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

914 WEST PATAPSCO AVENUE ● BALTIMORE, MARYLAND 21230-3432 ● PHONE (410) 354-3300 ● FAX (410) 354-3313
33439 WESTERN AVENUE ● UNION CITY, CALIFORNIA 94587 ● PHONE (510) 489-6300 ● FAX (510) 489-6372
3162 BELICK STREET ● SANTA CLARA, CALIFORNIA 95054 ● PHONE (408) 748-3585 ● FAX (510) 489-6372
13301 MCCALLEN PASS ● AUSTIN, TEXAS 78753 ● PHONE (512) 287-2500 ● FAX (512) 287-2513

April 16, 2014

Harris RF Communications
221 Jefferson Ridge Pkwy.
Lynchburg, VA 24501

Dear Tony Bond,

Enclosed is the EMC Wireless test report for compliance testing of the Harris RF Communications, MASTR V, Model: SV-RTXMV, tested to the requirements of Title 47 of the Code of Federal Regulations (CFR), Part 90 and Industry Canada RSS-119, Issue 11, June 2011 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: (\Harris RF Communications\EMC40588-FCC90 Rev. 1)

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Electromagnetic Compatibility Criteria
Class II Permissive Change Test Report

For the

Harris RF Communications
MASTR V, Model: SV-RTXMV

Tested under

The FCC Verification Rules
Contained in Title 47 of the CFR, Part 90
and
RSS-119, Issue 11, June 2011
for Private Land Mobile Radio Services

MET Report: EMC40588-FCC90 Rev. 1

April 16, 2014

Prepared For:
Harris RF Communications
221 Jefferson Ridge Pkwy.
Lynchburg, VA 24501

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

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MET Report: EMC40588-FCC90 Rev. 1

Ben Taylor, 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 90 of the FCC Rules and RSS-119 of the Industry Canada standards under normal use and maintenance.

Asad Bajwa,
Director, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	April 14, 2014	Initial Issue.
1	April 16, 2014	Revised to reflect engineer 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

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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 Part 90. All tests were conducted using measurement procedure ANSI TIA/EIA-603-A-2004.

FCC Reference	Industry Canada References	Description	Compliance
§2.1046; §90.1215(a)	RSS-119 Section 5.4	RF Power Output	Compliant
§2.1047	N/A	Modulation Characteristics	Not Applicable – Digital voice only.
§2.1047	N/A	Audio Response	Not Applicable – Digital voice only.
§2.1049; §90.210(D)	RSS-119 Section 5.5	Occupied Bandwidth	Compliant
§2.1051; §90.210(D)	RSS-119 Section 5.8	Conducted Spurious Emissions & Emission Mask at Antenna Terminals	Compliant
§2.1053; §90.210(D)	RSS-119 Section 5.8	Radiated Spurious Emissions from Cabinet	Compliant
§2.1055; §90	RSS-119 Section 5.3	Frequency Stability	Compliant
§90. 214	RSS-119 Section 5.9	Transient Frequency Behavior	Compliant

II. Equipment Configuration

2. Equipment Configuration

2.1. Overview

MET Laboratories, Inc. was contracted by Harris RF Communications to perform testing on the MASTR V, Model: SV-RTXMV under quote number 1138488.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Harris RF Communications., MASTR V, Model: SV-RTXMV.

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. Harris RF Communications 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:	MASTR V, model SV-RTXMV	
Model(s) Covered:	MASTR V, model SV-RTXMV	
Filing Option:	Original	
EUT Specifications:	Primary Power Source: 110 VAC, 60 Hz	
	FCC ID: OWDTR-0129-E IC: 3636B-0129	
	Type of Modulations:	C4FM, CQPSK, HDQPSK
	Equipment Code:	TNB
	EUT Frequency Ranges:	420 MHz – 430 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:	Ben Taylor	
Report Date(s):	April 16, 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 MASTR V is a Radio Base Station/Repeater designed for communications in the Land Mobile Radio environment. The primary communication users are Public Safety, Utility and Military Commercial Off The Shelf.

2.4. Equipment Configuration

Ref. ID	Slot #	Name / Description	Model Number	Serial Number	Rev. #
Tx #1	1	Transmit Module #1	EA-555008-006	HR0806210022	5
Tx #2	3	Transmit Module #2	EA-555008-006	HR0806210023	5
Tx #3	8	Transmit Module #3	EA-555008-006	HR0806210026	5
Tx #4	10	Transmit Module #4	EA-555008-006	HR0806210027	5
PA #1	1	Linear Power Amplifier #1	PA: EA-555010-006 LIN: EA-555009-006	CR0006306258 HR0906210030	3 3
PA #2	2	Linear Power Amplifier #2	PA: EA-555010-006 LIN: EA-555009-006	CR0006306273 HR0906210027	3 3
PA #3	3	Linear Power Amplifier #3	PA: EA-555010-006 LIN: EA-555009-006	CR0006306262 HR0906210026	3 3
PA #4	4	Linear Power Amplifier #4	PA: EA-555010-006 LIN: EA-555009-006	CR0006306275 HR0906210025	3 3
Rx #1	2	Receive Module #1	EA-555007-006	HR0706210042	2
Rx #2	4	Receive Module #2	EA-555007-006	HR0706210041	2
Rx #3	9	Receive Module #3	EA-555007-006	HR0706210025	2
Rx #4	11	Receive Module #4	EA-555007-006	HR0706210038	2
BB #1	5	Baseband Module #1	EA-555005-001	EP5199D03340	D
BB #2	12	Baseband Module #2	EA-555005-001	EP5199D03335	D
TC #1	6	Traffic Controller #1	EA-555004-001	EP5197B00171	B
TC #2	7	Traffic Controller #2	EA-555004-001	EP5197B-0001	B
TC #3	13	Traffic Controller #3	EA-555004-001	EP5197001458	D
TC #4	14	Traffic Controller #4	EA-555004-001	EP5197001438	D
ES #1	S2	E-Switch (Primary)	EA-555012-001	EP5198000342	D
ES #2	S1	E-Switch (Redundant)	EA-555012-001	EP5198000343	D
PS #1	1	Power Supply #1	EA-555011-001	XH11236	C
PS #2	2	Power Supply #2	EA-555011-001	XH11296	C
PS #3	3	Power Supply #3	EA-555011-001	XE71719	C
PS #4	4	Power Supply #4	EA-555011-001	XE71463	C

Table 1. Equipment Configuration

2.5. Support Equipment

Harris RF Communications supplied support equipment necessary for the operation and testing of the MASTR V, Model: SV-RTXMV. All support equipment supplied is listed in the following Support Equipment List.

Ref. ID	Name / Description	Manufacturer	Model Number	Serial Number
N/A	Handheld Barcode Scanner	HP	LS2208-SR20361RSBRE	None
N/A	100 Watt Dummy Load (qty 4)	N/A	N/A	None

Table 2. 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)	Max Length (m)	Shielded? (Y/N)	Termination Box ID & Port Name
PA #1	RF Out	Coaxial Cable	1	1		Y	100W Dummy Load
PA #2	RF Out	Coaxial Cable	1	1		Y	100W Dummy Load
PA #3	RF Out	Coaxial Cable	1	1		Y	100W Dummy Load
PA #4	RF Out	Coaxial Cable	1	1		Y	100W Dummy Load
Rx #1	RF In	Cable to pre-selector	1	1.5		Y	50Ω Dummy Load
Rx #1	Audio	none, bench test only	0	-		-	-
Rx #2	RF In	Cable to pre-selector	1	-		Y	50Ω Dummy Load
Rx #2	Audio	none, bench test only	0	-		-	-
Rx #3	RF In	Cable to pre-selector	1	-		Y	50Ω Dummy Load
Rx #3	Audio	none, bench test only	0	-		-	-
Rx #4	RF In	Cable to pre-selector	1	-		Y	50Ω Dummy Load
Rx #4	Audio	none, bench test only	0	-		-	-
BB #1	M-LAN	Ethernet Cable, CAT5	0	-		-	
BB #1	Simulcast	15-Conductor Cable	0	-		-	
BB #1	COMM	none, test/local control	0	-		-	
BB #1	Ref In	none, terminated	0	-		-	
BB #2	M-LAN	Ethernet Cable, CAT5	0	-		-	
BB #2	Simulcast	15-Conductor Cable	0	-		-	
BB #2	COMM	none, test/local control	0	-		-	
BB #2	Ref In	none, terminated	0	-		-	
TC #1	M-LAN	Ethernet Cable, CAT5	0	-		-	
TC #1	P-LAN	Ethernet Cable, CAT5	0	-		-	
TC #1	COMM	none, test/local prog	0	-		-	
TC #2	M-LAN	Ethernet Cable, CAT5	0	-		-	
TC #2	P-LAN	Ethernet Cable, CAT5	0	-		-	
TC #2	COMM	none, test/local prog	0	-		-	
TC #3	M-LAN	Ethernet Cable, CAT5	0	-		-	
TC #3	P-LAN	Ethernet Cable, CAT5	0	-		-	
TC #3	COMM	none, test/local prog	0	-		-	

