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Dormakaba USA Inc. TEST REPORT

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

REPORT NUMBER
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EMC TEST REPORT

(FULL COMPLIANCE)

Report Number: 104024249LEX-001a
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

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

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Table of Contents

1 Introduction and Conclusion 4
2 Test Summary 4
3 Client Information 5
4 Description of Equipment under Test and Variant Models 6
5 System Setup and Method 7
6 Receiver Spurious Emissions 8
7 Transmitter Spurious Emissions 19
8 Conducted Spurious Emissions 80
9 Output Power 83
10 Occupied Bandwidth 85
11 Peak Power Spectral Density 89
12 Antenna Requirement 92
13 Conducted Emissions 93
14 Revision History 99

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 Spurious Emissions (FCC Part 15.247(d), RSS-247 Issue 2 § 5.5, ANSI C63.10:2013 § 11.11.3)	Pass
9	Output Power (FCC Part 15.247(b)(3), RSS-247 Issue 2 § 5.4(d), ANSI C63.10:2013 § 11.9.1.3)	Pass
10	Occupied Bandwidth (FCC Part 15.247(a)(2), RSS-247 Issue 2 § 5.2(a), ANSI C63.10:2013 § 11.8.1)	Pass
11	Peak Power Spectral Density (FCC Part 15.247(e), RSS-247 Issue 2 § 5.2(b), ANSI C63.10:2013 § 11.10.2)	Pass
12	Antenna Requirement (FCC Part 15.203, RSS-Gen Issue 4 § 8.3)	Pass
13	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
Maximum Output Power (dBm)	20.38dBm (power setting 26)
Maximum Antenna Gain (dBi)	Pulse W1030W Antenna: 2.0 PCTEL (Maxrad) MC2400PTMSMA Ceiling Mount Antenna: 2.5 Mobile Mark (Comtelco) CMTB36247V Wall Mount Antenna: 7.5 Mobile Mark (Comntelco) CMTBS2400XL3 Omnidirectional Antenna: 5.0
Test Channels	11 (2405MHz), 18 (2440MHz), 26 (2480MHz)
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:

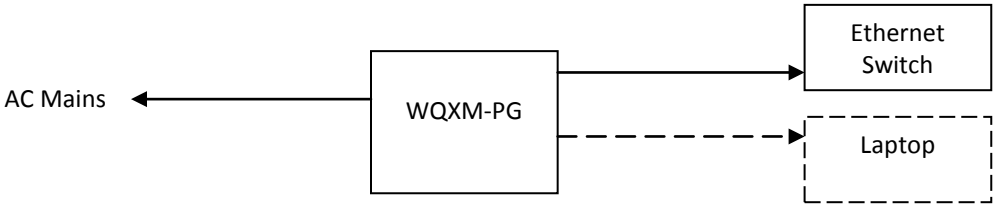
Configuration as required by ANSI C63.4: 2014 and ANSI C63.10:2013

No.	Descriptions of EUT Exercising
1	Transmitting a Zigbee 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

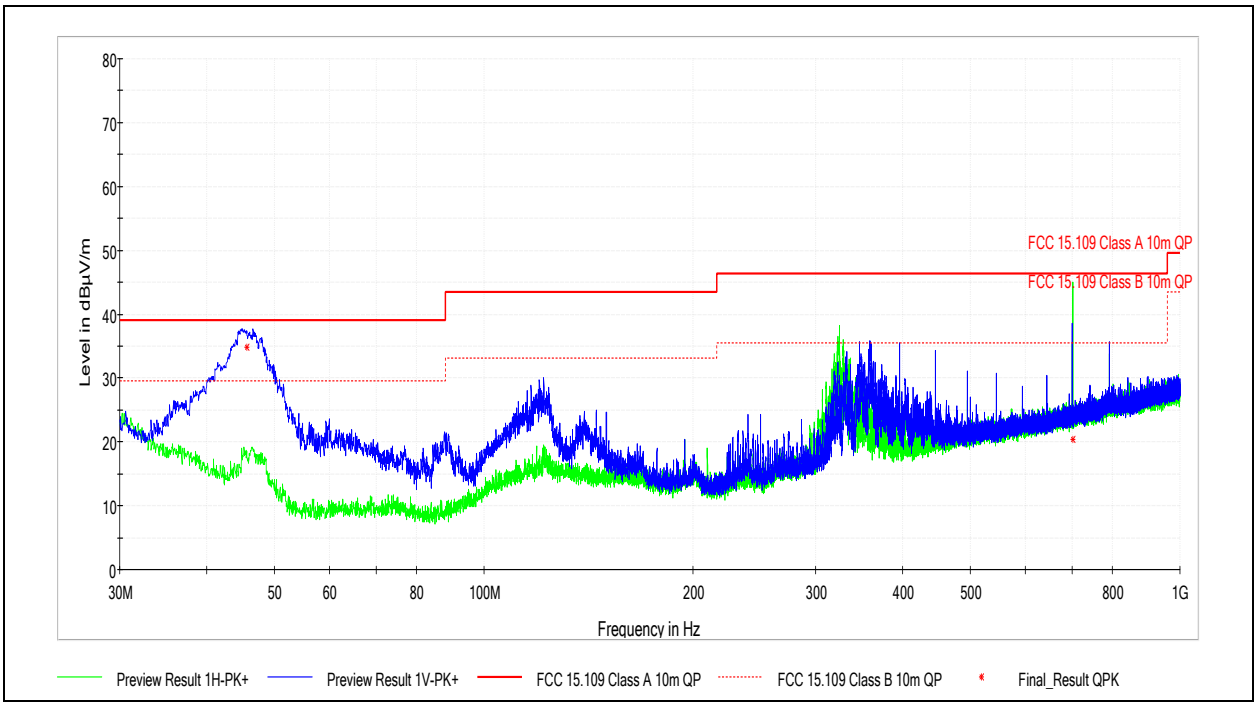
Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 9.15.02

6.5 Test Results

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

6.6 Pulse W1030W Antenna

6.6.1 Test Data: 30MHz – 1GHz

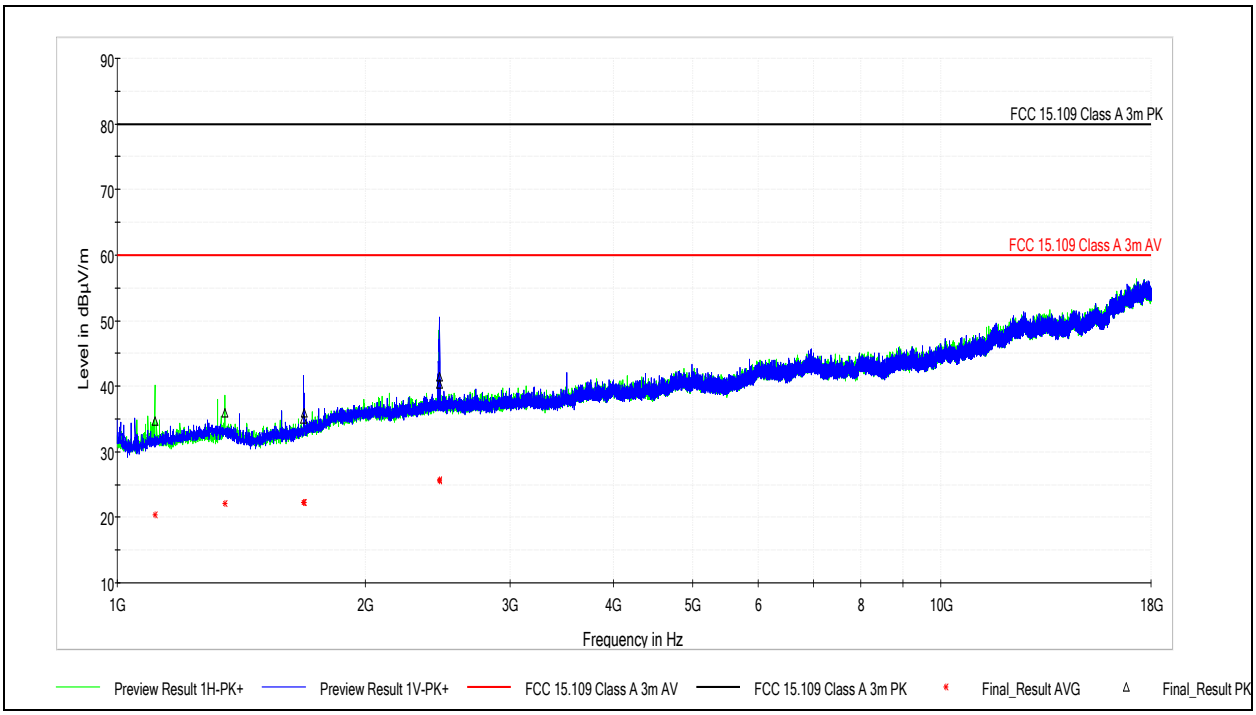


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
45.651111	34.76	39.08	4.32	120.000	336.6	V	295.0	-12.5
702.381667	20.42	46.44	26.02	120.000	359.2	H	-1.0	2.2

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

6.6.2 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

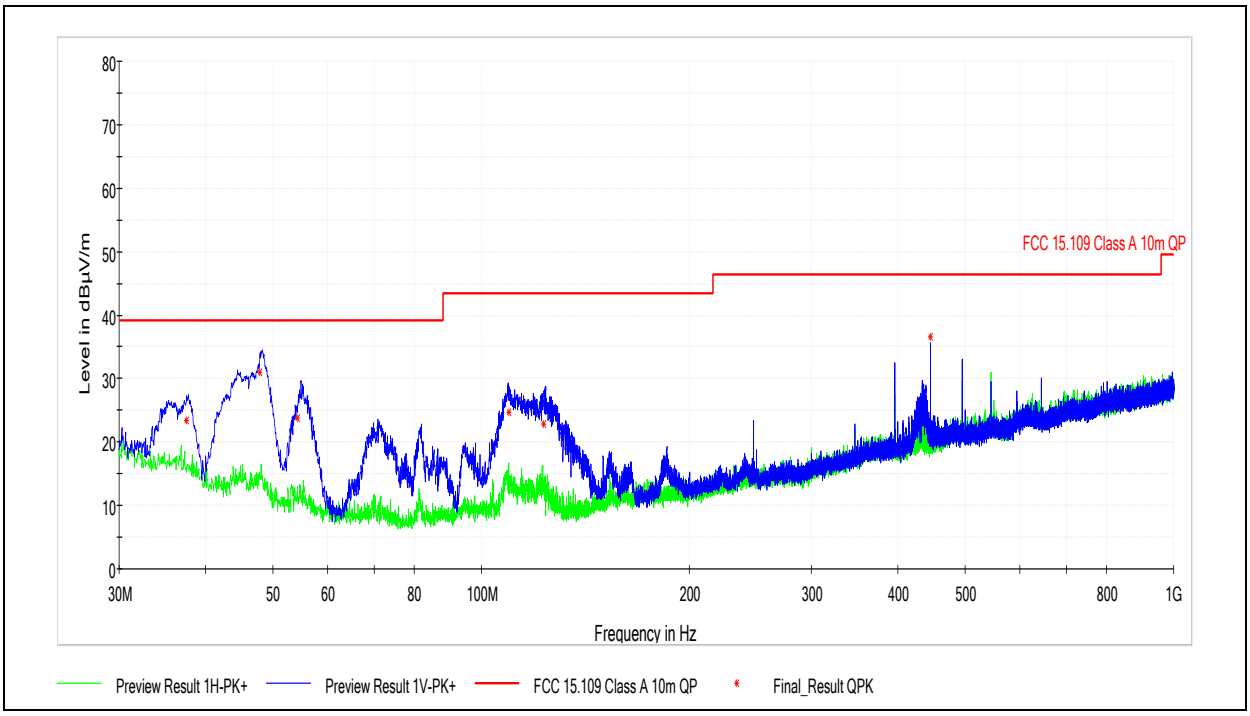
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1110.500000	20.45	60.00	39.55	1000.000	283.0	H	310.0	-3.2
1350.500000	22.06	60.00	37.94	1000.000	214.0	H	13.0	-1.4
1683.500000	22.30	60.00	37.70	1000.000	286.0	V	205.0	-1.0
1687.500000	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

6.7 PCTEL (Maxrad) MC2400PTMSMA Ceiling Mount Antenna

6.7.1 Test Data: 30MHz – 1GHz

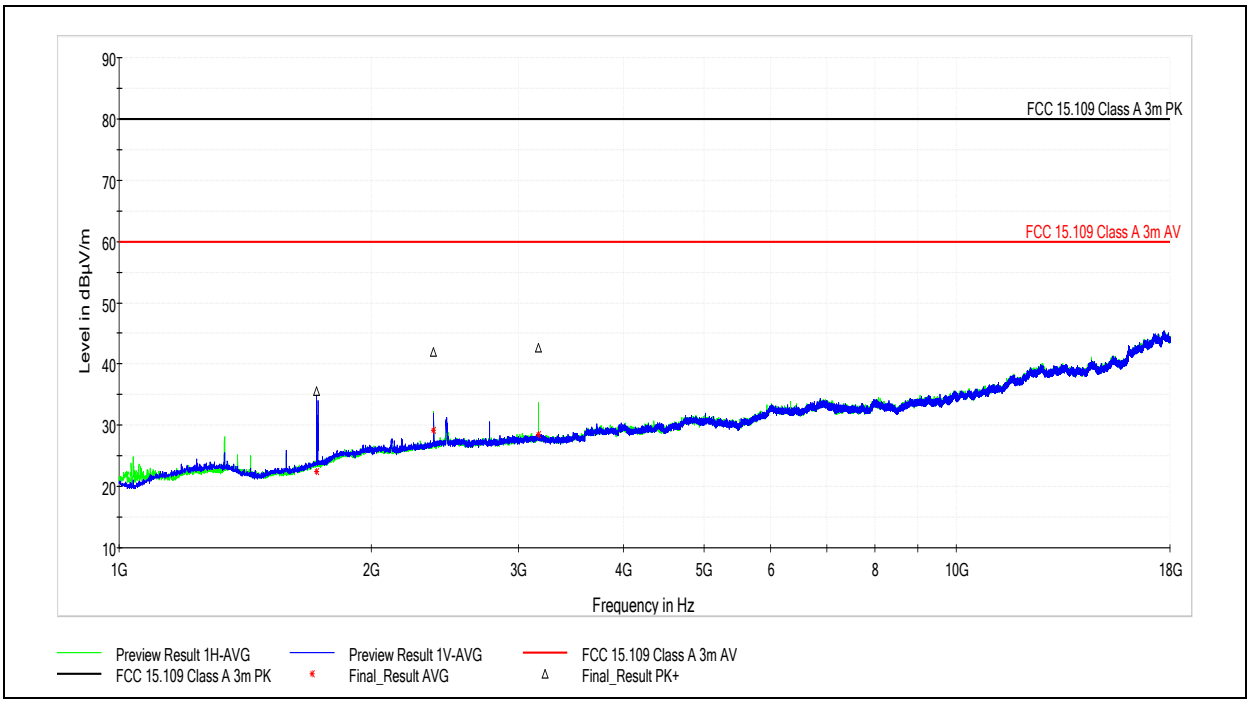


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
37.490000	23.46	39.08	15.62	120.000	100.2	V	44.0	-10.5
47.905000	31.07	39.08	8.01	120.000	99.9	V	258.0	-13.3
54.270556	23.73	39.08	15.35	120.000	367.7	V	268.0	-14.2
109.726111	24.67	43.52	18.85	120.000	180.9	V	82.0	-14.3
123.108889	22.78	43.52	20.74	120.000	106.0	V	185.0	-15.3
445.503333	36.51	46.44	9.93	120.000	356.0	V	195.0	-2.7

Test Personnel:	Brian Lackey	Test Date:	7/30/3029
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15B ICES-003 Issue 6	Ambient Temperature:	25.7C
Input Voltage:	120V/60Hz	Relative Humidity:	53.5%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	984.8mbar

Deviations, Additions, or Exclusions: None

6.7.2 Test Data: 1GHz – 18GHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1722.000000	35.63	80.00	44.37	1000.000	310.0	V	202.0	-0.5
2376.000000	41.98	80.00	38.02	1000.000	201.0	H	218.0	2.9
3168.000000	42.63	80.00	37.37	1000.000	187.0	H	26.0	4.5

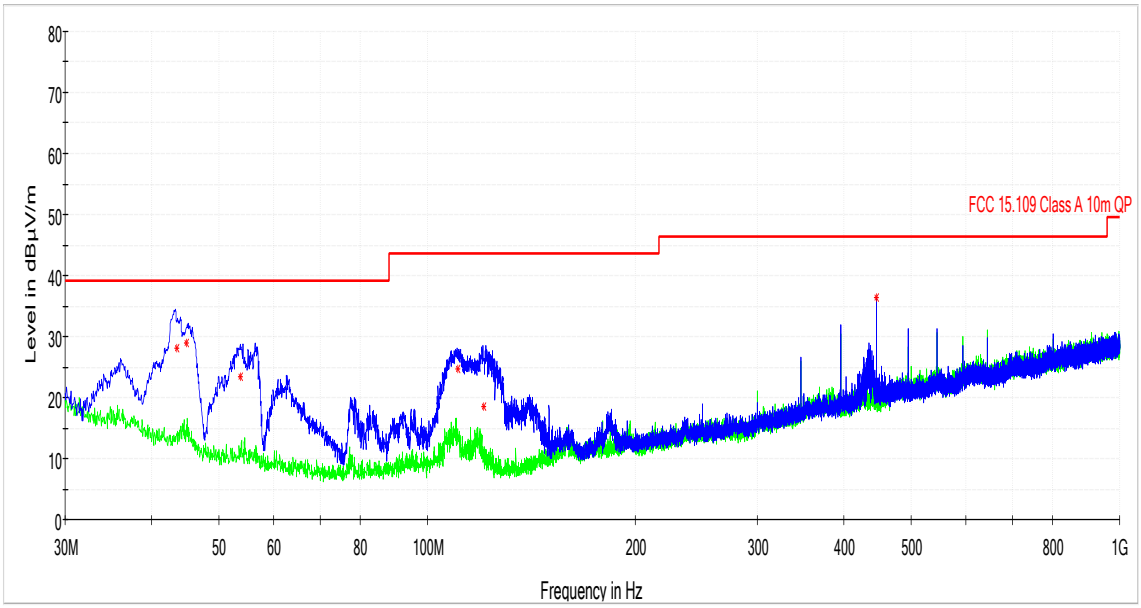
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1722.000000	22.41	60.00	37.59	1000.000	310.0	V	202.0	-0.5
2376.000000	29.25	60.00	30.75	1000.000	201.0	H	218.0	2.9
3168.000000	28.52	60.00	31.48	1000.000	187.0	H	26.0	4.5

Test Personnel:	Brian Lackey	Test Date:	8/8/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15B ICES-003 Issue 6	Ambient Temperature:	26.3C
Input Voltage:	120V/60Hz	Relative Humidity:	43.6%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.2mbar

Deviations, Additions, or Exclusions: None

6.8 Mobile Mark (Comtelco) CMTB36247V Wall Mount Antenna

6.8.1 Test Data: 30MHz – 1GHz

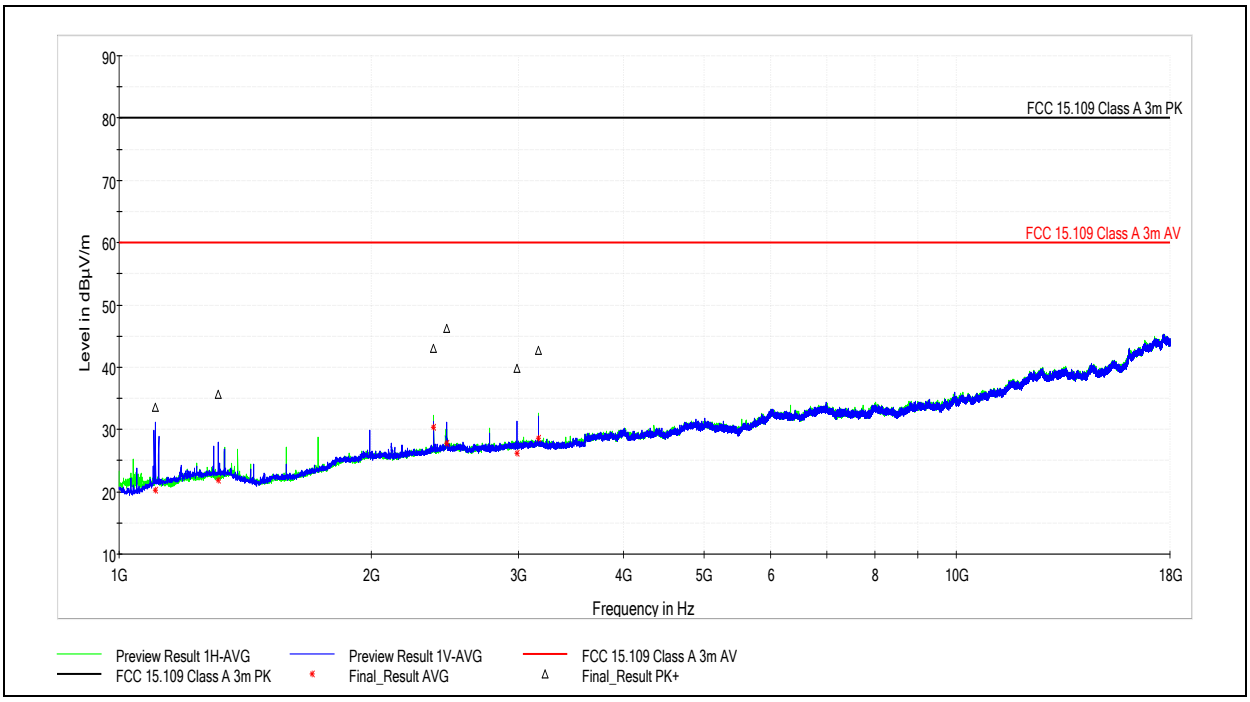


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
43.518889	28.12	39.08	10.96	120.000	356.0	V	-1.0	-12.8
44.926667	29.01	39.08	10.07	120.000	331.7	V	0.0	-13.1
53.731111	23.36	39.08	15.72	120.000	224.7	V	258.0	-14.1
110.797222	24.68	43.52	18.84	120.000	177.8	V	82.0	-14.5
120.725556	18.43	43.52	25.09	120.000	141.7	V	10.0	-15.4
445.493333	36.38	46.44	10.06	120.000	307.6	V	194.0	-2.7

Test Personnel:	Brian Lackey	Test Date:	7/30/3029
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15B ICES-003 Issue 6	Ambient Temperature:	25.7C
Input Voltage:	120V/60Hz	Relative Humidity:	53.5%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	984.8mbar

Deviations, Additions, or Exclusions: None

6.8.2 Test Data: 1GHz – 18GHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1105.000000	33.63	80.00	46.37	1000.000	134.0	V	12.0	-3.1
1312.500000	35.68	80.00	44.32	1000.000	293.0	V	161.0	-1.2
2376.000000	42.98	80.00	37.02	1000.000	247.0	H	223.0	2.9
2461.000000	46.29	80.00	33.71	1000.000	384.0	V	96.0	3.0
2988.000000	39.79	80.00	40.21	1000.000	100.0	V	25.0	4.3
3168.000000	42.74	80.00	37.26	1000.000	136.0	H	24.0	4.5

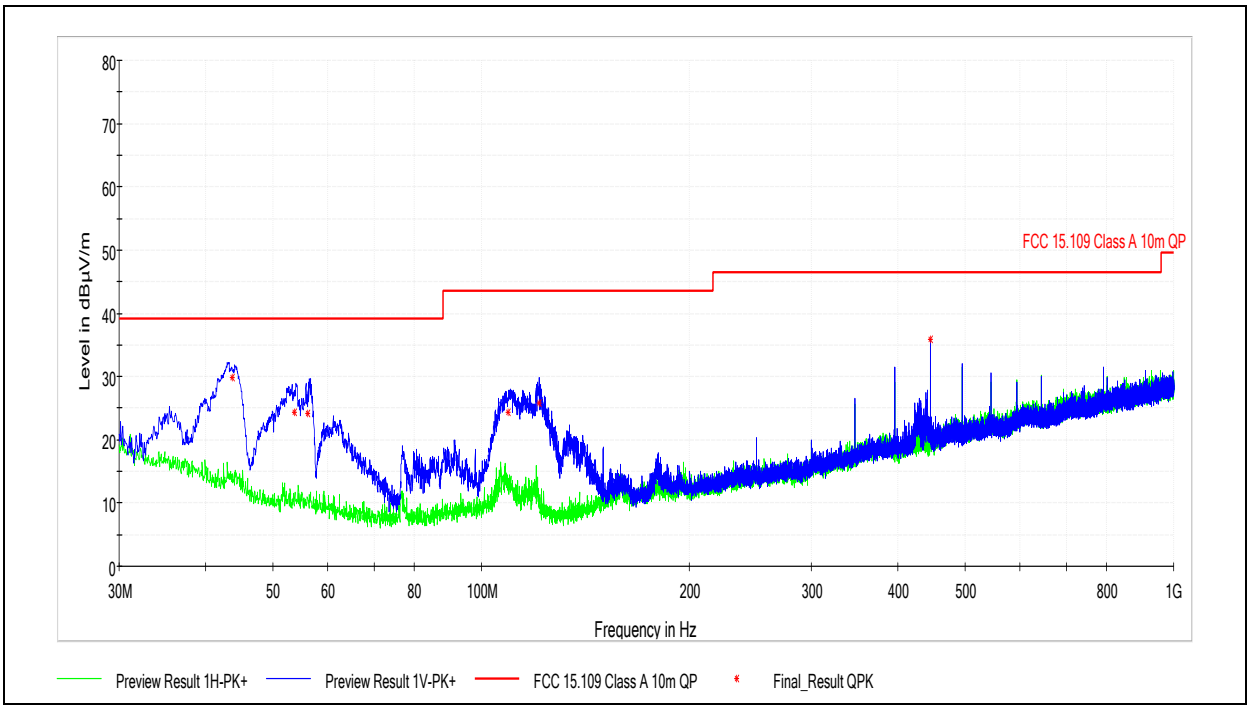
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1105.000000	20.21	60.00	39.79	1000.000	134.0	V	12.0	-3.1
1312.500000	21.84	60.00	38.16	1000.000	293.0	V	161.0	-1.2
2376.000000	30.43	60.00	29.57	1000.000	247.0	H	223.0	2.9
2461.000000	27.78	60.00	32.22	1000.000	384.0	V	96.0	3.0
2988.000000	26.21	60.00	33.79	1000.000	100.0	V	25.0	4.3
3168.000000	28.55	60.00	31.45	1000.000	136.0	H	24.0	4.5

Test Personnel:	Brian Lackey	Test Date:	8/8/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15B ICES-003 Issue 6	Ambient Temperature:	26.3C
Input Voltage:	120V/60Hz	Relative Humidity:	43.6%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.2mbar

Deviations, Additions, or Exclusions: None

6.9 Mobile Mark (Comntelco) CMTBS2400XL3 Omnidirectional Antenna

6.9.1 Test Data: 30MHz – 1GHz

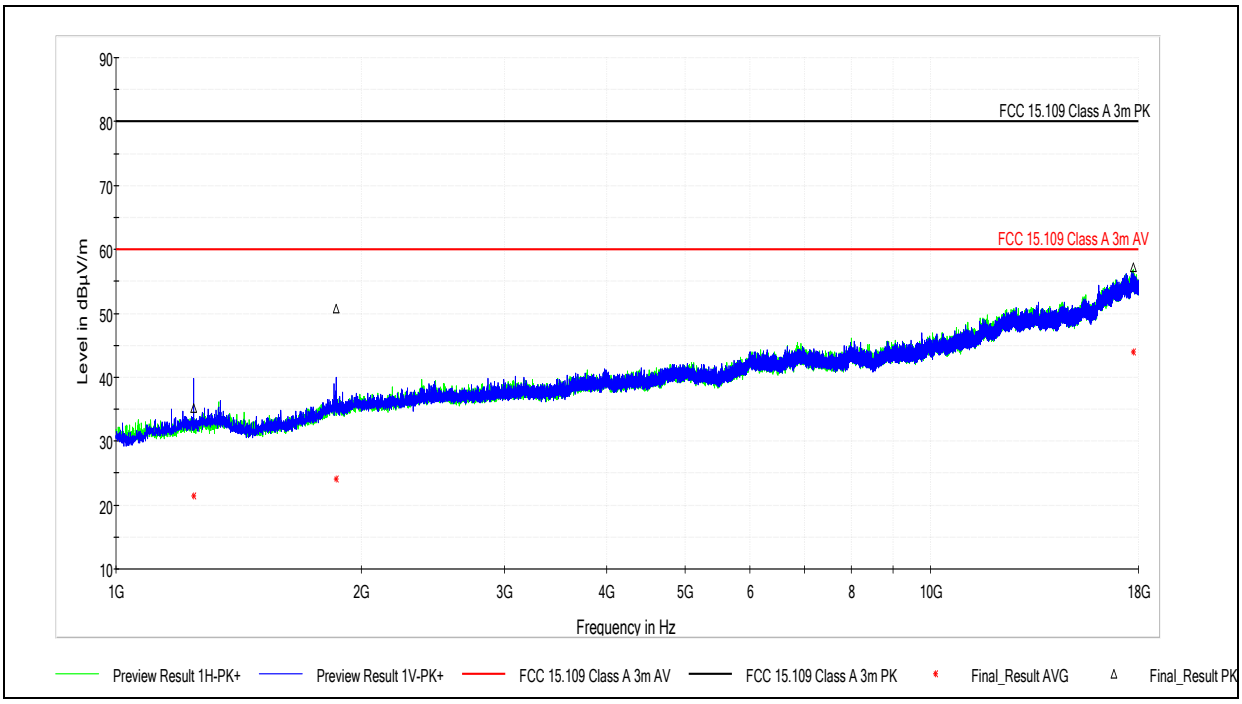


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
43.677222	29.82	39.08	9.26	120.000	319.7	V	0.0	-12.8
53.723889	24.29	39.08	14.79	120.000	100.0	V	254.0	-14.1
56.169444	24.17	39.08	14.91	120.000	236.5	V	266.0	-14.4
109.346111	24.37	43.52	19.15	120.000	153.2	V	99.0	-14.2
121.317778	25.83	43.52	17.69	120.000	100.1	V	114.0	-15.4
445.493333	35.84	46.44	10.60	120.000	343.3	V	194.0	-2.7

Test Personnel:	Brian Lackey	Test Date:	7/30/3029
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15B ICES-003 Issue 6	Ambient Temperature:	25.7C
Input Voltage:	120V/60Hz	Relative Humidity:	53.5%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	984.8mbar

Deviations, Additions, or Exclusions: None

6.9.2 Test Data: 1GHz – 18GHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1245.000000	35.14	80.00	44.86	1000.000	100.0	V	221.0	-1.7
1863.000000	50.80	80.00	29.20	1000.000	233.0	V	182.0	1.2
17744.500000	57.26	80.00	22.74	1000.000	109.0	H	286.0	25.1

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1245.000000	21.48	60.00	38.52	1000.000	100.0	V	221.0	-1.7
1863.000000	24.07	60.00	35.93	1000.000	233.0	V	182.0	1.2
17744.500000	43.89	60.00	16.11	1000.000	109.0	H	286.0	25.1

Test Personnel:	Brian Lackey	Test Date:	7/30/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15B ICES-003 Issue 6	Ambient Temperature:	25.7C
Input Voltage:	120V/60Hz	Relative Humidity:	53.5%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	984.8mbar

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

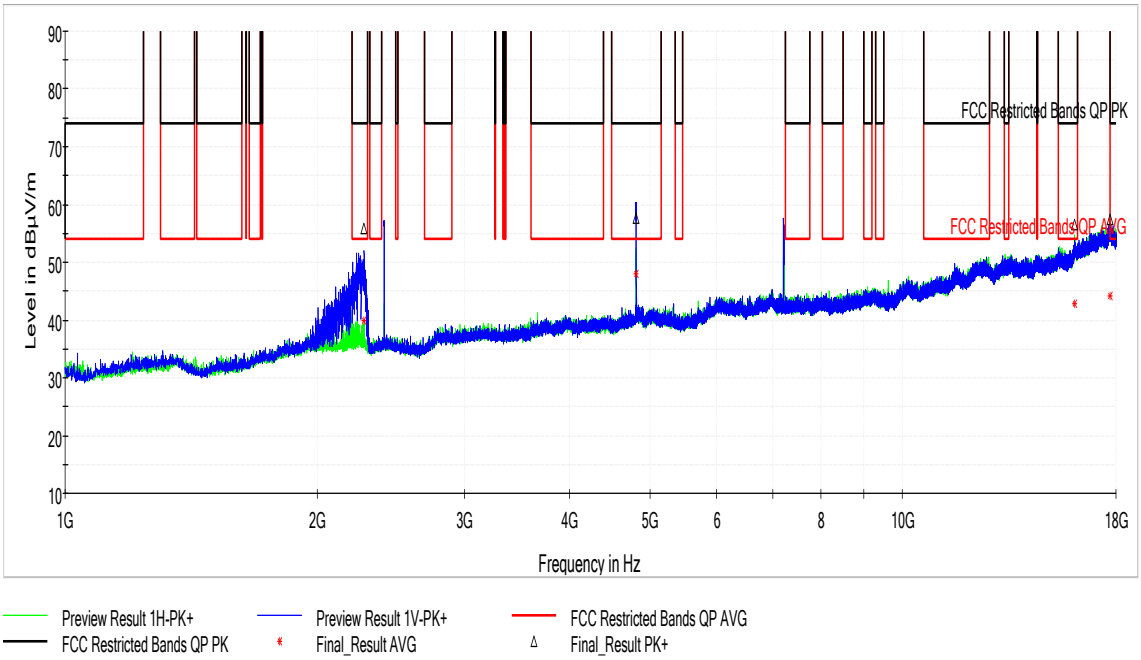
Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 9.15.02

