MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
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October 7, 2013

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

Dear Rajesh Patel,

Enclosed is the EMC Wireless Class II Permissive Change 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.), Title 47 of the CFR, Part 15.407 Subpart E 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.\EMCS39580-FCC407 UNII 3)

Electromagnetic Compatibility Criteria
Class II Permissive Change Test Report

for the

Firetide, Inc.
Model HotPort 5020 Wireless Mesh Node

Tested under
the Certification Rules
contained in
Title 47 of the CFR, 15.407 Subpart E
for Intentional Radiators

MET Report: EMCS39580-FCC407 UNII 3

October 7, 2013

Prepared For:

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

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

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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 Part 15.407, of the FCC Rules under normal use and maintenance.

Asad Bajwa,
Director, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	October 7, 2013	Initial Issue.

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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 Firetide, Inc. HotPort 5020 Wireless Mesh Node, 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 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, §15.407, in accordance with Firetide, Inc., purchase order number PO-3617. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference	Description	Results
Title 47 of the CFR, Part 15 §15.407 (a)(3)	Conducted Transmitter Output Power	Compliant
Title 47 of the CFR, Part 15 §15.407 (b)(4), (5), (6)	Undesirable Emissions (15.205/15.209 - General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Compliant
Title 47 of the CFR, Part 15 §15.407(f)	RF Exposure	Compliant

Table 1. Executive Summary of EMC Part 15.407 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 PO-3617.

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:	5020-M, 5020-E, 5020 ER and 5020- LNK	
EUT Specifications:	Primary Power: 120 VAC, 60 Hz	
	FCC ID: REP-5020-1	
	Type of Modulations:	OFDM
	Equipment Code:	NII
	Peak RF Output Power:	13.28 dBm
	EUT Frequency Ranges:	5745-5805 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):	October 7, 2013	

Table 2. EUT Summary

B. References

CFR 47, Part 15, Subpart E	Unlicensed National Information Infrastructure Devices (UNII)
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

A Firetide Mesh Network, which is composed of two or more Mesh Nodes, gives you the convenience of a wired-Ethernet switch combined with the deployment flexibility of wireless technology. Each Mesh Node in the network can accept a wired Ethernet connection. That connection's Ethernet data is sent wirelessly to another Mesh Node. If the receiving Mesh Node is connected to the wired destination for the data packet, the Node routes that packet to its Ethernet connection. If it is not the final destination, the packet is forwarded wirelessly to the next Mesh Node and ultimately to its final destination. It also can be used as Point to Point link.

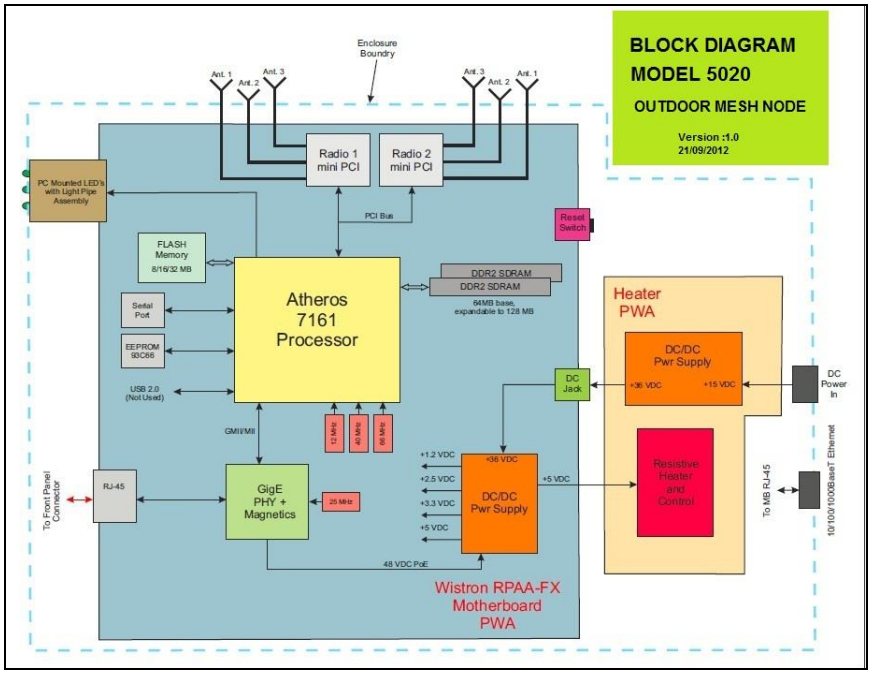


Figure 1. Block Diagram of Test Configuration

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	Part Number	Serial Number	Revision
--	HotPort	5020E/ER/LNK/M	--	--	--

Table 4. Equipment Configuration

F. Support Equipment

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

Ref. ID	Name / Description	Manufacturer	Model Number
--	POE Injector with Cables	Phihong	POE30U-560(G)-HT
--	AC-DC Power supply with LTW connector	--	--
--	AC-DC Convertor 15VDC	--	--
--	Antenna Cables	--	--
--	RJ45 Cable	--	--
--	Antennas	--	--
--	Omni Panel Panel	Firetide/	AO-050-MIMO-9 MA-WE55-MIMOFT15 MA-WD55-MIMOFT16 MA-WA55-MIMO
--	Omni	Firetide	MA-WO24-MIMONHFT8
--	Patch	Firetide	MA-WD24-MIMOFT13

Table 5. Support Equipment

G. Mode of Operation

Selected Operational Mode:
Once the DC power/POE Power is applied 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.

Dual radio or single Radio mode.

Rationale for the Selection of the Operation Mode:
The frequency of highest disturbance, with respect to the limit, was found by investigating disturbances at a number of significant frequencies. This provides confidence that the probable frequency of maximum disturbance has been found and that the associated cable, EUT arrangement and mode of operation has been identified.

H. Method of Monitoring EUT Operation

To verify whether the EUT is power ON, if the EUT is ON the Power LED will glow Green.

When the unit meshes with another unit the Radio 1 and Radio 2 LED will glow.

With the Ethernet cable connected to PC or Laptop Ping the EUT with the IP address 192.168.224.xxx (150) for 5020.

I. 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.

J. 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 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. The antenna is for point-to-point applications only.

Test Engineer(s): Aaron Chang

Test Date(s): 08/21/13

Gain	Type	Model	Manufacturer
28 dBi	Parabolic Dish Antenna	AP5-50-MIMO-28	Firetide

Table 6. Antenna List

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15. 407(a)(3) 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 through an RF cable and an attenuator. The EUT was set to transmit on low, mid, and high channels and the power was measured according to method SA-1 from FCC Publication Number 789033. Power across the antenna ports was summed.

Test Results: Equipment was compliant with the Peak Power Output limits of **§ 15.401(a)(1)**.

Test Engineer(s): Aaron Chang

Test Date(s): 08/27/13

Mode	Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)
802.11a	5745	7.03	0.005047
	5785	6.86	0.004853
	5805	6.92	0.004920
802.11n 20 MHz Port 1	5745	7.48	0.005598
	5785	6.75	0.004732
	5805	6.56	0.004529
802.11n 20 MHz Port 2	5745	7.72	0.005916
	5785	7.64	0.005808
	5805	7.03	0.005047
802.11n 20 MHz Port 3	5745	7.42	0.005521
	5785	7.09	0.005117
	5805	7.31	0.005383
802.11n 40 MHz Port 1	5755	7.99	0.006295
	5795	7.32	0.005395
802.11n 40 MHz Port 2	5755	8.58	0.007211
	5795	8.41	0.006934
802.11n 40 MHz Port 3	5755	8.92	0.007798
	5795	8.20	0.006607

Table 7. RF Power Output, Test Results

Frequency MHz	Mode	OP Port 1 dBm	OP Port 2 dBm	OP Port 3 dBm	Sum Port dBm	Limit dBm
5745	802.11a	7.03	NA	NA	7.03	25
5785	802.11a	6.86	NA	NA	6.86	25
5805	802.11a	6.92	NA	NA	6.92	25
5745	802.11n 20MHz	7.48	7.72	7.42	12.31	25
5785	802.11n 20MHz	6.75	7.64	7.09	11.95	25
5805	802.11n 20MHz	6.56	7.03	7.31	11.75	25
5755	802.11n 40 MHz	7.99	8.58	8.92	13.28	25
5795	802.11n 40 MHz	7.32	8.41	8.2	12.77	25

