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Sargent & Greenleaf, Inc.

TEST REPORT

SCOPE OF WORK

EMC TESTING – AXISBLU SYSTEM

REPORT NUMBER

103621914LEX-002.1

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EMC TEST REPORT

(FULL COMPLIANCE)

Report Number: 103621914LEX-002.1

Project Number: G103621914

Report Issue Date: 9/25/2018

Model(s) Tested: AX26-302

Model(s) Partially Tested: AX26-102

AX26-202

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:

Sargent & Greenleaf, Inc.
One Security Drive
Nicholasville, KY 40356-0569
USA

Report prepared by



Brian Lackey, Project Engineer

Report reviewed by



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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
-	Conducted Emissions (ANSI C63.4: 2014)	NA ¹

¹ Test it not applicable. Unit is battery powered and does not connect directly or indirectly to AC Mains.



3 Client Information

This product was tested at the request of the following:

Client Information	
Client Name:	Sargent & Greenleaf, Inc.
Address:	One Security Drive Nicholasville, KY 40356-0569 USA
Contact:	Jeff Howell
Telephone:	+1 (859) 241-2256
Email:	Jeff.howell@sbdinc.com
Manufacturer Information	
Manufacturer Name:	Sargent & Greenleaf, Inc.
Manufacturer Address:	One Security Drive Nicholasville, KY 40356-0569 USA



4 Description of Equipment under Test and Variant Models

Equipment Under Test	
Product Name	AxisBlu System
Model Number	AX26-102 AX26-202 AX26-302
Serial Number	AX26-102: 00000050 AX26-202: 00000051 AX26-302: 00000049
Receive Date	8/27/2018
Test Start Date	8/28/2018
Test End Date	9/4/2018
Device Received Condition	Good
Test Sample Type	Production
Rated Voltage	9V Battery
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)	2.5 (from datasheet)
Maximum Output Power (dBm)	-0.19 (conducted)
Description of Equipment Under Test (provided by client)	
The system provides a Remote Keypad for a proven Electronic Lock. The system was designed to insert itself between the physical keypad and the internal lock in a secure container. The transmitter will reside within the secure container with the lock, with the antenna is installed in either a keypad, or an escutcheon, on the outside of the container. A mobile device (and APP) provide the input device for the remote keypad, and the BLE provides the communications link.	

4.1 Variant Models:

The following variant models were partially tested as part of this evaluation, but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

- AX26-102, identical electronics with different front cover
- AX26-202, identical electronics with different front cover

5 System Setup and Method

5.1 Method:

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

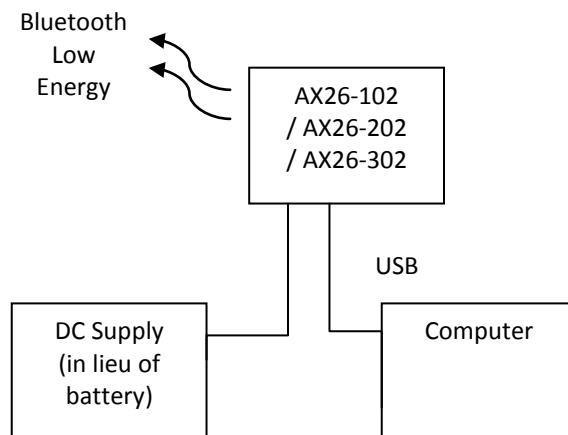


No.	Descriptions of EUT Exercising
1	Transmitting a Bluetooth Low Energy (BLE) signal or low, middle, or high channel
2	Idle, not transmitting. External DC supply used in lieu of battery for testing.

Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
1	DC Supply (in lieu of battery)	2	No	No	Bare Wire
2	USB-Serial Debug Cable	2	No	No	USB

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
DC Supply	HP	-	-
Computer	Dell	-	-

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 $\text{dB}\mu\text{V}/\text{m}$

RA = Receiver Amplitude (including preamplifier) in $\text{dB}\mu\text{V}$

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 $\text{dB}\mu\text{V}$ 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 $\text{dB}\mu\text{V}/\text{m}$. This value in $\text{dB}\mu\text{V}/\text{m}$ was converted to its corresponding level in $\mu\text{V}/\text{m}$.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB}/\text{m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 32 \text{ dB}\mu\text{V}/\text{m}$$

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

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

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

Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V}/\text{m} / 20)} = 39.8 \mu\text{V}/\text{m}$$



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 Results

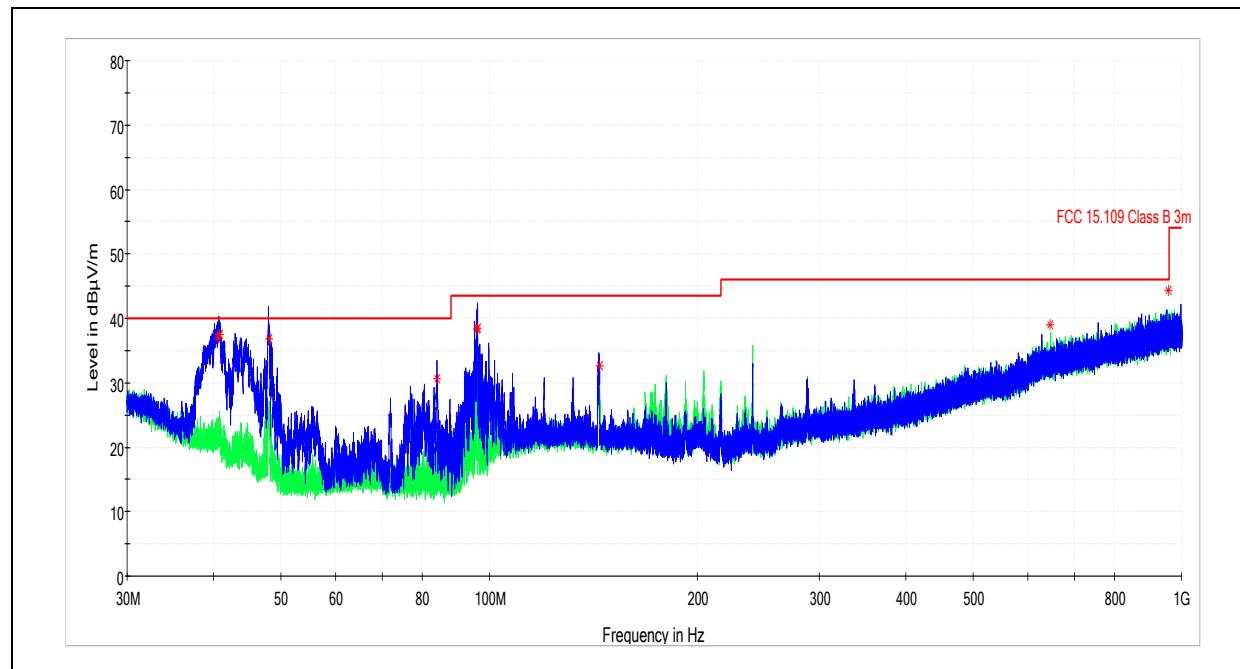
The sample tested was found to be **compliant**.

6.6 Test Conditions

Test Personnel:	B. Lackey	Test Date:	8/28/2018
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	Class B
Product Standard:	FCC Part 15.247	Ambient Temperature:	23.0C
Input Voltage:	RSS-247 Issue 2	Relative Humidity:	47.2%
Pretest Verification w / Ambient Signals or BB Source:	Battery	Atmospheric Pressure:	988.8mbar
	Yes		



6.7 Test Data: 30MHz – 1GHz (AX26-102)

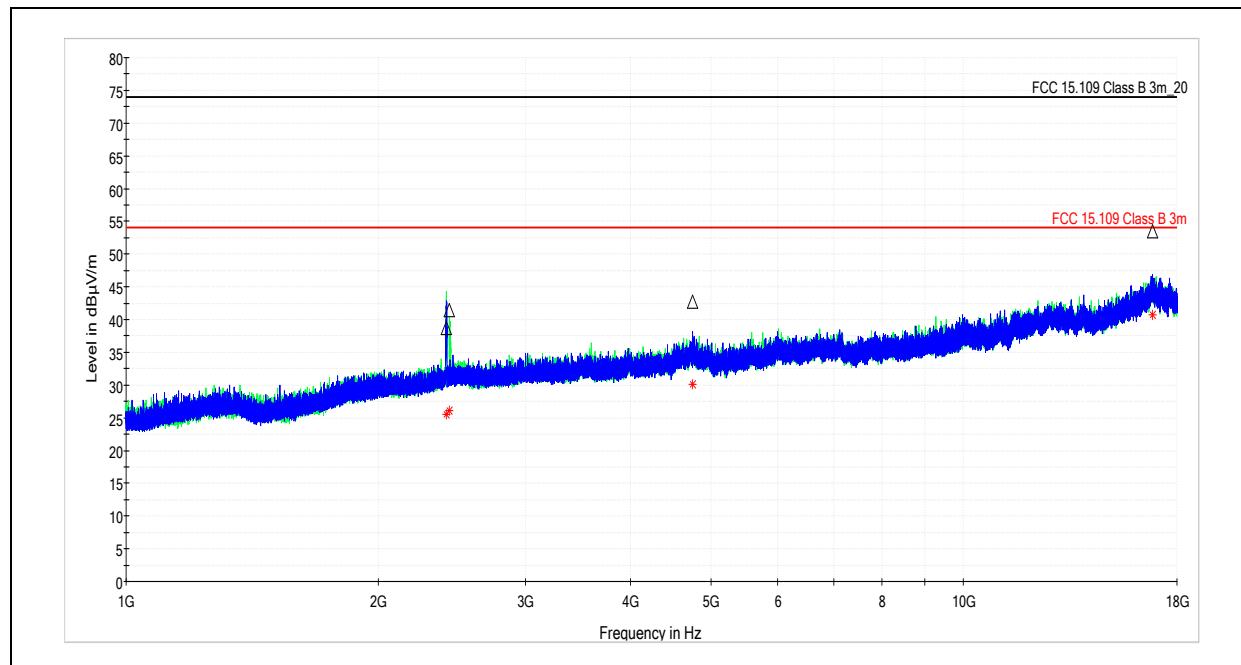


Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
40.602000	37.05	40.00	2.95	120.000	105.3	V	272.0	19.7
40.790000	37.42	40.00	2.58	120.000	105.3	V	311.0	19.5
40.809000	37.49	40.00	2.51	120.000	105.1	V	284.0	19.5
48.096000	36.79	40.00	3.21	120.000	105.7	V	300.0	15.7
84.103000	30.66	40.00	9.34	120.000	100.1	V	312.0	14.9
95.905000	38.39	43.52	5.13	120.000	99.7	V	310.0	17.2
96.190000	38.56	43.52	4.96	120.000	105.3	V	299.0	17.3
144.380000	32.70	43.52	10.82	120.000	99.5	V	347.0	21.0
645.450000	38.94	46.02	7.08	120.000	118.4	H	191.0	31.2
956.640000	44.37	46.02	1.65	120.000	367.8	V	322.0	35.5

Deviations, Additions, or Exclusions: None



6.8 Test Data: 1GHz – 18GHz (AX26-102)



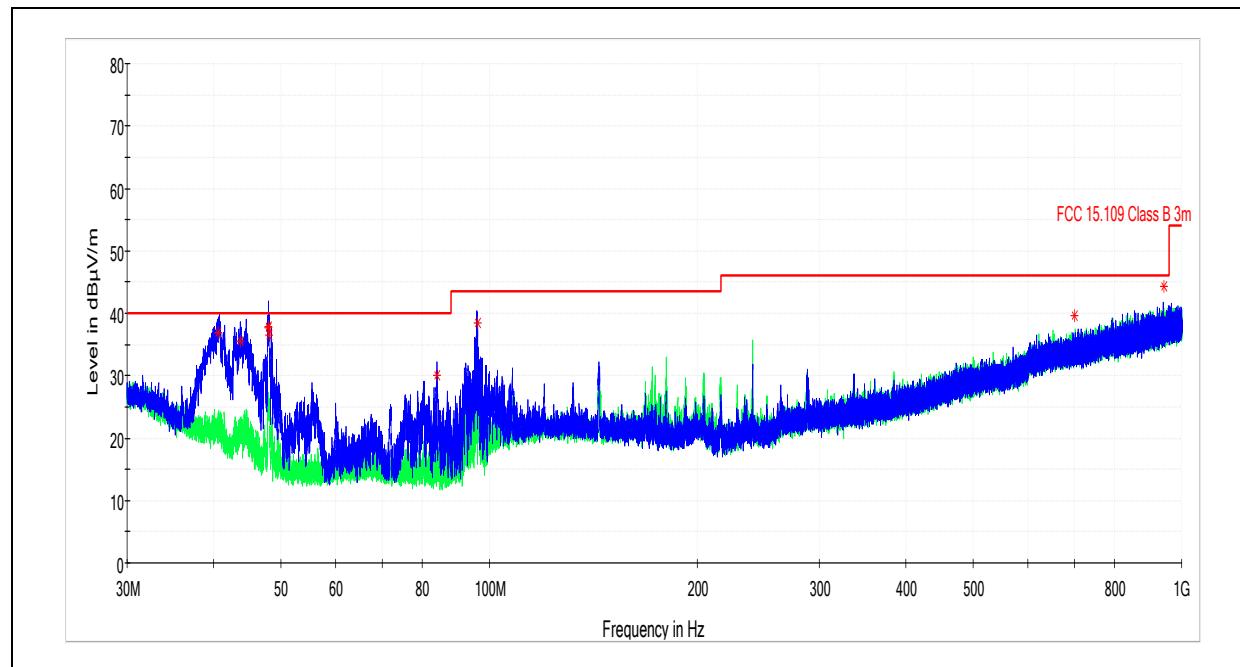
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2411.000000	38.66	74.00	35.34	1000.000	410.0	H	277.0	3.2
2434.800000	41.47	74.00	32.53	1000.000	228.0	H	154.0	3.4
4747.200000	42.74	74.00	31.26	1000.000	410.0	V	335.0	7.3
16818.600000	53.47	74.00	20.53	1000.000	241.0	V	182.0	21.7

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2411.000000	25.56	54.00	28.44	1000.000	410.0	H	277.0	3.2
2434.800000	26.12	54.00	27.88	1000.000	228.0	H	154.0	3.4
4747.200000	30.16	54.00	23.84	1000.000	410.0	V	335.0	7.3
16818.600000	40.67	54.00	13.33	1000.000	241.0	V	182.0	21.7

Deviations, Additions, or Exclusions: None



6.9 Test Data: 30MHz – 1GHz (AX26-202)

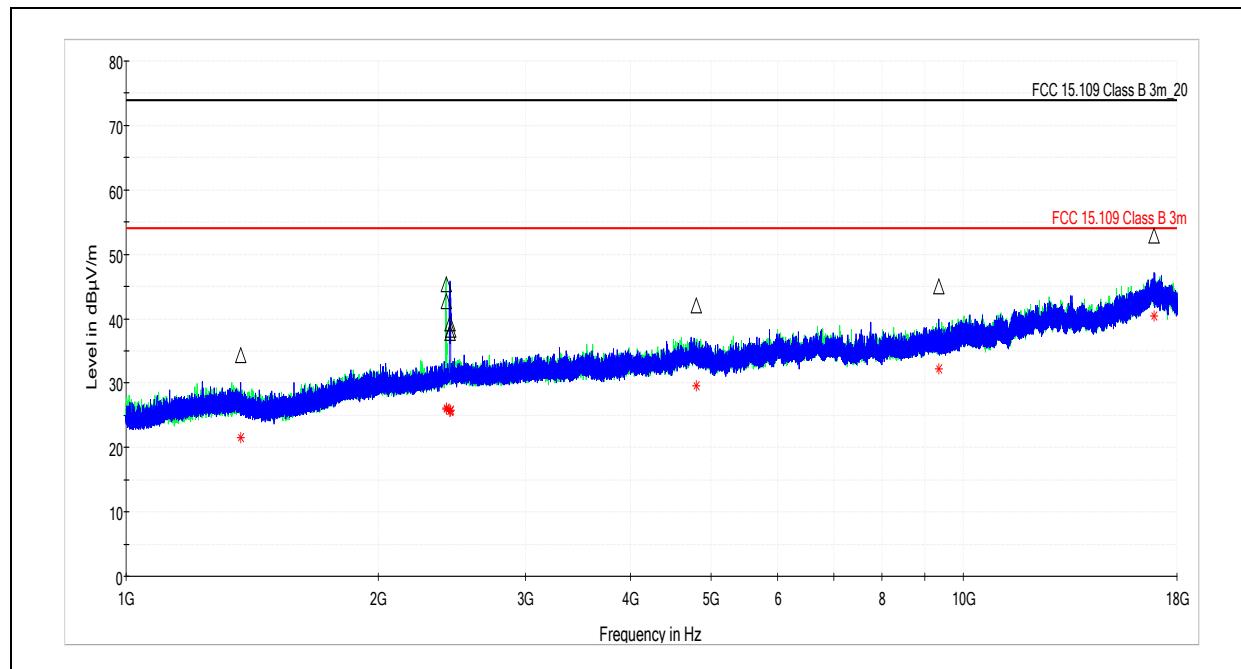


Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
40.588000	36.87	40.00	3.13	120.000	105.3	V	273.0	19.7
43.719000	35.46	40.00	4.54	120.000	105.4	V	266.0	17.7
47.988000	37.90	40.00	2.10	120.000	100.8	V	292.0	15.7
47.993000	37.74	40.00	2.26	120.000	105.3	V	299.0	15.7
48.108000	36.57	40.00	3.43	120.000	106.5	V	280.0	15.7
84.103000	30.09	40.00	9.91	120.000	118.4	V	292.0	14.9
96.165000	38.50	43.52	5.02	120.000	104.4	V	274.0	17.3
699.490000	39.69	46.02	6.33	120.000	297.4	H	84.0	31.9
941.680000	44.20	46.02	1.82	120.000	237.9	V	166.0	35.3

Deviations, Additions, or Exclusions: None



6.10 Test Data: 1GHz – 18GHz (AX26-202)



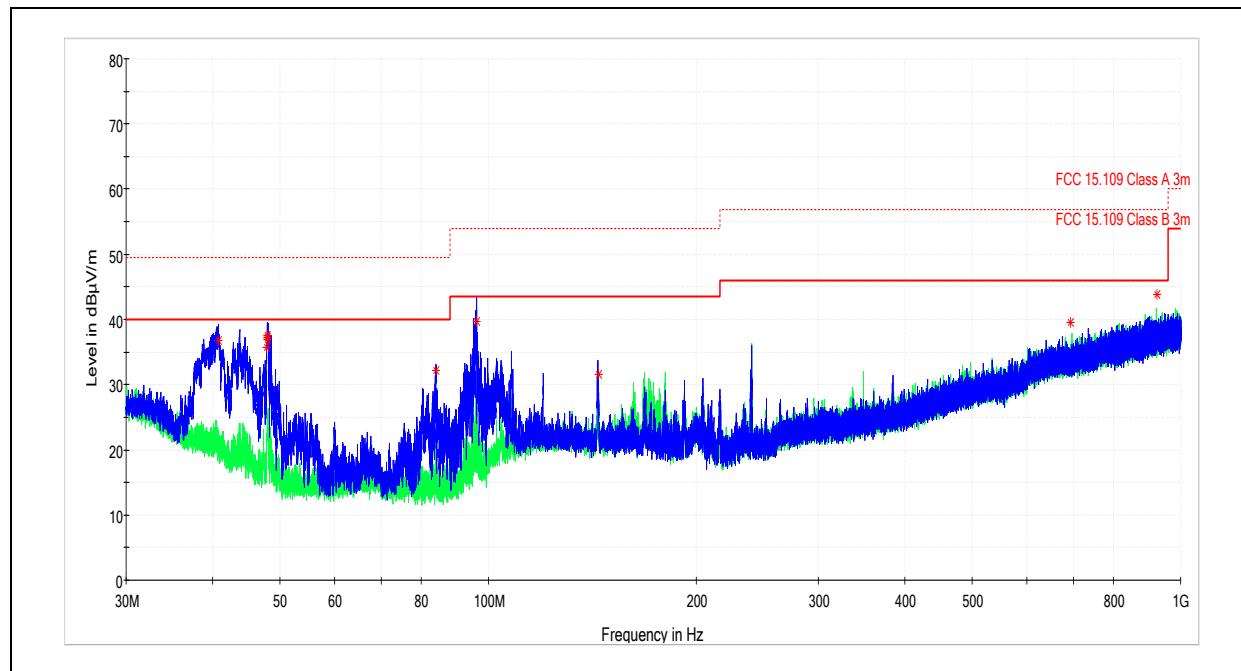
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1370.400000	34.41	74.00	39.59	1000.000	410.0	V	345.0	-1.5
2410.400000	42.63	74.00	31.37	1000.000	341.0	H	0.0	3.2
2412.400000	45.34	74.00	28.66	1000.000	410.0	H	156.0	3.2
2435.400000	39.28	74.00	34.72	1000.000	280.0	V	325.0	3.3
2437.400000	37.76	74.00	36.24	1000.000	360.0	V	0.0	3.3
2441.200000	38.34	74.00	35.66	1000.000	410.0	V	335.0	3.3
4798.000000	41.99	74.00	32.01	1000.000	410.0	H	268.0	7.4
9344.800000	44.93	74.00	29.07	1000.000	410.0	V	281.0	12.3
16891.200000	52.95	74.00	21.05	1000.000	380.0	V	340.0	21.8

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1370.400000	21.54	54.00	32.46	1000.000	410.0	V	345.0	-1.5
2410.400000	26.03	54.00	27.97	1000.000	341.0	H	0.0	3.2
2412.400000	26.12	54.00	27.88	1000.000	410.0	H	156.0	3.2
2435.400000	25.64	54.00	28.36	1000.000	280.0	V	325.0	3.3
2437.400000	25.68	54.00	28.32	1000.000	360.0	V	0.0	3.3
2441.200000	25.74	54.00	28.26	1000.000	410.0	V	335.0	3.3
4798.000000	29.54	54.00	24.46	1000.000	410.0	H	268.0	7.4
9344.800000	32.14	54.00	21.86	1000.000	410.0	V	281.0	12.3
16891.200000	40.46	54.00	13.54	1000.000	380.0	V	340.0	21.8

Deviations, Additions, or Exclusions: None

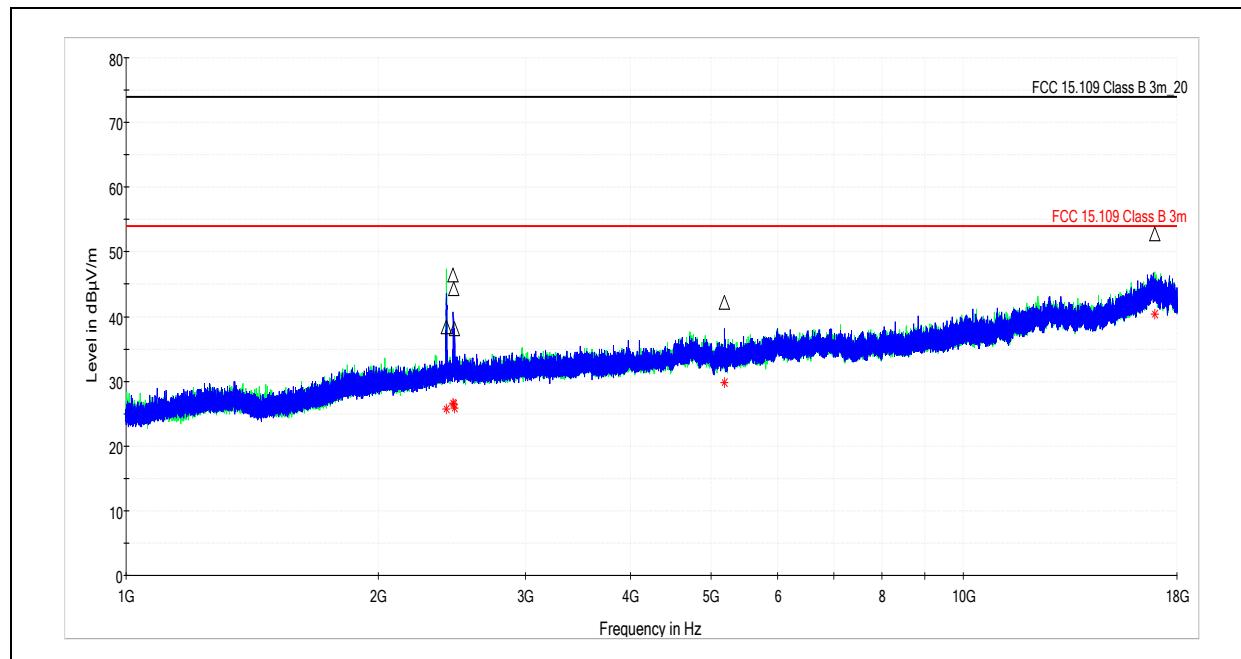


6.11 Test Data: 30MHz – 1GHz (AX26-302)



Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
40.754000	36.75	40.00	3.25	120.000	105.8	V	0.0	19.6
47.918000	35.78	40.00	4.22	120.000	105.1	V	0.0	15.7
47.941000	37.00	40.00	3.00	120.000	99.9	V	337.0	15.7
48.018000	37.18	40.00	2.82	120.000	99.2	V	0.0	15.7
48.042000	37.61	40.00	2.39	120.000	100.1	V	348.0	15.7
84.087000	32.25	40.00	7.75	120.000	107.1	V	8.0	14.9
96.171000	39.72	43.52	3.80	120.000	100.4	V	128.0	17.3
144.320000	31.60	43.52	11.92	120.000	105.3	V	68.0	21.0
692.380000	39.54	46.02	6.48	120.000	368.2	H	36.0	31.8
924.360000	43.78	46.02	2.24	120.000	356.1	H	119.0	35.2

