MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
914 WEST PATAPSCO AVENUE ● BALTIMORE, MARYLAND 21230-3432 ● PHONE (410) 354-3300 ● FAX (410) 354-3313
33439 WESTERN AVENUE ● UNION CITY, CALIFORNIA 94587 ● PHONE (510) 489-6300 ● FAX (510) 489-6372
3162 BELICK STREET ● SANTA CLARA, CALIFORNIA 95054 ● PHONE (408 748-3585 ● FAX (510) 489-6372

June 30, 2011

Echelon Corporation
550 Meridian Avenue
San Jose, CA 95126

Dear James Smith,

Enclosed is the EMC Wireless test report for compliance testing of the Echelon Corporation, Edge Control Node (ECN) 70101-0026 as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 15, Subpart B, ICES-003, Issue 4 February 2004 for a Class B Digital Device and FCC Part 15 Subpart C, RSS-210, Issue 8, Dec. 2010 for Intentional Radiators.

Thank you for using the services of MET Laboratories, Inc. 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,
MET LABORATORIES, INC.

Jennifer Warnell
Documentation Department

Reference: (\Echelon Corporation\EMCS83011-FCC247 Rev. 3)

Electromagnetic Compatibility Criteria
Test Report

for the

Echelon Corporation
Edge Control Node (ECN) 70101-0026

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Parts 15 Subpart B & ICES-003
for Class B Digital Devices
&
15.247 Subpart C & RSS-210, Issue 8, Dec. 2010
for Intentional Radiators

MET Report: EMCS83011-FCC247 Rev. 3

June 30, 2011

Prepared For:

Echelon Corporation
550 Meridian Avenue
San Jose, CA 95126

Prepared By:
MET Laboratories, Inc.
3162 Belick St.
Santa Clara, CA 95054

Electromagnetic Compatibility Criteria
Test Report

for the

Echelon Corporation
Edge Control Node (ECN) 70101-0026

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Parts 15 Subpart B & ICES-003
for Class B Digital Devices
&
15.247 Subpart C & RSS-210, Issue 8, Dec. 2010
for Intentional Radiators

Lionel Gabrillo, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Warnell
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 Parts 15B, 15.247 and Industry Canada standards ICES-003, Issue 4 February 2004, RSS-210, Issue 8, Dec. 2010 under normal use and maintenance.

Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	June 16, 2011	Initial Issue.
1	June 22, 2011	Revised to reflect customer corrections.
2	June 27, 2011	Revised to reflect engineer corrections.
3	June 30, 2011	Revised to reflect engineer corrections.

Table of Contents

List of Tables

List of Plots

List of Figures

List of Photographs

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 Echelon Corporation Edge Control Node (ECN) 70101-0026, with the requirements of Part 15, §15.247. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the Edge Control Node (ECN) 70101-0026. Echelon Corporation should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Edge Control Node (ECN) 70101-0026, 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 Part 15, §15.247, in accordance with Echelon Corporation, purchase order number 32432. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference 47 CFR Part 15.247:2005	IC Reference RSS-210 Issue 8: 2010; RSS-GEN Issue 3: 2010	Description	Compliance
47 CFR Part 15.107 (a)	ICES-003 Issue 4 February 2004	Conducted Emission Limits for a Class B Digital Device	Compliant
47 CFR Part 15.109 (a)	ICES-003 Issue 4 February 2004	Radiated Emission Limits for a Class B Digital Device	Compliant
Title 47 of the CFR, Part 15 §15.203	N/A	Antenna Requirement	Compliant
Title 47 of the CFR, Part 15 §15.207(a)	RSS-GEN (7.2.4)	Conducted Emission Limits	Compliant
Title 47 of the CFR, Part 15 §15.247(a)(2)	RSS-Gen(4.6)	6dB Occupied Bandwidth	Compliant
		99% Occupied Bandwidth	Compliant
Title 47 of the CFR, Part 15 §15.247(b)	RSS-210(A8.4)	Peak Power Output	Compliant
Title 47 of the CFR, Part 15 §15.247(d); §15.209; §15.205	RSS-210(A8.5)	Radiated Spurious Emissions Requirements	Compliant
Title 47 of the CFR, Part 15 §15.247(d)	RSS-210(A8.5)	RF Conducted Spurious Emissions Requirements	Compliant
Title 47 of the CFR, Part 15 §15.247(d)	RSS-210(A8.5)	RF Conducted Band Edge	Compliant
Title 47 of the CFR, Part 15; §15.247(e)	RSS-210(A8.2)	Peak Power Spectral Density	Compliant
Title 47 of the CFR, Part 15 §15.247(i)	RSS-Gen(5.6)	Maximum Permissible Exposure (MPE)	Compliant
N/A	RSS-Gen(4.10)	Receiver Spurious Emissions	Compliant

Table 1. Executive Summary of EMC Part 15.247 ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Echelon Corporation to perform testing on the Edge Control Node (ECN) 70101-0026, under Echelon Corporation's purchase order number 32432.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Echelon Corporation, Edge Control Node (ECN) 70101-0026.

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

Model(s) Tested:	Edge Control Node (ECN) 70101-0026	
Model(s) Covered:	Edge Control Node (ECN) 70101-0026	
EUT Specifications:	Primary Power: 240 VAC, 60 Hz	
	FCC ID: IZP70101-R003	
	Type of Modulations:	DSSS, OFDM
	Equipment Code:	DTS
	Peak RF Output Power:	2.4GHz = 28.86 dBm 5.8 GHz = 28.915 dBm
	EUT Frequency Ranges:	2412 - 2462 MHz, 5745 – 5825 MHz
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:	Lionel Gabrillo	
Report Date(s):	June 30, 2011	

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
CFR 47, Part 15, Subpart B	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
RSS-210, Issue 8, Dec. 2010	Low-power Licence-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment
RSS-GEN, Issue 3, Dec. 2010	General Requirements and Information for the Certification of Radio Apparatus
ICES-003, Issue 4 February 2004	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
ANSI C63.4:2003	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI/NCSL Z540-1-1994	Calibration Laboratories and Measuring and Test Equipment - General Requirements
ANSI/ISO/IEC 17025:2000	General Requirements for the Competence of Testing and Calibration Laboratories
ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices

Table 3. References

C. Test Site

All testing was performed at MET Laboratories, Inc., 3162 Belick St., Santa Clara, CA 95054. 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 3 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. Description of Test Sample

The Echelon Corporation Edge Control Node (ECN) 70101-0026, Equipment Under Test (EUT), is as follows:

The nBox is a telemetry device that is intended to collect electrical power usage data from electrical utility power meters, and gas meters. Electrical power meters can communicate over PLC band A or band C; or they can use 900 MHz ISM band.

The new version added an OEM 802.11a/b/g/n Wi-Fi simultaneous dual band access point, a 900 MHz ISM band receiver, a second PLC (Power Line Communications) card, a serial (RS-232) interface, and a local power line current monitor. The unit is a fixed stationary device, powered from the AC line, with a battery backup option. This unit is intended for mounting on a utility pole or on a pad mounted distribution transformer. The original unit has FCC ID number IZP70101-0002. Generic information on the product can be found on our web page at "http://www.echelon.com/metering/ecn.htm."

List of Interfaces
Ethernet
802.11a/an/b/g/gn 2x2 simultaneous dual band Wi-Fi access point.
RS-232 2X
Power Line Communications (PLC) Band A
Power Line Communications (PLC) Band C
900 MHz ISM band receiver

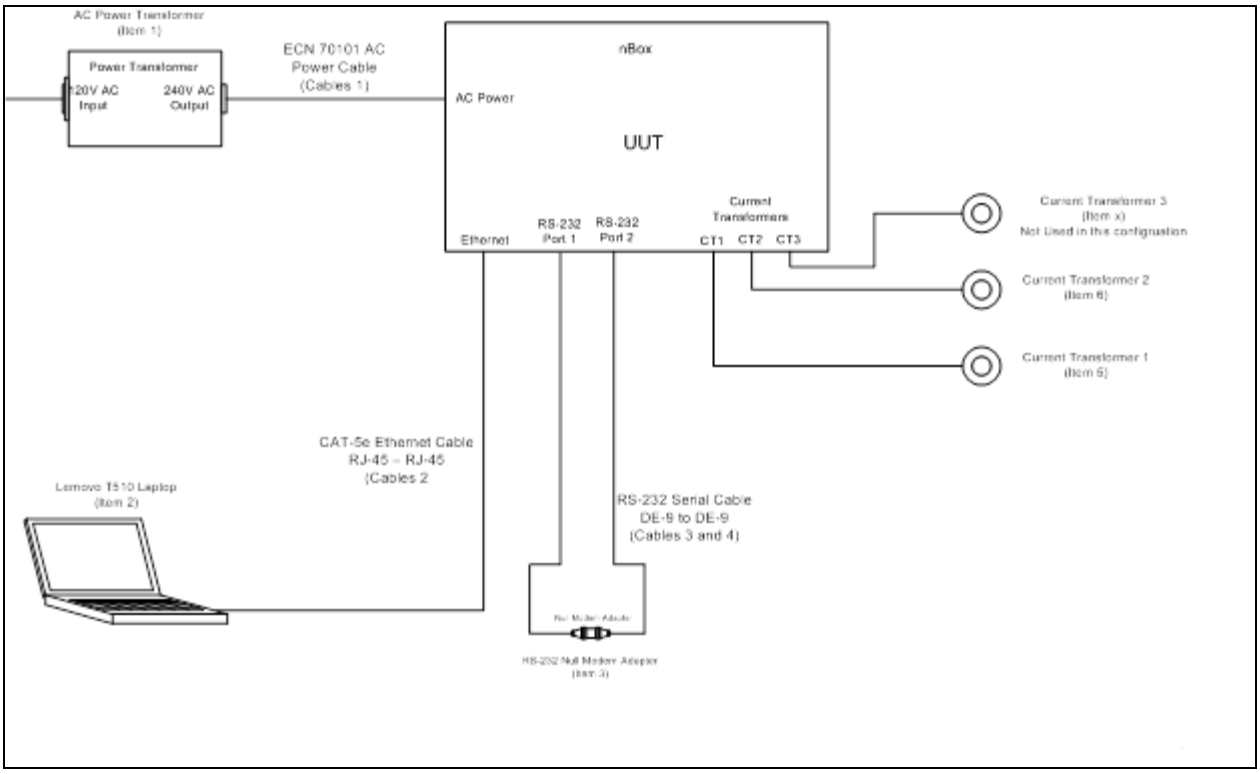


Figure 1. Block Diagram of Test Configuration

E. Equipment Configuration

The EUT was set up as outlined in Figure 1, Block Diagram of Test Setup. All cards, racks, etc., incorporated as part of the EUT is included in the following list.

Ref. ID	Name / Description	Model Number	Serial Number
1	7xxx series Edge Control Node	770101-0026	0020, 0093, 0094

Table 4. Equipment Configuration

F. 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
1	Power Transformer 120V in 240V CT out	Echelon	NA
2	Laptop PC (Echelon Asset 105331)	Lenovo	T510
3	Null Modem Adapter	Pan Pacific	D25NM3
5	Current Transformer	Dent Instruments	CT-RMV-16-1000
6	Current Transformer	Dent Instruments	CT-RMV-16-1000

Table 5. Support Equipment

G. Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Point
1	AC Power	AC Power cable	1	6’	N	1
2	Ethernet	CAT-5e Ethernet cable with clamp on ferrites on the PC end.	1	6’	N	2
3	RS-232 Serial Port 1	DE-9 –DE-9 Serial Cable	1	6’	Y	3
4	RS-232 Serial Port 2	DE-9 –DE-9 Serial Cable	1	6’	Y	3

Table 6. Ports and Cabling Information

H. Mode of Operation

The Ethernet port will be connected to a Lenovo laptop PC which will be used to control the UUT and provide stimulus to the Ethernet port.

A script will be run on the UUT main processor that sends data on the Serial port.

A script will be run on the UUT main processor that sends data on the PLC Band A port.

A script will be run on the UUT main processor that sends data on the PLC Band C port.

The laptop will be used to run the ART (Atheros Radio Test) software to control the Wi-Fi access point. A laptop could also be used as a client connecting to the wireless point to provide traffic in the normal Wi-Fi operation.

I. Method of Monitoring EUT Operation

A series of ping messages were sent from the laptop to the UUT over the Ethernet and monitored in a separate command window to verify the Ethernet port and the UUT main CPU is operating normally.

Data received on the Serial port can be forwarded to a terminal session window on the PC where it can be monitored to verify activity.

A PLC A band and C band node can be connected to the PC to monitor PLC data sent by the UUT.

Data read from the 900 MHz ISM.

J. 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.

K. Disposition of EUT

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

III. Electromagnetic Compatibility Criteria for Unintentional Radiators

Electromagnetic Compatibility Criteria

§ 15.107 Conducted Emissions Limits

Test Requirement(s):

15.107 (a) Except for Class A digital devices, for equipment 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 30 MHz shall not exceed the limits in Table 7. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

15.107 (b) For a Class A digital device 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 30 MHz shall not exceed the limits in Table 7. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

15.207(a), Except as shown in paragraphs (b) and (c) of this section*, charging, AC adapters or battery eliminators the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the Table 7, as measured using a 50 μH/50 ohms 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 frequencies ranges.

Frequency range (MHz)	Class A Conducted Limits (dBμV)		*Class B Conducted Limits (dBμV)	
	Quasi-Peak	Average	Quasi-Peak	Average
* 0.15- 0.45	79	66	66 - 56	56 - 46
0.45 - 0.5	79	66	56	46
0.5 - 30	73	60	60	50
Note 1 — The lower limit shall apply at the transition frequencies. Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz. * -- Limits per Subsection 15.207(a).				

Table 7. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Subsections 15.107(a) (b) and 15.207(a)

Test Results: The EUT was compliant with the Class B requirement(s) of this section. Measured emissions were below applicable limits.

Test Engineer(s): Lionel Gabrillo and Tunji Yusuf

Test Date(s): 05/09/11

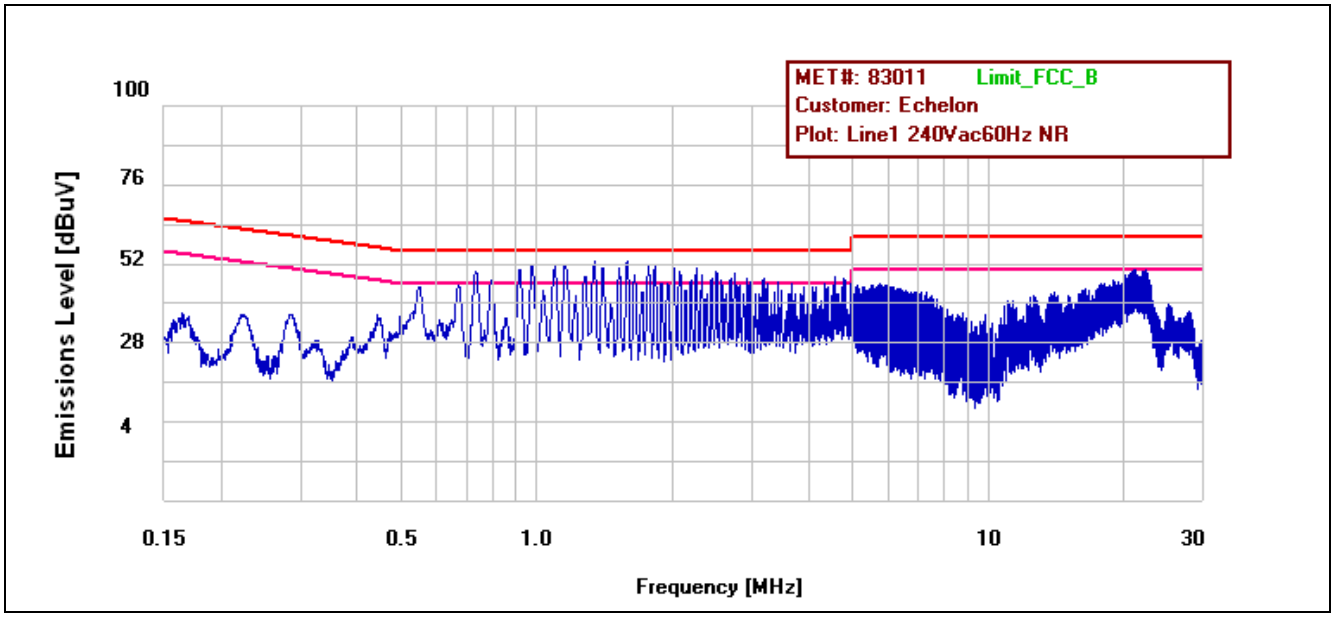
Conducted Emissions - Voltage, AC Power, Phase Line (240 VAC, 60 Hz)

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
Line1 240Vac60Hz	0.162	48.3	65.363	-17.063	Pass	35.1	55.363	-20.263	Pass
Line1 240Vac60Hz	0.542	50.87	56	-5.13	Pass	39.6	46	-6.4	Pass
Line1 240Vac60Hz	0.650	49.91	56	-6.09	Pass	38.6	46	-7.4	Pass
Line1 240Vac60Hz	0.706	54.95	56	-1.05	Pass	43.56	46	-2.44	Pass
Line1 240Vac60Hz	0.762	51.42	56	-4.58	Pass	39.9	46	-6.1	Pass
Line1 240Vac60Hz	0.922	54.4	56	-1.6	Pass	42.6	46	-3.4	Pass
Line1 240Vac60Hz	0.978	48.41	56	-7.59	Pass	37.3	46	-8.7	Pass
Line1 240Vac60Hz	1.086	54.2	56	-1.8	Pass	43	46	-3	Pass
Line1 240Vac60Hz	1.142	53.5	56	-2.5	Pass	42.5	46	-3.5	Pass
Line1 240Vac60Hz	1.302	52.57	56	-3.43	Pass	41.6	46	-4.4	Pass
Line1 240Vac60Hz	1.522	53.34	56	-2.66	Pass	42.32	46	-3.68	Pass
Line1 240Vac60Hz	1.783	51.72	56	-4.28	Pass	40.6	46	-5.4	Pass
Line1 240Vac60Hz	22.006	44.15	60	-15.85	Pass	29.8	50	-20.2	Pass

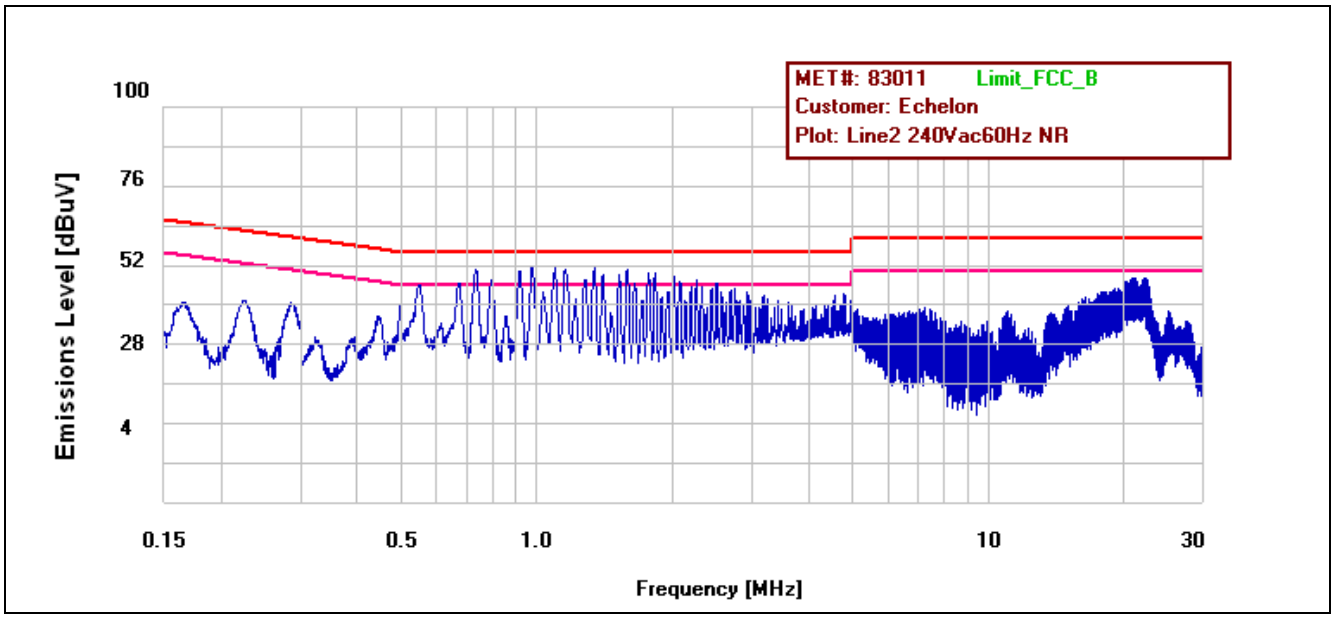
Table 8. Conducted Emissions - Voltage, AC Power, Phase Line 1 (240 VAC, 60 Hz)

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
Line2 240Vac60Hz	0.162	55.65	65.363	-9.713	Pass	43.34	55.363	-12.023	Pass
Line2 240Vac60Hz	0.546	50.85	56	-5.15	Pass	39.8	46	-6.2	Pass
Line2 240Vac60Hz	0.654	51.07	56	-4.93	Pass	39.6	46	-6.4	Pass
Line2 240Vac60Hz	0.706	55.69	56	-0.31	Pass	44.3	46	-1.7	Pass
Line2 240Vac60Hz	0.762	51.98	56	-4.02	Pass	40.73	46	-5.27	Pass
Line2 240Vac60Hz	0.870	53.82	56	-2.18	Pass	42.71	46	-3.29	Pass
Line2 240Vac60Hz	0.926	53.77	56	-2.23	Pass	42.5	46	-3.5	Pass
Line2 240Vac60Hz	1.086	53.39	56	-2.61	Pass	42.02	46	-3.98	Pass
Line2 240Vac60Hz	1.142	53.14	56	-2.86	Pass	41.91	46	-4.09	Pass
Line2 240Vac60Hz	1.306	52.43	56	-3.57	Pass	41.21	46	-4.79	Pass
Line2 240Vac60Hz	1.522	51.84	56	-4.16	Pass	40.6	46	-5.4	Pass
Line2 240Vac60Hz	1.738	49.69	56	-6.31	Pass	38.2	46	-7.8	Pass
Line2 240Vac60Hz	22.014	44.32	60	-15.68	Pass	30.8	50	-19.2	Pass

Table 9. Conducted Emissions - Voltage, AC Power, Phase Line 2 (240 VAC, 60 Hz)



Plot 1. Conducted Emission, Phase Line 1 Plot

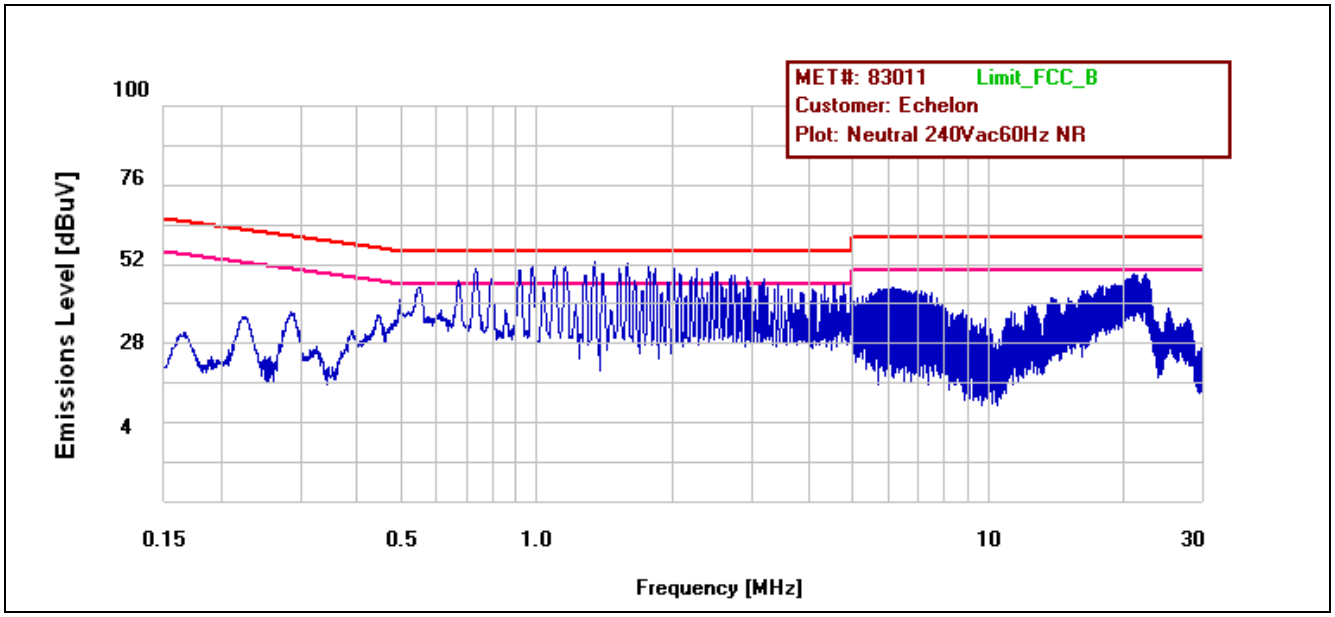


Plot 2. Conducted Emission, Phase Line 2 Plot

Conducted Emissions - Voltage, AC Power, Neutral Line (240 VAC, 60 Hz)

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
Neutral 240Vac60Hz	0.162	45.78	65.363	-19.583	Pass	33.6	55.363	-21.763	Pass
Neutral 240Vac60Hz	0.546	49.92	56	-6.08	Pass	38.9	46	-7.1	Pass
Neutral 240Vac60Hz	0.654	50.58	56	-5.42	Pass	39.4	46	-6.6	Pass
Neutral 240Vac60Hz	0.706	54.76	56	-1.24	Pass	43.75	46	-2.25	Pass
Neutral 240Vac60Hz	0.762	51.15	56	-4.85	Pass	39.92	46	-6.08	Pass
Neutral 240Vac60Hz	0.870	53.7	56	-2.3	Pass	42.3	46	-3.7	Pass
Neutral 240Vac60Hz	0.926	53.94	56	-2.06	Pass	42.67	46	-3.33	Pass
Neutral 240Vac60Hz	1.086	53.87	56	-2.13	Pass	42.6	46	-3.4	Pass

Table 10. Conducted Emissions - Voltage, AC Power, Neutral Line (240 VAC, 60 Hz)



Plot 3. Conducted Emission, Neutral Line Plot

Conducted Emission Limits Test Setup

Photograph 1. Conducted Emissions, Test Setup

Radiated Emission Limits

§ 15.109 Radiated Emissions Limits

Test Requirement(s): **15.109 (a)** Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the Class B limits expressed in Table 11.

15.109 (b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the Class A limits expressed in Table 11.

Frequency (MHz)	Field Strength (dBµV/m)	
	§15.109 (b), Class A Limit (dBµV) @ 10m	§15.109 (a),Class B Limit (dBµV) @ 3m
30 - 88	39.00	40.00
88 - 216	43.50	43.50
216 - 960	46.40	46.00
Above 960	49.50	54.00

Table 11. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b)

Test Procedures: The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.4 were used. An antenna was located 3 m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1 m and 4 m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. Unless otherwise specified, measurements were made using a quasi-peak detector with a 120 kHz bandwidth (30MHz - 1GHz) and 1 MHz (1 – 10GHz).

Test Results: The EUT was compliant with the Class B requirement(s) of this section. Measured emissions were below applicable limits.

Test Engineer(s): Joe Vang

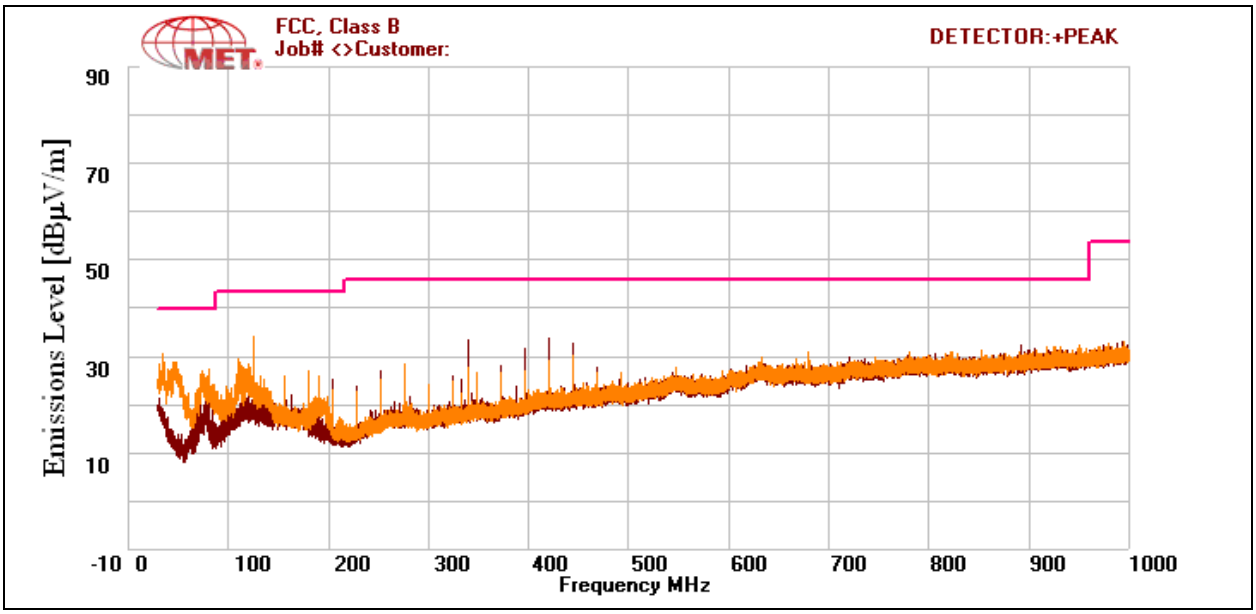
Test Date(s): 05/12/11

Radiated Emissions Limits Test Results, Class B

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBuV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)
45.24	V	86	100	15.24	10.156	0	1.684	0	27.08	40	-12.92
125	V	151	110.4	20.49	12.2	0	3.115	0	35.805	43.5	-7.695
276	V	324	100	8.03	13.18	0	3.652	0	24.862	46	-21.138
340	H	116	100	12.54	14.1	0	3.802	0	30.442	46	-15.558
420	H	239	100	11.67	16.3	0	4.264	0	32.234	46	-13.766
444	H	227	100	11.62	16.48	0	4.401	0	32.501	46	-13.499

Table 12. Radiated Emissions Limits, Test Results, 30 MHz – 1 GHz, FCC Limits

Note: The EUT was tested at 3 m.



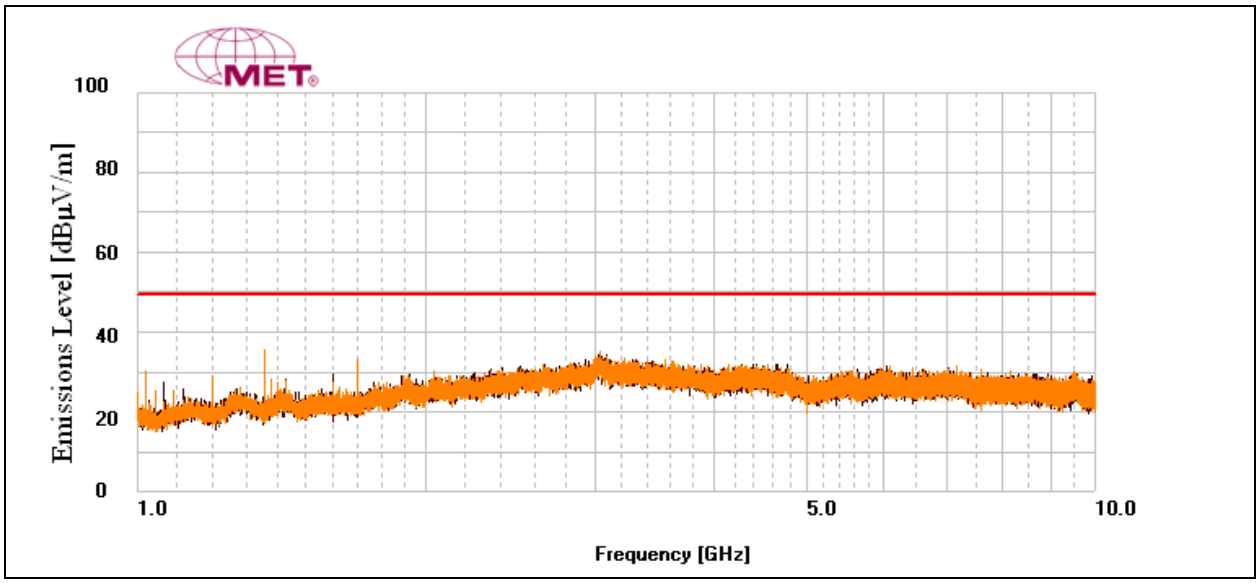
Plot 4. Radiated Emissions, 30 MHz - 1 GHz, FCC Limits

Radiated Emissions Limits Test Results, Class B

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBuV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)
1360	V	277.0	100.0	75.38	29.005	76.258	8.602	0	36.729	54	-17.271
1700	V	329.0	100.0	74.81	28.495	75.636	9.59	0	37.259	54	-16.741
1700	H	116.0	134.35	68.66	28.495	75.636	9.59	0	31.109	54	-22.891

Table 13. Radiated Emissions Limits, Test Results, Above 1 GHz, FCC Limits

Note: The EUT was tested at 3 m.



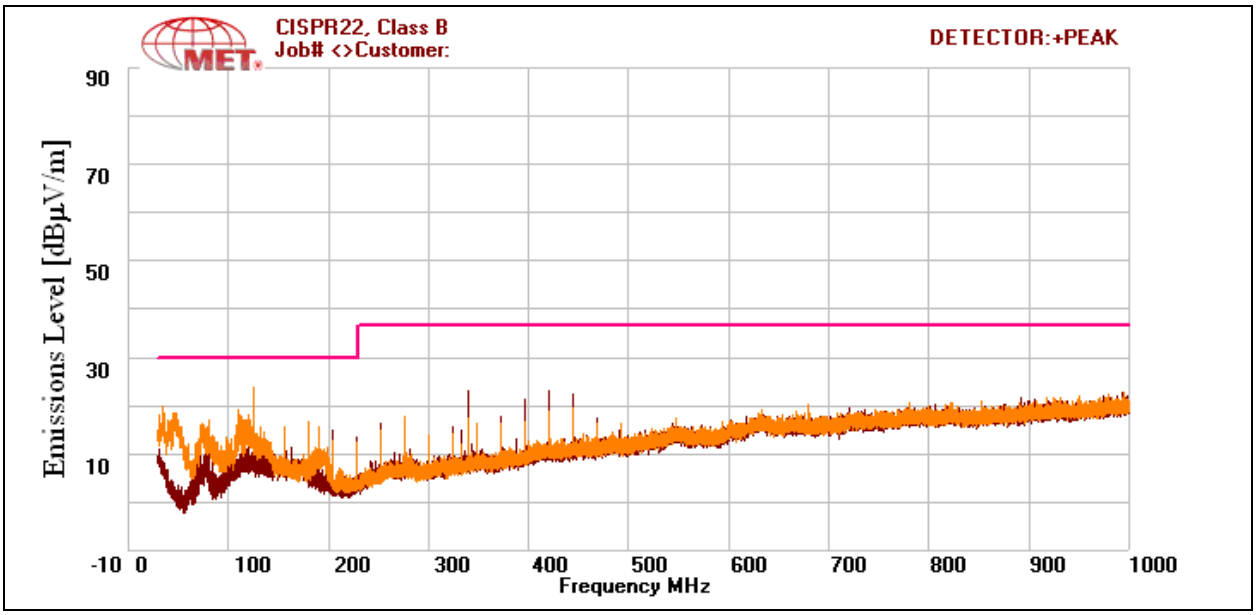
Plot 5. Radiated Emissions, Above 1 GHz, FCC Limits

Radiated Emissions Limits Test Results, Class B

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBuV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)
45.24	V	86	100	15.24	10.156	0	1.684	-10.46	16.62	30	-13.38
125	V	151	110.4	20.49	12.2	0	3.115	-10.46	25.345	30	-4.655
276	V	324	100	8.03	13.18	0	3.652	-10.46	14.402	37	-22.598
340	H	116	100	12.54	14.1	0	3.802	-10.46	19.982	37	-17.018
420	H	239	100	11.67	16.3	0	4.264	-10.46	21.774	37	-15.226
444	H	227	100	11.62	16.48	0	4.401	-10.46	22.041	37	-14.959

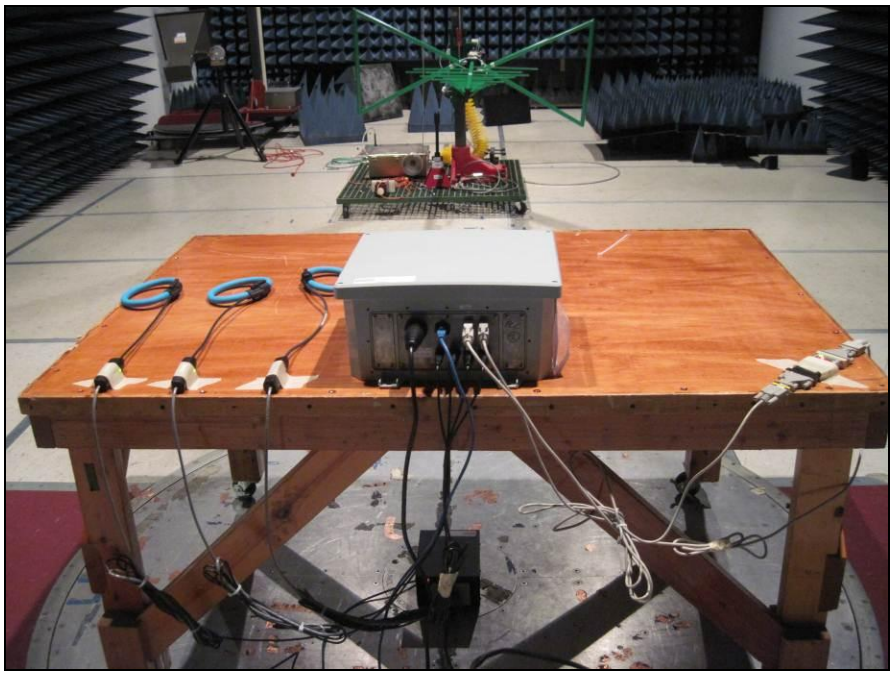
Table 14. Radiated Emissions Limits, Test Results, ICES-003 Limits

Note: The EUT was tested at 3 m.



Plot 6. Radiated Emissions, ICES-003 Limits

Radiated Emission Limits Test Setup



Photograph 2. Radiated Emission, Test Setup, 30 MHz – 1 GHz

Photograph 3. Radiated Emission, Test Setup, 1 GHz – 10 GHz

IV. 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. Antennas are internal (not accessible to the user) and are permanently attached to the radio transceivers.

Test Engineer(s): Lionel Gabrillo

Test Date(s): 05/31/11

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- 0.45	66 - 56	56 - 46
0.45 - 0.5	56	46
0.5 - 30	60	50

Table 15. 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 inside a screen room. 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 C63.4-2003 "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 over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω/50 μH LISN as the input transducer to an EMC/field intensity meter. For the purpose of this testing, the transmitter was turned on. Scans were performed with the transmitter on.

Test Results: The EUT was compliant with this requirement. Measured emissions were below applicable limits.

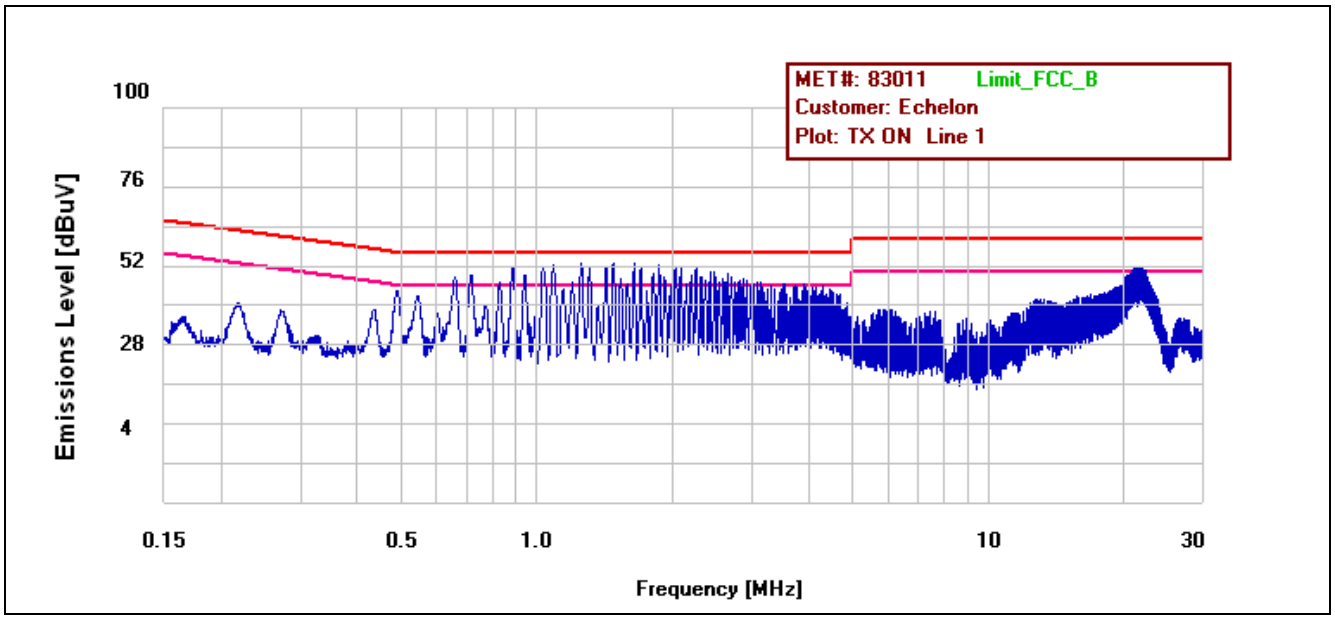
Test Engineer(s): Lionel Gabrillo

Test Date(s): 05/09/11

15.207(a) Conducted Emissions Test Results

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
TX ON Line 1	0.162	47.62	65.363	-17.743	Pass	37.19	55.363	-18.173	Pass
TX ON Line 1	0.870	55.23	56	-0.77	Pass	45.5	46	-0.5	Pass
TX ON Line 1	0.218	52.12	62.903	-10.783	Pass	42.45	52.903	-10.453	Pass
TX ON Line 1	0.654	53.11	56	-2.89	Pass	43.45	46	-2.55	Pass
TX ON Line 1	0.706	53.12	56	-2.88	Pass	42.65	46	-3.35	Pass
TX ON Line 1	0.926	52.1	56	-3.9	Pass	42.66	46	-3.34	Pass
TX ON Line 1	1.088	54.7	56	-1.3	Pass	45.35	46	-0.65	Pass
TX ON Line 1	1.632	53.1	56	-2.9	Pass	43.4	46	-2.6	Pass
TX ON Line 1	1.468	53.22	56	-2.78	Pass	43.71	46	-2.29	Pass
TX ON Line 1	2.232	51.11	56	-4.89	Pass	41.6	46	-4.4	Pass
TX ON Line 1	2.448	48.59	56	-7.41	Pass	39.14	46	-6.86	Pass
TX ON Line 1	3.268	44.75	56	-11.25	Pass	35.94	46	-10.06	Pass
TX ON Line 1	21.448	49.12	60	-10.88	Pass	34.54	50	-15.46	Pass

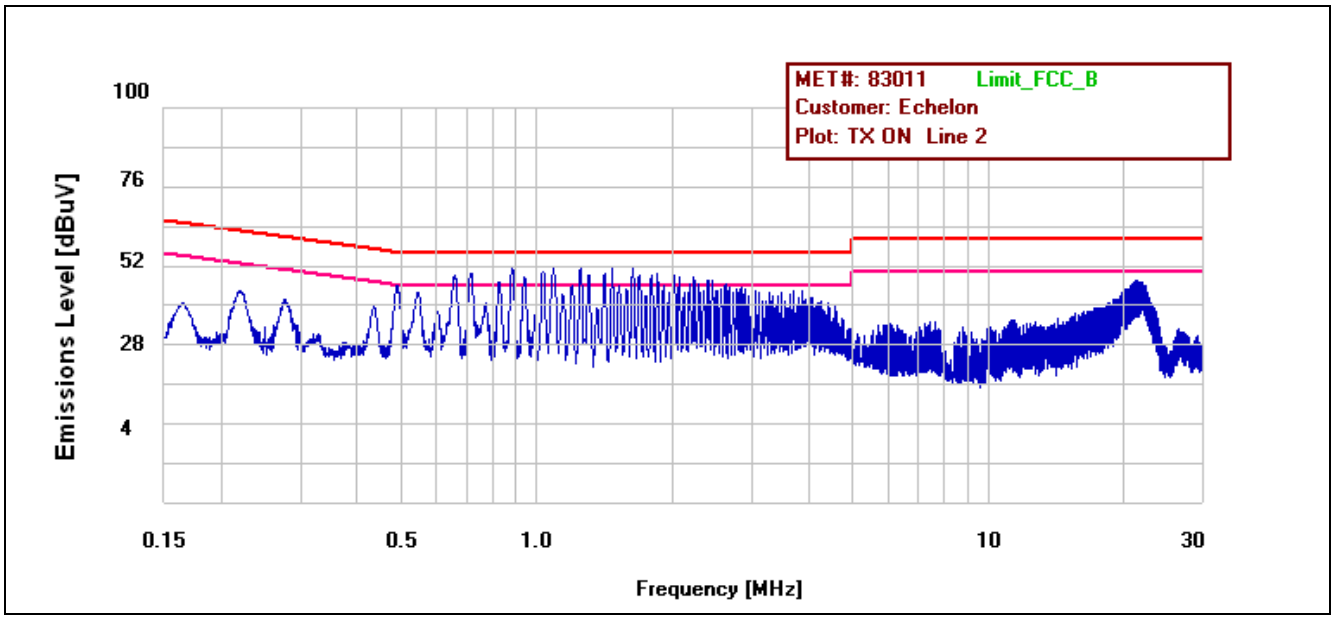
Table 16. Conducted Emissions, 15.207(a), Test Results, TX ON, Line 1



Plot 7. Conducted Emissions, 15.207(a), TX ON, Line 1

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
TX ON Line 2	0.870	54.94	56	-1.06	Pass	45.31	46	-0.69	Pass
TX ON Line 2	0.654	54.24	56	-1.76	Pass	44.57	46	-1.43	Pass
TX ON Line 2	0.218	57.33	62.903	-5.573	Pass	47.07	52.903	-5.833	Pass
TX ON Line 2	0.706	53.93	56	-2.07	Pass	44.32	46	-1.68	Pass
TX ON Line 2	0.162	54.14	65.363	-11.223	Pass	44.15	55.363	-11.213	Pass
TX ON Line 2	0.818	50.1	56	-5.9	Pass	40.36	46	-5.64	Pass
TX ON Line 2	1.088	53.95	56	-2.05	Pass	44.34	46	-1.66	Pass
TX ON Line 2	1.252	53.43	56	-2.57	Pass	43.69	46	-2.31	Pass
TX ON Line 2	1.036	52.29	56	-3.71	Pass	42.62	46	-3.38	Pass
TX ON Line 2	1.472	51.44	56	-4.56	Pass	41.74	46	-4.26	Pass
TX ON Line 2	2.068	48.65	56	-7.35	Pass	38.76	46	-7.24	Pass
TX ON Line 2	2.232	48.42	56	-7.58	Pass	38.35	46	-7.65	Pass
TX ON Line 2	2.016	48.23	56	-7.77	Pass	38.34	46	-7.66	Pass
TX ON Line 2	3.704	42.19	56	-13.81	Pass	31.6	46	-14.4	Pass
TX ON Line 2	21.56	45.35	60	-14.65	Pass	33.77	50	-16.23	Pass

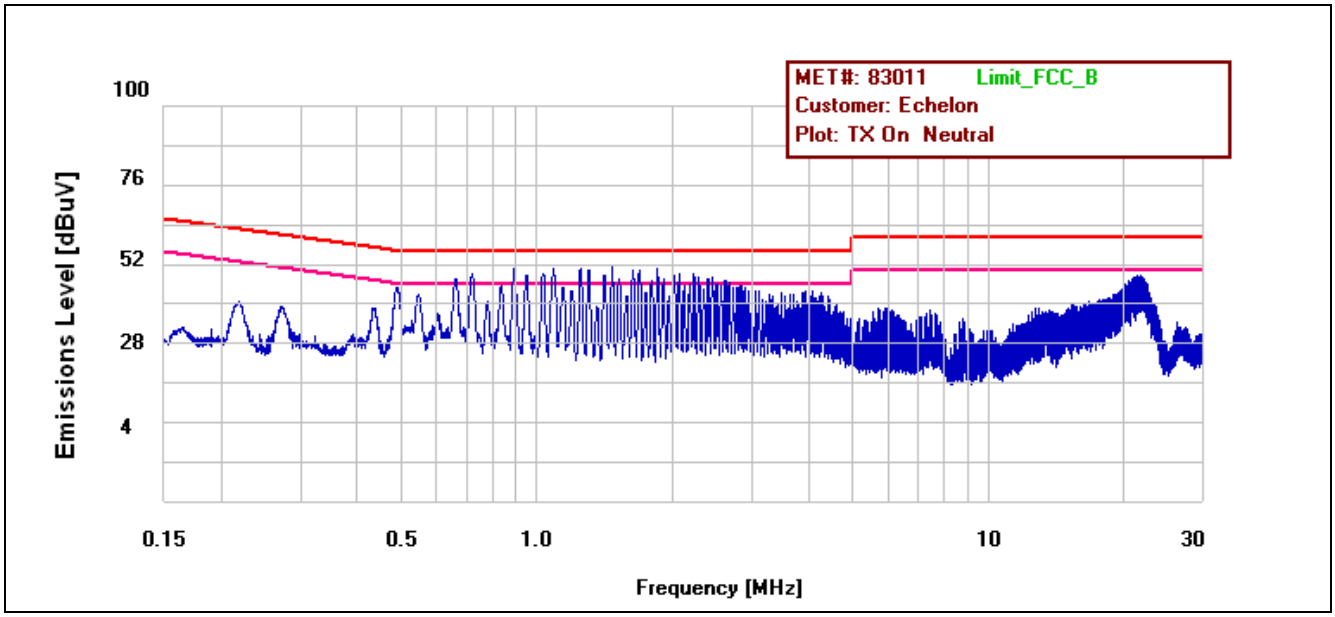
Table 17. Conducted Emissions, 15.207(a), Test Results, TX ON, Line 2



Plot 8. Conducted Emissions, 15.207(a), TX ON, Line 2

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
TX On Neutral	0.870	53.72	56	-2.28	Pass	44	46	-2	Pass
TX On Neutral	1.09	53.35	56	-2.65	Pass	43.66	46	-2.34	Pass
TX On Neutral	0.710	53.33	56	-2.67	Pass	42.6	46	-3.4	Pass
TX On Neutral	0.654	53.84	56	-2.16	Pass	43.05	46	-2.95	Pass
TX On Neutral	1.254	53.23	56	-2.77	Pass	42.94	46	-3.06	Pass
TX On Neutral	1.47	52.46	56	-3.54	Pass	43.05	46	-2.95	Pass
TX On Neutral	0.218	52.74	62.903	-10.163	Pass	42.5	52.903	-10.403	Pass
TX On Neutral	0.490	51.85	56.173	-4.323	Pass	42.56	46.173	-3.613	Pass
TX On Neutral	0.926	51.45	56	-4.55	Pass	41.98	46	-4.02	Pass
TX On Neutral	1.634	51.17	56	-4.83	Pass	41.53	46	-4.47	Pass
TX On Neutral	2.07	49.63	56	-6.37	Pass	39.92	46	-6.08	Pass
TX On Neutral	2.234	48.84	56	-7.16	Pass	39.08	46	-6.92	Pass
TX On Neutral	21.456	46.59	60	-13.41	Pass	35.33	50	-14.67	Pass

Table 18. Conducted Emissions, 15.207(a), Test Results, TX ON, Neutral



Plot 9. Conducted Emissions, 15.207(a), TX ON, Neutral

15.207(a) Conducted Emissions Test Setup Photo

Photograph 4. Conducted Emissions, 15.207(a), Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(a)(2) 6 dB and 99% 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, 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 and 99% Bandwidth was determined from the plots on the following pages.

Test Engineer(s): Lionel Gabrillo

Test Date(s): 05/02/11 – 05/06/11

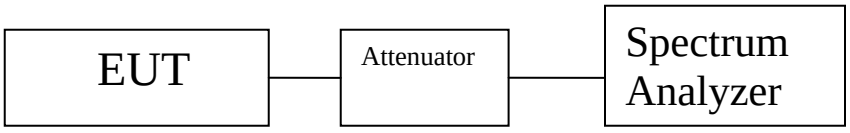


Figure 2. Block Diagram, Occupied Bandwidth Test Setup

Occupied Bandwidth Test Results

Occupied Bandwidth			
Mode	**Carrier Channel**	**Frequency (MHz)**	**Measured 6 dB Bandwidth (MHz)**
802.11b	Low	2412	11.489
	Mid	2437	10.149
	High	2462	10.205
802.11g	Low	2412	16.554
	Mid	2437	16.564
	High	2462	16.568
802.11n 20 MHz Port 0	Low	2412	17.841
	Mid	2437	17.823
	High	2462	17.817
802.11n 20 MHz Port 1	Low	2412	17.791
	Mid	2437	17.793
	High	2462	17.801
802.11n 40 MHz Port 0	Low	2422	36.553
	Mid	2437	36.559
	High	2452	36.542
802.11n 40 MHz Port 1	Low	2422	36.526
	Mid	2437	36.543
	High	2452	36.575

Table 19. 6 dB Occupied Bandwidth, Test Results, 2.4 GHz

Occupied Bandwidth			
Mode	**Carrier Channel**	**Frequency (MHz)**	**Measured 99% Bandwidth (MHz)**
802.11b	Low	2412	15.7200
	Mid	2437	15.8145
	High	2462	15.7012
802.11g	Low	2412	16.6746
	Mid	2437	16.7298
	High	2462	16.7449
802.11n 20 MHz Port 0	Low	2412	17.8421
	Mid	2437	17.8851
	High	2462	17.8603
802.11n 20 MHz Port 1	Low	2412	19.2373
	Mid	2437	20.1765
	High	2462	21.3037
802.11n 40 MHz Port 0	Low	2412	37.2536
	Mid	2437	37.5673
	High	2452	36.7560
802.11n 40 MHz Port 1	Low	2422	38.5948
	Mid	2437	42.1986
	High	2452	43.0086

Table 20. 99% Occupied Bandwidth, Test Results, 2.4 GHz

Occupied Bandwidth Test Results

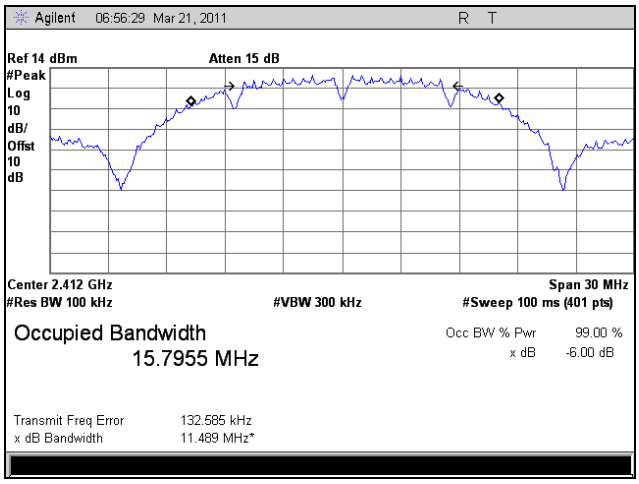
Occupied Bandwidth			
Mode	**Carrier Channel**	**Frequency (MHz)**	**Measured 6 dB Bandwidth (MHz)**
802.11a	Low	5745	16.506
	Mid	5785	16.533
	High	5825	16.521
802.11n 20 MHz Port 0	Low	5745	17.814
	Mid	5785	17.820
	High	5825	17.817
802.11n 20 MHz Port 1	Low	5745	17.812
	Mid	5785	17.789
	High	5825	17.760
802.11n 40 MHz Port 0	Low	5755	36.512
	Mid	5765	36.529
	High	5795	36.555
802.11n 40 MHz Port 1	Low	5755	36.548
	Mid	5765	36.528
	High	5795	36.531

Table 21. 6 dB Occupied Bandwidth, Test Results, 5.8 GHz

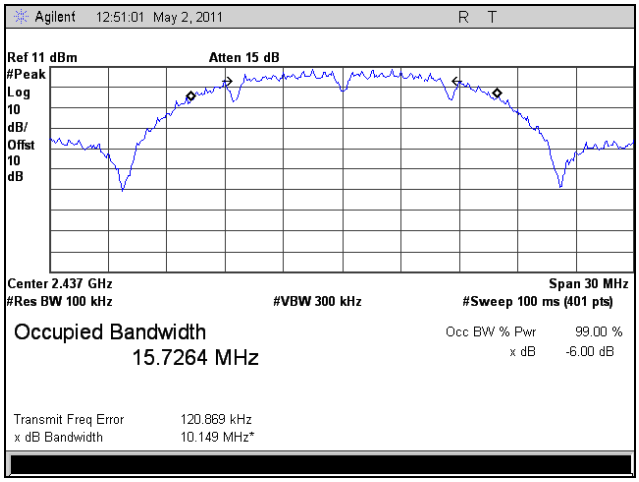
Occupied Bandwidth			
Mode	**Carrier Channel**	**Frequency (MHz)**	**Measured 99% Bandwidth (MHz)**
802.11a	Low	5745	16.5518
	Mid	5785	16.5629
	High	5825	16.6626
802.11n 20 MHz Port 0	Low	5745	17.8296
	Mid	5785	17.8143
	High	5825	17.9001
802.11n 20 MHz Port 1	Low	5745	17.7616
	Mid	5785	17.7839
	High	5825	17.9172
802.11n 40 MHz Port 0	Low	5755	36.4065
	Mid	5765	36.4853
	High	5795	36.3572
802.11n 40 MHz Port 1	Low	5755	37.0029
	Mid	5765	36.8456
	High	5795	36.5888

Table 22. 99% Occupied Bandwidth, Test Results, 5.8 GHz

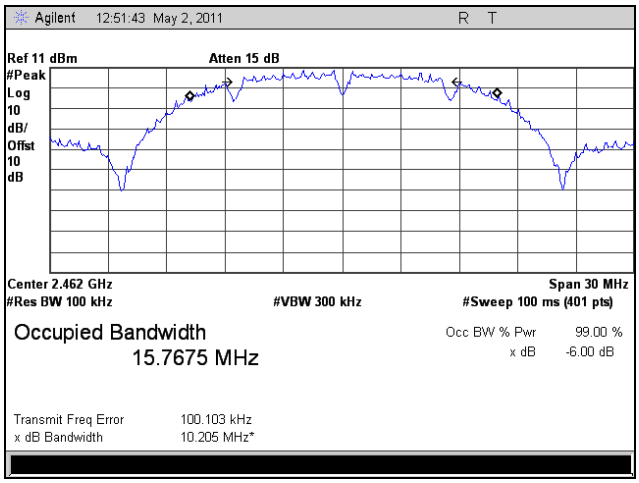
6 dB Occupied Bandwidth Test Results, 802.11b, 2.4 GHz



Plot 10. 6 dB Occupied Bandwidth, Low Channel, 802.11b, 2.4 GHz

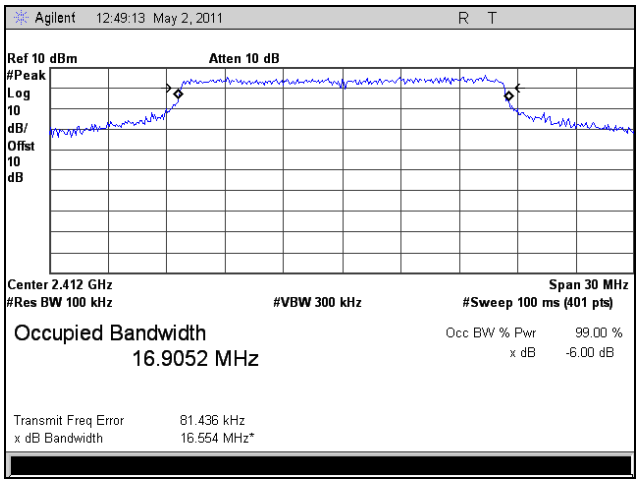


Plot 11. 6 dB Occupied Bandwidth, Mid Channel, 802.11b, 2.4 GHz

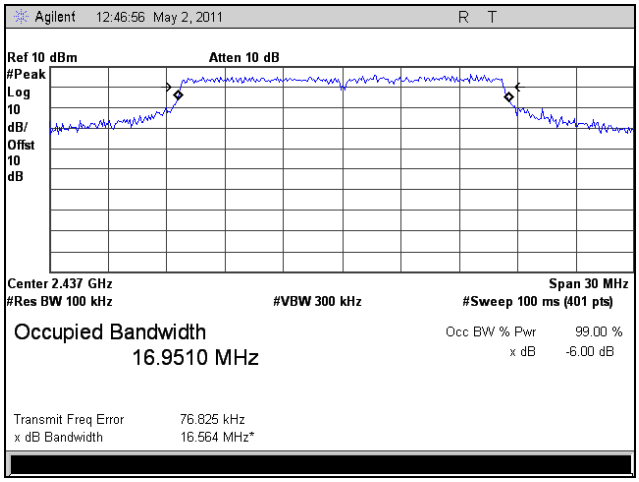


Plot 12. 6 dB Occupied Bandwidth, High Channel, 802.11b, 2.4 GHz

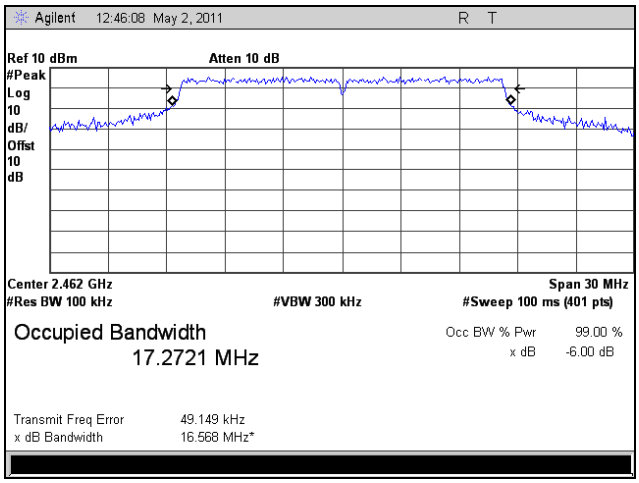
6 dB Occupied Bandwidth Test Results, 802.11g, 2.4 GHz



Plot 13. 6 dB Occupied Bandwidth, Low Channel, 802.11g, 2.4 GHz

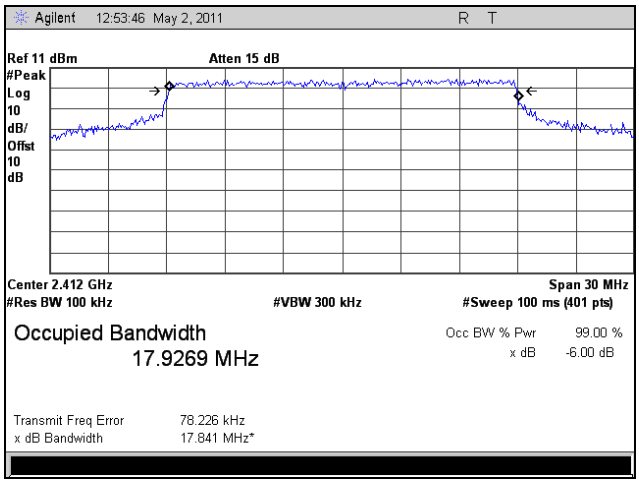


Plot 14. 6 dB Occupied Bandwidth, Mid Channel, 802.11g, 2.4 GHz

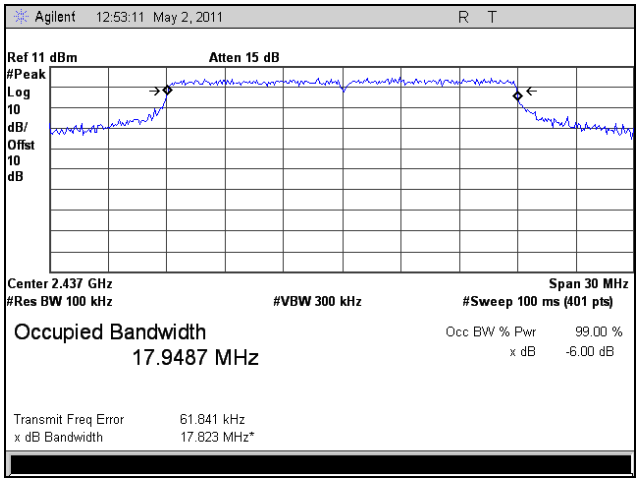


Plot 15. 6 dB Occupied Bandwidth, High Channel, 802.11g, 2.4 GHz

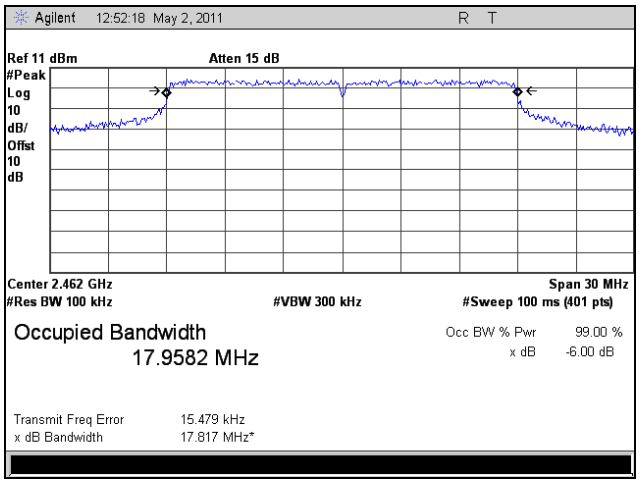
6 dB Occupied Bandwidth Test Results, 802.11n 20 MHz, Port 0, 2.4 GHz



