MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
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May 8, 2013

S&C Electric Company
1135 Atlantic Avenue
Alameda, CA 94501

Dear Prakash Ramadass,

Enclosed is the EMC Wireless test report for compliance testing of the S&C Electric Company, IntelliCom DA Mesh Radio 1710 as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Title 47 of the CFR, Part 15, Subpart B and ICES-003, Issue 5 August 2012 for Unintentional Radiators and Part 15.407 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: (\S&C Electric Company\EMCS37379C-FCC407 (UNII 3) Rev. 1)

Electromagnetic Compatibility Criteria
Test Report

for the

S&C Electric Company
Model IntelliCom DA Mesh Radio 1710

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Parts 15 Subpart B & ICES-003
for Class B Digital Devices
&
Title 47 of the CFR, Part 15.407 & RSS-210, Issue 8, Dec. 2010
for Intentional Radiators

MET Report: EMCS37379C-FCC407 (UNII 3) Rev. 1

May 8, 2013

Prepared For:

S&C Electric Company
1135 Atlantic Avenue
Alameda, CA 94501

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

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for Intentional Radiators

Jonathan Chao, 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 FCC Rules Parts 15B, 15.407, 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
∅	March 22, 2013	Initial Issue.
1	May 8, 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
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 S&C Electric Company IntelliCom DA Mesh Radio 1710, with the requirements of Part 15, §15.407. 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 IntelliCom DA Mesh Radio 1710. S&C Electric Company should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the IntelliCom DA Mesh Radio 1710, 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, §15.407, in accordance with S&C Electric Company, purchase order number 3455. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference	Industry Canada Reference	Description	Results
15.107	ICES-003 Issue 5 August 2012	Conducted Emissions	Compliant
15.109	ICES-003 Issue 5 August 2012	Radiated Emissions	Compliant
15.203	RSS-GEN 7.1.4	Antenna Requirements	Compliant
15.207	RSS-GEN 7.2.2; RSS-210 2.2	AC Conducted Emissions 150KHz – 30MHz	Compliant
15.403 (i)	A8.2	26dB Occupied Bandwidth	Compliant
15.407 (a)(2)	A9.2(3)	Conducted Transmitter Output Power	Compliant
15.407 (a)(2)	A9.2(3)	Power Spectral Density	Compliant
15.407 (a)(6)	A8.2	Peak Excursion	Compliant
15.407 (b)(2), (3), (5), (6)	A9.3(4)	Undesirable Emissions (15.205/15.209 - General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Compliant
15.407(f)	RSS-GEN	RF Exposure	Compliant
15.407(g)	2.1	Frequency Stability	Compliant

Table 1. Executive Summary of EMC Part 15.407 ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by S&C Electric Company to perform testing on the IntelliCom DA Mesh Radio 1710, under S&C Electric Company's purchase order number 3455.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the S&C Electric Company IntelliCom DA Mesh Radio 1710.

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

Model(s) Tested:	IntelliCom DA Mesh Radio 1710	
Model(s) Covered:	IntelliCom DA Mesh Radio 1710	
EUT Specifications:	Primary Power: 120 VAC, 60 Hz	
	FCC ID: U3D-US1710DA IC: 5349C-CA1710DA	
	Type of Modulations:	OFDM/DSSS
	OATS:	2043C-1
	Equipment Code:	NII
	Peak RF Output Power:	24.26 dBm
	EUT Frequency Ranges:	5725-5825MHz
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:	Jonathan Chao	
Report Date(s):	May 8, 2013	

Table 2. EUT Summary

B. References

CFR 47, Part 15, Subpart B	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
CFR 47, Part 15, Subpart E	Unlicensed National Information Infrastructure Devices (UNII)
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 10 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

D. Description of Test Sample

The S&C Electric Company IntelliCom DA Mesh Radio 1710, Equipment Under Test (EUT), provides reliable Ethernet connectivity over a high performance, self-forming wireless mesh backbone. All nodes have an Ethernet port for connecting network devices or other networks to the wireless mesh. 1710 mesh features a single radio solution with capability of expansion to dual Radio operating in the 2.4 GHz, 4.9 GHz (U.S. public safety licensed band) or 5 GHz frequency ranges on the other. This is not a MIMO. Two identical radios with one port each and they do not simultaneously transmit.

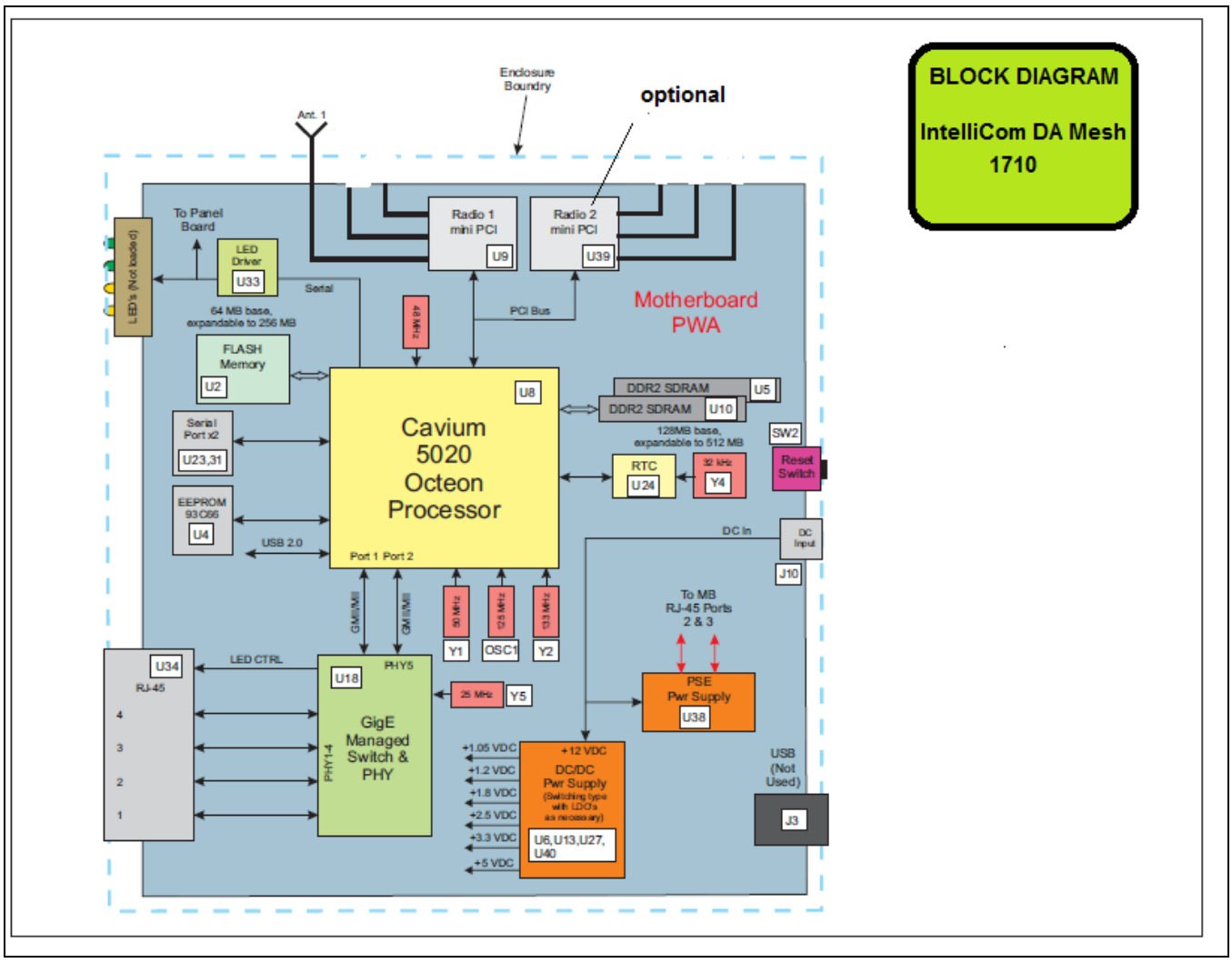


Figure 1. Block Diagram of Test Configuration

E. Equipment Configuration

All cards, racks, etc., incorporated as part of the EUT is included in the following list.

Ref. ID	Name / Description	Model Number
1	Mesh Node	IntelliCom 1710

Table 4. Equipment Configuration

F. Support Equipment

S&C Electric Company supplied support equipment necessary for the operation and testing of the IntelliCom DA Mesh Radio 1710. All support equipment supplied is listed in the following Support Equipment List.

Name / Description	Manufacturer	Model Number
External DC Adapter	FSP Group	FSP040-1ADF03A
Omni	Master Wave	98144PRSX003

Table 5. Support Equipment

G. Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Point
1	Antenna Ports and Cables	--	1	--	Y	Antenna
2	RJ45 Port and Cable	--	1	--	NA	Laptop
3	DC Power Input Port	--	1	--	Y	DC Supply

Table 6. Ports and Cabling Information

H. Mode of Operation

Once the DC power is applied on board 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.

I. Method of Monitoring EUT Operation

IntelliCom 1710 will be used for wireless mesh node application and all the IntelliCom 1710 always be verified using the IntelliCom provided Software which will run on server PC or Laptop. If some connectivity is broken then we can verify this with IntelliCom software running on the server then we can take necessary action accordingly. Nodes connectivity will be monitored using a common server (PC or Laptop).

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 S&C Electric Company 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. * -- Limits per Subsection 15.207(a).				

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

Test 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 is a Class A device but was compliant with the Class B requirement(s) of this section. Measured emissions were below applicable limits.

Test Engineer(s):

Jonathan Chao

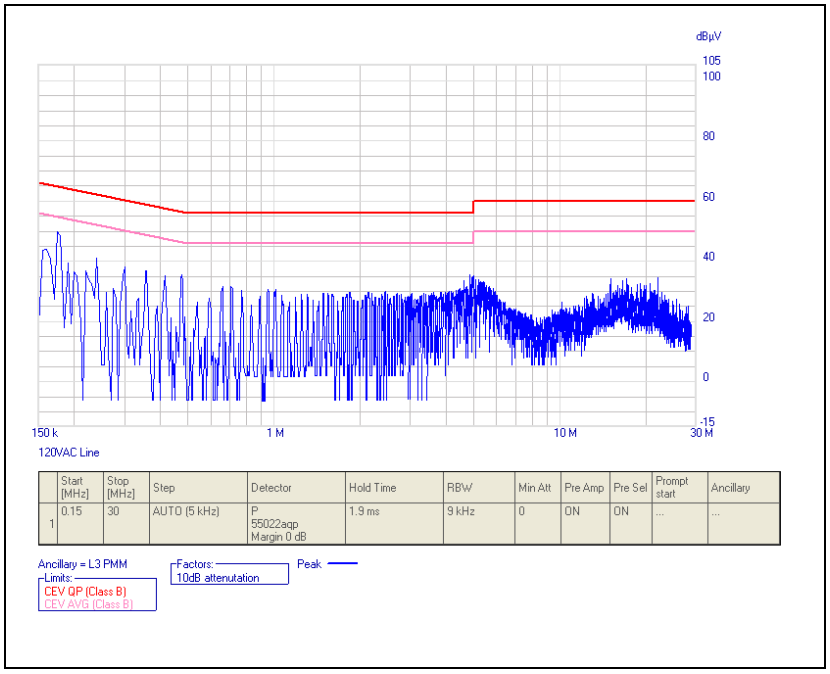
Test Date(s):

01/24/13

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

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
120VAC Line	.16	37.27	65.465	-28.195	Pass	9.88	55.465	-45.585	Pass
120VAC Line	.175	40.23	64.723	-24.493	Pass	28	54.723	-26.723	Pass
120VAC Line	.24	40.14	62.107	-21.967	Pass	30.83	52.107	-21.277	Pass

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

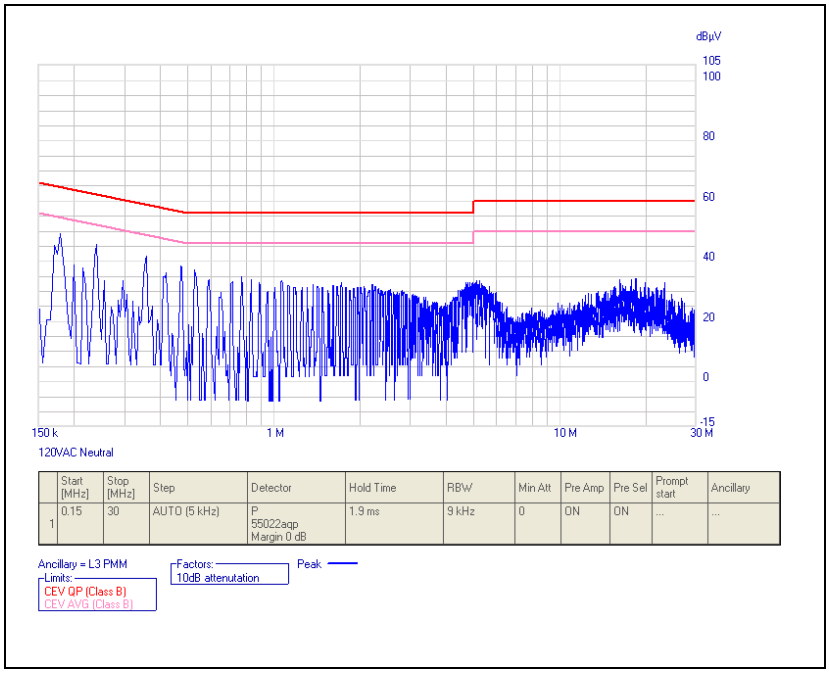


Plot 1. Conducted Emission, Phase Line Plot

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

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
120VAC Neutral	.17	40.1	64.963	-24.863	Pass	14.04	54.963	-40.923	Pass
120VAC Neutral	.18	53.01	64.49	-11.48	Pass	43.44	54.49	-11.05	Pass
120VAC Neutral	.24	46.6	62.107	-15.507	Pass	38.55	52.107	-13.557	Pass

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



Plot 2. Conducted Emission, Neutral Line Plot

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 10.

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 10.

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 10. 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 3m 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.

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

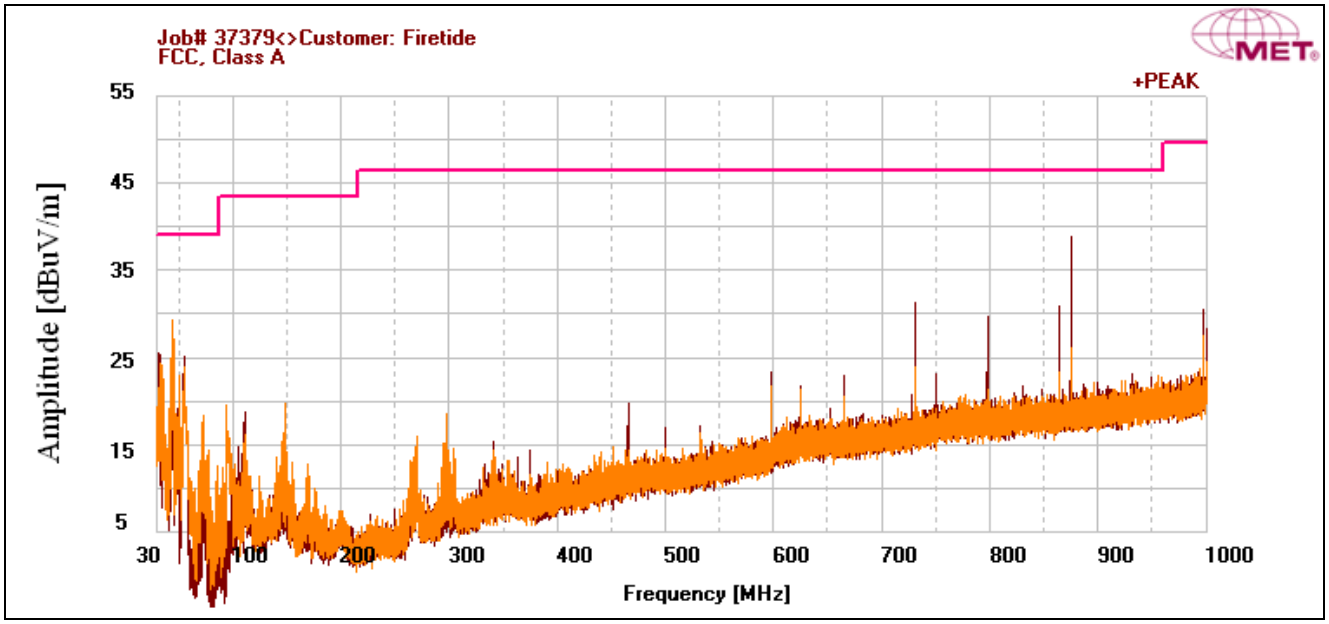
Test Engineer(s): Jonathan Chao

Test Date(s): 01/31/13

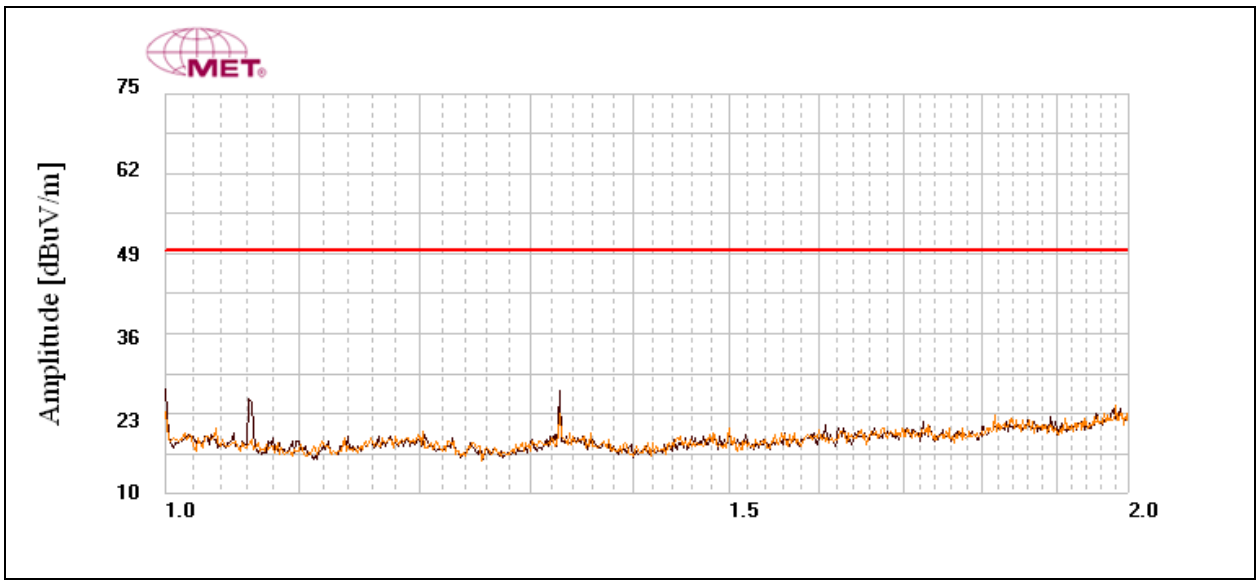
Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBuV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)
875	H	263	100	22.33	22.5	0	4.668	-10.46	39.038	46.4	-7.362
864	H	273	100	14.62	22.38	0	4.618	-10.46	31.158	46.4	-15.242
797	H	111	100	12.5	21.86	0	4.384	-10.46	28.284	46.4	-18.116
731	H	100	100	17.5	21.1	0	4.149	-10.46	32.289	46.4	-14.111
465	H	290	100	9.68	17.6	0	3.342	-10.46	20.162	46.4	-26.238
43.8	V	0	100	24.89	11.82	0	0.918	-10.46	27.168	39	-11.832

