Intertek
731 Enterprise Drive
Lexington, KY 40510

Tel 859 226 1000
Fax 859 226 1040

www.intertek.com

Dormakaba USA Inc.
RSE TEST REPORT

SCOPE OF WORK
FCC PART 15.247 / RSS-247 WIFI SPURIOUS EMISSIONS TESTING – WI-Q PORTAL GATEWAY

REPORT NUMBER
104024249LEX-001b

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9/10/2019

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

RSE TEST REPORT

(PARTIAL COMPLIANCE)

Report Number: 104024249LEX-001b
Project Number: G104024249

Report Issue Date: 9/10/2019

Model(s) Tested: Wi-Q Portal Gateway

Standards: FCC Title 47 CFR Part 15.247
FCC Title 47 CFR Part 15B
RSS-247 Issue 2
RSS-Gen Issue 4
ICES-003 Issue 6
(Verification of Spurious Emissions)

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

Client:
Dormakaba USA Inc.
6161 E. 75th Street
Indianapolis, IN 46250
USA

Report prepared by

Brian Lackey, Staff Engineer

Report reviewed by

Bryan Taylor, Team Leader

Table of Contents

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, ANSI C63.10:2013 § 11.12.1)	Pass
8	Conducted Emissions (ANSI C63.4:2014)	Pass

3 Client Information

This product was tested at the request of the following:

Client Information	
Client Name:	Dormakaba USA Inc.
Address:	6161 E. 75th Street Indianapolis, IN 46250 USA
Contact:	Robert Strong
Telephone:	+1 (317) 806-3288
Email:	Bob.strong@dormakaba.com
Manufacturer Information	
Manufacturer Name:	Dormakaba USA Inc.
Manufacturer Address:	6161 E. 75th Street Indianapolis, IN 46250 USA

4 Description of Equipment under Test and Variant Models

Equipment Under Test	
Product Name	Wi-Q Portal Gateway
Model Number	WQXM-PG
Serial Number	LAN MAC 00:14:F5:20:8C:05
Receive Date	7/23/2019
Test Start Date	7/23/2019
Test End Date	8/28/2019
Device Received Condition	Good
Test Sample Type	Production
Input Ratings	100-240V, 50/60Hz, 0.6A to 12V/1.5A
Frequency Band	2400-2483.5MHz
Test Channels	1 (2412MHz), 6 (2437MHz), 11 (2462MHz)
Description of Equipment Under Test (provided by client)	
The Wi-Q Portal Gateway WQXM-PG is a device that communicates information from access control software to wireless door controllers.	

4.1 Variant Models:

There were no variant models covered by this evaluation.

5 System Setup and Method

5.1 Method:

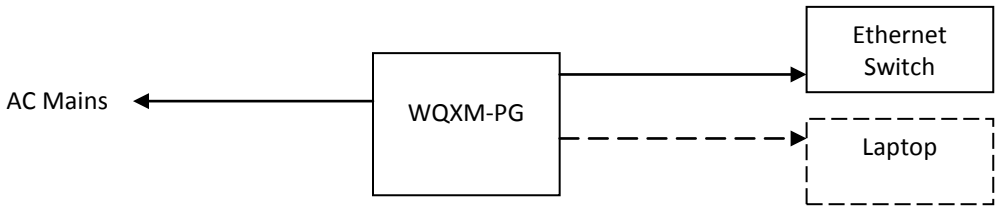
Configuration as required by ANSI C63.4: 2014 and ANSI C63.10:2013

No.	Descriptions of EUT Exercising
1	Transmitting a signal or low, middle, or high channel
2	Radios idle

Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
1	AC Mains	2	No	No	AC/DC Adapter
2	Ethernet	2	Yes	Yes	Network Switch

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Ethernet Switch	Cisco	-	-
Laptop	Lenovo	-	-

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 dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
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 dBμV 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 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

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

6.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde & Schwarz	ESU40	9/18/2018	9/18/2019
Bilog Antenna	3133	ETS	3142C	5/13/2019	5/13/2020
Bilog Antenna	7088	SunAR	JB6	7/24/2018	7/24/2019
Horn Antenna	3780	ETS Lindgren	3117	6/7/2019	6/7/2020
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
Preamplifier (1-18GHz)	3918	Rohde&Schwarz	TS-PR18	11/26/2018	11/26/2019
Coaxial Cable	3074			11/26/2018	11/26/2019
Coaxial Cable	2588			11/26/2018	11/26/2019
Coaxial Cable	6085			11/26/2018	11/26/2019
Coaxial Cable	2593			11/26/2018	11/26/2019
Coaxial Cable	2592			11/26/2018	11/26/2019
Coaxial Cable	3339			11/26/2018	11/26/2019
Coaxial Cable	3172			11/26/2018	11/26/2019
Coaxial Cable	2590			11/26/2018	11/26/2019
Coaxial Cable	2589			11/26/2018	11/26/2019

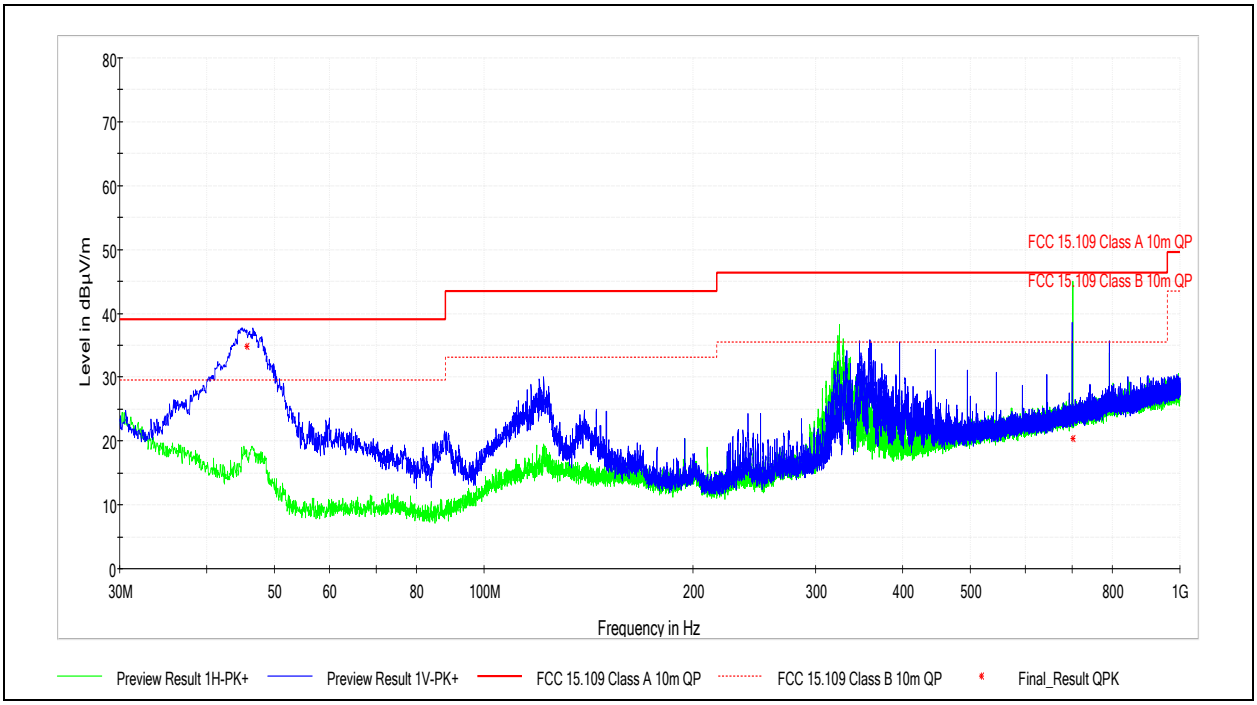
6.4 Software Utilized

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 Data: 30MHz – 1GHz

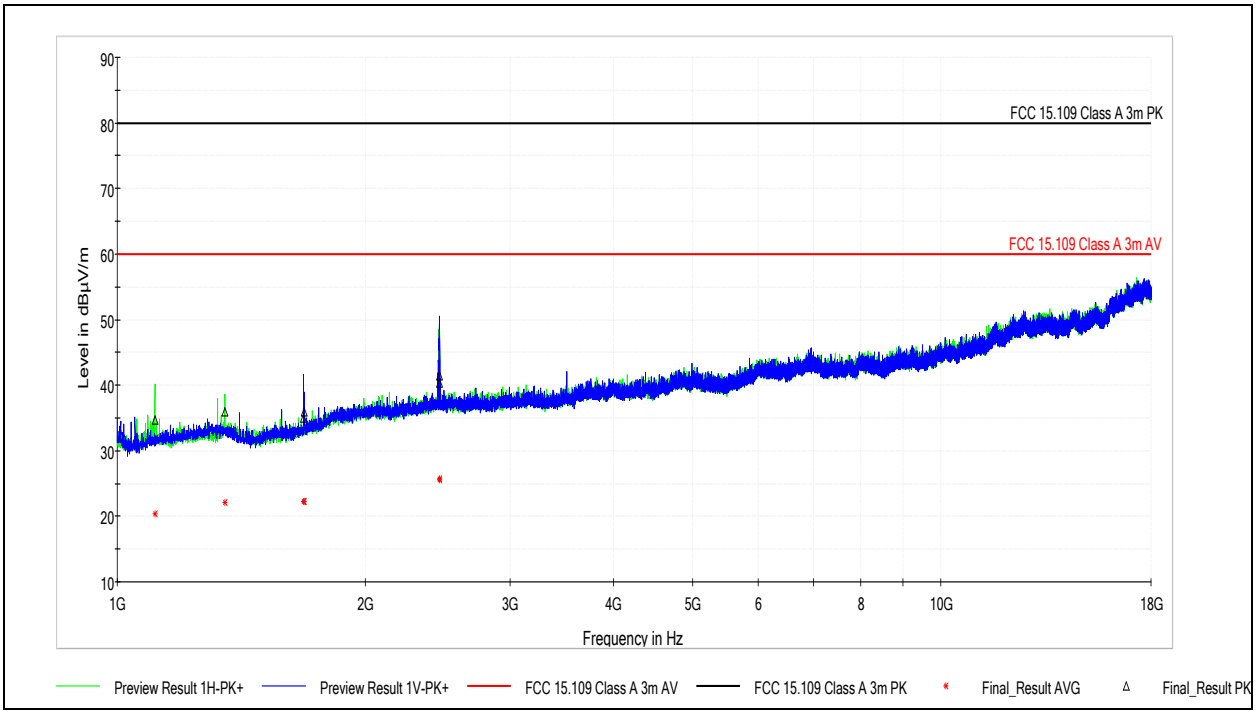


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
45.651111	34.76	39.08	4.32	120.000	336.6	V	295.0	-12.5
702.381667	20.42	46.44	26.02	120.000	359.2	H	-1.0	2.2