Plot 16. 6 dB Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port 0, 2.4 GHz

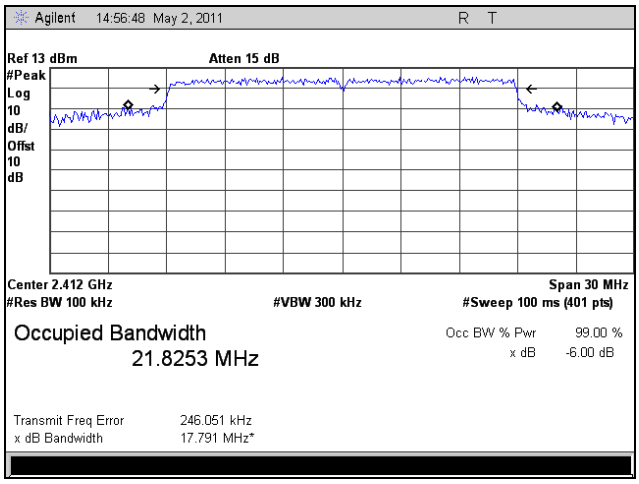


Plot 17. 6 dB Occupied Bandwidth, Mid Channel, 802.11n 20 MHz, Port 0, 2.4 GHz

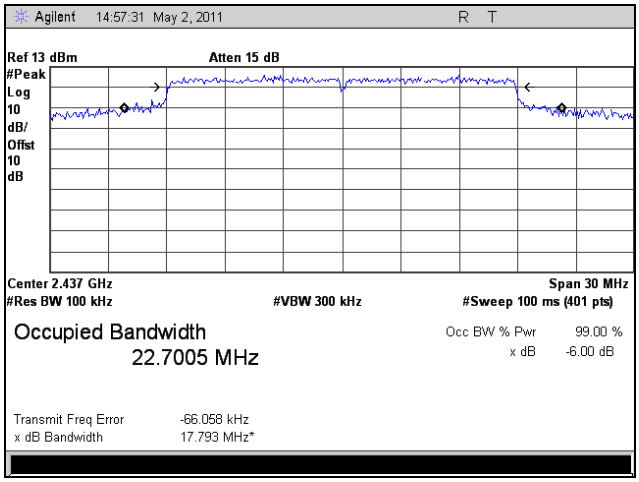


Plot 18. 6 dB Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port 0, 2.4 GHz

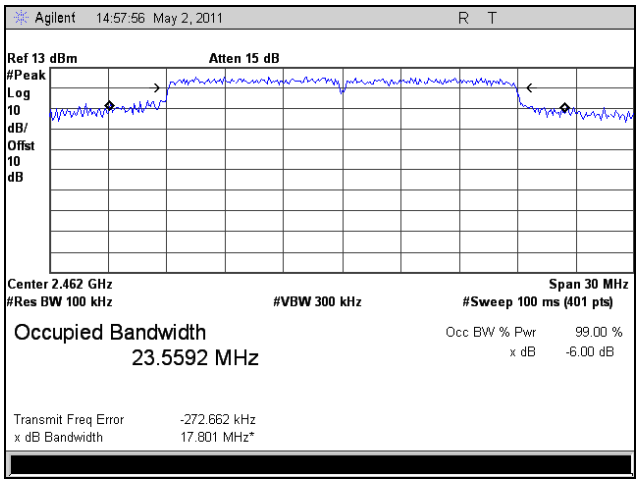
6 dB Occupied Bandwidth Test Results, 802.11n 20 MHz, Port 1, 2.4 GHz



Plot 19. 6 dB Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port 1, 2.4 GHz

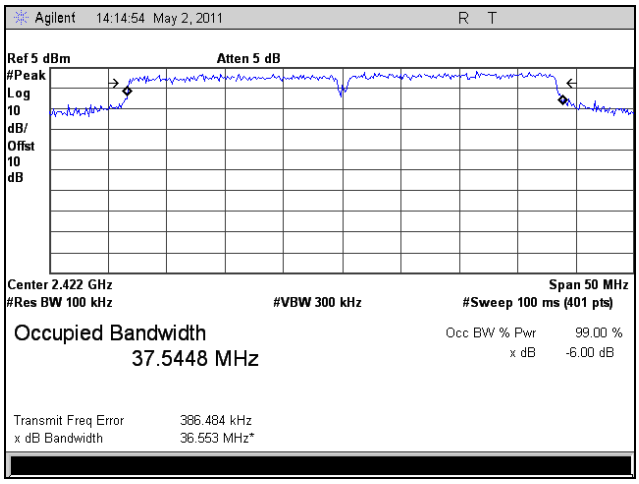


Plot 20. 6 dB Occupied Bandwidth, Mid Channel, 802.11n 20 MHz, Port 1, 2.4 GHz

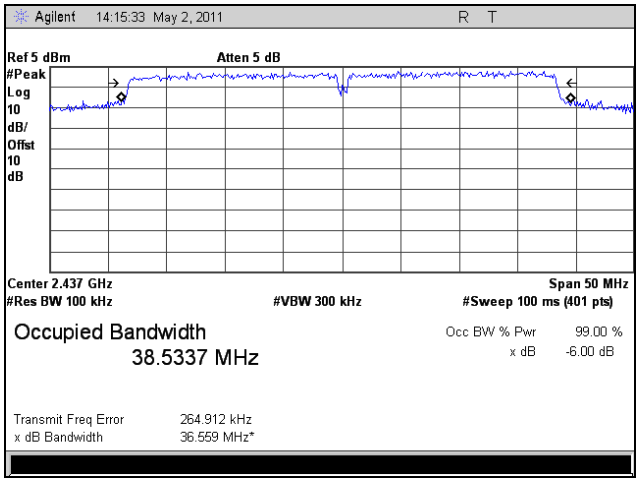


Plot 21. 6 dB Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port 1, 2.4 GHz

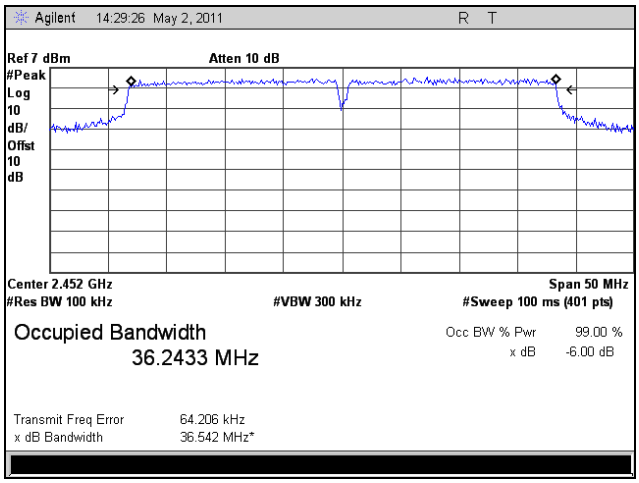
6 dB Occupied Bandwidth Test Results, 802.11n 40 MHz, Port 0, 2.4 GHz



Plot 22. 6 dB Occupied Bandwidth, Low Channel, 802.11n 40 MHz, Port 0, 2.4 GHz

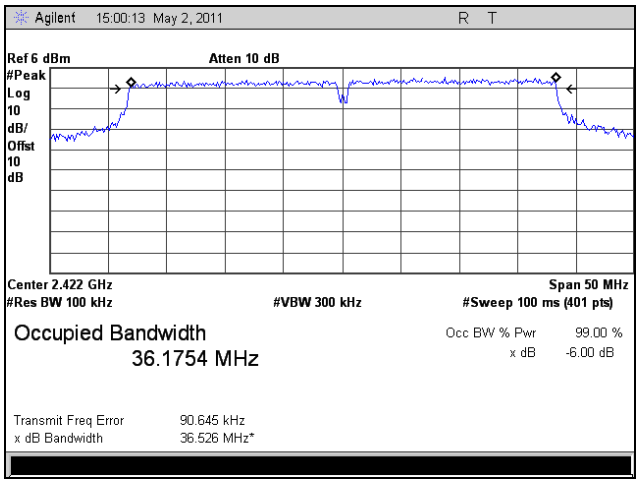


Plot 23. 6 dB Occupied Bandwidth, Mid Channel, 802.11n 40 MHz, Port 0, 2.4 GHz

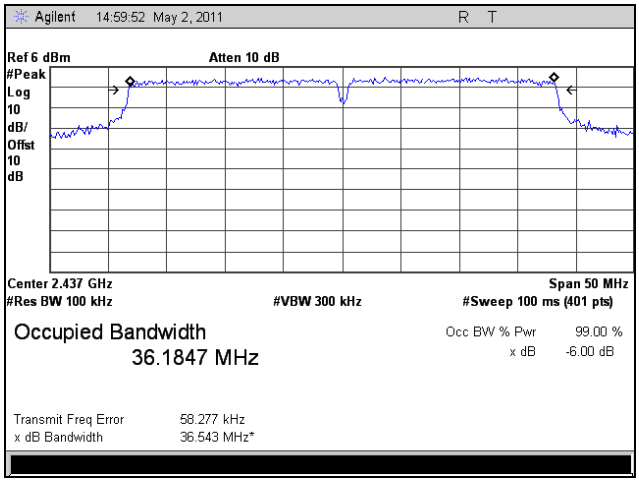


Plot 24. 6 dB Occupied Bandwidth, High Channel, 802.11n 40 MHz, Port 0, 2.4 GHz

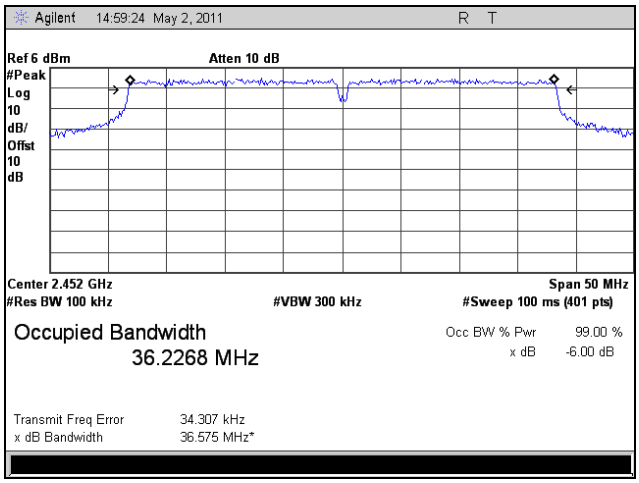
6 dB Occupied Bandwidth Test Results, 802.11n 40 MHz, Port 1, 2.4 GHz



Plot 25. 6 dB Occupied Bandwidth, Low Channel, 802.11n 40 MHz, Port 1, 2.4 GHz

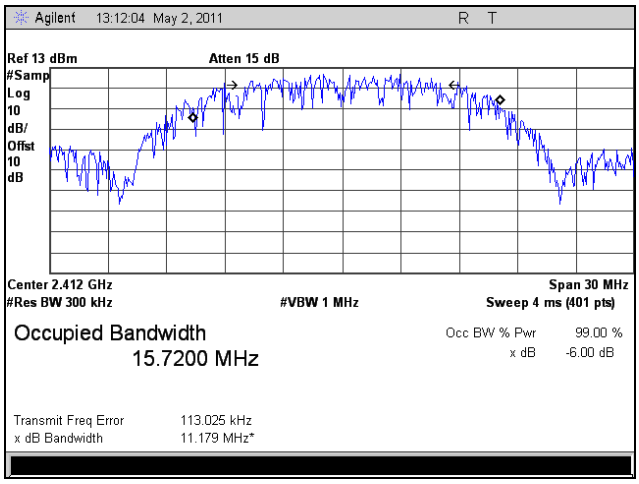


Plot 26. 6 dB Occupied Bandwidth, Mid Channel, 802.11n 40 MHz, Port 1, 2.4 GHz

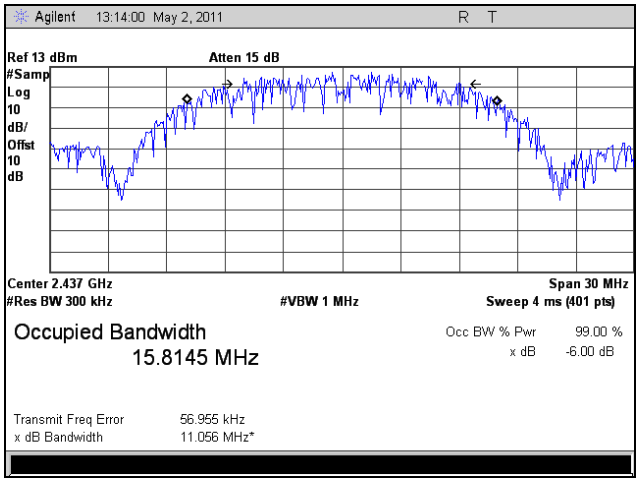


Plot 27. 6 dB Occupied Bandwidth, High Channel, 802.11n 40 MHz, Port 1, 2.4 GHz

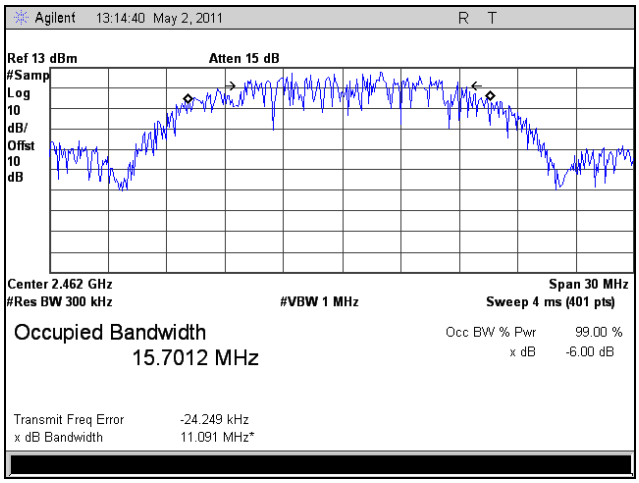
99% Occupied Bandwidth Test Results, 802.11b, 2.4 GHz



Plot 28. 99% Occupied Bandwidth, Low Channel, 802.11b, 2.4 GHz

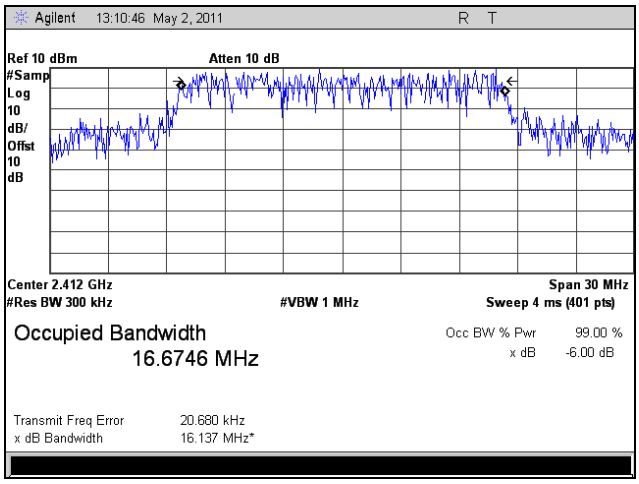


Plot 29. 99% Occupied Bandwidth, Mid Channel, 802.11b, 2.4 GHz

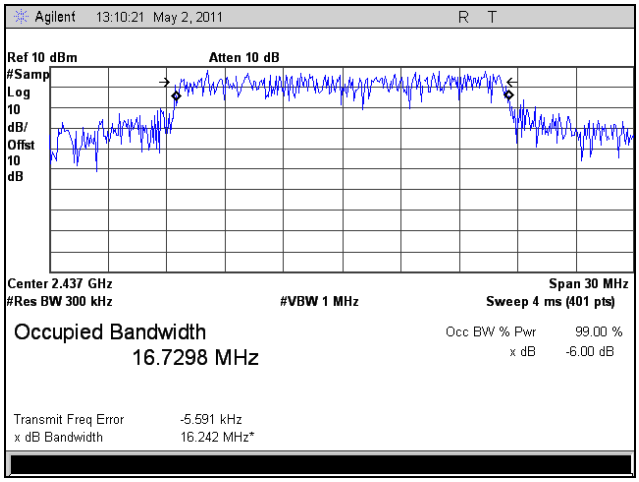


Plot 30. 99% Occupied Bandwidth, High Channel, 802.11b, 2.4 GHz

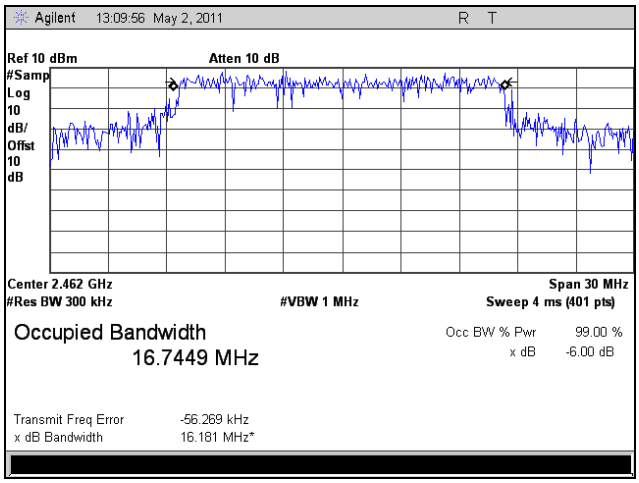
99% Occupied Bandwidth Test Results, 802.11g, 2.4 GHz



Plot 31. 99% Occupied Bandwidth, Low Channel, 802.11g, 2.4 GHz

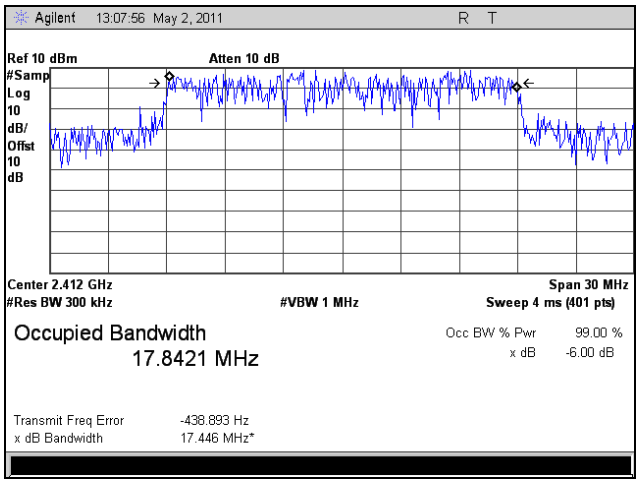


Plot 32. 99% Occupied Bandwidth, Mid Channel, 802.11g, 2.4 GHz

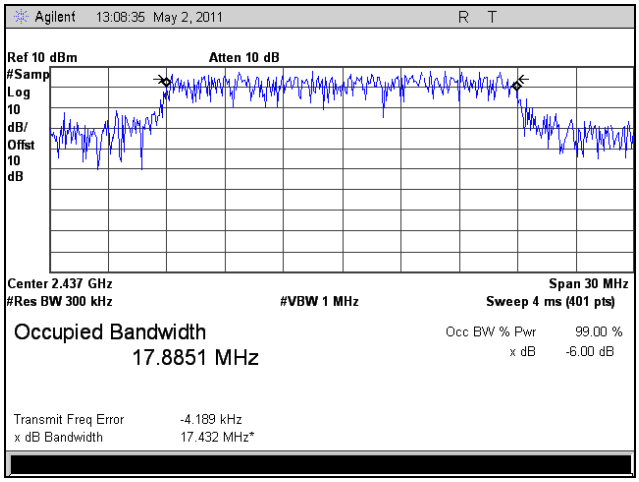


Plot 33. 99% Occupied Bandwidth, High Channel, 802.11g, 2.4 GHz

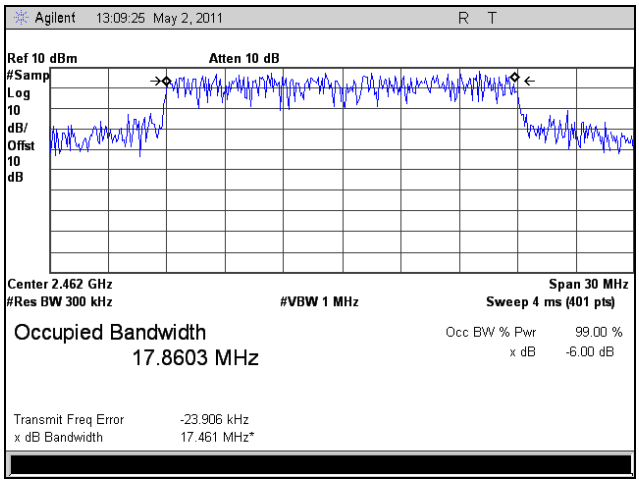
99% Occupied Bandwidth Test Results, 802.11n 20 MHz, Port 0, 2.4 GHz



Plot 34. 99% Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port 0, 2.4 GHz

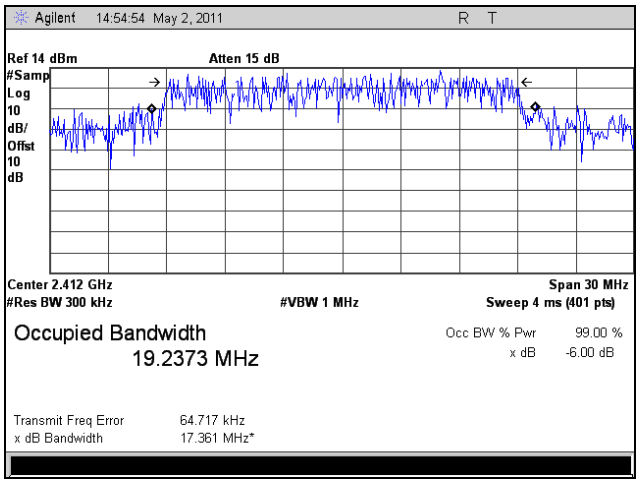


Plot 35. 99% Occupied Bandwidth, Mid Channel, 802.11n 20 MHz, Port 0, 2.4 GHz

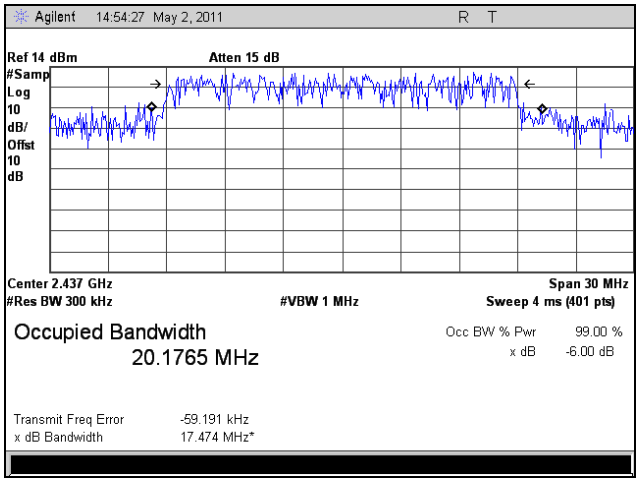


Plot 36. 99% Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port 0, 2.4 GHz

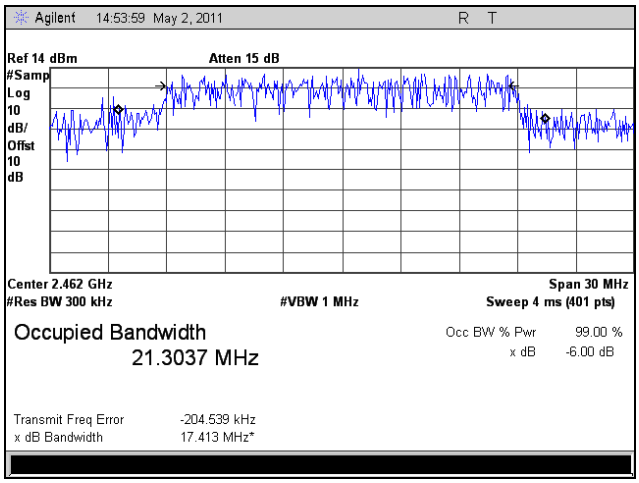
99% Occupied Bandwidth Test Results, 802.11n 20 MHz, Port 1, 2.4 GHz



Plot 37. 99% Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port 1, 2.4 GHz

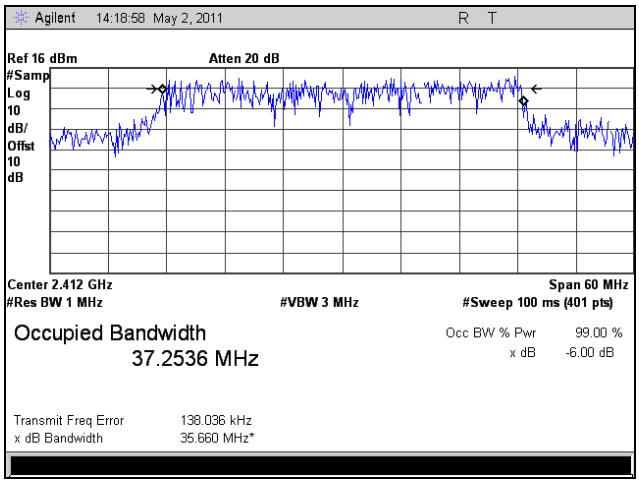


Plot 38. 99% Occupied Bandwidth, Mid Channel, 802.11n 20 MHz, Port 1, 2.4 GHz

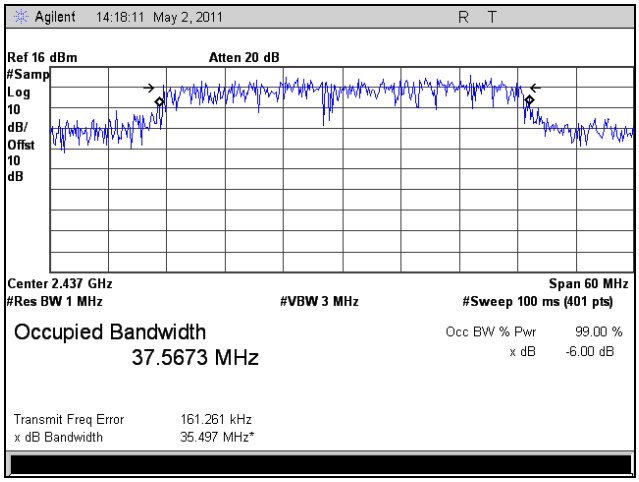


Plot 39. 99% Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port 1, 2.4 GHz

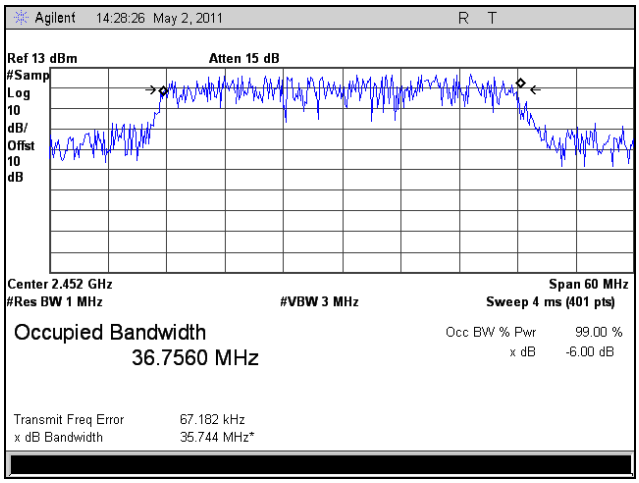
99% Occupied Bandwidth Test Results, 802.11n 40 MHz, Port 0, 2.4 GHz



Plot 40. 99% Occupied Bandwidth, Low Channel, 802.11n 40 MHz, Port 0, 2.4 GHz

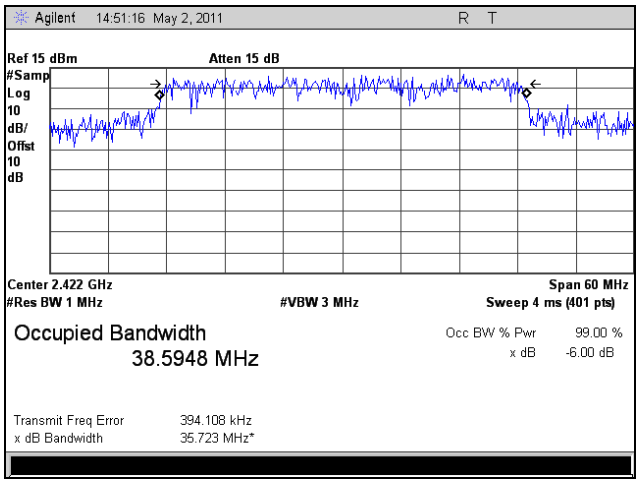


Plot 41. 99% Occupied Bandwidth, Mid Channel, 802.11n 40 MHz, Port 0, 2.4 GHz

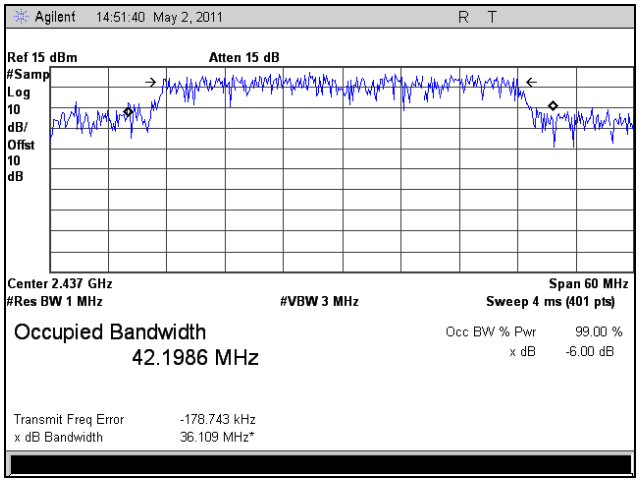


Plot 42. 99% Occupied Bandwidth, High Channel, 802.11n 40 MHz, Port 0, 2.4 GHz

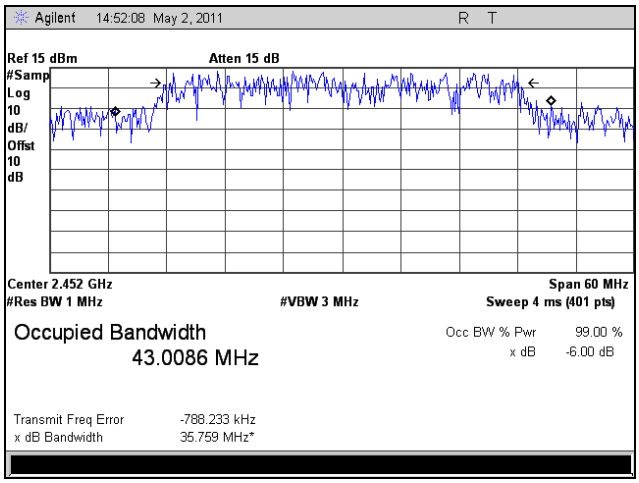
99% Occupied Bandwidth Test Results, 802.11n 40 MHz, Port 1, 2.4 GHz



Plot 43. 99% Occupied Bandwidth, Low Channel, 802.11n 40 MHz, Port 1, 2.4 GHz

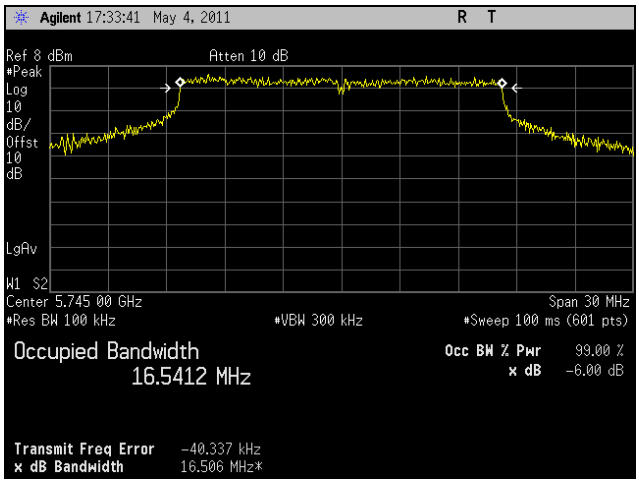


Plot 44. 99% Occupied Bandwidth, Mid Channel, 802.11n 40 MHz, Port 1, 2.4 GHz

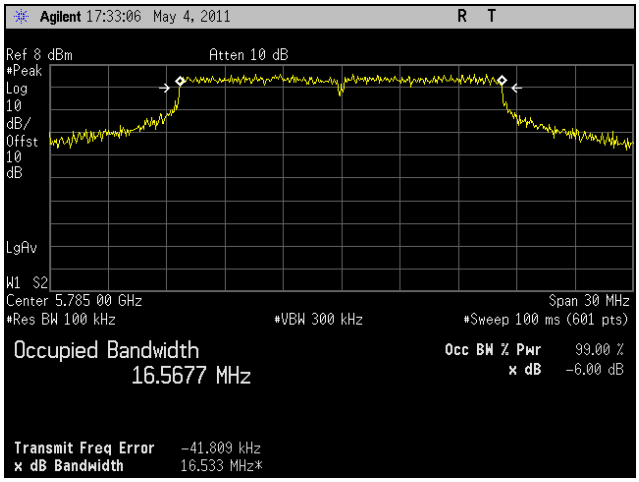


Plot 45. 99% Occupied Bandwidth, High Channel, 802.11n 40 MHz, Port 1, 2.4 GHz

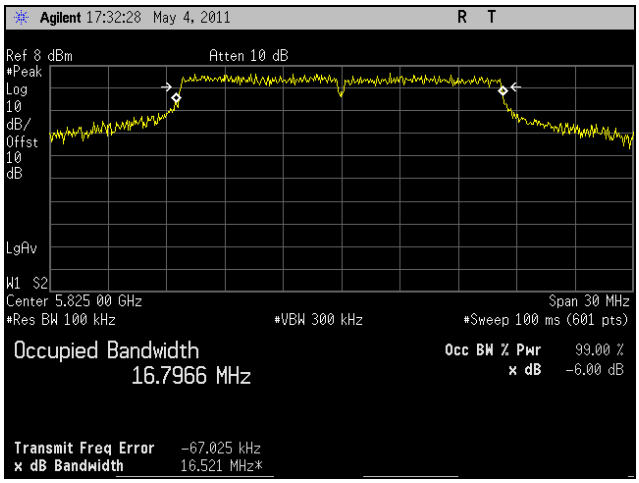
6 dB Occupied Bandwidth Test Results, 802.11a, 5.8 GHz



Plot 46. 6 dB Occupied Bandwidth, Low Channel, 802.11a, 5.8 GHz

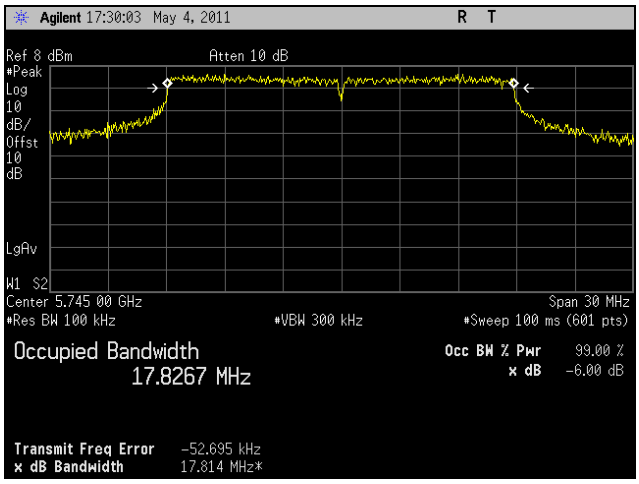


Plot 47. 6 dB Occupied Bandwidth, Mid Channel, 802.11a, 5.8 GHz

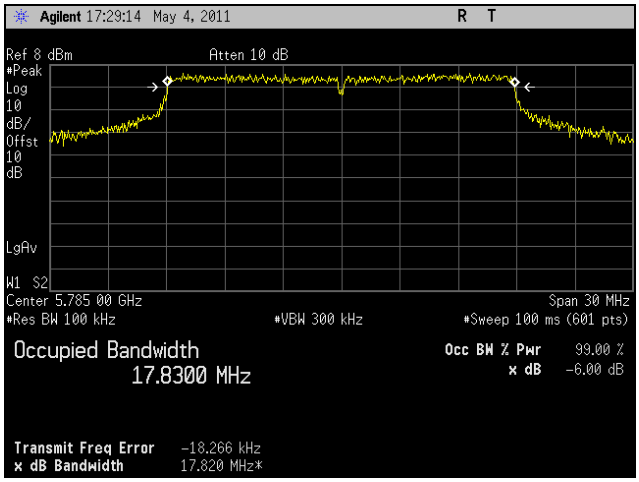


Plot 48. 6 dB Occupied Bandwidth, High Channel, 802.11a, 5.8 GHz

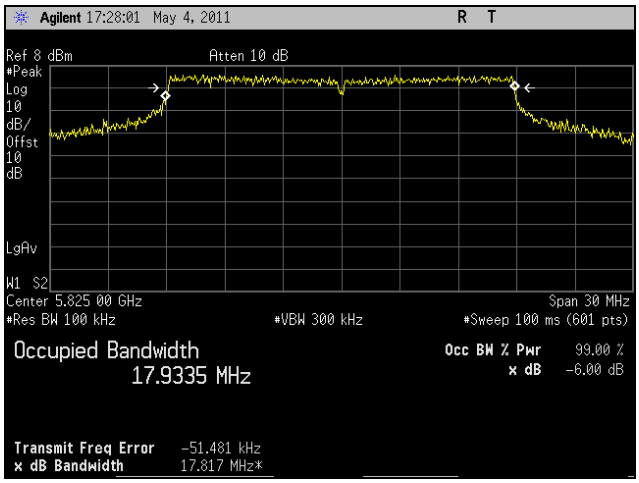
6 dB Occupied Bandwidth Test Results, 802.11n 20 MHz, Port 0, 5.8 GHz



Plot 49. 6 dB Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port 0, 5.8 GHz

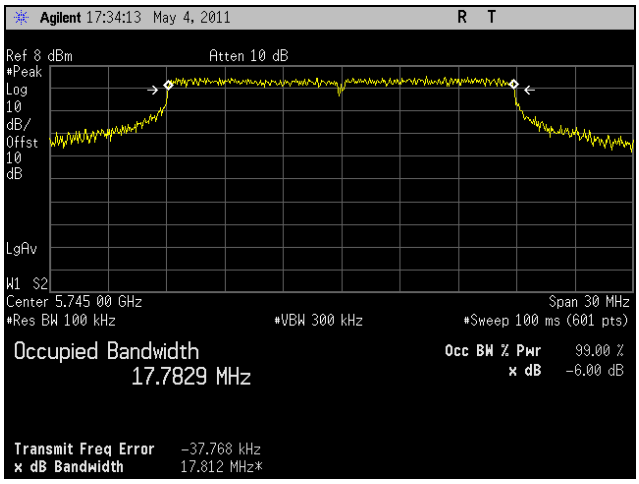


Plot 50. 6 dB Occupied Bandwidth, Mid Channel, 802.11n 20 MHz, Port 0, 5.8 GHz

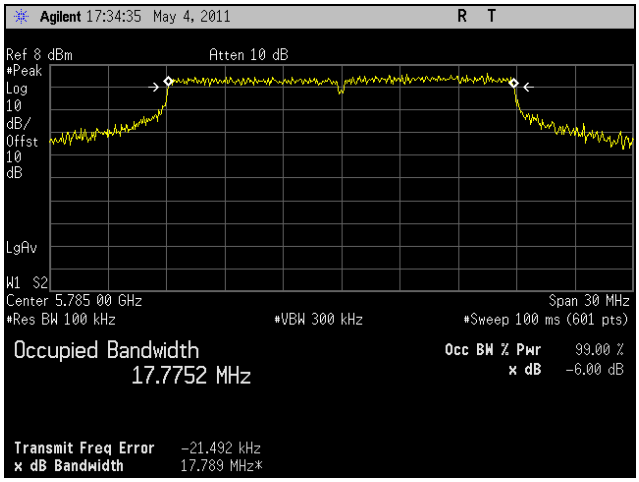


Plot 51. 6 dB Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port 0, 5.8 GHz

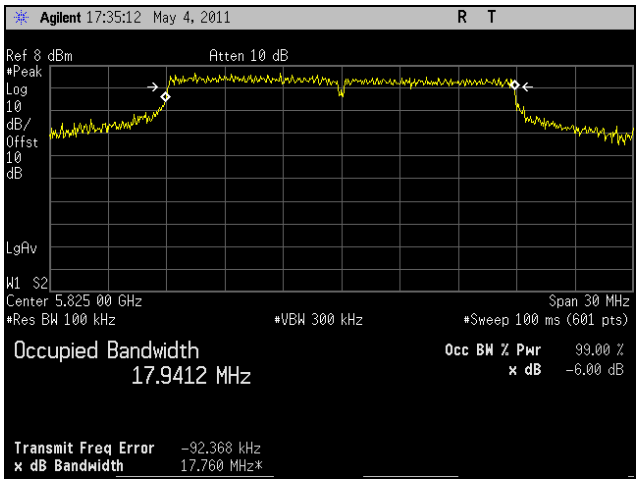
6 dB Occupied Bandwidth Test Results, 802.11n 20 MHz, Port 1, 5.8 GHz



Plot 52. 6 dB Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port 1, 5.8 GHz

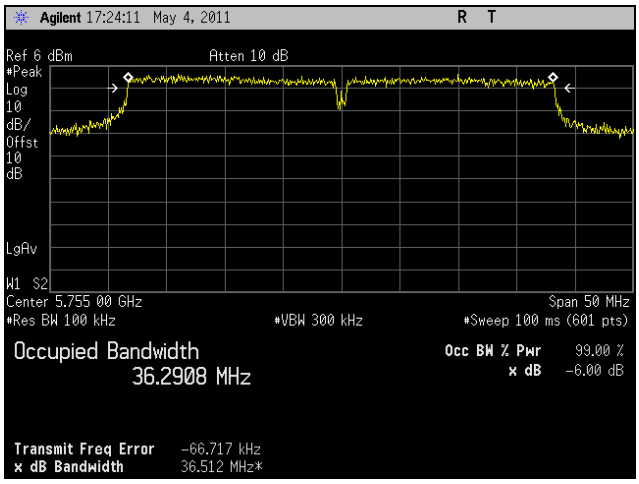


Plot 53. 6 dB Occupied Bandwidth, Mid Channel, 802.11n 20 MHz, Port 1, 5.8 GHz

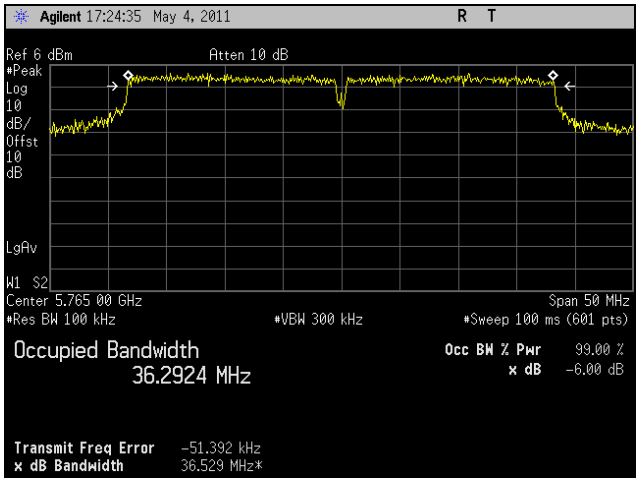


Plot 54. 6 dB Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port 1, 5.8 GHz

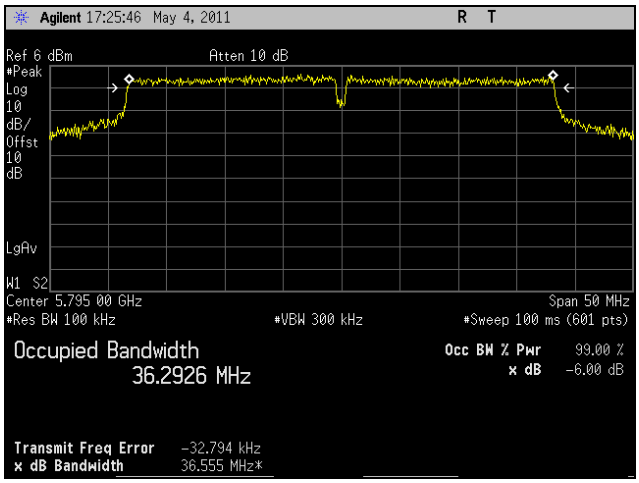
6 dB Occupied Bandwidth Test Results, 802.11n 40 MHz, Port 0, 5.8 GHz



Plot 55. 6 dB Occupied Bandwidth, Low Channel, 802.11n 40 MHz, Port 0, 5.8 GHz

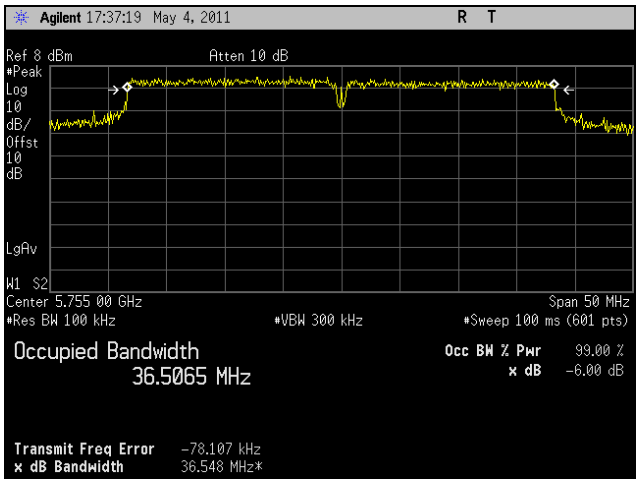


Plot 56. 6 dB Occupied Bandwidth, Mid Channel, 802.11n 40 MHz, Port 0, 5.8 GHz

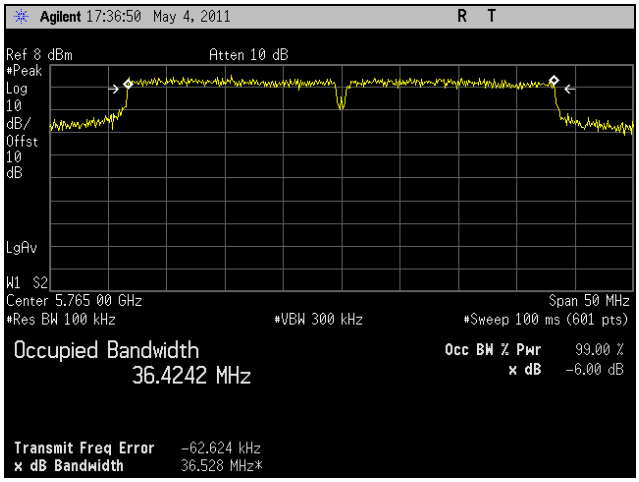


Plot 57. 6 dB Occupied Bandwidth, High Channel, 802.11n 40 MHz, Port 0, 5.8 GHz

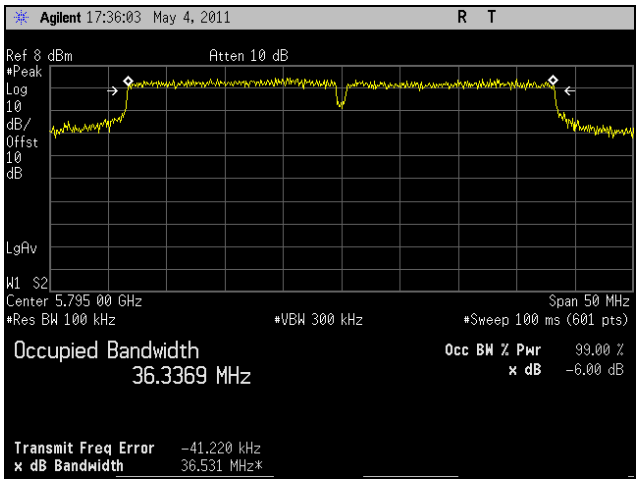
6 dB Occupied Bandwidth Test Results, 802.11n 40 MHz, Port 1, 5.8 GHz



Plot 58. 6 dB Occupied Bandwidth, Low Channel, 802.11n 40 MHz, Port 1, 5.8 GHz

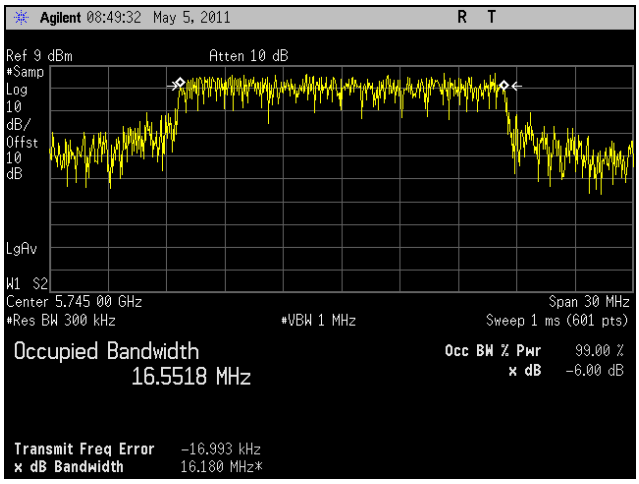


Plot 59. 6 dB Occupied Bandwidth, Mid Channel, 802.11n 40 MHz, Port 1, 5.8 GHz

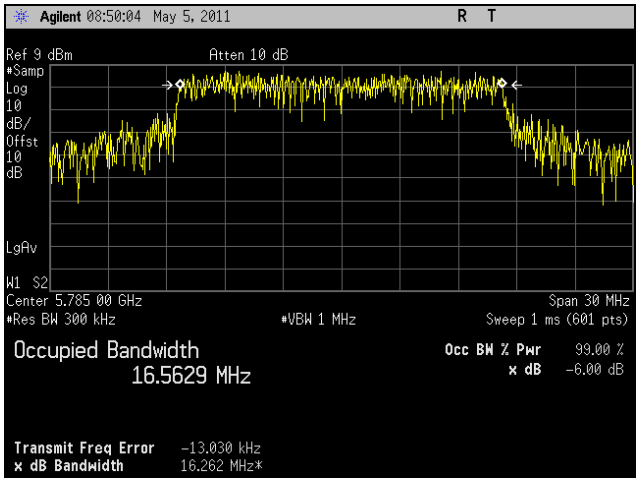


Plot 60. 6 dB Occupied Bandwidth, High Channel, 802.11n 40 MHz, Port 1, 5.8 GHz

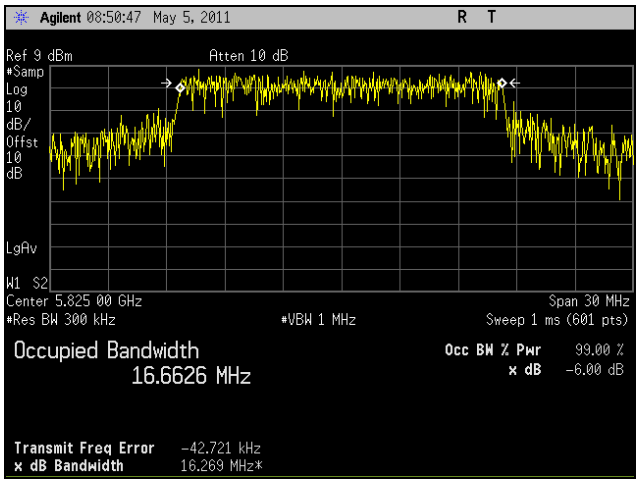
99% Occupied Bandwidth Test Results, 802.11a, 5.8 GHz



Plot 61. 99% Occupied Bandwidth, Low Channel, 802.11a, 5.8 GHz

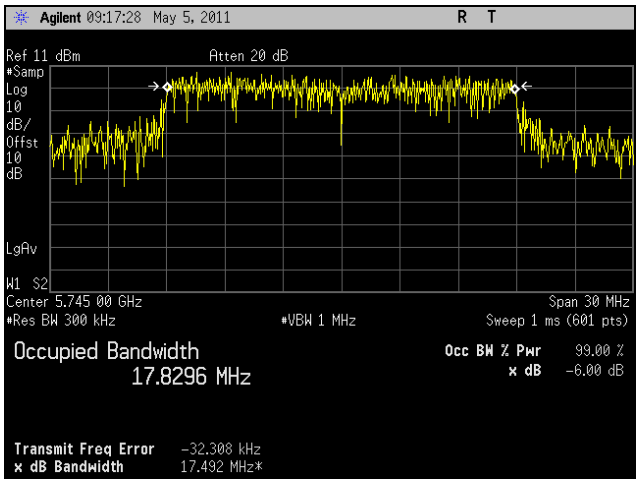


Plot 62. 99% Occupied Bandwidth, Mid Channel, 802.11a, 5.8 GHz

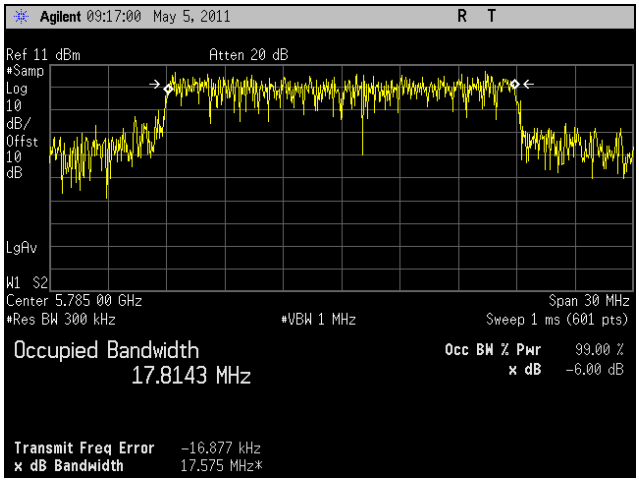


Plot 63. 99% Occupied Bandwidth, High Channel, 802.11a, 5.8 GHz

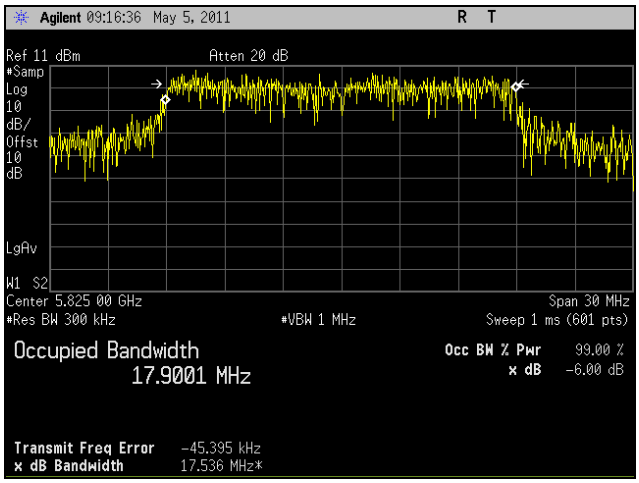
99% Occupied Bandwidth Test Results, 802.11n 20 MHz, Port 0, 5.8 GHz



Plot 64. 99% Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port 0, 5.8 GHz

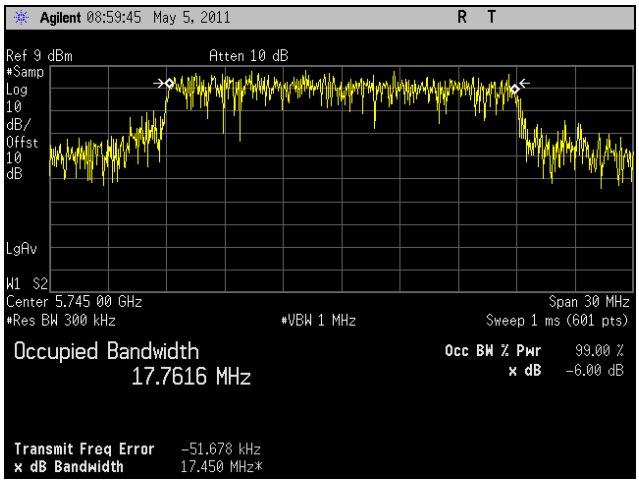


Plot 65. 99% Occupied Bandwidth, Mid Channel, 802.11n 20 MHz, Port 0, 5.8 GHz

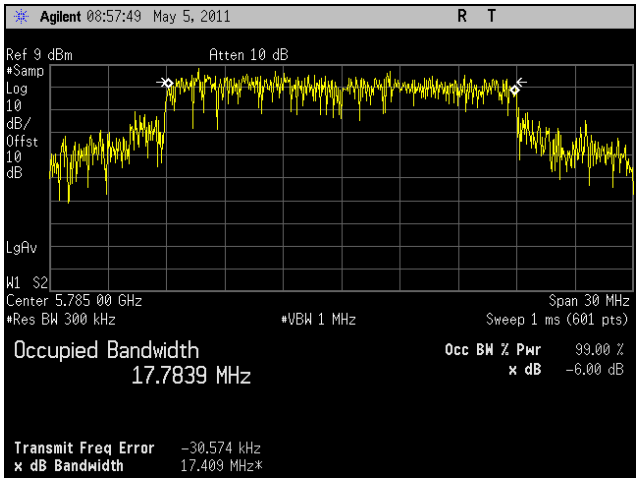


Plot 66. 99% Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port 0, 5.8 GHz

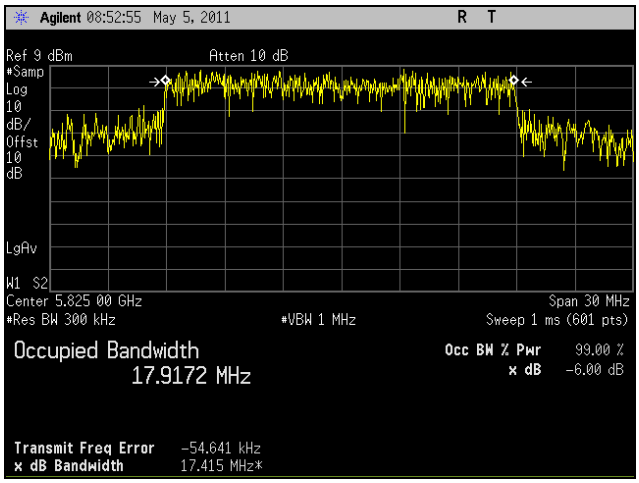
99% Occupied Bandwidth Test Results, 802.11n 20 MHz, Port 1, 5.8 GHz



Plot 67. 99% Occupied Bandwidth, Low Channel, 802.11n 20 MHz, Port 1, 5.8 GHz

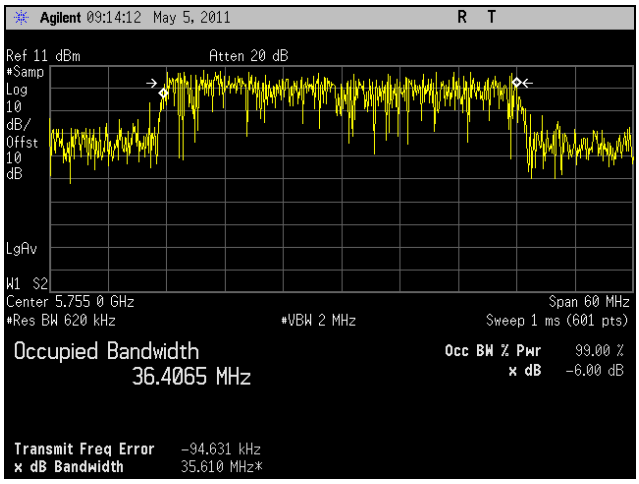


Plot 68. 99% Occupied Bandwidth, Mid Channel, 802.11n 20 MHz, Port 1, 5.8 GHz

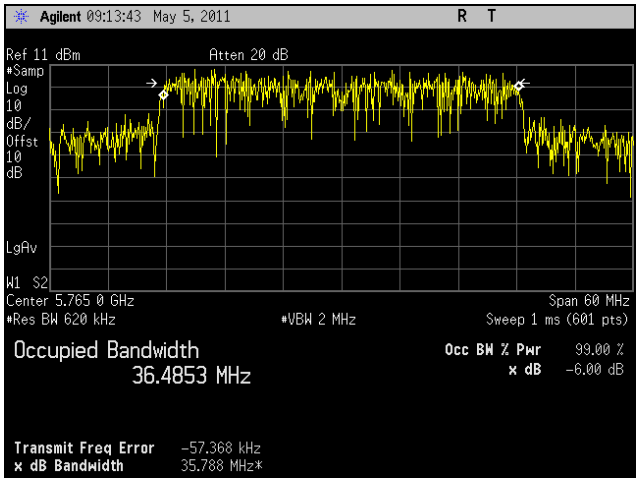


Plot 69. 99% Occupied Bandwidth, High Channel, 802.11n 20 MHz, Port 1, 5.8 GHz

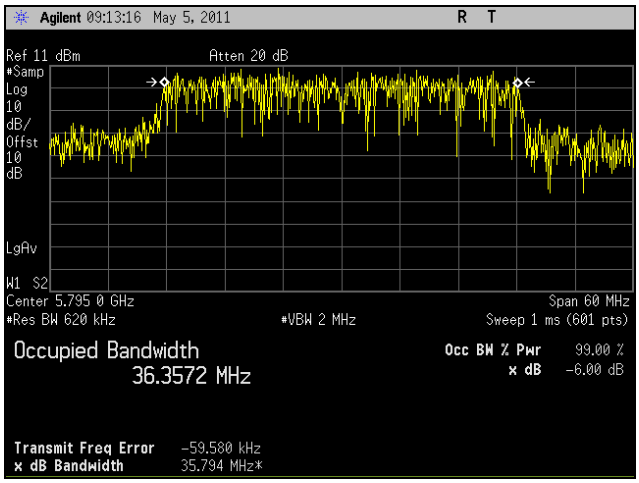
99% Occupied Bandwidth Test Results, 802.11n 40 MHz, Port 0, 5.8 GHz



Plot 70. 99% Occupied Bandwidth, Low Channel, 802.11n 40 MHz, Port 0, 5.8 GHz

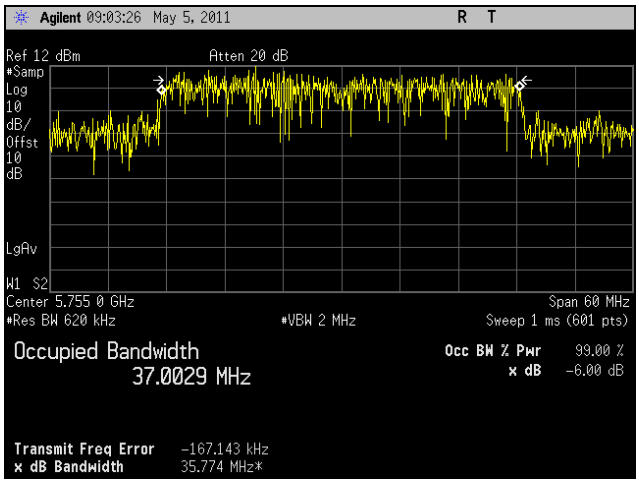


Plot 71. 99% Occupied Bandwidth, Mid Channel, 802.11n 40 MHz, Port 0, 5.8 GHz

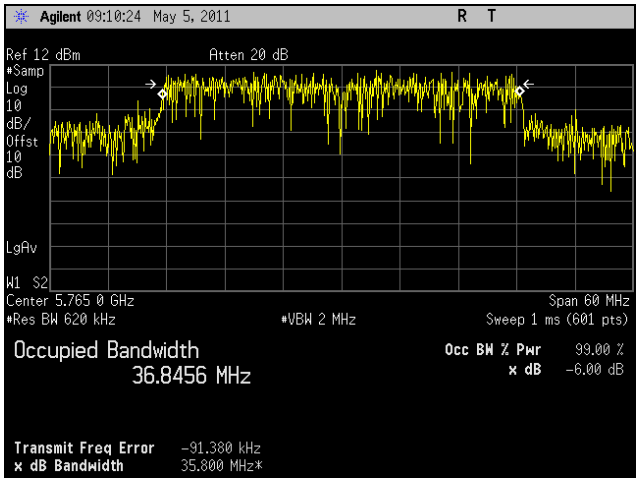


Plot 72. 99% Occupied Bandwidth, High Channel, 802.11n 40 MHz, Port 0, 5.8 GHz

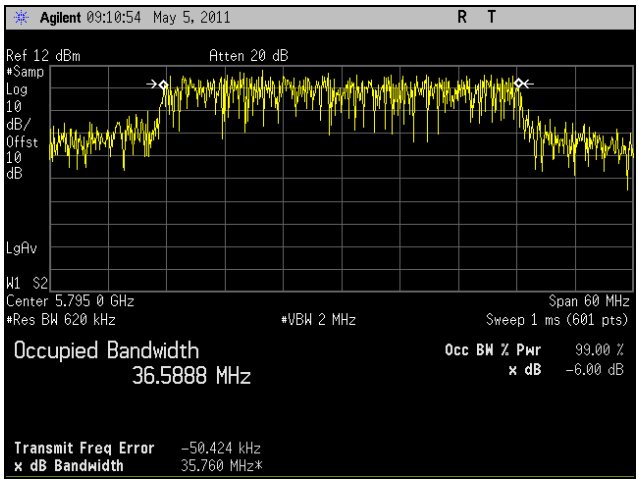
99% Occupied Bandwidth Test Results, 802.11n 40 MHz, Port 1, 5.8 GHz



