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VIRTUAL ACCESS IRELAND LTD. TEST REPORT

SCOPE OF WORK

EMC TESTING – GW1042M-QFR

REPORT NUMBER

104922051LEX-001.2

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EMC TEST REPORT

(FULL COMPLIANCE)

Report Number: 104922051LEX-001.2

Project Number: G104922051

Report Issue Date: 8/17/2022

Report Revised Date: 4/10/2023

Model(s) Tested: GW1042M-QFR

Standards: FCC Part 15B
ICES-003 Issue 7
FCC Part 15C
RSS 247 issue 2

Tested by:
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Lexington, KY 40510
USA

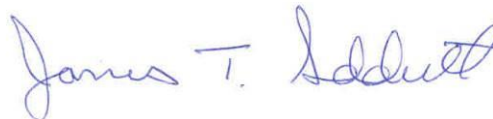
Client:
VIRTUAL ACCESS IRELAND LTD.
Unit 9B Beckett Way
Park West Business Park
Dublin
D12 PK44
Ireland

Report prepared by



Brian Lackey, Team Leader

Report reviewed by



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1 Introduction and Conclusion

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

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

2 Test Summary

Section	Test full name	Result
6	Radiated Spurious Emissions & Band Edge (FCC Part 15.247(d); RSS-247 Issue 2 § 5.5)	Pass
7	Occupied Bandwidth (ANSI C63.10:2013)	Pass
8	Maximum Peak Output Power (FCC Part 15.247(b); RSS-247 Issue 2 § 5.4(b))	Pass
9	Power Spectral Density (FCC Part 15.247(e); RSS-247 Issue 2 § 5.2(b))	Pass
10	Conducted Spurious Emissions (FCC Part 15.247(d); RSS-247 Issue 2 § 5.5(b))	Pass
11	Conducted Emissions (ANSI C63.4:2014)	Pass
12	Antenna Requirement (FCC Part 15.203; RSS-Gen Issue 2 § 6.8)	Pass



3 Client Information

This product was tested at the request of the following:

Client Information	
Client Name:	VIRTUAL ACCESS IRELAND LTD.
Address:	Unit 9B Beckett Way Park West Business Park Dublin D12 PK44 Ireland
Contact:	Nigel Ifill
Telephone:	+353 1 604 1800
Email:	nigel.ifill@virtualaccess.com
Manufacturer Information	
Manufacturer Name:	VIRTUAL ACCESS IRELAND LTD.
Manufacturer Address:	Unit 9B Beckett Way Park West Business Park Dublin D12 PK44 Ireland



4 Description of Equipment under Test and Variant Models

Equipment Under Test	
Product Name	GW1042M-QFR
Model Number	GW1042M-QFR
Serial Number	Sample #1
Hardware Version	CPX-25.01.40.028
Software Version	Rev8
Supported Transmit Bands	GSM Band 850, 900, 1800, 1900 WCDMA I, III, VIII LTE band 1,2,3,4,5,7, 8, 12,13,18, 19, 20, 25, 26, 28, 38, 39, 40, 41 802.11 b/g/n 2.4GHz
Embedded Module	EG25-G MiniPCIE
Embedded Module hardware Version	R1.0
Embedded Module Software Version	EG25GGBR07A07M2G
Embedded Module FCCID	XMR201903EG25G
Receive Date	4/15/2022
Test Start Date	4/15/2022
Test End Date	4/10/2023
Device Received Condition	Good
Test Sample Type	Production
Rated Voltage	12 VDC
Low Voltage	9 VDC
High Voltage	36 VDC
Description of Equipment Under Test (provided by client)	
The Virtual Access GW1000M Series router is a compact and rugged 4G/LTE router with Wi-Fi for use in both vehicles and a wide range of site-based applications. The GW1000M enables 4G/LTE or 3G connectivity in a wide range of applications including telemetry, remote monitoring and Wi-Fi services in buses, taxis and fleet vehicles. The product is equally at home in site locations offering primary WAN, 4G/LTE failover to fixed line connections. Its small size is ideal for M2M applications such as remote monitoring and control. The product line supports the following radio access technologies: LTE, HSPA+, HSPA, UMTS, EDGE, GPRS and GSM.	

4.1 Variant Models:

There were no variant models covered by this evaluation.



5 System Setup and Method

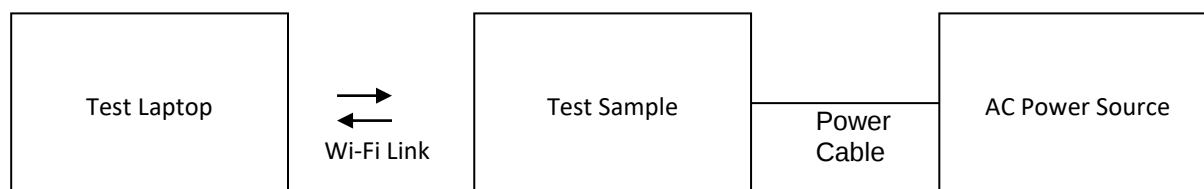
5.1 Method:

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

No.	Descriptions of EUT Exercising
1	The GW1042M-QFR was powered and operating normally for the duration of the evaluation.
2	The GW1042M-QFR was provisioned to connect to a test Laptop over Wi-Fi. The was configured to operate on a low, mid, and high channel.

Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
1	Power Cable	2	None	None	AC to DC power converter
2	Ethernet Cable	1	None	None	None
3	Antenna Cable	3	None	None	Cellular Antenna

5.2 EUT Block Diagram:





6 Radiated Spurious Emissions & Band Edge

6.1 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.

6.2 Test Method

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

TEST SITE: 10m ALSE

Site Designation: 10m Chamber

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	U _{CISPR}
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.



6.3 Sample Calculation

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

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

Where

FS = Field Strength in dB μ V/m

RA = Receiver Amplitude (including preamplifier) in dB μ V

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB

AG = Amplifier Gain in dB

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

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

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

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

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

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

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

To convert from dB μ V to μ V or mV the following was used:

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

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

Example:

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

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



6.4 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	8181	Rohde & Schwarz	ESW44	11/16/2021	11/16/2022
EMI Test Receiver	8285	Rohde & Schwarz	ESW44	12/22/2022	12/22/2023
Bilog Antenna	3133	ETS	3142C	8/26/2021 8/10/2022	8/26/2022 8/10/2023
Horn Antenna	4001	ETS	3117	2/23/2022 2/28/2023	2/23/2023 2/28/2024
Magnetic Loop Antenna	2366	ETS	6502	8/22/2022	8/22/2023
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	3918	Rohde & Schwarz	TS-PR18	1/13/2022 1/13/2023	1/13/2023 1/13/2024
Coaxial Cable	3074			1/13/2022 1/13/2023	1/13/2023 1/13/2024
Coaxial Cable	2588			1/13/2022 1/13/2023	1/13/2023 1/13/2024
Coaxial Cable	2593			1/13/2022 1/13/2023	1/13/2023 1/13/2024
Coaxial Cable	8185			1/13/2022 1/13/2023	1/13/2023 1/13/2024
Coaxial Cable	8188			1/13/2022 1/13/2023	1/13/2023 1/13/2024
Coaxial Cable	3339			1/13/2022 1/13/2023	1/13/2023 1/13/2024
Preamplifier	3919	Rohde & Schwarz	TS-PR3	1/13/2022 1/13/2023	1/13/2023 1/13/2024
Coaxial Cable	3172			1/13/2022 1/13/2023	1/13/2023 1/13/2024
Coaxial Cable	2590			1/13/2022 1/13/2023	1/13/2023 1/13/2024
Coaxial Cable	8186			1/13/2022 1/13/2023	1/13/2023 1/13/2024
Coaxial Cable	8187			1/13/2022 1/13/2023	1/13/2023 1/13/2024
Preamplifier (18-40GHz)	3921	Rohde & Schwarz	TS-PR40	1/13/2022 1/13/2023	1/13/2023 1/13/2024
Horn Antenna (18-40GHz)	3779	ETS	3116c	7/30/2021 8/22/2022	7/30/2022 8/22/2023



6.5 Software Utilized

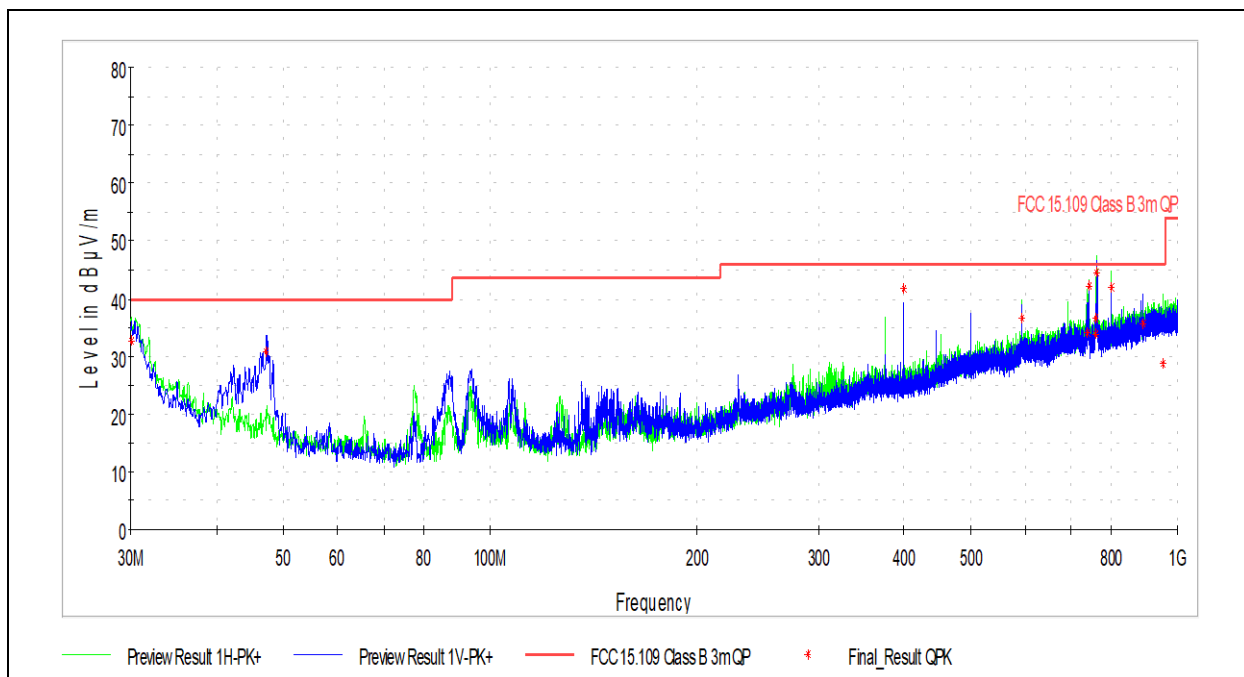
Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 10.60.20

6.6 Test Results

The sample tested was found to be **compliant**. The data presented represents the worst-case emissions with the device positioned in three orthogonal positions. All observed emissions outside of the band of operation were attenuated by at least 20dB.



6.7 Plots/Data: Radiated Emissions, 30MHz – 1GHz (Transmitters Idle)

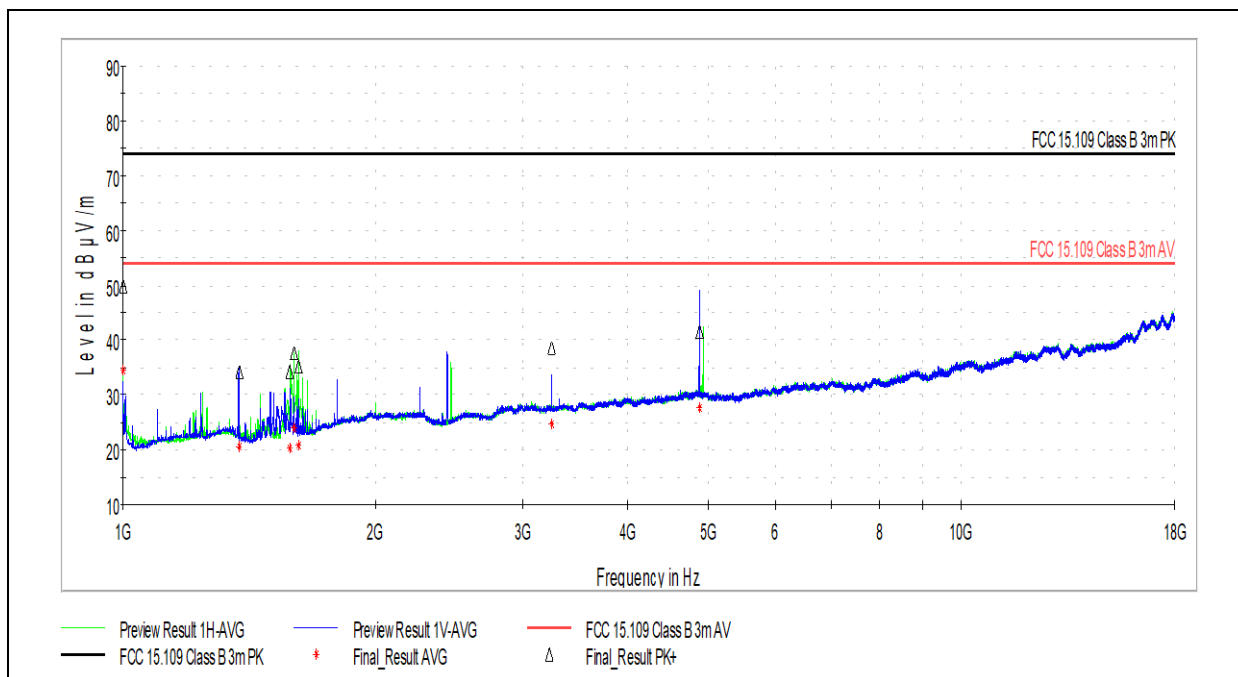


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.053889	32.70	40.000	7.30	120.000	217.0	H	6.0	25.15
47.244444	30.93	40.000	9.07	120.000	100.0	V	292.0	16.14
400.001111	41.65	46.021	4.37	120.000	105.0	V	28.0	25.91
594.001111	36.60	46.021	9.42	120.000	204.0	H	0.0	31.94
738.962222	34.07	46.021	11.95	120.000	205.0	H	198.0	34.19
743.596667	42.10	46.021	3.92	120.000	354.0	H	176.0	34.21
759.763333	33.84	46.021	12.18	120.000	244.0	H	276.0	34.20
760.895000	36.67	46.021	9.35	120.000	309.0	H	96.0	34.20
762.511667	44.46	46.021	1.56	120.000	151.0	H	217.0	34.21
800.018333	42.02	46.021	4.00	120.000	95.0	H	58.0	34.69
891.036667	35.81	46.021	10.21	120.000	149.0	V	71.0	35.41
952.416111	28.66	46.021	17.36	120.000	99.0	H	77.0	37.19

Test Personnel: Michael Carlson
Supervising/Reviewing Engineer: N/A
(Where Applicable)
Product Standard: FCC Part 15B
Input Voltage: ICES-003 Issue 7
120VAC / 60Hz
Pretest Verification w / Ambient
Signals or BB Source: Yes

Test Date: 4/15/2022
Limit Applied: Class B
Ambient Temperature: 23.4°C
Relative Humidity: 31.1%
Atmospheric Pressure: 986.9 mbar

Deviations, Additions, or Exclusions: The FCC Part 15.109 limits are more stringent than the corresponding limits from ICES-003 Issue 7.

**6.8 Plots/Data: Radiated Emissions, 1GHz – 18GHz (Transmitters Idle)**

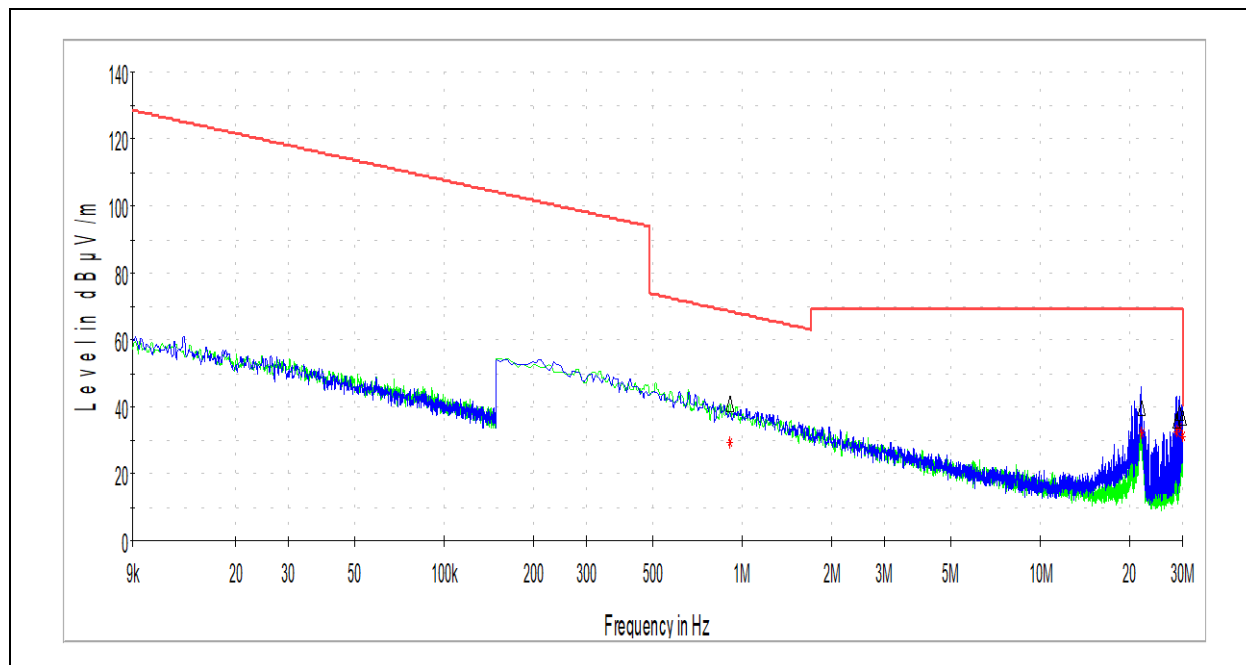
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1000.000000	49.84	73.979	24.14	1000.000	301.0	H	0.0	-0.15
1375.000000	34.22	73.979	39.76	1000.000	339.0	V	327.0	-0.72
1580.000000	34.30	73.979	39.68	1000.000	324.0	H	279.0	-0.89
1600.000000	37.71	73.979	36.27	1000.000	137.0	H	306.0	-0.72
1620.000000	35.09	73.979	38.89	1000.000	180.0	H	48.0	-0.44
3249.000000	38.68	73.979	35.30	1000.000	327.0	V	0.0	5.90
4874.000000	41.62	73.979	32.36	1000.000	360.0	V	0.0	9.37

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1000.000000	34.51	53.979	19.47	1000.000	301.0	H	0.0	-0.15
1375.000000	20.52	53.979	33.46	1000.000	339.0	V	327.0	-0.72
1580.000000	20.17	53.979	33.81	1000.000	324.0	H	279.0	-0.89
1600.000000	23.83	53.979	30.15	1000.000	137.0	H	306.0	-0.72
1620.000000	20.68	53.979	33.30	1000.000	180.0	H	48.0	-0.44
3249.000000	24.65	53.979	29.33	1000.000	327.0	V	0.0	5.90
4874.000000	27.60	53.979	26.38	1000.000	360.0	V	0.0	9.37

Test Personnel: Michael Carlson
Supervising/Reviewing Engineer: N/A
(Where Applicable) FCC Part 15B
Product Standard: ICES-003 Issue 7
Input Voltage: 120VAC / 60Hz
Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 4/15/2022
Limit Applied: Class B
Ambient Temperature: 23.4°C
Relative Humidity: 31.1%
Atmospheric Pressure: 986.9 mbar

Deviations, Additions, or Exclusions: None

**6.9 FCC Part 15.247 Radiated Spurious Emissions (9kHz – 30MHz)**

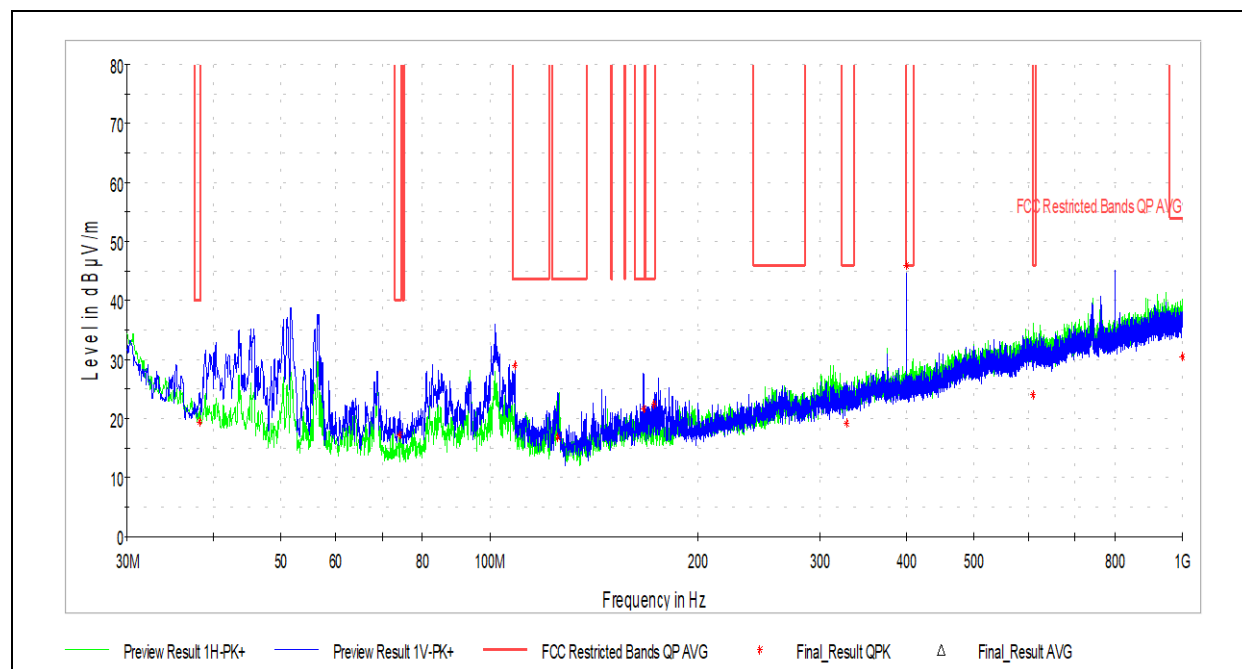
Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Azimuth (deg)	Corr. (dB/m)
0.909419	41.03	88.44	47.41	9.000	318.0	11.5
21.905382	39.61	89.50	49.89	9.000	90.0	9.7
28.687478	35.86	89.50	53.64	9.000	110.0	8.4
29.236191	38.22	89.50	51.28	9.000	82.0	8.3
29.969272	36.69	89.50	52.81	9.000	108.0	8.1

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Azimuth (deg)	Corr. (dB/m)
0.909419	29.43	68.44	39.01	9.000	318.0	11.5
21.905382	32.29	69.50	37.21	9.000	90.0	9.7
28.687478	32.41	69.50	37.09	9.000	110.0	8.4
29.236191	33.98	69.50	35.52	9.000	82.0	8.3
29.969272	31.15	69.50	38.35	9.000	108.0	8.1

Test Personnel: David Perry
 Supervising/Reviewing Engineer: Brian Lackey
 (Where Applicable) FCC Part 15.247
 Product Standard: RSS-247 Issue 2
 Input Voltage: 120VAC / 60Hz
 Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 4/10/2023
 Limit Applied: FCC Part 15.209 in Restricted Bands from FCC Part 15.205
 Ambient Temperature: 21.6C
 Relative Humidity: 26.2%
 Atmospheric Pressure: 996.9mbar

Deviations, Additions, or Exclusions: Testing was performed on 802.11b channel 1, representative of the worst-case emissions for all Wi-Fi modes.

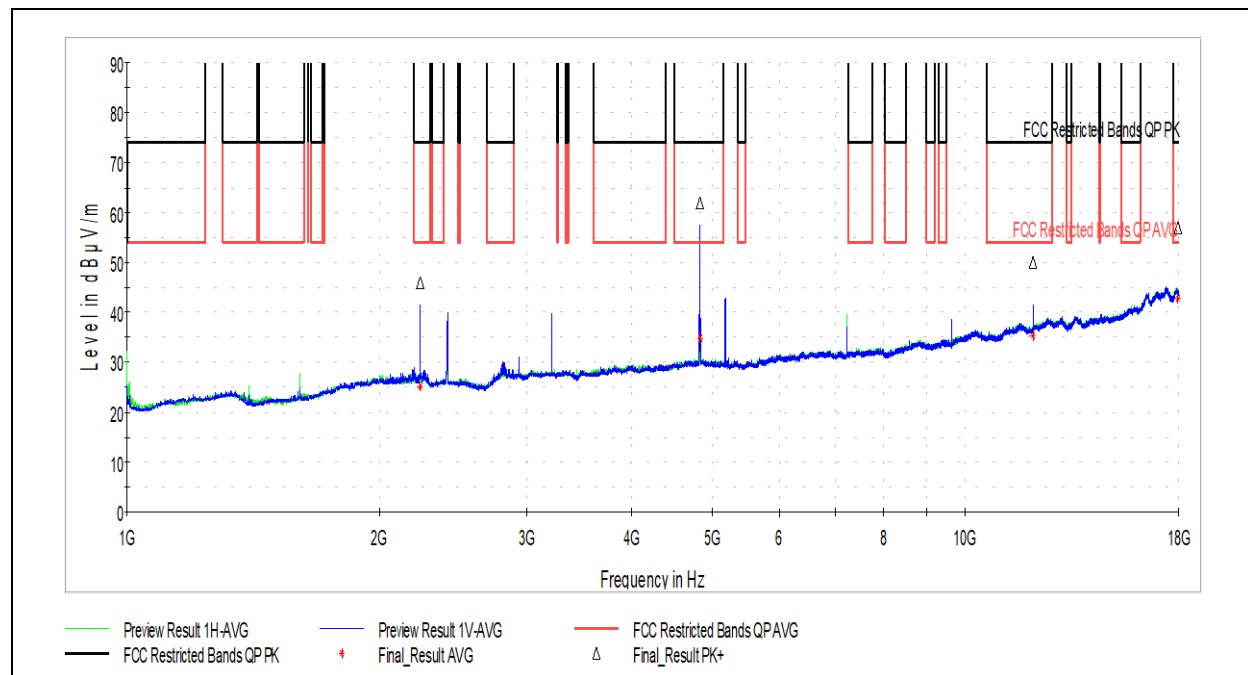
**6.10 FCC Part 15.247 Radiated Spurious Emissions (Wi-Fi 802.11b)****6.10.1 Radiated Spurious Emissions, 30 MHz – 1 GHz, Channel 1**

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
38.137222	19.38	40.000	20.62	120.000	100.0	V	338.0	19.07
74.135000	17.12	40.000	22.88	120.000	100.0	V	113.0	14.17
108.785556	29.10	43.522	14.42	120.000	100.0	V	231.0	16.77
125.652778	16.79	43.522	26.74	120.000	100.0	V	94.0	15.92
166.770000	21.59	43.522	21.94	120.000	100.0	V	248.0	18.73
172.751667	22.46	43.522	21.07	120.000	100.0	V	263.0	18.89
327.412778	19.25	46.021	26.77	120.000	95.0	H	38.0	24.83
400.001111	45.93	46.021	0.09	120.000	100.0	V	72.0	25.91
608.389444	23.99	46.021	22.03	120.000	115.0	H	0.0	32.42
999.461111	30.35	53.979	23.63	120.000	95.0	H	113.0	37.40

Test Personnel: Ben Coolbear
Supervising/Reviewing Engineer: _____
(Where Applicable) N/A
FCC Part 15.247
Product Standard: RSS-247 Issue 2
Input Voltage: 120VAC / 60Hz
Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 4/21/2022
Limit Applied: FCC Part 15.209 in Restricted Bands from FCC Part 15.205
Ambient Temperature: 23.8°C
Relative Humidity: 26.7%
Atmospheric Pressure: 987.7 mbar

Deviations, Additions, or Exclusions: Testing was performed on channel 1, representative of the worst case evaluation for the 802.11b across the 30MHz to the 1GHz range.