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty	Length as tested (m)	Max Length (m)	Shielded? (Y/N)	Termination Box ID & Port Name
TC #4	M-LAN	Ethernet Cable, CAT5	0	-		-	
TC #4	P-LAN	Ethernet Cable, CAT5	0	-		-	
TC #4	COMM	none, test/local prog	0	-		-	
PS #1	A/C In	A/C Power Cord	1	1		N	110 VAC Power
PS #1	5V,12V VDC AUX	none, unused	0	-		-	-
PS #2	A/C In	A/C Power Cord	1	1		N	110 VAC Power
PS #2	5V,12V VDC AUX	none, unused	0	-		-	-
PS #3	A/C In	A/C Power Cord	1	1		N	110 VAC Power
PS #3	5V,12V VDC AUX	none, unused	0	-		-	-
PS #4	A/C In	A/C Power Cord	1	1		N	110 VAC Power
PS #4	5V,12V VDC AUX	none, unused	0	-		-	-
TP	Test Port	none, unused	0	-		-	on Backplane

Table 3. Ports and Cabling Information

2.7. Mode of Operation

The MASTR V can generate internal Test Patterns for each modulation mode, selecting the mode and enabling the transmitter is controller with a Bar Code Scanner connected via a standard Laptop PC to M-LAN port of the Baseband Module. No special software is required; all the commands can be sent using a Telnet session.
There are three modes of operation:

P25 Phase I – modulation C4FM
P25 Linear Simulcast – modulation WCQPSK
P25 Phase II – modulation HDQPSK

2.8. Method of Monitoring EUT Operation

A "STATUS" LED is part of each of the following modules: Tx Module, PA Module, Rx Module, Baseband Module, Traffic Controller and E-Switch. A Red indication on the "STATUS" LED of the Tx, PA, or Rx modules indicates that the module is not functioning properly and the associated channel is taken "Out Of Service".

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 Harris RF Communications upon completion of testing.

III. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility RF Power Output Requirements

3.1. § 2.1046 RF Power Output

Test Requirements: **§2.1046 Measurements required: RF power output:**

§2.1046 (a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8).The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

§2.1046 (b) For single sideband, independent sideband, and single channel, controlled carrier radiotelephone transmitters, the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as specified and as applicable in § 2.1046 (b) (1-5). In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.

§2.1046 (c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

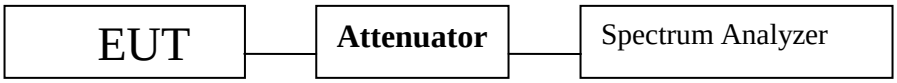
RSS-119 Issue 11 June 2011, Section 5.4 The output power shall be within ±1.0 dB of the manufacturer's rated power.

Test Procedures: As required by 47 CFR 2.1046, RF power output measurements were made at the RF output terminals using an attenuator and spectrum analyzer or power meter. This test was performed in all applicable modulations and power output configurations.

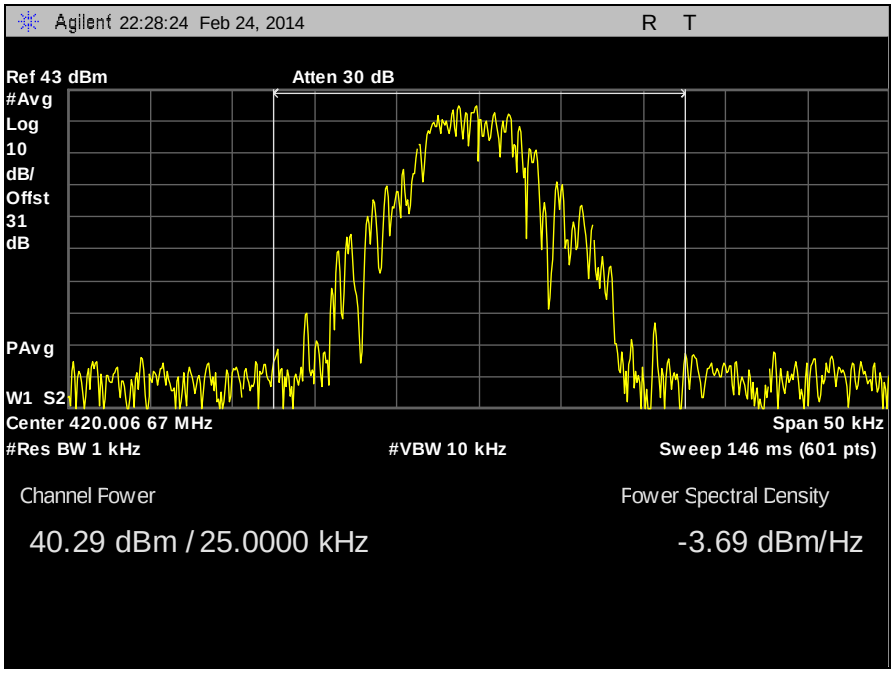
Test Results: The EUT was compliant with the requirements of this section. The EUT conducted power does not exceed limit at the carrier frequency.

Test Engineer(s): Benjamin Taylor

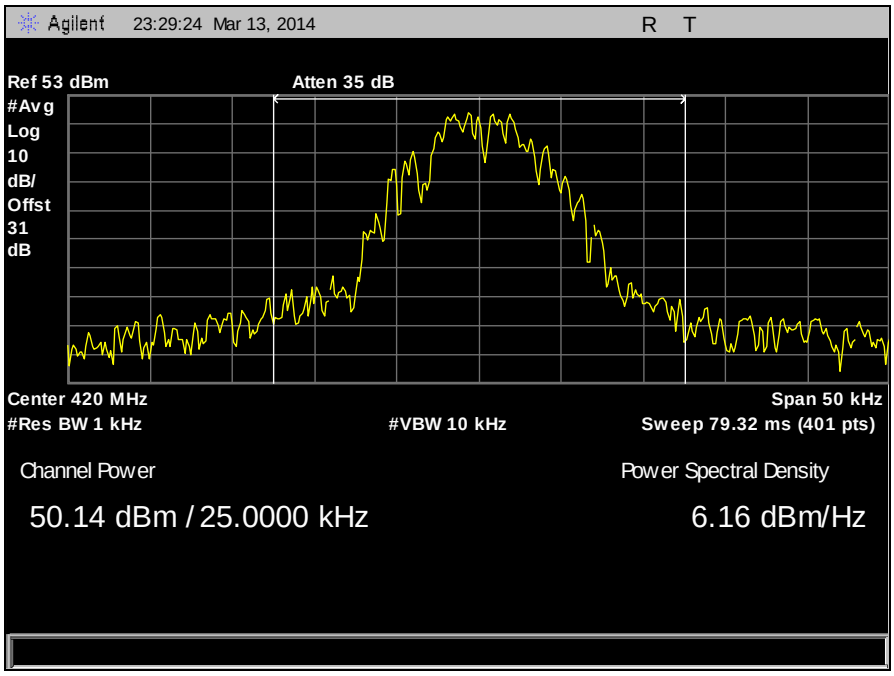
Test Date(s): 02/24/14



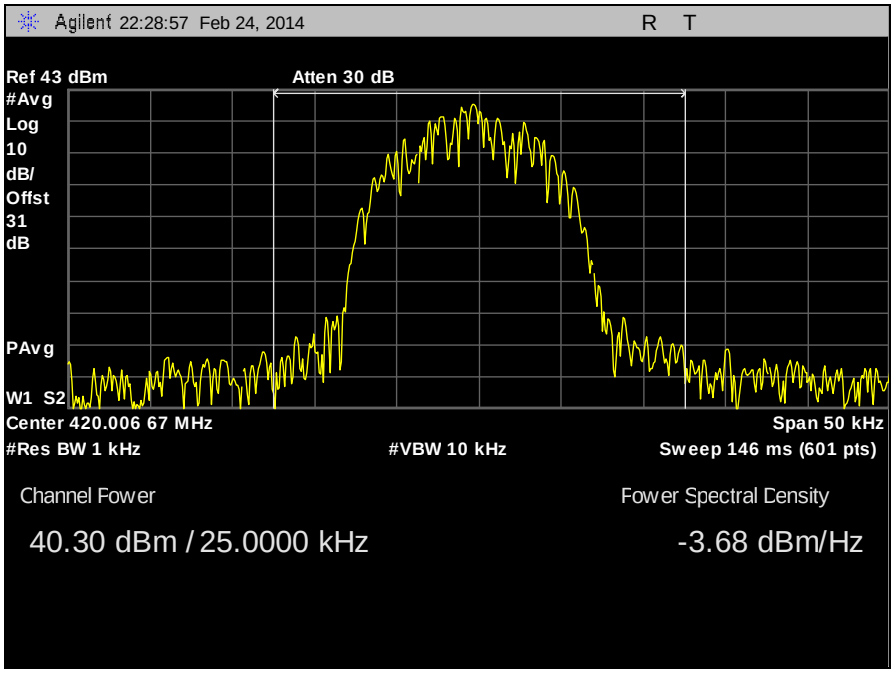
Block Diagram 1. RF Power Output Test Setup