Deviations, Additions, or Exclusions: None

**6.12 Test Data: 1GHz – 18GHz (AX26-302)**

Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2414.000000	38.42	74.00	35.58	1000.000	410.0	H	0.0	3.2
2459.400000	46.39	74.00	27.61	1000.000	294.0	V	-1.0	3.3
2462.600000	44.32	74.00	29.68	1000.000	370.0	V	202.0	3.3
2469.600000	38.08	74.00	35.92	1000.000	337.0	V	193.0	3.3
5182.400000	42.12	74.00	31.88	1000.000	410.0	V	151.0	7.4
16936.200000	52.73	74.00	21.27	1000.000	349.0	H	133.0	21.7

Frequency (MHz)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2414.000000	25.65	54.00	28.35	1000.000	410.0	H	0.0	3.2
2459.400000	26.69	54.00	27.31	1000.000	294.0	V	-1.0	3.3
2462.600000	26.43	54.00	27.57	1000.000	370.0	V	202.0	3.3
2469.600000	25.84	54.00	28.16	1000.000	337.0	V	193.0	3.3
5182.400000	29.77	54.00	24.23	1000.000	410.0	V	151.0	7.4
16936.200000	40.35	54.00	13.65	1000.000	349.0	H	133.0	21.7

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
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

7.4 Software Utilized

Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 9.15.02

7.5 Test Results

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

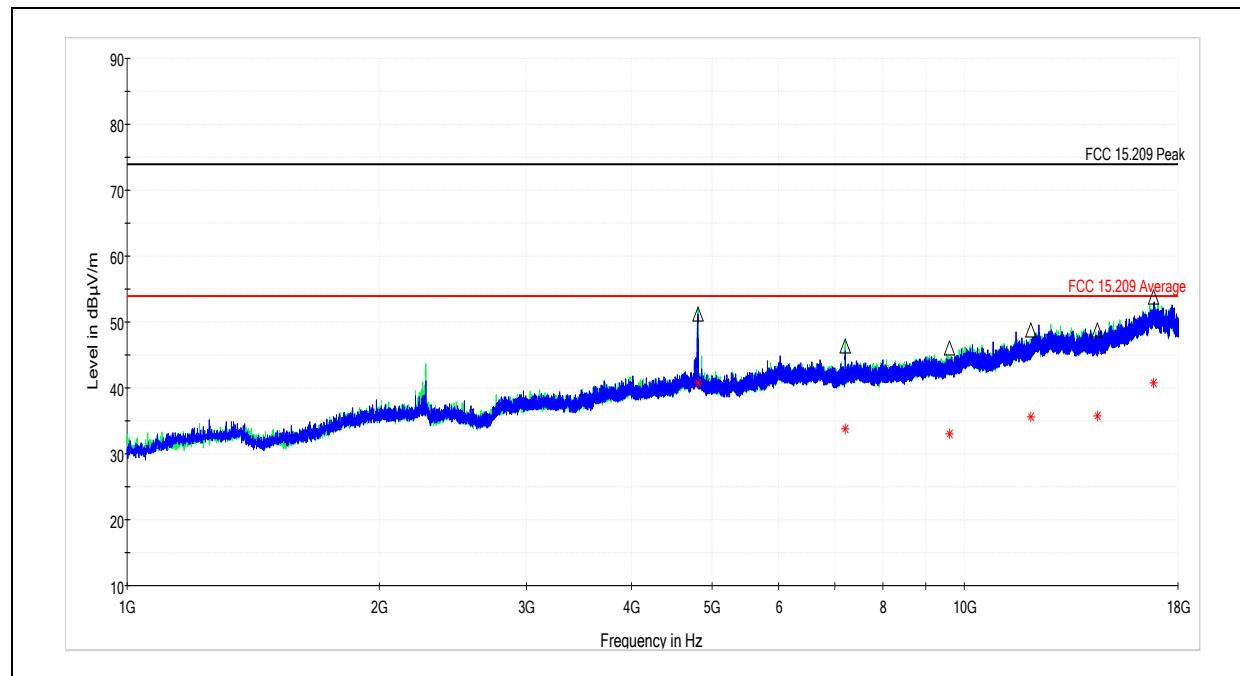
7.6 Test Conditions

Test Personnel:	B. Lackey	Test Date:	8/28/2018
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
	FCC Part 15.247	Ambient Temperature:	23.0C
Product Standard:	RSS-247 Issue 2	Relative Humidity:	47.2%
Input Voltage:	Battery	Atmospheric Pressure:	988.8mbar
Pretest Verification w / Ambient Signals or BB Source:	Yes		



7.7 Test Data (AX26-102)

7.7.1 BLE Channel 0 (2402MHz) Spurious Emissions:

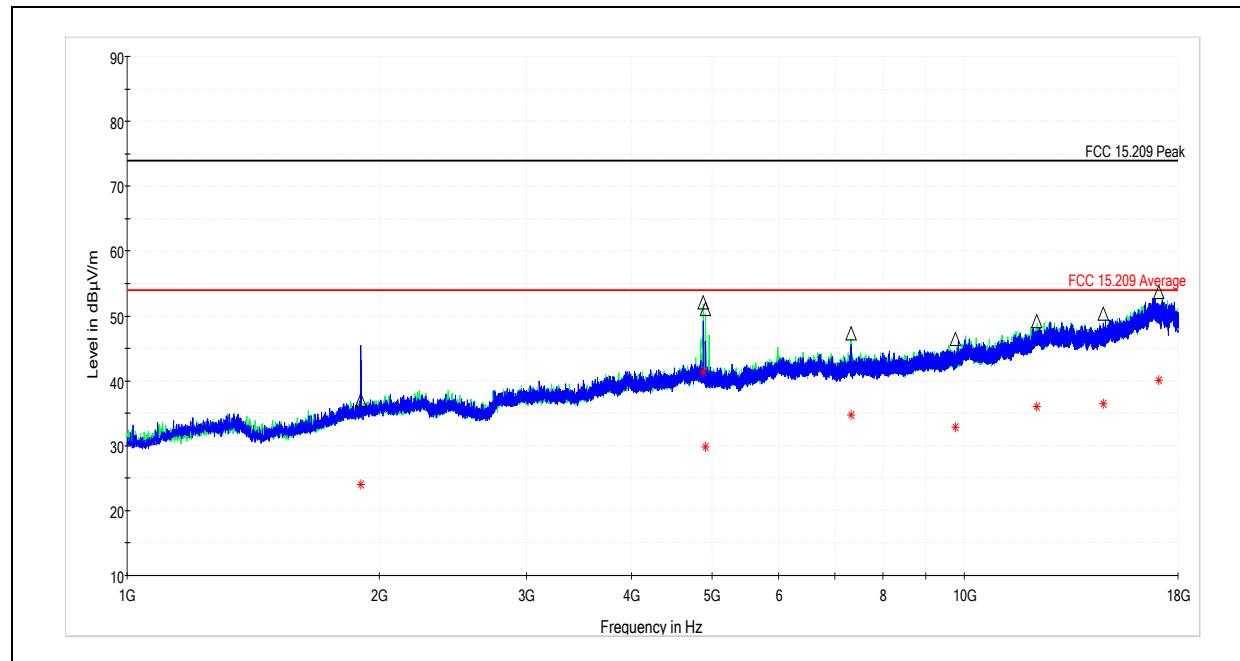


Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4803.500000	51.18	74.00	22.82	1000.000	313.0	H	231.0	7.4
7205.000000	46.32	74.00	27.68	1000.000	301.0	H	133.0	10.2
9607.500000	46.11	74.00	27.89	1000.000	410.0	H	346.0	13.1
12009.500000	48.78	74.00	25.22	1000.000	370.0	V	231.0	16.3
14410.000000	48.82	74.00	25.18	1000.000	410.0	V	136.0	16.4
16814.500000	53.83	74.00	20.17	1000.000	100.0	H	252.0	21.7

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4803.500000	40.71	54.00	13.29	1000.000	313.0	H	231.0	7.4
7205.000000	33.73	54.00	20.27	1000.000	301.0	H	133.0	10.2
9607.500000	32.97	54.00	21.03	1000.000	410.0	H	346.0	13.1
12009.500000	35.58	54.00	18.42	1000.000	370.0	V	231.0	16.3
14410.000000	35.72	54.00	18.28	1000.000	410.0	V	136.0	16.4
16814.500000	40.73	54.00	13.27	1000.000	100.0	H	252.0	21.7



7.7.2 BLE Channel 19 (2440MHz) Spurious Emissions:

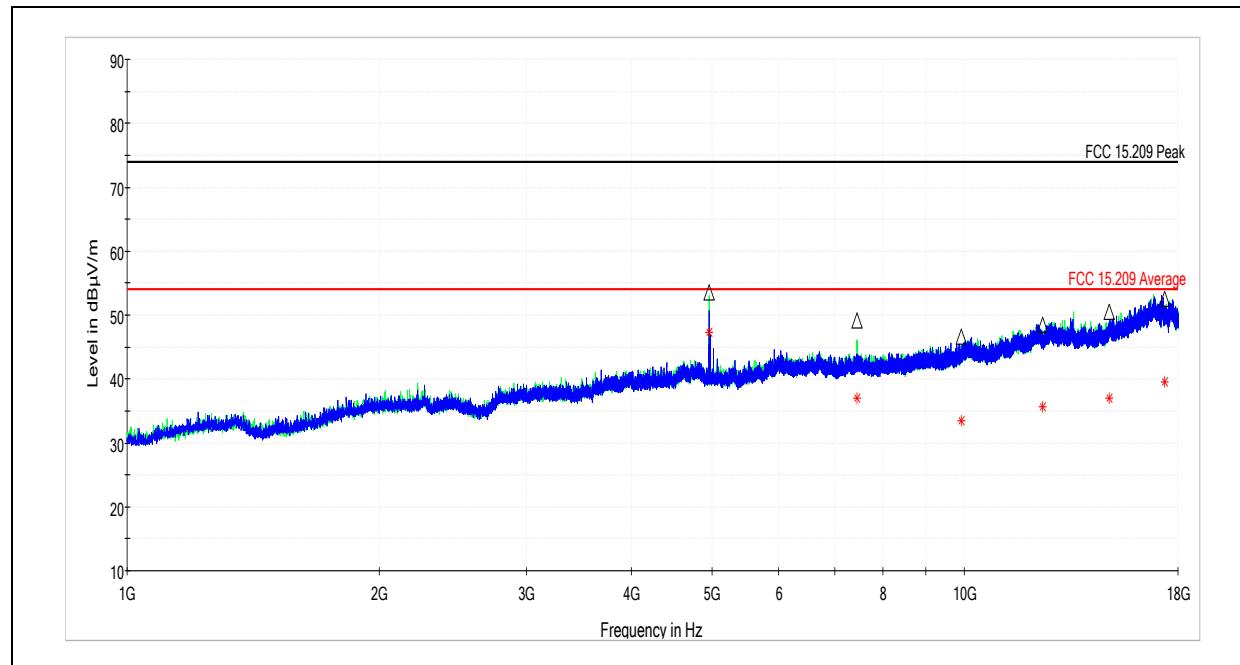


Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1903.000000	37.09	74.00	36.91	1000.000	410.0	V	71.0	1.3
4881.000000	52.08	74.00	21.92	1000.000	174.0	H	318.0	6.9
4911.500000	51.09	74.00	22.91	1000.000	370.0	H	322.0	6.9
7321.500000	47.32	74.00	26.68	1000.000	361.0	H	182.0	10.5
9760.500000	46.47	74.00	27.53	1000.000	410.0	V	144.0	13.1
12199.500000	49.24	74.00	24.76	1000.000	166.0	H	198.0	16.6
14642.500000	50.43	74.00	23.57	1000.000	410.0	V	139.0	16.8
17083.500000	53.67	74.00	20.33	1000.000	359.0	V	46.0	21.5

Frequency (MHz)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1903.000000	24.01	54.00	29.99	1000.000	410.0	V	71.0	1.3
4881.000000	41.33	54.00	12.67	1000.000	174.0	H	318.0	6.9
4911.500000	29.78	54.00	24.22	1000.000	370.0	H	322.0	6.9
7321.500000	34.68	54.00	19.32	1000.000	361.0	H	182.0	10.5
9760.500000	32.82	54.00	21.18	1000.000	410.0	V	144.0	13.1
12199.500000	36.09	54.00	17.91	1000.000	166.0	H	198.0	16.6
14642.500000	36.46	54.00	17.54	1000.000	410.0	V	139.0	16.8
17083.500000	40.14	54.00	13.86	1000.000	359.0	V	46.0	21.5



7.7.3 BLE Channel 39 (2480MHz) Spurious Emissions:

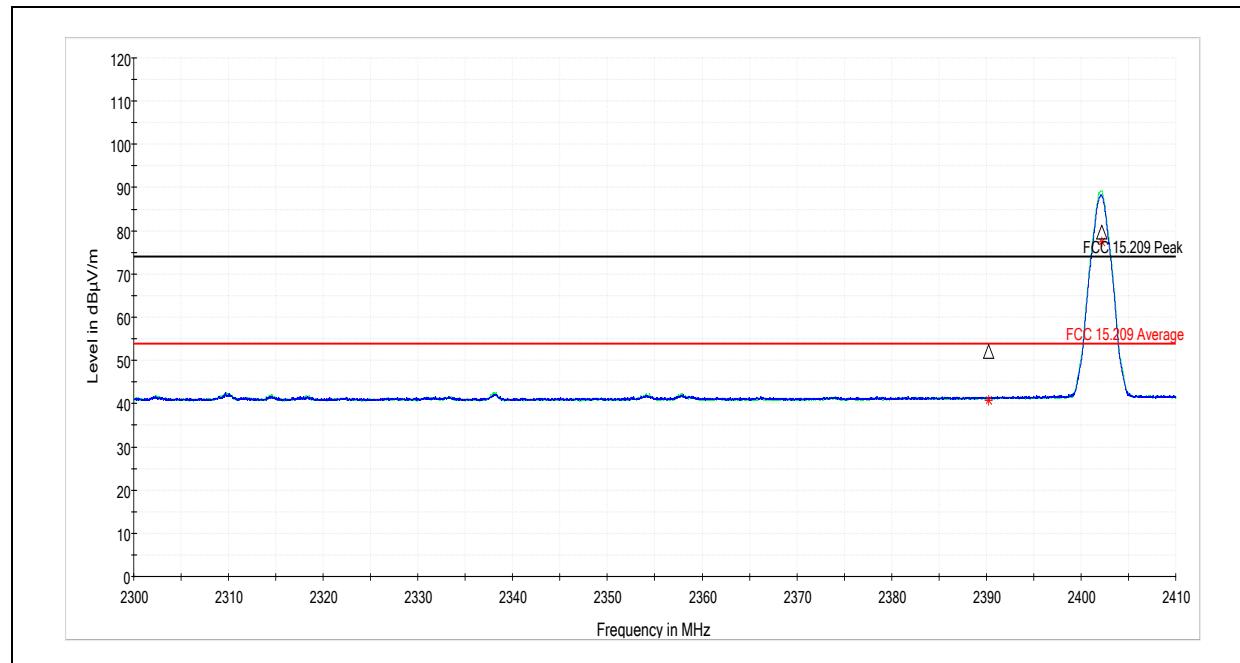


Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4960.500000	53.53	74.00	20.47	1000.000	209.0	H	320.0	6.7
7439.500000	49.13	74.00	24.87	1000.000	410.0	H	142.0	10.7
9919.500000	46.60	74.00	27.40	1000.000	262.0	V	259.0	13.4
12410.500000	48.54	74.00	25.46	1000.000	410.0	H	100.0	16.2
14884.500000	50.56	74.00	23.44	1000.000	410.0	V	325.0	18.0
17360.000000	52.54	74.00	21.46	1000.000	410.0	V	309.0	20.7

Frequency (MHz)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4960.500000	47.38	54.00	6.62	1000.000	209.0	H	320.0	6.7
7439.500000	37.05	54.00	16.95	1000.000	410.0	H	142.0	10.7
9919.500000	33.52	54.00	20.48	1000.000	262.0	V	259.0	13.4
12410.500000	35.64	54.00	18.36	1000.000	410.0	H	100.0	16.2
14884.500000	37.06	54.00	16.94	1000.000	410.0	V	325.0	18.0
17360.000000	39.47	54.00	14.53	1000.000	410.0	V	309.0	20.7



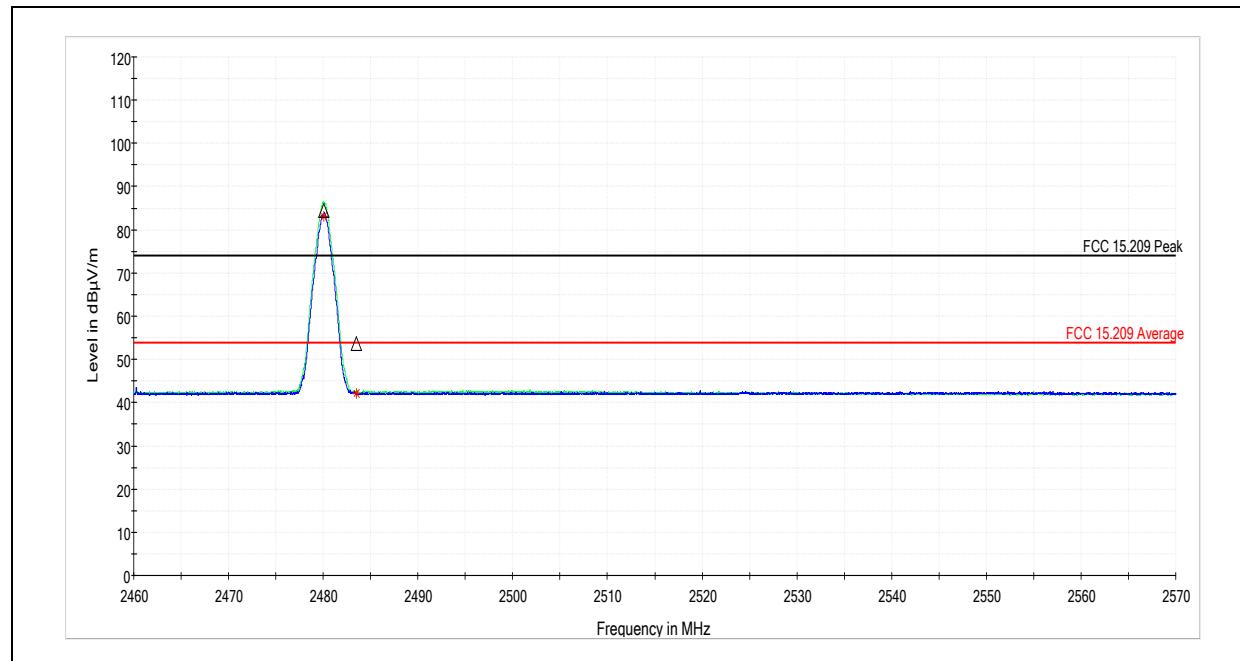
7.7.4 Emissions at the low band edge:



Frequency (MHz)	Average (dB μ V/m)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2390.211000	40.73	---	54.00	13.27	1000.000	295.0	V	257.0	37.0
2390.211000	---	52.11	74.00	21.89	1000.000	295.0	V	257.0	37.0



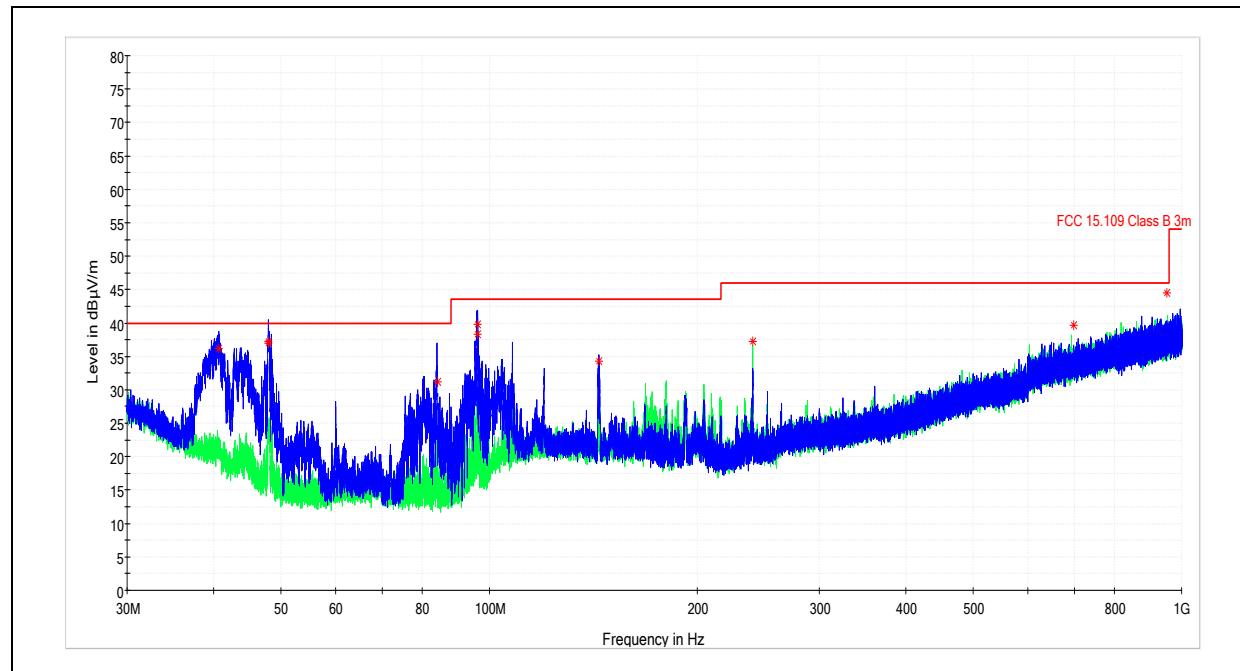
7.7.5 Emissions at the high band edge:



Frequency (MHz)	Average (dB μ V/m)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2483.496000	42.10	---	54.00	11.90	1000.000	270.0	H	276.0	37.5
2483.496000	---	53.58	74.00	20.42	1000.000	270.0	H	276.0	37.5



7.7.6 Spurious Emissions, 30MHz-1GHz:

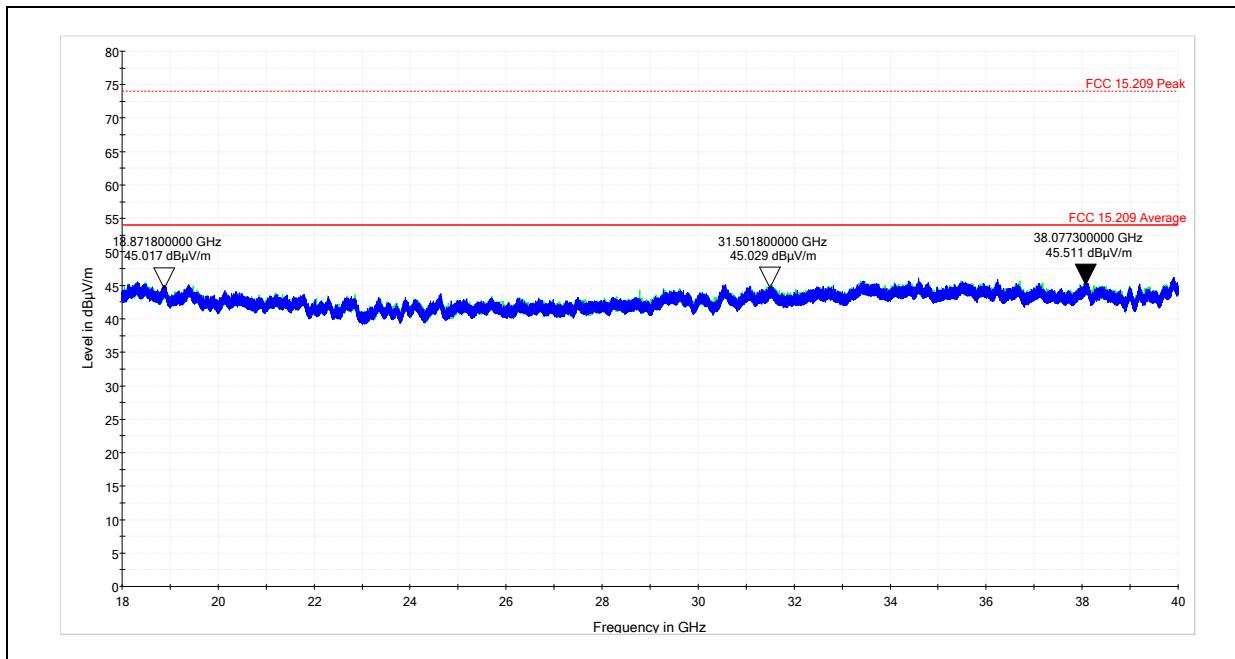


Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
40.689000	36.21	40.00	3.79	120.000	104.9	V	318.0	19.6
47.955000	36.92	40.00	3.08	120.000	110.5	V	302.0	15.7
47.988000	37.20	40.00	2.80	120.000	100.3	V	292.0	15.7
84.169000	31.19	40.00	8.81	120.000	107.0	V	8.0	14.9
96.166000	39.85	43.52	3.67	120.000	104.7	V	311.0	17.3
96.206000	38.26	43.52	5.26	120.000	100.3	V	311.0	17.3
144.160000	34.28	43.52	9.24	120.000	110.2	V	10.0	21.0
240.040000	37.31	46.02	8.71	120.000	191.9	H	202.0	20.7
697.780000	39.62	46.02	6.40	120.000	298.1	H	202.0	31.9
952.480000	44.49	46.02	1.53	120.000	400.1	H	1.0	35.4

Note: results shown represent the worst case of three channels under test



7.7.7 Spurious Emissions, 18GHz-40GHz:

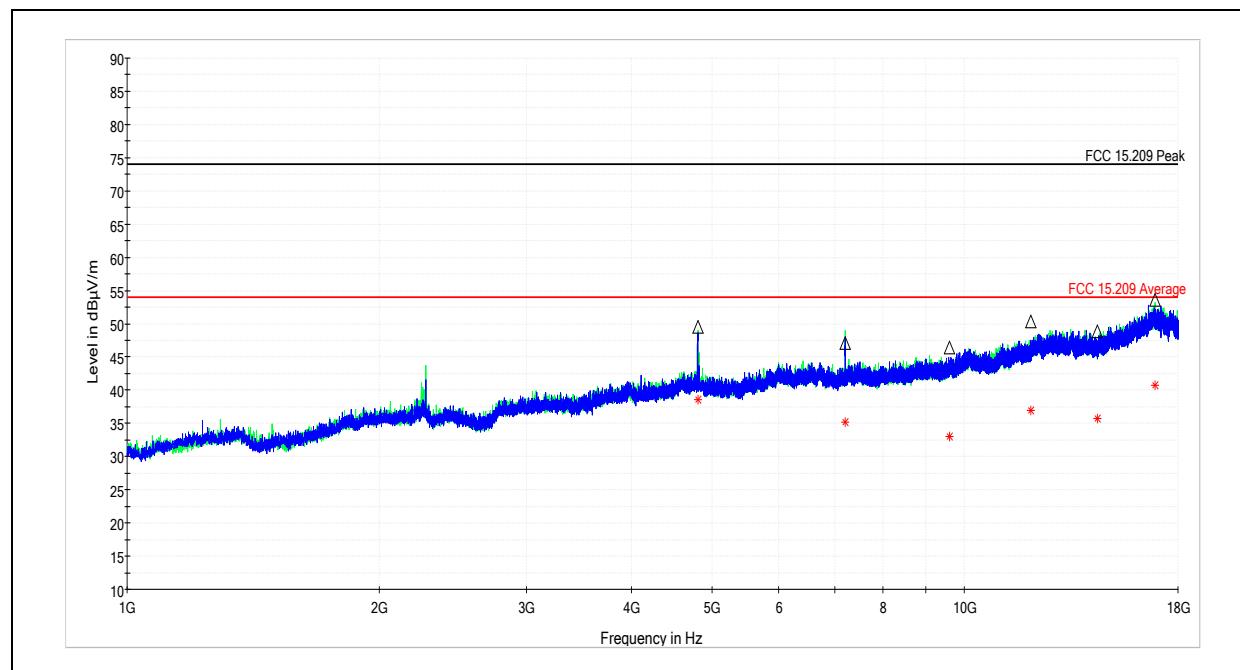


Note: results shown represent the worst case of three channels under test. All observed peak emissions were below the average limit from FCC Title 47 CFR Part 15.209.