Test Personnel:	Brian Lackey	Test Date:	7/23/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15B ICES-003 Issue 6	Ambient Temperature:	25.4C
Input Voltage:	120V/60Hz	Relative Humidity:	44.0%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	983.8mbar

Deviations, Additions, or Exclusions: None

6.7 Test Data: 1GHz – 18GHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1110.500000	34.70	80.00	45.30	1000.000	283.0	H	310.0	-3.2
1350.500000	35.97	80.00	44.03	1000.000	214.0	H	13.0	-1.4
1683.500000	35.06	80.00	44.94	1000.000	286.0	V	205.0	-1.0
1687.500000	35.89	80.00	44.11	1000.000	292.0	V	197.0	-0.9
2460.000000	41.46	80.00	38.54	1000.000	391.0	V	320.0	3.0
2464.500000	40.41	80.00	39.59	1000.000	323.0	V	239.0	3.0

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1110.500000	20.45	60.00	39.55	1000.000	283.0	H	310.0	-3.2
1350.500000	22.06	60.00	37.94	1000.000	214.0	H	13.0	-1.4
1683.500000	22.30	60.00	37.70	1000.000	286.0	V	205.0	-1.0
1687.500000	22.27	60.00	37.73	1000.000	292.0	V	197.0	-0.9
2460.000000	25.63	60.00	34.37	1000.000	391.0	V	320.0	3.0
2464.500000	25.73	60.00	34.27	1000.000	323.0	V	239.0	3.0

Test Personnel:	Brian Lackey	Test Date:	7/23/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15B ICES-003 Issue 6	Ambient Temperature:	25.4C
Input Voltage:	120V/60Hz	Relative Humidity:	44.0%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	983.8mbar

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. The sample was tested in three orthogonal axes. The fundamental emission was suppressed with a filter.

7.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde & Schwarz	ESU40	9/18/2018	9/18/2019
Bilog Antenna	7088	SunAR	JB6	7/24/2018	7/24/2019
Bilog Antenna	3133	ETS	3142C	5/13/2019	5/13/2020
Horn Antenna	3780	ETS Lindgren	3117	6/7/2019	6/7/2020
Horn Antenna	3779	ETS	3116c	6/10/2019	6/10/2020
Preamplifier	3921	Rohde&Schwarz	TS-PR40	11/26/2018	11/26/2019
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
Coaxial Cable	3074			11/26/2018	11/26/2019
3m Cable Preamplifier	3918	Rohde & Schwarz	TS-PR18	11/26/2018	11/26/2019
Coaxial Cable	2588			11/26/2018	11/26/2019
Coaxial Cable	2593			11/26/2018	11/26/2019
Coaxial Cable	2592			11/26/2018	11/26/2019
Coaxial Cable	3339			11/26/2018	11/26/2019

7.4 Software Utilized

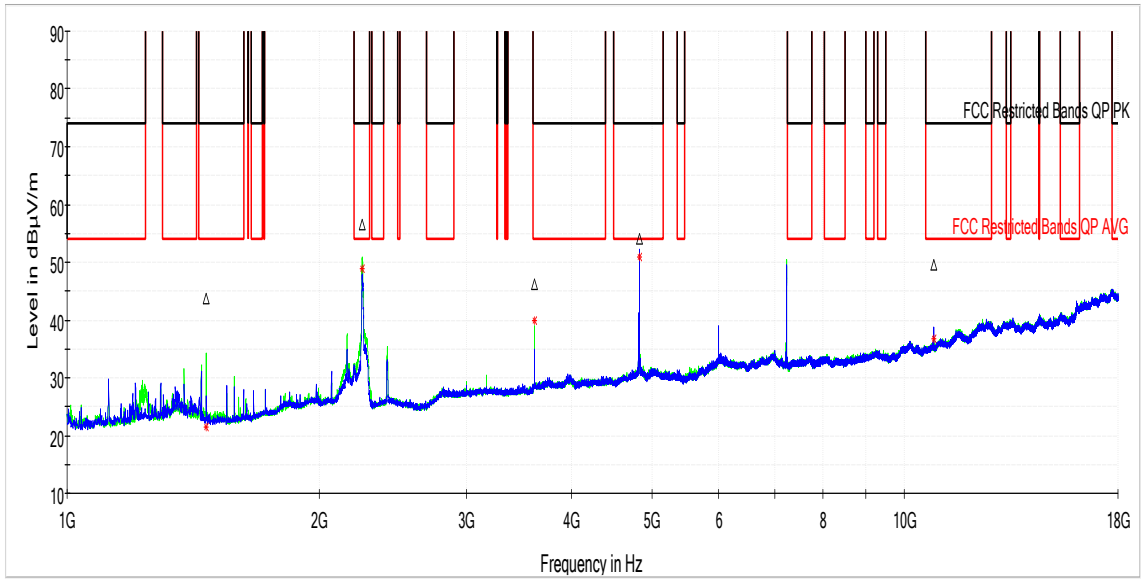
Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 9.15.02

7.5 Test Results

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

7.6 802.11b

7.6.1 Channel 1 (2412MHz) Spurious Emissions, 1GHz-18GHz



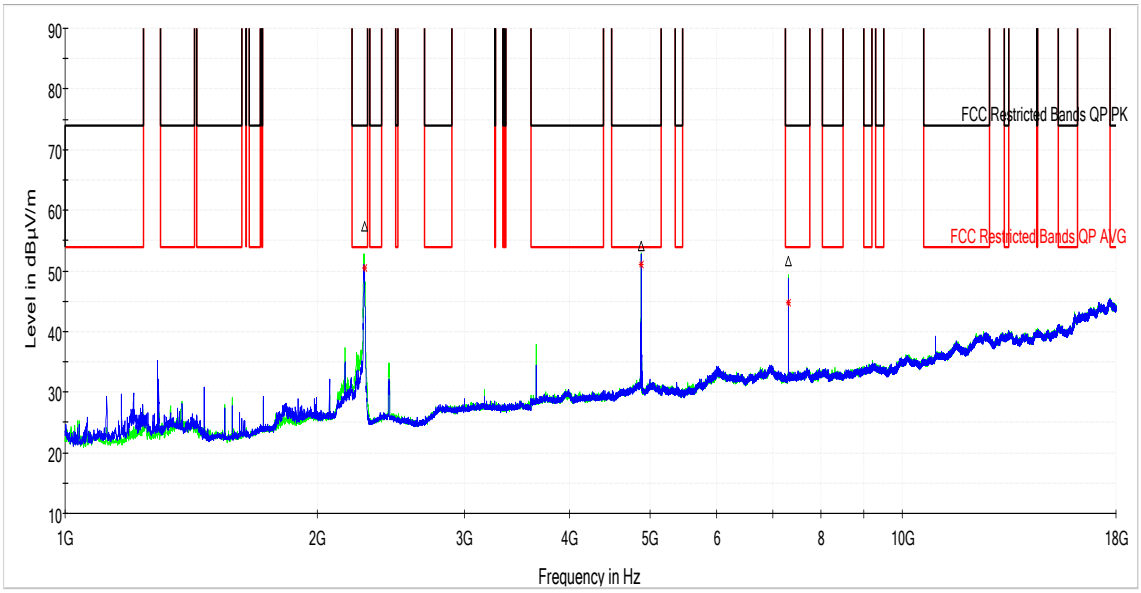
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1466.000000	43.60	73.98	30.38	1000.000	224.0	H	300.0	-2.5
2252.500000	56.52	73.98	17.46	1000.000	304.0	H	346.0	2.6
3618.000000	46.26	73.98	27.72	1000.000	207.0	H	212.0	5.1
4824.000000	53.97	73.98	20.01	1000.000	295.0	V	131.0	7.3
10853.500000	49.52	73.98	24.46	1000.000	197.0	V	132.0	15.7

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1466.000000	21.43	53.98	32.55	1000.000	224.0	H	300.0	-2.5
2252.500000	48.82	53.98	5.16	1000.000	304.0	H	346.0	2.6
3618.000000	39.90	53.98	14.08	1000.000	207.0	H	212.0	5.1
4824.000000	50.97	53.98	3.01	1000.000	295.0	V	131.0	7.3
10853.500000	36.65	53.98	17.33	1000.000	197.0	V	132.0	15.7

Test Personnel:	Brian Lackey	Test Date:	8/27/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.6C
Input Voltage:	120V/60Hz	Relative Humidity:	49.7%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	980.8mbar