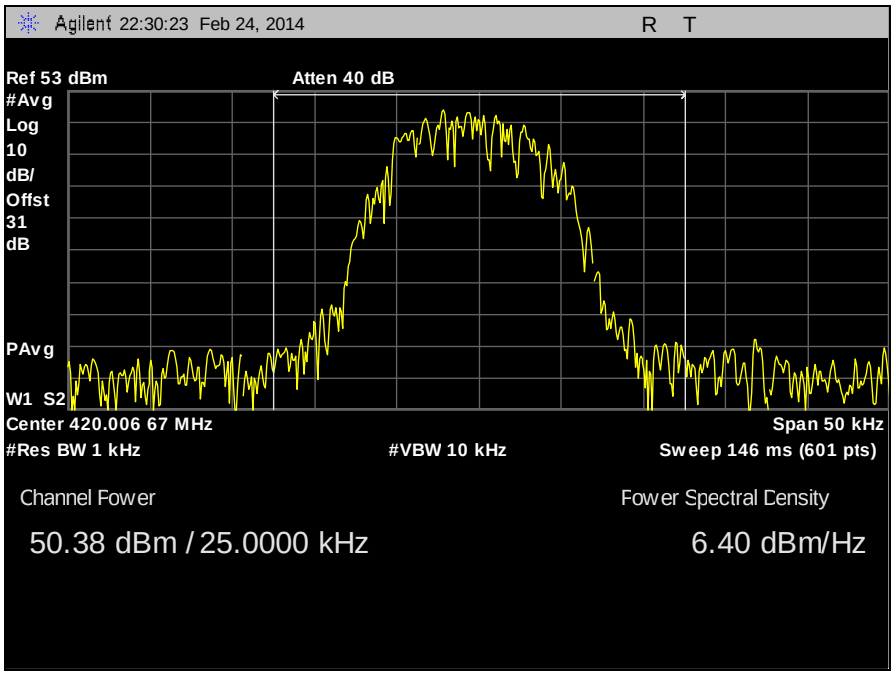
Plot 1. RF Power Output, 420 MHz, C4FM, 10W



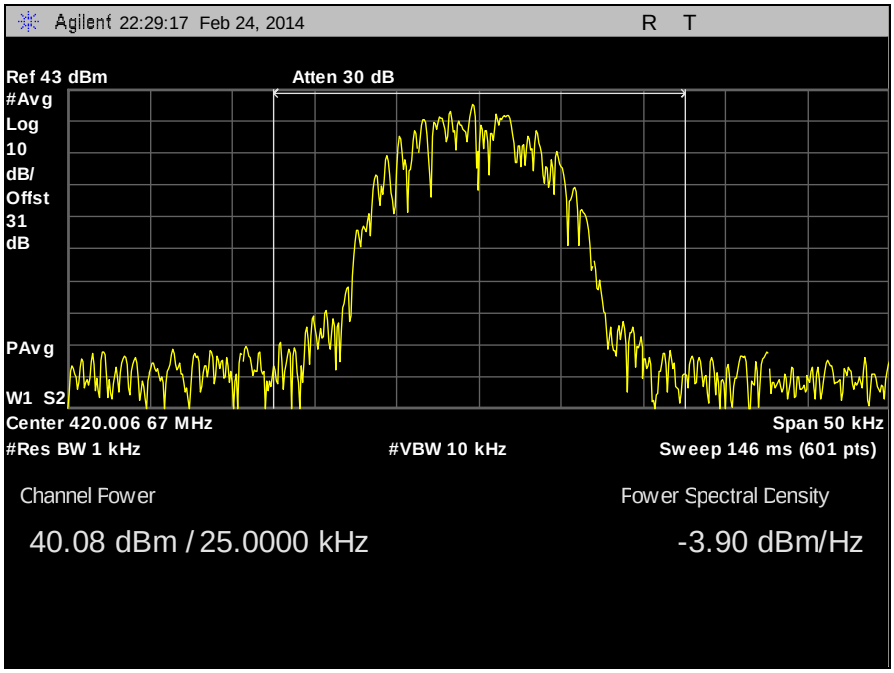
Plot 2. RF Power Output, 420 MHz, C4FM, 100W



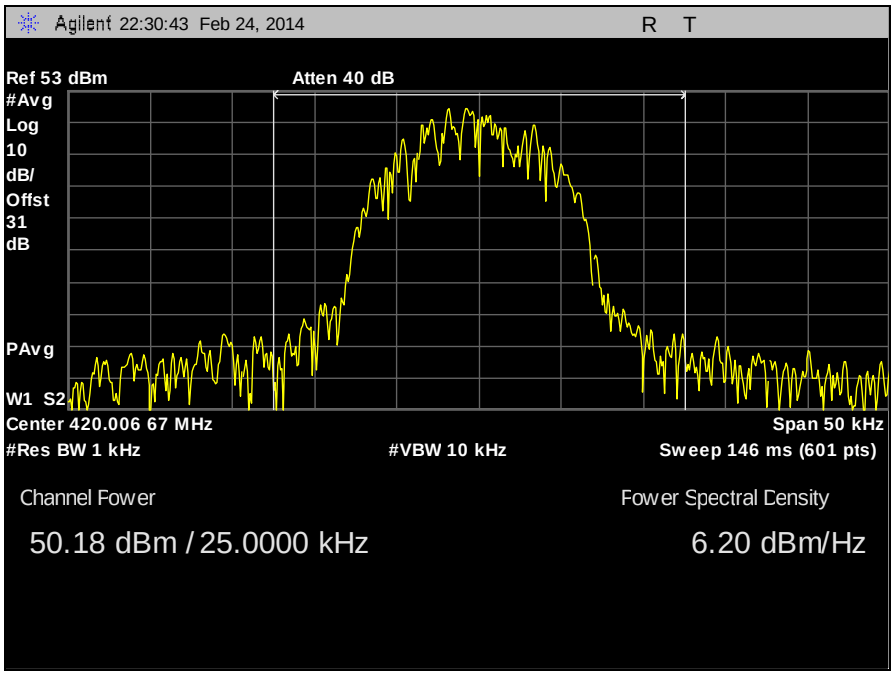
Plot 3. RF Power Output, 420 MHz, CQPSK, 10W



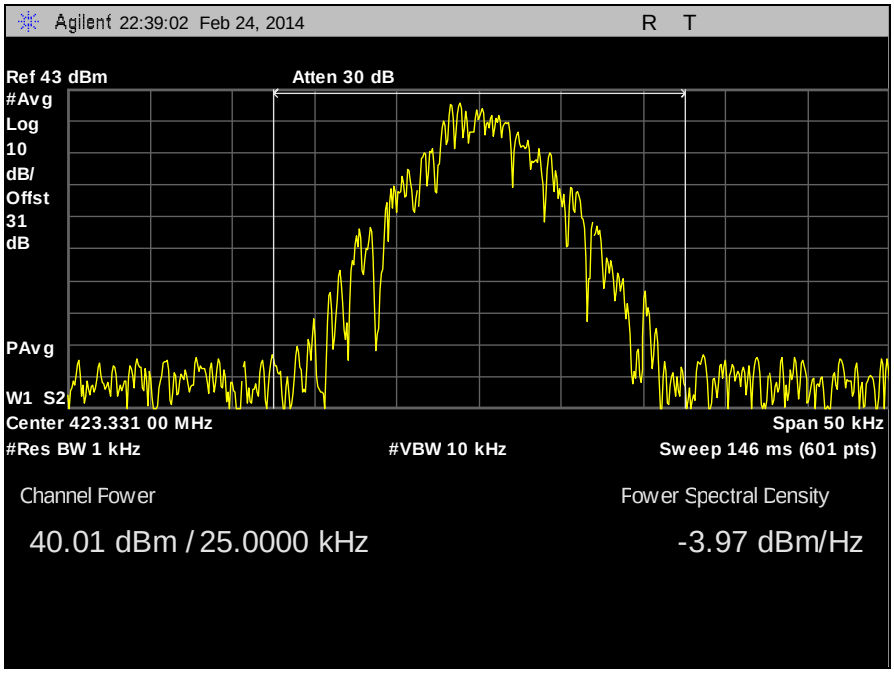
Plot 4. RF Power Output, 420 MHz, CQPSK, 100W