Table 11. Radiated Emissions Limits, Test Results, 30 MHz – 1 GHz, FCC Limits



Plot 3. Radiated Emissions, 30 MHz - 1 GHz, FCC Limits

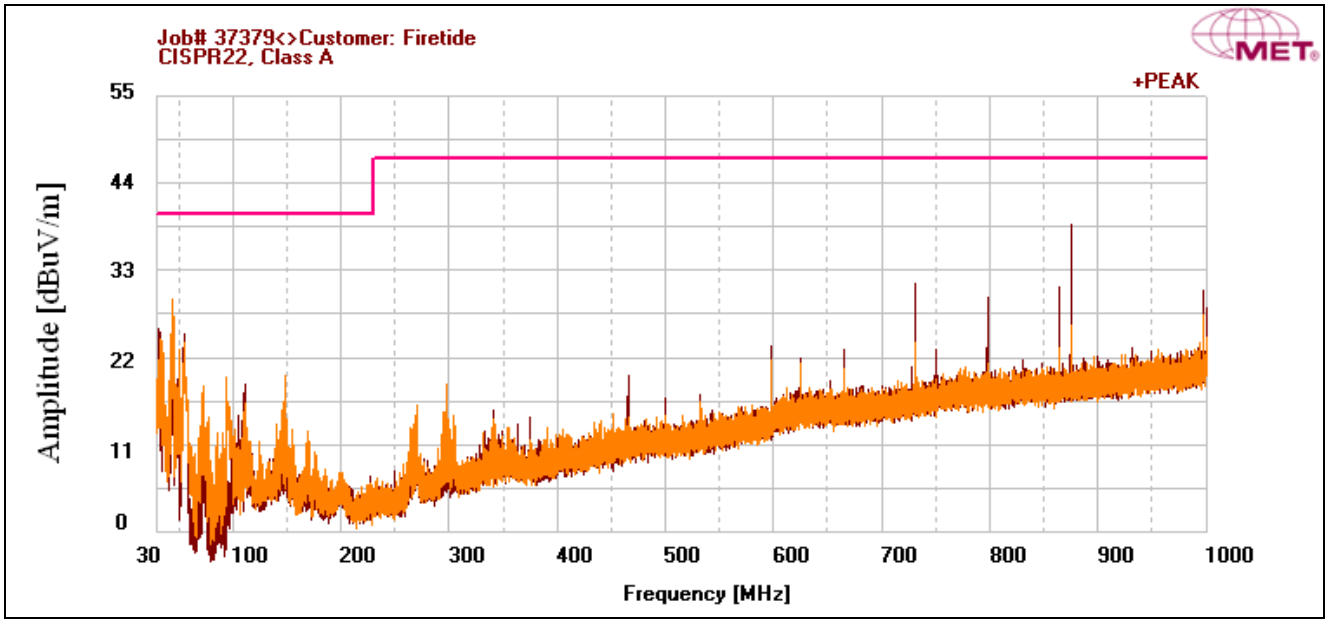


Plot 4. Radiated Emissions, Above 1 GHz, FCC Limits

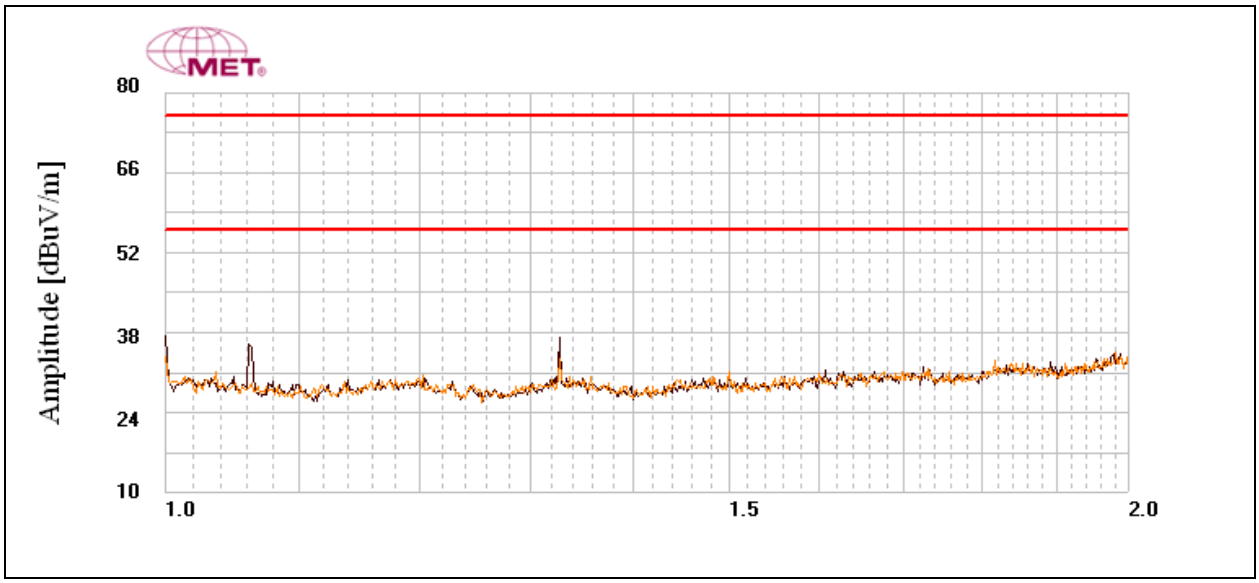
Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBuV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)
875	H	263	100	22.33	22.5	0	4.668	-10.46	39.038	47	-7.962
864	H	273	100	14.62	22.38	0	4.618	-10.46	31.158	47	-15.842
797	H	111	100	12.5	21.86	0	4.384	-10.46	28.284	47	-18.716
731	H	100	100	17.5	21.1	0	4.149	-10.46	32.289	47	-14.711
465	H	290	100	9.68	17.6	0	3.342	-10.46	20.162	47	-26.838
43.8	V	0	100	24.89	11.82	0	0.918	-10.46	27.168	40	-12.832

Table 12. Radiated Emissions Limits, Test Results, ICES-003 Limits



Plot 5. Radiated Emissions, 30 MHz - 1 GHz, CISPR Limits



Plot 6. Radiated Emissions, Above 1GHz, CISPR Limits

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. EUT uses a reverse SMA connector which is a unique type of connector

Test Engineer(s): Jonathan Chao

Test Date(s): 02/06/13

Gain	Type	Model	Manufacturer
3dBi	Omni	98144PRSX003	Master Wave Technology Co.

Electromagnetic Compatibility Criteria for Intentional Radiators

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

Test Procedure: The EUT was placed on a 0.8 m-high wooden table inside a screen room. The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a 50 Ω/50 μH Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.4-2003 "Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz"*. The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω/50 μH LISN as the input transducer to an EMC/field intensity meter. For the purpose of this testing, the transmitter was turned on. Scans were performed with the transmitter on.

Test Results: The EUT was compliant with this requirement.

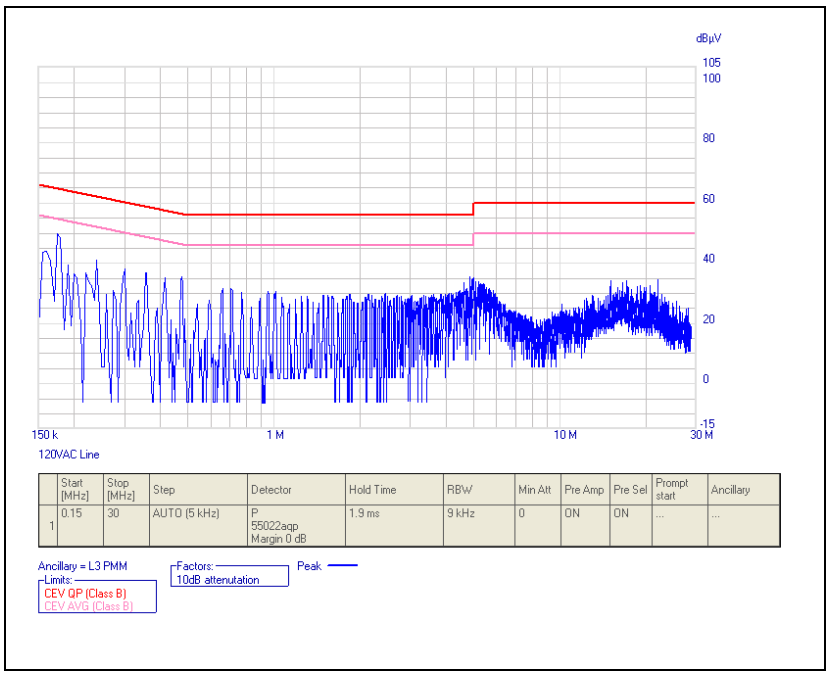
Test Engineer(s): Jonathan Chao

Test Date(s): 02/05/13

15.207(a) Conducted Emissions Test Results

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
120VAC Line	.16	37.27	65.465	-28.195	Pass	9.88	55.465	-45.585	Pass
120VAC Line	.175	40.23	64.723	-24.493	Pass	28	54.723	-26.723	Pass
120VAC Line	.24	40.14	62.107	-21.967	Pass	30.83	52.107	-21.277	Pass

Table 14. Conducted Emissions, 15.207(a), Phase Line, Test Results

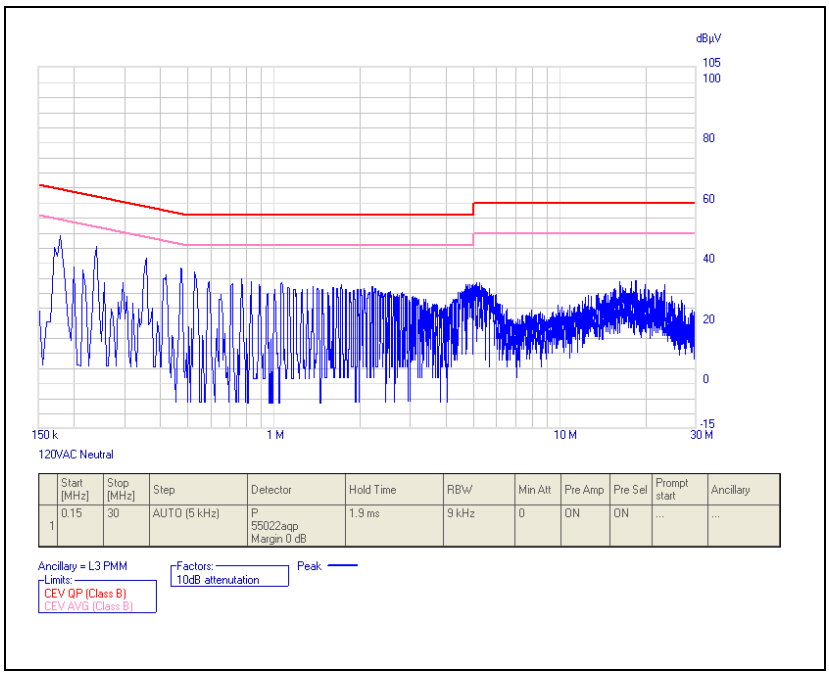


Plot 7. Conducted Emissions, 15.207(a), Phase Line

15.207(a) Conducted Emissions Test Results

Line	Freq. (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
120VAC Neutral	.17	40.1	64.963	-24.863	Pass	14.04	54.963	-40.923	Pass
120VAC Neutral	.18	53.01	64.49	-11.48	Pass	43.44	54.49	-11.05	Pass
120VAC Neutral	.24	46.6	62.107	-15.507	Pass	38.55	52.107	-13.557	Pass

Table 15. Conducted Emissions, 15.207(a), Neutral Line, Test Results



Plot 8. Conducted Emissions, 15.207(a), Neutral Line

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15. 403(c) 26dB Bandwidth

Test Requirements: **§ 15.403 (i):** For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

Test Procedure: The transmitter was set to both operating frequencies at the highest output power and connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a Peak detector with a RBW approximately equal to 1% of the total emission bandwidth, VBW > RBW. The 26 dB Bandwidth was measured and recorded.

Test Results The 26 dB Bandwidth was compliant with the requirements of this section and was determined from the plots on the following pages.

Test Engineer(s): Jonathan Chao

Test Date(s): 01/23/13

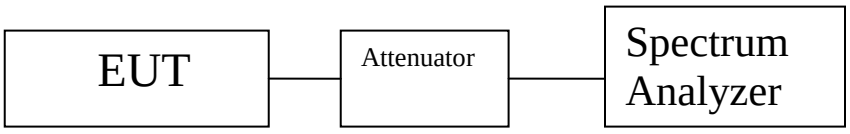


Figure 2. Occupied Bandwidth, Test Setup

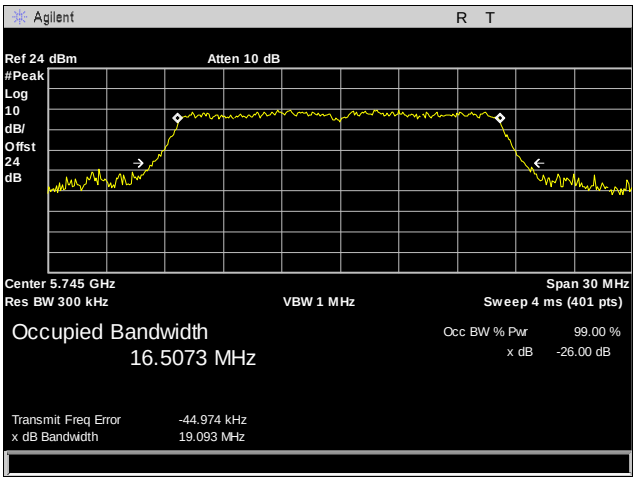
	Frequency (MHz)	26 dB Bandwidth (MHz)
802.11a 20 MHz Port 1	5745	19.093
	5785	19.003
	5805	19.269
802.11n 20 MHz Port 1	5745	20.314
	5785	20.094
	5805	19.269
802.11n 40 MHz Port 1	5755	50.173
	5795	46.766

Table 16. 26 dB Occupied Bandwidth, Test Results

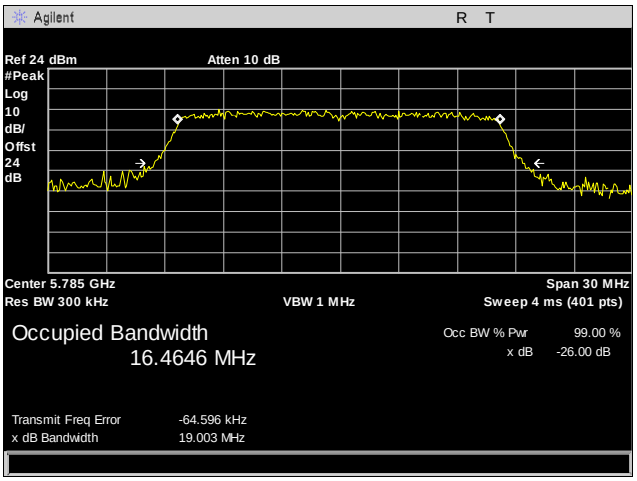
	Frequency (MHz)	99% Bandwidth (MHz)
802.11a 20 MHz Port 1	5745	17.0983
	5785	16.9860
	5805	18.9767
802.11n 20 MHz Port 1	5745	18.2267
	5785	18.2363
	5805	17.4222
802.11n 40 MHz Port 1	5755	37.1237
	5795	37.0898

