

Intertek  
731 Enterprise Drive  
Lexington, KY 40510

Tel 859 226 1000  
Fax 859 226 1040

[www.intertek.com](http://www.intertek.com)

# Aquana LLC BLE TEST REPORT

**SCOPE OF WORK**  
BLE TEST REPORT

**REPORT NUMBER**  
103553976LEX-003

<b>ISSUE DATE</b>	<b>[REVISED DATE]</b>
10/30/2018	10/30/2018

**PAGES**  
47

**DOCUMENT CONTROL NUMBER**  
Non-Specific EMC Report Shell Rev. December 2017  
© 2017 INTERTEK



**BLE TEST REPORT**  
(FULL COMPLIANCE)

**Report Number:** 103553976LEX-003

**Project Number:** G103553976

**Report Issue Date:** 10/30/2018

**Model(s) Tested:** SV-1

**Product Name:** Smart Valve

**Standards:** Title 47 CFR Part 15.247  
RSS-247 Issue 2  
RSS-Gen Issue 5

Tested by:  
Intertek Testing Services NA, Inc.  
731 Enterprise Dr.  
Lexington, KY 40510  
USA

Client:  
Aquana LLC  
1099 Plunkton Rd  
Warren, VT 05674  
USA

Report prepared by



Bryan Taylor, Team Leader

Report reviewed by



Brian Lackey, Project Engineer

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to copy or distribute this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.





Table of Contents

**1 Introduction and Conclusion ..... 4**

**2 Test Summary ..... 4**

**3 Client Information ..... 5**

**4 Description of Equipment under Test and Variant Models ..... 6**

**5 System Setup and Method ..... 7**

**6 Receiver Spurious Emissions ..... 8**

**7 Transmitter Spurious Emissions ..... 13**

**8 Output Power ..... 26**

**9 Occupied Bandwidth ..... 30**

**10 Power Spectral Density ..... 35**

**11 Conducted Spurious Emissions ..... 38**

**12 Antenna Requirement ..... 40**

**13 Conducted Emissions ..... 41**

**14 Revision History ..... 47**



## 1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

## 2 Test Summary

Section	Test full name	Result
6	Receiver Spurious Emissions (ANSI C63.4: 2014)	Pass
7	Transmitter Spurious Emissions (FCC Part 15.247(d), RSS-247 Issue 2 § 5.5)	Pass
8	Output Power (FCC Part 15.247(b)(3), RSS-247 Issue 2 § 5.4(d))	Pass
9	Occupied Bandwidth (FCC Part 15.247, RSS-247 Issue 2 § 5.2(a))	Pass
10	Power Spectral Density (FCC Part 15.247(e), RSS-247 Issue 2 § 5.2(b))	Pass
11	Conducted Spurious Emissions (FCC Part 15.247(d), RSS-247 Issue 2 § 5.5)	Pass
12	Antenna Requirement (FCC Part 15.203, RSS-Gen Issue 5 § 6.8)	Pass
13	Conducted Emissions (ANSI C63.4: 2014)	Pass



### 3 Client Information

This product was tested at the request of the following:

Client Information	
<b>Client Name:</b>	Aquana LLC
<b>Address:</b>	1099 Plunkton Rd Warren, VT 05674 USA
<b>Contact:</b>	Steve Askew
<b>Telephone:</b>	(802) 498-5158
<b>Email:</b>	Steve.askew@aquana.com
Manufacturer Information	
<b>Manufacturer Name:</b>	Aquana LLC
<b>Manufacturer Address:</b>	1099 Plunkton Rd Warren, VT 05674 USA



#### 4 Description of Equipment under Test and Variant Models

Equipment Under Test	
Product Name	Smart Valve
Model Number	SV-1
Serial Number	Not labeled
Receive Date	6/19/2018
Test Start Date	6/19/2018
Test End Date	10/19/2018
Device Received Condition	Good
Test Sample Type	Production
Rated Voltage	12VDC
Rated Current	-
Rated Frequency	-
Number of Phases	-
Software Used By EUT	None
Frequency Band(s)	2400-2483.5MHz
Modulation Type(s)	GFSK
Test Channel(s)	0 (2402MHz), 19 (2440MHz), 39 (2480MHz)
Maximum Antenna Gain (dBi)	3.18dBi
Maximum Output Power (dBm)	3.242dBm (conducted)
Description of Equipment Under Test (provided by client)	
The Aquana LLC Smart Valve (Model SV-1) is an irrigation valve that can be controlled remotely by an app using Bluetooth Low Energy (BLE)	

##### 4.1 Variant Models:

There were no variant models covered by this evaluation.



## 5 System Setup and Method

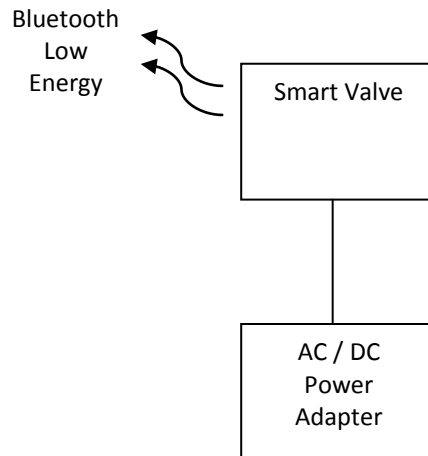
### 5.1 Method:

Configuration as required by ANSI C63.4: 2014 and ANSI C63.10:2013

No.	Descriptions of EUT Exercising
1	Transmitting a Bluetooth Low Energy (BLE) signal or low, middle, or high channel
2	Idle, not transmitting.

Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
1	12VDC Cable to power adapter	2m	None	None	AC Power Adapter

### 5.2 EUT Block Diagram:





## 6 Receiver Spurious Emissions

### 6.1 Test Method

Tests are performed in accordance with ANSI C63.4: 2014

**TEST SITE:** 10m ALSE

**Site Designation:** 10m Chamber

#### Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	3.9dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.0dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.7dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.7dB	5.5 dB

As shown in the table above our radiated emissions  $U_{lab}$  is less than the corresponding  $U_{CISPR}$  reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required.





## 6.2 Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength in dB $\mu$ V/m
- RA = Receiver Amplitude (including preamplifier) in dB $\mu$ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB $\mu$ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

RA = 52.0 dB $\mu$ V  
AF = 7.4 dB/m  
CF = 1.6 dB  
AG = 29.0 dB  
FS = 32 dB $\mu$ V/m

To convert from dB $\mu$ V to  $\mu$ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

NF = Net Reading in dB $\mu$ V

### Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$
$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$



### 6.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde&Schwarz	ESU40	9/20/2017	9/20/2018
Bilog Antenna(JB6)	7088	SunAR	JB6	7/24/2018	7/24/2019
Horn Antenna	3780	ETS	3117	6/11/2018	6/11/2019
System Controller	4096	ETS Lindgren	2090	Verify at Time of Use	Verify at Time of Use
System Controller	3957	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use
3m Cable Antenna→Preamp	3074			11/29/2017	11/29/2018
3m Cable Preamplifier	3918	TS-PR18	122005	11/29/2017	11/29/2018
3m Cable Preamp→Chamber	2588			11/29/2017	11/29/2018
3m Cable Chamber→Control Room	2593			11/29/2017	11/29/2018
3m Cable Control Room→Receiver	2592			11/29/2017	11/29/2018
10m Cable Antenna→Preamp	3339			11/29/2017	11/29/2018

### 6.4 Software Utilized

Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 9.15.02

### 6.5 Test Conditions

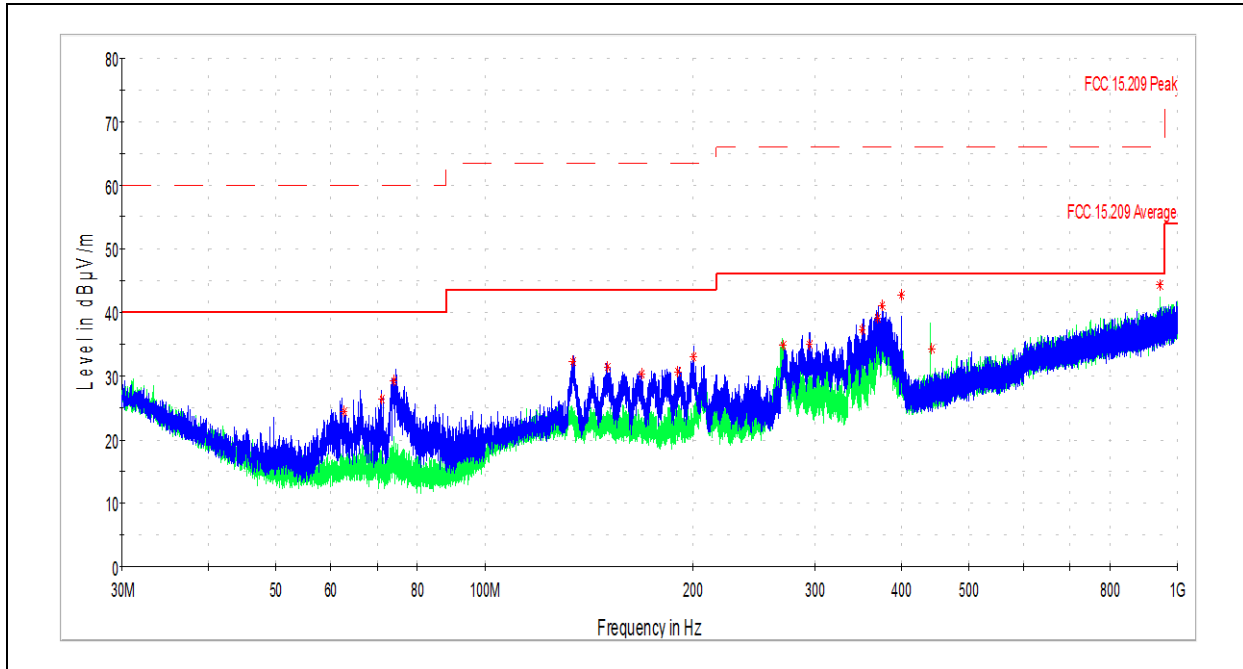
Test Personnel:	<u>Michael Carlson</u>	Test Date:	<u>9/12/2018</u>
Supervising/Reviewing Engineer: (Where Applicable)	<u>NA</u>	Limit Applied:	<u>Class B</u>
Product Standard:	<u>FCC Part 15.247</u>	Ambient Temperature:	<u>23.0C</u>
Input Voltage:	<u>RSS-247 Issue 2</u>	Relative Humidity:	<u>47.2%</u>
Pretest Verification w / Ambient Signals or BB Source:	<u>12VDC</u>	Atmospheric Pressure:	<u>988.8mbar</u>
	<u>Yes</u>		

### 6.6 Test Results

The sample tested was found to be **compliant**.



6.7 Test Data: 30MHz – 1GHz

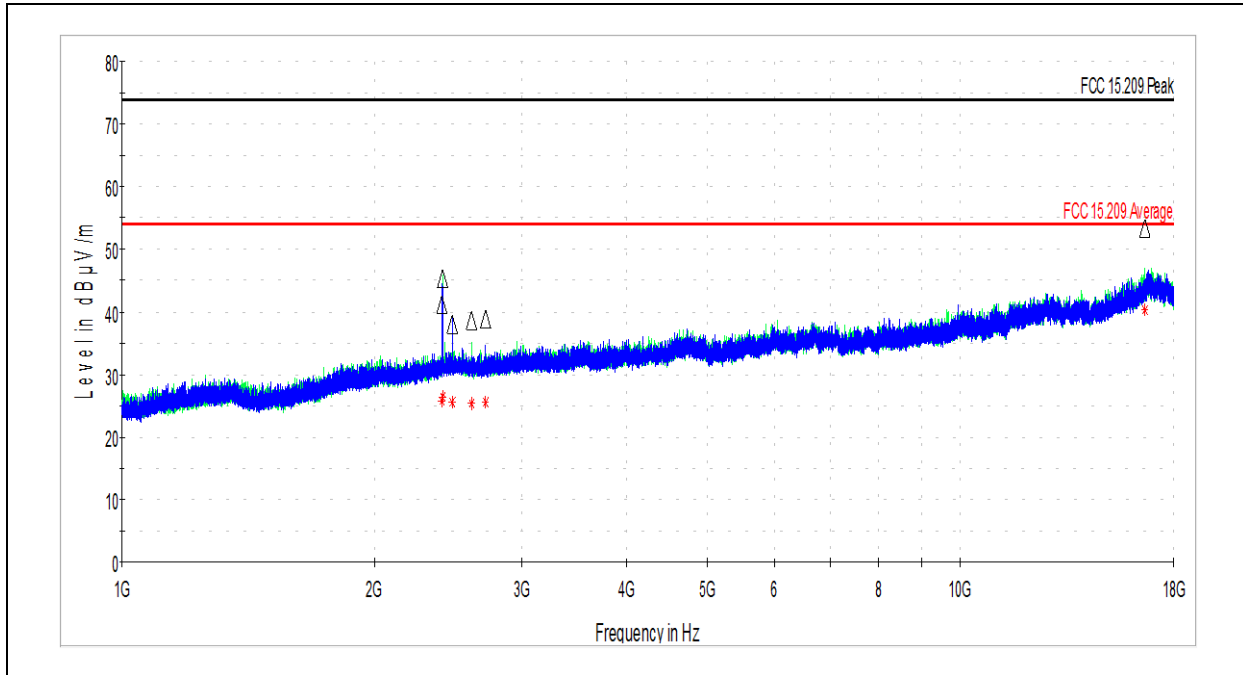


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
62.811000	24.36	40.00	15.64	120.000	100.3	V	74.0	15.2
71.119000	26.36	40.00	13.64	120.000	99.9	V	8.0	15.4
73.889000	29.32	40.00	10.68	120.000	99.9	V	309.0	15.4
134.080000	32.23	43.52	11.29	120.000	99.7	V	93.0	21.5
150.660000	31.36	43.52	12.16	120.000	100.2	V	18.0	21.0
168.560000	30.27	43.52	13.25	120.000	100.9	V	257.0	20.8
190.060000	30.76	43.52	12.76	120.000	105.9	V	291.0	19.9
200.160000	33.05	43.52	10.47	120.000	105.5	V	46.0	21.5
269.580000	34.73	46.02	11.29	120.000	189.6	H	0.0	22.7
294.760000	35.00	46.02	11.02	120.000	141.6	V	332.0	23.1
351.120000	37.23	46.02	8.79	120.000	117.9	V	339.0	24.4
369.100000	39.04	46.02	6.98	120.000	100.1	V	312.0	24.9
375.000000	41.07	46.02	4.95	120.000	100.1	V	332.0	25.0
400.000000	42.76	46.02	3.26	120.000	106.5	V	8.0	25.8
442.280000	34.29	46.02	11.73	120.000	141.9	H	11.0	27.2
943.300000	44.32	46.02	1.70	120.000	99.9	H	72.0	35.4