7.8 Test Data (AX26-202)

7.8.1 BLE Channel 0 (2402MHz) Spurious Emissions:

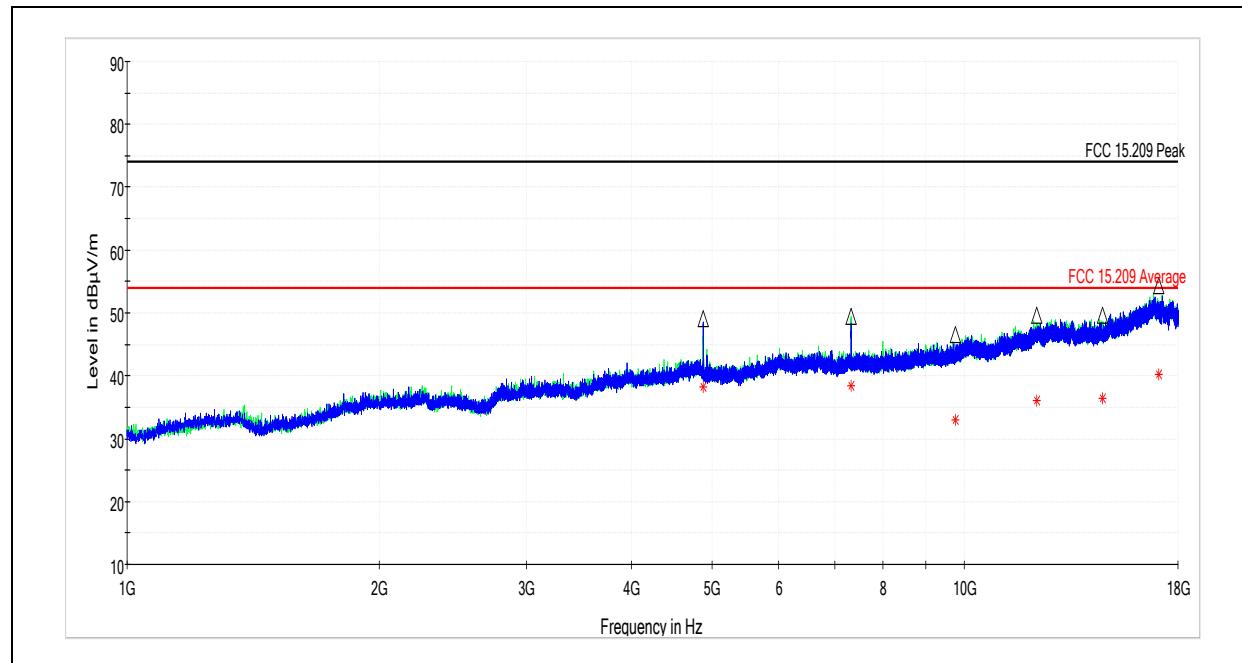


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4805.000000	49.46	74.00	24.54	1000.000	202.0	H	93.0	7.3
7207.000000	47.13	74.00	26.87	1000.000	358.0	H	170.0	10.2
9609.000000	46.35	74.00	27.65	1000.000	354.0	V	165.0	13.0
12012.000000	50.31	74.00	23.69	1000.000	333.0	V	170.0	16.3
14415.000000	48.90	74.00	25.10	1000.000	410.0	H	184.0	16.5
16891.000000	53.63	74.00	20.37	1000.000	410.0	H	304.0	21.8

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4805.000000	38.55	54.00	15.45	1000.000	202.0	H	93.0	7.3
7207.000000	35.15	54.00	18.85	1000.000	358.0	H	170.0	10.2
9609.000000	33.07	54.00	20.93	1000.000	354.0	V	165.0	13.0
12012.000000	36.98	54.00	17.02	1000.000	333.0	V	170.0	16.3
14415.000000	35.75	54.00	18.25	1000.000	410.0	H	184.0	16.5
16891.000000	40.71	54.00	13.29	1000.000	410.0	H	304.0	21.8

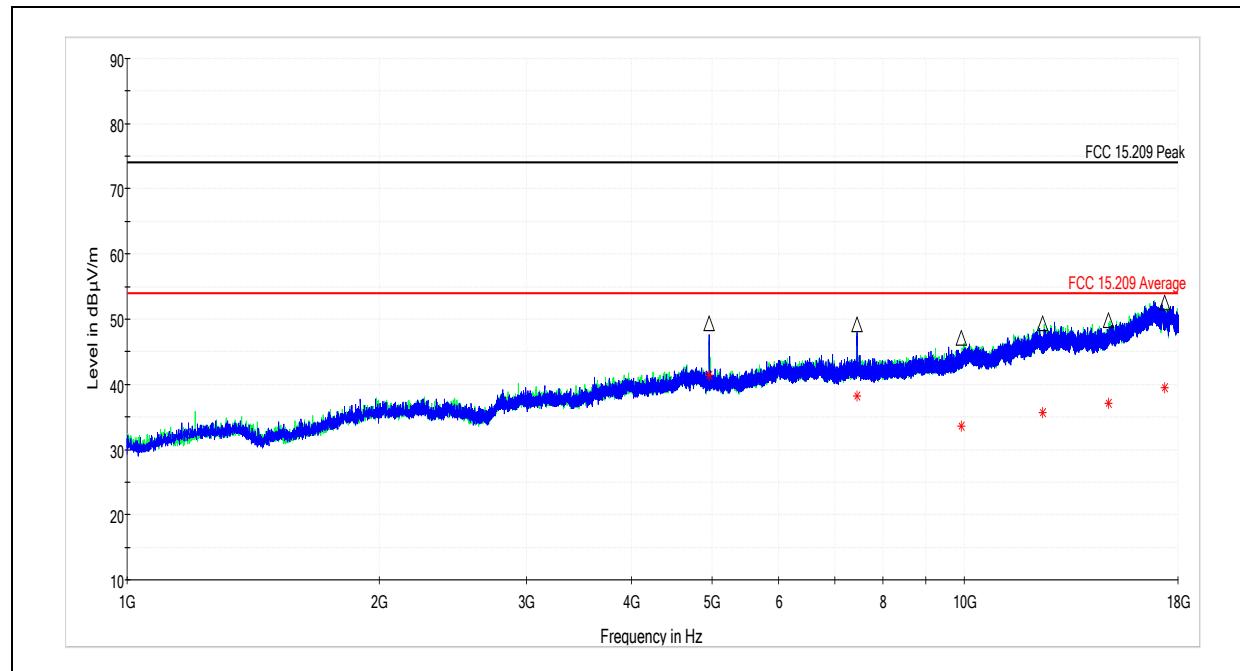


7.8.2 BLE Channel 19 (2440MHz) Spurious Emissions:



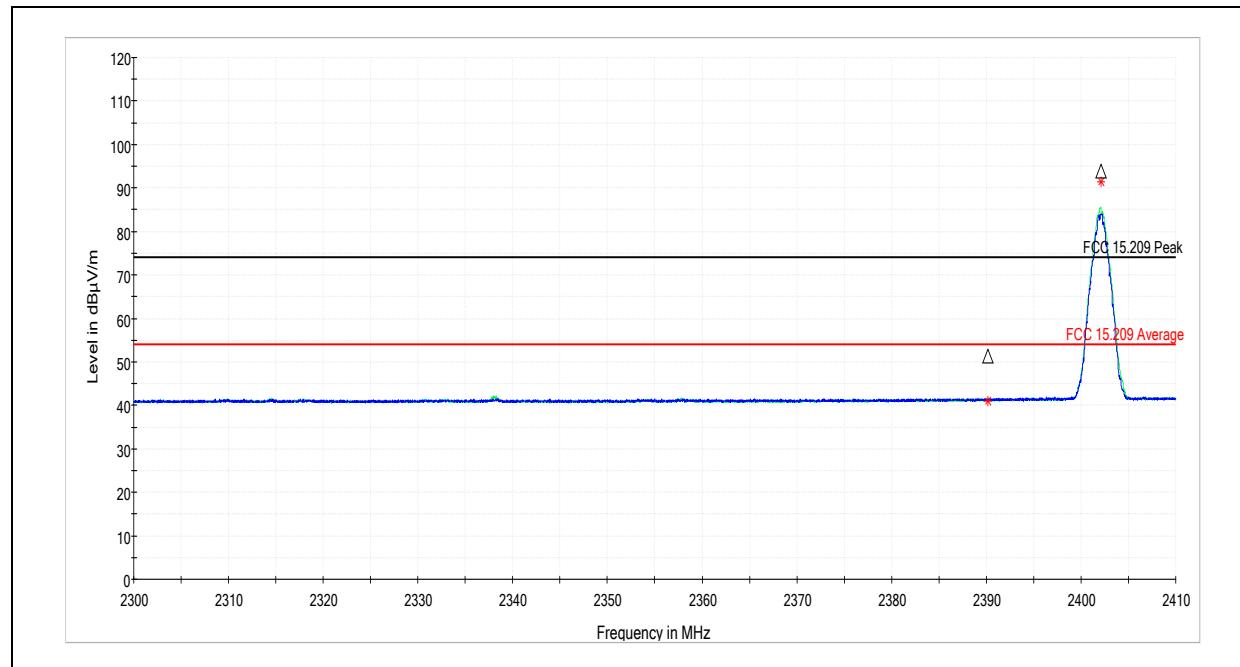
Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4879.500000	49.03	74.00	24.97	1000.000	241.0	V	197.0	6.8
7321.000000	49.40	74.00	24.60	1000.000	394.0	H	194.0	10.5
9759.500000	46.51	74.00	27.49	1000.000	410.0	V	252.0	13.1
12197.000000	49.69	74.00	24.31	1000.000	410.0	H	315.0	16.5
14637.000000	49.55	74.00	24.45	1000.000	410.0	H	139.0	16.9
17077.000000	54.30	74.00	19.70	1000.000	410.0	H	57.0	21.6

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4879.500000	38.20	54.00	15.80	1000.000	241.0	V	197.0	6.8
7321.000000	38.41	54.00	15.59	1000.000	394.0	H	194.0	10.5
9759.500000	32.92	54.00	21.08	1000.000	410.0	V	252.0	13.1
12197.000000	36.07	54.00	17.93	1000.000	410.0	H	315.0	16.5
14637.000000	36.34	54.00	17.66	1000.000	410.0	H	139.0	16.9
17077.000000	40.29	54.00	13.71	1000.000	410.0	H	57.0	21.6

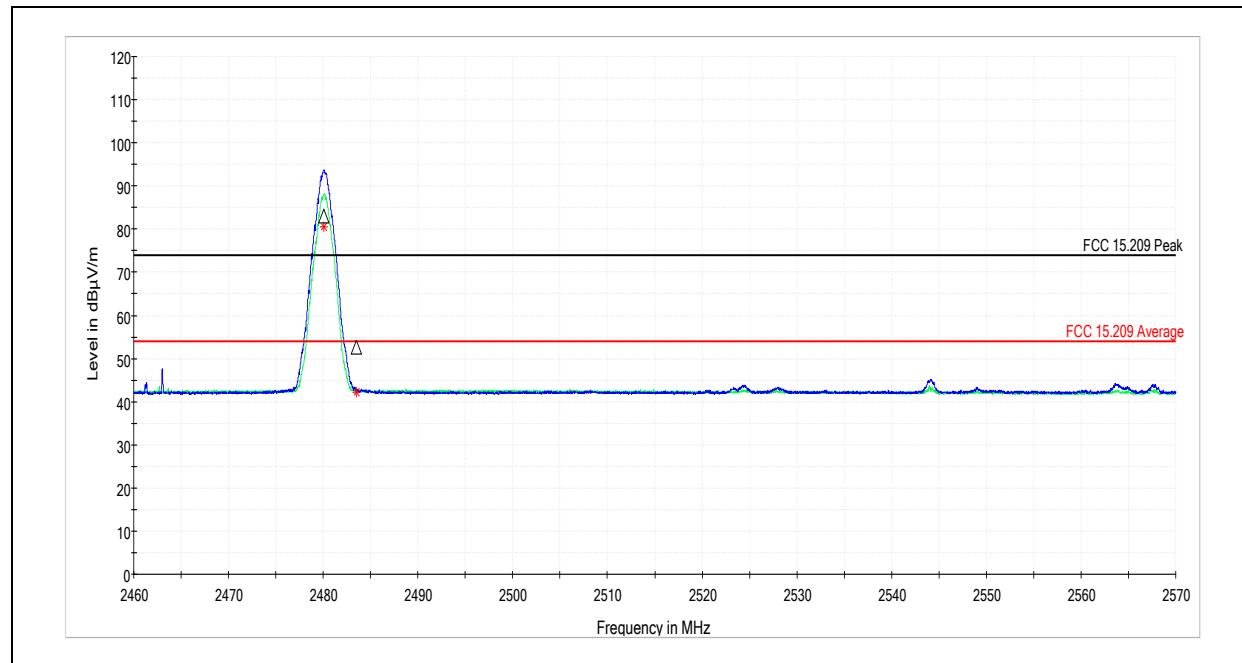
**7.8.3 BLE Channel 39 (2480MHz) Spurious Emissions:**

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4960.500000	49.34	74.00	24.66	1000.000	263.0	V	216.0	6.6
7441.000000	49.19	74.00	24.81	1000.000	261.0	V	0.0	10.6
9919.500000	47.21	74.00	26.79	1000.000	193.0	H	252.0	13.3
12406.000000	49.29	74.00	24.71	1000.000	374.0	H	46.0	16.2
14880.500000	49.90	74.00	24.10	1000.000	393.0	H	220.0	18.1
17362.000000	52.61	74.00	21.39	1000.000	370.0	V	245.0	20.7

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4960.500000	41.45	54.00	12.55	1000.000	263.0	V	216.0	6.6
7441.000000	38.28	54.00	15.72	1000.000	261.0	V	0.0	10.6
9919.500000	33.64	54.00	20.36	1000.000	193.0	H	252.0	13.3
12406.000000	35.60	54.00	18.40	1000.000	374.0	H	46.0	16.2
14880.500000	37.05	54.00	16.95	1000.000	393.0	H	220.0	18.1
17362.000000	39.46	54.00	14.54	1000.000	370.0	V	245.0	20.7

**7.8.4 Emissions at the low band edge:**

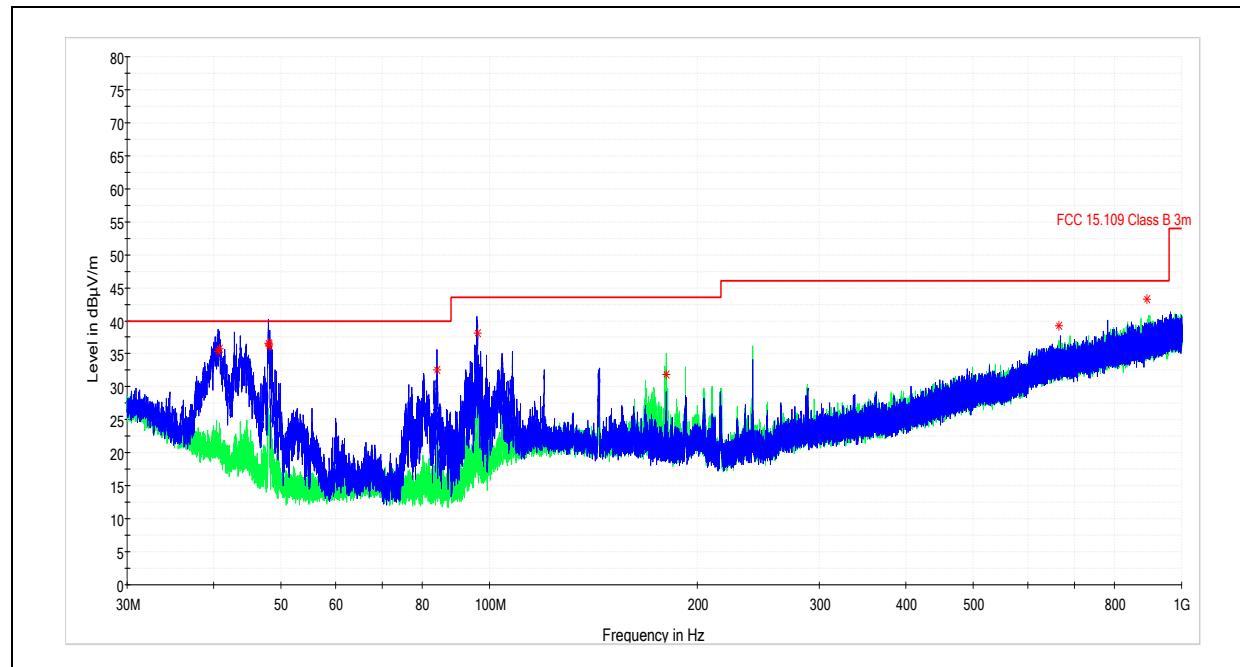
Frequency (MHz)	Average (dB μ V/m)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2390.200000	---	51.40	74.00	22.60	1000.000	312.0	H	156.0	37.0
2390.200000	40.96	---	54.00	13.04	1000.000	312.0	H	156.0	37.0

**7.8.5 Emissions at the high band edge:**

Frequency (MHz)	Average (dB μ V/m)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2483.496000	42.15	---	54.00	11.85	1000.000	189.0	H	279.0	37.5
2483.496000	---	52.56	74.00	21.44	1000.000	189.0	H	279.0	37.5

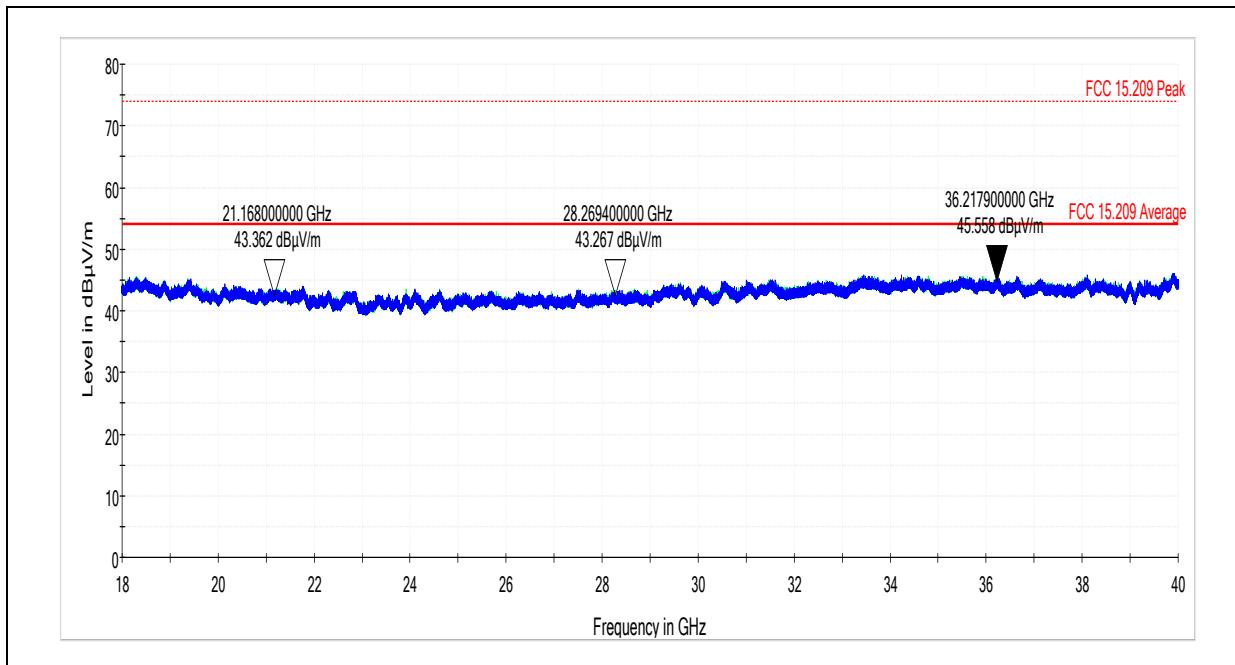


7.8.6 Spurious Emissions, 30MHz-1GHz:



Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
40.579000	35.36	40.00	4.64	120.000	104.9	V	301.0	19.7
40.767000	35.81	40.00	4.19	120.000	110.1	V	293.0	19.6
48.019000	36.64	40.00	3.36	120.000	104.8	V	302.0	15.7
48.052000	36.40	40.00	3.60	120.000	105.2	V	291.0	15.7
48.091000	36.16	40.00	3.84	120.000	99.8	V	283.0	15.7
84.098000	32.62	40.00	7.38	120.000	118.2	V	8.0	14.9
96.172000	38.18	43.52	5.34	120.000	99.8	V	156.0	17.3
180.080000	31.86	43.52	11.66	120.000	227.8	H	0.0	19.9
664.180000	39.17	46.02	6.85	120.000	201.6	V	182.0	31.4
891.680000	43.22	46.02	2.80	120.000	104.9	H	282.0	34.8

Note: results shown represent the worst case of three channels under test

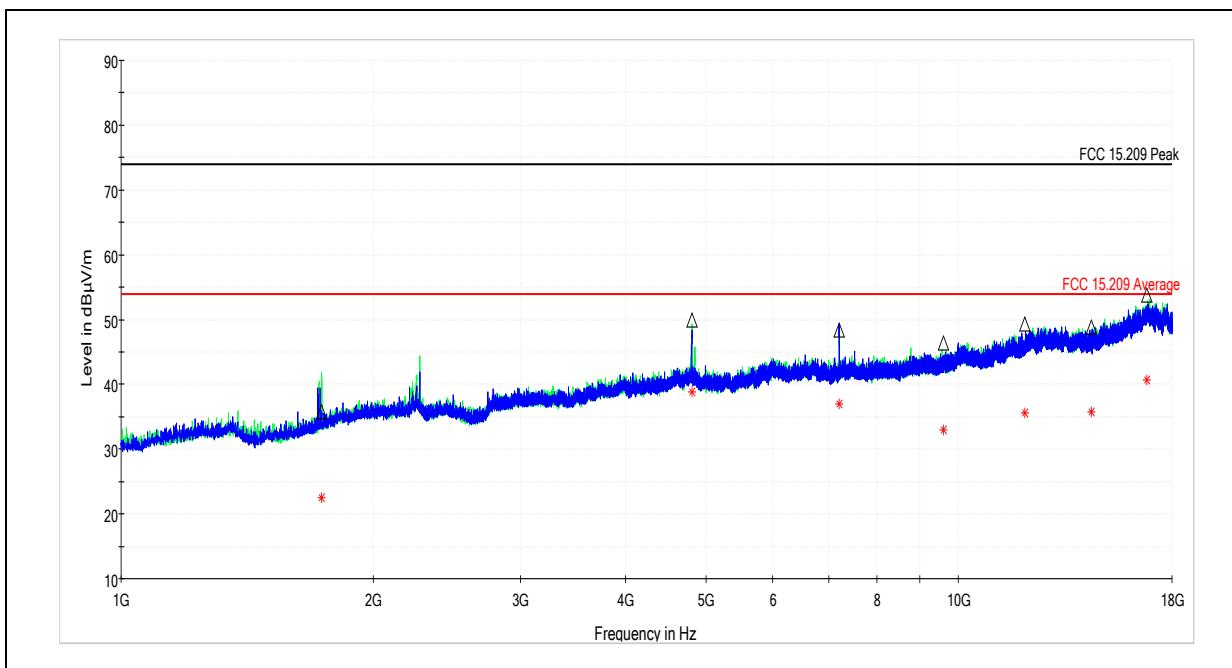
**7.8.7 Spurious Emissions, 18GHz-40GHz:**

Note: results shown represent the worst case of three channels under test. All observed peak emissions were below the average limit from FCC Title 47 CFR Part 15.209.