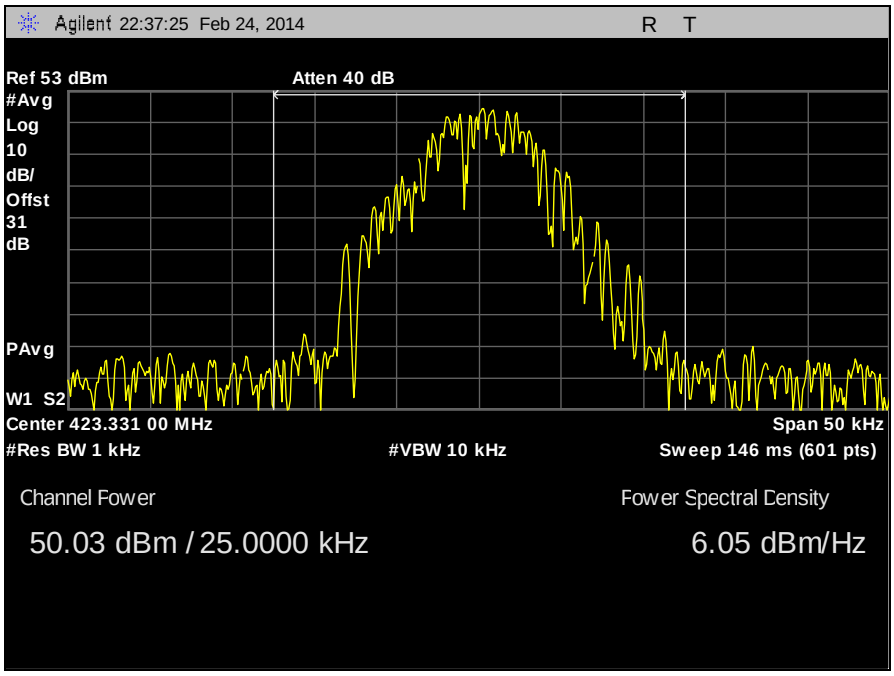
Plot 5. RF Power Output, 420 MHz, HDQPSK, 10W



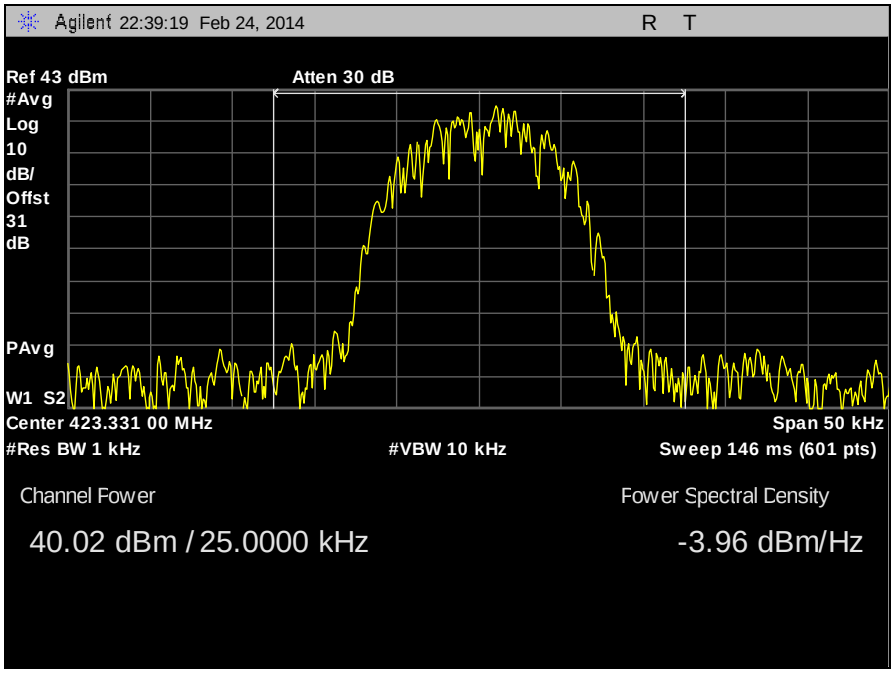
Plot 6. RF Power Output, 420 MHz, HDQPSK, 100W



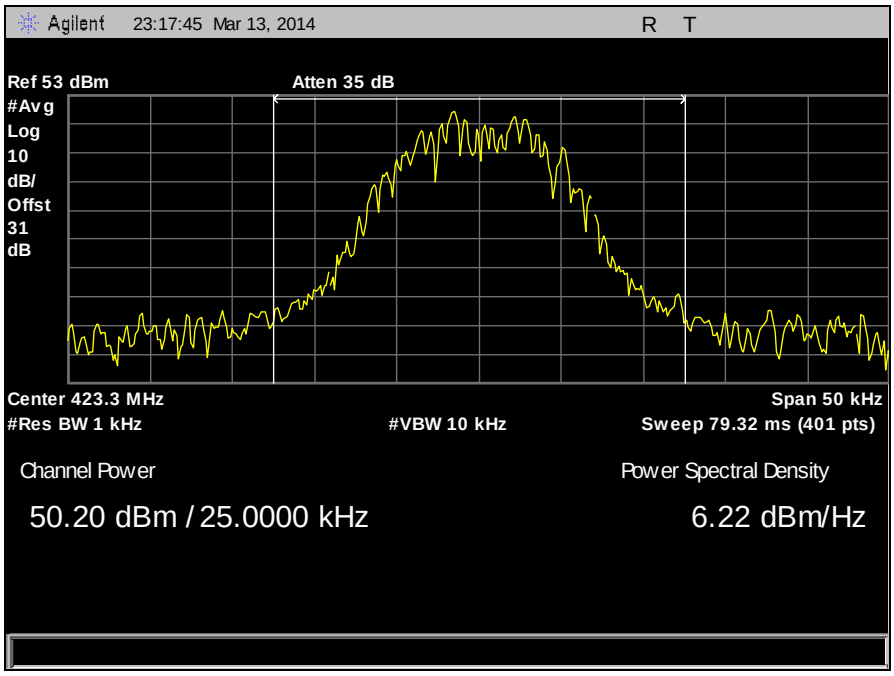
Plot 7. RF Power Output, 423 MHz, C4FM, 10W



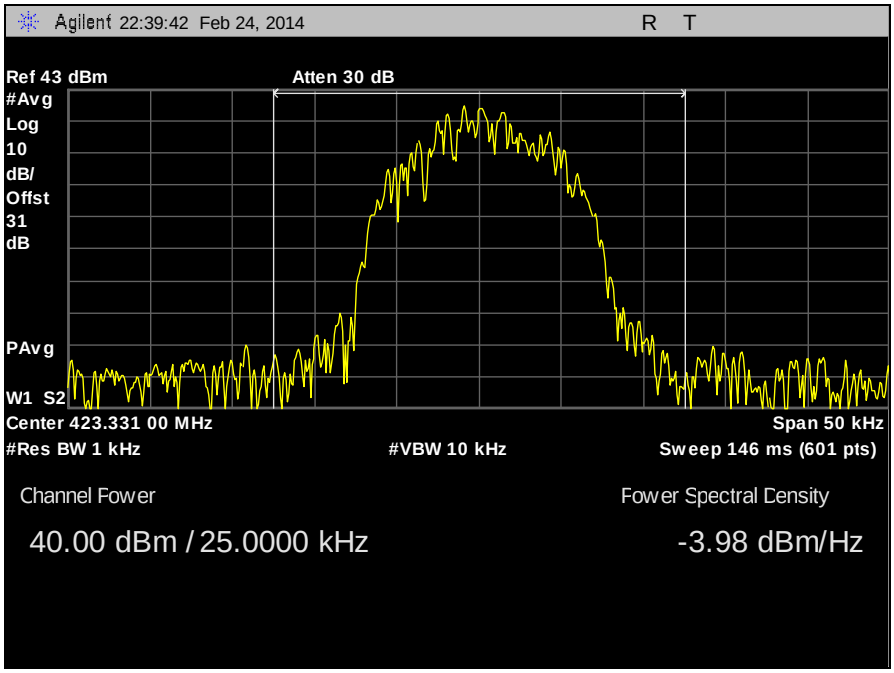
Plot 8. RF Power Output, 423 MHz, C4FM, 100W



