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 11, 2013

Amimon
2 Maskit St. Building D, 2nd Floor
Herzelia, Israel 46733

Dear Guy Dar,

Enclosed is the EMC Wireless test report for compliance testing of the Amimon, Falcon RX, Amimon P/N-AMN36254 as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Title 47 of the CFR, Part 15, Subpart B for Unintentional Radiators and Part 15.407 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: (\Amimon\EMC37062B-FCC407 UNII 2 Rev. 1)

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Electromagnetic Compatibility Criteria
Test Report

for the

Amimon
Model Falcon RX, Amimon P/N-AMN36254

Tested under
the Certification Rules
contained in
Title 47 of the CFR, Part 15, Subpart B
for Unintentional Radiators
and
Title 47 of the CFR, Part 15.407
for Intentional Radiators

MET Report: EMC37062B-FCC407

March 11, 2013

Prepared For:

Amimon
2 Maskit St. Building D, 2nd Floor
Herzelia, 46733

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 under normal use and maintenance.

Asad Bajwa, Director
Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	February 19, 2013	Initial Issue.
1	March 11, 2013	Revised to reflect customer corrections.

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List of Terms and Abbreviations

AC	**A**lternating **C**urrent
ACF	**A**ntenna **C**orrection **F**actor
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci**b**els
dBµA	**D**eci**b**els above one **micro**amp
dBµV	**D**eci**b**els above one **micro**volt
dBµA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBµV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**ert**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**ert**z**
kPa	**k**ilo**pa**scal
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µ**H**	**microh**enry
µ	**microf**arad
µ**s**	**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 Amimon Falcon RX, Amimon P/N-AMN36254, 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 Falcon RX, Amimon P/N-AMN36254. Amimon should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Falcon RX, Amimon P/N-AMN36254, 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 Amimon, purchase order number 120291. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference	Description	Results
15.107	Conducted Emissions	Compliant
15.109	Radiated Emissions	Compliant
15.203	Antenna Requirements	Compliant
15.207	AC Conducted Emissions 150KHz – 30MHz	Compliant
15.403 (i)	26dB Occupied Bandwidth	Compliant
15.407 (a)(2)	Conducted Transmitter Output Power	Compliant
15.407 (a)(2)	Power Spectral Density	Compliant
15.407 (a)(6)	Peak Excursion	Compliant
15.407 (b)(2), (3), (5), (6)	Undesirable Emissions (15.205/15.209 - General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Compliant
15.407(f)	RF Exposure	Compliant
15.407(g)	Frequency Stability	Compliant
15.407 (h)(2)(ii)	Initial Channel Availability Check Time	Compliant
15.407 (h)	DFS Bandwidth	Compliant
15.407 (h)(2)(ii)	Radar Burst at the Beginning of Channel Availability Check Time	Compliant
15.407 (h)(2)(ii)	Radar Burst at the End of Channel Availability Check Time	Compliant
15.407 (h)(2)(iii)	Channel Move Time and Channel Closing Time	Compliant
15.407 (h)(2)(iv)	Non-Occupancy Period	Compliant
15.407 (h)(2)	Statistical Performance Check	Compliant

Table 1. Executive Summary of EMC Part 15.407 ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Amimon to perform testing on the Falcon RX, Amimon P/N-AMN36254, under Amimon's purchase order number 120291.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Amimon Falcon RX, Amimon P/N-AMN36254.

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

Model(s) Tested:	Falcon RX, Amimon P/N-AMN36254	
Model(s) Covered:	Falcon RX, Amimon P/N-AMN36254	
EUT Specifications:	Primary Power: 120 VAC, 60 Hz	
	Secondary Power: 12 VDC	
	FCC ID: VQSAMN36254	
	Type of Modulations:	OFDM
	Equipment Code:	NII
	Peak RF Output Power:	18.58 dBm
	EUT Frequency Ranges:	5260 – 5320 MHz 5500 – 5580 MHz 5660 – 5700 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:	Jeffrey Pratt	
Report Date(s):	March 11, 2013	

Table 2. EUT Summary

B. References

CFR 47, Part 15, Subpart B	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
CFR 47, Part 15, Subpart E	Unlicensed National Information Infrastructure Devices (UNII)
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

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 AMN35254/AMN36254 are respectively wireless A/V transmitter/receiver boards, which works at the 5GHz unlicensed band.

Photograph 1. Amimon Falcon RX, Amimon P/N-AMN36254

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
N/A	HD-SDI Wireless Receiver module	AMN36254	N/A	SDT1260044	2.0

Table 4. Equipment Configuration

F. Support Equipment

Amimon supplied support equipment necessary for the operation and testing of the Falcon RX, Amimon P/N-AMN36254. All support equipment supplied is listed in the following Support Equipment List.

Ref. ID	Name / Description	Manufacturer	Model Number
N/A	PC Laptop		
N/A	Debug Board (MAC)	Amimon	AMN043PCB
N/A	Debug Board (APP)	Amimon	AMN043PCB
N/A	USB-to-Serial Converter (MAC)	ATEN	UC-232A
N/A	USB-to-Serial Converter (APP)	ATEN	UC-232A
N/A	SDI to HDMI Converter	CYPRESS	CLUX-SDI2SHC
N/A	12V Power Supply	Switching Power Supply	S075AQ12000600
N/A	HDMI Cable	Standard	standard

Table 5. Support Equipment

G. Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Point
J1	J1 power supply	XH-4P-with Tin L=200 1007-28#	1	0.2	N	Power Supply
J16	J16 – SDI out#1	75 ohm SDI cable BNC-P to BNC-P	1	3	Y	HDMI to SDI converter
J21	J21 – MAC	Standard USB able with USB to serial converter	1	2	Y	PC
J20	J20 – APP	Standard USB able with USB to serial converter	1	2	Y	PC
J15	J16 – SDI out#2	75ohm BNC termination	N/A	N/A	N/A	N/A

Table 6. Ports and Cabling Information

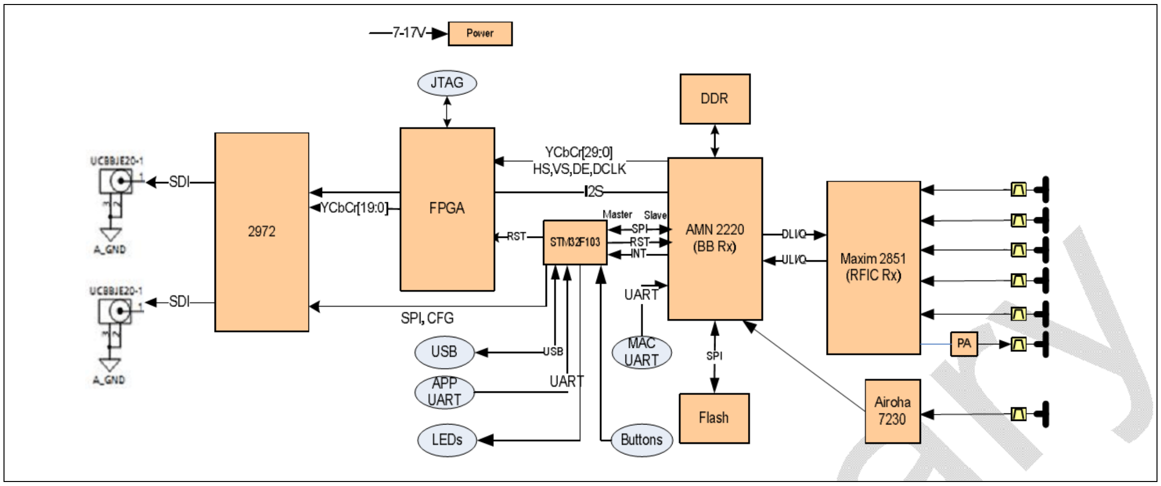


Figure 1. Block Diagram of Equipment

H. Mode of Operation

The AMN36254 WHDI Sink is designed to be at the receiver end of the WHDI downstream. TheAMN36254 receives wireless downstream transmission, demodulates it and regenerates the video, audio and control content transmitted by the AMN15020 WHDI source. The receiver works at the5GHz unlicensed band.
The AMN36254 has a MIMO design of five wireless input channels and one channel output wireless channel, which generates an upstream channel for data content transmissions.
The uncompressed video and audio from the WHDI sink are connected to the Gennum SDI 2972 transmitter with an SDI connector.
The ST STM32F103 application microcontroller controls the SDI transmitter and the AMN2220 baseband receiver using SPI bus. The application microcontroller provides USB device interface through a mini USB connector.

I. Method of Monitoring EUT Operation

Using AppCom (Amimon designated SW) for commands and LOG.

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 Amimon upon completion of testing.

III. Electromagnetic Compatibility Criteria for Unintentional Radiators

Electromagnetic Compatibility Criteria

§ 15.107 Conducted Emissions Limits

Test Requirement(s): **15.107 (a)** Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 7. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

15.107 (b) For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 7. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

Frequency range (MHz)	Class A Conducted Limits (dBμV)		*Class B Conducted Limits (dBμV)	
	Quasi-Peak	Average	Quasi-Peak	Average
* 0.15- 0.45	79	66	66 - 56	56 - 46
0.45 - 0.5	79	66	56	46
0.5 - 30	73	60	60	50

Note 1 — The lower limit shall apply at the transition frequencies.

Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz.

* -- Limits per Subsection 15.207(a).

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

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

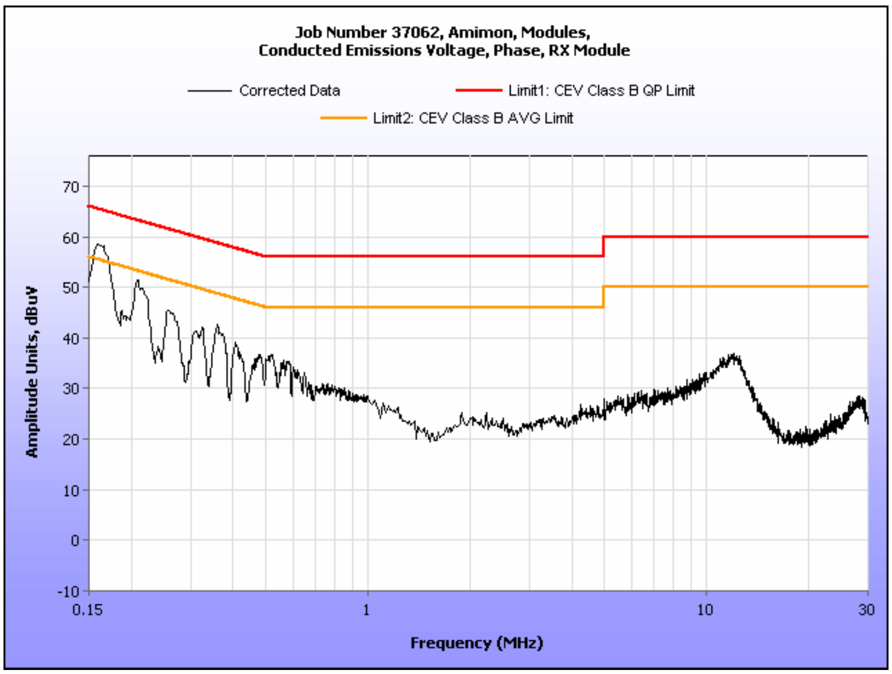
Test Engineer(s): Zijun Tong

Test Date(s): 12/17/12

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.
0.152	53.82	0	53.82	65.89	-12.07	35.62	0	35.62	55.89	-20.27
0.2009	45.65	0	45.65	63.57	-17.92	30.64	0	30.64	53.57	-22.93
0.254	39.01	0	39.01	61.63	-22.62	24.3	0	24.3	51.63	-27.33
0.3211	34.93	0	34.93	59.68	-24.75	21.75	0	21.75	49.68	-27.93
0.365	36.33	0	36.33	58.61	-22.28	26.41	0	26.41	48.61	-22.2
0.403	33.19	0	33.19	57.79	-24.6	20.52	0	20.52	47.79	-27.27

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

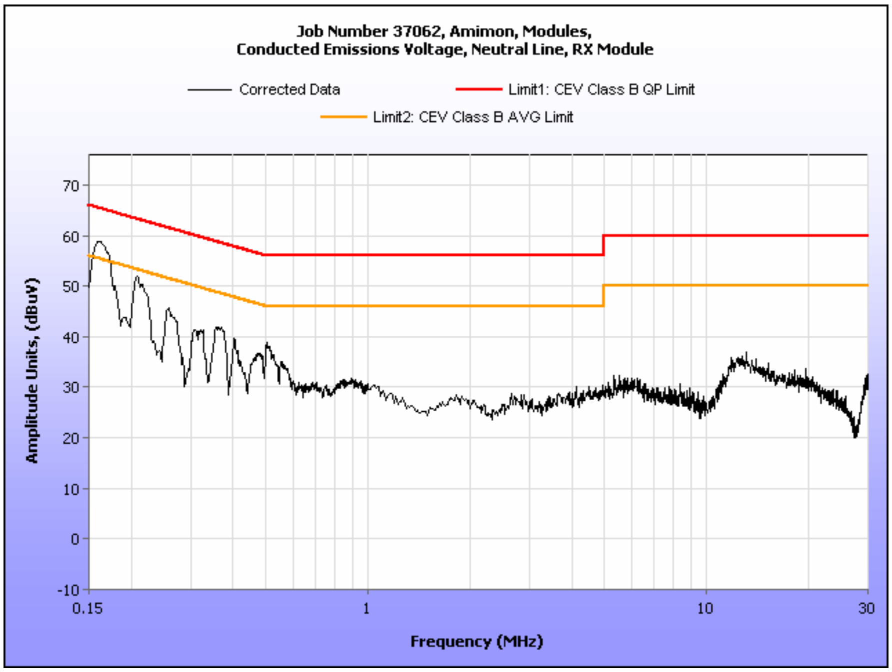


Plot 1. Conducted Emission, Phase Line Plot

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

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.
0.1513	52.9	0	52.9	65.93	-13.03	33.37	0	33.37	55.93	-22.56
0.2	45.22	0	45.22	63.61	-18.39	30.41	0	30.41	53.61	-23.2
0.2505	37.23	0	37.23	61.74	-24.51	23	0	23	51.74	-28.74
0.3166	35.99	0	35.99	59.8	-23.81	23.85	0	23.85	49.8	-25.95
0.359	35.92	0	35.92	58.75	-22.83	23.6	0	23.6	48.75	-25.15
0.5025	33.64	0	33.64	56	-22.36	21.84	0	21.84	46	-24.16

Table 9. 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 10.

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

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

Table 10. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b)

Test Procedures: The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.4 were used. An antenna was located 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 B requirement(s) of this section. Measured emissions were below applicable limits.

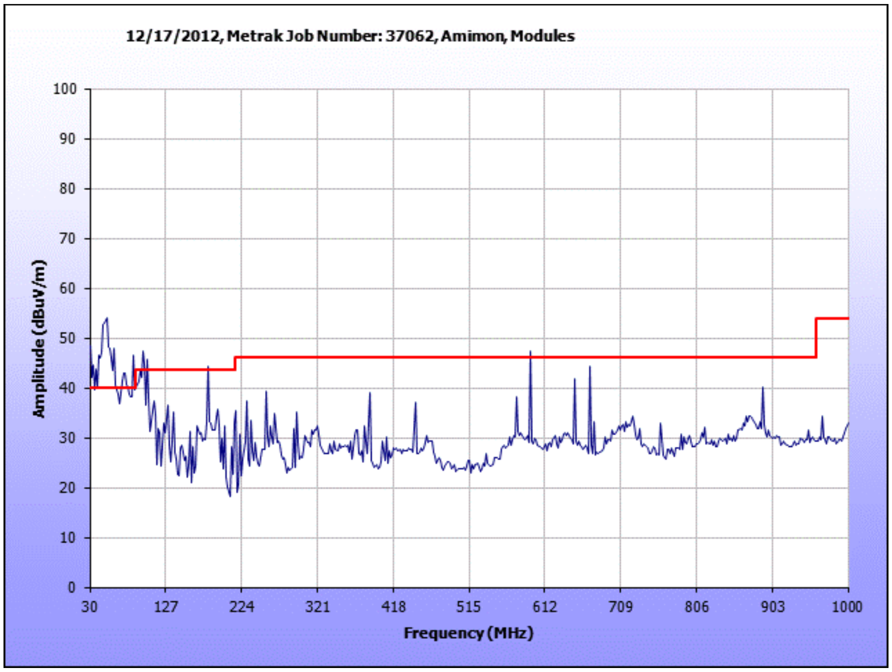
Test Engineer(s): Zijun Tong

Test Date(s): 12/17/12

Radiated Emissions Limits Test Results, Class B

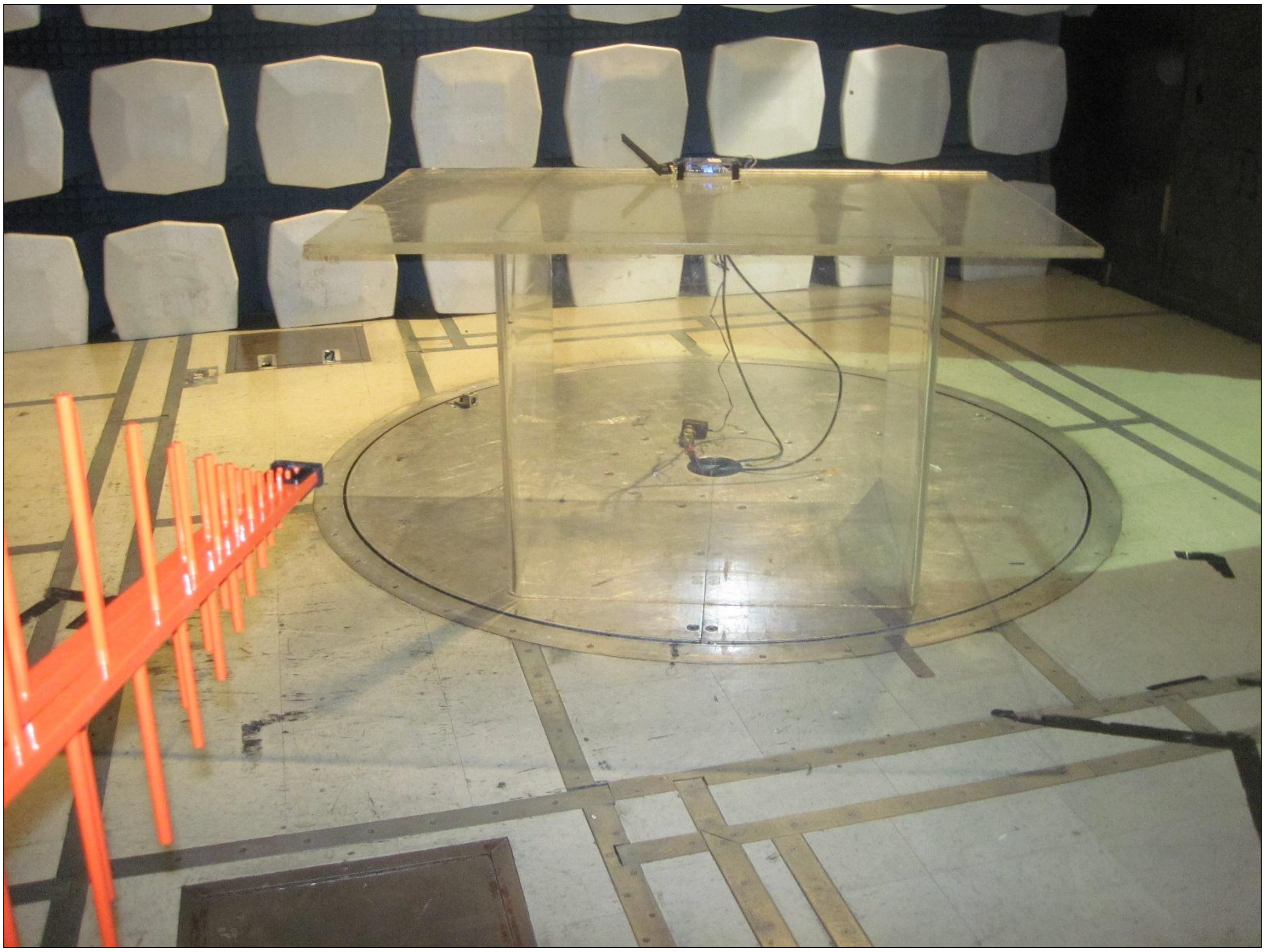
Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
38.376482	360	H	1.05	5.02	15.70	0.57	0.00	21.29	40.00	-18.71
38.376482	309	V	1.02	14.09	15.70	0.57	0.00	30.36	40.00	-9.64
45.04097	360	H	1.00	5.10	11.18	0.62	0.00	16.90	40.00	-23.10
45.04097	307	V	1.04	24.25	11.18	0.62	0.00	36.05	40.00	-3.95
48.095634	233	H	1.65	6.30	9.55	0.66	0.00	16.51	40.00	-23.49
48.095634	262	V	1.01	21.69	9.55	0.66	0.00	31.90	40.00	-8.10
55.646722	360	H	1.64	5.50	7.54	0.68	0.00	13.72	40.00	-26.28
55.646722	360	V	1.00	15.96	7.54	0.68	0.00	24.18	40.00	-15.82
67.040887	360	H	1.48	5.42	8.01	0.75	0.00	14.18	40.00	-25.82
67.040887	0	V	1.57	5.57	8.01	0.75	0.00	14.33	40.00	-25.67
82.386559	360	H	1.45	5.02	7.80	0.85	0.00	13.67	40.00	-26.33
82.386559	0	V	1.29	11.04	7.80	0.85	0.00	19.69	40.00	-20.31
82.585441	360	H	1.61	5.02	7.80	0.86	0.00	13.68	40.00	-26.32
82.585441	0	V	1.11	12.73	7.80	0.86	0.00	21.39	40.00	-18.61
87.995171	252	H	1.55	5.65	7.70	0.89	0.00	14.24	40.00	-25.76
87.995171	0	V	1.02	13.47	7.70	0.89	0.00	22.06	40.00	-17.94
102.70444	61	H	1.43	5.72	10.97	0.96	0.00	17.65	43.50	-25.85
102.70444	0	V	1.05	9.78	10.97	0.96	0.00	21.71	43.50	-21.79
148.48178	0	H	1.89	5.57	13.10	1.11	0.00	19.78	43.50	-23.72
148.48178	360	V	1.00	12.15	13.10	1.11	0.00	26.36	43.50	-17.14
171.31324	327	H	1.63	9.44	11.87	1.16	0.00	22.47	43.50	-21.03
171.31324	360	V	1.00	18.75	11.87	1.16	0.00	31.78	43.50	-11.72
174.50431	235	H	1.52	10.28	11.55	1.16	0.00	22.99	43.50	-20.51
174.50431	0	V	1.02	10.37	11.55	1.16	0.00	23.08	43.50	-20.42
222.73308	227	H	1.05	11.00	11.61	1.24	0.00	23.85	46.00	-22.15
222.73308	166	V	1.02	18.64	11.61	1.24	0.00	31.49	46.00	-14.51
296.98999	358	H	1.33	22.39	14.04	1.56	0.00	37.99	46.00	-8.01
296.98999	318	V	1.48	22.39	14.04	1.56	0.00	37.99	46.00	-8.01
319.78033	64	H	1.19	16.05	14.60	1.52	0.00	32.17	46.00	-13.83
319.78033	1	V	1.38	11.89	14.60	1.52	0.00	28.01	46.00	-17.99
593.98702	0	H	2.09	15.14	19.50	2.21	0.00	36.85	46.00	-9.15
593.98702	167	V	1.03	18.20	19.50	2.21	0.00	39.91	46.00	-6.09
668.23637	309	H	1.38	10.00	20.56	2.34	0.00	32.90	46.00	-13.10
668.23637	86	V	1.73	11.16	20.56	2.34	0.00	34.06	46.00	-11.94

Table 11. Radiated Emissions Limits, Test Results



Plot 3. Radiated Emissions, Pre-Scan

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 has a unique antenna connector. Therefore, the EUT as tested is compliant with the criteria of §15.203.

Gain	Type	Manufacturer	Model
5 dBi	Omni	Laird	RD2458-5-RSMA
2 dBi	Omni	Wanshih	WSS 002
2 dBi	Chip	Johanson	5400AT18A1000 (See note)

Note: Chip antenna only used for Channel Availability Check in UNII2 bands. Not used for transmission.

Test Engineer(s): Jeff Pratt

Test Date(s): 01/14/2013

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). 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.

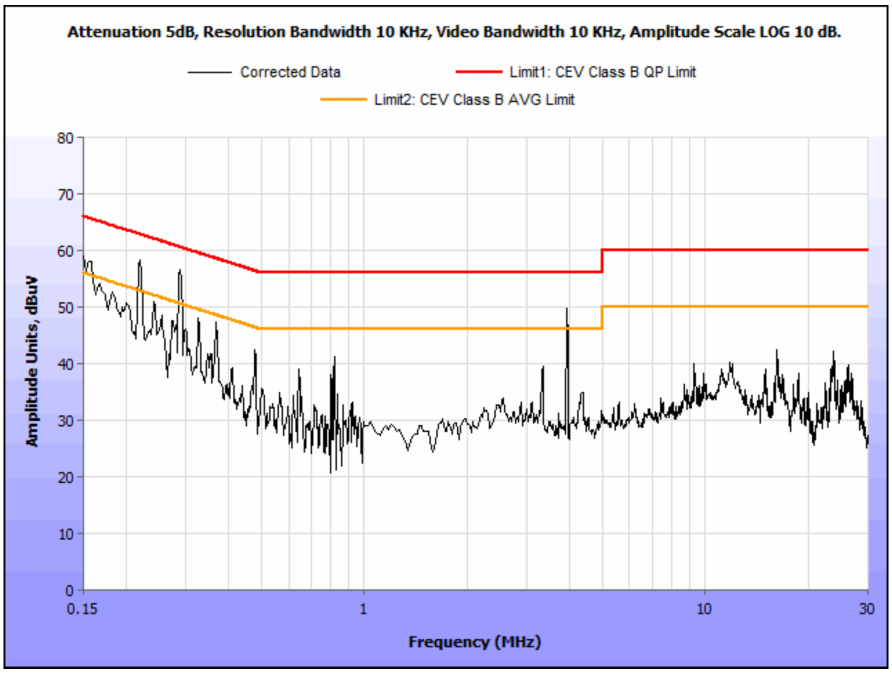
Test Engineer(s): Jeff Pratt

Test Date(s): 01/18/13

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.
0.208	32.53	0	32.53	63.29	-30.76	19.66	0	19.66	53.29	-33.63
0.295	25.13	0	25.13	60.38	-35.25	15.99	0	15.99	50.38	-34.39
0.722	27.6	0	27.6	56	-28.4	25.7	0	25.7	46	-20.3
3.321	25.98	0	25.98	56	-30.02	19.11	0	19.11	46	-26.89
3.927	41.44	0	41.44	56	-14.56	17.15	0	17.15	46	-28.85
16.24	33.65	0	33.65	60	-26.35	27.87	0	27.87	50	-22.13

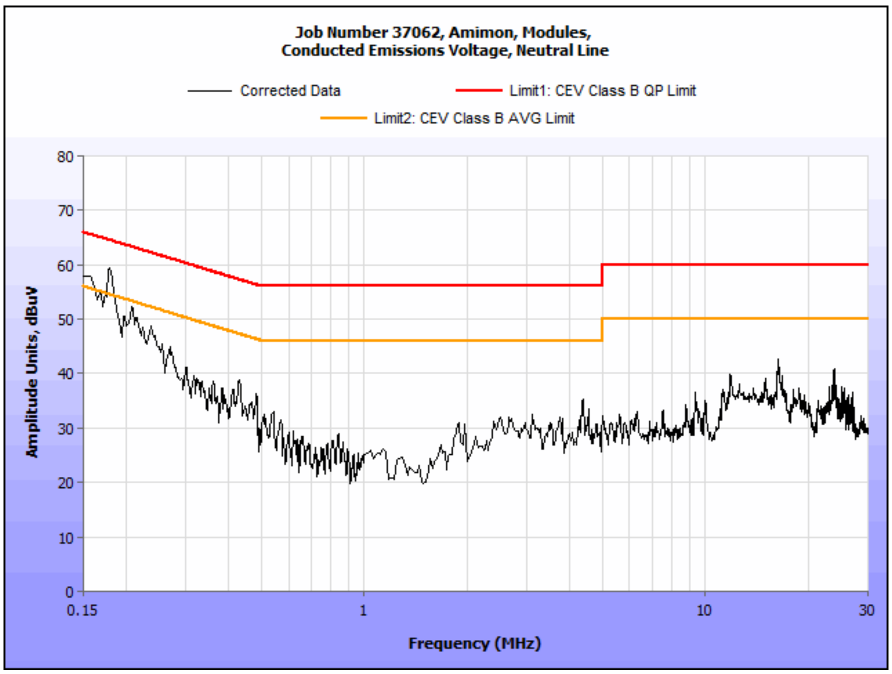
Table 13. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz)



Plot 4. Conducted Emissions, 15.207, Pre-Scan, 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.
4.342	28.68	0	28.68	56	-27.32	24.08	0	24.08	46	-21.92
11.16	31.46	0	31.46	60	-28.54	26.93	0	26.93	50	-23.07
11.88	33.93	0	33.93	60	-26.07	28.61	0	28.61	50	-21.39
16.33	34.72	0	34.72	60	-25.28	28.92	0	28.92	50	-21.08
23.73	34.3	0	34.3	60	-25.7	28.86	0	28.86	50	-21.14
26.48	24.78	0	24.78	60	-35.22	18.37	0	18.37	50	-31.63

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



Plot 5. Conducted Emissions, 15.207, Pre-Scan, Neutral 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): 01/20/13

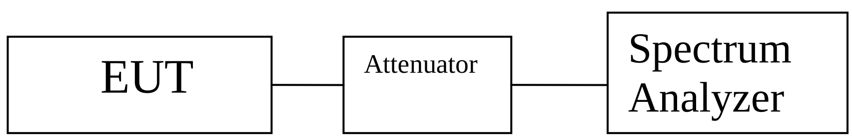
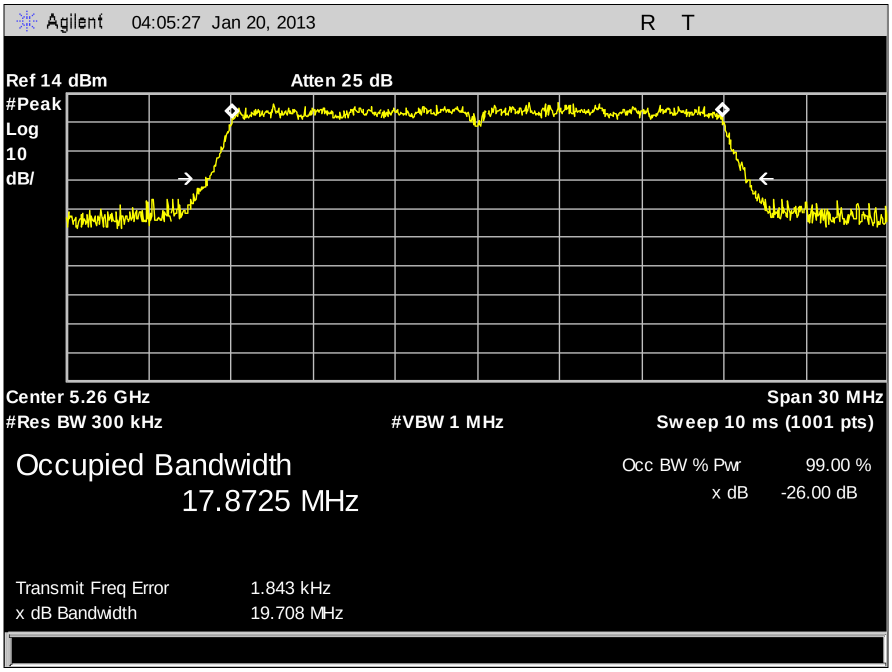
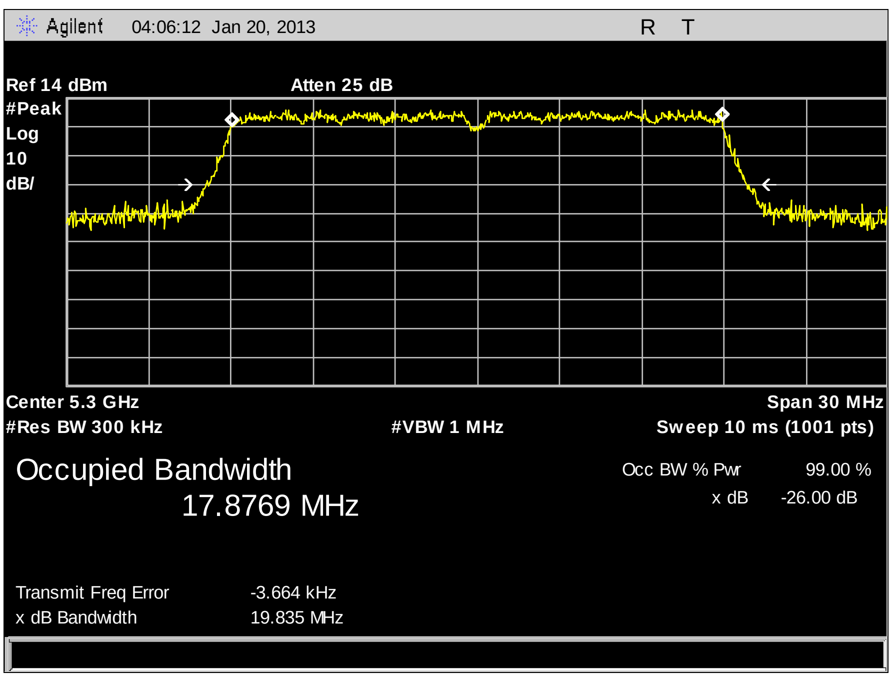


Figure 2. Occupied Bandwidth, Test Setup

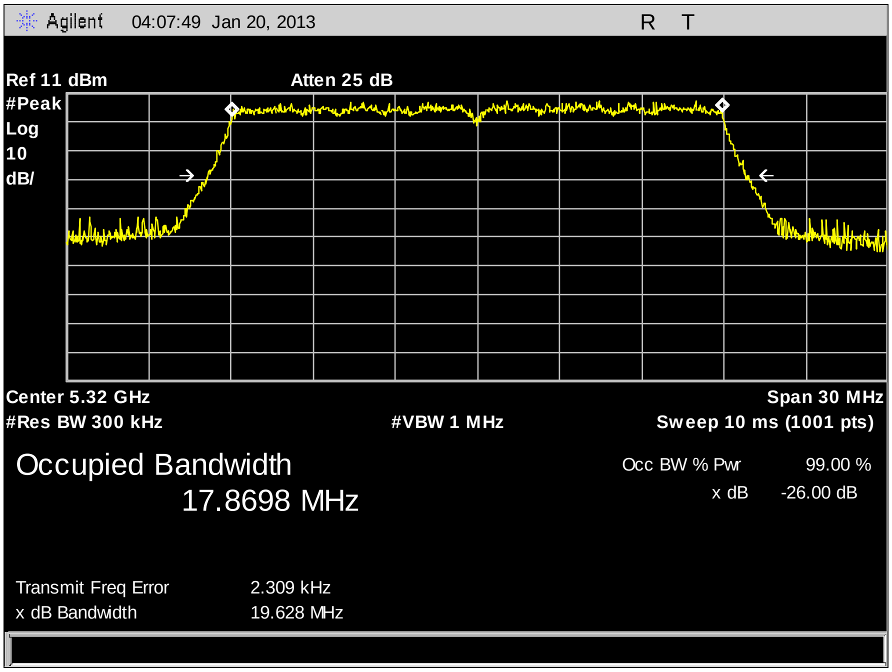
Electromagnetic Compatibility Criteria for Intentional Radiators



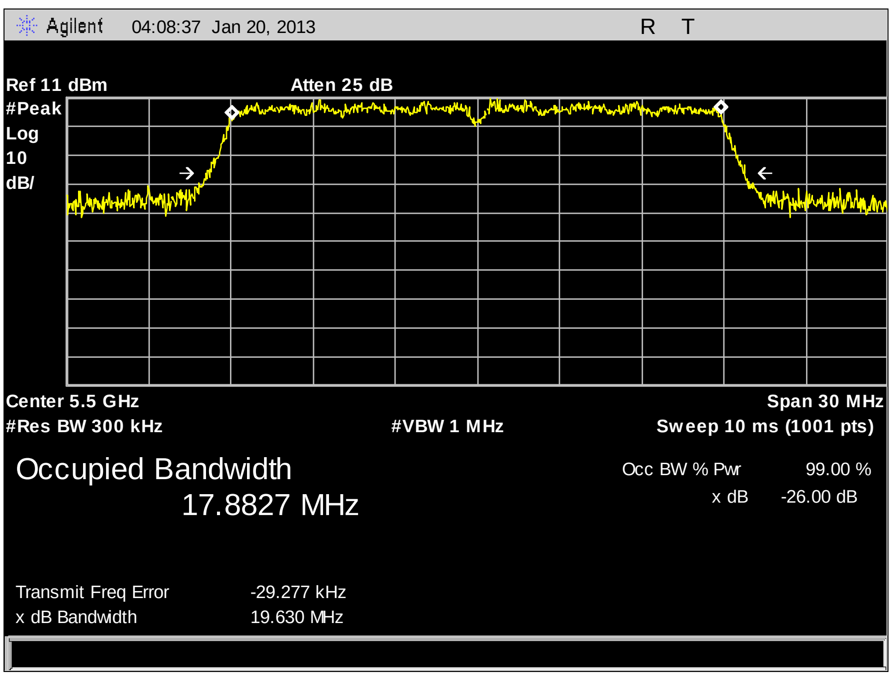
Plot 6. Occupied Bandwidth, 5260 MHz, 26 dB



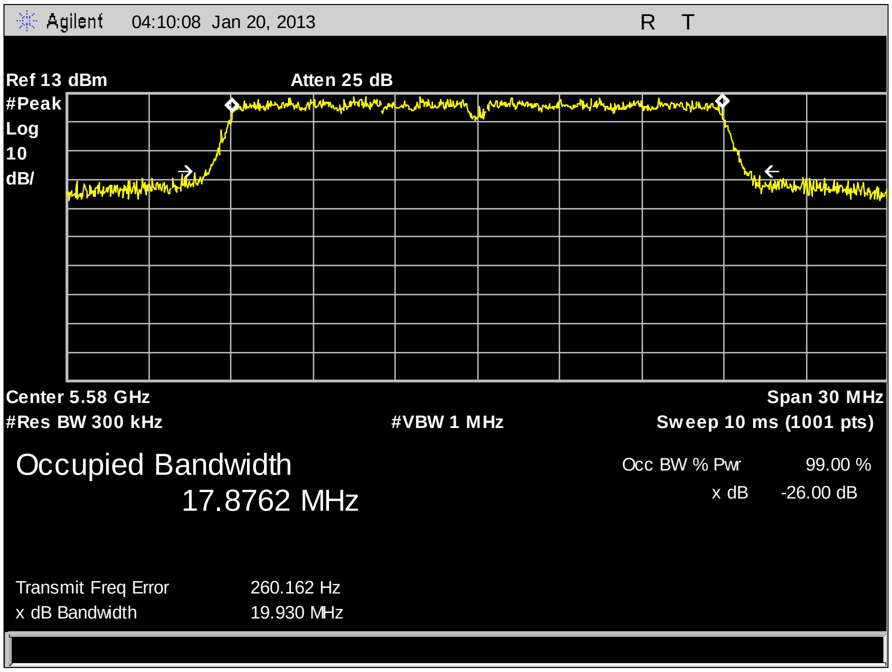
Plot 7. Occupied Bandwidth, 5300 MHz, 26 dB



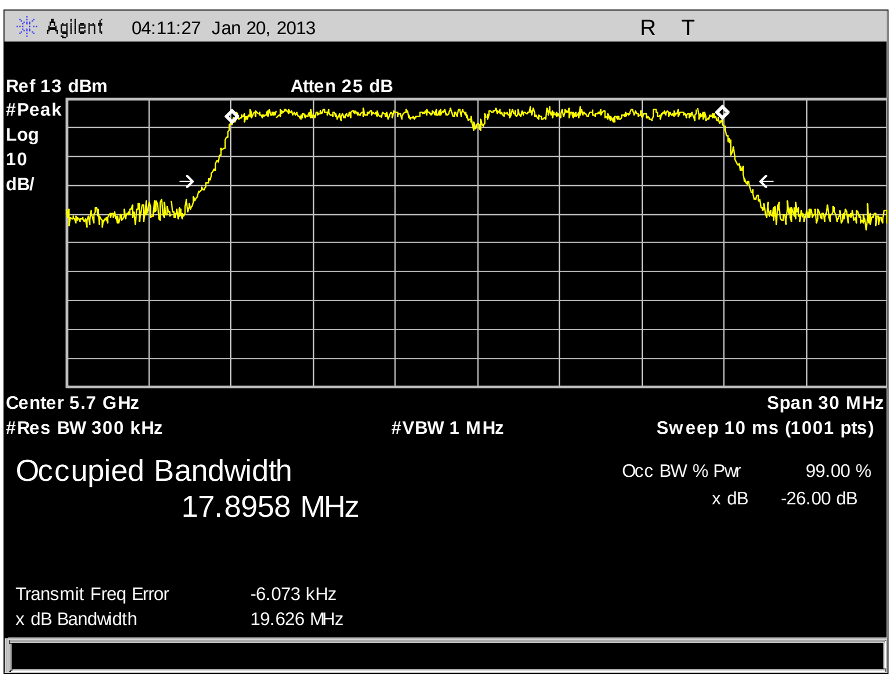
Plot 8. Occupied Bandwidth, 5320 MHz, 26 dB



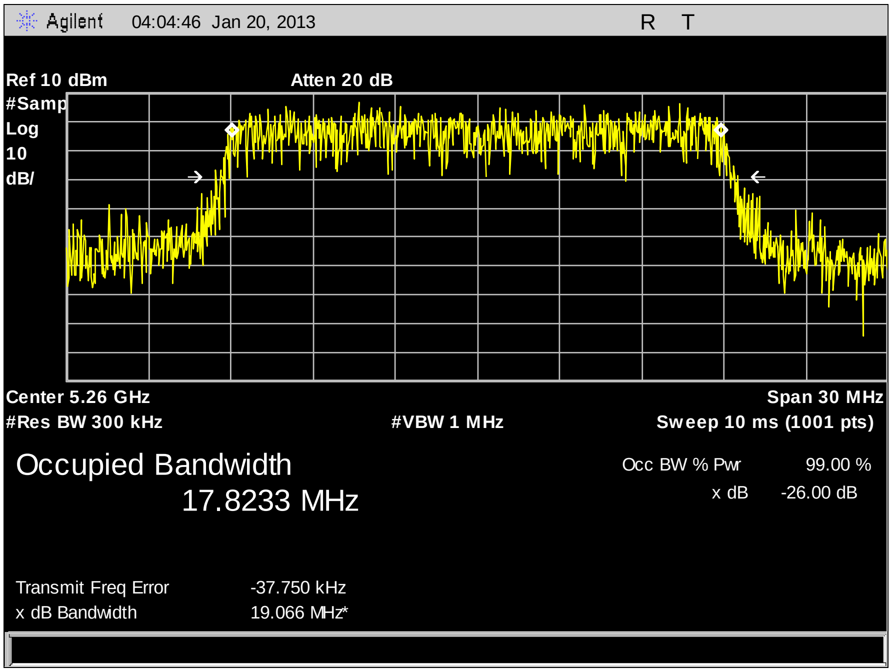
Plot 9. Occupied Bandwidth, 5500 MHz, 26 dB



