HEADQUARTERS: 914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230 • PHONE (410) 354-3300 • FAX (410) 354-3313

January 27, 2023

HP Inc.
Tony Griffiths
1501 Paige Mill Road
Palo Alto, CA 94304

Dear Tony Griffiths,

Enclosed is the EMC Wireless test report for compliance testing of the P033 as tested to the requirements of FCC Part 15 C and RSS-247 Issue 2 for Intentional Radiators.

Thank you for using the services of Eurofins MET Labs. If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,
EUROFINS MET LABS

Nancy LaBrecque
Documentation Department

Reference: WIR118717-FCC247 RSS247 2.4GHz WiFi Rev 5

2.4GHz WiFi
Test Report

for the

P033

Tested under
FCC Part 15 C and RSS-247 Issue 2
For Intentional Radiators

Bryan Taylor, Wireless Team Lead
Electromagnetic Compatibility Lab

Nancy LaBrecque
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC Rules Part 15.247 under normal use and maintenance.

Matthew Hinojosa
EMC Manager, Austin Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	September 30, 2022	Initial Issue.
1	November 4, 2022	Change Customer's Name and Address
2	December 19, 2022	Corrections Requested by Customer
3	January 7, 2023	Technical Revisions After TCB Review
4	January 17, 2023	Added test channels and power setting table
5	January 27, 2023	Corrected typos in the spectral density table

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List of Terms and Abbreviations

AC	**A**lternating **C**urrent
ACF	**A**ntenna **C**orrection **F**actor
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci**b**els
dBµA	**D**eci**b**els above one **micro**amp
dBµV	**D**eci**b**els above one **micro**volt
dBµA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBµV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**ert**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**ert**z**
kPa	**k**ilo**pa**scal
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µH	**microh**enry
µ	**microf**arad
µs	**micros**econds
NEBS	**N**etwork **E**quipment-**B**uilding **S**ystem
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
TWT	**T**raveling **W**ave **T**ube
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane

I. Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the P033, with the requirements of FCC Part 15 C and RSS-247 Issue 2. HP, Inc. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the P033, has been **permanently** discontinued.

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15 C and RSS-247 Issue 2, in accordance with HP, Inc. purchase order number 10000013761. All tests were conducted using measurement procedures ANSI C63.4-2014 and ANSI C63.10-2013.

FCC Reference 47 CFR Part 15.247:2005	IC Reference RSS-247 Issue 2: 2017; RSS-GEN Issue 5: 2018	Description	Compliance
Title 47 of the CFR, Part 15 §15.203	---	Antenna Requirement	Compliant
Title 47 of the CFR, Part 15 §15.207(a)	RSS-GEN(8.8)	Conducted Emission Limits	Compliant
Title 47 of the CFR, Part 15 §15.247(a)(2)	RSS-247 (5.2)	6dB Occupied Bandwidth	Compliant
---	RSS-GEN(6.7)	99% Occupied Bandwidth	Compliant
Title 47 of the CFR, Part 15 §15.247(b)	RSS-247(5.4)	Peak Power Output	Compliant
Title 47 of the CFR, Part 15 §15.247(d); §15.209; §15.205	RSS-GEN (6.13), (8.9), & (8.10)	Radiated Spurious Emissions Requirements	Compliant
Title 47 of the CFR, Part 15 §15.247(d)	RSS-247(5.5)	RF Conducted Spurious Emissions Requirements	Compliant
Title 47 of the CFR, Part 15; §15.247(e)	RSS-247(5.2)	Peak Power Spectral Density	Compliant

Table 1. Executive Summary

II. Equipment Configuration

A. Overview

Eurofins MET Labs was contracted by HP, Inc. to perform testing on the P033, under HP, Inc.'s purchase order number 10000013761.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the P033.

The results obtained relate only to the item(s) tested.

Model(s) Tested:	P033	
Model(s) Covered:	P033	
EUT Specifications:	Primary Power: 120VAC	
	Type of Modulations:	802.11b, 802.11g, 802.11n (20MHz Channels), 802.11 (40MHz Channels)
	Equipment Code:	DTS
	Peak RF Output Power:	15.17dBm
	EUT Frequency Ranges:	2412-2462 MHz
	Antenna Gain (declared by HP, Inc.)	4.07dBi (Antenna Path 1) 4.09dBi (Antenna Path 2) Directional Gain = $10\log[(10^{4.07/20} + 10^{4.09/20})^2 / 2] = 7.08$dBi Note: the array gain was calculated per KDB 662911 D01 Section F.2.d.(i) for correlated signals with unequal antenna gains.
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature: 15-35º C	
	Relative Humidity: 30-60%	
	Barometric Pressure: 860-1060 mbar	
Evaluated by:	Bryan Taylor	
Report Date(s):	4/20/2022 through 5/27/2022	

Table 2. EUT Summary Table

B. References

CFR 47, Part 15, Subpart C	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: General Rules and Regulations, Allocation, Assignment, and Use of Radio Frequencies
RSS-247, Issue 2, February 2017	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
RSS-GEN, Issue 5, March 2019	General Requirements and Information for the Certification of Radio Apparatus
ANSI C63.4:2014	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ISO/IEC 17025:2017	General Requirements for the Competence of Testing and Calibration Laboratories
ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

Table 3. References

C. Test Site

All testing was performed at Eurofins MET Labs, 13501 McCallen Pass, Austin, TX 78753. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a 10 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

D. Measurement Uncertainty

Test Method	Typical Expanded Uncertainty	K	Confidence Level
RF Frequencies	±4.52 Hz	2	95%
RF Power Conducted Emissions	±2.97 dB	2	95%
RF Power Radiated Emissions	±2.95 dB	2	95%

Table 4. Uncertainty Calculations Summary

E. Description of Test Sample

The HP, Inc. P033 (marketed as Studio X52), is a video conferencing video bar designed to act as an audio / video endpoint codec over LAN networks. The device is powered by a AC/DC mains adapter and contains 2.4GHz / 5Ghz Wifi and Bluetooth radio interfaces.

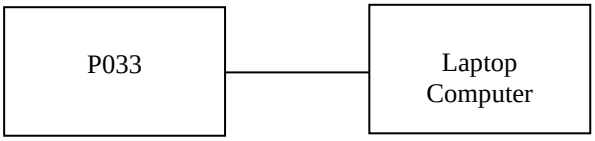


Figure 1. Block Diagram of Test Configuration

F. Equipment Configuration

The EUT was set up as outlined in Figure 1, Block Diagram of Test Setup. The laptop computer was used to send test commands to force the transmitters to operate in the appropriate test mode.

Ref. ID	Name / Description	Model Number	Part Number	Serial Number	Revision
1	P033	P033	N/A	Test Sample 1	N/A

Table 5. Equipment Configuration

G. Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

Ref. ID	Name / Description	Manufacturer	Model Number	Customer Supplied Calibration Data
1	Laptop Computer	Dell	HW_Lab	--

Table 6. Support Equipment

H. Ports and Cabling Information

Ref. Id	Port Name on EUT	Qty	Length as tested (m)	Shielded? (Y/N)	Termination Box ID & Port Name
5	DC Power	1	2m	No	AC/DC adaptor
9	USB C	1	10m	No	Laptop Computer

Table 7. Ports and Cabling Information

I. Mode of Operation

The support laptop provided a direct means of controlling transmitter parameters. Unless otherwise stated or shown, all tests were performed at worst-case modulation and data rates on the following channels.

Transmit Band	Operating Mode	Worst Case Transmission Bandwidth	Channel Numbers Tested	Channel Frequencies Tested	Test Tool Power Setting
2400 – 2483.5MHz	802.11b	20MHz	1 / 6 / 11	2412MHz / 2437MHz / 2462MHz	12.0dBm
	802.11g	20MHz	1 / 6 / 11	2412MHz / 2437MHz / 2462MHz	10.5dBm
	802.11n	20MHz	1 / 6 / 11	2412MHz / 2437MHz / 2462MHz	10.5dBm
	802.11n (40)	40MHz	3 / 6 / 9	2422MHz / 2437MHz / 2452MHz	10.5dBm

Table 8. Test Channels Utilized

J. Method of Monitoring EUT Operation

A spectrum analyzer was used to confirm proper transmitter operation.

K. Modifications

a) Modifications to EUT

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

L. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to HP, Inc. upon completion of testing.

III. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 Antenna Requirement

Test Requirement: **§ 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.

The structure and application of the EUT were analyzed to determine compliance with Section 15.203 of the Rules. Section 15.203 states that the subject device must meet at least one of the following criteria:

a.) Antenna must be permanently attached to the unit.

b.) Antenna must use a unique type of connector to attach to the EUT.

c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

Results: The EUT as tested is compliant the criteria of §15.203. The TX antenna is not accessible by the end user.

Test Engineer(s): Bryan Taylor

Test Date(s): 5/3/2022

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.207(a) Conducted Emissions Limits

Test Requirement(s): **§ 15.207 (a):** For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency range (MHz)	§ 15.207(a), Conducted Limit (dBμV)	
	Quasi-Peak	Average
0.15-0.5	66 - 56	56 - 46
0.5-5	56	46
5-30	60	50

Table 9. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

Test Procedure: The EUT was placed on a 0.8 m-high wooden table. The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a 50 Ω/50 μH Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.4-2014 "Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz"*. The measurements were performed using a 50 Ω/50 μH LISN as the input transducer to an EMI receiver. For the purpose of this testing, the transmitter was turned on.

Test Results: The EUT was compliant with this requirement.

Test Engineer(s): James Seib

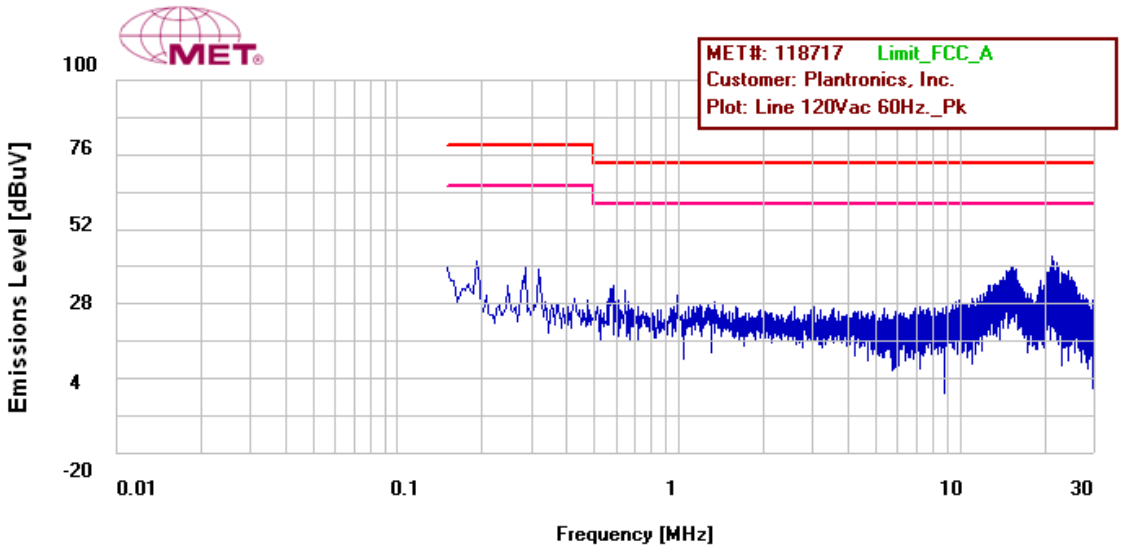
Test Date(s): 4/20/2022

15.207(a) Conducted Emissions Test Results

Measurement Location	Measurement	Limit	Result
Bonding measurement from LISN ground to ground plane	2.095 mΩ	< 2.5 mΩ	Pass

Line	Freq (MHz)	QP Amplitude (dBµV)	QP Limit (dBµV)	Margin (dB)	Result	Average Amplitude (dBµV)	Average Limit (dBµV)	Margin (dB)	Result
Line 120 VAC/60 Hz.	21.234	42.40	73.00	-30.60	Pass	38.90	60.00	-21.10	Pass
Line 120 VAC/60 Hz.	0.190	42.40	79.00	-36.60	Pass	28.50	66.00	-37.50	Pass
Line 120 VAC/60 Hz.	15.578	36.90	73.00	-36.10	Pass	31.50	60.00	-28.50	Pass
Line 120 VAC/60 Hz.	0.150	48.50	79.00	-30.50	Pass	32.50	66.00	-33.50	Pass
Line 120 VAC/60 Hz.	0.286	33.40	79.00	-45.60	Pass	21.70	66.00	-44.30	Pass
Line 120 VAC/60 Hz.	0.318	32.00	79.00	-47.00	Pass	22.00	66.00	-44.00	Pass

Table 10. Conducted Emissions, 15.207(a), Phase Line, Test Results



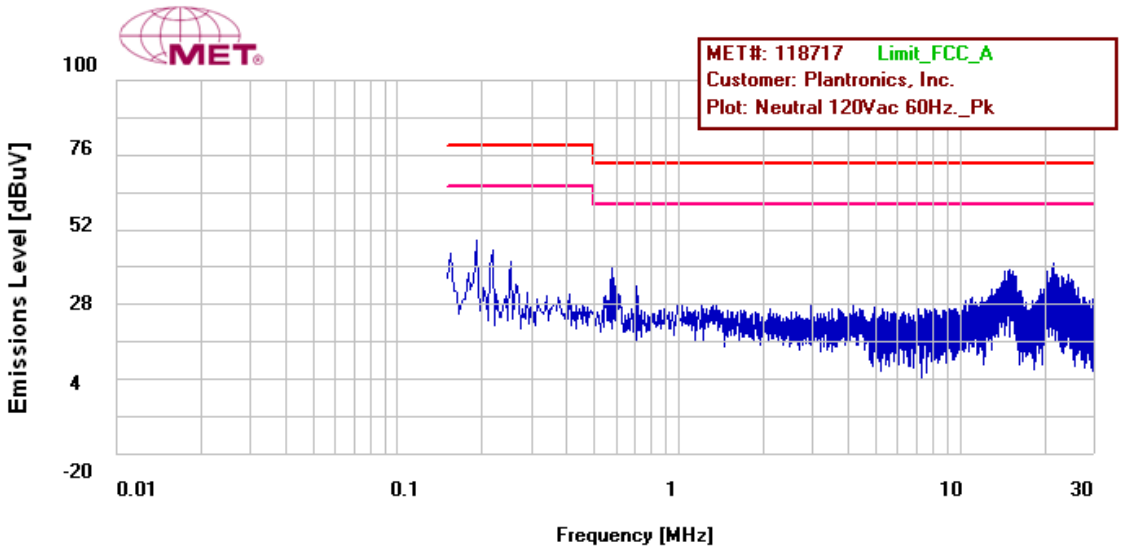
Conducted Emissions, 15.207(a), Phase Line

15.207(a) Conducted Emissions Test Results

Measurement Location	Measurement	Limit	Result
Bonding measurement from LISN ground to ground plane	2.095 mΩ	< 2.5 mΩ	Pass

Line	Freq (MHz)	QP Amplitude (dBµV)	QP Limit (dBµV)	Margin (dB)	Result	Average Amplitude (dBµV)	Average Limit (dBµV)	Margin (dB)	Result
Neutral 120 VAC/60 Hz.	0.190	43.20	79.00	-35.80	Pass	29.20	66.00	-36.80	Pass
Neutral 120 VAC/60 Hz.	0.218	39.50	79.00	-39.50	Pass	25.90	66.00	-40.10	Pass
Neutral 120 VAC/60 Hz.	0.154	48.40	79.00	-30.60	Pass	32.00	66.00	-34.00	Pass
Neutral 120 VAC/60 Hz.	0.254	36.00	79.00	-43.00	Pass	23.00	66.00	-43.00	Pass
Neutral 120 VAC/60 Hz.	21.482	41.70	73.00	-31.30	Pass	38.20	60.00	-21.80	Pass
Neutral 120 VAC/60 Hz.	0.582	37.50	73.00	-35.50	Pass	30.20	60.00	-29.80	Pass

Table 11. Conducted Emissions, 15.207(a), Neutral Line, Test Results



Conducted Emissions, 15.207(a), Neutral Line

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(a)(2) 6 dB Bandwidth

Test Requirements: **§ 15.247(a)(2):** Operation under the provisions of this section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

For systems using digital modulation techniques, the EUT may operate in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

Test Procedure: The transmitter was on and transmitting at the highest output power. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately 1% of the total emission bandwidth, and the VBW > RBW. The 6 dB Bandwidth was measured and recorded. The measurements were performed on the low, mid and high channels.

Test Results The EUT was compliant with § 15.247 (a)(2).

The 6 dB Bandwidth was determined from the plots on the following pages.

Test Engineer(s): Bryan Taylor

Test Date(s): 5/3/2022

Electromagnetic Compatibility Criteria for Intentional Radiators

RSS-GEN (6.7) 99% Bandwidth

Test Requirements: The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency rang between two points, one above and the other blow the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

Test Procedure: The transmitter was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately equal to 1% of the total emission bandwidth, and the VBW > RBW. The 99% Bandwidth was measured and recorded.

Test Results The 99% Bandwidth determined from the plots on the following pages.

Test Engineer(s): Bryan Taylor

Test Date(s): 5/2/2022

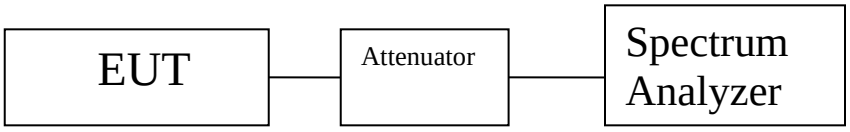
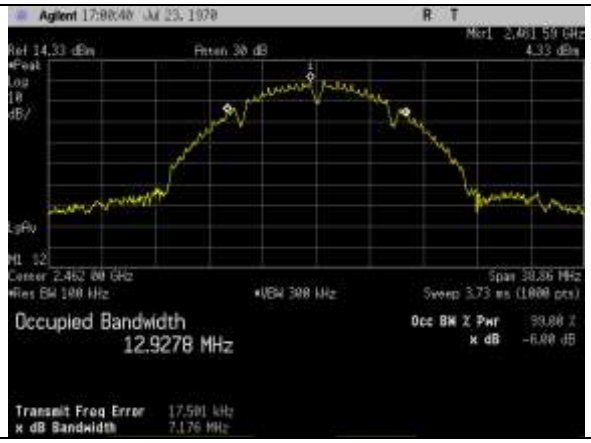
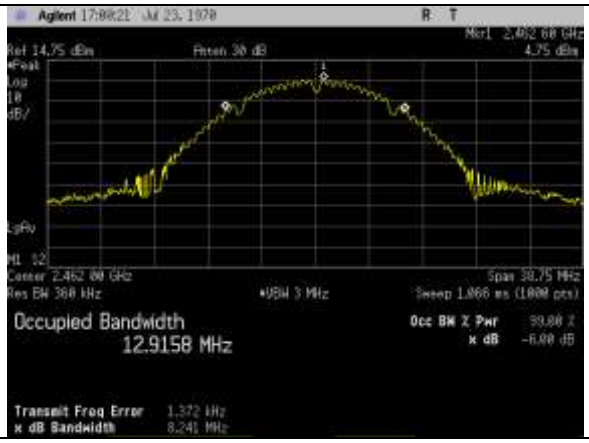


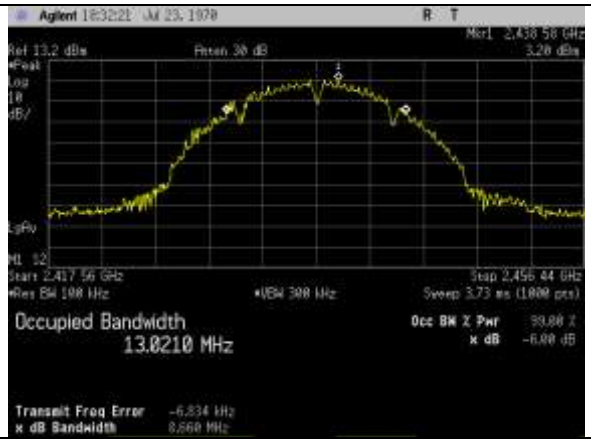
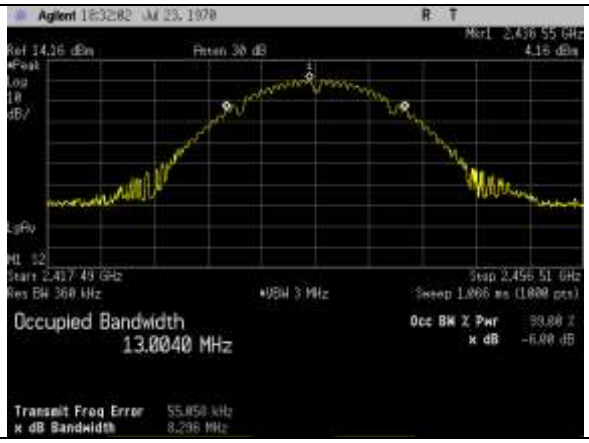
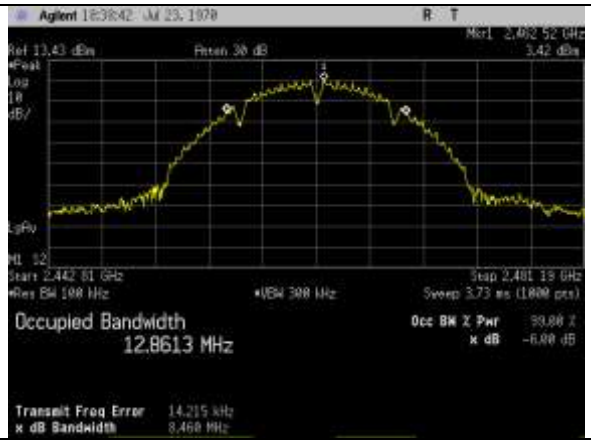
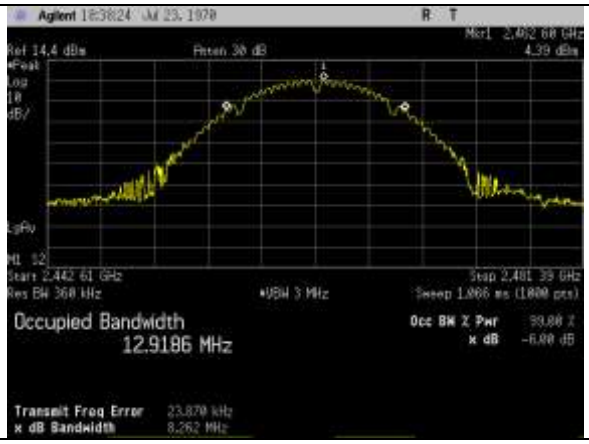
Figure 2. Block Diagram, Occupied Bandwidth Test Setup

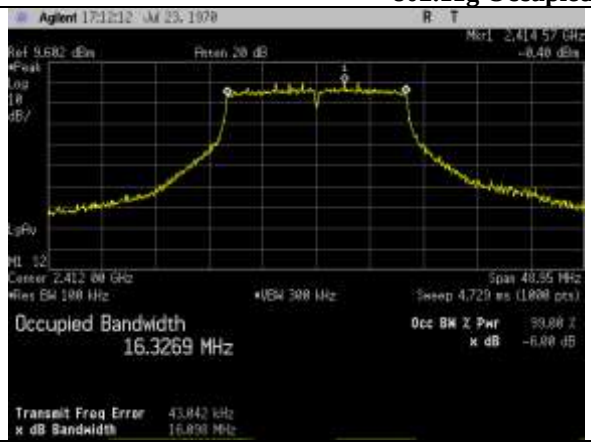
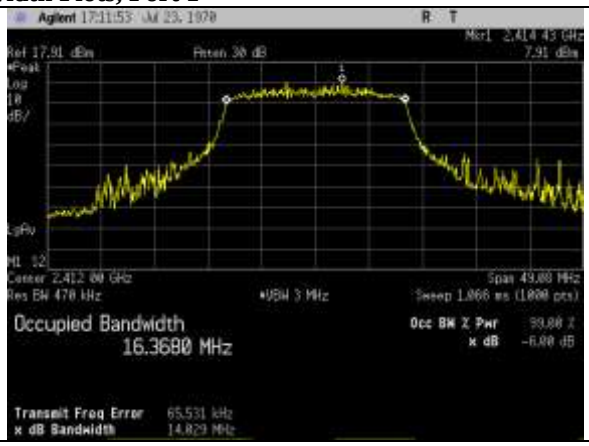
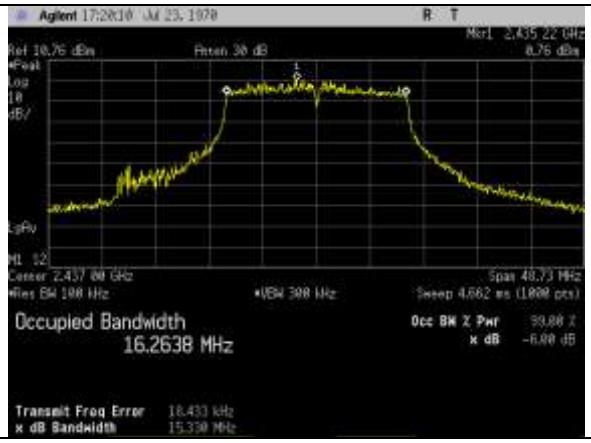
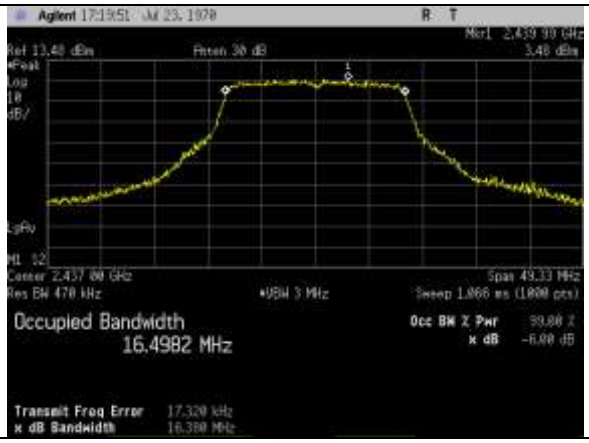
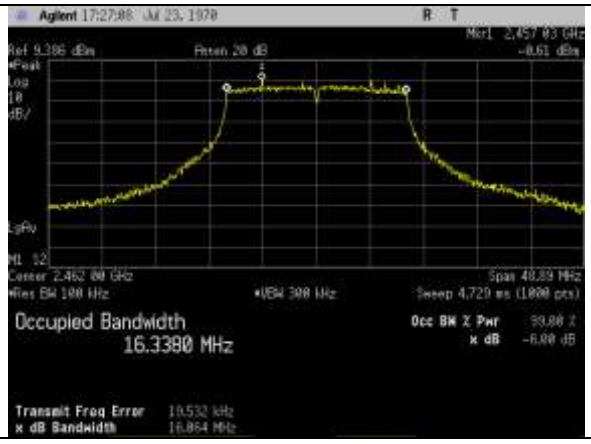
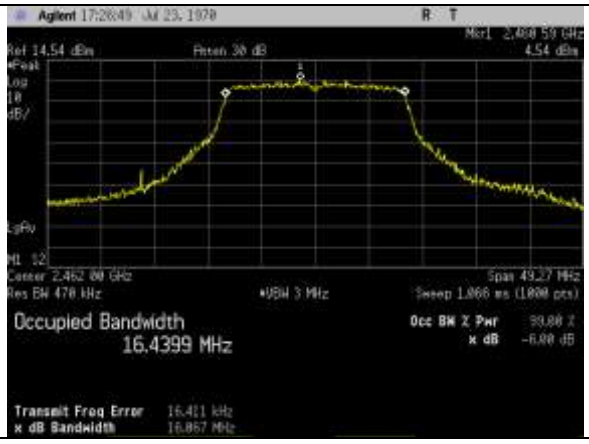
Channel and Mode	Port 1 (-6dB)	Port 1 (99%)	Port 2 (-6dB)	Port 2 (99%)
WIFI_Low Ch_2412MHz_20MHz BW_b-mode	7.152	13.017	7.141	12.920
WIFI_Mid Ch_2437MHz_20MHz BW_b-mode	8.153	13.038	8.660	13.004
WIFI_High Ch_2462MHz_20MHz BW_b-mode	7.176	12.916	8.460	12.919
WIFI_Low Ch_2412MHz_20MHz BW_g-mode	16.098	16.368	14.222	16.480
WIFI_Mid Ch_2437MHz_20MHz BW_g-mode	15.330	16.498	16.381	16.489
WIFI_High Ch_2462MHz_20MHz BW_g-mode	16.064	16.440	13.618	16.465
WIFI_Low Ch_2412MHz_20MHz BW_n-mode	16.477	17.630	14.992	17.630
WIFI_Mid Ch_2437MHz_20MHz BW_n-mode	15.330	17.699	17.445	17.581
WIFI_High Ch_2462MHz_20MHz BW_n-mode	16.509	17.569	17.042	17.547
WIFI_Low Ch_2422MHz_40MHz BW_n-mode	35.310	35.979	34.646	36.046
WIFI_Mid Ch_2437MHz_40MHz BW_n-mode	36.540	35.208	12.614	35.282
WIFI_High Ch_2452MHz_40MHz BW_n-mode	35.155	35.138	12.013	36.080

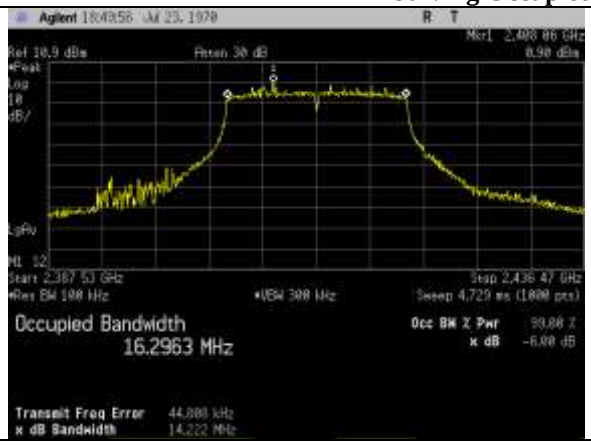
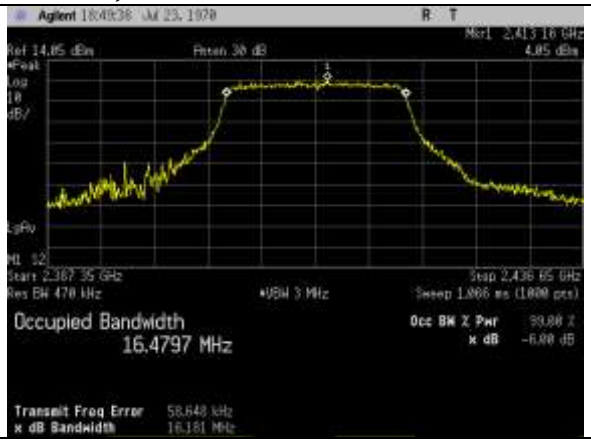
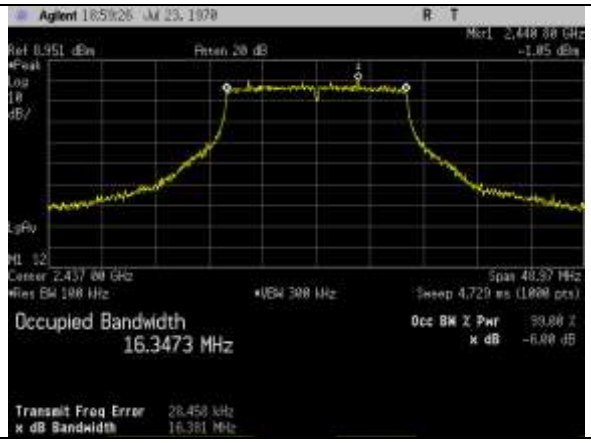
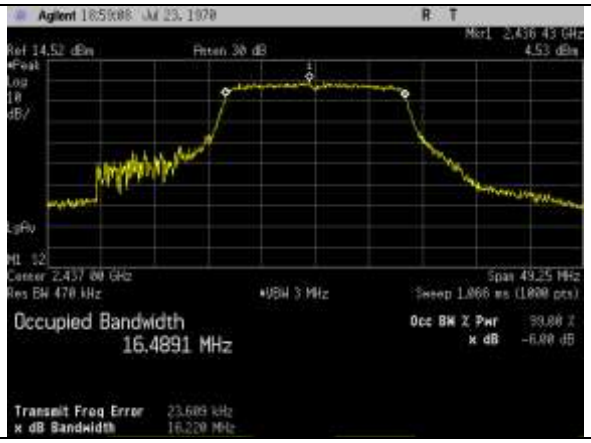
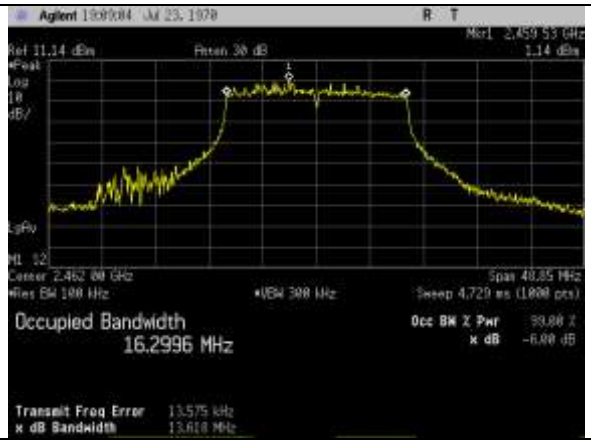
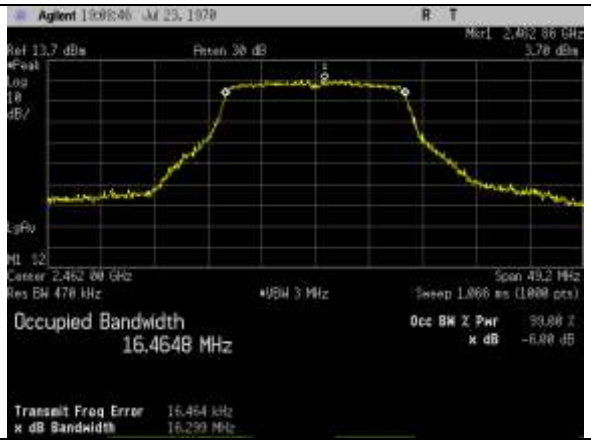
Table 12. 99% and 6 dB Occupied Bandwidth, Test Results

