MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
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September 20, 2013

Firetide, Inc.
2105 South Bascom Ave., Suite 220
Campbell, CA 95008

Dear Pramod Akkarachittor,

Enclosed is the EMC Wireless test report for compliance testing of the Firetide, Inc., HotPort 5020 Wireless Mesh Node as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 15, Subpart B and ICES-003, Issue 5 August 2012 for a Class A Digital Device, and FCC Part 15 Subpart C and 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: (\Firetide, Inc.\EMCS38293-FCC247 Rev. 2)

Electromagnetic Compatibility Criteria
Test Report

for the

Firetide, Inc.
HotPort 5020 Wireless Mesh Node

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

MET Report: EMCS38293-FCC247 Rev. 2

September 20, 2013

Prepared For:

Firetide, Inc.
2105 South Bascom Ave., Suite 220
Campbell, CA 95008

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

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for Intentional Radiators

Aaron Chang, 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 5 August 2012, RSS-210, Issue 8, Dec. 2010 under normal use and maintenance.

Asad Bajwa,
Director, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	August 12, 2013	Initial Issue.
1	September 9, 2013	Revised to reflect customer corrections.
2	September 20, 2013	Revised to reflect engineer corrections.

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List of Terms and Abbreviations

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

I. Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Firetide, Inc. HotPort 5020 Wireless Mesh Node, 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 HotPort 5020 Wireless Mesh Node. Firetide, Inc. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the HotPort 5020 Wireless Mesh Node, 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 Firetide, Inc., purchase order number 3522. 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 5 August 2012	Conducted Emission Limits for a Class A Digital Device	Compliant
47 CFR Part 15.109 (a)	ICES-003 Issue 5 August 2012	Radiated Emission Limits for a Class A 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

Table 1. Executive Summary of EMC Part 15.247 ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Firetide, Inc. to perform testing on the HotPort 5020 Wireless Mesh Node, under Firetide, Inc.'s purchase order number 3522.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Firetide, Inc., HotPort 5020 Wireless Mesh Node.

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

Model(s) Tested:	HotPort 5020 Wireless Mesh Node		
Model(s) Covered:	HotPort 5020E, 5020ER, 5020LNK, 5020M		
EUT Specifications:	Primary Power: 120 VAC, 60 Hz		
	FCC ID: REP-5020-1 IC: 4988A-5020		
	Type of Modulations:	OFDM	
	Equipment Code:	DTS	
	Peak RF Output Power:	**2.4 GHz**	**5 GHz**
		802.11g: 26.09 dBm	802.11a: 29.62 dBm
		802.11n 20MHz: 26.21 dBm	802.11n 20MHz: 26.19 dBm
		802.11n 40MHz: 25.51 dBm	802.11n 40MHz: 25.59 dBm
	EUT Frequency Ranges:	2412 MHz – 2462 MHz; 2437 MHz – 2437 MHz 5745 MHz – 5825 MHz; 5755 MHz – 5795 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:	Aaron Chang		
Report Date(s):	September 20, 2013		

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 5 August 2012	Information Technology Equipment (ITE) — Limits and methods of measurement
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
ISO/IEC 17025:2005	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 5 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 Firetide, Inc. HotPort 5020 Wireless Mesh Node, Equipment Under Test (EUT), is a member of Firetide's HotPort family of wireless mesh nodes. Firetide mesh network gives you the convenience of a wired-Ethernet switch combined with the flexibility of wireless technology in the 2.4, 4.9 (public safety), and 5 GHz bands in MIMO environment ,satisfies the demands of high-bandwidth/low-latency applications, such as video, voice, and data. The EUT has two identical radio modules. Each radio module is a 3x3 MIMO. The modules are not co-located.

The HotPort 5020 powered using external AC-PoE power adapter which operates from 100~230V and provides 56 VDC output to the EUT. The EUT may alternatively be powered by an external AC-DC power adapter which operates from 100~230V and provides 15 VDC output to the EUT.

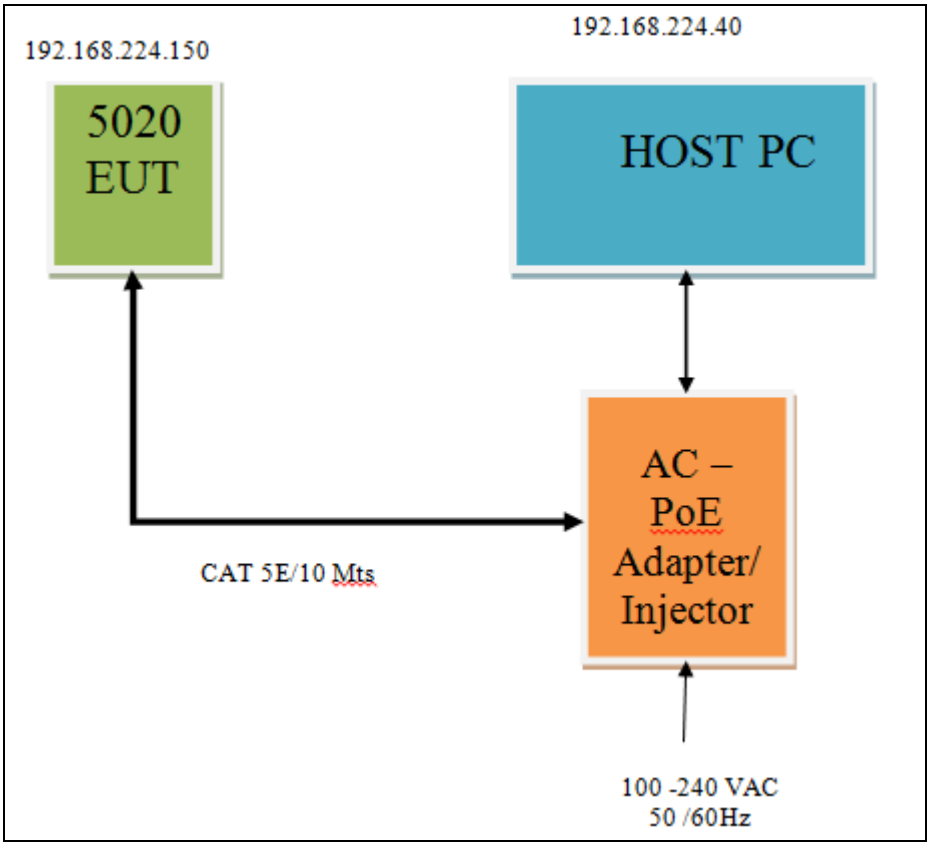


Figure 1. Block Diagram of Test Configuration, 1

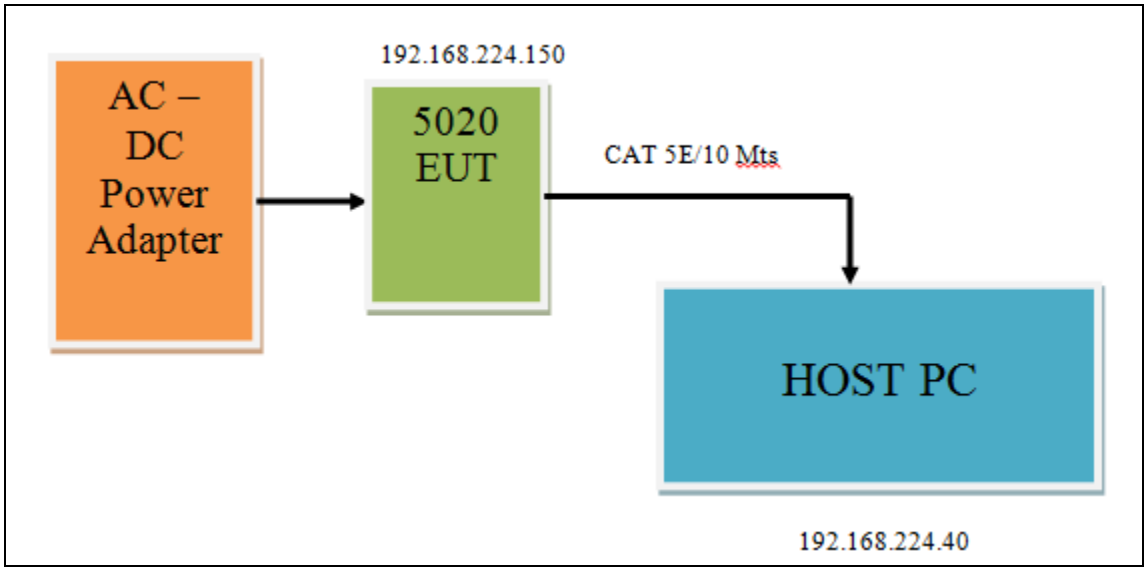


Figure 2. Block Diagram of Test Configuration, 2

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	Slot #	Name / Description	Model Number	Part Number	Serial Number	Rev. #
A	Chassis	Wireless Mesh Node	HotPort 5020	130-0094-001	WV6011235503291	1
B	N/A	External DC Adapter	HON-KWANG	HK-D532-A16	K0000003353	--
C	N/A	PoE Adapter	Phihong	POE30U-560(G)	P15000113D1	--

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	Customer Supplied Calibration Data
D	Laptop	Sony	N/A	N/A

Table 5. Support Equipment

G. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty.	Length as tested (m)	Max Length (m)	Shielded (Y/N)	Termination Box ID & Port Name
E	Ethernet Port	RJ45	1	5	>100	N	RJ45 Port and Cable
F	DC Power Input Port	6-PIN DIN Cable	1	8	>100	Y	DC Power Source

Table 6. Ports and Cabling Information

H. Mode of Operation

Once the DC power is applied to the EUT, an LED indicates to mention that the unit is powered on properly. Proper IP address should be set in the PC prior to the Ethernet cable connection. The Ethernet connectivity needs to be made by connecting an Ethernet cable. Once the connection is established, you can verify this in the PC's LAN connectivity status. Proper IP address should be set in the PC prior to the Ethernet cable connection. Both the radios will be disabled.

I. Method of Monitoring EUT Operation

HotPort5020 will be used for wireless mesh node application and all the 5020 nodes connectivity will be monitored using a common server (PC or Laptop). The link connectivity can always be verified using the Firetide provided Software which will run on server PC or Laptop. If some connectivity is broken then we can verify this with Firetide software running on the server then we can take necessary action accordingly.

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 Firetide, Inc. 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.

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.				

Table 7. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Subsections 15.107(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, test conditions, and test procedures of ANSI C63.4 were used. The EUT was powered through a 50Ω/50µH LISN. An EMI receiver, connected to the measurement port of the LISN, scanned the frequency range from 150 kHz to 30 MHz in order to find the peak conducted emissions. All peak emissions within 6 dB of the limit were re-measured using a quasi-peak and/or average detector as appropriate.

Test Results:

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

Test Engineer(s):

Joseph Mendoza

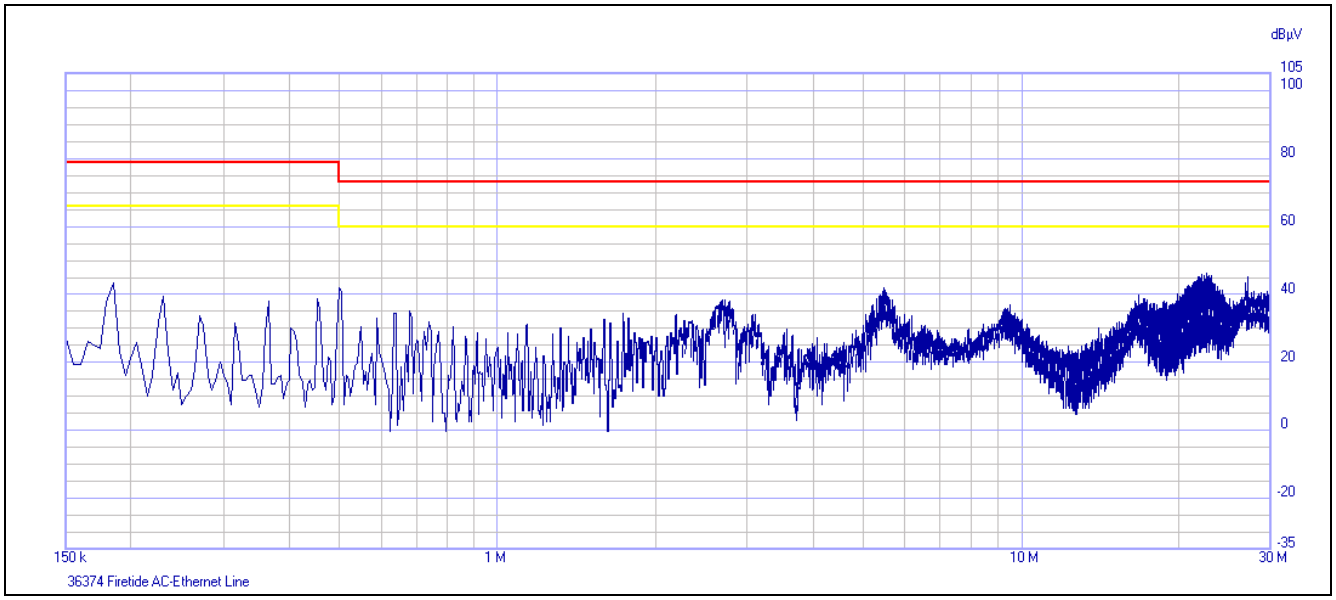
Test Date(s):

10/5/2012 & 10/10/2012

Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz)

Freq. (MHz)	QP Amplitude	QP Limit	Delta	Results	Average Amplitude	Average Limit	Delta	Results
.185	42.47	79	-36.53	Pass	39.89	66	-26.11	Pass
.5	41.38	73	-31.62	Pass	39.78	60	-20.22	Pass
2.66	35.43	73	-37.57	Pass	29.83	60	-30.17	Pass
5.455	43.35	73	-29.65	Pass	24.52	60	-35.48	Pass
22.405	43	73	-30	Pass	37.97	60	-22.03	Pass
27	45.54	73	-27.46	Pass	42.68	60	-17.32	Pass

Table 8. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz), PoE Adapter

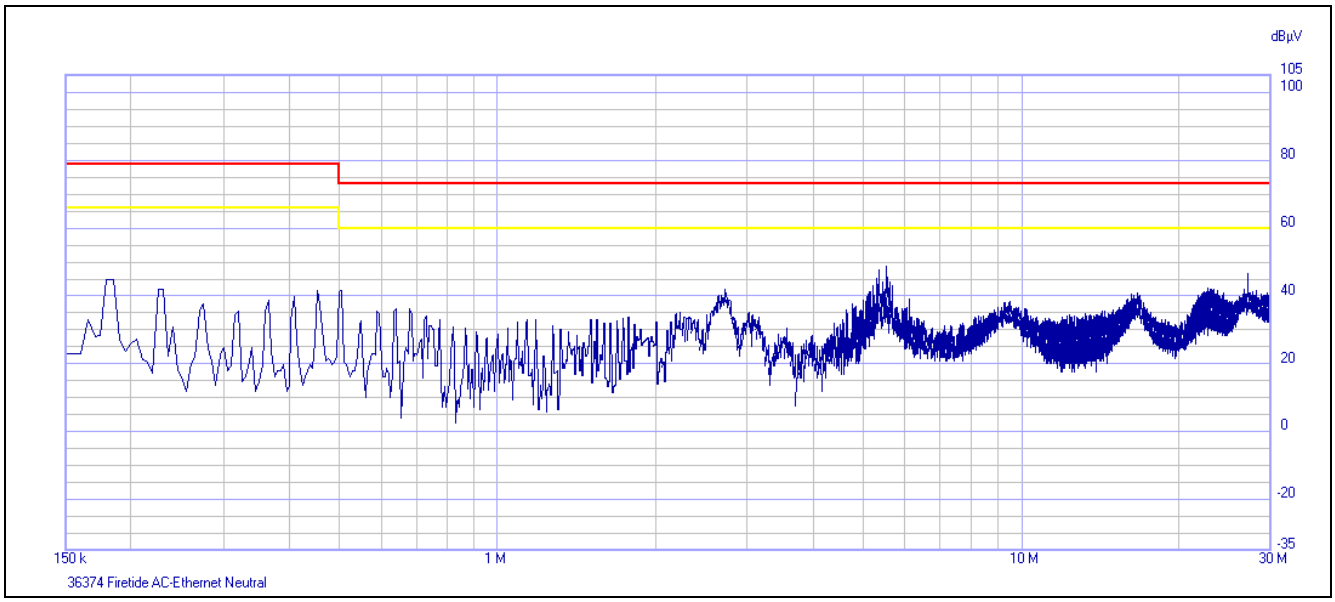


Plot 1. Conducted Emissions, Phase Line, PoE Adapter

Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz)

Freq. (MHz)	QP Amplitude	QP Limit	Delta	Results	Average Amplitude	Average Limit	Delta	Results
.18	43.49	79	-35.51	Pass	41.78	66	-24.22	Pass
.455	40.05	79	-38.95	Pass	38.81	66	-27.19	Pass
1.23	32.48	73	-40.52	Pass	30.37	60	-29.63	Pass
2.71	36.1	73	-36.9	Pass	30.34	60	-29.66	Pass
5.515	40.97	73	-32.03	Pass	34.75	60	-25.25	Pass
27	45.62	73	-27.38	Pass	43	60	-17	Pass

Table 9. Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz), PoE Adapter

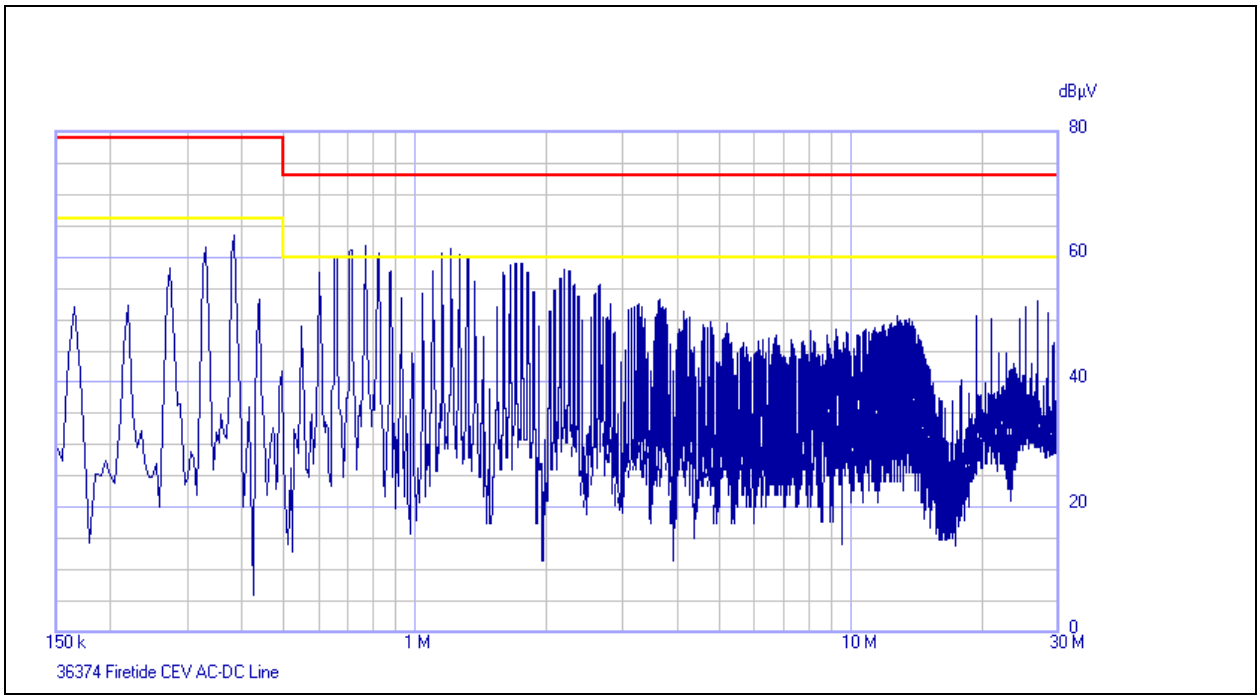


Plot 2. Conducted Emissions, Neutral Line, PoE Adapter

Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz)

Freq. (MHz)	QP Amplitude	QP Limit	Delta	Results	Average Amplitude	Average Limit	Delta	Results
.33	61.46	79	-17.54	Pass	58.64	66	-7.36	Pass
.385	62.88	79	-16.12	Pass	60.08	66	-5.92	Pass
.715	60.61	73	-12.39	Pass	57.39	60	-2.61	Pass
.77	61.16	73	-11.84	Pass	58.08	60	-1.92	Pass
.825	59.92	73	-13.08	Pass	56.94	60	-3.06	Pass
1.15	60.26	73	-12.74	Pass	57.14	60	-2.86	Pass
1.205	60.88	73	-12.12	Pass	57.86	60	-2.14	Pass
1.26	59.98	73	-13.02	Pass	56.97	60	-3.03	Pass

Table 10. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz), DC Adapter

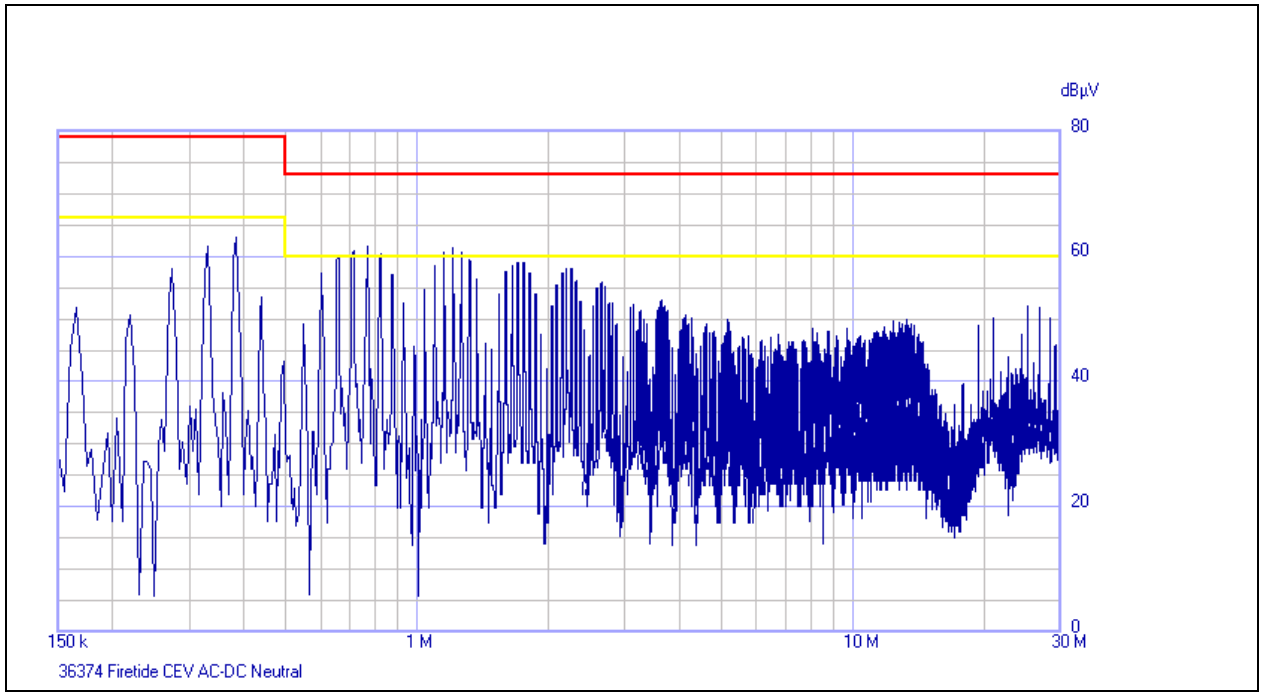


Plot 3. Conducted Emissions, Phase Line, DC Adapter

Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz)

Freq. (MHz)	QP Amplitude	QP Limit	Delta	Results	Average Amplitude	Average Limit	Delta	Results
.33	61.4	79	-17.6	Pass	58.67	66	-7.33	Pass
.385	62.71	79	-16.29	Pass	59.93	66	-6.07	Pass
.715	60.55	73	-12.45	Pass	57.66	60	-2.34	Pass
.77	61.04	73	-11.96	Pass	58.02	60	-1.98	Pass
.825	60.55	73	-12.45	Pass	57.62	60	-2.38	Pass
1.15	60.41	73	-12.59	Pass	57.33	60	-2.67	Pass
1.205	60.74	73	-12.26	Pass	57.77	60	-2.23	Pass
1.26	59.75	73	-13.25	Pass	56.81	60	-3.19	Pass

Table 11. Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz), DC Adapter



Plot 4. Conducted Emissions, Neutral Line, DC Adapter

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 12.

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 12.

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 12. 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.

Emissions measured at 3m were normalized using an inverse proportionality factor of 20dB per decade for comparison to the 10 m limit.

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

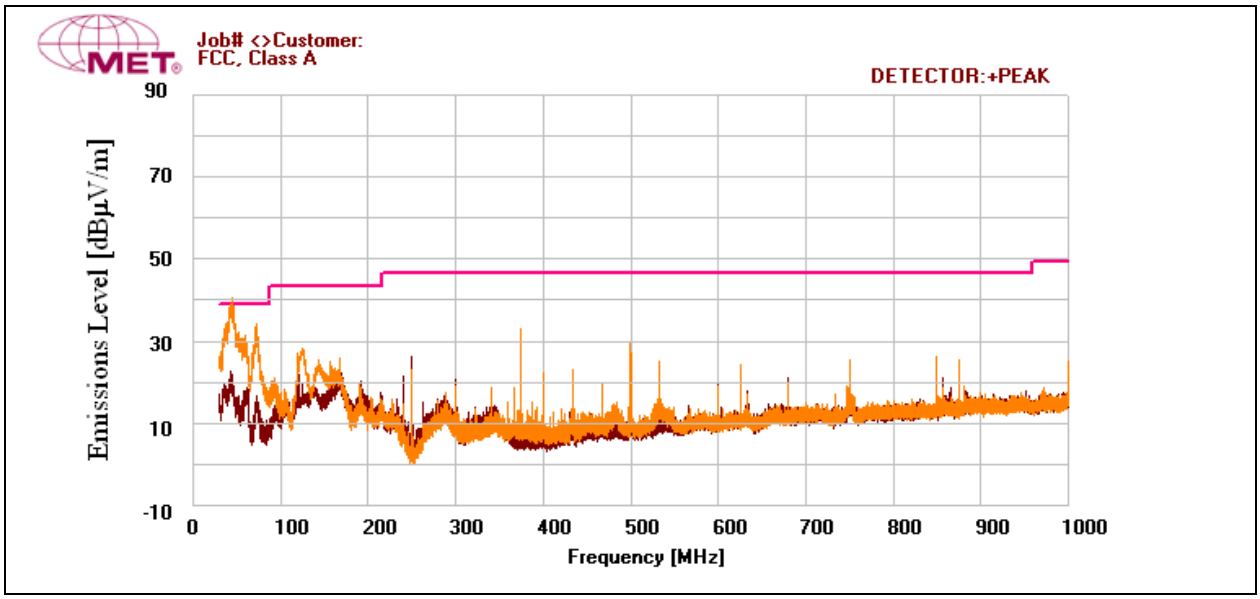
Test Engineer(s): Joseph Mendoza

Test Date(s): 10/5/2012 & 10/10/2012

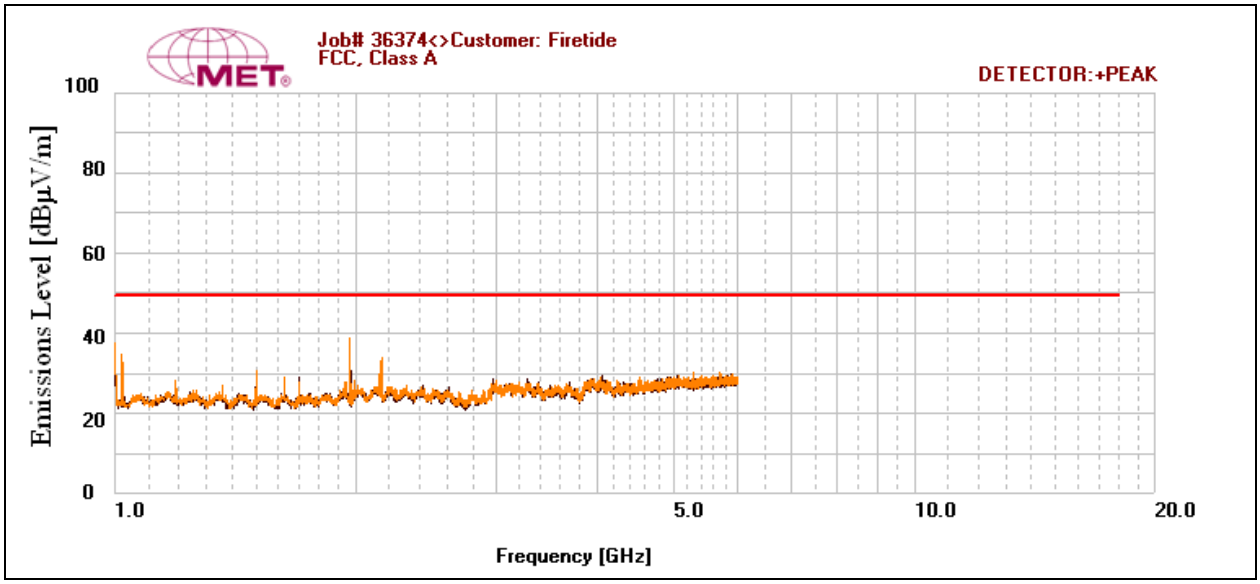
Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBµV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
44.368	V	316	99	33.689	11.39	0	0.639	-10.46	35.258	39	-3.742
249.99	H	360	99	22.667	12.3	0	1.31	-10.46	25.817	46.4	-20.583
374.981	V	348	99	23.538	16.199	0	1.77	-10.46	31.047	46.4	-15.353
499.989	V	166	99	18.1	18.5	0	2.11	-10.46	28.25	46.4	-18.15
750.015	V	79	99	9.336	21.499	0	2.63	-10.46	23.005	46.4	-23.395
849.99	V	216	100	10.141	22.899	0	2.73	-10.46	25.31	46.4	-21.09
1000	V	205	100	74.74	22.075	56.682	4.513	-10.46	34.186	49.5	-15.314
1020	V	204	100	73.94	22.517	57.815	4.604	-10.46	32.786	49.5	-16.714
1962	V	267	100	74.48	27.906	62.194	7.888	-10.46	37.62	49.5	-11.88

Table 13. Radiated Emissions Limits, Test Results, 30 MHz – 6 GHz, FCC Limits, PoE Adapter



Plot 5. Radiated Emissions, 30 MHz - 1 GHz, FCC Limits, PoE Adapter



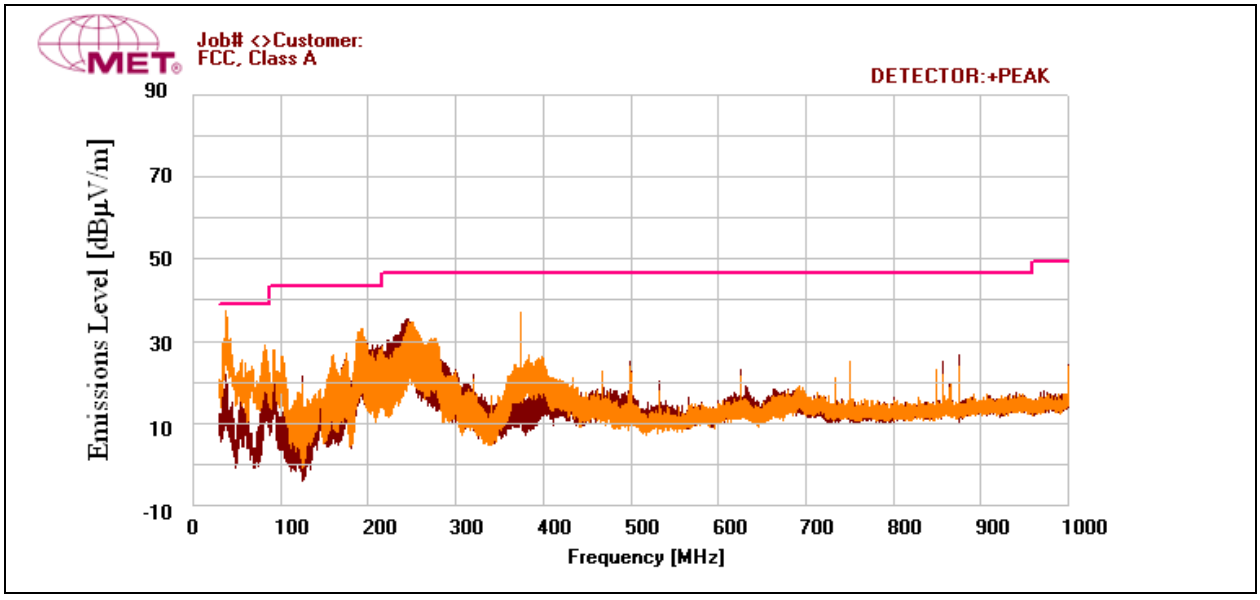
Plot 6. Radiated Emissions, Above 1 GHz, FCC Limits, PoE Adapter

Radiated Emissions Limits Test Results, Class A

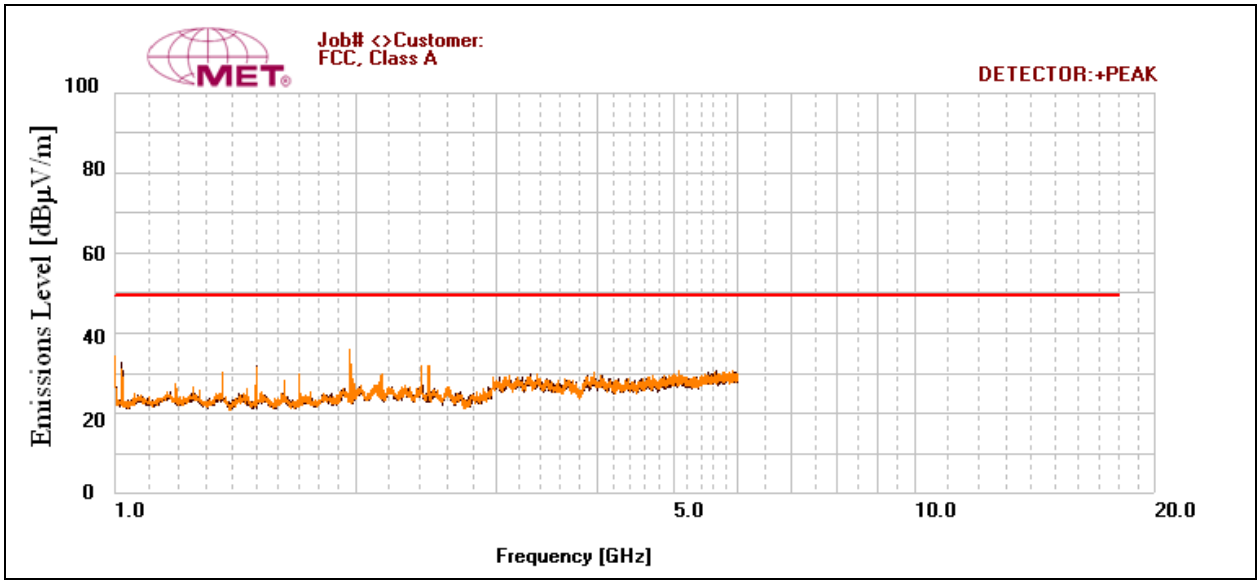
Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBµV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
*37.857	V	277	100	31.731	14.372	0	0.659	-10.46	36.302	39	-2.698
245.054	H	195	99	30.1	12.201	0	1.306	-10.46	33.147	46.4	-13.253
374.988	V	189	122	29.124	16.2	0	1.77	-10.46	36.634	46.4	-9.766
499.993	H	19	99	17.137	18.5	0	2.11	-10.46	27.287	46.4	-19.113
750.012	V	149	100	11.435	21.5	0	2.63	-10.46	25.105	46.4	-21.295
875.003	H	146	99	11.299	22.7	0	2.84	-10.46	26.379	46.4	-20.021
1000	V	143	187	71.18	22.075	56.682	4.513	-10.46	30.626	49.5	-18.874
1020	H	167	108	74.85	22.507	57.815	4.604	-10.46	33.686	49.5	-15.814
1962	V	343	187	71.95	27.906	62.194	7.888	-10.46	35.09	49.5	-14.41

Table 14. Radiated Emissions Limits, Test Results, 30 MHz – 6 GHz, FCC Limits, DC Adapter

Note: * - At this frequency, the measured electric-field strength exhibits a margin of compliance that is less than 3 dB below the specification limit. We recommend that every emission measured, have at least a 3 dB margin to allow for deviations in the emission characteristics that may occur during the production process.



Plot 7. Radiated Emissions, 30 MHz - 1 GHz, FCC Limits, DC Adapter



Plot 8. Radiated Emissions, Above 1 GHz, FCC Limits, DC Adapter

Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBµV)	ACF (dB/m)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
44.368	V	316	1.00	33.69	11.39	0.64	10.46	35.26	40.00	-4.74
374.981	V	348	1.00	23.54	16.20	1.77	10.46	31.05	47.00	-15.95
249.99	H	360	1.00	22.67	12.30	1.31	10.46	25.82	47.00	-21.18
499.989	V	166	1.00	18.10	18.50	2.11	10.46	28.25	47.00	-18.75
750.015	V	79	1.00	9.34	21.50	2.63	10.46	23.01	47.00	-24.00
849.99	V	216	1.00	10.14	22.90	2.73	10.46	25.31	47.00	-21.69

Table 15. Radiated Emissions Limits, Test Results, ICES-003 Limits, PoE Adapter

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBµV)	ACF (dB/m)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
37.857	V	277	100.00	31.73	14.37	0.66	10.46	36.30	40.00	-3.70
245.054	H	195	99.00	30.10	12.20	1.31	10.46	33.15	47.00	-13.85
374.988	V	189	122.00	29.12	16.20	1.77	10.46	36.63	47.00	-10.37
499.993	H	19	99.00	17.14	18.50	2.11	10.46	27.29	47.00	-19.71
750.012	V	149	100.00	11.44	21.50	2.63	10.46	25.11	47.00	-21.90
875.003	H	146	99.00	11.30	22.70	2.84	10.46	26.38	47.00	-20.62

Table 16. Radiated Emissions Limits, Test Results, ICES-003 Limits, DC Adapter

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. The unit will be professionally installed.

Test Engineer(s): Aaron Chang

Test Date(s): 05/26/13

Gain/Type	Model	Manufacturer
5dBi Omni (2.4GHz)	C812-510010-A	WHA YU INDUSTRIAL CO. LTD.
5dBi Omni (5GHz)	C812-510012-A	WHA YU INDUSTRIAL CO. LTD.
19dBi Panel (5GHz)	MA-WA55-MIMO	MARS ANTENNAS & RF Systems LTD

Table 17. Antenna List

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 Σ 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 18. 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 semi-anechoic chamber. 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.

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

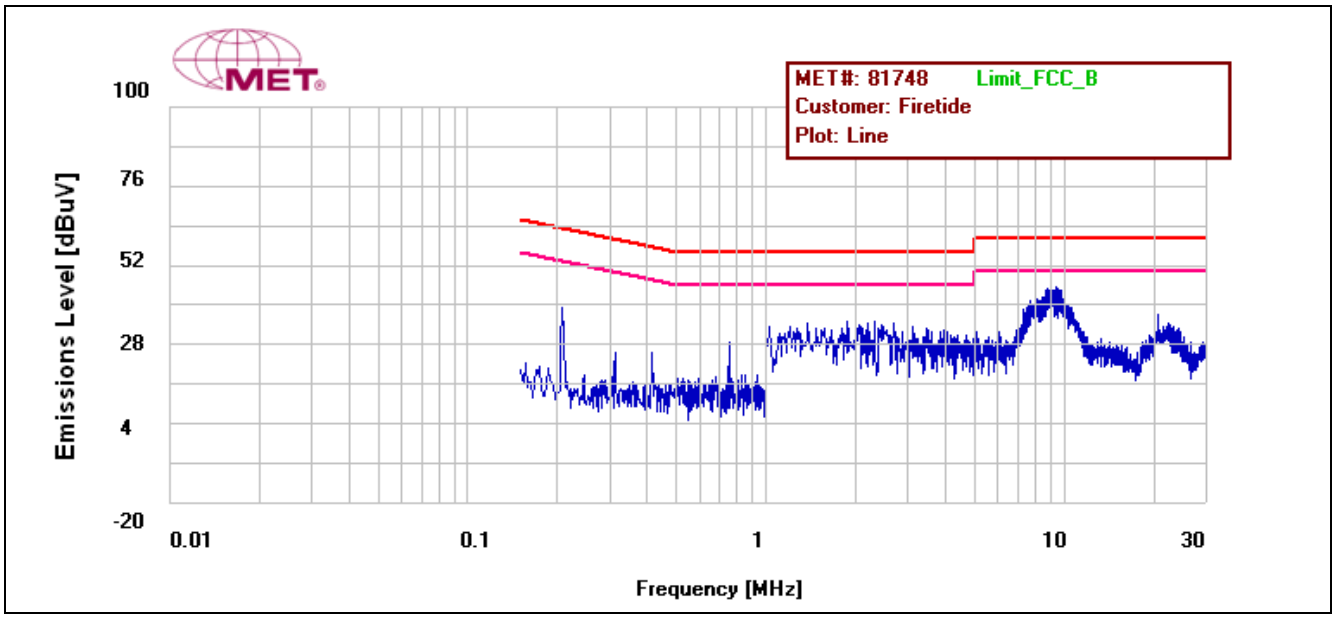
Test Engineer(s): Minh Ly

Test Date(s): 08/17/09

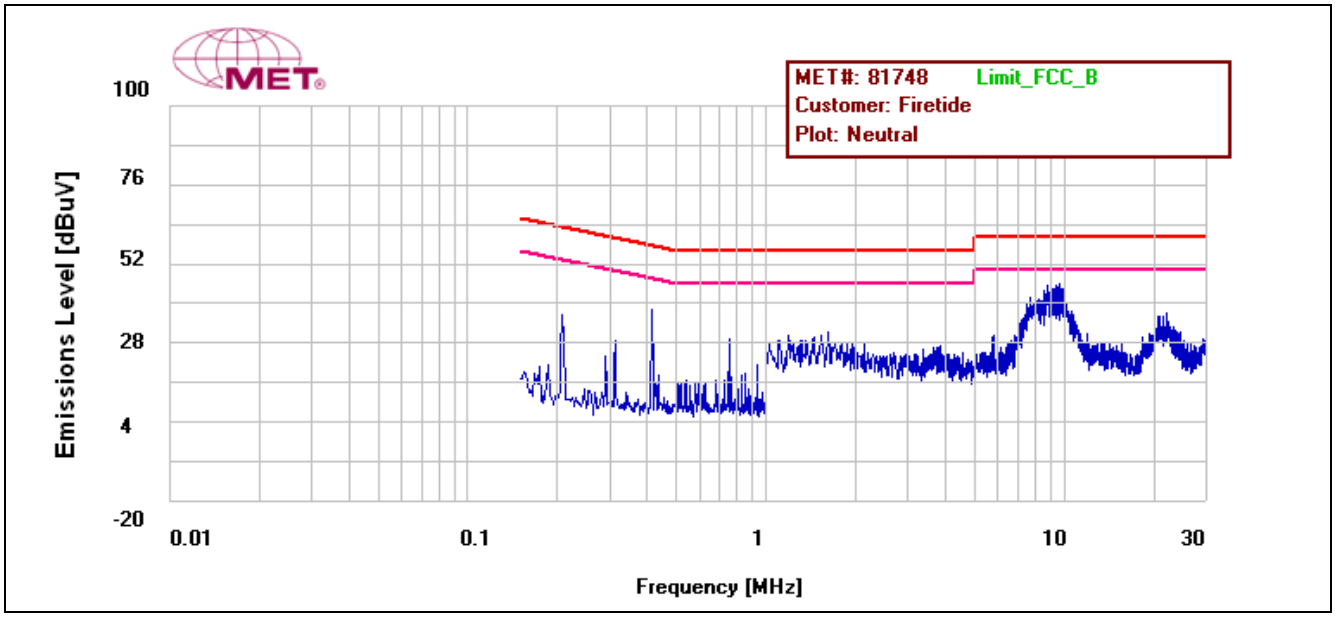
15.207(a) Conducted Emissions Test Results

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
Line	0.206	38.73	63.372	-24.642	Pass	33.83	53.372	-19.542	Pass
Line	0.76	21.03	56	-34.97	Pass	16.023	46	-29.977	Pass
Line	9.45	37.95	60	-22.05	Pass	31.47	50	-18.53	Pass
Neutral	0.207	36.5	63.332	-26.832	Pass	33.9	53.332	-19.432	Pass
Neutral	0.414	33.77	57.591	-23.821	Pass	32.7	47.591	-14.891	Pass
Neutral	9.117	38.87	60	-21.13	Pass	32.33	50	-17.67	Pass

Table 19. Conducted Emissions, 15.207(a), Test Results



Plot 9. Conducted Emissions, 15.207(a), Phase Line



Plot 10. Conducted Emissions, 15.207(a), Neutral Line

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): Aaron Chang

Test Date(s): 05/31/13

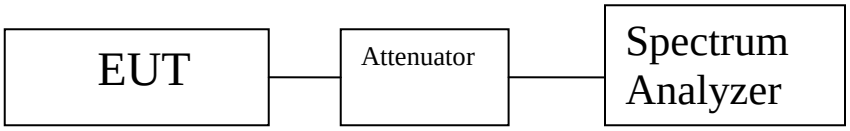


Figure 3. Block Diagram, Occupied Bandwidth Test Setup

Occupied Bandwidth Test Results

Occupied Bandwidth			
	Carrier Channel	**Frequency (MHz)**	**Measured 6 dB Bandwidth (MHz)**
802.11g Port 1	Low	2412	16.500
	Mid	2442	16.489
	High	2472	16.417
802.11g Port 2	Low	2412	16.452
	Mid	2442	16.548
	High	2472	16.528
802.11g Port 3	Low	2412	16.522
	Mid	2442	16.479
	High	2472	16.500
802.11n 20 MHz Port 1	Low	2412	17.760
	Mid	2442	17.781
	High	2472	17.787
802.11n 20 MHz Port 2	Low	2412	17.747
	Mid	2442	17.743
	High	2472	17.769
802.11n 20 MHz Port 3	Low	2412	17.721
	Mid	2442	17.729
	High	2472	17.758
802.11n 40 MHz Port 1	Low	2422	36.558
	Mid	2442	36.575
	High	2462	36.518
802.11 40n MHz Port 2	Low	2422	36.661
	Mid	2442	36.620
	High	2462	36.596
802.11n 40 MHz Port 3	Low	2422	36.599
	Mid	2442	36.593
	High	2462	36.161

Table 20. 6 dB Occupied Bandwidth, Test Results, 2.4 GHz

Occupied Bandwidth			
	Carrier Channel	**Frequency (MHz)**	**Measured 6 dB Bandwidth (MHz)**
802.11a Port 1	Low	5745	16.461
	Mid	5785	16.487
	High	5825	16.488
802.11a Port 2	Low	5745	16.437
	Mid	5785	16.456
	High	5825	16.400
802.11a Port 3	Low	5745	16.453
	Mid	5785	16.440
	High	5825	16.456
802.11n 20 MHz Port 1	Low	5745	17.757
	Mid	5785	17.756
	High	5825	17.758
802.11n 20 MHz Port 2	Low	5745	17.734
	Mid	5785	17.798
	High	5825	17.657
802.11n 20 MHz Port 3	Low	5745	17.751
	Mid	5785	17.690
	High	5825	17.657
802.11n 40 MHz Port 1	Low	5755	36.580
	High	5795	36.557
802.11 40n MHz Port 2	Low	5755	36.509
	High	5795	36.540
802.11n 40 MHz Port 3	Low	5755	36.506
	High	5795	36.577

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

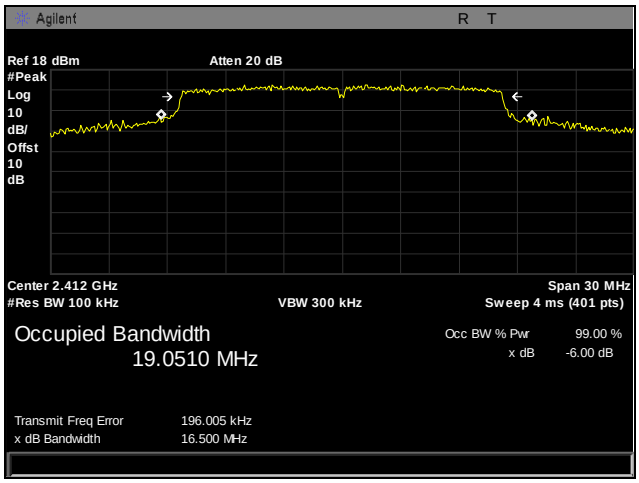
Occupied Bandwidth			
	Carrier Channel	**Frequency (MHz)**	**Measured 99% Bandwidth (MHz)**
802.11g Port 1	Low	2412	16.3824
	Mid	2437	16.6273
	High	2462	16.3991
802.11g Port 2	Low	2412	16.5220
	Mid	2437	16.4468
	High	2462	16.4526
802.11g Port 3	Low	2412	16.4475
	Mid	2437	16.5468
	High	2462	16.5007
802.11n 20 MHz Port 1	Low	2412	17.7415
	Mid	2437	17.8602
	High	2462	17.5680
802.11n 20 MHz Port 2	Low	2412	17.7517
	Mid	2437	17.6329
	High	2462	17.6302
802.11n 20 MHz Port 3	Low	2412	17.5003
	Mid	2437	17.7059
	High	2462	17.4889
802.11n 40 MHz Port 1	Low	2422	36.5284
	Mid	2442	36.2092
	High	2462	36.2502
802.11 40n MHz Port 2	Low	2422	36.4285
	Mid	2442	36.2075
	High	2462	35.9805
802.11n 40 MHz Port 3	Low	2422	36.5319
	Mid	2442	36.3701
	High	2462	36.1860

Table 22. 99% Occupied Bandwidth, Test Results, 2.4 GHz

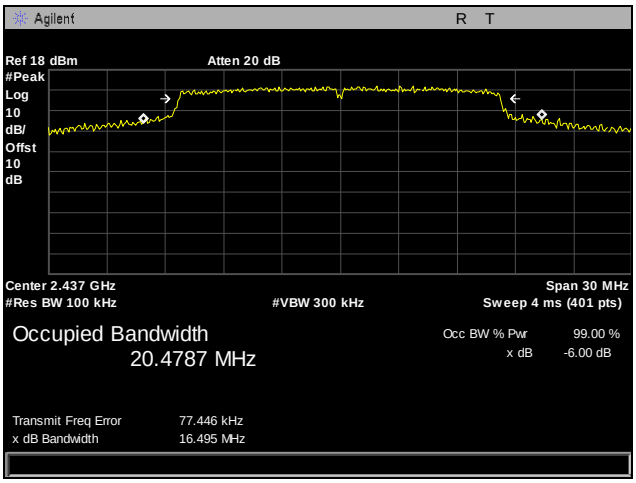
Occupied Bandwidth			
	Carrier Channel	**Frequency (MHz)**	**Measured 99% Bandwidth (MHz)**
802.11a Port 1	Low	5745	19.8445
	Mid	5785	19.0403
	High	5825	19.0871
802.11a Port 2	Low	5745	19.8584
	Mid	5785	19.0386
	High	5825	17.2691
802.11a Port 3	Low	5745	20.4902
	Mid	5785	18.1686
	High	5825	16.8233
802.11n 20 MHz Port 1	Low	5745	20.2644
	Mid	5785	19.9875
	High	5825	19.7555
802.11n 20 MHz Port 2	Low	5745	20.8045
	Mid	5785	21.3993
	High	5825	18.4164
802.11n 20 MHz Port 3	Low	5745	20.5770
	Mid	5785	18.1509
	High	5825	17.9166
802.11n 40 MHz Port 1	Low	5755	36.4253
	High	5795	36.5387
802.11 40n MHz Port 2	Low	5755	36.7801
	High	5795	36.5517
802.11n 40 MHz Port 3	Low	5755	36.6943
	High	5795	36.3922

Table 23. 99% Occupied Bandwidth, Test Results, 5.8 GHz

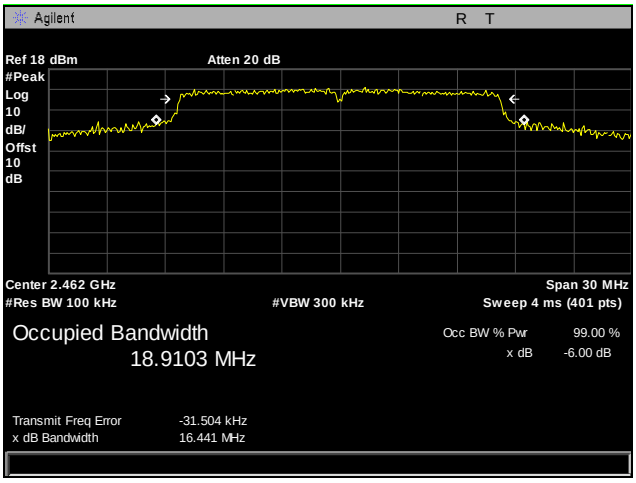
6 dB Occupied Bandwidth Test Results, 802.11g, 2.4 GHz, Port 1



Plot 11. 6 dB Occupied Bandwidth, 802.11g, 2412 MHz, Port 1

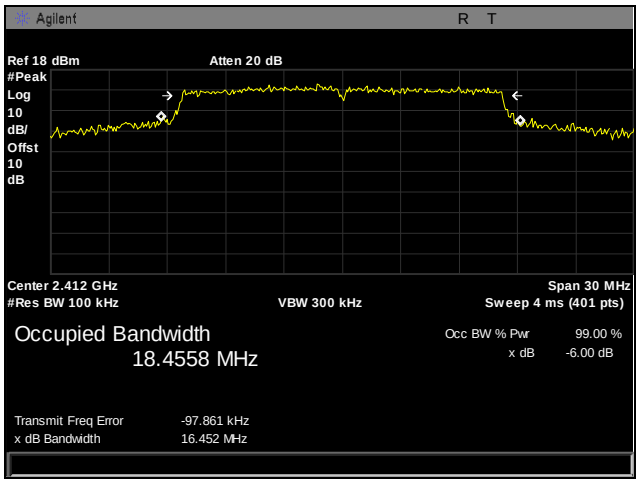


Plot 12. 6 dB Occupied Bandwidth, 802.11g, 2437 MHz, Port 1

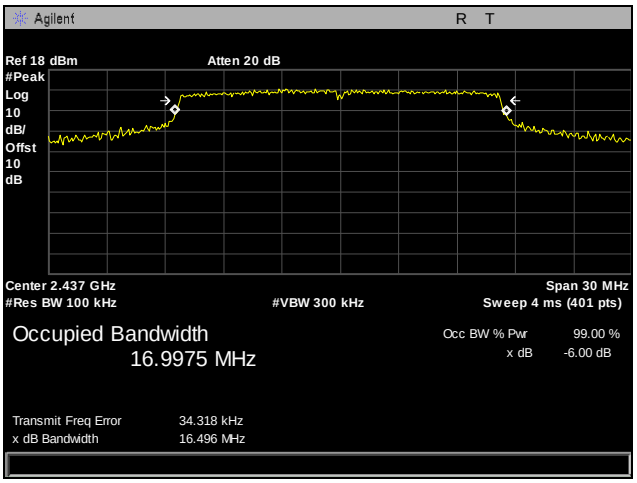


Plot 13. 6 dB Occupied Bandwidth, 802.11g, 2462 MHz, Port 1

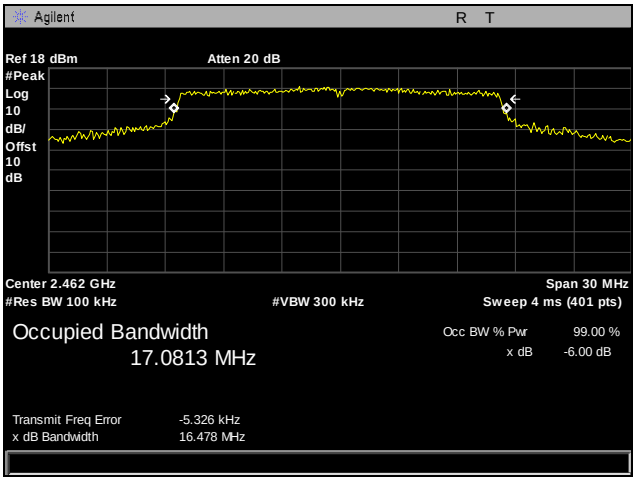
6 dB Occupied Bandwidth Test Results, 802.11g, 2.4 GHz, Port 2



