

RF Test Report

Project Number: 4451806

Report Number: 4451806EMC03

Revision Level: 0

Client: 3Si Security Systems Inc.

Equipment Under Test: Wireless Tracking Device

Model Number: AT170503US

FCC ID: Q6KAT170503A

IC ID: 5043A-AT170503A

Applicable Standards: FCC Part 15 Subpart C, § 15.247

RSS-247, Issue 2

ANSI C63.10: 2013

RSS-GEN, Issue 5

Report issued on: 13 May 2019

Test Result: Compliant

Tested by:


Shawn McGuinness, EMC Engineering Leader

Reviewed by:


Martin Taylor, RF/EMC Engineer

Remarks: This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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1 Summary of Test Results

Test Description	Test Specification		Test Result
Bandwidth	15.247(d)	RSS-247 S5.2 (1) RSS-GEN S6.6	NIS(2)
Transmitter Output Power	15.247(b)(3)	RSS-247 S5.4 (4)	NIS(2)
Power Spectral Density	15.247(e)	RSS-247 S5.2 (2)	NIS(2)
Conducted Spurious Emissions / Band edge	15.247(d)	RSS-247 S5.5	NIS(2)
Radiated Spurious Emissions / Restricted Bands	15.35(b), 15.209	RSS-GEN S6.13 RSS-GEN S8.10	Compliant
Antenna Requirement	15.203	RSS-GEN S8.3	Compliant (1)
AC Powerline Conducted Emission	15.107, 15.207	RSS-GEN S8.8	Compliant

(1) PCB trace antenna.

(2) Not in the Scope of this evaluation. Per class 2 permissive change, only RSE measurements taken.

1.1 Modifications Required for Compliance

None

2 General Information

2.1 Client Information

Name: 3Si Security Systems Inc.
Address: 101 Lindenwood Drive Suite 200
City, State, Zip, Country: Malvern, PA 19355 USA

2.2 Test Laboratory

Name: SGS North America, Inc.
Address: 620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country: Suwanee, GA 30024, USA

Accrediting Body: A2LA
Type of lab: Testing Laboratory
Certificate Number: 3212.01

2.3 General Information of EUT

Type of Product: Wireless Tracking Device
Model Number: AT170503US
FCC ID: Q6KAT170503A
IC: 5043A-AT170503A
IMEI: 352753092914371
FW Ver: 13.1.36072

Transmit Frequency: 2412 – 2462MHz, WLAN Channels 1-11, 802.11b/g/n(HT20)
Antenna: Trace Antenna

Rated Voltage: 3.7Vdc Battery/DC In
Tested Voltage: 3.7Vdc DC In
AC Power In: 120VAC/60Hz, 1.2A

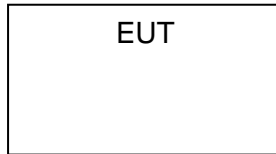
Sample Received Date: 29 April 2019
Dates of testing: 29 April to 1 May 2019

2.4 Operating Modes and Conditions

For spurious emissions measurements, only the worst-case mode with respect to peak power was investigated: 802.11b, 1Mbps. Investigations covered the low, middle, and high channels in the 2400-2483.5MHz band.

Continuous traffic was generated using test commands. Where the duty cycle measured below 99% and an RMS detector was employed, corrections of $10 \cdot \text{LOG}(1/D)$ were applied according to KDB publication 558074 D01 15.247 Meas Guidance v05r02.

2.5 EUT Connection Block Diagram – Radiated Measurements



2.6 System Configurations

Device reference	Manufacturer	Description	Model Number	Prototype ID
A	3Si Security	Wireless Tracking Device	AT170503US	PROTO-1U
B	Rigol	DC Power Supply	DP711	DP7A182700833

2.7 Cable List

Cable reference	Port Name	Start	End	Cable Length (m)	Ferrite installed?	Shielded?
None						

3 Field Strength of Spurious Radiation

3.1 Test Result

Test Description	Test Specification		Test Result
Spurious Emissions	15.247 (d) and 15.209	RSS-247 S5.5	Compliant

3.2 Test Method

Radiated spurious emissions measurements were recorded with the device configured to transmit at the lowest, middle, and highest channels. The frequency range investigated was up through the 10th harmonic of the fundamental transmit frequency. The methods defined in ANSI C63.10: 2013 were used.

Lowest, middle, and highest channels were investigated. Only the worst-case (802.11b, 1Mbps) was reported.

Test distance:

- 9k to 30 MHz – Near field prescan to determine if there were any emissions.
- 30 to 1000 MHz - The EUT to measurement antenna distance was 10 meters
- 1 to 18 GHz - The EUT to measurement antenna distance was 3 meters
- 18 to 26 GHz - The EUT to measurement antenna distance was 1 meter

Limits within restricted bands of operation:

Frequency	Limits ⁽¹⁾		Peak Limits dBuV/m
	Microvolts/m	dBuV/m	
30 - 88 MHz	100	40 ⁽²⁾	--
88 - 216 MHz	150	43.5 ⁽²⁾	--
216 - 960 MHz	200	46 ⁽²⁾	--
960 - 1000 MHz	500	54 ⁽²⁾	--
1 - 40 GHz	500	54 ⁽³⁾	74

(1) These limits are applicable to emissions outside of the intentional transmit frequency band.

(2) Quasi-peak limit

(3) Average limit

3.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.3 °C

Relative Humidity: 42.7 %

3.4 Test Equipment

Test End Date: 1-May-2019

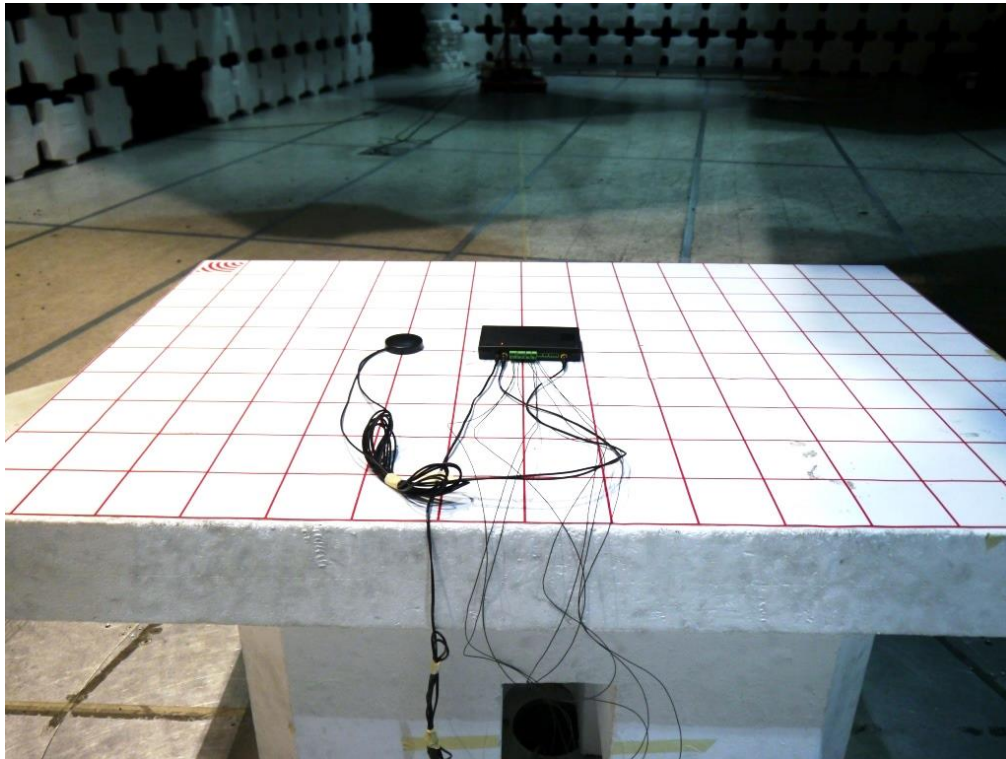
Tester: SKM

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	2-Jul-2019
ANTENNA, BILOG	JB6	SUNOL	B079689	30-Oct-2019
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079691	10-Aug-2020
ANTENNA, DRG HORN (SMALL)	3116B	ETS LINDGREN	B079697	30-Mar-2020
RF CABLE	SF106	HUBER & SUHNER	B079712	24-Jul-2019
RF CABLE	SF106	HUBER & SUHNER	B079713	24-Jul-2019
RF CABLE	SF106	HUBER & SUHNER	B079659	23-Jul-2019
RF CABLE	SUCOFLEX 100	HUBER & SUHNER	B108523	24-Jul-2019
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	15003	24-Jan-2020
FILTER, HIGH PASS (>2800MHZ)	HPM50111	MICRO-TRONICS	B085747	26-Jul-2019
LOW NOISE AMPLIFIER	NSP1840-HG	MITEQ	B087572	27-Jul-2019
RF CABLE	SF102	HUBER & SUHNER	B079822	25-Jul-2019
RF CABLE	SF102	HUBER & SUHNER	B079824	25-Jul-2019