7.9 Test Data (AX26-302)

7.9.1 BLE Channel 0 (2402MHz) Spurious Emissions:

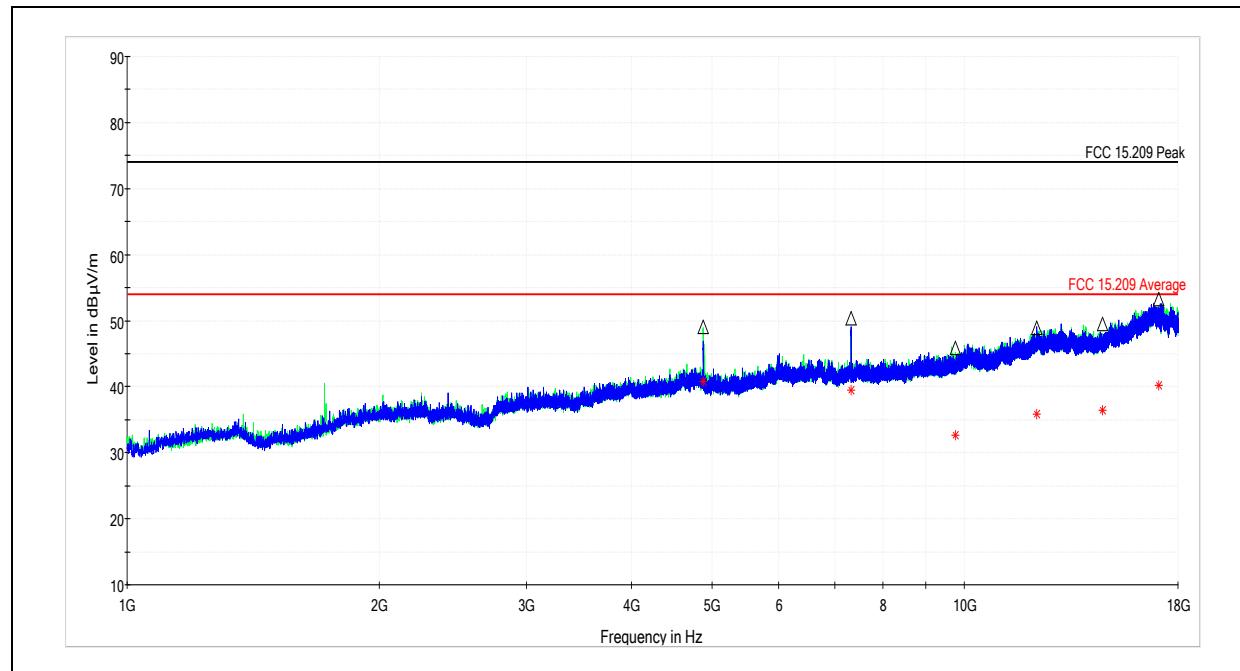


Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1736.500000	35.79	74.00	38.21	1000.000	410.0	H	239.0	-0.2
4805.000000	49.87	74.00	24.13	1000.000	221.0	H	38.0	7.3
7207.500000	48.38	74.00	25.62	1000.000	185.0	V	151.0	10.2
9609.000000	46.44	74.00	27.56	1000.000	396.0	H	220.0	13.1
12010.000000	49.23	74.00	24.77	1000.000	304.0	H	96.0	16.4
14413.000000	48.88	74.00	25.12	1000.000	410.0	V	180.0	16.4
16811.500000	53.84	74.00	20.16	1000.000	410.0	V	130.0	21.7

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1736.500000	22.50	54.00	31.50	1000.000	410.0	H	239.0	-0.2
4805.000000	38.86	54.00	15.14	1000.000	221.0	H	38.0	7.3
7207.500000	36.96	54.00	17.04	1000.000	185.0	V	151.0	10.2
9609.000000	32.97	54.00	21.03	1000.000	396.0	H	220.0	13.1
12010.000000	35.60	54.00	18.40	1000.000	304.0	H	96.0	16.4
14413.000000	35.73	54.00	18.27	1000.000	410.0	V	180.0	16.4
16811.500000	40.69	54.00	13.31	1000.000	410.0	V	130.0	21.7



7.9.2 BLE Channel 19 (2440MHz) Spurious Emissions:

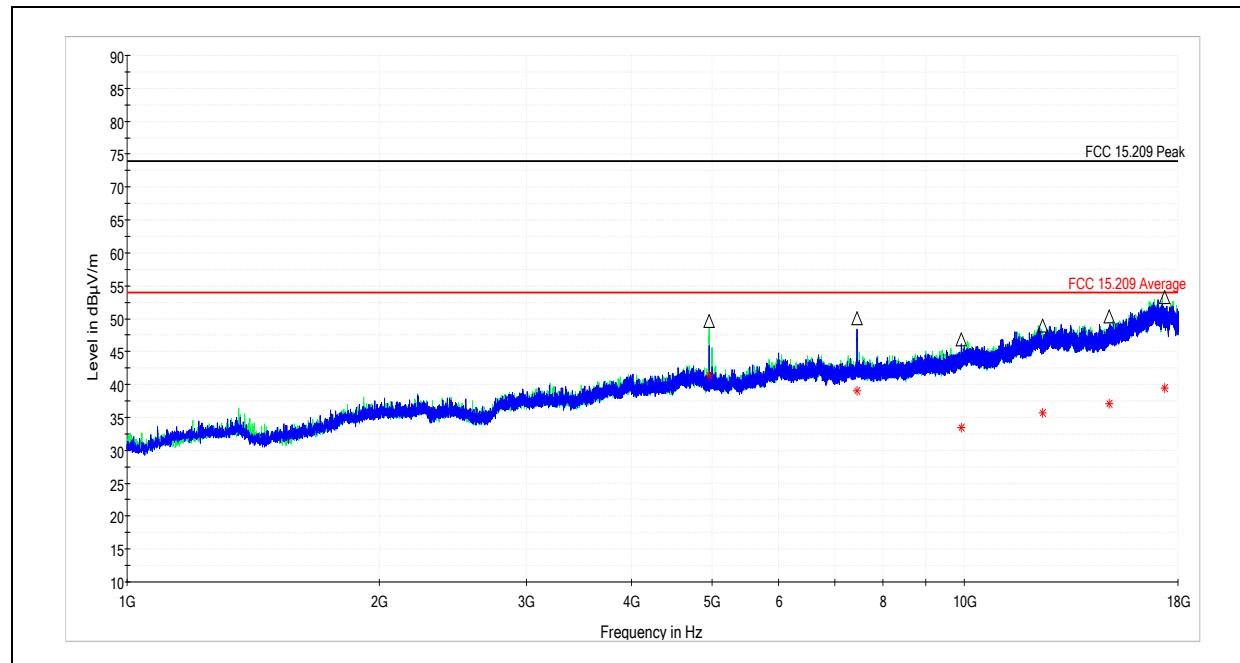


Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4880.000000	49.11	74.00	24.89	1000.000	192.0	H	34.0	6.9
7319.000000	50.41	74.00	23.59	1000.000	209.0	V	165.0	10.4
9757.500000	45.92	74.00	28.08	1000.000	410.0	H	257.0	13.1
12196.500000	48.90	74.00	25.10	1000.000	335.0	V	14.0	16.5
14638.500000	49.55	74.00	24.45	1000.000	410.0	V	171.0	16.8
17079.500000	53.29	74.00	20.71	1000.000	410.0	V	105.0	21.5

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4880.000000	40.75	54.00	13.25	1000.000	192.0	H	34.0	6.9
7319.000000	39.47	54.00	14.53	1000.000	209.0	V	165.0	10.4
9757.500000	32.69	54.00	21.31	1000.000	410.0	H	257.0	13.1
12196.500000	35.83	54.00	18.17	1000.000	335.0	V	14.0	16.5
14638.500000	36.48	54.00	17.52	1000.000	410.0	V	171.0	16.8
17079.500000	40.20	54.00	13.80	1000.000	410.0	V	105.0	21.5



7.9.3 BLE Channel 39 (2480MHz) Spurious Emissions:

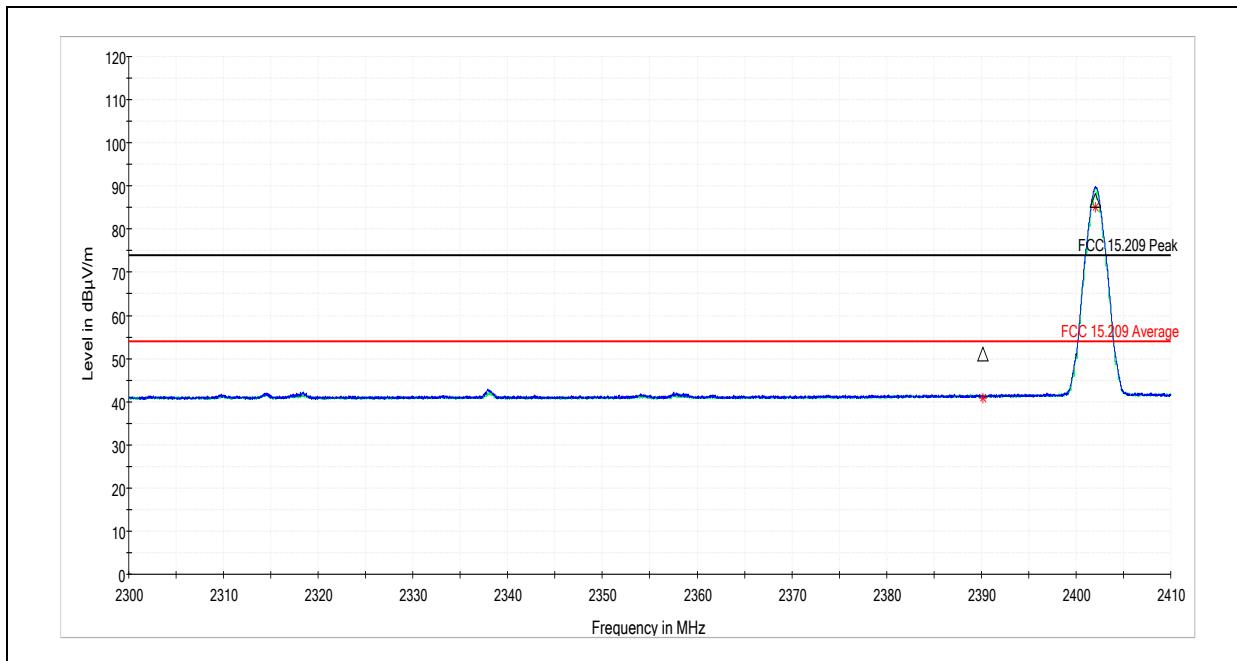


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4960.500000	49.68	74.00	24.32	1000.000	256.0	H	51.0	6.7
7441.000000	50.10	74.00	23.90	1000.000	209.0	V	154.0	10.6
9918.500000	46.83	74.00	27.17	1000.000	370.0	V	160.0	13.4
12407.000000	48.95	74.00	25.05	1000.000	410.0	H	246.0	16.2
14885.000000	50.40	74.00	23.60	1000.000	410.0	H	218.0	18.1
17358.000000	53.24	74.00	20.76	1000.000	410.0	V	166.0	20.7

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4960.500000	41.43	54.00	12.57	1000.000	256.0	H	51.0	6.7
7441.000000	39.03	54.00	14.97	1000.000	209.0	V	154.0	10.6
9918.500000	33.43	54.00	20.57	1000.000	370.0	V	160.0	13.4
12407.000000	35.67	54.00	18.33	1000.000	410.0	H	246.0	16.2
14885.000000	37.11	54.00	16.89	1000.000	410.0	H	218.0	18.1
17358.000000	39.52	54.00	14.48	1000.000	410.0	V	166.0	20.7



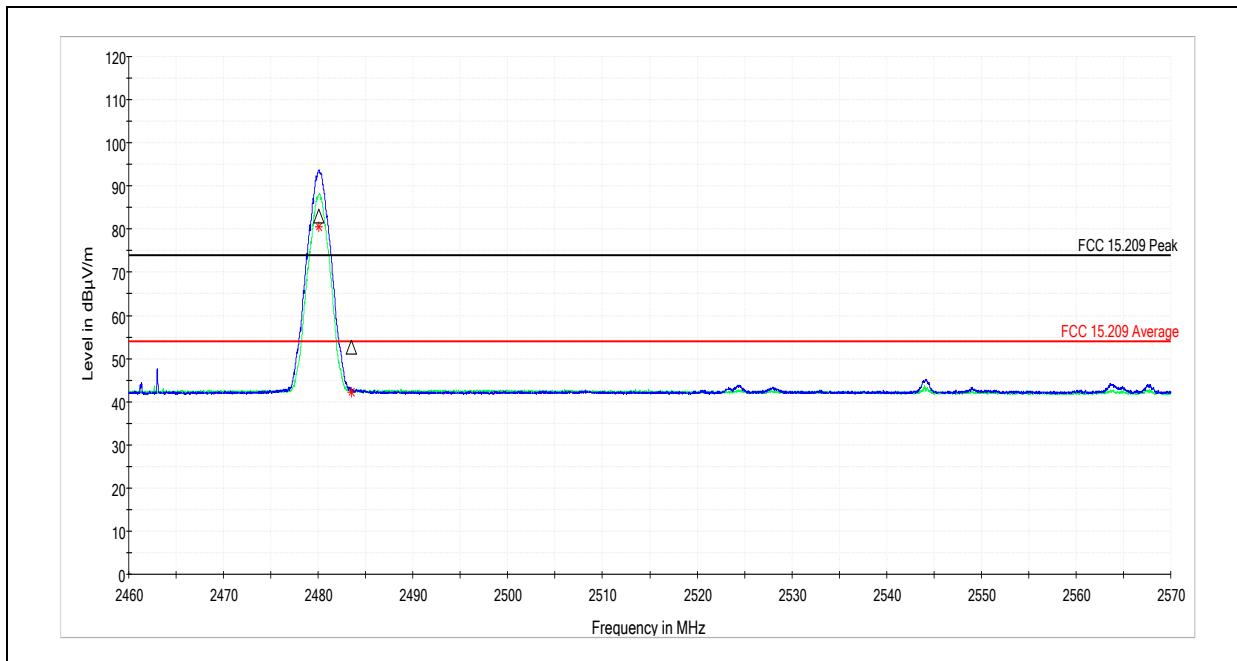
7.9.4 Emissions at the low band edge:



Frequency (MHz)	Average (dB μ V/m)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2390.200000	---	51.05	74.00	22.95	1000.000	260.0	H	203.0	37.0
2390.200000	40.77	---	54.00	13.23	1000.000	260.0	H	203.0	37.0



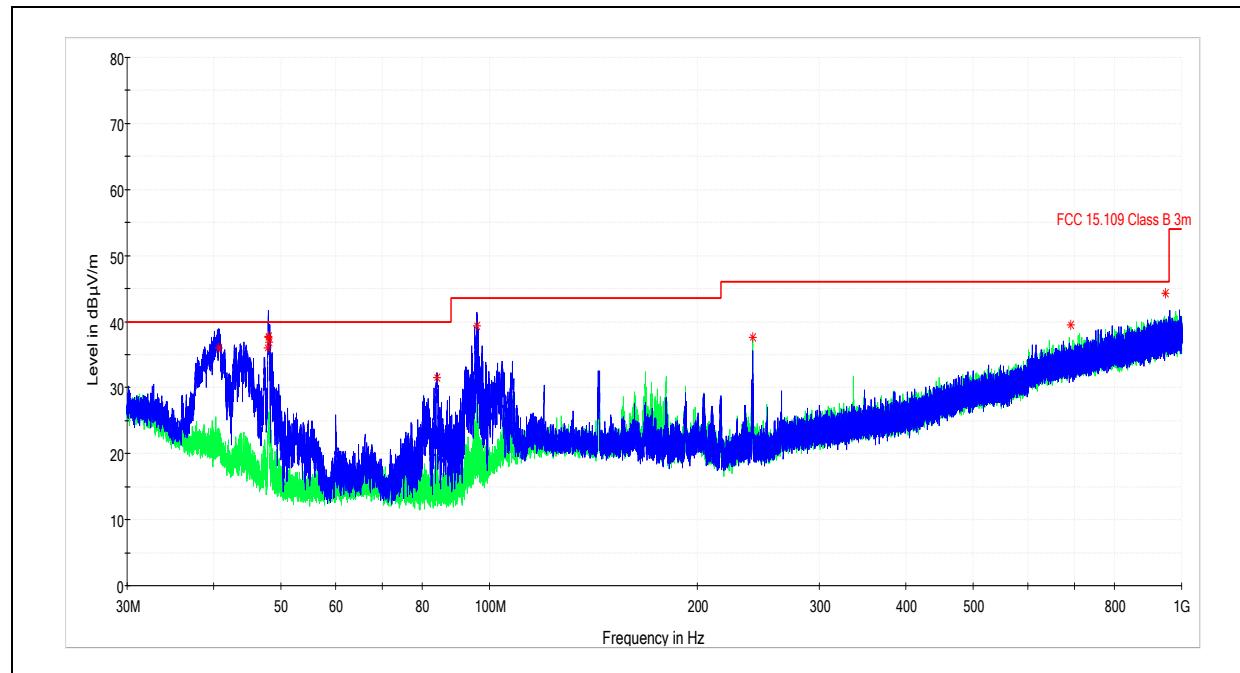
7.9.5 Emissions at the high band edge:



Frequency (MHz)	Average (dB μ V/m)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2483.496000	42.15	---	54.00	11.85	1000.000	189.0	H	279.0	37.5
2483.496000	---	52.56	74.00	21.44	1000.000	189.0	H	279.0	37.5



7.9.6 Spurious Emissions, 30MHz-1GHz:

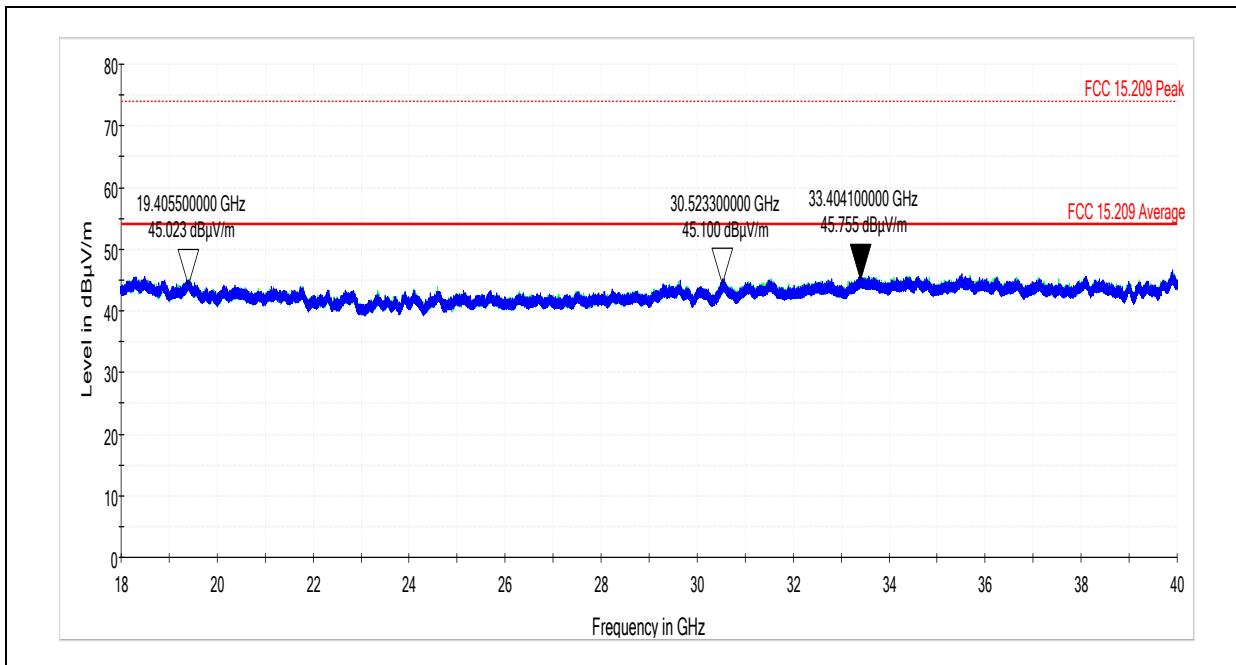


Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
40.698000	36.06	40.00	3.94	120.000	106.0	V	0.0	19.6
47.915000	36.04	40.00	3.96	120.000	105.3	V	348.0	15.7
47.988000	37.61	40.00	2.39	120.000	105.1	V	312.0	15.7
47.993000	37.74	40.00	2.26	120.000	105.4	V	302.0	15.7
48.096000	36.92	40.00	3.08	120.000	104.7	V	319.0	15.7
84.132000	31.52	40.00	8.48	120.000	109.4	V	10.0	14.9
96.094000	39.30	43.52	4.22	120.000	105.2	V	110.0	17.3
240.020000	37.57	46.02	8.45	120.000	189.4	H	18.0	20.7
692.310000	39.50	46.02	6.52	120.000	309.4	H	0.0	31.8
947.720000	44.28	46.02	1.74	120.000	342.7	H	111.0	35.4

Note: results shown represent the worst case of three channels under test



7.9.7 Spurious Emissions, 18GHz-40GHz:



Note: results shown represent the worst case of three channels under test. All observed peak emissions were below the average limit from FCC Title 47 CFR Part 15.209.



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

Tests are performed in accordance with ANSI C63.10:2013 § 11.9.2.3.1 Method AVGPM.