7.5 Test Results

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

7.6 Pulse W1030W Antenna

7.6.1 Antenna 1+2, Channel 11 (2405MHz) Spurious Emissions, 1GHz-18GHz



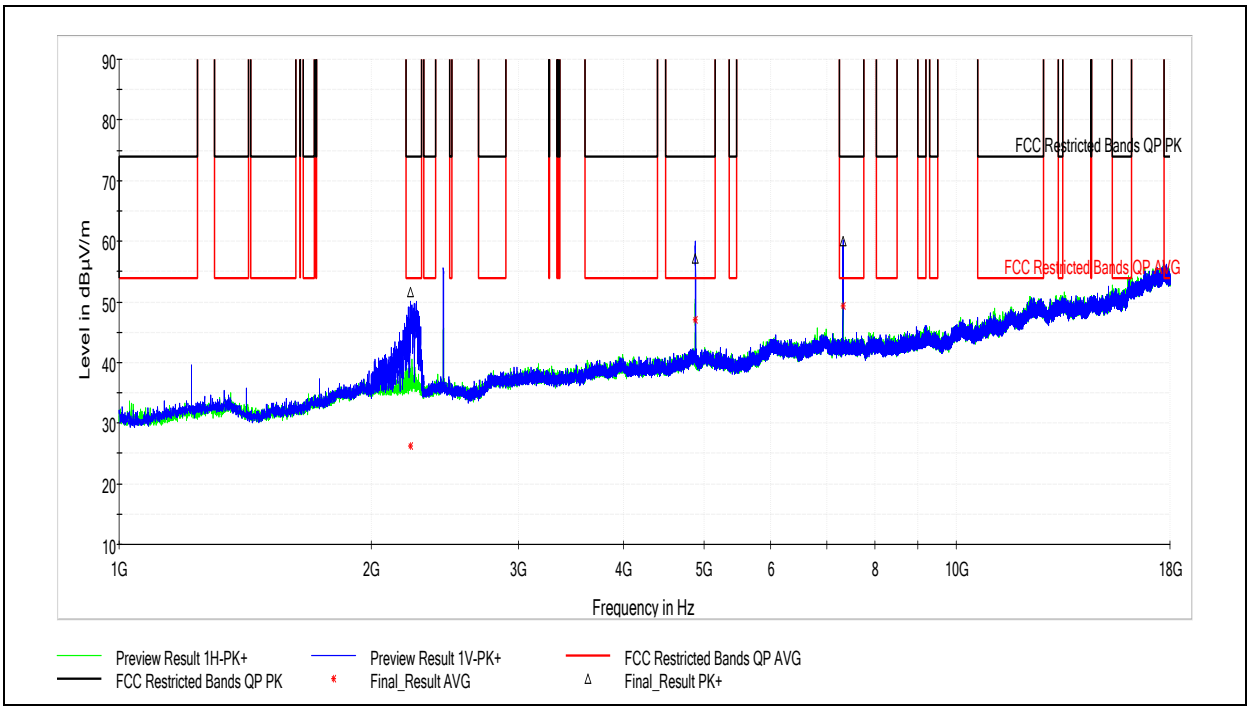
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2276.500000	55.81	73.98	18.17	1000.000	197.0	V	346.0	2.5
4809.500000	57.68	73.98	16.30	1000.000	163.0	V	162.0	7.1
16072.000000	56.42	73.98	17.56	1000.000	100.0	H	260.0	24.4
17714.000000	57.49	73.98	16.49	1000.000	100.0	H	301.0	25.1

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2276.500000	39.99	53.98	13.99	1000.000	197.0	V	346.0	2.5
4809.500000	48.02	53.98	5.96	1000.000	163.0	V	162.0	7.1
16072.000000	42.77	53.98	11.21	1000.000	100.0	H	260.0	24.4
17714.000000	44.23	53.98	9.75	1000.000	100.0	H	301.0	25.1

Test Personnel:	Brian Lackey	Test Date:	7/28/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	27.7C
Input Voltage:	120V/60Hz	Relative Humidity:	45.8%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	990.6mbar

Deviations, Additions, or Exclusions: None

7.6.2 Antenna 1+2, Channel 18 (2440MHz) Spurious Emissions, 1GHz-18GHz



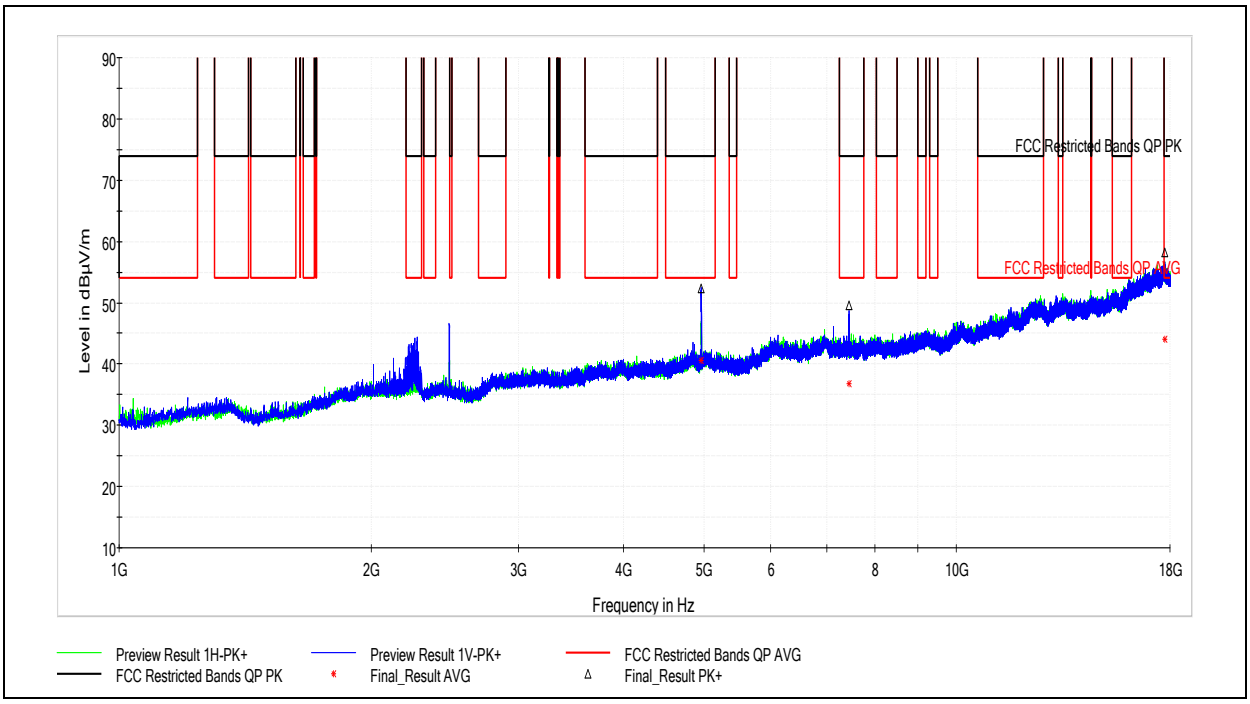
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2227.500000	51.57	73.98	22.41	1000.000	233.0	V	0.0	2.4
4879.500000	57.17	73.98	16.81	1000.000	132.0	V	166.0	7.1
7319.000000	59.93	73.98	14.05	1000.000	241.0	V	170.0	10.8

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2227.500000	26.21	53.98	27.77	1000.000	233.0	V	0.0	2.4
4879.500000	47.05	53.98	6.93	1000.000	132.0	V	166.0	7.1
7319.000000	49.36	53.98	4.62	1000.000	241.0	V	170.0	10.8

Test Personnel:	Brian Lackey	Test Date:	7/28/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	27.7C
Input Voltage:	120V/60Hz	Relative Humidity:	45.8%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	990.6mbar

Deviations, Additions, or Exclusions: None

7.6.3 Antenna 1+2, Channel 26 (2480MHz) Spurious Emissions, 1GHz-18GHz



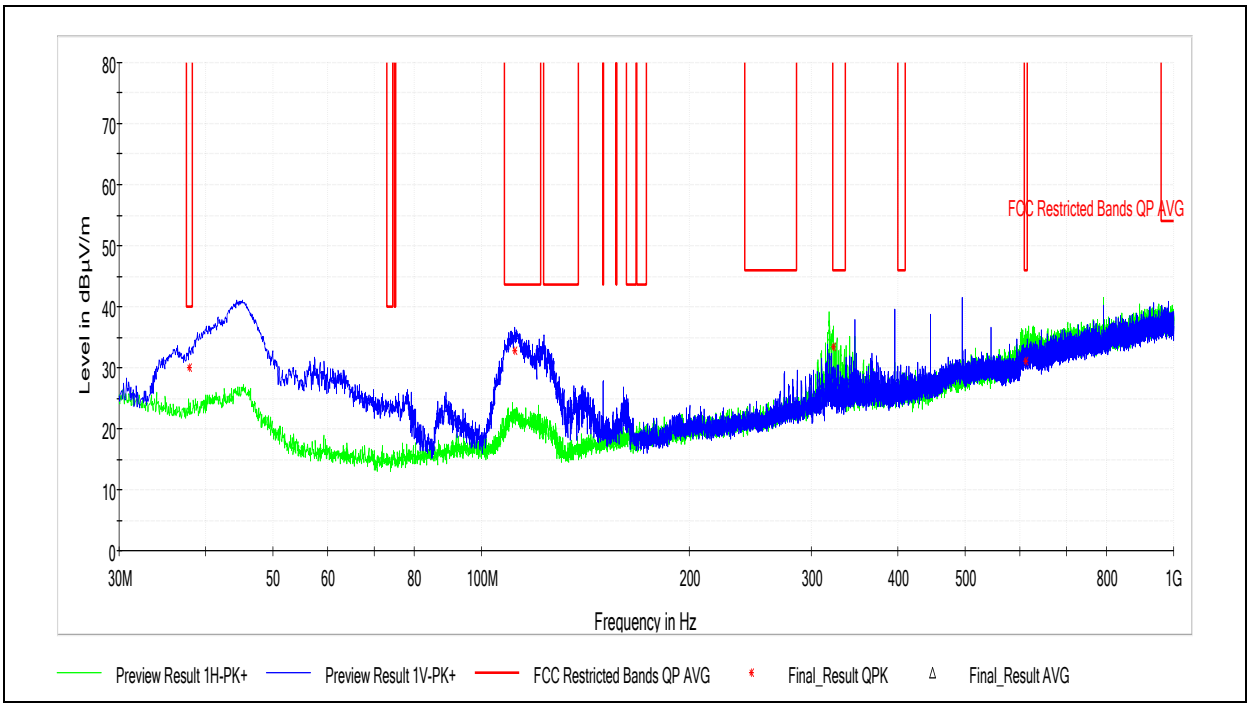
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4961.500000	52.31	73.98	21.67	1000.000	332.0	V	168.0	7.0
7439.000000	49.58	73.98	24.40	1000.000	187.0	V	209.0	11.0
17738.500000	58.29	73.98	15.69	1000.000	410.0	V	322.0	25.1

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4961.500000	40.65	53.98	13.33	1000.000	332.0	V	168.0	7.0
7439.000000	36.86	53.98	17.12	1000.000	187.0	V	209.0	11.0
17738.500000	44.12	53.98	9.86	1000.000	410.0	V	322.0	25.1

Test Personnel:	Brian Lackey	Test Date:	7/28/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	27.7C
Input Voltage:	120V/60Hz	Relative Humidity:	45.8%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	990.6mbar

Deviations, Additions, or Exclusions: None

7.6.4 Antenna 1+2, Spurious Emissions, 30MHz-1GHz

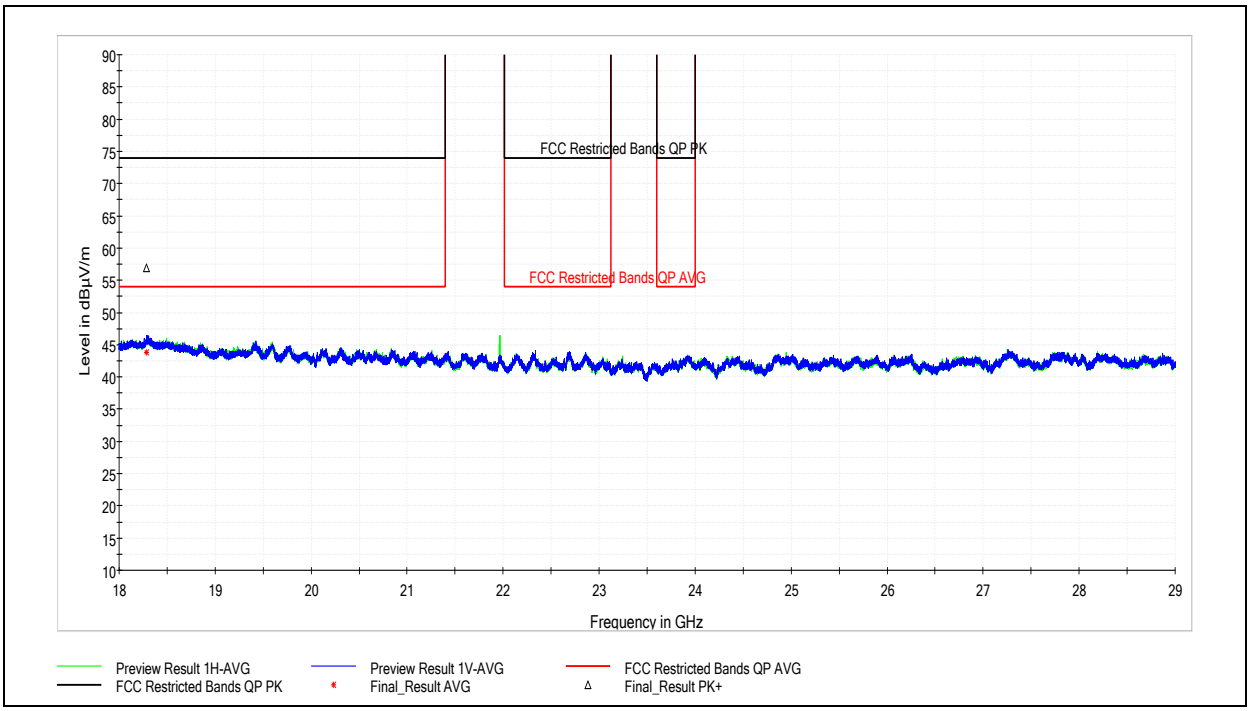


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
37.867778	30.00	40.00	10.00	120.000	104.6	V	303.0	19.7
111.857222	32.86	43.52	10.66	120.000	104.9	V	203.0	15.6
322.455000	33.31	46.02	12.71	120.000	103.5	H	349.0	23.8
611.137778	31.05	46.02	14.97	120.000	131.1	H	182.0	31.1

Test Personnel:	Brian Lackey	Test Date:	7/29/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	29.3C
Input Voltage:	120V/60Hz	Relative Humidity:	40.3%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	983.4mbar

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

7.6.5 Antenna 1+2, Spurious Emissions, 18-29GHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18288.500000	56.96	73.98	17.02	1000.000	100.0	V	126.0	20.1

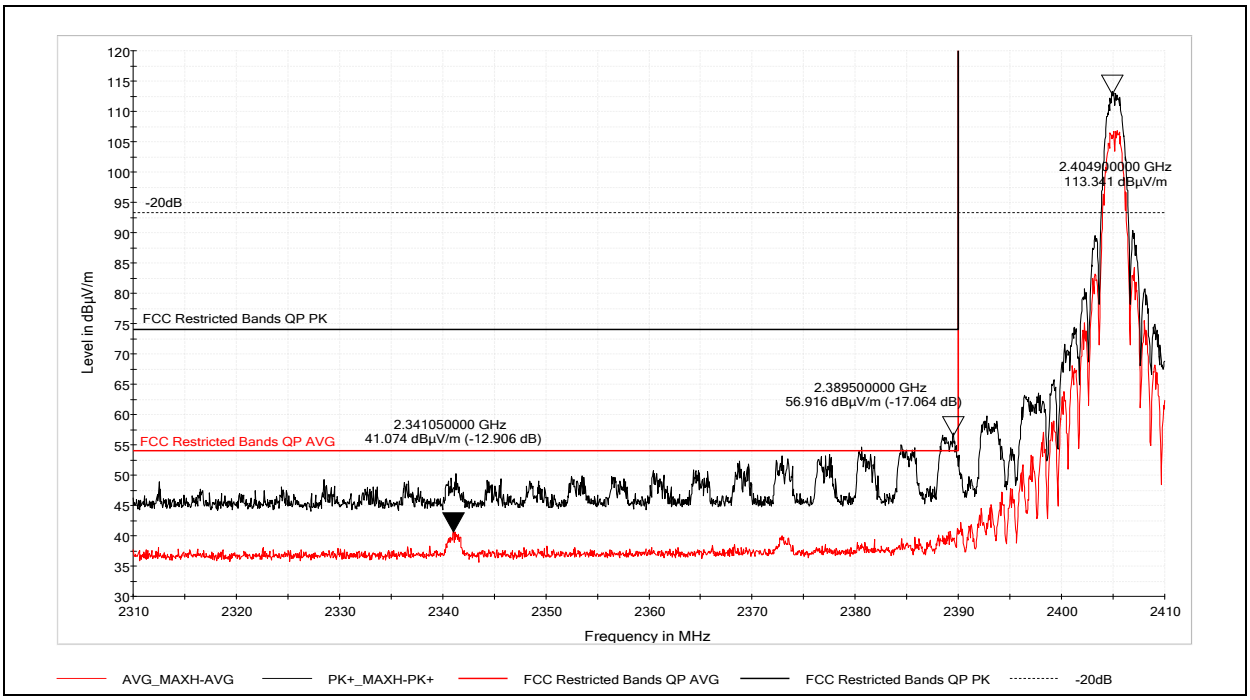
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18288.500000	43.76	53.98	10.22	1000.000	100.0	V	126.0	20.1

Test Personnel:	Brian Lackey	Test Date:	7/31/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.3C
Input Voltage:	120V/60Hz	Relative Humidity:	44.8%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	986.9mbar

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

7.6.6 Emissions at the Low Band Edge

7.6.6.1 Antenna 1, Channel 11 (2405MHz)



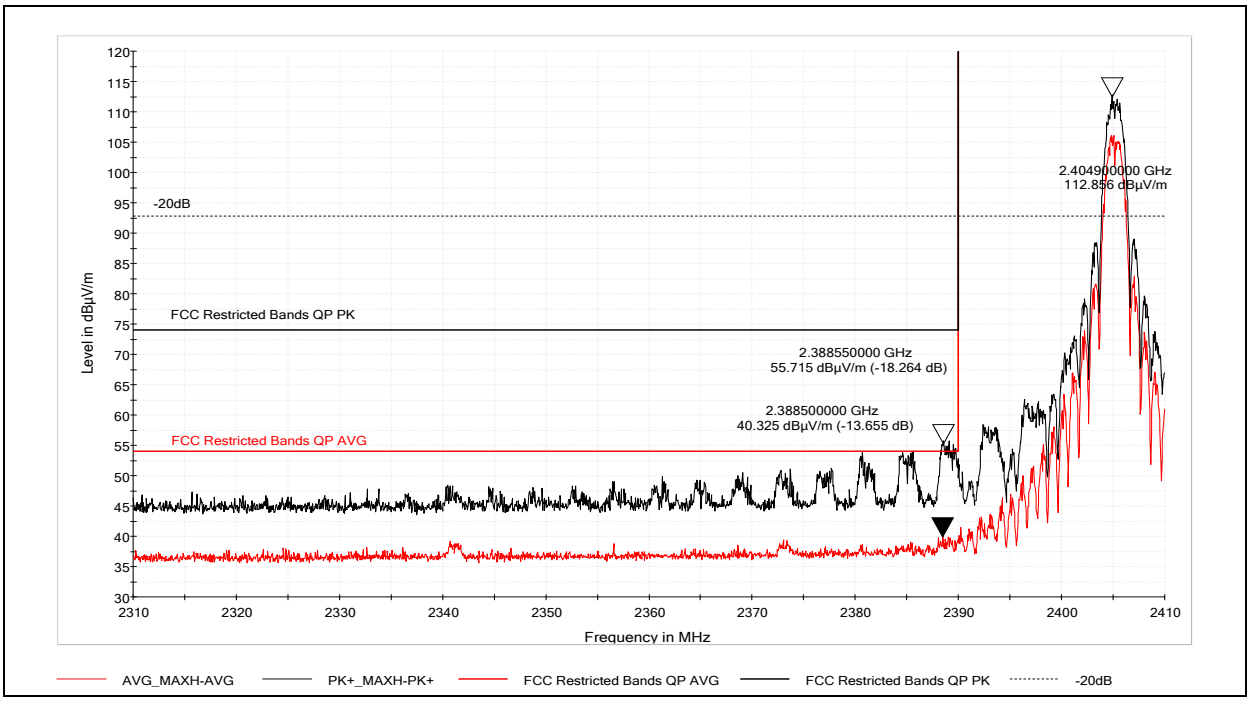
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2389.50	56.916	73.97	17.064

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2341.05	41.074	53.97	12.906

Test Personnel:	Brian Lackey	Test Date:	8/14/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.7C
Input Voltage:	120V/60Hz	Relative Humidity:	45.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.7mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation.

7.6.6.2 Antenna 2, Channel 11 (2405MHz)



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2388.55	55.715	73.97	18.264

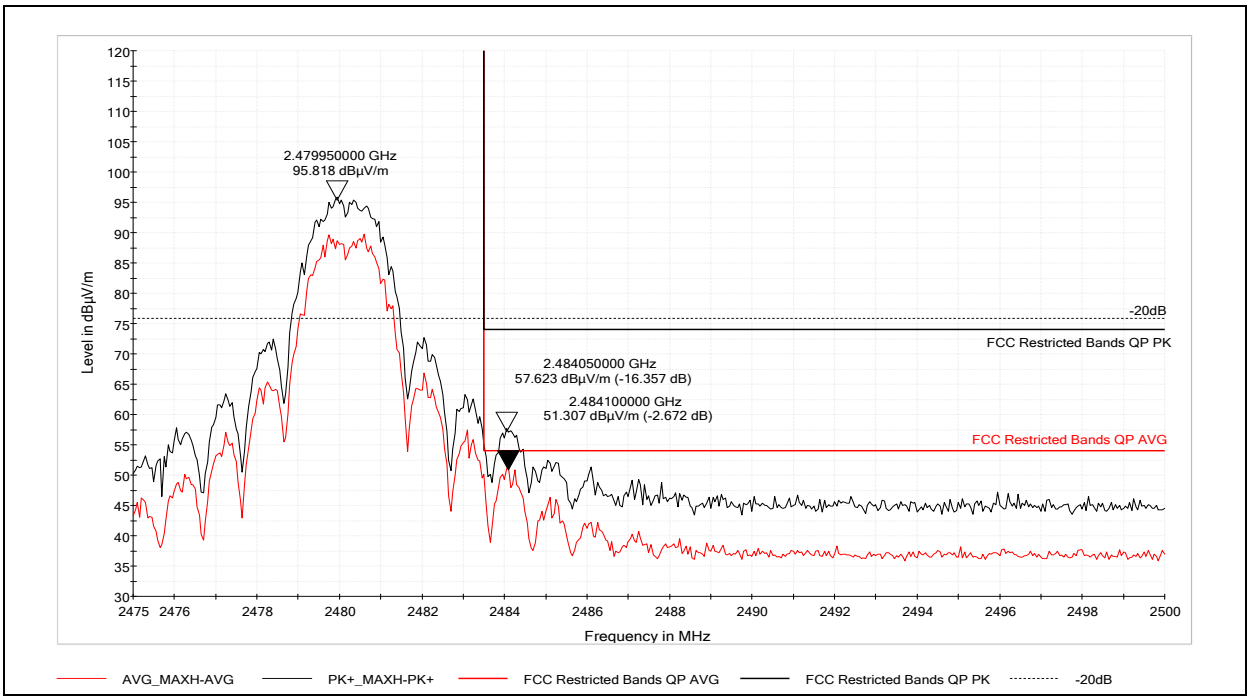
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2388.50	40.325	53.97	13.655

Test Personnel:	Brian Lackey	Test Date:	8/9/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.1C
Input Voltage:	120V/60Hz	Relative Humidity:	46.1%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	982.0mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation.

7.6.7 Emissions at the High Band Edge

7.6.7.1 Antenna 1, Channel 26 (2480MHz), Power Setting 4



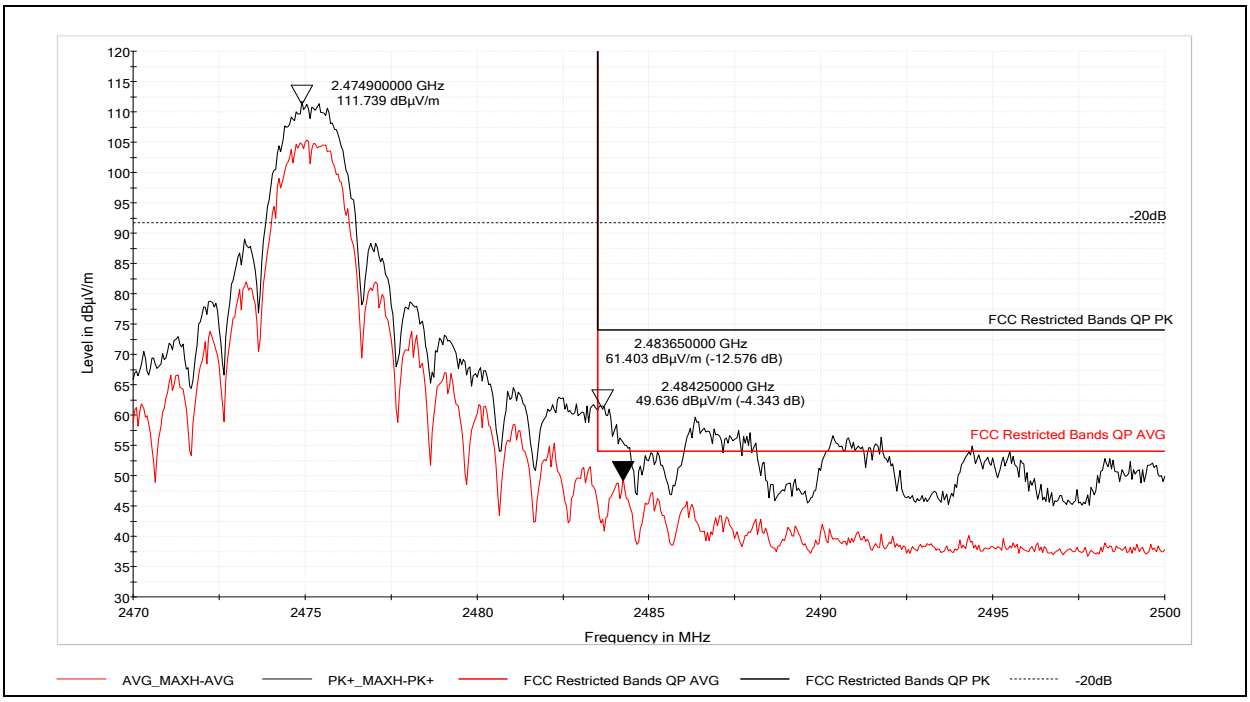
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.05	57.623	73.97	16.357

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.10	51.307	53.97	2.672

Test Personnel:	Brian Lackey	Test Date:	8/14/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.7C
Input Voltage:	120V/60Hz	Relative Humidity:	45.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.7mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation. Tested at a reduced output power level to meet average limit.

7.6.7.2 Antenna 1, Channel 25 (2475MHz), Power Setting 26



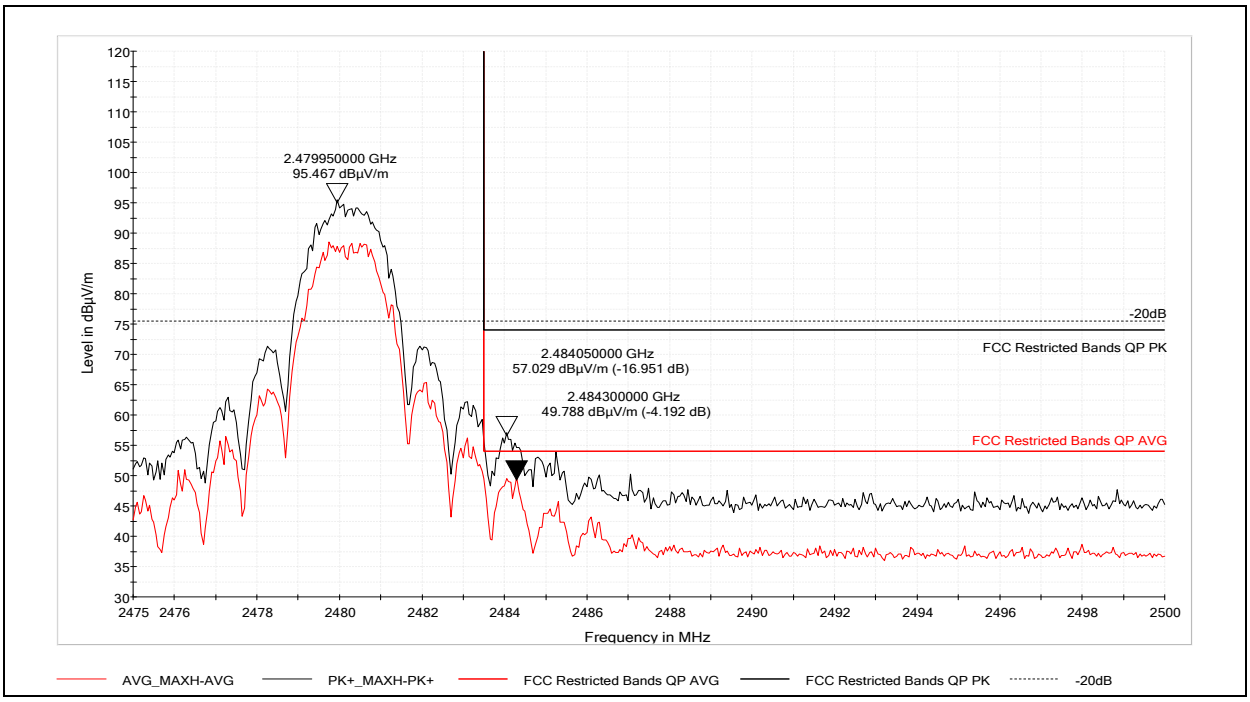
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2483.65	**61.403**	**73.97**	**12.576**

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.25	**49.636**	**53.97**	**4.343**

Test Personnel:	Brian Lackey	Test Date:	8/14/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.7C
Input Voltage:	120V/60Hz	Relative Humidity:	45.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.7mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation.

7.6.7.3 Antenna 2, Channel 26 (2480MHz), Power Setting 4



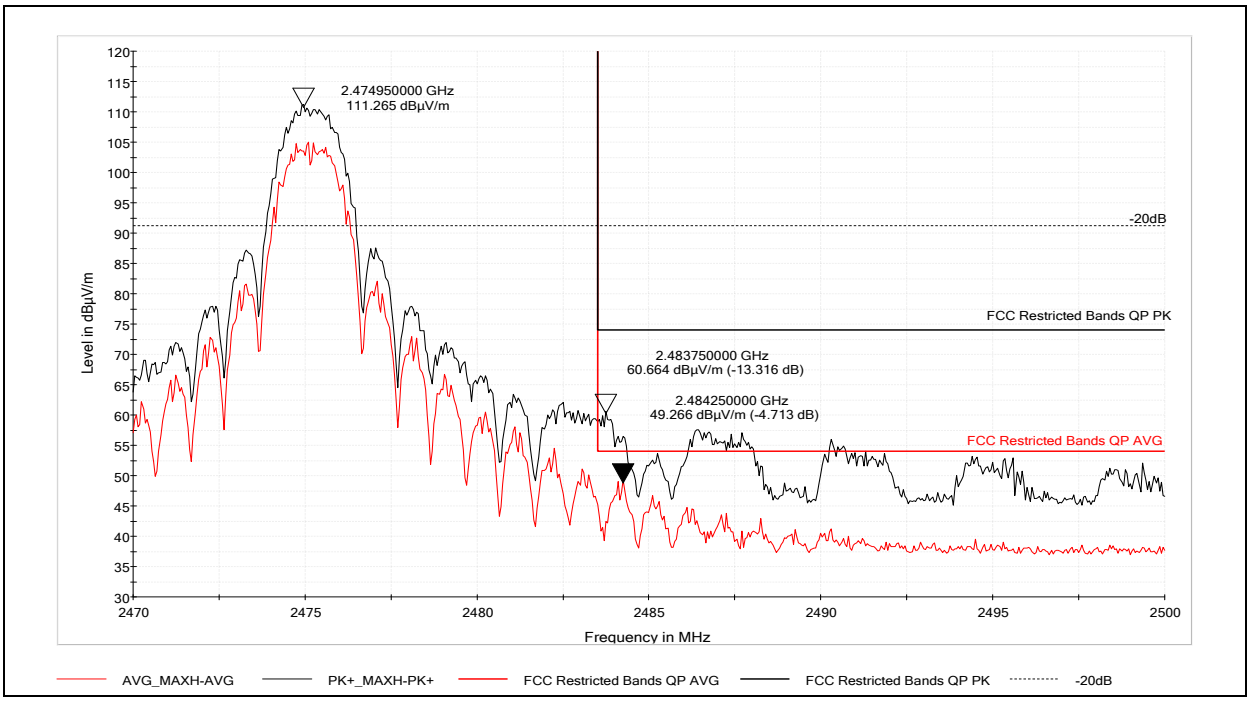
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.05	57.029	73.97	16.951

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.30	49.788	53.97	4.192

Test Personnel:	Brian Lackey	Test Date:	8/9/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.1C
Input Voltage:	120V/60Hz	Relative Humidity:	46.1%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	982.0mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation. Tested at a reduced output power level to meet average limit.

7.6.7.4 Antenna 2, Channel 25 (2475MHz), Power Setting 26



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2483.75	60.664	73.97	13.316

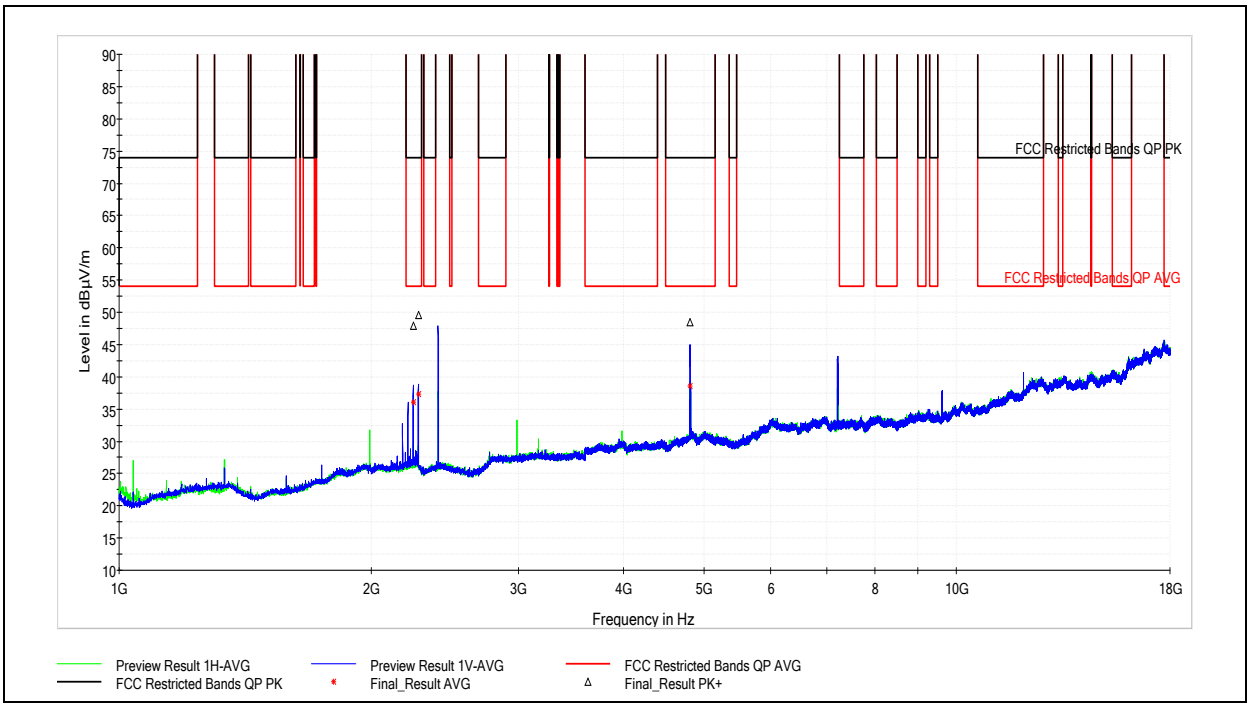
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.25	49.266	53.97	4.713

Test Personnel:	Brian Lackey	Test Date:	8/9/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.1C
Input Voltage:	120V/60Hz	Relative Humidity:	46.1%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	982.0mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation.