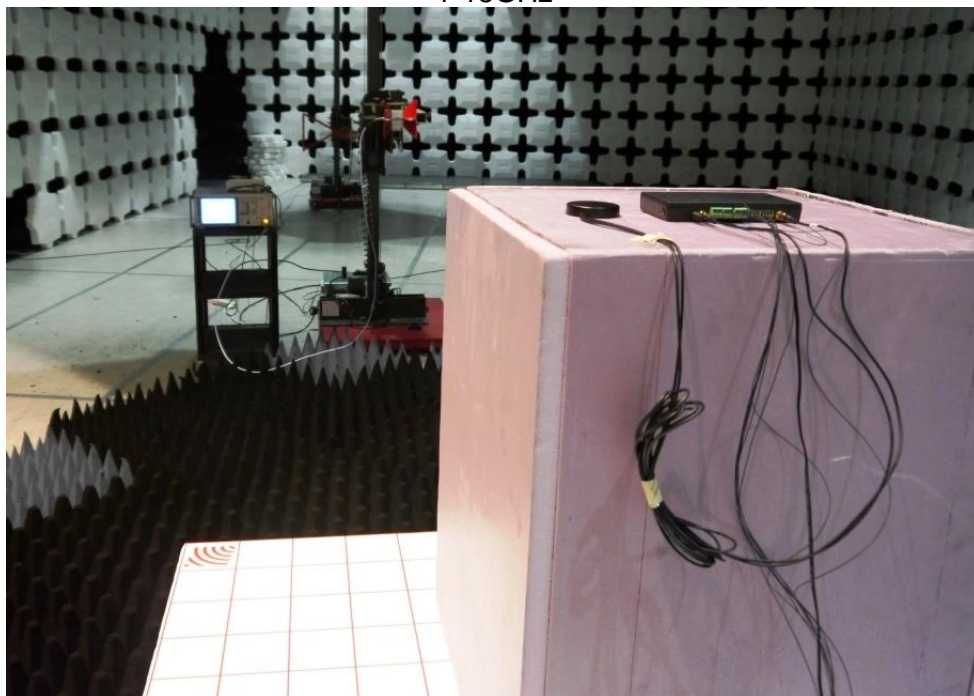
Note: The equipment calibration period is 1 year.

3.1 Test Setup Photographs

30-1000MHz



1-18GHz



18 -26Ghz

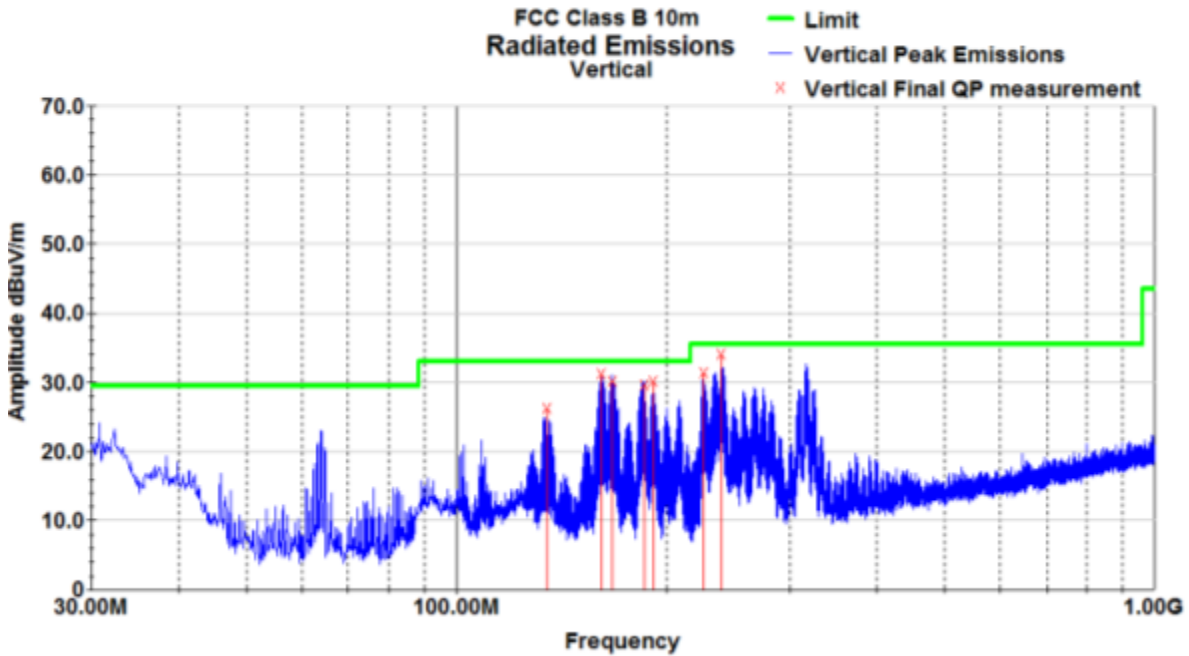


3.2 Peak Plots

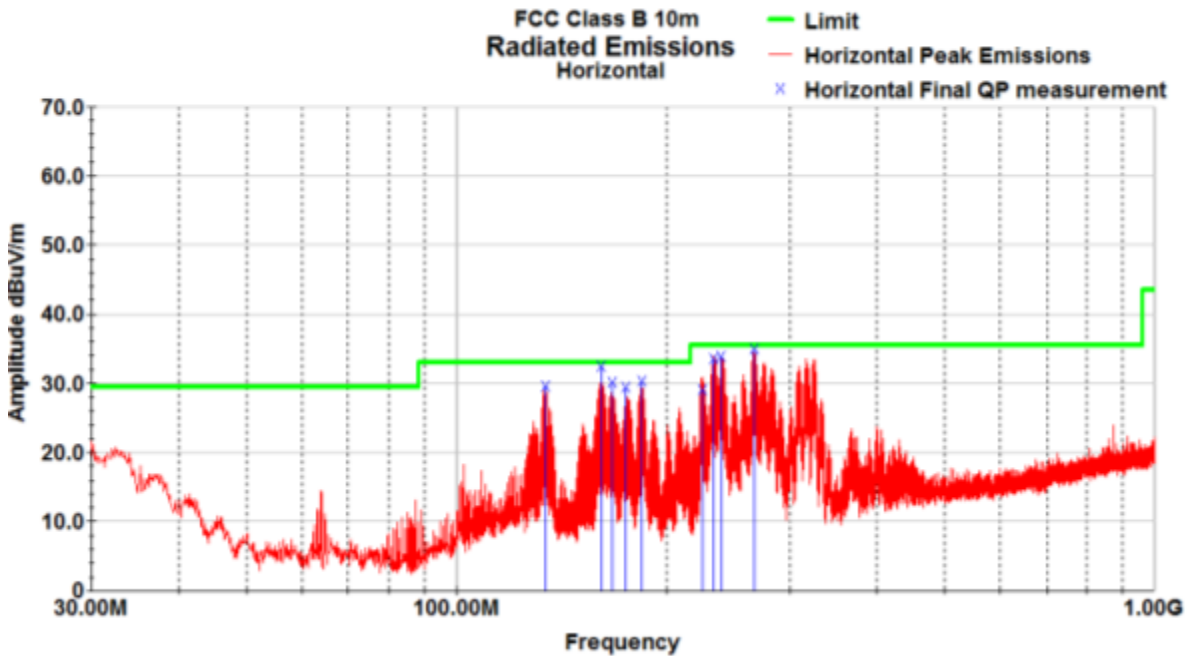
No emissions were detected in the range 9kHz to 30MHz.