Plot 14. 6 dB Occupied Bandwidth, 802.11g, 2412 MHz, Port 2

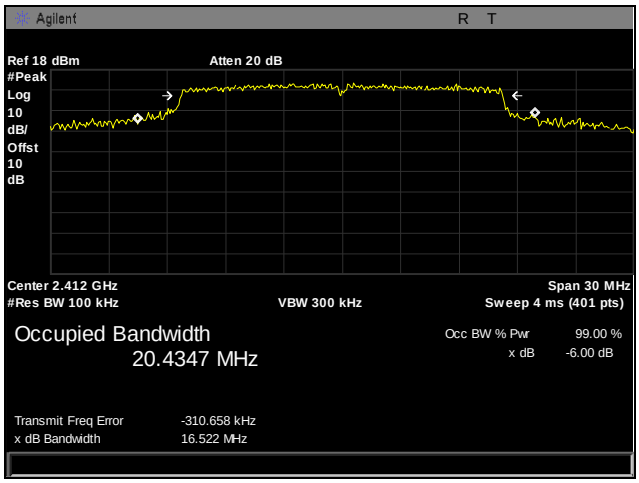


Plot 15. 6 dB Occupied Bandwidth, 802.11g, 2437 MHz, Port 2

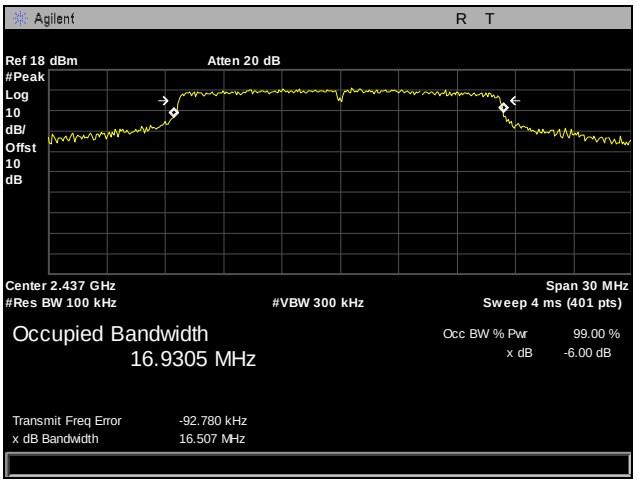


Plot 16. 6 dB Occupied Bandwidth, 802.11g, 2462 MHz, Port 2

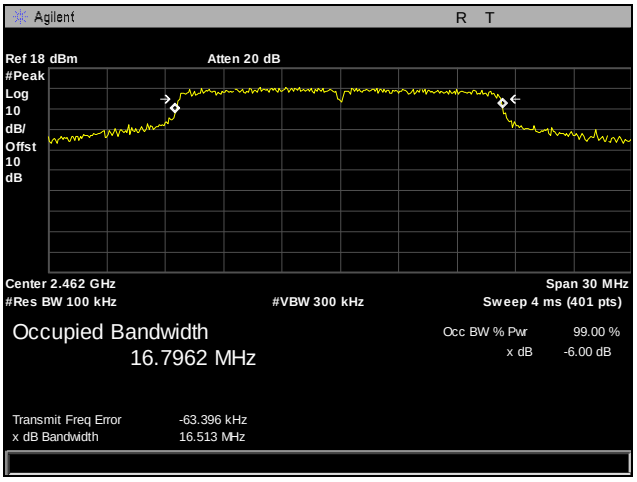
6 dB Occupied Bandwidth Test Results, 802.11g, 2.4 GHz, Port 3



Plot 17. 6 dB Occupied Bandwidth, 802.11g, 2412 MHz, Port 3

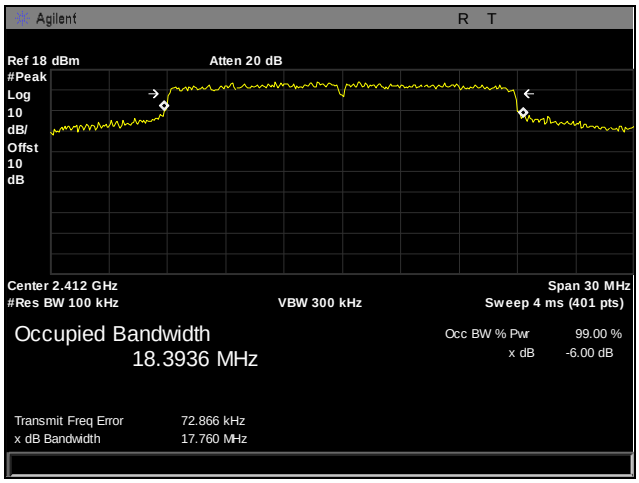


Plot 18. 6 dB Occupied Bandwidth, 802.11g, 2437 MHz, Port 3

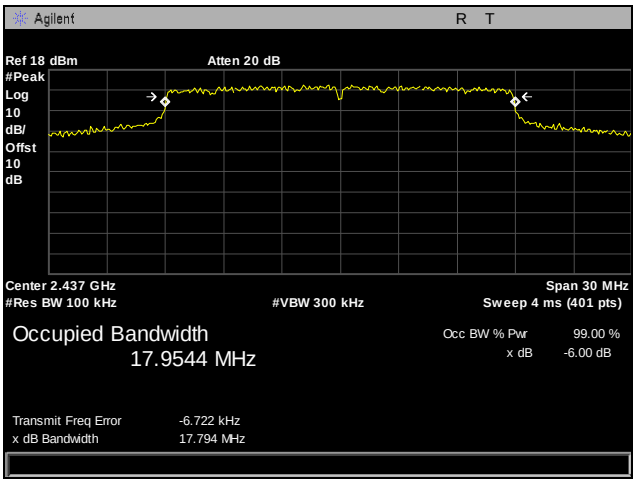


Plot 19. 6 dB Occupied Bandwidth, 802.11g, 2462 MHz, Port 3

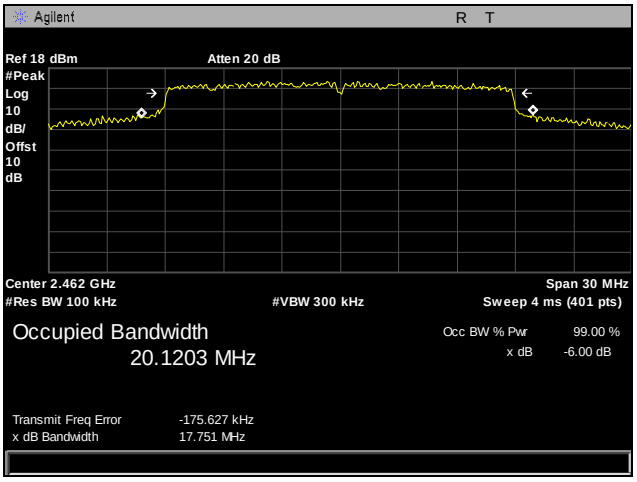
6 dB Occupied Bandwidth Test Results, 802.11n 20 MHz, 2.4 GHz, Port 1



Plot 20. 6 dB Occupied Bandwidth, 802.11n 20 MHz, 2412 MHz, Port 1

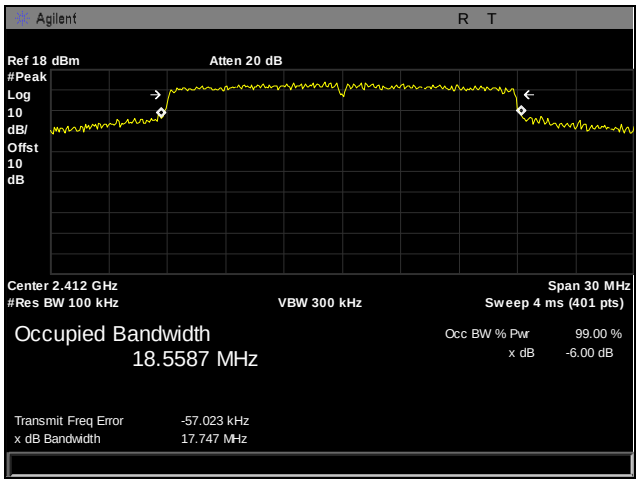


Plot 21. 6 dB Occupied Bandwidth, 802.11n 20 MHz, 2437 MHz, Port 1

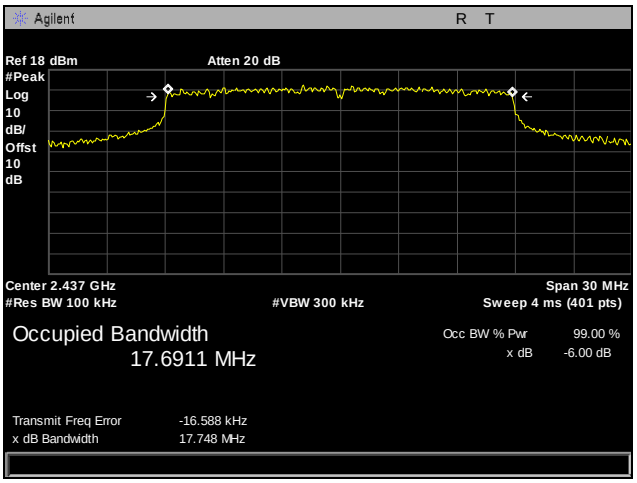


Plot 22. 6 dB Occupied Bandwidth, 802.11n 20 MHz, 2462 MHz, Port 1

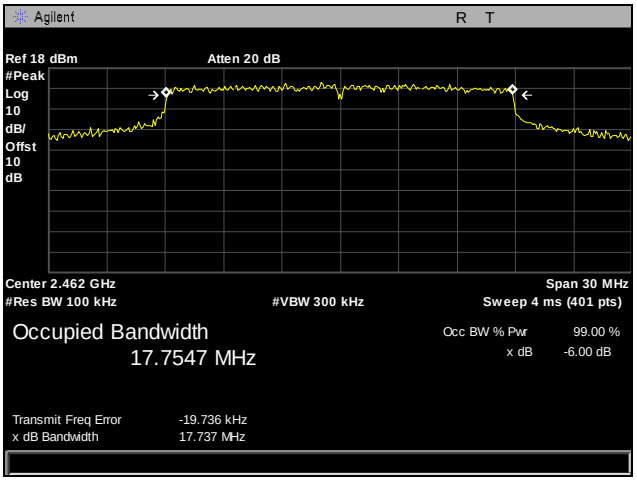
6 dB Occupied Bandwidth Test Results, 802.11n 20 MHz, 2.4 GHz, Port 2



Plot 23. 6 dB Occupied Bandwidth, 802.11n 20 MHz, 2412 MHz, Port 2

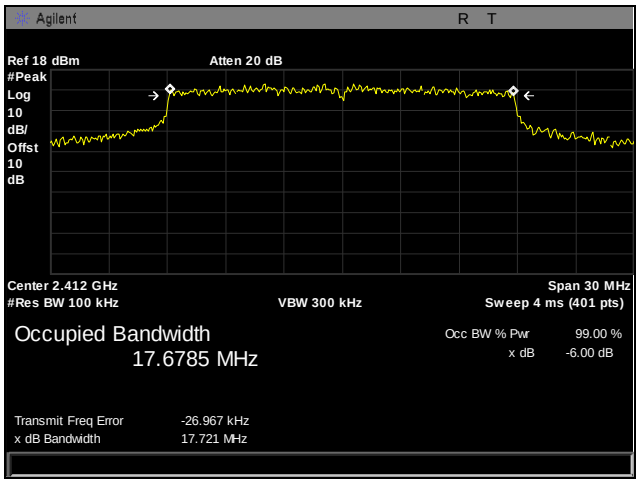


Plot 24. 6 dB Occupied Bandwidth, 802.11n 20 MHz, 2437 MHz, Port 2

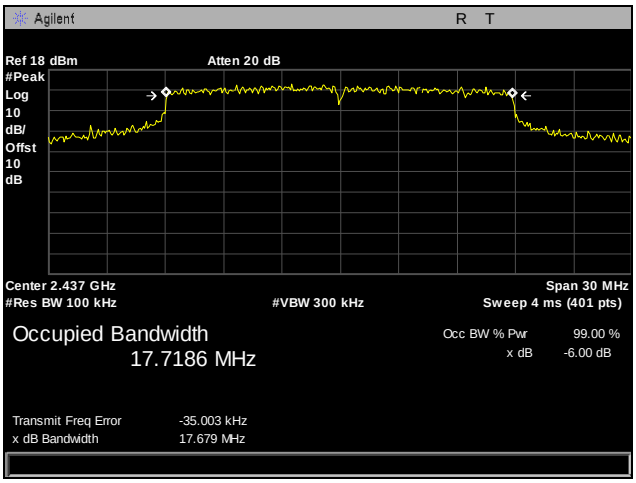


Plot 25. 6 dB Occupied Bandwidth, 802.11n 20 MHz, 2462 MHz, Port 2

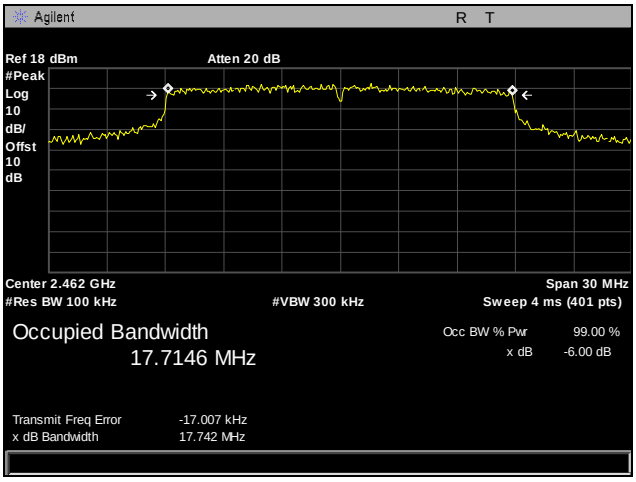
6 dB Occupied Bandwidth Test Results, 802.11n 20 MHz, 2.4 GHz, Port 3



Plot 26. 6 dB Occupied Bandwidth, 802.11n 20 MHz, 2412 MHz, Port 3

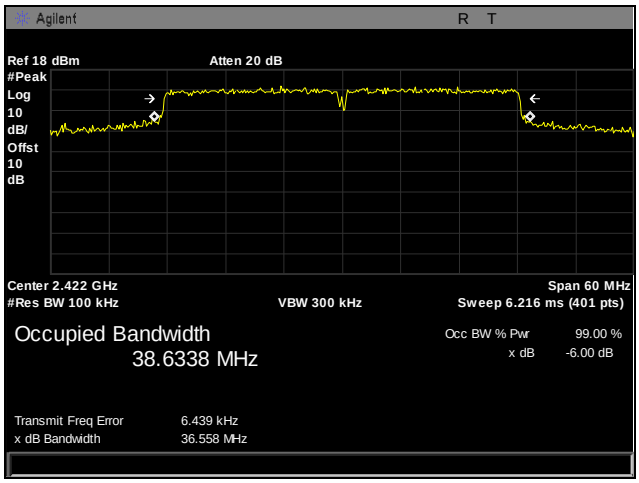


Plot 27. 6 dB Occupied Bandwidth, 802.11n 20 MHz, 2437 MHz, Port 3

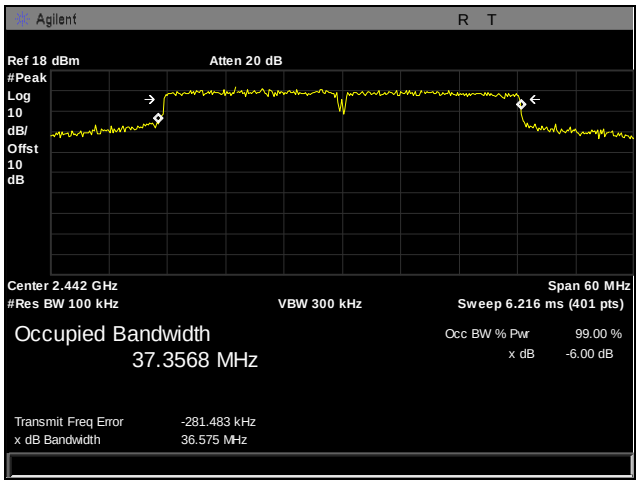


Plot 28. 6 dB Occupied Bandwidth, 802.11n 20 MHz, 2462 MHz, Port 3

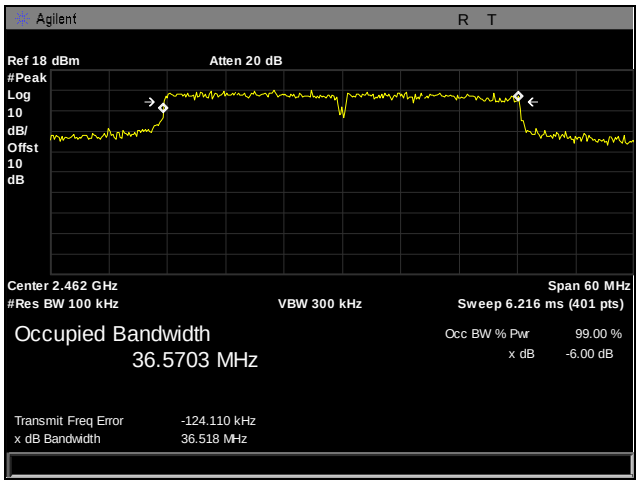
6 dB Occupied Bandwidth Test Results, 802.11n 40 MHz, 2.4 GHz, Port 1



Plot 29. 6 dB Occupied Bandwidth, 802.11n 40 MHz, 2422 MHz, Port 1

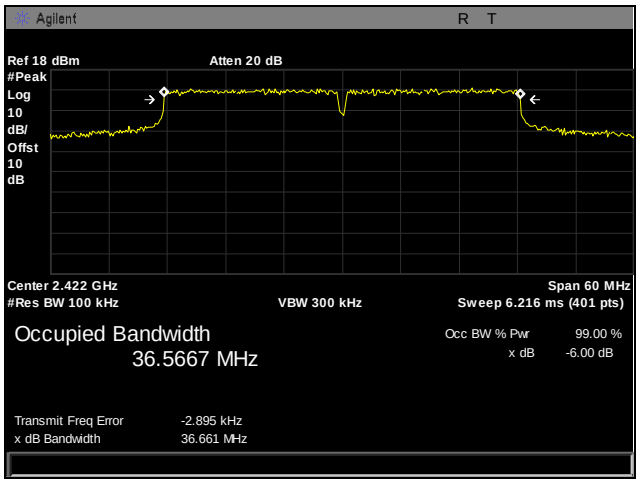


Plot 30. 6 dB Occupied Bandwidth, 802.11n 40 MHz, 2442 MHz, Port 1

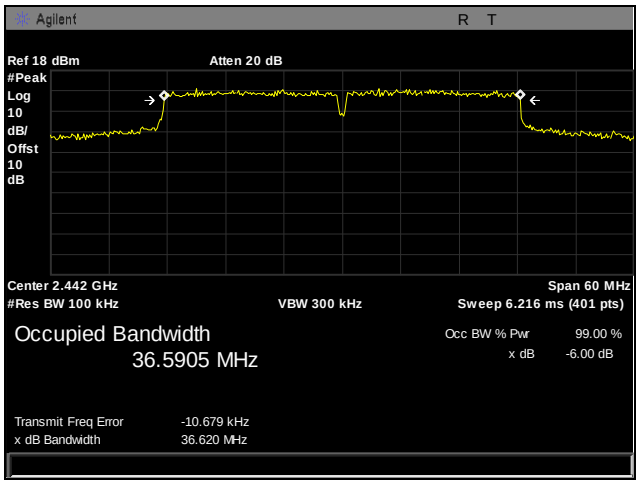


Plot 31. 6 dB Occupied Bandwidth, 802.11n 40 MHz, 2462 MHz, Port 1

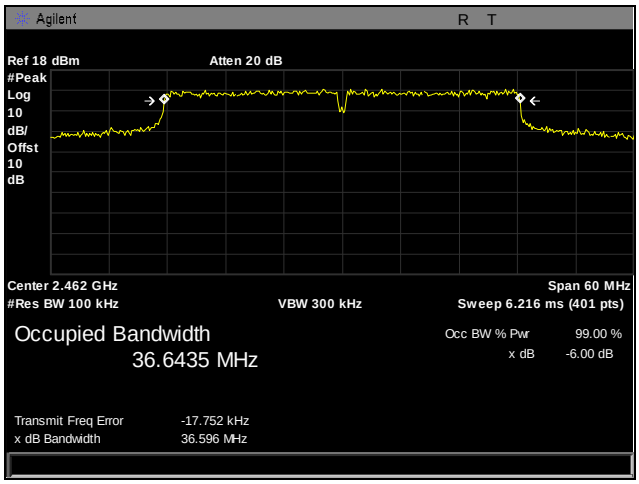
6 dB Occupied Bandwidth Test Results, 802.11n 40 MHz, 2.4 GHz, Port 2



Plot 32. 6 dB Occupied Bandwidth, 802.11n 40 MHz, 2422 MHz, Port 2

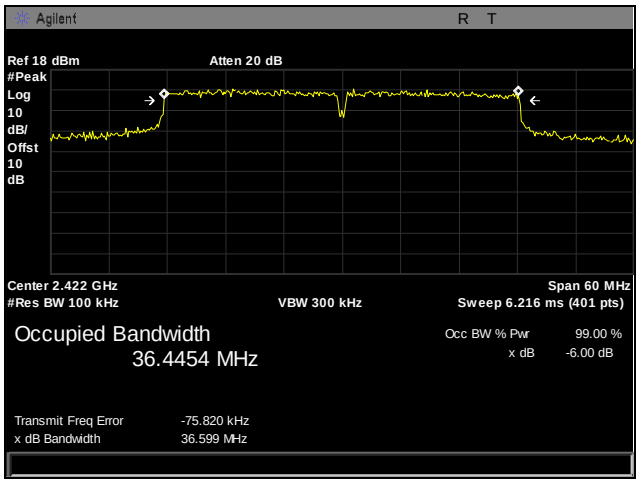


Plot 33. 6 dB Occupied Bandwidth, 802.11n 40 MHz, 2442 MHz, Port 2

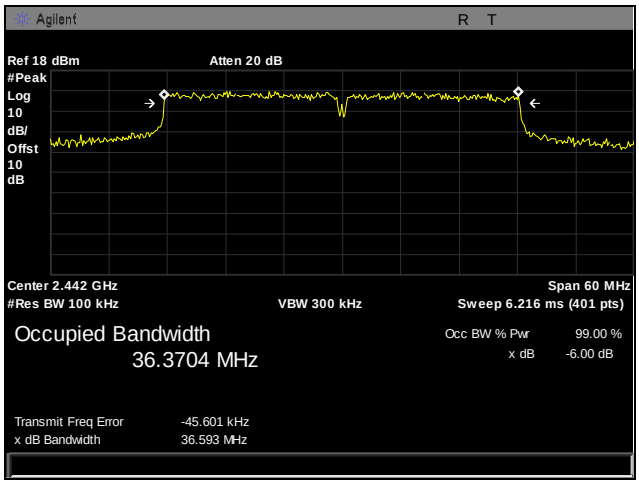


Plot 34. 6 dB Occupied Bandwidth, 802.11n 40 MHz, 2462 MHz, Port 2

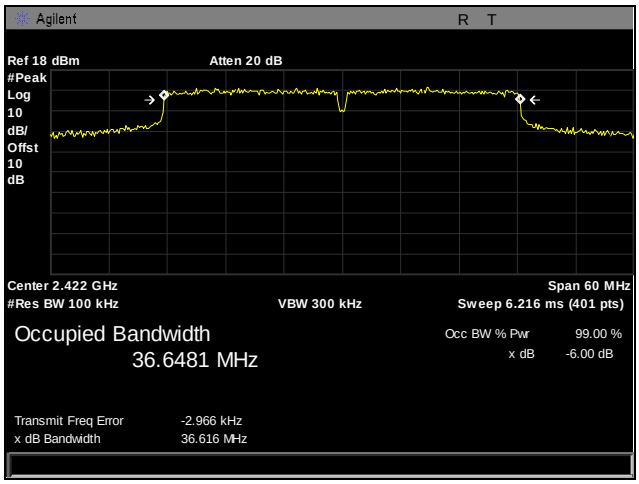
6 dB Occupied Bandwidth Test Results, 802.11n 40 MHz, 2.4 GHz, Port 3



Plot 35. 6 dB Occupied Bandwidth, 802.11n 40 MHz, 2422 MHz, Port 3

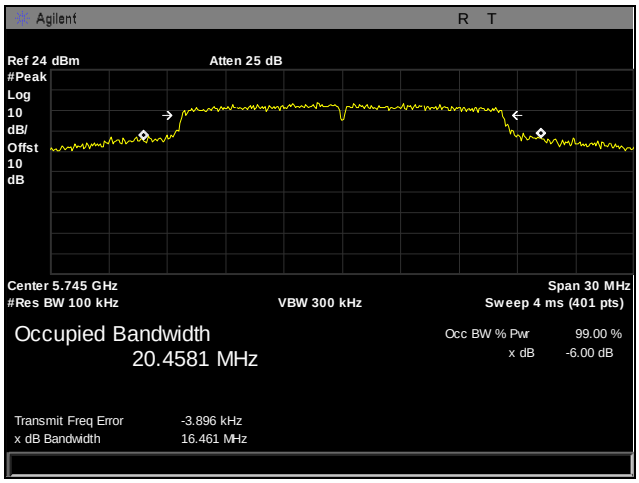


Plot 36. 6 dB Occupied Bandwidth, 802.11n 40 MHz, 2442 MHz, Port 3

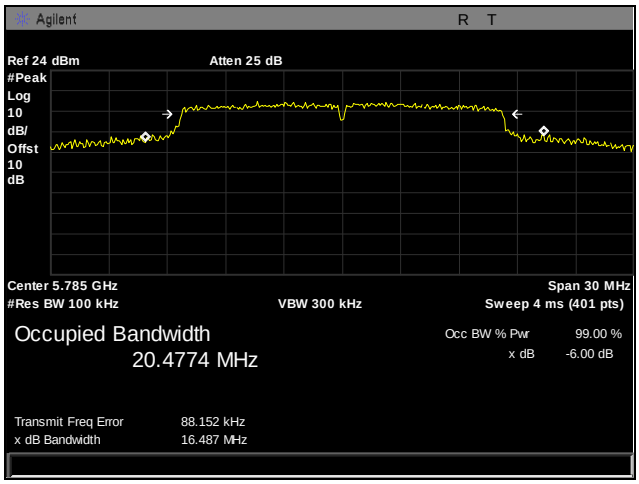


Plot 37. 6 dB Occupied Bandwidth, 802.11n 40 MHz, 2462 MHz, Port 3

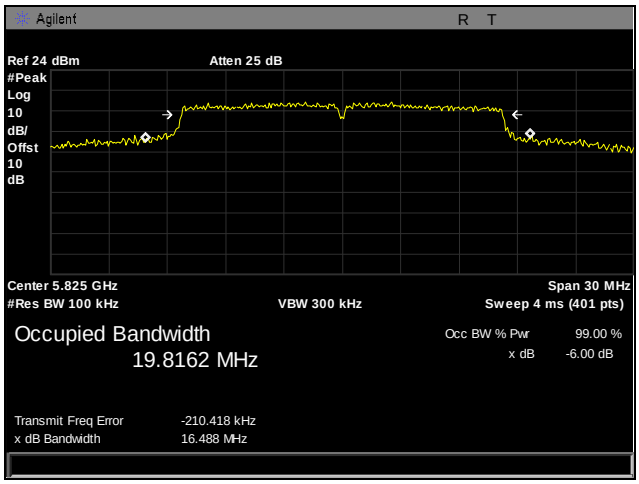
6 dB Occupied Bandwidth Test Results, 802.11a, 5.8 GHz, Port 1



Plot 38. 6 dB Occupied Bandwidth, 802.11a, 5745 MHz, Port 1

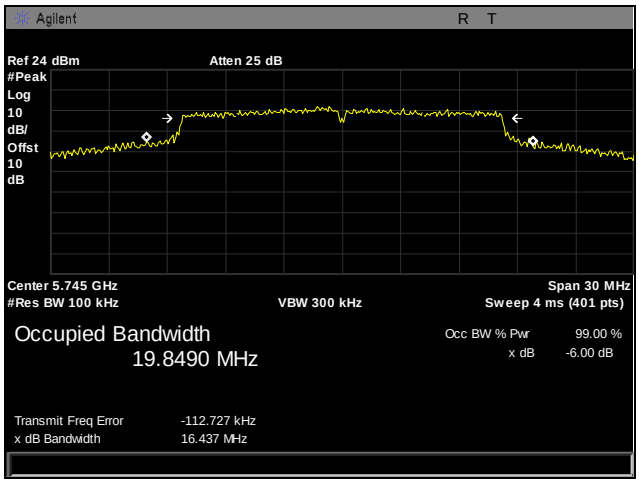


Plot 39. 6 dB Occupied Bandwidth, 802.11a, 5785 MHz, Port 1

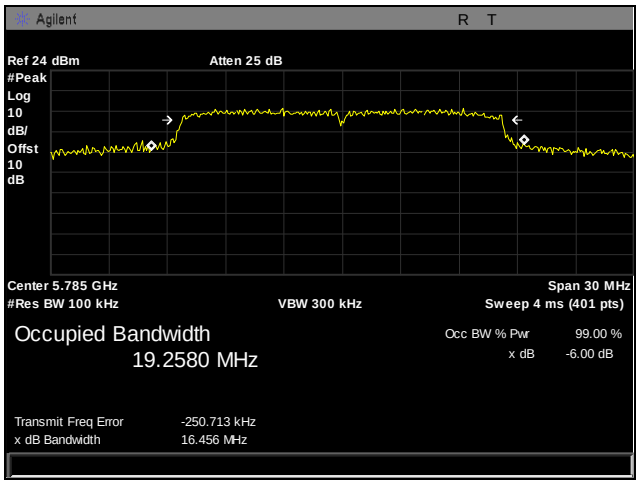


Plot 40. 6 dB Occupied Bandwidth, 802.11a, 5825 MHz, Port 1

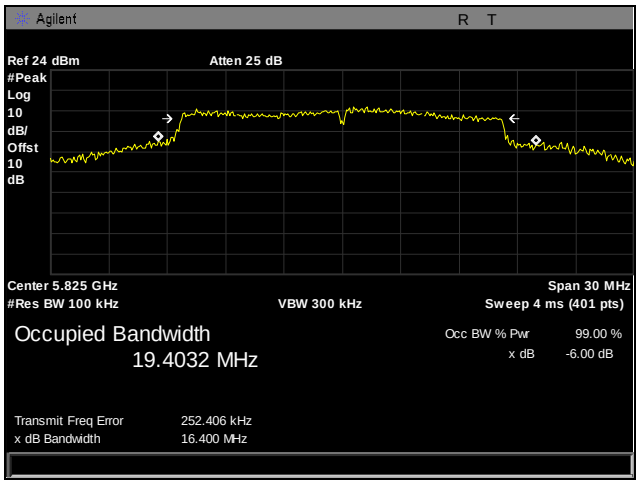
6 dB Occupied Bandwidth Test Results, 802.11a, 5.8 GHz, Port 2



Plot 41. 6 dB Occupied Bandwidth, 802.11a, 5745 MHz, Port 2

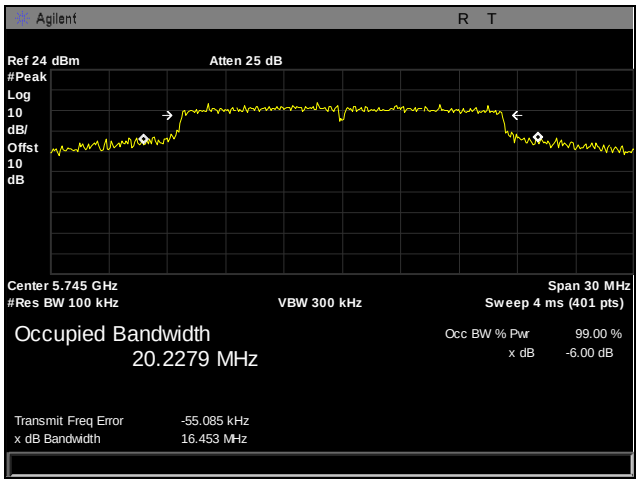


Plot 42. 6 dB Occupied Bandwidth, 802.11a, 5785 MHz, Port 2

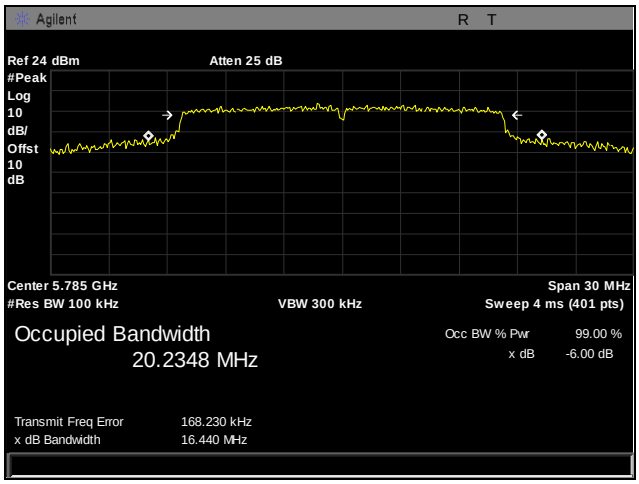


Plot 43. 6 dB Occupied Bandwidth, 802.11a, 5825 MHz, Port 2

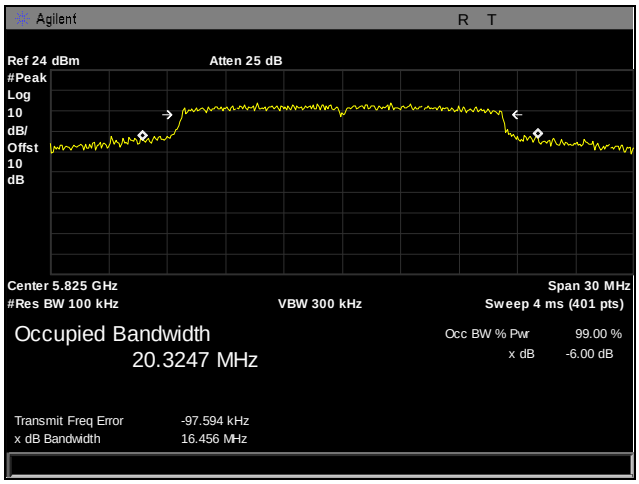
6 dB Occupied Bandwidth Test Results, 802.11a, 5.8 GHz, Port 3



Plot 44. 6 dB Occupied Bandwidth, 802.11a, 5745 MHz, Port 3

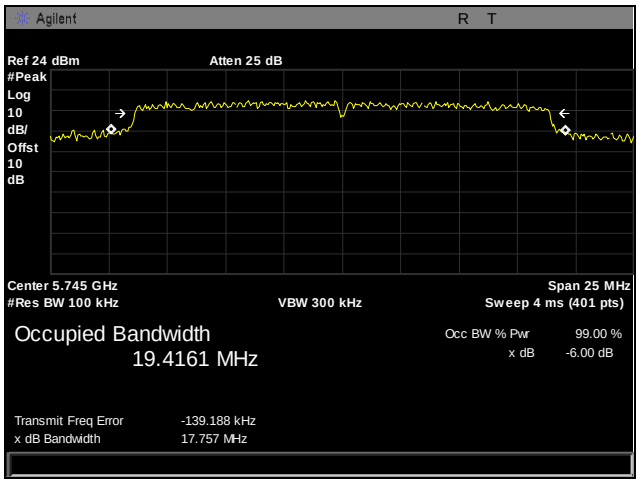


Plot 45. 6 dB Occupied Bandwidth, 802.11a, 5785 MHz, Port 3

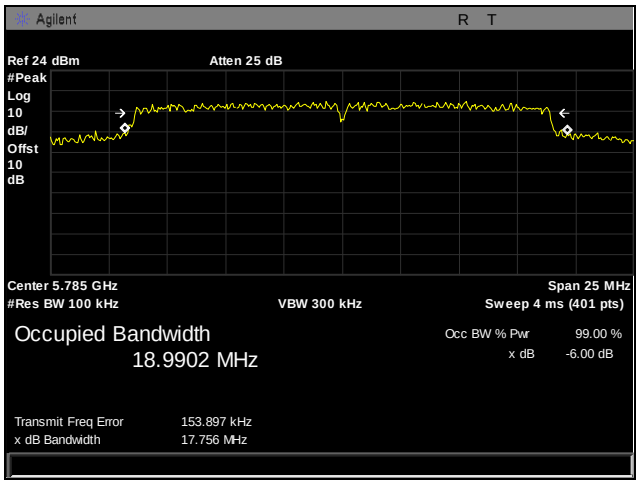


Plot 46. 6 dB Occupied Bandwidth, 802.11a, 5825 MHz, Port 3

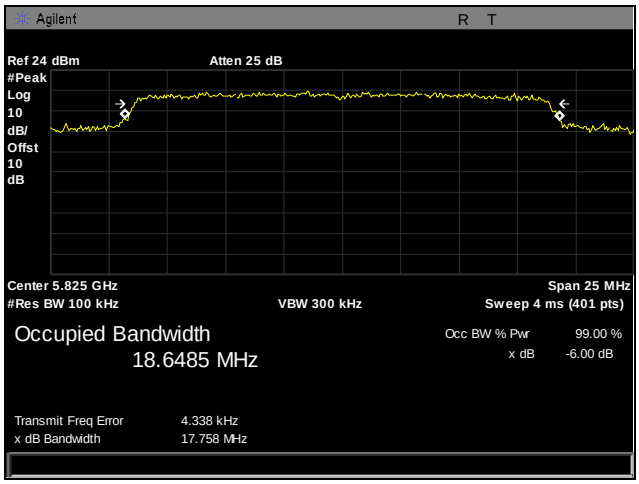
6 dB Occupied Bandwidth Test Results, 802.11n 20 MHz, 5.8 GHz, Port 1



Plot 47. 6 dB Occupied Bandwidth, 802.11n 20 MHz, 5745 MHz, Port 1

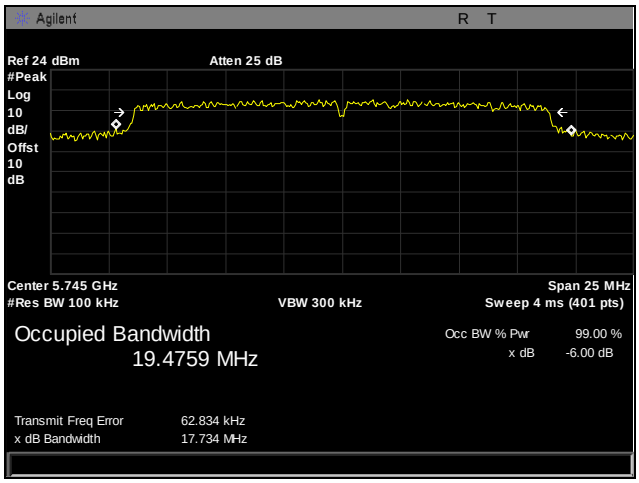


Plot 48. 6 dB Occupied Bandwidth, 802.11n 20 MHz, 5785 MHz, Port 1

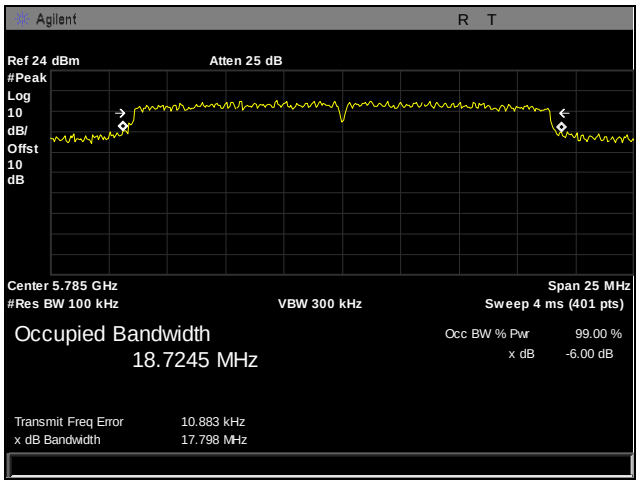


Plot 49. 6 dB Occupied Bandwidth, 802.11n 20 MHz, 5825 MHz, Port 1

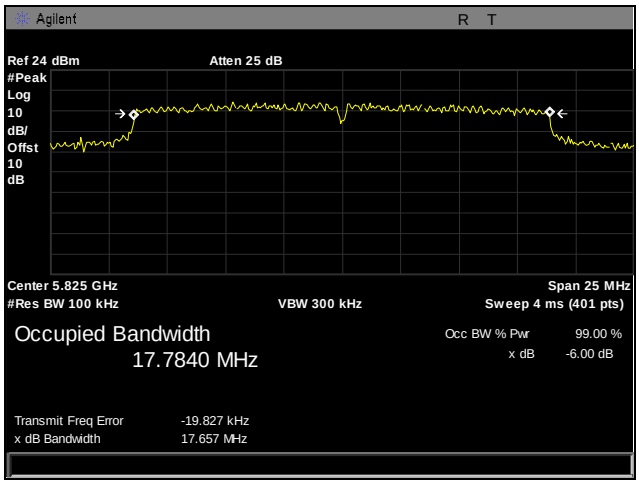
6 dB Occupied Bandwidth Test Results, 802.11n 20 MHz, 5.8 GHz, Port 2



Plot 50. 6 dB Occupied Bandwidth, 802.11n 20 MHz, 5745 MHz, Port 2

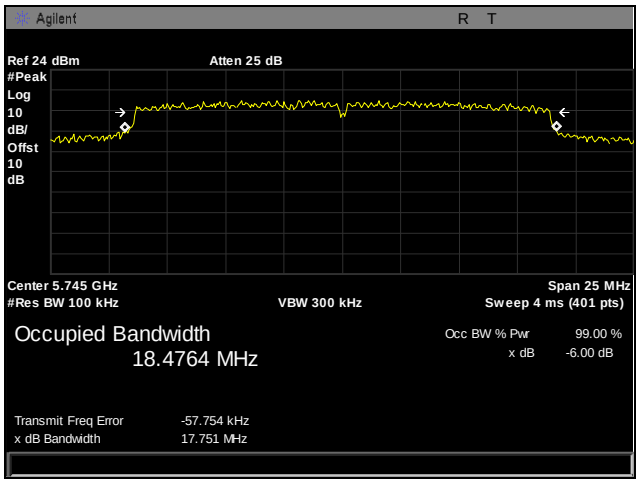


Plot 51. 6 dB Occupied Bandwidth, 802.11n 20 MHz, 5785 MHz, Port 2

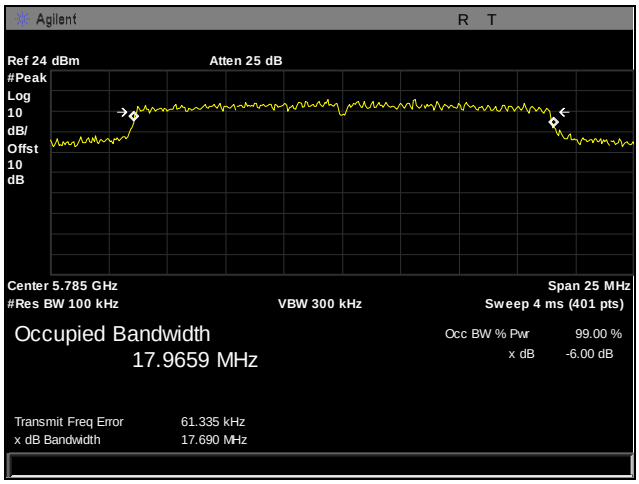


Plot 52. 6 dB Occupied Bandwidth, 802.11n 20 MHz, 5825 MHz, Port 2

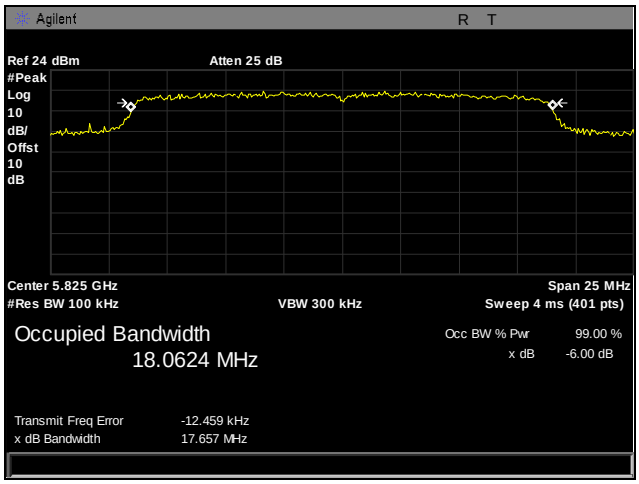
6 dB Occupied Bandwidth Test Results, 802.11n 20 MHz, 5.8 GHz, Port 3



Plot 53. 6 dB Occupied Bandwidth, 802.11n 20 MHz, 5745 MHz, Port 3

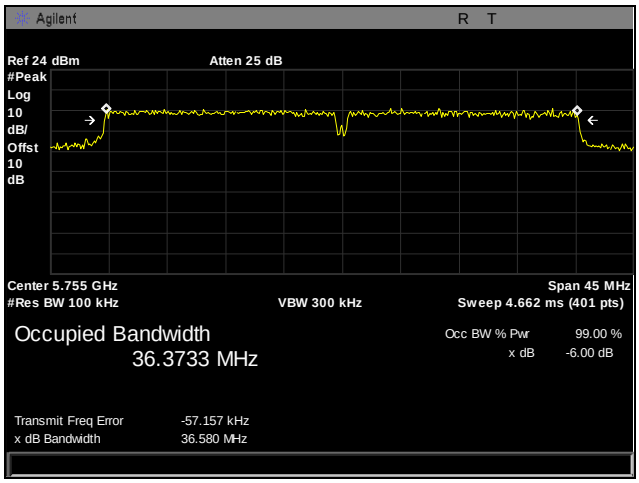


Plot 54. 6 dB Occupied Bandwidth, 802.11n 20 MHz, 5785 MHz, Port 3

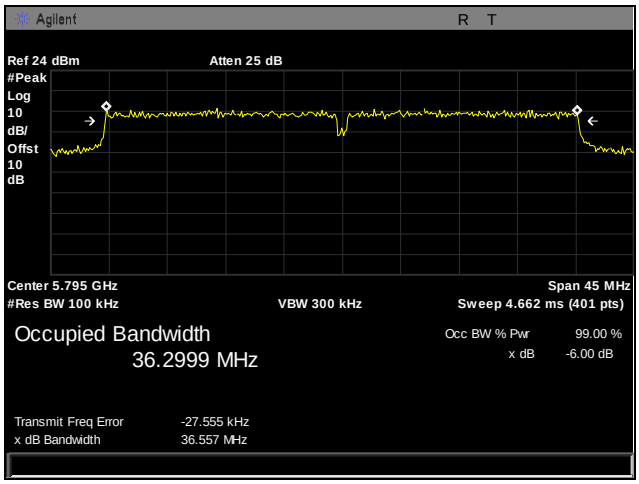


Plot 55. 6 dB Occupied Bandwidth, 802.11n 20 MHz, 5825 MHz, Port 3

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

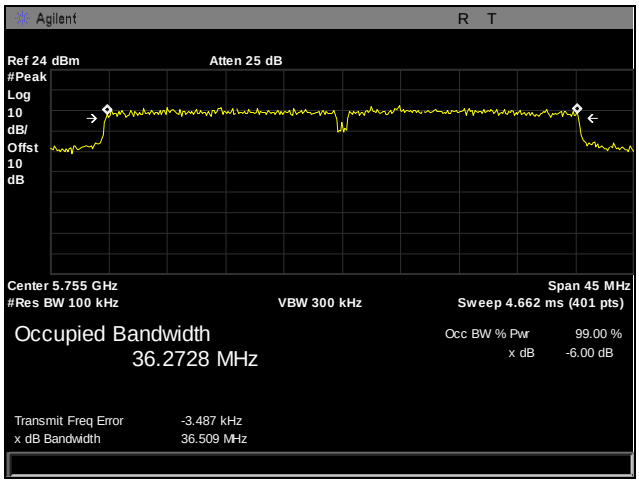


Plot 56. 6 dB Occupied Bandwidth, 802.11n 40 MHz, 5755 MHz, Port 1

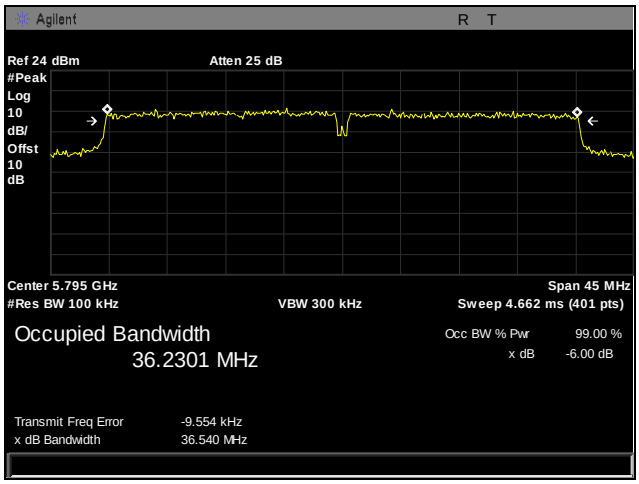


Plot 57. 6 dB Occupied Bandwidth, 802.11n 40 MHz, 5795 MHz, Port 1

6 dB Occupied Bandwidth Test Results, 802.11n 40 MHz, 5.8 GHz, Port 2

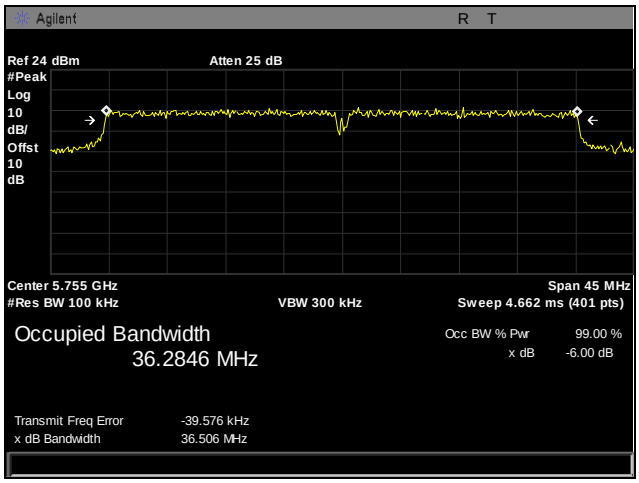


Plot 58. 6 dB Occupied Bandwidth, 802.11n 40 MHz, 5755 MHz, Port 2

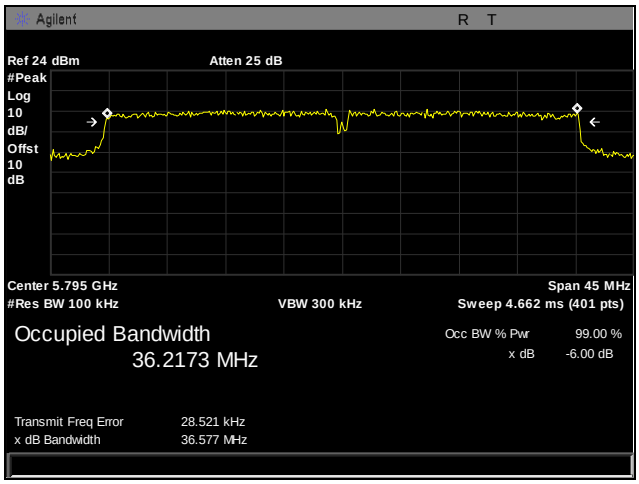


Plot 59. 6 dB Occupied Bandwidth, 802.11n 40 MHz, 5795 MHz, Port 2

6 dB Occupied Bandwidth Test Results, 802.11n 40 MHz, 5.8 GHz, Port 3

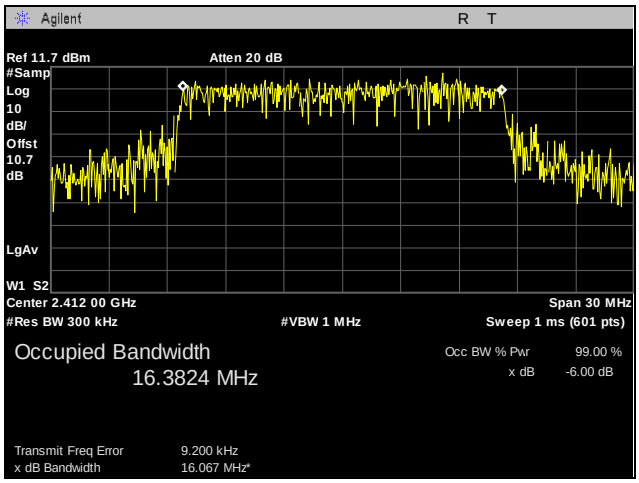


Plot 60. 6 dB Occupied Bandwidth, 802.11n 40 MHz, 5755 MHz, Port 3

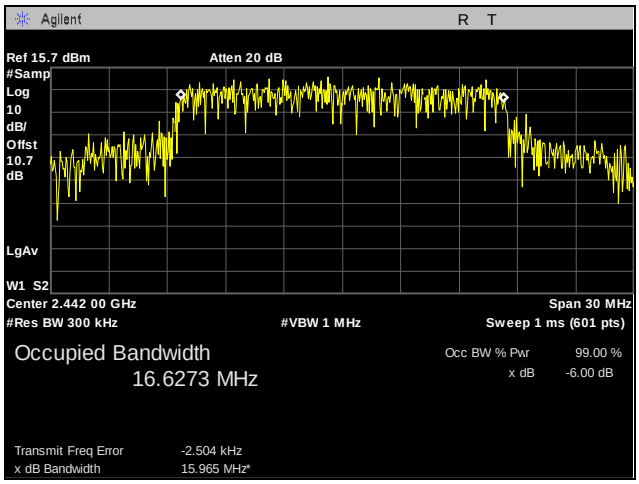


Plot 61. 6 dB Occupied Bandwidth, 802.11n 40 MHz, 5795 MHz, Port 3

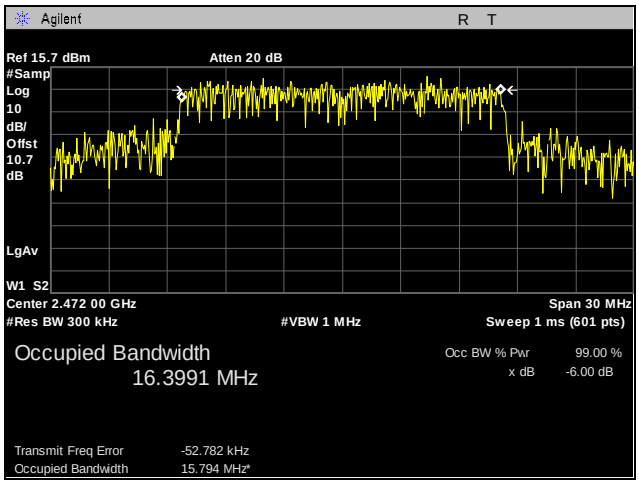
99% Occupied Bandwidth Test Results, 802.11g, 2.4 GHz, Port 1



Plot 62. 99% Occupied Bandwidth, 802.11g, 2412 MHz, Port 1

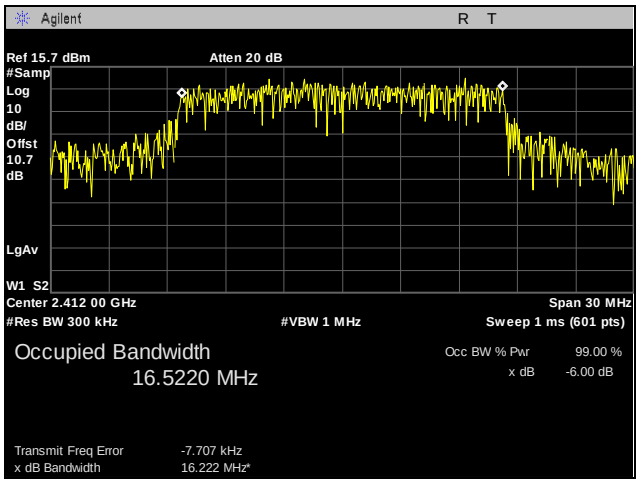


Plot 63. 99% Occupied Bandwidth, 802.11g, 2442 MHz, Port 1

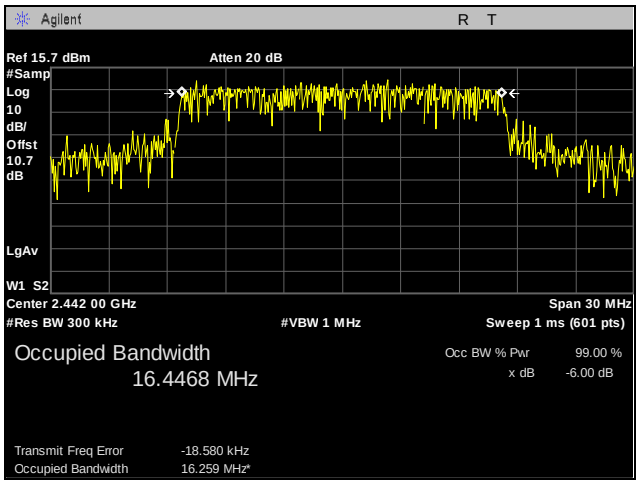


Plot 64. 99% Occupied Bandwidth, 802.11g, 2472 MHz, Port 1

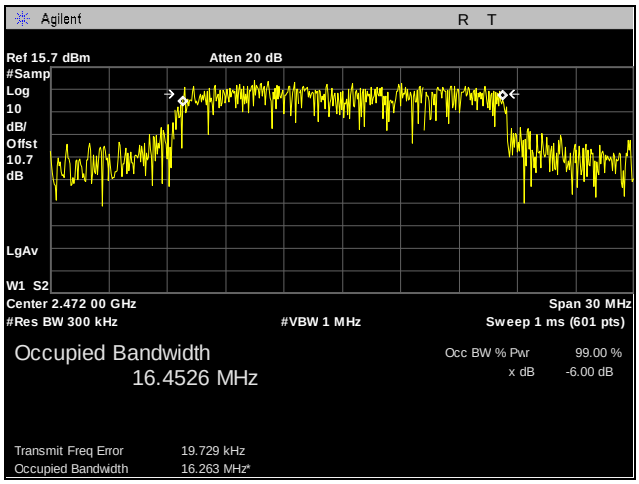
99% Occupied Bandwidth Test Results, 802.11g, 2.4 GHz, Port 2