7.7 PCTEL (Maxrad) MC2400PTMSMA Ceiling Mount Antenna

7.7.1 Antenna 1, Channel 11 (2405MHz) Spurious Emissions, 1GHz-18GHz



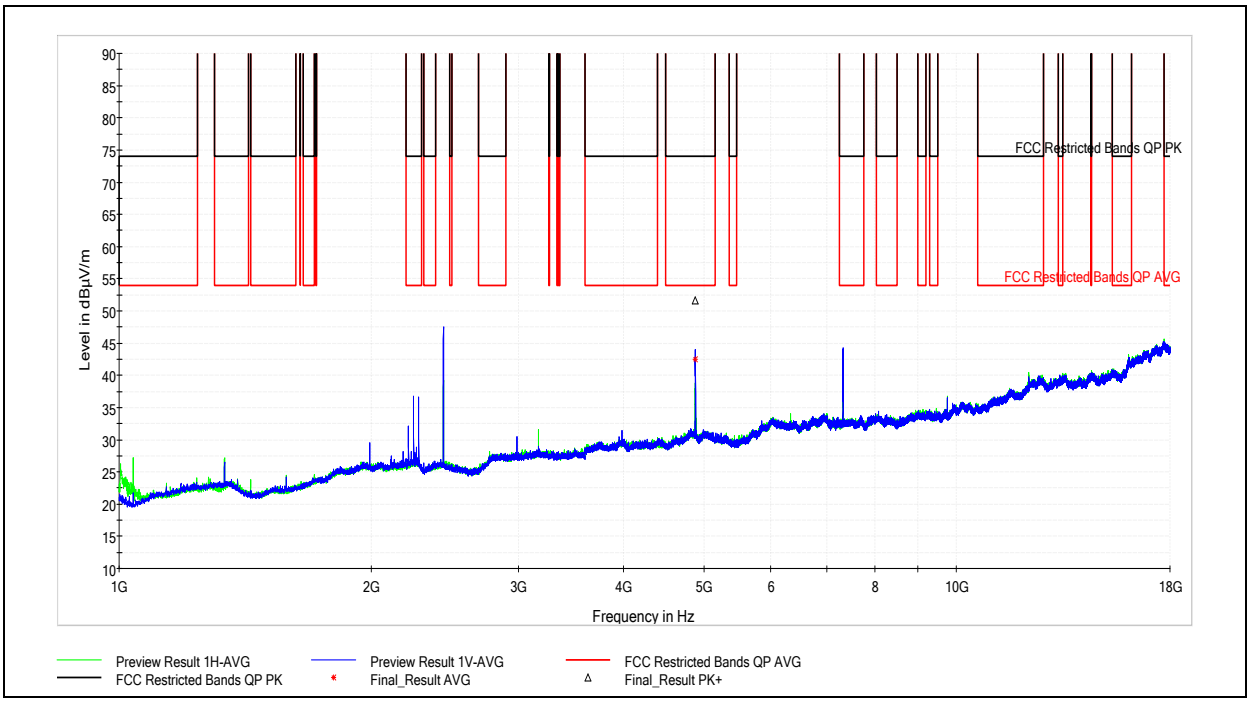
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2245.000000	47.84	73.98	26.14	1000.000	100.0	V	238.0	2.4
2277.000000	49.62	73.98	24.36	1000.000	100.0	V	245.0	2.5
4811.000000	48.53	73.98	25.45	1000.000	239.0	V	77.0	7.1

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2245.000000	36.01	53.98	17.97	1000.000	100.0	V	238.0	2.4
2277.000000	37.38	53.98	16.60	1000.000	100.0	V	245.0	2.5
4811.000000	38.64	53.98	15.34	1000.000	239.0	V	77.0	7.1

Test Personnel:	Brian Lackey	Test Date:	8/1/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.0C
Input Voltage:	120V/60Hz	Relative Humidity:	44.0%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	987.2mbar

Deviations, Additions, or Exclusions: None

7.7.2 Antenna 1, Channel 18 (2440MHz) Spurious Emissions, 1GHz-18GHz



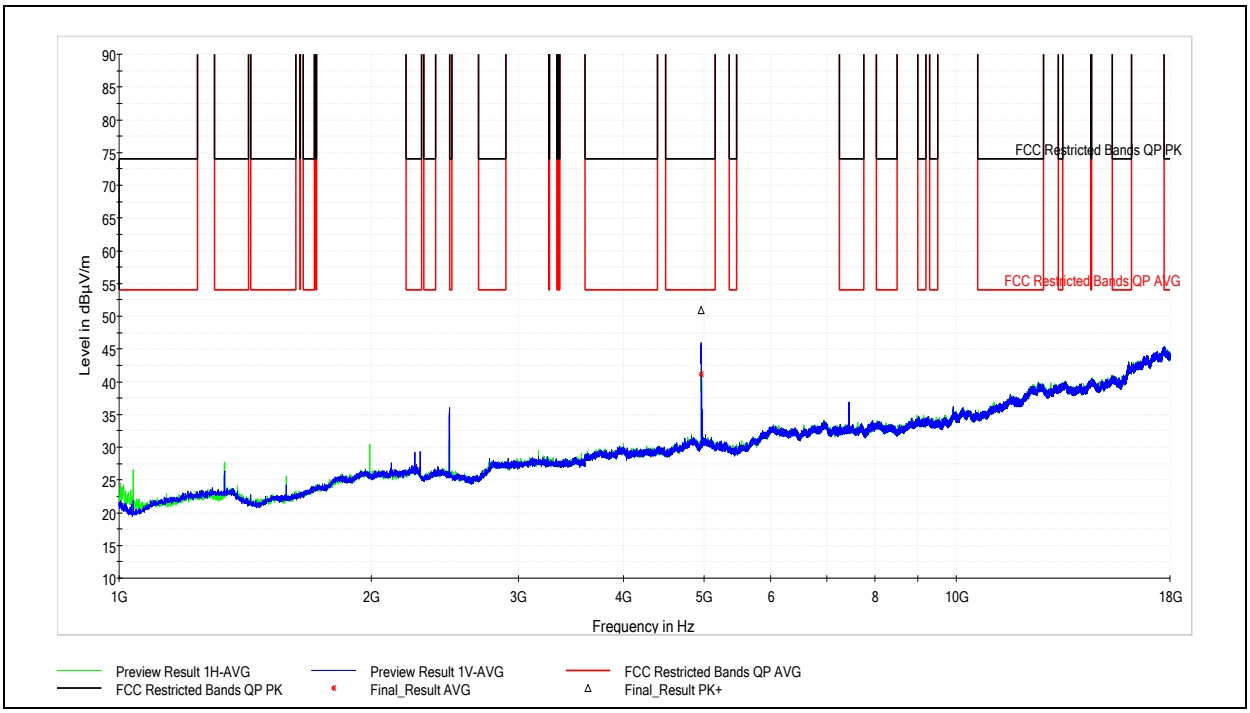
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4881.000000	51.61	73.98	22.37	1000.000	308.0	V	196.0	7.1

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4881.000000	42.53	53.98	11.45	1000.000	308.0	V	196.0	7.1

Test Personnel:	Brian Lackey	Test Date:	8/1/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.0C
Input Voltage:	120V/60Hz	Relative Humidity:	44.0%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	987.2mbar

Deviations, Additions, or Exclusions: None

7.7.3 Antenna 1, Channel 26 (2480MHz) Spurious Emissions, 1GHz-18GHz



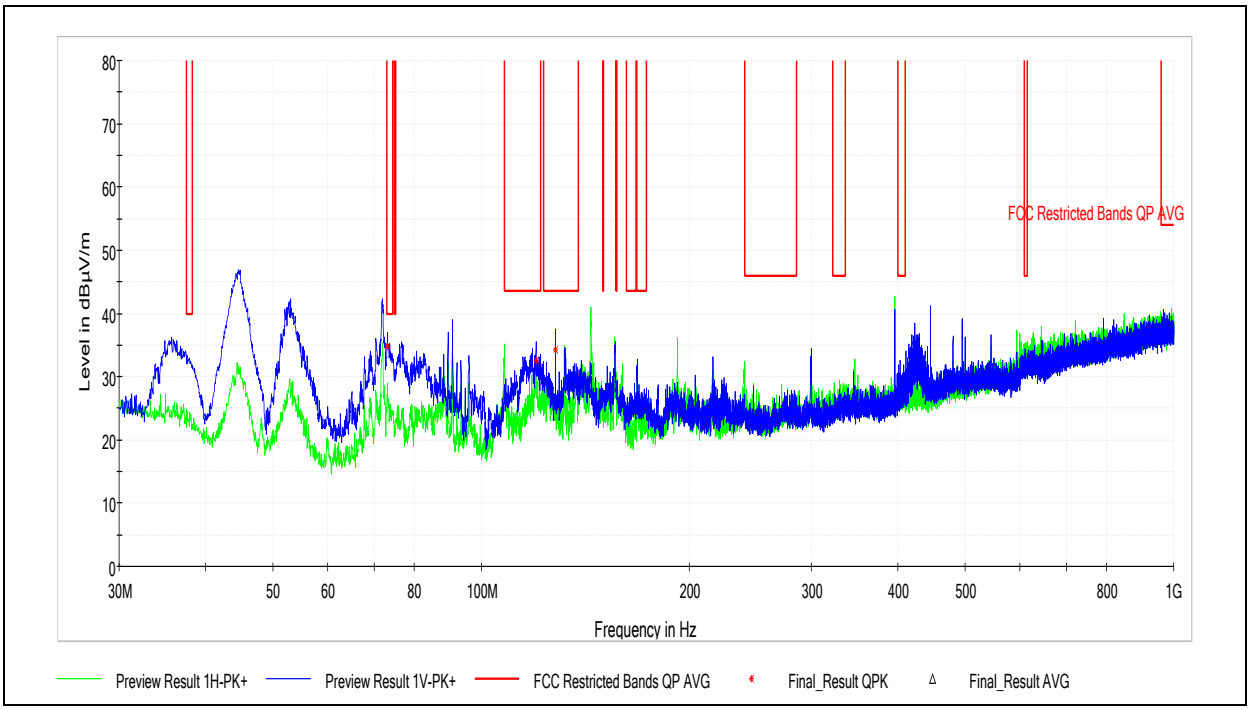
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4961.500000	50.90	73.98	23.08	1000.000	398.0	V	217.0	7.0

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4961.500000	41.08	53.98	12.90	1000.000	398.0	V	217.0	7.0

Test Personnel:	Brian Lackey	Test Date:	8/1/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.0C
Input Voltage:	120V/60Hz	Relative Humidity:	44.0%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	987.2mbar

Deviations, Additions, or Exclusions: None

7.7.4 Antenna 1, Spurious Emissions, 30MHz-1GHz

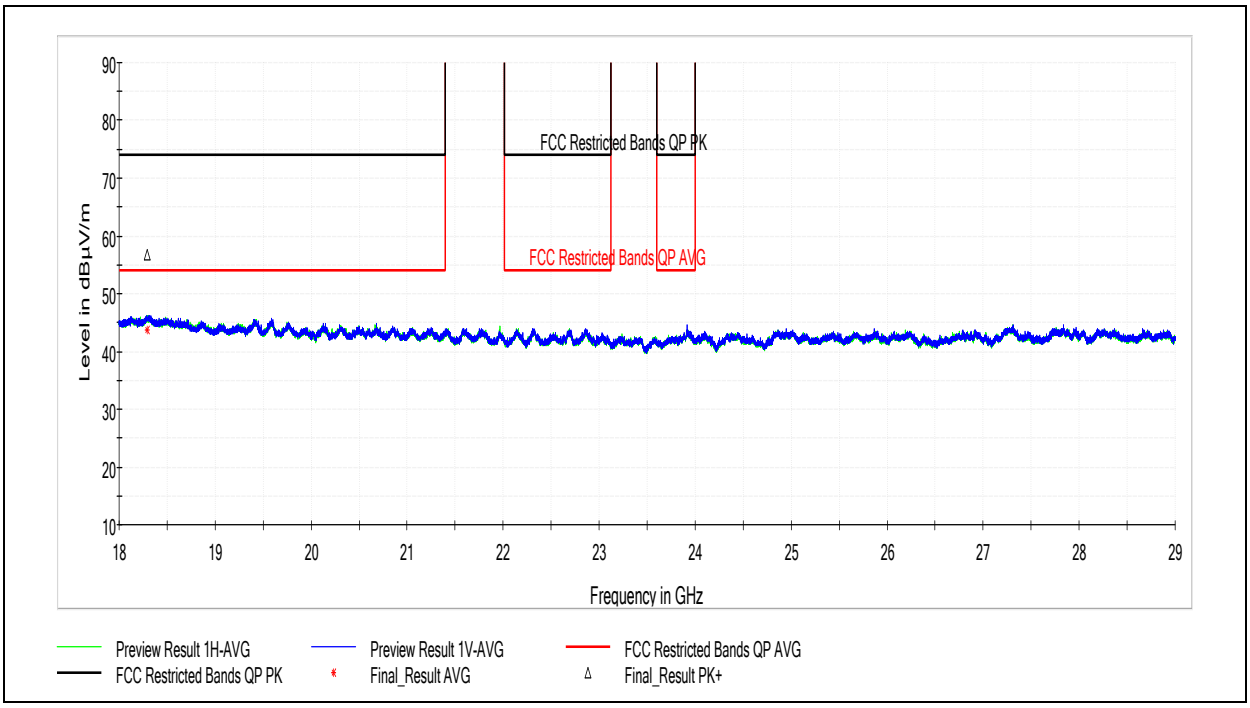


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
73.218889	34.81	40.00	5.19	120.000	105.1	V	172.0	14.9
119.994445	32.65	43.52	10.87	120.000	100.1	V	101.0	14.8
127.970000	34.27	43.52	9.25	120.000	105.1	V	181.0	14.7

Test Personnel:	Brian Lackey	Test Date:	8/8/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.3C
Input Voltage:	120V/60Hz	Relative Humidity:	43.6%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.2mbar

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

7.7.5 Antenna 1, Spurious Emissions, 18-29GHz



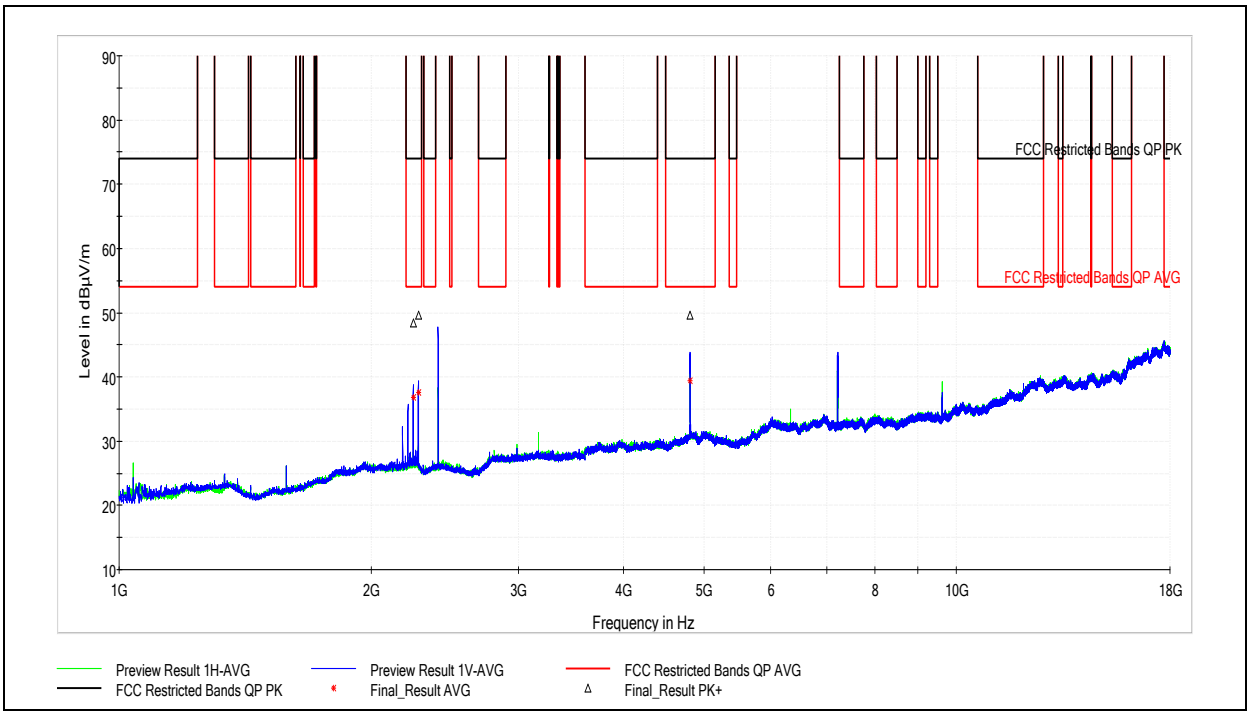
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18292.000000	56.83	73.98	17.15	1000.000	100.0	H	31.0	20.0

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18292.000000	43.70	53.98	10.28	1000.000	100.0	H	31.0	20.0

Test Personnel:	Brian Lackey	Test Date:	7/31/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.3C
Input Voltage:	120V/60Hz	Relative Humidity:	44.8%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	986.9mbar

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

7.7.6 Antenna 2, Channel 11 (2405MHz) Spurious Emissions, 1GHz-18GHz



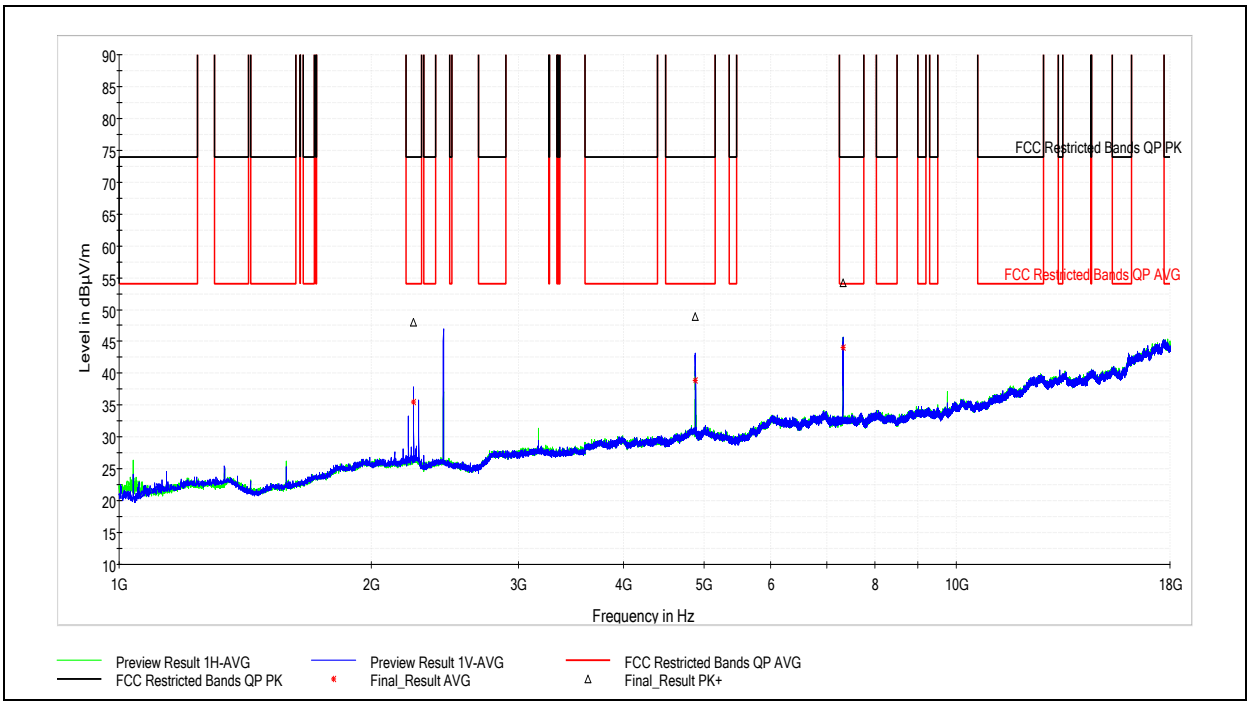
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2245.000000	48.33	73.98	25.65	1000.000	100.0	V	232.0	2.4
2277.000000	49.58	73.98	24.40	1000.000	100.0	V	232.0	2.5
4809.500000	49.59	73.98	24.39	1000.000	335.0	V	175.0	7.1

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2245.000000	36.78	53.98	17.20	1000.000	100.0	V	232.0	2.4
2277.000000	37.60	53.98	16.38	1000.000	100.0	V	232.0	2.5
4809.500000	39.39	53.98	14.59	1000.000	335.0	V	175.0	7.1

Test Personnel:	Brian Lackey	Test Date:	8/1/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.0C
Input Voltage:	120V/60Hz	Relative Humidity:	44.0%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	987.2mbar

Deviations, Additions, or Exclusions: None

7.7.7 Antenna 2, Channel 18 (2440MHz) Spurious Emissions, 1GHz-18GHz



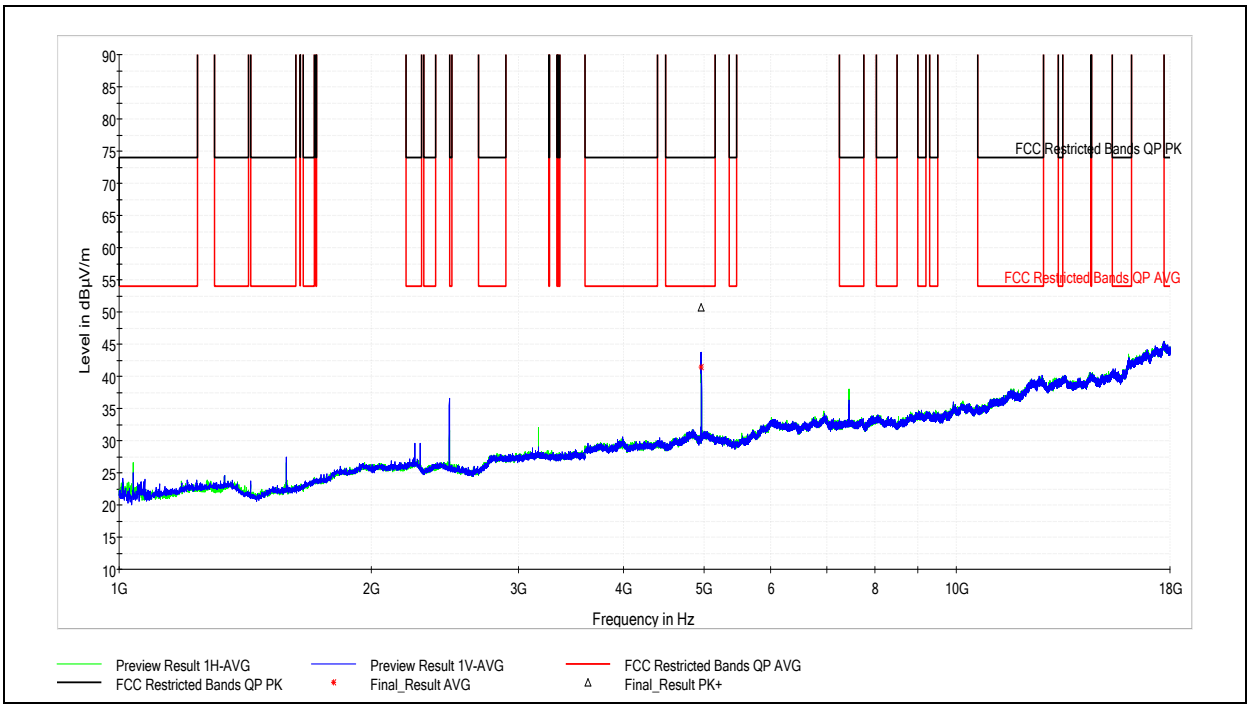
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2248.000000	48.01	73.98	25.97	1000.000	100.0	V	234.0	2.5
4879.500000	48.93	73.98	25.05	1000.000	349.0	V	179.0	7.1
7319.000000	54.24	73.98	19.74	1000.000	197.0	V	156.0	10.8

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2248.000000	35.53	53.98	18.45	1000.000	100.0	V	234.0	2.5
4879.500000	38.82	53.98	15.16	1000.000	349.0	V	179.0	7.1
7319.000000	44.10	53.98	9.88	1000.000	197.0	V	156.0	10.8

Test Personnel:	Brian Lackey	Test Date:	8/1/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.0C
Input Voltage:	120V/60Hz	Relative Humidity:	44.0%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	987.2mbar

Deviations, Additions, or Exclusions: None

7.7.8 Antenna 2, Channel 26 (2480MHz) Spurious Emissions, 1GHz-18GHz



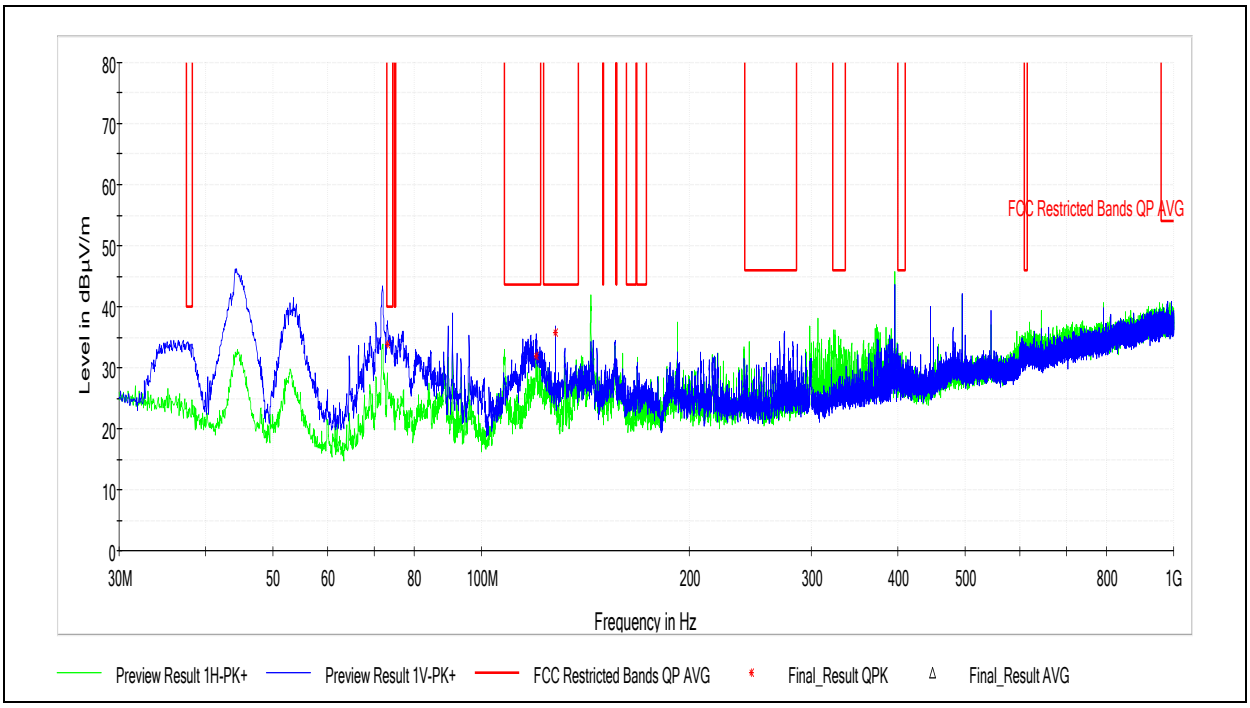
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4961.000000	50.75	73.98	23.23	1000.000	268.0	V	217.0	7.0

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4961.000000	41.45	53.98	12.53	1000.000	268.0	V	217.0	7.0

Test Personnel:	Brian Lackey	Test Date:	8/1/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.0C
Input Voltage:	120V/60Hz	Relative Humidity:	44.0%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	987.2mbar

Deviations, Additions, or Exclusions: None

7.7.9 Antenna 2, Spurious Emissions, 30MHz-1GHz

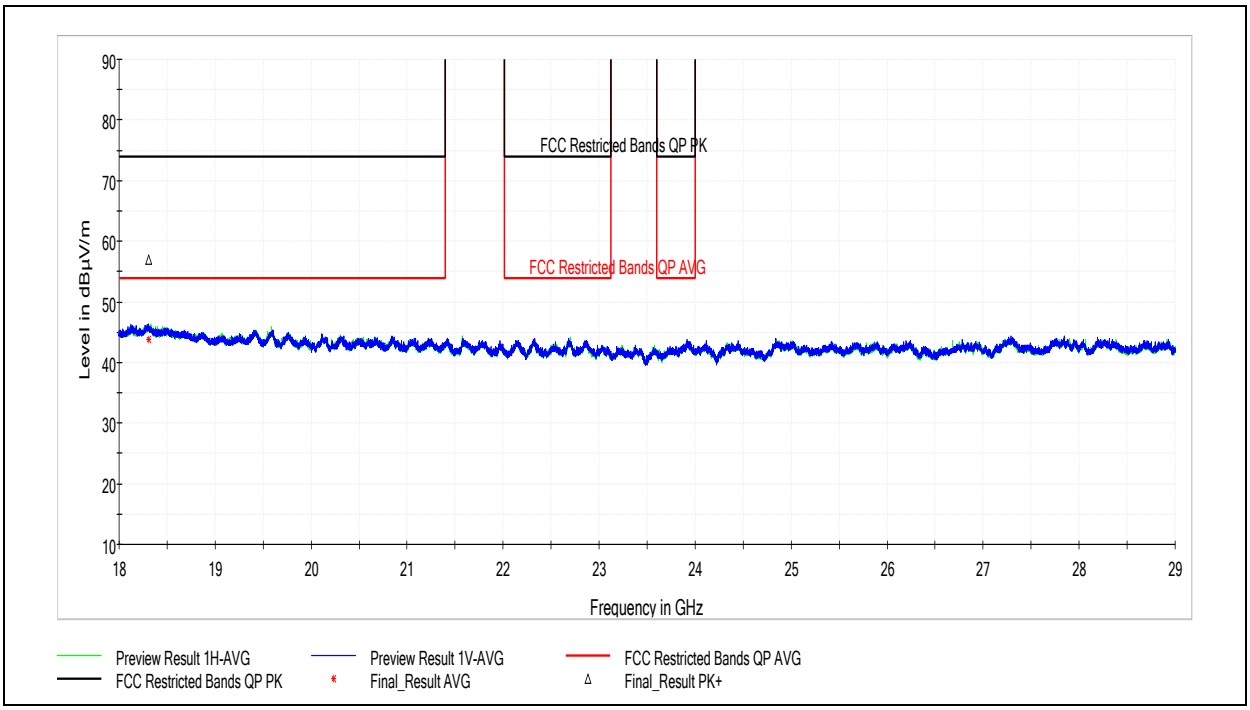


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
73.218889	33.84	40.00	6.16	120.000	100.3	V	313.0	14.9
120.048333	31.99	43.52	11.53	120.000	100.2	V	64.0	14.8
128.023889	35.69	43.52	7.83	120.000	104.6	V	127.0	14.7

Test Personnel:	Brian Lackey	Test Date:	8/8/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.3C
Input Voltage:	120V/60Hz	Relative Humidity:	43.6%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.2mbar

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

7.7.10 Antenna 2, Spurious Emissions, 18-29GHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18305.000000	56.93	73.98	17.05	1000.000	100.0	H	75.0	19.9

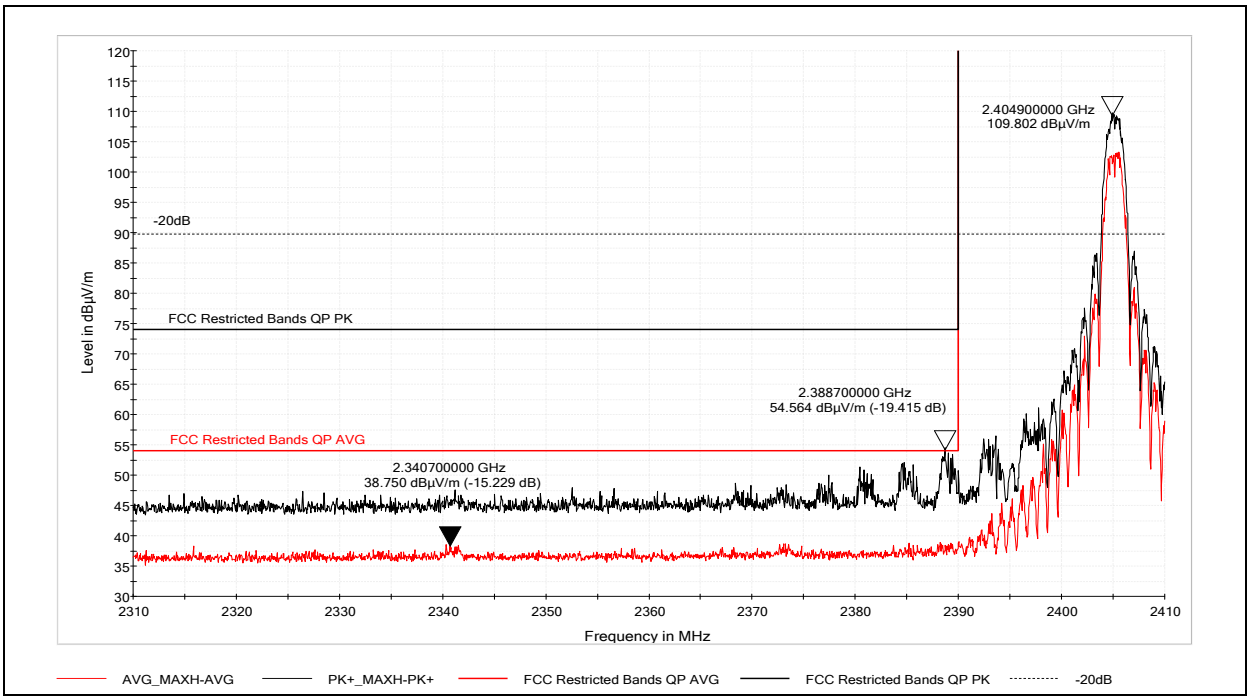
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18305.000000	43.85	53.98	10.13	1000.000	100.0	H	75.0	19.9

Test Personnel:	Brian Lackey	Test Date:	7/31/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.3C
Input Voltage:	120V/60Hz	Relative Humidity:	44.8%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	986.9mbar

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

7.7.11 Emissions at the Low Band Edge

7.7.11.1 Antenna 1, Channel 11 (2405MHz)



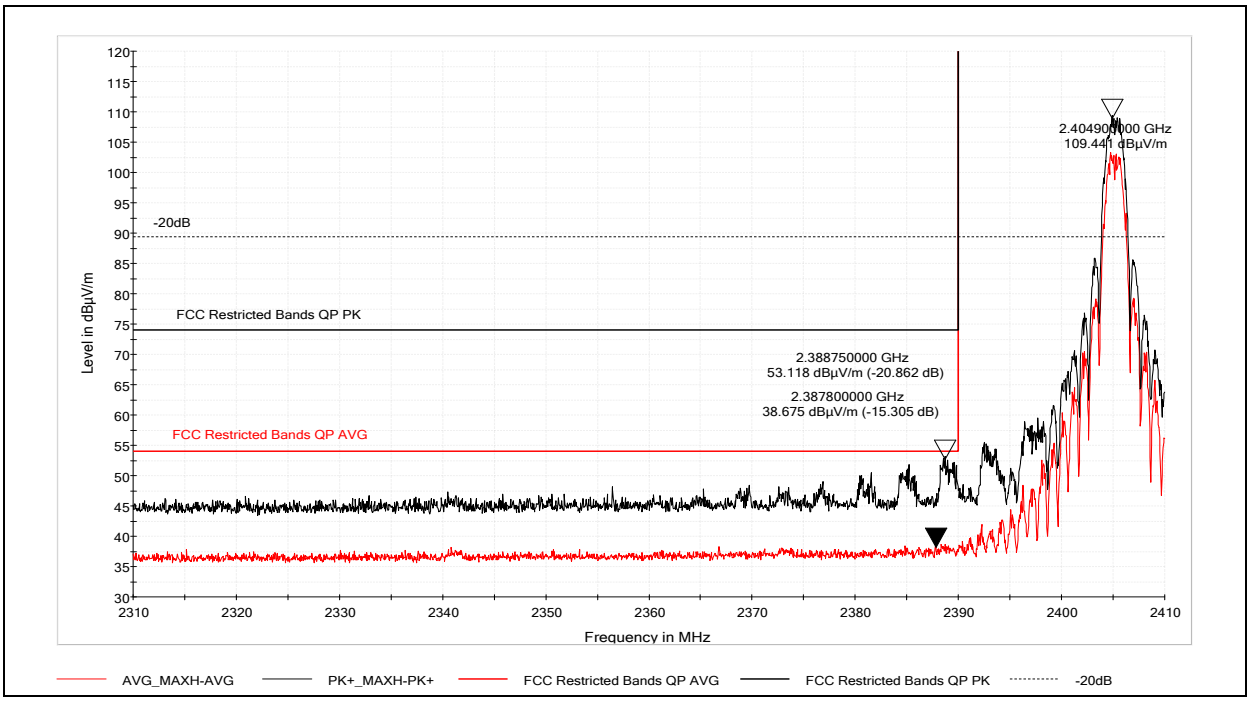
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2388.7	54.564	73.97	19.415

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2340.7	38.750	53.97	15.229

Test Personnel:	Brian Lackey	Test Date:	8/14/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.7C
Input Voltage:	120V/60Hz	Relative Humidity:	45.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.7mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation.