Deviations, Additions, or Exclusions: None

7.6.2 Channel 6 (2437MHz) Spurious Emissions, 1GHz-18GHz



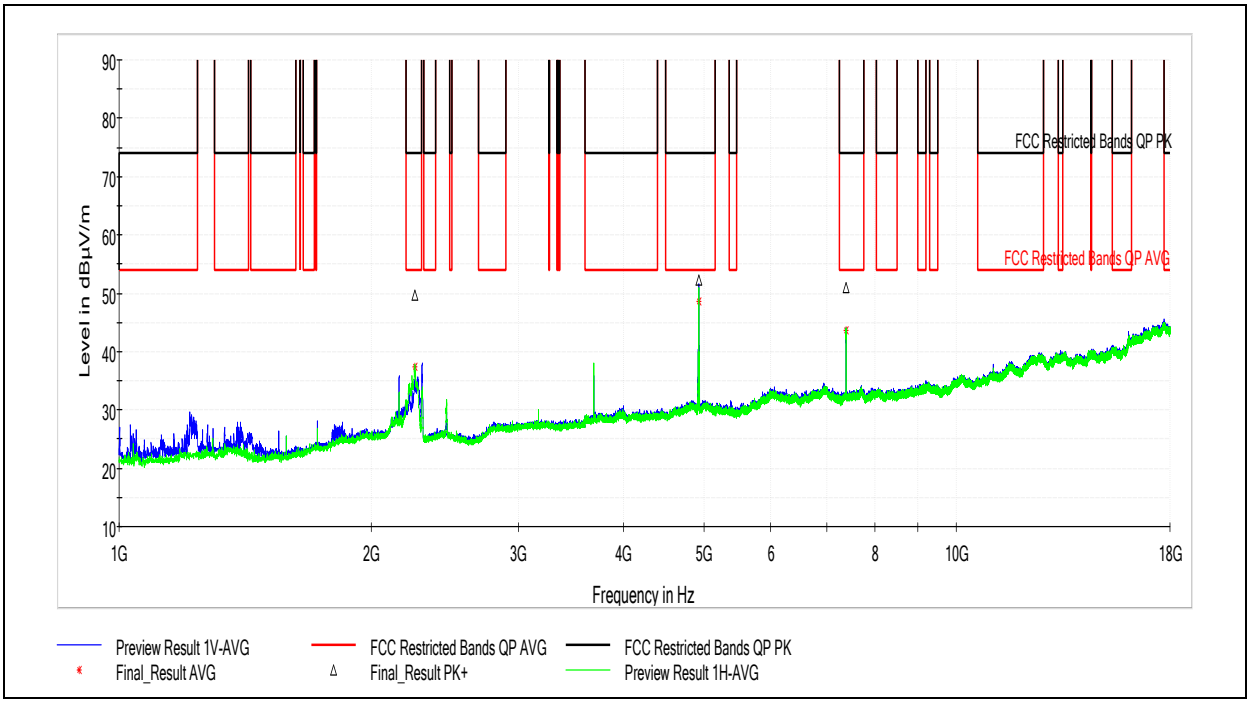
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2278.500000	57.36	73.98	16.62	1000.000	196.0	H	0.0	2.5
4874.000000	54.04	73.98	19.94	1000.000	252.0	H	108.0	7.1
7312.000000	51.54	73.98	22.44	1000.000	397.0	H	125.0	10.9

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2278.500000	50.46	53.98	3.52	1000.000	196.0	H	0.0	2.5
4874.000000	51.13	53.98	2.85	1000.000	252.0	H	108.0	7.1
7312.000000	44.78	53.98	9.20	1000.000	397.0	H	125.0	10.9

Test Personnel:	Brian Lackey	Test Date:	8/27/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.6C
Input Voltage:	120V/60Hz	Relative Humidity:	49.7%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	980.8mbar

Deviations, Additions, or Exclusions: None

7.6.3 Channel 11 (2462MHz) Spurious Emissions, 1GHz-18GHz



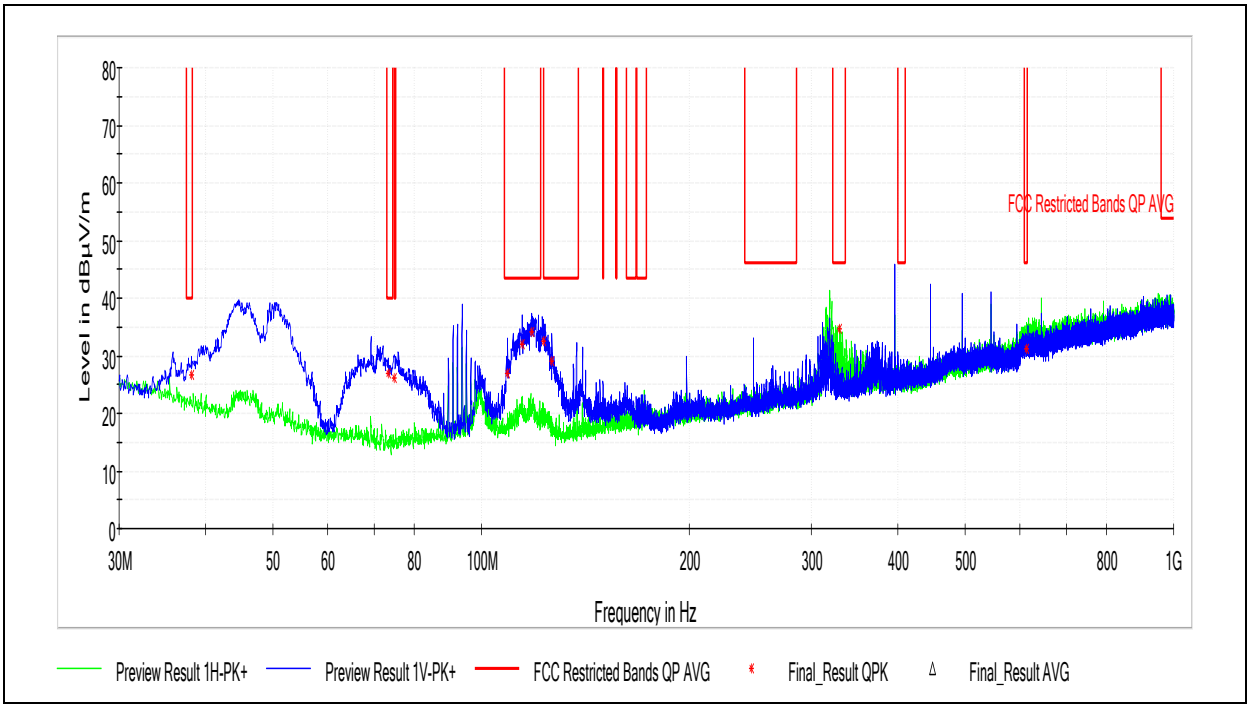
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2256.000000	49.70	73.98	24.28	1000.000	283.0	H	0.0	2.6
4924.000000	52.22	73.98	21.76	1000.000	368.0	V	159.0	7.0
7385.000000	51.05	73.98	22.93	1000.000	364.0	H	141.0	11.0

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2256.000000	37.47	53.98	16.51	1000.000	283.0	H	0.0	2.6
4924.000000	48.55	53.98	5.43	1000.000	368.0	V	159.0	7.0
7385.000000	43.74	53.98	10.24	1000.000	364.0	H	141.0	11.0

Test Personnel:	Brian Lackey	Test Date:	8/27/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.6C
Input Voltage:	120V/60Hz	Relative Humidity:	49.7%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	980.8mbar

Deviations, Additions, or Exclusions: None

7.6.4 Spurious Emissions, 30MHz-1GHz

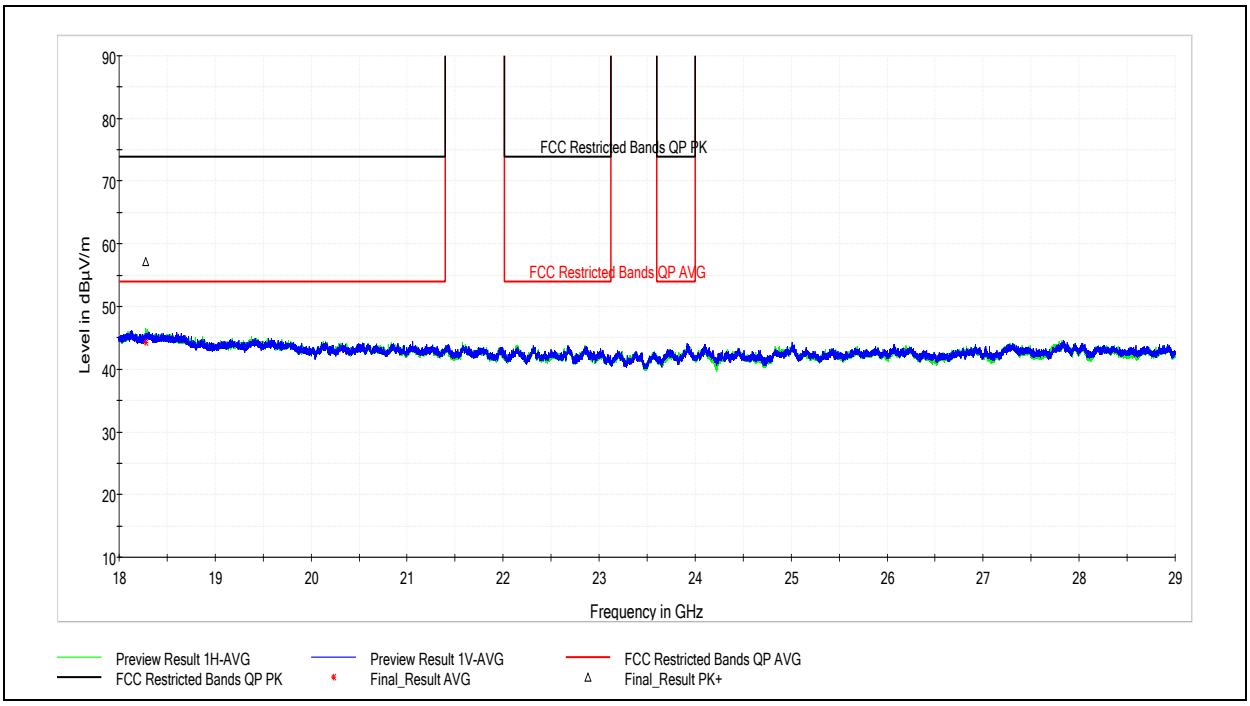


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
38.137222	26.78	40.00	13.22	120.000	99.9	V	264.0	19.6
73.380556	27.06	40.00	12.94	120.000	106.3	V	220.0	14.9
74.889445	26.06	40.00	13.94	120.000	99.9	V	195.0	14.9
109.216667	26.89	43.52	16.63	120.000	99.6	V	109.0	15.5
114.551667	32.00	43.52	11.52	120.000	105.2	V	155.0	15.3
118.377778	34.13	43.52	9.39	120.000	105.0	V	166.0	14.9
123.066111	32.49	43.52	11.03	120.000	103.4	V	166.0	14.7
126.568889	29.05	43.52	14.47	120.000	108.8	V	129.0	14.6
328.921667	34.59	46.02	11.43	120.000	110.2	H	337.0	23.8
613.131667	31.14	46.02	14.88	120.000	177.5	H	321.0	31.1

Test Personnel:	Brian Lackey	Test Date:	8/28/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.5C
Input Voltage:	120V/60Hz	Relative Humidity:	46.4%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	984.5mbar

Deviations, Additions, or Exclusions: Testing represents the worst case of low, middle, and high channels.