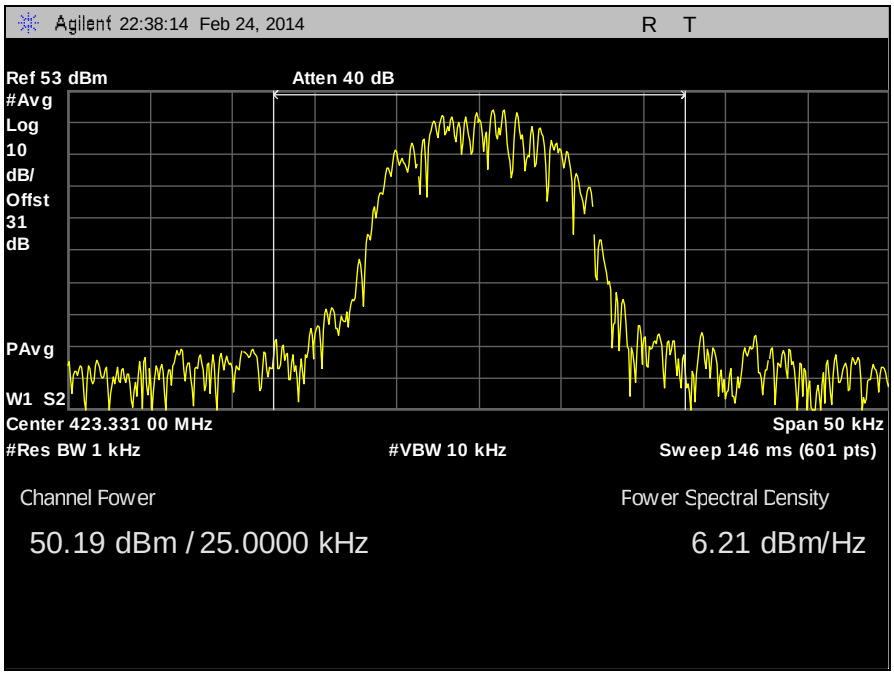
Plot 9. RF Power Output, 423 MHz, CQPSK, 10W



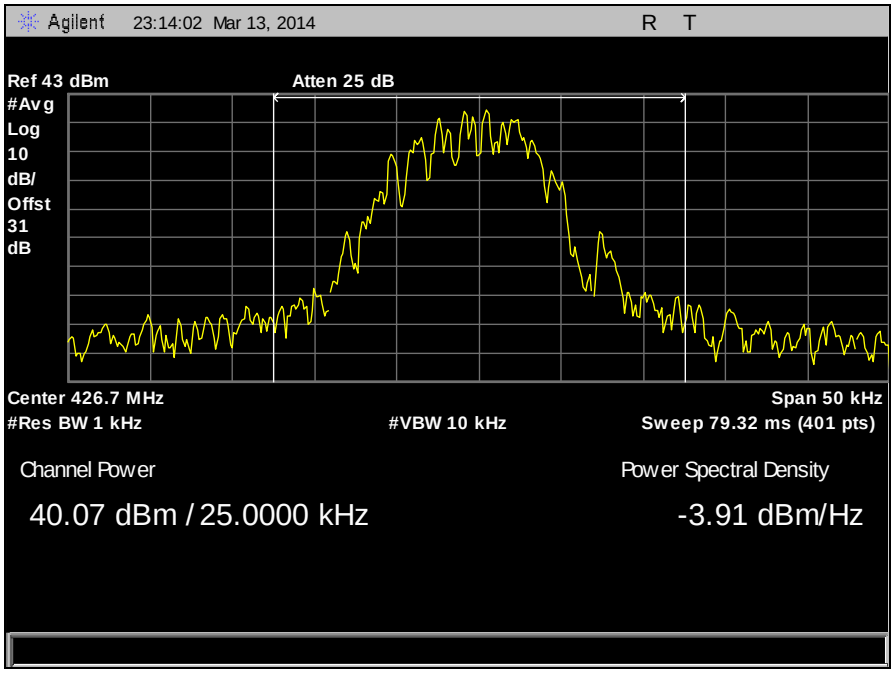
Plot 10. RF Power Output, 423 MHz, CQPSK, 100W



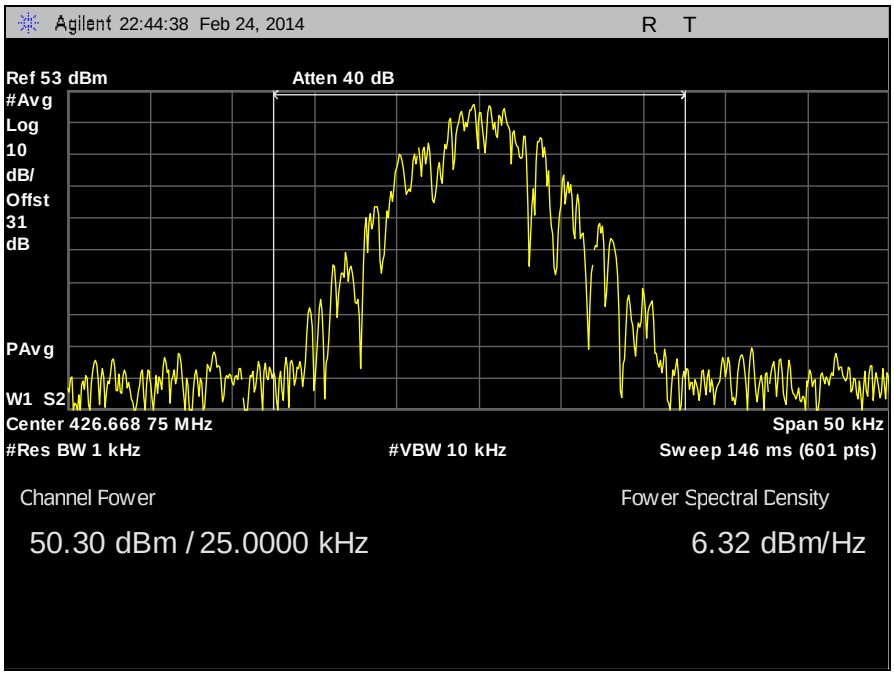
Plot 11. RF Power Output, 423 MHz, HDQPSK, 10W



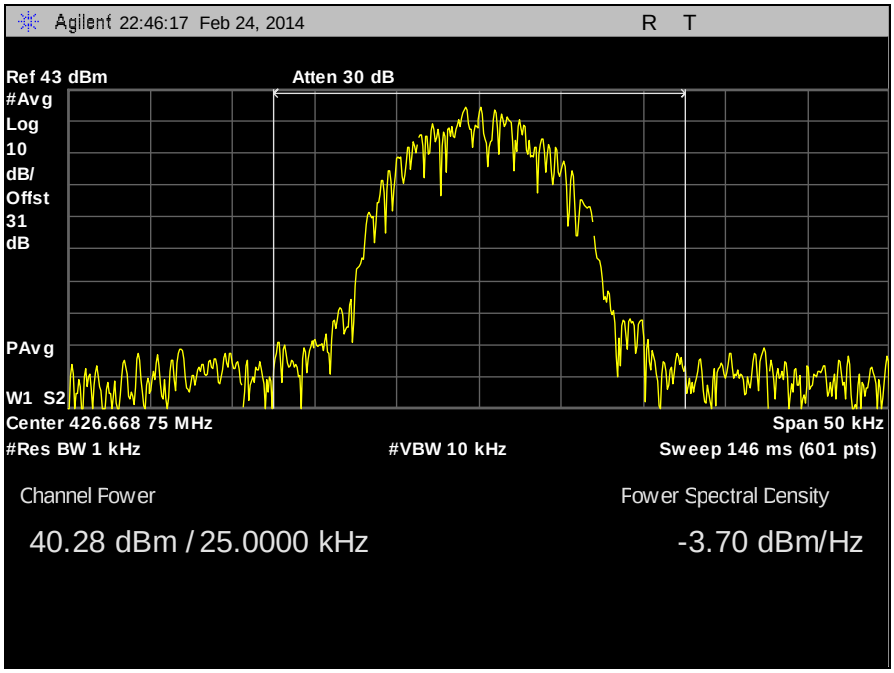
Plot 12. RF Power Output, 423 MHz, HDQPSK, 100W



