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
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3162 BELICK STREET ● SANTA CLARA, CALIFORNIA 95054 ● PHONE (408) 748-3585 ● FAX (510) 489-6372
13301 MCCALLEN PASS ● AUSTIN, TEXAS 78753 ● PHONE (512) 287-2500 ● FAX (512) 287-2513

August 12, 2014

Electronic Systems Technology
415 N. Quay Street
Kennewick, WA 99336

Dear Todd Elliot,

Enclosed is the EMC Wireless test report for compliance testing of the Electronic Systems Technology, 195H, tested to the requirements of Title 47 of the Code of Federal Regulations (CFR), Part 15 Subpart B for a Class A Digital Device, Part 90 for Land Mobile Radio Services.

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: (\Electronic Systems Technology\EMC42069-FCC90 Rev. 1)

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Electromagnetic Compatibility Criteria Test Report

For the

Electronic Systems Technology
195H

Tested under

The FCC and IC Verification Rules
Contained in Title 47 of the CFR, Part 15 B
for a Class A Digital Device
&
Part 90 for Private Land Mobile Radio Services

MET Report: EMC42069-FCC90 Rev. 1

August 12, 2014

Prepared For:
Electronic Systems Technology
415 N. Quay Street
Kennewick, WA 99336

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

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MET Report: EMC42069-FCC90 Rev. 1

Jason Allnutt, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Warnell
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 15 B and Part 90 of the FCC Rules under normal use and maintenance.

Asad Bajwa,
Director, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	July 31, 2014	Initial Issue.
1	August 12, 2014	Editorial corrections.

Table of Contents

All references to section numbers are taken directly from the standard/specification used. Only sections requiring testing or evaluation are included.

List of Tables

List of Figures

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List of Terms and Abbreviations

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

I. Executive Summary

1. Testing Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC 47CFR Part 15, and Part 90. All tests were conducted using measurement procedure ANSI TIA/EIA-603-A-2004 and KDB 971168 D01.

Title 47 of the CFR, Part 15, Part 90, and FCC 04-265 Reference and Test Description	Compliance
47 CFR Part 15.107 (a) Conducted Emissions	Compliant
47 CFR Part 15.109 (a) Radiated Emissions	Compliant
§2.1046, §90.259(a)(4) RF Output Power	Compliant
§2.1047, §90.207 Modulation Characteristics, Audio Frequency & Filter Response	Not Applicable – No voice, only digital data.
§2.1049, 90.210(d) Occupied Bandwidth (Emission Mask C)	Compliant
§2.1051, §90.210(c) Spurious Emissions at Antenna Terminals	Compliant
§2.1055, §90.213 Frequency Stability	Compliant
§2.1053, §90.210(c) Field Strength of Spurious Radiation	Compliant
§90.214 Transient Frequency Behavior	Not Applicable – Only required for device operating in the 400 MHz band.

Table 1. Testing Compliance Summary

II. Equipment Configuration

2. Equipment Configuration

2.1. Overview

MET Laboratories, Inc. was contracted by Electronic Systems Technology to perform testing on the 195H purchase order number 1620.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Electronic Systems Technology, 195H.

An EMC evaluation to determine compliance of the TB 4.9 with the requirements of Part 90 was conducted. (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 TB4.9. Electronic Systems Technology should retain a copy of this document and it should be kept on file for at least five years after the manufacturing of the EUT has been **permanently** discontinued. The results obtained relate only to the item(s) tested.

Model(s) Tested:	195H	
Model(s) Covered:	195H	
Filing Option:	Original	
EUT Specifications:	Primary Power Source: 48 VDC	
	FCC ID: ENPESTEEM195H	
	Type of Modulations:	GFSK
	Bandwidths	6.25/12.5/25/50 kHz
	EUT Frequency Ranges:	217 – 220 MHz
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature (15-35° C)	
	Relative Humidity (30-60%)	
	Barometric Pressure (860-1060 mbar)	
Evaluated by:	Jason Allnutt	
Report Date(s):	August 12, 2014	

2.2. 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 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.

2.3. Description of Test Sample

The Electronic Systems Technology 195H, Equipment Under Test (EUT), is a 150-174 MHz pole-mounted radio modem with 6.25 kHz and 12.5 kHz channel spacing. Modulation is 4-level FSK. It is utilized in industrial applications for accessing and programming remote programmable logic controllers from fixed locations.

2.4. Equipment Configuration

Ref. ID	Name / Description	Model Number	Serial Number	Rev. #
1	EUT (ip 172.18.9.153	195H	H-22222	0

Table 2. Equipment Configuration

2.5. Support Equipment

Electronic Systems Technology supplied the support equipment necessary for the operation and testing of the 195H. All support equipment supplied is listed in the following Support Equipment List.

Ref. ID	Name / Description	Manufacturer	Model Number	Customer Supplied Calibration Data
2	Dell Laptop w/power supply	PP08L	P3373 A02	--
3	Qty(2) 300-ft RJ-45 to RJ45 cables	--	--	--
4	Qty(2) 20-ft RJ45- to RJ45 cables with terminal block adaptor / dummy loads	--	--	--
5	30-Watt AC adaptor 48VDC Power Supply for EUT testing	SL Power Electronics	PW183RB4800F01	--

Table 3. Support Equipment

2.6. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty.	Length as tested (m)	Shielded? (Y/N)	Termination Box ID & Port Name
1	RS-485	20-ft, dummy load	1	6.5	N	Dummy load
2	Ethernet	300-ft, worst case length	1	100	Y	Laptop Ethernet
3	RS-232 Data	20-ft dummy load	1	6.5	N	Dummy Load
4	RMT Power	300-ft, worst case length	1	100	Y	48VDC supply, PWR-LAN-OUT port

Table 4. Ports and Cabling Information

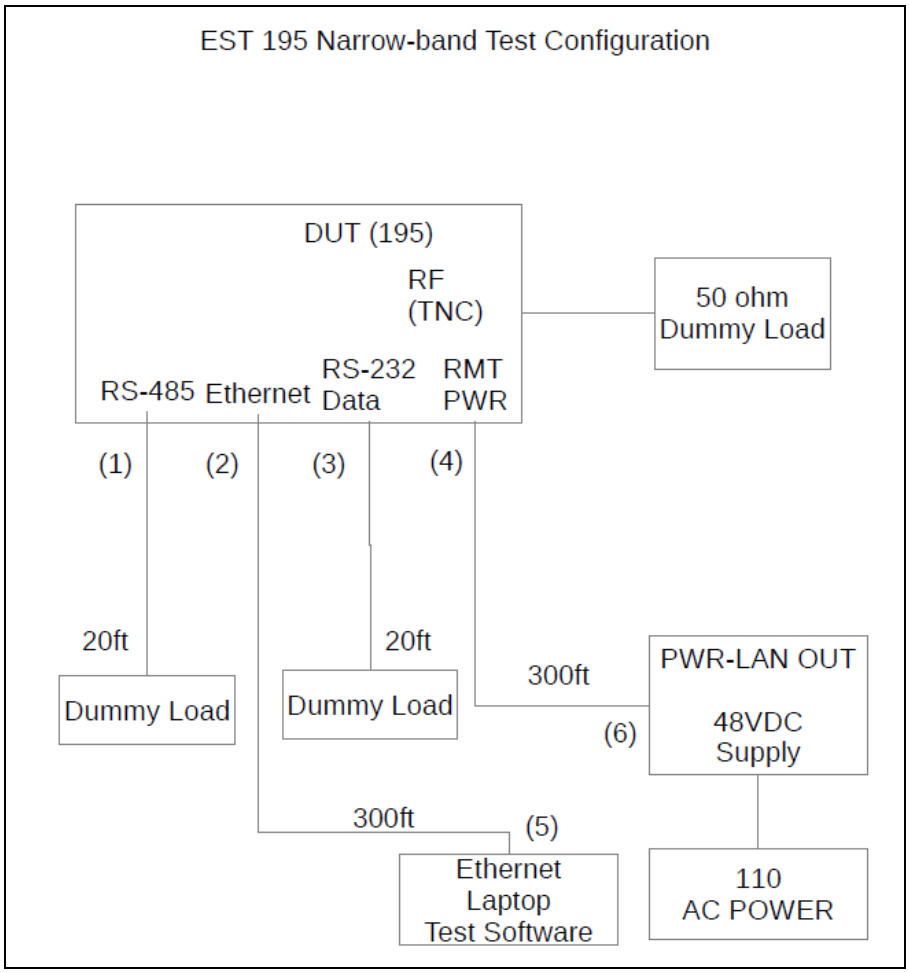


Figure 1. Equipment Configuration, Block Diagram

2.7. Mode of Operation

The following tests will be performed by the test engineer:

1) RF Power Output
2) Modulation Characteristics
3) Modulation Limiting
4) Occupied Bandwidth
5) Spurious Emissions at Antenna Terminals
6) Field Strength of Spurious Emissions (with dummy load attached to antenna terminals)
7) Frequency Stability

2.8. Method of Monitoring EUT Operation

Status LED will be off when no carrier is detected.
Status LED will be yellow when carrier detected.
Status LED will be red when transmitting.

2.9. Modifications

2.9.1. Modifications to EUT

No modifications were made to the EUT.

2.9.2. Modifications to Test Standard

No modifications were made to the test standard.

2.10. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Electronic Systems Technology upon completion of testing.

III. Electromagnetic Compatibility Criteria for Unintentional Radiators

3. Electromagnetic Compatibility Criteria

3.1. 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 5. 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 5. 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- 0.50	79	66	66 - 56	56 - 46
0.5 – 5	73	60	56	46
5 - 30	73	60	60	50
Note 1 — The lower limit shall apply at the transition frequencies. Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz.				

Table 5. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Subsections 15.107(a) (b)

Test Procedures: The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber. The method of testing, test conditions, and test procedures of ANSI C63.4 were used. The EUT was powered through a 50Ω/50µH LISN. An EMI receiver, connected to the measurement port of the LISN, scanned the frequency range from 150 kHz to 30 MHz in order to find the peak conducted emissions. All peak emissions within 6 dB of the limit were re-measured using a quasi-peak and/or average detector as appropriate.

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

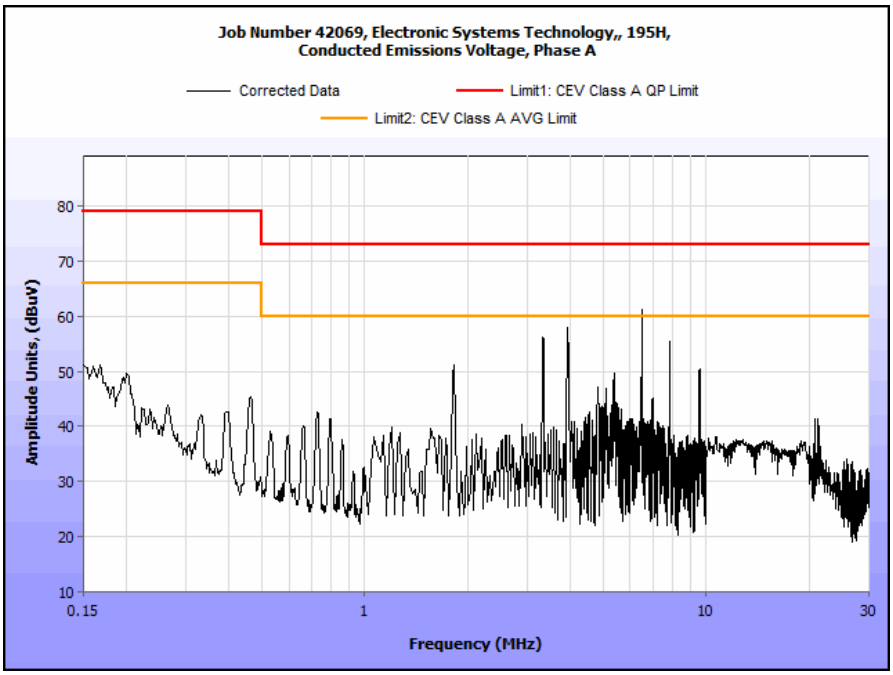
Test Engineer(s): Jason Allnutt

Test Date(s): 06/19/14

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

Frequency (MHz)	Uncorrected Meter Reading (dBµV) QP	Cable Loss (dB)	Corrected Measurement (dBµV) QP	Limit (dBµV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBµV) Avg.	Cable Loss (dB)	Corrected Measurement (dBµV) AVG	Limit (dBµV) AVG	Margin (dB) AVG
1.817	57.77	0	57.77	73	-15.23	37.86	0	37.86	60	-22.14
3.323	56.42	0	56.42	73	-16.58	36.75	0	36.75	60	-23.25
3.927	59.78	0	59.78	73	-13.22	43.2	0	43.2	60	-16.8
6.46	60.71	0	60.71	73	-12.29	41.1	0	41.1	60	-18.9
7.818	56.15	0	56.15	73	-16.85	33.79	0	33.79	60	-26.21
9.555	48.93	0	48.93	73	-24.07	24.75	0	24.75	60	-35.25

Table 6. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz)

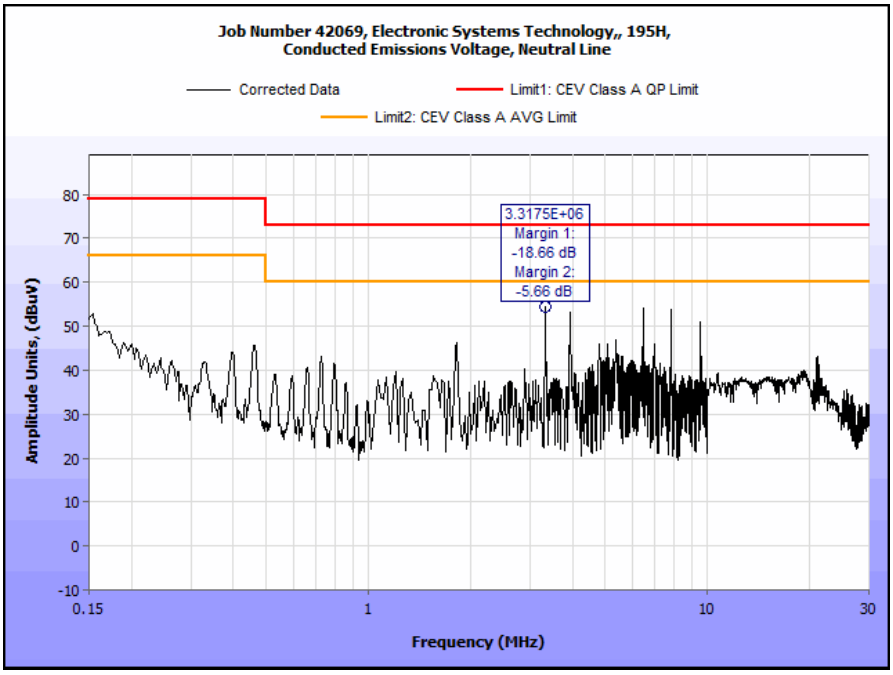


Plot 1. Conducted Emission, Phase Line

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

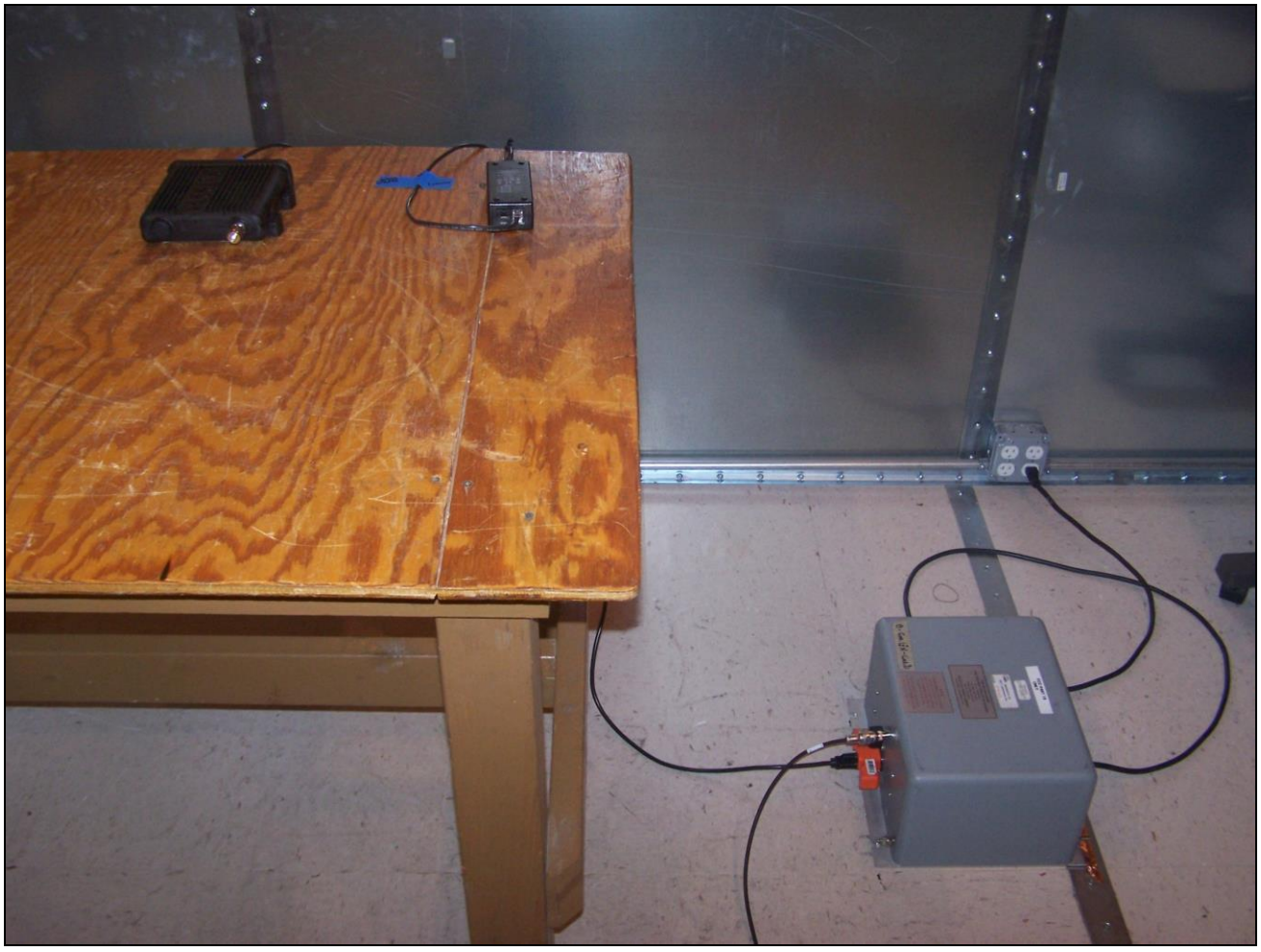
Frequency (MHz)	Uncorrected Meter Reading (dBµV) QP	Cable Loss (dB)	Corrected Measurement (dBµV) QP	Limit (dBµV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBµV) Avg.	Cable Loss (dB)	Corrected Measurement (dBµV) AVG	Limit (dBµV) AVG	Margin (dB) AVG
1.817	46.83	0	46.83	73	-26.17	22.57	0	22.57	60	-37.43
3.323	52.24	0	52.24	73	-20.76	28.27	0	28.27	60	-31.73
3.927	51.28	0	51.28	73	-21.72	27.5	0	27.5	60	-32.5
6.46	55.32	0	55.32	73	-17.68	31.26	0	31.26	60	-28.74
7.818	51.71	0	51.71	73	-21.29	29.37	0	29.37	60	-30.63
9.555	43.89	0	43.89	73	-29.11	20.75	0	20.75	60	-39.25

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



Plot 2. Conducted Emission, Neutral Line

Conducted Emission Limits Test Setup



Photograph 1. Conducted Emissions, Test Setup

3.2. 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 8.

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 8.

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

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

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

Test Engineer(s): Jason Allnutt

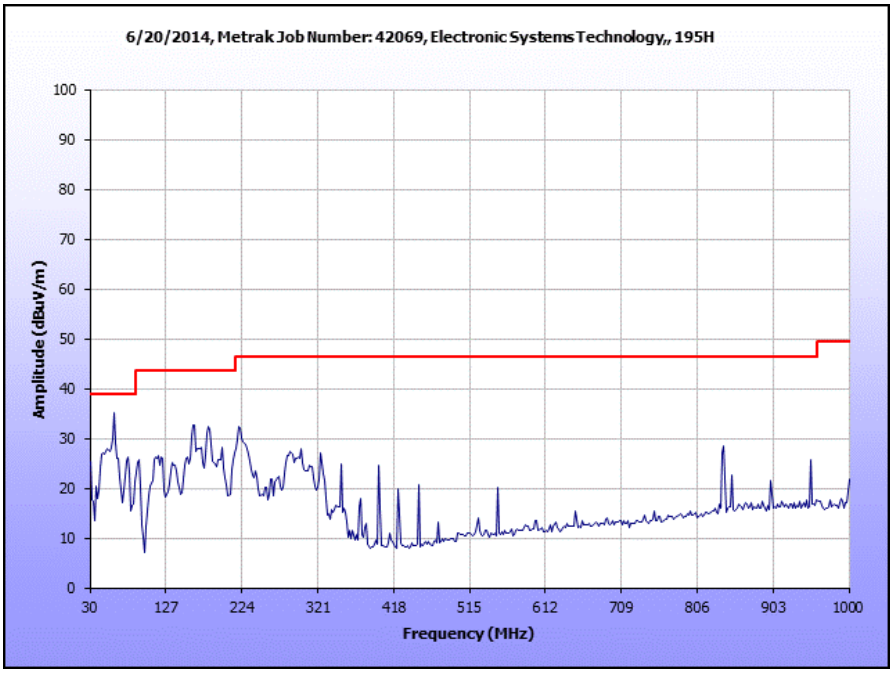
Test Date(s): 06/20/14

Radiated Emissions Limits Test Results, Class A

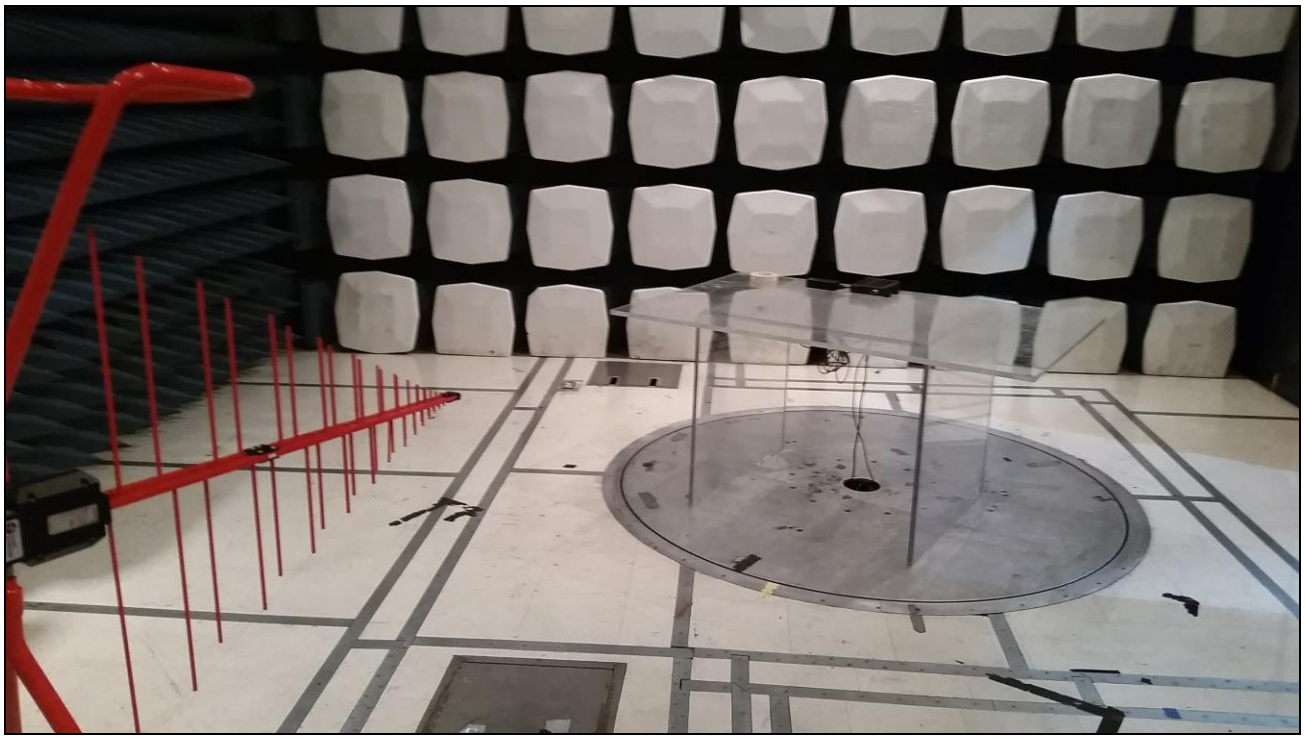
Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBµV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
61.422846	16	H	1.02	16.98	7.54	0.73	10.46	14.79	39.00	-24.21
61.422846	68	V	1.02	32.77	7.54	0.73	10.46	30.58	39.00	-8.42
183.56713	9	H	1.46	23.66	11.20	1.13	10.46	25.53	43.50	-17.97
183.56713	295	V	1.02	25.66	11.20	1.13	10.46	27.53	43.50	-15.97
300.00603	194	H	1.73	21.69	14.10	1.58	10.46	26.91	46.40	-19.49
300.00603	67	V	1.03	18.13	14.10	1.58	10.46	23.35	46.40	-23.05
399.97869	269	H	1.33	15.19	16.20	1.72	10.46	22.65	46.40	-23.75
399.97869	334	V	2.48	16.05	16.20	1.72	10.46	23.51	46.40	-22.89
449.9838	189	H	1.01	11.24	17.20	1.77	10.46	19.75	46.40	-26.65
449.9838	27	V	2.65	11.44	17.20	1.77	10.46	19.95	46.40	-26.45
849.99413	307	H	1.02	8.84	22.60	2.86	10.46	23.84	46.40	-22.56
849.99413	311	V	3.10	9.09	22.60	2.86	10.46	24.09	46.40	-22.31

Table 9. Radiated Emissions Limits, Test Results

Note: The EUT was tested at 3 m.



Plot 3. Radiated Emissions, 30 MHz - 1 GHz



Photograph 2. Radiated Emissions, Test Setup

IV. Electromagnetic Compatibility Criteria for Intentional Radiators

4. Electromagnetic Compatibility RF Power Output Requirements

4.1. RF Output Power

Test Requirement(s): **§2.1046 and §90.259(a)(4)** In the 217-220 MHz band, the maximum transmitter output power is 2 watts. The maximum antenna height above average terrain (HAAT) is 152 m (500 feet).

Test Procedures: As required by 47 CFR §2.1046, *RF power output measurements* were made at the RF output terminals using a Spectrum Analyzer.

A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected to a Spectrum Analyzer via an attenuator to measure power. Measurements were made at the low, mid and High Powers of each appropriate frequency range. Plots were correct for attenuator and cable loss.

Test Results: Equipment is compliant with the requirements of this section.

All RF Power output measurements were direct connection to RF output Terminal of EUT from a Spectrum Analyzer.

Test Engineer(s): Jason Allnutt

Test Date(s): 06/13/14

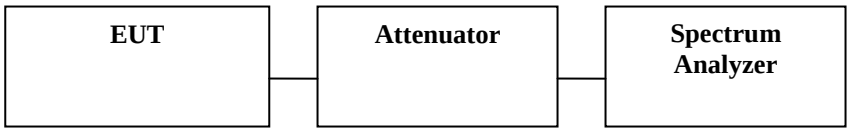
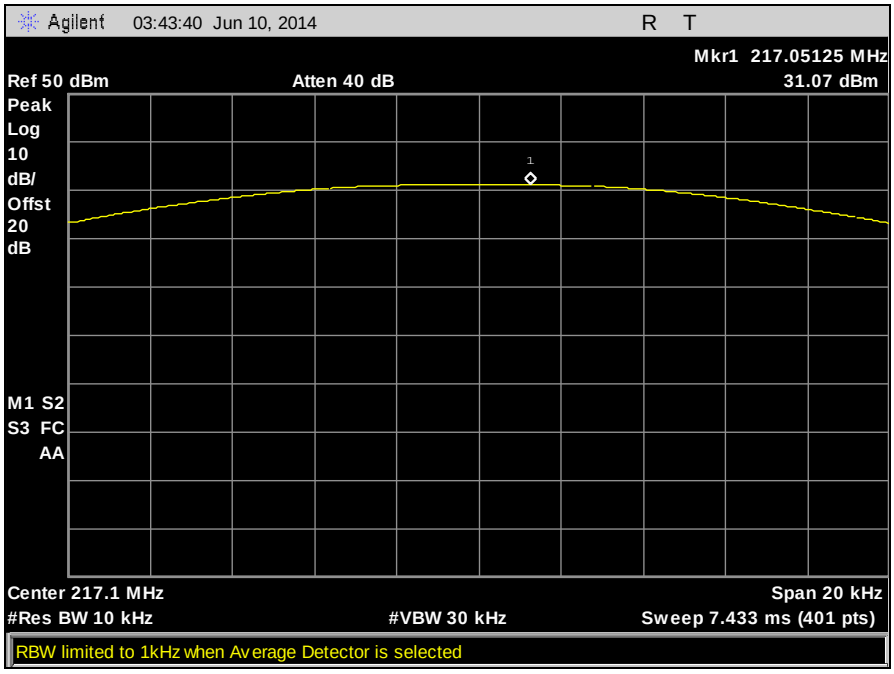


Figure 2. RF Power Output Test Setup

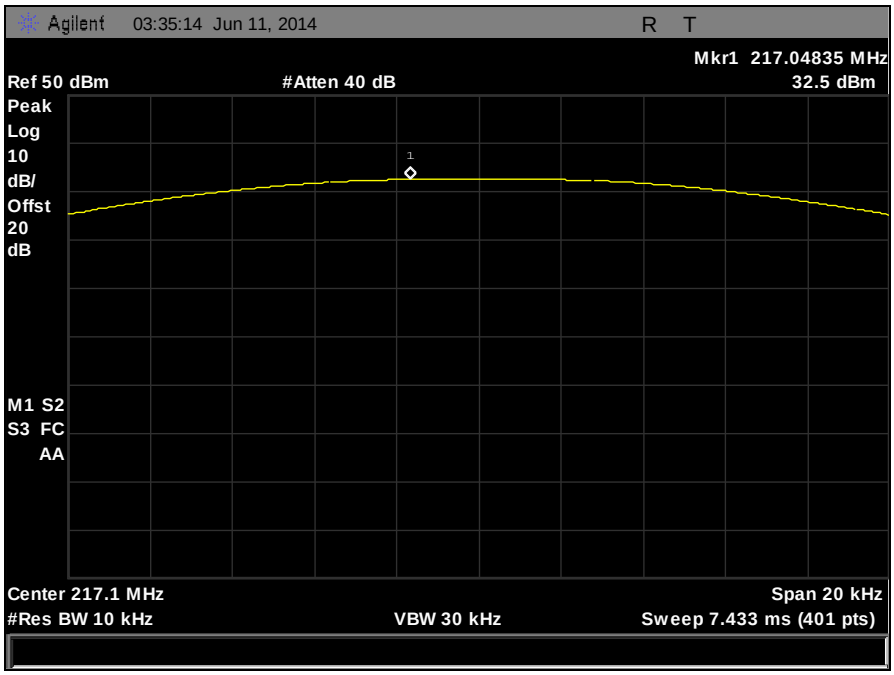
Frequency (MHz)	Bandwidth (kHz)	Power Setting	Measured Output (dBm)	Limit (dBm)	Margin (dB)
217	6.25	High	32.5	33	0.5
217	12.5	High	32.62	33	0.38
217	25	High	32.71	33	0.29
217	50	High	32.59	33	0.41
217	6.25	Low	31.07	33	1.93
217	12.5	Low	30.95	33	2.05
217	25	Low	31.12	33	1.88
217	50	Low	31.18	33	1.82
218	6.25	High	32.39	33	0.61
218	12.5	High	32.6	33	0.4
218	25	High	32.57	33	0.43
218	50	High	32.5	33	0.5
218	6.25	Low	31.05	33	1.95
218	12.5	Low	30.86	33	2.14
218	25	Low	30.75	33	2.25
218	50	Low	30.94	33	2.06
219	6.25	High	32.37	33	0.63
219	12.5	High	32.52	33	0.48
219	25	High	32.44	33	0.56
219	50	High	32.41	33	0.59
219	6.25	Low	30.72	33	2.28
219	12.5	Low	30.74	33	2.26
219	25	Low	30.73	33	2.27
219	50	Low	30.69	33	2.31

Table 10. RF Output Power, Test Results

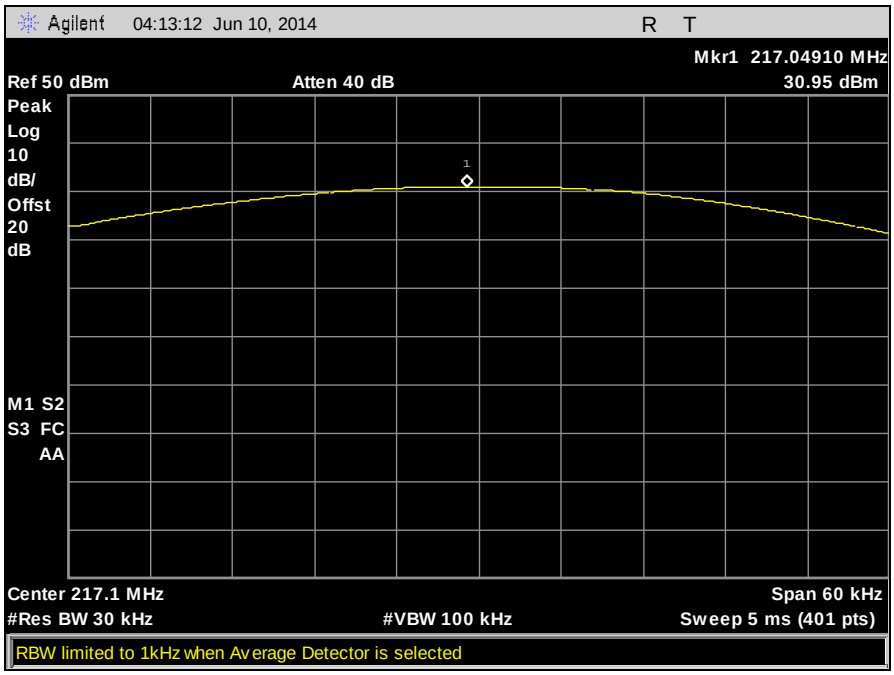
RF Output Power, 217 MHz



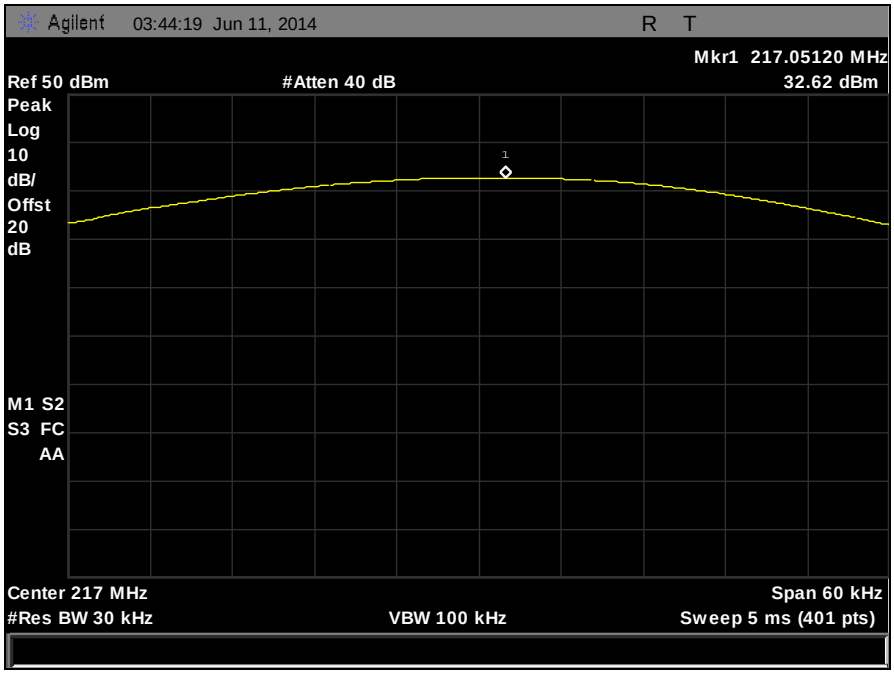
Plot 4. RF Power Output, Low Power, 217 MHz, 6.25 kHz Bandwidth



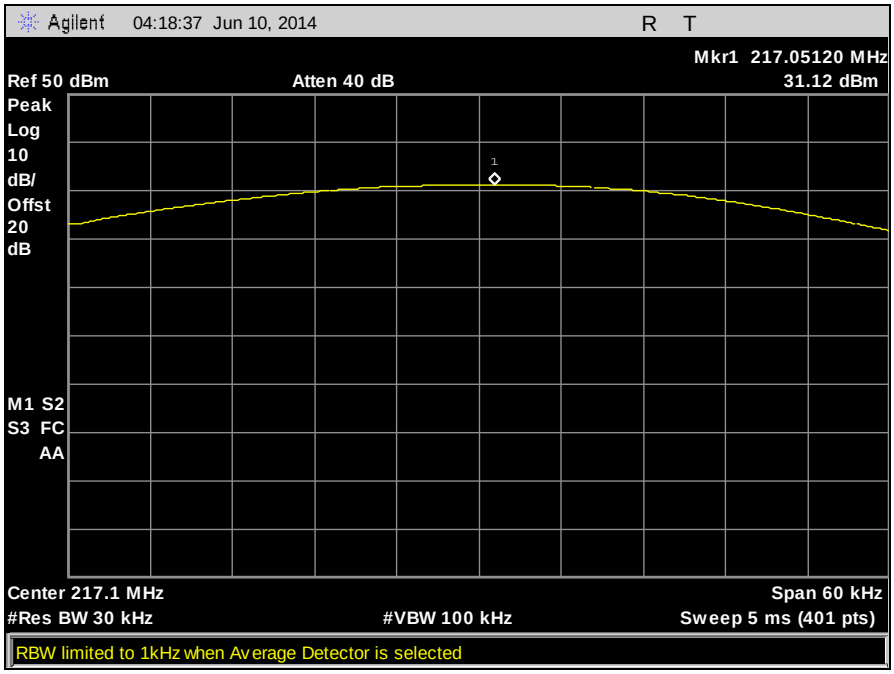
Plot 5. RF Power Output, High Power, 217 MHz, 6.25 kHz Bandwidth



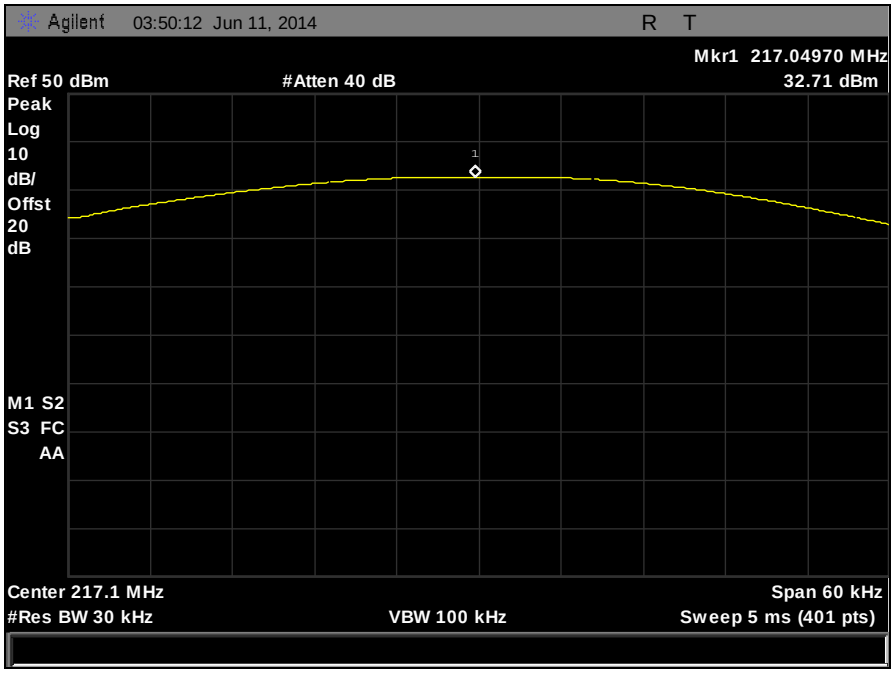
Plot 6. RF Power Output, Low Power, 217 MHz, 12.5 kHz Bandwidth



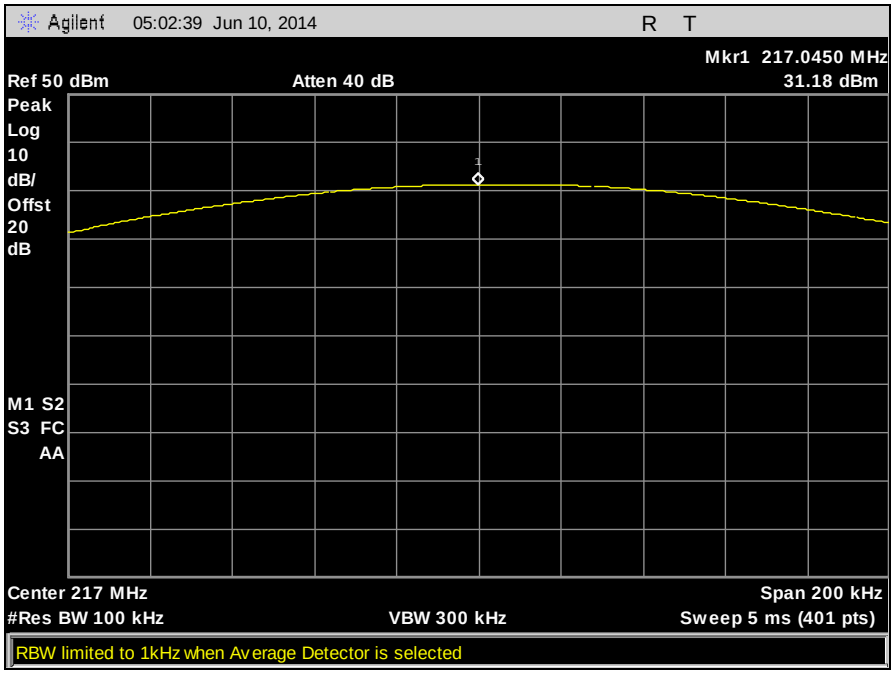
Plot 7. RF Power Output, High Power, 217 MHz, 12.5 kHz Bandwidth