7.6.5 Spurious Emissions, 18-29GHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18277.000000	57.12	73.98	16.86	1000.000	207.0	H	199.0	19.9

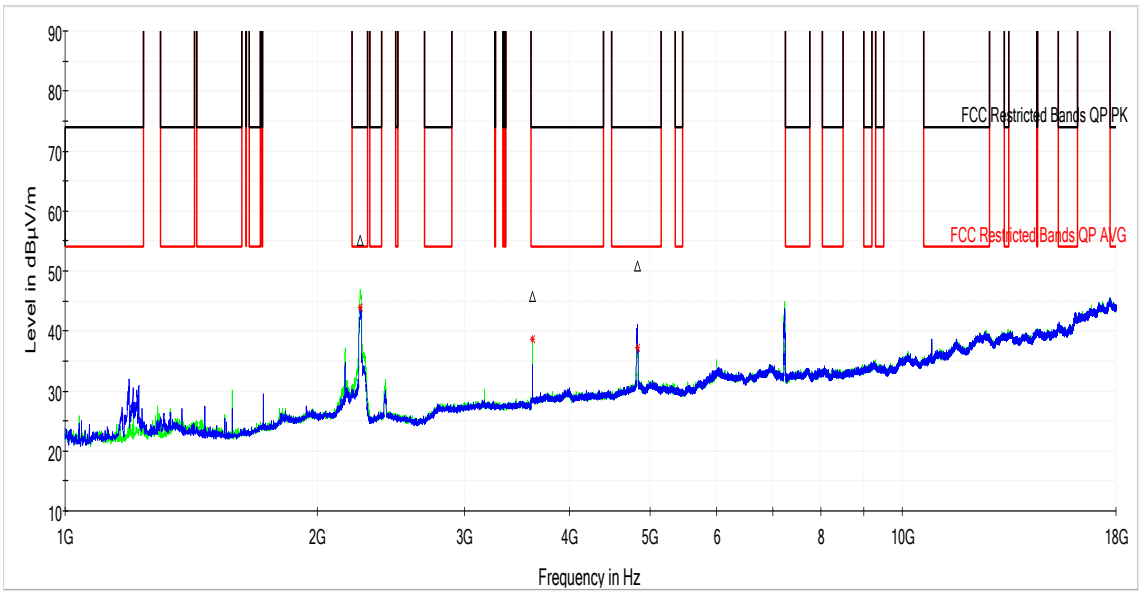
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18277.000000	44.31	53.98	9.67	1000.000	207.0	H	199.0	19.9

Test Personnel:	Brian Lackey	Test Date:	8/28/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.5C
Input Voltage:	120V/60Hz	Relative Humidity:	46.4%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	984.5mbar

Deviations, Additions, or Exclusions: Testing represents the worst case of low, middle, and high channels.

7.7 802.11g

7.7.1 Channel 1 (2412MHz) Spurious Emissions, 1GHz-18GHz



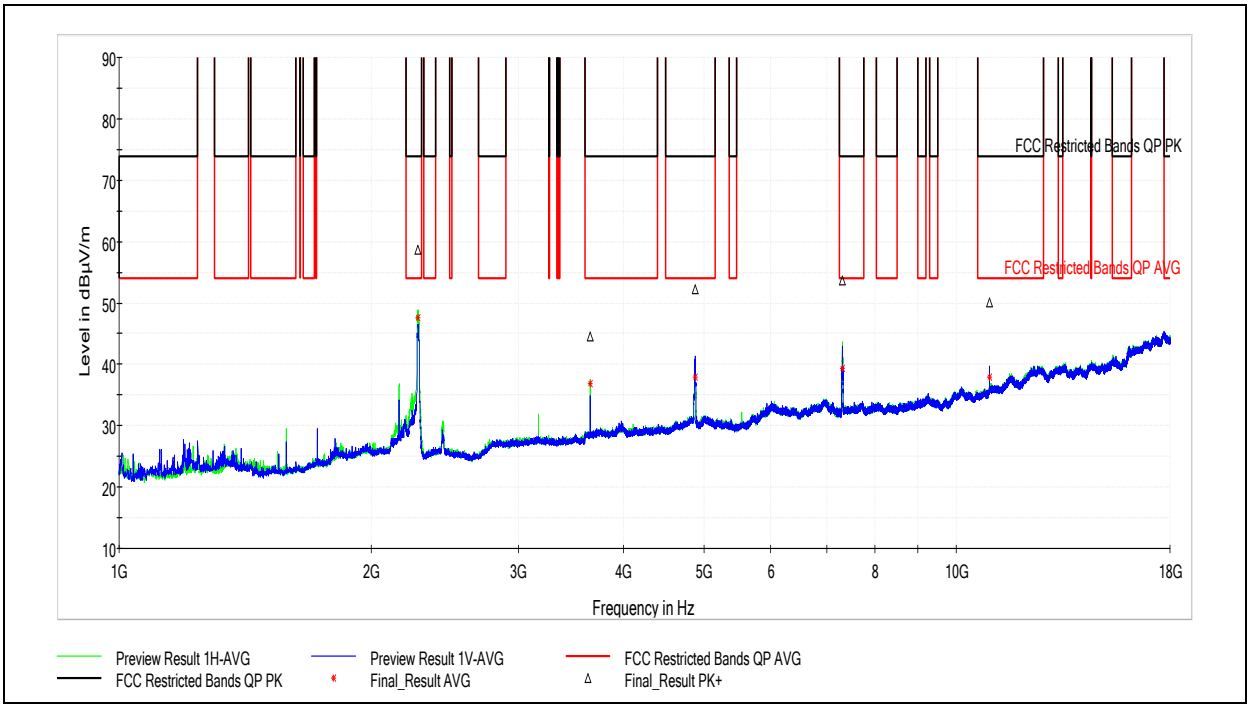
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2251.000000	55.10	73.98	18.88	1000.000	304.0	H	342.0	2.6
3618.000000	45.66	73.98	28.32	1000.000	176.0	H	218.0	5.1
4824.500000	50.90	73.98	23.08	1000.000	268.0	V	137.0	7.3

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2251.000000	43.89	53.98	10.09	1000.000	304.0	H	342.0	2.6
3618.000000	38.71	53.98	15.27	1000.000	176.0	H	218.0	5.1
4824.500000	37.18	53.98	16.80	1000.000	268.0	V	137.0	7.3

Test Personnel:	Brian Lackey	Test Date:	8/27/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.6C
Input Voltage:	120V/60Hz	Relative Humidity:	49.7%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	980.8mbar

Deviations, Additions, or Exclusions: None

7.7.2 Channel 6 (2437MHz) Spurious Emissions, 1GHz-18GHz



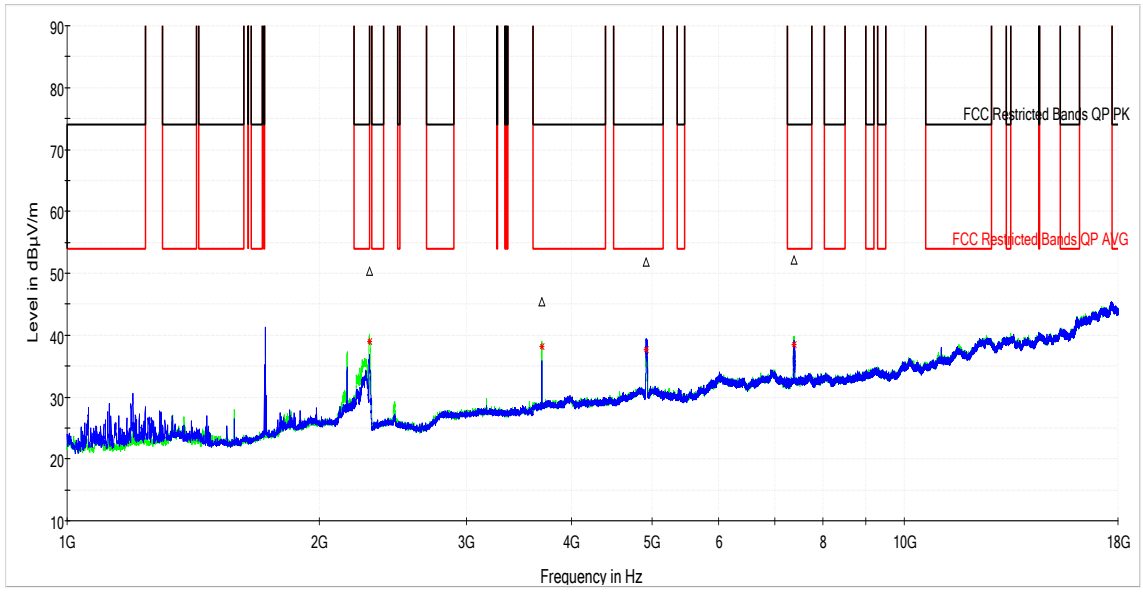
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2276.000000	58.76	73.98	15.22	1000.000	378.0	H	0.0	2.6
3655.500000	44.49	73.98	29.49	1000.000	159.0	H	209.0	5.2
4873.500000	52.18	73.98	21.80	1000.000	376.0	V	166.0	7.1
7311.500000	53.75	73.98	20.23	1000.000	399.0	H	142.0	10.9
10966.000000	50.02	73.98	23.96	1000.000	199.0	V	139.0	15.9

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2276.000000	47.59	53.98	6.39	1000.000	378.0	H	0.0	2.6
3655.500000	36.90	53.98	17.08	1000.000	159.0	H	209.0	5.2
4873.500000	37.96	53.98	16.02	1000.000	376.0	V	166.0	7.1
7311.500000	39.31	53.98	14.67	1000.000	399.0	H	142.0	10.9
10966.000000	37.85	53.98	16.13	1000.000	199.0	V	139.0	15.9

Test Personnel:	Brian Lackey	Test Date:	8/27/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.6C
Input Voltage:	120V/60Hz	Relative Humidity:	49.7%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	980.8mbar