Plot 73. 99% Occupied Bandwidth, Low Channel, 802.11n 40 MHz, Port 1, 5.8 GHz



Plot 74. 99% Occupied Bandwidth, Mid Channel, 802.11n 40 MHz, Port 1, 5.8 GHz



Plot 75. 99% Occupied Bandwidth, High Channel, 802.11n 40 MHz, Port 1, 5.8 GHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(b) Peak Power Output

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 23. 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 23, 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 EUT 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): Lionel Gabrillo

Test Date(s): 05/02/11 – 05/11/11

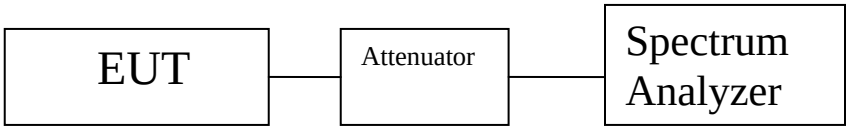


Figure 3. Peak Power Output Test Setup

Peak Power Output Test Results

Peak Conducted Output Power			
Mode	**Carrier Channel**	**Frequency (MHz)**	**Measured Peak Output Power (dBm)**
802.11b	Low	2412	21.81
	Mid	2437	27.58
	High	2462	21.57
802.11g	Low	2412	22.63
	Mid	2437	28.86
	High	2462	23.49
802.11n 20 MHz Port 0	Low	2412	21.72
	Mid	2437	25.07
	High	2462	22.00
802.11n 20 MHz Port 1	Low	2412	22.66
	Mid	2437	25.81
	High	2462	21.93
802.11n 40 MHz Port 0	Low	2422	18.77
	Mid	2437	25.49
	High	2452	21.48
802.11n 40 MHz Port 1	Low	2422	19.93
	Mid	2437	25.91
	High	2452	21.37

Table 24. Peak Power Output, Test Results, 2.4 GHz

Channel	Port 0 (dBm)	Port 0 (mW)	Port 1 (dBm)	Port 1 (mW)	Sum (mW)	Sum (dBm)	Limit (dBm)	Delta
Low	21.72	148.594	22.66	184.502	333.095	25.226	29	-3.774
Mid	25.07	321.366	25.81	381.066	702.432	28.466	29	-0.534
High	22	158.489	21.93	155.955	314.445	24.975	29	-4.025

Table 25. Peak Power Output, Test Results, 2.4 GHz, Summed Ports, 802.11n 20 MHz

Channel	Port 0 (dBm)	Port 0 (mW)	Port 1 (dBm)	Port 1 (mW)	Sum (mW)	Sum (dBm)	Limit (dBm)	Delta
Low	18.77	75.336	19.93	98.401	173.737	22.399	29	-6.601
Mid	25.49	353.997	25.91	389.942	743.939	28.715	29	-0.285
High	21.48	140.605	21.37	137.088	277.693	24.436	29	-4.564

Table 26. Peak Power Output, Test Results, 2.4 GHz, Summed Ports, 802.11n 40 MHz

Peak Conducted Output Power			
Mode	**Carrier Channel**	**Frequency (MHz)**	**Measured Peak Output Power (dBm)**
802.11a	Low	5745	28.78
	Mid	5785	28.62
	High	5825	27.53
802.11n 20 MHz Port 0	Low	5745	25.07
	Mid	5785	25.00
	High	5825	23.84
802.11n 20 MHz Port 1	Low	5745	25.42
	Mid	5785	25.47
	High	5825	24.80
802.11n 40 MHz Port 0	Low	5755	24.04
	Mid	5765	26.51
	High	5795	23.56
802.11n 40 MHz Port 1	Low	5755	24.44
	Mid	5765	25.20
	High	5795	24.34

Table 27. Peak Power Output, Test Results, 5.8 GHz

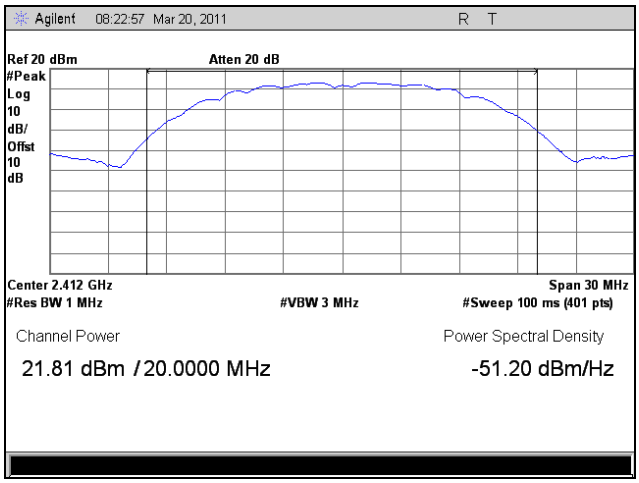
Channel	Port 0 (dBm)	Port 0 (mW)	Port 1 (dBm)	Port 1 (mW)	Sum (mW)	Sum (dBm)	Limit (dBm)	Delta
Low	25.07	321.366	25.42	348.337	669.703	28.259	29	-0.741
Mid	25.00	316.228	25.47	352.371	668.599	28.252	29	-0.748
High	23.84	242.103	24.80	301.995	544.098	27.357	29	-1.643

Table 28. Peak Power Output, Test Results, 5.8 GHz, Summed Ports, 802.11n 20 MHz

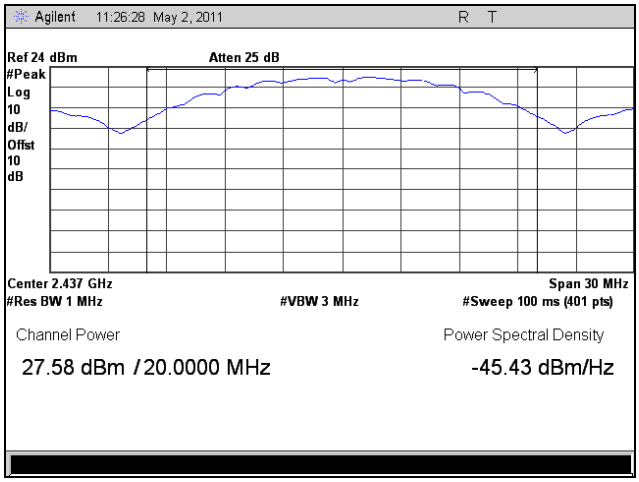
Channel	Port 0 (dBm)	Port 0 (mW)	Port 1 (dBm)	Port 1 (mW)	Sum (mW)	Sum (dBm)	Limit (dBm)	Delta
Low	24.04	253.513	24.44	277.971	531.484	27.255	29	-1.745
Mid	26.51	447.713	25.2	331.131	778.844	28.915	29	-0.085
High	23.56	226.986	24.34	271.644	498.630	26.978	29	-2.022

Table 29. Peak Power Output, Test Results, 5.8 GHz, Summed Ports, 802.11n 40 MHz

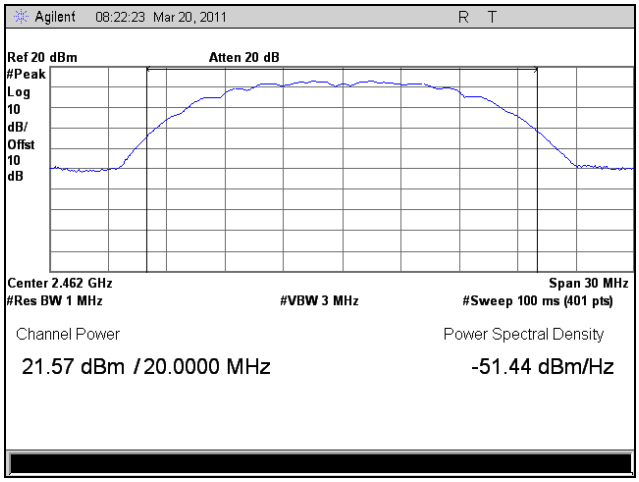
Peak Power Output Test Results, 802.11b, 2.4 GHz



Plot 76. Peak Power Output, Low Channel, 802.11b, 2.4 GHz

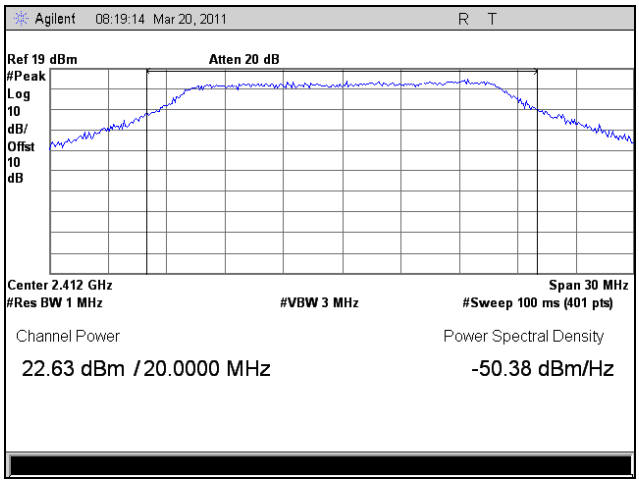


Plot 77. Peak Power Output, Mid Channel, 802.11b, 2.4 GHz

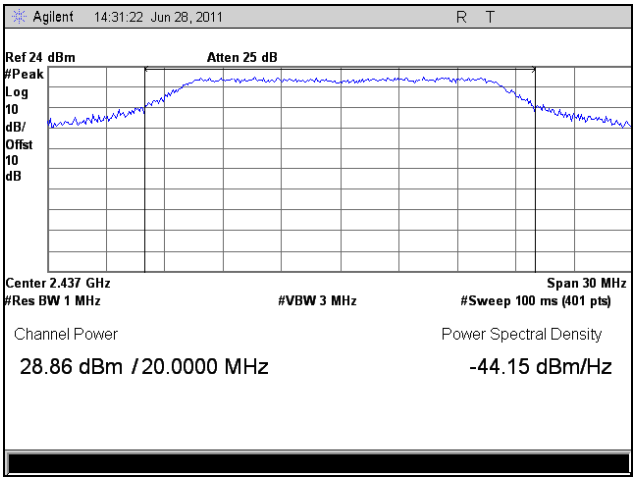


Plot 78. Peak Power Output, High Channel, 802.11b, 2.4 GHz

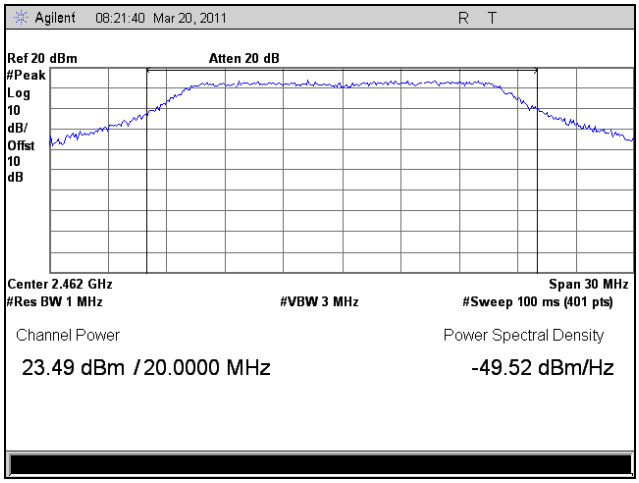
Peak Power Output Test Results, 802.11g, 2.4 GHz



Plot 79. Peak Power Output, Low Channel, 802.11g, 2.4 GHz

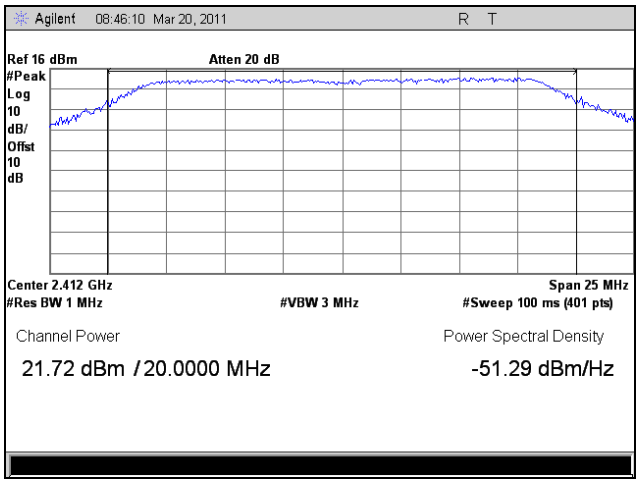


Plot 80. Peak Power Output, Mid Channel, 802.11g, 2.4 GHz

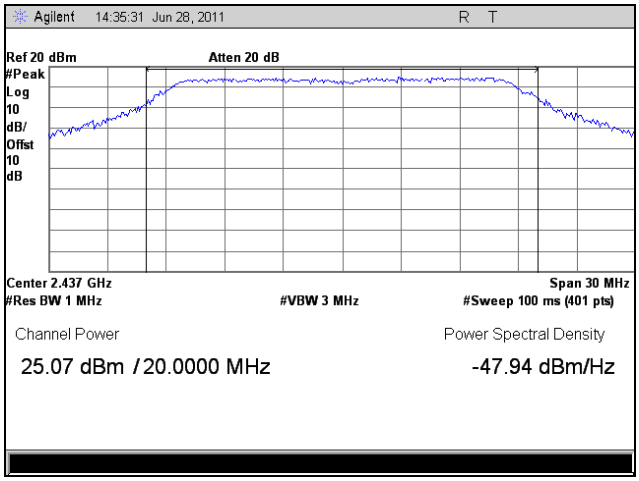


Plot 81. Peak Power Output, High Channel, 802.11g, 2.4 GHz

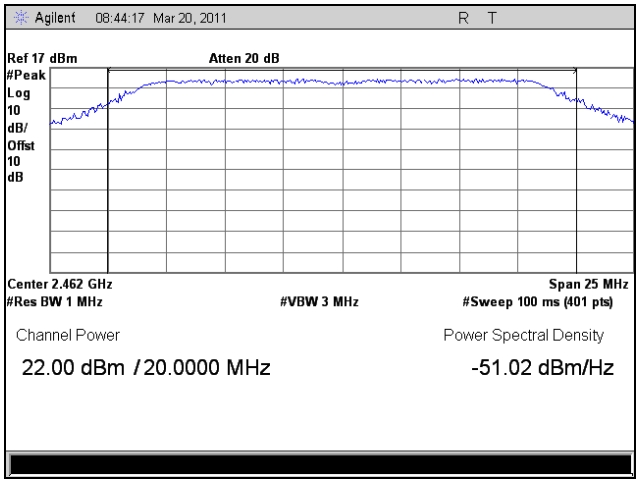
Peak Power Output Test Results, 802.11n 20 MHz, Port 0, 2.4 GHz



Plot 82. Peak Power Output, Low Channel, 802.11n 20 MHz, Port 0, 2.4 GHz

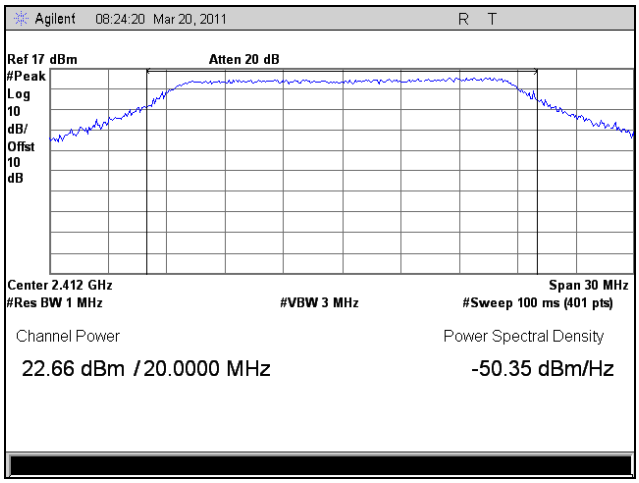


Plot 83. Peak Power Output, Mid Channel, 802.11n 20 MHz, Port 0, 2.4 GHz

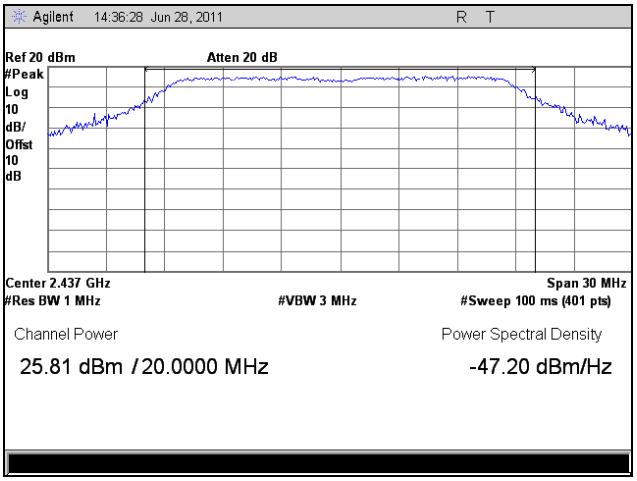


Plot 84. Peak Power Output, High Channel, 802.11n 20 MHz, Port 0, 2.4 GHz

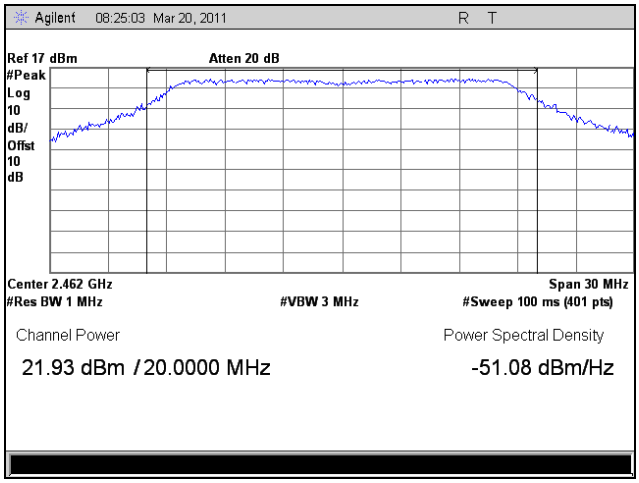
Peak Power Output Test Results, 802.11n 20 MHz, Port 1, 2.4 GHz



Plot 85. Peak Power Output, Low Channel, 802.11n 20 MHz, Port 1, 2.4 GHz

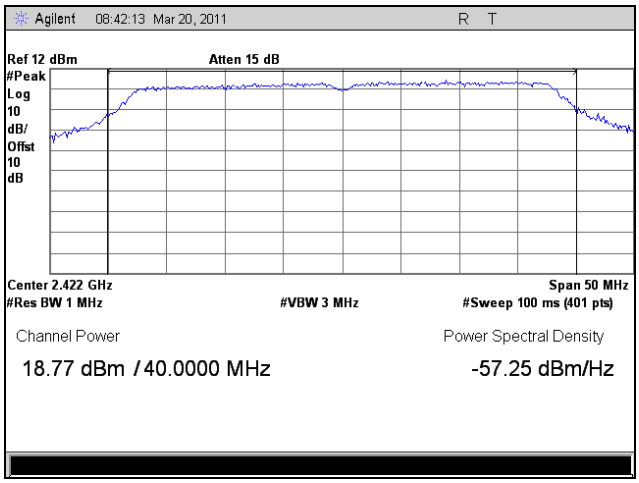


Plot 86. Peak Power Output, Mid Channel, 802.11n 20 MHz, Port 1, 2.4 GHz

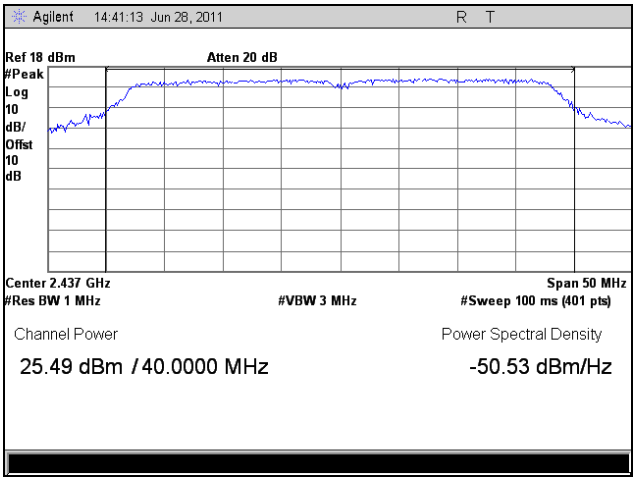


Plot 87. Peak Power Output, High Channel, 802.11n 20 MHz, Port 1, 2.4 GHz

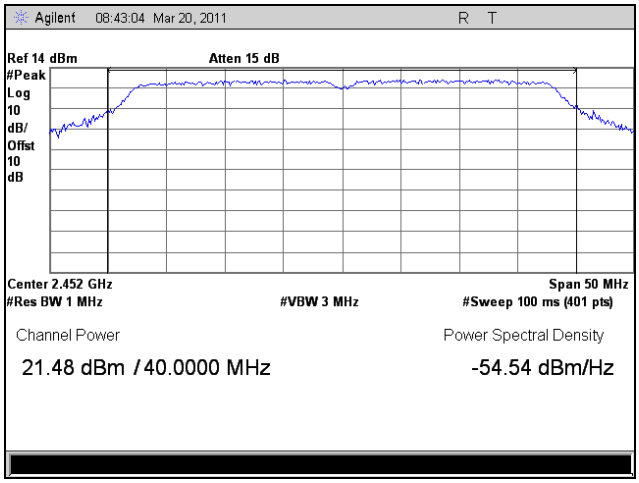
Peak Power Output Test Results, 802.11n 40 MHz, Port 0, 2.4 GHz



Plot 88. Peak Power Output, Low Channel, 802.11n 40 MHz, Port 0, 2.4 GHz

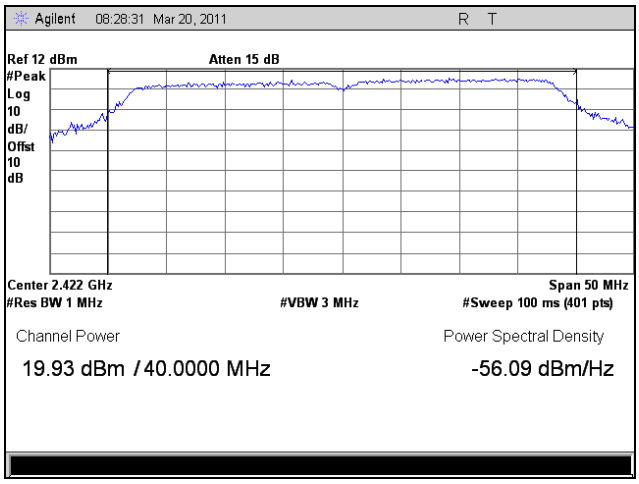


Plot 89. Peak Power Output, Mid Channel, 802.11n 40 MHz, Port 0, 2.4 GHz

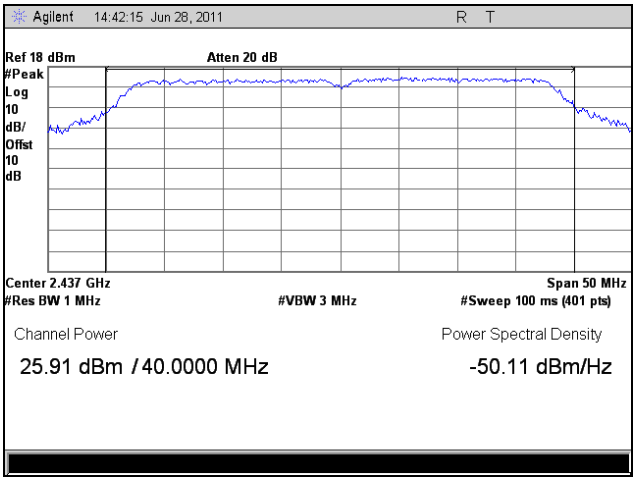


Plot 90. Peak Power Output, High Channel, 802.11n 40 MHz, Port 0, 2.4 GHz

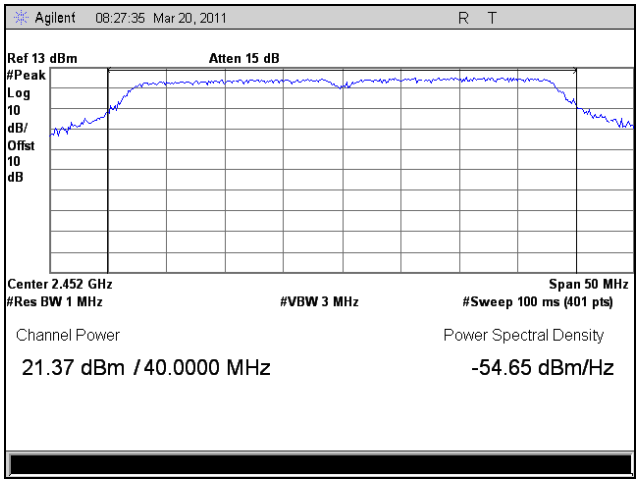
Peak Power Output Test Results, 802.11n 40 MHz, Port 1, 2.4 GHz



Plot 91. Peak Power Output, Low Channel, 802.11n 40 MHz, Port 1, 2.4 GHz

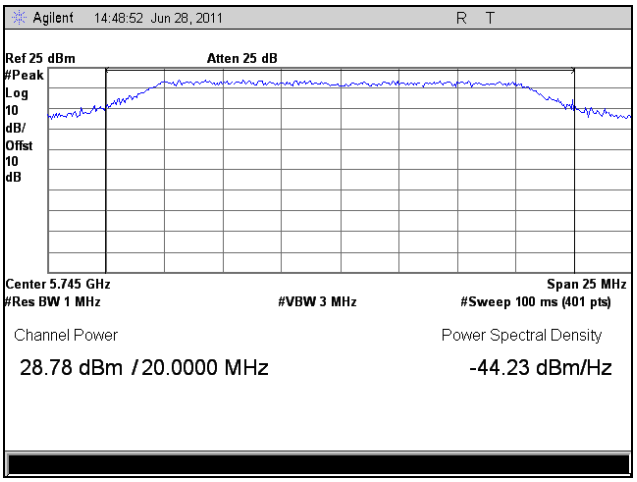


Plot 92. Peak Power Output, Mid Channel, 802.11n 40 MHz, Port 1, 2.4 GHz

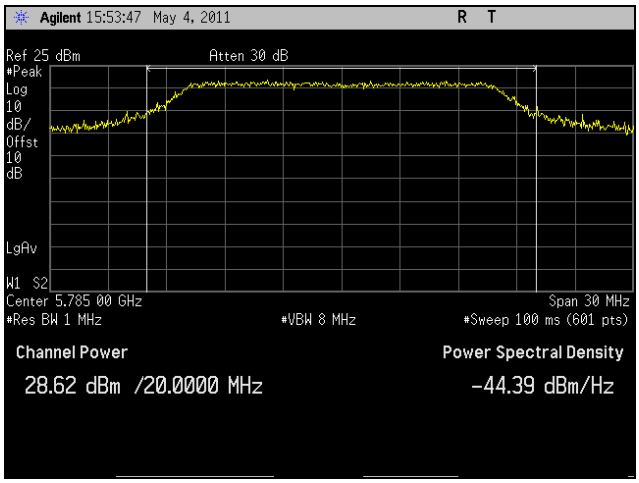


Plot 93. Peak Power Output, High Channel, 802.11n 40 MHz, Port 1, 2.4 GHz

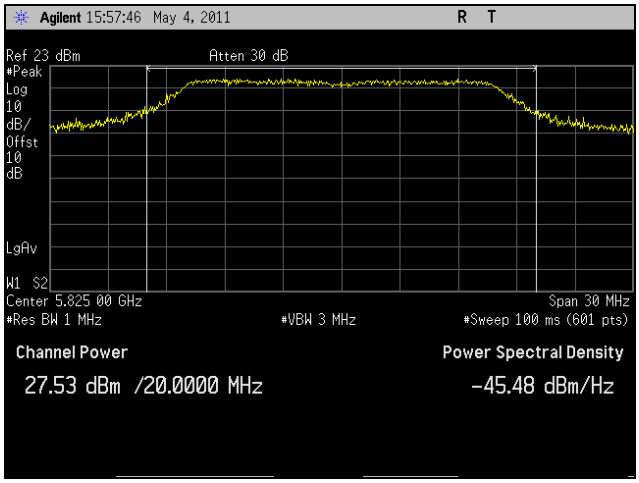
Peak Power Output Test Results, 802.11a, 5.8 GHz



Plot 94. Peak Power Output, Low Channel, 802.11a, 5.8 GHz

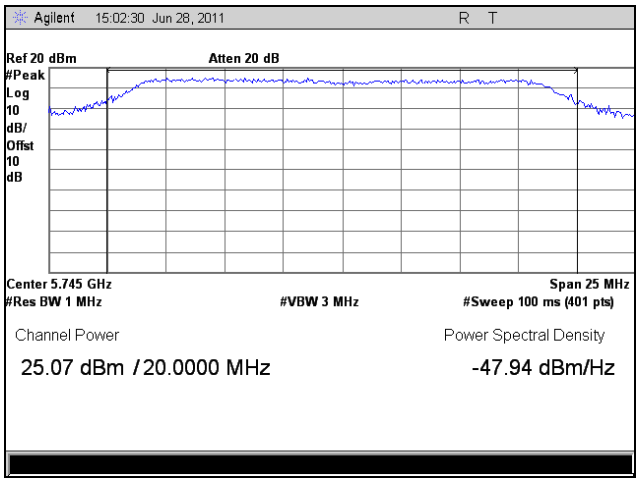


Plot 95. Peak Power Output, Mid Channel, 802.11a, 5.8 GHz

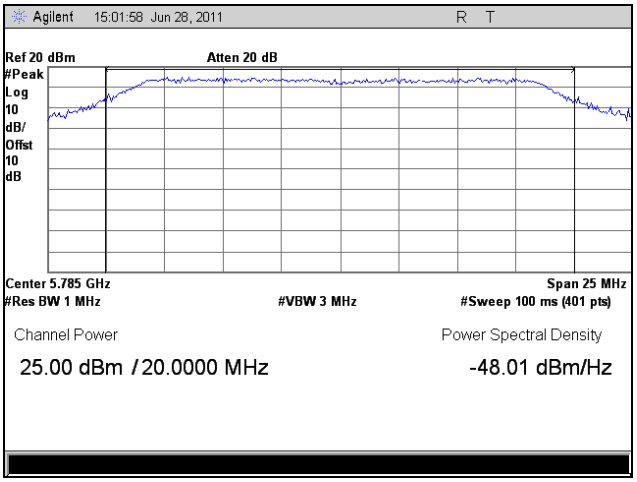


Plot 96. Peak Power Output, High Channel, 802.11a, 5.8 GHz

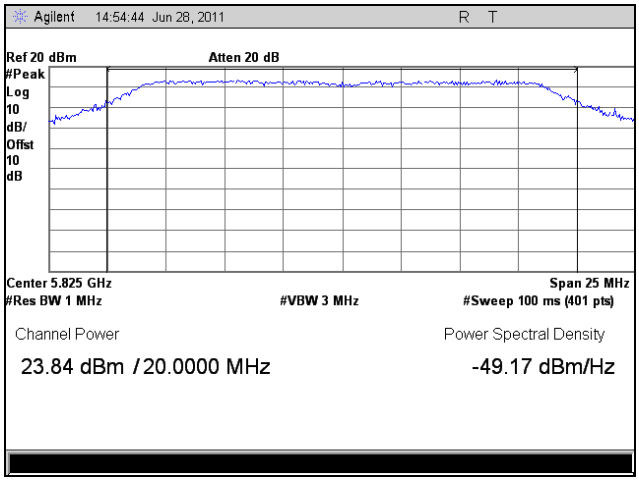
Peak Power Output Test Results, 802.11n 20 MHz, Port 0, 5.8 GHz



Plot 97. Peak Power Output, Low Channel, 802.11n 20 MHz, Port 0, 5.8 GHz

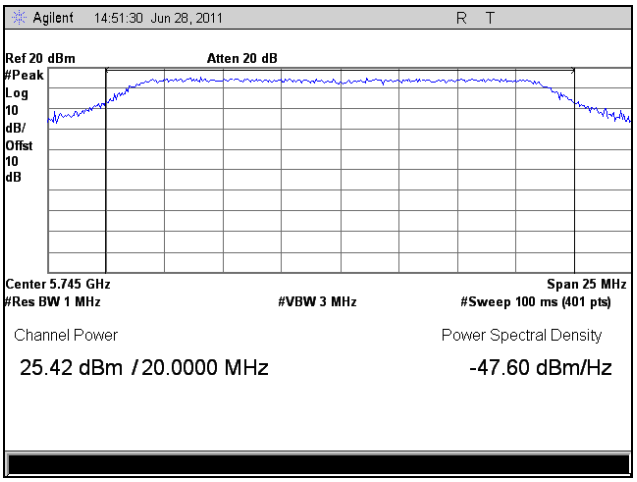


Plot 98. Peak Power Output, Mid Channel, 802.11n 20 MHz, Port 0, 5.8 GHz

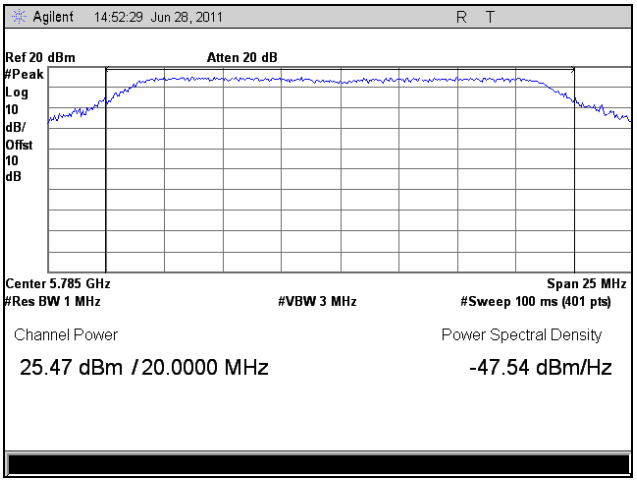


Plot 99. Peak Power Output, High Channel, 802.11n 20 MHz, Port 0, 5.8 GHz

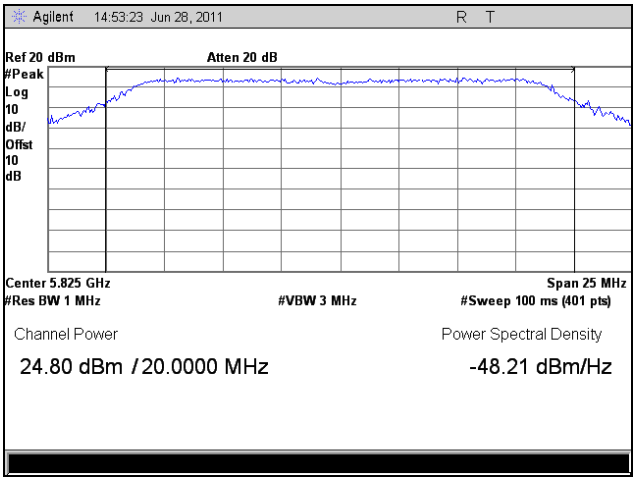
Peak Power Output Test Results, 802.11n 20 MHz, Port 1, 5.8 GHz



Plot 100. Peak Power Output, Low Channel, 802.11n 20 MHz, Port 1, 5.8 GHz

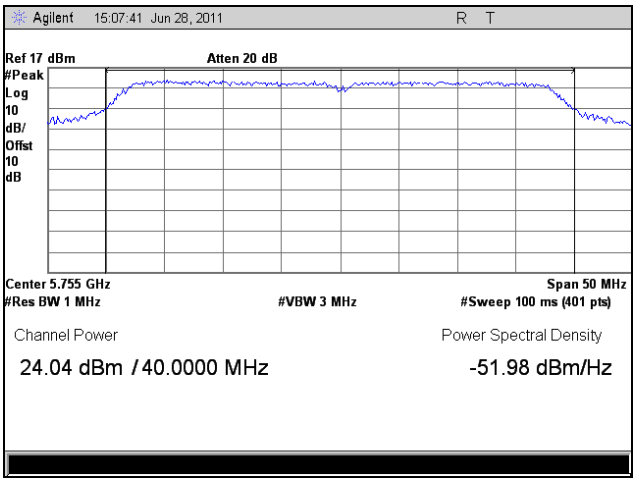


Plot 101. Peak Power Output, Mid Channel, 802.11n 20 MHz, Port 1, 5.8 GHz

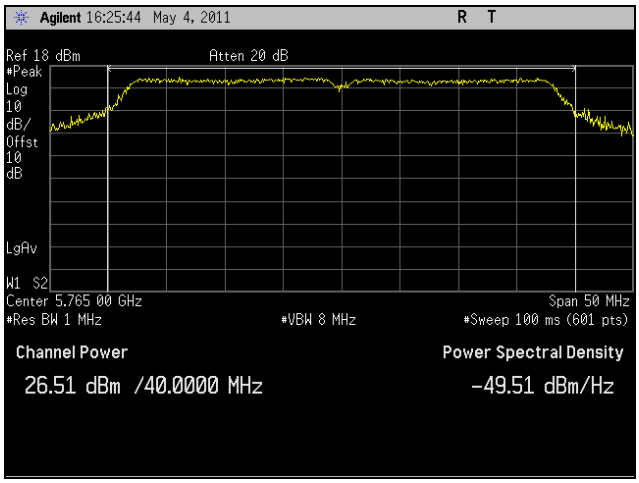


Plot 102. Peak Power Output, High Channel, 802.11n 20 MHz, Port 1, 5.8 GHz

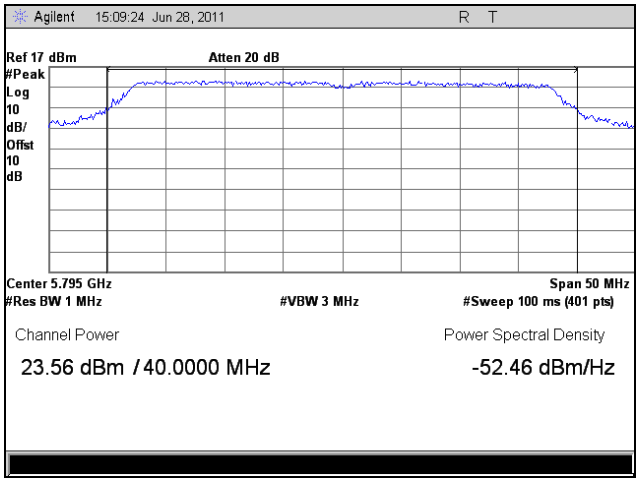
Peak Power Output Test Results, 802.11n 40 MHz, Port 0, 5.8 GHz



Plot 103. Peak Power Output, Low Channel, 802.11n 40 MHz, Port 0, 5.8 GHz

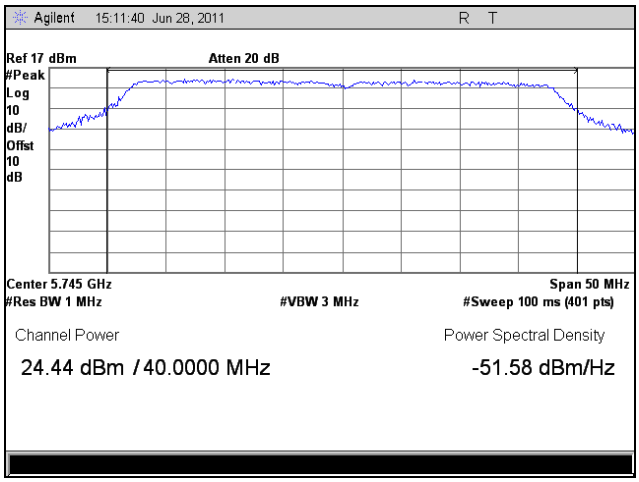


Plot 104. Peak Power Output, Mid Channel, 802.11n 40 MHz, Port 0, 5.8 GHz



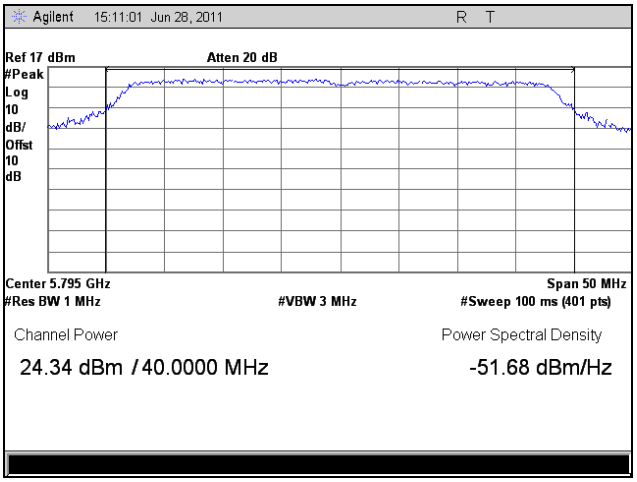
Plot 105. Peak Power Output, High Channel, 802.11n 40 MHz, Port 0, 5.8 GHz

Peak Power Output Test Results, 802.11n 40 MHz, Port 1, 5.8 GHz



Plot 106. Peak Power Output, Low Channel, 802.11n 40 MHz, Port 1, 5.8 GHz

Plot 107. Peak Power Output, Mid Channel, 802.11n 40 MHz, Port 1, 5.8 GHz



Plot 108. Peak Power Output, High Channel, 802.11n 40 MHz, Port 1, 5.8 GHz

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 30. 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 31.

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

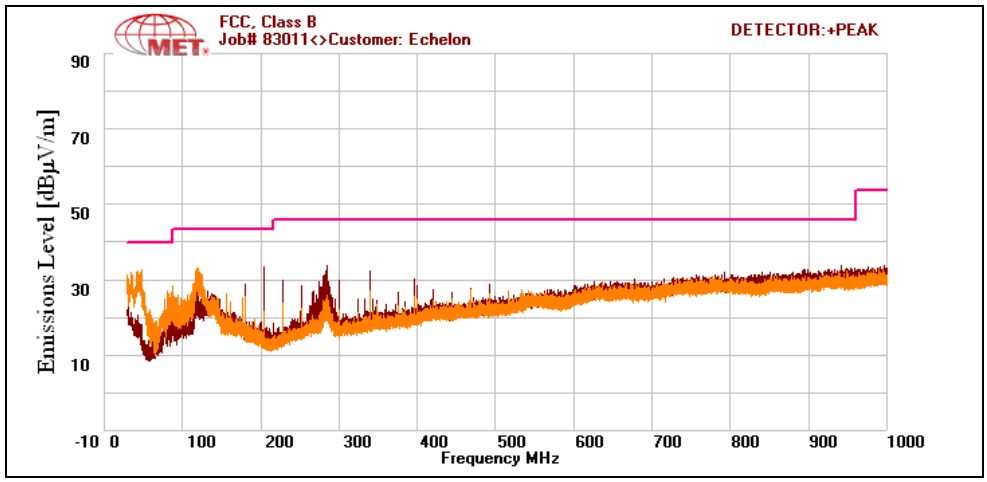
Test Procedures: The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line. Only noise floor was measured above 18 GHz.

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

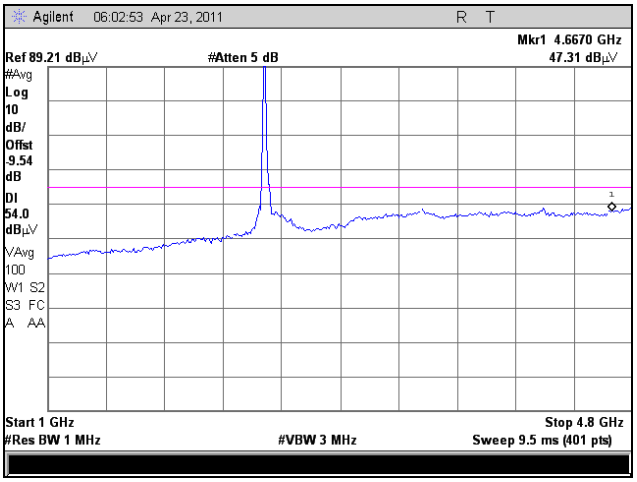
Test Engineer(s): Lionel Gabrillo

Test Date(s): 06/02/11

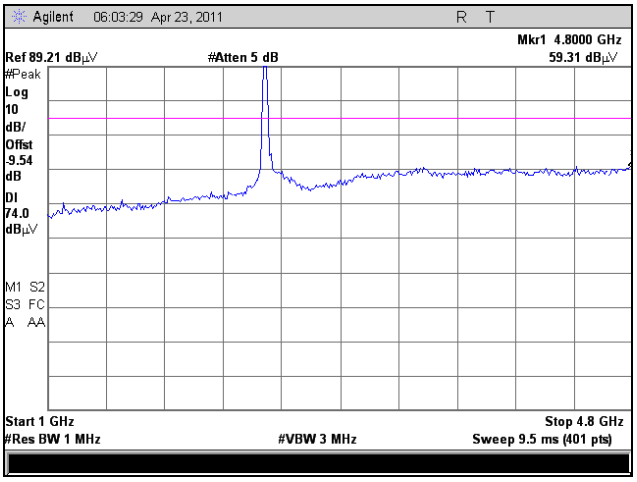
Radiated Spurious Emissions Test Results, 802.11b, 2.4 GHz



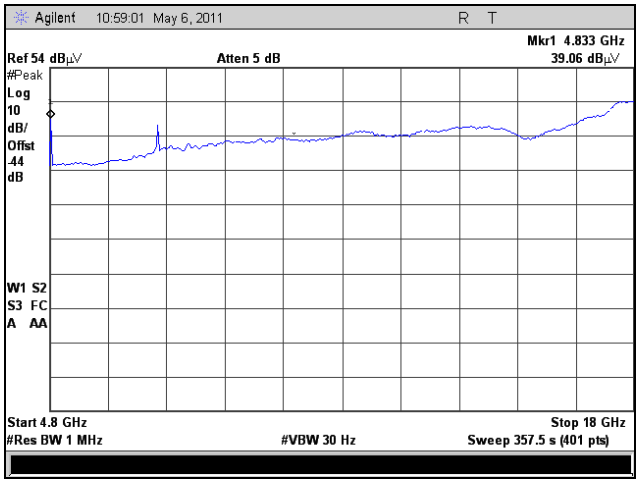
Plot 109. Radiated Spurious Emissions, Low Channel, 802.11b, 30 MHz – 1 GHz, 2.4 GHz



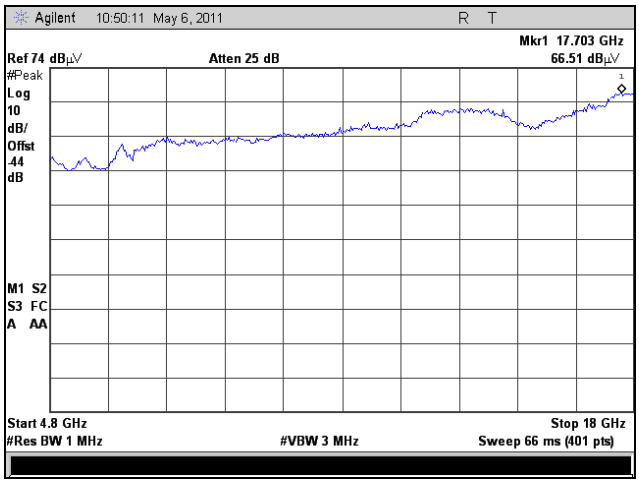
Plot 110. Radiated Spurious Emissions, Low Channel, 802.11b, 1 GHz – 4 GHz, Average, 2.4 GHz



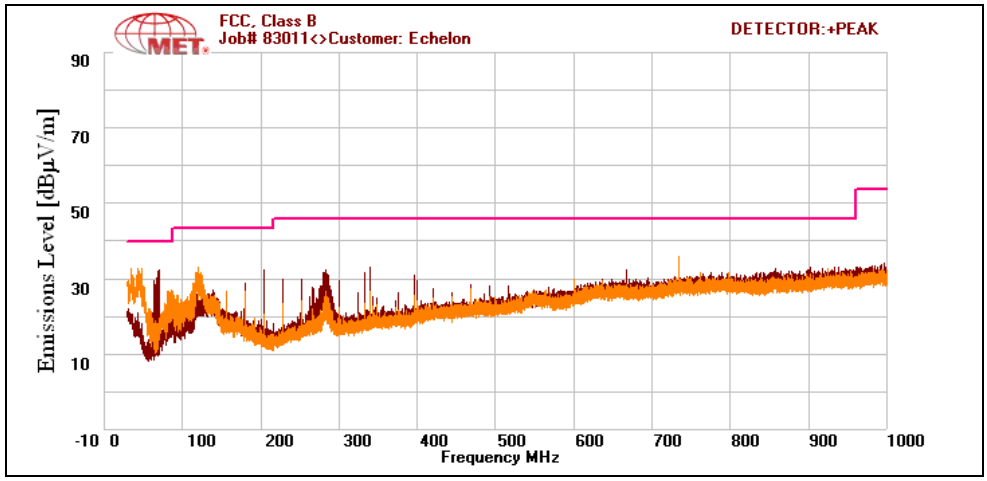
Plot 111. Radiated Spurious Emissions, Low Channel, 802.11b, 1 GHz – 4 GHz, Peak, 2.4 GHz



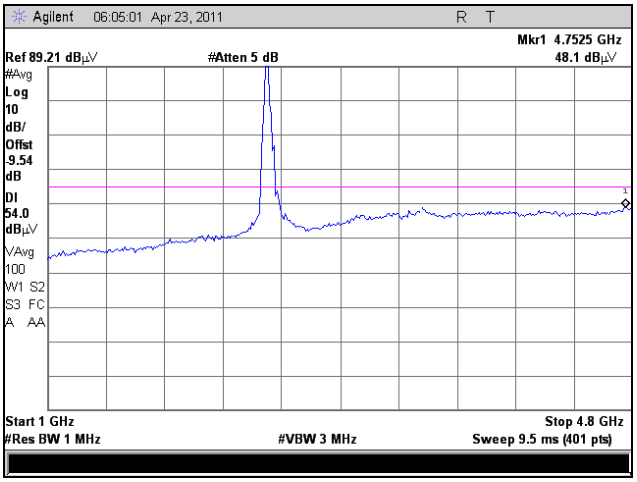
Plot 112. Radiated Spurious Emissions, Low Channel, 802.11b, 4.8 GHz – 18 GHz, Average, 2.4 GHz



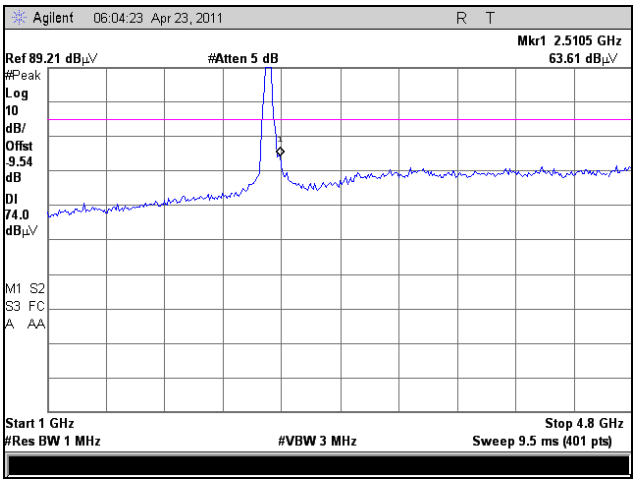
Plot 113. Radiated Spurious Emissions, Low Channel, 802.11b, 4.8 GHz – 18 GHz, Peak, 2.4 GHz



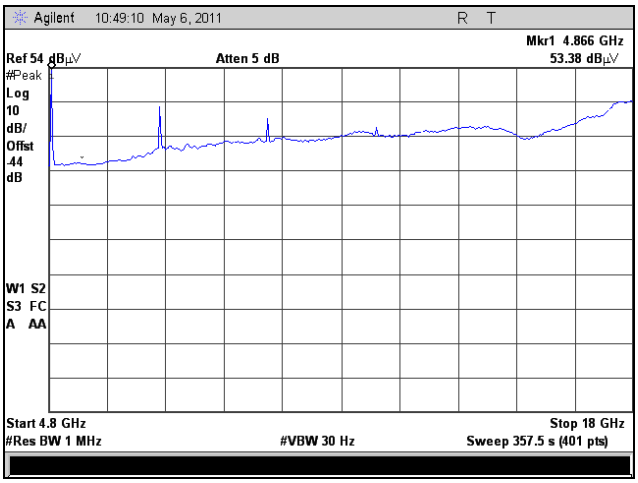
Plot 114. Radiated Spurious Emissions, Mid Channel, 802.11b, 30 MHz – 1 GHz, 2.4 GHz



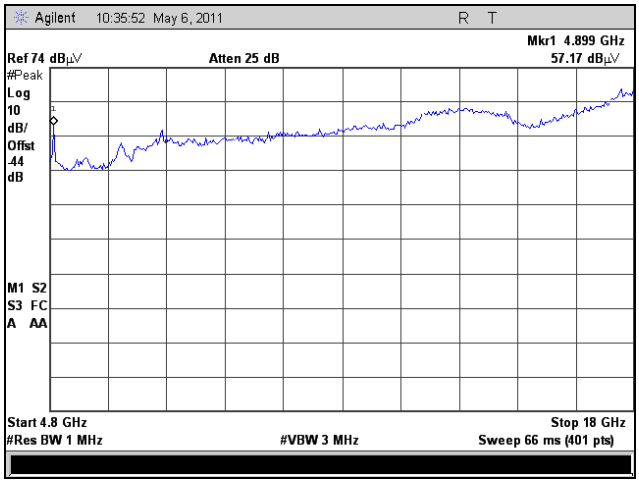
Plot 115. Radiated Spurious Emissions, Mid Channel, 802.11b, 1 GHz – 4 GHz, Average, 2.4 GHz



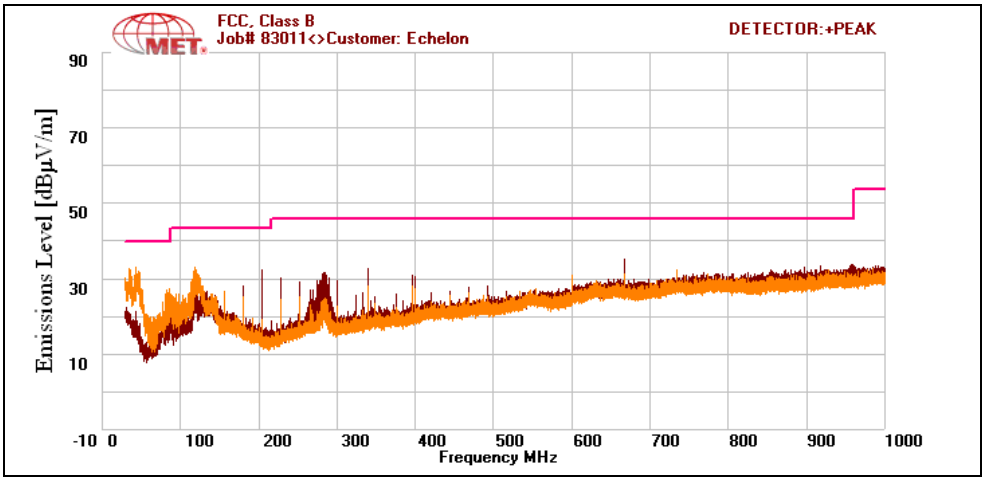
Plot 116. Radiated Spurious Emissions, Mid Channel, 802.11b, 1 GHz – 4 GHz, Peak, 2.4 GHz



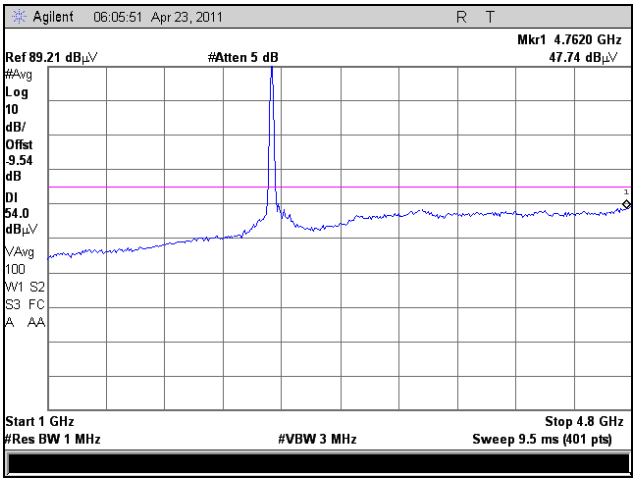
Plot 117. Radiated Spurious Emissions, Mid Channel, 802.11b, 4.8 GHz – 18 GHz, Average, 2.4 GHz



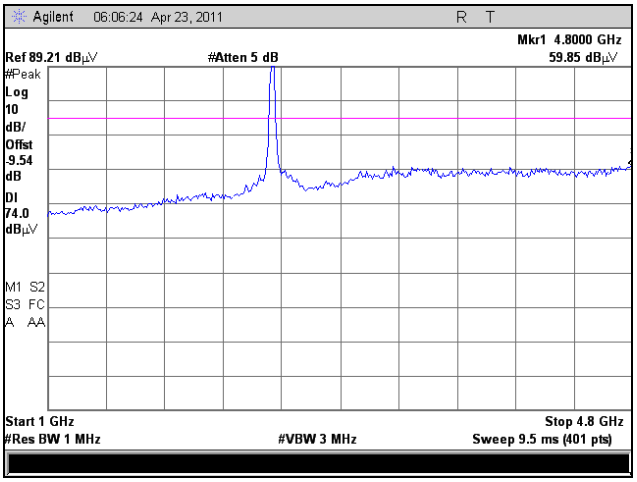
Plot 118. Radiated Spurious Emissions, Mid Channel, 802.11b, 4.8 GHz – 18 GHz, Peak, 2.4 GHz



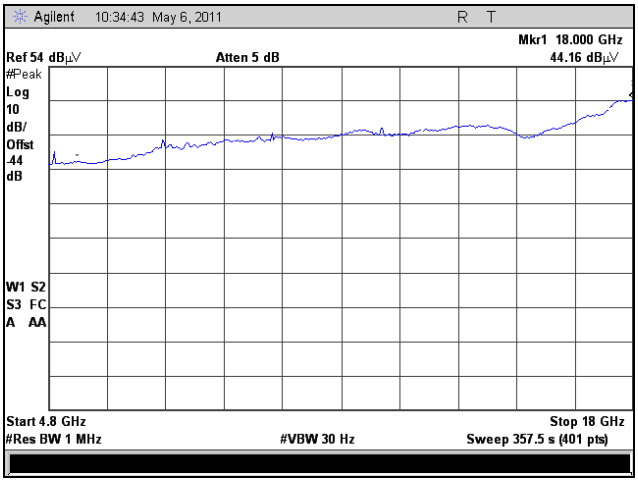
Plot 119. Radiated Spurious Emissions, High Channel, 802.11b, 30 MHz – 1 GHz, 2.4 GHz



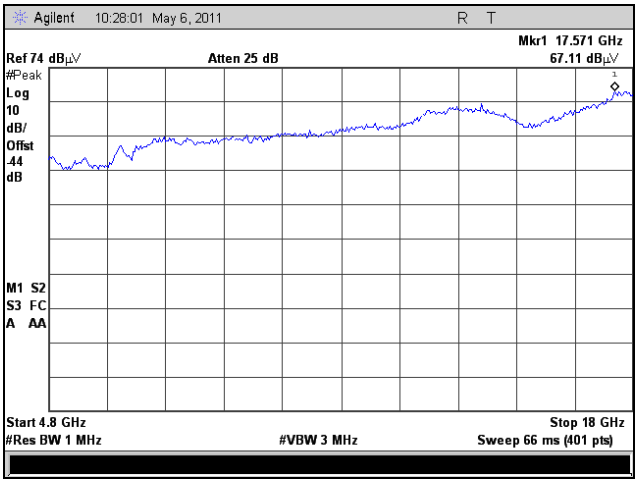
Plot 120. Radiated Spurious Emissions, High Channel, 802.11b, 1 GHz – 4 GHz, Average, 2.4 GHz



Plot 121. Radiated Spurious Emissions, High Channel, 802.11b, 1 GHz – 4 GHz, Peak, 2.4 GHz

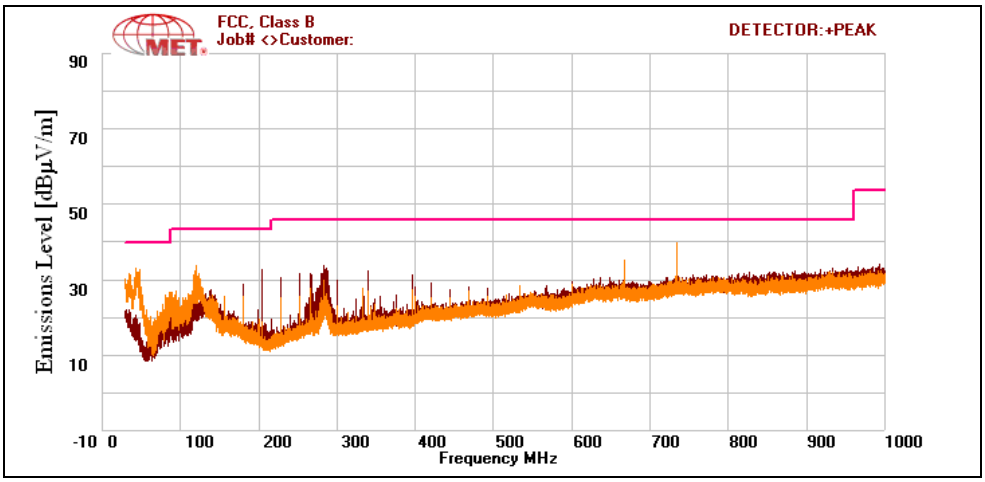


Plot 122. Radiated Spurious Emissions, High Channel, 802.11b, 4.8 GHz – 18 GHz, Average, 2.4 GHz

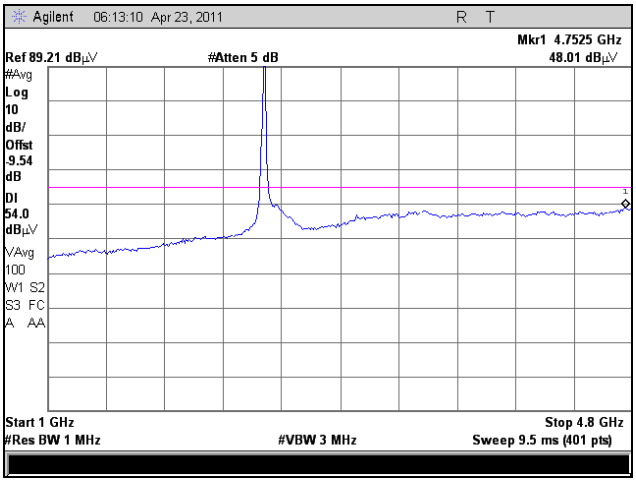


Plot 123. Radiated Spurious Emissions, High Channel, 802.11b, 4.8 GHz – 18 GHz, Peak, 2.4 GHz

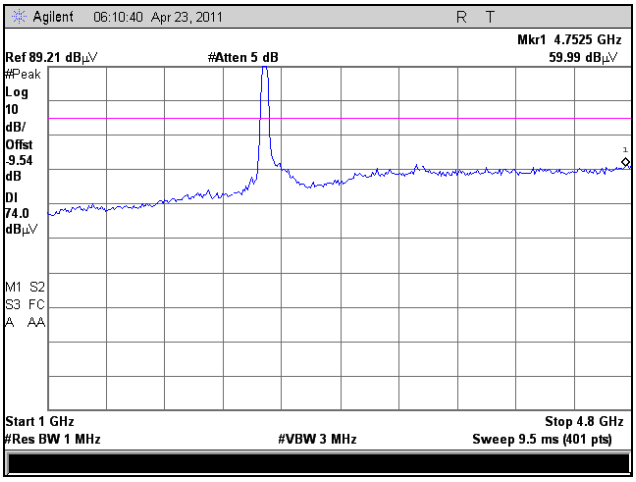
Radiated Spurious Emissions Test Results, 802.11g, 2.4 GHz