Table 17. 99% Occupied Bandwidth, Test Results

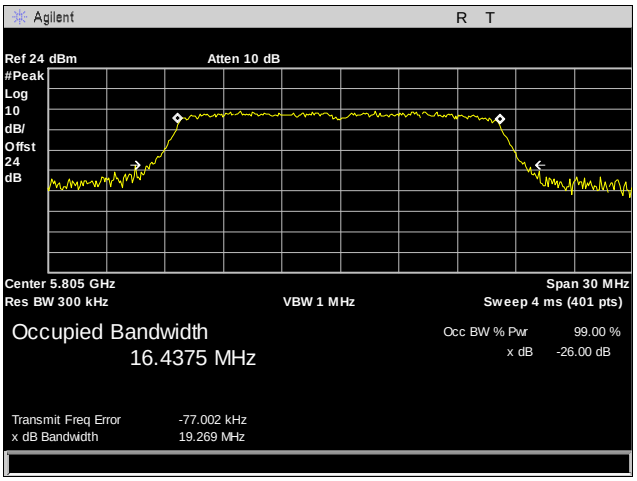
26 dB Occupied Bandwidth



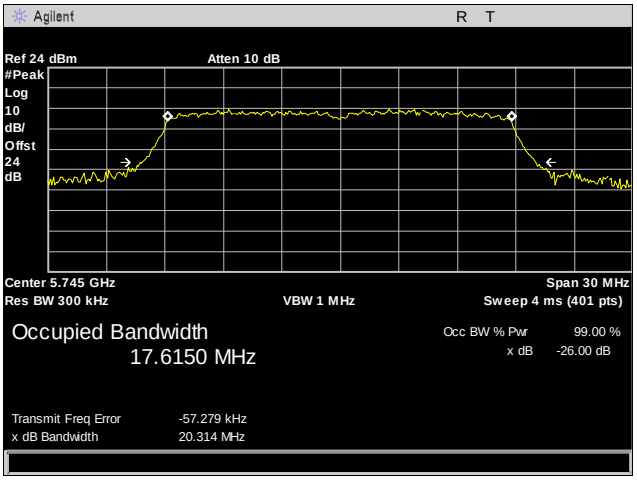
Plot 9. 26 dB Occupied Bandwidth, 802.11a 20 MHz, 5745 MHz, Low Port 1



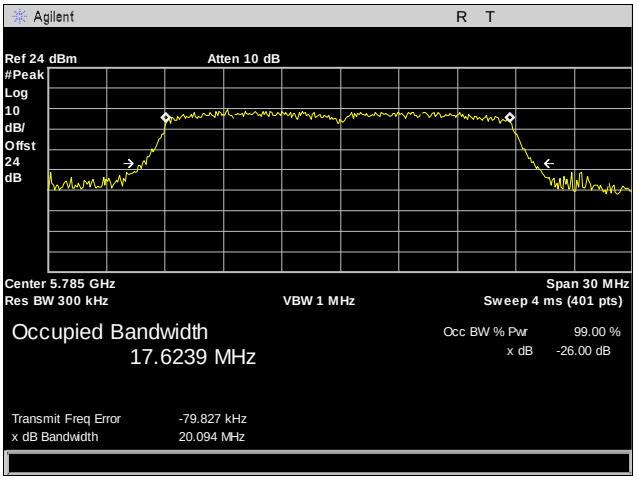
Plot 10. 26 dB Occupied Bandwidth, 802.11a 20 MHz, 5785 MHz, Mid Port 1



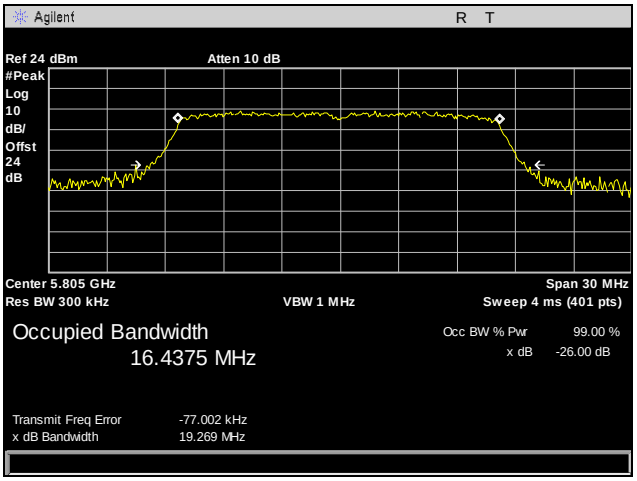
Plot 11. 26 dB Occupied Bandwidth, 802.11a 20 MHz, 5805 MHz, High Port 1



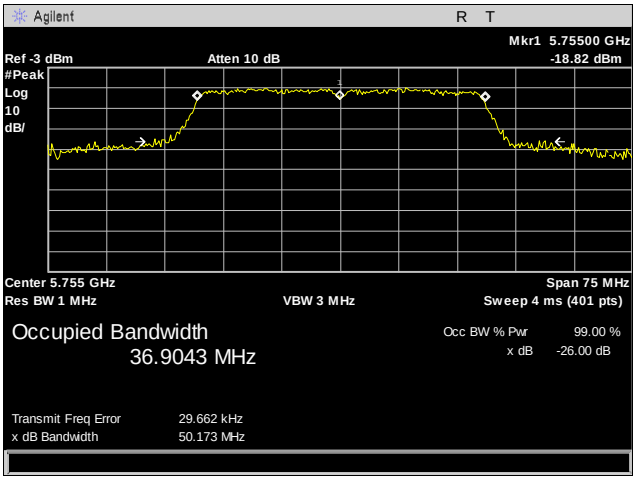
Plot 12. 26 dB Occupied Bandwidth, 802.11n 20 MHz, 5745 MHz, Low Port 1



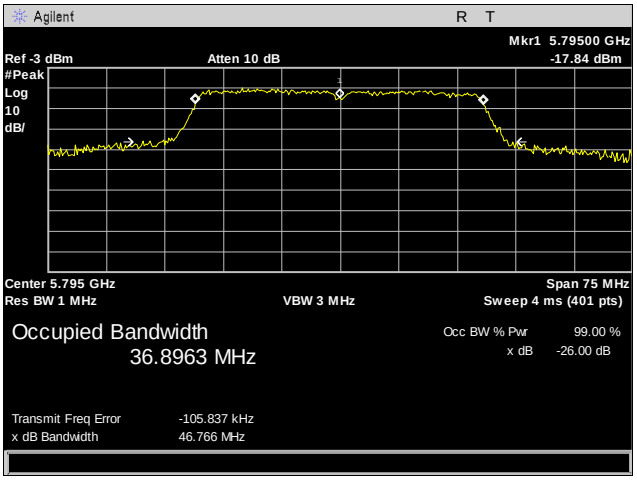
Plot 13. 26 dB Occupied Bandwidth, 802.11n 20 MHz, 5785 MHz, Mid Port 1



Plot 14. 26 dB Occupied Bandwidth, 802.11n 20 MHz, 5805 MHz, High Port 1

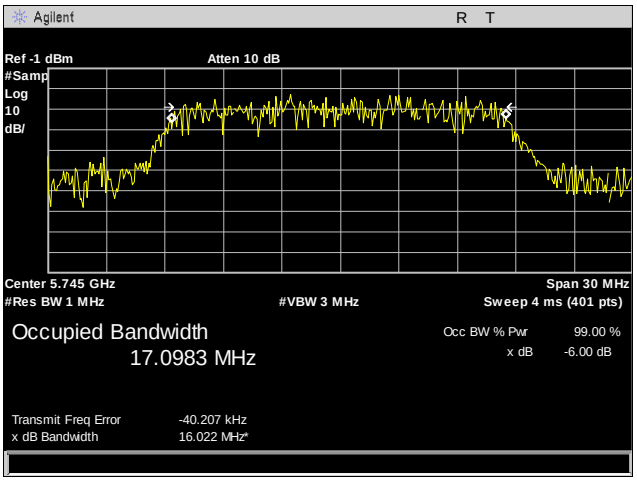


Plot 15. 26 dB Occupied Bandwidth, 802.11n 40 MHz, 5755 MHz, Low Port 1

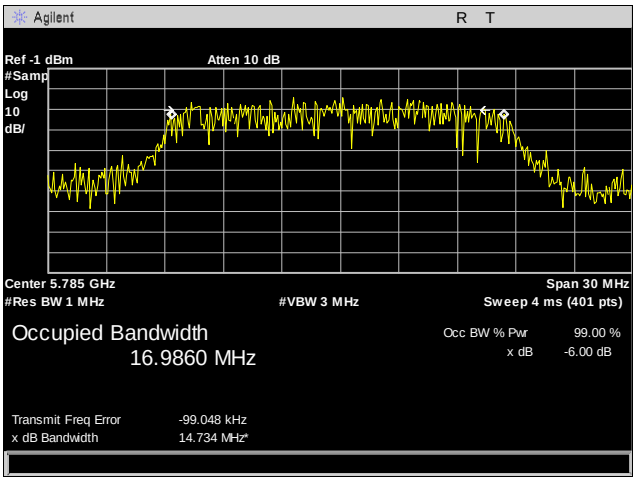


Plot 16. 26 dB Occupied Bandwidth, 802.11n 40 MHz, 5795 MHz, High Port 1

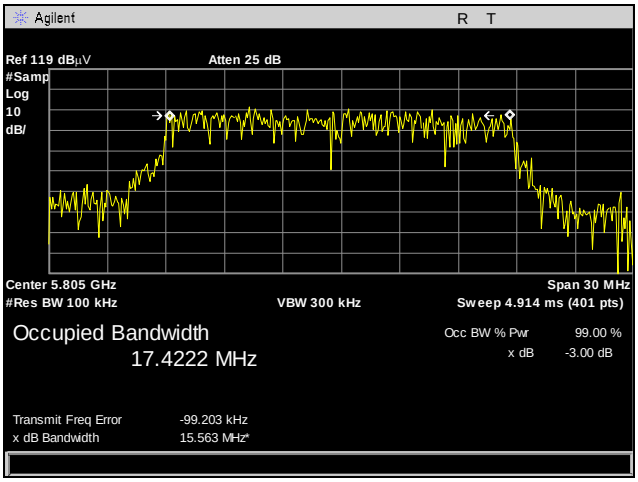
99% Occupied Bandwidth



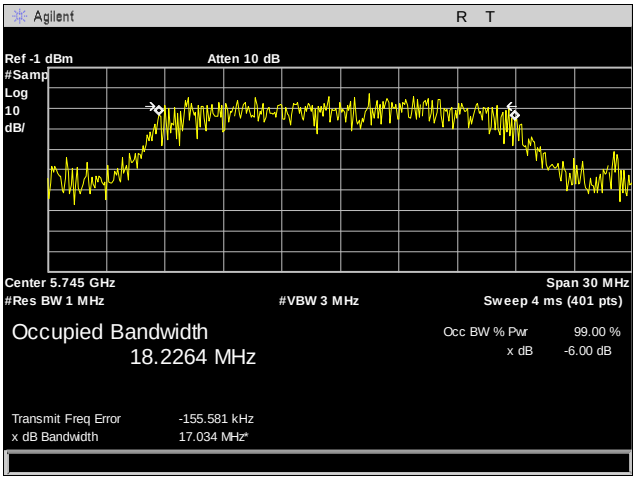
Plot 17. 99% Occupied Bandwidth, 802.11a 20 MHz, 5745 MHz, Low Port 1



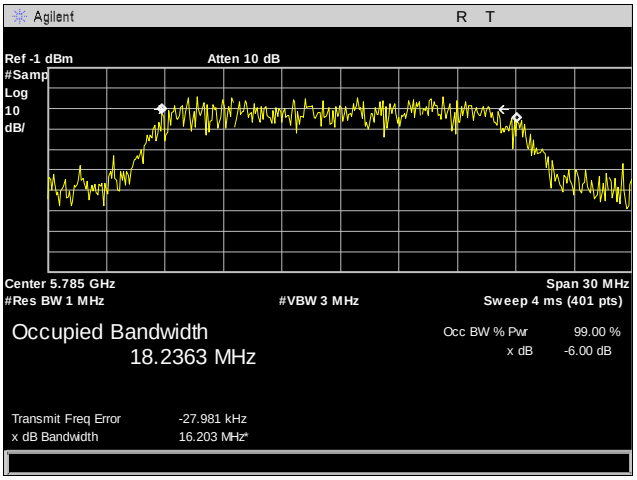
Plot 18. 99% Occupied Bandwidth, 802.11a 20 MHz, 5785 MHz, Mid Port 1



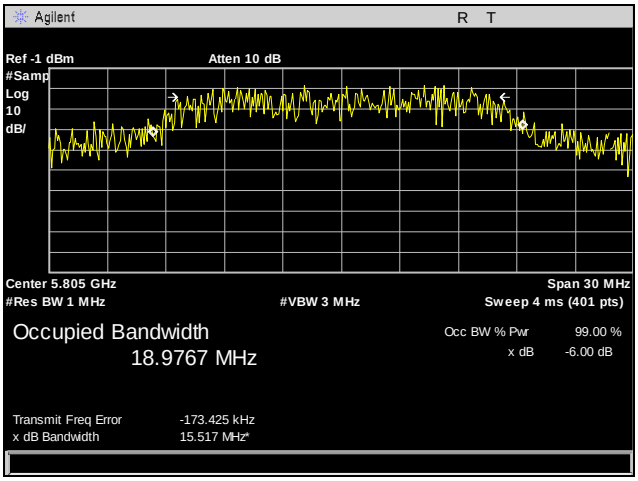
Plot 19. 99% Occupied Bandwidth, 802.11a 20 MHz, 5805 MHz, High Port 1



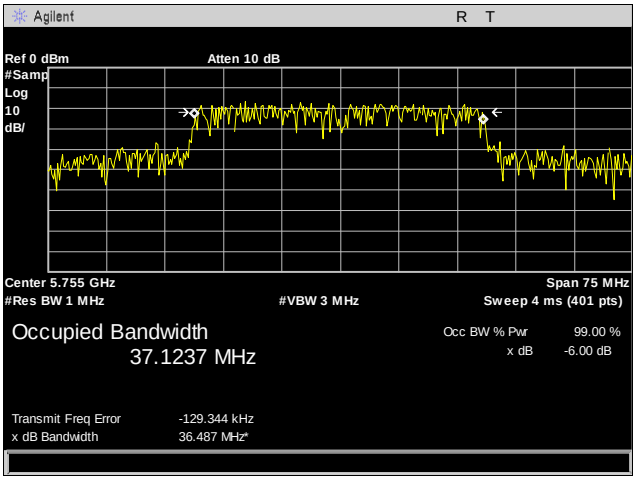
Plot 20. 99% Occupied Bandwidth, 802.11n 20 MHz, 5745 MHz, Low Port 1



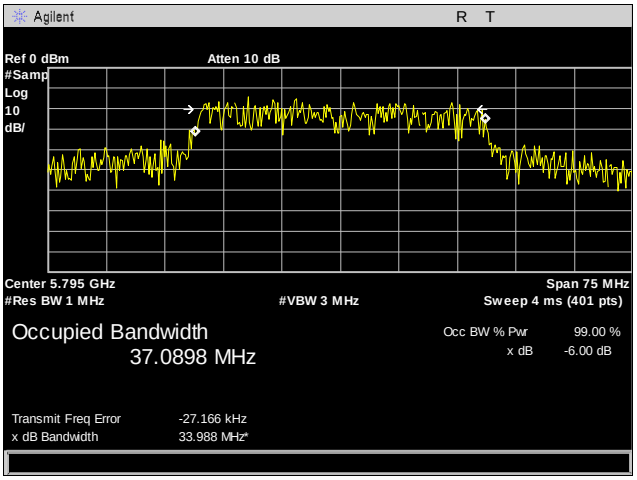
Plot 21. 99% Occupied Bandwidth, 802.11n 20 MHz, 5785 MHz, Mid Port 1



Plot 22. 99% Occupied Bandwidth, 802.11n 20 MHz, 5805 MHz, High Port 1



Plot 23. 99% Occupied Bandwidth, 802.11n 40 MHz, 5755 MHz, Low Port 1



Plot 24. 99% Occupied Bandwidth, 802.11n 40 MHz, 5795 MHz, High Port 1

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15. 407(a)(2) RF Power Output

Test Requirements: **§15.407(a) (3):** For the band 5.725-5.825 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 1 W or 17 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz.

Test Procedure: The EUT was connected to a Spectrum Analyzer with a 20 dB attenuator in line. An average detector with power averaging over 100 traces was used with a Resolution Bandwidth of 1MHz and Video Bandwidth of 3MHz.

Test Results: Equipment was compliant with the Peak Power Output limits of **§ 15.401(a)(3)**.