Plot 65. 99% Occupied Bandwidth, 802.11g, 2412 MHz, Port 2

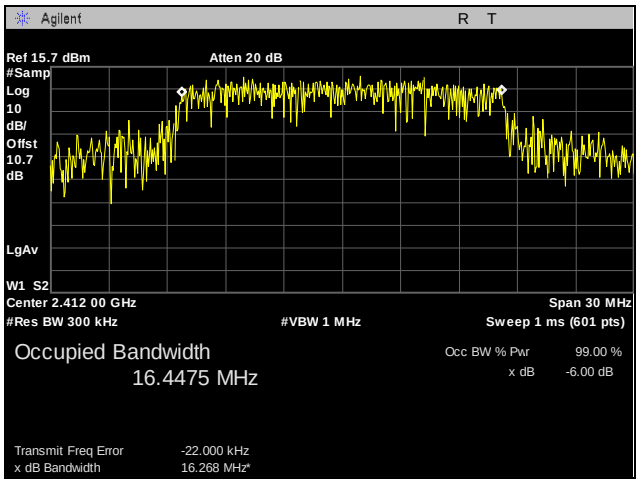


Plot 66. 99% Occupied Bandwidth, 802.11g, 2442 MHz, Port 2

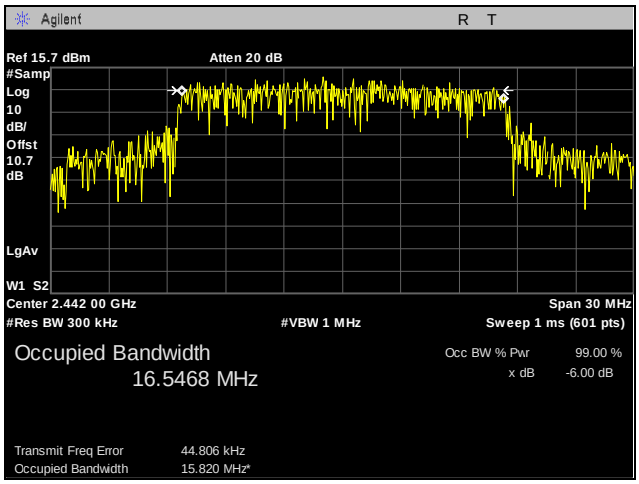


Plot 67. 99% Occupied Bandwidth, 802.11g, 2472 MHz, Port 2

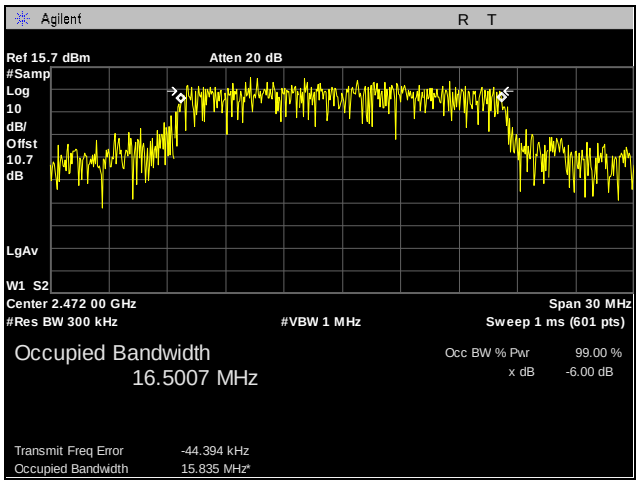
99% Occupied Bandwidth Test Results, 802.11g, 2.4 GHz, Port 3



Plot 68. 99% Occupied Bandwidth, 802.11g, 2412 MHz, Port 3

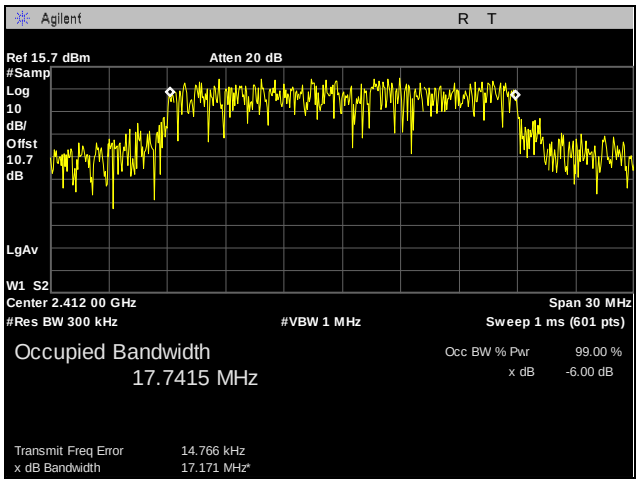


Plot 69. 99% Occupied Bandwidth, 802.11g, 2442 MHz, Port 3

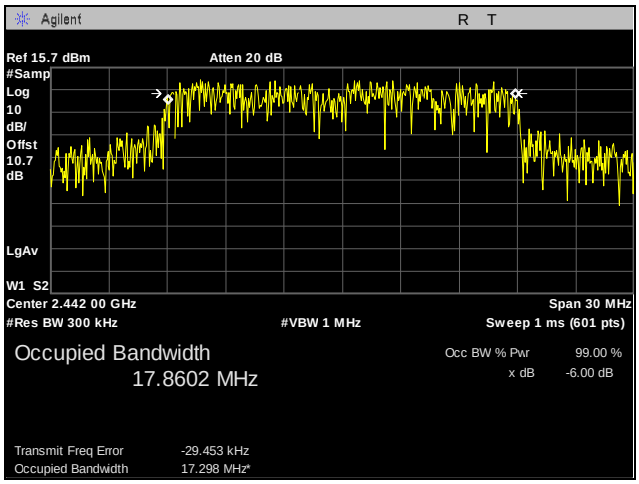


Plot 70. 99% Occupied Bandwidth, 802.11g, 2472 MHz, Port 3

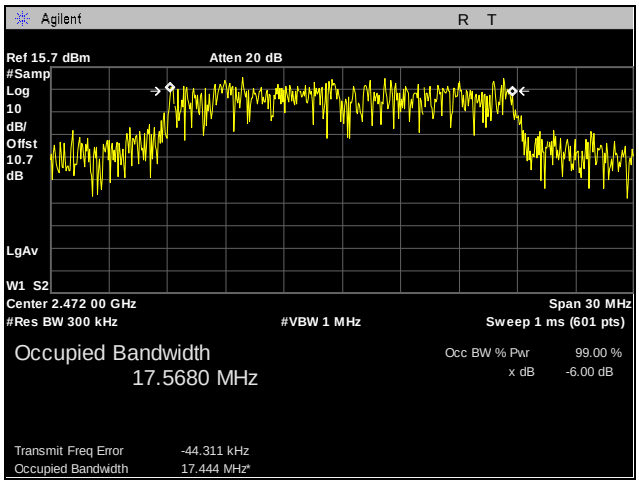
99% Occupied Bandwidth Test Results, 802.11n 20 MHz, 2.4 GHz, Port 1



Plot 71. 99% Occupied Bandwidth, 802.11n 20 MHz, 2412 MHz, Port 1

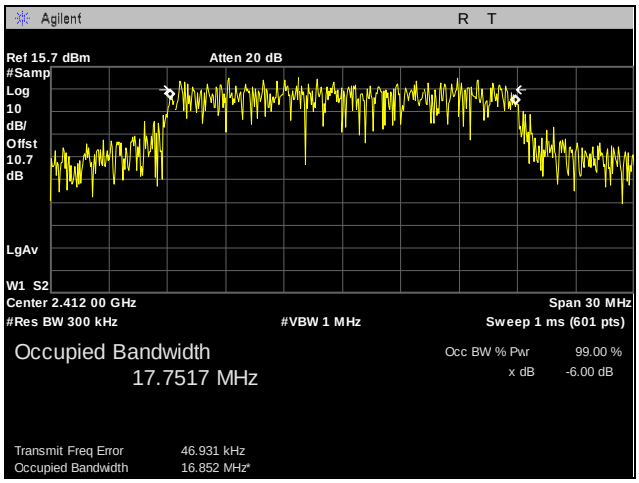


Plot 72. 99% Occupied Bandwidth, 802.11n 20 MHz, 2442 MHz, Port 1

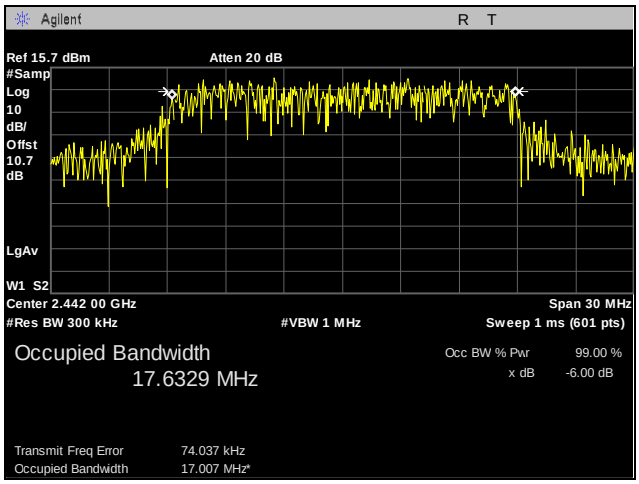


Plot 73. 99% Occupied Bandwidth, 802.11n 20 MHz, 2472 MHz, Port 1

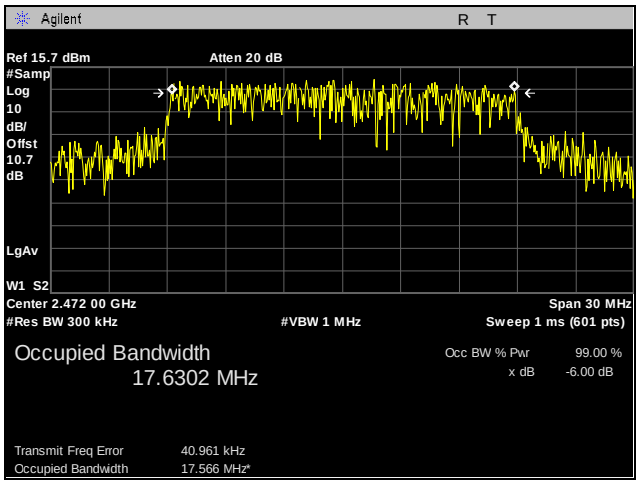
99% Occupied Bandwidth Test Results, 802.11n 20 MHz, 2.4 GHz, Port 2



Plot 74. 99% Occupied Bandwidth, 802.11n 20 MHz, 2412 MHz, Port 2

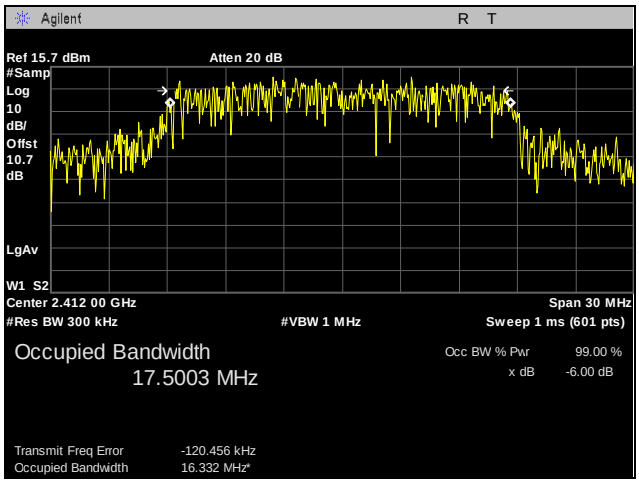


Plot 75. 99% Occupied Bandwidth, 802.11n 20 MHz, 2442 MHz, Port 2

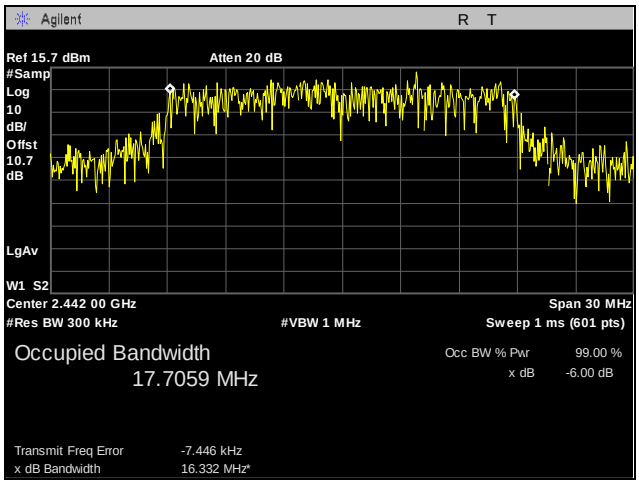


Plot 76. 99% Occupied Bandwidth, 802.11n 20 MHz, 2472 MHz, Port 2

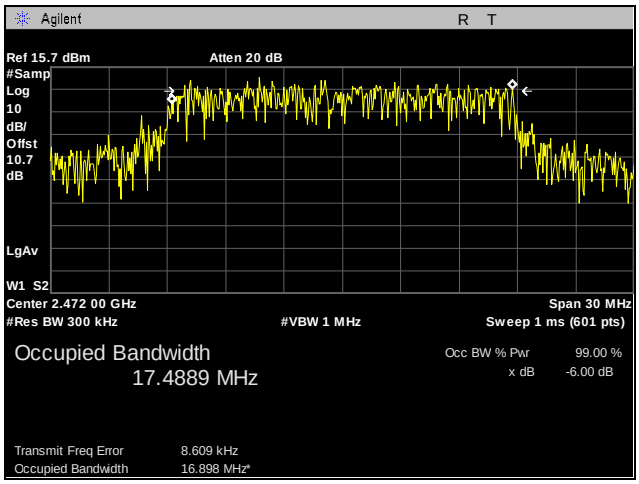
99% Occupied Bandwidth Test Results, 802.11n 20 MHz, 2.4 GHz, Port 3



Plot 77. 99% Occupied Bandwidth, 802.11n 20 MHz, 2412 MHz, Port 3

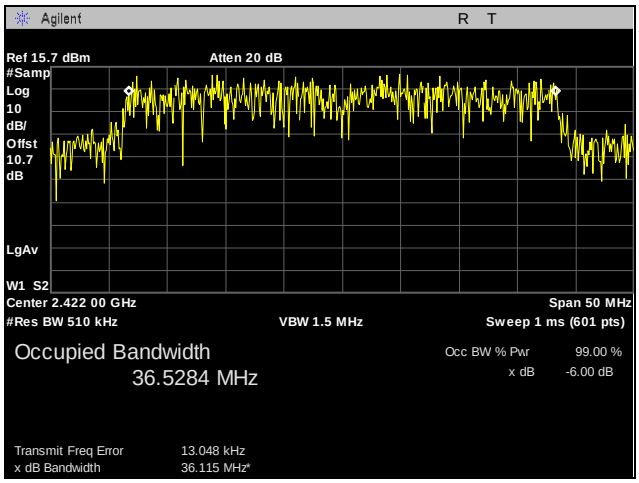


Plot 78. 99% Occupied Bandwidth, 802.11n 20 MHz, 2442 MHz, Port 3

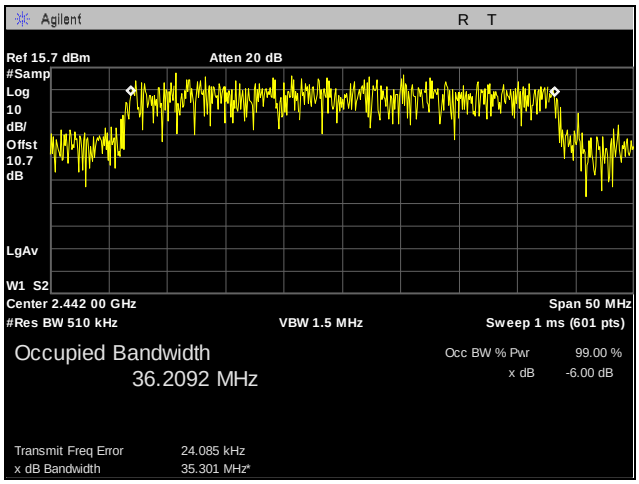


Plot 79. 99% Occupied Bandwidth, 802.11n 20 MHz, 2472 MHz, Port 3

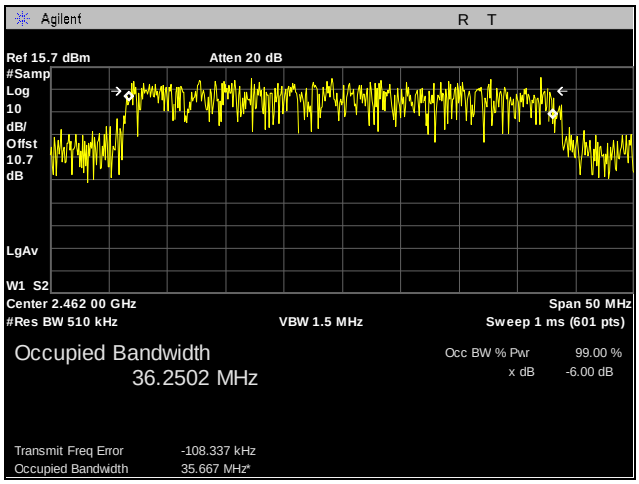
99% Occupied Bandwidth Test Results, 802.11n 40 MHz, 2.4 GHz, Port 1



Plot 80. 99% Occupied Bandwidth, 802.11n 40 MHz, 2422 MHz, Port 1

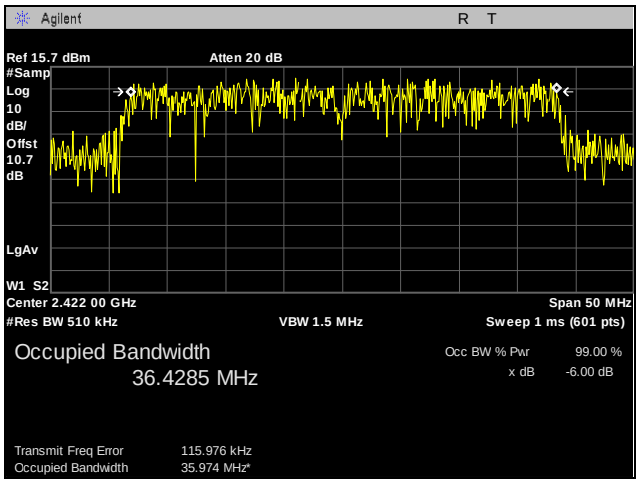


Plot 81. 99% Occupied Bandwidth, 802.11n 40 MHz, 2442 MHz, Port 1

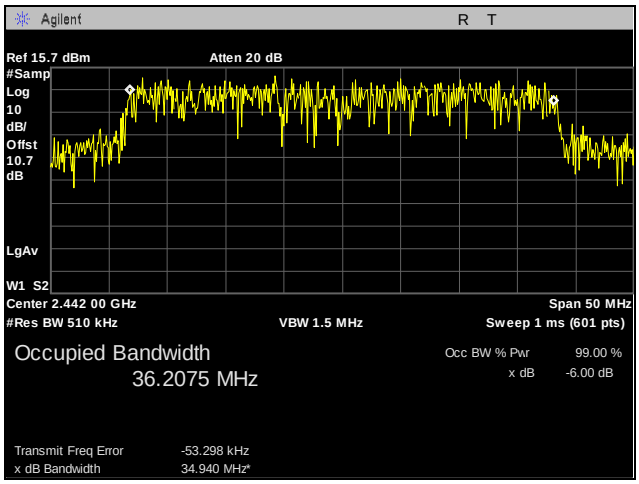


Plot 82. 99% Occupied Bandwidth, 802.11n 40 MHz, 2462 MHz, Port 1

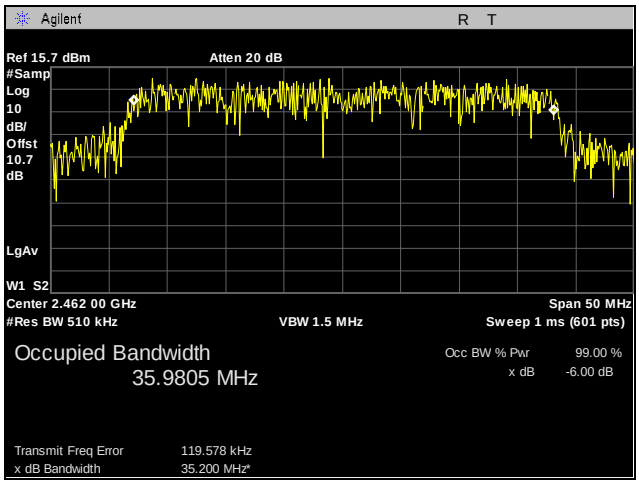
99% Occupied Bandwidth Test Results, 802.11n 40 MHz, 2.4 GHz, Port 2



Plot 83. 99% Occupied Bandwidth, 802.11n 40 MHz, 2422 MHz, Port 2

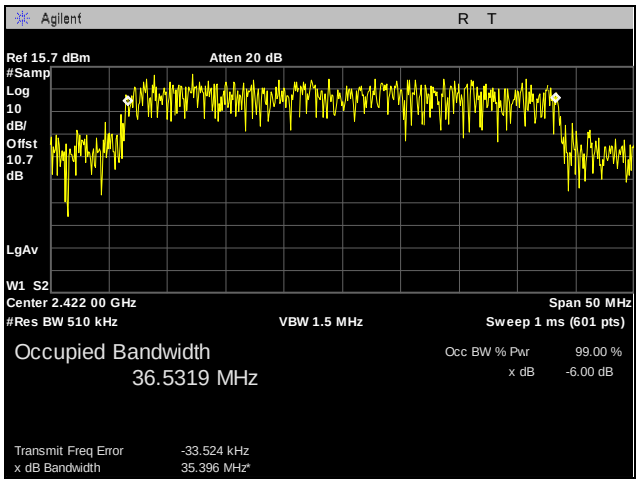


Plot 84. 99% Occupied Bandwidth, 802.11n 40 MHz, 2442 MHz, Port 2

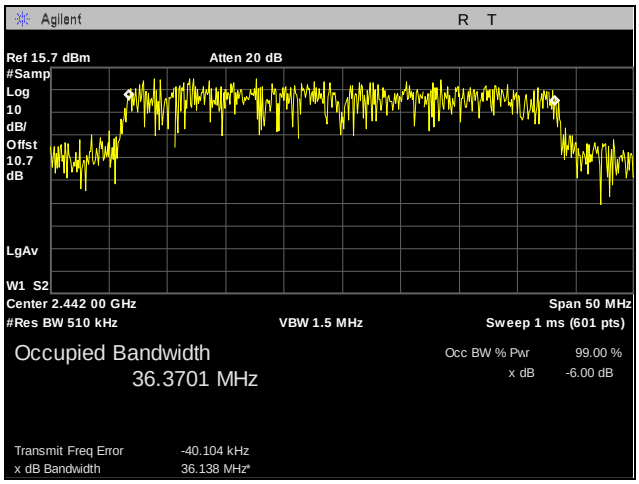


Plot 85. 99% Occupied Bandwidth, 802.11n 40 MHz, 2462 MHz, Port 2

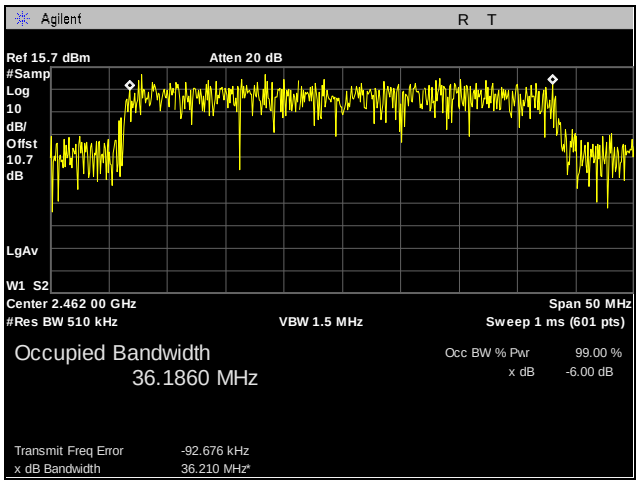
99% Occupied Bandwidth Test Results, 802.11n 40 MHz, 2.4 GHz, Port 3



Plot 86. 99% Occupied Bandwidth, 802.11n 40 MHz, 2422 MHz, Port 3

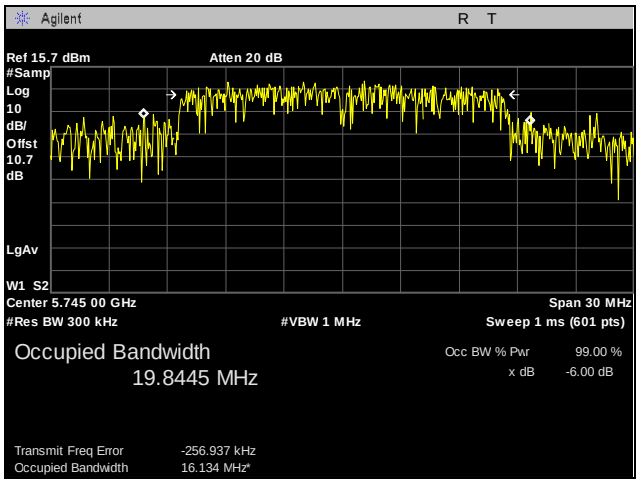


Plot 87. 99% Occupied Bandwidth, 802.11n 40 MHz, 2442 MHz, Port 3

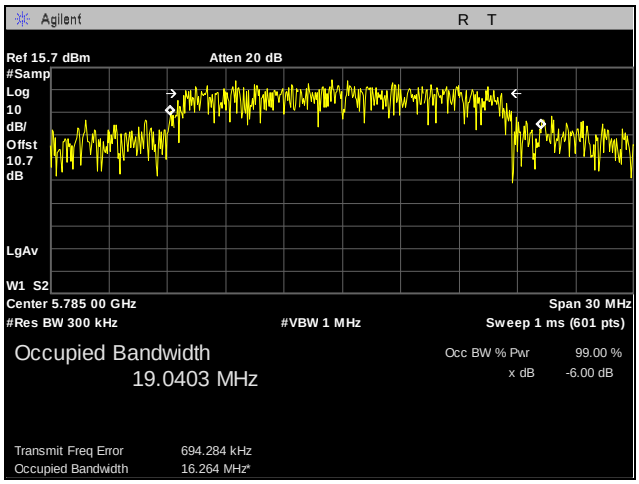


Plot 88. 99% Occupied Bandwidth, 802.11n 40 MHz, 2462 MHz, Port 3

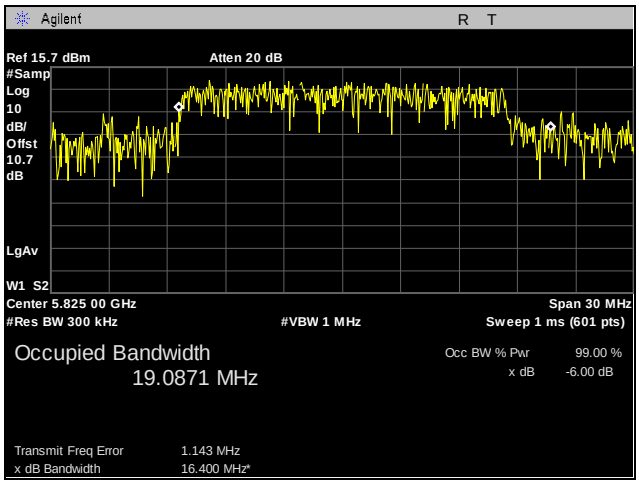
99% Occupied Bandwidth Test Results, 802.11a, 5.8 GHz, Port 1



Plot 89. 99% Occupied Bandwidth, 802.11a, 5745 MHz, Port 1

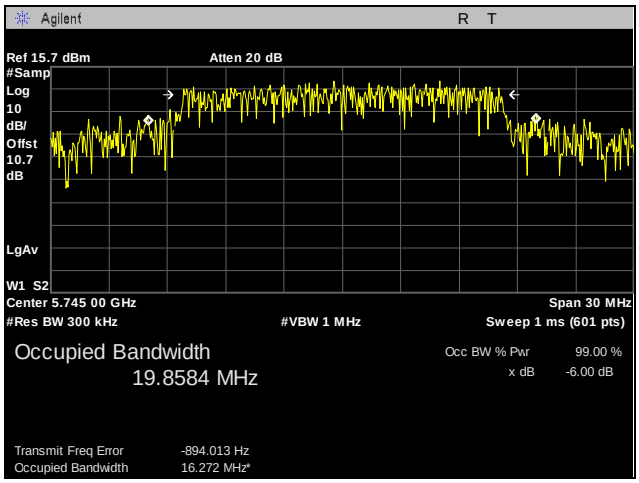


Plot 90. 99% Occupied Bandwidth, 802.11a, 5785 MHz, Port 1

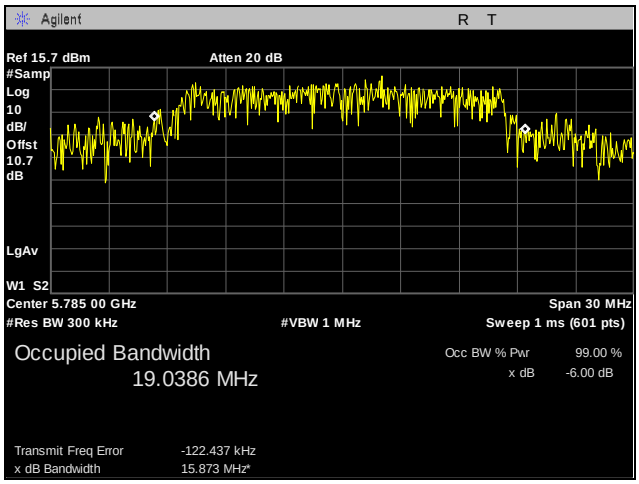


Plot 91. 99% Occupied Bandwidth, 802.11a, 5825 MHz, Port 1

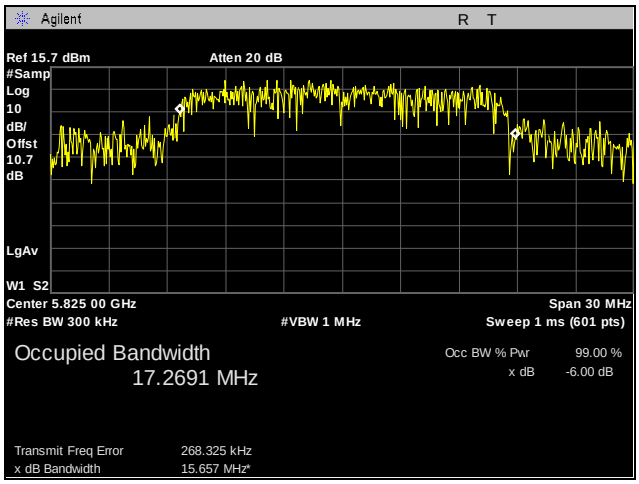
99% Occupied Bandwidth Test Results, 802.11a, 5.8 GHz, Port 2



Plot 92. 99% Occupied Bandwidth, 802.11a, 5745 MHz, Port 2

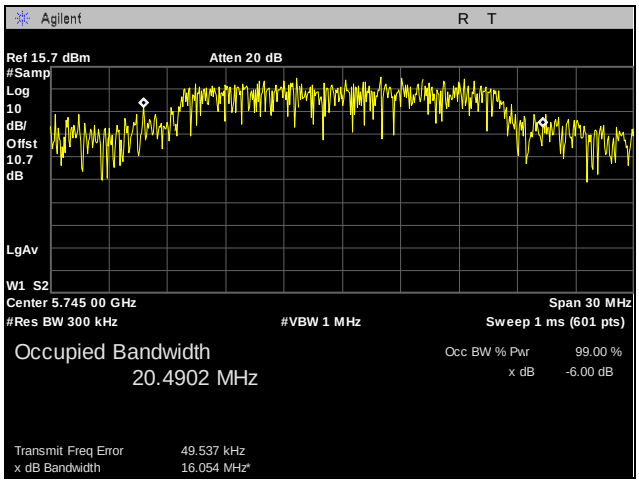


Plot 93. 99% Occupied Bandwidth, 802.11a, 5785 MHz, Port 2

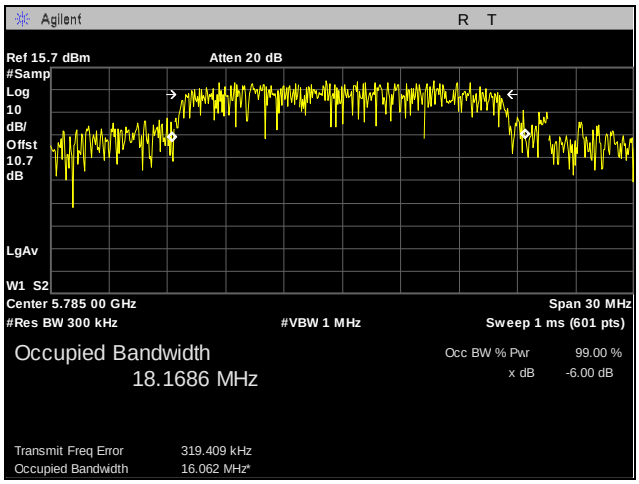


Plot 94. 99% Occupied Bandwidth, 802.11a, 5825 MHz, Port 2

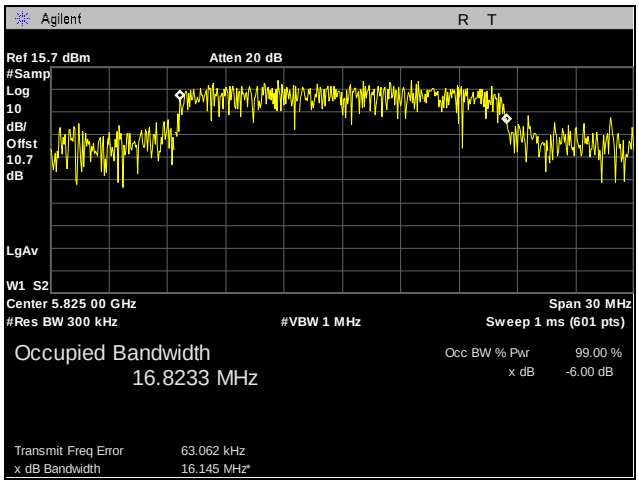
99% Occupied Bandwidth Test Results, 802.11a, 5.8 GHz, Port 3



Plot 95. 99% Occupied Bandwidth, 802.11a, 5745 MHz, Port 3

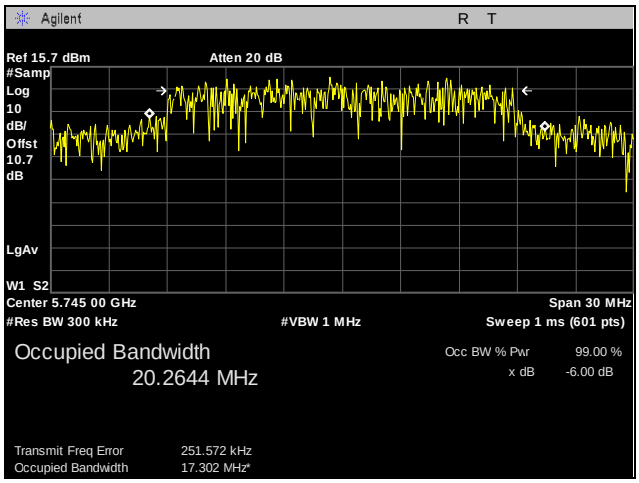


Plot 96. 99% Occupied Bandwidth, 802.11a, 5785 MHz, Port 3

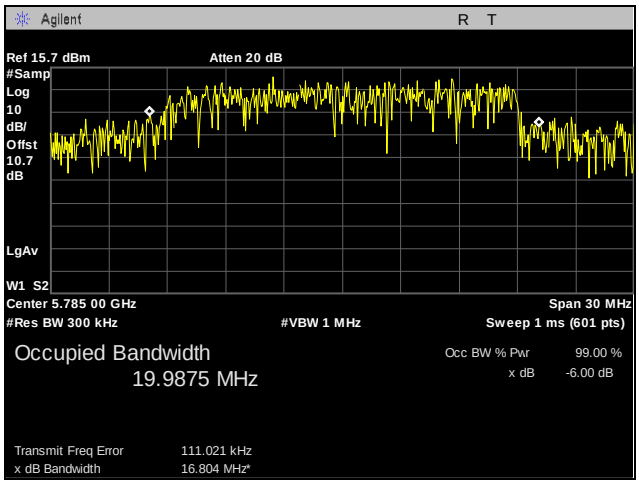


Plot 97. 99% Occupied Bandwidth, 802.11a, 5825 MHz, Port 3

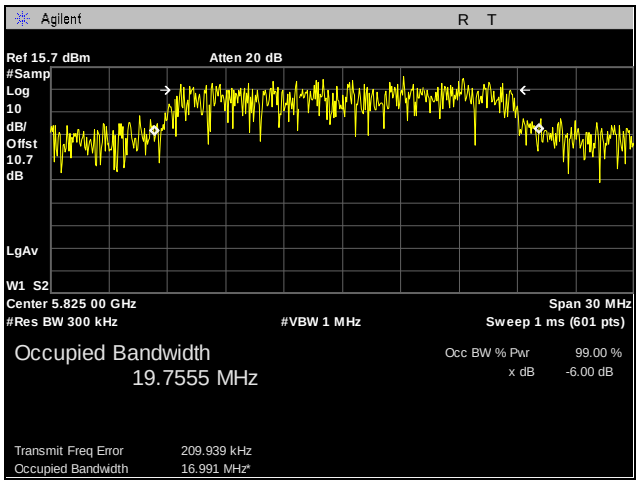
99% Occupied Bandwidth Test Results, 802.11n 20 MHz, 5.8 GHz, Port 1



Plot 98. 99% Occupied Bandwidth, 802.11n 20 MHz, 5745 MHz, Port 1

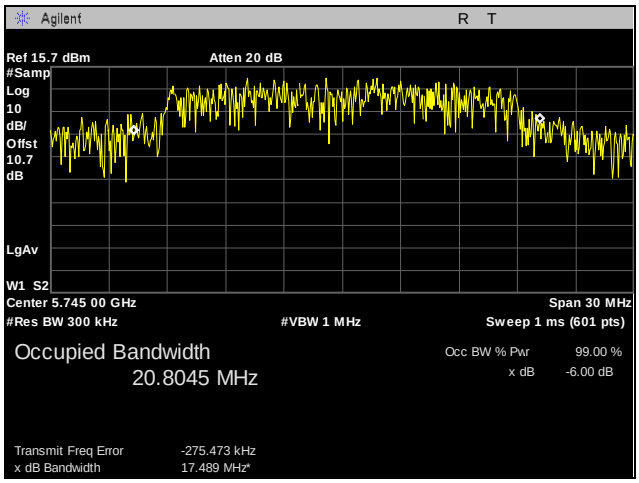


Plot 99. 99% Occupied Bandwidth, 802.11n 20 MHz, 5785 MHz, Port 1

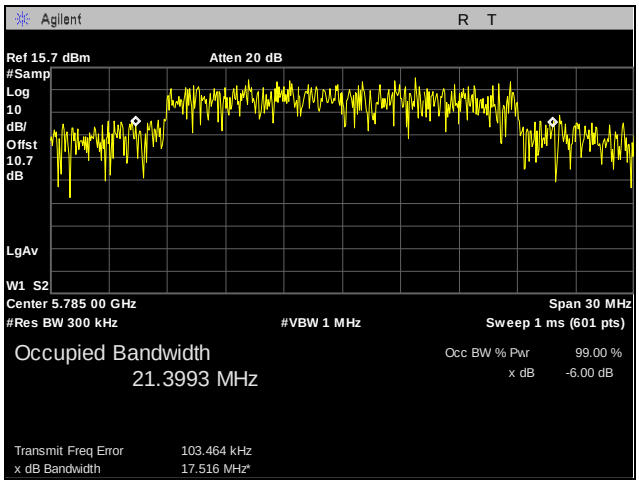


Plot 100. 99% Occupied Bandwidth, 802.11n 20 MHz, 5825 MHz, Port 1

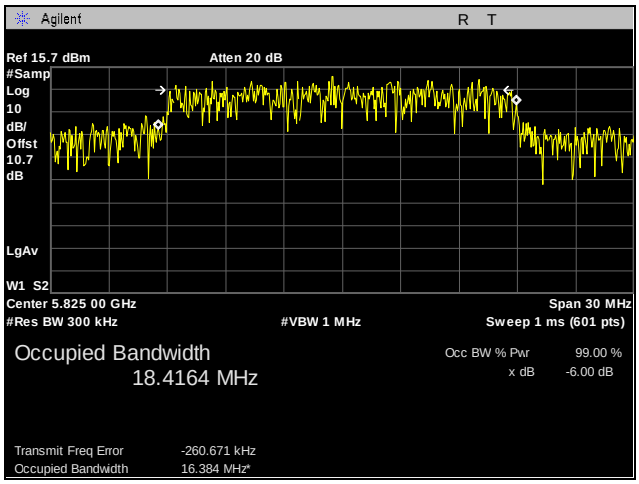
99% Occupied Bandwidth Test Results, 802.11n 20 MHz, 5.8 GHz, Port 2



Plot 101. 99% Occupied Bandwidth, 802.11n 20 MHz, 5745 MHz, Port 2

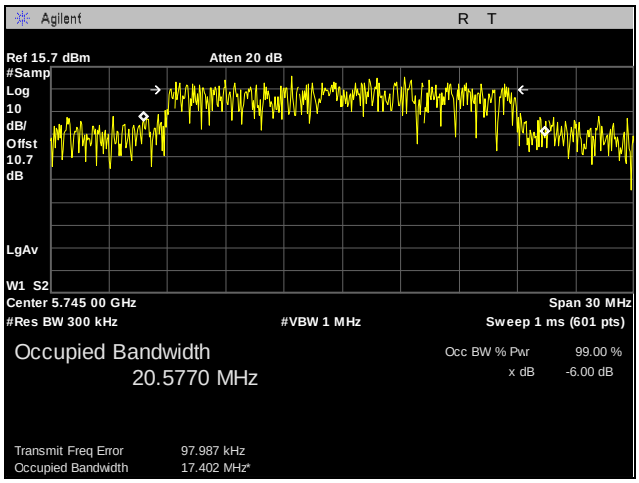


Plot 102. 99% Occupied Bandwidth, 802.11n 20 MHz, 5785 MHz, Port 2

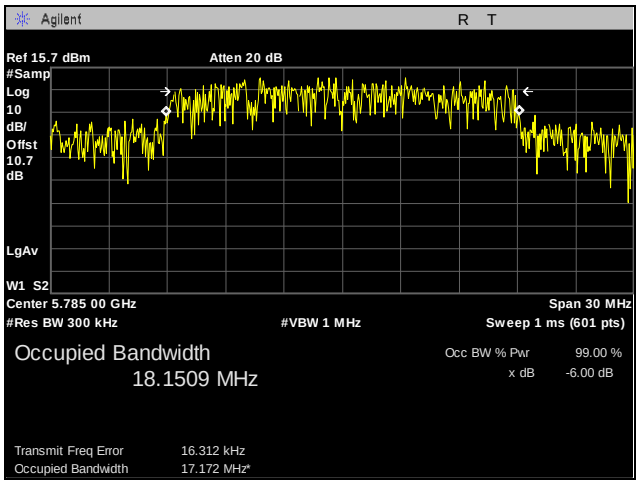


Plot 103. 99% Occupied Bandwidth, 802.11n 20 MHz, 5825 MHz, Port 2

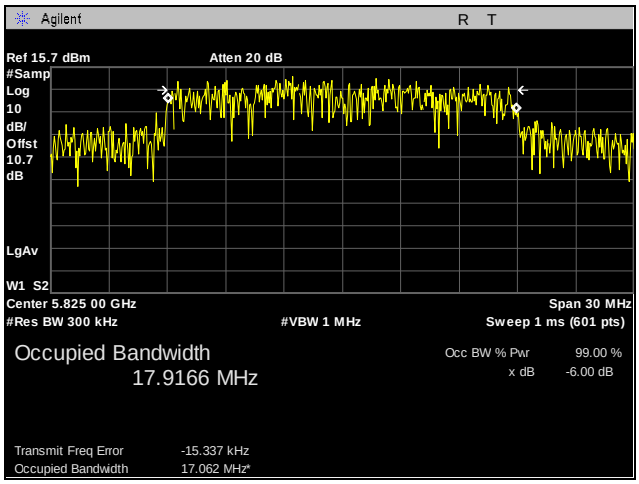
99% Occupied Bandwidth Test Results, 802.11n 20 MHz, 5.8 GHz, Port 3



Plot 104. 99% Occupied Bandwidth, 802.11n 20 MHz, 5745 MHz, Port 3

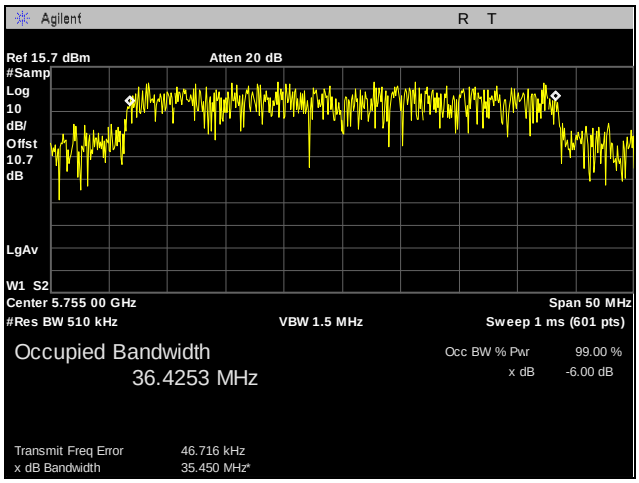


Plot 105. 99% Occupied Bandwidth, 802.11n 20 MHz, 5785 MHz, Port 3

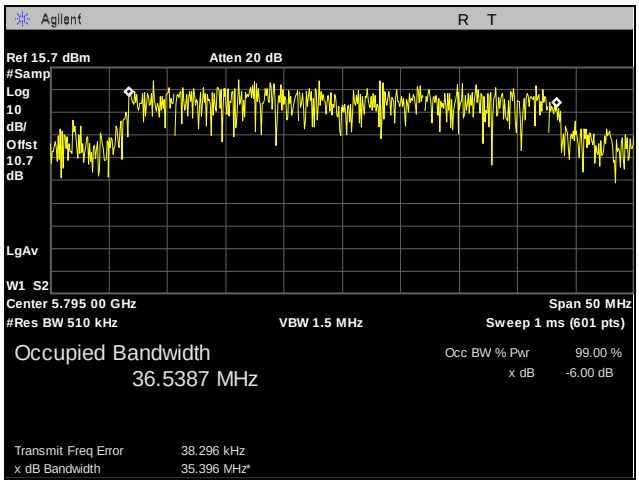


Plot 106. 99% Occupied Bandwidth, 802.11n 20 MHz, 5825 MHz, Port 3

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

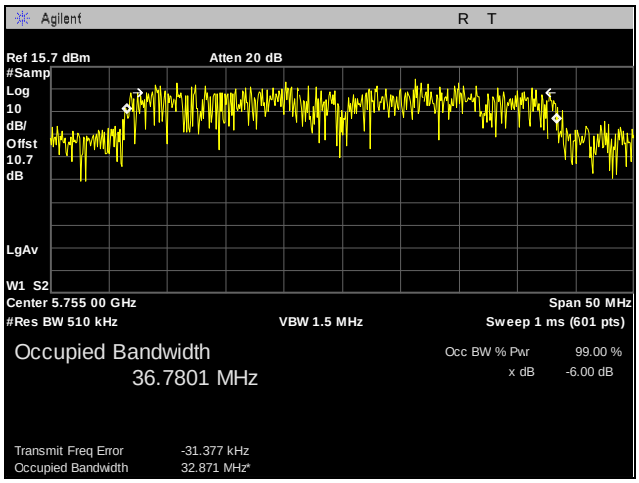


Plot 107. 99% Occupied Bandwidth, 802.11n 40 MHz, 5755 MHz, Port 1

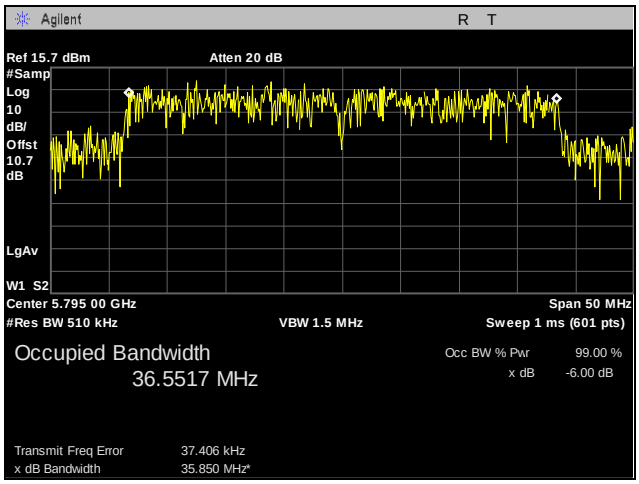


Plot 108. 99% Occupied Bandwidth, 802.11n 40 MHz, 5795 MHz, Port 1

99% Occupied Bandwidth Test Results, 802.11n 40 MHz, 5.8 GHz, Port 2

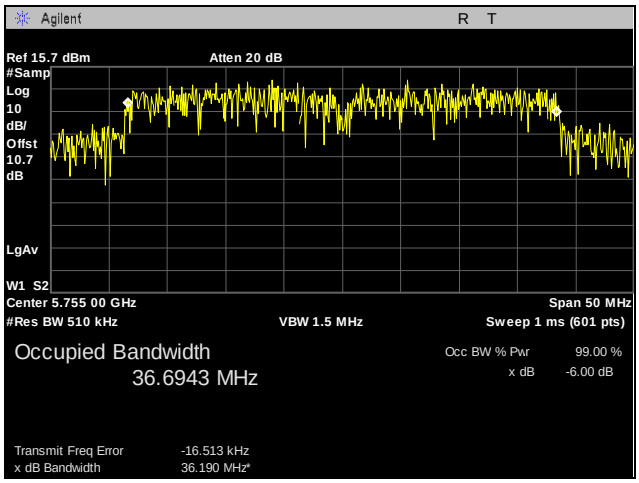


Plot 109. 99% Occupied Bandwidth, 802.11n 40 MHz, 5755 MHz, Port 2

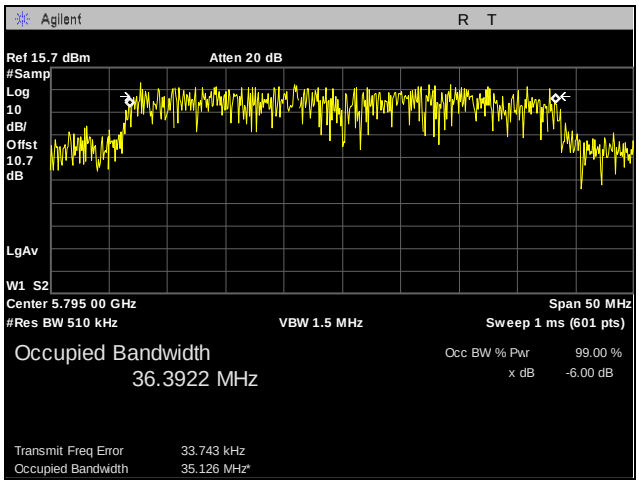


Plot 110. 99% Occupied Bandwidth, 802.11n 40 MHz, 5795 MHz, Port 2

99% Occupied Bandwidth Test Results, 802.11n 40 MHz, 5.8 GHz, Port 3



Plot 111. 99% Occupied Bandwidth, 802.11n 40 MHz, 5755 MHz, Port 3



Plot 112. 99% Occupied Bandwidth, 802.11n 40 MHz, 5795 MHz, Port 3

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 24. Output Power Requirements from §15.247(b)

§15.247(b)(4): The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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): Minh Ly

Test Date(s): 08/17/09

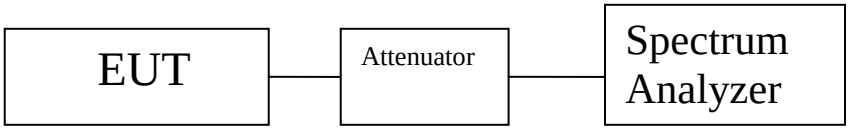


Figure 4. Peak Power Output Test Setup

Peak Power Output Test Results

Peak Conducted Output Power, 2.4 GHz, Port 1			
Mode/Antenna	**Carrier Channel**	**Frequency (MHz)**	**Measured Peak Output Power dBm**
802.11g	Low	2412	25.98
	Mid	2437	25.71
	High	2462	26.09
802.11n 20MHz	Low	2412	20.33
	Mid	2437	21.40
	High	2462	21.76
802.11n 40MHz	Low	2422	20.10
	Mid	2442	20.45
	High	2462	20.63

Table 25. Peak Power Output, Test Results, 2.4 GHz, Port 1

Peak Conducted Output Power, 2.4 GHz, Port 2			
Mode/Antenna	**Carrier Channel**	**Frequency (MHz)**	**Measured Peak Output Power dBm**
802.11n 20MHz	Low	2412	21.94
	Mid	2437	21.51
	High	2462	21.53
802.11n 40MHz	Low	2422	20.69
	Mid	2442	20.33
	High	2462	20.37

Table 26. Peak Output Power, Test Results, 2.4 GHz, Port 2

Peak Conducted Output Power, 2.4 GHz, Port 3			
Mode/Antenna	**Carrier Channel**	**Frequency (MHz)**	**Measured Peak Output Power dBm**
802.11n 20MHz	Low	2412	21.18
	Mid	2437	21.42
	High	2462	21.00
802.11n 40MHz	Low	2422	20.38
	Mid	2442	20.29
	High	2462	21.19

Table 27. Peak Output Power, Test Results, 2.4 GHz, Port 3

802.11n mode (20MHz)								
Carrier Channel	**Frequency (MHz)**	**Port 1 (dBm)**	**Port 2 (dBm)**	**Port 3 (dBm)**	**Total (dBm)**	**Total (W)**	**Limit (dBm)**	**Margin (dBm)**
Low	2412	20.33	21.94	21.18	25.97	0.395	26.23	-0.02
Mid	2437	21.40	21.51	21.42	26.21	0.418	26.23	-0.02
High	2462	21.76	21.53	21.00	26.21	0.418	26.23	-0.02

Table 28. RF Output Power Results – All Ports, 802.11n Mode (20MHz) – 5dBi antenna

802.11n mode (40MHz)								
Carrier Channel	Frequency (MHz)	Port 1 (dBm)	Port 2 (dBm)	Port 3 (dBm)	Total (dBm)	Total (W)	Limit (dBm)	Margin (dBm)
Low	2422	20.10	20.69	20.38	25.17	0.329	26.23	-1.06
Mid	2442	20.45	20.33	20.29	25.13	0.326	26.23	-1.1
High	2462	20.63	20.37	21.19	25.51	0.356	26.23	-0.72

Table 29. RF Output Power Results – All Ports, 802.11n Mode (40MHz) – 5 dBi antenna

Note: Total Output Power=Port 1 (10^(Output Power/10)/1000) + Port 2 (10^(Output Power/10)/1000) + Port 3 (10^(Output Power/10)/1000)

Peak Conducted Output Power, 5 GHz, Port 1			
Mode	Carrier Channel	Frequency (MHz)	Measured Peak Output Power dBm
802.11a	Low	5745	29.20
	Mid	5785	29.62
	High	5825	28.53
802.11n 20MHz	Low	5745	21.60
	Mid	5785	21.10
	High	5825	21.04
802.11n 40MHz	Low	5755	20.00
	High	5795	20.54

Table 30. Peak Output Power, Test Results, 5 GHz, Port 1

Peak Conducted Output Power, 5 GHz, Port 2			
Mode	Carrier Channel	Frequency (MHz)	Measured Peak Output Power dBm
802.11n 20MHz	Low	5745	21.08
	Mid	5785	21.32
	High	5825	21.78
802.11n 40MHz	Low	5755	20.07
	High	5795	20.65

Table 31. Peak Output Power, Test Results, 5 GHz, Port 2

Peak Conducted Output Power, 5 GHz, Port 3			
Mode	Carrier Channel	Frequency (MHz)	Measured Peak Output Power dBm
802.11n 20MHz	Low	5745	21.16
	Mid	5785	21.32
	High	5825	21.42
802.11n 40MHz	Low	5755	20.14
	High	5795	21.24

Table 32. Peak Output Power, Test Results, 5 GHz, Port 3

802.11n mode (20MHz)								
Carrier Channel	Frequency (MHz)	Port 1 (dBm)	Port 2 (dBm)	Port 3 (dBm)	Total (dBm)	Total (W)	Limit (dBm)	Margin (dBm)
Low	5745	21.60	21.08	21.16	26.06	0.403	26.23	-0.17
Mid	5785	21.10	21.32	21.32	26.02	0.400	26.23	-0.21
High	5825	21.04	21.78	21.42	26.19	0.416	26.23	-0.04

Table 33. RF Output Power Results – All Ports, 802.11n Mode (20MHz) – 5 dBi antenna

802.11n mode (40MHz)								
Carrier Channel	Frequency (MHz)	Port 1 (dBm)	Port 2 (dBm)	Port 3 (dBm)	Total (dBm)	Total (W)	Limit (dBm)	Margin (dBm)
Low	5755	20.00	20.07	20.14	24.84	0.305	26.23	-1.39
High	5795	20.54	20.65	21.24	25.59	0.362	26.23	-1.64

Table 34. RF Output Power Results – All Ports, 802.11n mode (40MHz) – 5 dBi antenna

Note: Total Output Power=Port 1 (10^(Output Power/10)/1000) + Port 2 (10^(Output Power/10)/1000) + Port 3 (10^(Output Power/10)/1000)

Peak Conducted Output Power, 5 GHz						
Mode	Carrier Channel	Frequency (MHz)	Measured Combined Peak Output Power (dBm)	Measured Peak Output Power (W)	Limit (dBm)	Margin (dBm)
802.11n 20MHz	Low	5745	16.53	0.044	17.00	-0.47
	Mid	5785	16.62	0.046	17.00	-0.38
	High	5825	16.34	0.043	17.00	-0.66
802.11n 40MHz	Low	5755	17.00	0.050	17.00	0.00
	High	5795	16.67	0.046	17.00	-0.23

Table 35. RF Output Power Results – 19 dBi Antenna

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 36. 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 37.