Deviations, Additions, or Exclusions: None



6.8 Test Data: 1GHz – 18GHz



Peak

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2409.600000	41.18	74.00	32.82	1000.000	410.0	V	337.0	3.2
2413.800000	45.20	74.00	28.80	1000.000	410.0	H	-1.0	3.2
2479.800000	38.09	74.00	35.91	1000.000	385.0	V	141.0	3.2
2614.000000	38.70	74.00	35.30	1000.000	238.0	H	186.0	3.3
2716.200000	38.78	74.00	35.22	1000.000	353.0	V	246.0	3.4
16631.400000	53.40	74.00	20.60	1000.000	410.0	H	0.0	21.3

Average

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2409.600000	25.86	54.00	28.14	1000.000	410.0	V	337.0	3.2
2413.800000	26.31	54.00	27.69	1000.000	410.0	H	-1.0	3.2
2479.800000	25.59	54.00	28.41	1000.000	385.0	V	141.0	3.2
2614.000000	25.31	54.00	28.69	1000.000	238.0	H	186.0	3.3
2716.200000	25.48	54.00	28.52	1000.000	353.0	V	246.0	3.4
16631.400000	40.25	54.00	13.75	1000.000	410.0	H	0.0	21.3

Deviations, Additions, or Exclusions: None



## 7 Transmitter Spurious Emissions

### 7.1 Test Limits

#### **FCC Part 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 §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

#### **RSS-247 Issue 2 § 5.5:**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

### 7.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 11.12.1 Radiated emission measurements.



### 7.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde&Schwarz	ESU40	9/20/2017	9/20/2018
EMI Test Receiver	3900	Rohde&Schwarz	ESU40	9/18/2018	9/18/2019
Bilog Antenna(JB6)	7088	SunAR	JB6	7/24/2018	7/24/2019
Horn Antenna	3780	ETS	3117	6/11/2018	6/11/2019
Horn Antenna (18 - 40GHz)	3779	ETS	3116c	6/7/2018	6/7/2019
40GHz Preamplifier	3921	Rohde&Schwarz	TS-PR40	11/29/2017	11/29/2018
System Controller	4096	ETS Lindgren	2090	Verify at Time of Use	Verify at Time of Use
System Controller	3957	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use
3m Cable Antenna→Preamp	3074			11/29/2017	11/29/2018
3m Cable Preamplifier	3918	TS-PR18	122005	11/29/2017	11/29/2018
3m Cable Preamp→Chamber	2588			11/29/2017	11/29/2018
3m Cable Chamber→Control Room	2593			11/29/2017	11/29/2018
3m Cable Control Room→Receiver	2592			11/29/2017	11/29/2018
10m Cable Antenna→Preamp	3339			11/29/2017	11/29/2018

### 7.4 Software Utilized

Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 9.15.02

### 7.5 Test Conditions

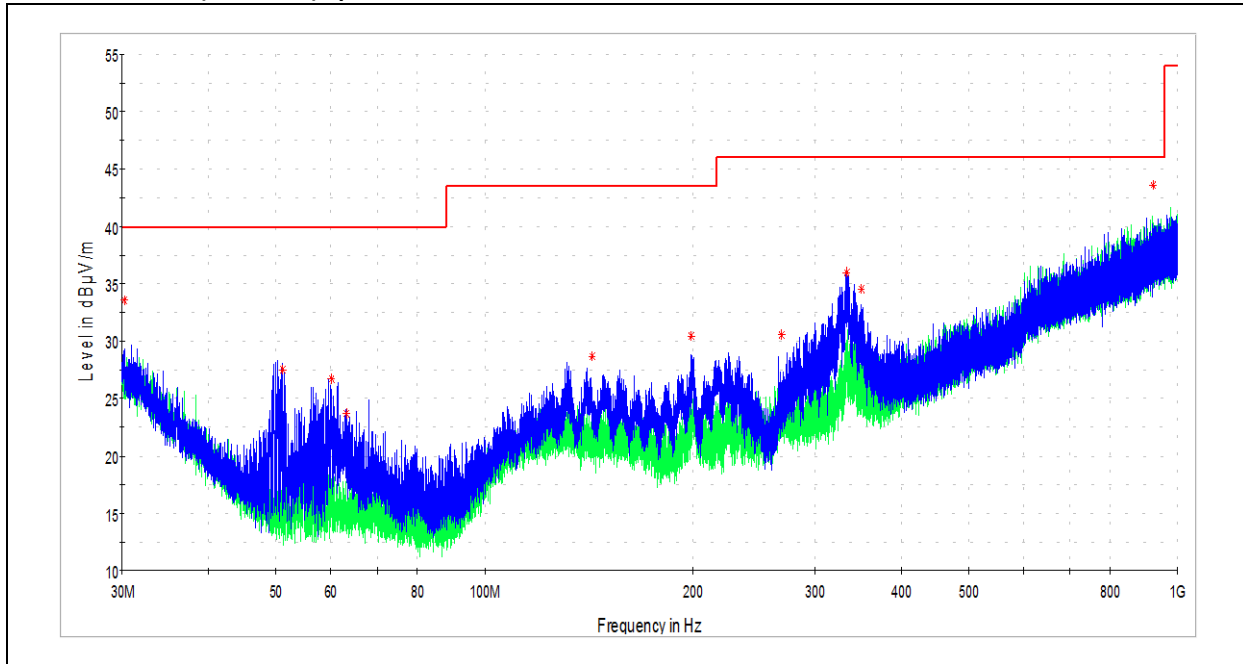
Test Personnel:	<u>Michael Carlson</u>	Test Date:	<u>9/6/2018 – 10/11/2018</u>
Supervising/Reviewing Engineer: (Where Applicable)	<u>NA</u>	Limit Applied:	<u>15.209</u>
Product Standard:	<u>FCC Part 15.247</u>	Ambient Temperature:	<u>23.0C</u>
Input Voltage:	<u>RSS-247 Issue 2</u>	Relative Humidity:	<u>47.2%</u>
Pretest Verification w / Ambient Signals or BB Source:	<u>12VD</u>	Atmospheric Pressure:	<u>988.8mbar</u>
	<u>Yes</u>		

### 7.6 Test Results

The sample tested was found to be **compliant**.



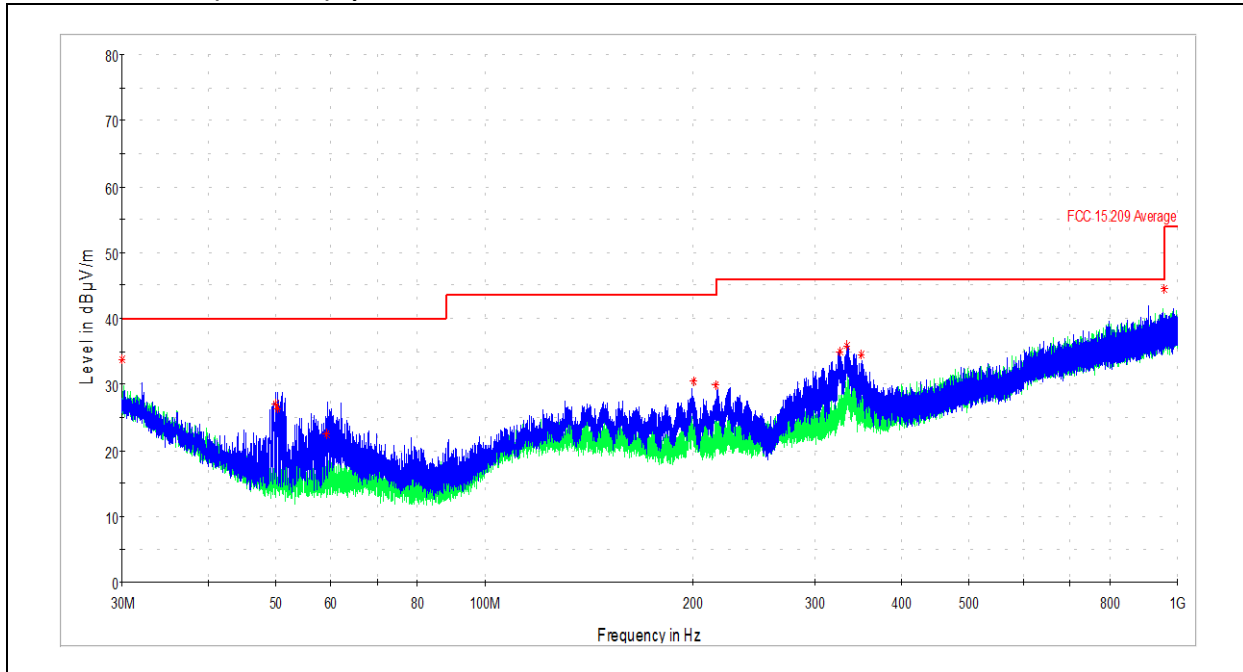
7.7 Channel 0 (2402MHz) Spurious Emissions, 30MHz-1GHz:



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.200000	33.59	40.00	6.41	120.000	212.0	V	156.0	26.8
51.157000	27.51	40.00	12.49	120.000	105.5	V	9.0	14.9
60.197000	26.74	40.00	13.26	120.000	99.9	V	1.0	15.0
63.224000	23.67	40.00	16.33	120.000	99.9	V	319.0	15.2
142.820000	28.65	43.52	14.87	120.000	236.6	V	154.0	21.1
198.800000	30.49	43.52	13.03	120.000	153.9	V	64.0	21.3
268.220000	30.56	46.02	15.46	120.000	106.5	V	18.0	22.6
333.520000	35.97	46.02	10.05	120.000	191.9	V	322.0	23.9
349.680000	34.54	46.02	11.48	120.000	177.2	V	346.0	24.3
921.500000	43.63	46.02	2.39	120.000	261.1	H	28.0	35.1



7.8 Channel 19 (2440MHz) Spurious Emissions, 30MHz-1GHz:

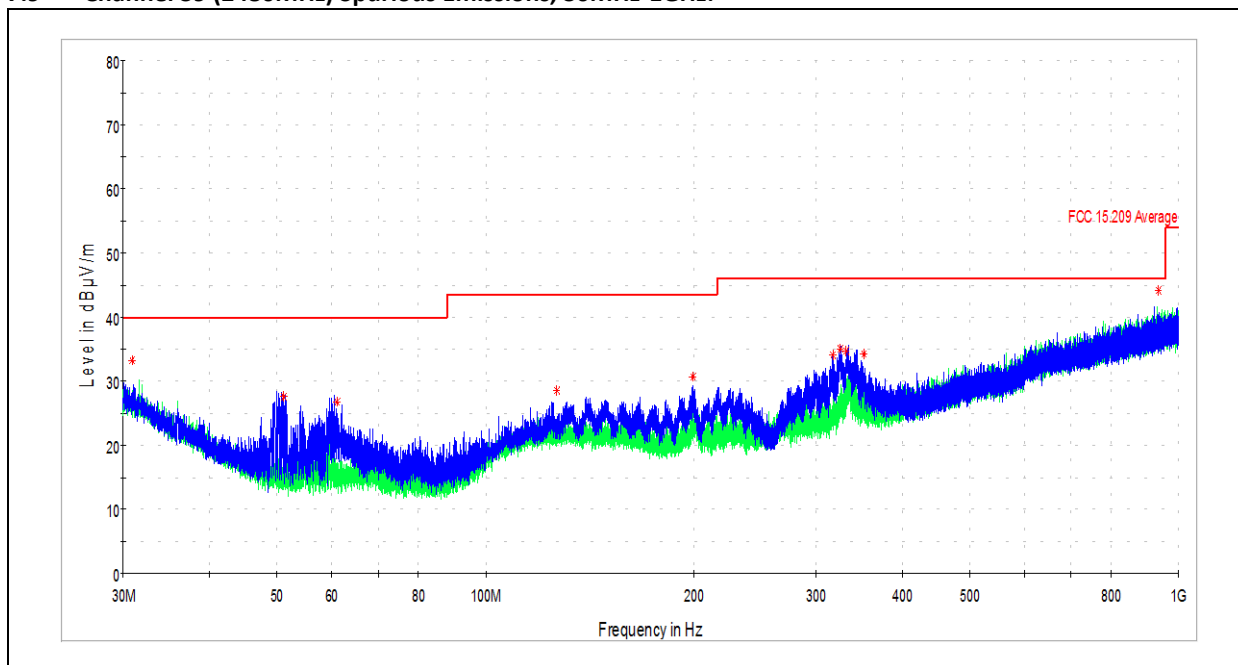


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.000000	33.69	40.00	6.31	120.000	118.5	V	330.0	26.9
49.928000	27.05	40.00	12.95	120.000	100.1	V	38.0	15.2
50.272000	26.39	40.00	13.61	120.000	100.0	V	27.0	15.1
59.133000	22.51	40.00	17.49	120.000	104.7	V	0.0	14.9
200.380000	30.50	43.52	13.02	120.000	141.6	V	26.0	21.4
215.320000	29.83	43.52	13.69	120.000	135.1	V	294.0	19.4
326.020000	34.87	46.02	11.15	120.000	105.0	V	0.0	23.7
333.460000	35.81	46.02	10.21	120.000	189.6	V	328.0	23.9
349.680000	34.52	46.02	11.50	120.000	177.2	V	0.0	24.3
956.640000	44.45	46.02	1.57	120.000	105.3	H	82.0	35.5