Test Engineer(s): Jonathan Chao

Test Date(s): 01/24/13

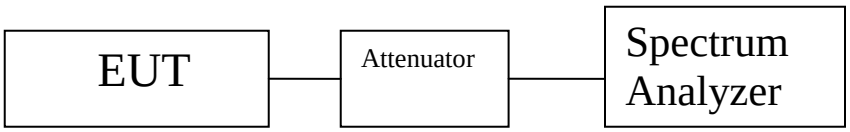
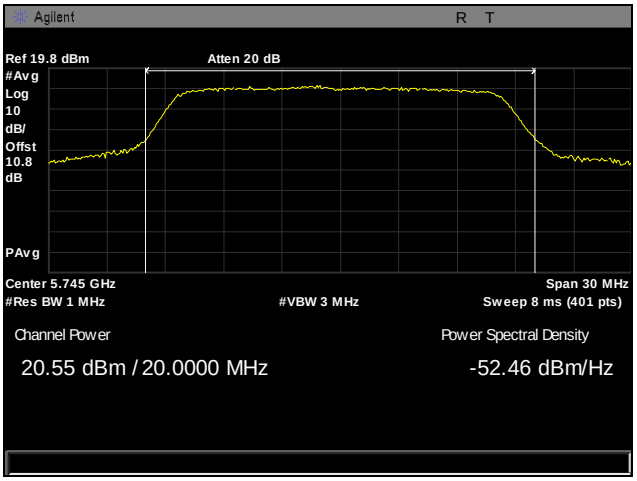


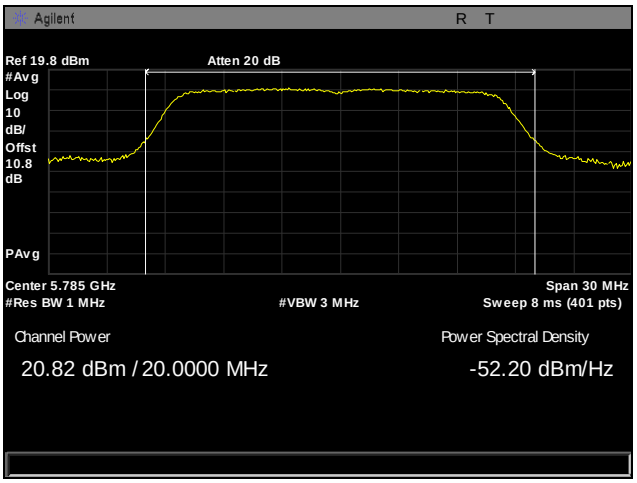
Figure 3. Power Output Test Setup

Frequency (MHz)	Mode/Modulation Type	Port 1 (dB)	Output power Limit (dB)
5745	802.11a	20.55	30
5785	802.11a	20.82	30
5805	802.11a	24.3	30
5745	802.11n HT20	24.26	30
5785	802.11n HT20	20.74	30
5825	802.11n HT20	21.98	30
5755	802.11n HT40	22.68	30
5795	802.11n HT40	21.3	30

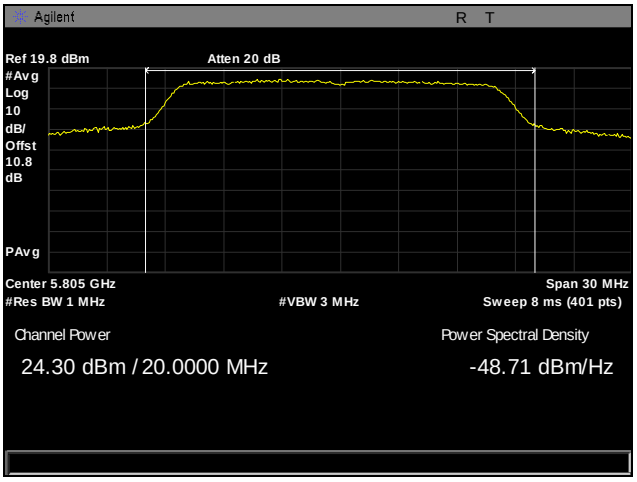
Table 18. RF Power Output, Test Results



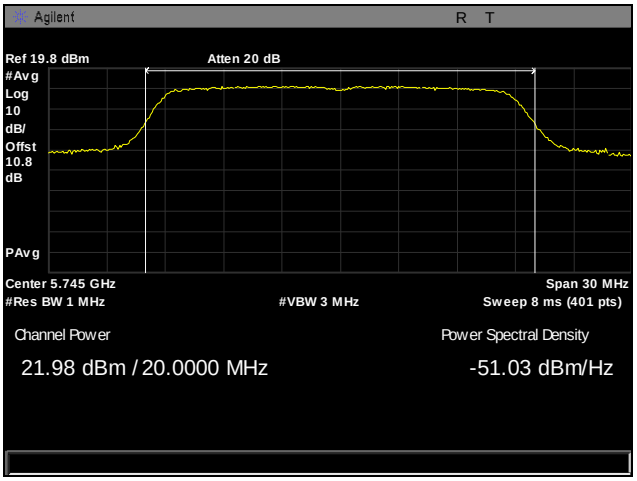
Plot 25. RF Power Output, 802.11a 20 MHz, 5745 MHz, Low



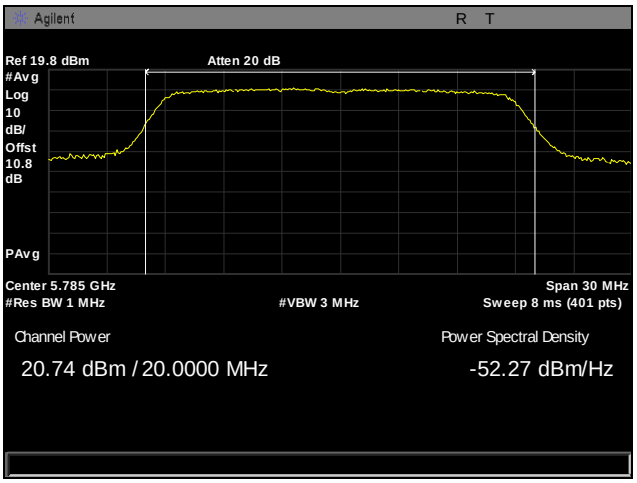
Plot 26. RF Power Output, 802.11a 20 MHz, 5785 MHz, Mid



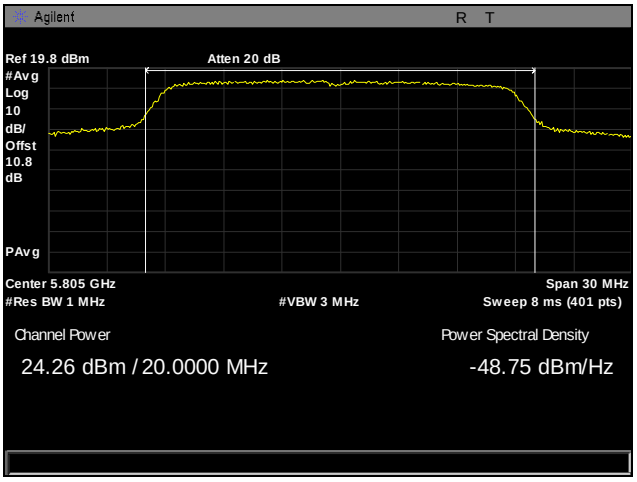
Plot 27. RF Power Output, 802.11a 20 MHz, 5805 MHz, High



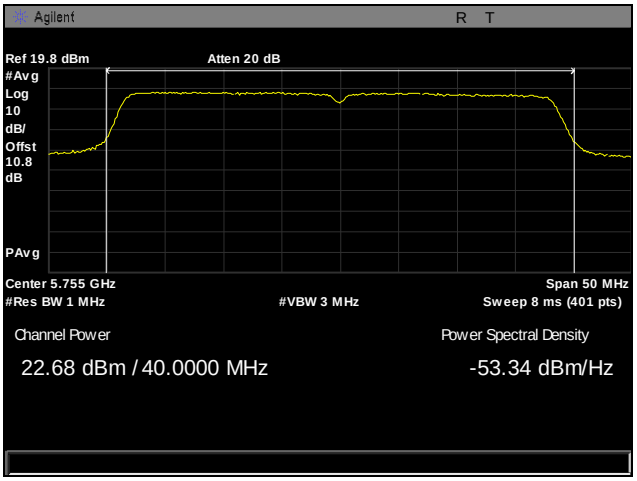
Plot 28. RF Power Output, 802.11n 20 MHz, 5745 MHz, Low



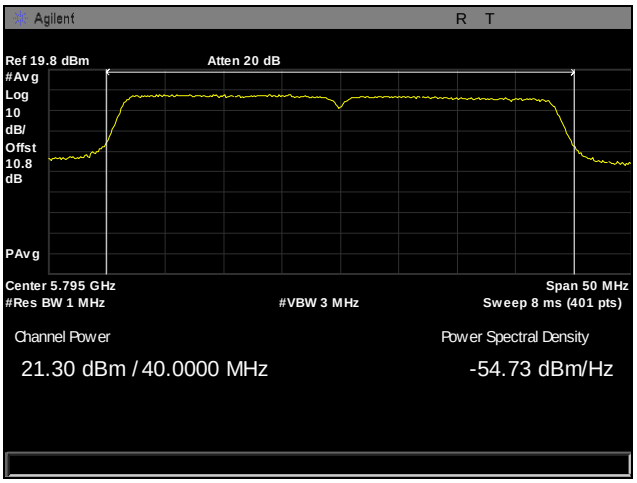
Plot 29. RF Power Output, 802.11n 20 MHz, 5785 MHz, Mid



Plot 30. RF Power Output, 802.11n 20 MHz, 5825 MHz, High



Plot 31. RF Power Output, 802.11n 40 MHz, 5755 MHz, Low



Plot 32. RF Power Output, 802.11n 40 MHz, 5795 MHz, High

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(a)(3) Peak Power Spectral Density

Test Requirements: **§ 15.407(a)(3):** In addition, the peak power spectral density shall not exceed 17 dBm in any 1 megahertz band.

Test Procedure: The transmitter was connected directly to a Spectrum Analyzer through an attenuator. The power level was set to the maximum level on the EUT. The RBW was set to 1MHz and the VBW was set to 3MHz. The method of measurement of 789033 D01 UNII General Test Procedures v01r02 section E with method SA-1 was used.

Test Results: Equipment was compliant with the peak power spectral density limits of **§ 15.407 (a)(3).** The peak power spectral density was determined from plots on the following page(s).

Test Engineer(s): Jonathan Chao

Test Date(s): 01/24/13

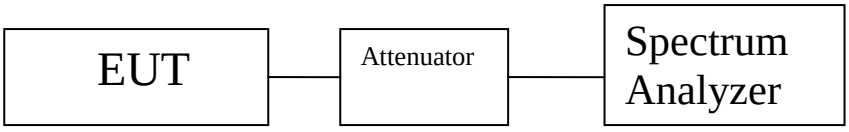
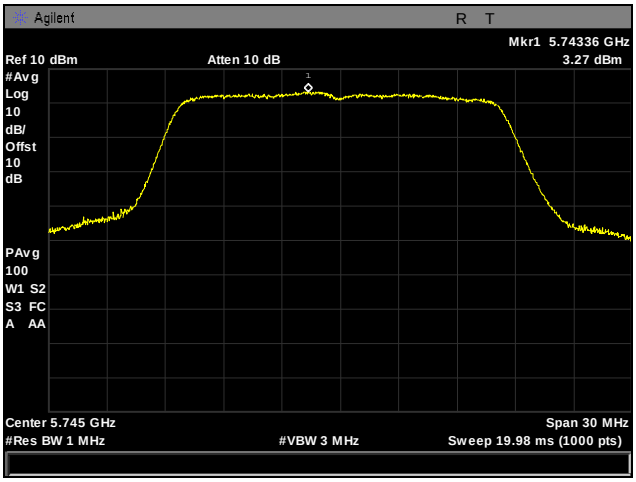


Figure 4. Power Spectral Density Test Setup

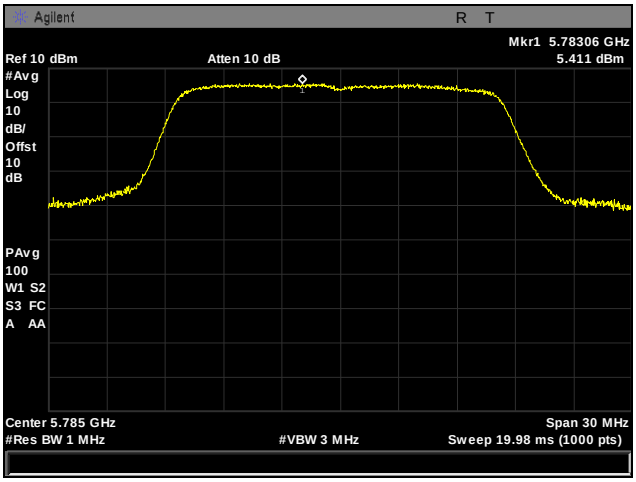
	Frequency (MHz)	PSD (dBm)
802.11a 20 MHz	5745	3.27
	5785	5.411
	5805	5.816
802.11n 20 MHz	5745	6.863
	5785	10.79
	5805	10.24
802.11n 40 MHz	5755	2.682
	5795	2.388

Table 19. Power Spectral Density, Test Results

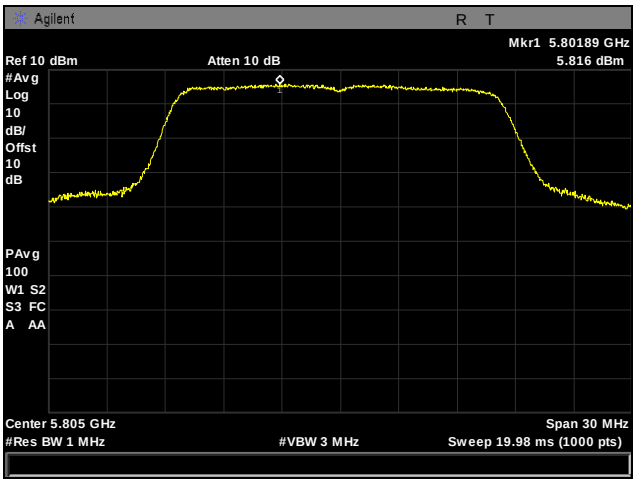
Electromagnetic Compatibility Criteria for Intentional Radiators



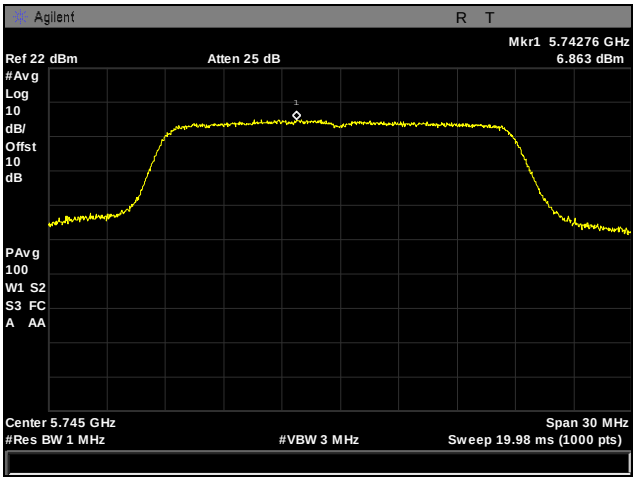
Plot 33. Power Spectral Density, 802.11a 20 MHz, 5745 MHz, Low



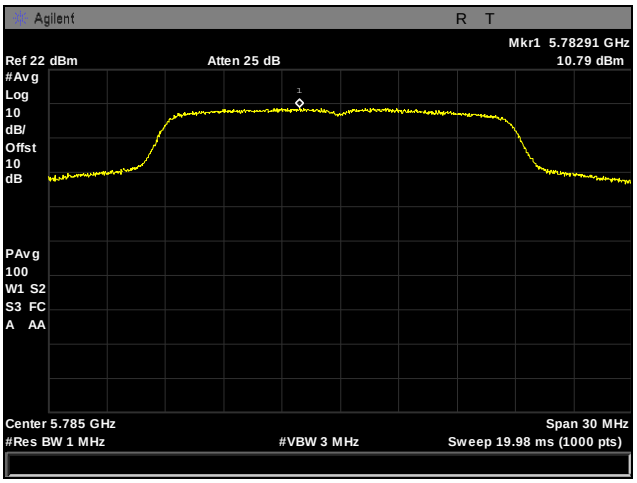
Plot 34. Power Spectral Density, 802.11a 20 MHz, 5785 MHz, Mid



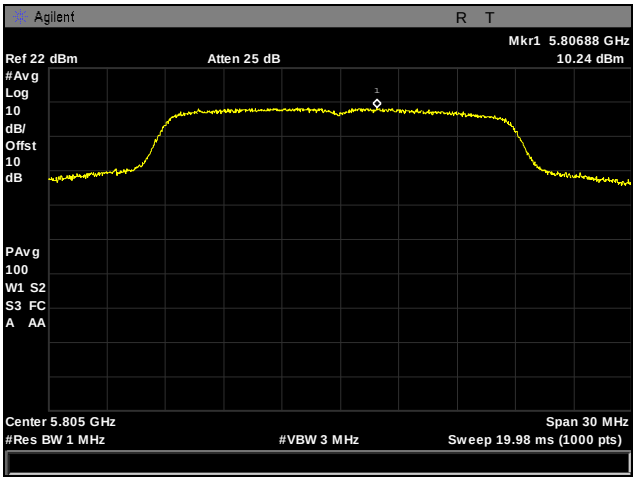
Plot 35. Power Spectral Density, 802.11a 20 MHz, 5805 MHz, High