8.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Wideband Power Sensor	4022	Rohde&Schwarz	NRP-Z81	9/20/2017	9/20/2018

8.4 Test Results

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

8.5 Test Conditions

Test Personnel:	B. Lackey	Test Date:	8/29/2018
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
	FCC Part 15.247	Ambient Temperature:	25.6C
Product Standard:	RSS-247 Issue 2	Relative Humidity:	52.2%
Input Voltage:	Battery	Atmospheric Pressure:	985.4mbar
Pretest Verification w / Ambient Signals or BB Source:	Yes		



8.6 Test Data

Data Rate	Channel	Frequency (MHz)	Average Output Power (dBm)	Average Output Power (mW)	Limit (mW)	Result
250kb/s	0	2402	-0.29	0.94	1000	Pass
	19	2440	-0.19	0.96	1000	Pass
	39	2480	-0.32	0.93	1000	Pass
1Mb/s	0	2402	-0.46	0.90	1000	Pass
	19	2440	-0.36	0.92	1000	Pass
	39	2480	-0.50	0.89	1000	Pass
2Mb/s	0	2402	-0.69	0.85	1000	Pass
	19	2440	-0.59	0.87	1000	Pass
	39	2480	-0.72	0.85	1000	Pass

Deviations, Additions, or Exclusions: None



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
EMI Test Receiver	2327	Rohde & Schwarz	ESI26	9/20/2017	9/20/2018

9.4 Test Results

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

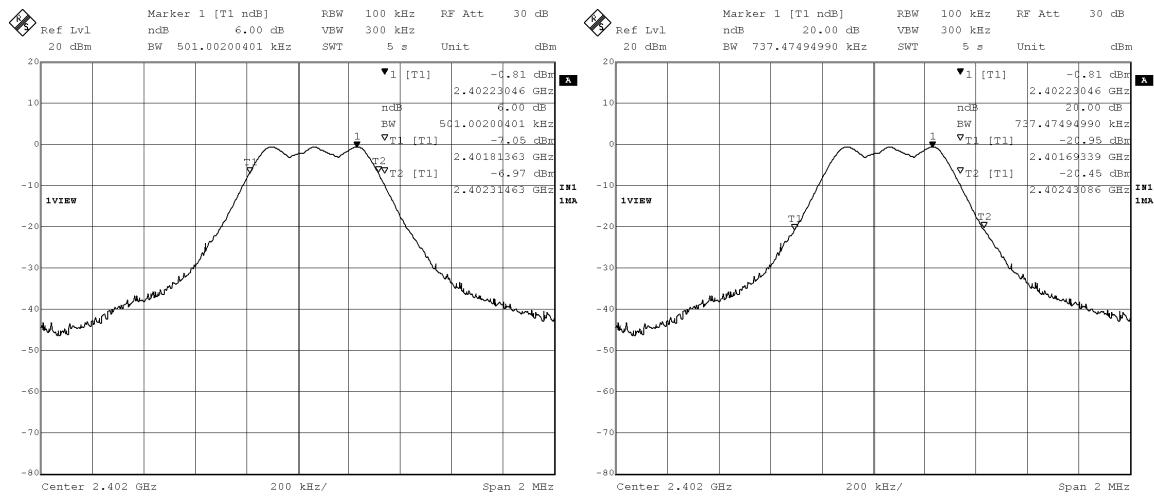
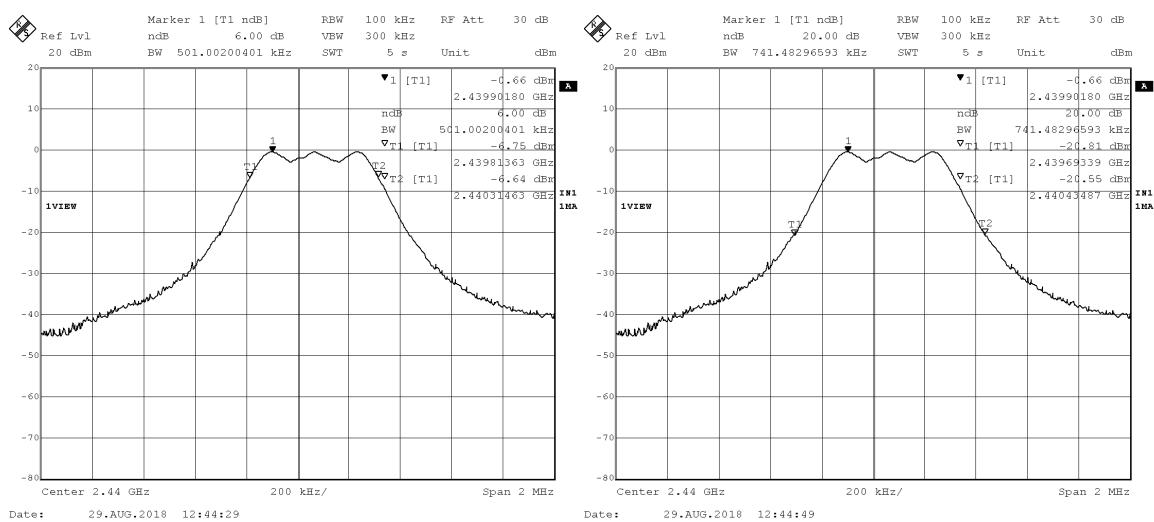
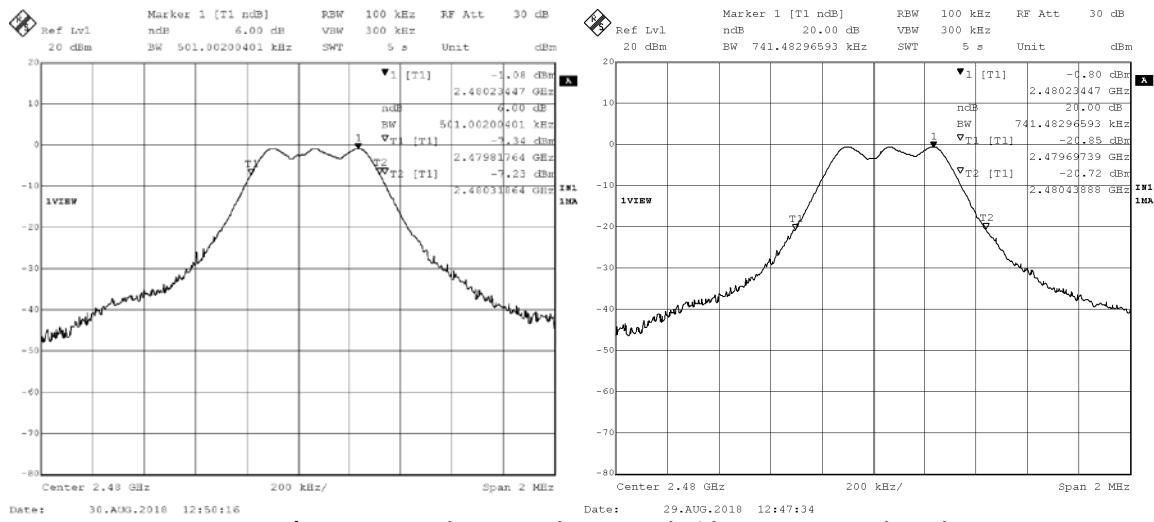
9.5 Test Conditions

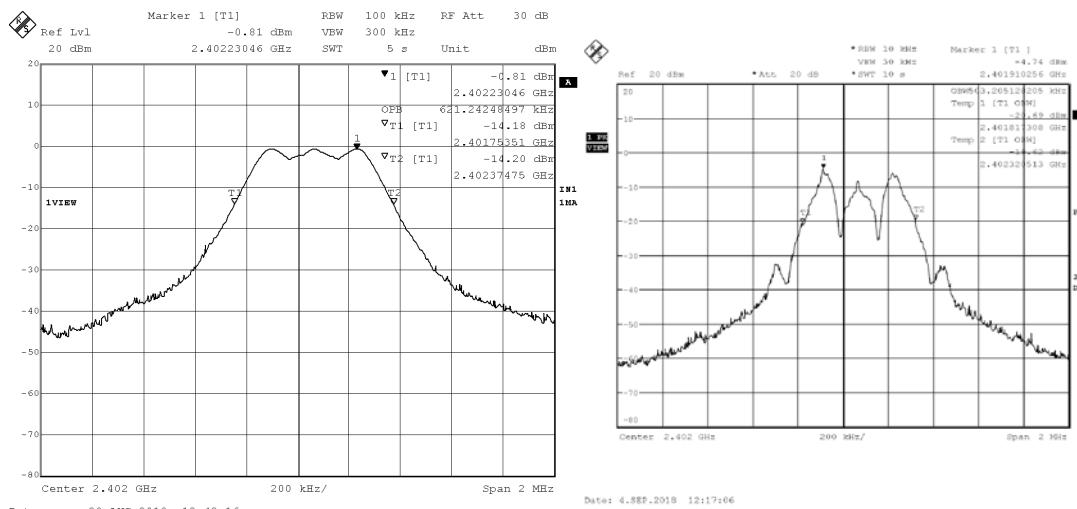
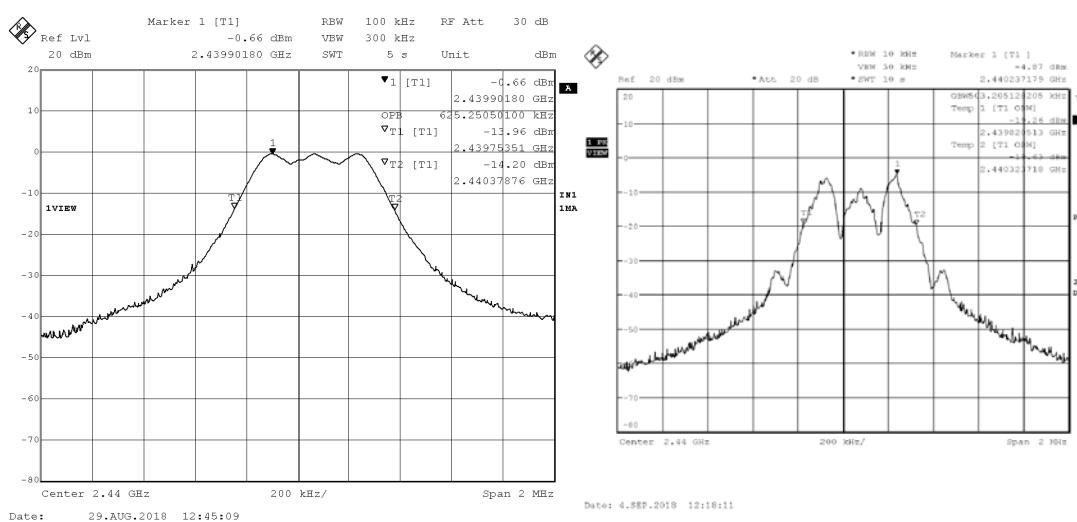
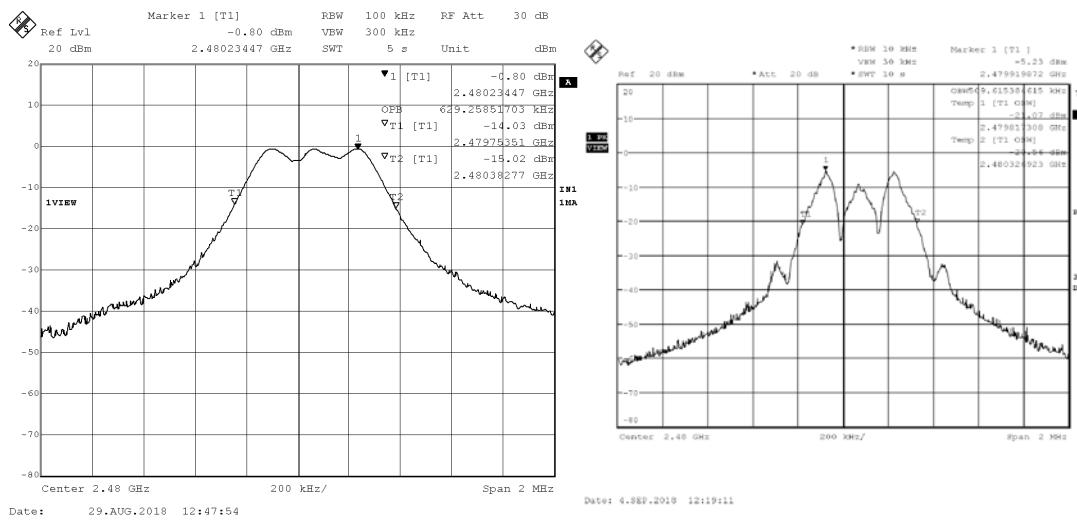
Test Personnel:	B. Lackey	Test Date:	8/29/2018
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247	Ambient Temperature:	25.6C
Input Voltage:	RSS-247 Issue 2	Relative Humidity:	52.2%
Pretest Verification w / Ambient Signals or BB Source:	Battery	Atmospheric Pressure:	985.4mbar
	Yes		



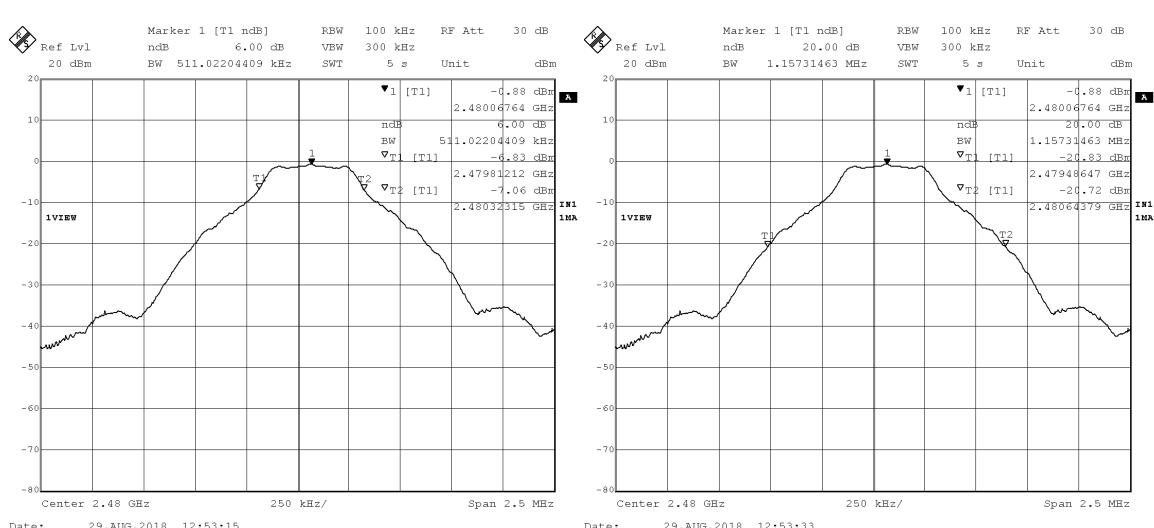
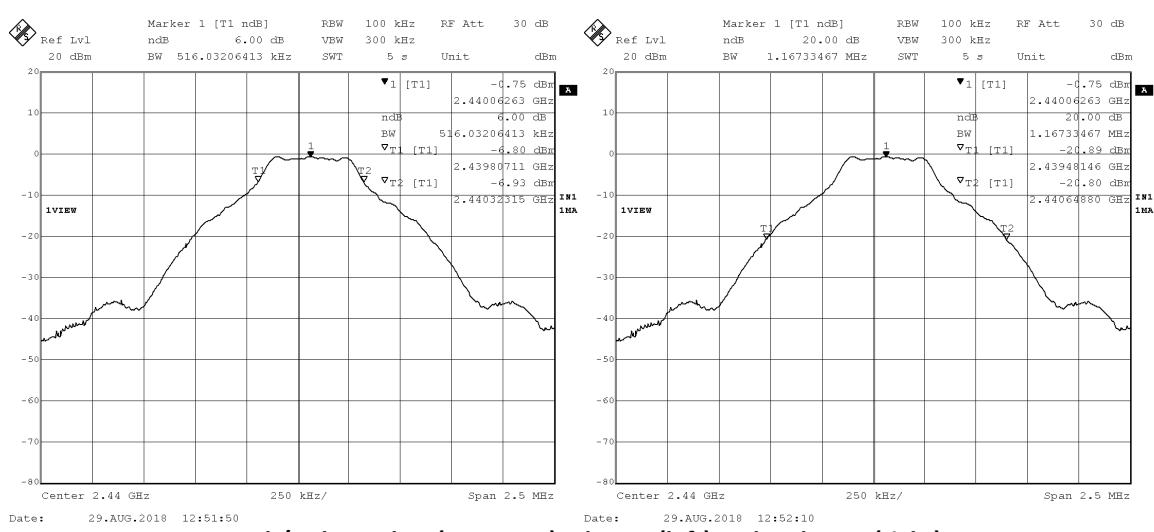
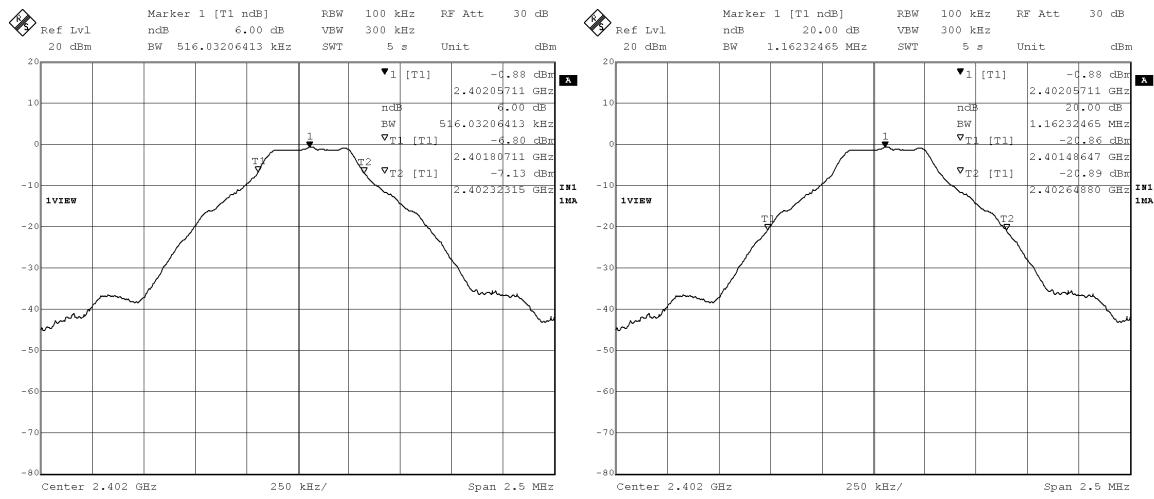
9.6 Test Data

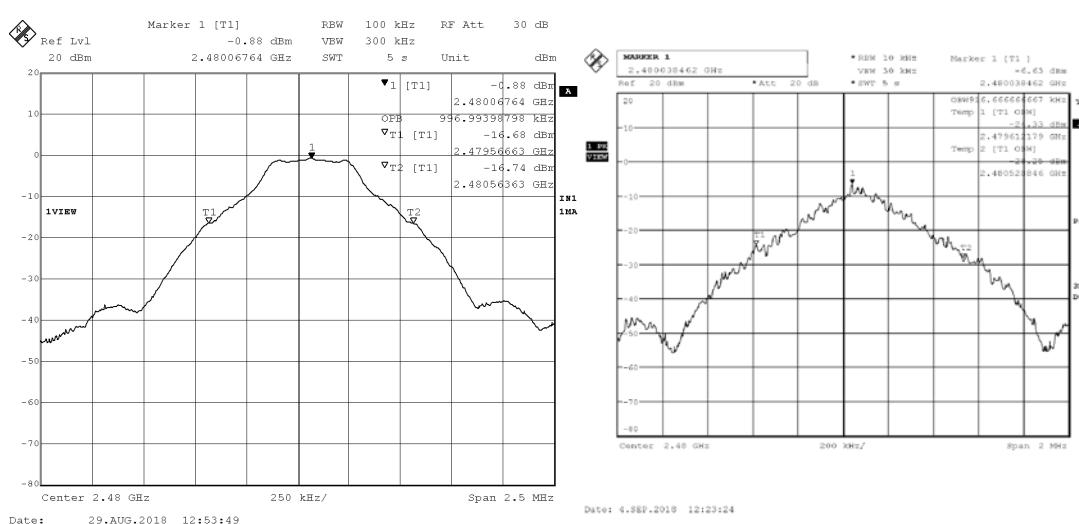
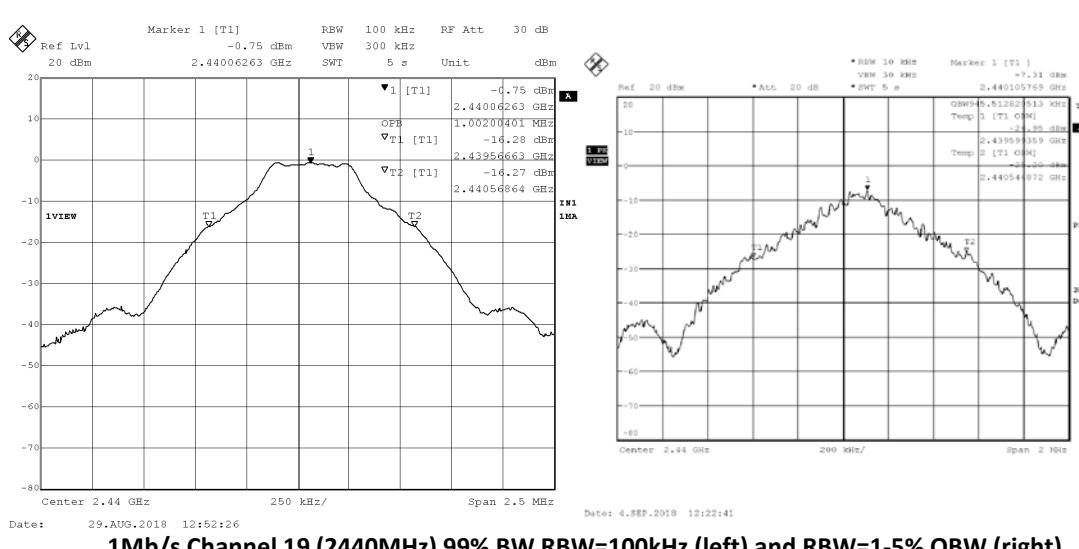
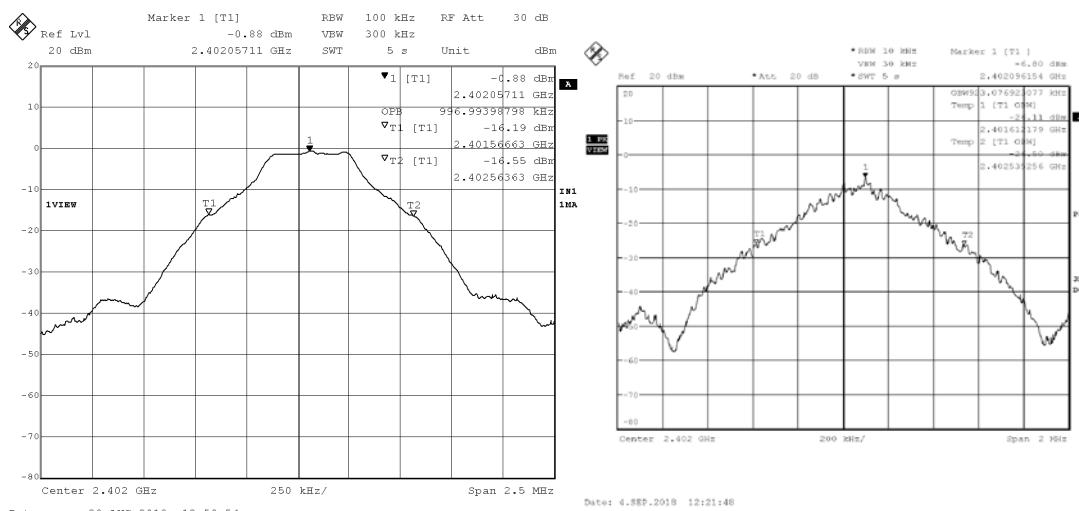
Data Rate	Channel	Frequency (MHz)	6dB BW (kHz) RBW = 100kHz	20dB BW (kHz) RBW = 100kHz	99% BW (kHz) RBW = 100kHz	99% BW (kHz) RBW = 1-5% OBW
250kb/s	0	2402	501.0	737.5	621.2	503.2
	19	2440	501.0	741.5	625.3	503.2
	39	2480	501.0	741.5	629.3	509.6
1Mb/s	0	2402	516.0	1162	997.0	923.1
	19	2440	516.0	1167	1002	945.5
	39	2480	511.0	1157	997.0	916.7
2Mb/s	0	2402	889.8	2050	1844	1835
	19	2440	849.7	2028	1860	1771
	39	2480	801.6	2092	1844	1795

**250kb/s Channel 0 (2402MHz) 6dB BW (left) and 20dB BW (right)****250kb/s Channel 19 (2440MHz) 6dB BW (left) and 20dB BW (right)****250kb/s Channel 39 (2480MHz) 6dB BW (left) and 20dB BW (right)**

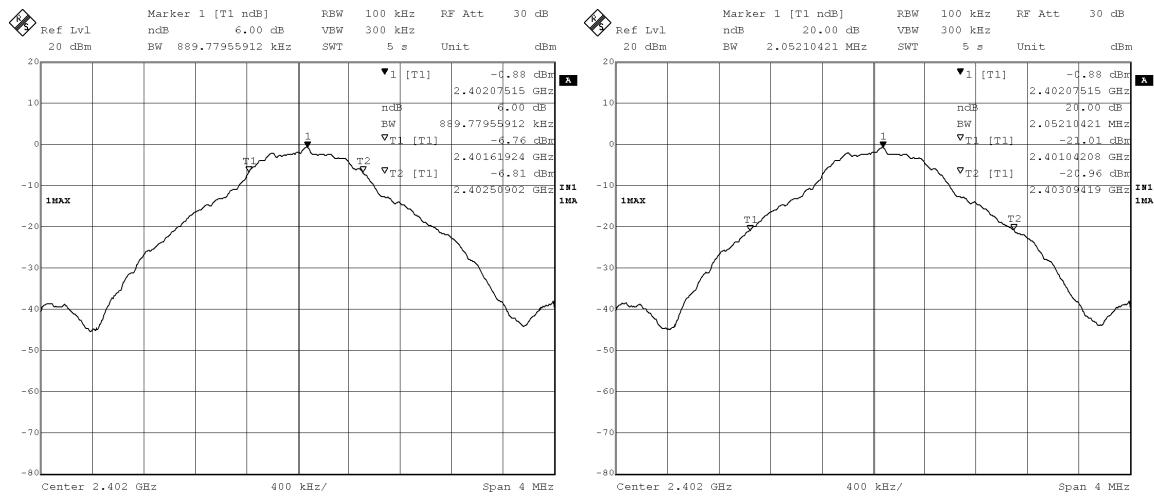
**250kb/s Channel 0 (2402MHz) 99% BW RBW=100kHz (left) and RBW=1-5% OBW (right)****250kb/s Channel 19 (2440MHz) 99% BW RBW=100kHz (left) and RBW=1-5% OBW (right)****250kb/s Channel 39 (2480MHz) 99% BW RBW=100kHz (left) and RBW=1-5% OBW (right)**

