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

March 29, 2012

Fortress Technologies
2 Technology Park Drive
Westford, MA 01886

Dear John Pacheco,

Enclosed is the EMC Wireless test report for compliance testing of the Fortress Technologies, Deployable Mesh Point Model: ES520 (with Senao Modular Approved Radio) as tested to the requirements of Title 47 of the CFR, Part 15, Subpart B and ICES-003, Issue 4 February 2004for Unintentional Radiators and Part 15.407 and Industry Canada RSS-210, Annex 9, Issue 8, December 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: (\Fortress Technologies\EMC33010C-FCC407)

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Electromagnetic Compatibility Criteria
Test Report

for the

Fortress Technologies
Deployable Mesh Point Model: ES520 (with Senao Modular Approved Radio)

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Parts 15 Subpart B & ICES-003
for Class A Digital Devices
&
FCC Part 15.407 & RSS-210, Annex 9
for Intentional Radiators

MET Report: EMC33010C-FCC407

March 29, 2012

Prepared For:

Fortress Technologies
2 Technology Park Drive
Westford, MA 01886

Prepared By:
MET Laboratories, Inc.
914 W. Patapsco Ave.
Baltimore, MD 21230

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for Intentional Radiators

Jeffrey Pratt, 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 Parts 15B, 15.407, of the FCC Rules and 407 and Industry Canada standards ICES-003, Issue 4 February 2004, RSS-210 Annex 9 under normal use and maintenance.

Shawn McMillen, Wireless Manager
Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	March 29, 2012	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 Fortress Technologies Deployable Mesh Point Model: ES520 (with Senao Modular Approved Radio), 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 Deployable Mesh Point Model: ES520 (with Senao Modular Approved Radio). Fortress Technologies should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Deployable Mesh Point Model: ES520 (with Senao Modular Approved Radio), 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 Fortress Technologies, purchase order number 0003308. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference	Industry Canada Reference	Description	Results
15.107	ICES-003 Issue 4 February 2004	Conducted Emissions	Compliant
15.109	ICES-003 Issue 4 February 2004	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 / 99% 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)	N/A	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
N/A	RSS-Gen(4.8)	Receiver Spurious Emissions	Compliant

Table 1. Executive Summary of EMC Part 15.407 ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Fortress Technologies to perform testing on the Deployable Mesh Point Model: ES520 (with Senao Modular Approved Radio), under Fortress Technologies' purchase order number 0003308.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Fortress Technologies Deployable Mesh Point Model: ES520 (with Senao Modular Approved Radio).

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

Model(s) Tested:	Deployable Mesh Point Model: ES520 (with Senao Modular Approved Radio)	
Model(s) Covered:	Deployable Mesh Point Model: ES520 (with Senao Modular Approved Radio)	
EUT Specifications:	Primary Power: 120 VAC, 60 Hz	
	FCC ID: WYK-ES520 IC: 8190A-ES520	
	Type of Modulations:	OFDM
	Emission Designators:	D7D
	Equipment Code:	NII
	Peak RF Output Power:	14.15 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:	Jeff Pratt	
Report Date(s):	March 29, 2012	

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 4 February 2004	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
ANSI C63.4:2003	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI/NCSL Z540-1-1994	Calibration Laboratories and Measuring and Test Equipment - General Requirements
ANSI/ISO/IEC 17025:2000	General Requirements for the Competence of Testing and Calibration Laboratories

Table 3. References

C. Test Site

All testing was performed at MET Laboratories, Inc., 914 W. Patapsco Ave., Baltimore, MD 21230. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

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

D. Description of Test Sample

The Fortress Technologies Deployable Mesh Point Model: ES520 (with Senao Modular Approved Radio), Equipment Under Test (EUT), is a dual radio access point/bridge. It embeds two COTS high power radios and multiple Ethernet ports in a ruggedized enclosure. The radio operates in accordance to the 802.11a and 802.11g standards.

The ES520 is intended to provided outdoor mobile connectivity in a secure manner both wired and wirelessly.

Photograph 1. Fortress Technologies Deployable Mesh Point Model: ES520 (with Senao Modular Approved Radio)

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	Serial Number
1	Fortress Deployable Mesh Point	ES520	108530006

Table 4. Equipment Configuration

F. Support Equipment

The EUT did not require any support equipment for operation or monitoring.

G. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty.	Length (m)	Shielded? (Y/N)	Termination Box ID & Port ID
1	ANT 1, ANT 2	Antenna	2	--	--	--
2	12/24V 48V	Provides power	1	--	--	External AC Charger
3	1,2,3,4,5,6,7, or 8	Ethernet Port; Standard CAT5 Ethernet Cable	8	--	--	--
4	WAN	Ethernet Port; Standard CAT5 Ethernet Cable	1	--	--	--
5	Serial	Not Used	1	--	--	--
6	Console	Serial Console Port; Standard CAT5 Ethernet cable	1	--	--	--
6	USB	Not used	1	--	--	--

Table 5. Ports and Cabling Information

H. Mode of Operation

The ES520 can operate in 802.11a and 802.11g modes. These modes may be configured using the UI of the product (either through the GUI or CLI).

I. Method of Monitoring EUT Operation

A Spectrum Analyzer and a Power Meter was used to monitor the EUT's transmitter channel and power output.

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 Fortress Technologies 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 6. 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 6. 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 6. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Subsections 15.107(a) (b) and 15.207(a)

Test Results: The EUT was compliant with the Class A requirement(s) of this section.

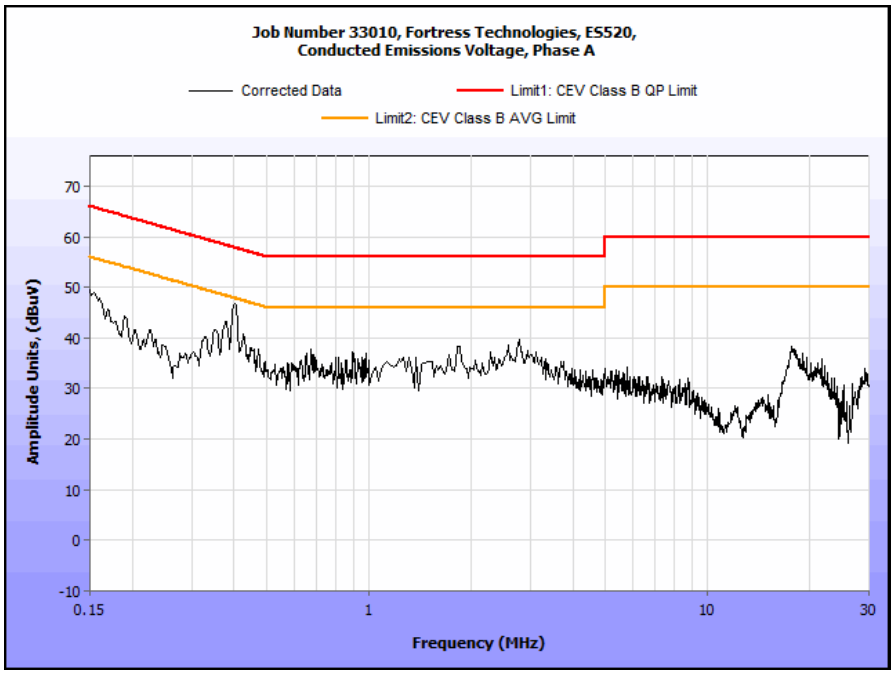
Test Engineer(s): Jeff Pratt

Test Date(s): 01/12/12 – 02/2/12

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

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) Avg.	Limit (dBuV) Avg.	Margin (dB) Avg.
0.241	38.75	0.02	38.77	79	-40.23	32.44	0.02	32.46	66	-33.54
0.401	37.07	0	37.07	79	-41.93	34.41	0	34.41	66	-31.59
0.48	36.01	0	36.01	79	-42.99	34.38	0	34.38	66	-31.62
8.068	32.26	0.11	32.37	73	-40.63	29.1	0.11	29.21	60	-30.79
15.15	49.54	0.12	49.66	73	-23.34	48.15	0.12	48.27	60	-11.73
23.05	17.71	0.18	17.89	73	-55.11	12.35	0.18	12.53	60	-47.47

Table 7. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz)

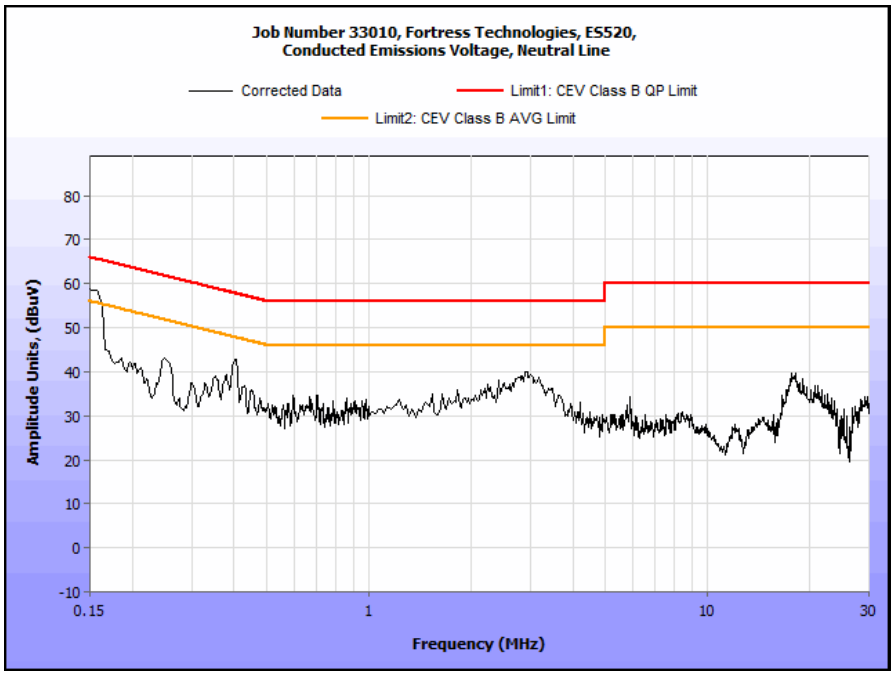


Plot 1. Conducted Emission, Phase Line Plot

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

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) Avg.	Limit (dBuV) Avg.	Margin (dB) Avg.
0.322	30.82	0.02	30.84	79	-48.16	25.91	0.02	25.93	66	-40.07
0.483	33.5	0	33.5	79	-45.5	30.99	0	30.99	66	-35.01
1.45	33.87	0	33.87	73	-39.13	33.52	0	33.52	60	-26.48
8.191	48.33	0.11	48.44	73	-24.56	47.07	0.11	47.18	60	-12.82
15.15	49.16	0.12	49.28	73	-23.72	47.34	0.12	47.46	60	-12.54
22.74	36.68	0.18	36.86	73	-36.14	34.76	0.18	34.94	60	-25.06

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



Plot 2. Conducted Emission, Neutral Line Plot

Conducted Emission Limits Test Setup

Photograph 2. Conducted Emissions, Test Setup

Radiated Emission Limits

§ 15.109 Radiated Emissions Limits

Test Requirement(s): **15.109 (a)** Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the Class B limits expressed in Table 9.

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 9.

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

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

Test Results: The EUT was compliant with the Class A requirement(s) of this section.

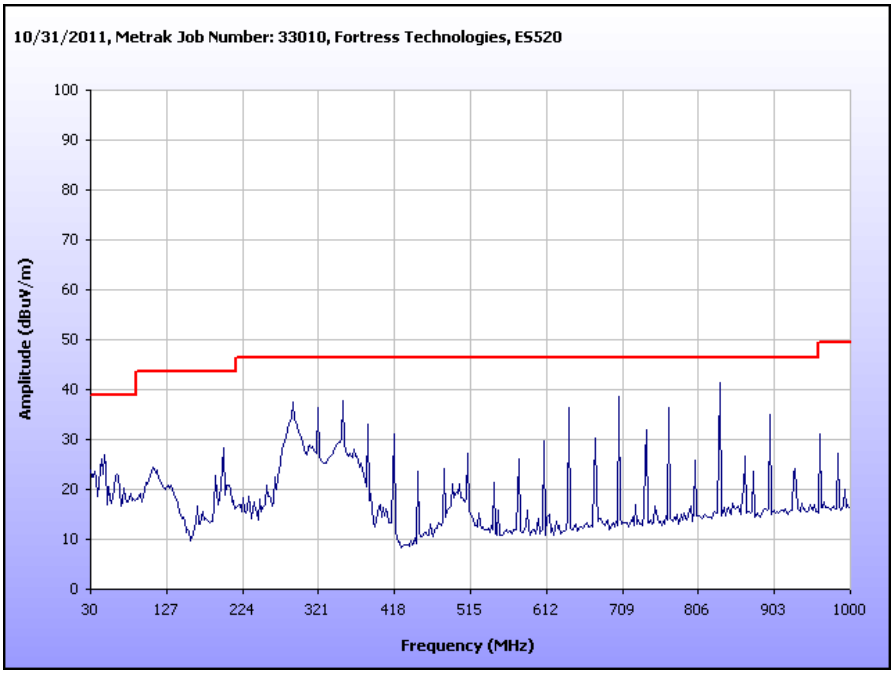
Test Engineer(s): Jeff Pratt

Test Date(s): 10/31/11

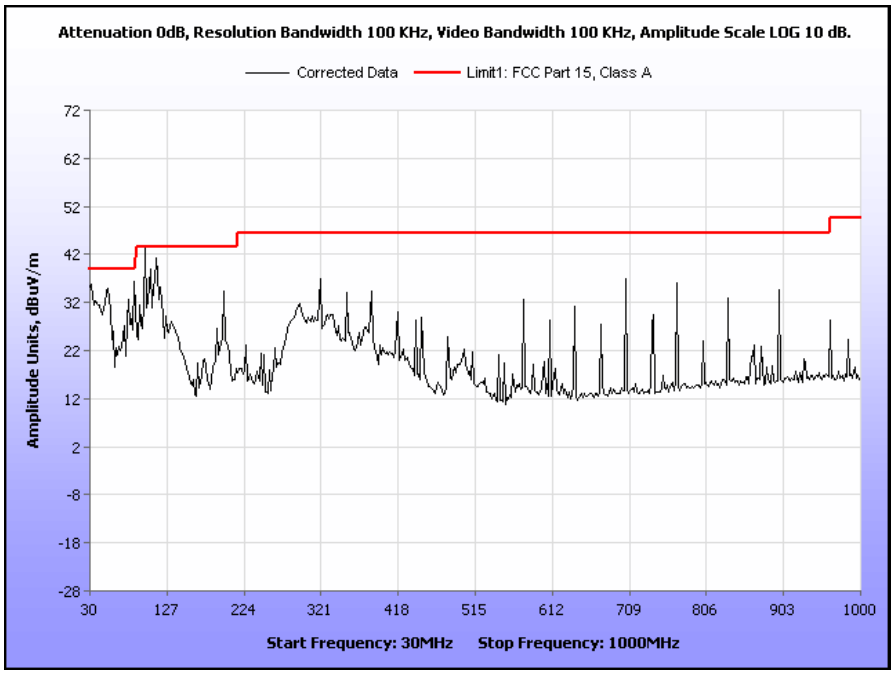
Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
48.569639	296	H	3.57	13.65	9.03	0.23	10.46	12.45	39.00	-26.55
48.569639	21	V	1.01	25.73	9.03	0.23	10.46	24.53	39.00	-14.47
64.749499	300	H	1.90	12.18	7.80	0.23	10.46	9.75	39.00	-29.25
64.749499	10	V	1.07	23.65	7.80	0.23	10.46	21.22	39.00	-17.78
200.03507	312	H	1.01	21.52	12.99	0.23	10.46	24.28	43.50	-19.22
200.03507	283	V	1.01	21.21	12.99	0.23	10.46	23.97	43.50	-19.53
288.0511	270	H	1.05	32.06	13.86	0.75	10.46	36.21	46.40	-10.19
288.0511	171	V	1.01	20.23	13.86	0.75	10.46	24.38	46.40	-22.02
384.0506	66	H	1.01	25.80	15.70	0.83	10.46	31.87	46.40	-14.53
384.0506	208	V	1.01	24.19	15.70	0.83	10.46	30.26	46.40	-16.14
320.0263	63	H	1.00	32.02	14.50	0.83	10.46	36.89	46.40	-9.51
320.0263	282	V	1.35	21.06	14.50	0.83	10.46	25.93	46.40	-20.47