7.7.11.2 Antenna 2, Channel 11 (2405MHz)



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2388.75	53.118	73.97	20.862

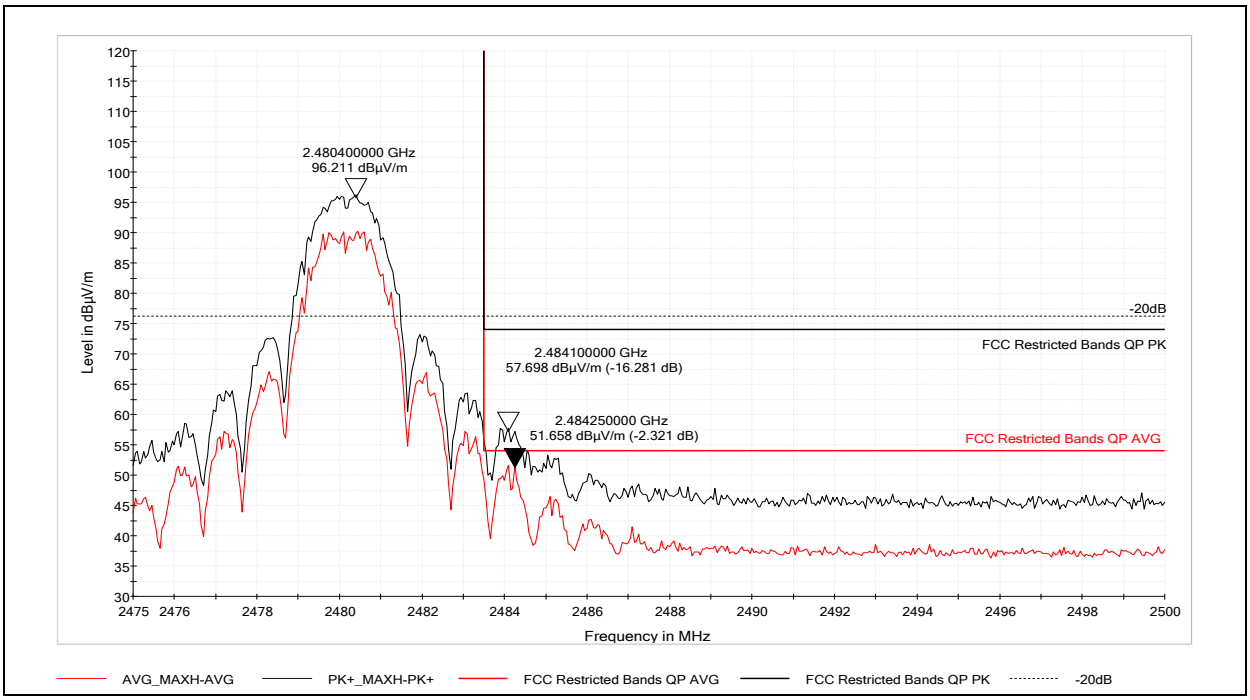
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2387.80	38.675	53.97	15.305

Test Personnel:	Brian Lackey	Test Date:	8/9/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.1C
Input Voltage:	120V/60Hz	Relative Humidity:	46.1%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	982.0mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation.

7.7.12 Emissions at the High Band Edge

7.7.12.1 Antenna 1, Channel 26 (2480MHz), Power Setting 6



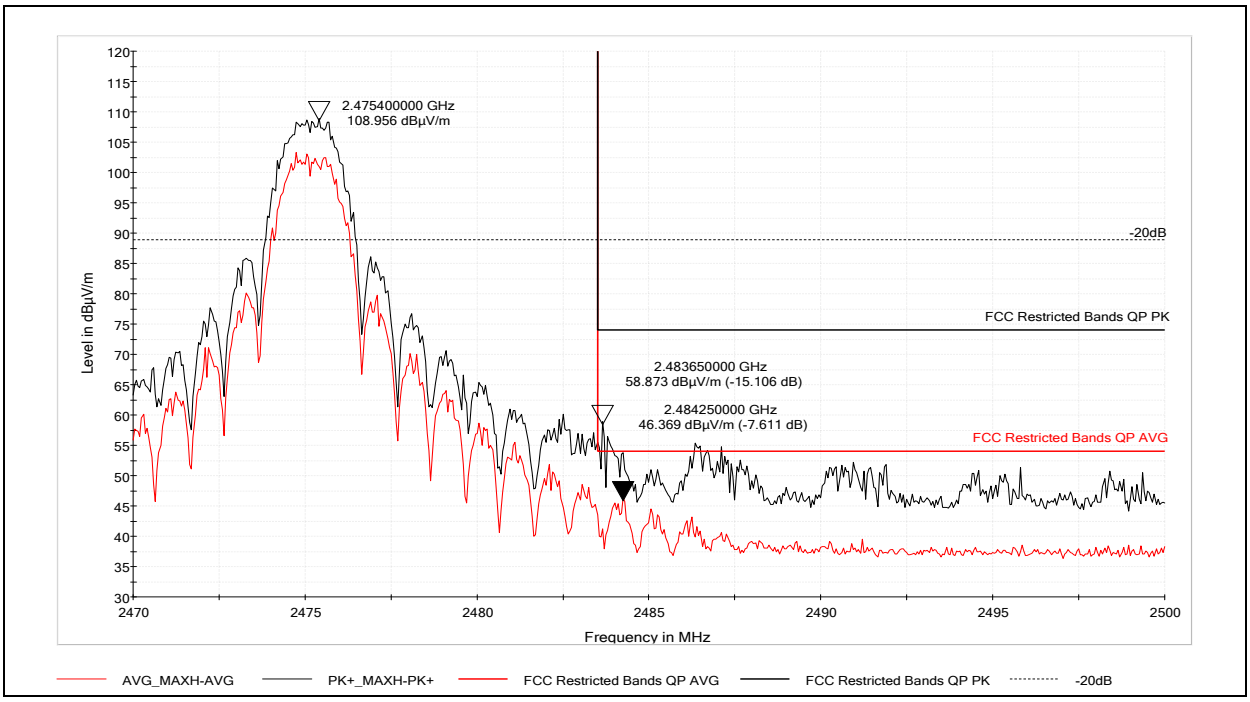
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.10	57.698	73.97	16.281

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.25	51.658	53.97	2.321

Test Personnel:	Brian Lackey	Test Date:	8/14/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.7C
Input Voltage:	120V/60Hz	Relative Humidity:	45.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.7mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation. Tested at a reduced output power level to meet average limit.

7.7.12.2 Antenna 1, Channel 25 (2475MHz), Power Setting 26



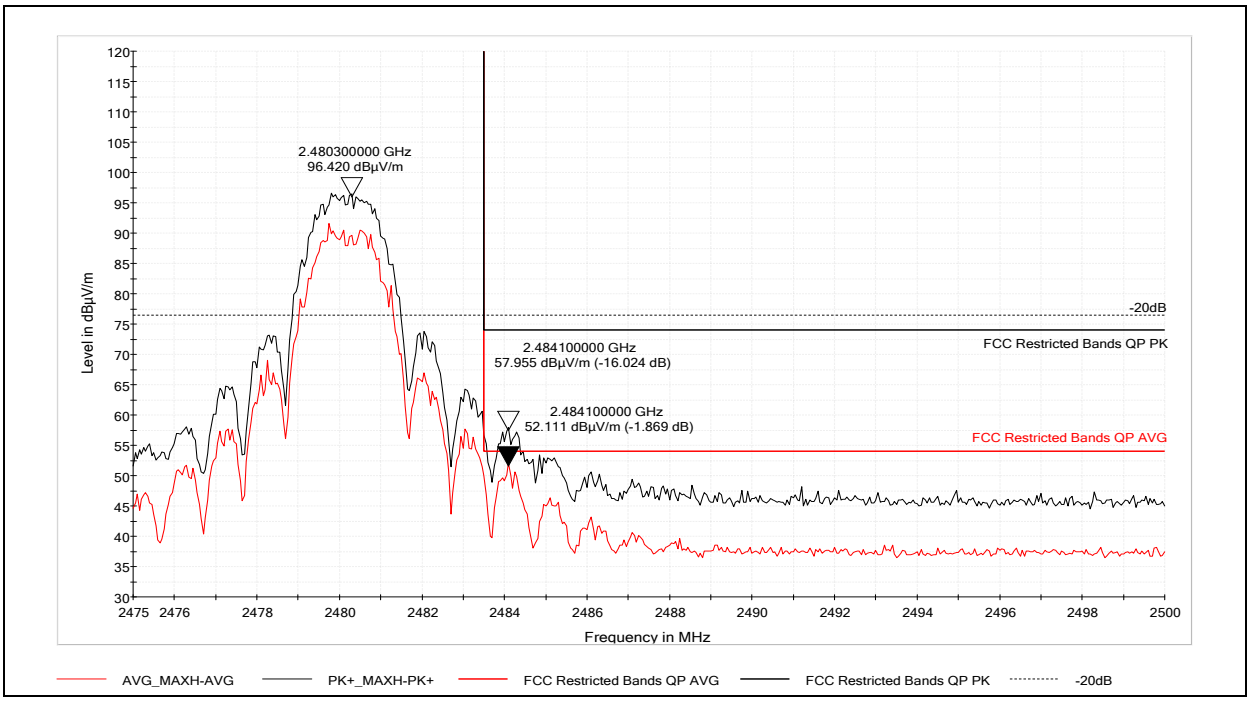
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2483.65	58.873	73.97	15.106

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.25	46.369	53.97	7.611

Test Personnel:	Brian Lackey	Test Date:	8/14/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.7C
Input Voltage:	120V/60Hz	Relative Humidity:	45.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.7mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation.

7.7.12.3 Antenna 2, Channel 26 (2480MHz), Power Setting 6



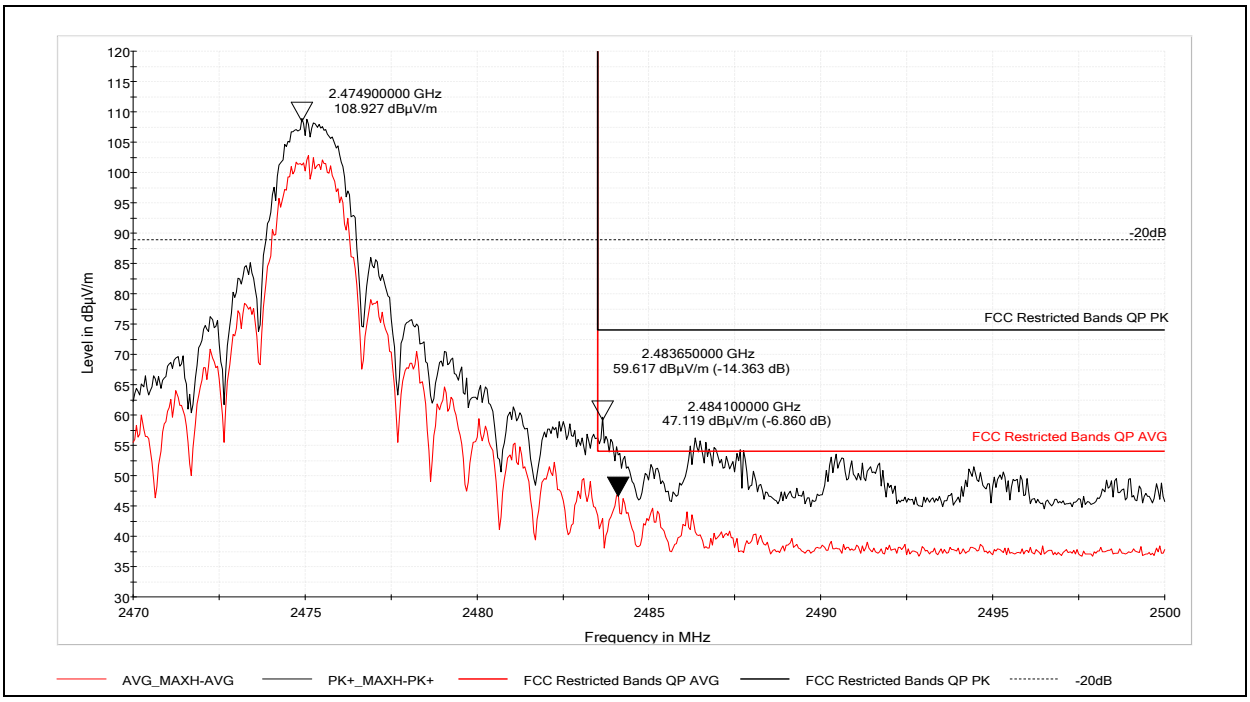
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.10	57.955	73.97	16.024

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.10	52.111	53.97	1.869

Test Personnel:	Brian Lackey	Test Date:	8/14/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.7C
Input Voltage:	120V/60Hz	Relative Humidity:	45.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.7mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation. Tested at a reduced output power level to meet average limit.

7.7.12.4 Antenna 2, Channel 25 (2475MHz), Power Setting 26



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2483.65	59.617	73.97	14.363

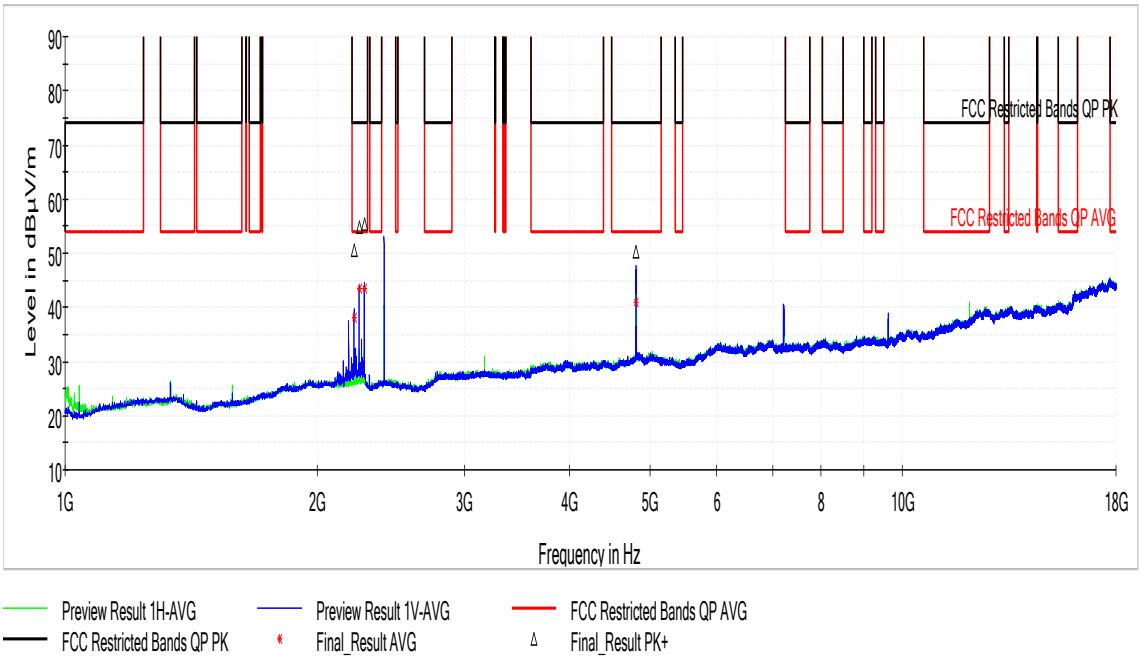
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.10	47.119	53.97	6.860

Test Personnel:	Brian Lackey	Test Date:	8/9/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.1C
Input Voltage:	120V/60Hz	Relative Humidity:	46.1%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	982.0mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation.

7.8 Mobile Mark (Comtelco) CMTB36247V Wall Mount Antenna

7.8.1 Antenna 1, Channel 11 (2405MHz) Spurious Emissions, 1GHz-18GHz



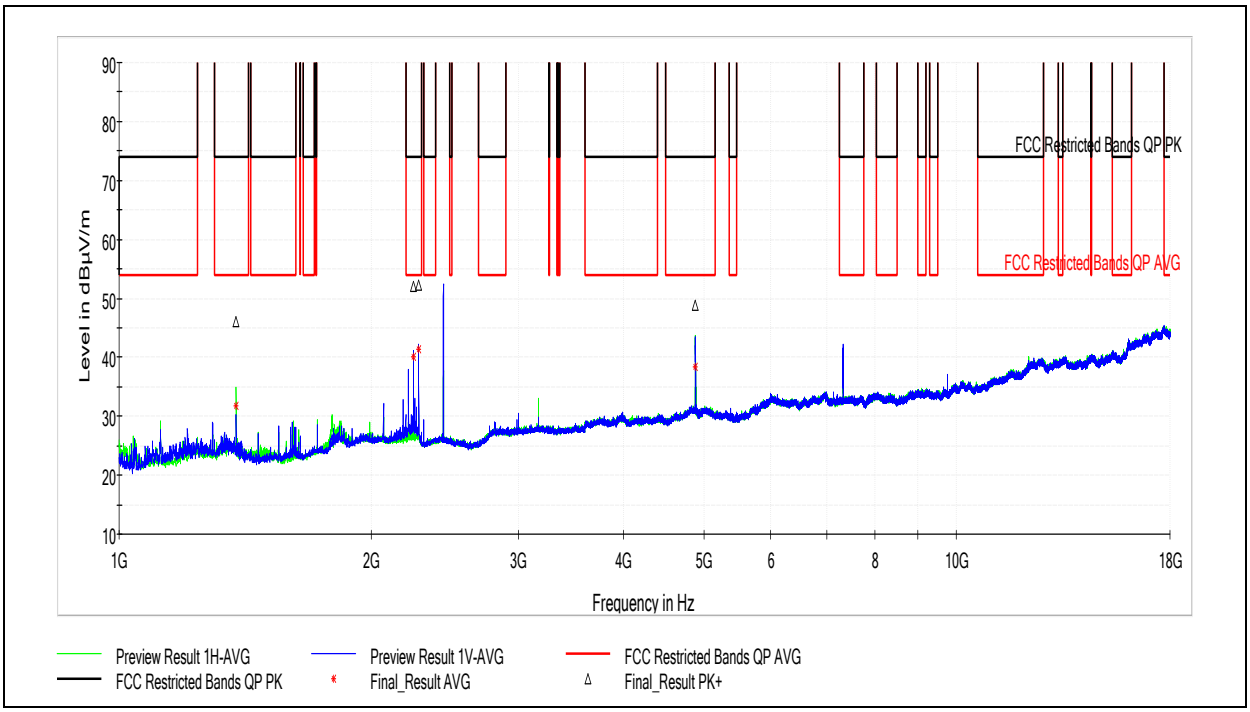
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2213.000000	50.54	73.98	23.44	1000.000	182.0	V	326.0	2.3
2245.000000	54.78	73.98	19.20	1000.000	187.0	V	331.0	2.4
2277.000000	55.25	73.98	18.73	1000.000	172.0	V	325.0	2.5
4811.000000	50.15	73.98	23.83	1000.000	143.0	V	0.0	7.1

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2213.000000	38.12	53.98	15.86	1000.000	182.0	V	326.0	2.3
2245.000000	43.35	53.98	10.63	1000.000	187.0	V	331.0	2.4
2277.000000	43.47	53.98	10.51	1000.000	172.0	V	325.0	2.5
4811.000000	40.85	53.98	13.13	1000.000	143.0	V	0.0	7.1

Test Personnel:	Brian Lackey	Test Date:	8/1/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.0C
Input Voltage:	120V/60Hz	Relative Humidity:	44.0%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	987.2mbar

Deviations, Additions, or Exclusions: None

7.8.2 Antenna 1, Channel 18 (2440MHz) Spurious Emissions, 1GHz-18GHz



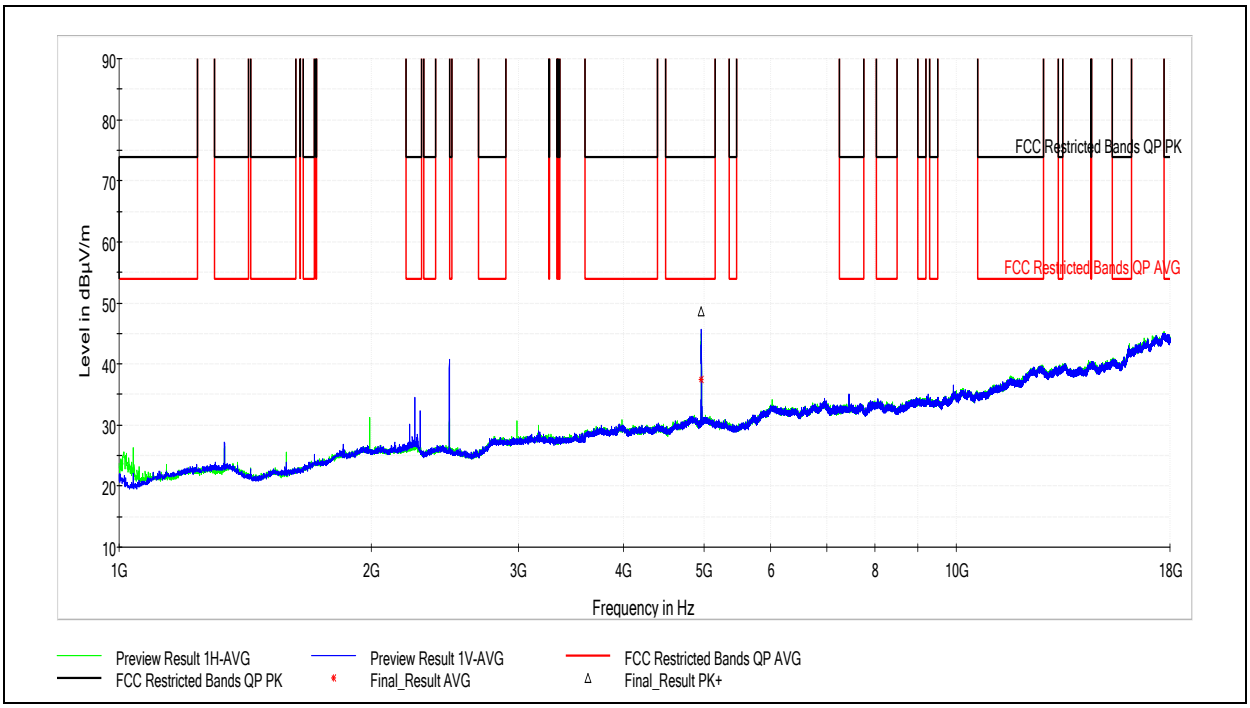
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1380.000000	46.14	73.98	27.84	1000.000	173.0	H	31.0	-1.6
2248.000000	51.98	73.98	22.00	1000.000	186.0	V	331.0	2.5
2280.000000	52.25	73.98	21.73	1000.000	178.0	V	325.0	2.4
4881.000000	48.73	73.98	25.25	1000.000	248.0	H	44.0	7.2

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1380.000000	31.85	53.98	22.13	1000.000	173.0	H	31.0	-1.6
2248.000000	40.18	53.98	13.80	1000.000	186.0	V	331.0	2.5
2280.000000	41.33	53.98	12.65	1000.000	178.0	V	325.0	2.4
4881.000000	38.38	53.98	15.60	1000.000	248.0	H	44.0	7.2

Test Personnel:	Brian Lackey	Test Date:	8/1/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.0C
Input Voltage:	120V/60Hz	Relative Humidity:	44.0%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	987.2mbar

Deviations, Additions, or Exclusions: None

7.8.3 Antenna 1, Channel 26 (2480MHz) Spurious Emissions, 1GHz-18GHz



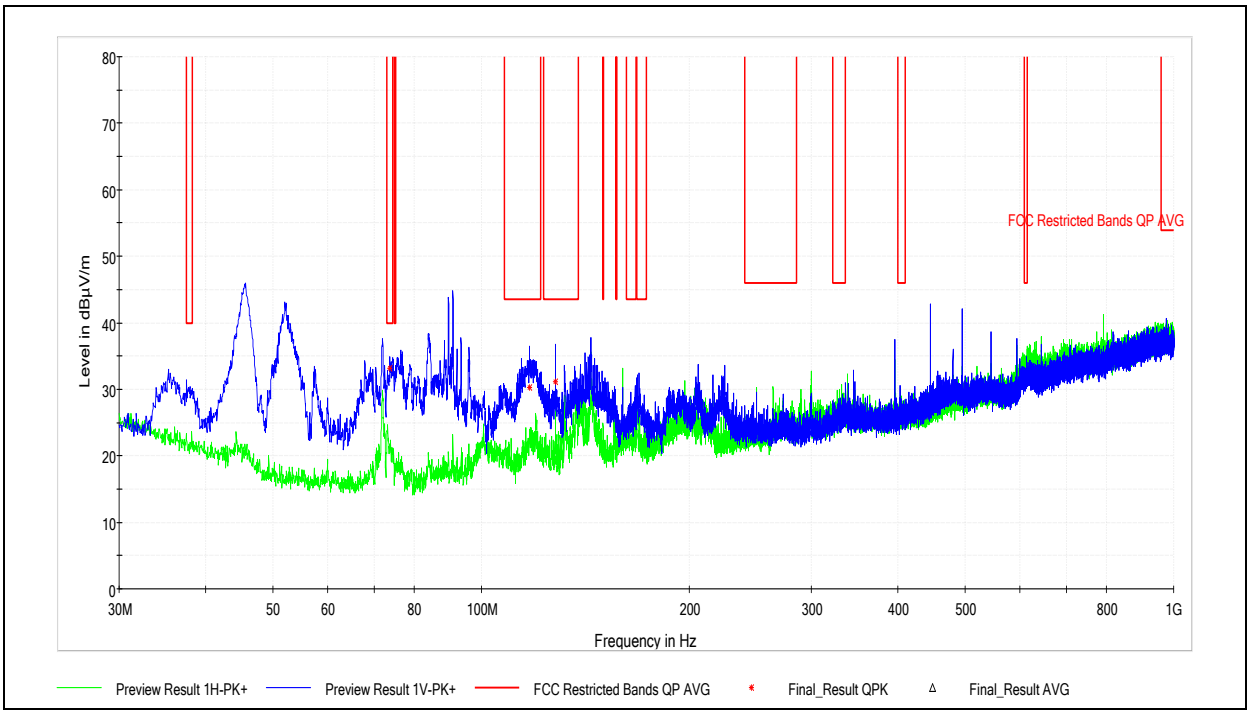
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4961.500000	48.71	73.98	25.27	1000.000	317.0	V	289.0	7.0

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4961.500000	37.54	53.98	16.44	1000.000	317.0	V	289.0	7.0

Test Personnel:	Brian Lackey	Test Date:	8/1/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.0C
Input Voltage:	120V/60Hz	Relative Humidity:	44.0%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	987.2mbar

Deviations, Additions, or Exclusions: None

7.8.4 Antenna 1, Spurious Emissions, 30MHz-1GHz

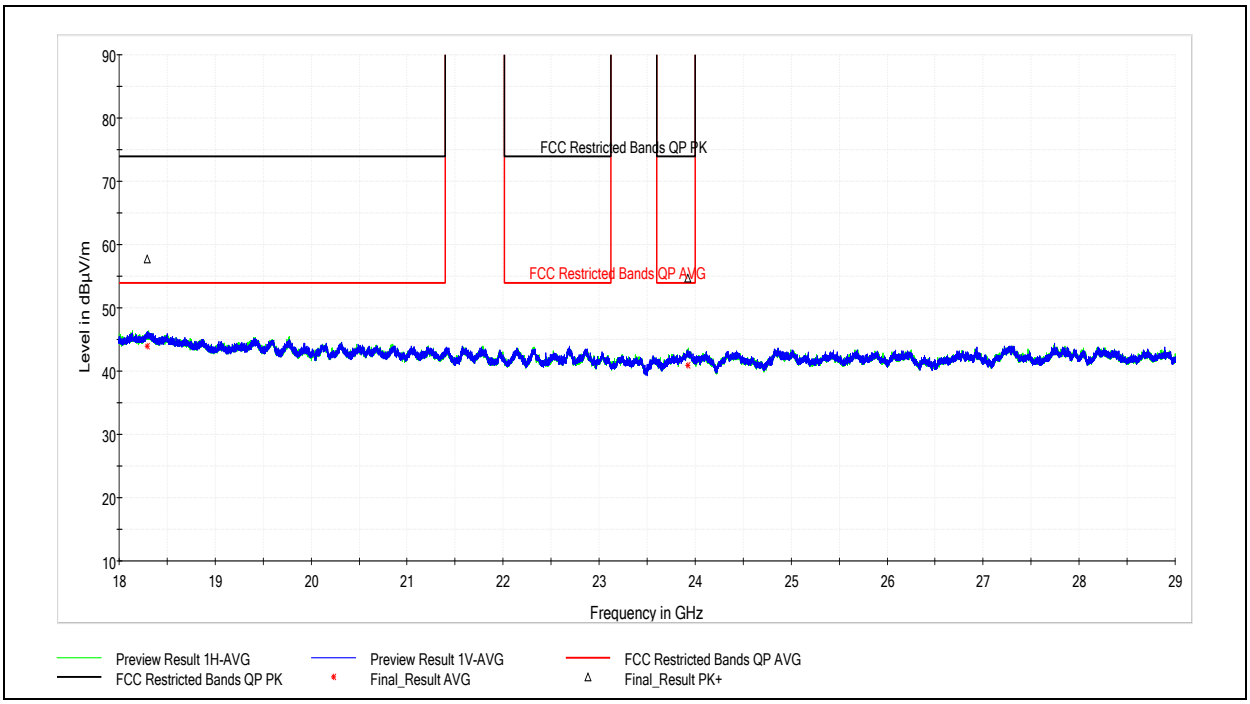


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
73.757778	33.20	40.00	6.80	120.000	104.9	V	66.0	14.9
117.407778	30.20	43.52	13.32	120.000	110.6	V	100.0	15.0
127.970000	31.08	43.52	12.44	120.000	100.3	V	291.0	14.7

Test Personnel:	Brian Lackey	Test Date:	8/8/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.3C
Input Voltage:	120V/60Hz	Relative Humidity:	43.6%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.2mbar