Deviations, Additions, or Exclusions: None

7.7.3 Channel 11 (2462MHz) Spurious Emissions, 1GHz-18GHz



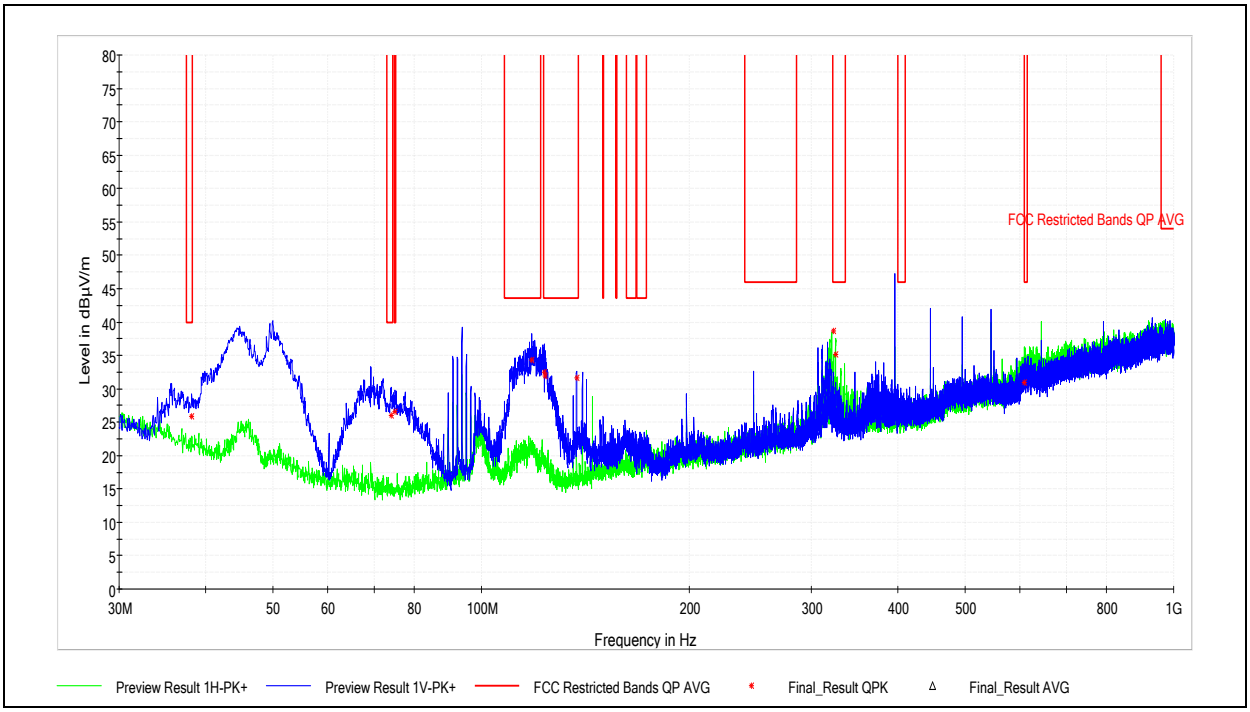
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2295.500000	50.32	73.98	23.66	1000.000	369.0	H	0.0	2.6
3693.000000	45.44	73.98	28.54	1000.000	184.0	H	213.0	5.5
4921.500000	51.73	73.98	22.25	1000.000	393.0	V	143.0	7.0
7384.000000	52.21	73.98	21.77	1000.000	410.0	H	139.0	11.0

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2295.500000	38.93	53.98	15.05	1000.000	369.0	H	0.0	2.6
3693.000000	38.07	53.98	15.91	1000.000	184.0	H	213.0	5.5
4921.500000	37.72	53.98	16.26	1000.000	393.0	V	143.0	7.0
7384.000000	38.44	53.98	15.54	1000.000	410.0	H	139.0	11.0

Test Personnel:	Brian Lackey	Test Date:	8/27/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.6C
Input Voltage:	120V/60Hz	Relative Humidity:	49.7%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	980.8mbar

Deviations, Additions, or Exclusions: None

7.7.4 Spurious Emissions, 30MHz-1GHz

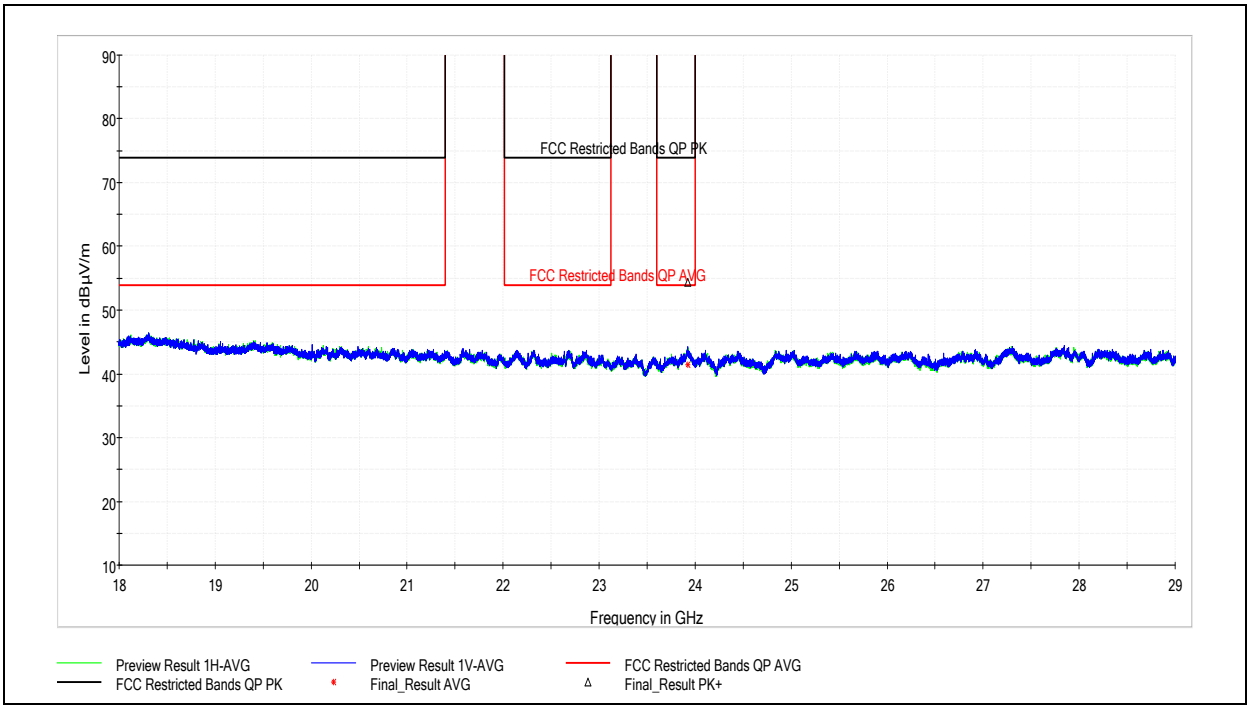


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
38.191111	25.94	40.00	14.06	120.000	100.1	V	268.0	19.5
74.081111	25.96	40.00	14.04	120.000	106.2	V	211.0	14.9
75.158889	26.64	40.00	13.36	120.000	103.6	V	220.0	14.9
118.270000	34.36	43.52	9.16	120.000	99.9	V	146.0	14.9
123.335556	32.54	43.52	10.98	120.000	105.0	V	146.0	14.6
123.658889	31.98	43.52	11.54	120.000	105.1	V	165.0	14.6
137.292778	31.60	43.52	11.92	120.000	107.0	V	337.0	15.0
322.616667	38.62	46.02	7.40	120.000	104.6	H	339.0	23.8
324.933889	35.20	46.02	10.82	120.000	100.2	H	0.0	23.8
608.982222	30.93	46.02	15.09	120.000	108.2	H	194.0	31.0

Test Personnel:	Brian Lackey	Test Date:	8/28/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.5C
Input Voltage:	120V/60Hz	Relative Humidity:	46.4%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	984.5mbar

Deviations, Additions, or Exclusions: Testing represents the worst case of low, middle, and high channels.

7.7.5 Spurious Emissions, 18-29GHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
23920.000000	54.42	73.98	19.56	1000.000	100.0	V	334.0	6.1

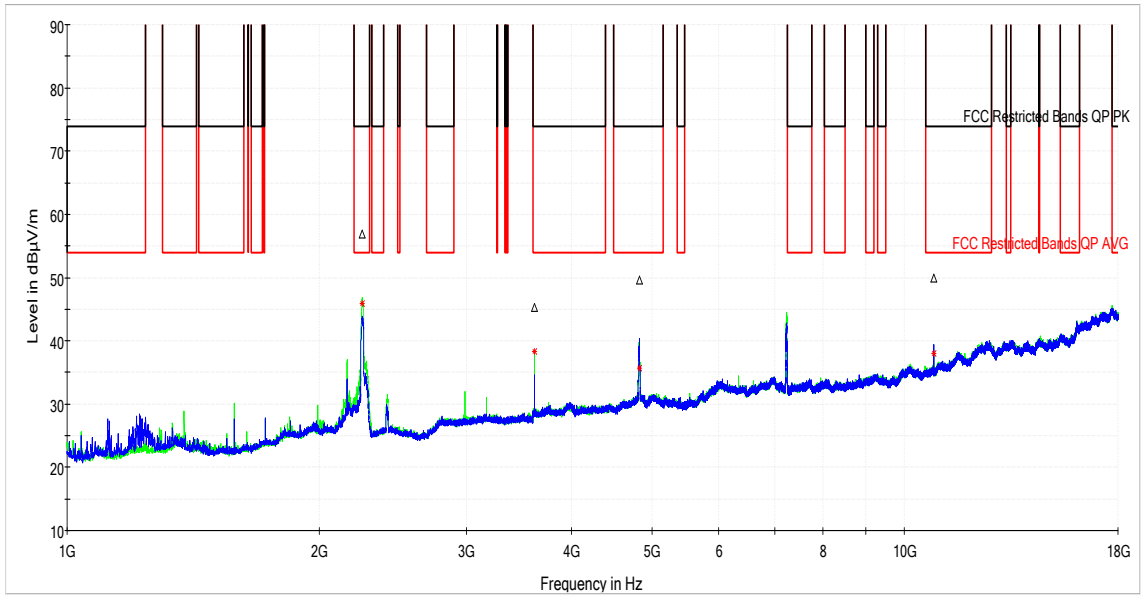
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
23920.000000	41.37	53.98	12.61	1000.000	100.0	V	334.0	6.1

Test Personnel:	Brian Lackey	Test Date:	8/28/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.5C
Input Voltage:	120V/60Hz	Relative Humidity:	46.4%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	984.5mbar

Deviations, Additions, or Exclusions: Testing represents the worst case of low, middle, and high channels.