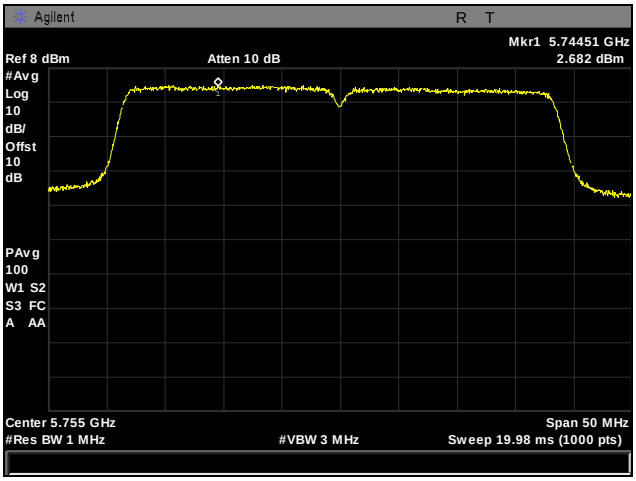
Plot 36. Power Spectral Density, 802.11n 20 MHz, 5745 MHz, Low



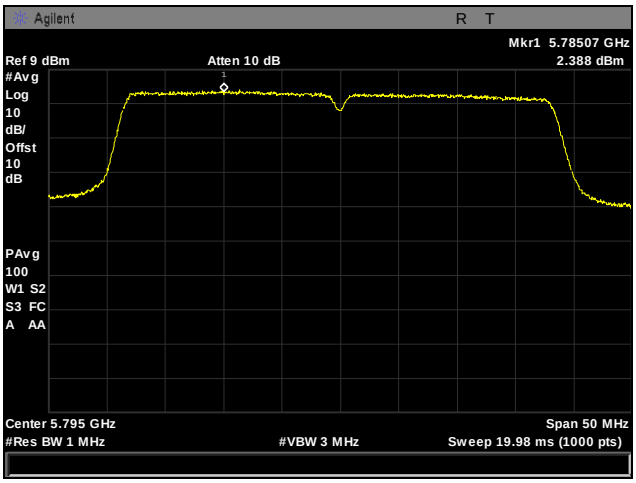
Plot 37. Power Spectral Density, 802.11n 20 MHz, 5785 MHz, Mid



Plot 38. Power Spectral Density, 802.11n 20 MHz, 5805 MHz, High



Plot 39. Power Spectral Density, 802.11n 40 MHz, 5755 MHz, Low



Plot 40. Power Spectral Density, 802.11n 40 MHz, 5795 MHz, High

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(a)(6) Peak Excursion Ratio

Test Requirements: **§ 15.407(a)(6):** The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

Test Procedure: The EUT was connected directly to the spectrum analyzer through cabling and attenuation. The 1st trace on the spectrum analyzer was set to RBW=1MHz, VBW=3MHz. The peak detector mode was used and the trace max held. The 2nd trace on the spectrum analyzer was set according to the method of measurement of 789033 D01 UNII General Test Procedures v01r02 section F with method SA-1.

Test Results: Equipment was compliant with the peak excursion ratio limits of **§ 15.407(a)(6).** The peak excursion ratio was determined from plots on the following page(s).

Test Engineer(s): Jonathan Chao

Test Date(s): 01/24/13

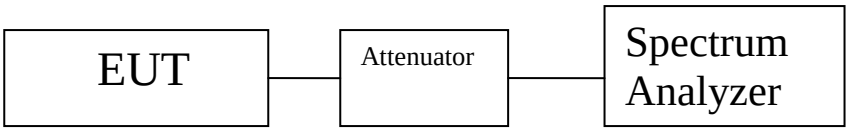
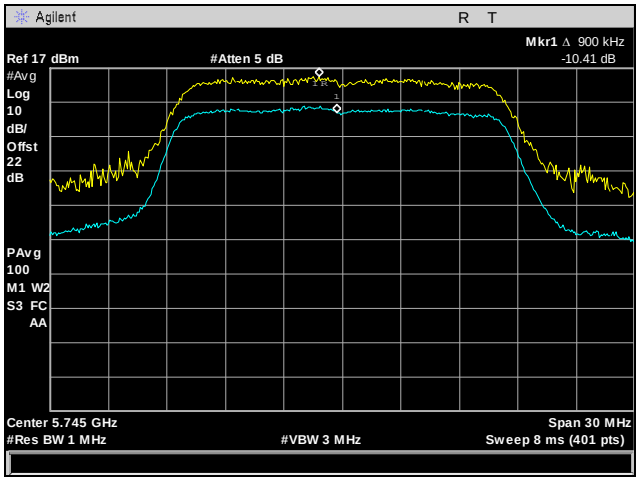
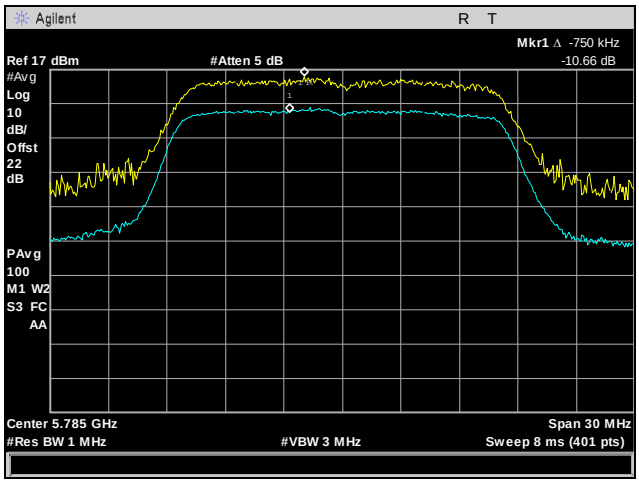


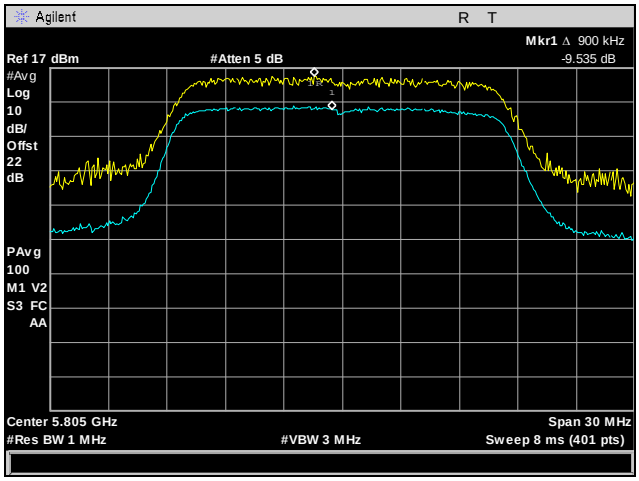
Figure 5. Peak Excursion Ration Test Setup



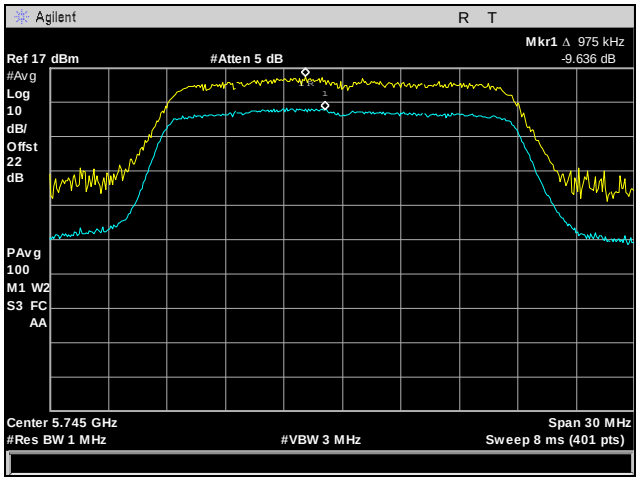
Plot 41. Peak Excursion Ratio, 802.11a 20 MHz, 5745 MHz, Low Port 1



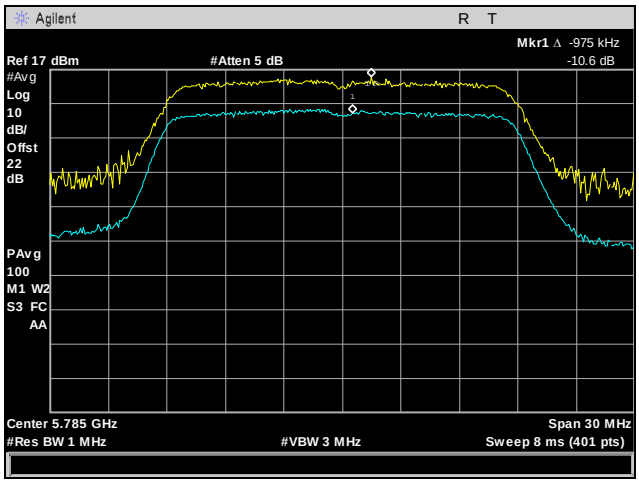
Plot 42. Peak Excursion Ratio, 802.11a 20 MHz, 5785 MHz, Mid Port 1



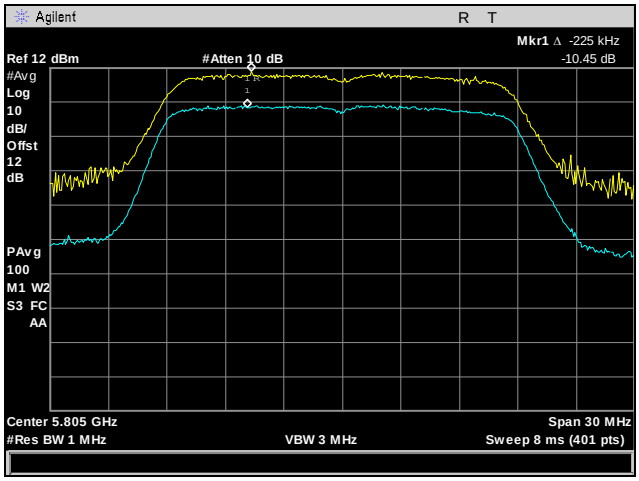
Plot 43. Peak Excursion Ratio, 802.11a 20 MHz, 5805 MHz, High Port 1



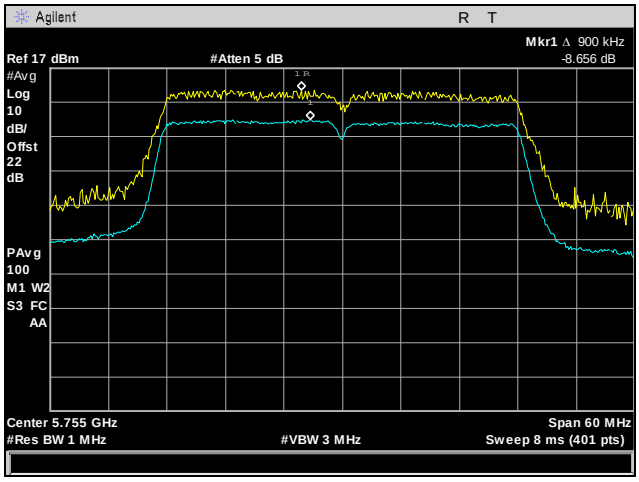
Plot 44. Peak Excursion Ratio, 802.11n 20 MHz 20 MHz, 5745 MHz, Low Port 1



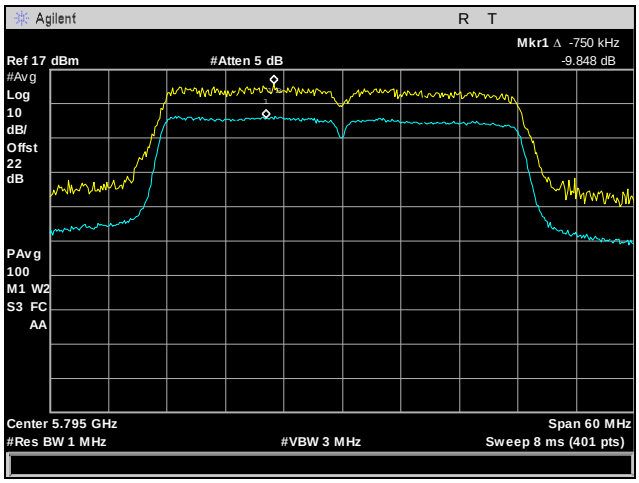
Plot 45. Peak Excursion Ratio, 802.11n 20 MHz 20 MHz, 5785 MHz, Mid Port 1



Plot 46. Peak Excursion Ratio, 802.11n 20 MHz 20 MHz, 5805 MHz, High Port 1



Plot 47. Peak Excursion Ratio, 802.11n 40 MHz 20 MHz, 5755 MHz, Low Port 1



Plot 48. Peak Excursion Ratio, 802.11n 40 MHz 20 MHz, 5795 MHz, High Port 1

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(b)(2), (3), (6), (7) Undesirable Emissions

Test Requirements: **§ 15.407(b)(2), (3), (6), (7)**; **§15.205:** Emissions outside the frequency band.

§ 15.407(b)(2): For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

§ 15.407(b)(3): For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz**.**

§ 15.407(b)(6): Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Section 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in Section 15.207.

§ 15.407(b)(7): The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.

Test Procedure: The transmitter was placed on an acrylic stand inside in a semi-anechoic chamber. Measurements were performed with the EUT rotated 360 degrees and varying the adjustable antenna mast height to determine worst case orientation for maximum emissions.

For frequencies from 30 MHz to 1 GHz, measurements were made using a quasi-peak detector with a 120 kHz bandwidth. At 733.25MHz the emission is determined to originate from a digital signal while scan was taken with transmission off.

For measurements above 1 GHz, measurements were made with a Peak detector with 1 MHz resolution bandwidth. Where the spurious emissions fell into a restricted band, measurements were also made with an average detector to make sure they complied with 15.209 limits. Emissions were explored up to 40 GHz. Measurements were made above 18 GHz but only noise floor was recorded.

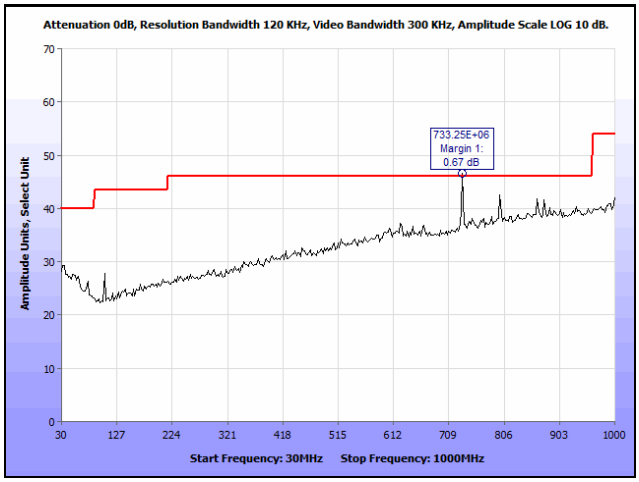
For EIRP radiated measurements the equation, **EIRP= E + 20 log D – 104.8** was used to convert an EIRP limit to a field strength limit.
E = field strength (dBUv/m)
D = Reference measurement distance

Test Results: The EUT was compliant with the Radiated Emission limits for Intentional Radiators. See following pages for detailed test results.