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

7.8.5 Antenna 1, Spurious Emissions, 18-29GHz



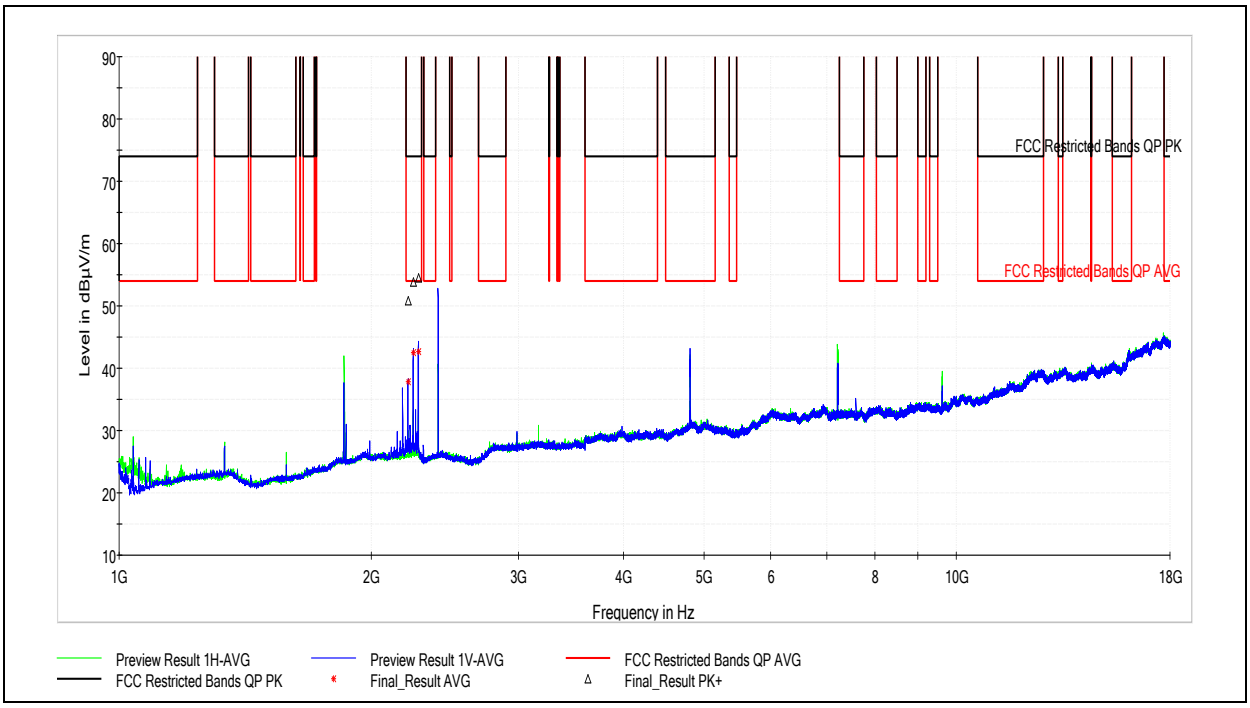
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18289.000000	57.66	73.98	16.32	1000.000	100.0	H	-1.0	20.0
23927.500000	54.69	73.98	19.29	1000.000	100.0	H	192.0	6.0

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18289.000000	43.96	53.98	10.02	1000.000	100.0	H	-1.0	20.0
23927.500000	40.89	53.98	13.09	1000.000	100.0	H	192.0	6.0

Test Personnel:	Brian Lackey	Test Date:	7/31/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.3C
Input Voltage:	120V/60Hz	Relative Humidity:	44.8%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	986.9mbar

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

7.8.6 Antenna 2, Channel 11 (2405MHz) Spurious Emissions, 1GHz-18GHz



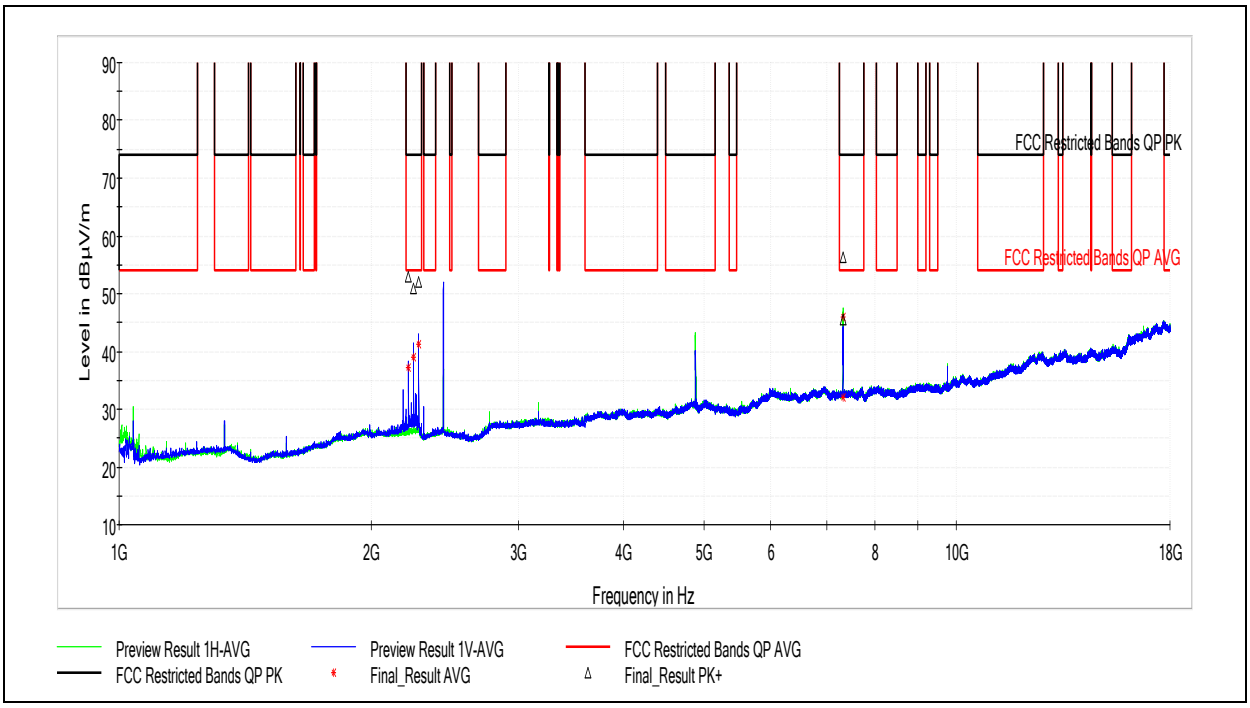
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2213.000000	50.88	73.98	23.10	1000.000	187.0	V	346.0	2.3
2245.000000	53.81	73.98	20.17	1000.000	187.0	V	342.0	2.4
2277.000000	54.48	73.98	19.50	1000.000	180.0	V	340.0	2.5

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2213.000000	37.84	53.98	16.14	1000.000	187.0	V	346.0	2.3
2245.000000	42.48	53.98	11.50	1000.000	187.0	V	342.0	2.4
2277.000000	42.63	53.98	11.35	1000.000	180.0	V	340.0	2.5

Test Personnel:	Brian Lackey	Test Date:	8/1/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.0C
Input Voltage:	120V/60Hz	Relative Humidity:	44.0%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	987.2mbar

Deviations, Additions, or Exclusions: None

7.8.7 Antenna 2, Channel 18 (2440MHz) Spurious Emissions, 1GHz-18GHz



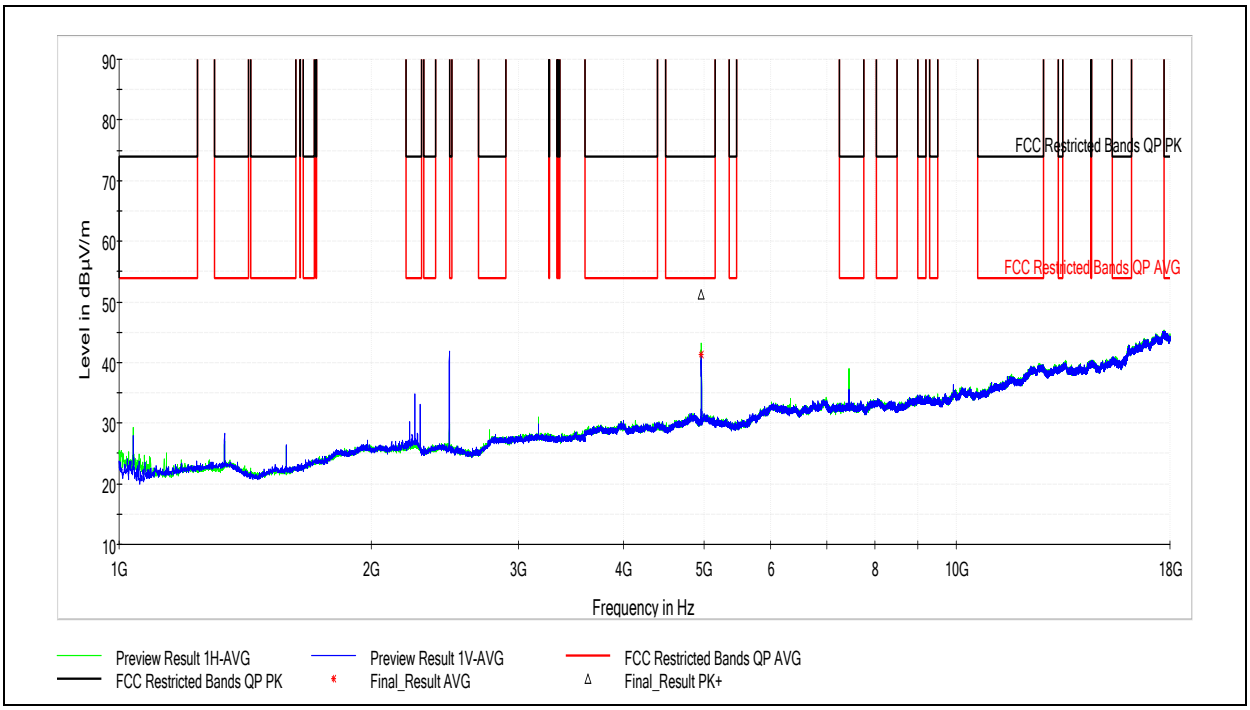
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2216.000000	52.82	73.98	21.16	1000.000	216.0	V	1.0	2.3
2248.000000	50.86	73.98	23.12	1000.000	205.0	V	359.0	2.5
2280.000000	52.06	73.98	21.92	1000.000	179.0	V	347.0	2.4
7319.000000	45.49	73.98	28.49	1000.000	162.0	H	147.0	10.9
7322.000000	56.25	73.98	17.73	1000.000	198.0	H	165.0	10.8

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2216.000000	37.20	53.98	16.78	1000.000	216.0	V	1.0	2.3
2248.000000	38.98	53.98	15.00	1000.000	205.0	V	359.0	2.5
2280.000000	41.28	53.98	12.70	1000.000	179.0	V	347.0	2.4
7319.000000	32.02	53.98	21.96	1000.000	162.0	H	147.0	10.9
7322.000000	46.06	53.98	7.92	1000.000	198.0	H	165.0	10.8

Test Personnel:	Brian Lackey	Test Date:	8/1/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.0C
Input Voltage:	120V/60Hz	Relative Humidity:	44.0%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	987.2mbar

Deviations, Additions, or Exclusions: None

7.8.8 Antenna 2, Channel 26 (2480MHz) Spurious Emissions, 1GHz-18GHz



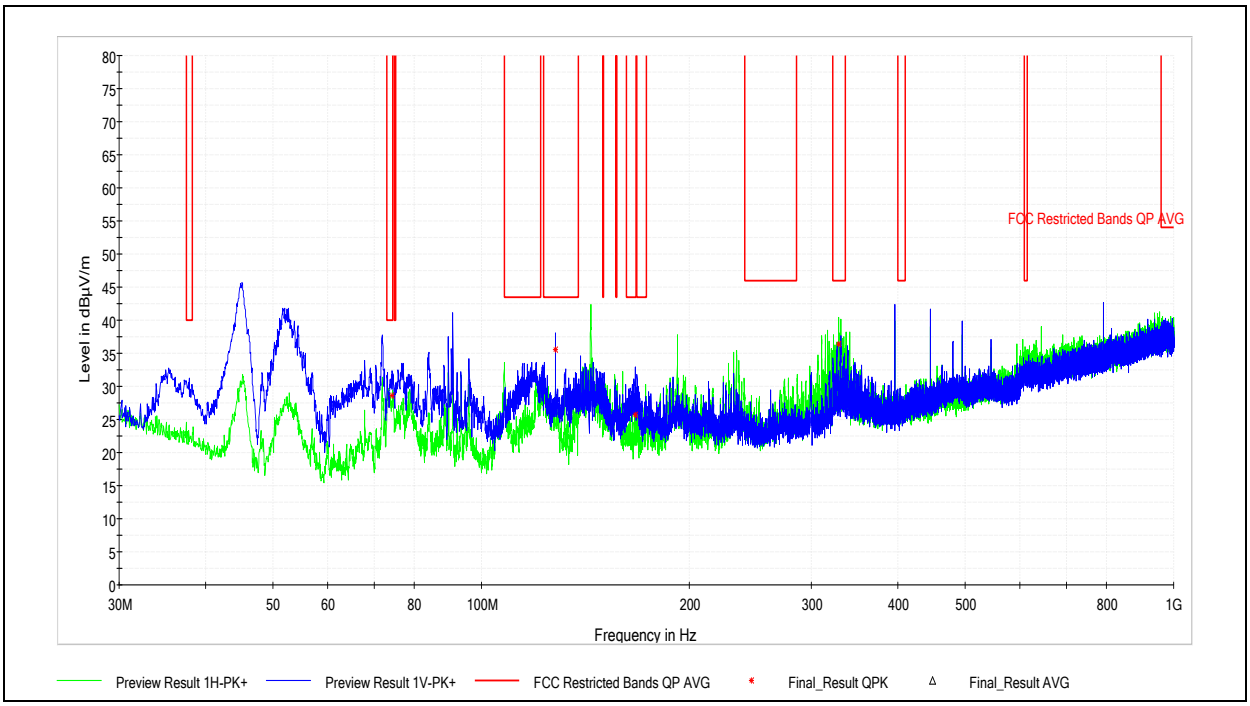
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4961.500000	51.19	73.98	22.79	1000.000	236.0	H	86.0	7.1

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4961.500000	41.26	53.98	12.72	1000.000	236.0	H	86.0	7.1

Test Personnel:	Brian Lackey	Test Date:	8/1/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.0C
Input Voltage:	120V/60Hz	Relative Humidity:	44.0%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	987.2mbar

Deviations, Additions, or Exclusions: None

7.8.9 Antenna 2, Spurious Emissions, 30MHz-1GHz

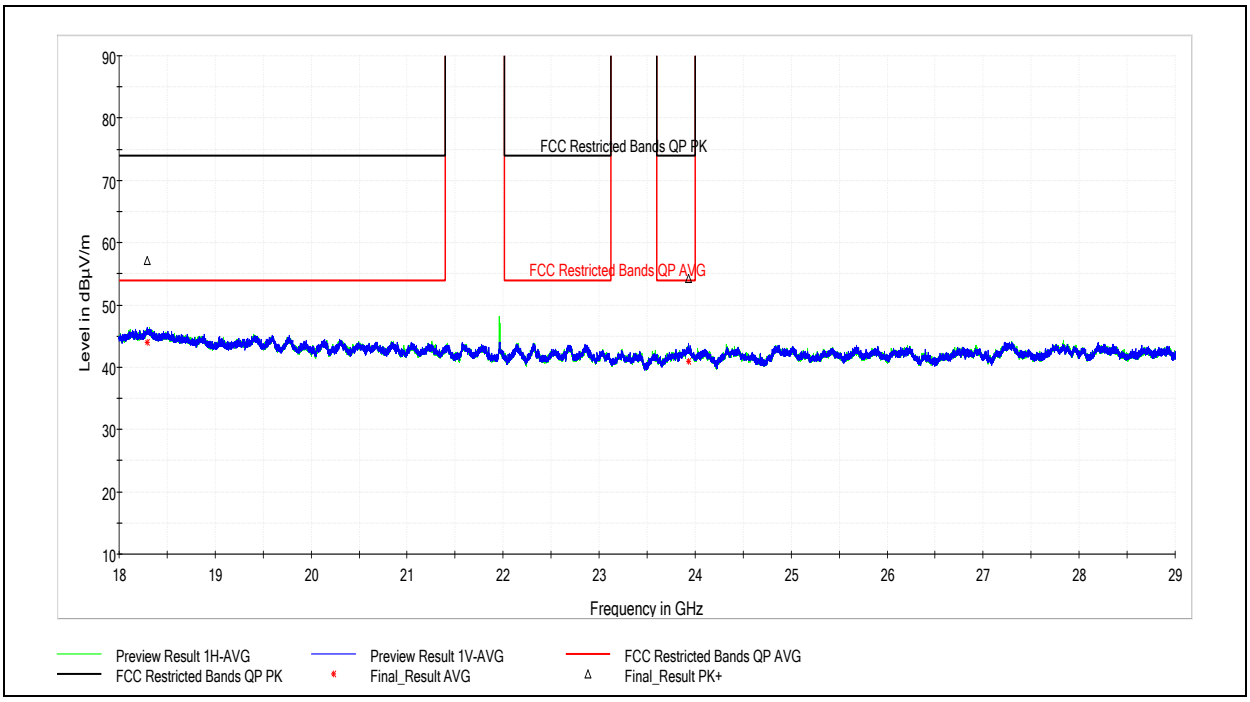


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
74.404445	28.56	40.00	11.44	120.000	100.2	V	137.0	14.9
127.970000	35.55	43.52	7.97	120.000	104.9	V	286.0	14.7
166.931667	25.72	43.52	17.80	120.000	104.9	V	183.0	17.6
328.544445	36.41	46.02	9.61	120.000	100.2	H	145.0	23.8

Test Personnel:	Brian Lackey	Test Date:	8/8/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.3C
Input Voltage:	120V/60Hz	Relative Humidity:	43.6%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.2mbar

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

7.8.10 Antenna 2, Spurious Emissions, 18-29GHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18289.500000	57.17	73.98	16.81	1000.000	100.0	V	32.0	20.1
23932.500000	54.23	73.98	19.75	1000.000	323.0	V	0.0	5.9

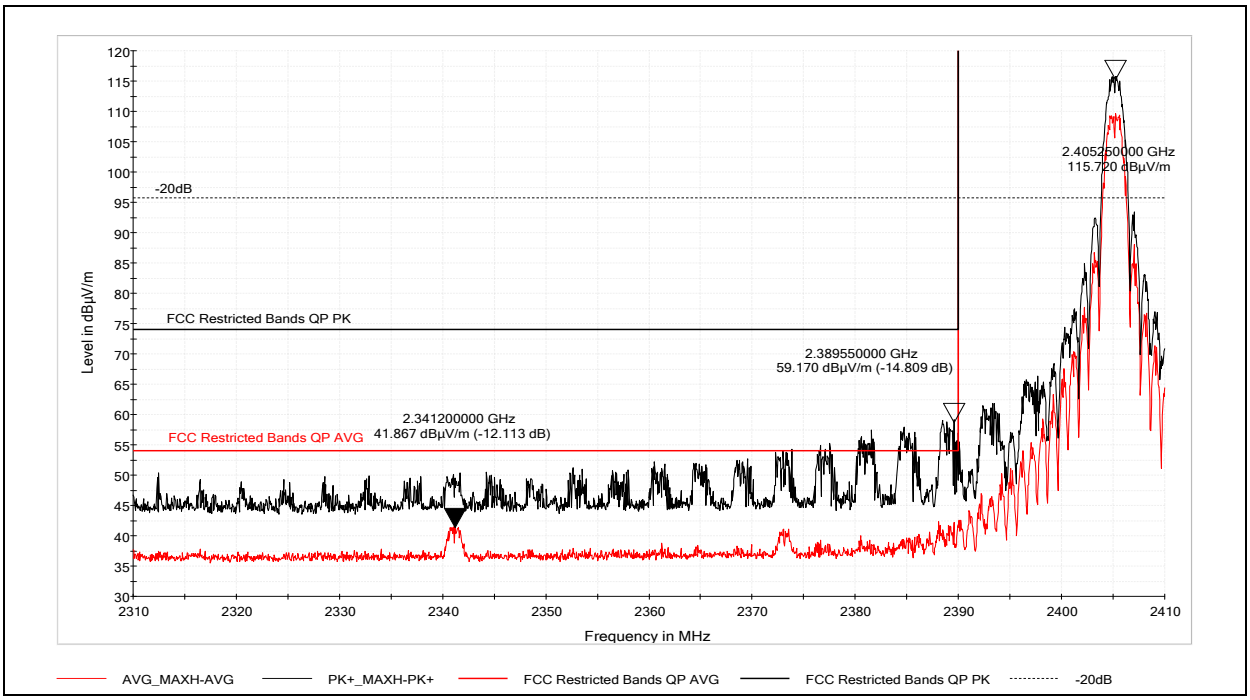
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18289.500000	43.94	53.98	10.04	1000.000	100.0	V	32.0	20.1
23932.500000	40.94	53.98	13.04	1000.000	323.0	V	0.0	5.9

Test Personnel:	Brian Lackey	Test Date:	7/31/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.3C
Input Voltage:	120V/60Hz	Relative Humidity:	44.8%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	986.9mbar

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

7.8.11 Emissions at the Low Band Edge

7.8.11.1 Antenna 1, Channel 11 (2405MHz)



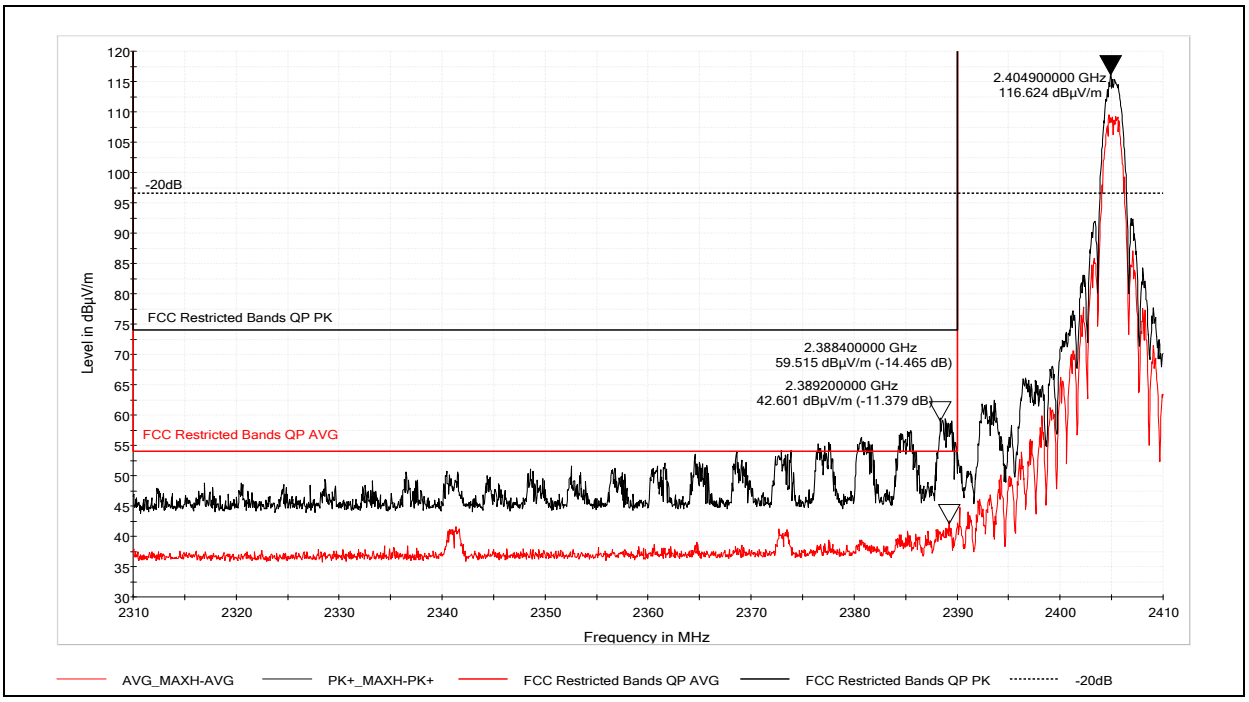
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2389.55	59.170	73.97	14.809

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2341.20	41.867	53.97	12.113

Test Personnel:	Brian Lackey	Test Date:	8/14/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.7C
Input Voltage:	120V/60Hz	Relative Humidity:	45.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.7mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation.

7.8.11.2 Antenna 2, Channel 11 (2405MHz)



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2388.40	59.515	73.97	14.465

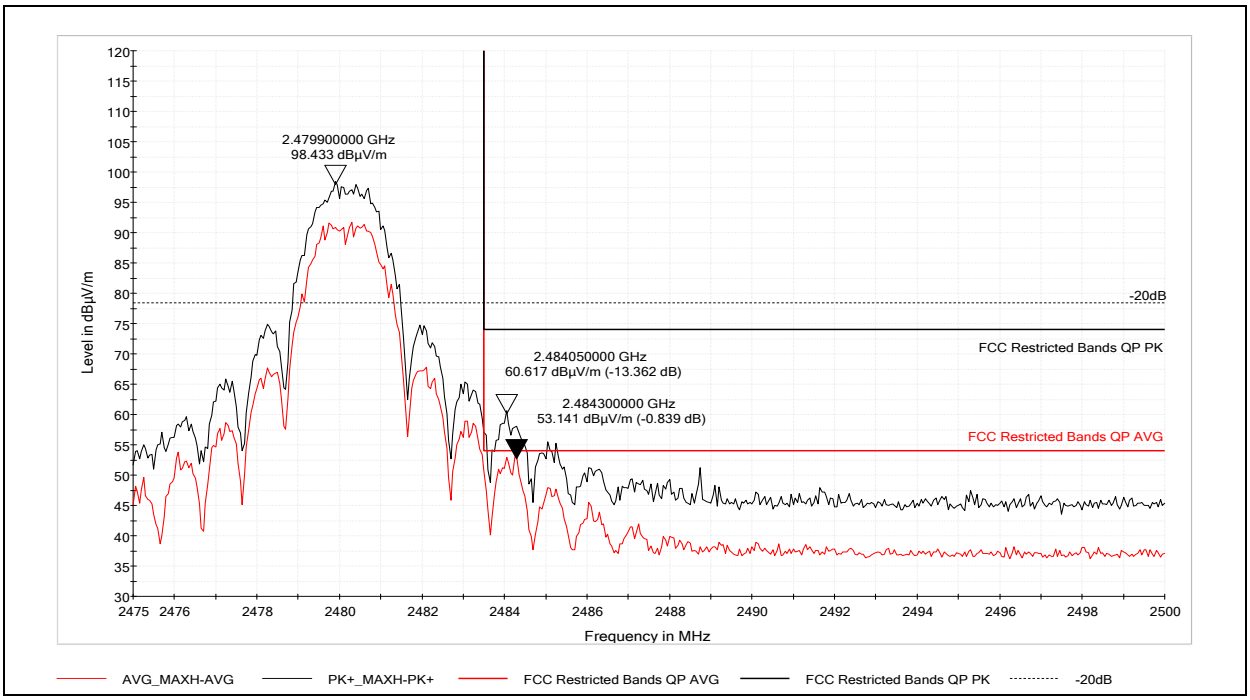
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2389.20	42.601	53.97	11.379

Test Personnel:	Brian Lackey	Test Date:	8/9/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.1C
Input Voltage:	120V/60Hz	Relative Humidity:	46.1%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	982.0mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation.

7.8.12 Emissions at the High Band Edge

7.8.12.1 Antenna 1, Channel 26 (2480MHz), Power Setting 4



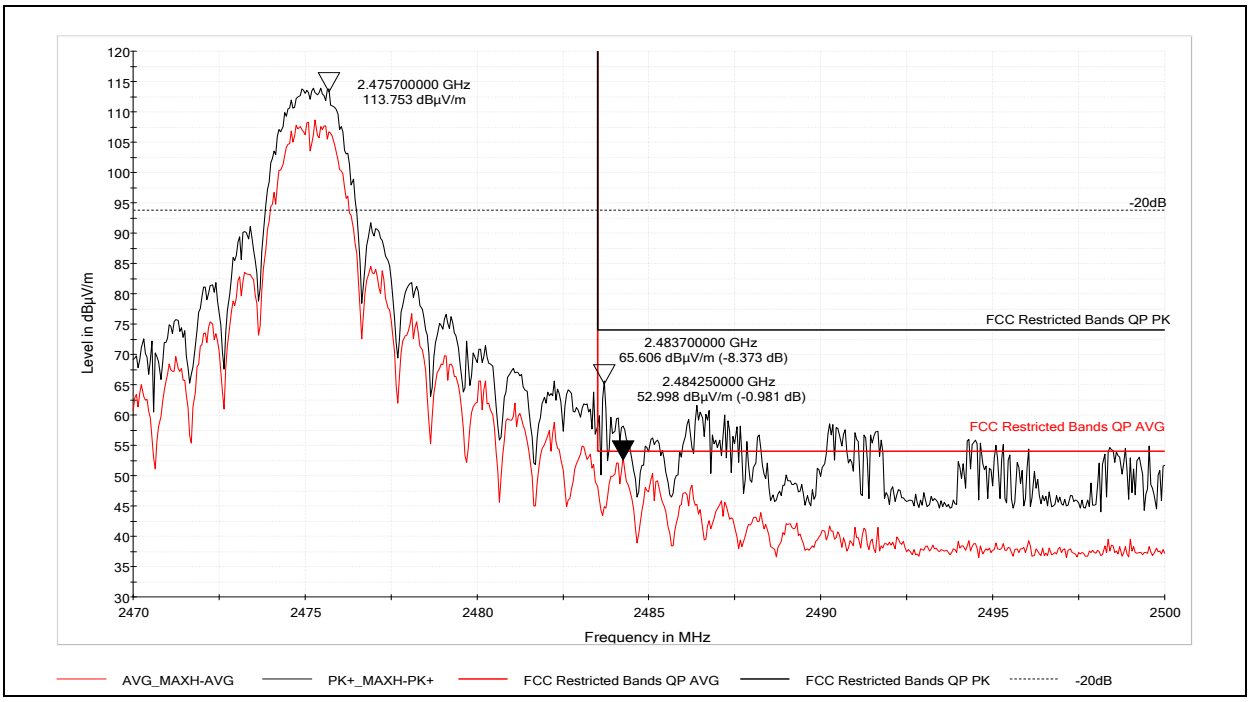
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.05	60.617	73.97	13.362

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.30	53.141	53.97	0.839

Test Personnel:	Brian Lackey	Test Date:	8/14/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.7C
Input Voltage:	120V/60Hz	Relative Humidity:	45.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.7mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation. Tested at a reduced output power level to meet average limit.

7.8.12.2 Antenna 1, Channel 25 (2475MHz), Power Setting 26



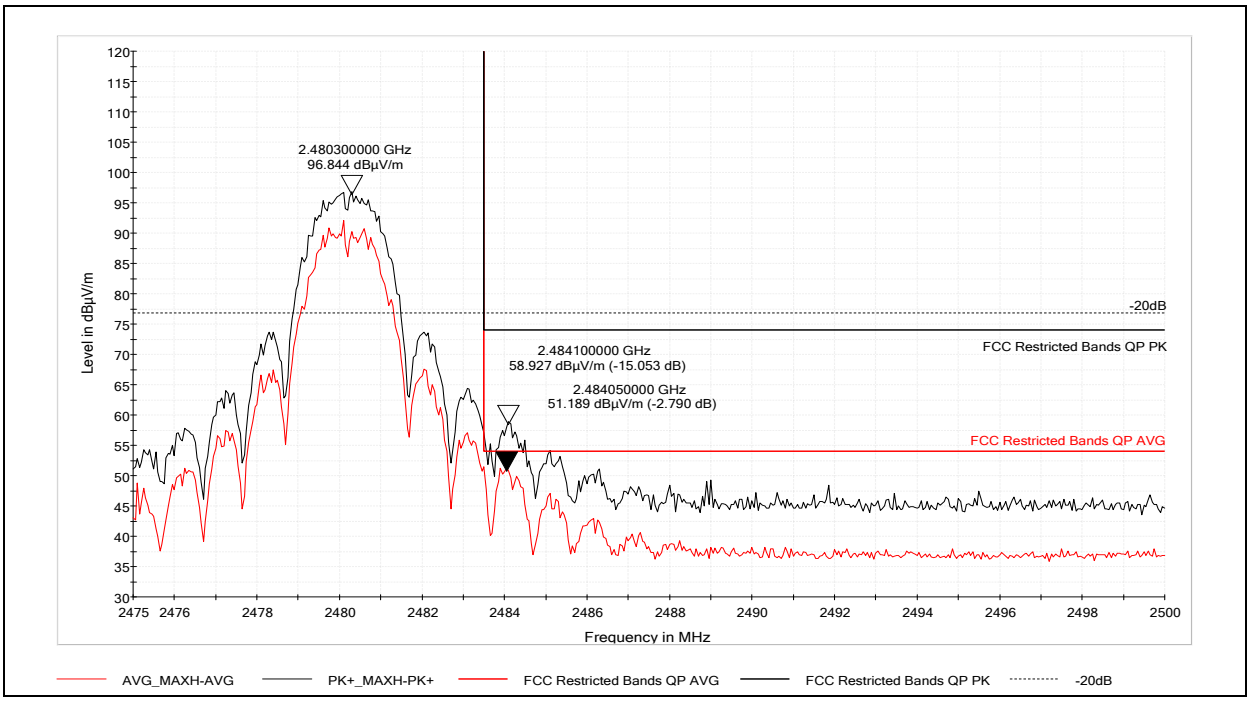
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2483.70	**65.606**	**73.97**	**8.373**

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.25	**52.998**	**53.97**	**0.981**

Test Personnel:	Brian Lackey	Test Date:	8/14/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.7C
Input Voltage:	120V/60Hz	Relative Humidity:	45.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.7mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation.

7.8.12.3 Antenna 2, Channel 26 (2480MHz), Power Setting 4



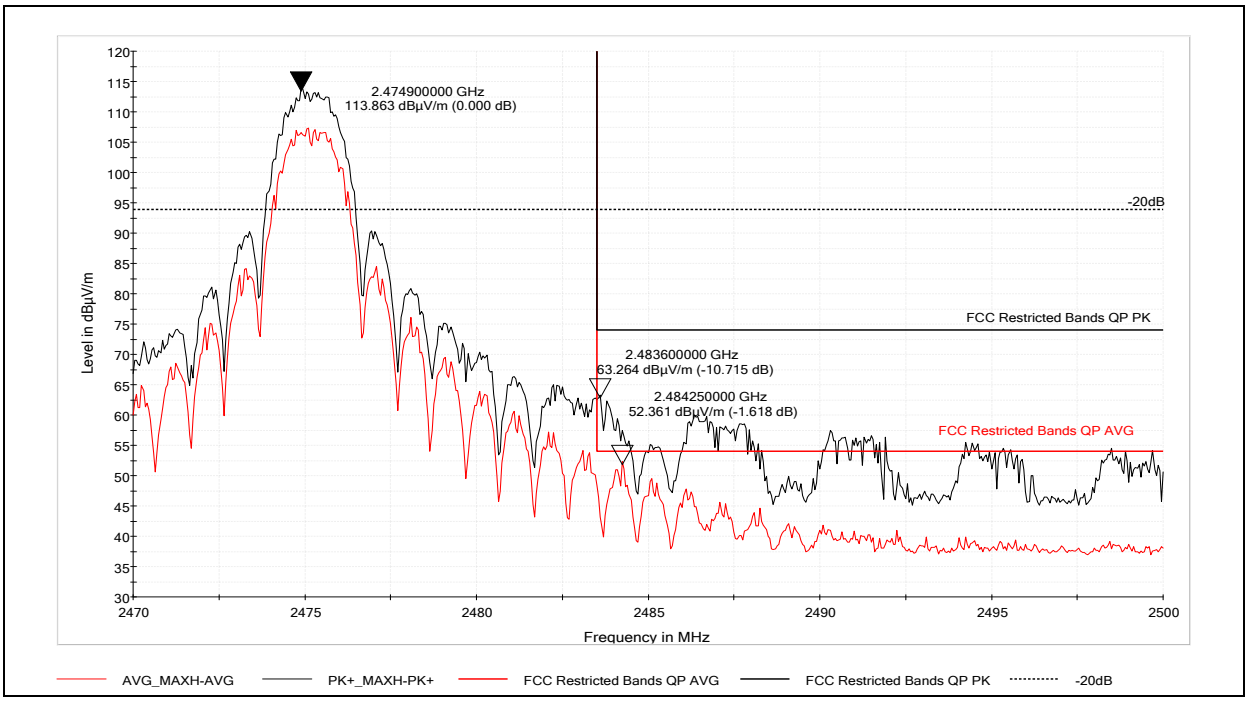
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.10	58.927	73.97	15.053

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.05	51.189	53.97	2.790

Test Personnel:	Brian Lackey	Test Date:	8/14/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.7C
Input Voltage:	120V/60Hz	Relative Humidity:	45.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.7mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation. Tested at a reduced output power level to meet average limit.