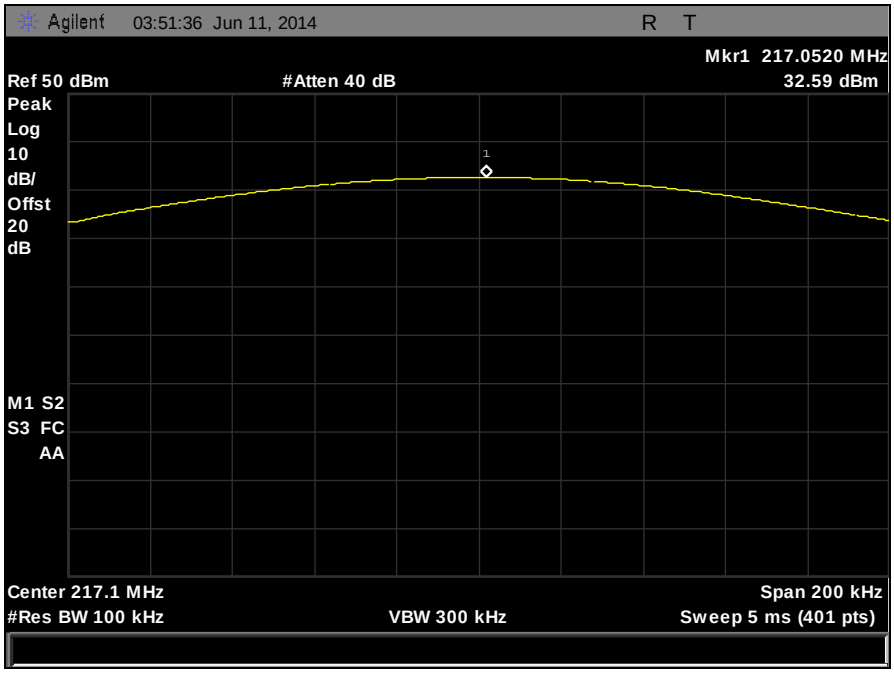
Plot 8. RF Power Output, Low Power, 217 MHz, 25 kHz Bandwidth



Plot 9. RF Power Output, High Power, 217 MHz, 25 kHz Bandwidth

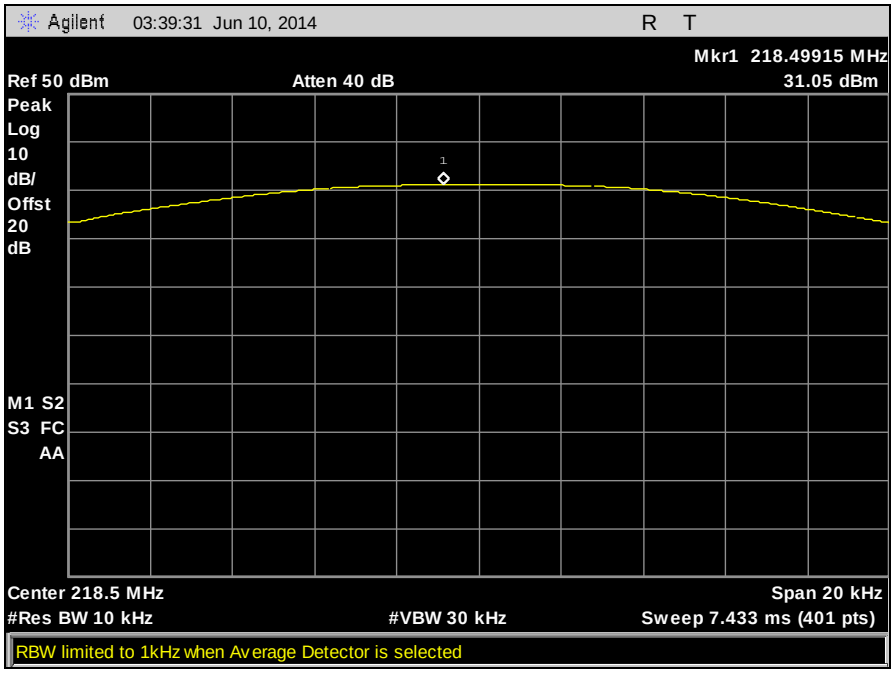


Plot 10. RF Power Output, Low Power, 217 MHz, 50 kHz Bandwidth

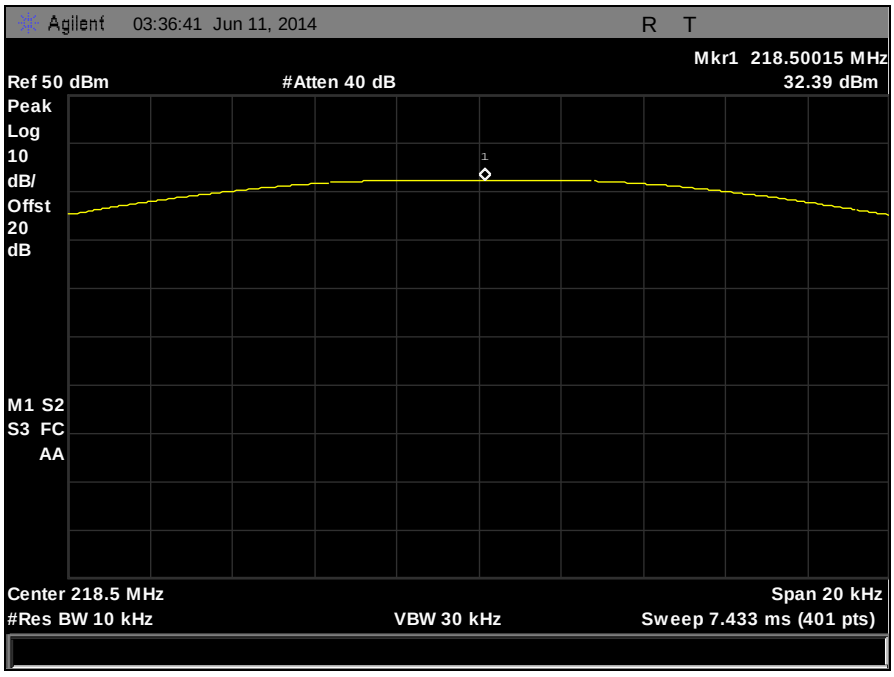


Plot 11. RF Power Output, High Power, 217 MHz, 50 kHz Bandwidth

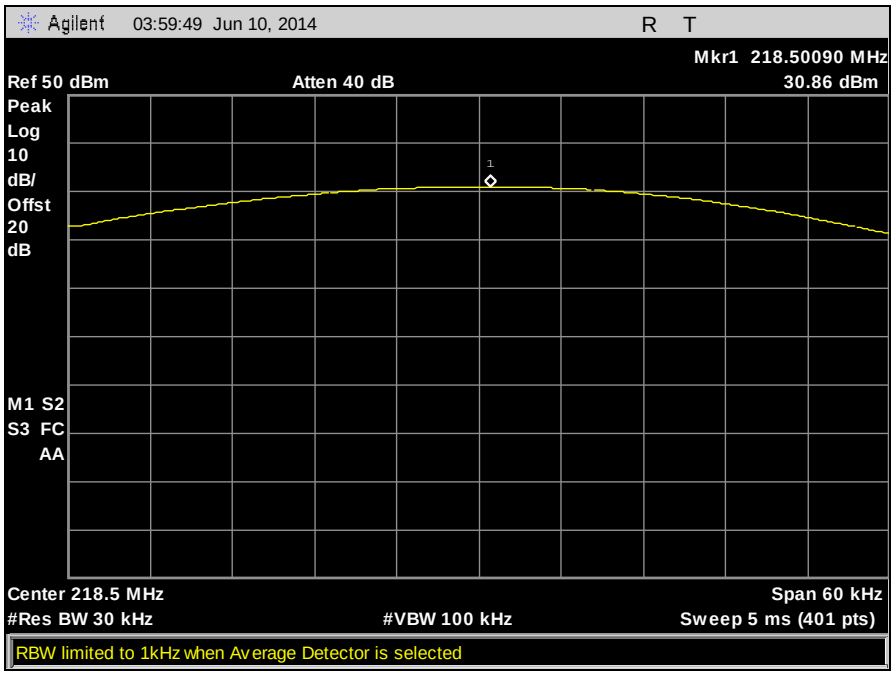
RF Output Power, 218 MHz



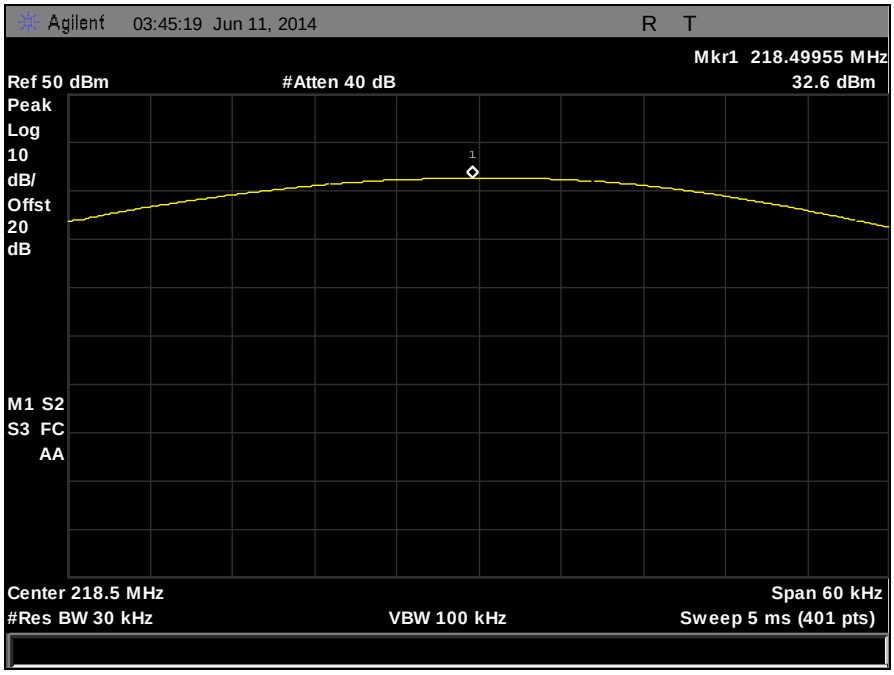
Plot 12. RF Power Output, Low Power, 218 MHz, 6.25 kHz Bandwidth



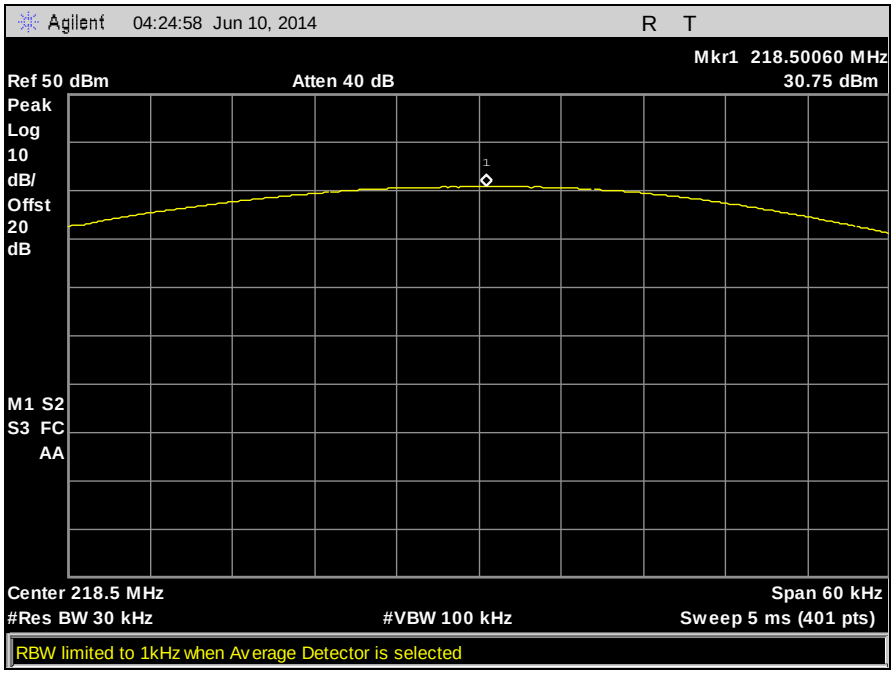
Plot 13. RF Power Output, High Power, 218 MHz, 6.25 kHz Bandwidth



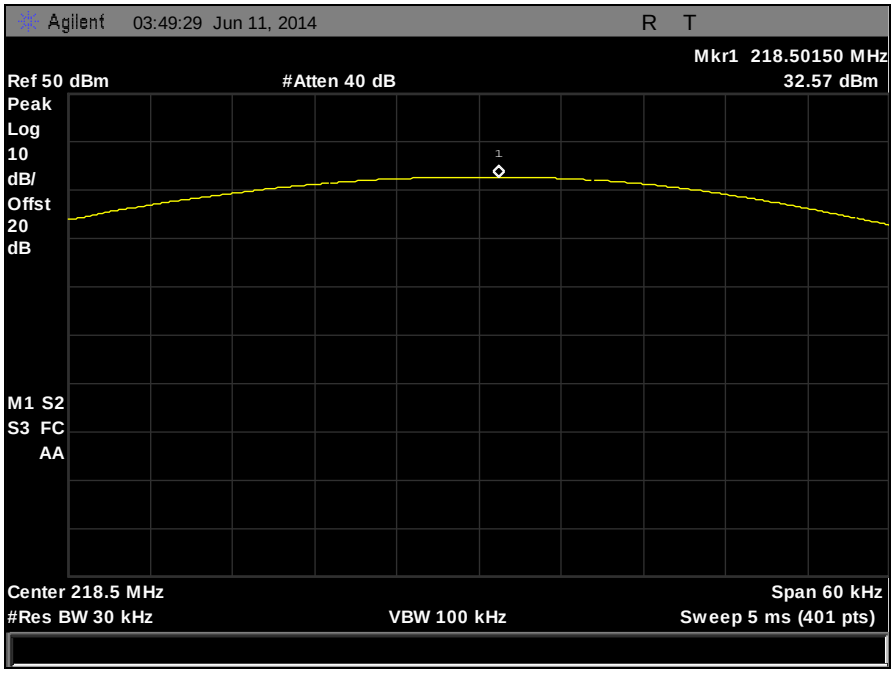
Plot 14. RF Power Output, Low Power, 218 MHz, 12.5 kHz Bandwidth



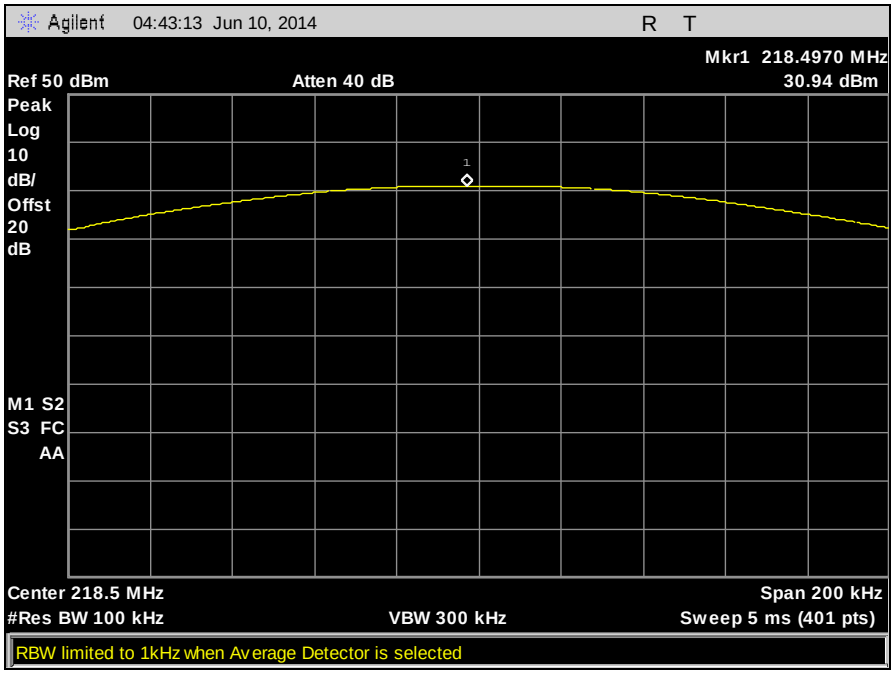
Plot 15. RF Power Output, High Power, 218 MHz, 12.5 kHz Bandwidth



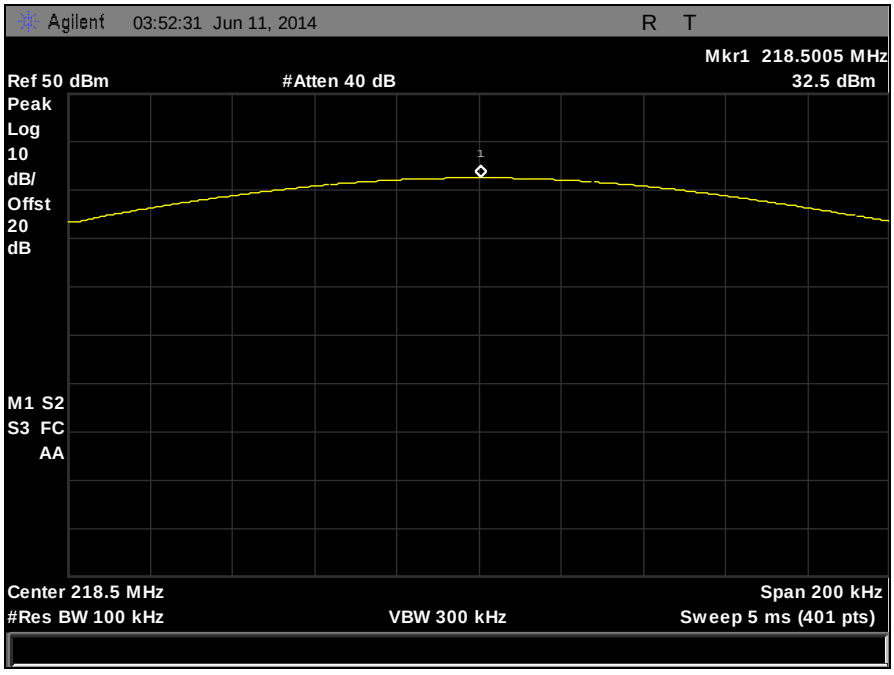
Plot 16. RF Power Output, Low Power, 218 MHz, 25 kHz Bandwidth



Plot 17. RF Power Output, High Power, 218 MHz, 25 kHz Bandwidth

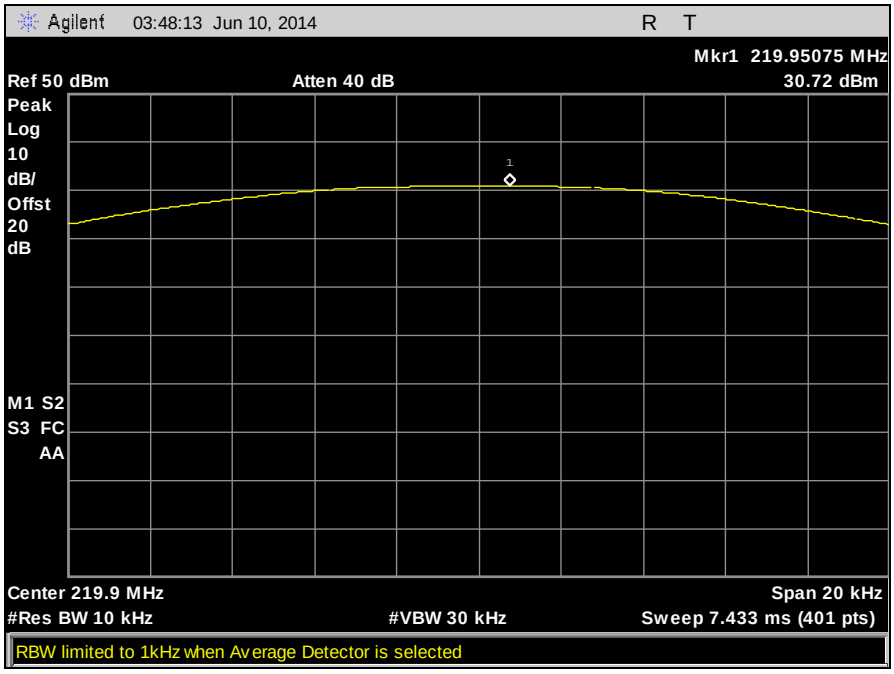


Plot 18. RF Power Output, Low Power, 218 MHz, 50 kHz Bandwidth

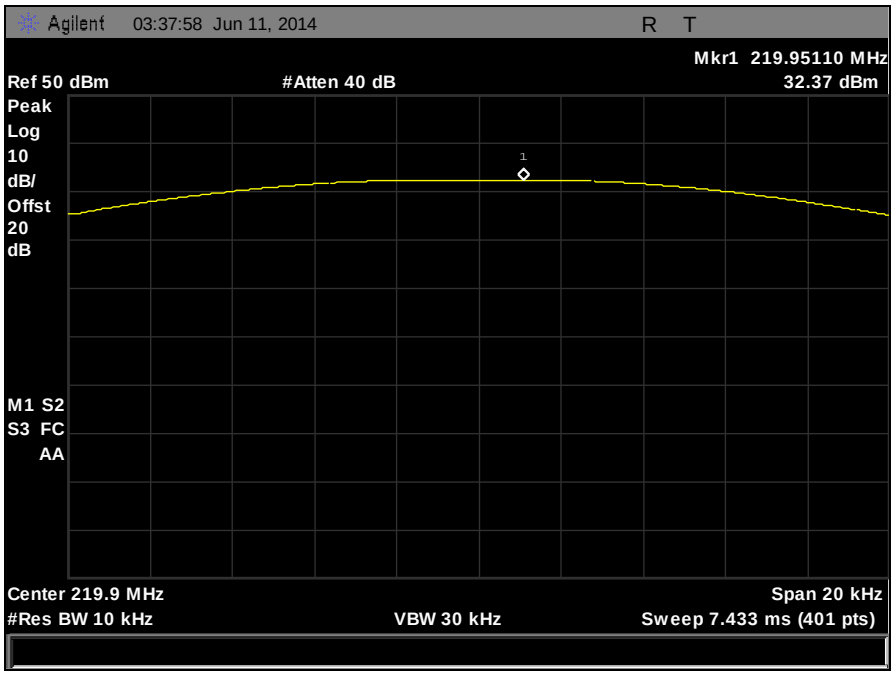


Plot 19. RF Power Output, High Power, 218 MHz, 50 kHz Bandwidth

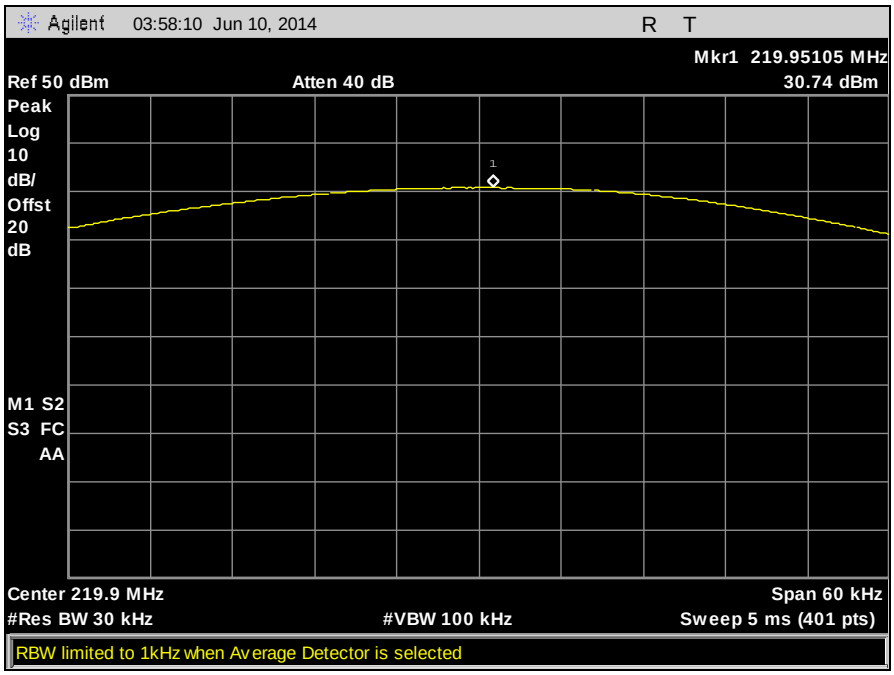
RF Output Power, 219 MHz



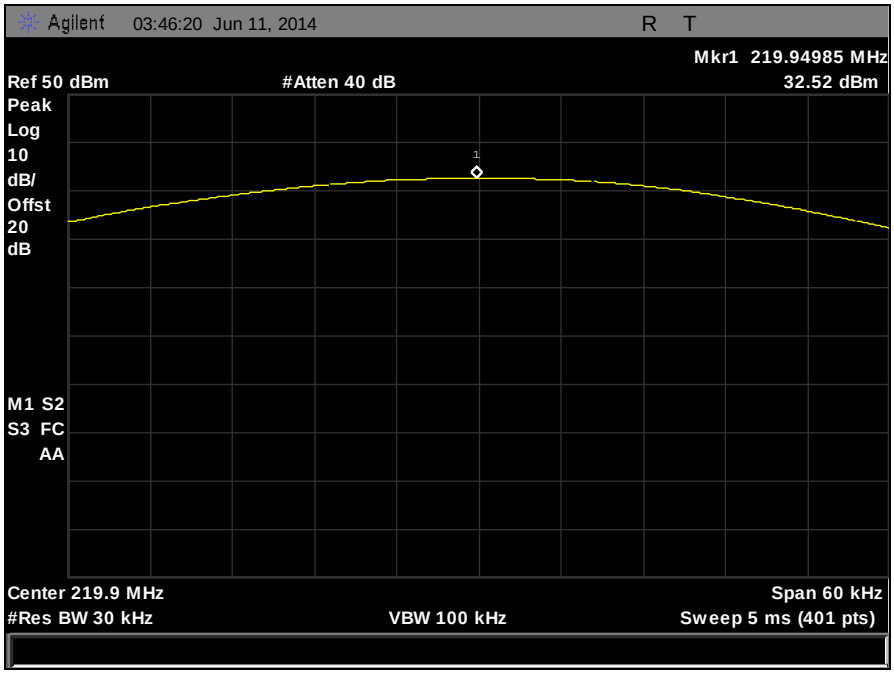
Plot 20. RF Power Output, Low Power, 219 MHz, 6.25 kHz Bandwidth



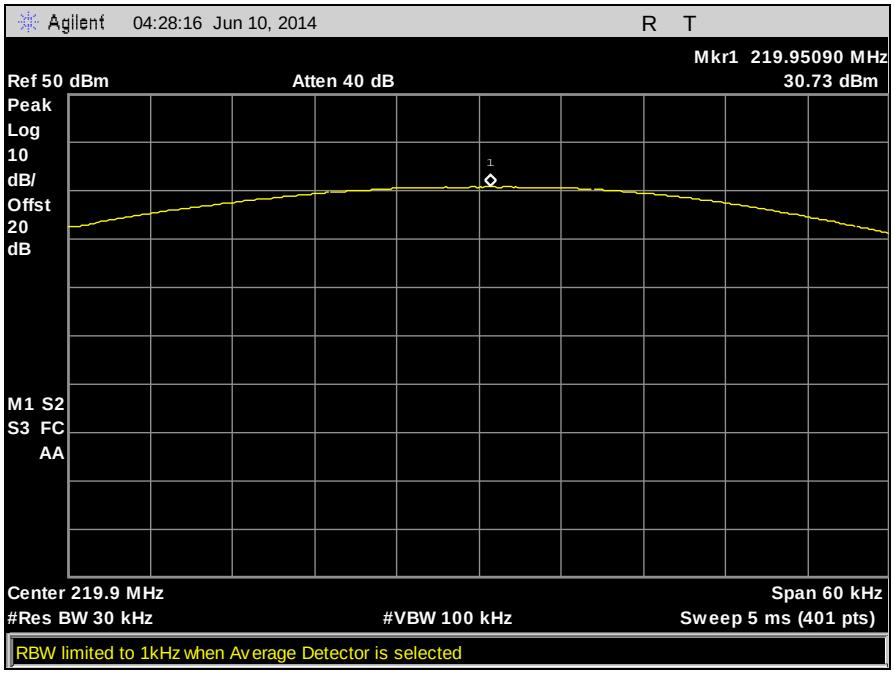
Plot 21. RF Power Output, High Power, 219 MHz, 6.25 kHz Bandwidth



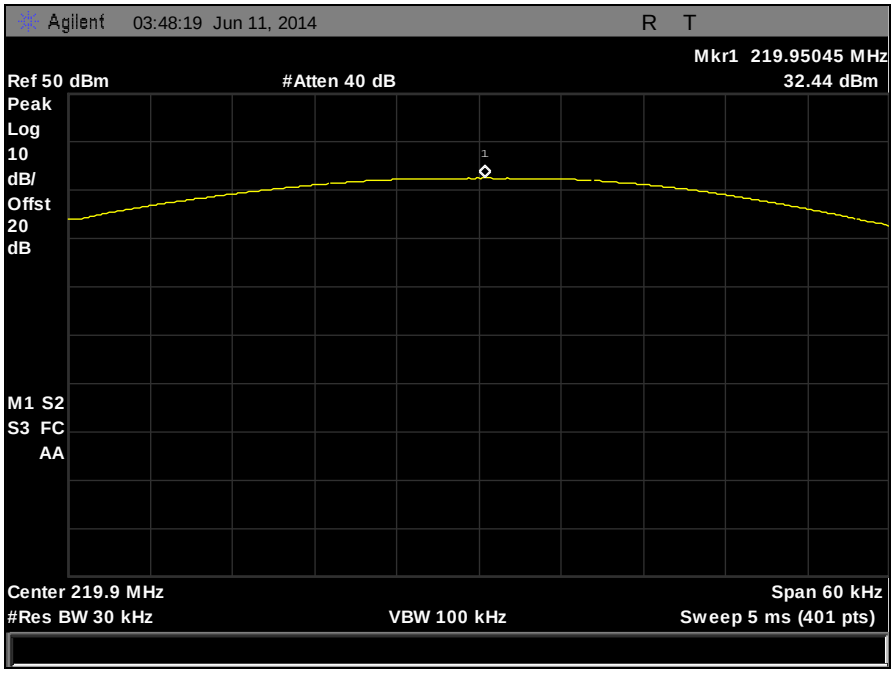
Plot 22. RF Power Output, Low Power, 219 MHz, 12.5 kHz Bandwidth



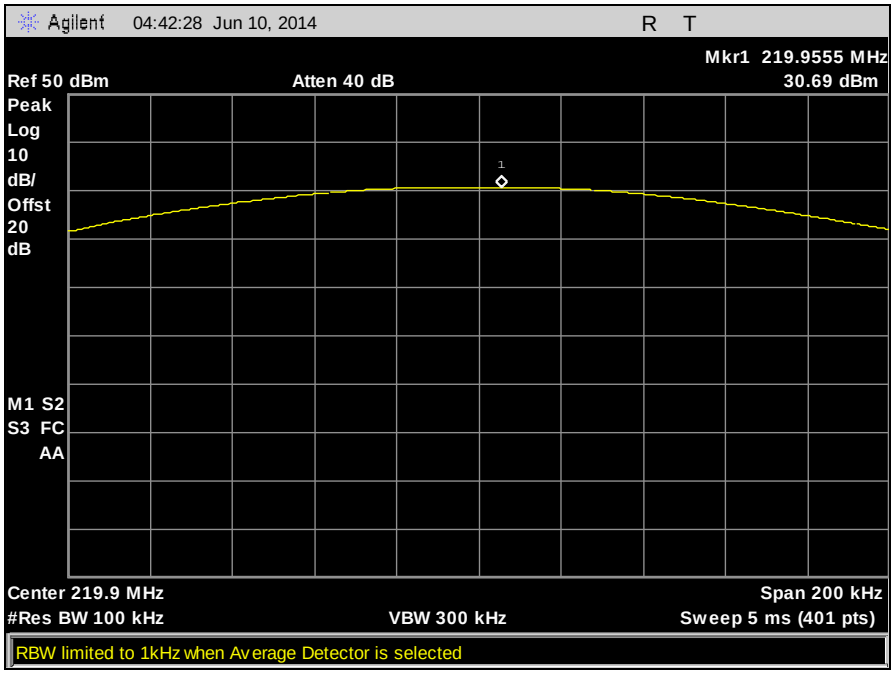
Plot 23. RF Power Output, High Power, 219 MHz, 12.5 kHz Bandwidth



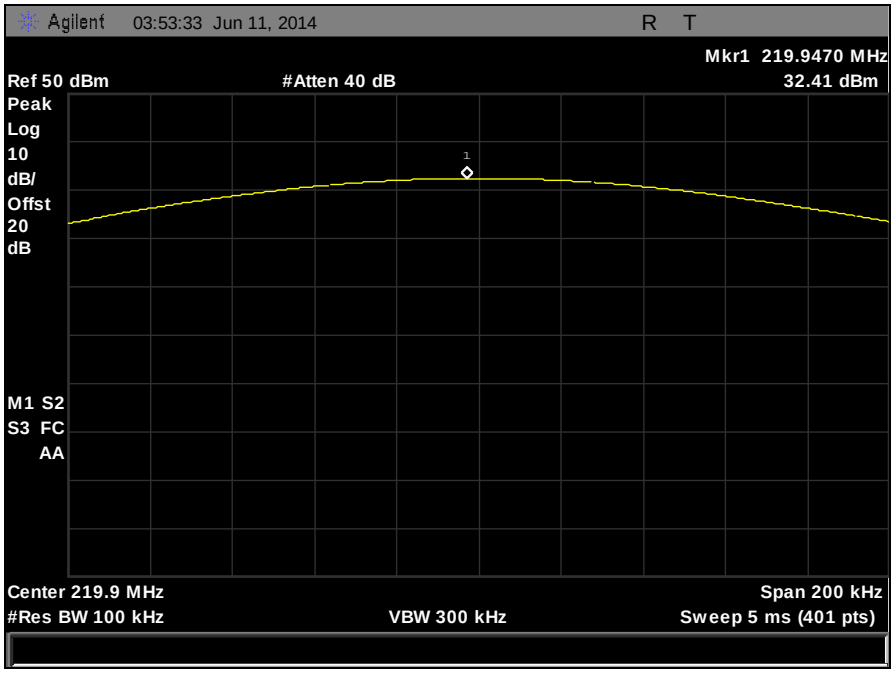
Plot 24. RF Power Output, Low Power, 219 MHz, 25 kHz Bandwidth



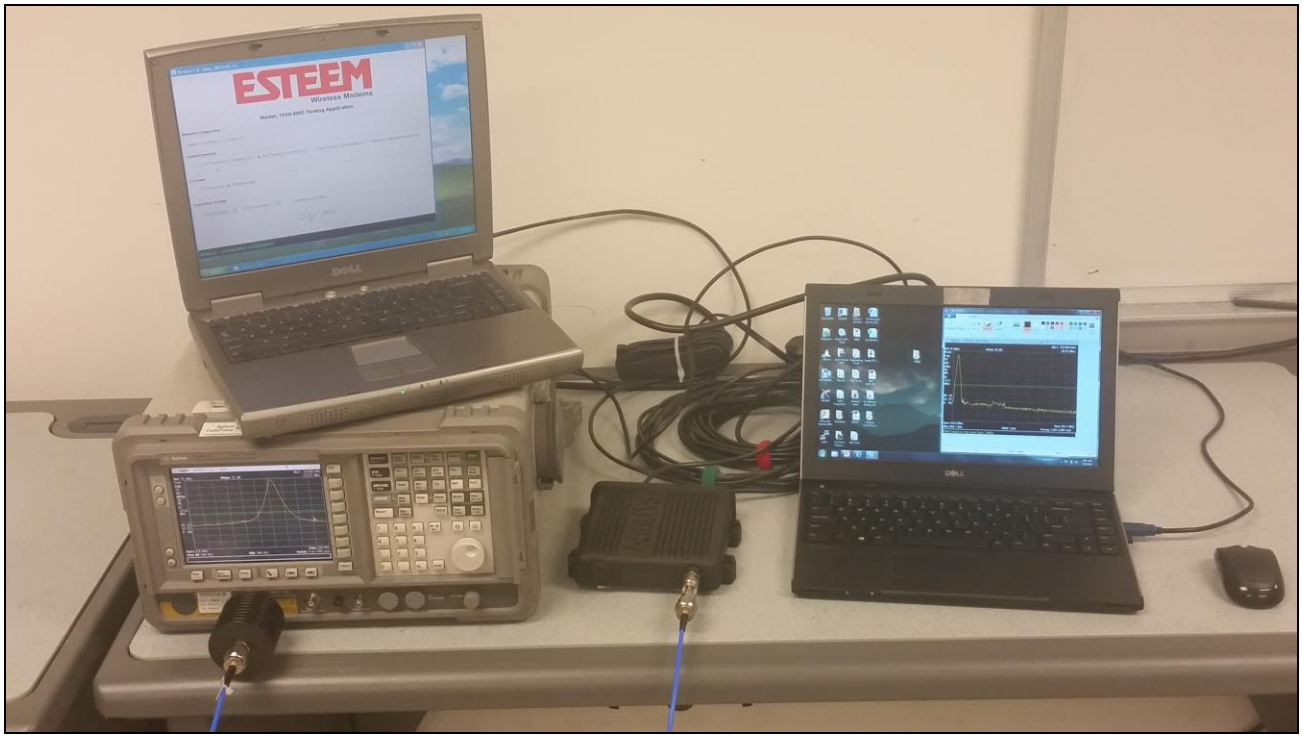
Plot 25. RF Power Output, High Power, 219 MHz, 25 kHz Bandwidth



Plot 26. RF Power Output, Low Power, 219 MHz, 50 kHz Bandwidth



Plot 27. RF Power Output, High Power, 219 MHz, 50 kHz Bandwidth



Photograph 3. RF Power Output, Test Setup

4.2. Occupied Bandwidth

Test Requirement(s): **§2.1049**

Test Procedures: As required by 47 CRF 2.1049, *occupied bandwidth measurements* were made at the RF output terminals using a Spectrum Analyzer.

A laptop was connected to EUT to control the RF frequency channel. The EUT was connected to a Spectrum Analyzer via attenuator. The RBW of the Spectrum Analyzer was set to at least 1% of the channel bandwidth. Measurements were carried out at the low, mid, and High Powers of the TX band.

Test Results: Equipment complies with Section §2.1049.

