Measurement Result:	Compliant	Compliant	Compliant	

¹ Taken from column 3 of the 802.11b table in Section 7.3 of this test report.

² When the minimum test separation distance is < 5 mm, a distance of 5 mm according to KDB 447498, 4.1 f) is applied to determine SAR test exclusion.

802.11g	Channel:	1	6	11	
	Input¹:	P_{MAX}	1	6	11 mW
		d_{MIN}^2	15	14	13 mm
		$f_{(\text{GHz})}$	5.00	5.00	5.00 GHz
	Test Exclusion:	4.6	4.4	4.1	
	Limit Exemption:	7.5	7.5	7.5	
	Measurement Result:	Compliant	Compliant	Compliant	

¹ Taken from column 3 of the 802.11g table in Section 7.3 of this test report.

² When the minimum test separation distance is < 5 mm, a distance of 5 mm according to KDB 447498, 4.1 f) is applied to determine SAR test exclusion.

7. Measurement Data (continued)
**7.11. Public Exposure to Radio Frequency Energy Levels (15.247(i) (1.1307 (b)(1))
RSS-GEN, ISSUE 4 5.5, RSS 102) (continued)**
7.12.1. 15.247(i) (1.1307 (b)(1) Requirements (continued)

802.11n	Channel:	1	6	11	
	Input¹:				
	P_{MAX}	15	13	13	mW
	d_{MIN}^2	5.00	5.00	5.00	mm
	$f_{(GHz)}$	2.412	2.437	2.462	GHz
	Test Exclusion:	4.6	4.1	4.0	
	Limit Exemption:	7.5	7.5	7.5	
	Measurement Result:	Compliant	Compliant	Compliant	

¹ Taken from column 3 of the 802.11n table in Section 7.3 of this test report.

² When the minimum test separation distance is < 5 mm, a distance of 5 mm according to KDB 447498, 4.1 f) is applied to determine SAR test exclusion.

7.11.2. RSS-102 Issue 5 Requirements

Requirement: SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1. Portable devices are subject to radio frequency radiation exposure requirements.

Test Notes: The limit was taken from Table 1 of RSS-102 Issue 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5.

Results: Failed - The device under test meets the exclusion requirement detailed in FCC OET 447498. The did not meet the RSS-102 Issue 5 requirements and will require testing in accordance with Industry Canada Spectrum Management and Telecommunications: Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

802.11b	Frequency	Separation Distance	Maximum Power	RSS-102 Limit	Result
	MHz	mm	mW	mW	
	2412	≤5	10.50	10.52	Compliant
	2437	≤5	10.81	10.18	SAR Required
	2462	≤5	9.75	9.94	Compliant

7. Measurement Data (continued)

7.11. Public Exposure to Radio Frequency Energy Levels (15.247(i) (1.1307 (b)(1))
RSS-GEN, ISSUE 4 5.5, RSS 102) (continued)

7.11.2. RSS-102 Issue 5 Requirements

802.11g	Frequency	Separation Distance	Maximum Power	RSS-102 Limit	Result
	MHz	mm	mW	mW	
	2412	≤5	14.89	10.52	SAR Required
	2437	≤5	13.96	10.18	SAR Required
	2462	≤5	13.12	9.94	SAR Required

802.11n	Frequency	Separation Distance	Maximum Power	RSS-102 Limit	Result
	MHz	mm	mW	mW	
	2412	≤5	14.69	10.52	SAR Required
	2437	≤5	13.12	10.18	SAR Required
	2462	≤5	12.71	9.94	SAR Required

8. Test Setup Photographs

8.1. Conducted Mode Measurements



8. Test Setup Photographs

8.2. Spurious Radiated Emissions, 10 kHz to 1 GHz – Front



8. Test Setup Photographs

8.3. Spurious Radiated Emissions, 10 kHz to 30 MHz – Rear



8. Test Setup Photographs

8.4. Spurious Radiated Emissions, 30 MHz to 1 GHz – Rear



8. Test Setup Photographs

8.5. Radiated Emissions above 1 GHz – Front



8. Test Setup Photographs

8.6. Radiated Emissions 1 to 18 GHz – Rear



8. Test Setup Photographs

8.7. Harmonic Radiated Emissions above 18 GHz– Rear



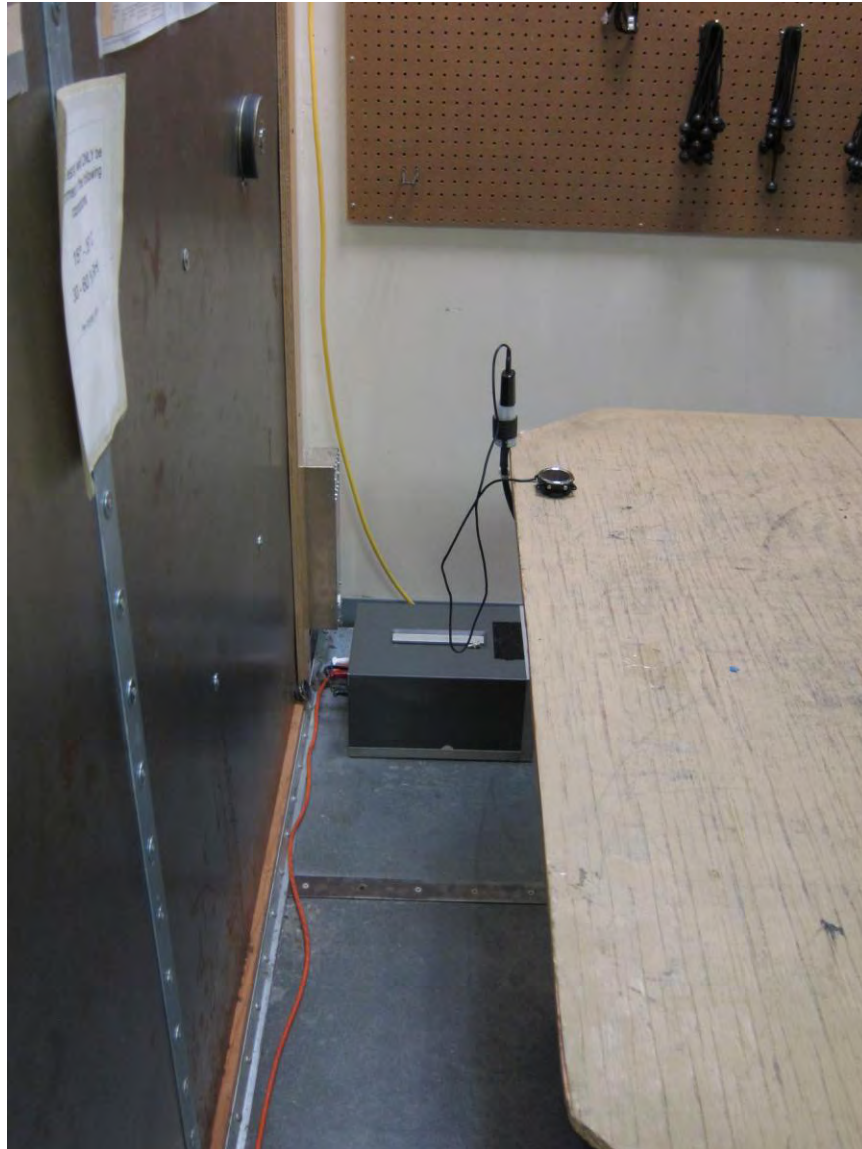
8. Test Setup Photographs

8.8. Power Line Conducted Emissions – Front



8. Test Setup Photographs

8.9. Power Line Conducted Emissions – Rear



9. Test Site Description

Compliance Worldwide is located at 357 Main Street in Sandown, New Hampshire. The test sites at Compliance Worldwide are used for conducted and radiated emissions testing in accordance with the Federal Communications Commission (FCC) and Industry Canada standards. Through our American Association for Laboratory Accreditation (A2LA) ISO Guide 17025:2005 Accreditation our test sites are designated with the FCC (designation number **US1091**), Industry Canada (file number **IC 3023A-1**) and VCCI (Member number 3168) under registration number A-0208.

Compliance Worldwide is also designated as a Phase 1 CAB under APEC-MRA (US0132) for Australia/New Zealand AS/NZS CISPR 22, Chinese-Taipei (Taiwan) BSMI CNS 13438 and Korea (RRA) KN 11, KN 13, KN 14-1, KN 22, KN 32, KN 61000-6-3, KN 61000-6-4.

The radiated emissions test site is a 3 and 10 meter enclosed open area test site (OATS). Personnel, support equipment and test equipment are located in the basement beneath the OATS ground plane.

The conducted emissions site is part of a 16' x 20' x 12' ferrite tile chamber and uses one of the walls for the vertical ground plane required by EN 55022. A second conducted emissions site is also located in the basement of the OATS site with a 2.3 x 2.5 meter ground plane and a 2.4 x 2.4 meter vertical wall.

Both sites are designed to test products or systems 1.5 meters W x 1.5 meters L x 2.0 meters H, floor standing or table top.