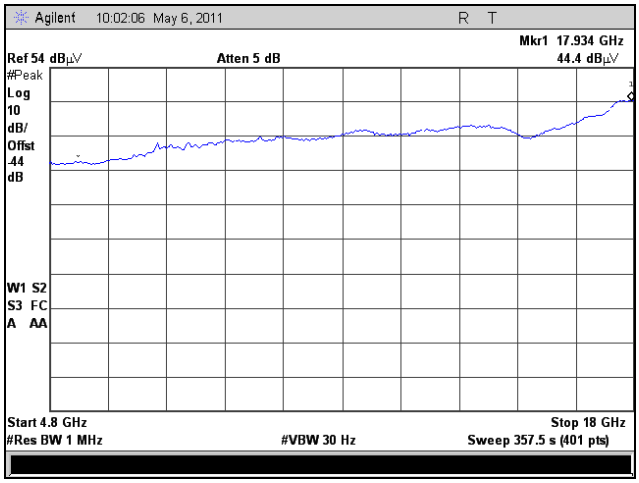
Plot 124. Radiated Spurious Emissions, Low Channel, 802.11g, 30 MHz – 1 GHz, 2.4 GHz



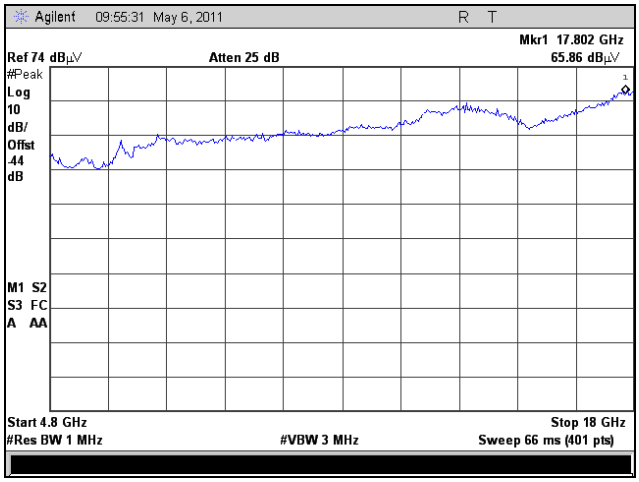
Plot 125. Radiated Spurious Emissions, Low Channel, 802.11g, 1 GHz – 4 GHz, Average, 2.4 GHz



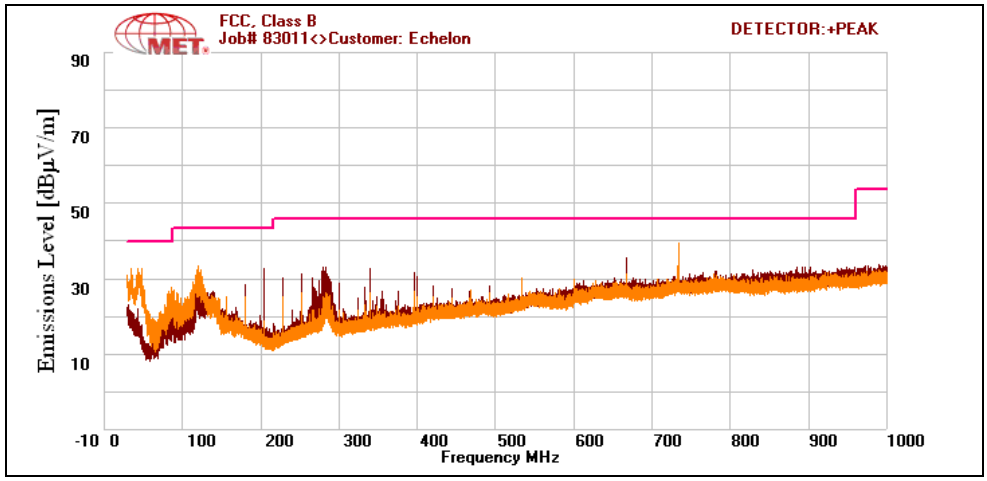
Plot 126. Radiated Spurious Emissions, Low Channel, 802.11g, 1 GHz – 4 GHz, Peak, 2.4 GHz



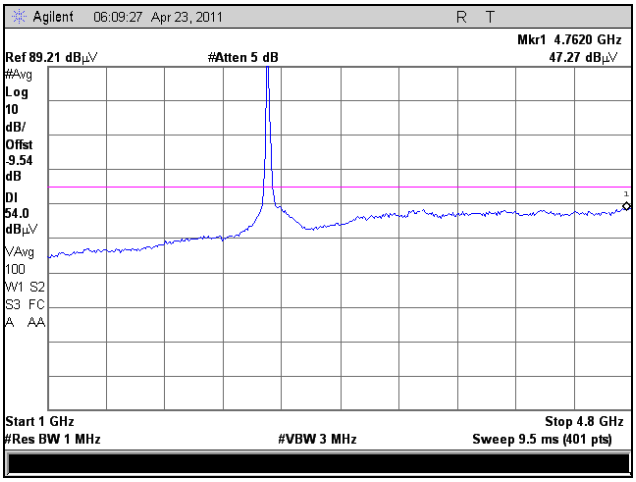
Plot 127. Radiated Spurious Emissions, Low Channel, 802.11g, 4.8 GHz – 18 GHz, Average, 2.4 GHz



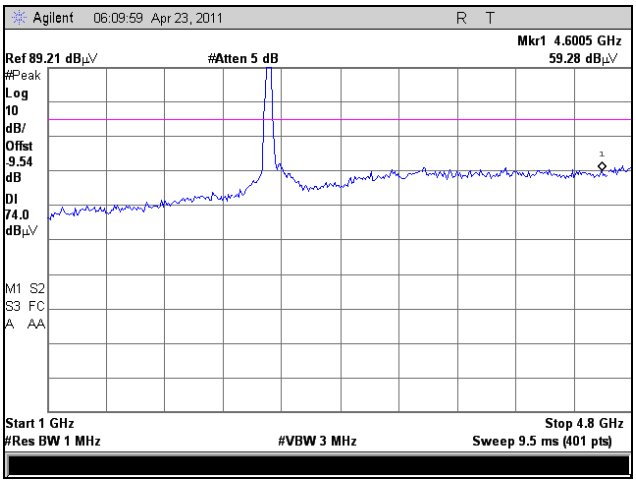
Plot 128. Radiated Spurious Emissions, Low Channel, 802.11g, 4.8 GHz – 18 GHz, Peak, 2.4 GHz



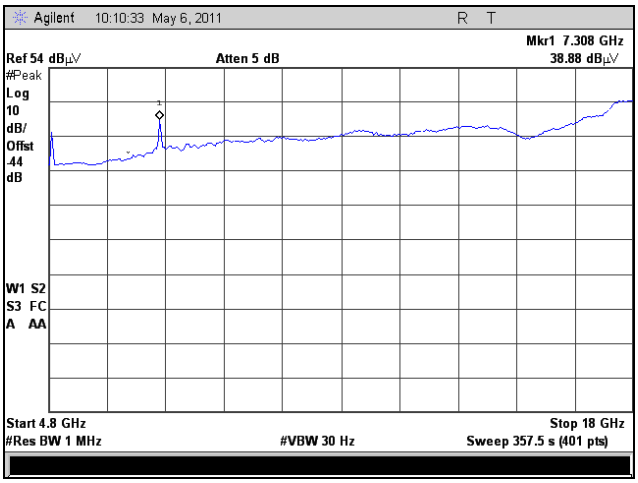
Plot 129. Radiated Spurious Emissions, Mid Channel, 802.11g, 30 MHz – 1 GHz, 2.4 GHz



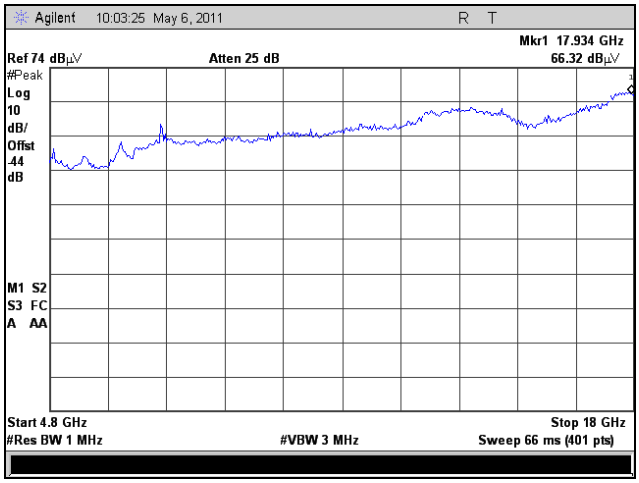
Plot 130. Radiated Spurious Emissions, Mid Channel, 802.11g, 1 GHz – 4 GHz, Average, 2.4 GHz



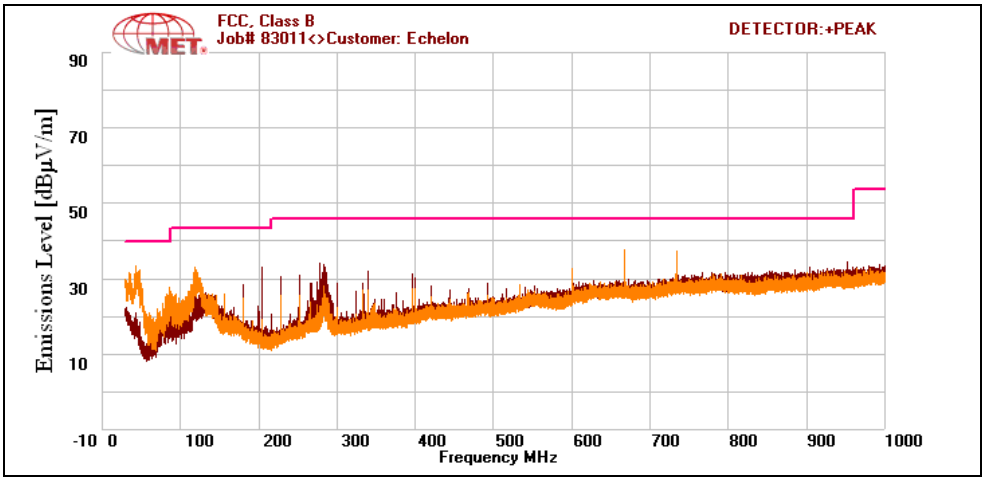
Plot 131. Radiated Spurious Emissions, Mid Channel, 802.11g, 1 GHz – 4 GHz, Peak, 2.4 GHz



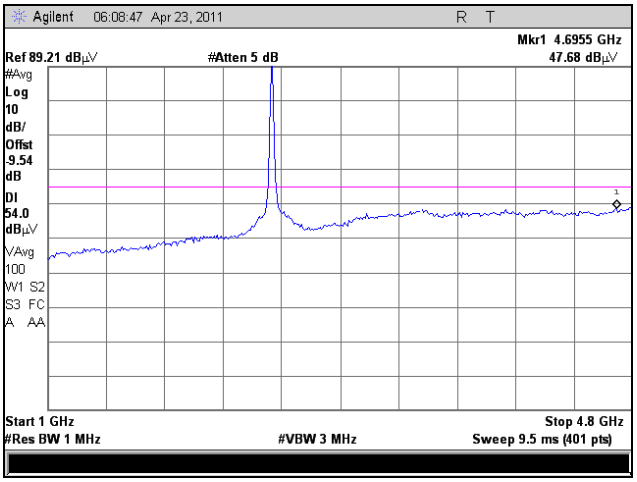
Plot 132. Radiated Spurious Emissions, Mid Channel, 802.11g, 4.8 GHz – 18 GHz, Average, 2.4 GHz



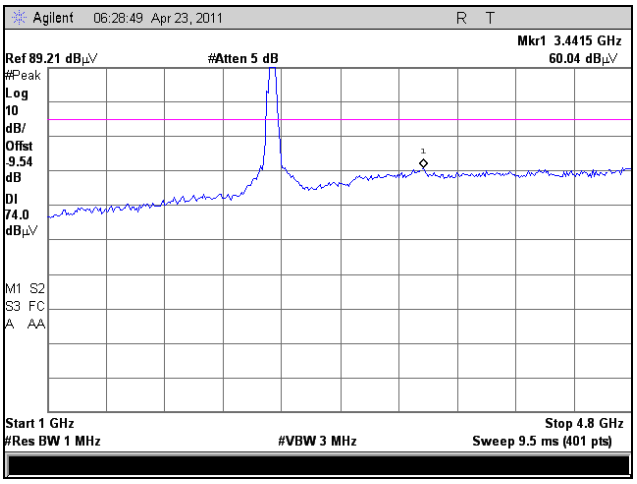
Plot 133. Radiated Spurious Emissions, Mid Channel, 802.11g, 4.8 GHz – 18 GHz, Peak, 2.4 GHz



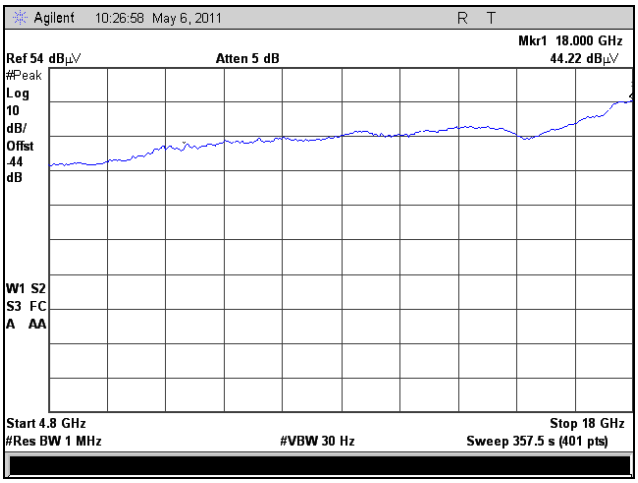
Plot 134. Radiated Spurious Emissions, High Channel, 802.11g, 30 MHz – 1 GHz, 2.4 GHz



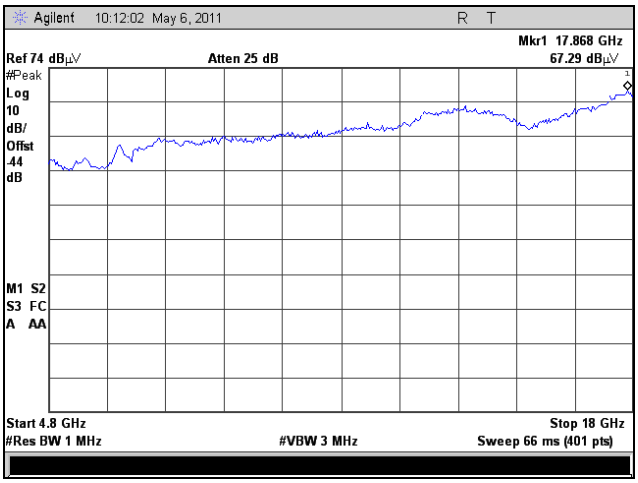
Plot 135. Radiated Spurious Emissions, High Channel, 802.11g, 1 GHz – 4 GHz, Average, 2.4 GHz



Plot 136. Radiated Spurious Emissions, High Channel, 802.11g, 1 GHz – 4 GHz, Peak, 2.4 GHz

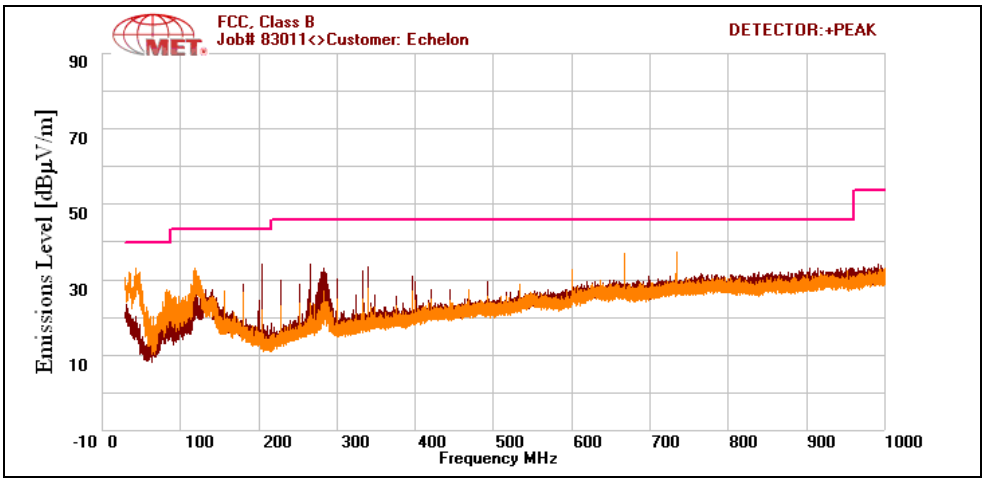


Plot 137. Radiated Spurious Emissions, High Channel, 802.11g, 4.8 GHz – 18 GHz, Average, 2.4 GHz

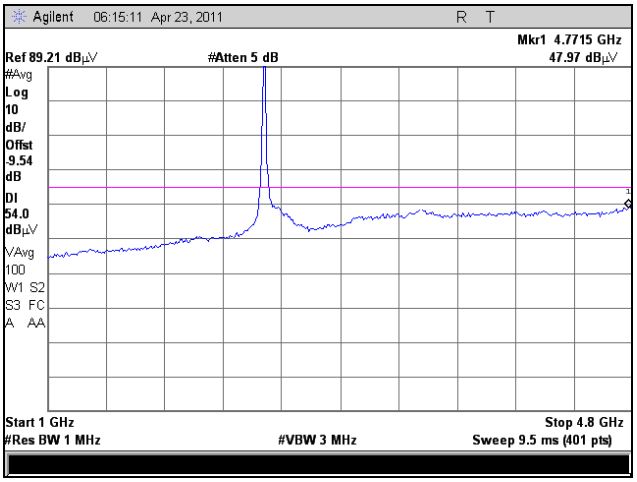


Plot 138. Radiated Spurious Emissions, High Channel, 802.11g, 4.8 GHz – 18 GHz, Peak, 2.4 GHz

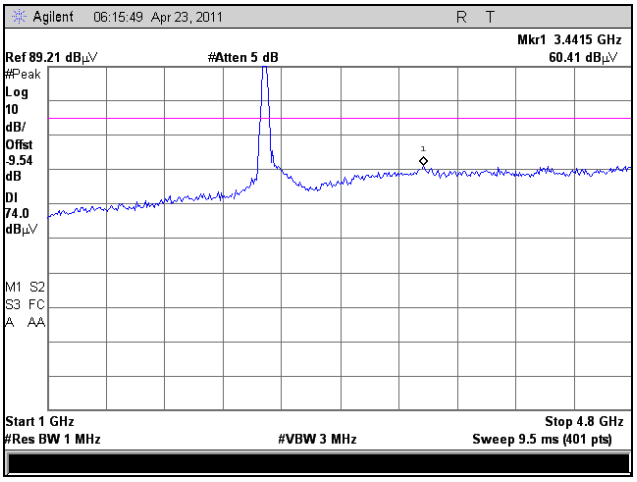
Radiated Spurious Emissions Test Results, 802.11n 20 MHz, 2.4 GHz



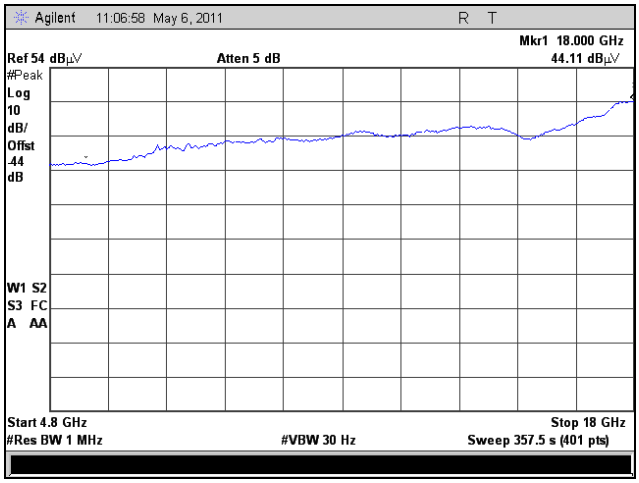
Plot 139. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, 30 MHz – 1 GHz, 2.4 GHz



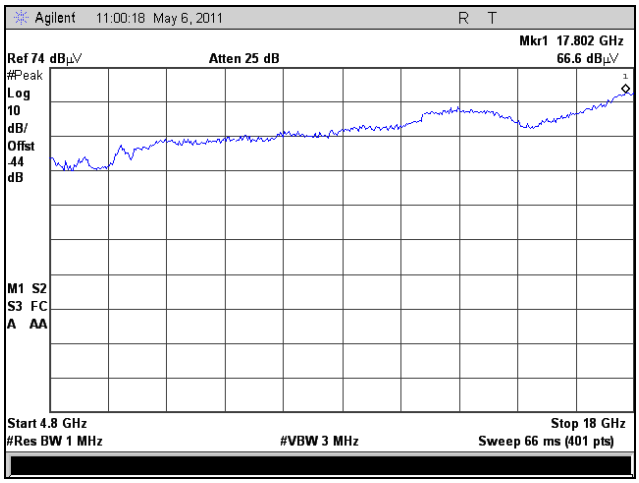
Plot 140. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, 1 GHz – 4 GHz, Average, 2.4 GHz



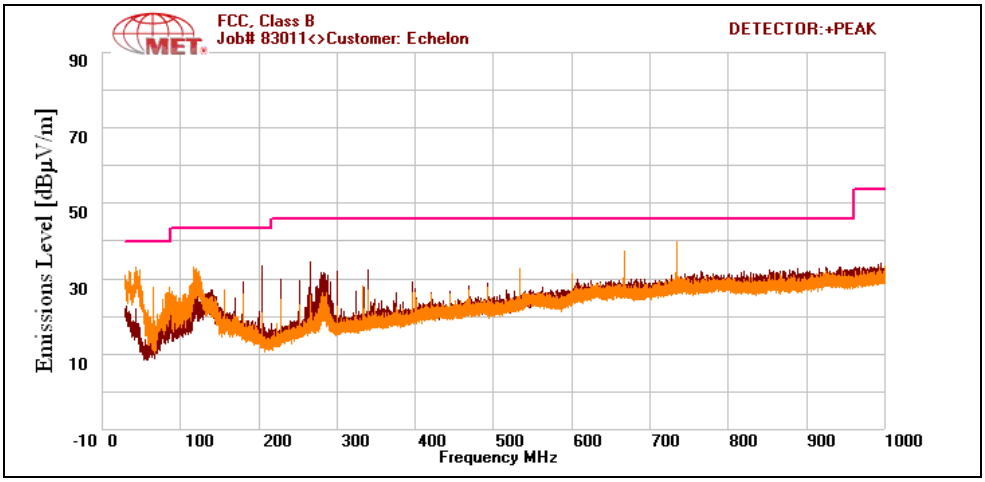
Plot 141. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, 1 GHz – 4 GHz, Peak, 2.4 GHz



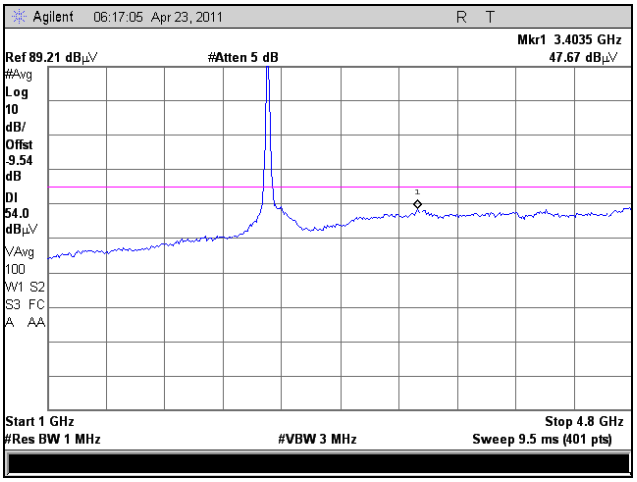
Plot 142. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, 4.8 GHz – 18 GHz, Average, 2.4 GHz



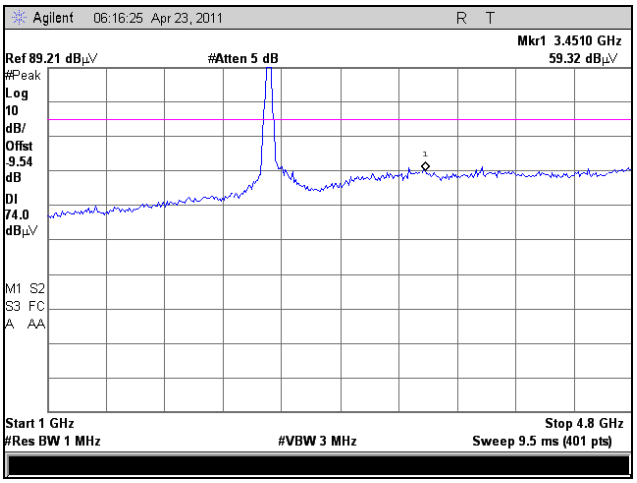
Plot 143. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, 4.8 GHz – 18 GHz, Peak, 2.4 GHz



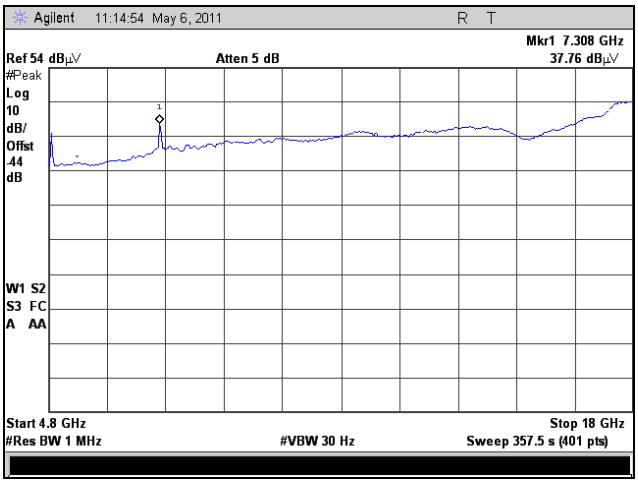
Plot 144. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, 30 MHz – 1 GHz, 2.4 GHz



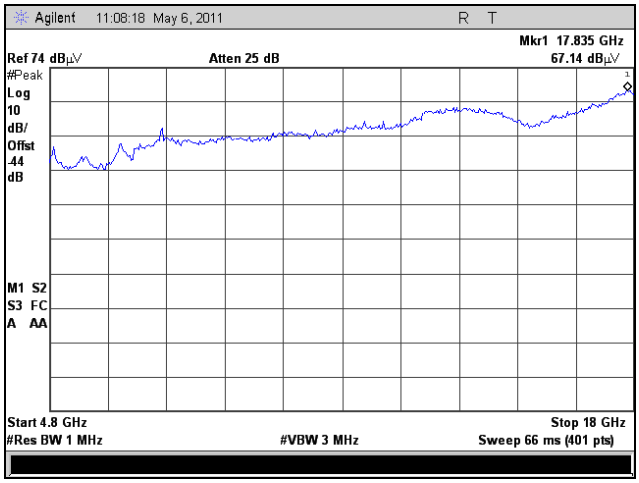
Plot 145. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, 1 GHz – 4 GHz, Average, 2.4 GHz



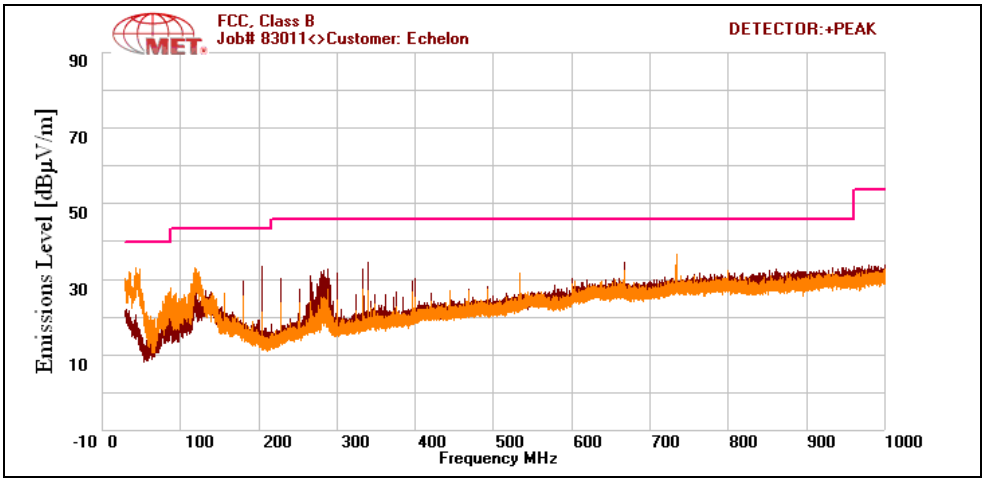
Plot 146. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, 1 GHz – 4 GHz, Peak, 2.4 GHz



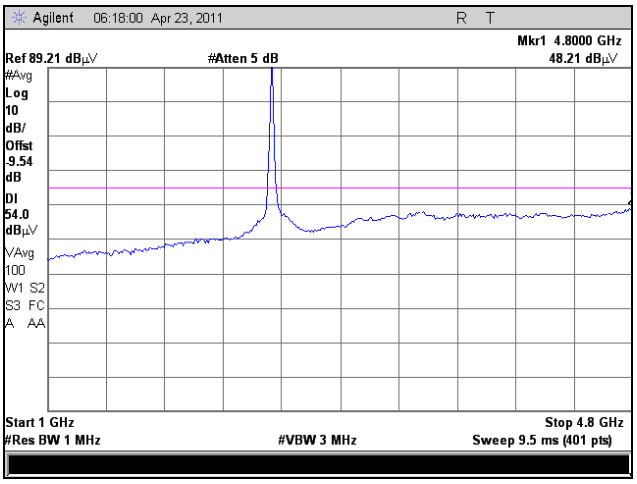
Plot 147. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, 4.8 GHz – 18 GHz, Average, 2.4 GHz



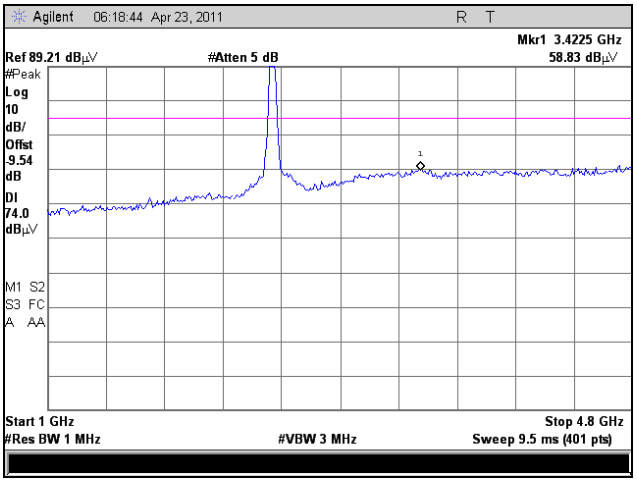
Plot 148. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, 4.8 GHz – 18 GHz, Peak, 2.4 GHz



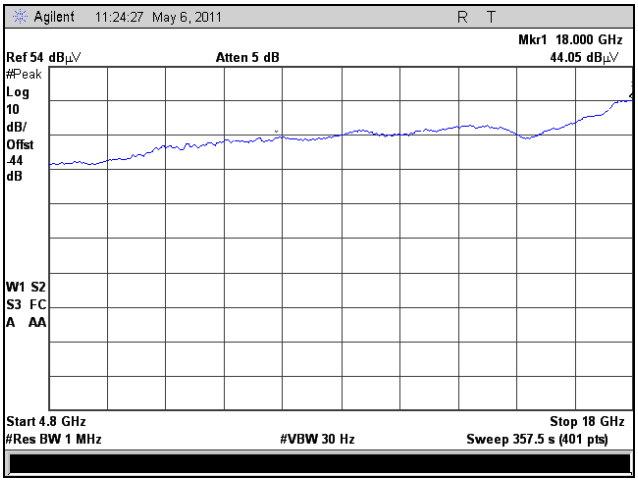
Plot 149. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, 30 MHz – 1 GHz, 2.4 GHz



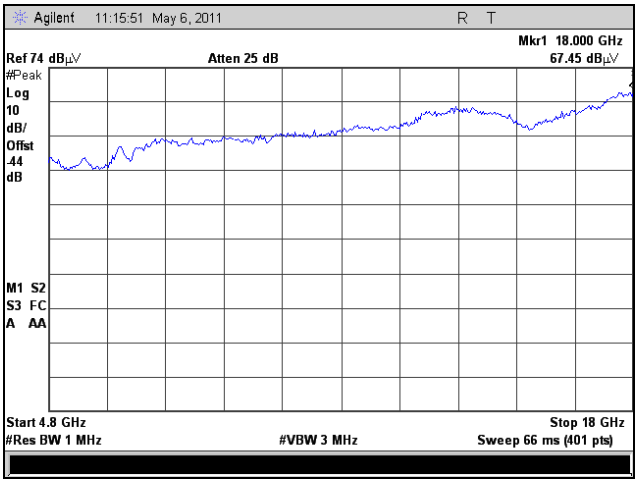
Plot 150. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, 1 GHz – 4 GHz, Average, 2.4 GHz



Plot 151. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, 1 GHz – 4 GHz, Peak, 2.4 GHz

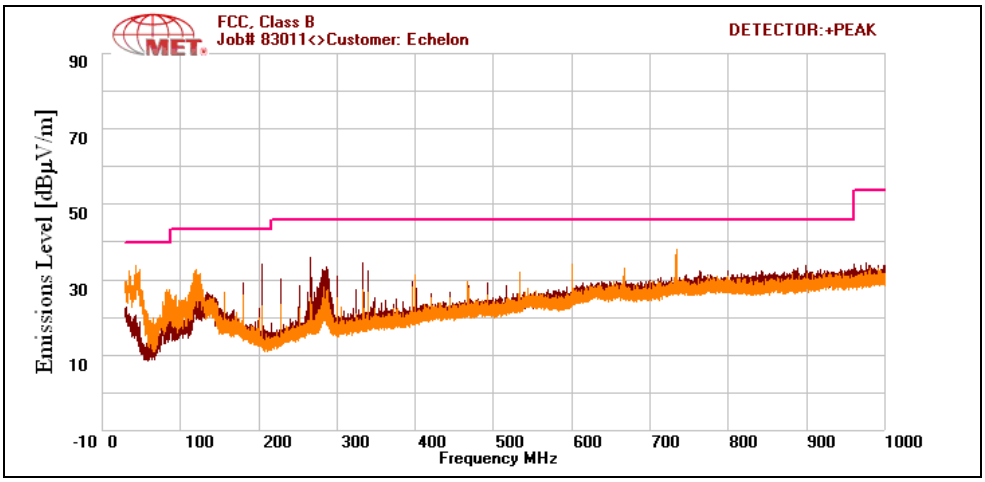


Plot 152. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, 4.8 GHz – 18 GHz, Average, 2.4 GHz

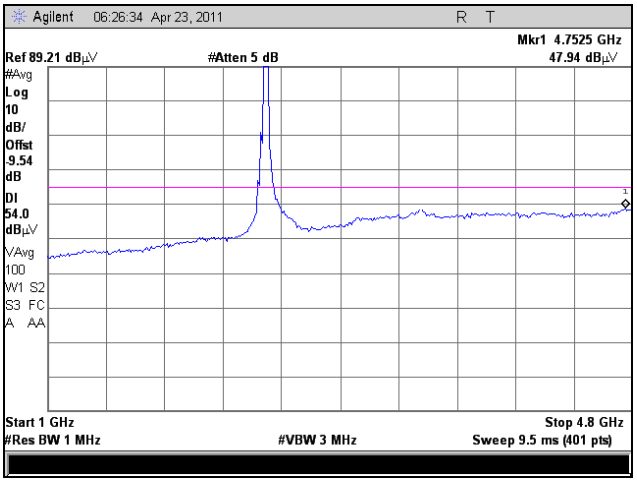


Plot 153. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, 4.8 GHz – 18 GHz, Peak, 2.4 GHz

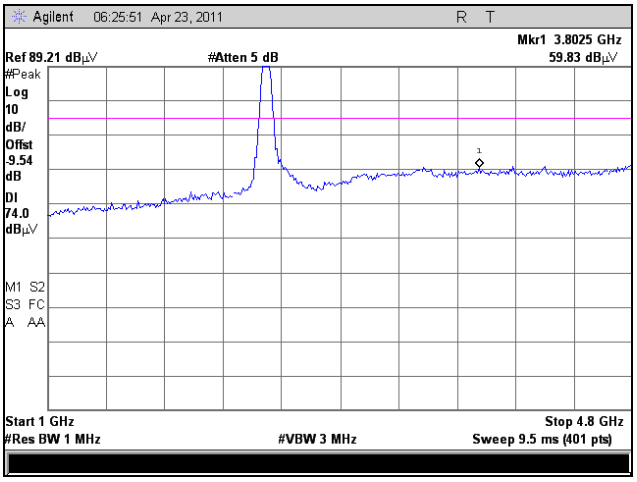
Radiated Spurious Emissions Test Results, 802.11n 40 MHz, 2.4 GHz



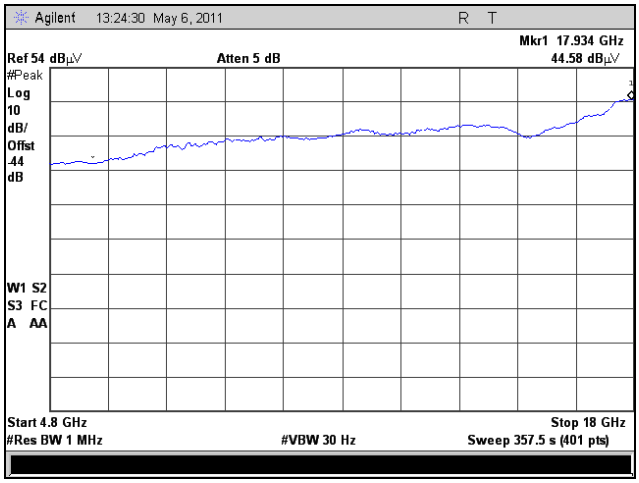
Plot 154. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, 30 MHz – 1 GHz, 2.4 GHz



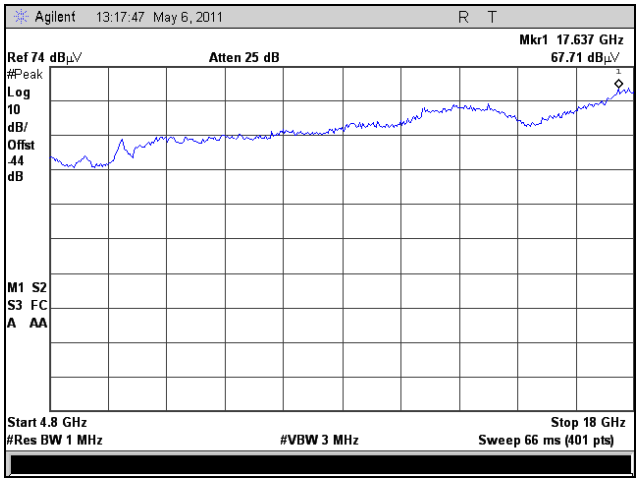
Plot 155. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, 1 GHz – 4 GHz, Average, 2.4 GHz



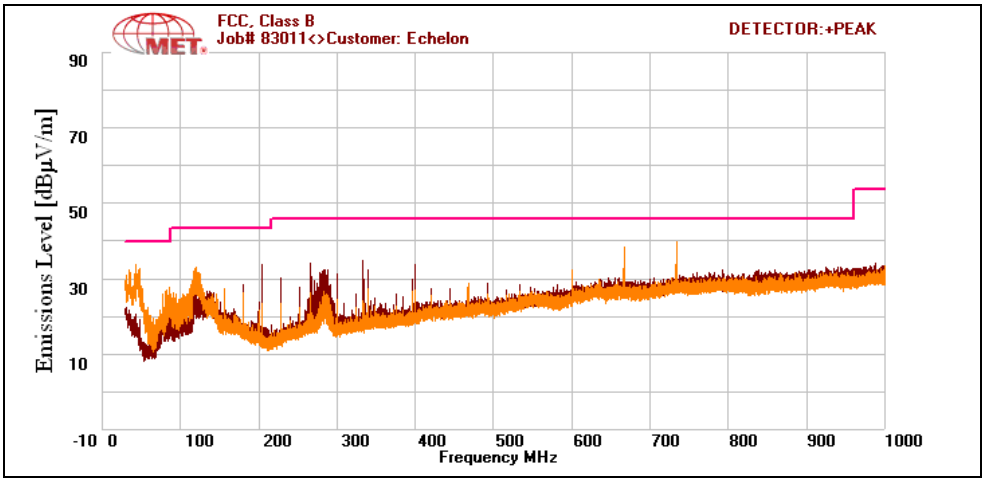
Plot 156. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, 1 GHz – 4 GHz, Peak, 2.4 GHz



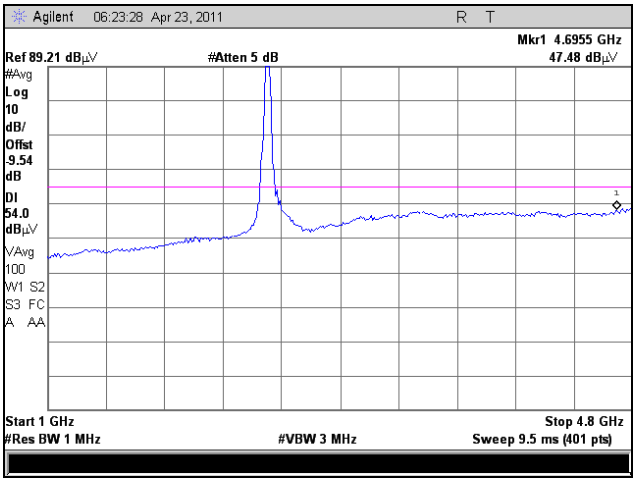
Plot 157. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, 4.8 GHz – 18 GHz, Average, 2.4 GHz



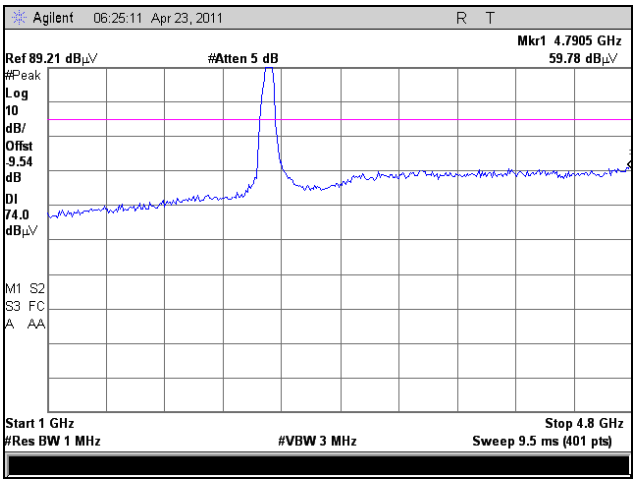
Plot 158. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, 4.8 GHz – 18 GHz, Peak, 2.4 GHz



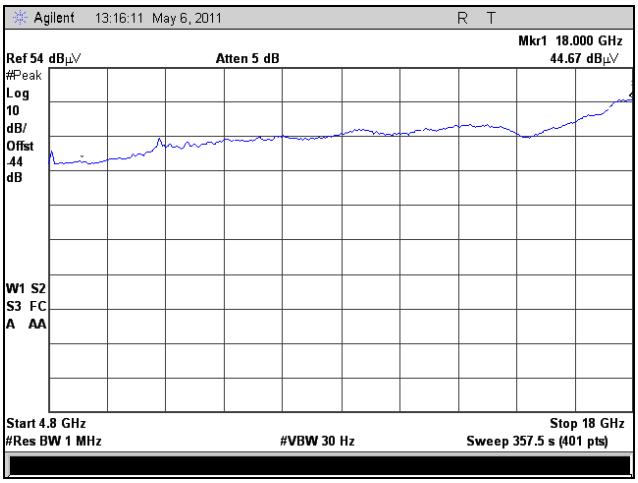
Plot 159. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, 30 MHz – 1 GHz, 2.4 GHz



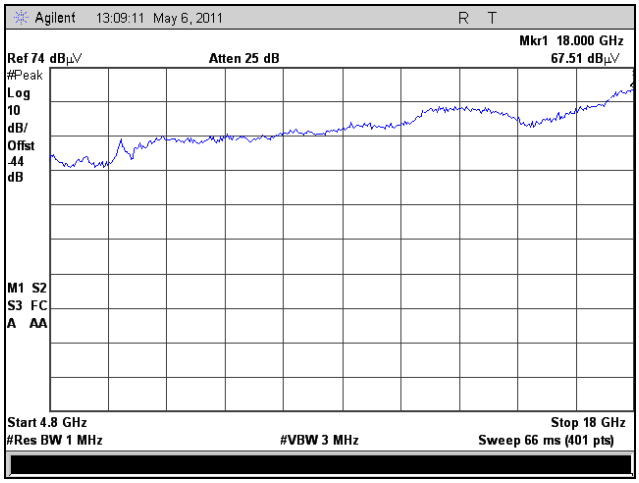
Plot 160. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, 1 GHz – 4 GHz, Average, 2.4 GHz



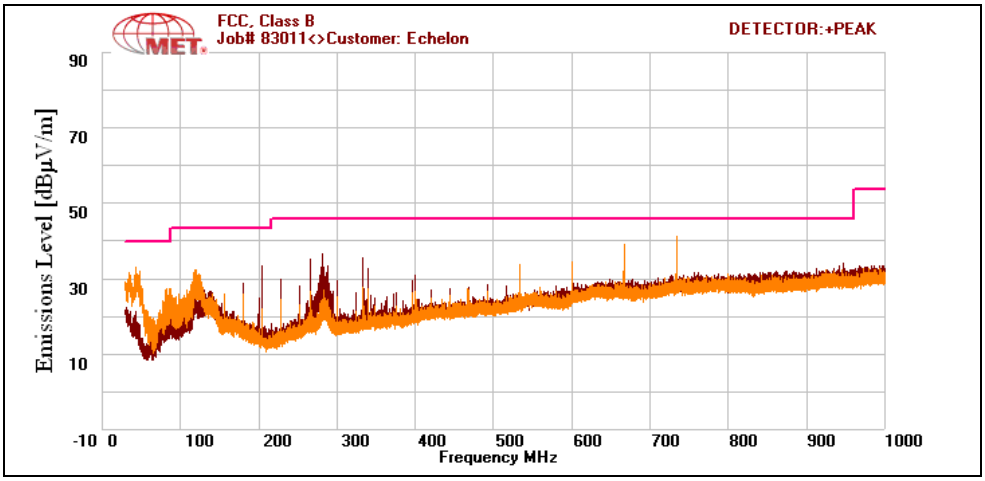
Plot 161. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, 1 GHz – 4 GHz, Peak, 2.4 GHz



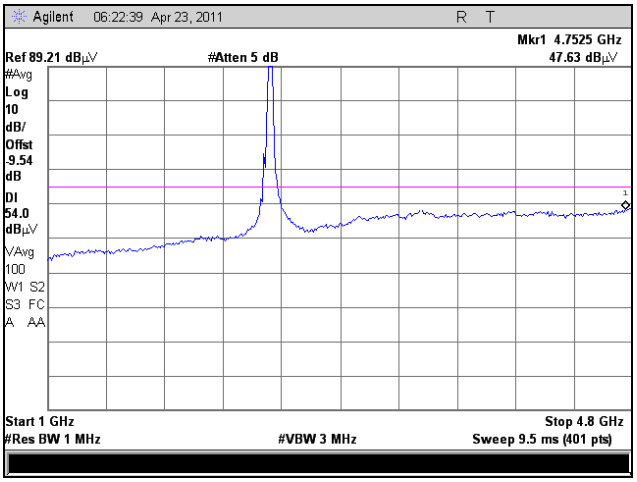
Plot 162. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, 4.8 GHz – 18 GHz, Average, 2.4 GHz



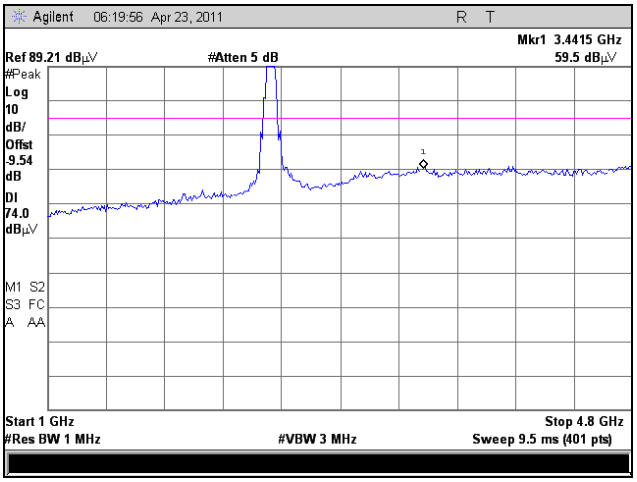
Plot 163. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, 4.8 GHz – 18 GHz, Peak, 2.4 GHz



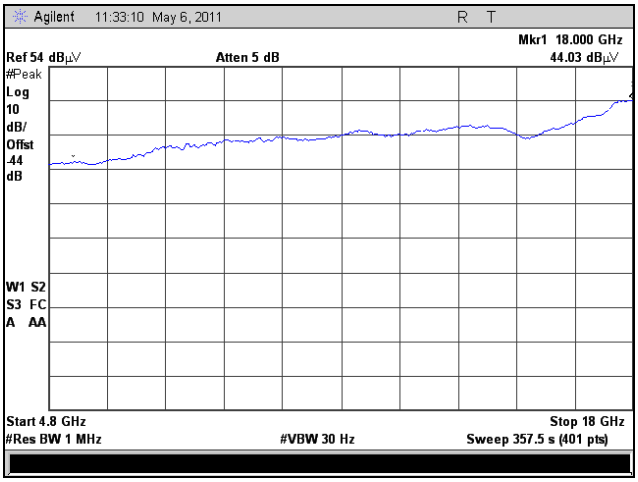
Plot 164. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, 30 MHz – 1 GHz, 2.4 GHz



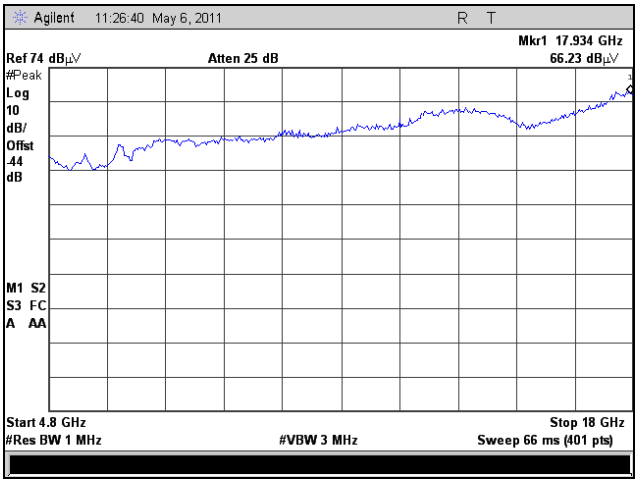
Plot 165. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, 1 GHz – 4 GHz, Average, 2.4 GHz



Plot 166. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, 1 GHz – 4 GHz, Peak, 2.4 GHz

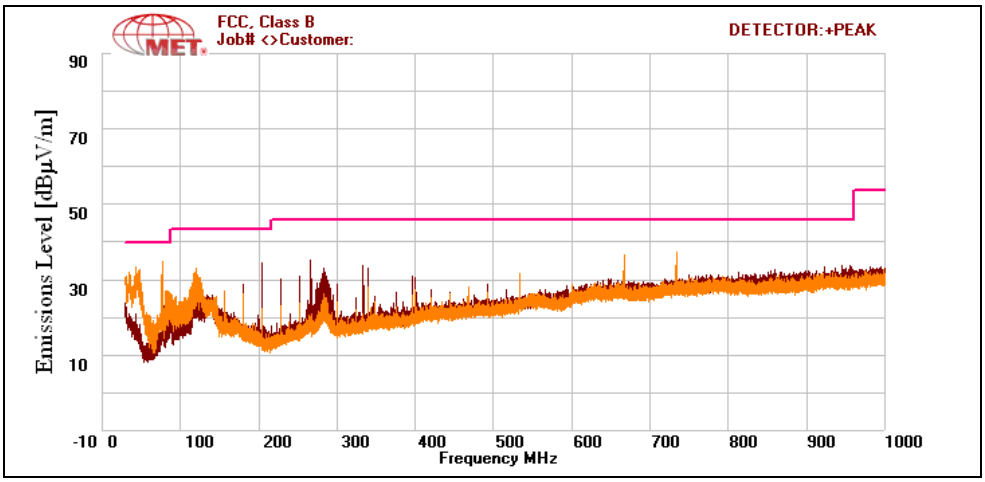


Plot 167. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, 4.8 GHz – 18 GHz, Average, 2.4 GHz

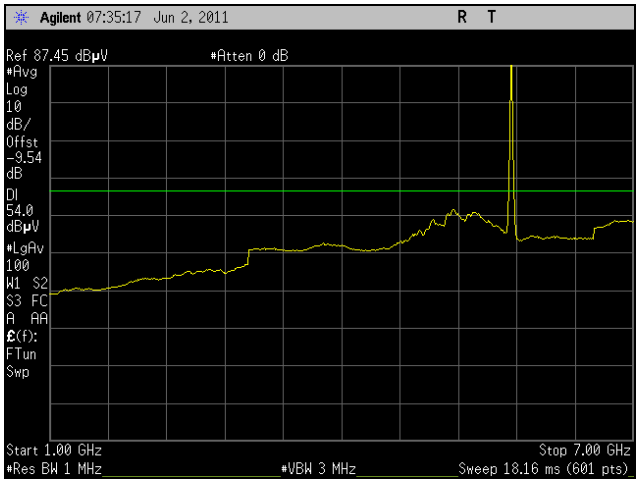


Plot 168. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, 4.8 GHz – 18 GHz, Peak, 2.4 GHz

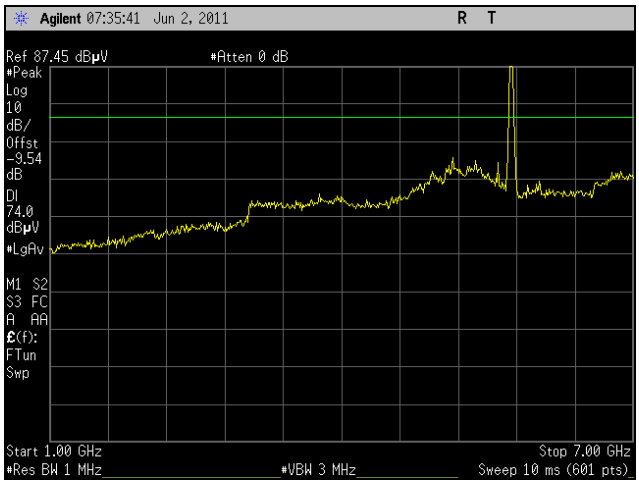
Radiated Spurious Emissions Test Results, 802.11a, 5.8 GHz



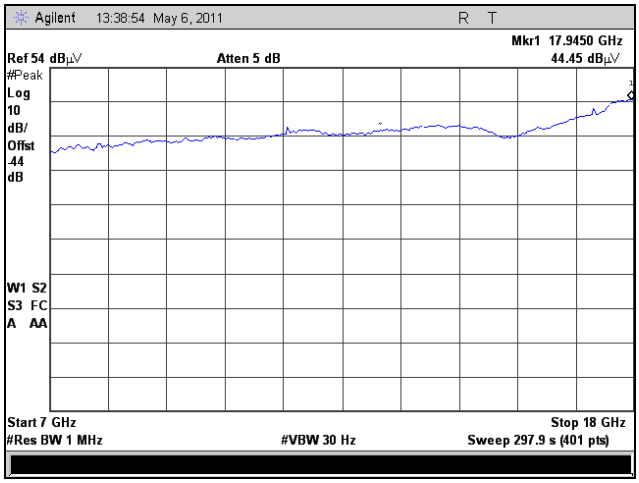
Plot 169. Radiated Spurious Emissions, Low Channel, 802.11a, 30 MHz – 1 GHz, 5.8 GHz



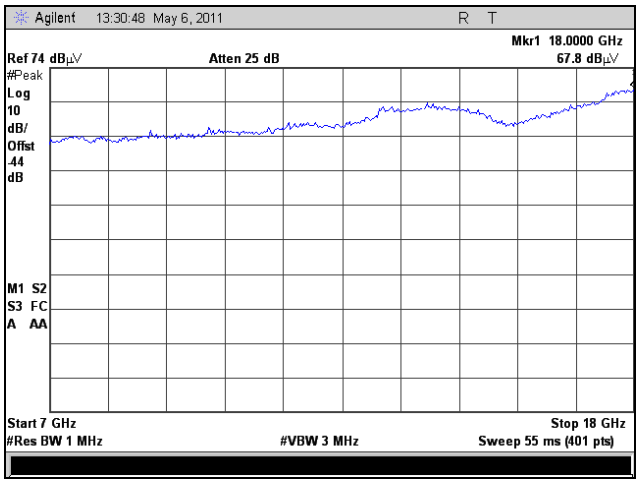
Plot 170. Radiated Spurious Emissions, Low Channel, 802.11a, 1 GHz – 7 GHz, Average, 5.8 GHz



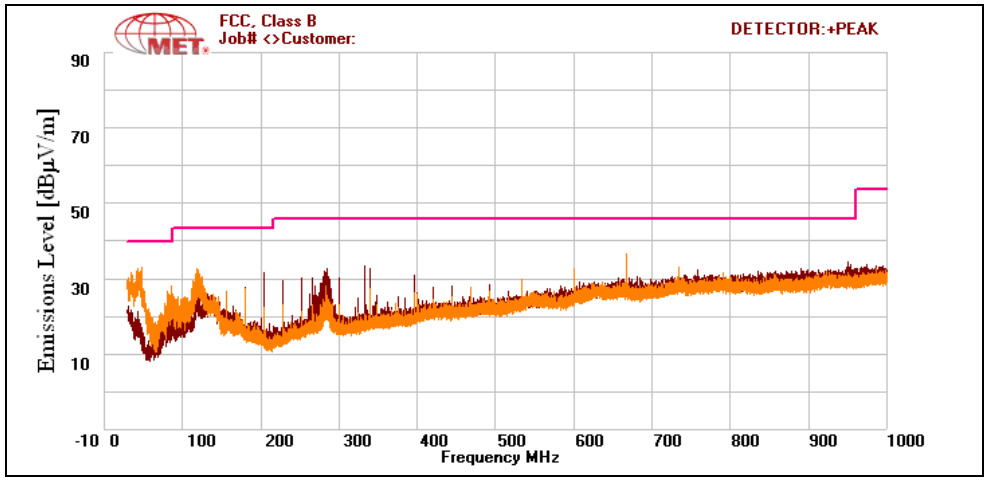
Plot 171. Radiated Spurious Emissions, Low Channel, 802.11a, 1 GHz – 7 GHz, Peak, 5.8 GHz



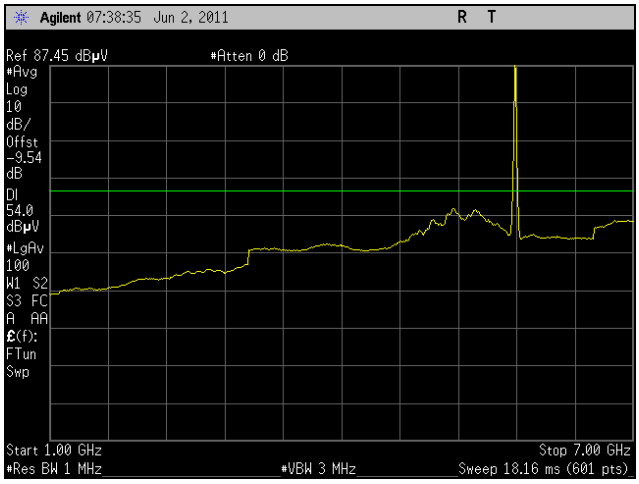
Plot 172. Radiated Spurious Emissions, Low Channel, 802.11a, 7 GHz – 18 GHz, Average, 5.8 GHz



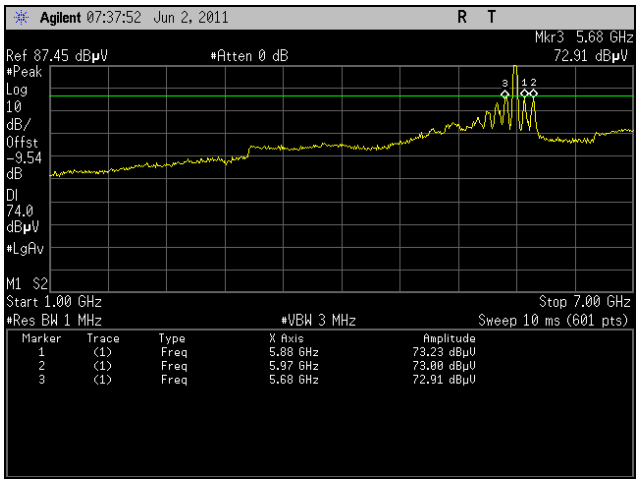
Plot 173. Radiated Spurious Emissions, Low Channel, 802.11a, 7 GHz – 18 GHz, Peak, 5.8 GHz



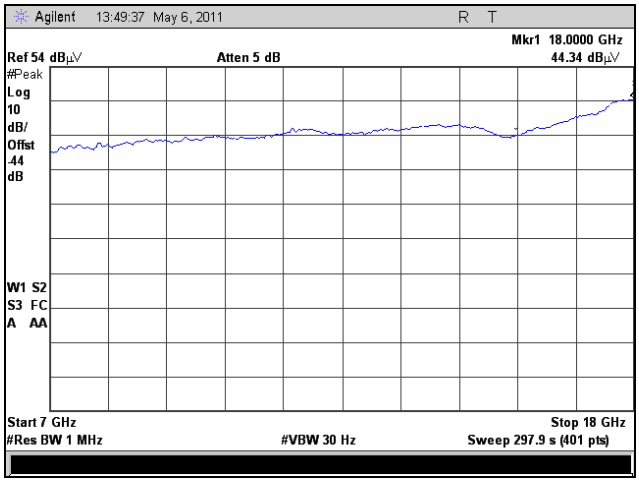
Plot 174. Radiated Spurious Emissions, Mid Channel, 802.11a, 30 MHz – 1 GHz, 5.8 GHz



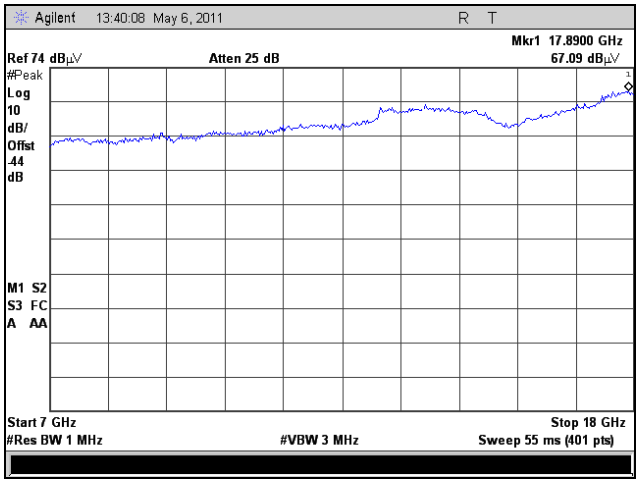
Plot 175. Radiated Spurious Emissions, Mid Channel, 802.11a, 1 GHz – 7 GHz, Average, 5.8 GHz



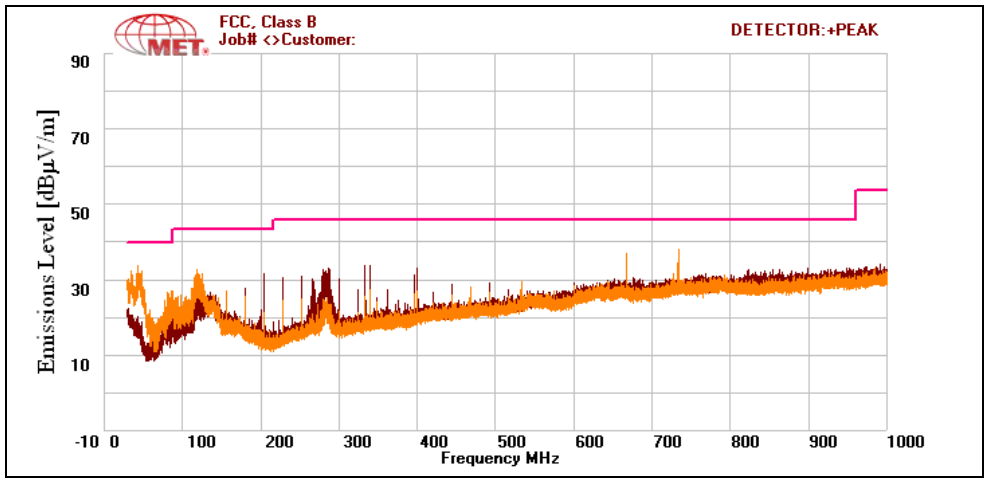
Plot 176. Radiated Spurious Emissions, Mid Channel, 802.11a, 1 GHz – 7 GHz, Peak, 5.8 GHz