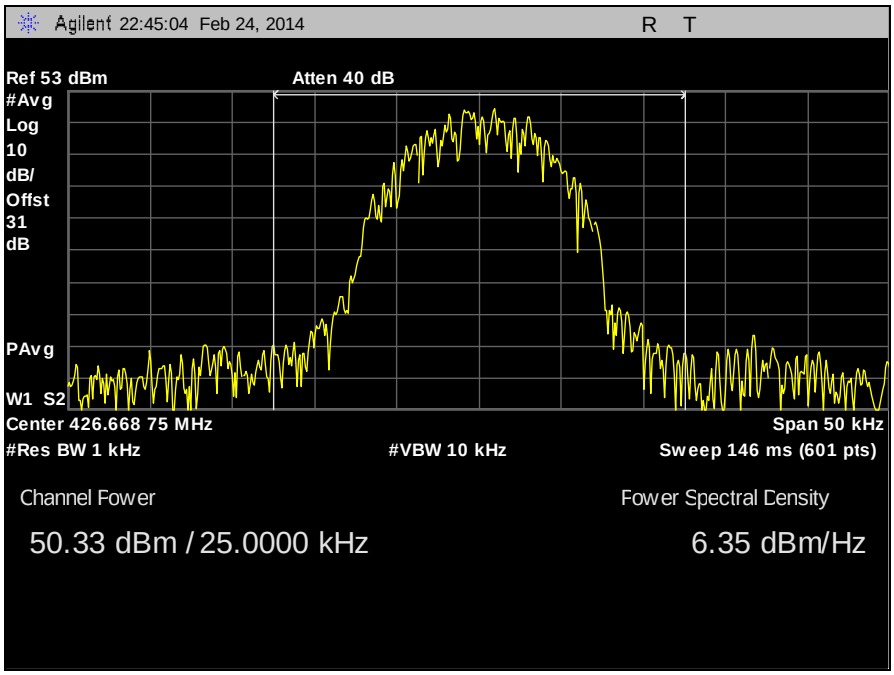
Plot 13. RF Power Output, 426 MHz, C4FM, 10W



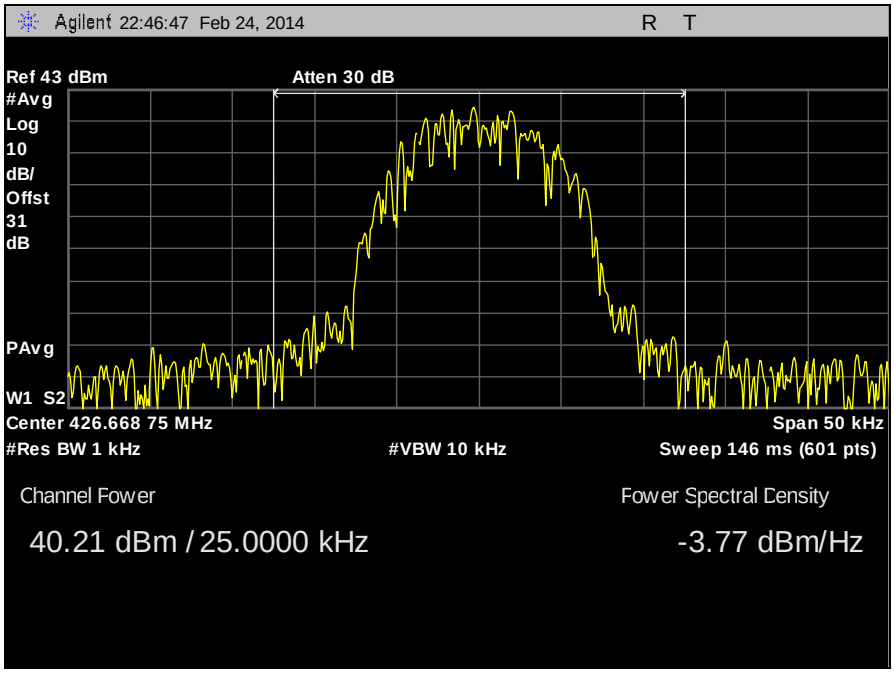
Plot 14. RF Power Output, 426 MHz, C4FM, 100W



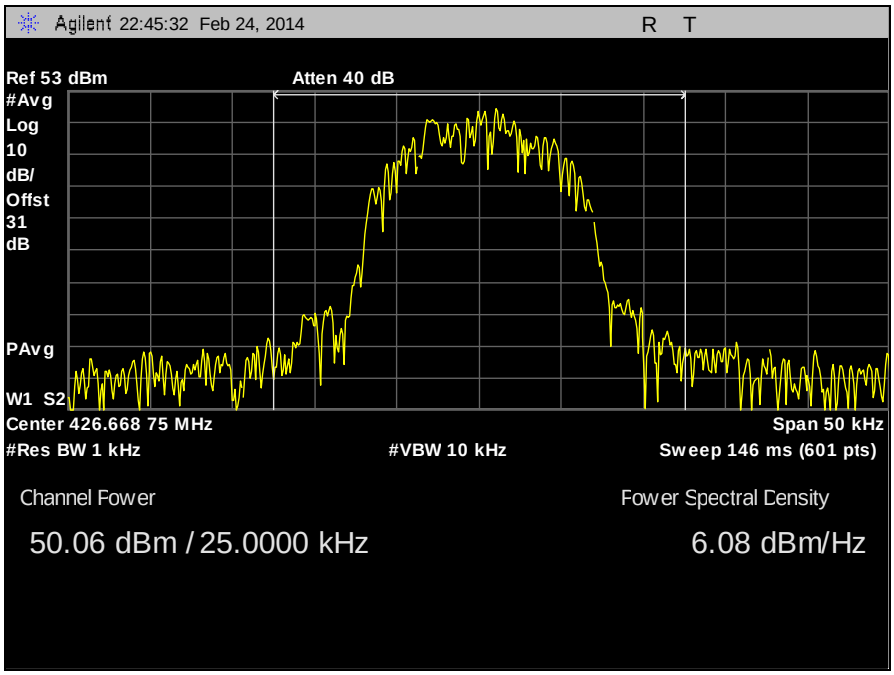
Plot 15. RF Power Output, 426 MHz, CQPSK, 10W



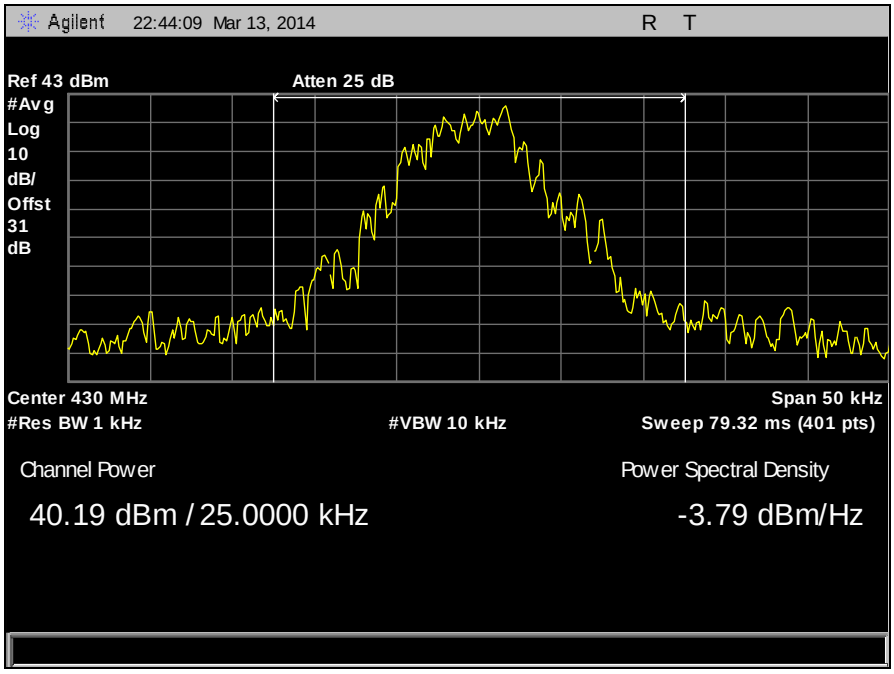
Plot 16. RF Power Output, 426 MHz, CQPSK, 100W