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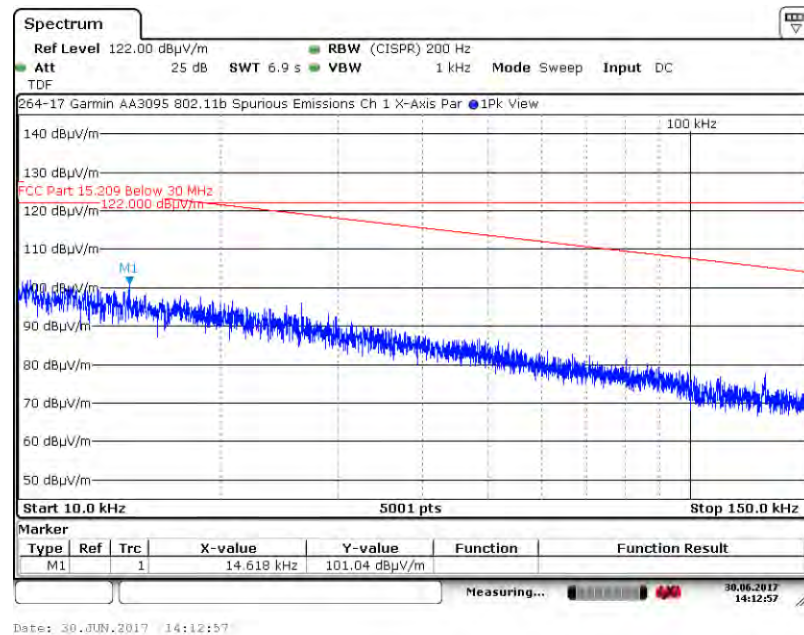
Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

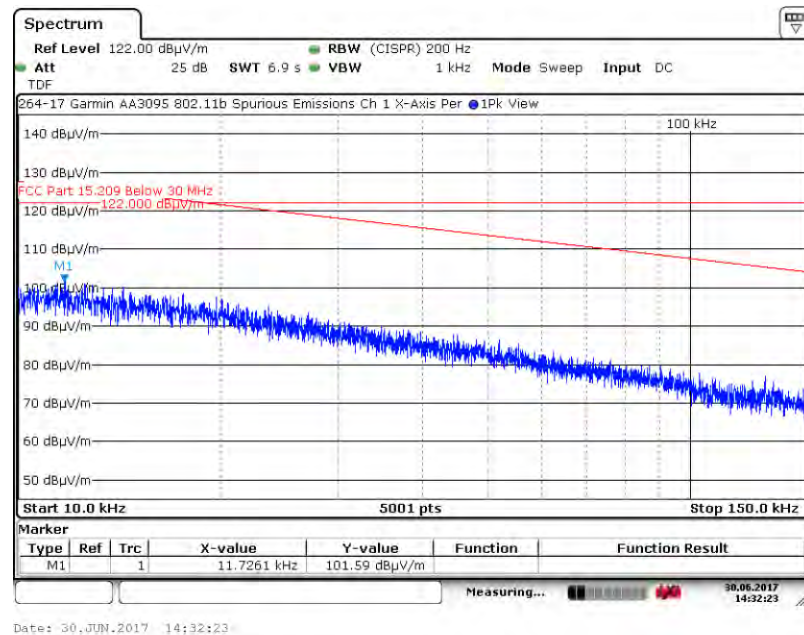
A1.1. 802.11b

A.1.1.1. Channel 1, 2412 MHz

A1.1.1.1. Measurement Results: X-Axis, Parallel Antenna



A1.1.1.2. Measurement Results: X-Axis, Perpendicular Antenna



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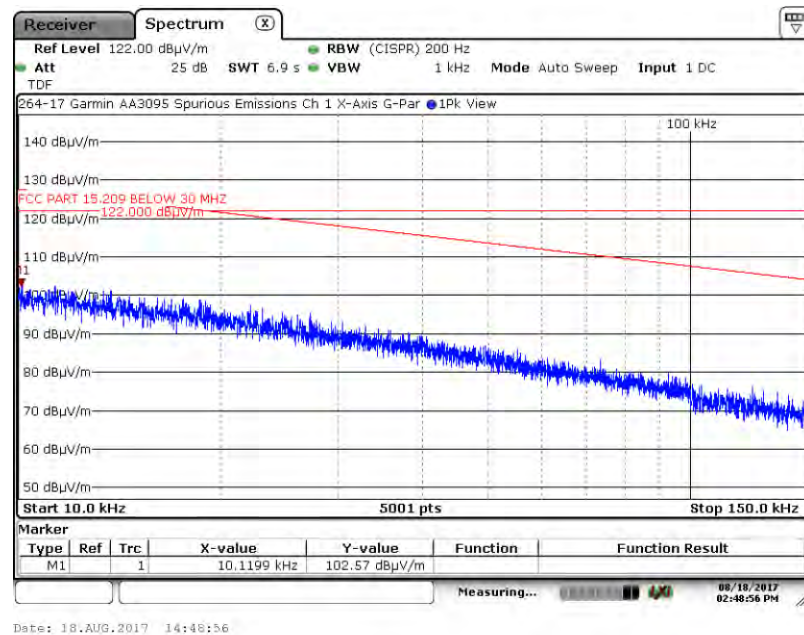
Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

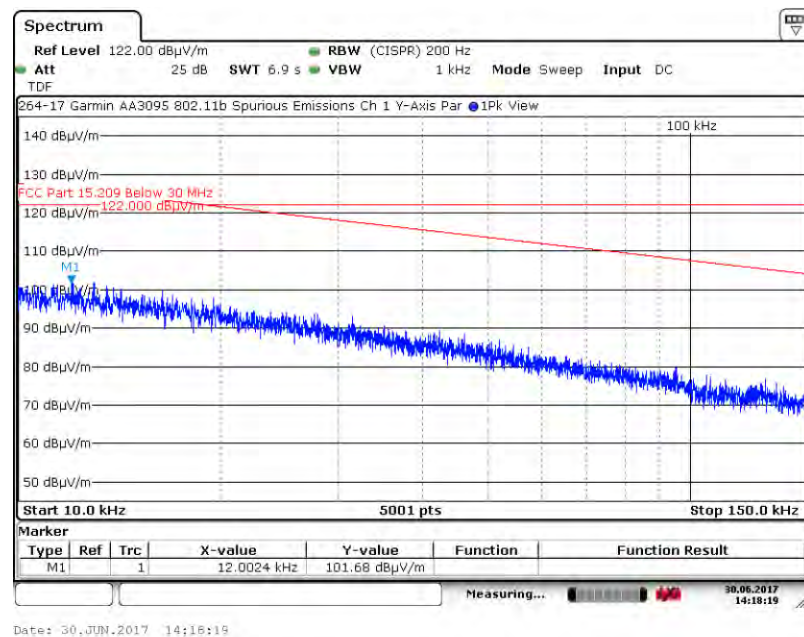
A1.1. 802.11b

A1.1.1. Channel 1, 2412 MHz

A1.1.1.3. Measurement Results: X-Axis, Ground-Parallel Antenna



A1.1.1.4. Measurement Results: Y-Axis, Parallel Antenna



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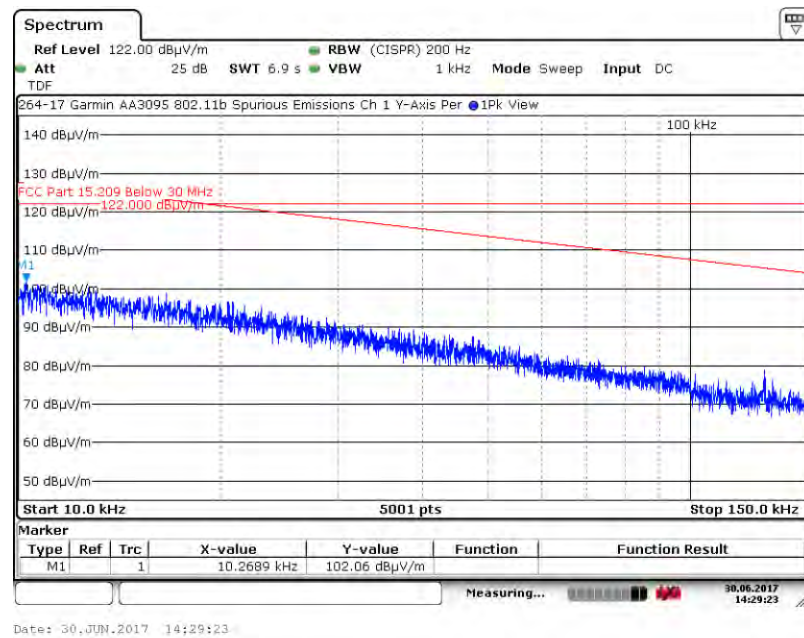
Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