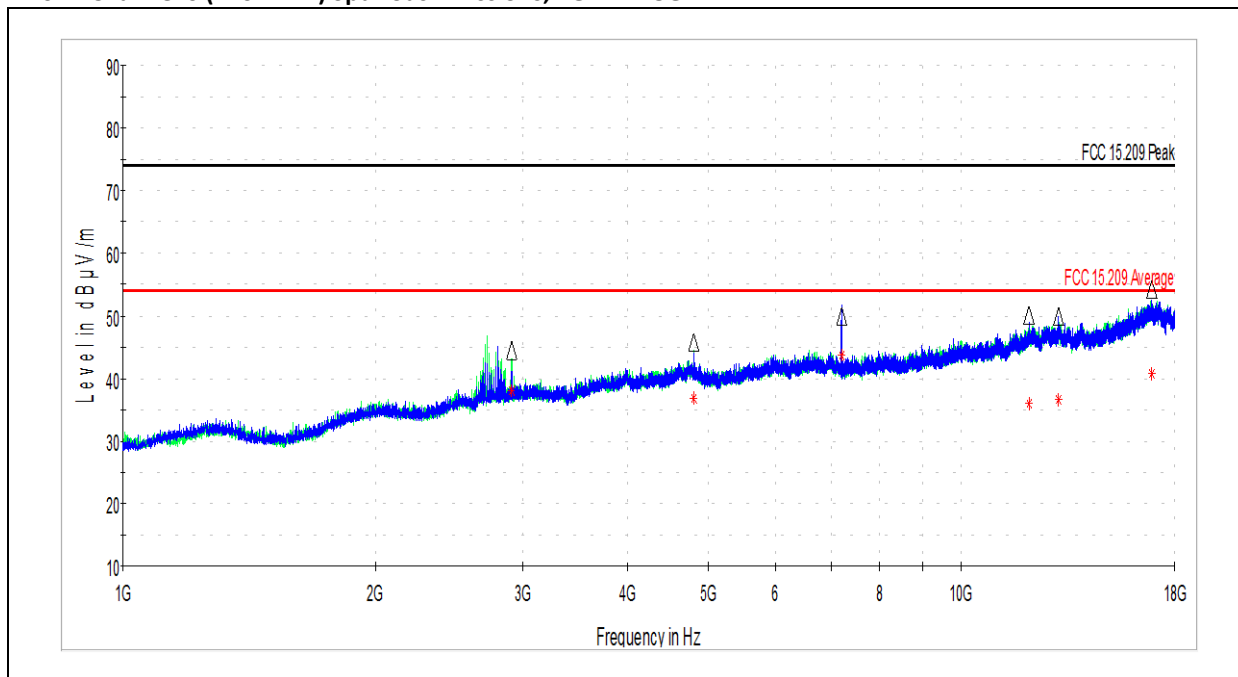
### 7.9 Channel 39 (2480MHz) Spurious Emissions, 30MHz-1GHz:



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.880000	33.24	40.00	6.76	120.000	380.0	H	100.0	26.5
51.168000	27.52	40.00	12.48	120.000	100.4	V	10.0	14.9
61.106000	26.75	40.00	13.25	120.000	104.7	V	322.0	15.0
126.600000	28.55	43.52	14.97	120.000	105.7	V	72.0	21.8
199.360000	30.74	43.52	12.78	120.000	177.9	V	156.0	21.4
317.420000	34.01	46.02	12.01	120.000	100.1	V	0.0	23.6
324.760000	35.04	46.02	10.98	120.000	99.9	V	0.0	23.7
331.540000	34.72	46.02	11.30	120.000	189.8	V	338.0	23.9
351.820000	34.29	46.02	11.73	120.000	165.2	V	338.0	24.4
935.540000	44.17	46.02	1.85	120.000	129.2	H	331.0	35.4



**7.10 Channel 0 (2402MHz) Spurious Emissions, 1GHz – 18GHz:**



**Peak**

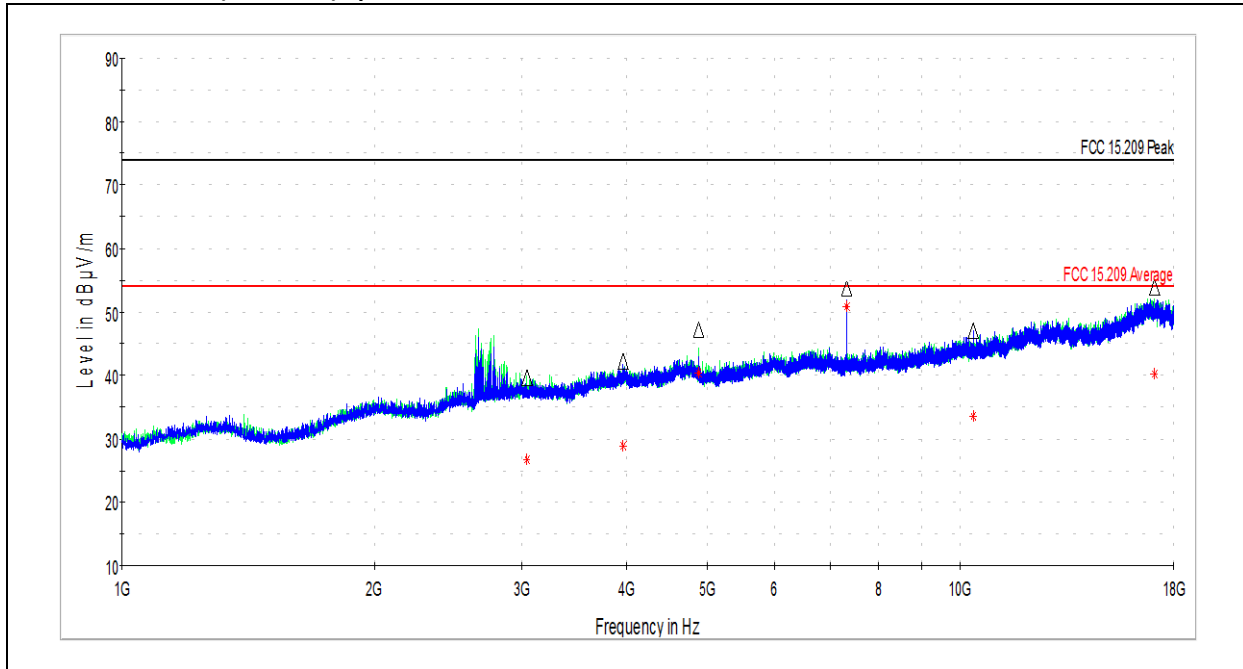
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2912.000000	44.41	74.00	29.59	1000.000	251.0	H	136.0	4.0
4800.000000	45.76	74.00	28.24	1000.000	222.0	H	168.0	7.4
7200.500000	49.91	74.00	24.09	1000.000	117.0	V	313.0	10.1
12067.000000	50.16	74.00	23.84	1000.000	410.0	V	106.0	16.4
13071.500000	49.80	74.00	24.20	1000.000	342.0	V	205.0	17.2
16895.000000	54.16	74.00	19.84	1000.000	390.0	V	172.0	21.8

**Average**

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2912.000000	37.97	54.00	16.03	1000.000	251.0	H	136.0	4.0
4800.000000	36.72	54.00	17.28	1000.000	222.0	H	168.0	7.4
7200.500000	43.64	54.00	10.36	1000.000	117.0	V	313.0	10.1
12067.000000	35.99	54.00	18.01	1000.000	410.0	V	106.0	16.4
13071.500000	36.66	54.00	17.34	1000.000	342.0	V	205.0	17.2
16895.000000	40.83	54.00	13.17	1000.000	390.0	V	172.0	21.8



7.11 Channel 19 (2440MHz) Spurious Emissions, 1GHz – 18GHz:



Peak

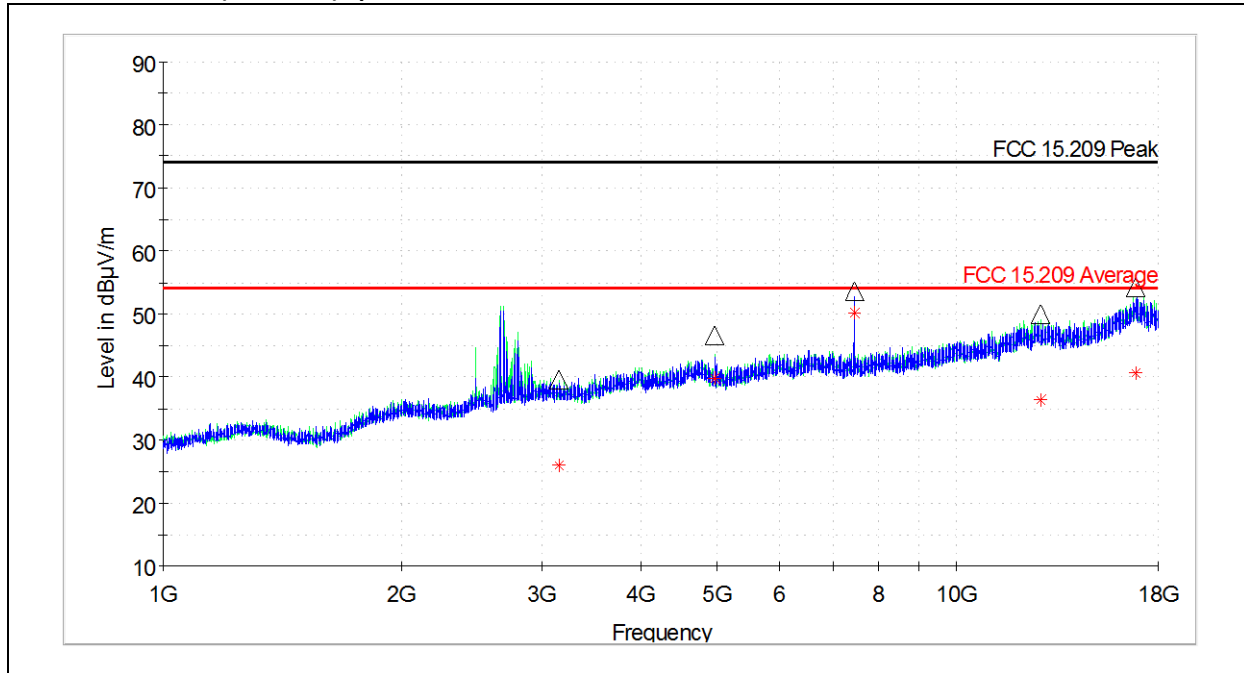
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3044.000000	39.75	74.00	34.25	1000.000	313.0	H	227.0	4.6
3964.500000	42.13	74.00	31.87	1000.000	371.0	V	241.0	6.4
4880.000000	47.23	74.00	26.77	1000.000	309.0	H	12.0	6.9
7320.000000	53.77	74.00	20.23	1000.000	141.0	V	320.0	10.4
10363.500000	46.95	74.00	27.05	1000.000	410.0	V	12.0	13.8
17078.000000	53.78	74.00	20.22	1000.000	100.0	H	170.0	21.6

Average

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3044.000000	26.78	54.00	27.22	1000.000	313.0	H	227.0	4.6
3964.500000	28.89	54.00	25.11	1000.000	371.0	V	241.0	6.4
4880.000000	40.44	54.00	13.56	1000.000	309.0	H	12.0	6.9
7320.000000	50.75	54.00	3.25	1000.000	141.0	V	320.0	10.4
10363.500000	33.47	54.00	20.53	1000.000	410.0	V	12.0	13.8
17078.000000	40.17	54.00	13.83	1000.000	100.0	H	170.0	21.6



**7.12 Channel 39 (2480MHz) Spurious Emissions, 1GHz – 18GHz:**



**Peak**

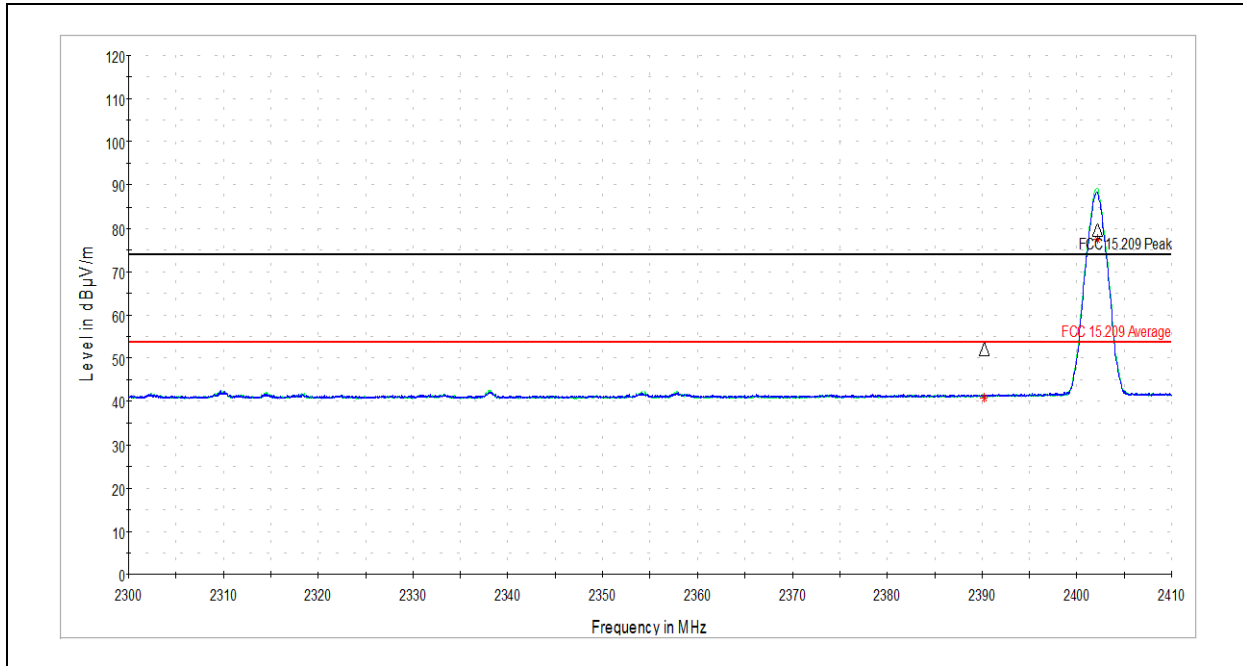
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3157.500000	39.49	74.00	34.51	1000.000	100.0	H	184.0	4.5
4960.000000	46.58	74.00	27.42	1000.000	237.0	H	302.0	6.7
7440.000000	53.66	74.00	20.34	1000.000	193.0	V	326.0	10.6
12778.000000	50.02	74.00	23.98	1000.000	365.0	H	170.0	17.0
16853.500000	54.34	74.00	19.66	1000.000	100.0	H	241.0	21.9

**Average**

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3157.500000	26.02	54.00	27.98	1000.000	100.0	H	184.0	4.5
4960.000000	39.72	54.00	14.28	1000.000	237.0	H	302.0	6.7
7440.000000	50.29	54.00	3.71	1000.000	193.0	V	326.0	10.6
12778.000000	36.28	54.00	17.72	1000.000	365.0	H	170.0	17.0
16853.500000	40.72	54.00	13.28	1000.000	100.0	H	241.0	21.9