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

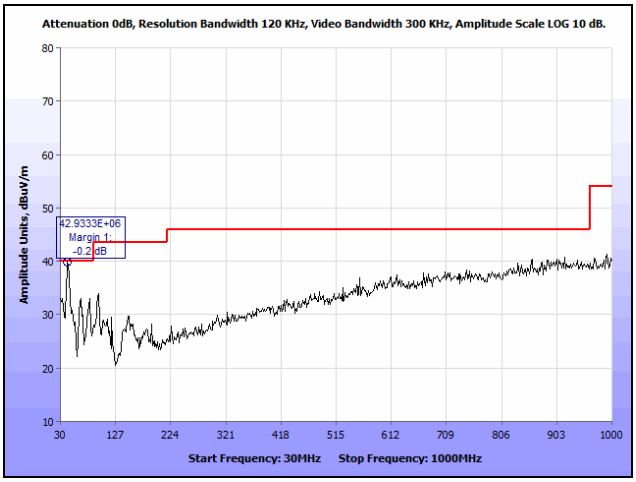
Test Procedures: The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line. Only noise floor was measured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

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

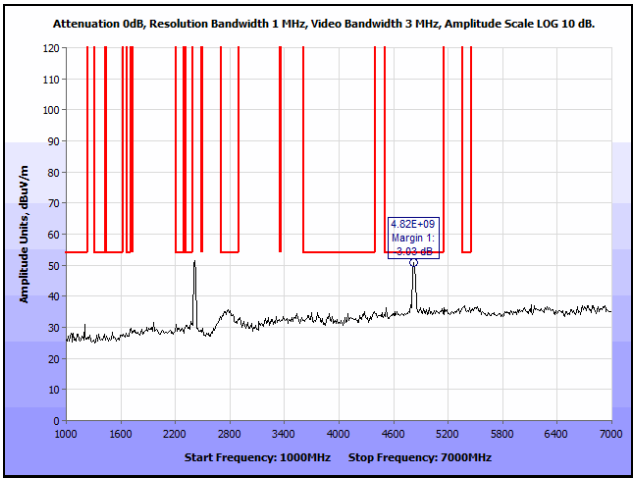
Test Engineer(s): Aaron Chang

Test Date(s): 06/24/13

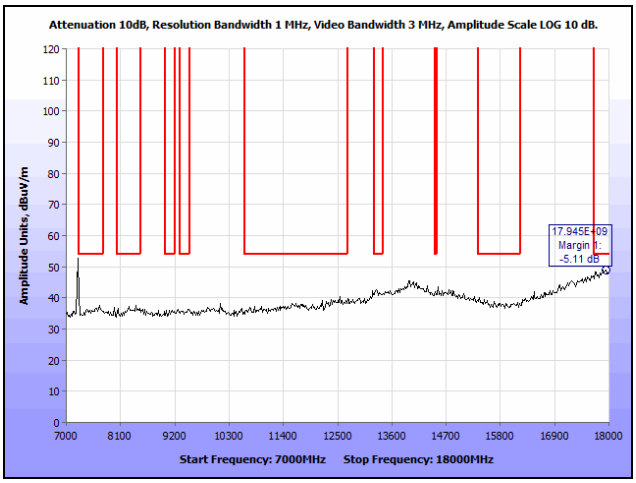
Radiated Spurious Emissions Test Results, 802.11g, 2.4 GHz, 5 dBi Omni



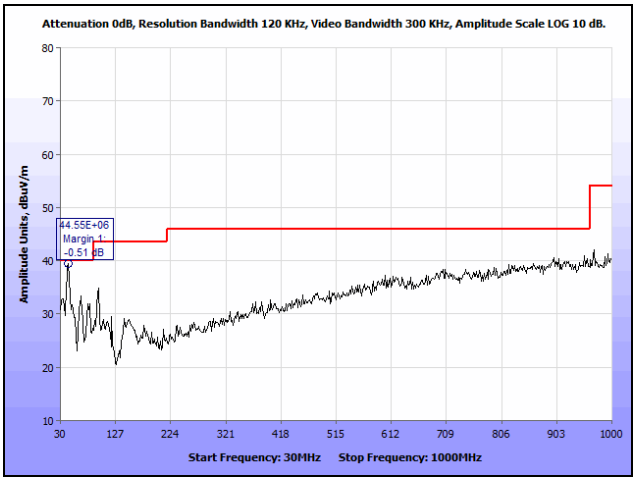
Plot 113. Radiated Spurious Emissions, 2412 MHz, 802.11g, 5 dBi Omni, 30 MHz – 1 GHz



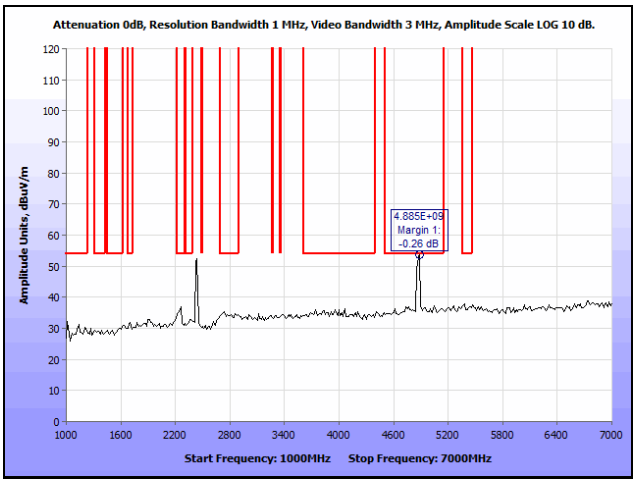
Plot 114. Radiated Spurious Emissions, 2412 MHz, 802.11g, 5 dBi Omni, 1 GHz – 7 GHz



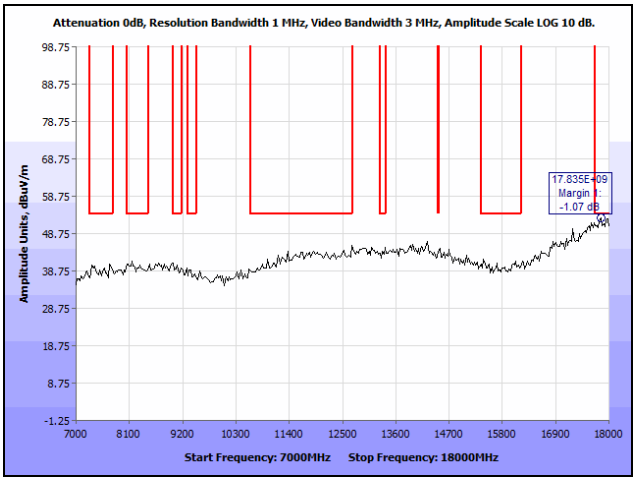
Plot 115. Radiated Spurious Emissions, 2412 MHz, 802.11g, 5 dBi Omni, 7 GHz – 18 GHz



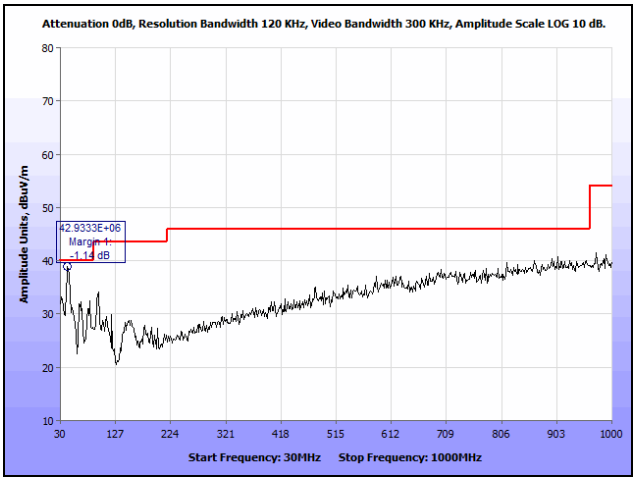
Plot 116. Radiated Spurious Emissions, 2437 MHz, 802.11g, 5 dBi Omni, 30 MHz – 1 GHz



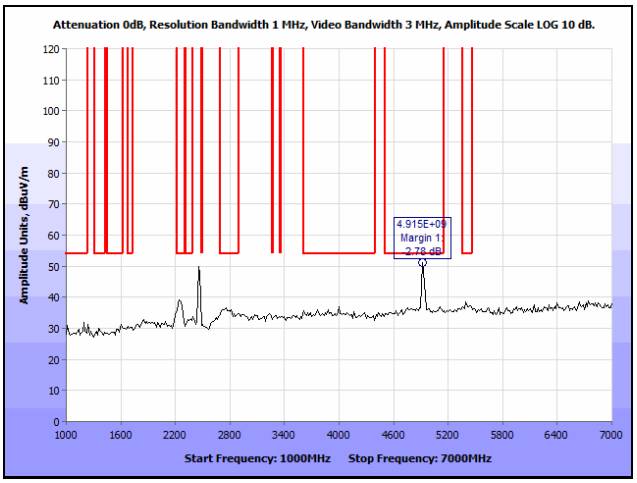
Plot 117. Radiated Spurious Emissions, 2437 MHz, 802.11g, 5 dBi Omni, 1 GHz – 7 GHz



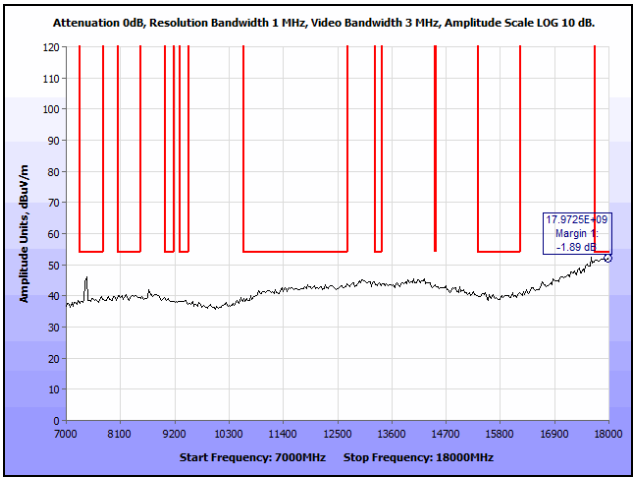
Plot 118. Radiated Spurious Emissions, 2437 MHz, 802.11g, 5 dBi Omni, 7 GHz – 18 GHz



Plot 119. Radiated Spurious Emissions, 2462 MHz, 802.11g, 5 dBi Omni, 30 MHz – 1 GHz

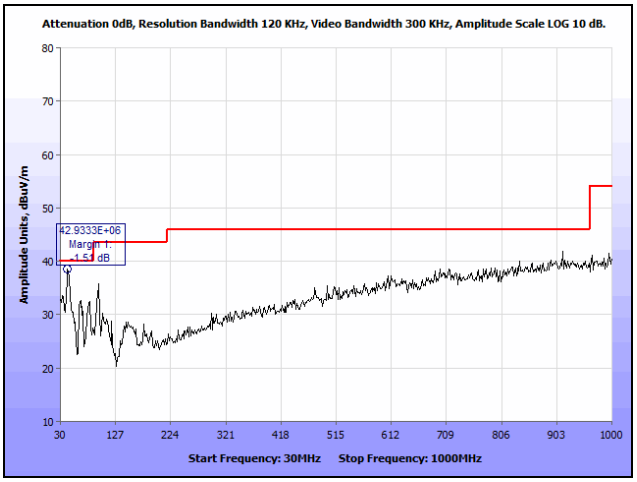


Plot 120. Radiated Spurious Emissions, 2462 MHz, 802.11g, 5 dBi Omni, 1 GHz – 7 GHz

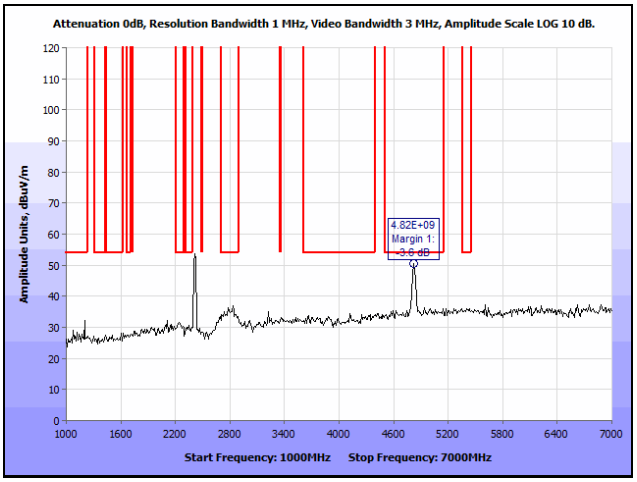


Plot 121. Radiated Spurious Emissions, 2462 MHz, 802.11g, 5 dBi Omni, 7 GHz – 18 GHz

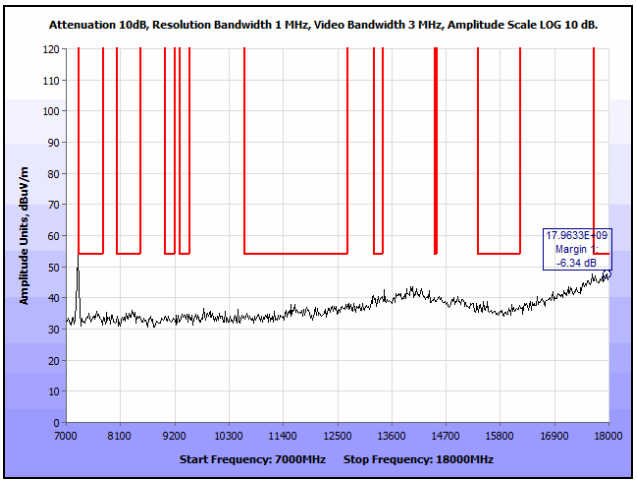
Radiated Spurious Emissions Test Results, 802.11n 20 MHz, 2.4 GHz, 5 dBi Omni



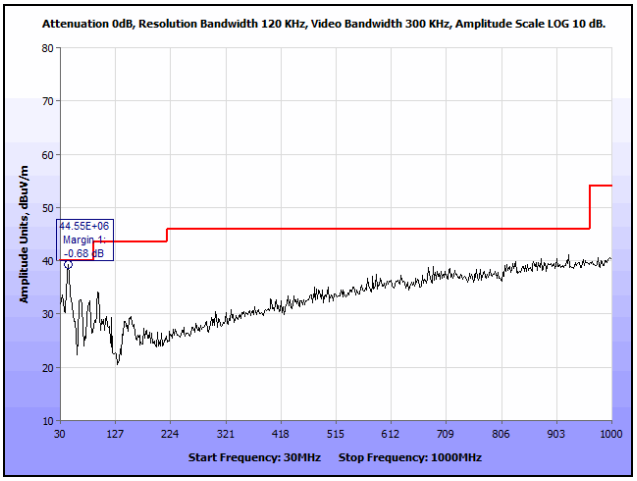
Plot 122. Radiated Spurious Emissions, 2412 MHz, 802.11n 20 MHz, 5 dBi Omni, 30 MHz – 1 GHz



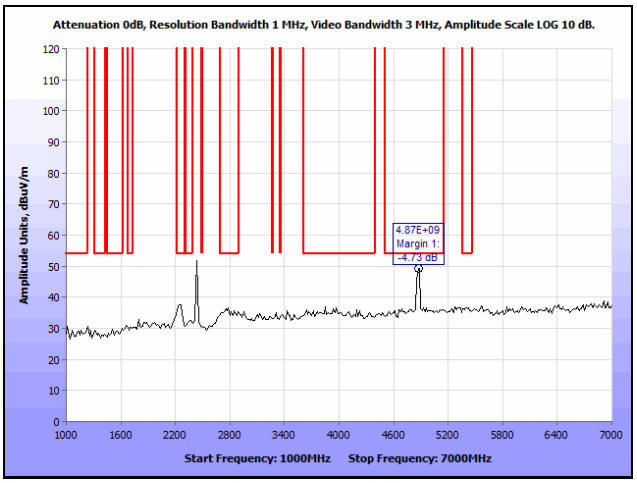
Plot 123. Radiated Spurious Emissions, 2412 MHz, 802.11n 20 MHz, 5 dBi Omni, 1 GHz – 7 GHz



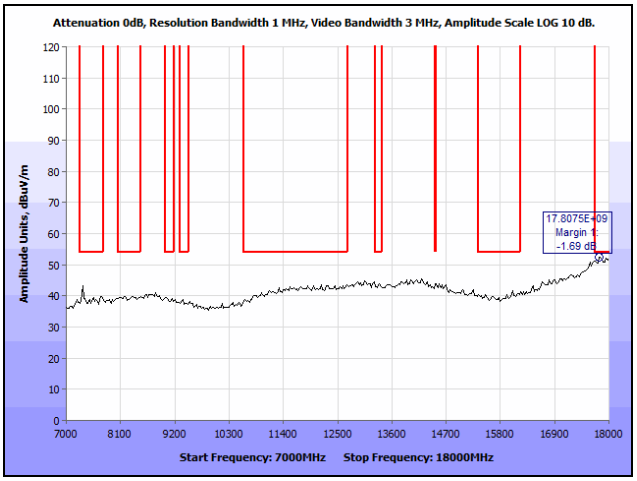
Plot 124. Radiated Spurious Emissions, 2412 MHz, 802.11n 20 MHz, 5 dBi Omni, 7 GHz – 18 GHz



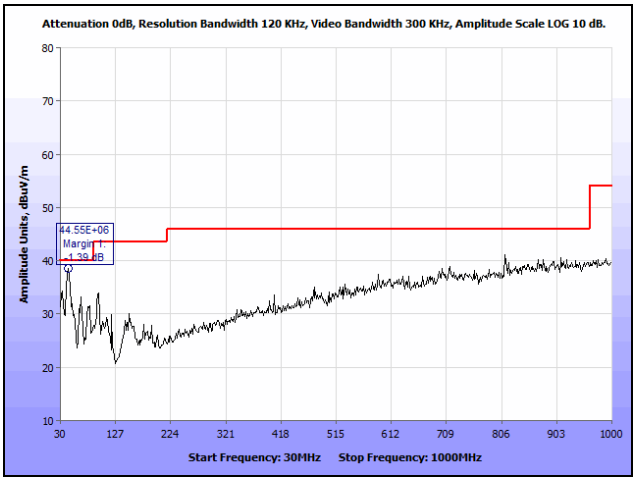
Plot 125. Radiated Spurious Emissions, 2437 MHz, 802.11n 20 MHz, 5 dBi Omni, 30 MHz – 1 GHz



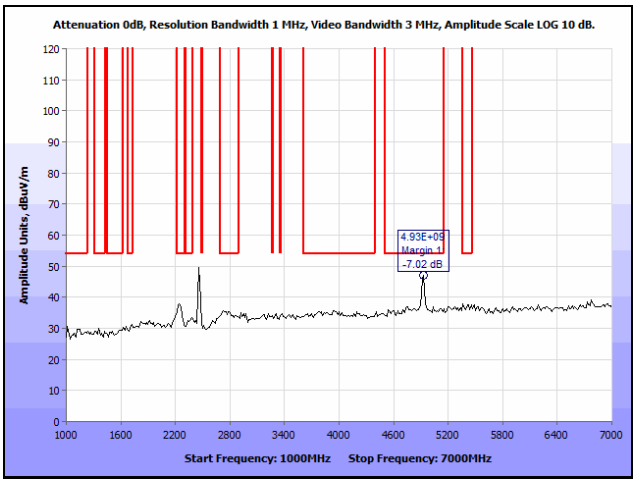
Plot 126. Radiated Spurious Emissions, 2437 MHz, 802.11n 20 MHz, 5 dBi Omni, 1 GHz – 7 GHz



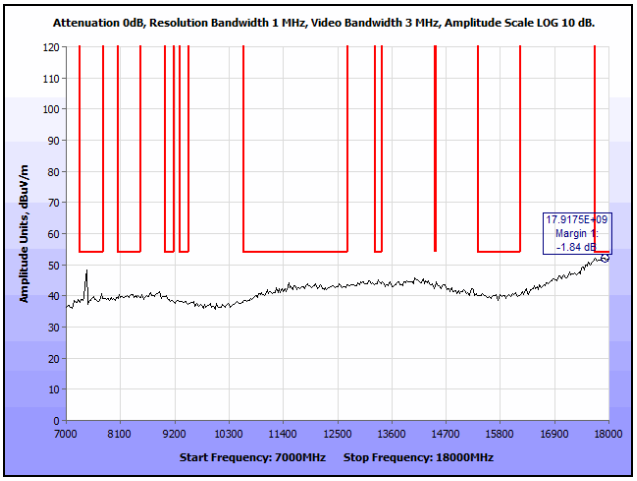
Plot 127. Radiated Spurious Emissions, 2437 MHz, 802.11n 20 MHz, 5 dBi Omni, 7 GHz – 18 GHz



Plot 128. Radiated Spurious Emissions, 2462 MHz, 802.11n 20 MHz, 5 dBi Omni, 30 MHz – 1 GHz

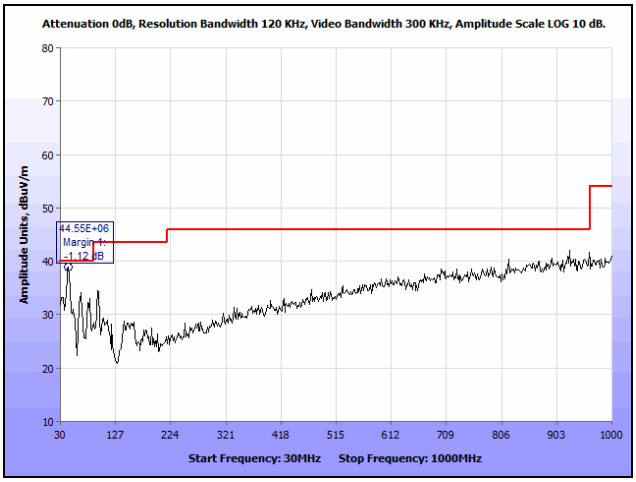


Plot 129. Radiated Spurious Emissions, 2462 MHz, 802.11n 20 MHz, 5 dBi Omni, 1 GHz – 7 GHz

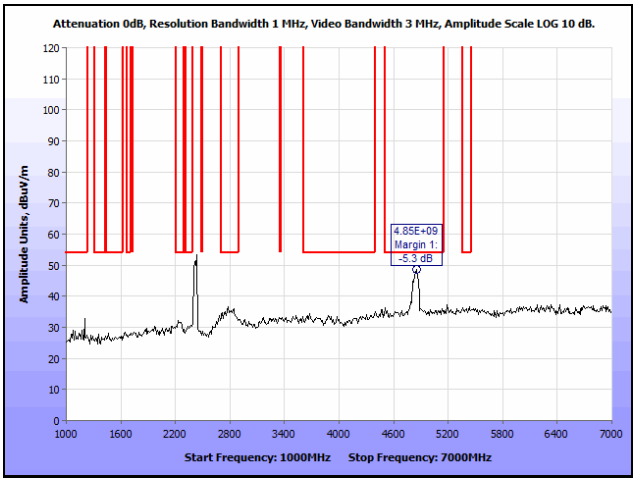


Plot 130. Radiated Spurious Emissions, 2462 MHz, 802.11n 20 MHz, 5 dBi Omni, 7 GHz – 18 GHz

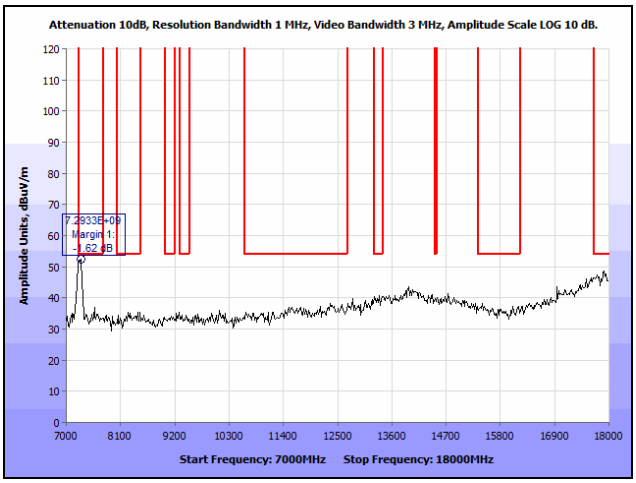
Radiated Spurious Emissions Test Results, 802.11n 40 MHz, 2.4 GHz, 5 dBi Omni



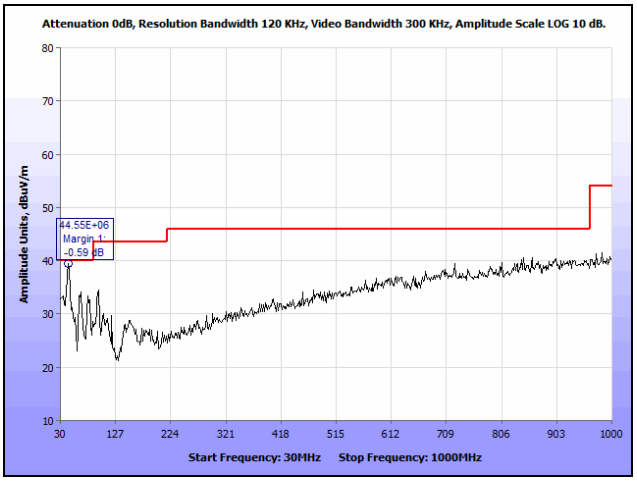
Plot 131. Radiated Spurious Emissions, 2422 MHz, 802.11n 40 MHz, 5 dBi Omni, 30 MHz – 1 GHz



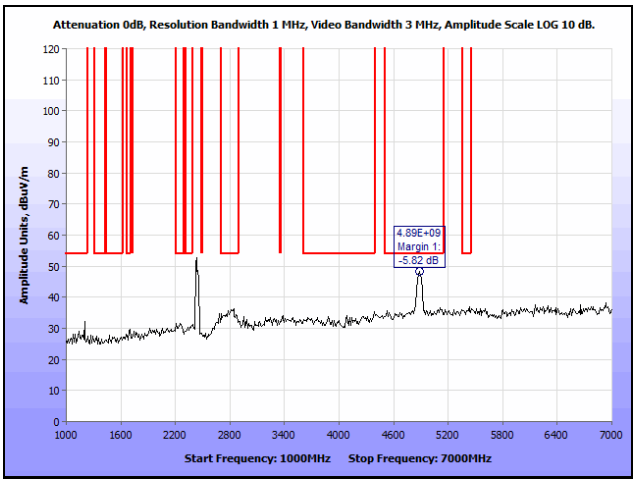
Plot 132. Radiated Spurious Emissions, 2422 MHz, 802.11n 40 MHz, 5 dBi Omni, 1 GHz – 7 GHz



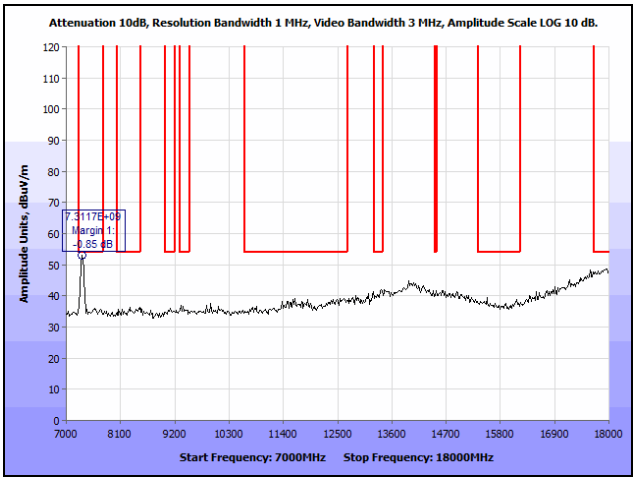
Plot 133. Radiated Spurious Emissions, 2422 MHz, 802.11n 40 MHz, 5 dBi Omni, 7 GHz – 18 GHz



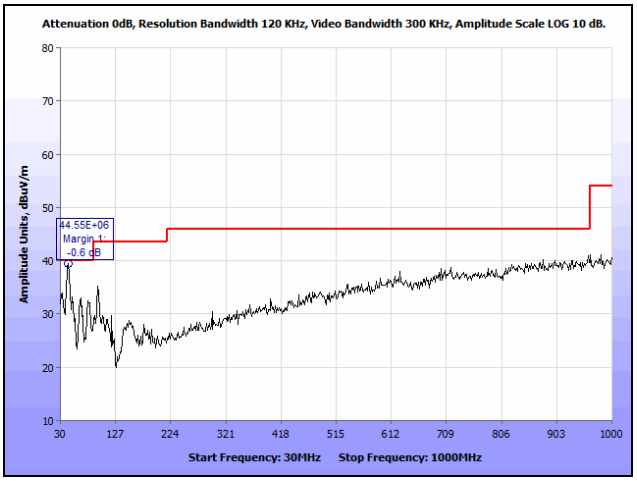
Plot 134. Radiated Spurious Emissions, 2442 MHz, 802.11n 40 MHz, 5 dBi Omni, 30 MHz – 1 GHz



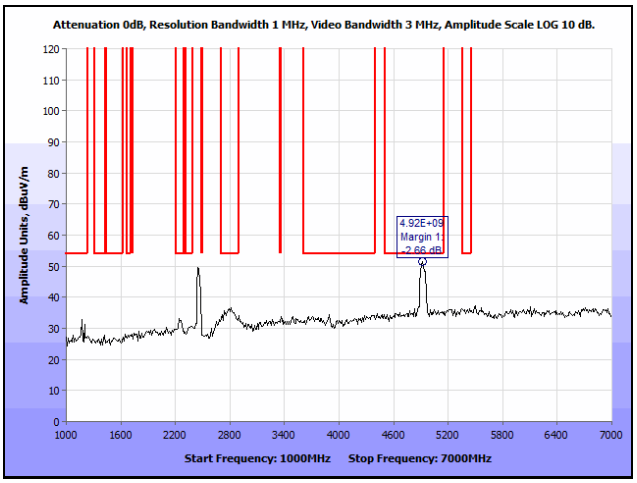
Plot 135. Radiated Spurious Emissions, 2442 MHz, 802.11n 40 MHz, 5 dBi Omni, 1 GHz – 7 GHz



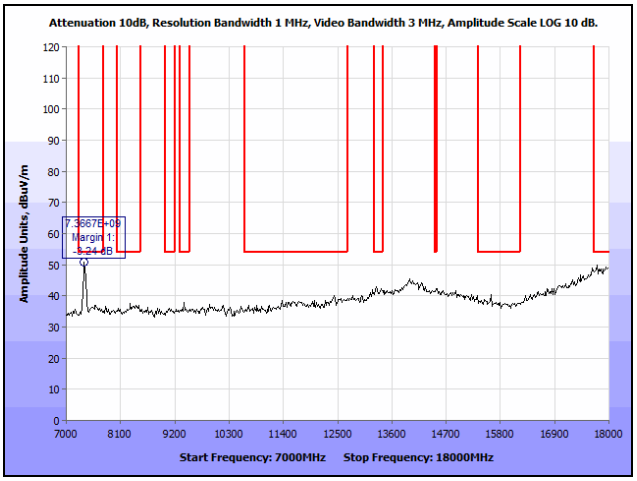
Plot 136. Radiated Spurious Emissions, 2442 MHz, 802.11n 40 MHz, 5 dBi Omni, 7 GHz – 18 GHz



Plot 137. Radiated Spurious Emissions, 2462 MHz, 802.11n 40 MHz, 5 dBi Omni, 30 MHz – 1 GHz

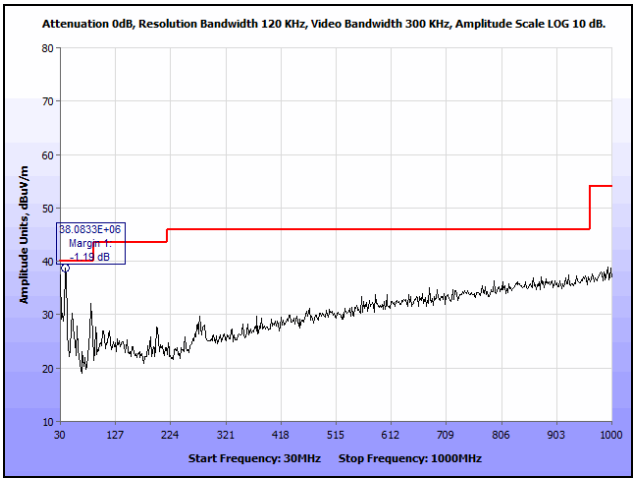


Plot 138. Radiated Spurious Emissions, 2462 MHz, 802.11n 40 MHz, 5 dBi Omni, 1 GHz – 7 GHz

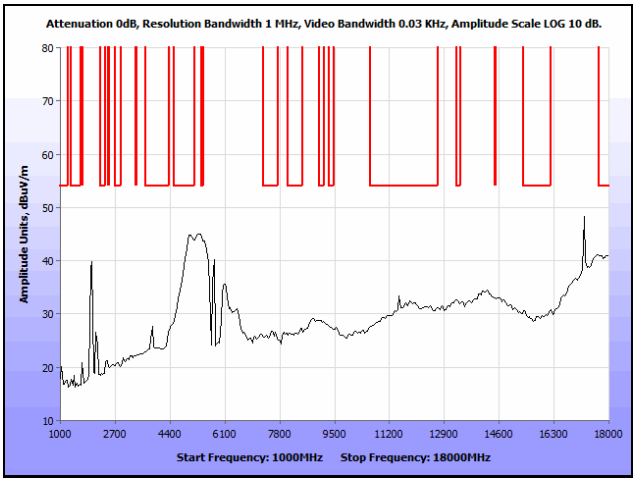


Plot 139. Radiated Spurious Emissions, 2462 MHz, 802.11n 40 MHz, 5 dBi Omni, 7 GHz – 18 GHz

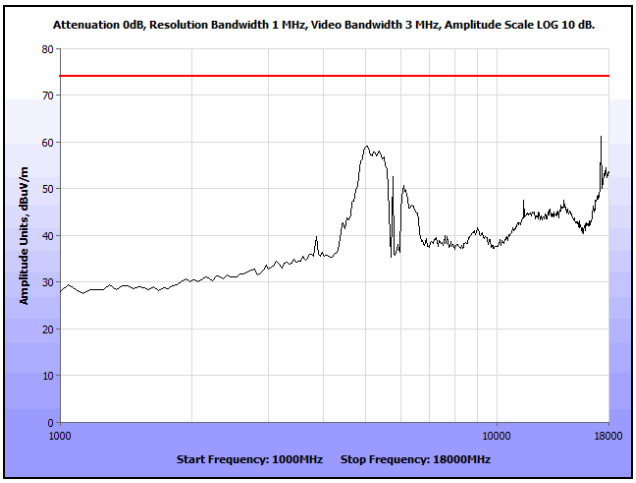
Radiated Spurious Emissions Test Results, 802.11a, 5.8 GHz, 5 dBi Omni



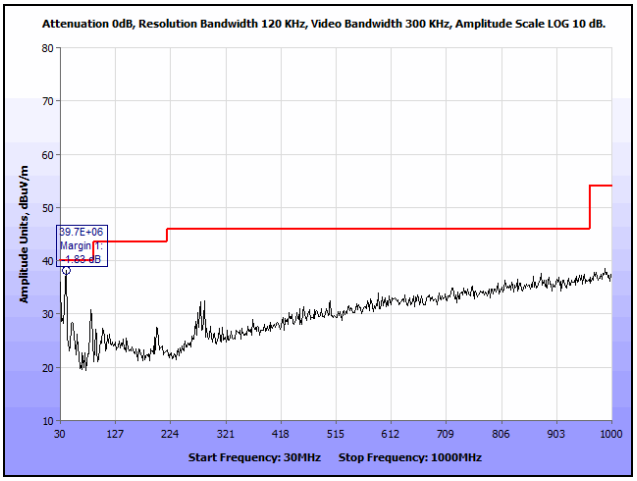
Plot 140. Radiated Spurious Emissions, 5745 MHz, 802.11a, 5 dBi Omni, 30 MHz – 1 GHz



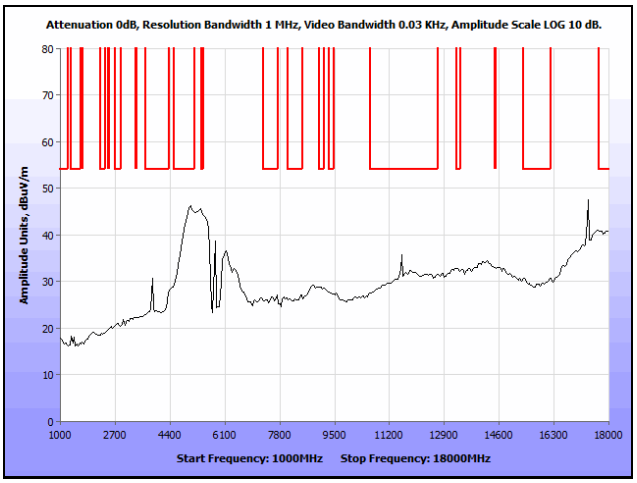
Plot 141. Radiated Spurious Emissions, 5745 MHz, 802.11a, 5 dBi Omni, 1 GHz – 18 GHz, Average



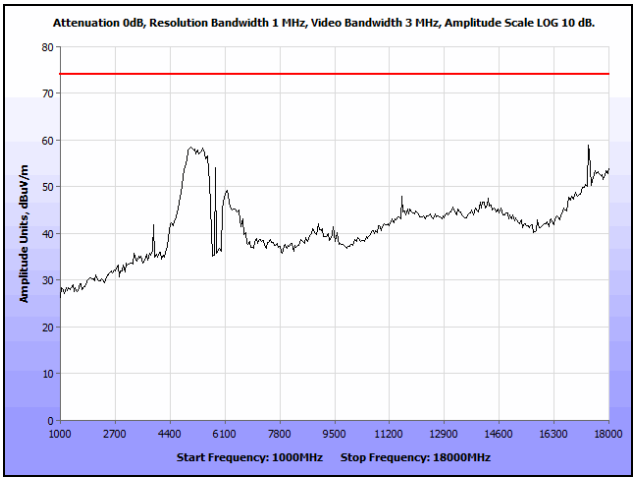
Plot 142. Radiated Spurious Emissions, 5745 MHz, 802.11a, 5dBi Omni, 1 GHz – 18 GHz, Peak



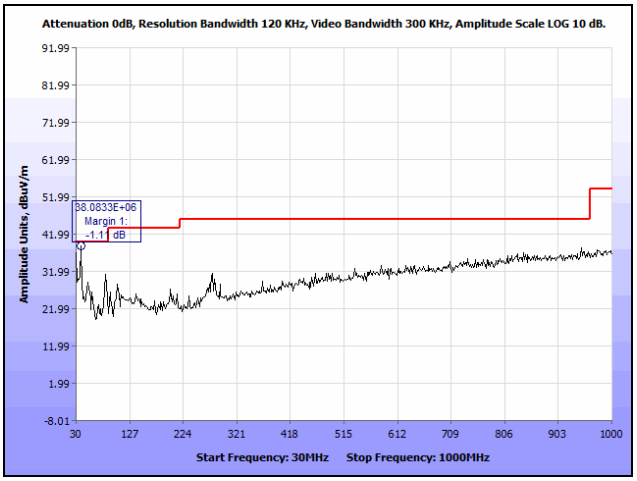
Plot 143. Radiated Spurious Emissions, 5785 MHz, 802.11a, 5 dBi Omni, 30 MHz – 1 GHz



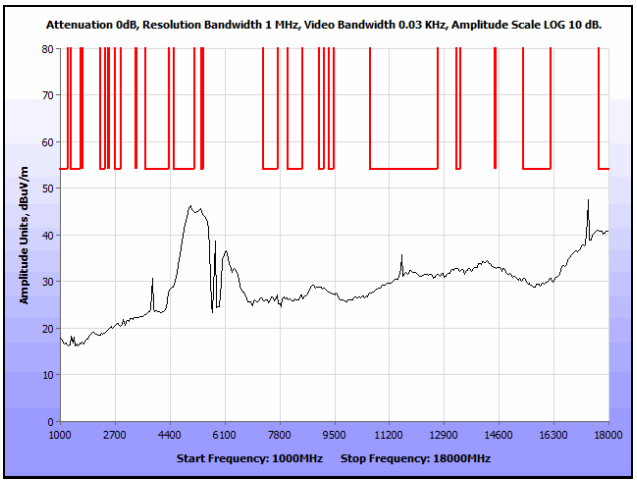
Plot 144. Radiated Spurious Emissions, 5785 MHz, 802.11a, 5 dBi Omni, 1 GHz – 18 GHz, Average



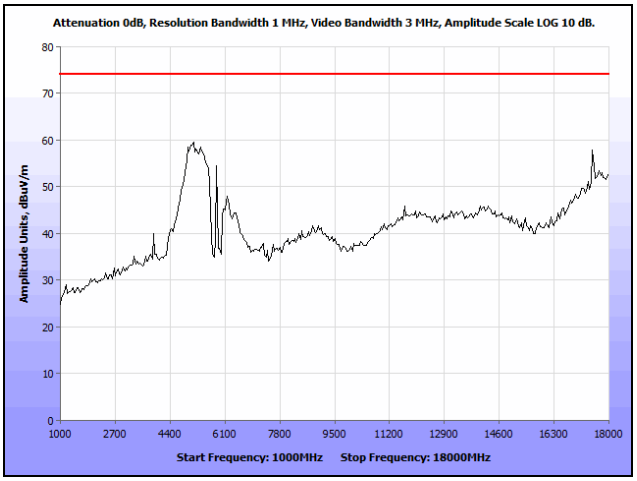
Plot 145. Radiated Spurious Emissions, 5785 MHz, 802.11a, 5 dBi Omni, 1 GHz – 18 GHz, Peak



Plot 146. Radiated Spurious Emissions, 5825 MHz, 802.11a, 5 dBi Omni, 30 MHz – 1 GHz

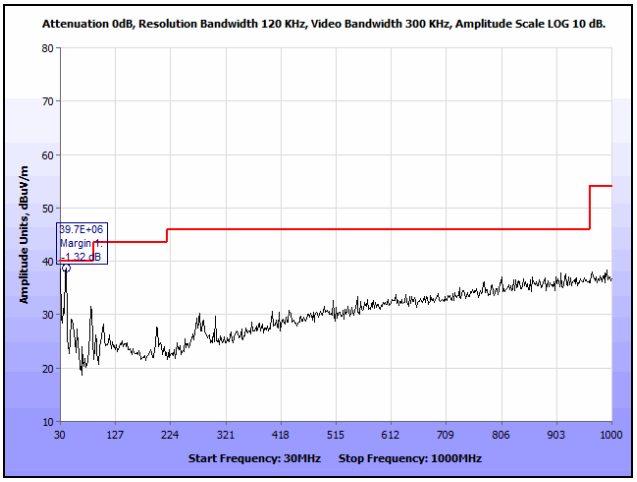


Plot 147. Radiated Spurious Emissions, 5825 MHz, 802.11a, 5 dBi Omni, 1 GHz – 18 GHz, Average

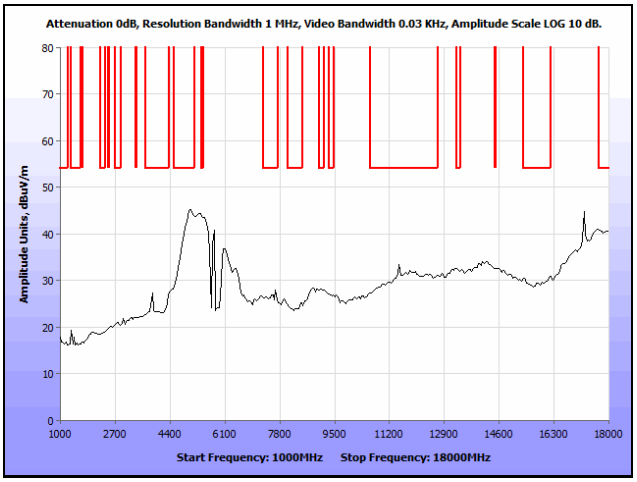


Plot 148. Radiated Spurious Emissions, 5825 MHz, 802.11a, 5 dBi Omni, 1 GHz – 18 GHz, Peak

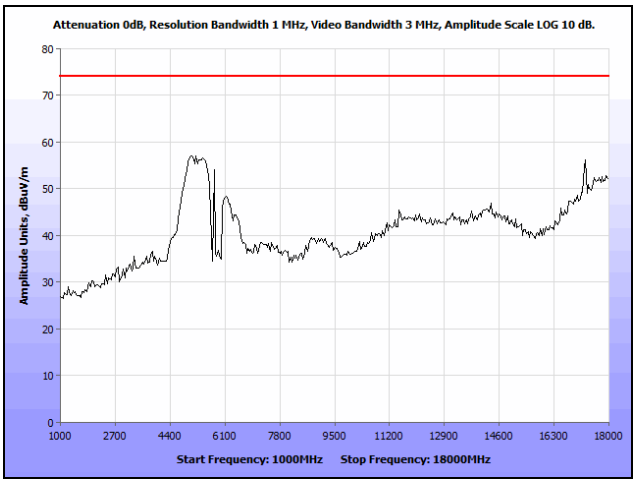
Radiated Spurious Emissions Test Results, 802.11n 20 MHz, 5.8 GHz, 5 dBi Omni



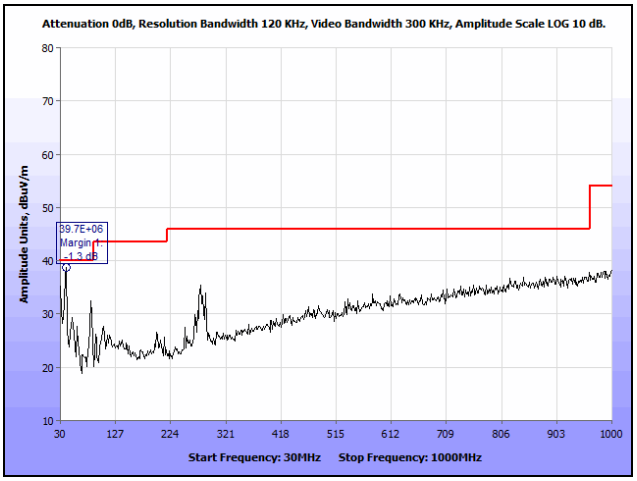
Plot 149. Radiated Spurious Emissions, 5745 MHz, 802.11n 20 MHz, 5 dBi Omni, 30 MHz – 1 GHz



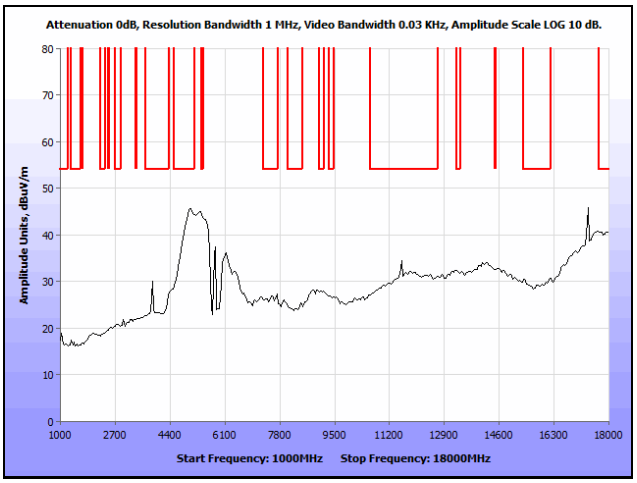
Plot 150. Radiated Spurious Emissions, 5745 MHz, 802.11n 20 MHz, 5 dBi Omni, 1 GHz – 18 GHz, Average



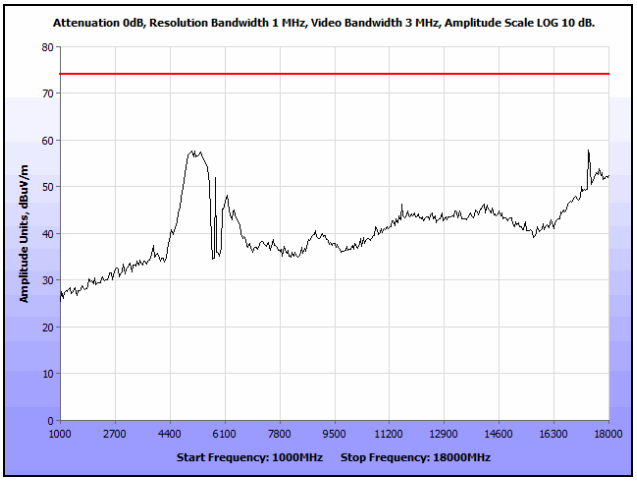
Plot 151. Radiated Spurious Emissions, 5745 MHz, 802.11n 20 MHz, 5 dBi Omni, 1 GHz – 18 GHz, Peak



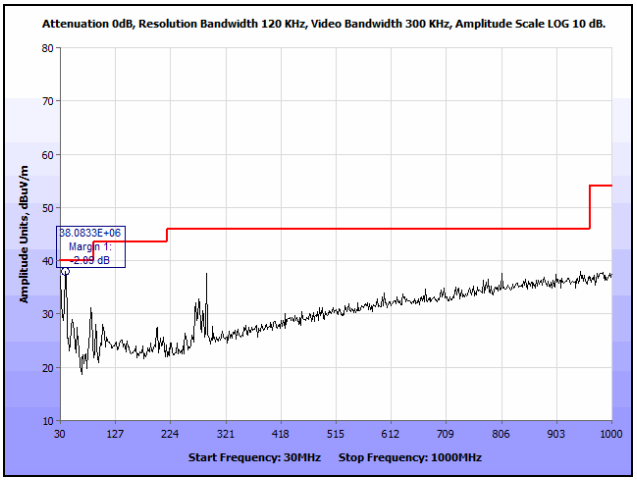
Plot 152. Radiated Spurious Emissions, 5785 MHz, 802.11n 20 MHz, 5 dBi Omni, 30 MHz – 1 GHz



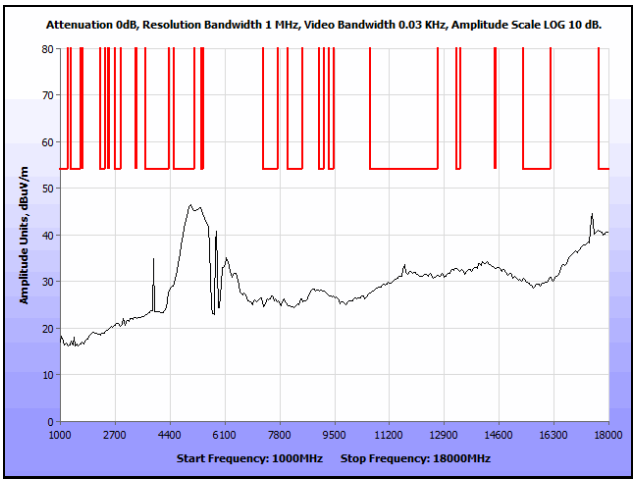
Plot 153. Radiated Spurious Emissions, 5785 MHz, 802.11n 20 MHz, 5 dBi Omni, 1 GHz – 18 GHz, Average



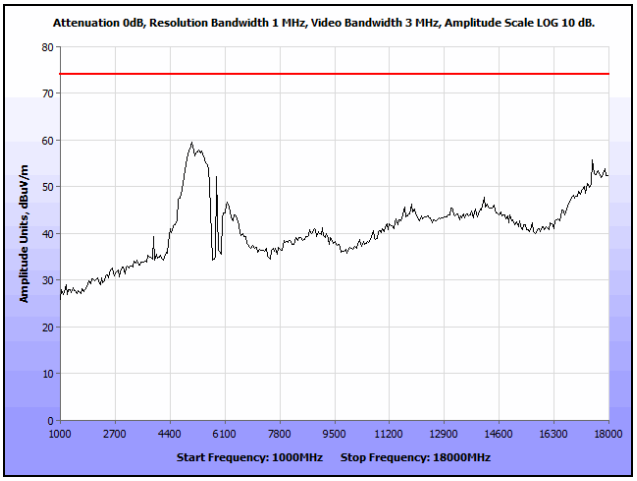
Plot 154. Radiated Spurious Emissions, 5785 MHz, 802.11n 20 MHz, 5 dBi Omni, 1 GHz – 18 GHz, Peak



Plot 155. Radiated Spurious Emissions, 5825 MHz, 802.11n 20 MHz, 5 dBi Omni, 30 MHz – 1 GHz

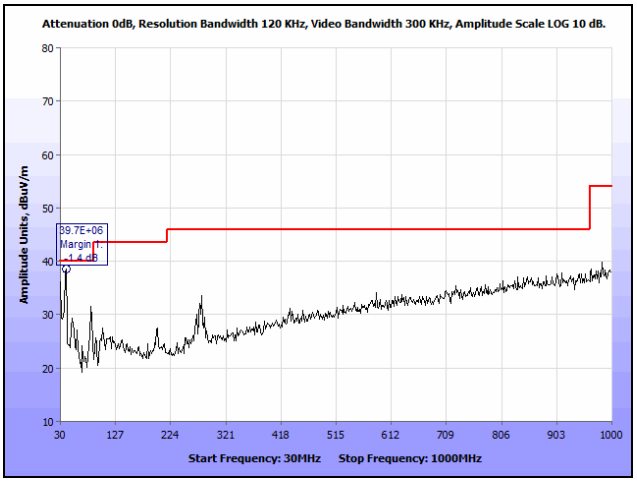


Plot 156. Radiated Spurious Emissions, 5825 MHz, 802.11n 20 MHz, 5 dBi Omni, 1 GHz – 18 GHz, Average

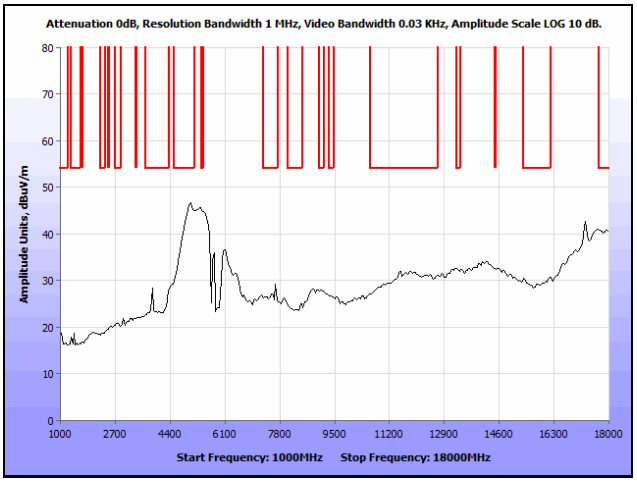


Plot 157. Radiated Spurious Emissions, 5825 MHz, 802.11n 20 MHz, 5 dBi Omni, 1 GHz – 18 GHz, Peak