Test Engineer(s): Jason Allnutt

Test Date(s): 06/13/14

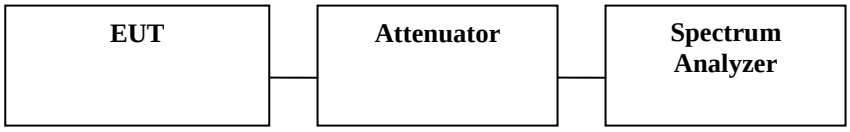
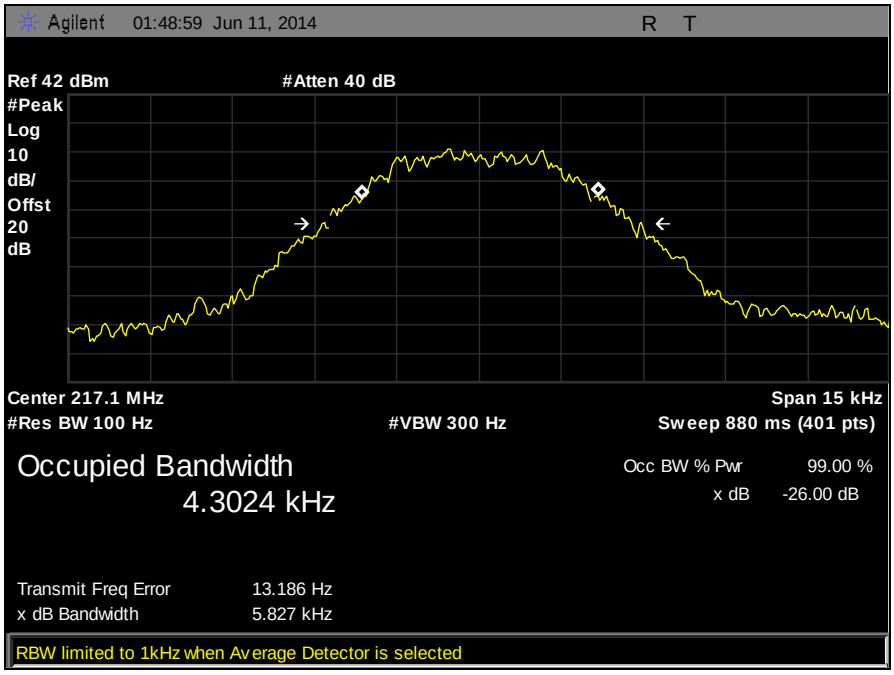


Figure 3. Occupied Bandwidth Test Setup

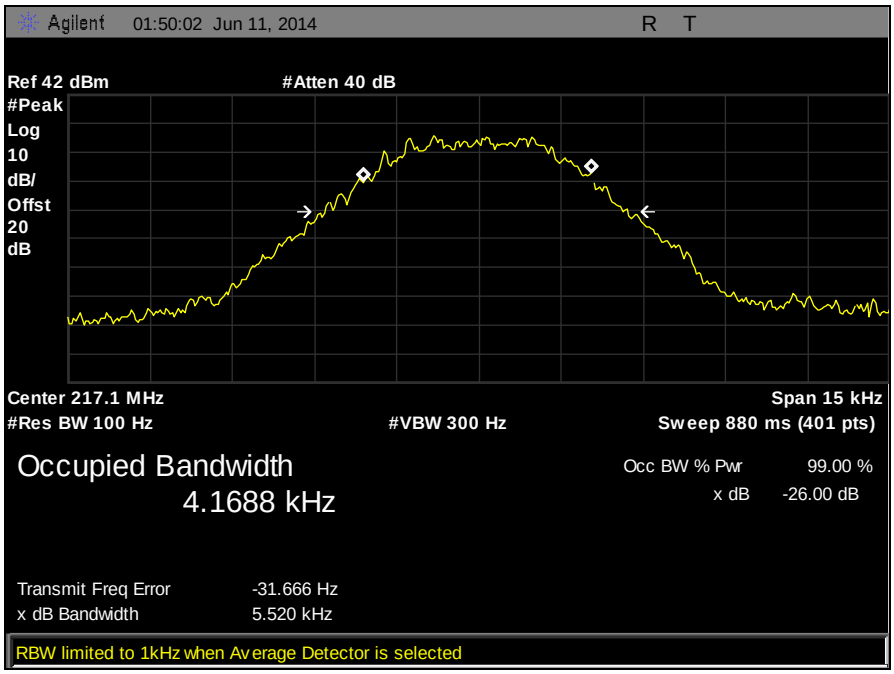
Frequency (MHz)	Bandwidth (kHz)	Power Setting	99% OBW Measurement (kHz)
217	6.25	High	4.1688
217	12.5	High	6.8949
217	25	High	11.8235
217	50	High	28.2054
217	6.25	Low	4.3024
217	12.5	Low	6.83
217	25	Low	11.5527
217	50	Low	28.4247
218	6.25	High	4.2183
218	12.5	High	6.7614
218	25	High	11.6027
218	50	High	27.9039
218	6.25	Low	4.1896
218	12.5	Low	7.0923
218	25	Low	11.5689
218	50	Low	27.6594
219	6.25	High	4.2802
219	12.5	High	6.9921
219	25	High	11.9318
219	50	High	28.2605
219	6.25	Low	4.1573
219	12.5	Low	6.784
219	25	Low	11.8246
219	50	Low	27.8597

Table 11. Occupied Bandwidth, Test Results

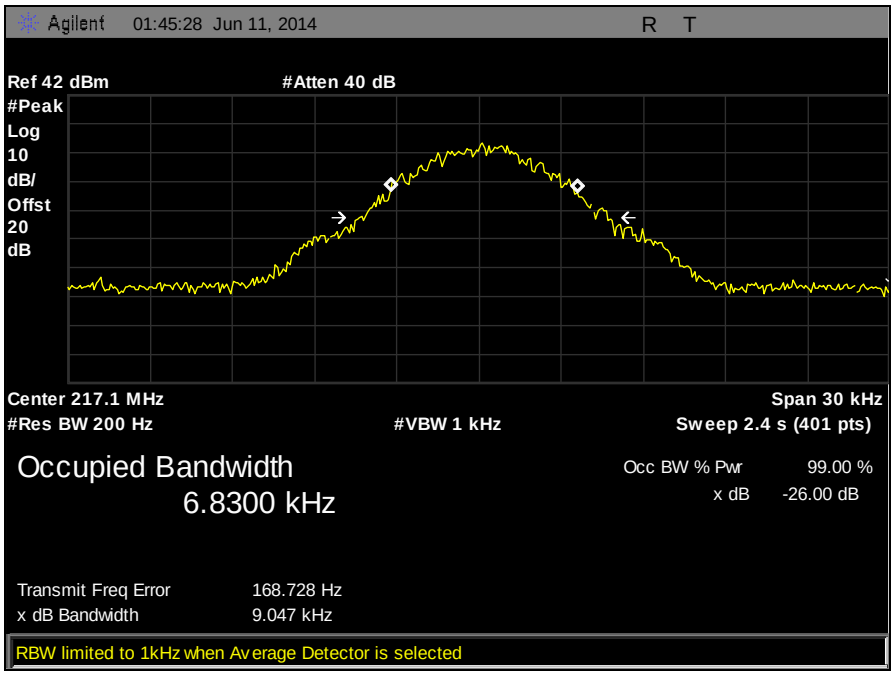
Occupied Bandwidth, 217 MHz



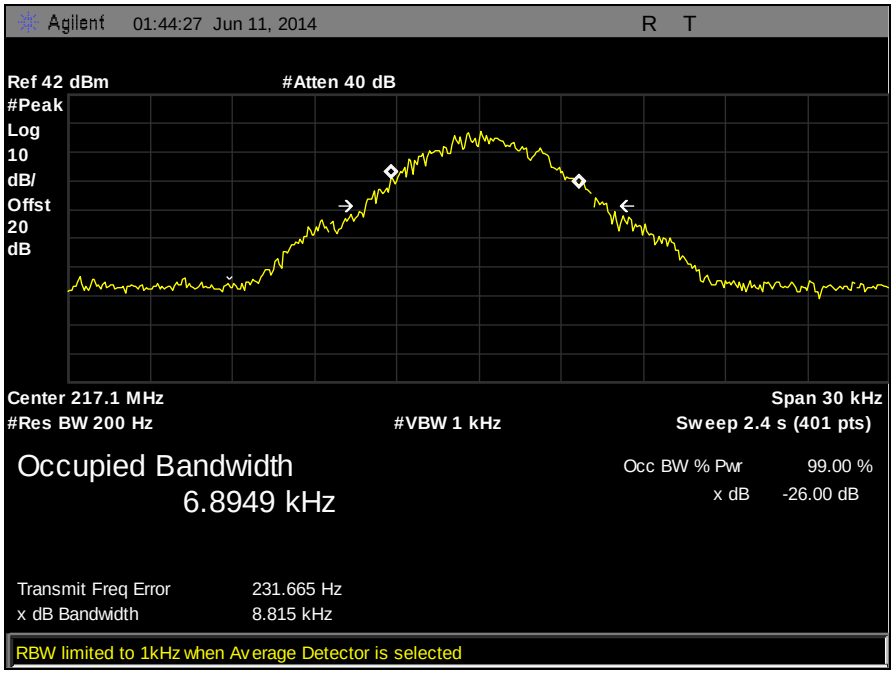
Plot 28. Occupied Bandwidth, Low Power, 217 MHz, 6.25 kHz Bandwidth



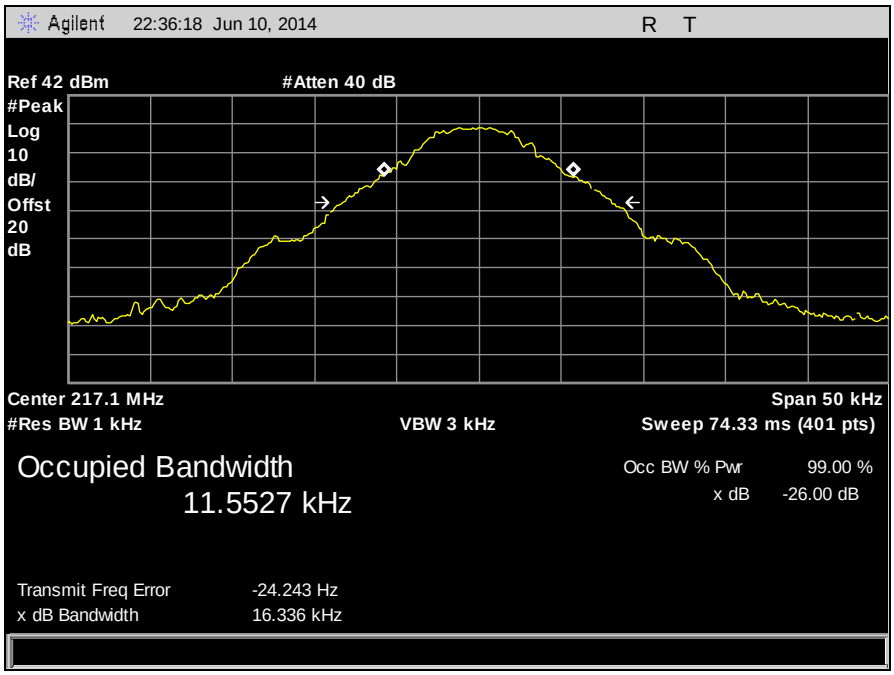
Plot 29. Occupied Bandwidth, High Power, 217 MHz, 6.25 kHz Bandwidth



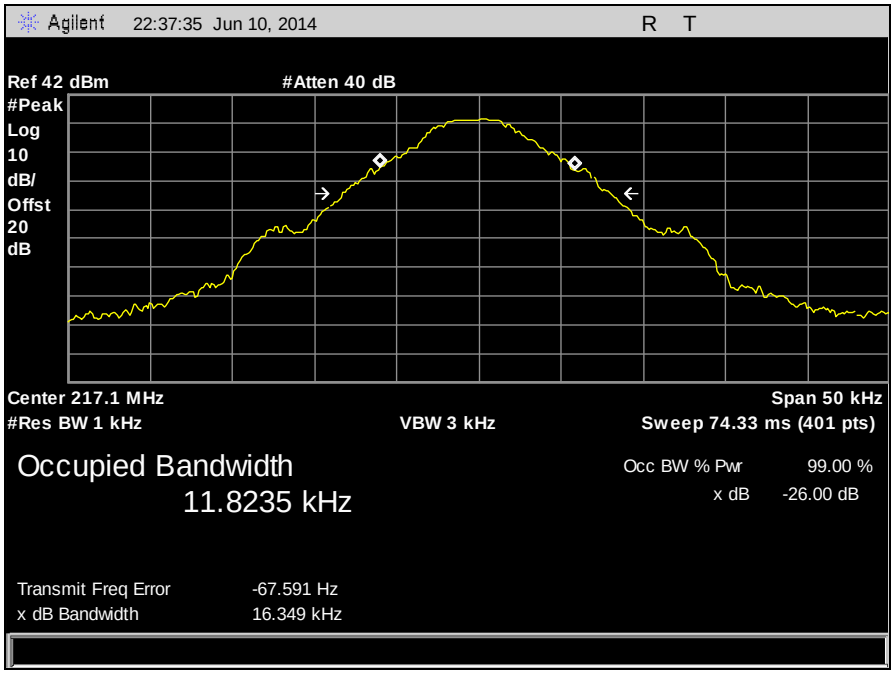
Plot 30. Occupied Bandwidth, Low Power, 217 MHz, 12.5 kHz Bandwidth



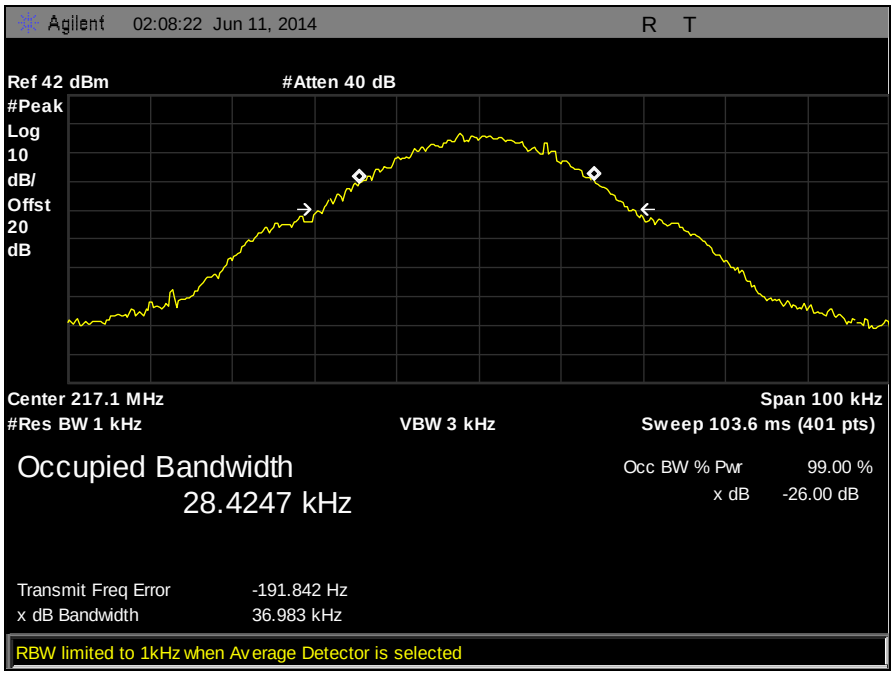
Plot 31. Occupied Bandwidth, High Power, 217 MHz, 12.5 kHz Bandwidth



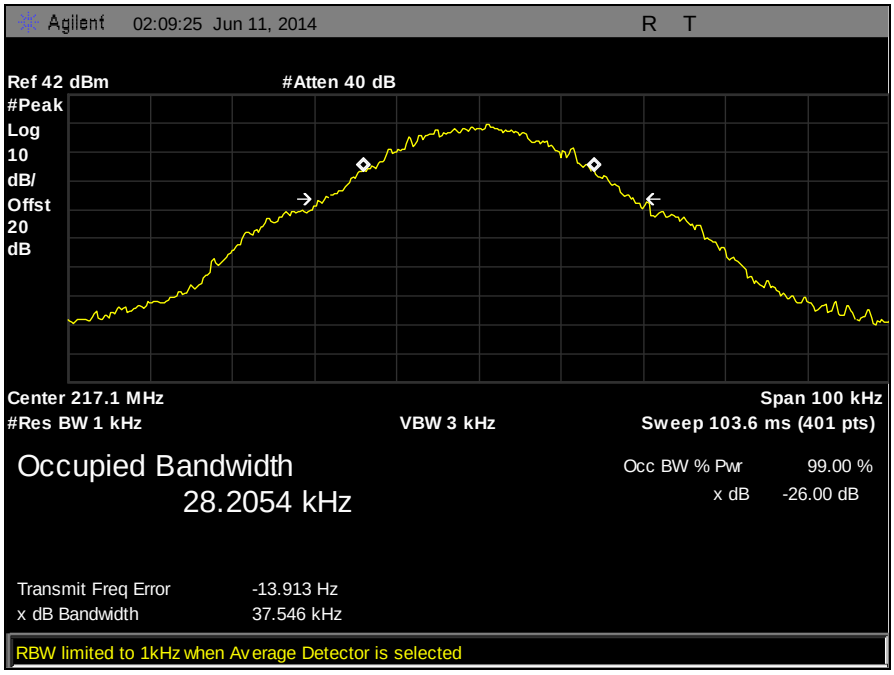
Plot 32. Occupied Bandwidth, Low Power, 217 MHz, 25 kHz Bandwidth



Plot 33. Occupied Bandwidth, High Power, 217 MHz, 25 kHz Bandwidth

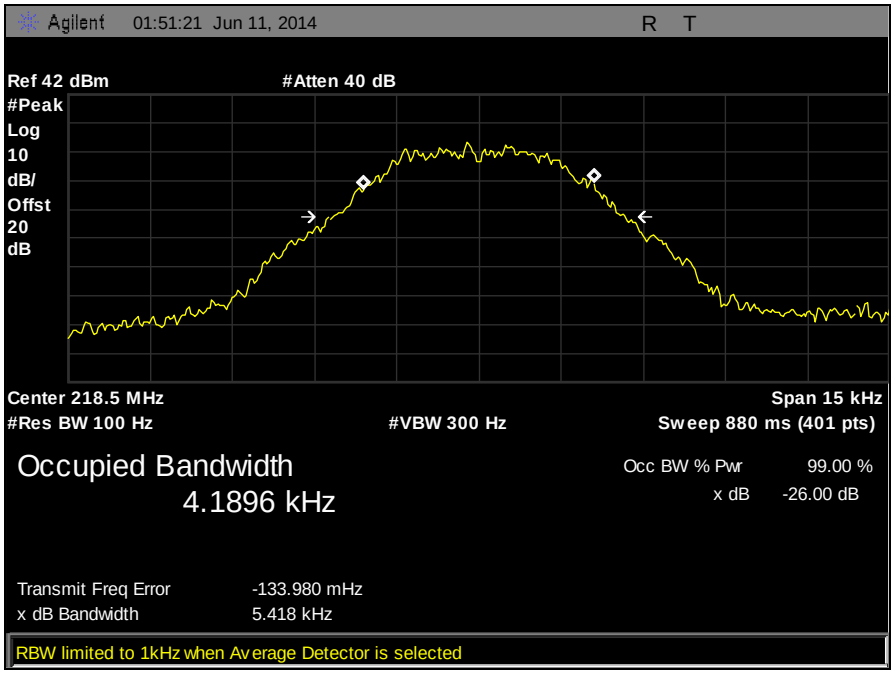


Plot 34. Occupied Bandwidth, Low Power, 217 MHz, 50 kHz Bandwidth

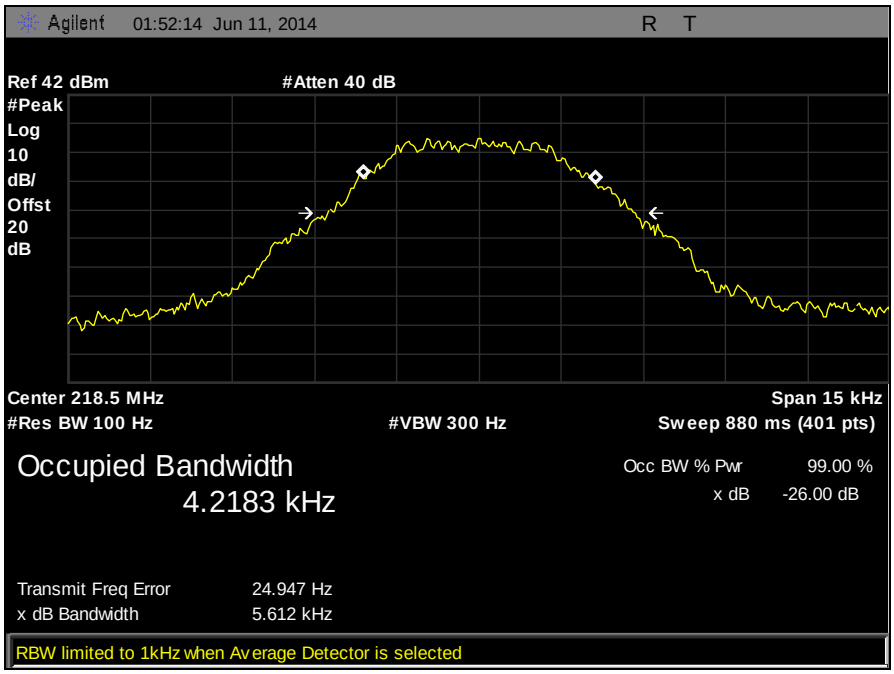


Plot 35. Occupied Bandwidth, High Power, 217 MHz, 50 kHz Bandwidth

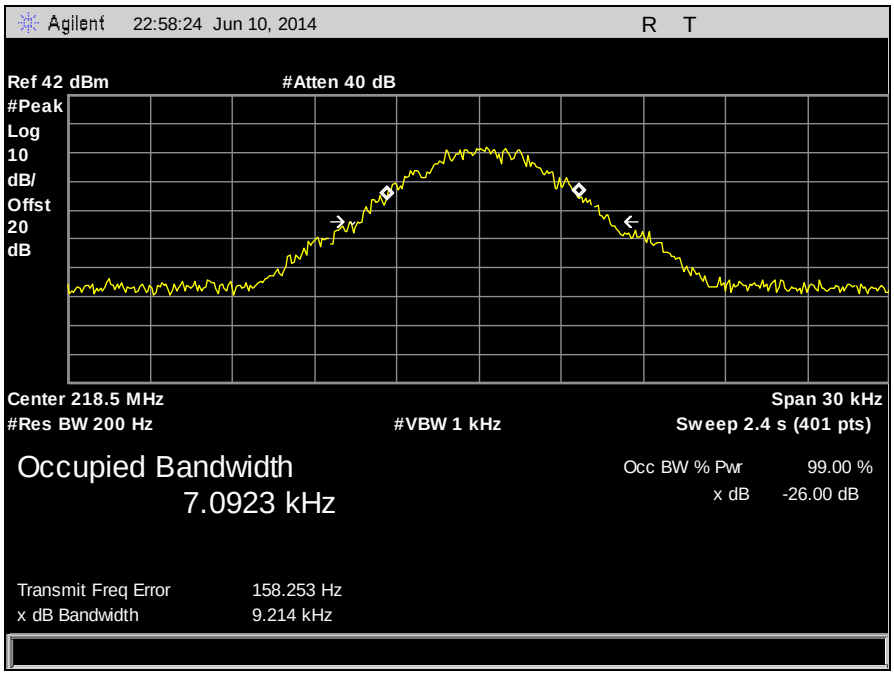
Occupied Bandwidth, 218 MHz



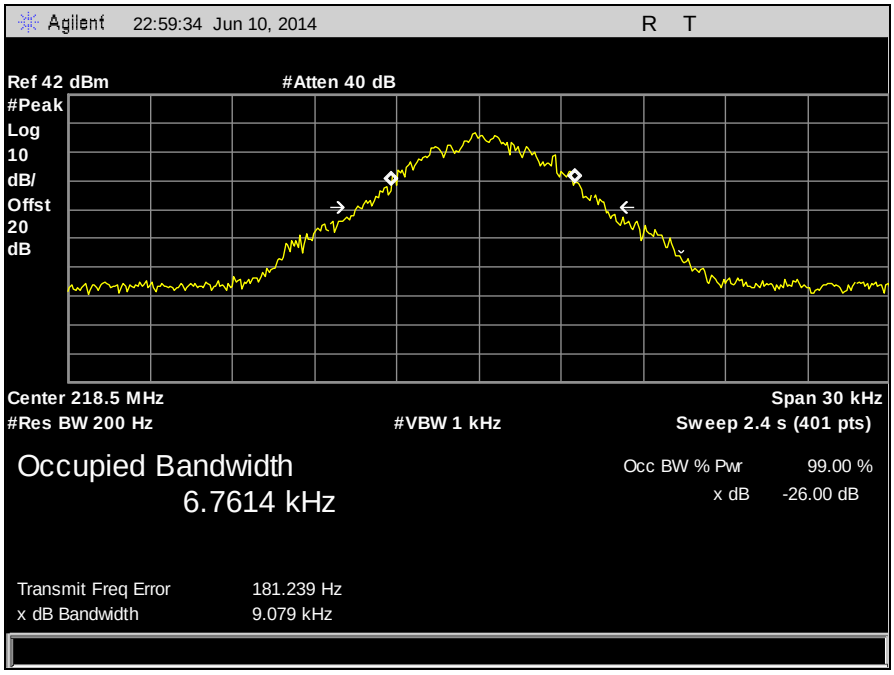
Plot 36. Occupied Bandwidth, Low Power, 218 MHz, 6.25 kHz Bandwidth



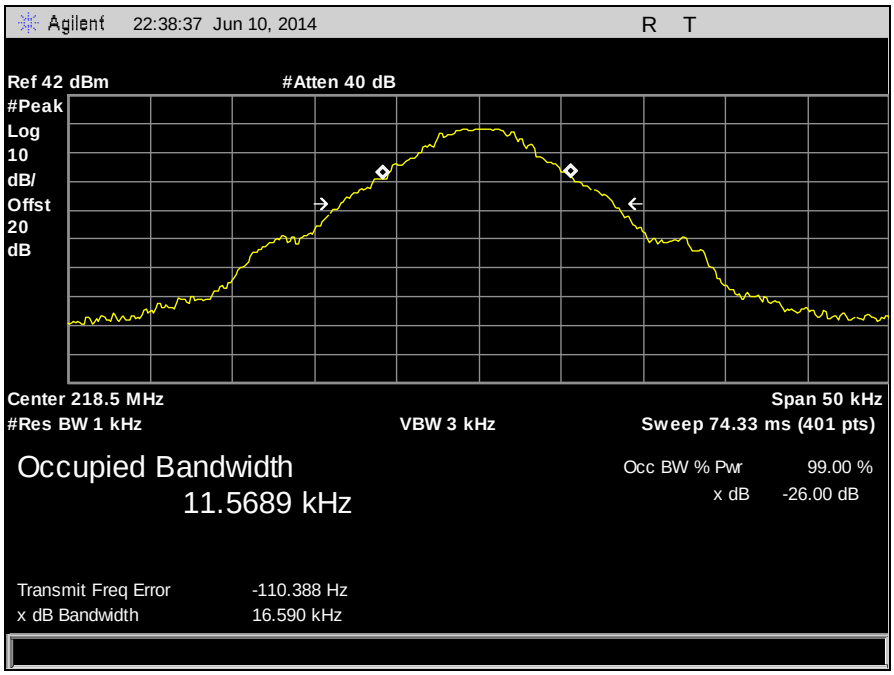
Plot 37. Occupied Bandwidth, High Power, 218 MHz, 6.25 kHz Bandwidth



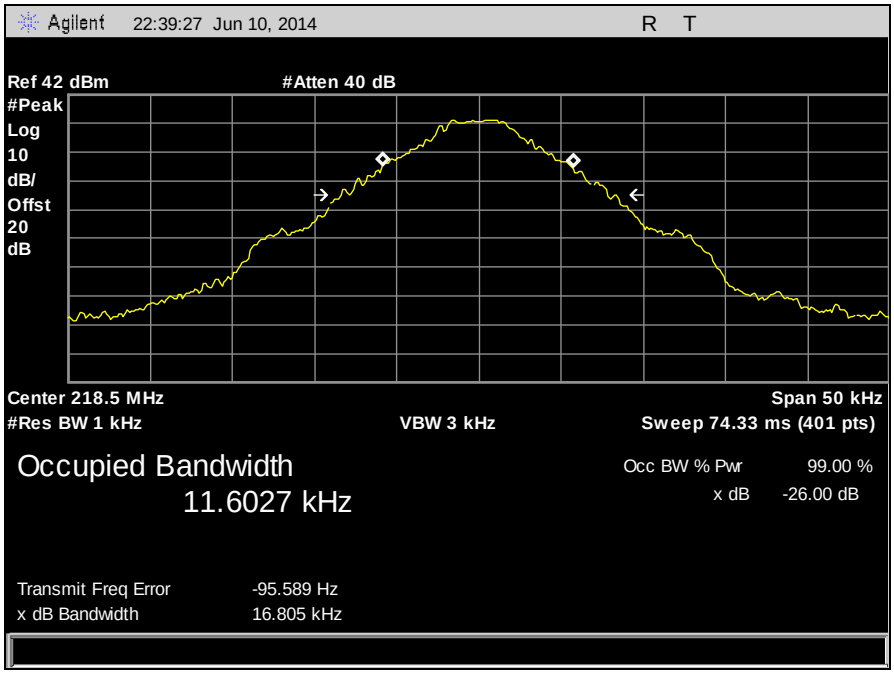
Plot 38. Occupied Bandwidth, Low Power, 218 MHz, 12.5 kHz Bandwidth



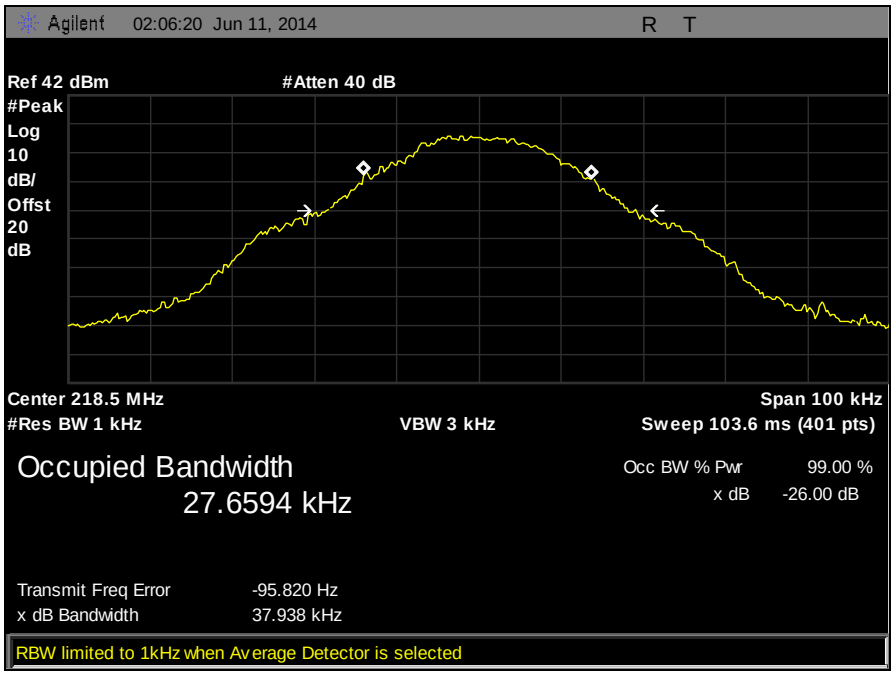
Plot 39. Occupied Bandwidth, High Power, 218 MHz, 12.5 kHz Bandwidth



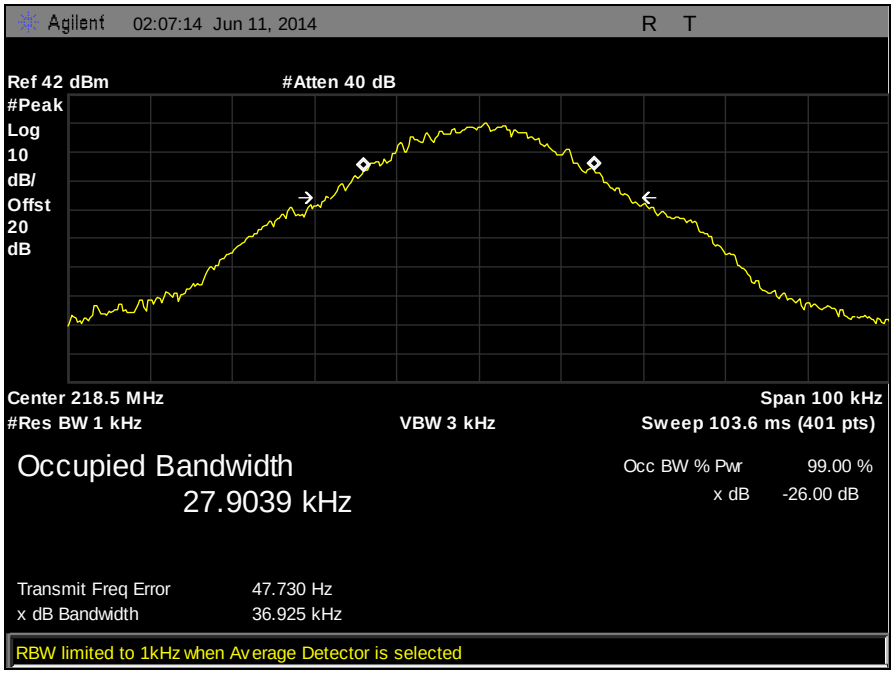
Plot 40. Occupied Bandwidth, Low Power, 218 MHz, 25 kHz Bandwidth



Plot 41. Occupied Bandwidth, High Power, 218 MHz, 25 kHz Bandwidth

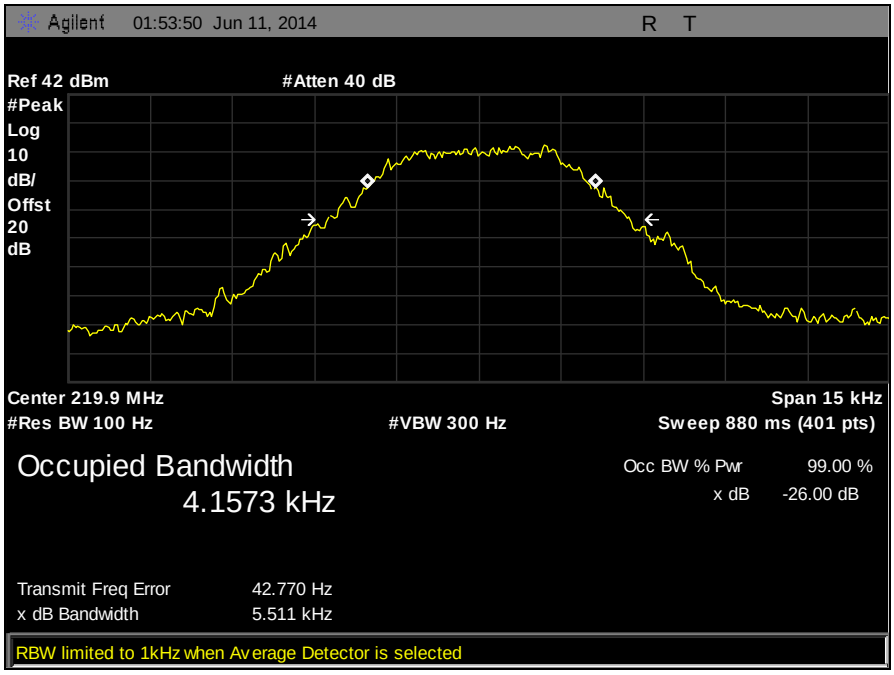


Plot 42. Occupied Bandwidth, Low Power, 218 MHz, 50 kHz Bandwidth

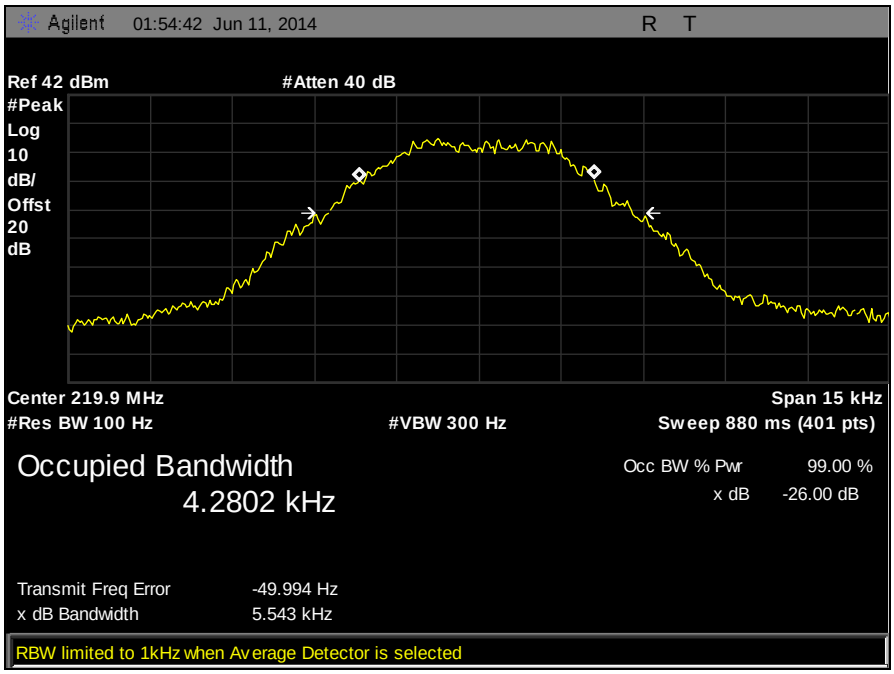


Plot 43. Occupied Bandwidth, High Power, 218 MHz, 50 kHz Bandwidth

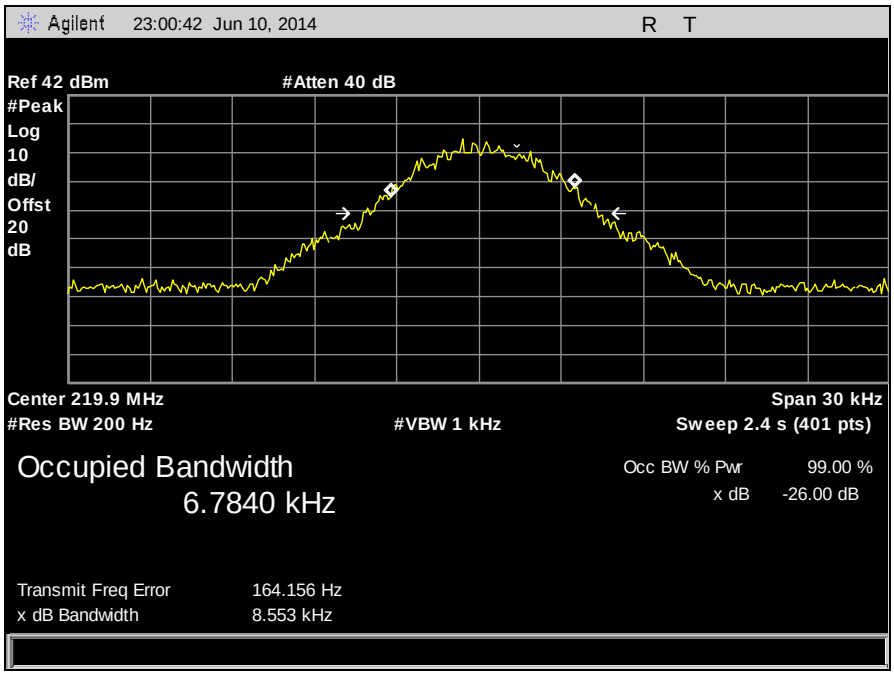
Occupied Bandwidth, 219 MHz



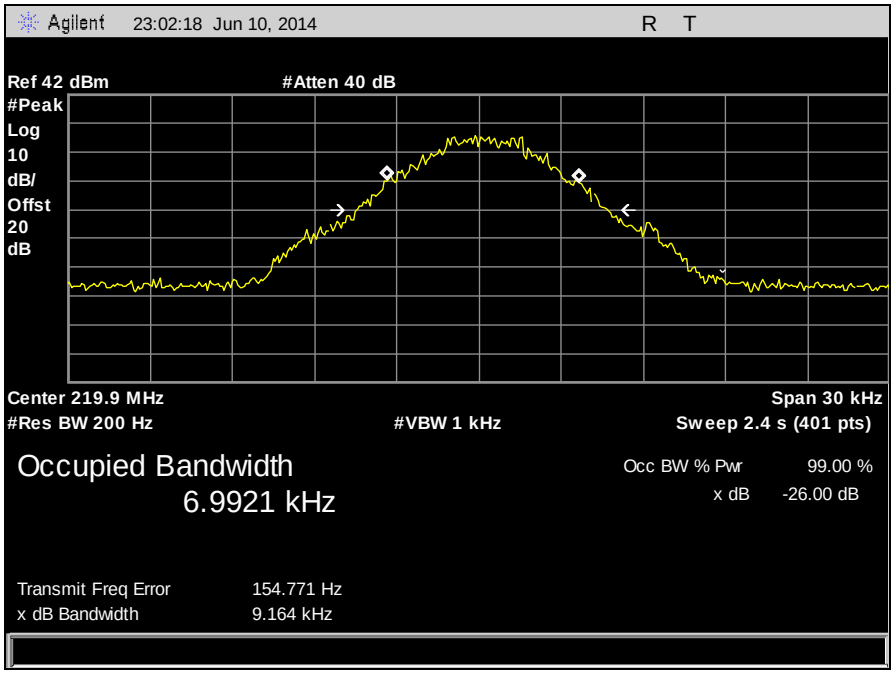
Plot 44. Occupied Bandwidth, Low Power, 219 MHz, 6.25 kHz Bandwidth



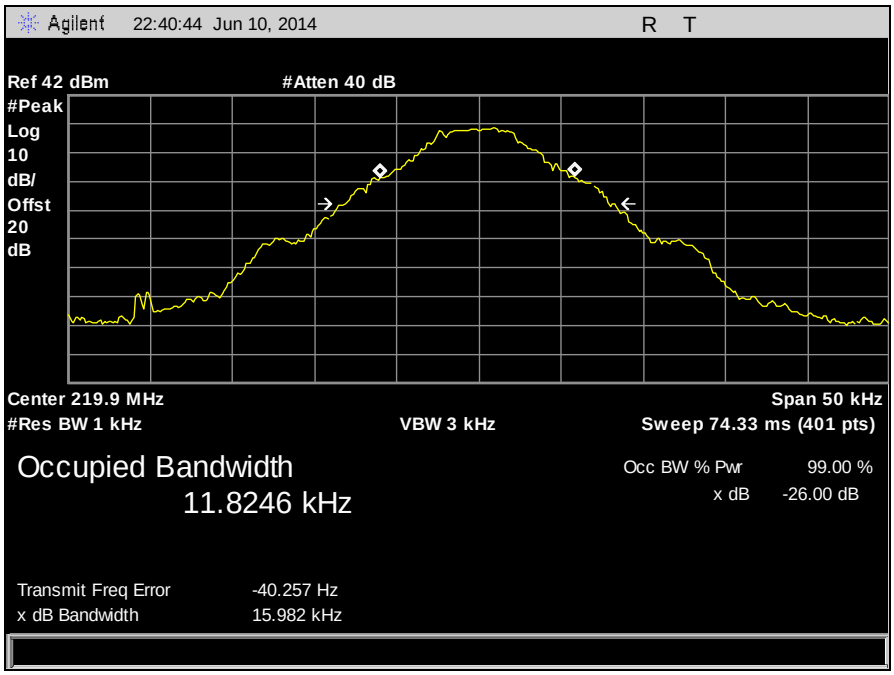
Plot 45. Occupied Bandwidth, High Power, 219 MHz, 6.25 kHz Bandwidth



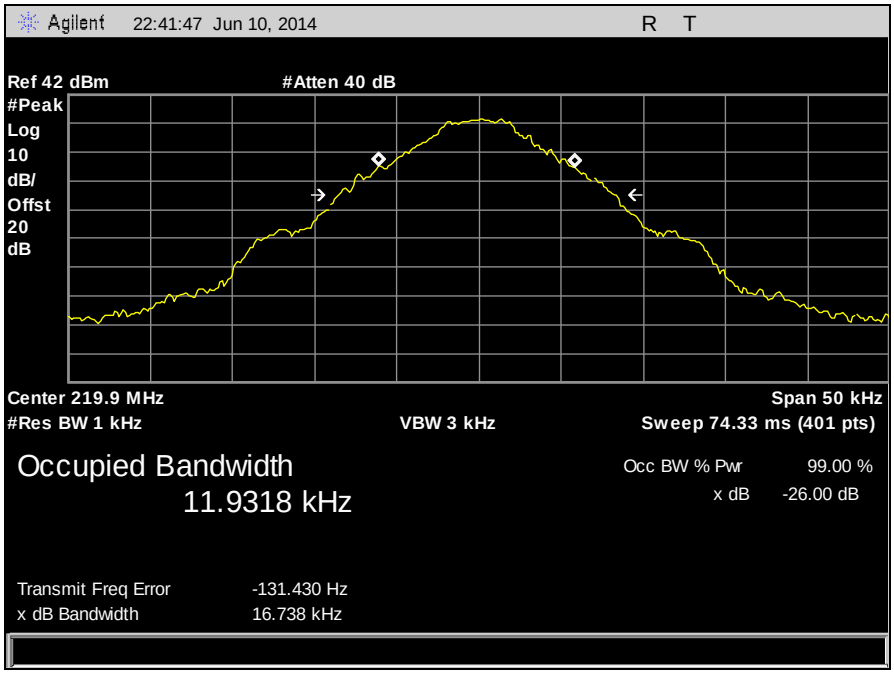
Plot 46. Occupied Bandwidth, Low Power, 219 MHz, 12.5 kHz Bandwidth



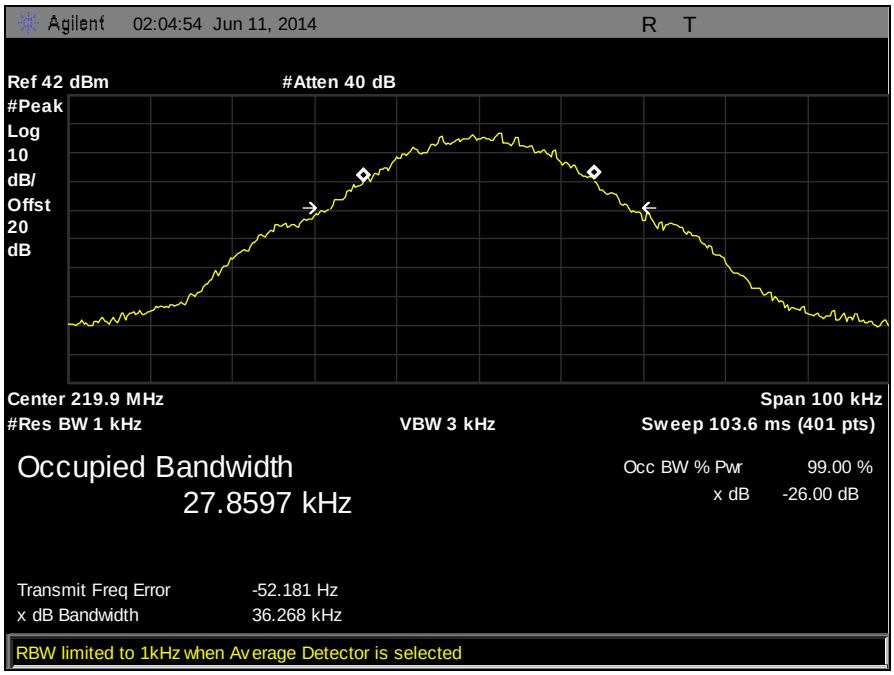
Plot 47. Occupied Bandwidth, High Power, 219 MHz, 12.5 kHz Bandwidth



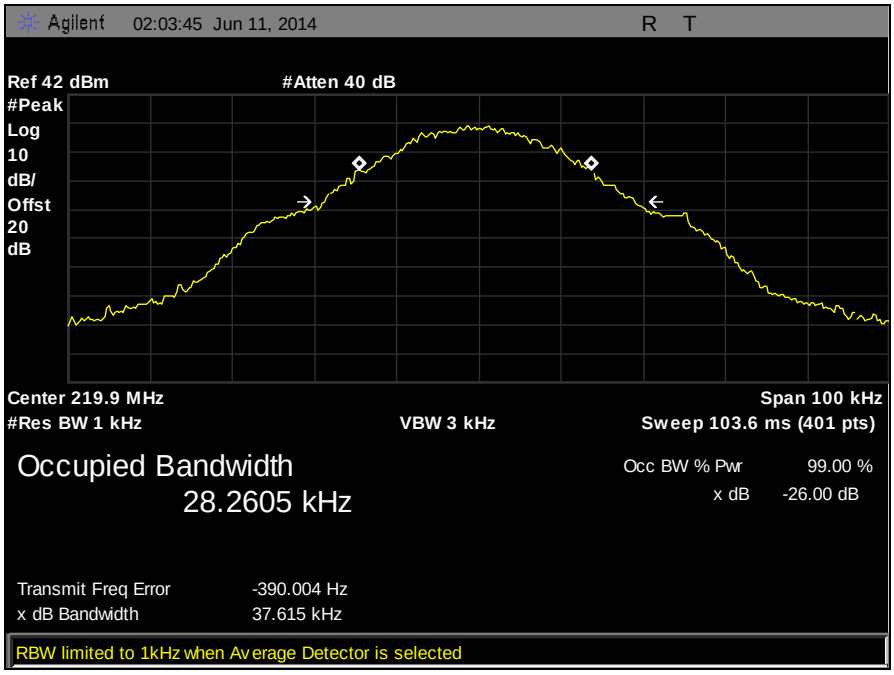
Plot 48. Occupied Bandwidth, Low Power, 219 MHz, 25 kHz Bandwidth



Plot 49. Occupied Bandwidth, High Power, 219 MHz, 25 kHz Bandwidth



Plot 50. Occupied Bandwidth, Low Power, 219 MHz, 50 kHz Bandwidth



Plot 51. Occupied Bandwidth, High Power, 219 MHz, 50 kHz Bandwidth

4.3. Emission Mask

Test Requirement(s): **§90.210 with FCC 04-265 (Emissions Mask C)**

(c) *Emission Mask C.* For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5 kHz, but not more than 10 kHz: At least 83 log (f_d/5) dB;

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least 29 log (f_d^2/11) dB or 50 dB, whichever is the lesser attenuation;

(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

Test Procedures: A laptop was connected to the EUT to control the RF output frequency channel. The EUT was connected to a spectrum analyzer. The measured power was set relative to zero dB reference. The RBW of the spectrum analyzer was set to at least 1% of the channel bandwidth. For 50 kHz bandwidth signal the OOBE at the outer most edges of contiguous channels were verified per FCC direction (FCC tracking number 623172).