Channel 1

Vertical (30-1000MHz)

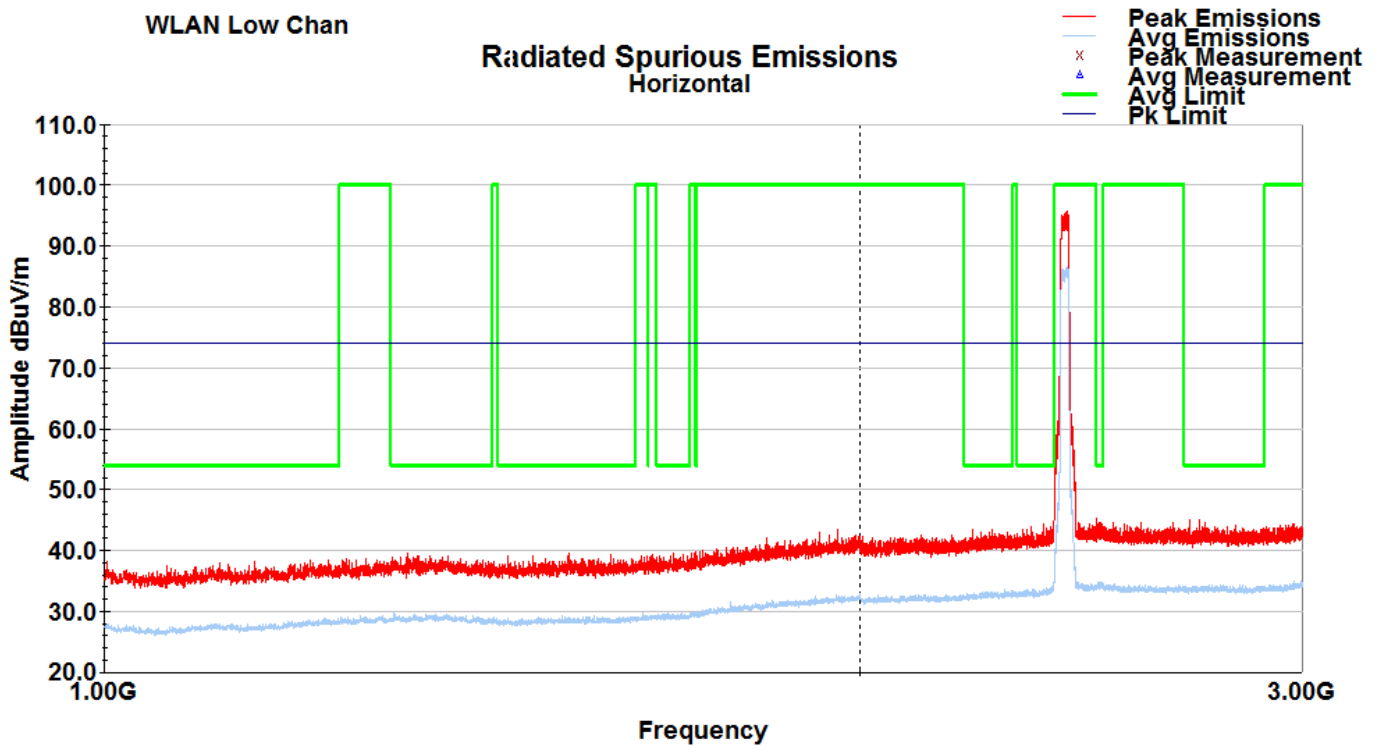
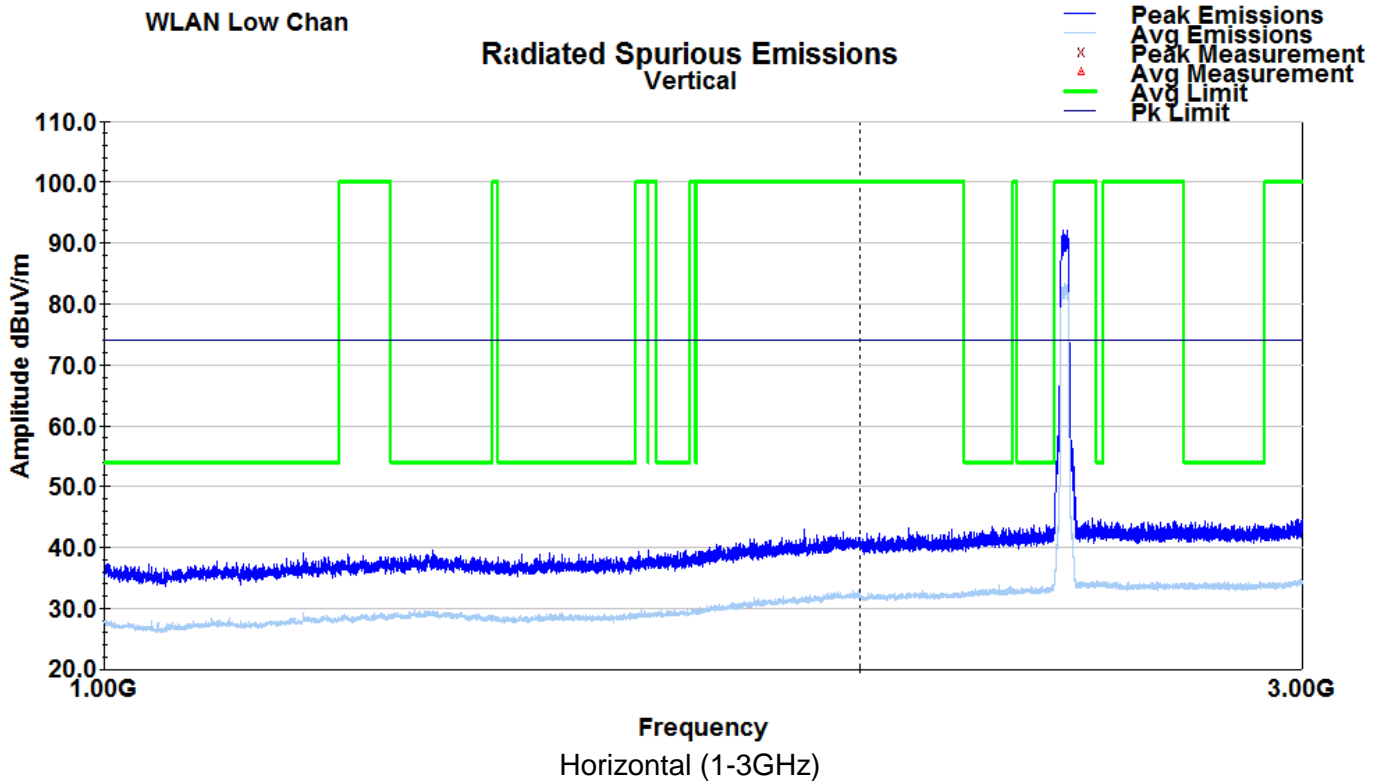


Horizontal (30-1000MHz)

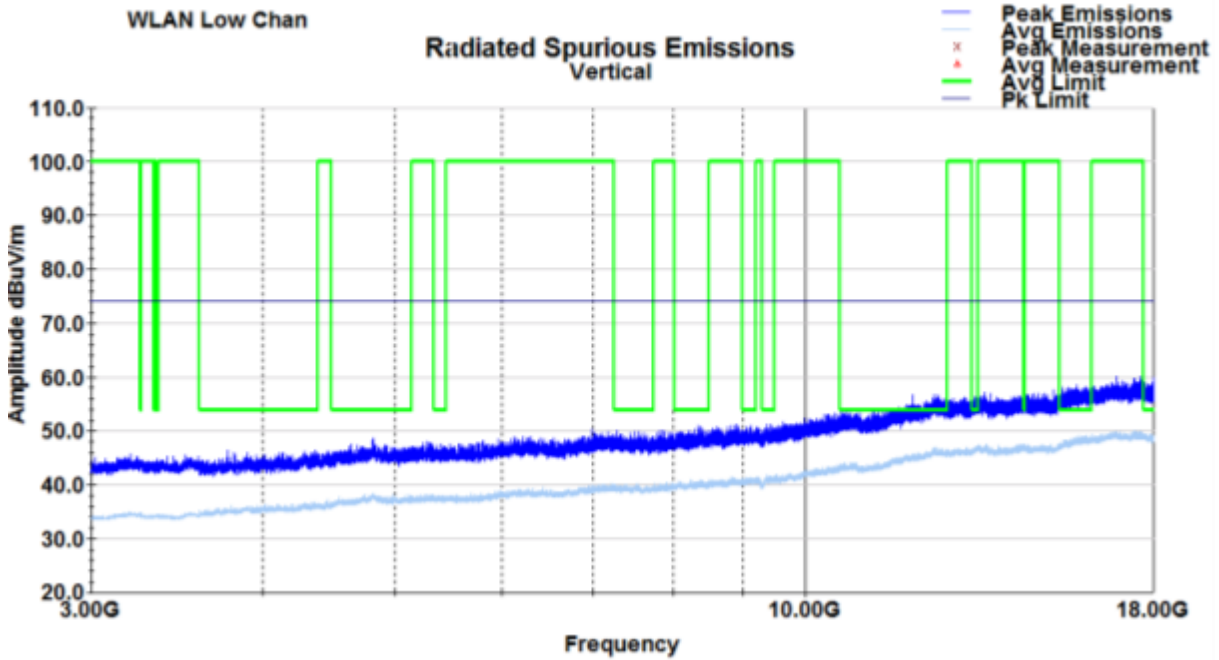


There was no discernible difference in the emissions profile below 1GHz when changing between WLAN channels.