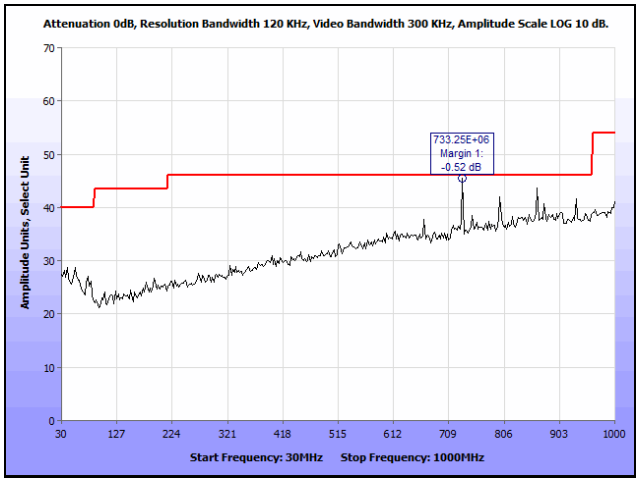
Test Engineer(s): Jonathan Chao

Test Date(s): 02/01/13

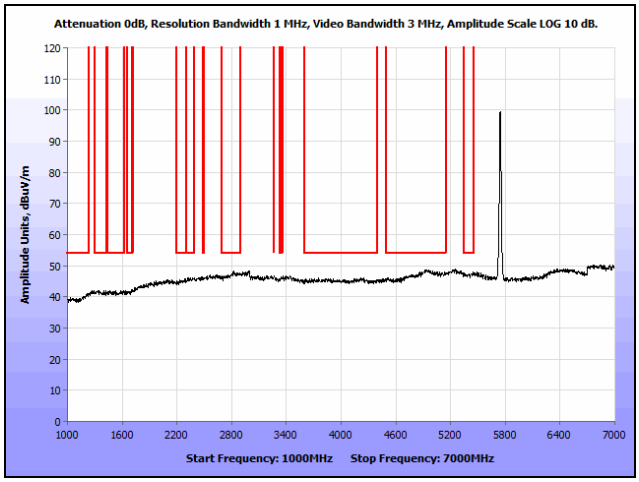
§ 15.209 Radiated Emissions Limits



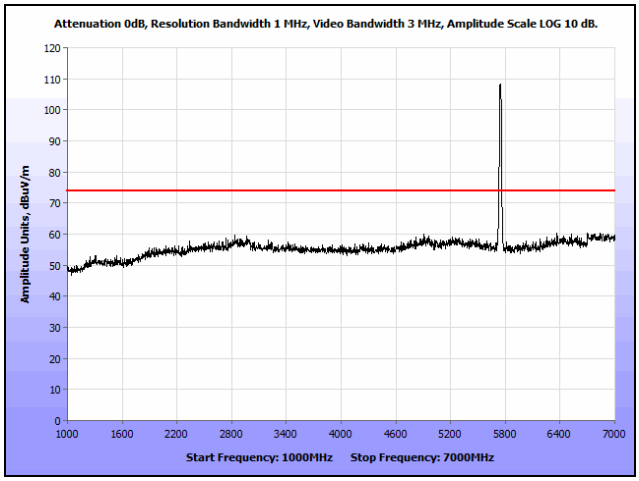
Plot 49. Radiated Spurious Emissions, RF off, Digital Device baseline Scan, 30 MHz – 1 GHz



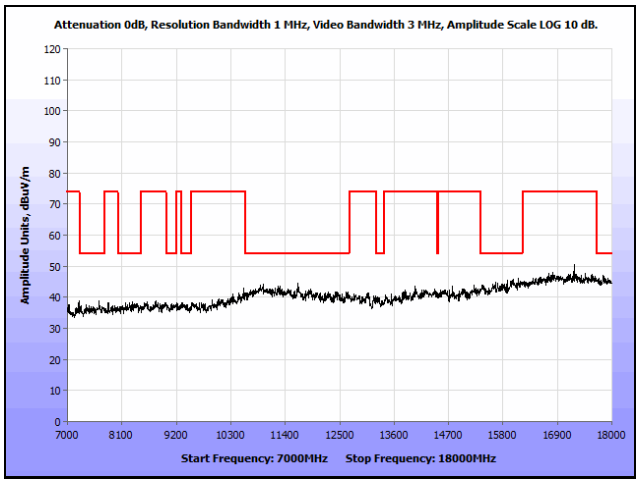
Plot 50. Radiated Spurious Emissions, 802.11a 20 MHz, 5745 MHz, Low Channel, 30 MHz – 1 GHz



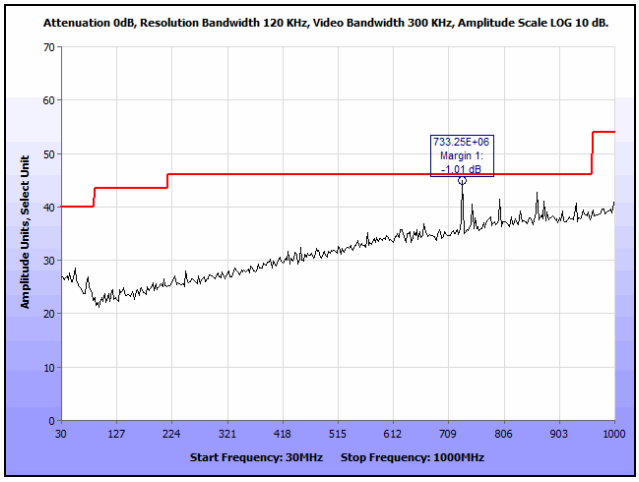
Plot 51. Radiated Spurious Emissions, 802.11a 20 MHz, 5745 MHz, Low Channel, 1 GHz – 7 GHz, Average



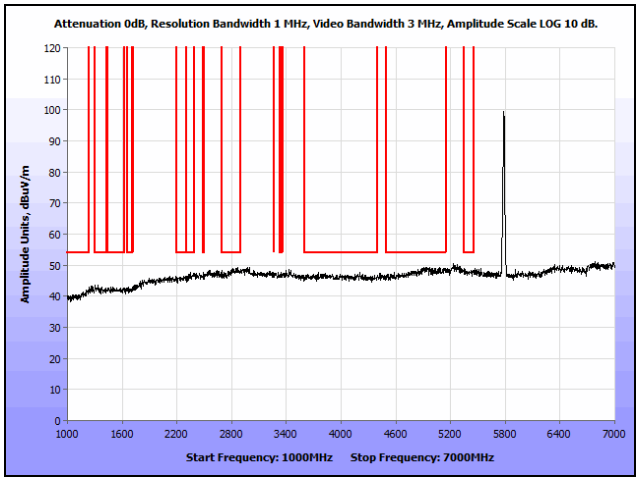
Plot 52. Radiated Spurious Emissions, 802.11a 20 MHz, 5745 MHz, Low Channel, 1 GHz – 7 GHz, Peak



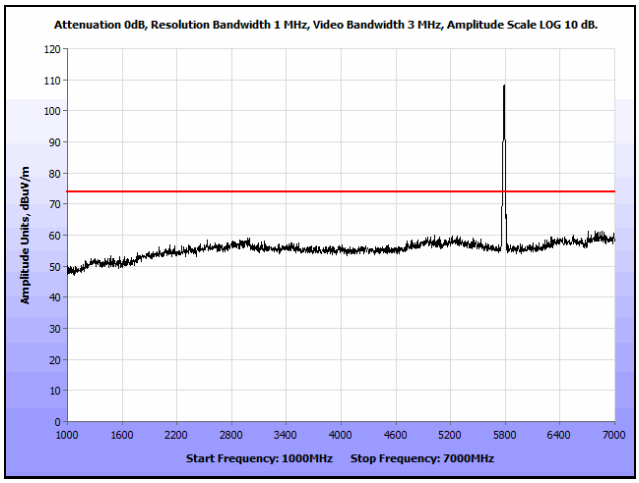
Plot 53. Radiated Spurious Emissions, 802.11a 20 MHz, 5745 MHz, Low Channel, 7 GHz – 18 GHz



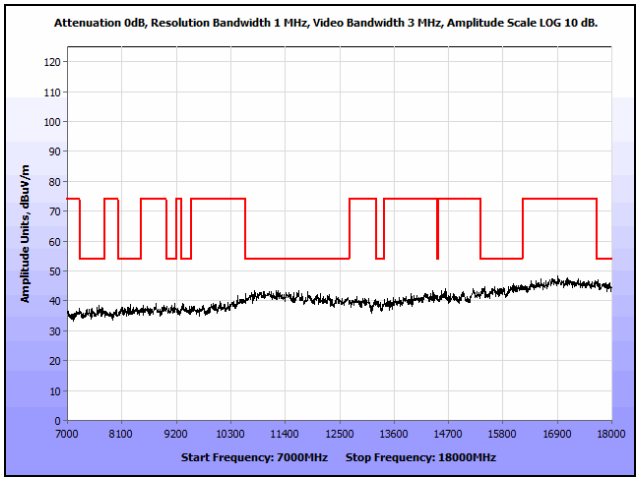
Plot 54. Radiated Spurious Emissions, 802.11a 20 MHz, 5785 MHz, Mid Channel, 30 MHz – 1 GHz



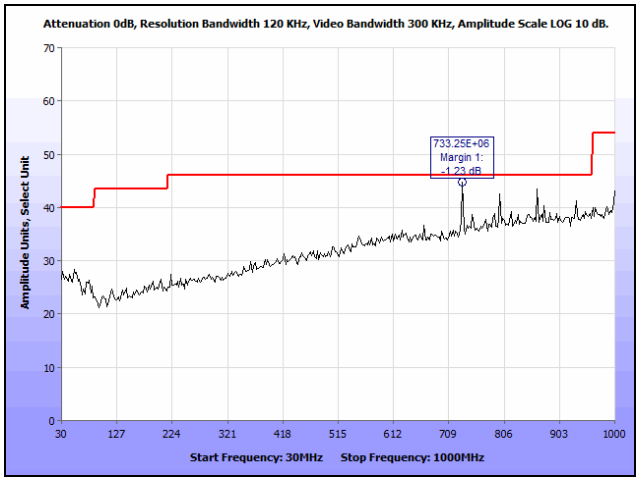
Plot 55. Radiated Spurious Emissions, 802.11a 20 MHz, 5785 MHz, Mid Channel, 1 GHz – 7 GHz, Average



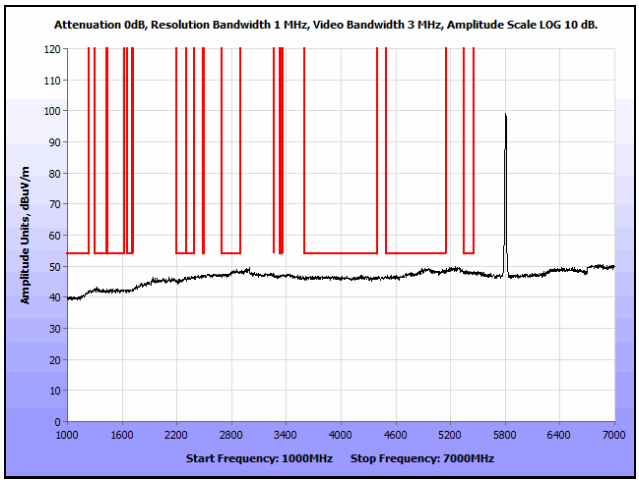
Plot 56. Radiated Spurious Emissions, 802.11a 20 MHz, 5785 MHz, Mid Channel, 1 GHz – 7 GHz, Peak



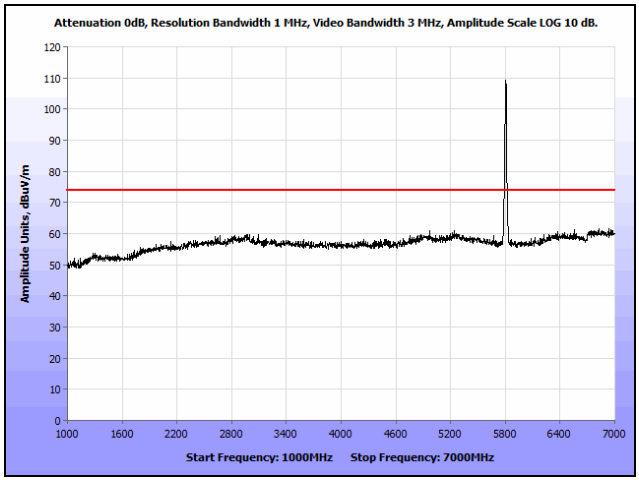
Plot 57. Radiated Spurious Emissions, 802.11a 20 MHz, 5785 MHz, Mid Channel, 7 GHz – 18 GHz



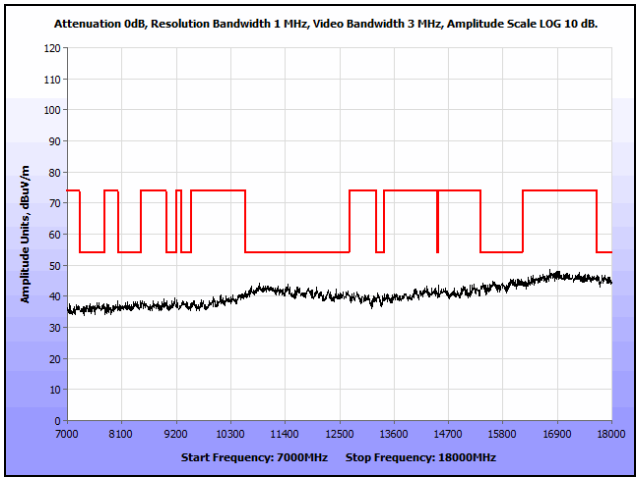
Plot 58. Radiated Spurious Emissions, 802.11a 20 MHz, 5805 MHz, High Channel, 30 MHz – 1 GHz



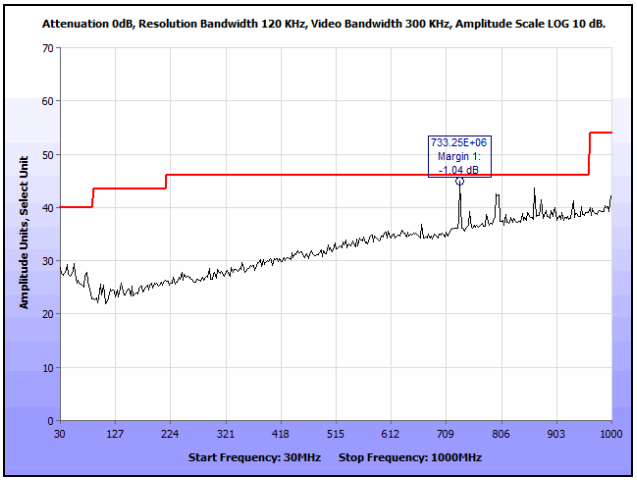
Plot 59. Radiated Spurious Emissions, 802.11a 20 MHz, 5805 MHz, High Channel, 1 GHz – 7 GHz, Average



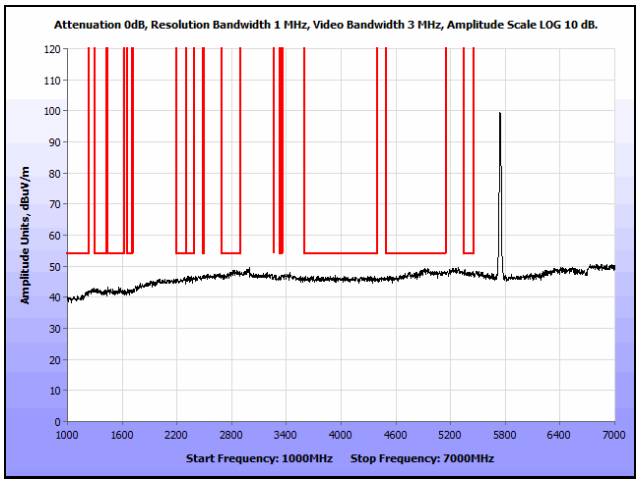
Plot 60. Radiated Spurious Emissions, 802.11a 20 MHz, 5805 MHz, High Channel, 1 GHz – 7 GHz, Peak



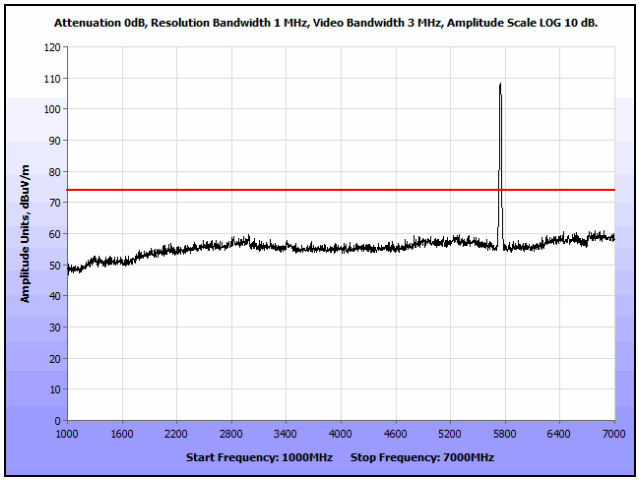
Plot 61. Radiated Spurious Emissions, 802.11a 20 MHz, 5805 MHz, High Channel, 7 GHz – 18 GHz



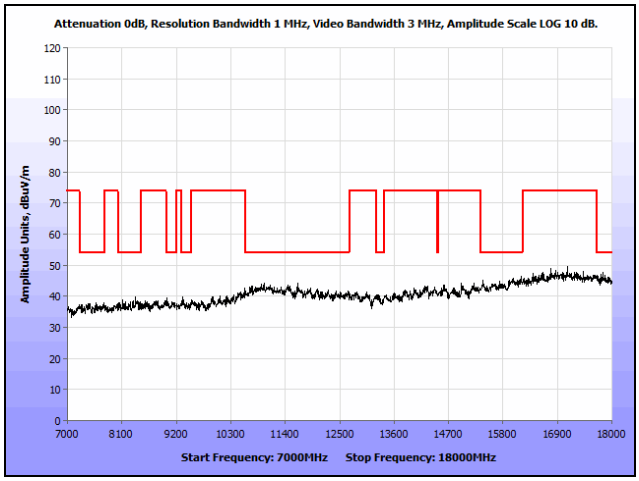
Plot 62. Radiated Spurious Emissions, 802.11n 20 MHz, 5745 MHz, Low Channel, 30 MHz – 1 GHz



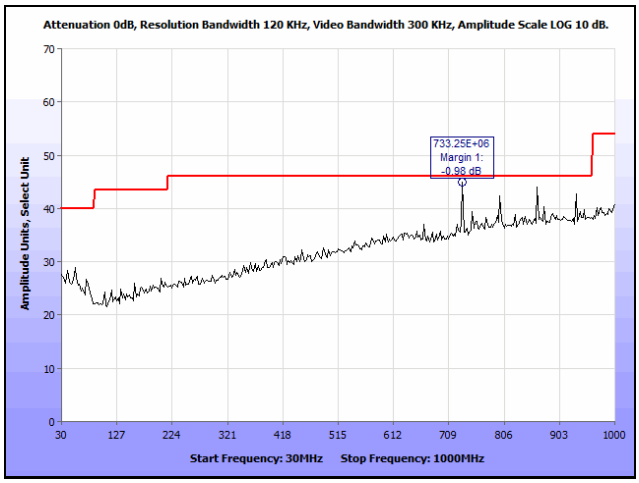
Plot 63. Radiated Spurious Emissions, 802.11n 20 MHz, 5745 MHz, Low Channel, 1 GHz – 7 GHz, Average