Test Results: Equipment complies with Section §90.210 with FCC 04-265.

The following pages show measurements of Emission Mask plots:

Test Engineer(s): Jason Allnutt

Test Date(s): 07/08/14

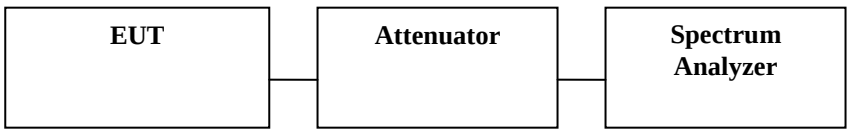
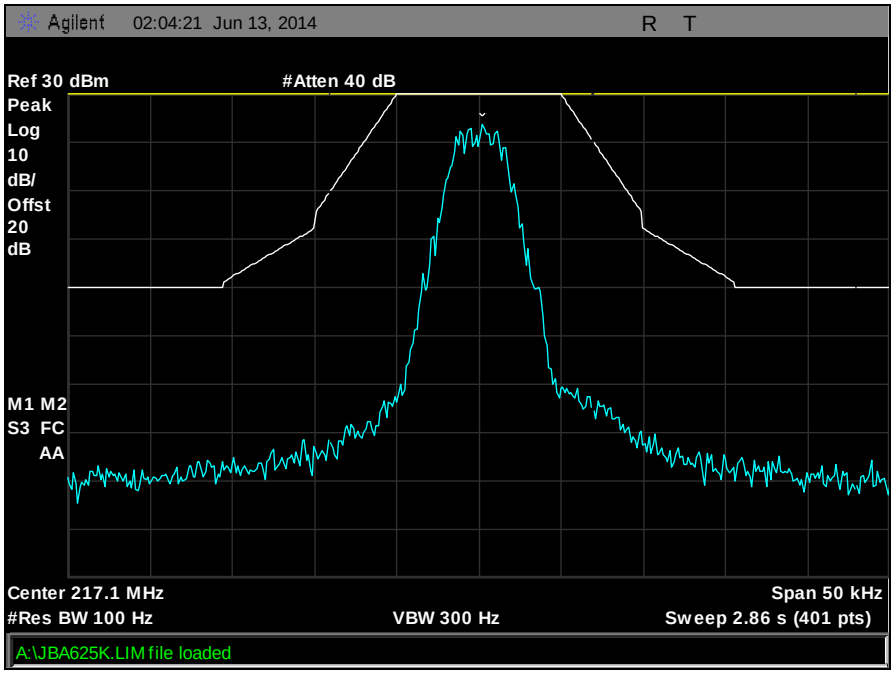


Figure 4. Emission Mask Test Setup

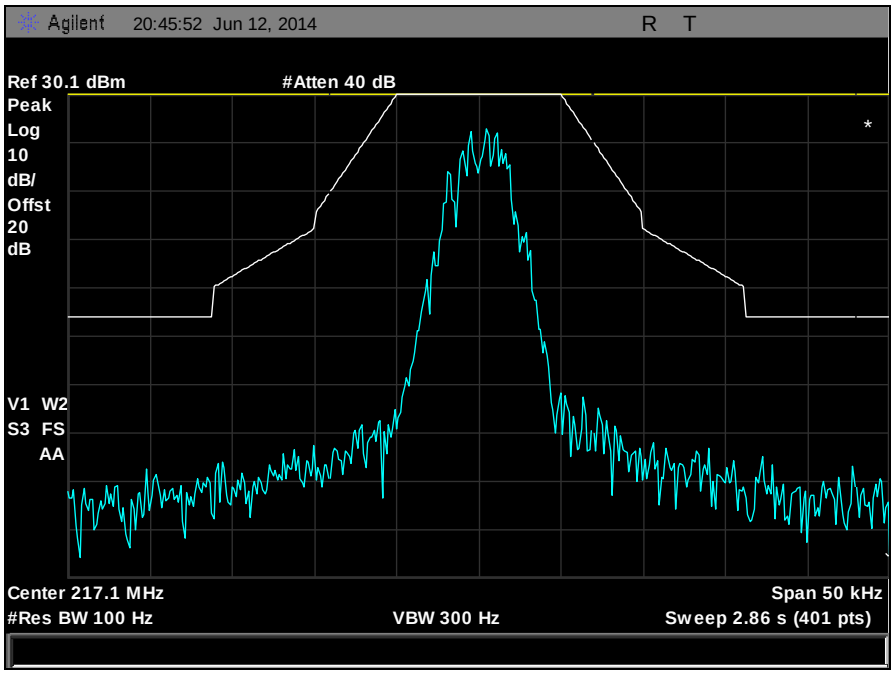
Frequency (MHz)	Bandwidth (kHz)	Power Setting	Does Emission fit Under the Mask (Yes/No)
217	6.25	High	Yes
217	12.5	High	Yes
217	25	High	Yes
217	50	High	Yes
217	6.25	Low	Yes
217	12.5	Low	Yes
217	25	Low	Yes
217	50	Low	Yes
218	6.25	High	Yes
218	12.5	High	Yes
218	25	High	Yes
218	50	High	Yes
218	6.25	Low	Yes
218	12.5	Low	Yes
218	25	Low	Yes
218	50	Low	Yes
219	6.25	High	Yes
219	12.5	High	Yes
219	25	High	Yes
219	50	High	Yes
219	6.25	Low	Yes
219	12.5	Low	Yes
219	25	Low	Yes
219	50	Low	Yes

Table 12. Emissions Mask, Test Results

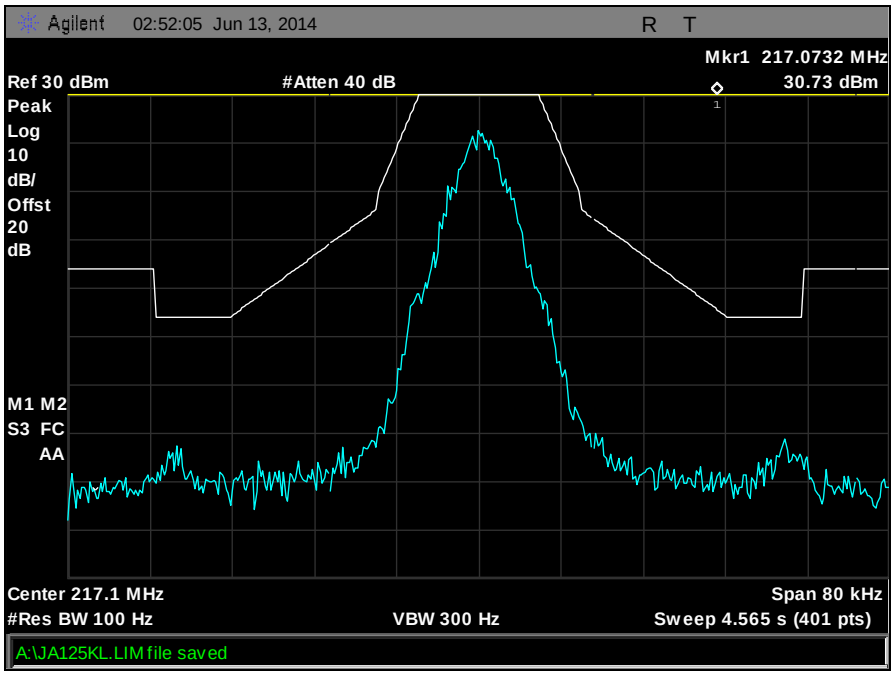
Emission Mask, 217 MHz



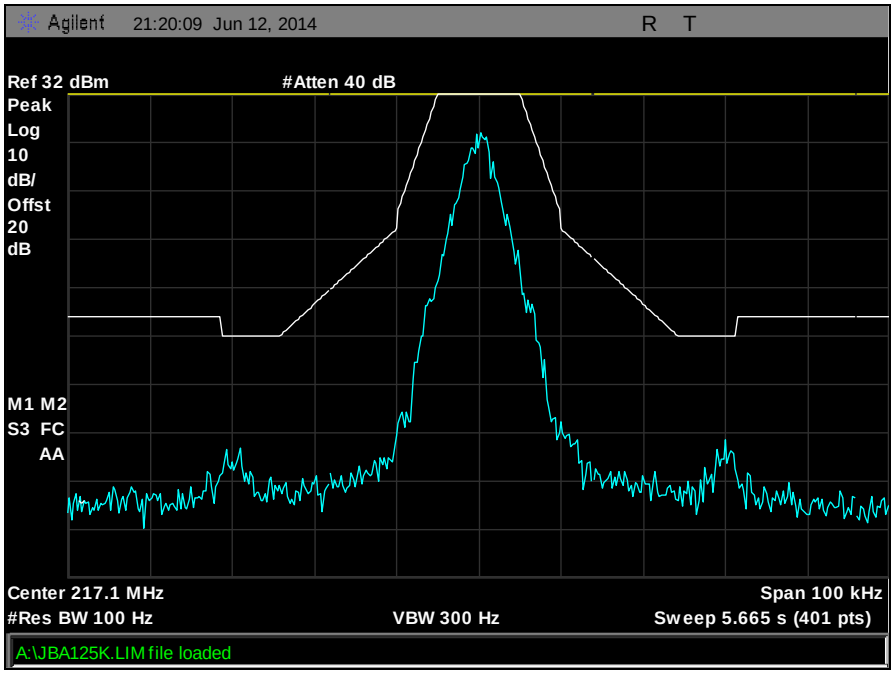
Plot 52. Emission Mask, Low Power, 217 MHz, 6.25 kHz Bandwidth



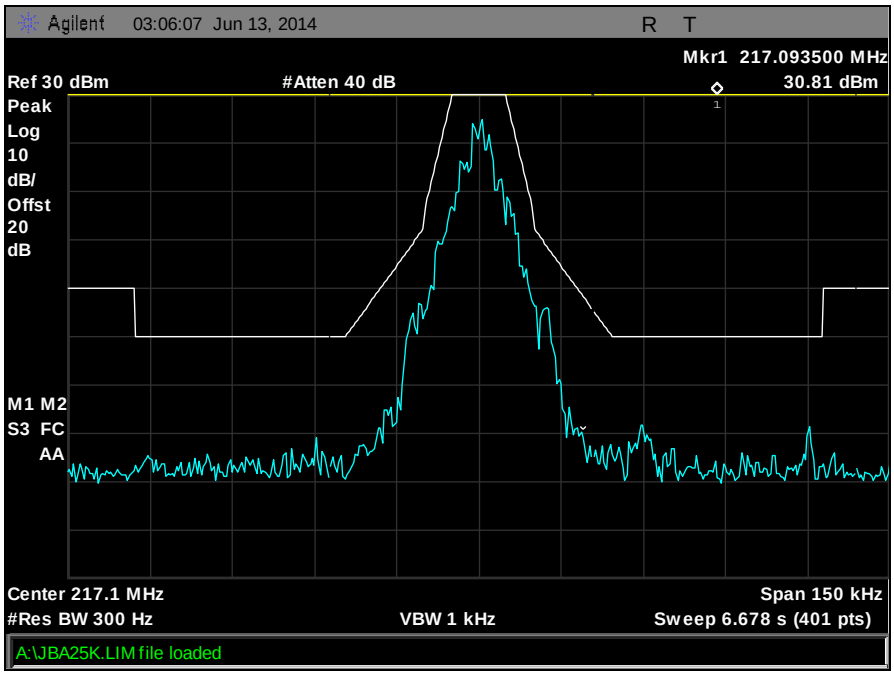
Plot 53. Emission Mask, High Power, 217 MHz, 6.25 kHz Bandwidth



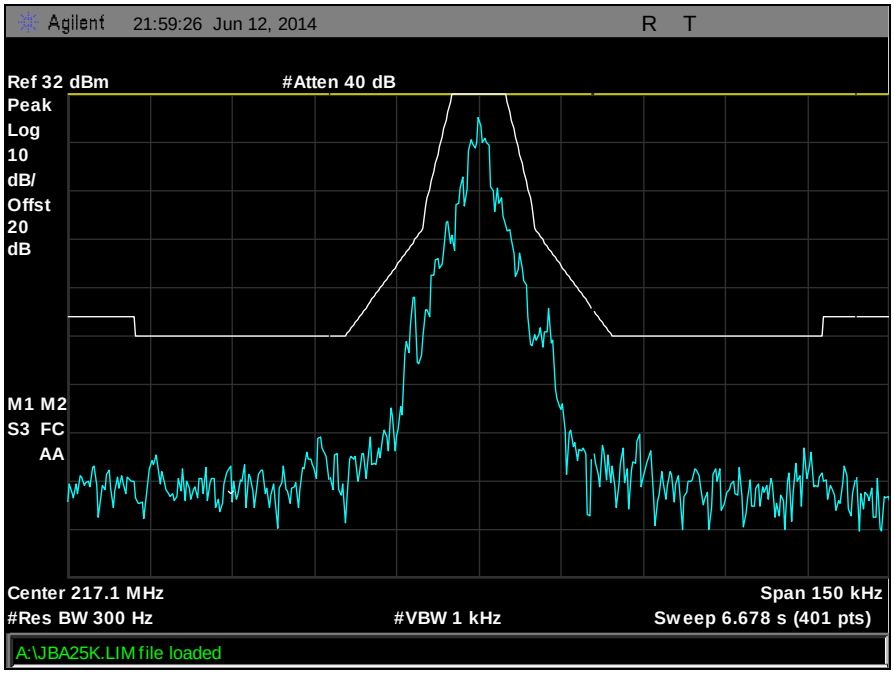
Plot 54. Emission Mask, Low Power, 217 MHz, 12.5 kHz Bandwidth



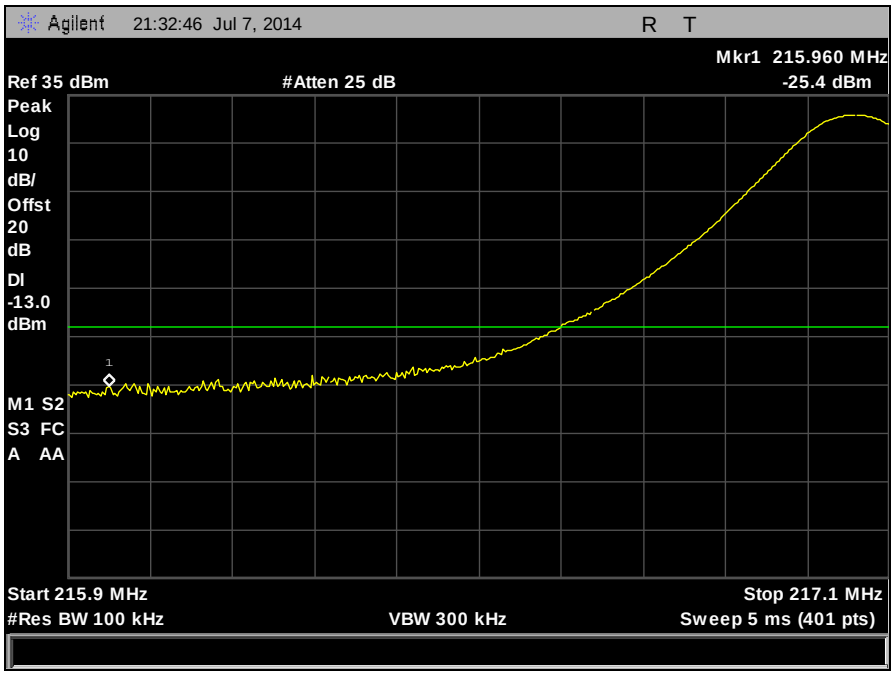
Plot 55. Emission Mask, High Power, 217 MHz, 12.5 kHz Bandwidth



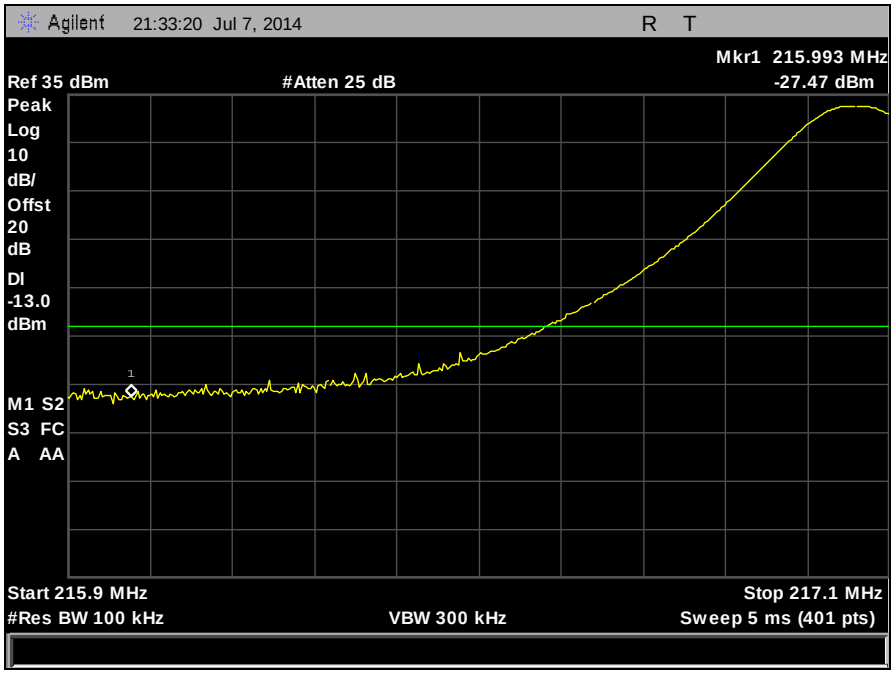
Plot 56. Emission Mask, Low Power, 217 MHz, 25 kHz Bandwidth



Plot 57. Emission Mask, High Power, 217 MHz, 25 kHz Bandwidth

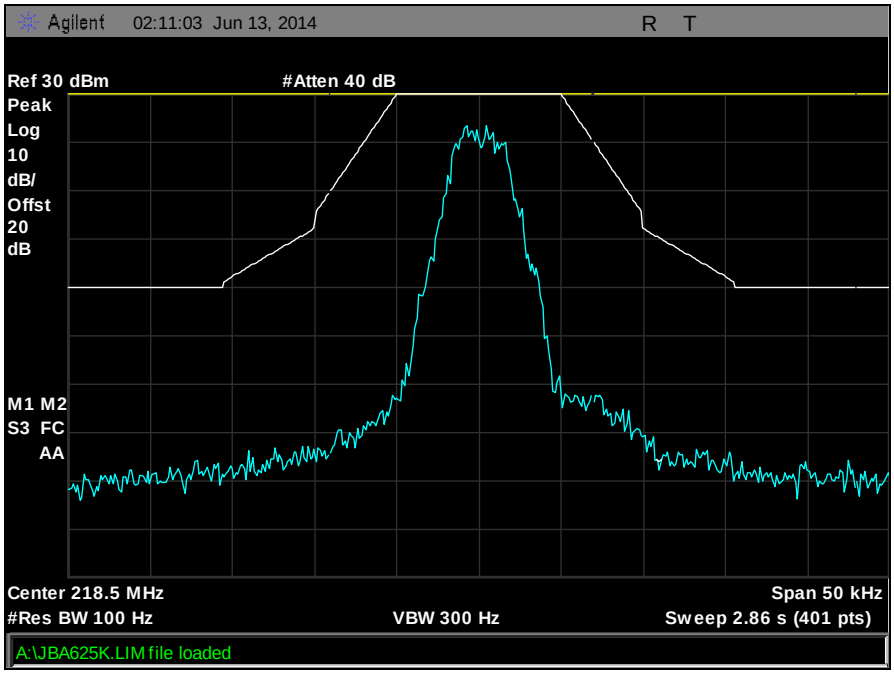


Plot 58. Emission Mask, Low Power, 217 MHz, 50 kHz Bandwidth

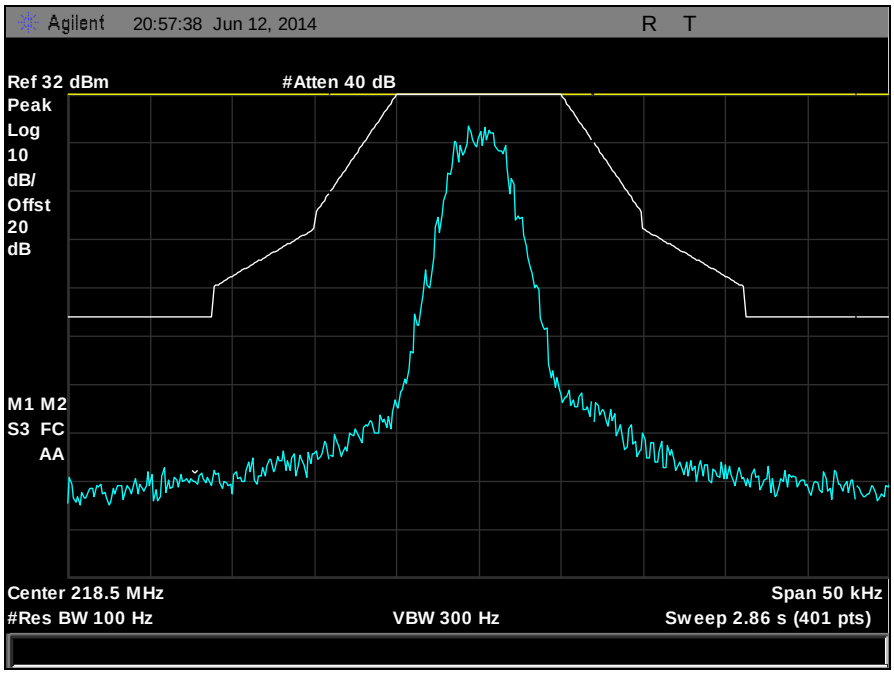


Plot 59. Emission Mask, High Power, 217 MHz, 50 kHz Bandwidth

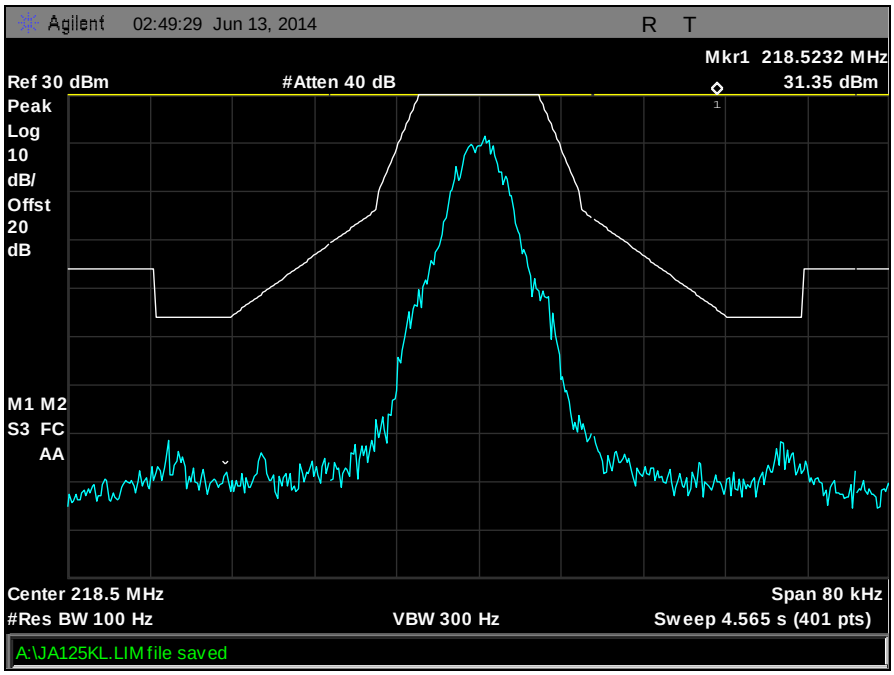
Emission Mask, 218 MHz



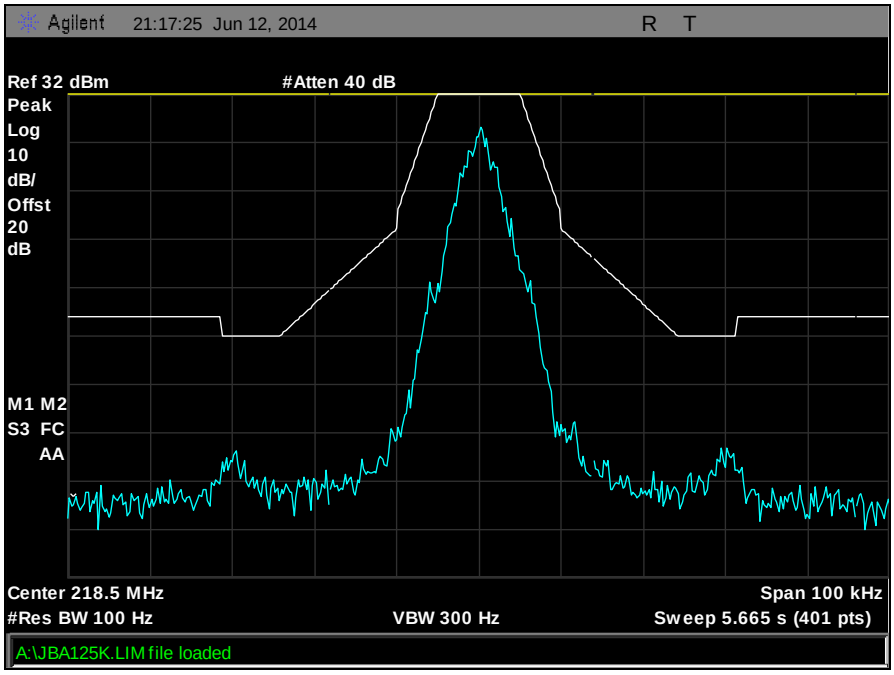
Plot 60. Emission Mask, Low Power, 218 MHz, 6.25 kHz Bandwidth



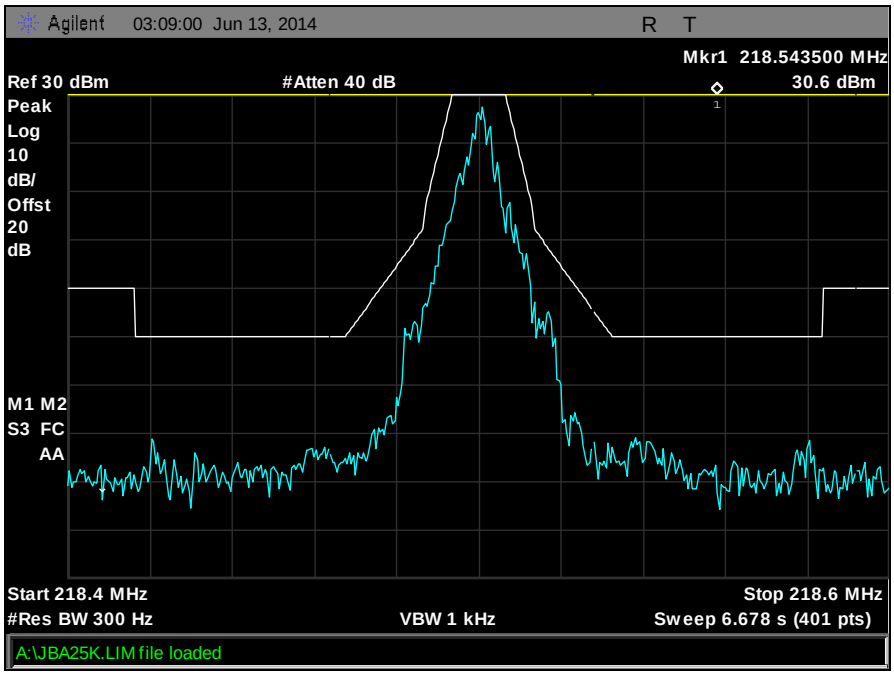
Plot 61. Emission Mask, High Power, 218 MHz, 6.25 kHz Bandwidth



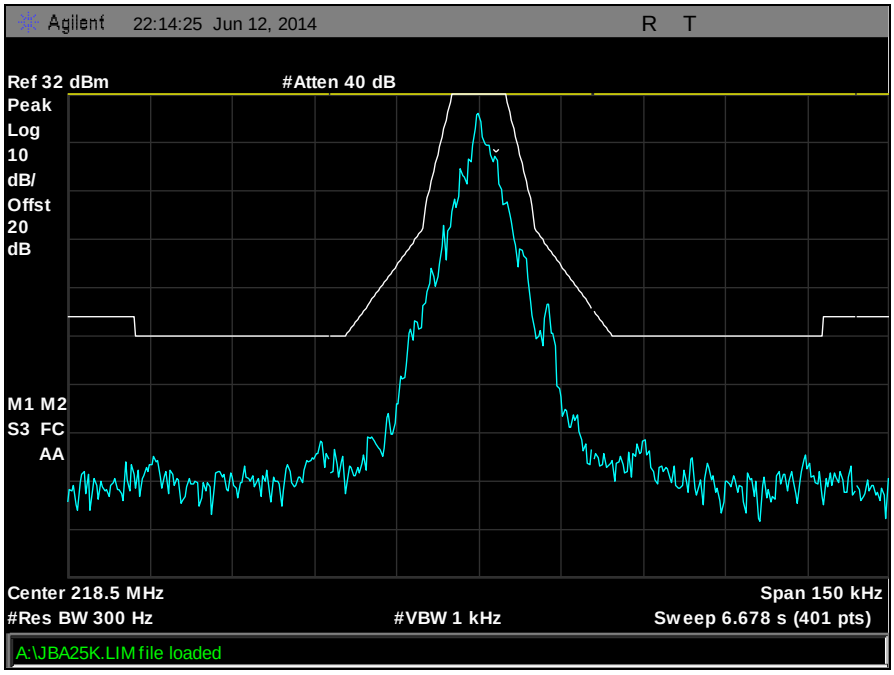
Plot 62. Emission Mask, Low Power, 218 MHz, 12.5 kHz Bandwidth



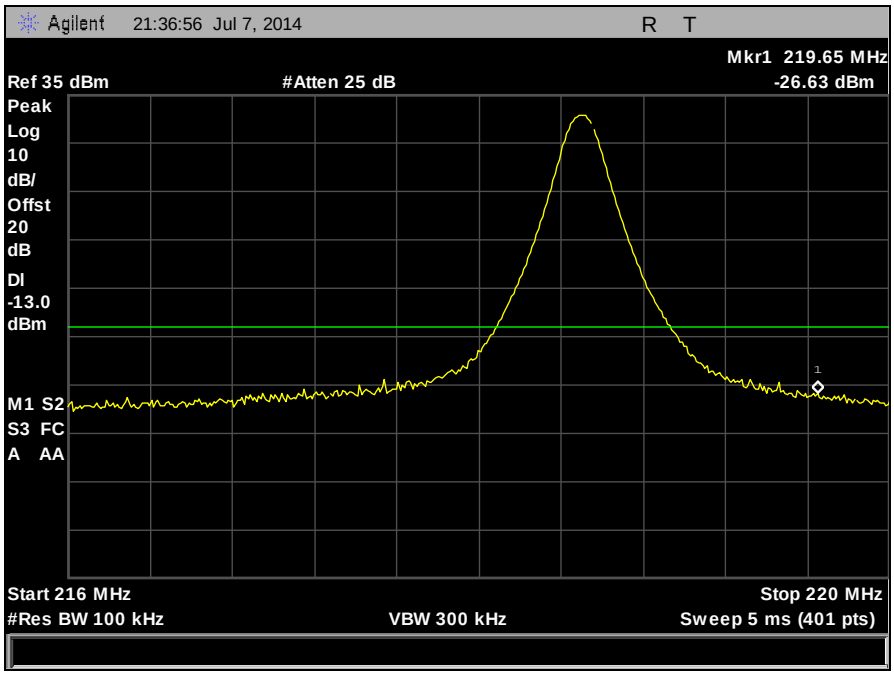
Plot 63. Emission Mask, High Power, 218 MHz, 12.5 kHz Bandwidth



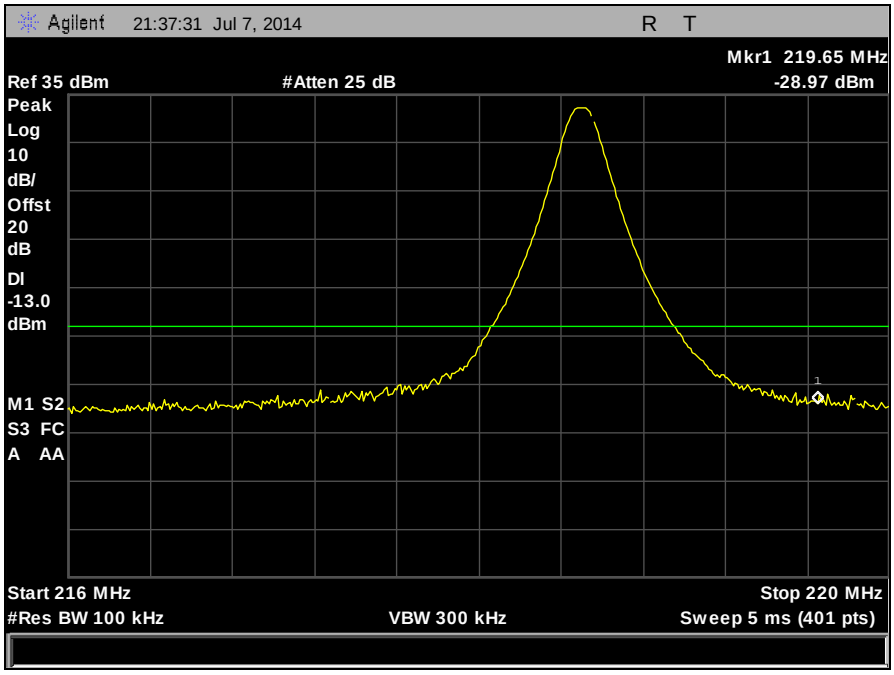
Plot 64. Emission Mask, Low Power, 218 MHz, 25 kHz Bandwidth



Plot 65. Emission Mask, High Power, 218 MHz, 25 kHz Bandwidth

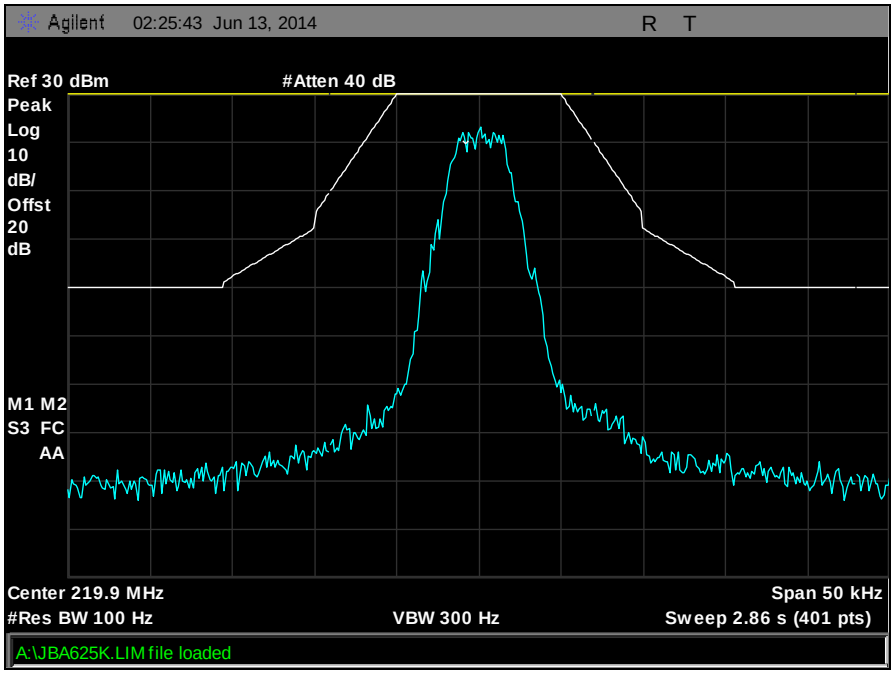


Plot 66. Emission Mask, Low Power, 218 MHz, 50 kHz Bandwidth

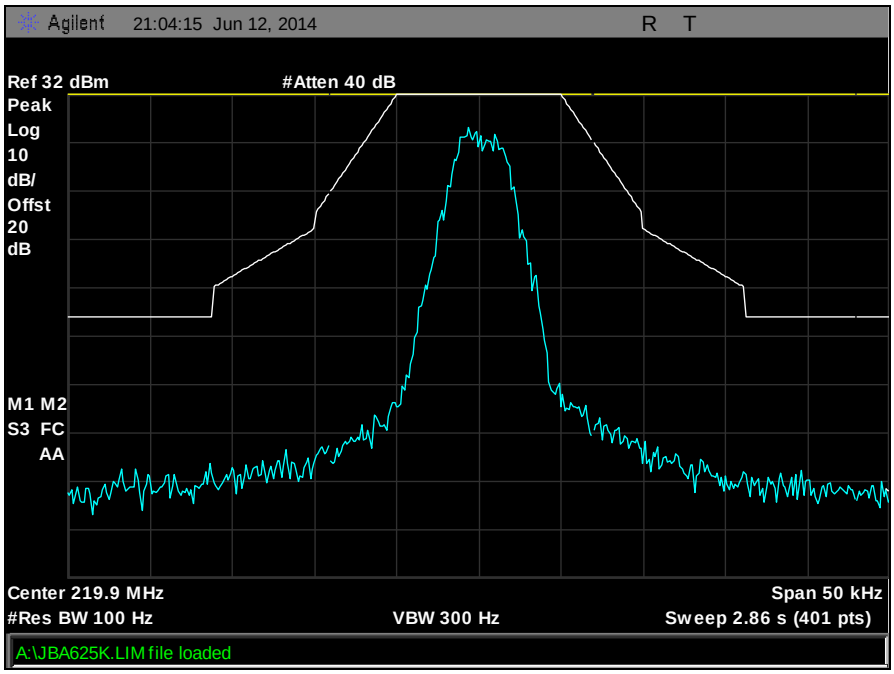


Plot 67. Emission Mask, High Power, 218 MHz, 50 kHz Bandwidth

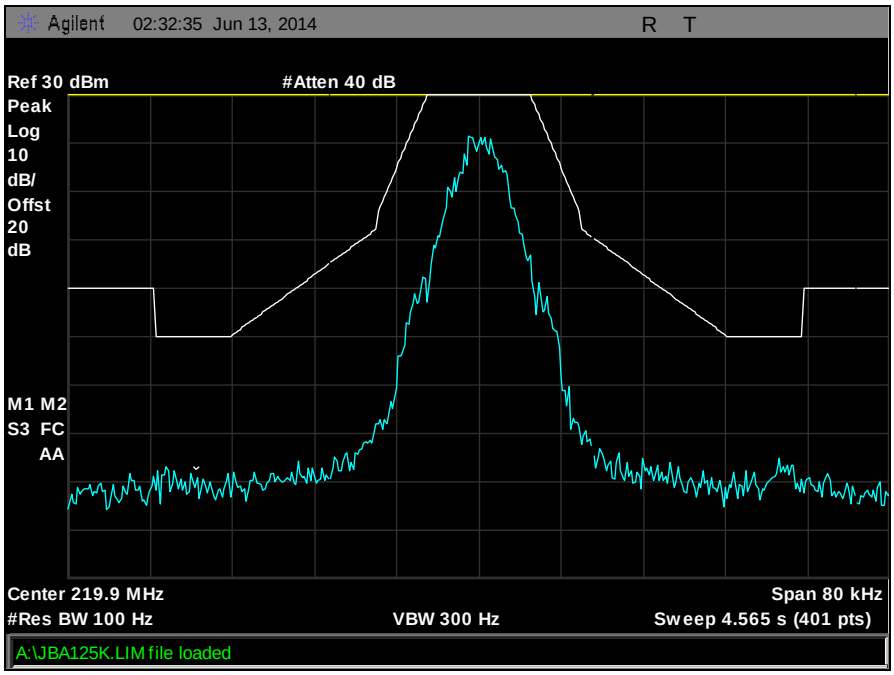
Emission Mask, 219 MHz



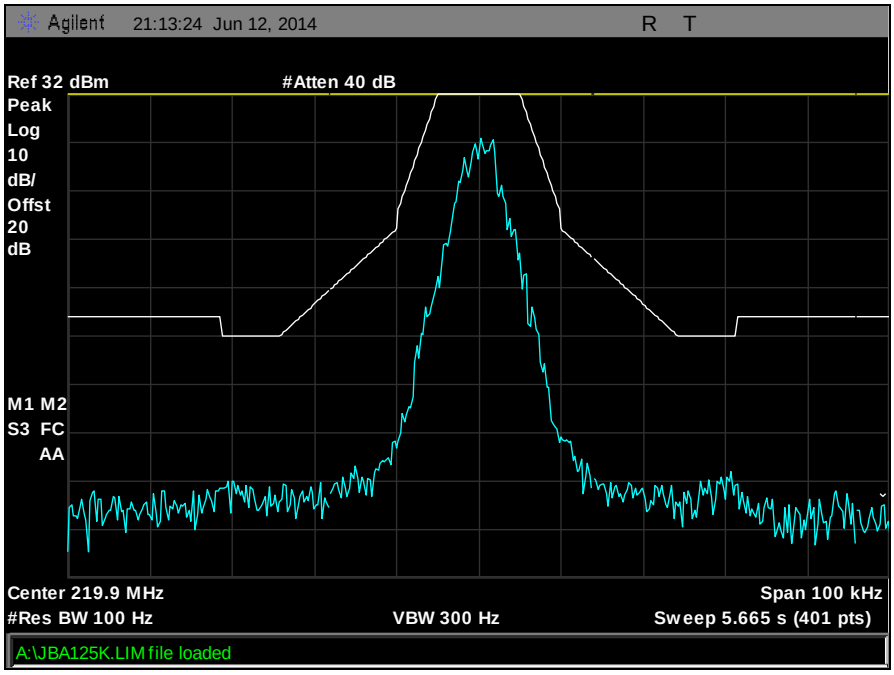
Plot 68. Emission Mask, Low Power, 219 MHz, 6.25 kHz Bandwidth