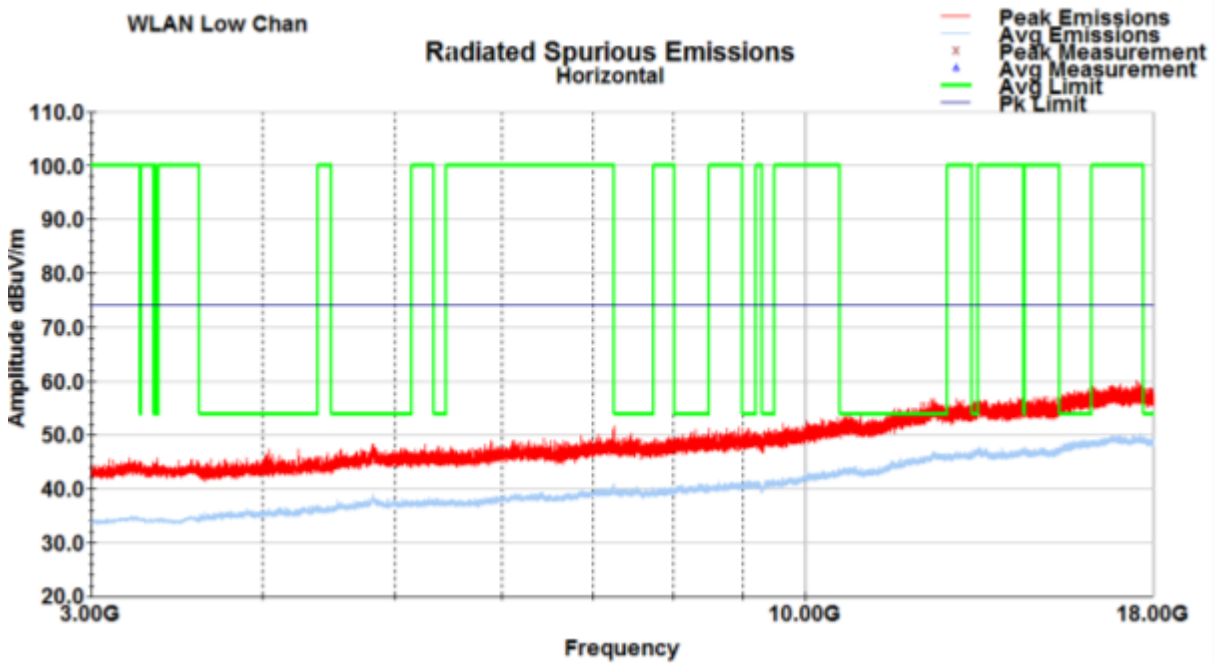
Channel 1
Vertical (1-3GHz)



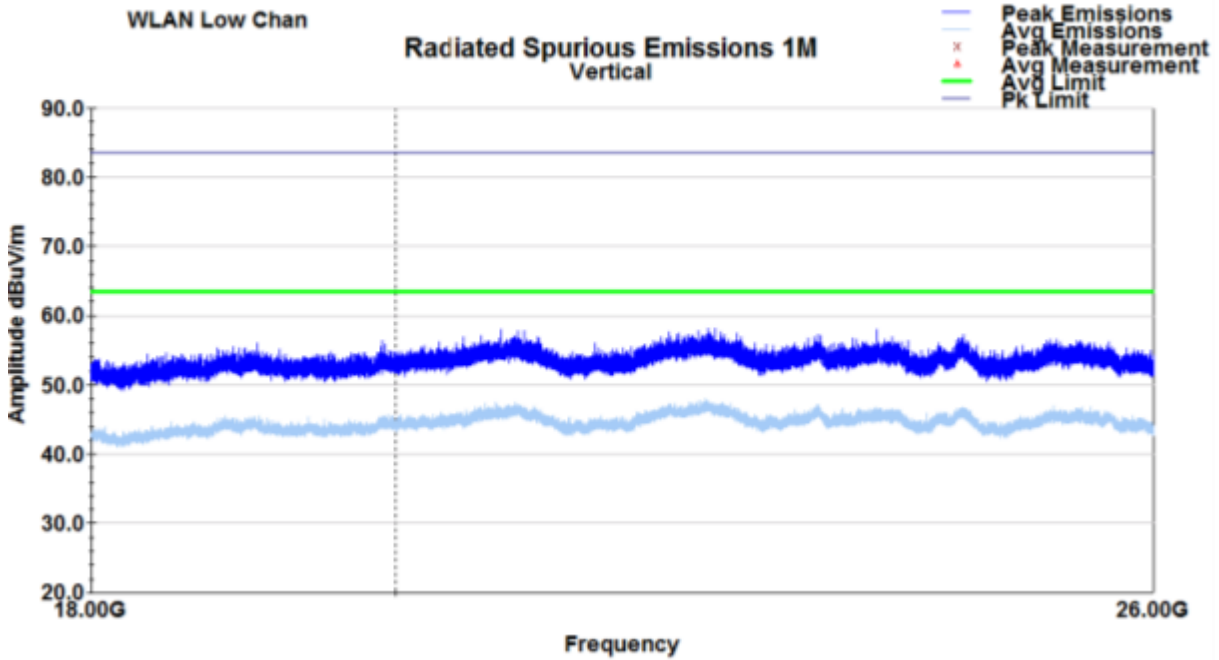
Channel 1
Vertical (3-18GHz)



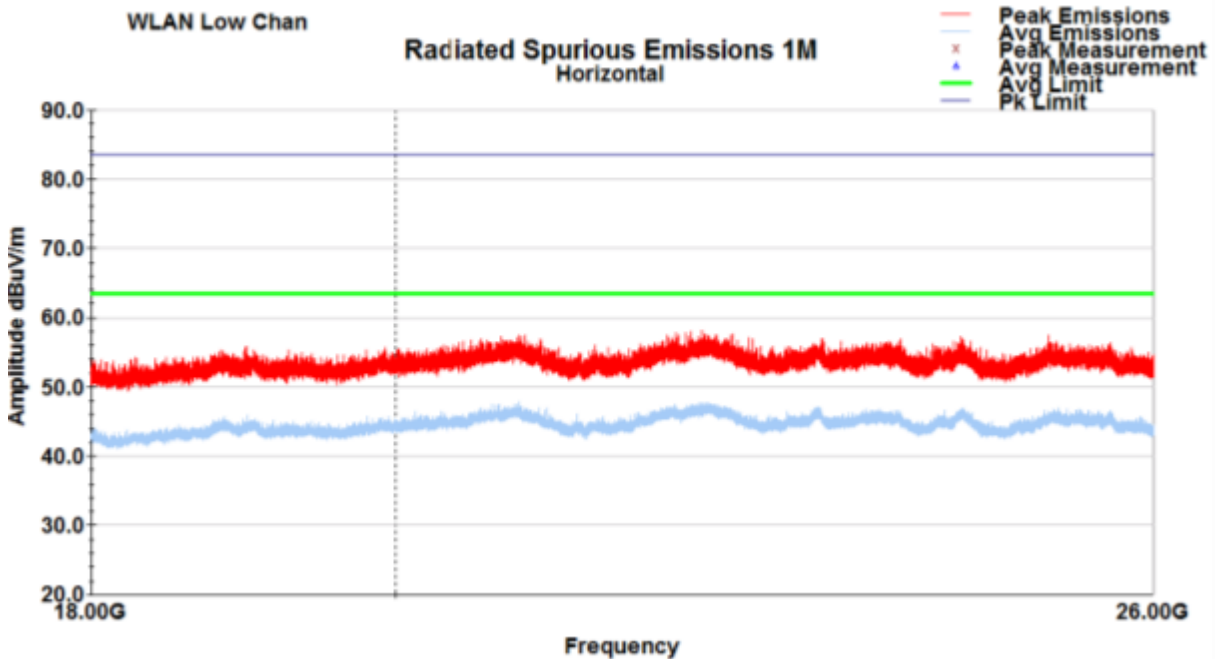
Horizontal (3-18GHz)