Table 8. RF Power Output, Summed

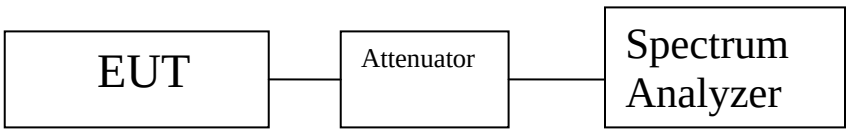
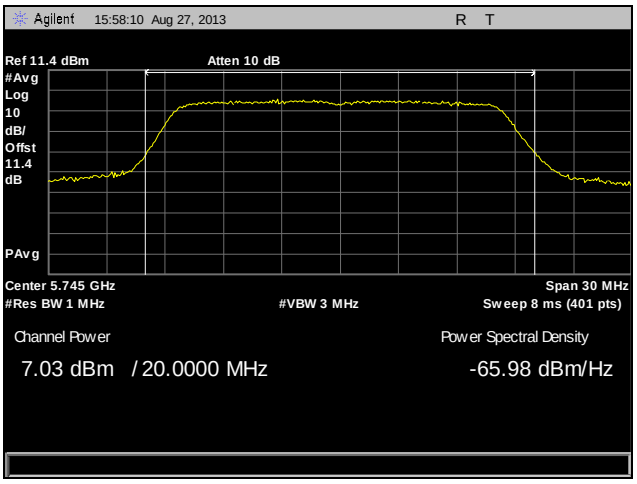
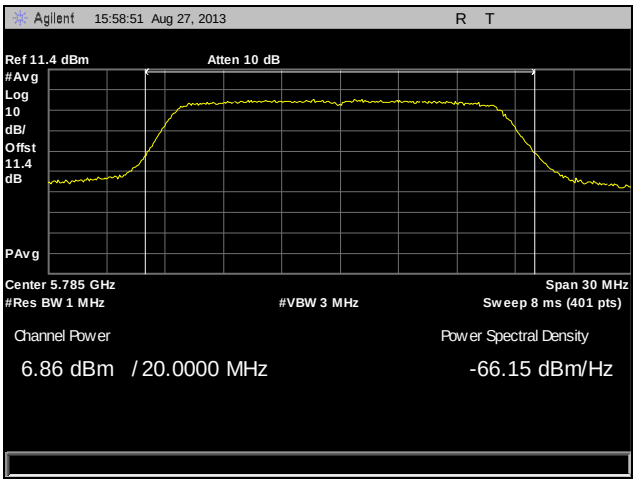


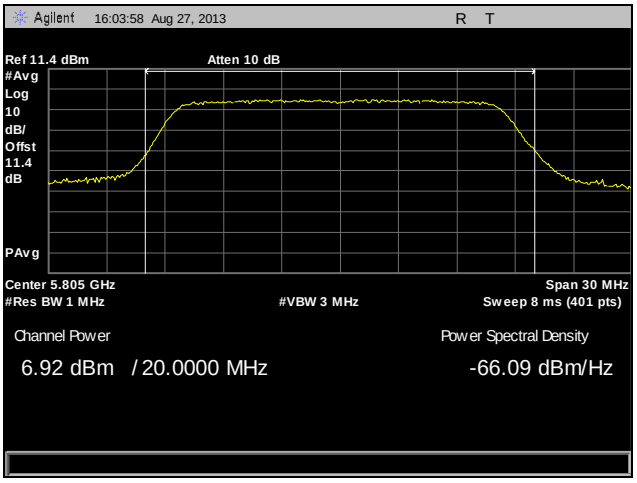
Figure 2. Power Output Test Setup



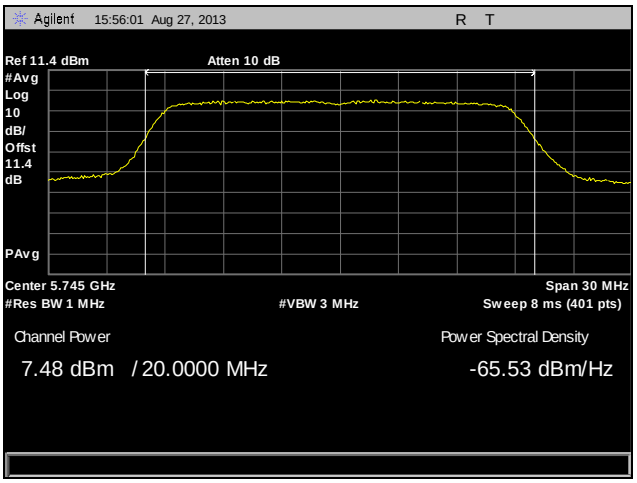
Plot 1. RF Output Power, 802.11a, Low Channel



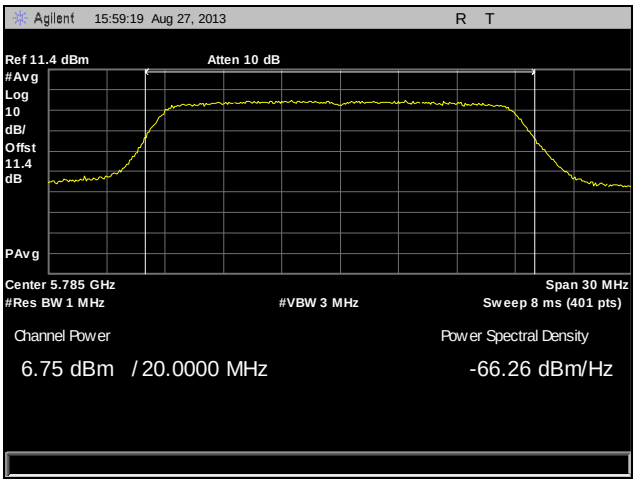
Plot 2. RF Output Power, 802.11a, Mid Channel



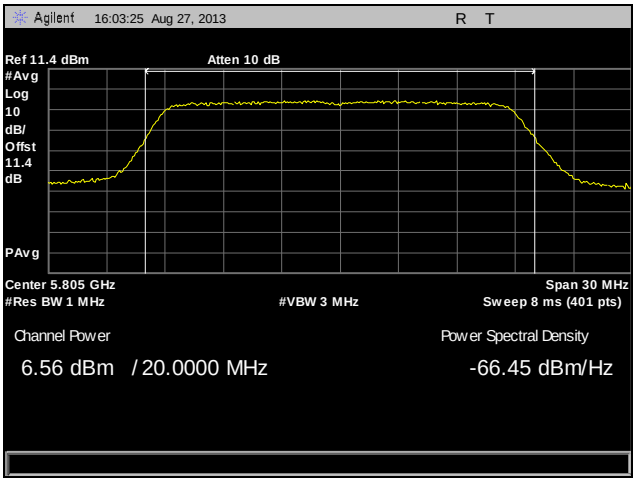
Plot 3. RF Output Power, 802.11a, High Channel



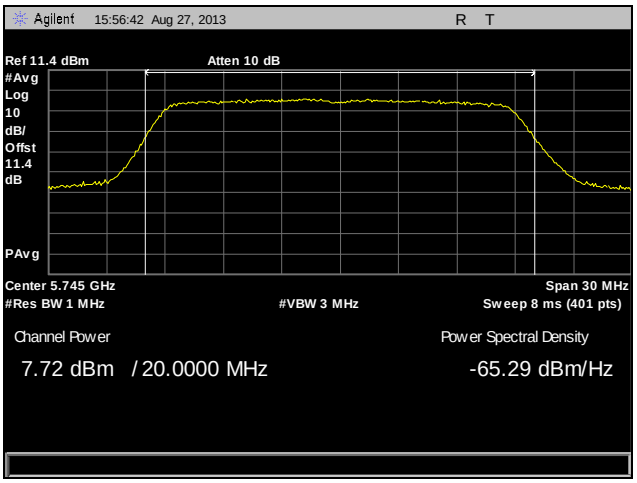
Plot 4. RF Output Power, 802.11n 20 MHz, Port 1, Low Channel



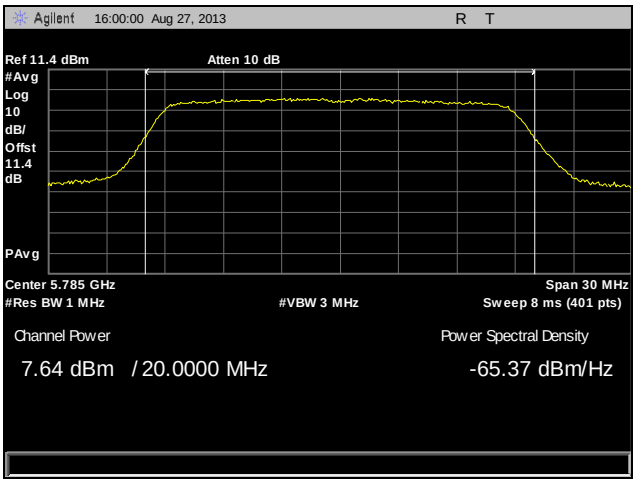
Plot 5. RF Output Power, 802.11n 20 MHz, Port 1, Mid Channel