Table 10. Radiated Emissions Limits, Test Results, 30 MHz – 1 GHz, FCC Limits



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



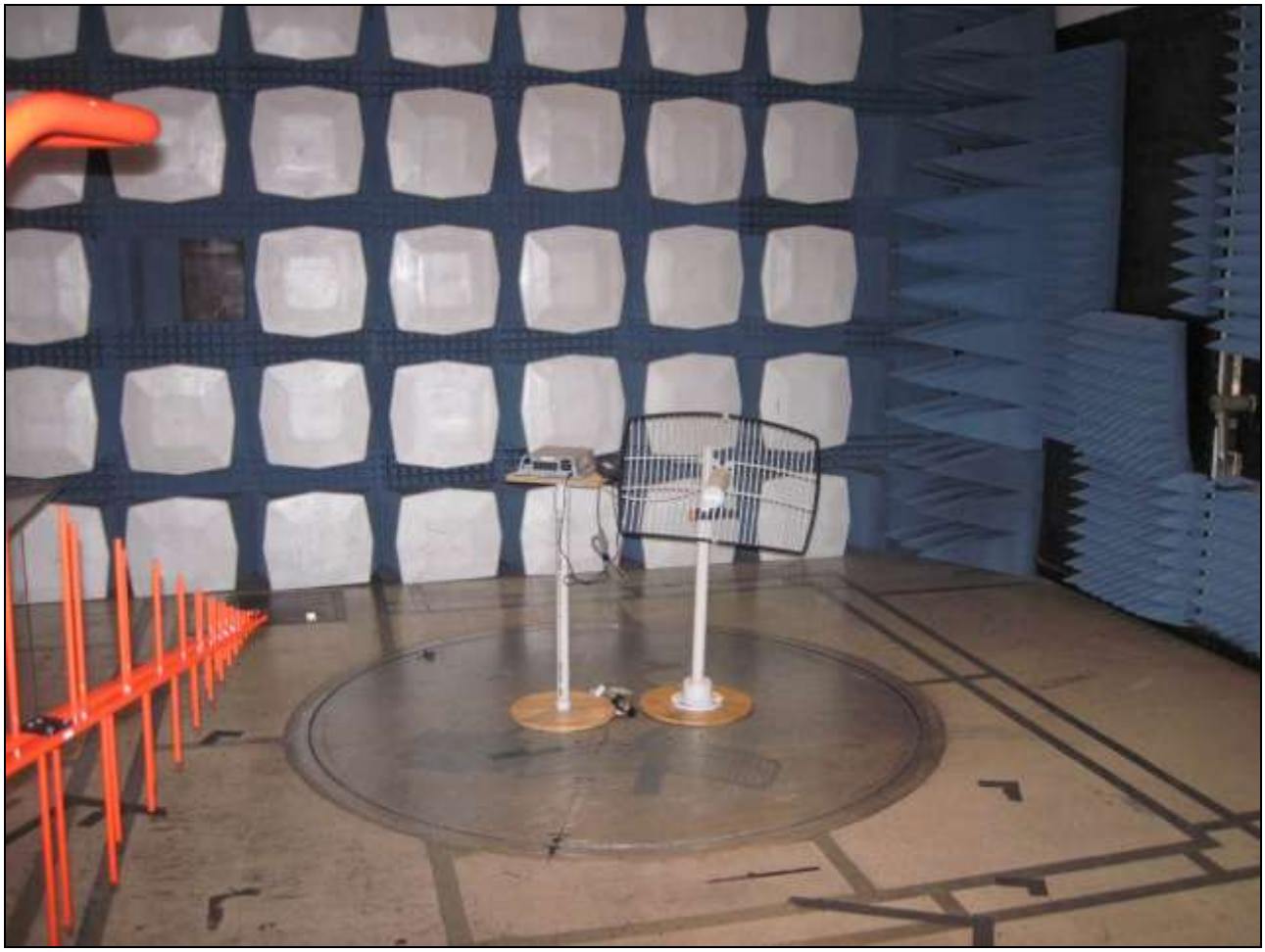
Plot 4. Radiated Emissions, 30 MHz - 1 GHz, FCC Limits, Dish Antenna

Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
48.569639	296	H	3.57	13.65	9.03	0.23	10.46	12.45	40.00	-27.55
48.569639	21	V	1.01	25.73	9.03	0.23	10.46	24.53	40.00	-15.47
64.749499	300	H	1.90	12.18	7.80	0.23	10.46	9.75	40.00	-30.25
64.749499	10	V	1.07	23.65	7.80	0.23	10.46	21.22	40.00	-18.78
200.03507	312	H	1.01	21.52	12.99	0.23	10.46	24.28	40.00	-15.72
200.03507	283	V	1.01	21.21	12.99	0.23	10.46	23.97	40.00	-16.03
288.0511	270	H	1.05	32.06	13.86	0.75	10.46	36.21	47.00	-10.79
288.0511	171	V	1.01	20.23	13.86	0.75	10.46	24.38	47.00	-22.62
384.0506	66	H	1.01	25.80	15.70	0.83	10.46	31.87	47.00	-15.13
384.0506	208	V	1.01	24.19	15.70	0.83	10.46	30.26	47.00	-16.74
320.0263	63	H	1.00	32.02	14.50	0.83	10.46	36.89	47.00	-10.11
320.0263	282	V	1.35	21.06	14.50	0.83	10.46	25.93	47.00	-21.07

Table 11. Radiated Emissions Limits, Test Results, ICES-003 Limits

Radiated Emission Limits Test Setup



Photograph 3. Radiated Emission, Test Setup

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 with the criteria of §15.203. The EUT is professional installed.

Test Engineer(s): Jeff Pratt

Test Date(s): 02/02/12

Type	Gain	Manufacturer	Model
Omni	9 dBi	Mobile Mark	ECO9-5500
Dish	26 dBi	mWave	GS2-54-N-R

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 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency range (MHz)	§ 15.207(a), Conducted Limit (dBμV)	
	Quasi-Peak	Average
* 0.15- 0.45	66 - 56	56 - 46
0.45 - 0.5	56	46
0.5 - 30	60	50

Table 12. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

Test Procedure: The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber. The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a 50 Ω/50 μH Line Impedance Stabilization Network (LISN) and the transmit set to transmit on its mid channel. The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.4-1992 "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.

Test Results: The EUT was compliant with the requirement(s) of this section.

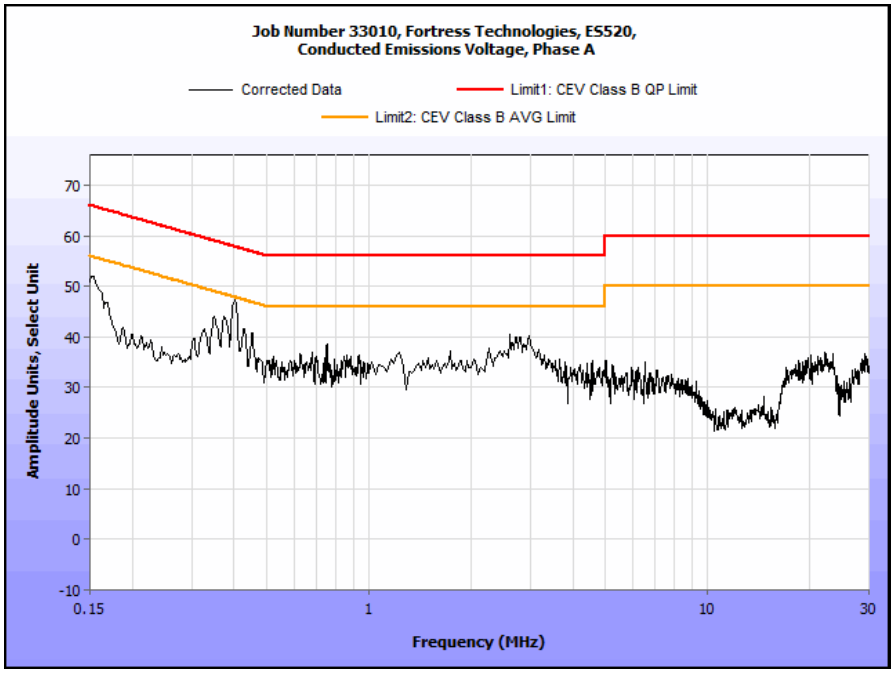
Test Engineer(s): Jeff Pratt

Test Date(s): 01/13/12

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

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) Avg.	Limit (dBuV) Avg.	Margin (dB) Avg.
0.373	39.61	0	39.61	58.43	-18.82	33.19	0	33.19	48.43	-15.24
0.401	45.9	0	45.9	57.83	-11.93	38.29	0	38.29	47.83	-9.54
0.763	19.24	0	19.24	56	-36.76	9.535	0	9.535	46	-36.465
2.796	35.06	0.01	35.07	56	-20.93	26.62	0.01	26.63	46	-19.37
21.14	27.42	0.17	27.59	60	-32.41	18.8	0.17	18.97	50	-31.03
28.73	29.57	0.21	29.78	60	-30.22	23.86	0.21	24.07	50	-25.93

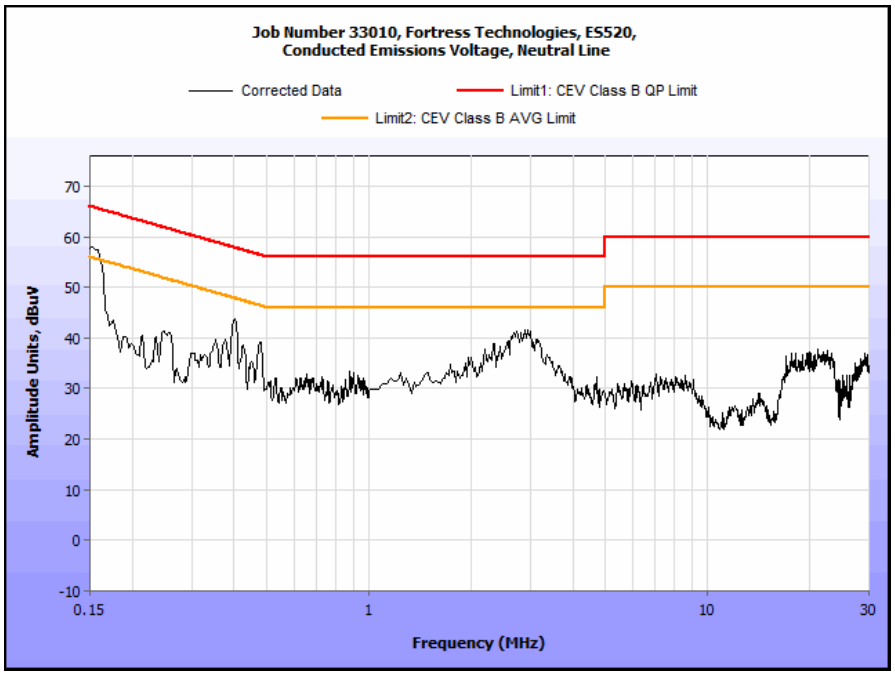
Table 13. Conducted Emissions - Voltage, AC Power, 15.207, Phase Line (120 VAC, 60 Hz)



Plot 5. Conducted Emissions, 15.207, Phase Line

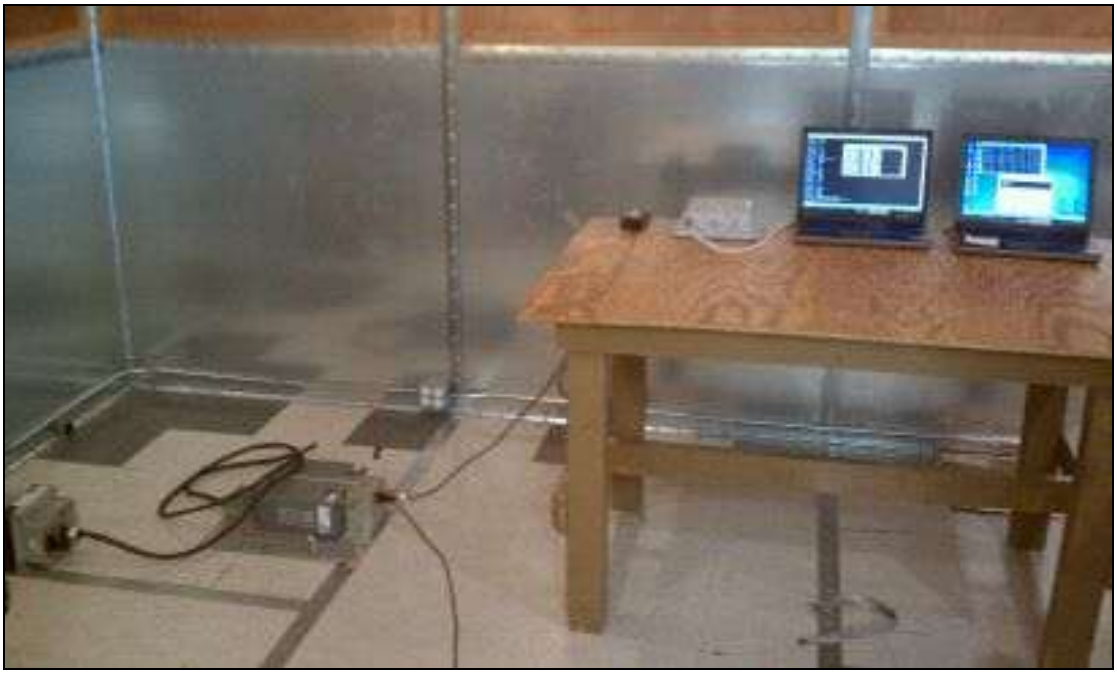
Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) Avg.	Limit (dBuV) Avg.	Margin (dB) Avg.
0.251	34.19	0.03	34.22	61.72	-27.5	25.93	0.03	25.96	51.72	-25.76
0.399	44.17	0	44.17	57.87	-13.7	41.04	0	41.04	47.87	-6.83
0.426	35.18	0	35.18	57.33	-22.15	34.05	0	34.05	47.33	-13.28
2.791	36.71	0.01	36.72	56	-19.28	32.05	0.01	32.06	46	-13.94
23.55	31.38	0.19	31.57	60	-28.43	26.46	0.19	26.65	50	-23.35
27.32	32.22	0.21	32.43	60	-27.57	27.31	0.21	27.52	50	-22.48

Table 14. Conducted Emissions - Voltage, AC Power, 15.207, Neutral Line (120 VAC, 60 Hz)



Plot 6. Conducted Emissions, 15.207, Phase Line

Conducted Emission Limits Test Setup



Photograph 4. Conducted Emissions, Test Setup

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 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): Jeff Pratt

Test Date(s): 11/15/11

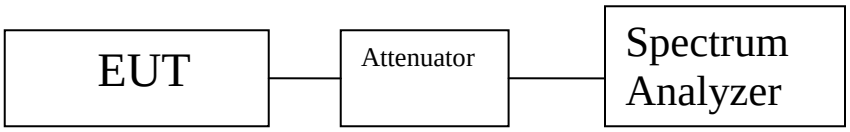
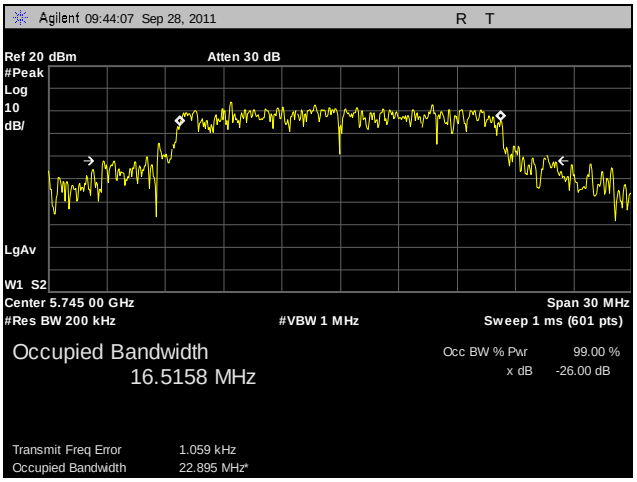


Figure 1. Occupied Bandwidth, Test Setup

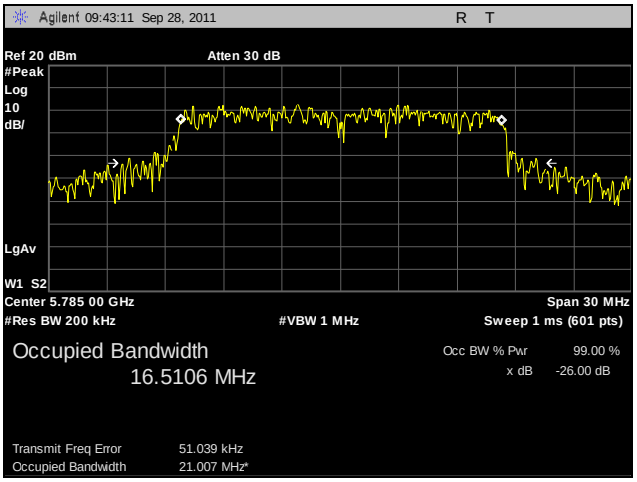
Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
5745	22.895	16.4626
5785	21.007	16.4720
5805	21.356	16.5909