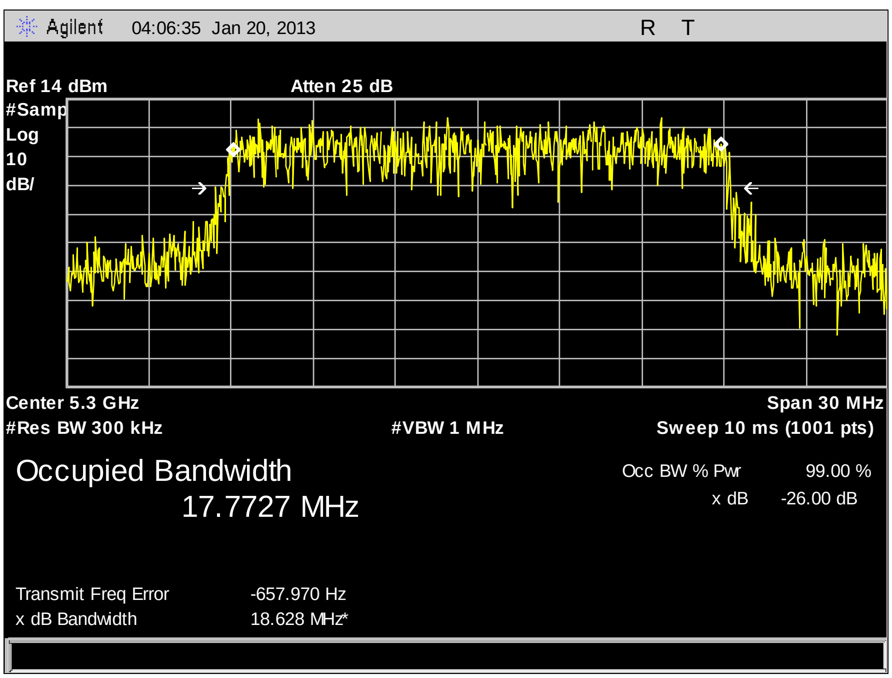
Plot 10. Occupied Bandwidth, 5580 MHz, 26 dB



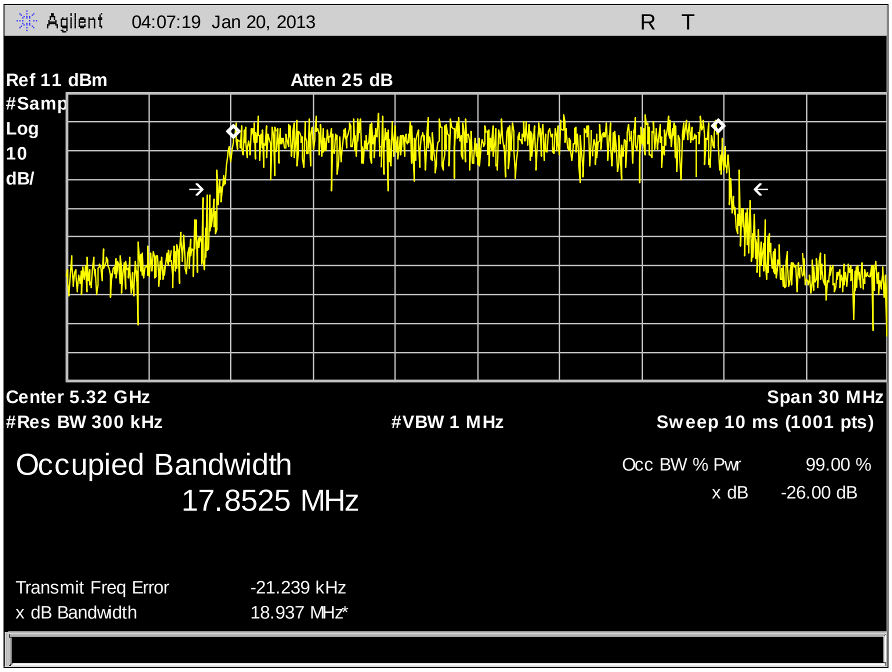
Plot 11. Occupied Bandwidth, 5700 MHz, 26 dB



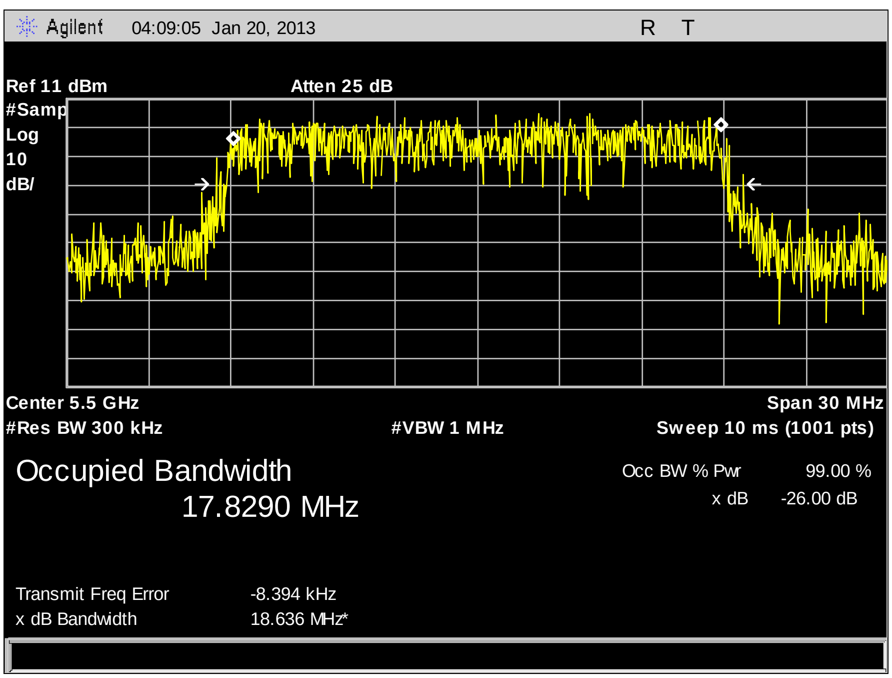
Plot 12. Occupied Bandwidth, 5260 MHz, 99%



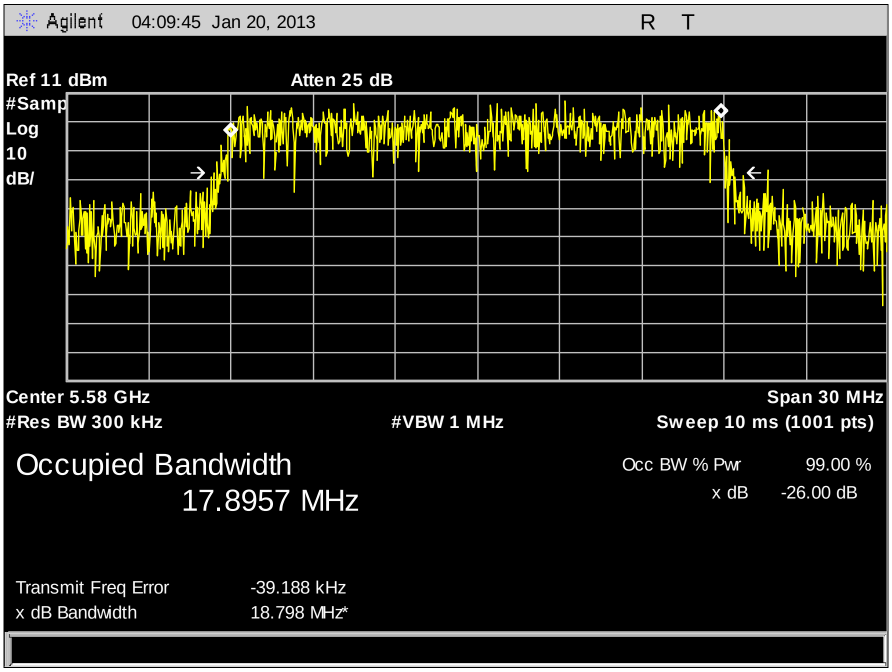
Plot 13. Occupied Bandwidth, 5300 MHz, 99%



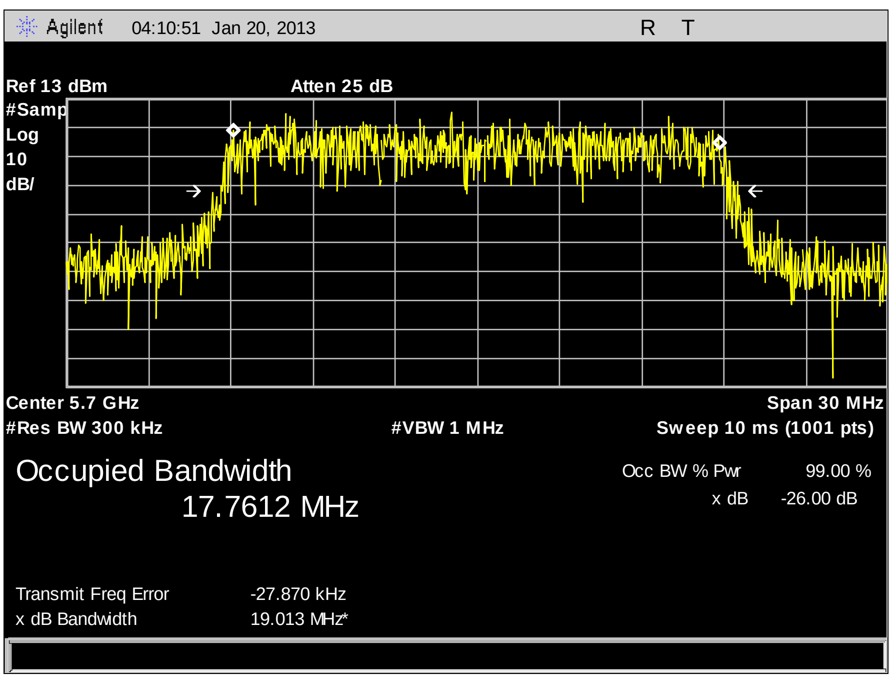
Plot 14. Occupied Bandwidth, 5320 MHz, 99%



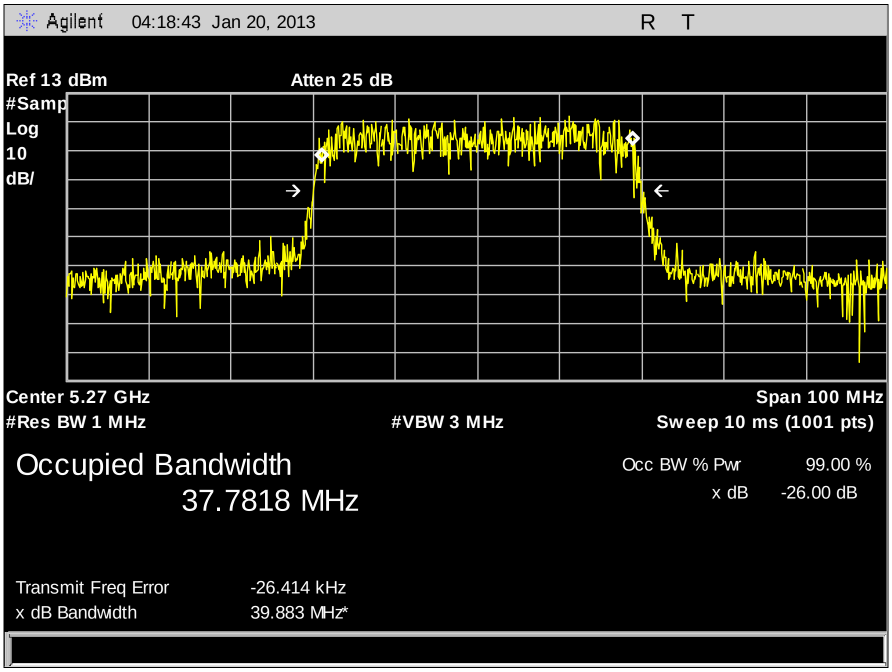
Plot 15. Occupied Bandwidth, 5500 MHz, 99%



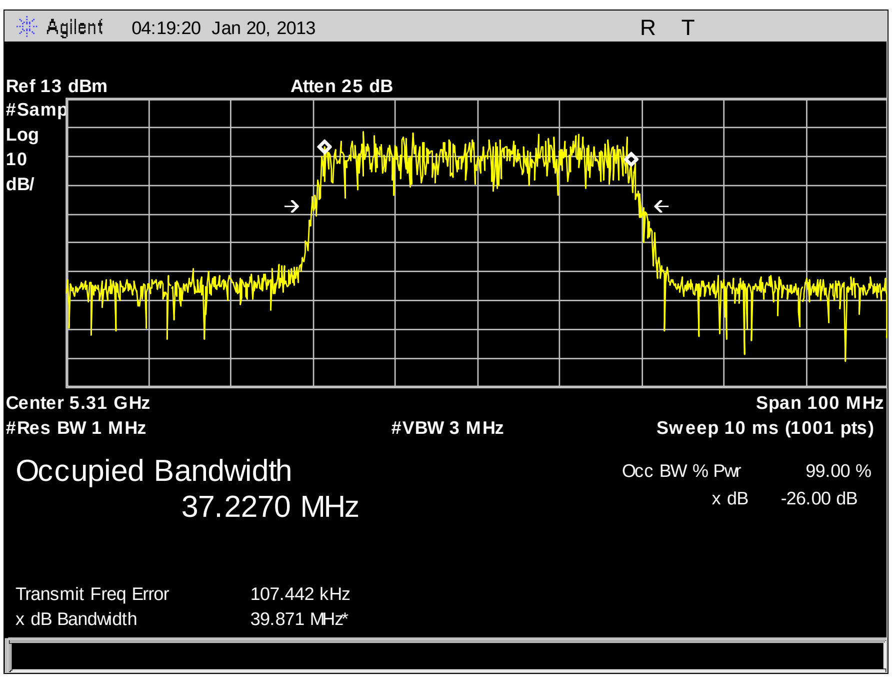
Plot 16. Occupied Bandwidth, 5580 MHz, 99%



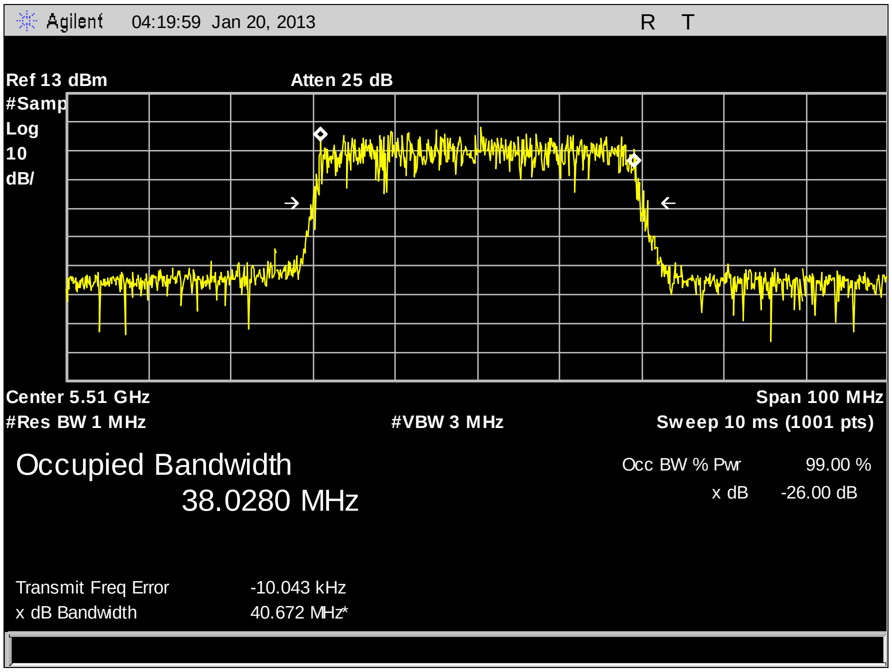
Plot 17. Occupied Bandwidth, 5700 MHz, 99%



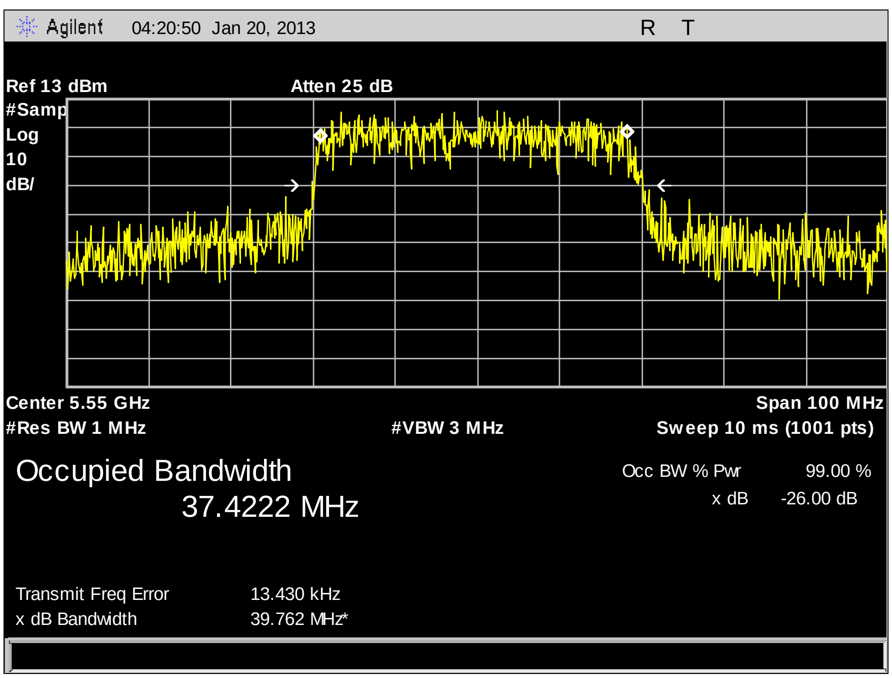
Plot 18. Occupied Bandwidth, 5270 MHz, 99%



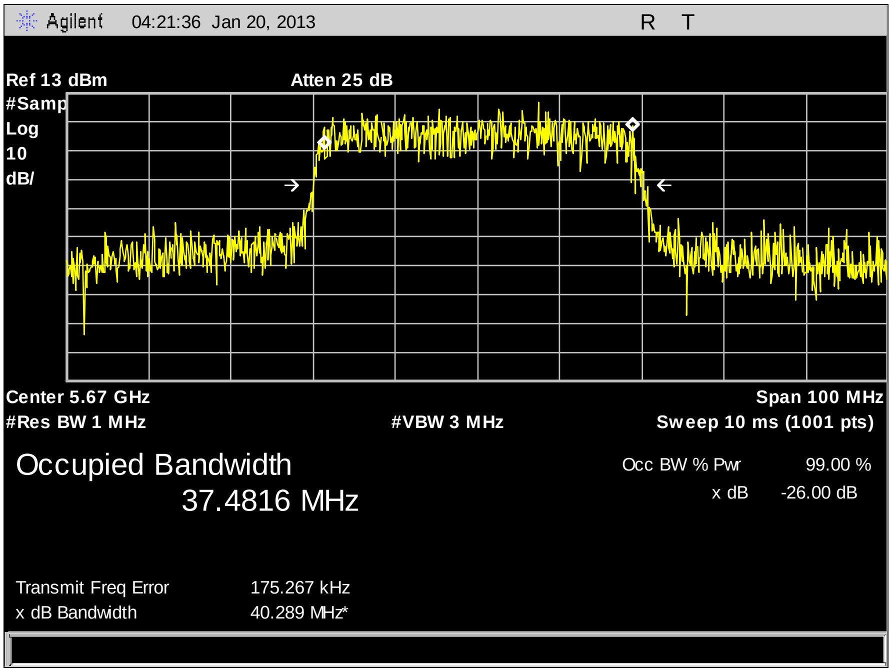
Plot 19. Occupied Bandwidth, 5310 MHz, 99%



Plot 20. Occupied Bandwidth, 5510 MHz, 99%



Plot 21. Occupied Bandwidth, 5550 MHz, 99%



Plot 22. Occupied Bandwidth, 5670 MHz, 99%

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15. 407(a)(2) RF Power Output

Test Requirements: **§15.407(a)(2):** The maximum output power of the intentional radiator shall not exceed the following:

§15.407(a) (2): For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10log B, where B is the 26 dB emission bandwidth in megahertz.

Test Procedure: The EUT was connected to a Spectrum Analyzer. The power was measured on low, mid (where applicable), and high channels.

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

Test Engineer(s): Jeff Pratt

Test Date(s): 01/20/13

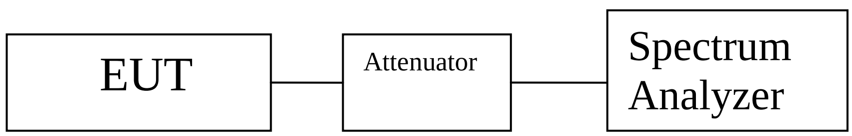
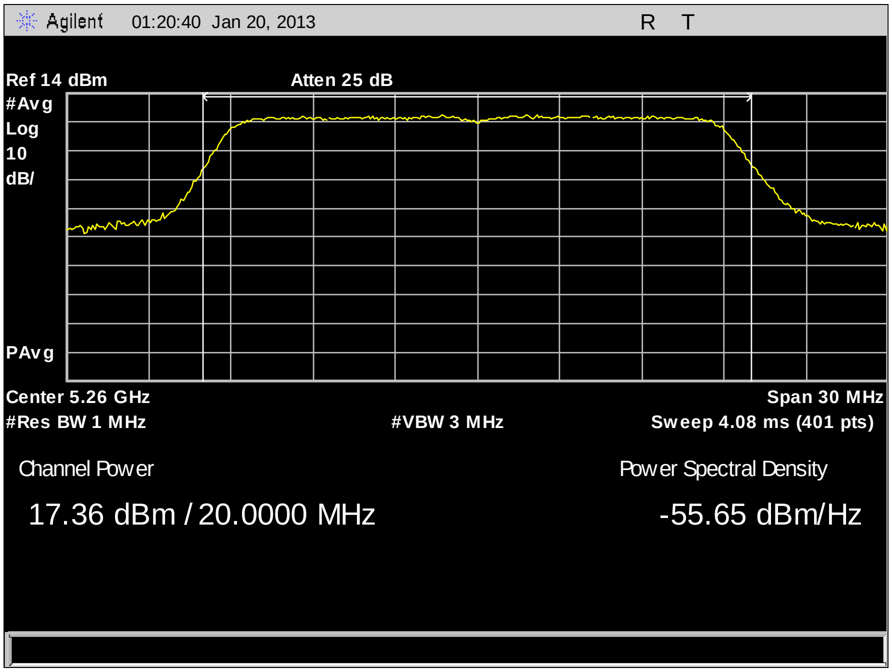


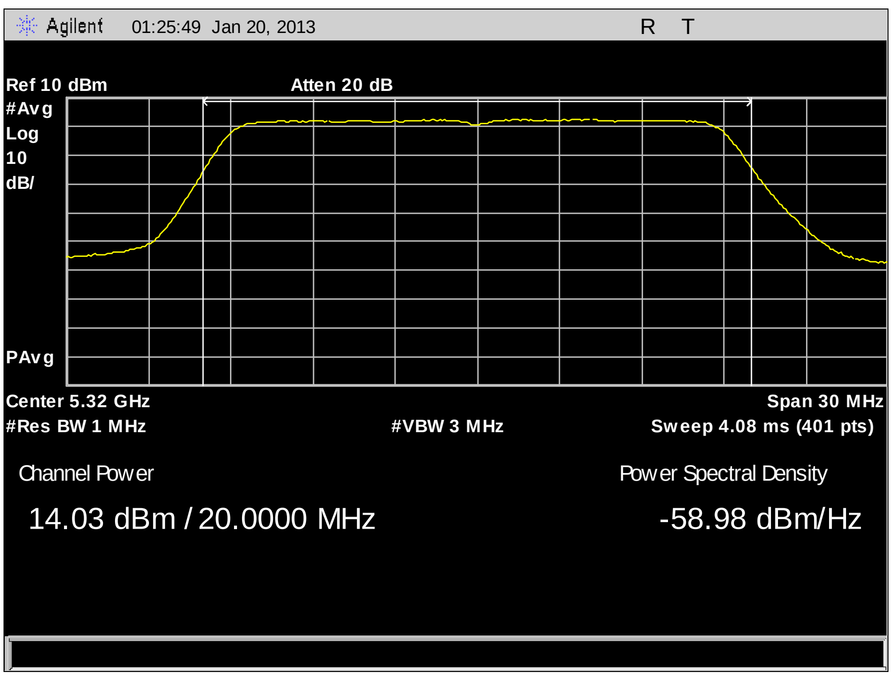
Figure 3. Power Output Test Setup

Frequency (MHz)	Bandwidth	Power (dBm)	Antenna Gain (dBi)	Limit (dBm)	Margin (dB)
5260	20 MHz	17.36	5	23.9794	-6.6194
5300	20 MHz	18.58	5	23.9794	-5.3994
5320	20 MHz	14.03	5	23.9794	-9.9494
5500	20 MHz	16.26	5	23.9794	-7.7194
5580	20 MHz	16.31	5	23.9794	-7.6694
5700	20 MHz	15.57	5	23.9794	-8.4094
5270	40 MHz	17.19	5	23.9794	-6.7894
5310	40 MHz	13.95	5	23.9794	-10.0294
5510	40 MHz	14.03	5	23.9794	-9.9494
5550	40MHz	17.77	5	23.9794	-6.2094
5670	40 MHz	15.79	5	23.9794	-8.1894

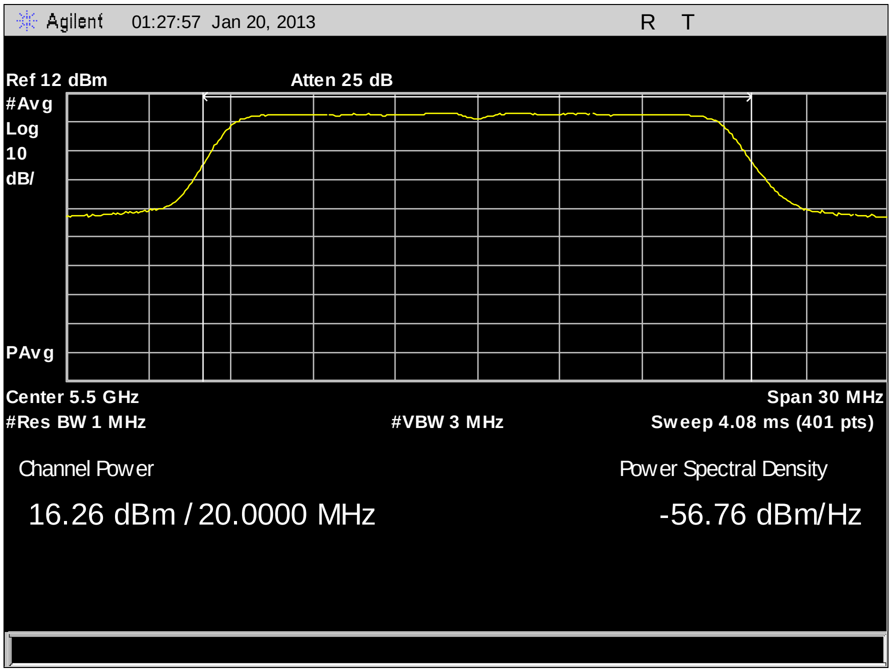
Table 15. RF Output Power, Test Results



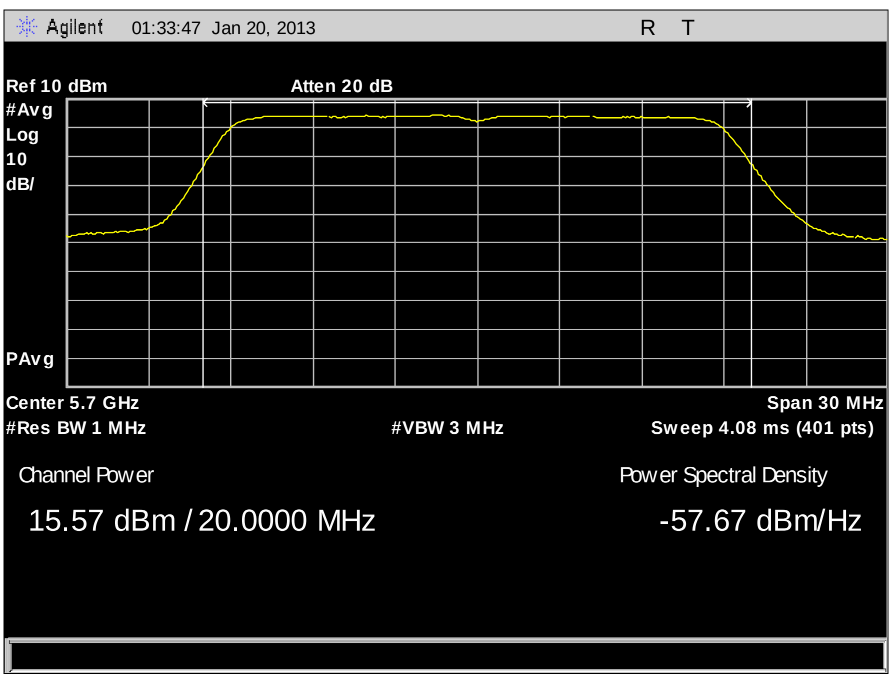
Plot 23. RF Power Output, 5260 MHz



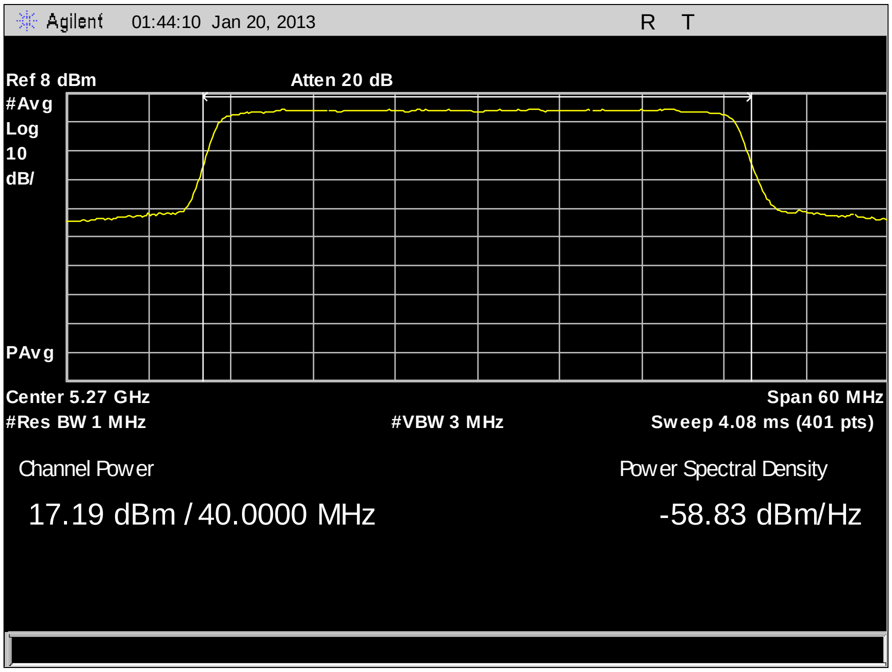
Plot 24. RF Power Output, 5320 MHz



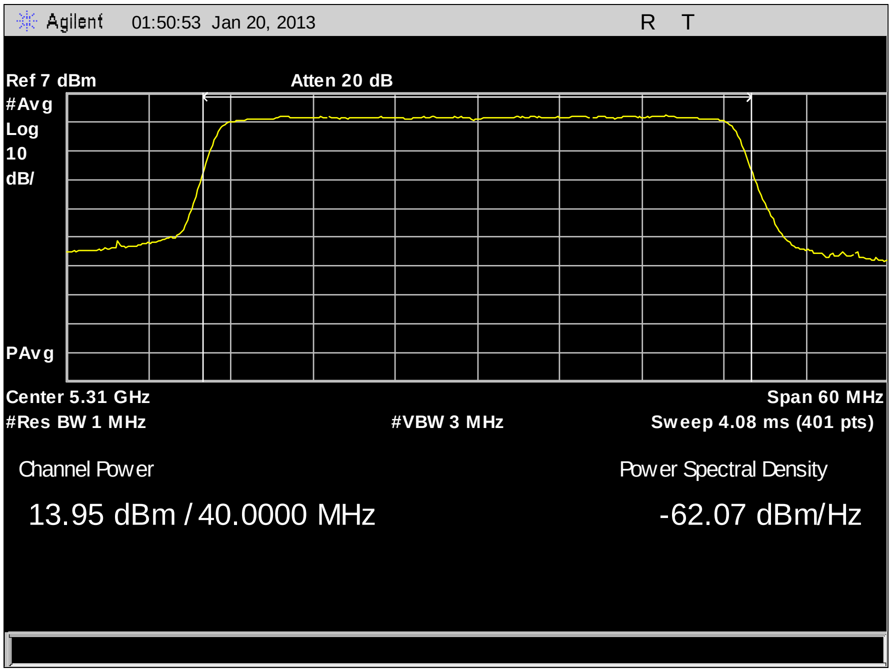
Plot 25. RF Power Output, 5500 MHz



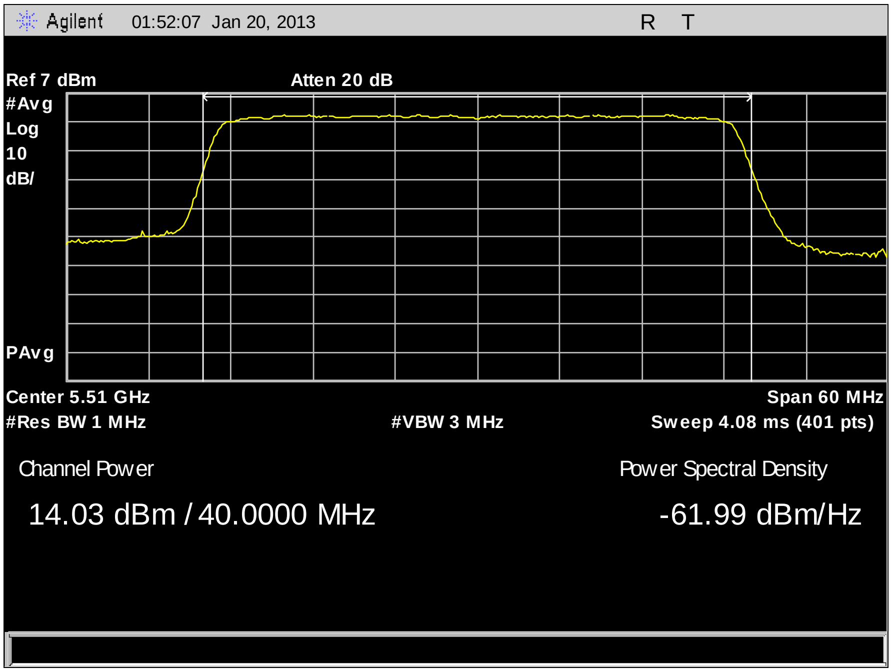
Plot 26. RF Power Output, 5700 MHz



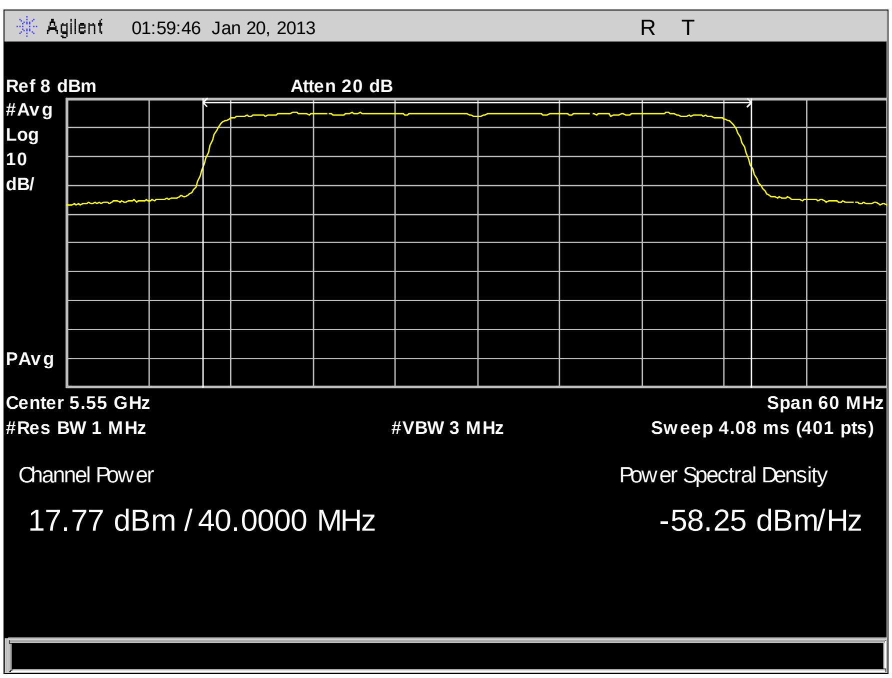
Plot 27. RF Power Output, 5270 MHz



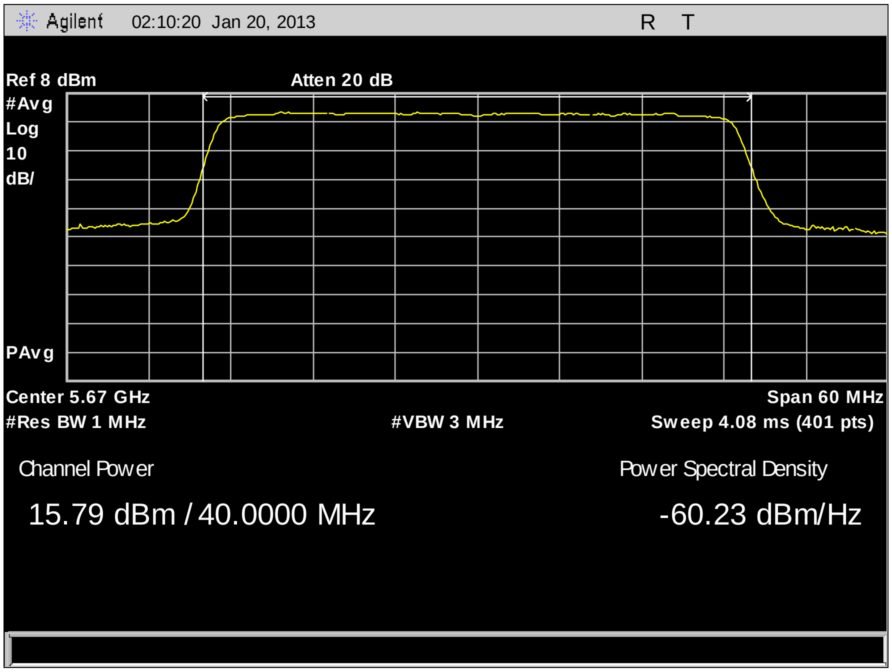
Plot 28. RF Power Output, 5310 MHz



Plot 29. RF Power Output, 5510 MHz



Plot 30. RF Power Output, 5550 MHz



Plot 31. RF Power Output, 5670 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

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

Test Requirements: **§ 15.407(a)(2):** In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band.

Test Procedure: The transmitter was connected directly to a Spectrum Analyzer through an attenuator. The power level was set to the maximum level on the EUT. The RBW was set to 1MHz and the VBW was set to 3MHz. The method of measurement SA-1 from FCC Publication 789033.

Test Results: Equipment was compliant with the peak power spectral density limits of **§ 15.407 (a)(2).** The peak power spectral density was determined from plots on the following page(s).