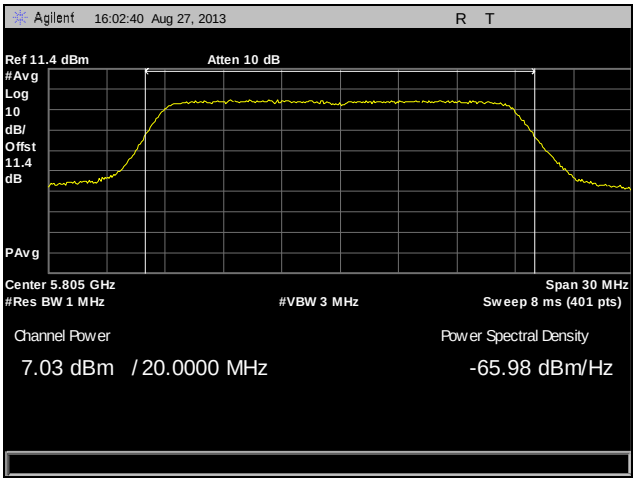
Plot 6. RF Output Power, 802.11n 20 MHz, Port 1, High Channel



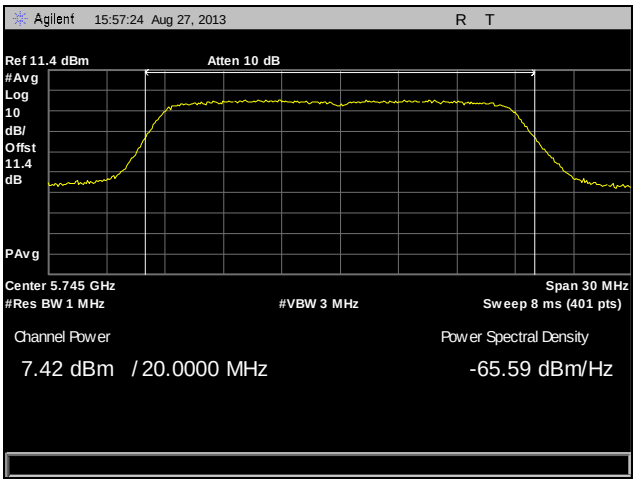
Plot 7. RF Output Power, 802.11n 20 MHz, Port 2, Low Channel



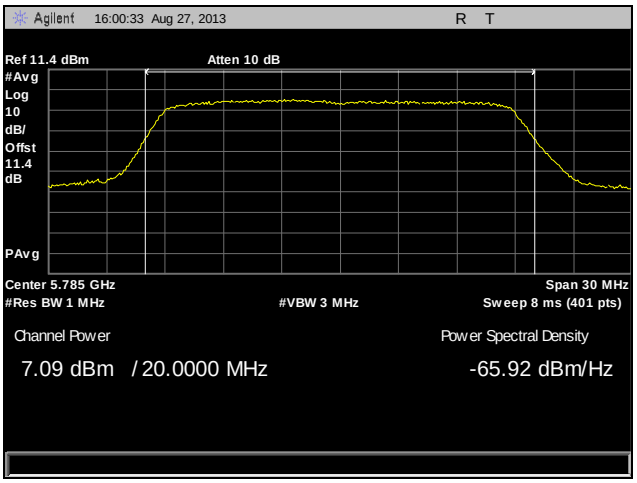
Plot 8. RF Output Power, 802.11n 20 MHz, Port 2, Mid Channel



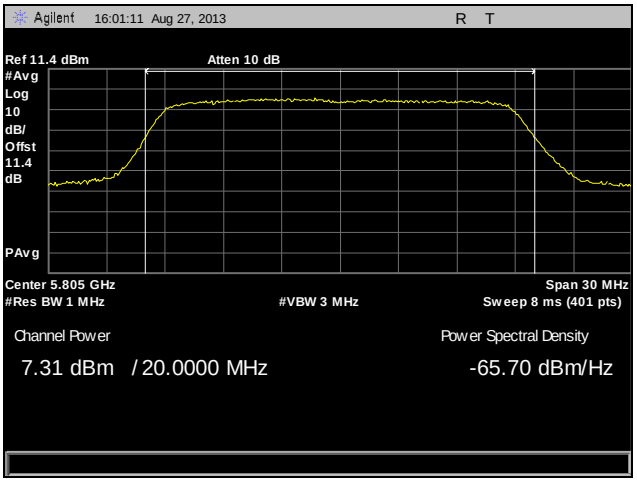
Plot 9. RF Output Power, 802.11n 20 MHz, Port 2, High Channel



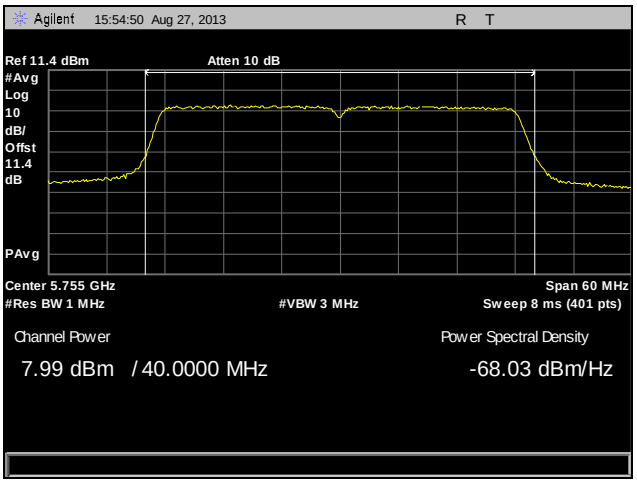
Plot 10. RF Output Power, 802.11n 20 MHz, Port 3, Low Channel



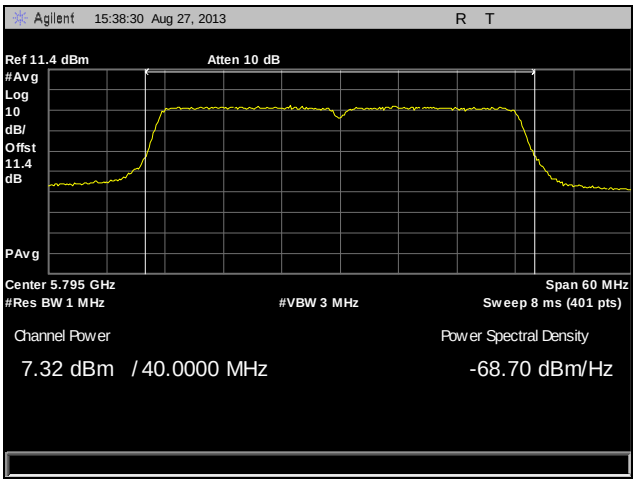
Plot 11. RF Output Power, 802.11n 20 MHz, Port 3, Mid Channel



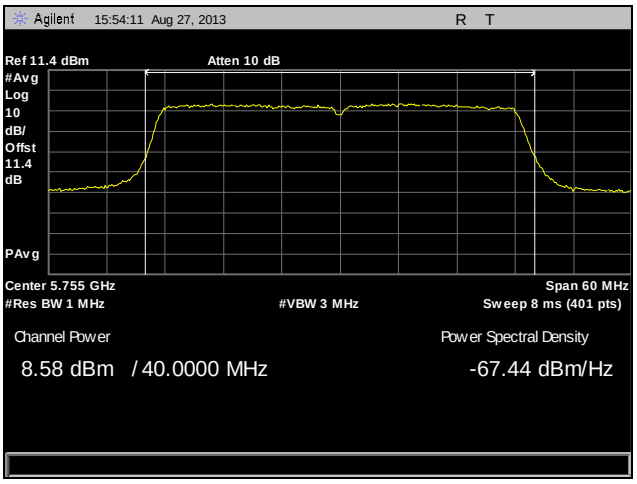
Plot 12. RF Output Power, 802.11n 20 MHz, Port 3, High Channel



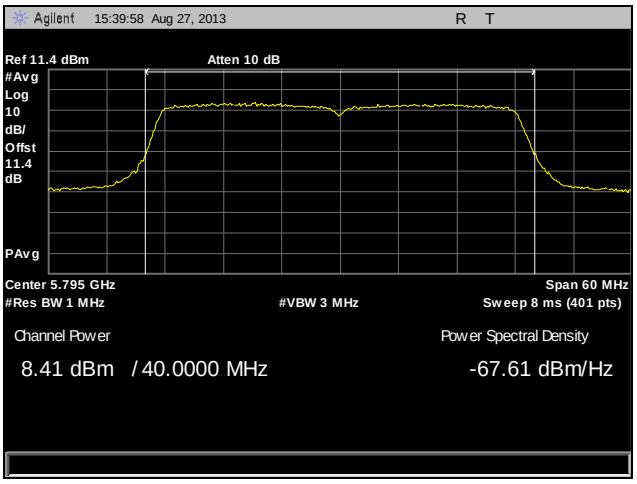
Plot 13. RF Output Power, 802.11n 40 MHz, Port 1, Low Channel