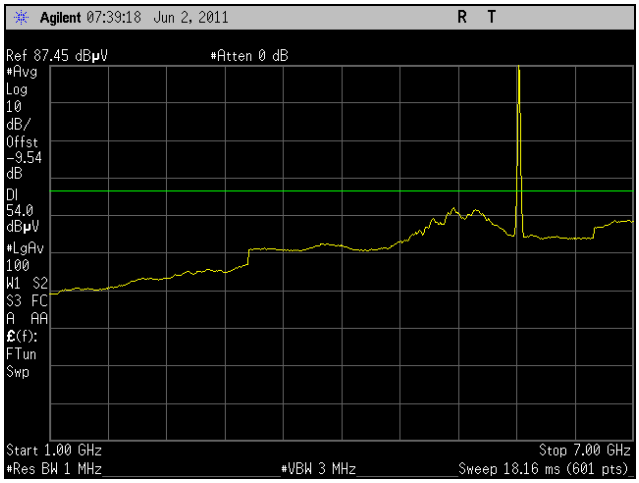
Plot 177. Radiated Spurious Emissions, Mid Channel, 802.11a, 7 GHz – 18 GHz, Average, 5.8 GHz



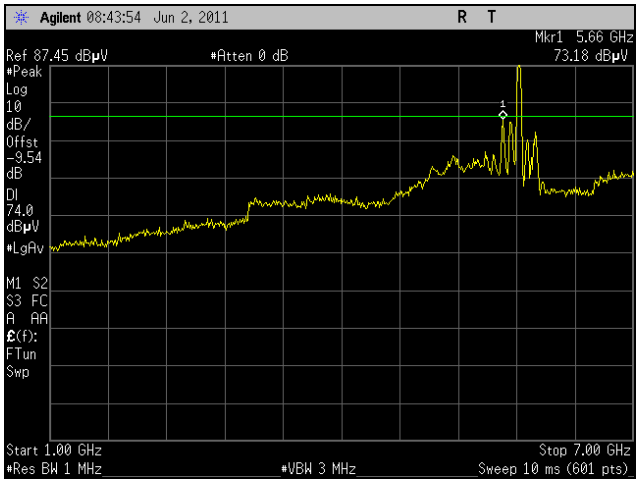
Plot 178. Radiated Spurious Emissions, Mid Channel, 802.11a, 7 GHz – 18 GHz, Peak, 5.8 GHz



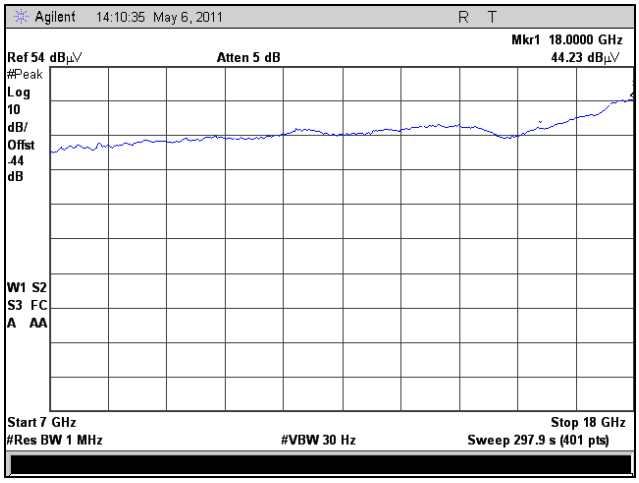
Plot 179. Radiated Spurious Emissions, High Channel, 802.11a, 30 MHz – 1 GHz, 5.8 GHz



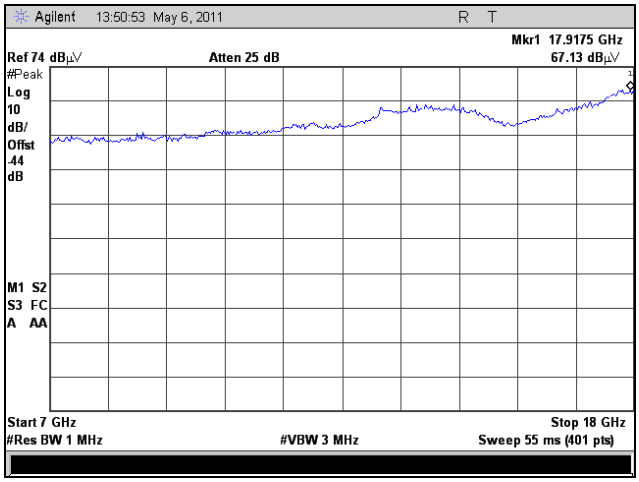
Plot 180. Radiated Spurious Emissions, High Channel, 802.11a, 1 GHz – 7 GHz, Average, 5.8 GHz



Plot 181. Radiated Spurious Emissions, High Channel, 802.11a, 1 GHz – 7 GHz, Peak, 5.8 GHz

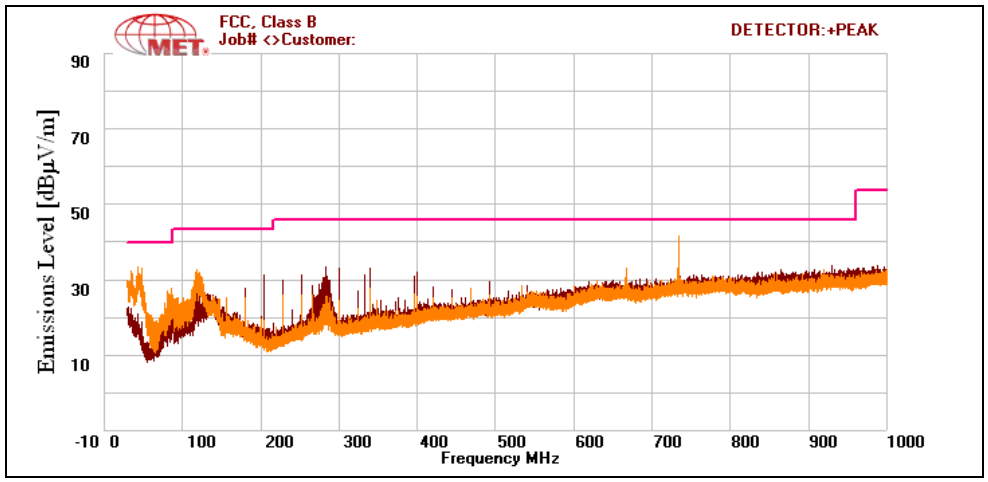


Plot 182. Radiated Spurious Emissions, High Channel, 802.11a, 7 GHz – 18 GHz, Average, 5.8 GHz

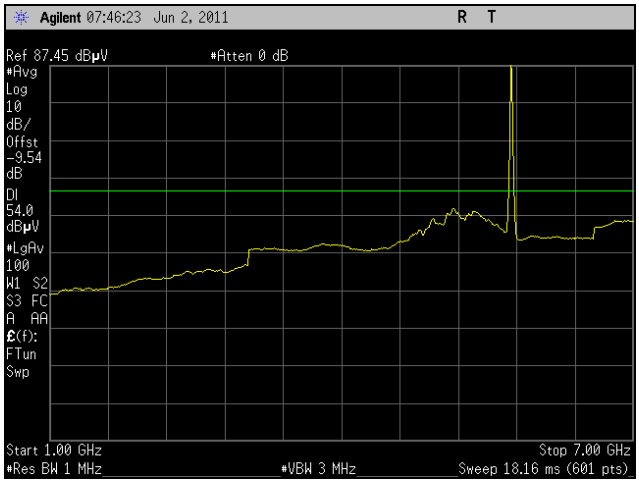


Plot 183. Radiated Spurious Emissions, High Channel, 802.11a, 7 GHz – 18 GHz, Peak, 5.8 GHz

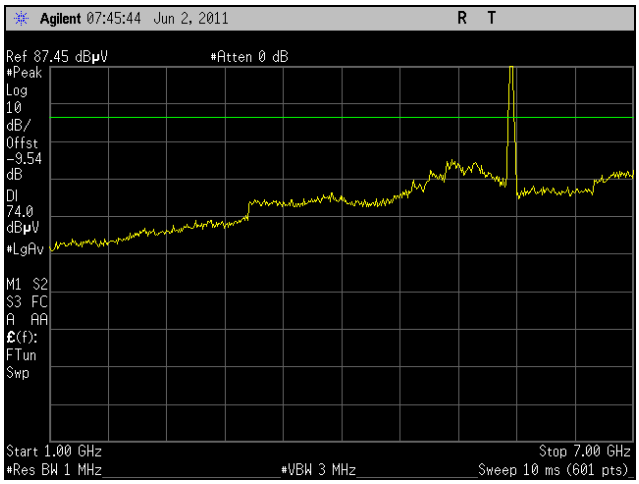
Radiated Spurious Emissions Test Results, 802.11n 20 MHz, 5.8 GHz



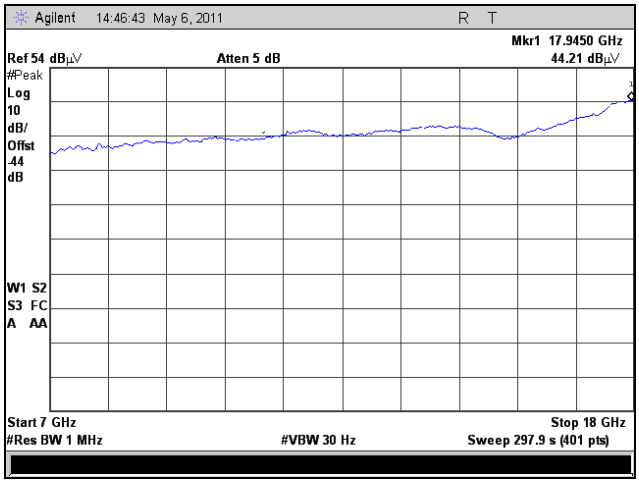
Plot 184. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, 30 MHz – 1 GHz, 5.8 GHz



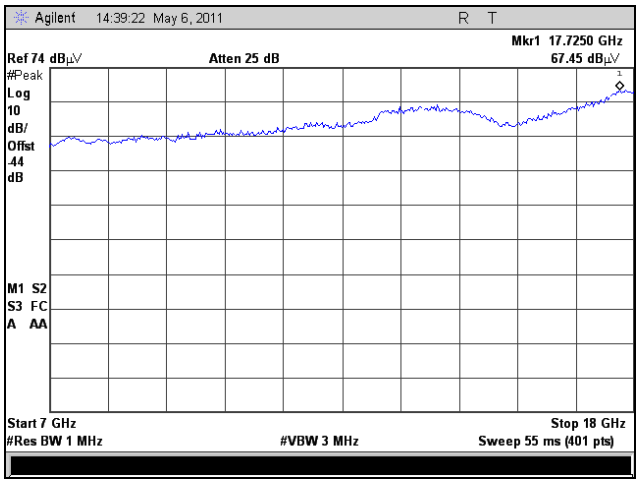
Plot 185. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, 1 GHz – 7 GHz, Average, 5.8 GHz



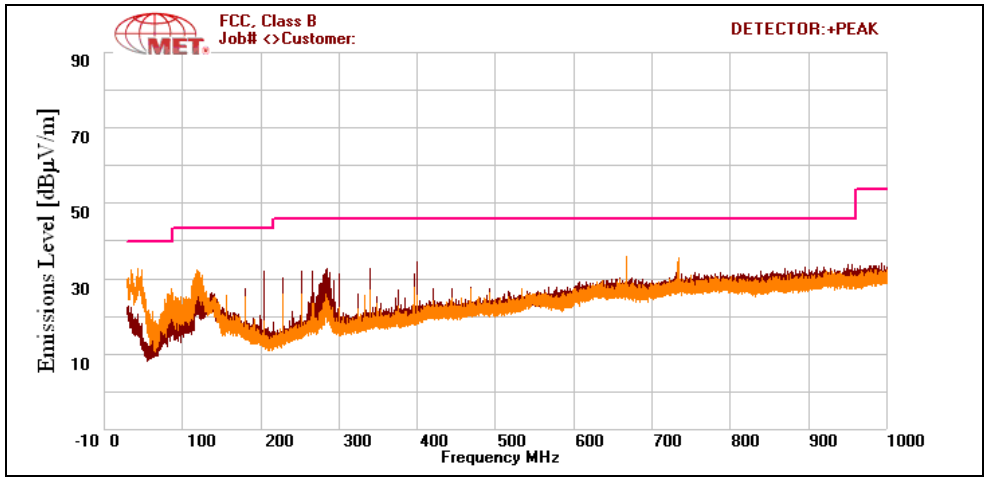
Plot 186. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, 1 GHz – 7 GHz, Peak, 5.8 GHz



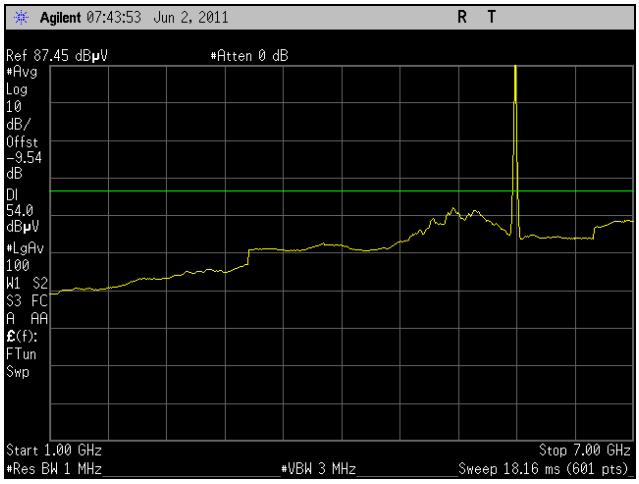
Plot 187. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, 7 GHz – 18 GHz, Average, 5.8 GHz



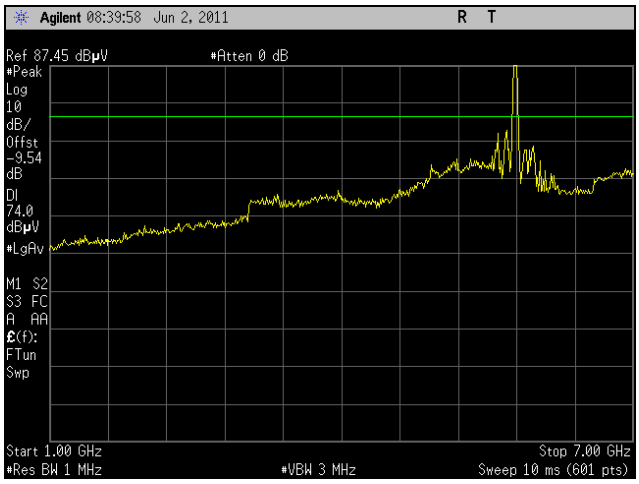
Plot 188. Radiated Spurious Emissions, Low Channel, 802.11n 20 MHz, 7 GHz – 18 GHz, Peak, 5.8 GHz



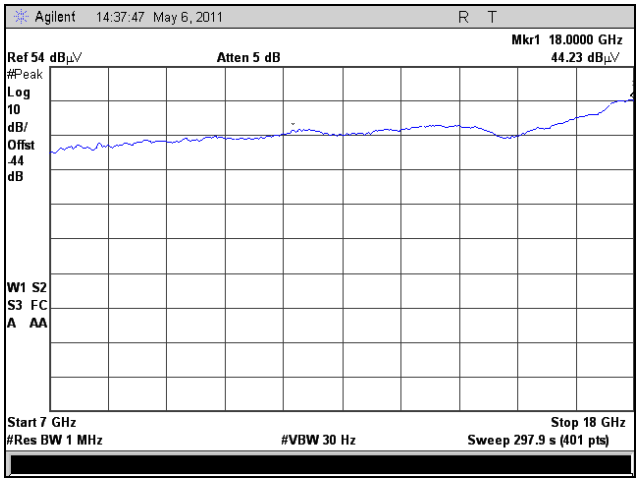
Plot 189. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, 30 MHz – 1 GHz, 5.8 GHz



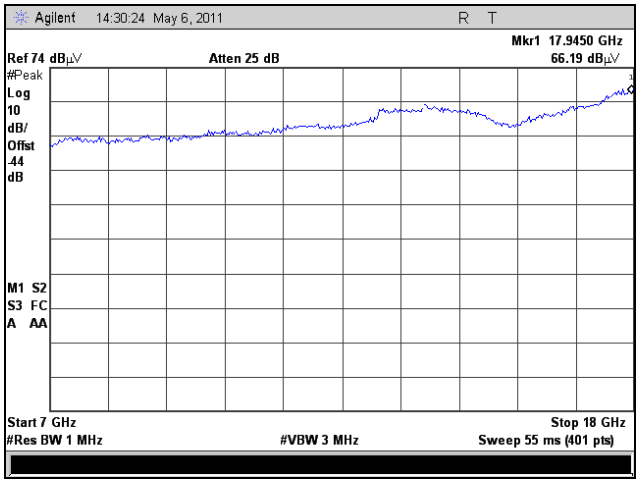
Plot 190. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, 1 GHz – 7 GHz, Average, 5.8 GHz



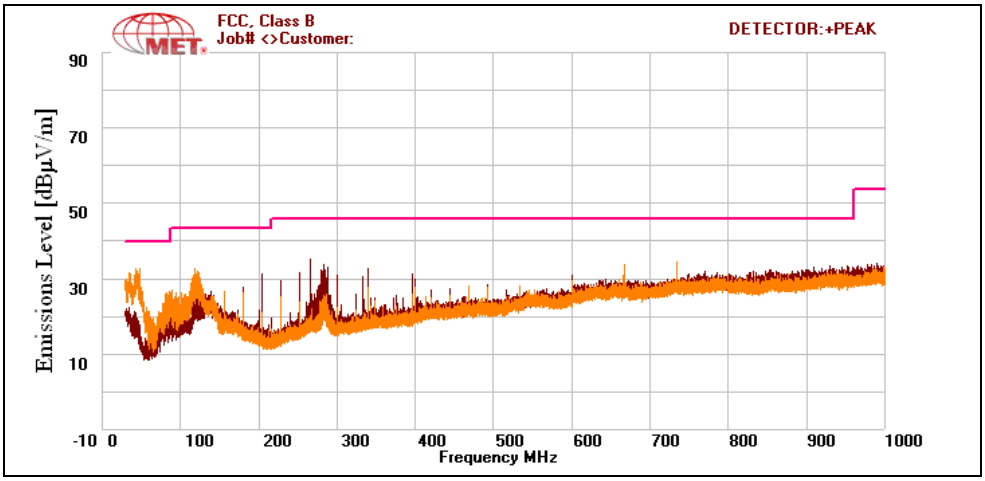
Plot 191. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, 1 GHz – 7 GHz, Peak, 5.8 GHz



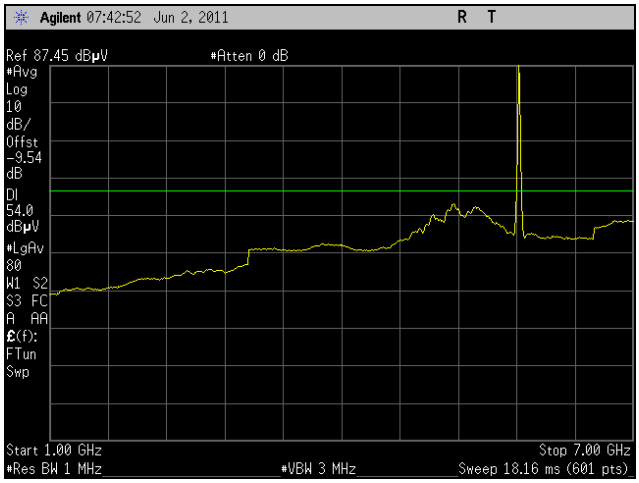
Plot 192. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, 7 GHz – 18 GHz, Average, 5.8 GHz



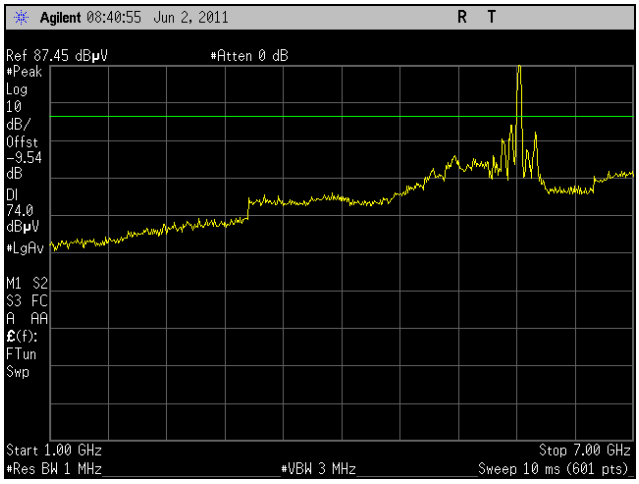
Plot 193. Radiated Spurious Emissions, Mid Channel, 802.11n 20 MHz, 7 GHz – 18 GHz, Peak, 5.8 GHz



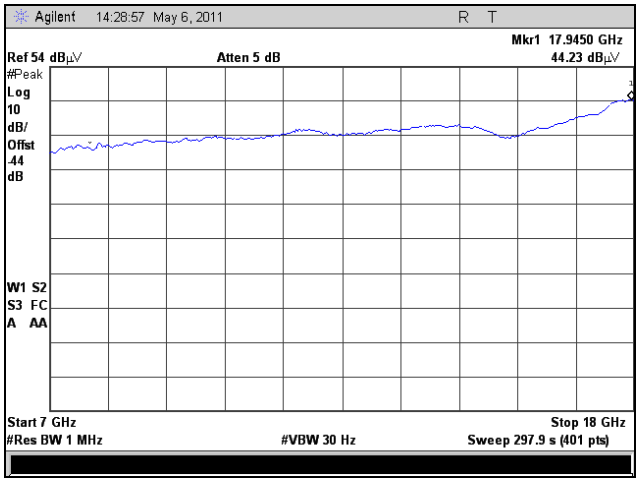
Plot 194. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, 30 MHz – 1 GHz, 5.8 GHz



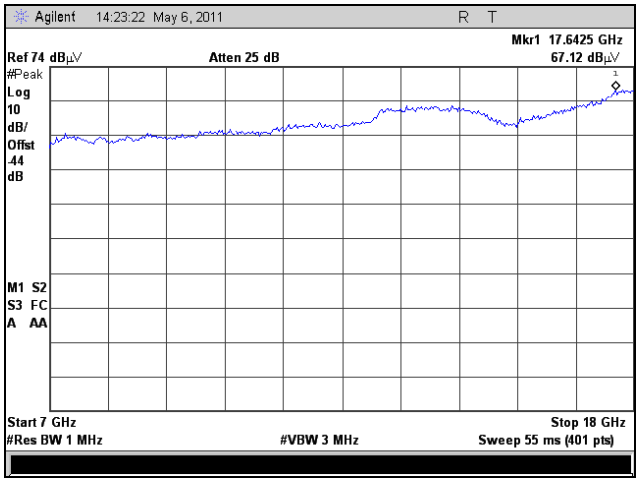
Plot 195. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, 1 GHz – 7 GHz, Average, 5.8 GHz



Plot 196. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, 1 GHz – 7 GHz, Peak, 5.8 GHz

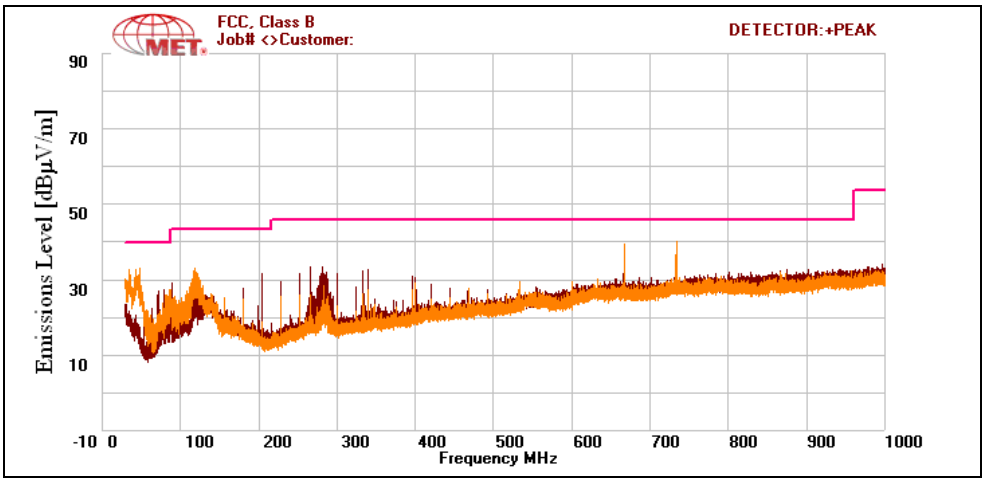


Plot 197. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, 7 GHz – 18 GHz, Average, 5.8 GHz

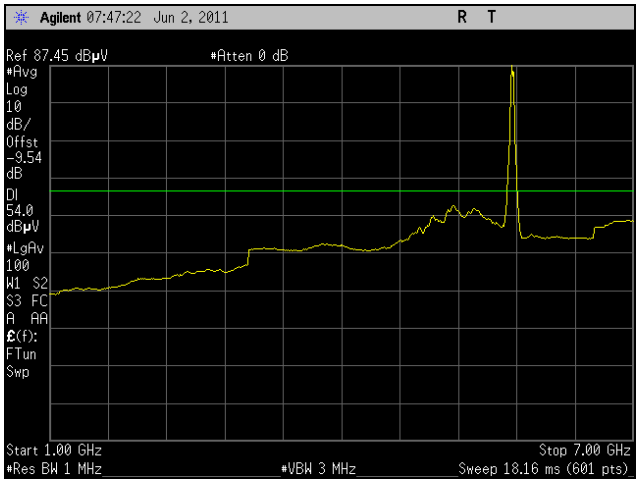


Plot 198. Radiated Spurious Emissions, High Channel, 802.11n 20 MHz, 7 GHz – 18 GHz, Peak, 5.8 GHz

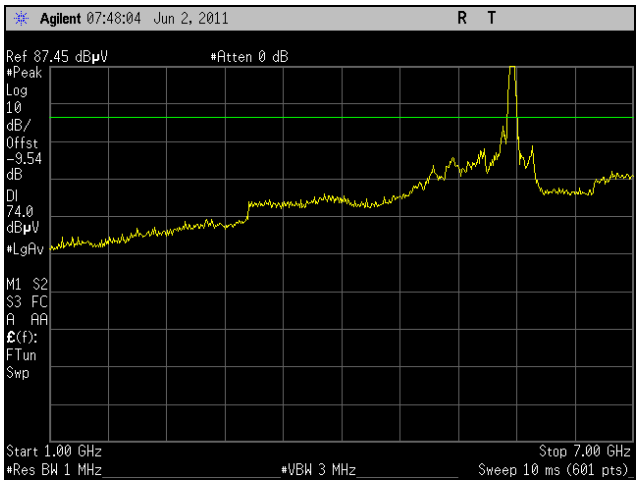
Radiated Spurious Emissions Test Results, 802.11n 40 MHz, 5.8 GHz



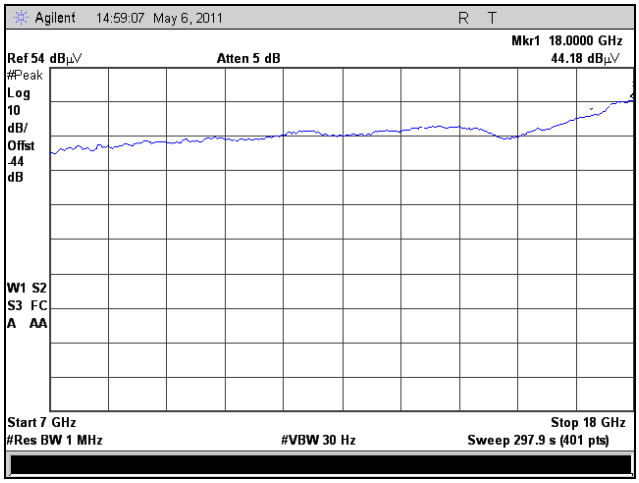
Plot 199. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, 30 MHz – 1 GHz, 5.8 GHz



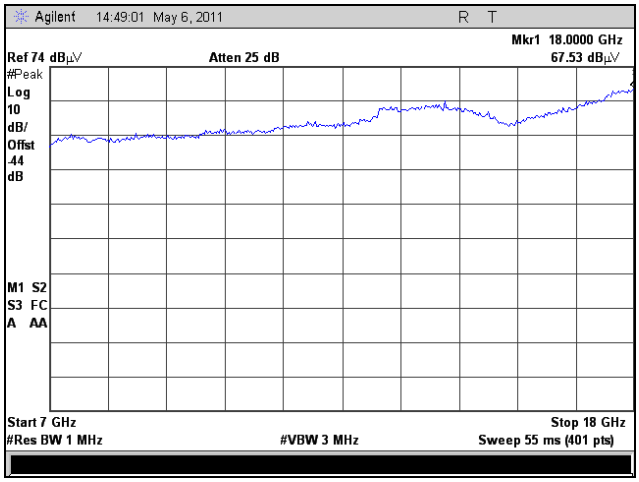
Plot 200. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, 1 GHz – 7 GHz, Average, 5.8 GHz



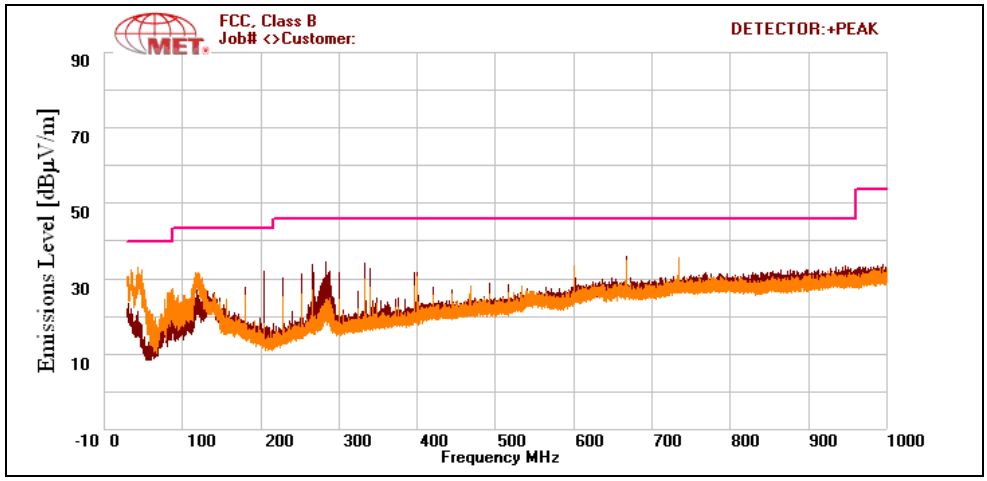
Plot 201. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, 1 GHz – 7 GHz, Peak, 5.8 GHz



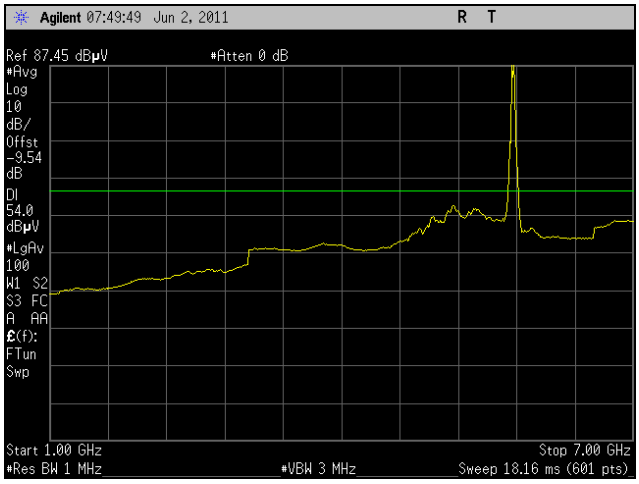
Plot 202. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, 7 GHz – 18 GHz, Average, 5.8 GHz



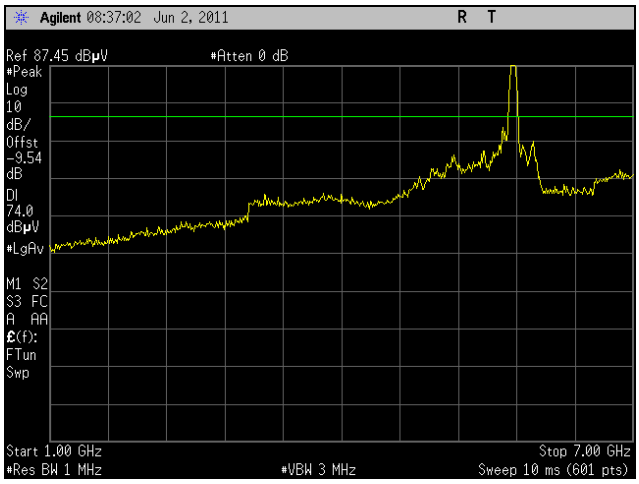
Plot 203. Radiated Spurious Emissions, Low Channel, 802.11n 40 MHz, 7 GHz – 18 GHz, Peak, 5.8 GHz



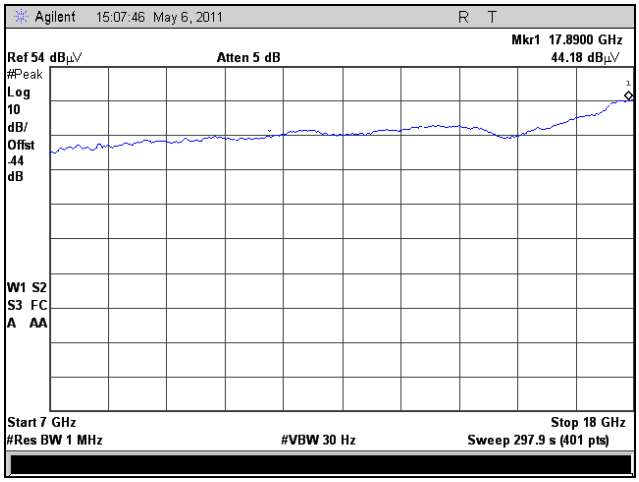
Plot 204. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, 30 MHz – 1 GHz, 5.8 GHz



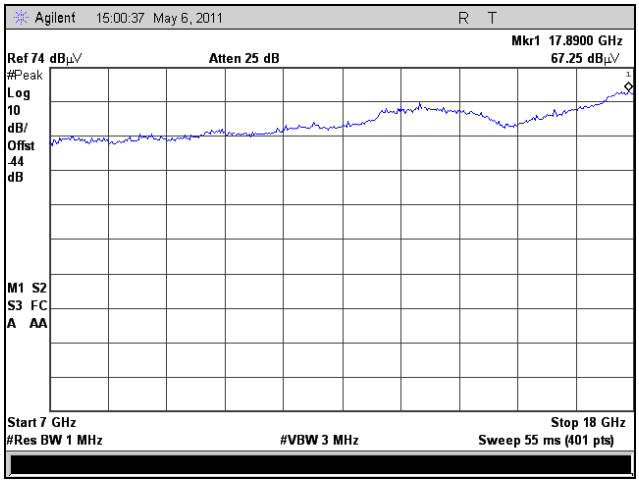
Plot 205. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, 1 GHz – 7 GHz, Average, 5.8 GHz



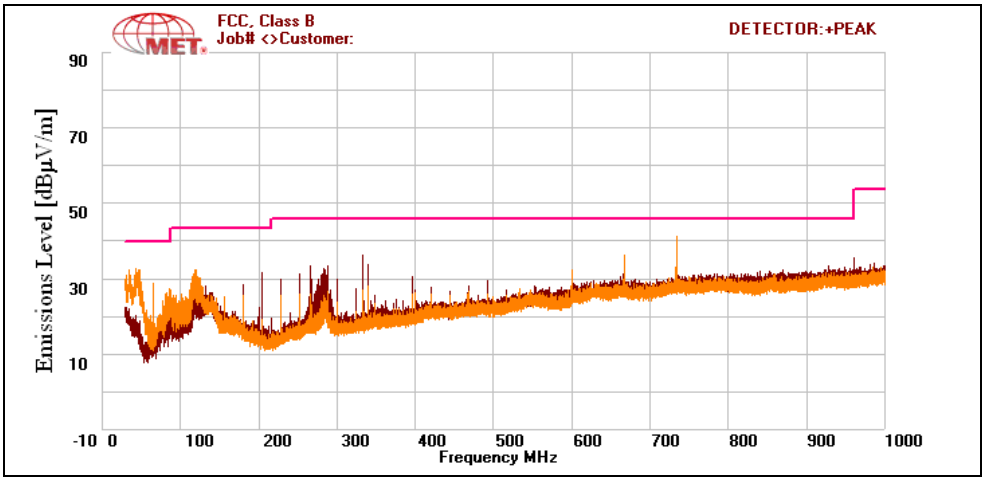
Plot 206. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, 1 GHz – 7 GHz, Peak, 5.8 GHz



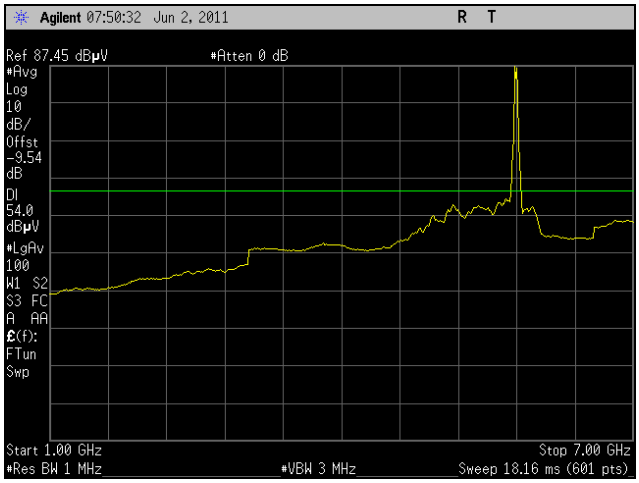
Plot 207. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, 7 GHz – 18 GHz, Average, 5.8 GHz



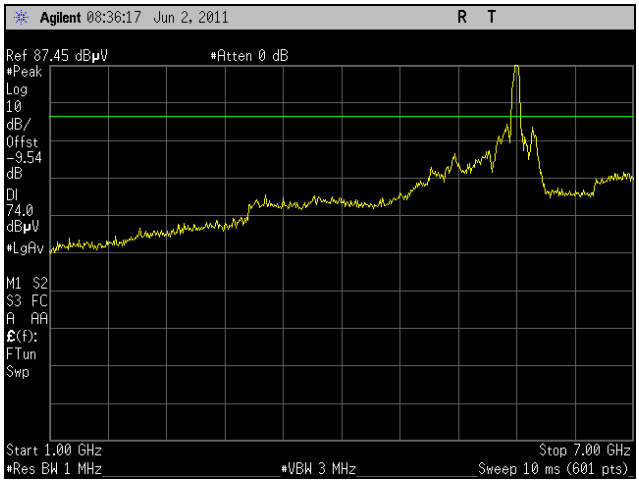
Plot 208. Radiated Spurious Emissions, Mid Channel, 802.11n 40 MHz, 7 GHz – 18 GHz, Peak, 5.8 GHz



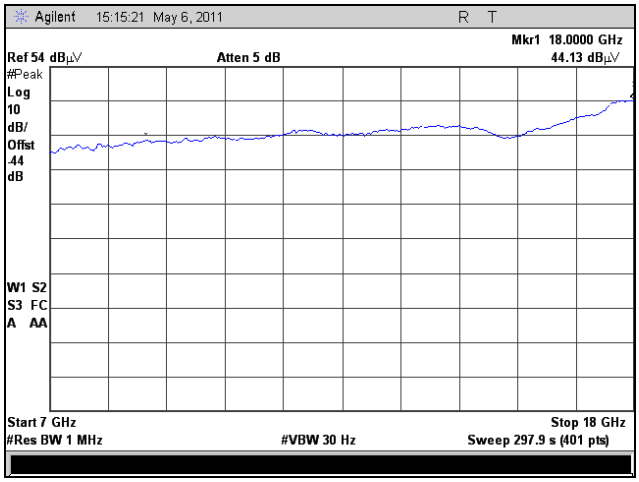
Plot 209. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, 30 MHz – 1 GHz, 5.8 GHz



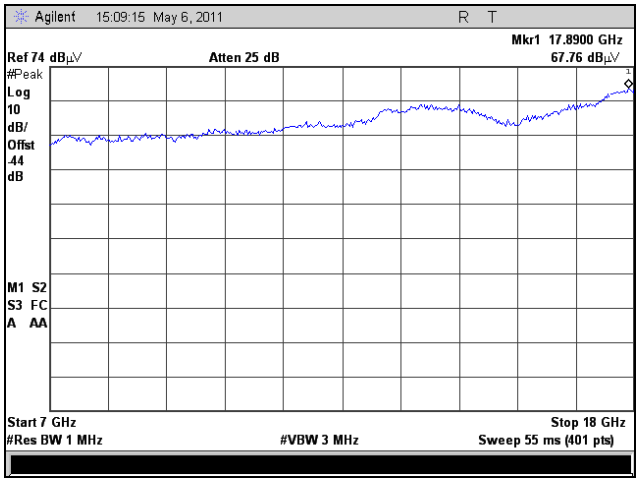
Plot 210. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, 1 GHz – 7 GHz, Average, 5.8 GHz



Plot 211. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, 1 GHz – 7 GHz, Peak, 5.8 GHz



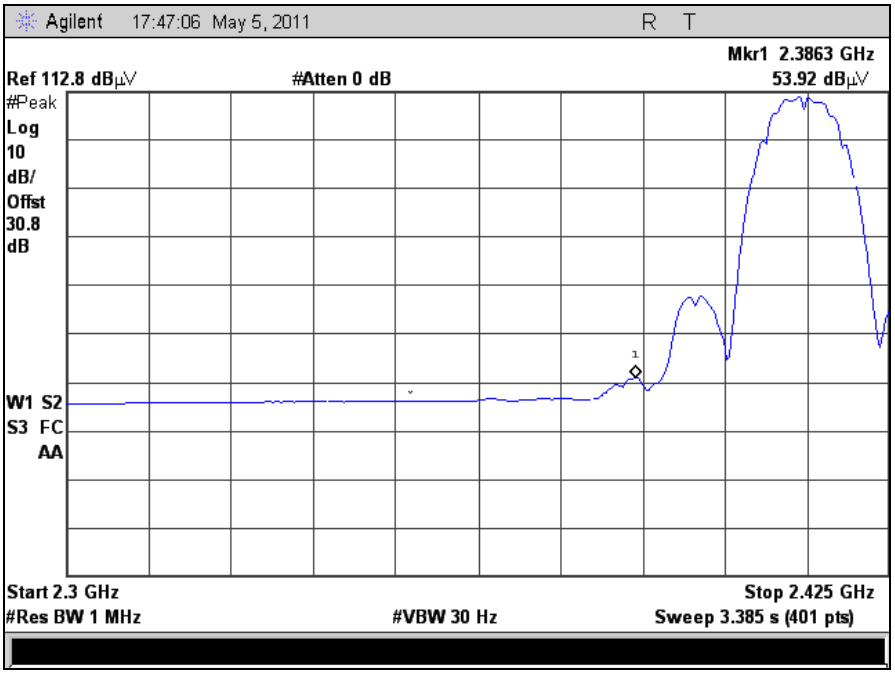
Plot 212. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, 7 GHz – 18 GHz, Average, 5.8 GHz



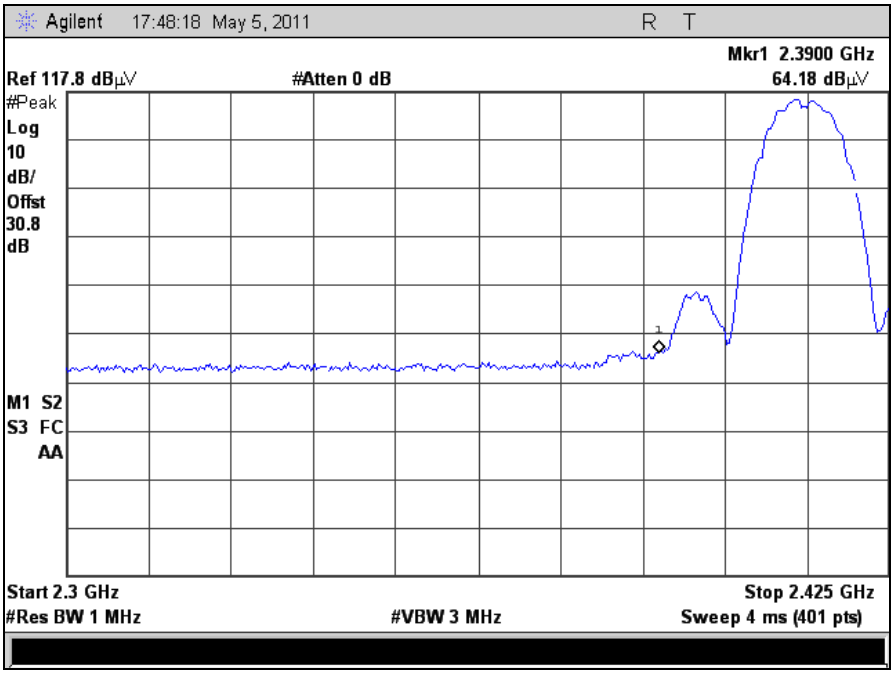
Plot 213. Radiated Spurious Emissions, High Channel, 802.11n 40 MHz, 7 GHz – 18 GHz, Peak, 5.8 GHz

Radiated Band Edge Measurements, 802.11b, 2.4 GHz

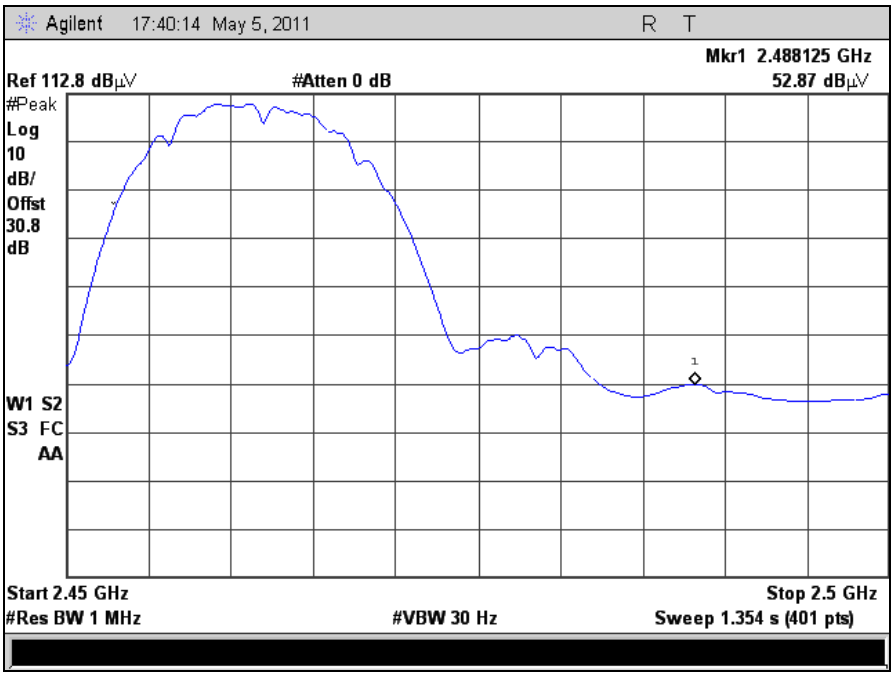
Test Procedures: The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line. The Band Edges were investigated and found compliant. Markers were placed on the highest peak in the Restricted Band.



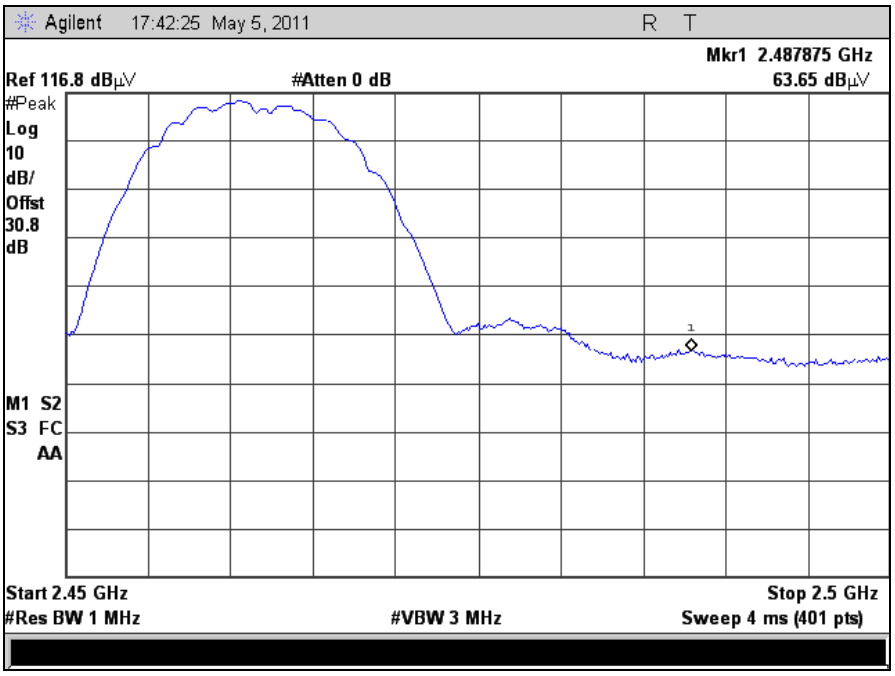
Plot 214. Radiated Restricted Band Edge, 802.11b, Low Channel, Average, 2.4 GHz



Plot 215. Radiated Restricted Band Edge, 802.11b, Low Channel, Peak, 2.4 GHz

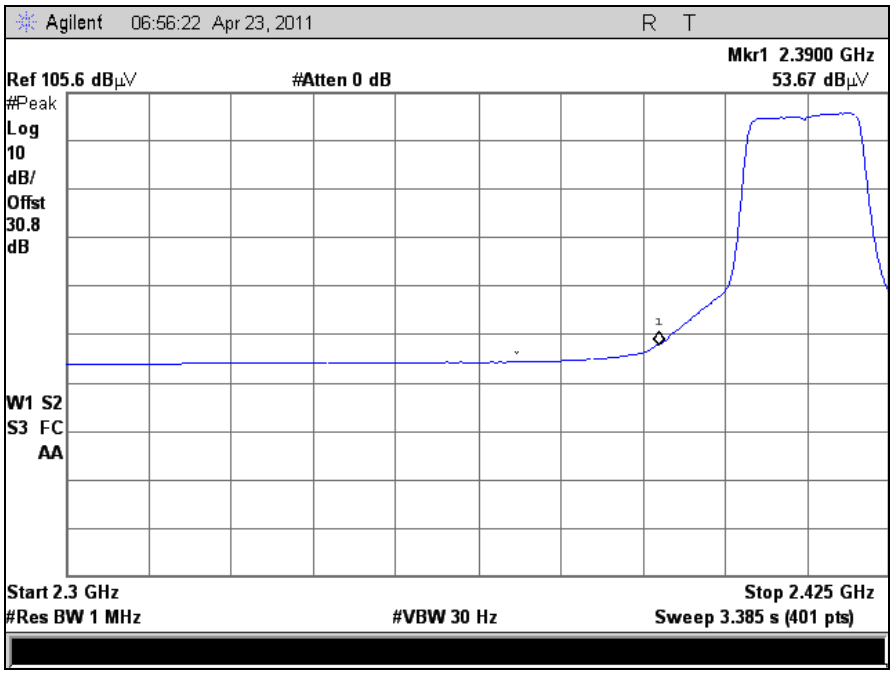


Plot 216. Radiated Restricted Band Edge, 802.11b, High Channel, Average, 2.4 GHz

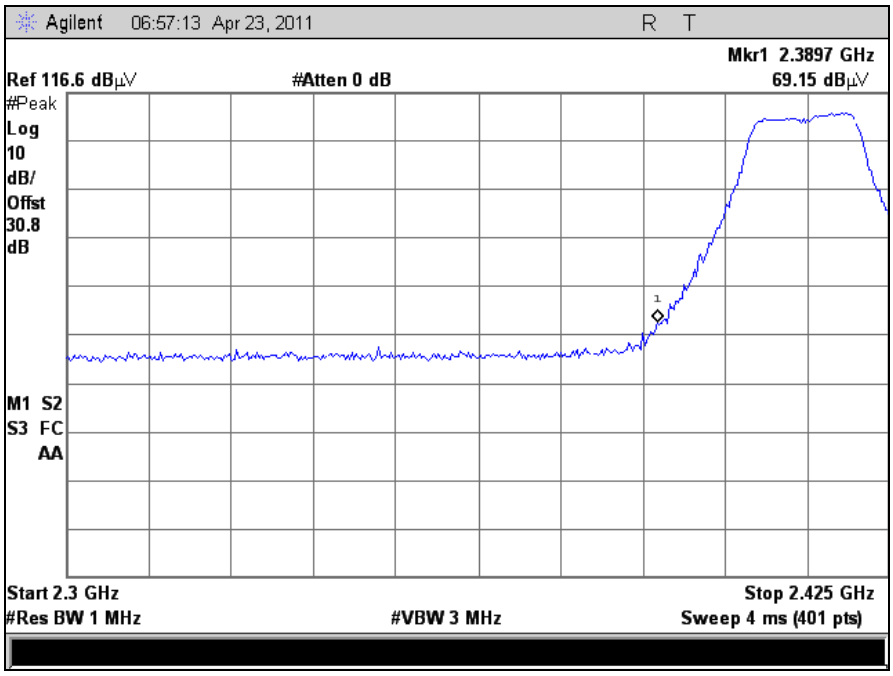


Plot 217. Radiated Restricted Band Edge, 802.11b, High Channel, Peak, 2.4 GHz

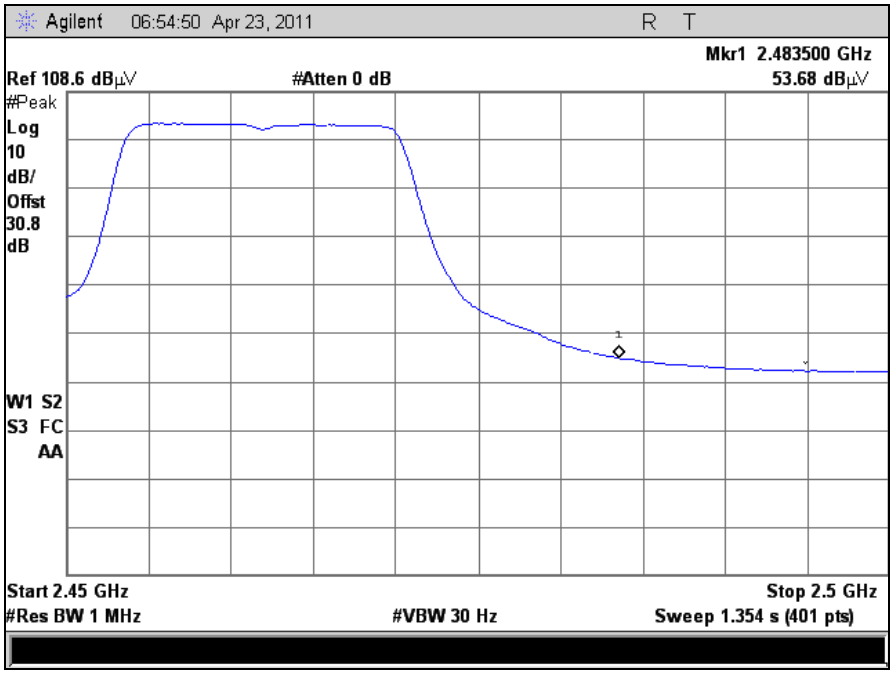
Radiated Band Edge Measurements, 802.11g, 2.4 GHz



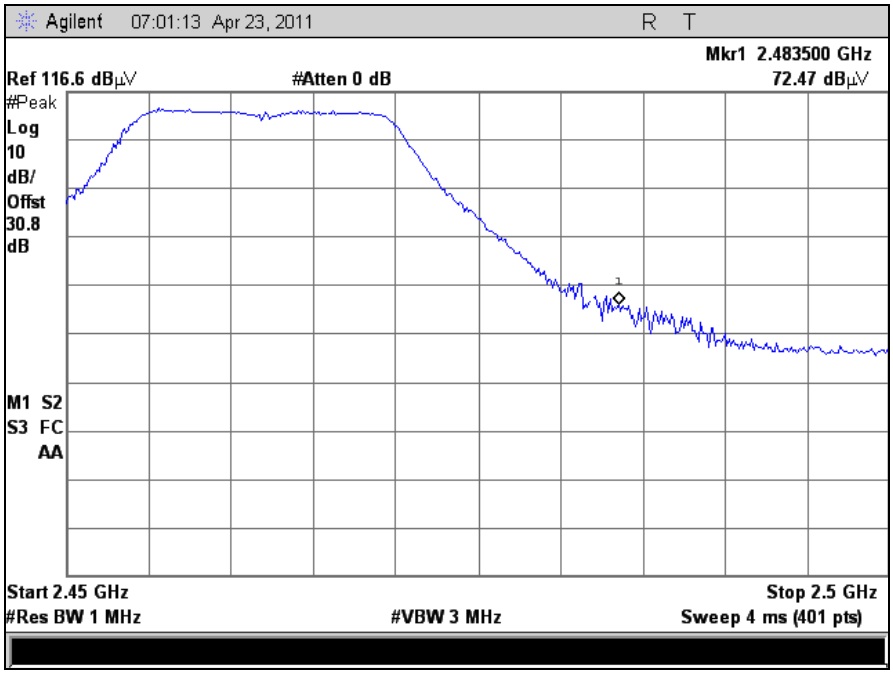
Plot 218. Radiated Restricted Band Edge, 802.11g, Low Channel, Average, 2.4 GHz



Plot 219. Radiated Restricted Band Edge, 802.11g, Low Channel, Peak, 2.4 GHz

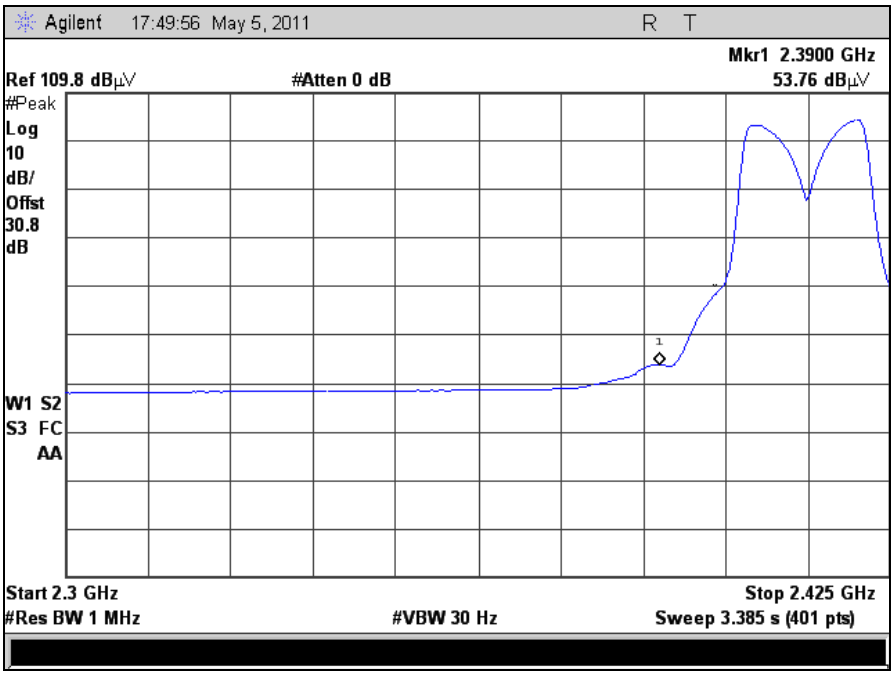


Plot 220. Radiated Restricted Band Edge, 802.11g, High Channel, Average, 2.4 GHz

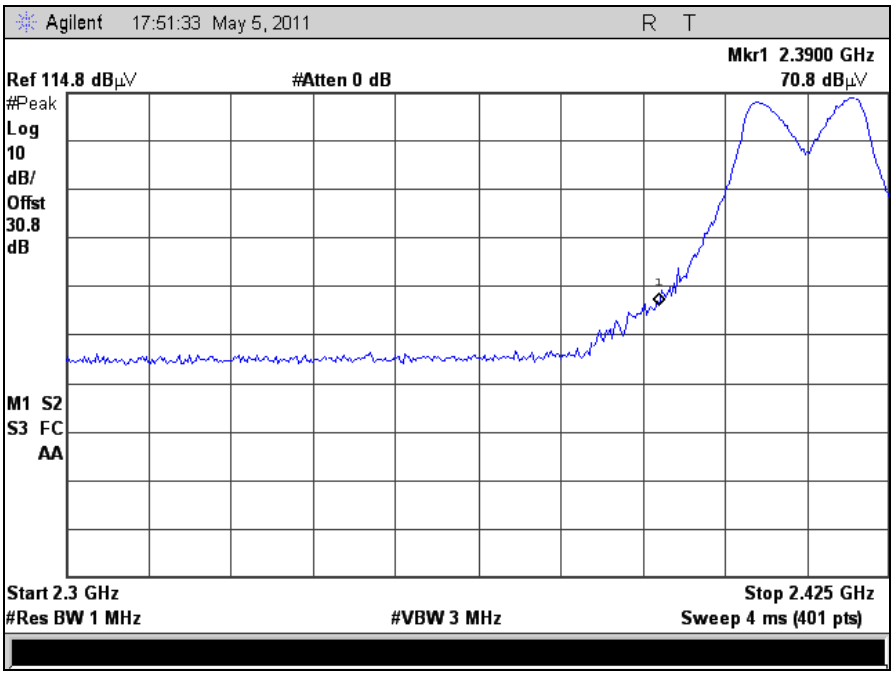


Plot 221. Radiated Restricted Band Edge, 802.11g, High Channel, Peak, 2.4 GHz

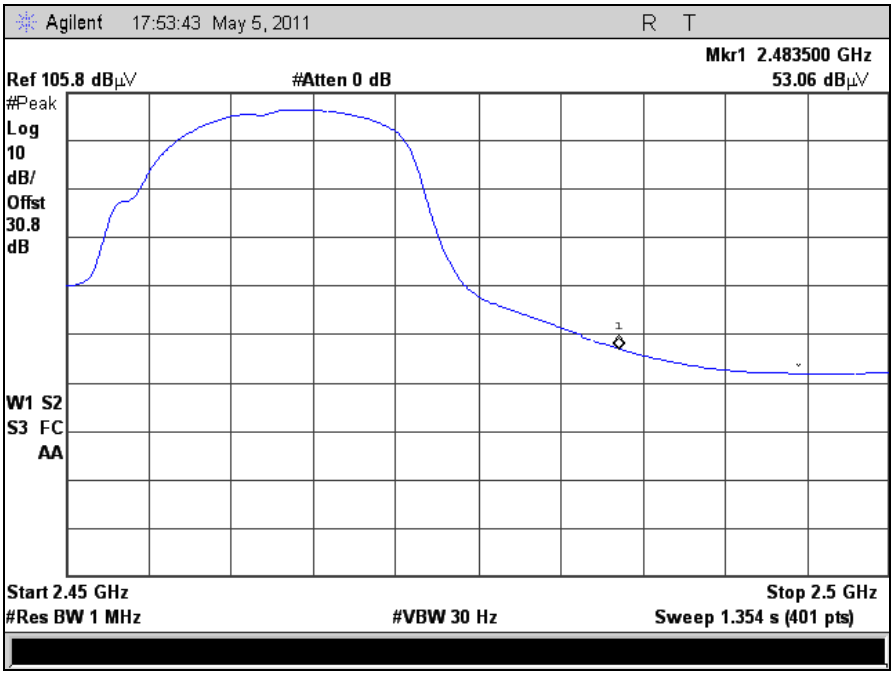
Radiated Band Edge Measurements, 802.11n 20 MHz, 2.4 GHz



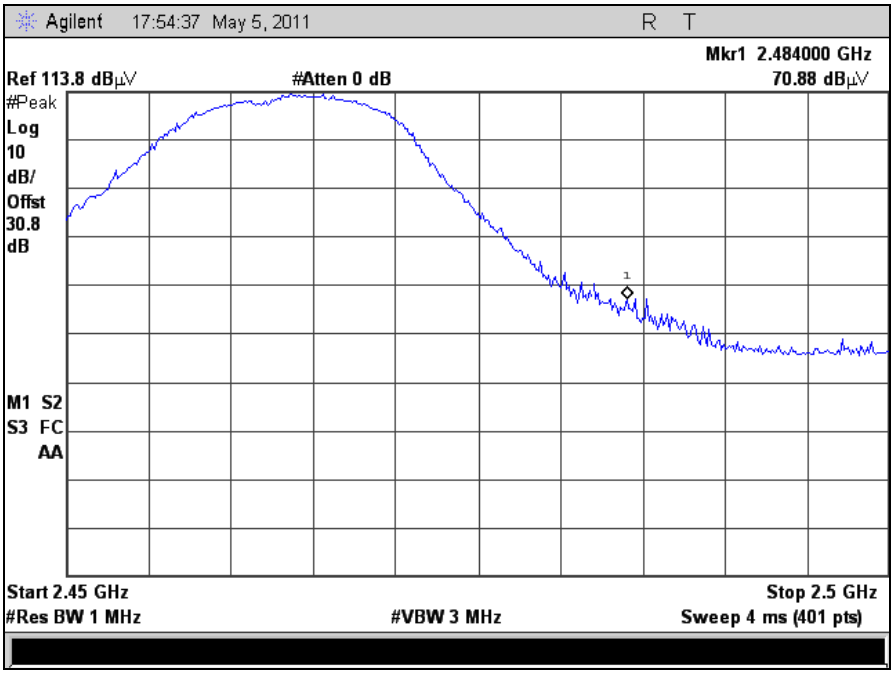
Plot 222. Radiated Restricted Band Edge, 802.11n 20 MHz, Low Channel, Average, 2.4 GHz