Test Engineer(s): Jeff Pratt

Test Date(s): 01/20/13

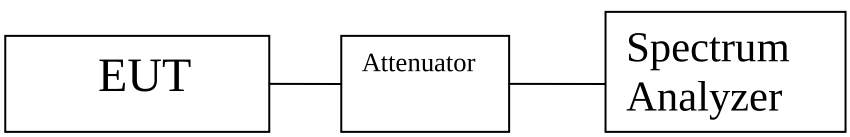
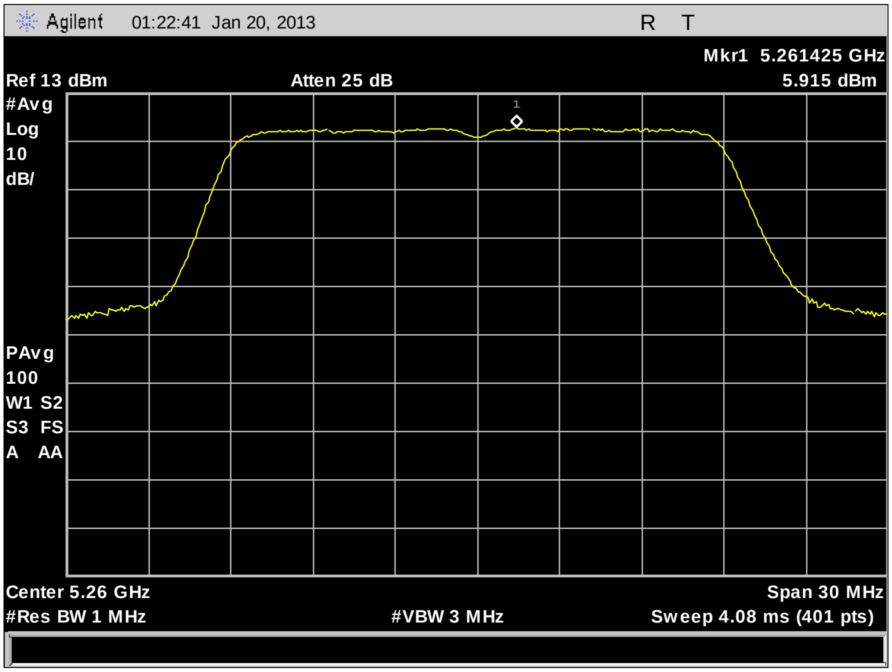


Figure 4. Power Spectral Density Test Setup

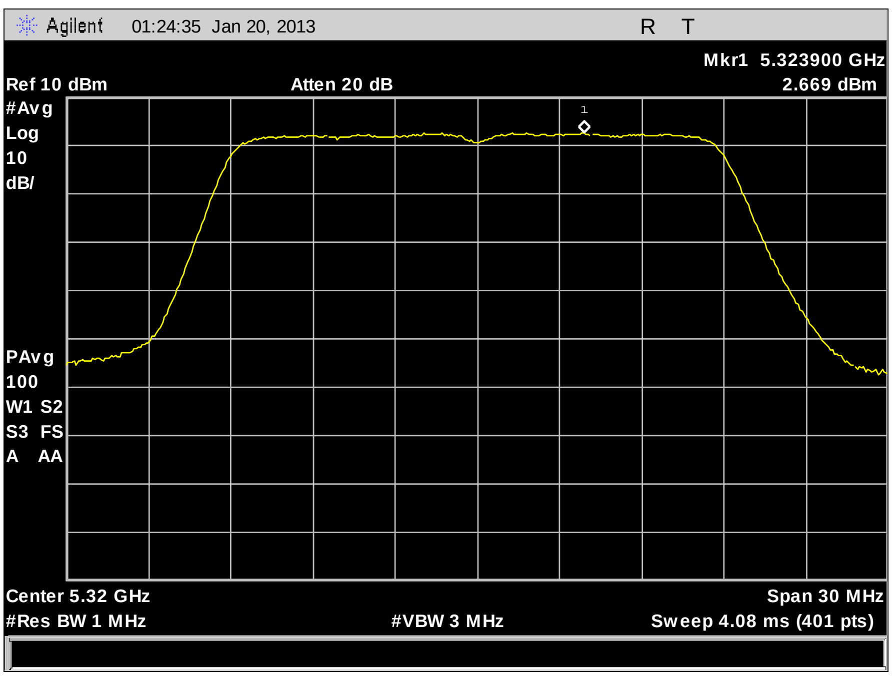
Frequency (MHz)	Bandwidth	Power Spectral Density (dBm)	Antenna Gain (dBi)	Limit (dBm)	Margin (dB)
5260	20 MHz	5.915	5	11	-5.085
5300	20 MHz	8.27	5	11	-2.73
5320	20 MHz	2.669	5	11	-8.331
5500	20 MHz	5.193	5	11	-5.807
5580	20 MHz	5.955	5	11	-5.045
5700	20 MHz	4.289	5	11	-6.711
5270	40 MHz	2.235	5	11	-8.765
5310	40 MHz	-0.724	5	11	-11.724
5510	40 MHz	-0.5	5	11	-11.5
5550	40 MHz	3.295	5	11	-7.705
5670	40 MHz	2.18	5	11	-8.82

Table 16. Peak Power Spectral Density, Test Results

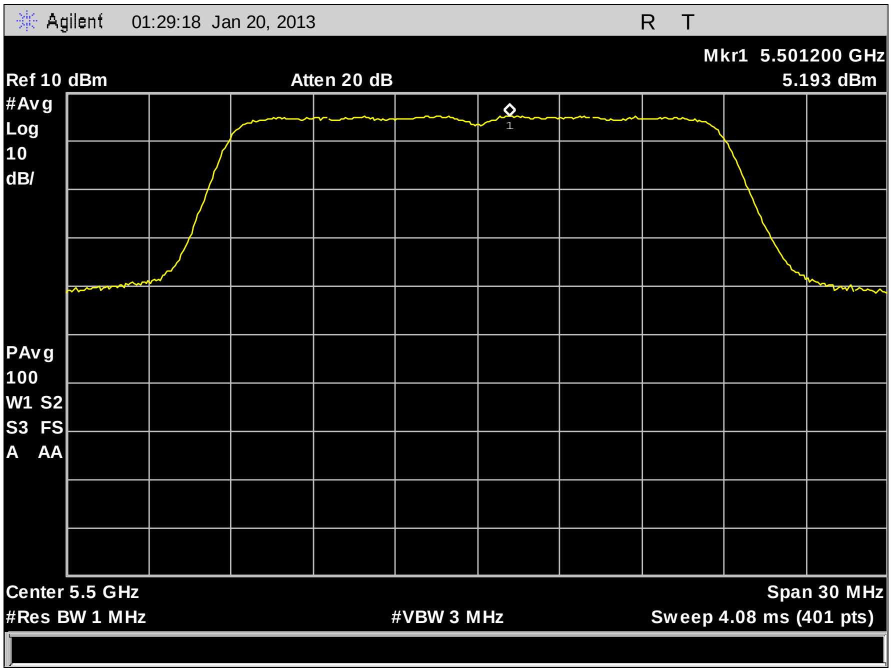
Electromagnetic Compatibility Criteria for Intentional Radiators



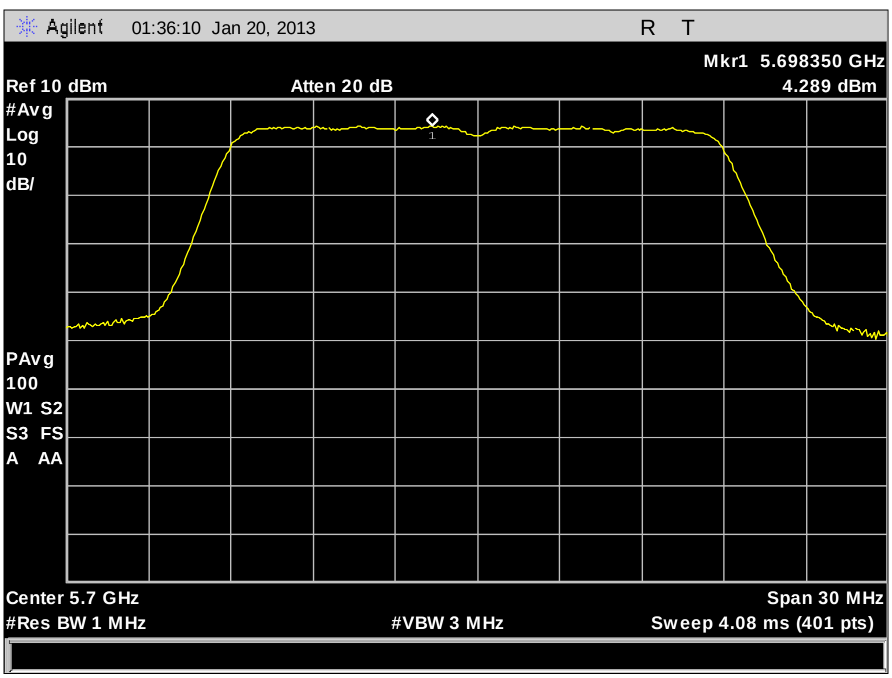
Plot 32. Power Spectral Density, 5260 MHz



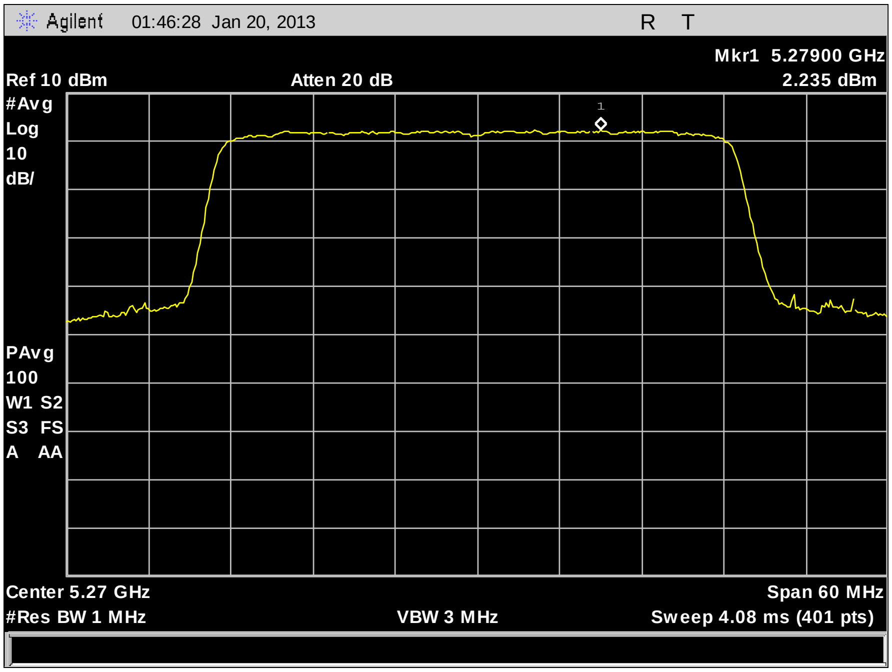
Plot 33. Power Spectral Density, 5320 MHz



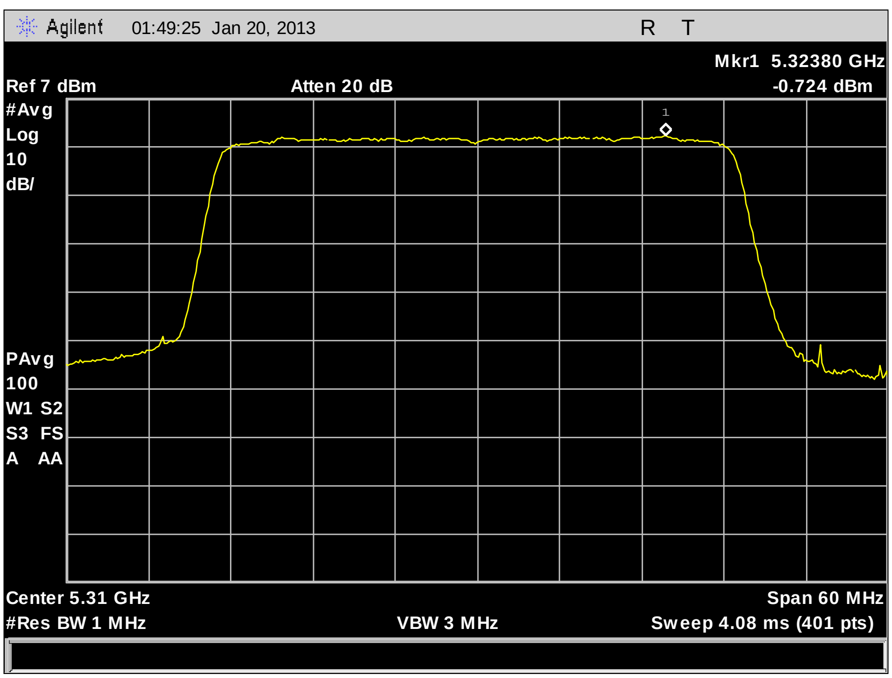
Plot 34. Power Spectral Density, 5500 MHz



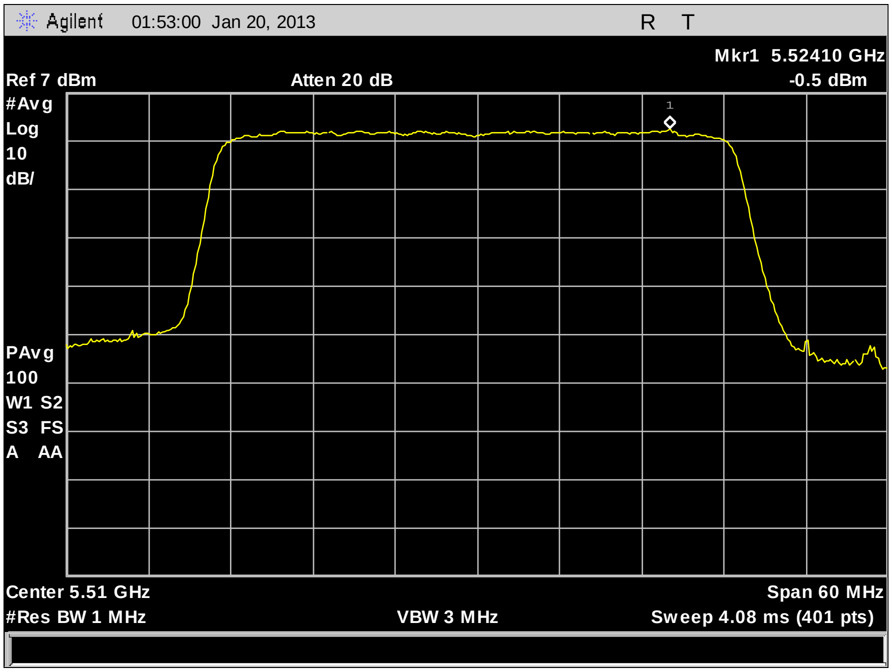
Plot 35. Power Spectral Density, 5700 MHz



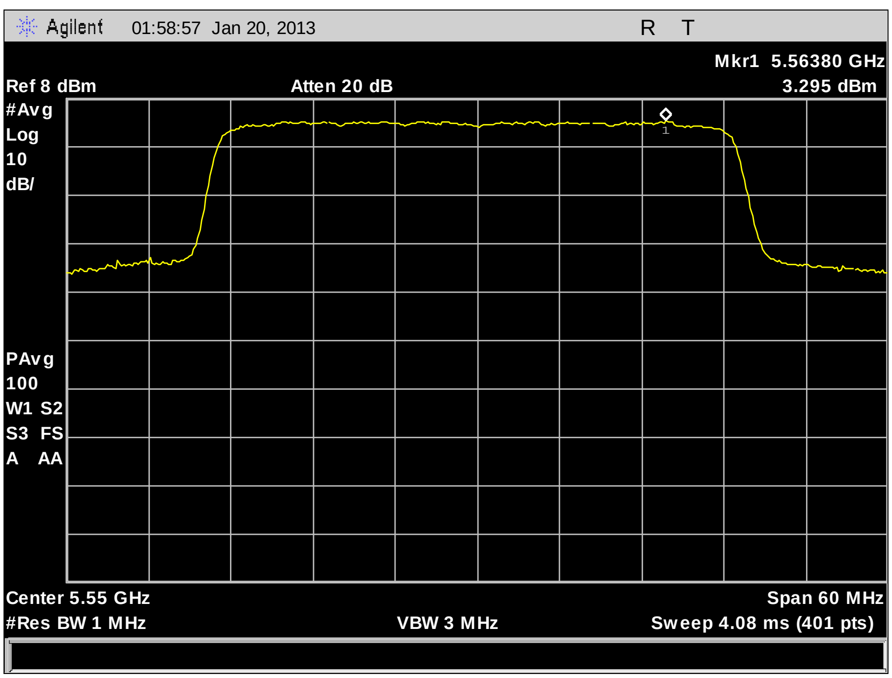
Plot 36. Power Spectral Density, 5270 MHz



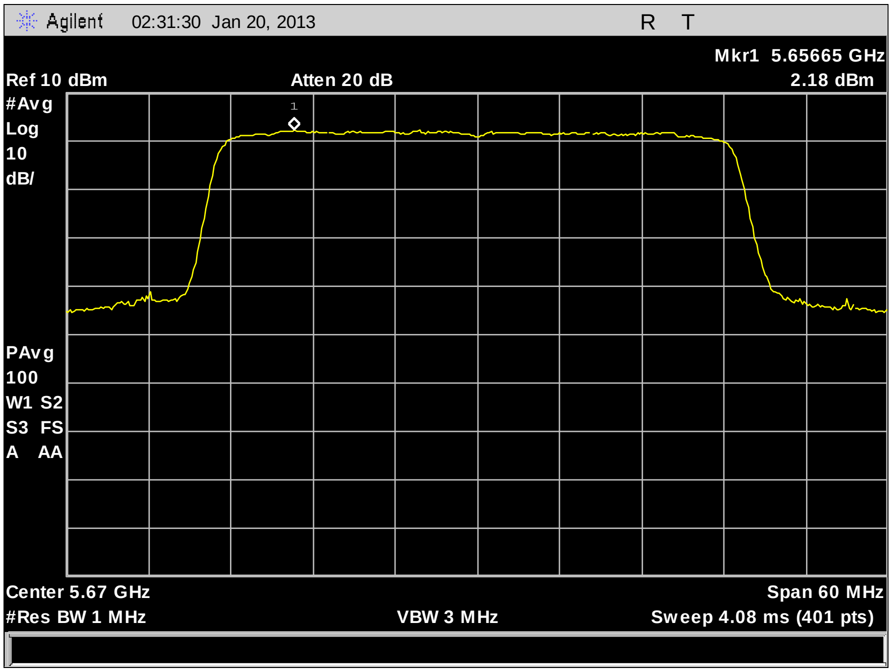
Plot 37. Power Spectral Density, 5310 MHz



Plot 38. Power Spectral Density, 5510 MHz



Plot 39. Power Spectral Density, 5550 MHz



Plot 40. Power Spectral Density, 5670 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 SA-1 from FCC Publication 789033.

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): 01/20/13

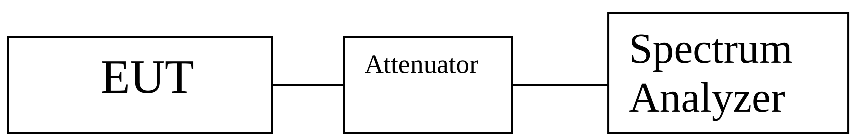
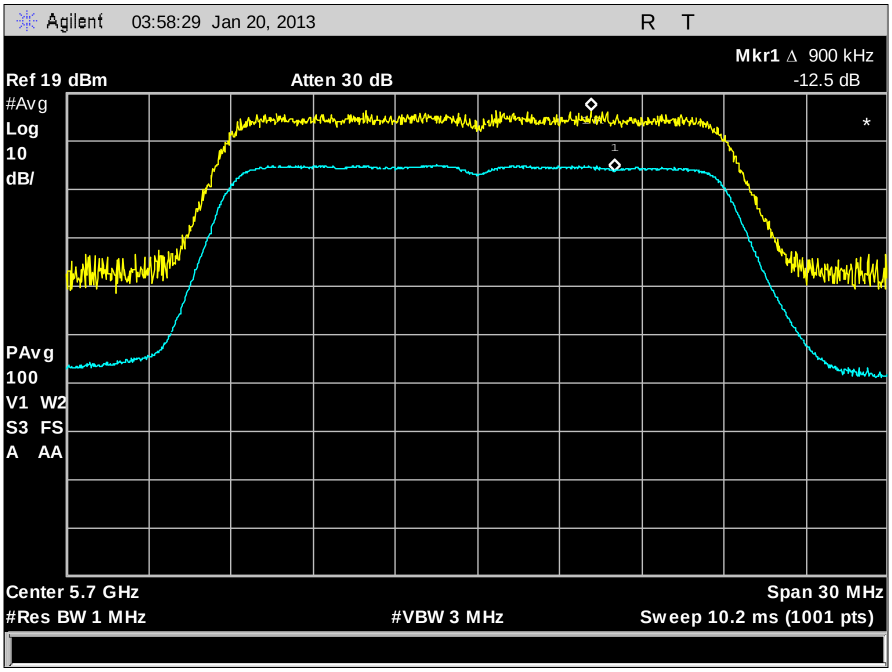
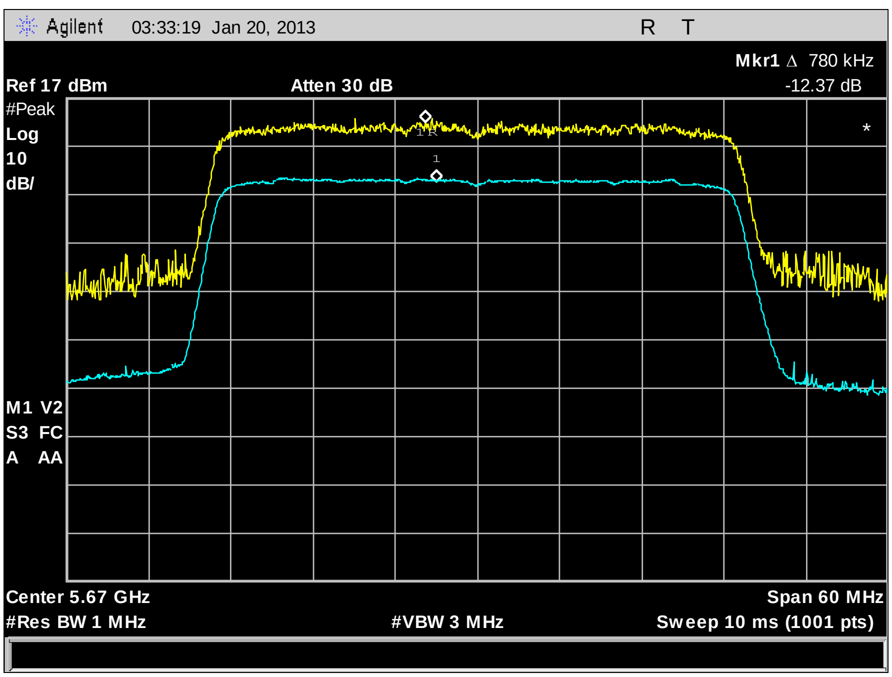


Figure 5. Peak Excursion Ration Test Setup



Plot 41. Peak Excursion Ratio, 5700 MHz



Plot 42. Peak Excursion Ratio, 5670 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

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

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

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

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

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

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

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

For frequencies from 30 MHz to 1 GHz, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

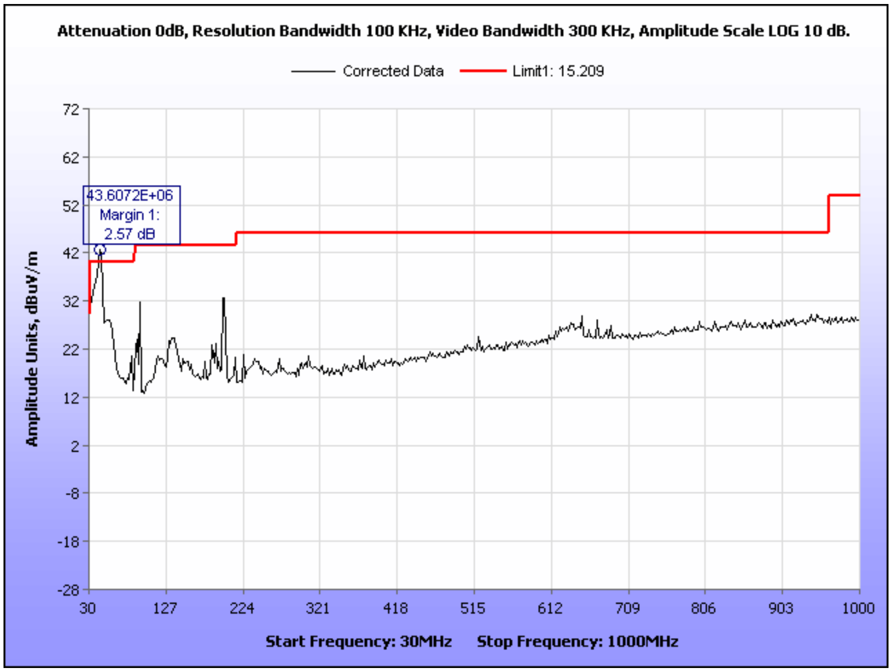
For measurements above 1 GHz, measurements were made with a Peak detector with 1 MHz resolution bandwidth. Where the spurious emissions fell into a restricted band, measurements were also made with an average detector to make sure they complied with 15.209 limits. Emissions were explored up to 40 GHz.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

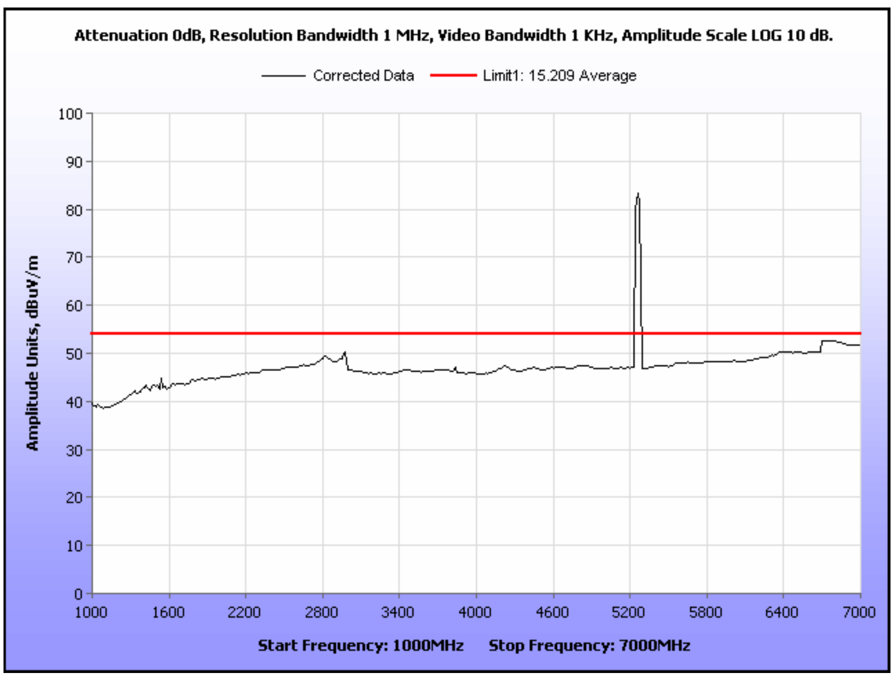
Test Date(s): 12/18/12 – 01/24/13

§ 15.209 Radiated Emissions Limits

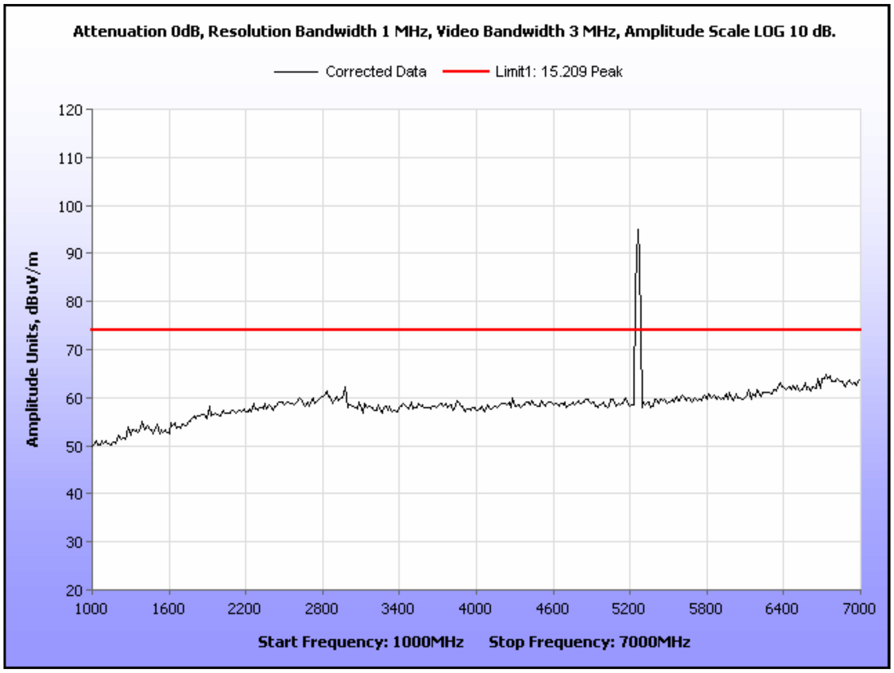


Plot 43. Radiated Spurious Emissions, 5260 MHz, 20 MHz Channel, Tx Power 18.5, 30 MHz – 1 GHz

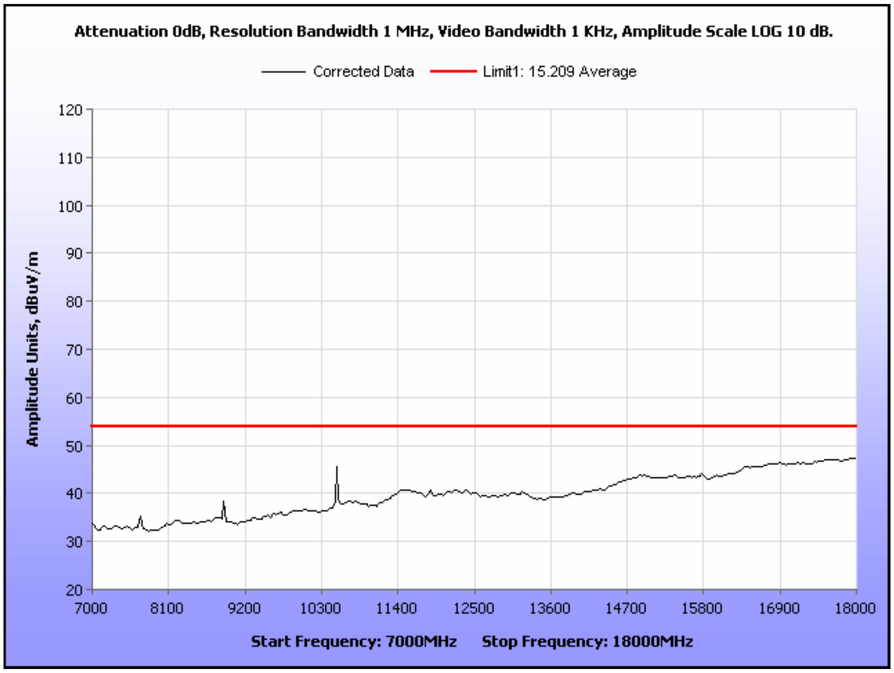
Note: Emissions exceeding the 15.209 limit are digital and meet the Class B limits of 15.109. Refer to Table 11.



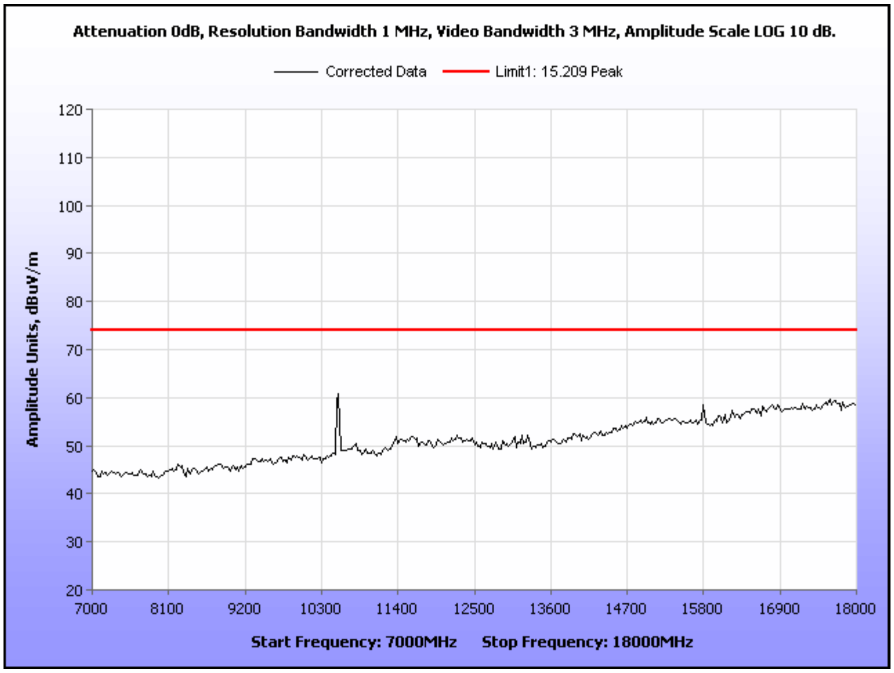
Plot 44. Radiated Spurious Emissions, 5260 MHz, 20 MHz Channel, 1 GHz – 7 GHz, Average



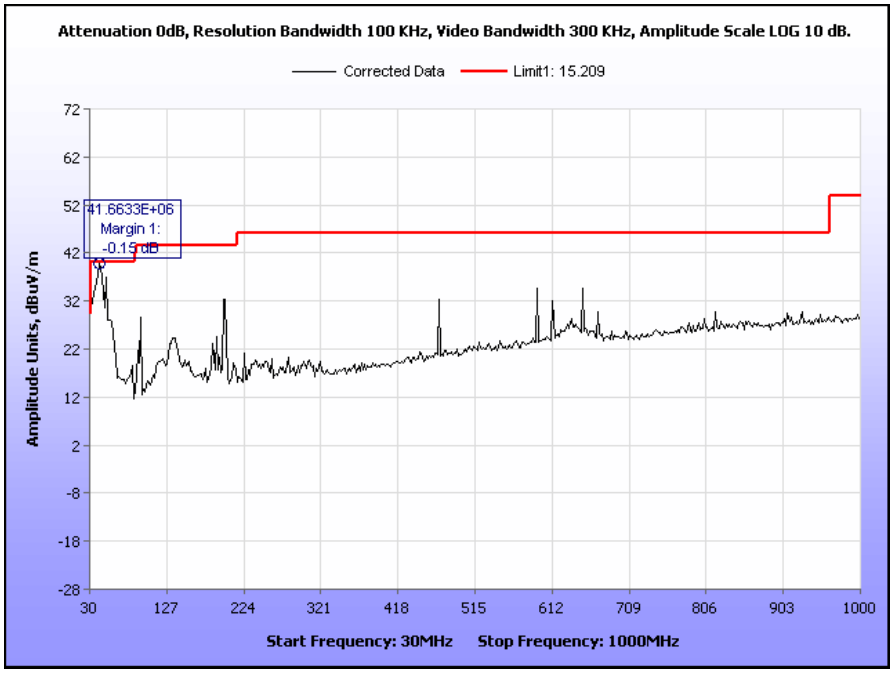
Plot 45. Radiated Spurious Emissions, 5260 MHz, 20 MHz Channel, 1 GHz – 7 GHz, Peak



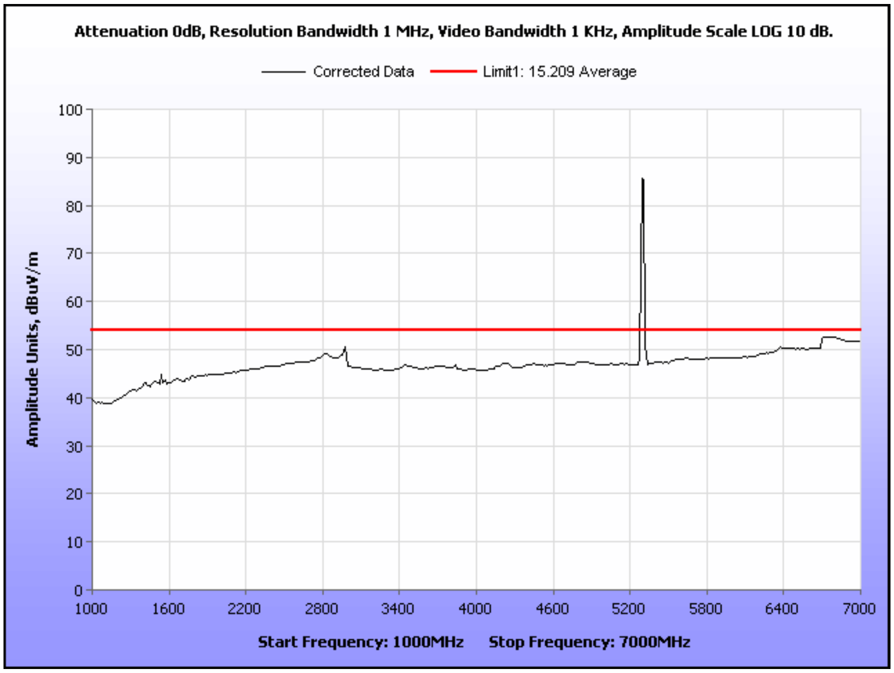
Plot 46. Radiated Spurious Emissions, 5260 MHz, 20 MHz Channel, 7 GHz – 18 GHz, Average



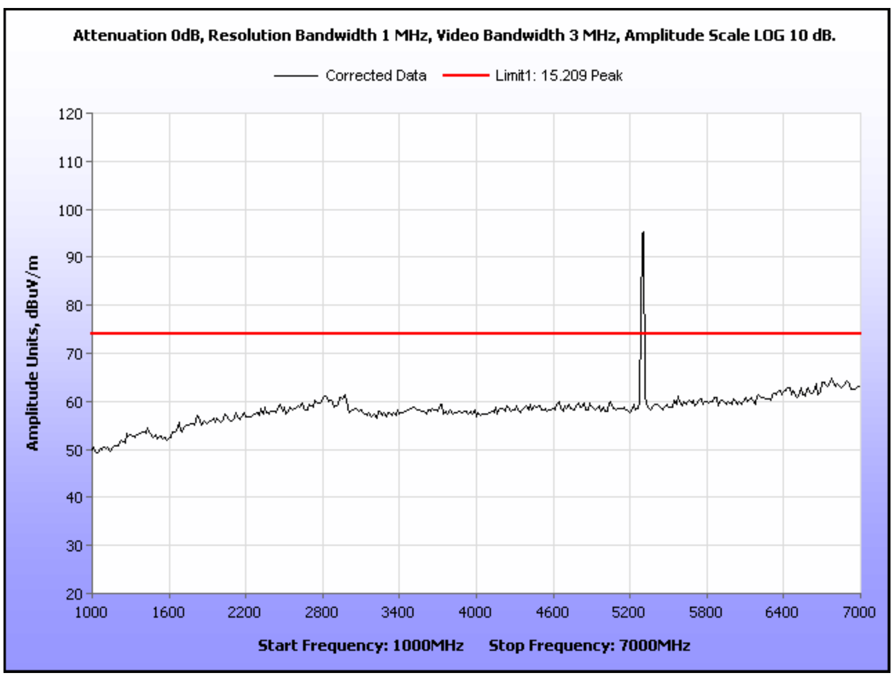
Plot 47. Radiated Spurious Emissions, 5260 MHz, 20 MHz Channel, 7 GHz – 18 GHz, Peak



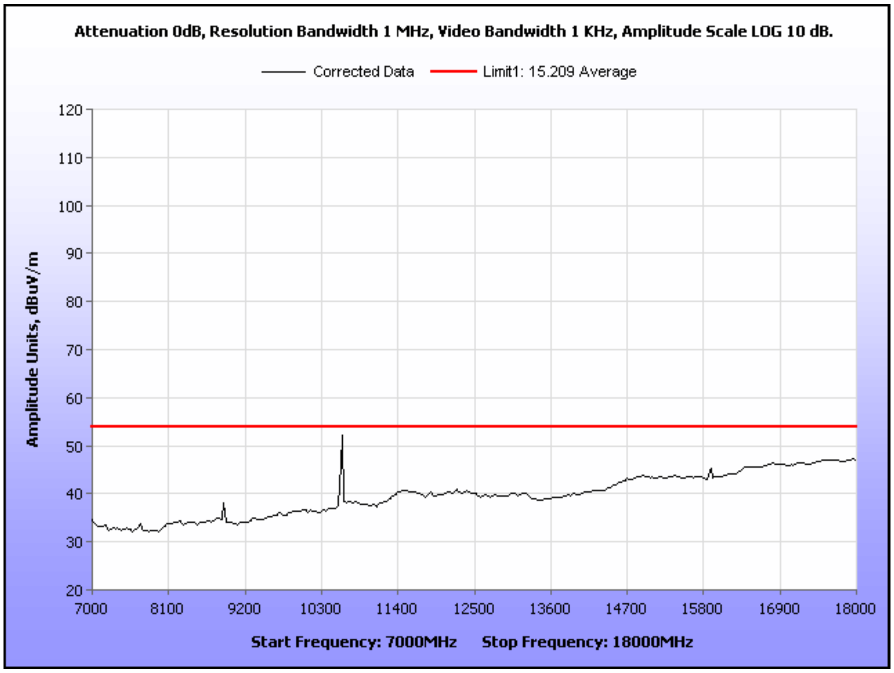
Plot 48. Radiated Spurious Emissions, 5300 MHz, 20 MHz Channel, Tx Power 20, 30 MHz – 1 GHz



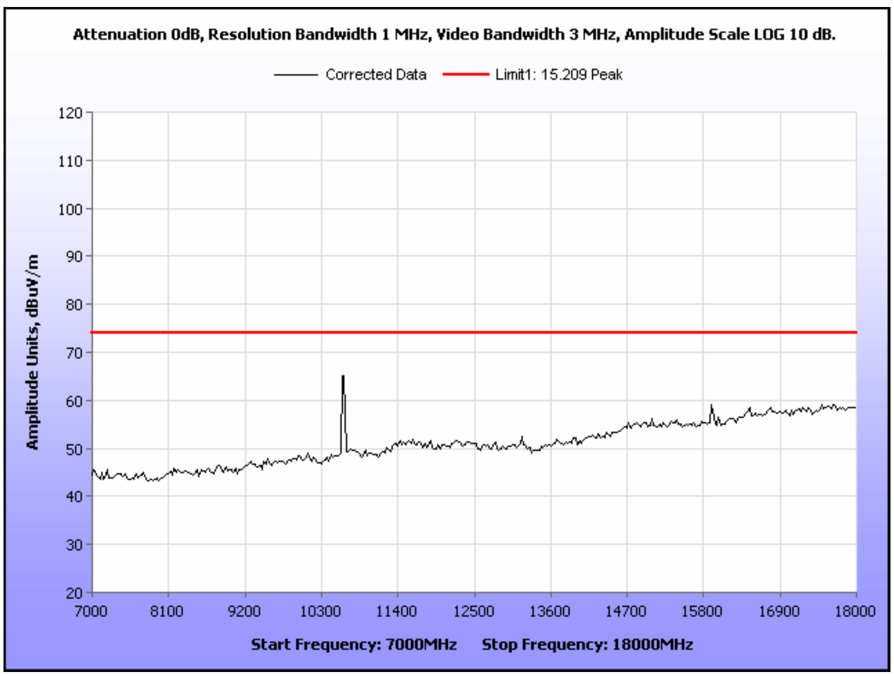
Plot 49. Radiated Spurious Emissions, 5300 MHz, 20 MHz Channel, 1 GHz – 7 GHz, Average



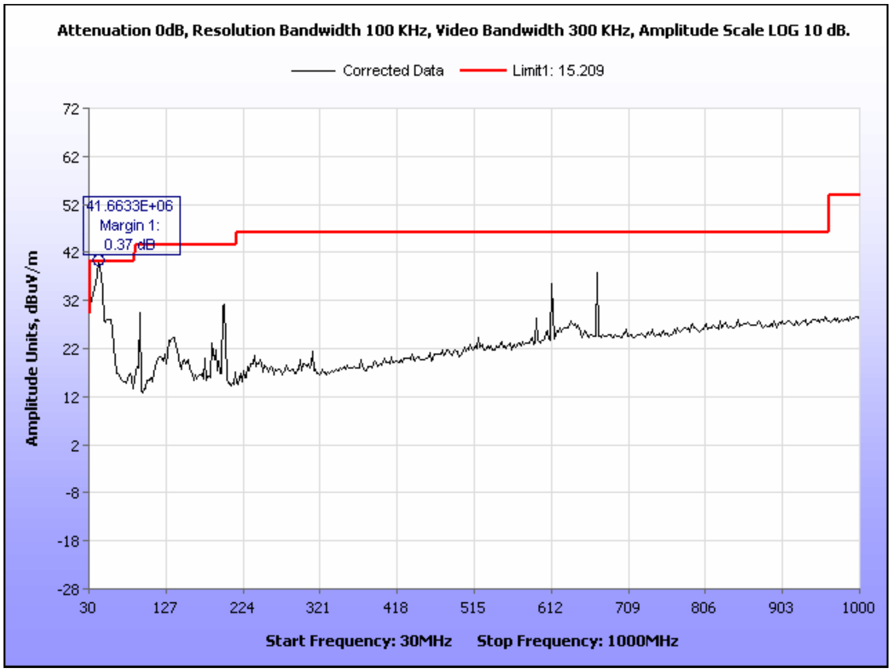
Plot 50. Radiated Spurious Emissions, 5300 MHz, 20 MHz Channel, 1 GHz – 7 GHz, Peak