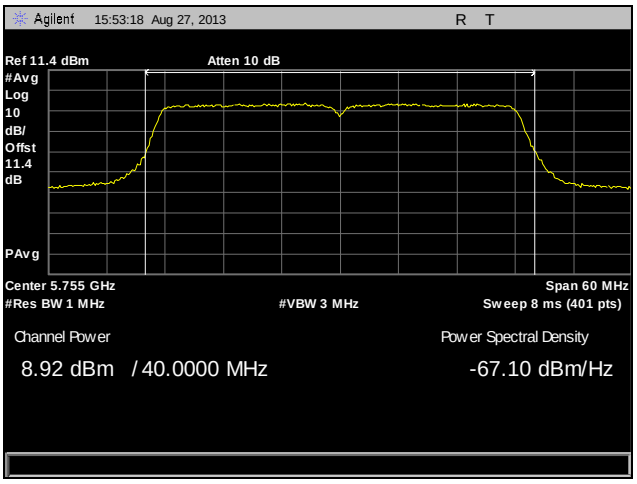
Plot 14. RF Output Power, 802.11n 40 MHz, Port 1, High Channel



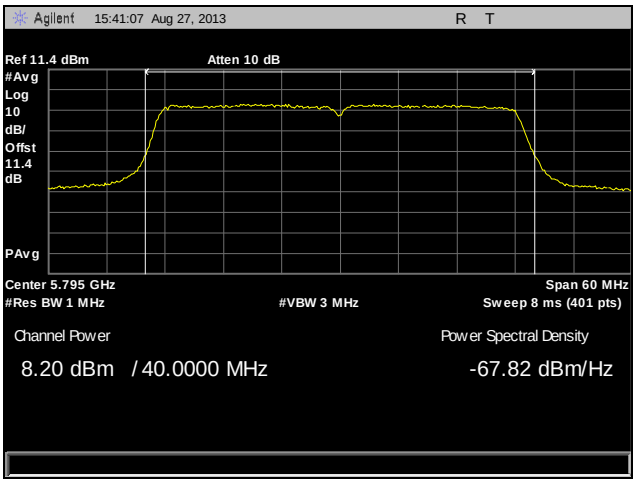
Plot 15. RF Output Power, 802.11n 40 MHz, Port 2, Low Channel



Plot 16. RF Output Power, 802.11n 40 MHz, Port 2, High Channel



Plot 17. RF Output Power, 802.11n 40 MHz, Port 3, Low Channel



Plot 18. RF Output Power, 802.11n 40 MHz, Port 3, High Channel

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(b)(4), (6), (7) Undesirable Emissions

Test Requirements: **§ 15.407(b)(1), (6), (7)**; **§15.205:** Emissions outside the frequency band.

§ 15.407(b)(4): For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions 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 EUT was placed on a non-conducting 0.8m high stand on a turntable in a semi-anechoic chamber. The EUT was set to transmit on low, mid, and high channels, while the turntable was rotated 360 degrees through three orthogonal axes and the receiving antenna height was varied to maximize emissions.

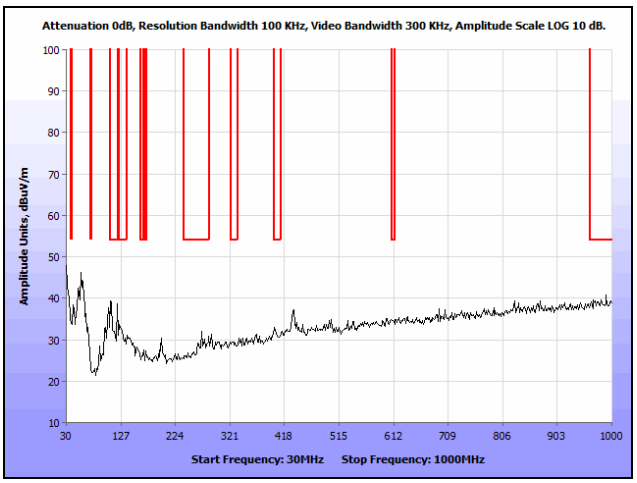
For frequencies from 30MHz to 1GHz, measurements were first made using a peak detector with a 100kHz resolution bandwidth. Emissions which exceeded the limits were re-measured using a quasi-peak detector with a 120kHz resolution bandwidth.

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.
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

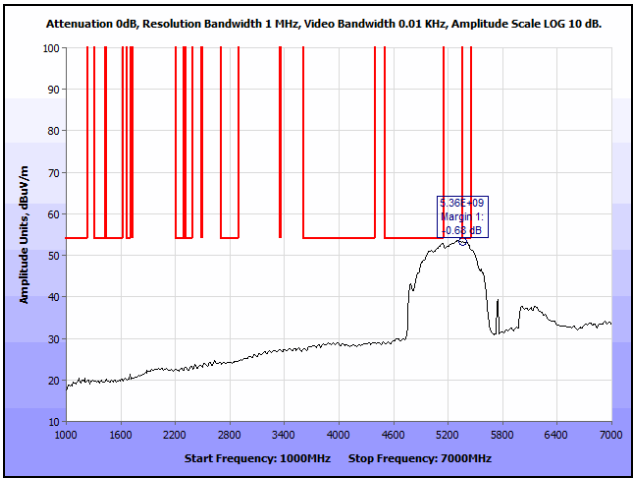
Test Results: The EUT was compliant with the Radiated Emission limits for Intentional Radiators. See following pages for detailed test results.

Test Engineer(s): Aaron Chang

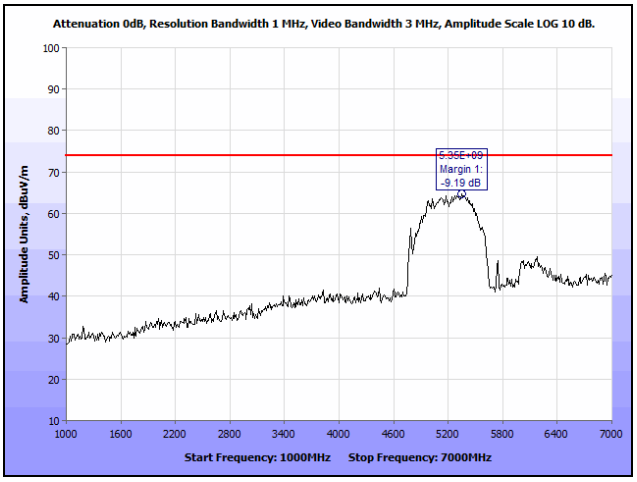
Test Date(s): 08/25/13



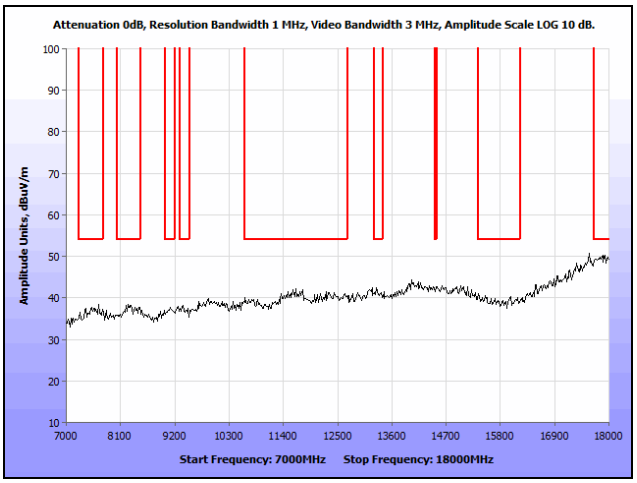
Plot 19. Radiated Spurious Emissions, 802.11a, 28 dBi Dish Antenna, Low Channel, 30 MHz – 1 GHz