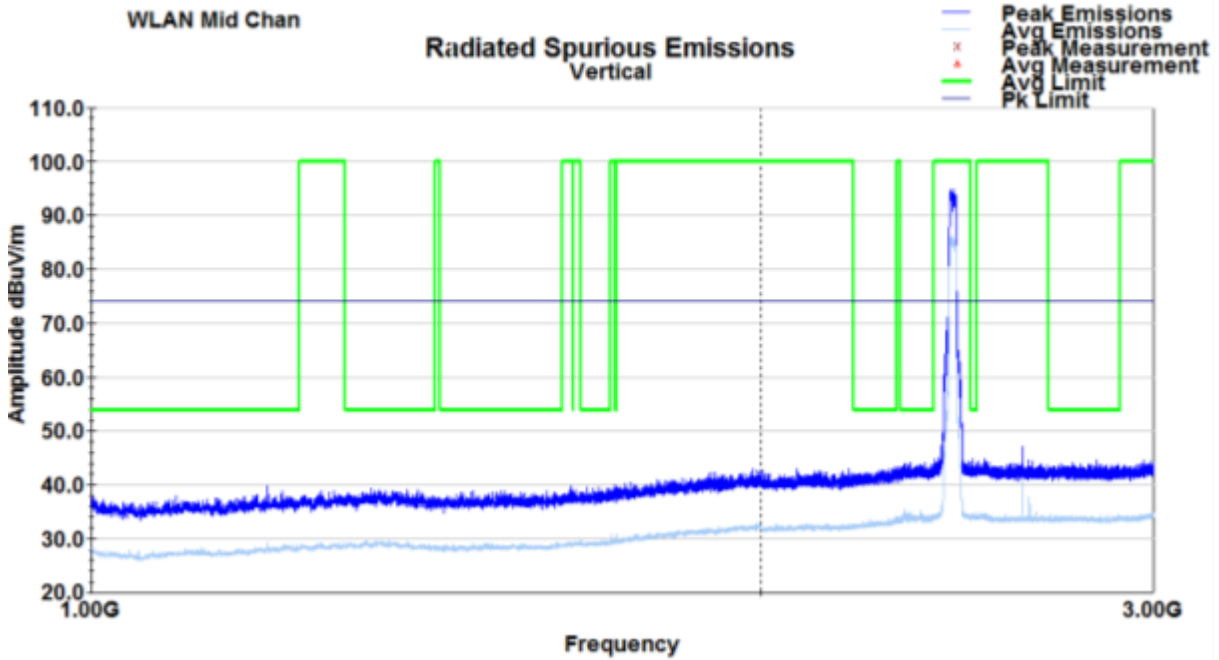
Channel 1
Vertical (18-26GHz)



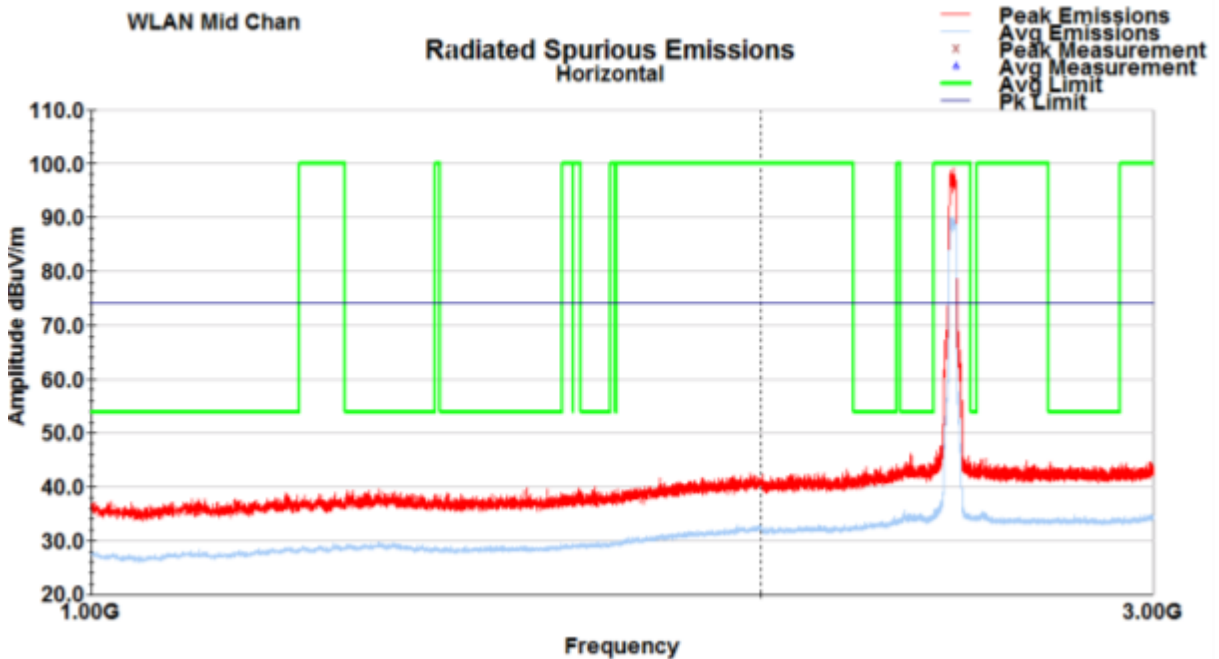
Horizontal (18-26GHz)



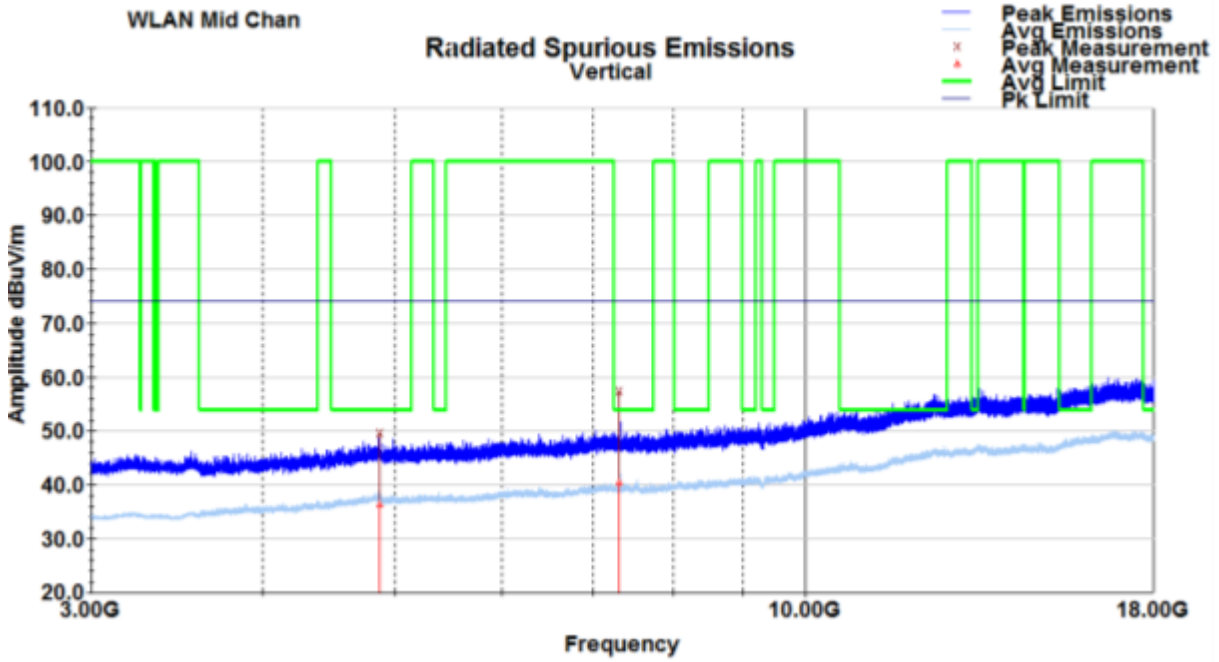
Channel 6
Vertical (1-3GHz)



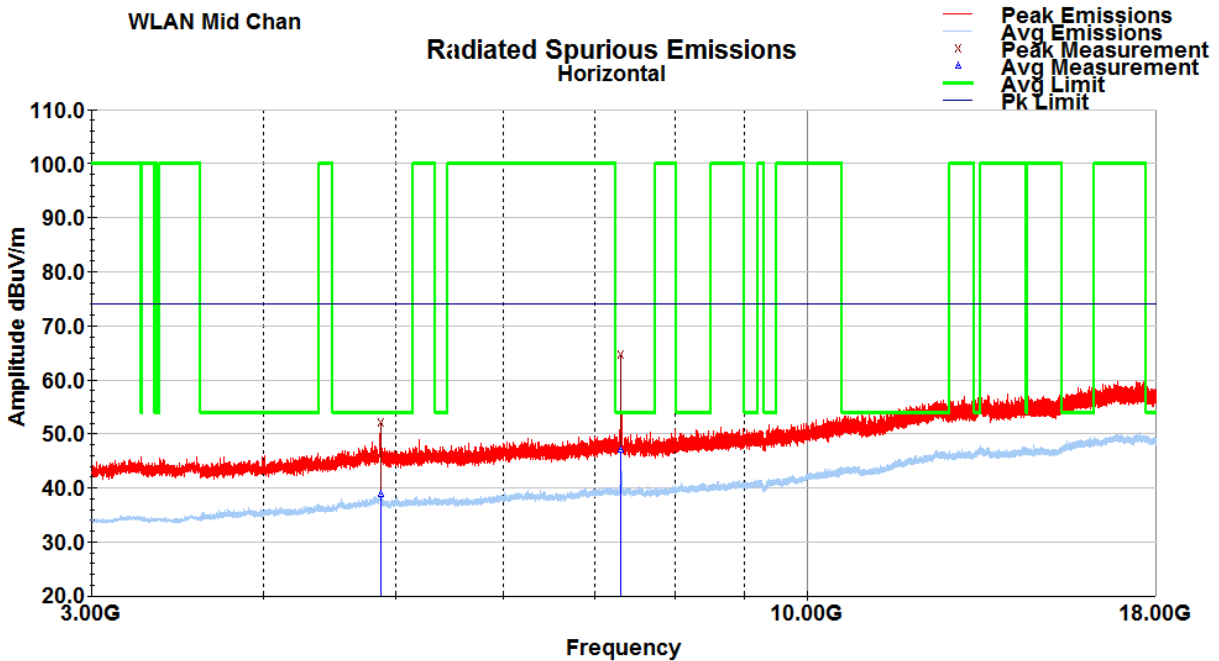
Horizontal (1-3GHz)