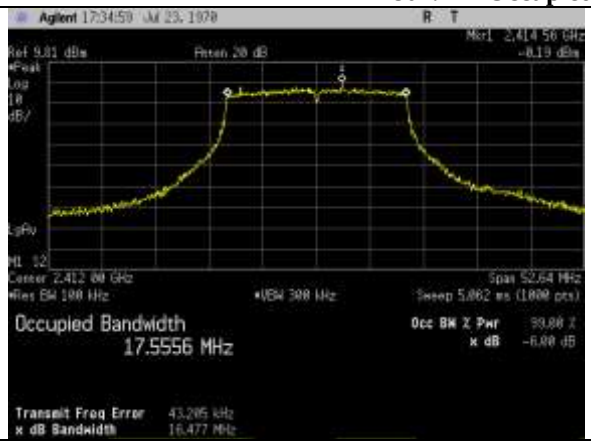
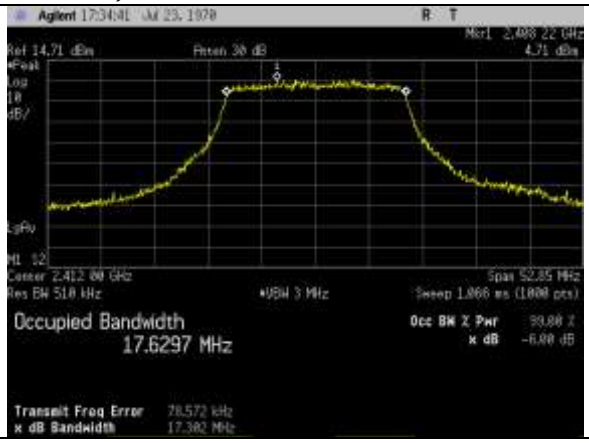
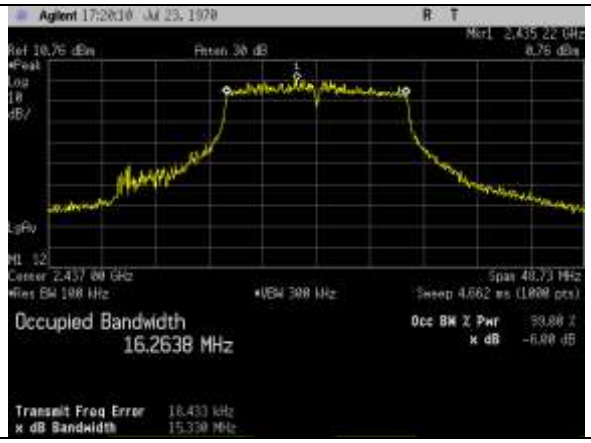
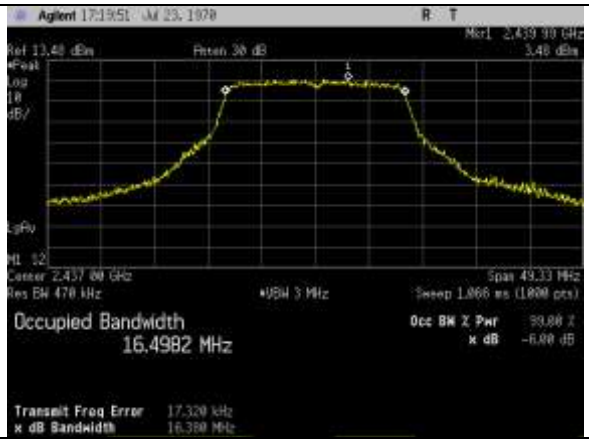
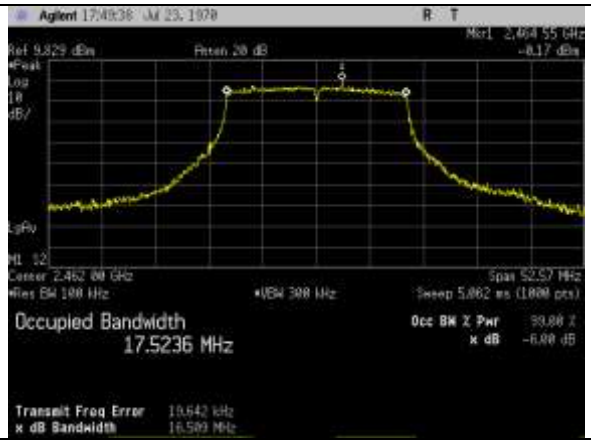
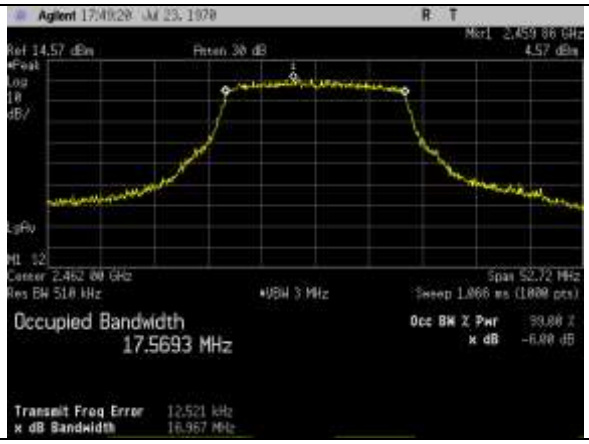
Occupied Bandwidth Test Results

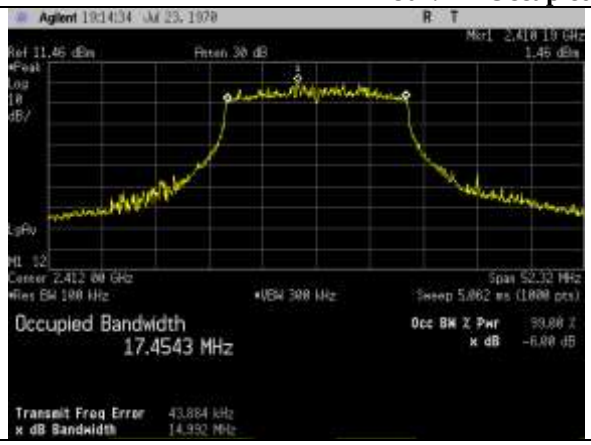
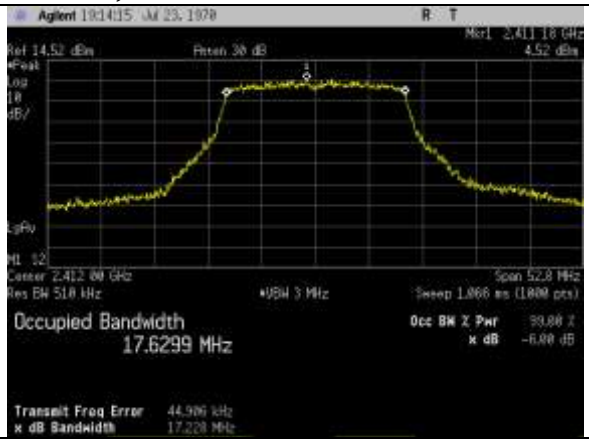
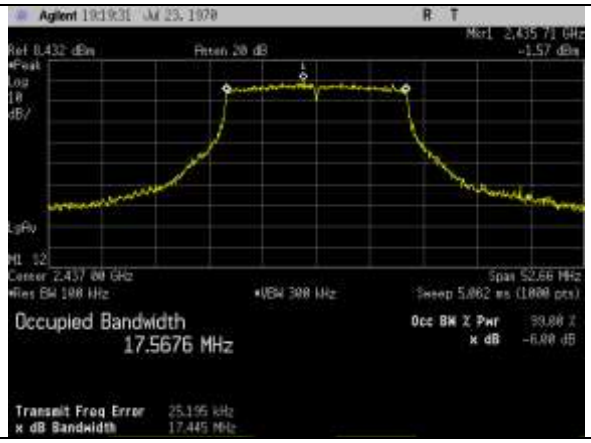
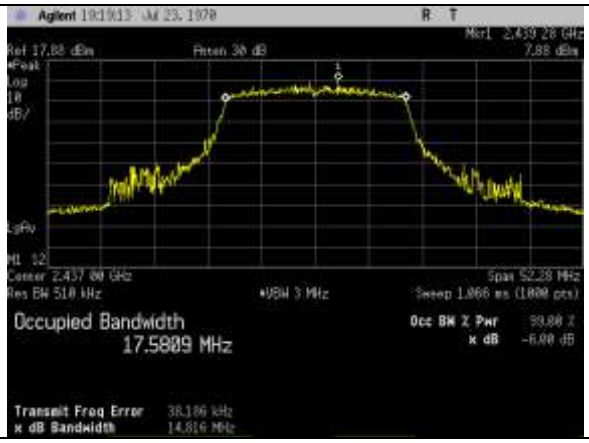
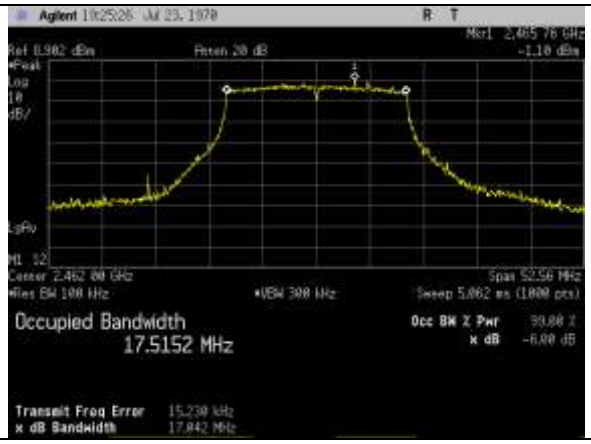
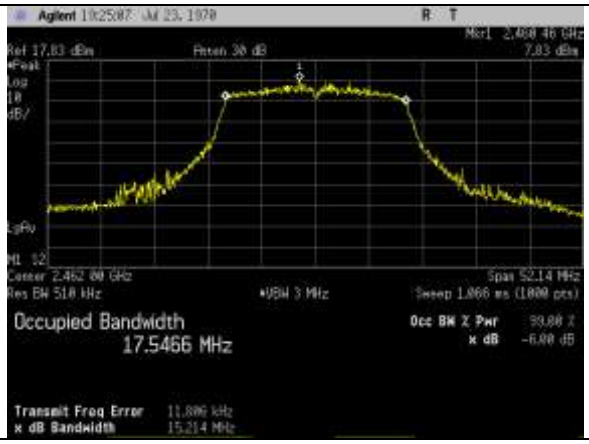
802.11b Occupied Bandwidth Plots, Port 1	
	
2412MHz 6dB Bandwidth	2412MHz 99% Bandwidth
	
2437MHz 6dB Bandwidth	2437MHz 99% Bandwidth
	
2462MHz 6dB Bandwidth	2462MHz 99% Bandwidth

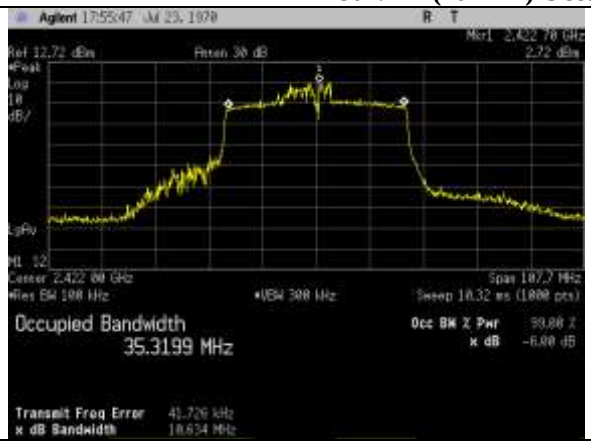
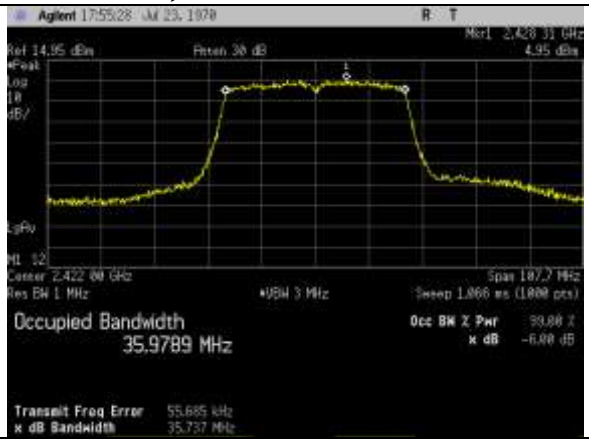
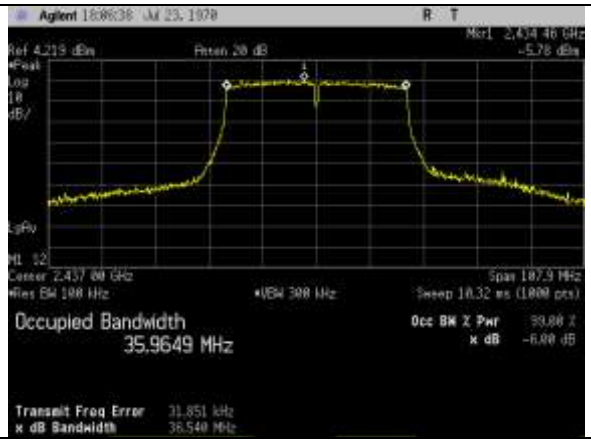
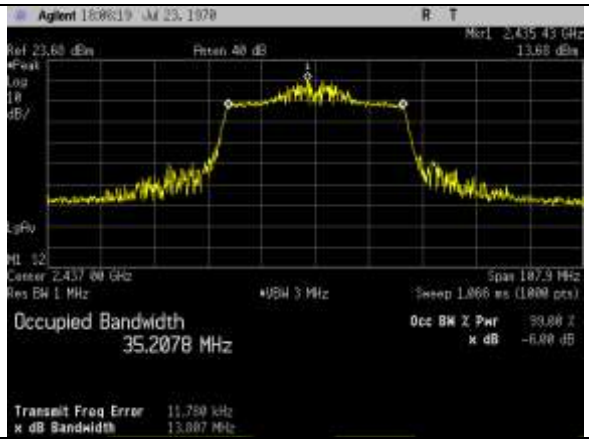
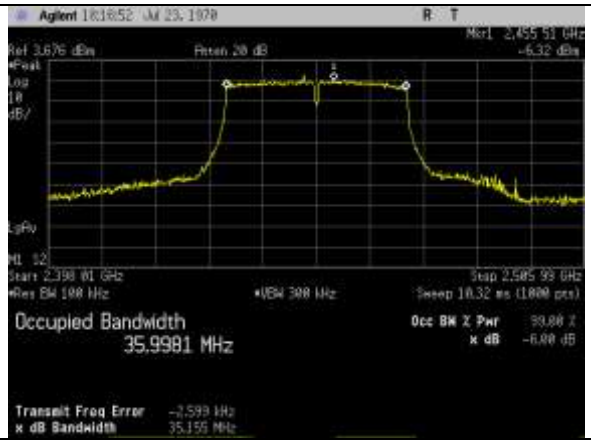
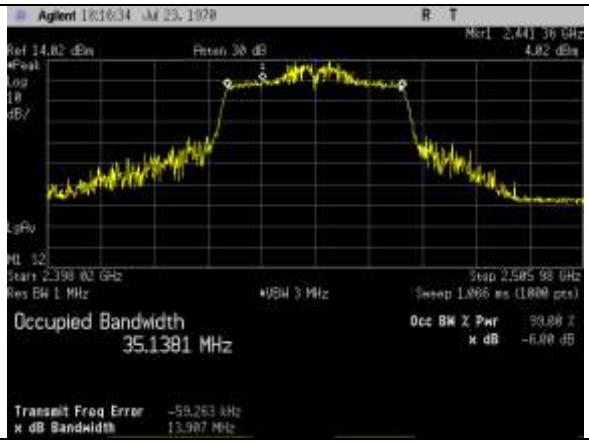
802.11b Occupied Bandwidth Plots, Port 2	
	
2412MHz 6dB Bandwidth	2412MHz 99% Bandwidth
	
2437MHz 6dB Bandwidth	2437MHz 99% Bandwidth
	
2462MHz 6dB Bandwidth	2462MHz 99% Bandwidth

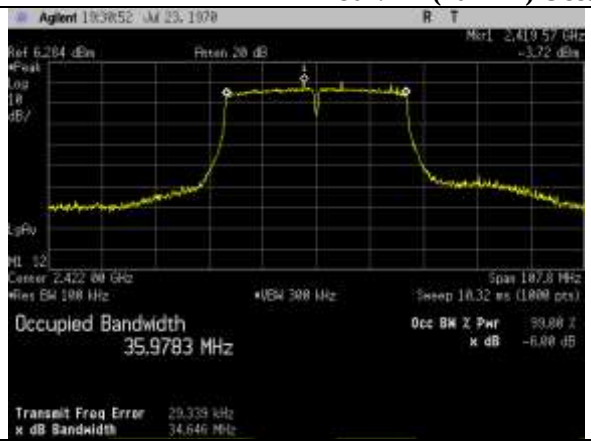
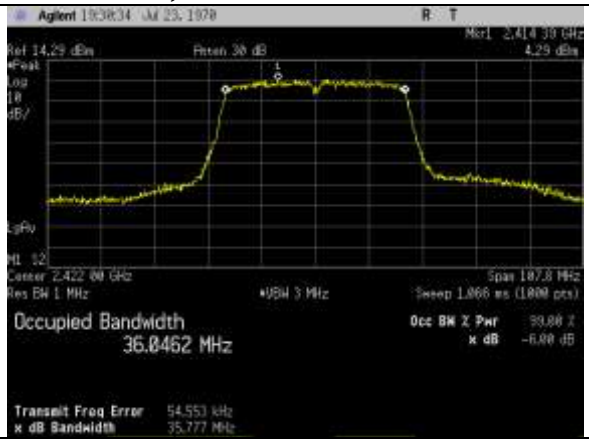
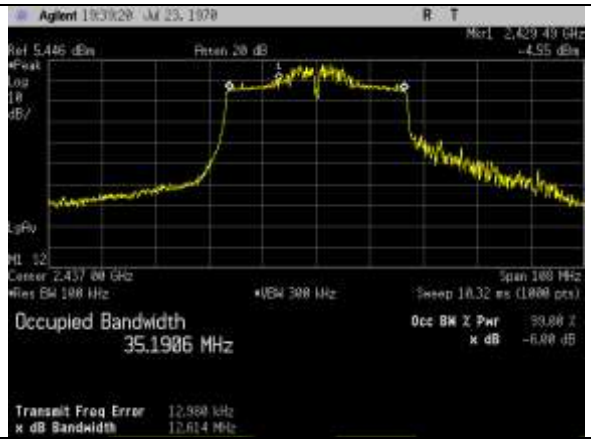
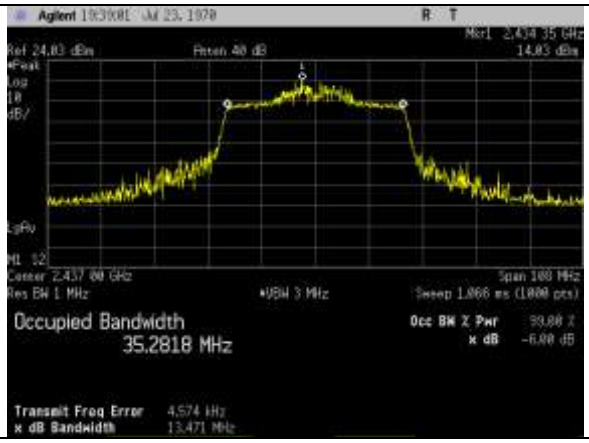
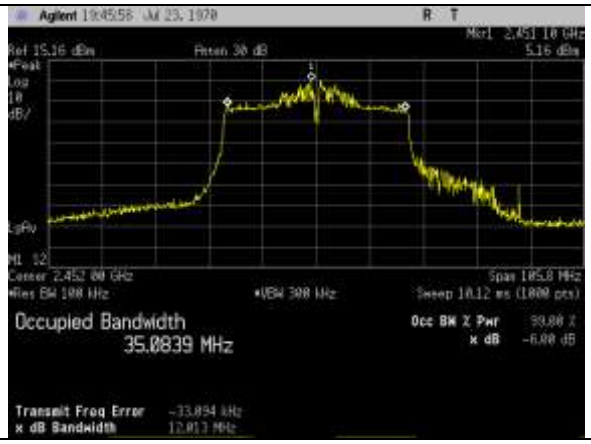
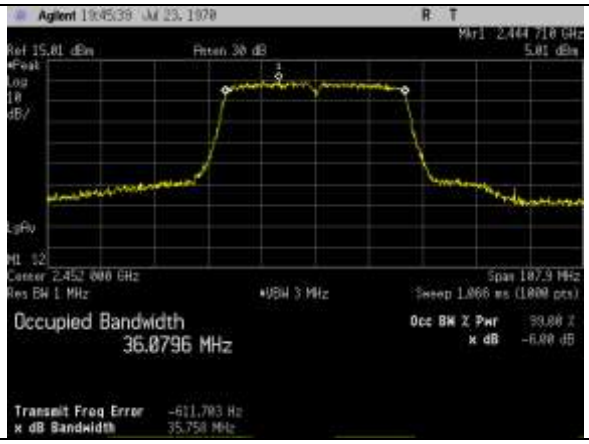
802.11g Occupied Bandwidth Plots, Port 1	
	
2412MHz 6dB Bandwidth	2412MHz 99% Bandwidth
	
2437MHz 6dB Bandwidth	2437MHz 99% Bandwidth
	
2462MHz 6dB Bandwidth	2462MHz 99% Bandwidth

802.11g Occupied Bandwidth Plots, Port 2	
	
2412MHz 6dB Bandwidth	2412MHz 99% Bandwidth
	
2437MHz 6dB Bandwidth	2437MHz 99% Bandwidth
	
2462MHz 6dB Bandwidth	2462MHz 99% Bandwidth

802.11n Occupied Bandwidth Plots, Port 1	
	
2412MHz 6dB Bandwidth	2412MHz 99% Bandwidth
	
2437MHz 6dB Bandwidth	2437MHz 99% Bandwidth
	
2462MHz 6dB Bandwidth	2462MHz 99% Bandwidth

802.11n Occupied Bandwidth Plots, Port 2	
	
2412MHz 6dB Bandwidth	2412MHz 99% Bandwidth
	
2437MHz 6dB Bandwidth	2437MHz 99% Bandwidth
	
2462MHz 6dB Bandwidth	2462MHz 99% Bandwidth

802.11n (40MHz) Occupied Bandwidth Plots, Port 1	
	
2422MHz 6dB Bandwidth	2422MHz 99% Bandwidth
	
2437MHz 6dB Bandwidth	2437MHz 99% Bandwidth
	
2452MHz 6dB Bandwidth	2452MHz 99% Bandwidth

802.11n (40MHz) Occupied Bandwidth Plots, Port 2	
	
2422MHz 6dB Bandwidth	2422MHz 99% Bandwidth
	
2437MHz 6dB Bandwidth	2437MHz 99% Bandwidth
	
2452MHz 6dB Bandwidth	2452MHz 99% Bandwidth

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(b) Conducted Output Power

Test Requirements: **§15.247(b):** The maximum peak output power of the intentional radiator shall not exceed the following:

Digital Transmission Systems (MHz)	Output Limit (Watts)
902-928	1.000
2400–2483.5	1.000
5725– 5850	1.000

Table 13. Output Power Requirements from §15.247(b)

§15.247(c): if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in the Table 13, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400 – 2483.5 MHz band and using a point to point application may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Fixed, point-to-point operation excludes the use of point-to-multipoint systems, Omni-directional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

Test Procedure: The transmitter was connected to a calibrated spectrum analyzer. The analyzer reference level was offset by cable loss connecting to the test sample. The peak power was measured at the low, mid and high channels of each band at the maximum power level.

Test Results: The EUT was compliant with the Peak Power Output limits of **§15.247(b)**.

Test Engineer(s): Bryan Taylor

Test Date(s): 5/2/2022

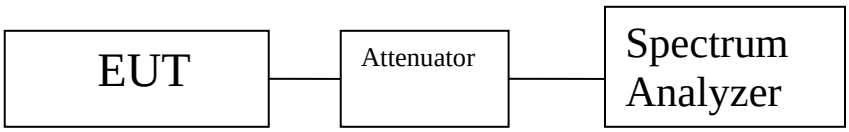


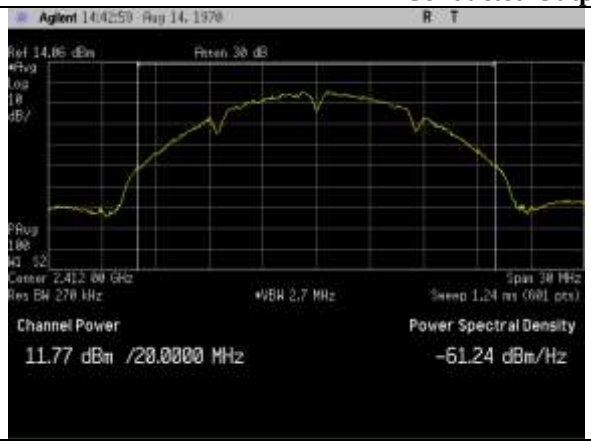
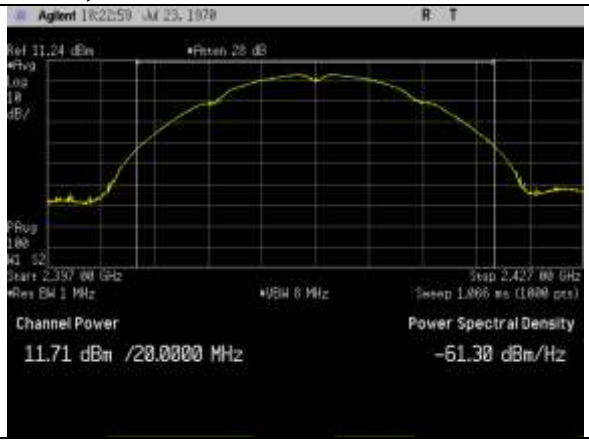
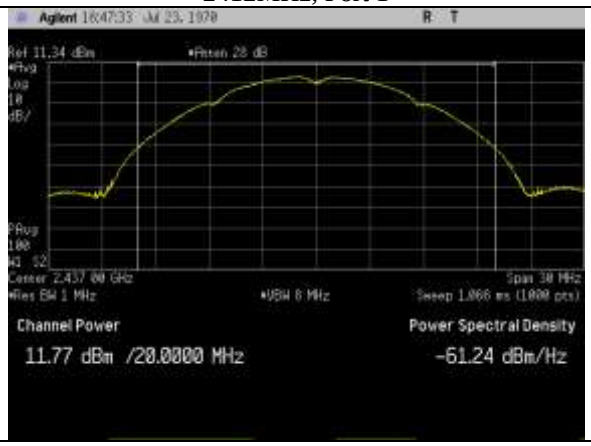
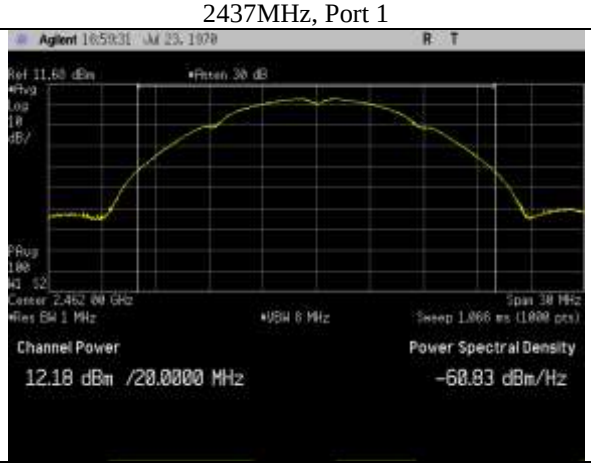
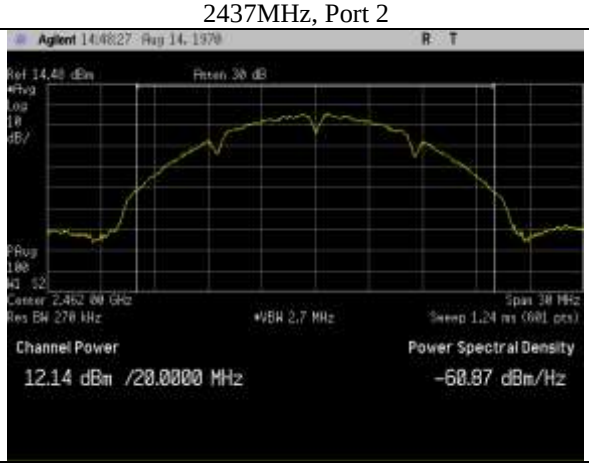
Figure 3. Peak Power Output Test Setup

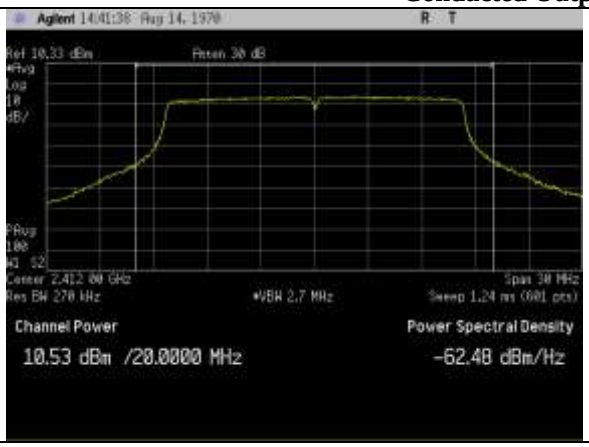
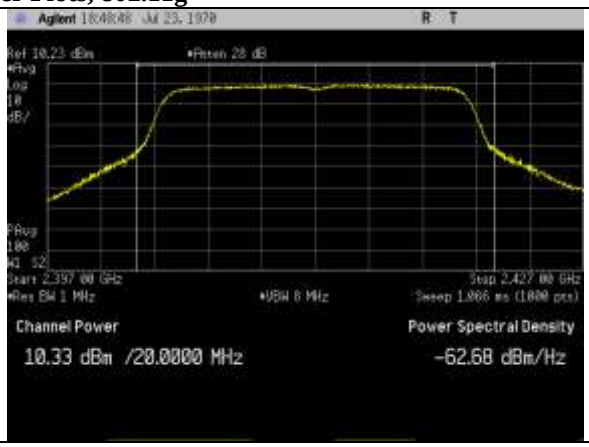
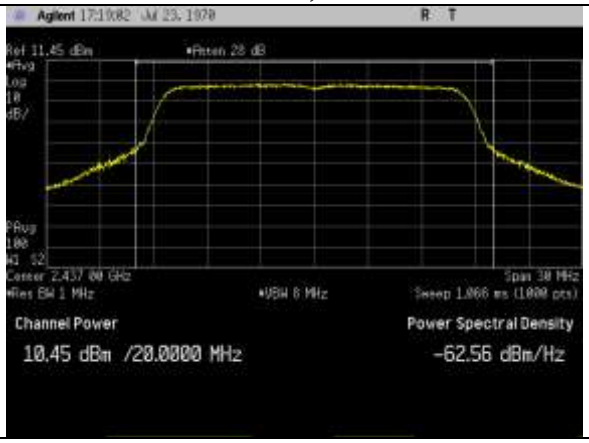
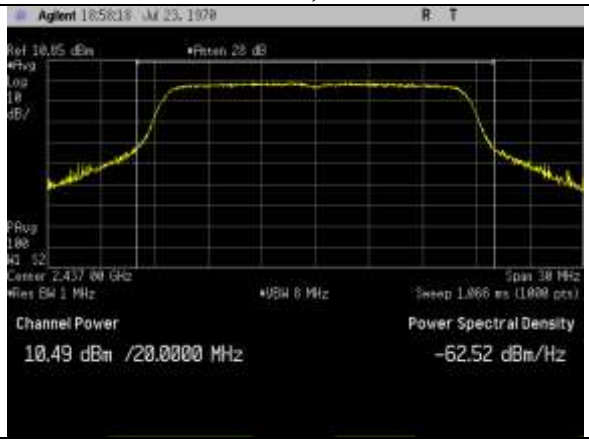
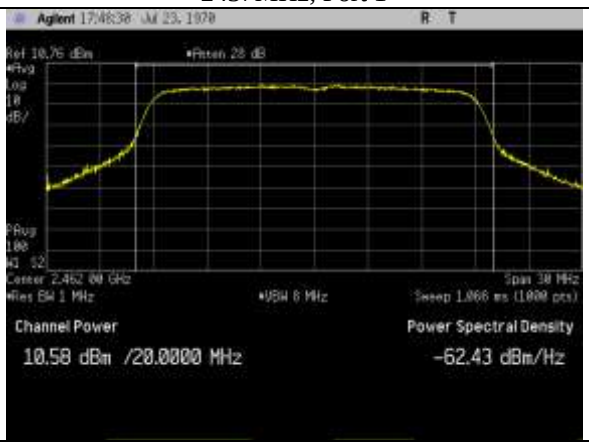
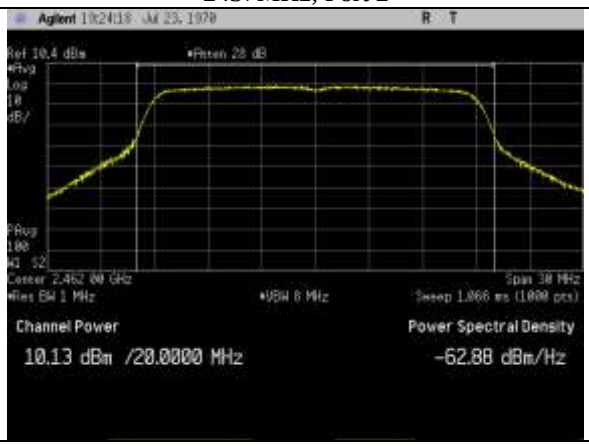
Conducted Output Test Results

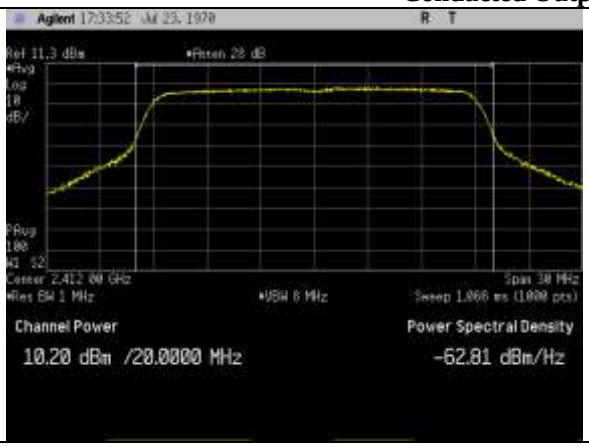
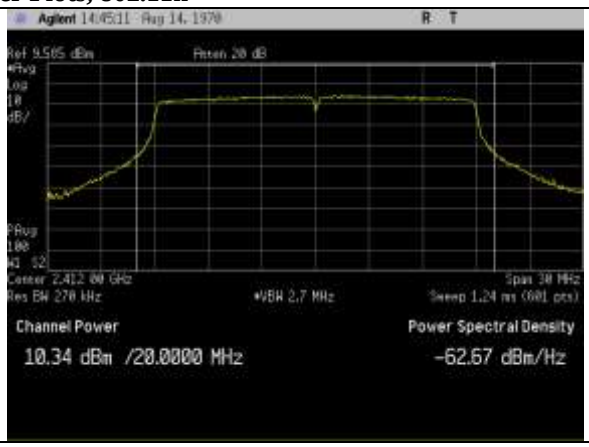
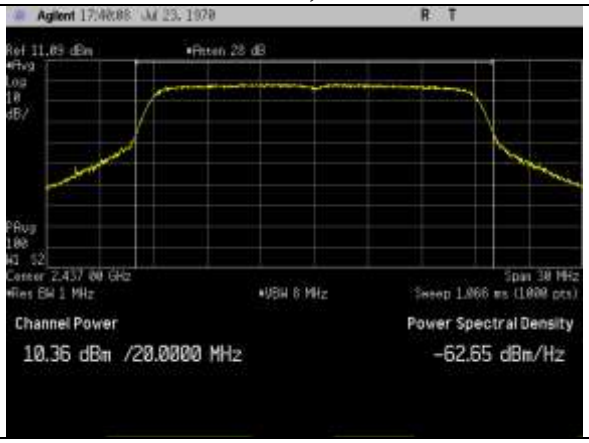
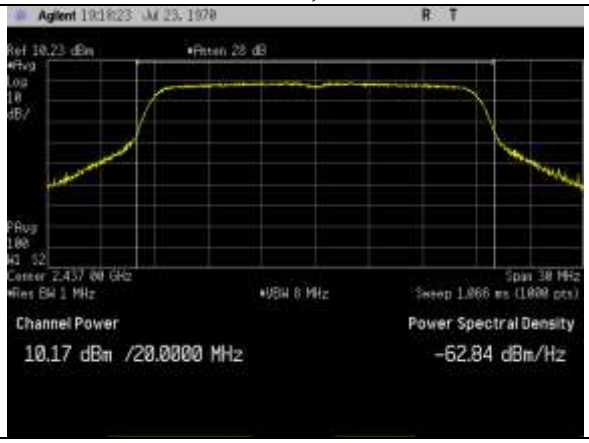
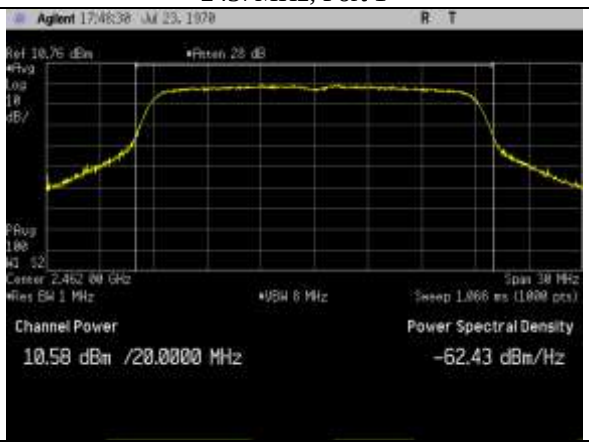
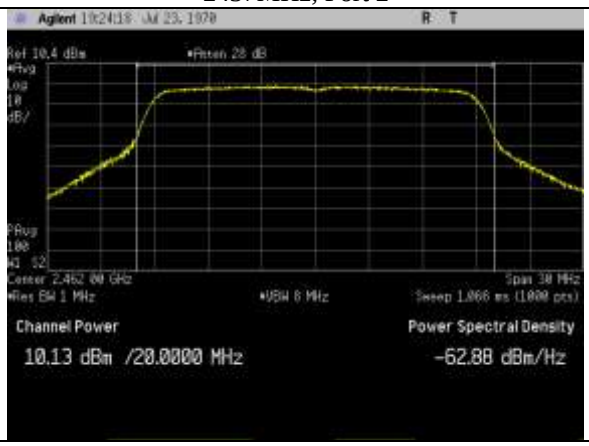
Channel and Mode	Port 1 (mW)	Port 2 (mW)	Port 1 (dBm)	Port 2 (dBm)	Sum (dBm)	Limit (dBm)	Margin dB
WIFI_Low Ch_2412MHz_20MHz BW_b-mode	15.0369	14.8369	11.77	11.71	14.75	30	15.25
WIFI_Mid Ch_2437MHz_20MHz BW_b-mode	15.0237	14.5837	11.77	11.64	14.71	30	15.29
WIFI_High Ch_2462MHz_20MHz BW_b-mode	16.5168	16.3629	12.18	12.14	15.17	30	14.83
WIFI_Low Ch_2412MHz_20MHz BW_g-mode	11.3028	10.7851	10.53	10.33	13.44	30	16.56
WIFI_Mid Ch_2437MHz_20MHz BW_g-mode	11.0963	11.1854	10.45	10.49	13.48	30	16.52
WIFI_High Ch_2462MHz_20MHz BW_g-mode	11.4532	10.7741	10.59	10.32	13.47	30	16.53
WIFI_Low Ch_2412MHz_20MHz BW_n-mode	10.4717	10.8222	10.20	10.34	13.28	30	16.72
WIFI_Mid Ch_2437MHz_20MHz BW_n-mode	10.8702	10.4102	10.36	10.17	13.28	30	16.72
WIFI_High Ch_2462MHz_20MHz BW_n-mode	11.4204	10.2950	10.58	10.13	13.37	30	16.63
WIFI_Low Ch_2422MHz_40MHz BW_n-mode	11.2069	10.5561	10.49	10.24	13.38	30	16.62
WIFI_Mid Ch_2437MHz_40MHz BW_n-mode	10.9802	11.0721	10.41	10.44	13.43	30	16.57
WIFI_High Ch_2452MHz_40MHz BW_n-mode	10.6116	10.4988	10.26	10.21	13.24	30	16.76