**6.10.2 Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 1**

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2236.000000	46.10	73.979	27.88	1000.000	100.0	V	317.0	3.61
4824.000000	61.93	73.979	12.05	1000.000	355.0	V	190.0	9.45
12058.500000	49.98	73.979	24.00	1000.000	410.0	V	0.0	19.84
17945.500000	56.87	73.979	17.11	1000.000	321.0	H	0.0	28.02

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2236.000000	25.19	53.979	28.79	1000.000	100.0	V	317.0	3.61
4824.000000	34.83	53.979	19.15	1000.000	355.0	V	190.0	9.45
12058.500000	35.27	53.979	18.71	1000.000	410.0	V	0.0	19.84
17945.500000	42.82	53.979	11.16	1000.000	321.0	H	0.0	28.02

Test Personnel: Ben Coolbear

Supervising/Reviewing Engineer: N/A

(Where Applicable) FCC Part 15.247

Product Standard: RSS-247 Issue 2

Input Voltage: 120VAC / 60Hz

Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 4/25/2022

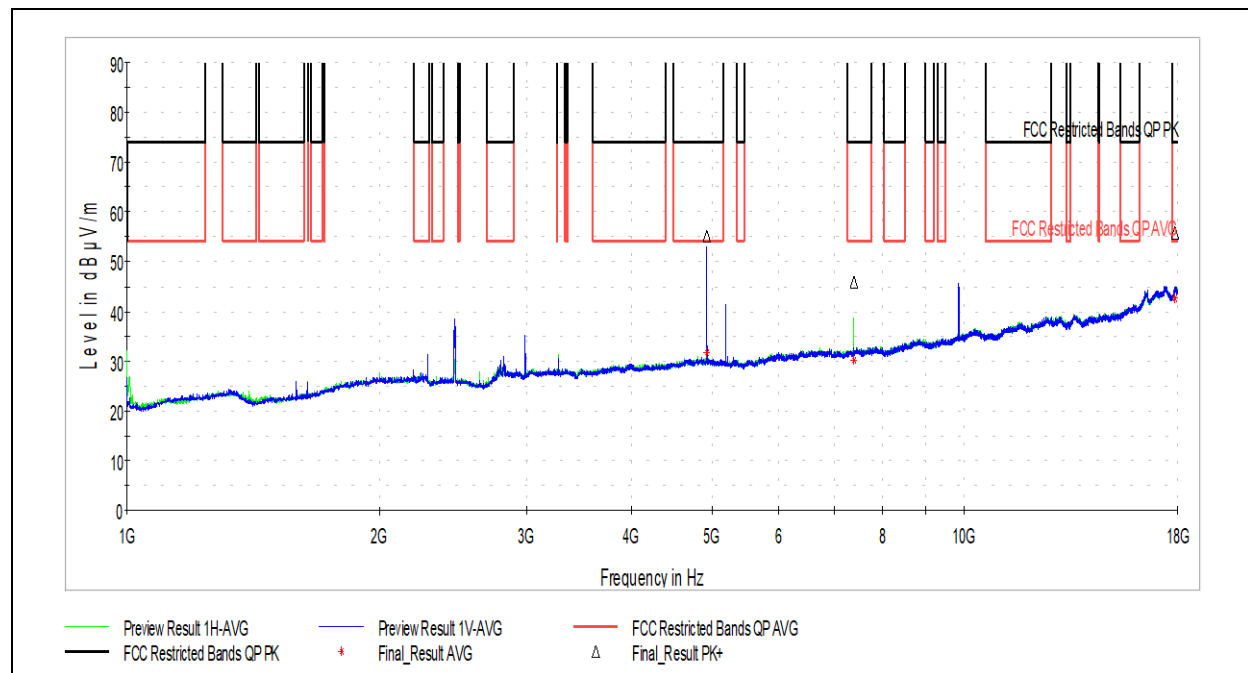
Limit Applied: FCC Part 15.209 in Restricted Bands from FCC Part 15.205

Ambient Temperature: 25.1°C

Relative Humidity: 49.7%

Atmospheric Pressure: 983.8 mbar

Deviations, Additions, or Exclusions: None

**6.10.3 Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 11**

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4924.000000	55.16	73.979	18.82	1000.000	410.0	V	199.0	9.27
7387.500000	45.95	73.979	28.03	1000.000	222.0	H	359.0	12.65
17851.000000	55.83	73.979	18.15	1000.000	353.0	H	120.0	27.56

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4924.000000	31.72	53.979	22.26	1000.000	410.0	V	199.0	9.27
7387.500000	30.26	53.979	23.72	1000.000	222.0	H	359.0	12.65
17851.000000	42.62	53.979	11.36	1000.000	353.0	H	120.0	27.56

Test Personnel: Ben Coolbear

Supervising/Reviewing Engineer: (Where Applicable) N/A

Product Standard: RSS-247 Issue 2

Input Voltage: 120VAC / 60Hz

Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 4/25/2022

Limit Applied: FCC Part 15.209 in Restricted Bands from FCC Part 15.205

Ambient Temperature: 25.1°C

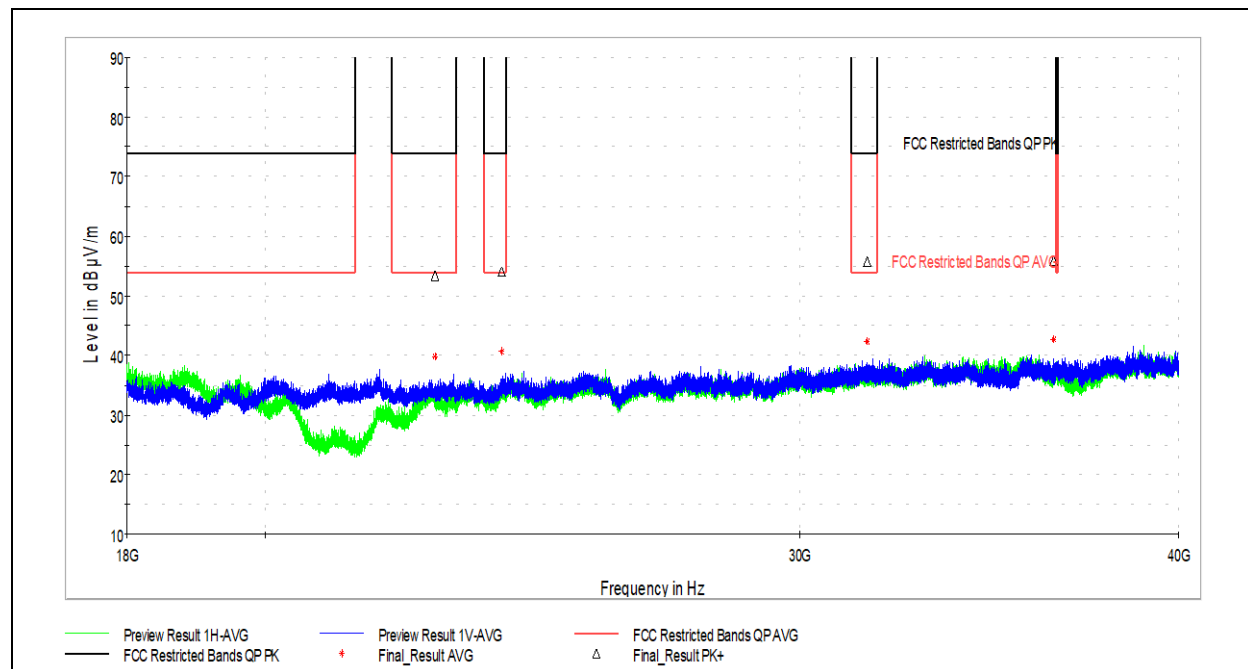
Relative Humidity: 49.7%

Atmospheric Pressure: 983.8 mbar

Deviations, Additions, or Exclusions: None



6.10.4 Radiated Spurious Emissions, 18GHz – 40 GHz, Channel 6



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
22740.000000	53.36	73.979	20.62	1000.000	118.0	V	185.0	6.72
23915.000000	54.12	73.979	19.86	1000.000	186.0	V	254.0	6.52
31581.000000	55.76	73.979	18.22	1000.000	126.0	V	0.0	11.21
36370.500000	55.96	1000.000	944.04	1000.000	100.0	V	11.0	11.58

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
22740.000000	39.90	53.979	14.08	1000.000	118.0	V	185.0	6.72
23915.000000	40.74	53.979	13.24	1000.000	186.0	V	254.0	6.52
31581.000000	42.32	53.979	11.66	1000.000	126.0	V	0.0	11.21
36370.500000	42.77	1000.000	957.23	1000.000	100.0	V	11.0	11.58

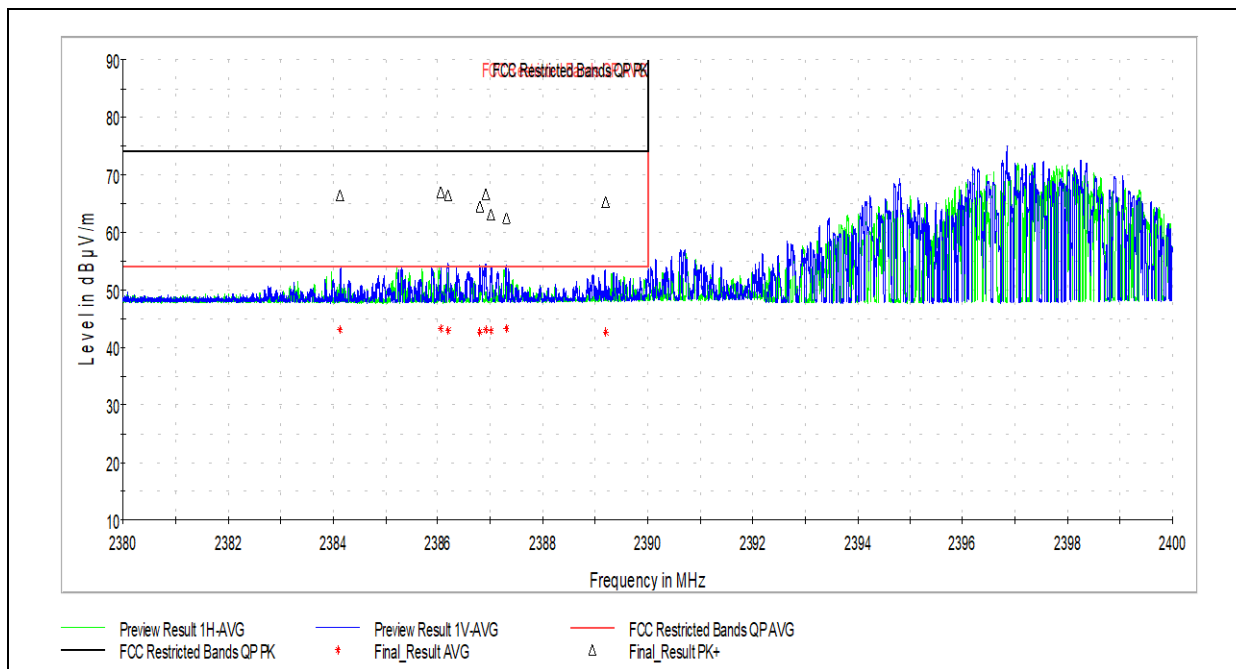
Test Personnel: Michael Carlson
Supervising/Reviewing Engineer: _____
(Where Applicable) N/A
FCC Part 15.247
Product Standard: RSS-247 Issue 2
Input Voltage: 120VAC / 60Hz
Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 4/30/2022
Limit Applied: FCC Part 15.209 in Restricted Bands from FCC Part 15.205
Ambient Temperature: 23.7°C
Relative Humidity: 38.1%
Atmospheric Pressure: 982.3 mbar

Deviations, Additions, or Exclusions: Testing was performed on channel 6, representative of the worst-case evaluation for the 802.11b across the 18GHz to the 40GHz range.



6.10.5 Emissions at the Low Band Edge



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2384.136250	66.42	73.979	7.56	1000.000	358.0	V	208.0	38.57
2386.047500	67.00	73.979	6.98	1000.000	237.0	V	190.0	38.56
2386.187500	66.44	73.979	7.54	1000.000	181.0	V	193.0	38.56
2386.803750	64.42	73.979	9.56	1000.000	331.0	V	316.0	38.55
2386.916250	66.62	73.979	7.36	1000.000	183.0	V	194.0	38.55
2387.010000	63.21	73.979	10.77	1000.000	294.0	V	0.0	38.55
2387.302500	62.65	73.979	11.33	1000.000	294.0	V	0.0	38.55
2389.192500	65.33	73.979	8.65	1000.000	341.0	V	0.0	38.54



Frequency (MHz)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2384.136250	43.12	53.979	10.86	1000.000	358.0	V	208.0	38.57
2386.047500	43.21	53.979	10.77	1000.000	237.0	V	190.0	38.56
2386.187500	42.97	53.979	11.01	1000.000	181.0	V	193.0	38.56
2386.803750	42.76	53.979	11.22	1000.000	331.0	V	316.0	38.55
2386.916250	43.11	53.979	10.87	1000.000	183.0	V	194.0	38.55
2387.010000	42.89	53.979	11.09	1000.000	294.0	V	0.0	38.55
2387.302500	43.26	53.979	10.72	1000.000	294.0	V	0.0	38.55
2389.192500	42.79	53.979	11.19	1000.000	341.0	V	0.0	38.54

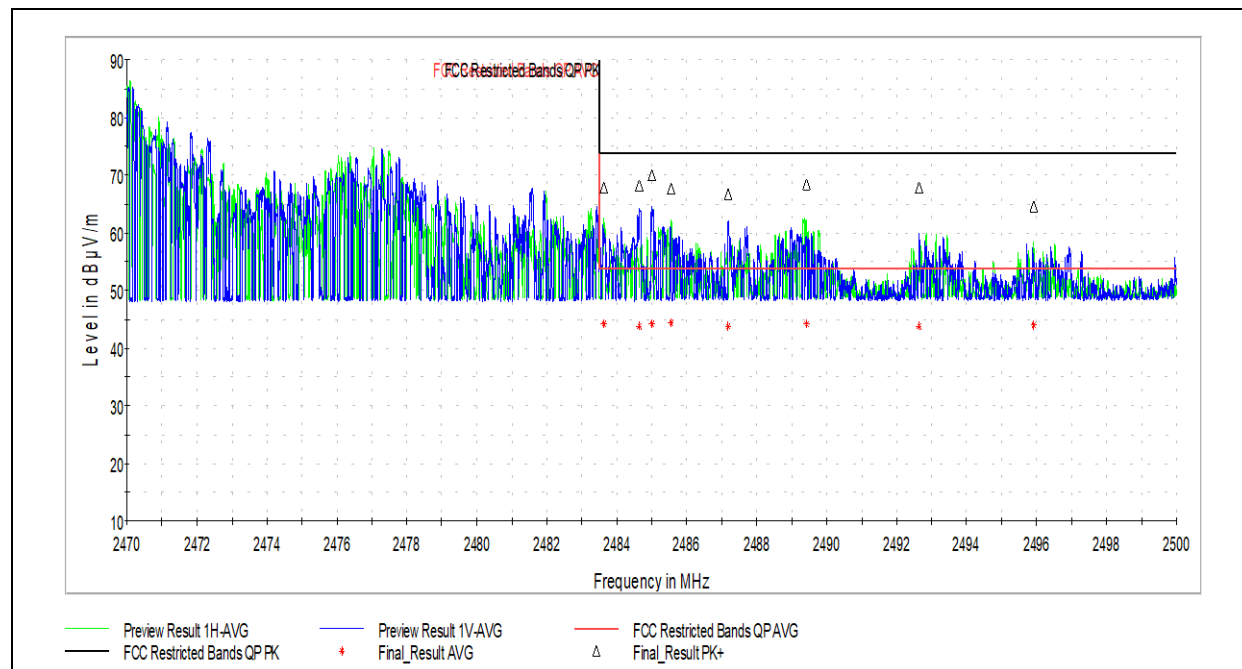
Test Personnel: Michael Carlson
Supervising/Reviewing Engineer: _____
(Where Applicable) N/A
FCC Part 15.247
Product Standard: RSS-247 Issue 2
Input Voltage: 120VAC / 60Hz
Pretest Verification w / Ambient
Signals or BB Source: Yes

Test Date: 6/26/2022
Limit Applied: FCC Part 15.209 in Restricted
Bands from FCC Part 15.205
Ambient Temperature: 25.3°C
Relative Humidity: 54.3%
Atmospheric Pressure: 984.3 mbar

Deviations, Additions, or Exclusions: None



6.10.6 Emissions at the High Band Edge



Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.625625	67.93	73.979	6.05	1000.000	297.0	H	317.0	39.01
2484.649375	68.25	73.979	5.73	1000.000	189.0	V	159.0	38.78
2485.005625	69.92	73.979	4.06	1000.000	165.0	V	199.0	38.78
2485.541875	67.59	73.979	6.39	1000.000	301.0	H	327.0	39.03
2487.188125	66.76	73.979	7.22	1000.000	173.0	V	155.0	38.78
2489.423125	68.44	73.979	5.54	1000.000	181.0	H	245.0	39.08
2492.638750	67.79	73.979	6.19	1000.000	100.0	V	192.0	38.80
2495.910625	64.51	73.979	9.47	1000.000	329.0	H	326.0	39.11

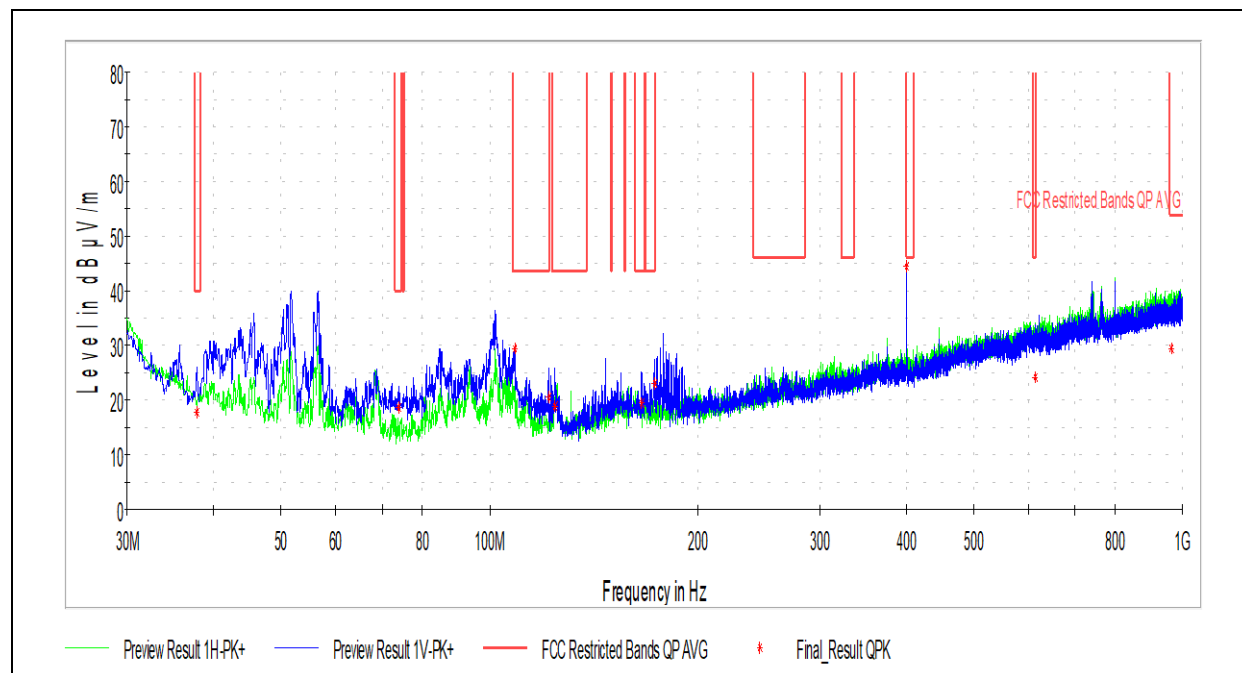


Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.625625	44.11	53.979	9.87	1000.000	297.0	H	317.0	39.01
2484.649375	43.77	53.979	10.21	1000.000	189.0	V	159.0	38.78
2485.005625	44.20	53.979	9.78	1000.000	165.0	V	199.0	38.78
2485.541875	44.28	53.979	9.70	1000.000	301.0	H	327.0	39.03
2487.188125	43.83	53.979	10.15	1000.000	173.0	V	155.0	38.78
2489.423125	44.16	53.979	9.82	1000.000	181.0	H	245.0	39.08
2492.638750	43.88	53.979	10.10	1000.000	100.0	V	192.0	38.80
2495.910625	44.05	53.979	9.93	1000.000	329.0	H	326.0	39.11

Test Personnel: Michael Carlson
Supervising/Reviewing Engineer: _____
(Where Applicable) N/A
FCC Part 15.247
Product Standard: RSS-247 Issue 2
Input Voltage: 120VAC / 60Hz
Pretest Verification w / Ambient
Signals or BB Source: Yes

Test Date: 6/26/2022
FCC Part 15.209 in Restricted
Limit Applied: Bands from FCC Part 15.205
Ambient Temperature: 25.3°C
Relative Humidity: 54.3%
Atmospheric Pressure: 984.3 mbar

Deviations, Additions, or Exclusions: None

**6.11 FCC Part 15.247 Radiated Spurious Emissions (Wi-Fi 802.11g)****6.11.1 Radiated Spurious Emissions, 30 MHz – 1 GHz, Channel 1**

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
37.813889	17.87	40.000	22.13	120.000	99.0	V	341.0	19.20
73.919444	18.64	40.000	21.36	120.000	100.0	V	229.0	14.19
108.785556	29.41	43.522	14.11	120.000	100.0	V	230.0	16.77
121.826667	20.47	43.522	23.05	120.000	100.0	V	0.0	15.99
124.305556	18.83	43.522	24.69	120.000	100.0	V	109.0	15.97
165.907778	19.41	43.522	24.11	120.000	100.0	V	264.0	18.71
173.075000	23.04	43.522	20.48	120.000	100.0	V	274.0	18.89
400.001111	44.35	46.021	1.67	120.000	100.0	V	65.0	25.91
613.131667	24.13	46.021	21.89	120.000	182.0	H	62.0	32.55
963.409444	29.42	53.979	24.56	120.000	100.0	H	229.0	37.34

Test Personnel: Ben Coolbear

Supervising/Reviewing Engineer: N/A

Product Standard: RSS-247 Issue 2

Input Voltage: 120VAC / 60Hz

Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 4/21/2022

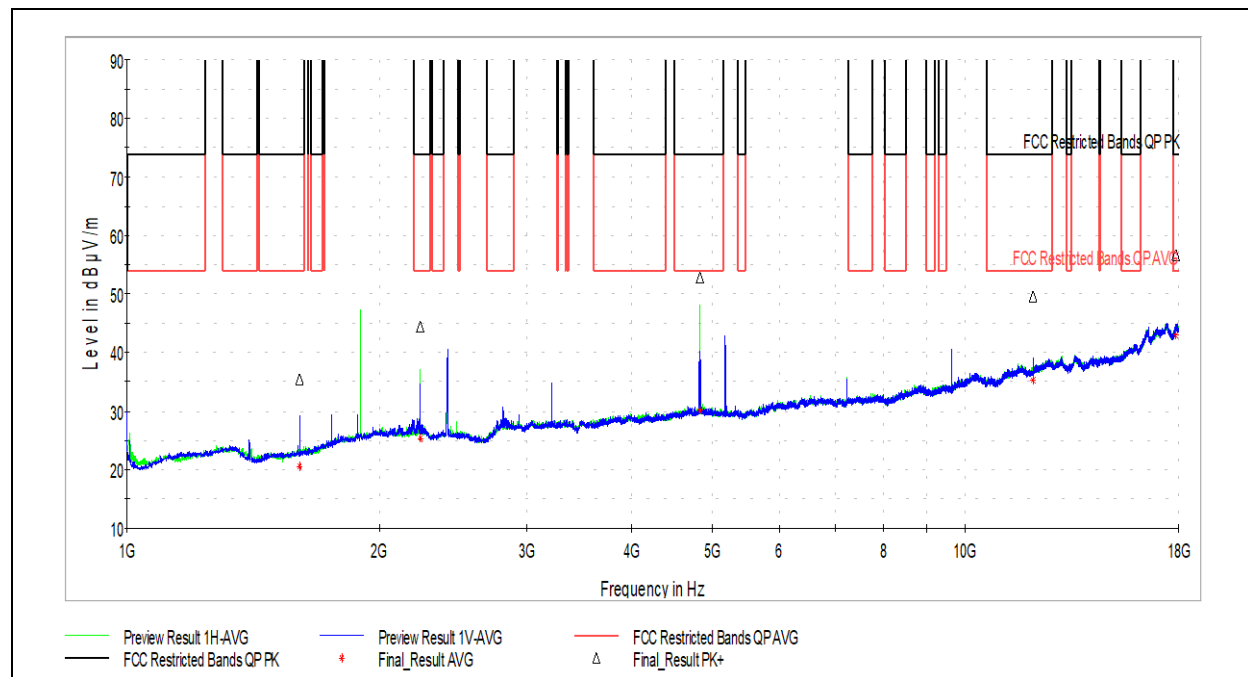
Limit Applied: FCC Part 15.209 in Restricted Bands from FCC Part 15.205

Ambient Temperature: 23.8°C

Relative Humidity: 26.7%

Atmospheric Pressure: 987.7 mbar

Deviations, Additions, or Exclusions: Testing was performed on channel 1, representative of the worst case evaluation for the 802.11g across the 30MHz to the 1GHz range.

**6.11.2 Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 1**

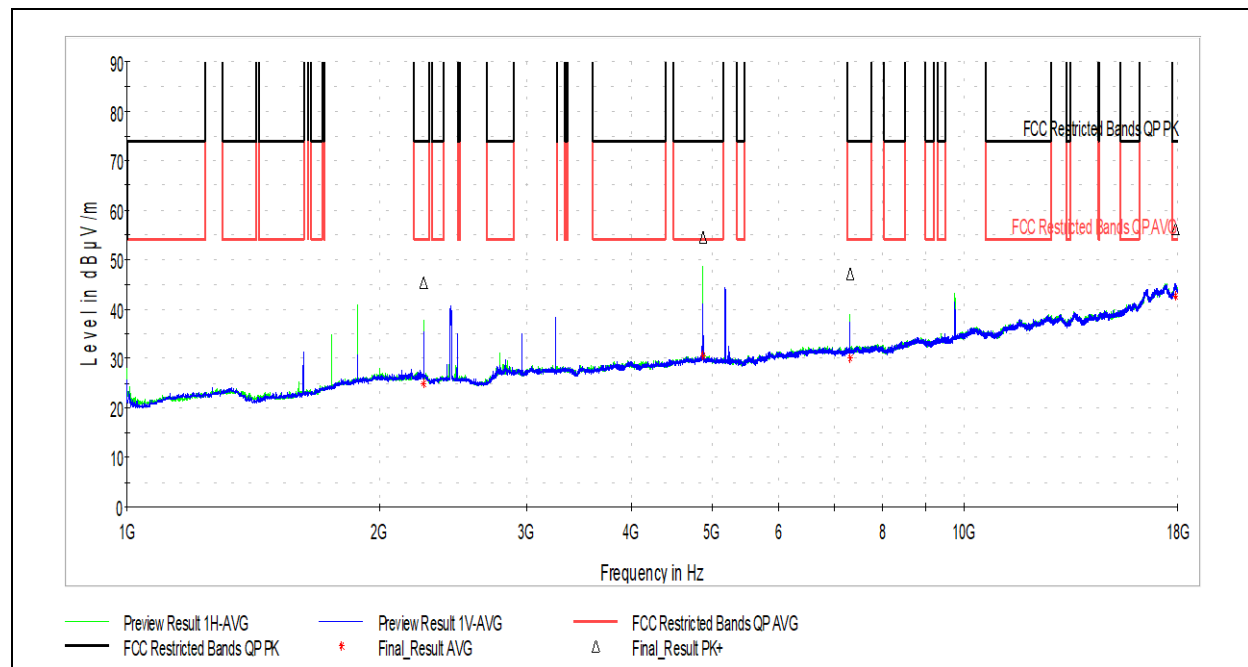
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1607.500000	35.36	73.979	38.62	1000.000	391.0	V	257.0	-0.85
2236.000000	44.46	73.979	29.52	1000.000	136.0	H	35.0	3.86
4824.000000	52.93	73.979	21.05	1000.000	410.0	H	264.0	9.49
12061.500000	49.59	73.979	24.39	1000.000	177.0	V	338.0	19.84
17859.500000	56.68	73.979	17.30	1000.000	410.0	H	0.0	27.60

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1607.500000	20.57	53.979	33.41	1000.000	391.0	V	257.0	-0.85
2236.000000	25.30	53.979	28.68	1000.000	136.0	H	35.0	3.86
4824.000000	30.16	53.979	23.82	1000.000	410.0	H	264.0	9.49
12061.500000	35.27	53.979	18.71	1000.000	177.0	V	338.0	19.84
17859.500000	42.84	53.979	11.14	1000.000	410.0	H	0.0	27.60

Test Personnel: Ben Coolbear
Supervising/Reviewing Engineer: N/A
(Where Applicable)
FCC Part 15.247
Product Standard: RSS-247 Issue 2
Input Voltage: 120VAC / 60Hz
Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 4/25/2022
Limit Applied: FCC Part 15.209 in Restricted Bands from FCC Part 15.205
Ambient Temperature: 25.1°C
Relative Humidity: 49.7%
Atmospheric Pressure: 983.8 mbar

Deviations, Additions, or Exclusions: None

**6.11.3 Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 11**

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2261.000000	45.39	73.979	28.59	1000.000	354.0	H	348.0	3.90
4874.000000	54.38	73.979	19.60	1000.000	100.0	H	0.0	9.40
7309.500000	46.98	73.979	27.00	1000.000	100.0	H	330.0	12.64
17896.000000	56.14	73.979	17.84	1000.000	342.0	V	256.0	27.66

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2261.000000	25.01	53.979	28.97	1000.000	354.0	H	348.0	3.90
4874.000000	30.48	53.979	23.50	1000.000	100.0	H	0.0	9.40
7309.500000	30.14	53.979	23.84	1000.000	100.0	H	330.0	12.64
17896.000000	42.78	53.979	11.20	1000.000	342.0	V	256.0	27.66

Test Personnel: Ben Coolbear

Supervising/Reviewing Engineer: (Where Applicable) N/A

FCC Part 15.247

Product Standard: RSS-247 Issue 2

Input Voltage: 120VAC / 60Hz

Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 4/25/2022

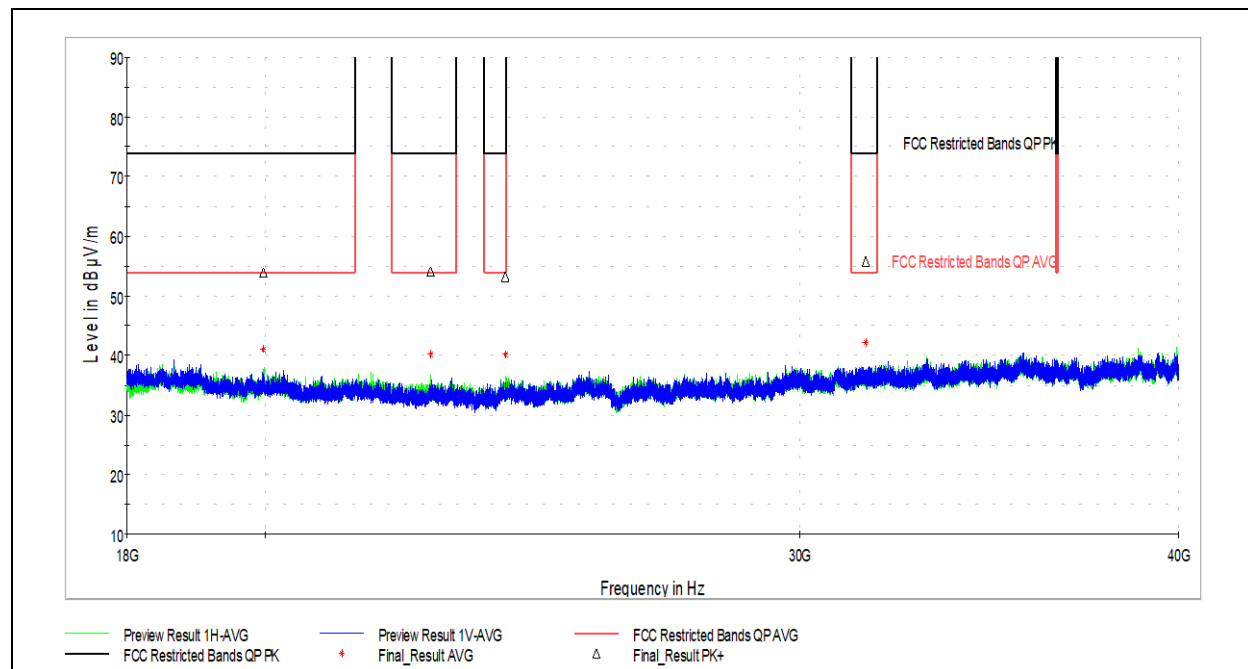
Limit Applied: FCC Part 15.209 in Restricted Bands from FCC Part 15.205

Ambient Temperature: 25.1°C

Relative Humidity: 49.7%

Atmospheric Pressure: 983.8 mbar

Deviations, Additions, or Exclusions: None

**6.11.4 Radiated Spurious Emissions, 18GHz – 40 GHz, Channel 6**

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
19957.000000	54.01	73.979	19.97	1000.000	100.0	H	312.0	14.33
22668.500000	54.18	73.979	19.80	1000.000	100.0	H	302.0	6.93
23991.000000	53.28	73.979	20.70	1000.000	100.0	H	324.0	6.55
31543.500000	55.71	73.979	18.27	1000.000	120.0	V	329.0	11.27

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
19957.000000	41.10	53.979	12.88	1000.000	100.0	H	312.0	14.33
22668.500000	40.24	53.979	13.74	1000.000	100.0	H	302.0	6.93
23991.000000	40.16	53.979	13.82	1000.000	100.0	H	324.0	6.55
31543.500000	42.26	53.979	11.72	1000.000	120.0	V	329.0	11.27

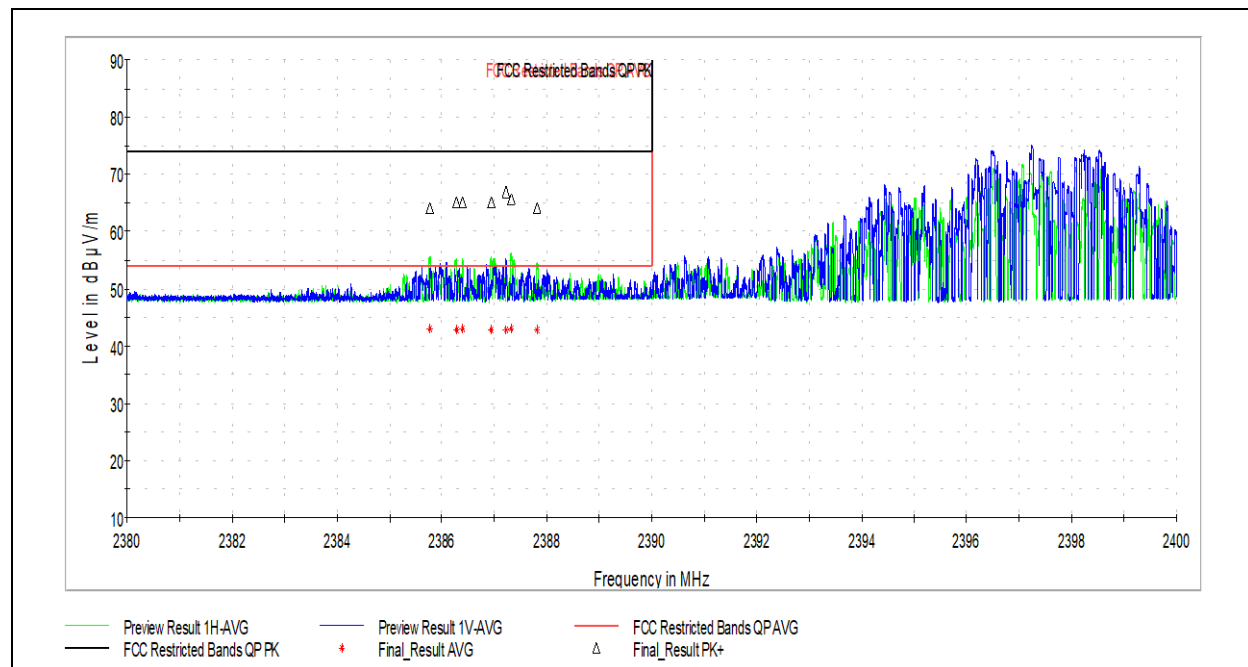
Test Personnel: Michael Carlson
Supervising/Reviewing Engineer: _____
(Where Applicable) N/A
FCC Part 15.247
Product Standard: RSS-247 Issue 2
Input Voltage: 120VAC / 60Hz
Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 4/30/2022
Limit Applied: FCC Part 15.209 in Restricted Bands from FCC Part 15.205
Ambient Temperature: 23.7°C
Relative Humidity: 38.1%
Atmospheric Pressure: 982.3 mbar

Deviations, Additions, or Exclusions: Testing was performed on channel 6, representative of the worst-case evaluation for the 802.11g across the 18GHz to the 40GHz range.