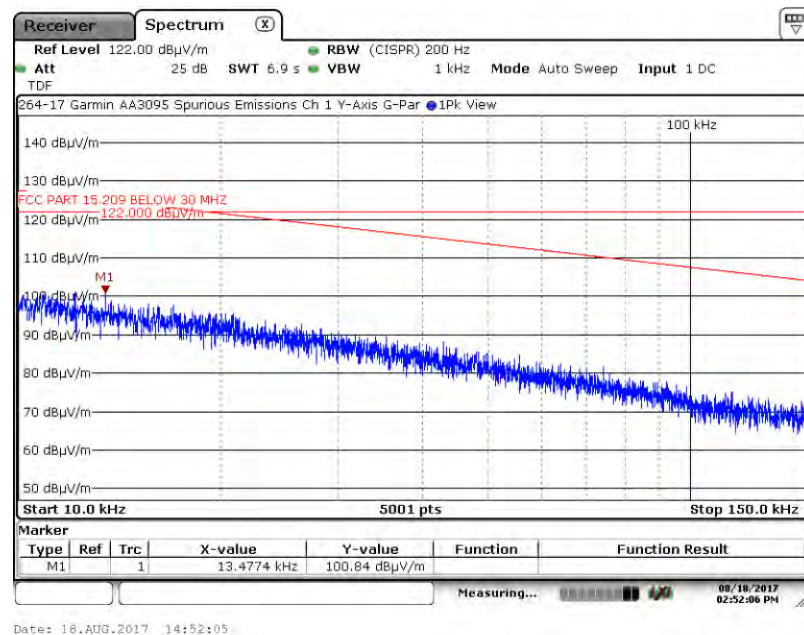
A1.1. 802.11b

A1.1.1. Channel 1, 2412 MHz

A1.1.1.5. Measurement Results: Y-Axis, Perpendicular Antenna



A1.1.1.6. Measurement Results: Y-Axis, Ground Parallel Antenna



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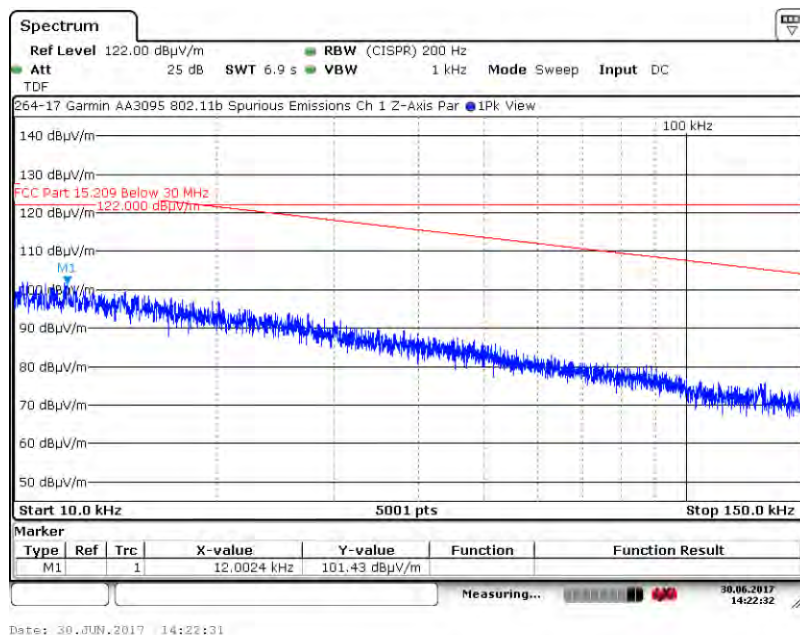
Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

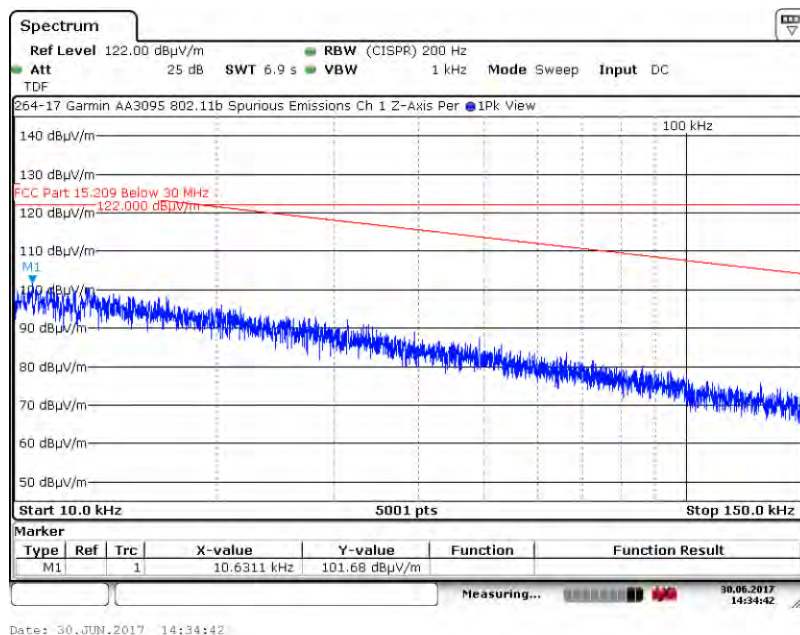
A1.1. 802.11b

A.1.1.1. Channel 1, 2412 MHz

A1.1.1.7. Measurement Results: Z-Axis, Parallel Antenna



A1.1.1.8. Measurement Results: Z-Axis, Perpendicular Antenna



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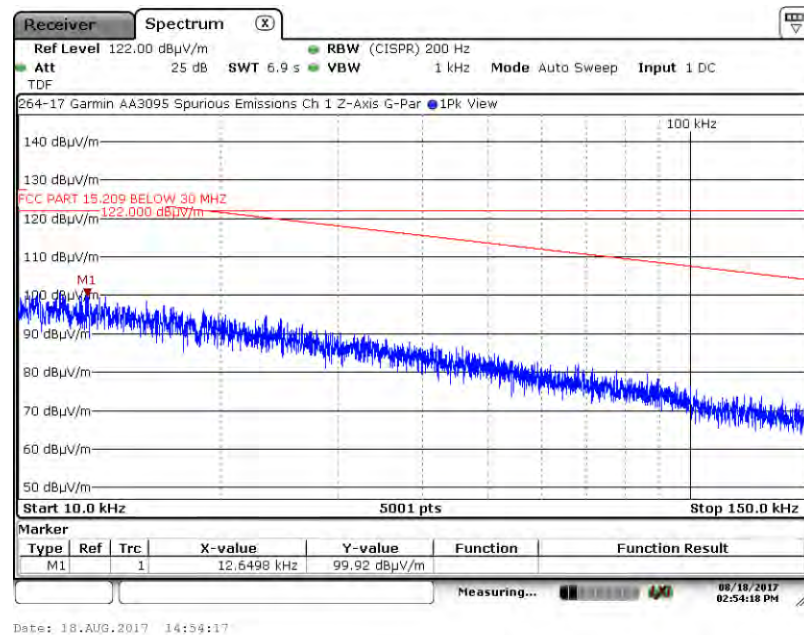
Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

A1.1. 802.11b

A.1.1.1. Channel 1, 2412 MHz

A1.1.1.9. Measurement Results: Z-Axis, Ground-Parallel Antenna



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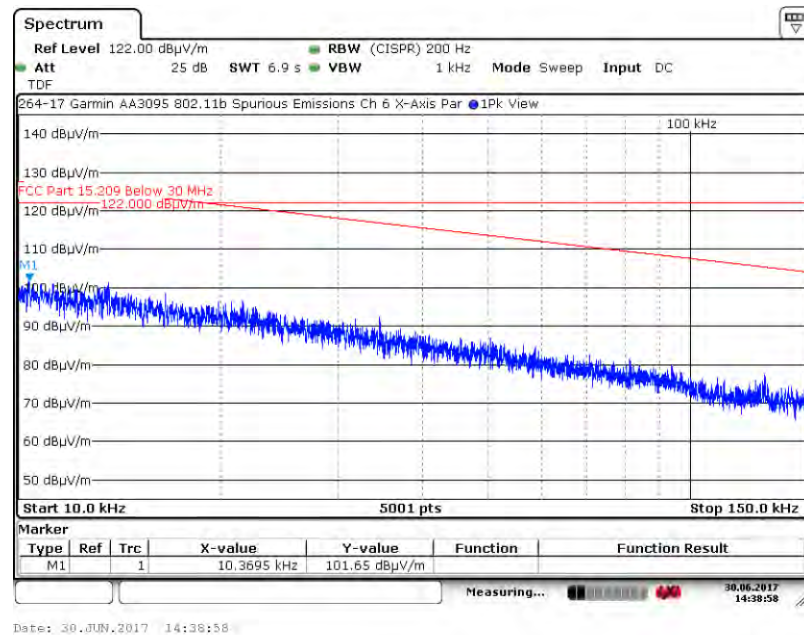
Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