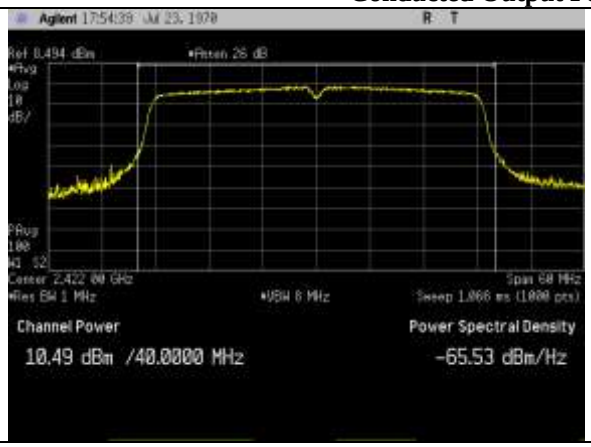
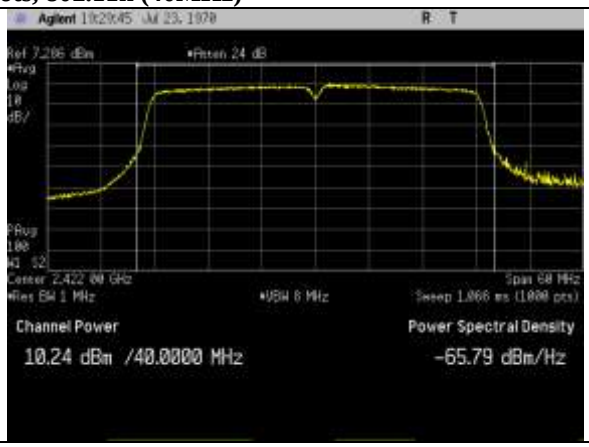
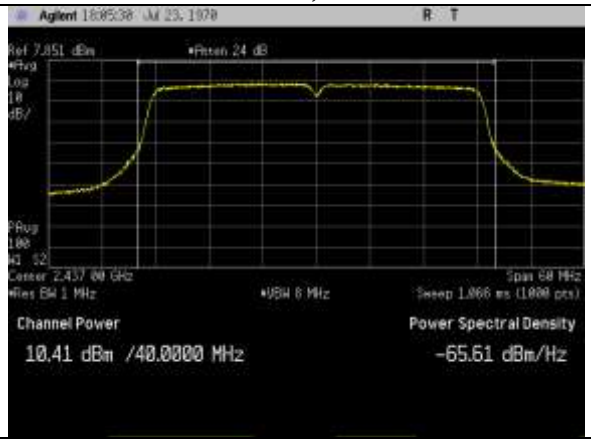
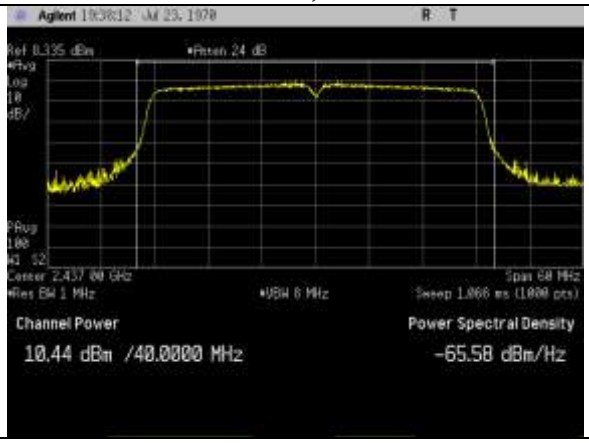
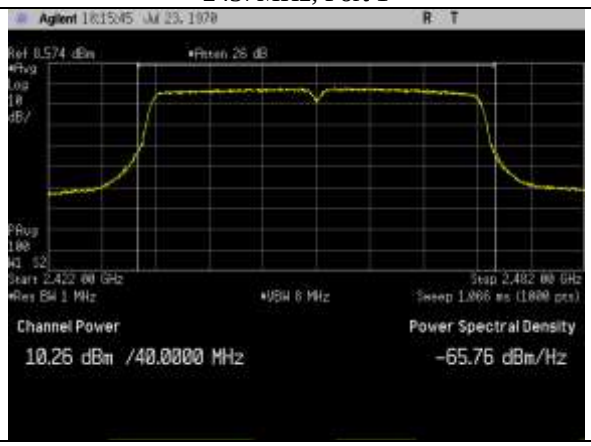
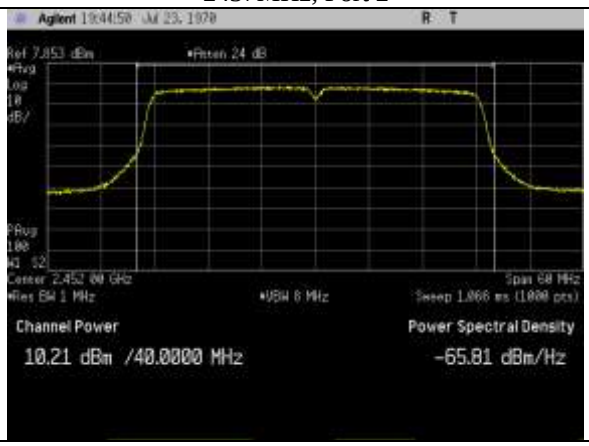
Table 14. Conducted Power Output, Test Results

Peak Power Output Test Results

Conducted Output Power Plots, 802.11b	
	
2412MHz, Port 1	2412MHz, Port 2
	
2437MHz, Port 1	2437MHz, Port 2
	
2462MHz, Port 1	2462MHz, Port 2

Conducted Output Power Plots, 802.11g	
	
2412MHz, Port 1	2412MHz, Port 2
	
2437MHz, Port 1	2437MHz, Port 2
	
2462MHz, Port 1	2462MHz, Port 2

Conducted Output Power Plots, 802.11n	
	
2412MHz, Port 1	2412MHz, Port 2
	
2437MHz, Port 1	2437MHz, Port 2
	
2462MHz, Port 1	2462MHz, Port 2

Conducted Output Power Plots, 802.11n (40MHz)	
	
2422MHz, Port 1	2422MHz, Port 2
	
2437MHz, Port 1	2437MHz, Port 2
	
2452MHz, Port 1	2452MHz, Port 2

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Radiated Spurious Emissions Requirements and Band Edge

Test Requirements: **§15.247(d); §15.205:** Emissions outside the frequency band.

§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. 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).

§15.205(a): Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090–0.110----------	16.42–16.423	399.9–410	4.5–5.15
[1] 0.495–0.505----------	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905----------	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128----------	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775----------	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775----------	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218----------	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825----------	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225----------	123–138	2200–2300	14.47–14.5
8.291–8.294----------	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366----------	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675----------	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475----------	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293----------	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025----------	240–285	3345.8–3358 36.	43–36.5
12.57675–12.57725----------	322–335.4	3600–4400	([2])

Table 15. Restricted Bands of Operation

[1] Until February 1, 1999, this restricted band shall be 0.490 – 0.510 MHz.

[2] Above 38.6

Test Requirement(s): **§ 15.209 (a):** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in Table 16.

Frequency (MHz)	§ 15.209(a),Radiated Emission Limits (dBµV) @ 3m
30 - 88	40.00
88 - 216	43.50
216 - 960	46.00
Above 960	54.00

Table 16. Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a)

Test Procedures: The antenna-port methodology form ANSI C63.10: 2013 Section 11.12.2 was utilized as an alternative to radiated emissions in the restricted bands.

The transmitter was connected directly to a Spectrum Analyzer through an attenuator. The power level was set to the maximum level. For frequencies below 1GHz, the RBW was set to 100 kHz and the VBW was set to 3x the RBW. For frequencies above 1GHz the RBW was set to 1MHz and the VBW was set to 3x the RBW. The spectrum analyzer was set to an auto sweep time and a peak detector was used. The maximum antenna gain was added to the measurement trace as was the appropriate maximum ground reflection factor as outlined in section 11.12.2 of ANSI C63.10. The resultant EIRP was then converted to an equivalent electric field strength which is shown on the graphical plots which follow. Measurements were carried out at the low, mid and high channels.

In order to assess the cabinet radiated spurious emissions, a radiated scan was performed with the antenna of proper impedance installed. The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes if multiple mounting orientations are supported. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line.

Radiated measurements below 30MHz were performed in a semi-anechoic chamber that has been correlated to an open area site.

Test Results: The EUT was compliant with the Radiated Spurious Emission limits of **§ 15.247(d)**.

The calculated directional gain (per KDB 662911 D01) was 7.09dBi. During the testing the scans on each transmit chain were performed with either 4dBi gain or the default 2dBi gain from ANSI C63.10. Due to the high margin on the plots the additional gain in all cases still demonstrates a passing result when the directional gain of 7.09dBi is applied in lieu of the 4dBi or 2dBi.

A table is presented showing the worst-case restricted band edge measurements for transmissions adjacent to the restricted bands with the directional array gain included.

Test Engineer(s): Bryan Taylor, James Seib

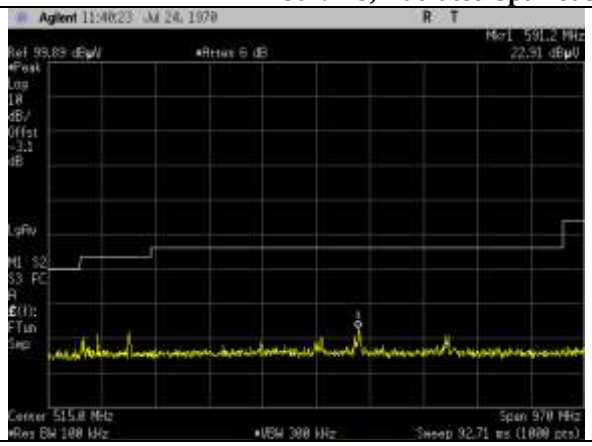
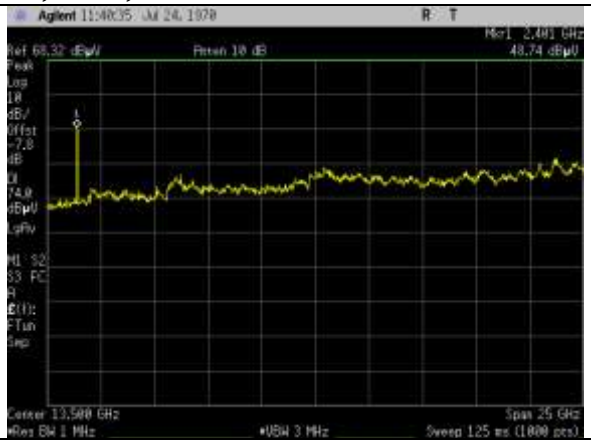
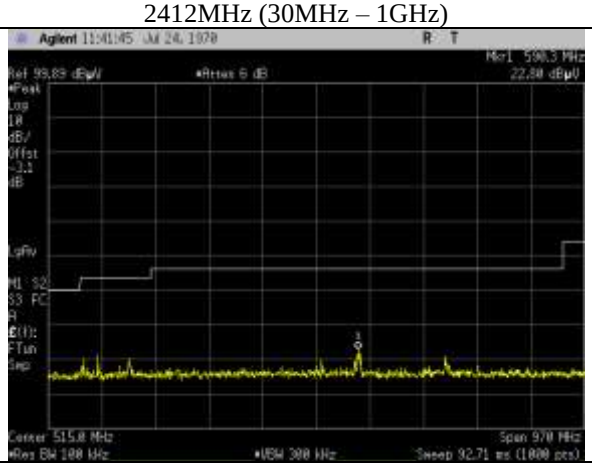
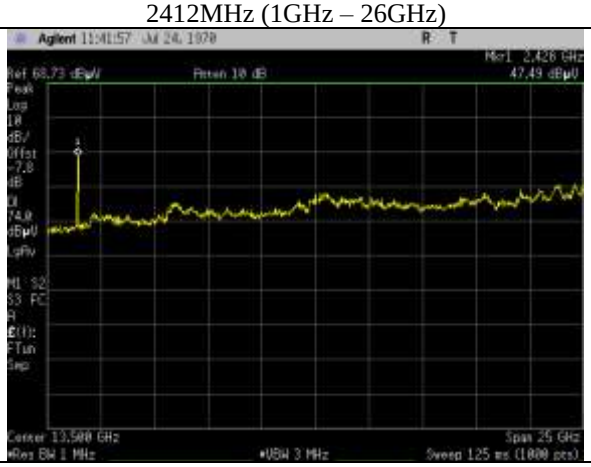
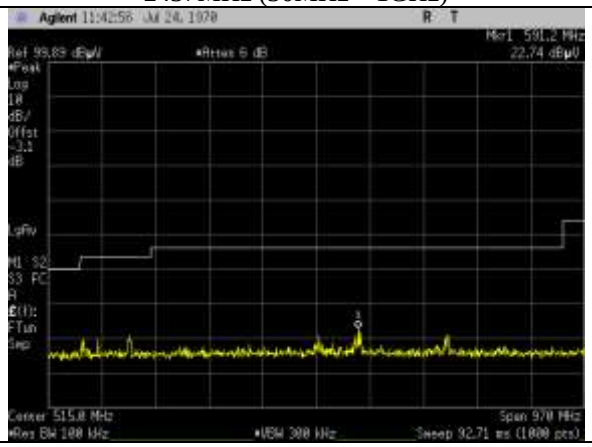
Test Date(s): 5/3/2022 – 5/18/2022

TX Port	TX Mode	Channel	Frequency (GHz)	Avg Amplitude (dBuV/m)	Avg Limit (dBuV/m)	Avg Margin (dBuV/m)	Peak Amplitude (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dBuV/m)	TX Antenna *Gain (dBi)
1	802.11b	1	2.39	41.08	54	12.92	58.65	74	15.35	7.09
2	802.11b	1	2.39	40.95	54	13.05	51.97	74	22.03	7.09
1	802.11b	11	2.4835	43.65	54	10.35	54.29	74	19.71	7.09
2	802.11b	11	2.4835	42.37	54	11.63	52.26	74	21.74	7.09
1	802.11g	1	2.39	40.71	54	13.29	58.65	74	15.35	7.09
2	802.11g	1	2.39	45.32	54	8.68	51.97	74	22.03	7.09
1	802.11g	11	2.4835	44.91	54	9.09	55.11	74	18.89	7.09
2	802.11g	11	2.4835	44.91	54	9.09	55.41	74	18.59	7.09
1	802.11n	1	2.39	41.29	54	12.71	51.38	74	22.62	7.09
2	802.11n	1	2.39	40.94	54	13.06	51.28	74	22.72	7.09
1	802.11n	11	2.4835	46.4	54	7.6	57.26	74	16.74	7.09
2	802.11n	11	2.4835	45.36	54	8.64	56.56	74	17.44	7.09
1	802.11n (40)	3	2.39	41.21	54	12.79	52.3	74	21.7	7.09
2	802.11n (40)	3	2.39	41.34	54	12.66	63.75	74	10.25	7.09
1	802.11n (40)	10	2.4835	43.65	54	10.35	54.29	74	19.71	7.09
2	802.11n (40)	10	2.4835	42.37	54	11.63	52.26	74	21.74	7.09

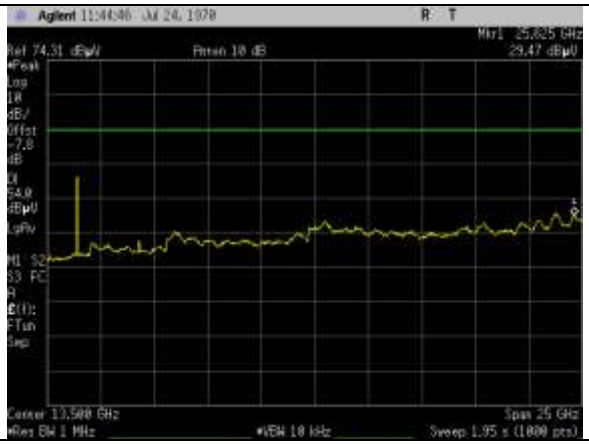
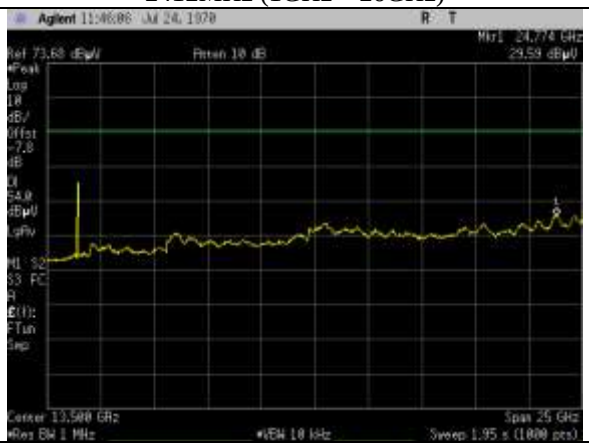
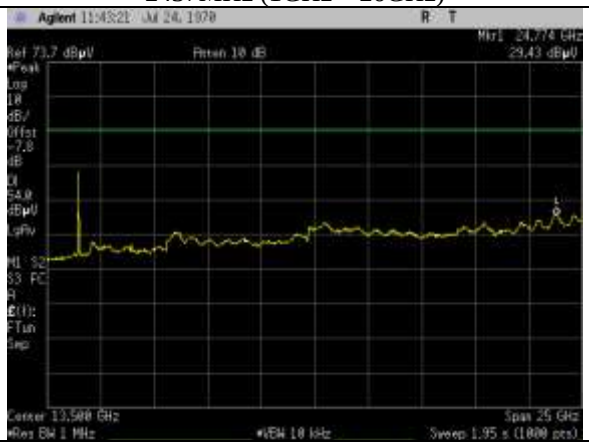
*These measurements were performed using the conducted methodology from ANSI C63.10 section 12.7.2. The antenna gain used is the directional array gain which was calculated per KDB 662911 D01 Section F.2.a.(i) for correlated signals with un-equal antenna gains.

Table 17. Worst Case Restricted Band Edge Emissions

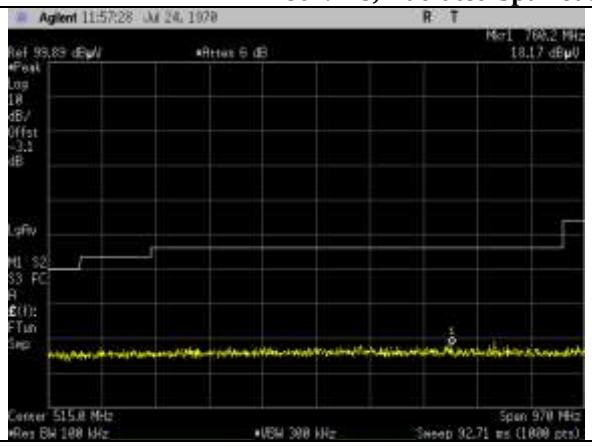
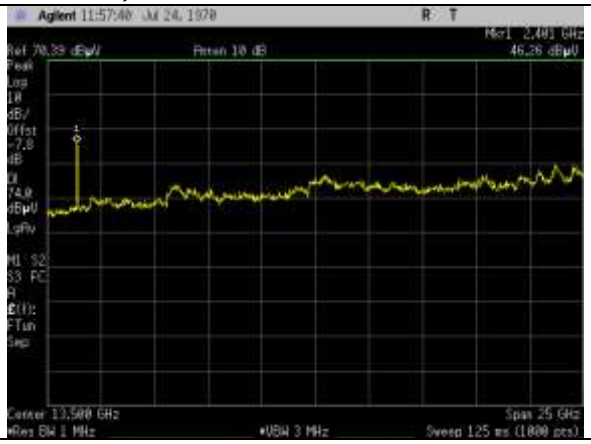
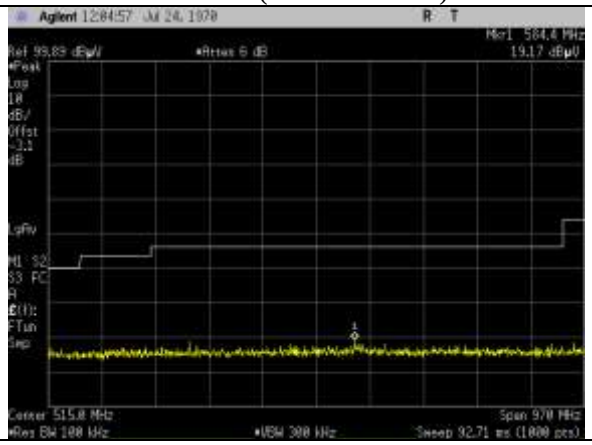
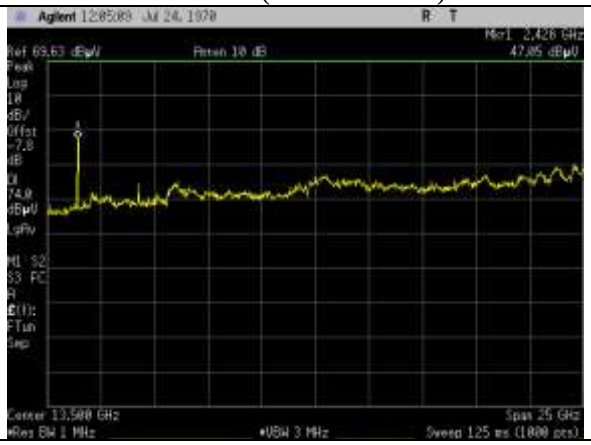
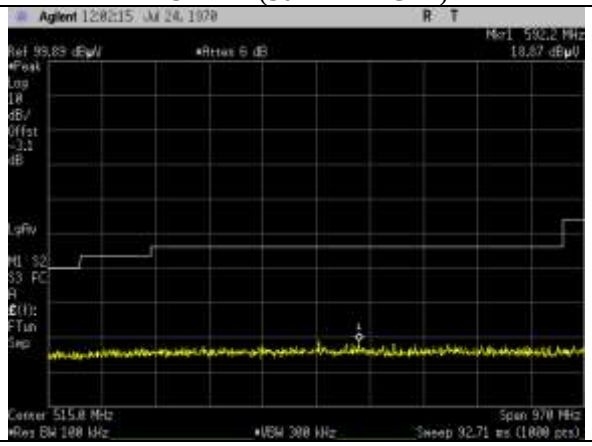
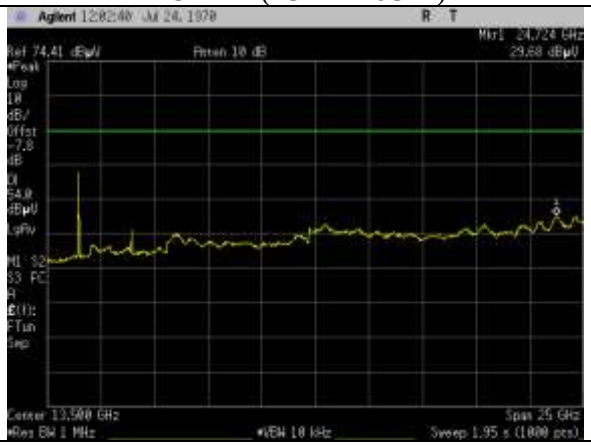
Radiated Spurious Emissions Test Results

802.11b, Radiated Spurious Emissions, Port 1, Peak Detection	
	
2412MHz (30MHz – 1GHz)	2412MHz (1GHz – 26GHz)
	
2437MHz (30MHz – 1GHz)	2437MHz (1GHz – 26GHz)
	
2462MHz (30MHz – 1GHz)	2462MHz (1GHz – 26GHz)

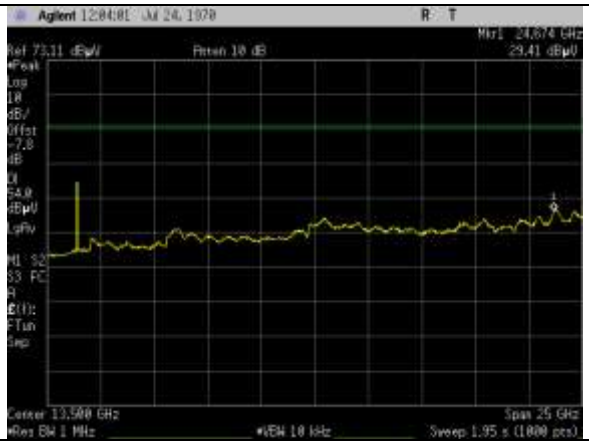
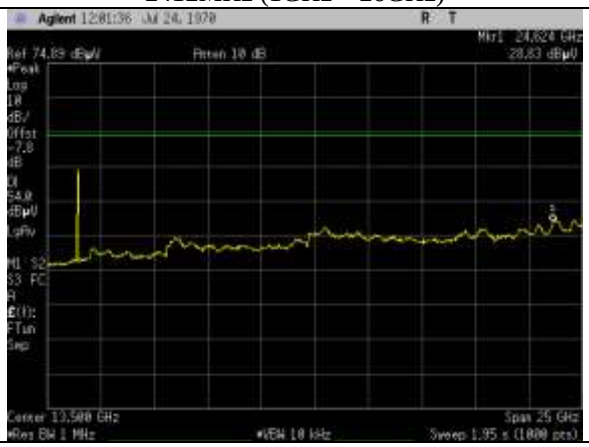
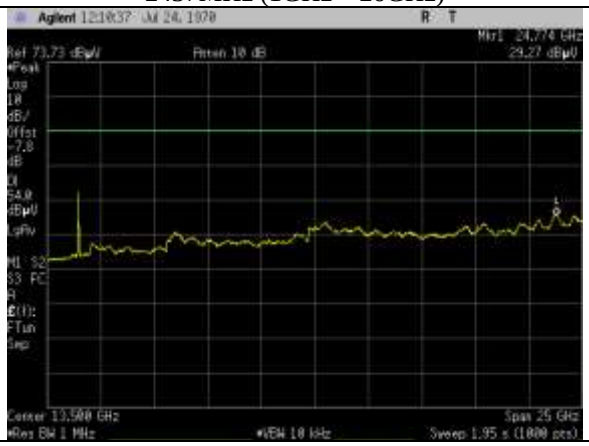
Note: The fundamental transmission was suppressed with the use of a band reject filter in the above plots

802.11b, Radiated Spurious Emissions, Port 1, Average Detection

2412MHz (1GHz – 26GHz)

2437MHz (1GHz – 26GHz)

2462MHz (1GHz – 26GHz)

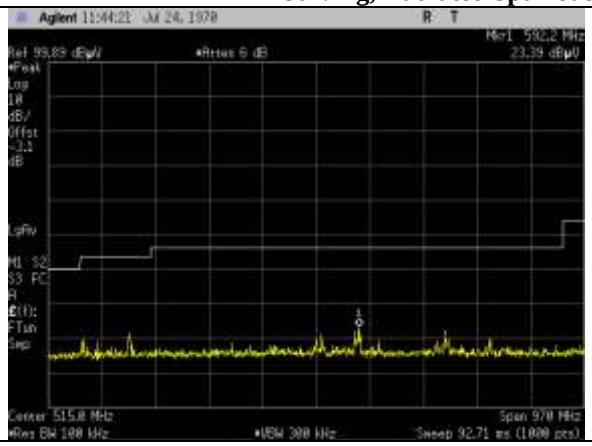
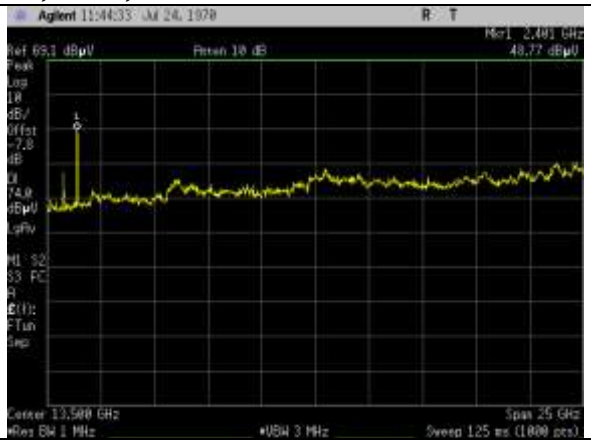
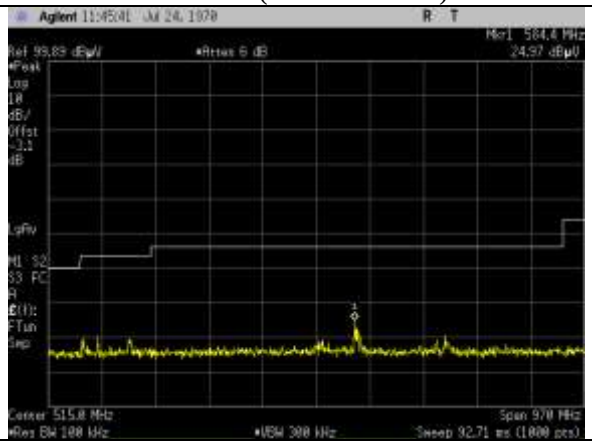
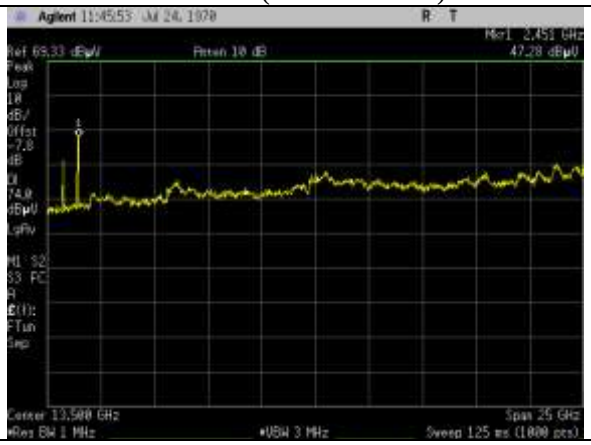
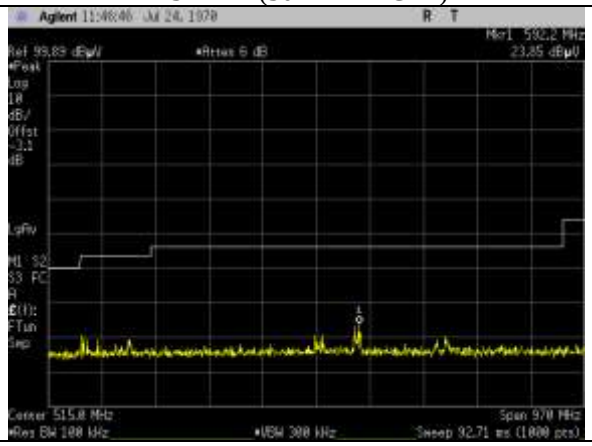
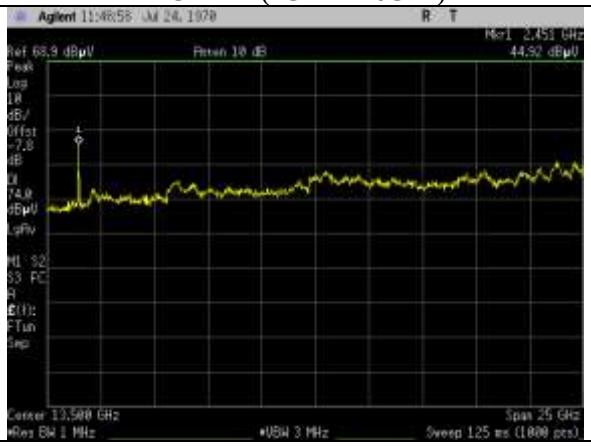
Note: The fundamental transmission was suppressed with the use of a band reject filter in the above plots

802.11b, Radiated Spurious Emissions Port 2, Peak Detection	
	
2412MHz (30MHz – 1GHz)	2412MHz (1GHz – 26GHz)
	
2437MHz (30MHz – 1GHz)	2437MHz (1GHz – 26GHz)
	
2462MHz (30MHz – 1GHz)	2462MHz (1GHz – 26GHz)