6.11.5 Emissions at the Low Band Edge



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2385.767500	64.16	73.979	9.82	1000.000	290.0	H	124.0	38.49
2386.271250	65.19	73.979	8.79	1000.000	172.0	H	102.0	38.49
2386.388750	65.16	73.979	8.82	1000.000	287.0	H	119.0	38.49
2386.942500	65.07	73.979	8.91	1000.000	283.0	H	135.0	38.49
2387.220000	66.99	73.979	6.99	1000.000	181.0	V	202.0	38.55
2387.323750	65.65	73.979	8.33	1000.000	259.0	H	94.0	38.48
2387.815000	64.11	73.979	9.87	1000.000	254.0	H	122.0	38.48

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2385.767500	43.05	53.979	10.93	1000.000	290.0	H	124.0	38.49
2386.271250	42.91	53.979	11.07	1000.000	172.0	H	102.0	38.49
2386.388750	42.99	53.979	10.99	1000.000	287.0	H	119.0	38.49
2386.942500	42.95	53.979	11.03	1000.000	283.0	H	135.0	38.49
2387.220000	42.92	53.979	11.06	1000.000	181.0	V	202.0	38.55
2387.323750	43.07	53.979	10.91	1000.000	259.0	H	94.0	38.48
2387.815000	42.95	53.979	11.03	1000.000	254.0	H	122.0	38.48

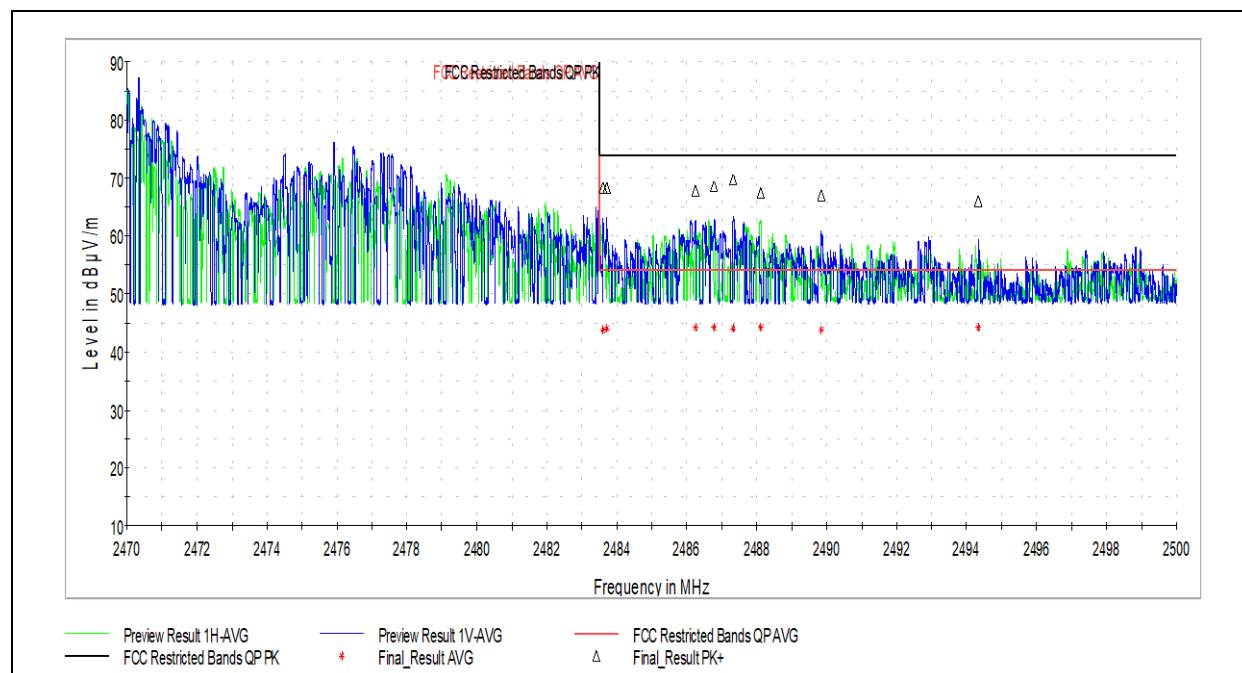
Test Personnel: Michael Carlson
Supervising/Reviewing Engineer: N/A
(Where Applicable)
FCC Part 15.247
Product Standard: RSS-247 Issue 2
Input Voltage: 120VAC / 60Hz
Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 6/26/2022
Limit Applied: FCC Part 15.209 in Restricted Bands from FCC Part 15.205
Ambient Temperature: 25.3°C
Relative Humidity: 54.3%
Atmospheric Pressure: 984.3 mbar

Deviations, Additions, or Exclusions: None



6.11.6 Emissions at the High Band Edge



Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.597500	68.28	73.979	5.70	1000.000	221.0	V	159.0	38.78
2483.702500	68.45	73.979	5.53	1000.000	109.0	V	181.0	38.78
2486.241250	67.76	73.979	6.22	1000.000	382.0	V	136.0	38.78
2486.777500	68.47	73.979	5.51	1000.000	265.0	V	143.0	38.78
2487.330625	69.69	73.979	4.29	1000.000	171.0	V	207.0	38.78
2488.108750	67.40	73.979	6.58	1000.000	292.0	H	125.0	39.06
2489.846875	67.00	73.979	6.98	1000.000	100.0	V	192.0	38.78
2494.328125	65.97	73.979	8.01	1000.000	238.0	V	191.0	38.81

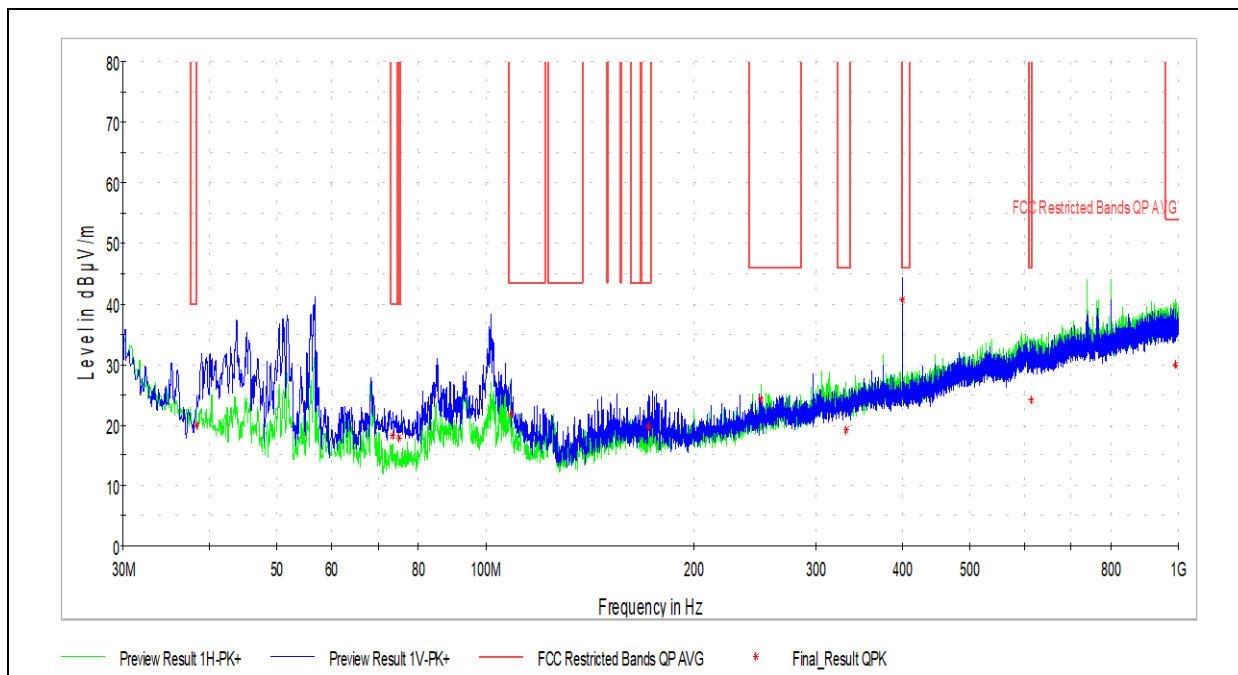


Frequency (MHz)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.597500	43.90	53.979	10.08	1000.000	221.0	V	159.0	38.78
2483.702500	43.93	53.979	10.05	1000.000	109.0	V	181.0	38.78
2486.241250	44.12	53.979	9.86	1000.000	382.0	V	136.0	38.78
2486.777500	44.16	53.979	9.82	1000.000	265.0	V	143.0	38.78
2487.330625	43.92	53.979	10.06	1000.000	171.0	V	207.0	38.78
2488.108750	44.23	53.979	9.75	1000.000	292.0	H	125.0	39.06
2489.846875	43.87	53.979	10.11	1000.000	100.0	V	192.0	38.78
2494.328125	44.11	53.979	9.87	1000.000	238.0	V	191.0	38.81

Test Personnel: Michael Carlson
Supervising/Reviewing Engineer: n/A
(Where Applicable) FCC Part 15.247
Product Standard: RSS-247 Issue 2
Input Voltage: 120VAC / 60Hz
Pretest Verification w / Ambient
Signals or BB Source: Yes

Test Date: 6/26/2022
Limit Applied: FCC Part 15.209 in Restricted Bands from FCC Part 15.205
Ambient Temperature: 25.3°C
Relative Humidity: 54.3%
Atmospheric Pressure: 984.3 mbar

Deviations, Additions, or Exclusions: None

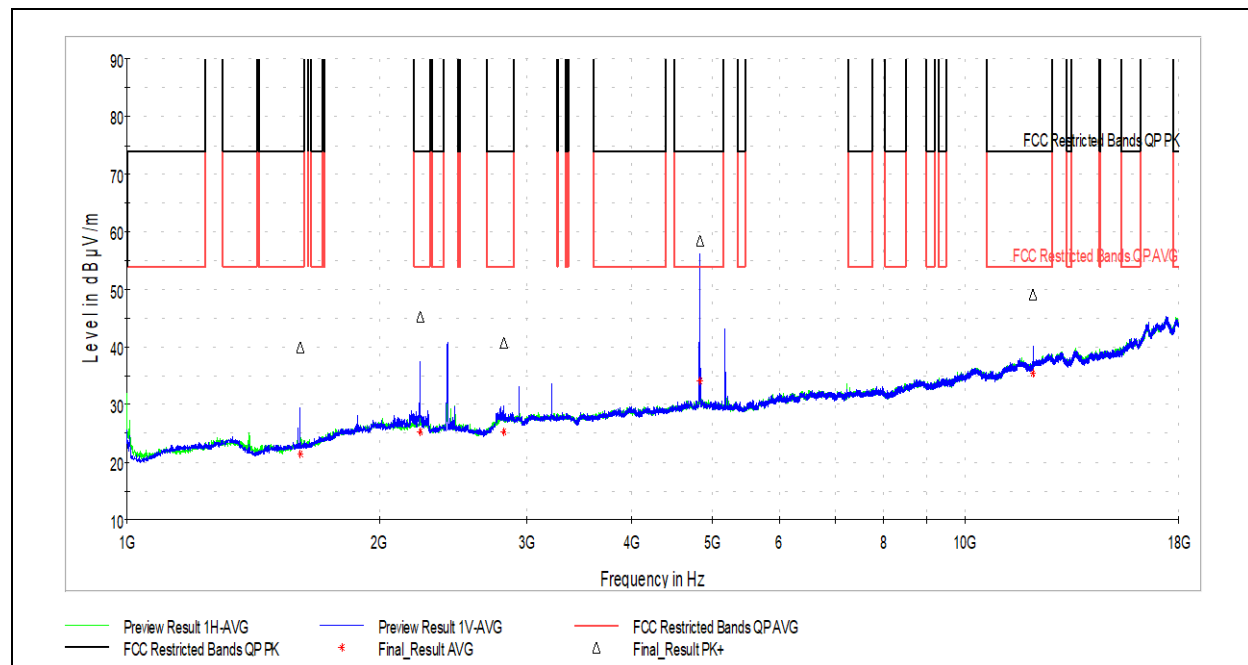
**6.12 FCC Part 15.247 Radiated Spurious Emissions (Wi-Fi 802.11n)****6.12.1 Radiated Spurious Emissions, 30 MHz – 1 GHz, Channel 1**

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
38.245000	19.98	40.000	20.02	120.000	100.0	V	346.0	19.01
73.434444	18.17	40.000	21.83	120.000	165.0	V	0.0	14.23
74.997222	17.86	40.000	22.14	120.000	135.0	V	82.0	14.10
108.731667	21.75	43.522	21.77	120.000	266.0	H	167.0	16.56
171.835556	19.86	43.522	23.66	120.000	100.0	V	272.0	18.88
249.974444	24.30	46.021	21.72	120.000	100.0	H	0.0	21.75
331.508333	19.28	46.021	26.74	120.000	95.0	H	17.0	24.86
399.947222	40.62	46.021	5.40	120.000	100.0	V	70.0	25.91
612.377222	24.15	46.021	21.87	120.000	114.0	H	0.0	32.55
991.377778	29.97	53.979	24.01	120.000	143.0	H	210.0	37.36

Test Personnel: Ben Coolbear
 Supervising/Reviewing Engineer: (Where Applicable) N/A
 Product Standard: FCC Part 15.247
 Input Voltage: RSS-247 Issue 2
 120VAC / 60Hz
 Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 4/21/2022
 Limit Applied: FCC Part 15.209 in Restricted Bands from FCC Part 15.205
 Ambient Temperature: 23.8°C
 Relative Humidity: 26.7%
 Atmospheric Pressure: 987.7 mbar

Deviations, Additions, or Exclusions: Testing was performed on channel 1, representative of the worst case evaluation for the 802.11b across the 30MHz to the 1GHz range.

**6.12.2 Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 1**

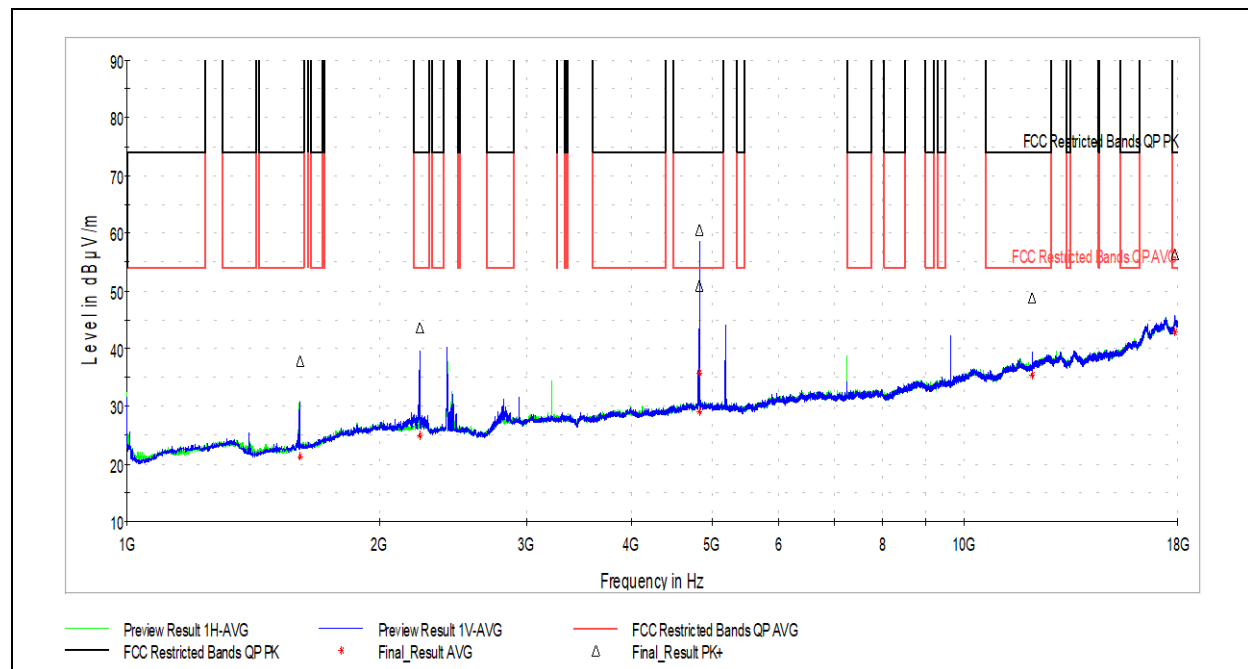
Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1608.000000	39.99	73.979	33.99	1000.000	204.0	V	108.0	-0.85
2236.000000	45.39	73.979	28.59	1000.000	160.0	V	160.0	3.61
2816.000000	40.83	73.979	33.15	1000.000	410.0	V	186.0	5.21
4824.000000	58.54	73.979	15.44	1000.000	410.0	V	183.0	9.45
12061.000000	49.17	73.979	24.81	1000.000	154.0	V	334.0	19.84

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1608.000000	21.52	53.979	32.46	1000.000	204.0	V	108.0	-0.85
2236.000000	25.33	53.979	28.65	1000.000	160.0	V	160.0	3.61
2816.000000	25.31	53.979	28.67	1000.000	410.0	V	186.0	5.21
4824.000000	34.04	53.979	19.94	1000.000	410.0	V	183.0	9.45
12061.000000	35.46	53.979	18.52	1000.000	154.0	V	334.0	19.84

Test Personnel: Ben Coolbear
 Supervising/Reviewing Engineer: _____
 (Where Applicable) N/A
 FCC Part 15.247
 Product Standard: RSS-247 Issue 2
 Input Voltage: 120VAC / 60Hz
 Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 4/25/2022
 Limit Applied: FCC Part 15.209 in Restricted Bands from FCC Part 15.205
 Ambient Temperature: 25.1°C
 Relative Humidity: 49.7%
 Atmospheric Pressure: 983.8 mbar

Deviations, Additions, or Exclusions: None

**6.12.3 Radiated Spurious Emissions, 1 GHz – 18 GHz, Channel 11**

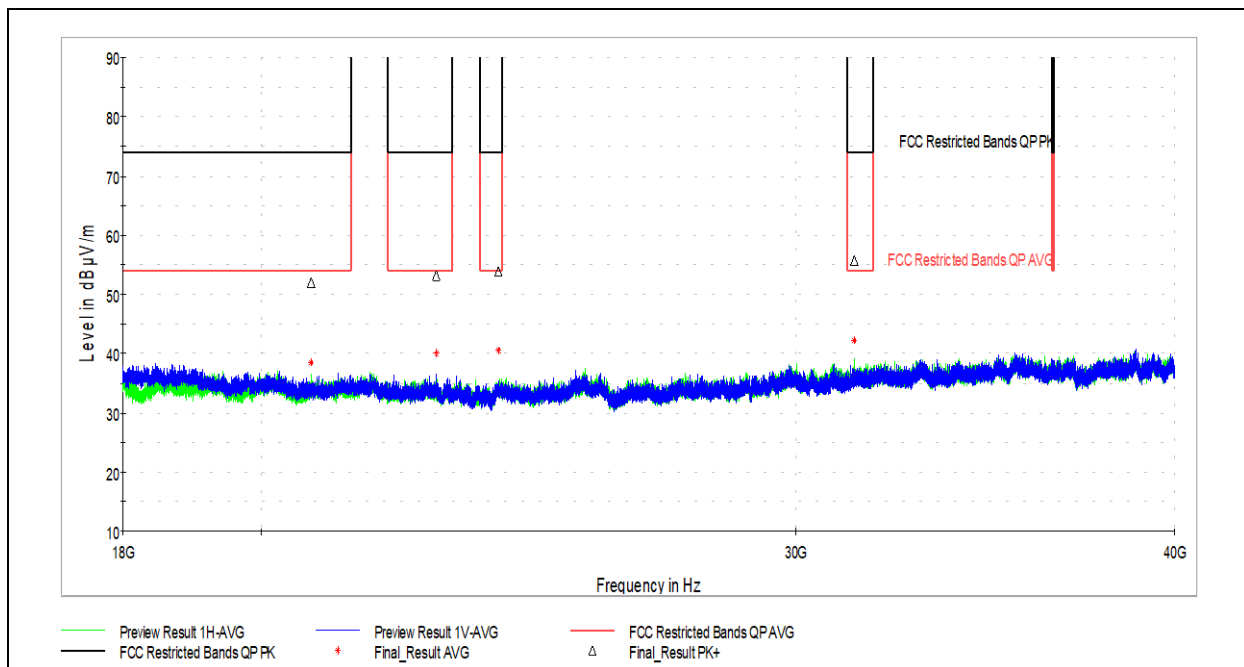
Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1608.000000	37.92	73.979	36.06	1000.000	168.0	H	359.0	-0.60
2235.500000	43.66	73.979	30.32	1000.000	100.0	V	310.0	3.61
4824.000000	60.58	73.979	13.40	1000.000	327.0	V	136.0	9.45
4827.000000	50.78	73.979	23.20	1000.000	128.0	V	137.0	9.45
12058.000000	48.70	73.979	25.28	1000.000	182.0	V	332.0	19.84
17870.000000	56.43	73.979	17.55	1000.000	100.0	V	100.0	27.57

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1608.000000	21.23	53.979	32.75	1000.000	168.0	H	359.0	-0.60
2235.500000	24.85	53.979	29.13	1000.000	100.0	V	310.0	3.61
4824.000000	35.84	53.979	18.14	1000.000	327.0	V	136.0	9.45
4827.000000	29.10	53.979	24.88	1000.000	128.0	V	137.0	9.45
12058.000000	35.31	53.979	18.67	1000.000	182.0	V	332.0	19.84
17870.000000	42.93	53.979	11.05	1000.000	100.0	V	100.0	27.57

Test Personnel: Ben Coolbear
Supervising/Reviewing Engineer: (Where Applicable) N/A
Product Standard: RSS-247 Issue 2
Input Voltage: 120VAC / 60Hz
Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 4/25/2022
Limit Applied: FCC Part 15.209 in Restricted Bands from FCC Part 15.205
Ambient Temperature: 25.1°C
Relative Humidity: 49.7%
Atmospheric Pressure: 983.8 mbar

Deviations, Additions, or Exclusions: None

**6.12.4 Radiated Spurious Emissions, 18GHz – 40 GHz, Channel 1**

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
20763.000000	52.02	73.979	21.96	1000.000	100.0	H	138.0	11.35
22824.500000	53.28	73.979	20.70	1000.000	155.0	V	252.0	6.43
23933.000000	53.85	73.979	20.13	1000.000	214.0	V	123.0	6.56
31356.500000	55.72	73.979	18.26	1000.000	168.0	H	333.0	11.25

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
20763.000000	38.58	53.979	15.40	1000.000	100.0	H	138.0	11.35
22824.500000	40.08	53.979	13.90	1000.000	155.0	V	252.0	6.43
23933.000000	40.61	53.979	13.37	1000.000	214.0	V	123.0	6.56
31356.500000	42.25	53.979	11.73	1000.000	168.0	H	333.0	11.25

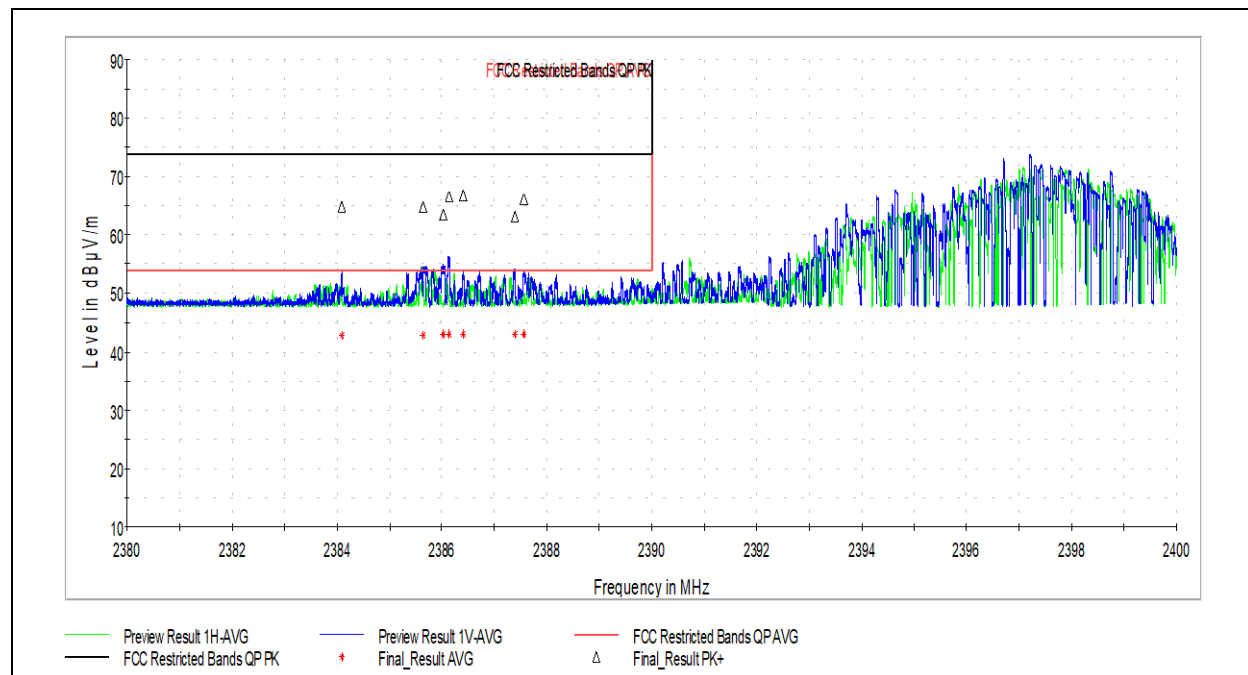
Test Personnel: Michael Carlson
 Supervising/Reviewing Engineer: _____
 (Where Applicable) N/A
 FCC Part 15.247
 Product Standard: RSS-247 Issue 2
 Input Voltage: 120VAC / 60Hz
 Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 4/30/2022
 Limit Applied: FCC Part 15.209 in Restricted Bands from FCC Part 15.205
 Ambient Temperature: 23.7°C
 Relative Humidity: 38.1%
 Atmospheric Pressure: 982.3 mbar

Deviations, Additions, or Exclusions: Testing was performed on channel 1, representative of the worst-case evaluation for the 802.11n across the 18GHz to the 40GHz range.



6.12.5 Emissions at the Low Band Edge



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2384.090000	64.81	73.979	9.17	1000.000	109.0	V	192.0	38.57
2385.646250	64.86	73.979	9.12	1000.000	289.0	H	113.0	38.49
2386.016250	63.55	73.979	10.43	1000.000	292.0	V	0.0	38.56
2386.136250	66.64	73.979	7.34	1000.000	208.0	V	181.0	38.56
2386.400000	66.70	73.979	7.28	1000.000	109.0	V	196.0	38.56
2387.387500	63.17	73.979	10.81	1000.000	295.0	V	0.0	38.55
2387.553750	66.29	73.979	7.69	1000.000	237.0	V	172.0	38.55

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2384.090000	42.86	53.979	11.12	1000.000	109.0	V	192.0	38.57
2385.646250	42.89	53.979	11.09	1000.000	289.0	H	113.0	38.49
2386.016250	43.01	53.979	10.97	1000.000	292.0	V	0.0	38.56
2386.136250	43.04	53.979	10.94	1000.000	208.0	V	181.0	38.56
2386.400000	43.07	53.979	10.91	1000.000	109.0	V	196.0	38.56
2387.387500	43.00	53.979	10.98	1000.000	295.0	V	0.0	38.55
2387.553750	42.93	53.979	11.05	1000.000	237.0	V	172.0	38.55

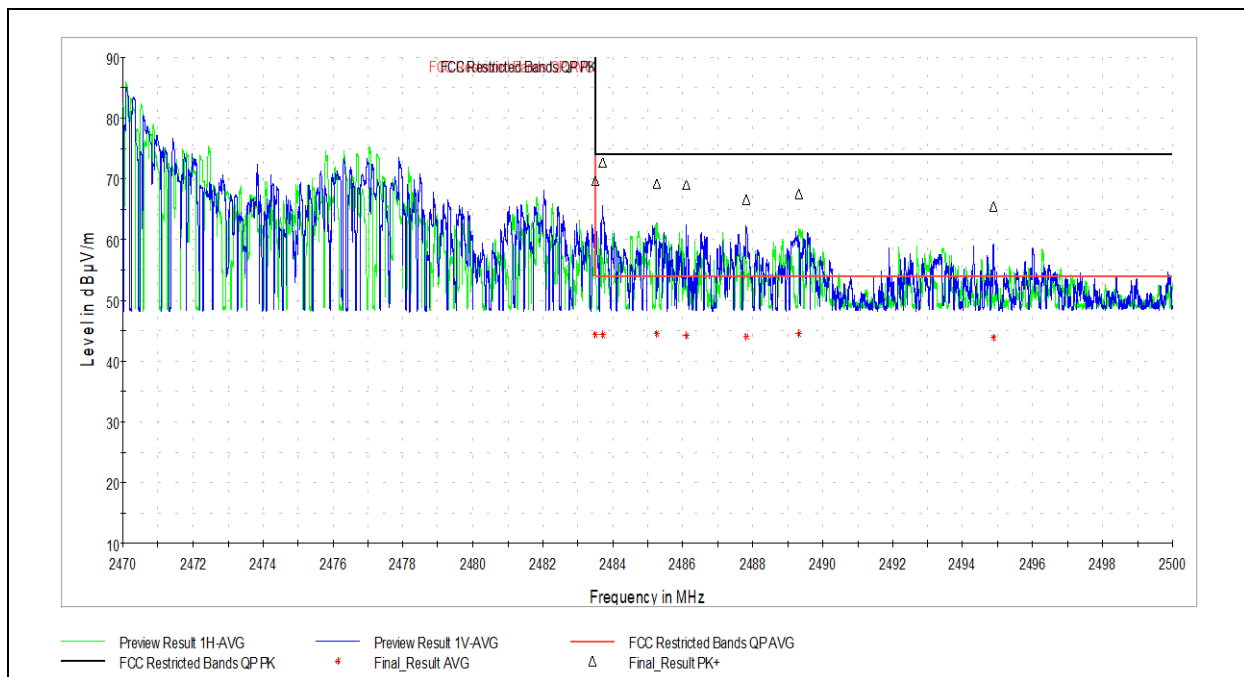
Test Personnel: Michael Carlson
Supervising/Reviewing Engineer: (Where Applicable) N/A
Product Standard: RSS-247 Issue 2
Input Voltage: 120VAC / 60Hz
Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 6/26/2022
Limit Applied: FCC Part 15.209 in Restricted Bands from FCC Part 15.205
Ambient Temperature: 25.3°C
Relative Humidity: 54.3%
Atmospheric Pressure: 984.3 mbar

Deviations, Additions, or Exclusions: None



6.12.6 Emissions at the High Band Edge



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.502500	69.63	73.979	4.35	1000.000	301.0	V	135.0	38.78
2483.702500	72.70	73.979	1.28	1000.000	245.0	V	172.0	38.78
2485.262500	69.19	73.979	4.79	1000.000	295.0	H	128.0	39.03
2486.102500	69.08	73.979	4.90	1000.000	244.0	V	181.0	38.78
2487.810000	66.69	73.979	7.29	1000.000	145.0	V	159.0	38.78
2489.315000	67.51	73.979	6.47	1000.000	265.0	H	130.0	39.07
2494.870000	65.50	73.979	8.48	1000.000	100.0	V	195.0	38.82

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.502500	44.30	53.979	9.68	1000.000	301.0	V	135.0	38.78
2483.702500	44.36	53.979	9.62	1000.000	245.0	V	172.0	38.78
2485.262500	44.46	53.979	9.52	1000.000	295.0	H	128.0	39.03
2486.102500	44.17	53.979	9.81	1000.000	244.0	V	181.0	38.78
2487.810000	43.99	53.979	9.99	1000.000	145.0	V	159.0	38.78
2489.315000	44.59	53.979	9.39	1000.000	265.0	H	130.0	39.07
2494.870000	43.87	53.979	10.11	1000.000	100.0	V	195.0	38.82

Test Personnel: Michael Carlson
Supervising/Reviewing Engineer: (Where Applicable) n/A
Product Standard: FCC Part 15.247
Input Voltage: RSS-247 Issue 2
Pretest Verification w / Ambient Signals or BB Source: 120VAC / 60Hz
Yes

Test Date: 6/26/2022
Limit Applied: FCC Part 15.209 in Restricted Bands from FCC Part 15.205
Ambient Temperature: 25.3°C
Relative Humidity: 54.3%
Atmospheric Pressure: 984.3 mbar

Deviations, Additions, or Exclusions: None



7 Occupied Bandwidth

7.1 Test Method

Tests are performed in accordance with ANSI C63.10: 2013; FCC Part 15.247 (a)(3).