Table 15. Occupied Bandwidth, Test Results

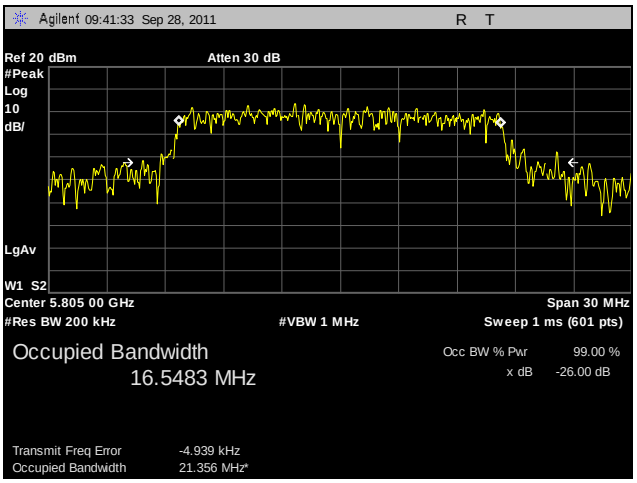
26 dB Occupied Bandwidth



Plot 7. 26 dB Occupied Bandwidth, 5745 MHz

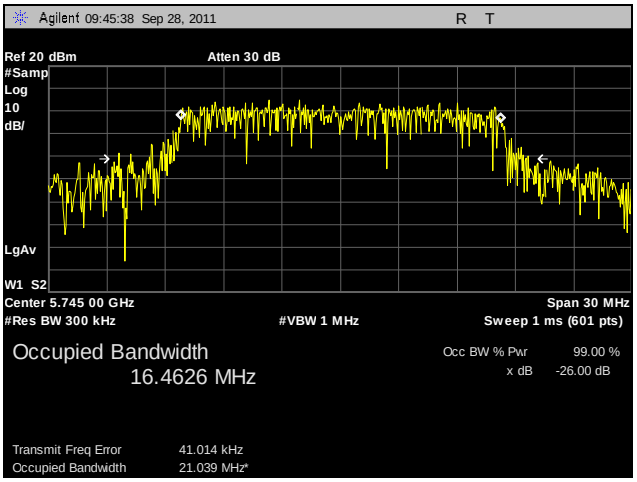


Plot 8. 26 dB Occupied Bandwidth, 5785 MHz

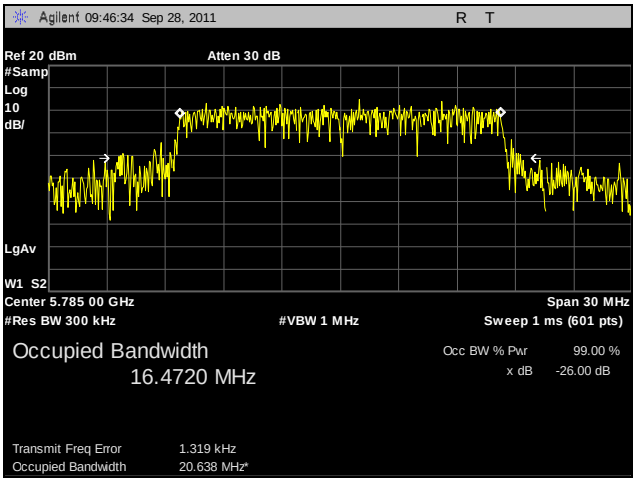


Plot 9. 26 dB Occupied Bandwidth, 5805 MHz

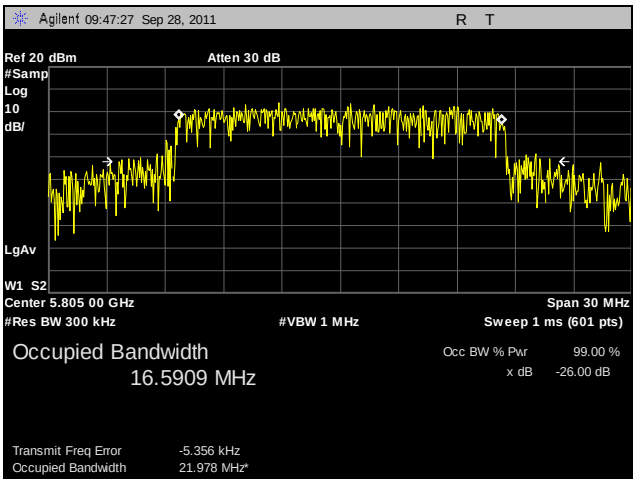
99% Occupied Bandwidth



Plot 10. 99% Occupied Bandwidth, 5745 MHz



Plot 11. 99% Occupied Bandwidth, 5785 MHz



Plot 12. 99% Occupied Bandwidth, 5805 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15. 407(a)(3) RF Power Output

Test Requirements: **§15.407(a)(3):** The maximum output power of the intentional radiator shall not exceed the following:

§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 1W or 17 dBm+10logB, where B is the 26dB emission bandwidth in megahertz.

Test Procedure: The EUT was connected directly to a spectrum analyzer through an attenuator and set to transmit on low, mid, and high channels. The power was measured according to method SA-1 from KDB Publication 789033.

Test Results: Equipment was compliant with the Peak Power Output limits of **§ 15.401(a)(2)**.

Test Engineer(s): Jeff Pratt

Test Date(s): 11/15/11

Frequency (MHz)	Conducted power (dBm)
5745	14.15
5785	13.75
5805	13.75

Table 16. RF Power Output, Test Results

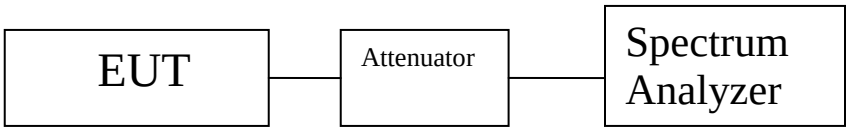
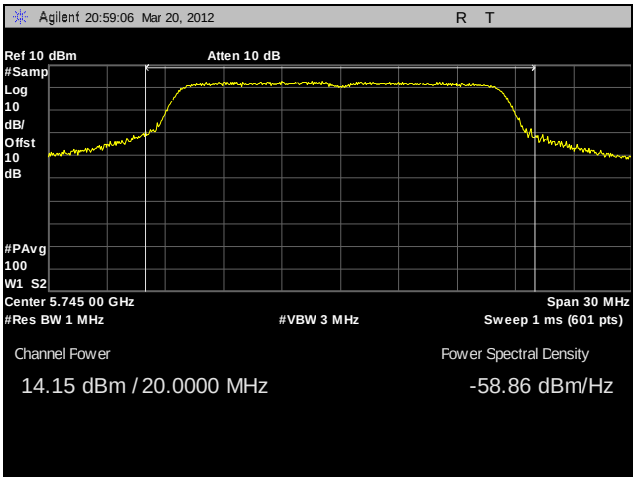
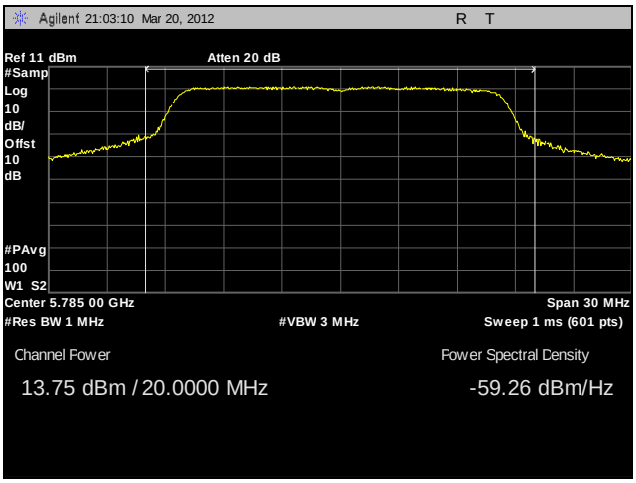


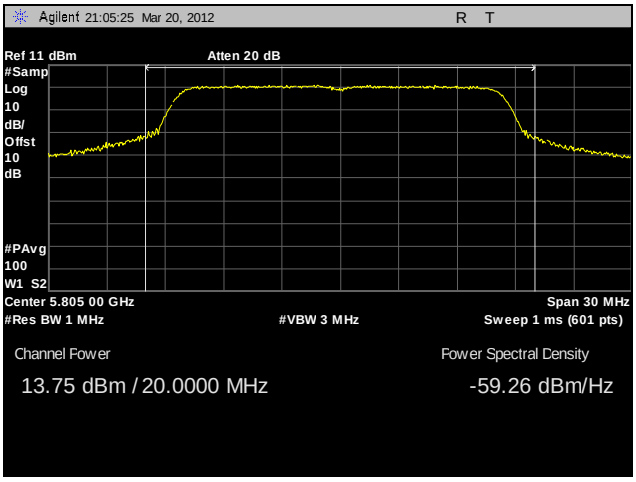
Figure 2. Power Output Test Setup



Plot 13. RF Power Output, 5745 MHz



Plot 14. RF Power Output, 5785 MHz



Plot 15. RF Power Output, 5805 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(a)(2) Peak Power Spectral Density

Test Requirements: **§ 15.407(a)(3):** In addition, the peak power spectral density shall not exceed 17 dBm in any 1MHz 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. A sample detector was used with power averaging over 100 sweeps. The method of measurement SA-1 from 789033 D01 General UNII Test Procedures v01 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): Jeff Pratt

Test Date(s): 11/15/11

Frequency (MHz)	PSD (dBm)
5745	2.668
5785	2.894
5805	2.376

Table 17. Power Spectral Density, Test Results

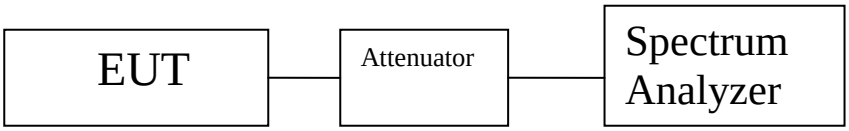
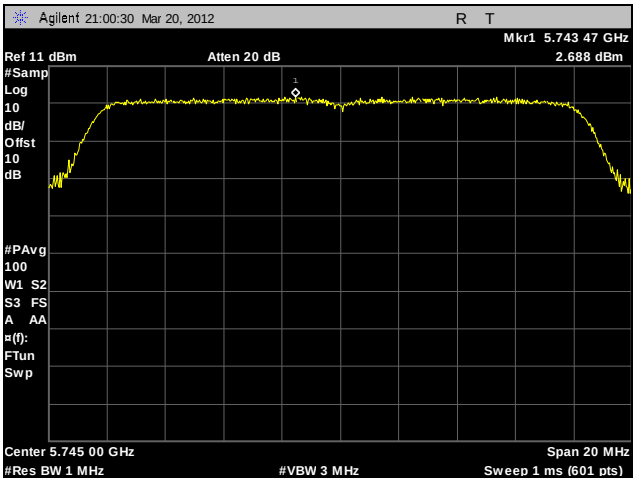
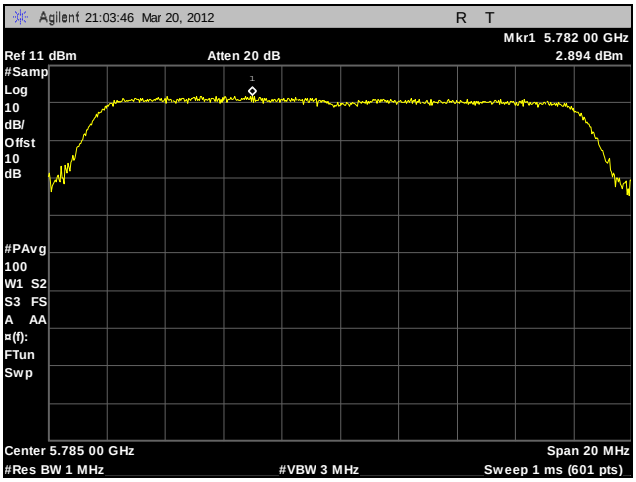


Figure 3. Power Spectral Density Test Setup

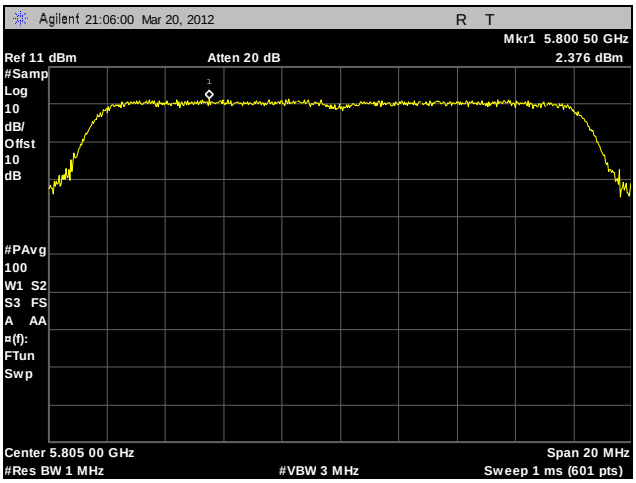
Electromagnetic Compatibility Criteria for Intentional Radiators



Plot 16. Power Spectral Density, 5745 MHz



Plot 17. Power Spectral Density, 5785 MHz



Plot 18. Power Spectral Density, 5805 MHz

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 measurement method SA-1 from 789033-D01 General UNII Test Procedures v01.

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): Jeff Pratt

Test Date(s): 11/15/11

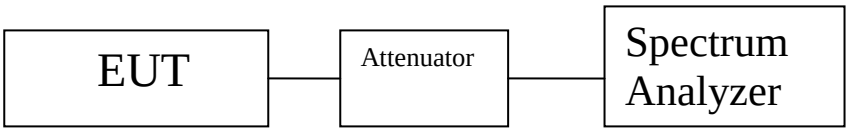
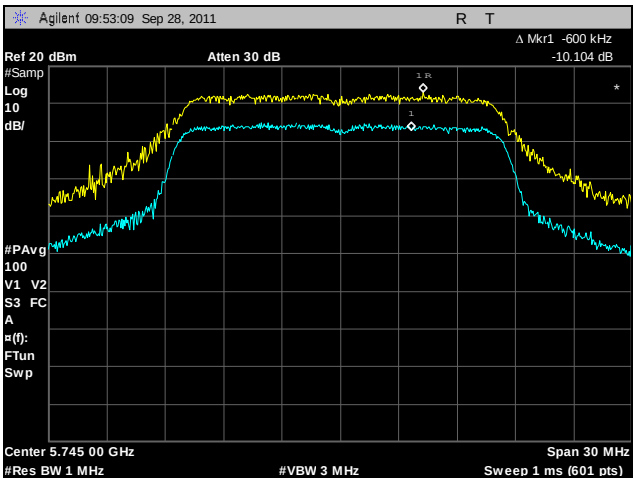
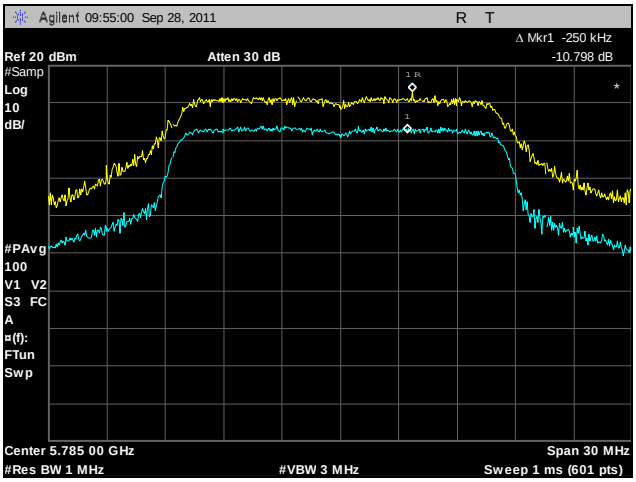


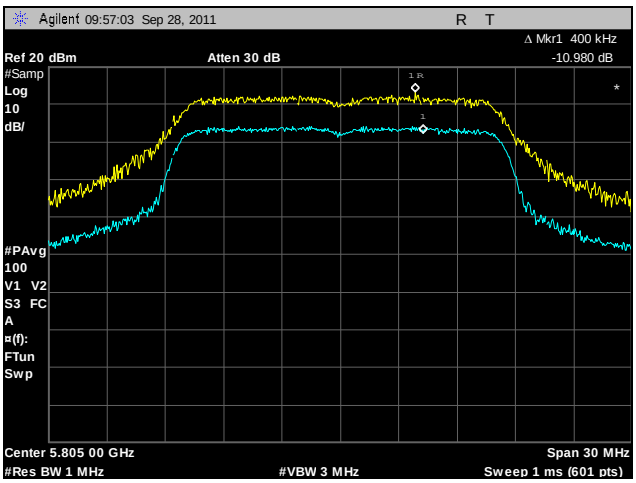
Figure 4. Peak Excursion Ration Test Setup



Plot 19. Peak Excursion Ratio, 5745 MHz



Plot 20. Peak Excursion Ratio, 5785 MHz



Plot 21. Peak Excursion Ratio, 5805 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

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

Test Requirements: **§ 15.407(b)(4), (6), (7)**; **§15.205:** Emissions outside the frequency band.

§ 15.407(b)(4): For transmitters operating in the 5.725-5.825 GHz: 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 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.