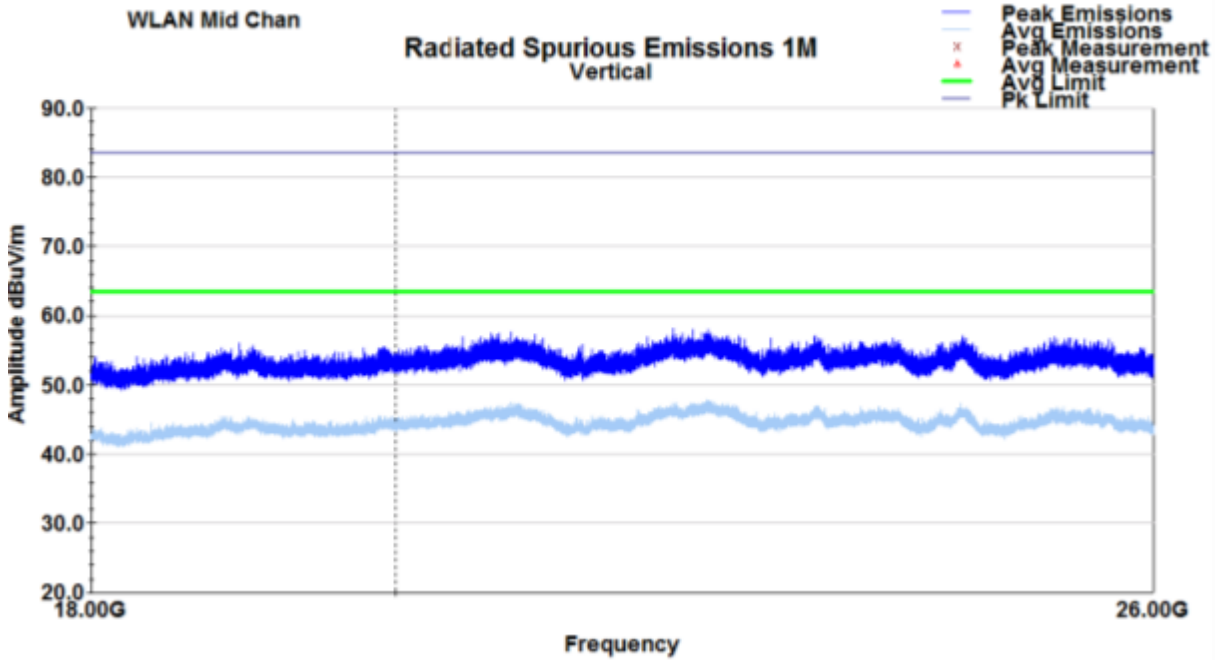
Channel 6
Vertical (3-18GHz)



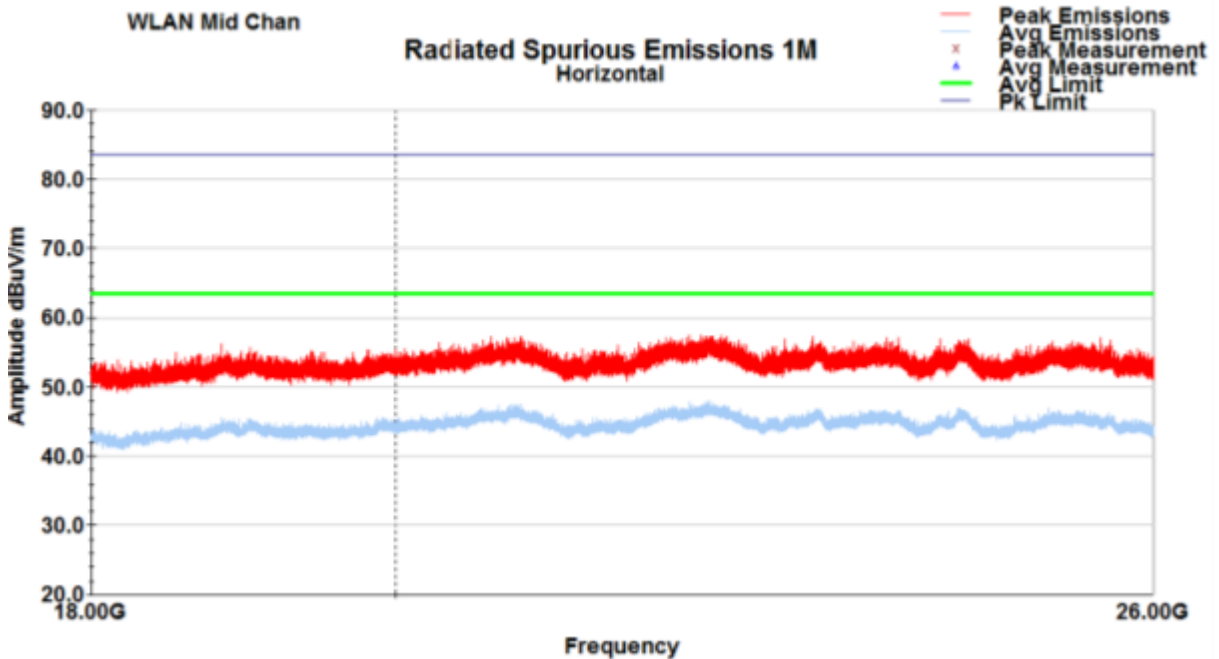
Horizontal (3-18GHz)



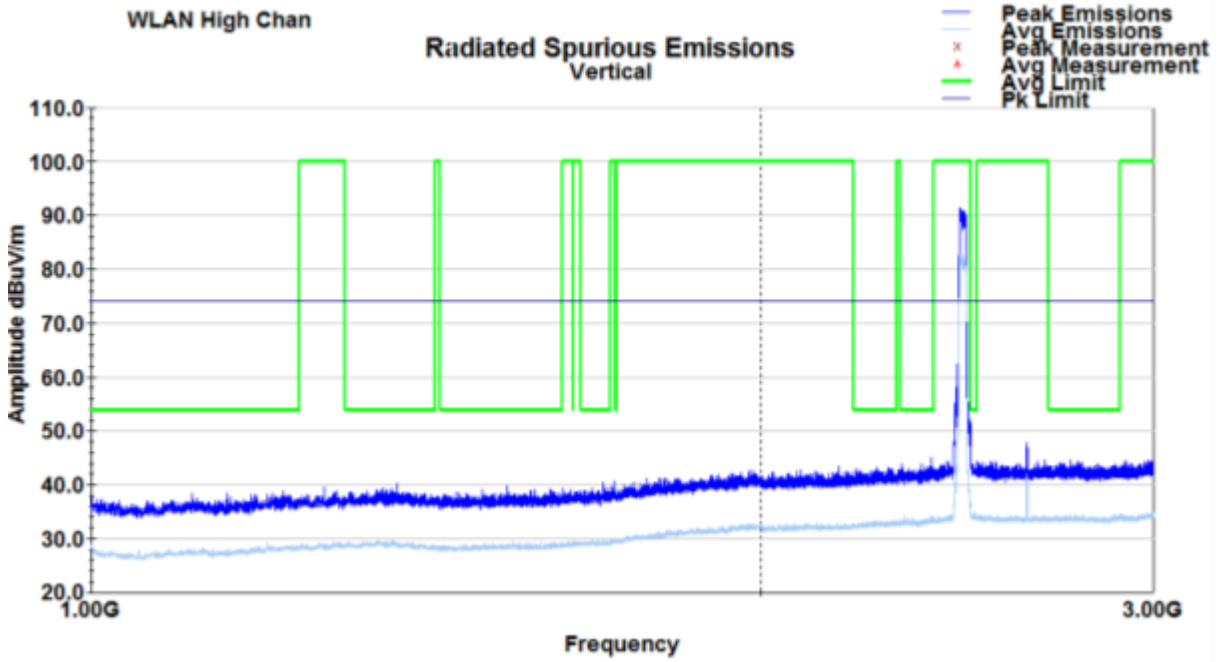
Channel 6
Vertical (18-26GHz)