FCC Part 15.247(a)(2):

(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):

DTSs include systems that employ digital modulation techniques resulting in spectral characteristics similar to direct sequence systems. The following applies to the bands 902-928 MHz and 2400-2483.5 MHz: Footnote1

- a. The minimum 6 dB bandwidth shall be 500 kHz.

7.2 Test Equipment Used:

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Signal Analyzer	3727	Rohde & Schwarz	FSQ	9/17/2021	9/17/2022

7.3 Test Conditions

Test Personnel:	Ben Coolbear	Test Date:	4/29/2022 -4/30/2022
Supervising/Reviewing Engineer:	Brian Lackey	Limit Applied:	> 500 kHz for DTS Systems
Product Standard:	FCC Part 15.247 & RSS-247 Issue 2	Ambient Temperature:	23.7°C
Input Voltage:	120V/60Hz	Relative Humidity:	38.1%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	982.3 mbar



7.4 Test Data: Wi-Fi0

Operating Mode	Frequency (MHz)	6dB down Bandwidth (MHz)	20dB down Bandwidth (MHz)	99% Bandwidth (MHz)
802.11b	2412	8.91	15.4487	13.3974
	2437	9.04	15.1923	13.1410
	2462	8.97	15.1282	13.3333
802.11g	2412	13.79	17.5641	16.6026
	2437	15.21	17.3718	16.4744
	2462	15.04	17.4359	16.4103
802.11n	2412	15.35	18.5897	17.5641
	2437	14.95	18.4615	17.5641
	2462	15.31	18.5256	17.5000

Deviations, Additions, or Exclusions: None

7.5 Test Data: Wi-Fi1

Operating Mode	Frequency (MHz)	6dB down Bandwidth (MHz)	20dB down Bandwidth (MHz)	99% Bandwidth (MHz)
802.11b	2412	9.04	15.1282	13.2692
	2437	10.58	15.6410	13.1410
	2462	9.36	15.3846	13.1410
802.11g	2412	14.83	17.8846	16.6667
	2437	14.88	17.4359	16.6026
	2462	14.14	17.8205	16.6667
802.11n	2412	15.22	18.5256	17.6282
	2437	15.70	18.6538	17.5000
	2462	15.06	18.4615	17.4359

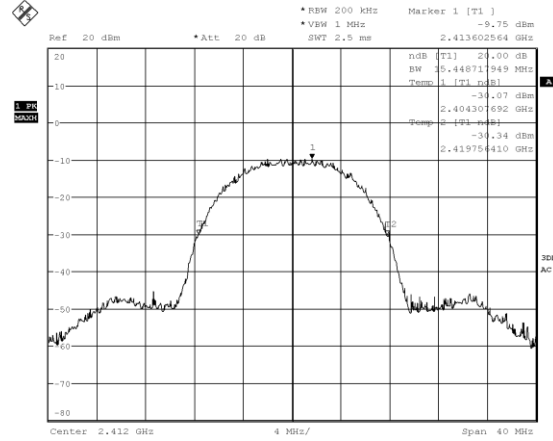
Deviations, Additions, or Exclusions: None



7.6 Spectrum Plots

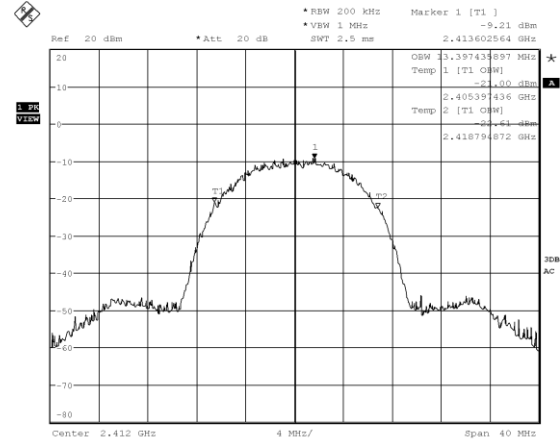
7.6.1 Wi-Fi

7.6.1.1 802.11b Channel1 20dB down, Wi-Fi 0



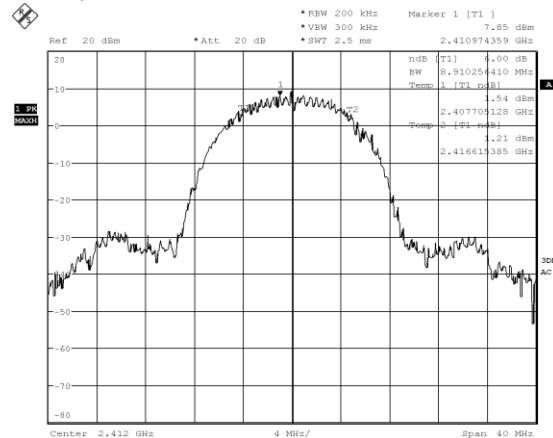
Date: 28.APR.2022 20:18:53

7.6.1.2 802.11b Channel1 99% OPB, Wi-Fi 0



Date: 28.APR.2022 20:22:38

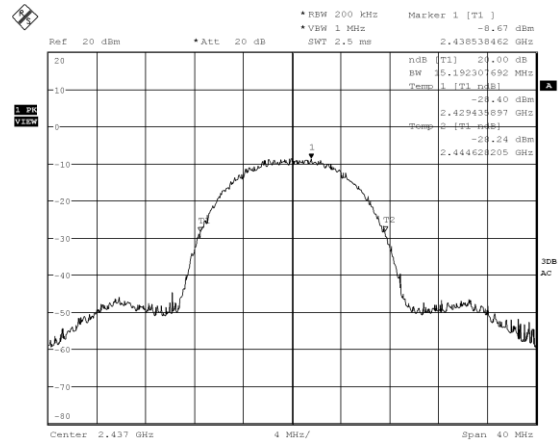
7.6.1.3 802.11b Channel1 6dB down, Wi-Fi 0



Date: 9.AUG.2022 17:40:47

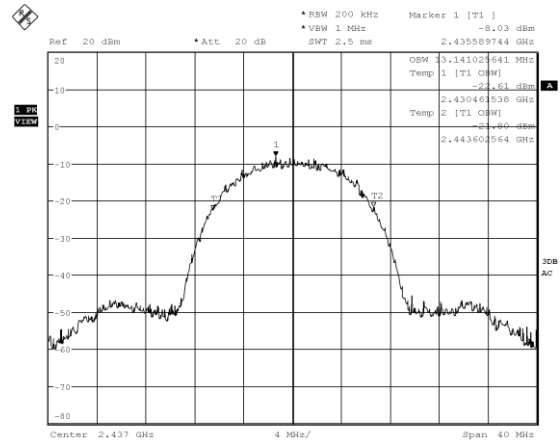


7.6.1.4 802.11b Channel6 20dB down, Wi-Fi 0



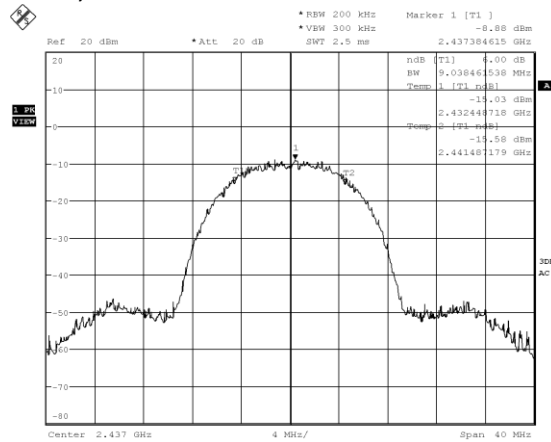
Date: 28.APR.2022 20:29:14

7.6.1.5 802.11b Channel6 99% OPB, Wi-Fi 0

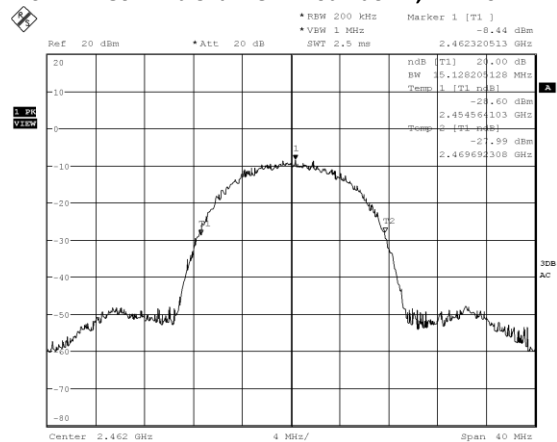


Date: 28.APR.2022 20:26:09

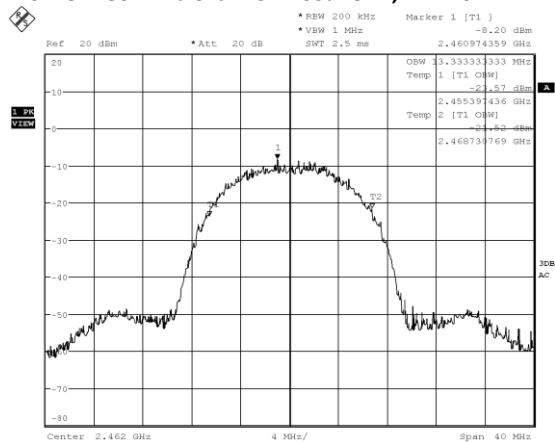
7.6.1.6 802.11b Channel6 6dB down, Wi-Fi 0



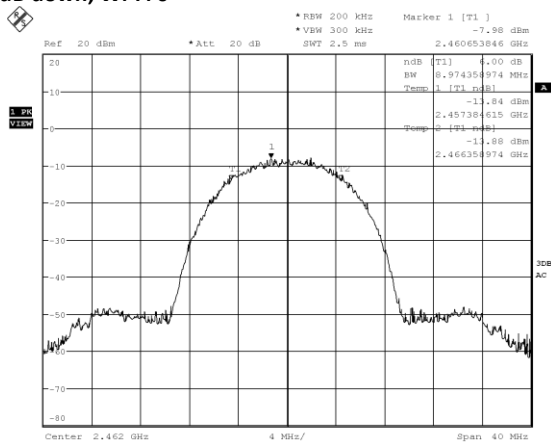
Date: 30.APR.2022 01:15:36

**7.6.1.7 802.11b Channel11 20dB down, Wi-Fi 0**

Date: 28.APR.2022 20:33:11

7.6.1.8 802.11b Channel11 99% OPB, Wi-Fi 0

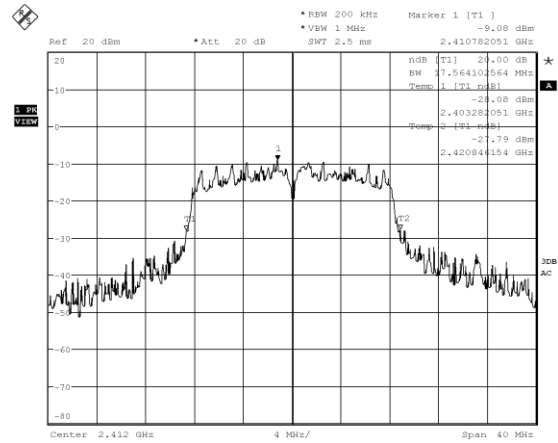
Date: 28.APR.2022 20:35:02

7.6.1.9 802.11b Channel11 6dB down, Wi-Fi 0

Date: 30.APR.2022 01:10:28

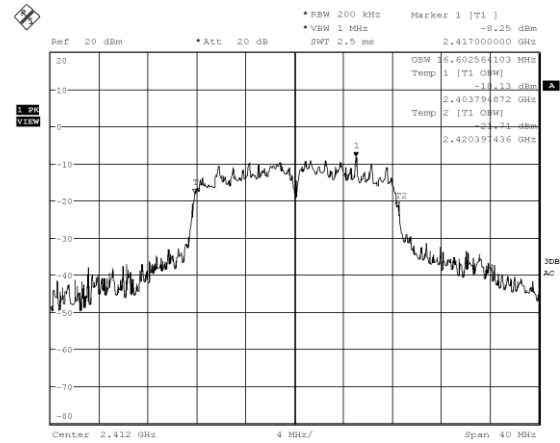


7.6.1.10 802.11g Channel1 20dB down, Wi-Fi 0



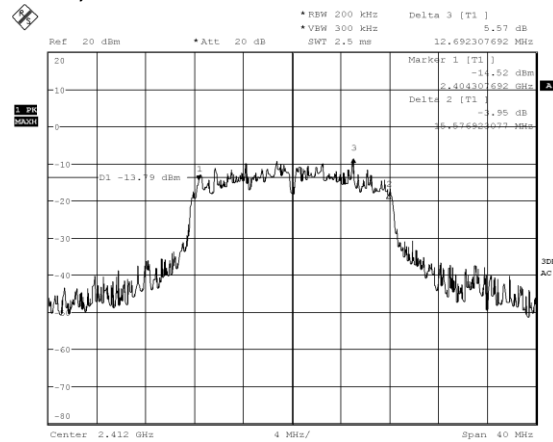
Date: 28.APR.2022 20:39:23

7.6.1.11 802.11g Channel1 99% OPB, Wi-Fi 0



Date: 28.APR.2022 20:37:49

7.6.1.12 802.11g Channel1 6dB down, Wi-Fi 0

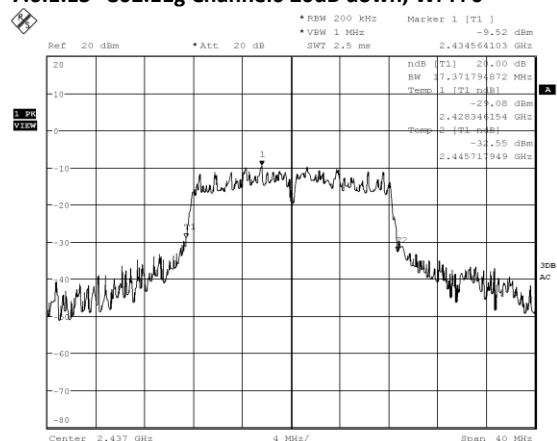


Date: 29.APR.2022 21:58:32



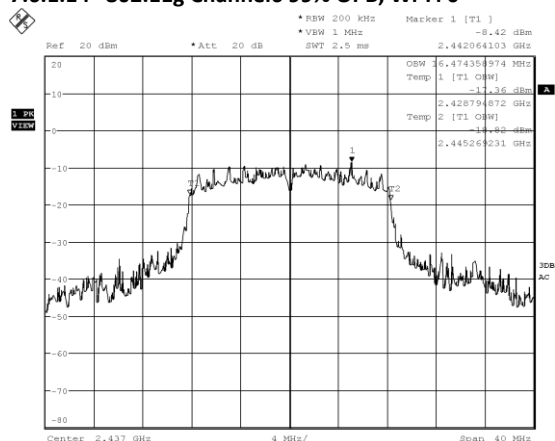
EMC Test Report

7.6.1.13 802.11g Channel6 20dB down, Wi-Fi 0



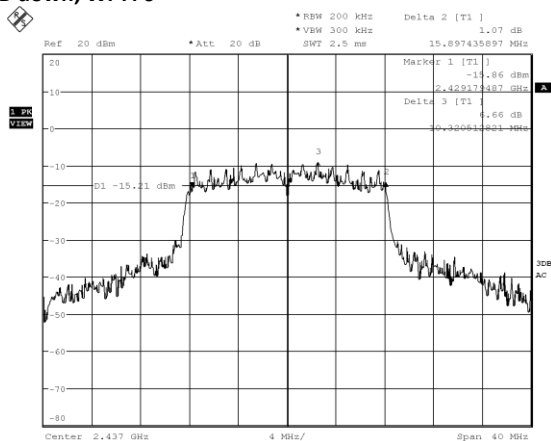
Date: 27.APR.2022 20:47:10

7.6.1.14 802.11g Channel6 99% OPB, Wi-Fi 0



Date: 28.APR.2022 20:44:23

7.6.1.15 802.11g Channel6 6dB down, Wi-Fi 0

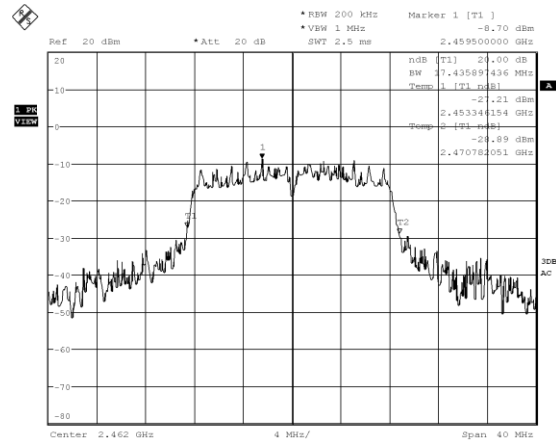


Date: 29.APR.2022 22:07:41



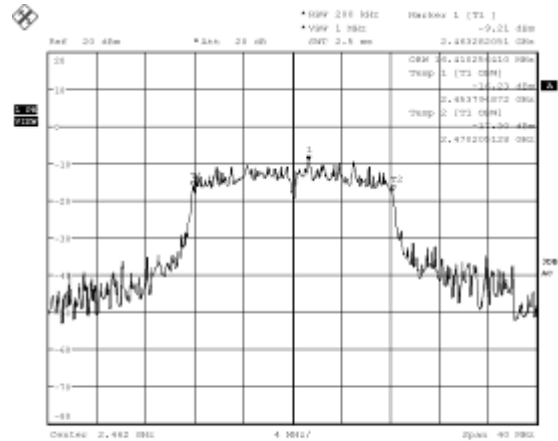
EMC Test Report

7.6.1.16 802.11g Channel11 20dB down, Wi-Fi 0



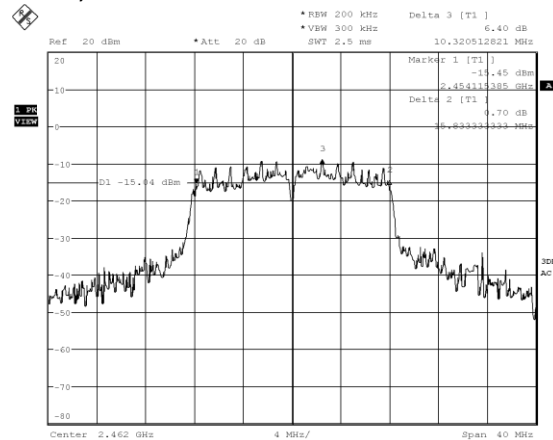
Date: 28.APR.2022 20:50:07

7.6.1.17 802.11g Channel11 99% OPB, Wi-Fi 0



Date: 28.APR.2022 20:50:08

7.6.1.18 802.11g Channel11 6dB down, Wi-Fi 0

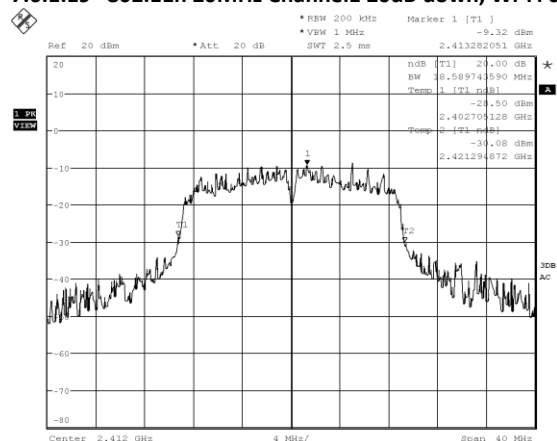


Date: 29.APR.2022 22:11:45



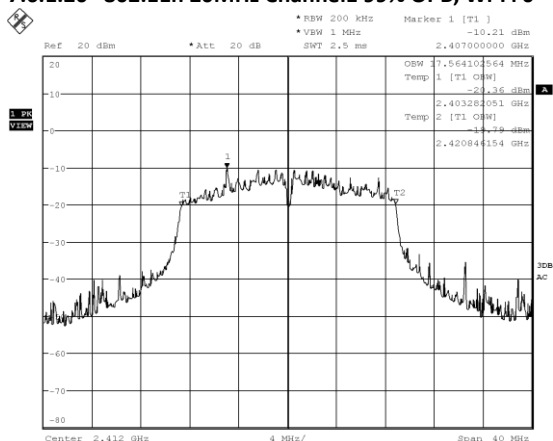
EMC Test Report

7.6.1.19 802.11n 20MHz Channel1 20dB down, Wi-Fi 0



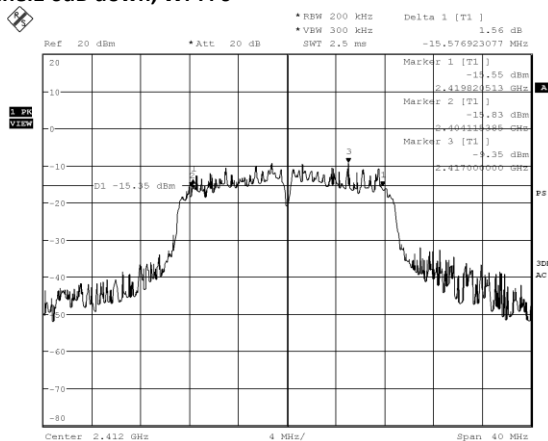
Date: 28.APR.2022 20:53:25

7.6.1.20 802.11n 20MHz Channel1 99% OPB, Wi-Fi 0

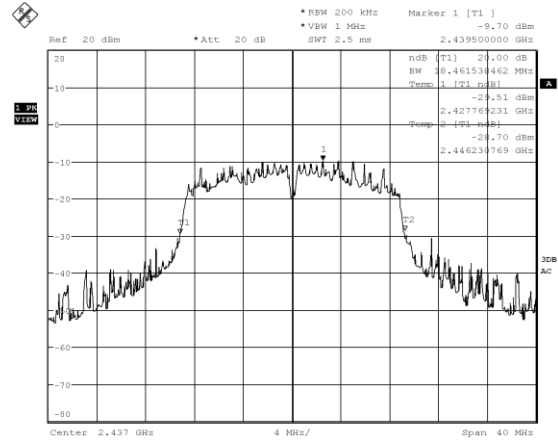


Date: 28.APR.2022 20:55:40

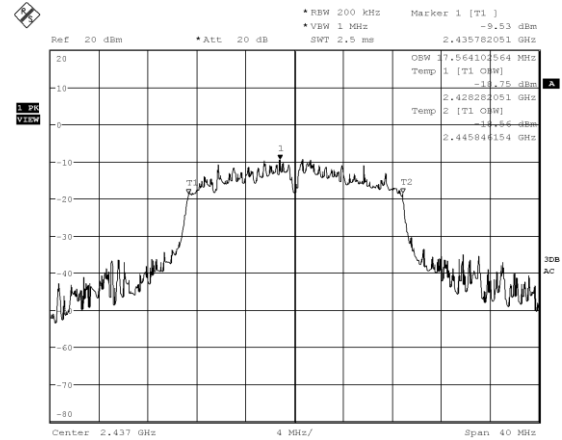
7.6.1.21 802.11n 20MHz Channel1 6dB down, Wi-Fi 0



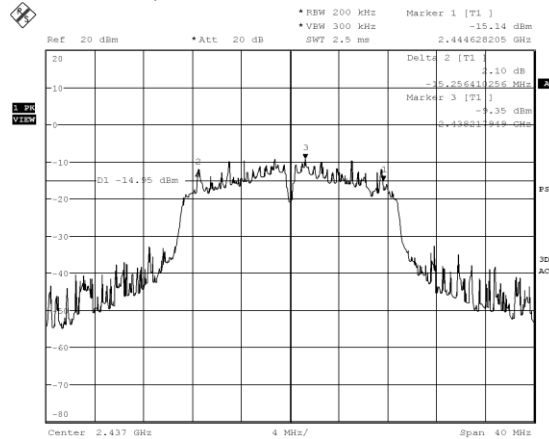
Date: 29.APR.2022 04:42:21

**7.6.1.22 802.11 n 20MHz Channel6 20dB down, Wi-Fi 0**

Date: 28.APR.2022 21:02:30

7.6.1.23 802.11 n 20MHz Channel6 99% OPB, Wi-Fi 0

Date: 28.APR.2022 21:00:21

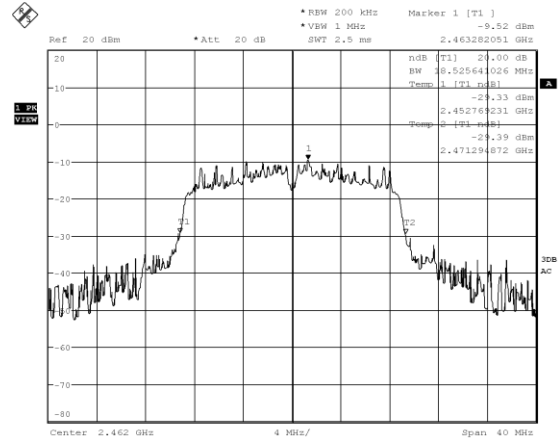
7.6.1.24 802.11n 20MHz Channel6 6dB down, Wi-Fi 0

Date: 29.APR.2022 04:35:08



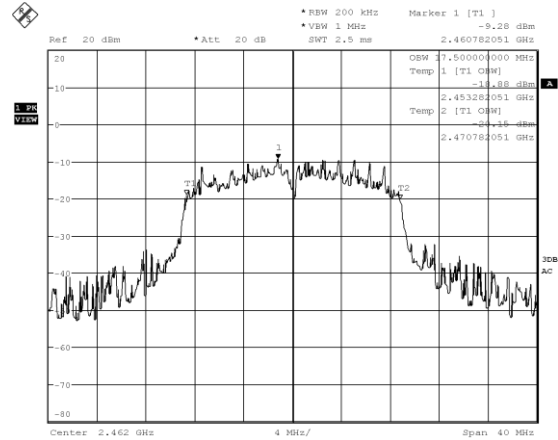
EMC Test Report

7.6.1.25 802.11 n 20MHz Channel11 20dB down, Wi-Fi 0



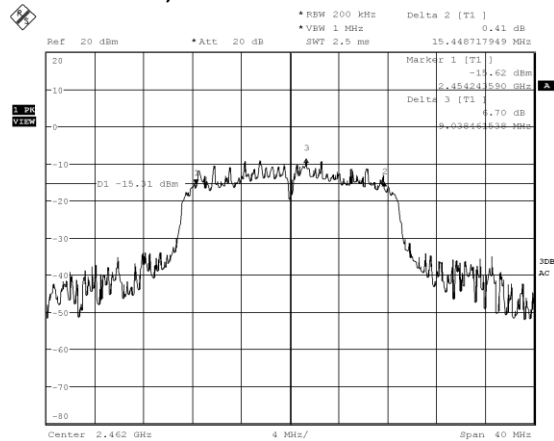
Date: 28.APR.2022 21:13:19

7.6.1.26 802.11 n 20MHz Channel11 99% OPB, Wi-Fi 0



Date: 28.APR.2022 21:15:28

7.6.1.27 802.11n 20MHz Channel11 6dB down, Wi-Fi 0

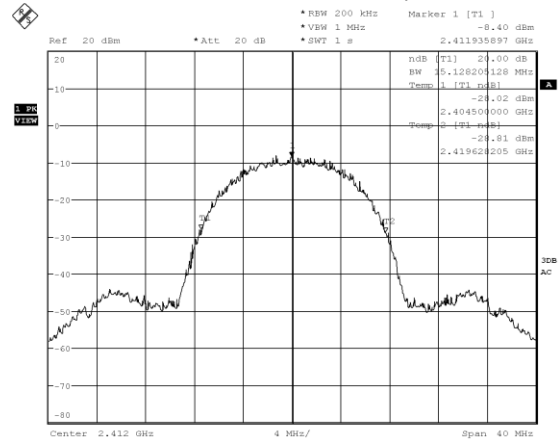


Date: 28.APR.2022 21:20:42



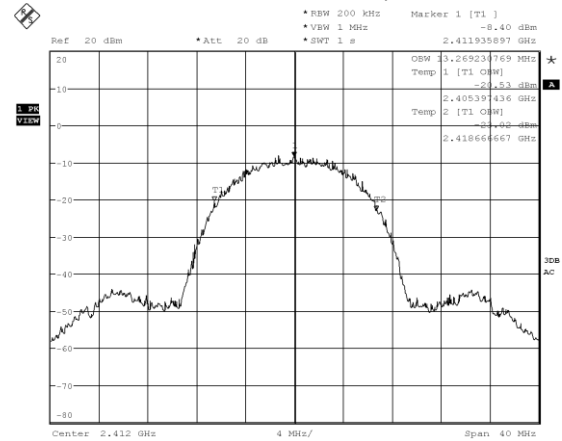
7.6.2 Wi-Fi 1

7.6.2.1 802.11b Channel1 20dB down, Wi-Fi 1



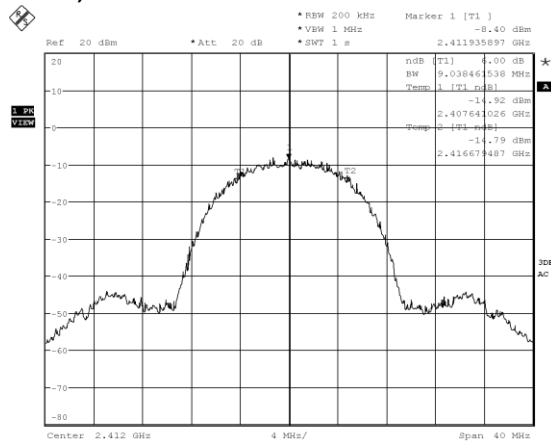
Date: 26.APR.2022 20:23:33

7.6.2.2 802.11b Channel1 99% OPB, Wi-Fi 1

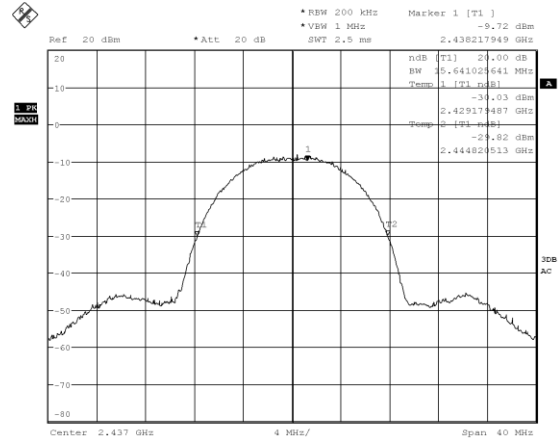


Date: 26.APR.2022 20:25:28

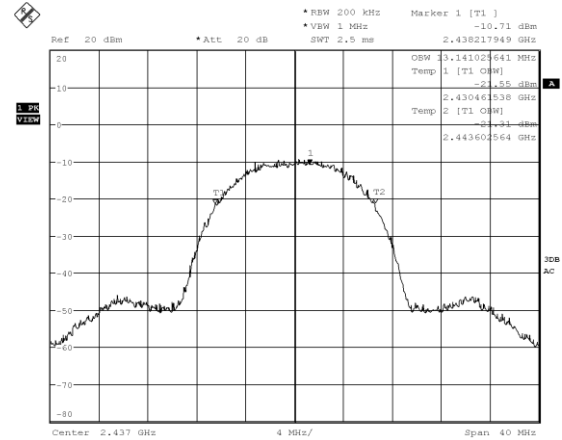
7.6.2.3 802.11b Channel1 6dB down, Wi-Fi 1