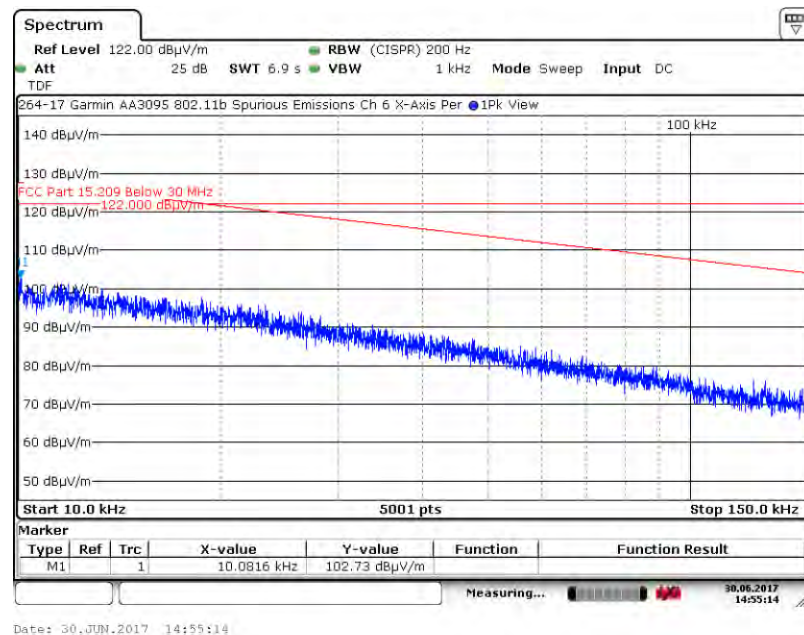
A1.1. 802.11b

A.1.1.2. Channel 6, 2437 MHz

A1.1.2.1. Measurement Results: X-Axis, Parallel Antenna



A1.1.2.2. Measurement Results: X-Axis, Perpendicular Antenna



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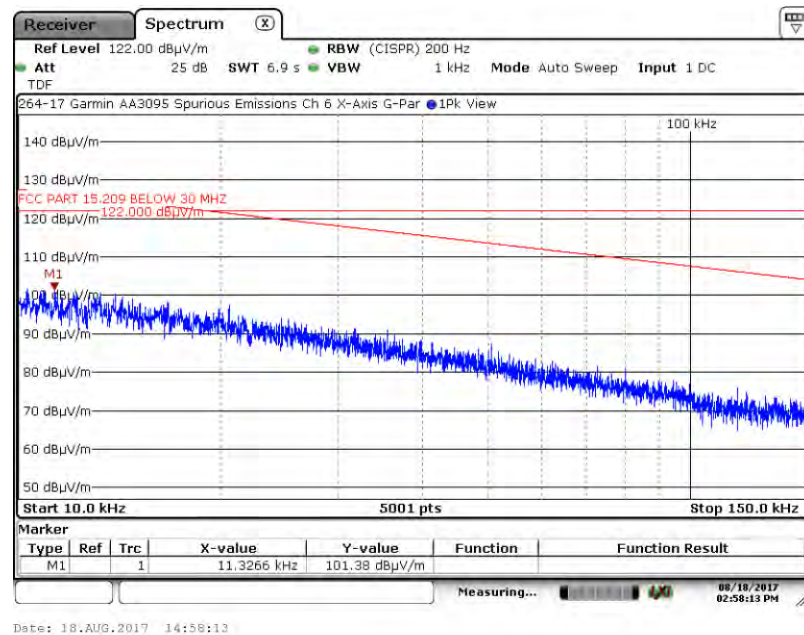
Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

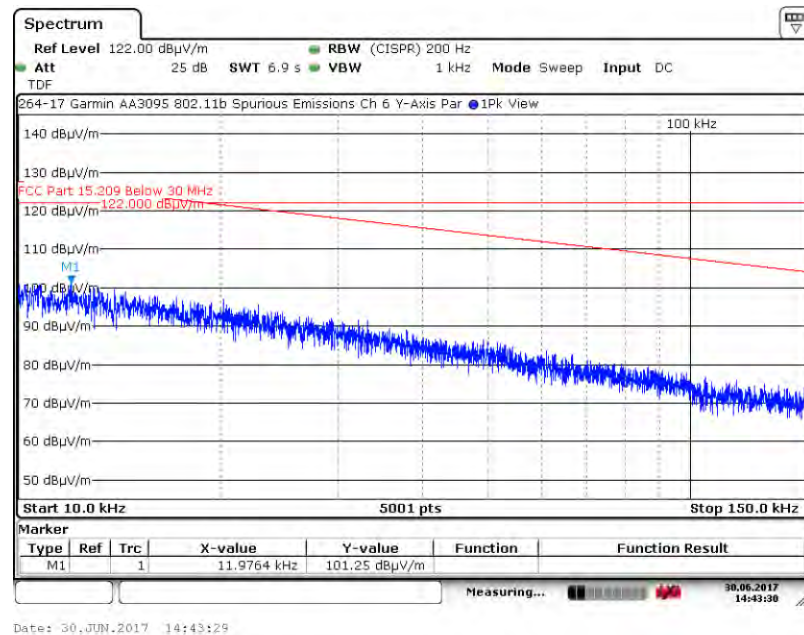
A1.1. 802.11b

A1.1.1.2. Channel 6, 2437 MHz

A1.1.2.3. Measurement Results: X-Axis, Ground-Parallel Antenna



A1.1.2.4. Measurement Results: Y-Axis, Parallel Antenna



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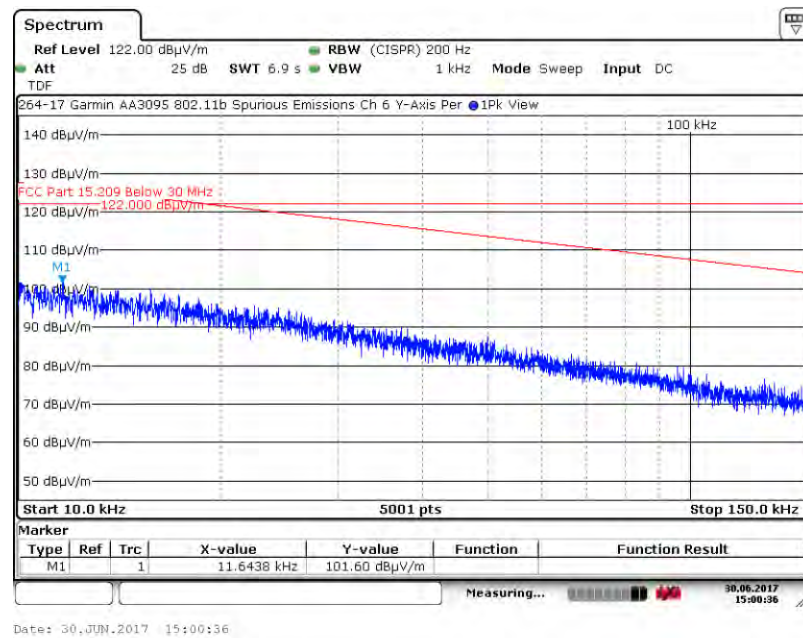
Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