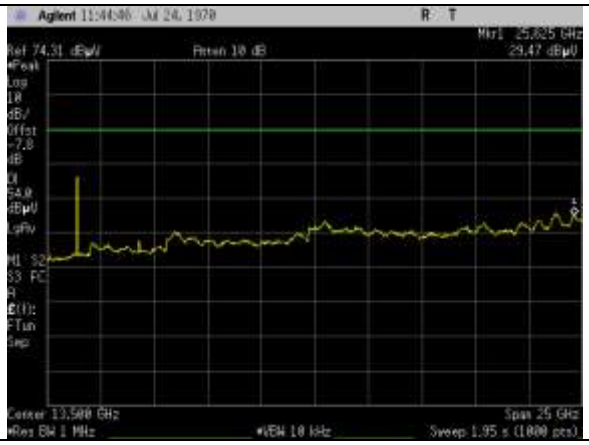
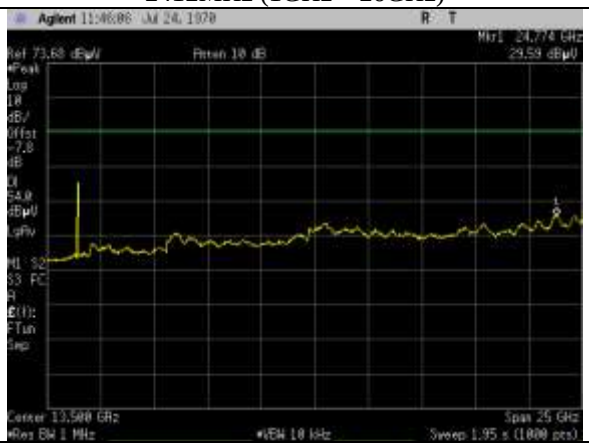
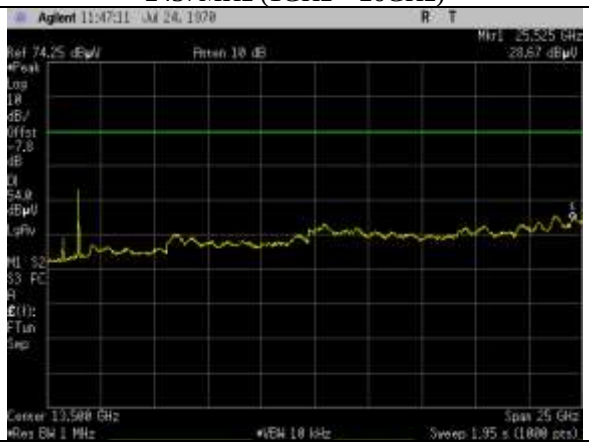
Note: The fundamental transmission was suppressed with the use of a band reject filter in the above plots

802.11b, Radiated Spurious Emissions, Port 2, Average Detection

2412MHz (1GHz – 26GHz)

2437MHz (1GHz – 26GHz)

2462MHz (1GHz – 26GHz)

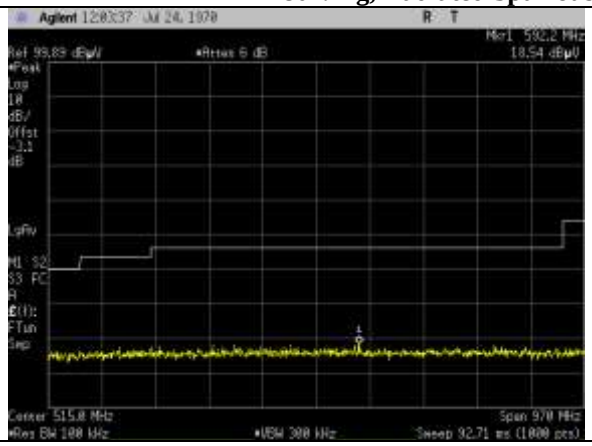
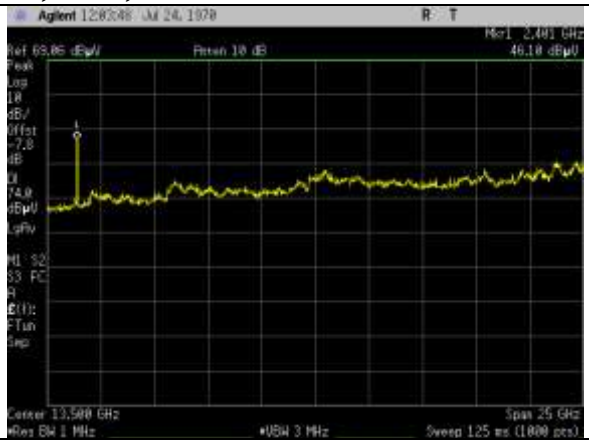
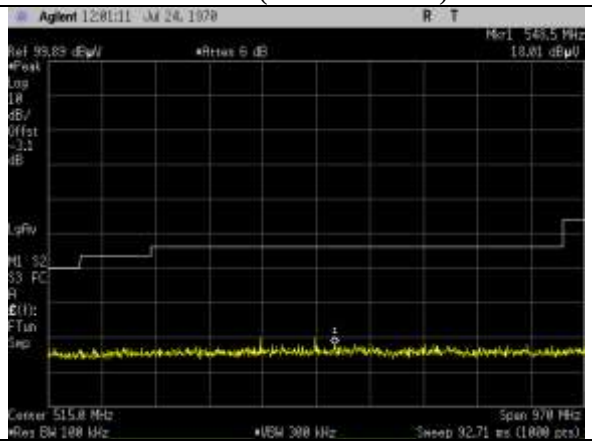
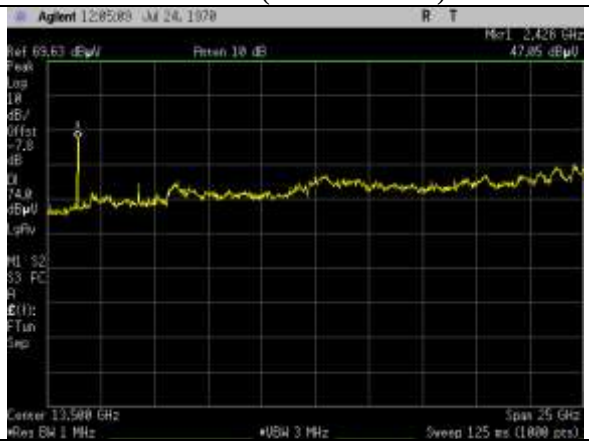
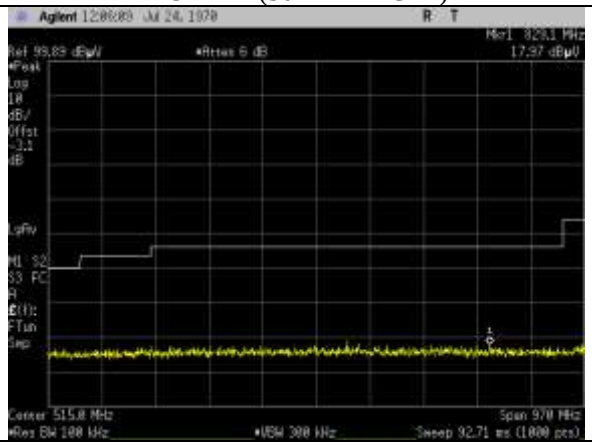
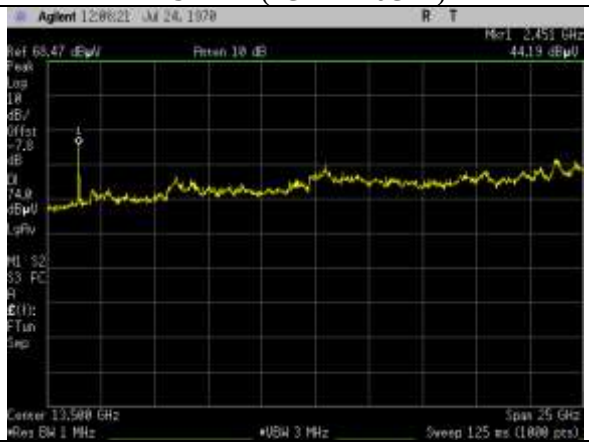
Note: The fundamental transmission was suppressed with the use of a band reject filter in the above plots

802.11g, Radiated Spurious Emissions, Port 1, Peak Detection	
	
2412MHz (30MHz – 1GHz)	2412MHz (1GHz – 26GHz)
	
2437MHz (30MHz – 1GHz)	2437MHz (1GHz – 26GHz)
	
2462MHz (30MHz – 1GHz)	2462MHz (1GHz – 26GHz)

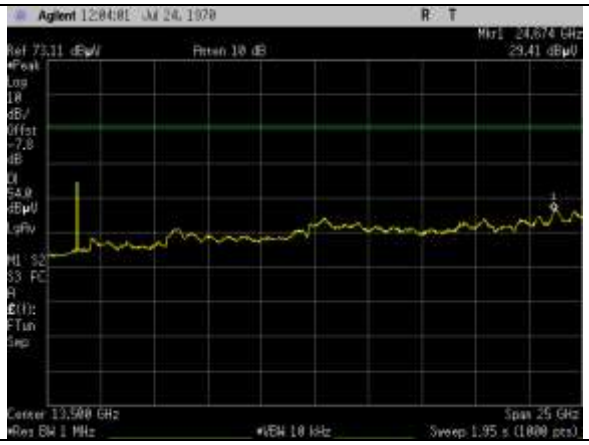
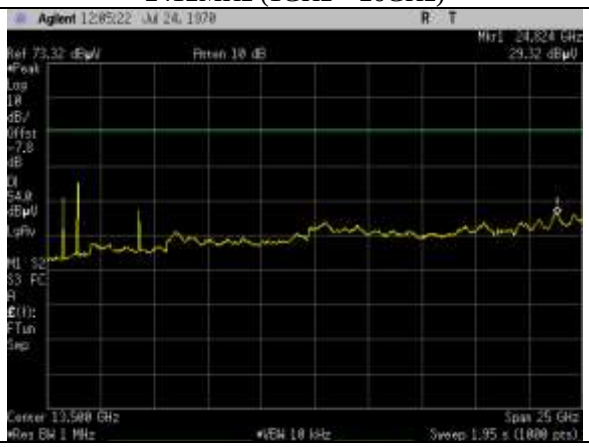
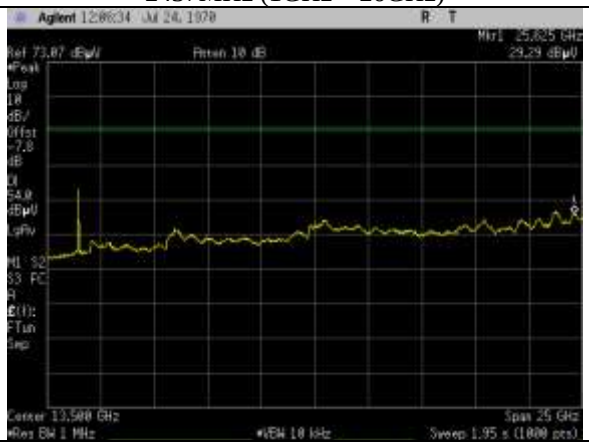
Note: The fundamental transmission was suppressed with the use of a band reject filter in the above plots

802.11g, Radiated Spurious Emissions, Port 1, Average Detection

2412MHz (1GHz – 26GHz)

2437MHz (1GHz – 26GHz)

2462MHz (1GHz – 26GHz)

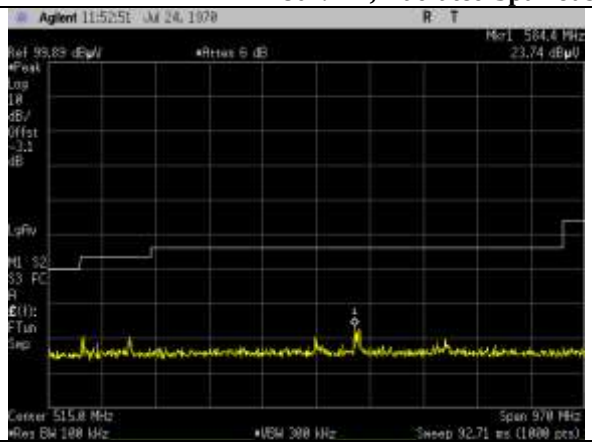
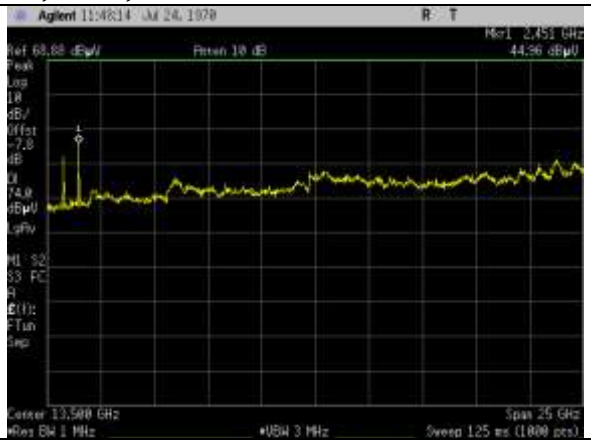
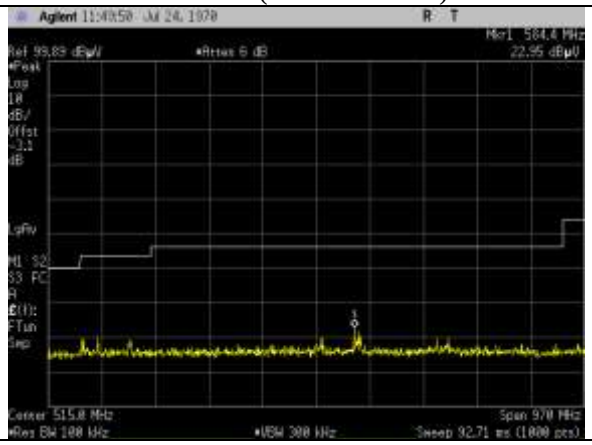
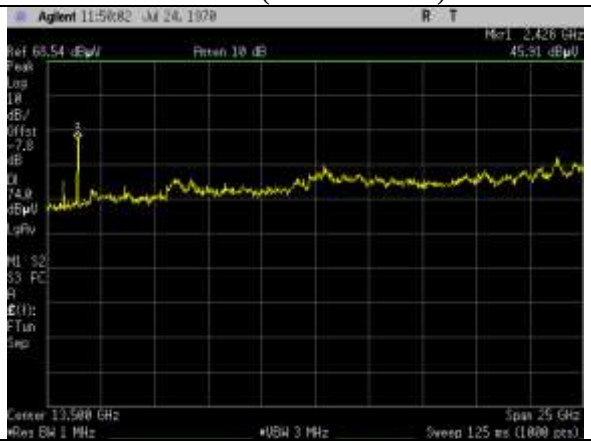
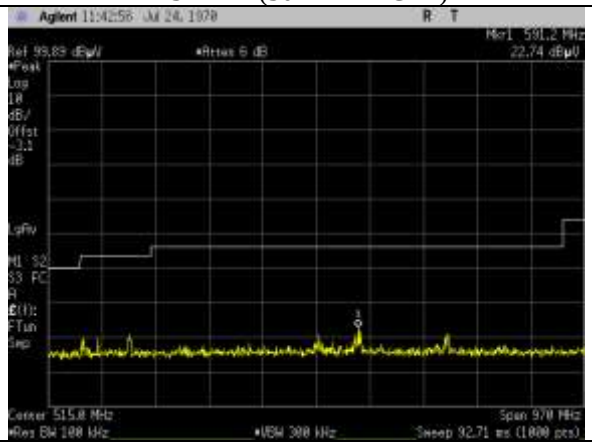
Note: The fundamental transmission was suppressed with the use of a band reject filter in the above plots

802.11g, Radiated Spurious Emissions, Port 2, Peak Detection	
	
2412MHz (30MHz – 1GHz)	2412MHz (1GHz – 26GHz)
	
2437MHz (30MHz – 1GHz)	2437MHz (1GHz – 26GHz)
	
2462MHz (30MHz – 1GHz)	2462MHz (1GHz – 26GHz)

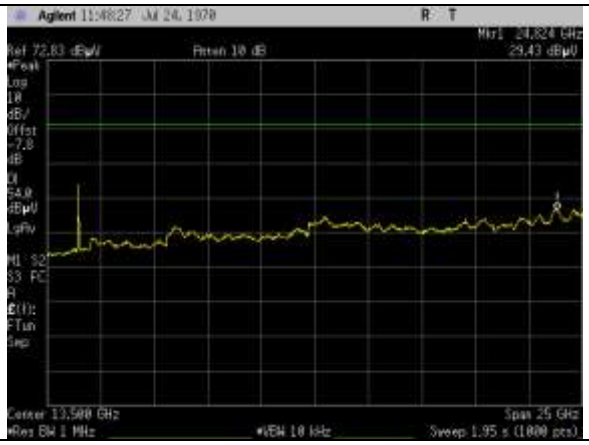
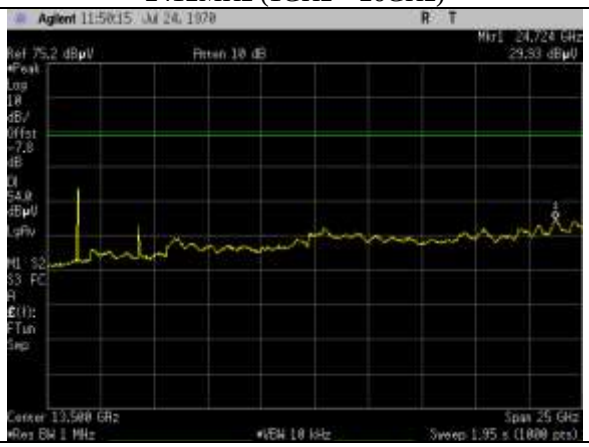
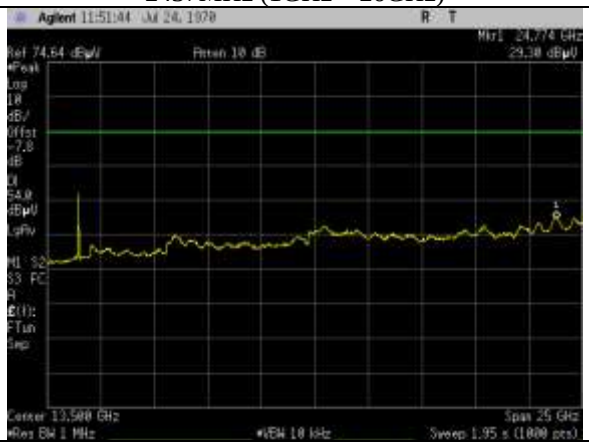
Note: The fundamental transmission was suppressed with the use of a band reject filter in the above plots

802.11g, Radiated Spurious Emissions, Port 2, Average Detection

2412MHz (1GHz – 26GHz)

2437MHz (1GHz – 26GHz)

2462MHz (1GHz – 26GHz)

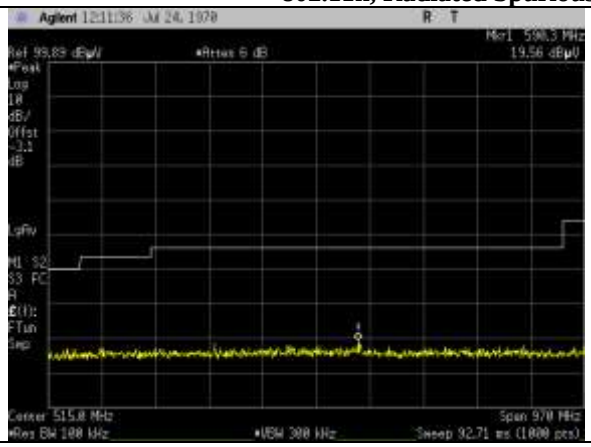
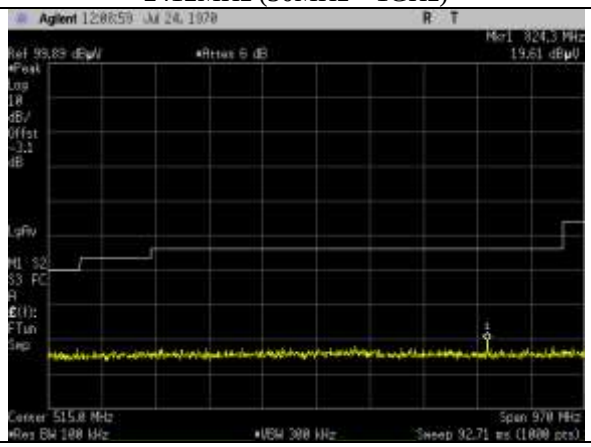
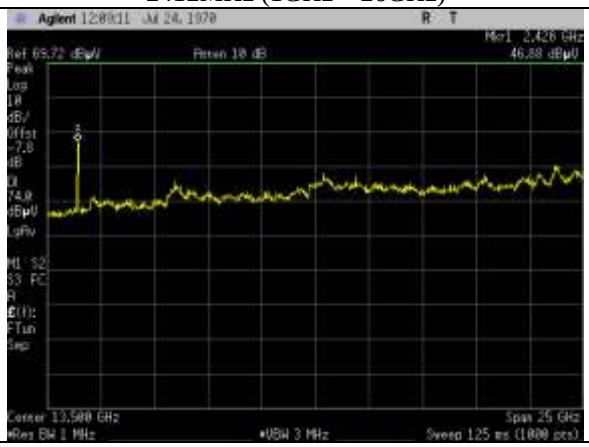
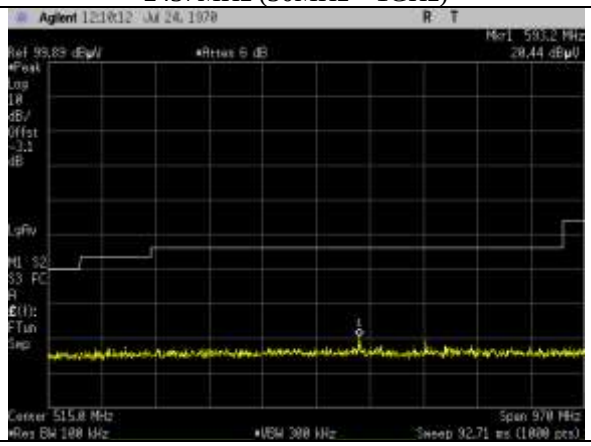
Note: The fundamental transmission was suppressed with the use of a band reject filter in the above plots

802.11n, Radiated Spurious Emissions, Port 1, Peak Detection	
	
2412MHz (30MHz – 1GHz)	2412MHz (1GHz – 26GHz)
	
2437MHz (30MHz – 1GHz)	2437MHz (1GHz – 26GHz)
	
2462MHz (30MHz – 1GHz)	2462MHz (1GHz – 26GHz)

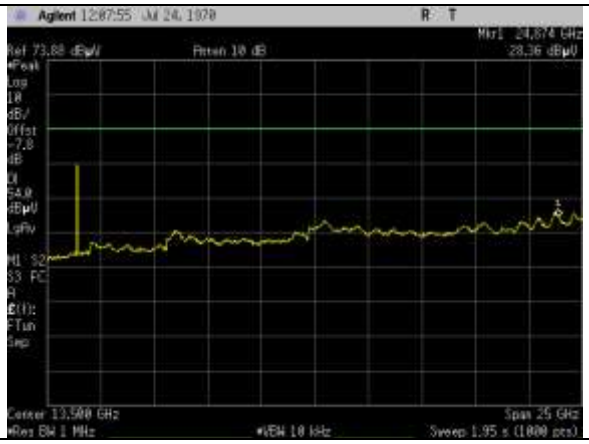
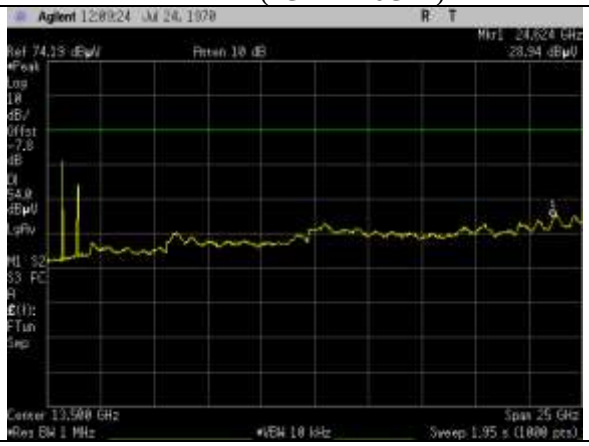
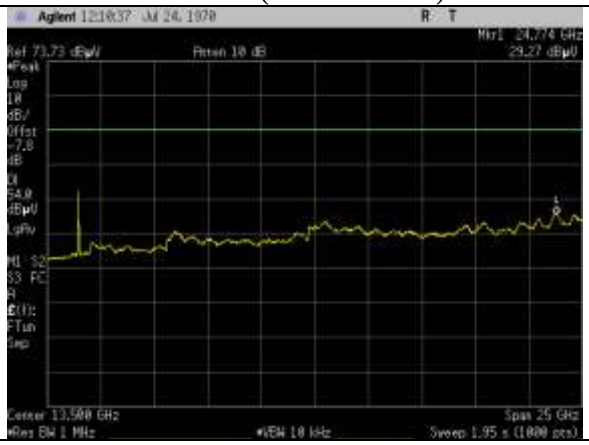
Note: The fundamental transmission was suppressed with the use of a band reject filter in the above plots

802.11n, Radiated Spurious Emissions, Port 1, Average Detection

2412MHz (1GHz – 26GHz)

2437MHz (1GHz – 26GHz)

2462MHz (1GHz – 26GHz)

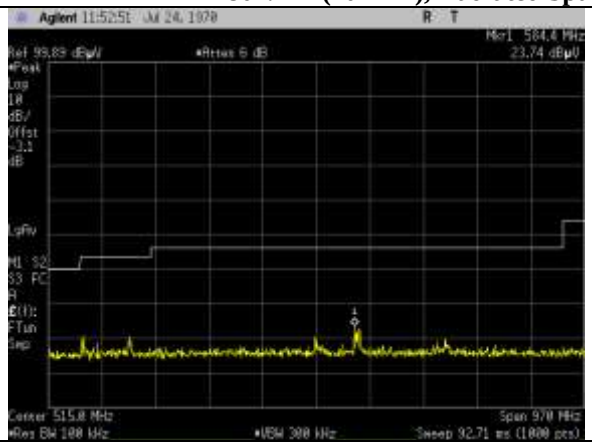
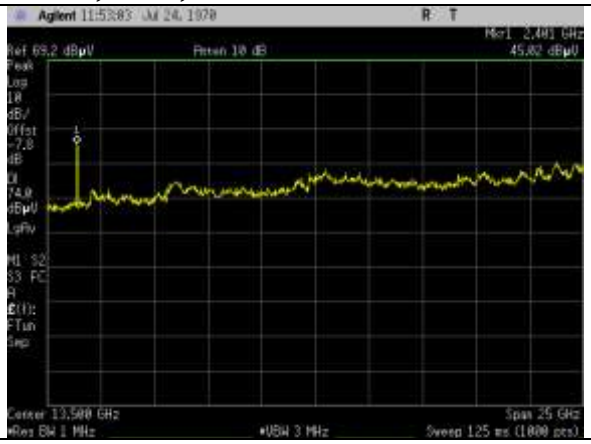
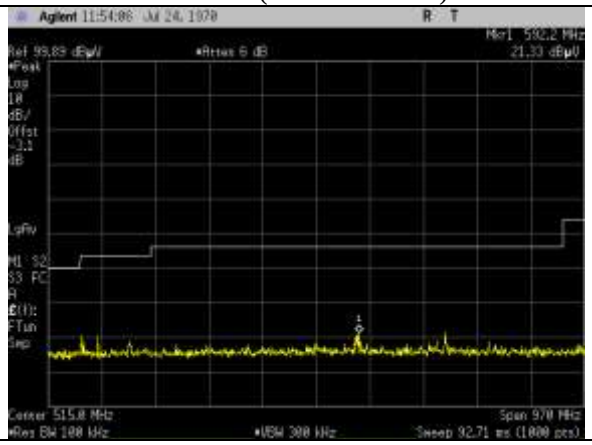
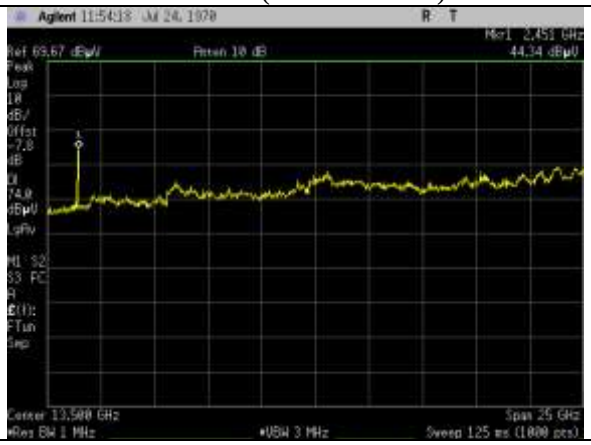
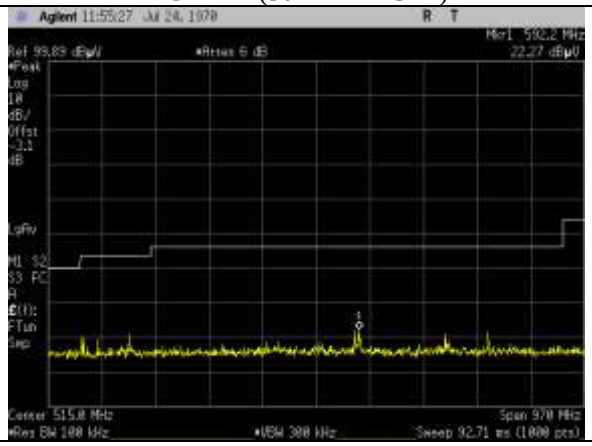
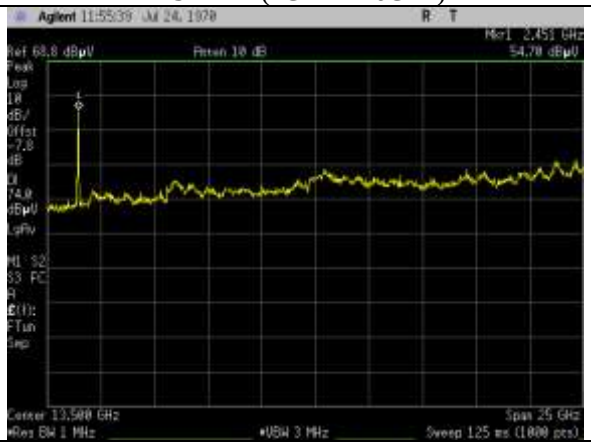
Note: The fundamental transmission was suppressed with the use of a band reject filter in the above plots

802.11n, Radiated Spurious Emissions, Port 2, Peak Detection	
	
2412MHz (30MHz – 1GHz)	2412MHz (1GHz – 26GHz)
	
2437MHz (30MHz – 1GHz)	2437MHz (1GHz – 26GHz)
	
2462MHz (30MHz – 1GHz)	2462MHz (1GHz – 26GHz)

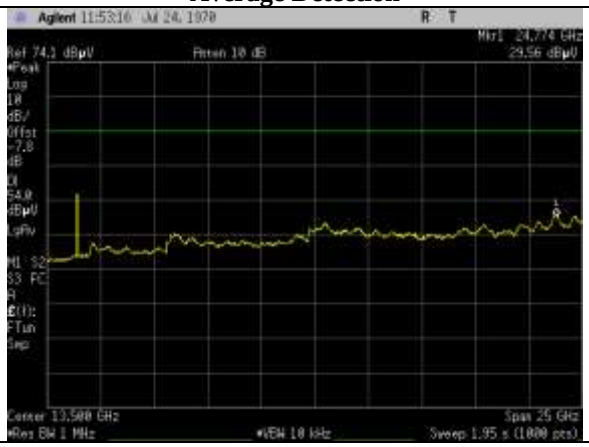
Note: The fundamental transmission was suppressed with the use of a band reject filter in the above plots

802.11n, Radiated Spurious Emissions, Port 2, Average Detection

2412MHz (1GHz – 26GHz)

2437MHz (1GHz – 26GHz)

2462MHz (1GHz – 26GHz)

Note: The fundamental transmission was suppressed with the use of a band reject filter in the above plots

802.11n (40MHz), Radiated Spurious Emissions, Port 1, Peak Detection	
	
2422MHz (30MHz – 1GHz)	2422MHz (1GHz – 26GHz)
	
2437MHz (30MHz – 1GHz)	2437MHz (1GHz – 26GHz)
	
2452MHz (30MHz – 1GHz)	2452MHz (1GHz – 26GHz)

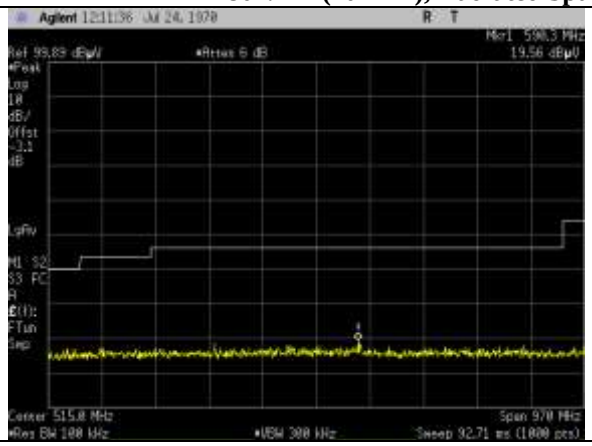
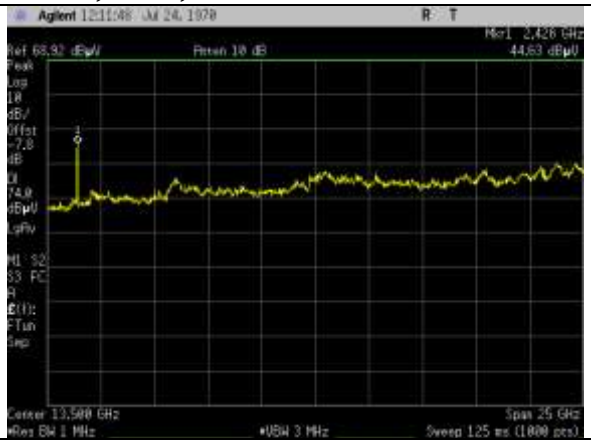
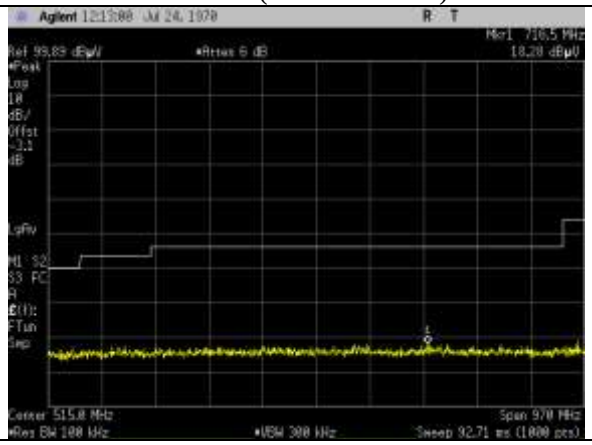
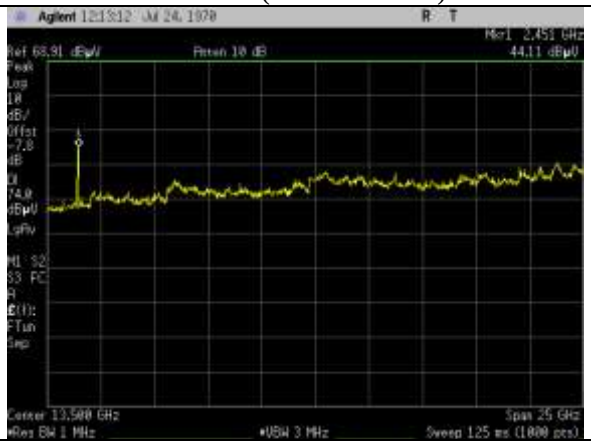
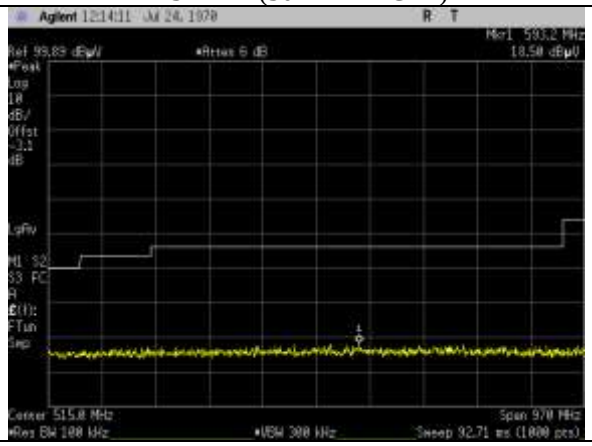
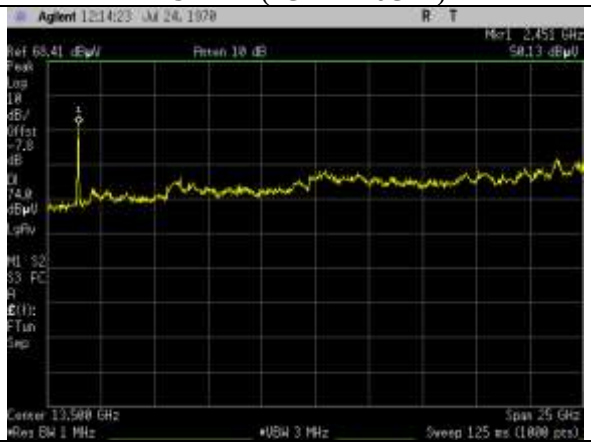
Note: The fundamental transmission was suppressed with the use of a band reject filter in the above plots