7.8 802.11n

7.8.1 Channel 1 (2412MHz) Spurious Emissions, 1GHz-18GHz



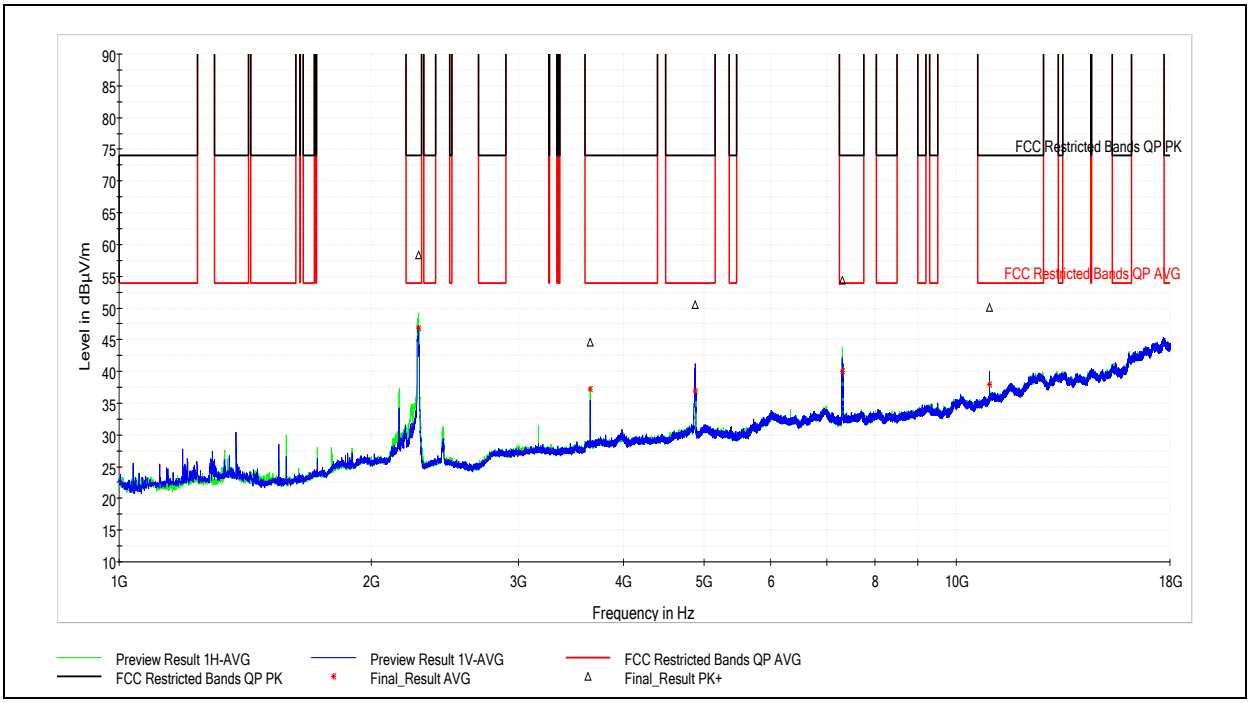
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2253.000000	56.88	73.98	17.10	1000.000	275.0	H	0.0	2.6
3618.000000	45.31	73.98	28.67	1000.000	206.0	H	210.0	5.1
4824.000000	49.56	73.98	24.42	1000.000	269.0	V	130.0	7.3
10853.500000	49.89	73.98	24.09	1000.000	152.0	V	155.0	15.7

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2253.000000	45.85	53.98	8.13	1000.000	275.0	H	0.0	2.6
3618.000000	38.26	53.98	15.72	1000.000	206.0	H	210.0	5.1
4824.000000	35.67	53.98	18.31	1000.000	269.0	V	130.0	7.3
10853.500000	38.03	53.98	15.95	1000.000	152.0	V	155.0	15.7

Test Personnel:	Brian Lackey	Test Date:	8/27/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.6C
Input Voltage:	120V/60Hz	Relative Humidity:	49.7%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	980.8mbar

Deviations, Additions, or Exclusions: None

7.8.2 Channel 6 (2437MHz) Spurious Emissions, 1GHz-18GHz



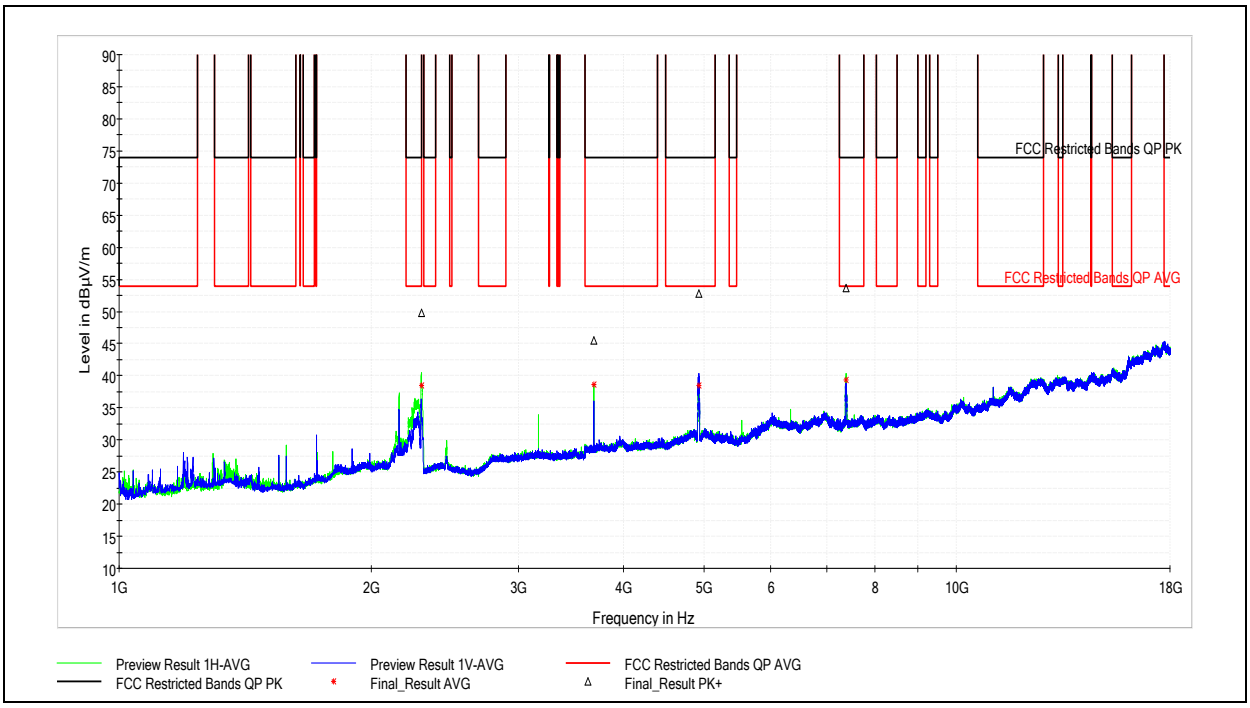
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2277.500000	58.34	73.98	15.64	1000.000	371.0	H	-1.0	2.6
3655.500000	44.60	73.98	29.38	1000.000	158.0	H	215.0	5.2
4873.000000	50.45	73.98	23.53	1000.000	395.0	V	243.0	7.1
7311.500000	54.39	73.98	19.59	1000.000	386.0	H	142.0	10.9
10966.000000	50.12	73.98	23.86	1000.000	197.0	V	139.0	15.9

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2277.500000	46.89	53.98	7.09	1000.000	371.0	H	-1.0	2.6
3655.500000	37.21	53.98	16.77	1000.000	158.0	H	215.0	5.2
4873.000000	36.89	53.98	17.09	1000.000	395.0	V	243.0	7.1
7311.500000	40.05	53.98	13.93	1000.000	386.0	H	142.0	10.9
10966.000000	37.91	53.98	16.07	1000.000	197.0	V	139.0	15.9

Test Personnel:	Brian Lackey	Test Date:	8/27/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.6C
Input Voltage:	120V/60Hz	Relative Humidity:	49.7%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	980.8mbar

Deviations, Additions, or Exclusions: None

7.8.3 Channel 11 (2462MHz) Spurious Emissions, 1GHz-18GHz



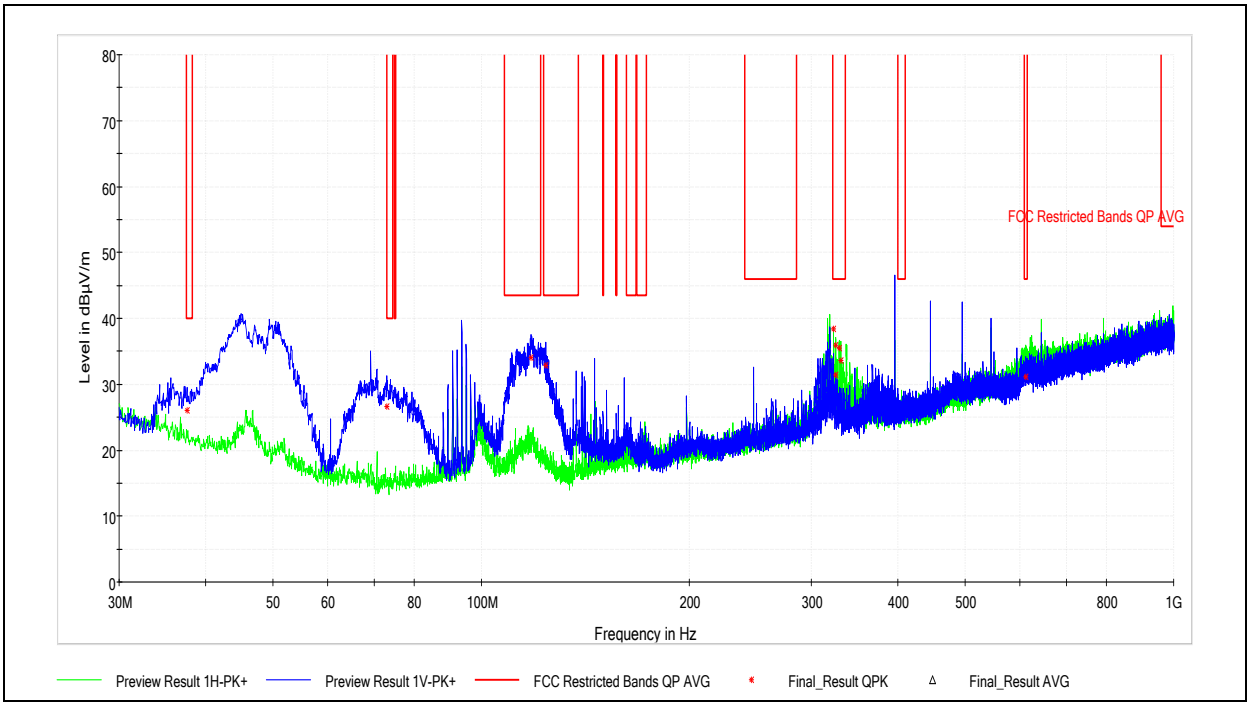
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2295.500000	49.79	73.98	24.19	1000.000	274.0	H	179.0	2.6
3693.000000	45.51	73.98	28.47	1000.000	199.0	H	215.0	5.5
4924.000000	52.77	73.98	21.21	1000.000	371.0	V	154.0	7.0
7382.000000	53.62	73.98	20.36	1000.000	394.0	H	148.0	11.0