7.8.12.4 Antenna 2, Channel 25 (2475MHz), Power Setting 26



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2483.60	63.264	73.97	10.715

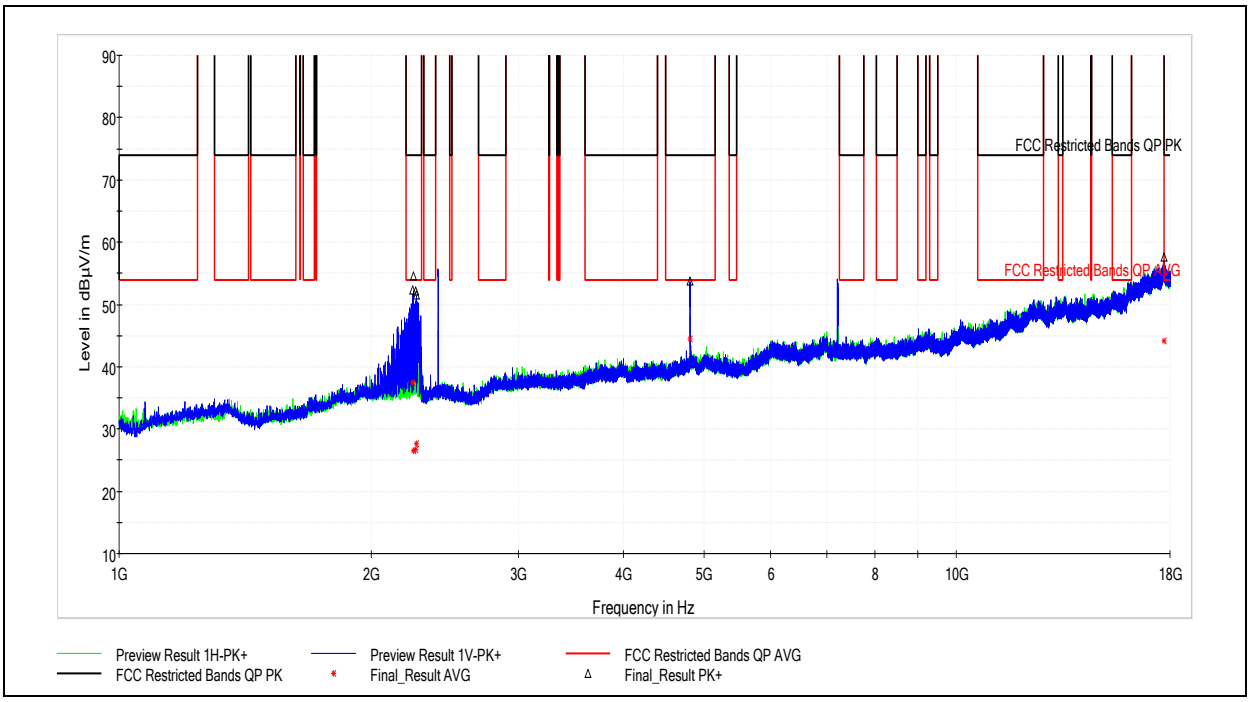
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.25	52.361	53.97	1.618

Test Personnel:	Brian Lackey	Test Date:	8/9/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.1C
Input Voltage:	120V/60Hz	Relative Humidity:	46.1%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	982.0mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation.

7.9 Mobile Mark (Comntelco) CMTBS2400XL3 Omnidirectional Antenna

7.9.1 Antenna 1, Channel 11 (2405MHz) Spurious Emissions, 1GHz-18GHz



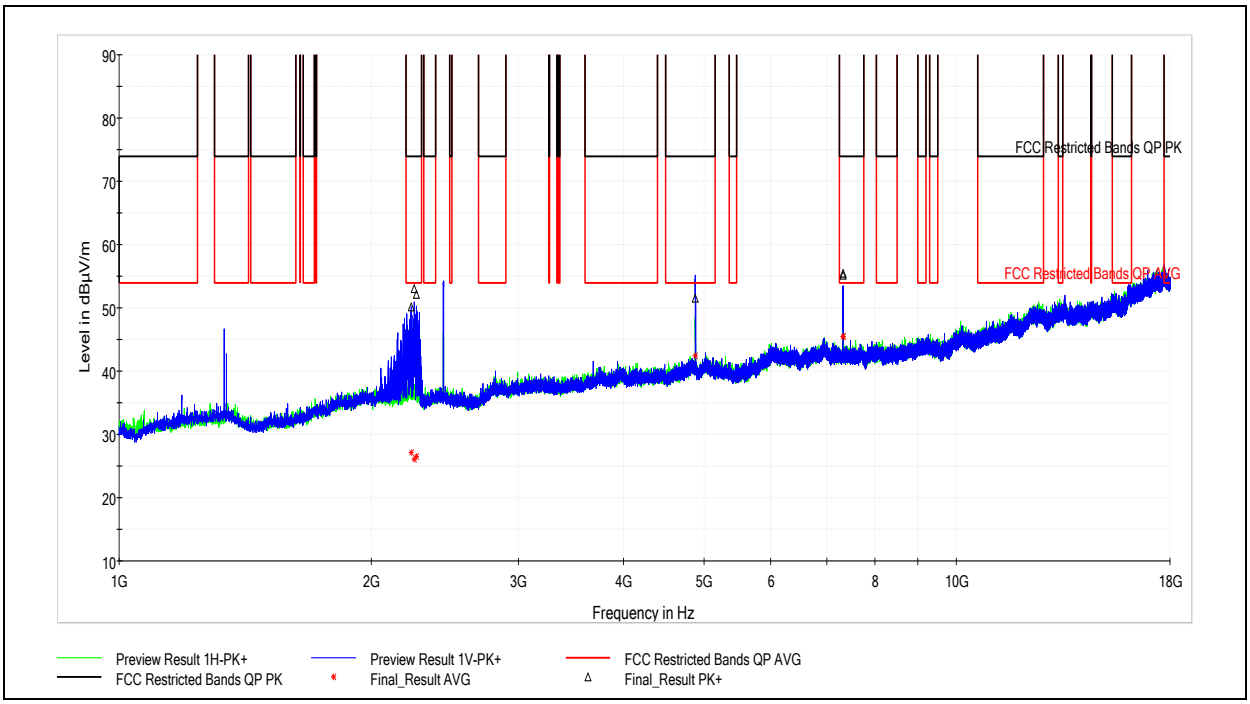
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2244.500000	52.27	73.98	21.71	1000.000	100.0	V	304.0	2.4
2248.500000	54.55	73.98	19.43	1000.000	100.0	V	310.0	2.5
2260.000000	52.09	73.98	21.89	1000.000	100.0	V	317.0	2.5
2267.000000	51.54	73.98	22.44	1000.000	100.0	V	309.0	2.5
4811.500000	53.74	73.98	20.24	1000.000	375.0	V	0.0	7.1
17715.000000	57.60	73.98	16.38	1000.000	410.0	V	310.0	25.1

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2244.500000	37.42	53.98	16.56	1000.000	100.0	V	304.0	2.4
2248.500000	26.45	53.98	27.53	1000.000	100.0	V	310.0	2.5
2260.000000	26.67	53.98	27.31	1000.000	100.0	V	317.0	2.5
2267.000000	27.63	53.98	26.35	1000.000	100.0	V	309.0	2.5
4811.500000	44.41	53.98	9.57	1000.000	375.0	V	0.0	7.1
17715.000000	44.18	53.98	9.80	1000.000	410.0	V	310.0	25.1

Test Personnel:	Brian Lackey	Test Date:	7/30/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.7C
Input Voltage:	120V/60Hz	Relative Humidity:	53.5%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	984.8mbar

Deviations, Additions, or Exclusions: None

7.9.2 Antenna 1, Channel 18 (2440MHz) Spurious Emissions, 1GHz-18GHz



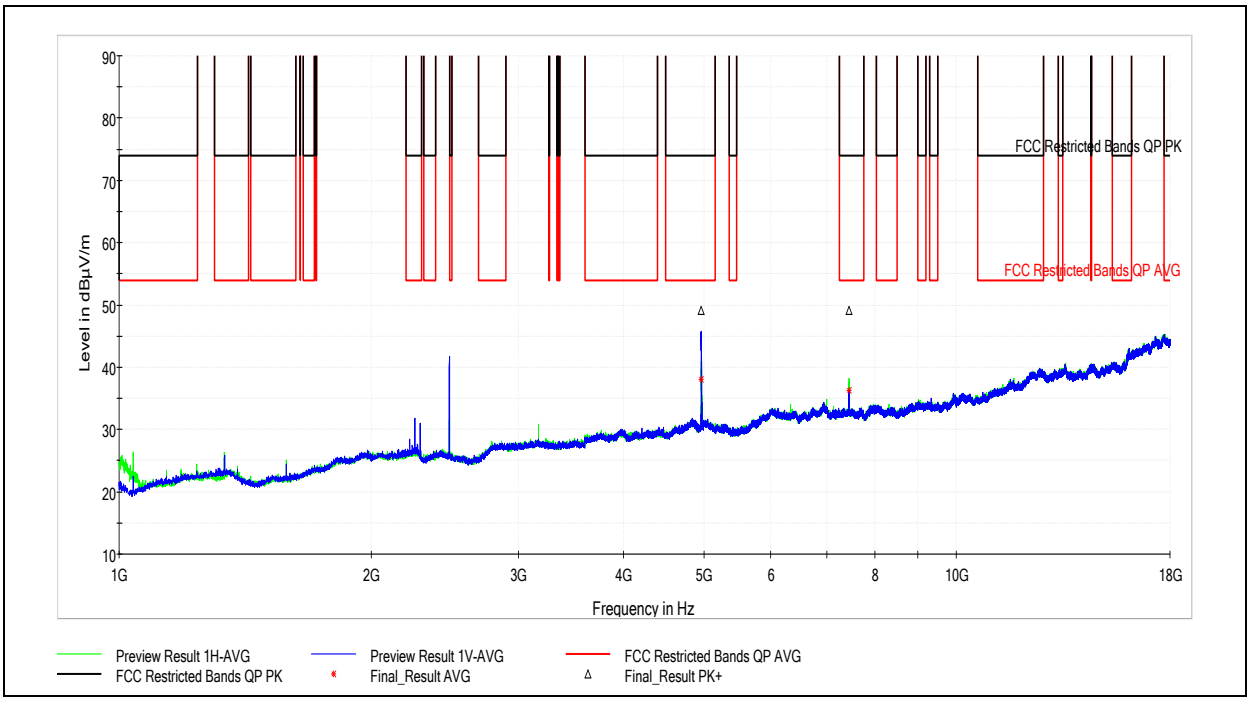
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2233.000000	50.14	73.98	23.84	1000.000	100.0	V	296.0	2.4
2251.500000	53.01	73.98	20.97	1000.000	100.0	V	298.0	2.5
2263.000000	52.08	73.98	21.90	1000.000	100.0	V	309.0	2.5
4881.000000	51.51	73.98	22.47	1000.000	410.0	V	126.0	7.1
7319.000000	55.10	73.98	18.88	1000.000	398.0	V	9.0	10.8
7322.000000	55.42	73.98	18.56	1000.000	410.0	V	336.0	10.8

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2233.000000	27.13	53.98	26.85	1000.000	100.0	V	296.0	2.4
2251.500000	26.05	53.98	27.93	1000.000	100.0	V	298.0	2.5
2263.000000	26.50	53.98	27.48	1000.000	100.0	V	309.0	2.5
4881.000000	42.48	53.98	11.50	1000.000	410.0	V	126.0	7.1
7319.000000	45.47	53.98	8.51	1000.000	398.0	V	9.0	10.8
7322.000000	45.47	53.98	8.51	1000.000	410.0	V	336.0	10.8

Test Personnel:	Brian Lackey	Test Date:	7/30/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.7C
Input Voltage:	120V/60Hz	Relative Humidity:	53.5%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	984.8mbar

Deviations, Additions, or Exclusions: None

7.9.3 Antenna 1, Channel 26 (2480MHz) Spurious Emissions, 1GHz-18GHz



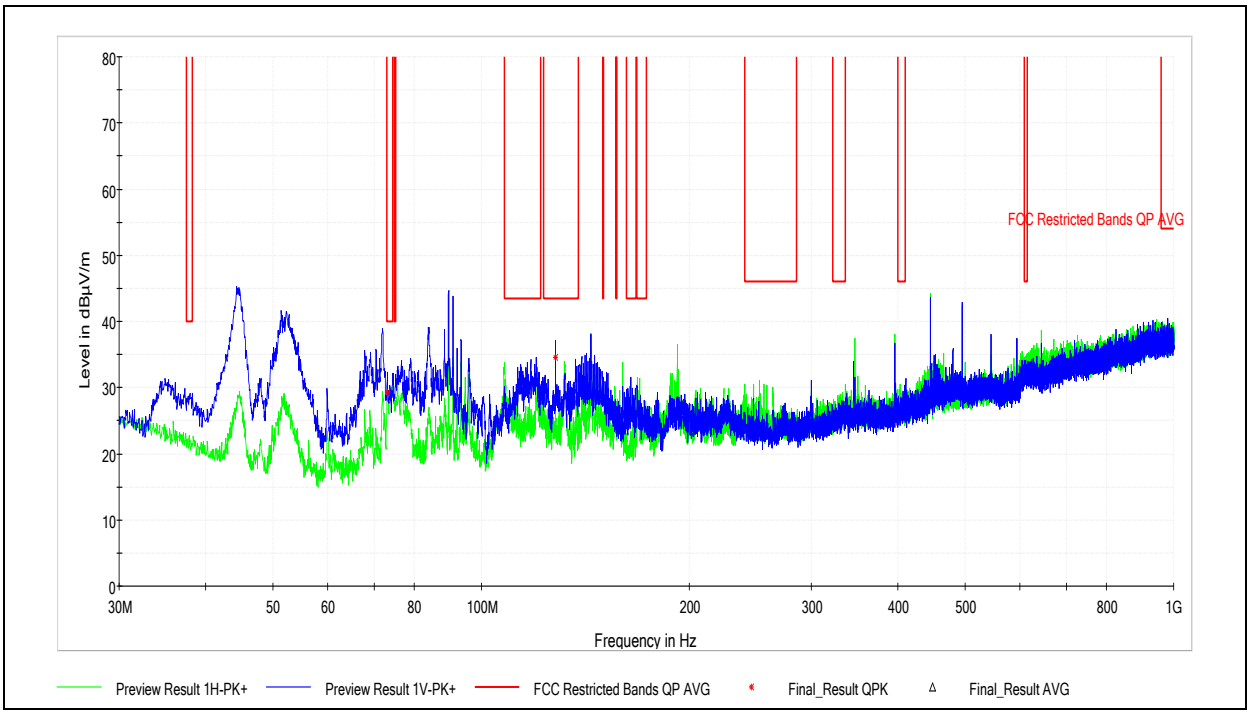
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4959.000000	49.16	73.98	24.82	1000.000	391.0	V	224.0	7.0
7442.000000	49.08	73.98	24.90	1000.000	141.0	H	100.0	11.1

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4959.000000	38.00	53.98	15.98	1000.000	391.0	V	224.0	7.0
7442.000000	36.36	53.98	17.62	1000.000	141.0	H	100.0	11.1

Test Personnel:	Brian Lackey	Test Date:	8/2/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	27.7C
Input Voltage:	120V/60Hz	Relative Humidity:	38.7%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	986.5mbar

Deviations, Additions, or Exclusions: None

7.9.4 Antenna 1, Spurious Emissions, 30MHz-1GHz

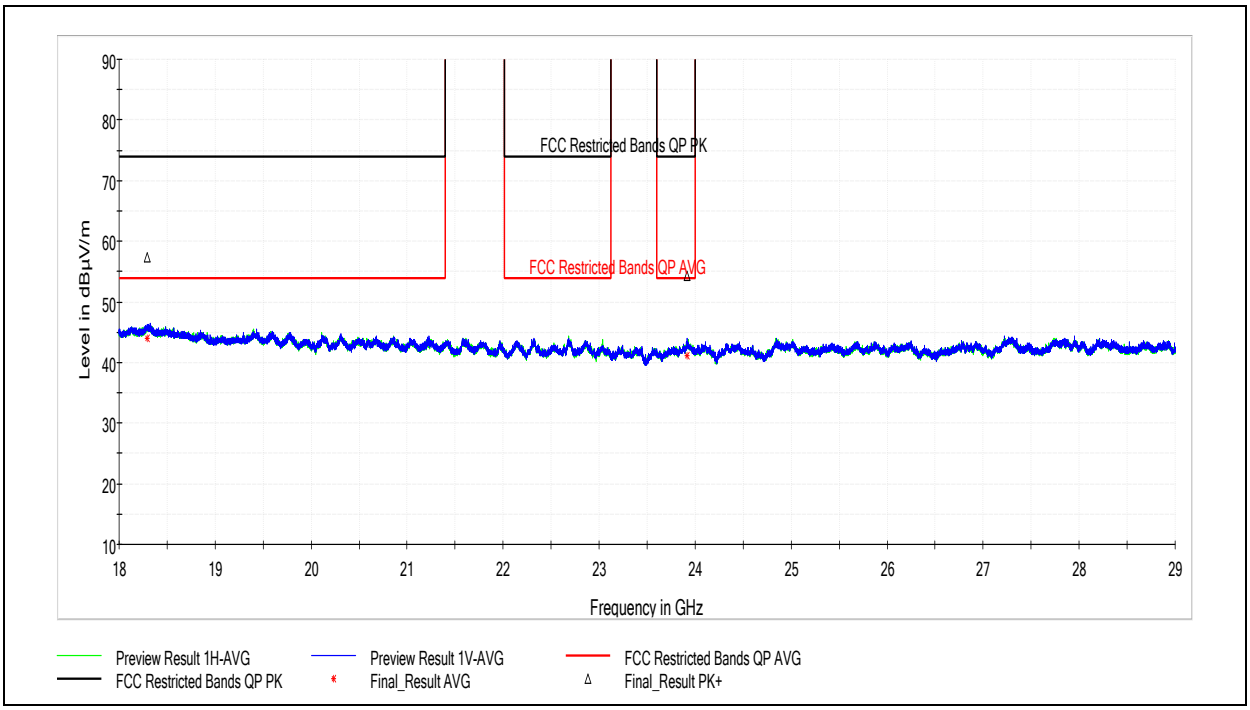


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
73.218889	29.22	40.00	10.78	120.000	153.9	V	72.0	14.9
127.970000	34.54	43.52	8.98	120.000	105.2	V	282.0	14.7

Test Personnel:	Brian Lackey	Test Date:	8/8/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.3C
Input Voltage:	120V/60Hz	Relative Humidity:	43.6%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.2mbar

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

7.9.5 Antenna 1, Spurious Emissions, 18-29GHz



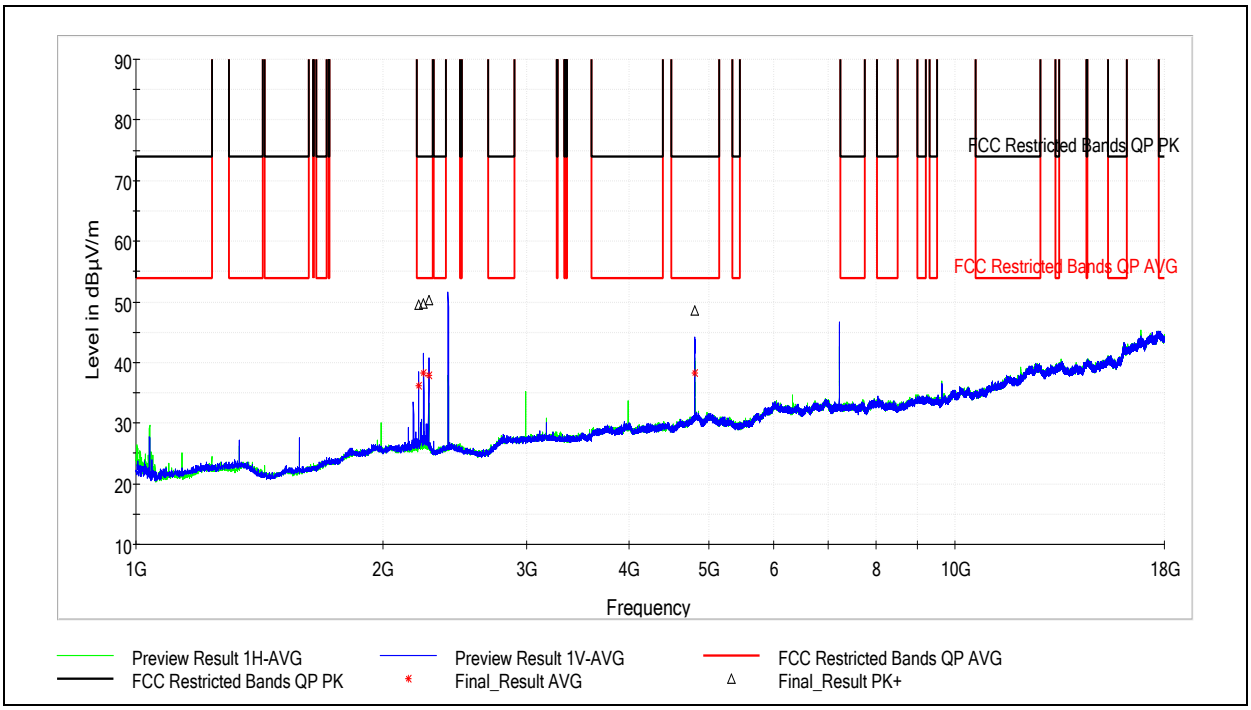
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18296.000000	57.40	73.98	16.58	1000.000	100.0	V	241.0	20.0
23917.000000	54.21	73.98	19.77	1000.000	100.0	V	0.0	6.1

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18296.000000	44.06	53.98	9.92	1000.000	100.0	V	241.0	20.0
23917.000000	41.11	53.98	12.87	1000.000	100.0	V	0.0	6.1

Test Personnel:	Brian Lackey	Test Date:	7/31/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.3C
Input Voltage:	120V/60Hz	Relative Humidity:	44.8%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	986.9mbar

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

7.9.6 Antenna 2, Channel 11 (2405MHz) Spurious Emissions, 1GHz-18GHz



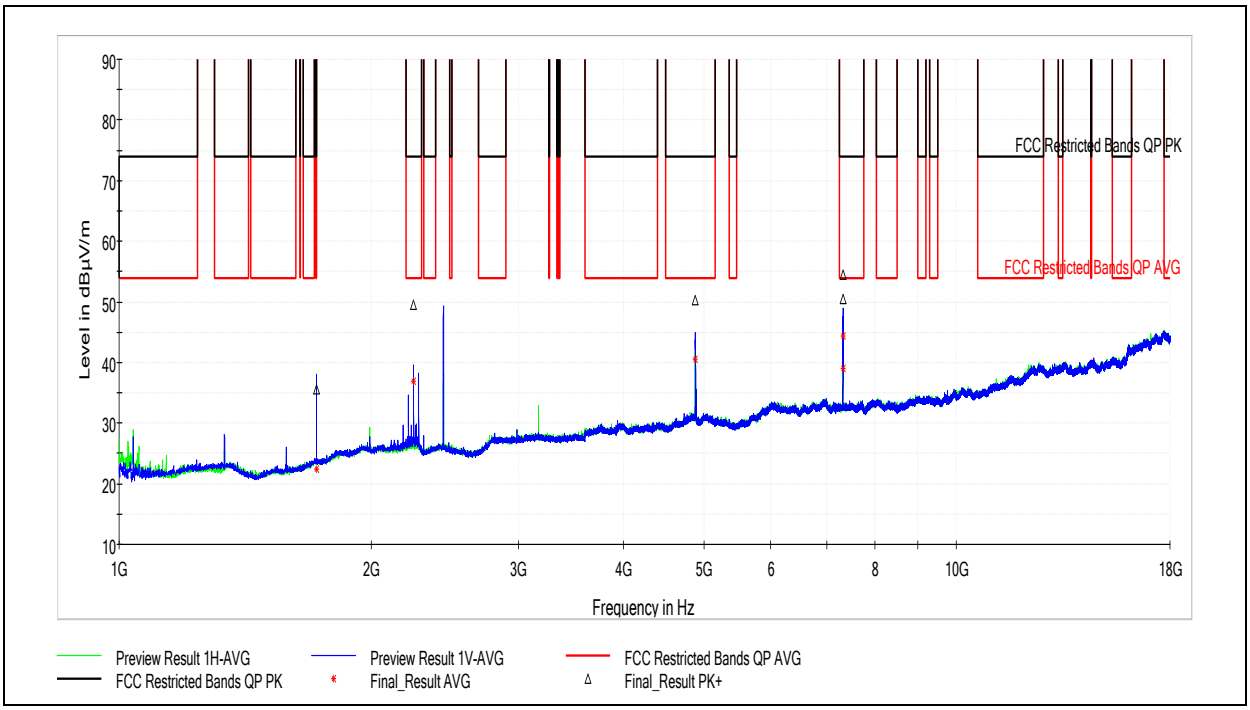
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2213.000000	49.58	73.98	24.40	1000.000	116.0	V	322.0	2.3
2245.000000	49.66	73.98	24.32	1000.000	153.0	V	326.0	2.4
2277.000000	50.27	73.98	23.71	1000.000	177.0	V	331.0	2.5
4811.000000	48.54	73.98	25.44	1000.000	389.0	V	242.0	7.1

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2213.000000	36.14	53.98	17.84	1000.000	116.0	V	322.0	2.3
2245.000000	38.33	53.98	15.65	1000.000	153.0	V	326.0	2.4
2277.000000	37.94	53.98	16.04	1000.000	177.0	V	331.0	2.5
4811.000000	38.34	53.98	15.64	1000.000	389.0	V	242.0	7.1

Test Personnel:	Brian Lackey	Test Date:	8/2/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	27.7C
Input Voltage:	120V/60Hz	Relative Humidity:	38.7%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	986.5mbar

Deviations, Additions, or Exclusions: None

7.9.7 Antenna 2, Channel 18 (2440MHz) Spurious Emissions, 1GHz-18GHz



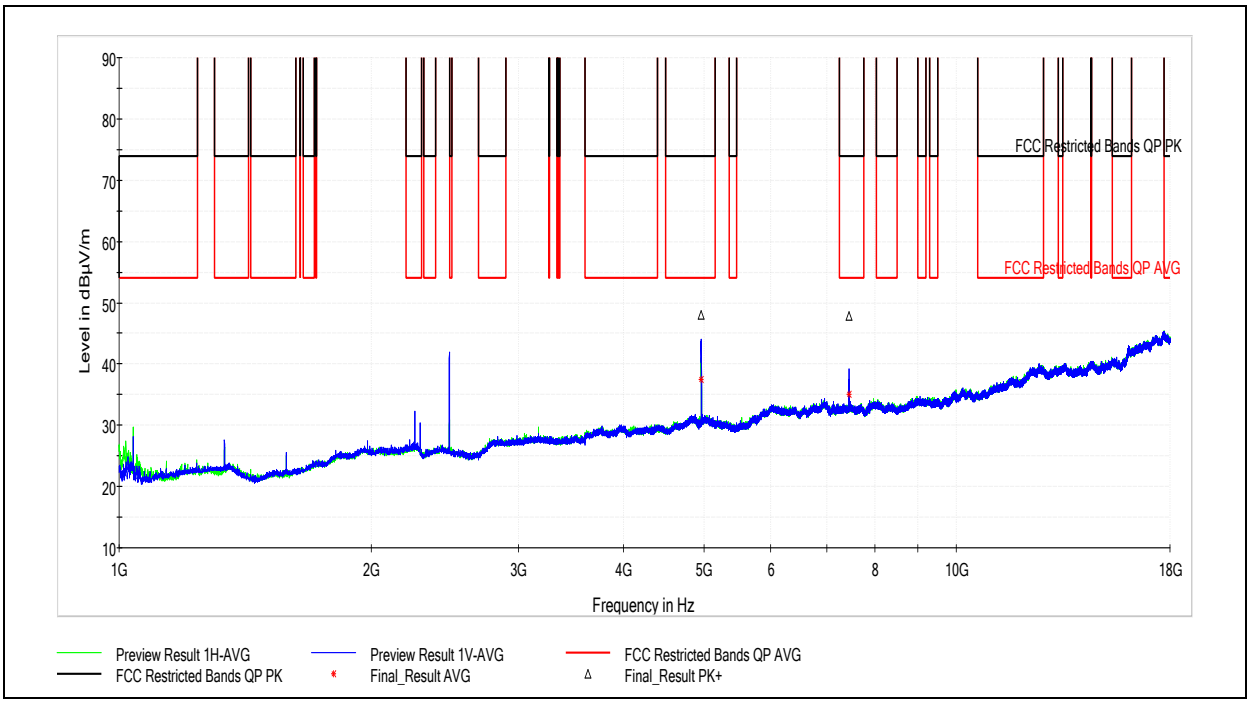
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1721.000000	35.55	73.98	38.43	1000.000	410.0	V	203.0	-0.5
2248.000000	49.61	73.98	24.37	1000.000	136.0	V	329.0	2.5
4879.500000	50.20	73.98	23.78	1000.000	397.0	V	180.0	7.1
7319.000000	54.48	73.98	19.50	1000.000	100.0	V	168.0	10.8
7322.000000	50.39	73.98	23.59	1000.000	372.0	V	158.0	10.8

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1721.000000	22.39	53.98	31.59	1000.000	410.0	V	203.0	-0.5
2248.000000	36.88	53.98	17.10	1000.000	136.0	V	329.0	2.5
4879.500000	40.49	53.98	13.49	1000.000	397.0	V	180.0	7.1
7319.000000	44.33	53.98	9.65	1000.000	100.0	V	168.0	10.8
7322.000000	38.93	53.98	15.05	1000.000	372.0	V	158.0	10.8

Test Personnel:	Brian Lackey	Test Date:	8/2/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	27.7C
Input Voltage:	120V/60Hz	Relative Humidity:	38.7%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	986.5mbar

Deviations, Additions, or Exclusions: None

7.9.8 Antenna 2, Channel 26 (2480MHz) Spurious Emissions, 1GHz-18GHz



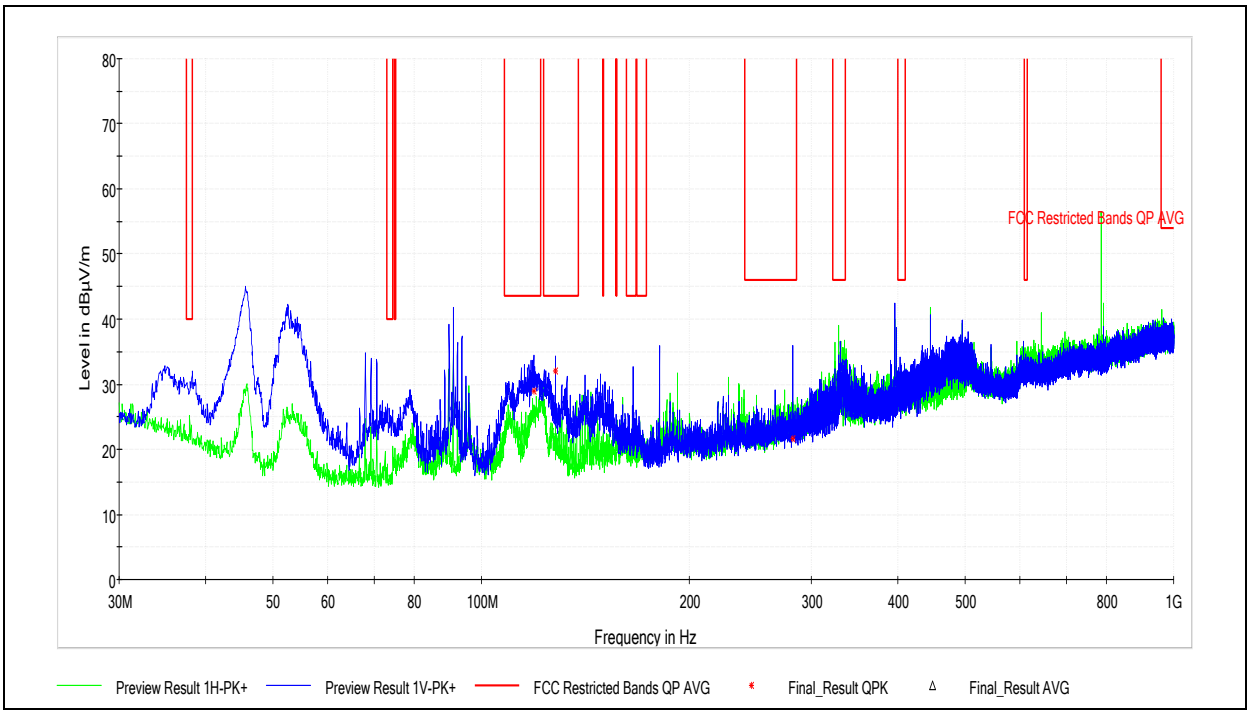
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4961.000000	48.07	73.98	25.91	1000.000	410.0	V	176.0	7.0
7439.000000	47.82	73.98	26.16	1000.000	181.0	V	142.0	11.0

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4961.000000	37.41	53.98	16.57	1000.000	410.0	V	176.0	7.0
7439.000000	35.05	53.98	18.93	1000.000	181.0	V	142.0	11.0

Test Personnel:	Brian Lackey	Test Date:	8/1/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.0C
Input Voltage:	120V/60Hz	Relative Humidity:	44.0%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	987.2mbar