802.11n (40MHz), Radiated Spurious Emissions, Port 1, Average Detection

2422MHz (1GHz – 26GHz)

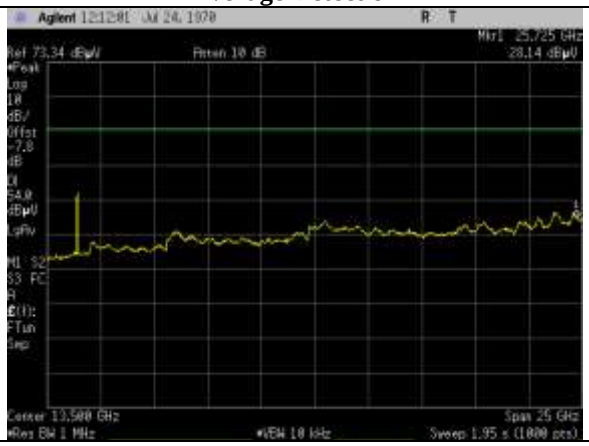
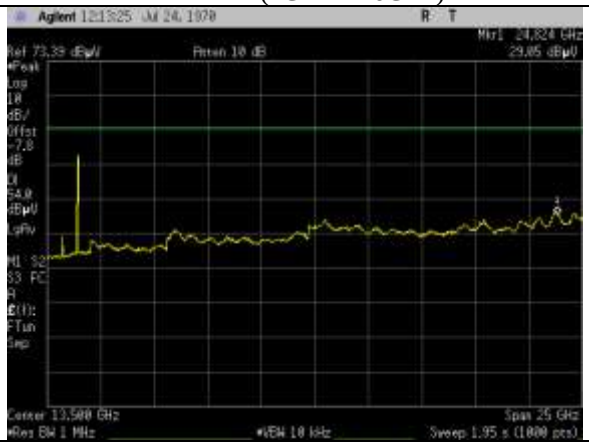
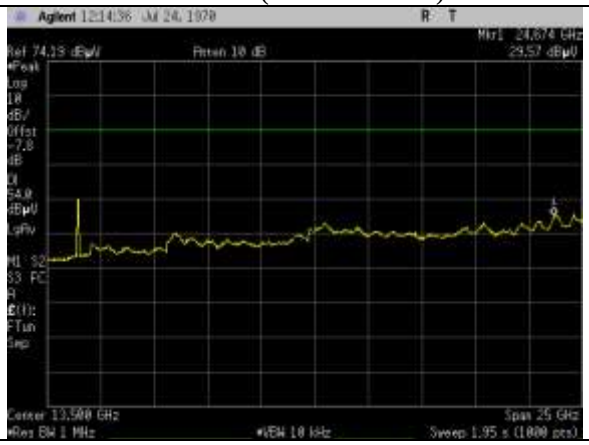
2437MHz (1GHz – 26GHz)

2452MHz (1GHz – 26GHz)

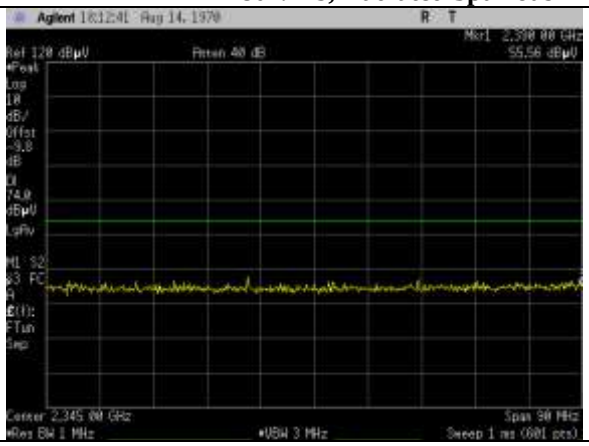
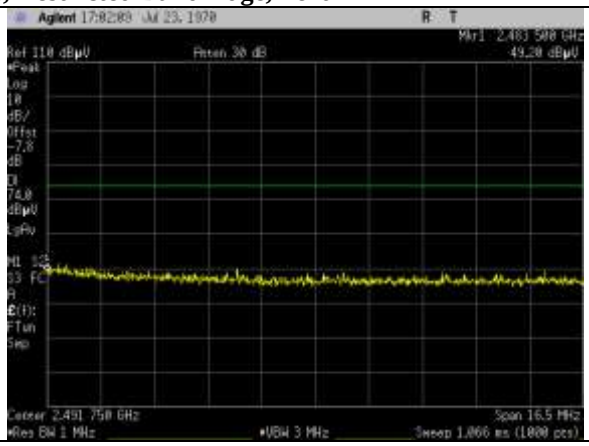
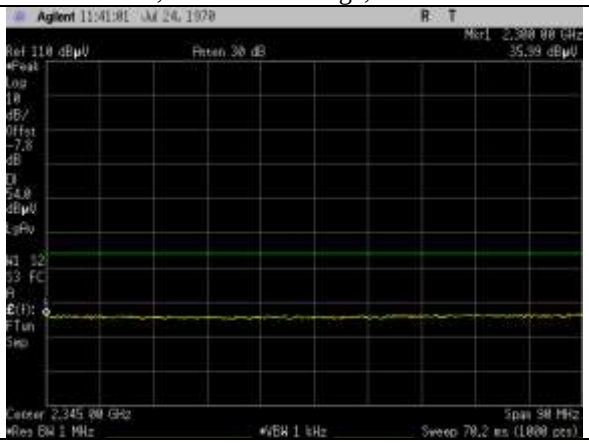
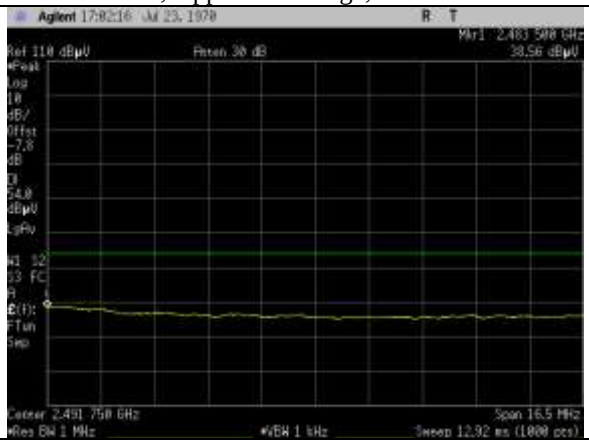
Note: The fundamental transmission was suppressed with the use of a band reject filter in the above plots

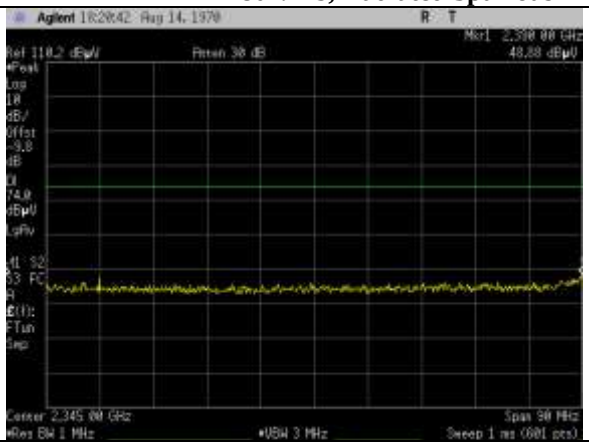
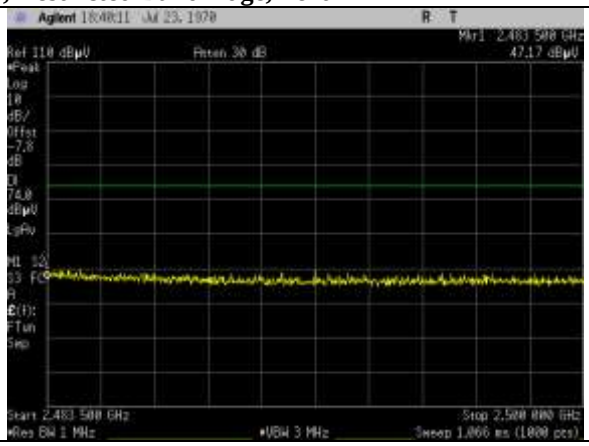
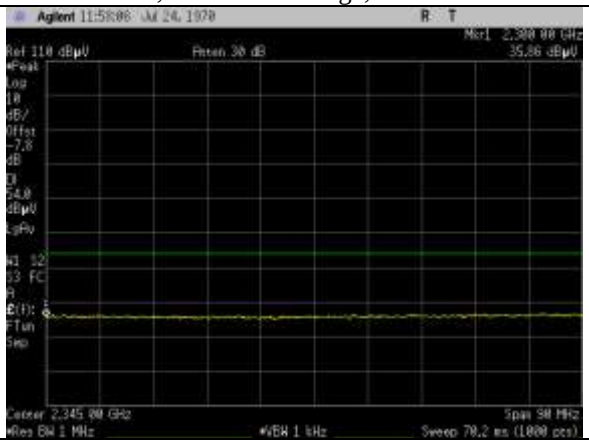
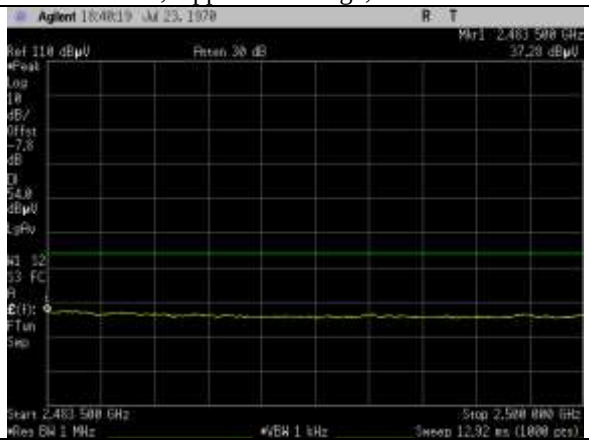
802.11n (40MHz), Radiated Spurious Emissions, Port 2, Peak Detection	
	
2422MHz (30MHz – 1GHz)	2422MHz (1GHz – 26GHz)
	
2437MHz (30MHz – 1GHz)	2437MHz (1GHz – 26GHz)
	
2452MHz (30MHz – 1GHz)	2452MHz (1GHz – 26GHz)

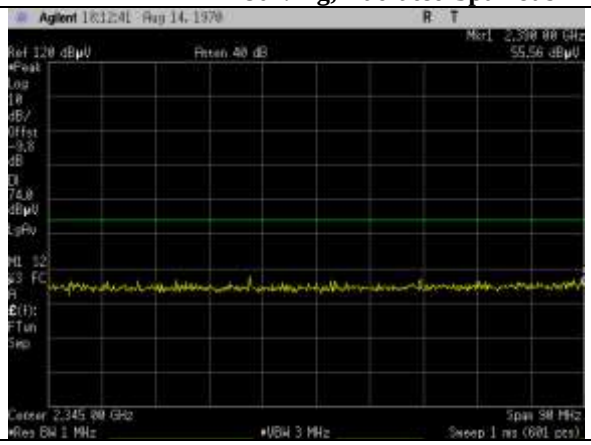
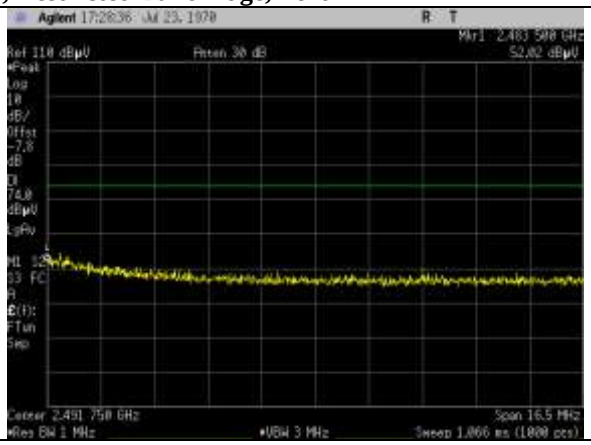
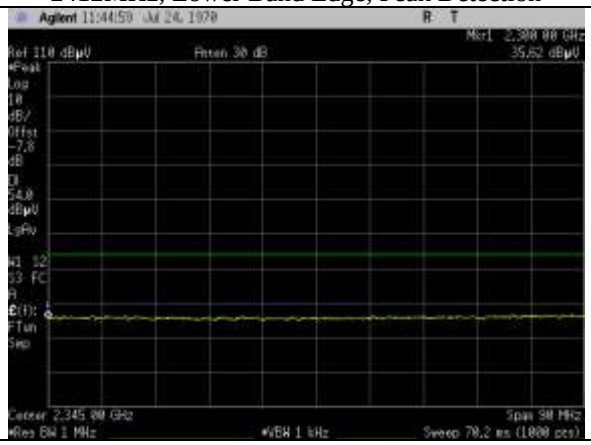
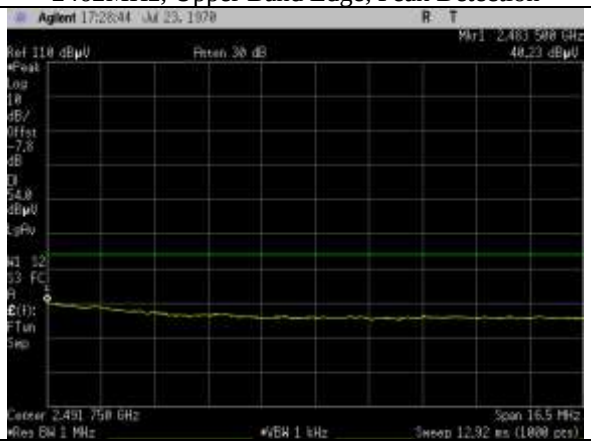
Note: The fundamental transmission was suppressed with the use of a band reject filter in the above plots

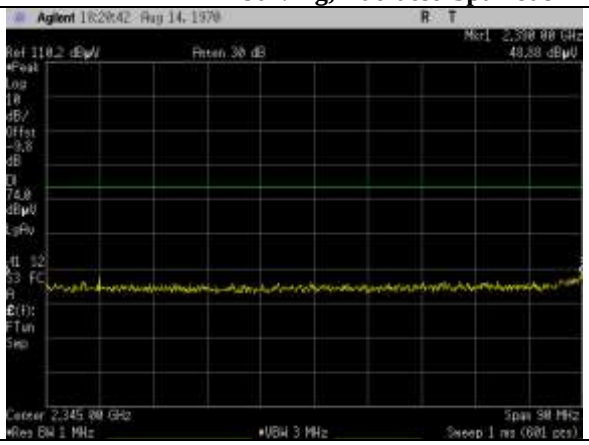
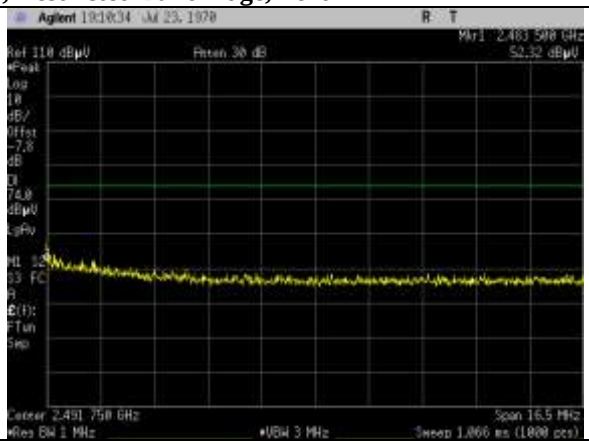
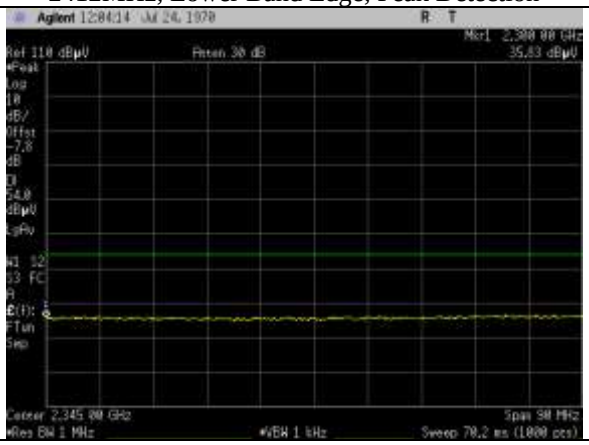
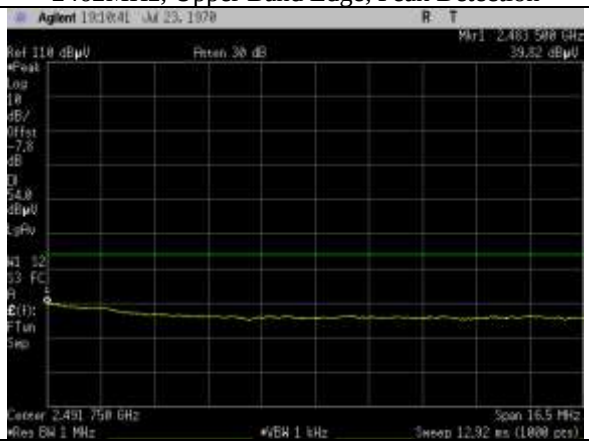
802.11n (40MHz), Radiated Spurious Emissions, Port 2, Average Detection

2422MHz (1GHz – 26GHz)

2437MHz (1GHz – 26GHz)

2452MHz (1GHz – 26GHz)

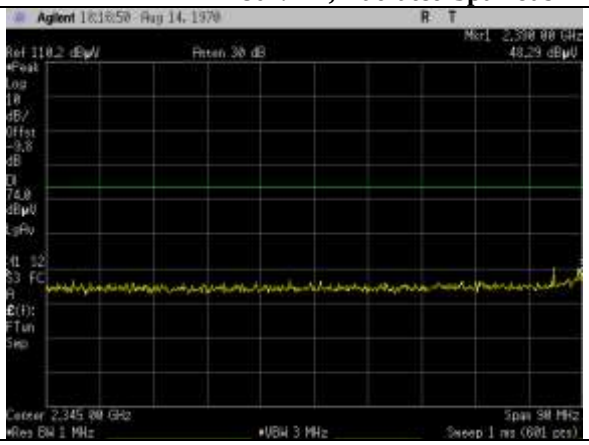
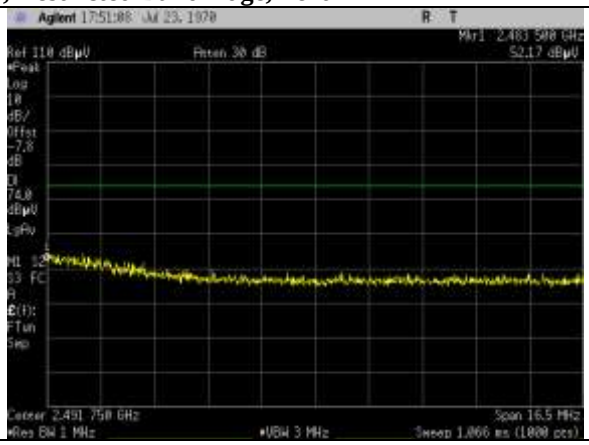
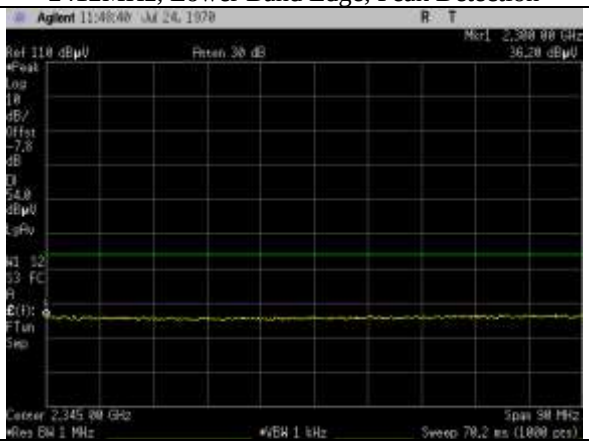
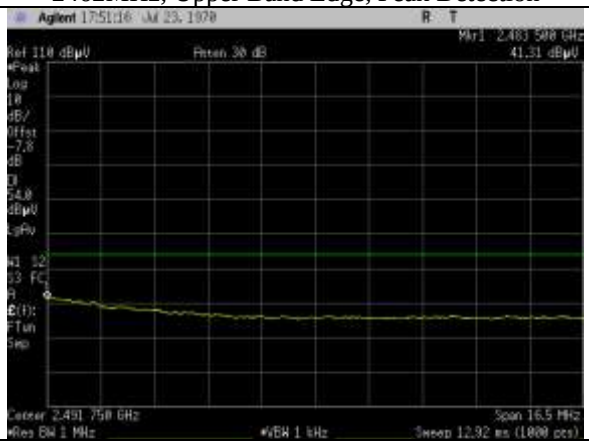
Note: The fundamental transmission was suppressed with the use of a band reject filter in the above plots

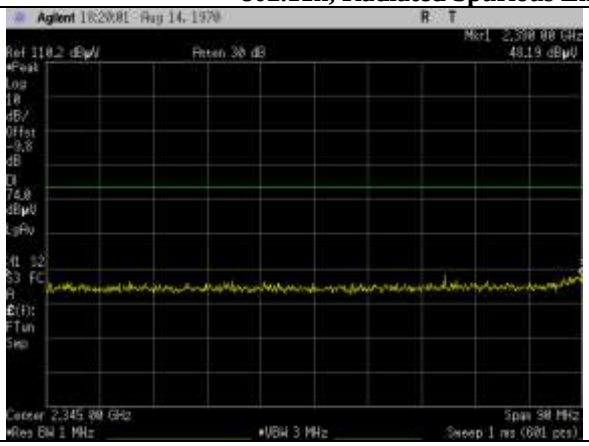
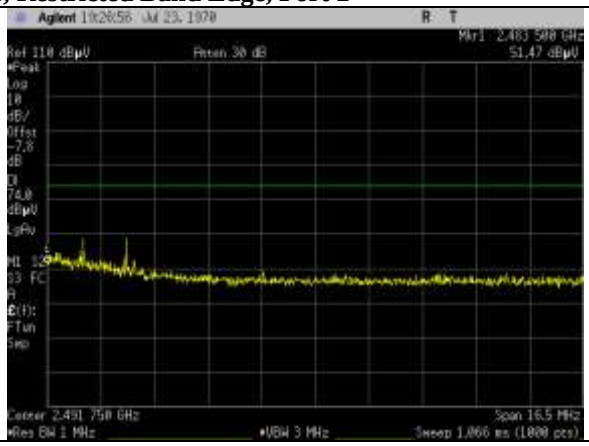
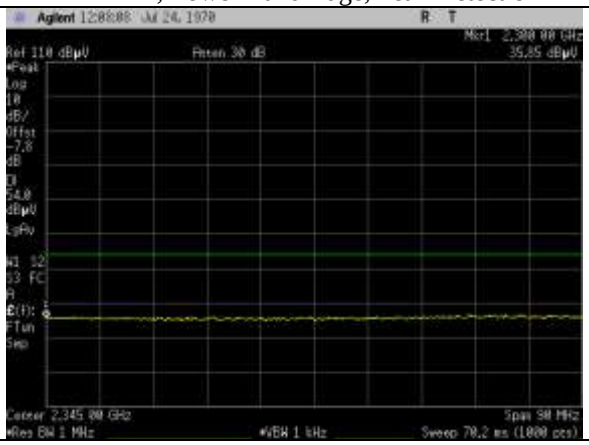
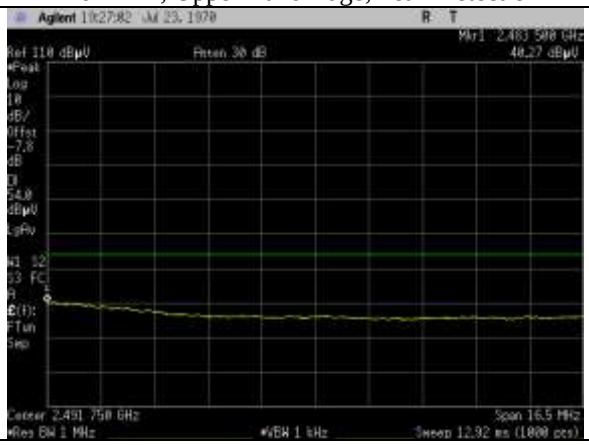
802.11b, Radiated Spurious Emissions, Restricted Band Edge, Port 1	
	
2412MHz, Lower Band Edge, Peak Detection	2462MHz, Upper Band Edge, Peak Detection
	
2412MHz, Lower Band Edge, Avg Detection	2462MHz, Upper Band Edge, Avg Detection

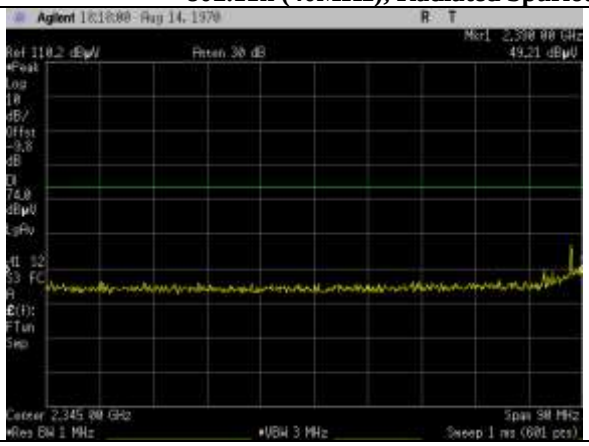
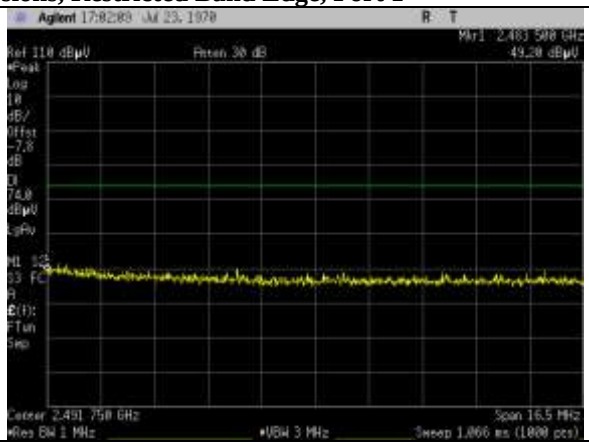
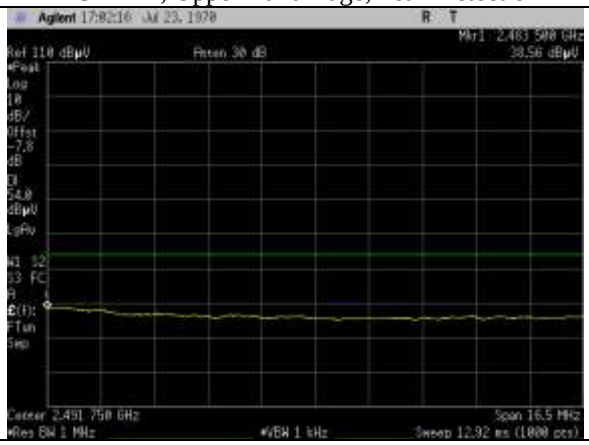
802.11b, Radiated Spurious Emissions, Restricted Band Edge, Port 2	
	
2412MHz, Lower Band Edge, Peak Detection	2462MHz, Upper Band Edge, Peak Detection
	
2412MHz, Lower Band Edge, Avg Detection	2462MHz, Upper Band Edge, Avg Detection

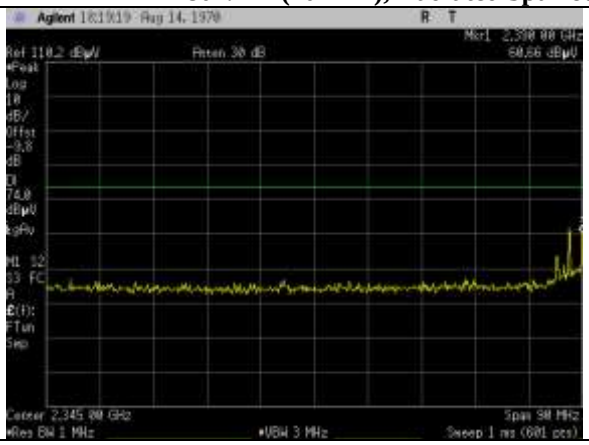
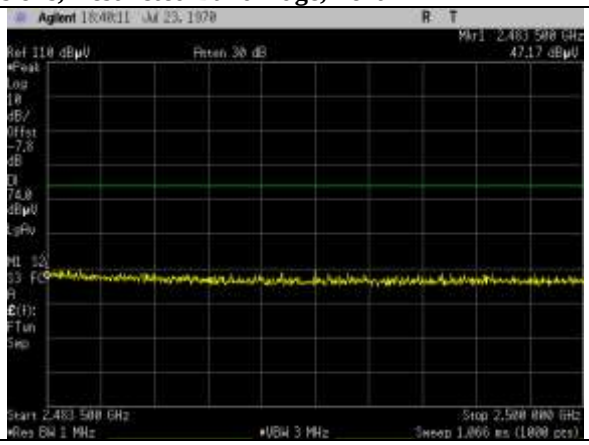
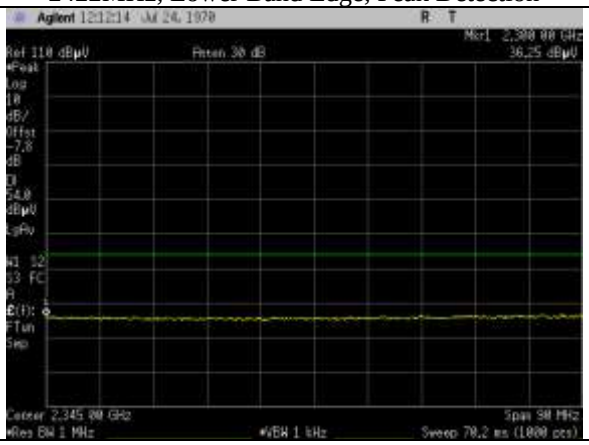
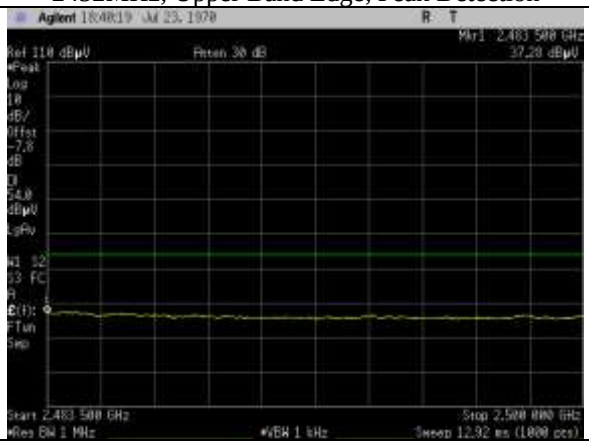
802.11g, Radiated Spurious Emissions, Restricted Band Edge, Port 1	
	
2412MHz, Lower Band Edge, Peak Detection	2462MHz, Upper Band Edge, Peak Detection
	
2412MHz, Lower Band Edge, Avg Detection	2462MHz, Upper Band Edge, Avg Detection

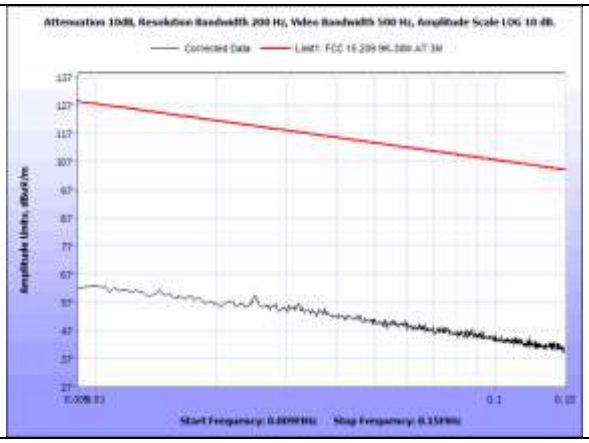
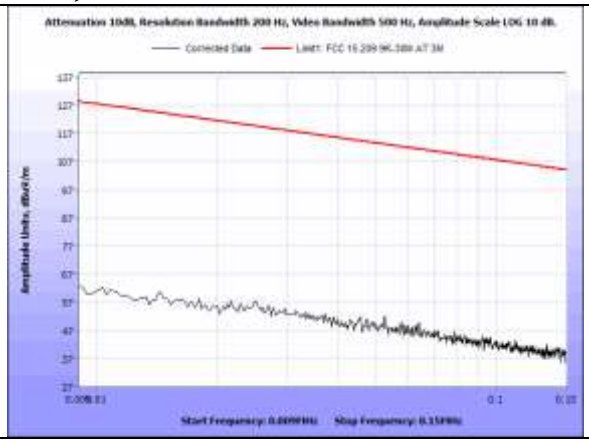
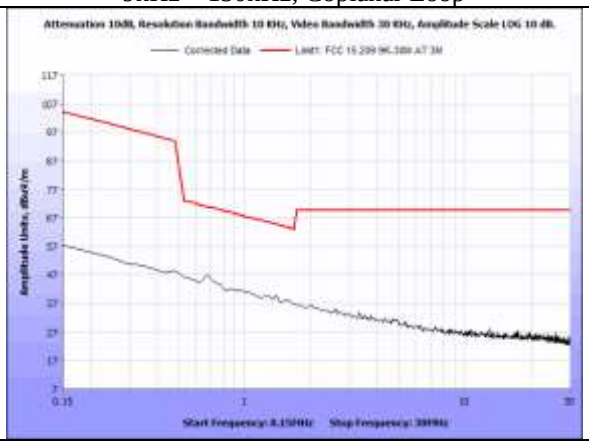
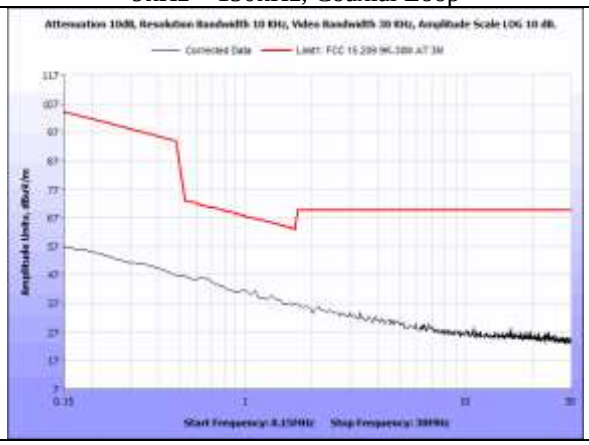
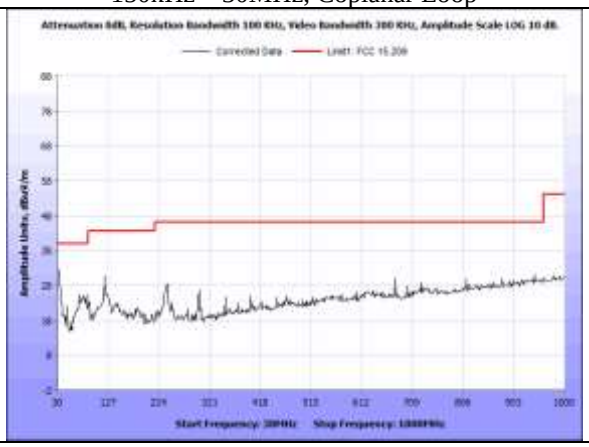
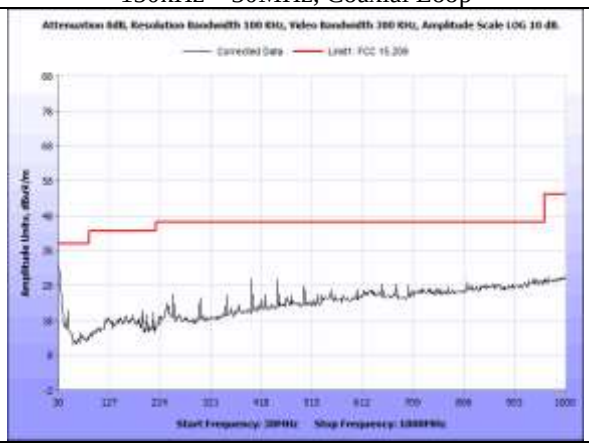
802.11g, Radiated Spurious Emissions, Restricted Band Edge, Port 2	
	