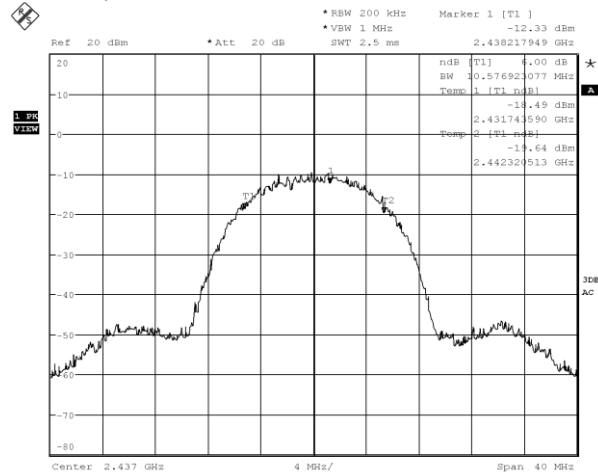
Date: 26.APR.2022 20:31:25

**7.6.2.4 802.11b Channel6 20dB down, Wi-Fi 1**

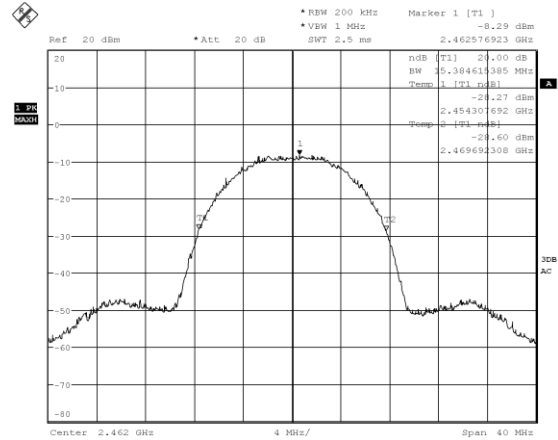
Date: 26.APR.2022 22:05:48

7.6.2.5 802.11b Channel6 99% OPB, Wi-Fi 1

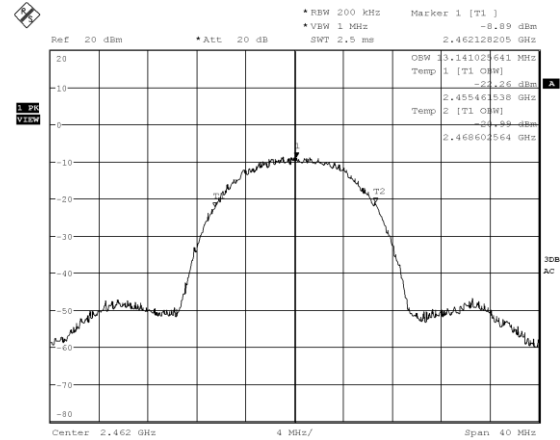
Date: 26.APR.2022 22:07:35

7.6.2.6 802.11b Channel6 6dB down, Wi-Fi 1

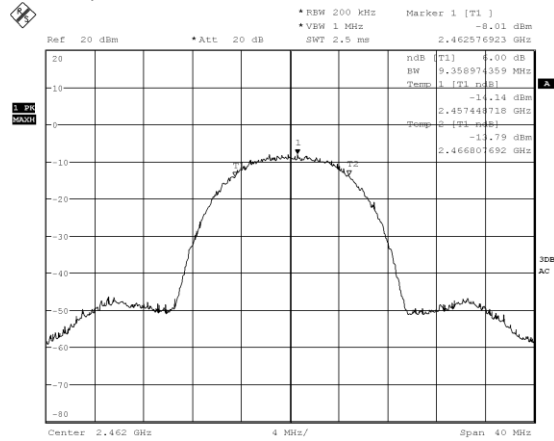
Date: 26.APR.2022 22:17:05

**7.6.2.7 802.11b Channel11 20dB down, Wi-Fi 1**

Date: 27.APR.2022 18:04:44

7.6.2.8 802.11b Channel11 99% OPB, Wi-Fi 1

Date: 27.APR.2022 18:06:44

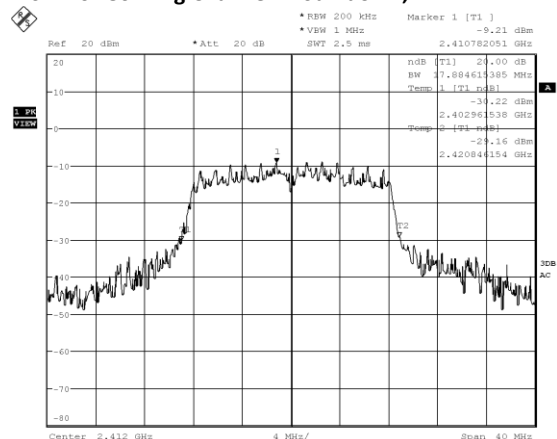
7.6.2.9 802.11b Channel11 6dB down, Wi-Fi 1

Date: 27.APR.2022 18:03:42



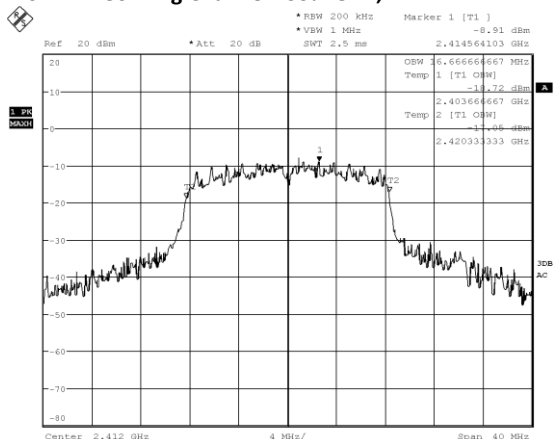
EMC Test Report

7.6.2.10 802.11g Channel1 20dB down, Wi-Fi 1



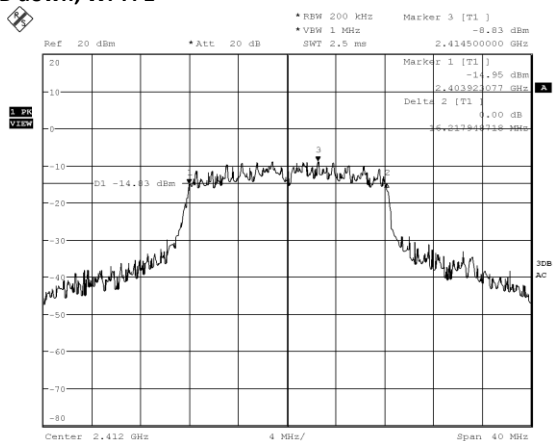
Date: 27.APR.2022 20:37:23

7.6.2.11 802.11g Channel1 99% OPB, Wi-Fi 1



Date: 27.APR.2022 20:34:20

7.6.2.12 802.11g Channel1 6dB down, Wi-Fi 1

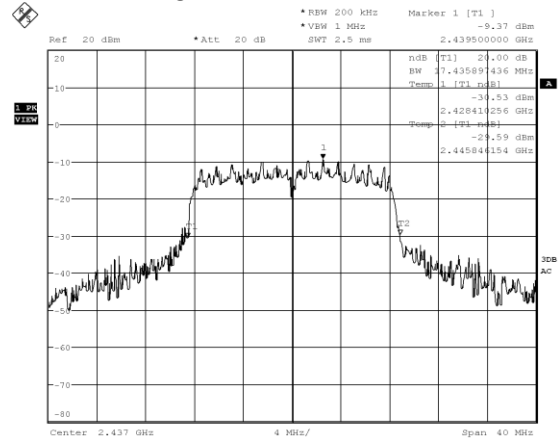


Date: 27.APR.2022 18:49:56



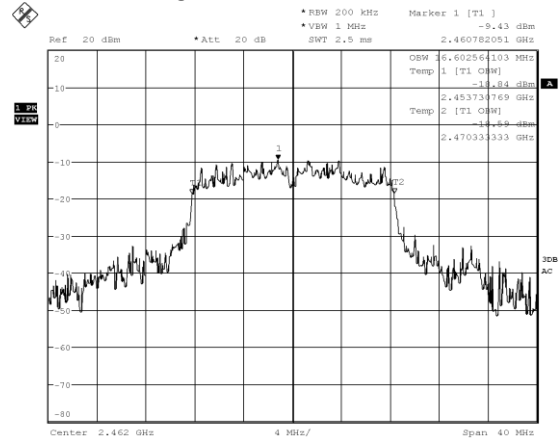
EMC Test Report

7.6.2.13 802.11g Channel6 20dB down, Wi-Fi 1



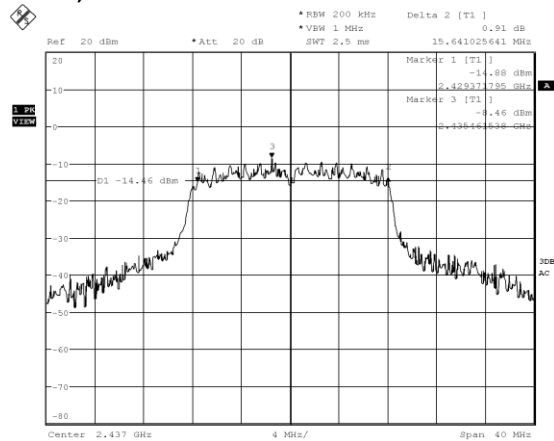
Date: 27.APR.2022 20:39:43

7.6.2.14 802.11g Channel6 99% OPB, Wi-Fi 1

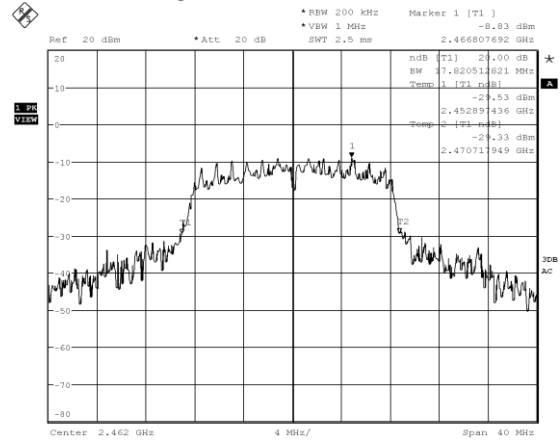


Date: 27.APR.2022 20:27:36

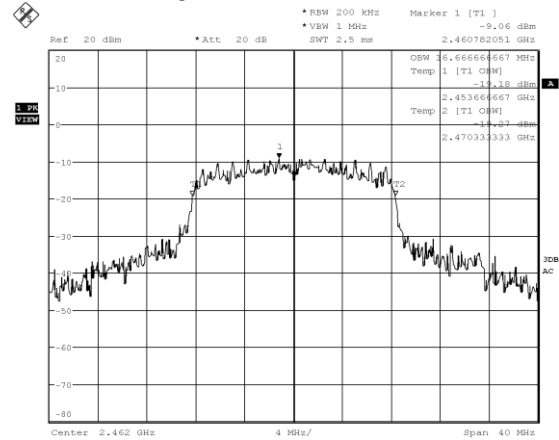
7.6.2.15 802.11g Channel6 6dB down, Wi-Fi 1



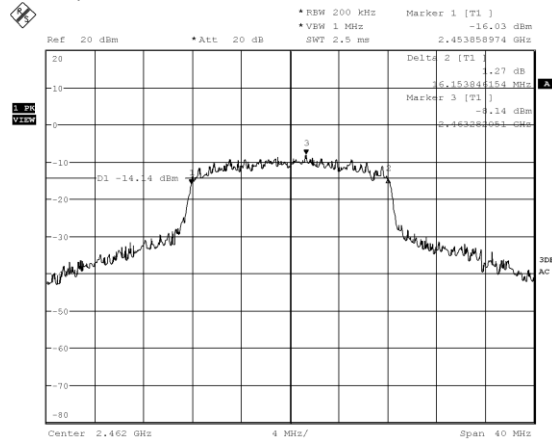
Date: 27.APR.2022 18:55:45

**7.6.2.16 802.11g Channel11 20dB down, Wi-Fi 1**

Date: 27.APR.2022 18:15:37

7.6.2.17 802.11g Channel11 99% OPB, Wi-Fi 1

Date: 27.APR.2022 18:13:17

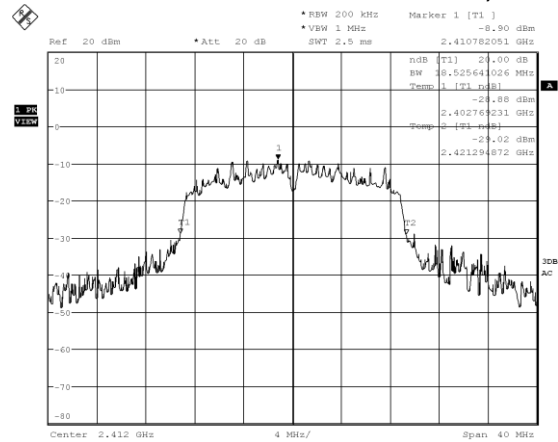
7.6.2.18 802.11g Channel11 6dB down, Wi-Fi 1

Date: 27.APR.2022 18:29:11



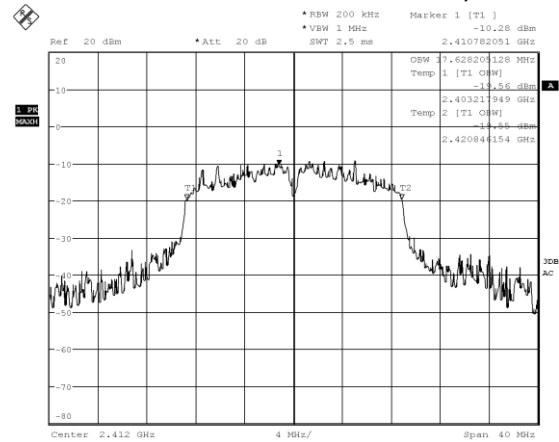
EMC Test Report

7.6.2.19 802.11 n 20MHz Channel1 20dB down, Wi-Fi 1



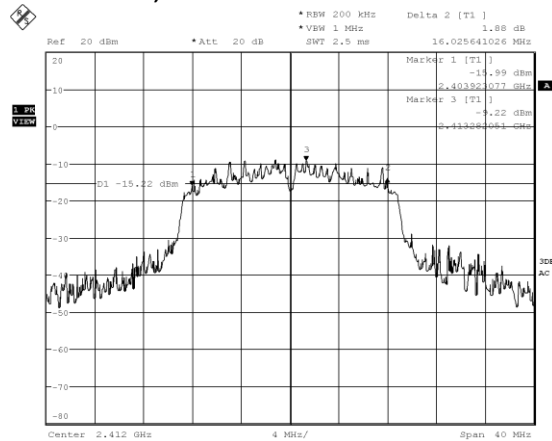
Date: 27.APR.2022 19:59:49

7.6.2.20 802.11 n 20MHz Channel1 99% OPB, Wi-Fi 1



Date: 27.APR.2022 20:02:46

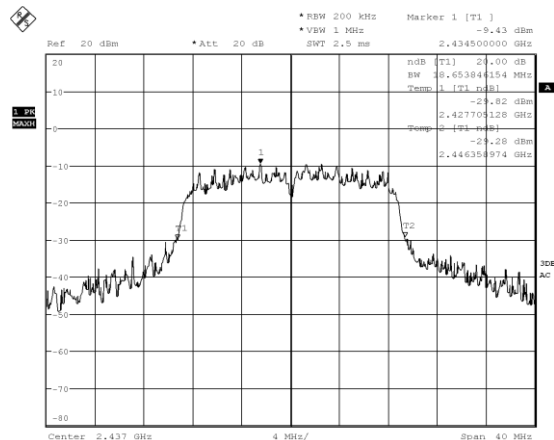
7.6.2.21 802.11n 20MHz Channel1 6dB down, Wi-Fi 1



Date: 27.APR.2022 19:57:02

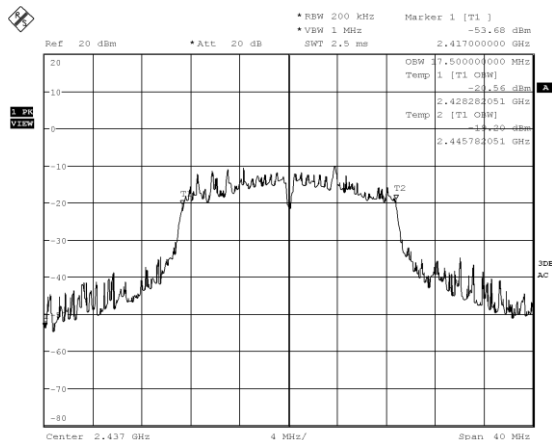


7.6.2.22 802.11 n 20MHz Channel6 20dB down, Wi-Fi 1



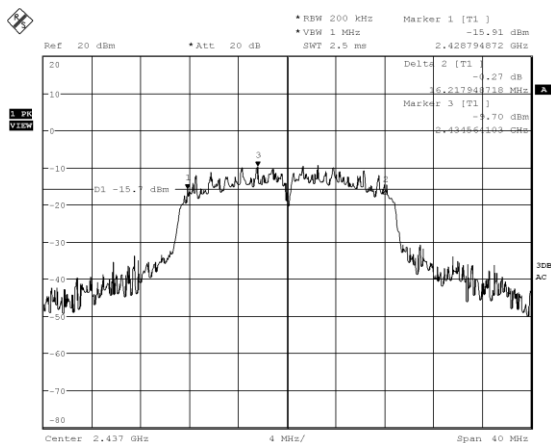
Date: 27.APR.2022 20:09:32

7.6.2.23 802.11 n 20MHz Channel6 99% OPB, Wi-Fi 1



Date: 27.APR.2022 20:07:22

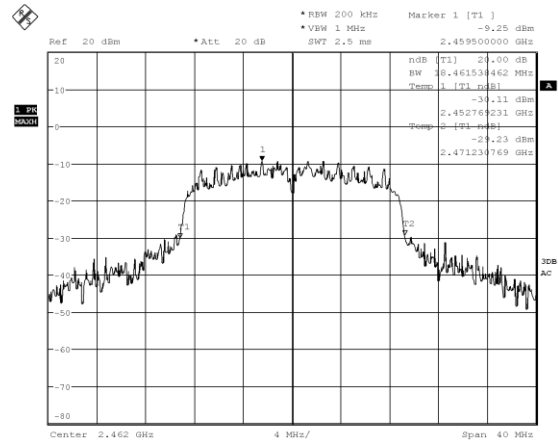
7.6.2.24 802.11n 20MHz Channel6 6dB down, Wi-Fi 1



Date: 27.APR.2022 19:25:06

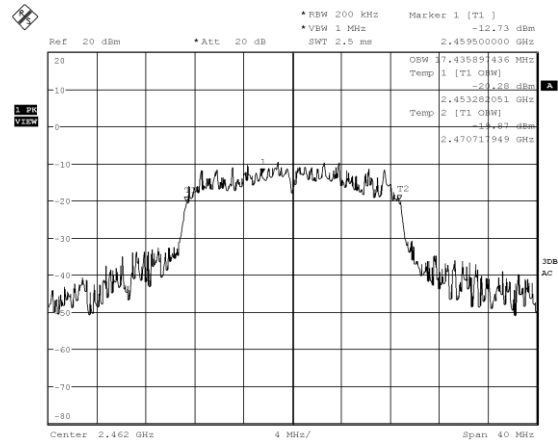


7.6.2.25 802.11 n 20MHz Channel11 20dB down, Wi-Fi 1



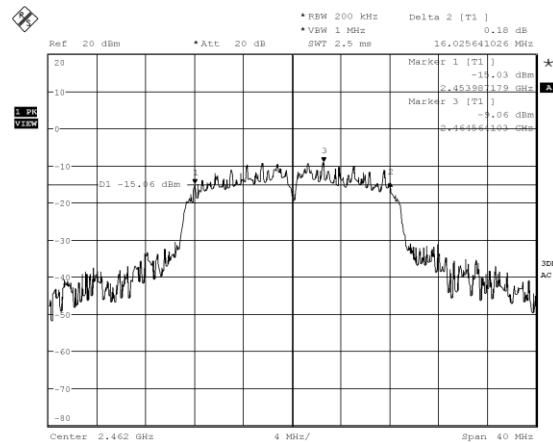
Date: 27.APR.2022 20:12:03

7.6.2.26 802.11 n 20MHz Channel11 99% OPB, Wi-Fi 1



Date: 27.APR.2022 20:15:10

7.6.2.27 802.11n 20MHz Channel11 6dB down, Wi-Fi 1



Date: 27.APR.2022 19:36:56



8 Maximum Peak Output Power

8.1 Test Method

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

FCC Part 15.247(b):

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(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(b):

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

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

8.2 Test Equipment Used:

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Signal Analyzer	3727	Rohde & Schwarz	FSQ	9/17/2021	9/17/2022



8.3 Test Conditions

Test Personnel:	Ben Coolbear	Test Date:	4/29/2022 - 4/30/2022
Supervising/Reviewing Engineer:	Brian Lackey	Limit Applied:	See Above
Product Standard:	FCC Part 15.247 & RSS-247 Issue 2	Ambient Temperature:	23.7°C
Input Voltage:	120V/60Hz	Relative Humidity:	38.1%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	982.3 mbar

8.4 Test Data: Wi-Fi0

Operating Mode	Frequency (MHz)	Conducted Power (dBm)	Limit		Margin (dB)
			(mW)	(dBm)	
802.11b	2412	22.09	1000	30.00	7.91
	2437	21.49			8.51
	2462	20.43			9.57
802.11g	2412	26.33			3.67
	2437	25.48			4.52
	2462	24.23			5.77
802.11n 20MHz	2412	26.30			3.70
	2437	25.38			4.62
	2462	24.28			5.72

Deviations, Additions, or Exclusions: None

8.5 Test Data: Wi-Fi1

Operating Mode	Frequency (MHz)	Conducted Power (dBm)	Limit		Margin (dB)
			(mW)	(dBm)	
802.11b	2412	21.80	1000	30.00	8.20
	2437	20.79			9.21
	2462	20.81			9.19
802.11g	2412	26.27			3.73
	2437	25.20			4.80
	2462	23.92			6.08
802.11n 20MHz	2412	26.22			3.78
	2437	25.18			4.82
	2462	23.95			6.05

Deviations, Additions, or Exclusions: None



9 Power Spectral Density

9.1 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).

9.2 Test Method

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

9.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde & Schwarz	ESU40	3/10/2022	3/10/2023

9.4 Test Results

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

9.5 Test Conditions

Test Personnel:	Ben Coolbear	Test Date:	4/29/2022 – 4/30/2022
Supervising/Reviewing Engineer:		Limit Applied:	See Above
(Where Applicable)	Brian Lackey	Ambient Temperature:	23.7°C
Product Standard:	FCC Part 15.247	Relative Humidity:	38.1%
Input Voltage:	RSS-247 Issue 2	Atmospheric Pressure:	982.3 mbar
Pretest Verification w / Ambient	Battery		
Signals or BB Source:	Yes		

Deviations, Additions, or Exclusions: None.



9.6 Test Data Wi-Fi 0

Mode	Channel	Frequency (MHz)	RBW (kHz)	Measured Value (dBm)	Correction Factor+ Antenna Gain (dB)	PPSD (dBm)	Limit (dBm EIRP)	Result
802.11b	1	2409.84	3	-26.16	-19.78	-6.38	8	Compliant
	6	2438.09	3	-26.03	-19.02	-7.01	8	Compliant
	11	2461.13	3	-24.85	-18.13	-6.72	8	Compliant

Mode	Channel	Frequency (MHz)	RBW (kHz)	Measured Value (dBm)	Correction Factor+ Antenna Gain (dB)	PPSD (dBm)	Limit (dBm EIRP)	Result
802.11g	1	2411.12	3	-26.40	-19.78	-6.62	8	Compliant
	6	2432.63	3	-26.65	-19.02	-7.63	8	Compliant
	11	2464.49	3	-26.87	-18.13	-8.74	8	Compliant

Mode	Channel	Frequency (MHz)	RBW (kHz)	Measured Value (dBm)	Correction Factor+ Antenna Gain (dB)	PPSD (dBm)	Limit (dBm EIRP)	Result
802.11n 20MHz	1	2411.12	3	-26.96	-19.78	-7.18	8	Compliant
	6	2432.63	3	-27.24	-19.02	-8.22	8	Compliant
	11	2464.49	3	-25.81	-18.13	-7.68	8	Compliant

9.7 Test Data Wi-Fi 1

Mode	Channel	Frequency (MHz)	RBW (kHz)	Measured Value (dBm)	Correction Factor+ Antenna Gain (dB)	PPSD (dBm)	Limit (dBm EIRP)	Result
802.11b	1	2411.12	3	-25.62	-19.78	-5.84	8	Compliant
	6	2432.63	3	-26.45	-19.02	-7.43	8	Compliant
	11	2464.49	3	-25.27	-18.13	-7.14	8	Compliant

Mode	Channel	Frequency (MHz)	RBW (kHz)	Measured Value (dBm)	Correction Factor+ Antenna Gain (dB)	PPSD (dBm)	Limit (dBm EIRP)	Result
802.11g	1	2411.12	3	-25.19	-19.78	-5.41	8	Compliant
	6	2432.63	3	-26.60	-19.02	-7.58	8	Compliant
	11	2464.49	3	-25.89	-18.13	-7.76	8	Compliant

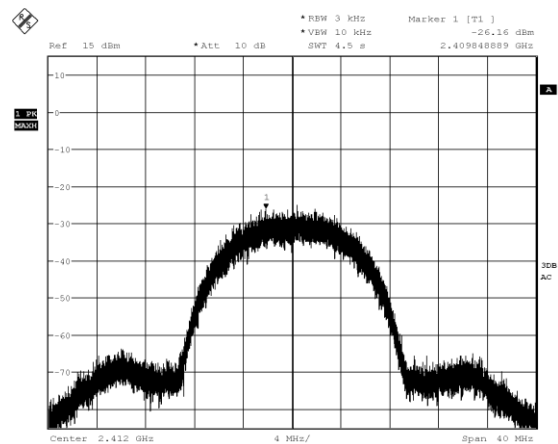
Mode	Channel	Frequency (MHz)	RBW (kHz)	Measured Value (dBm)	Correction Factor+ Antenna Gain (dB)	PPSD (dBm)	Limit (dBm EIRP)	Result
802.11n 20MHz	1	2411.12	3	-26.73	-19.78	-6.95	8	Compliant
	6	2432.63	3	-28.93	-19.02	-9.91	8	Compliant
	11	2464.49	3	-28.87	-18.13	-10.74	8	Compliant