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2295.500000	38.48	53.98	15.50	1000.000	274.0	H	179.0	2.6
3693.000000	38.59	53.98	15.39	1000.000	199.0	H	215.0	5.5
4924.000000	38.50	53.98	15.48	1000.000	371.0	V	154.0	7.0
7382.000000	39.33	53.98	14.65	1000.000	394.0	H	148.0	11.0

Test Personnel:	Brian Lackey	Test Date:	8/27/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.6C
Input Voltage:	120V/60Hz	Relative Humidity:	49.7%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	980.8mbar

Deviations, Additions, or Exclusions: None

7.8.4 Spurious Emissions, 30MHz-1GHz

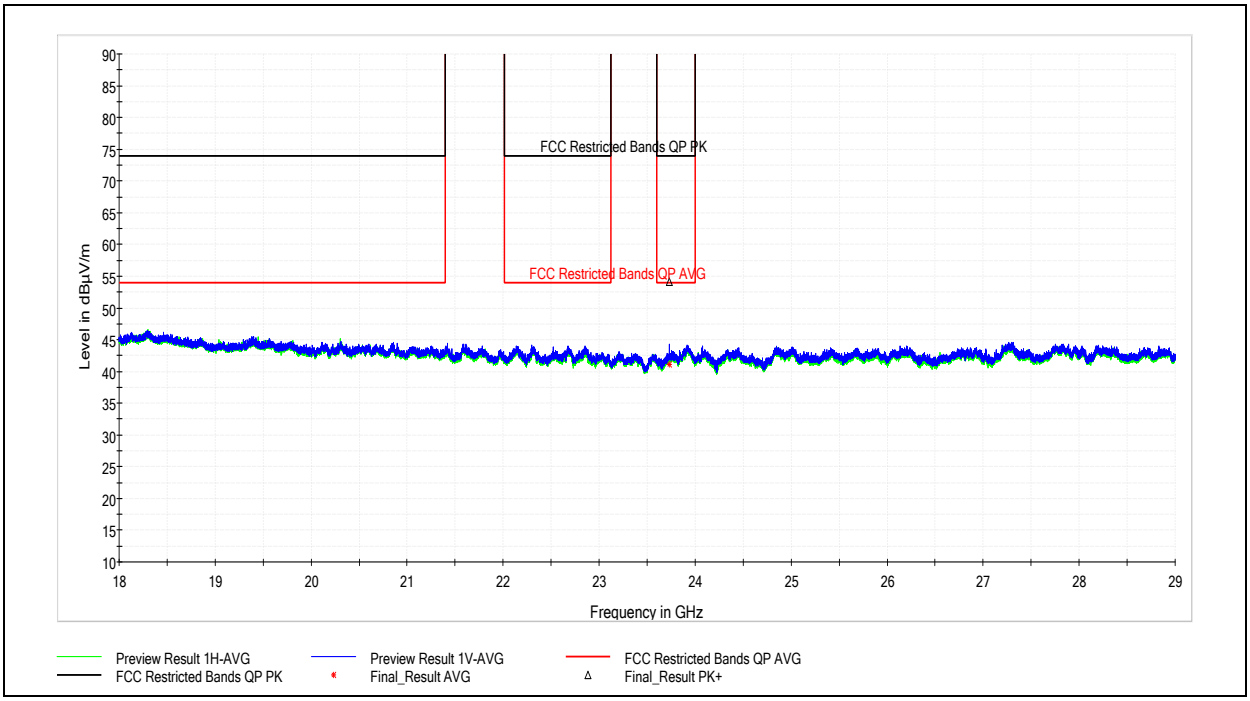


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
37.598333	25.98	40.00	14.02	120.000	102.4	V	267.0	19.8
73.057222	26.67	40.00	13.33	120.000	100.3	V	233.0	14.8
117.946667	34.01	43.52	9.51	120.000	102.7	V	146.0	14.9
124.036111	32.86	43.52	10.66	120.000	102.5	V	146.0	14.6
322.616667	38.35	46.02	7.67	120.000	105.2	H	332.0	23.8
324.664445	35.96	46.02	10.06	120.000	105.5	H	8.0	23.8
325.149445	31.45	46.02	14.57	120.000	100.0	H	0.0	23.8
328.867778	35.51	46.02	10.51	120.000	102.3	H	331.0	23.8
330.753889	33.54	46.02	12.48	120.000	99.7	H	329.0	23.8
611.353333	31.11	46.02	14.91	120.000	284.2	H	35.0	31.1

Test Personnel:	Brian Lackey	Test Date:	8/28/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.5C
Input Voltage:	120V/60Hz	Relative Humidity:	46.4%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	984.5mbar

Deviations, Additions, or Exclusions: Testing represents the worst case of low, middle, and high channels.

7.8.5 Spurious Emissions, 18-29GHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
23732.000000	54.15	73.98	19.83	1000.000	109.0	V	0.0	6.0

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
23732.000000	41.10	53.98	12.88	1000.000	109.0	V	0.0	6.0

Test Personnel:	Brian Lackey	Test Date:	8/28/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.5C
Input Voltage:	120V/60Hz	Relative Humidity:	46.4%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	984.5mbar

Deviations, Additions, or Exclusions: Testing represents the worst case of low, middle, and high channels.

8 Conducted Emissions

8.1 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)	Ucispr
AC Line Conducted Emissions	150 kHz - 30 MHz	3.1dB	3.4dB

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.

8.2 Sample Calculations

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

NF = RF + LF + CF + AF
Where NF = Net Reading in dBµV
RF = Reading from receiver in dBµV
LF = LISN or ISN Correction Factor in dB
CF = Cable Correction Factor in dB
AF = Attenuator Loss Factor in dB

To convert from dBµV to µV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in µV
NF = Net Reading in dBµV

Example:

NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 dBµV
$UF = 10^{(49.1\ dB\mu V / 20)}$ = 285.1 µV/m

8.3 Test Equipment Used:

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	2327	Rohde & Schwarz	ESI26	9/21/2018	9/21/2019
LISN	3333	Teseq	NNB52	4/16/2019	4/16/2020
Coaxial Cable	7024			11/26/2018	11/26/2019

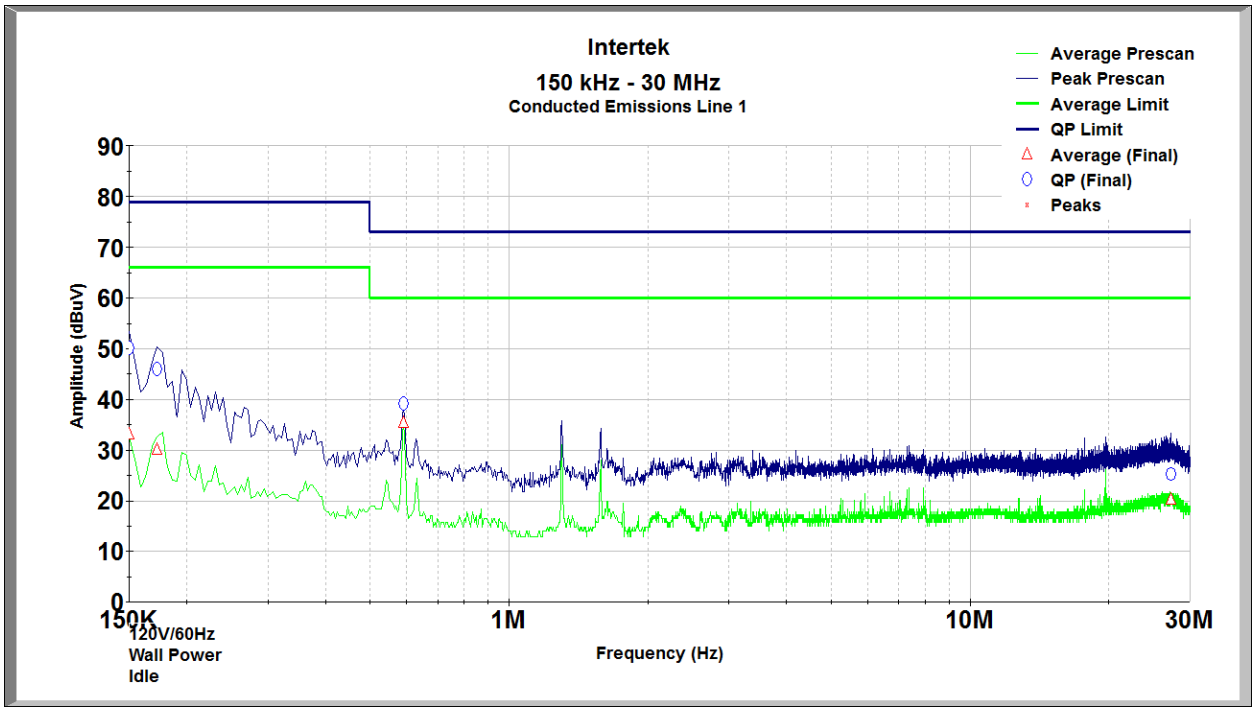
8.4 Software Utilized:

Name	Manufacturer	Version
TILE	ETS Lindgren	V7.0.6.545

8.5 Results:

The sample tested was found to Comply.