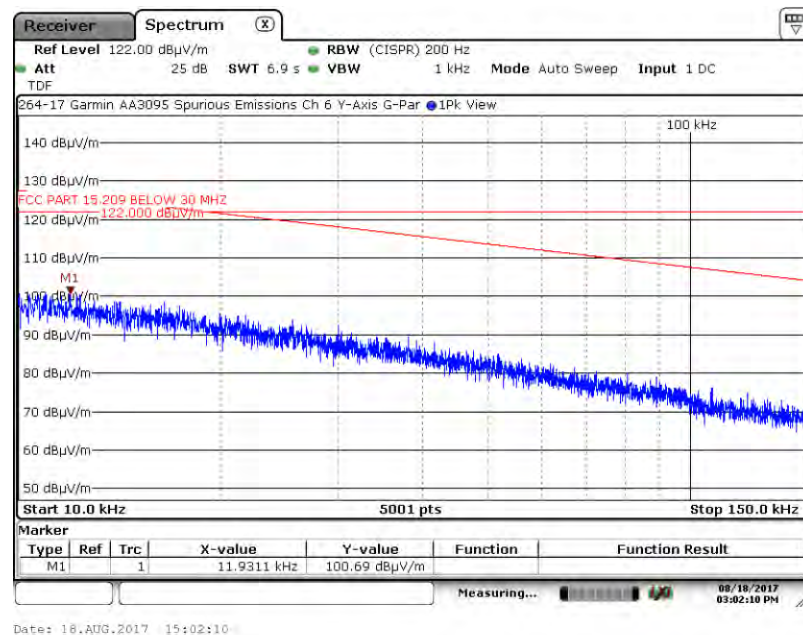
A1.1. 802.11b

A1.1.1.2. Channel 6, 2437 MHz

A1.1.2.5. Measurement Results: Y-Axis, Perpendicular Antenna



A1.1.2.6. Measurement Results: Y-Axis, Ground-Parallel Antenna



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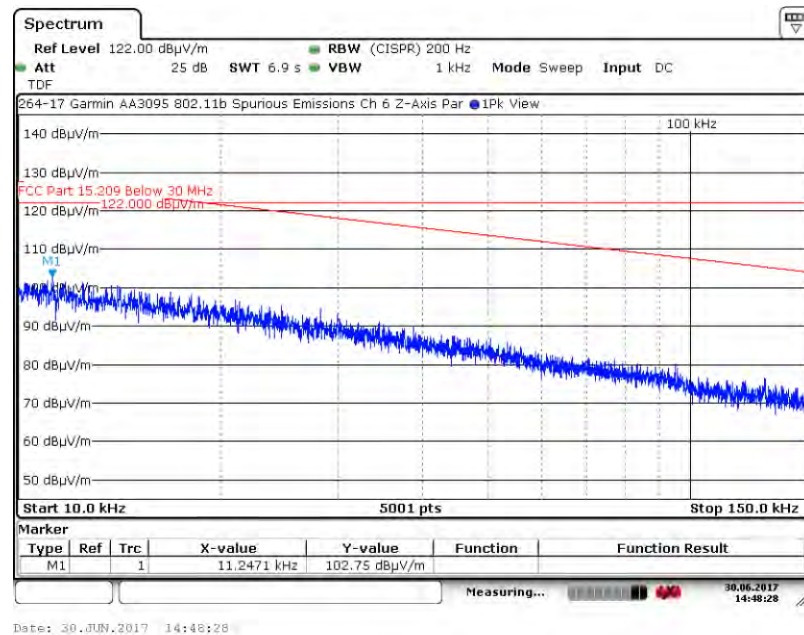
Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

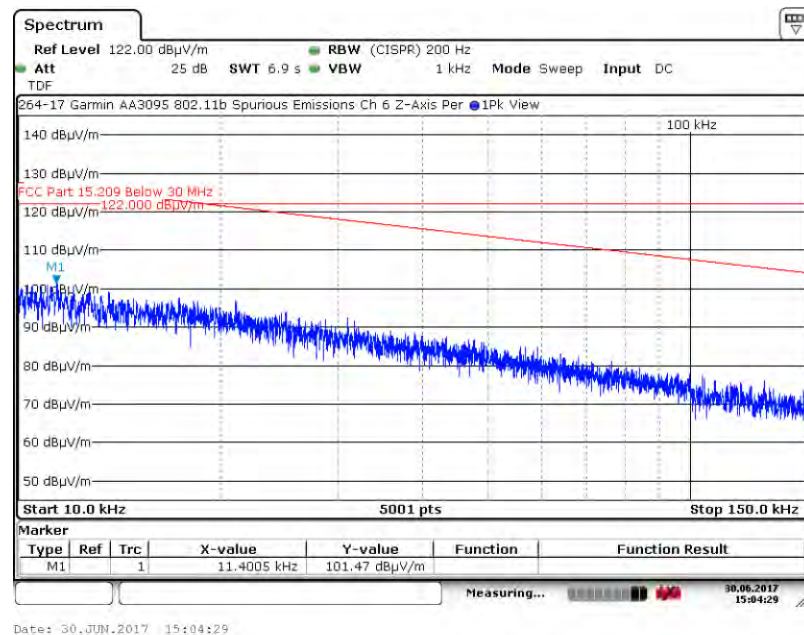
A1.1. 802.11b

A1.1.1.2. Channel 6, 2437 MHz

A1.1.2.7. Measurement Results: Z-Axis, Parallel Antenna



A1.1.2.8. Measurement Results: Z-Axis, Perpendicular Antenna



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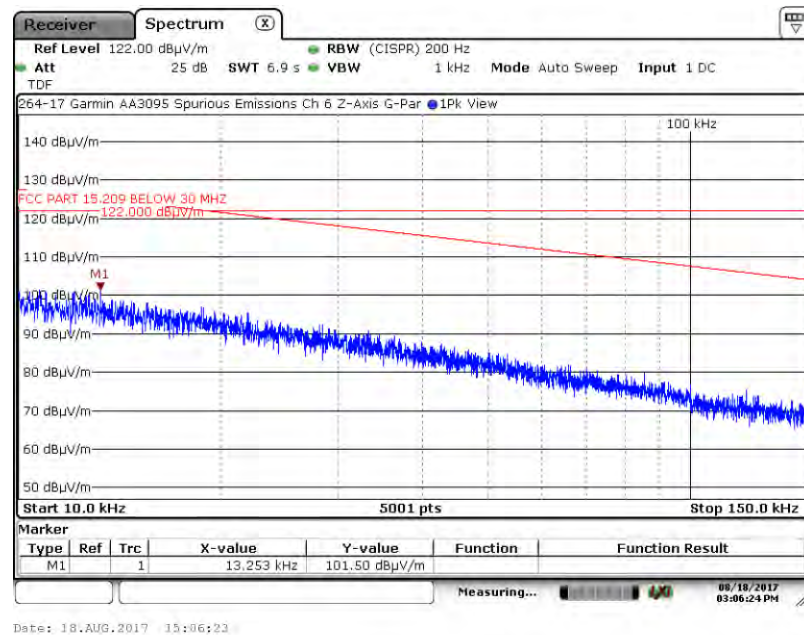
Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

A1.1. 802.11b

A.1.1.2. Channel 6, 2437 MHz

A1.1.2.9. Measurement Results: Z-Axis, Ground-Parallel Antenna



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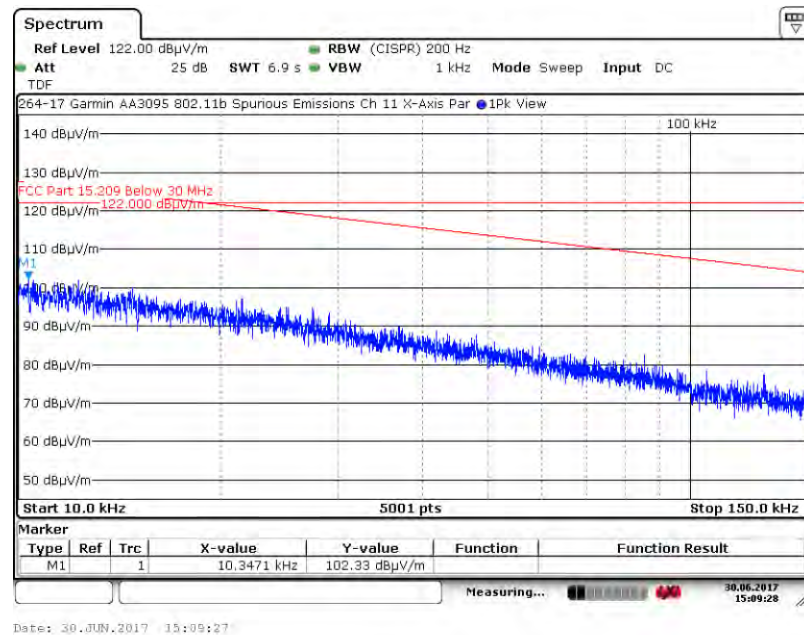
Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