Plot 51. Radiated Spurious Emissions, 5300 MHz, 20 MHz Channel, 7 GHz – 18 GHz, Average

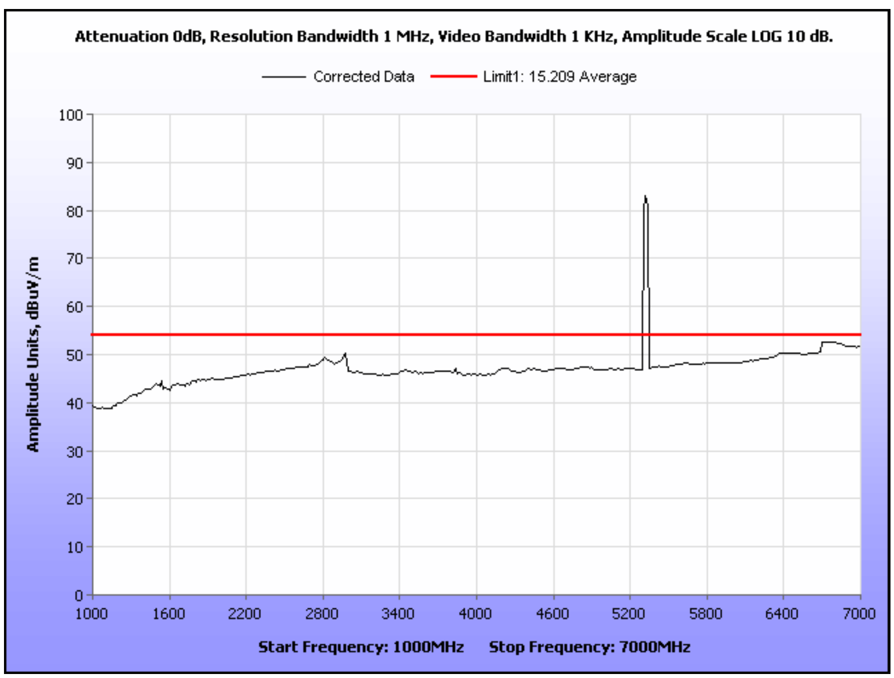


Plot 52. Radiated Spurious Emissions, 5300 MHz, 20 MHz Channel, 7 GHz – 18 GHz, Peak

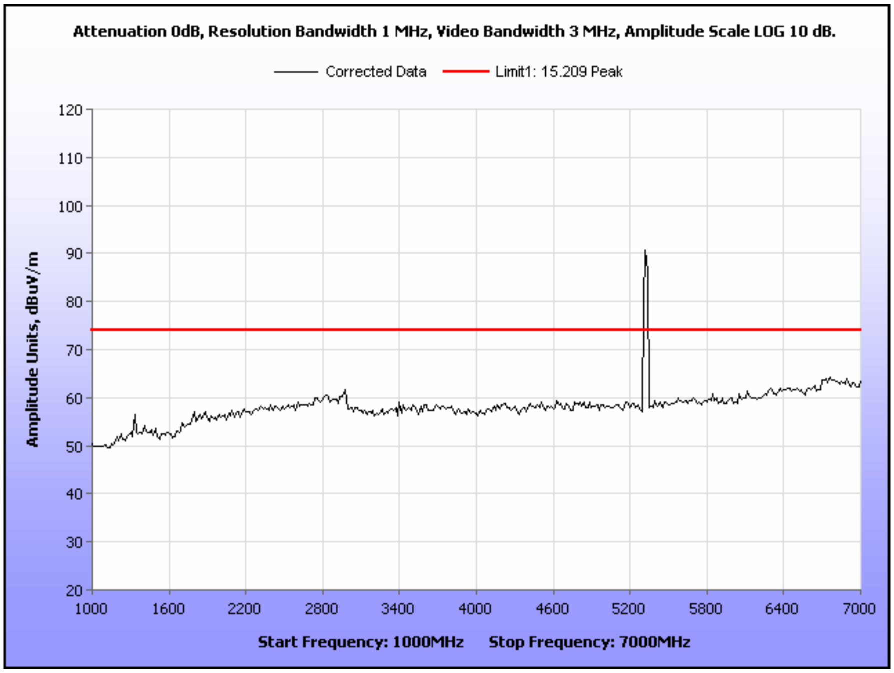


Plot 53. Radiated Spurious Emissions, 5320 MHz, 20 MHz Channel, Tx Power 19, 30 MHz – 1 GHz

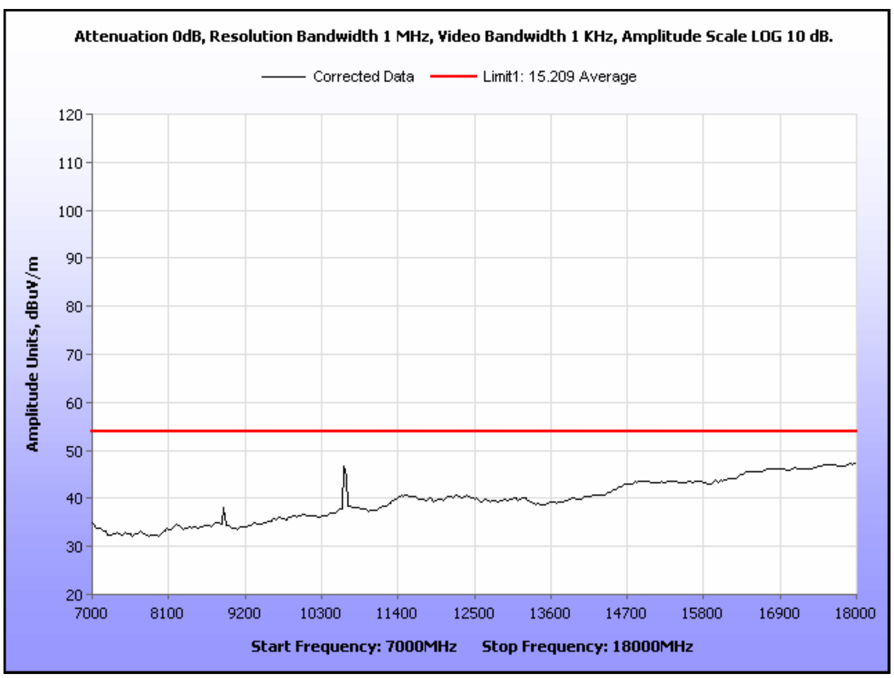
Note: Emissions exceeding the 15.209 limit are digital and meet the Class B limits of 15.109. Refer to Table 11.



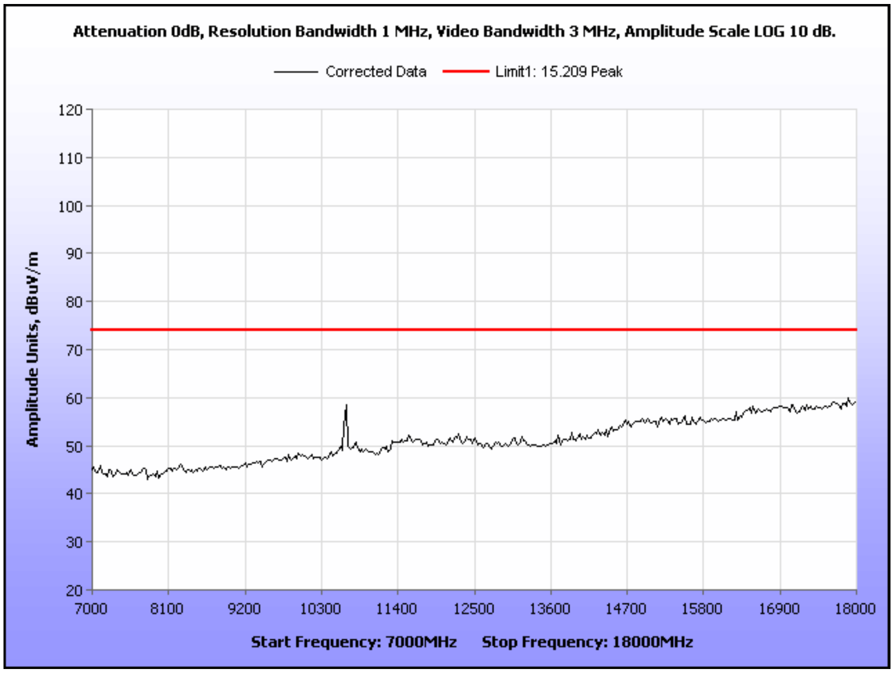
Plot 54. Radiated Spurious Emissions, 5320 MHz, 20 MHz Channel, 1 GHz – 7 GHz, Average



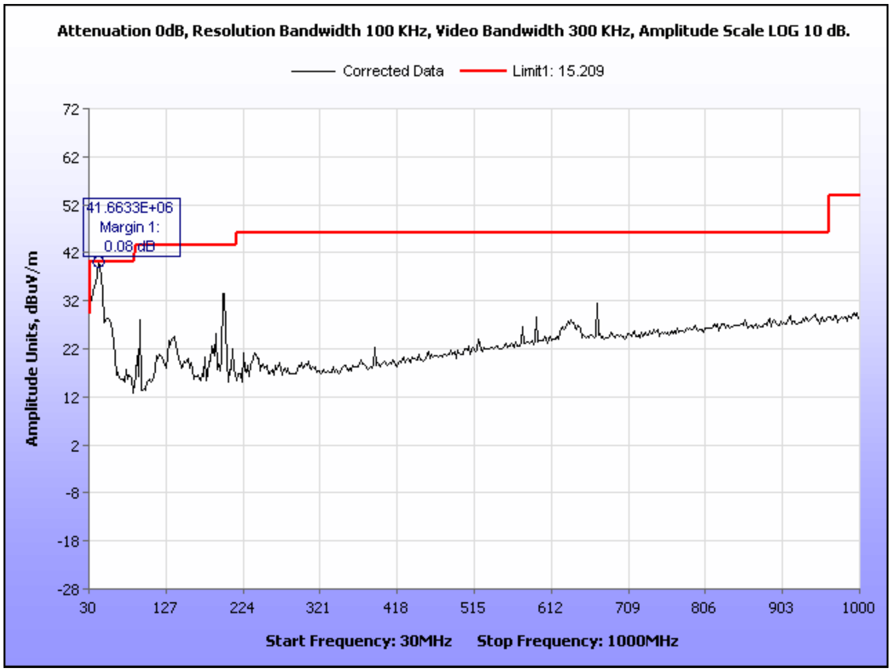
Plot 55. Radiated Spurious Emissions, 5320 MHz, 20 MHz Channel, 1 GHz – 7 GHz, Peak



Plot 56. Radiated Spurious Emissions, 5320 MHz, 20 MHz Channel, 7 GHz – 18 GHz, Average

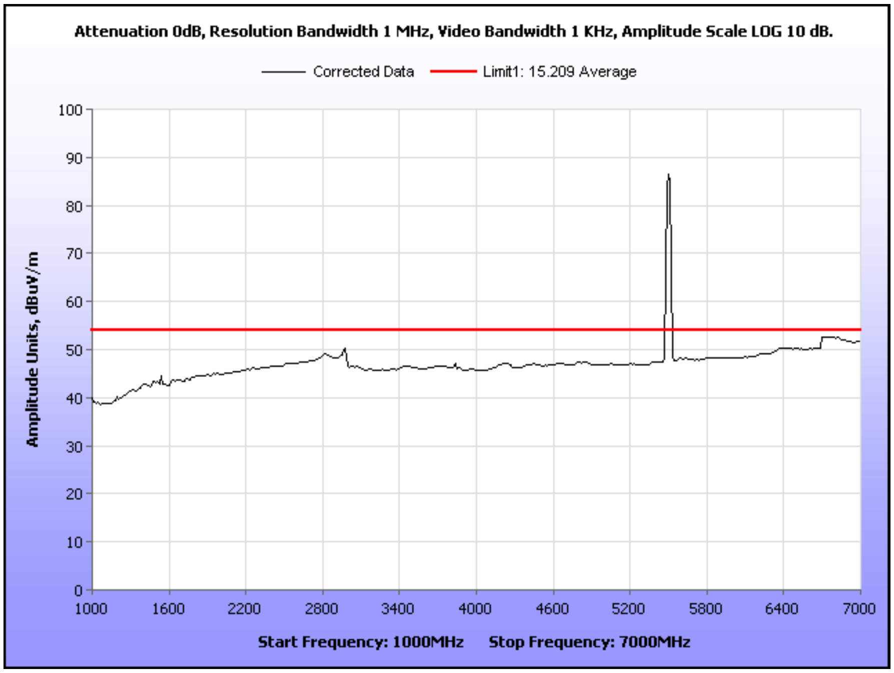


Plot 57. Radiated Spurious Emissions, 5320 MHz, 20 MHz Channel, 7 GHz – 18 GHz, Peak

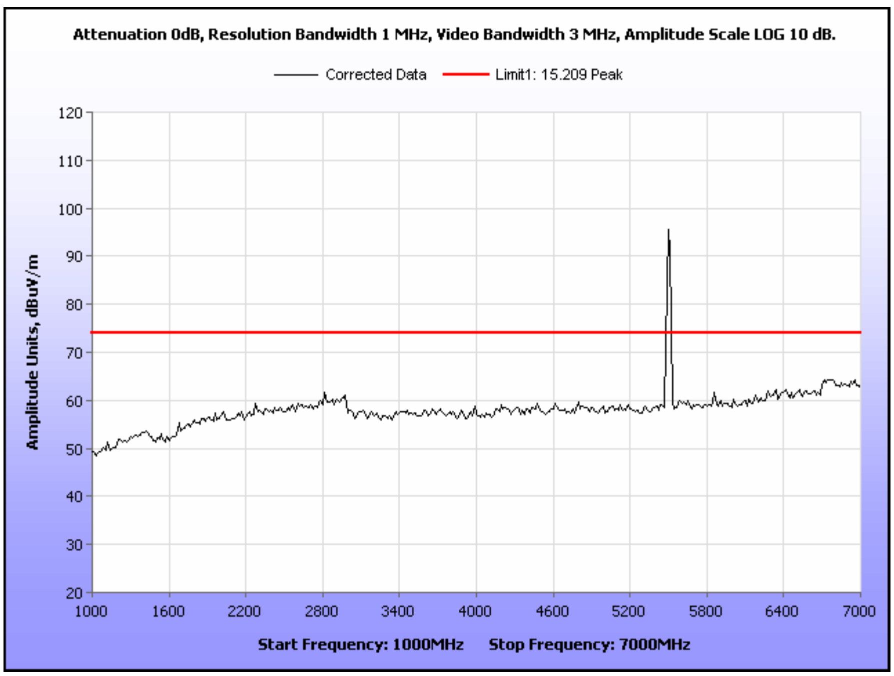


Plot 58. Radiated Spurious Emissions, 5500 MHz, 20 MHz Channel, Tx Power 19, 30 MHz – 1 GHz

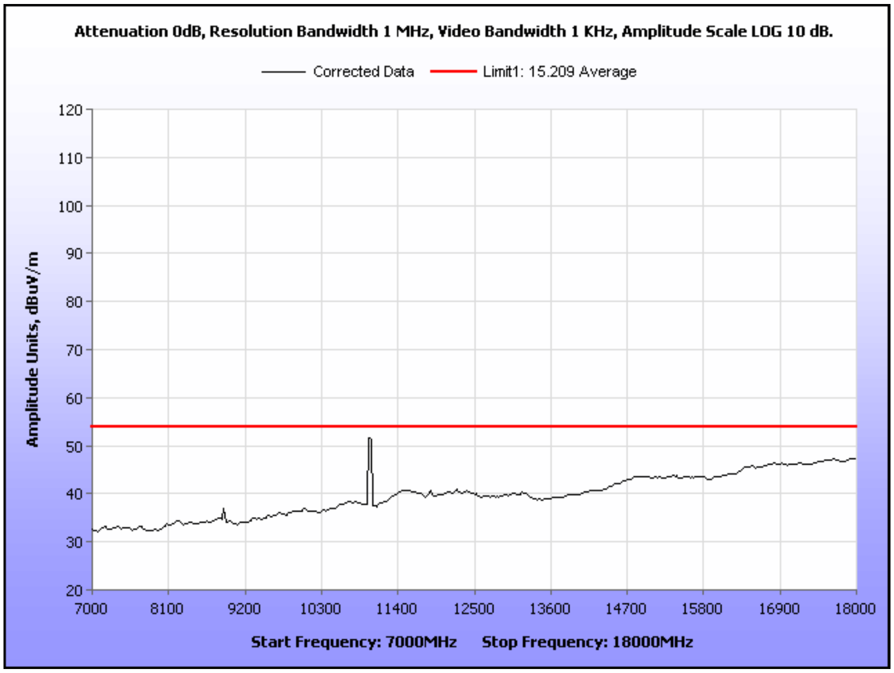
Note: Emissions exceeding the 15.209 limit are digital and meet the Class B limits of 15.109. Refer to Table 11.



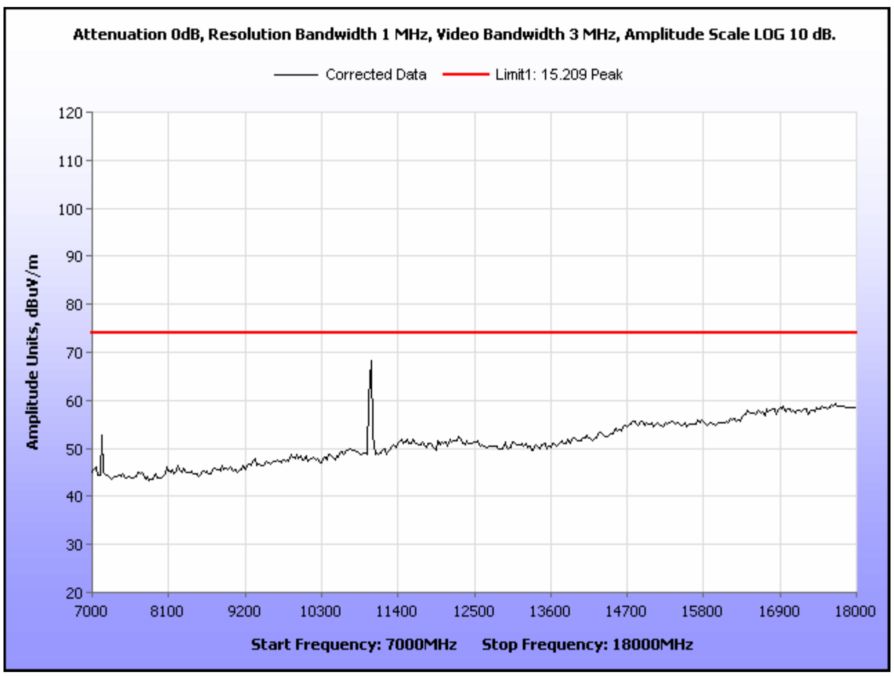
Plot 59. Radiated Spurious Emissions, 5500 MHz, 20 MHz Channel, 1 GHz – 7 GHz, Average



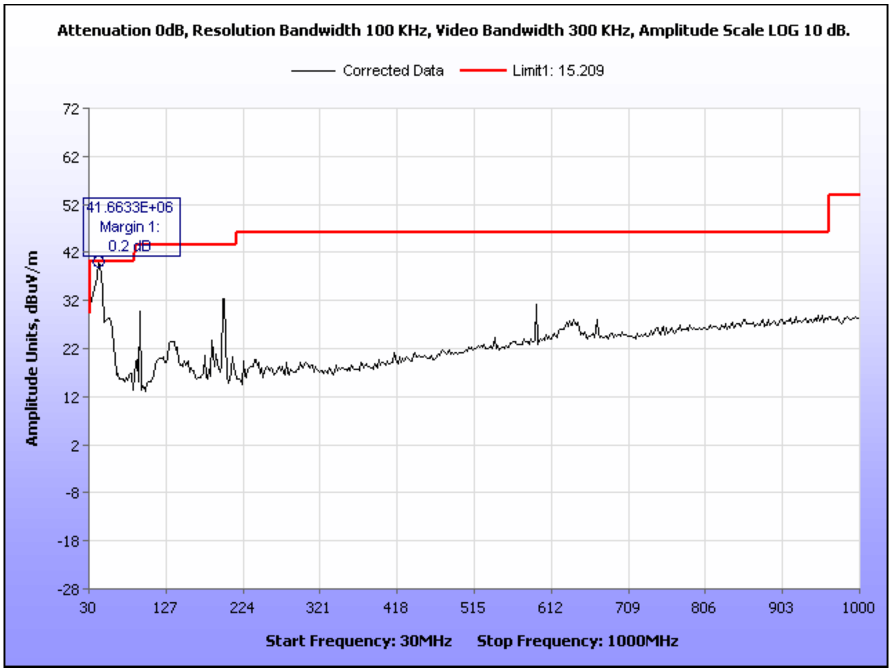
Plot 60. Radiated Spurious Emissions, 5500 MHz, 20 MHz Channel, 1 GHz – 7 GHz, Peak



Plot 61. Radiated Spurious Emissions, 5500 MHz, 20 MHz Channel, 7 GHz – 18 GHz, Average

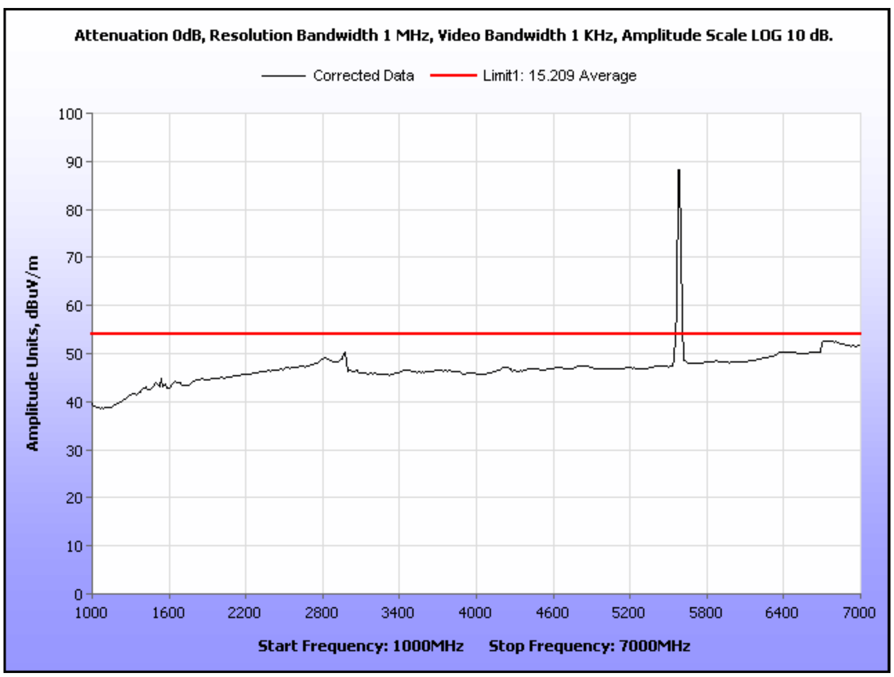


Plot 62. Radiated Spurious Emissions, 5500 MHz, 20 MHz Channel, 7 GHz – 18 GHz, Peak

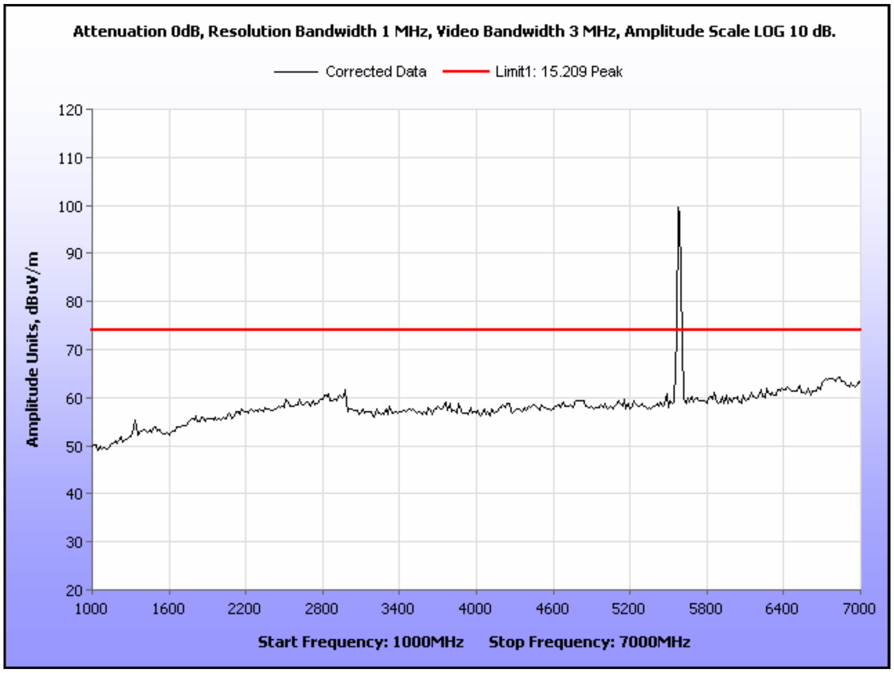


Plot 63. Radiated Spurious Emissions, 5580 MHz, 20 MHz Channel, Tx Power 19, 30 MHz – 1 GHz

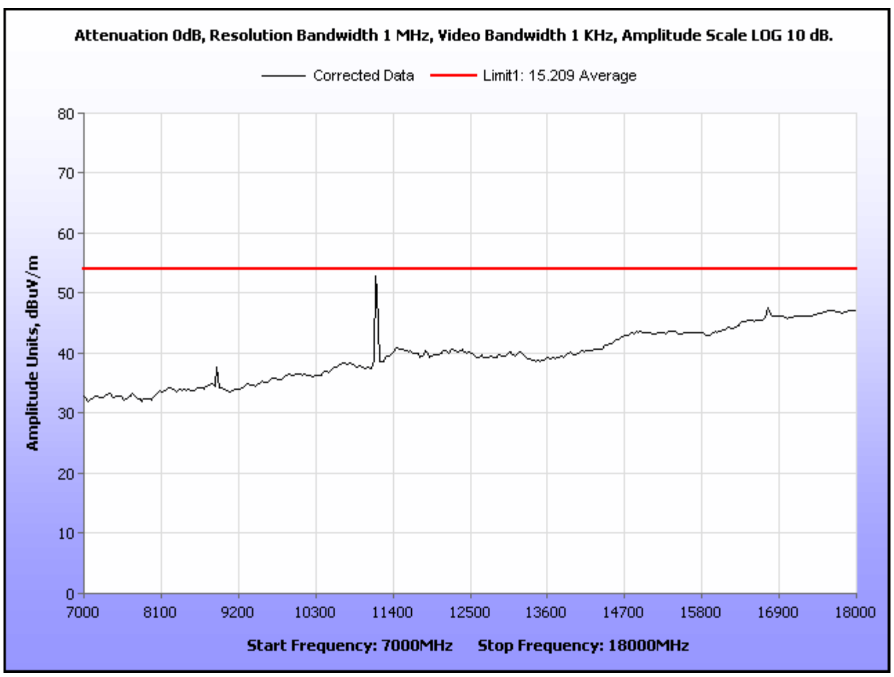
Note: Emissions exceeding the 15.209 limit are digital and meet the Class B limits of 15.109. Refer to Table 11.



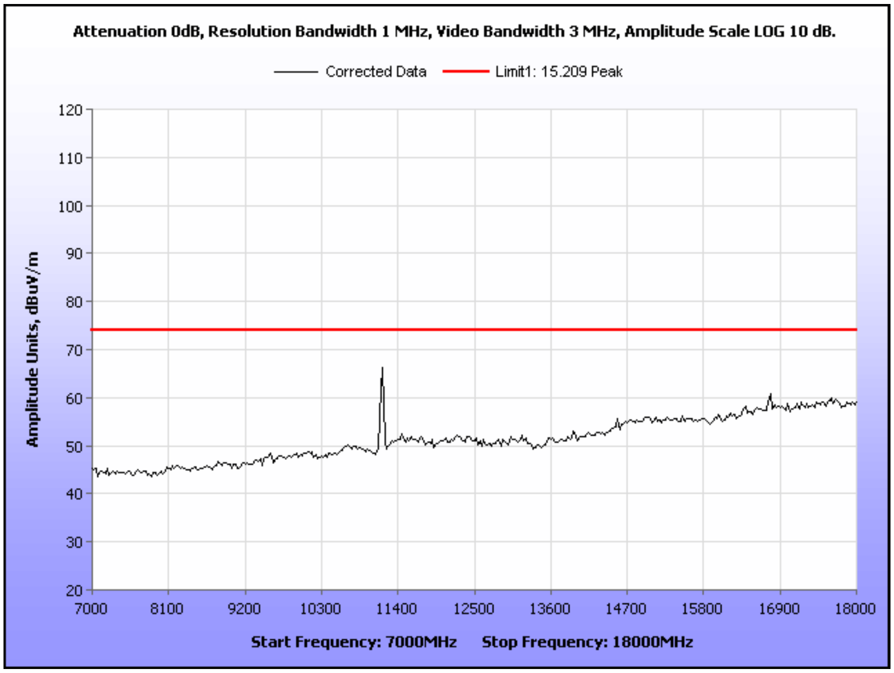
Plot 64. Radiated Spurious Emissions, 5580 MHz, 20 MHz Channel, 1 GHz – 7 GHz, Average



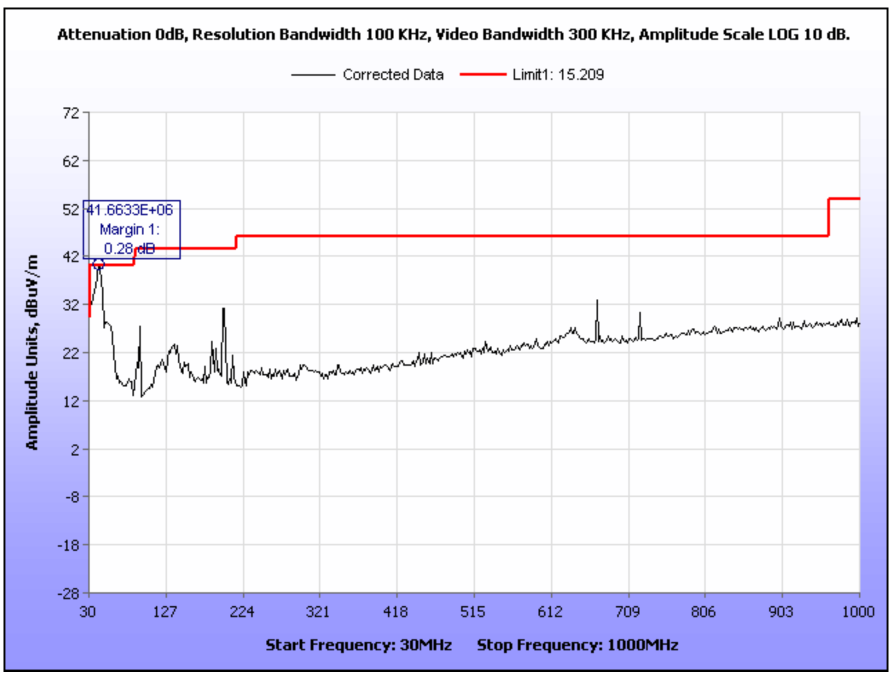
Plot 65. Radiated Spurious Emissions, 5580 MHz, 20 MHz Channel, 1 GHz – 7 GHz, Peak



Plot 66. Radiated Spurious Emissions, 5580 MHz, 20 MHz Channel, 7 GHz – 18 GHz, Average

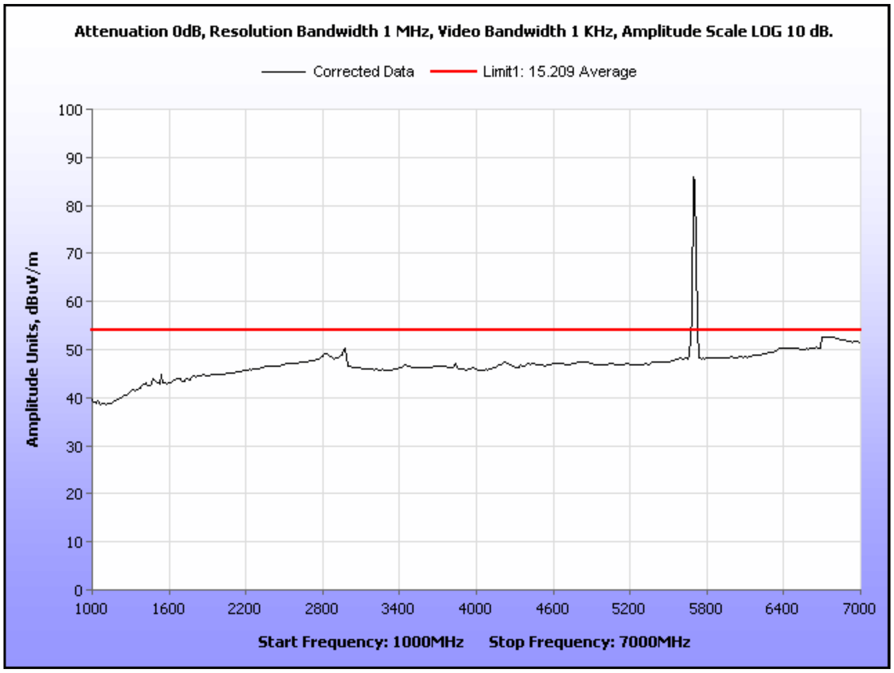


Plot 67. Radiated Spurious Emissions, 5580 MHz, 20 MHz Channel, 7 GHz – 18 GHz, Peak

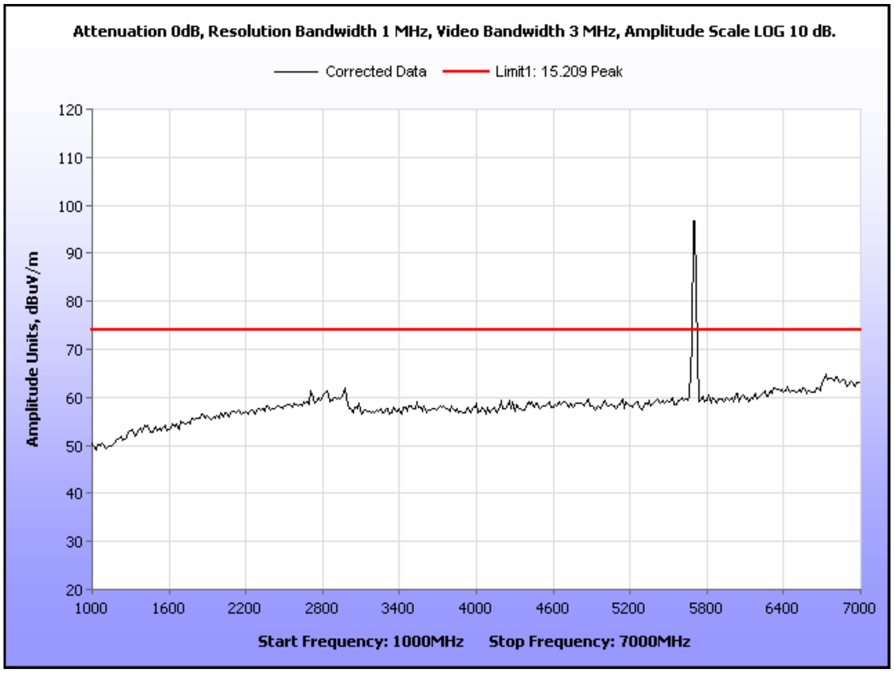


Plot 68. Radiated Spurious Emissions, 5700 MHz, 20 MHz Channel, Tx Power 20, 30 MHz – 1 GHz

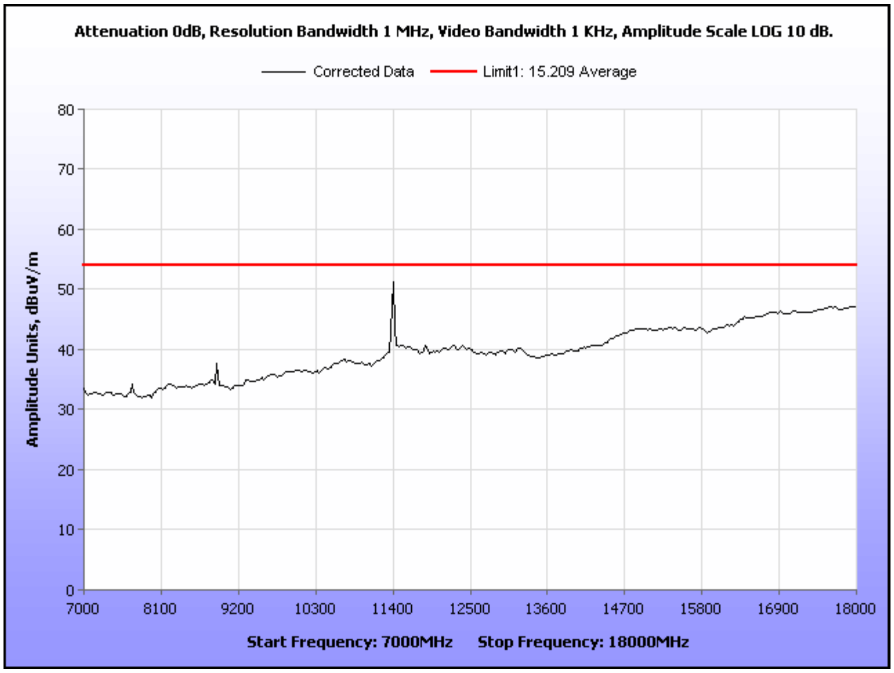
Note: Emissions exceeding the 15.209 limit are digital and meet the Class B limits of 15.109. Refer to Table 11.