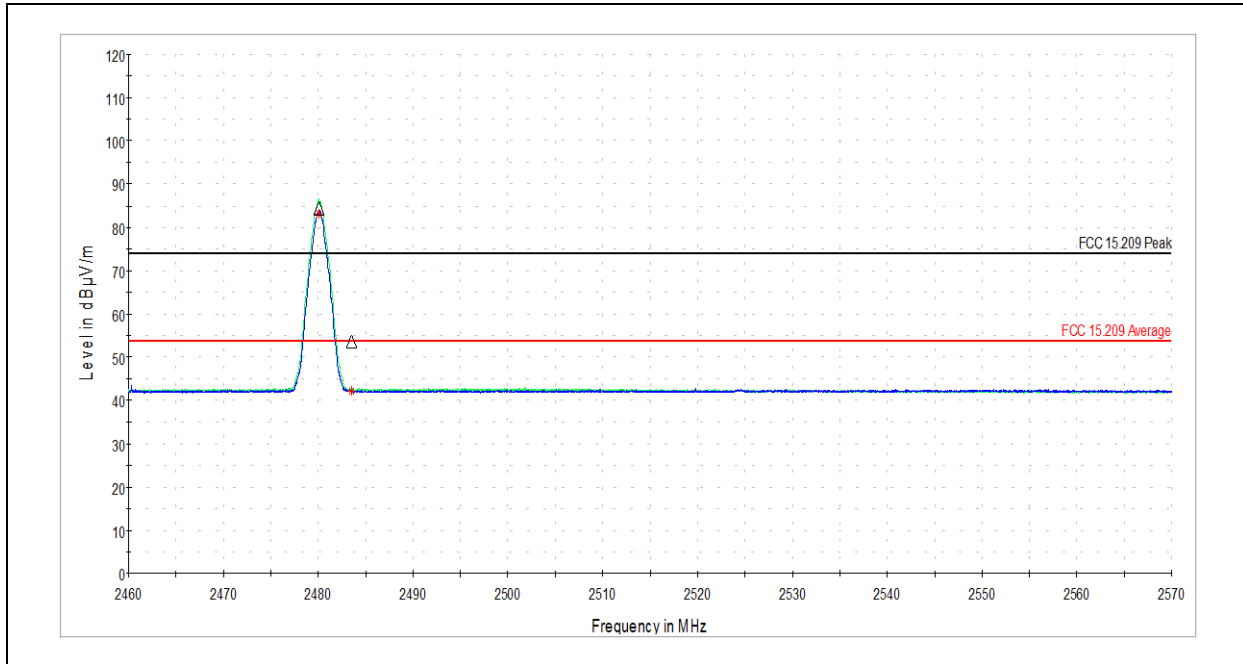
7.13 Emissions at the low band edge:



Frequency (MHz)	Average (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2390.211000	41.23	---	54.00	12.77	1000.000	295.0	V	257.0	37.0
2390.211000	---	52.56	74.00	21.44	1000.000	295.0	V	257.0	37.0



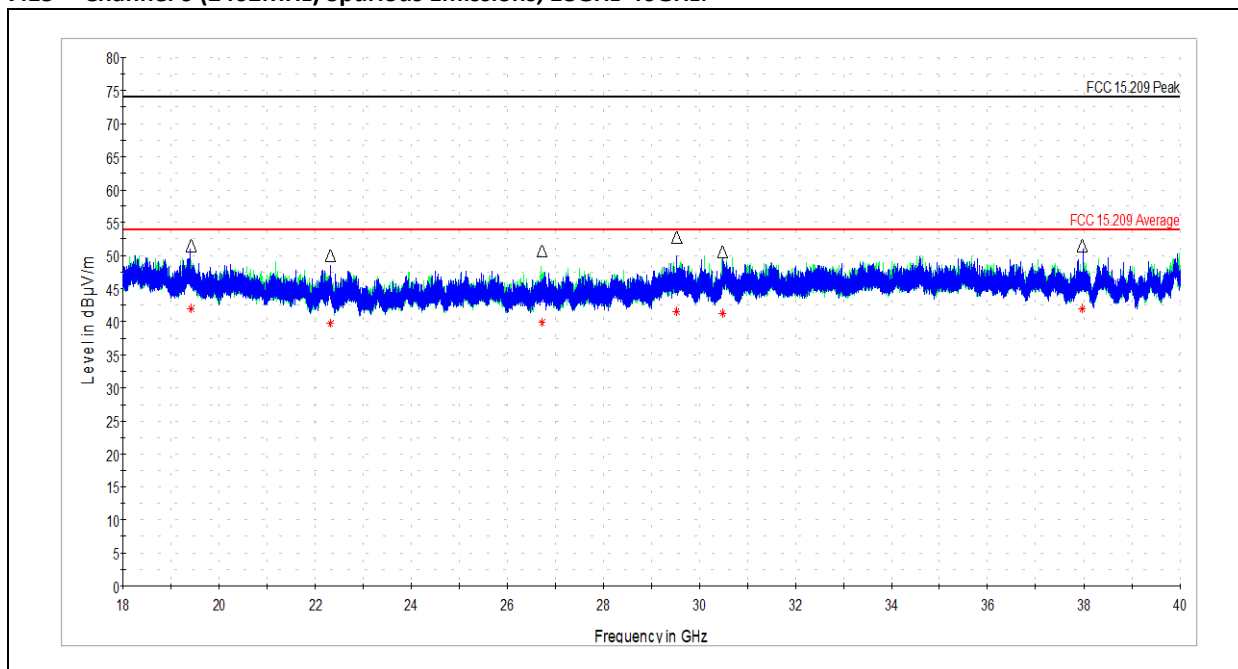
7.14 Emissions at the high band edge:



Frequency (MHz)	Average (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2483.5	42.41	---	54.00	11.59	1000.000	270.0	H	276.0	37.5
2483.5	---	52.97	74.00	21.03	1000.000	270.0	H	276.0	37.5



### 7.15 Channel 0 (2402MHz) Spurious Emissions, 18GHz-40GHz:



#### Peak

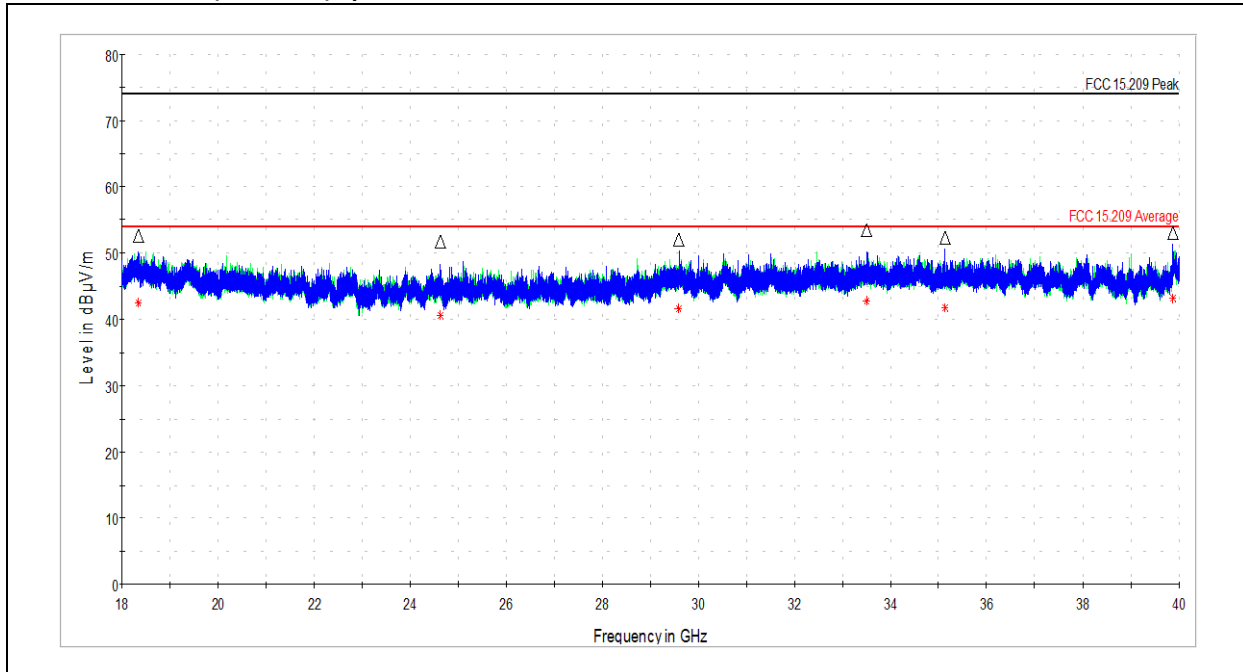
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
19411.124546	51.52	74.00	22.48	1000.000	177.0	V	29.0
22311.776364	50.06	74.00	23.94	1000.000	191.0	V	-1.0
26722.141818	50.74	74.00	23.26	1000.000	258.0	H	0.0
29527.794545	52.81	74.00	21.19	1000.000	243.0	V	190.0
30483.572727	50.59	74.00	23.41	1000.000	257.0	V	24.0
37972.040000	51.60	74.00	22.40	1000.000	126.0	V	150.0

#### Average

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
19411.124546	42.01	54.00	11.99	1000.000	177.0	V	29.0
22311.776364	39.74	54.00	14.26	1000.000	191.0	V	-1.0
26722.141818	39.92	54.00	14.08	1000.000	258.0	H	0.0
29527.794545	41.56	54.00	12.44	1000.000	243.0	V	190.0
30483.572727	41.32	54.00	12.68	1000.000	257.0	V	24.0
37972.040000	41.96	54.00	12.04	1000.000	126.0	V	150.0



7.16 Channel 19 (2440MHz) Spurious Emissions, 18GHz-40GHz:



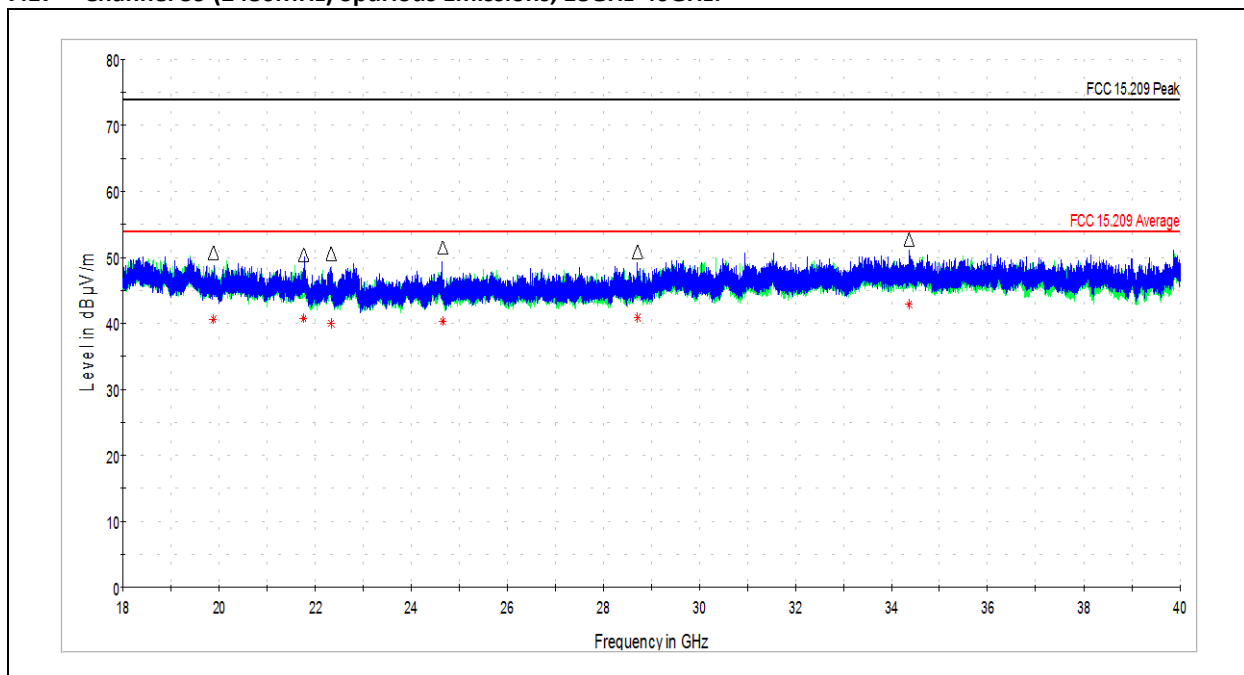
Peak

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
18336.281819	52.61	74.00	21.39	1000.000	324.0	V	-10.0
24622.605455	51.70	74.00	22.30	1000.000	172.0	V	172.0
29590.983637	52.04	74.00	21.96	1000.000	315.0	V	312.0
33496.707273	53.50	74.00	20.50	1000.000	201.0	V	289.0
35127.673637	52.37	74.00	21.63	1000.000	158.0	V	103.0
39878.837273	53.03	74.00	20.97	1000.000	225.0	V	26.0

Average

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
18336.281819	42.44	54.00	11.56	1000.000	324.0	V	-10.0
24622.605455	40.51	54.00	13.49	1000.000	172.0	V	172.0
29590.983637	41.64	54.00	12.36	1000.000	315.0	V	312.0
33496.707273	42.82	54.00	11.18	1000.000	201.0	V	289.0
35127.673637	41.77	54.00	12.23	1000.000	158.0	V	103.0
39878.837273	43.24	54.00	10.76	1000.000	225.0	V	26.0



**7.17 Channel 39 (2480MHz) Spurious Emissions, 18GHz-40GHz:****Peak**

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
19886.942728	50.82	74.00	23.18	1000.000	289.0	V	128.0
21765.486364	50.38	74.00	23.62	1000.000	269.0	V	31.0
22334.350909	50.63	74.00	23.37	1000.000	390.0	H	119.0
24648.451818	51.55	74.00	22.45	1000.000	171.0	V	229.0
28707.681818	50.86	74.00	23.14	1000.000	272.0	V	275.0
34363.716364	52.75	74.00	21.25	1000.000	229.0	V	12.0

**Average**

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
19886.942728	40.64	54.00	13.36	1000.000	289.0	V	128.0
21765.486364	40.71	54.00	13.29	1000.000	269.0	V	31.0
22334.350909	40.02	54.00	13.98	1000.000	390.0	H	119.0
24648.451818	40.30	54.00	13.70	1000.000	171.0	V	229.0
28707.681818	40.94	54.00	13.06	1000.000	272.0	V	275.0
34363.716364	42.92	54.00	11.08	1000.000	229.0	V	12.0



## 8 Output Power

### 8.1 Test Limits

#### **FCC Part 15.247(b)(3):**

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

#### **RSS-247 Issue 2 § 5.4(d):**

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.