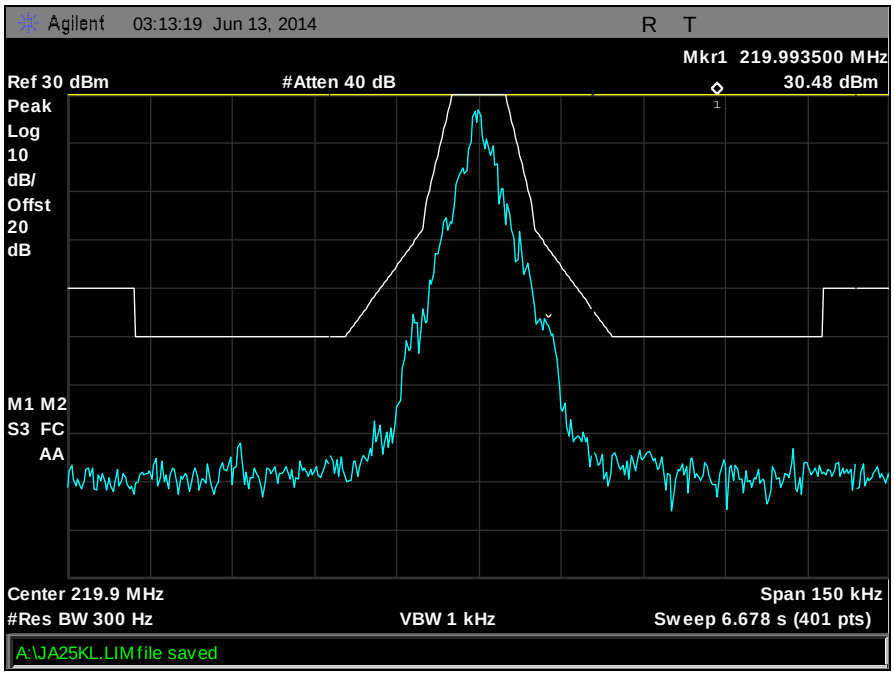
Plot 69. Emission Mask, High Power, 219 MHz, 6.25 kHz Bandwidth



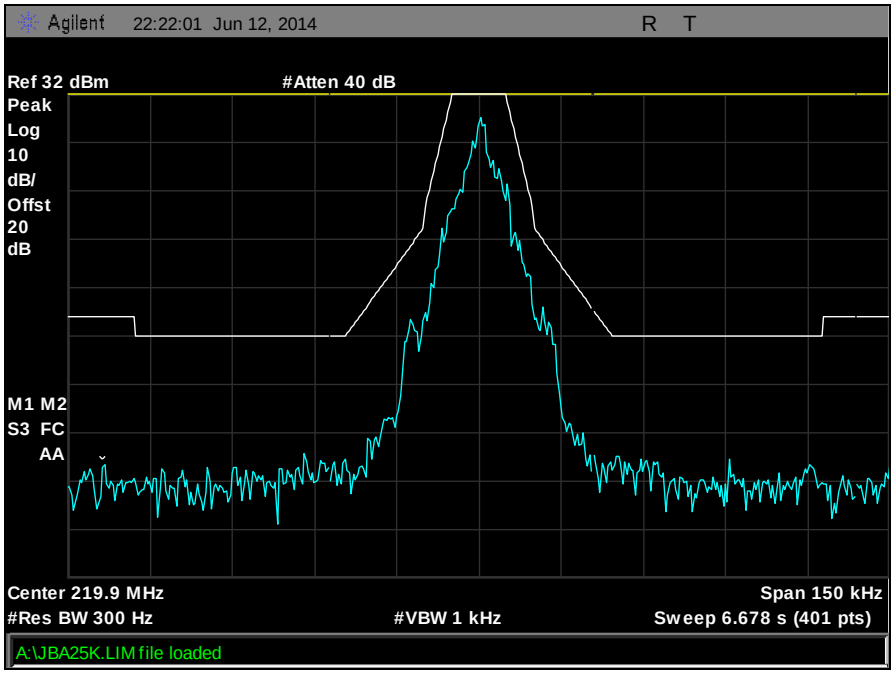
Plot 70. Emission Mask, Low Power, 219 MHz, 12.5 kHz Bandwidth



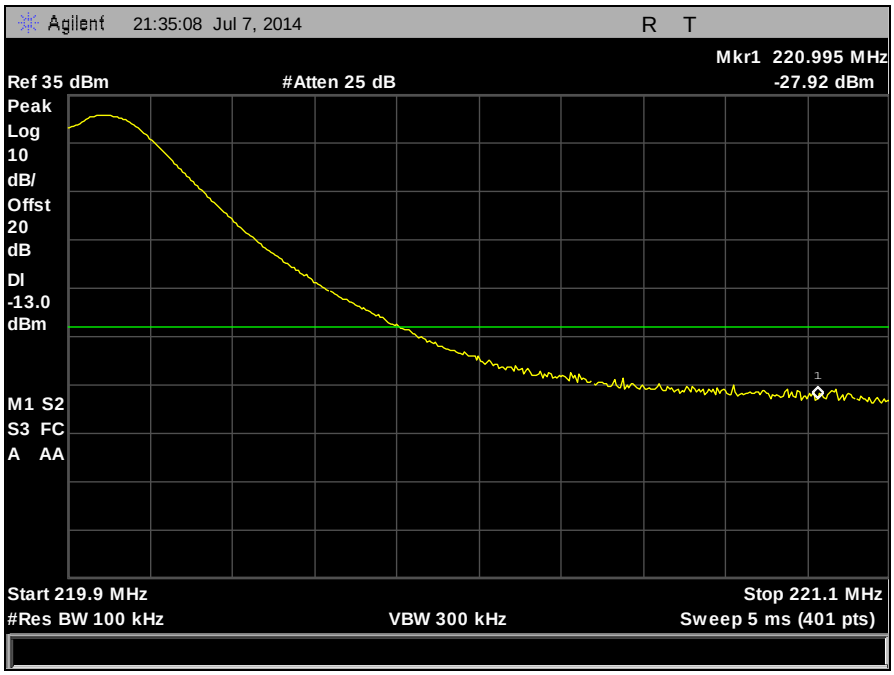
Plot 71. Emission Mask, High Power, 219 MHz, 12.5 kHz Bandwidth



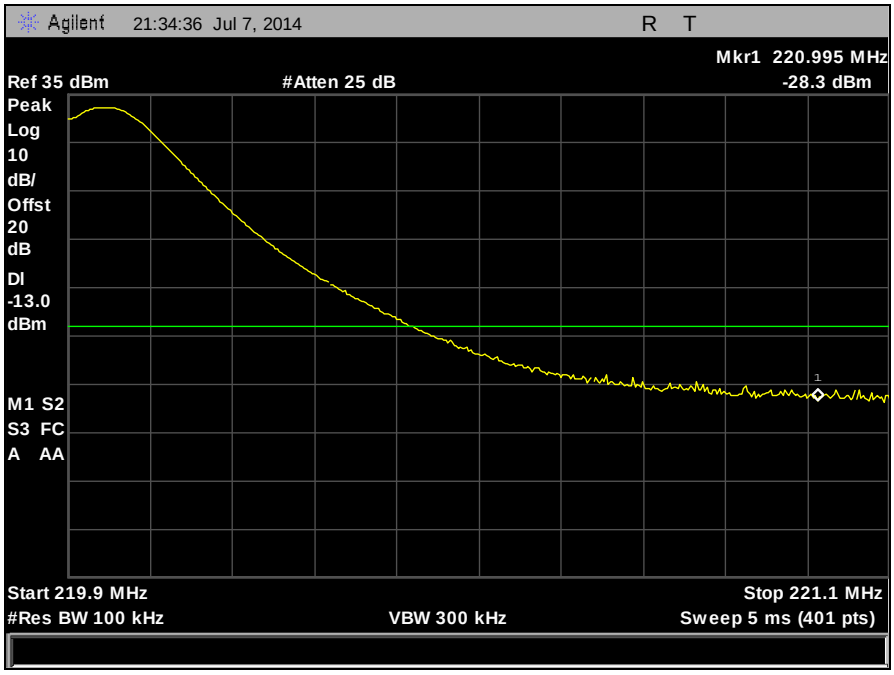
Plot 72. Emission Mask, Low Power, 219 MHz, 25 kHz Bandwidth



Plot 73. Emission Mask, High Power, 219 MHz, 25 kHz Bandwidth



Plot 74. Emission Mask, Low Power, 219 MHz, 50 kHz Bandwidth



Plot 75. Emission Mask, High Power, 219 MHz, 50 kHz Bandwidth

4.4. Spurious Emissions at Antenna Terminals

Test Requirement(s): **§2.1051 & 90.210(c)(3)** On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

Test Procedures: As required by 47 CFR §2.1051, *spurious emissions at antenna terminal measurements* were made at the RF output terminals using a Spectrum Analyzer.

A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected to a Spectrum Analyzer through an attenuator. The Spectrum Analyzer was set to sweep 30 MHz and up to 10th harmonic of the fundamental or 40 GHz whichever is the lesser. Measurements were made in all applicable frequency bands.

Test Results: Equipment complies with Section §2.1051, and §90.210(C)(3) with FCC 04-265.

Test Engineer(s): Jason Allnutt

Test Date(s): 06/13/14

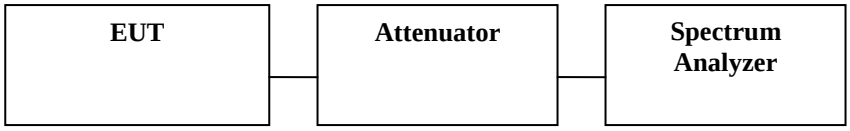
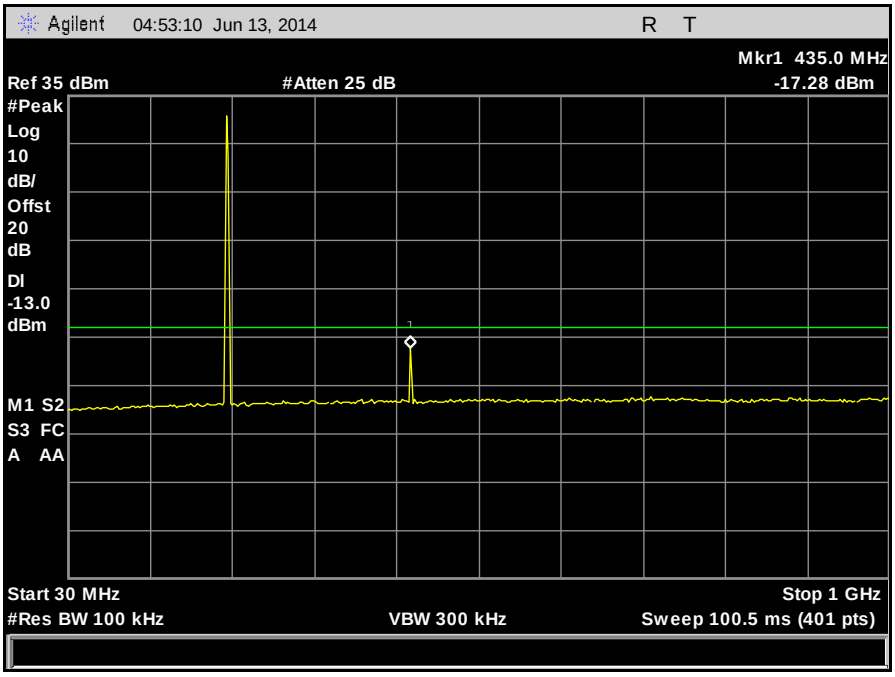


Figure 5. Spurious Emissions at Antenna Terminals Test Setup

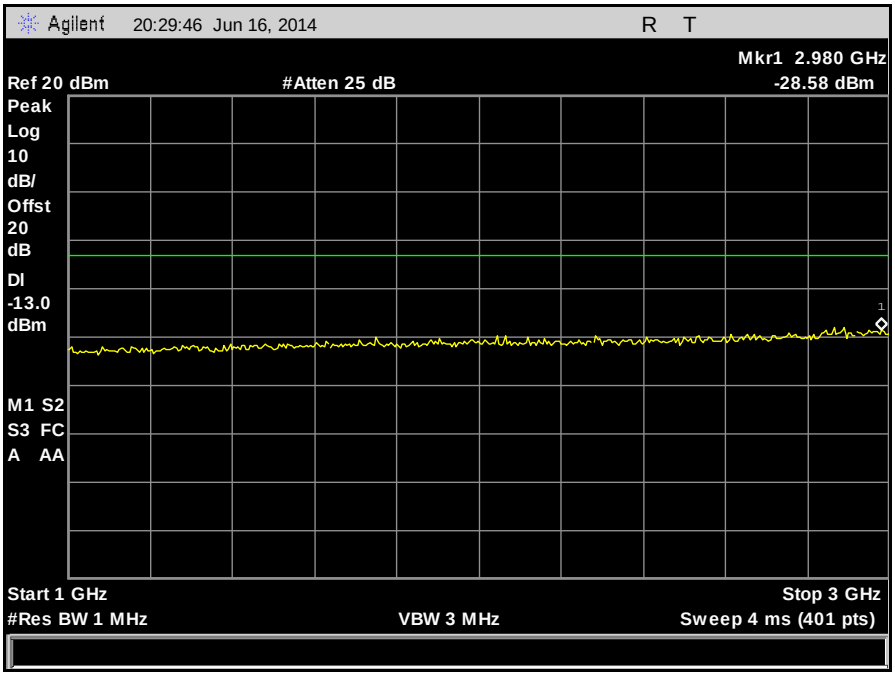
Frequency (MHz)	Bandwidth (kHz)	Power Setting	Under the Limit (Yes/No)
Less than 1 GHz			
217	6.25	High	Yes
217	12.5	High	Yes
217	25	High	Yes
217	50	High	Yes
217	6.25	Low	Yes
217	12.5	Low	Yes
217	25	Low	Yes
217	50	Low	Yes
218	6.25	High	Yes
218	12.5	High	Yes
218	25	High	Yes
218	50	High	Yes
218	6.25	Low	Yes
218	12.5	Low	Yes
218	25	Low	Yes
218	50	Low	Yes
219	6.25	High	Yes
219	12.5	High	Yes
219	25	High	Yes
219	50	High	Yes
219	6.25	Low	Yes
219	12.5	Low	Yes
219	25	Low	Yes
219	50	Low	Yes
1 GHz and Above			
217	6.25	High	Yes
217	12.5	High	Yes
217	25	High	Yes
217	50	High	Yes
217	6.25	Low	Yes
217	12.5	Low	Yes
217	25	Low	Yes
217	50	Low	Yes
218	6.25	High	Yes
218	12.5	High	Yes
218	25	High	Yes
218	50	High	Yes
218	6.25	Low	Yes
218	12.5	Low	Yes
218	25	Low	Yes
218	50	Low	Yes
219	6.25	High	Yes
219	12.5	High	Yes
219	25	High	Yes
219	50	High	Yes
219	6.25	Low	Yes
219	12.5	Low	Yes
219	25	Low	Yes
219	50	Low	Yes

Table 13. Conducted Spurious Emissions, Test Results

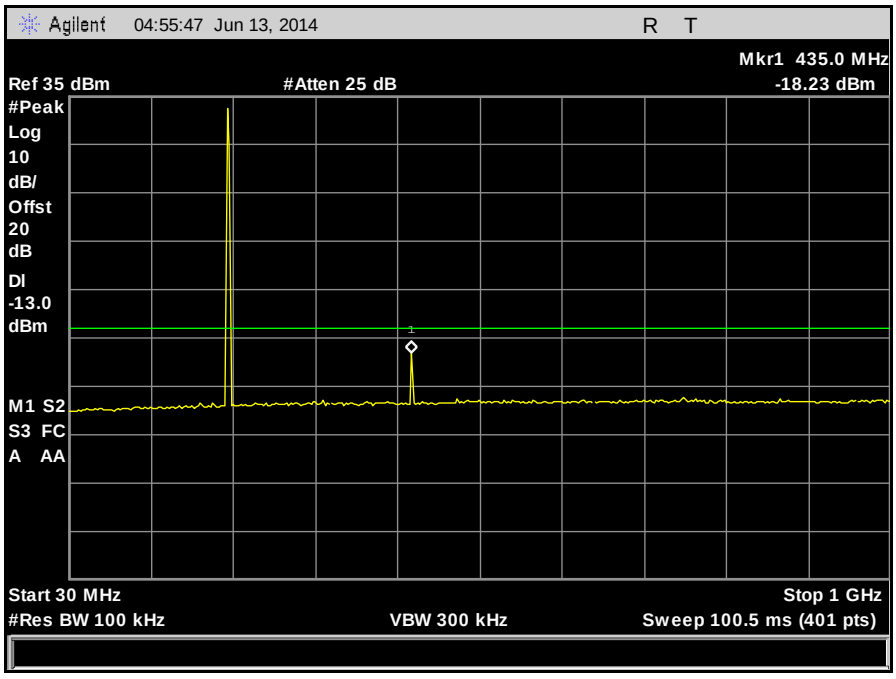
Conducted Spurious Emissions, 217 MHz



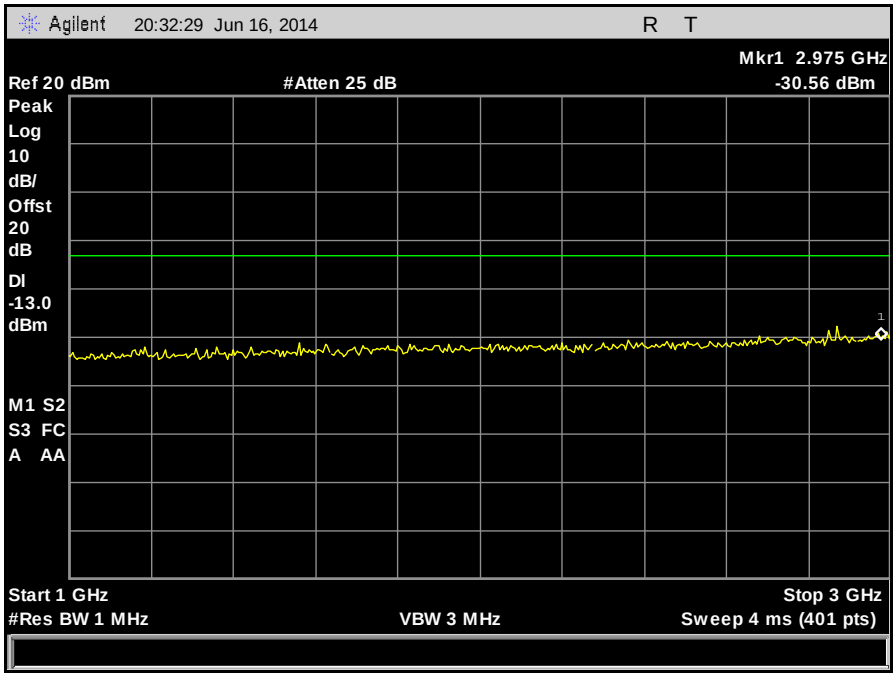
Plot 76. Conducted Spurious Emissions, Low Power, 217 MHz, 6.25 kHz Bandwidth, 30 MHz - 1 GHz



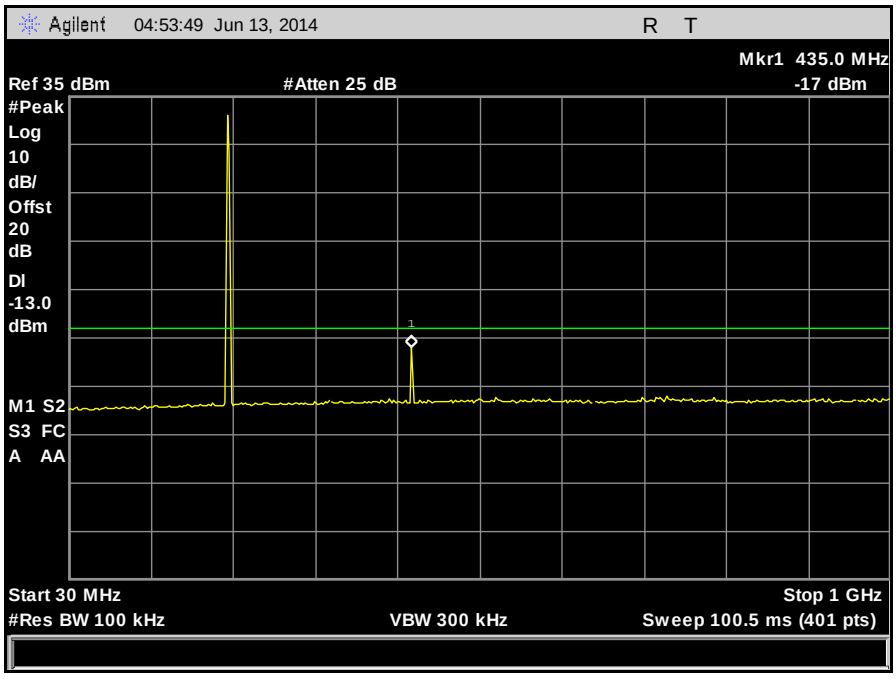
Plot 77. Conducted Spurious Emissions, Low Power, 217 MHz, 6.25 kHz Bandwidth, 1 GHz - 3 GHz



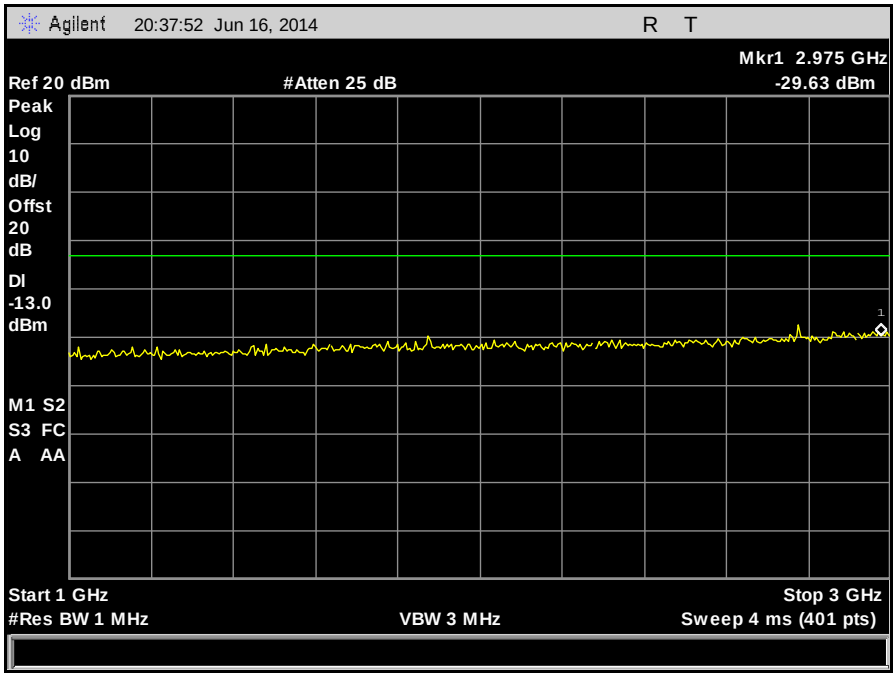
Plot 78. Conducted Spurious Emissions, High Power, 217 MHz, 6.25 kHz Bandwidth, 30 MHz - 1 GHz



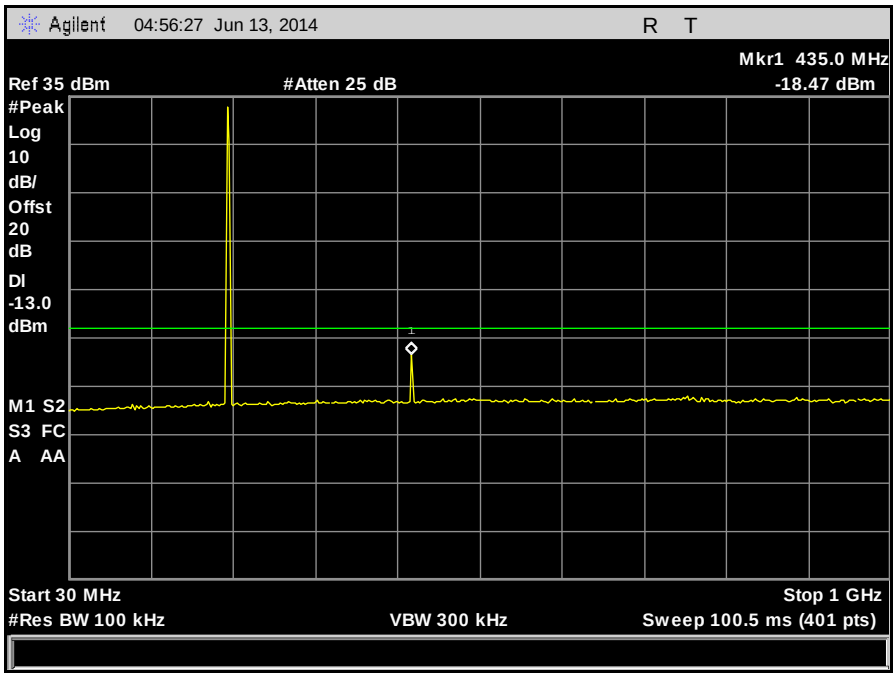
Plot 79. Conducted Spurious Emissions, High Power, 217 MHz, 6.25 kHz Bandwidth, 1 GHz - 3 GHz



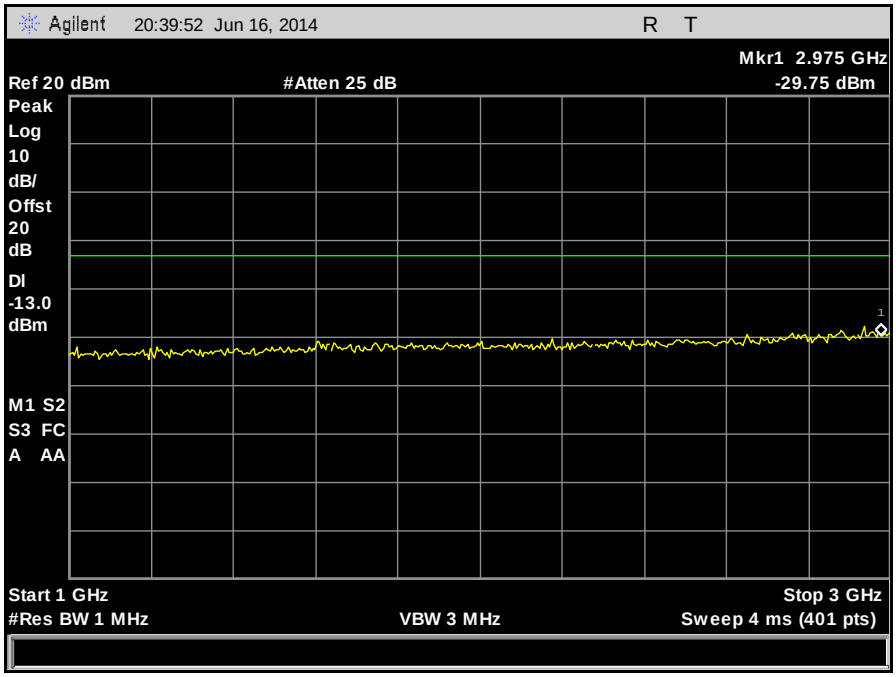
Plot 80. Conducted Spurious Emissions, Low Power, 217 MHz, 12.5 kHz Bandwidth, 30 MHz - 1 GHz



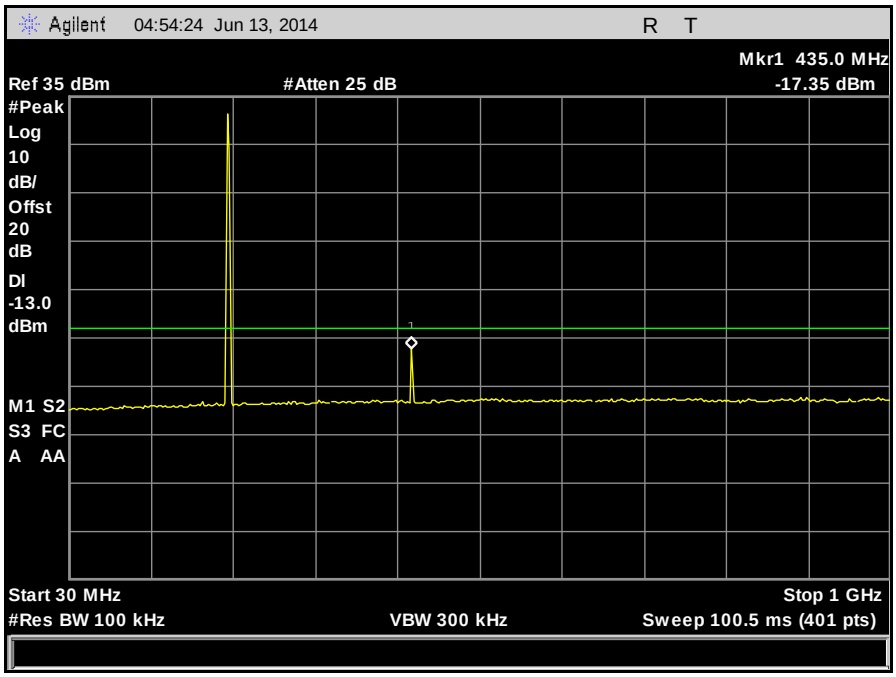
Plot 81. Conducted Spurious Emissions, Low Power, 217 MHz, 12.5 kHz Bandwidth, 1 GHz - 3 GHz



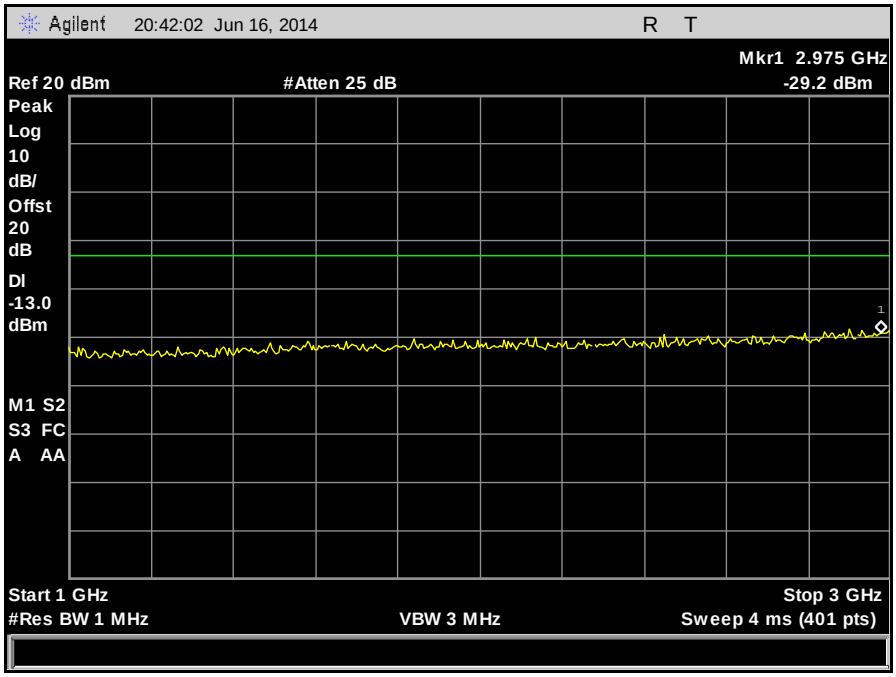
Plot 82. Conducted Spurious Emissions, High Power, 217 MHz, 12.5 kHz Bandwidth, 30 MHz - 1 GHz



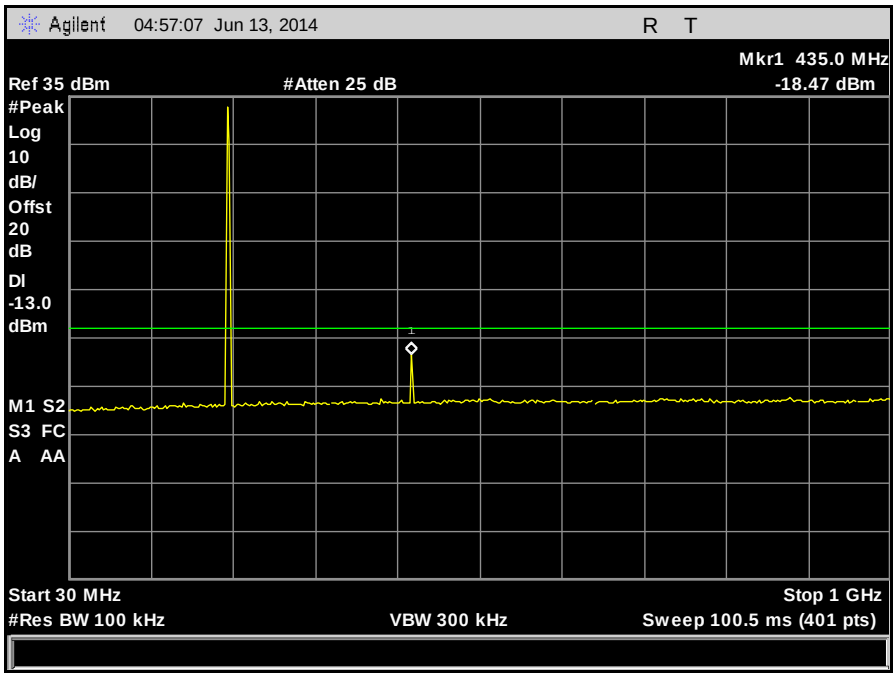
Plot 83. Conducted Spurious Emissions, High Power, 217 MHz, 12.5 kHz Bandwidth, 1 GHz - 3 GHz



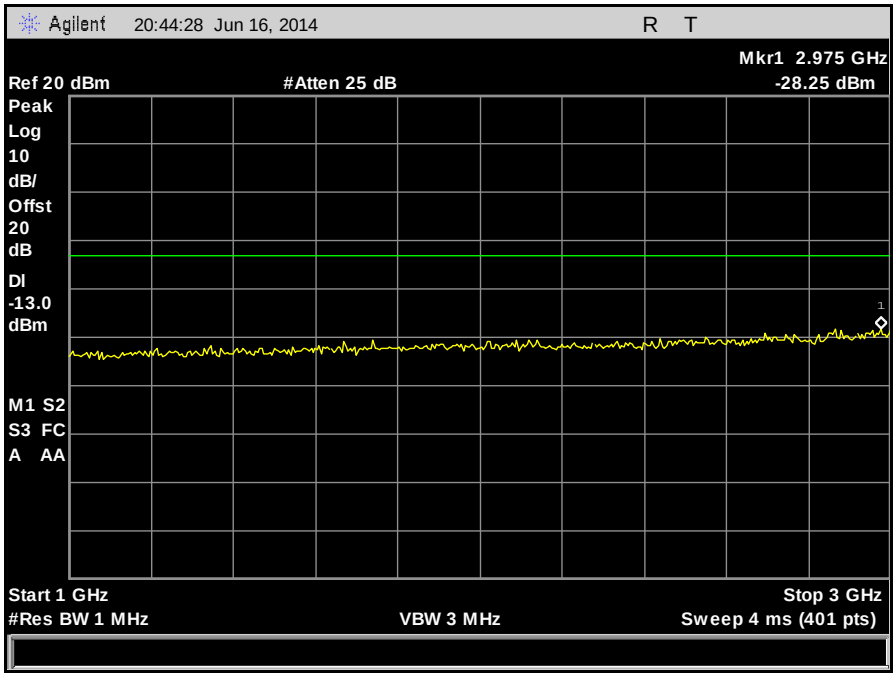
Plot 84. Conducted Spurious Emissions, Low Power, 217 MHz, 25 kHz Bandwidth, 30 MHz - 1 GHz



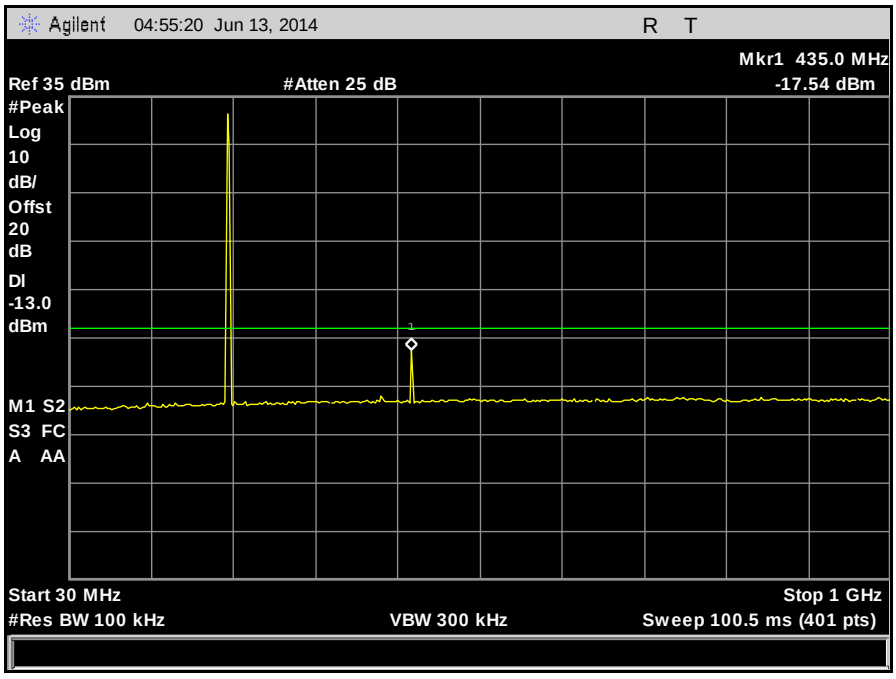
Plot 85. Conducted Spurious Emissions, Low Power, 217 MHz, 25 kHz Bandwidth, 1 GHz - 3 GHz



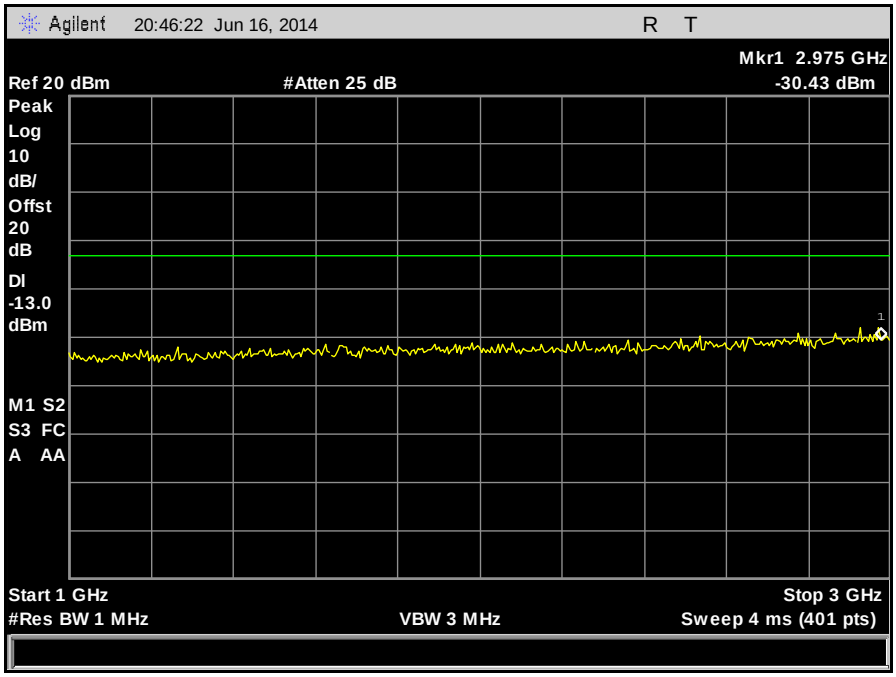
Plot 86. Conducted Spurious Emissions, High Power, 217 MHz, 25 kHz Bandwidth, 30 MHz - 1 GHz



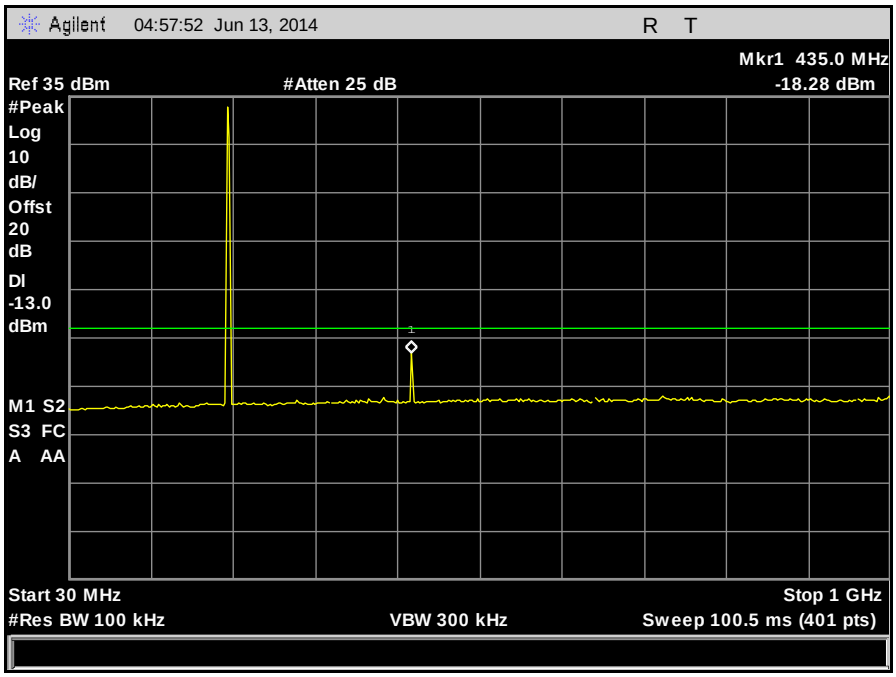
Plot 87. Conducted Spurious Emissions, High Power, 217 MHz, 25 kHz Bandwidth, 1 GHz - 3 GHz