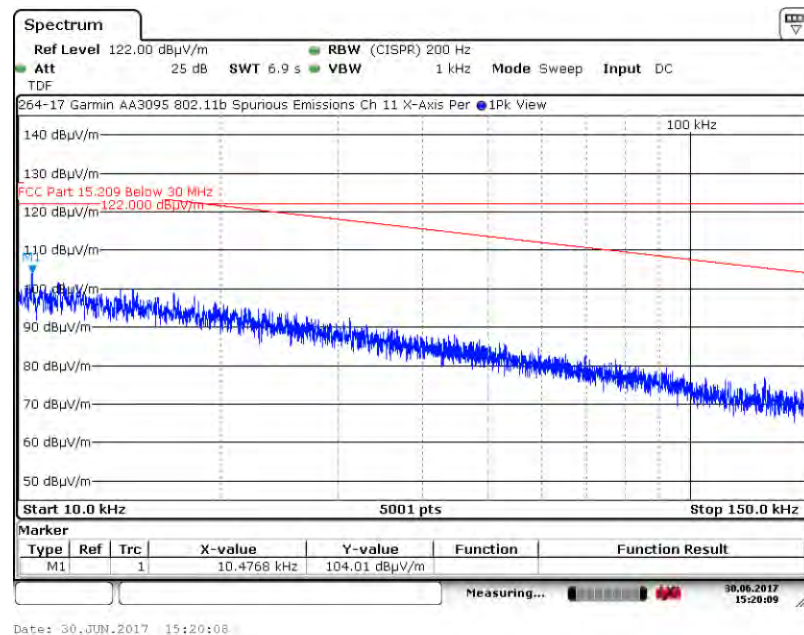
A1.1. 802.11b

A.1.1.3. Channel 11, 2462 MHz

A1.1.3.1. Measurement Results: X-Axis, Parallel Antenna



A1.1.3.2. Measurement Results: X-Axis, Perpendicular Antenna



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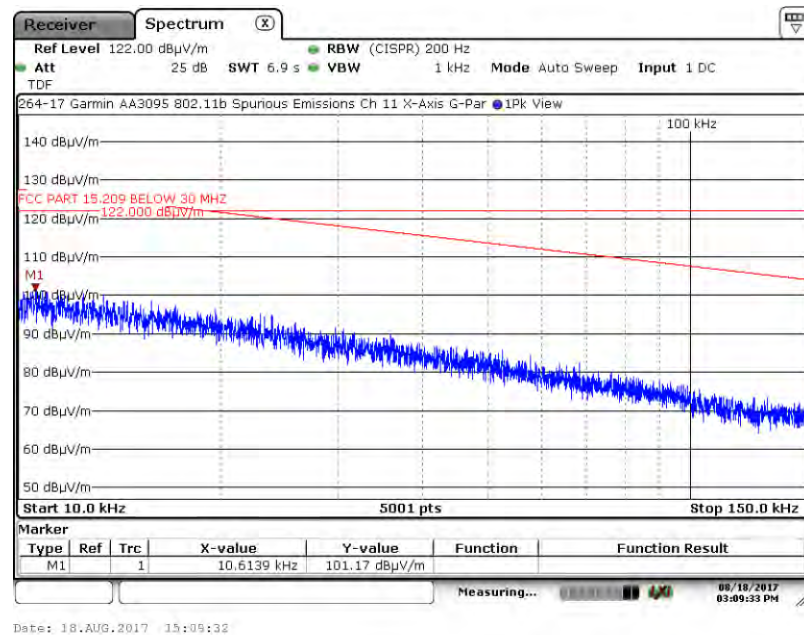
Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

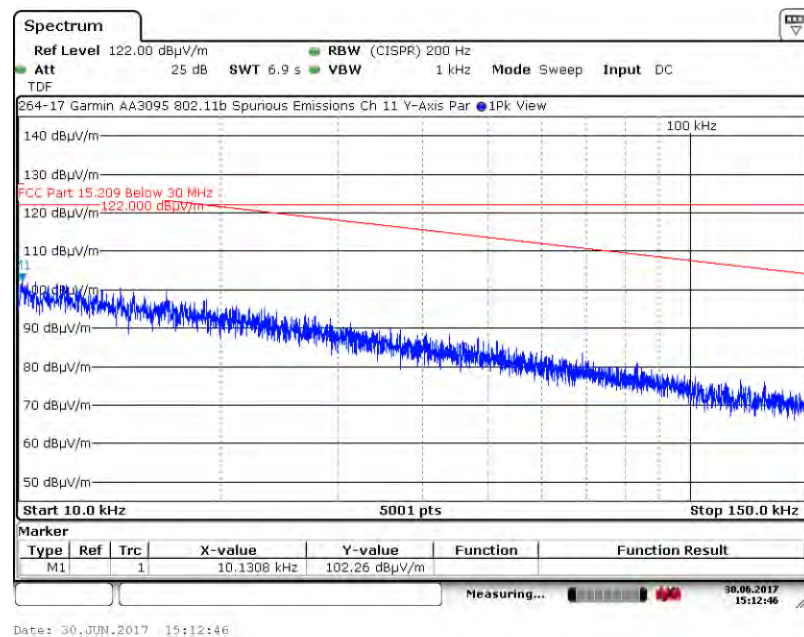
A1.1. 802.11b

A1.1.1.3. Channel 11, 2462 MHz

A1.1.3.3. Measurement Results: X-Axis, Ground-Parallel Antenna



A1.1.3.4. Measurement Results: Y-Axis, Parallel Antenna



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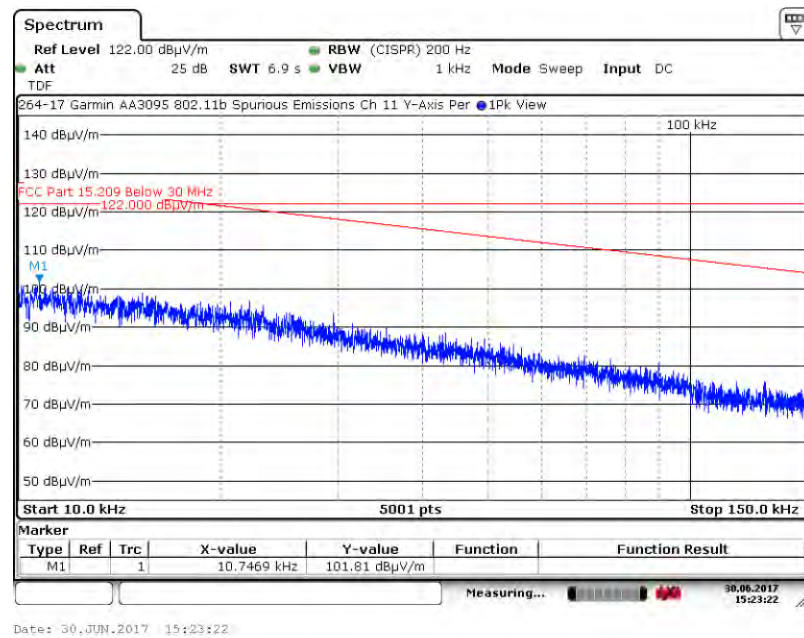
Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

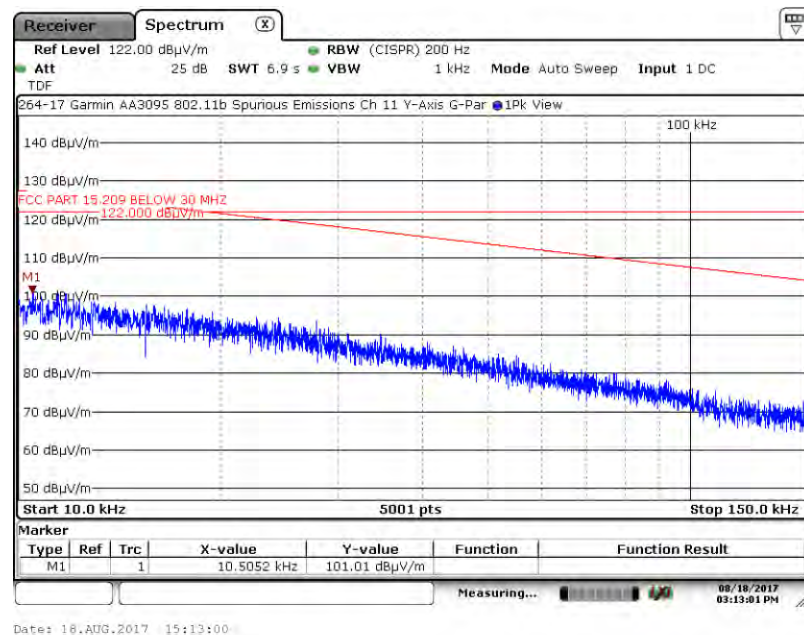
A1.1. 802.11b

A1.1.1.3. Channel 11, 2462 MHz

A1.1.3.5. Measurement Results: Y-Axis, Perpendicular Antenna



A1.1.3.6. Measurement Results: Y-Axis, Ground-Parallel Antenna



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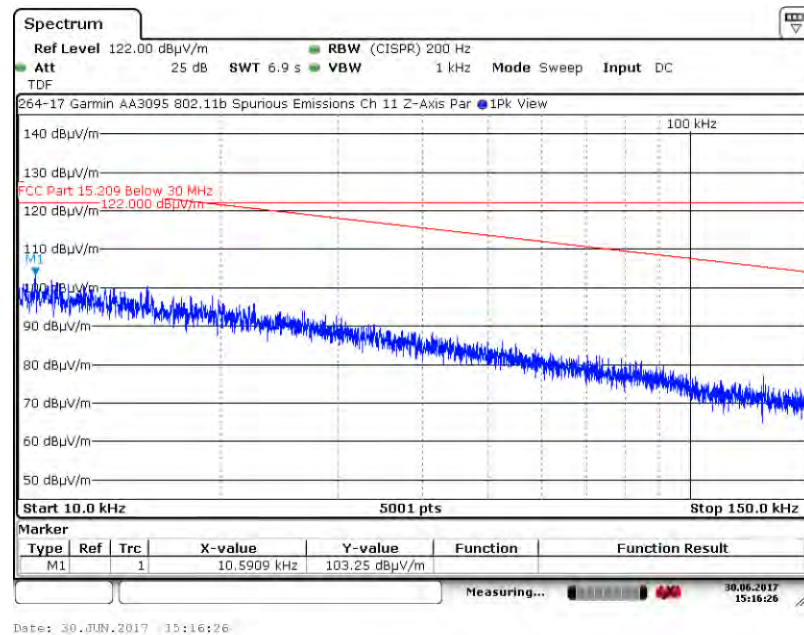
Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