### 8.2 Test Method

Peak power measurements were performed in accordance with ANSI C63.10:2013 § 11.9.1.1 RBW ≥ DTS bandwidth

### 8.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Spectrum Analyzer	3720	Rohde & Schwarz	FSEK30	9/21/2018	9/21/2019

### 8.4 Test Conditions

Test Personnel:	<u>Bryan Taylor</u>	Test Date:	<u>10/19/2018</u>
Supervising/Reviewing Engineer:	<u>NA</u>	Limit Applied:	<u>See Above</u>
(Where Applicable)	<u>FCC Part 15.247</u>	Ambient Temperature:	<u>25.6C</u>
Product Standard:	<u>RSS-247 Issue 2</u>	Relative Humidity:	<u>52.2%</u>
Input Voltage:	<u>12VDC</u>	Atmospheric Pressure:	<u>985.4mbar</u>
Pretest Verification w / Ambient			
Signals or BB Source:	<u>Yes</u>		

### 8.5 Test Results

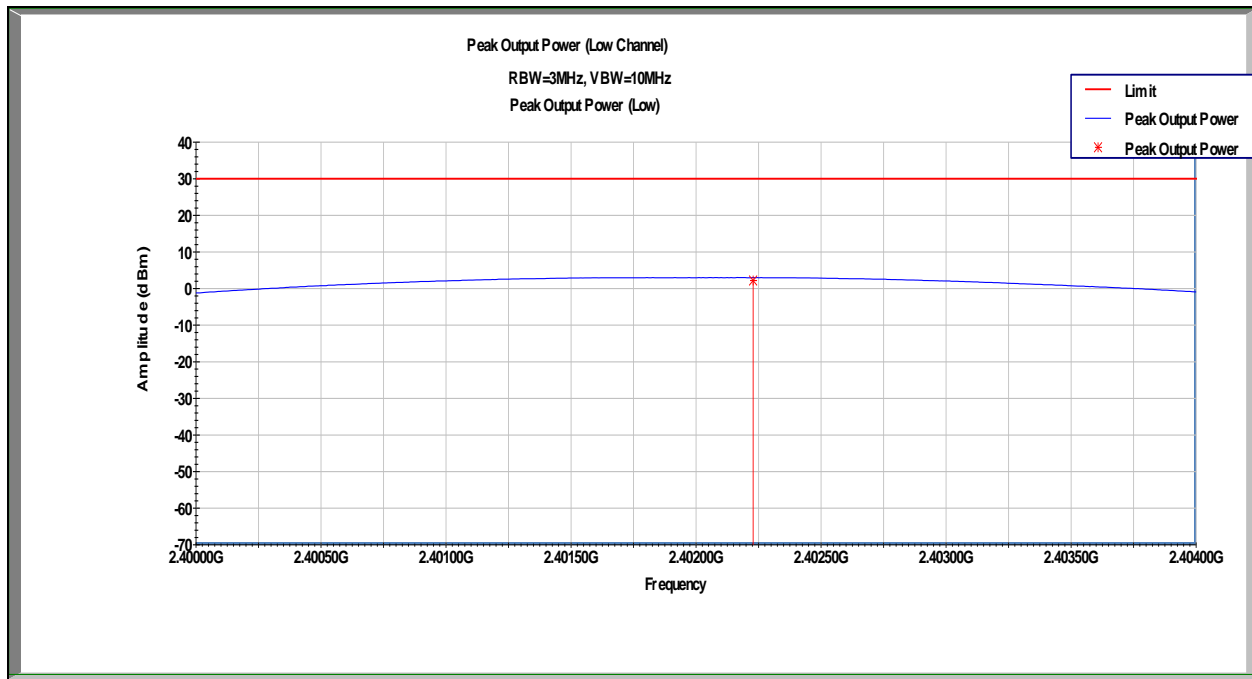
The device was found to be **compliant**. The average output power was less than 1W.



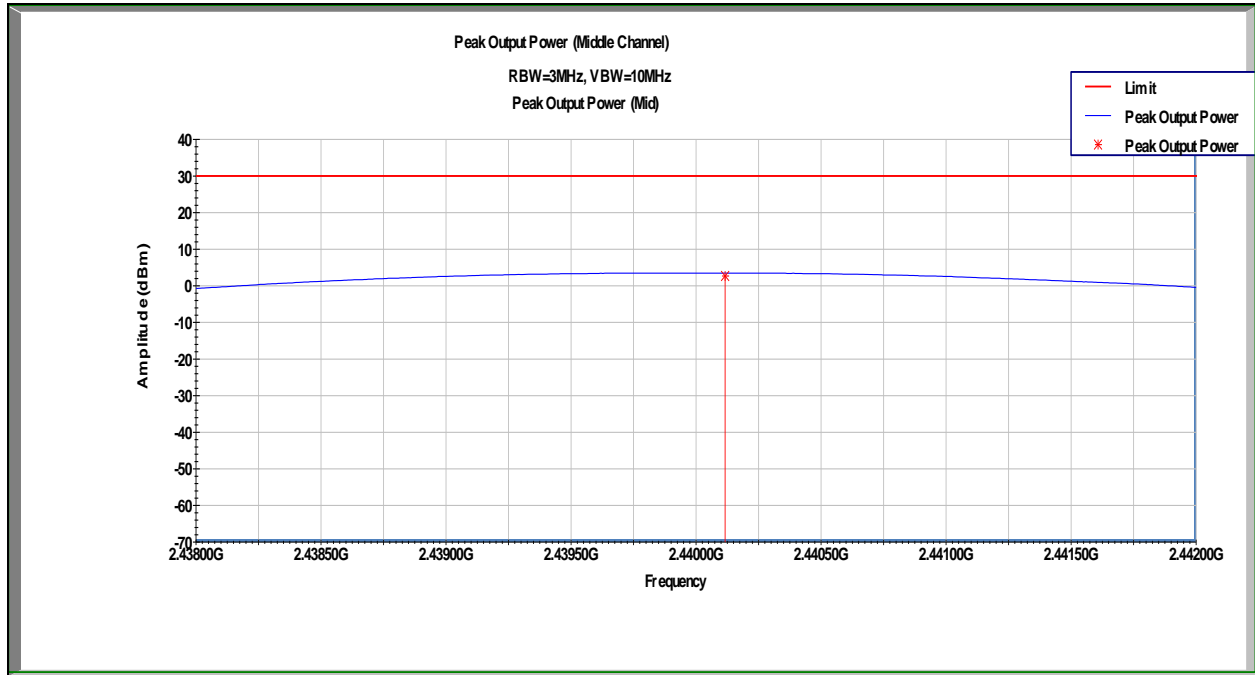
### 8.6 Test Data

Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	Margin (dB)	Result
2.402 GHz	2.188	30	27.812	Pass
2.440 GHz	2.660	30	27.340	Pass
2.480 GHz	3.242	30	26.758	Pass

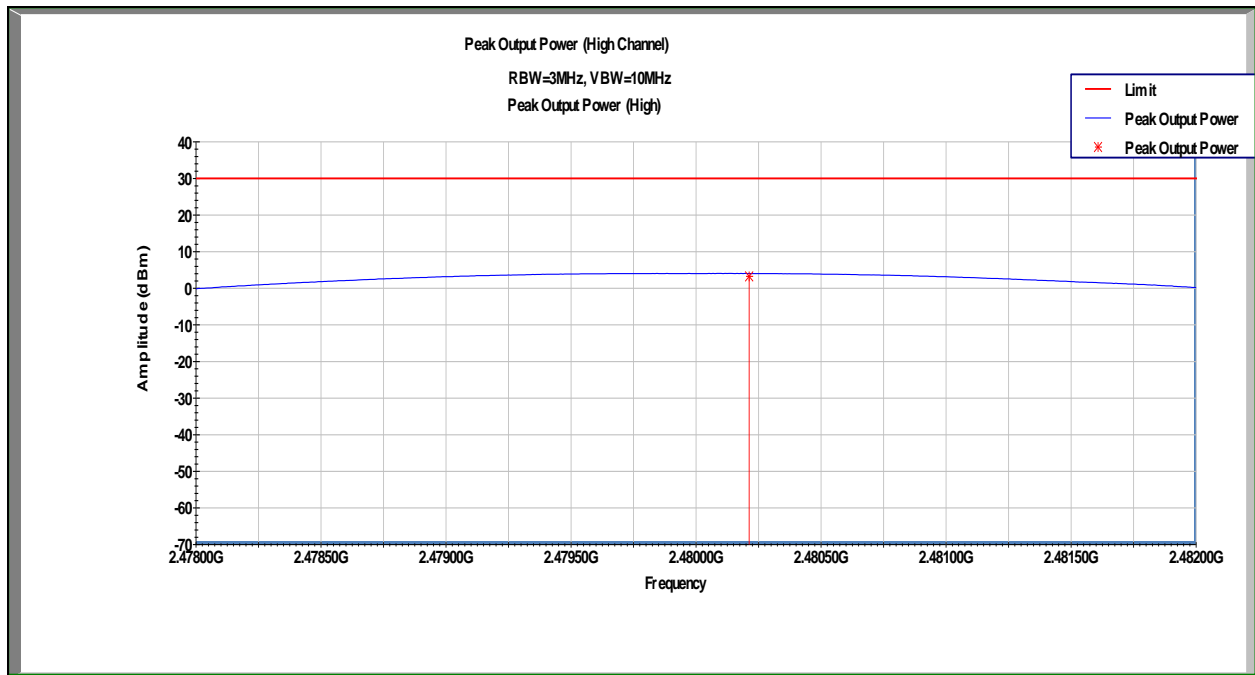
Deviations, Additions, or Exclusions: None



1Mb/s Ch 0 (2402MHz) Peak Output Power



1Mb/s Ch 19 (2440MHz) Peak Output Power



1Mb/s Ch 39 (2480MHz) Peak Output Power



## 9 Occupied Bandwidth

### 9.1 Test Limits

#### FCC Part 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.

#### RSS-247 Issue 2 § 5.2(a):

The minimum 6 dB bandwidth shall be 500 kHz.

### 9.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 11.8.1 and § 6.9.3.

### 9.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Spectrum Analyzer	3720	Rohde & Schwarz	FSEK30	9/21/2018	9/21/2019



### 9.4 Test Conditions

Test Personnel:	<u>Bryan Taylor</u>	Test Date:	<u>10/19/2018</u>
Supervising/Reviewing Engineer:		Limit Applied:	<u>See Above</u>
(Where Applicable)	<u>NA</u>	Ambient Temperature:	<u>25.6C</u>
Product Standard:	<u>FCC Part 15.247</u>	Relative Humidity:	<u>52.2%</u>
Input Voltage:	<u>RSS-247 Issue 2</u>	Atmospheric Pressure:	<u>985.4mbar</u>
Pretest Verification w / Ambient	<u>12VDC</u>		
Signals or BB Source:	<u>Yes</u>		

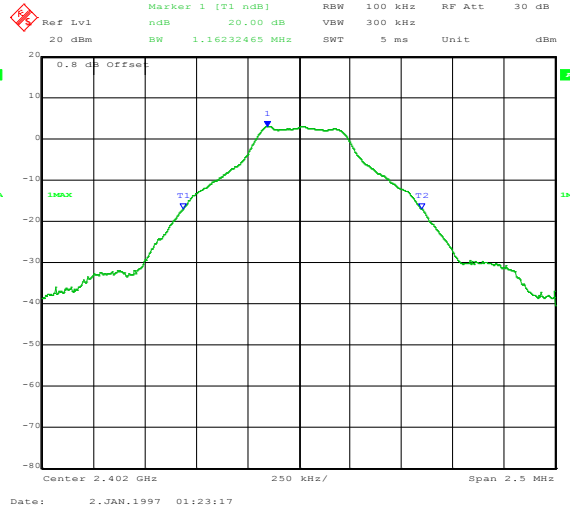
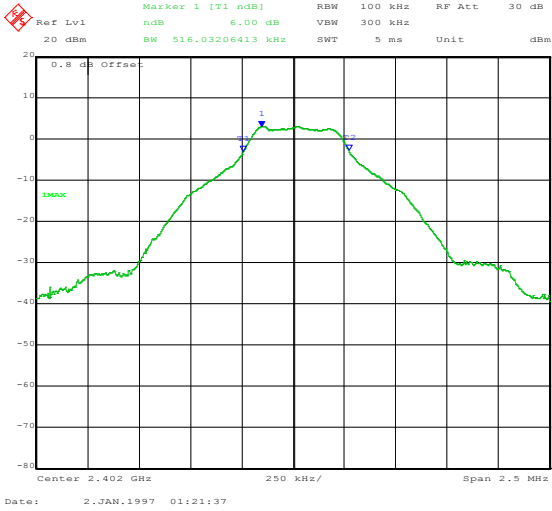
### 9.5 Test Results

The device was found to be **compliant**. The 6dB bandwidth was at least 500kHz.