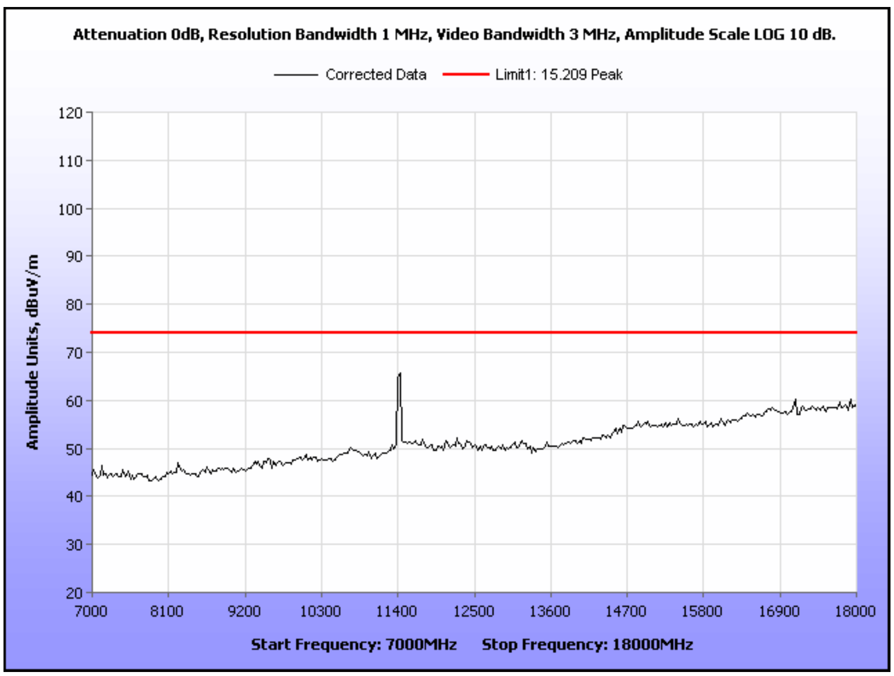
Plot 69. Radiated Spurious Emissions, 5700 MHz, 20 MHz Channel, 1 GHz – 7 GHz, Average



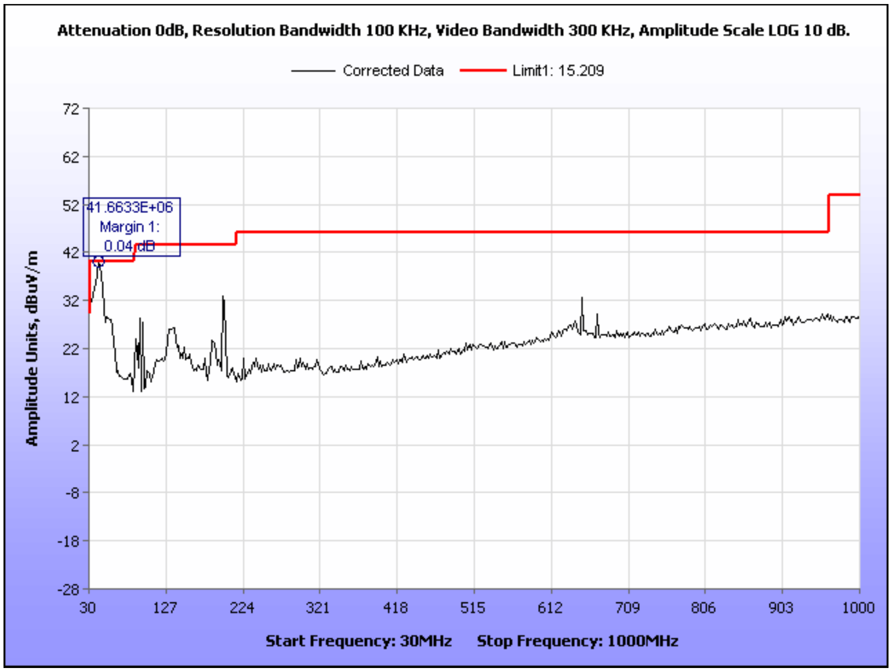
Plot 70. Radiated Spurious Emissions, 5700 MHz, 20 MHz Channel, 1 GHz – 7 GHz, Peak



Plot 71. Radiated Spurious Emissions, 5700 MHz, 20 MHz Channel, 7 GHz – 18 GHz, Average

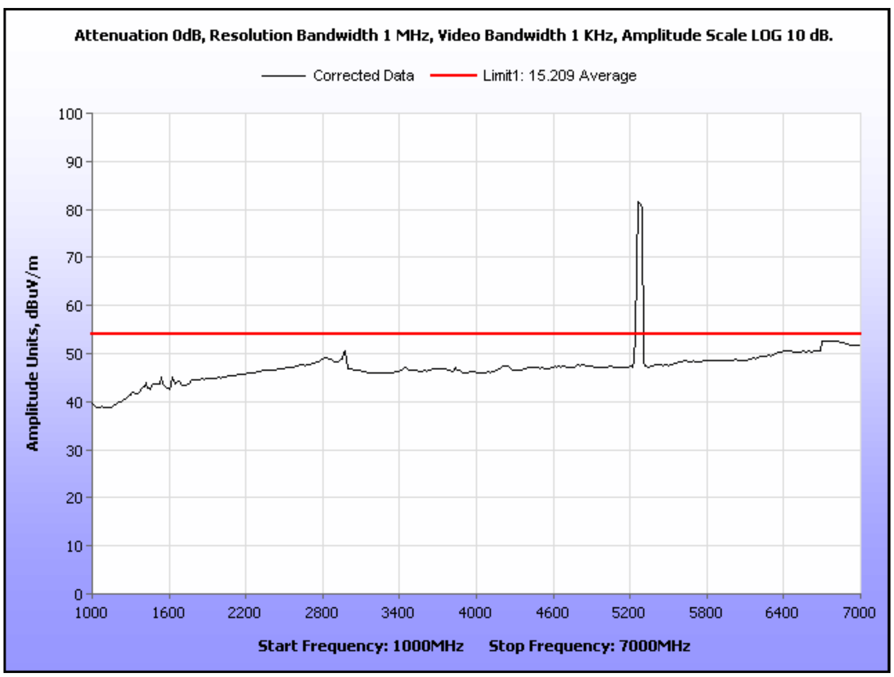


Plot 72. Radiated Spurious Emissions, 5700 MHz, 20 MHz Channel, 7 GHz – 18 GHz, Peak

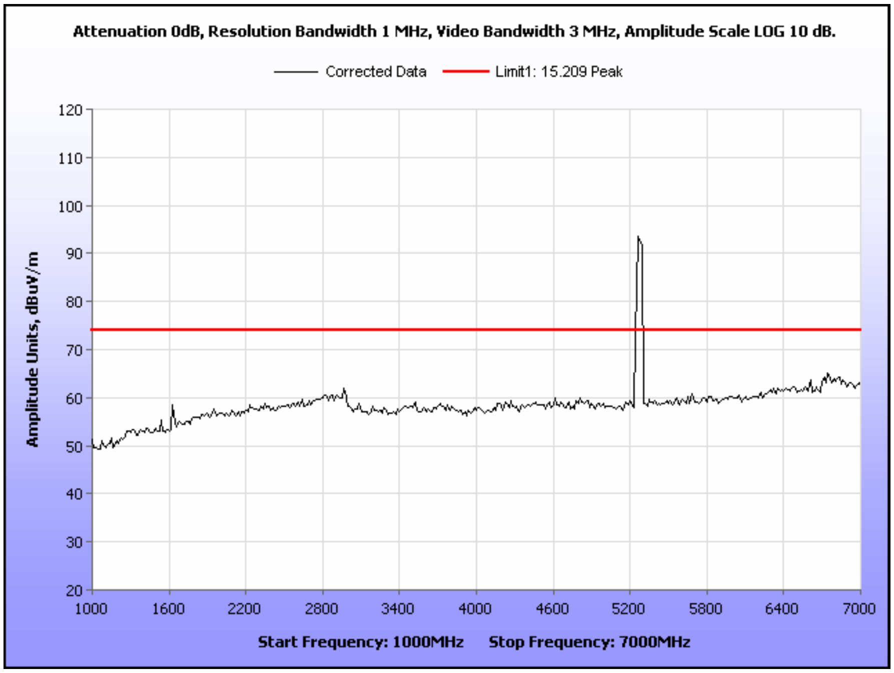


Plot 73. Radiated Spurious Emissions, 5270 MHz, 40 MHz Channel, Tx Power 20, 30 MHz – 1 GHz

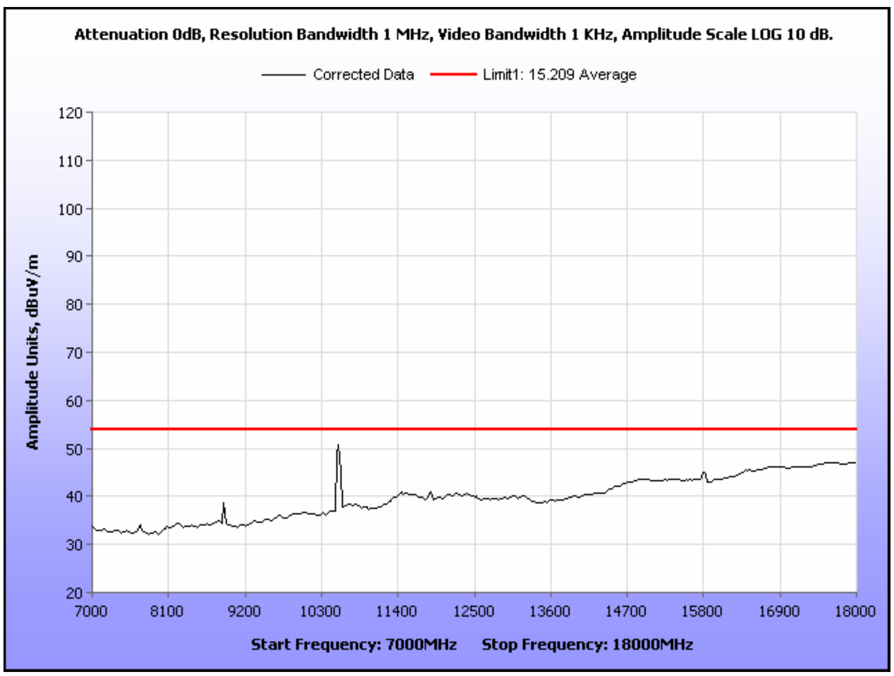
Note: Emissions exceeding the 15.209 limit are digital and meet the Class B limits of 15.109. Refer to Table 11.



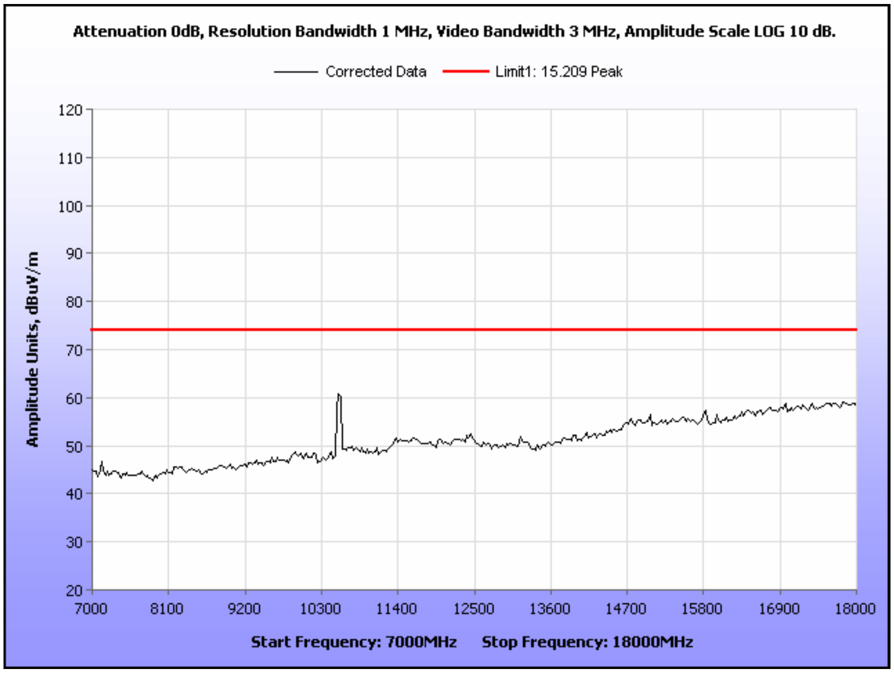
Plot 74. Radiated Spurious Emissions, 5270 MHz, 40 MHz Channel, 1 GHz – 7 GHz, Average



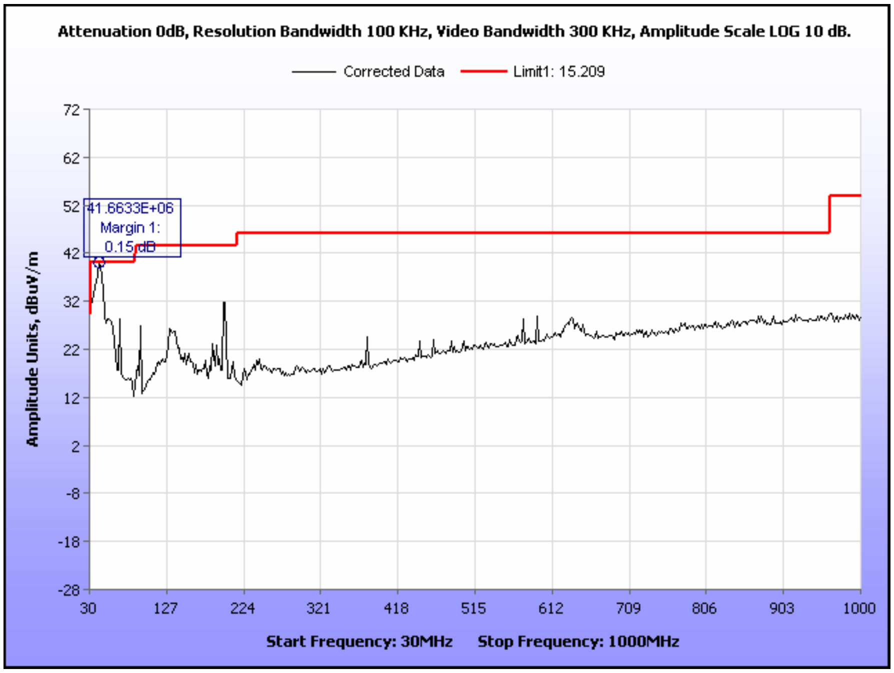
Plot 75. Radiated Spurious Emissions, 5270 MHz, 40 MHz Channel, 1 GHz – 7 GHz, Peak



Plot 76. Radiated Spurious Emissions, 5270 MHz, 40 MHz Channel, 7 GHz – 18 GHz, Average

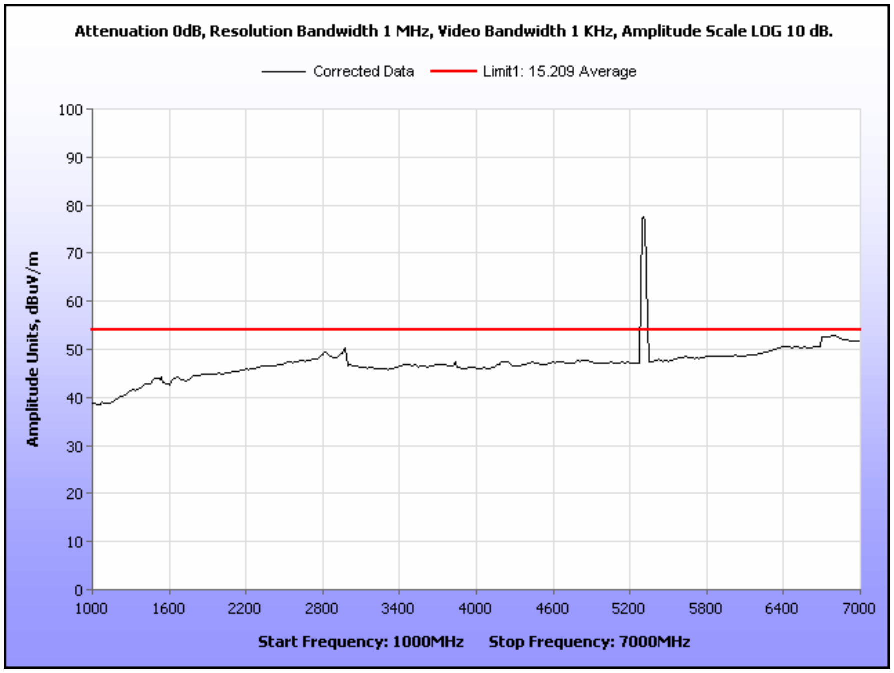


Plot 77. Radiated Spurious Emissions, 5270 MHz, 40 MHz Channel, 7 GHz – 18 GHz, Peak

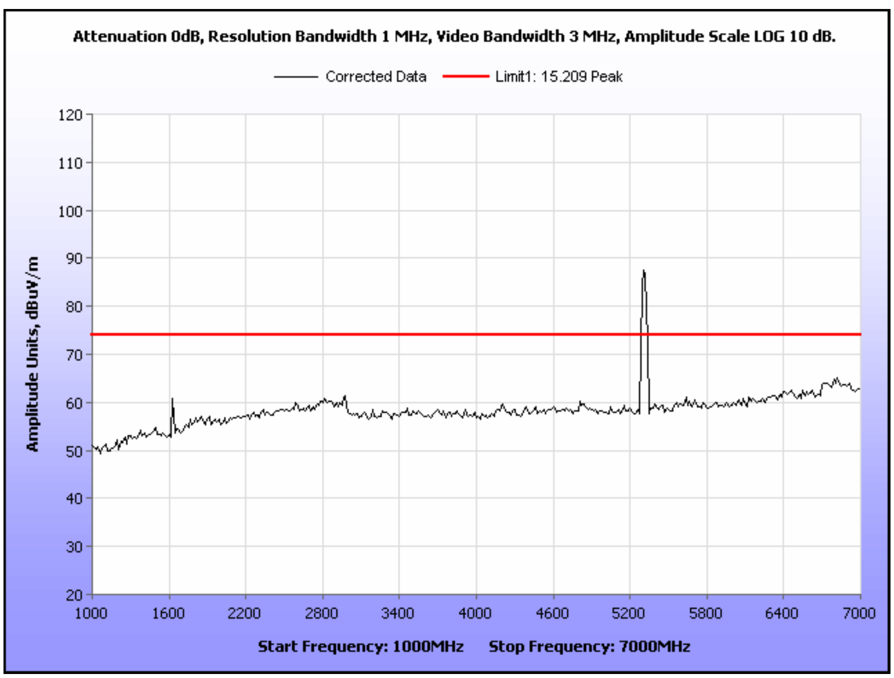


Plot 78. Radiated Spurious Emissions, 5310 MHz, 40 MHz Channel, Tx Power 18, 30 MHz – 1 GHz

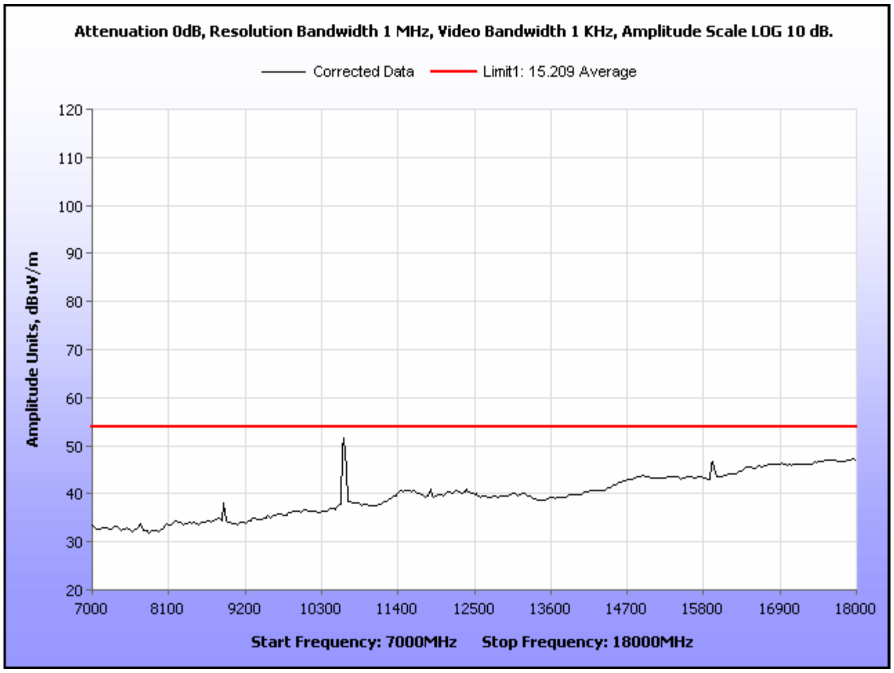
Note: Emissions exceeding the 15.209 limit are digital and meet the Class B limits of 15.109. Refer to Table 11.



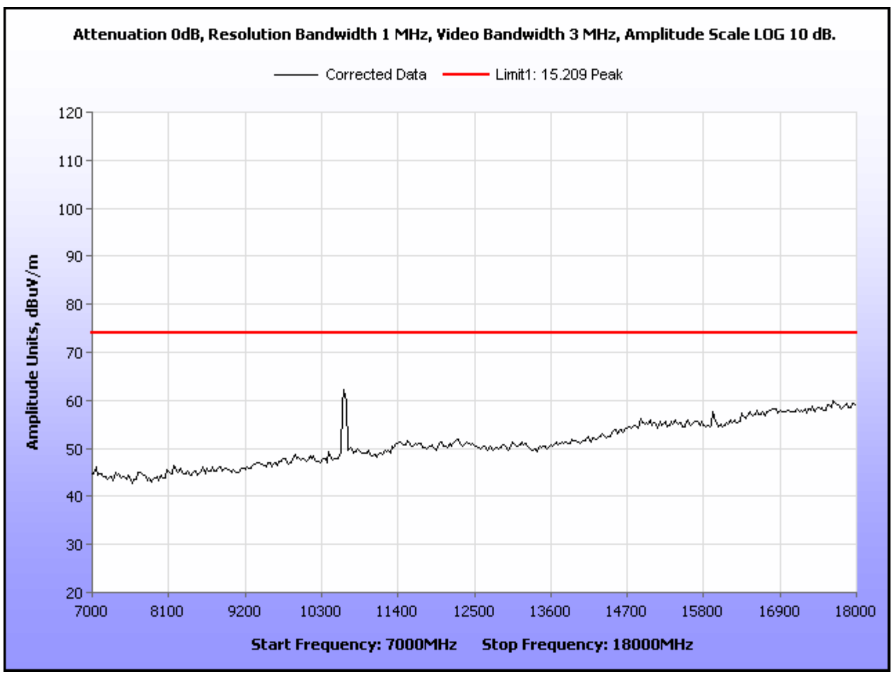
Plot 79. Radiated Spurious Emissions, 5310 MHz, 40 MHz Channel, 1 GHz – 7 GHz, Average



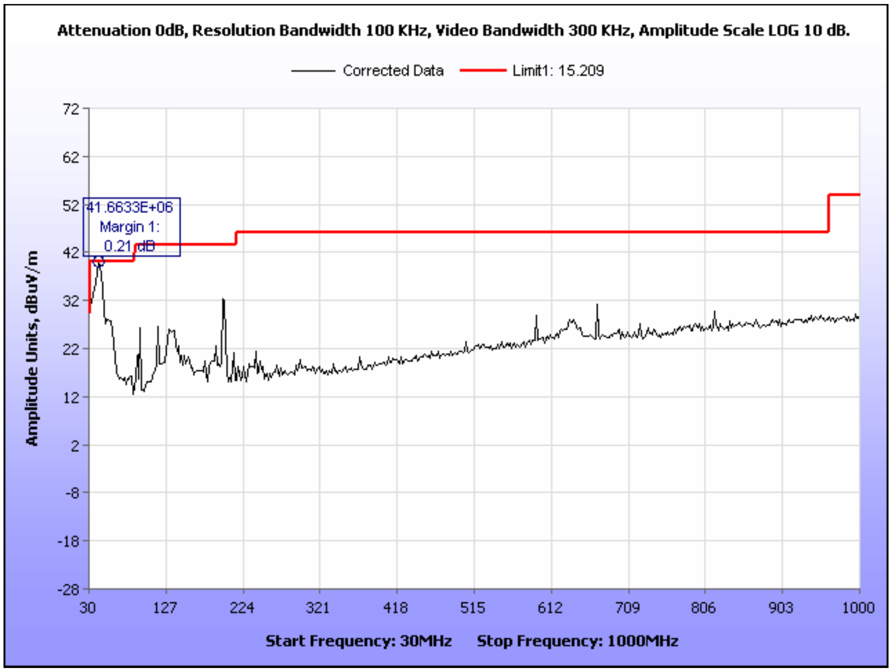
Plot 80. Radiated Spurious Emissions, 5310 MHz, 40 MHz Channel, 1 GHz – 7 GHz, Peak



Plot 81. Radiated Spurious Emissions, 5310 MHz, 40 MHz Channel, 7 GHz – 18 GHz, Average

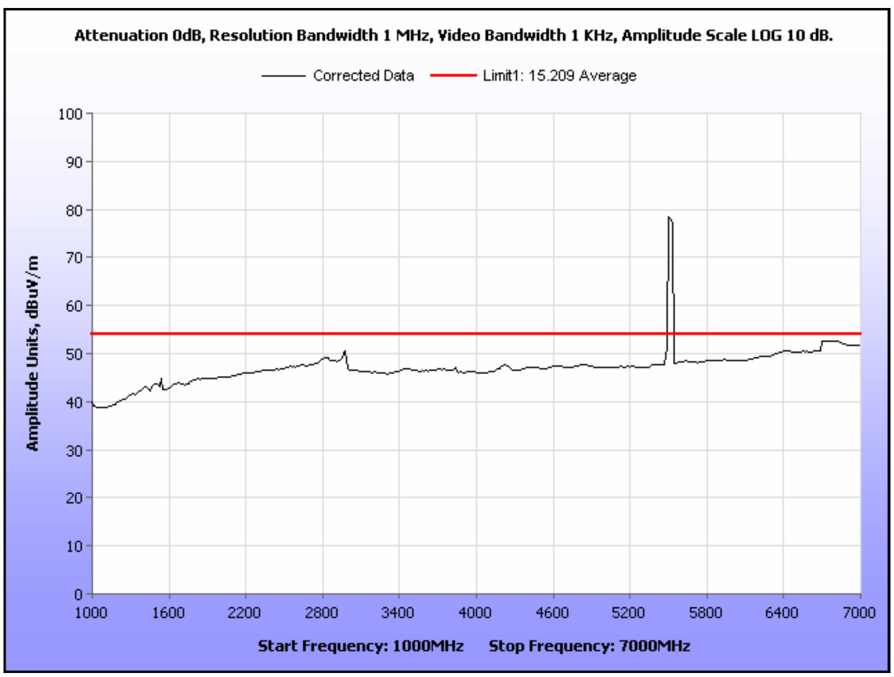


Plot 82. Radiated Spurious Emissions, 5310 MHz, 40 MHz Channel, 7 GHz – 18 GHz, Peak

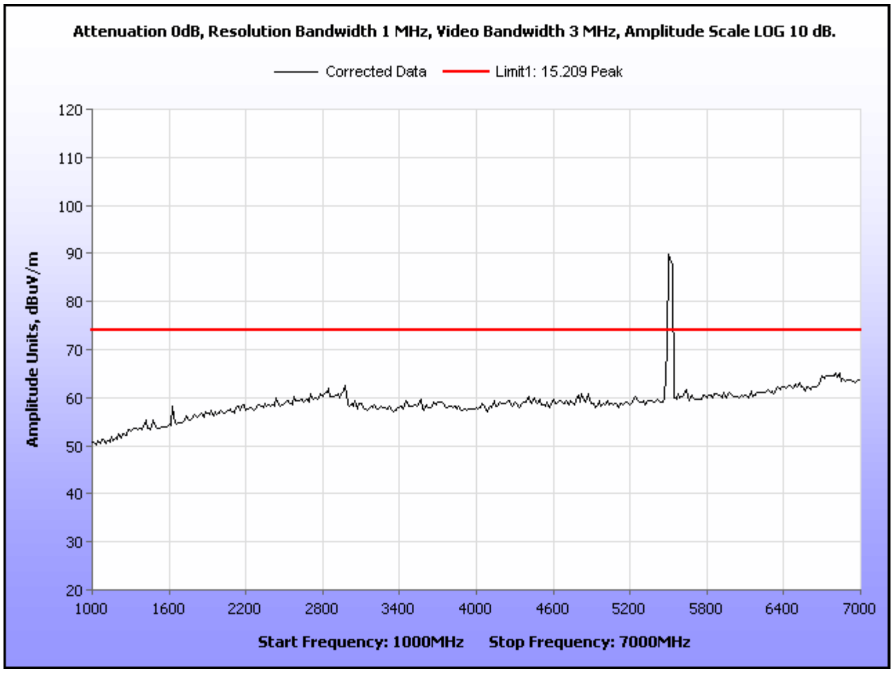


Plot 83. Radiated Spurious Emissions, 5510 MHz, 40 MHz Channel, Tx Power 20, 30 MHz – 1 GHz

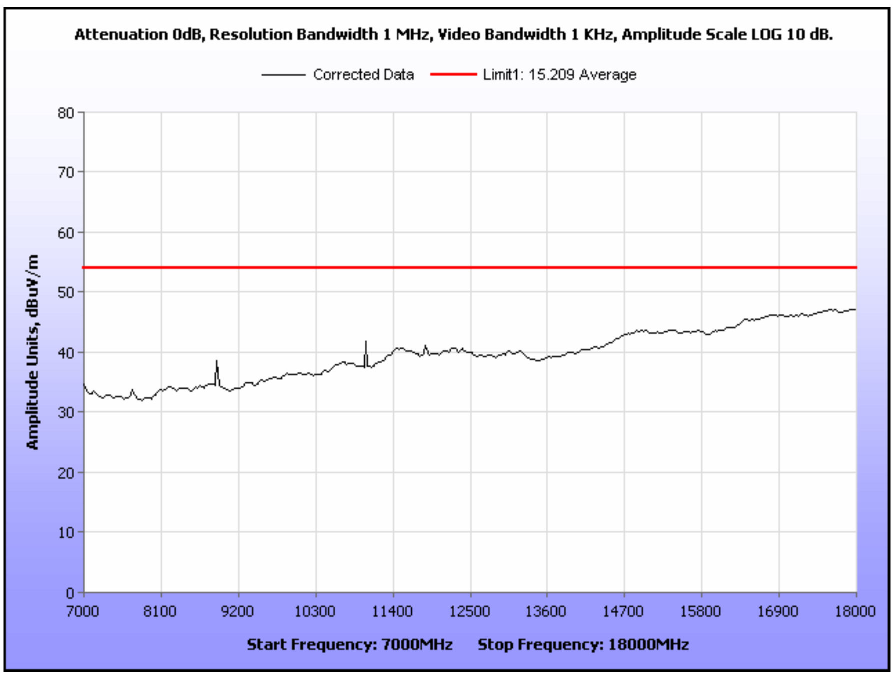
Note: Emissions exceeding the 15.209 limit are digital and meet the Class B limits of 15.109. Refer to Table 11.



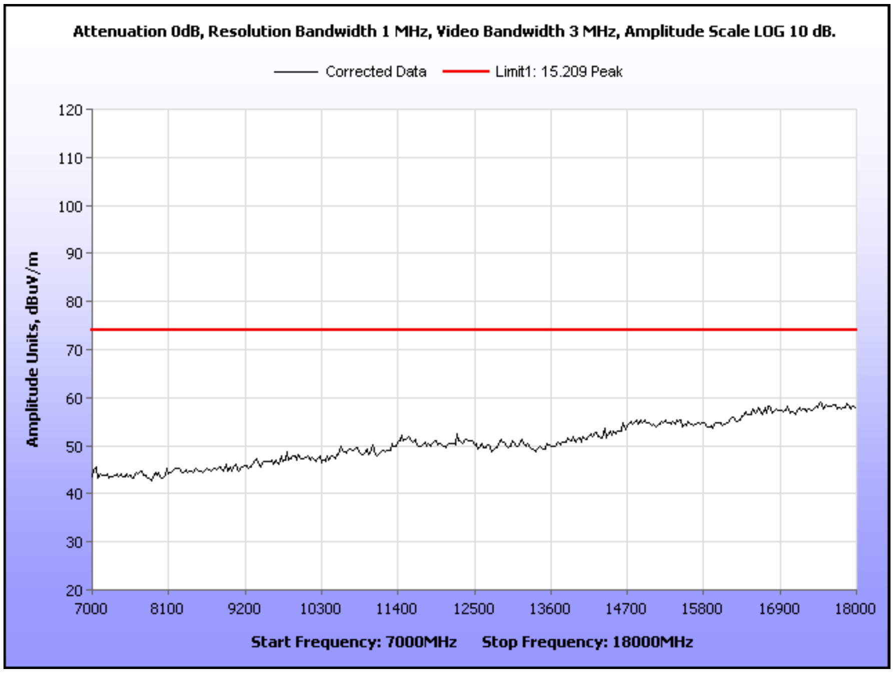
Plot 84. Radiated Spurious Emissions, 5510 MHz, 40 MHz Channel, 1 GHz – 7 GHz, Average



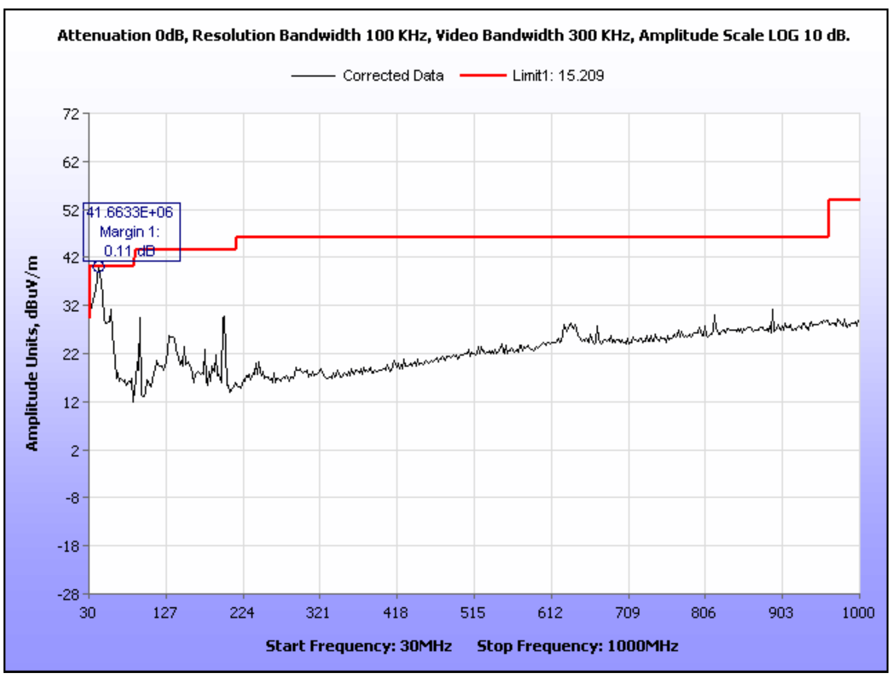
Plot 85. Radiated Spurious Emissions, 5510 MHz, 40 MHz Channel, 1 GHz – 7 GHz, Peak



Plot 86. Radiated Spurious Emissions, 5510 MHz, 40 MHz Channel, 7 GHz – 18 GHz, Average

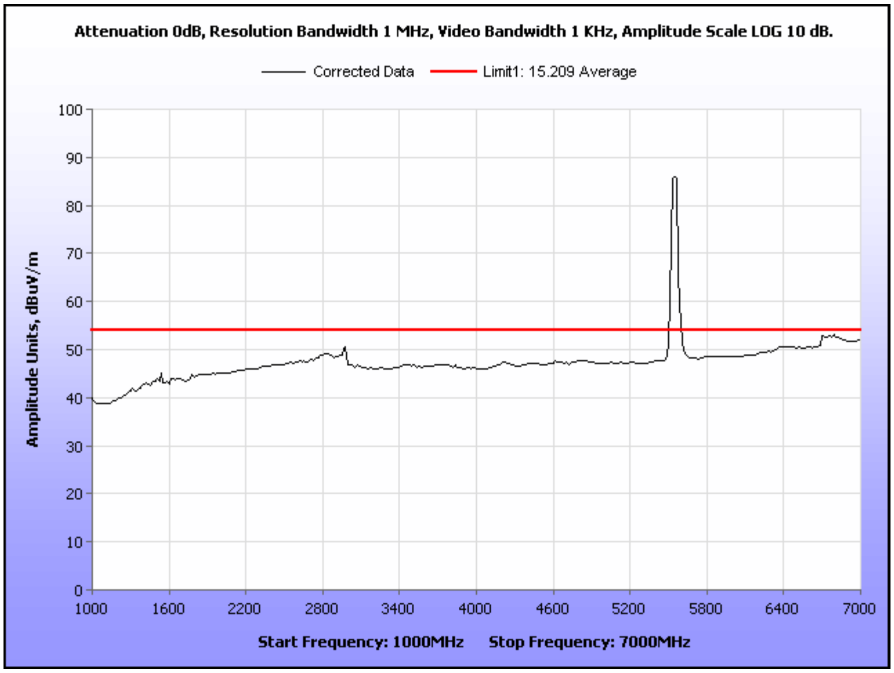


Plot 87. Radiated Spurious Emissions, 5510 MHz, 40 MHz Channel, 7 GHz – 18 GHz, Peak

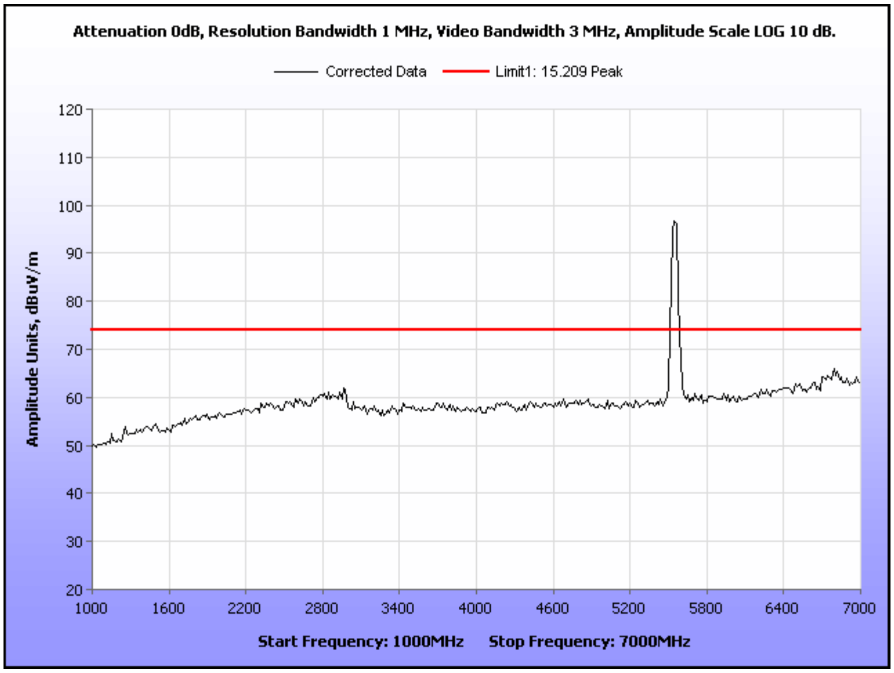


Plot 88. Radiated Spurious Emissions, 5550 MHz, 40 MHz Channel, Tx Power 20, 30 MHz – 1 GHz

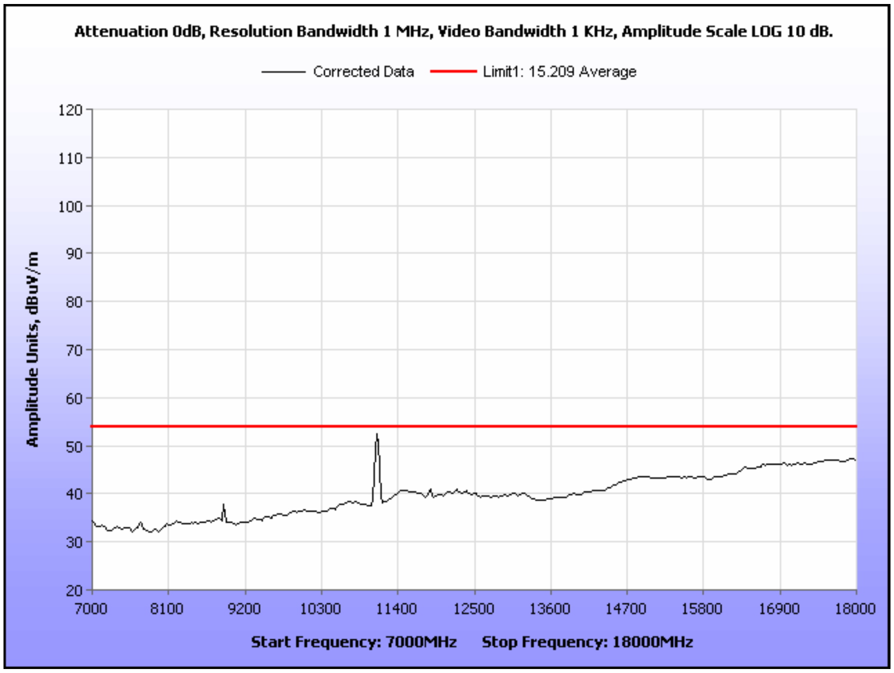
Note: Emissions exceeding the 15.209 limit are digital and meet the Class B limits of 15.109. Refer to Table 11.



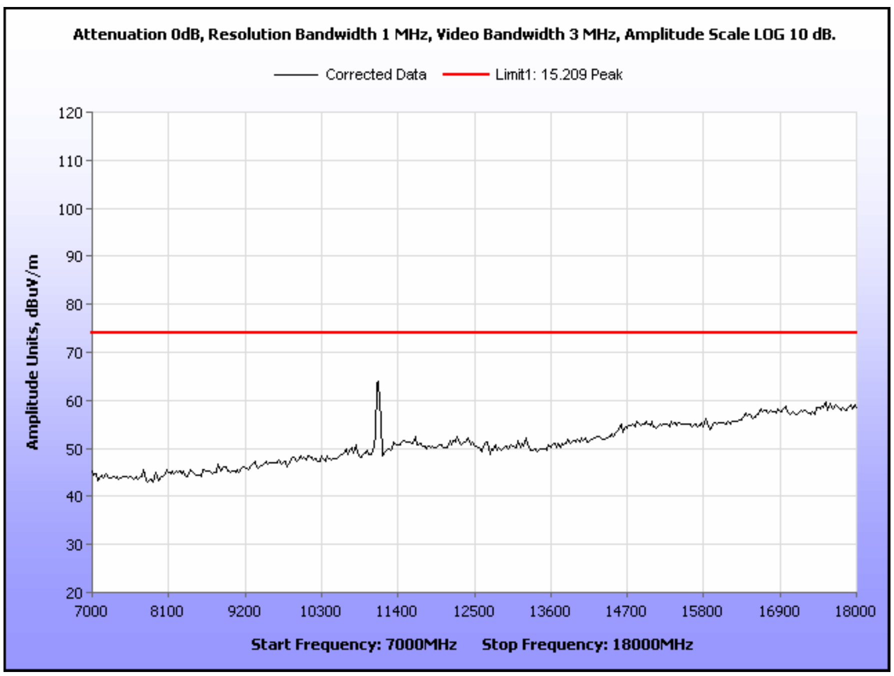
Plot 89. Radiated Spurious Emissions, 5550 MHz, 40 MHz Channel, 1 GHz – 7 GHz, Average



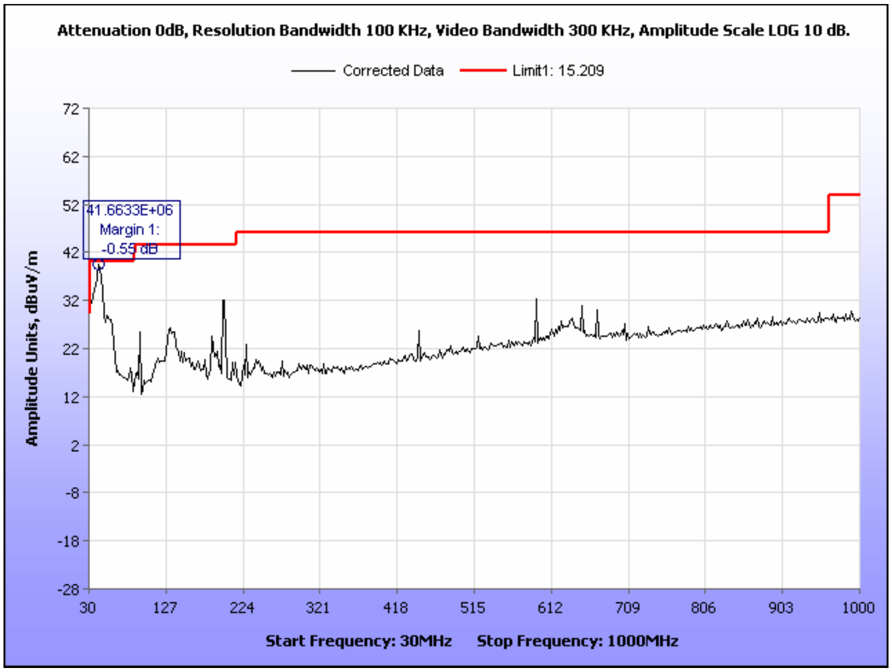
Plot 90. Radiated Spurious Emissions, 5550 MHz, 40 MHz Channel, 1 GHz – 7 GHz, Peak



Plot 91. Radiated Spurious Emissions, 5550 MHz, 40 MHz Channel, 7 GHz – 18 GHz, Average

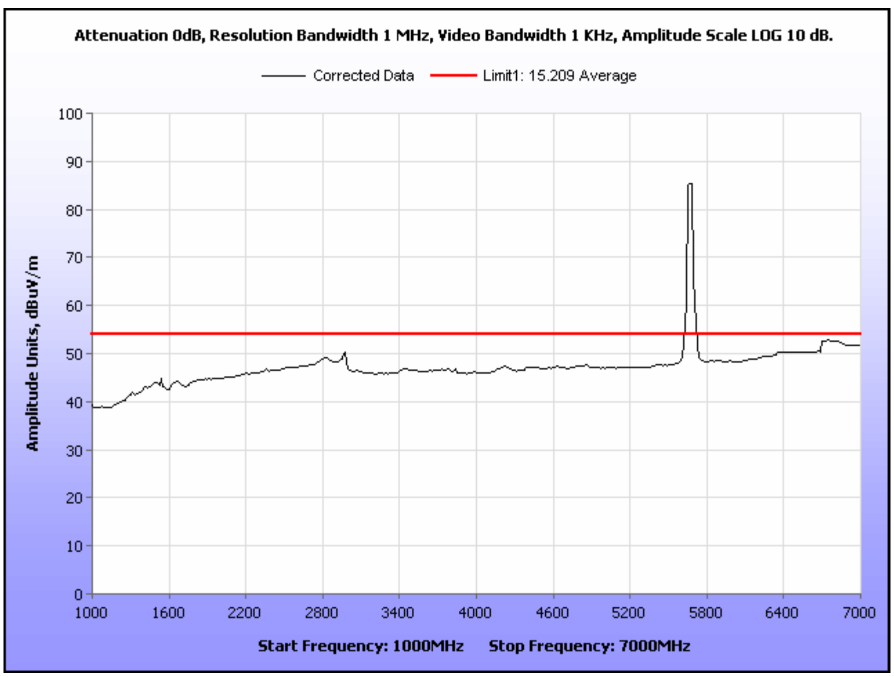


Plot 92. Radiated Spurious Emissions, 5550 MHz, 40 MHz Channel, 7 GHz – 18 GHz, Peak

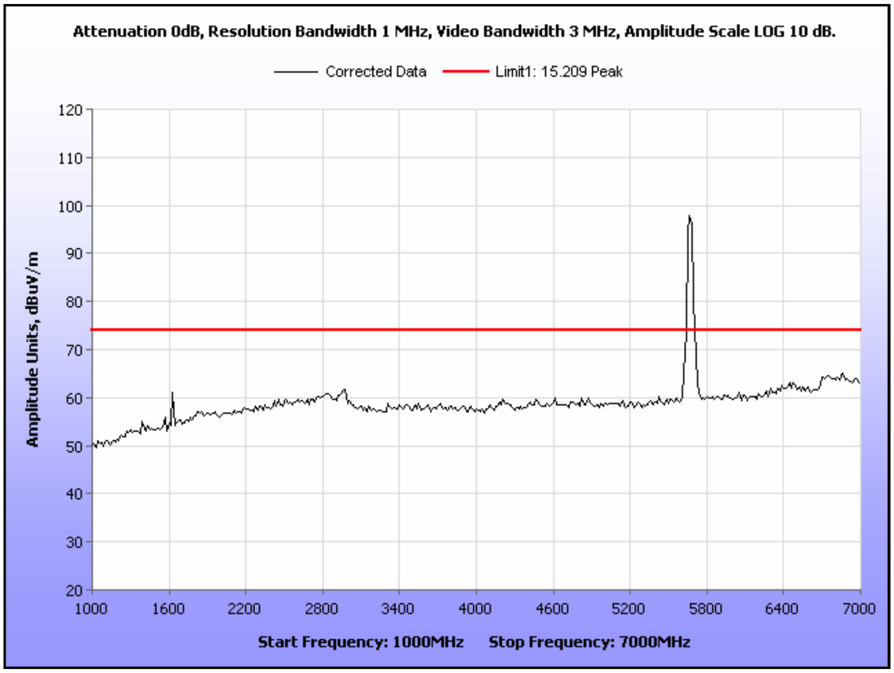


Plot 93. Radiated Spurious Emissions, 5670 MHz, 40 MHz Channel, Tx Power 20, 30 MHz – 1 GHz

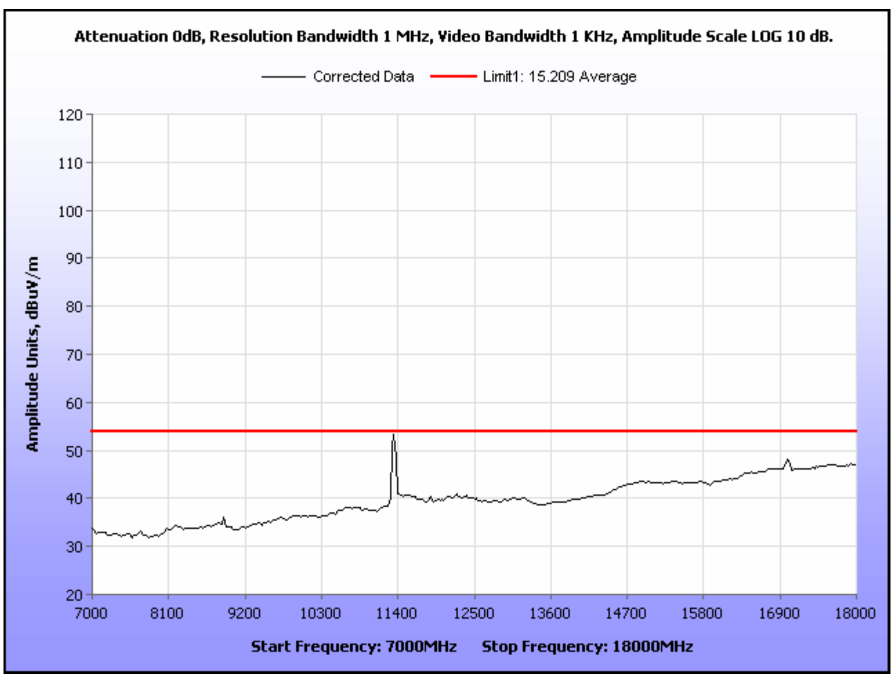
Note: Emissions exceeding the 15.209 limit are digital and meet the Class B limits of 15.109. Refer to Table 11.