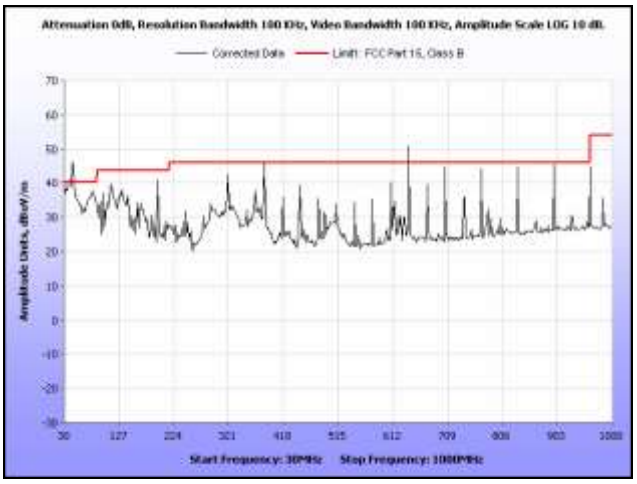
For measurements above 1 GHz, measurements were made with a Peak detector with 1 MHz resolution bandwidth. Where the spurious emissions fell into a restricted band, measurements were also made with an average detector to make sure they complied with 15.209 limits. Emissions were explored up to 40 GHz.
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): Jeff Pratt

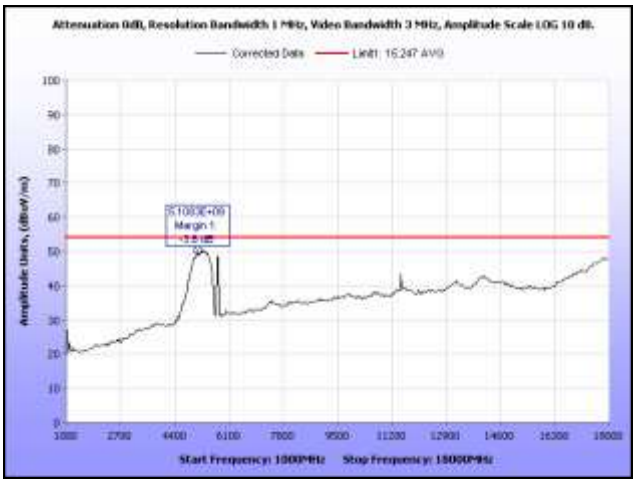
Test Date(s): 12/01/11

§ 15.209 Radiated Emissions Limits

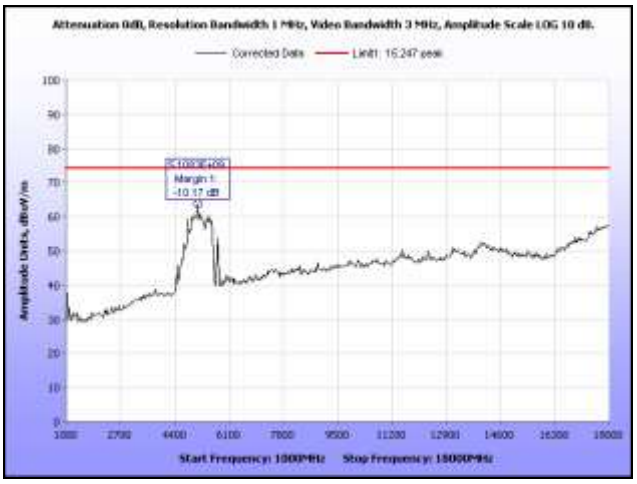


Plot 22. Radiated Spurious Emissions, 5745 MHz, 30 MHz – 1 GHz, Omni Antenna

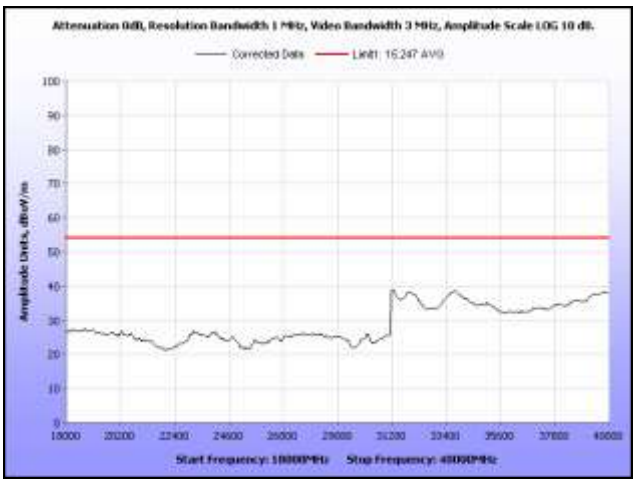
Note: emissions which are over the 15.209 limit line are digital emissions which meet the Class A limits.



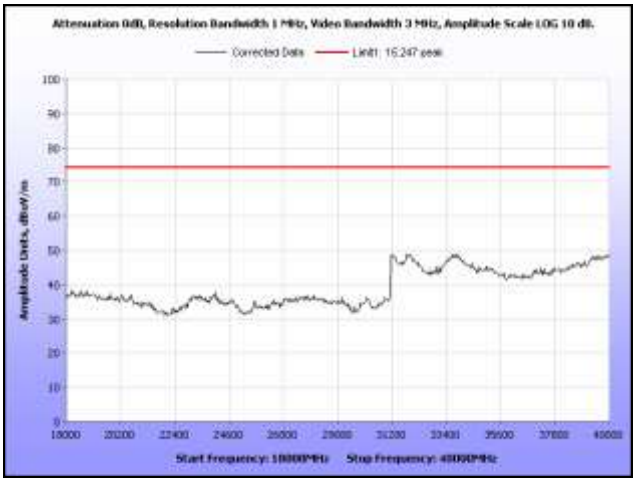
Plot 23. Radiated Spurious Emissions, 5745 MHz, 1 GHz – 18 GHz, Average, Omni Antenna



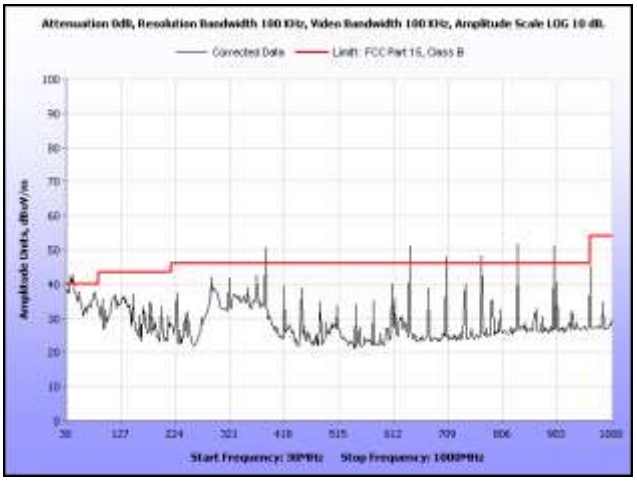
Plot 24. Radiated Spurious Emissions, 5745 MHz, 1 GHz – 18 GHz, Peak, Omni Antenna



Plot 25. Radiated Spurious Emissions, 5745 MHz, 18 GHz – 40 GHz, Average, Omni Antenna



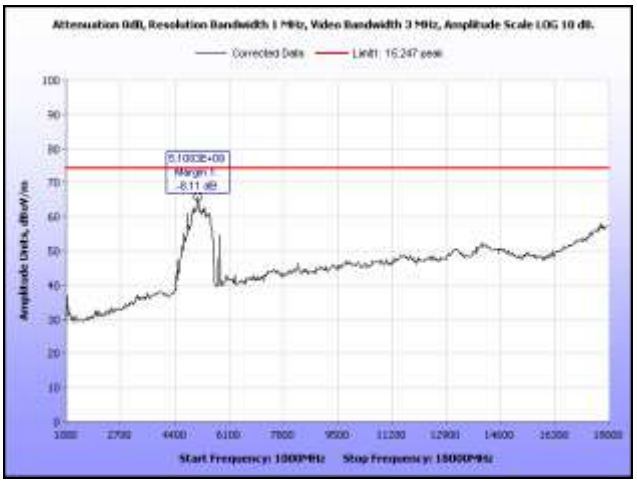
Plot 26. Radiated Spurious Emissions, 5745 MHz, 18 GHz – 40 GHz, Peak, Omni Antenna



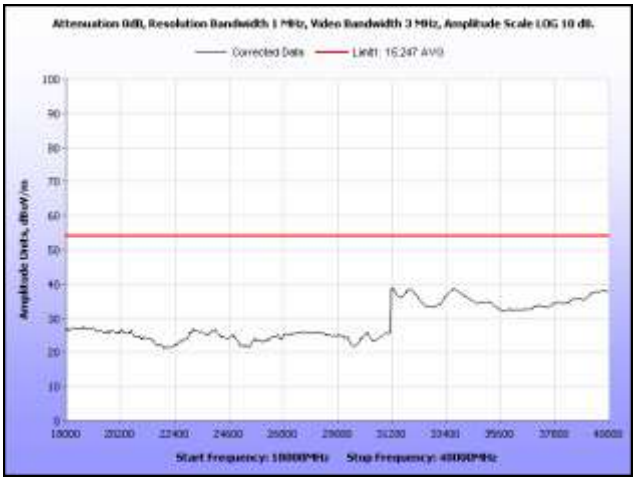
Plot 27. Radiated Spurious Emissions, 5785 MHz, 30 MHz – 1 GHz, Omni Antenna

Note: emissions which are over the 15.209 limit line are digital emissions which meet the Class A limits.

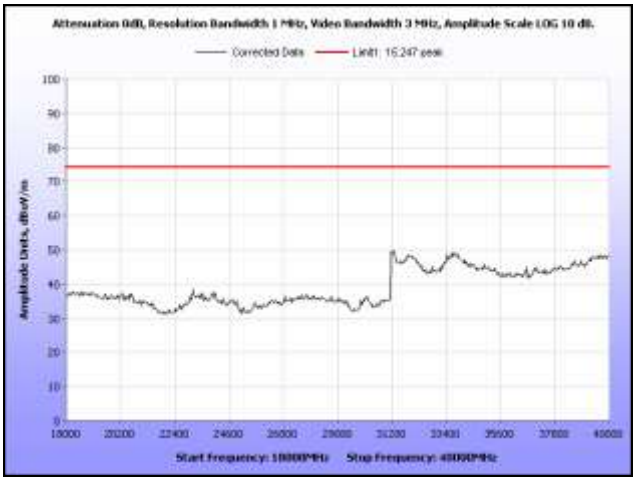
Plot 28. Radiated Spurious Emissions, 5785 MHz, 1 GHz – 18 GHz, Average, Omni Antenna



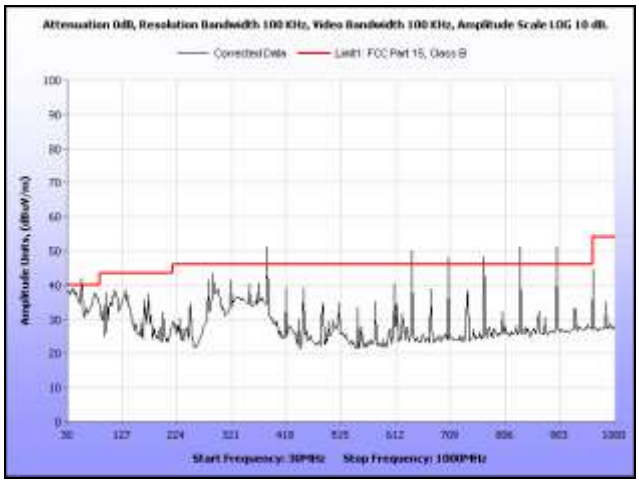
Plot 29. Radiated Spurious Emissions, 5785 MHz, 1 GHz – 18 GHz, Peak, Omni Antenna



Plot 30. Radiated Spurious Emissions, 5785 MHz, 18 GHz – 40 GHz, Average, Omni Antenna

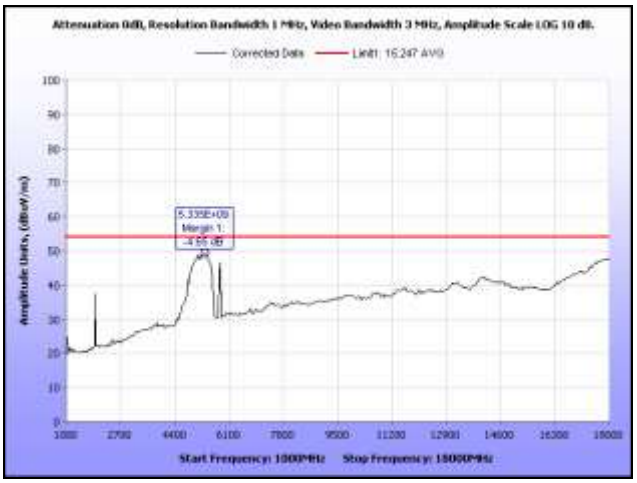


Plot 31. Radiated Spurious Emissions, 5785 MHz, 18 GHz – 40 GHz, Peak, Omni Antenna

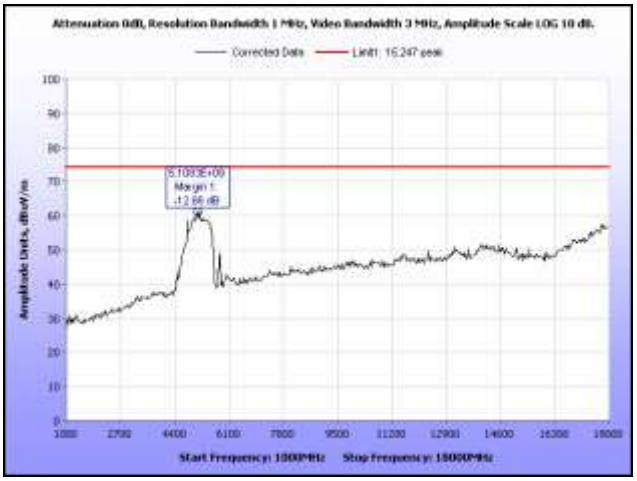


Plot 32. Radiated Spurious Emissions, 5805 MHz, 30 MHz – 1 GHz, Omni Antenna

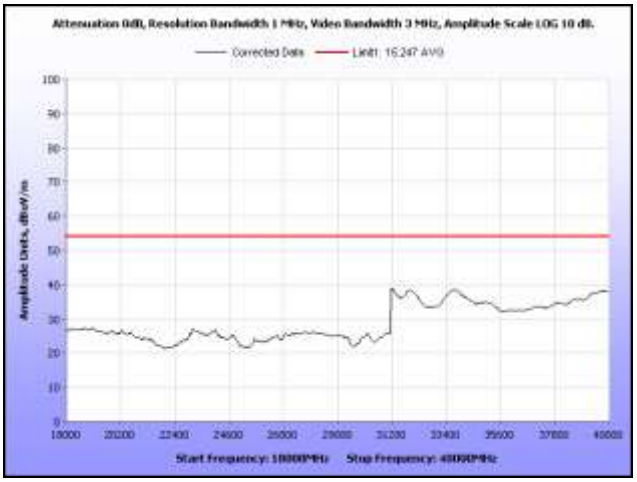
Note: emissions which are over the 15.209 limit line are digital emissions which meet the Class A limits.



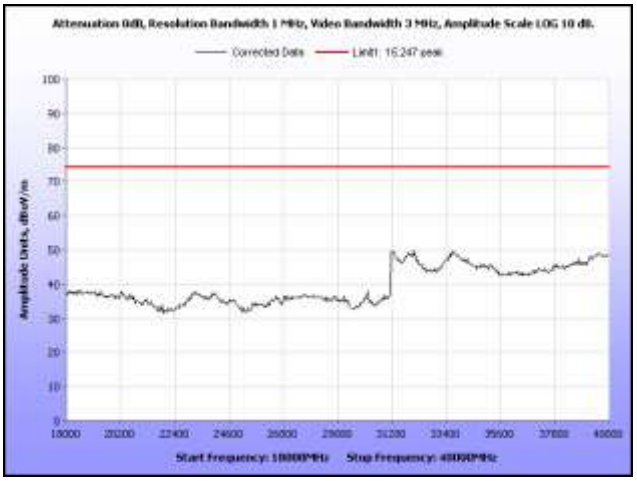
Plot 33. Radiated Spurious Emissions, 5805 MHz, 1 GHz – 18 GHz, Average, Omni Antenna



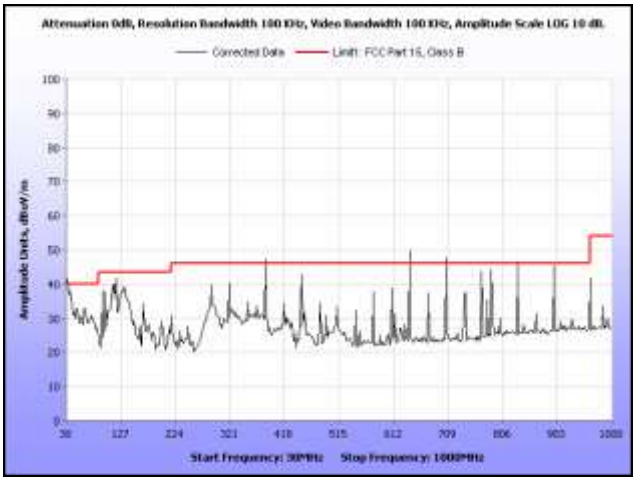
Plot 34. Radiated Spurious Emissions, 5805 MHz, 1 GHz – 18 GHz, Peak, Omni Antenna



Plot 35. Radiated Spurious Emissions, 5805 MHz, 18 GHz – 40 GHz, Average, Omni Antenna