2412MHz, Lower Band Edge, Peak Detection	2462MHz, Upper Band Edge, Peak Detection
	
2412MHz, Lower Band Edge, Avg Detection	2462MHz, Upper Band Edge, Avg Detection

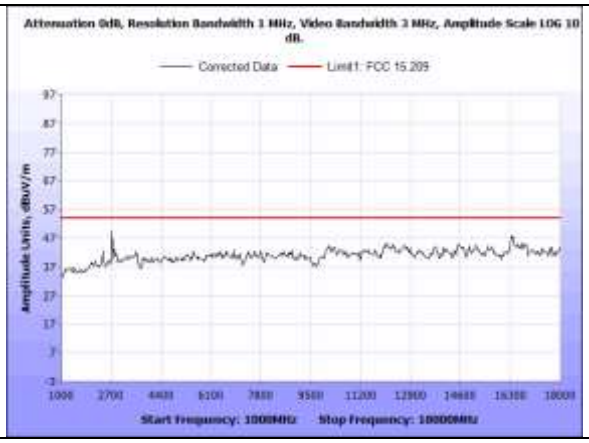
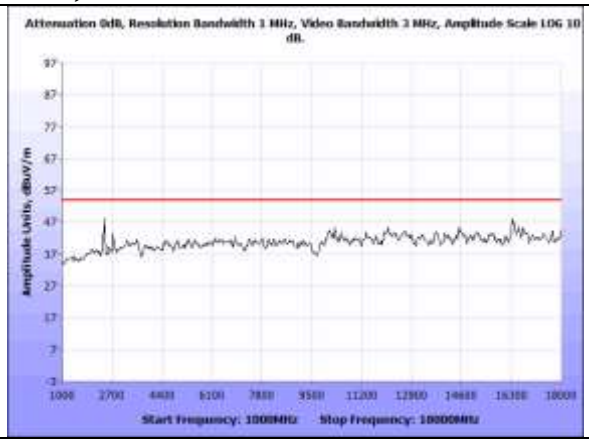
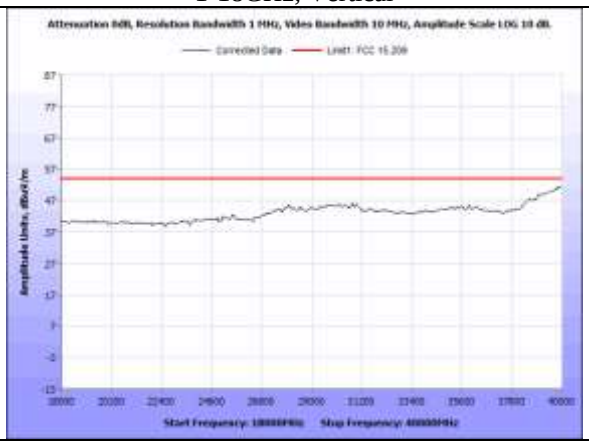
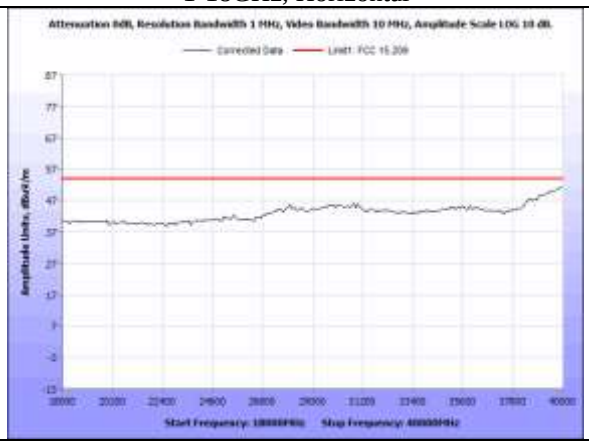
802.11n, Radiated Spurious Emissions, Restricted Band Edge, Port 1	
	
2412MHz, Lower Band Edge, Peak Detection	2462MHz, Upper Band Edge, Peak Detection
	
2412MHz, Lower Band Edge, Avg Detection	2462MHz, Upper Band Edge, Avg Detection

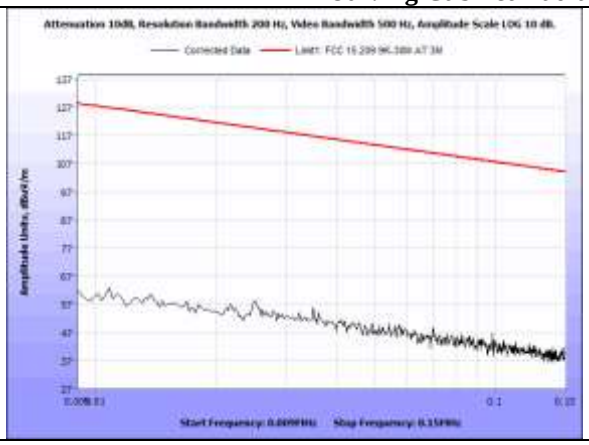
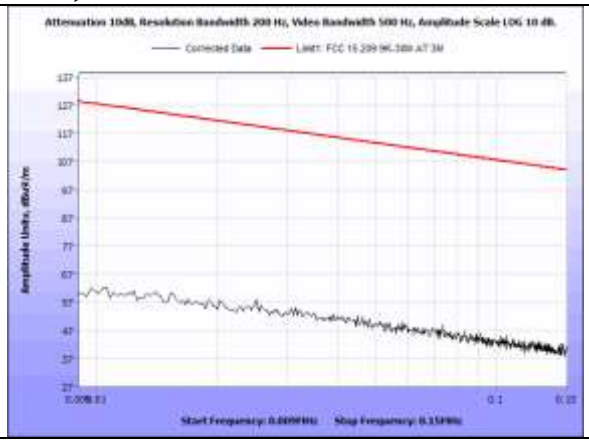
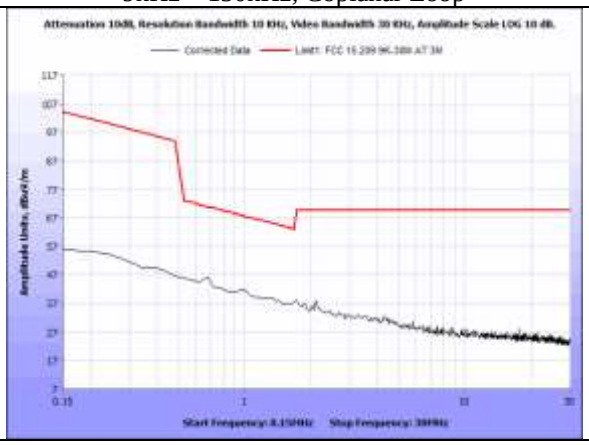
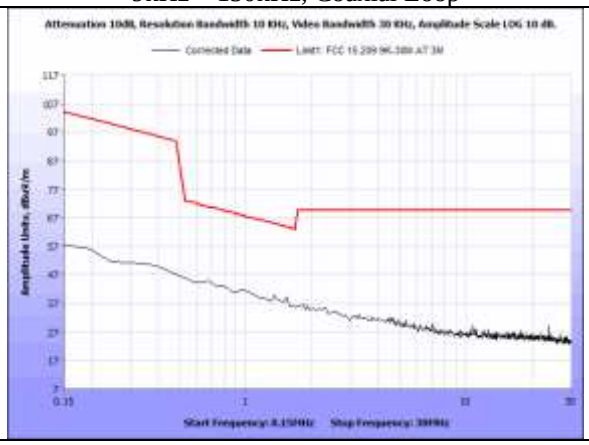
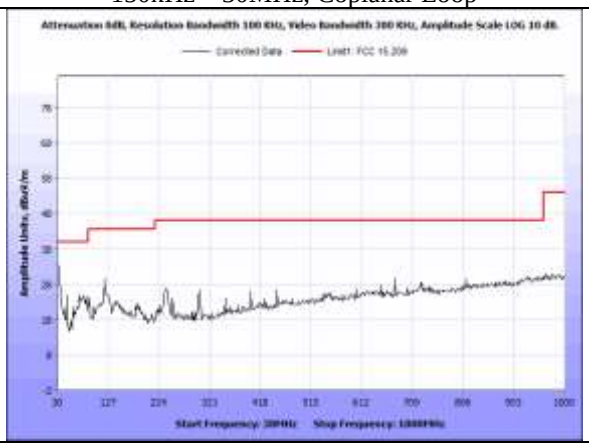
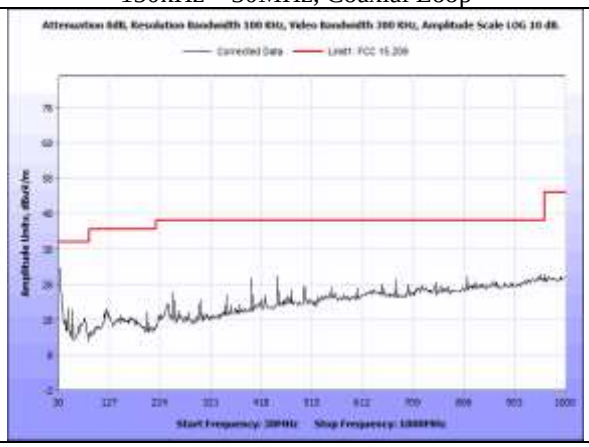
802.11n, Radiated Spurious Emissions, Restricted Band Edge, Port 2	
	
2412MHz, Lower Band Edge, Peak Detection	2462MHz, Upper Band Edge, Peak Detection
	
2412MHz, Lower Band Edge, Avg Detection	2462MHz, Upper Band Edge, Avg Detection

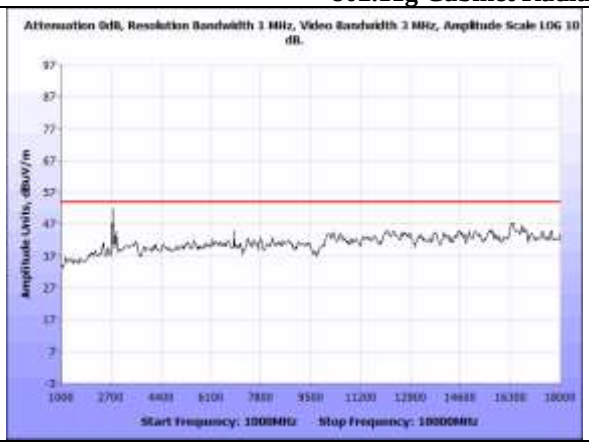
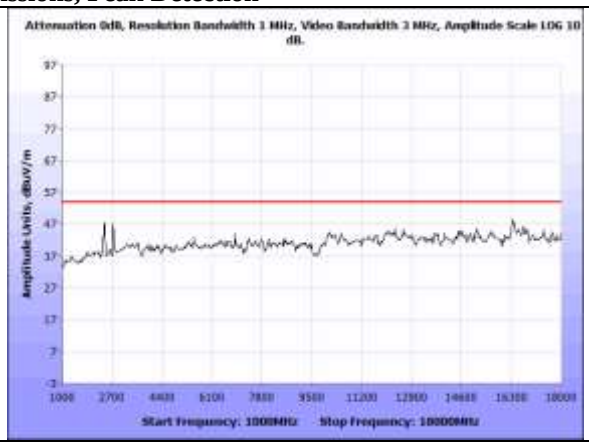
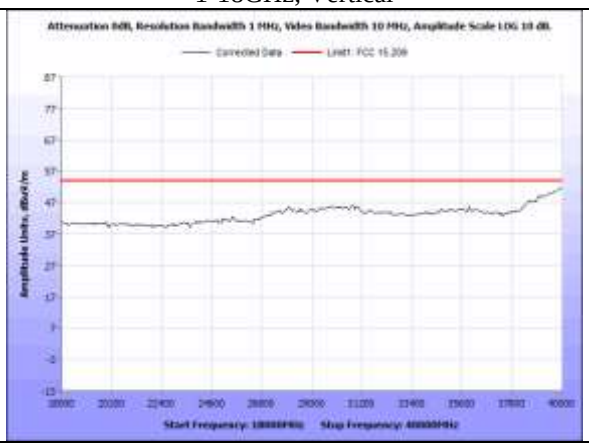
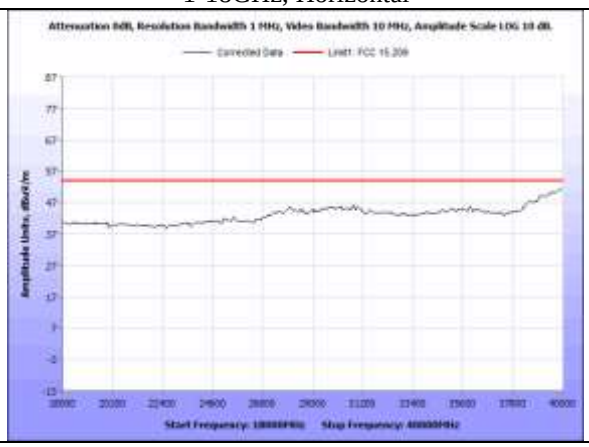
802.11n (40MHz), Radiated Spurious Emissions, Restricted Band Edge, Port 1	
	
2422MHz, Lower Band Edge, Peak Detection	2452MHz, Upper Band Edge, Peak Detection
	
2422MHz, Lower Band Edge, Avg Detection	2452MHz, Upper Band Edge, Avg Detection

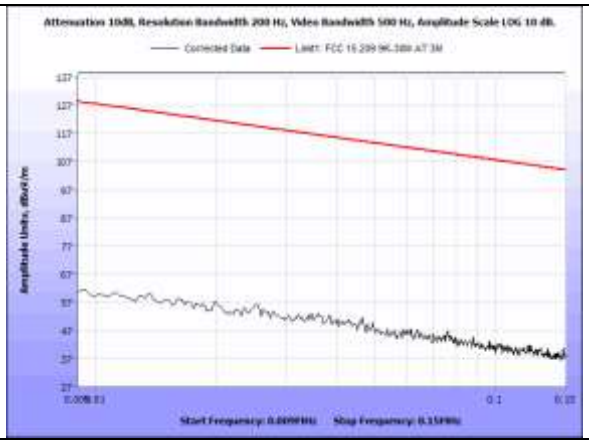
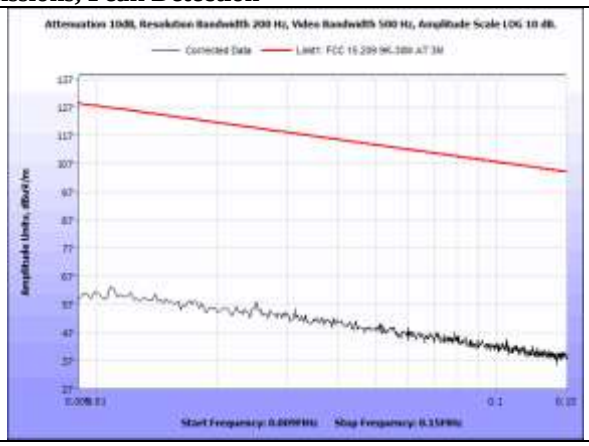
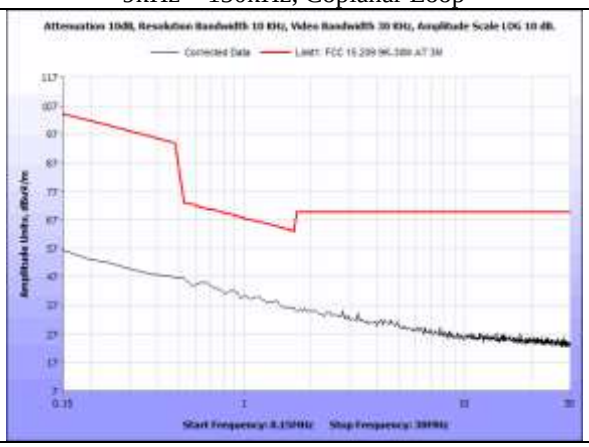
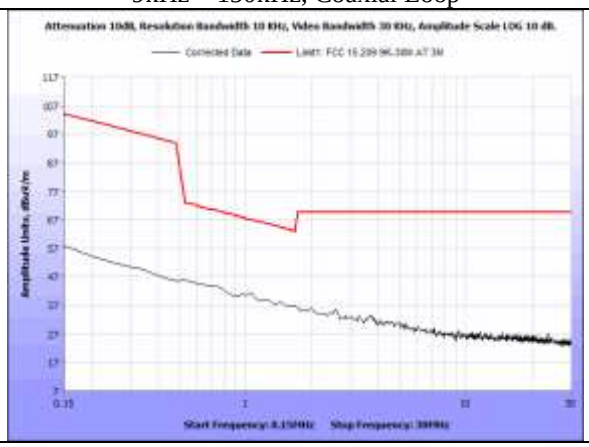
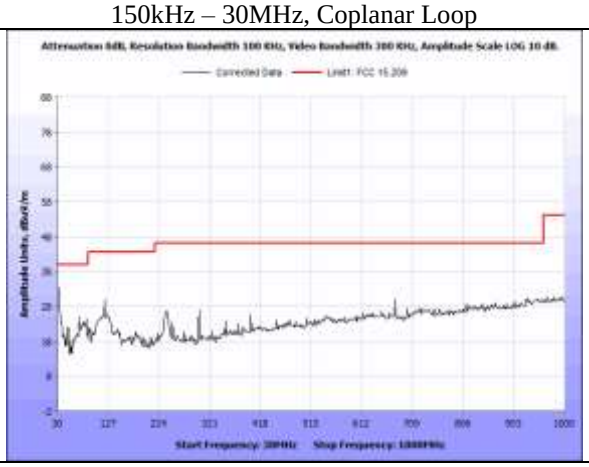
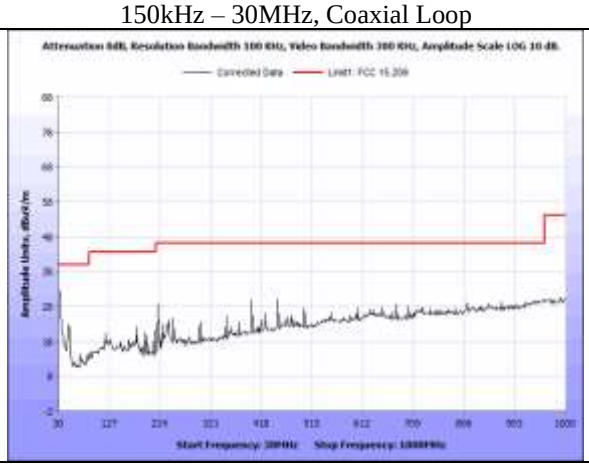
802.11n (40MHz), Radiated Spurious Emissions, Restricted Band Edge, Port 2	
	
2422MHz, Lower Band Edge, Peak Detection	2452MHz, Upper Band Edge, Peak Detection
	
2422MHz, Lower Band Edge, Avg Detection	2452MHz, Upper Band Edge, Avg Detection

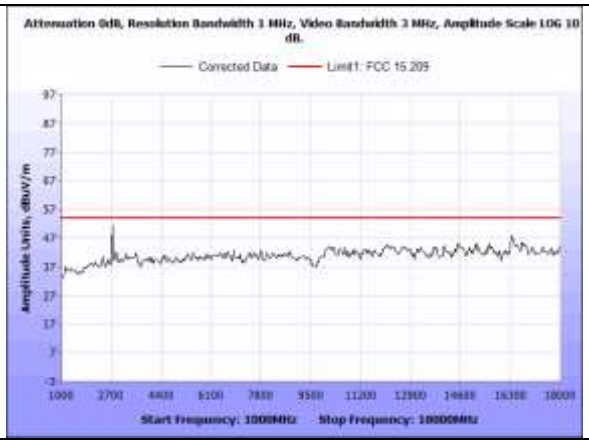
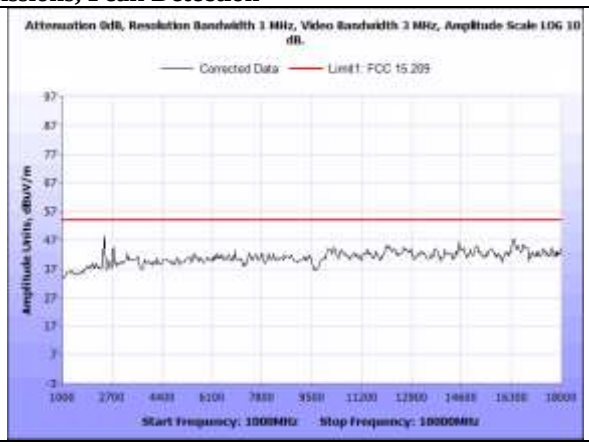
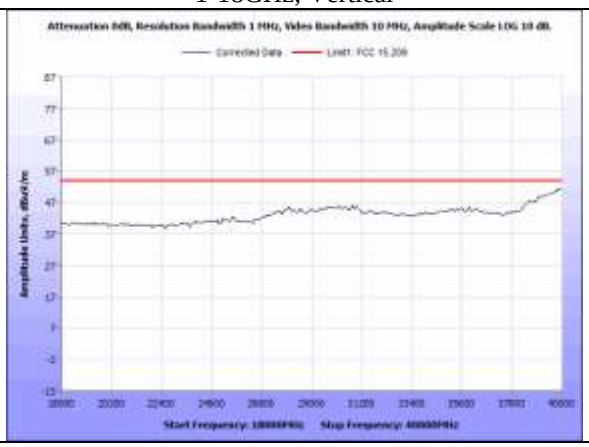
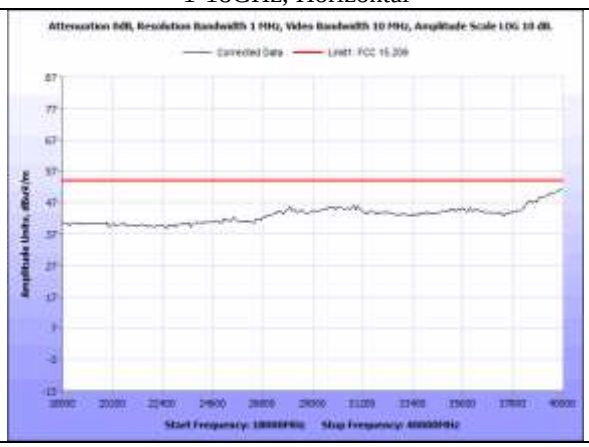
802.11b Cabinet Radiated Emissions, Peak Detection	
	
9kHz – 150kHz, Coplanar Loop	9kHz – 150kHz, Coaxial Loop
	
150kHz – 30MHz, Coplanar Loop	150kHz – 30MHz, Coaxial Loop
	
30MHz -1GHz, Vertical	30MHz – 1GHz, Horizontal

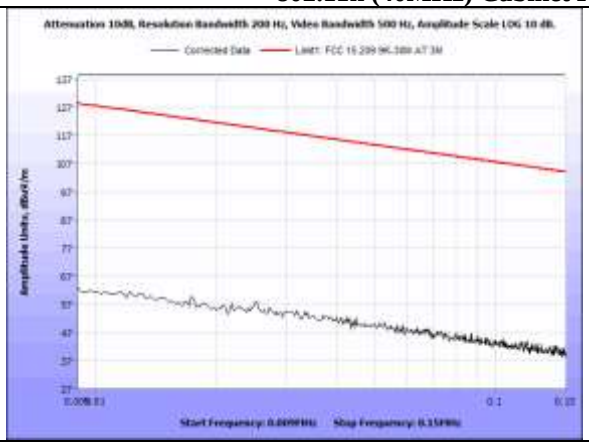
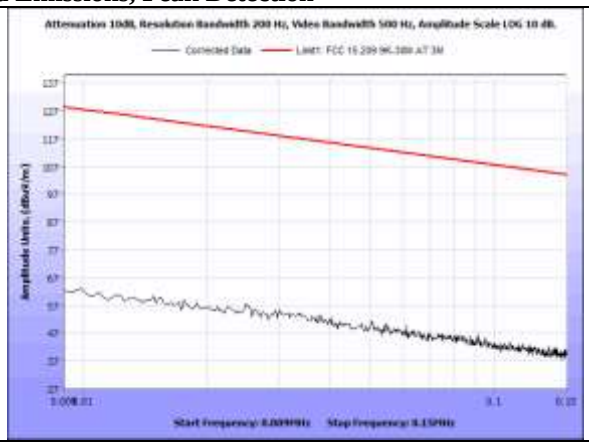
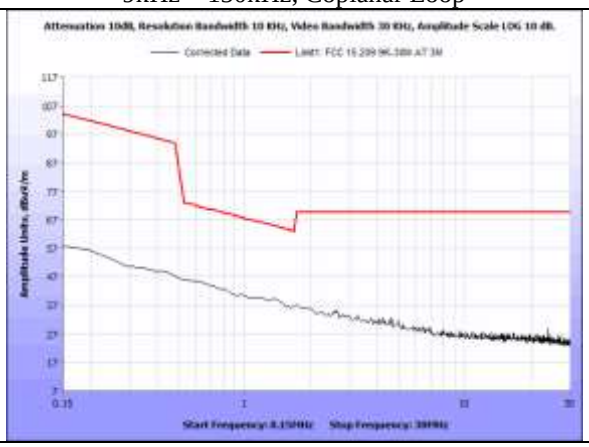
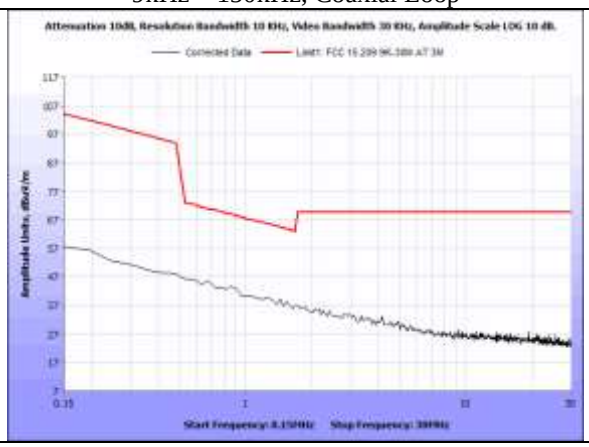
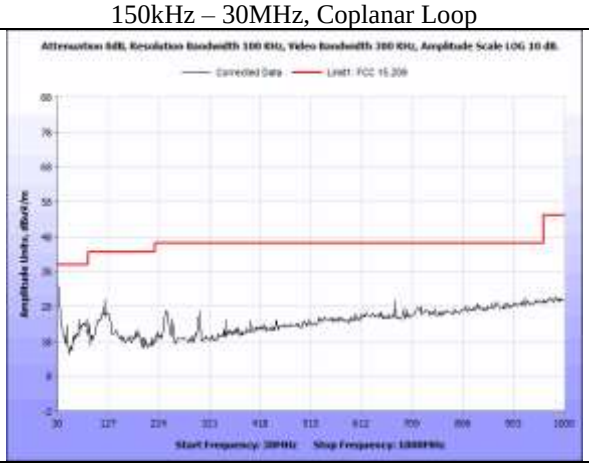
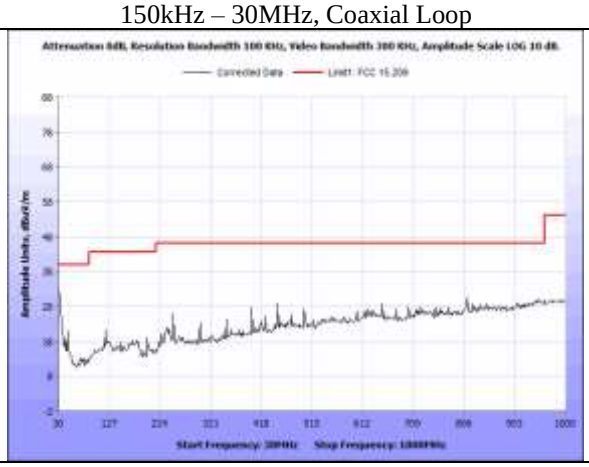
802.11b Cabinet Radiated Emissions, Peak Detection	
	
1-18GHz, Vertical	1-18GHz, Horizontal
	
18-40GHz, Vertical	18-40GHz, Horizontal

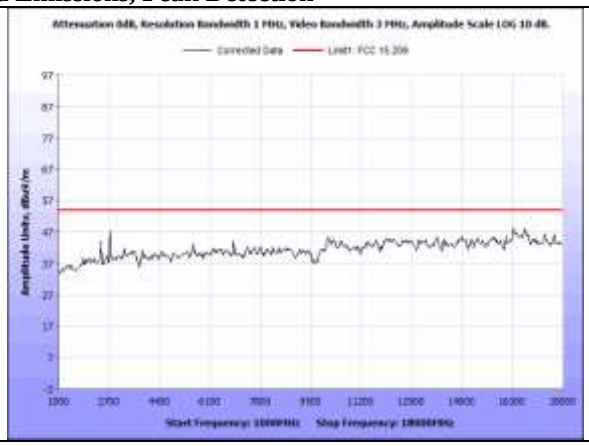
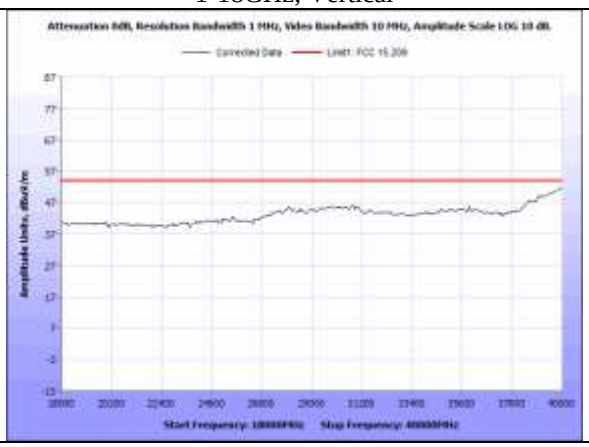
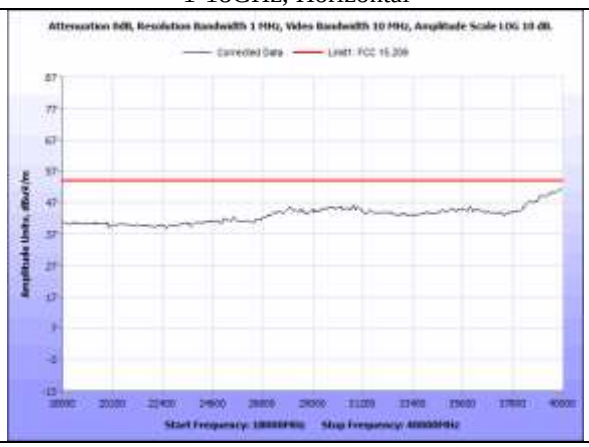
802.11g Cabinet Radiated Emissions, Peak Detection	
	
9kHz – 150kHz, Coplanar Loop	9kHz – 150kHz, Coaxial Loop
	
150kHz – 30MHz, Coplanar Loop	150kHz – 30MHz, Coaxial Loop
	
30MHz -1GHz, Vertical	30MHz – 1GHz, Horizontal

802.11g Cabinet Radiated Emissions, Peak Detection	
	
1-18GHz, Vertical	1-18GHz, Horizontal
	
18-40GHz, Vertical	18-40GHz, Horizontal

802.11n Cabinet Radiated Emissions, Peak Detection	
	
9kHz – 150kHz, Coplanar Loop	9kHz – 150kHz, Coaxial Loop
	
150kHz – 30MHz, Coplanar Loop	150kHz – 30MHz, Coaxial Loop
	
30MHz -1GHz, Vertical	30MHz – 1GHz, Horizontal

802.11n Cabinet Radiated Emissions, Peak Detection	
	
1-18GHz, Vertical	1-18GHz, Horizontal
	
18-40GHz, Vertical	18-40GHz, Horizontal

802.11n (40MHz) Cabinet Radiated Emissions, Peak Detection	
	
9kHz – 150kHz, Coplanar Loop	9kHz – 150kHz, Coaxial Loop
	
150kHz – 30MHz, Coplanar Loop	150kHz – 30MHz, Coaxial Loop
	
30MHz -1GHz, Vertical	30MHz – 1GHz, Horizontal

802.11n (40MHz) Cabinet Radiated Emissions, Peak Detection	
	
1-18GHz, Vertical	1-18GHz, Horizontal
	
18-40GHz, Vertical	18-40GHz, Horizontal

Worst Case Cabinet Spurious Emissions (802.11b, Horizontal Polarity)

Frequency (Hz)	Meter Reading (dBuV)	RBW (Hz)	Antenna Factor (dBuV)	Cable Factor (dB)	Preamp Factor (dB)	Corrected Measurement dBuV/m	Limit 1, FCC 15.209 dBuV/m	Margin 1 (dB)
30.0E+06	34.8	100000	22.8	1.16	-25.16	33.6	40	-6.4
31.5545E+06	32.93	100000	21.92	1.27	-25.06	31.07	40	-8.93
33.109E+06	31.42	100000	21.25	1.36	-24.97	29.05	40	-10.95
2.4167E+09	50.86	1000000	31.89	3.51	-37.87	48.39	54	-5.61
10.2901E+09	45.29	1000000	37.07	8.29	-45.32	45.33	54	-8.67
12.0881E+09	46.47	1000000	38.55	9.26	-48.97	45.31	54	-8.69
14.5401E+09	46.12	1000000	39.01	10.29	-49.75	45.66	54	-8.34
16.3381E+09	48.51	1000000	40.5	11.66	-52.51	48.17	54	-5.83
16.3654E+09	47.53	1000000	40.53	11.69	-52.54	47.21	54	-6.79
19.516E+09	29.23	1000000	44.55	7.22	-40.49	40.5	54	-13.5
21.9487E+09	27.44	1000000	45.16	8.13	-41.24	39.49	54	-14.51
24.3814E+09	26.85	1000000	45.34	9.12	-40.36	40.94	54	-13.06
26.8141E+09	28.64	1000000	45.95	10.29	-42.68	42.2	54	-11.8

Worst Case Cabinet Spurious Emissions (802.11b Vertical Polarity)

Frequency (Hz)	Meter Reading (dBuV)	RBW (Hz)	Antenna Factor (dBuV)	Cable Factor (dB)	Preamp Factor (dB)	Corrected Measurement dBuV/m	Limit 1, FCC 15.209 dBuV/m	Margin 1 (dB)
30.0E+06	34.24	100000	22.3	1.16	-25.16	32.54	40	-7.46
71.9712E+06	38.5	100000	10.19	1.84	-25.21	25.33	40	-14.67
120.1603E+06	37.6	100000	15.92	2.31	-25.14	30.69	43.5	-12.81
2.7163E+09	52.04	1000000	32.25	3.69	-38.82	49.16	54	-4.84
12.1154E+09	46.34	1000000	38.6	9.33	-49.1	45.17	54	-8.83
16.3381E+09	48	1000000	40.48	11.66	-52.51	47.64	54	-6.36
16.3654E+09	47.38	1000000	40.52	11.69	-52.54	47.05	54	-6.95
16.3926E+09	47.81	1000000	40.55	11.71	-52.57	47.5	54	-6.5
16.4199E+09	47.36	1000000	40.6	11.78	-52.99	46.75	54	-7.25
19.516E+09	29.21	1000000	44.4	7.22	-40.49	40.34	54	-13.66
21.9487E+09	27.69	1000000	45.23	8.13	-41.24	39.81	54	-14.19
24.3814E+09	26.94	1000000	45.43	9.12	-40.36	41.13	54	-12.87
26.8141E+09	28.56	1000000	45.93	10.29	-42.68	42.11	54	-11.89

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) RF Conducted Spurious Emissions Requirements

Test Requirement: **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.