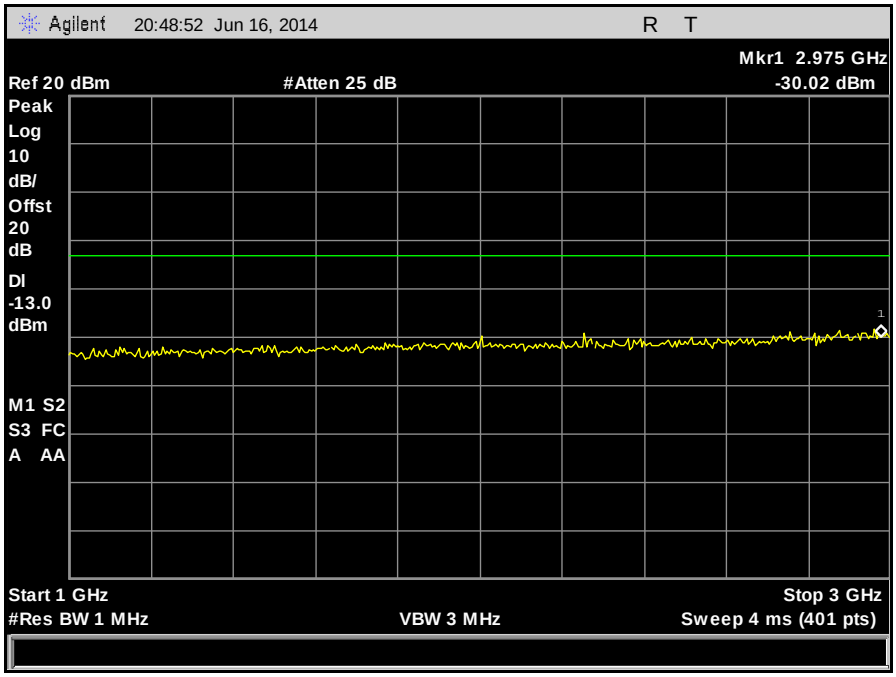
Plot 88. Conducted Spurious Emissions, Low Power, 217 MHz, 50 kHz Bandwidth, 30 MHz - 1 GHz



Plot 89. Conducted Spurious Emissions, Low Power, 217 MHz, 50 kHz Bandwidth, 1 GHz - 3 GHz

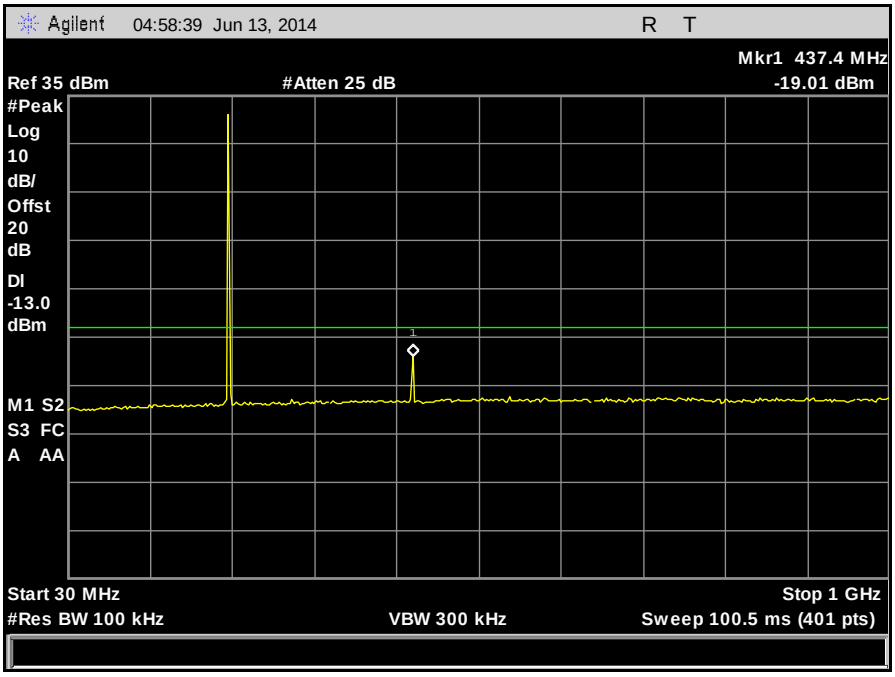


Plot 90. Conducted Spurious Emissions, High Power, 217 MHz, 50 kHz Bandwidth, 30 MHz - 1 GHz

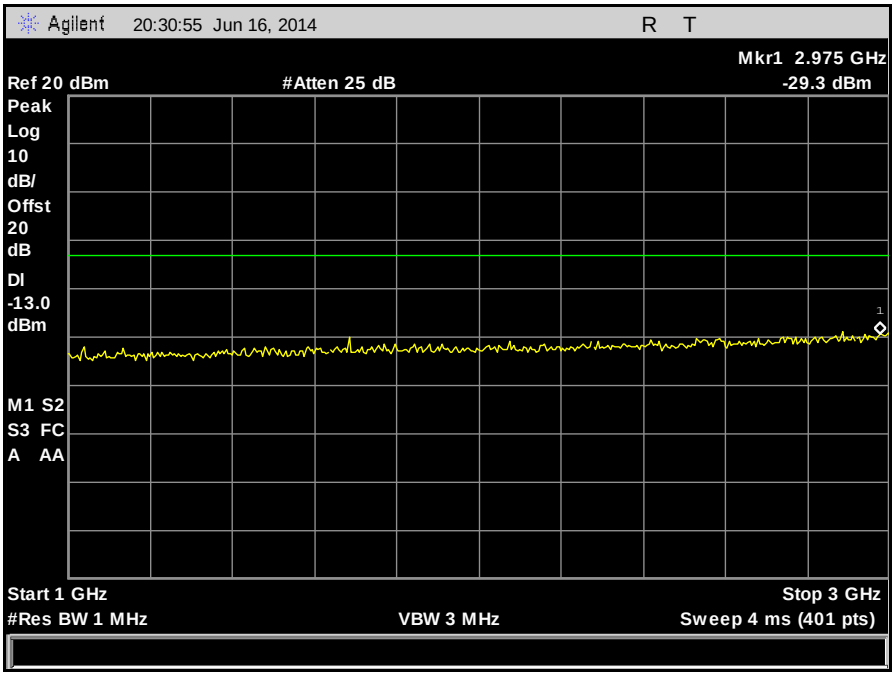


Plot 91. Conducted Spurious Emissions, High Power, 217 MHz, 50 kHz Bandwidth, 1 GHz - 3 GHz

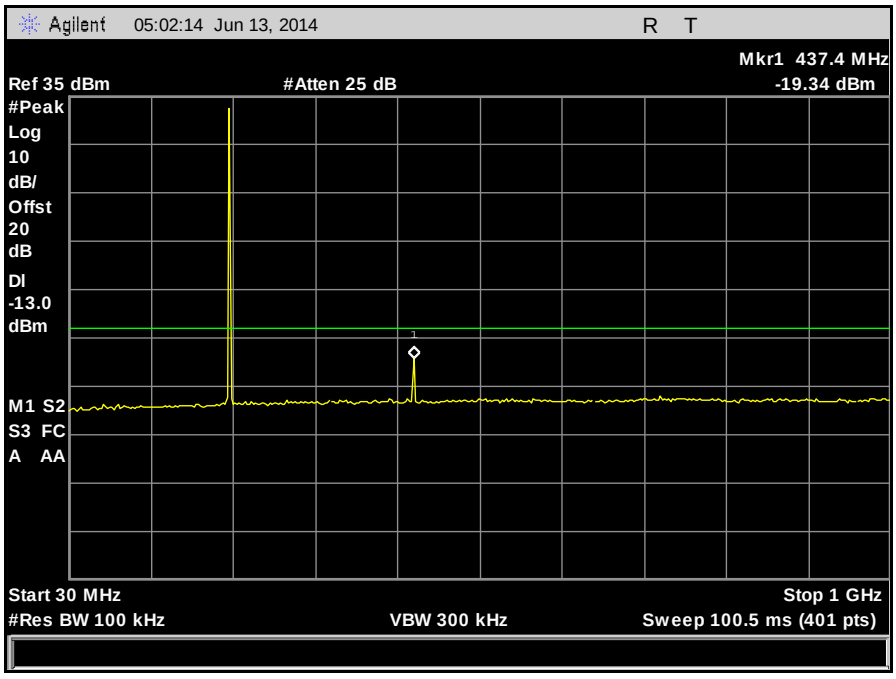
Conducted Spurious Emissions, 218 MHz



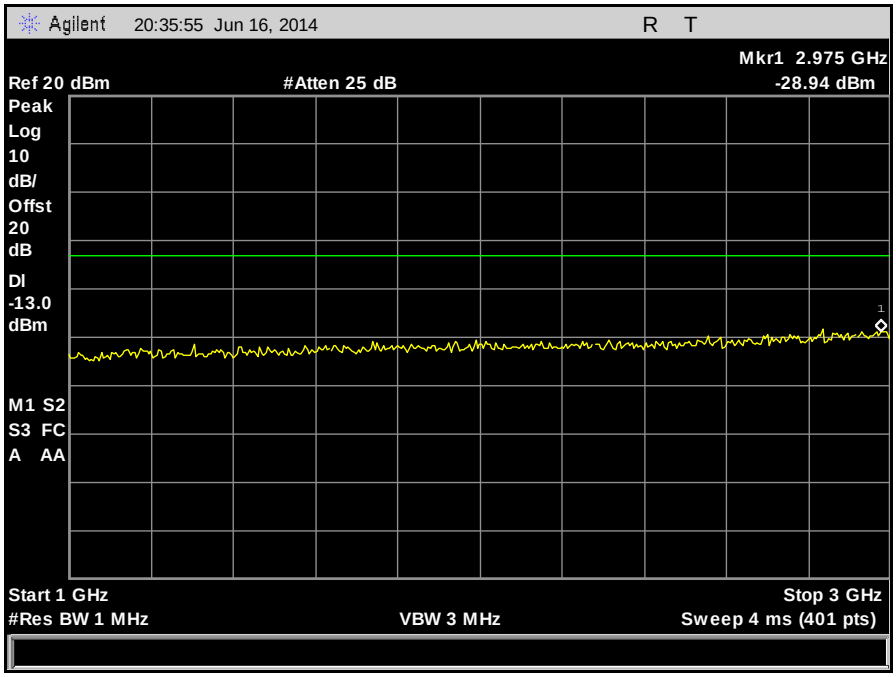
Plot 92. Conducted Spurious Emissions, Low Power, 218 MHz, 6.25 kHz Bandwidth, 30 MHz - 1 GHz



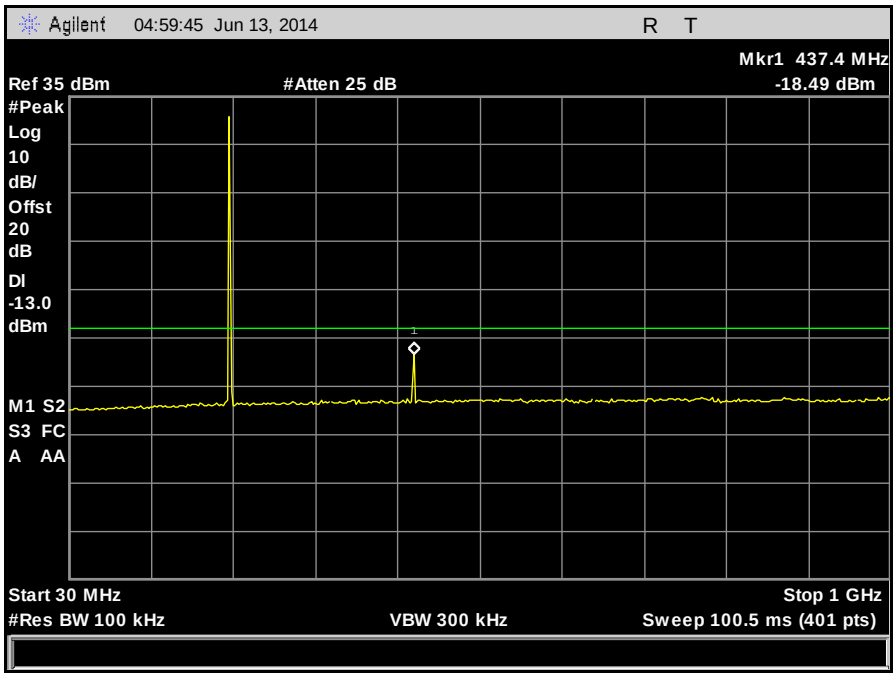
Plot 93. Conducted Spurious Emissions, Low Power, 218 MHz, 6.25 kHz Bandwidth, 1 GHz - 3 GHz



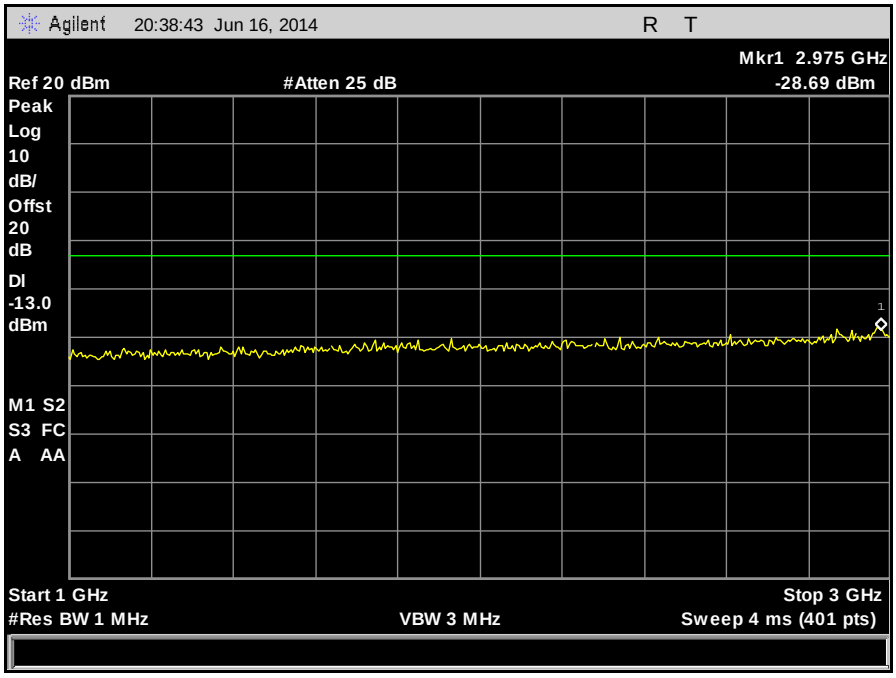
Plot 94. Conducted Spurious Emissions, High Power, 218 MHz, 6.25 kHz Bandwidth, 30 MHz - 1 GHz



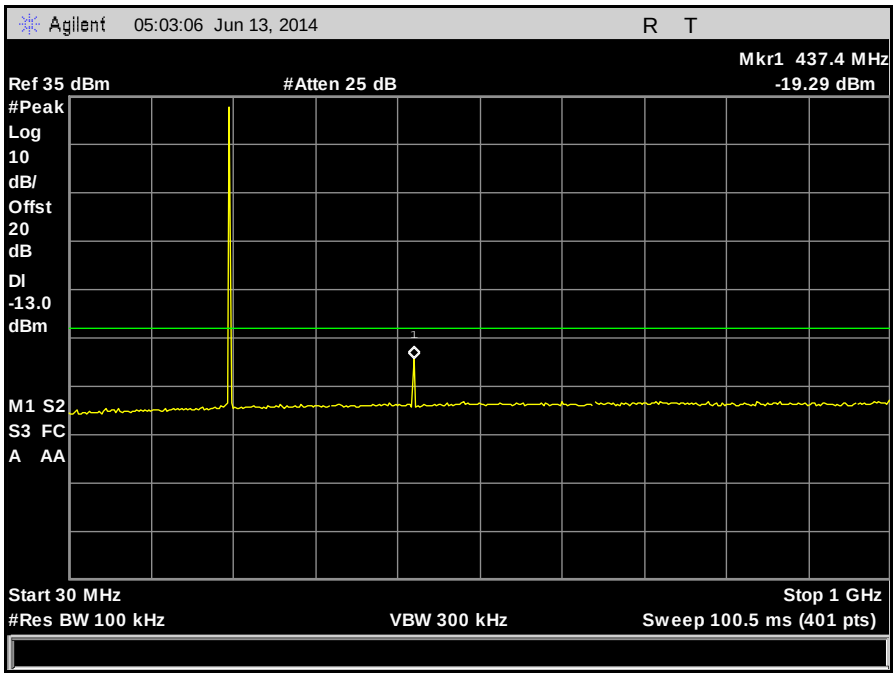
Plot 95. Conducted Spurious Emissions, High Power, 218 MHz, 6.25 kHz Bandwidth, 1 GHz - 3 GHz



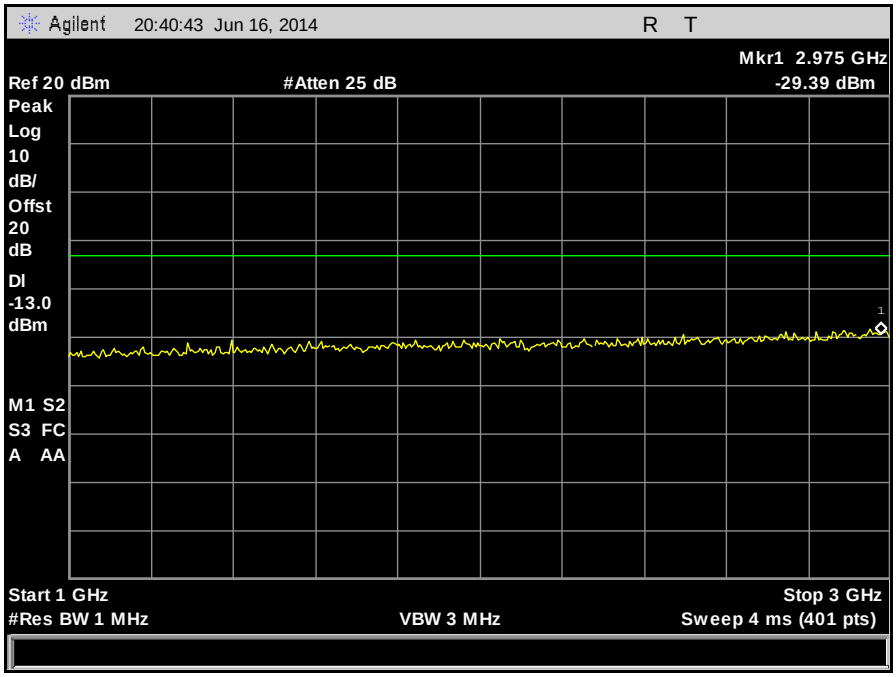
Plot 96. Conducted Spurious Emissions, Low Power, 218 MHz, 12.5 kHz Bandwidth, 30 MHz - 1 GHz



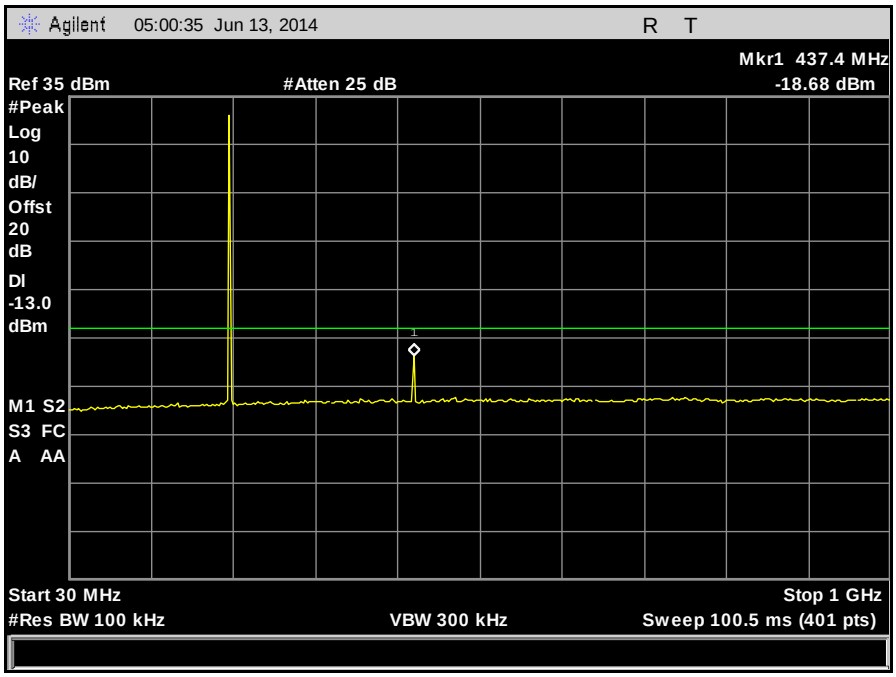
Plot 97. Conducted Spurious Emissions, Low Power, 218 MHz, 12.5 kHz Bandwidth, 1 GHz - 3 GHz



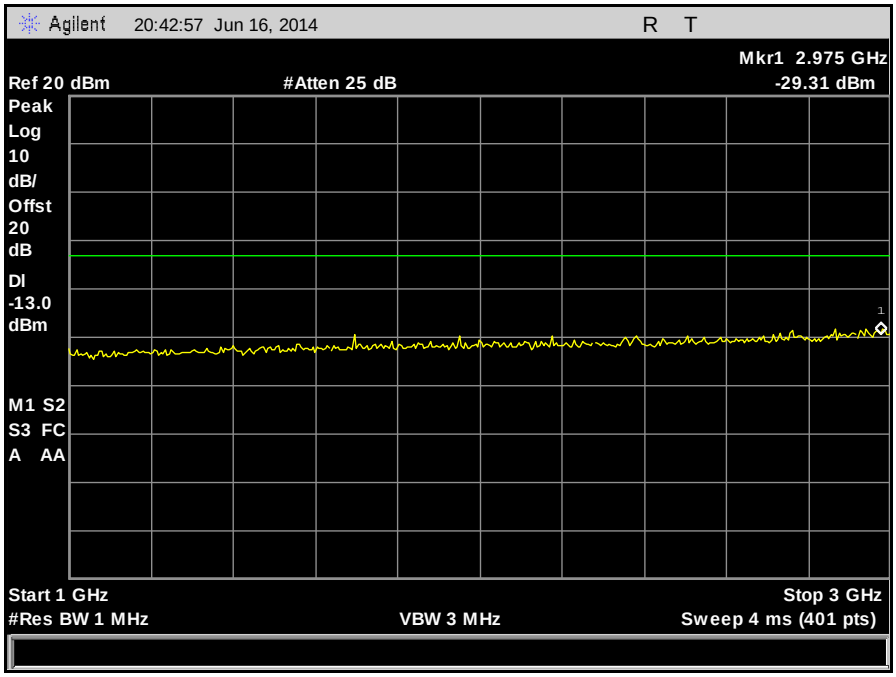
Plot 98. Conducted Spurious Emissions, High Power, 218 MHz, 12.5 kHz Bandwidth, 30 MHz - 1 GHz



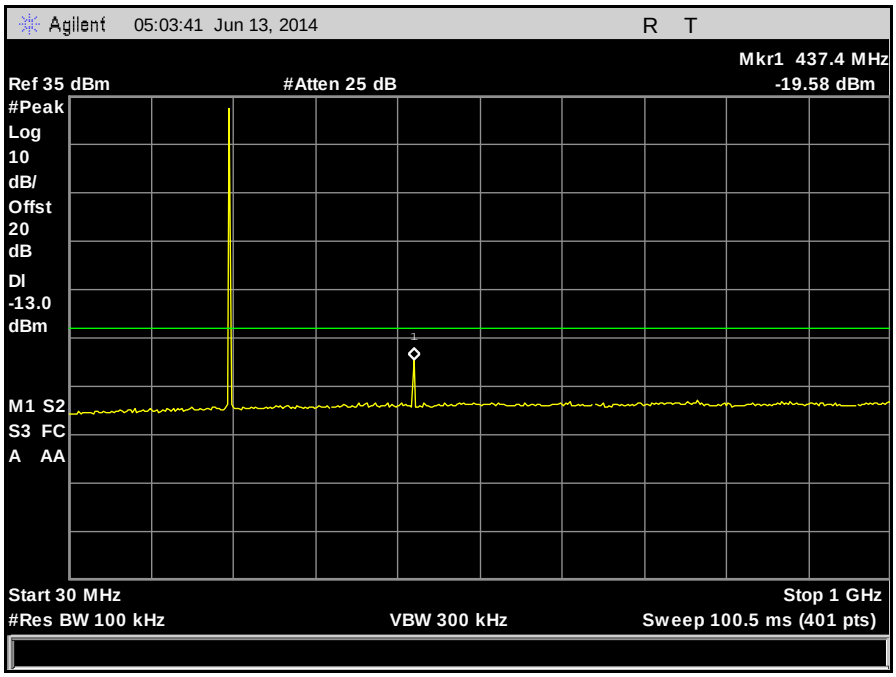
Plot 99. Conducted Spurious Emissions, High Power, 218 MHz, 12.5 kHz Bandwidth, 1 GHz - 3 GHz



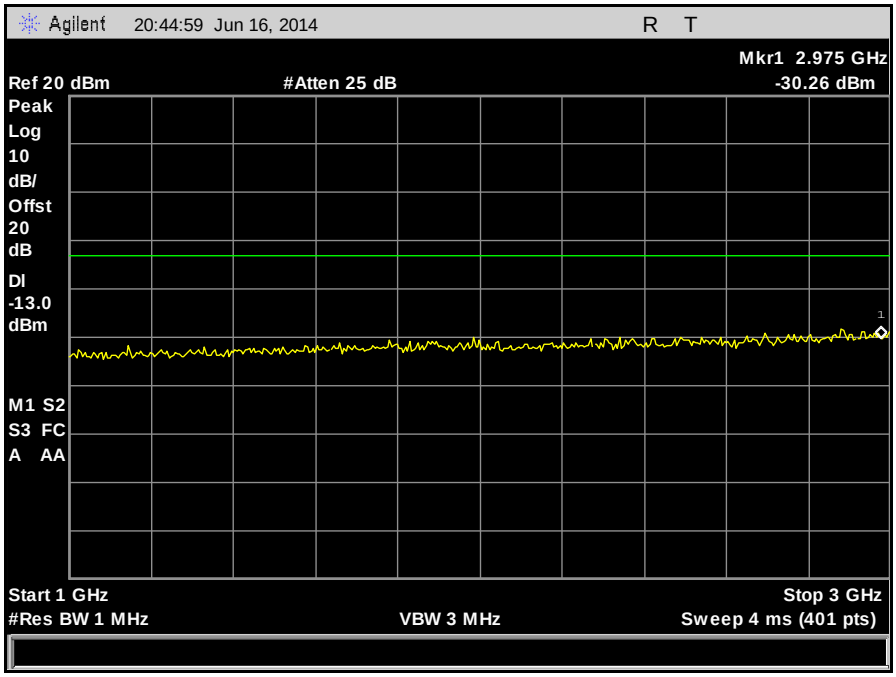
Plot 100. Conducted Spurious Emissions, Low Power, 218 MHz, 25 kHz Bandwidth, 30 MHz - 1 GHz



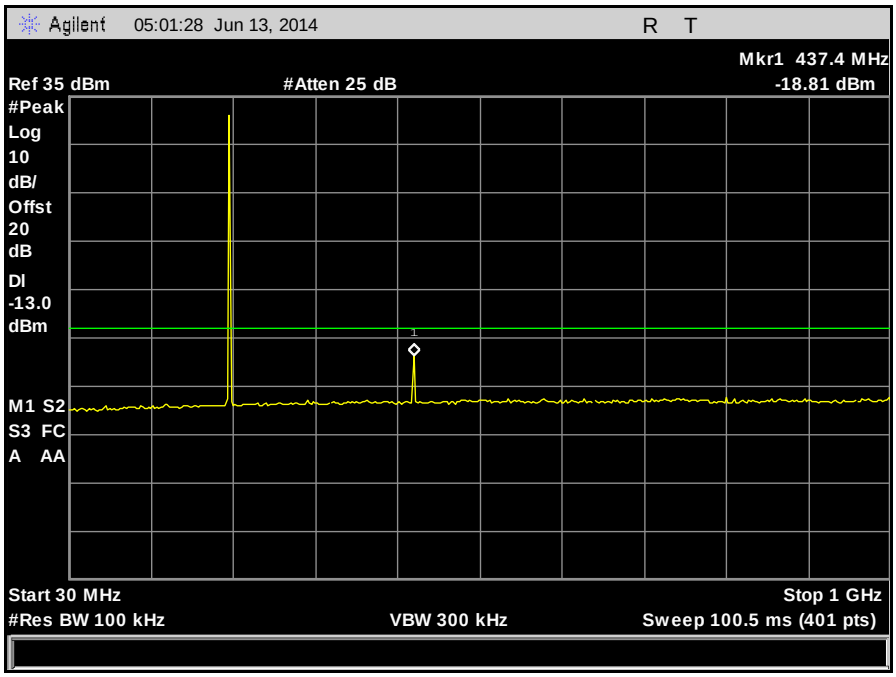
Plot 101. Conducted Spurious Emissions, Low Power, 218 MHz, 25 kHz Bandwidth, 1 GHz - 3 GHz



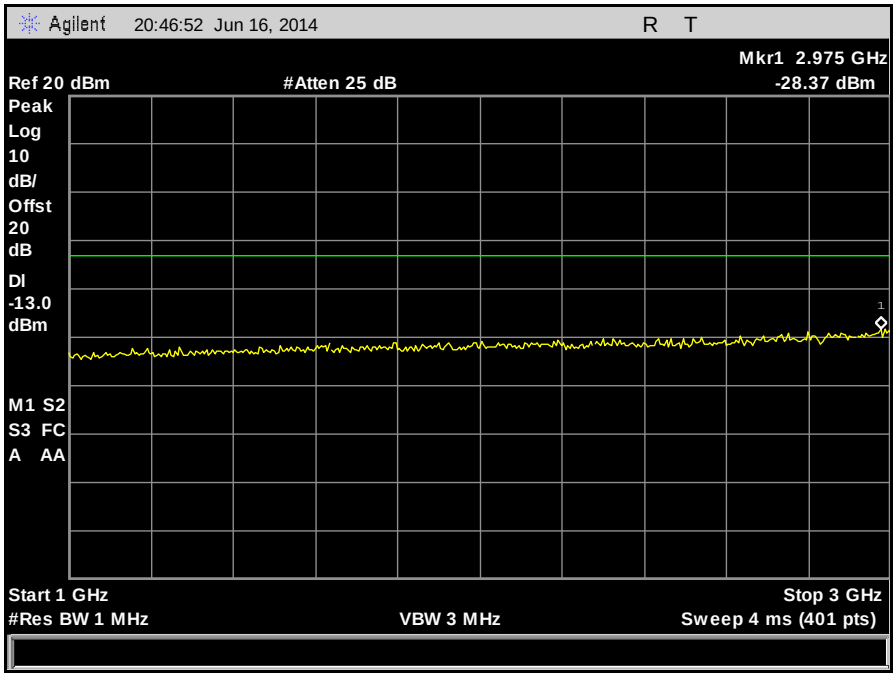
Plot 102. Conducted Spurious Emissions, High Power, 218 MHz, 25 kHz Bandwidth, 30 MHz - 1 GHz



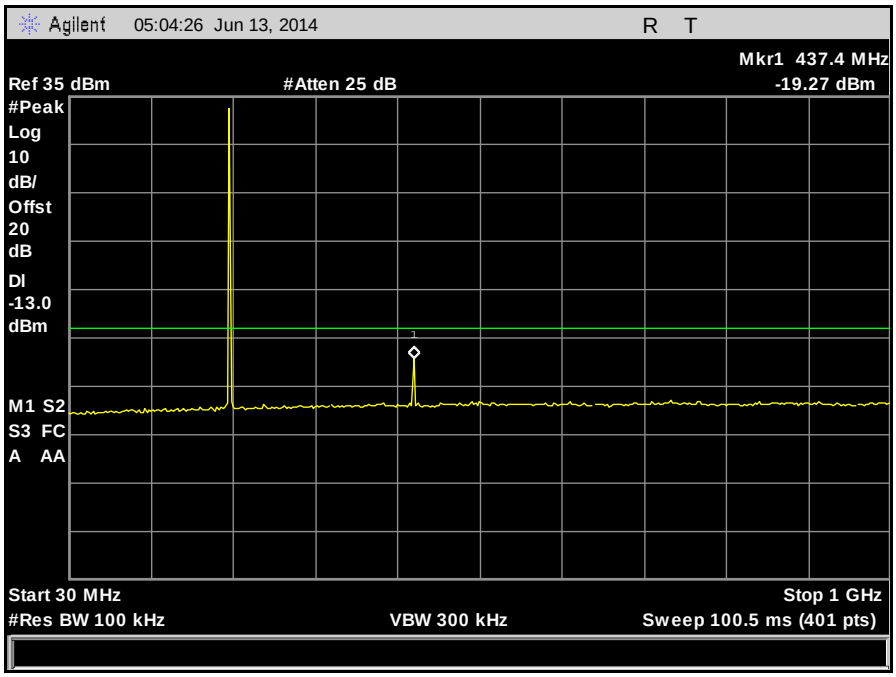
Plot 103. Conducted Spurious Emissions, High Power, 218 MHz, 25 kHz Bandwidth, 1 GHz - 3 GHz



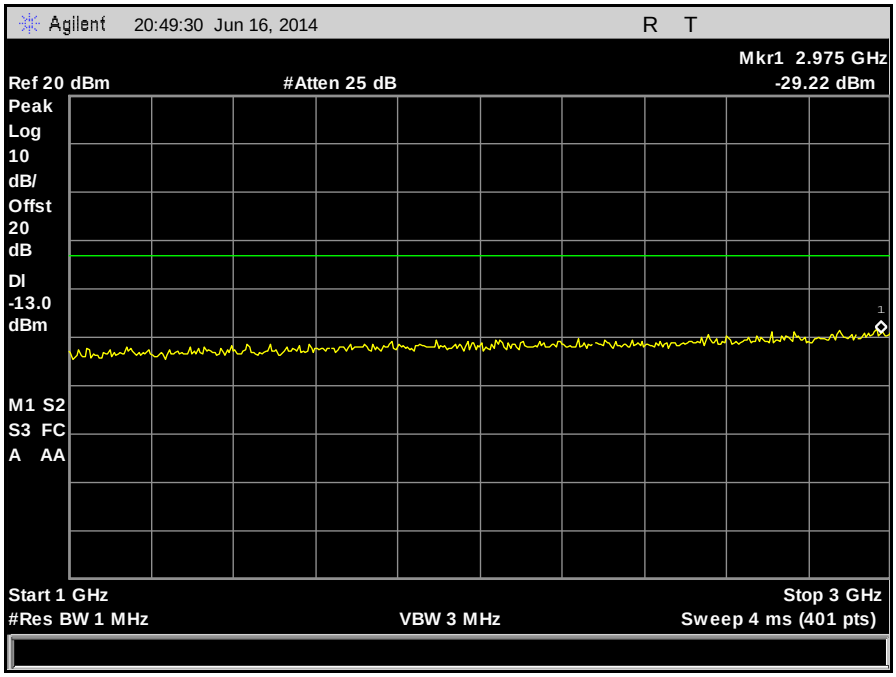
Plot 104. Conducted Spurious Emissions, Low Power, 218 MHz, 50 kHz Bandwidth, 30 MHz - 1 GHz



Plot 105. Conducted Spurious Emissions, Low Power, 218 MHz, 50 kHz Bandwidth, 1 GHz - 3 GHz

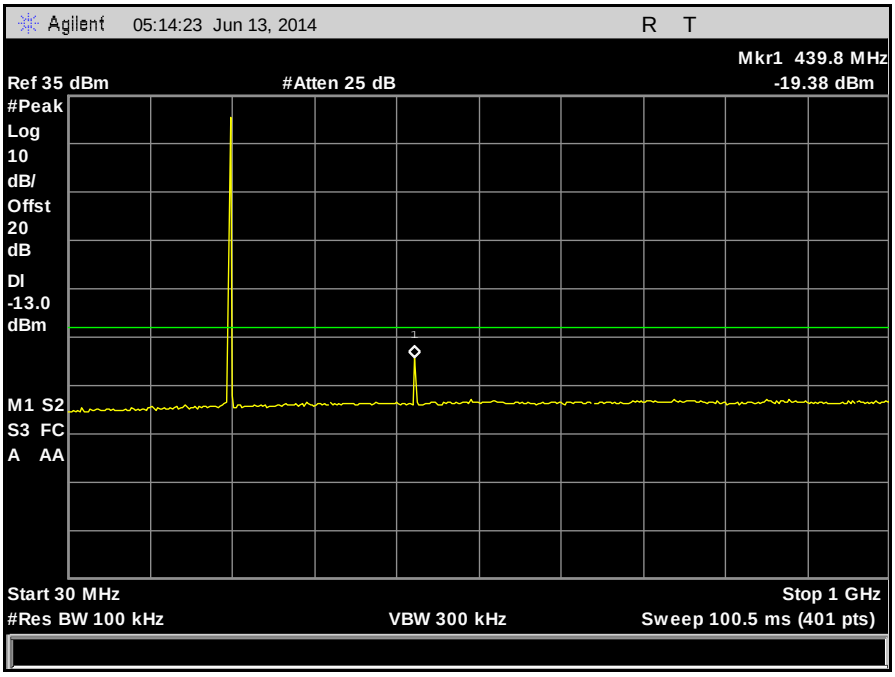


Plot 106. Conducted Spurious Emissions, High Power, 218 MHz, 50 kHz Bandwidth, 30 MHz - 1 GHz

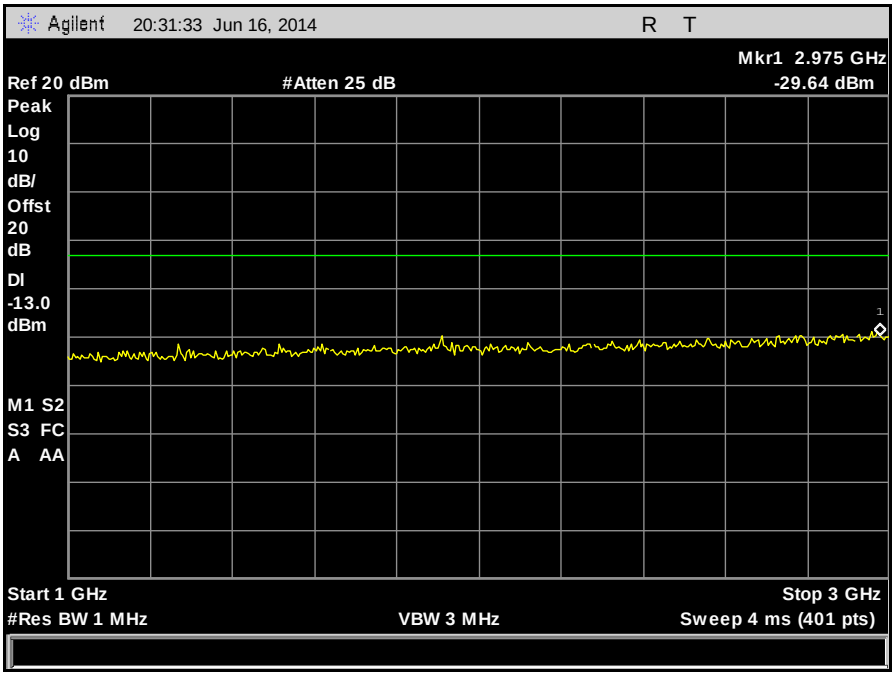


Plot 107. Conducted Spurious Emissions, High Power, 218 MHz, 50 kHz Bandwidth, 1 GHz - 3 GHz

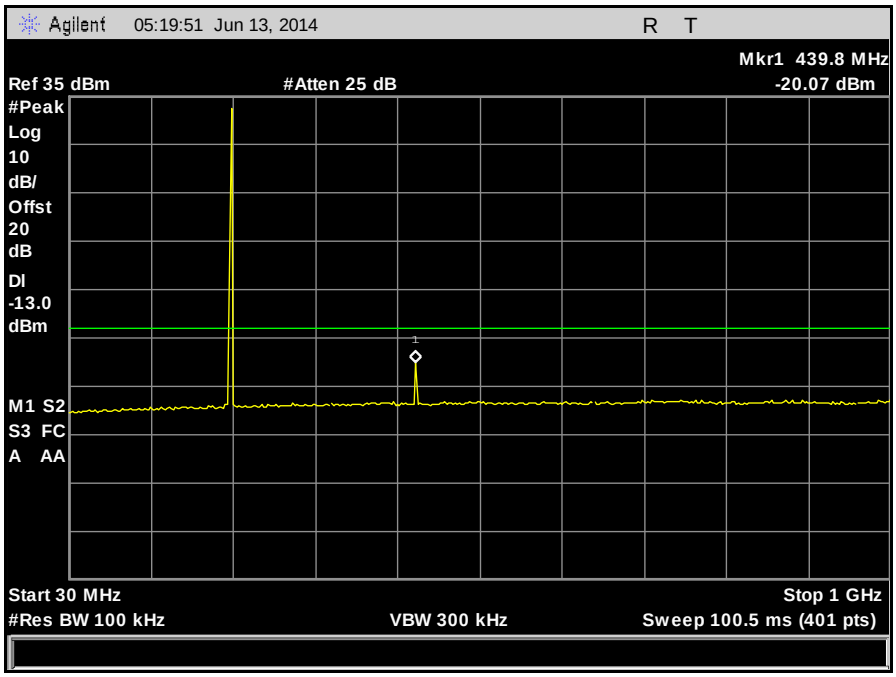
Conducted Spurious Emissions, 219 MHz



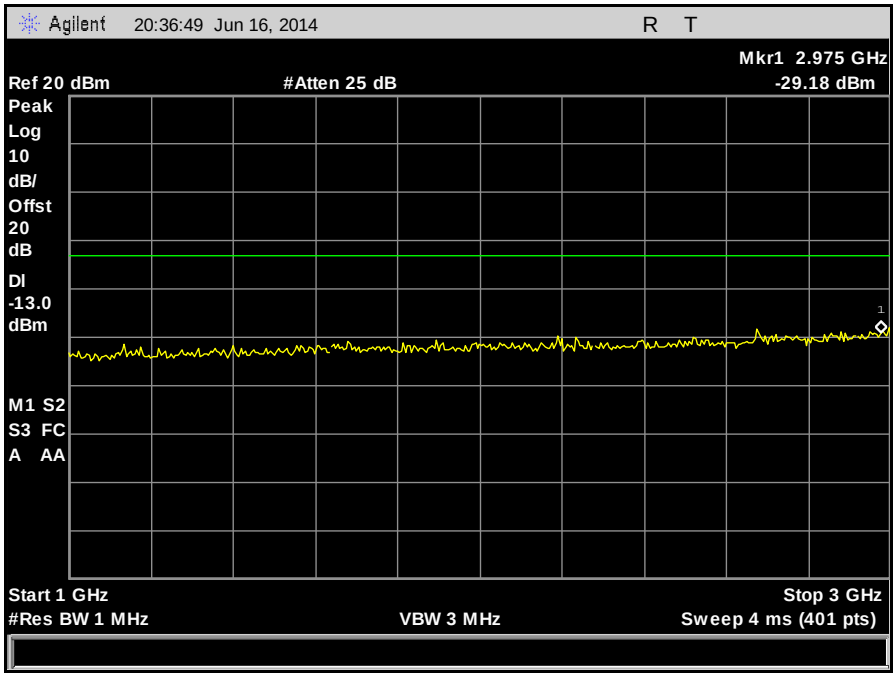
Plot 108. Conducted Spurious Emissions, Low Power, 219 MHz, 6.25 kHz Bandwidth, 30 MHz - 1 GHz