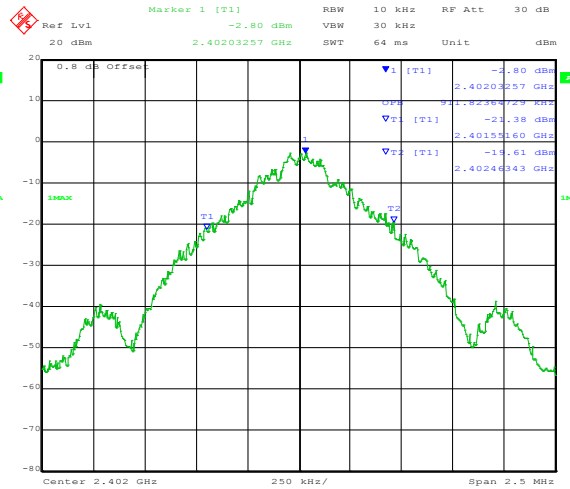
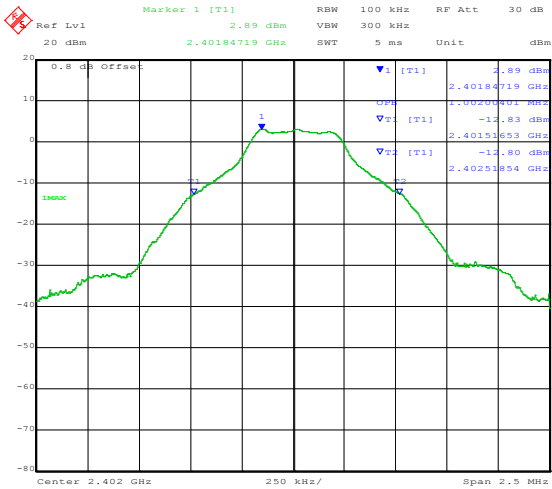
### 9.6 Test Data

Data Rate	Channel	Frequency (MHz)	6dB BW (kHz) RBW = 100kHz	20dB BW (kHz) RBW = 100kHz	99% BW (kHz) RBW = 100kHz	99% BW (kHz) RBW = 1-5% OBW
1Mb/s	0	2402	515kHz	1162kHz	1000kHz	911.8kHz
	19	2440	516kHz	1162kHz	991.9kHz	896.8kHz
	39	2480	511kHz	1152kHz	1002kHz	931.8kHz

Deviations, Additions, or Exclusions: None

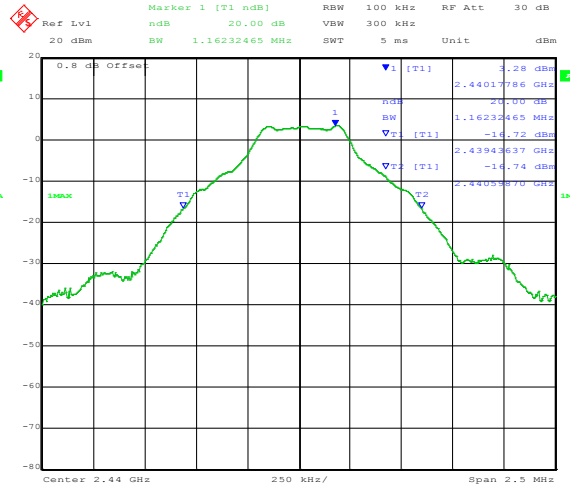
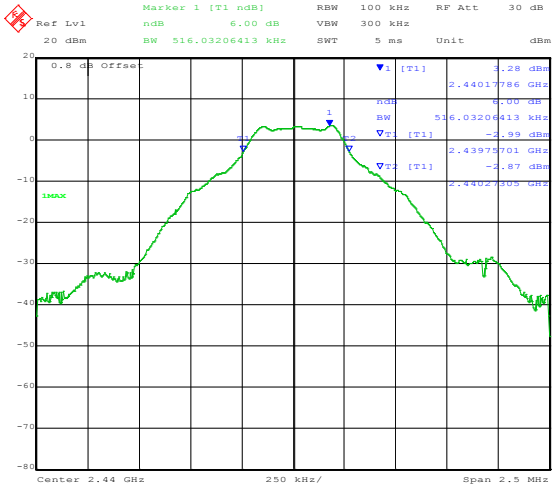


1Mb/s Channel 0 (2402MHz) 6dB BW (left) and 20dB BW (right)

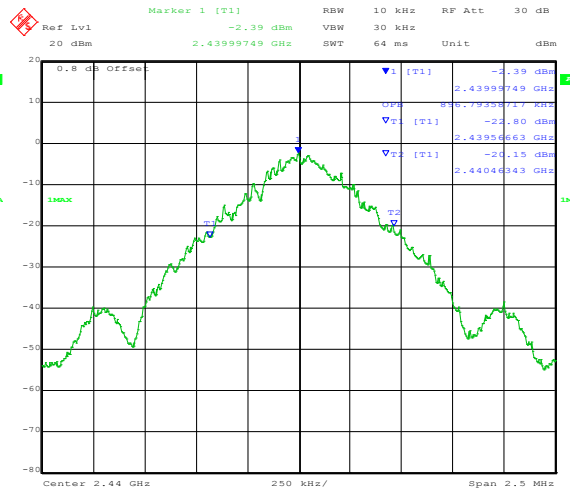
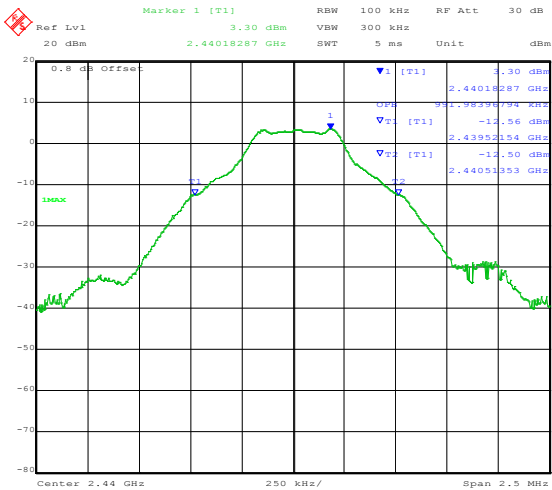


1Mb/s Channel 0 (2402MHz) 99% BW RBW=100kHz (left) and RBW=1-5% OBW (right)

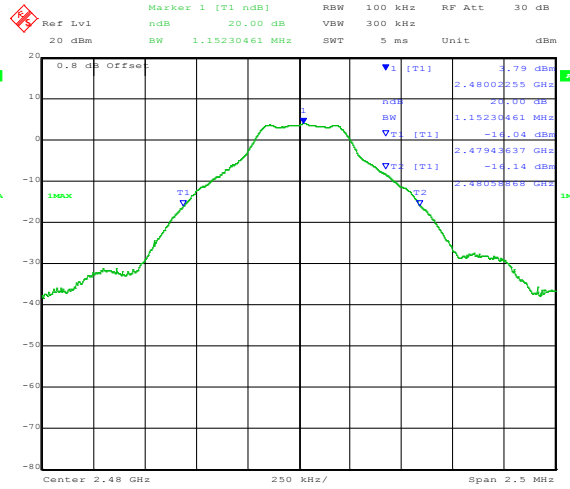
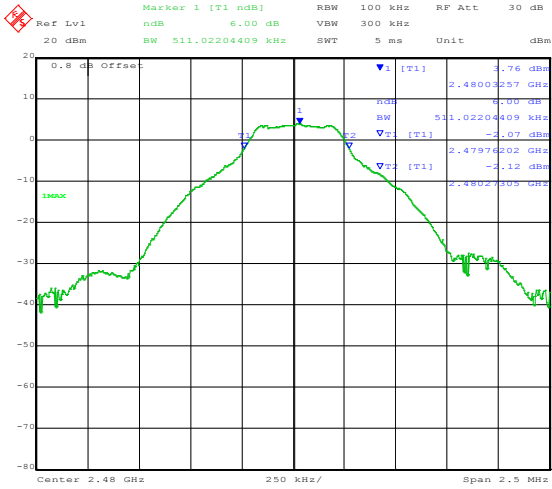




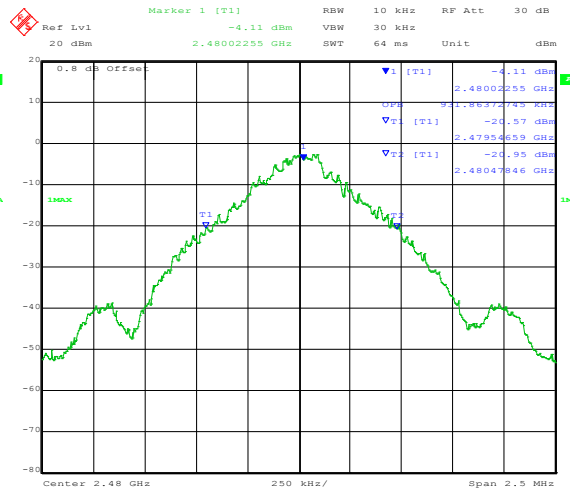
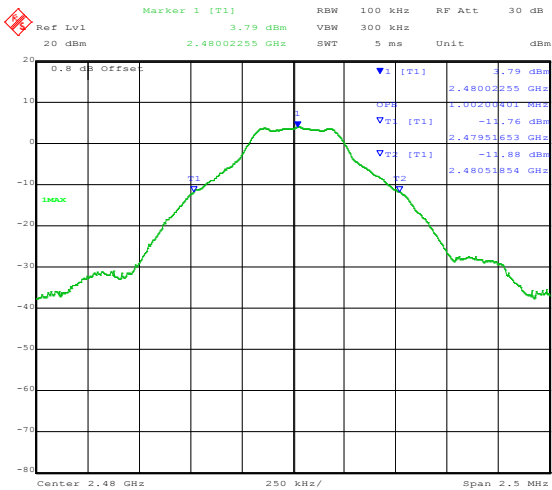
1Mb/s Channel 39 (2440MHz) 6dB BW (left) and 20dB BW (right)



1Mb/s Channel 39 (2440MHz) 99% BW RBW=100kHz (left) and RBW=1-5% OBW (right)



1Mb/s Channel 80 (2480MHz) 6dB BW (left) and 20dB BW (right)



1Mb/s Channel 80 (2480MHz) 99% BW RBW=100kHz (left) and RBW=1-5% OBW (right)



## 10 Power Spectral Density

### 10.1 Test Limits

#### FCC Part 15.247(e):

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 this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

#### RSS-247 Issue 2 § 5.2(b):

The transmitter power spectral density conducted from the transmitter 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 section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

### 10.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 11.10.2 Method PKPSD (peak PSD).

### 10.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Spectrum Analyzer	3720	Rohde & Schwarz	FSEK30	9/21/2018	9/21/2019



### 10.4 Test Conditions

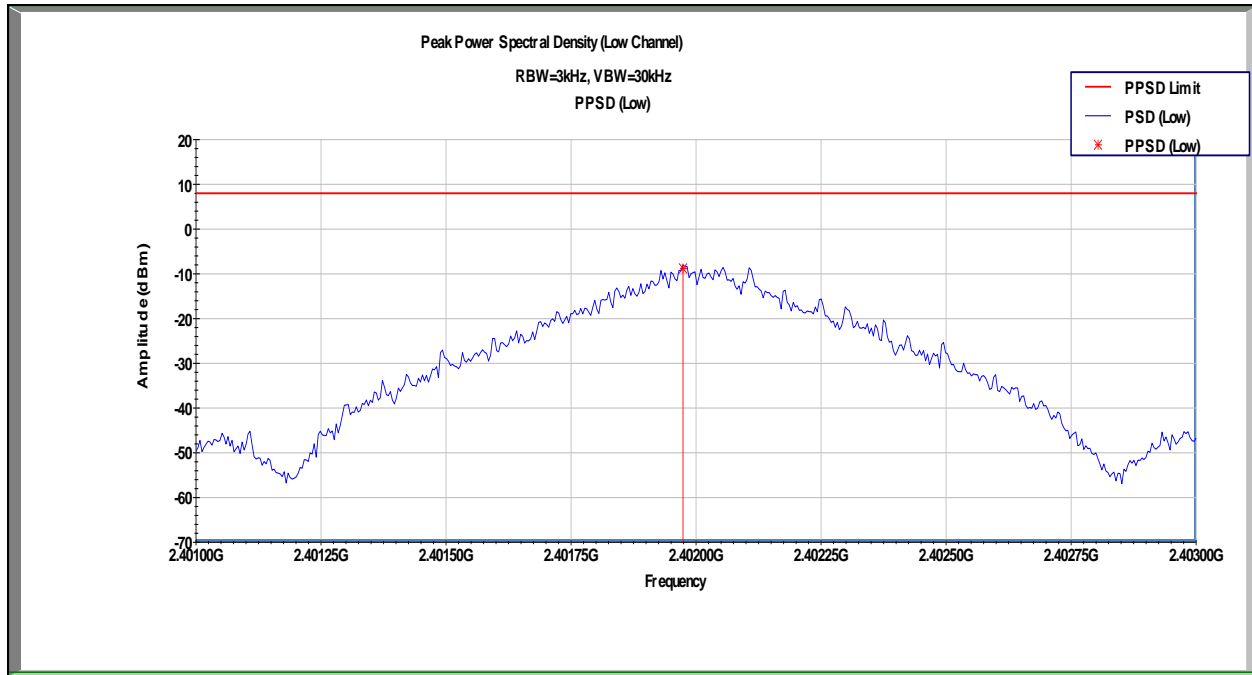
Test Personnel:	<u>Bryan Taylor</u>	Test Date:	<u>10/19/2018</u>
Supervising/Reviewing Engineer:	<u>NA</u>	Limit Applied:	<u>See Above</u>
(Where Applicable)	<u>FCC Part 15.247</u>	Ambient Temperature:	<u>25.6C</u>
Product Standard:	<u>RSS-247 Issue 2</u>	Relative Humidity:	<u>52.2%</u>
Input Voltage:	<u>12VDC</u>	Atmospheric Pressure:	<u>985.4mbar</u>
Pretest Verification w / Ambient			
Signals or BB Source:	<u>Yes</u>		

### 10.5 Test Results

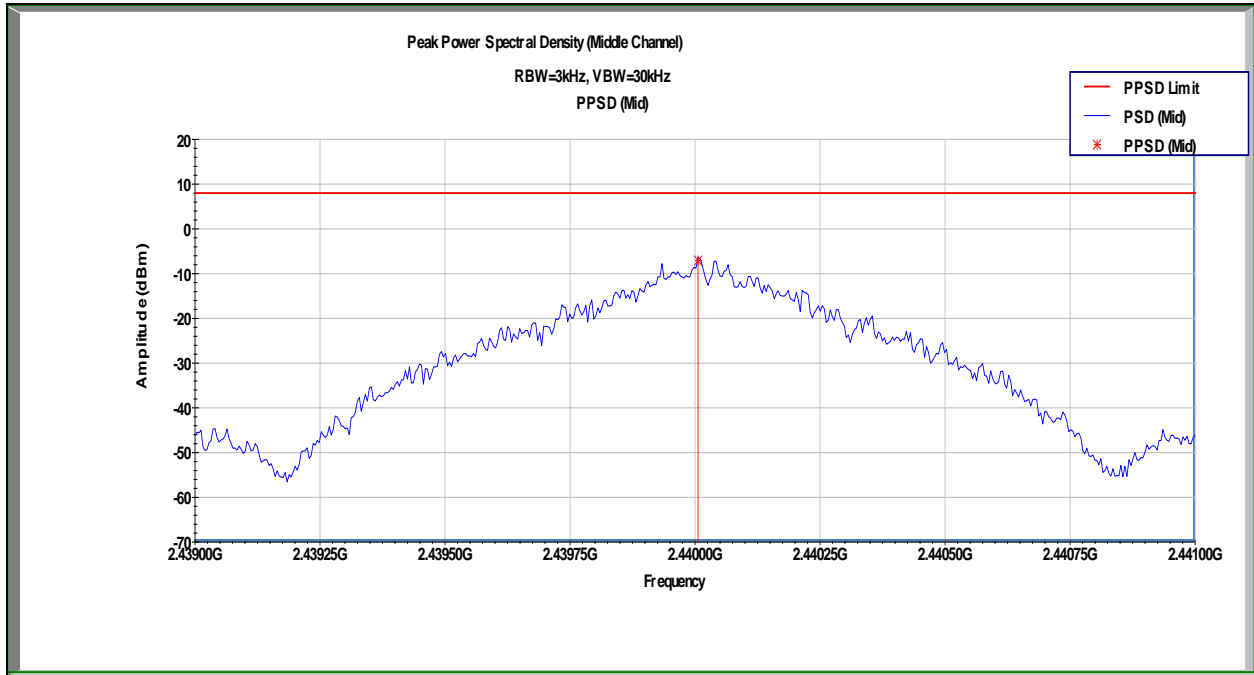
The device was found to be **compliant**. The peak power spectral density was less than 8dBm.

Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)	Result
2.402 GHz	-8.788	8	16.788	Pass
2.440 GHz	-7.104	8	15.104	Pass
2.480 GHz	-7.767	8	15.767	Pass

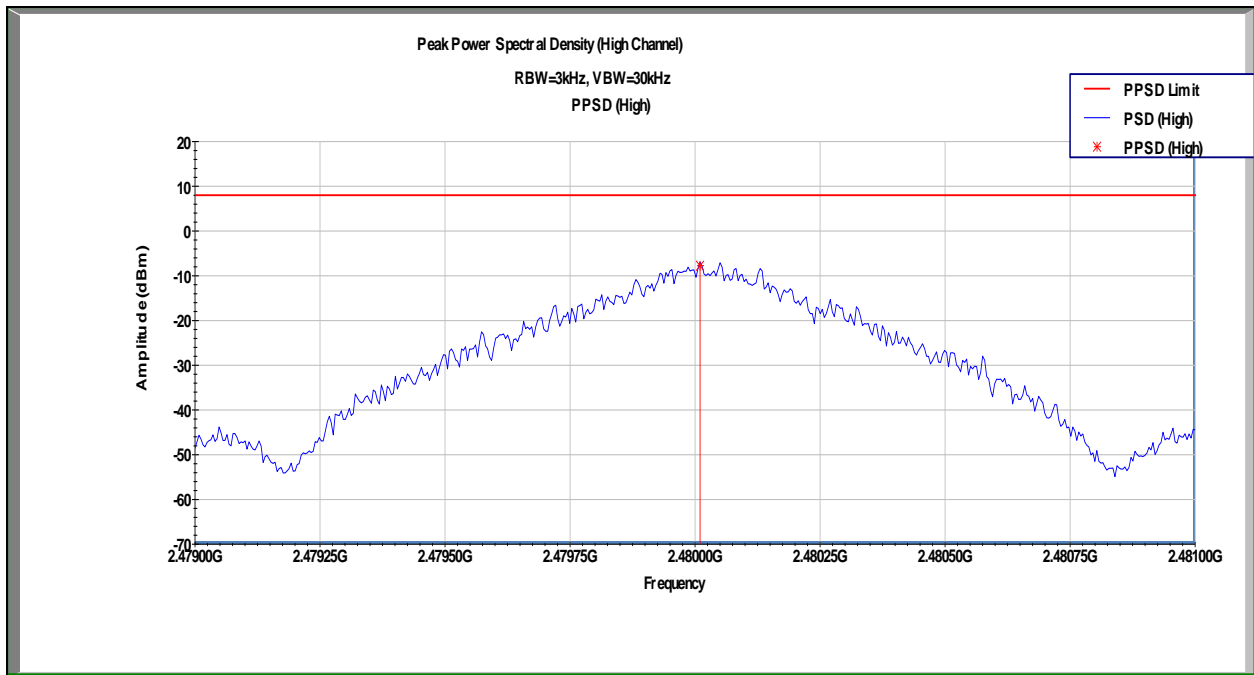
### 10.6 Test Data



1Mb/s Ch 0 (2402MHz)



1Mb/s Ch 19 (2440MHz) Conducted Spurious Emissions



1Mb/s Ch 39 (2480MHz) Conducted Spurious Emissions



## 11 Conducted Spurious Emissions

### 11.1 Test Limits

#### FCC Part 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 §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

#### RSS-247 Issue 2 § 5.5:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

### 11.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 11.11 Emissions in nonrestricted frequency bands.

### 11.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Spectrum Analyzer	3720	Rohde & Schwarz	FSEK30	9/21/2018	9/21/2019

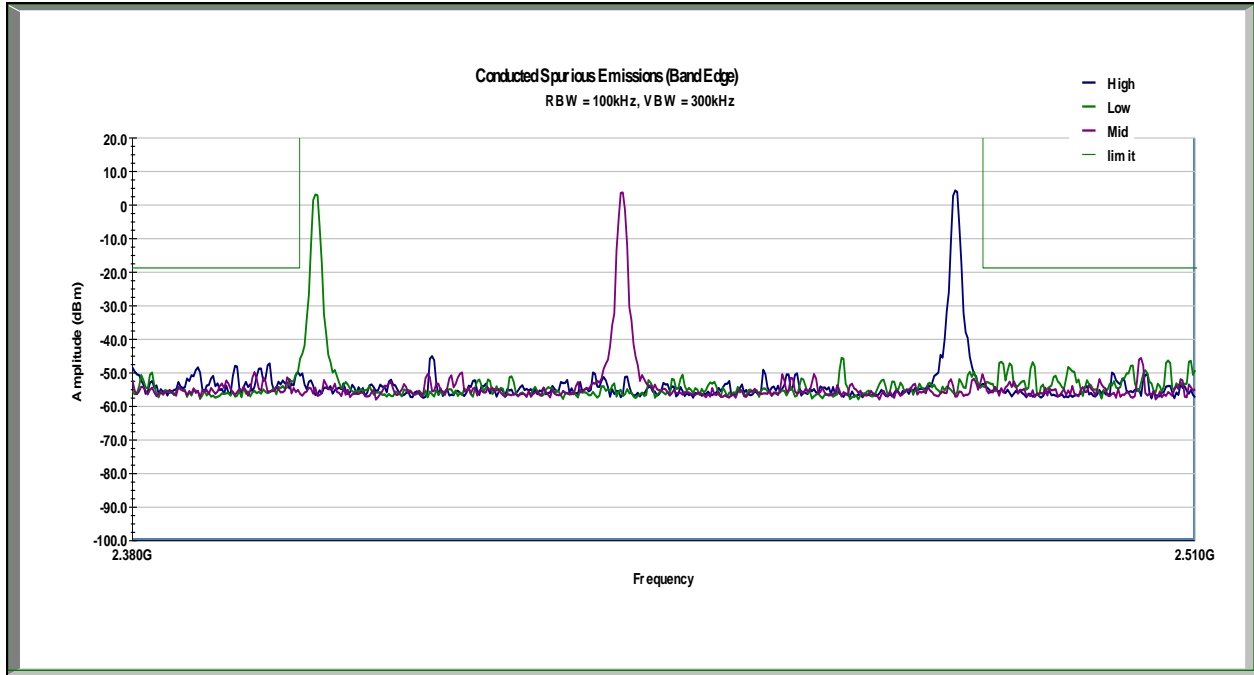
### 11.4 Test Conditions

Test Personnel:	<u>Bryan Taylor</u>	Test Date:	<u>10/19/2018</u>
Supervising/Reviewing Engineer:	<u>NA</u>	Limit Applied:	<u>See Above</u>
(Where Applicable)	<u>FCC Part 15.247</u>	Ambient Temperature:	<u>25.6C</u>
Product Standard:	<u>RSS-247 Issue 2</u>	Relative Humidity:	<u>52.2%</u>
Input Voltage:	<u>12VDC</u>	Atmospheric Pressure:	<u>985.4mbar</u>
Pretest Verification w / Ambient Signals or BB Source:	<u>Yes</u>		

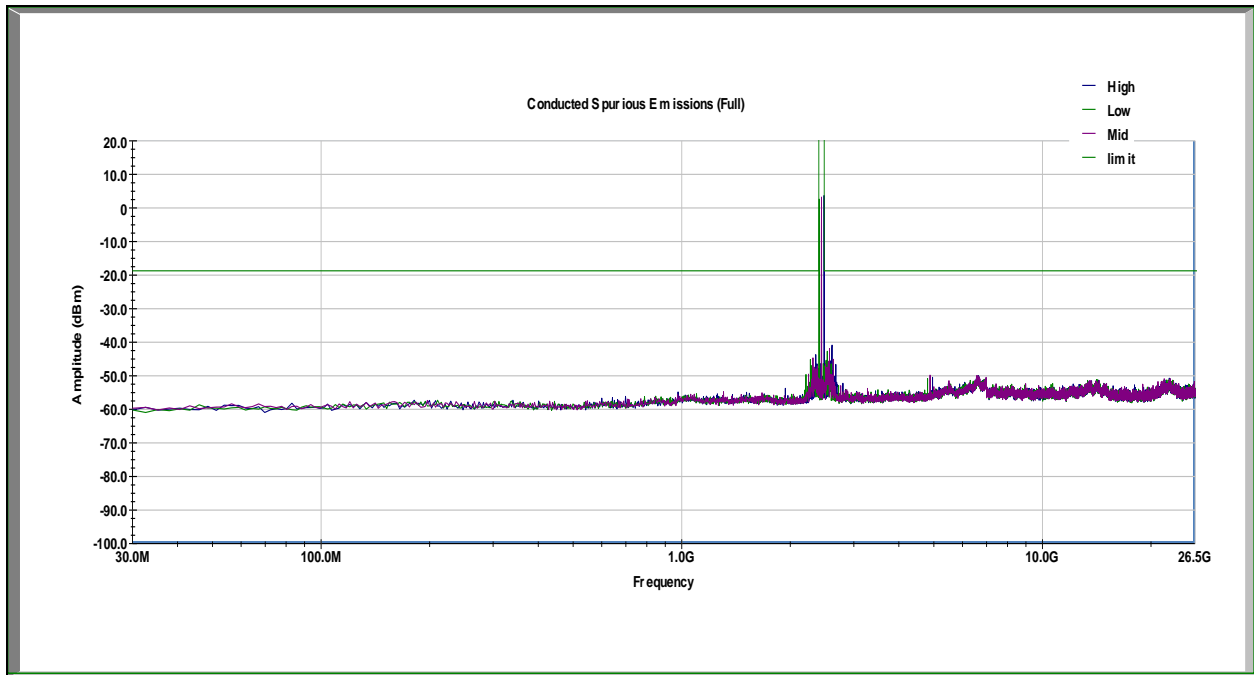


### 11.5 Test Results

The device was found to be **compliant**. All spurious emissions were found to be attenuated more than 20dB below the level of the fundamental.



1Mb/s Conducted Spurious Emissions (Band)



1Mb/s Ch 0 (2402MHz), Ch 19 (2440MHz), and 1Mb/s Ch 39 (2480MHz) Conducted Spurious Emissions



## 12 Antenna Requirement

### 12.1 Test Limits

#### FCC Part 15.203:

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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

#### RSS-Gen Issue 5 § 6.8:

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

*This radio transmitter (identify the device by certification number) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.*

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

### 12.2 Test Results

The device was found to be **compliant**. The device has an internal, permanently affixed antenna.





## 13 Conducted Emissions

### 13.1 Method

Tests are performed in accordance with ANSI C63.4: 2014

**TEST SITE:** Ground Plane

**Site Designation:** Ground Plane

### Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	U <sub>CISPR</sub>
AC Line Conducted Emissions	150 kHz - 30 MHz	3.1dB	3.4dB
Telco Port Emissions	150 kHz - 30 MHz	3.2dB	5.0dB

As shown in the table above our conducted emissions  $U_{lab}$  is less than the corresponding  $U_{CISPR}$  reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required.

### 13.2 Sample Calculations

The following is how net line-conducted readings were determined:

$$NF = RF + LF + CF + AF$$

Where NF = Net Reading in dB $\mu$ V

RF = Reading from receiver in dB $\mu$ V

LF = LISN or ISN Correction Factor in dB

CF = Cable Correction Factor in dB

AF = Attenuator Loss Factor in dB

To convert from dB $\mu$ V to  $\mu$ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

$$NF = \text{Net Reading in dB}\mu\text{V}$$

#### Example:

$$NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V}$$

$$UF = 10^{(49.1 \text{ dB}\mu\text{V} / 20)} = 285.1 \mu\text{V/m}$$

**13.3 Test Equipment Used:**

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde&Schwarz	ESU40	9/18/2018	9/18/2019
LISN	2509	Fischer Custom Communication	FCC-LISN-50- 50-2M	4/10/2019	4/10/2019
COND3	6026			12/1/2017	12/1/2018

**13.4 Software Utilized:**

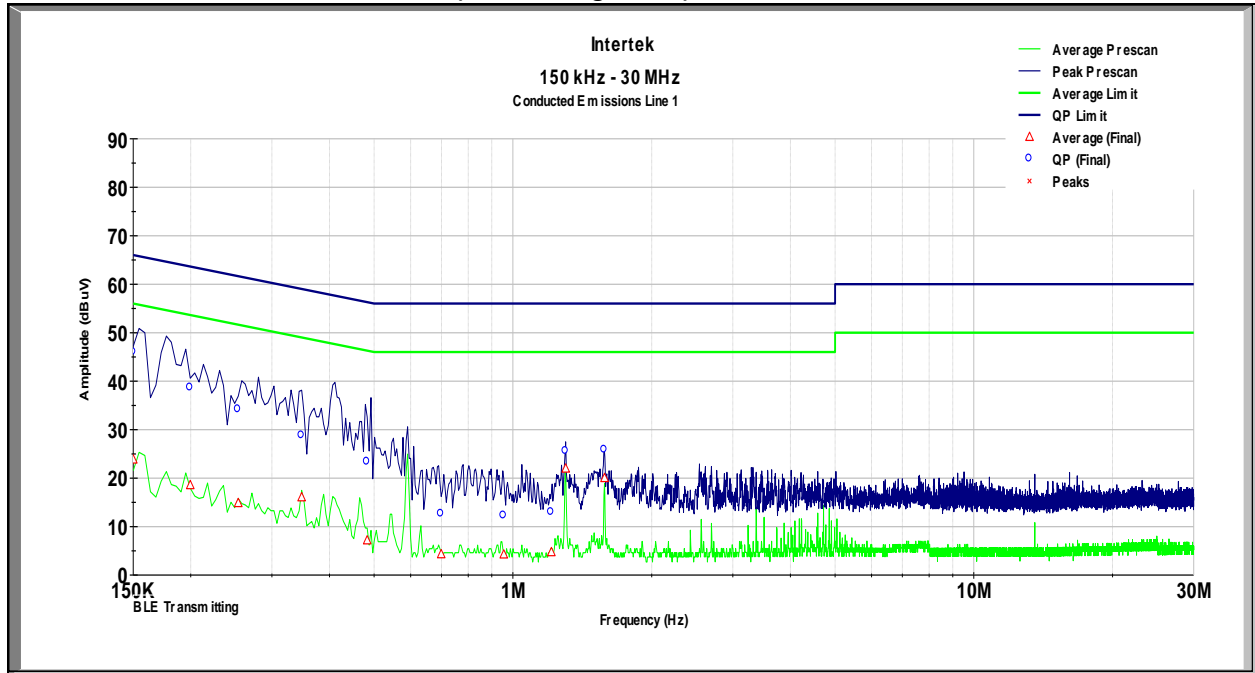
Name	Manufacturer	Version
TILE	ETS Lindgren	V7.0.6.545

**13.5 Results:**

The sample tested was found to Comply.