9.8 Spectrum Plots

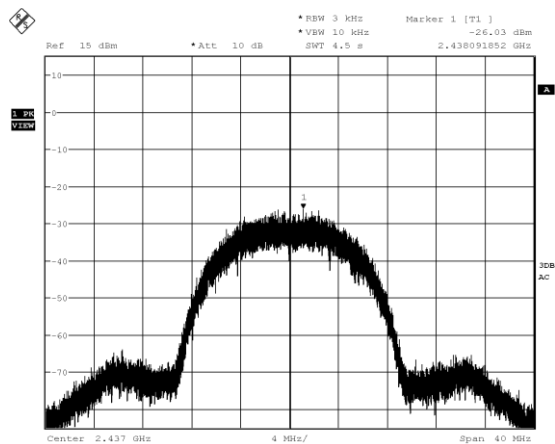
9.8.1 Wi-Fi 0

9.8.1.1 802.11b Channel1 PPSD



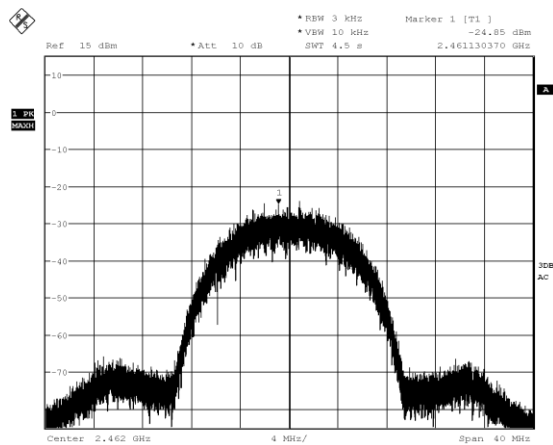
Date: 30.APR.2022 04:16:02

9.8.1.2 802.11b Channel6 PPSD



Date: 30.APR.2022 04:19:24

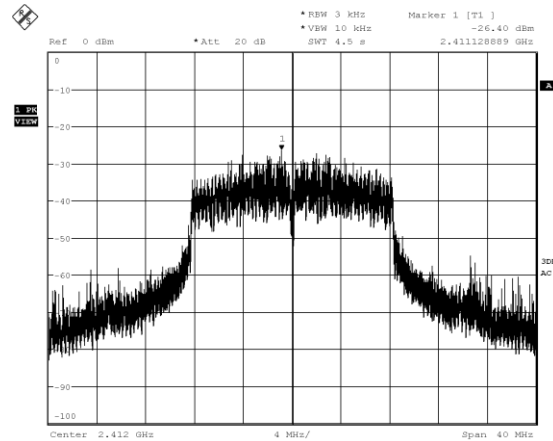
9.8.1.3 802.11b Channel11 PPSD



Date: 30.APR.2022 04:21:31

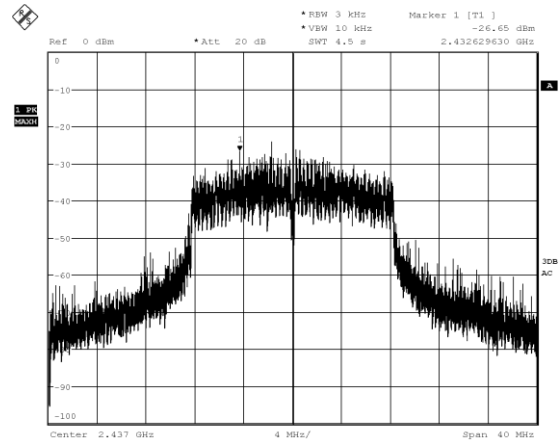


9.8.1.4 802.11g Channel1 PPSP



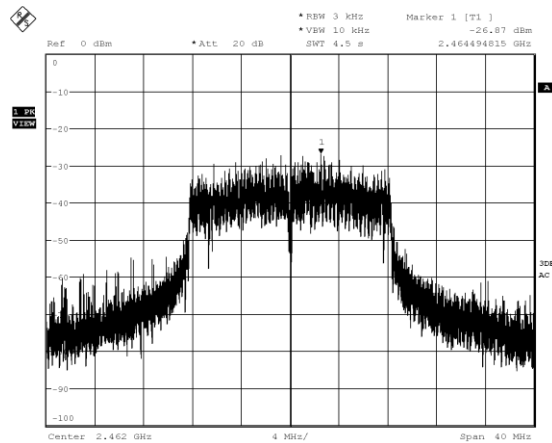
Date: 30.APR.2022 04:25:28

9.8.1.5 802.11g Channel6 PPSP



Date: 30.APR.2022 04:27:15

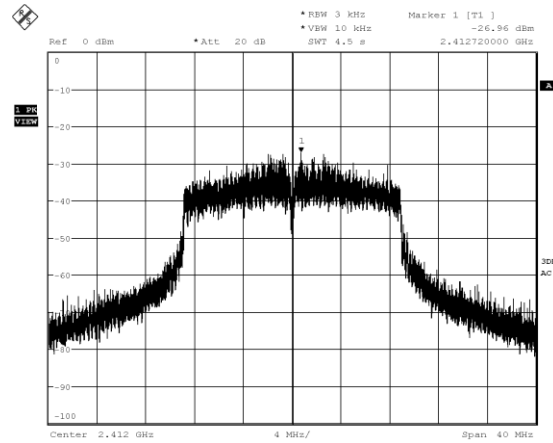
9.8.1.6 802.11g Channel11 PPSP



Date: 30.APR.2022 04:30:45

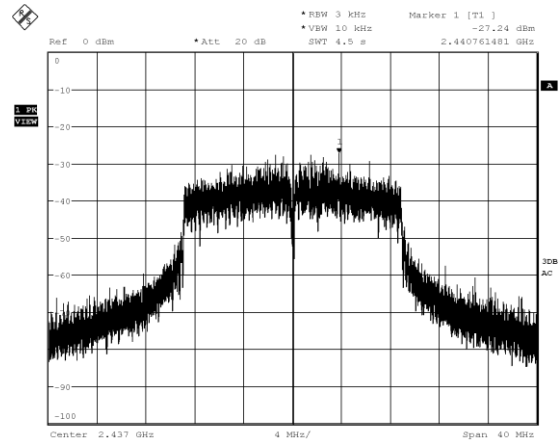


9.8.1.7 802.11 n 20MHz Channel1 PPSP



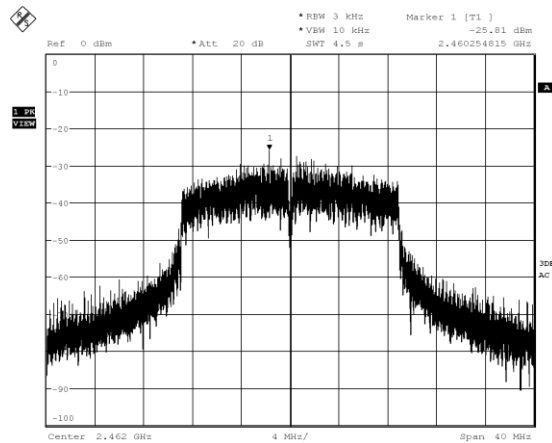
Date: 30.APR.2022 04:32:57

9.8.1.8 802.11 n 20MHz Channel6 PPSP



Date: 30.APR.2022 04:50:41

9.8.1.9 802.11 n 20MHz Channel11 PPSP

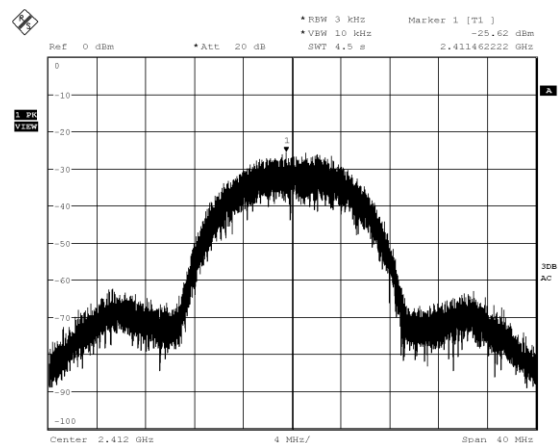


Date: 30.APR.2022 04:39:12



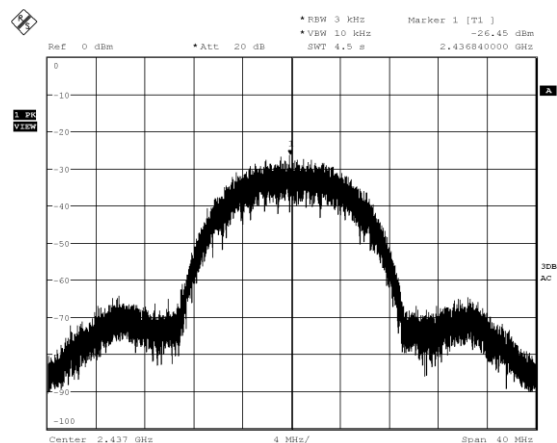
9.8.2 Wi-Fi 1

9.8.2.1 802.11b Channel1 PPSD



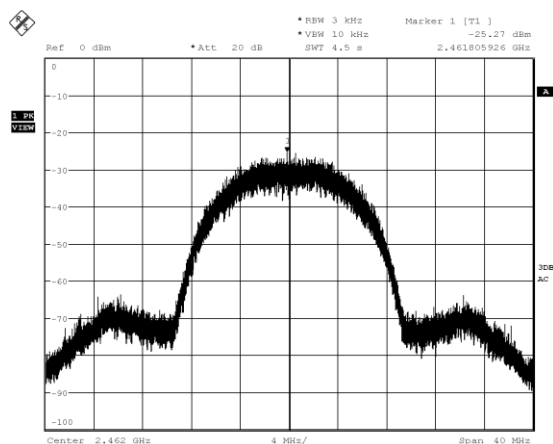
Date: 30.APR.2022 05:09:52

9.8.2.2 802.11b Channel6 PPSD



Date: 30.APR.2022 05:07:45

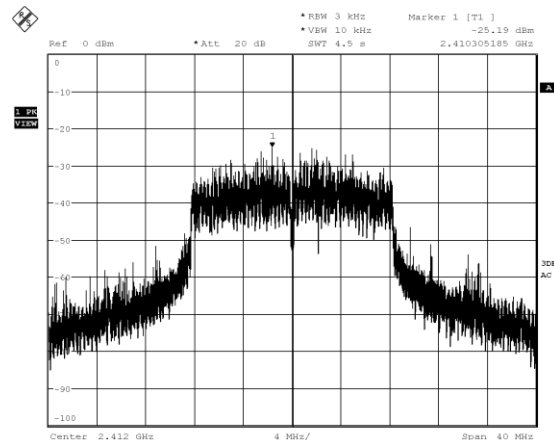
9.8.2.3 802.11b Channel11 PPSD



Date: 30.APR.2022 05:04:08

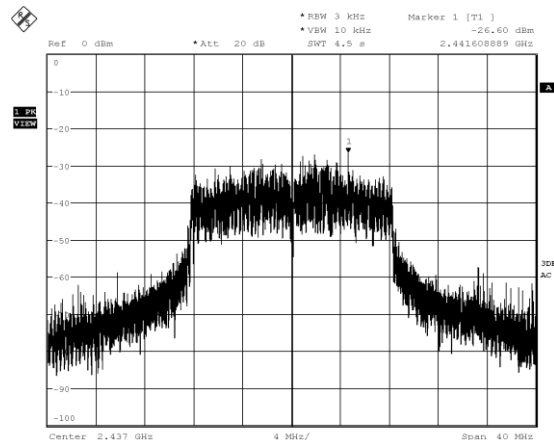


9.8.2.4 802.11g Channel1 PPSP



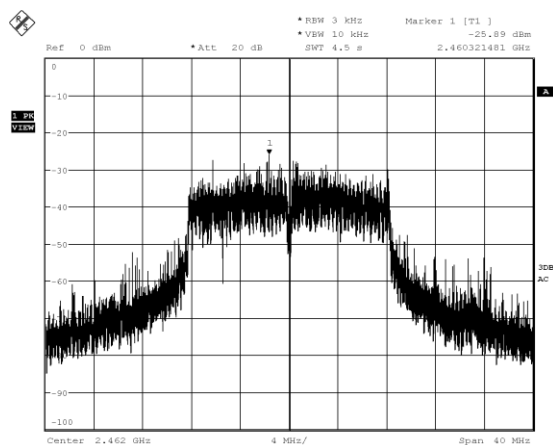
Date: 30.APR.2022 04:57:02

9.8.2.5 802.11g Channel6 PPSP



Date: 30.APR.2022 04:59:09

9.8.2.6 802.11g Channel11 PPSP



Date: 30.APR.2022 05:01:18





10 Conducted Spurious Emissions

10.1 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.

10.2 Test Method

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

10.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde & Schwarz	ESU40	3/10/2022	3/10/2023

10.4 Test Results

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

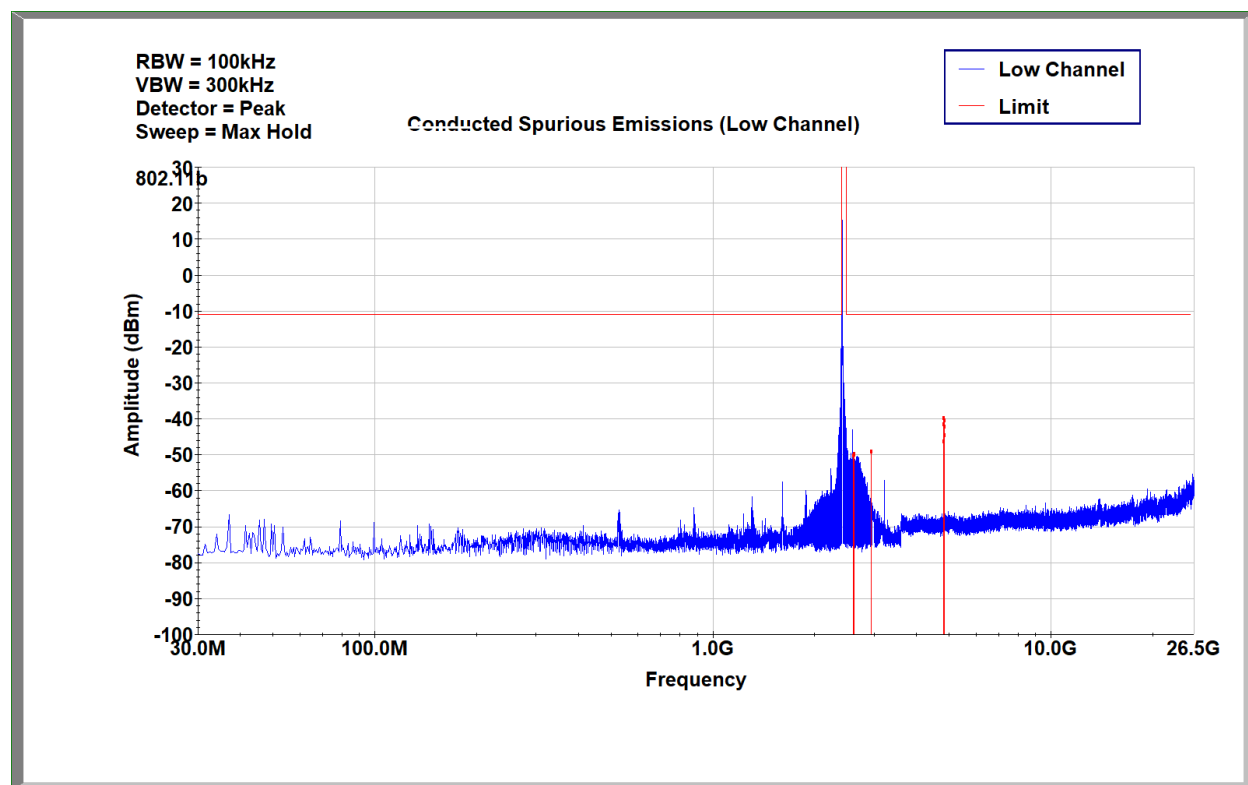


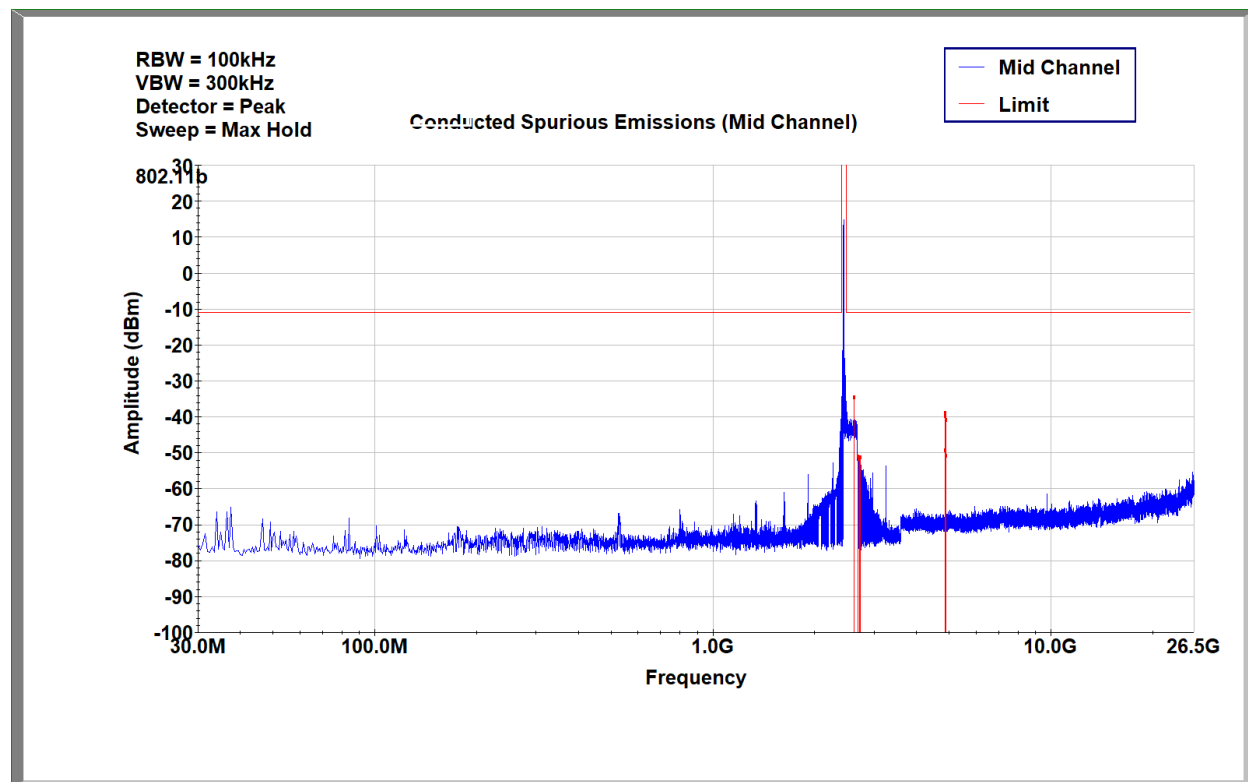
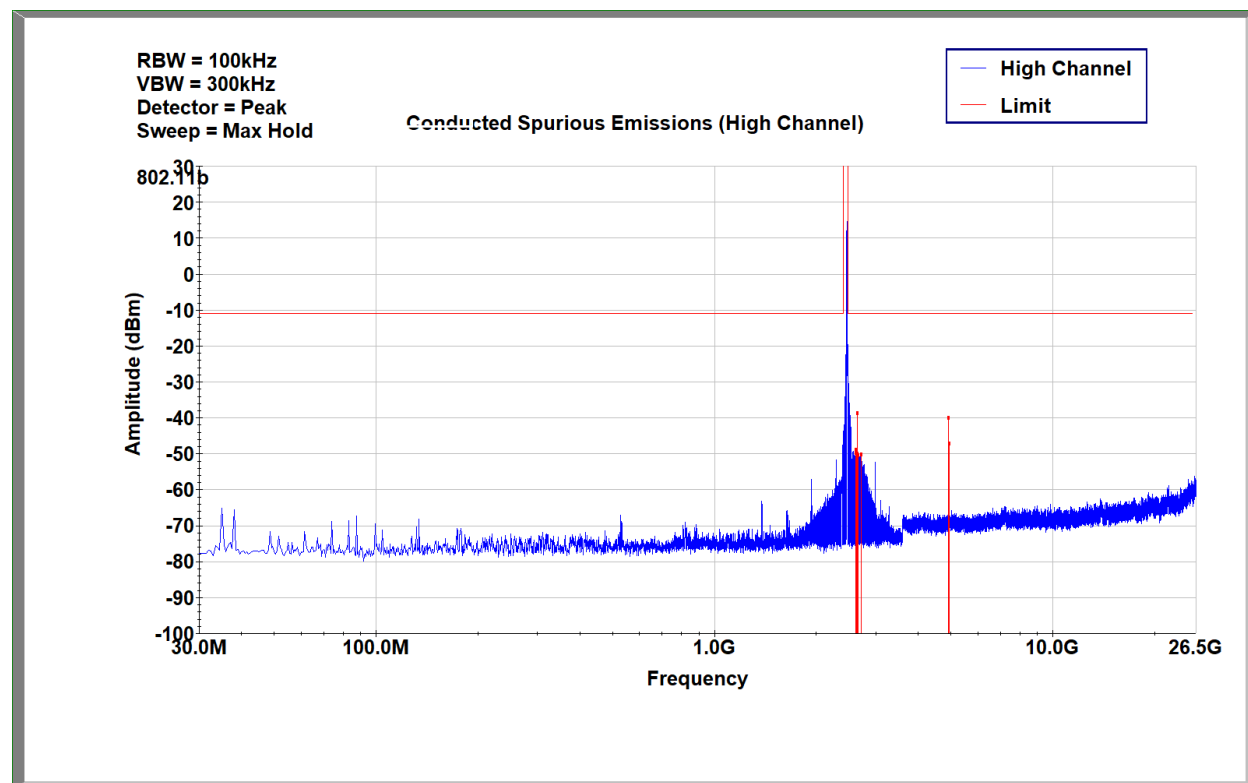
10.5 Test Conditions

Test Personnel:	Brian Lackey	Test Date:	4/29/2022
Supervising/Reviewing Engineer:			
(Where Applicable)	NA	Limit Applied:	See Above
	FCC Part 15.247		
Product Standard:	RSS-247 Issue 2	Ambient Temperature:	23.7°C
Input Voltage:	Battery	Relative Humidity:	38.1%
Pretest Verification w / Ambient			
Signals or BB Source:	Yes	Atmospheric Pressure:	982.3 mbar

10.6 Test Data: Wi-Fi 0

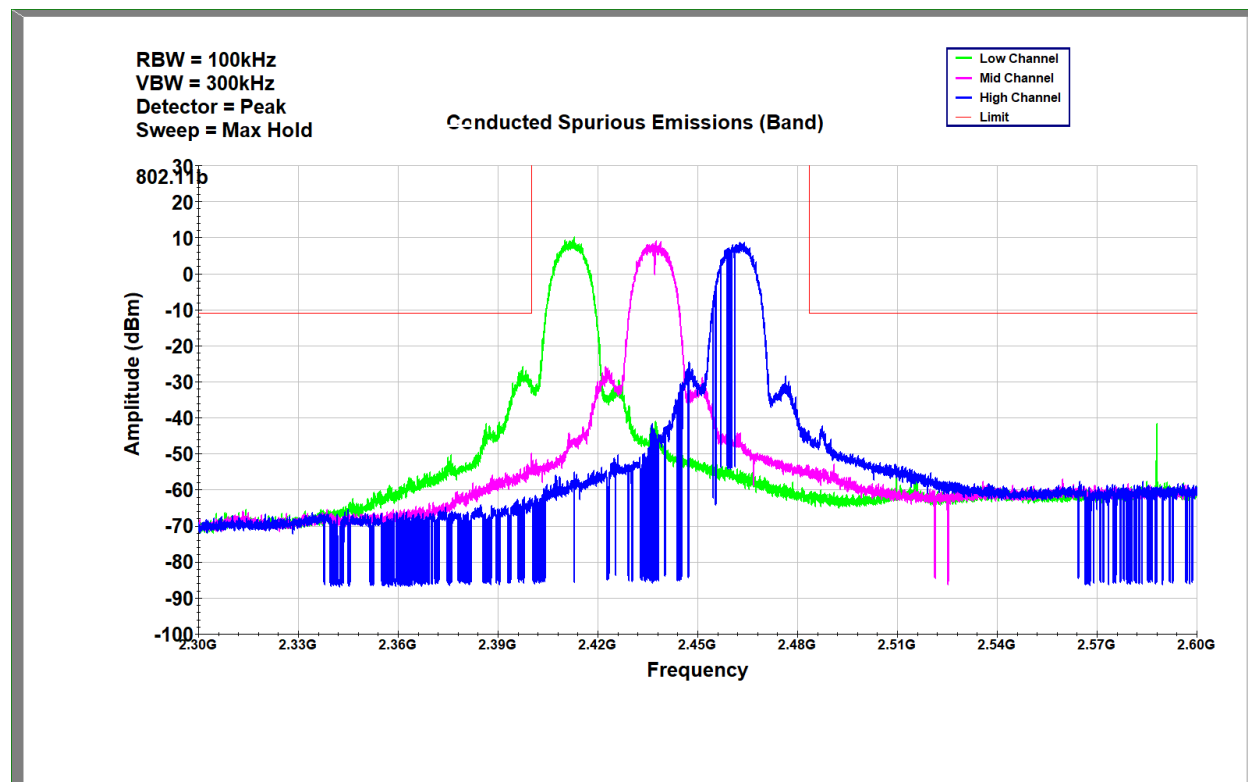
10.6.1.1 Conducted Spurious Emissions (802.11b 2412MHz Channel 1)



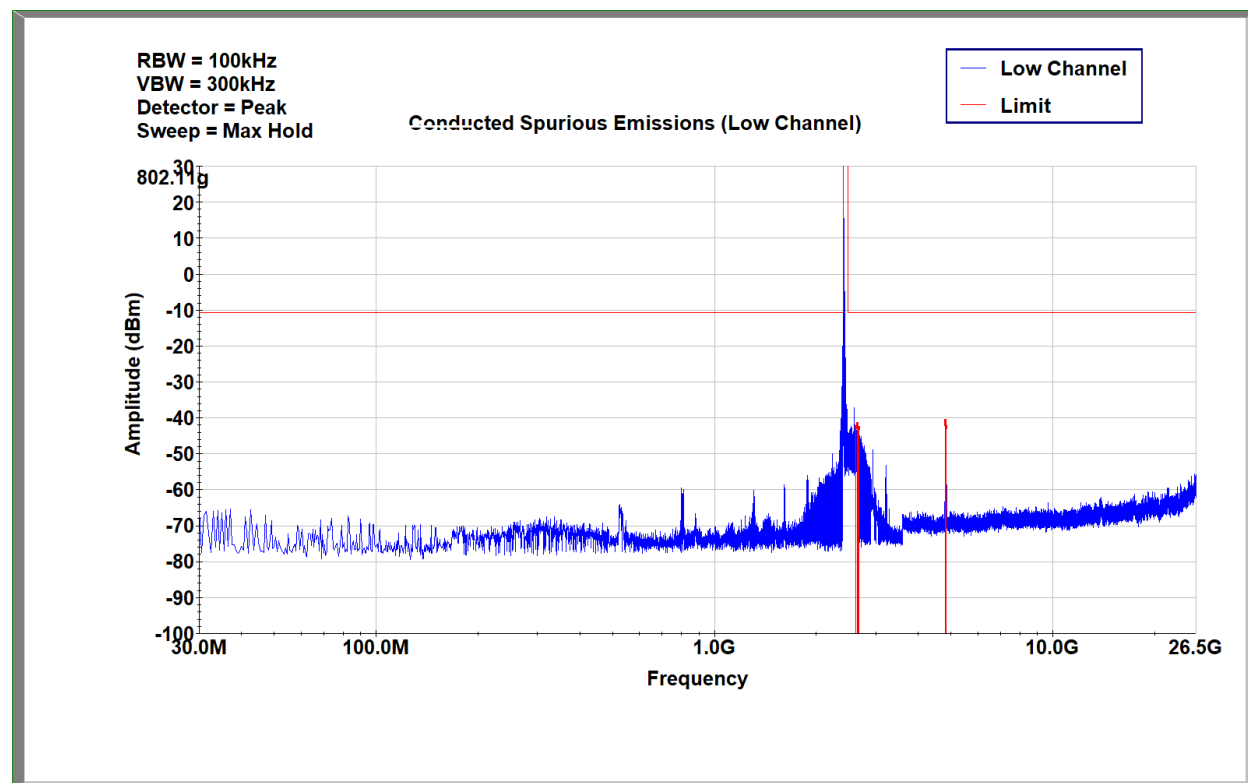
**10.6.1.2 Conducted Spurious Emissions (802.11b 2437MHz Channel 6)****10.6.1.3 Conducted Spurious Emissions (802.11b 2462MHz Channel 11)**