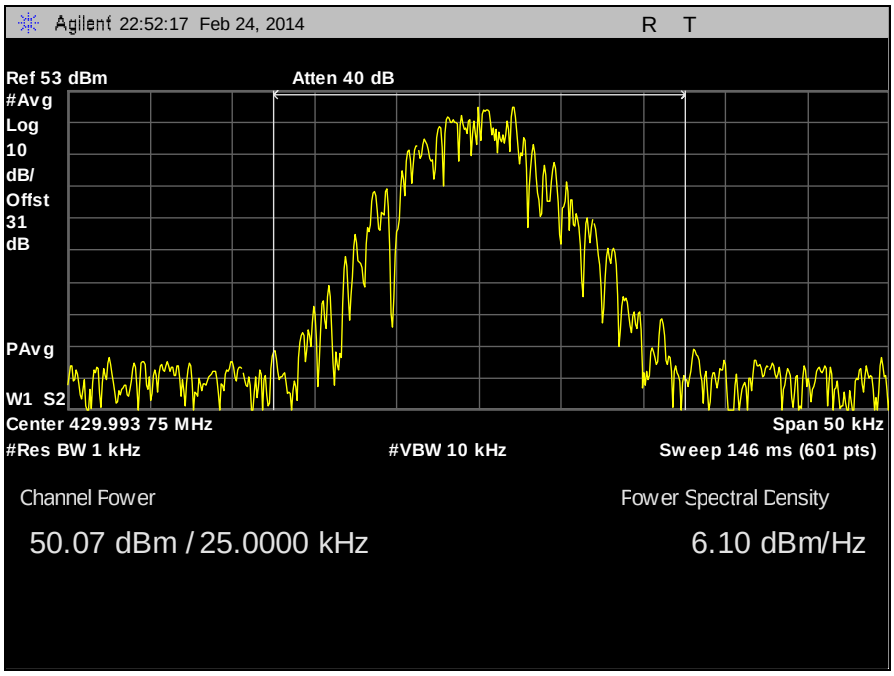
Plot 17. RF Power Output, 426 MHz, HDQPSK, 10W



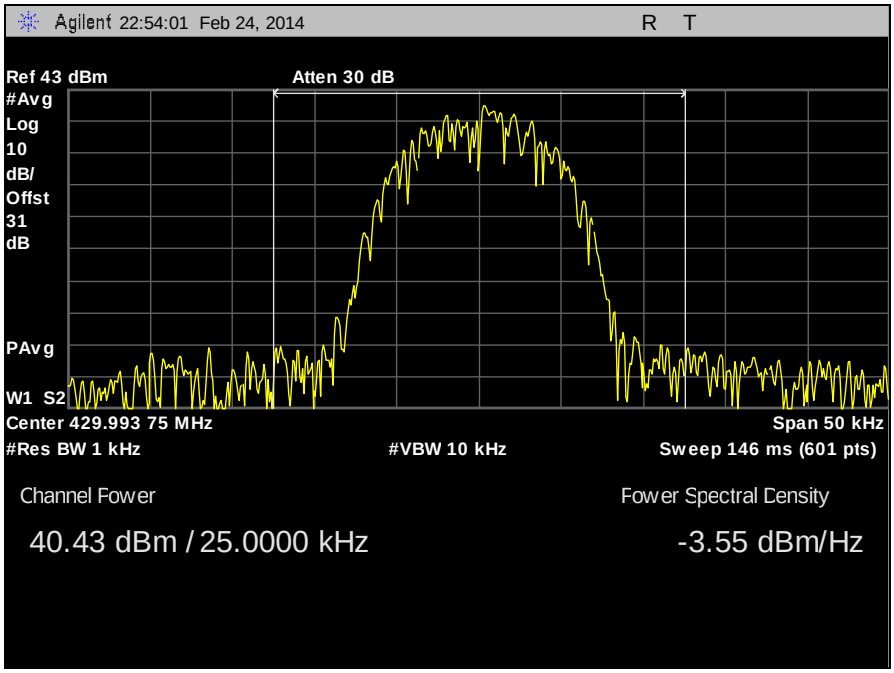
Plot 18. RF Power Output, 426 MHz, HDQPSK, 100W



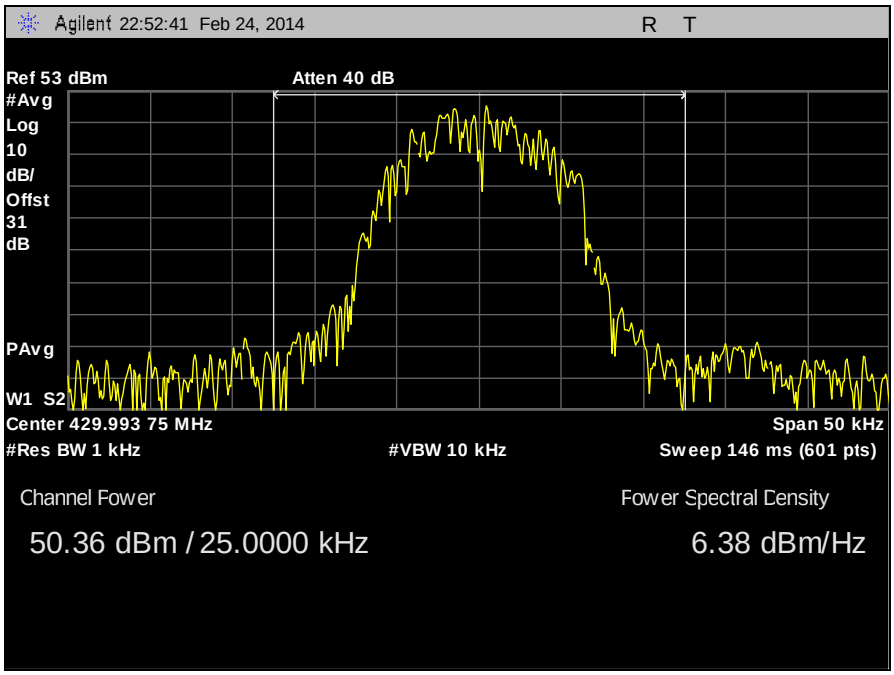
Plot 19. RF Power Output, 430 MHz, C4FM, 10W



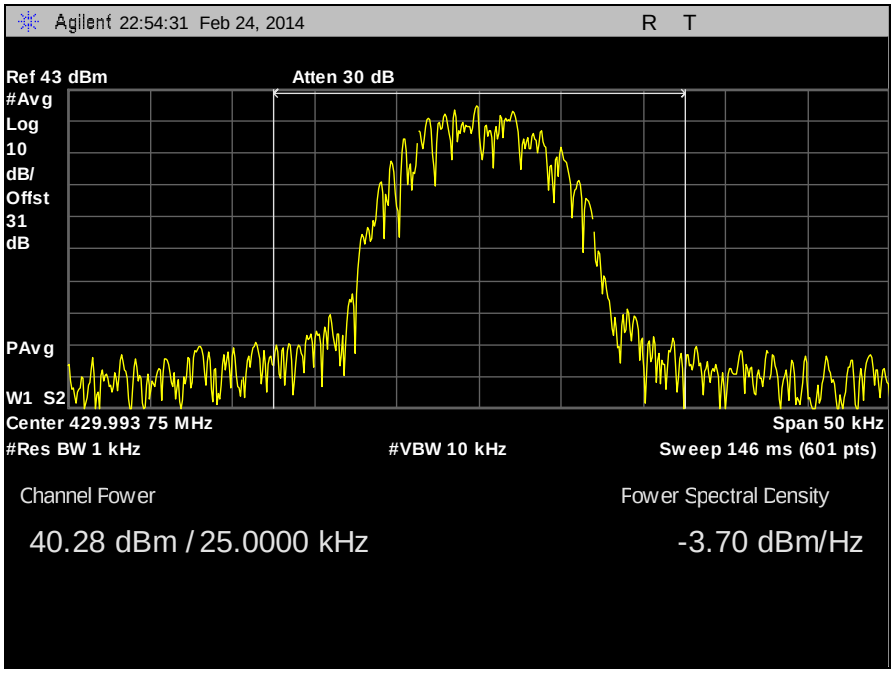
Plot 20. RF Power Output, 430 MHz, C4FM, 100W