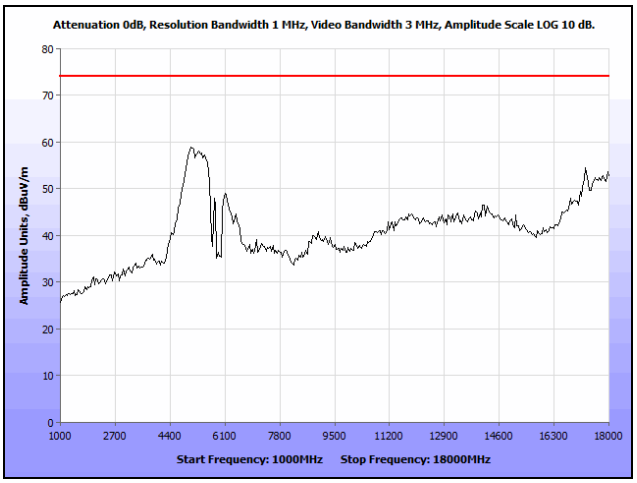
Radiated Spurious Emissions Test Results, 802.11n 40 MHz, 5.8 GHz, 5 dBi Omni



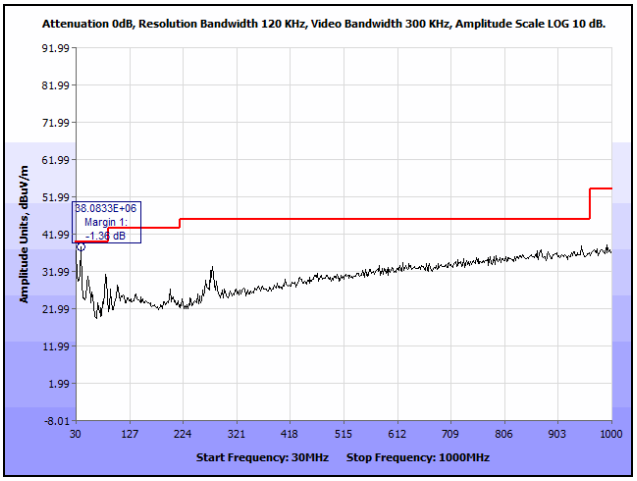
Plot 158. Radiated Spurious Emissions, 5755 MHz, 802.11n 40 MHz, 5 dBi Omni, 30 MHz – 1 GHz



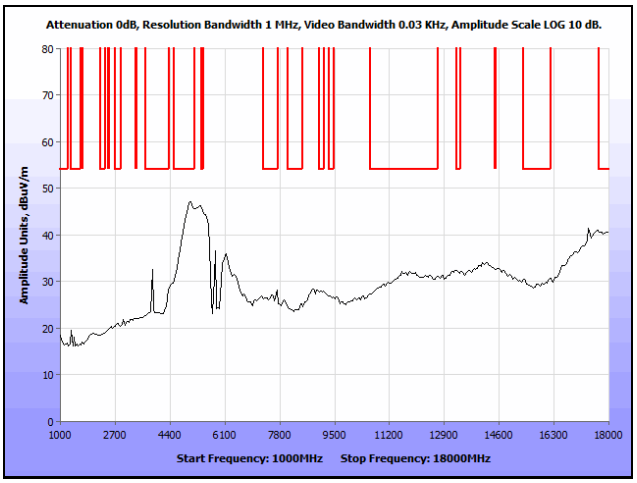
Plot 159. Radiated Spurious Emissions, 5755 MHz, 802.11n 40 MHz, 5 dBi Omni, 1 GHz – 18 GHz, Average



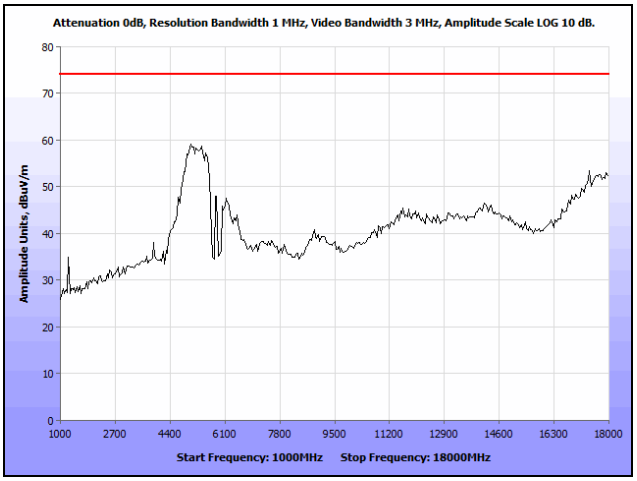
Plot 160. Radiated Spurious Emissions, 5755 MHz, 802.11n 40 MHz, 5 dBi Omni, 1 GHz – 18 GHz, Peak



Plot 161. Radiated Spurious Emissions, 5795 MHz, 802.11n 40 MHz, 5 dBi Omni, 30 MHz – 1 GHz

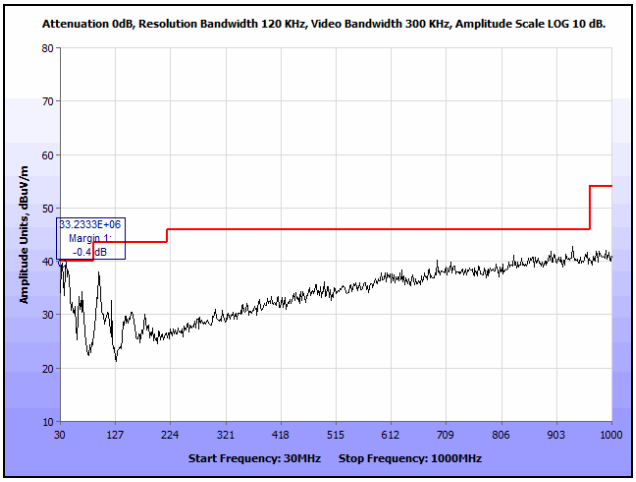


Plot 162. Radiated Spurious Emissions, 5795 MHz, 802.11n 40 MHz, 5 dBi Omni, 1 GHz – 18 GHz, Average

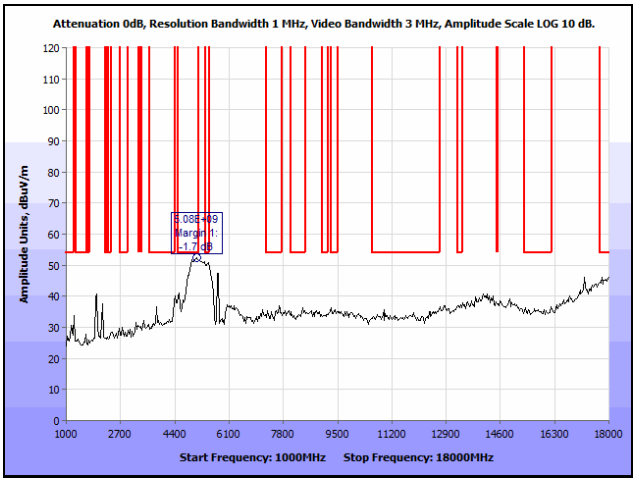


Plot 163. Radiated Spurious Emissions, 5795 MHz, 802.11n 40 MHz, 5 dBi Omni, 1 GHz – 18 GHz, Peak

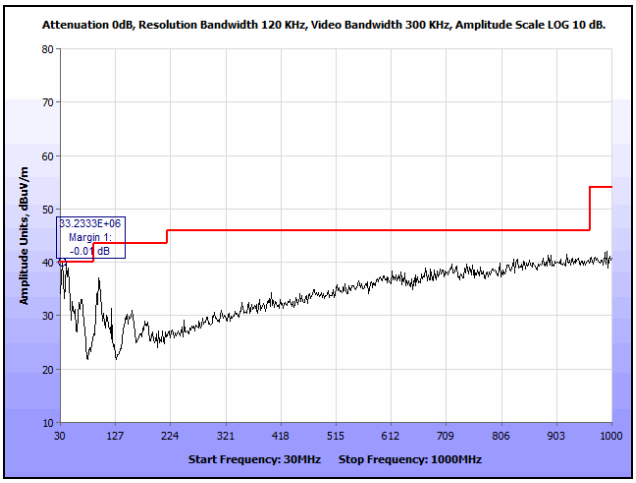
Radiated Spurious Emissions Test Results, 802.11a, 5.8 GHz, 19 dBi Patch



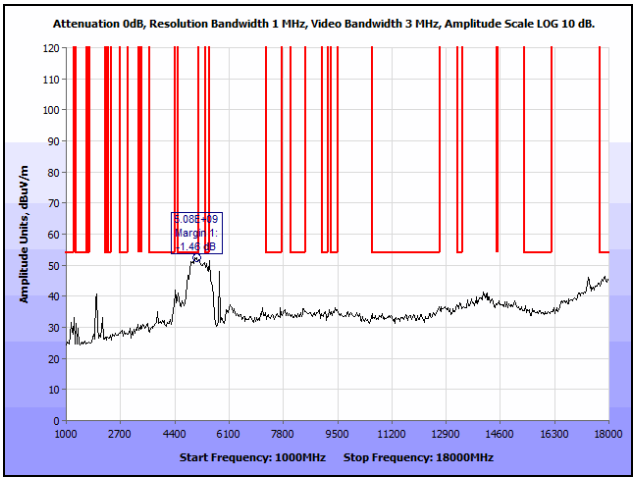
Plot 164. Radiated Spurious Emissions, 5745 MHz, 802.11a, 19 dBi Patch, 30 MHz – 1 GHz



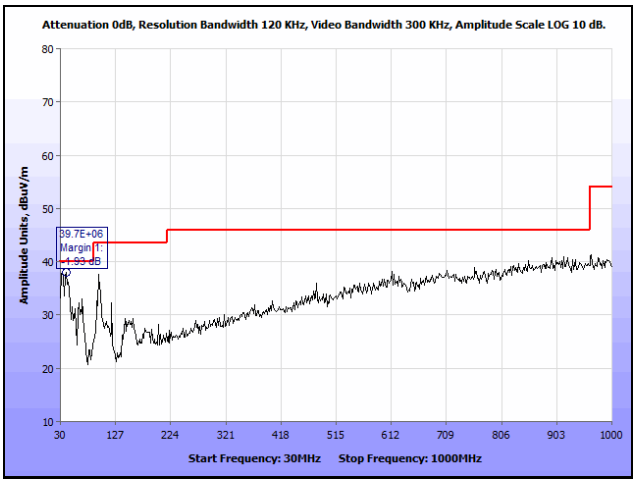
Plot 165. Radiated Spurious Emissions, 5745 MHz, 802.11a, 19 dBi Patch, 1 GHz – 18 GHz



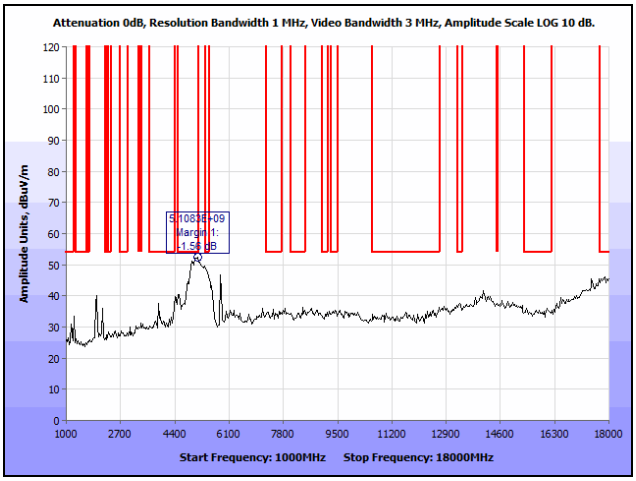
Plot 166. Radiated Spurious Emissions, 5785 MHz, 802.11a, 19 dBi Patch, 30 MHz – 1 GHz



Plot 167. Radiated Spurious Emissions, 5785 MHz, 802.11a, 19 dBi Patch, 1 GHz – 18 GHz

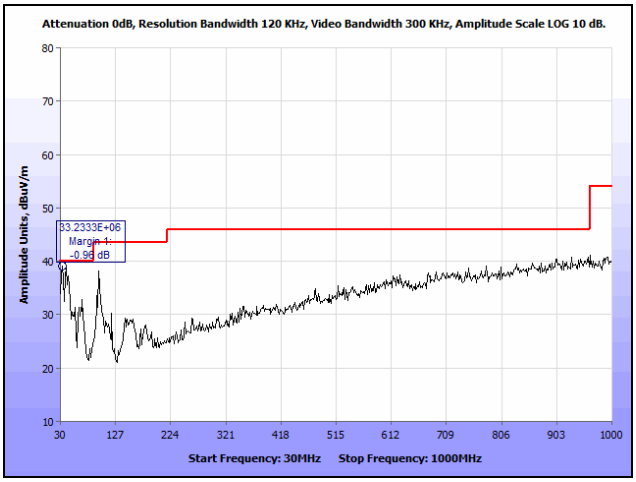


Plot 168. Radiated Spurious Emissions, 5825 MHz, 802.11a, 19 dBi Patch, 30 MHz – 1 GHz

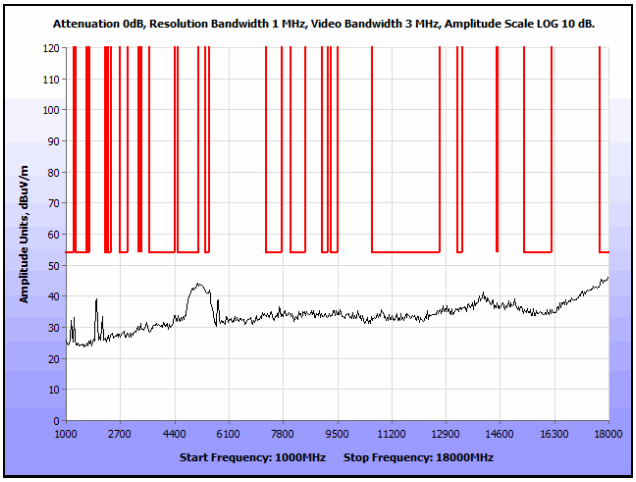


Plot 169. Radiated Spurious Emissions, 5825 MHz, 802.11a, 19 dBi Patch, 1 GHz – 18 GHz

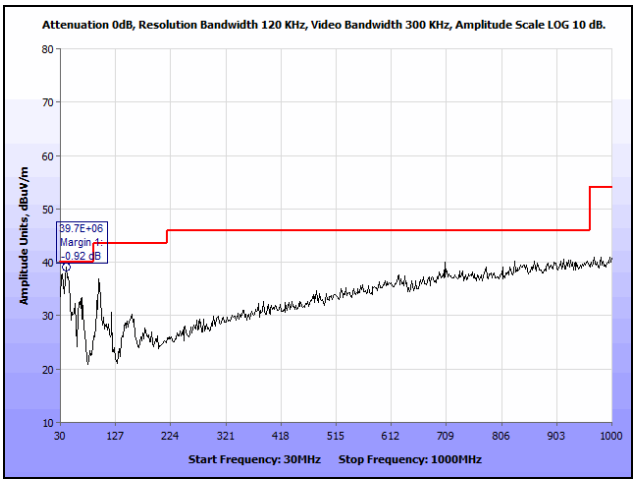
Radiated Spurious Emissions Test Results, 802.11n 20 MHz, 5.8 GHz, 19 dBi Patch



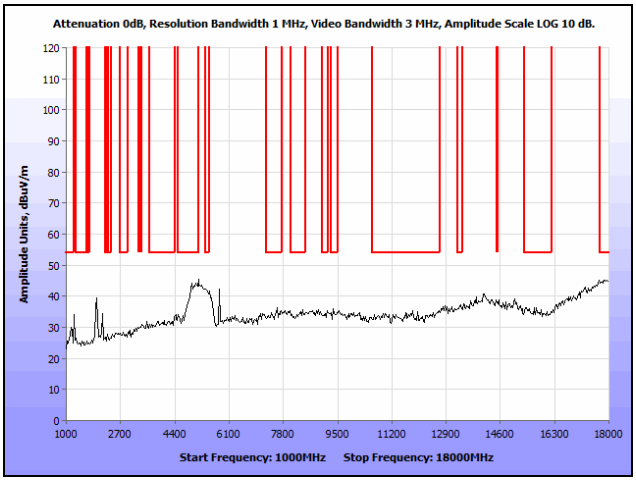
Plot 170. Radiated Spurious Emissions, 5745 MHz, 802.11n 20 MHz, 19 dBi Patch, 30 MHz – 1 GHz



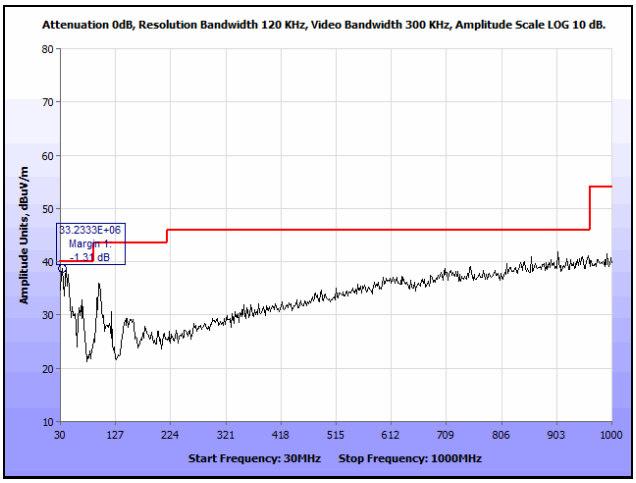
Plot 171. Radiated Spurious Emissions, 5745 MHz, 802.11n 20 MHz, 19 dBi Patch, 1 GHz – 18 GHz



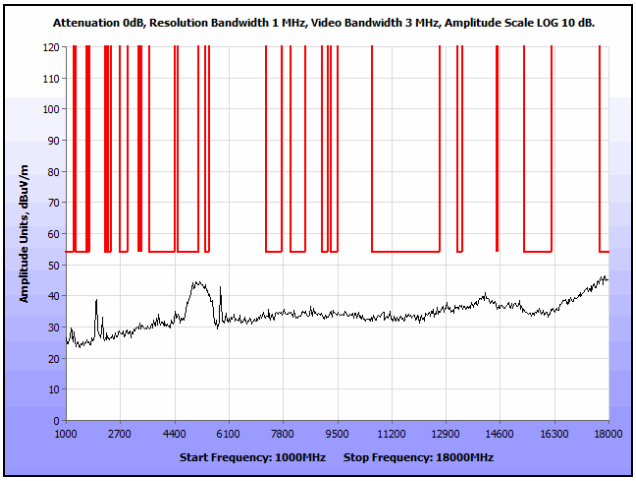
Plot 172. Radiated Spurious Emissions, 5785 MHz, 802.11n 20 MHz, 19 dBi Patch, 30 MHz – 1 GHz



Plot 173. Radiated Spurious Emissions, 5785 MHz, 802.11n 20 MHz, 19 dBi Patch, 1 GHz – 18 GHz

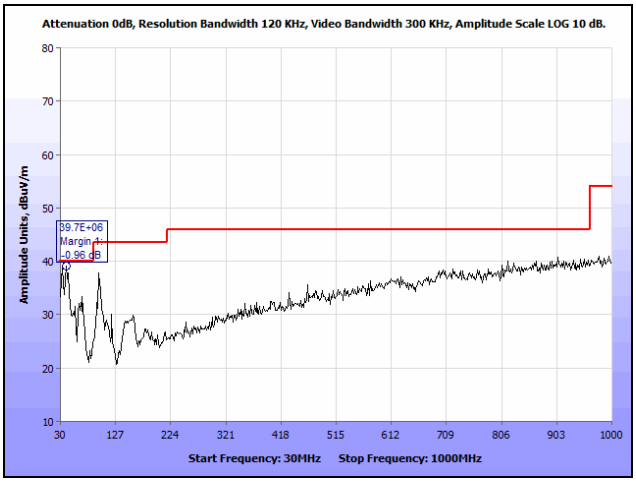


Plot 174. Radiated Spurious Emissions, 5825 MHz, 802.11n 20 MHz, 19 dBi Patch, 30 MHz – 1 GHz

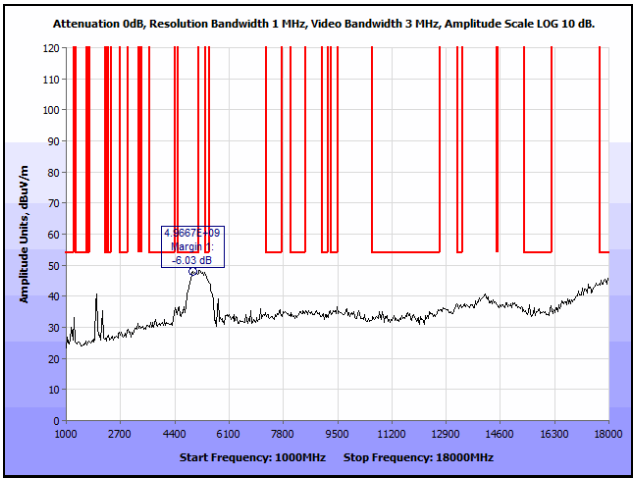


Plot 175. Radiated Spurious Emissions, 5825 MHz, 802.11n 20 MHz, 19 dBi Patch, 1 GHz – 18 GHz

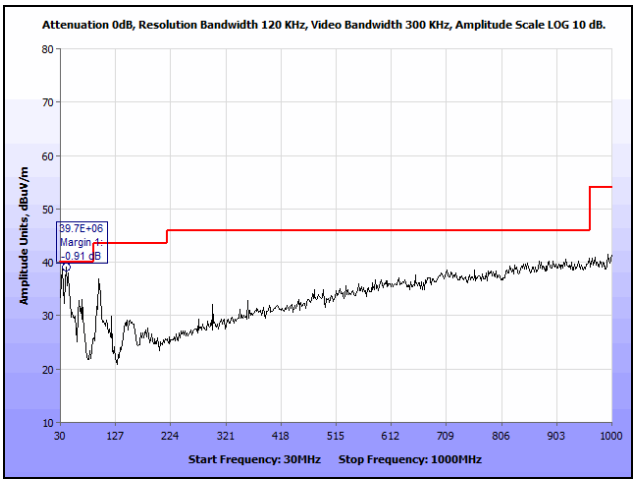
Radiated Spurious Emissions Test Results, 802.11n 40 MHz, 5.8 GHz, 19 dBi Patch



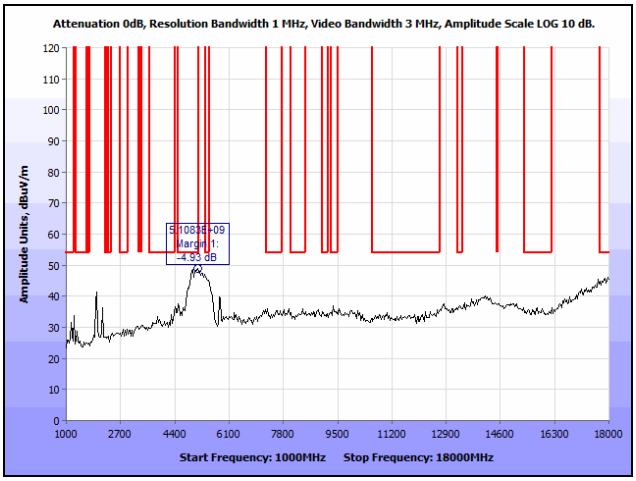
Plot 176. Radiated Spurious Emissions, 5755 MHz, 802.11n 40 MHz, 19 dBi Patch, 30 MHz – 1 GHz



Plot 177. Radiated Spurious Emissions, 5755 MHz, 802.11n 40 MHz, 19 dBi Patch, 1 GHz – 18 GHz



Plot 178. Radiated Spurious Emissions, 5795 MHz, 802.11n 40 MHz, 19 dBi Patch, 30 MHz – 1 GHz



Plot 179. Radiated Spurious Emissions, 5795 MHz, 802.11n 40 MHz, 19 dBi Patch, 1 GHz – 18 GHz

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)**.

Test Engineer(s): Minh Ly

Test Date(s): 08/17/09

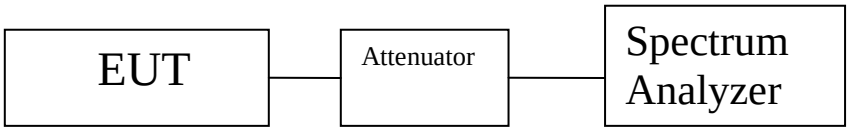
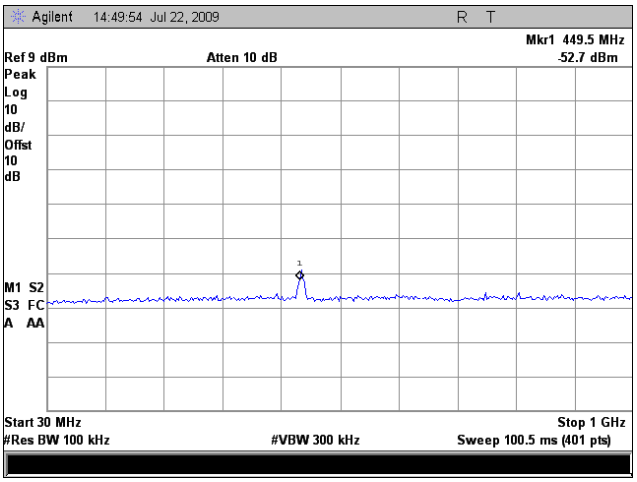
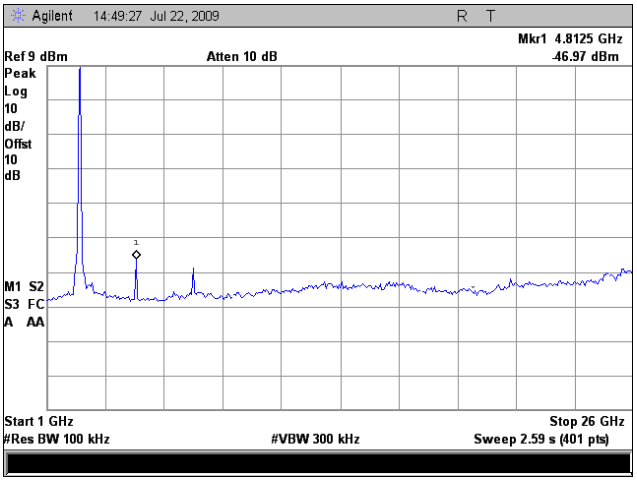


Figure 5. Block Diagram, Conducted Spurious Emissions Test Setup

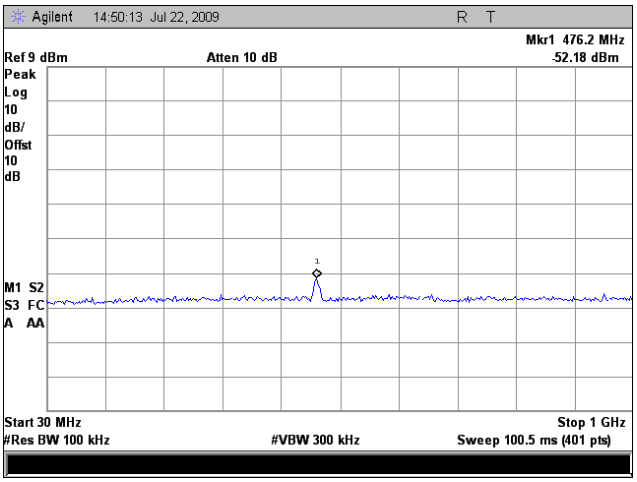
RF Conducted Spurious Emissions Requirements, 2.4 GHz, 802.11g, Port 1



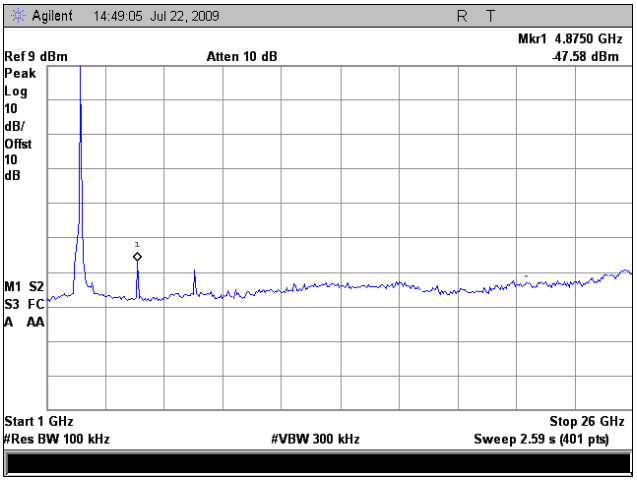
Plot 180. Conducted Emissions, Low Channel, 2.4 GHz, 802.11g, Port 1, 30 MHz – 1 GHz



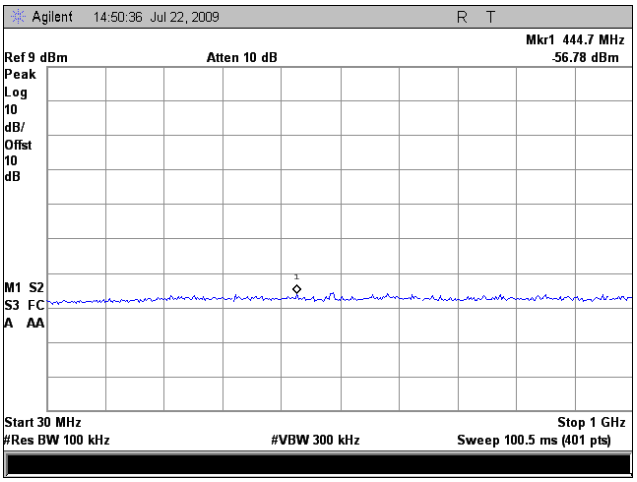
Plot 181. Conducted Emissions, Low Channel, 2.4 GHz, 802.11g, Port 1, 1 GHz – 26 GHz



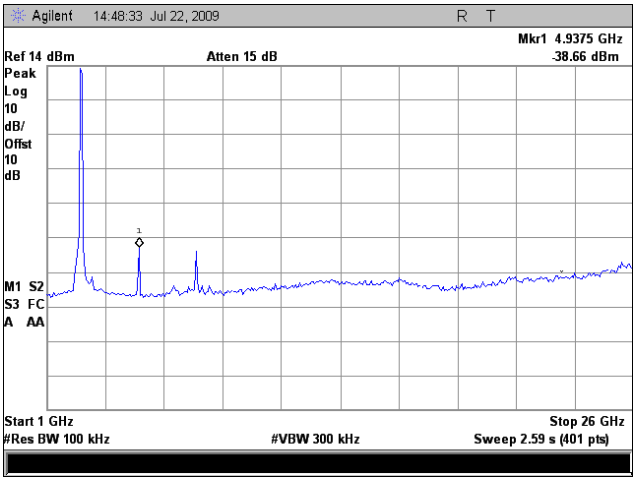
Plot 182. Conducted Emissions, Mid Channel, 2.4 GHz, 802.11g, Port 1, 30 MHz – 1 GHz



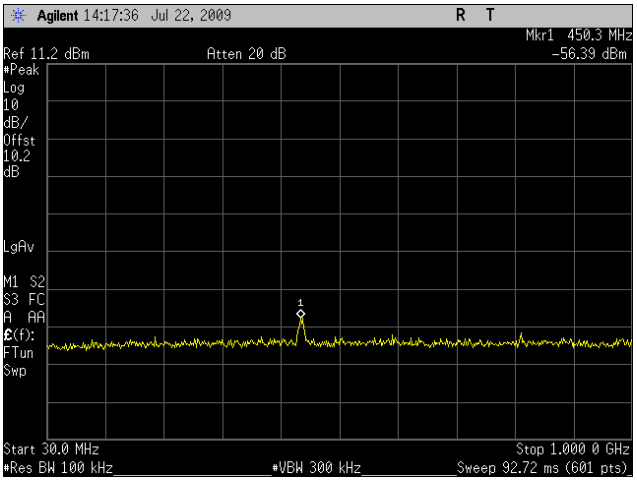
Plot 183. Conducted Emissions, Mid Channel, 2.4 GHz, 802.11g, Port 1, 1 GHz – 26 GHz



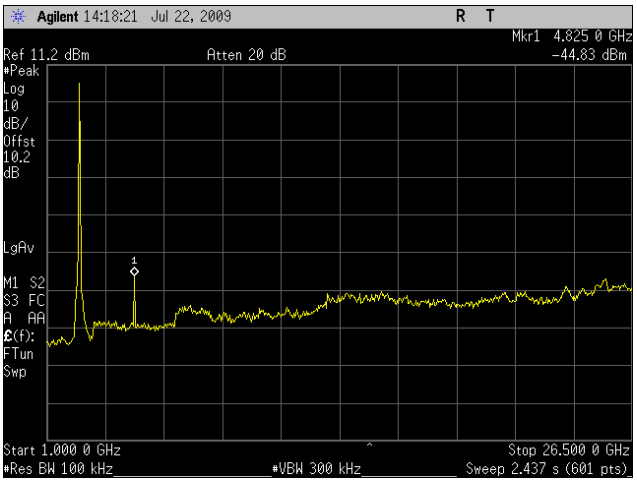
Plot 184. Conducted Emissions, High Channel, 2.4 GHz, 802.11g, Port 1, 30 MHz – 1 GHz



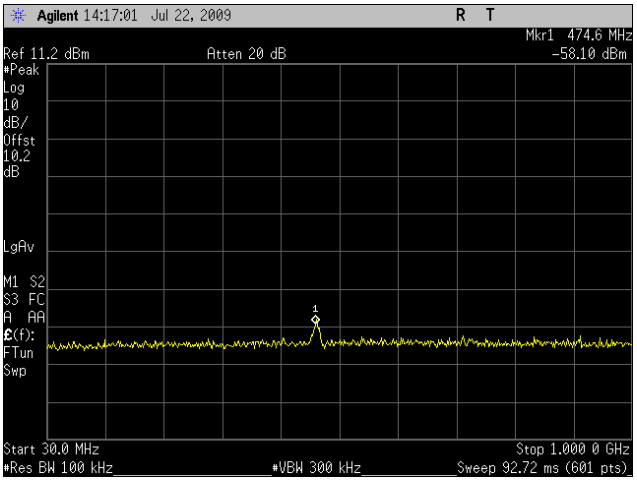
Plot 185. Conducted Emissions, High Channel, 2.4 GHz, 802.11g, Port 1, 1 GHz – 26 GHz



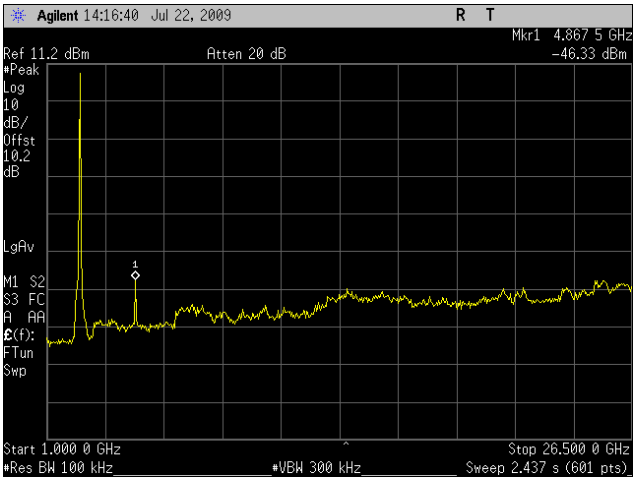
Plot 186. Conducted Emissions, Low Channel, 2.4 GHz, Port 1, 802.11n 20MHz, 30 MHz – 1 GHz



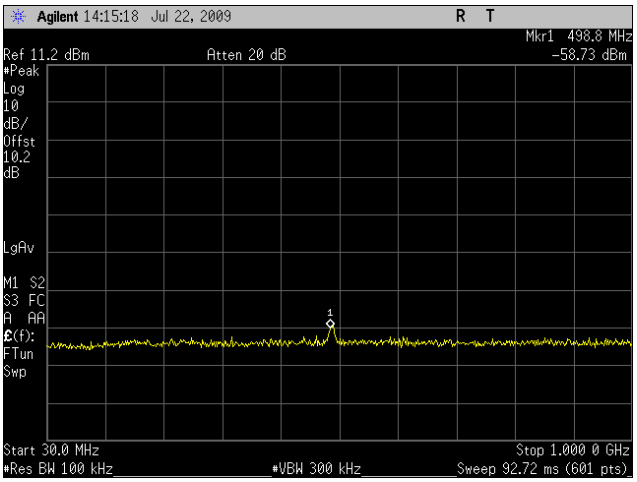
Plot 187. Conducted Emissions, Low Channel, 2.4 GHz, Port 1, 802.11n 20MHz, 1 GHz – 26.5 GHz



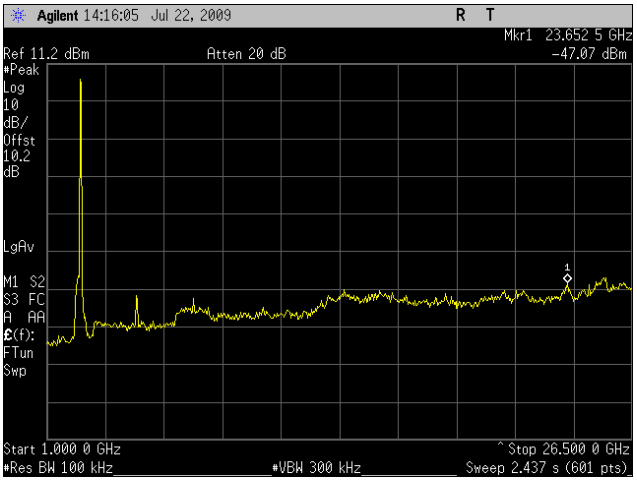
Plot 188. Conducted Emissions, Mid Channel, 2.4 GHz, Port 1, 802.11n 20MHz, 30 MHz – 1 GHz



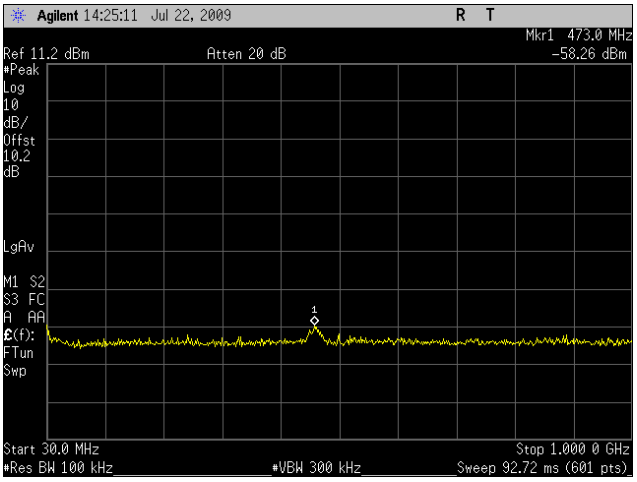
Plot 189. Conducted Emissions, Mid Channel, 2.4 GHz, Port 1, 802.11n 20MHz, 1 GHz – 26.5 GHz



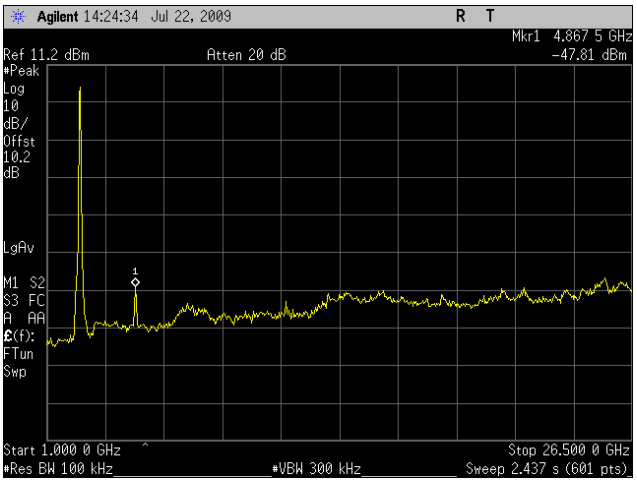
Plot 190. Conducted Emissions, High Channel, 2.4 GHz, Port 1, 802.11n 20MHz, 30 MHz – 1 GHz



Plot 191. Conducted Emissions, High Channel, 2.4 GHz, Port 1, 802.11n 20MHz, 1 GHz – 26.5 GHz

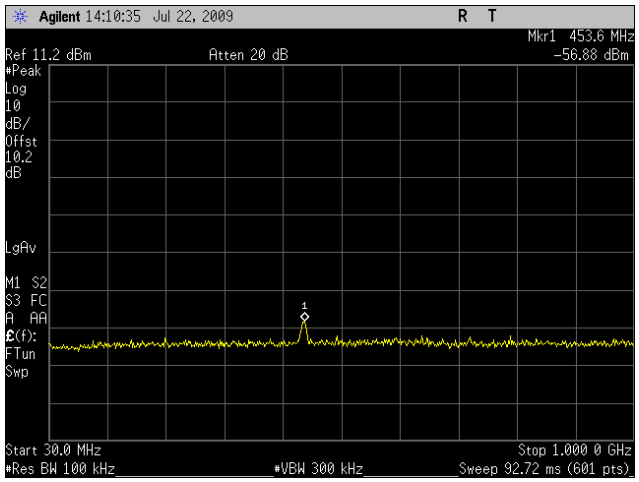


Plot 192. Conducted Emissions, Mid Channel, 2.4 GHz, Port 1, 802.11n 40MHz, 30 MHz – 1 GHz

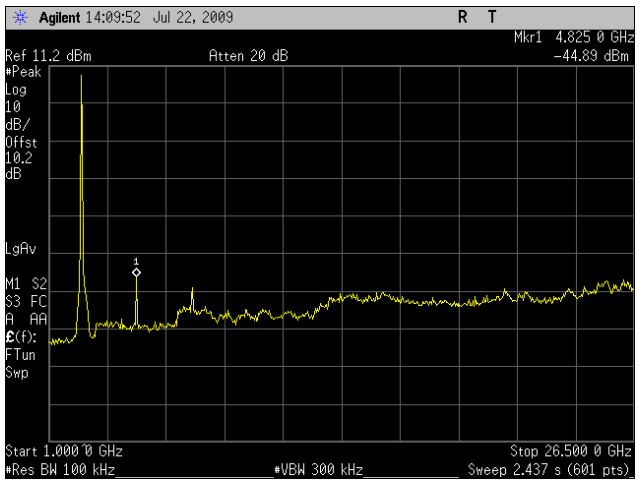


Plot 193. Conducted Emissions, Mid Channel, 2.4 GHz, Port 1, 802.11n 40MHz, 1 GHz – 26.5 GHz

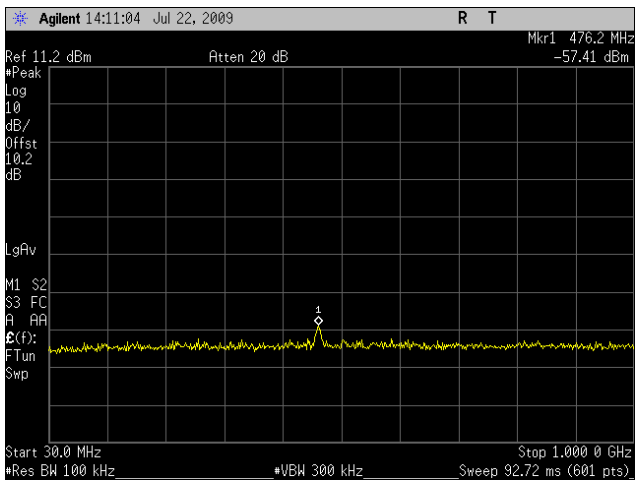
RF Conducted Spurious Emissions Requirements, 2.4 GHz, Port 2



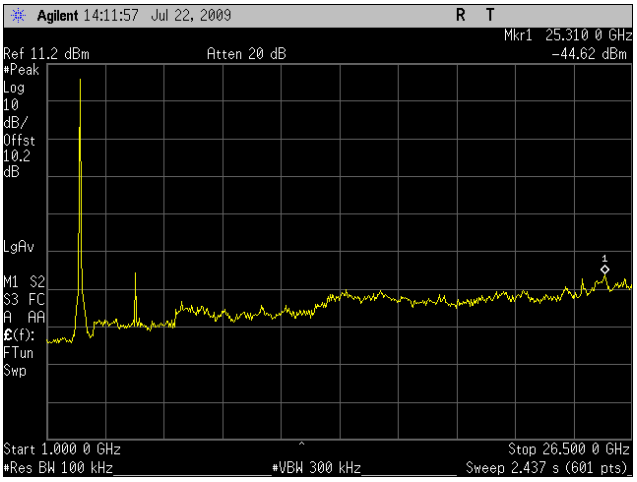
Plot 194. Conducted Emissions, Low Channel, 2.4 GHz, Port 2, 802.11n 20MHz, 30 MHz – 1 GHz



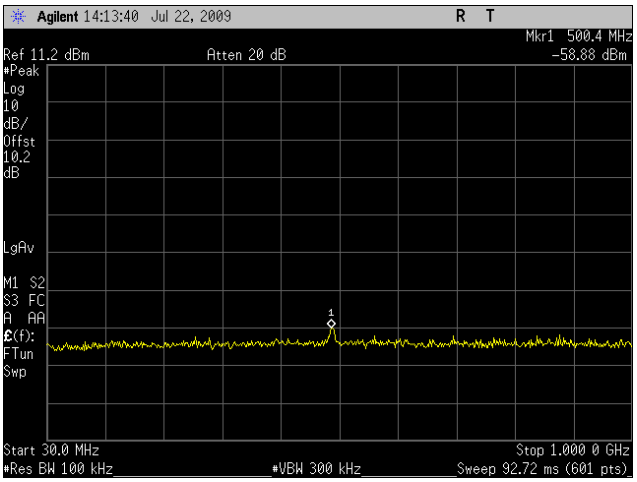
Plot 195. Conducted Emissions, Low Channel, 2.4 GHz, Port 2, 802.11n 20MHz, 1 GHz – 26.5 GHz



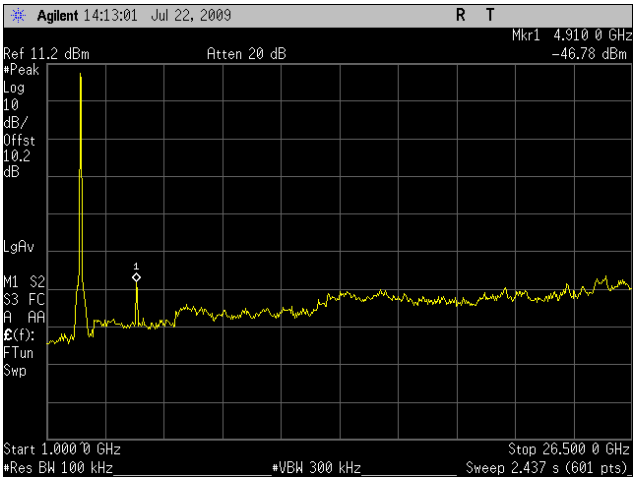
Plot 196. Conducted Emissions, Mid Channel, 2.4 GHz, Port 2, 802.11n 20MHz, 30 MHz – 1 GHz



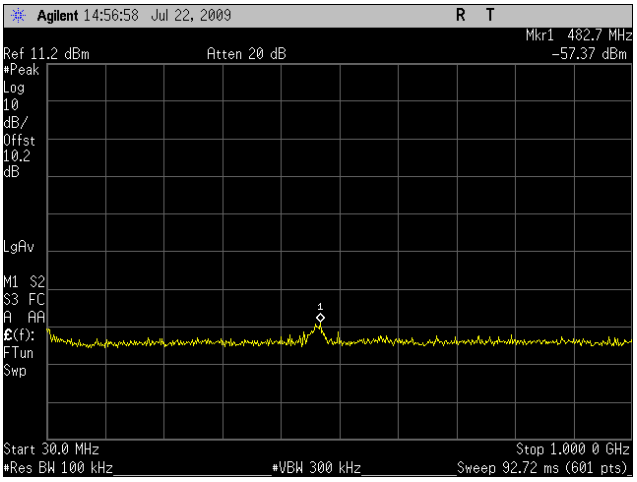
Plot 197. Conducted Emissions, Mid Channel, 2.4 GHz, Port 2, 802.11n 20MHz, 1 GHz – 26.5 GHz



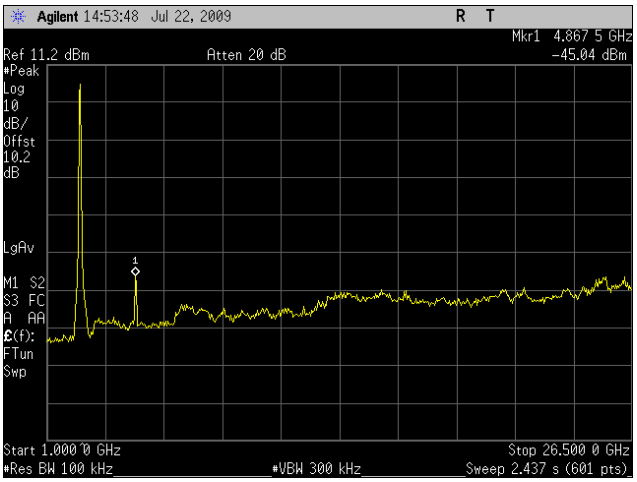
Plot 198. Conducted Emissions, High Channel, 2.4 GHz, Port 2, 802.11n 20MHz, 30 MHz – 1 GHz



Plot 199. Conducted Emissions, High Channel, 2.4 GHz, Port 2, 802.11n 20MHz, 1 GHz – 26.5 GHz

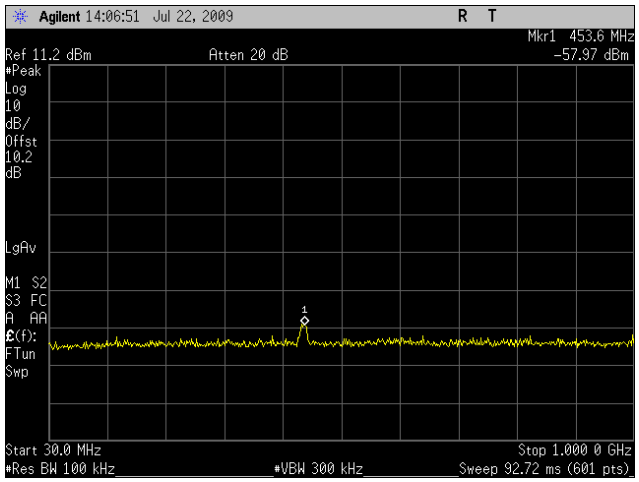


Plot 200. Conducted Emissions, Mid Channel, 2.4 GHz, Port 2, 802.11n 40MHz, 30 MHz – 1 GHz

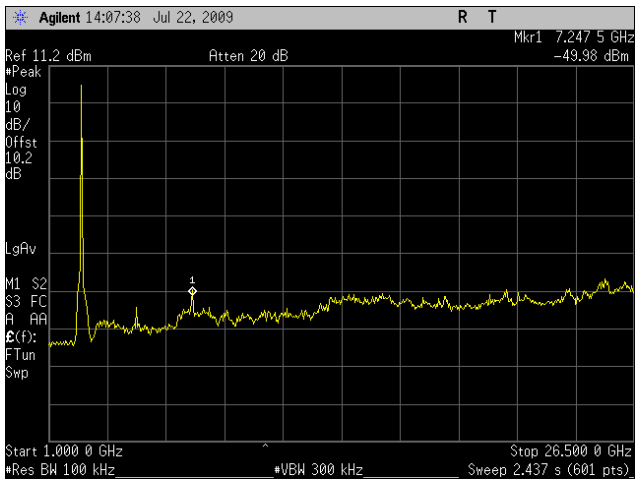


Plot 201. Conducted Emissions, Mid Channel, 2.4 GHz, Port 2, 802.11n 40MHz, 1 GHz – 26.5 GHz

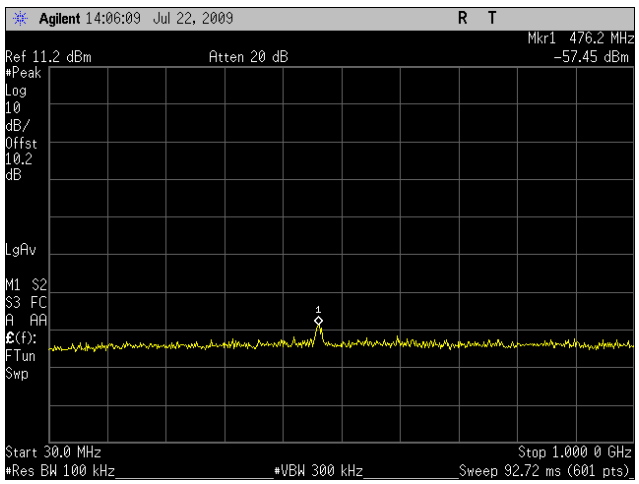
RF Conducted Spurious Emissions Requirements, 2.4 GHz, Port 3



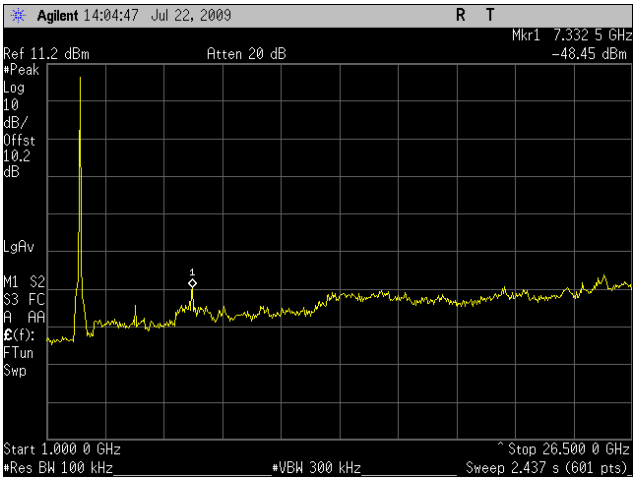
Plot 202. Conducted Emissions, Low Channel, 2.4 GHz, Port 3, 802.11n 20MHz, 30 MHz – 1 GHz



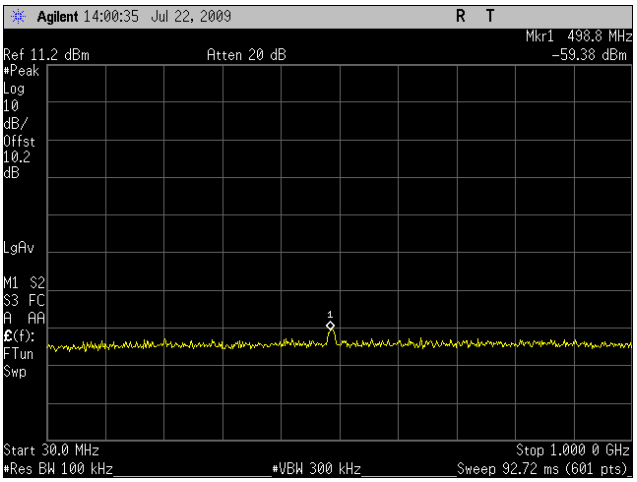
Plot 203. Conducted Emissions, Low Channel, 2.4 GHz, Port 3, 802.11n 20MHz, 1 GHz – 26.5 GHz



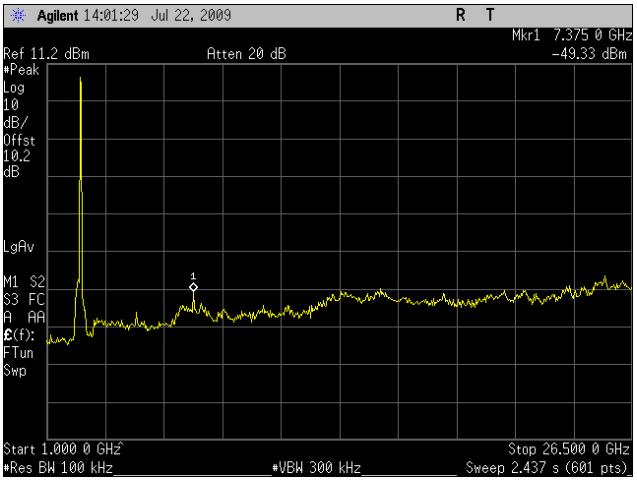
Plot 204. Conducted Emissions, Mid Channel, 2.4 GHz, Port 3, 802.11n 20MHz, 30 MHz – 1 GHz



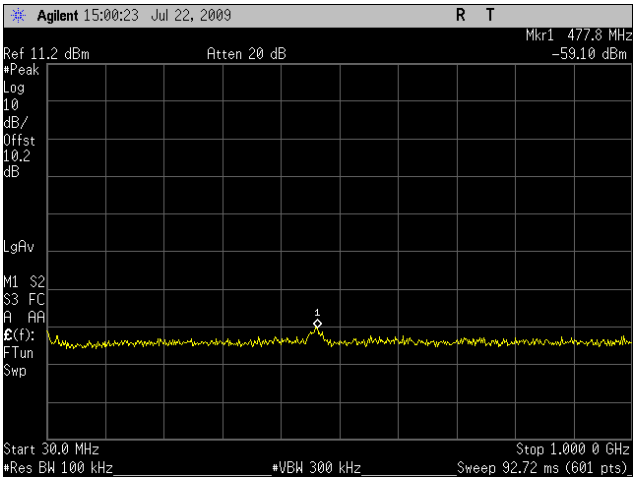
Plot 205. Conducted Emissions, Mid Channel, 2.4 GHz, Port 3, 802.11n 20MHz, 1 GHz – 26.5 GHz