10.6.1.4 Conducted Band Edge (802.11b)

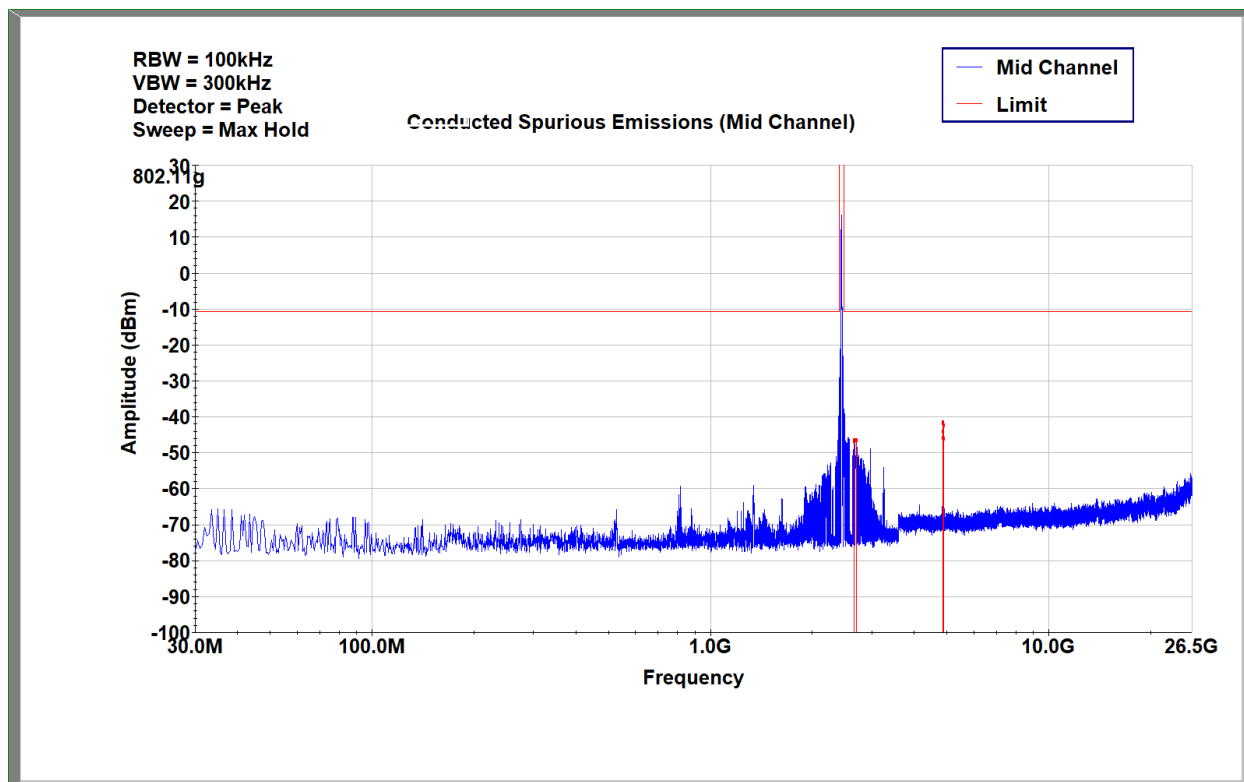


10.6.1.5 Conducted Spurious Emissions (802.11g 2412MHz Channel 1)

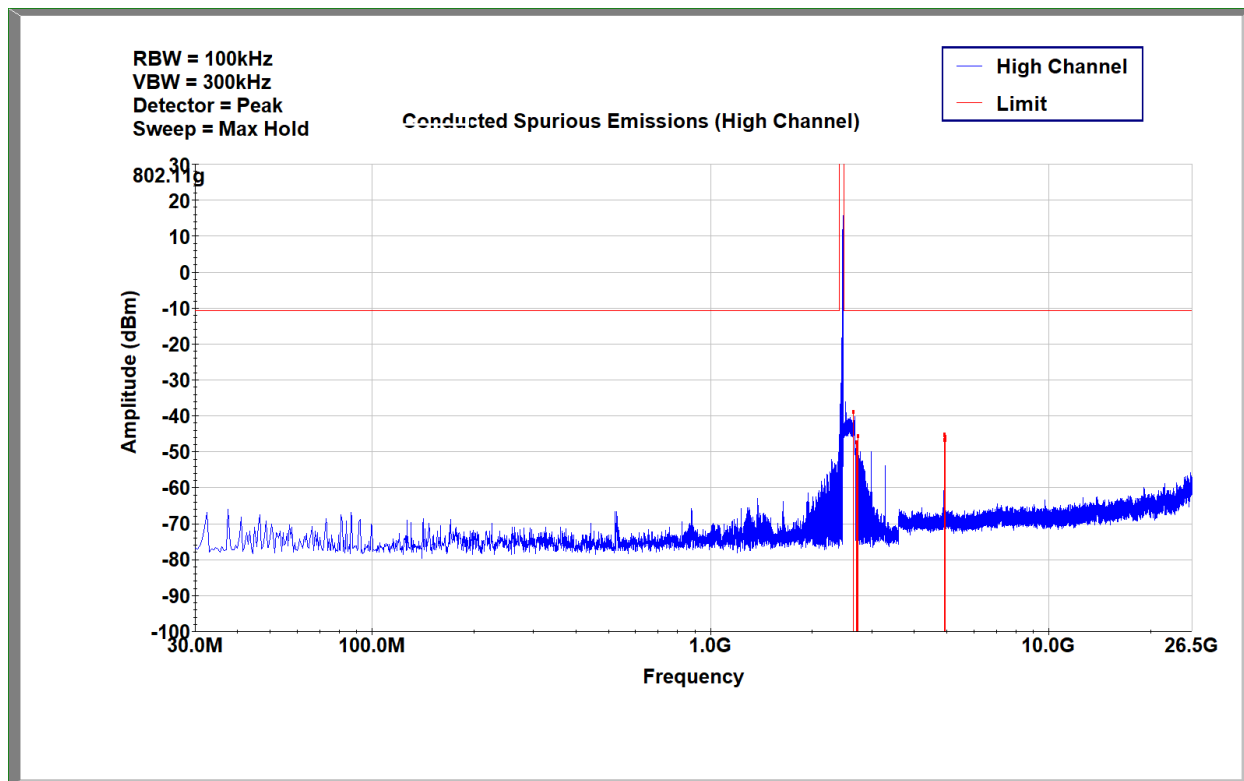




10.6.1.6 Conducted Spurious Emissions (802.11g 2437MHz Channel 6)

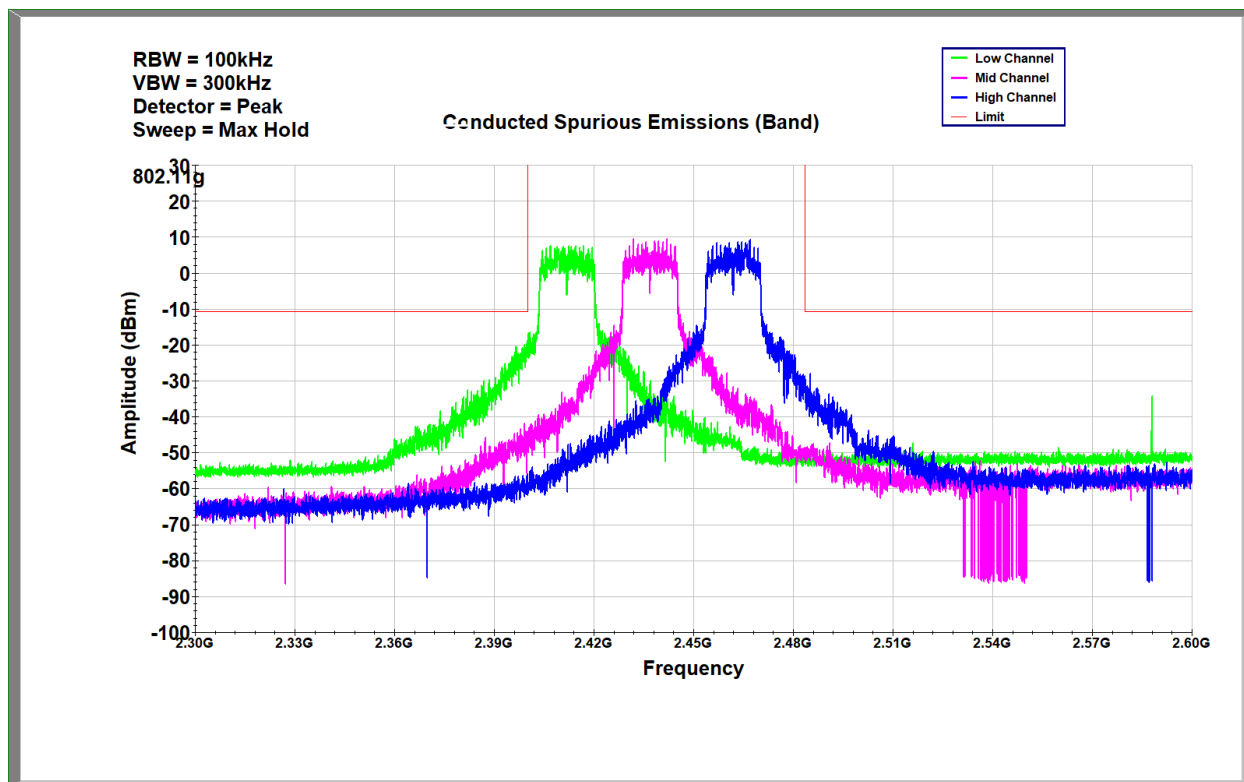


10.6.1.7 Conducted Spurious Emissions (802.11g 2462MHz Channel 11)

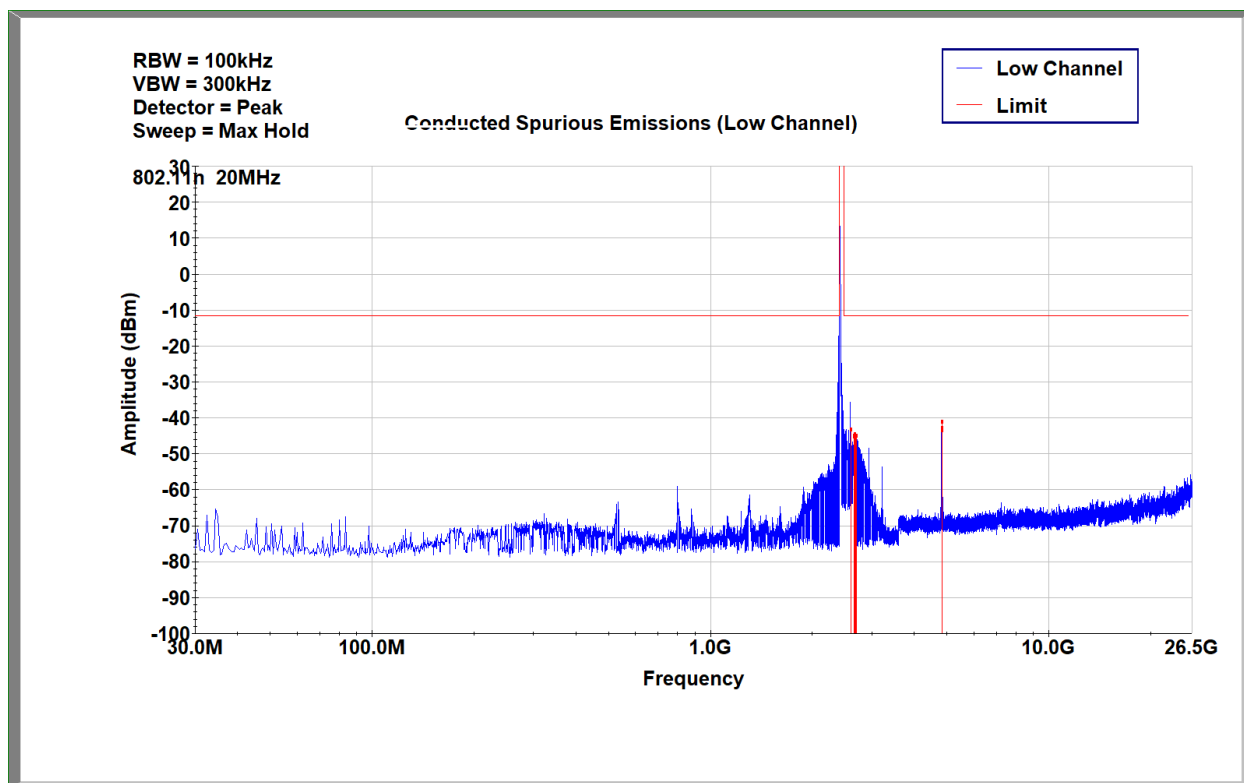




10.6.1.8 Conducted Band Edge (802.11g)

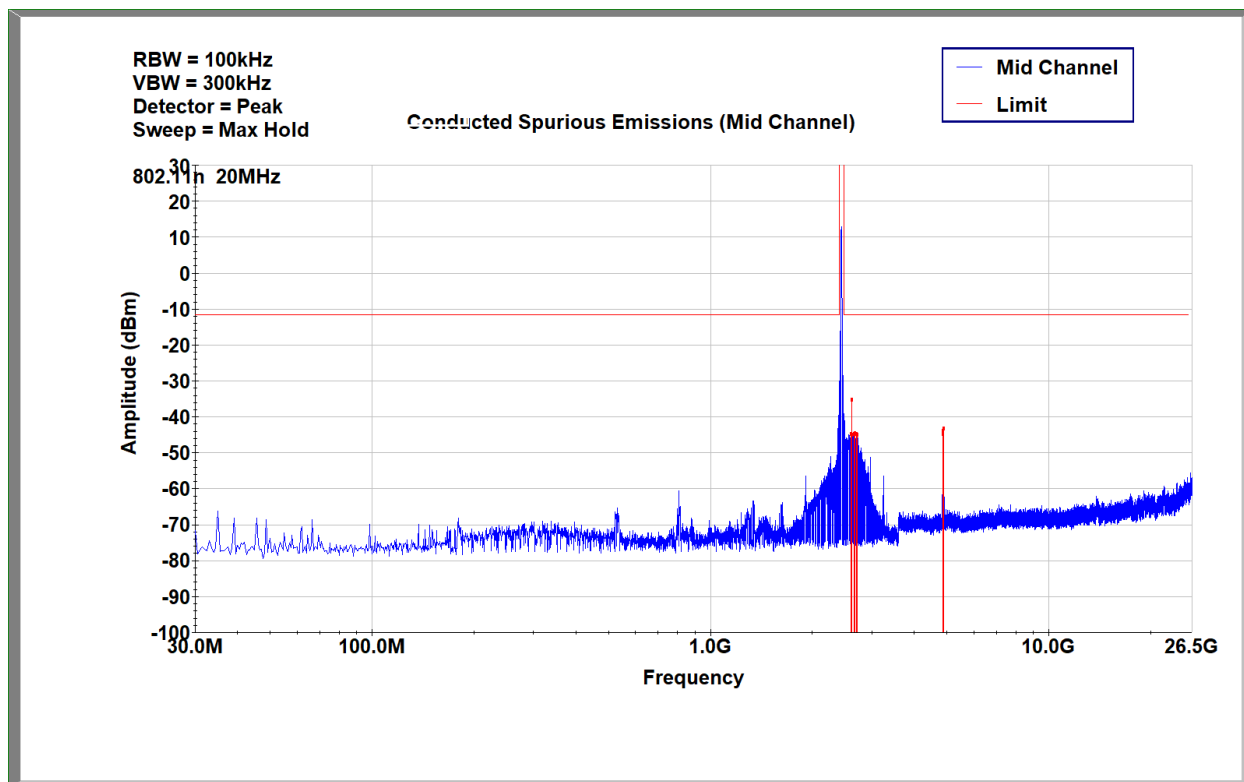


10.6.1.9 Conducted Spurious Emissions (802.11n 20MHz 2412MHz Channel 1)

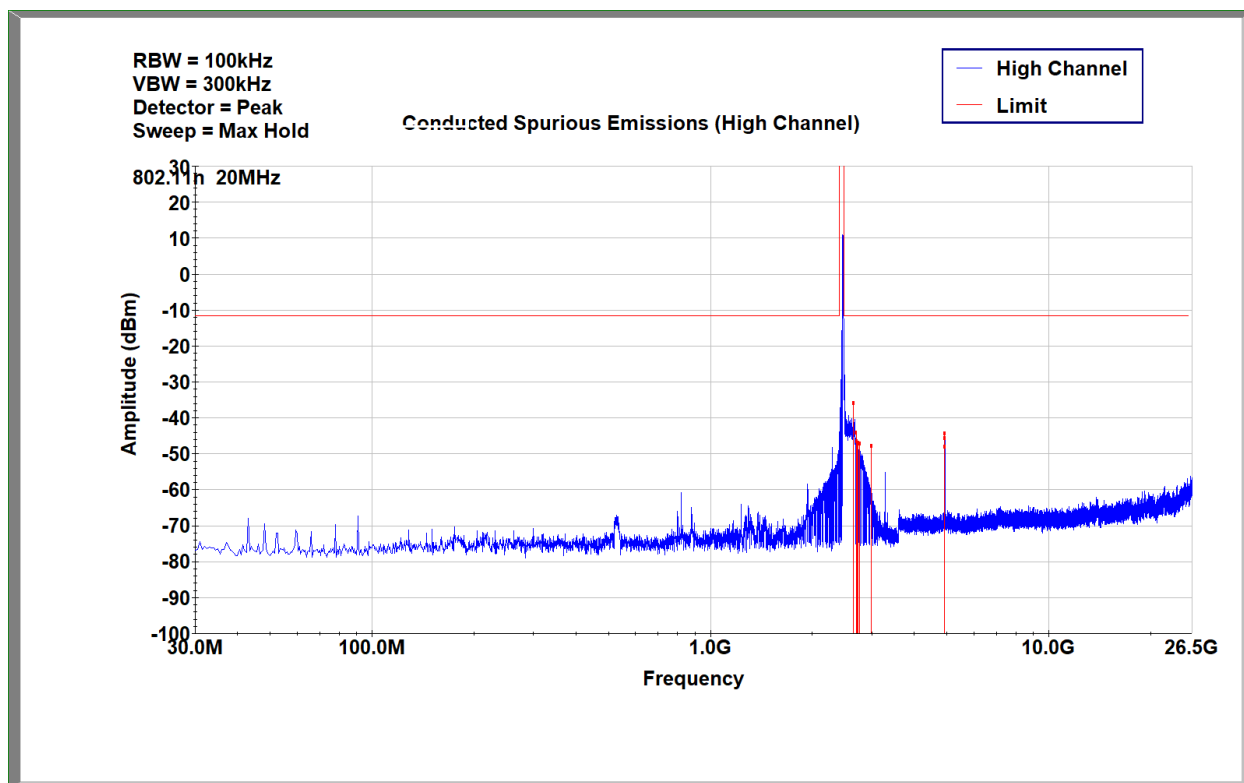




10.6.1.10 Conducted Spurious Emissions (802.11n 20MHz 2437MHz Channel 6)

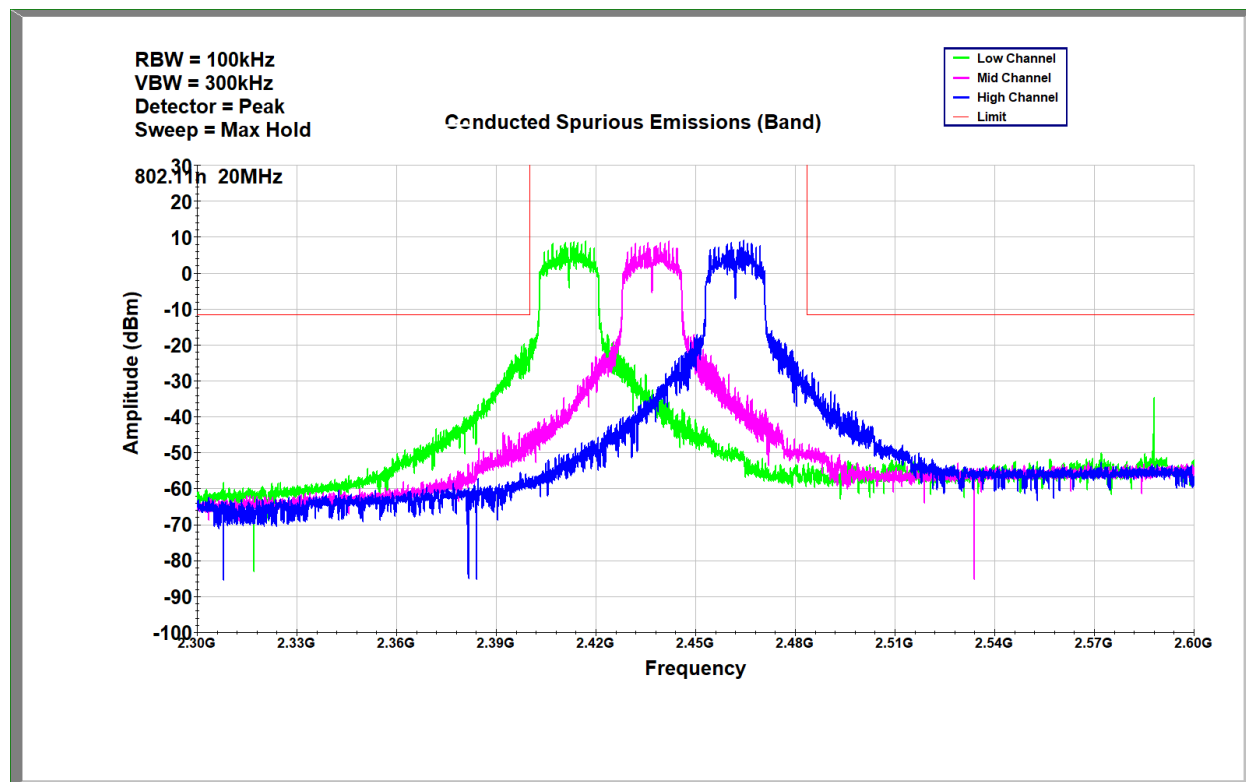


10.6.1.11 Conducted Spurious Emissions (802.11n 20MHz 2462MHz Channel 11)





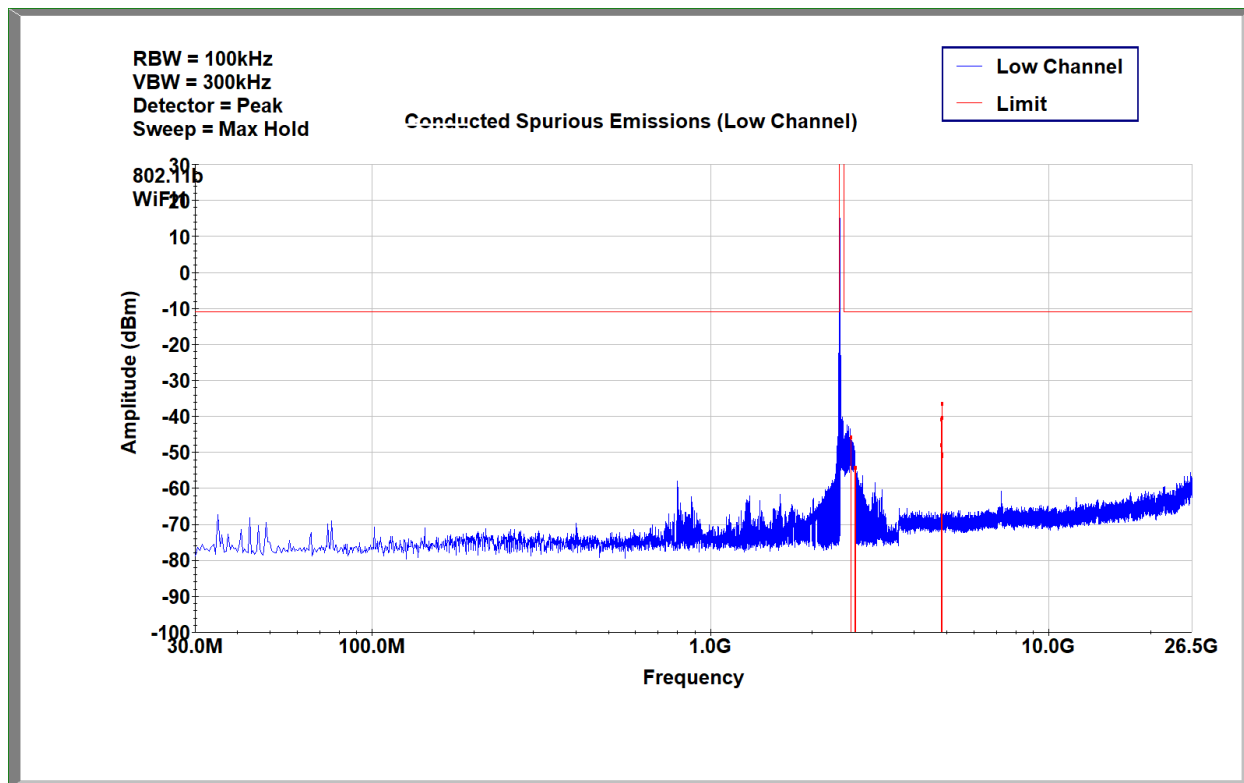
10.6.1.12 Conducted Band Edge (802.11n)