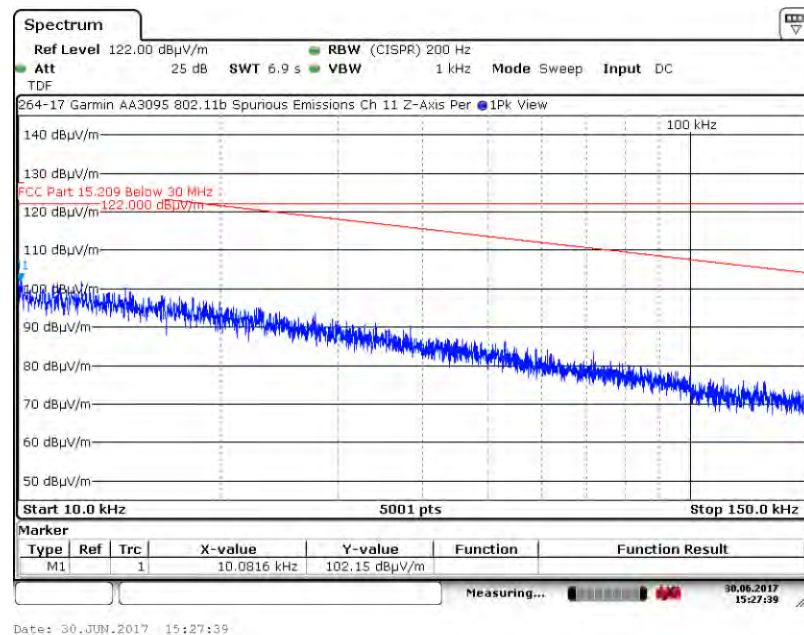
A1.1. 802.11b

A1.1.1.3. Channel 11, 2462 MHz

A1.1.3.7. Measurement Results: Z-Axis, Parallel Antenna



A1.1.3.8. Measurement Results: Z-Axis, Perpendicular Antenna



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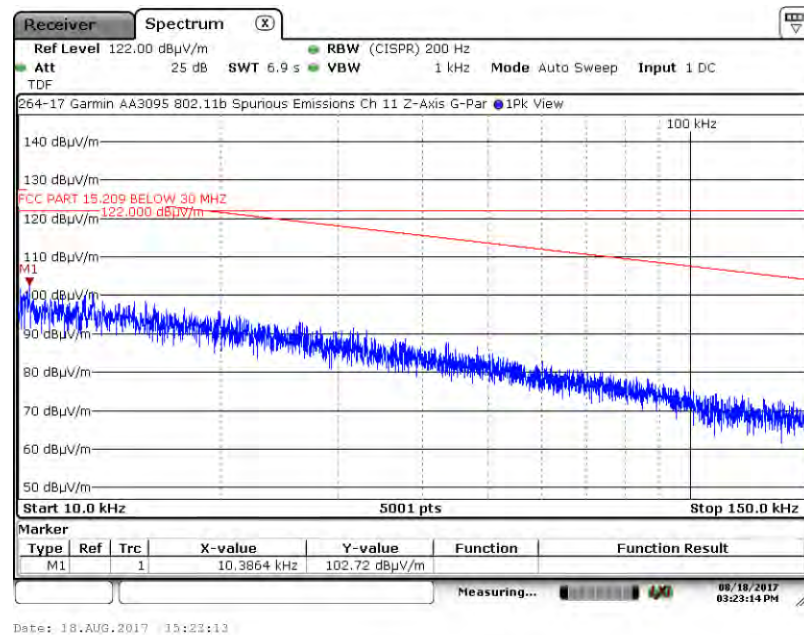
Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

A1.1. 802.11b

A1.1.1.3. Channel 11, 2462 MHz

A1.1.3.9. Measurement Results: Z-Axis, Ground-Parallel Antenna



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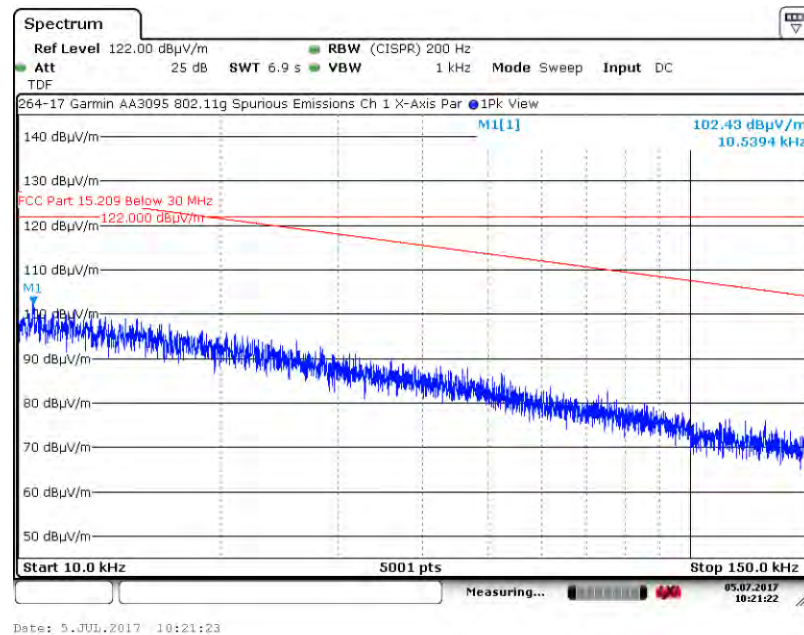
Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

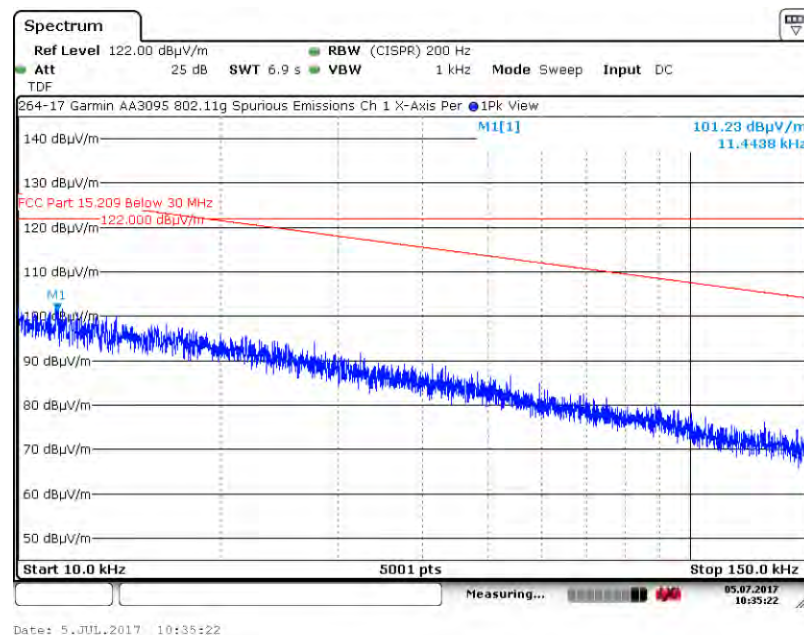
A1.2. 802.11g

A1.2.1. Channel 1, 2412 MHz

A1.2.1.1. Measurement Results: X-Axis, Parallel Antenna



A1.2.1.2. Measurement Results: X-Axis, Perpendicular Antenna



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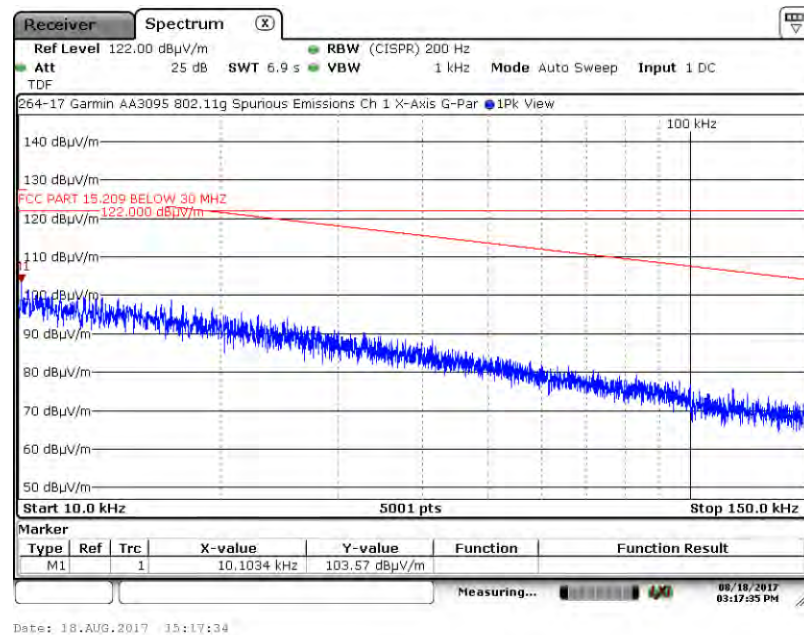
Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