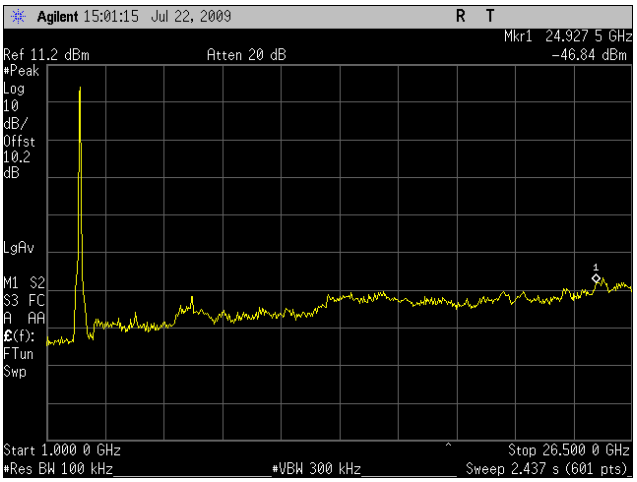
Plot 206. Conducted Emissions, High Channel, 2.4 GHz, Port 3, 802.11n 20MHz 30 MHz – 1 GHz



Plot 207. Conducted Emissions, High Channel, 2.4 GHz, Port 3, 802.11n 20MHz, 1 GHz – 26.5 GHz

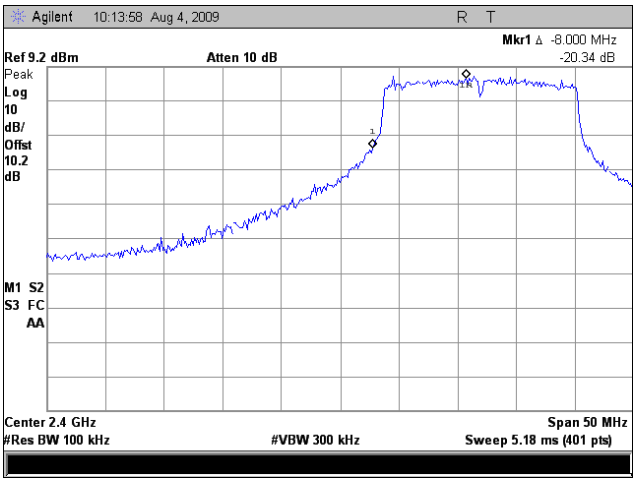


Plot 208. Conducted Emissions, Mid Channel, 2.4 GHz, Port 3, 802.11n 40MHz, 30 MHz – 1 GHz

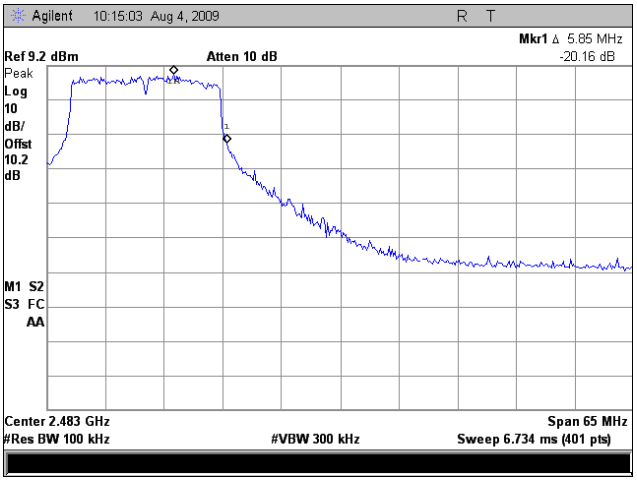


Plot 209. Conducted Emissions, Mid Channel, 2.4 GHz, Port 3, 802.11n 40MHz, 1 GHz – 26.5 GHz

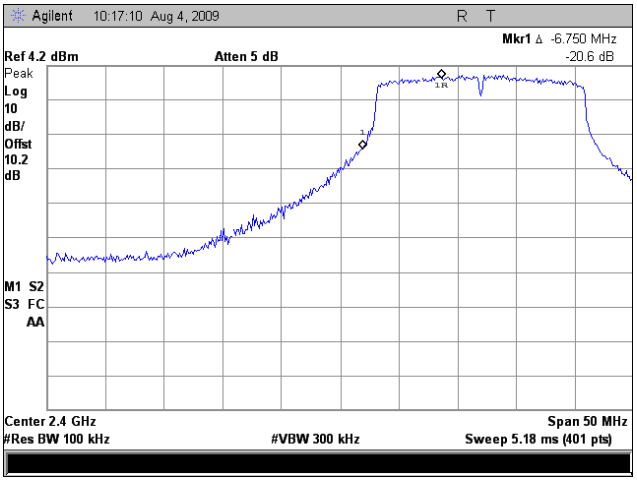
Conducted Band Edge, 2.4 GHz, Port 1



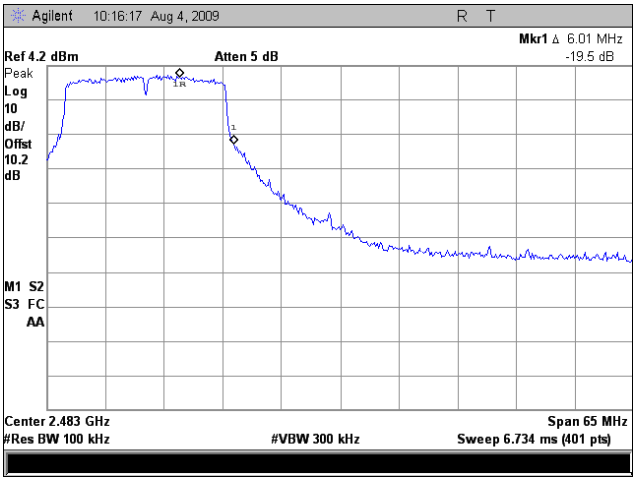
Plot 210. Lower Conducted Band Edge, 2.4 GHz, Port 1, 802.11g



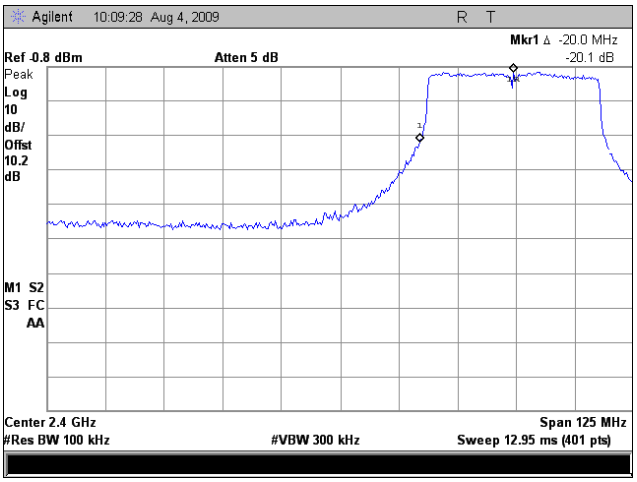
Plot 211. Upper Conducted Band Edge, 2.4 GHz, Port 1, 802.11g



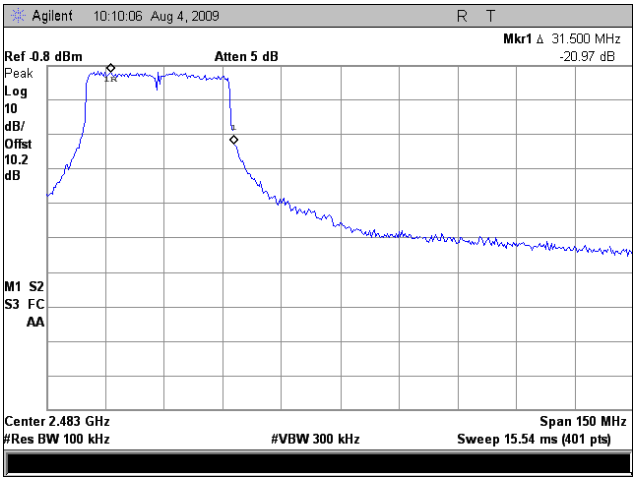
Plot 212. Lower Conducted Band Edge, 2.4 GHz, Port 1, 802.11n 20MHz



Plot 213. Upper Conducted Band Edge, 2.4 GHz, Port 1, 802.11n 20MHz

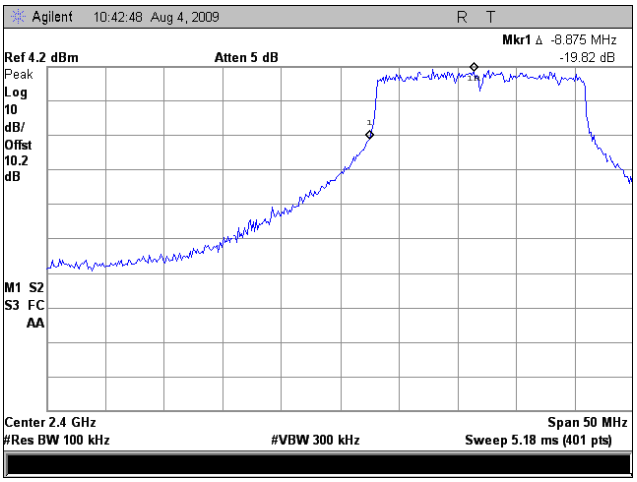


Plot 214. Lower Conducted Band Edge, 2.4 GHz, Port 1, 802.11n 40MHz

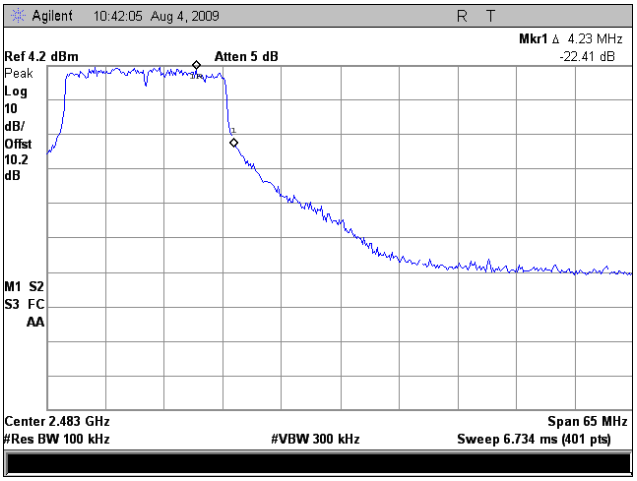


Plot 215. Upper Conducted Band Edge, 2.4 GHz, Port 1, 802.11n 40MHz

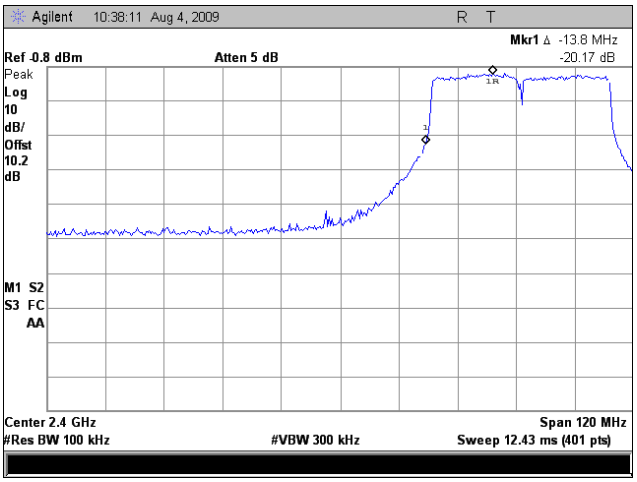
Conducted Band Edge, 2.4 GHz, Port 2



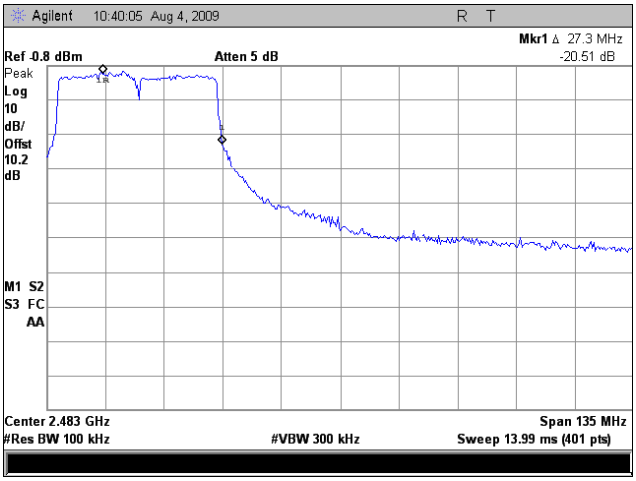
Plot 216. Lower Conducted Band Edge, 2.4 GHz, Port 2, 802.11n 20MHz



Plot 217. Upper Conducted Band Edge, 2.4 GHz, Port 2, 802.11n 20MHz

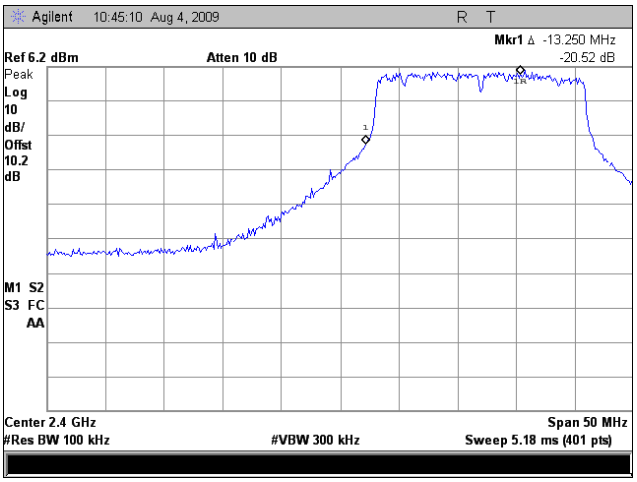


Plot 218. Lower Conducted Band Edge, 2.4 GHz, Port 2, 802.11n 40MHz

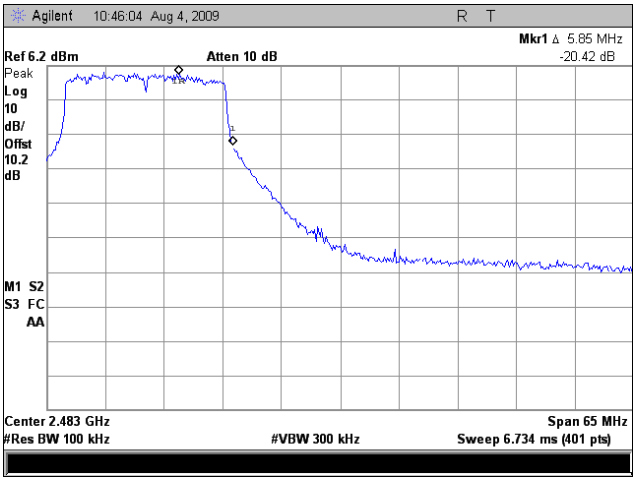


Plot 219. Upper Conducted Band Edge, 2.4 GHz, Port 2, 802.11n 40MHz

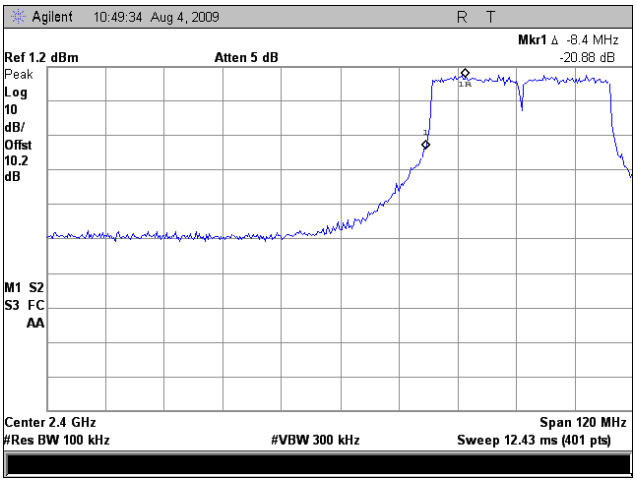
Conducted Band Edge, 2.4 GHz, Port 3



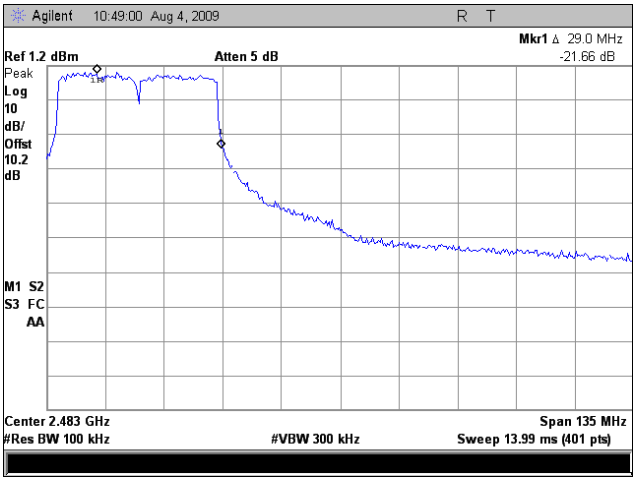
Plot 220. Lower Conducted Band Edge, 2.4 GHz, Port 3, 802.11n 20MHz



Plot 221. Upper Conducted Band Edge, 2.4 GHz, Port 3, 802.11n 20MHz

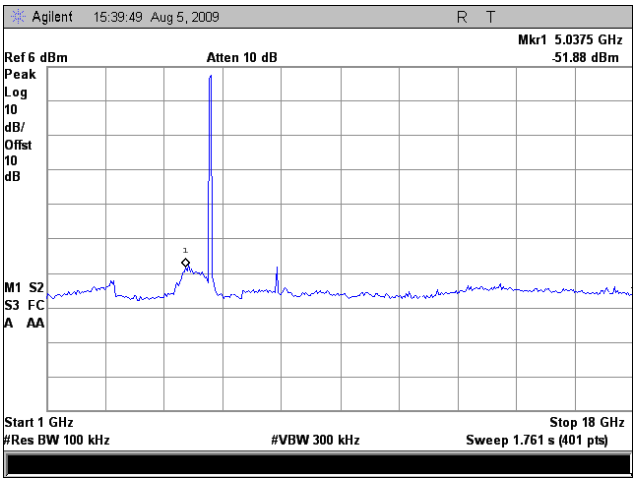


Plot 222. Lower Conducted Band Edge, 2.4 GHz, Port 3, 802.11n 40MHz

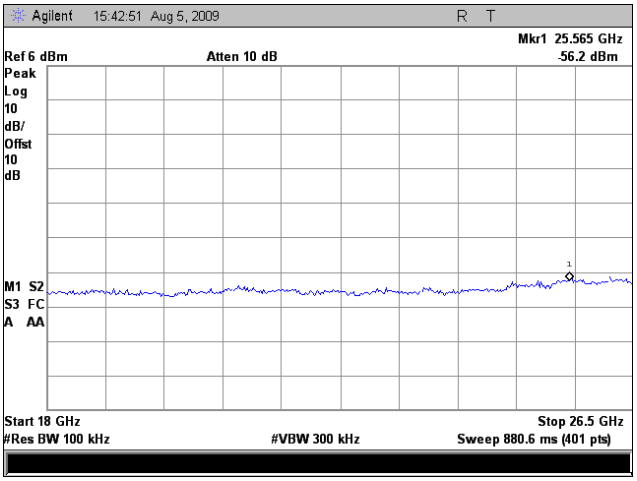


Plot 223. Upper Conducted Band Edge, 2.4 GHz, Port 3, 802.11n 40MHz

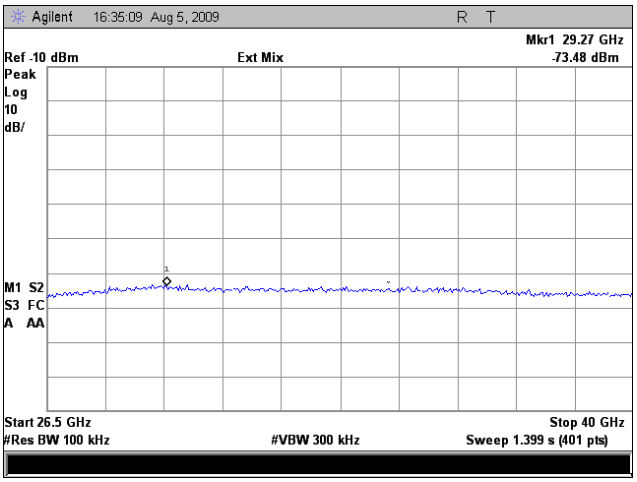
RF Conducted Spurious Emissions Requirements, 5 GHz, Port 1



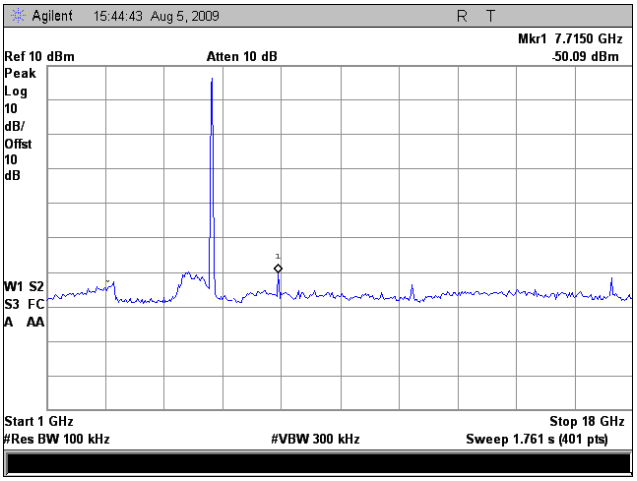
Plot 224. Conducted Emissions, Low Channel, 5 GHz, Port 1, 802.11a, 1 GHz – 18 GHz



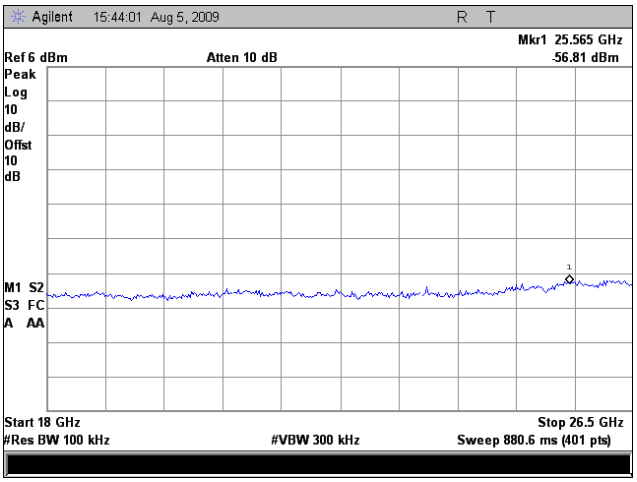
Plot 225. Conducted Emissions, Low Channel, 5 GHz, Port 1, 802.11a, 18 GHz – 26.5 GHz



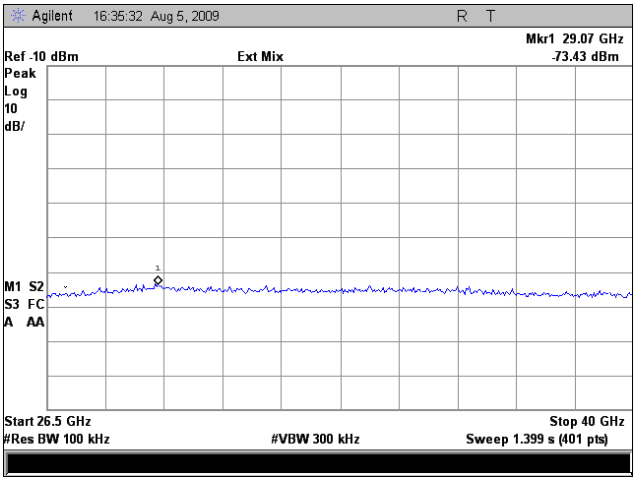
Plot 226. Conducted Emissions, Low Channel, 5 GHz, Port 1, 802.11a, 26.5 GHz – 40 GHz



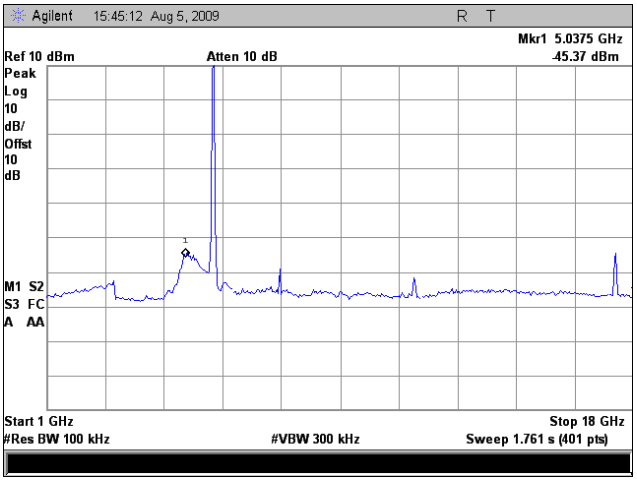
Plot 227. Conducted Emissions, Mid Channel, 5 GHz, Port 1, 802.11a, 1 GHz – 18 GHz



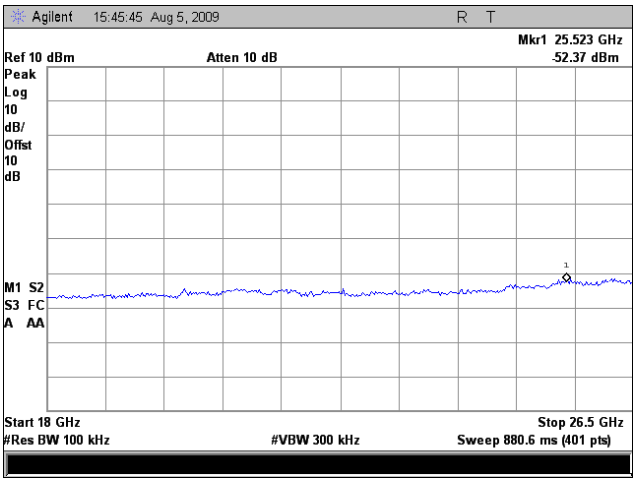
Plot 228. Conducted Emissions, Mid Channel, 5 GHz, Port 1, 802.11a, 18 GHz – 26 GHz



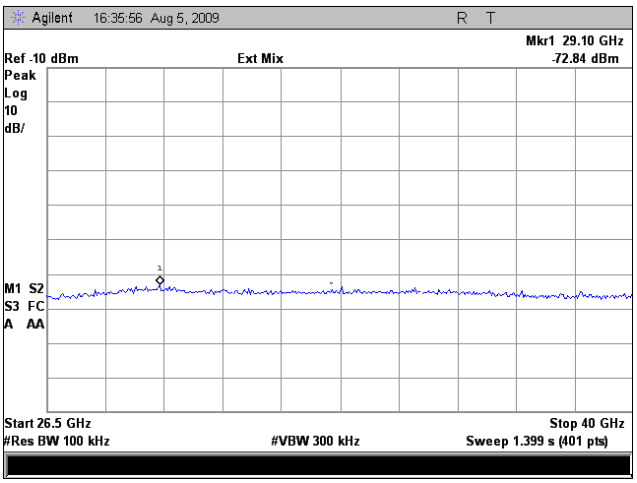
Plot 229. Conducted Emissions, Mid Channel, 5 GHz, Port 1, 802.11a, 26 GHz – 40 GHz



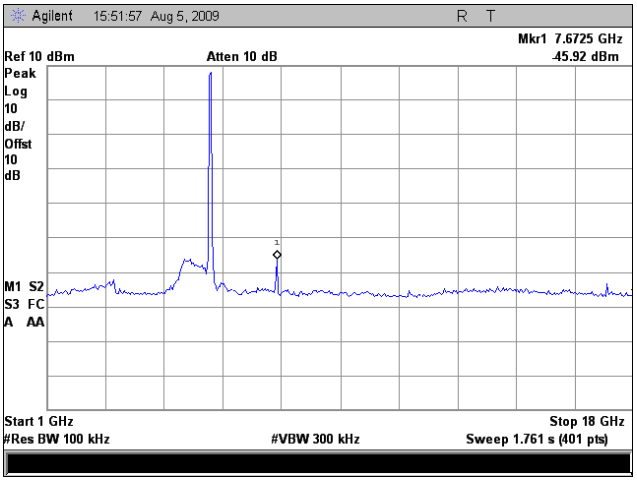
Plot 230. Conducted Emissions, High Channel, 5 GHz, Port 1, 802.11a, 1 GHz – 18 GHz



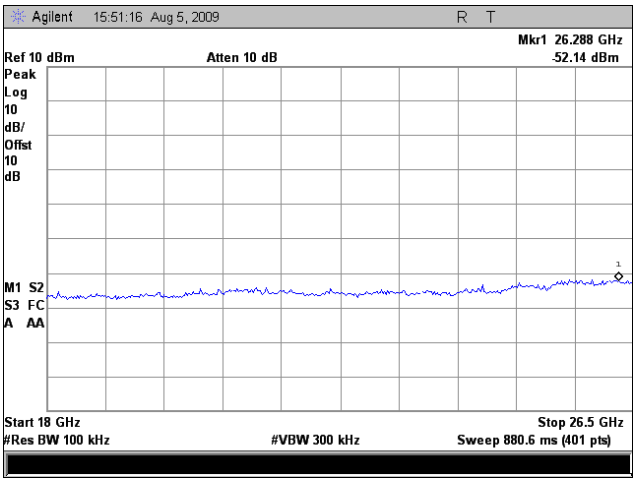
Plot 231. Conducted Emissions, High Channel, 5 GHz, Port 1, 802.11a, 18 GHz – 26 GHz



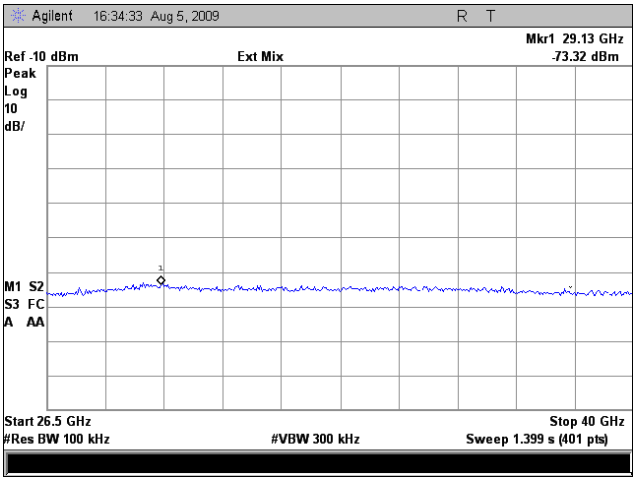
Plot 232. Conducted Emissions, High Channel, 5 GHz, Port 1, 802.11a, 26 GHz – 40 GHz



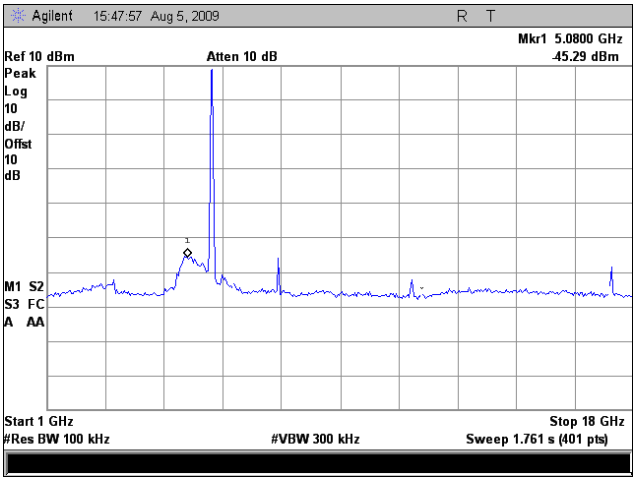
Plot 233. Conducted Emissions, Low Channel, 5 GHz, Port 1, 802.11n 20MHz, 1 GHz – 18 GHz



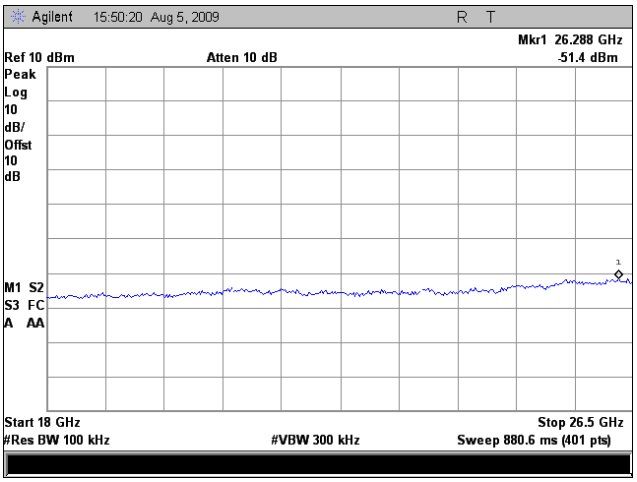
Plot 234. Conducted Emissions, Low Channel, 5 GHz, Port 1, 802.11n 20MHz, 18 GHz – 26.5 GHz



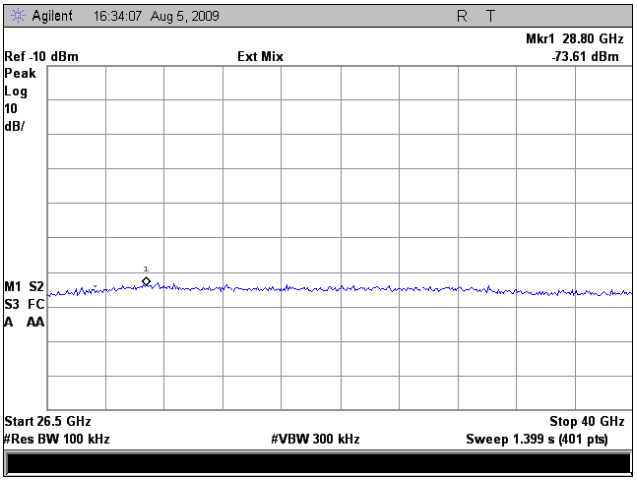
Plot 235. Conducted Emissions, Low Channel, 5 GHz, Port 1, 802.11n 20MHz, 26.5 GHz – 40 GHz



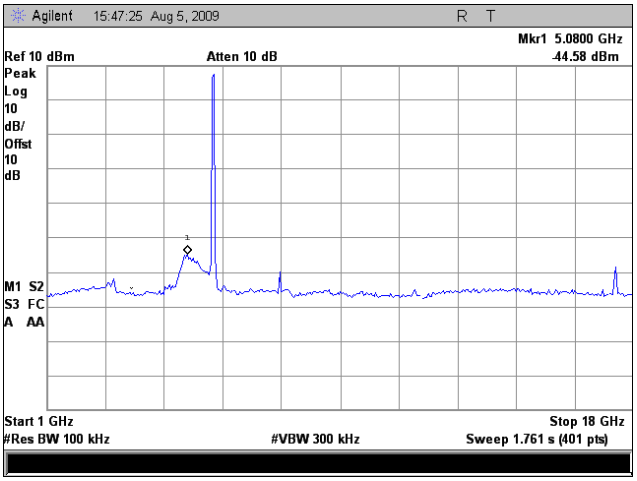
Plot 236. Conducted Emissions, Mid Channel, 5 GHz, Port 1, 802.11n 20MHz, 1 GHz – 18 GHz



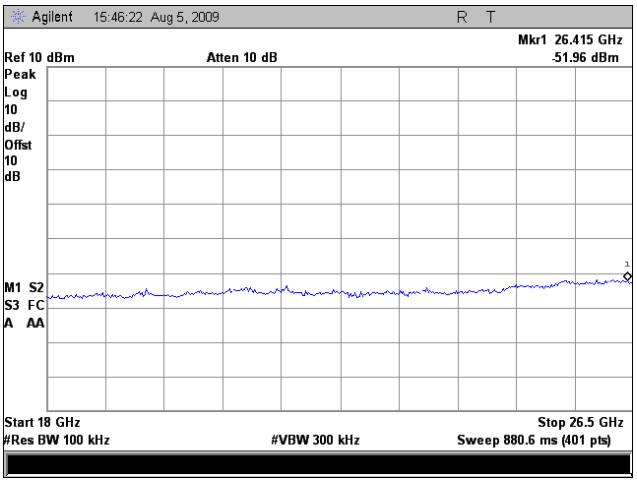
Plot 237. Conducted Emissions, Mid Channel, 5 GHz, Port 1, 802.11n 20MHz, 18 GHz – 26.5 GHz



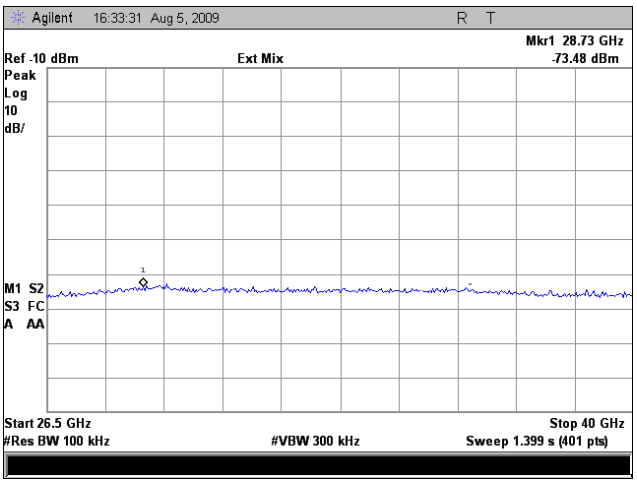
Plot 238. Conducted Emissions, Mid Channel, 5 GHz, Port 1, 802.11n 20MHz, 26.5 GHz – 40 GHz



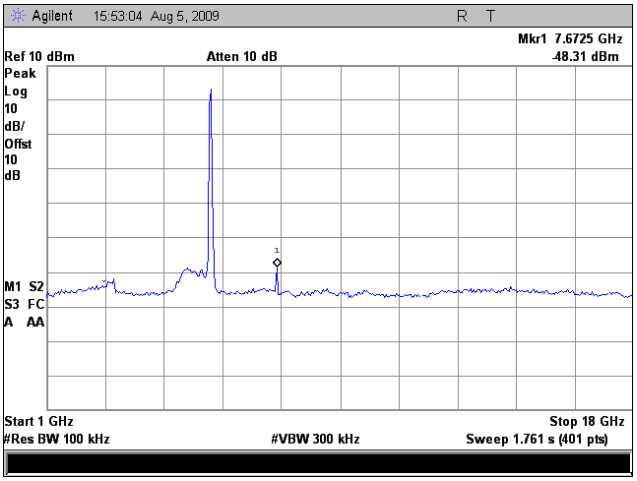
Plot 239. Conducted Emissions, High Channel, 5 GHz, Port 1, 802.11n 20MHz, 1 GHz – 18 GHz



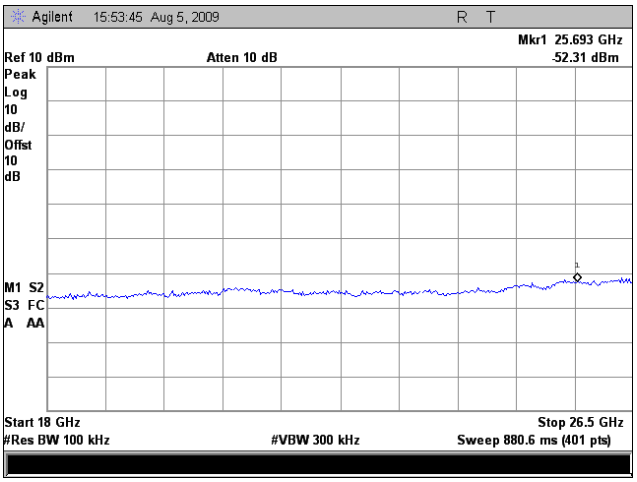
Plot 240. Conducted Emissions, High Channel, 5 GHz, Port 1, 802.11n 20MHz, 18 GHz – 26.5 GHz



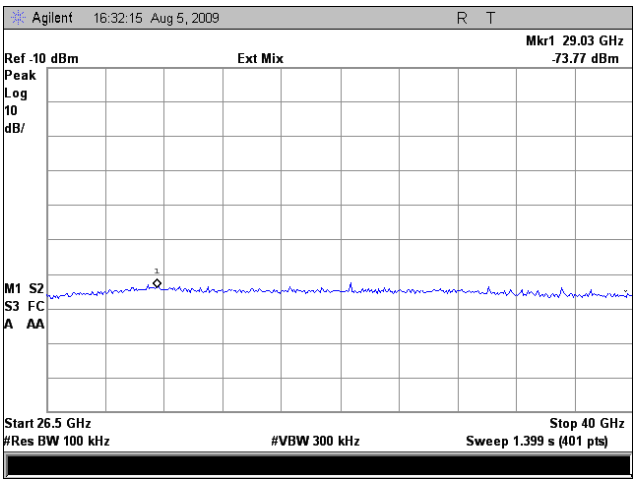
Plot 241. Conducted Emissions, High Channel, 5 GHz, Port 1, 802.11n 20MHz, 26.5 GHz – 40 GHz



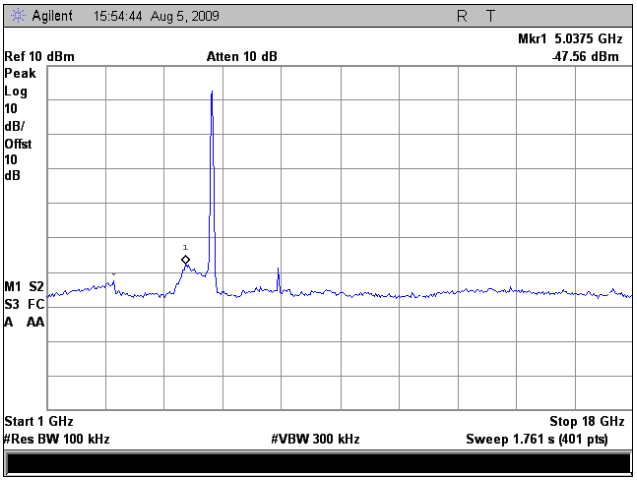
Plot 242. Conducted Emissions, Low Channel, 5 GHz, Port 1, 802.11n 40MHz, 1 GHz – 18 GHz



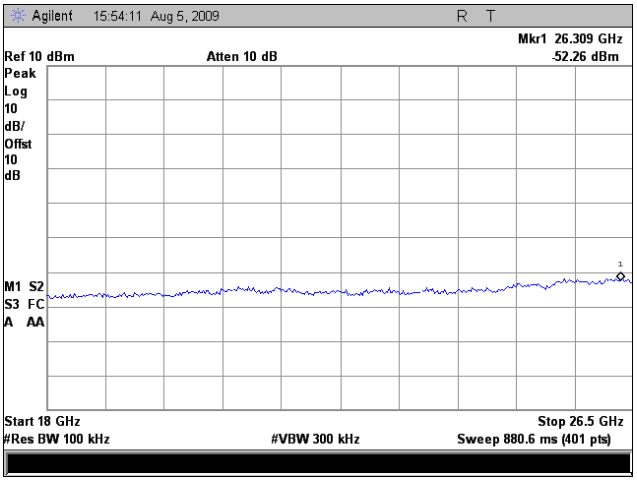
Plot 243. Conducted Emissions, Low Channel, 5 GHz, Port 1, 802.11n 40MHz, 18 GHz – 26.5 GHz



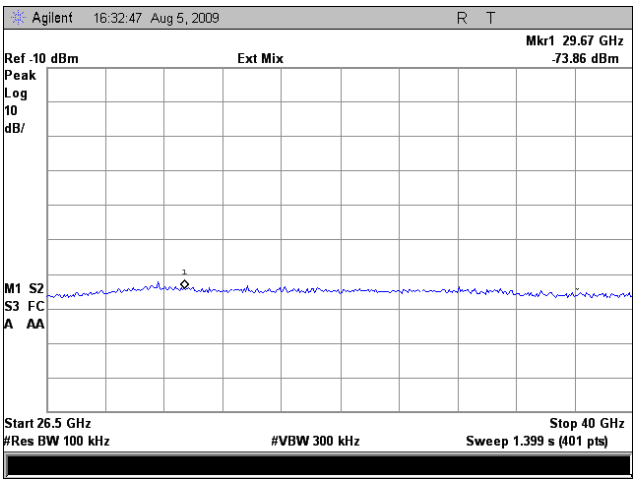
Plot 244. Conducted Emissions, Low Channel, 5 GHz, Port 1, 802.11n 40MHz, 26.5 GHz – 40 GHz



Plot 245. Conducted Emissions, High Channel, 5 GHz, Port 1, 802.11n 40MHz, 1 GHz – 18 GHz

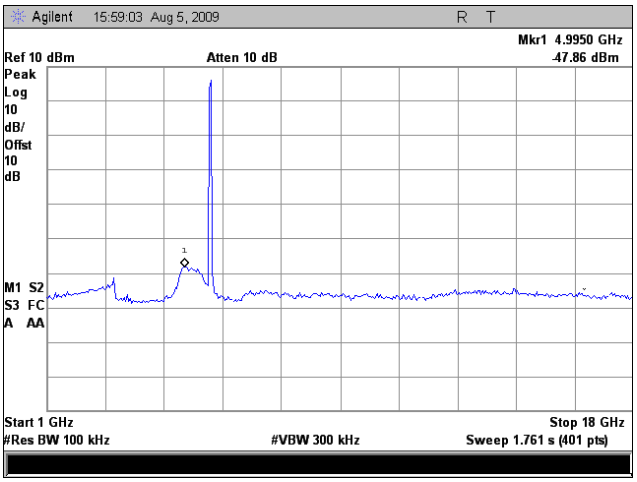


Plot 246. Conducted Emissions, High Channel, 5 GHz, Port 1, 802.11n 40MHz, 18 GHz – 26.5 GHz

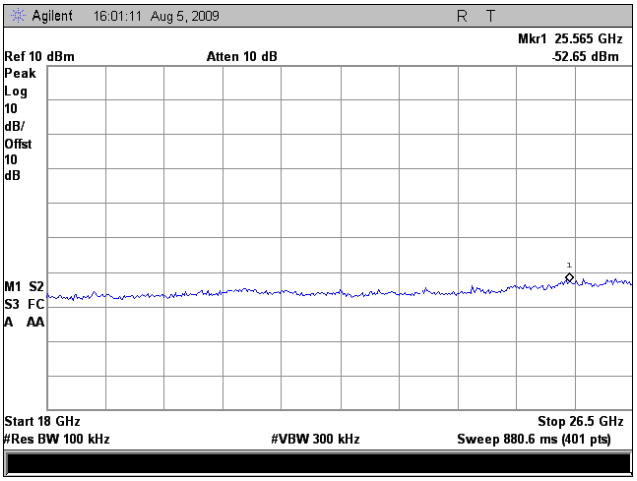


Plot 247. Conducted Emissions, High Channel, 5 GHz, Port 1, 802.11n 40MHz, 26.5 GHz – 40 GHz

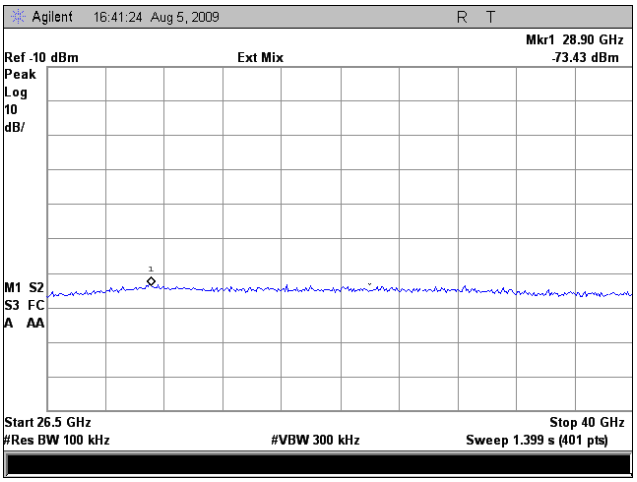
RF Conducted Spurious Emissions Requirements, 5 GHz, Port 2



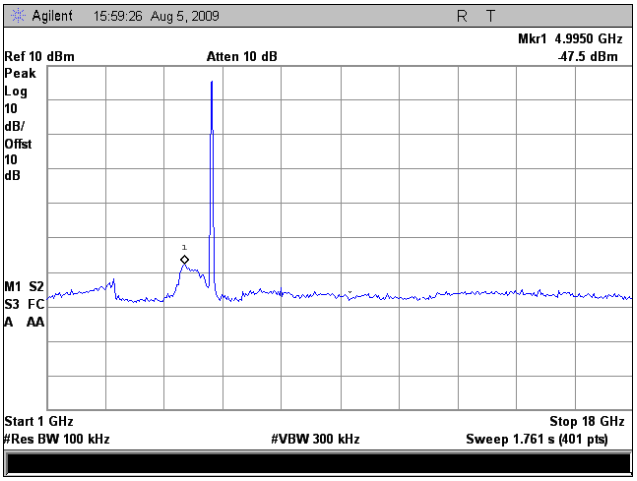
Plot 248. Conducted Emissions, Low Channel, 5 GHz, Port 2, 802.11n 20MHz, 1 GHz – 18 GHz



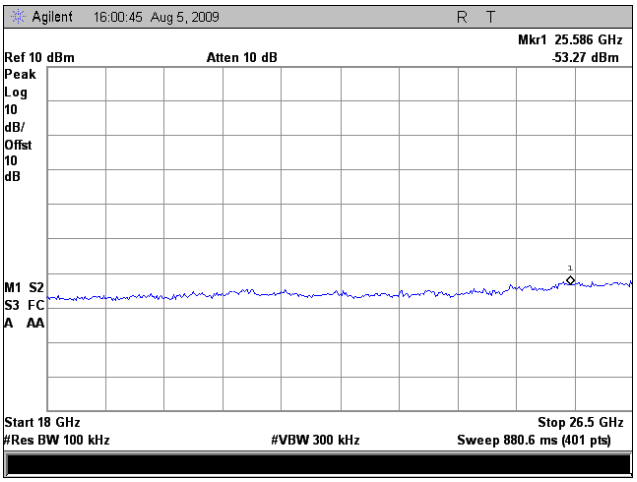
Plot 249. Conducted Emissions, Low Channel, 5 GHz, Port 2, 802.11n 20MHz, 18 GHz – 26.5 GHz



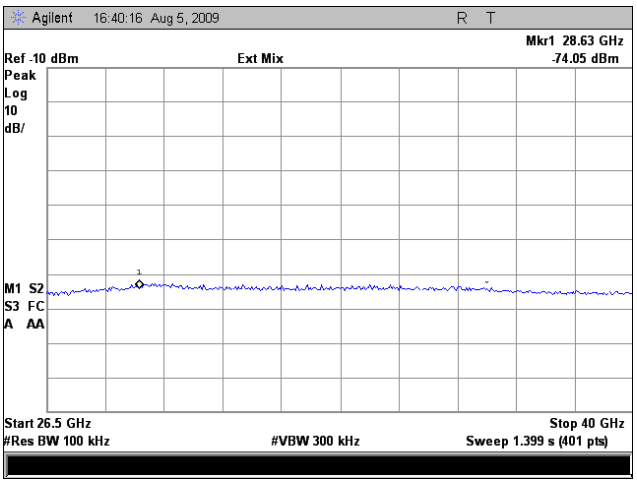
Plot 250. Conducted Emissions, Low Channel, 5 GHz, Port 2, 802.11n 20MHz, 26.5 GHz – 40 GHz



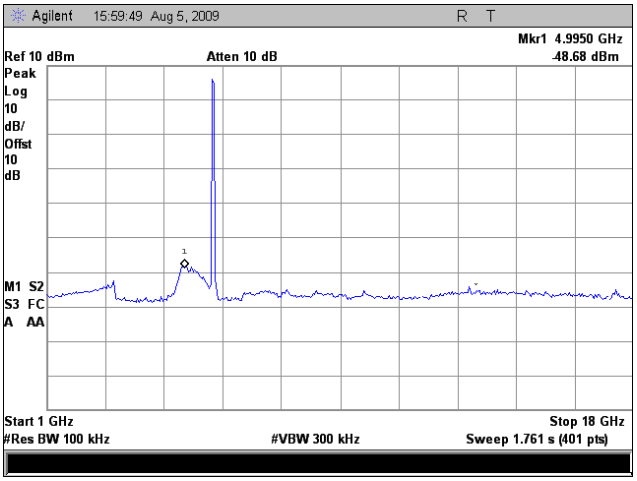
Plot 251. Conducted Emissions, Mid Channel, 5 GHz, Port 2, 802.11n 20MHz, 1 GHz – 18 GHz



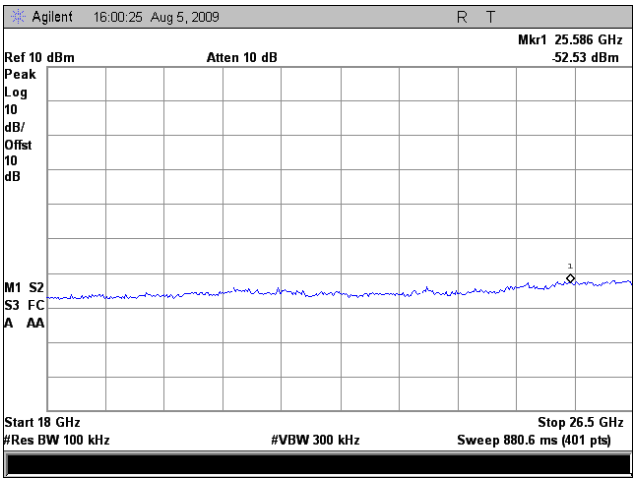
Plot 252. Conducted Emissions, Mid Channel, 5 GHz, Port 2, 802.11n 20MHz, 18 GHz – 26.5 GHz



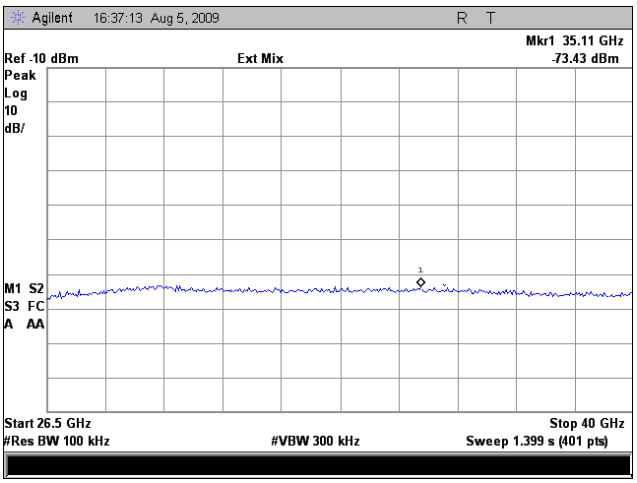
Plot 253. Conducted Emissions, Mid Channel, 5 GHz, Port 2, 802.11n 20MHz, 26.5 GHz – 40 GHz



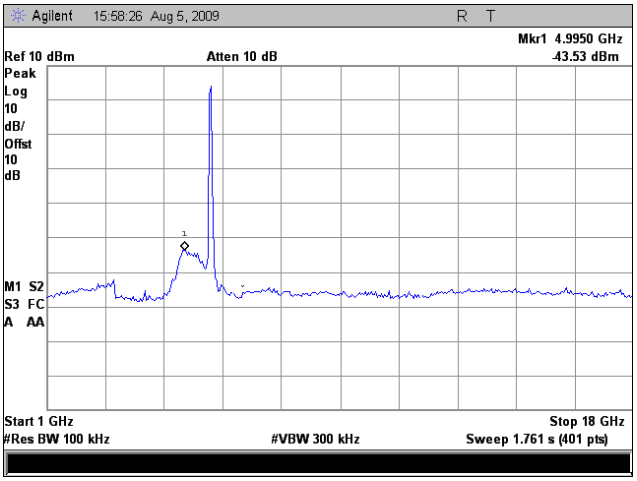
Plot 254. Conducted Emissions, High Channel, 5 GHz, Port 2, 802.11n 20MHz, 1 GHz – 18 GHz



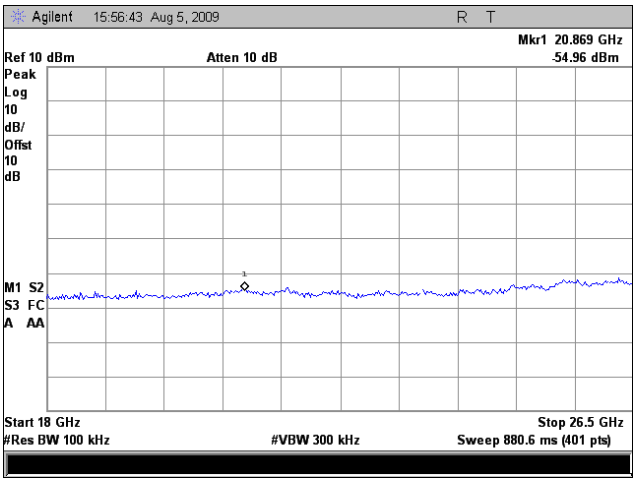
Plot 255. Conducted Emissions, High Channel, 5 GHz, Port 2, 802.11n 20MHz, 18 GHz – 26.5 GHz