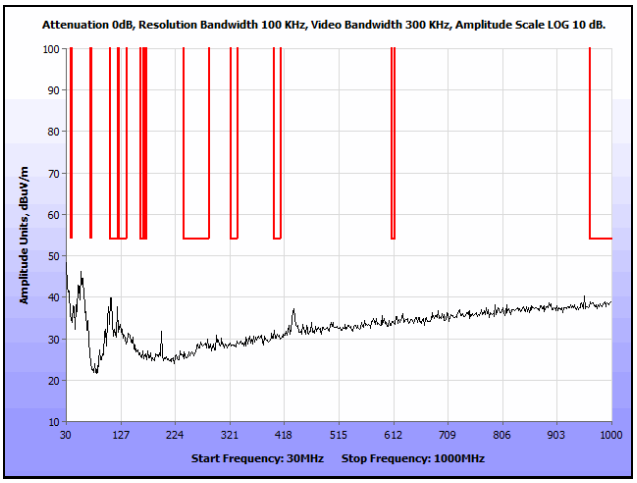
Plot 20. Radiated Spurious Emissions, 802.11a, 28 dBi Dish Antenna, Low Channel, 1 GHz – 7 GHz, Average



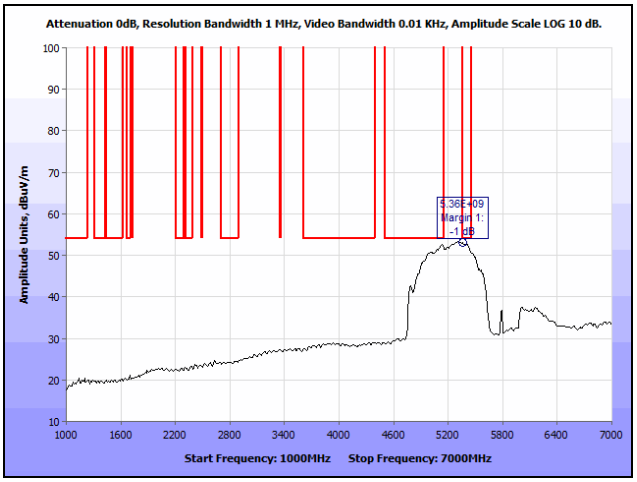
Plot 21. Radiated Spurious Emissions, 802.11a, 28 dBi Dish Antenna, Low Channel, 1 GHz – 7 GHz, Peak



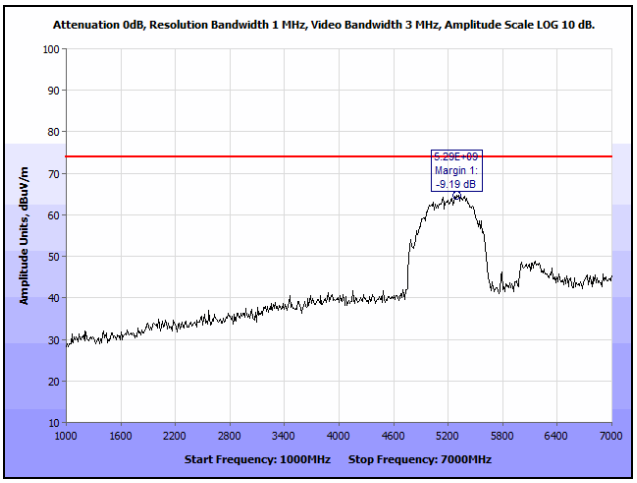
Plot 22. Radiated Spurious Emissions, 802.11a, 28 dBi Dish Antenna, Low Channel, 7 GHz – 18 GHz



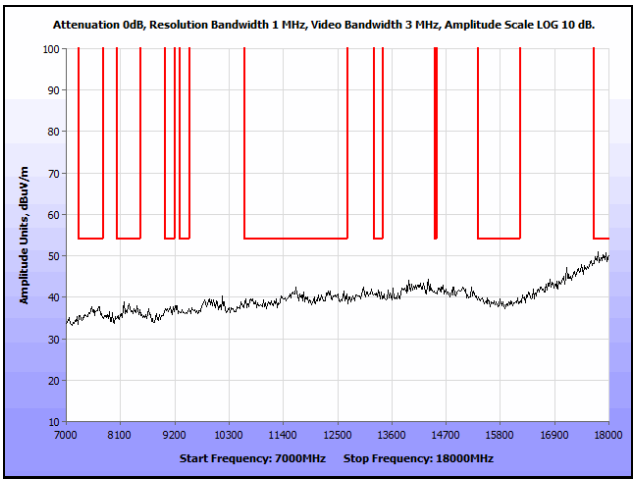
Plot 23. Radiated Spurious Emissions, 802.11a, 28 dBi Dish Antenna, Mid Channel, 30 MHz – 1 GHz



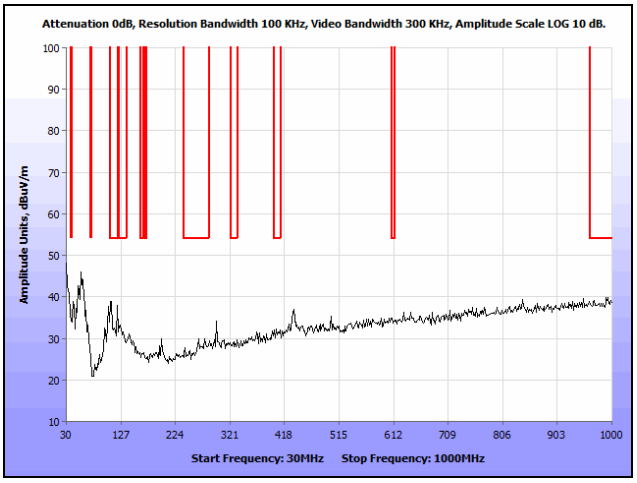
Plot 24. Radiated Spurious Emissions, 802.11a, 28 dBi Dish Antenna, Mid Channel, 1 GHz – 7 GHz, Average



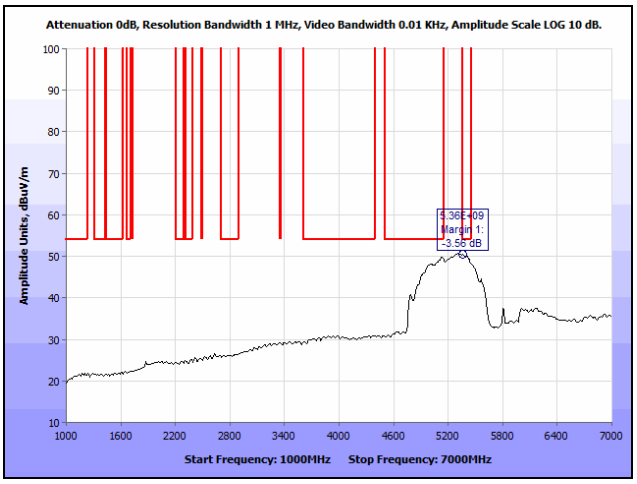
Plot 25. Radiated Spurious Emissions, 802.11a, 28 dBi Dish Antenna, Mid Channel, 1 GHz – 7 GHz, Peak



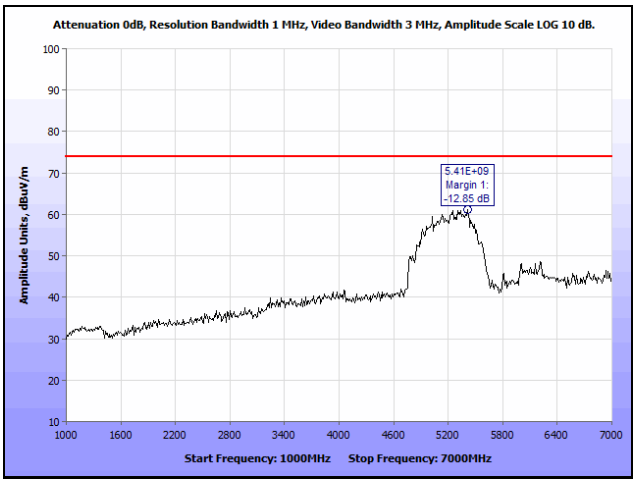
Plot 26. Radiated Spurious Emissions, 802.11a, 28 dBi Dish Antenna, Mid Channel, 7 GHz – 18 GHz



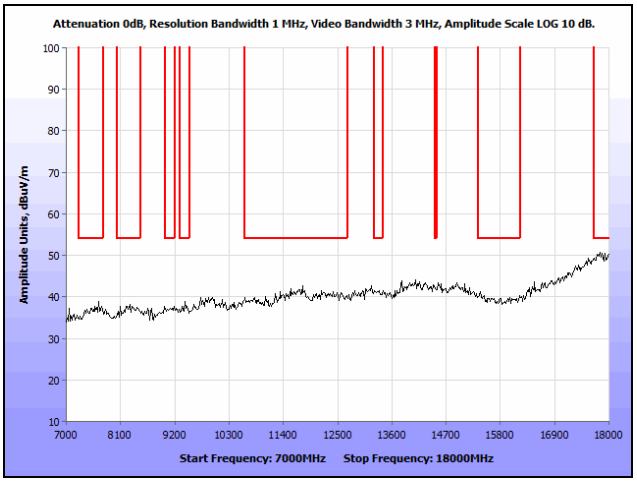
Plot 27. Radiated Spurious Emissions, 802.11a, 28 dBi Dish Antenna, High Channel, 30 MHz – 1 GHz