13.6 Plots/Data: Conducted Emissions (Transmitting, Line 1)



Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.150	45.923	66.000	20.077	23.823	56.000	32.177
0.200	38.587	64.586	25.999	18.544	54.586	36.042
0.254	34.096	63.043	28.947	14.832	53.043	38.211
0.348	28.733	60.343	31.610	16.022	50.343	34.321
0.483	23.280	56.486	33.206	7.131	46.486	39.355
0.699	12.560	56.000	43.440	4.283	46.000	41.717
0.956	12.195	56.000	43.805	4.238	46.000	41.762
1.212	12.904	56.000	43.096	4.698	46.000	41.302
1.302	25.510	56.000	30.490	21.956	46.000	24.044
1.581	25.754	56.000	30.246	19.997	46.000	26.003

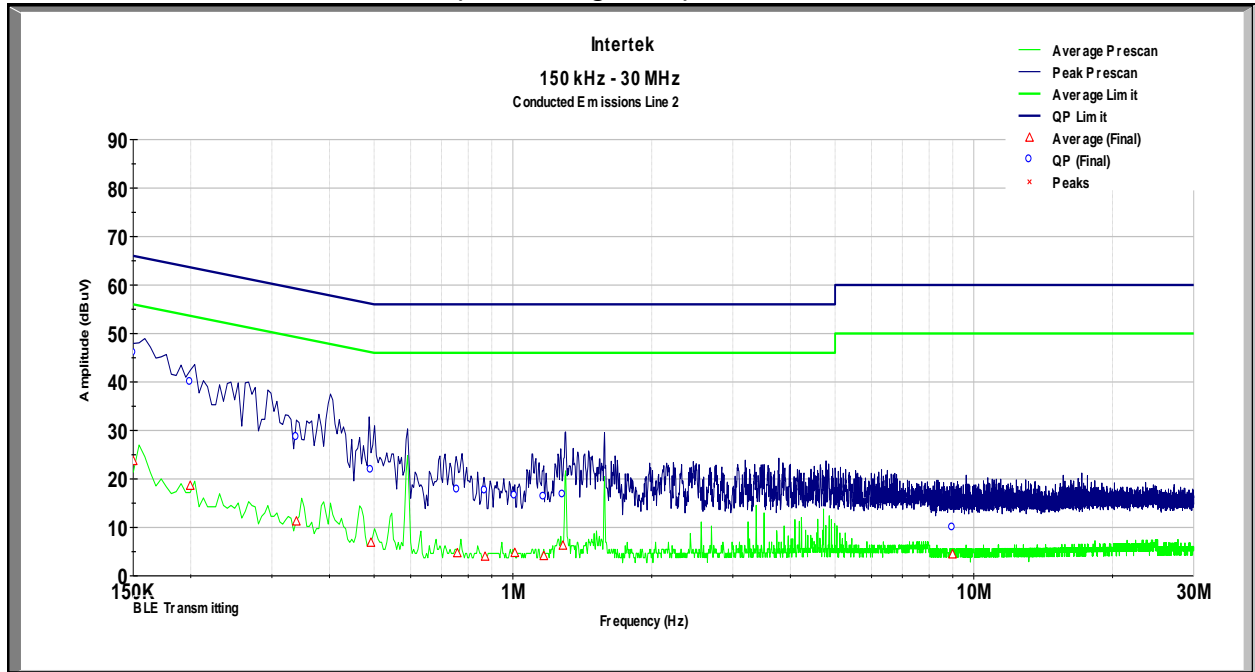
Test Personnel: Bryan Taylor  
 Supervising/Reviewing Engineer: NA  
 (Where Applicable)  
 Product Standard: FCC Part 15C / RSS-247  
120VAC / 60Hz into AC  
 Input Voltage: power adapter  
 Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 10/16/2018  
 Limit Applied: Part 15.207  
 Ambient Temperature: 25.0°C  
 Relative Humidity: 51.2 %  
 Atmospheric Pressure: 982 mbar

Deviations, Additions, or Exclusions: None



13.7 Plots/Data: Conducted Emissions (Transmitting, Line 2)



Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.150	45.953	66.000	20.047	23.671	56.000	32.329
0.200	39.885	64.586	24.701	18.551	54.586	36.034
0.339	28.549	60.600	32.051	11.202	50.600	39.398
0.492	21.768	56.229	34.460	6.821	46.229	39.407
0.757	17.693	56.000	38.307	4.660	46.000	41.340
0.870	17.489	56.000	38.511	3.941	46.000	42.059
1.010	16.454	56.000	39.546	4.694	46.000	41.306
1.167	16.231	56.000	39.769	4.052	46.000	41.948
1.284	16.675	56.000	39.325	6.226	46.000	39.774
8.994	9.891	60.000	50.109	4.413	50.000	45.587

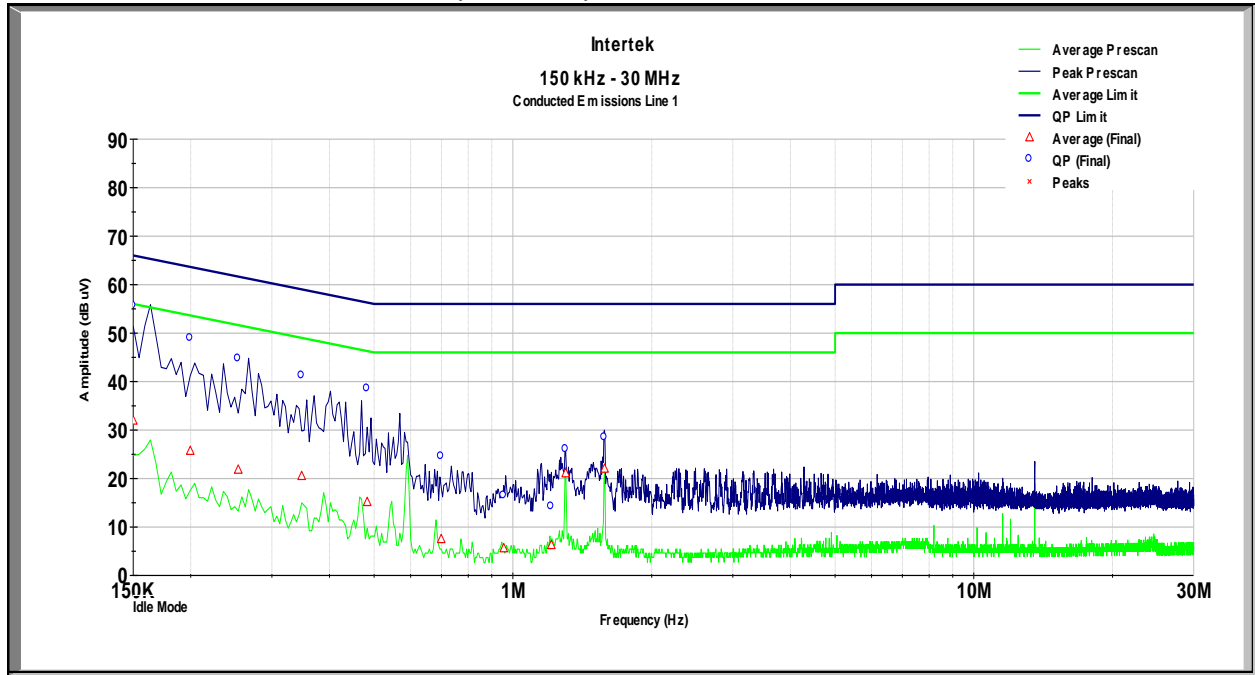
Test Personnel: Bryan Taylor  
 Supervising/Reviewing Engineer: NA  
 (Where Applicable)  
 Product Standard: FCC Part 15C / RSS-247  
120VAC / 60Hz into AC  
 Input Voltage: power adapter  
 Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 10/16/2018  
 Limit Applied: Part 15.207  
 Ambient Temperature: 25.0°C  
 Relative Humidity: 51.2 %  
 Atmospheric Pressure: 982 mbar

Deviations, Additions, or Exclusions: None



13.8 Plots/Data: Conducted Emissions (Idle, Line 1)



Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.150	55.546	66.000	10.454	31.950	56.000	24.050
0.200	48.894	64.586	15.691	25.696	54.586	28.890
0.254	44.641	63.043	18.402	21.813	53.043	31.230
0.348	41.182	60.343	19.160	20.483	50.343	29.860
0.483	38.465	56.486	18.021	15.132	46.486	31.353
0.699	24.514	56.000	31.486	7.480	46.000	38.520
0.956	16.412	56.000	39.588	5.599	46.000	40.401
1.212	14.147	56.000	41.853	6.234	46.000	39.766
1.302	25.967	56.000	30.033	21.060	46.000	24.940
1.581	28.422	56.000	27.578	22.002	46.000	23.998

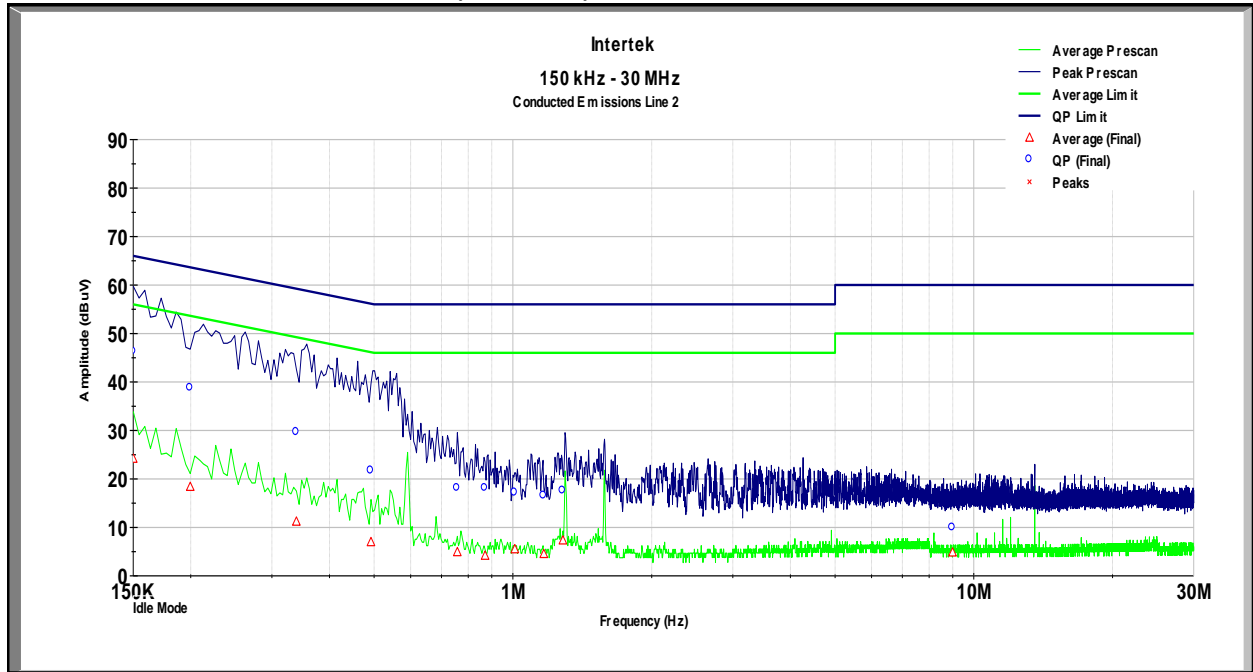
Test Personnel: Bryan Taylor  
 Supervising/Reviewing Engineer: NA  
 (Where Applicable)  
 Product Standard: FCC Part 15C / RSS-247  
120VAC / 60Hz into AC  
power adapter  
 Input Voltage:  
 Pretest Verification w / Ambient  
 Signals or BB Source: Yes

Test Date: 10/16/2018  
 Limit Applied: Part 15.207  
 Ambient Temperature: 25.0°C  
 Relative Humidity: 51.2 %  
 Atmospheric Pressure: 982 mbar

Deviations, Additions, or Exclusions: None



13.9 Plots/Data: Conducted Emissions (Idle, Line 2)



Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.150	46.214	66.000	19.786	24.137	56.000	31.863
0.200	38.721	64.586	25.865	18.344	54.586	36.241
0.339	29.590	60.600	31.010	11.170	50.600	39.430
0.492	21.647	56.229	34.582	6.929	46.229	39.300
0.757	18.070	56.000	37.930	4.875	46.000	41.125
0.870	18.062	56.000	37.938	4.131	46.000	41.869
1.010	17.098	56.000	38.902	5.469	46.000	40.531
1.167	16.457	56.000	39.543	4.471	46.000	41.529
1.284	17.503	56.000	38.497	7.291	46.000	38.709
8.994	9.891	60.000	50.109	4.809	50.000	45.191

Test Personnel: Bryan Taylor  
 Supervising/Reviewing Engineer: NA  
 (Where Applicable)  
 Product Standard: FCC Part 15C / RSS-247  
120VAC / 60Hz into AC  
 Input Voltage: power adapter  
 Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 10/16/2018  
 Limit Applied: Part 15.207  
 Ambient Temperature: 25.0°C  
 Relative Humidity: 51.2 %  
 Atmospheric Pressure: 982 mbar

Deviations, Additions, or Exclusions: None



#### 14 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	10/30/2018	103553976LEX-003	BCT	BZ	Original Issue