Test Procedure: For intentional radiators with a digital device portion which operates below 10 GHz, the spectrum was investigated as per §15.33(a)(1) and §15.33(a)(4); i.e., the lowest RF signal generated or used in the device up to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

The transmitter was connected directly to a Spectrum Analyzer through an attenuator. The power level was set to the maximum level. The RBW was set to 100 kHz. The VBW was set to 3x the RBW. The spectrum analyzer was set to an auto sweep time and a peak detector was used. Measurements were carried out at the low, mid and high channels.

See following pages for detailed test results with RF Conducted Spurious Emissions.

Test Results: The EUT was compliant with the Conducted Spurious Emission limits of **§15.247(d)**.

Test Engineer(s): Bryan Taylor

Test Date(s): 5/2/2022

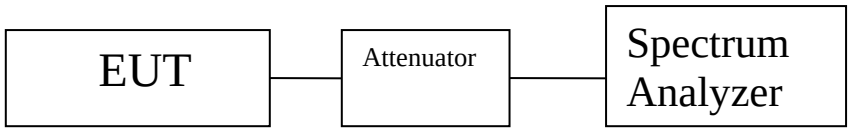
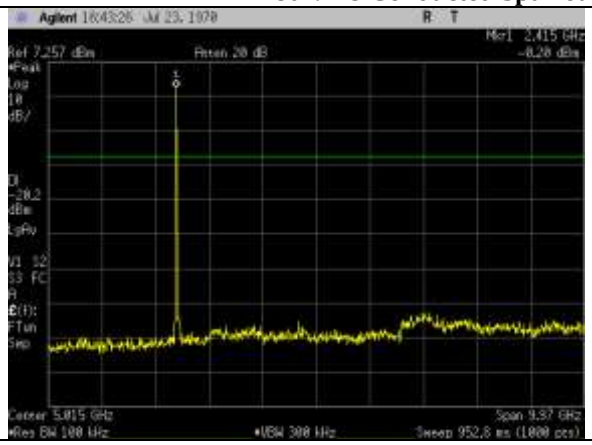
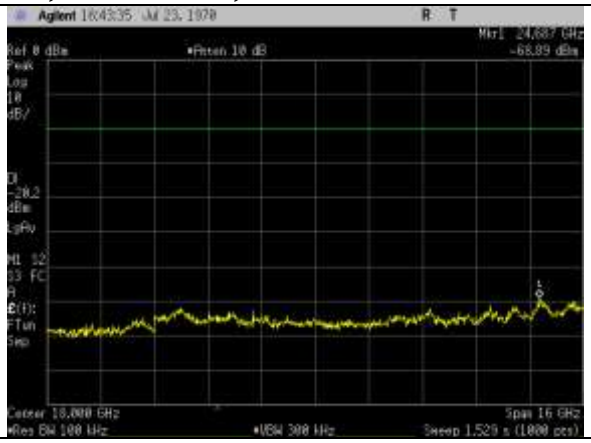
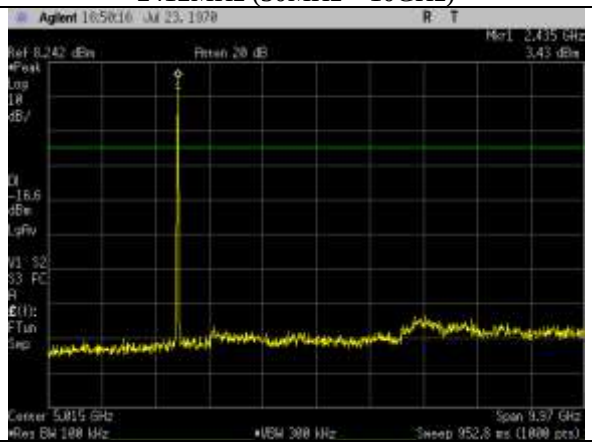
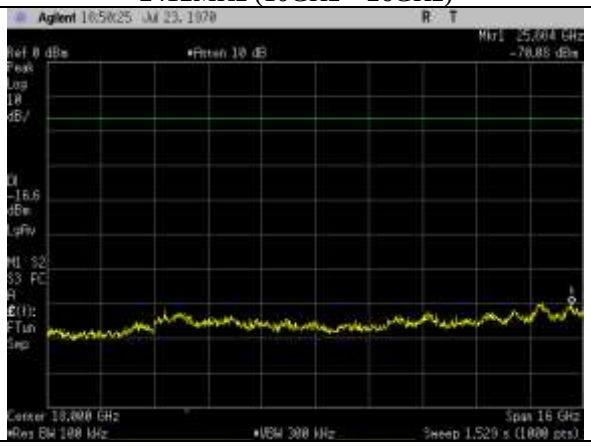
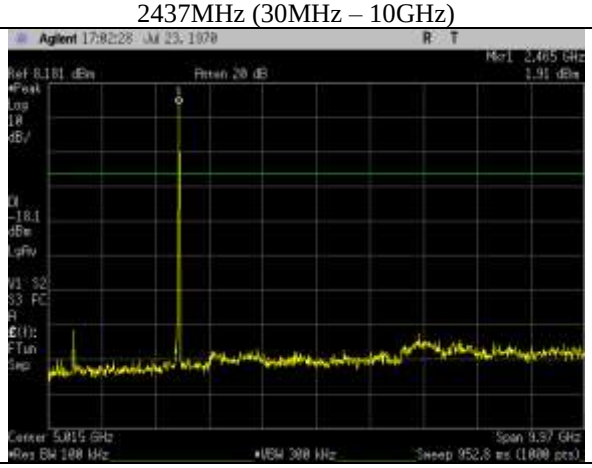
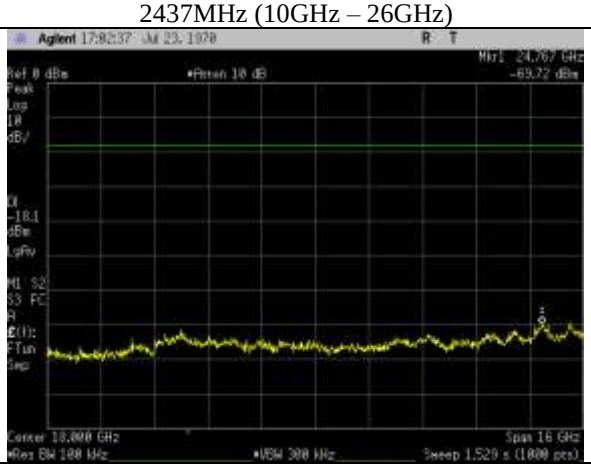
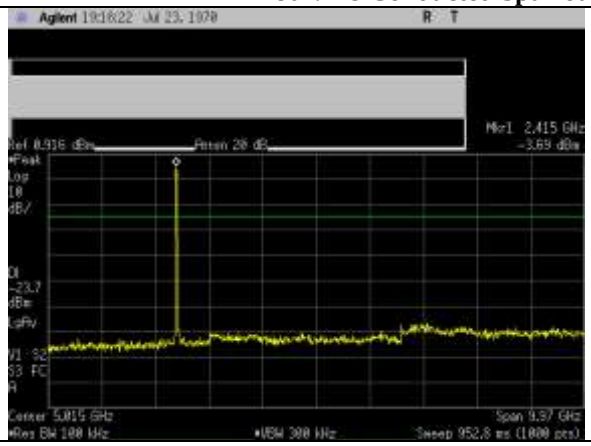
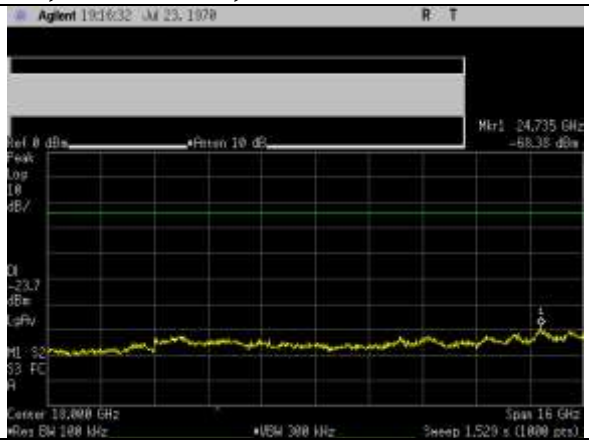
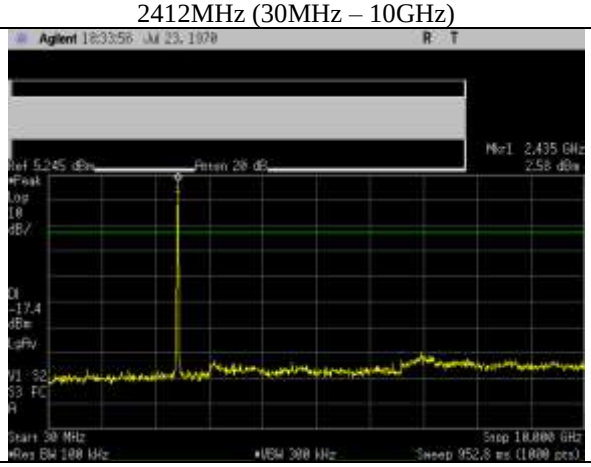
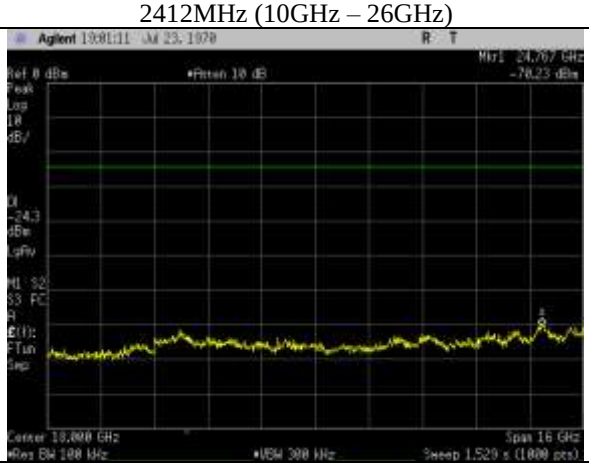
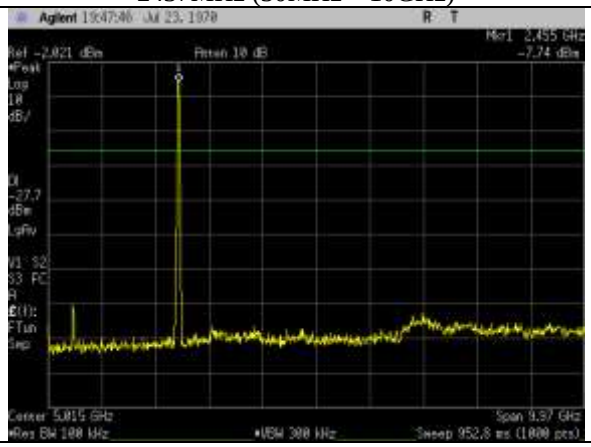
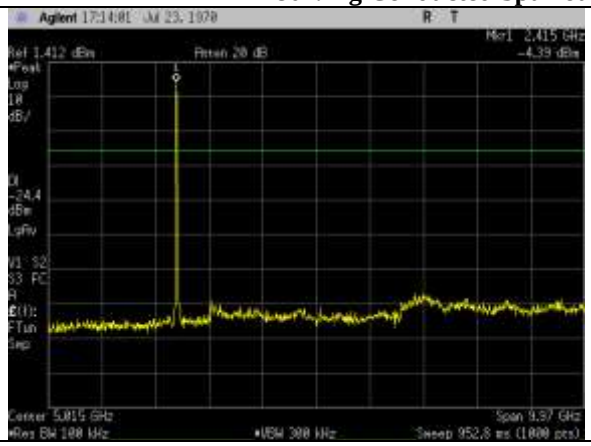
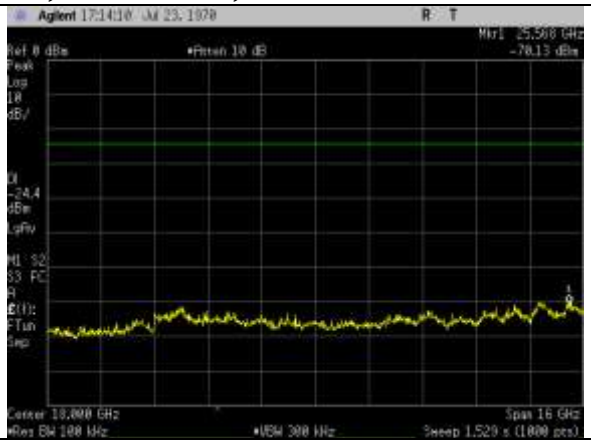
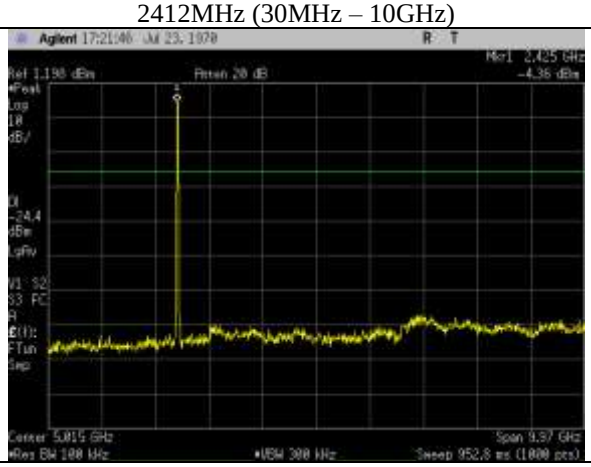
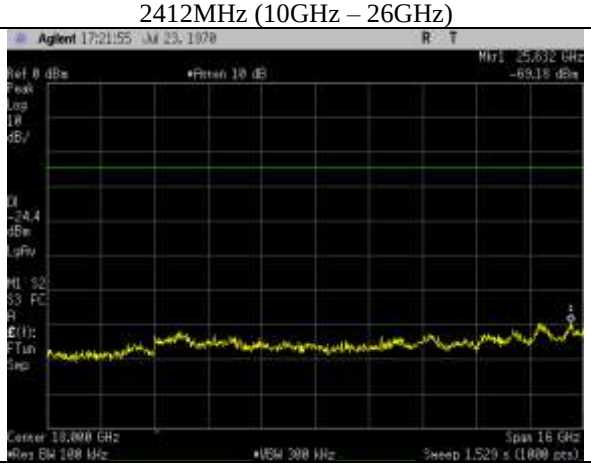
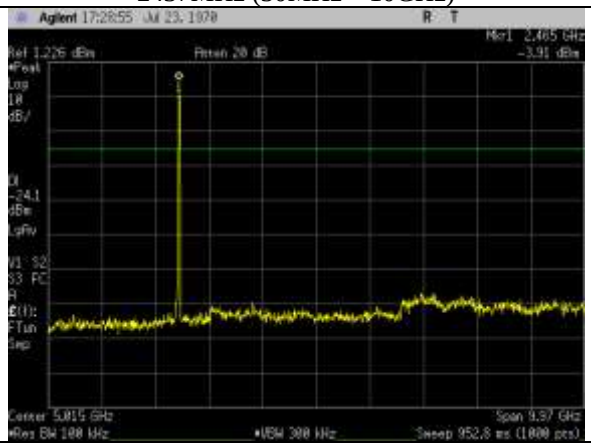
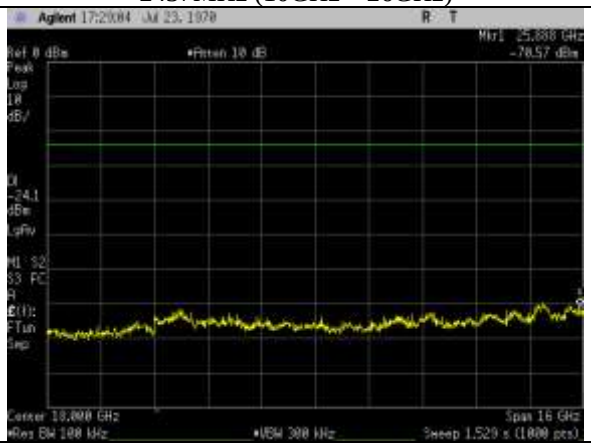


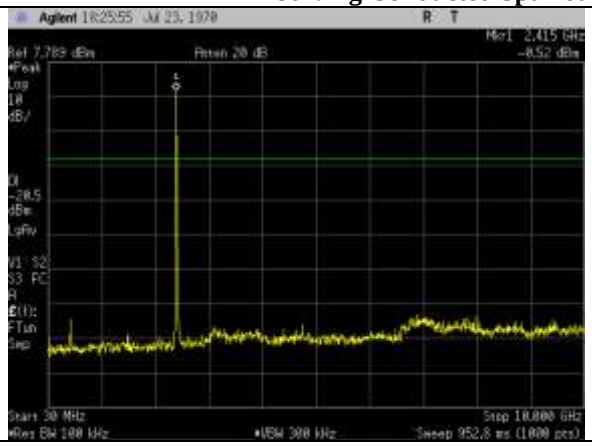
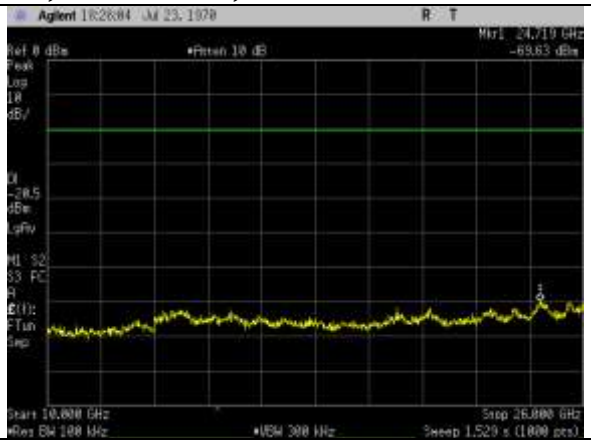
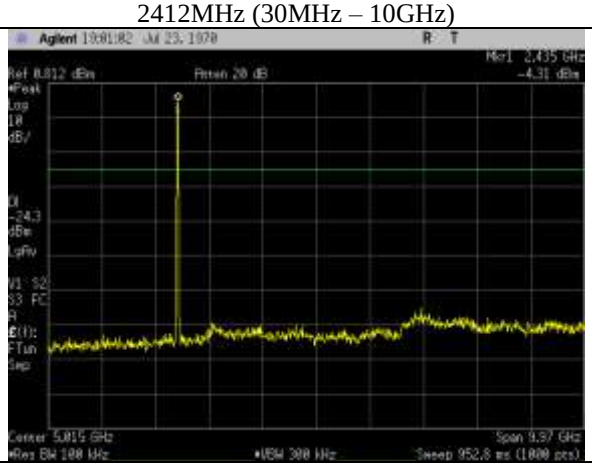
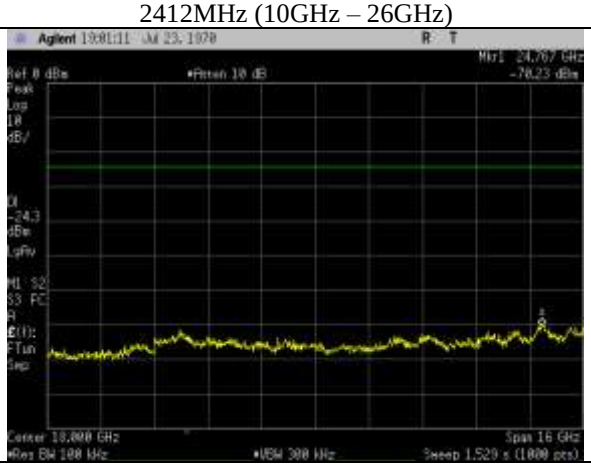
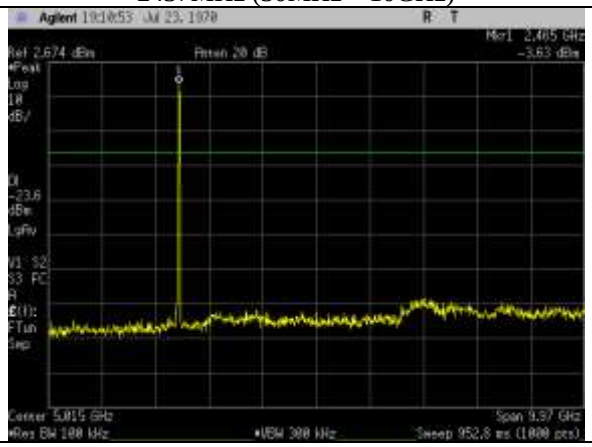
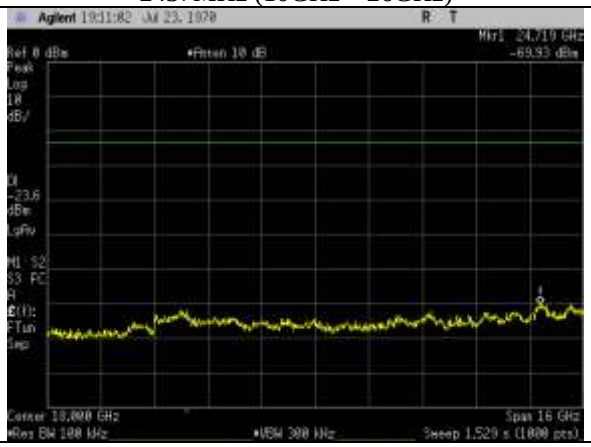
Figure 4. Block Diagram, Conducted Spurious Emissions Test Setup

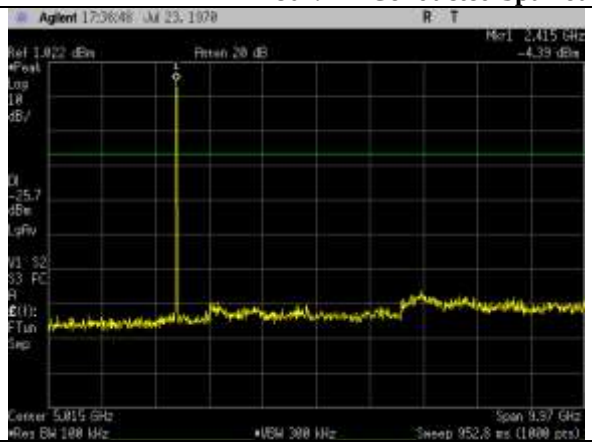
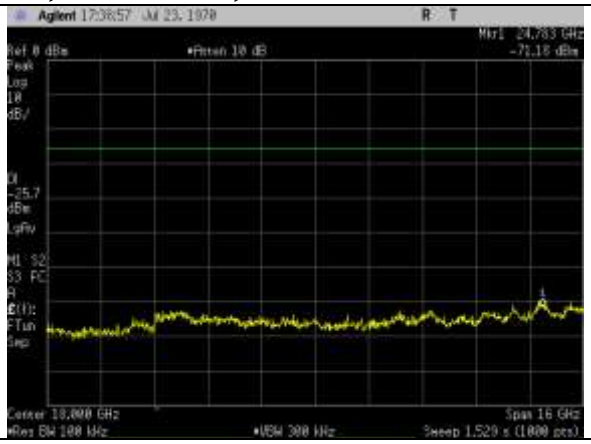
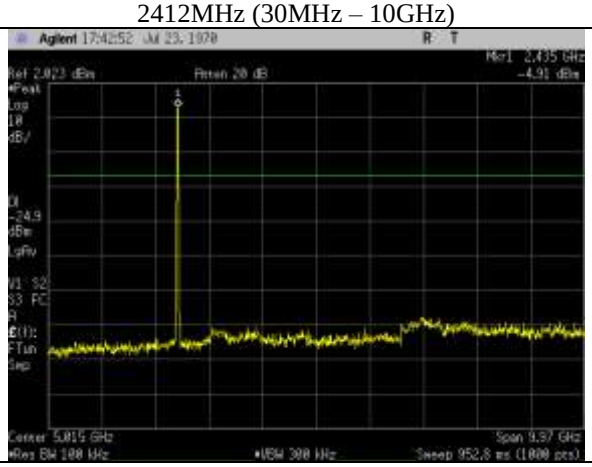
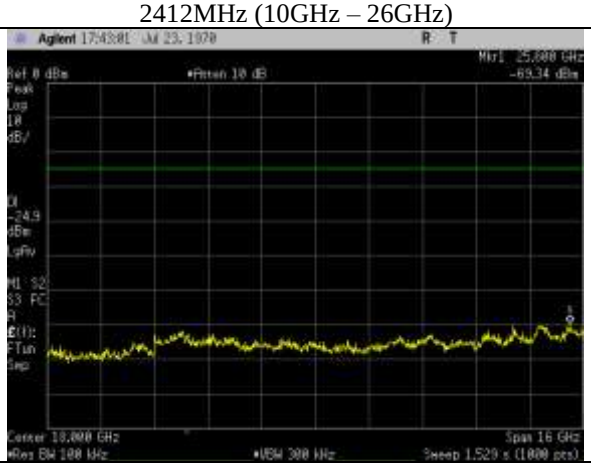
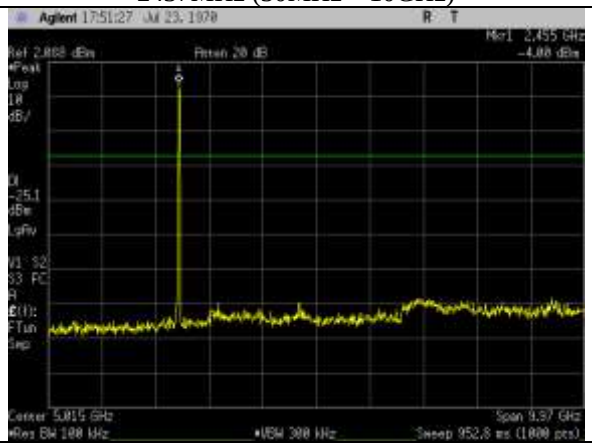
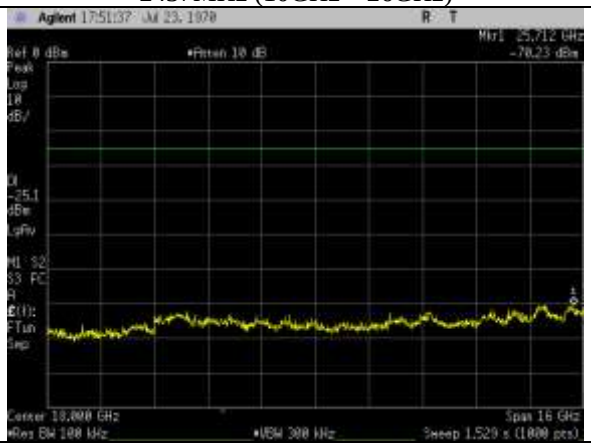
Conducted Spurious Emissions Test Results

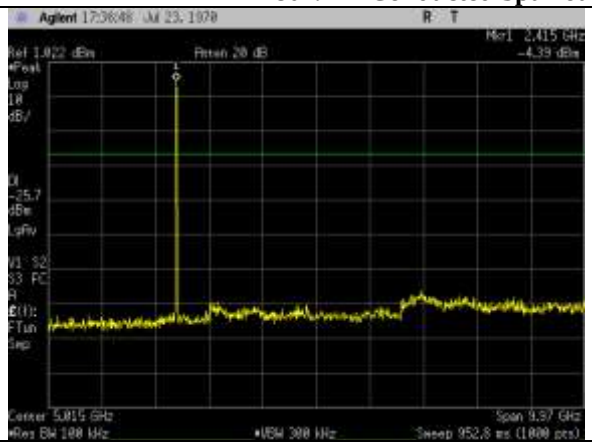
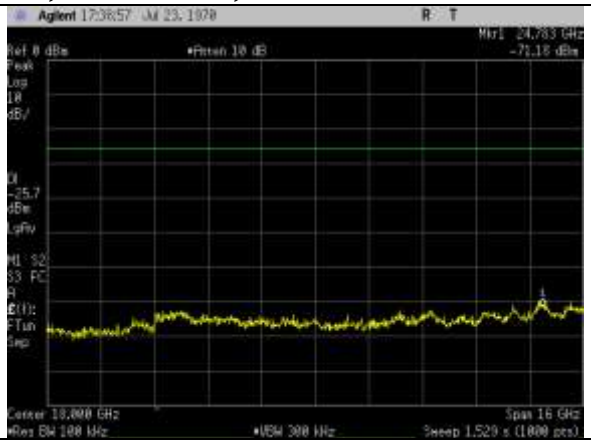
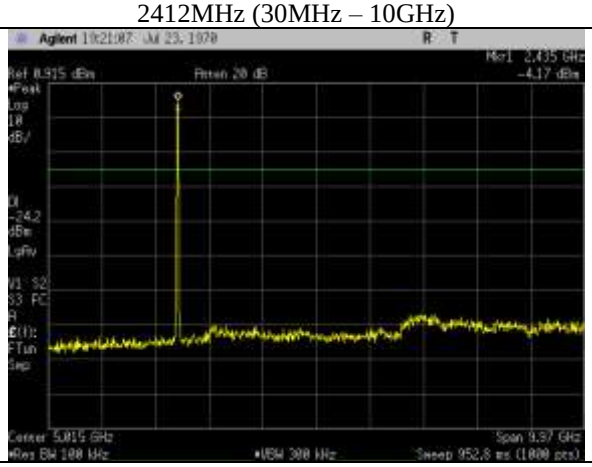
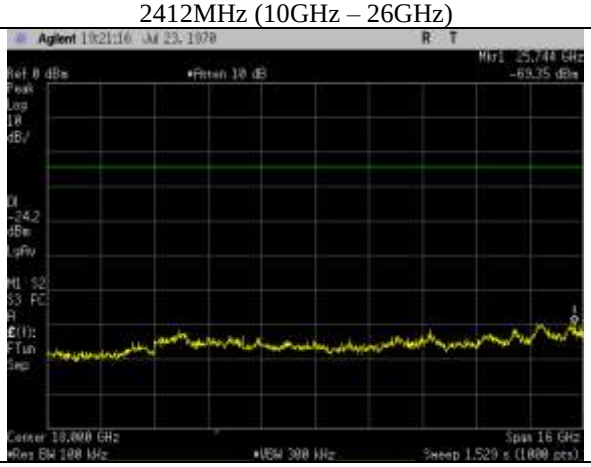
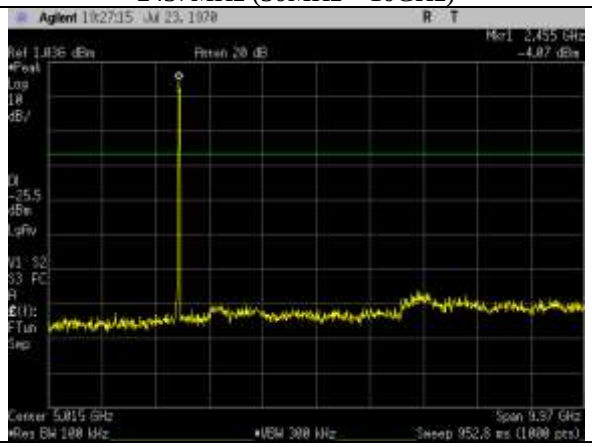
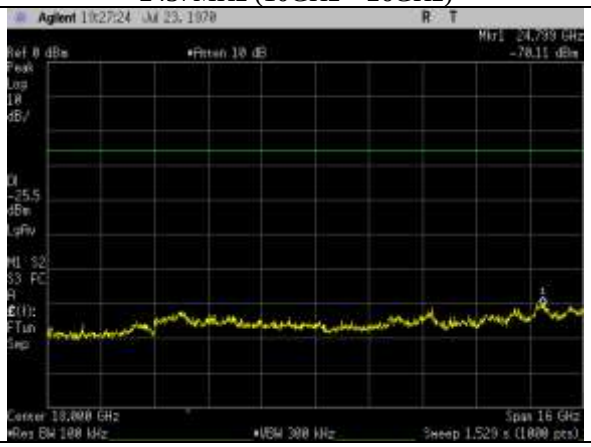
802.11b Conducted Spurious Emissions, Peak Detection, Port 1	
	
2412MHz (30MHz – 10GHz)	2412MHz (10GHz – 26GHz)
	
2437MHz (30MHz – 10GHz)	2437MHz (10GHz – 26GHz)
	
2462MHz (30MHz – 10GHz)	2462MHz (10GHz – 26GHz)

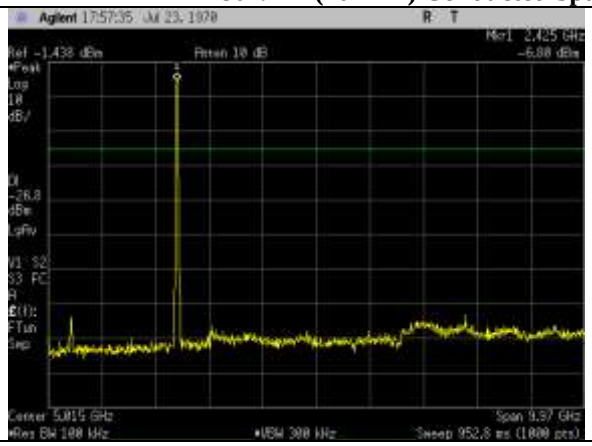
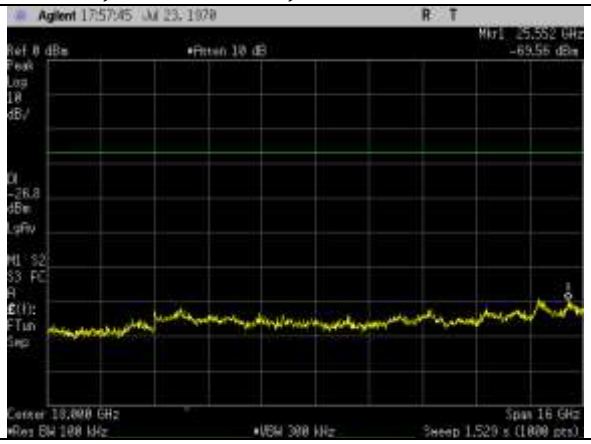
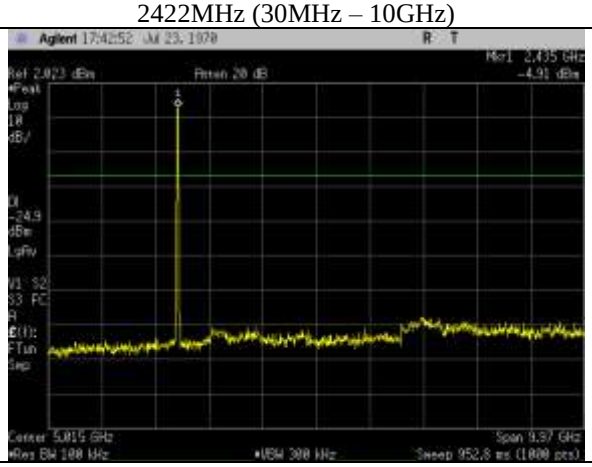
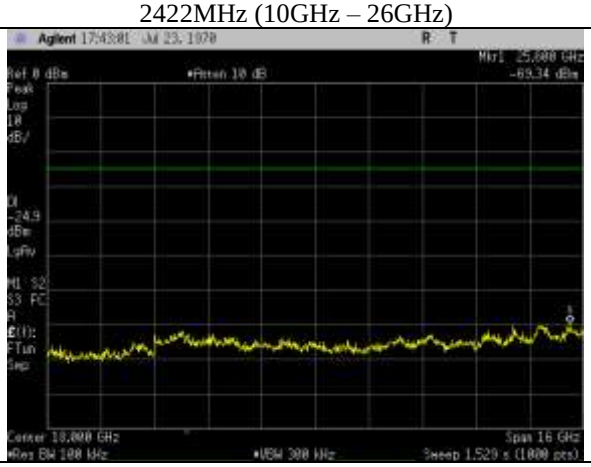
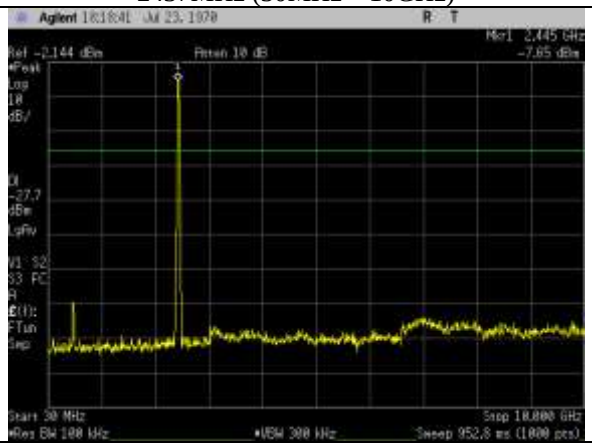
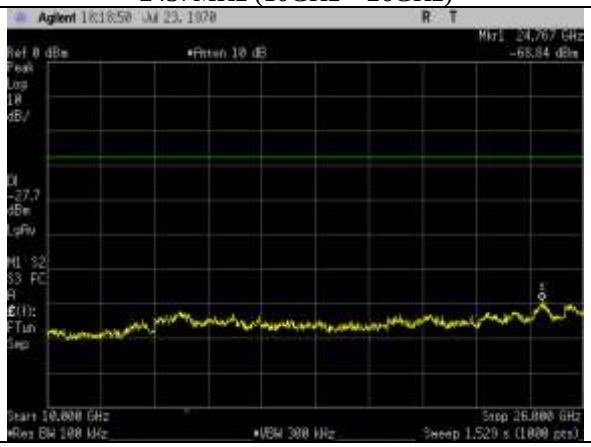
802.11b Conducted Spurious Emissions, Peak Detection, Port 2	
	