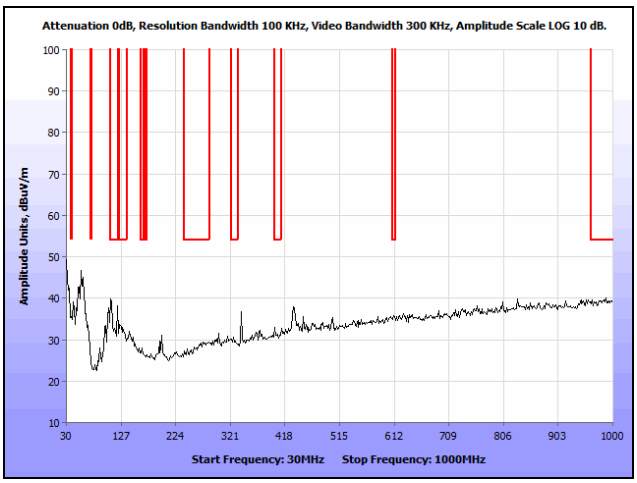
Plot 28. Radiated Spurious Emissions, 802.11a, 28 dBi Dish Antenna, High Channel, 1 GHz – 7 GHz, Average



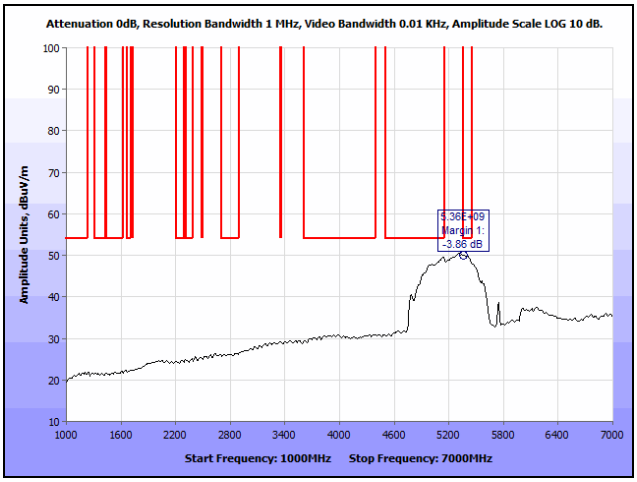
Plot 29. Radiated Spurious Emissions, 802.11a, 28 dBi Dish Antenna, High Channel, 1 GHz – 7 GHz, Peak



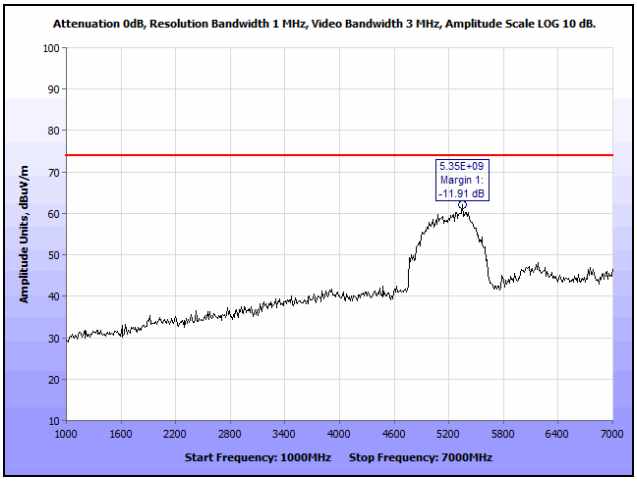
Plot 30. Radiated Spurious Emissions, 802.11a, 28 dBi Dish Antenna, High Channel, 7 GHz – 18 GHz



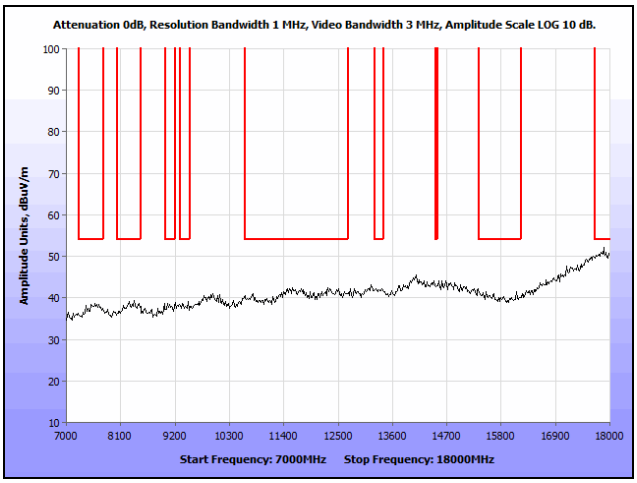
Plot 31. Radiated Spurious Emissions, 802.11n 20 MHz, 28 dBi Dish Antenna, Low Channel, 30 MHz – 1 GHz



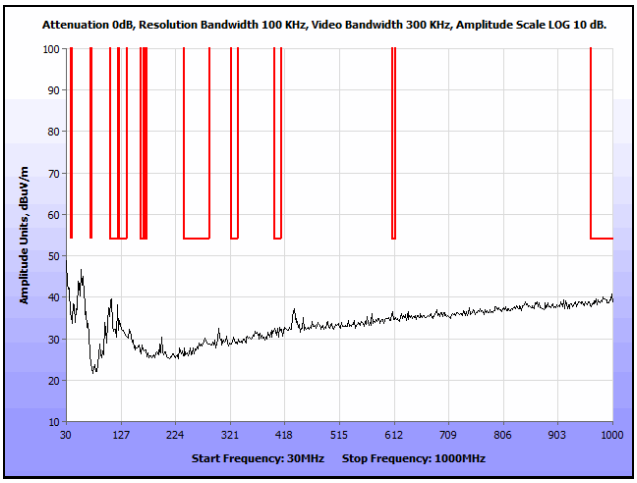
Plot 32. Radiated Spurious Emissions, 802.11n 20 MHz, 28 dBi Dish Antenna, Low Channel, 1 GHz – 7 GHz, Average



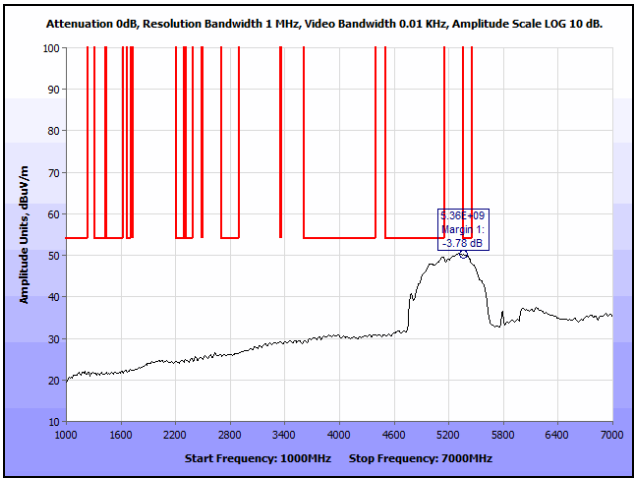
Plot 33. Radiated Spurious Emissions, 802.11n 20 MHz, 28 dBi Dish Antenna, Low Channel, 1 GHz – 7 GHz, Peak



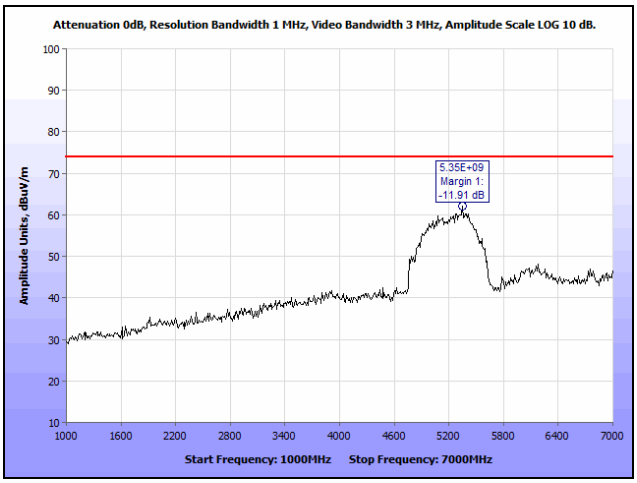
Plot 34. Radiated Spurious Emissions, 802.11n 20 MHz, 28 dBi Dish Antenna, Low Channel, 7 GHz – 18 GHz