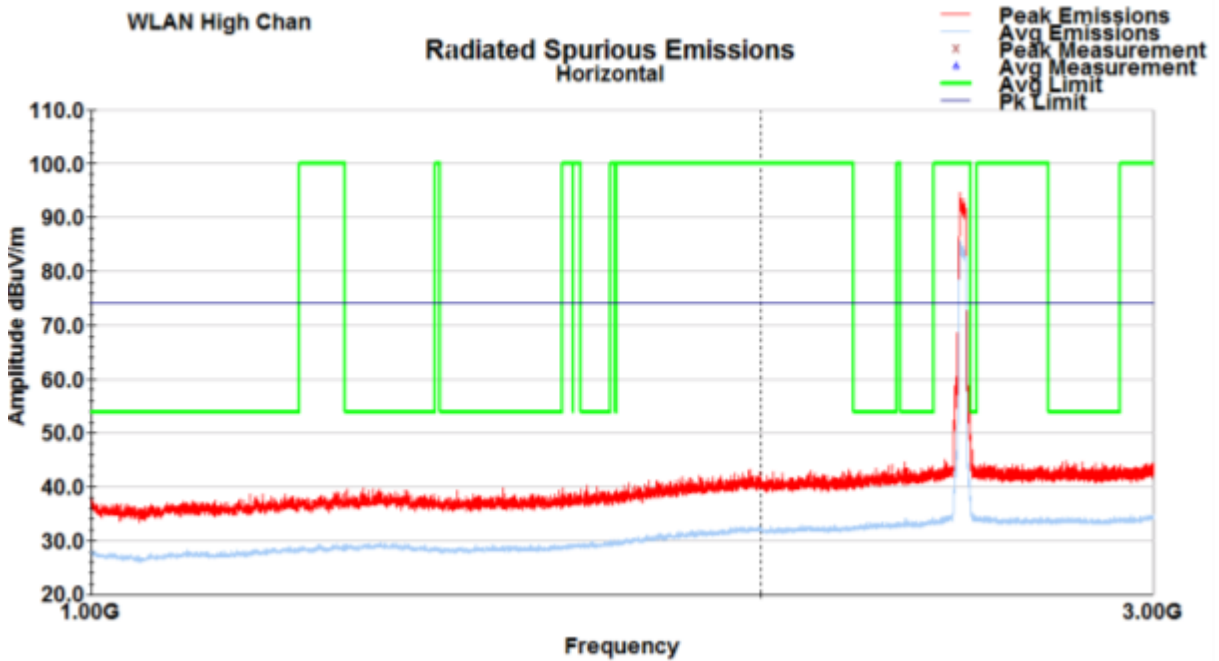
Horizontal (18-26GHz)



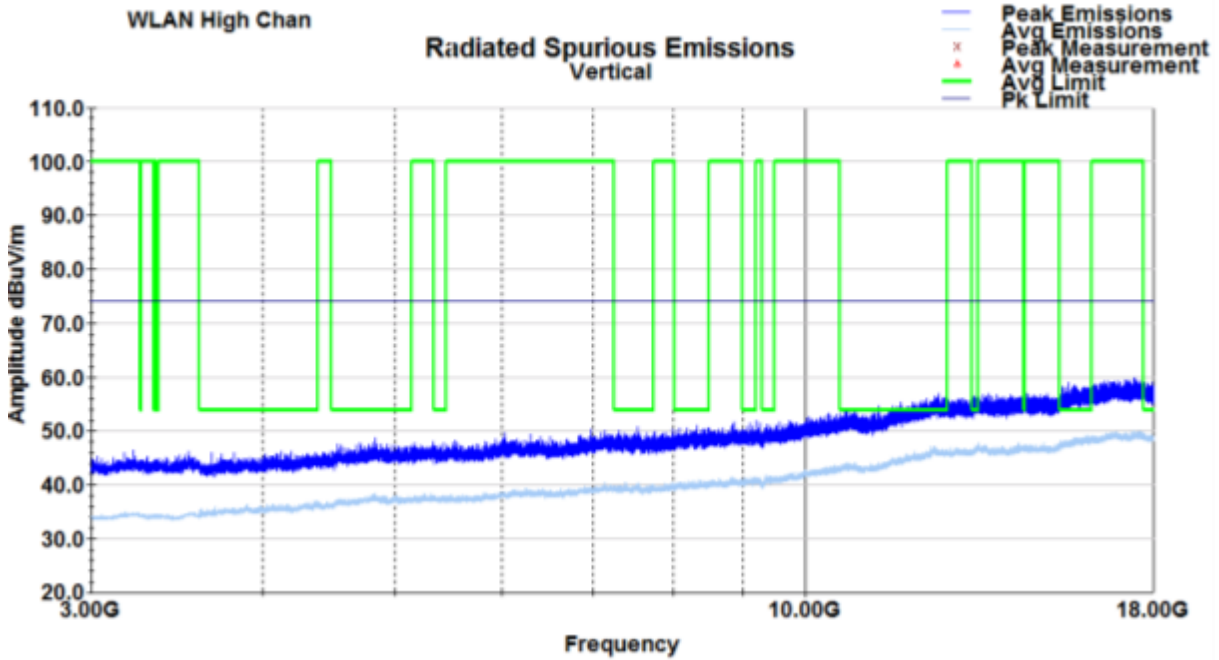
Channel 11
Vertical (1-3GHz)



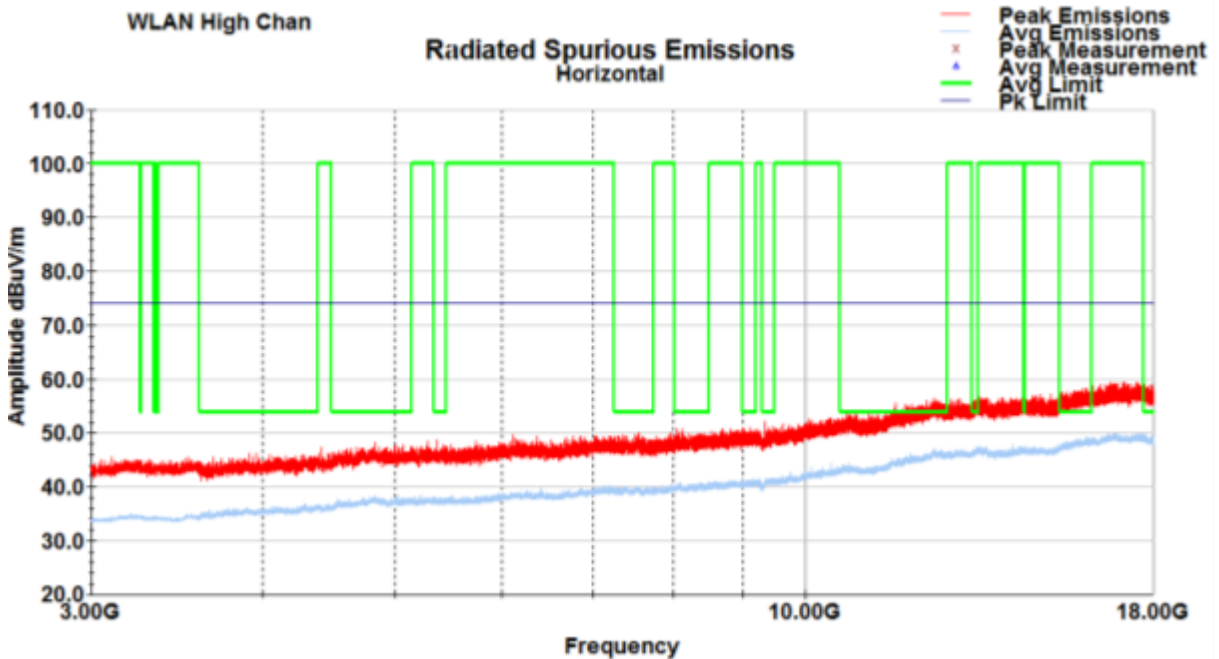
Horizontal (1-3GHz)