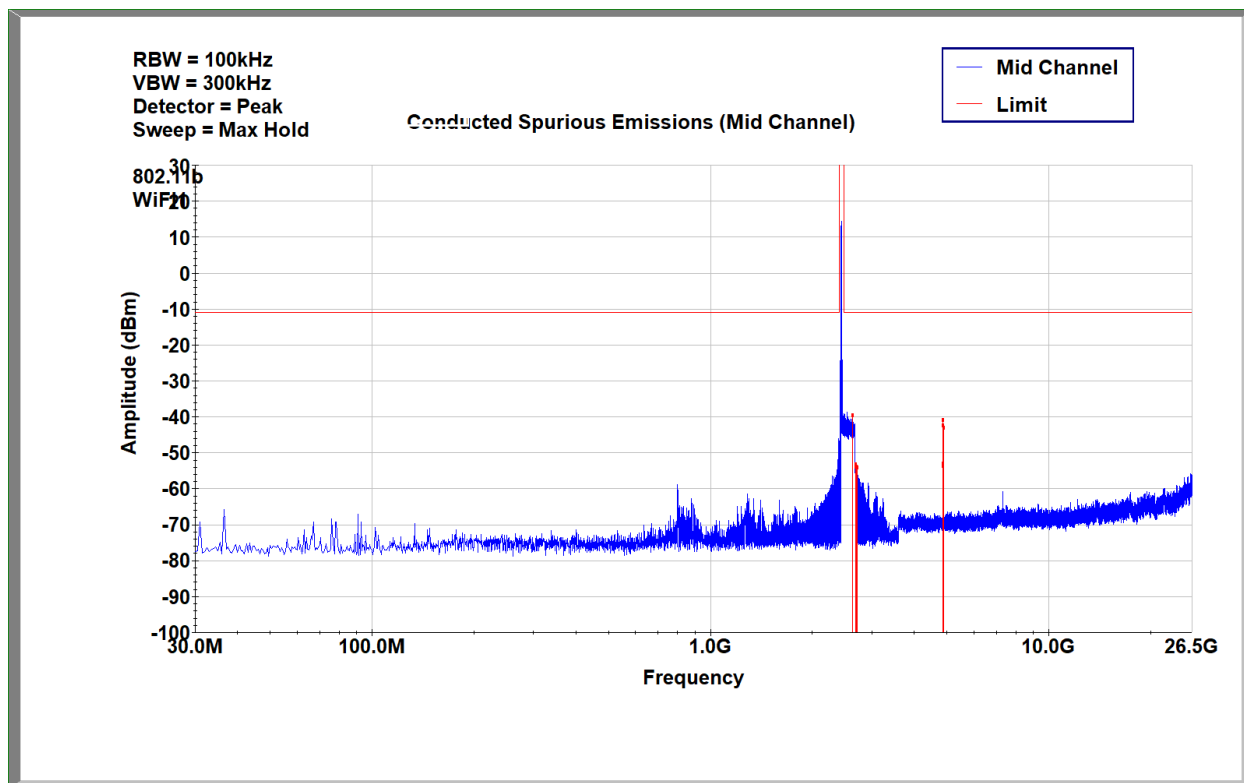


10.7 Test Data: Wi-Fi 1

10.7.1.1 Conducted Spurious Emissions (802.11b 2412MHz Channel 1)

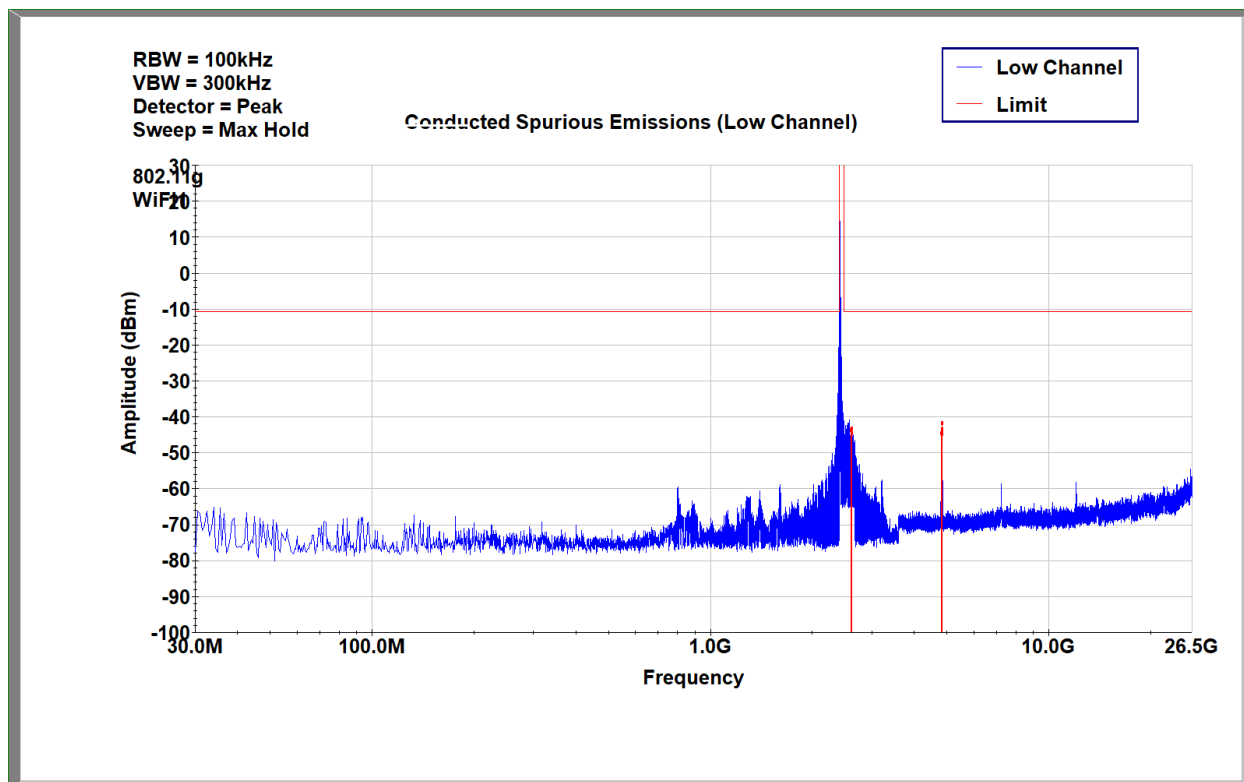


10.7.1.2 Conducted Spurious Emissions (802.11b 2437MHz Channel 6)

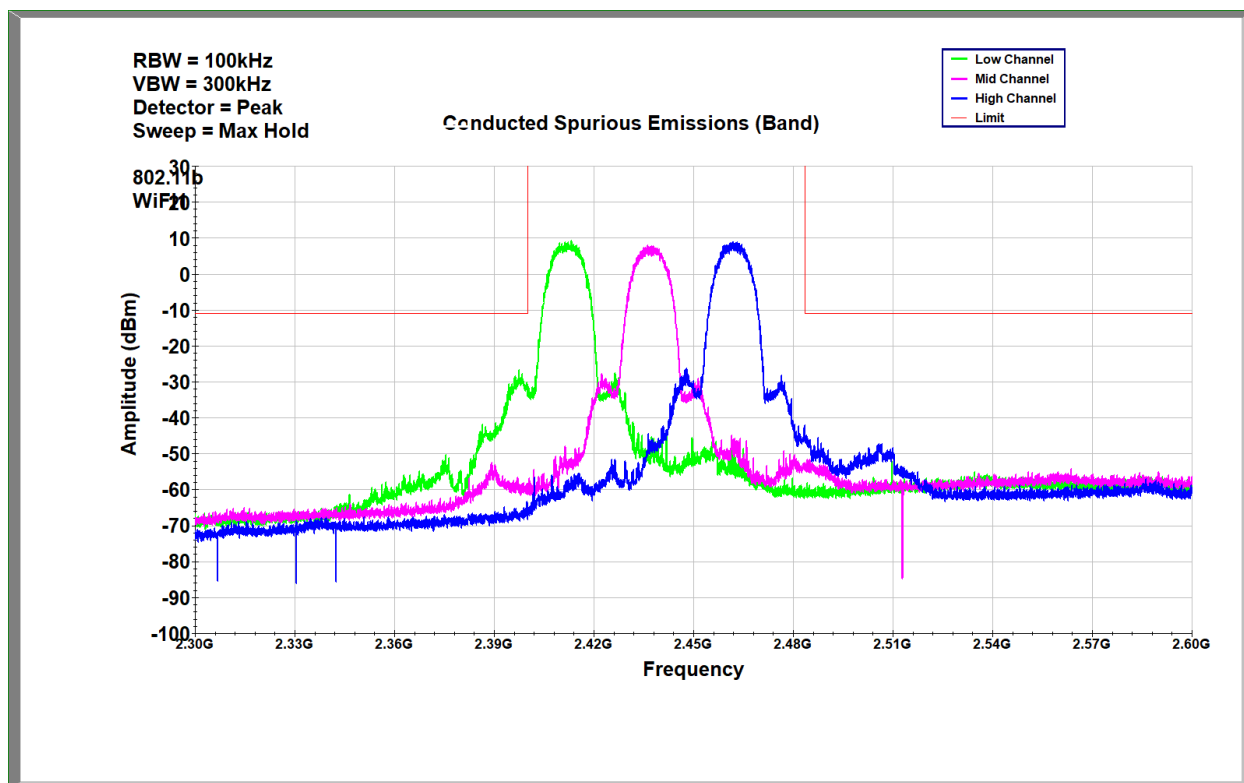




10.7.1.3 Conducted Spurious Emissions (802.11b 2462MHz Channel 11)

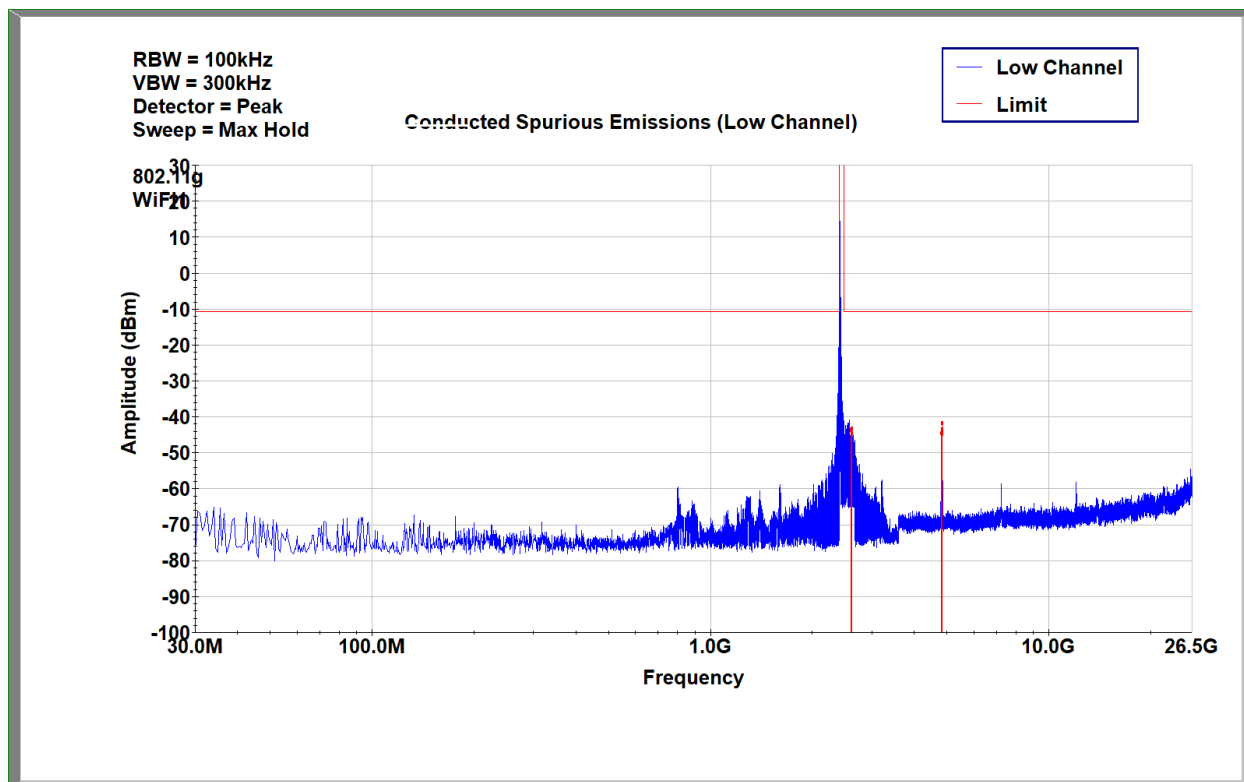


10.7.1.4 Conducted Band Edge (802.11b)

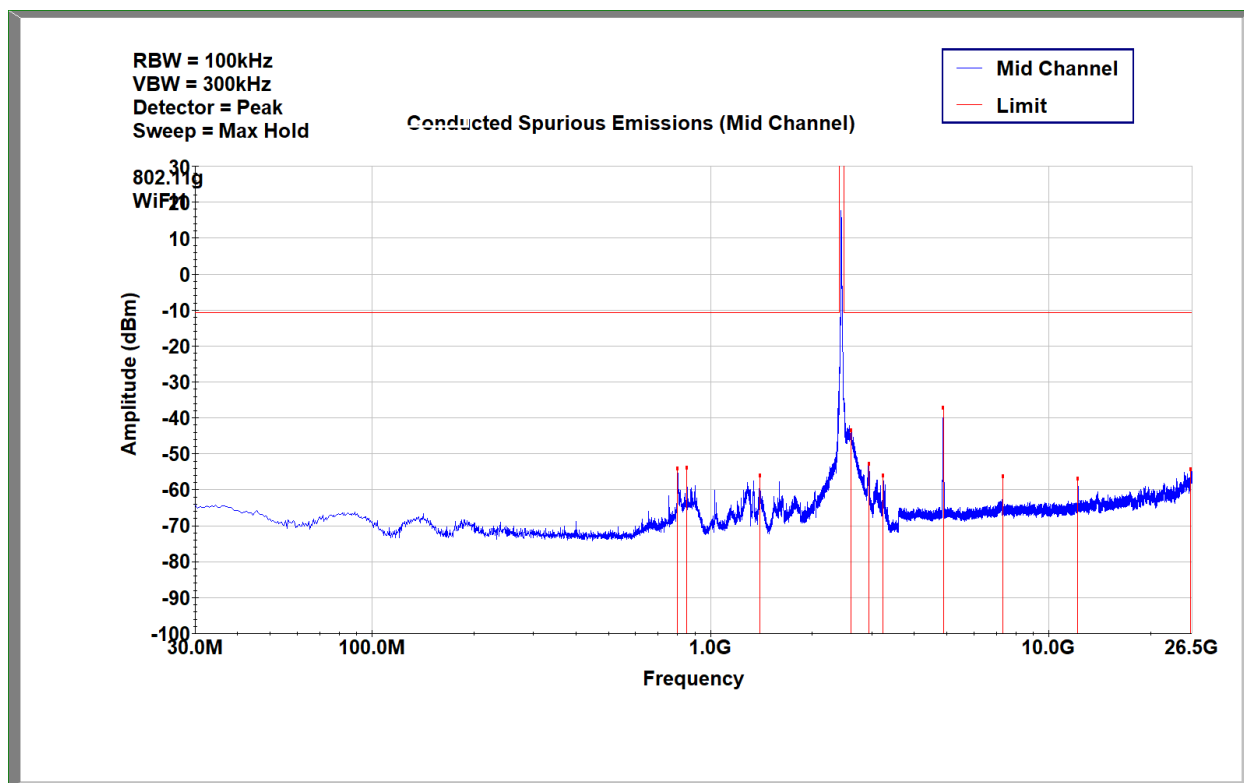




10.7.1.5 Conducted Spurious Emissions (802.11g 2412MHz Channel 1)

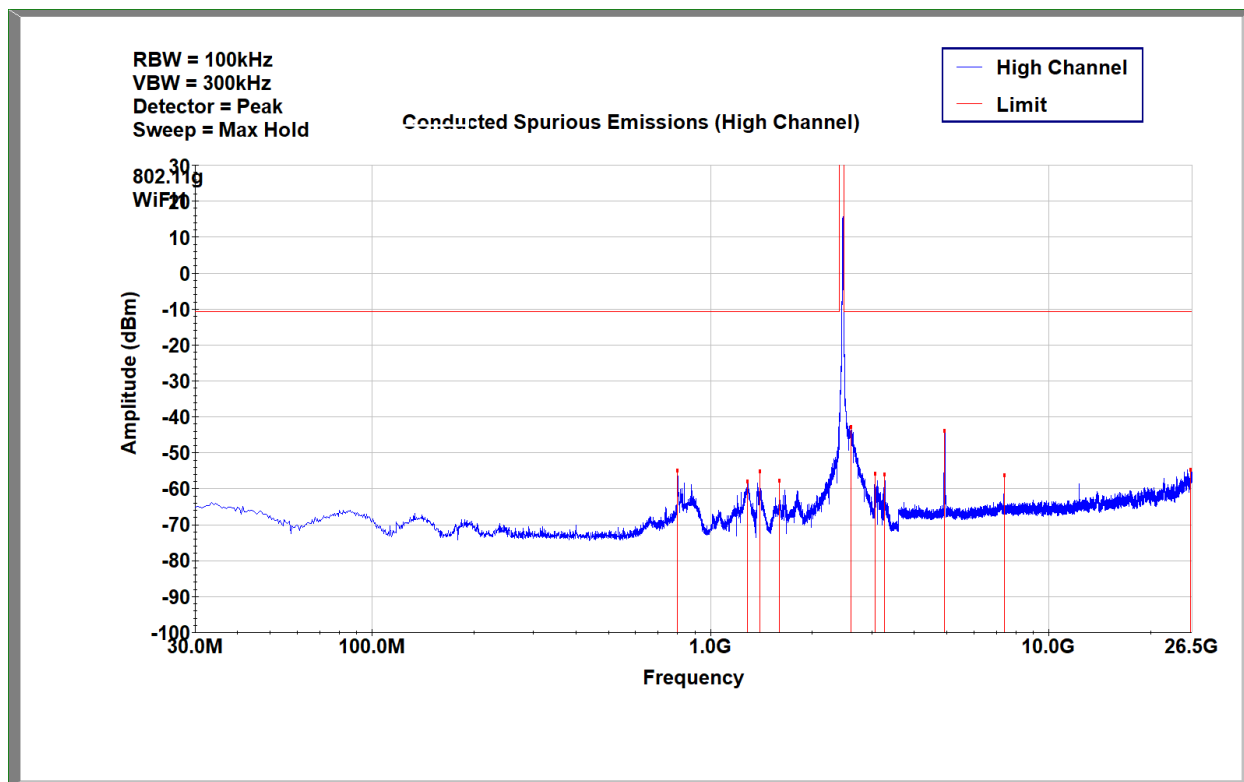


10.7.1.6 Conducted Spurious Emissions (802.11g 2437MHz Channel 6)

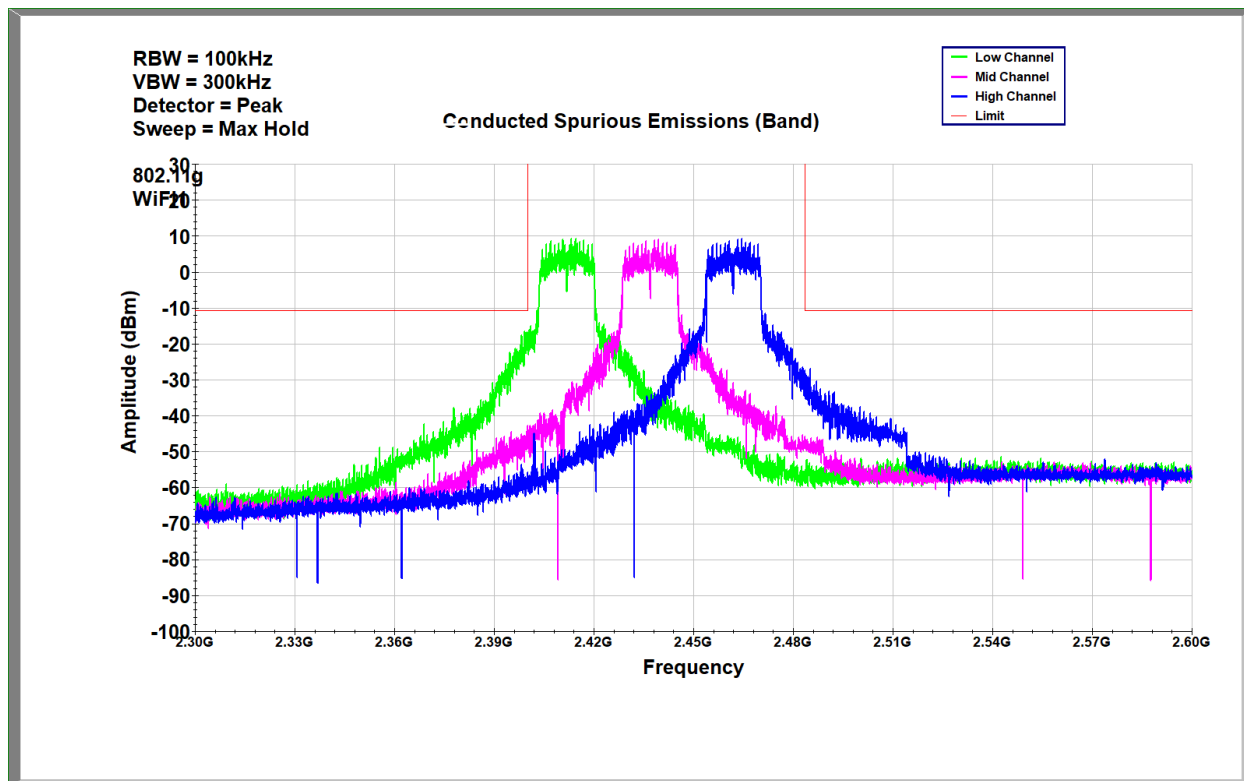


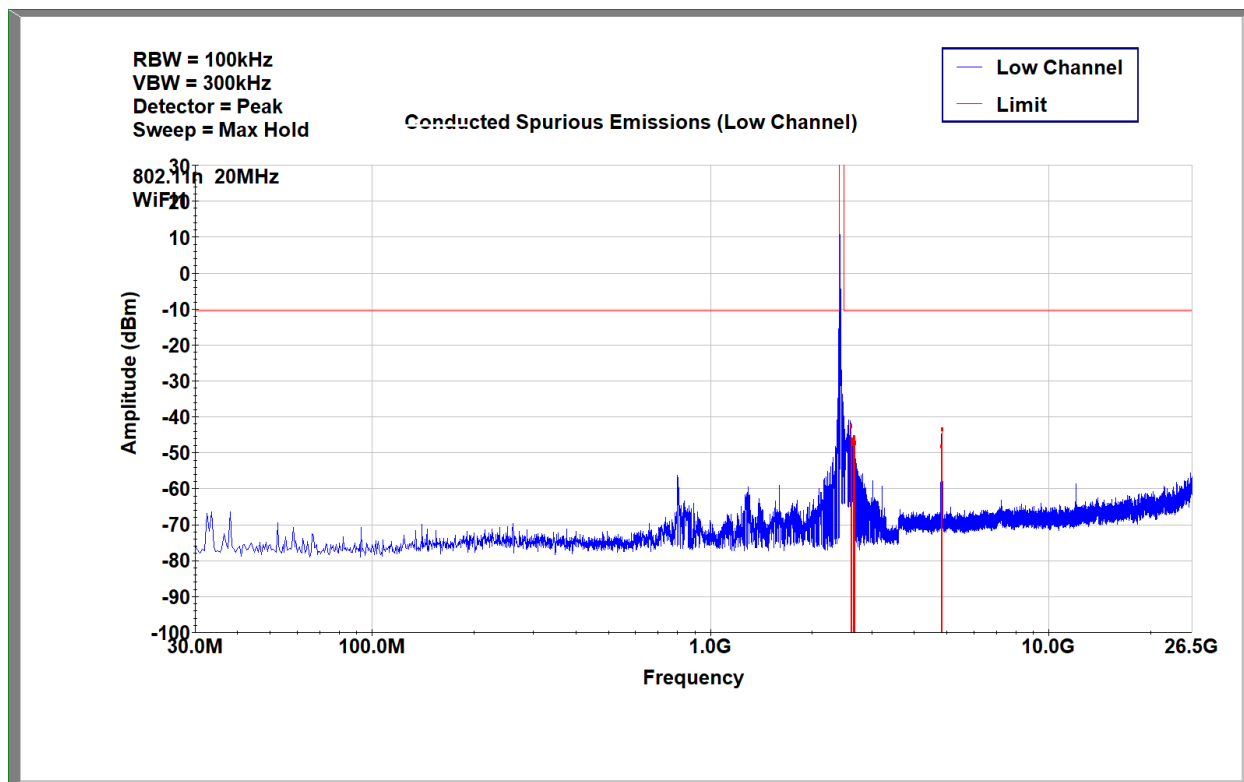
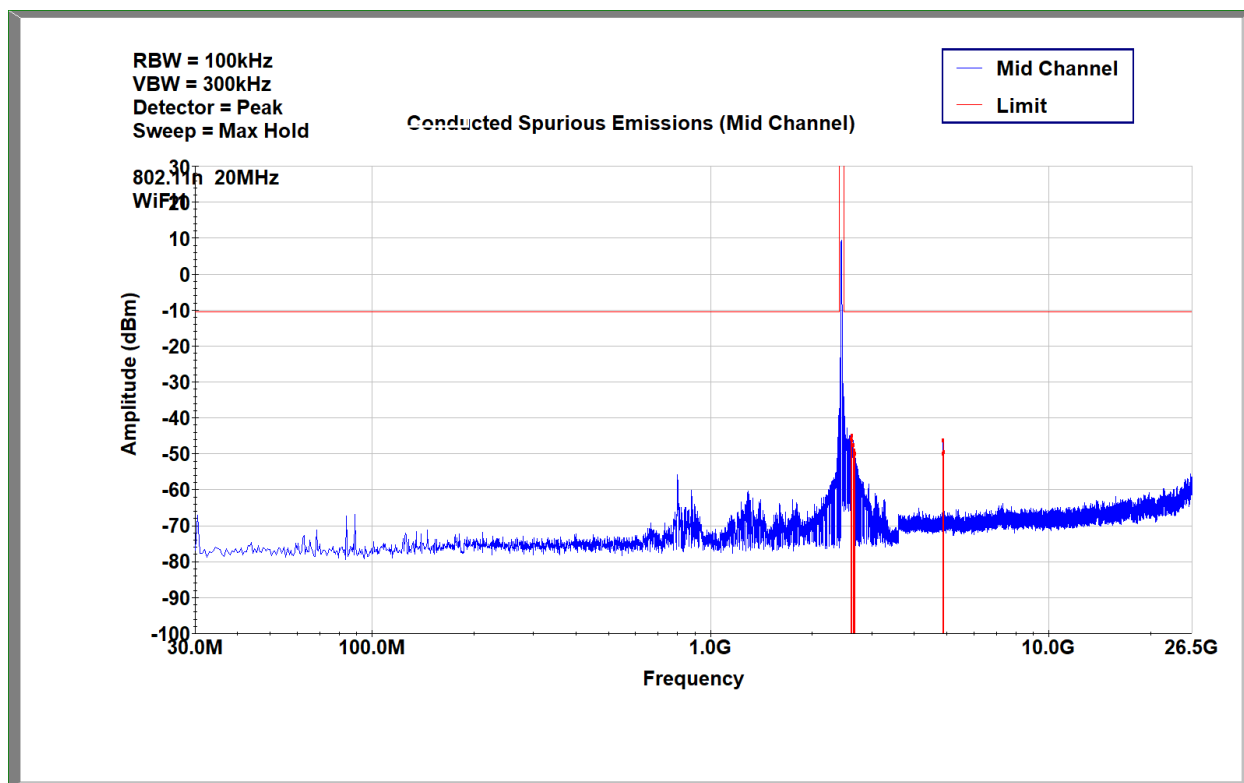


10.7.1.7 Conducted Spurious Emissions (802.11g 2462MHz Channel 11)



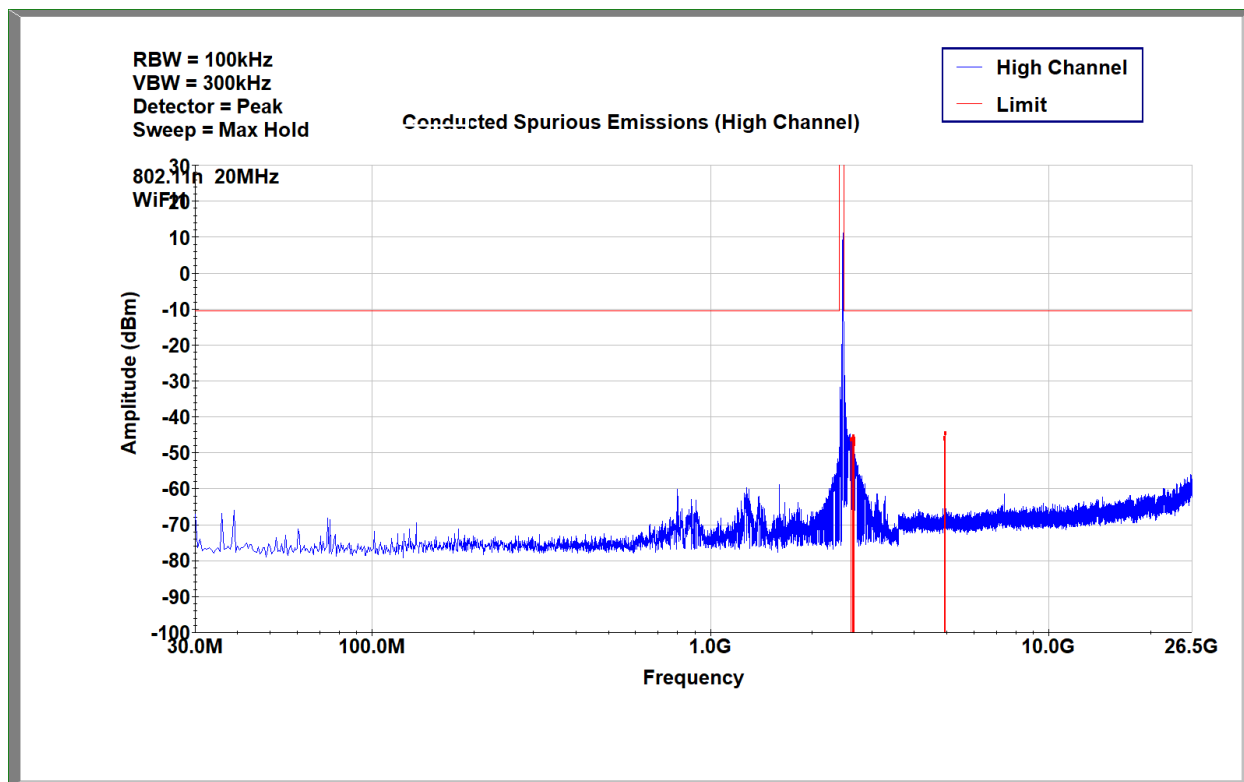
10.7.1.8 Conducted Band Edge (802.11g)



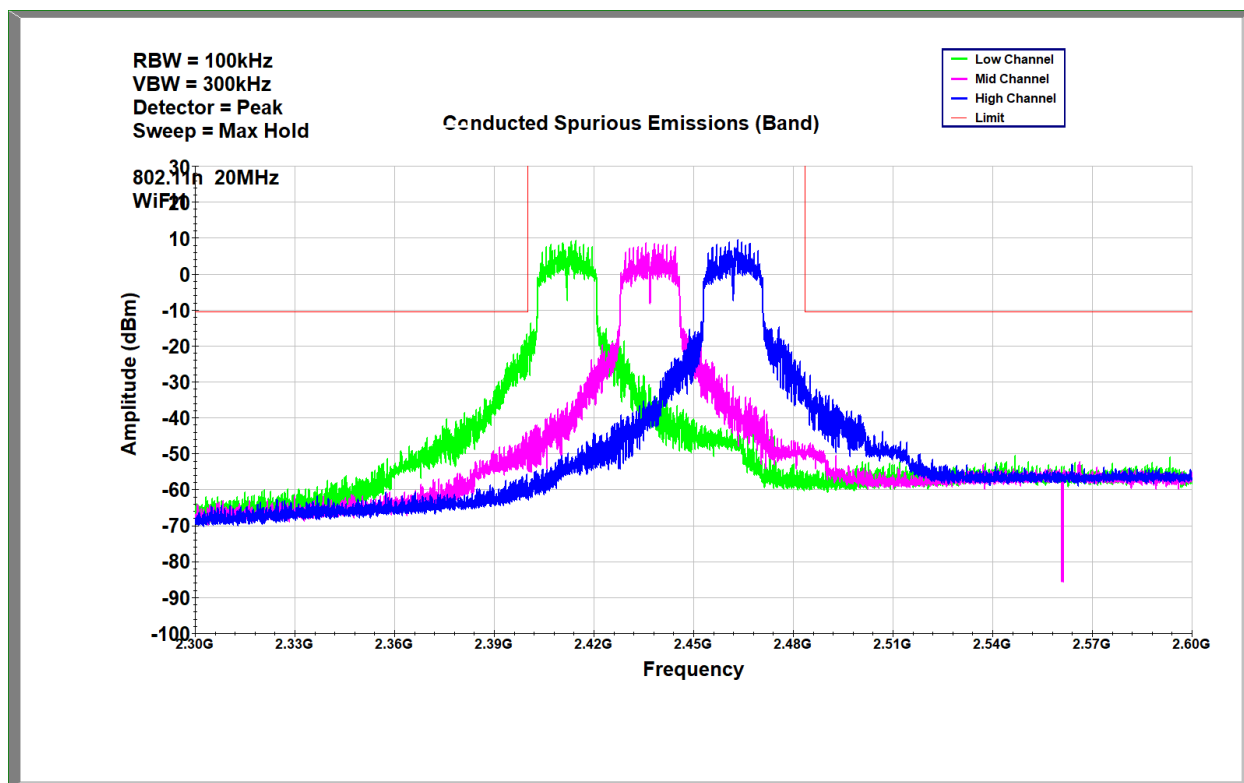
**10.7.1.9 Conducted Spurious Emissions (802.11n 20MHz 2412MHz Channel 1)****10.7.1.10 Conducted Spurious Emissions (802.11n 20MHz 2437MHz Channel 6)**



10.7.1.11 Conducted Spurious Emissions (802.11n 20MHz 2462MHz Channel 11)



10.7.1.12 Conducted Band Edge (802.11n)





11 Conducted Emissions

11.1 Method

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

TEST SITE: Ground Plane

Site Designation: Ground Plane

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	U _{CISPR}
Power 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.

11.2 Sample Calculations

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

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

Where NF = Net Reading in dB μ V

RF = Reading from receiver in dB μ V

LF = LISN or ISN Correction Factor in dB

CF = Cable Correction Factor in dB

AF = Attenuator Loss Factor in dB

To convert from dB μ V to μ V or mV the following was used:

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

NF = Net Reading in dB μ V

Example:

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

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

**11.3 Test Equipment Used:**

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde & Schwarz	ESU40	10/11/2021	10/11/2022
LISN	2508	Fischer Custom Communication	FCC-LISN-50-50-2M	6/22/2021	6/22/2022
Coaxial Cable	6026			1/13/2022	1/13/2023

11.4 Software Utilized:

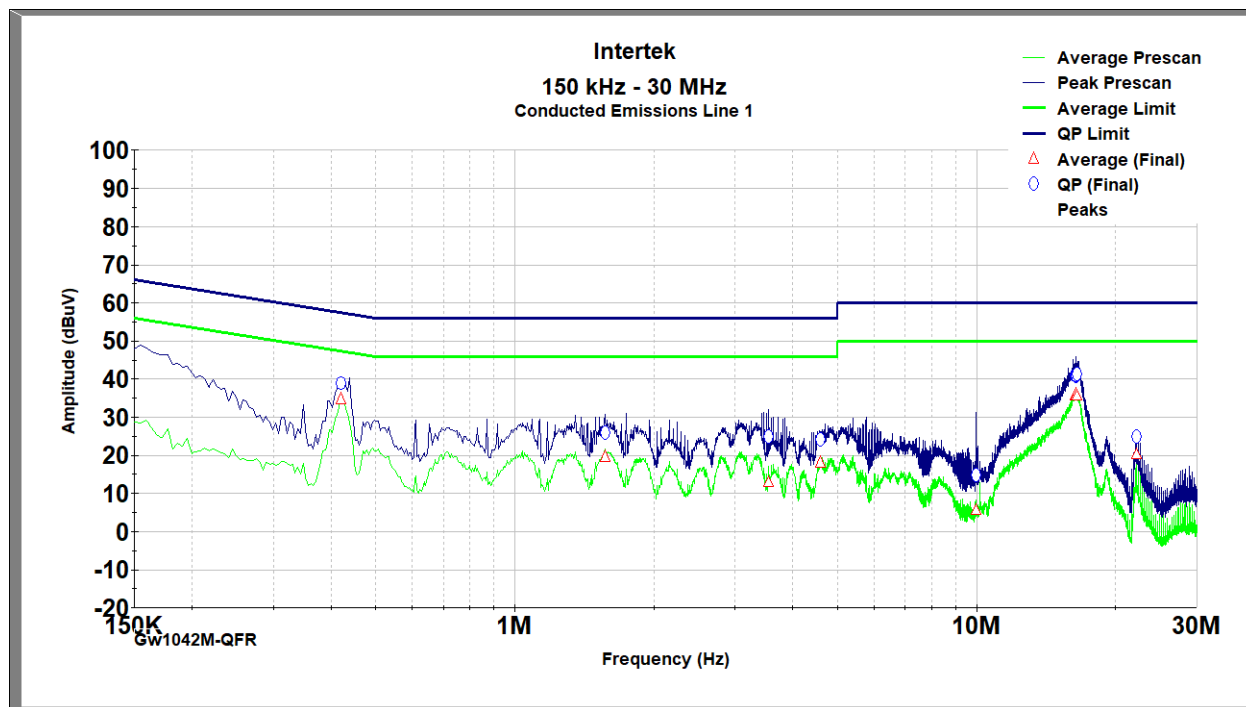
Name	Manufacturer	Version
TILE	ETS Lindgren	V7.0.6.545

11.5 Results:

The sample tested was found to Comply.



11.6 Plots/Data: Conducted Emissions (Line)



Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.420	38.930	58.286	19.355	34.672	48.286	13.614
1.567	25.851	56.000	30.149	19.612	46.000	26.388
3.549	24.822	56.000	31.178	13.091	46.000	32.909
4.588	24.148	56.000	31.852	18.022	46.000	27.978
9.992	14.855	60.000	45.145	5.808	50.000	44.192
16.371	41.176	60.000	18.824	35.835	50.000	14.165
16.384	40.822	60.000	19.178	35.880	50.000	14.120
16.412	40.964	60.000	19.036	36.098	50.000	13.902
16.456	41.328	60.000	18.672	35.910	50.000	14.090
22.143	24.793	60.000	35.207	20.434	50.000	29.566

Test Personnel: Ben Coolbear

Supervising/Reviewing Engineer: N/A

(Where Applicable) FCC Part 15B

Product Standard: ICES-003 Issue 7

Input Voltage: 120VAC / 60Hz

Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 4/30/2022

Limit Applied: Class B

Ambient Temperature: 23.7°C

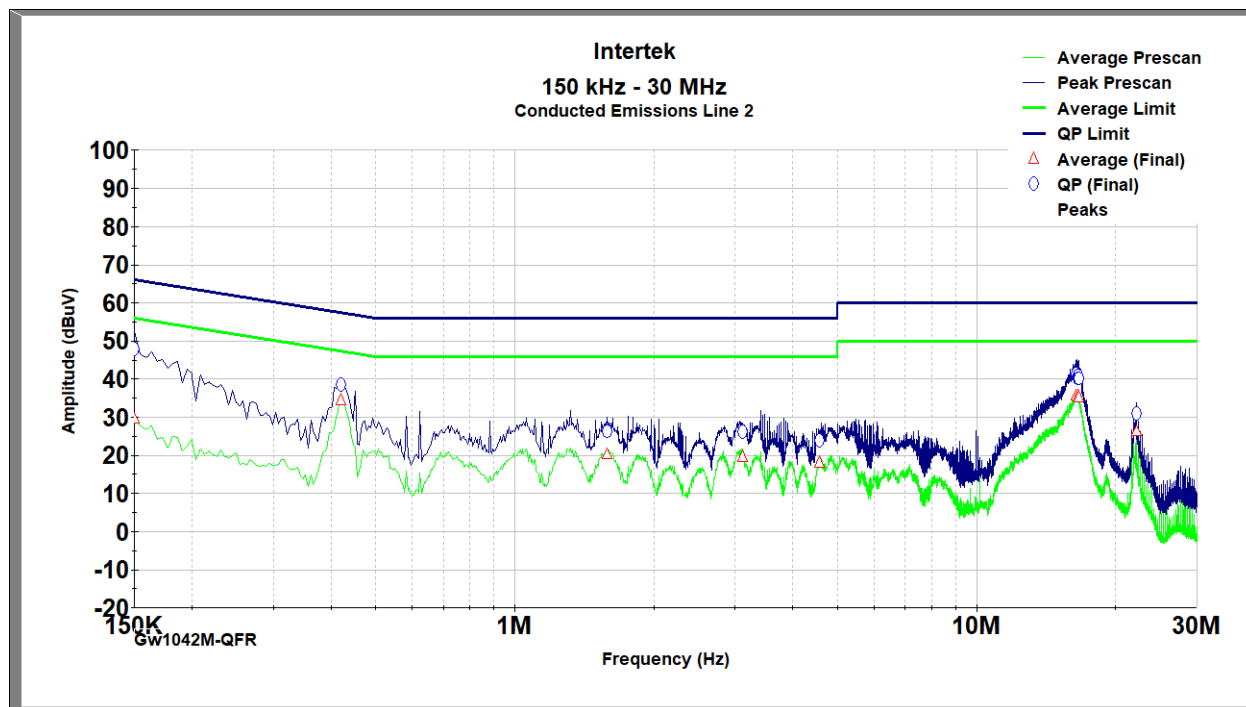
Relative Humidity: 38.1%

Atmospheric Pressure: 982.3 mbar

Deviations, Additions, or Exclusions: None



11.7 Plots/Data: Conducted Emissions (Neutral)



Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.150	47.918	66.000	18.082	29.636	56.000	26.364
0.420	38.440	58.286	19.845	34.558	48.286	13.727
1.585	26.396	56.000	29.604	20.296	46.000	25.704
3.115	26.099	56.000	29.901	19.621	46.000	26.379
4.575	23.949	56.000	32.051	18.211	46.000	27.789
16.421	41.249	60.000	18.751	35.776	50.000	14.224
16.551	40.965	60.000	19.035	35.600	50.000	14.400
16.596	40.372	60.000	19.628	35.486	50.000	14.514
16.614	40.388	60.000	19.612	35.230	50.000	14.770
22.143	30.885	60.000	29.115	26.530	50.000	23.470

Test Personnel: Ben Coolbear

Supervising/Reviewing Engineer: N/A

(Where Applicable) FCC Part 15B

Product Standard: ICES-003 Issue 7

Input Voltage: 120VAC / 60Hz

Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 4/30/2022

Limit Applied: Class B

Ambient Temperature: 23.7°C

Relative Humidity: 38.1%

Atmospheric Pressure: 982.3 mbar

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 5 § 6.8:

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

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

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

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

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

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

12.2 Test Results

The device was found to be **compliant**. The used a Wi-Fi antenna port with a unique coupling.



13 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	8/17/2022	104922051LEX-001	<i>BL</i>	<i>BL</i>	Original Issue
1	3/8/2023	104922051LEX0-01.1	<i>BL</i>	JTS	Updated with feedback from TCB Reviewer
2	4/10/2023	104922051LEX-001.2	<i>BL</i>	JTS	Updated with feedback from TCB Reviewer