Plot 223. Radiated Restricted Band Edge, 802.11n 20 MHz, Low Channel, Peak, 2.4 GHz

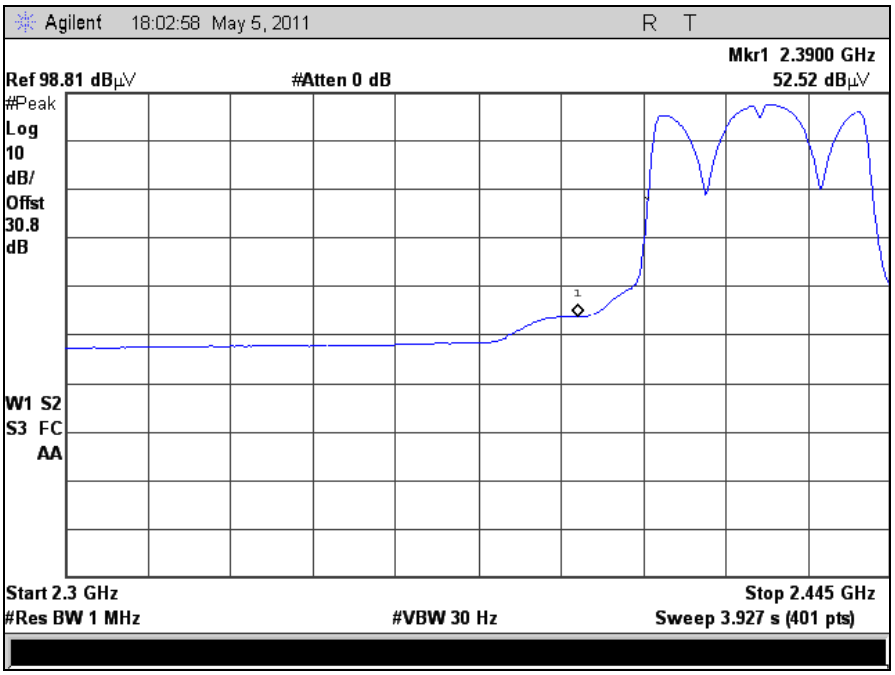


Plot 224. Radiated Restricted Band Edge, 802.11n 20MHz, High Channel, Average, 2.4 GHz

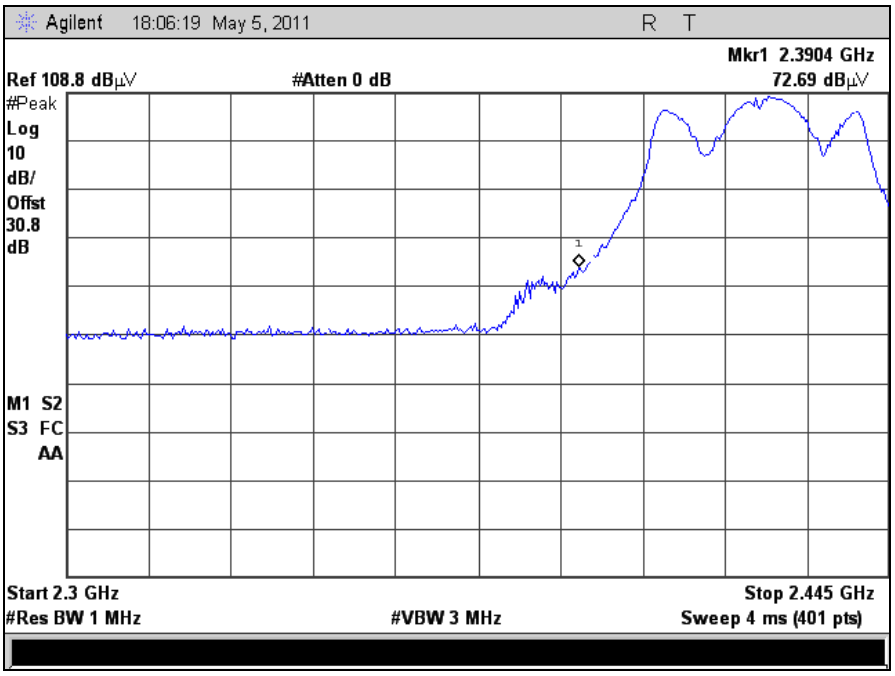


Plot 225. Radiated Restricted Band Edge, 802.11n 20 MHz, High Channel, Peak, 2.4 GHz

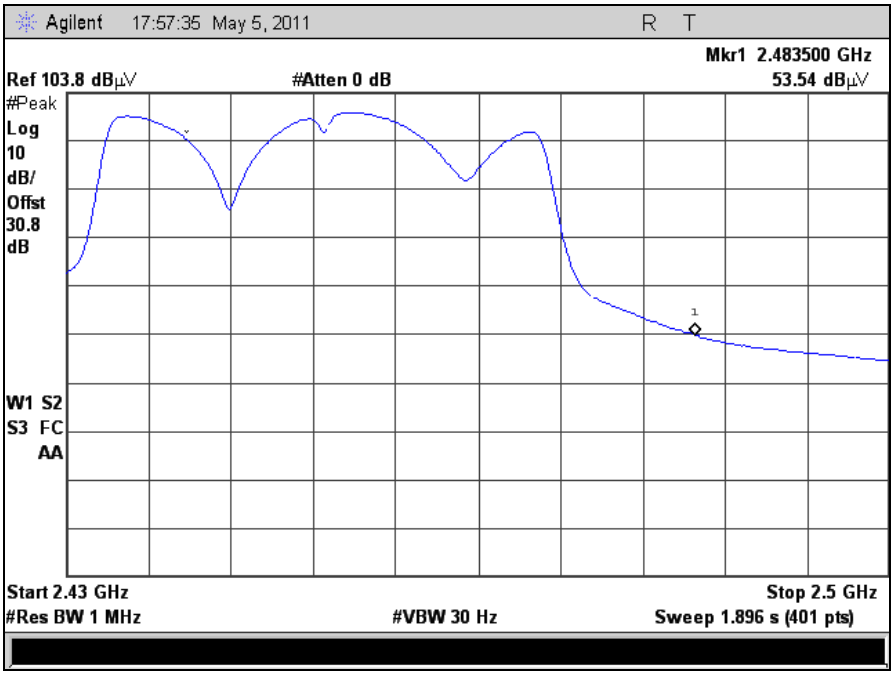
Radiated Band Edge Measurements, 802.11n 40 MHz, 2.4 GHz



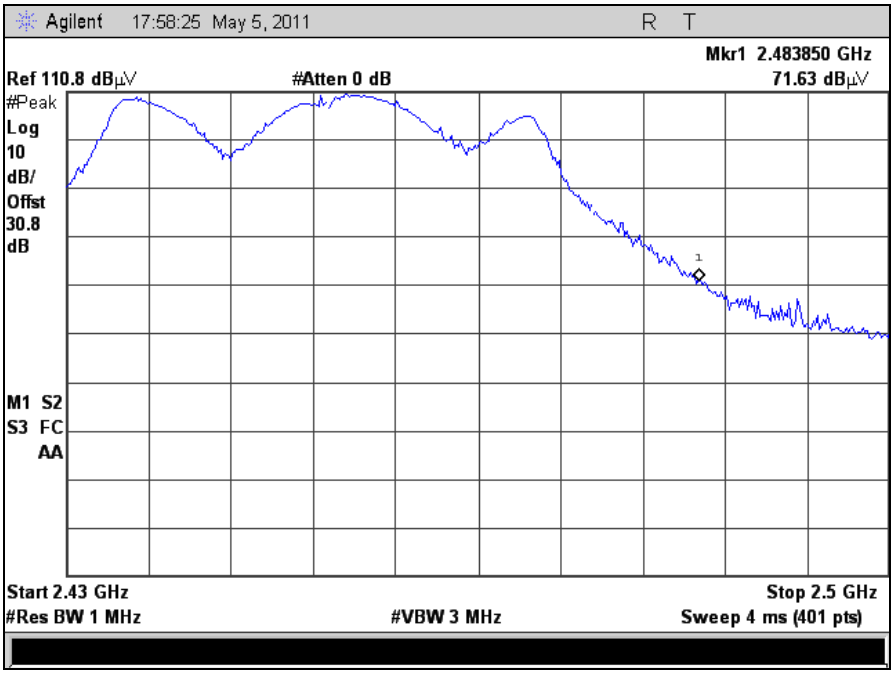
Plot 226. Radiated Restricted Band Edge, 802.11n 40 MHz, Low Channel, Average, 2.4 GHz



Plot 227. Radiated Restricted Band Edge, 802.11n 40 MHz, Low Channel, Peak, 2.4 GHz

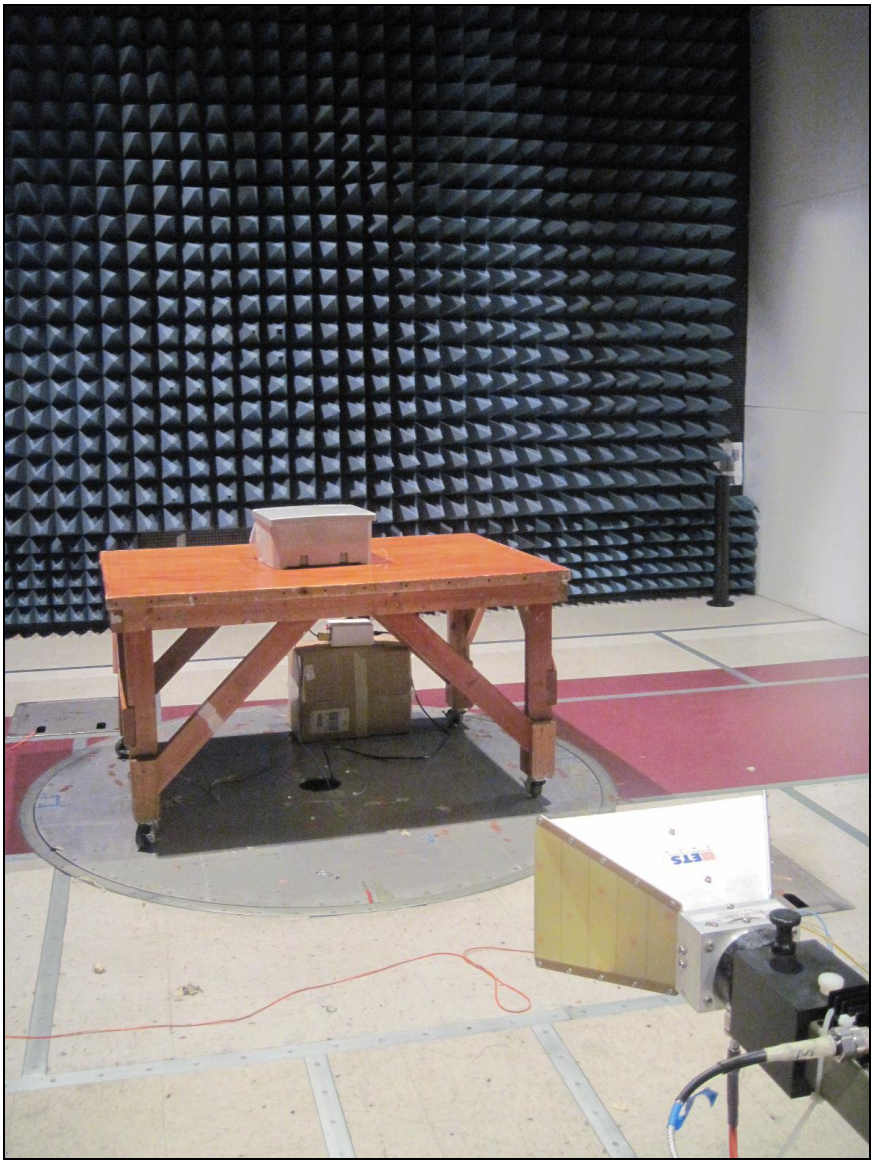


Plot 228. Radiated Restricted Band Edge, 802.11n 40MHz, High Channel, Average, 2.4 GHz



Plot 229. Radiated Restricted Band Edge, 802.11n 40 MHz, High Channel, Peak, 2.4 GHz

Radiated Spurious Emissions Test Setup



Photograph 5. Radiated Harmonics, Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) RF Conducted Spurious Emissions Requirements and Band Edge

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.

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)**. Measured emissions were below applicable limits.

Test Engineer(s): Lionel Gabrillo

Test Date(s): 05/04/11 – 05/06/11

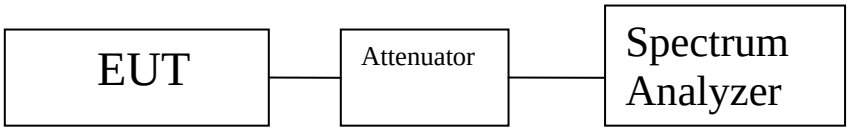
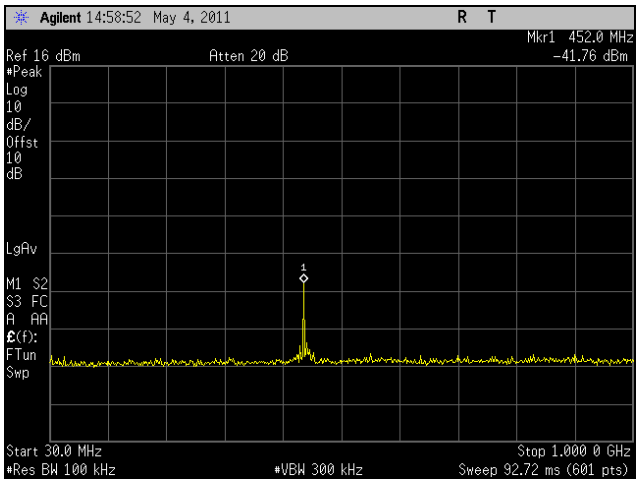
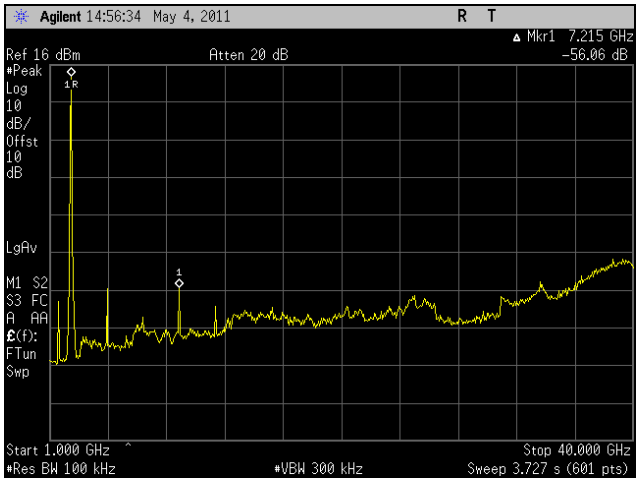


Figure 4. Block Diagram, Conducted Spurious Emissions Test Setup

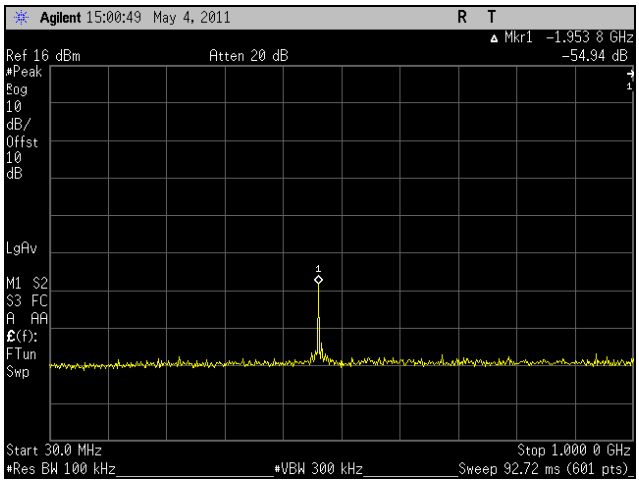
Conducted Spurious Emissions Test Results, 802.11b, 2.4 GHz



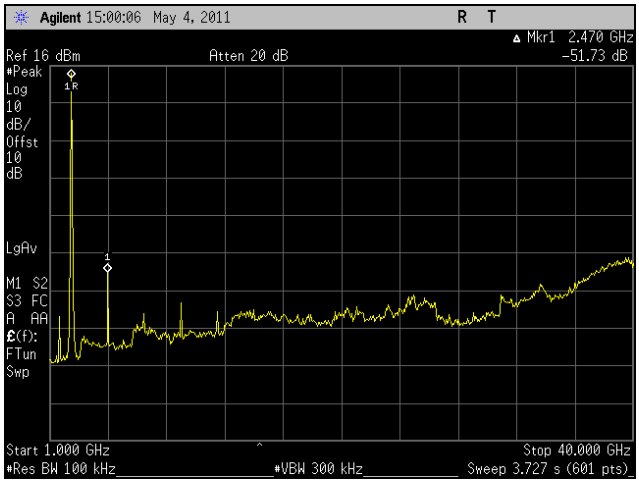
Plot 230. Conducted Spurious Emissions, Low Channel, 802.11b, 30 MHz – 1 GHz, 2.4 GHz



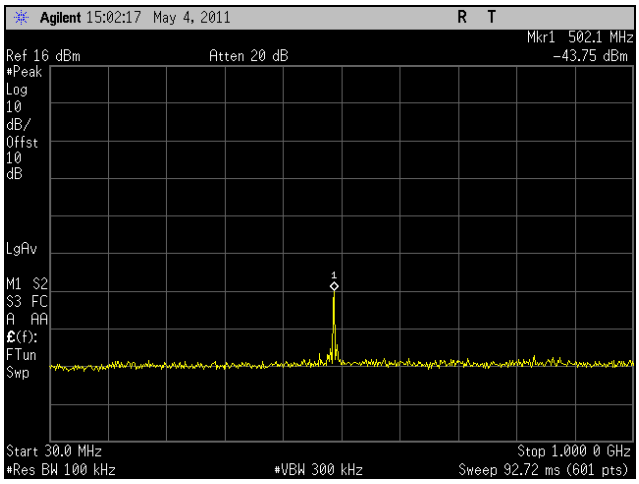
Plot 231. Conducted Spurious Emissions, Low Channel, 802.11b, 1 GHz – 40 GHz, 2.4 GHz



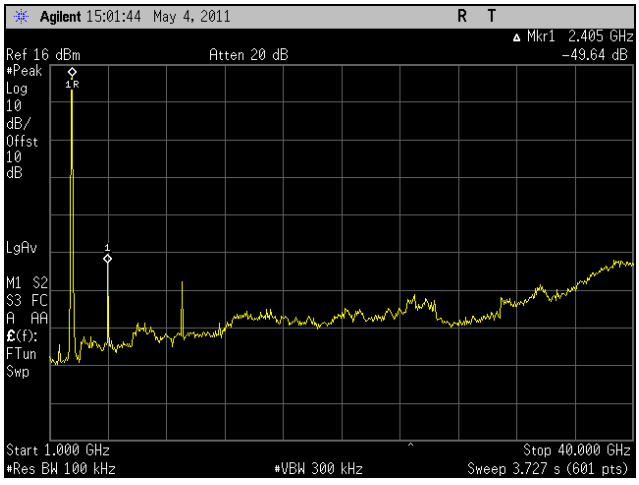
Plot 232. Conducted Spurious Emissions, Mid Channel, 802.11b, 30 MHz – 1 GHz, 2.4 GHz



Plot 233. Conducted Spurious Emissions, Mid Channel, 802.11b, 1 GHz – 40 GHz, 2.4 GHz

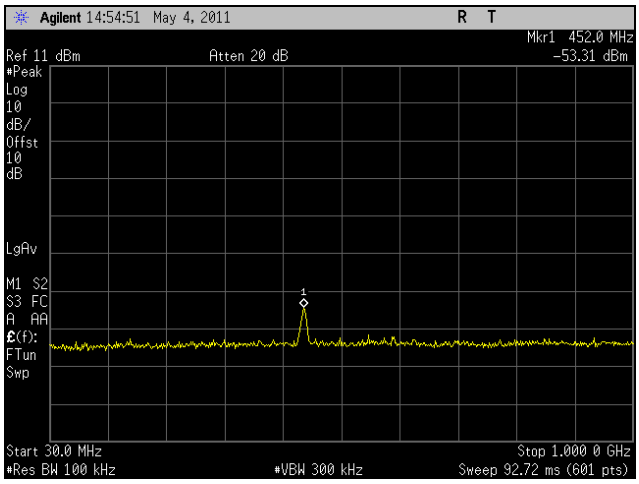


Plot 234. Conducted Spurious Emissions, High Channel, 802.11b, 30 MHz – 1 GHz, 2.4 GHz

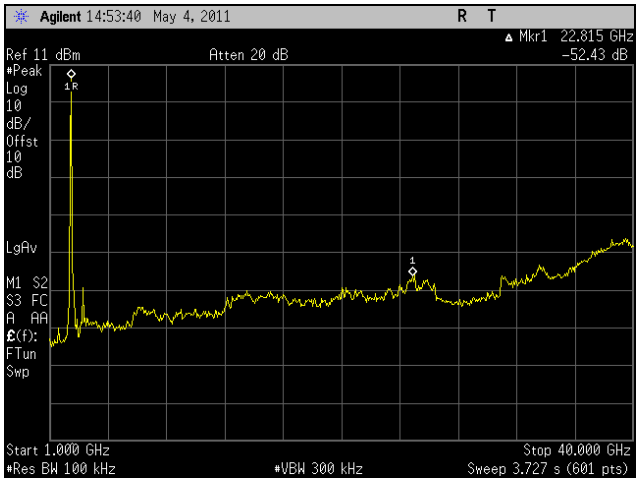


Plot 235. Conducted Spurious Emissions, High Channel, 802.11b, 1 GHz – 40 GHz, 2.4 GHz

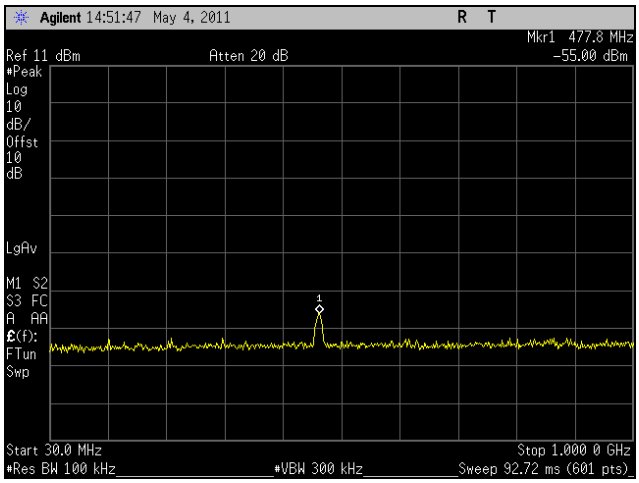
Conducted Spurious Emissions Test Results, 802.11g, 2.4 GHz



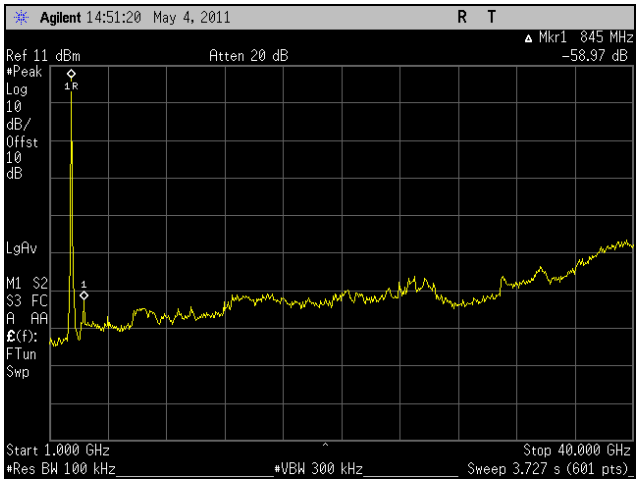
Plot 236. Conducted Spurious Emissions, Low Channel, 802.11g, 30 MHz – 1 GHz, 2.4 GHz



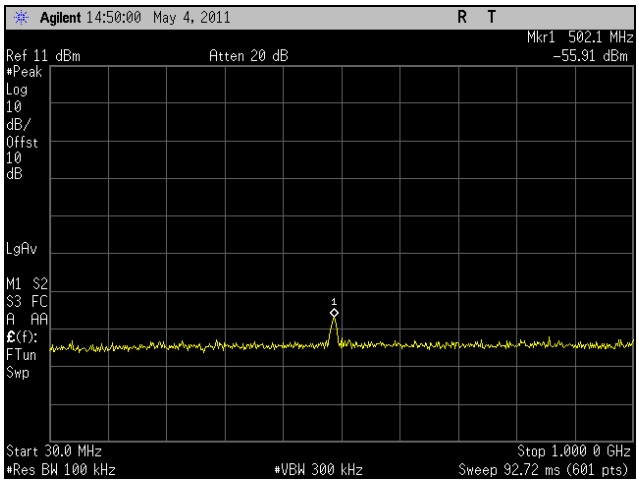
Plot 237. Conducted Spurious Emissions, Low Channel, 802.11g, 1 GHz – 40 GHz, 2.4 GHz



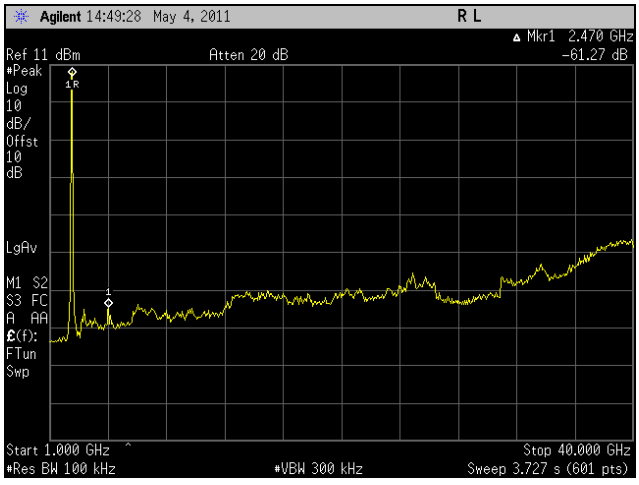
Plot 238. Conducted Spurious Emissions, Mid Channel, 802.11g, 30 MHz – 1 GHz, 2.4 GHz



Plot 239. Conducted Spurious Emissions, Mid Channel, 802.11g, 1 GHz – 40 GHz, 2.4 GHz

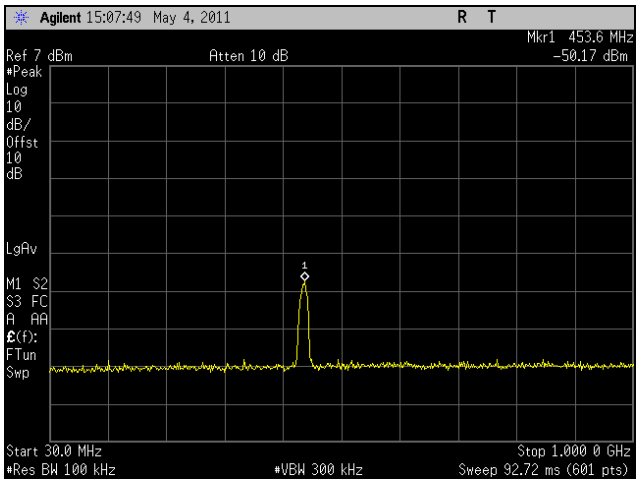


Plot 240. Conducted Spurious Emissions, High Channel, 802.11g, 30 MHz – 1 GHz, 2.4 GHz

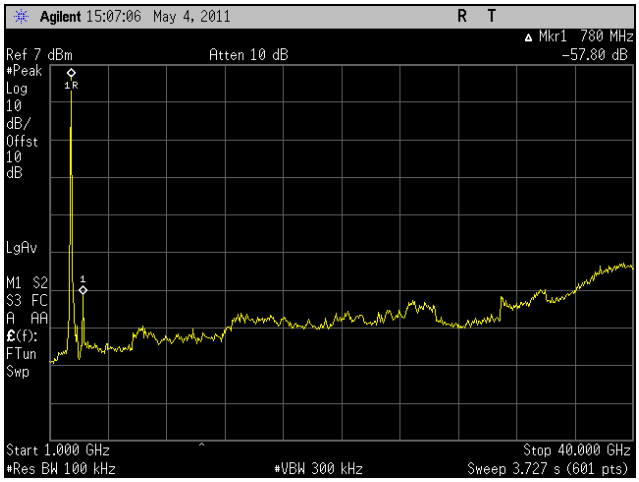


Plot 241. Conducted Spurious Emissions, High Channel, 802.11g, 1 GHz – 40 GHz, 2.4 GHz

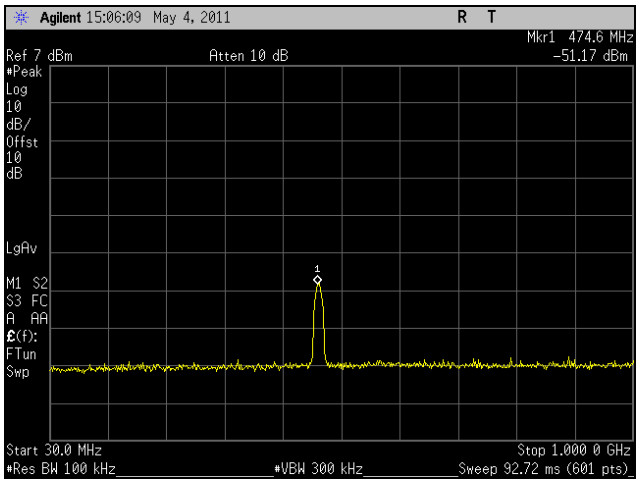
Conducted Spurious Emissions Test Results, 802.11n 20 MHz, Port 0, 2.4 GHz



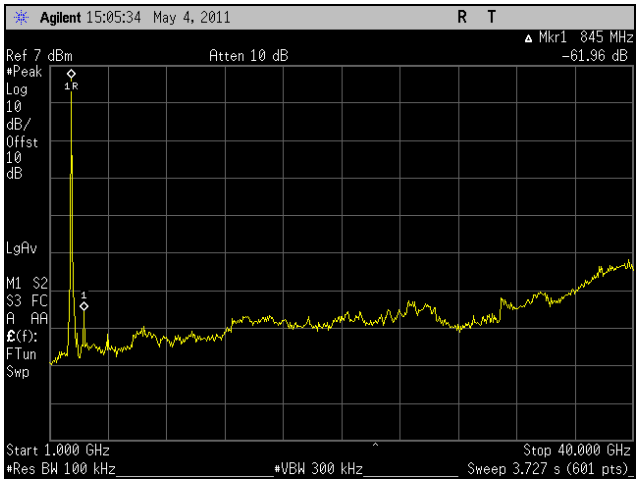
Plot 242. Conducted Spurious Emissions, Low Channel, 802.11n 20 MHz, Port 0, 30 MHz – 1 GHz, 2.4 GHz



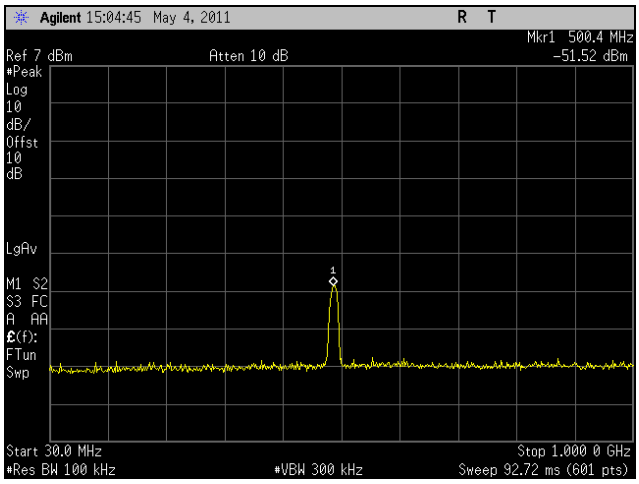
Plot 243. Conducted Spurious Emissions, Low Channel, 802.11n 20 MHz, Port 0, 1 GHz – 40 GHz, 2.4 GHz



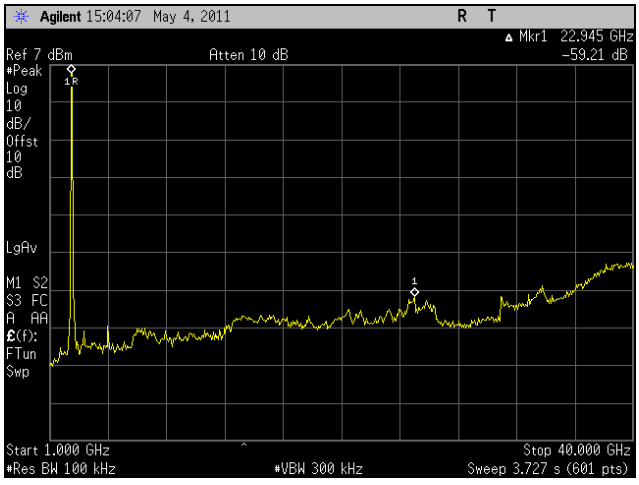
Plot 244. Conducted Spurious Emissions, Mid Channel, 802.11n 20 MHz, Port 0, 30 MHz – 1 GHz, 2.4 GHz



Plot 245. Conducted Spurious Emissions, Mid Channel, 802.11n 20 MHz, Port 0, 1 GHz – 40 GHz, 2.4 GHz

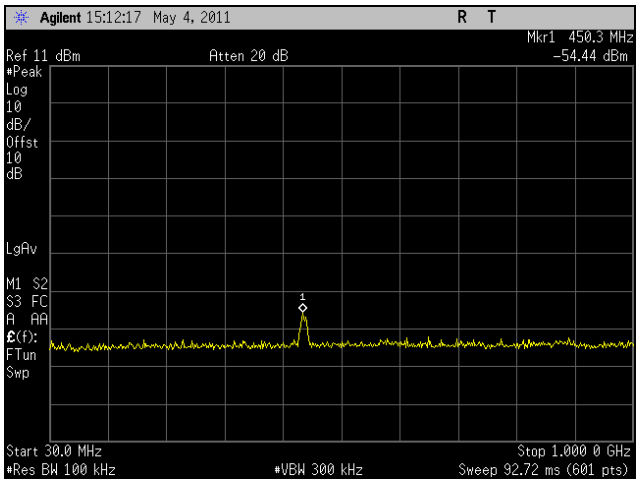


Plot 246. Conducted Spurious Emissions, High Channel, 802.11n 20 MHz, Port 0, 30 MHz – 1 GHz, 2.4 GHz

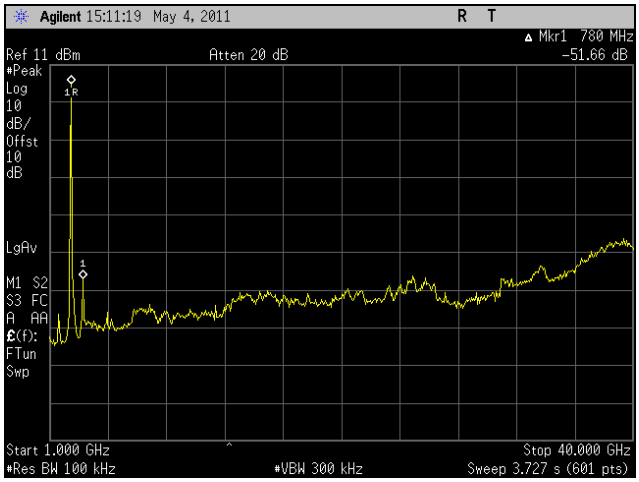


Plot 247. Conducted Spurious Emissions, High Channel, 802.11n 20 MHz, Port 0, 1 GHz – 40 GHz, 2.4 GHz

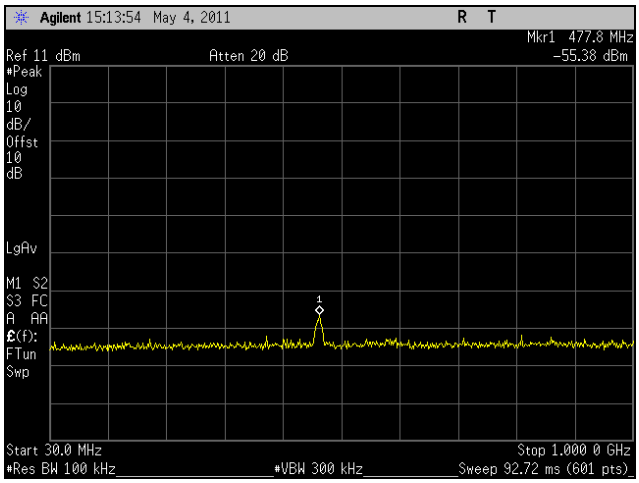
Conducted Spurious Emissions Test Results, 802.11n 20 MHz, Port 1, 2.4 GHz



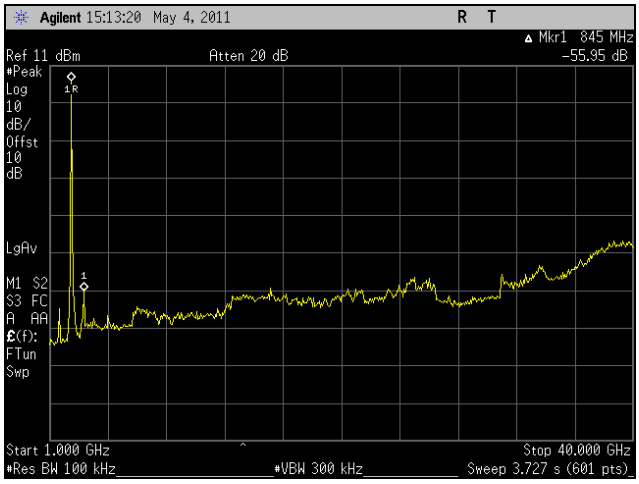
Plot 248. Conducted Spurious Emissions, Low Channel, 802.11n 20 MHz, Port 1, 30 MHz – 1 GHz, 2.4 GHz



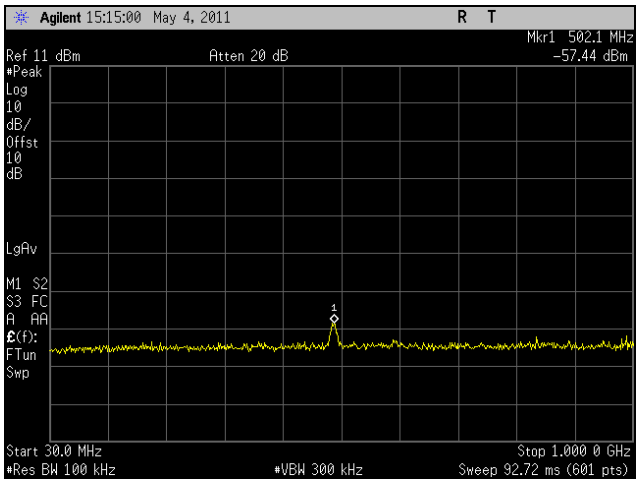
Plot 249. Conducted Spurious Emissions, Low Channel, 802.11n 20 MHz, Port 1, 1 GHz – 40 GHz, 2.4 GHz



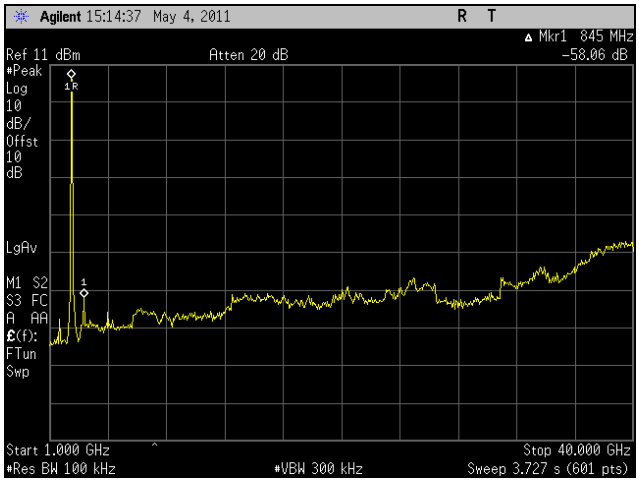
Plot 250. Conducted Spurious Emissions, Mid Channel, 802.11n 20 MHz, Port 1, 30 MHz – 1 GHz, 2.4 GHz



Plot 251. Conducted Spurious Emissions, Mid Channel, 802.11n 20 MHz, Port 1, 1 GHz – 40 GHz, 2.4 GHz

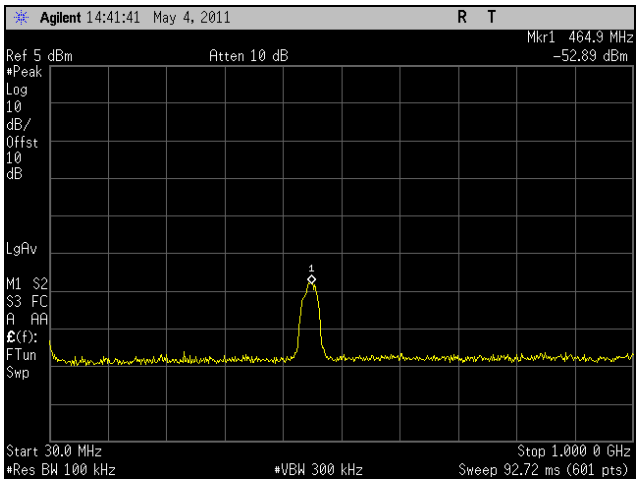


Plot 252. Conducted Spurious Emissions, High Channel, 802.11n 20 MHz, Port 1, 30 MHz – 1 GHz, 2.4 GHz

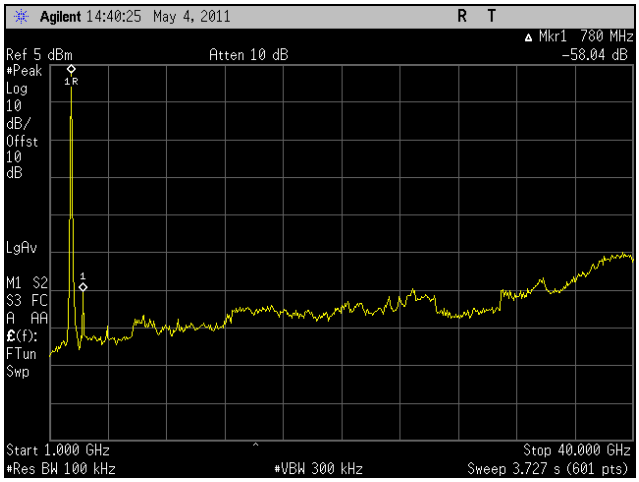


Plot 253. Conducted Spurious Emissions, High Channel, 802.11n 20 MHz, Port 1, 1 GHz – 40 GHz, 2.4 GHz

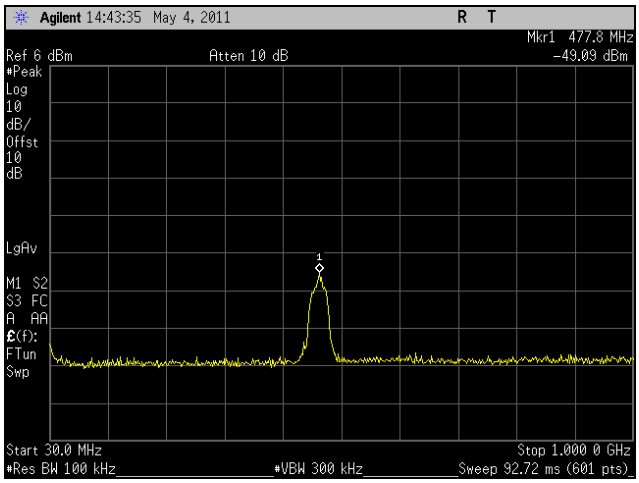
Conducted Spurious Emissions Test Results, 802.11n 40 MHz, Port 0, 2.4 GHz



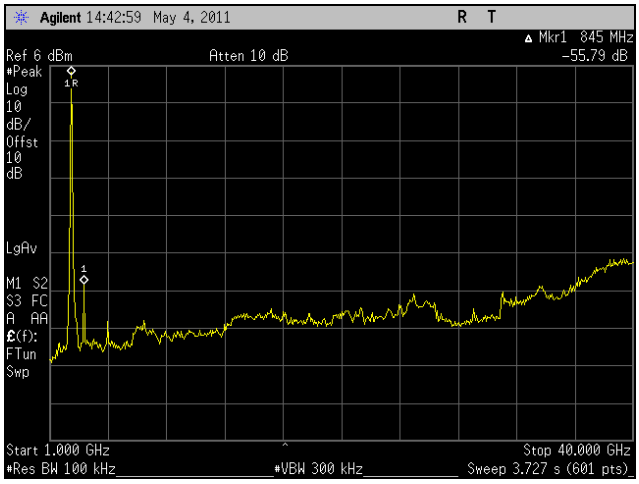
Plot 254. Conducted Spurious Emissions, Low Channel, 802.11n 40 MHz, Port 0, 30 MHz – 1 GHz, 2.4 GHz



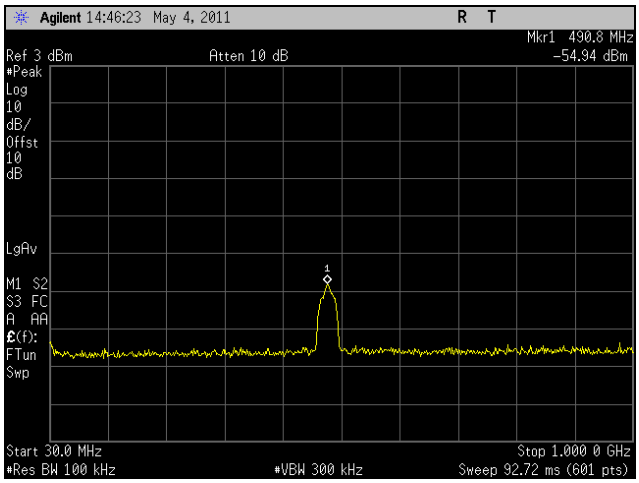
Plot 255. Conducted Spurious Emissions, Low Channel, 802.11n 40 MHz, Port 0, 1 GHz – 40 GHz, 2.4 GHz



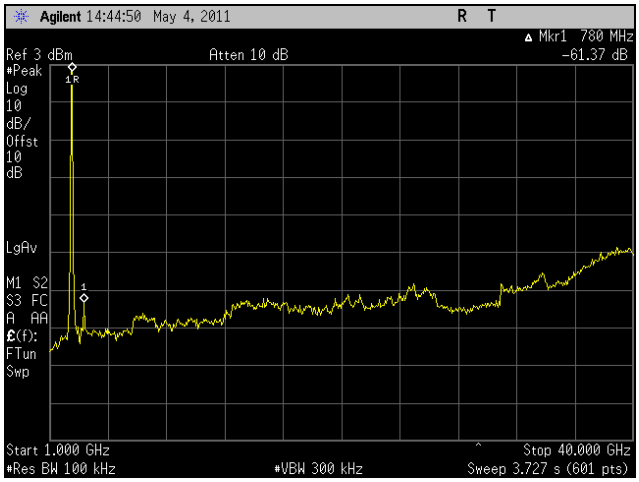
Plot 256. Conducted Spurious Emissions, Mid Channel, 802.11n 40 MHz, Port 0, 30 MHz – 1 GHz, 2.4 GHz



Plot 257. Conducted Spurious Emissions, Mid Channel, 802.11n 40 MHz, Port 0, 1 GHz – 40 GHz, 2.4 GHz

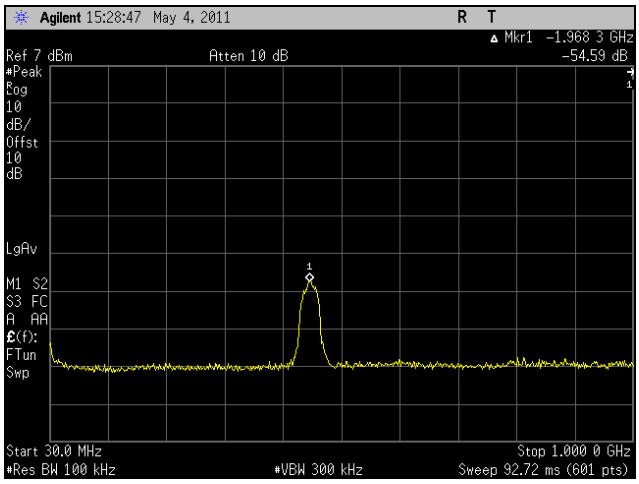


Plot 258. Conducted Spurious Emissions, High Channel, 802.11n 40 MHz, Port 0, 30 MHz – 1 GHz, 2.4 GHz

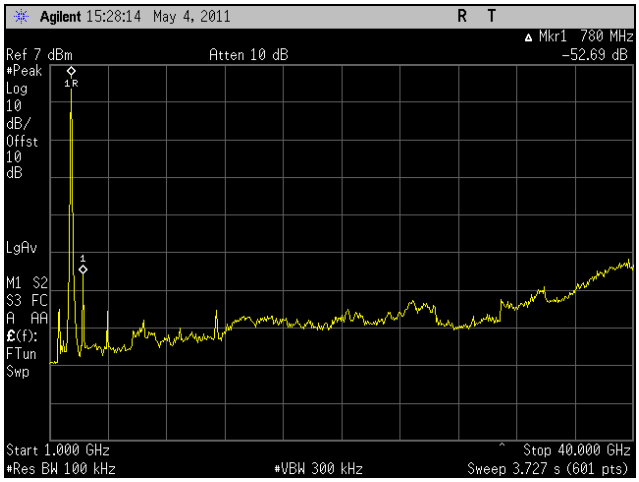


Plot 259. Conducted Spurious Emissions, High Channel, 802.11n 40 MHz, Port 0, 1 GHz – 40 GHz, 2.4 GHz

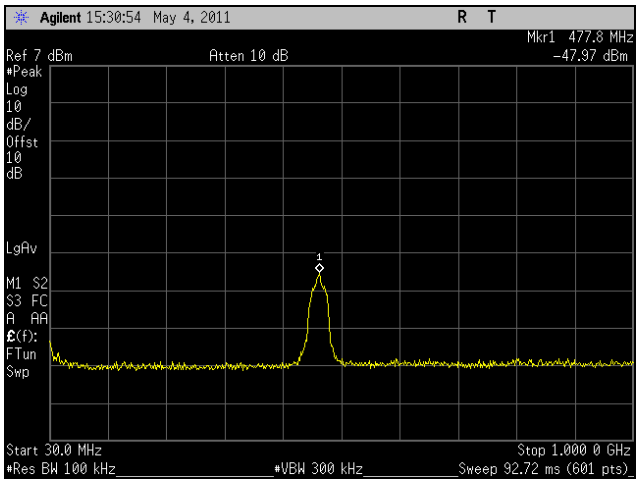
Conducted Spurious Emissions Test Results, 802.11n 40 MHz, Port 1, 2.4 GHz



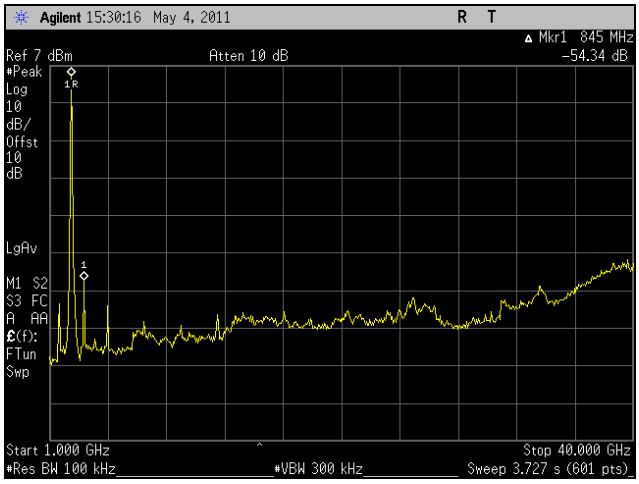
Plot 260. Conducted Spurious Emissions, Low Channel, 802.11n 40 MHz, Port 1, 30 MHz – 1 GHz, 2.4 GHz



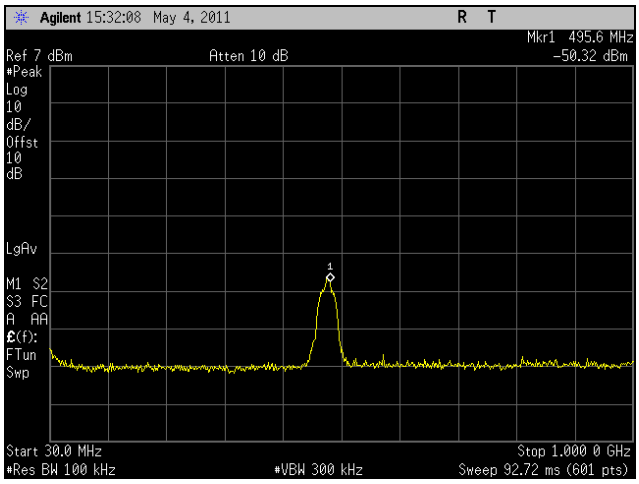
Plot 261. Conducted Spurious Emissions, Low Channel, 802.11n 40 MHz, Port 1, 1 GHz – 40 GHz, 2.4 GHz



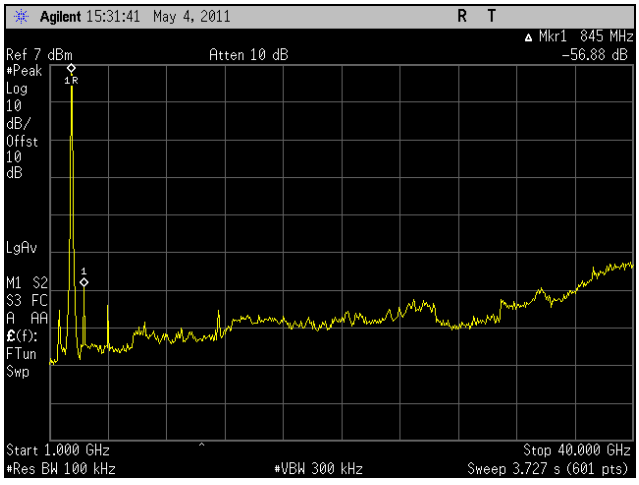
Plot 262. Conducted Spurious Emissions, Mid Channel, 802.11n 40 MHz, Port 1, 30 MHz – 1 GHz, 2.4 GHz



Plot 263. Conducted Spurious Emissions, Mid Channel, 802.11n 40 MHz, Port 1, 1 GHz – 40 GHz, 2.4 GHz

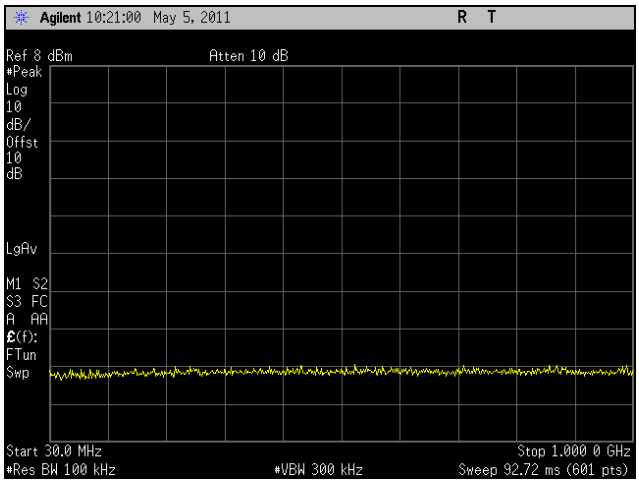


Plot 264. Conducted Spurious Emissions, High Channel, 802.11n 40 MHz, Port 1, 30 MHz – 1 GHz, 2.4 GHz

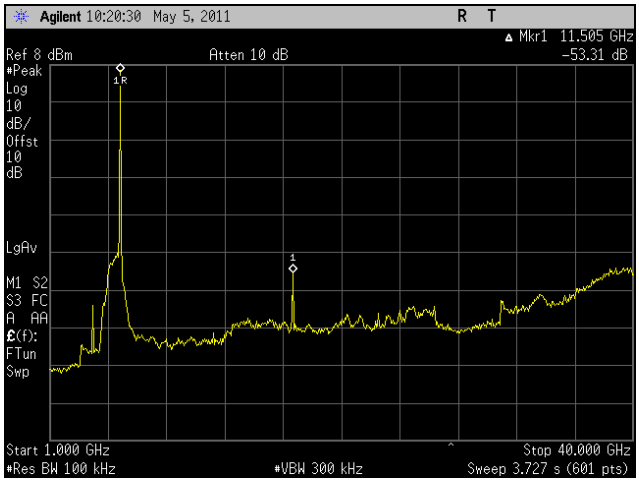


Plot 265. Conducted Spurious Emissions, High Channel, 802.11n 40 MHz, Port 1, 1 GHz – 40 GHz, 2.4 GHz

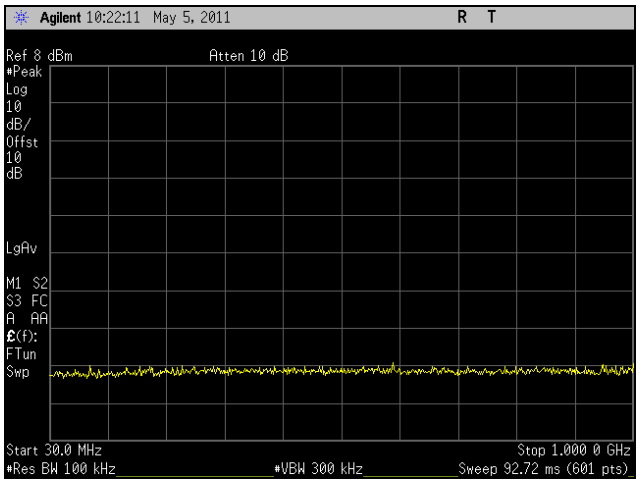
Conducted Spurious Emissions Test Results, 802.11a, 5.8 GHz



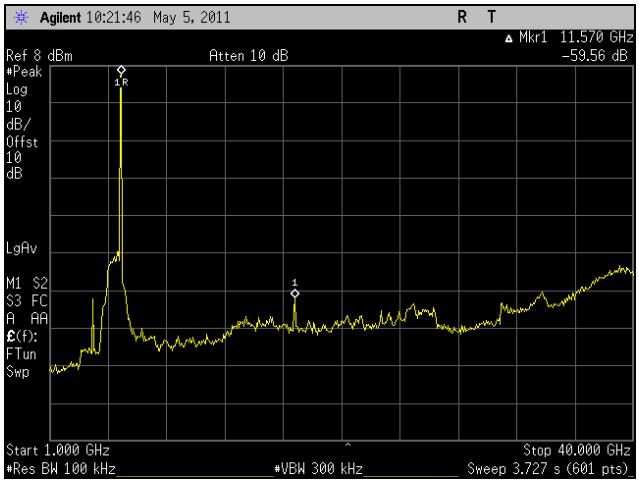
Plot 266. Conducted Spurious Emissions, Low Channel, 802.11a, 30 MHz – 1 GHz, 5.8 GHz



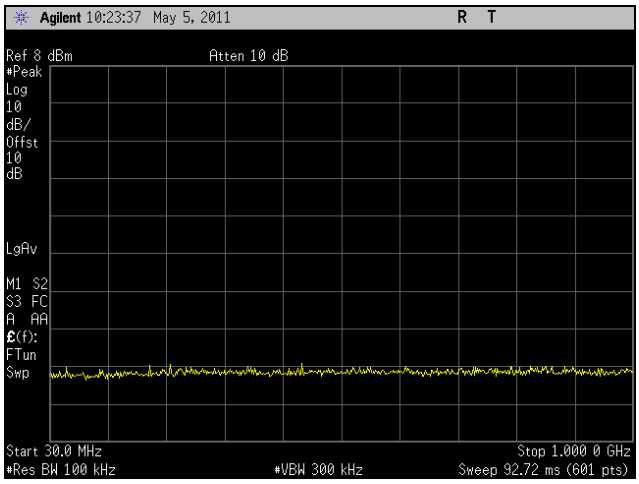
Plot 267. Conducted Spurious Emissions, Low Channel, 802.11a, 1 GHz – 40 GHz, 5.8 GHz



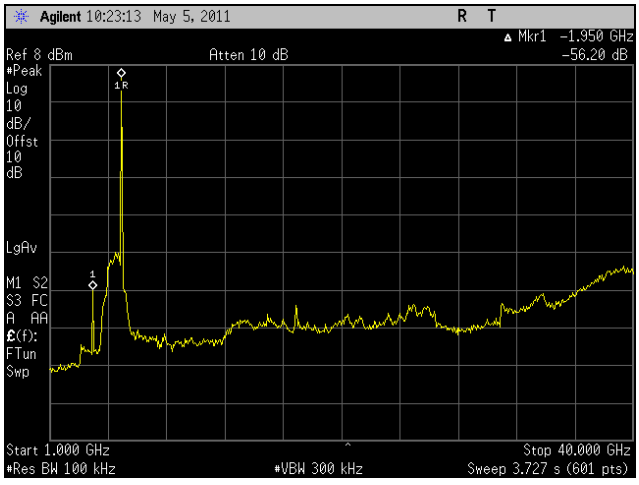
Plot 268. Conducted Spurious Emissions, Mid Channel, 802.11a, 30 MHz – 1 GHz, 5.8 GHz



Plot 269. Conducted Spurious Emissions, Mid Channel, 802.11a, 1 GHz – 40 GHz, 5.8 GHz

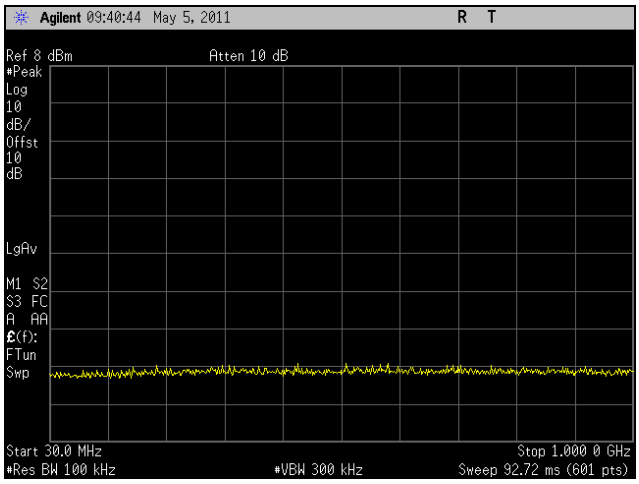


Plot 270. Conducted Spurious Emissions, High Channel, 802.11a, 30 MHz – 1 GHz, 5.8 GHz

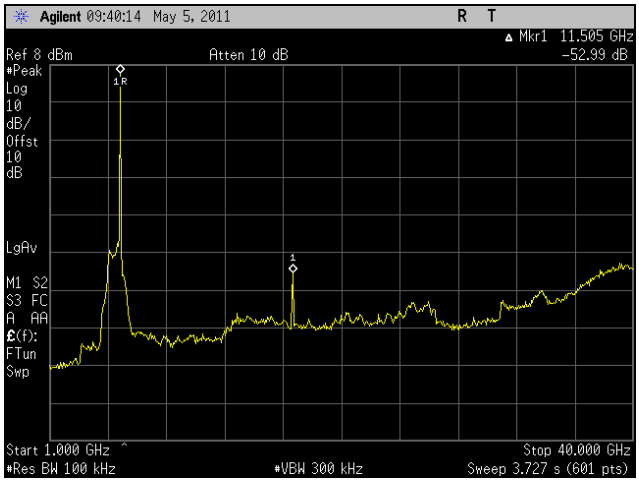


Plot 271. Conducted Spurious Emissions, High Channel, 802.11a, 1 GHz – 40 GHz, 5.8 GHz

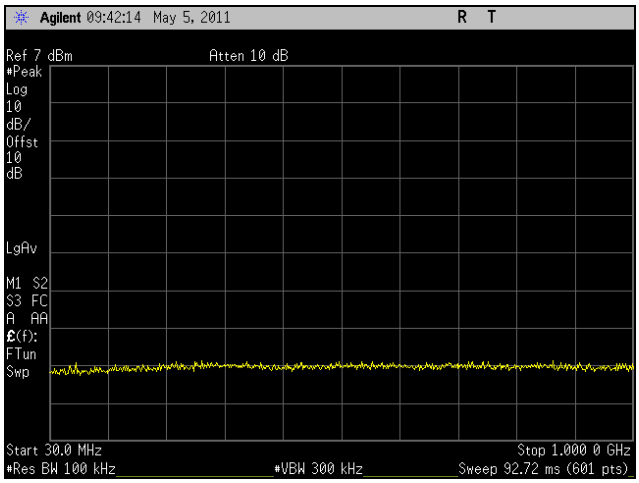
Conducted Spurious Emissions Test Results, 802.11n 20 MHz, Port 0, 5.8 GHz