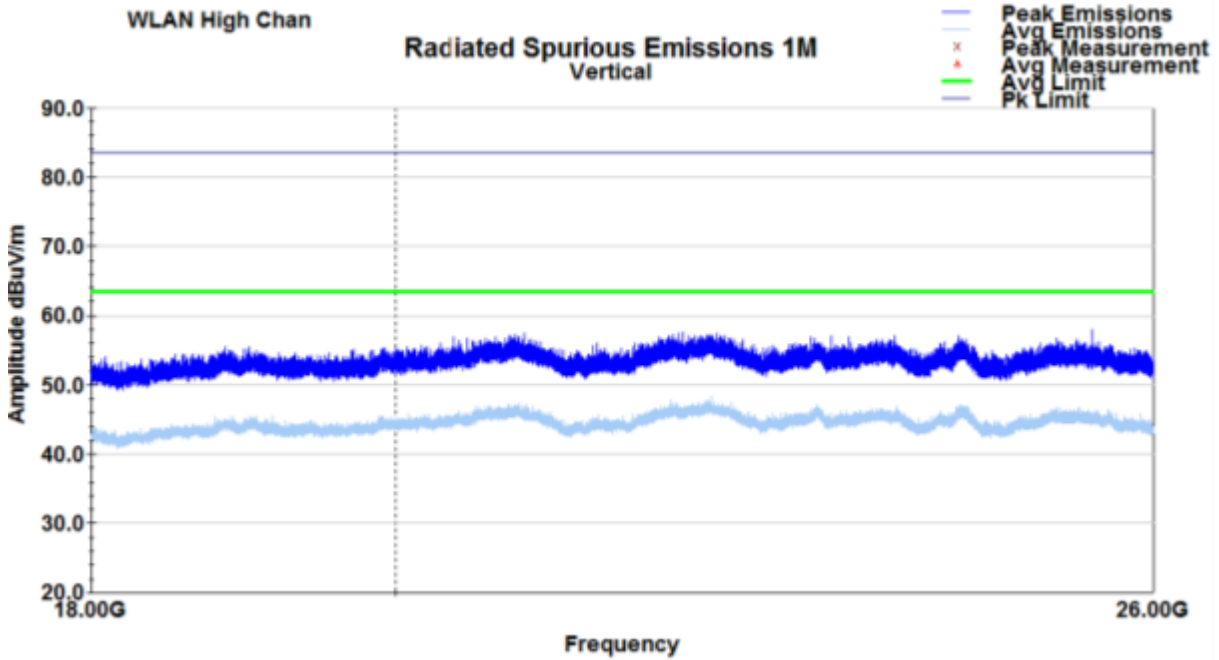
Channel 11
Vertical (3-18GHz)



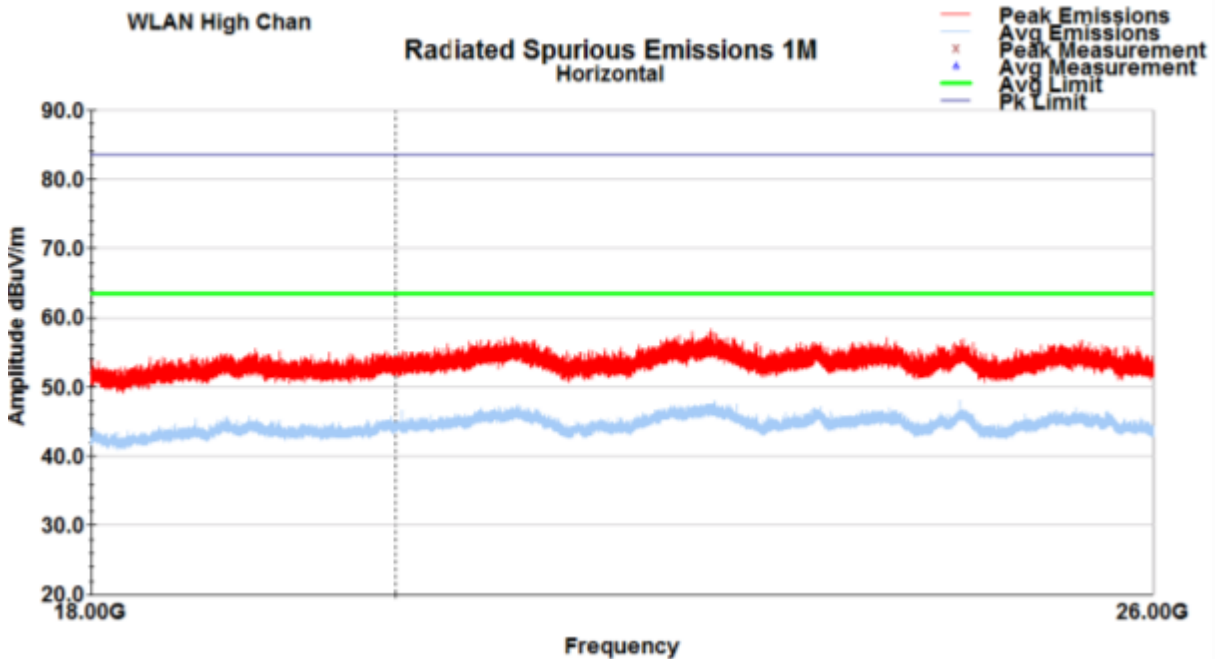
Horizontal (3-18GHz)



Channel 11
Vertical (18-26GHz)



Horizontal (18-26GHz)



3.3 Tabular Data

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
134.86	46.2	V	152.0	100.0	13.3	1.6	34.7	26.4	33.0	-6.6
161.24	51.8	V	265.0	119.0	12.5	1.7	34.7	31.3	33.0	-1.7
167.28	51.2	V	276.0	201.0	12.1	1.8	34.7	30.3	33.0	-2.7
186.07	51.8	V	127.0	116.0	10.8	1.9	34.7	29.7	33.0	-3.3
191.37	52.0	V	97.0	129.0	11.0	1.9	34.7	30.2	33.0	-2.8
226.00	53.0	V	271.0	102.0	11.2	2.1	34.8	31.6	35.5	-3.9
239.58	55.0	V	97.0	102.0	11.8	2.1	34.8	34.2	35.5	-1.3
QP Value = Level + AF + CL - Amp										

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
134.08	49.5	H	100.0	362.0	13.4	1.6	34.7	29.8	33.0	-3.2
161.24	53.0	H	115.0	395.0	12.5	1.7	34.7	32.5	33.0	-0.5
167.28	51.1	H	118.0	399.0	12.1	1.8	34.7	30.2	33.0	-2.8
174.78	51.3	H	102.0	399.0	11.2	1.8	34.7	29.5	33.0	-3.5
184.58	52.5	H	276.0	394.0	10.8	1.9	34.7	30.4	33.0	-2.6
225.26	50.7	H	3.0	361.0	11.1	2.1	34.8	29.2	35.5	-6.3
233.57	54.6	H	293.0	369.0	11.6	2.1	34.8	33.5	35.5	-2.0
239.58	54.8	H	105.0	399.0	11.8	2.1	34.8	33.9	35.5	-1.6
266.68	54.2	H	235.0	389.0	13.3	2.2	34.7	35.0	35.5	-0.5

Margin = QP Value - Limit

Note: There was no discernible difference in the measurement data below 1GHz when transmitting at different channels. QP measurements were only recorded with the device transmitting on Channel 1.

Mid Ch. 3 - 18 GHz Tabulated Data Vertical

Frequency MHz	Raw Pk dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Pk dBuV/m	Limit dBuV/m	Margin dB
4875.38	46.1	V	68.0	225.0	34.5	3.2	34.2	49.6	74.0	-24.4
7312.00	52.1	V	302.0	183.0	35.7	3.5	33.9	57.4	74.0	-16.6

Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Avg dBuV/m	Limit (dBuV/m)	Margin (dB)
4875.38	33.0	V	68.0	225.0	34.5	3.2	34.2	36.5	54.0	-17.5
7312.00	35.0	V	302.0	183.0	35.7	3.5	33.9	40.4	54.0	-13.6

Mid Ch. 3 -18 GHz Tabulated Data Horizontal

Frequency MHz	Raw Pk dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Pk dBuV/m	Limit dBuV/m	Margin dB
4878.82	48.7	H	129.0	167.0	34.5	3.2	34.2	52.2	74.0	-21.8
7312.18	59.3	H	130.0	171.0	35.7	3.5	33.9	64.6	74.0	-9.4

Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Avg Value dBuV/m	Limit (dBuV/m)	Margin (dB)
4878.82	35.5	H	129.0	167.0	34.5	3.2	34.2	38.9	54.0	-15.1
7312.18	41.7	H	130.0	171.0	35.7	3.5	33.9	47.1	54.0	-6.9

4 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	13 May 2019