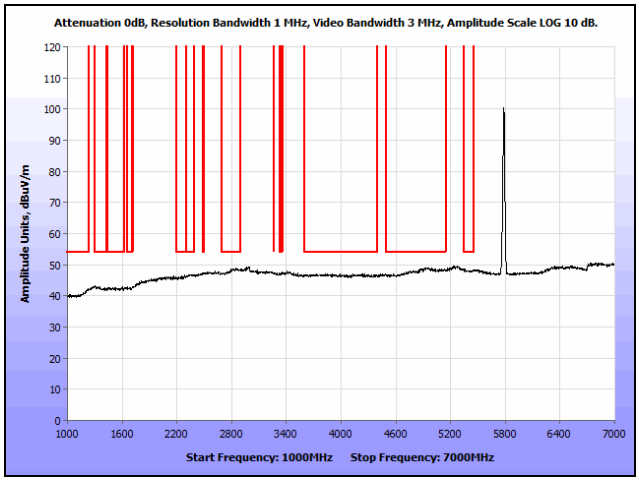
Plot 64. Radiated Spurious Emissions, 802.11n 20 MHz, 5745 MHz, Low Channel, 1 GHz – 7 GHz, Peak



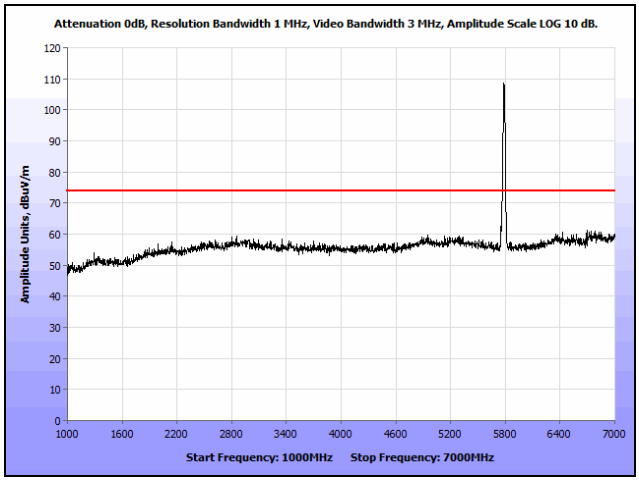
Plot 65. Radiated Spurious Emissions, 802.11n 20 MHz, 5745 MHz, Low Channel, 7 GHz – 18 GHz



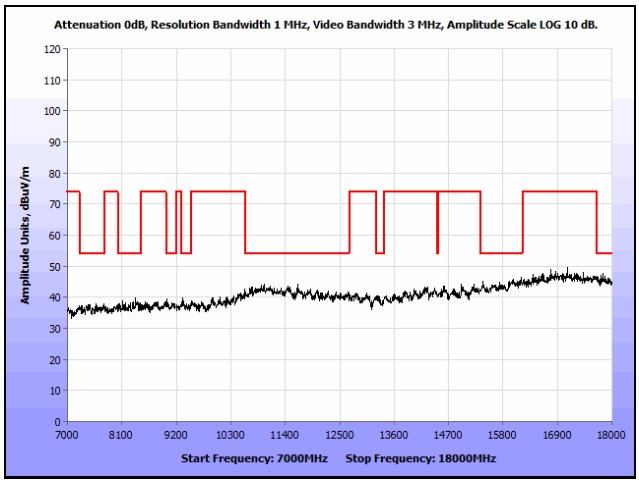
Plot 66. Radiated Spurious Emissions, 802.11n 20 MHz, 5785 MHz, Mid Channel, 30 MHz – 1 GHz



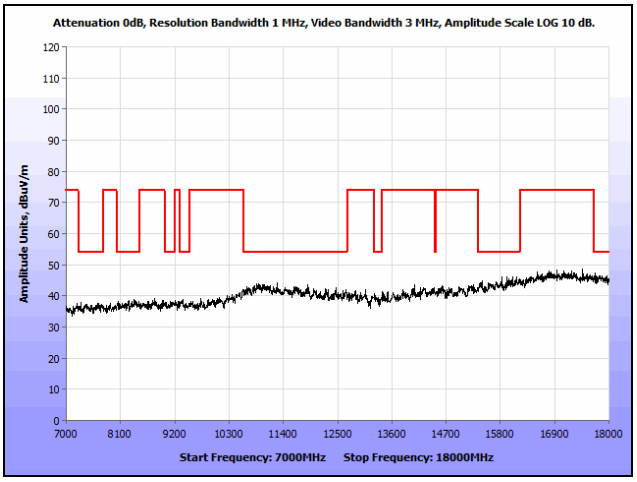
Plot 67. Radiated Spurious Emissions, 802.11n 20 MHz, 5785 MHz, Mid Channel, 1 GHz – 7 GHz, Average



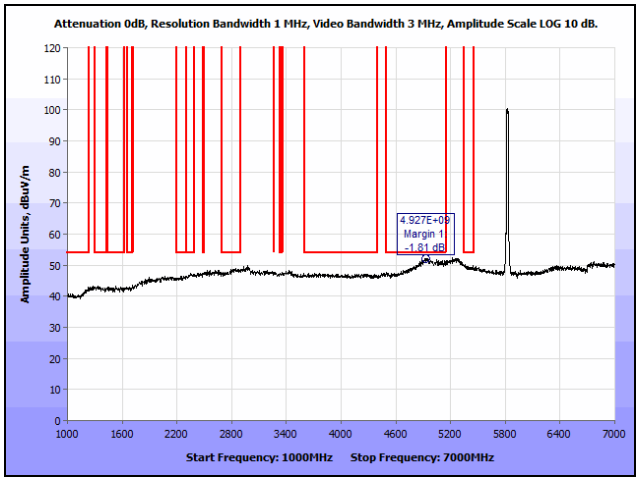
Plot 68. Radiated Spurious Emissions, 802.11n 20 MHz, 5785 MHz, Mid Channel, 1 GHz – 7 GHz, Peak



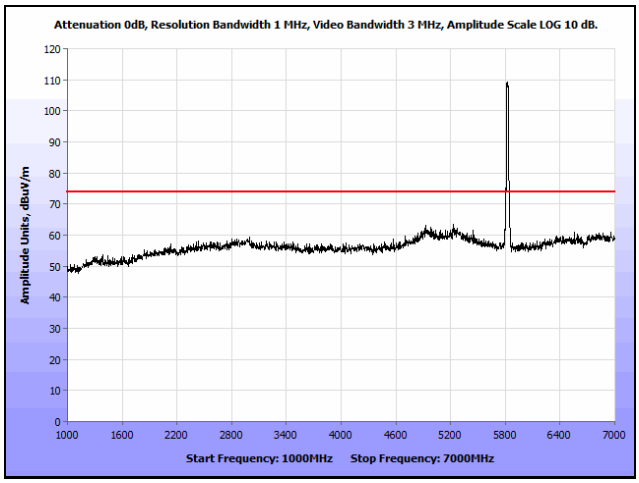
Plot 69. Radiated Spurious Emissions, 802.11n 20 MHz, 5785 MHz, Mid Channel, 7 GHz – 18 GHz



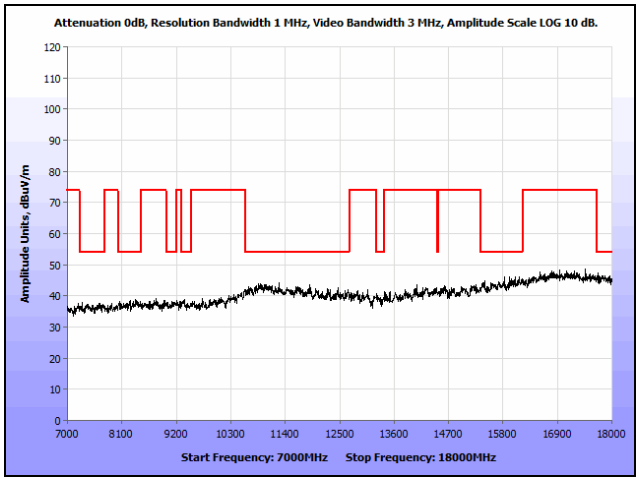
Plot 70. Radiated Spurious Emissions, 802.11n 20 MHz, 5805 MHz, High Channel, 30 MHz – 1 GHz



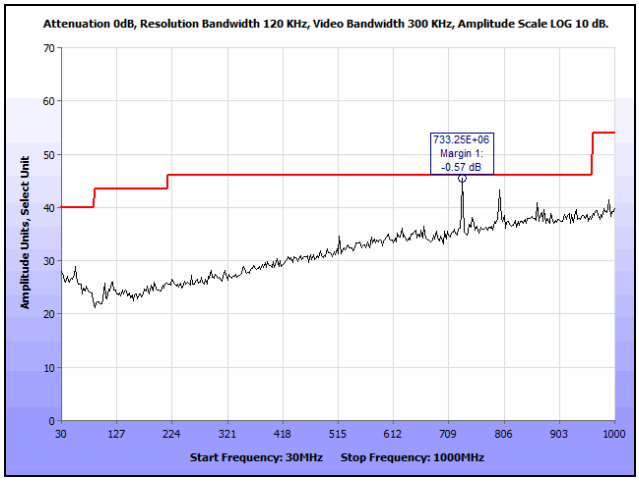
Plot 71. Radiated Spurious Emissions, 802.11n 20 MHz, 5805 MHz, High Channel, 1 GHz – 7 GHz, Average



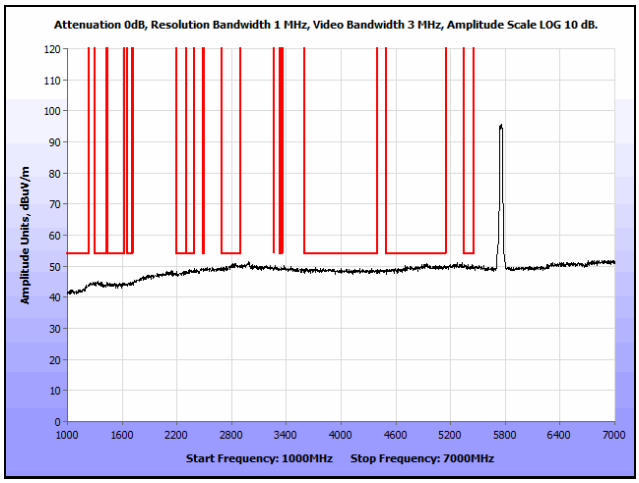
Plot 72. Radiated Spurious Emissions, 802.11n 20 MHz, 5805 MHz, High Channel, 1 GHz – 7 GHz, Peak



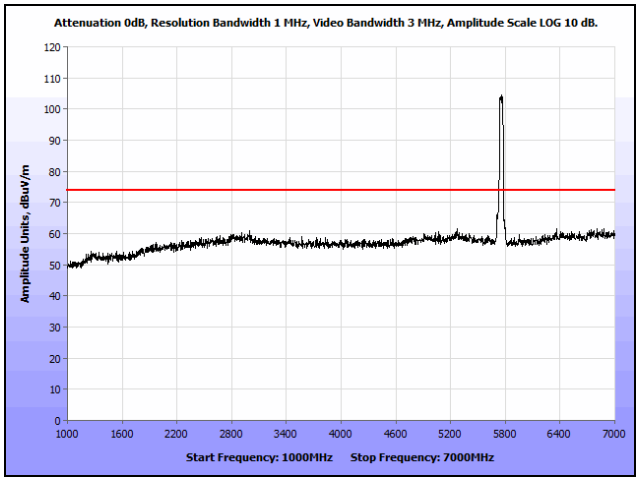
Plot 73. Radiated Spurious Emissions, 802.11n 20 MHz, 5805 MHz, High Channel, 7 GHz – 18 GHz



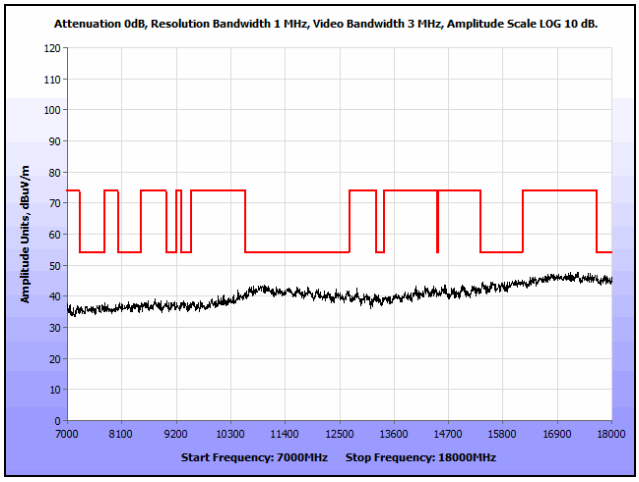
Plot 74. Radiated Spurious Emissions, 802.11n 40 MHz, 5755 MHz, Low Channel, 30 MHz – 1 GHz



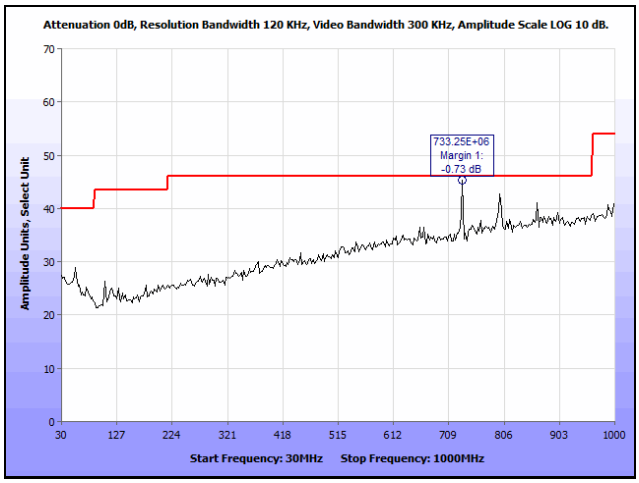
Plot 75. Radiated Spurious Emissions, 802.11n 40 MHz, 5755 MHz, Low Channel, 1 GHz – 7 GHz, Average



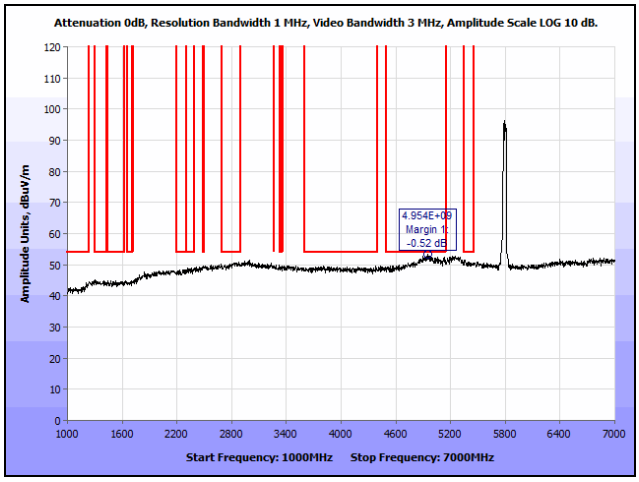
Plot 76. Radiated Spurious Emissions, 802.11n 40 MHz, 5755 MHz, Low Channel, 1 GHz – 7 GHz, Peak



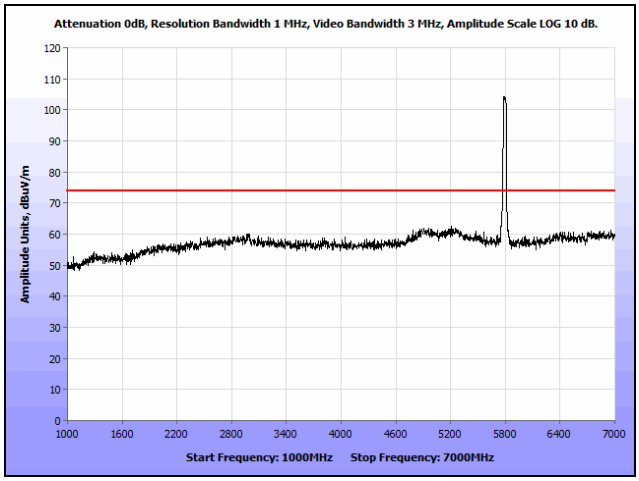
Plot 77. Radiated Spurious Emissions, 802.11n 40 MHz, 5755 MHz, Low Channel, 7 GHz – 18 GHz



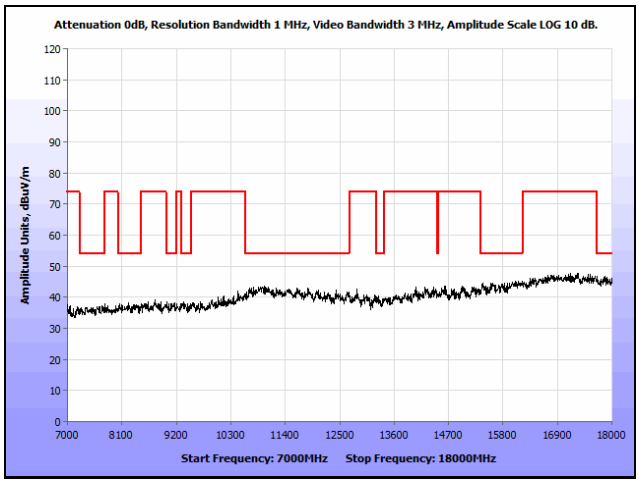
Plot 78. Radiated Spurious Emissions, 802.11n 40 MHz, 5795 MHz, High Channel, 30 MHz – 1 GHz



Plot 79. Radiated Spurious Emissions, 802.11n 40 MHz, 5795 MHz, High Channel, 1 GHz – 7 GHz, Average