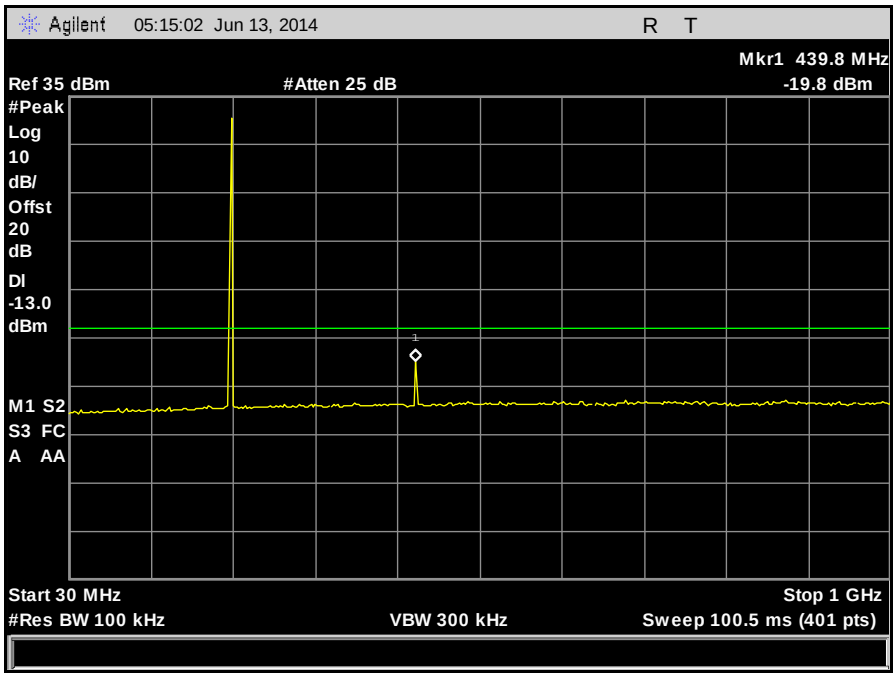
Plot 109. Conducted Spurious Emissions, Low Power, 219 MHz, 6.25 kHz Bandwidth, 1 GHz - 3 GHz



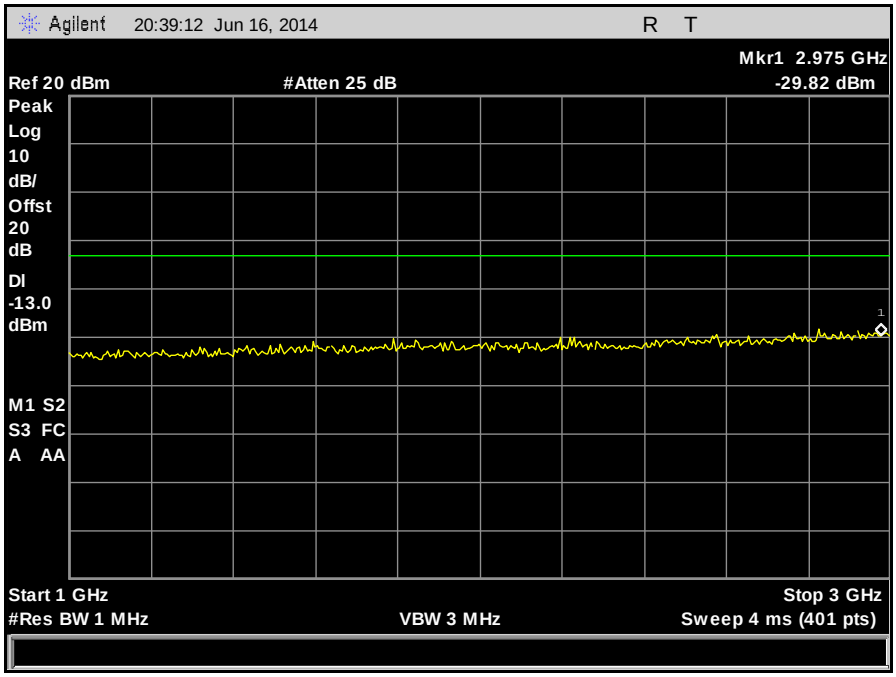
Plot 110. Conducted Spurious Emissions, High Power, 219 MHz, 6.25 kHz Bandwidth, 30 MHz - 1 GHz



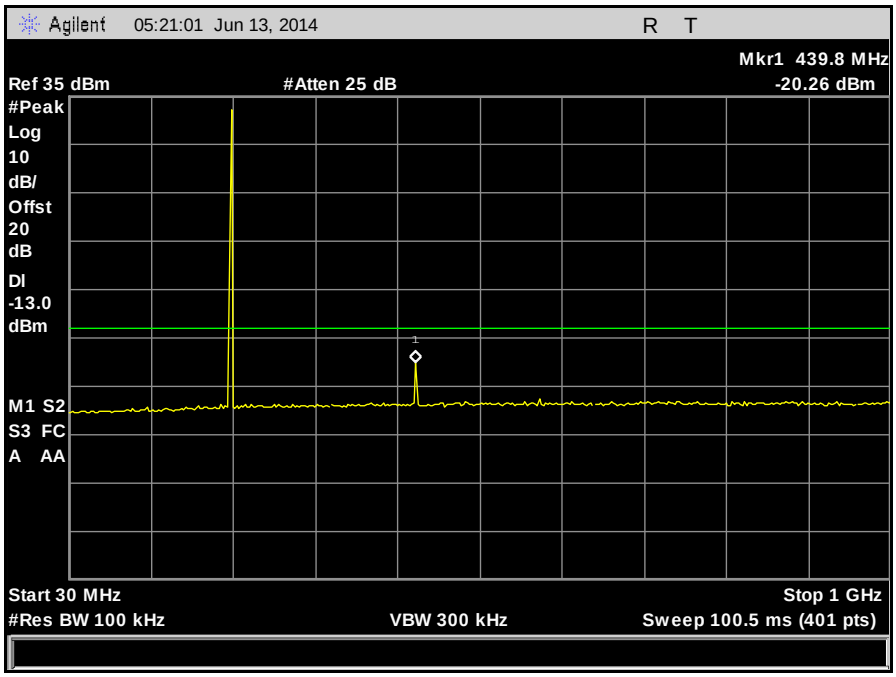
Plot 111. Conducted Spurious Emissions, High Power, 219 MHz, 6.25 kHz Bandwidth, 1 GHz - 3 GHz



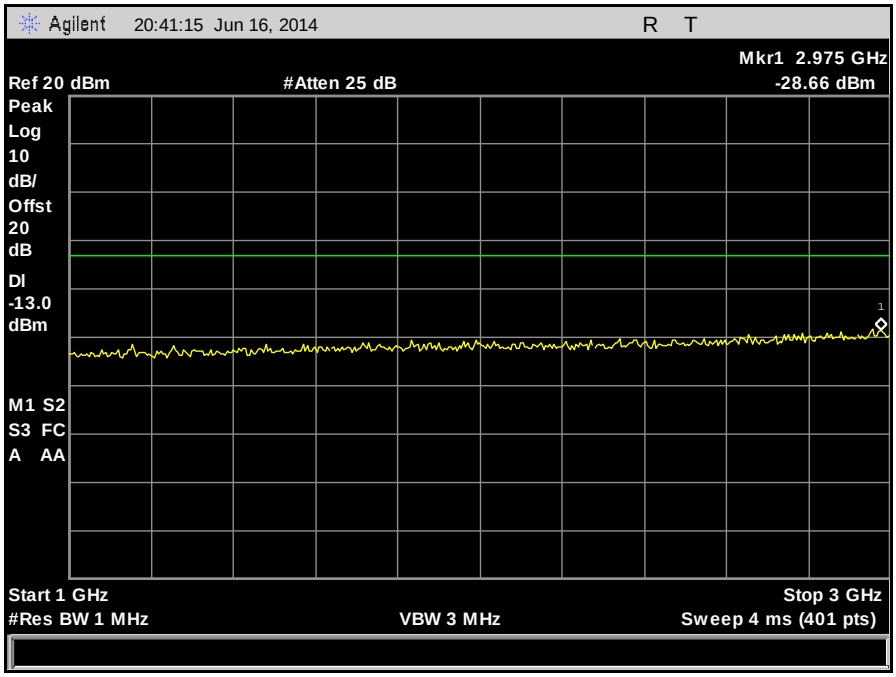
Plot 112. Conducted Spurious Emissions, Low Power, 219 MHz, 12.5 kHz Bandwidth, 30 MHz - 1 GHz



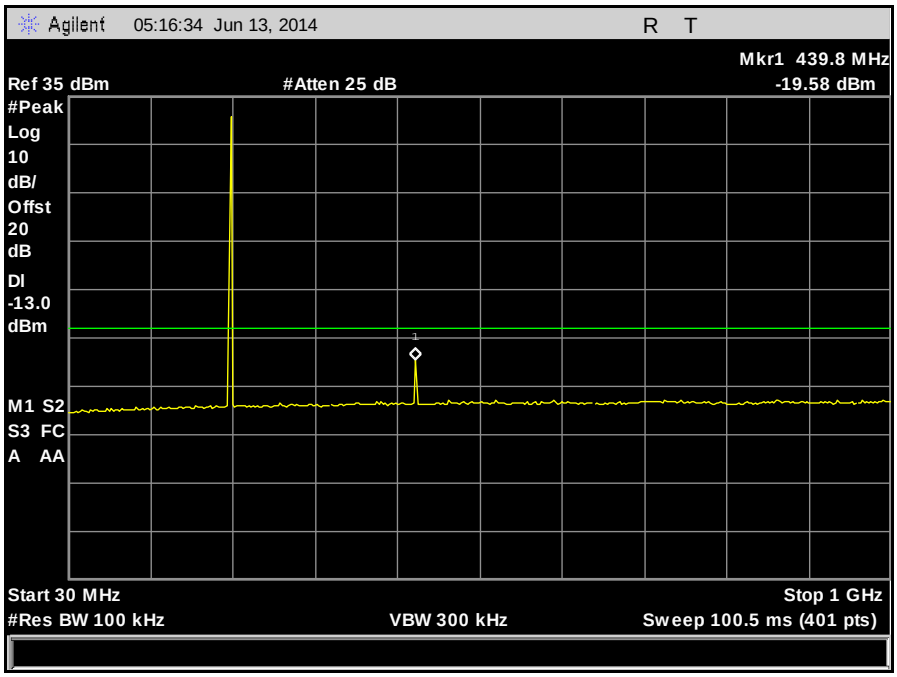
Plot 113. Conducted Spurious Emissions, Low Power, 219 MHz, 12.5 kHz Bandwidth, 1 GHz - 3 GHz



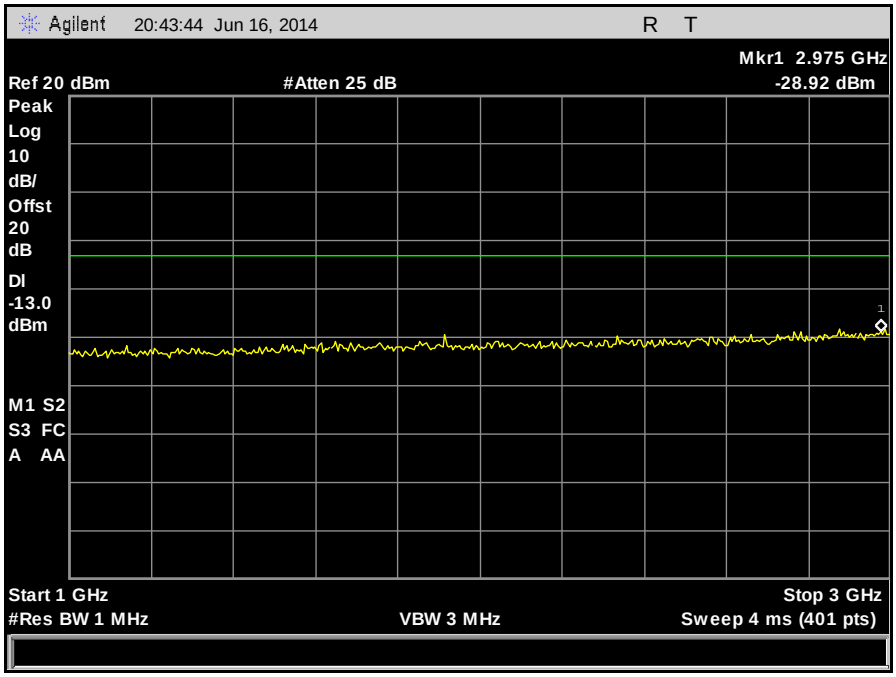
Plot 114. Conducted Spurious Emissions, High Power, 219 MHz, 12.5 kHz Bandwidth, 30 MHz - 1 GHz



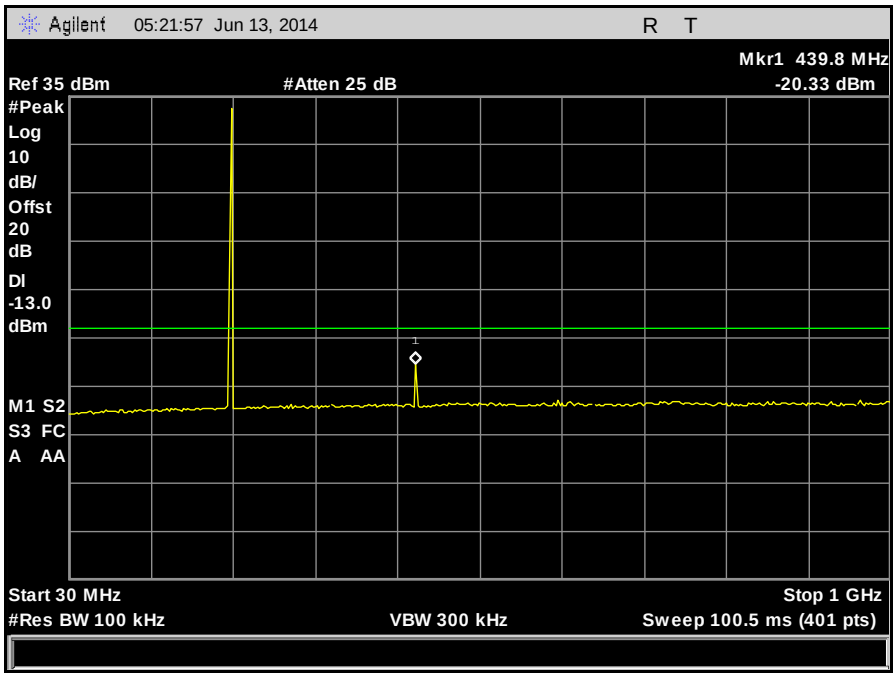
Plot 115. Conducted Spurious Emissions, High Power, 219 MHz, 12.5 kHz Bandwidth, 1 GHz - 3 GHz



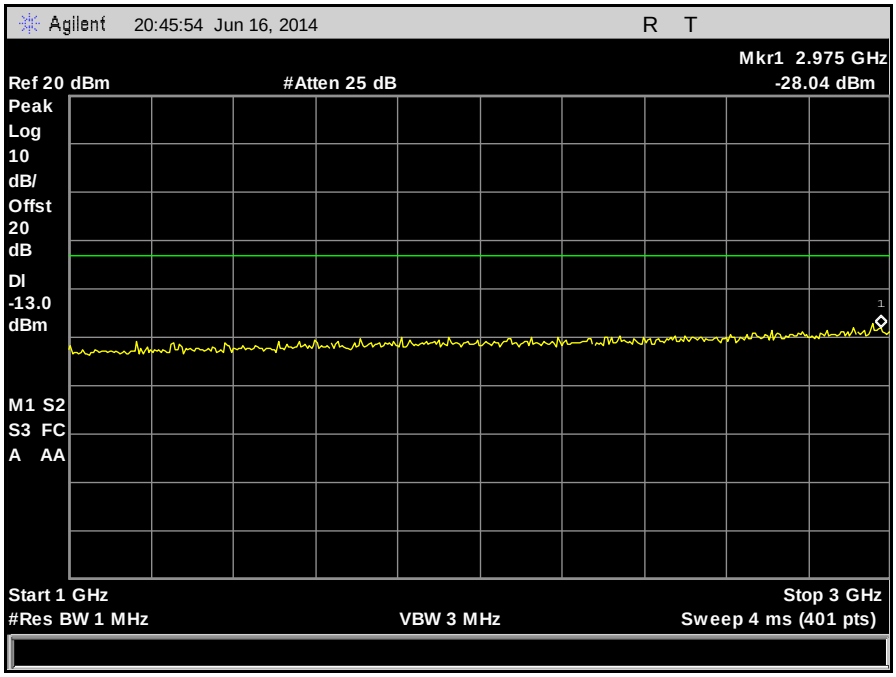
Plot 116. Conducted Spurious Emissions, Low Power, 219 MHz, 25 kHz Bandwidth, 30 MHz - 1 GHz



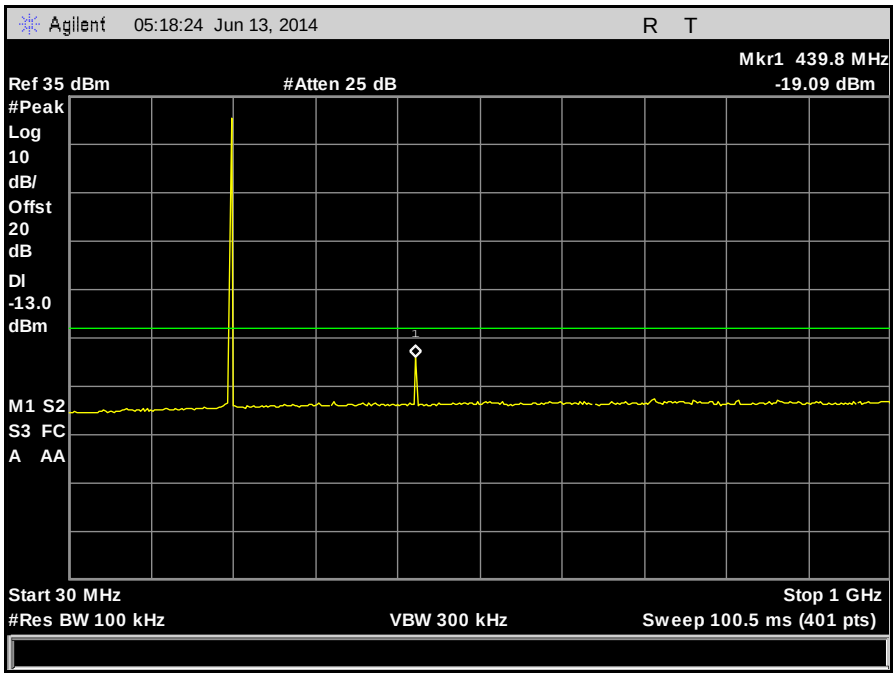
Plot 117. Conducted Spurious Emissions, Low Power, 219 MHz, 25 kHz Bandwidth, 1 GHz - 3 GHz



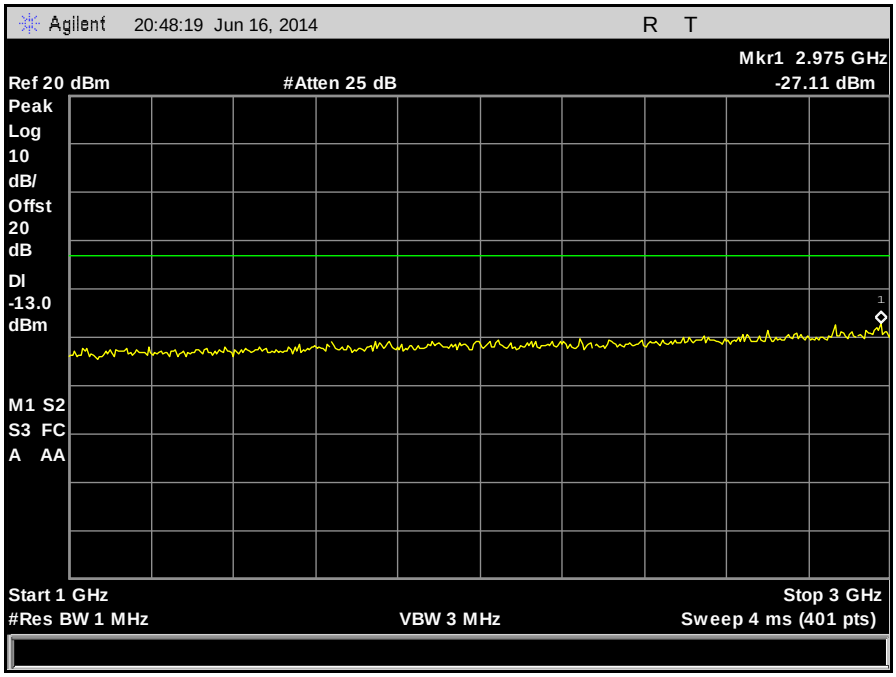
Plot 118. Conducted Spurious Emissions, High Power, 219 MHz, 25 kHz Bandwidth, 30 MHz - 1 GHz



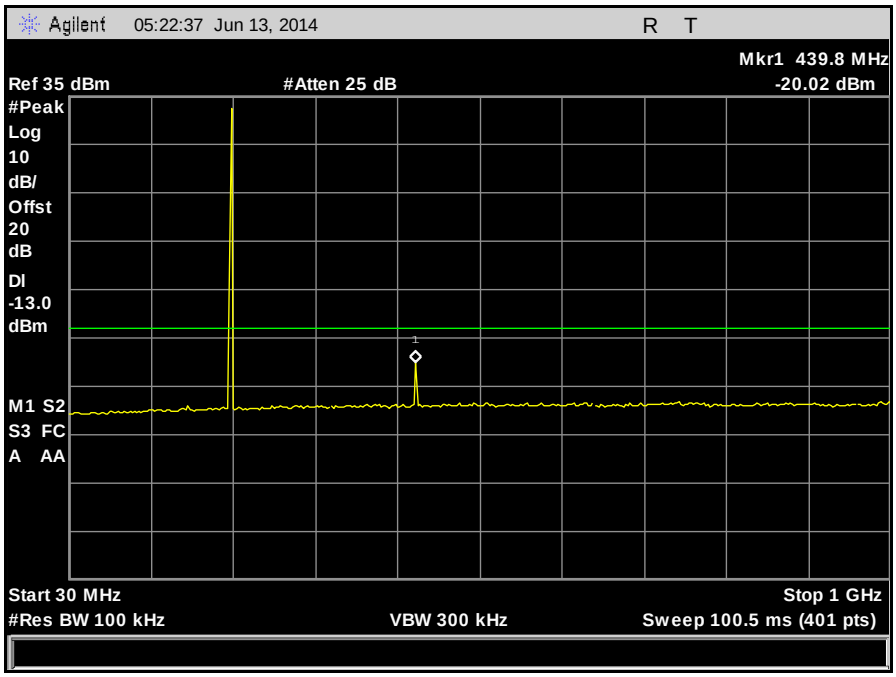
Plot 119. Conducted Spurious Emissions, High Power, 219 MHz, 25 kHz Bandwidth, 1 GHz - 3 GHz



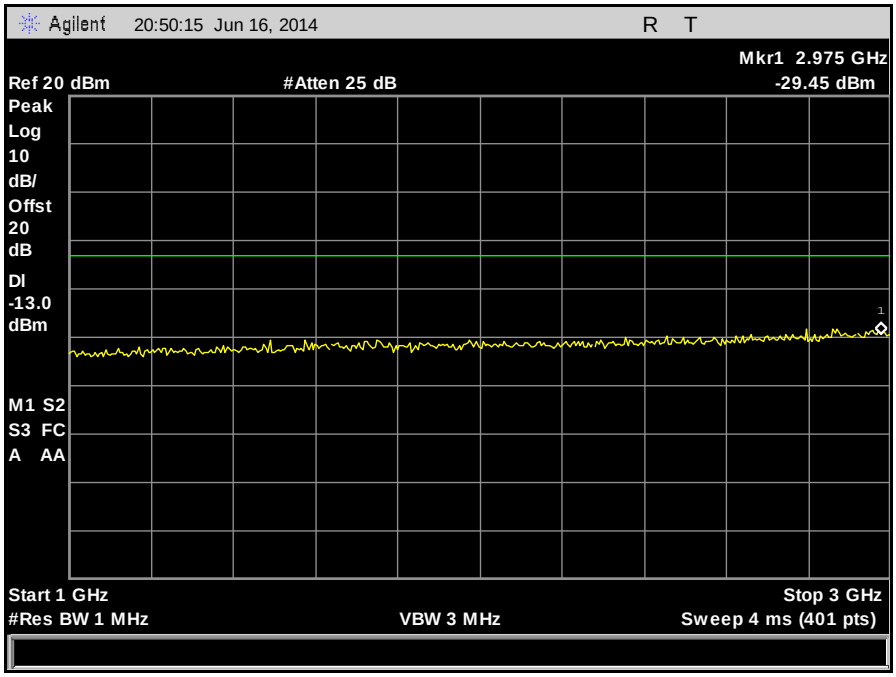
Plot 120. Conducted Spurious Emissions, Low Power, 219 MHz, 50 kHz Bandwidth, 30 MHz - 1 GHz



Plot 121. Conducted Spurious Emissions, Low Power, 219 MHz, 50 kHz Bandwidth, 1 GHz - 3 GHz



Plot 122. Conducted Spurious Emissions, High Power, 219 MHz, 50 kHz Bandwidth, 30 MHz - 1 GHz



Plot 123. Conducted Spurious Emissions, High Power, 219 MHz, 50 kHz Bandwidth, 1 GHz - 3 GHz

4.5. Frequency Stability

Test Requirement(s): **§2.1055 & 90.213**

Test Procedures: As required by 47 CFR 2.1055, *Frequency Stability measurements* were made at the RF output terminals using a direct connect to a Spectrum Analyzer.

The EUT was placed in the Environmental Chamber with the support equipment on the outside. The EUT was set to transmit at its mid channel using a CW carrier. The frequency drift was investigated for every 10°C increment until the unit was stabilized. Measurements were made using the frequency counter function of the spectrum analyzer.

Reference temperature was set at 20°C.

Test Results: Equipment complies with Section §2.1055 and §90.213.

Test Engineer(s): Jason Allnutt

Test Date(s): 06/18/14

Test Frequency (MHz)	Temperature (°C)	Voltage (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
217.05	-30	120	85	0.392	1
217.05	-20	120	17	0.078	1
217.05	-10	120	53	0.244	1
217.05	0	120	8	0.037	1
217.05	10	120	60	0.276	1
217.05	20	120	0	0.000	1
217.05	30	120	7	0.032	1
217.05	40	120	60	0.276	1
217.05	50	120	85	0.392	1
Test Frequency (MHz)	**Temperature (°C)**	**Voltage (VDC)**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Limit (ppm)**
217.05	20	102	90	0.415	1
217.05	20	120	0	0.000	1
217.05	20	138	72	0.332	1

Table 14. Frequency Stability, Test Results

4.6. Field Strength of Spurious Radiation

Test Requirement(s): **§2.1053 Measurements required: Field strength of spurious radiation.**

§ 2.1053 (a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of § 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

§ 2.1053 (b): The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.

(2) All equipment operating on frequencies higher than 25 MHz.

(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.

(4) Other types of equipment as required, when deemed necessary by the Commission.

Test Procedures: As required by 47 CFR §2.1053, *field strength of radiated spurious measurements* was made in accordance with the procedures of TIA/EIA-603-A-2001 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards".

Radiated emission measurements were performed inside a 3 meter semi-anechoic chamber. The EUT's RF ports were terminated to 50ohm load. The EUT was tested using both bandwidths and at the low, mid, and High Powers. The EUT was rotated about 360^0 and the receiving antenna scanned from 1-4m in order to capture the maximum emission. The plots are corrected for cable loss, antenna correction factor, and distance correction. The field strength was mathematically corrected to an E.I.R.P. Harmonic emissions up to the 10^{th} or 40GHz, which ever was the lesser, were investigated.

The spectrum analyzer was set to 1MHz RBW and 3MHz VBW above 1 GHz and 100 kHz RBW and 300 kHz VBW below 1 GHz. The spectrum was investigated from 30MHz to the 10^{th} harmonic of the carrier.

Test Results: Equipment complies with Section §2.1055 and §90.210.

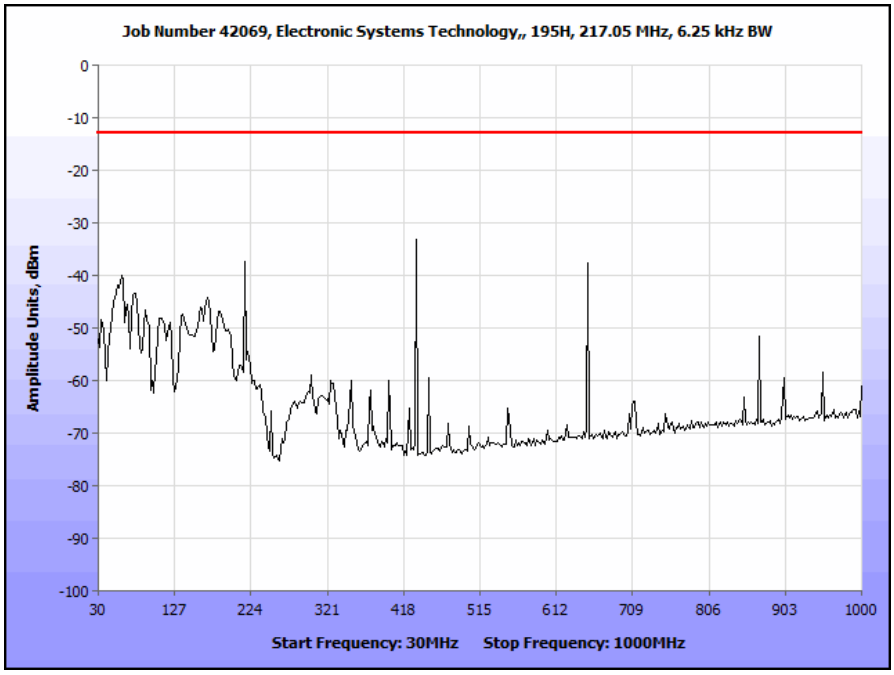
Test Engineer(s): Jason Allnutt

Test Date(s): 06/13/14

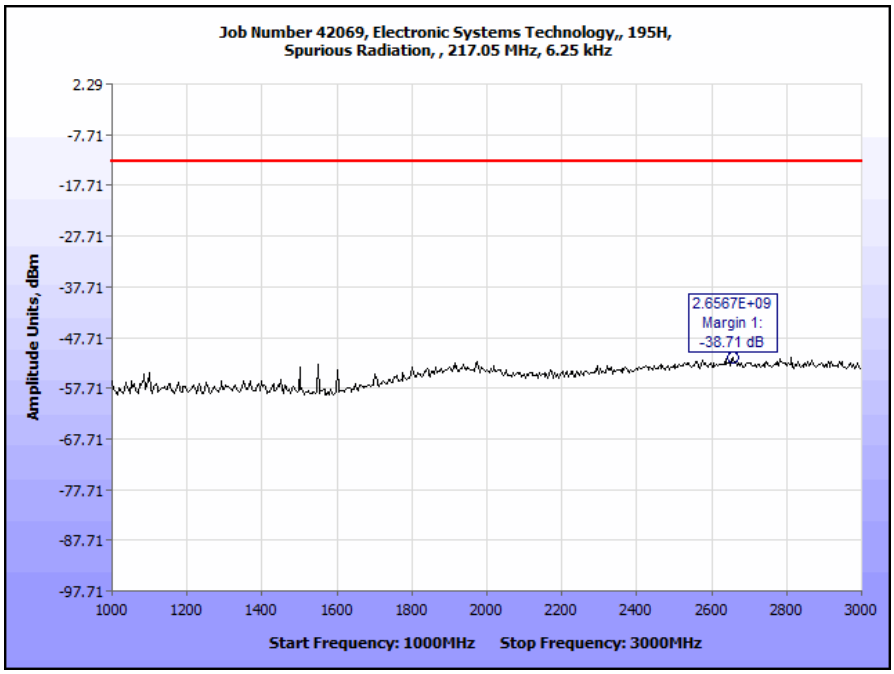
Frequency (MHz)	Bandwidth (kHz)	Under the Limit (Yes/No)
Less than 1 GHz		
217	6.25	Yes
217	12.5	Yes
217	25	Yes
217	50	Yes
218	6.25	Yes
218	12.5	Yes
218	25	Yes
218	50	Yes
219	6.25	Yes
219	12.5	Yes
219	25	Yes
219	50	Yes
1 GHz and Above		
217	6.25	Yes
217	12.5	Yes
217	25	Yes
217	50	Yes
218	6.25	Yes
218	12.5	Yes
218	25	Yes
218	50	Yes
219	6.25	Yes
219	12.5	Yes
219	25	Yes
219	50	Yes

Table 15. Radiated Spurious Emissions, Test Results

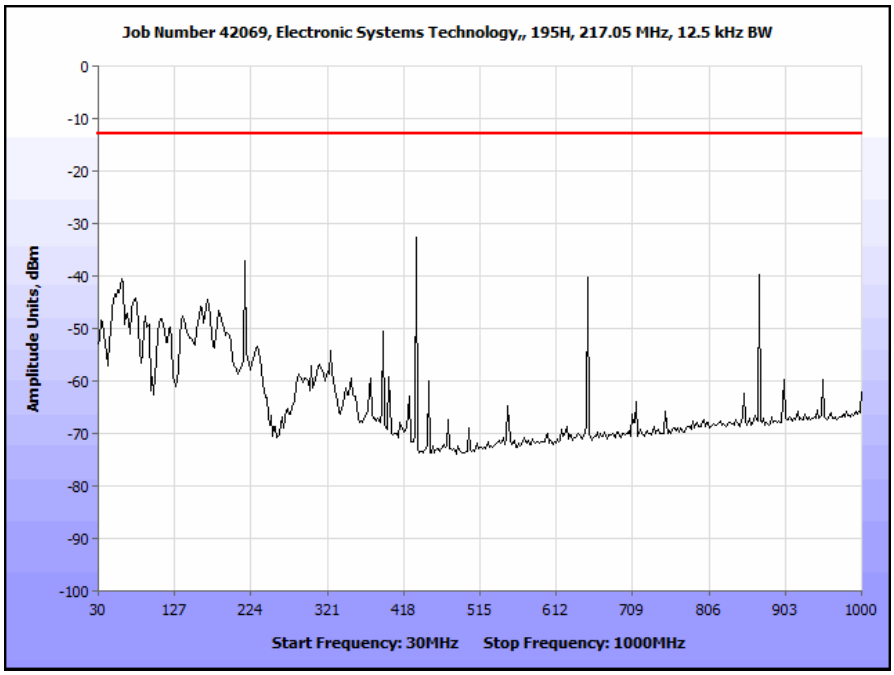
Radiated Spurious Emissions, 217 MHz



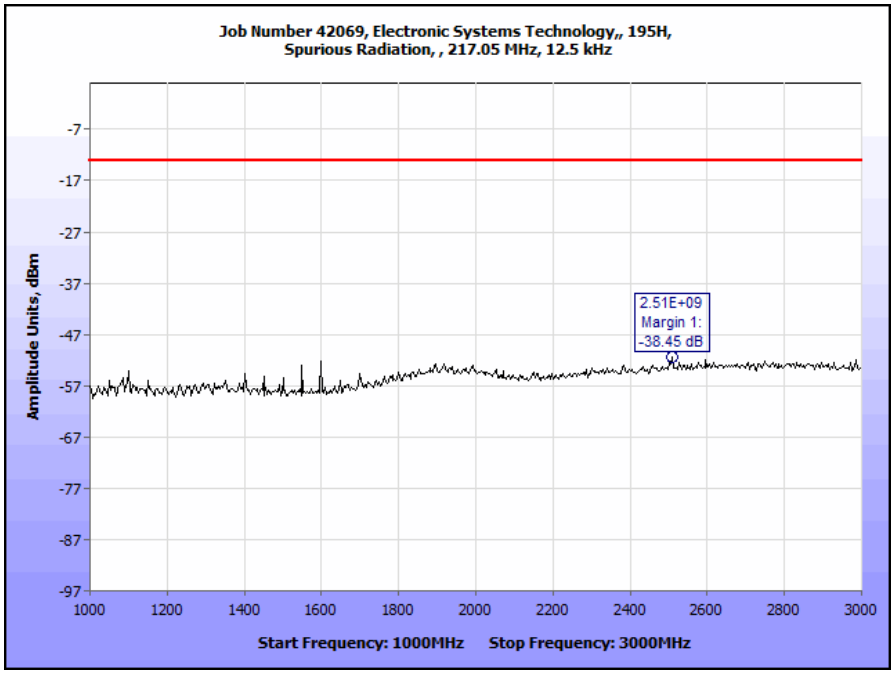
Plot 124. Radiated Spurious Emissions, 217 MHz, 6.25 kHz Bandwidth, 30 MHz - 1 GHz



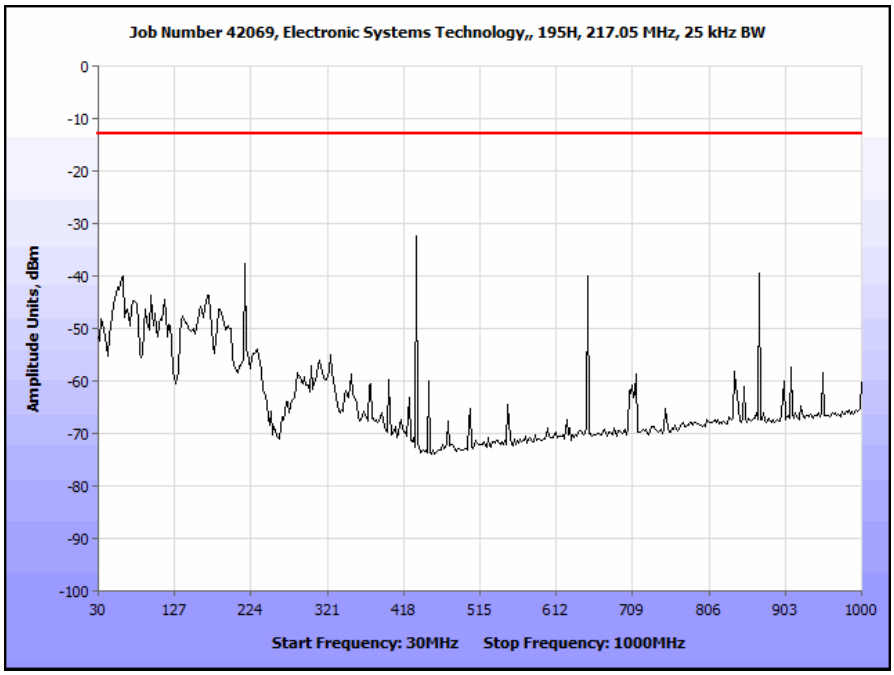
Plot 125. Radiated Spurious Emissions, 217 MHz, 6.25 kHz Bandwidth, 1 GHz - 3 GHz



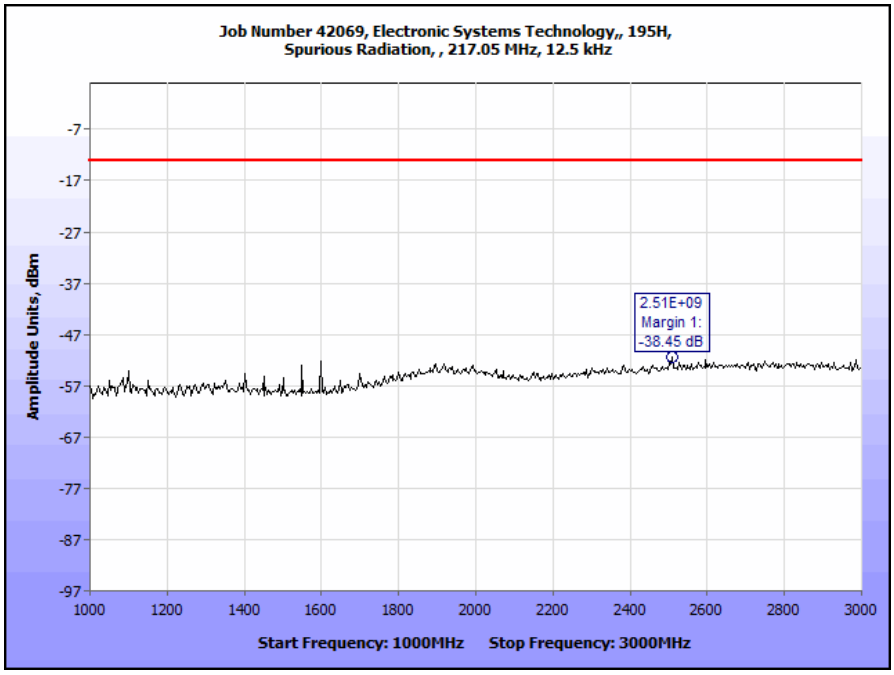
Plot 126. Radiated Spurious Emissions, 217 MHz, 12.5 kHz Bandwidth, 30 MHz - 1 GHz



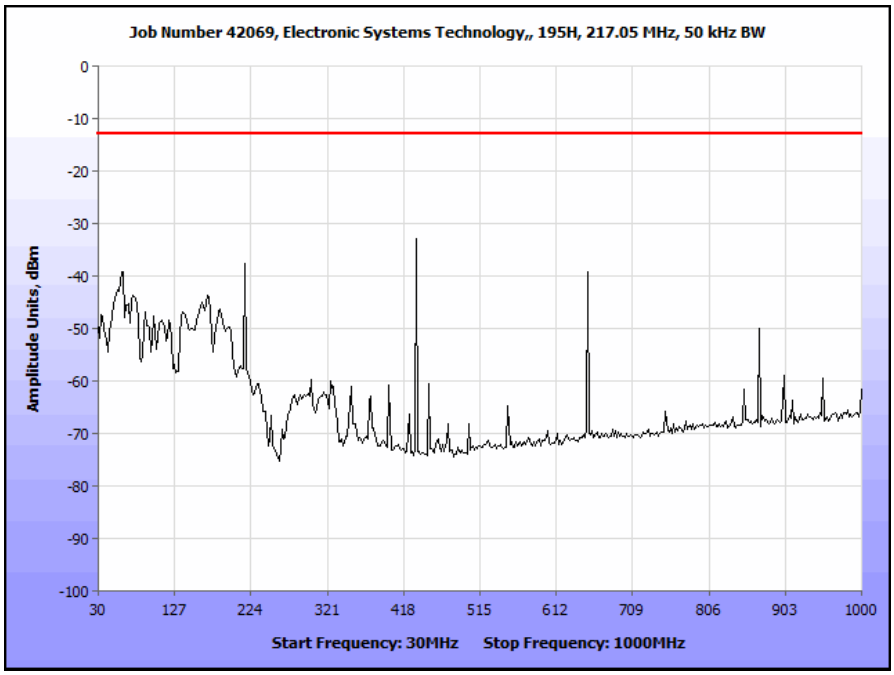
Plot 127. Radiated Spurious Emissions, 217 MHz, 12.5 kHz Bandwidth, 1 GHz - 3 GHz