2412MHz (30MHz – 10GHz)	2412MHz (10GHz – 26GHz)
	
2437MHz (30MHz – 10GHz)	2437MHz (10GHz – 26GHz)
	
2462MHz (30MHz – 10GHz)	2462MHz (10GHz – 26GHz)

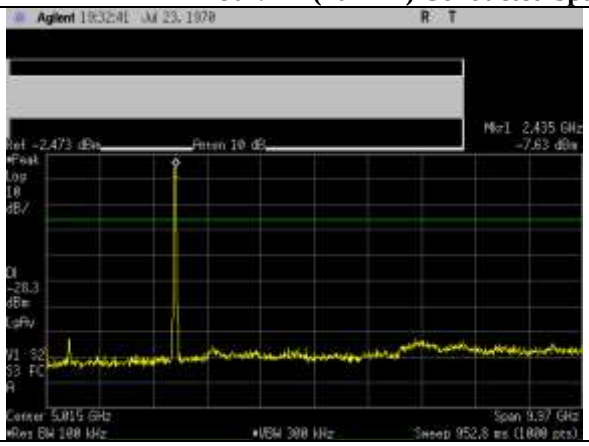
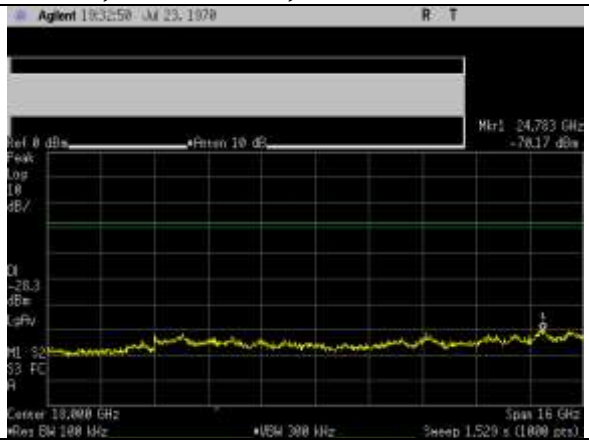
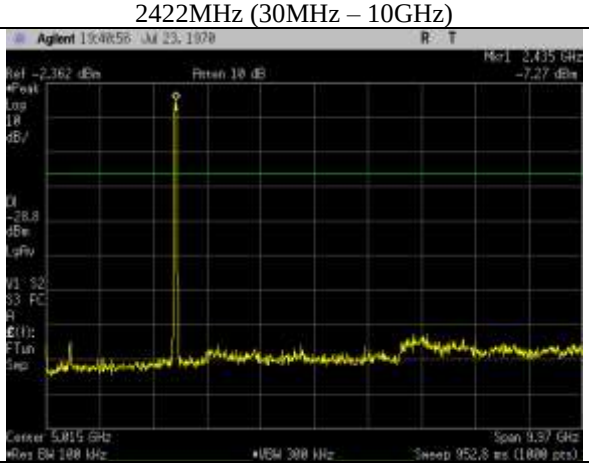
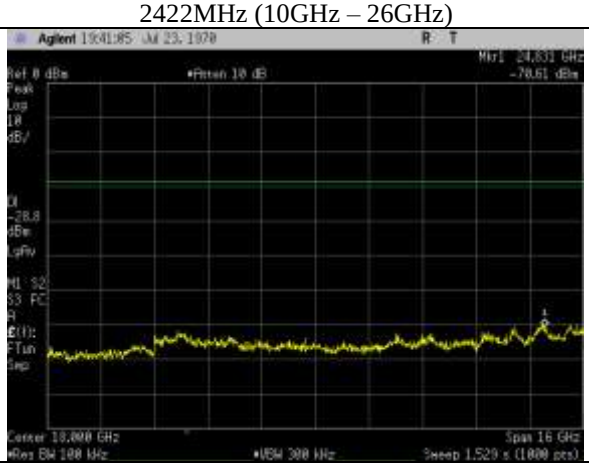
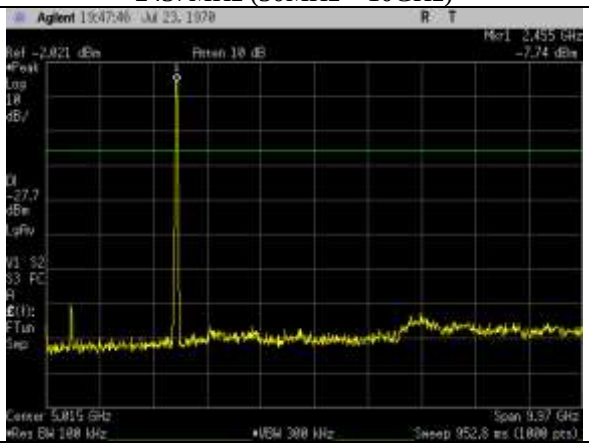
802.11g Conducted Spurious Emissions, Peak Detection, Port 1	
	
2412MHz (30MHz – 10GHz)	2412MHz (10GHz – 26GHz)
	
2437MHz (30MHz – 10GHz)	2437MHz (10GHz – 26GHz)
	
2462MHz (30MHz – 10GHz)	2462MHz (10GHz – 26GHz)

802.11g Conducted Spurious Emissions, Peak Detection, Port 2	
	
2412MHz (30MHz – 10GHz)	2412MHz (10GHz – 26GHz)
	
2437MHz (30MHz – 10GHz)	2437MHz (10GHz – 26GHz)
	
2462MHz (30MHz – 10GHz)	2462MHz (10GHz – 26GHz)

802.11n Conducted Spurious Emissions, Peak Detection, Port 1	
	
2412MHz (30MHz – 10GHz)	2412MHz (10GHz – 26GHz)
	
2437MHz (30MHz – 10GHz)	2437MHz (10GHz – 26GHz)
	
2462MHz (30MHz – 10GHz)	2462MHz (10GHz – 26GHz)

802.11n Conducted Spurious Emissions, Peak Detection, Port 2	
	
2412MHz (30MHz – 10GHz)	2412MHz (10GHz – 26GHz)
	
2437MHz (30MHz – 10GHz)	2437MHz (10GHz – 26GHz)
	
2462MHz (30MHz – 10GHz)	2462MHz (10GHz – 26GHz)

802.11n (40MHz) Conducted Spurious Emissions, Peak Detection, Port 1	
	
2422MHz (30MHz – 10GHz)	2422MHz (10GHz – 26GHz)
	
2437MHz (30MHz – 10GHz)	2437MHz (10GHz – 26GHz)
	
2452MHz (30MHz – 10GHz)	2452MHz (10GHz – 26GHz)

802.11n (40MHz) Conducted Spurious Emissions, Peak Detection, Port 2	
	
2422MHz (30MHz – 10GHz)	2422MHz (10GHz – 26GHz)
	
2437MHz (30MHz – 10GHz)	2437MHz (10GHz – 26GHz)
	
2452MHz (30MHz – 10GHz)	2452MHz (10GHz – 26GHz)

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(e) Peak Power Spectral Density

Test Requirements: **§15.247(e):** For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

Test Procedure: The transmitter was connected directly to a Spectrum Analyzer through an attenuator. The power level was set to the maximum level. The RBW was set between 3kHz and 100 kHz. The VBW was set to 3x the RBW. The spectrum analyzer was set to an auto sweep time and a peak detector was used. Measurements were carried out at the low, mid and high channels.

Test Results: The EUT was compliant with the peak power spectral density limits of **§ 15.247 (e)**.

The peak power spectral density was determined from plots on the following page(s).

Test Engineer: Bryan Taylor

Test Date: 5/3/2022

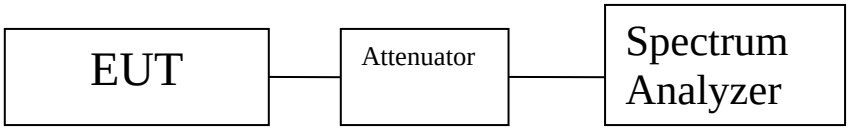
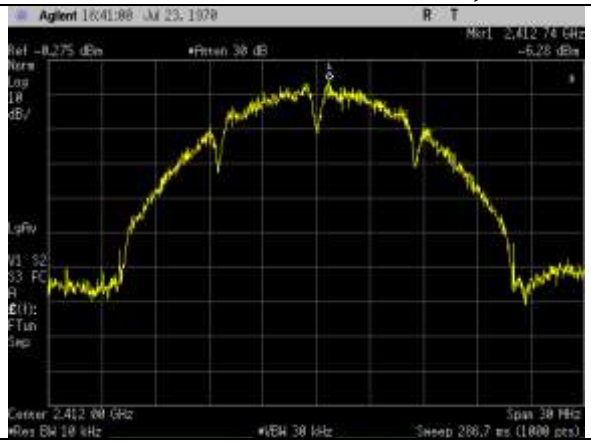
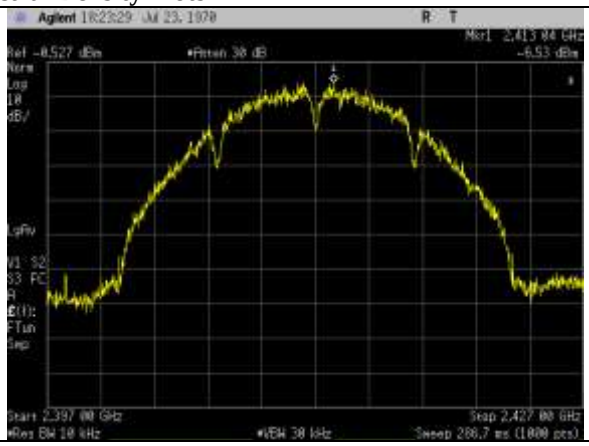
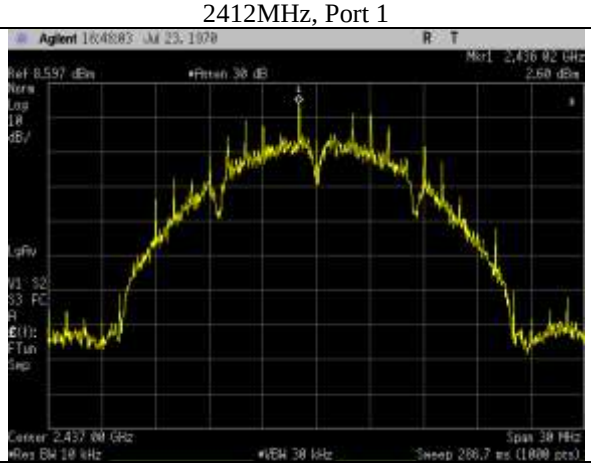
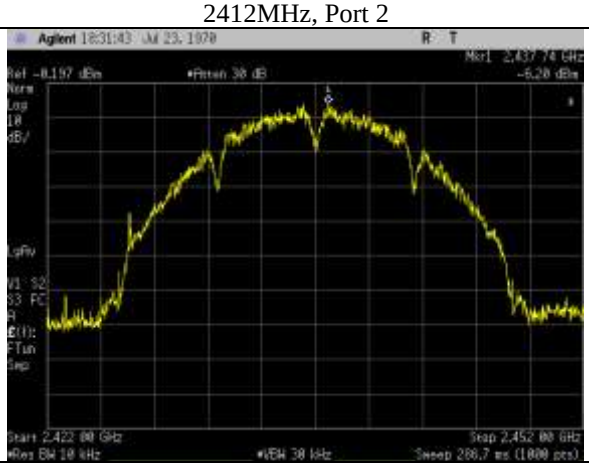
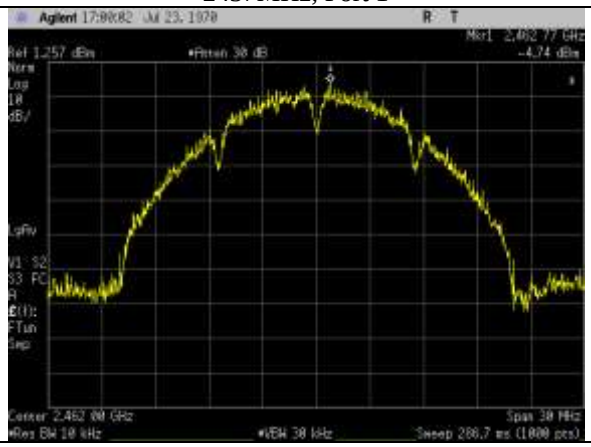
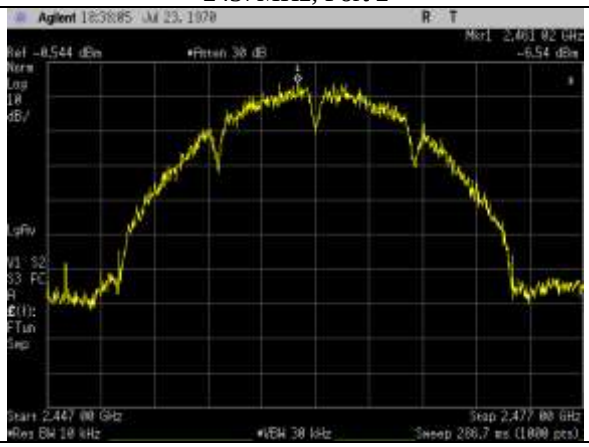


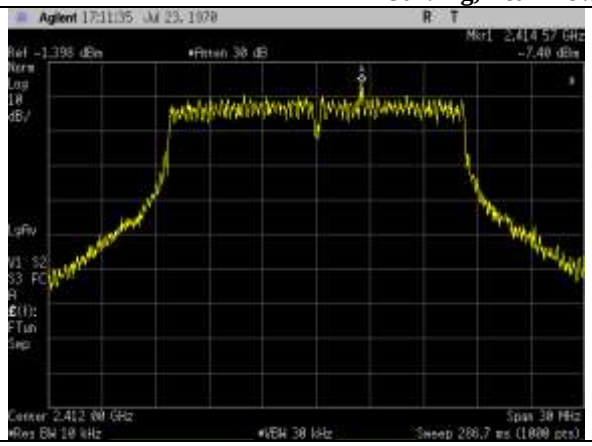
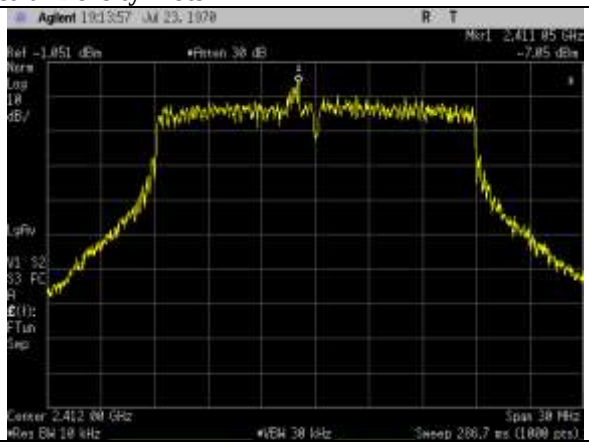
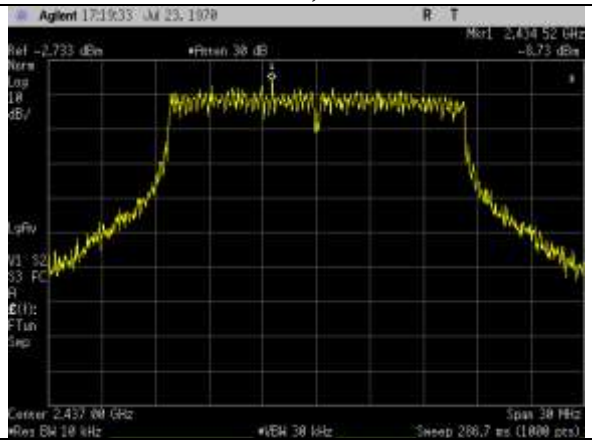
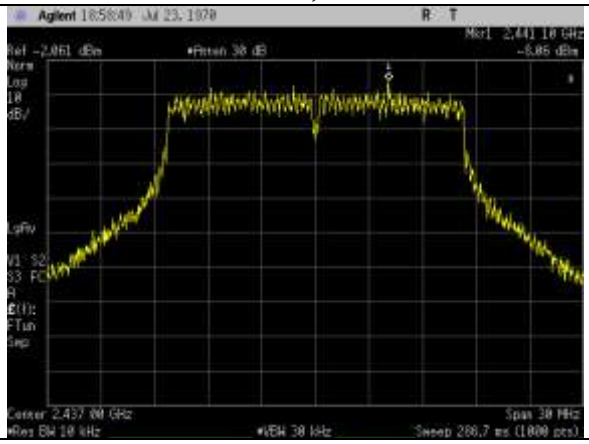
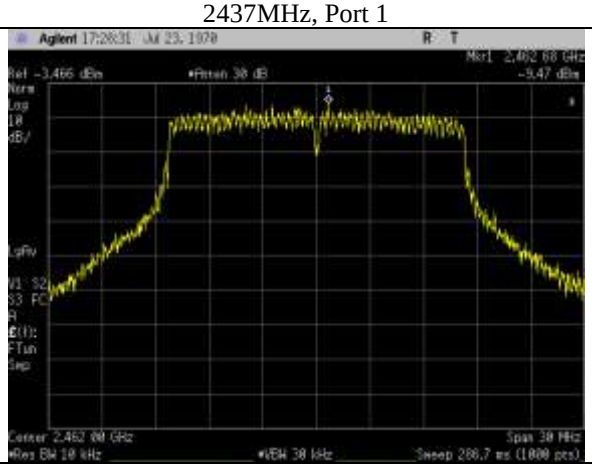
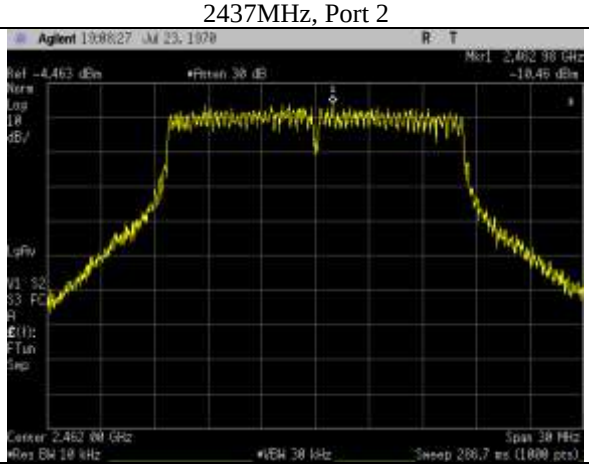
Figure 5. Block Diagram, Peak Power Spectral Density Test Setup

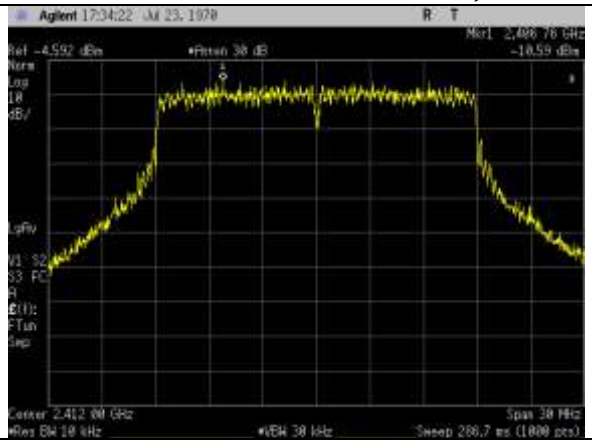
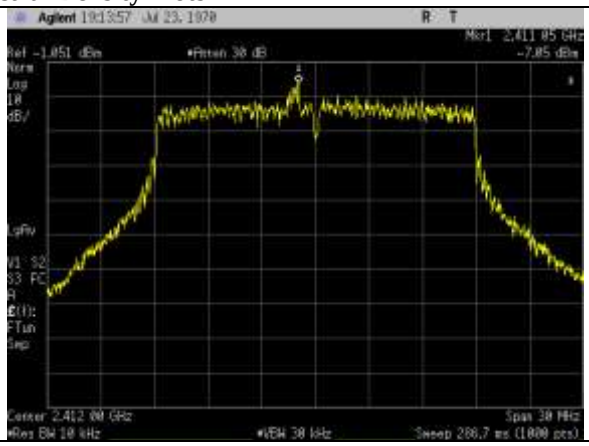
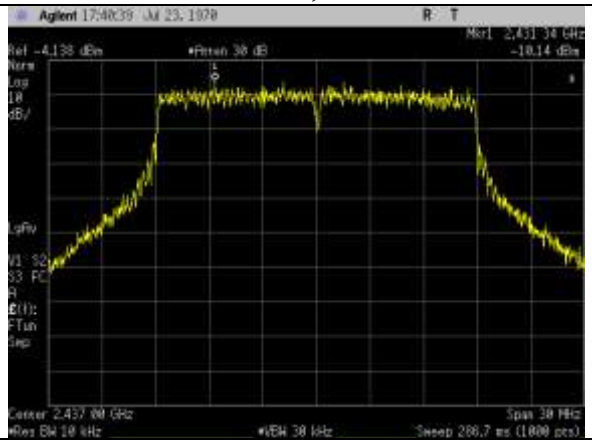
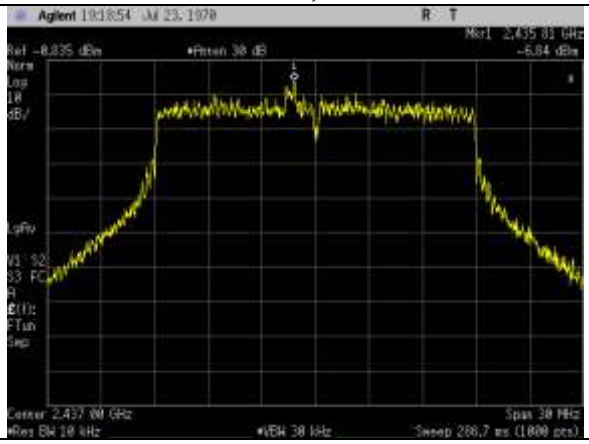
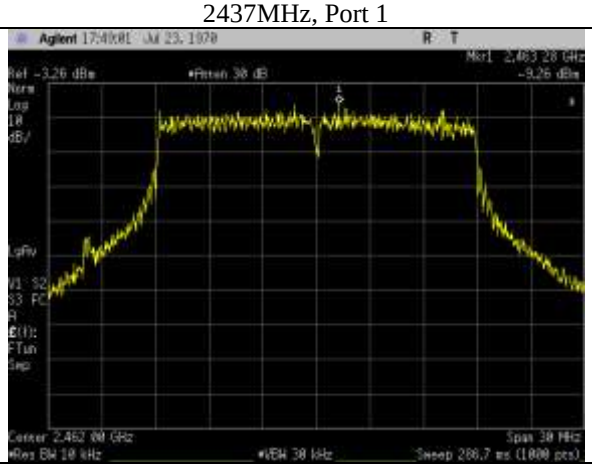
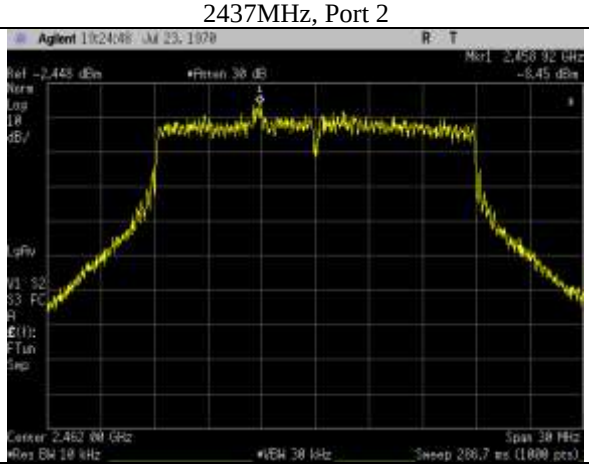
Channel and mode	Port 1 (mW)	Port 2 (mW)	Port 1 (dBm)	Port 2 (dBm)	Sum (dBm)	Limit (dBm)	Margin dB
WIFI_Low Ch_2412MHz_20MHz BW_b-mode	0.2358	0.2225	-6.28	-6.53	-3.39	8	11.39
WIFI_Mid Ch_2437MHz_20MHz BW_b-mode	1.8184	0.2400	2.60	-6.20	3.14	8	4.86
WIFI_High Ch_2462MHz_20MHz BW_b-mode	0.3355	0.2216	-4.74	-6.54	-2.54	8	10.54
WIFI_Low Ch_2412MHz_20MHz BW_g-mode	0.1821	0.0911	-7.40	-10.41	-5.64	8	13.64
WIFI_Mid Ch_2437MHz_20MHz BW_g-mode	0.1339	0.1563	-8.73	-8.06	-5.37	8	13.37
WIFI_High Ch_2462MHz_20MHz BW_g-mode	0.1131	0.0899	-9.47	-10.46	-6.93	8	14.93
WIFI_Low Ch_2412MHz_20MHz BW_n-mode	0.0873	0.1972	-10.59	-7.05	-5.46	8	13.46
WIFI_Mid Ch_2437MHz_20MHz BW_n-mode	0.0969	0.2073	-10.14	-6.83	-5.17	8	13.17
WIFI_High Ch_2462MHz_20MHz BW_n-mode	0.1186	0.1430	-9.26	-8.45	-5.82	8	13.82
WIFI_Low Ch_2422MHz_40MHz BW_n-mode	0.0437	0.0630	-13.60	-12.01	-9.72	8	17.72
WIFI_Mid Ch_2437MHz_40MHz BW_n-mode	0.4107	0.0540	-3.86	-12.68	-3.33	8	11.33
WIFI_High Ch_2452MHz_40MHz BW_n-mode	0.2718	0.2034	-5.66	-6.92	-3.23	8	11.23

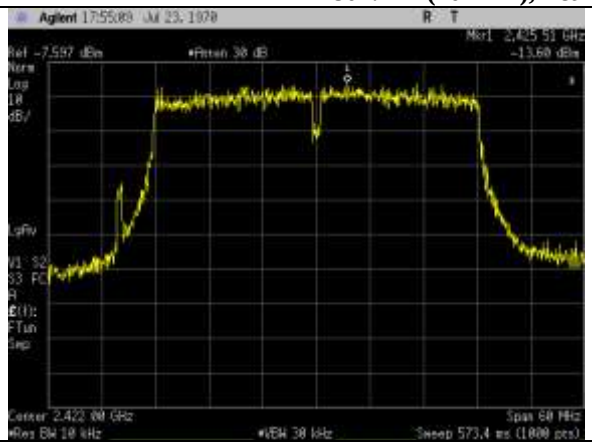
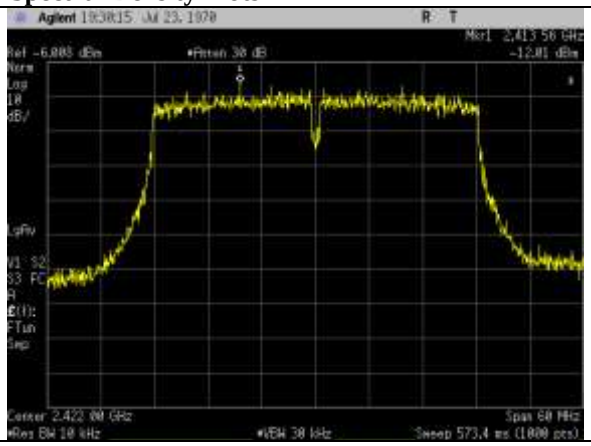
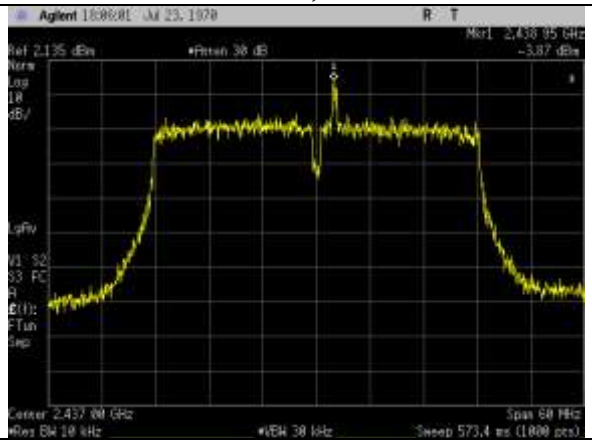
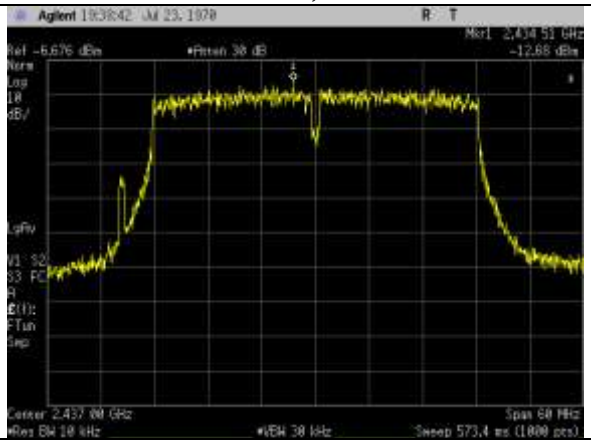
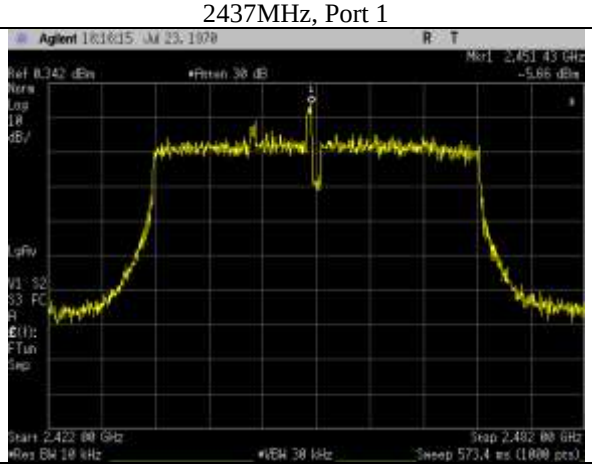
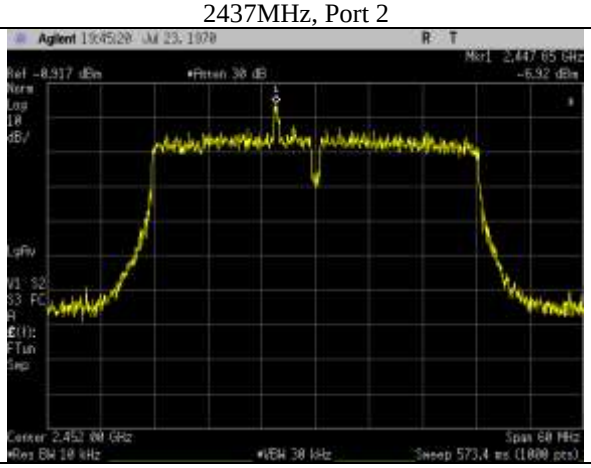
Table 18. Peak Power Spectral Density, Test Results

Peak Power Spectral Density

802.11b, Peak Power Spectral Density Plots	
	
2412MHz, Port 1	2412MHz, Port 2
	
2437MHz, Port 1	2437MHz, Port 2
	
2462MHz, Port 1	2462MHz, Port 2

802.11g, Peak Power Spectral Density Plots	
	
2412MHz, Port 1	2412MHz, Port 2
	
2437MHz, Port 1	2437MHz, Port 2
	
2462MHz, Port 1	2462MHz, Port 2

802.11n, Peak Power Spectral Density Plots	
	
2412MHz, Port 1	2412MHz, Port 2
	
2437MHz, Port 1	2437MHz, Port 2
	
2462MHz, Port 1	2462MHz, Port 2

802.11n (40MHz), Peak Power Spectral Density Plots	
	
2422MHz, Port 1	2422MHz, Port 2
	
2437MHz, Port 1	2437MHz, Port 2
	
2452MHz, Port 1	2452MHz, Port 2

IV. Test Equipment

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

MET Asset #	Description	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4771	Spectrum Analyzer	Keysight	E4446A	4/25/2022	10/25/2023
1A1083	Receiver	Rohde & Schwarz	ESU40	7/1/2021	7/1/2022
1A1176	Active Loop Antenna (9KHz-30MHz)	ETS-Lindgren	6502	06/28/2021	06/28/2022
1A1050	Bilog Antenna (30MHz – 1GHz)	Schaffner	CBL 6112D	12/01/2020	12/01/2022
1A1183	Horn Antenna (1GHz – 18GHz)	ETS Lindgren	3117	06/01/2020	06/01/2022
1A1161	Horn Antenna (18GHz – 40GHz)	ETS Lindgren	3116C	06/03/2020	06/03/2022
1A1065	EMI Receiver	Rohde & Schwarz	ESCI	07/01/2021	07/01/2022
1A1087	Pulse Limiter	Rohde & Schwarz	ESH3Z2	06/30/2021	06/30/2022
1A1122	LISN	Teseq	NNB 51	09/13/202	09/13/2022
1A1123	LISN	Teseq	NNB 51	11/20/2021	11/20/2022
1A1197	RF Current Probe	Fisher Custom Communications (FCC)	F-33-2	09/13/2021	09/13/2022
1A1169	Temp, Humidity, and Pressure Recorder	Omega	OM-CP-PRHTemp2000	03/02/2022	03/02/2023
1A1149	DC Milliohm Meter	GW Instek	GOM-802	06/08/2021	06/08/2022
1A1119	Conducted Emissions Test Area	Custom Made	N/A	06/08/2021	06/08/2022
1A1099	Generator	Com-Power	CGO-51000	See Note	
1A1088	Preamplifier	Rohde & Schwarz	TS-PR1	See Note	
1A1044	Generator	Com-Power	CG-520	See Note	
1A1073	Multi Device Controller	ETS	2090	See Note	
1A1074	System Controller	Panasonic	WV-CU101	See Note	
1A1080	Multi-Device	ETS	2090	See Note	
1A1180	Preamplifier	Miteq	AMF-7D-01001800-22-10P	See Note	

Table 19. Test Equipment List

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

End of Report