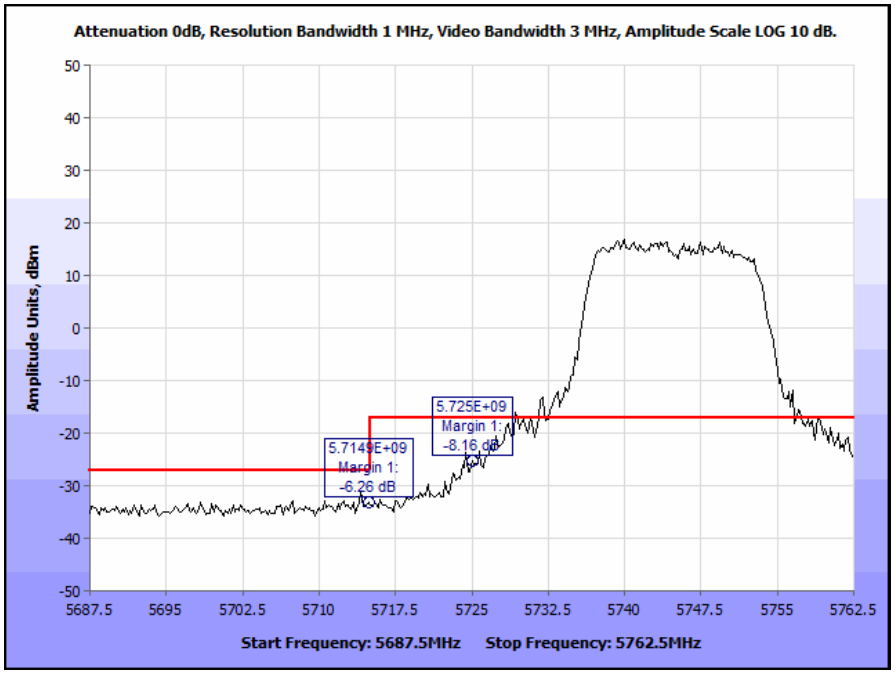


Plot 80. Radiated Spurious Emissions, 802.11n 40 MHz, 5795 MHz, High Channel, 1 GHz – 7 GHz, Peak

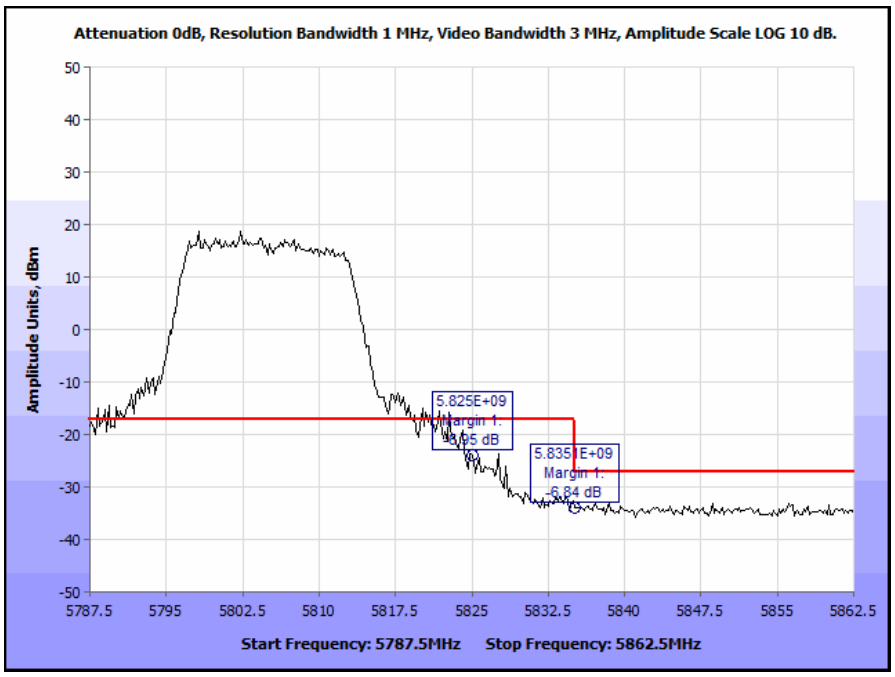


Plot 81. Radiated Spurious Emissions, 802.11n 40 MHz, 5795 MHz, High Channel, 7 GHz – 18 GHz

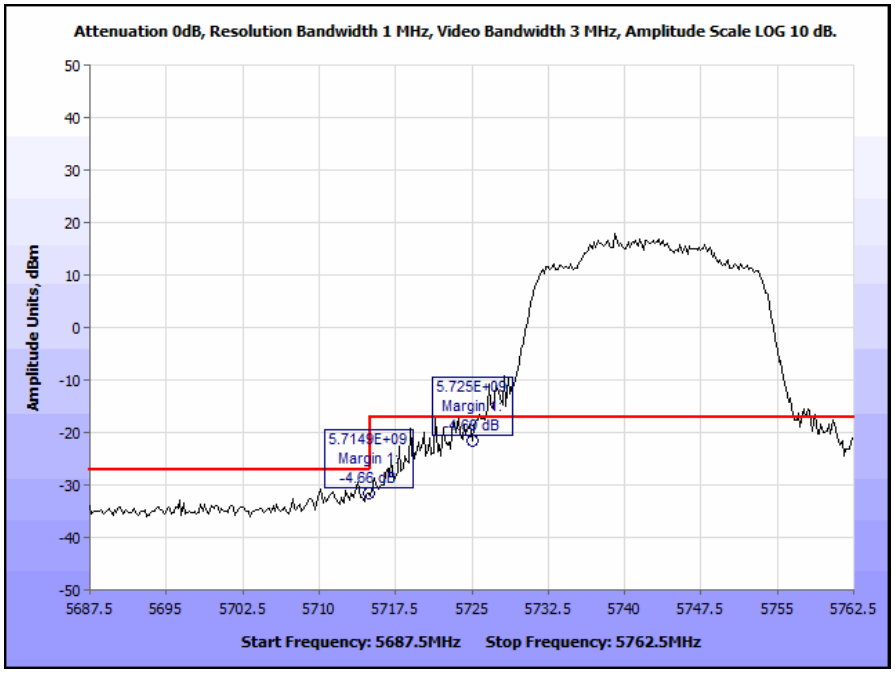
EIRP



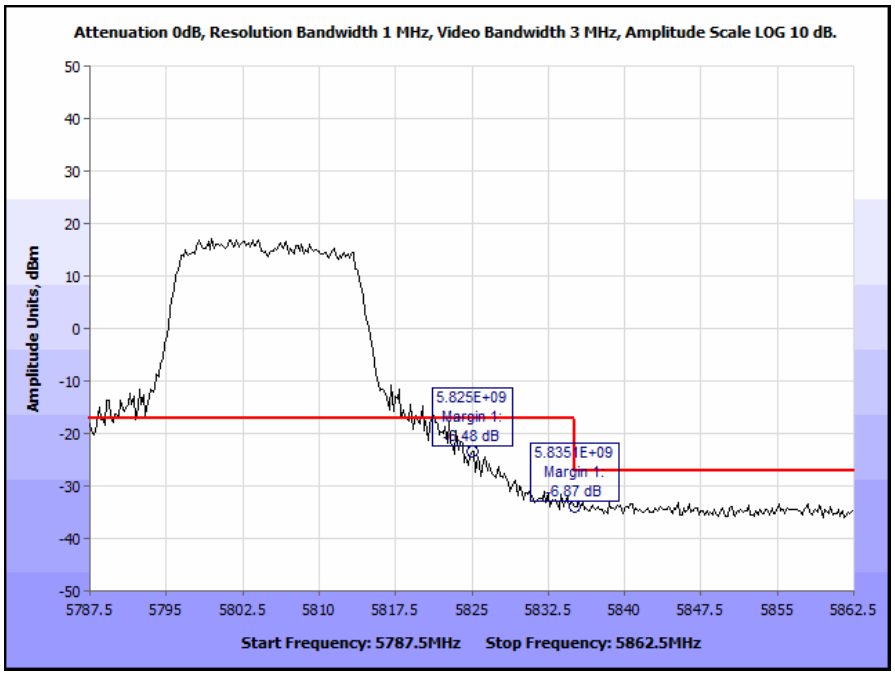
Plot 82. EIRP, Radiated Restricted Band Edge, 802.11a 20 MHz, 5745 MHz, Low Channel, Port 1 @ 5715 MHz



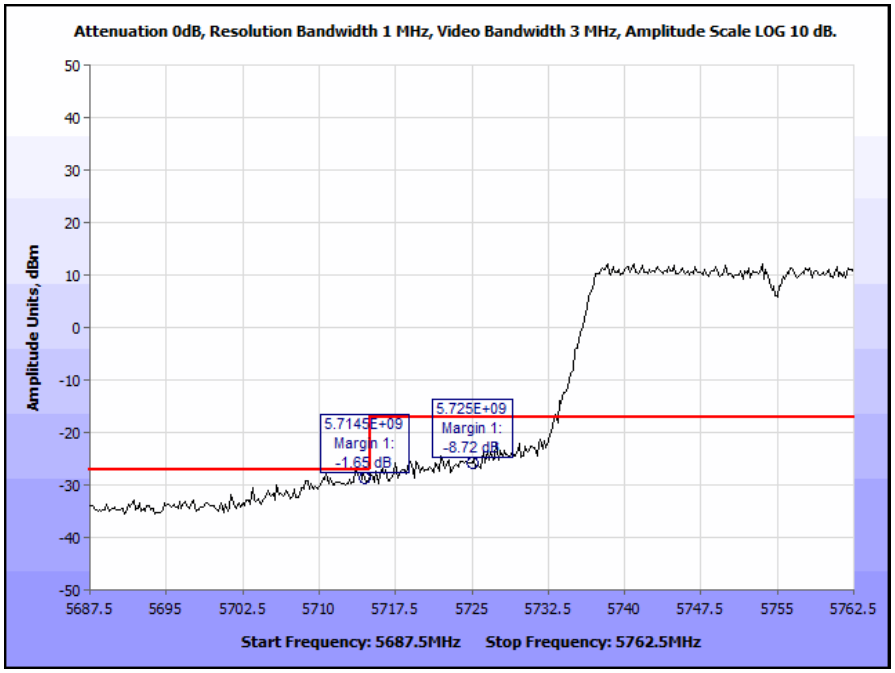
Plot 83. EIRP, Radiated Restricted Band Edge, 802.11a 20 MHz, 5805 MHz, High Channel, Port 1 @ 5835 MHz



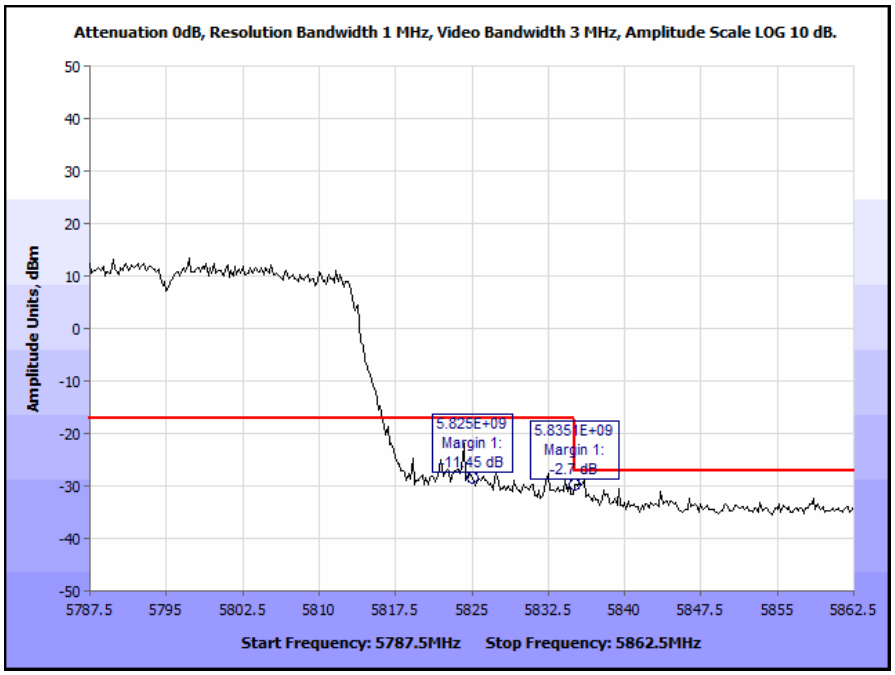
Plot 84. EIRP, Radiated Restricted Band Edge, 802.11n 20 MHz, 5745 MHz, Low Channel, Port 1 @ 5715 MHz



Plot 85. EIRP, Radiated Restricted Band Edge, 802.11n 20 MHz, 5805 MHz, High Channel, Port 1 @ 5835 MHz



Plot 86. EIRP, Radiated Restricted Band Edge, 802.11n 40 MHz, 5755 MHz, Low Channel, Port 1 @ 5725 & 5715 MHz



Plot 87. EIRP, Radiated Restricted Band Edge, 802.11n 40 MHz, 5795 MHz, High Channel, Port 1 @ 5825 & 5835 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(f) RF 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 frequency is 5725 and 5825 MHz;. Highest conducted power = 266.7 mW (i.e. 24.26 dBm). Therefore, **Limit for Uncontrolled exposure: 1 mW/cm^2.**

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

$$S = P G / 4\pi R^2$$

where,

S = Power Density mW/m^2
P = Power (mW)
R = Distance to the center of radiation of the antenna
G = Maximum antenna gain

Maximum antenna gain for EUT = 3 dBi = 1.99

P = 266.7 mW
R = 20 cm
G = 1.99

$S = 266.7*1.99 / 4(3.1416)(20)^2$

$S = 0.105$ mW/cm^2

Therefore, EUT meets the Uncontrolled Exposure limit at 20cm.

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(g) Frequency Stability

Test Requirements: **§ 15.407(g):** Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

Test Procedure: The EUT was connected directly to a spectrum analyzer through a attenuator. The resolution band width of the spectrum analyzer was set to 10 KHz. The 1st trace of the Spectrum Analyzer was used as a reference at 20°C. A 2nd trace was used to show the drift of the carrier at extreme conditions. A delta marker was used to find the drift at a given extreme condition.

Test Results: The EUT was compliant with the requirements of **§15.407(g)**.

Test Engineer(s): Anderson Soungpanya

Test Date(s): 02/08/13

5745				
	Voltage (AC)	Temperature (C)	Frequency (MHz)	PPM
Reference	120	60	5745.028550	9.23
	120	50	5745.058741	3.98
	120	40	5745.075407	1.07
	120	30	5745.082147	0.10
	120	20	5745.081581	0.00
	120	10	5745.081420	0.03
5745.081581	120	0	5745.083724	0.37
	120	-10	5745.084728	0.55
	120	-20	5745.070821	1.87
	120	-30	5745.072991	1.50
	120	-40	5745.082300	0.13
	102	20	5745.082215	0.11
	138	20	5745.082222	0.11
5785				
	Voltage (AC)	Temperature (C)	Frequency (MHz)	PPM
Reference	120	60	5784.970700	9.13
	120	50	5785.000890	3.91
	120	40	5785.017556	1.03
	120	30	5785.024296	0.13
	120	20	5785.023531	0.00
	120	10	5785.023569	0.01
5785.023531	120	0	5785.025873	0.40
	120	-10	5785.026877	0.58
	120	-20	5785.012970	1.83
	120	-30	5785.012228	1.95
	120	-40	5785.034349	1.87
	102	20	5785.024395	0.15
	138	20	5785.024346	0.14
5805				
	Voltage (AC)	Temperature (C)	Frequency (MHz)	PPM
Reference	120	60	5804.988115	9.62
	120	50	5805.018305	4.42
	120	40	5805.034971	1.55
	120	30	5805.041711	0.38
	120	20	5805.043941	0.00
	120	10	5805.040984	0.51
5805.043941	120	0	5805.043288	0.11
	120	-10	5805.044292	0.06
	120	-20	5805.035321	1.48
	120	-30	5805.030215	2.36
	120	-40	5805.041274	0.46
	102	20	5805.041780	0.37
	138	20	5805.041786	0.37

Table 20. Frequency Stability, Test Results

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
1S2600	BILOG ANTENNA	TESEQ	CBL6112D	4/14/2010	4/14/2013
1S2482	5 METER CHAMBER (NSA)	PANASHIELD	5 METER SEMI-ANECHOIC CHAMBER	11/22/2011	5/22/2013
1S2583	SPECTRUM ANALYZER	AGILENT/HP	E4447A	3/27/2012	9/27/2013
1S2460	1-26GHZ SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4407B	7/27/2012	1/27/2014
1S2202	HORN ANTENNA (1 METER)	EMCO	3116	4/23/2010	4/23/2013
1S2523	PREAMPLIFIER	AGILENT TECHNOLOGIES	8449B	SEE NOTE	
1S2603	DOUBLE RIDGED WAVEGUIDE HORN	ETS-LINDGREN	3117	4/15/2011	4/15/2013
1S2729	SONOMA AMPLIFIER	SONOMA INSTRUMENT	310N	4/18/2012	10/18/2013
1S2229	TEMPERATURE CHAMBER	TENNY ENGINEERING	T63C	2/18/2012	8/18/2013
1S2710	DRG HORN ANTENNA	AH SYSTEMS, INC	SAS-574	12/13/2012	6/13/2014
NA	HIGH PASS FILTER	MICRO-TRONICS	HPM13147	SEE NOTE	

Table 21. 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

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 users 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.

End of Report