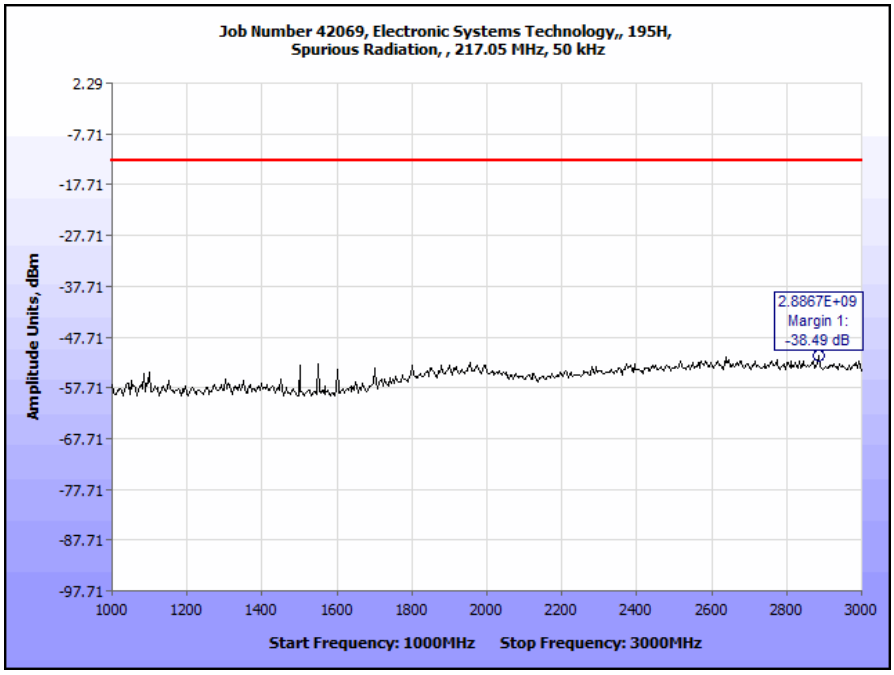
Plot 128. Radiated Spurious Emissions, 217 MHz, 25 kHz Bandwidth, 30 MHz - 1 GHz



Plot 129. Radiated Spurious Emissions, 217 MHz, 25 kHz Bandwidth, 1 GHz - 3 GHz

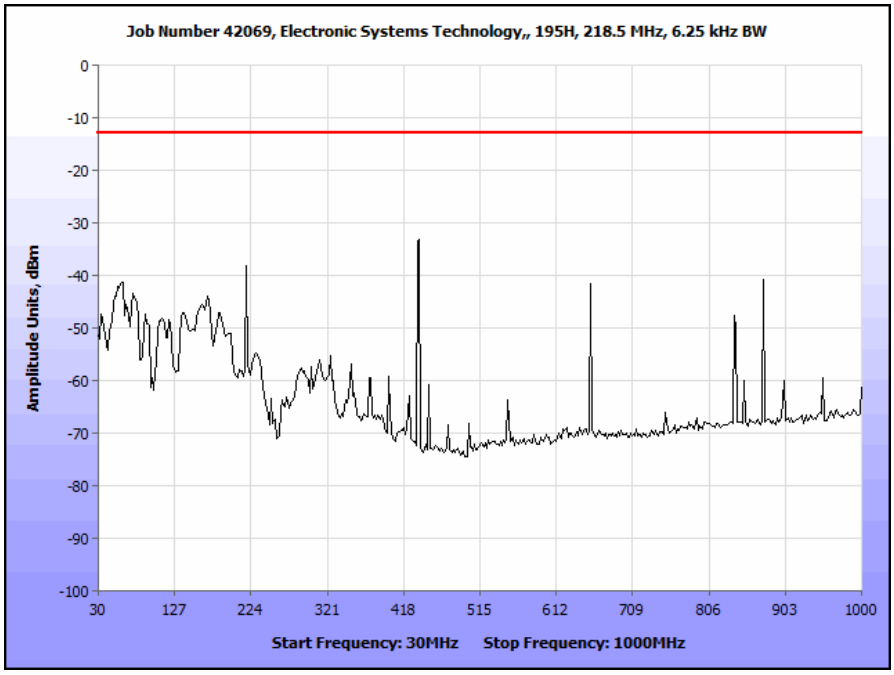


Plot 130. Radiated Spurious Emissions, 217 MHz, 50 kHz Bandwidth, 30 MHz - 1 GHz

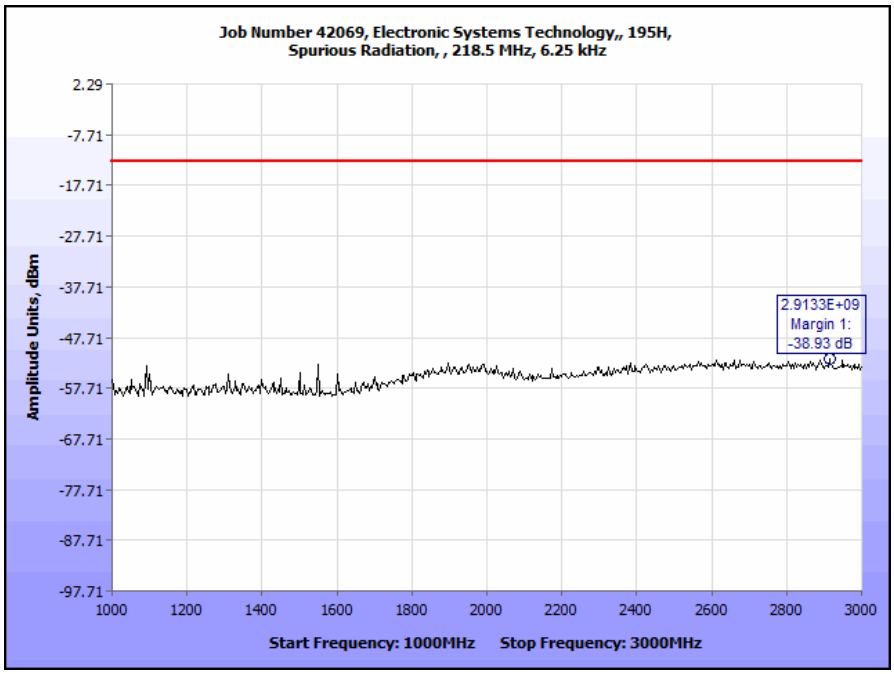


Plot 131. Radiated Spurious Emissions, 217 MHz, 50 kHz Bandwidth, 1 GHz - 3 GHz

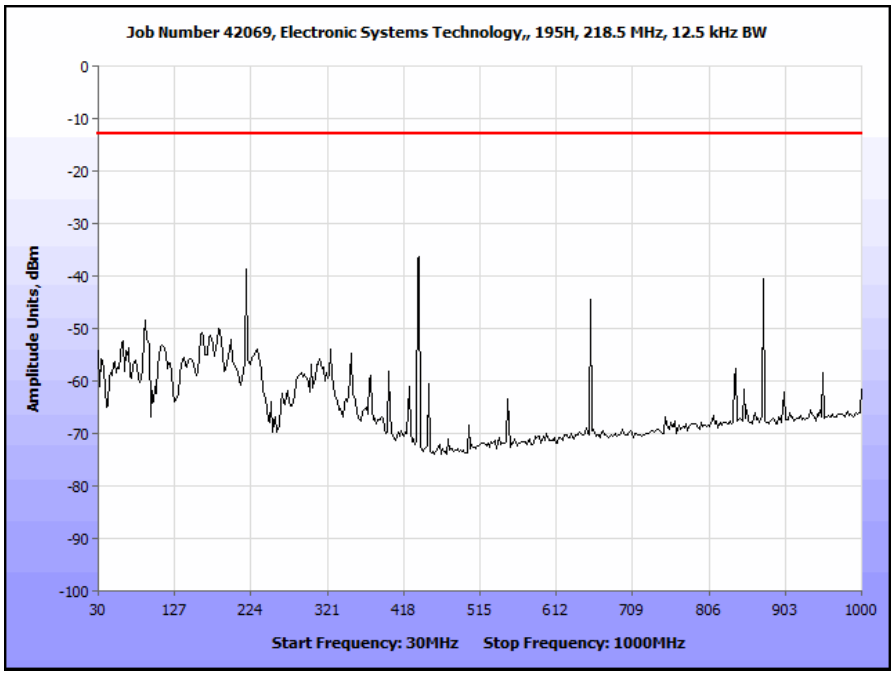
Radiated Spurious Emissions, 218 MHz



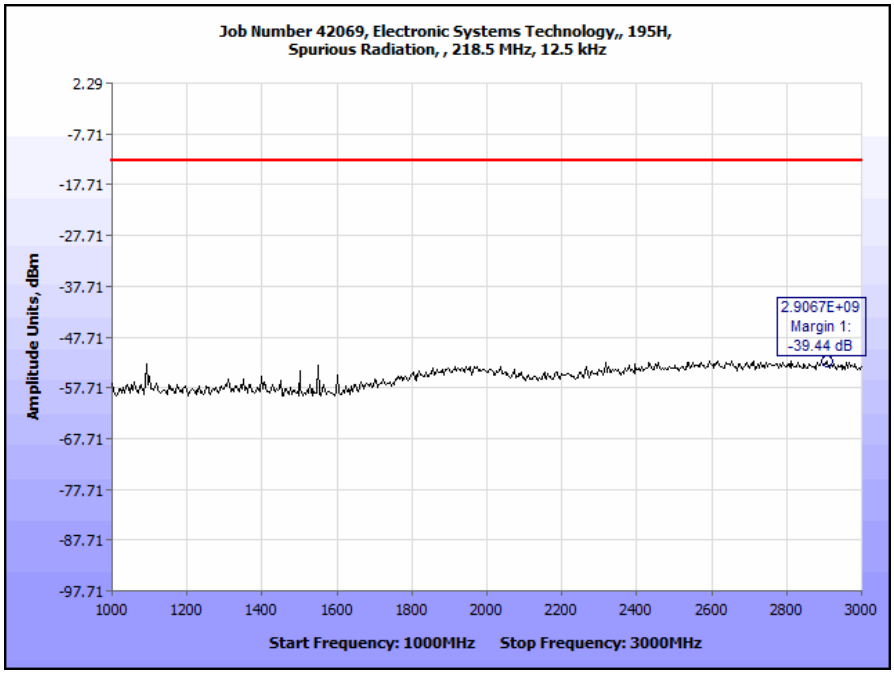
Plot 132. Radiated Spurious Emissions, 218 MHz, 6.25 kHz Bandwidth, 30 MHz - 1 GHz



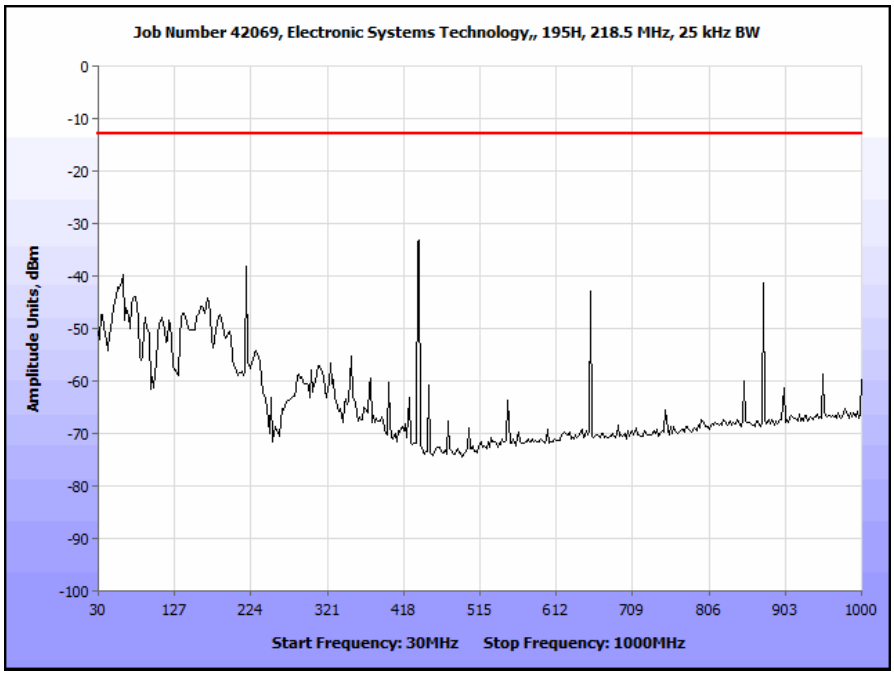
Plot 133. Radiated Spurious Emissions, 218 MHz, 6.25 kHz Bandwidth, 1 GHz - 3 GHz



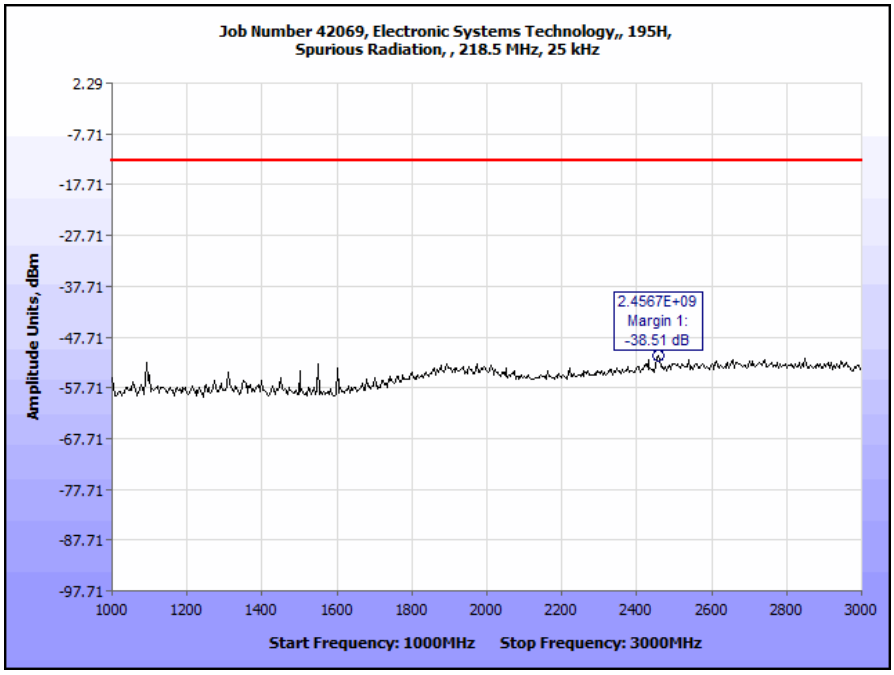
Plot 134. Radiated Spurious Emissions, 218 MHz, 12.5 kHz Bandwidth, 30 MHz - 1 GHz



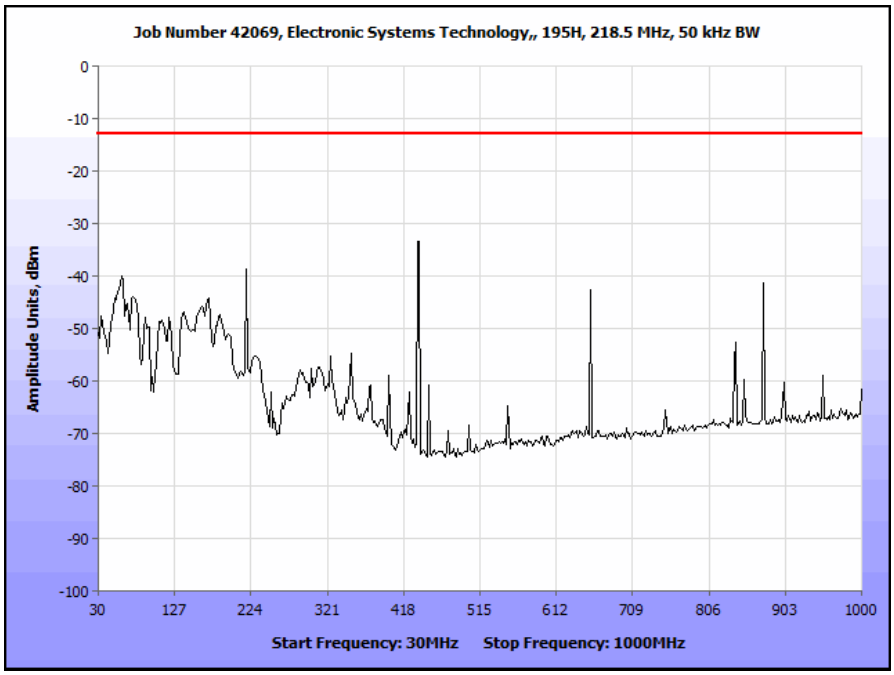
Plot 135. Radiated Spurious Emissions, Low Power, 12.5 kHz Bandwidth, 1 GHz - 3 GHz



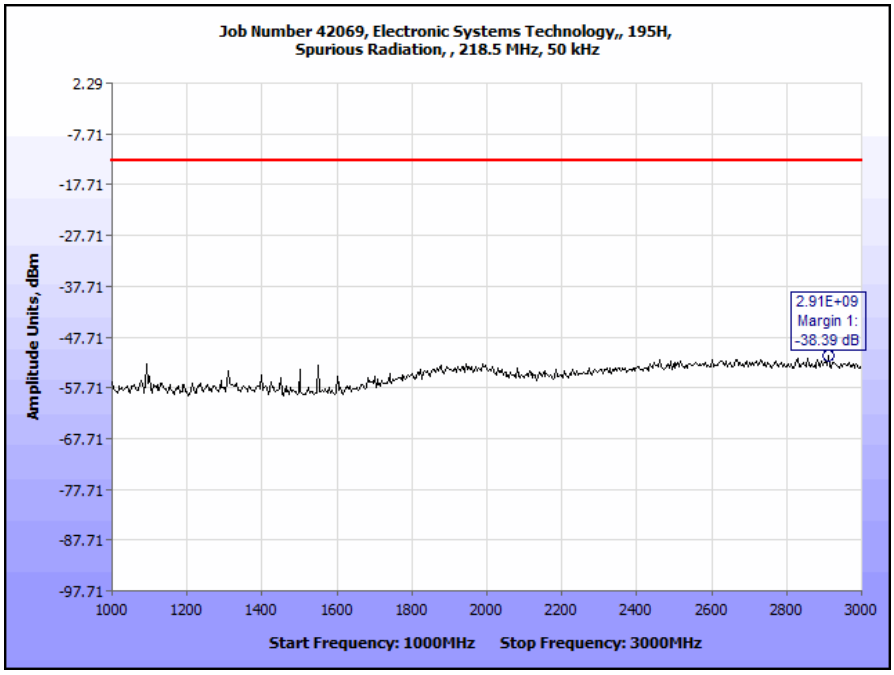
Plot 136. Radiated Spurious Emissions, 218 MHz, 25 kHz Bandwidth, 30 MHz - 1 GHz



Plot 137. Radiated Spurious Emissions, 218 MHz, 25 kHz Bandwidth, 1 GHz - 3 GHz

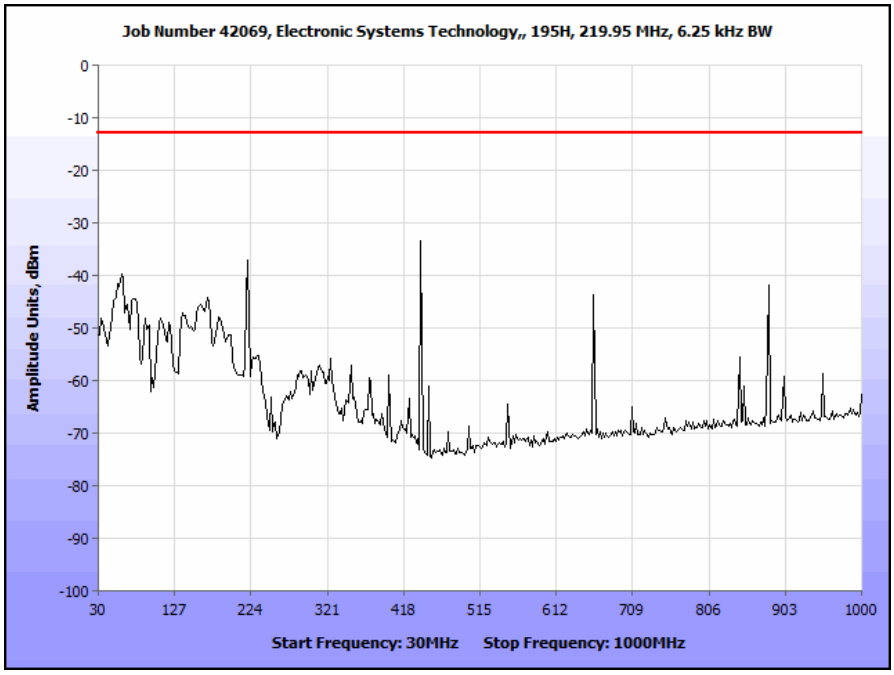


Plot 138. Radiated Spurious Emissions, 218 MHz, 50 kHz Bandwidth, 30 MHz - 1 GHz

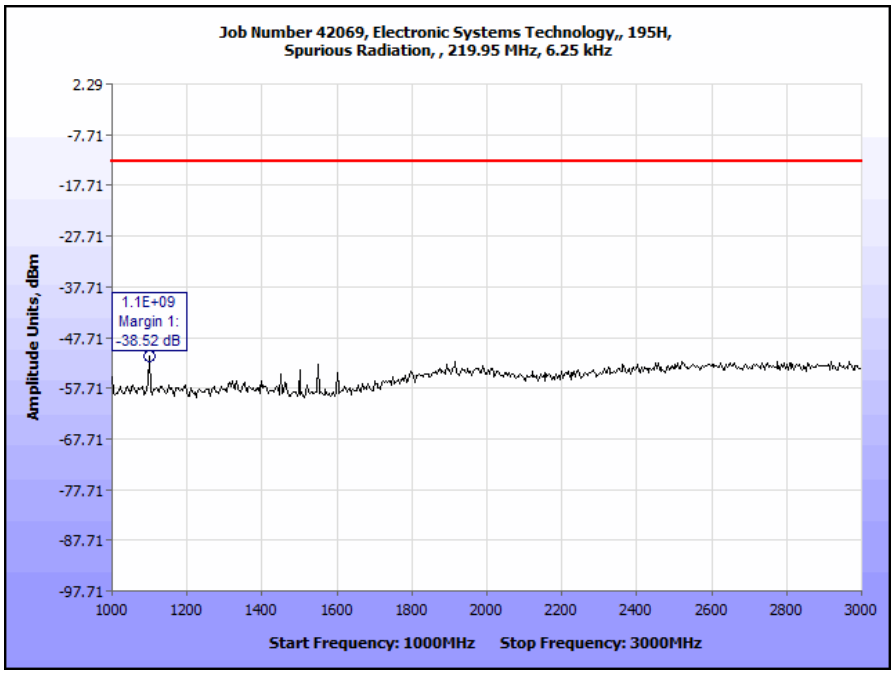


Plot 139. Radiated Spurious Emissions, 218 MHz, 50 kHz Bandwidth, 1 GHz - 3 GHz

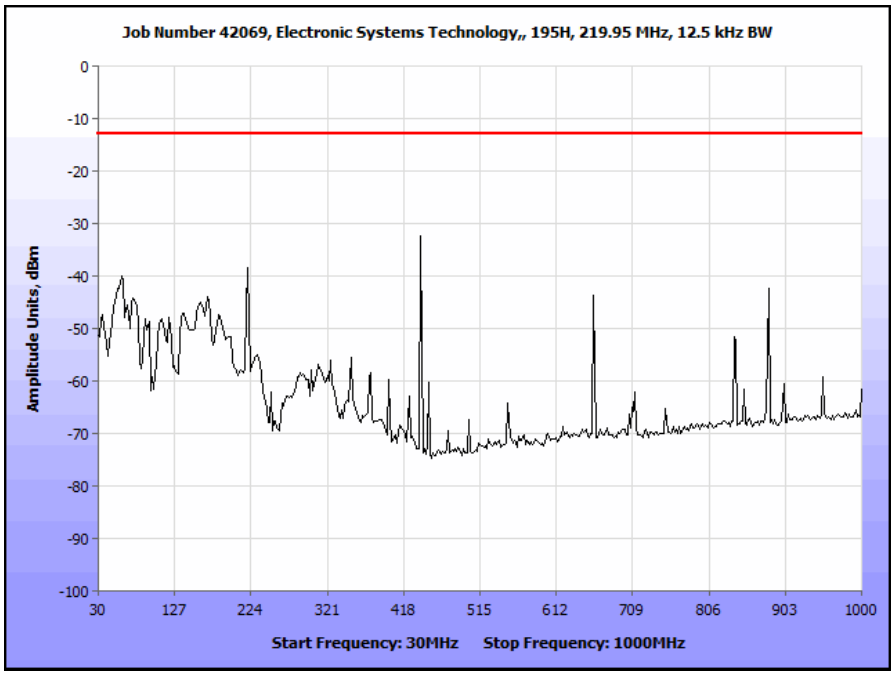
Radiated Spurious Emissions, 219 MHz



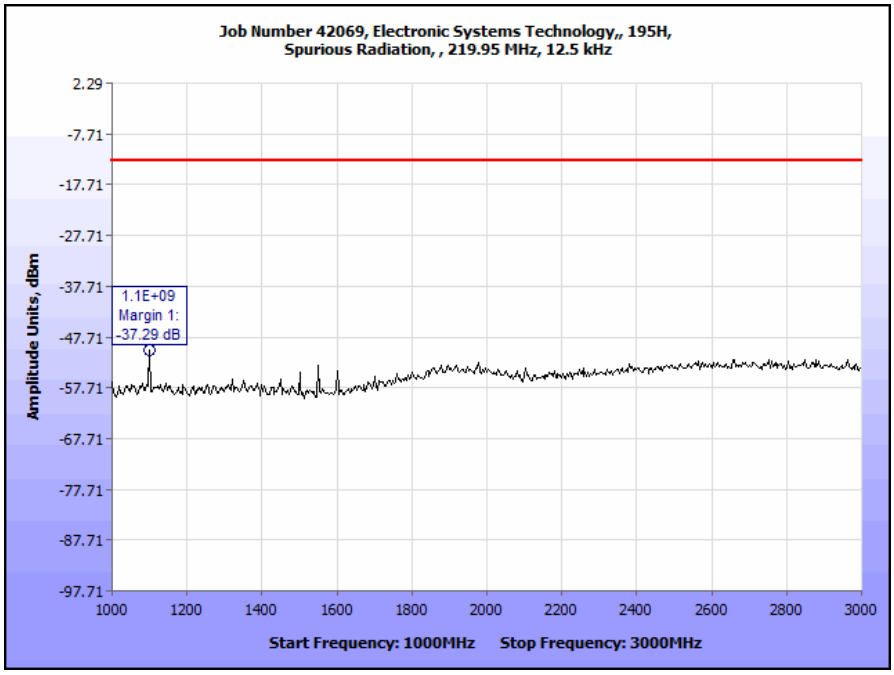
Plot 140. Radiated Spurious Emissions, 219 MHz, 6.25 kHz Bandwidth, 30 MHz - 1 GHz



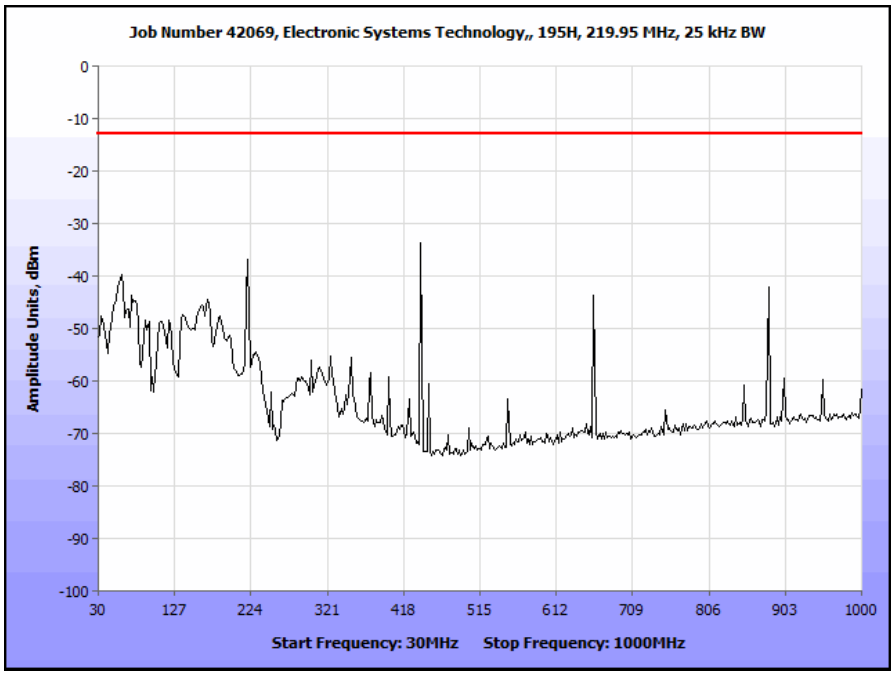
Plot 141. Radiated Spurious Emissions, 219 MHz, 6.25 kHz Bandwidth, 1 GHz - 3 GHz



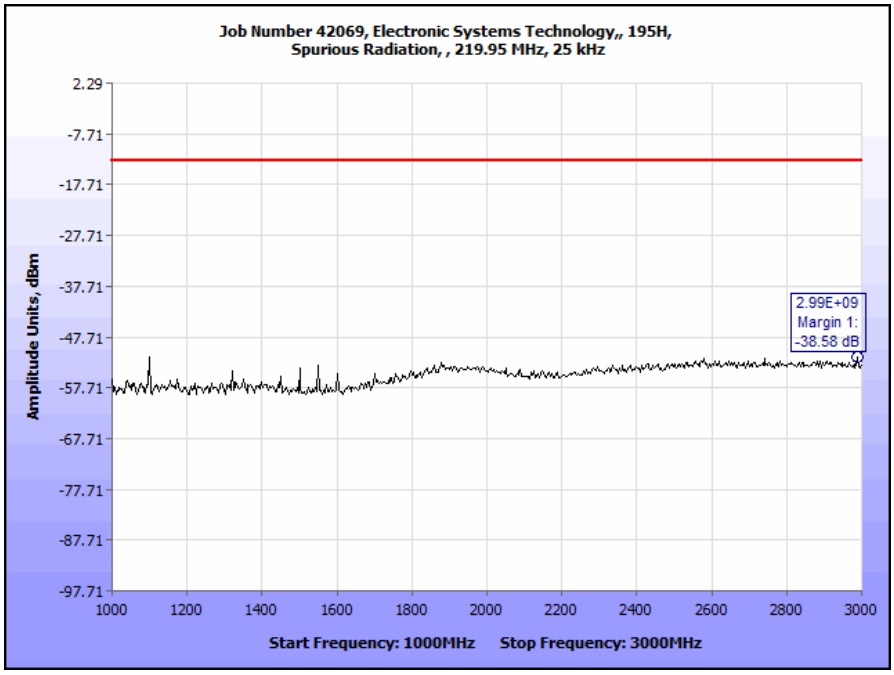
Plot 142. Radiated Spurious Emissions, 219 MHz, 12.5 kHz Bandwidth, 30 MHz - 1 GHz



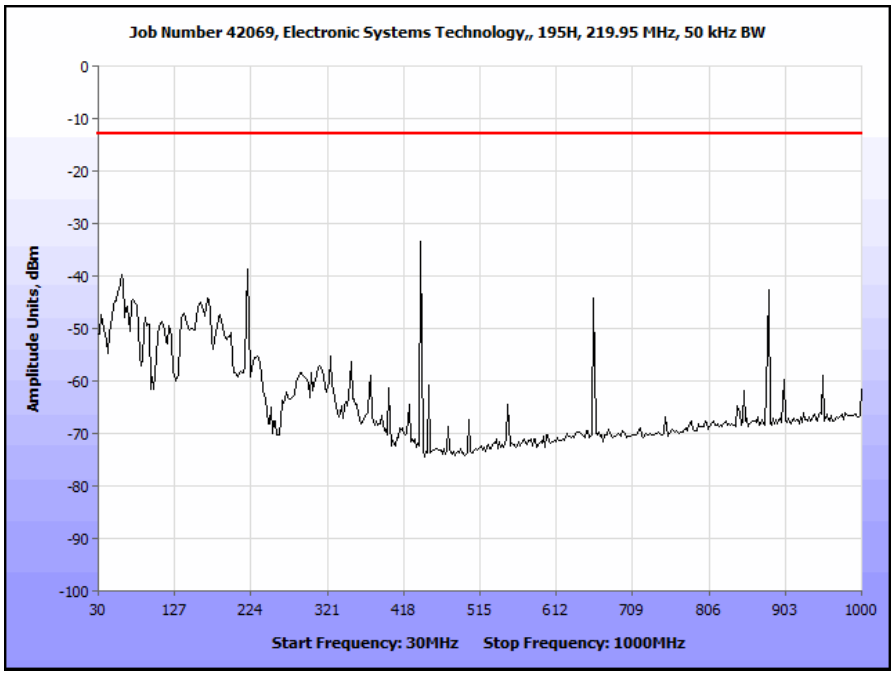
Plot 143. Radiated Spurious Emissions, 219 MHz, 12.5 kHz Bandwidth, 1 GHz - 3 GHz



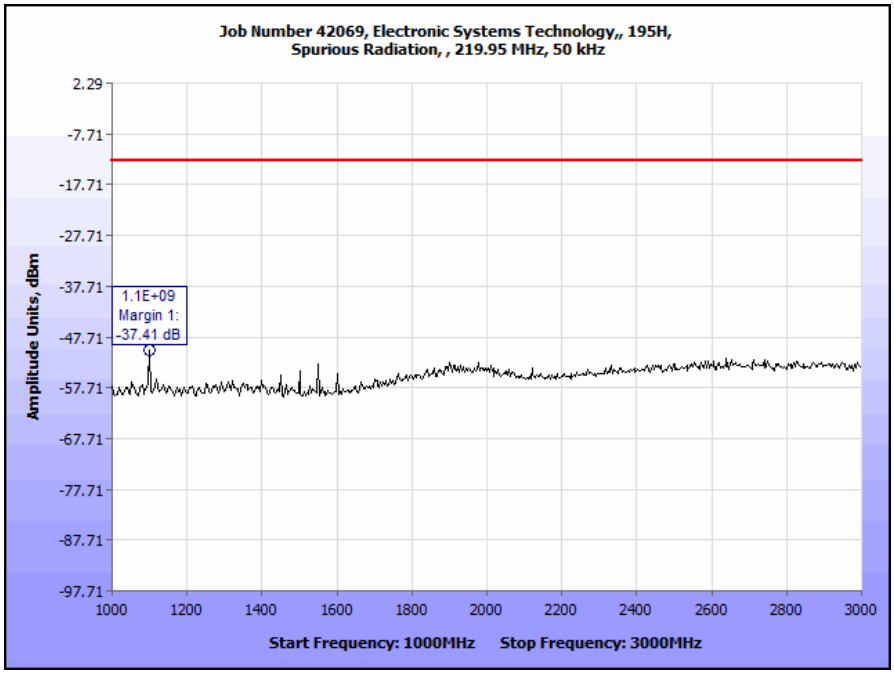
Plot 144. Radiated Spurious Emissions, 219 MHz, 25 kHz Bandwidth, 30 MHz - 1 GHz



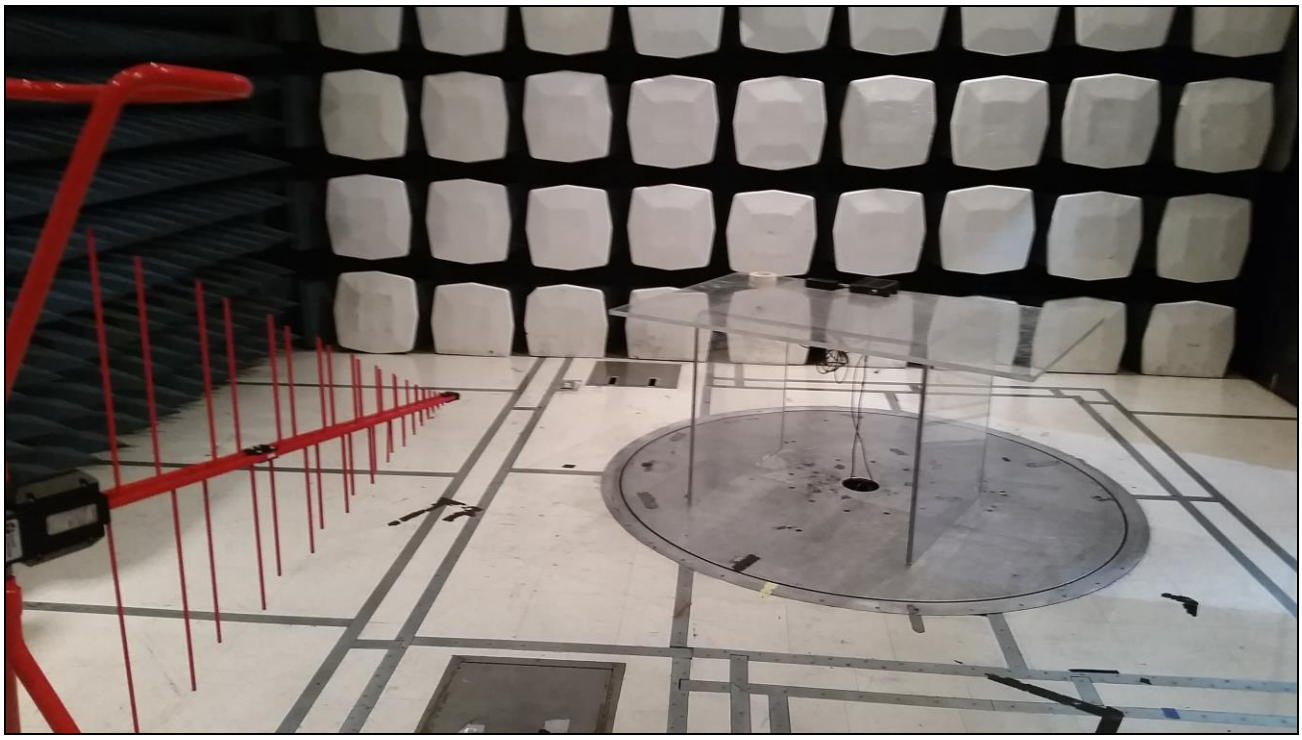
Plot 145. Radiated Spurious Emissions, 219 MHz, 25 kHz Bandwidth, 1 GHz - 3 GHz



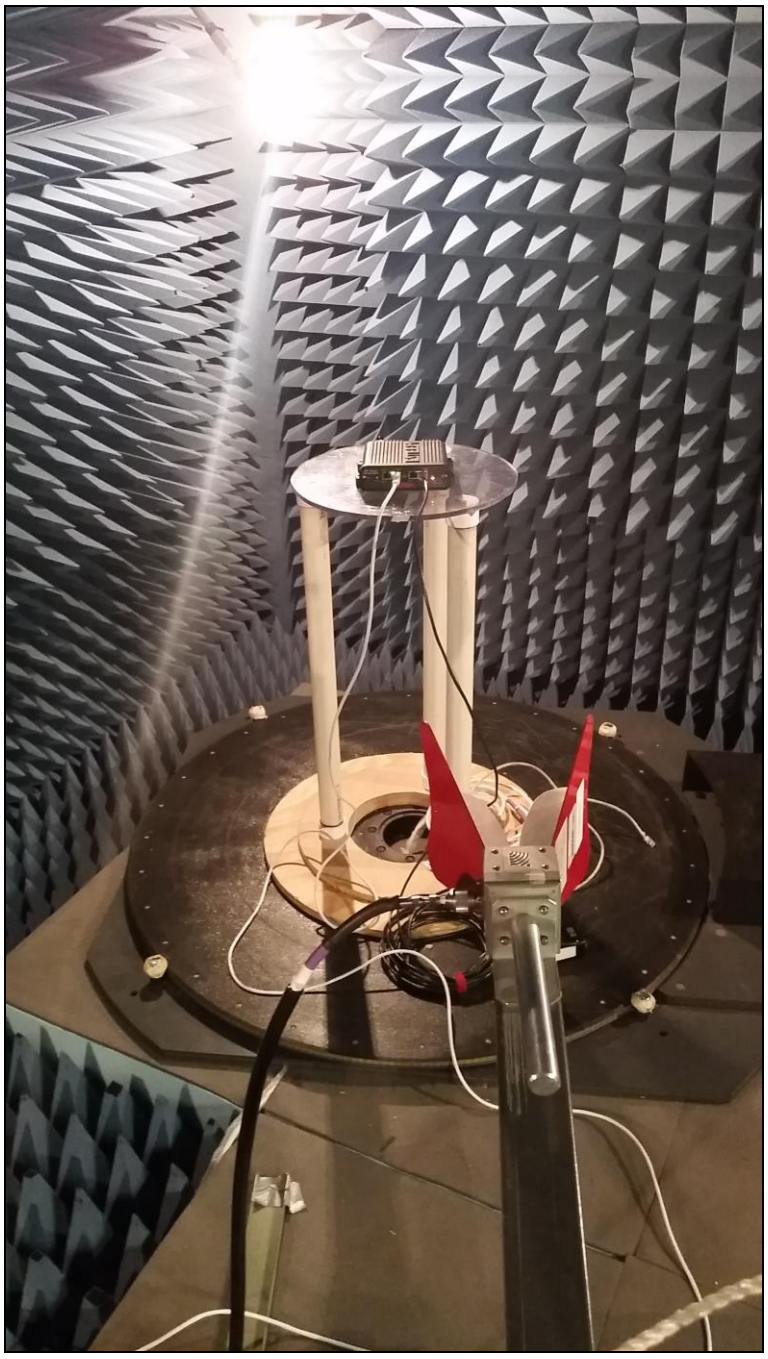
Plot 146. Radiated Spurious Emissions, 219 MHz, 50 kHz Bandwidth, 30 MHz - 1 GHz



Plot 147. Radiated Spurious Emissions, 219 MHz, 50 kHz Bandwidth, 1 GHz - 3 GHz



Photograph 4. Radiated Spurious Emissions, Test Setup, 30 MHz – 1 GHz



Photograph 5. Radiated Spurious Emissions, Test Setup, Above 1 GHz

V. Test Equipment

5. 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
1T4502	COMB GENERATOR	COM-POWER	CGC-255	03/31/2014	10/01/2015
1T4563	LISN (10 AMP)	SOLAR ELECTRONICS	9322-50-R-10-BNC	11/27/2012	06/27/2014
1T4642	TRANSFORMER - BIPHASE	SIGNAL TRANSFORMER	DU-1	SEE NOTE	
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	07/16/2012	07/16/2014
1T4751	ANTENNA - BILOG	SUNOL SCIENCES	JB6	01/08/2013	07/08/2014
1T4300C	SEMI-ANECHOIC 3M CHAMBER # 1 (VCCI)	EMC TEST SYSTEMS	NONE	01/31/2012	01/31/2015
1T4771	PSA SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4446A	02/15/2013	08/15/2014
1T4442	PRE-AMPLIFIER, MICROWAVE	MITEQ	AFS42-01001800-30-10P	SEE NOTE	
1T4483	ANTENNA; HORN	ETS-LINDGREN	3117	02/28/2014	08/28/2015
1T4505	TEMPERATURE CHAMBER	TEST EQUITY	115	01/05/2014	01/05/2015
1T4548	AC POWER SOURCE	CALIFORNIA INSTRUMENTS	1251P	SEE NOTE	

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

VI. Certification & User's Manual Information

6. Certification Label & User's Manual Information

6.1. 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 provision that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart Y — 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, whichever is applicable.

§ 2.902 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.

§ 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.

6.2. 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.

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 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