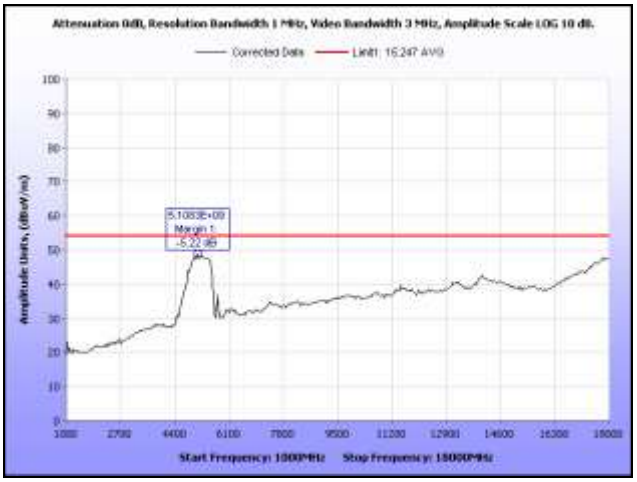


Plot 36. Radiated Spurious Emissions, 5805 MHz, 18 GHz – 40 GHz, Peak, Omni Antenna

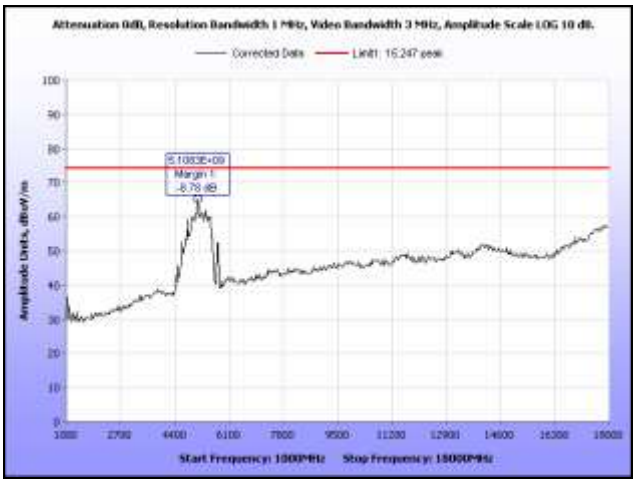


Plot 37. Radiated Spurious Emissions, 5745 MHz, 30 MHz – 1 GHz, Dish Antenna

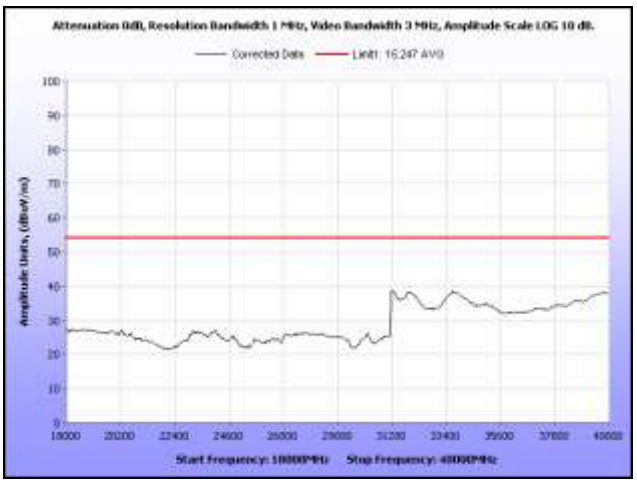
Note: emissions which are over the 15.209 limit line are digital emissions which meet the Class A limits.



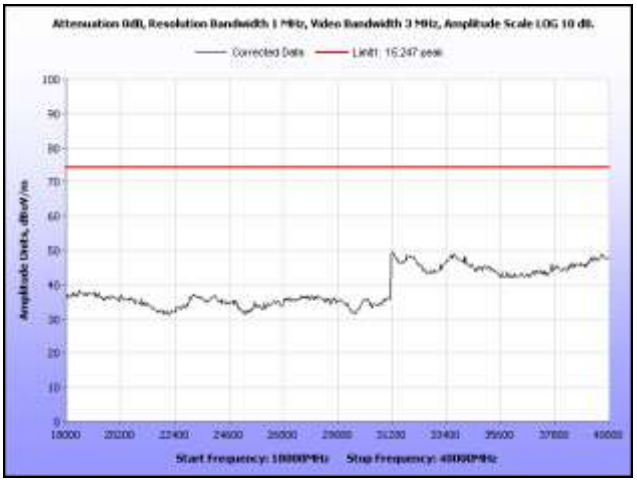
Plot 38. Radiated Spurious Emissions, 5745 MHz, 1 GHz – 18 GHz, Average, Dish Antenna



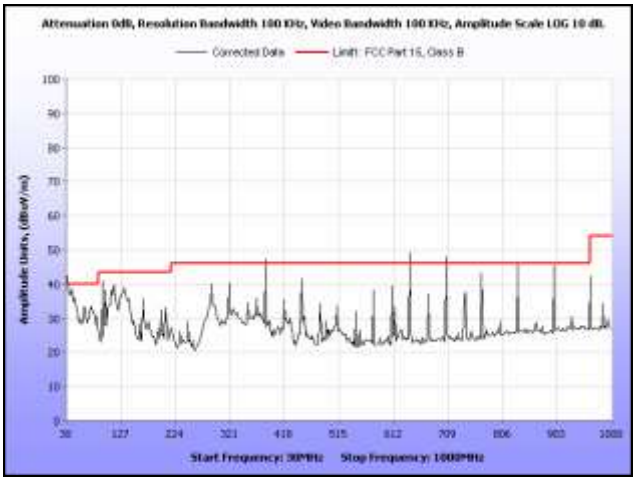
Plot 39. Radiated Spurious Emissions, 5745 MHz, 1 GHz – 18 GHz, Peak, Dish Antenna



Plot 40. Radiated Spurious Emissions, 5745 MHz, 18 GHz – 40 GHz, Average, Dish Antenna

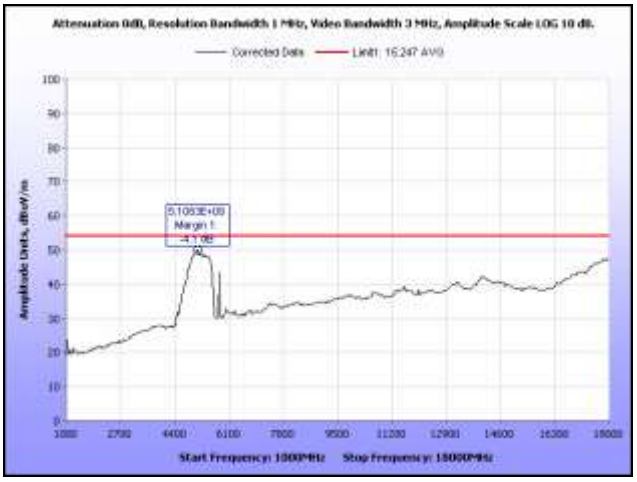


Plot 41. Radiated Spurious Emissions, 5745 MHz, 18 GHz – 40 GHz, Peak, Dish Antenna

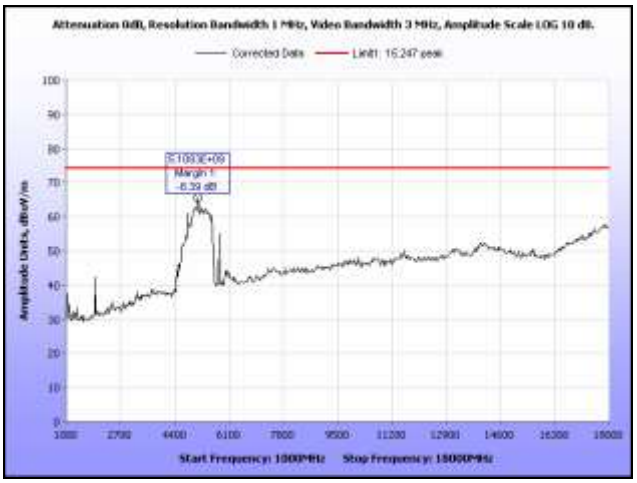


Plot 42. Radiated Spurious Emissions, 5785 MHz, 30 MHz – 1 GHz, Dish Antenna

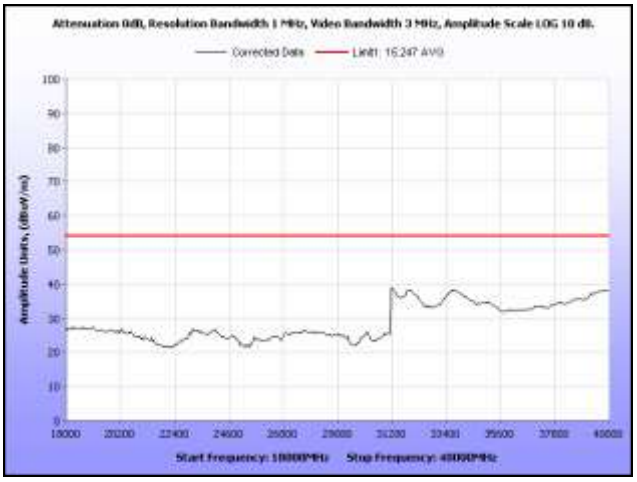
Note: emissions which are over the 15.209 limit line are digital emissions which meet the Class A limits.



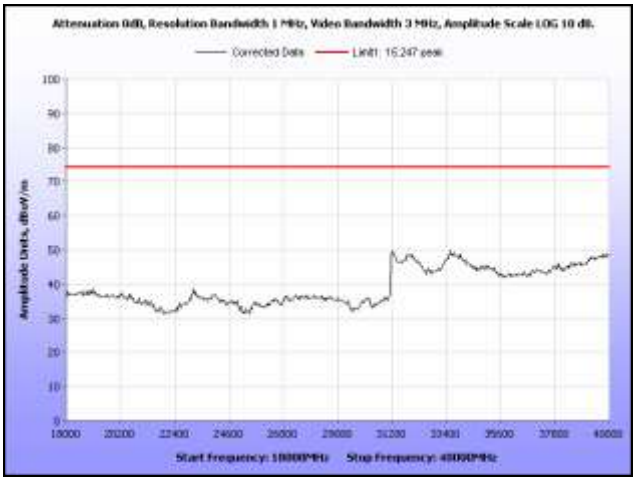
Plot 43. Radiated Spurious Emissions, 5785 MHz, 1 GHz – 18 GHz, Average, Dish Antenna



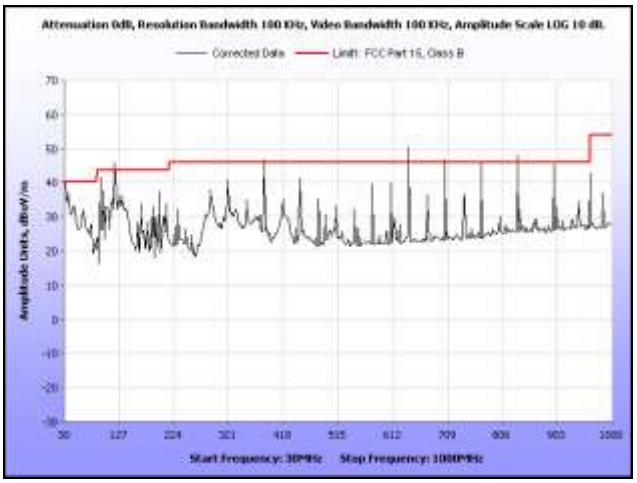
Plot 44. Radiated Spurious Emissions, 5785 MHz, 1 GHz – 18 GHz, Peak Antenna, Dish Antenna



Plot 45. Radiated Spurious Emissions, 5785 MHz, 18 GHz – 40 GHz, Average, Dish Antenna

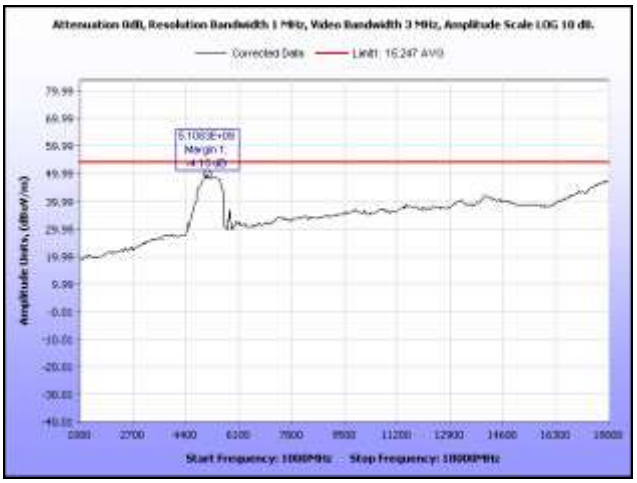


Plot 46. Radiated Spurious Emissions, 5785 MHz, 18 GHz – 40 GHz, Peak, Dish Antenna

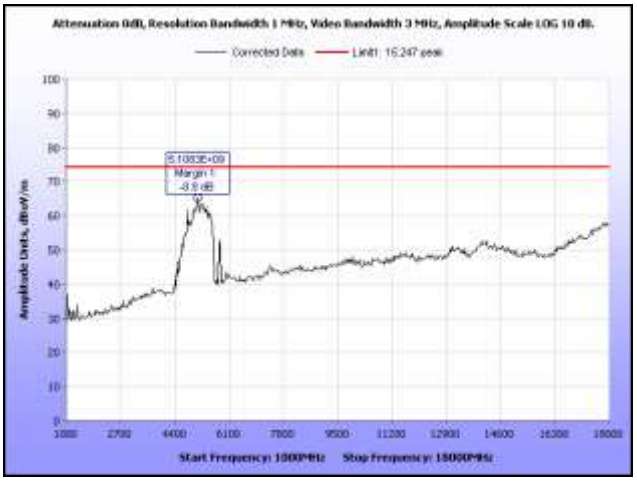


Plot 47. Radiated Spurious Emissions, 5805 MHz, 30 MHz – 1 GHz, Dish Antenna

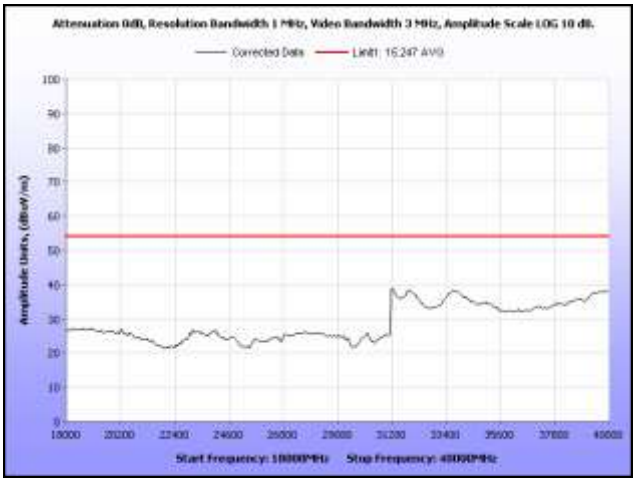
Note: emissions which are over the 15.209 limit line are digital emissions which meet the Class A limits.



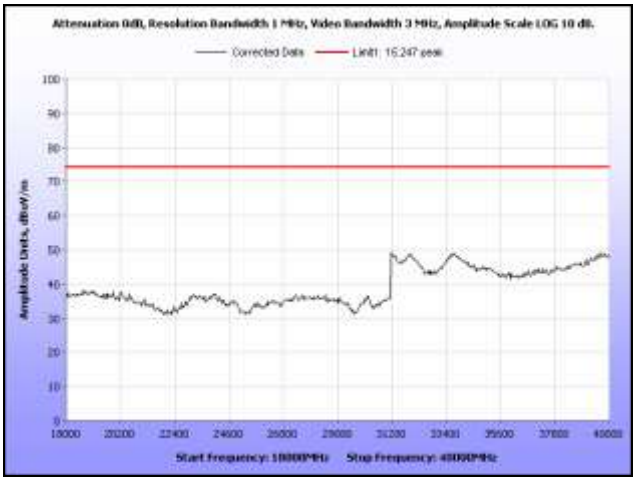
Plot 48. Radiated Spurious Emissions, 5805 MHz, 1 GHz – 18 GHz, Average, Dish Antenna



Plot 49. Radiated Spurious Emissions, 5805 MHz, 1 GHz – 18 GHz, Peak, Dish Antenna

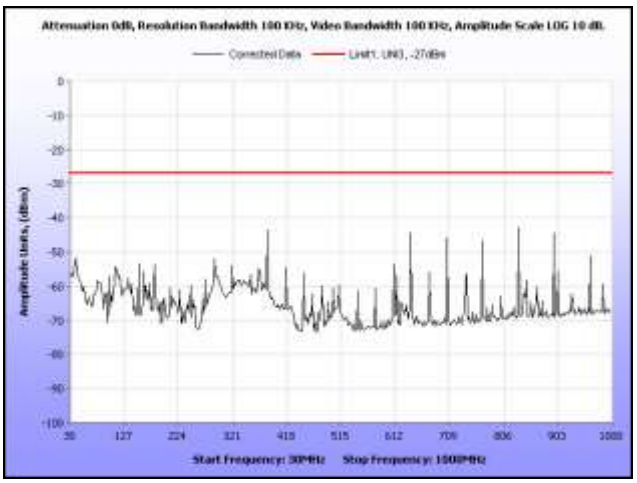


Plot 50. Radiated Spurious Emissions, 5805 MHz, 18 GHz – 40 GHz, Average, Dish Antenna