Deviations, Additions, or Exclusions: None

7.9.9 Antenna 2, Spurious Emissions, 30MHz-1GHz

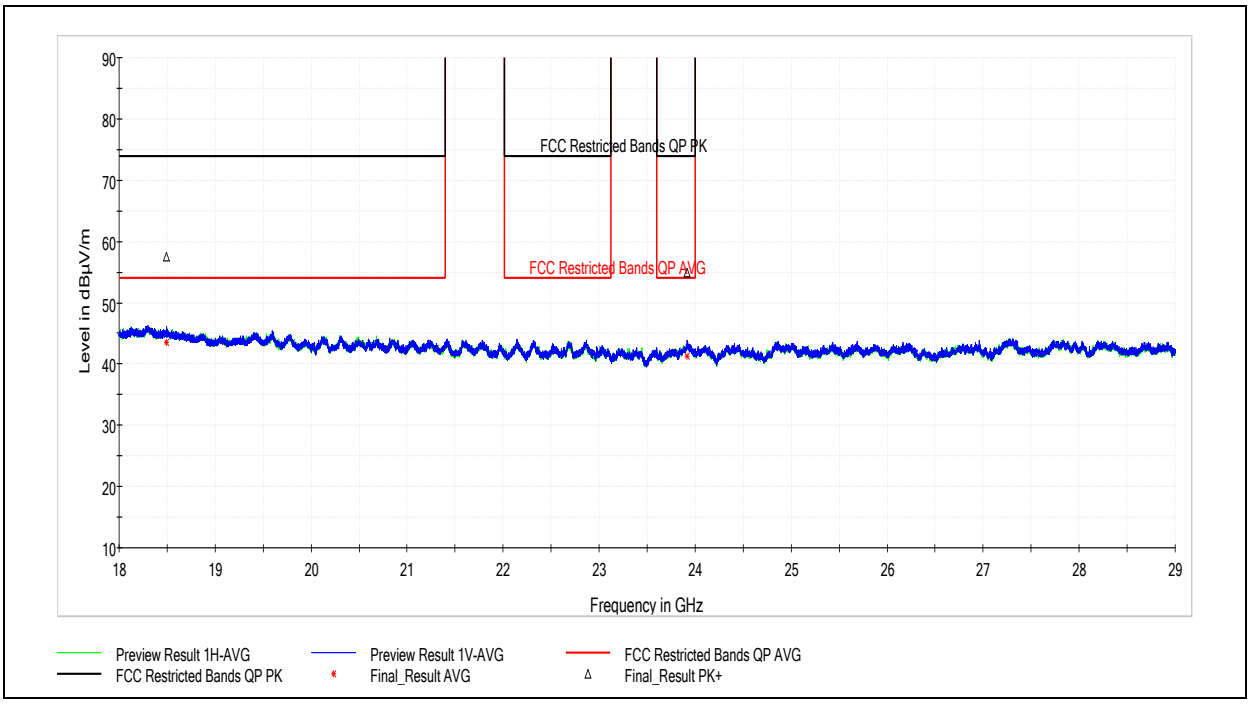


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
119.078333	28.87	43.52	14.65	120.000	105.2	V	284.0	14.9
127.970000	32.00	43.52	11.52	120.000	104.9	V	282.0	14.7
281.768889	21.70	46.02	24.32	120.000	142.1	V	0.0	21.8

Test Personnel:	Brian Lackey	Test Date:	8/8/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.3C
Input Voltage:	120V/60Hz	Relative Humidity:	43.6%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.2mbar

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

7.9.10 Antenna 2, Spurious Emissions, 18-29GHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18496.500000	57.55	73.98	16.43	1000.000	100.0	V	334.0	18.9
23916.000000	54.85	73.98	19.13	1000.000	100.0	V	330.0	6.1

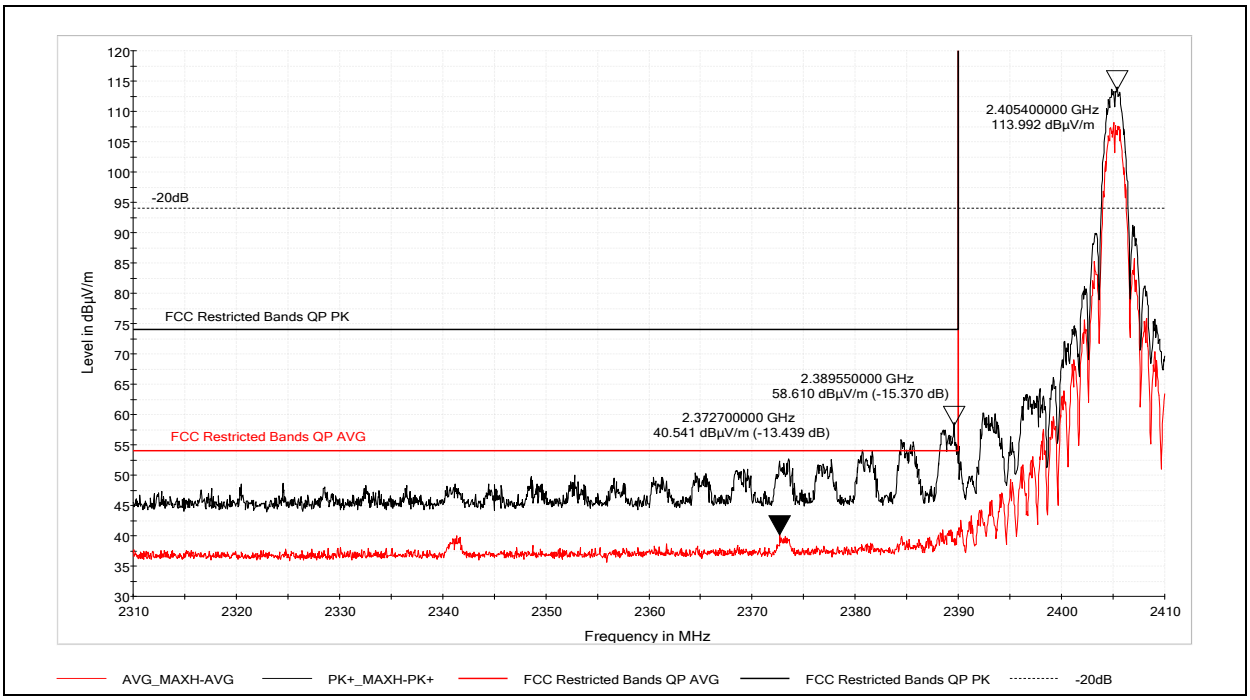
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18496.500000	43.57	53.98	10.41	1000.000	100.0	V	334.0	18.9
23916.000000	41.19	53.98	12.79	1000.000	100.0	V	330.0	6.1

Test Personnel:	Brian Lackey	Test Date:	7/31/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	25.3C
Input Voltage:	120V/60Hz	Relative Humidity:	44.8%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	986.9mbar

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

7.9.11 Emissions at the Low Band Edge

7.9.11.1 Antenna 1, Channel 11 (2405MHz)



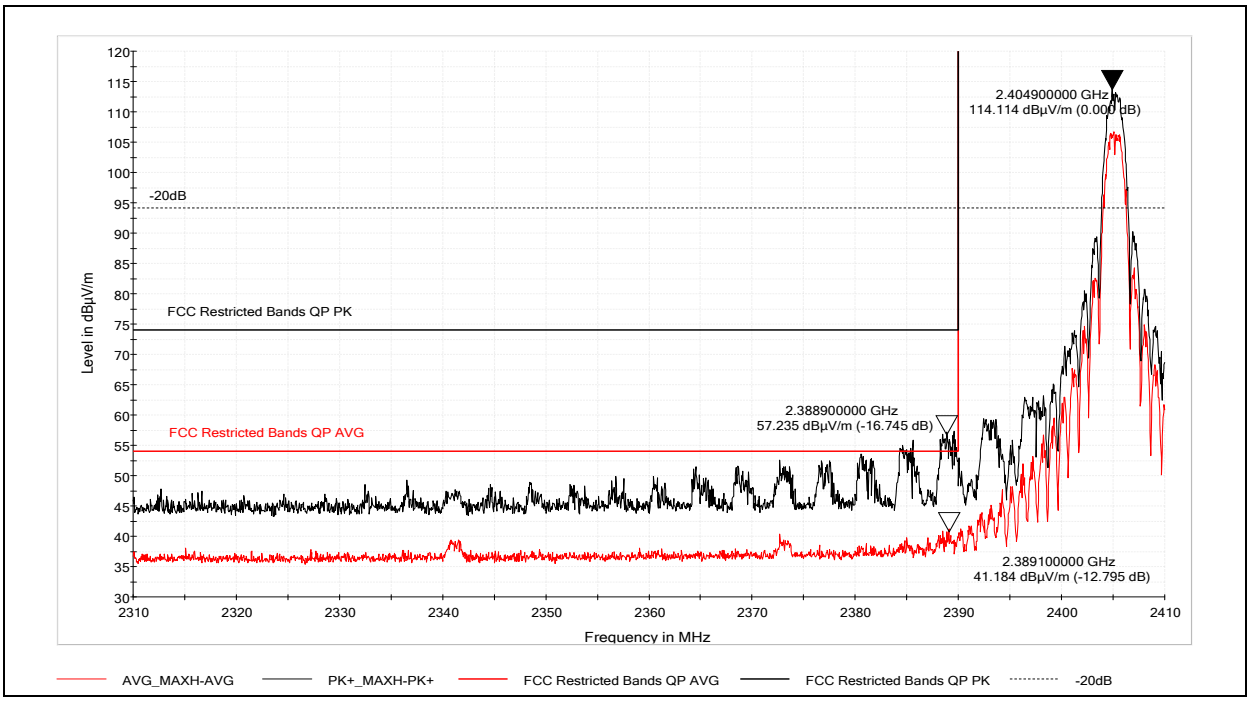
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2389.55	58.610	73.97	15.370

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2372.70	40.541	53.97	13.439

Test Personnel:	Brian Lackey	Test Date:	8/14/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.7C
Input Voltage:	120V/60Hz	Relative Humidity:	45.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.7mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation.

7.9.11.2 Antenna 2, Channel 11 (2405MHz)



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2388.90	57.235	73.97	16.745

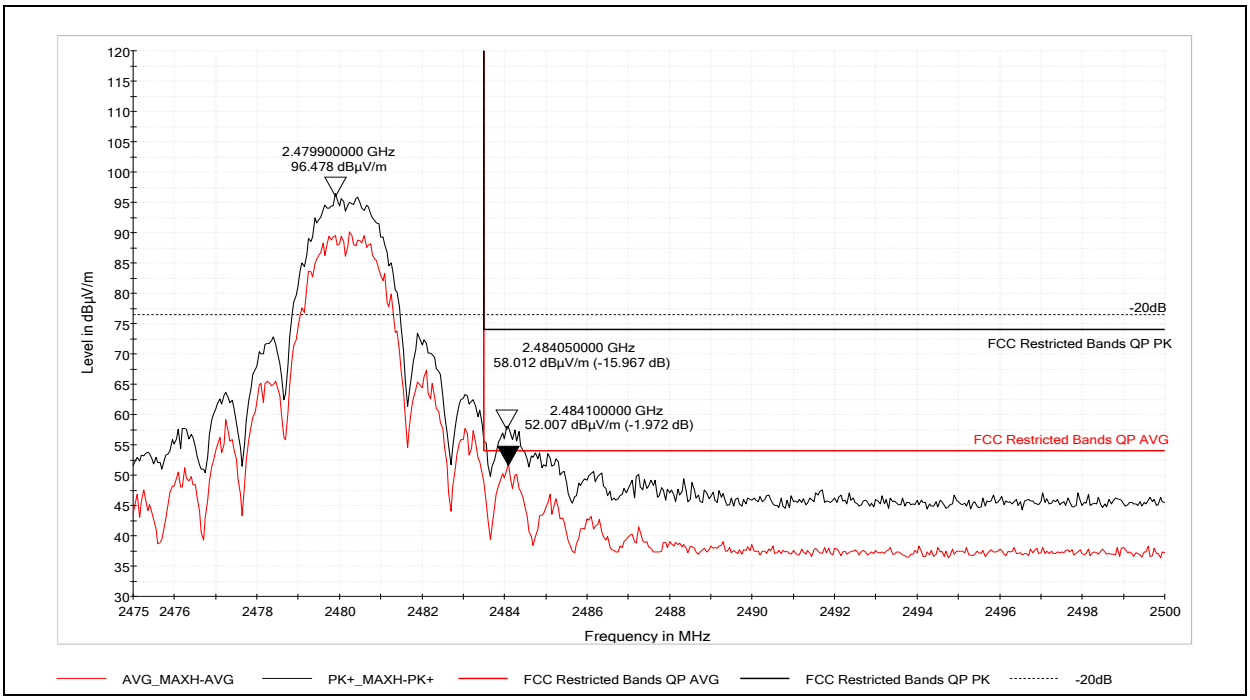
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2389.10	41.184	53.97	12.795

Test Personnel:	Brian Lackey	Test Date:	8/9/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.1C
Input Voltage:	120V/60Hz	Relative Humidity:	46.1%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	982.0mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation.

7.9.12 Emissions at the High Band Edge

7.9.12.1 Antenna 1, Channel 26 (2480MHz), Power Setting 4



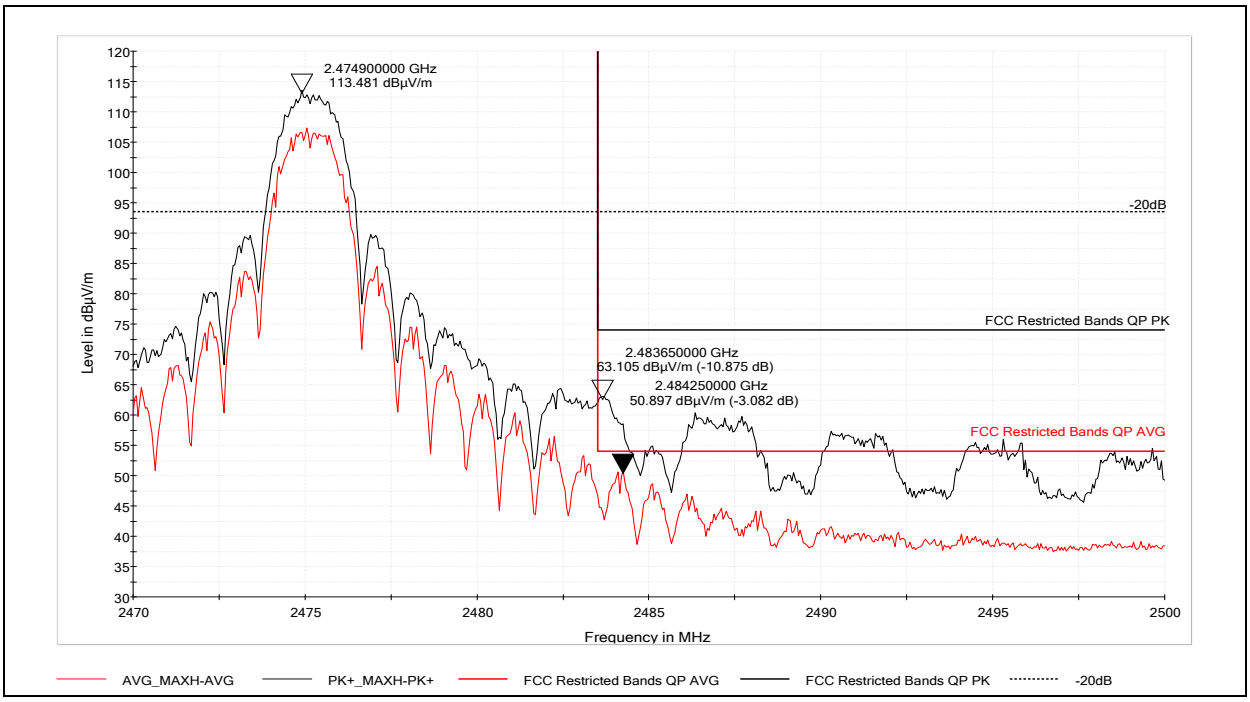
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.05	58.012	73.97	15.967

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.10	52.007	53.97	1.972

Test Personnel:	Brian Lackey	Test Date:	8/14/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.7C
Input Voltage:	120V/60Hz	Relative Humidity:	45.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.7mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation. Tested at a reduced output power level to meet average limit.

7.9.12.2 Antenna 1, Channel 25 (2475MHz), Power Setting 26



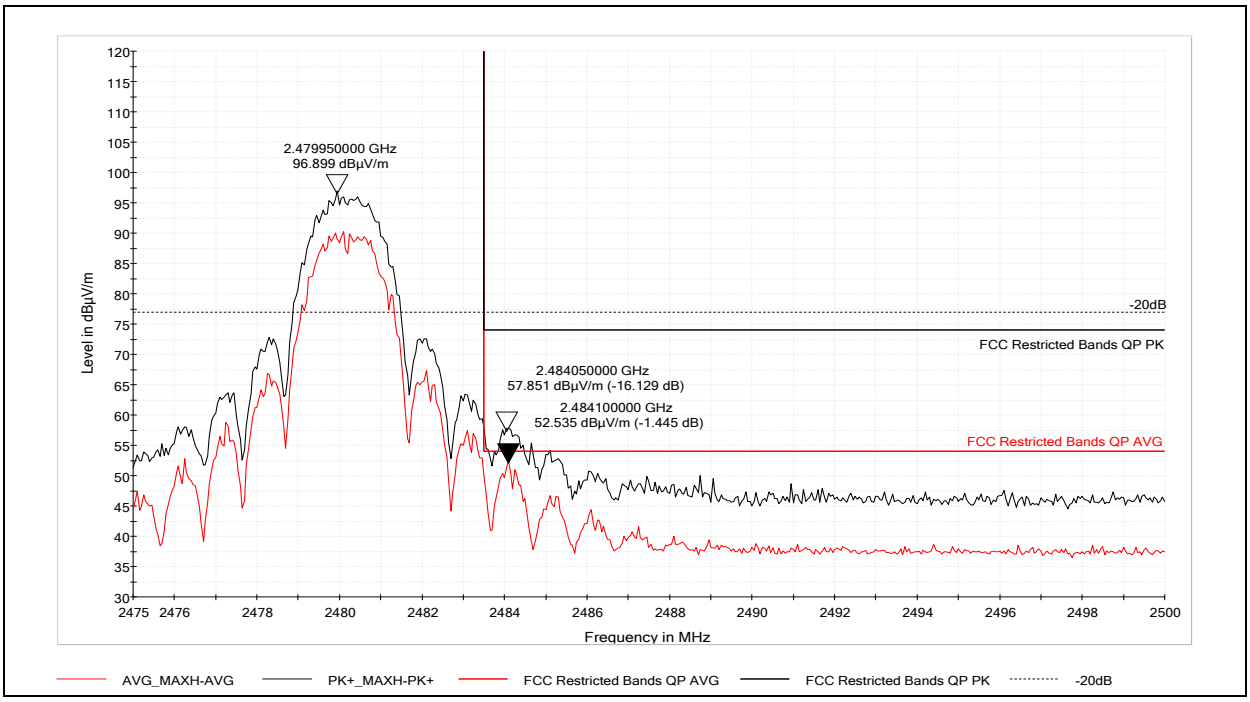
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2483.65	63.105	73.97	10.875

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.25	50.897	53.97	3.082

Test Personnel:	Brian Lackey	Test Date:	8/14/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.7C
Input Voltage:	120V/60Hz	Relative Humidity:	45.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.7mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation.

7.9.12.3 Antenna 2, Channel 26 (2480MHz), Power Setting 4



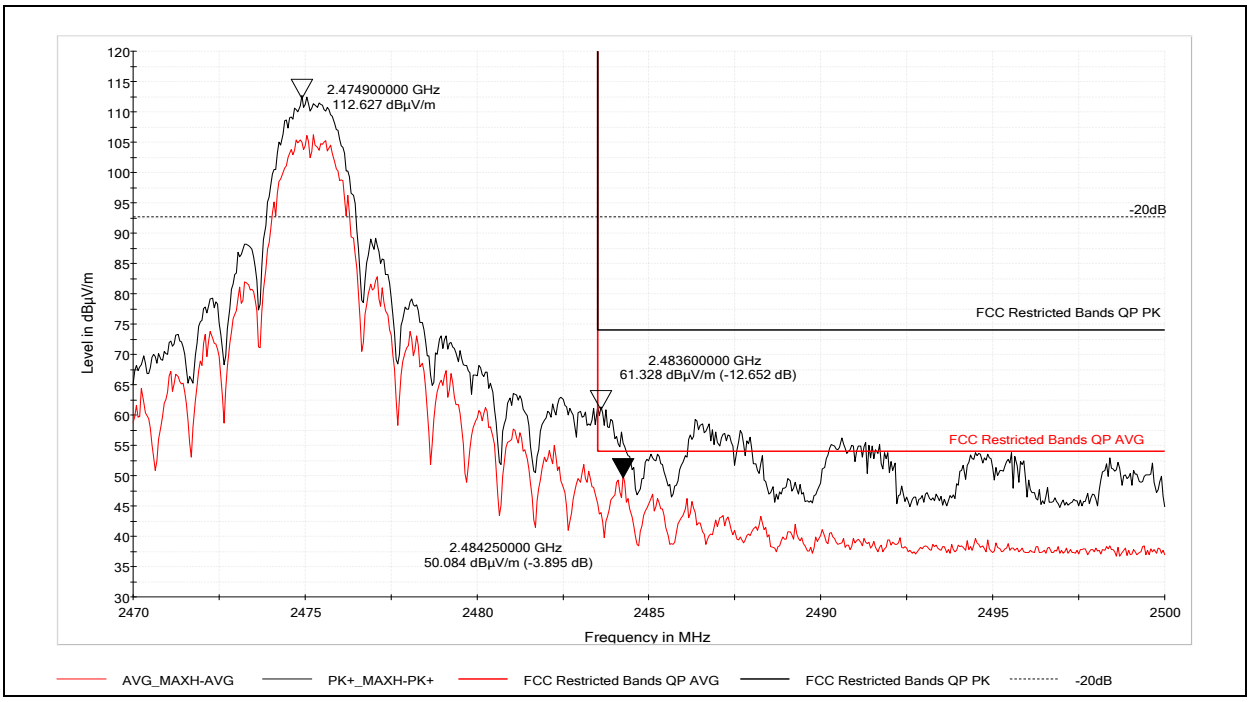
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.05	57.851	73.97	16.129

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.10	52.535	53.97	1.445

Test Personnel:	Brian Lackey	Test Date:	8/14/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.7C
Input Voltage:	120V/60Hz	Relative Humidity:	45.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	981.7mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation. Tested at a reduced output power level to meet average limit.

7.9.12.4 Antenna 2, Channel 25 (2475MHz), Power Setting 26



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2483.60	61.328	73.97	12.652

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2484.25	50.084	53.97	3.895

Test Personnel:	Brian Lackey	Test Date:	8/9/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	26.1C
Input Voltage:	120V/60Hz	Relative Humidity:	46.1%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	982.0mbar

Deviations, Additions, or Exclusions: results represent the worst case emissions over height, azimuth, polarization, and orientation.

8 Conducted Spurious Emissions

8.1 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.

8.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 11.11.3.

8.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	2327	Rohde & Schwarz	ESI26	9/21/2018	9/20/2019

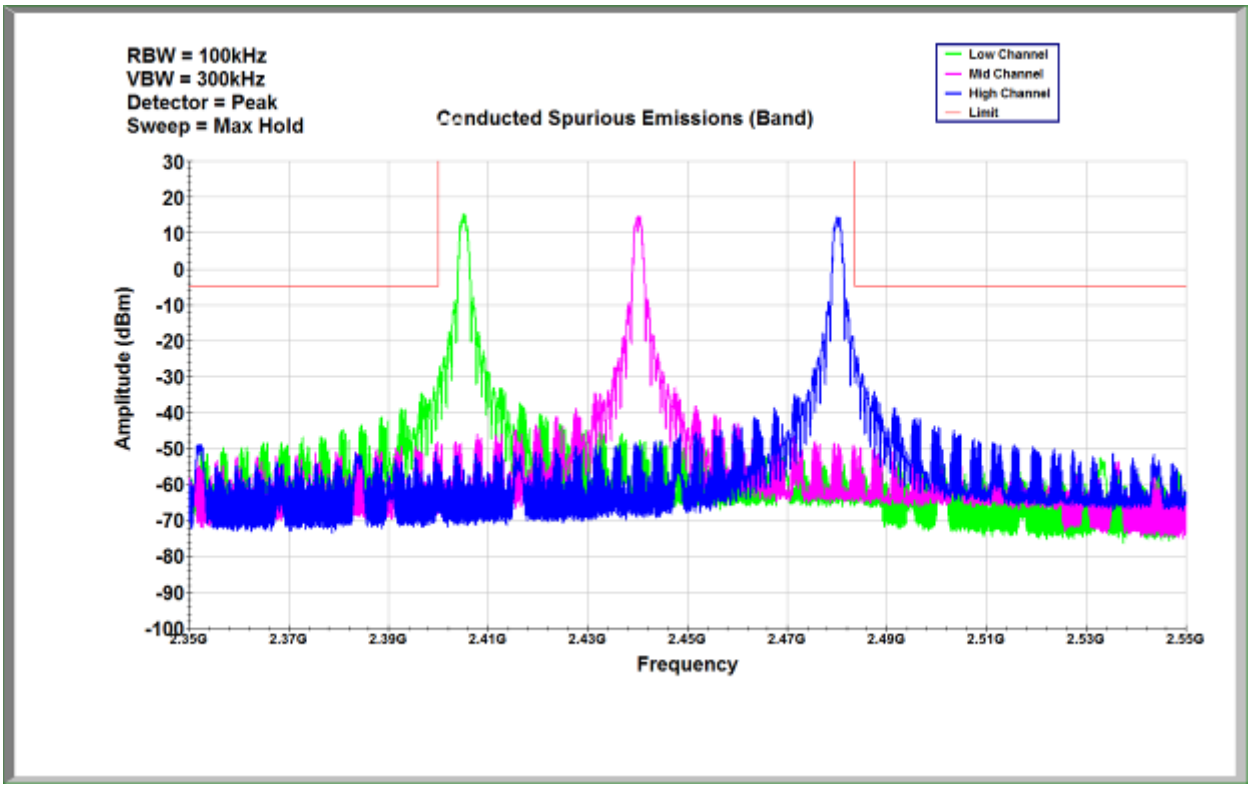
8.4 Test Results

The device was found to be **compliant**. All spurious emissions were attenuated at least 20dB below the level of the highest fundamental emission.

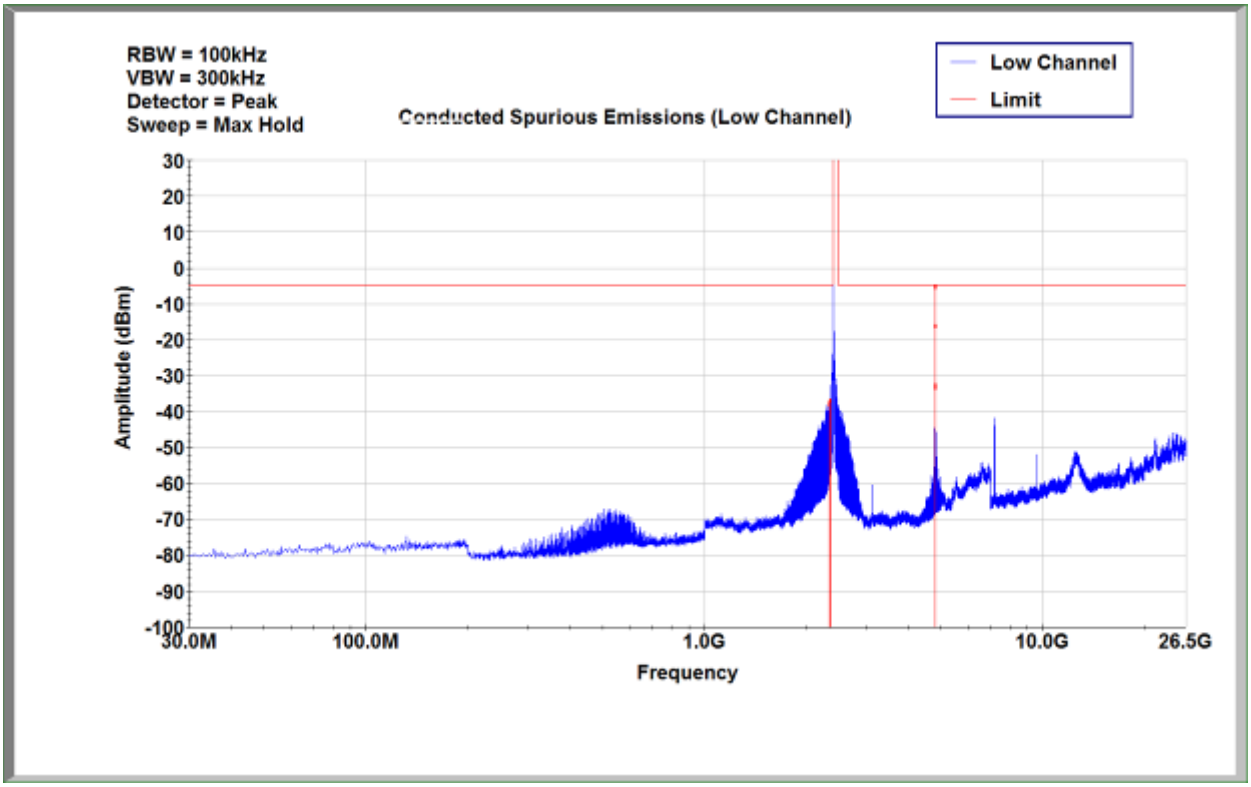
8.5 Test Conditions

Test Personnel:	Brian Lackey	Test Date:	7/27/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	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

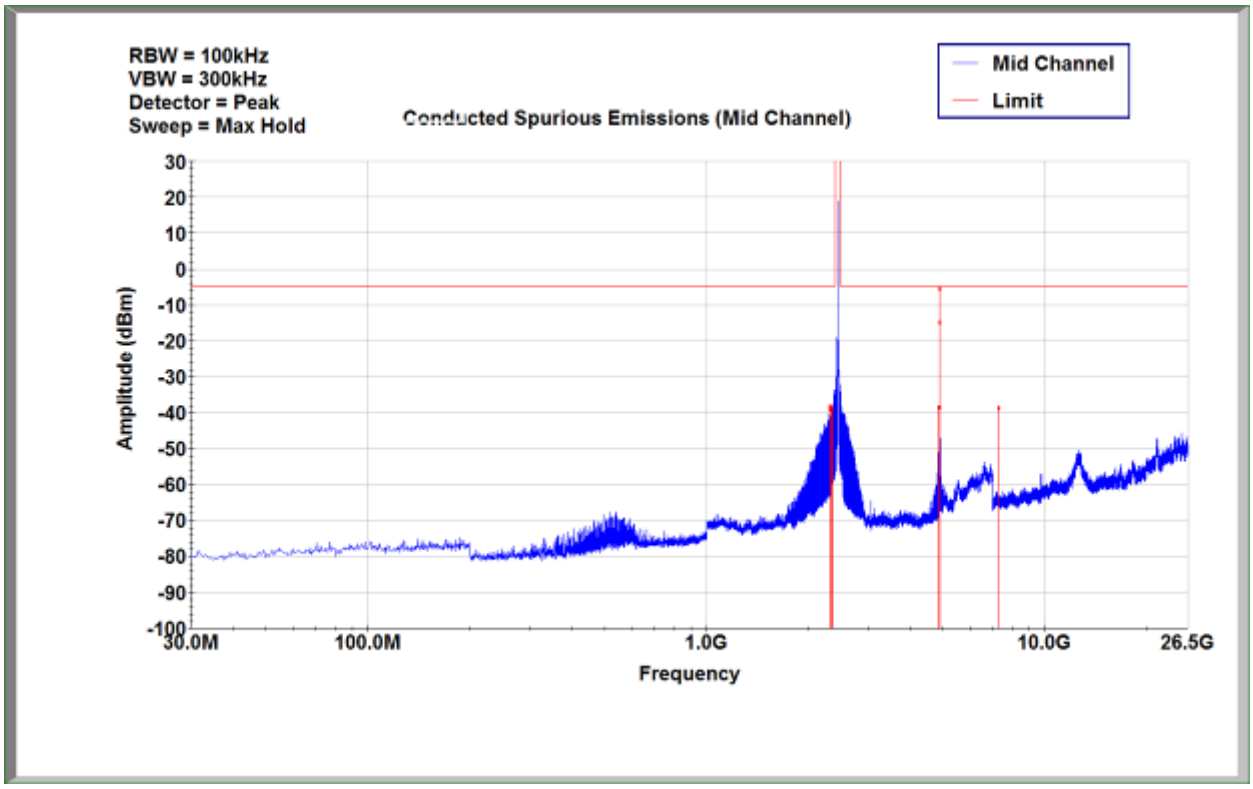
8.6 Test Data



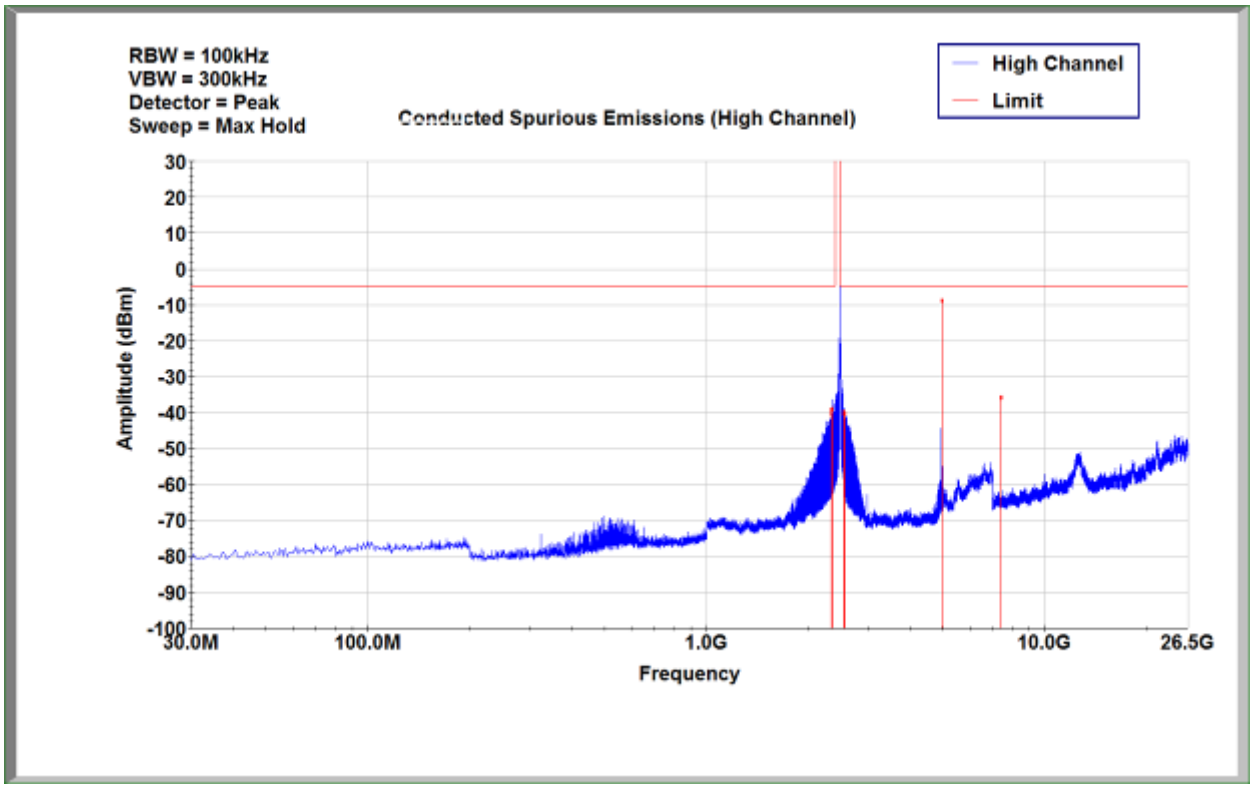
Conducted Spurious Emissions (Band)



Conducted Spurious Emissions, Channel 11 (2405MHz)



Conducted Spurious Emissions, Channel 18 (2440MHz)



Conducted Spurious Emissions, Channel 26 (2480MHz)

9 Output Power

9.1 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.