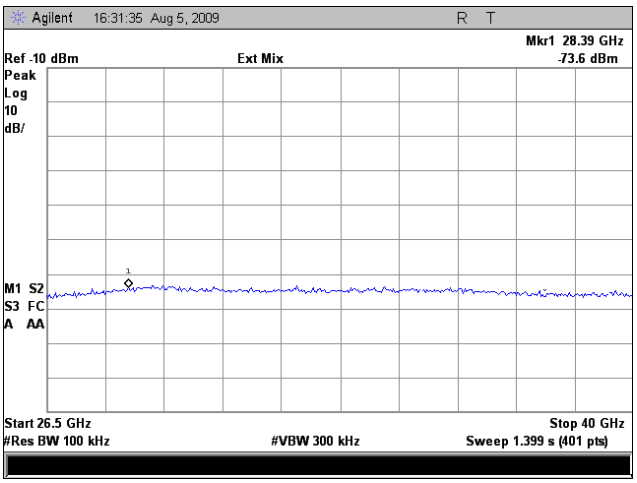
Plot 256. Conducted Emissions, High Channel, 5 GHz, Port 2, 802.11n 20MHz, 26.5 GHz – 40 GHz



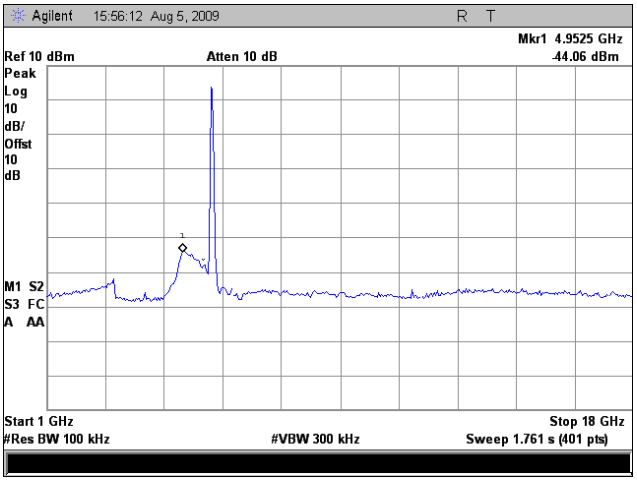
Plot 257. Conducted Emissions, Low Channel, 5 GHz, Port 2, 802.11n 40MHz, 1 GHz – 18 GHz



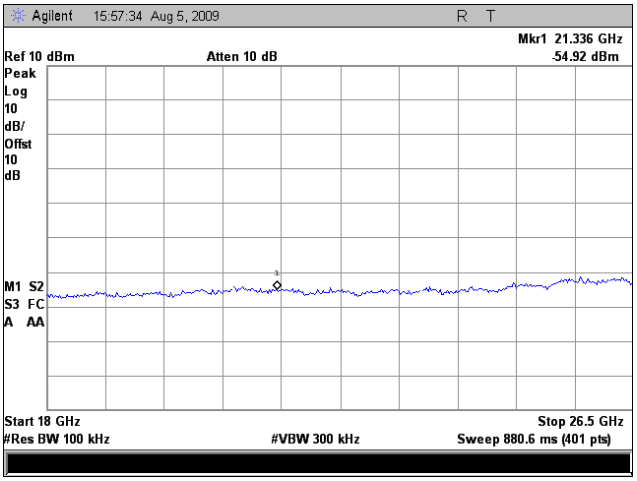
Plot 258. Conducted Emissions, Low Channel, 5 GHz, Port 2, 802.11n 40MHz, 18 GHz – 26.5 GHz



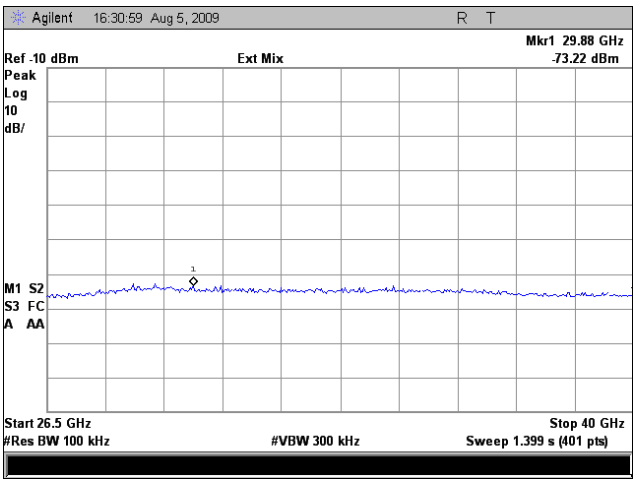
Plot 259. Conducted Emissions, Low Channel, 5 GHz, Port 2, 802.11n 40MHz, 26.5 GHz – 40 GHz



Plot 260. Conducted Emissions, High Channel, 5 GHz, Port 2, 802.11n 40MHz, 1 GHz – 18 GHz

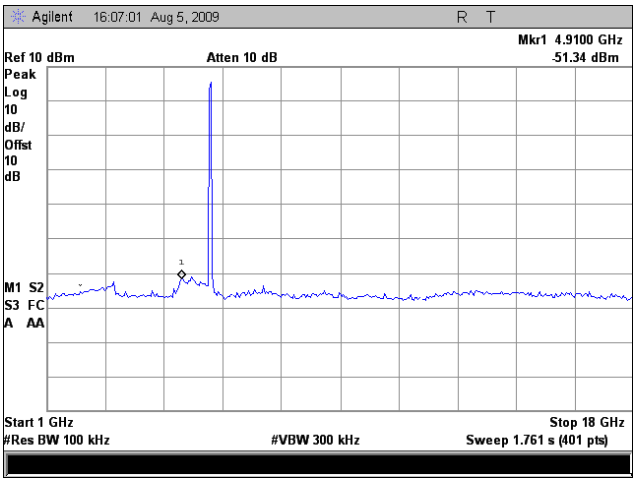


Plot 261. Conducted Emissions, High Channel, 5 GHz, Port 2, 802.11n 40MHz, 18 GHz – 26.5 GHz

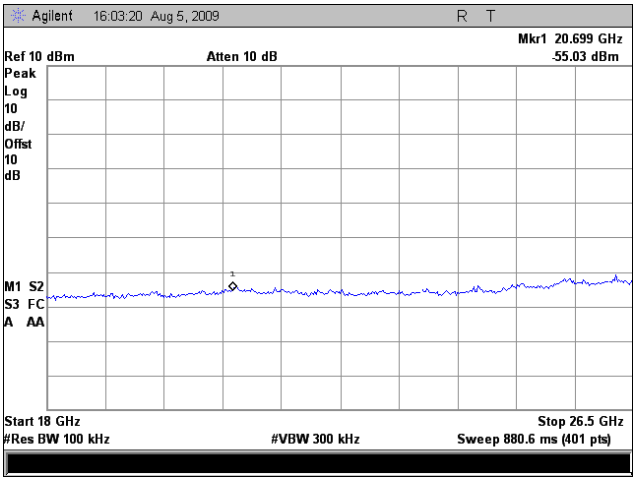


Plot 262. Conducted Emissions, High Channel, 5 GHz, Port 2, 802.11n 40MHz, 26.5 GHz – 40 GHz

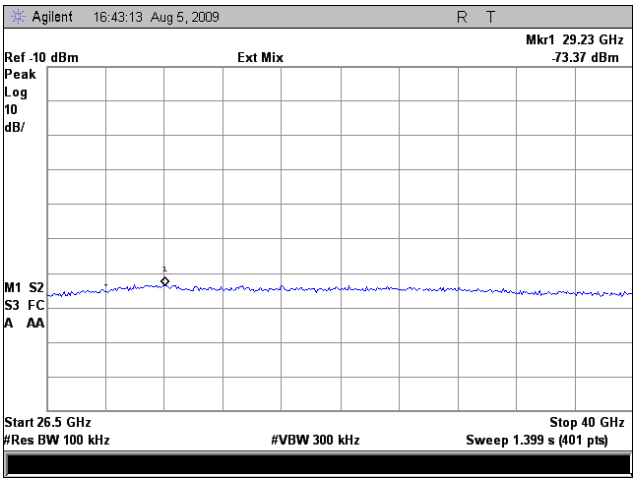
RF Conducted Spurious Emissions Requirements, 5 GHz, Port 3



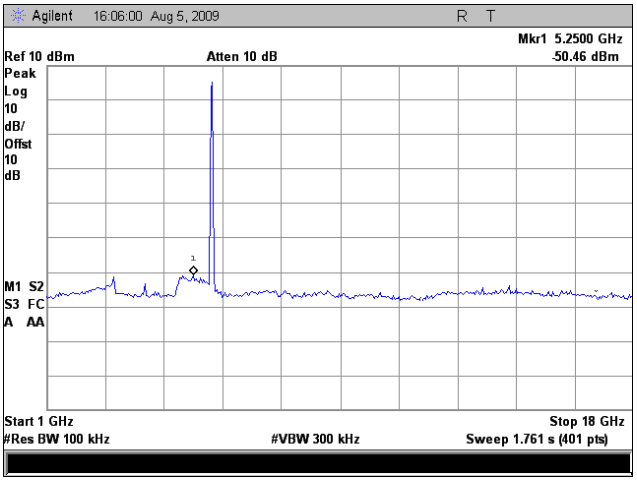
Plot 263. Conducted Emissions, Low Channel, 5 GHz, Port 3, 802.11n 20MHz, 1 GHz – 18 GHz



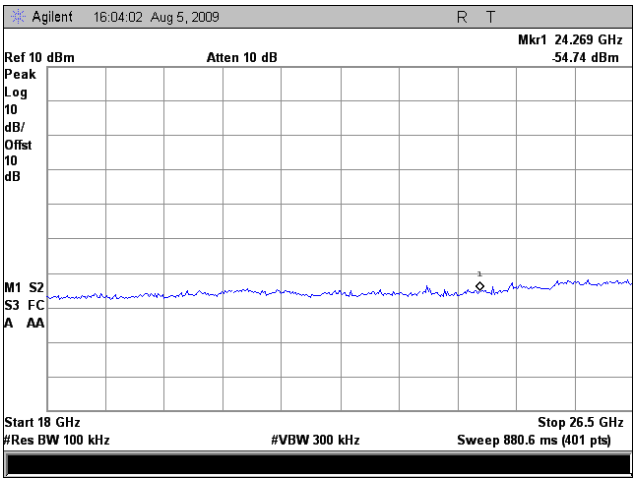
Plot 264. Conducted Emissions, Low Channel, 5 GHz, Port 3, 802.11n 20MHz, 18 GHz – 26.5 GHz



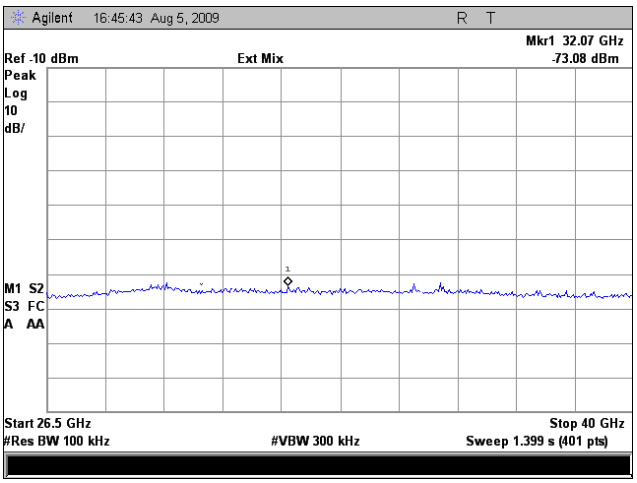
Plot 265. Conducted Emissions, Low Channel, 5 GHz, Port 3, 802.11n 20MHz, 26.5 GHz – 40 GHz



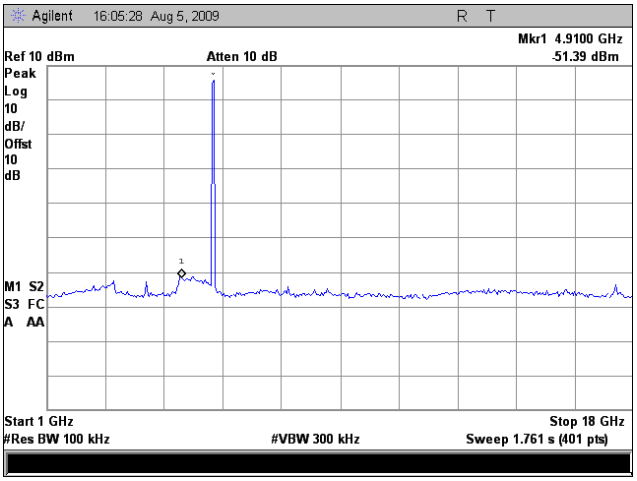
Plot 266. Conducted Emissions, Mid Channel, 5 GHz, Port 3, 802.11n 20MHz, 1 GHz – 18 GHz



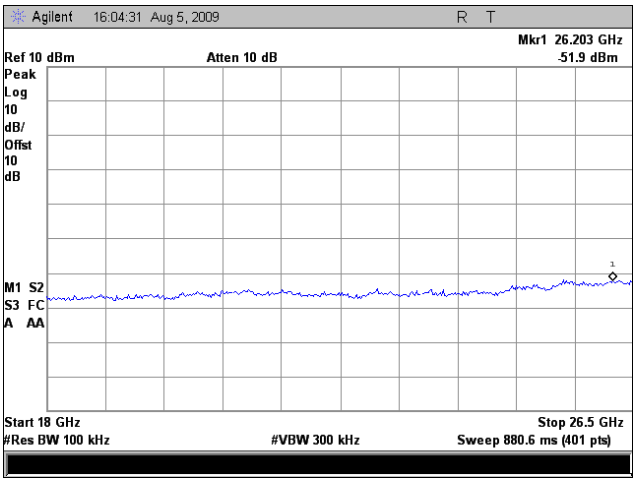
Plot 267. Conducted Emissions, Mid Channel, 5 GHz, Port 3, 802.11n 20MHz, 18 GHz – 26.5 GHz



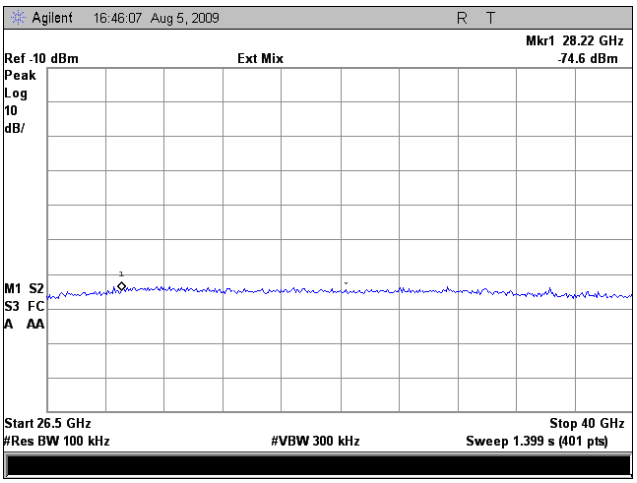
Plot 268. Conducted Emissions, Mid Channel, 5 GHz, Port 3, 802.11n 20MHz, 26.5 GHz – 40 GHz



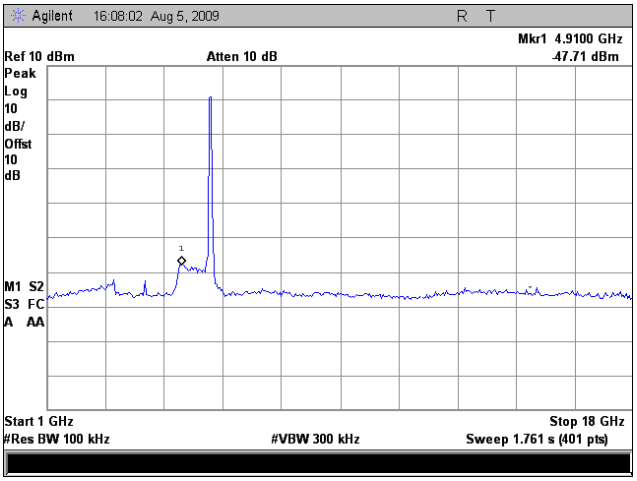
Plot 269. Conducted Emissions, High Channel, 5 GHz, Port 3, 802.11n 20MHz, 1 GHz – 18 GHz



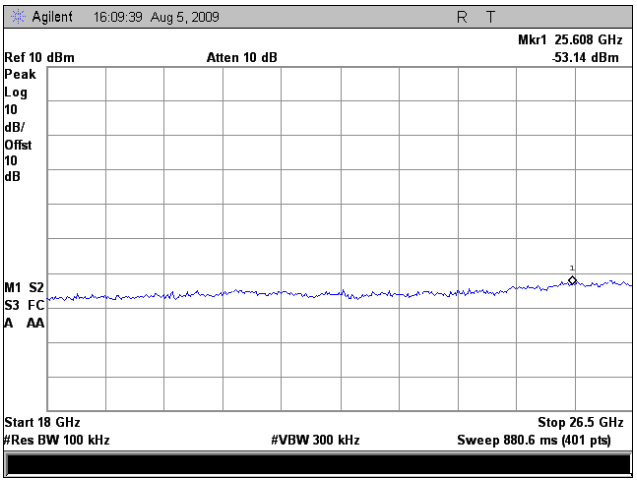
Plot 270. Conducted Emissions, High Channel, 5 GHz, Port 3, 802.11n 20MHz, 18 GHz – 26.5 GHz



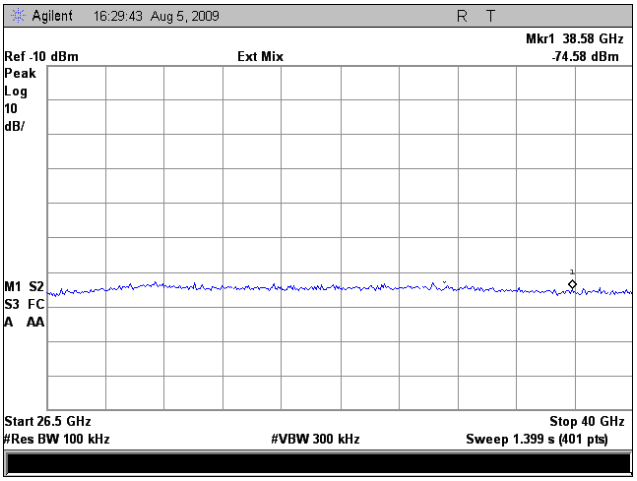
Plot 271. Conducted Emissions, High Channel, 5 GHz, Port 3, 802.11n 20MHz, 26.5 GHz – 40 GHz



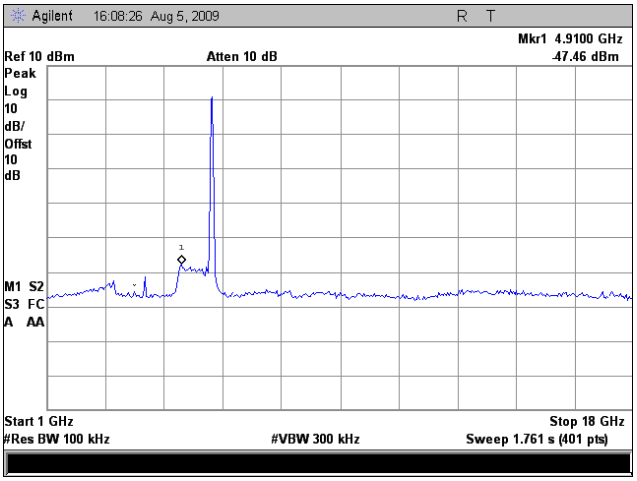
Plot 272. Conducted Emissions, Low Channel, 5 GHz, Port 3, 802.11n 40MHz, 1 GHz – 18 GHz



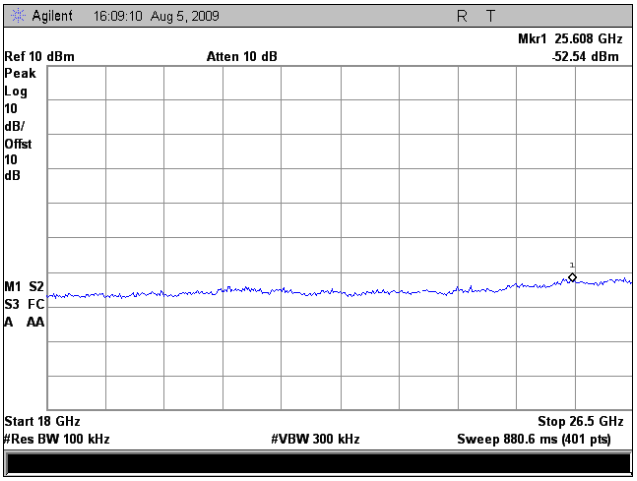
Plot 273. Conducted Emissions, Low Channel, 5 GHz, Port 3, 802.11n 40MHz, 18 GHz – 26.5 GHz



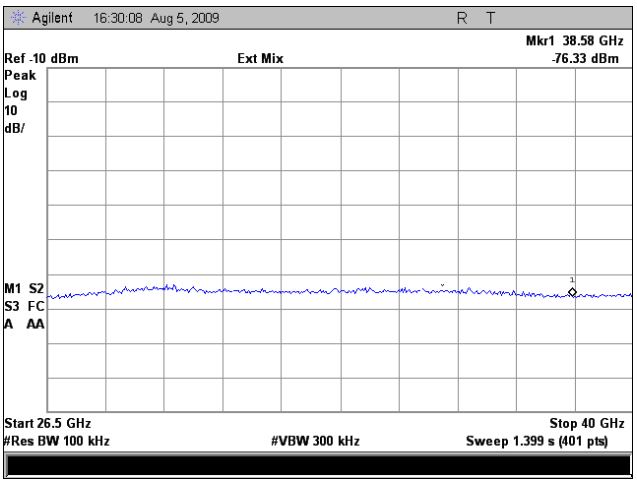
Plot 274. Conducted Emissions, Low Channel, 5 GHz, Port 3, 802.11n 40MHz, 26.5 GHz – 40 GHz



Plot 275. Conducted Emissions, High Channel, 5 GHz, Port 3, 802.11n 40MHz, 1 GHz – 18 GHz

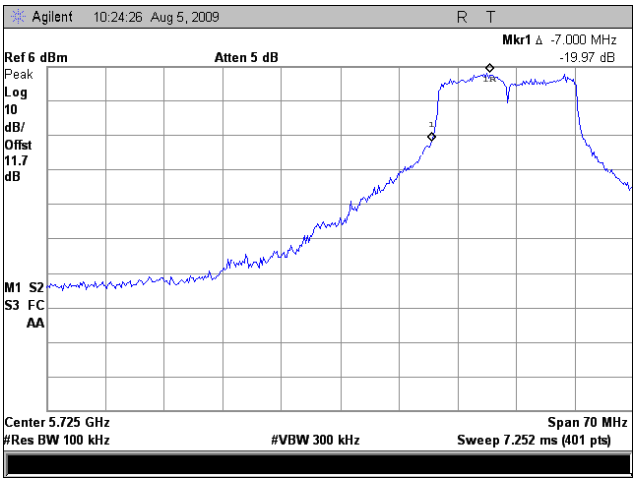


Plot 276. Conducted Emissions, High Channel, 5 GHz, Port 3, 802.11n 40MHz, 18 GHz – 26.5 GHz

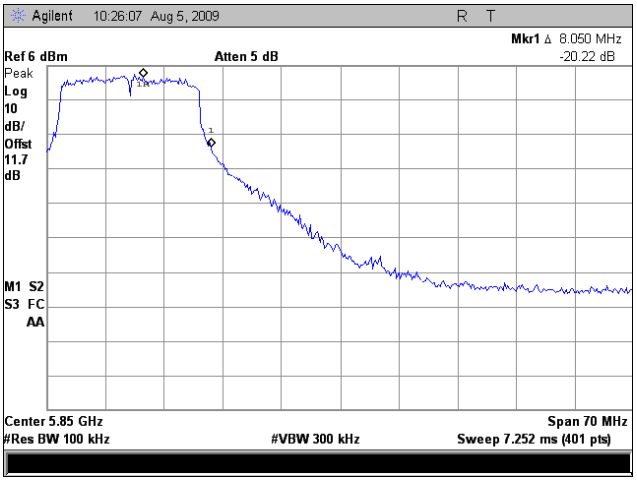


Plot 277. Conducted Emissions, High Channel, 5 GHz, Port 3, 802.11n 40MHz, 26.5 GHz – 40 GHz

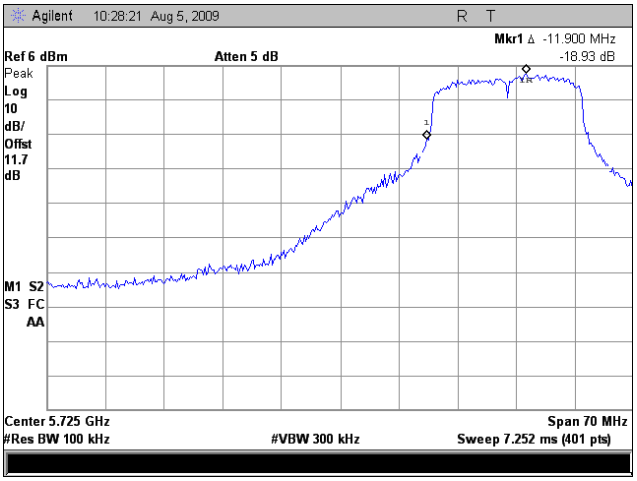
Conducted Band Edge, 5 GHz, Port 1



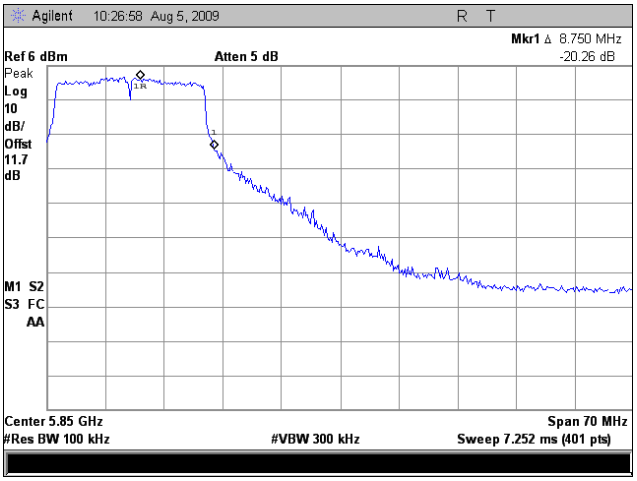
Plot 278. Lower Conducted Band Edge, 5 GHz, Port 1, 802.11a



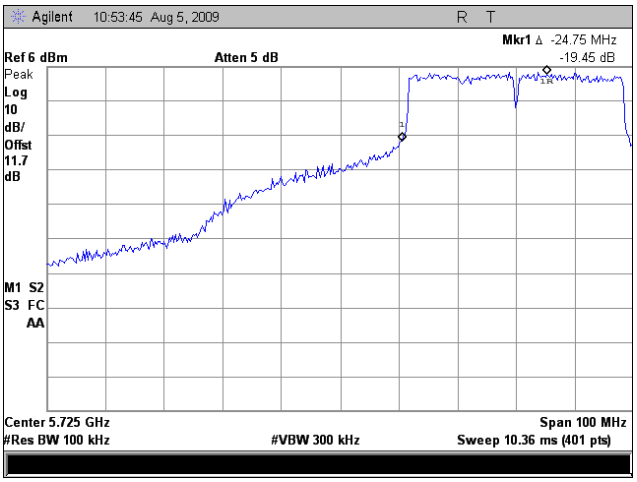
Plot 279. Upper Conducted Band Edge, 5 GHz, Port 1, 802.11a



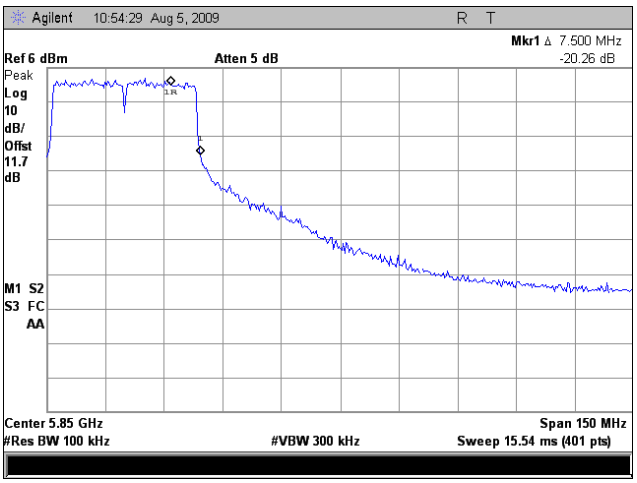
Plot 280. Lower Conducted Band Edge, 5 GHz, Port 1, 802.11n 20MHz



Plot 281. Upper Conducted Band Edge, 5 GHz, Port 1, 802.11n 20MHz

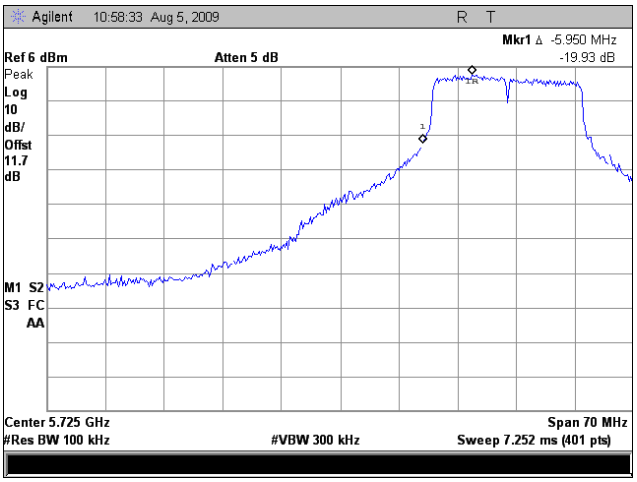


Plot 282. Lower Conducted Band Edge, 5 GHz, Port 1, 802.11n 40MHz

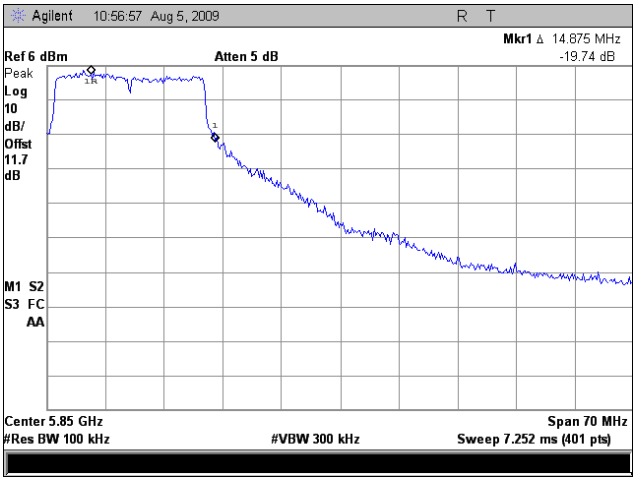


Plot 283. Upper Conducted Band Edge, 5 GHz, Port 1, 802.11n 40MHz

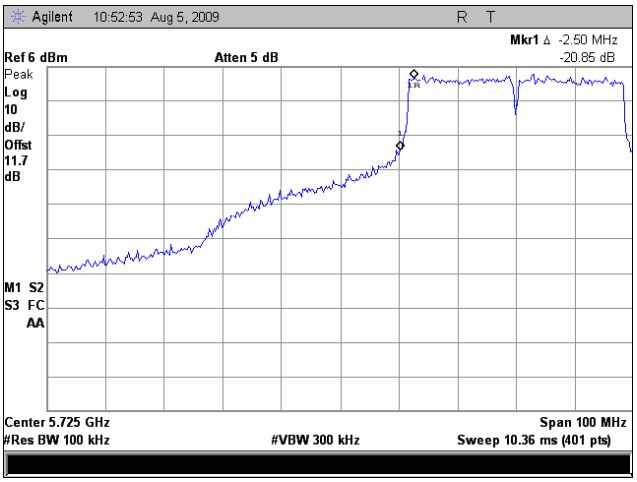
Conducted Band Edge, 5 GHz, Port 2



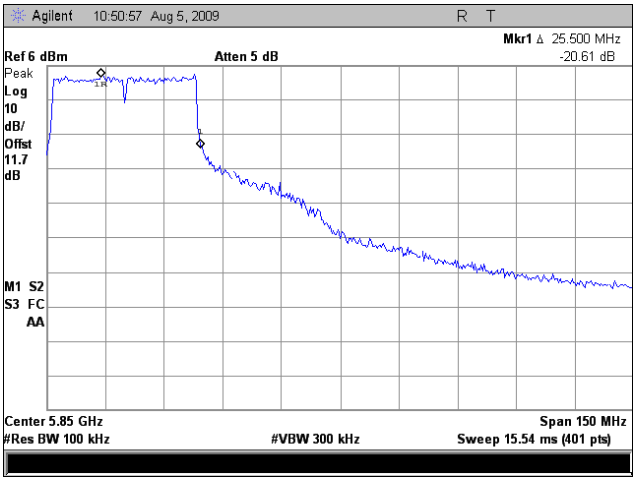
Plot 284. Lower Conducted Band Edge, 5 GHz, Port 2, 802.11n 20MHz



Plot 285. Upper Conducted Band Edge, 5 GHz, Port 2, 802.11n 20MHz

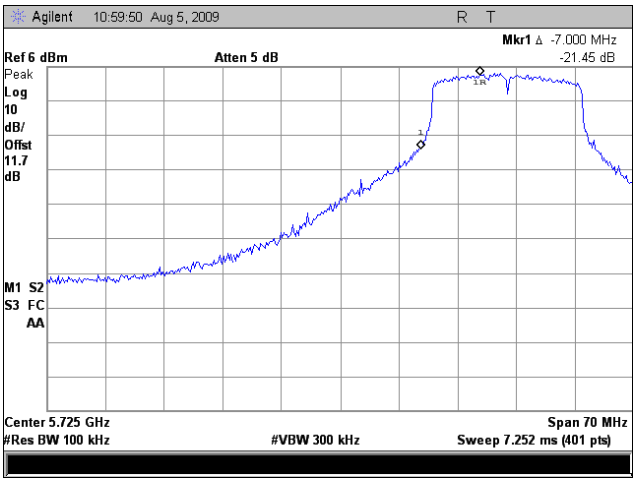


Plot 286. Lower Conducted Band Edge, 5 GHz, Port 2, 802.11n 40MHz

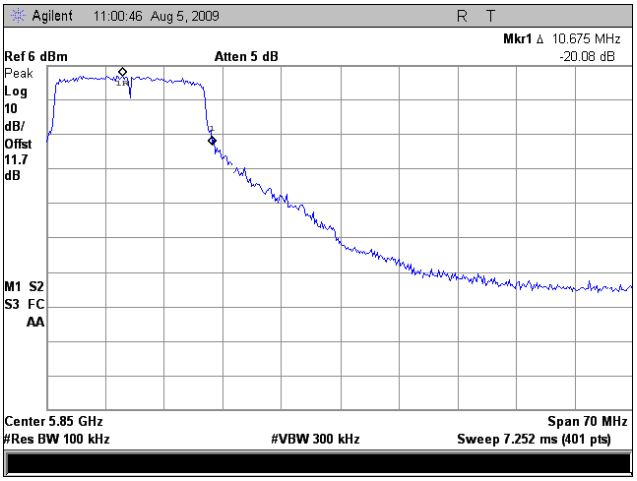


Plot 287. Upper Conducted Band Edge, 5 GHz, Port 2, 802.11n 40MHz

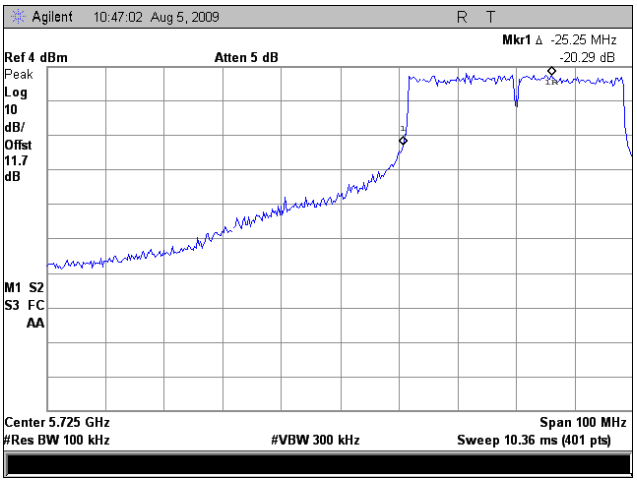
Conducted Band Edge, 5 GHz, Port 3



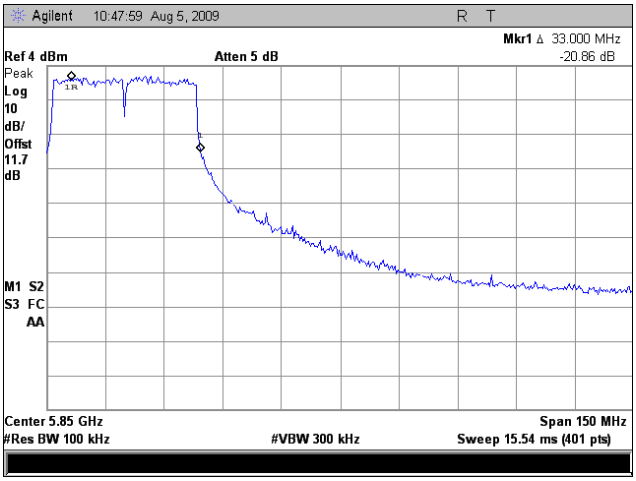
Plot 288. Lower Conducted Band Edge, 5 GHz, Port 3, 802.11n 20MHz



Plot 289. Upper Conducted Band Edge, 5 GHz, Port 3, 802.11n 20MHz



Plot 290. Lower Conducted Band Edge, 5 GHz, Port 3, 802.11n 40MHz



Plot 291. Upper Conducted Band Edge, 5 GHz, Port 3, 802.11n 40MHz

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 throughout each of the 100 sweeps of power averaging. The RBW was set to 3 kHz and a VBW set to 9 kHz or greater. The spectrum analyzer was set to an auto sweep time and a peak detector was used. Measurements were carried out at the low, mid and high channels.

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

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

Test Engineer: Minh Ly

Test Date: 08/17/09

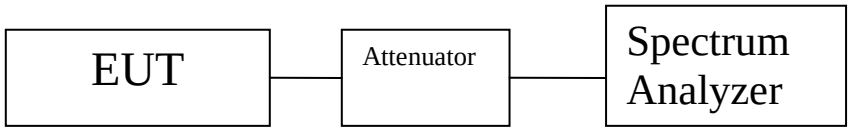


Figure 6. Block Diagram, Peak Power Spectral Density Test Setup

Peak Power Spectral Density, 2.4 GHz, Port 1					
Mode	**Carrier Channel**	**Frequency (MHz)**	**Measured PPSD (dBm)**	**Limit (dBm)**	**Margin (dB)**
802.11g	Low	2412	-2.275	8	10.275
	Mid	2437	-1.931	8	9.931
	High	2462	-2.119	8	10.119
802.11n 20MHz	Low	2412	-5.675	-	-
	Mid	2437	-7.694	-	-
	High	2462	-6.556	-	-
802.11n 40MHz	Low	2422	-6.961	-	-
	Mid	2442	-3.17	-	-
	High	2462	-1.225	-	-

Table 38. Peak Power Spectral Density, Test Results, 2.4 GHz, Port 1

Peak Power Spectral Density, 2.4 GHz, Port 2			
Mode	**Carrier Channel**	**Frequency (MHz)**	**Measured PPSD (dBm)**
802.11n 20MHz	Low	2412	-9.573
	Mid	2437	-9.686
	High	2462	-7.003
802.11n 40MHz	Low	2422	-3.05
	Mid	2442	-5.414
	High	2462	-4.189

Table 39. Peak Power Spectral Density, Test Results, 2.4 GHz, Port 2

Peak Power Spectral Density, 2.4 GHz, Port 3			
Mode	**Carrier Channel**	**Frequency (MHz)**	**Measured PPSD (dBm)**
802.11n 20MHz	Low	2412	-8.635
	Mid	2437	-8.825
	High	2462	-8.125
802.11n 40MHz	Low	2422	-4.169
	Mid	2442	-4.864
	High	2462	-1.52

Table 40. Peak Power Spectral Density, Test Results, 2.4 GHz, Port 3

Peak Power Spectral Density, 2.4 GHz, Combined Ports					
Mode	Carrier Channel	Frequency (MHz)	Measured PPSD (dBm)	Limit (dBm)	Margin (dB)
802.11n 20MHz	Low	2412	-2.857	8	-10.857
	Mid	2437	-3.887	8	-11.887
	High	2462	-2.408	8	-10.408
802.11n 40MHz	Low	2422	0.333	8	7.667
	Mid	2442	0.397	8	7.603
	High	2462	2.65	8	5.35

Table 41. Peak Power Spectral Density, Test Results, 2.4 GHz, Combined Ports

Peak Power Spectral Density, 5 GHz, Port 1					
Mode	Carrier Channel	Frequency (MHz)	Measured PPSD (dBm)	Limit (dBm)	Margin (dB)
802.11a	Low	5745	-8.054	8	16.054
	Mid	5785	-7.195	8	15.195
	High	5825	-6.632	8	14.632
802.11n 20MHz	Low	5745	-9.242	-	-
	Mid	5785	-8.811	-	-
	High	5825	-9.511	-	-
802.11n 40MHz	Low	5755	-12.17	-	-
	High	5795	-12.19	-	-

Table 42. Peak Power Spectral Density, Test Results, 5 GHz, Port 1

Peak Power Spectral Density, 5 GHz, Port 2			
Mode	Carrier Channel	Frequency (MHz)	Measured PPSD (dBm)
802.11n 20MHz	Low	5745	-7.79
	Mid	5785	-8.632
	High	5825	-8.348
802.11n 40Mhz	Low	5755	-10.51
	High	5795	-6.001

Table 43. Peak Power Spectral Density, Test Results, 5 GHz, Port 2

Peak Power Spectral Density, 5 GHz, Port 3			
Mode	**Carrier Channel**	**Frequency (MHz)**	**Measured PPSD (dBm)**
802.11n 20MHz	Low	5745	-7.691
	Mid	5785	-8.033
	High	5825	-6.516
802.11n 40Mhz	Low	5755	-9.65
	High	5795	-10.15

Table 44. Peak Power Spectral Density, Test Results, 5 GHz, Port 3

Peak Power Spectral Density, 5 GHz, Combined Ports					
Mode	**Carrier Channel**	**Frequency (MHz)**	**Measured PPSD (dBm)**	**Limit (dBm)**	**Margin (dB)**
802.11n 20MHz	Low	5745	-3.414	8	-11.414
	Mid	5785	-3.7078	8	-11.7078
	High	5825	-3.176	8	-11.176
802.11n 4MHz	Low	5755	-5.884	8	-13.884
	High	5795	-3.892	8	-11.892

Table 45. Peak Power Spectral Density, Test Results, 5 GHz, Combined Ports (5 dBi antenna)

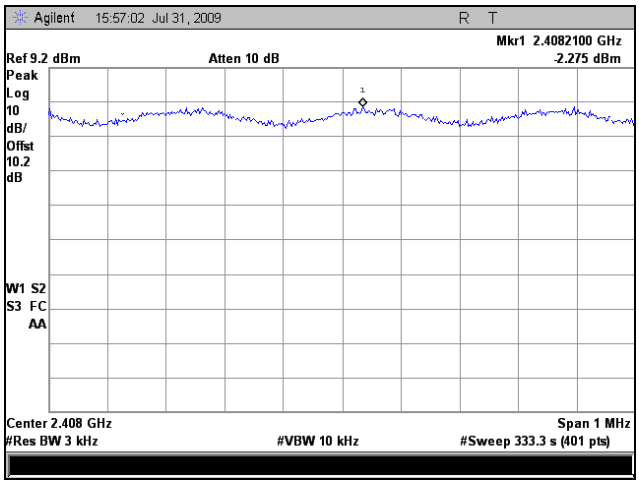
Peak Power Spectral Density, 5 GHz, Combined Ports					
Mode	**Carrier Channel**	**Frequency (MHz)**	**Measured PPSD (dBm)**	**Limit (dBm)**	**Margin (dB)**
802.11n 20MHz	Low	5745	-5.013	-5.00	-0.013
	Mid	5785	-6.533	-5.00	-1.533
	High	5825	-5.119	-5.00	-0.119
802.11n 4MHz	Low	5755	-5.692	-5.00	-0.692
	High	5795	-6.627	-5.00	-1.627

Table 46. Peak Power Spectral Density, Test Results, 5 GHz, Combined Ports (19 dBi antenna)

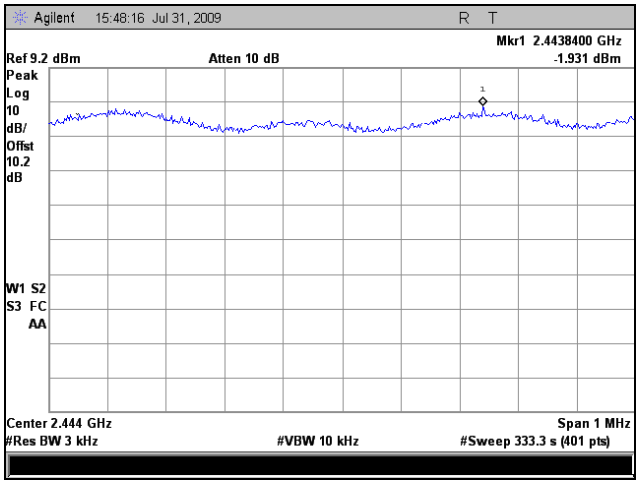
Peak Power Spectral Density Port 1							
Mode/Antenna	**Frequency (MHz)**	**Port 1**	**Port 2**	**Port 3**	**Summed Port**	**Limit**	**Margin**
802.11a	5.745	-7.517	NA	NA	-7.517	-5	-2.517
	5.785	-5.759	NA	NA	-5.759	-5	-0.759
	5.825	-7.23	NA	NA	-7.23	-5	-2.23
802.11n 20MHz	5.745	-11.43	-10.81	-12.47	-6.75	-5	-1.746
	5.785	-11.17	-10.03	-12.02	-6.23	-5	-1.225
	5.825	-12.11	-11.96	-12.5	-7.41	-5	-2.413
802.11n 40MHz	5.755	-15.38	-14.45	-15.7	-10.37	-5	-5.372
	5.795	-10.04	-9.594	-15.41	-6.24	-5	-1.241

Table 47. Peak Power Spectral Density, Test Results, 5 GHz, Combined Ports (19 dBi antenna)

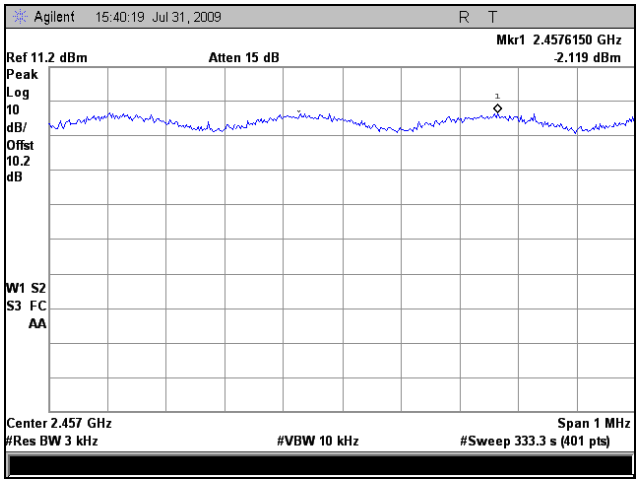
Peak Power Spectral Density, 2.4 GHz, Port 1



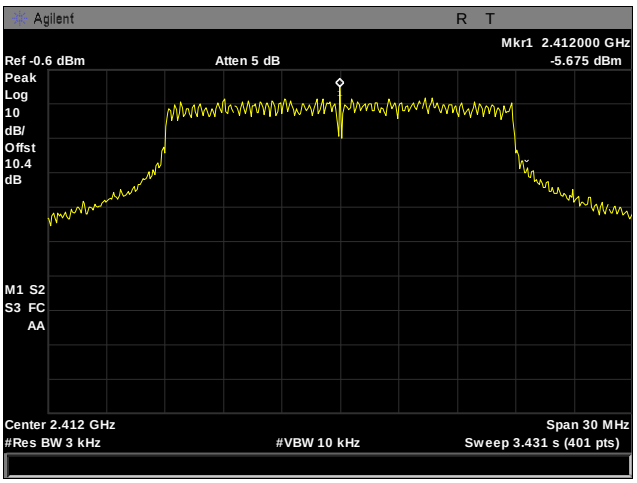
Plot 292. Peak Power Spectral Density, Low Channel, 2.4 GHz, Port 1, 802.11g



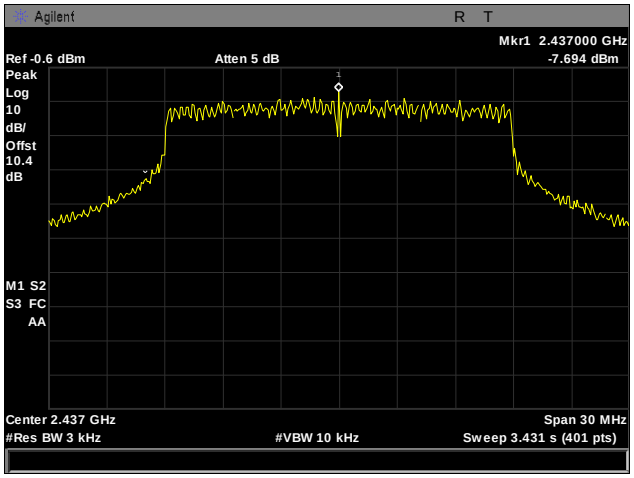
Plot 293. Peak Power Spectral Density, Mid Channel, 2.4 GHz, Port 1, 802.11g



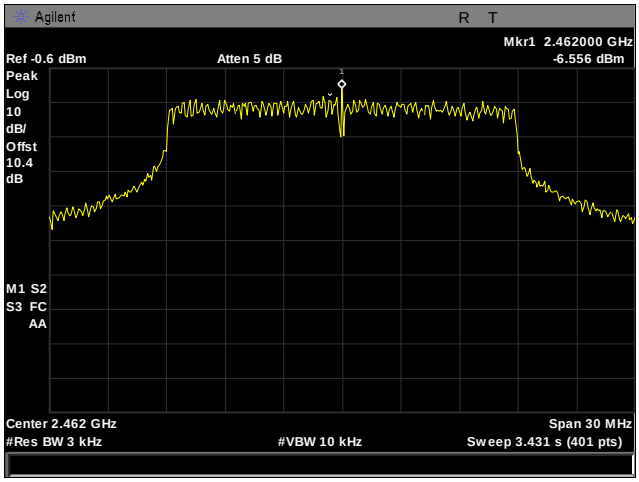
Plot 294. Peak Power Spectral Density, High Channel, 2.4 GHz, Port 1, 802.11g



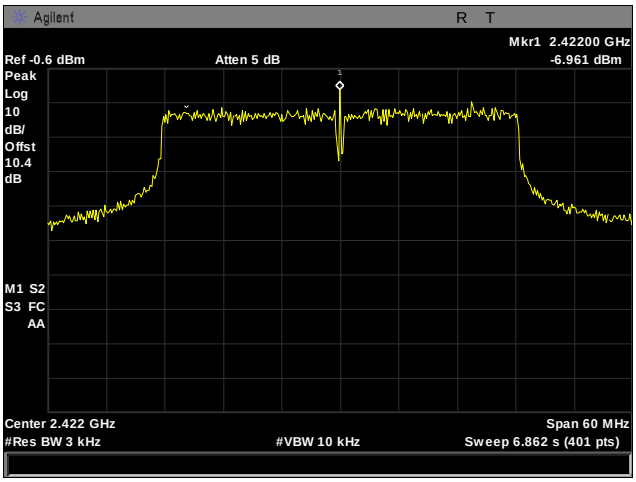
Plot 295. Peak Power Spectral Density, Low Channel, 2.4 GHz, Port 1, 802.11n 20MHz



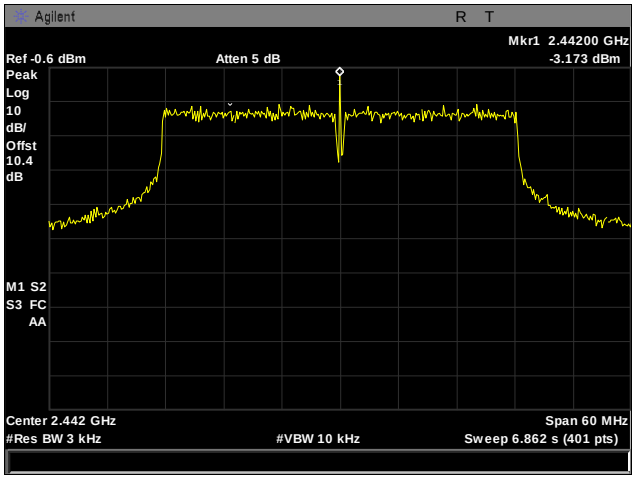
Plot 296. Peak Power Spectral Density, Mid Channel, 2.4 GHz, Port 1, 802.11n 20MHz



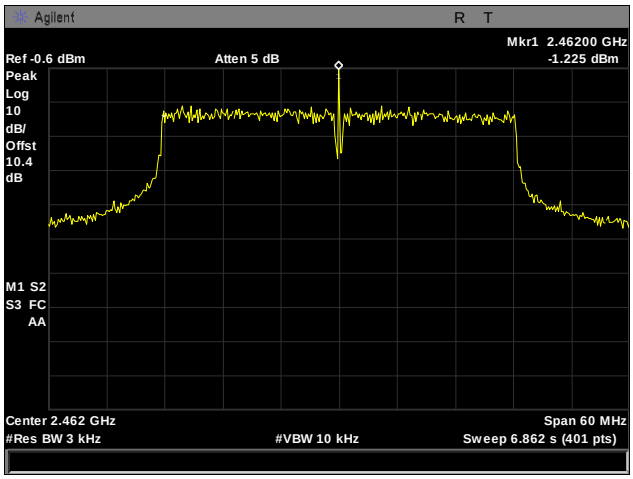
Plot 297. Peak Power Spectral Density, High Channel, 2.4 GHz, Port 1, 802.11n 20MHz



Plot 298. Peak Power Spectral Density, Low Channel, 2.4 GHz, Port 1, 802.11n 40MHz

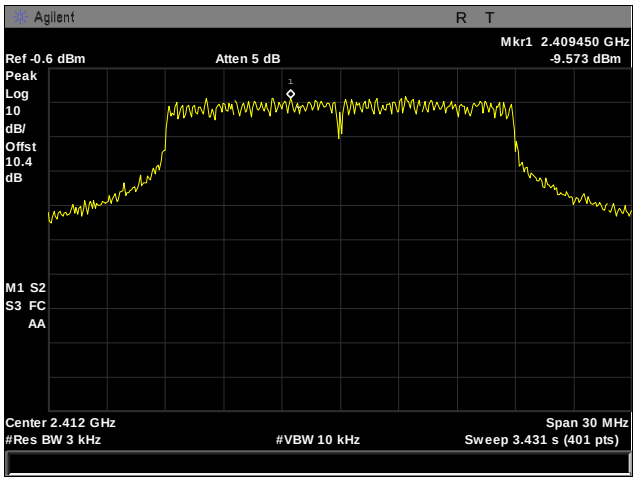


Plot 299. Peak Power Spectral Density, Mid Channel, 2.4 GHz, Port 1, 802.11n 40MHz

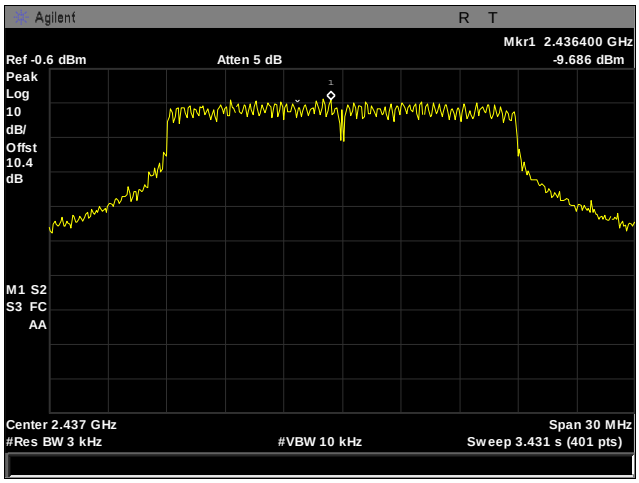


Plot 300. Peak Power Spectral Density, High Channel, 2.4 GHz, Port 1, 802.11n 40MHz