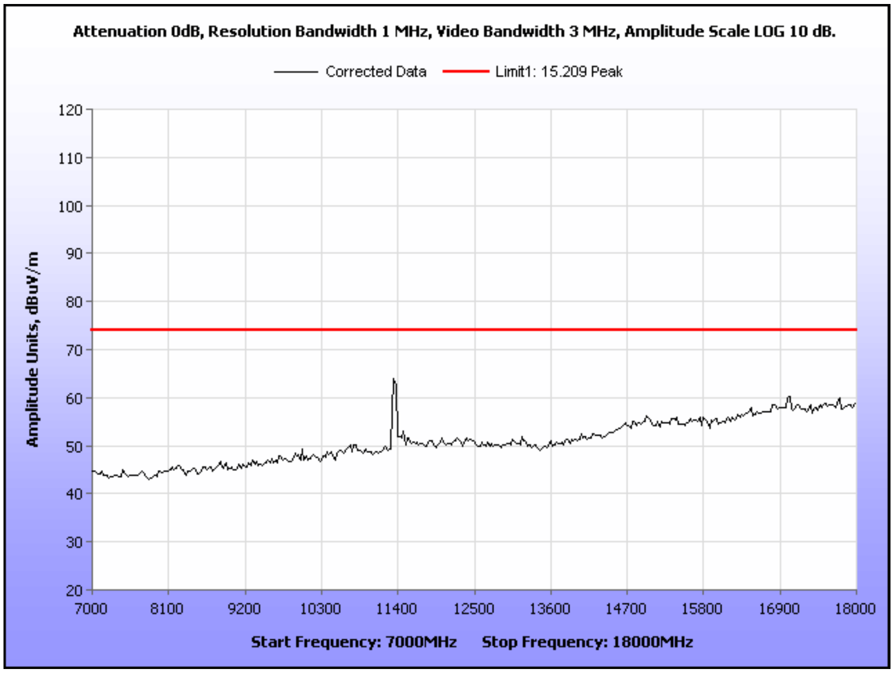
Plot 94. Radiated Spurious Emissions, 5670 MHz, 40 MHz Channel, 1 GHz – 7 GHz, Average



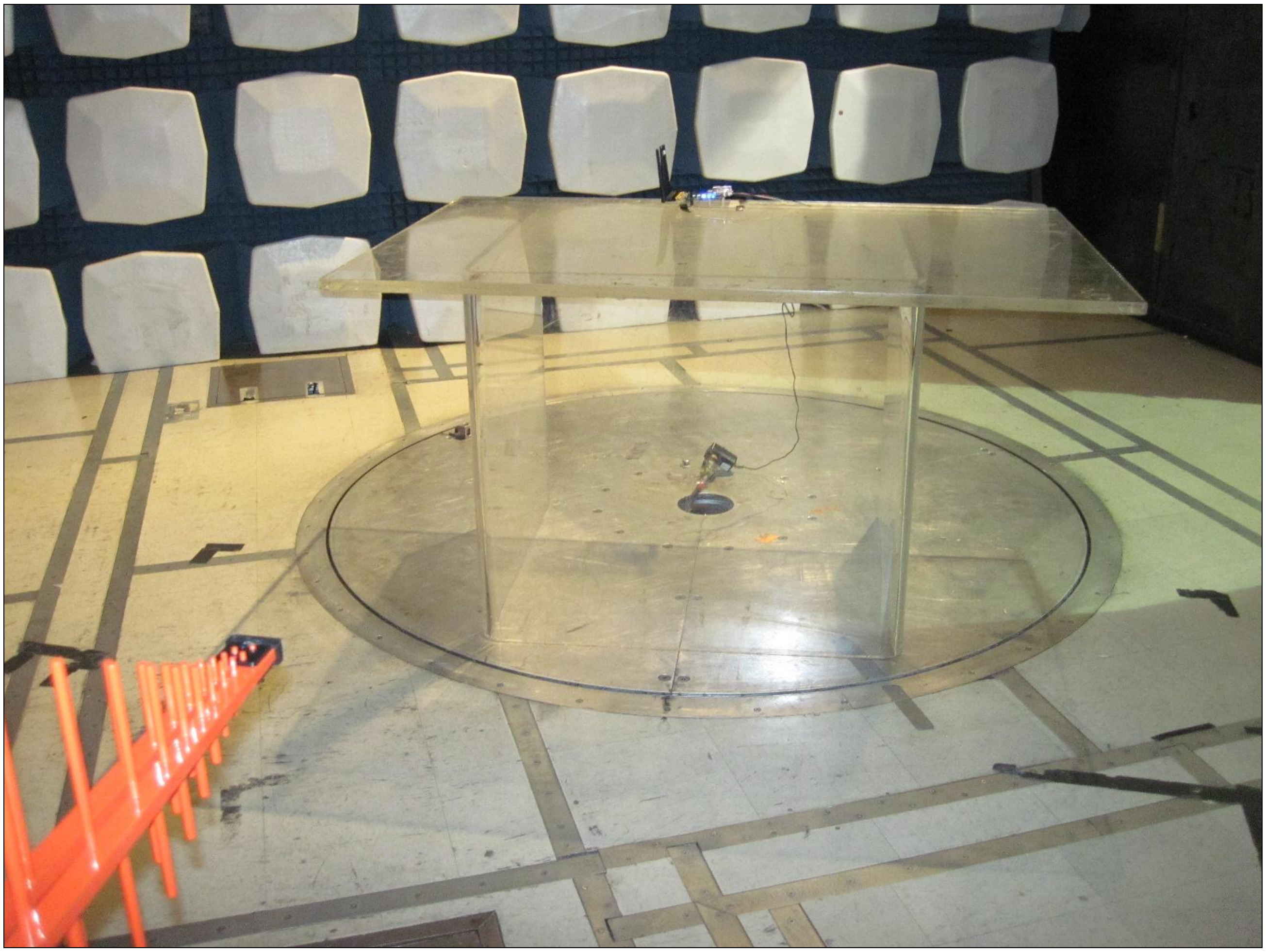
Plot 95. Radiated Spurious Emissions, 5670 MHz, 40 MHz Channel, 1 GHz – 7 GHz, Peak



Plot 96. Radiated Spurious Emissions, 5670 MHz, 40 MHz Channel, 7 GHz – 18 GHz, Average

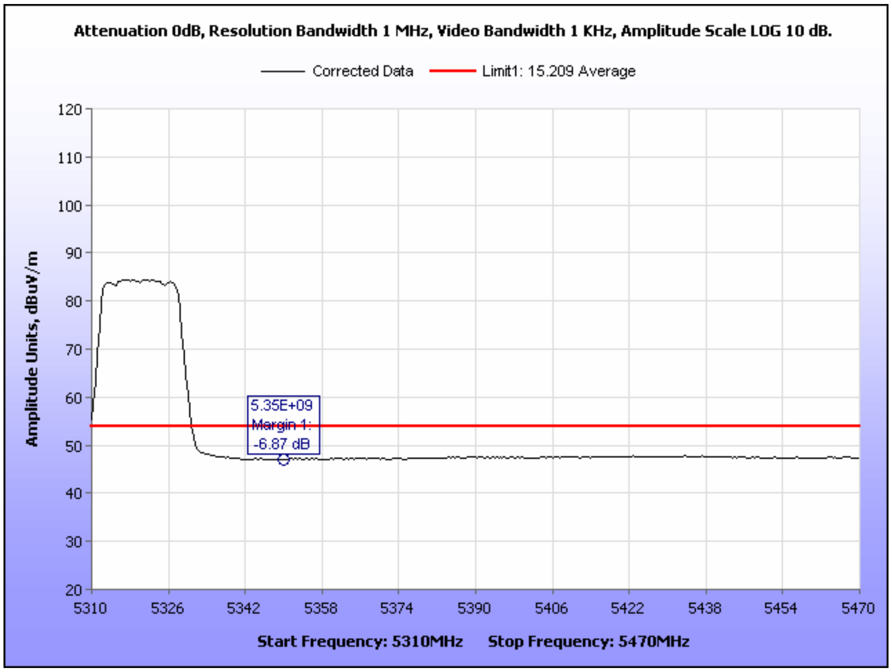


Plot 97. Radiated Spurious Emissions, 5670 MHz, 40 MHz Channel, 7 GHz – 18 GHz, Peak

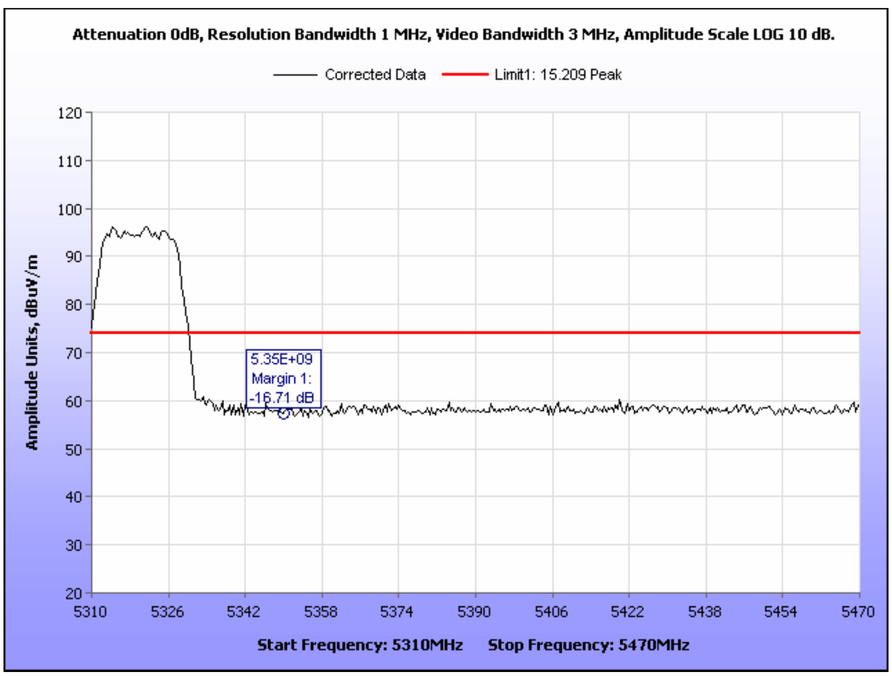


Photograph 5. Radiated Spurious Emissions, Test Setup

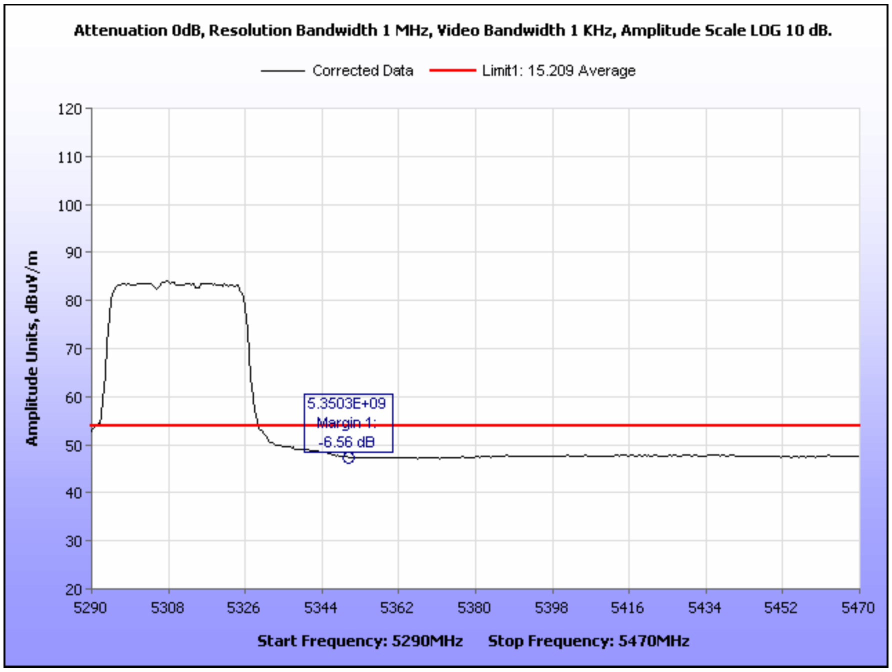
Restricted Band



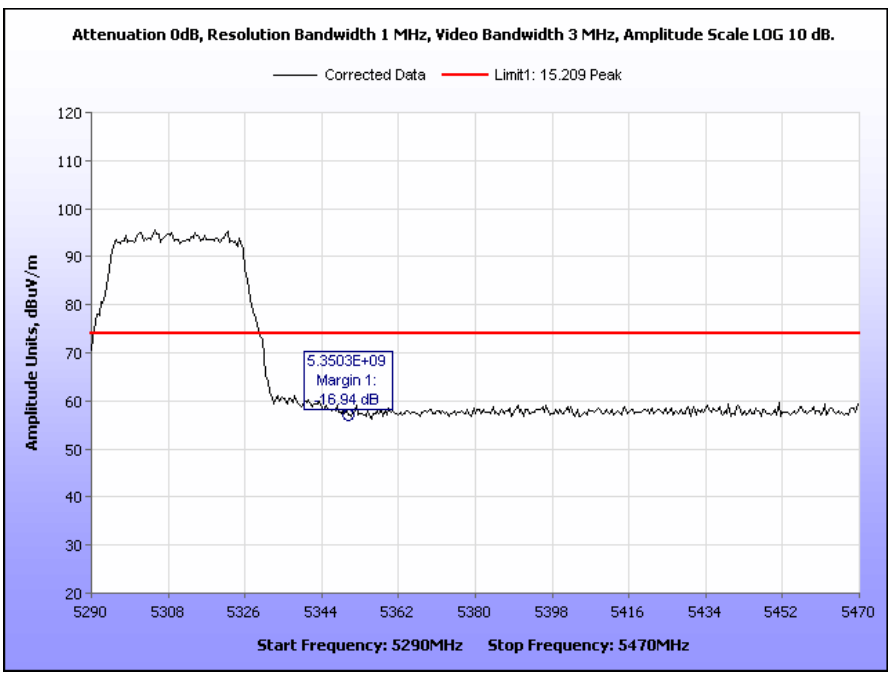
Plot 98. Restricted Band Emissions, 5320 MHz, 20 MHz, Average



Plot 99. Restricted Band Emissions, 5320 MHz, 20 MHz, Peak



Plot 100. Restricted Band Emissions, 5310 MHz, 40 MHz, Average



Plot 101. Restricted Band Emissions, 5310 MHz, 40 MHz, Peak

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 frequencies @ 5260-5320MHz and 5500-5700MHz; highest conducted power = 18.58 dBm (Avg) therefore, **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

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

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

where, S = Power Density (<1 mW/cm^2)
P = Power Input to antenna (72.11 mW)
G = Antenna Gain (3.16)
R = Minimum Distance between User and Antenna (20 cm)

$S = (72.11 * 3.16)/(4*3.14*20^2) = 0.045$ mW/cm^2

Since S < 1 mW/cm^2, the minimum distance (R) is 20cm

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(g) Frequency Stability

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

Test Procedure: The EUT was connected directly to a spectrum analyzer through an attenuator. The resolution band width of the spectrum analyzer was set to 10 KHz. The 1st trace of the Spectrum Analyzer was used as a reference at 23°C. A 2nd trace was used to show the drift of the carrier at extreme conditions. A delta marker was used to find the drift at a given extreme condition. The two frequencies (i.e. 5300 MHz and 5550 MHz) are derived from one oscillator. Therefore, only one channel was investigated for frequency stability.

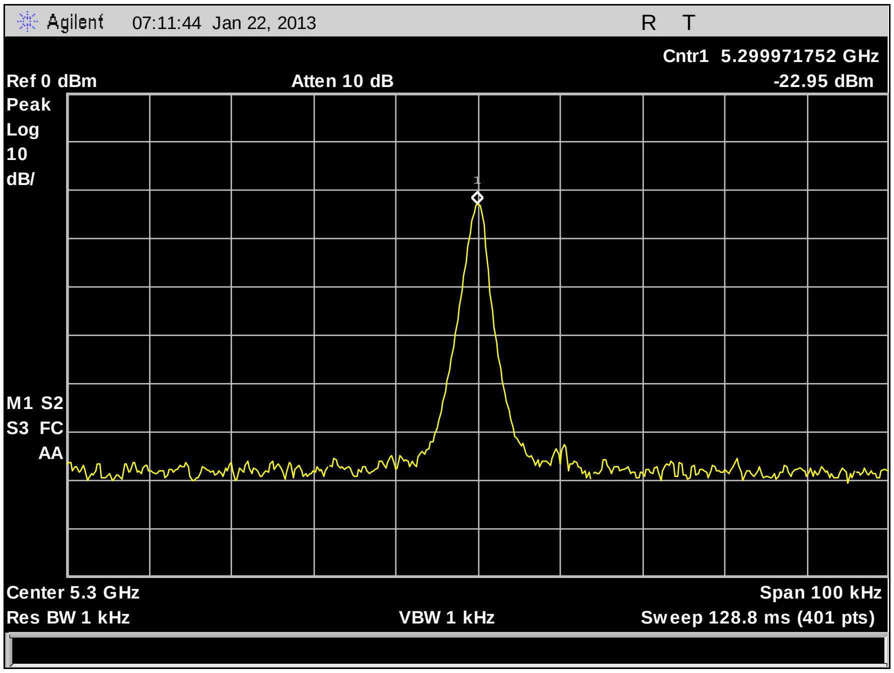
Test Results: The EUT was compliant with the requirements of **§15.407(g)**.

Test Engineer(s): Jeff Pratt

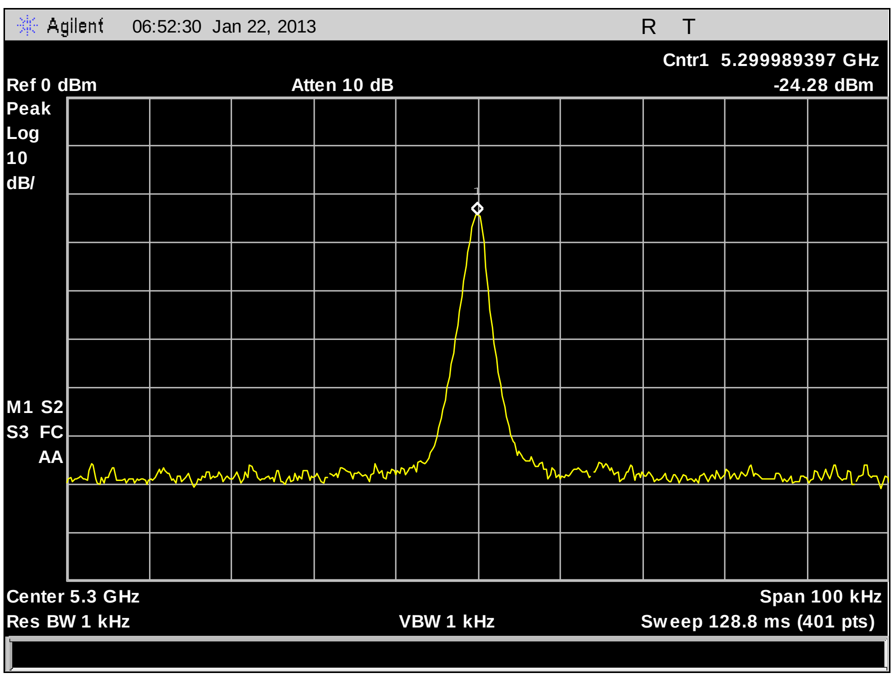
Test Date(s): 01/22/13

Frequency	5300 MHz	UNII2	
Temperature (C)	**Voltage (V)**	**Center Frequency (MHz)**	**Drift (PPM)**
-30	120	5299.971752	1.368311
-20	120	5299.989397	4.697579
-10	120	5299.995554	5.859285
0	120	5299.983466	3.578515
10	120	5299.963707	-0.14962
20	108	5299.9645	0
20	120	5299.9645	0
20	132	5299.96149	-0.56793
30	120	5299.954066	-1.96869
40	120	5299.944907	-3.69682
50	120	5299.94217	-4.21324
55	120	5299.945392	-3.60531

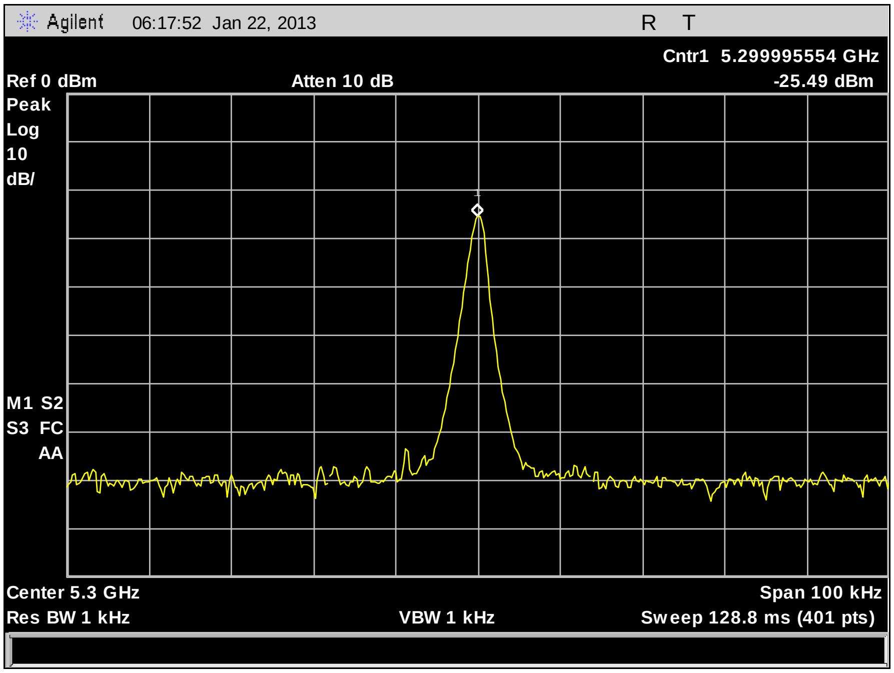
Table 17. Frequency Stability, Test Results



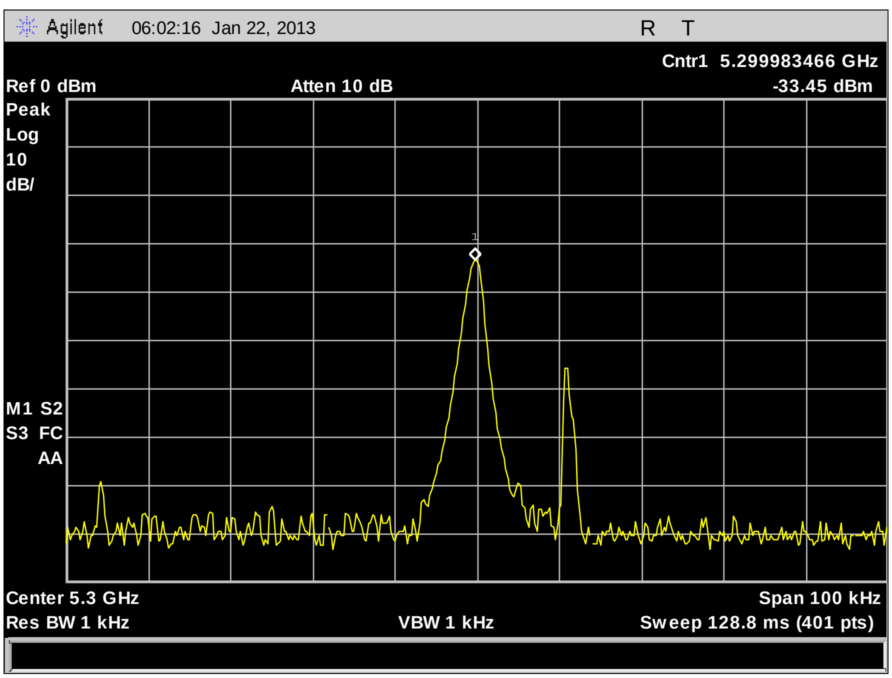
Plot 102. Frequency Stability, 5300 MHz, -30°C, 120 V



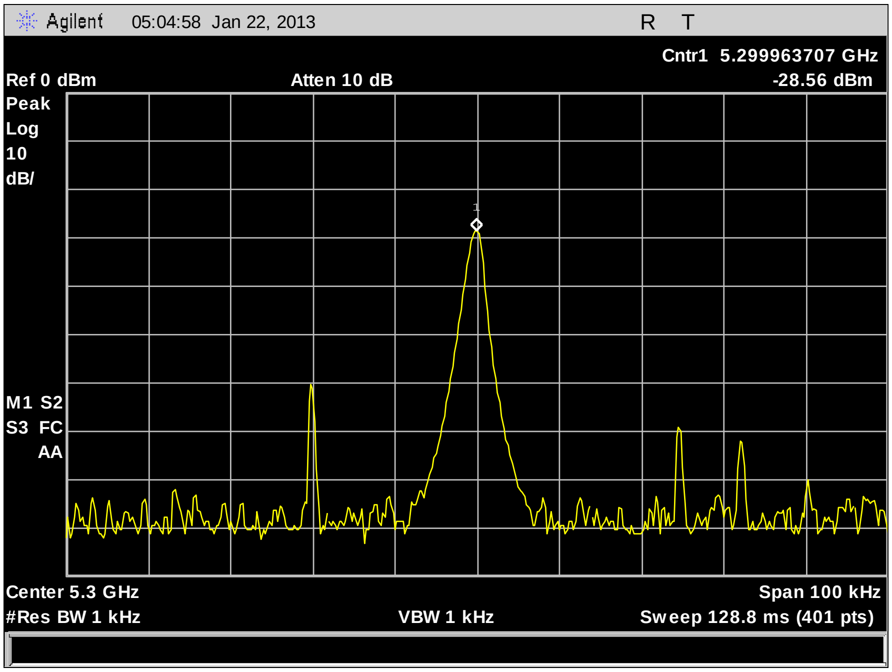
Plot 103. Frequency Stability, 5300 MHz, -20°C, 120 V



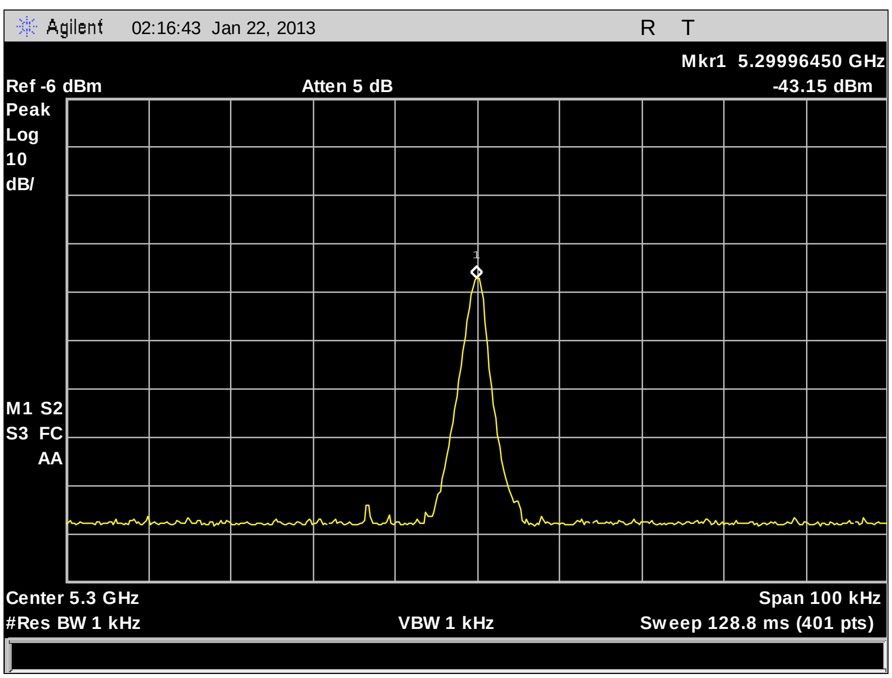
Plot 104. Frequency Stability, 5300 MHz, -10°C, 120 V



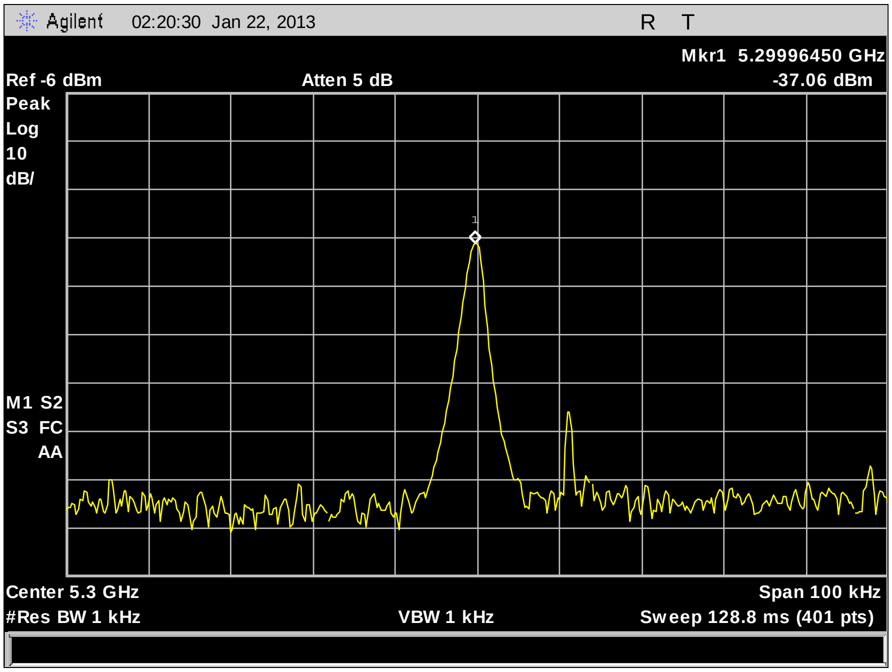
Plot 105. Frequency Stability, 5300 MHz, 0°C, 120 V



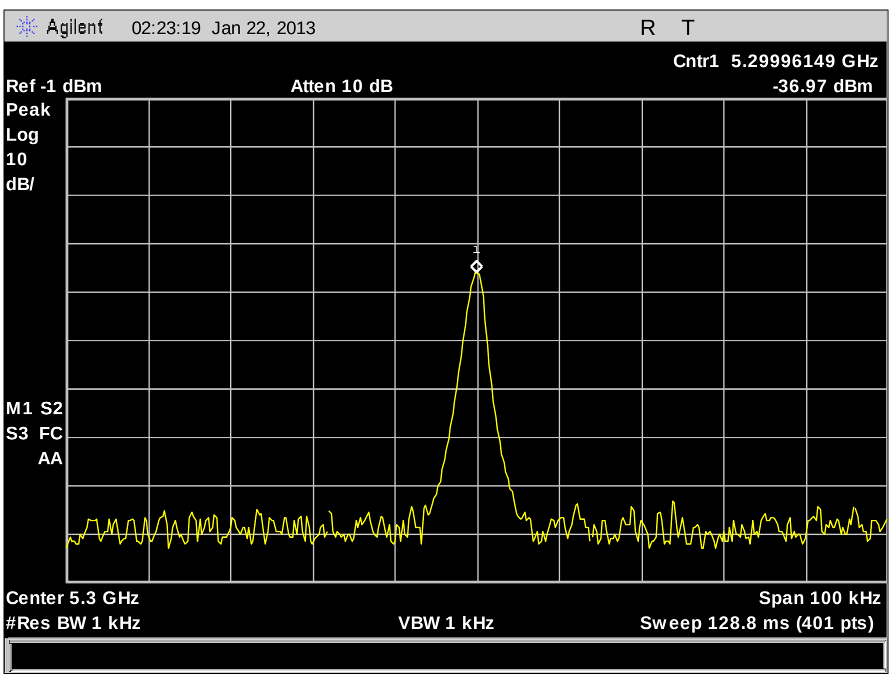
Plot 106. Frequency Stability, 5300 MHz, 10°C, 120 V



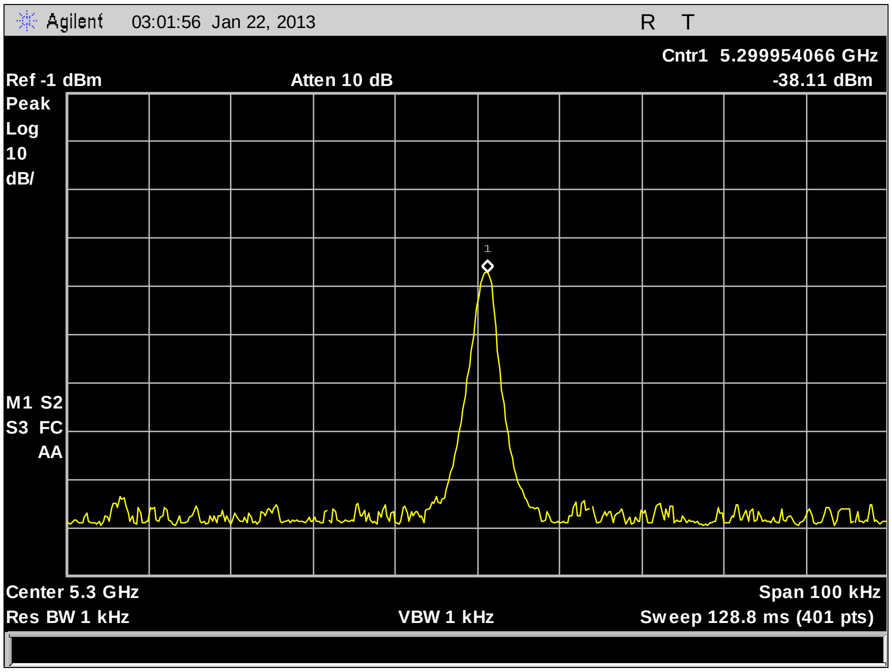
Plot 107. Frequency Stability, 5300 MHz, 20°C, 108V



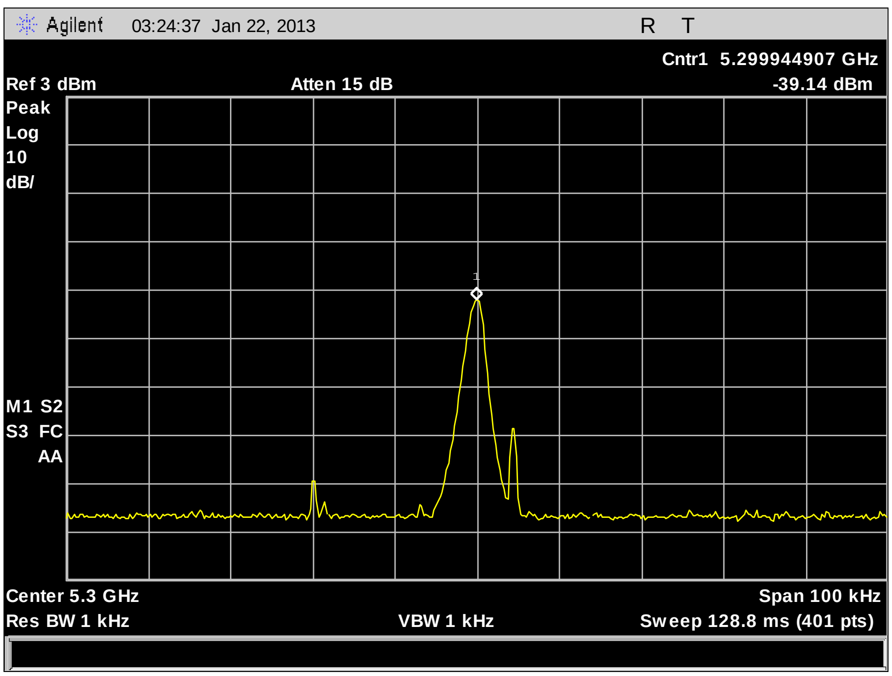
Plot 108. Frequency Stability, 5300 MHz, 20°C, 120 V



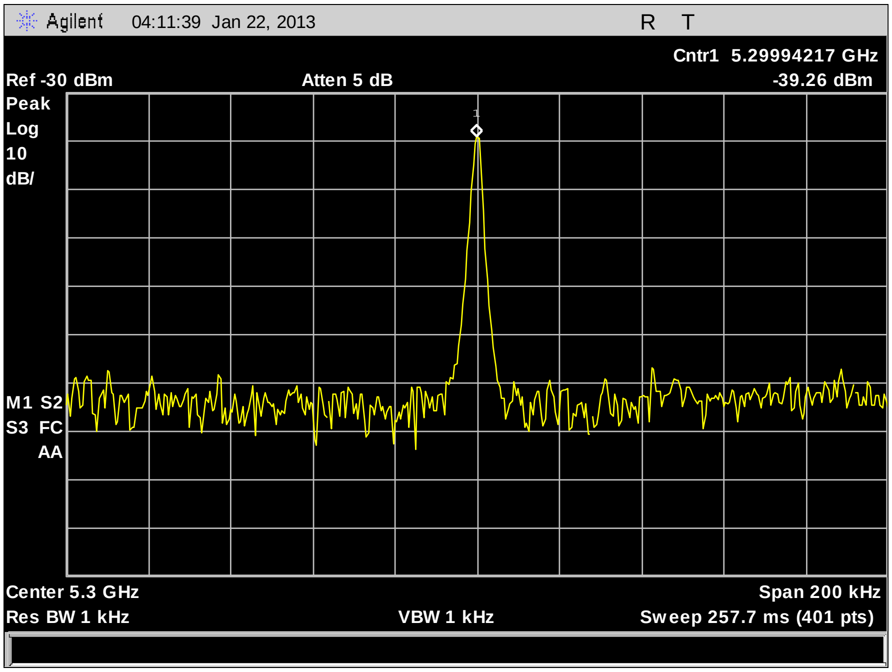
Plot 109. Frequency Stability, 5300 MHz, 20°C, 132 V



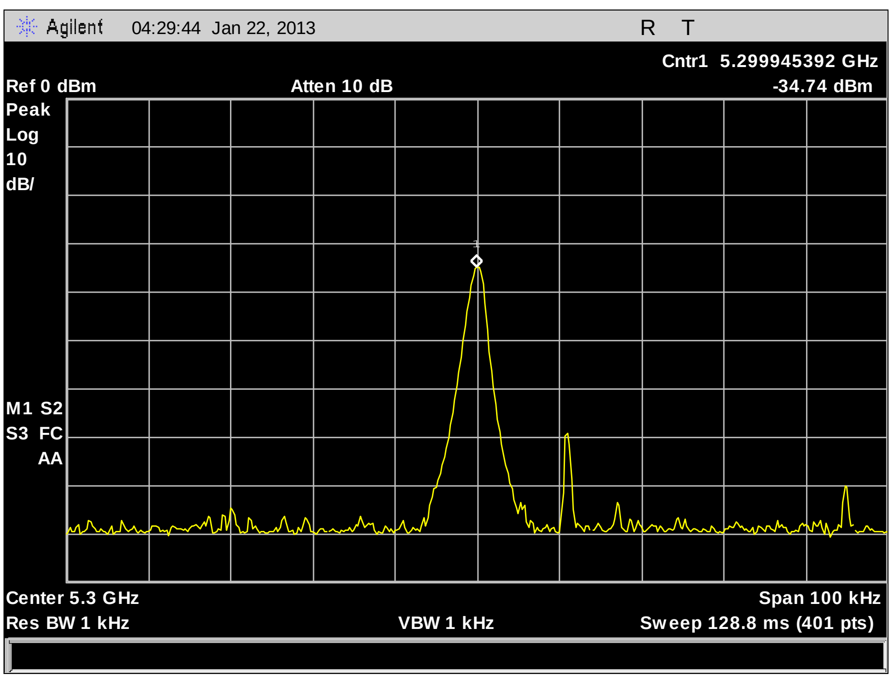
Plot 110. Frequency Stability, 5300 MHz, 30°C, 120 V



Plot 111. Frequency Stability, 5300 MHz, 40°C, 120 V



Plot 112. Frequency Stability, 5300 MHz, 50°C, 120 V



Plot 113. Frequency Stability, 5300 MHz, 55°C, 120 V

V. DFS Requirements and Radar Waveform Description & Calibration

A. DFS Requirements

Requirement	**Operational Mode**		
	Master	**Client Without Radar Detection**	**Client With Radar Detection**
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
Uniform Spreading	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

Table 18. Applicability of DFS Requirements Prior to Use of a Channel

Requirement	**Operational Mode**		
	Master	**Client Without Radar Detection**	**Client With Radar Detection**
DFS Detection Threshold	Yes	Not required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required	Yes

Table 19. Applicability of DFS Requirements During Normal Operation

Maximum Transmit Power	**Value**
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna **Note 2:** Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.	