Deviations, Additions, or Exclusions: None

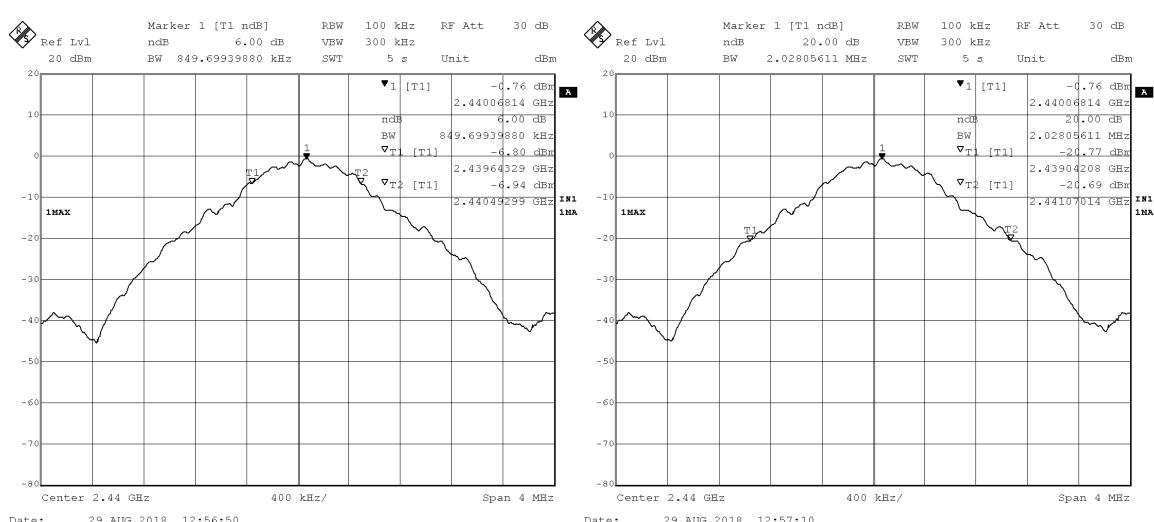




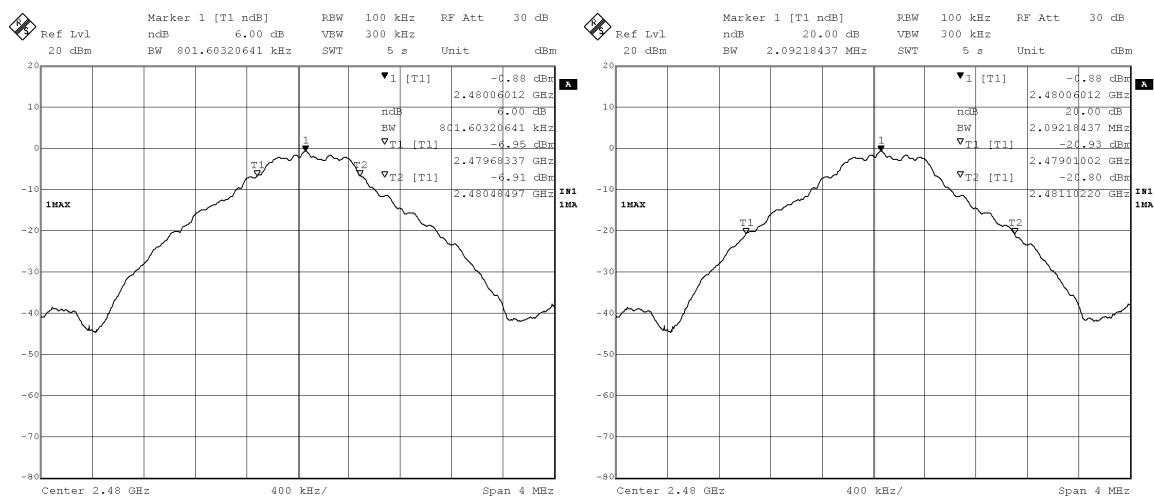
Deviations, Additions, or Exclusions: None



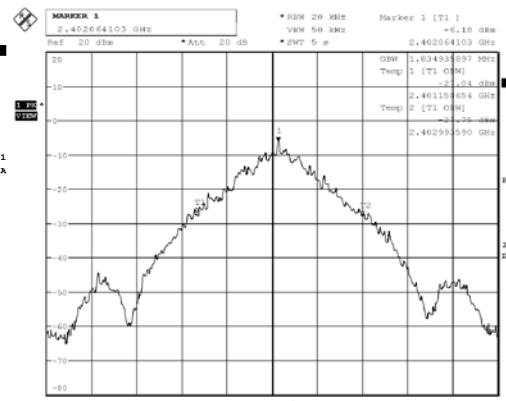
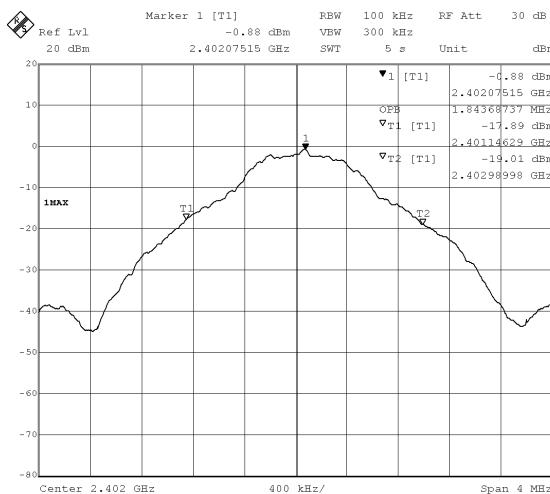
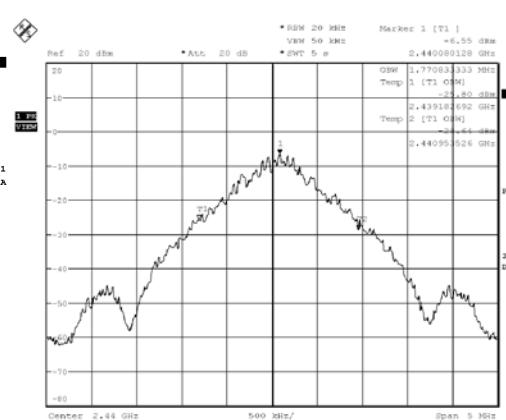
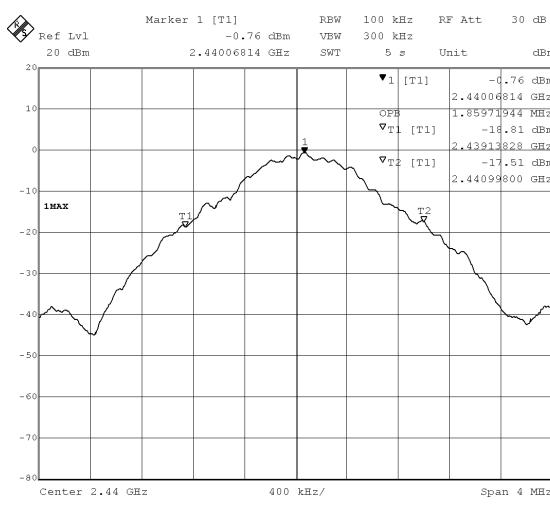
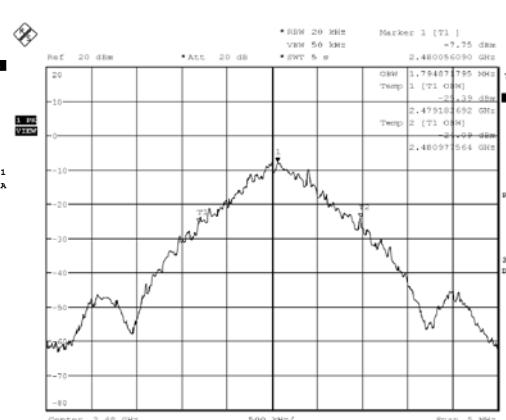
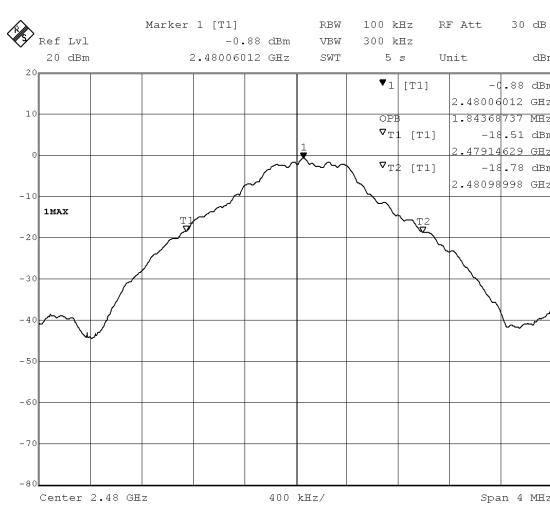
2Mb/s Channel 0 (2402MHz) 6dB BW (left) and 20dB BW (right)



2Mb/s Channel 19 (2440MHz) 6dB BW (left) and 20dB BW (right)



2Mb/s Channel 39 (2480MHz) 6dB BW (left) and 20dB BW (right)

**2Mb/s Channel 0 (2402MHz) 99% BW RBW=100kHz (left) and RBW=1-5% OBW (right)****2Mb/s Channel 19 (2440MHz) 99% BW RBW=100kHz (left) and RBW=1-5% OBW (right)****2Mb/s Channel 39 (2480MHz) 99% BW RBW=100kHz (left) and RBW=1-5% OBW (right)**

Deviations, Additions, or Exclusions: None



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
EMI Test Receiver	2327	Rohde & Schwarz	ESI26	9/20/2017	9/20/2018

10.4 Test Results

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

10.5 Test Conditions

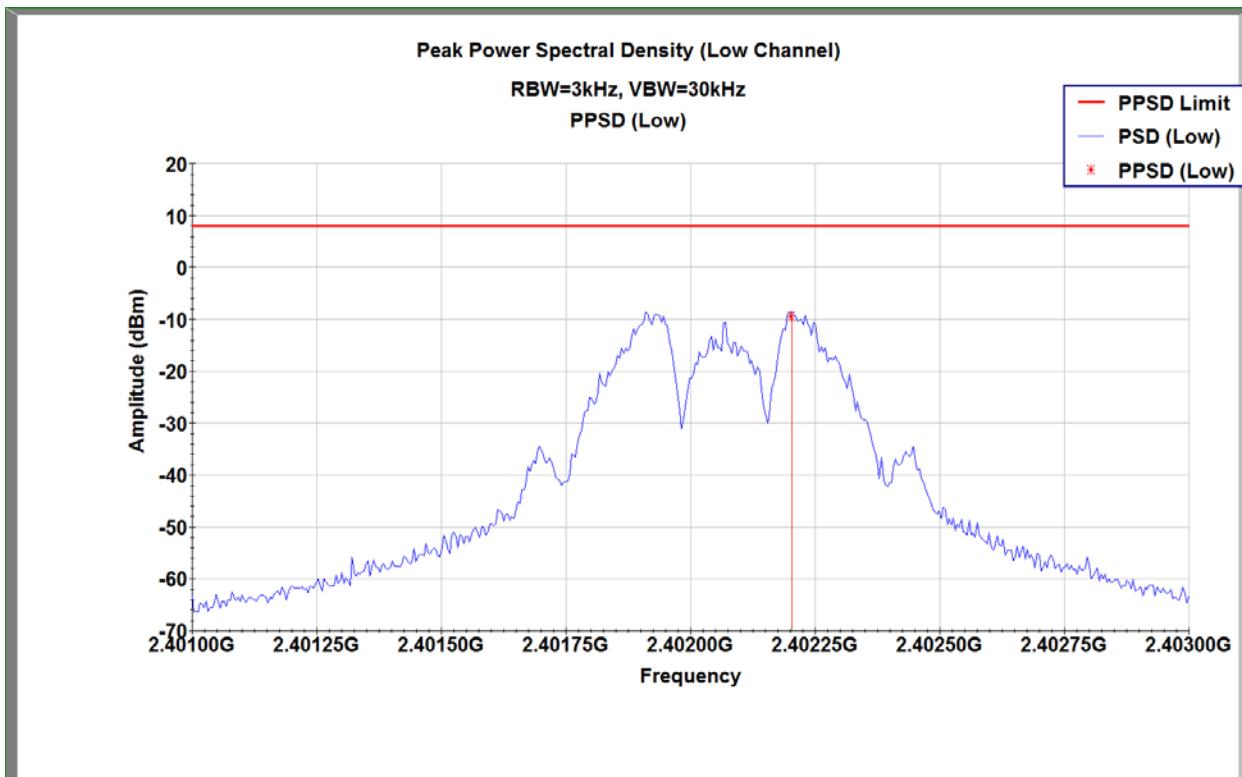
Test Personnel:	B. Lackey	Test Date:	8/29/2018
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247	Ambient Temperature:	25.6C
Input Voltage:	RSS-247 Issue 2	Relative Humidity:	52.2%
Pretest Verification w / Ambient Signals or BB Source:	Battery	Atmospheric Pressure:	985.4mbar
	Yes		



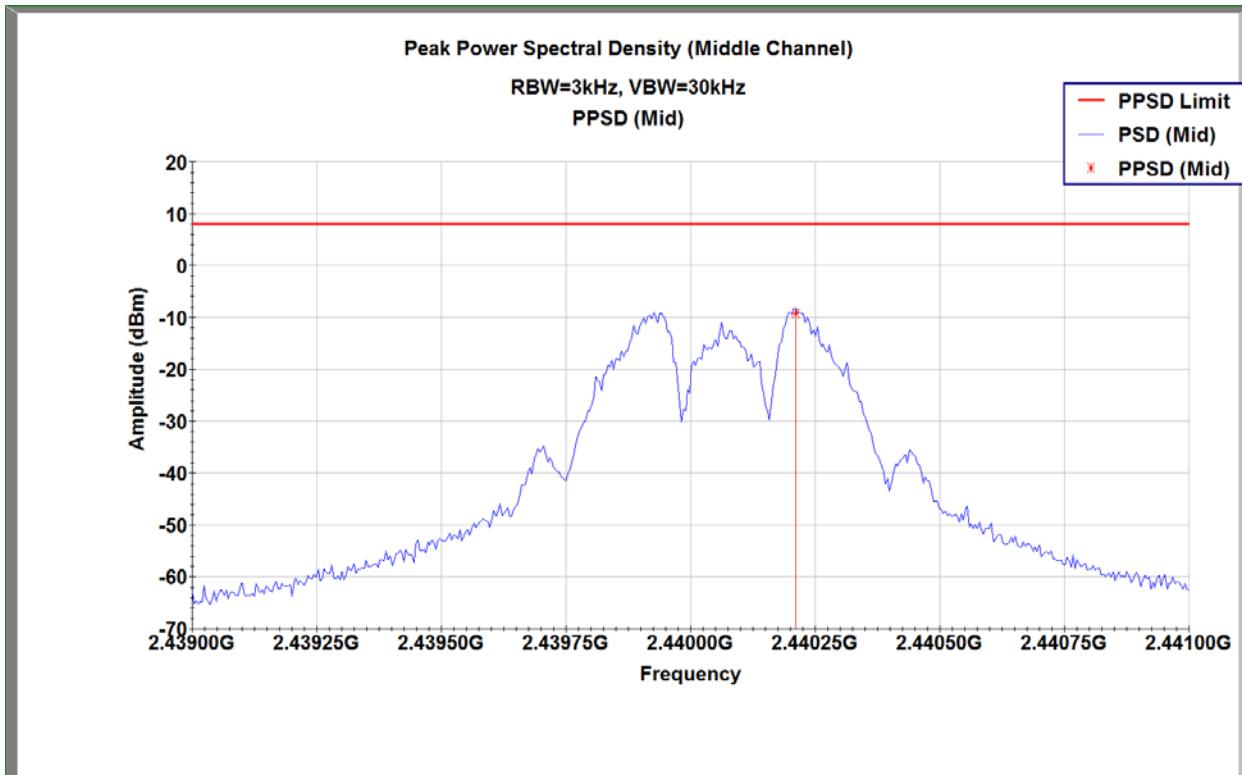
10.6 Test Data

Data Rate	Channel	Frequency (MHz)	RBW (kHz)	PPSD (dBm)	Limit (dBm EIRP)	Result
250kb/s	0	2402	3	-9.432	8	Pass
	19	2440	3	-9.241	8	Pass
	39	2480	3	-8.895	8	Pass
1Mb/s	0	2402	3	-11.698	8	Pass
	19	2440	3	-9.729	8	Pass
	39	2480	3	-11.228	8	Pass
2Mb/s	0	2402	3	-12.619	8	Pass
	19	2440	3	-14.478	8	Pass
	39	2480	3	-14.287	8	Pass

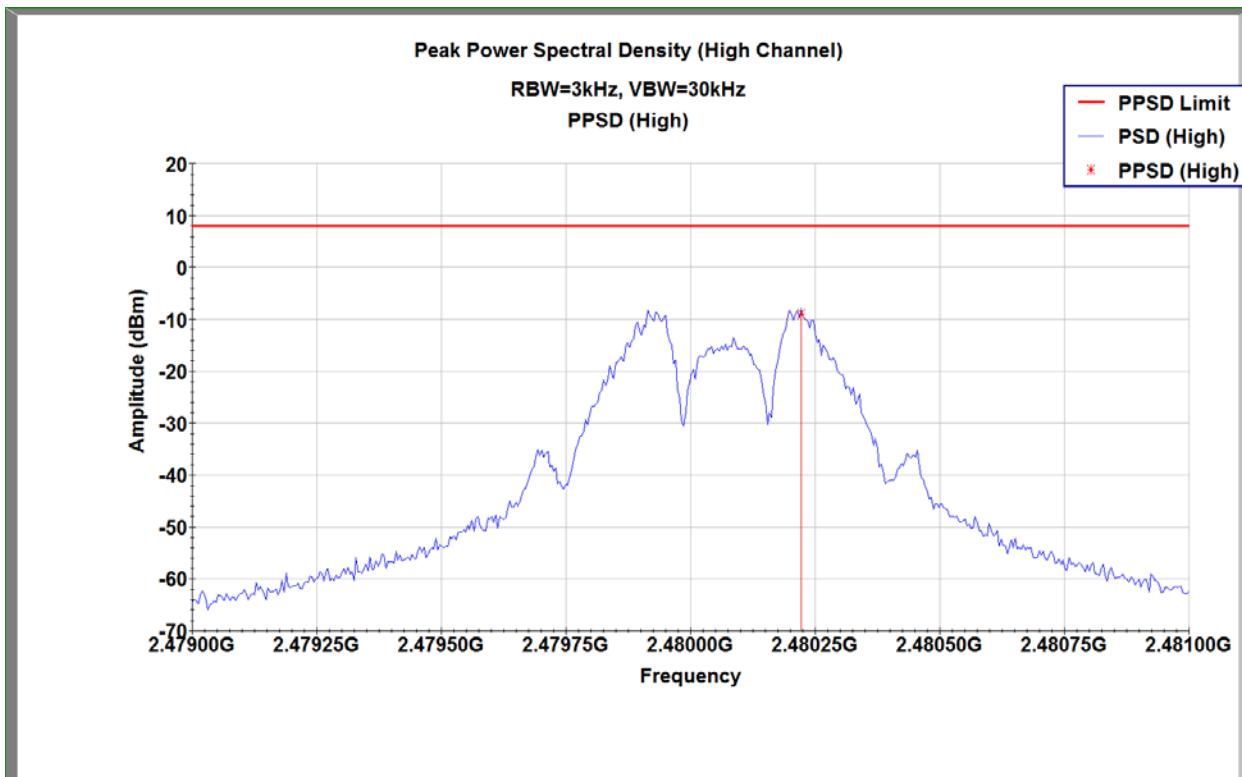
Deviations, Additions, or Exclusions: None.

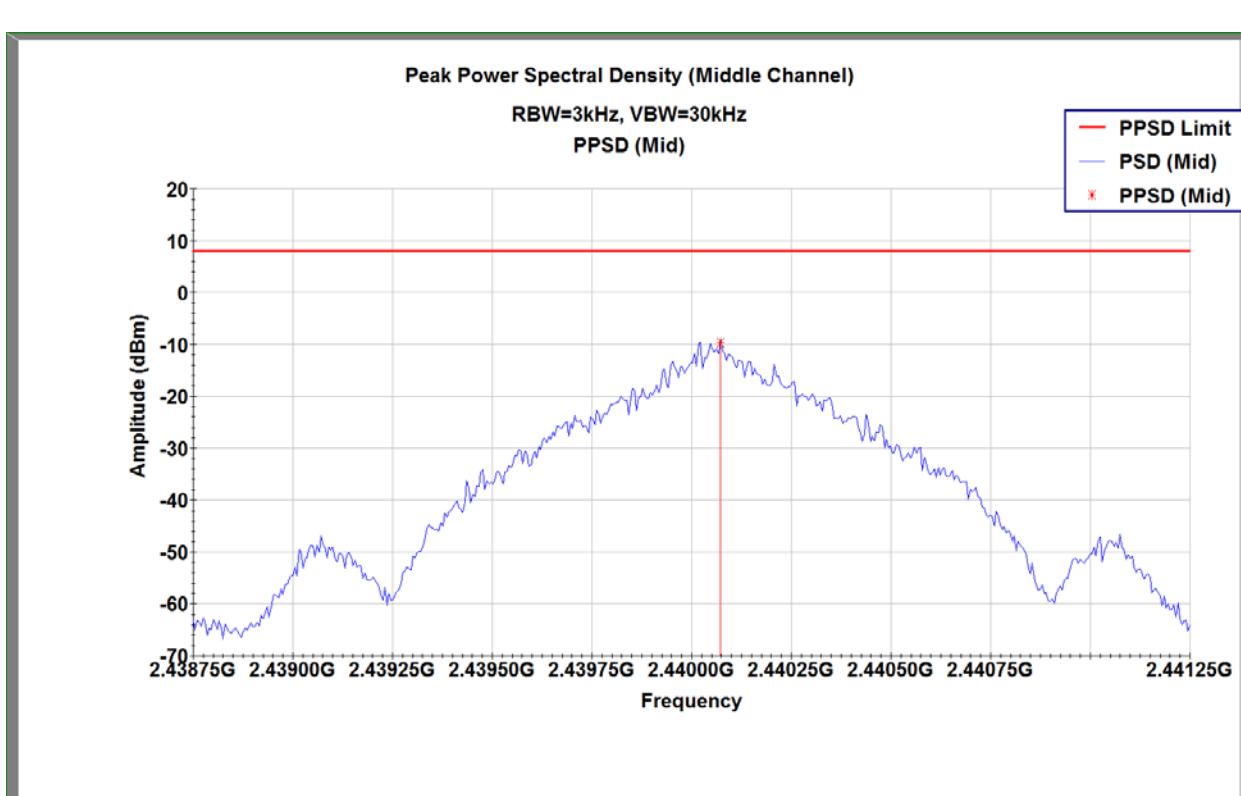
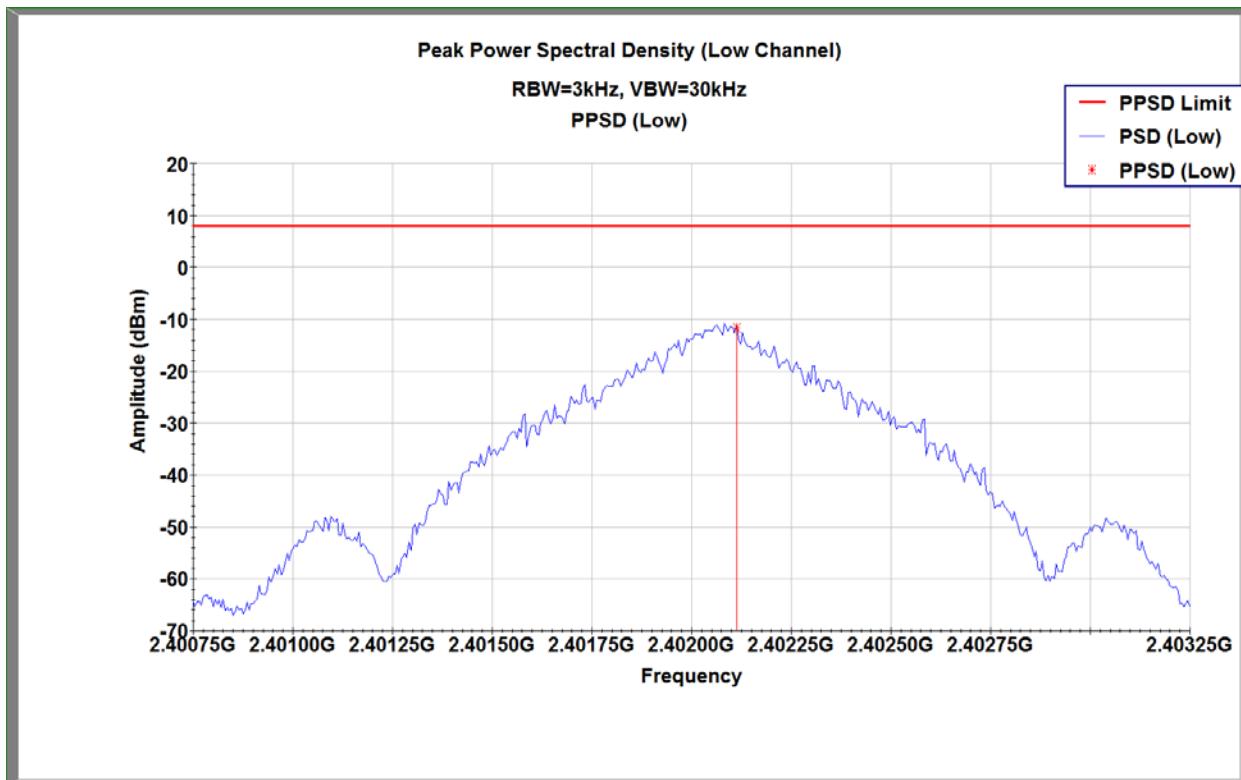