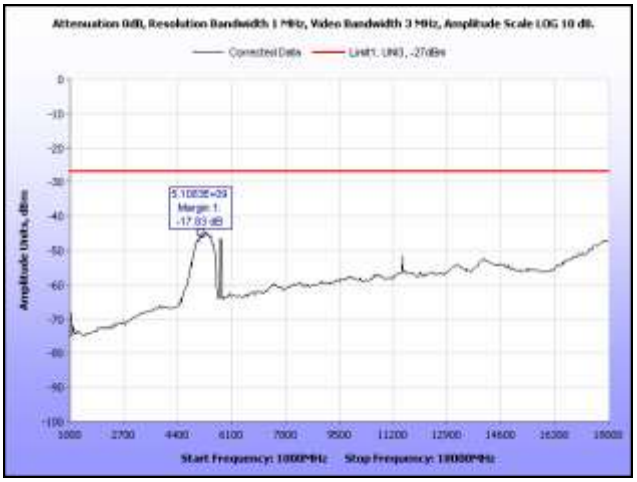


Plot 51. Radiated Spurious Emissions, 5805 MHz, 18 GHz – 40 GHz, Peak, Dish Antenna

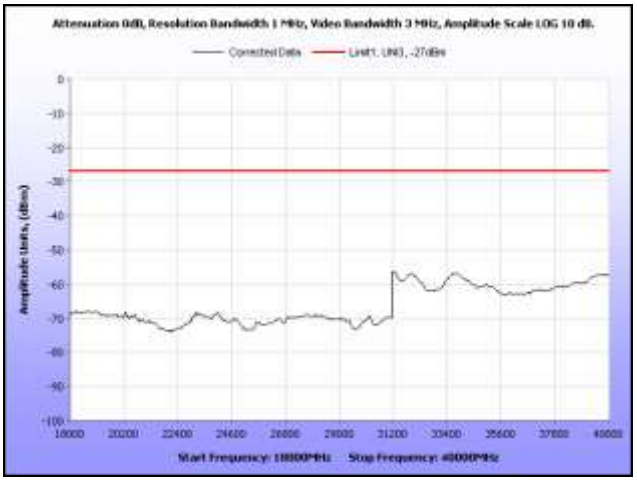
EIRP



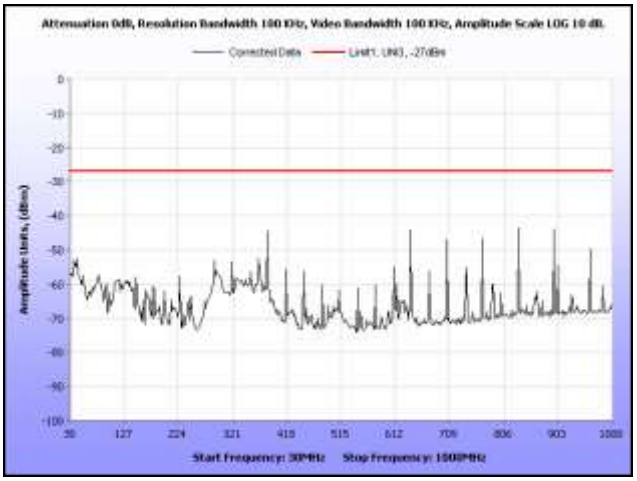
Plot 52. EIRP, 5745 MHz, 30 MHz – 1 GHz, Omni Antenna



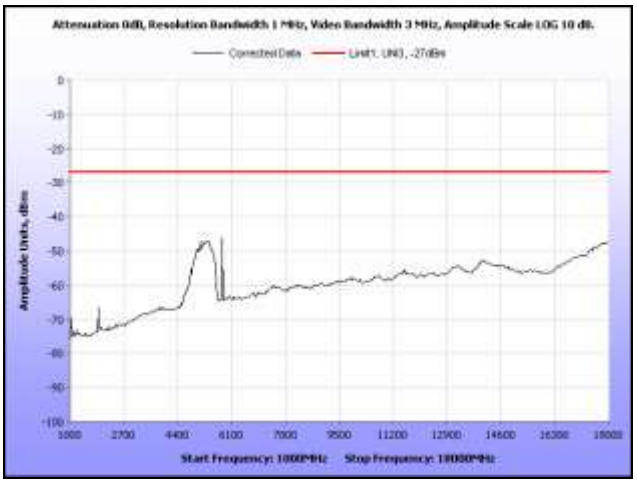
Plot 53. EIRP, 5745 MHz, 1 GHz – 18 GHz, Omni Antenna



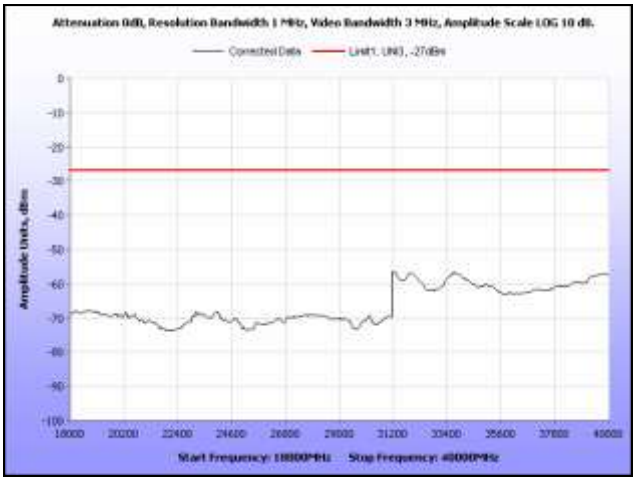
Plot 54. EIRP, 5745 MHz, 18 GHz – 40 GHz, Omni Antenna



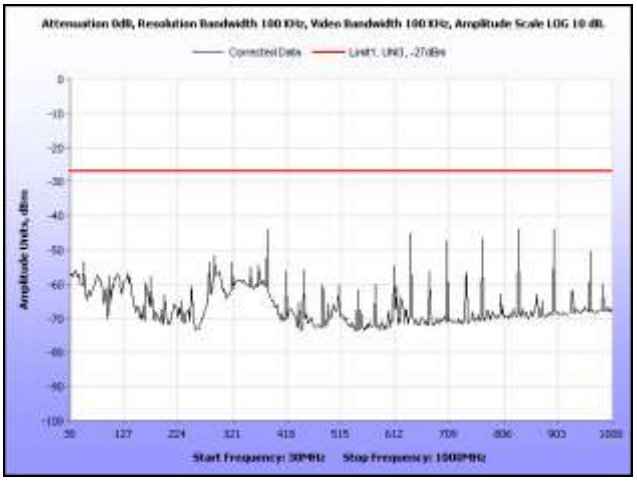
Plot 55. EIRP, 5785 MHz, 30 MHz – 1 GHz, Omni Antenna



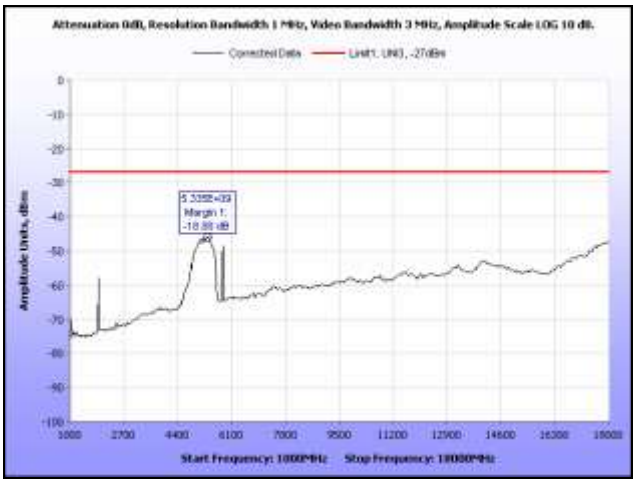
Plot 56. EIRP, 5785 MHz, 1 GHz – 18 GHz, Omni Antenna



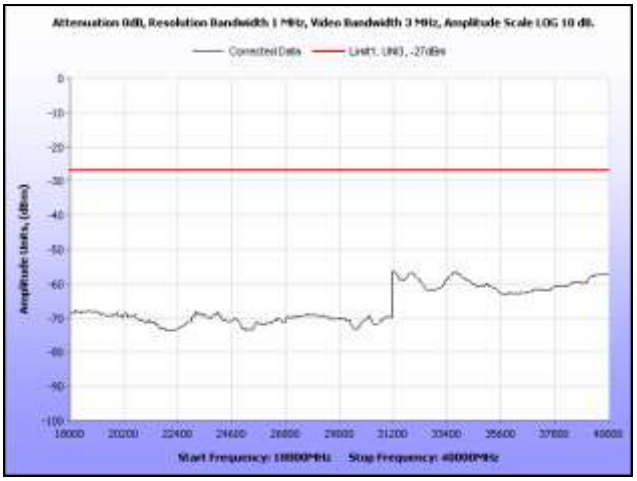
Plot 57. EIRP, 5785 MHz, 18 GHz – 40 GHz, Omni Antenna



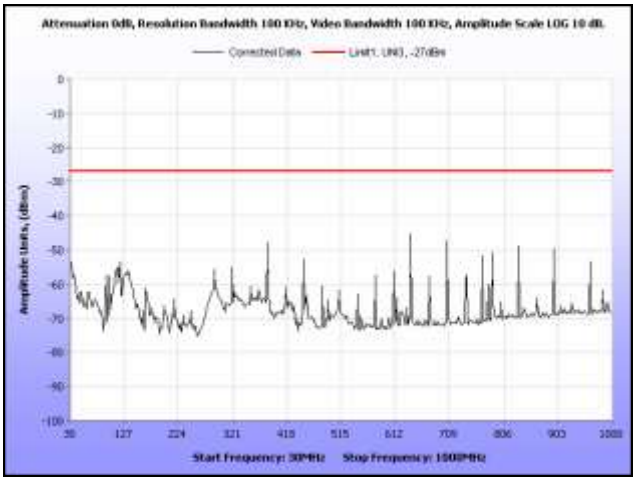
Plot 58. EIRP, 5805 MHz, 30 MHz – 1 GHz, Omni Antenna



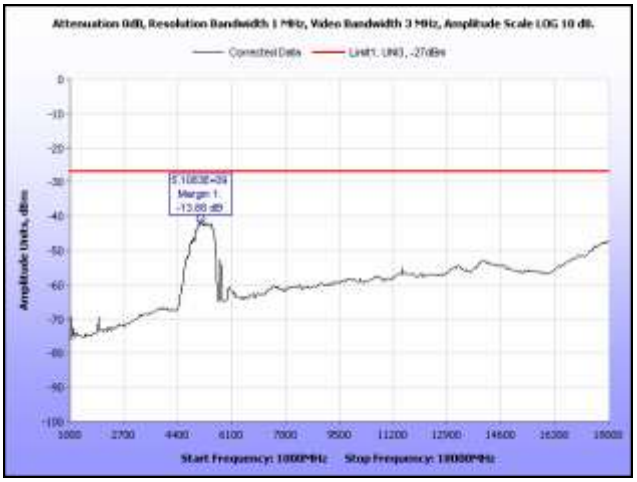
Plot 59. EIRP, 5805 MHz, 1 GHz – 18 GHz, Omni Antenna



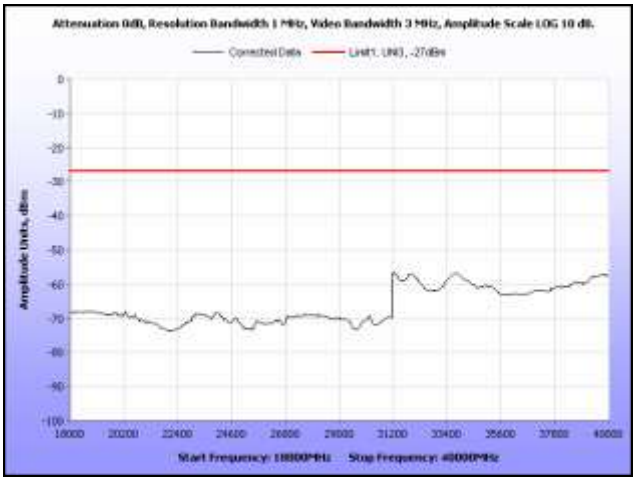
Plot 60. EIRP, 5805 MHz, 18 GHz – 40 GHz, Omni Antenna



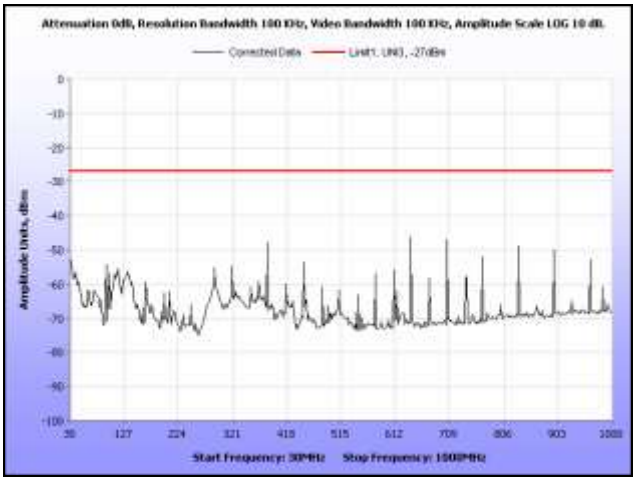
Plot 61. EIRP, 5745 MHz, 30 MHz – 1 GHz, Dish Antenna



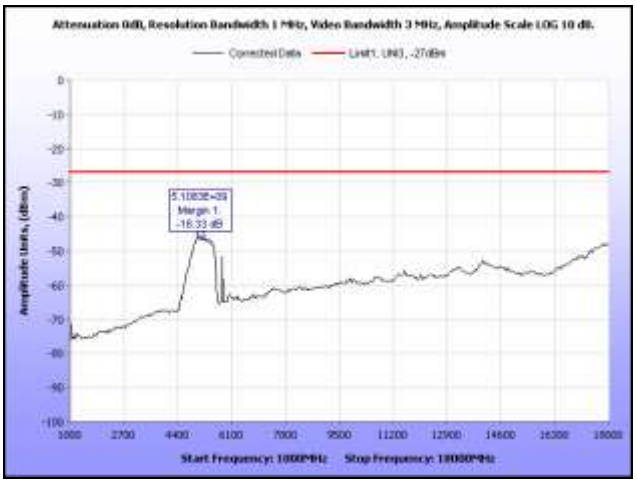
Plot 62. EIRP, 5745 MHz, 1 GHz – 18 GHz, Dish Antenna



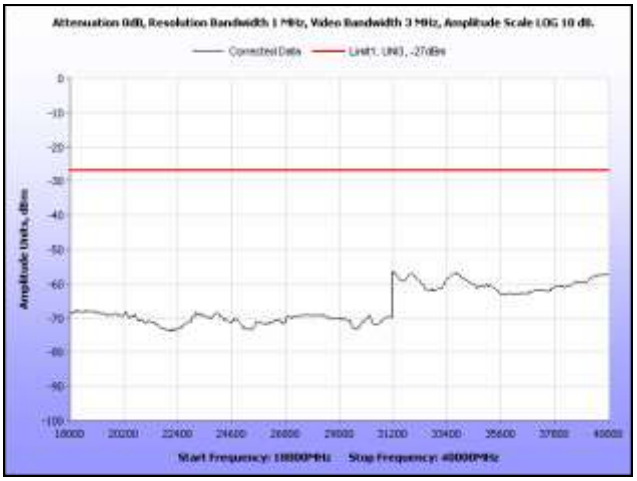
Plot 63. EIRP, 5745 MHz, 18 GHz – 40 GHz, Dish Antenna



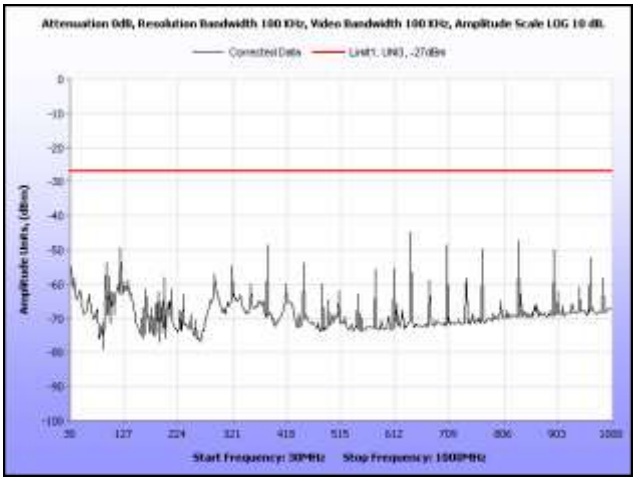
Plot 64. EIRP, 5785 MHz, 30 MHz – 1 GHz, Dish Antenna



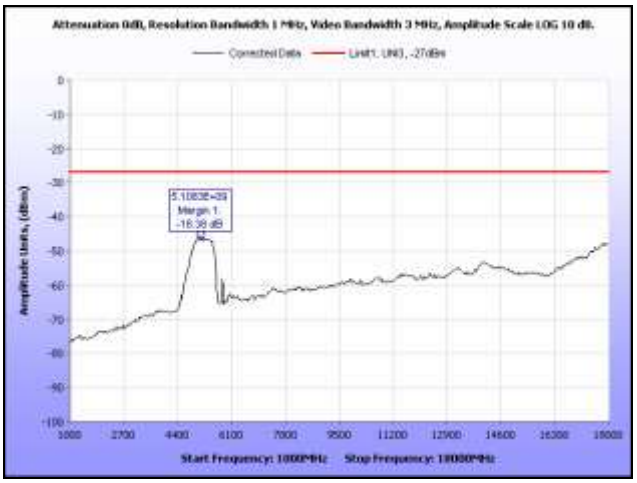
Plot 65. EIRP, 5785 MHz, 1 GHz – 18 GHz, Dish Antenna