Table 20. DFS Detection Thresholds for Master or Client Devices Incorporating DFS

Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds See Note 1
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2
U-NII Detection Bandwidth	Minimum 80% of the 99% power bandwidth. See Note 3.
Note 1: The instant that the *Channel Move Time* and the *Channel Closing Transmission Time* begins is as follows: • For the Short pulse radar Test Signals this instant is the end of the *Burst*. • For the Frequency Hopping radar Test Signal, this instant is the end of the last radar *Burst* generated. • For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission. **Note 2:** The *Channel Closing Transmission Time* is comprised of 200 milliseconds starting at the beginning of the *Channel Move Time* plus any additional intermittent control signals required facilitating *Channel* changes (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions. **Note 3:** During the *U-NII Detection Bandwidth* detection test, radar type 1 is used and for each frequency step the minimum percentage of detection is 90%. Measurements are performed with no data traffic.	

Table 21. DFS Response Requirement Values

B. Radar Test Waveforms

This section provides the parameters for required test waveforms, minimum percentage of successful detections, and the minimum number of trials that must be used for determining DFS conformance. Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms.

Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (μsec)	PRI (μsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Trials
1	1	1428	18	60%	30
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120

A minimum of 30 unique waveforms are required for each of the short pulse radar types 2 through 4. For short pulse radar type 1, the same waveform is used a minimum of 30 times. If more than 30 waveforms are used for short pulse radar types 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms. The aggregate is the average of the percentage of successful detections of short pulse radar types 1-4.

Long Pulse Radar Test Waveform

Radar Type	Pulse Width (μsec)	Chirp Width (MHz)	PRI (μsec)	Number of Pulses per Bursts	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for the Long Pulse radar test signal. If more than 30 waveforms are used for the Long Pulse radar test signal, then each additional waveform must also be unique and not repeated from the previous waveforms.

Each waveform is defined as follows:

1) The transmission period for the Long Pulse Radar test signal is 12 seconds.
2) There are a total of 8 to 20 Bursts in the 12 second period, with the number of Bursts being randomly chosen. This number is Burst_Count.
3) Each Burst consists of 1 to 3 pulses, with the number of pulses being randomly chosen. Each Burst within the 12 second sequence may have a different number of pulses.
4) The pulse width is between 50 and 100 microseconds, with the pulse width being randomly chosen. Each pulse within a Burst will have the same pulse width. Pulses in different Bursts may have different pulse widths.
5) Each pulse has a linear FM chirp between 5 and 20 MHz, with the chirp width being randomly chosen. Each pulse within a Burst will have the same chirp width. Pulses in different Bursts may have different chirp widths. The chirp is centered on the pulse. For example, with radar frequency of 5300 MHz and a 20 MHz chirped signal, the chirp starts at 5290 MHz and ends at 5310 MHz.
6) If more than one pulse is present in a Burst, the time between the pulses will be between 1000 and 2000 microseconds, with the time being randomly chosen. If three pulses are present in a Burst, the time between the first and second pulses is chosen independently of the time between the second and third pulses.
7) The 12 second transmission period is divided into even intervals. The number of intervals is equal to Burst_Count. Each interval is of length (12,000,000 / Burst_Count) microseconds. Each interval contains one Burst. The start time for the Burst, relative to the beginning of the interval, is between 1 and [(12,000,000 / Burst_Count) – (Total Burst Length) + (One Random PRI Interval)] microseconds, with the start time being randomly chosen. The step interval for the start time is 1 microsecond. The start time for each Burst is chosen independently.

A representative example of a Long Pulse radar test waveform:

1) The total test signal length is 12 seconds.
2) 8 Bursts are randomly generated for the Burst_Count.
3) Burst 1 has 2 randomly generated pulses.
4) The pulse width (for both pulses) is randomly selected to be 75 microseconds.
5) The PRI is randomly selected to be at 1213 microseconds.
6) Bursts 2 through 8 are generated using steps 3 – 5.
7) Each Burst is contained in even intervals of 1,500,000 microseconds. The starting location for Pulse 1, Burst 1 is randomly generated (1 to 1,500,000 minus the total Burst 1 length + 1 random PRI interval) at the 325,001 microsecond step. Bursts 2 through 8 randomly fall in successive 1,500,000 microsecond intervals (i.e. Burst 2 falls in the 1,500,001 – 3,000,000 microsecond range).

Graphical Representation of a Long Pulse radar Test Waveform

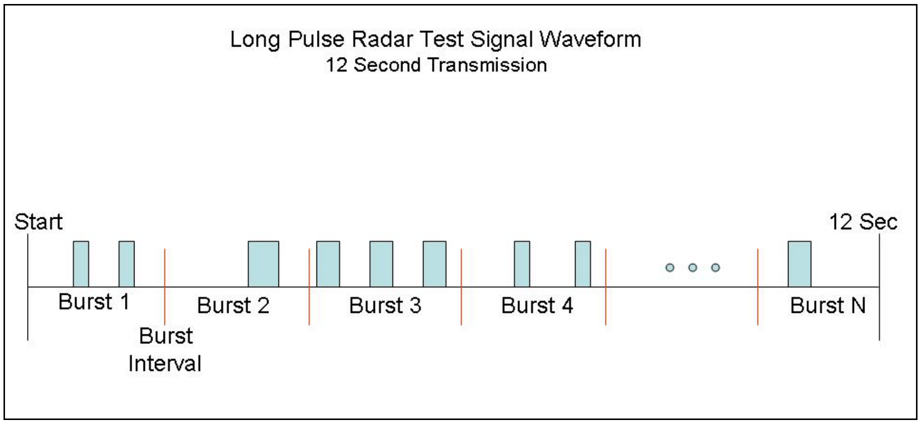


Figure 6. Long Pulse Radar Test Signal Waveform

Frequency Hopping Radar Test Waveform

Radar Type	Pulse Width (μsec)	PRI (μsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	9	.333	300	70%	30

For the Frequency Hopping Radar Type, the same *Burst* parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected1 from the hopping sequence defined by the following algorithm:

The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set. For selection of a random frequency, the frequencies remaining within the group are always treated as equally likely.

C. Radar Waveform Calibration

The following equipment setup was used to calibrate the radiated Radar Waveform. A spectrum analyzer was used to establish the test signal level for each radar type. During this process there were no transmissions by either the Master or Client Device. The spectrum analyzer was switched to the zero span (Time Domain) mode at the frequency of the Radar Waveform generator. Peak detection was utilized. The spectrum analyzer's resolution bandwidth (RBW) was set to 3 MHz and the video bandwidth (VBW) was set to 3 MHz. The calibration setup is diagrammed in Figure 7, and the radar test signal generator is shown in Photograph 6.

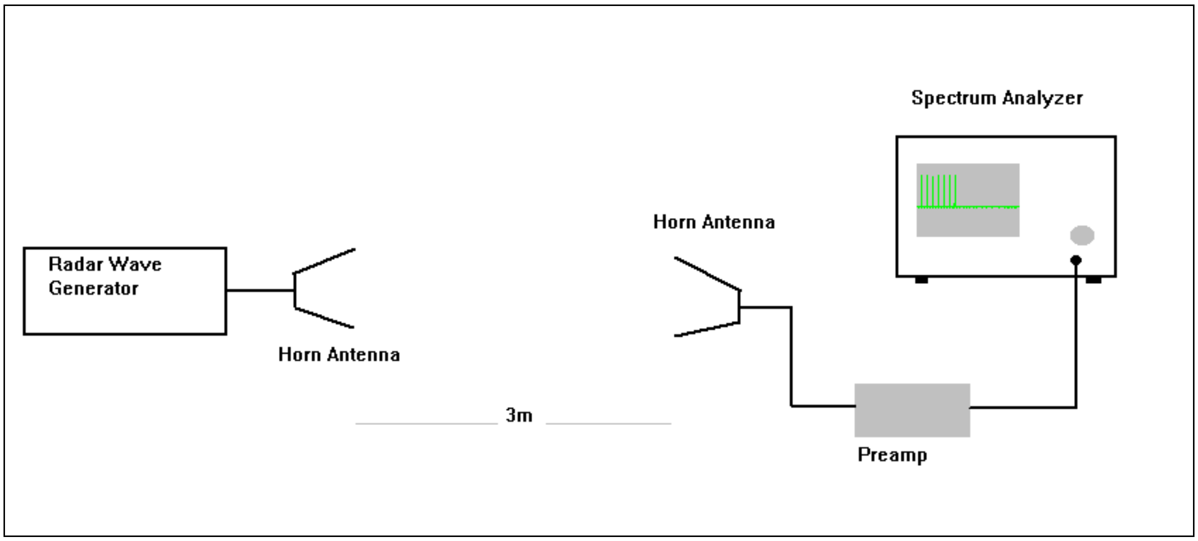
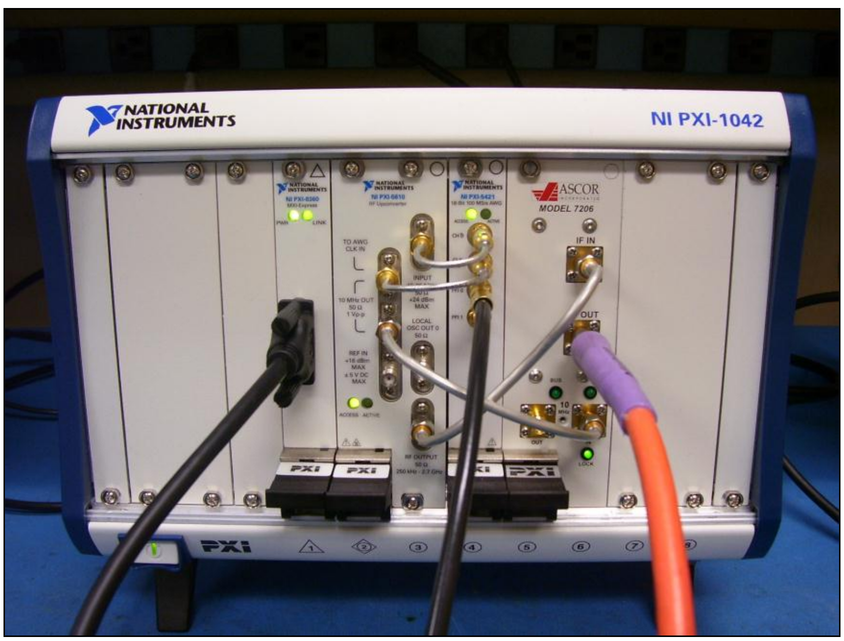
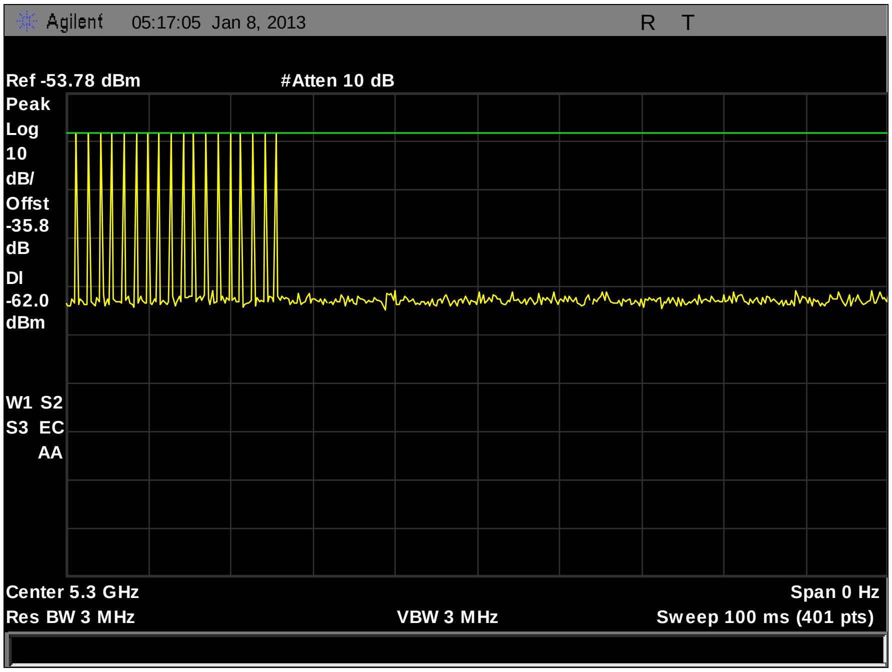


Figure 7. Calibration Test setup

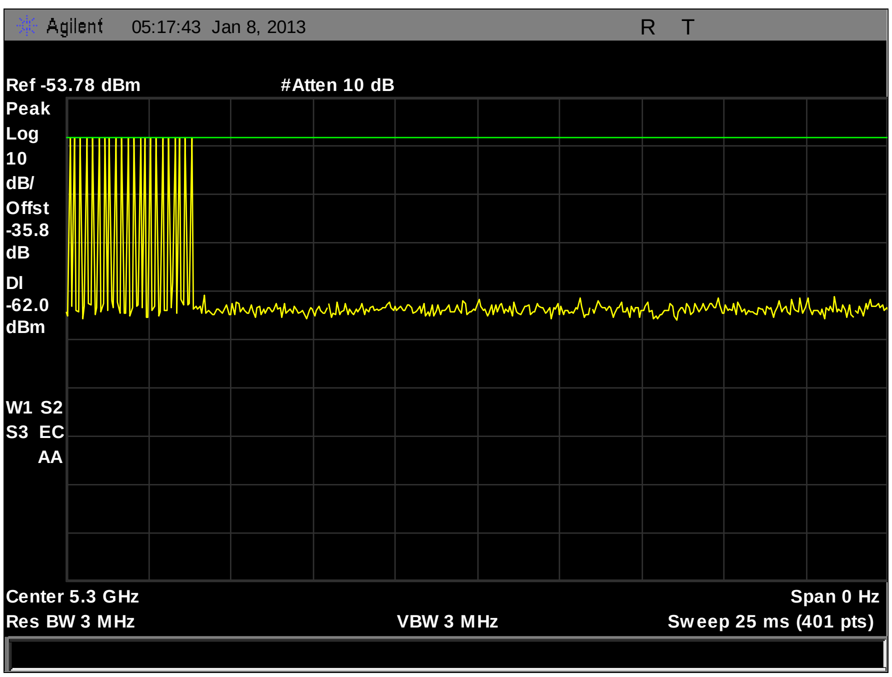


Photograph 6. DFS Radar Test Signal Generator

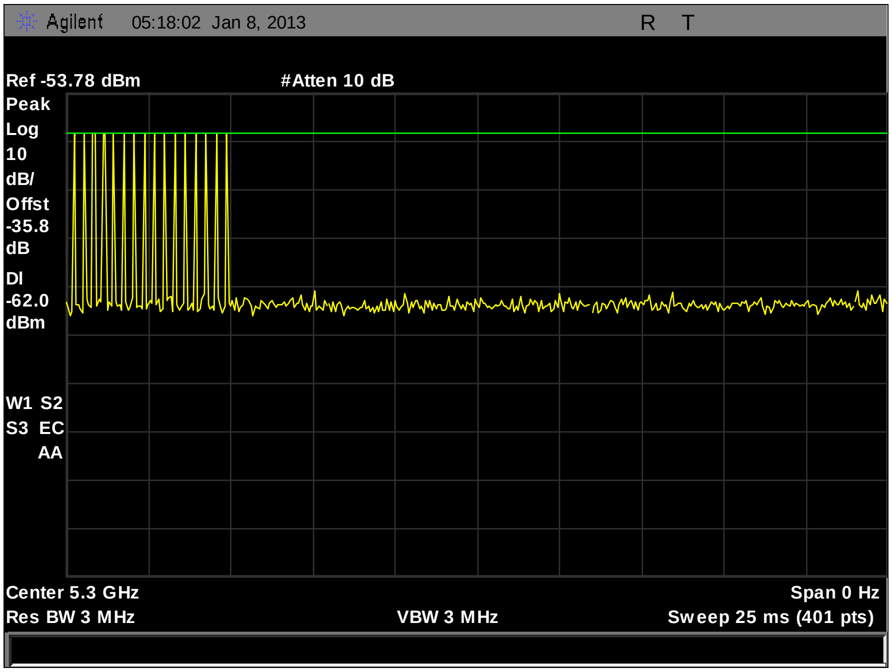
Radar Waveform Calibration



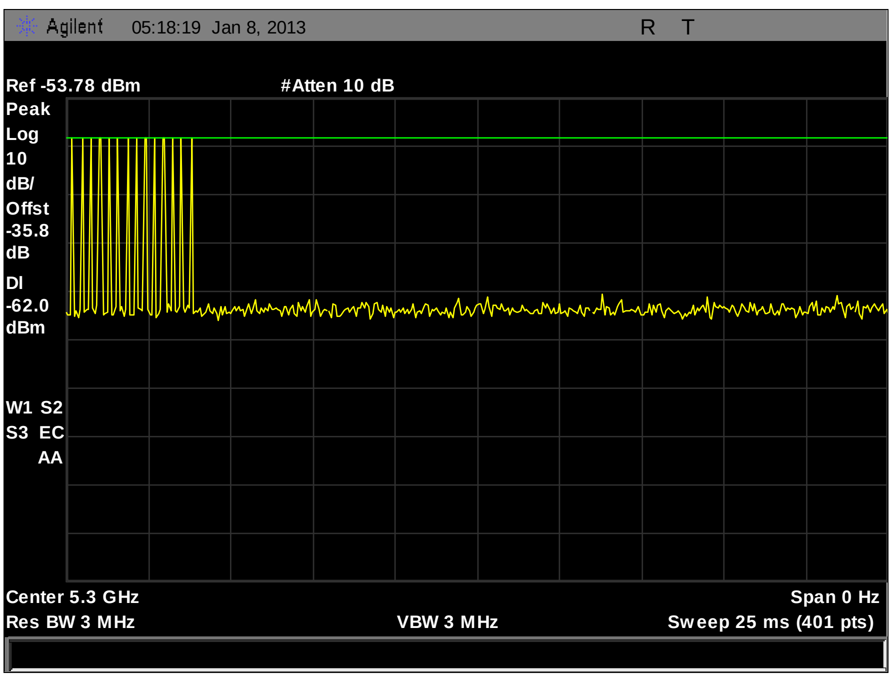
Plot 114. Bin 1 Calibration, 5300 MHz



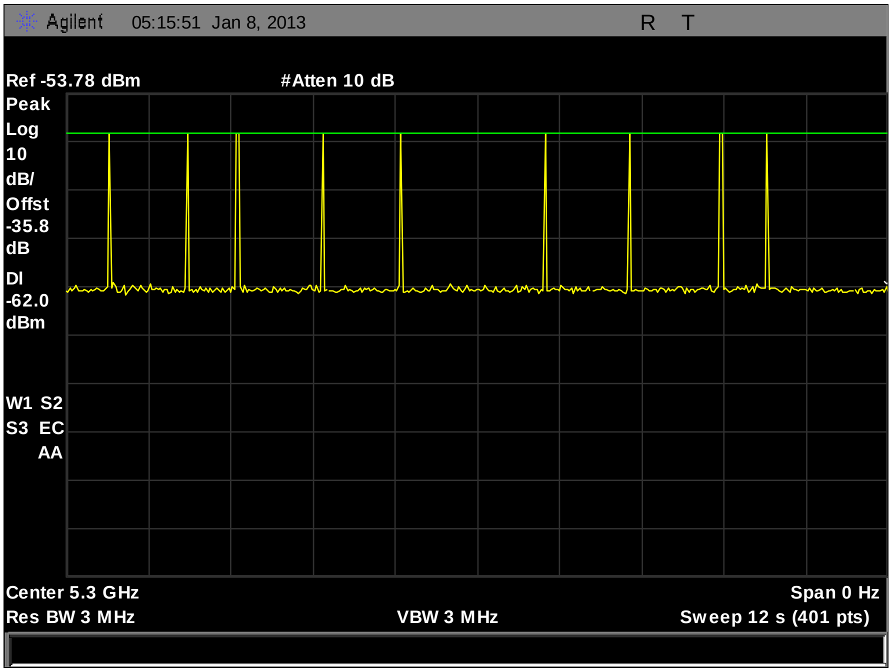
Plot 115. Bin 2 Calibration, 5300 MHz



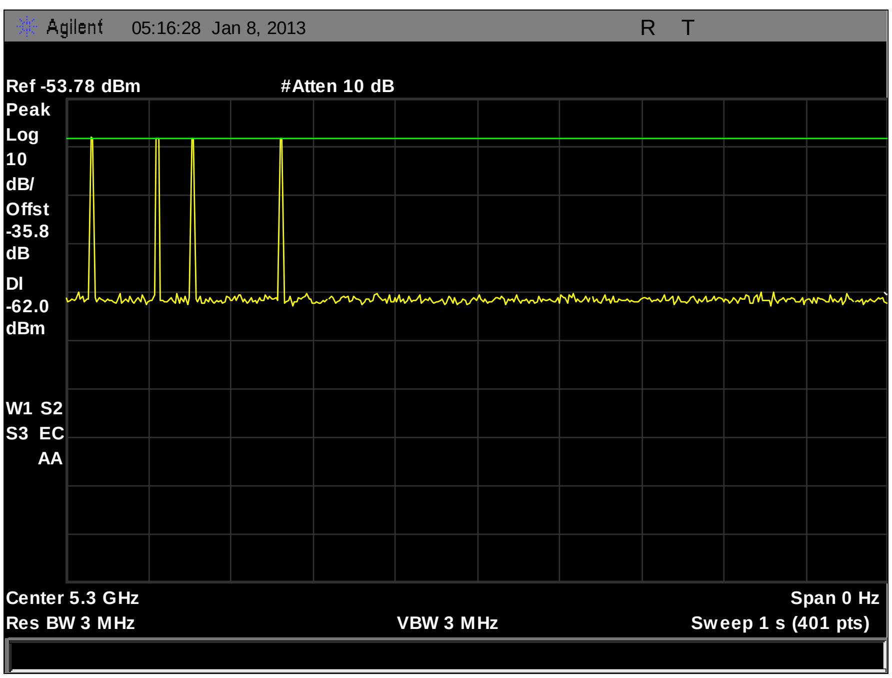
Plot 116. Bin 3 Calibration, 5300 MHz



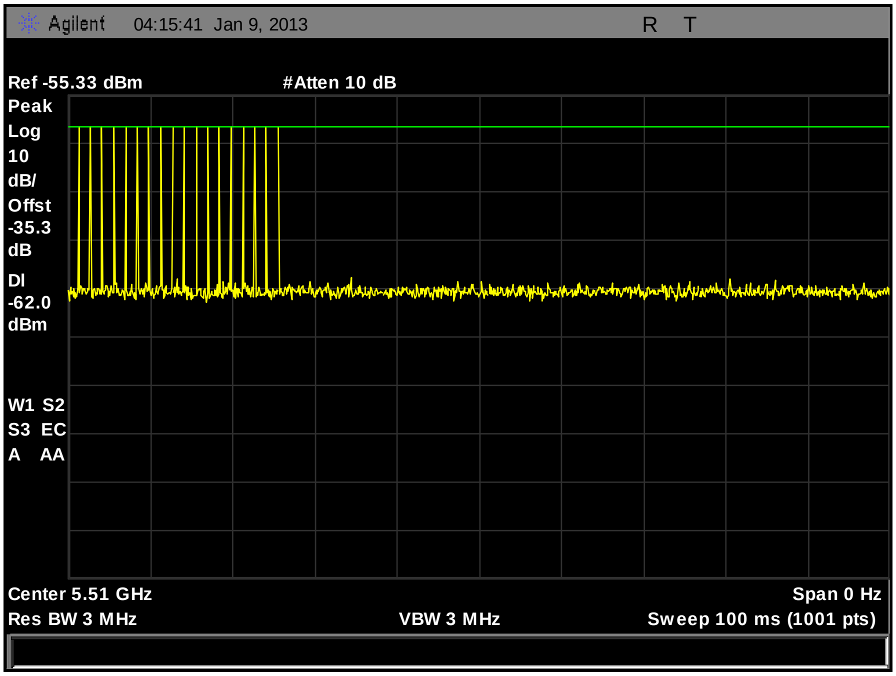
Plot 117. Bin 4 Calibration, 5300 MHz



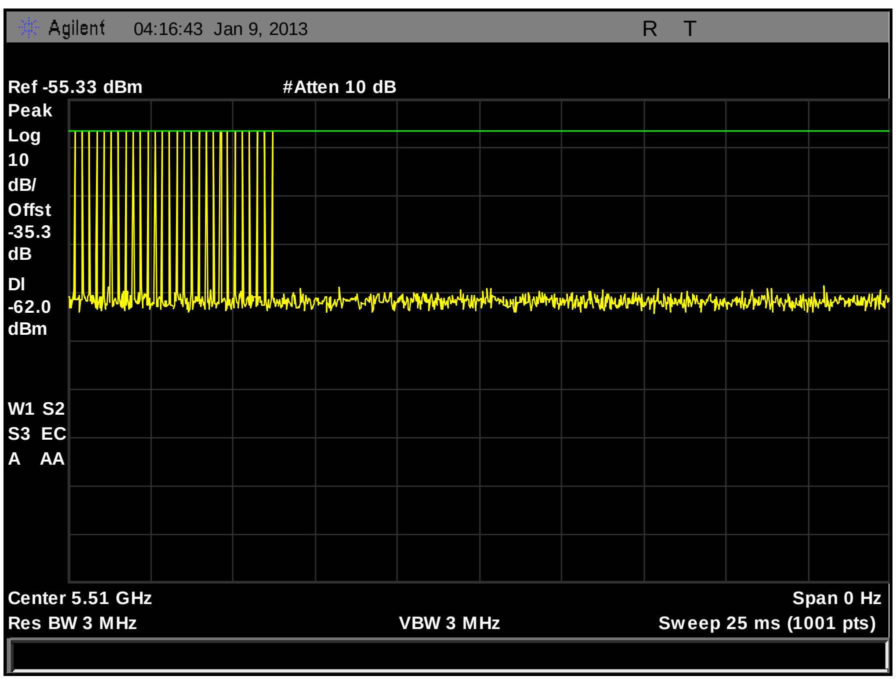
Plot 118. Bin 5 Calibration, 5300 MHz



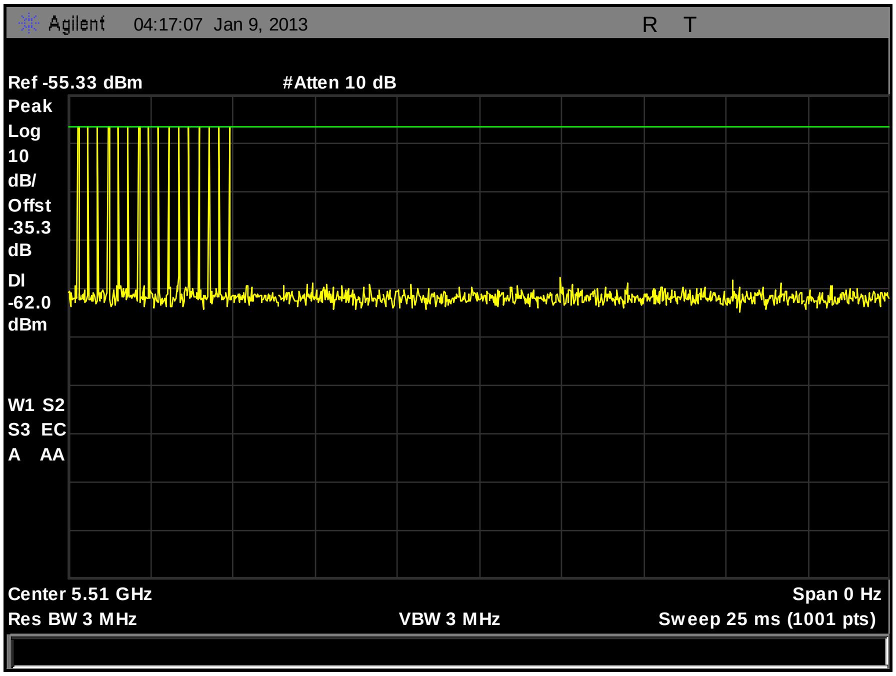
Plot 119. Bin 6 Calibration, 5300 MHz



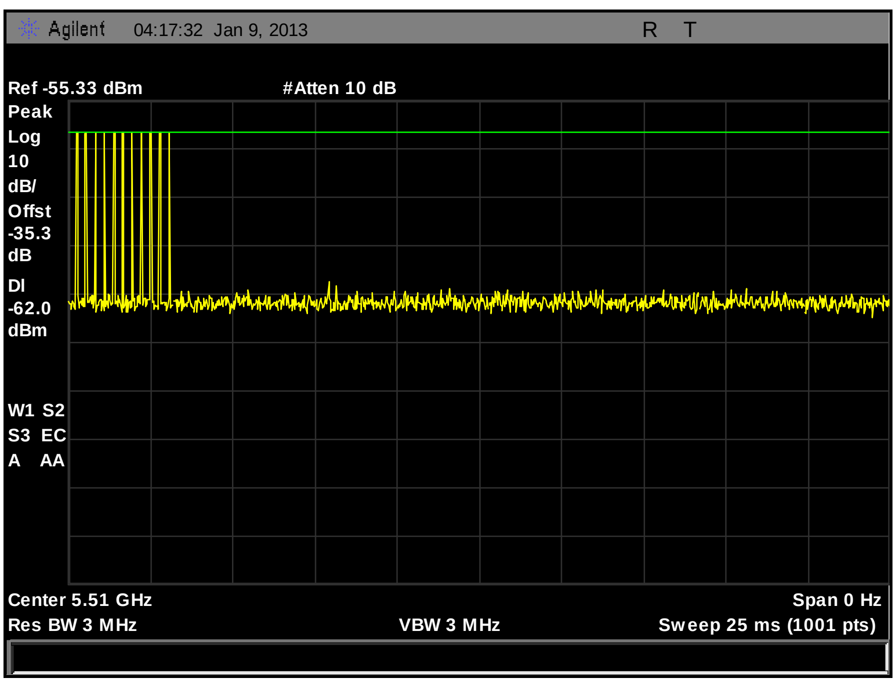
Plot 120. Bin 1 Calibration, 5510 MHz



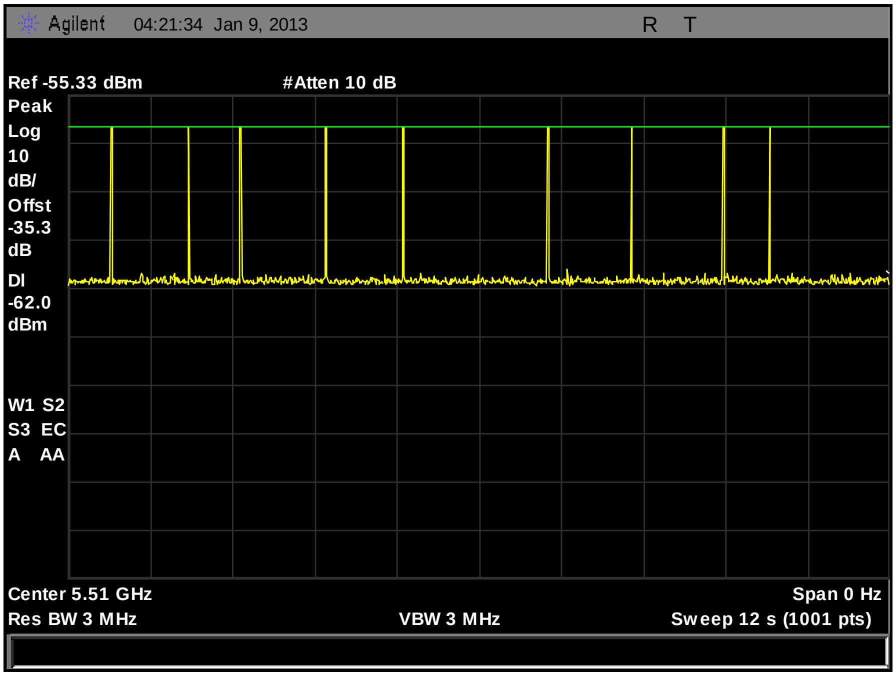
Plot 121. Bin 2 Calibration, 5510 MHz



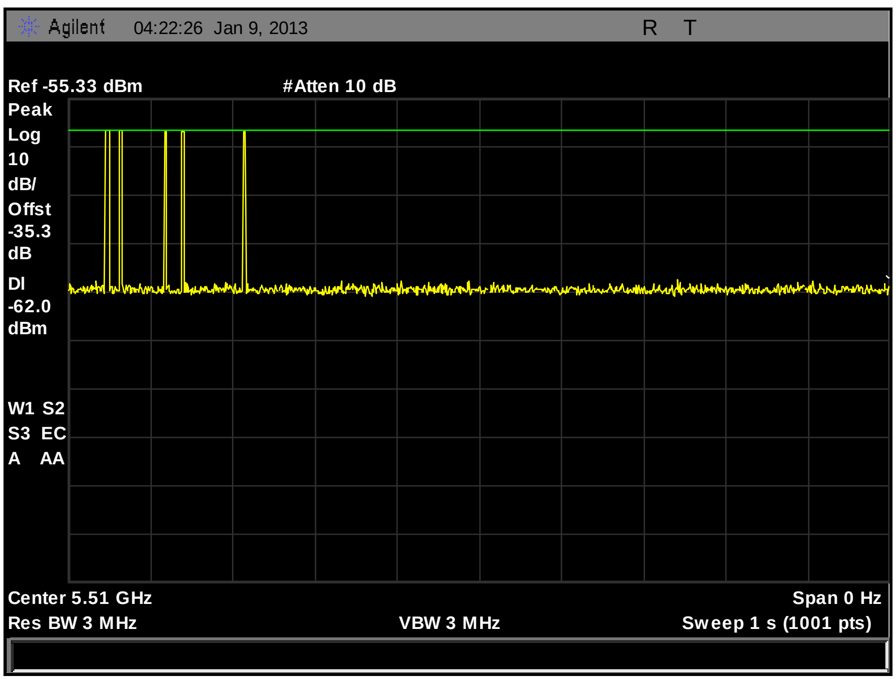
Plot 122. Bin 3 Calibration, 5510 MHz



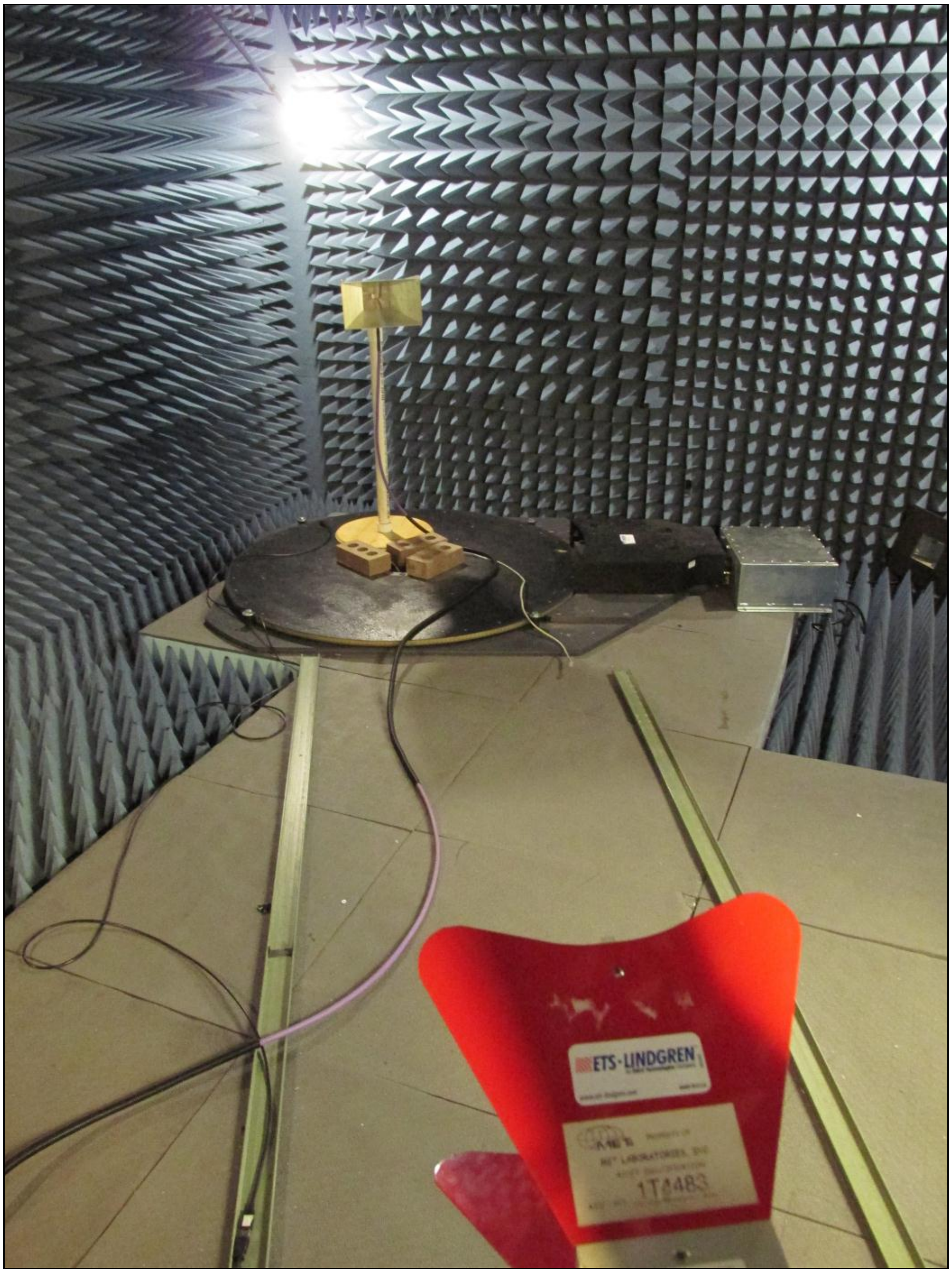
Plot 123. Bin 4 Calibration, 5510 MHz



Plot 124. Bin 5 Calibration, 5510 MHz



Plot 125. Bin 6 Calibration, 5510 MHz



Photograph 7. Calibration, Test Setup

VI. DFS Test Procedure and Test Results

A. DFS Test Setup

1. A spectrum analyzer is used as a monitor to verify that the Unit Under Test (UUT) has vacated the Channel within the Channel Closing Transmission Time and Channel Move Time, and does not transmit on a Channel during the Non-Occupancy Period after the detection and subsequent Channel move. It is also used to monitor UUT transmissions during the Channel Availability Check Time.
2. The test setup, which consists of test equipment and equipment under test(EUT), is diagrammed in Figure 8 and pictured in Photograph 9. The EUT was a master radio and was tested with 2dBi omnidirectional antennas (Wanshih WSS002) attached to its antenna ports. Refer to section 15.203 – Antenna Requirements.