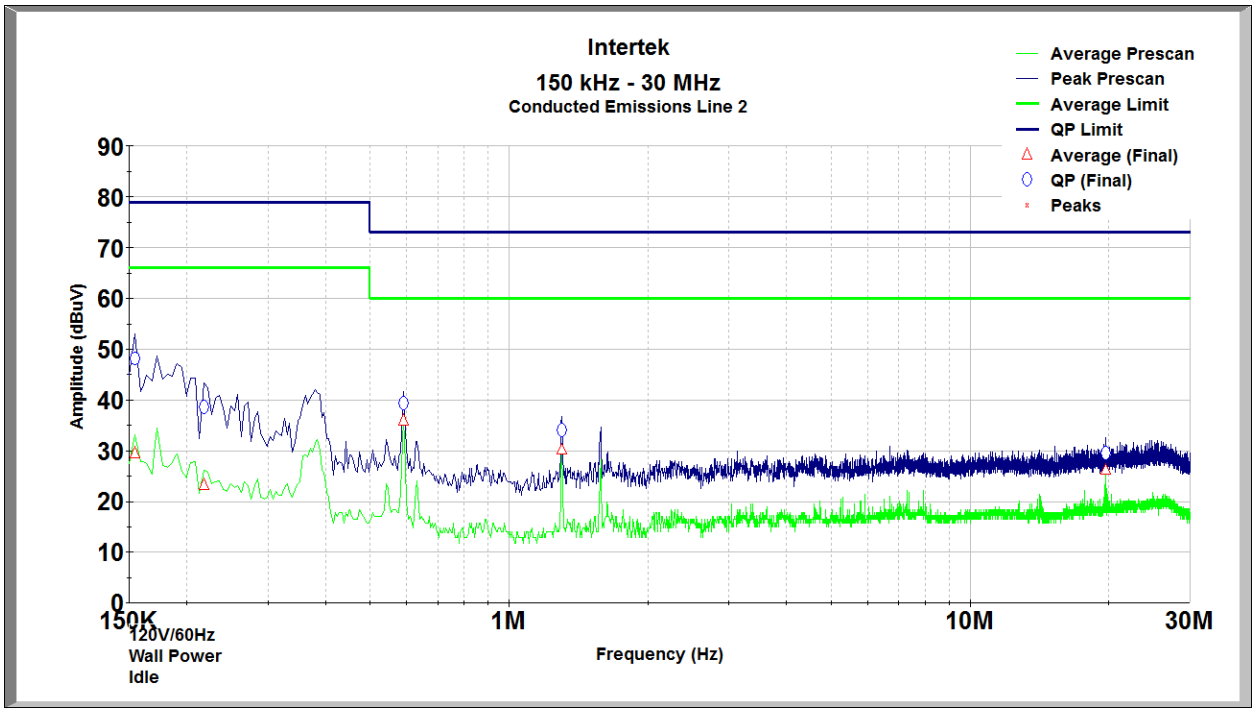
8.6 Plots/Data: Conducted Emissions (Idle)



Line

Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.150	50.223	79.000	28.777	33.200	66.000	32.800
0.172	45.937	79.000	33.063	30.090	66.000	35.910
0.591	39.187	73.000	33.813	35.416	60.000	24.584
27.249	25.285	73.000	47.715	20.164	60.000	39.836

Line



Neutral

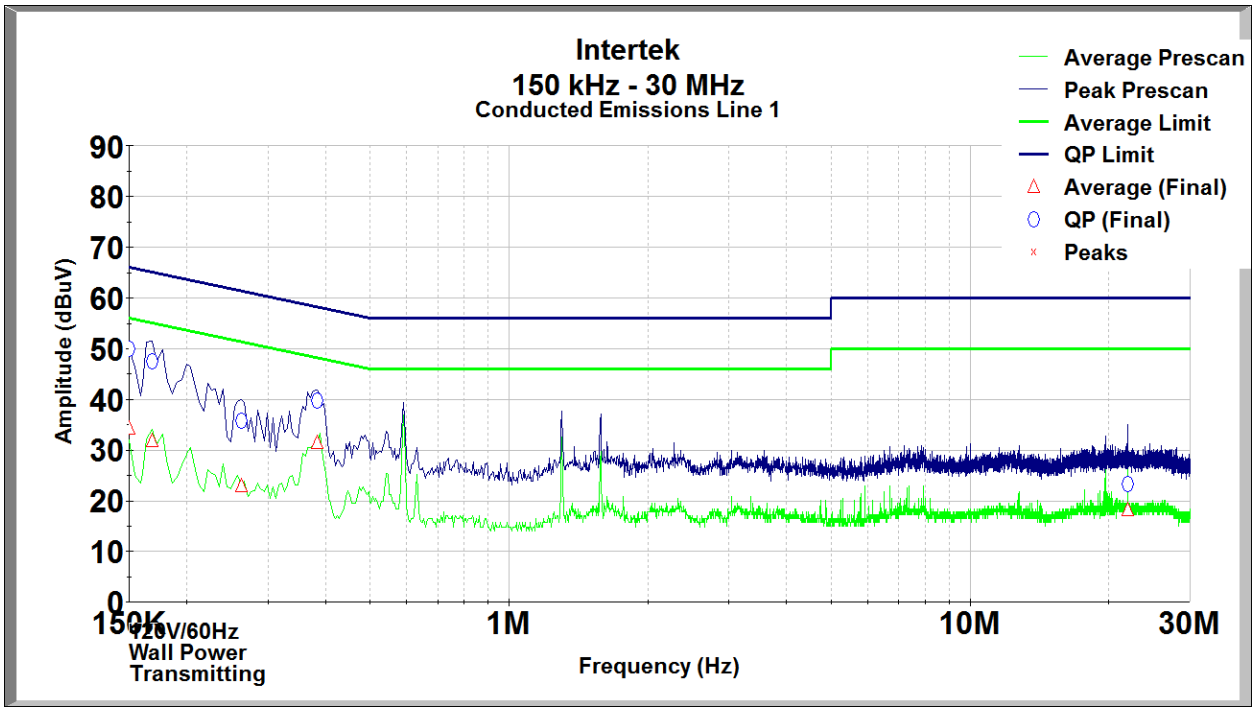
Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.155	48.314	79.000	30.686	29.487	66.000	36.513
0.218	38.632	79.000	40.368	23.269	66.000	42.731
0.591	39.343	73.000	33.657	35.905	60.000	24.095
1.302	34.031	73.000	38.969	30.366	60.000	29.634
19.710	29.557	73.000	43.443	26.364	60.000	33.636

Neutral

Test Personnel:	Brian Lackey	Test Date:	7/27/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	Class A
Product Standard:	FCC Part 15B ICES-003 Issue 6	Ambient Temperature:	22.3C
Input Voltage:	120V/60Hz	Relative Humidity:	54.8%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	988.8mbar

Deviations, Additions, or Exclusions: None

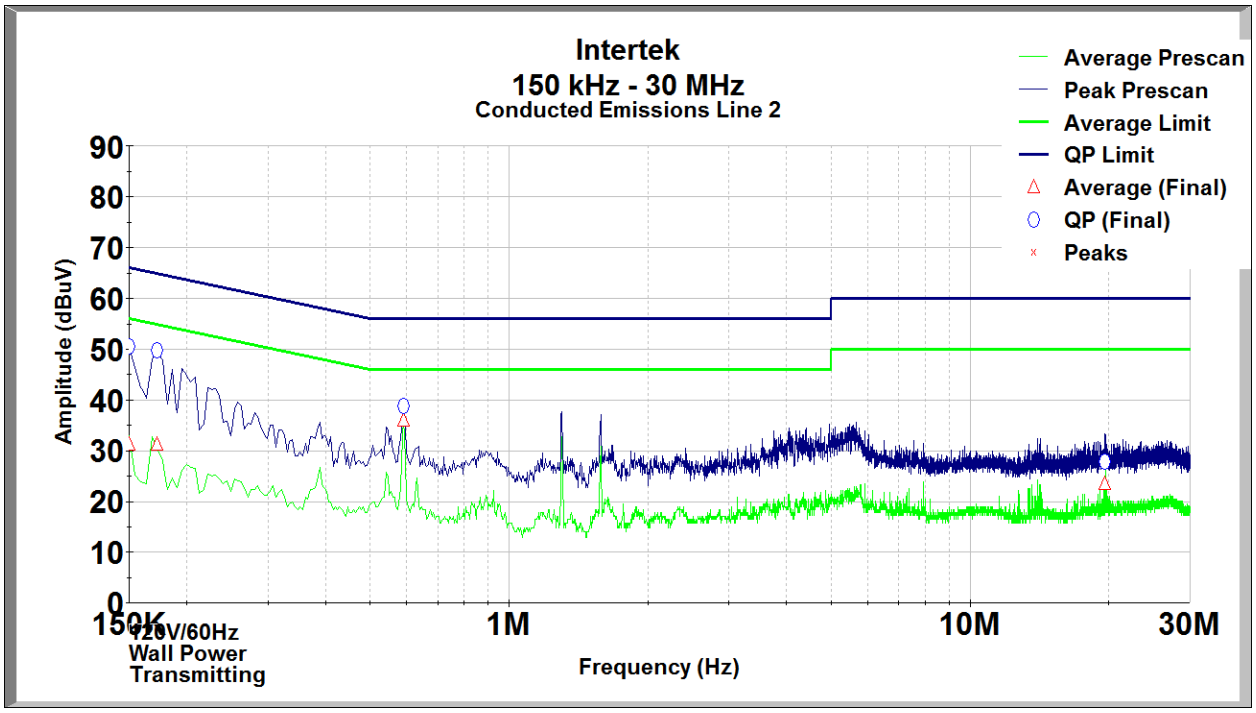
8.7 Plots/Data: Conducted Emissions (Transmitting)



Line

Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.150	49.998	66.000	16.002	34.253	56.000	21.747
0.168	47.565	65.486	17.921	31.770	55.486	23.716
0.263	35.820	62.786	26.966	22.963	52.786	29.823
0.384	39.746	59.314	19.568	31.496	49.314	17.819
21.978	23.205	60.000	35.511	18.205	50.000	30.512

Line



Neutral

Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.150	50.513	66.000	15.487	31.180	56.000	24.820
0.172	49.843	65.357	15.514	31.169	55.357	24.188
0.591	38.755	56.000	17.326	35.996	46.000	10.085
19.589	27.770	60.000	30.564	23.503	50.000	24.831

Neutral

Test Personnel:	Brian Lackey	Test Date:	7/27/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	15.207
Product Standard:	FCC Part 15B ICES-003 Issue 6	Ambient Temperature:	22.3C
Input Voltage:	120V/60Hz	Relative Humidity:	54.8%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	988.8mbar

Deviations, Additions, or Exclusions: None

9 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	9/10/2019	104024249LEX-001b	BL	BCT	Original Issue