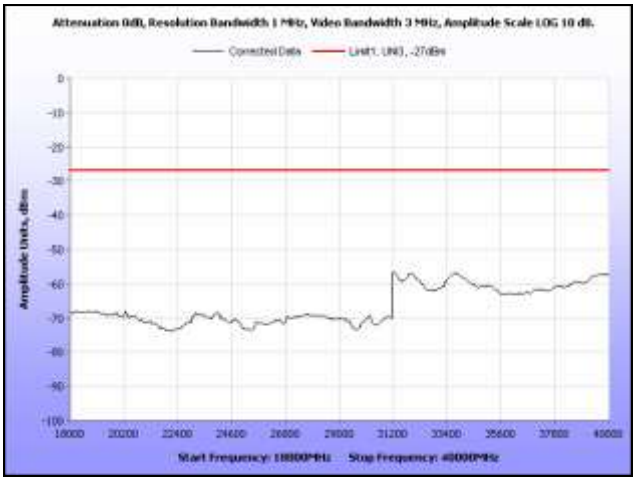
Plot 66. EIRP, 5785 MHz, 18 GHz – 40 GHz, Dish Antenna



Plot 67. EIRP, 5805 MHz, 30 MHz – 1 GHz, Dish Antenna

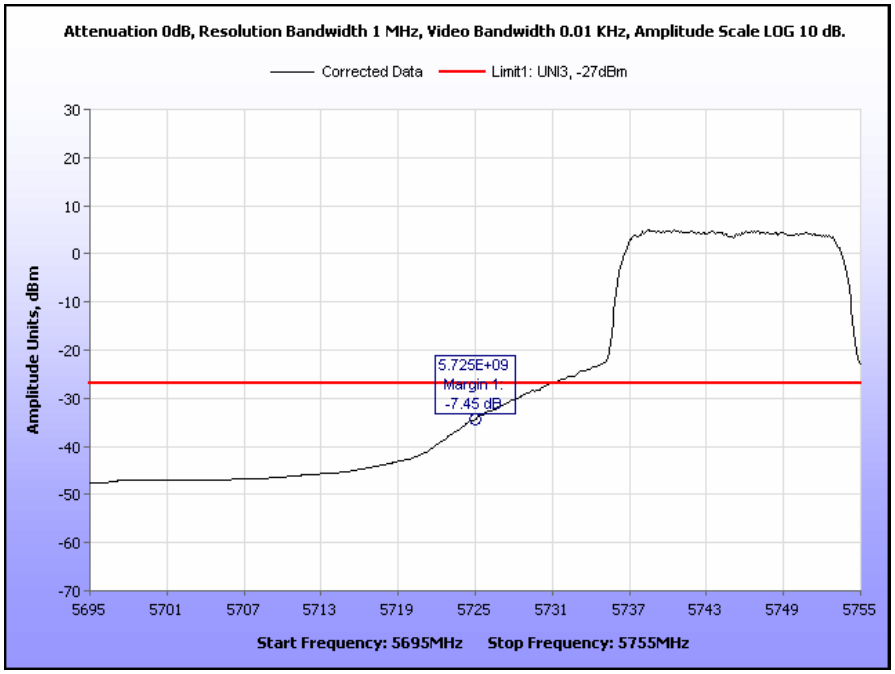


Plot 68. EIRP, 5805 MHz, 1 GHz – 18 GHz, Dish Antenna

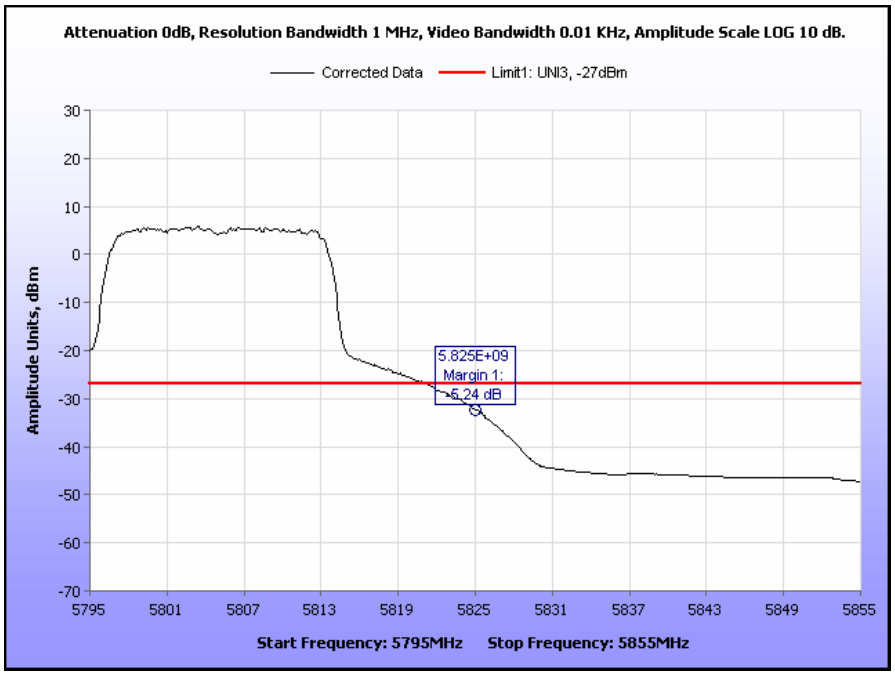


Plot 69. EIRP, 5805 MHz, 18 GHz – 40 GHz, Dish Antenna

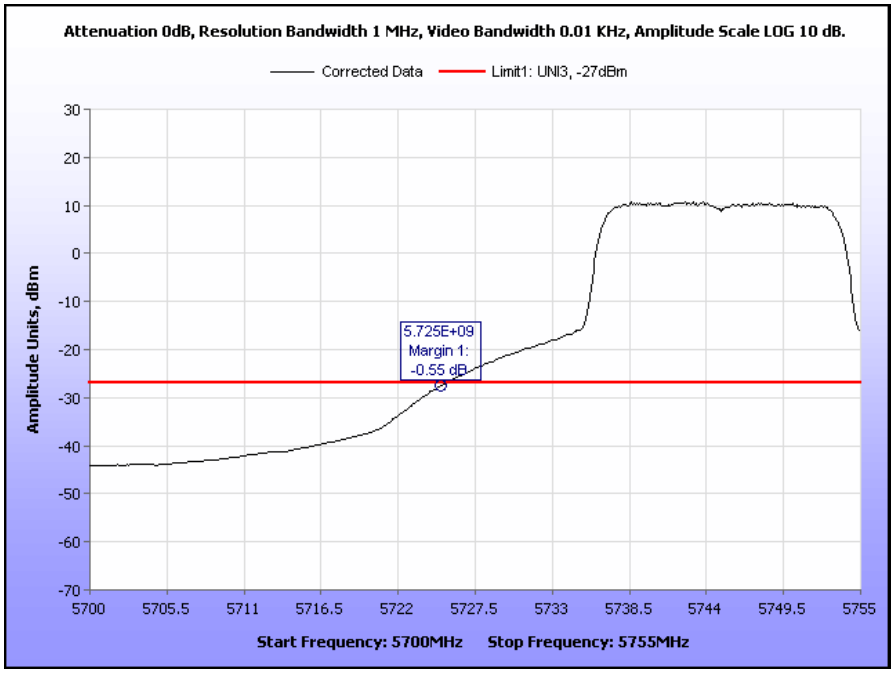
Radiated Band Edge



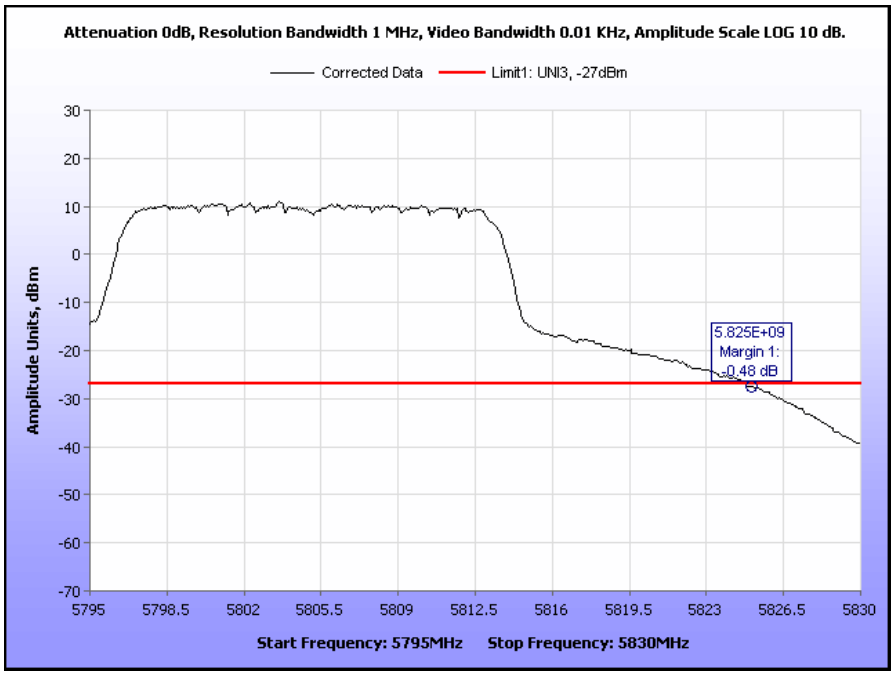
Plot 70. Radiated Band Edge, 5745 MHz



Plot 71. Radiated Band Edge, 5805 MHz



Plot 72. Radiated Band Edge, 5745 MHz, Dish Antenna



Plot 73. Radiated Band Edge, 5805 MHz, Dish Antenna

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 placed in a temperature chamber and connected directly to a spectrum analyzer through an attenuator. The EUT was set to transmit on the low channel. The resolution bandwidth was set to 1 MHz with a peak detector and the span was set to encompass the power envelope of the carrier. The peak of the channel was measured and the frequencies above and below the peak at which the spectral density was 6dB below the peak were found. These frequencies were used to calculate the center frequency of the channel and any frequency deviations. The frequency drift was investigated at increments of 10°C, with a temperature range of -20°C to +55°C. At ambient temperature (+20°C), the input voltage was varied between +/-10% of the nominal input voltage and the measurements were repeated.

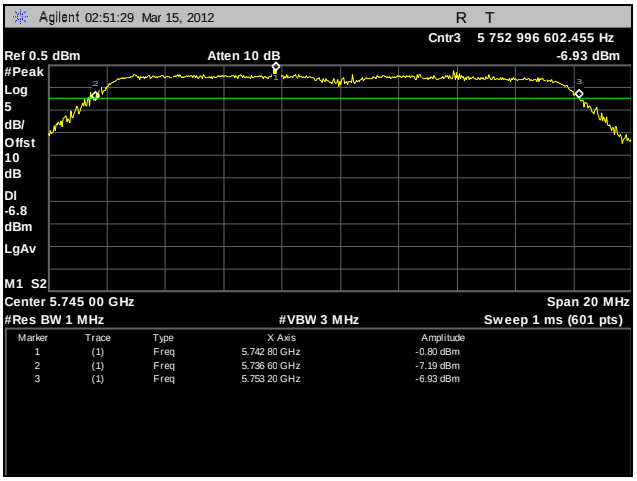
Test Results: The EUT was compliant with the requirements of **§15.407(g)**.

Test Engineer(s): Jeff Pratt

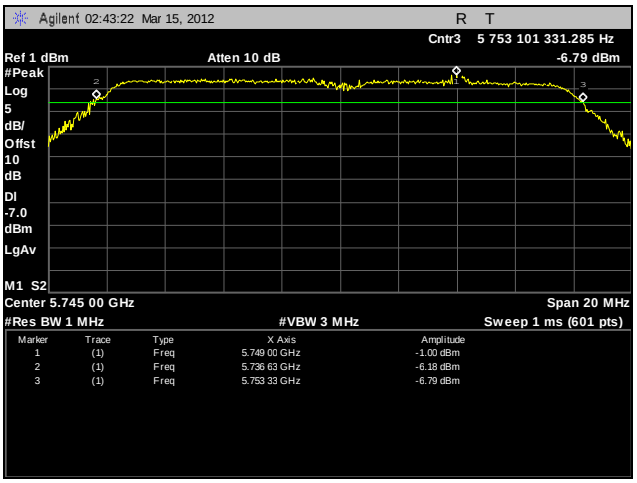
Test Date(s): 11/15/11

5745 MHz	Temperature (C)	Voltage (V)	Low Frequency (MHz)	High Frequency (MHz)	Center Frequency (MHz)	Departure (PPM)	Limit (PPM)	Margin (PPM)
Reference at 20C & 120V	-20	120	5736.874	5752.996	5744.935	6.09228595	20	-13.9077141
	-10	120	5736.926	5753.101	5745.0135	7.57184111	20	-12.4281589
	0	120	5736.902	5753.118	5745.01	6.96261251	20	-13.0373875
	10	120	5736.857	5753.047	5744.952	3.13317563	20	-16.8668244
	20	108	5736.878	5753.031	5744.9545	2.69801235	20	-17.3019877
5744.97	20	120	5736.91	5753.03	5744.97	0	20	-20
	20	132	5736.866	5753.035	5744.9505	3.3942736	20	-16.6057264
	30	120	5736.843	5753.066	5744.9545	2.69801235	20	-17.3019877
	40	120	5736.88	5753.069	5744.9745	0.78329391	20	-19.2167061
	50	120	5736.887	5753.093	5744.99	3.48130626	20	-16.5186937
	55	120	5736.921	5753.037	5744.979	1.56658782	20	-18.4334122

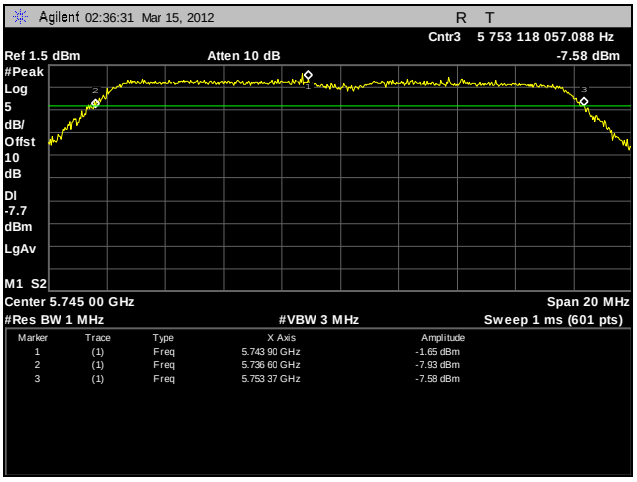
Table 18. Frequency Stability, Test Results



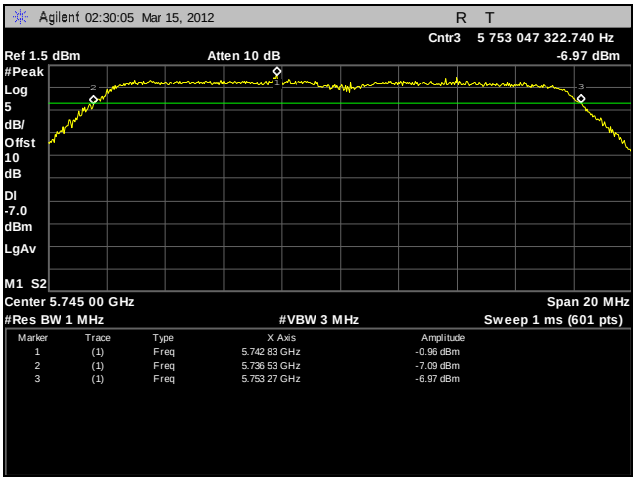
Plot 74. Frequency Stability, 5725 – 5825 MHz, -20°C, 120 V



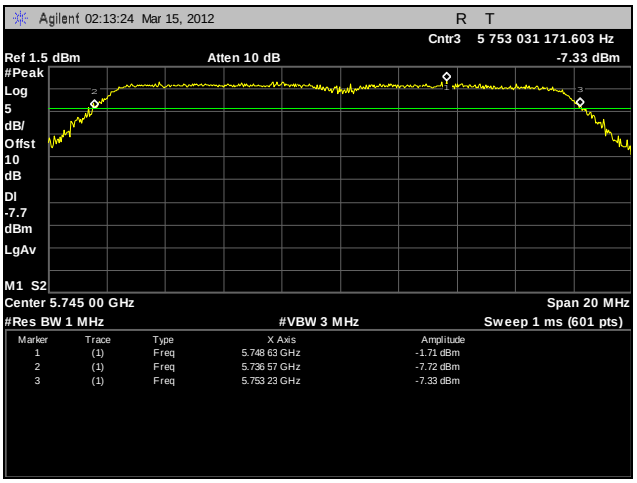
Plot 75. Frequency Stability, 5725 – 5825 MHz, -10°C, 120 V