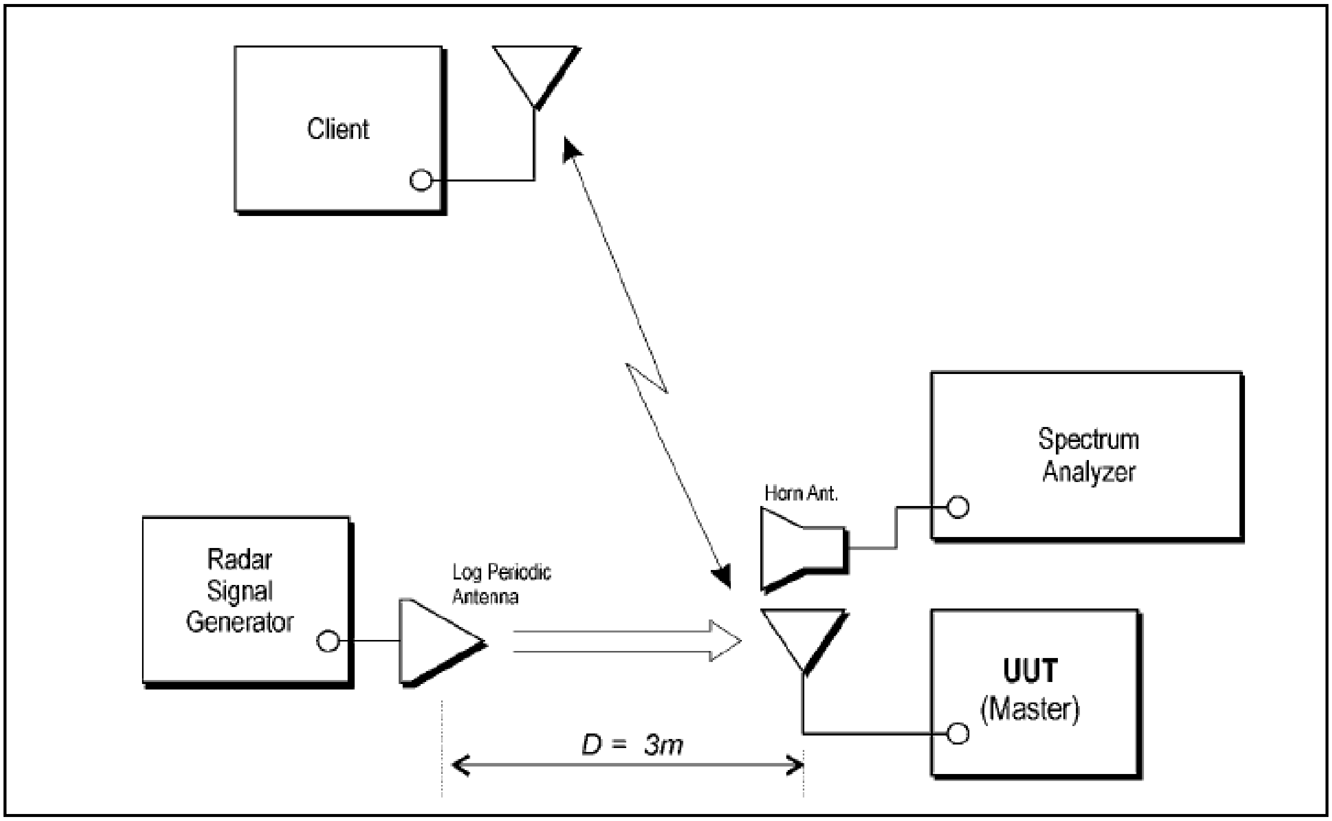
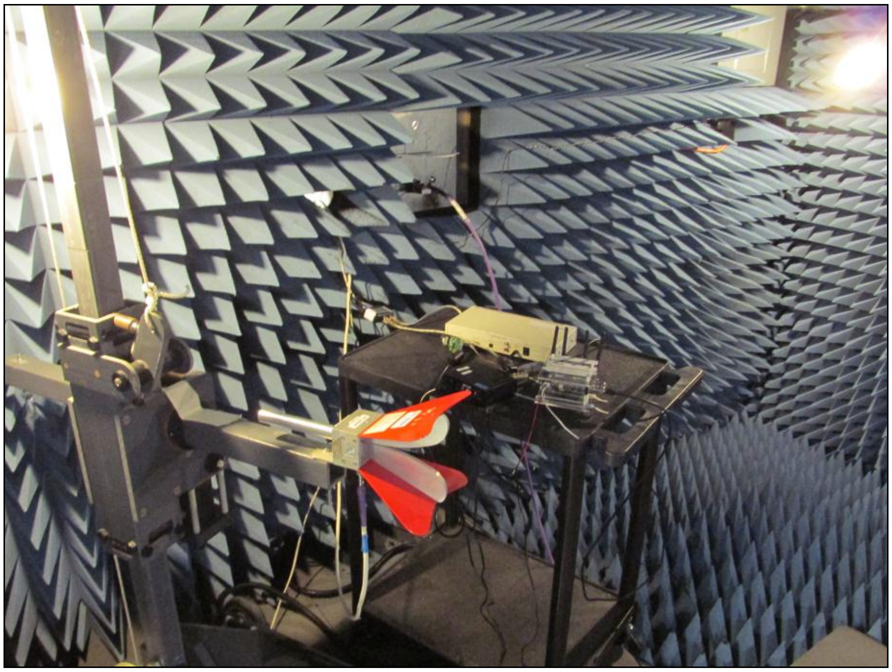
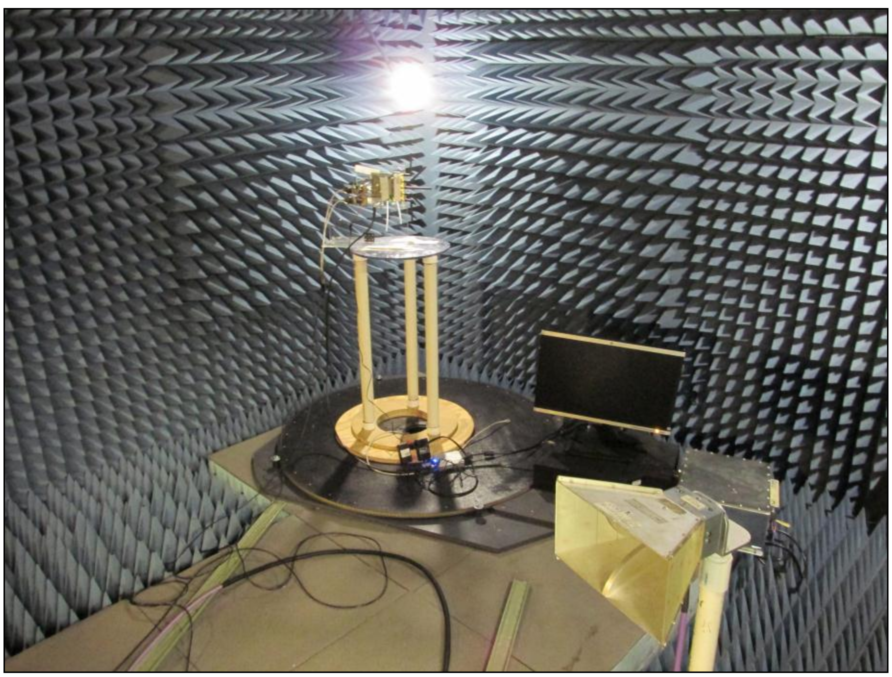


Figure 8. Test Setup Diagram, Master with injection at Master



Photograph 8. DFS Test Setup, Client



Photograph 9. DFS Test Setup, Master

B. UNII Detection Bandwidth

Test Requirement(s): **§ 15.407** A minimum 80% detection rate is required across an EUT's 99% bandwidth.

Test Procedure: All UNII channels for this device have identical channel bandwidths.

A single burst of the short pulse radar type 1 is produced at 5300 MHz, at the -63dBm test level. The UUT is set up as a standalone device (no associated client, and no data traffic).

A single radar burst is generated for a minimum of 10 trials, and the response of the UUT is recorded. The UUT must detect the radar waveform 90% or more of the time.

The radar frequency is increased in 1 MHz steps, repeating the above test sequence, until the detection rate falls below 90%. The highest frequency at which detection is greater than or equal to 90% is denoted F_H.

The radar frequency is decreased in 1 MHz steps, repeating the above test sequence, until the detection rate falls below 90%. The lowest frequency at which detection is greater than or equal to 90% is denoted F_L.

The U-NII Detection Bandwidth is calculated as follows:

U-NII Detection Bandwidth = $F_H – F_L$

Test Engineer: Jeff Pratt

Test Date: 01/09/13 – 01/10/13

UNII Detection Bandwidth – Test Results

EUT Frequency- 5300MHz											
	DFS Detection Trials (1=Detection, 0= No Detection)										
Radar Frequency (MHz)	1	2	3	4	5	6	7	8	9	10	Detection Rate (%)
5288	0	0	0	0	0	0	0	0	0	0	0
5289	1	1	1	1	1	1	1	1	1	1	100
5290	1	1	1	1	1	1	1	1	1	1	100
5291	1	1	1	1	1	1	1	1	1	1	100
5292	1	1	1	1	1	1	1	1	1	1	100
5293	1	1	1	1	1	1	1	1	1	1	100
5294	1	1	1	1	1	1	1	1	1	1	100
5295	1	1	1	1	1	1	1	1	1	1	100
5296	1	1	1	1	1	1	1	1	1	1	100
5297	1	1	1	1	1	1	1	1	1	1	100
5298	1	1	1	1	1	1	1	1	1	1	100
5299	1	1	1	1	1	1	1	1	1	1	100
5300	1	1	1	1	1	1	1	1	1	1	100
5301	1	1	1	1	1	1	1	1	1	1	100
5302	1	1	1	1	1	1	1	1	1	1	100
5303	1	1	1	1	1	1	1	1	1	1	100
5304	1	1	1	1	1	1	1	1	1	1	100
5305	1	1	1	1	1	1	1	1	1	1	100
5306	1	1	1	1	1	1	1	1	1	1	100
5307	1	1	1	1	1	1	1	1	1	1	100
5308	1	1	1	1	1	1	1	1	1	1	100
5309	0	0	0	0	0	0	0	0	0	0	0
Overall Detection Percentage											100%
Detection Bandwidth = f_h - f_l = 5308 MHz – 5289 MHz = 19 MHz											
EUT 99% Bandwidth = 17.79 MHz											
OBW* 80% = 14.232 MHz											

Table 22. UNII Detection Bandwidth, Test Results, 5300 MHz

EUT Frequency- 5510MHz											
	DFS Detection Trials (1=Detection, 0= No Detection)										
Radar Frequency (MHz)	1	2	3	4	5	6	7	8	9	10	Detection Rate (%)
5493	1	0	1	1	1	1	0	1	1	1	80
5494	1	1	1	1	0	1	1	1	1	1	90
5495	1	1	1	1	1	1	0	1	1	1	90
5496	1	1	1	1	1	1	1	1	1	1	100
5497	1	1	1	1	1	1	1	1	1	1	100
5498	1	1	1	1	1	1	1	1	1	1	100
5499	1	1	1	1	1	1	1	1	1	1	100
5500	1	1	1	1	1	1	1	1	0	1	90
5501	1	1	1	1	1	1	1	1	1	1	100
5502	1	1	1	1	1	0	1	1	1	1	90
5503	1	1	1	0	1	1	1	1	1	1	90
5504	1	1	1	1	1	1	1	1	1	1	100
5505	1	1	1	1	1	1	1	1	1	1	100
5506	1	1	1	1	1	1	1	1	1	1	100
5507	1	1	1	1	1	1	1	1	1	1	100
5508	1	1	1	1	1	1	1	1	1	1	100
5509	1	1	1	1	1	1	1	1	1	1	100
5510	1	1	1	1	1	1	1	1	1	1	100
5511	1	1	1	1	1	1	1	1	1	1	100
5512	1	1	1	1	1	1	1	1	1	1	100
5513	1	1	1	1	1	1	1	1	1	1	100
5514	1	1	1	1	1	1	1	1	1	1	100
5515	1	1	1	1	1	1	1	1	1	1	100
5516	1	1	1	1	1	1	1	1	1	1	100
5517	1	1	1	1	1	1	1	1	1	1	100
5518	1	1	1	1	1	1	1	1	1	1	100
5519	1	1	1	1	1	1	1	1	1	1	100
5520	1	1	1	1	1	1	1	1	1	1	100
5521	1	1	1	1	1	1	1	1	0	1	90
5522	1	1	1	1	1	1	1	1	1	1	100
5523	1	1	1	1	1	1	1	1	1	1	100
5524	1	1	1	1	1	1	1	1	1	1	100
5525	1	1	1	1	1	1	1	1	1	1	100
5526	1	1	1	1	1	1	1	1	1	1	100
5527	1	1	1	1	0	1	1	1	1	1	90
5528	1	1	0	1	1	1	1	1	1	1	90
5529	0	0	0	0	0	0	0	0	0	0	0
Overall Detection Percentage											%
Detection Bandwidth = f_h - f_l = 5528MHz - 5494MHz = 34MHz											
EUT 99% Bandwidth = 38.19MHz											
OBW* 80% = 30.552MHz											

Table 23. UNII Detection Bandwidth, Test Results, 5550 MHz

C. Initial Channel Availability Check Time

Test Requirements: **§ 15.407** The Initial Channel Availability Check Time tests that the UUT does not emit beacon, control, or data signals on the test channel until the power-up sequence has been completed and the U-NII device has checked for radar waveforms, for one minute, on the test channel. This test does not use any of the radar waveforms and only needs to be performed once.

The UUT should not make any transmissions over the test channel, for at least 1 minute after completion of its power-on cycle.

Test Procedure: The U-NII device is powered on and instructed to operate at 5300 MHz. At the same time the UUT is powered on, the spectrum analyzer is set to 5300MHz with a zero span and a 2 minute sweep time. The analyzer is triggered at the same time power is applied to the U-NII device.

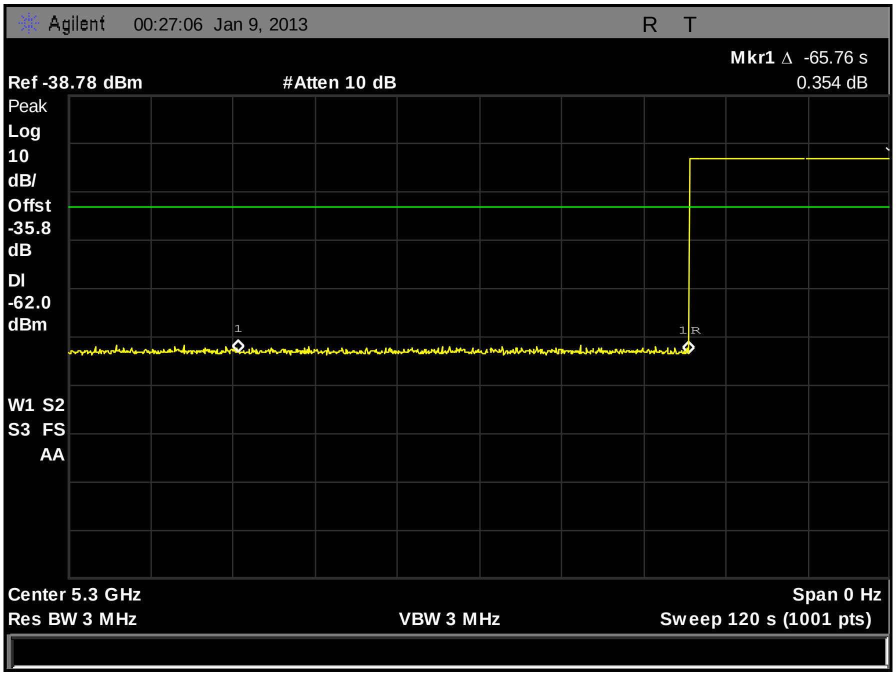
Test Results: Marker 1 on Plot 126 indicate the start of the channel availability check time. Initial beacon/data transmission is indicated by marker 1R.

The Equipment was compliant with § 15.407 Initial Channel Availability Check Time.

Test Engineer: Jeff Pratt

Test Date: 01/09/13

Initial Channel Availability Check Time – Plot



Plot 126. Initial Channel Availability Check Time

D. Radar Burst at the Beginning of Channel Availability Check Time

Test Requirements: **§ 15.407** A Radar Burst at the Beginning of the Channel Availability Check Time tests that the UUT does not emit beacon, control, or data signals on the test Channel if it has detected a radar burst during that time period until the power-up sequence has been completed and the U-NII device checks for Radar Waveforms for one minute on the test Channel. The steps below define the procedure to verify successful radar detection on the selected Channel during a period equal to the Channel Availability Check Time and avoidance of operation on that Channel when a radar Burst with a level equal to the DFS Detection Threshold + 1 dB occurs at the beginning of the Channel Availability Check Time.

Test Procedure: The UUT is powered on at T0. T1 denotes the instant when the UUT has completed its power-up sequence. The Channel Availability Check Time commences at instant T1 and will end no sooner than T1 + 60 seconds.

A single Burst of short pulse radar type 1, at a level equal to the interference detection threshold+1dB, will commence within a 6 second window starting at T1.

Visual indication of the UUT of successful detection of the radar Burst will be recorded and reported. Observation of transmission at 5300MHz will continue for 2 minutes after the radar Burst has been generated.

Verify that during the 2 minute measurement window, no UUT transmissions occur at 5300MHz.

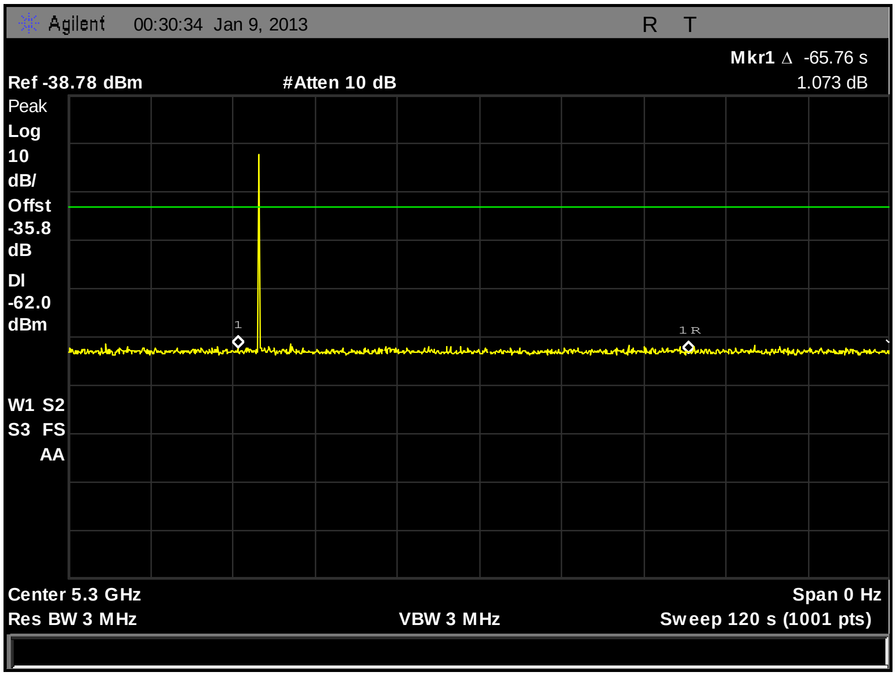
Test Results Plot 127 below indicates that there were no UUT transmissions during the 2 minute measurement window when a radar burst was injected 6 seconds into the CACT. Therefore, the UUT detected the presence of a radar during the CACT and moved away from that channel.

The equipment was compliant with § 15.407 Radar Burst at the Beginning of the Channel Availability Check Time.

Test Engineer: Jeff Pratt

Test Date: 01/09/13

Radar Burst at the Beginning of Channel Availability Check Time – Plot



Plot 127. Radar Burst at the Beginning of CACT

E. Radar Burst at the End of Channel Availability Check Time

Test Requirements: **§ 15.407** A Radar Burst at the End of the Channel Availability Check Time tests that the UUT does not emit beacon, control, or data signals on the test Channel if it has detected a radar burst during that time period until the power-up sequence has been completed and the U-NII device checks for Radar Waveforms for one minute on the test Channel. The steps below define the procedure to verify successful radar detection on the selected Channel during a period equal to the Channel Availability Check Time and avoidance of operation on that Channel when a radar Burst with a level equal to the DFS Detection Threshold + 1 dB occurs at the end of the Channel Availability Check Time.

Test Procedure: The steps below define the procedure to verify successful radar detection on the selected Channel during a period equal to the Channel Availability Check Time and avoidance of operation on that Channel when a radar Burst with a level equal to the DFS Detection Threshold + 1 dB occurs at the end of the Channel Availability Check Time.

The UUT is powered on at T0. T1 denotes the instant when the UUT has completed its power-up sequence. The Channel Availability Check Time commences at instant T1 and will end no sooner than T1 + 60 seconds.

A single Burst of short pulse of radar type 1 at a level equal to the interference detection threshold+1dB will commence within a 6 second window starting at T1+ 54 seconds.

Visual indication on the UUT of successful detection of the radar Burst will be recorded and reported. Observation of emissions at 5300MHz will continue for 2 minutes after the radar Burst has been generated.

Verify that during the 2 minute measurement window no UUT transmissions occurred at 5300MHz.

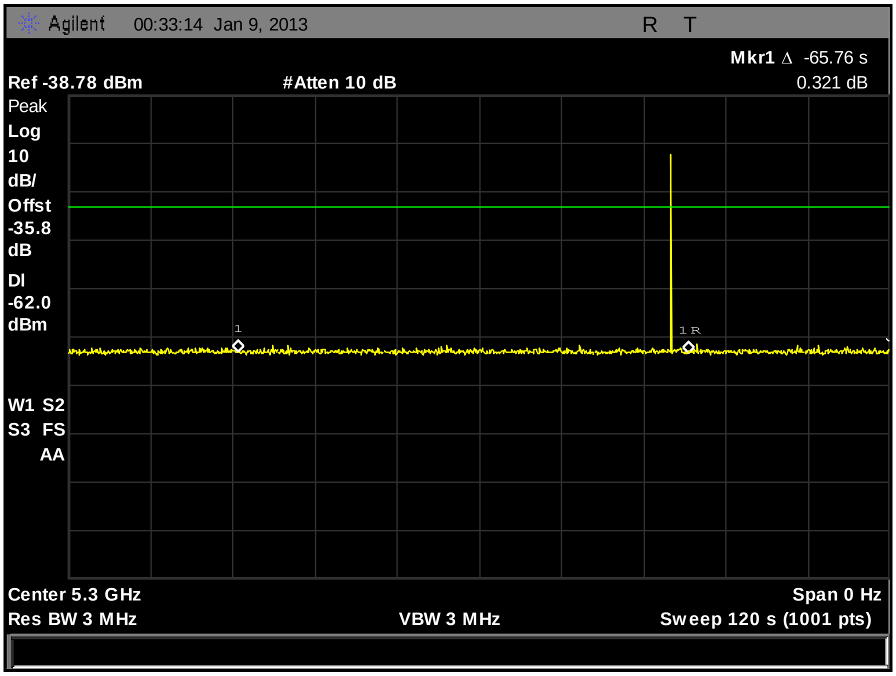
Test Results: Plot 128 indicates that no UUT transmissions occurred during the 2 minute measurement window when a radar burst was injected 6 seconds before the end of the CACT. Therefore, the UUT detected the presence of a radar and moved away from that channel.

The equipment was compliant with § 15.407 Radar Burst at the End of the Channel Availability Check Time.

Test Engineer: Jeff Pratt

Test Date: 01/09/13

Radar Burst at the End of Channel Availability Check Time – Plot



Plot 128. Radar Burst at the End of CACT

F. In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time, and Non-Occupancy Period

Test Requirements: **§ 15.407** (Refer to DFS Response Requirement Values table in section III-A of this report.) The UUT shall continuously monitor for radar transmissions in the operating test channel. When a radar burst occurs in the test channel, it has 10 seconds to move to another channel. This 10 second window is termed Channel Move Time (CMT).

When a radar burst occurs, the UUT has 200 milliseconds, plus an aggregate of 60 milliseconds, to cease transmission in the operating test channel. This 200 ms + 60 ms requirement is termed Channel Closing Transmission Time (CCT).

After radar burst and subsequent move to another channel, the UUT shall not resume transmission, on the channel it moved from, for a period of 30 minutes. This requirement is termed Non-Occupancy Period (NOP).

Test Procedure: These tests define how the following DFS parameters are verified during In-Service Monitoring: Channel Closing Transmission Time, Channel Move Time, and Non-Occupancy Period.

The steps below define the procedure to determine the above mentioned parameters when a radar Burst with a level equal to the DFS Detection Threshold + 1dB is generated on the Operating Channel of the U-NII device.

A U-NII device operating as a Client Device will associate with the UUT (Master) at 5300 MHz. Stream the MPEG test file from the Master Device to the Client Device on the selected Channel for the entire period of the test.

At time T0 the Radar Waveform generator sends a Burst of pulses for each of the radar types at a level equal to the interference detection threshold +1dB.

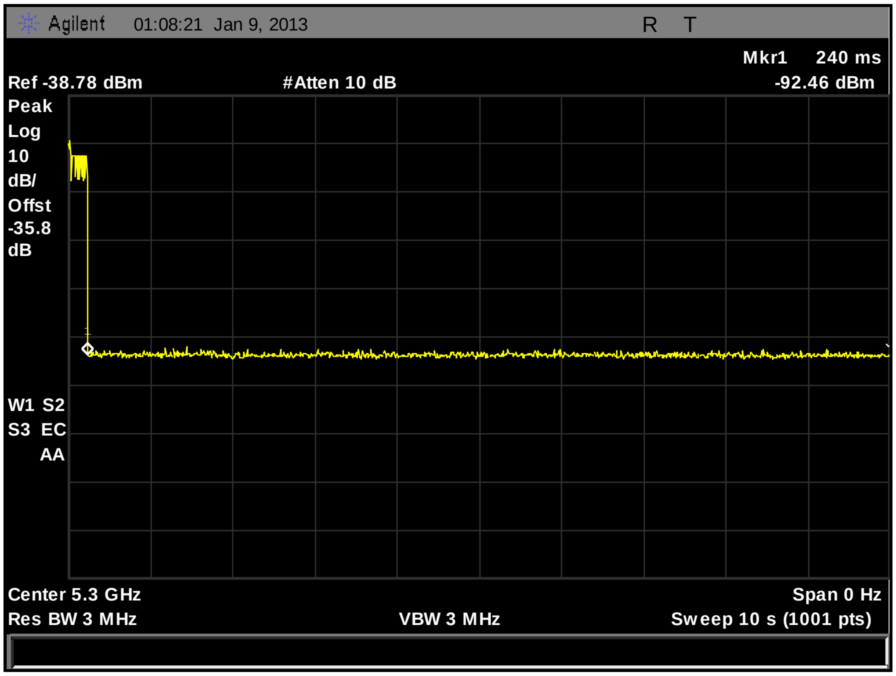
Observe the transmissions of the UUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds. Measure and record the transmissions from the UUT during the observation time (Channel Move Time). Compare the Channel Move Time and Channel Closing Transmission Time results to the limits defined in the *DFS Response Requirement Values table*.

Test Results: The EUT was compliant with § 15.407 In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time, and Non-Occupancy Period.

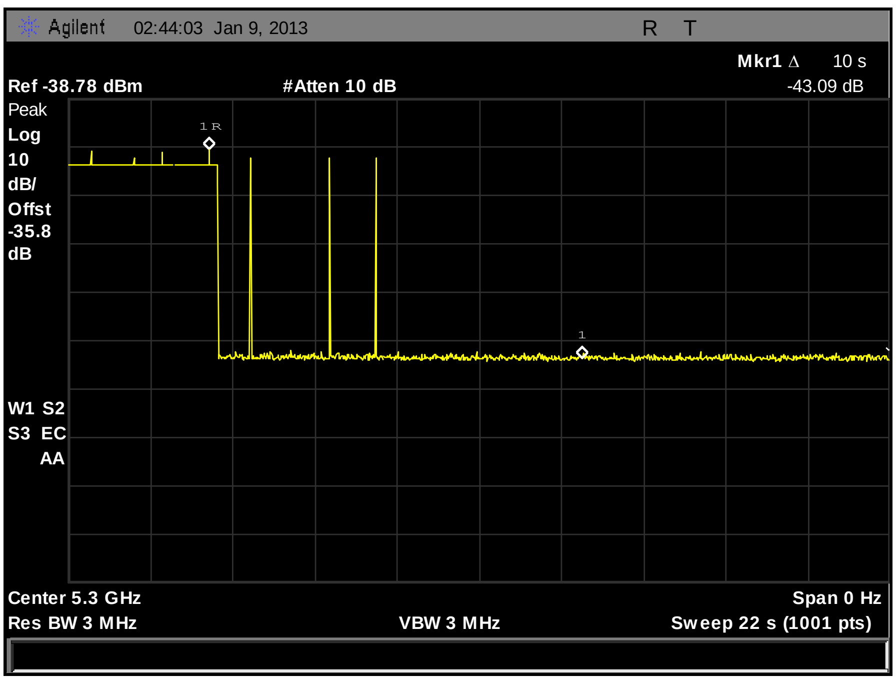
Test Engineer: Jeff Pratt

Test Date: 01/09/13

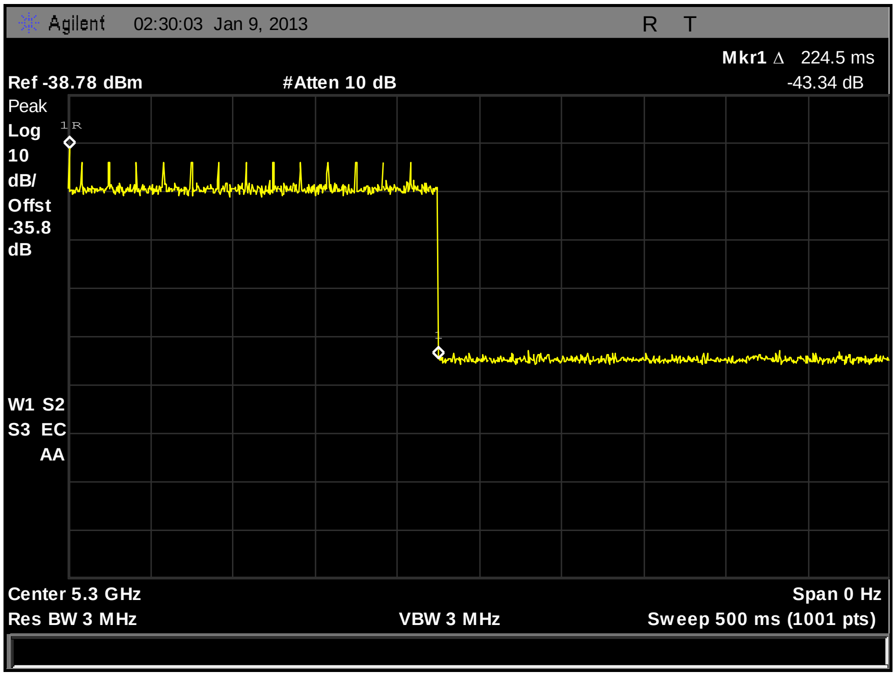
Channel Move Time – Plots



Plot 129. Channel Move Time

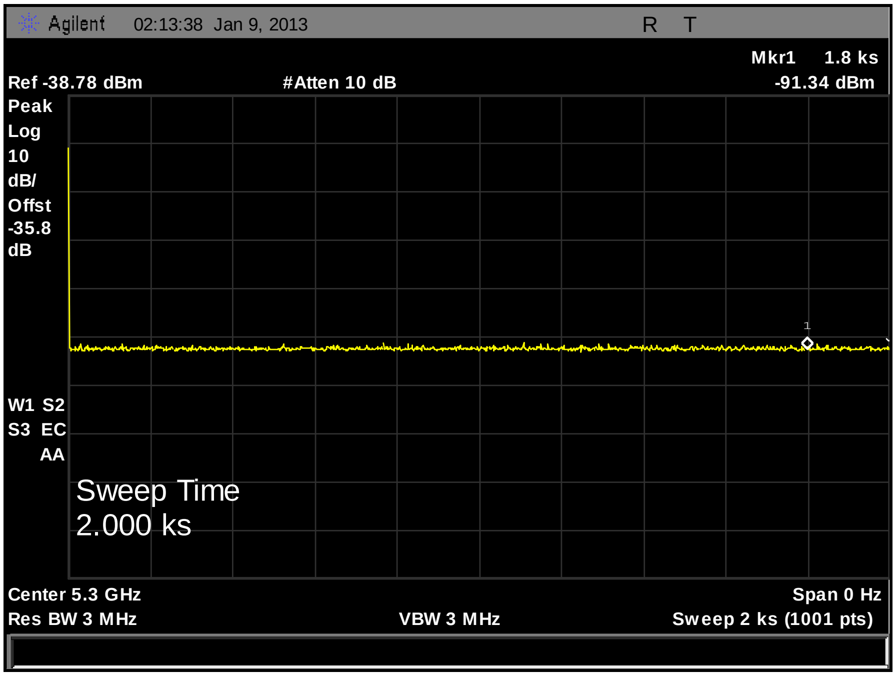


Plot 130. Channel Move Time, Bin 5



Plot 131. Channel Closing Transmission Time

Non-Occupancy Period – Plot



Plot 132. Non-Occupancy Period

G. Statistical Performance Check

Test Requirements: **§ 15.407** During In-Service Monitoring, the EUT requires a minimum percentage of successful radar detections from all required radar waveforms at a level equal to the DFS Detection Threshold + 1dB.

Test Procedure: Stream the MPEG test file from the Master Device to the Client Device on the selected Channel for the entire period of the test. The Radar Waveform generator sends the individual waveform for each of the radar types 1-6 at -63dbm. Statistical data is gathered to determine the ability of the device to detect the radar test waveforms. The device can utilize a test mode to demonstrate when detection occurs to prevent the need to reset the device between trial runs. The percentage of successful detection is calculated by:

$$\frac{TotalWaveformDetections}{TotalWaveformTrials} \times 100$$

The Minimum number of trails, minimum percentage of successful detection and the average minimum percentage of successful detection are found in the Radar Test Waveforms section.

Test Results: The equipment was compliant with § 15.407 Statistical Performance Check.

Test Engineer: Jeff Pratt

Test Date: 01/09/13 – 01/10/13

Statistical Performance Check – Radar Type 1

Radar Type	Trial #	Pulses per Burst	Pulse Width (μsec)	PRI (μsec)	Detection 1 = Yes, 0 = No
1	1	18	1	1428	1
	2	18	1	1428	1
	3	18	1	1428	1
	4	18	1	1428	1
	5	18	1	1428	1
	6	18	1	1428	1
	7	18	1	1428	1
	8	18	1	1428	1
	9	18	1	1428	1
	10	18	1	1428	1
	11	18	1	1428	1
	12	18	1	1428	1
	13	18	1	1428	1
	14	18	1	1428	0
	15	18	1	1428	0
	16	18	1	1428	0
	17	18	1	1428	1
	18	18	1	1428	1
	19	18	1	1428	1
	20	18	1	1428	1
	21	18	1	1428	1
	22	18	1	1428	1
	23	18	1	1428	0
	24	18	1	1428	1
	25	18	1	1428	1
	26	18	1	1428	1
	27	18	1	1428	1
	28	18	1	1428	1
	29	18	1	1428	1
	30	18	1	1428	1
	Detection Percentage				**86.7% (> 60%)**

Table 24. Statistical Performance Check – Radar Type 1, 5300 MHz

Statistical Performance Check – Radar Type 2

Radar Type	Trial #	Pulse Width 1 to 5 µsec	PRI 150 to 230 µsec	Pulses per Burst 23 to 29	Detection 1 = Yes, 0 = No
2	1	2.3	207	26	1
	2	3.1	194	25	1
	3	3.7	178	26	1
	4	1	170	23	1
	5	4.1	206	29	1
	6	2.8	169	29	1
	7	1	151	23	1
	8	1.8	210	26	0
	9	1.4	229	23	1
	10	1	200	25	1
	11	2.6	159	28	1
	12	3.6	187	29	0
	13	1.3	205	24	1
	14	2.1	214	27	1
	15	4.7	200	27	1
	16	3.4	189	27	1
	17	5	198	26	1
	18	1.5	220	27	1
	19	4.3	177	26	1
	20	1.7	172	26	1
	21	2.1	173	23	0
	22	1.9	172	24	0
	23	3.6	219	28	1
	24	2.8	189	23	1
	25	4.2	228	25	1
	26	1.7	170	26	1
	27	2.4	228	24	1
	28	2.3	216	28	1
	29	3.3	187	25	1
	30	4.3	162	25	1
	Detection Percentage				86.7% (> 60%)

Table 25. Statistical Performance Check – Radar Type 2, 5300 MHz

Statistical Performance Check – Radar Type 3

Radar Type	Trial #	Pulse Width 6 to 10 µsec	PRI 200 to 500 µsec	Pulses per Burst 16 to 18	Detection 1 = Yes, 0 = No
3	1	7.8	348	18	1
	2	9.3	341	16	1
	3	7.6	205	16	0
	4	6.4	279	16	1
	5	6.3	472	17	1
	6	6.5	390	17	1
	7	10	211	18	1
	8	9.9	377	18	1
	9	7.3	355	18	1
	10	9	268	16	1
	11	7.7	439	17	1
	12	7.5	488	16	1
	13	6.5	328	18	1
	14	8.7	263	18	1
	15	6.4	233	18	1
	16	7.1	424	18	1
	17	8.3	325	16	1
	18	9.5	290	18	1
	19	6.6	496	17	0
	20	6.4	257	16	1
	21	6.6	349	18	1
	22	8	234	16	1
	23	7.1	436	18	1
	24	9.1	236	17	1
	25	10	460	16	0
	26	9.2	436	16	1
	27	8	342	16	1
	28	8	221	17	1
	29	8.3	344	16	1
	30	9.7	344	16	1
	Detection Percentage				**90% (> 60%)**

Table 26. Statistical Performance Check – Radar Type 3, 5300 MHz

Statistical Performance Check – Radar Type 4

Radar Type	Trial #	Pulse Width 11 to 20 µsec	PRI 200 to 500 µsec	Pulses per Burst 12 to 16	Detection 1 = Yes, 0 = No
4	1	14.3	268	12	1
	2	19	340	16	1
	3	17.2	275	14	1
	4	17.3	446	14	1
	5	15	308	15	1
	6	17.8	207	15	1
	7	18.4	262	13	1
	8	11.3	399	13	1
	9	16.5	223	15	1
	10	16.3	421	14	1
	11	15.1	480	14	1
	12	14.9	333	15	1
	13	19.1	257	13	1
	14	13.2	324	16	1
	15	13.2	495	12	1
	16	14	252	13	1
	17	17.4	416	12	1
	18	15	330	14	1
	19	16.4	423	14	1
	20	11.3	332	16	1
	21	15.6	344	13	1
	22	19.1	235	16	1
	23	16.1	376	15	1
	24	17.1	399	16	1
	25	12.2	349	12	1
	26	15.9	331	15	1
	27	12.9	281	16	1
	28	16.2	492	14	1
	29	13.1	360	14	1
	30	11.5	204	12	1
	Detection Percentage				**100% (> 60%)**

Table 27. Statistical Performance Check – Radar Type 4, 5300 MHz

Statistical Performance Check – Radar Type 5

Radar Type	Trial #	Filename*	Detection 1 = Yes, 0 = No
5	1	bin5set323wav1	1
	2	bin5set323wav2	1
	3	bin5set323wav3	1
	4	bin5set323wav4	1
	5	bin5set323wav5	1
	6	bin5set323wav6	1
	7	bin5set323wav7	1
	8	bin5set323wav8	1
	9	bin5set323wav9	1
	10	bin5set323wav10	1
	11	bin5set323wav11	1
	12	bin5set323wav12	1
	13	bin5set323wav13	1
	14	bin5set323wav14	1
	15	bin5set323wav15	1
	16	bin5set323wav16	1
	17	bin5set323wav17	1
	18	bin5set323wav18	1
	19	bin5set323wav19	1
	20	bin5set323wav20	1
	21	bin5set323wav21	1
	22	bin5set323wav22	1
	23	bin5set323wav23	1
	24	bin5set323wav24	1
	25	bin5set323wav25	1
	26	bin5set323wav26	1
	27	bin5set323wav27	1
	28	bin5set323wav28	1
	29	bin5set323wav29	1
	30	bin5set323wav30	1
	Detection Percentage		100% (> 80%)

Table 28. Statistical Performance Check – Radar Type 5, 5300 MHz

Note: See Appendix for Bin 5 test data.

Statistical Performance Check – Radar Type 6

Radar Type	Trial #	Frequency (MHz)	Pulses/Hop	Pulse Width (µsec)	PRI (µsec)	Detection 1 = Yes, 0 = No
6	1	5300	9	1	333	1
	2	5300	9	1	333	1
	3	5300	9	1	333	1
	4	5300	9	1	333	1
	5	5300	9	1	333	1
	6	5300	9	1	333	0
	7	5300	9	1	333	1
	8	5300	9	1	333	1
	9	5300	9	1	333	0
	10	5300	9	1	333	1
	11	5300	9	1	333	1
	12	5300	9	1	333	1
	13	5300	9	1	333	0
	14	5300	9	1	333	1
	15	5300	9	1	333	1
	16	5300	9	1	333	1
	17	5300	9	1	333	0
	18	5300	9	1	333	1
	19	5300	9	1	333	1
	20	5300	9	1	333	1
	21	5300	9	1	333	1
	22	5300	9	1	333	1
	23	5300	9	1	333	1
	24	5300	9	1	333	0
	25	5300	9	1	333	1
	26	5300	9	1	333	0
	27	5300	9	1	333	1
	28	5300	9	1	333	1
	29	5300	9	1	333	1
	30	5300	9	1	333	1
	Detection Percentage					80% (> 60%)

Table 29. Statistical Performance Check – Radar Type 6, 5300 MHz

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
1T4568	RADIATING NOISE SOURCE	MET LABORATORIES	N/A	SEE NOTE	
1T4300	SEMI-ANECHOIC CHAMBER #1 (FCC)	EMC TEST SYSTEMS	NONE	7/24/2012	7/24/2015
1T4612	SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4407B	5/23/2012	11/23/2013
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	7/16/2012	7/16/2013
1T4753	ANTENNA - BILOG	SUNOL SCIENCES	JB6	1/5/2012	7/5/2013
1T4505	TEMPERATURE CHAMBER	TEST EQUITY	115	12/2/2012	12/2/2013
1T4483	ANTENNA; HORN	ETS-LINDGREN	3117	8/6/2012	2/6/2014
1T2511	ANTENNA; HORN	EMCO	3115	9/22/2011	3/22/2013
1T4502	COMB GENERATOR	COM-POWER	CGC-255	8/21/2012	2/21/2014
1T4814	COMB GENERATOR	COM-POWER	CGO-5100	SEE NOTE	
1T4791	THERM./CLOCK/HUMIDITY	CONTROL COMPANY	06-662-4	3/8/2012	3/8/2014
1T4563	LISN (10 AMP)	SOLAR ELECTRONICS	9322-50-R-10-BNC	11/27/2012	5/27/2014
1T2948	LISN	SOLAR ELECTRONICS	8028-50-TS-24-BNC	1/30/2012	7/30/2013
1T2278	SWEPT SIGNAL GENERATOR	HEWLETT PACKARD	83650B	10/31/2012	10/31/2013
1T4149	HIGH-FREQUENCY ANECHOIC CHAMBER	RAY-PROOF	81	SEE NOTE	
1T4503	SHIELDED ROOM	UNIVERSAL SHIELDING CORP	N/A	SEE NOTE	
1T4504	SHIELDED ROOM	UNIVERSAL SHIELDING CORP	N/A	SEE NOTE	
1S2602	DFS SIGNAL GENERATOR	NATIONAL INSTRUMENTS	NIPXI-1042	SEE NOTE	
1T4479	POWER SUPPLY PROGRAMMABLE	CALIFORNIA INSTRUMENTS	1501TC	SEE NOTE	

Table 30. 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