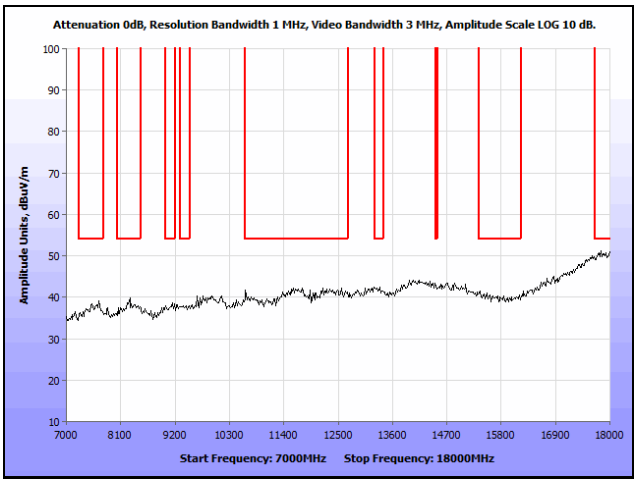
Plot 35. Radiated Spurious Emissions, 802.11n 20 MHz, 28 dBi Dish Antenna, Mid Channel, 30 MHz – 1 GHz



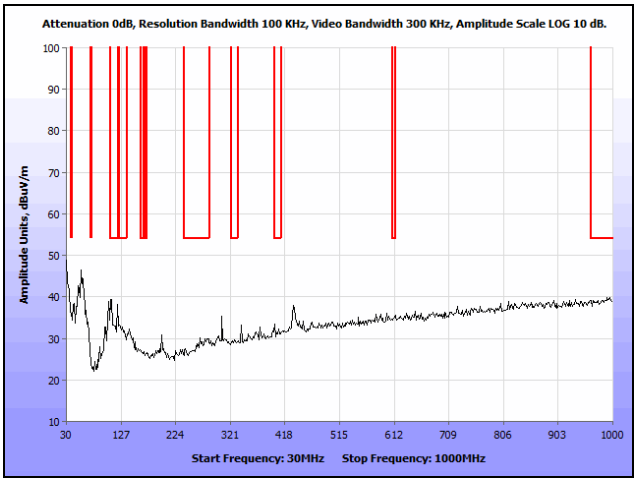
Plot 36. Radiated Spurious Emissions, 802.11n 20 MHz, 28 dBi Dish Antenna, Mid Channel, 1 GHz – 7 GHz, Average



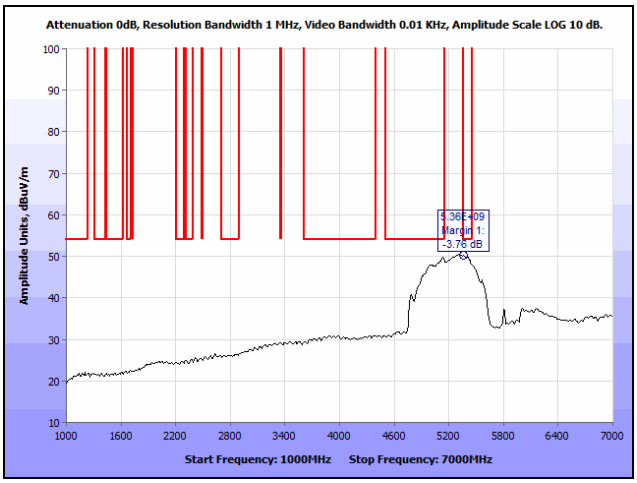
Plot 37. Radiated Spurious Emissions, 802.11n 20 MHz, 28 dBi Dish Antenna, Mid Channel, 1 GHz – 7 GHz, Peak



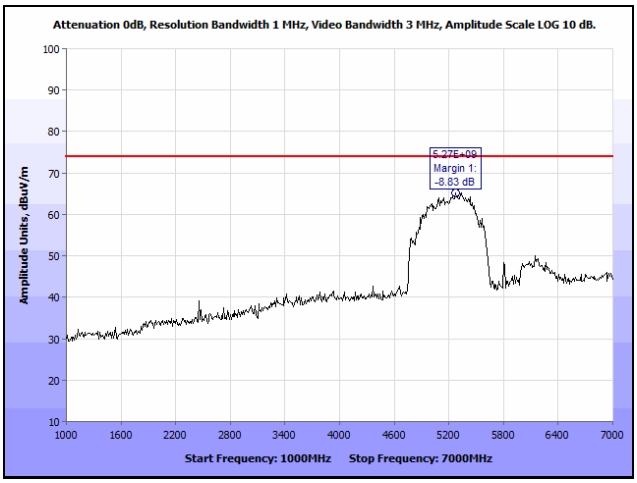
Plot 38. Radiated Spurious Emissions, 802.11n 20 MHz, 28 dBi Dish Antenna, Mid Channel, 7 GHz – 18 GHz



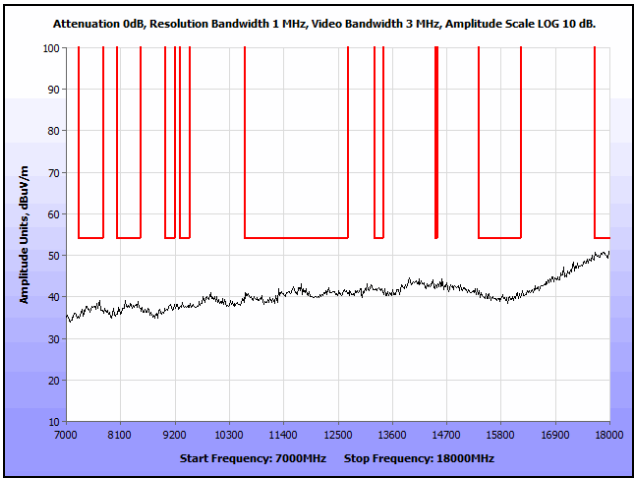
Plot 39. Radiated Spurious Emissions, 802.11n 20 MHz, 28 dBi Dish Antenna, High Channel, 30 MHz – 1 GHz



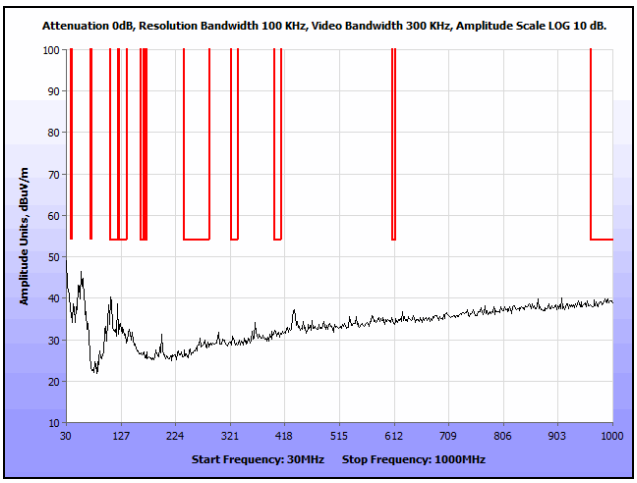
Plot 40. Radiated Spurious Emissions, 802.11n 20 MHz, 28 dBi Dish Antenna, High Channel, 1 GHz – 7 GHz, Average



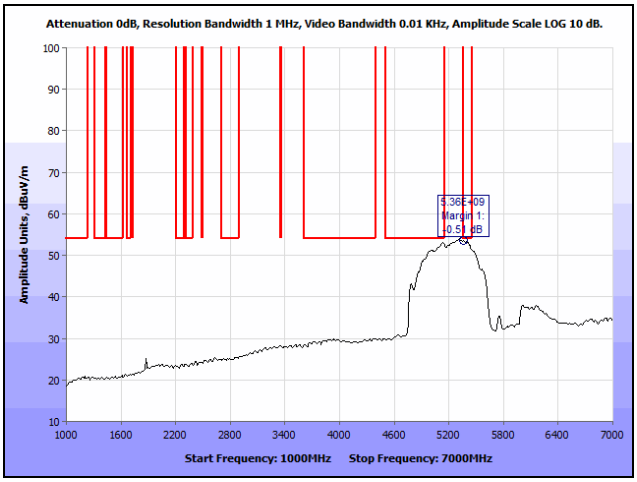
Plot 41. Radiated Spurious Emissions, 802.11n 20 MHz, 28 dBi Dish Antenna, High Channel, 1 GHz – 7 GHz, Peak