9.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 11.9.1.3.

9.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Wideband Power Sensor	4022	Rohde&Schwarz	NRP-Z81	9/21/2018	9/21/2019

9.4 Test Results

The device was found to be **compliant**. The output power of all modes of operation was less than 1W. The EIRP for each antenna configuration was less than 4 W.

9.5 Test Conditions

Test Personnel:	Brian Lackey	Test Date:	7/27/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	22.3C
Input Voltage:	Battery	Relative Humidity:	54.8%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	988.8mbar

9.6 Test Data

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (mW)	Result
11	2405	20.38	109.1	1000	Pass
18	2440	20.17	104.0	1000	Pass
26	2480	19.71	93.54	1000	Pass

Antenna	Output Power (dBm)	Peak Gain (dBi)	EIRP[1] (dBm)	EIRP[1] (W)	Limit (W)	Result
Pulse W1040W	20.38	2.0	25.38	0.3460	4	Pass
PCTEL (Maxrad) MC2400PTMSMA Ceiling Mount	20.38	2.5	25.88	0.3882	4	Pass
Mobile Mark (Comtelco) CMTB36247V Wall Mount	20.38	7.5	30.88	1.2275	4	Pass
Mobile Mark (Comtelco) CMTBS2400XL3 Omnidirectional	20.38	5.0	28.38	0.6903	4	Pass

Deviations, Additions, or Exclusions: None

[1] Assumes simultaneous transmission from both antenna ports with the addition of 3dB

10 Occupied Bandwidth

10.1 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.

10.2 Test Method

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

10.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	2327	Rohde & Schwarz	ESI26	9/21/2018	9/21/2019

10.4 Test Results

The device was found to be **compliant**. The 6dB, 20dB, and 99% occupied power bandwidth are reported below.

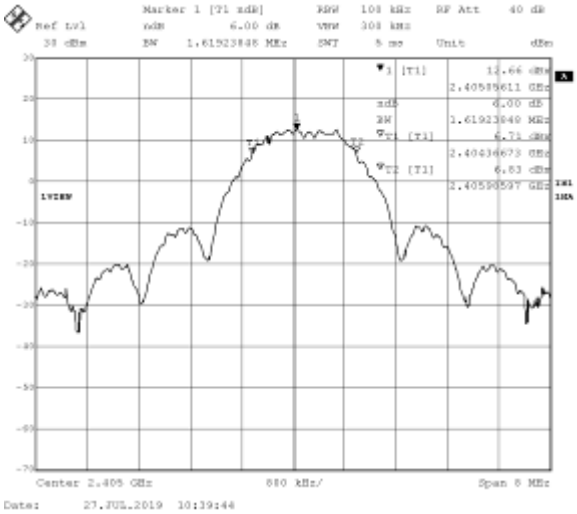
10.5 Test Conditions

Test Personnel:	B. Lackey	Test Date:	7/27/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	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

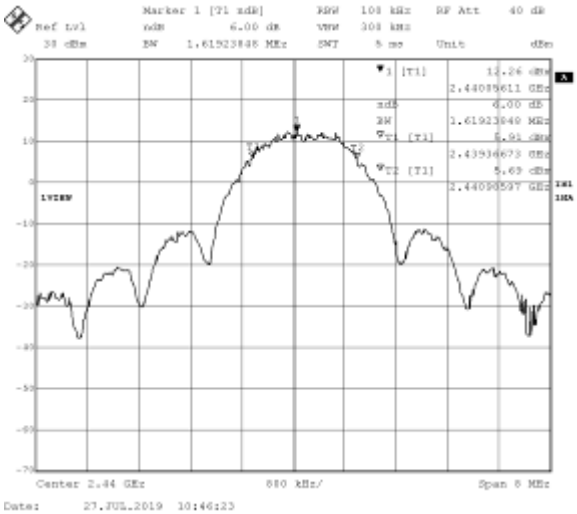
10.6 Test Data

Channel	Frequency (MHz)	6dB BW (MHz)	20dB BW (MHz)	99% OBW (MHz)
11	2405	1.619	2.645	2.357
18	2440	1.619	2.629	2.389
26	2480	1.636	2.645	2.357

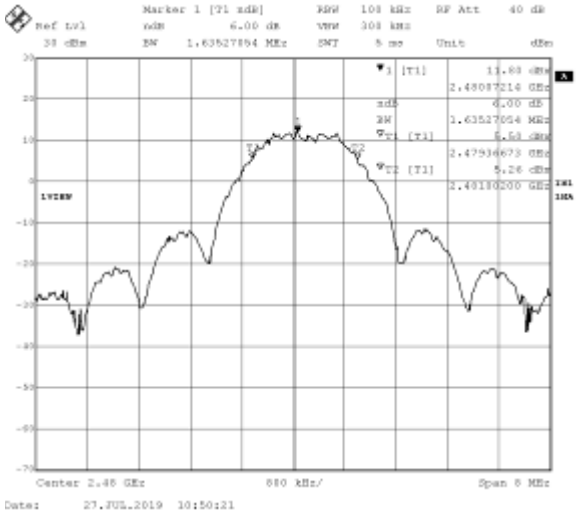
10.6.1 Bandwidth Plots



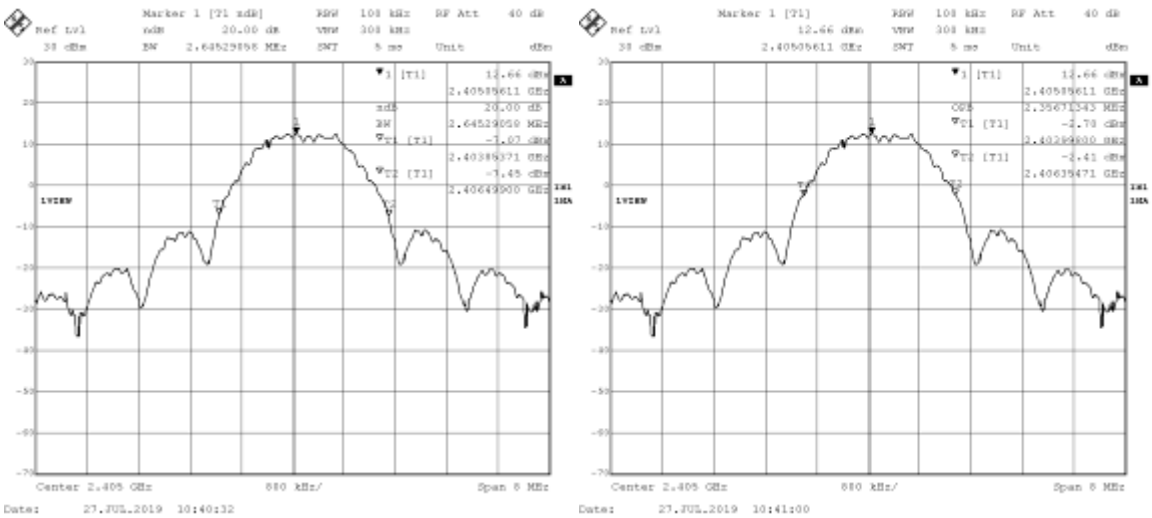
Ch11 (2405MHz)) 6dB Occupied Bandwidth



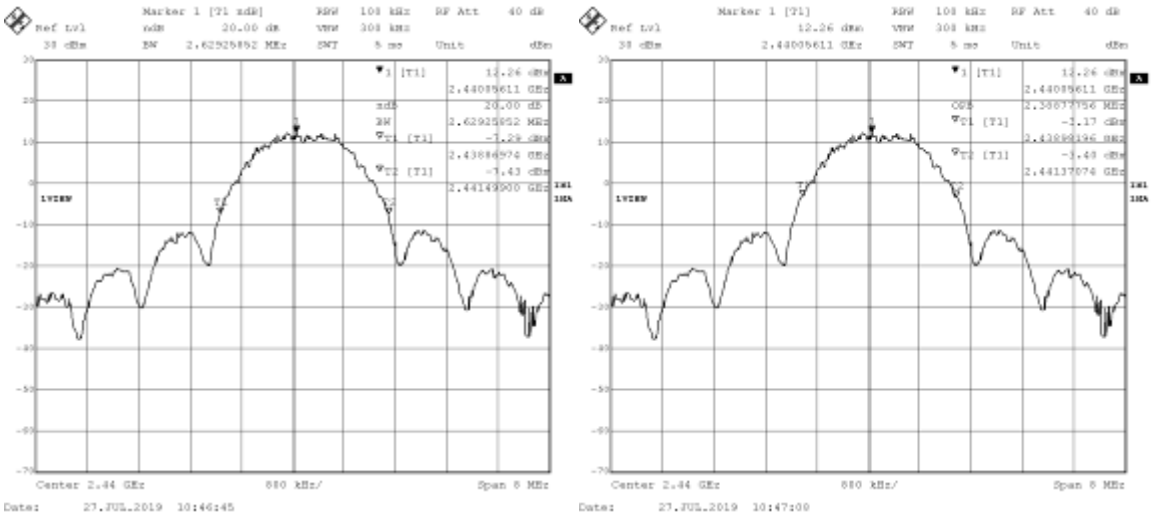
Ch18 (2440MHz)) 6dB Occupied Bandwidth



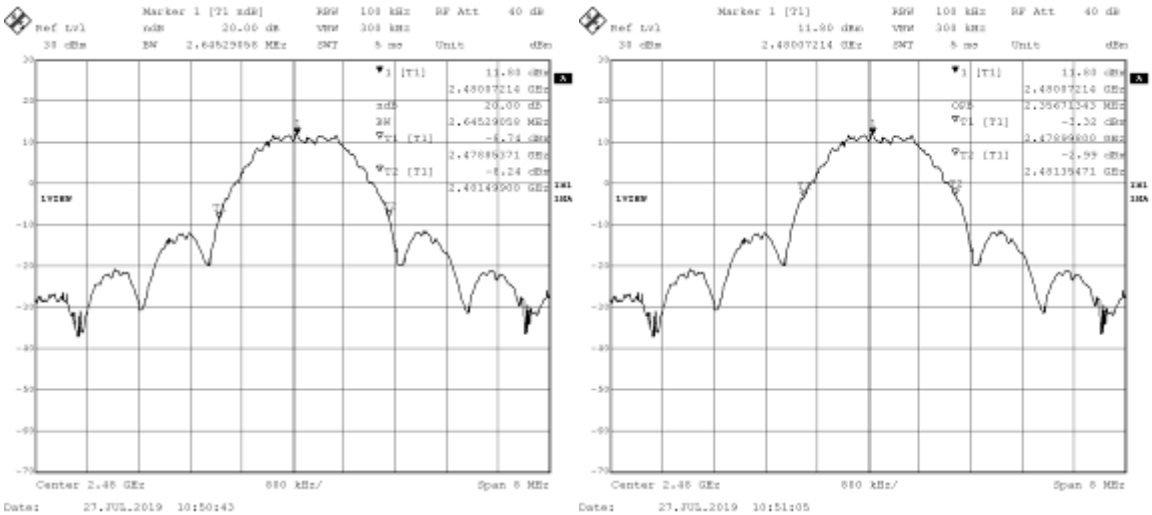
Ch26 (2480MHz)) 6dB Occupied Bandwidth



Ch11 (2405MHz) Occupied Bandwidth, 20dB (left), 99% (right)



Ch18 (2440MHz) Occupied Bandwidth, 20dB (left), 99% (right)



Ch121 (926.2MHz) Occupied Bandwidth, 20dB (left), 99% (right)

Deviations, Additions, or Exclusions: None

11 Peak Power Spectral Density

11.1 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).

11.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 11.10.2.

11.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	2327	Rohde & Schwarz	ESI26	9/21/2018	9/21/2019

11.4 Test Results

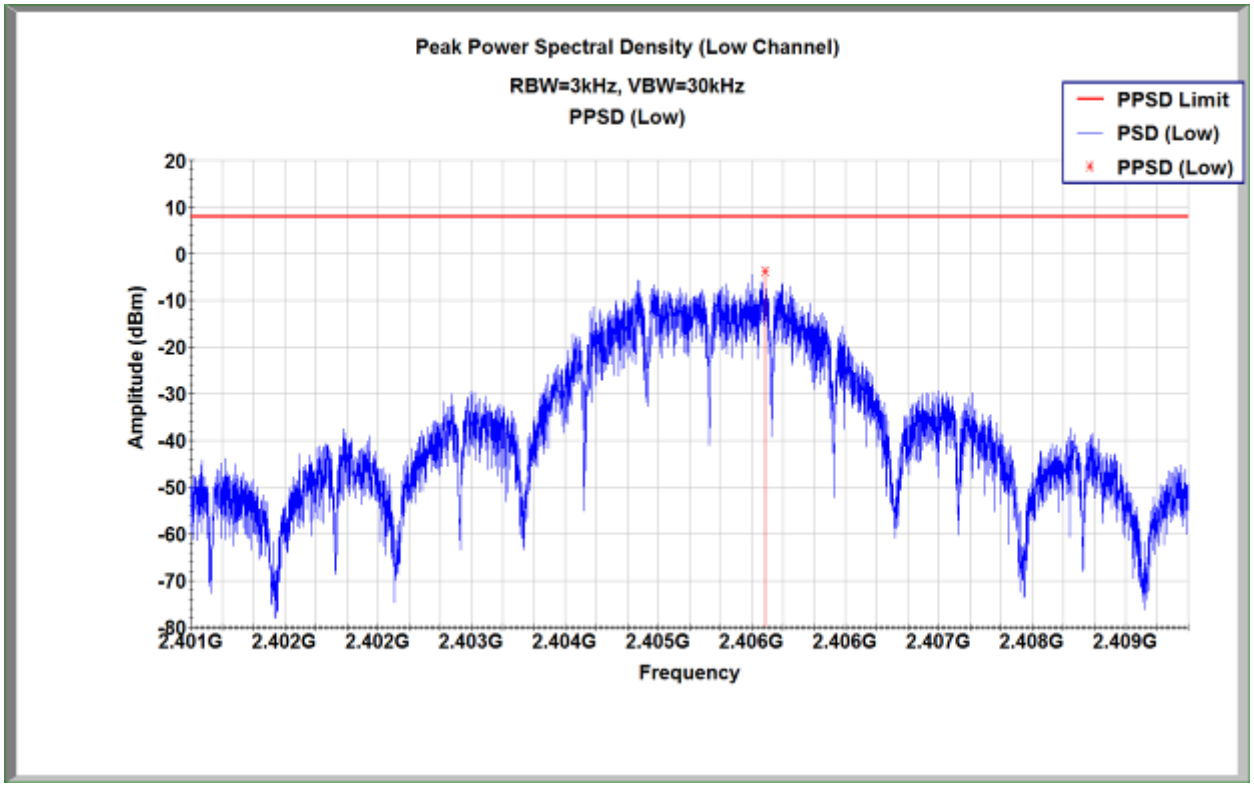
The device was found to be **compliant**. The peak power spectral density was less than 8 dBm.

11.5 Test Conditions

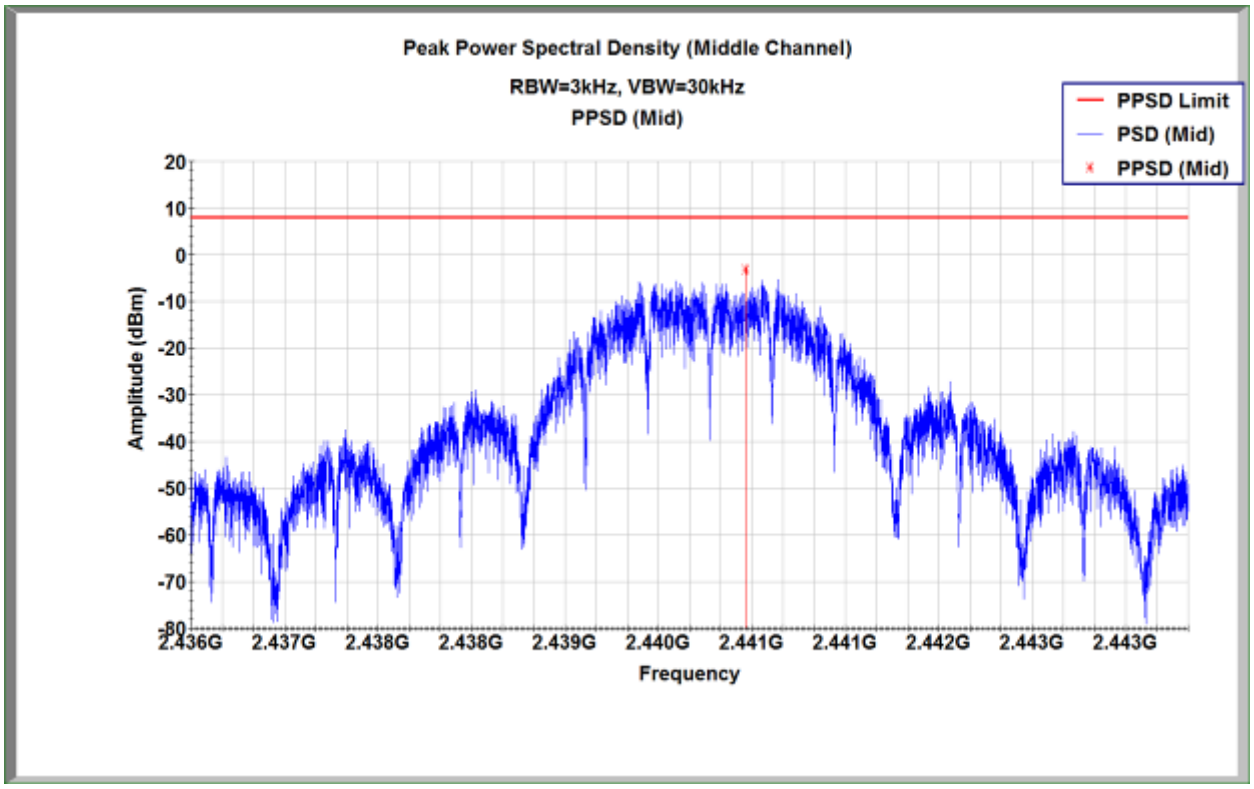
Test Personnel:	Brian Lackey	Test Date:	7/28/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	27.7C
Input Voltage:	120V/60Hz	Relative Humidity:	45.8%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	990.6mbar

11.6 Test Data

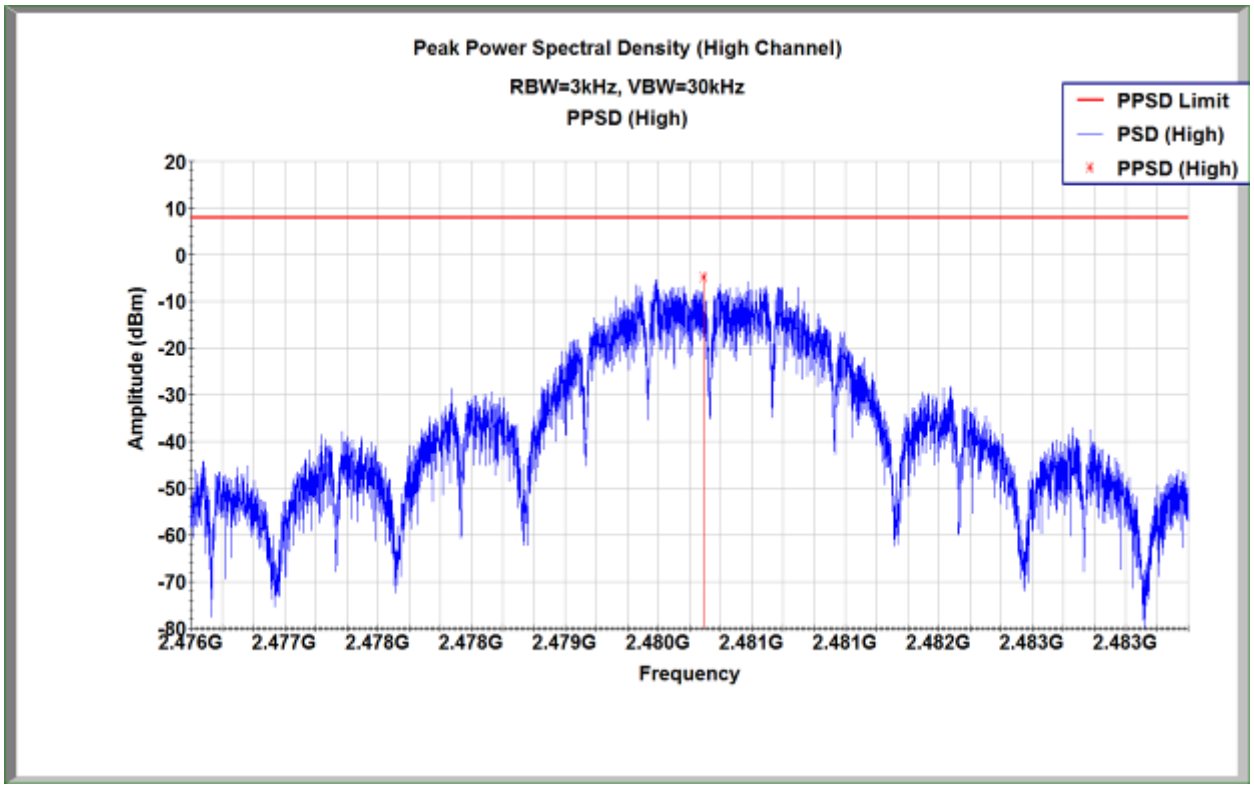
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
11	2405.61	-3.854	8	11.854
18	2440.45	-3.221	8	11.221
26	2480.11	-4.846	8	12.846



Channel 11 (2405MHz) PPSD



Channel 18 (2440MHz) PPSD



Channel 26 (2480MHz) PSSD

Deviations, Additions, or Exclusions: None

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 4 § 8.3:

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 uses antennas with unique coupling.

13 Conducted Emissions

13.1 Method

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

TEST SITE: Ground Plane

Site Designation: Ground Plane

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	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.

13.2 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

13.3 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

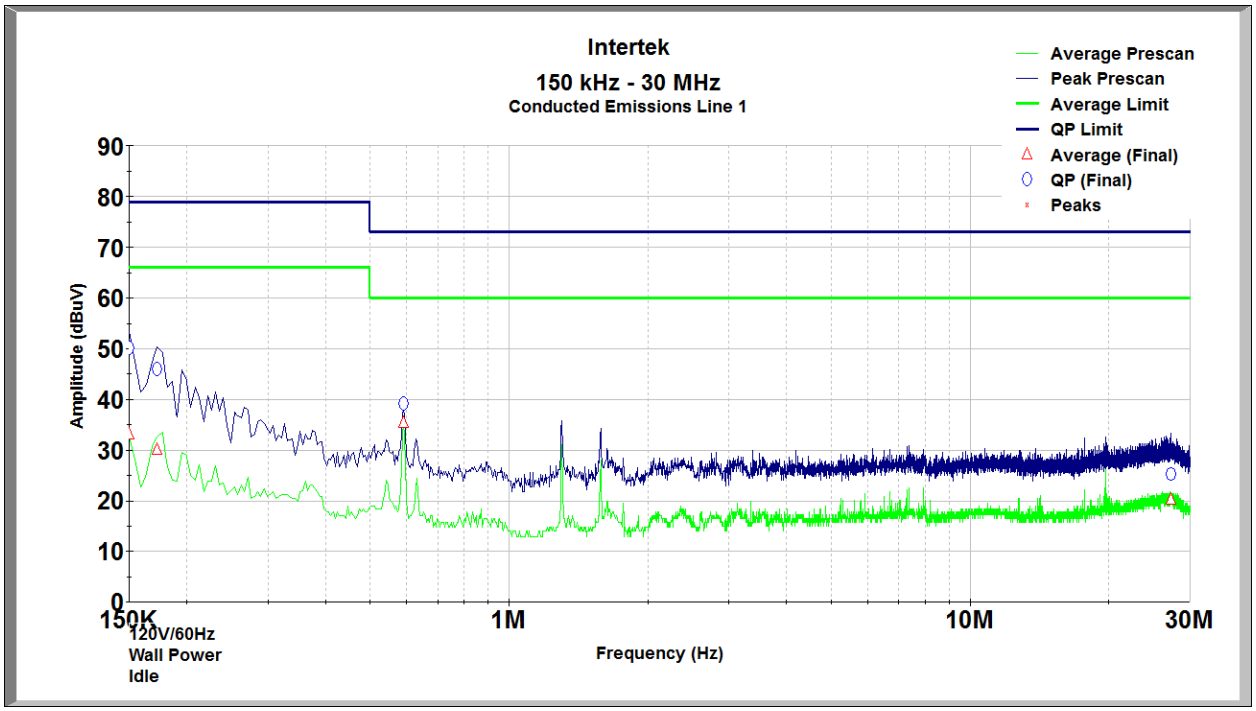
13.4 Software Utilized:

Name	Manufacturer	Version
TILE	ETS Lindgren	V7.0.6.545

13.5 Results:

The sample tested was found to Comply.

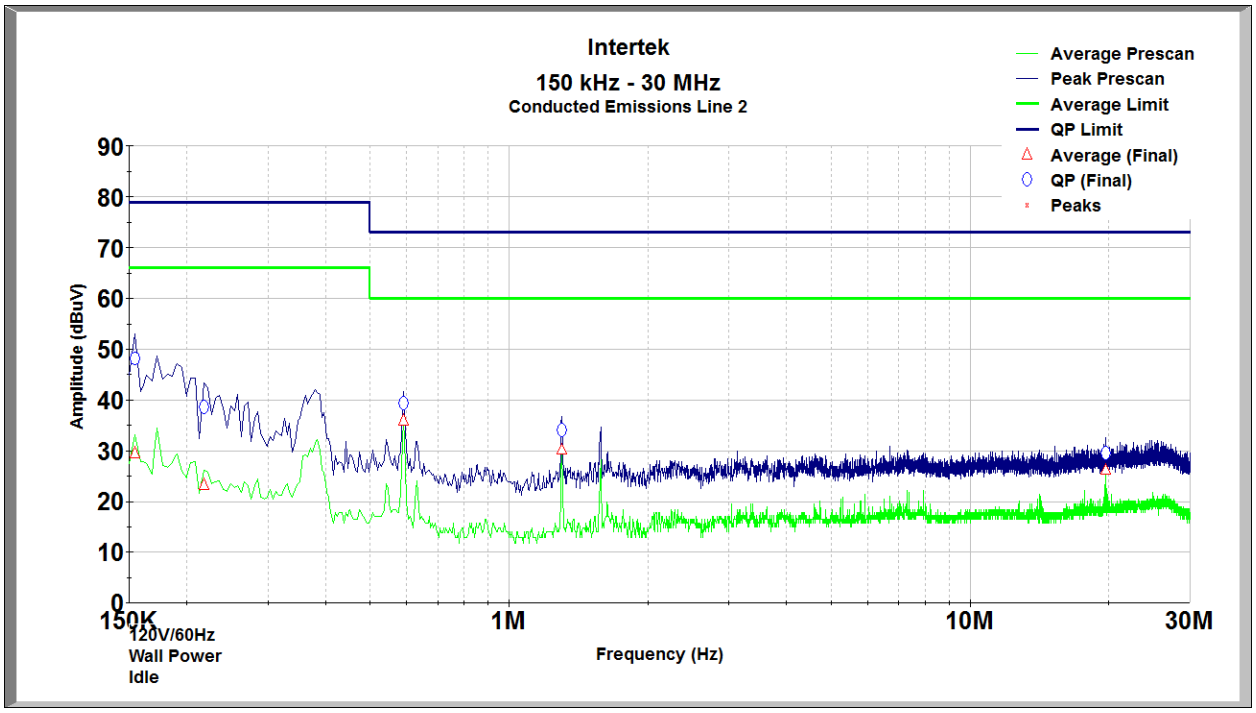
13.6 Plots/Data: Conducted Emissions (Idle)



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

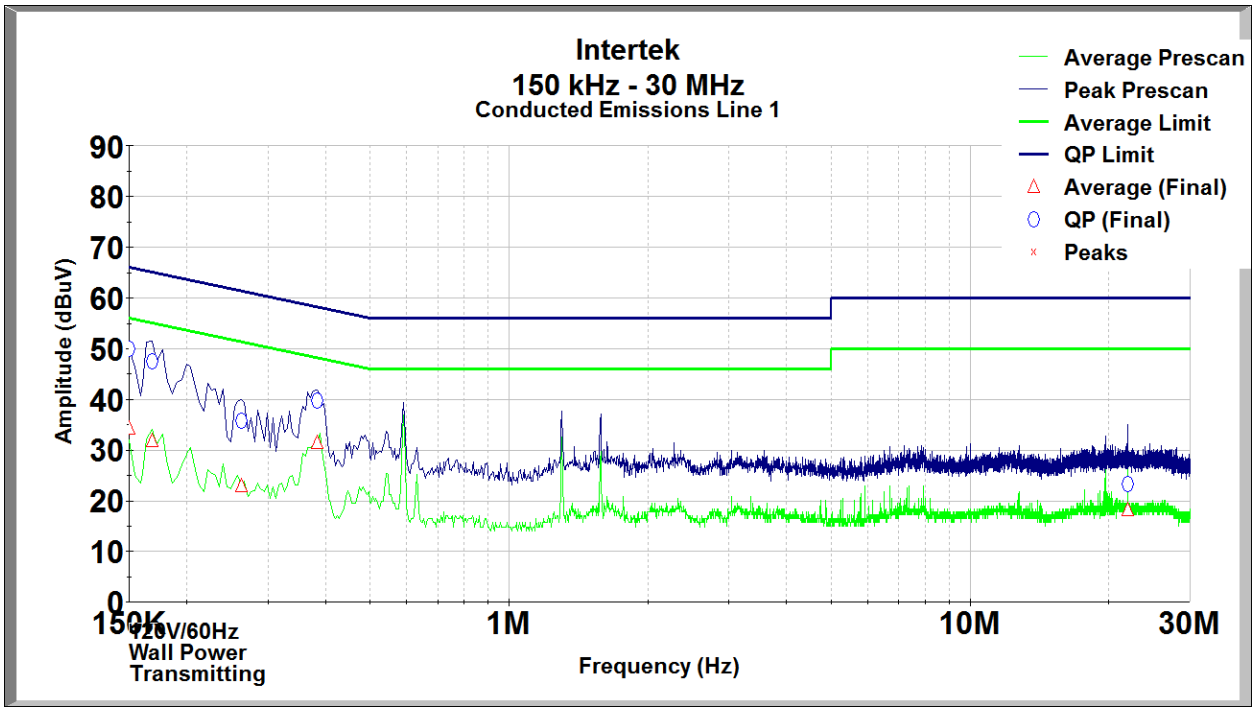
Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.155	48.314	79.000	30.686	29.487	66.000	36.513
0.218	38.632	79.000	40.368	23.269	66.000	42.731
0.591	39.343	73.000	33.657	35.905	60.000	24.095
1.302	34.031	73.000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

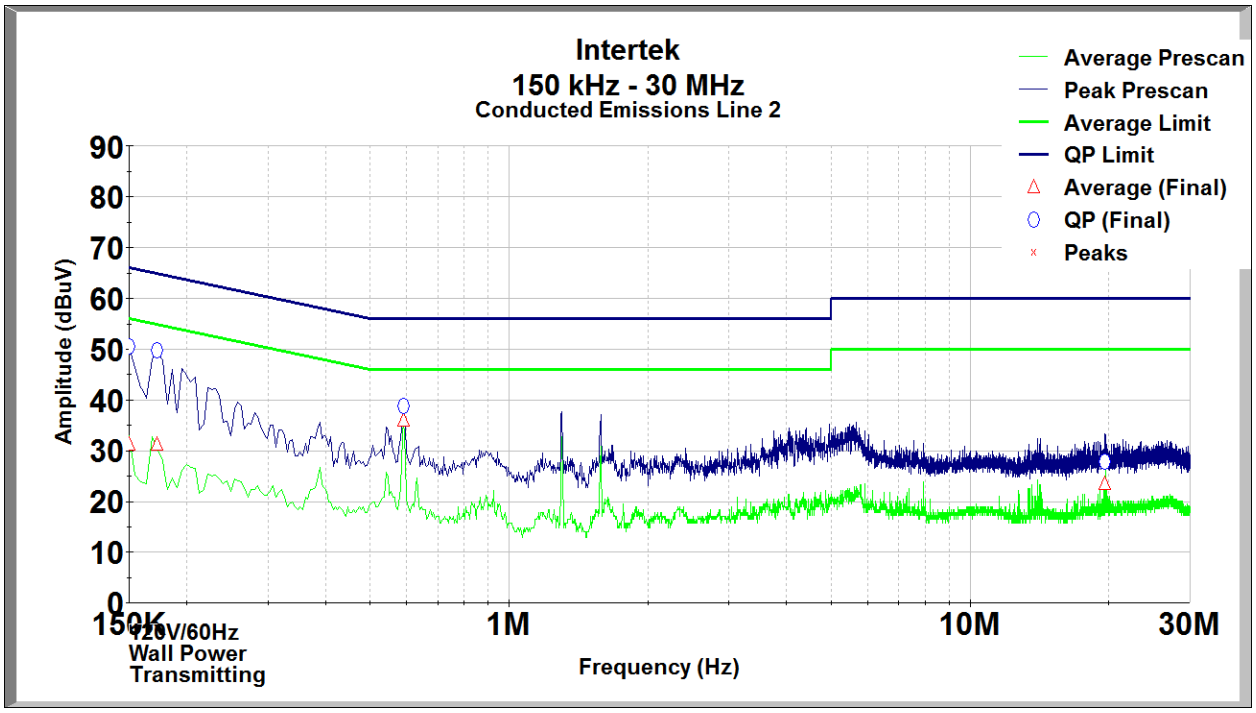
13.7 Plots/Data: Conducted Emissions (Transmitting)



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

14 Revision History

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