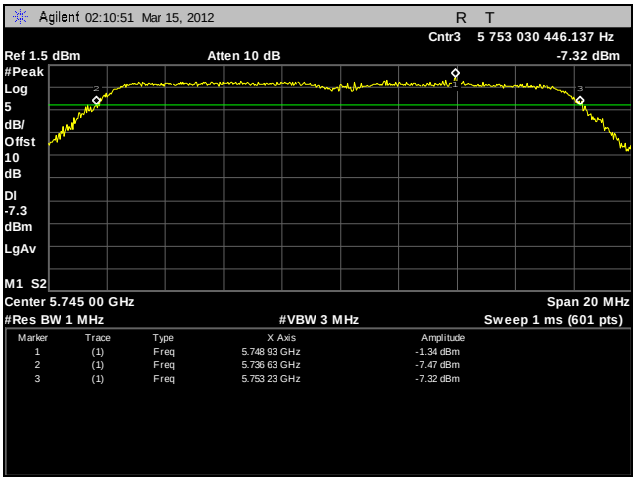
Plot 76. Frequency Stability, 5725 – 5825 MHz, 0°C, 120 V



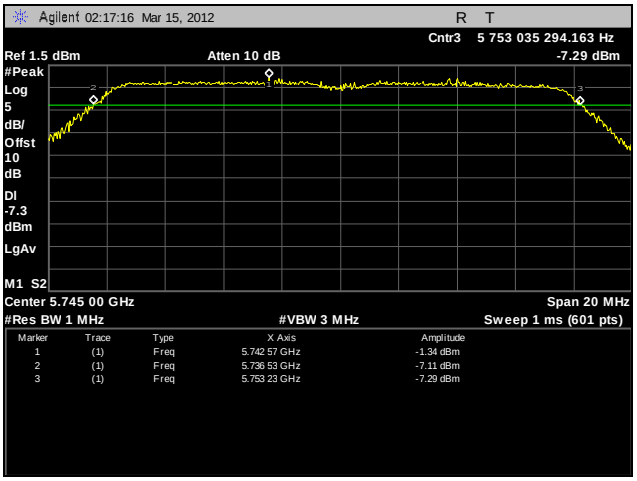
Plot 77. Frequency Stability, 5725 – 5825 MHz, 10°C, 120 V



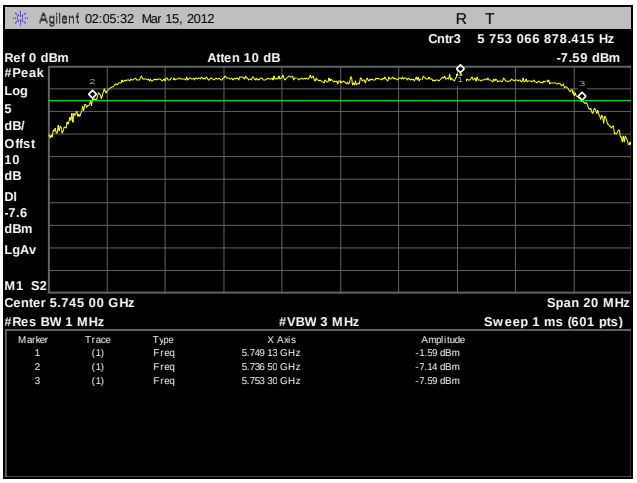
Plot 78. Frequency Stability, 5725 – 5825 MHz, 20°C, 108 V



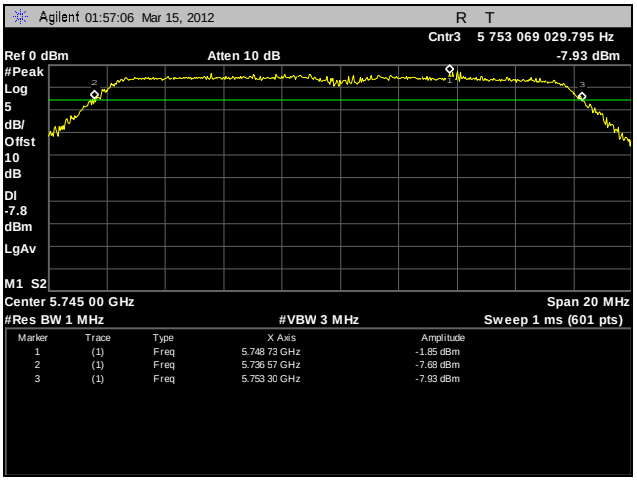
Plot 79. Frequency Stability, 5725 – 5825 MHz, 20°C, 120 V



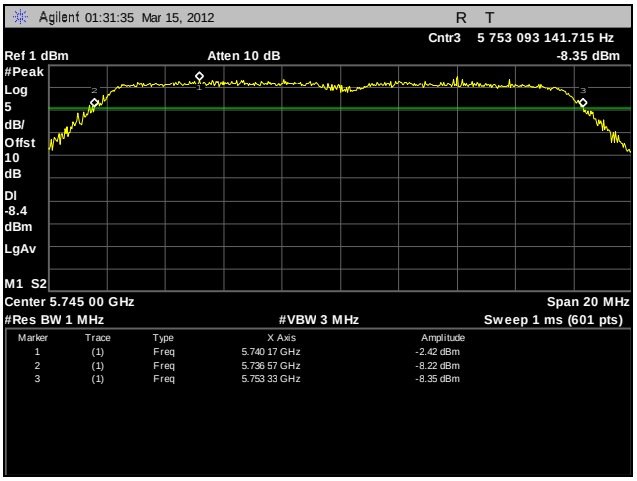
Plot 80. Frequency Stability, 5725 – 5825 MHz, 20°C, 132 V



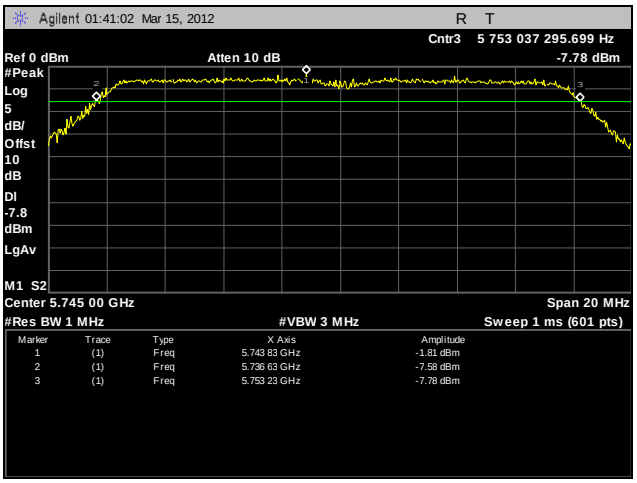
Plot 81. Frequency Stability, 5725 – 5825 MHz, 30°C, 120 V



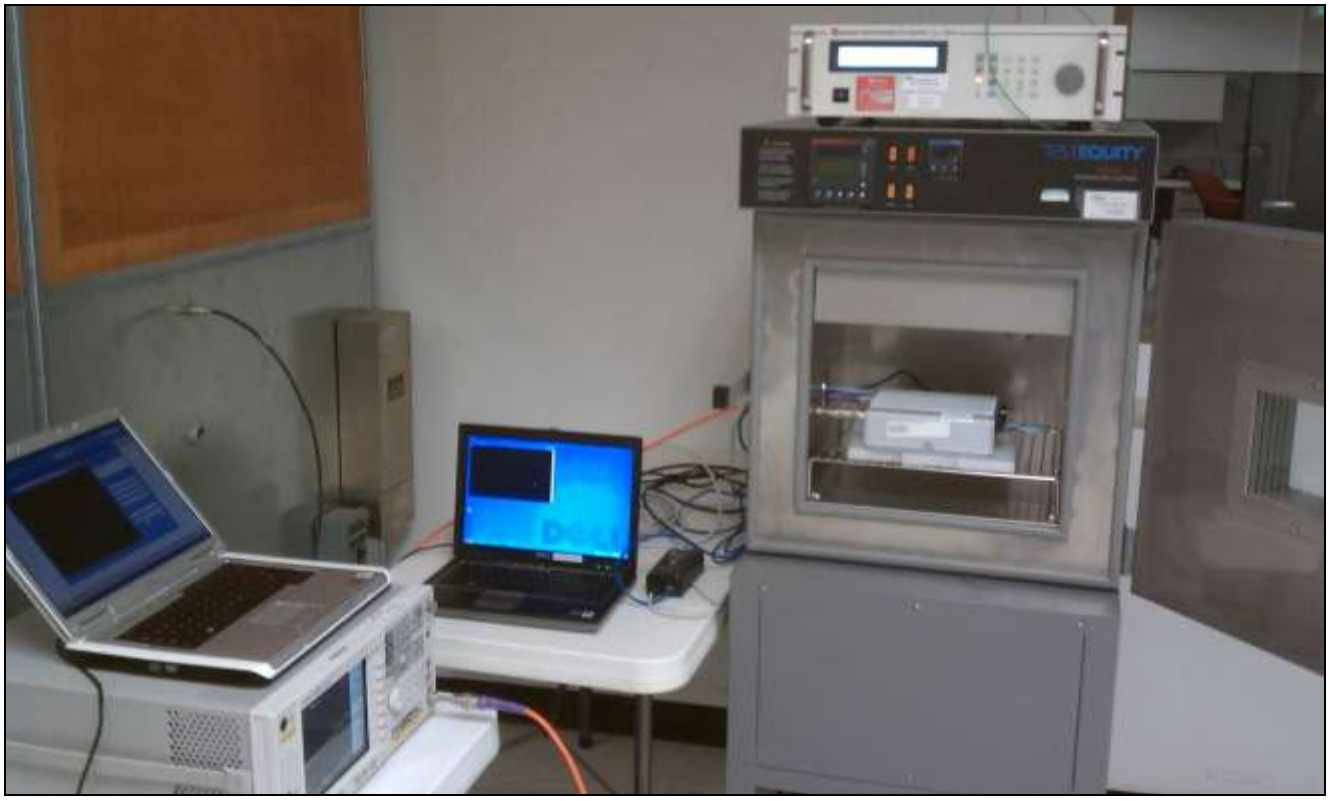
Plot 82. Frequency Stability, 5725 – 5825 MHz, 40°C, 120 V



Plot 83. Frequency Stability, 5725 – 5825 MHz, 50°C, 120 V



Plot 84. Frequency Stability, 5725 – 5825 MHz, 55°C, 120 V



Photograph 5. Frequency Stability, Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

RSS-GEN Receiver Spurious Emissions Requirements

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

(a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 19.

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

Table 19. Spurious Emission Limits for Receivers

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

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

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

Test Engineer(s): Jeff Pratt

Test Date(s): 03/19/12

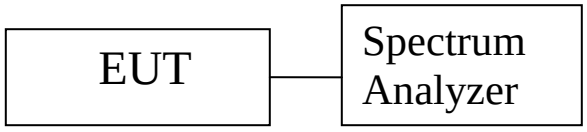
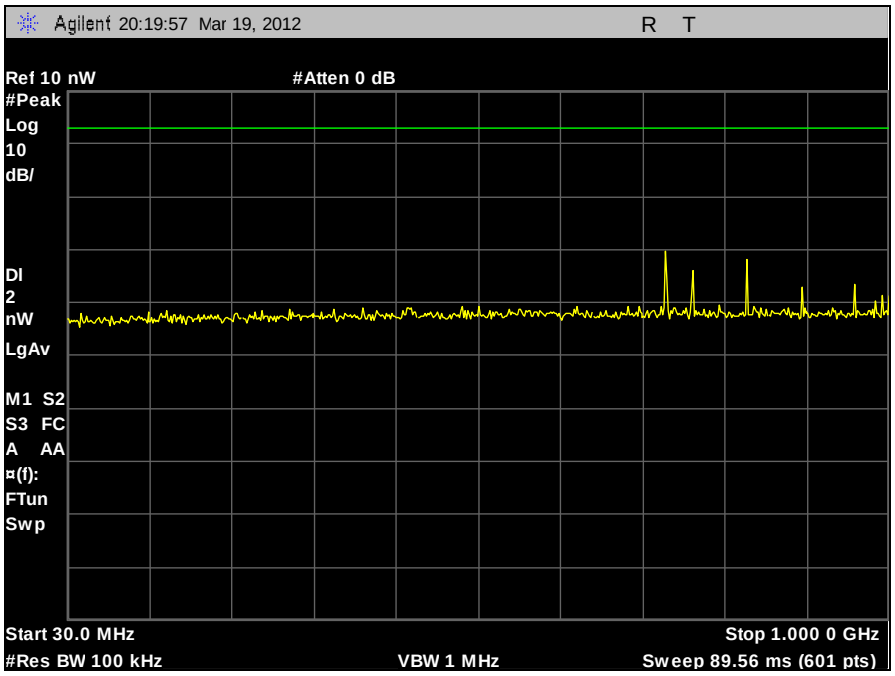
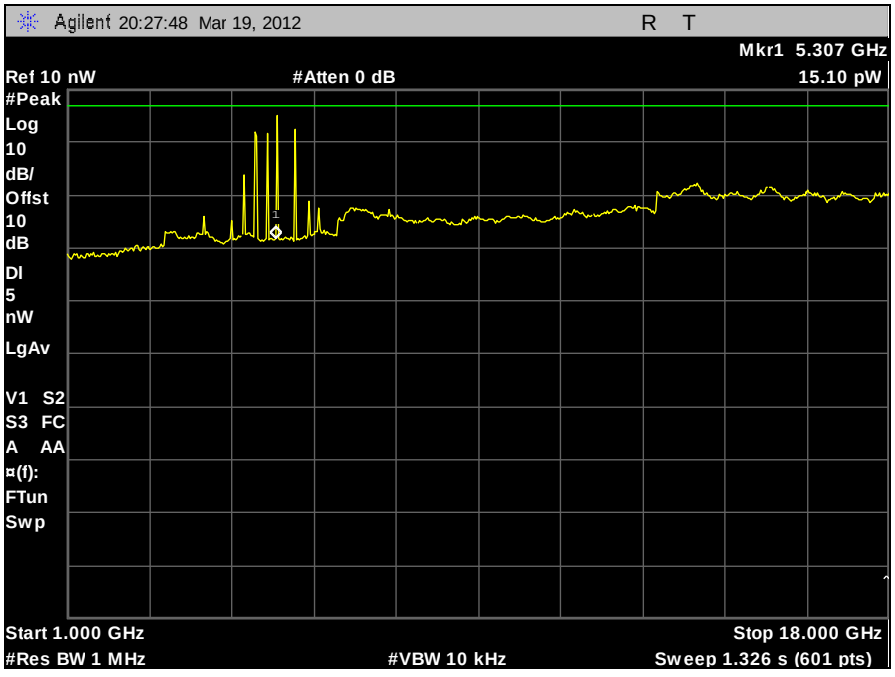


Figure 5. Block Diagram, Conducted Receiver Spurious Emissions Test Setup

Conducted Receiver Spurious Emissions



Plot 85. Receiver Spurious Emission, 30 MHz – 1 GHz



Plot 86. Receiver Spurious Emission, 1 GHz – 18 GHz

IV. Test Equipment

Test Equipment

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

MET ASSET #	EQUIPMENT	MANUFACTURER	MODEL	LAST CAL DATE	CAL DUE DATE
1T4214	SHIELD ROOM #4	UNIVERSAL SHIELD INC	N/A	SEE NOTE	
1T4621	ESA-E SERIES SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4402B	5/31/2011	5/31/2012
1T4565	LISN (10 AMP)	SOLAR ELECTRONICS	9252-50-R-24-BNC	12/15/2011	12/15/2012
1T4758	THERMO/HYGROMETER	CONTROL COMPANY	4040	5/21/2010	5/21/2012
1T4300	SEMI-ANECHOIC CHAMBER # 1	EMC TEST SYSTEMS	NONE	8/23/2010	8/23/2013
1T4751	ANTENNA; BILOG	SUNOL SCIENCES	JB6	12/7/2011	12/7/2012
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	6/14/2011	6/14/2012
1T4634	THERMO/HYGROMETER	CONTROL COMPANY	02-401	3/11/2010	3/11/2012
1T4505	TEMPERATURE CHAMBER	TEST EQUITY	115	11/30/2011	11/30/2012
1T4728	PROGRAMMABLE AC POWER SOURCE	QUADTECH	31010	SEE NOTE	
1T4612	SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4407B	12/15/2010	6/15/2012
1T4483	ANTENNA; HORN	ETS-LINDGREN	3117	7/19/2011	7/19/2012
1T4745	ANTENNA; HORN	ETS-LINDGREN	3116	10/4/2011	10/4/2012
1T4442	PRE-AMPLIFIER, MICROWAVE	MITEQ	AFS42-01001800-30-10P	SEE NOTE	
1T4752	PRE-AMPLIFIER	MITEQ	JS44-18004000-35-8P	SEE NOTE	
1T4771	SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4446A	6/25/2011	6/25/2012
1T4502	COMB GENERATOR	COM-POWER	CGC-255	11/3/2011	11/3/2012
1T4568	RADIATING NOISE SOURCE	MET LABORATORIES	N/A	SEE NOTE	
1T4149	HIGH-FREQUENCY ANECHOIC CHAMBER	RAY-PROOF	81	CAL NOT REQUIRED	
1T4246	DIRECTIONAL COUPLER	HP	11691D	SEE NOTE	

Table 20. 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