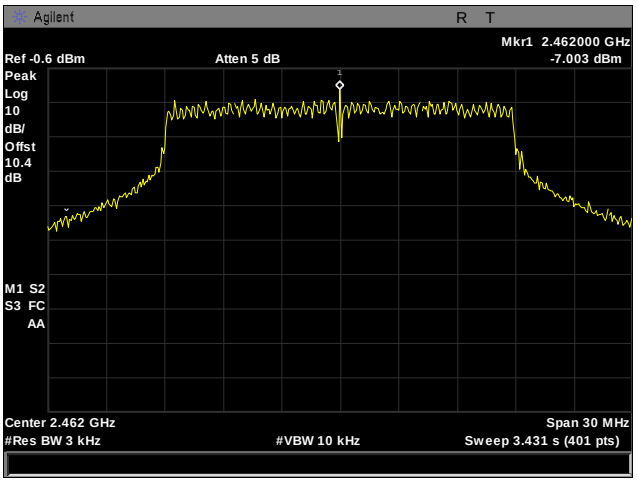
Peak Power Spectral Density, 2.4 GHz, Port 2



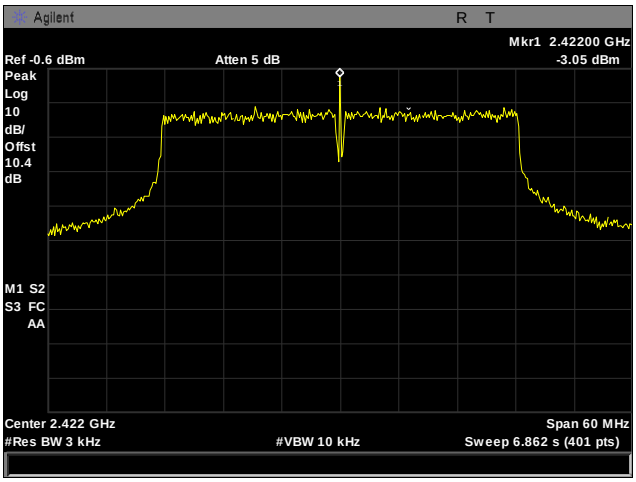
Plot 301. Peak Power Spectral Density, Low Channel, 2.4 GHz, Port 2, 802.11n 20MHz



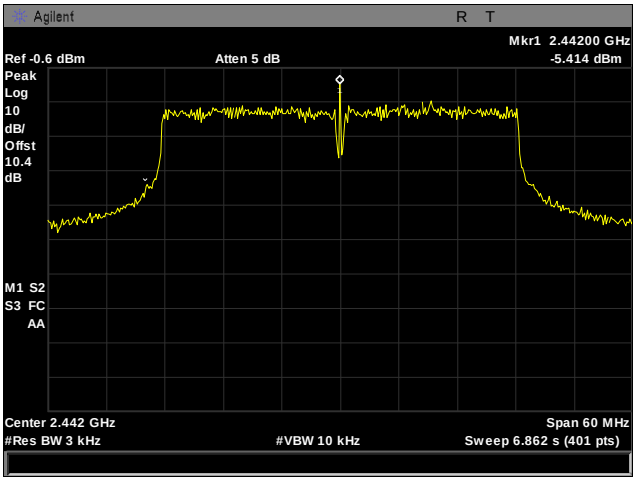
Plot 302. Peak Power Spectral Density, Mid Channel, 2.4 GHz, Port 2, 802.11n 20MHz



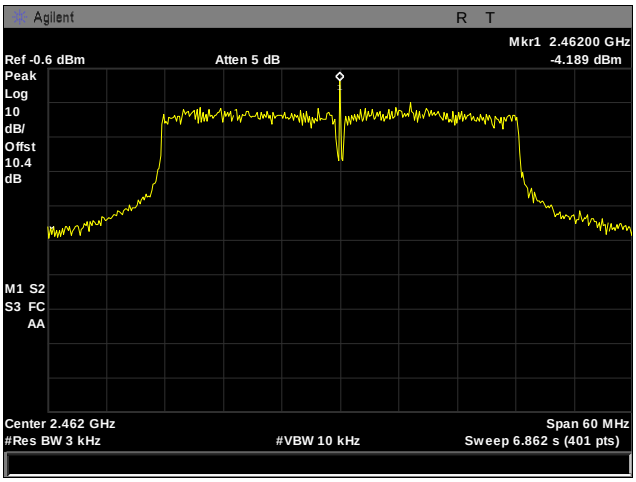
Plot 303. Peak Power Spectral Density, High Channel, 2.4 GHz, Port 2, 802.11n 20MHz



Plot 304. Peak Power Spectral Density, Low Channel, 2.4 GHz, Port 2, 802.11n 40MHz

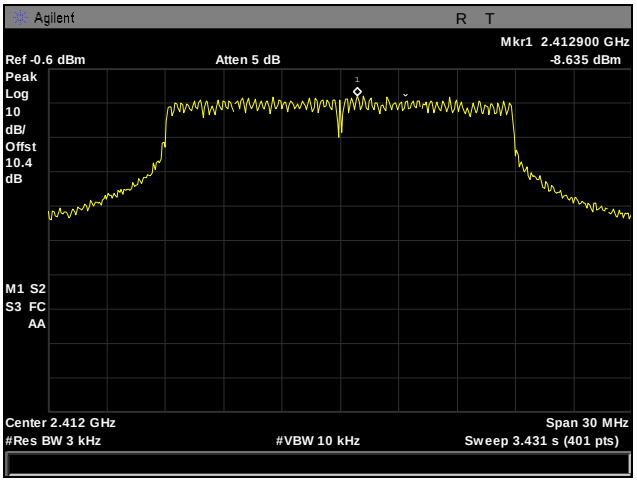


Plot 305. Peak Power Spectral Density, Mid Channel, 2.4 GHz, Port 2, 802.11n 40MHz

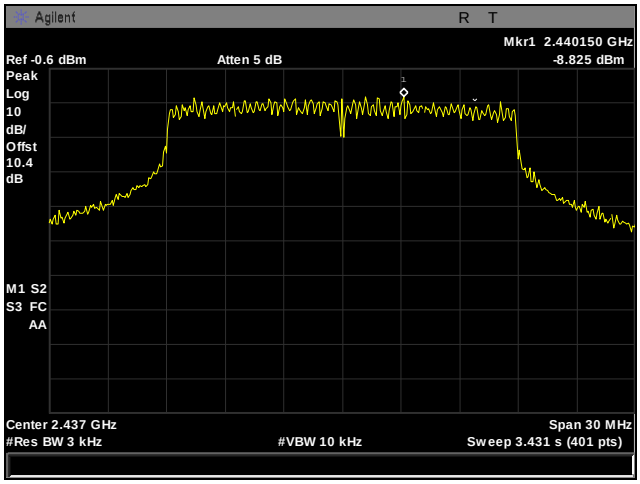


Plot 306. Peak Power Spectral Density, High Channel, 2.4 GHz, Port 2, 802.11n 40MHz

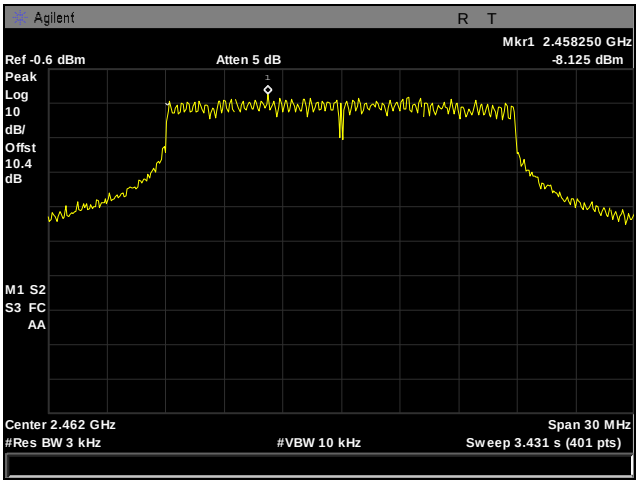
Peak Power Spectral Density, 2.4 GHz, Port 3



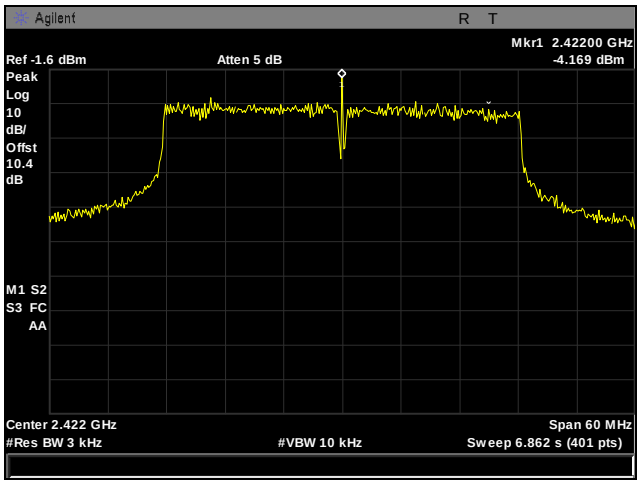
Plot 307. Peak Power Spectral Density, Low Channel, 2.4 GHz, Port 3, 802.11n 20MHz



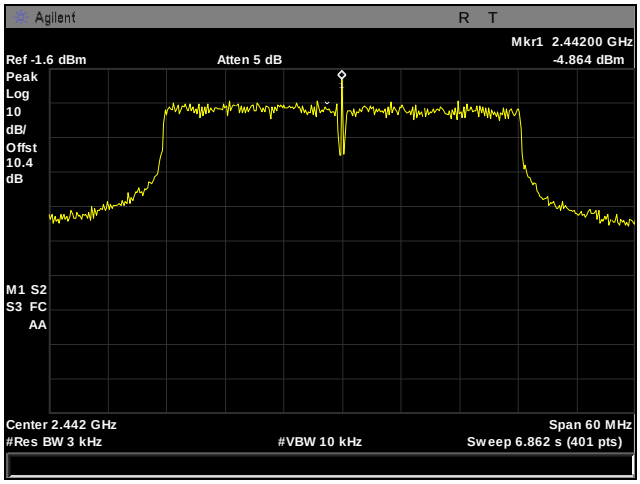
Plot 308. Peak Power Spectral Density, Mid Channel, 2.4 GHz, Port 3, 802.11n 20MHz



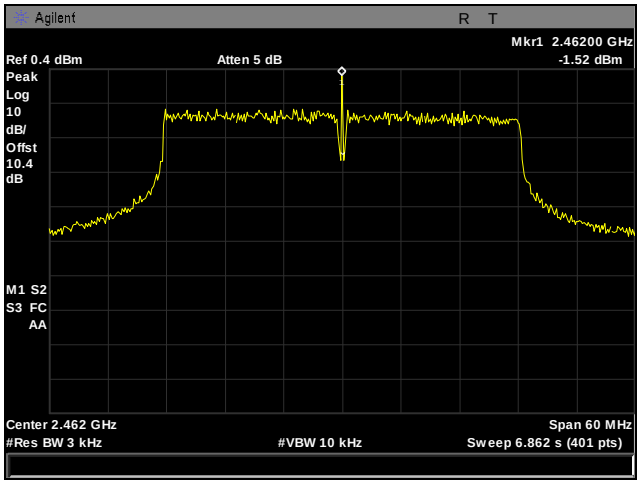
Plot 309. Peak Power Spectral Density, High Channel, 2.4 GHz, Port 3, 802.11n 20MHz



Plot 310. Peak Power Spectral Density, Low Channel, 2.4 GHz, Port 3, 802.11n 40MHz

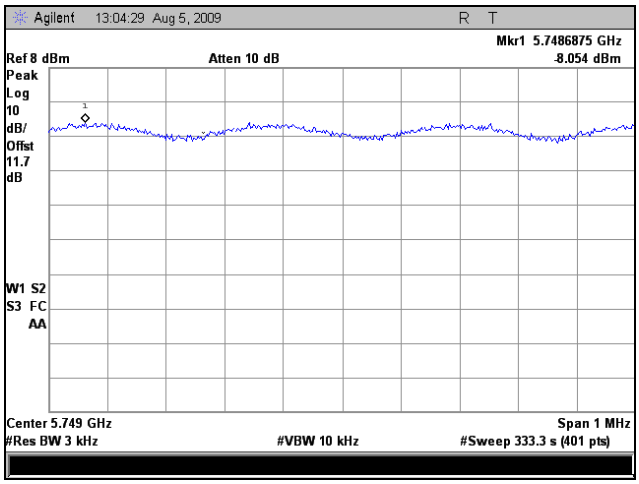


Plot 311. Peak Power Spectral Density, Mid Channel, 2.4 GHz, Port 3, 802.11n 40MHz

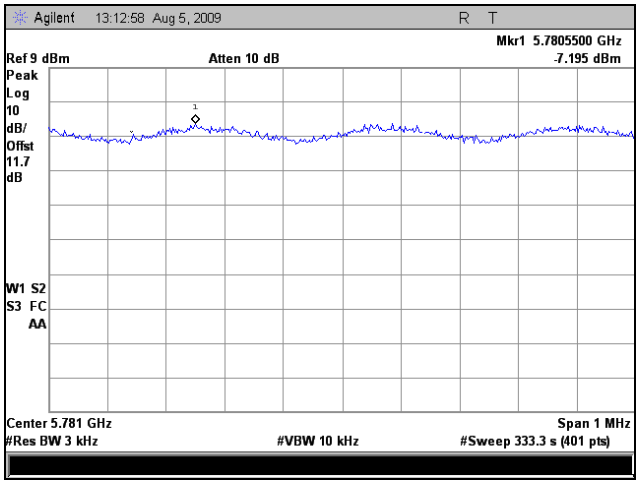


Plot 312. Peak Power Spectral Density, High Channel, 2.4 GHz, Port 3, 802.11n 40MHz

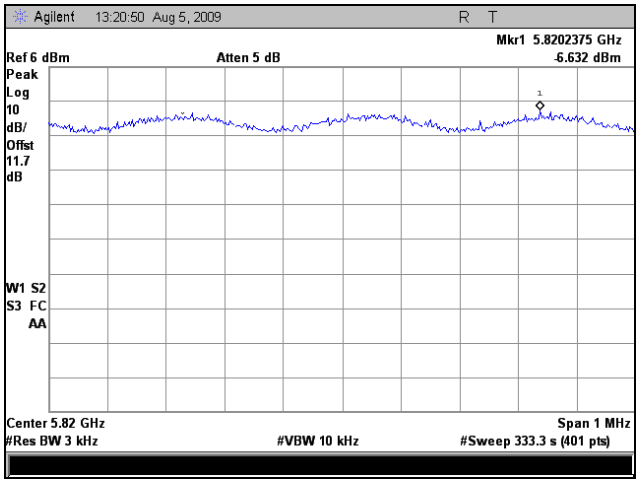
Peak Power Spectral Density, 5 GHz, Port 1



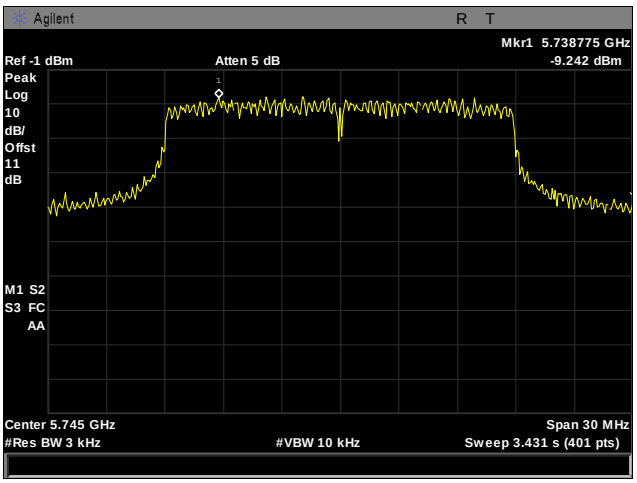
Plot 313. Peak Power Spectral Density, Low Channel, 5 GHz, Port 1, 802.11a



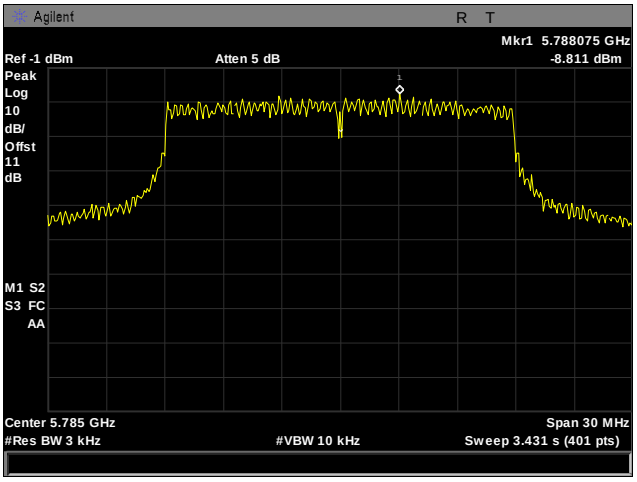
Plot 314. Peak Power Spectral Density, Mid Channel, 5 GHz, Port 1, 802.11a



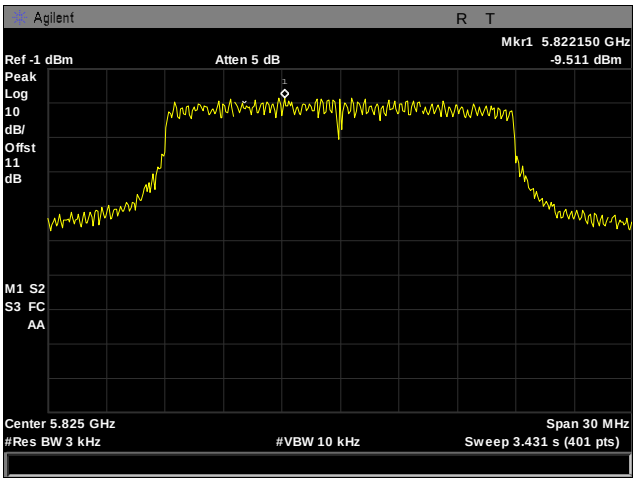
Plot 315. Peak Power Spectral Density, High Channel, 5 GHz, Port 1, 802.11a



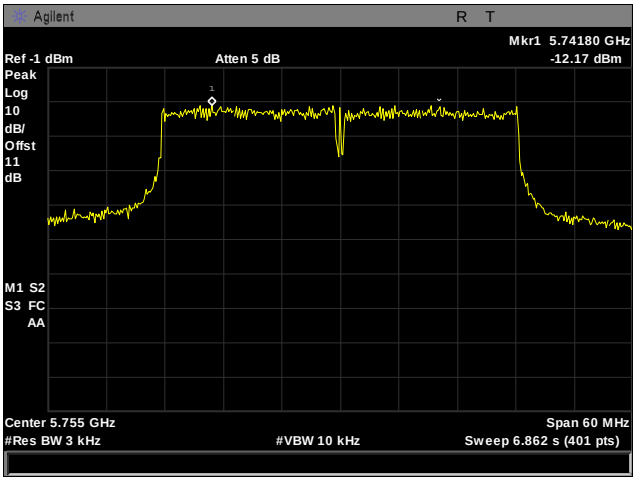
Plot 316. Peak Power Spectral Density, Low Channel, 5 GHz, Port 1, 802.11n 20MHz



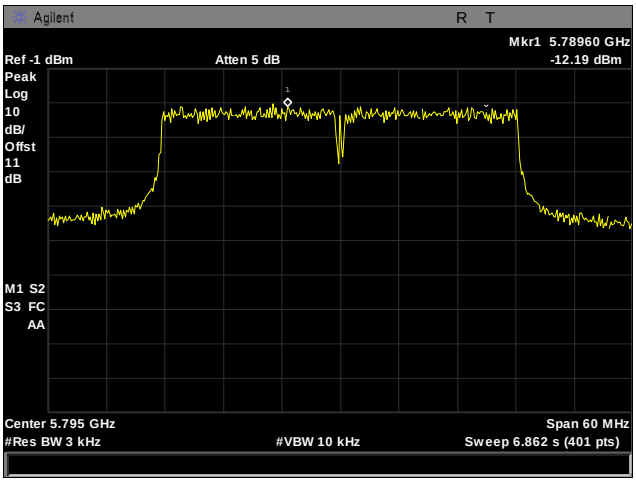
Plot 317. Peak Power Spectral Density, Mid Channel, 5 GHz, Port 1, 802.11n 20MHz



Plot 318. Peak Power Spectral Density, High Channel, 5 GHz, Port 1, 802.11n 20MHz

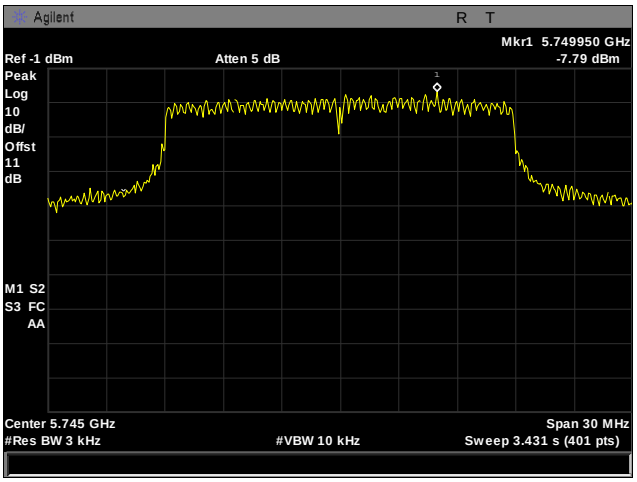


Plot 319. Peak Power Spectral Density, Low Channel, 5 GHz, Port 1, 802.11n 40MHz

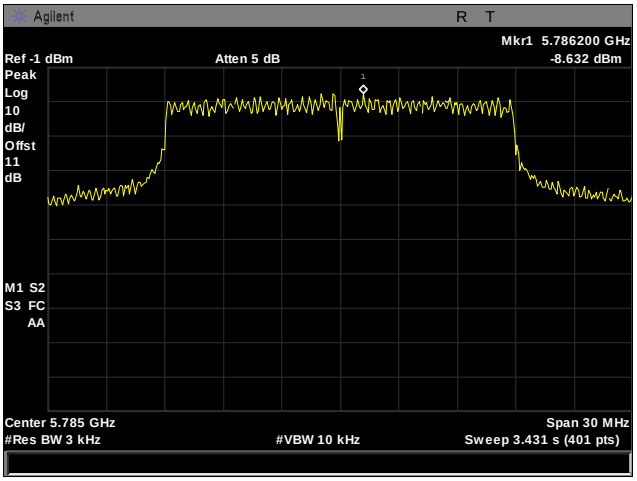


Plot 320. Peak Power Spectral Density, High Channel, 5 GHz, Port 1, 802.11n 40MHz

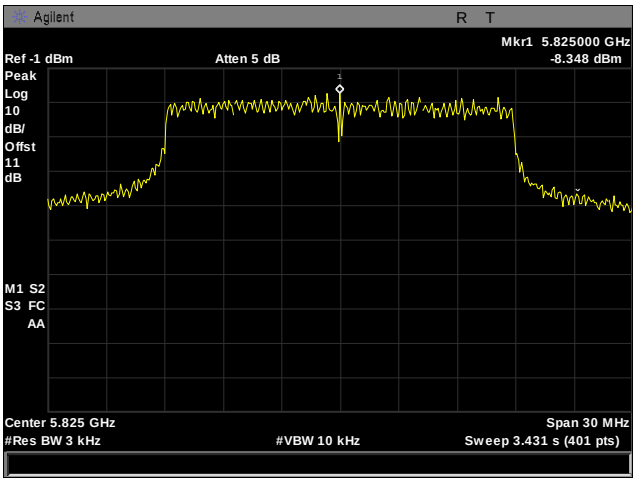
Peak Power Spectral Density, 5 GHz, Port 2



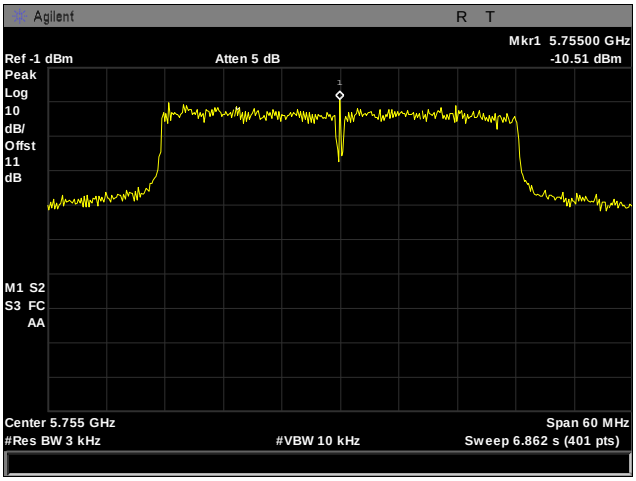
Plot 321. Peak Power Spectral Density, Low Channel, 5 GHz, Port 2, 802.11n 20MHz



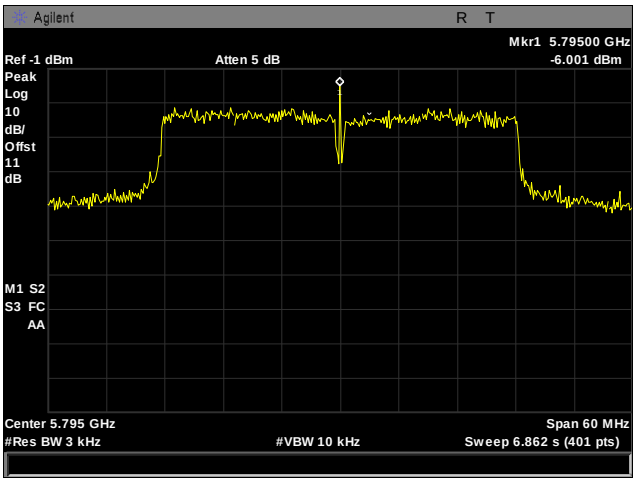
Plot 322. Peak Power Spectral Density, Mid Channel, 5 GHz, Port 2, 802.11n 20MHz



Plot 323. Peak Power Spectral Density, High Channel, 5 GHz, Port 2, 802.11n 20MHz

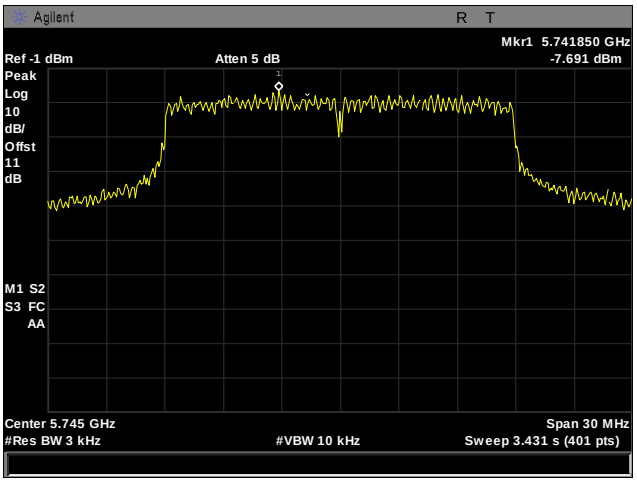


Plot 324. Peak Power Spectral Density, Low Channel, 5 GHz, Port 2, 802.11n 40MHz

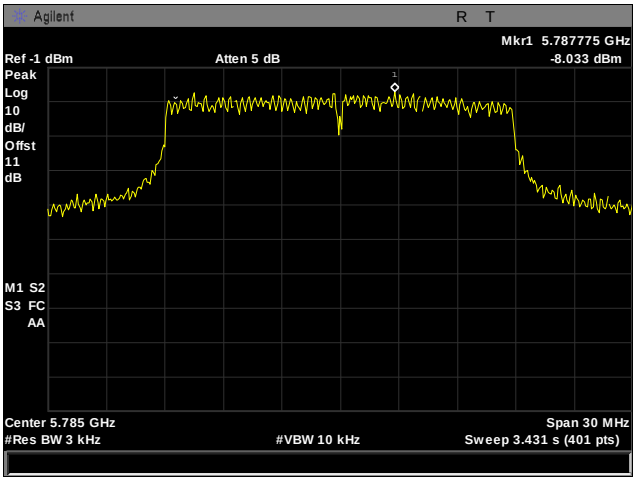


Plot 325. Peak Power Spectral Density, High Channel, 5 GHz, Port 2, 802.11n 40MHz

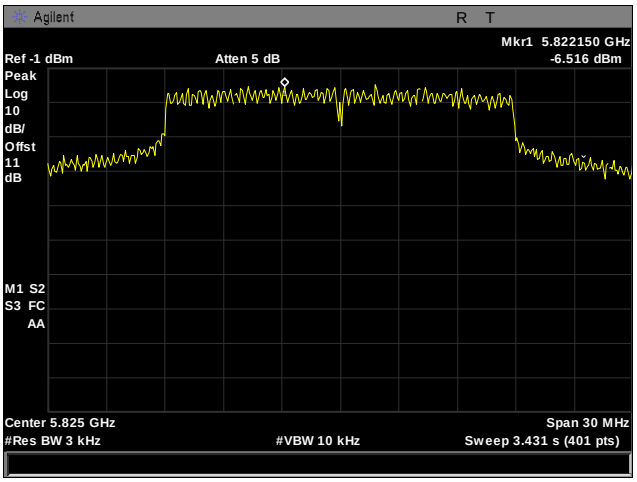
Peak Power Spectral Density, 5 GHz, Port 3



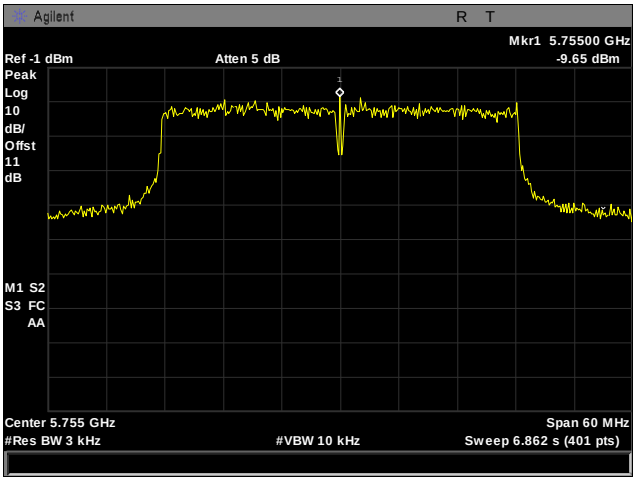
Plot 326. Peak Power Spectral Density, Low Channel, 5 GHz, Port 3, 802.11n 20MHz



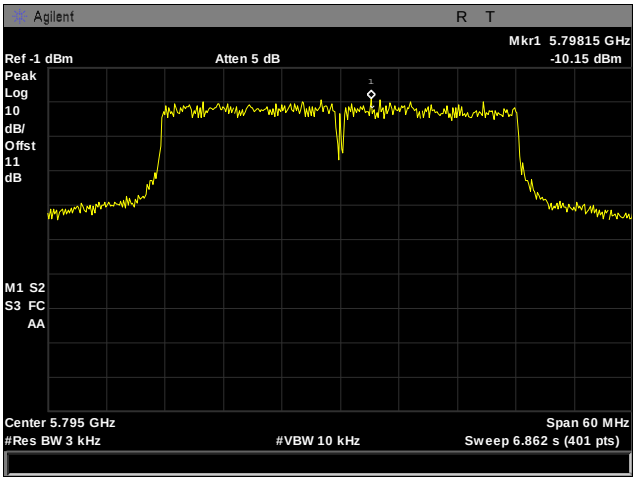
Plot 327. Peak Power Spectral Density, Mid Channel, 5 GHz, Port 3, 802.11n 20MHz



Plot 328. Peak Power Spectral Density, High Channel, 5 GHz, Port 3, 802.11n 20MHz

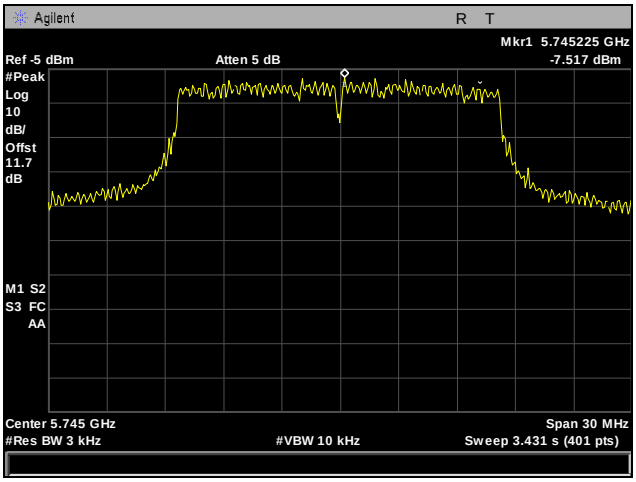


Plot 329. Peak Power Spectral Density, Low Channel, 5 GHz, Port 3, 802.11n 40MHz

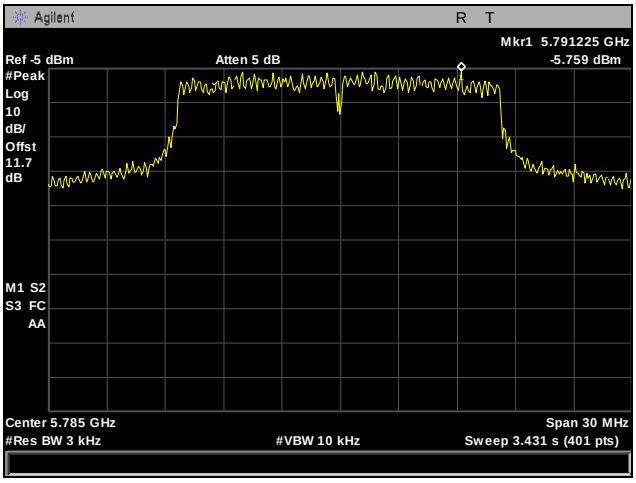


Plot 330. Peak Power Spectral Density, High Channel, 5 GHz, Port 3, 802.11n 40MHz

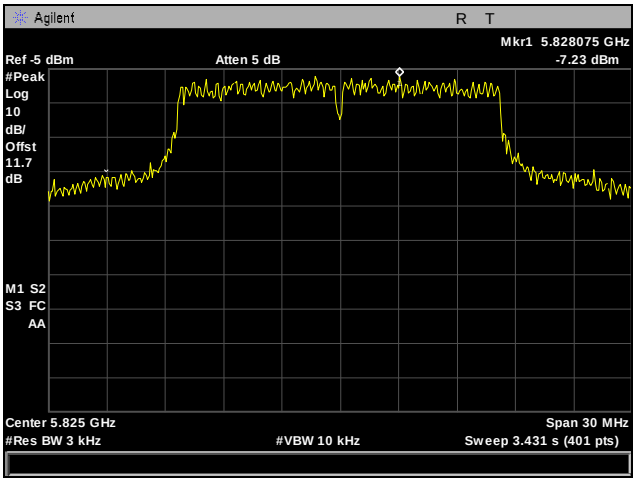
Peak Power Spectral Density, 5 GHz, 19 dBi Antenna



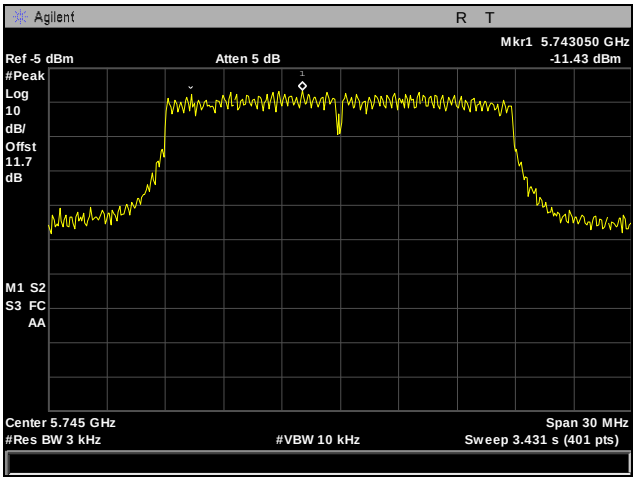
Plot 331. Peak Power Spectral Density, Low Channel, 5 GHz, 802.11a, 19 dBi



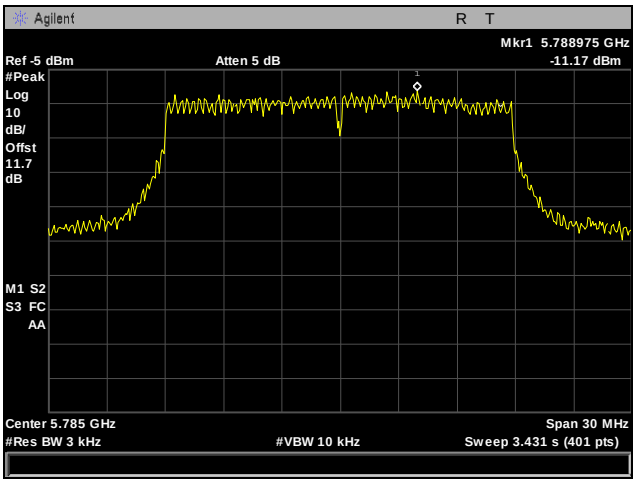
Plot 332. Peak Power Spectral Density, Mid Channel, 5 GHz, 802.11a, 19 dBi



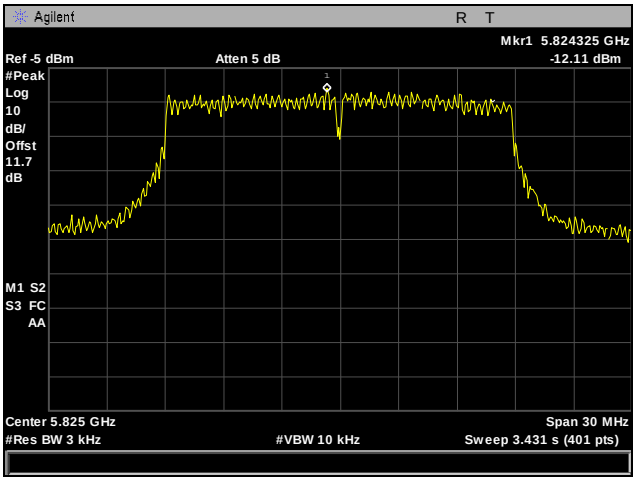
Plot 333. Peak Power Spectral Density, High Channel, 5 GHz, 802.11a, 19 dBi



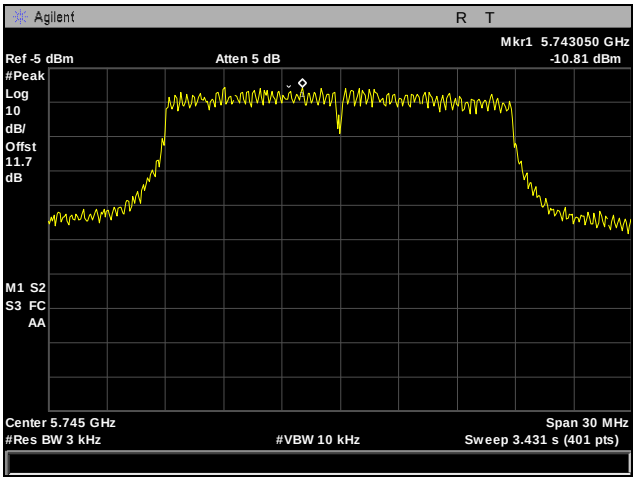
Plot 334. Peak Power Spectral Density, Low Channel, 5 GHz, 802.11n 20MHz, Port 1, 19 dBi



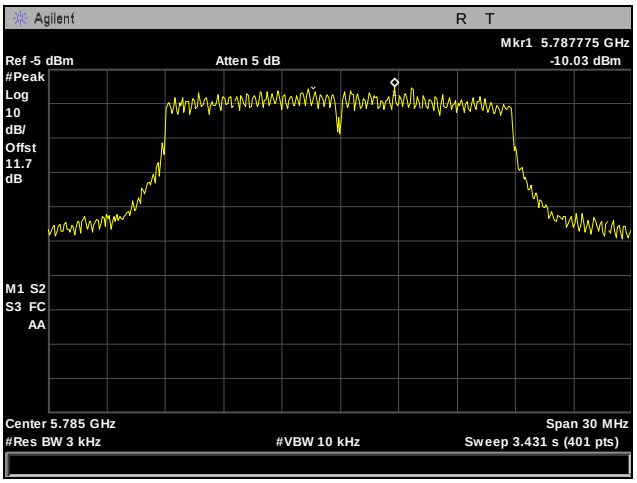
Plot 335. Peak Power Spectral Density, Mid Channel, 5 GHz, 802.11n 20MHz, Port 1, 19 dBi



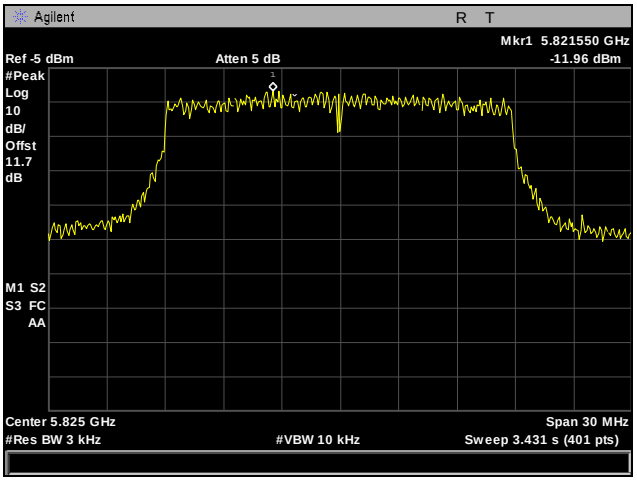
Plot 336. Peak Power Spectral Density, High Channel, 5 GHz, 802.11n 20MHz, Port 1, 19 dBi



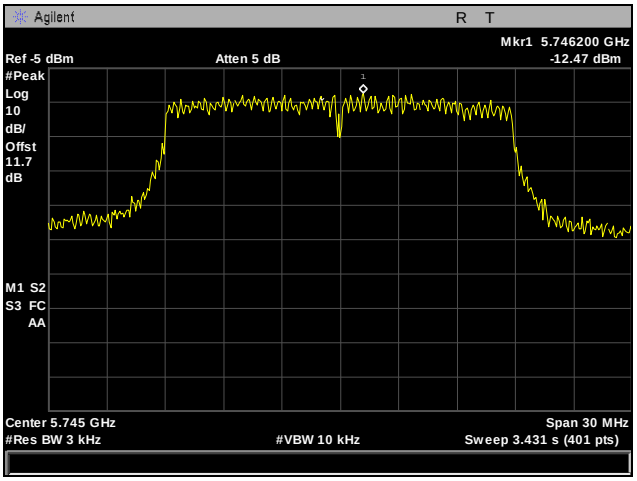
Plot 337. Peak Power Spectral Density, Low Channel, 5 GHz, 802.11n 20MHz, Port 2, 19 dBi



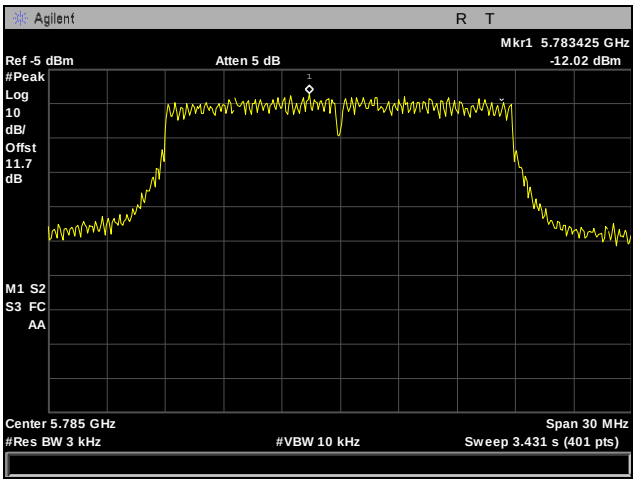
Plot 338. Peak Power Spectral Density, Mid Channel, 5 GHz, 802.11n 20MHz, Port 2, 19 dBi



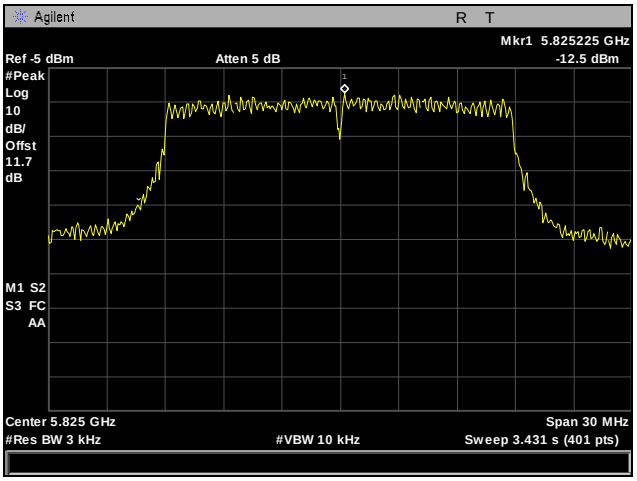
Plot 339. Peak Power Spectral Density, High Channel, 5 GHz, 802.11n 20MHz, Port 2, 19 dBi



Plot 340. Peak Power Spectral Density, Low Channel, 5 GHz, 802.11n 20MHz, Port 3, 19 dBi

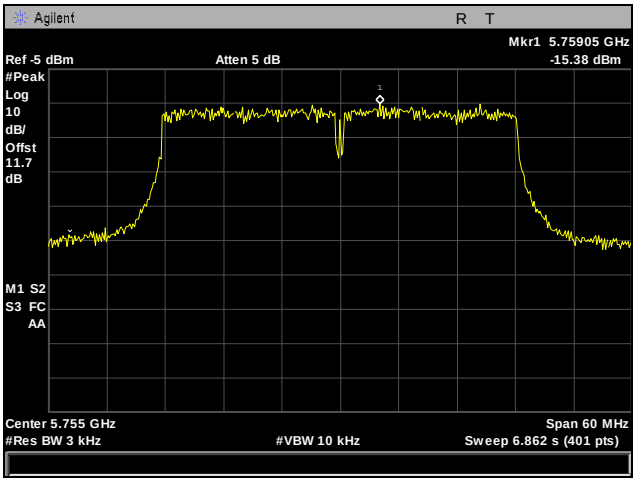


Plot 341. Peak Power Spectral Density, Mid Channel, 5 GHz, 802.11n 20MHz, Port 3, 19 dBi

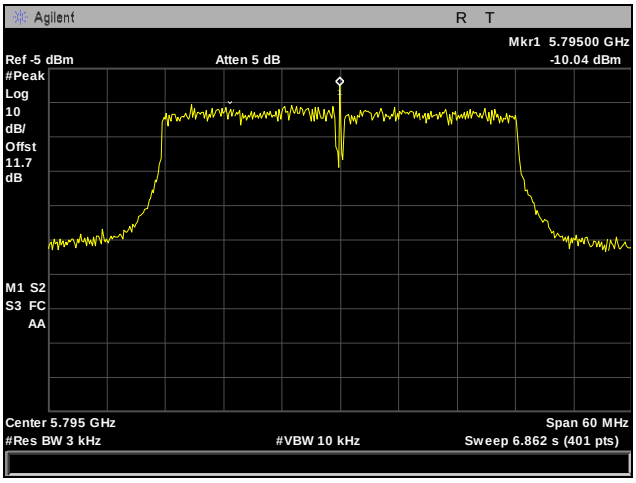


Plot 342. Peak Power Spectral Density, High Channel, 5 GHz, 802.11n 20MHz, Port 3, 19 dBi

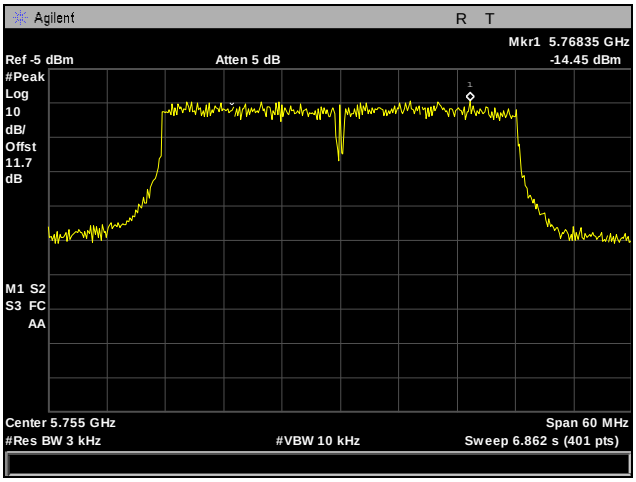
Peak Power Spectral Density, 5 GHz, 19 dBi Antenna



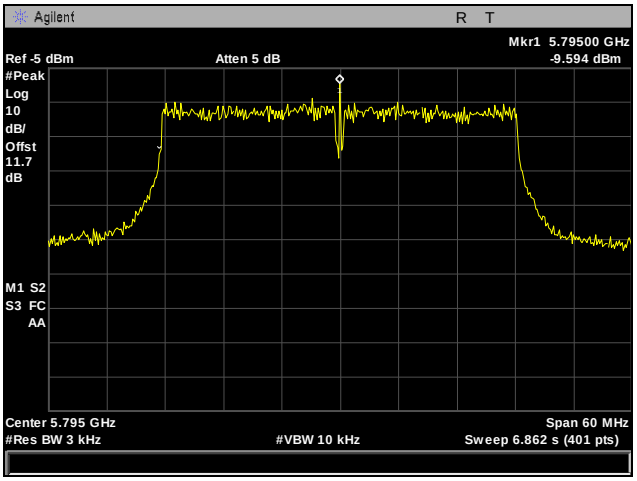
Plot 343. Peak Power Spectral Density, Low Channel, 5 GHz, 802.11n 40MHz, Port 1, 19 dBi



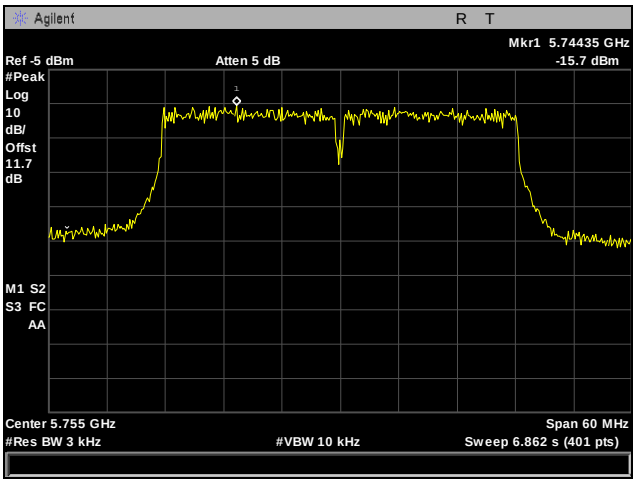
Plot 344. Peak Power Spectral Density, High Channel, 5 GHz, 802.11n 40MHz, Port 1, 19 dBi



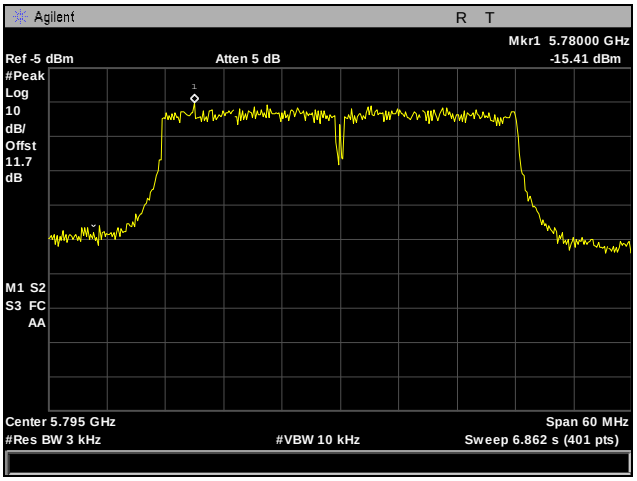
Plot 345. Peak Power Spectral Density, Low Channel, 5 GHz, 802.11n 40MHz, Port 2, 19 dBi



Plot 346. Peak Power Spectral Density, High Channel, 5 GHz, 802.11n 40MHz, Port 2, 19 dBi



Plot 347. Peak Power Spectral Density, Low Channel, 5 GHz, 802.11n 40MHz, Port 3, 19 dBi



Plot 348. Peak Power Spectral Density, High Channel, 5 GHz, 802.11n 40MHz, Port 3, 19 dBi

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.

MPE Limit Calculation: EUT's operating frequencies @ 2412-2462 MHz; highest conducted power = *26.21dBm* (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

EUT maximum antenna gain = 9.77dBi (3x5dBi)

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

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

where, S = Power Density (1 mW/cm^2)
P = Power Input to antenna (418 mW)
G = Antenna Gain (9.48 numeric)

$S = (418*9.48/ 4*3.14*20.0^2)$ = **0.79 mW/cm^2**@ 20cm separation

MPE Limit Calculation: EUT's operating frequencies @ 5725-5850 MHz; highest conducted power = *29.62dBm* (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

EUT maximum antenna gain = **19 dBi**

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

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

where, S = Power Density (1 mW/cm^2)
P = Power Input to antenna (916.2 mW)
G = Antenna Gain (79.43 numeric)

$R = (916.2*79.43 / 4*3.14*1.0)^{1/2} = (12971.79/ 12.56)^{1/2}$ = **76 cm**

Therefore, the exposure limit is achieved at distances greater than 76 cm.

IV. Test Equipment

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2005.

MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1S2421	EMI RECEIVER	ROHDE&SCHWARZ	ESIB 7	8/20/2012	8/20/2013
1U0260	LISN	SOLAR ELECTRONICS	9252-50-R-24-BNC	8/20/2012	2/20/2014
1U0032	SEMI- ANECHOIC CHAMBER (FACT 4) (NSA)	LINDGREN ENCLOSURES	FACT 4	4/5/2013	10/5/2014
1S2676	EMI CISPR RECEIVER	NARDA SAFETY TEST SOLUTIONS	PMM 9010	5/24/2013	11/24/2014
1U0284	TRANSIENT LIMITER	FISCHER CUSTOM COMMUNICATIONS INC.	FCC-450B-2.4-N	6/28/2012	6/28/2013
1U0007	ANTENNA, HORN	EMCO	3115	1/10/2013	7/10/2014
1U0027	PREAMPLIFIER	HEWLETT PACKARD	08449B H02	7/12/2012	7/12/2013
1U0149	BILOG ANTENNA	ETS LINDGREN	3142C	2/25/2013	8/25/2014
1U0150	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB7	5/14/2013	5/14/2014
1U0286	SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4407B	4/12/2012	10/12/2013
1S2198	HORN ANTENNA	EMCO	3115	10/18/2012	4/18/2014
1S2202	HORN ANTENNA (1 METER)	EMCO	3116	4/26/2013	4/26/2016
1S2128	HARMONIC MIXER	HEWLETT PACKARD	11970A	7/12/2012	1/12/2014
1S2129	HARMONIC MIXER	HEWLETT PACKARD	11970K	7/12/2012	1/12/2014
1S2481	10 METER CHAMBER (NSA)	ETS-LINGREN	DKE- 8X8 DBL	6/24/2013	12/24/2014
1S2460	1-26GHZ SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4407B	7/27/2012	1/27/2014
1S2108	RECIEVER, EMI, RF FILTER SECTION	HEWLETT PACKARD	85460A	9/12/2012	9/12/2013
1S2485	BILOG ANTENNA	TESEQ	CBL6112D	5/17/2011	5/17/2012
1S2464	LISN	SOLAR ELECTRONICS	9252-50-R24-BNC	7/20/2012	7/20/2013
1S2520	DIGITAL THERMO/HYGROMETER	CONTROL COMPANY	11-661-7D	11/27/2012	11/27/2014
1S2482	5 METER CHAMBER (NSA)	PANASHIELD	5 METER SEMI-ANECHOIC CHAMBER	12/22/2011	6/22/2013
1S2108	RECIEVER, EMI, RF FILTER SECTION	HEWLETT PACKARD	85460A	9/12/2012	9/12/2013
1U0297	PREAMPLIFIER	MINI CIRCUITS	ZVA-213-S+	SEE NOTE	
1S2121	PRE-AMPLIFIER	HEWLETT PACKARD	8449B	SEE NOTE	
N/A	HIGH PASS FILTER	MICRO-TRONICS	HPM13146	SEE NOTE	
1S2041	COUPLER, BI DIRECTIONALCOAXIAL	NARDA	N/A	SEE NOTE	
1S2034	COUPLER, DIRECTIONAL 1-20 GHZ	KRYTAR	101020020	SEE NOTE	
1S2512	TRANSIENT LIMITER	AGILENT	11947A	SEE NOTE	
1S2399	TURNTABLE CONTROLLER	SUNOL SCIENCE	SC99V	SEE NOTE	
N/A	2-6GHZ COMBINER	MINI CIRCUITS	ZN4PD-1-63-S+	SEE NOTE	
1S2041	COUPLER, BI DIRECTIONALCOAXIAL	NARDA	N/A	SEE NOTE	

Table 48. 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 5 August 2012:

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 users' 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