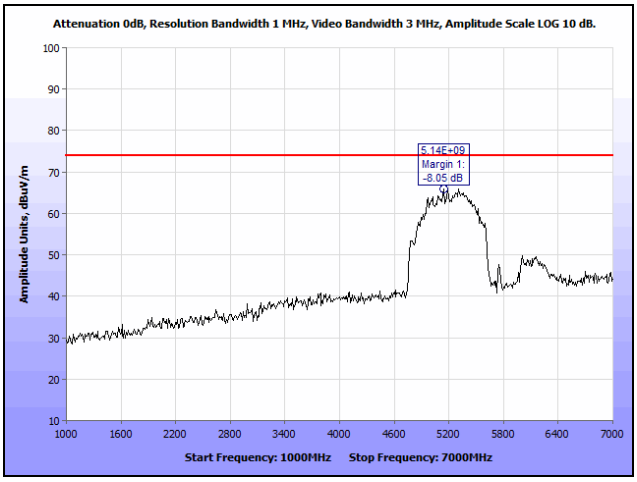
Plot 42. Radiated Spurious Emissions, 802.11n 20 MHz, 28 dBi Dish Antenna, High Channel, 7 GHz – 18 GHz



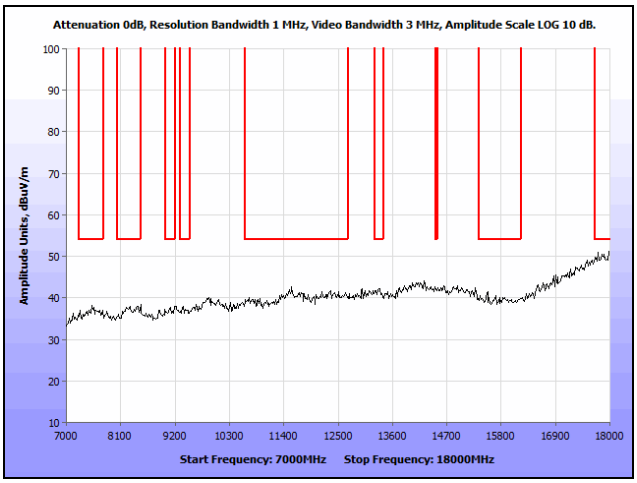
Plot 43. Radiated Spurious Emissions, 802.11n 40 MHz, 28 dBi Dish Antenna, Low Channel, 30 MHz – 1 GHz



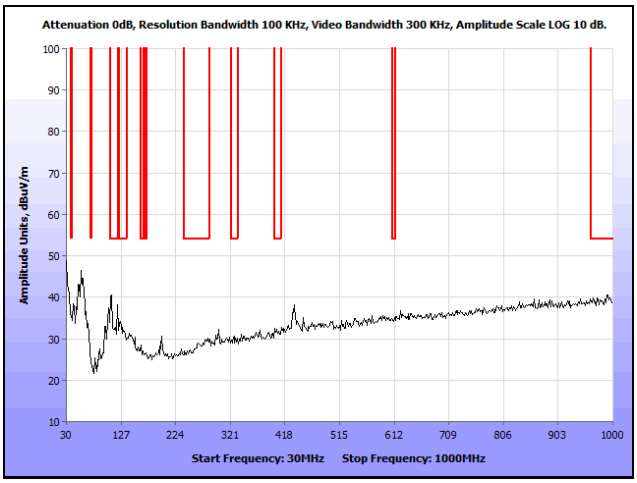
Plot 44. Radiated Spurious Emissions, 802.11n 40 MHz, 28 dBi Dish Antenna, Low Channel, 1 GHz – 7 GHz, Average



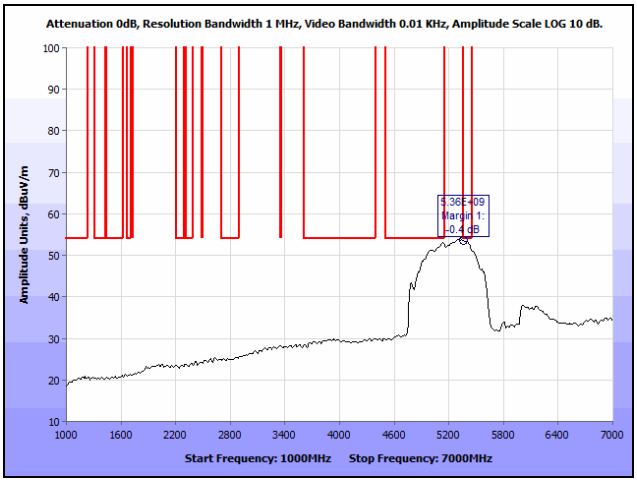
Plot 45. Radiated Spurious Emissions, 802.11n 40 MHz, 28 dBi Dish Antenna, Low Channel, 1 GHz – 7 GHz, Peak



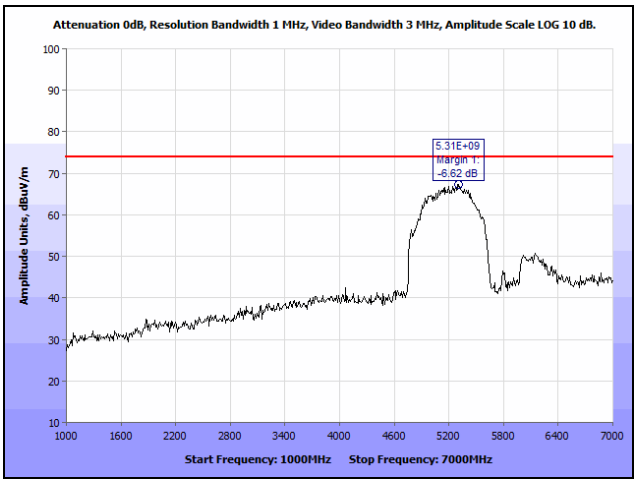
Plot 46. Radiated Spurious Emissions, 802.11n 40 MHz, 28 dBi Dish Antenna, Low Channel, 7 GHz – 18 GHz



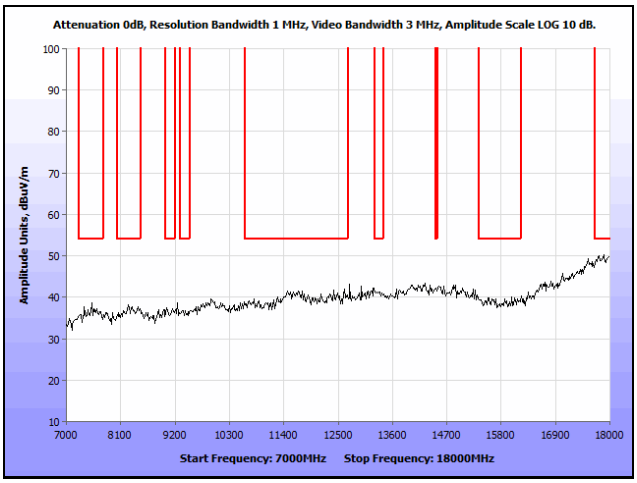
Plot 47. Radiated Spurious Emissions, 802.11n 40 MHz, 28 dBi Dish Antenna, High Channel, 30 MHz – 1 GHz



Plot 48. Radiated Spurious Emissions, 802.11n 40 MHz, 28 dBi Dish Antenna, High Channel, 1 GHz – 7 GHz, Average



Plot 49. Radiated Spurious Emissions, 802.11n 40 MHz, 28 dBi Dish Antenna, High Channel, 1 GHz – 7 GHz, Peak



Plot 50. Radiated Spurious Emissions, 802.11n 40 MHz, 28 dBi Dish Antenna, High Channel, 7 GHz – 18 GHz

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 5745 MHz and 5805 MHz;. Highest conducted power = 7.79 mW (i.e. 8.92 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 = 28 dBi = 630.9 mW

P = 21.3 mW
R = 33 cm
G = 630.9 mW

$$S = 21.3*630.9 / 4(3.1416)(33)^2$$

$$S = 0.982 \text{ mW/cm}^2$$

Therefore, EUT meets the Uncontrolled Exposure limit at 33cm.

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	9/20/2012	9/20/2013
1S2198	HORN ANTENNA	EMCO	3115	10/18/2012	4/18/2014
1S2202	HORN ANTENNA (1 METER)	EMCO	3116	4/26/2013	4/26/2016
1S2460	1-26GHZ SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4407B	7/27/2012	1/27/2014
1S2746	BILOG ANTENNA	SUNOL SCIENCE	JB3	11/6/2012	11/6/2013
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	8/12/2013	2/12/2015
1S2121	PRE-AMPLIFIER	HEWLETT PACKARD	8449B	SEE NOTE	
N/A	HIGH PASS FILTER	MICRO-TRONICS	HPM13146	SEE NOTE	
1S2399	TURNTABLE CONTROLLER	SUNOL SCIENCE	SC99V	SEE NOTE	

Table 9. 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.

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