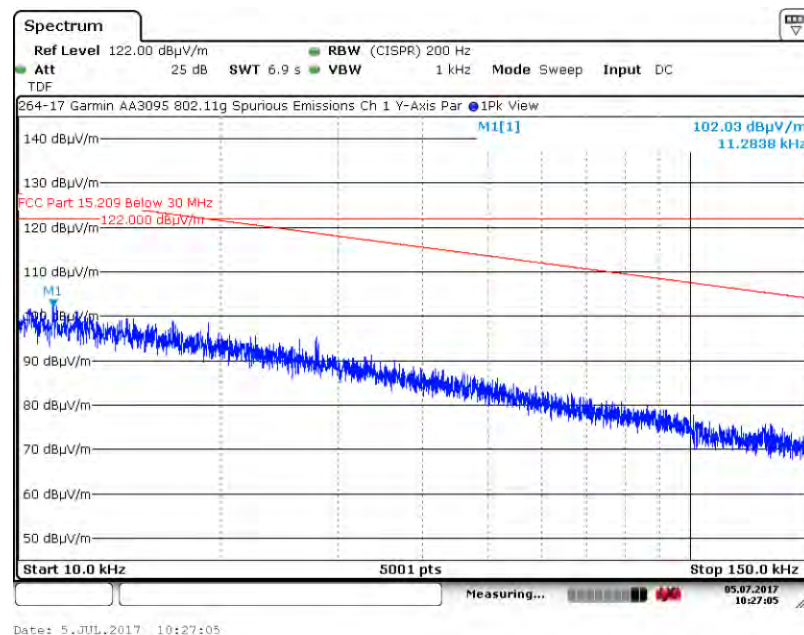
A1.2. 802.11g

A1.2.1. Channel 1, 2413 MHz

A1.2.1.3. Measurement Results: X-Axis, Ground-Parallel Antenna



A1.2.1.4. Measurement Results: Y-Axis, Parallel Antenna



Test Number: 264-17

Issue Date: 7/21/2017

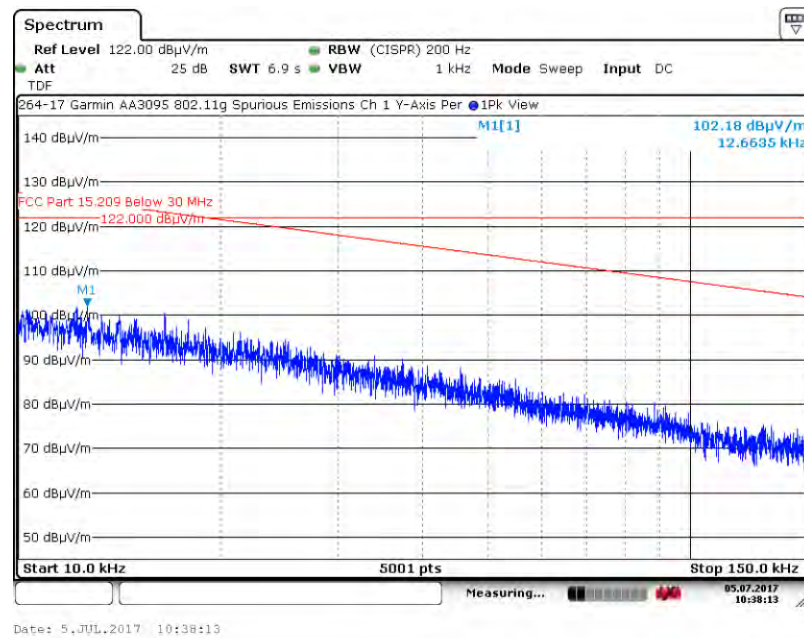
Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

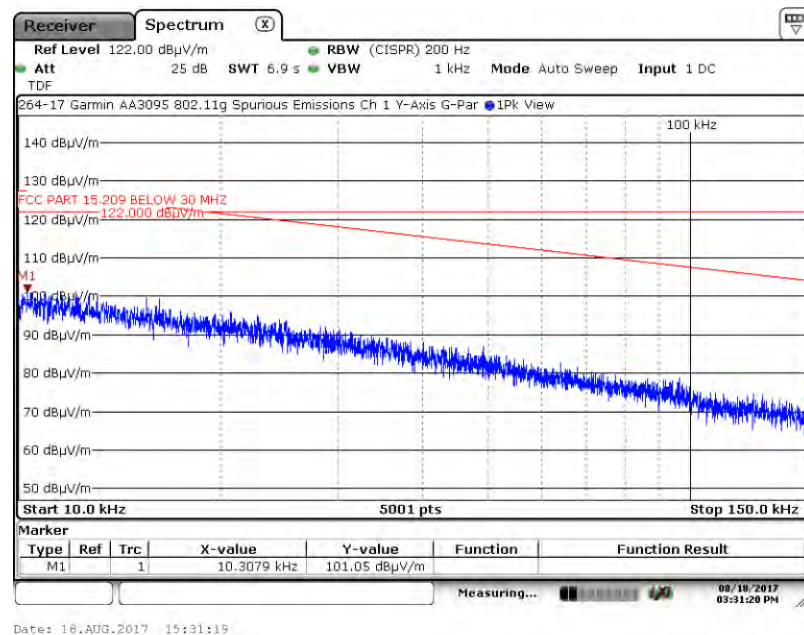
A1.2. 802.11g

A1.2.1. Channel 1, 2413 MHz

A1.2.1.5. Measurement Results: Y-Axis, Perpendicular Antenna



A1.2.1.6. Measurement Results: Y-Axis, Ground-Parallel Antenna



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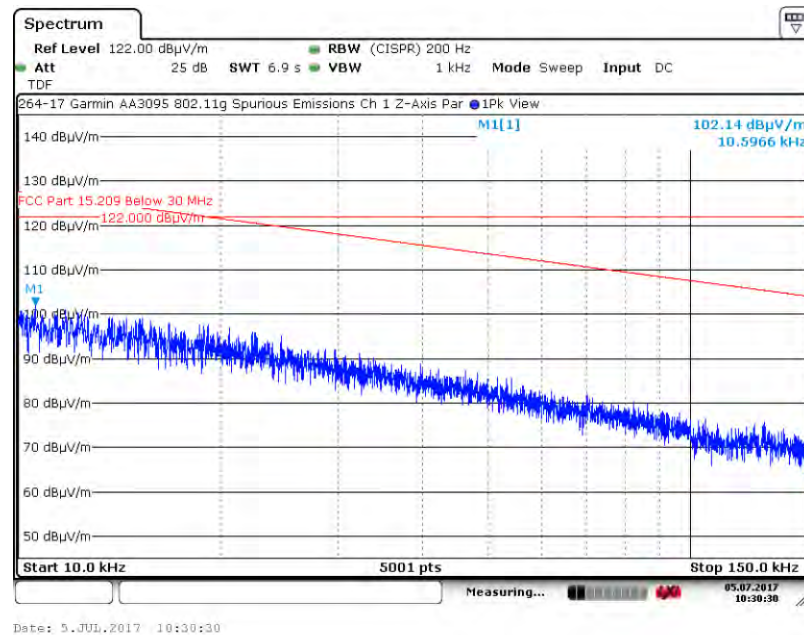
Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

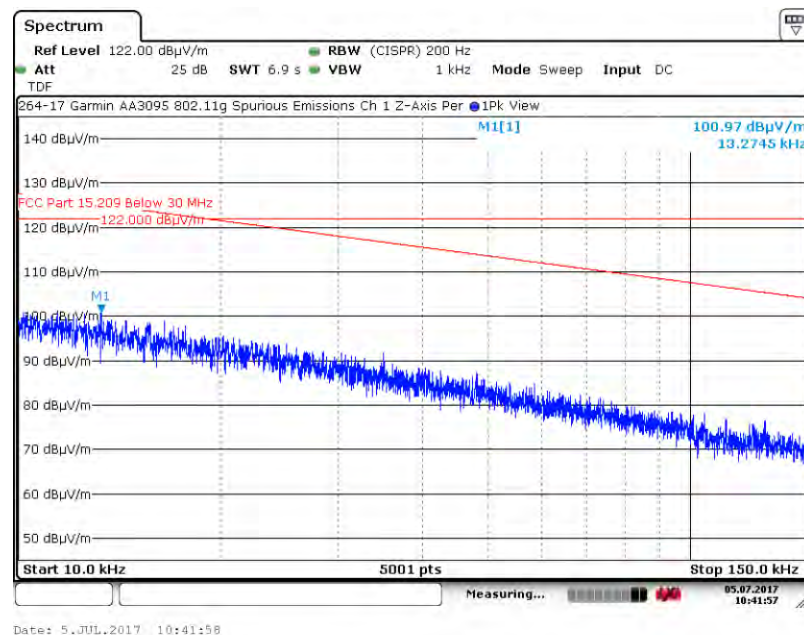
A1.2. 802.11g

A1.2.1. Channel 1, 2412 MHz

A1.2.1.7. Measurement Results: Z-Axis, Parallel Antenna



A1.2.1.8. Measurement Results: Z-Axis, Perpendicular Antenna



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Appendix A - Transmitter Spurious Radiated Emissions (10 kHz to 25 GHz)

A1. Spurious Radiated Emissions (10 kHz – 150 kHz) Test Results

A1.2. 802.11g

A.1.2.1. Channel 1, 2412 MHz

A1.2.1.9. Measurement Results: Z-Axis, Ground-Parallel Antenna