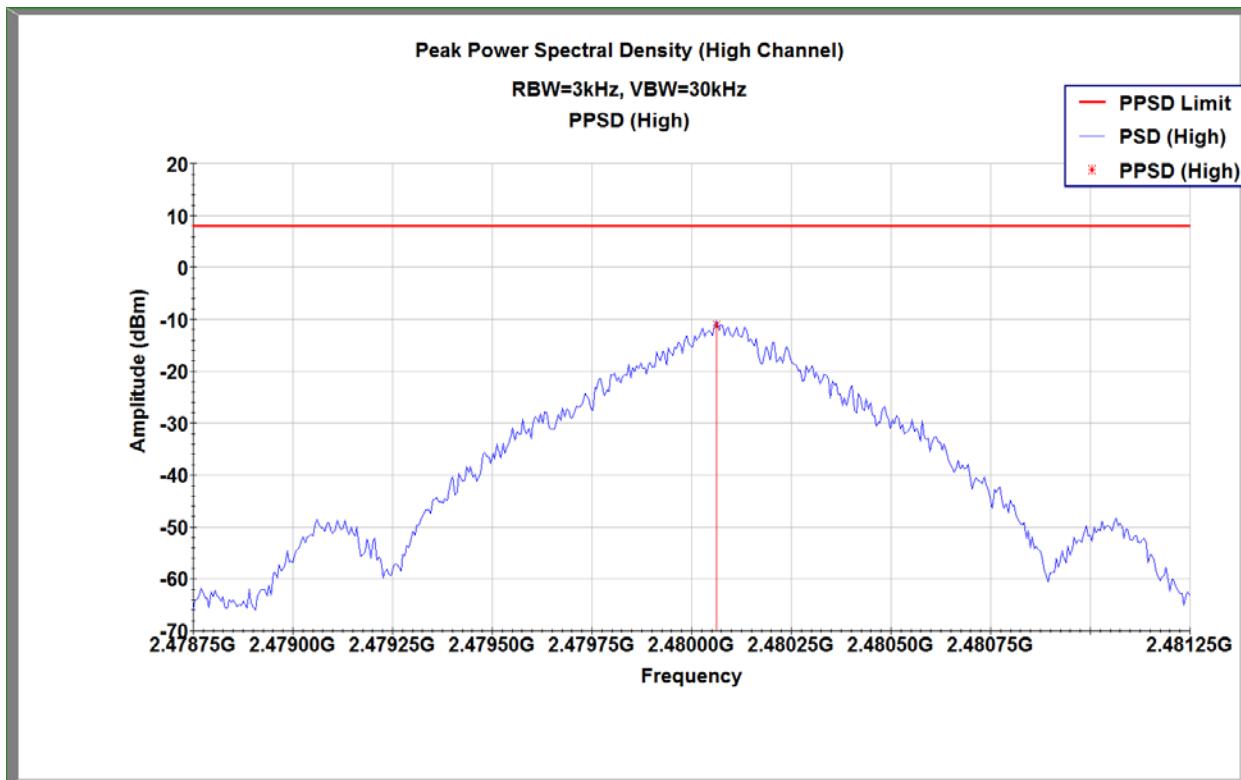
250kb/s Ch 0 (2402MHz) PPSD

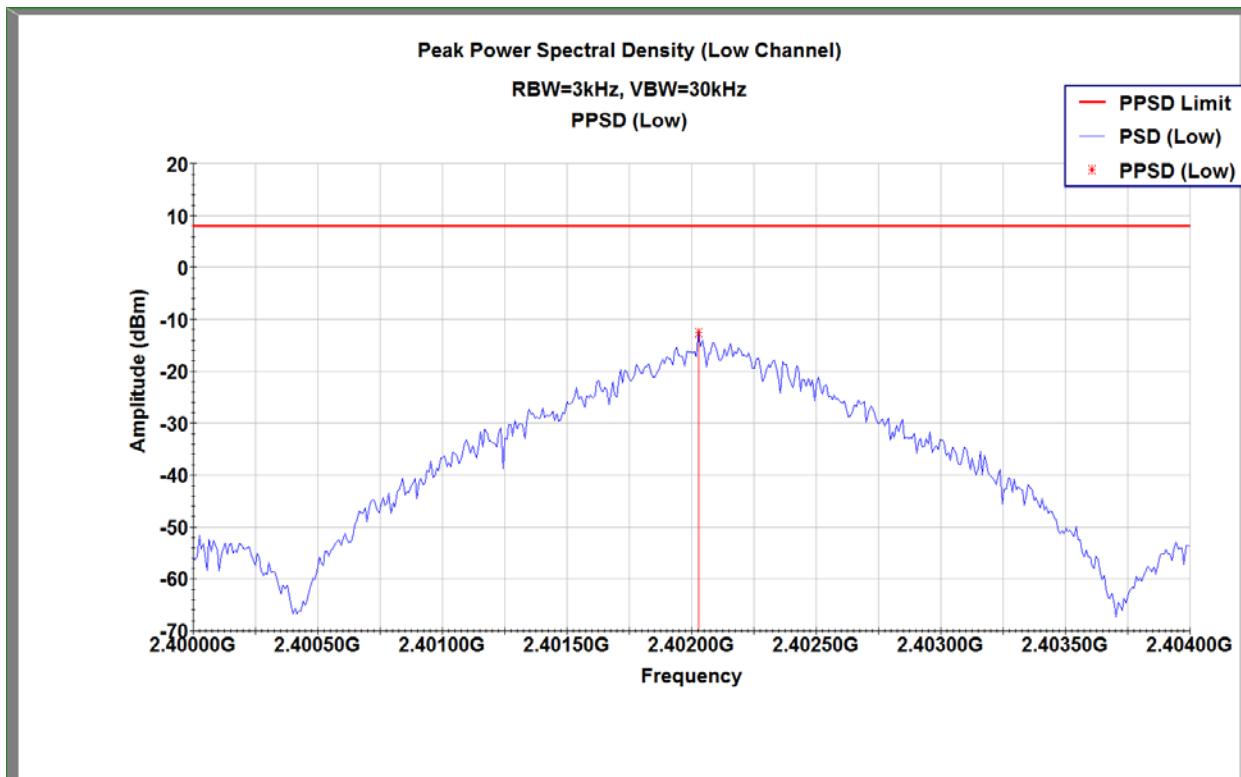


250kb/s Ch 19 (2440MHz) PPSD

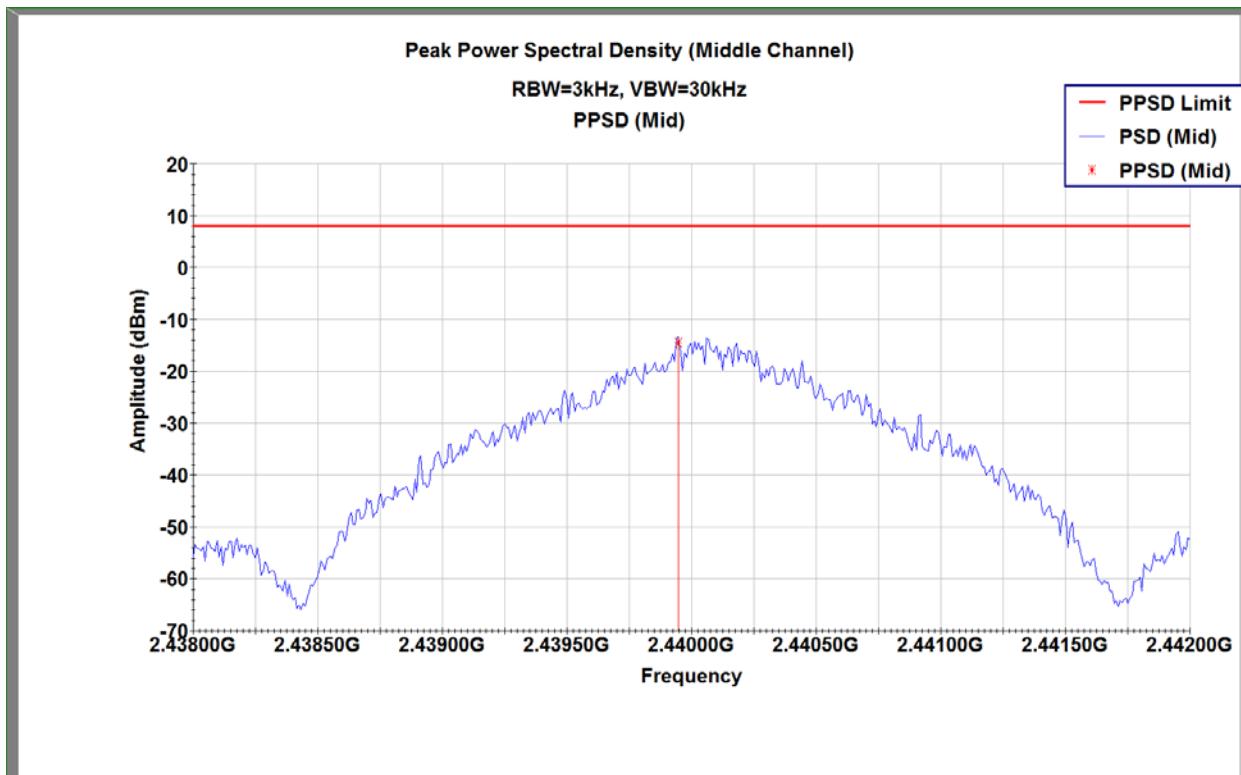




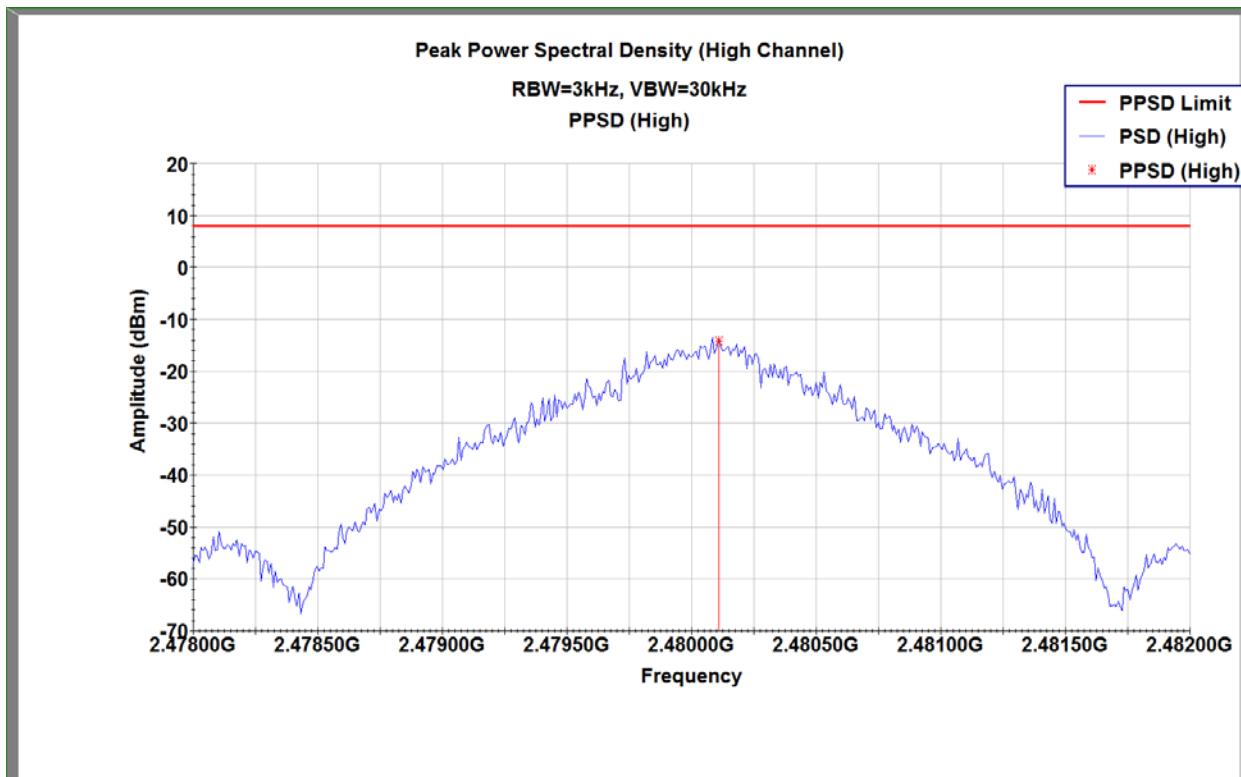




2Mb/s Ch 0 (2402MHz) PPSD



2Mb/s Ch 19 (2440MHz) PPSD





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
EMI Test Receiver	2327	Rohde & Schwarz	ESI26	9/20/2017	9/20/2018

11.4 Test Results

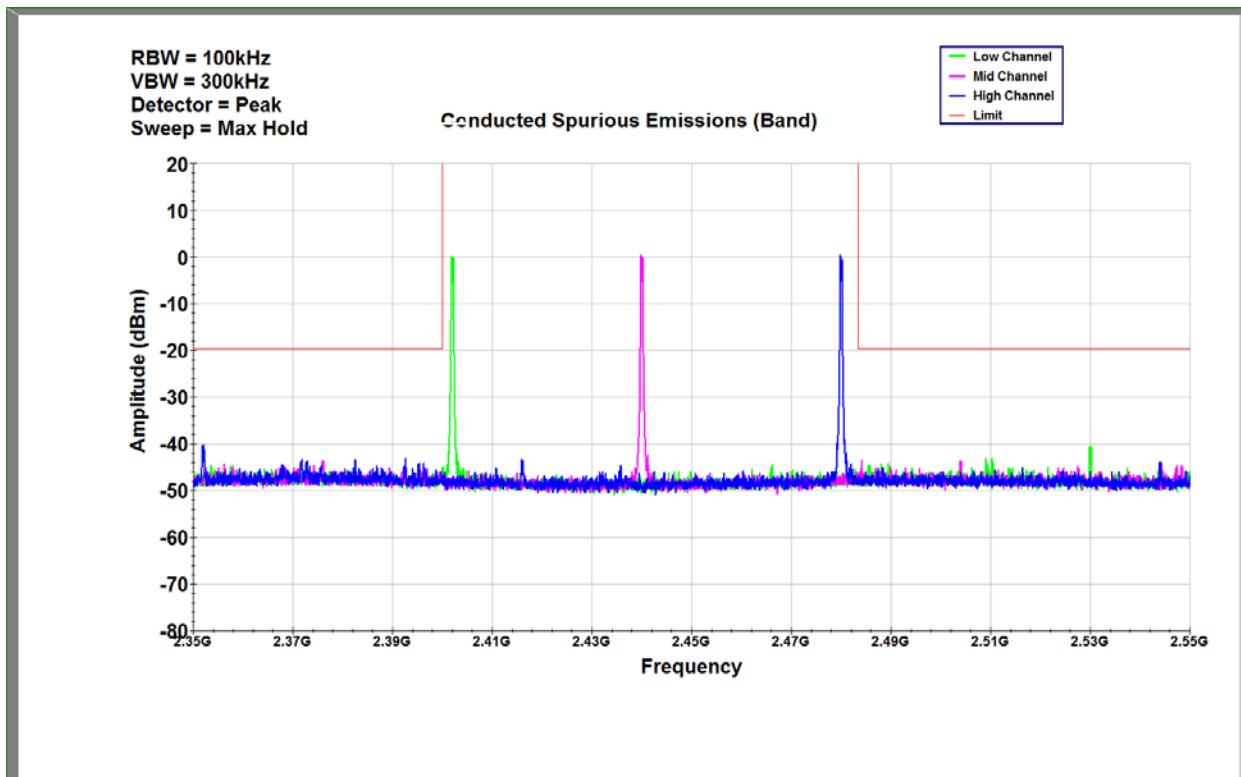
The device was found to be **compliant**. All spurious emissions were found to be attenuated more than 30dB below the level of the fundamental.

11.5 Test Conditions

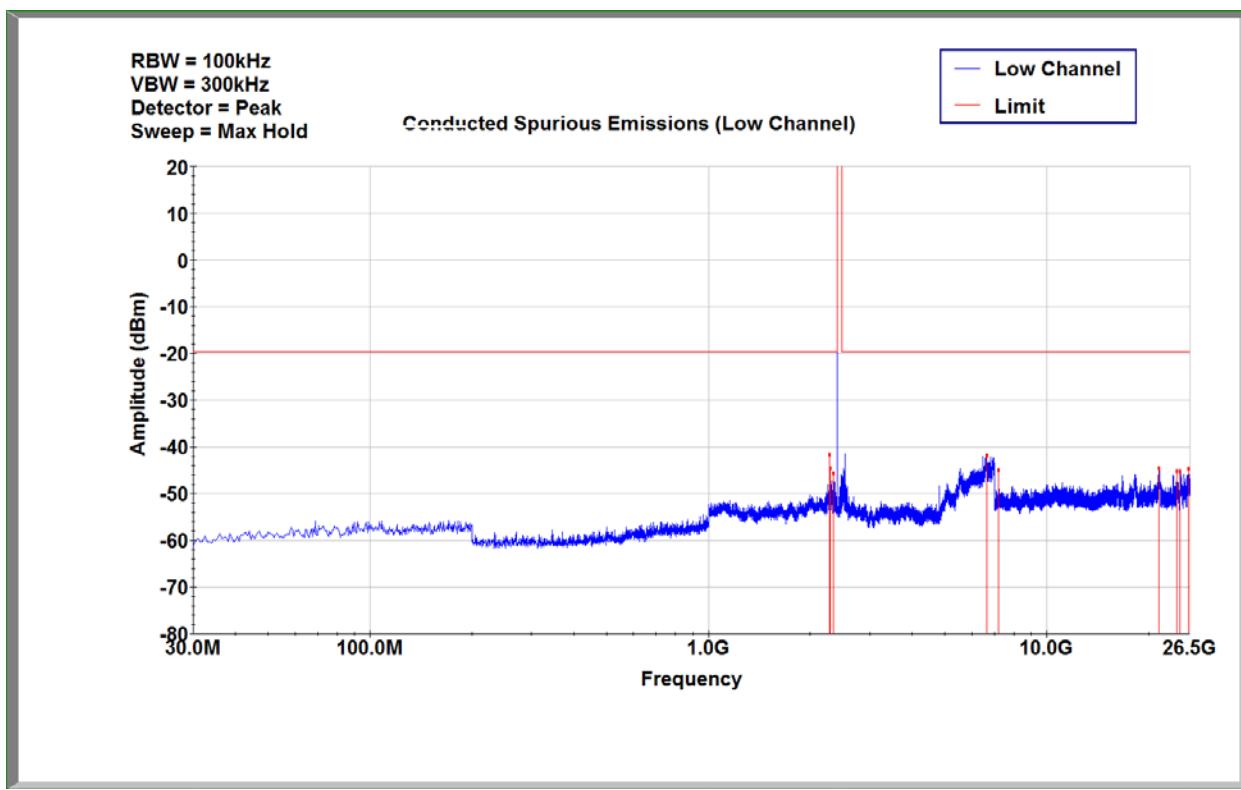
Test Personnel:	B. Lackey	Test Date:	8/29/2018
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
	FCC Part 15.247		
Product Standard:	RSS-247 Issue 2	Ambient Temperature:	25.6C
Input Voltage:	Battery	Relative Humidity:	52.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar



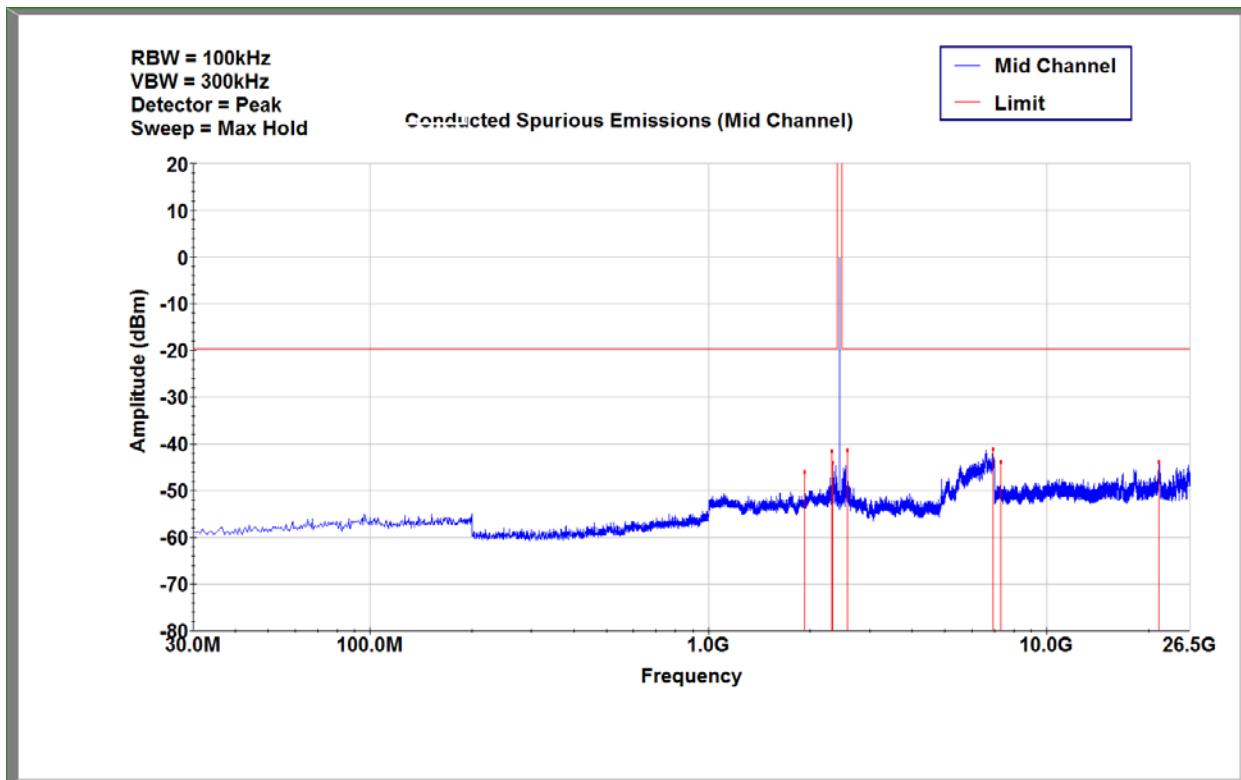
11.6 Test Data



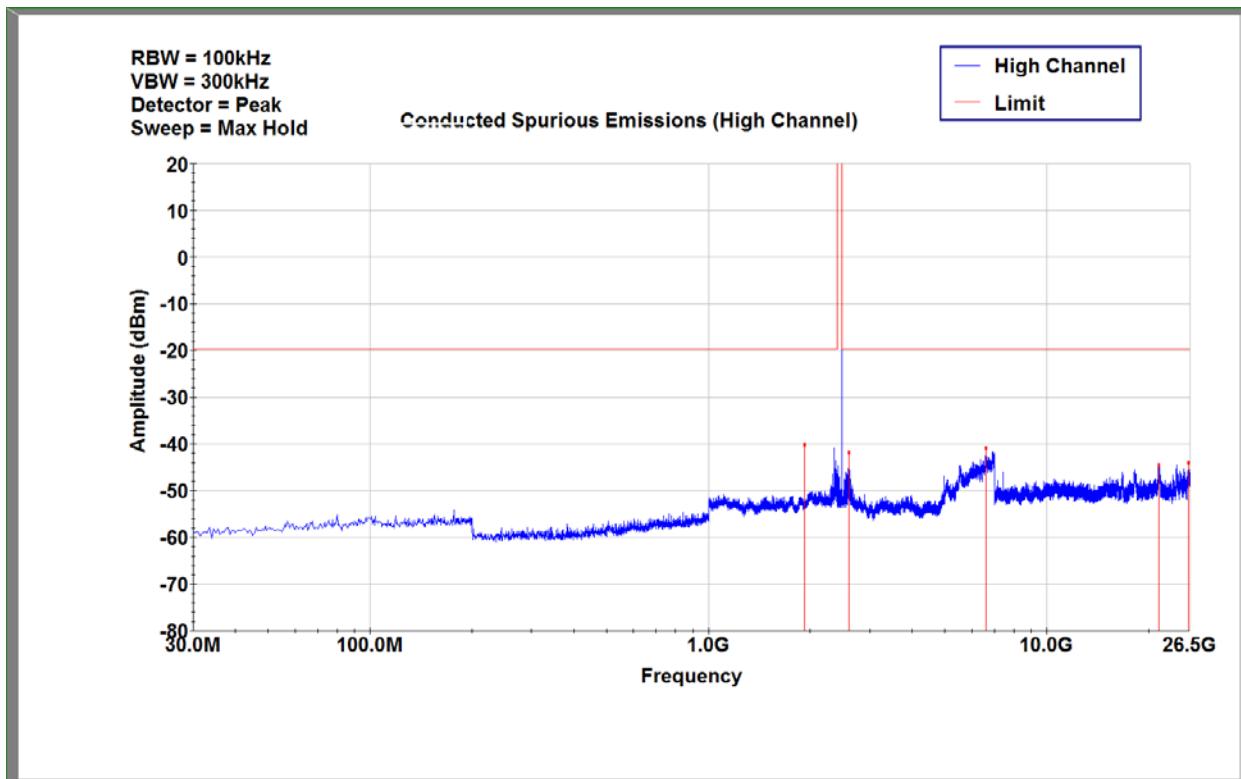
250kb/s Conducted Spurious Emissions (Band)