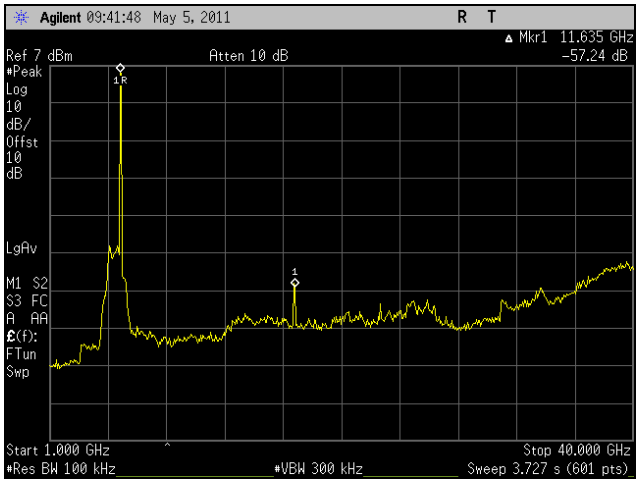
Plot 272. Conducted Spurious Emissions, Low Channel, 802.11n 20 MHz, Port 0, 30 MHz – 1 GHz, 5.8 GHz



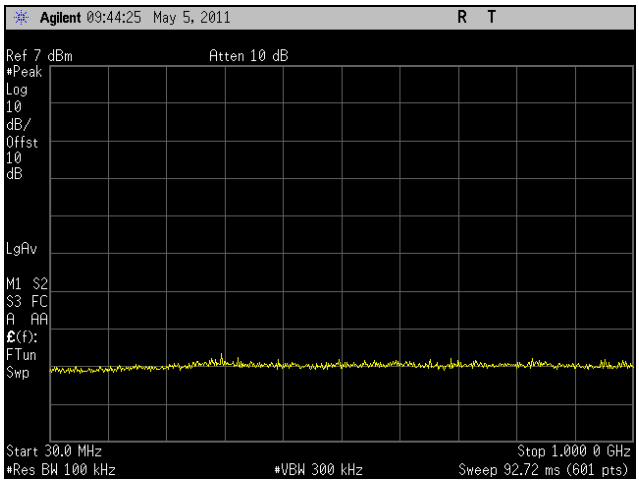
Plot 273. Conducted Spurious Emissions, Low Channel, 802.11n 20 MHz, Port 0, 1 GHz – 40 GHz, 5.8 GHz



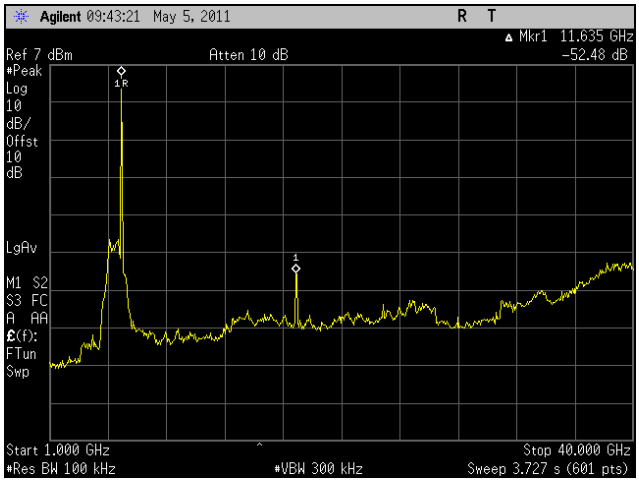
Plot 274. Conducted Spurious Emissions, Mid Channel, 802.11n 20 MHz, Port 0, 30 MHz – 1 GHz, 5.8 GHz



Plot 275. Conducted Spurious Emissions, Mid Channel, 802.11n 20 MHz, Port 0, 1 GHz – 40 GHz, 5.8 GHz

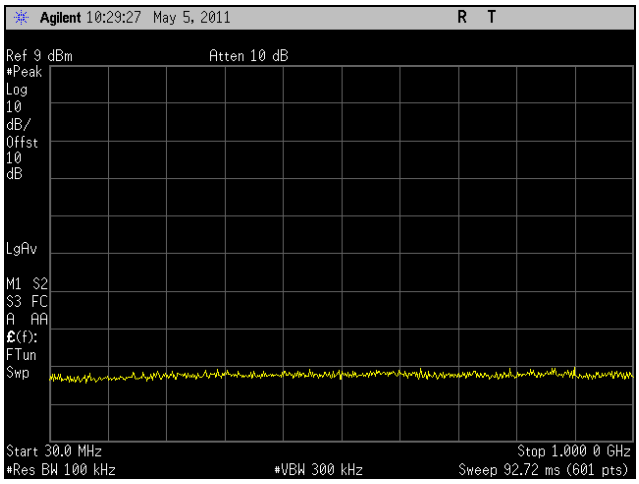


Plot 276. Conducted Spurious Emissions, High Channel, 802.11n 20 MHz, Port 0, 30 MHz – 1 GHz, 5.8 GHz

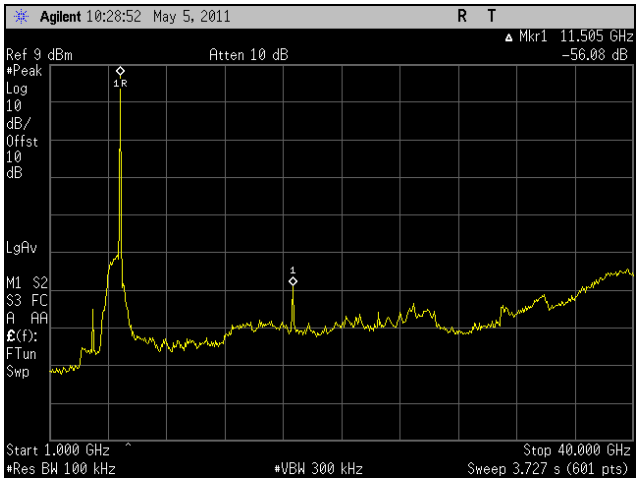


Plot 277. Conducted Spurious Emissions, High Channel, 802.11n 20 MHz, Port 0, 1 GHz – 40 GHz, 5.8 GHz

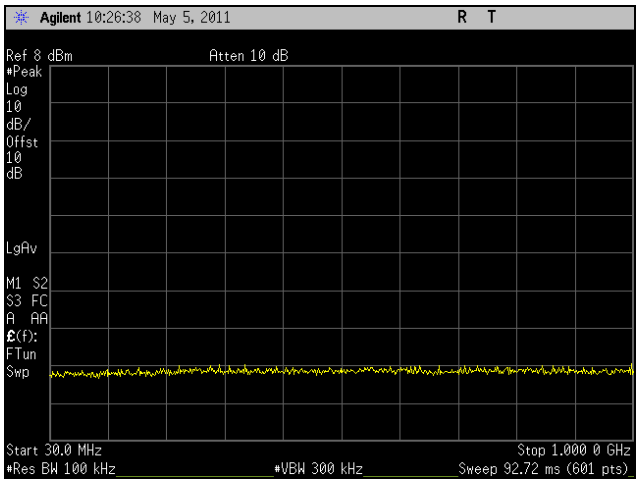
Conducted Spurious Emissions Test Results, 802.11n 20 MHz, Port 1, 5.8 GHz



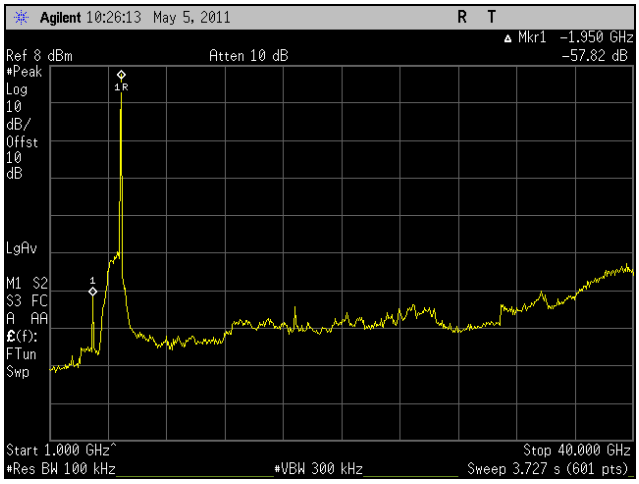
Plot 278. Conducted Spurious Emissions, Low Channel, 802.11n 20 MHz, Port 1, 30 MHz – 1 GHz, 5.8 GHz



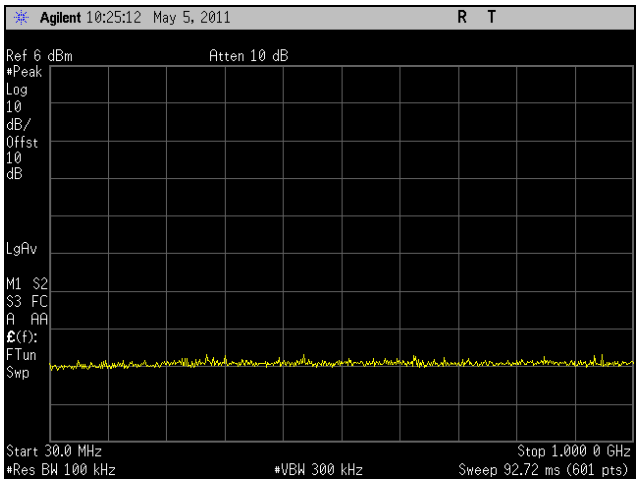
Plot 279. Conducted Spurious Emissions, Low Channel, 802.11n 20 MHz, Port 1, 1 GHz – 40 GHz, 5.8 GHz



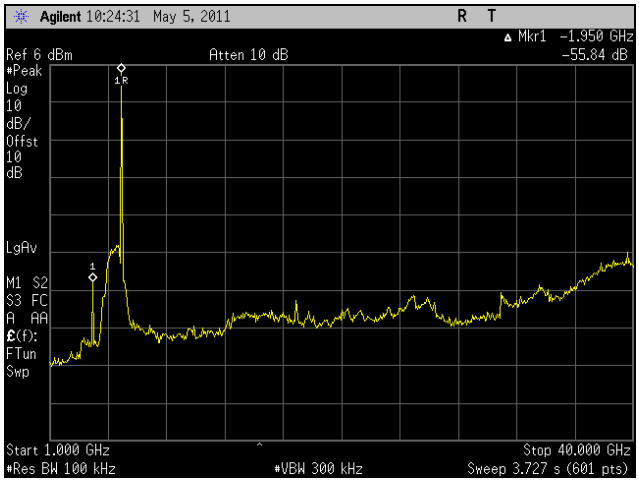
Plot 280. Conducted Spurious Emissions, Mid Channel, 802.11n 20 MHz, Port 1, 30 MHz – 1 GHz, 5.8 GHz



Plot 281. Conducted Spurious Emissions, Mid Channel, 802.11n 20 MHz, Port 1, 1 GHz – 40 GHz, 5.8 GHz

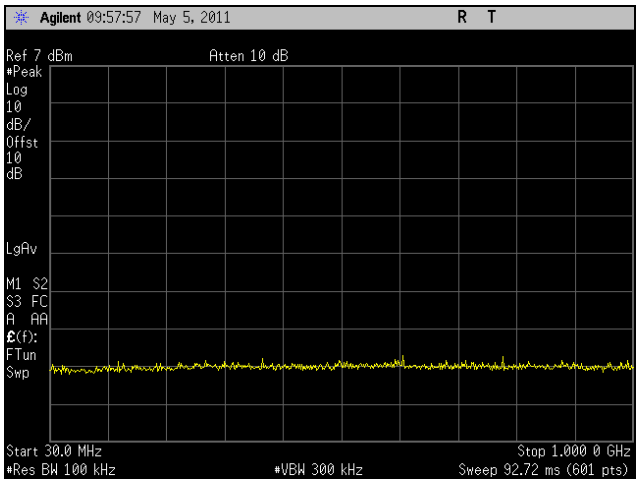


Plot 282. Conducted Spurious Emissions, High Channel, 802.11n 20 MHz, Port 1, 30 MHz – 1 GHz, 5.8 GHz

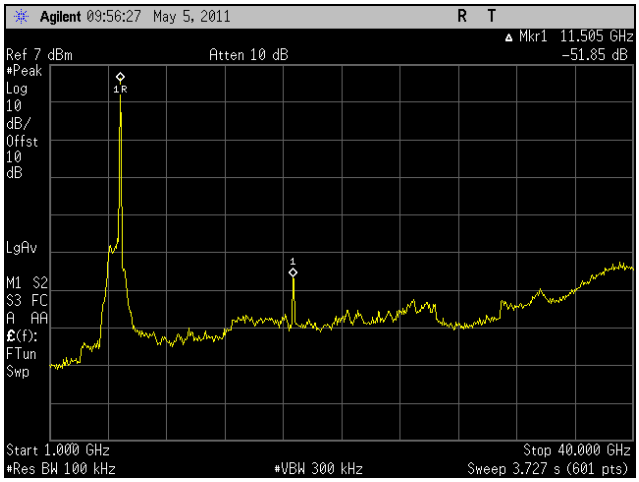


Plot 283. Conducted Spurious Emissions, High Channel, 802.11n 20 MHz, Port 1, 1 GHz – 40 GHz, 5.8 GHz

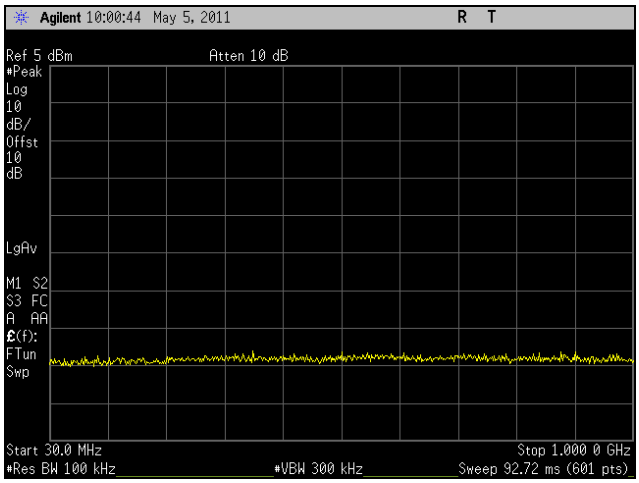
Conducted Spurious Emissions Test Results, 802.11n 40 MHz, Port 0, 5.8 GHz



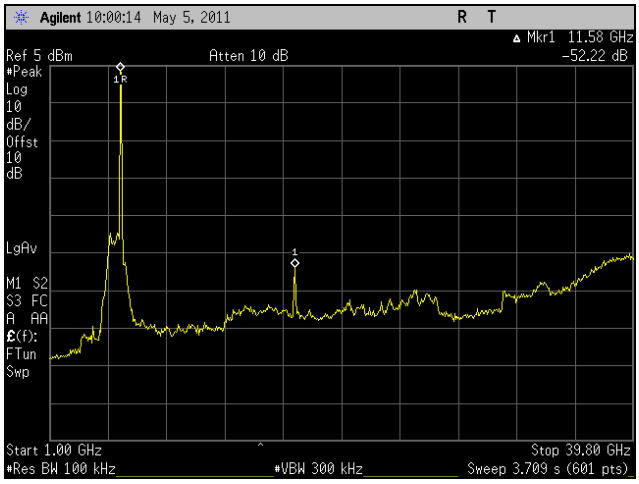
Plot 284. Conducted Spurious Emissions, Low Channel, 802.11n 40 MHz, Port 0, 30 MHz – 1 GHz, 5.8 GHz



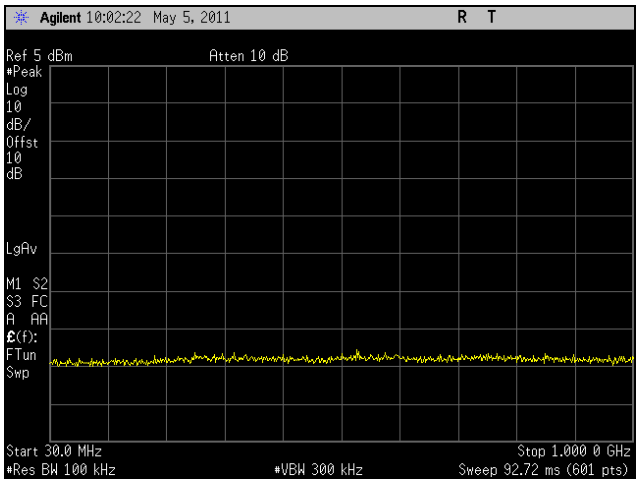
Plot 285. Conducted Spurious Emissions, Low Channel, 802.11n 40 MHz, Port 0, 1 GHz – 40 GHz, 5.8 GHz



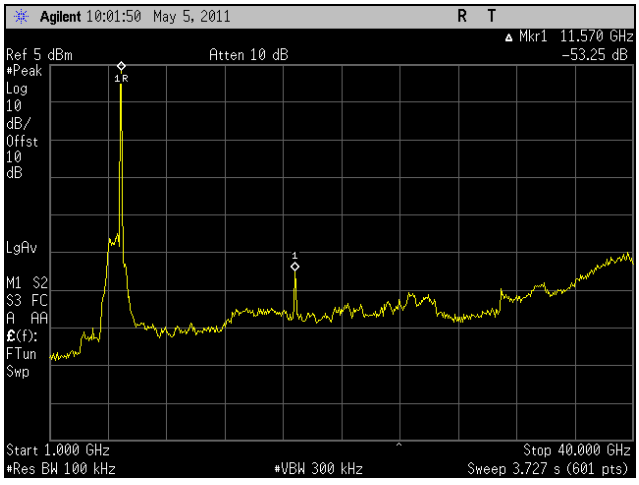
Plot 286. Conducted Spurious Emissions, Mid Channel, 802.11n 40 MHz, Port 0, 30 MHz – 1 GHz, 5.8 GHz



Plot 287. Conducted Spurious Emissions, Mid Channel, 802.11n 40 MHz, Port 0, 1 GHz – 40 GHz, 5.8 GHz

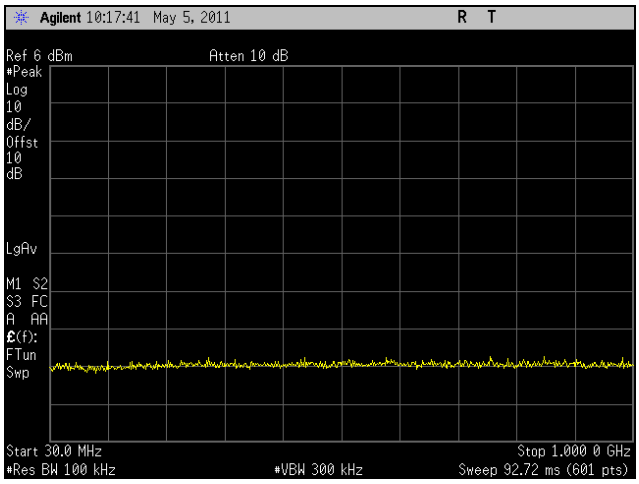


Plot 288. Conducted Spurious Emissions, High Channel, 802.11n 40 MHz, Port 0, 30 MHz – 1 GHz, 5.8 GHz

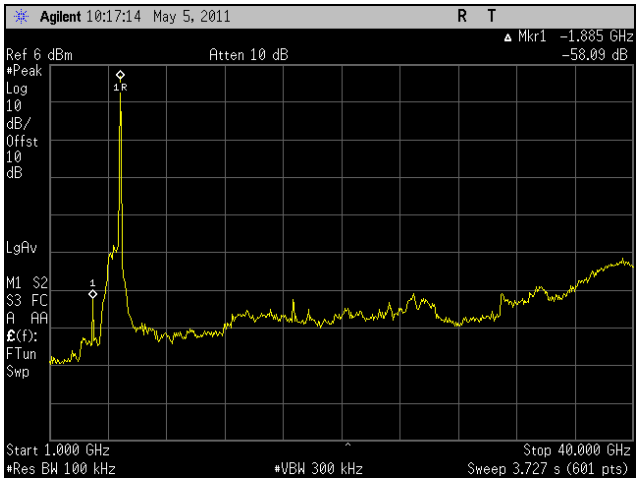


Plot 289. Conducted Spurious Emissions, High Channel, 802.11n 40 MHz, Port 0, 1 GHz – 40 GHz, 5.8 GHz

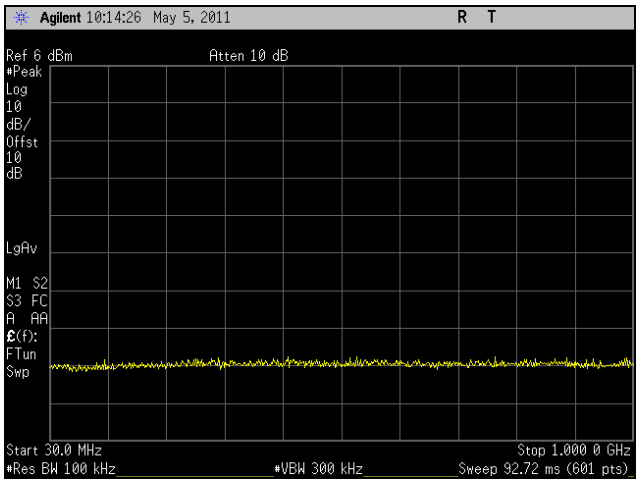
Conducted Spurious Emissions Test Results, 802.11n 40 MHz, Port 1, 5.8 GHz



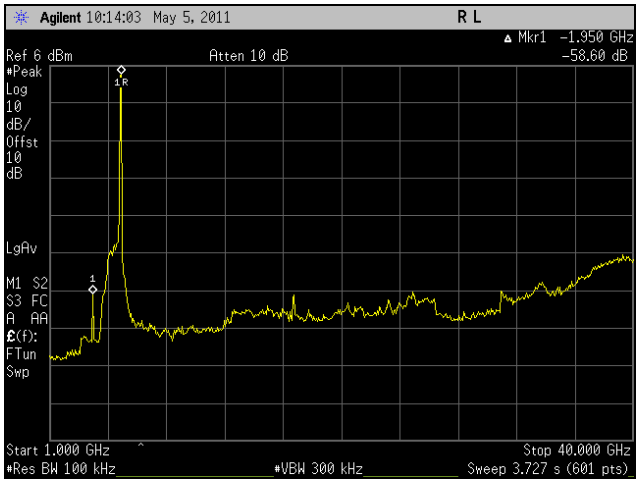
Plot 290. Conducted Spurious Emissions, Low Channel, 802.11n 40 MHz, Port 1, 30 MHz – 1 GHz, 5.8 GHz



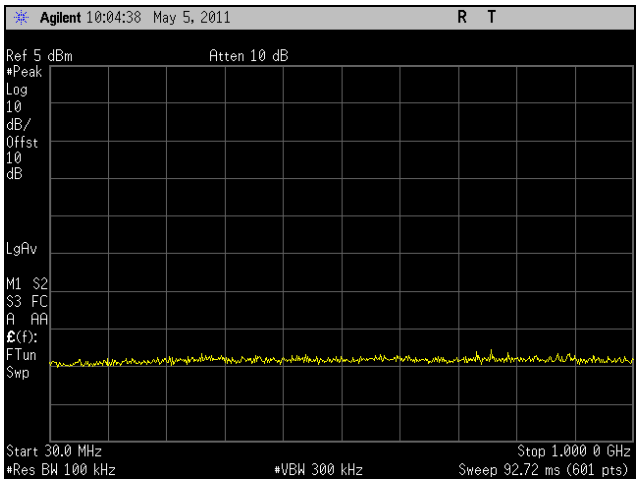
Plot 291. Conducted Spurious Emissions, Low Channel, 802.11n 40 MHz, Port 1, 1 GHz – 40 GHz, 5.8 GHz



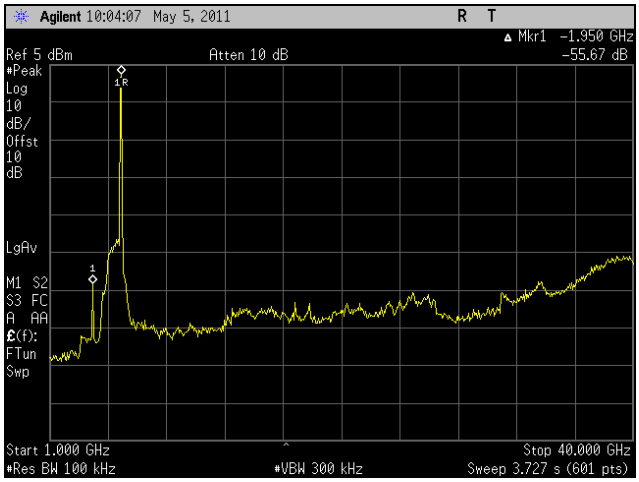
Plot 292. Conducted Spurious Emissions, Mid Channel, 802.11n 40 MHz, Port 1, 30 MHz – 1 GHz, 5.8 GHz



Plot 293. Conducted Spurious Emissions, Mid Channel, 802.11n 40 MHz, Port 1, 1 GHz – 40 GHz, 5.8 GHz

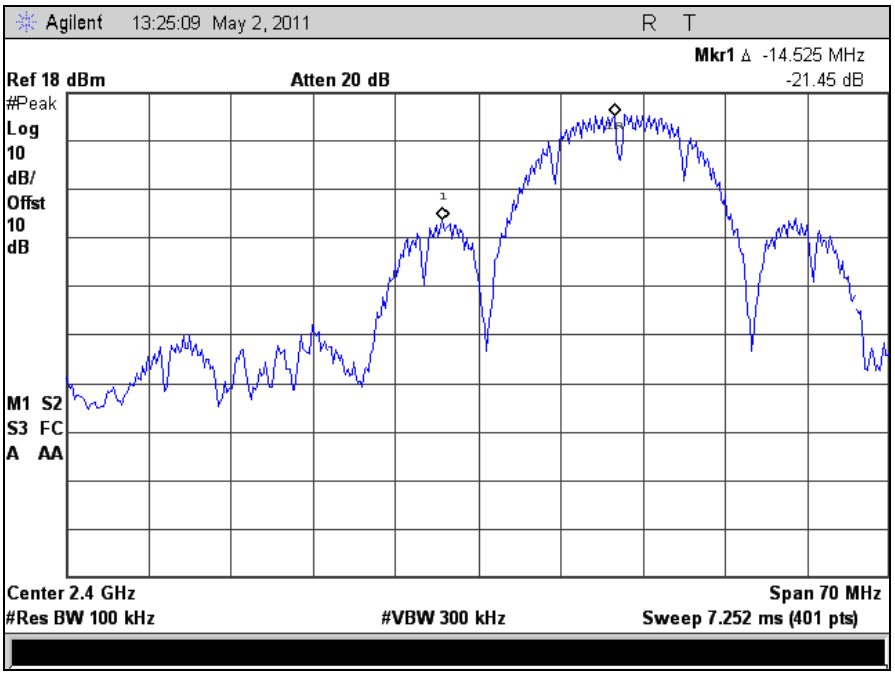


Plot 294. Conducted Spurious Emissions, High Channel, 802.11n 40 MHz, Port 1, 30 MHz – 1 GHz, 5.8 GHz

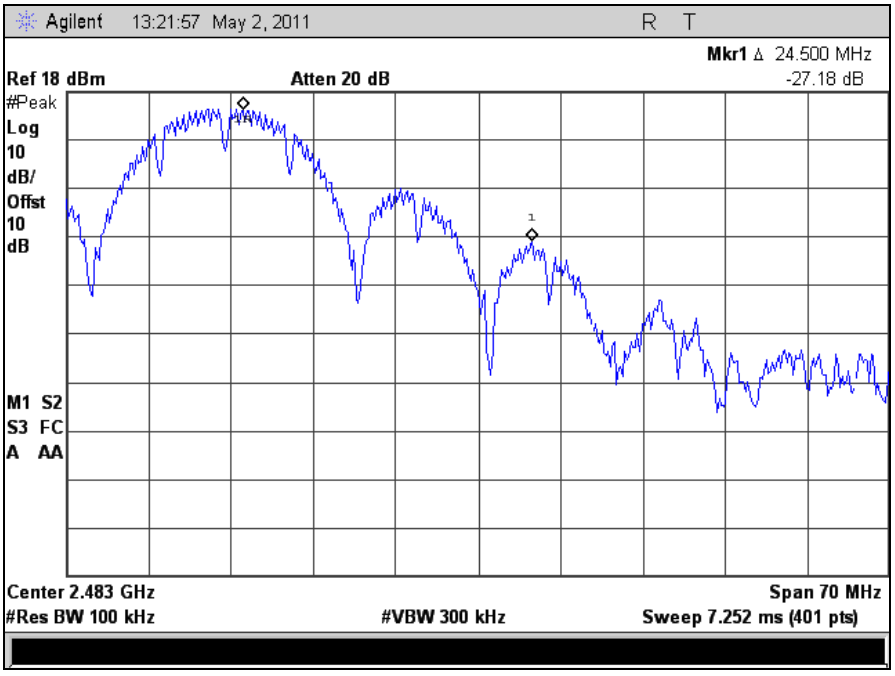


Plot 295. Conducted Spurious Emissions, High Channel, 802.11n 40 MHz, Port 1, 1 GHz – 40 GHz, 5.8 GHz

Conducted Band Edge Test Results, 802.11b, 2.4 GHz

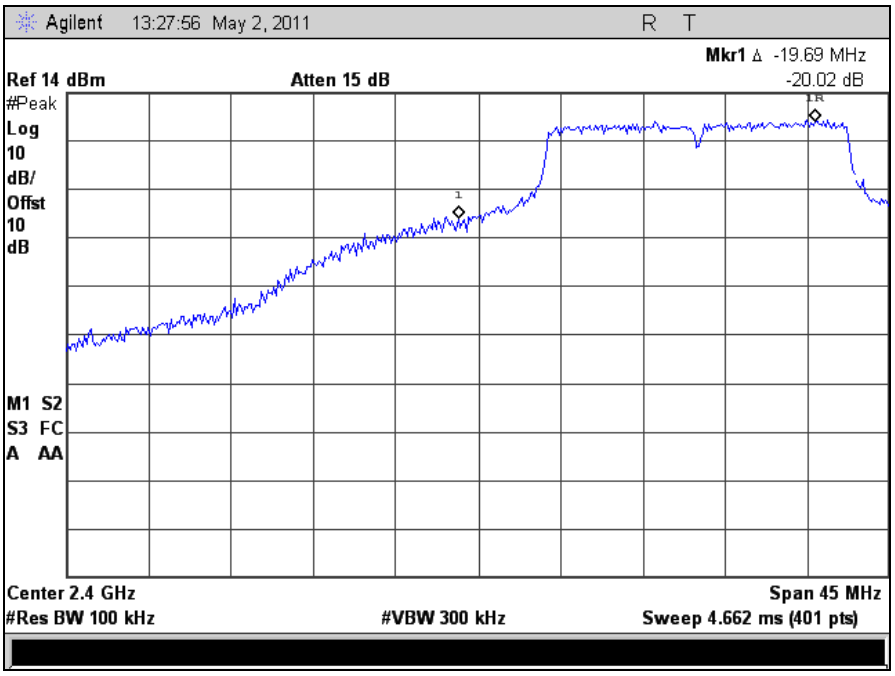


Plot 296. Conducted Band Edge, Low Channel, 802.11b, 2.4 GHz

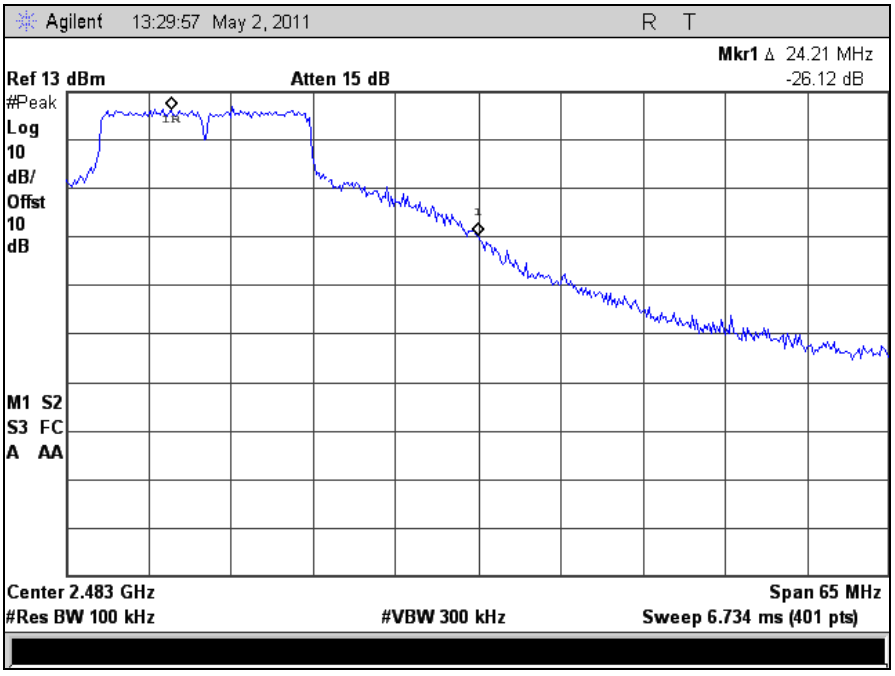


Plot 297. Conducted Band Edge, High Channel, 802.11b, 2.4 GHz

Conducted Band Edge Test Results, 802.11g, 2.4 GHz

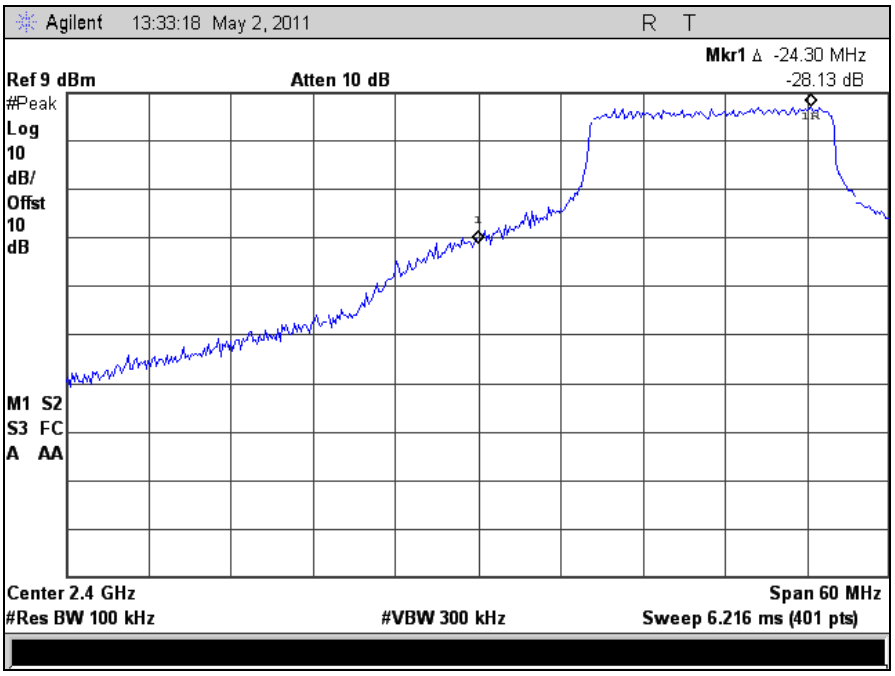


Plot 298. Conducted Band Edge, Low Channel, 802.11g, 2.4 GHz

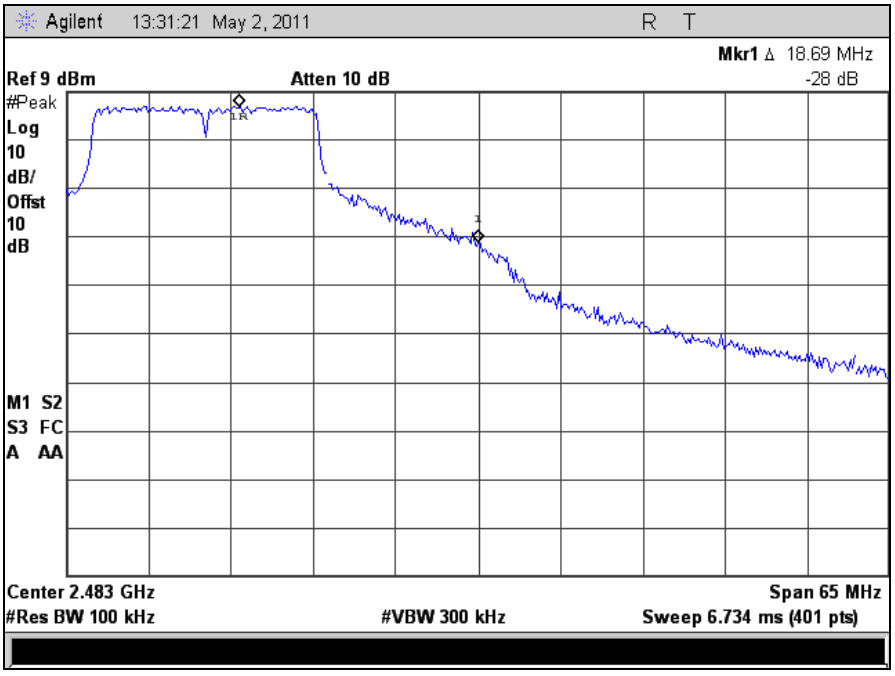


Plot 299. Conducted Band Edge, High Channel, 802.11g, 2.4 GHz

Conducted Band Edge Test Results, 802.11n 20 MHz, Port 0, 2.4 GHz

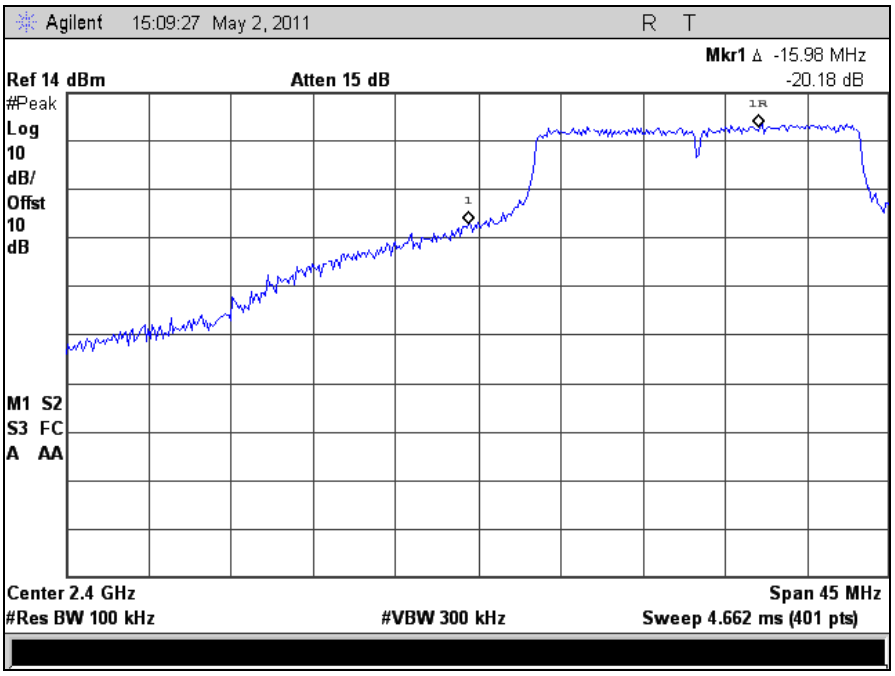


Plot 300. Conducted Band Edge, Low Channel, 802.11n 20 MHz, Port 0, 2.4 GHz

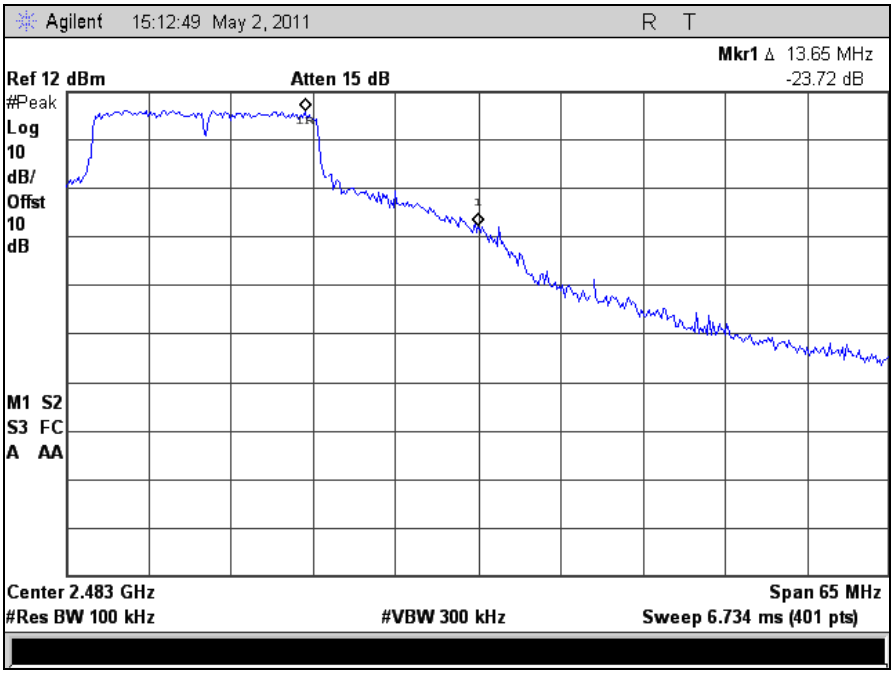


Plot 301. Conducted Band Edge, High Channel, 802.11n 20 MHz, Port 0, 2.4 GHz

Conducted Band Edge Test Results, 802.11n 20 MHz, Port 1, 2.4 GHz

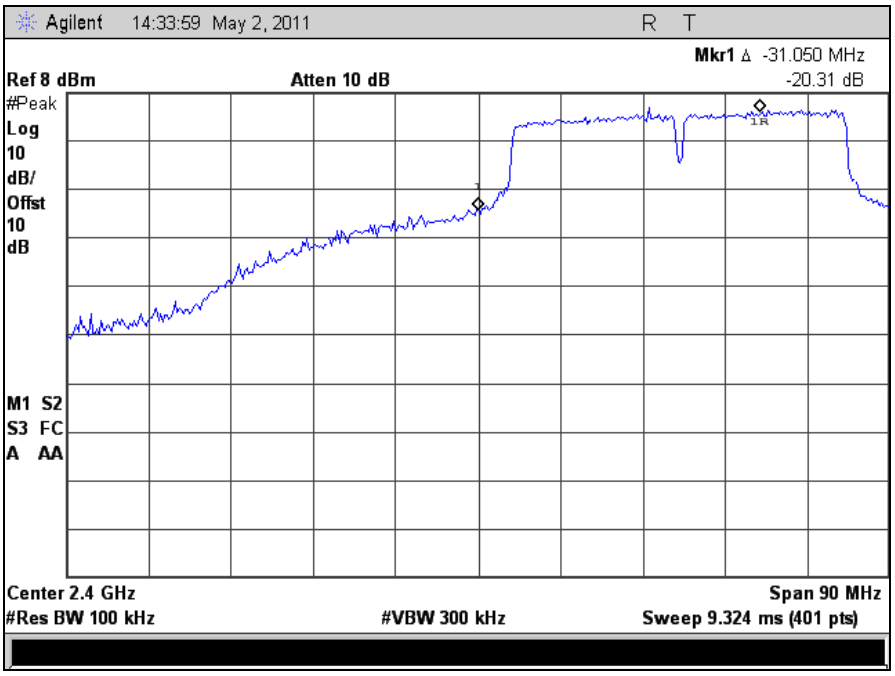


Plot 302. Conducted Band Edge, Low Channel, 802.11n 20 MHz, Port 1, 2.4 GHz

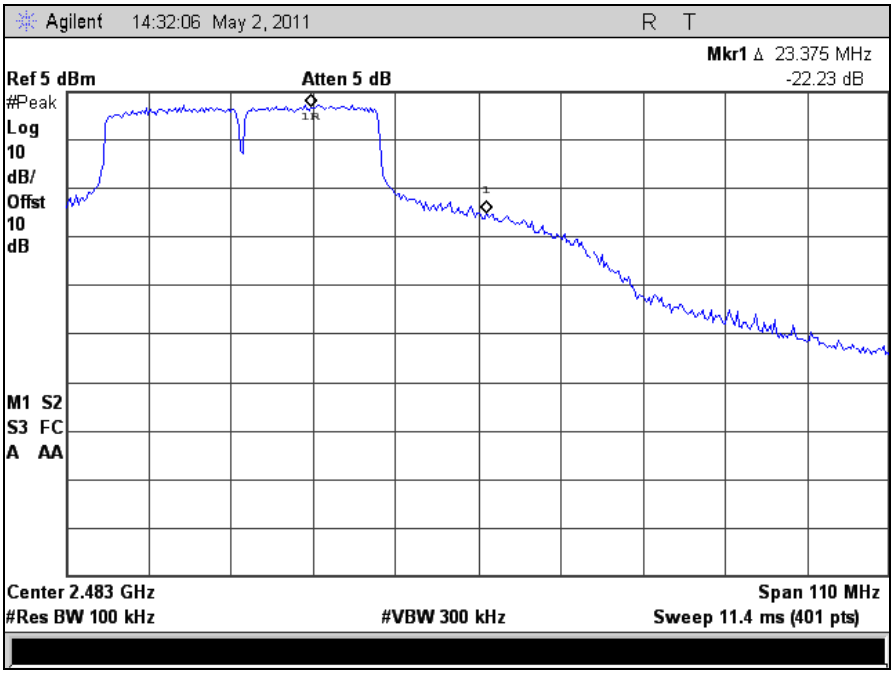


Plot 303. Conducted Band Edge, High Channel, 802.11n 20 MHz, Port 1, 2.4 GHz

Conducted Band Edge Test Results, 802.11n 40 MHz, Port 0, 2.4 GHz

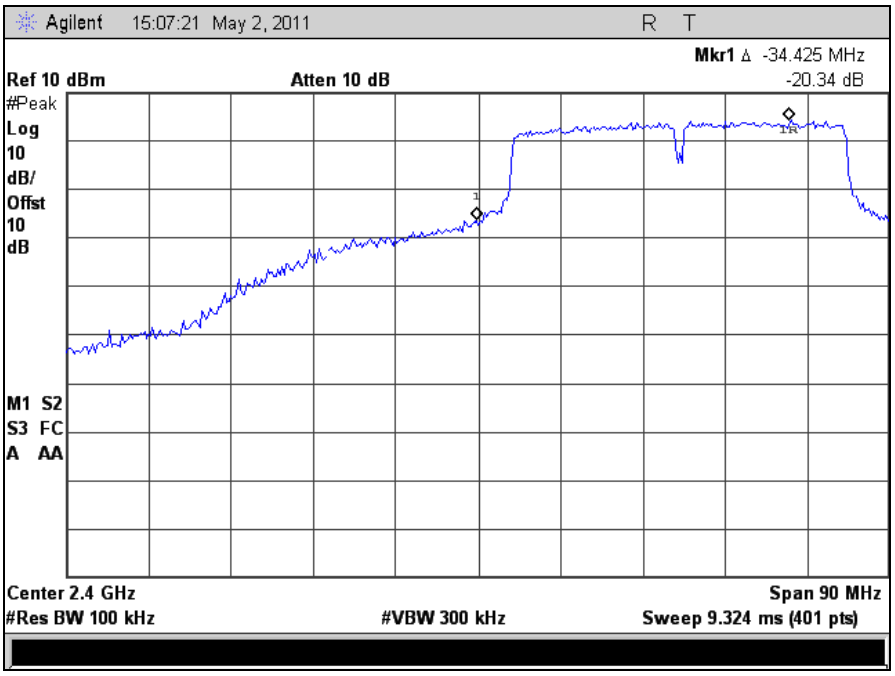


Plot 304. Conducted Band Edge, Low Channel, 802.11n 40 MHz, Port 0, 2.4 GHz

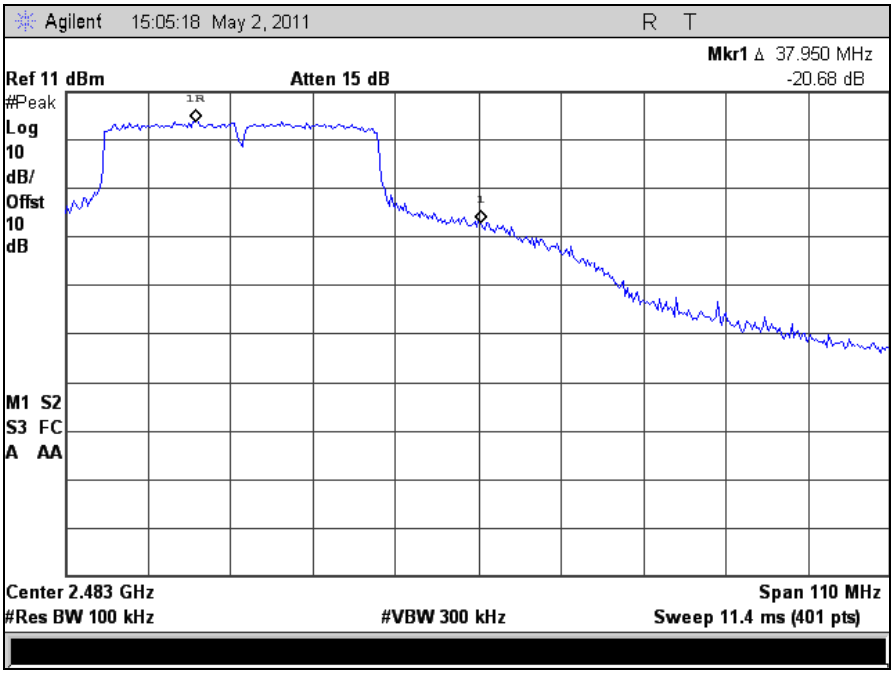


Plot 305. Conducted Band Edge, High Channel, 802.11n 40 MHz, Port 0, 2.4 GHz

Conducted Band Edge Test Results, 802.11n 40 MHz, Port 1, 2.4 GHz

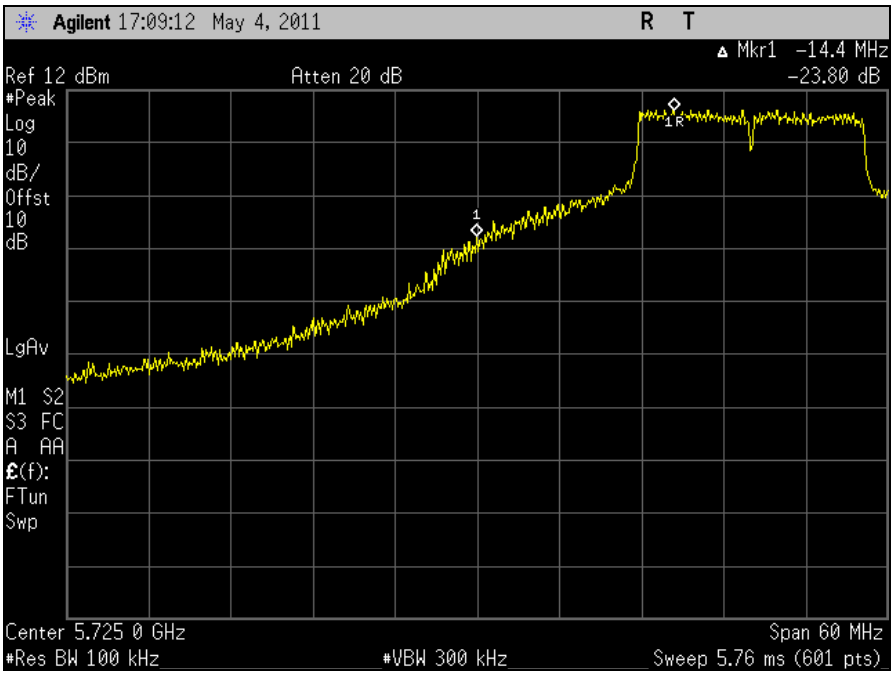


Plot 306. Conducted Band Edge, Low Channel, 802.11n 40 MHz, Port 1, 2.4 GHz

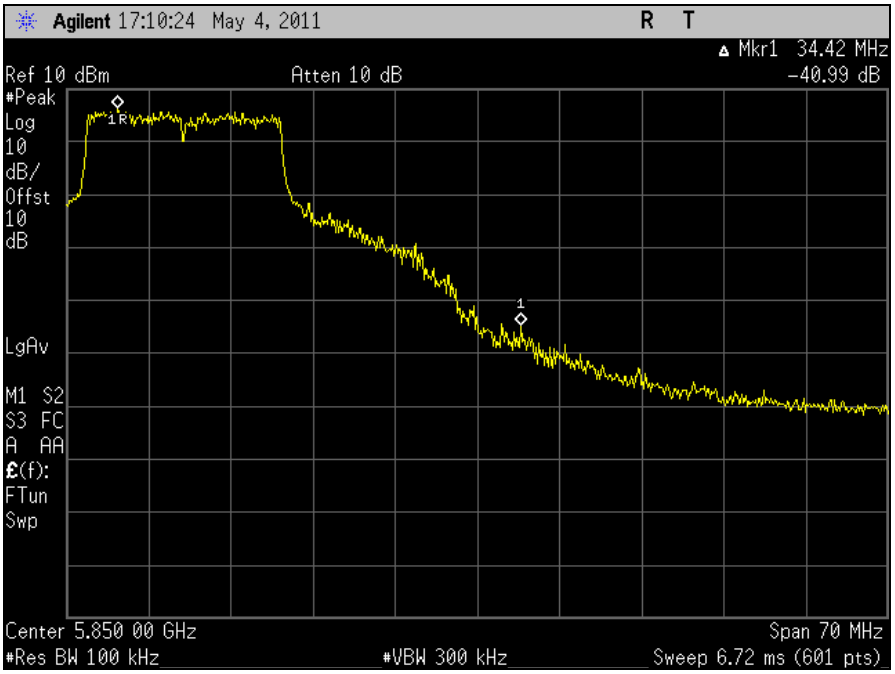


Plot 307. Conducted Band Edge, High Channel, 802.11n 40 MHz, Port 1, 2.4 GHz

Conducted Band Edge Test Results, 802.11a, 5.8 GHz

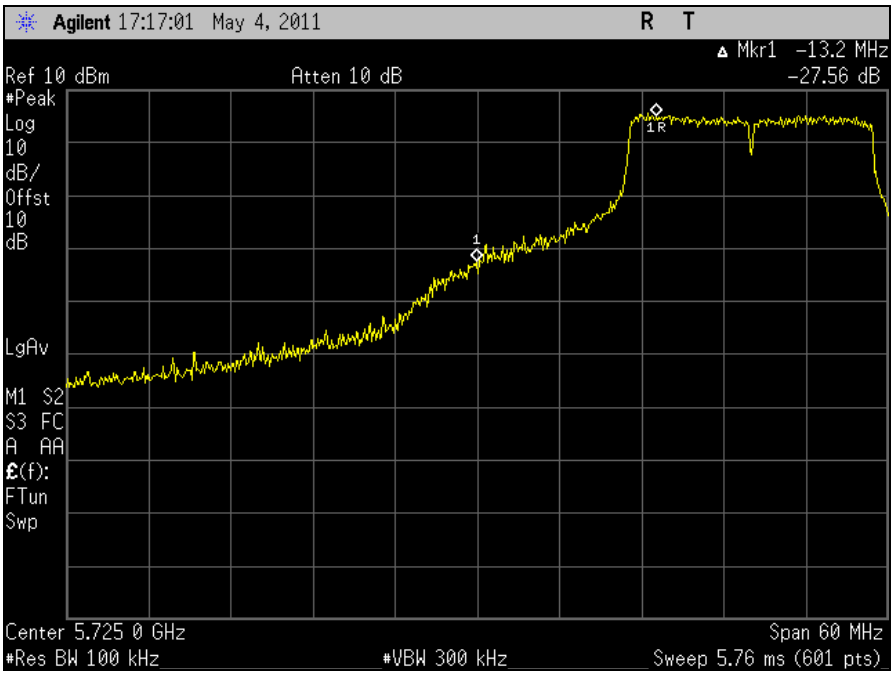


Plot 308. Conducted Band Edge, Low Channel, 802.11a, 5.8 GHz

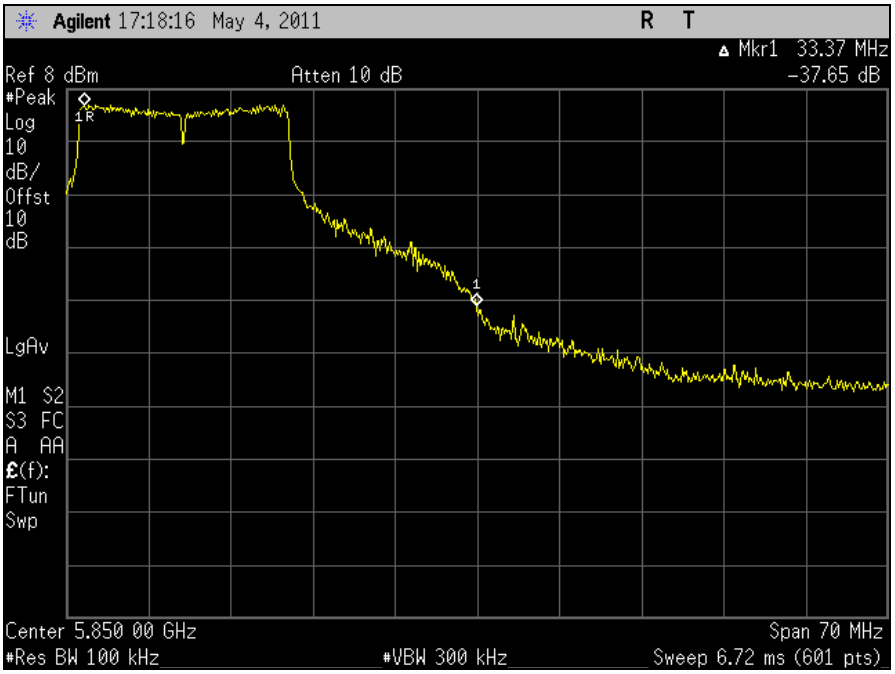


Plot 309. Conducted Band Edge, High Channel, 802.11a, 5.8 GHz

Conducted Band Edge Test Results, 802.11n 20 MHz, Port 0, 5.8 GHz

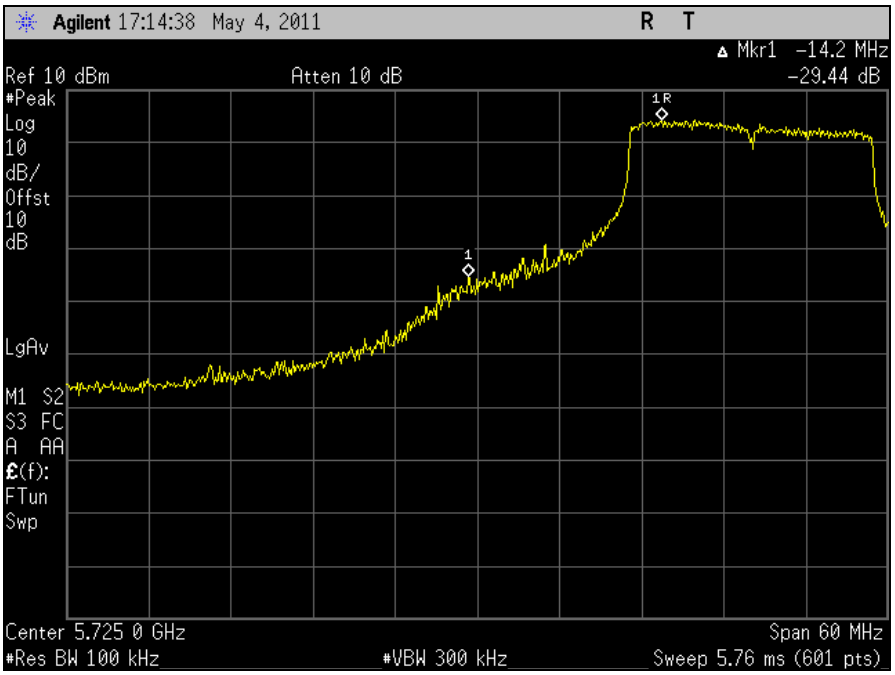


Plot 310. Conducted Band Edge, Low Channel, 802.11n 20 MHz, Port 0, 5.8 GHz

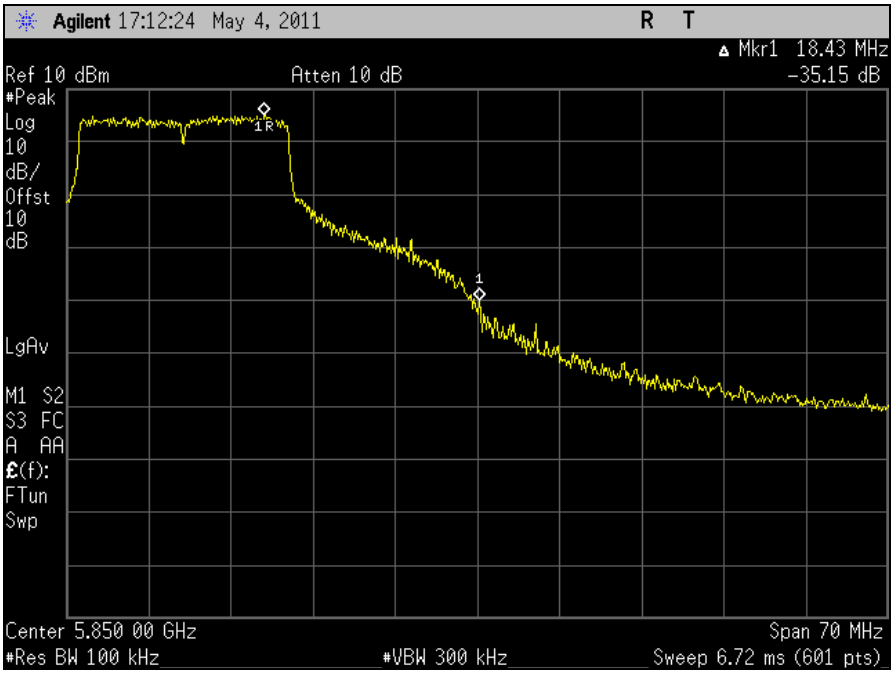


Plot 311. Conducted Band Edge, High Channel, 802.11n 20 MHz, Port 0, 5.8 GHz

Conducted Band Edge Test Results, 802.11n 20 MHz, Port 1, 5.8 GHz

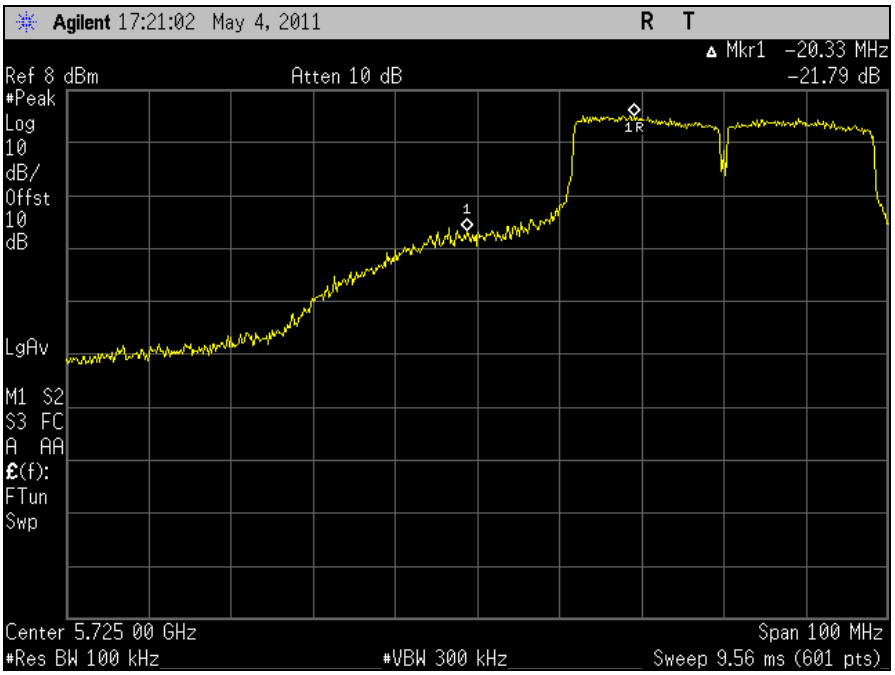


Plot 312. Conducted Band Edge, Low Channel, 802.11n 20 MHz, Port 1, 5.8 GHz

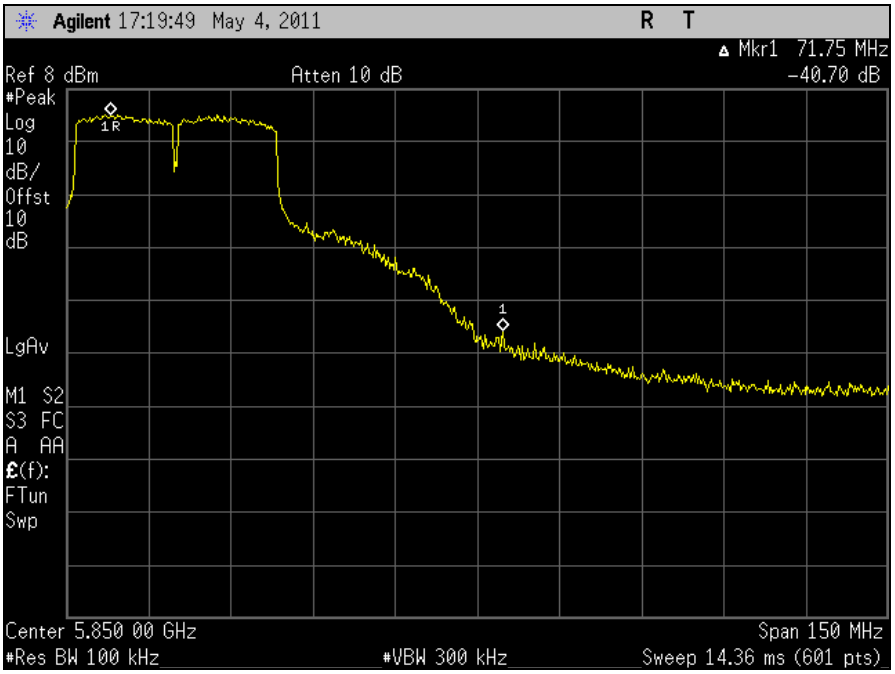


Plot 313. Conducted Band Edge, High Channel, 802.11n 20 MHz, Port 1, 5.8 GHz

Conducted Band Edge Test Results, 802.11n 40 MHz, Port 0, 5.8 GHz

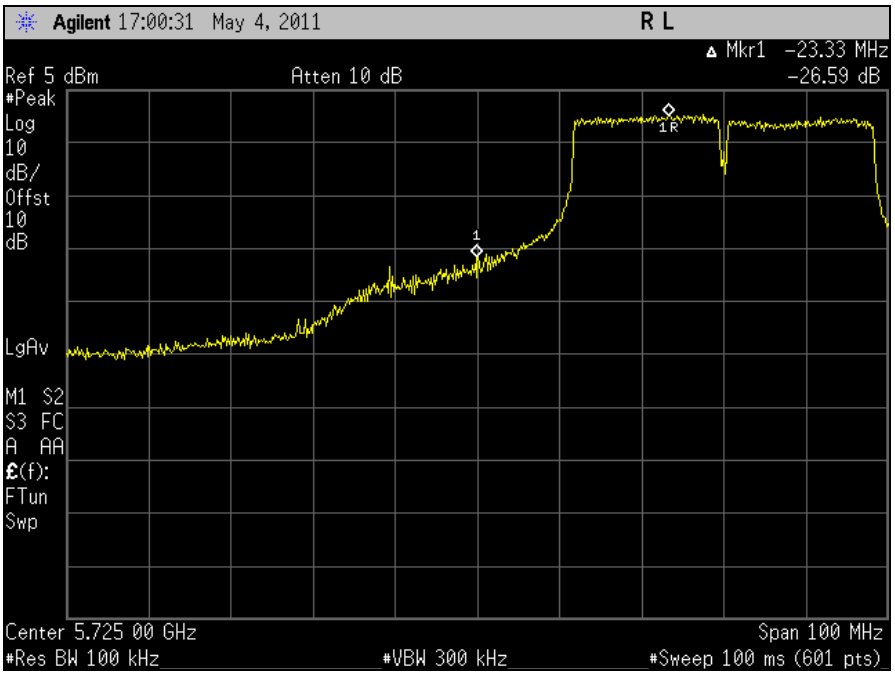


Plot 314. Conducted Band Edge, Low Channel, 802.11n 40 MHz, Port 0, 5.8 GHz

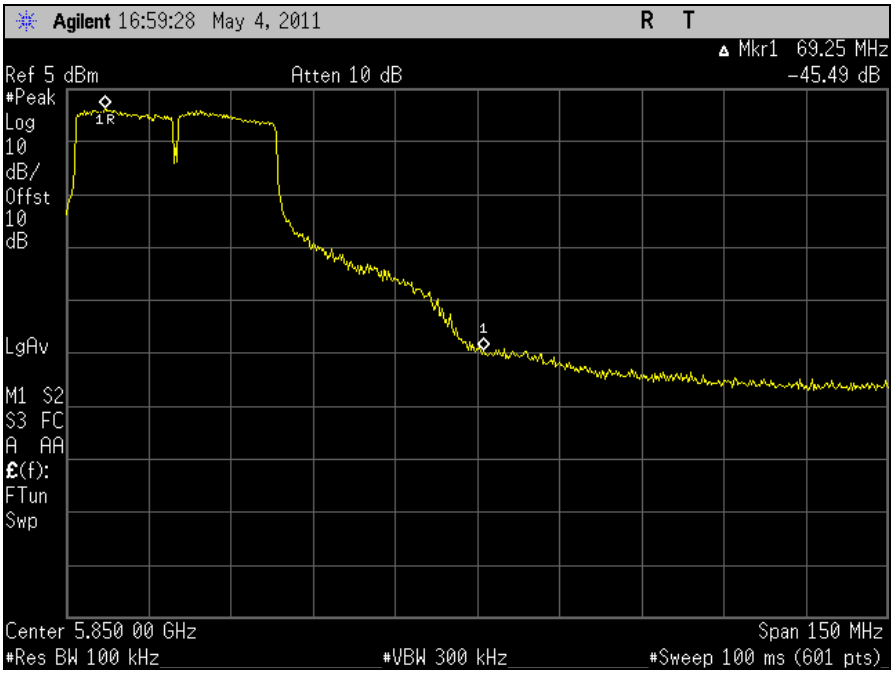


Plot 315. Conducted Band Edge, High Channel, 802.11n 40 MHz, Port 0, 5.8 GHz

Conducted Band Edge Test Results, 802.11n 40 MHz, Port 1, 5.8 GHz



Plot 316. Conducted Band Edge, Low Channel, 802.11n 40 MHz, Port 1, 5.8 GHz



Plot 317. Conducted Band Edge, High Channel, 802.11n 40 MHz, Port 1, 5.8 GHz

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. A RBW of 1 MHz and VBW of 3 MHz were used to determine the peak emissions within the band. The Spectrum analyzer was then set to a RBW of 3 kHz and VBW was set to 10 kHz. The SPAN of the analyzer was set to 1 MHz with a 333.3 second sweep. 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: Lionel Gabrillo

Test Date: 05/02/11 – 05/06/11

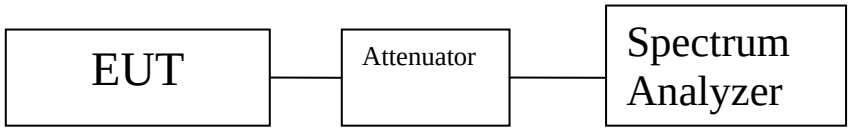


Figure 5. Block Diagram, Peak Power Spectral Density Test Setup

Peak Power Spectral Density Test Results

	Peak Power Spectral Density				
Mode	**Carrier Channel**	**Frequency (MHz)**	**Measured PPSD (dBm)**	**Limit (dBm)**	**Margin (dB)**
802.11b	Low	2412	-0.18	7	-7.18
	Mid	2437	-0.28	7	-7.28
	High	2462	-0.14	7	-7.14
802.11g	Low	2412	-2.59	7	-9.59
	Mid	2437	-3.19	7	-10.19
	High	2462	-2.28	7	-9.28

Table 32. Peak Power Spectral Density, Test Results, 2.4 GHz

Channel	Frequency (MHz)	Port 1 (dBm)	Port 1 + 10log(# of Ports)	Limit (dBm)	Margin (dB)
Low	2412	0.524	3.534	7.000	-3.466
Mid	2437	-3.66	-0.650	7.000	-7.650
High	2462	-3.099	-0.089	7.000	-7.089

Table 33. Peak Spectral Density, Test Results, 2.4 GHz, 802.11n 20 MHz

Note: Both ports were investigated and Port 1 was found to be the highest.