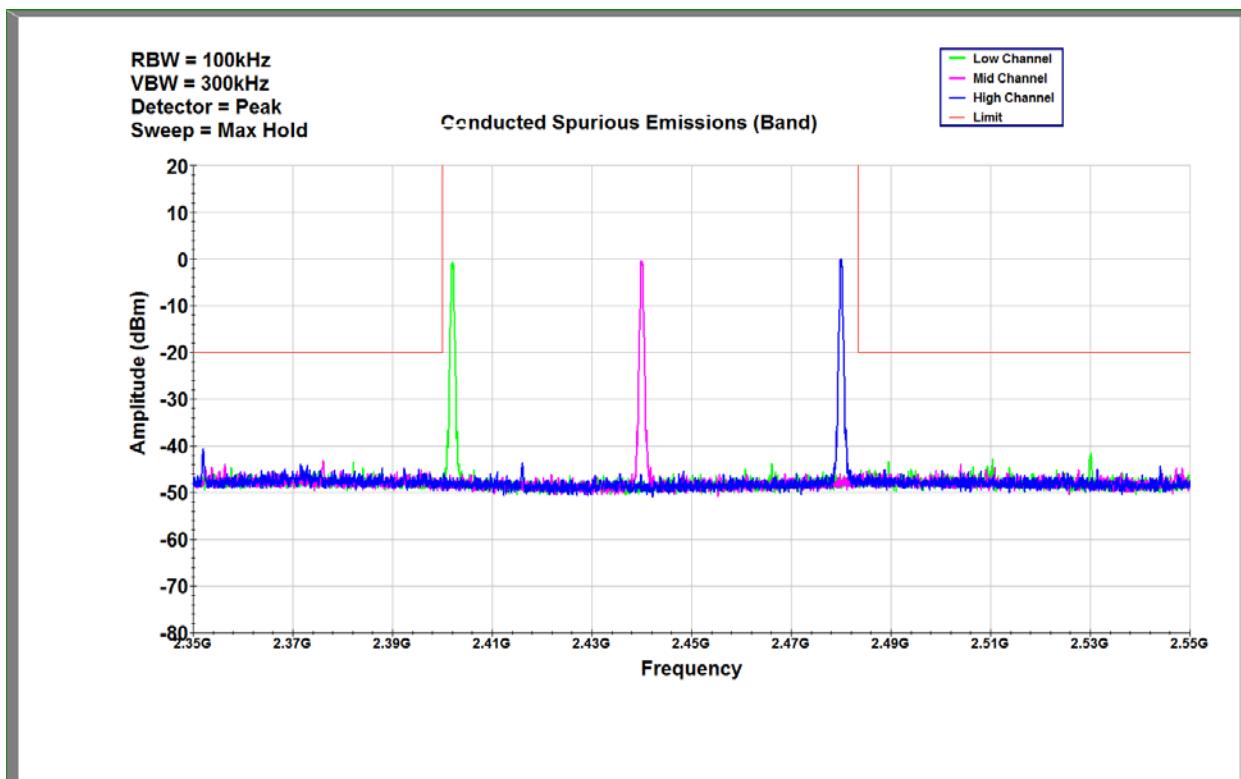
250kb/s Ch 0 (2402MHz) Conducted Spurious Emissions



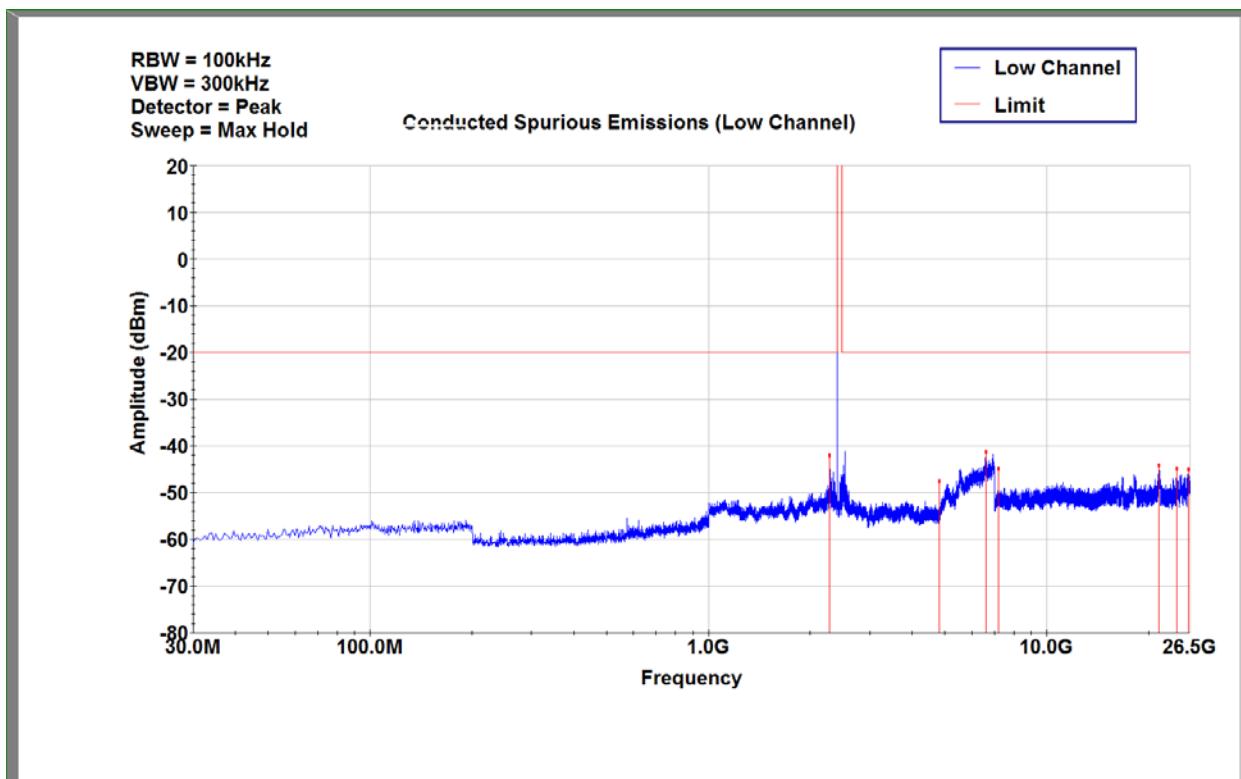
250kb/s Ch 19 (2440MHz) Conducted Spurious Emissions



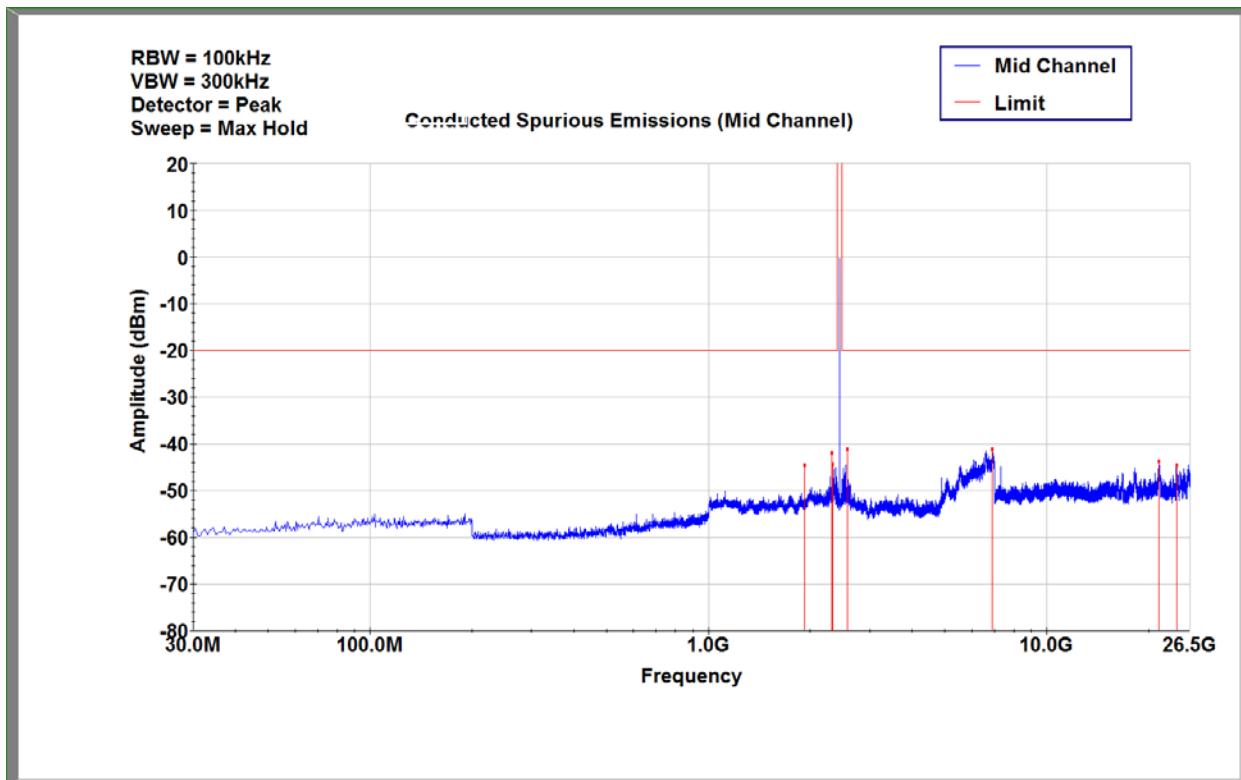
250kb/s Ch 39 (2480MHz) Conducted Spurious Emissions



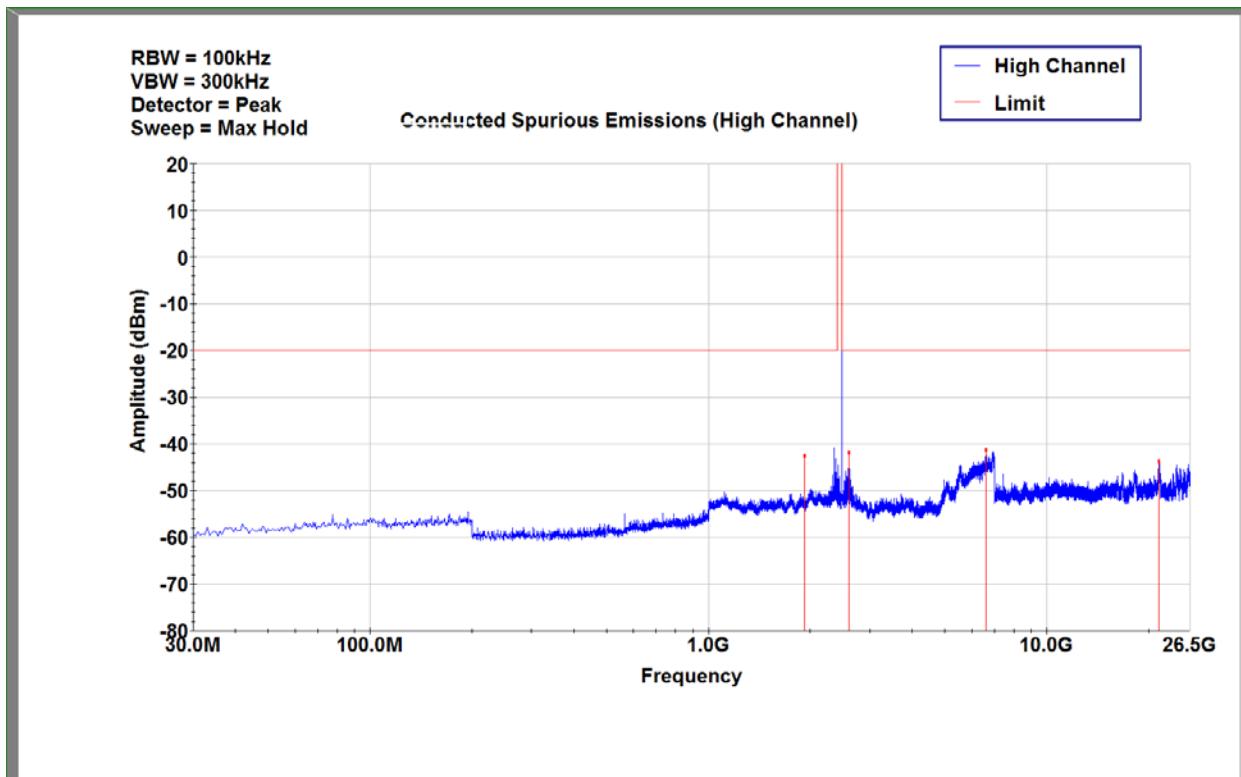
1Mb/s Conducted Spurious Emissions (Band)



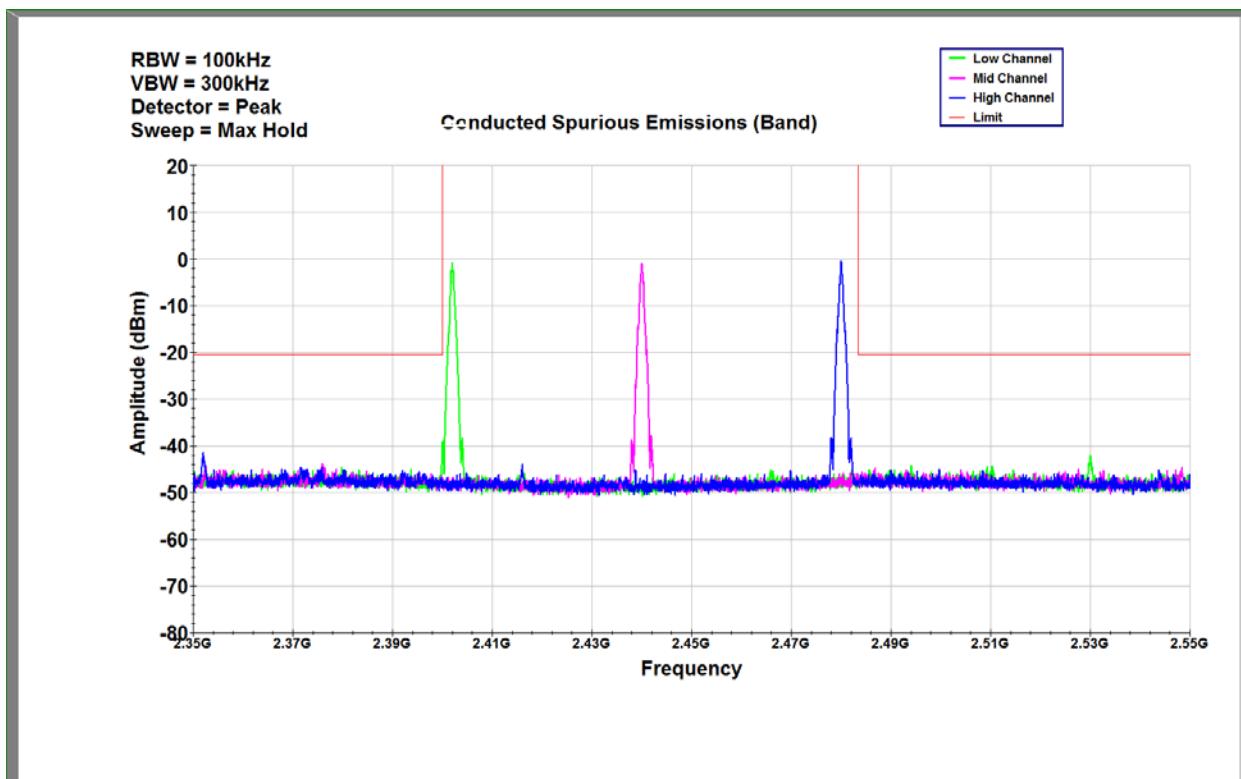
1Mb/s Ch 0 (2402MHz) Conducted Spurious Emissions



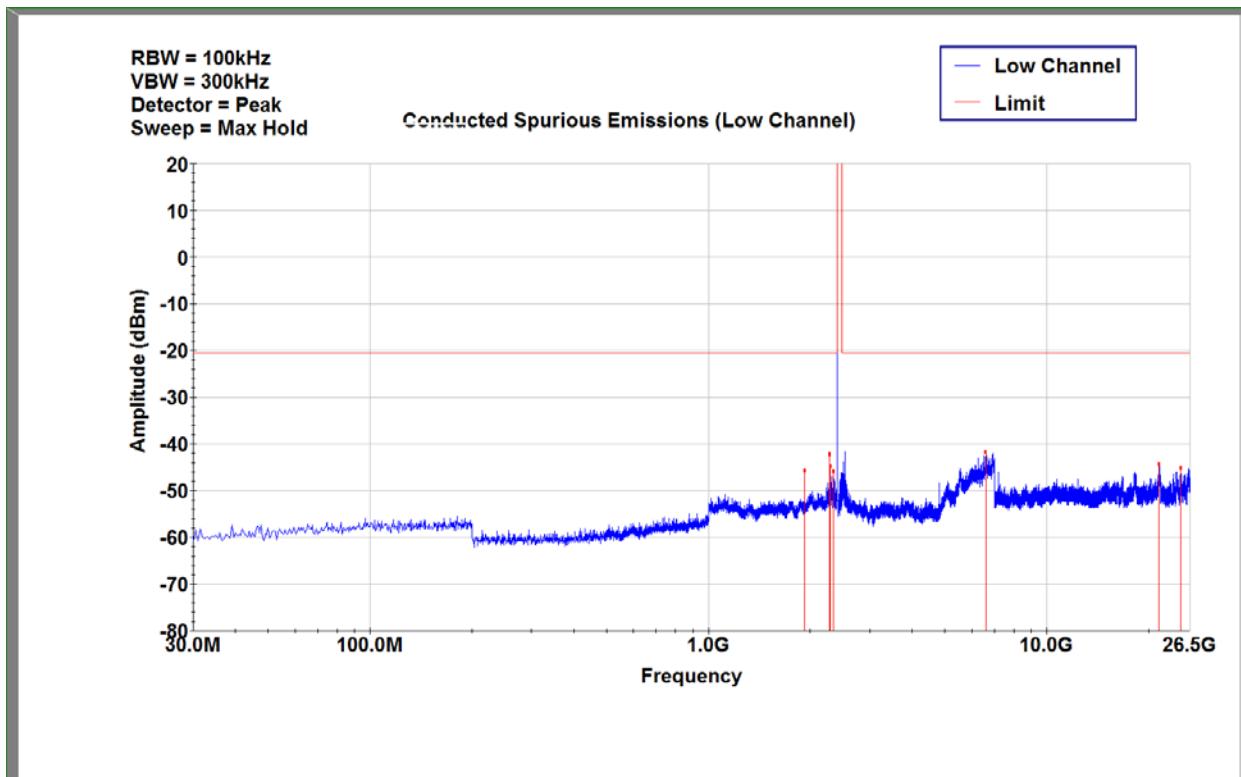
1Mb/s Ch 19 (2440MHz) Conducted Spurious Emissions



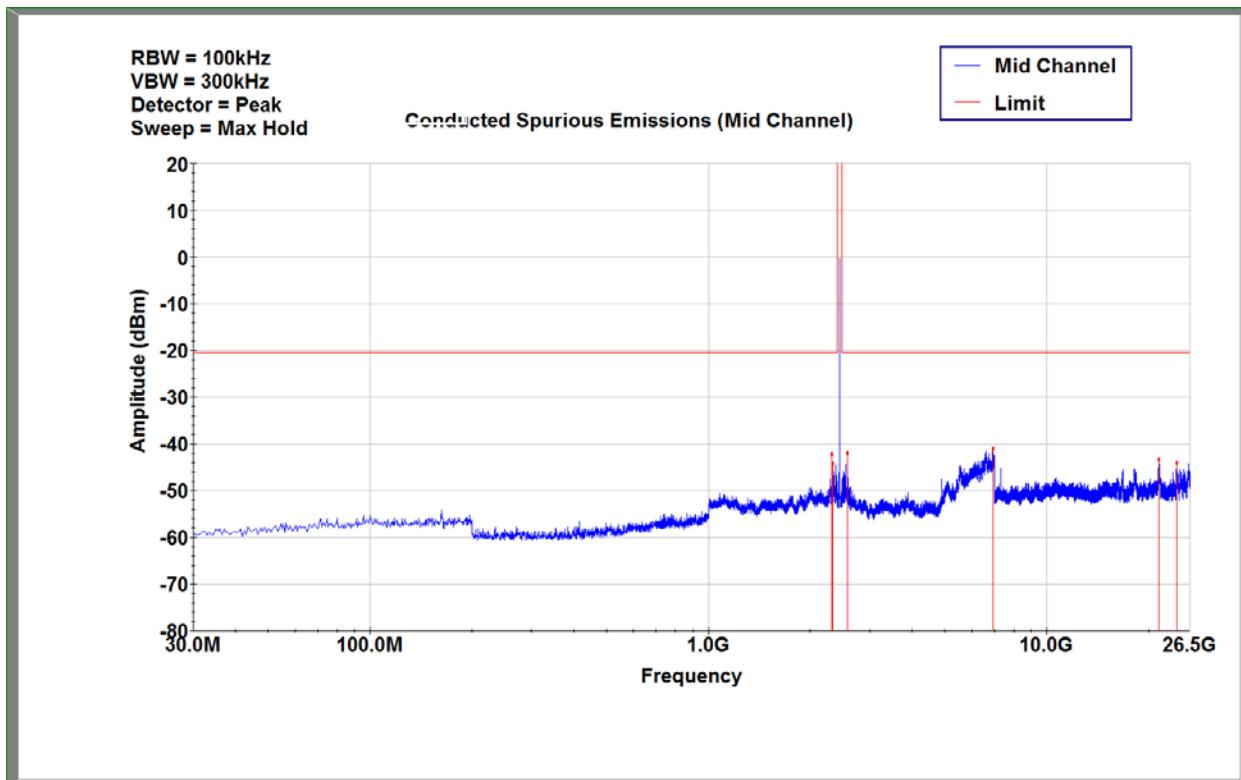
1Mb/s Ch 39 (2480MHz) Conducted Spurious Emissions



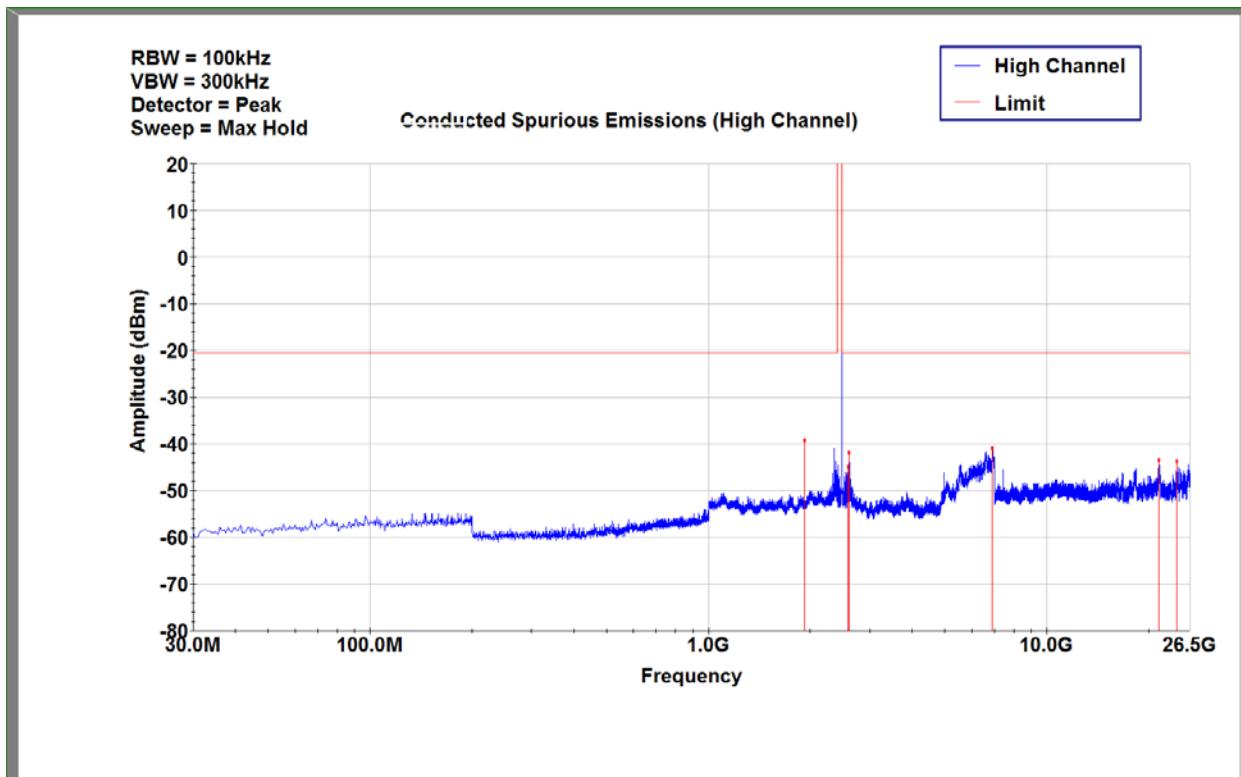
2Mb/s Conducted Spurious Emissions (Band)



2Mb/s Ch 0 (2402MHz) Conducted Spurious Emissions



2Mb/s Ch 19 (2440MHz) Conducted Spurious Emissions



2Mb/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 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	9/4/2018	103621914LEX-002	BZ	BCT	Original Issue
1	9/25/2018	103621914LEX-002.1	BZ	BCT	Updated per TCB reviewer feedback