Channel	Frequency (MHz)	Port 1 (dBm)	Port 1 + 10log(# of Ports)	Limit (dBm)	Margin (dB)
Low	2422	-3.526	-0.516	7.000	-7.516
Mid	2437	-3.943	-0.933	7.000	-7.933
High	2452	-3.003	0.007	7.000	-6.993

Table 34. Peak Spectral Density, Test Results, 2.4 GHz, 802.11n 40 MHz

Note: Both ports were investigated and Port 1 was found to be the highest.

	Peak Power Spectral Density				
Mode	**Carrier Channel**	**Frequency (MHz)**	**Measured PPSD (dBm)**	**Limit (dBm)**	**Margin (dB)**
802.11a	Low	5745	-3.39	7	-10.39
	Mid	5785	-4.17	7	-11.17
	High	5825	-4.279	7	-11.279

Table 35. Peak Power Spectral Density, Test Results, 5.8 GHz

Channel	Frequency (MHz)	Port 1 (dBm)	Port 1 + 10log(# of Ports)	Limit (dBm)	Margin (dB)
Low	2412	-2.632	0.378	7.000	-6.622
Mid	2437	-3.832	-0.822	7.000	-7.822
High	2462	-3.326	-0.316	7.000	-7.316

Table 36. Peak Spectral Density, Test Results, 5.8 GHz, Summed Ports, 802.11n 20 MHz

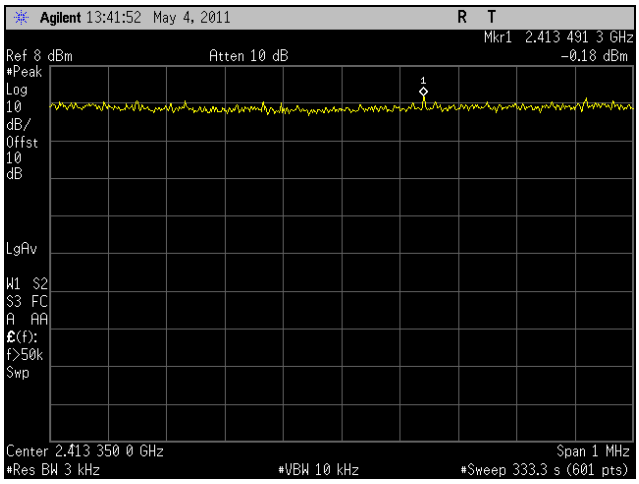
Note: Both ports were investigated and Port 1 was found to be the highest.

Channel	Frequency (MHz)	Port 0 (dBm)	Port 0 + 10log(# of Ports)	Limit (dBm)	Margin (dB)
Low	2422	-5.164	-2.154	7.000	-9.154
Mid	2437	-5.043	-2.033	7.000	-9.033
High	2452	-4.258	-1.248	7.000	-8.248

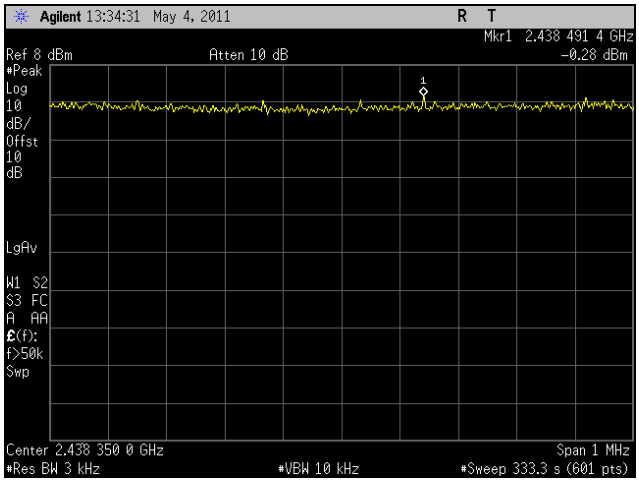
Table 37. Peak Spectral Density, Test Results, 5.8 GHz, Summed Ports, 802.11n 40 MHz

Note: Both ports were investigated and Port 0 was found to be the highest.

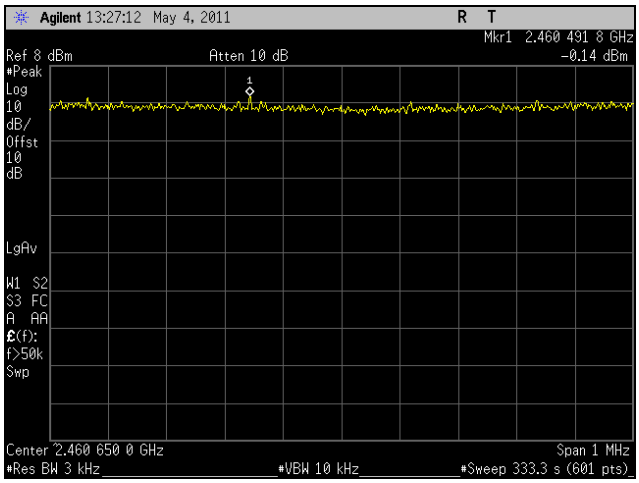
Peak Power Spectral Density, 802.11b, 2.4 GHz



Plot 318. Peak Power Spectral Density, Low Channel, 802.11b, 2.4 GHz

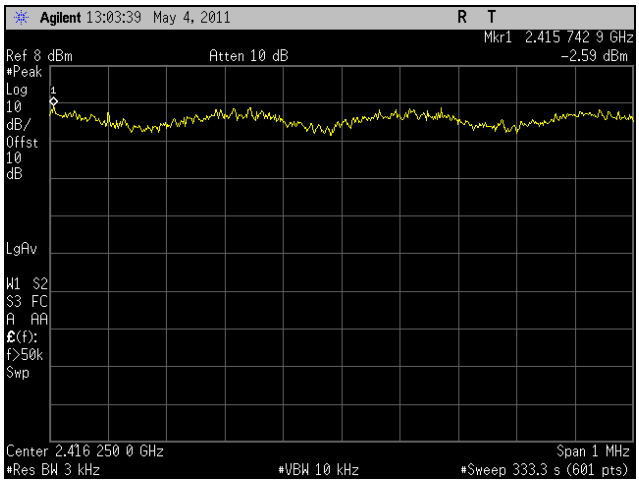


Plot 319. Peak Power Spectral Density, Mid Channel, 802.11b, 2.4 GHz

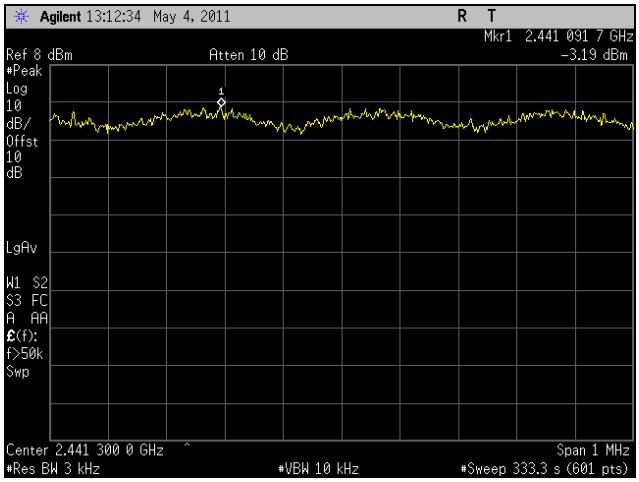


Plot 320. Peak Power Spectral Density, High Channel, 802.11b, 2.4 GHz

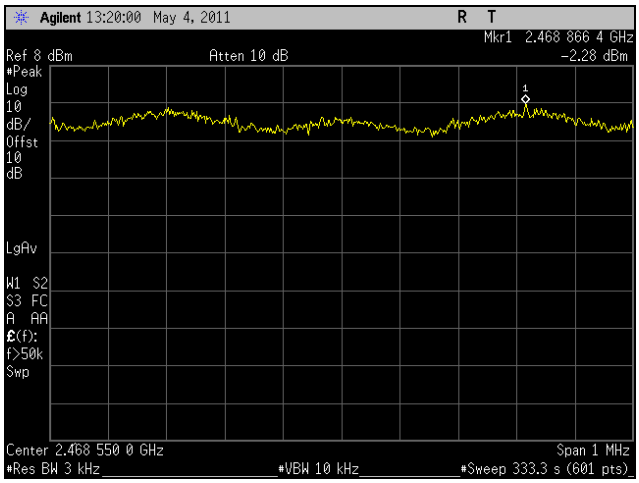
Peak Power Spectral Density, 802.11g, 2.4 GHz



Plot 321. Peak Power Spectral Density, Low Channel, 802.11g, 2.4 GHz

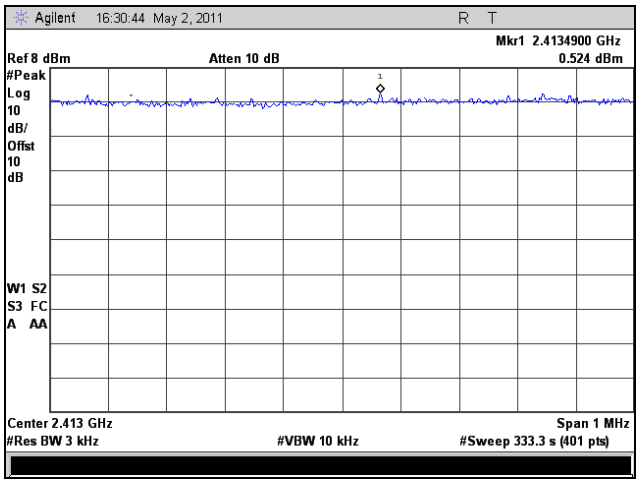


Plot 322. Peak Power Spectral Density, Mid Channel, 802.11g, 2.4 GHz

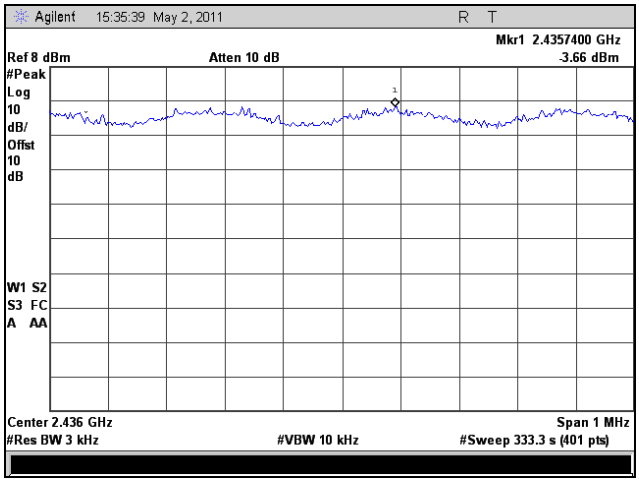


Plot 323. Peak Power Spectral Density, High Channel, 802.11g, 2.4 GHz

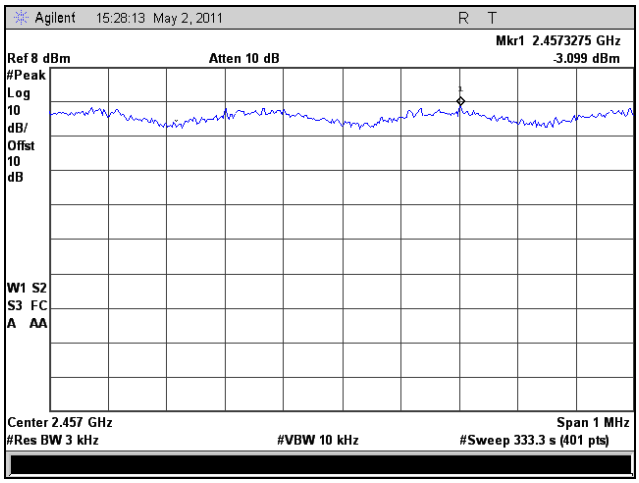
Peak Power Spectral Density, 802.11n 20 MHz, Port 1, 2.4 GHz



Plot 324. Peak Power Spectral Density, Low Channel, 802.11n 20 MHz, Port 1, 2.4 GHz

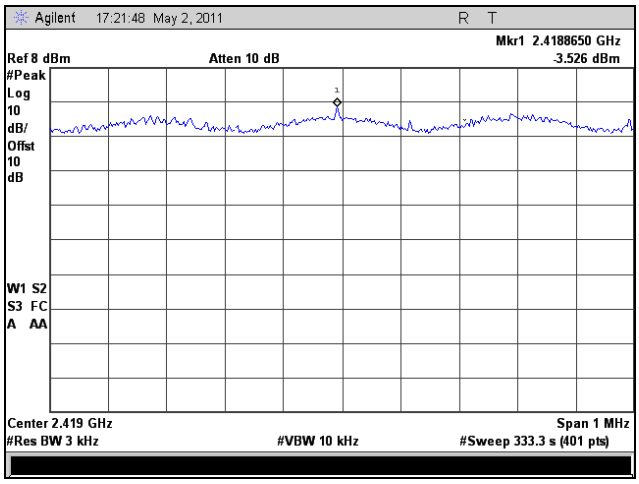


Plot 325. Peak Power Spectral Density, Mid Channel, 802.11n 20 MHz, Port 1, 2.4 GHz

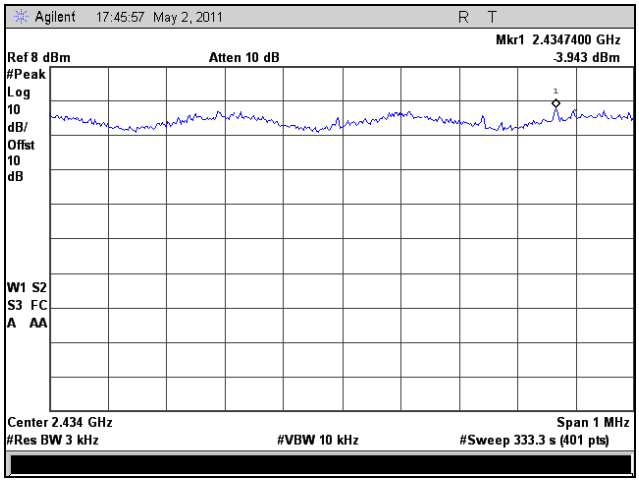


Plot 326. Peak Power Spectral Density, High Channel, 802.11n 20 MHz, Port 1, 2.4 GHz

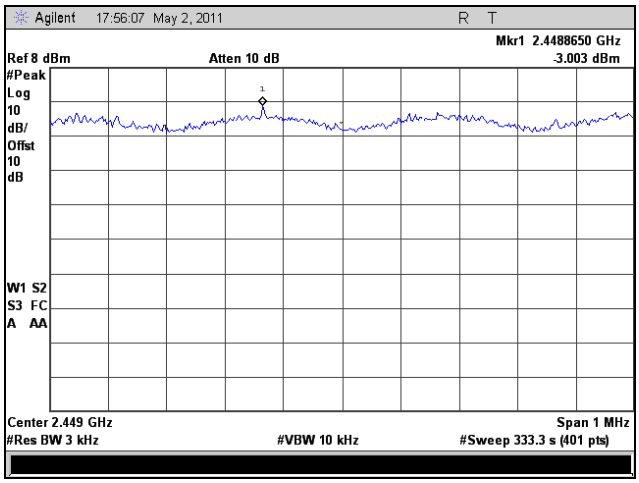
Peak Power Spectral Density, 802.11n 40 MHz, Port 1, 2.4 GHz



Plot 327. Peak Power Spectral Density, Low Channel, 802.11n 40 MHz, Port 1, 2.4 GHz

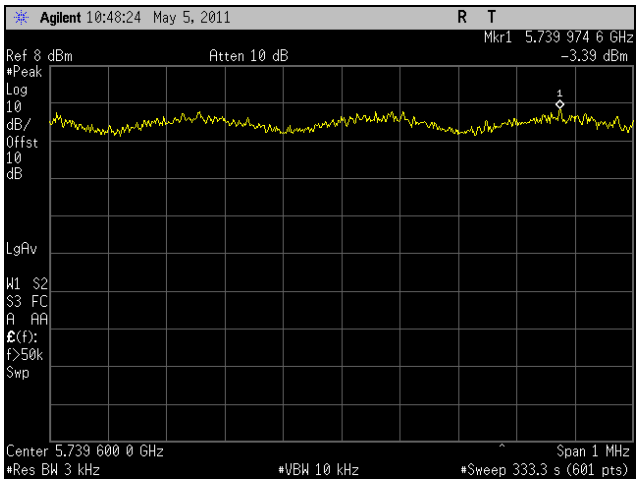


Plot 328. Peak Power Spectral Density, Mid Channel, 802.11n 40 MHz, Port 1, 2.4 GHz

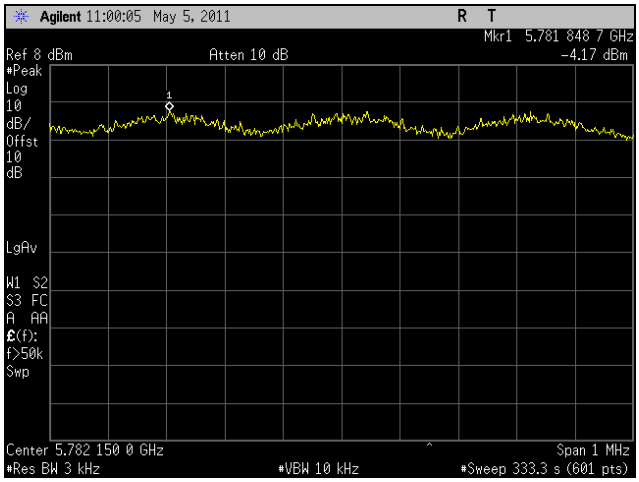


Plot 329. Peak Power Spectral Density, High Channel, 802.11n 40 MHz, Port 1, 2.4 GHz

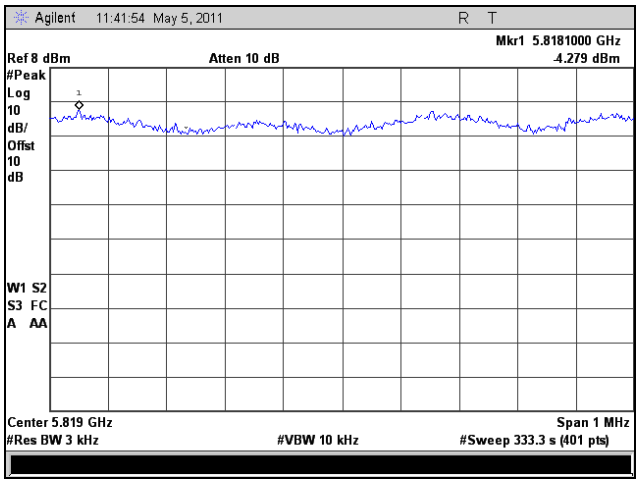
Peak Power Spectral Density, 802.11a, 5.8 GHz



Plot 330. Peak Power Spectral Density, Low Channel, 802.11a, 5.8 GHz

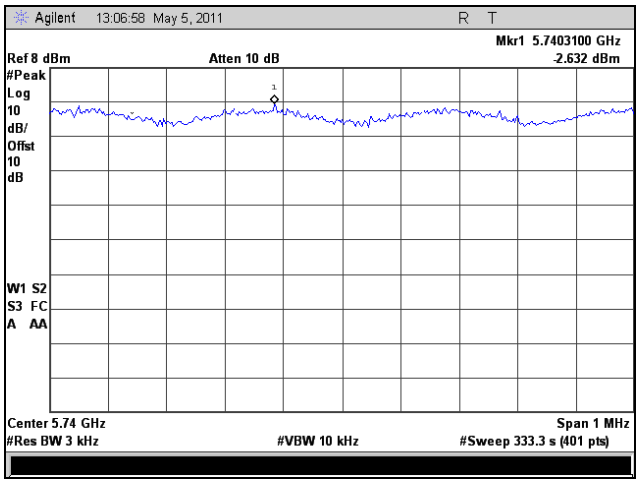


Plot 331. Peak Power Spectral Density, Mid Channel, 802.11a, 5.8 GHz

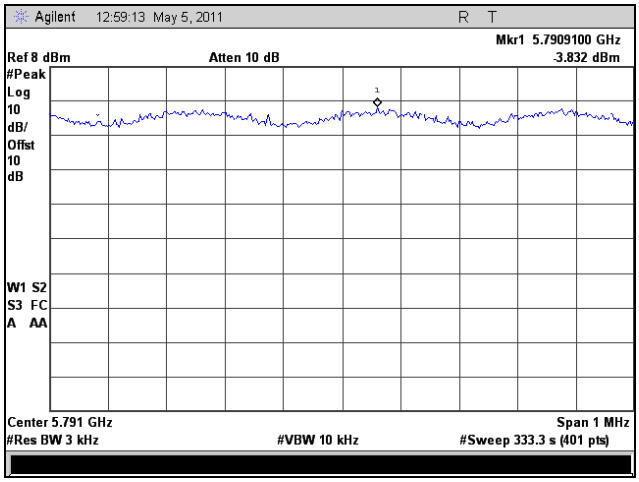


Plot 332. Peak Power Spectral Density, High Channel, 802.11a, 5.8 GHz

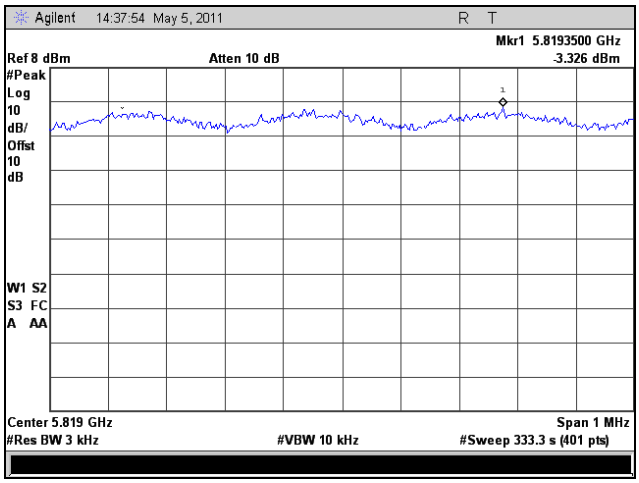
Peak Power Spectral Density, 802.11n 20 MHz, Port 1, 5.8 GHz



Plot 333. Peak Power Spectral Density, Low Channel, 802.11n 20 MHz, Port 1, 5.8 GHz

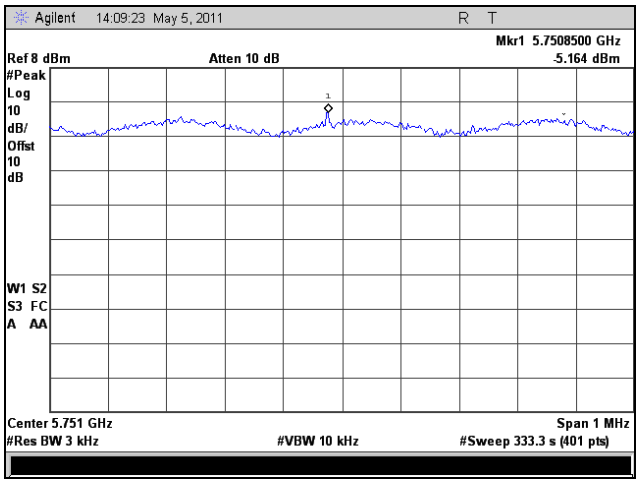


Plot 334. Peak Power Spectral Density, Mid Channel, 802.11n 20 MHz, Port 1, 5.8 GHz

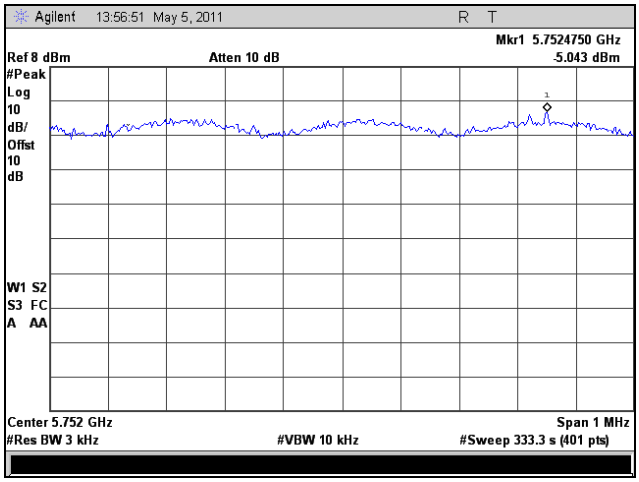


Plot 335. Peak Power Spectral Density, High Channel, 802.11n 20 MHz, Port 1, 5.8 GHz

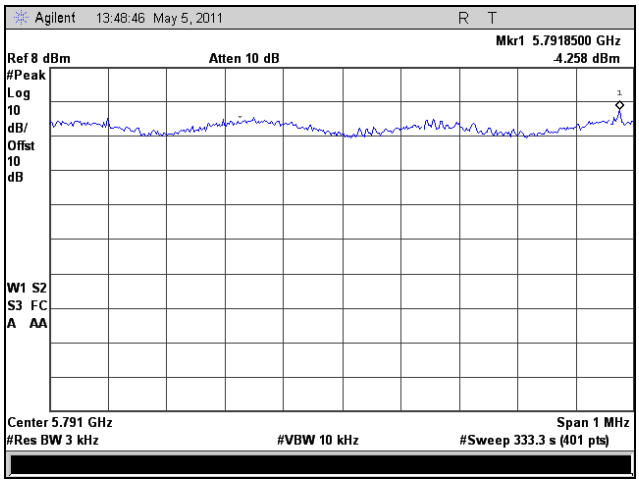
Peak Power Spectral Density, 802.11n 40 MHz, Port 0, 5.8 GHz



Plot 336. Peak Power Spectral Density, Low Channel, 802.11n 40 MHz, Port 0, 5.8 GHz



Plot 337. Peak Power Spectral Density, Mid Channel, 802.11n 40 MHz, Port 0, 5.8 GHz



Plot 338. Peak Power Spectral Density, High Channel, 802.11n 40 MHz, Port 0, 5.8 GHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(i) Maximum Permissible Exposure

RF Exposure Requirements: **§1.1307(b)(1) and §1.1307(b)(2):** Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

RF Radiation Exposure Limit: **§1.1310:** As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

Since EUT has co-located antennas:

MPE Limit Calculation: EUT's operating frequencies @ 824.2 – 849.2 MHz; highest conducted power = ERP – Max Antenna Gain = 23.93 – 11.5 = *12.43dBm* (peak) therefore, **Limit for Uncontrolled exposure = Freq/1500 = 824.2/1500= 0.549 mW/cm^2 or 5.49 W/m^2**

EUT maximum antenna gain = *8.5 dBi + 10log(# of antennas) = 8.5 + 3.0 =11.5dBi*

Equation from page 18 of OET 65, Edition 97-01

$$S1 = PG / 4\pi R^2 \quad \text{or} \quad R = \sqrt{PG / 4\pi S}$$

where, S1 = Power Density (Limit = 0.549 mW/cm^2)
P = Power Input to antenna (17.498mW)
G = Antenna Gain (14.125 numeric)
R = Minimum Distance between User and Antenna (20 cm)

$S1 = (17.498*14.125)/(4*3.14*20^2) = 247.172/5024 = 0.049$ mW/cm^2
$S1 < 0.549$ mW/cm^2 ,

MPE Limit Calculation: EUT's operating frequencies @ 1850-1910 MHz; highest conducted power = EIRP – Antenna Gain = 26.107 – 8.4 = 17.71*dBm* (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

EUT maximum antenna gain = *5.4 dBi + 10log(# of antennas) = 5.4 + 3.0 = 8.4dBi*

Equation from page 18 of OET 65, Edition 97-01

$$S2 = PG / 4\pi R^2 \quad \text{or} \quad R = \sqrt{PG / 4\pi S}$$

where, S2 = Power Density (Limit = 1 mW/cm^2)
P = Power Input to antenna (59.020mW)
G = Antenna Gain (6.918 numeric)
R = Minimum Distance between User and Antenna (20 cm)

$S2 = (59.020*6.918)/(4*3.14*20^2) = 408.319/5024 = 0.082$ mW/cm^2
$S2 < 1$ mW/cm^2 ,

MPE Limit Calculation: EUT's operating frequencies @ 2400-2483.5 MHz; highest conducted power = *28.86dBm* (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

EUT maximum antenna gain = *4.3dBi + 10log(# of antennas) = 4.3 + 3.0 = 7.3dBi*

Equation from page 18 of OET 65, Edition 97-01

$$S3 = PG / 4\pi R^2 \qquad \text{or} \qquad R = \sqrt{PG / 4\pi S}$$

where, S3 = Power Density (Limit = 1 mW/cm^2)
P = Power Input to antenna (770.96mW)
G = Antenna Gain (5.383 numeric)
R = Minimum Distance between User and Antenna (20 cm)

$S3 = (770.96*5.383)/(4*3.14*20^2) = 4150.08/5024 = 0.826$ mW/cm^2
$S3 < 1$ mW/cm^2

MPE Limit Calculation: EUT's operating frequencies @ 5725-5850 MHz; highest conducted power = *28.915dBm* (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

EUT maximum antenna gain = *4 dBi + 10log(# of antennas) = 4.0 + 3.0 = 7.0dBi.*

Equation from page 18 of OET 65, Edition 97-01

$$S4 = PG / 4\pi R^2 \qquad \text{or} \qquad R = \sqrt{PG / 4\pi S}$$

where, S4 = Power Density (Limit = 1 mW/cm^2)
P = Power Input to antenna (780.78mW)
G = Antenna Gain (5.024 numeric)
R = Minimum Distance between User and Antenna (20 cm)

$S4 = (780.78*5.024)/(4*3.14*20^2) = 3922.64/5024 = 0.781$ mW/cm^2
$S4 < 1$ mW/cm^2

For Co-located Antennas:

S1 + S2 + S3 + S4 < 1mW/cm2

Since,
0.049 mW/cm2 + 0.082 mW/cm2 + 0.826 mW/cm2 + 0.781 mW/cm2 > 1 mW/cm2

The Minimum Distance between User and Antennas is

$R = (\sqrt{P1G1} / (4*3.14*0.549)) + (\sqrt{(P2G2 + P3G3 + P4G4)} / (4*3.14*1))$
$= (\sqrt{247.17}/3.79) + ((408.32 + 4130.48 + 3903.91)/ 12.56)$
$= 27.15$ cm

Electromagnetic Compatibility Criteria for Intentional Radiators

RSS-GEN Receiver Spurious Emissions Requirements

Test Requirements: The following receiver spurious emission limits shall be complied with:

(a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 38.

Spurious Frequency (MHz)	Field Strength (microvolt/m at 3 metres)
30 – 88	100
88 – 216	150
216 – 960	200
Above 960	500

Table 38. Spurious Emission Limits for Receivers

(b) If a conducted measurement is made, no spurious output signals appearing at the antenna terminals shall exceed 2 nanowatts per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5 nanowatts above 1 GHz.

Test Procedures: The EUT was programmed for receive mode only. Conducted measurements were taken at the antenna port of the EUT. 100 kHz resolution bandwidth was used from 30 MHz - 1 GHz and 300 kHz resolution was used for measurements done above 1 GHz. All plots are corrected for cable loss.

Test Results: Equipment is compliant with the Receiver Spurious Emissions Requirements of RSS-GEN.

Test Engineer(s): Lionel Gabrillo

Test Date(s): 05/03/11 – 05/06/11

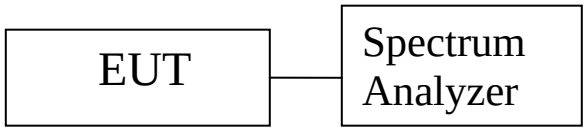
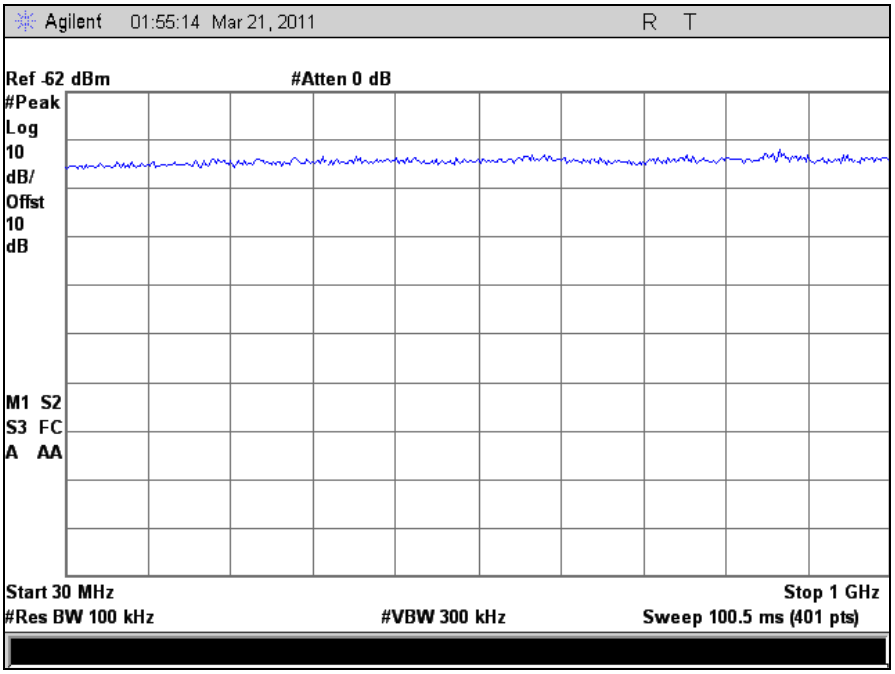


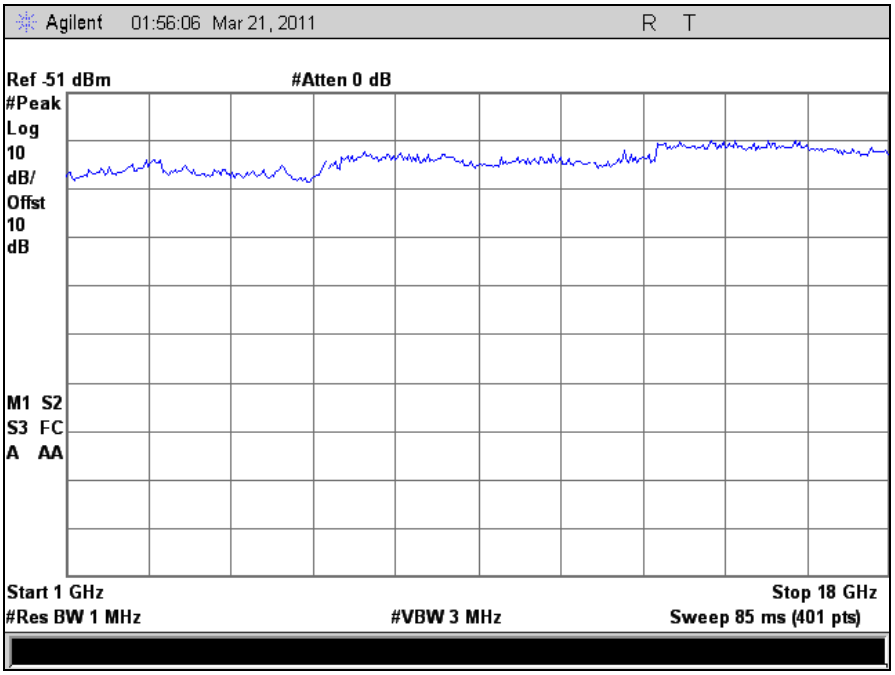
Figure 6. Block Diagram, Conducted Receiver Spurious Emissions Test Setup

Conducted Receiver Spurious Emissions, Port 0, 2.4 GHz



Ref Level = -62dBm = 0.632pW

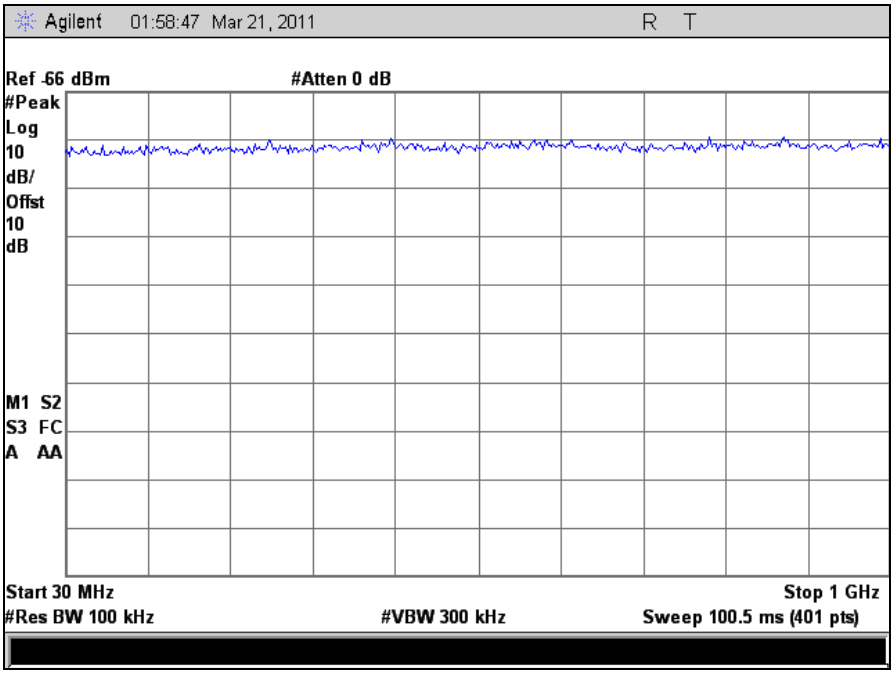
Plot 339. Receiver Spurious Emission, 30 MHz – 1 GHz, Port 0, 2.4 GHz



Ref Level = -51dBm = 7.962pW

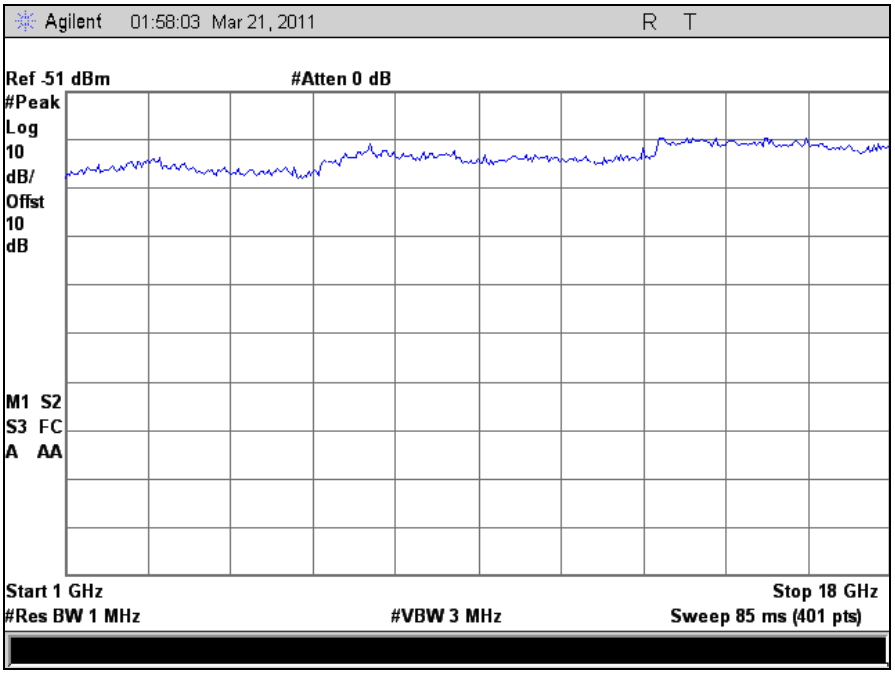
Plot 340. Receiver Spurious Emission, 1 GHz – 18 GHz, Port 0, 2.4 GHz

Conducted Receiver Spurious Emissions, Port 1, 2.4 GHz



Ref Level = -66dBm = 0.251pW

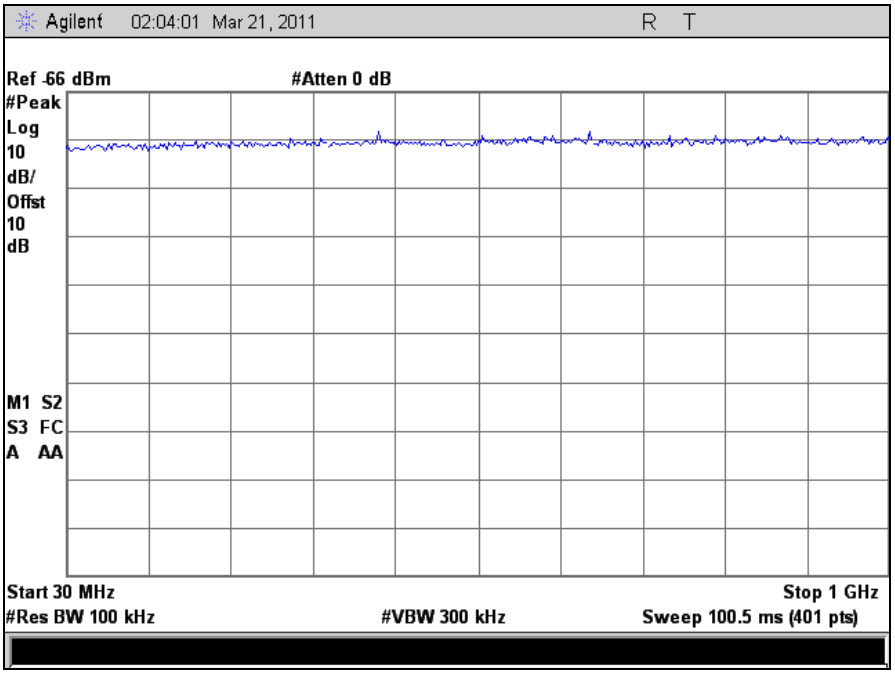
Plot 341. Receiver Spurious Emission, 30 MHz – 11 GHz, Port 1, 2.4 GHz



Ref Level = -51dBm = 7.962pW

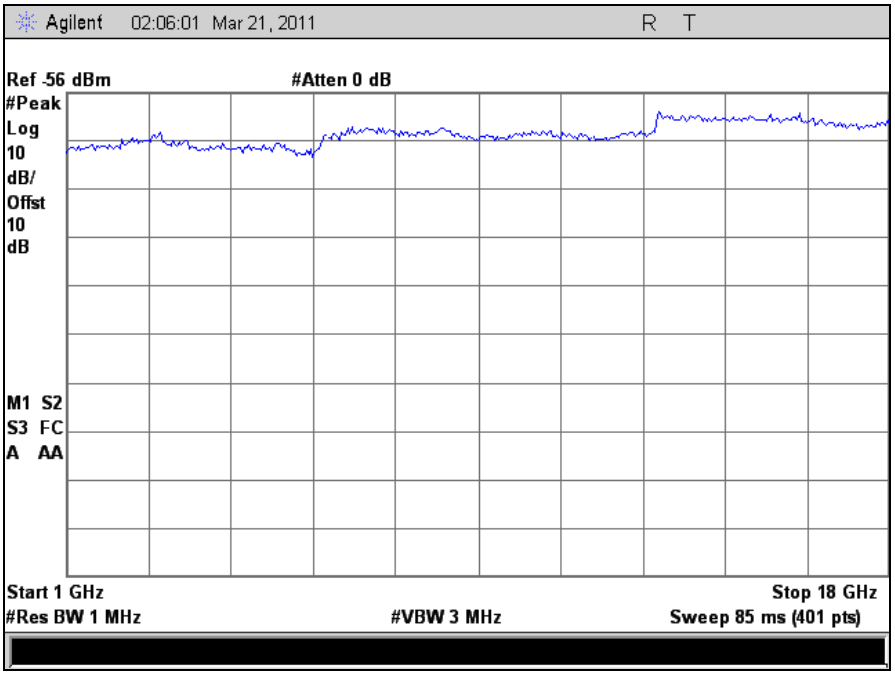
Plot 342. Receiver Spurious Emission, 1 GHz – 18 GHz, Port 1, 2.4 GHz

Conducted Receiver Spurious Emissions, Port 0, 5.8 GHz



Ref Level = -66dBm = 0.251pW

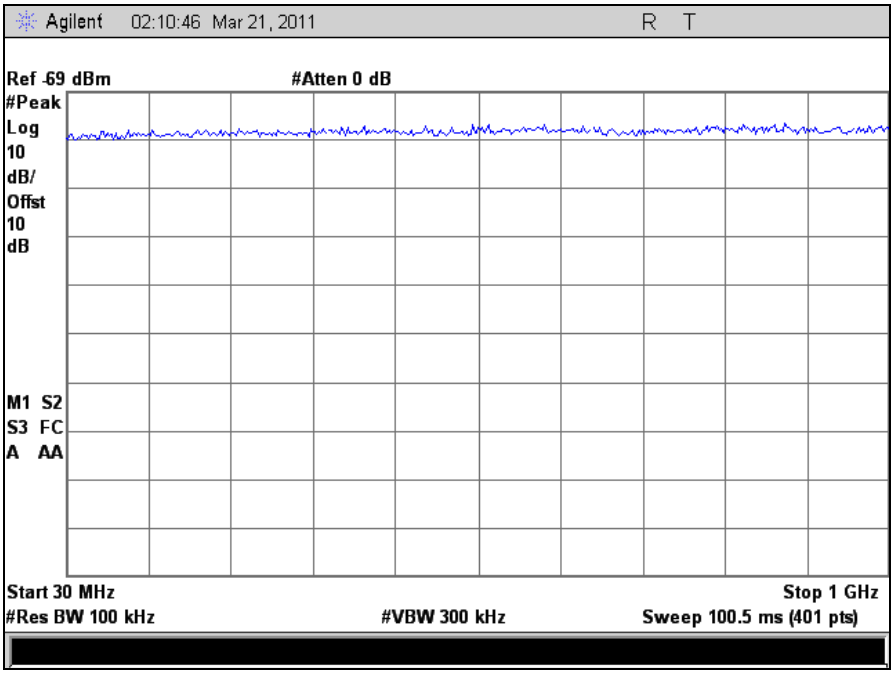
Plot 343. Receiver Spurious Emission, 30 MHz – 1 GHz, Port 0, 5.8 GHz



Ref Level = -56dBm = 2.517pW

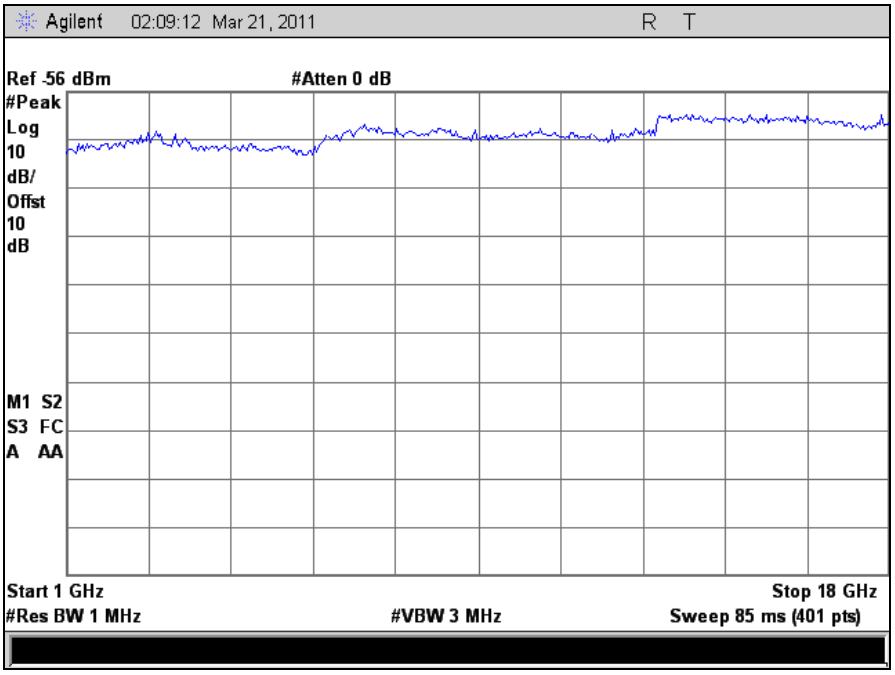
Plot 344. Receiver Spurious Emission, 1 GHz – 18 GHz, Port 0, 5.8 GHz

Conducted Receiver Spurious Emissions, Port 1, 5.8 GHz



Ref Level = -69dBm = 0.126pW

Plot 345. Receiver Spurious Emission, 30 MHz – 11 GHz, Port 1, 5.8 GHz



Ref Level = -56dBm = 2.517pW

Plot 346. Receiver Spurious Emission, 1 GHz – 18 GHz, Port 1, 5.8 GHz

IV. Test Equipment

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ANSI/NCSL Z540-1-1994 and ANSI/ISO/IEC 17025:2000.

MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1S2607	SPECTRUM ANALYZER	AGILENT	E4407B	7/30/10	7/30/11
1S2270	LISN	SCHWARZBECK	NNLK8121	2/15/2011	2/15/2012
1S2399	TURNTABLE CONTROLLER	SUNOL SCIENCE	SC99V	NO CALIBRATION REQUIRED	
1S2481	10M CHAMBER	ETS-LINDGREN	DKE 8X8 DBL	11/6/2010	11/6/2011
1S2482	5 METER CHAMBER	PANASHIELD	641431	11/13/2010	11/13/2011
1S2600	BILOG ANTENNA	TESEQ	CBL6112D	4/14/2010	4/14/2013
1S2499	MULTI DEVICE CONTROLLER	ETS	2090	NO CALIBRATION REQUIRED	
1S2421	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB7	7/6/2010	7/6/2011
1S2460	SPECTRUM ANALYZER	AGILENT	E4407B	7/13/2010	7/13/2011
1S2198	HORN ANTENNA	EMCO	3115	9/22/2010	9/22/2011
N/A	HIGH PASS FILTER	MICRO-TRONICS	HPM13147	SEE NOTE	
1S2521	THERMO-HYGROMETER	FISHER SCIENTIFIC	11-661-7D	12/2/2009	12/2/2011
1S2523	PREAMP (1-26.5GHZ)	AGILENT	8449B	SEE NOTE	
1S2670	HIGHPASS FILTER	TTE, INC.	H613-150K-50-21378	CAL NOT REQUIRED	
1S2587	PRE AMPLIFIER	AML COMM	AML0126L3801	SEE NOTE	

Table 39. Test Equipment List

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

V. Certification & User's Manual Information

Certification & User's Manual Information

A. Certification Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart I — Marketing of Radio frequency devices:

§ 2.801 Radio-frequency device defined.

As used in this part, a radio-frequency device is any device which in its operation is capable of Emitting radio-frequency energy by radiation, conduction, or other means. Radio- frequency devices include, but are not limited to:

(a) The various types of radio communication transmitting devices described throughout this chapter.

(b) The incidental, unintentional and intentional radiators defined in Part 15 of this chapter.

(c) The industrial, scientific, and medical equipment described in Part 18 of this chapter.

(d) Any part or component thereof which in use emits radio-frequency energy by radiation, conduction, or other means.

§ 2.803 Marketing of radio frequency devices prior to equipment authorization.

(a) Except as provided elsewhere in this chapter, no person shall sell or lease, or offer for sale or lease (including advertising for sale or lease), or import, ship or distribute for the purpose of selling or leasing or offering for sale or lease, any radio frequency device unless:

(1) In the case of a device subject to certification, such device has been authorized by the Commission in accordance with the rules in this chapter and is properly identified and labeled as required by §2.925 and other relevant sections in this chapter; or

(2) In the case of a device that is not required to have a grant of equipment authorization issued by the Commission, but which must comply with the specified technical standards prior to use, such device also complies with all applicable administrative (including verification of the equipment or authorization under a Declaration of Conformity, where required), technical, labeling and identification requirements specified in this chapter.

(d) Notwithstanding the provisions of paragraph (a) of this section, the offer for sale solely to business, commercial, industrial, scientific or medical users (but not an offer for sale to other parties or to end users located in a residential environment) of a radio frequency device that is in the conceptual, developmental, design or pre-production stage is permitted prior to equipment authorization or, for devices not subject to the equipment authorization requirements, prior to a determination of compliance with the applicable technical requirements *provided* that the prospective buyer is advised in writing at the time of the offer for sale that the equipment is subject to the FCC rules and that the equipment will comply with the appropriate rules before delivery to the buyer or to centers of distribution.

(e)(1) Notwithstanding the provisions of paragraph (a) of this section, prior to equipment authorization or determination of compliance with the applicable technical requirements any radio frequency device may be operated, but not marketed, for the following purposes and under the following conditions:

(i) Compliance testing;

(ii) Demonstrations at a trade show provided the notice contained in paragraph (c) of this section is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iii) Demonstrations at an exhibition conducted at a business, commercial, industrial, scientific or medical location, but excluding locations in a residential environment, provided the notice contained in paragraphs (c) or (d) of this section, as appropriate, is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iv) Evaluation of product performance and determination of customer acceptability, provided such operation takes place at the manufacturer's facilities during developmental, design or pre-production states; or

(v) Evaluation of product performance and determination of customer acceptability where customer acceptability of a radio frequency device cannot be determined at the manufacturer's facilities because of size or unique capability of the device, provided the device is operated at a business, commercial, industrial, scientific or medical user's site, but not at a residential site, during the development, design or pre-production stages.

(e)(2) For the purpose of paragraphs (e)(1)(iv) and (e)(1)(v) of this section, the term *manufacturer's facilities* includes the facilities of the party responsible for compliance with the regulations and the manufacturer's premises, as well as the facilities of other entities working under the authorization of the responsible party in connection with the development and manufacture, but not the marketing, of the equipment.

(f) For radio frequency devices subject to verification and sold solely to business, commercial, industrial, scientific and medical users (excluding products sold to other parties or for operation in a residential environment), parties responsible for verification of the devices shall have the option of ensuring compliance with the applicable technical specifications of this chapter at each end user's location after installation, provided that the purchase or lease agreement includes a proviso that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.

Certification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart J — Equipment Authorization Procedures:

§ 2.901 Basis and Purpose

(a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service wherein the equipment is to be operated.[1] *In addition to the technical standards provided, the rules governing the service may require that such equipment be verified by the manufacturer or importer*, be authorized under a Declaration of Conformity, or receive an equipment authorization from the Commission by one of the following procedures: certification or registration.

(b) The following sections describe the verification procedure, the procedure for a Declaration of Conformity, and the procedures to be followed in obtaining certification from the Commission and the conditions attendant to such a grant.

§ 2.907 Certification.

(a) Certification is an equipment authorization issued by the Commission, based on representation and test data submitted by the applicant.

(b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

[1] In this case, the equipment is subject to the rules of Part 15. More specifically, the equipment falls under Subpart B (of Part 15), which deals with unintentional radiators.

Certification & User's Manual Information

§ 2.948 Description of measurement facilities.

(a) Each party making measurements of equipment that is subject to an equipment authorization under Part 15 or Part 18 of this chapter, regardless of whether the measurements are filed with the Commission or kept on file by the party responsible for compliance of equipment marketed within the U.S. or its possessions, shall compile a description of the measurement facilities employed.

(1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.

(i) If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the Commission by that laboratory. In this situation, the party responsible for the verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.

(ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.

(2) If the equipment is to be authorized by the Commission under the certification procedure, the description of the measurement facilities shall be filed with the Commission's Laboratory in Columbia, Maryland. The data describing the measurement facilities need only be filed once but must be updated as changes are made to the measurement facilities or as otherwise described in this section. At least every three years, the organization responsible for filing the data with the Commission shall certify that the data on file is current.

Certification & User's Manual Information

1. Label and User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart A — General:

§ 15.19 Labeling requirements.

(a) In addition to the requirements in Part 2 of this chapter, a device subject to certification or verification shall be labeled as follows:

(1) Receivers associated with the operation of a licensed radio service, e.g., FM broadcast under Part 73 of this chapter, land mobile operation under Part 90, etc., shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

(2) A stand-alone cable input selector switch, shall bear the following statement in a conspicuous location on the device:

This device is verified to comply with Part 15 of the FCC Rules for use with cable television service.

(3) All other devices shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.

(5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

§ 15.21 Information to user.

The user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Verification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart B — Unintentional Radiators:

§ 15.105 Information to the user.

(a) For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at own expense.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

– Reorient or relocate the receiving antenna.

– Increase the separation between the equipment and receiver.

– Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

– Consult the dealer or an experienced radio/TV technician for help.

ICES-003 Procedural & Labeling Requirements

From the Industry Canada Electromagnetic Compatibility Advisory Bulletin entitled, "Implementation and Interpretation of the Interference-Causing Equipment Standard for Digital Apparatus, ICES-003" (EMCAB-3, Issue 2, July 1995):

> "At present, CISPR 22: 2002 and ICES technical requirements are essentially equivalent. Therefore, if you have CISPR 22: 2002 approval by meeting CISPR Publication 22, the only additional requirements are: to attach a note to the report of the test results for compliance, indicating that these results are deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations; to maintain these records on file for the requisite five year period; and to provide the device with a notice of compliance in accordance with ICES-003."

Procedural Requirements:

According to Industry Canada's Interference Causing Equipment Standard for Digital Apparatus ICES-003 Issue 4, February 2004:

Section 6.1: A record of the measurements and results, showing the date that the measurements were completed, shall be retained by the manufacturer or importer for a period of at least five years from the date shown in the record and made available for examination on the request of the Minister.

Section 6.2: A written notice indicating compliance must accompany each unit of digital apparatus to the end user. The notice shall be in the form of a label that is affixed to the apparatus. Where because of insufficient space or other constraints it is not feasible to affix a label to the apparatus, the notice may be in the form of a statement in the user's manual.

Labeling Requirements:

The suggested text for the notice, in English and in French, is provided below, from the Annex of ICES-003:

> This Class [2] digital apparatus complies with Canadian ICES-003.
>
> Cet appareil numérique de la classe [1] est conforme à la norme NMB-003 du Canada.

[2] Insert either A or B but not both as appropriate for the equipment requirements.

End of Report