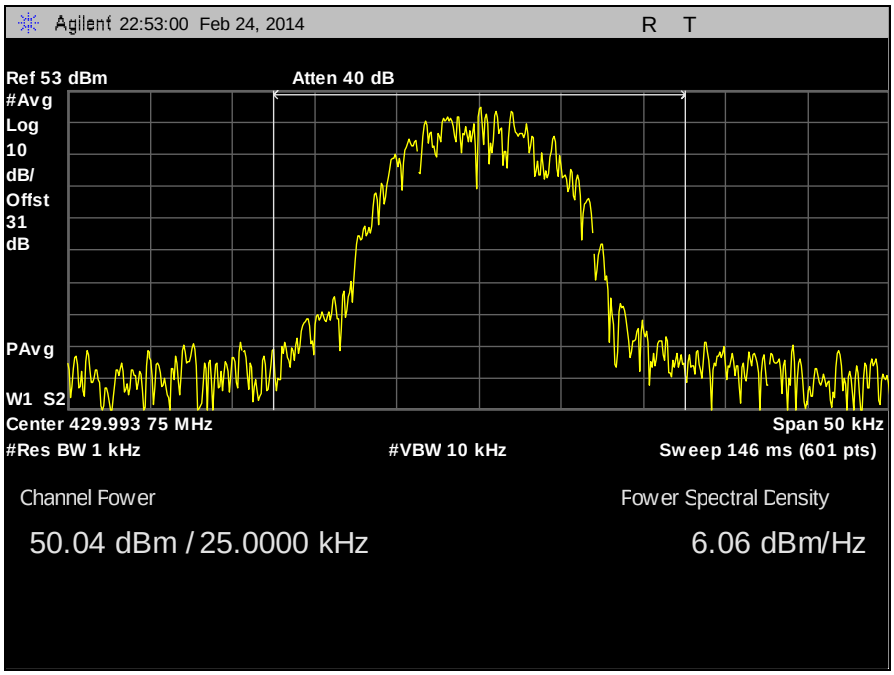
Plot 21. RF Power Output, 430 MHz, CQPSK, 10W



Plot 22. RF Power Output, 430 MHz, CQPSK, 100W



Plot 23. RF Power Output, 430 MHz, HDQPSK, 10W



Plot 24. RF Power Output, 430 MHz, HDQPSK, 100W

3.2. § 2.1049 Occupied Bandwidth

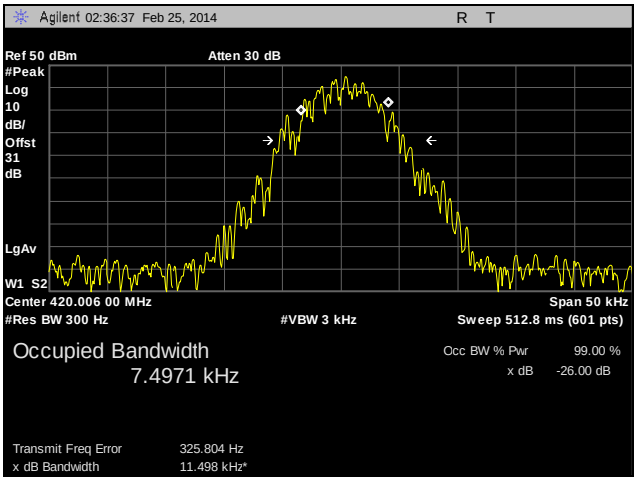
Test Requirement(s): **§ 2.1049Measurements required: Occupied bandwidth:** The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the specified conditions of § 2.1049 (a) through (i) as applicable.

Test Procedures: As required by 47 CFR 2.1049, *occupied bandwidth measurements* were made with a Spectrum Analyzer connected to the RF ports of the transmitter, with suitable attenuation.

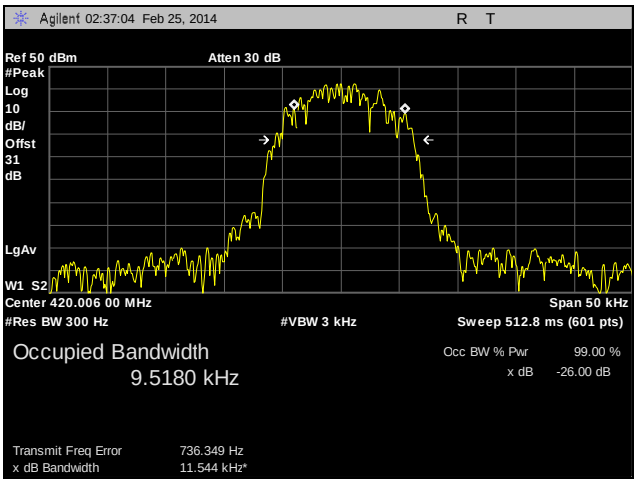
Test Results: The EUT was compliant with the requirements of this section. The variability in the Occupied Bandwidth plots was due to the duty cycles in use in the various modulation types.

Test Engineer(s): Benjamin Taylor

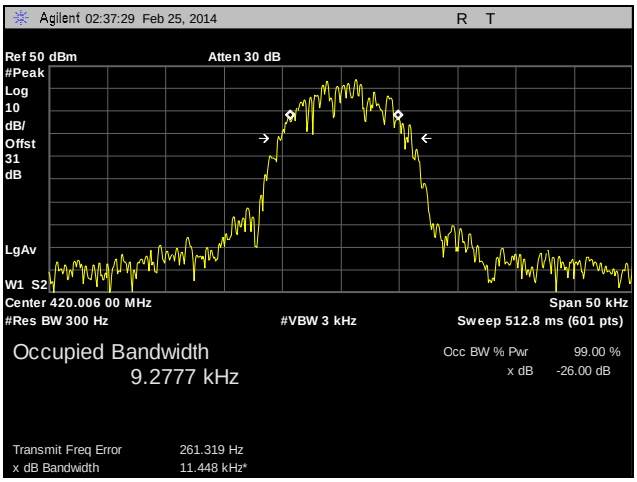
Test Date(s): 03/13/14



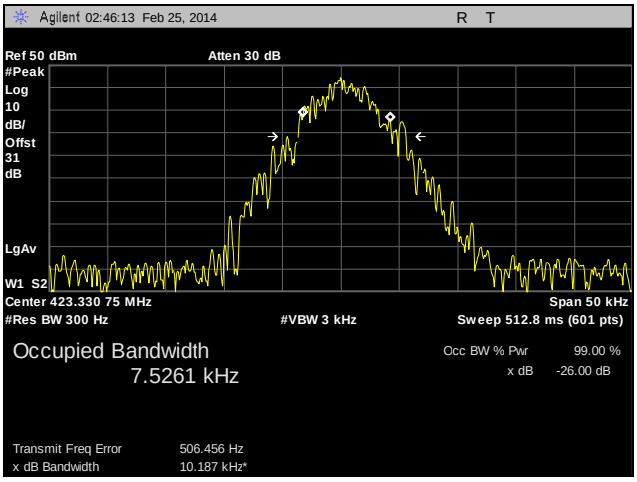
Plot 25. Occupied Bandwidth, 420 MHz, C4FM



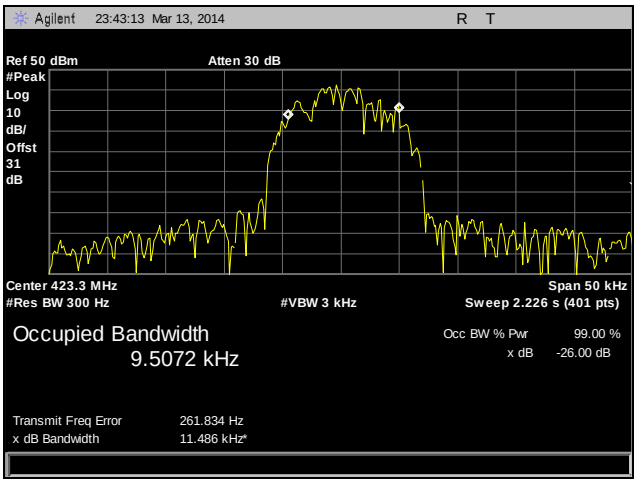
Plot 26. Occupied Bandwidth, 420 MHz, CQPSK



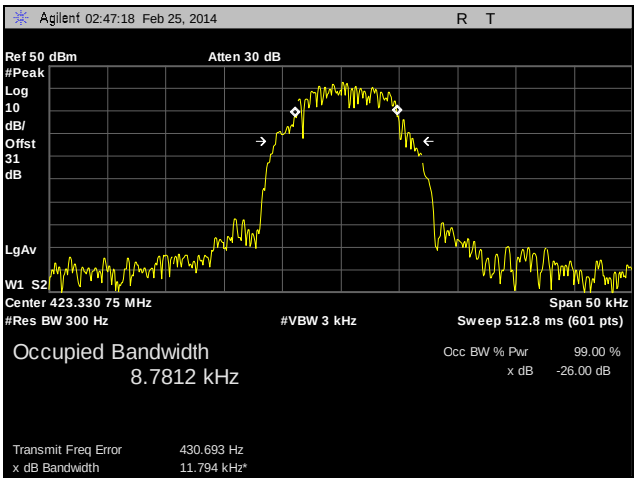
Plot 27. Occupied Bandwidth, 420 MHz, HDQPSK



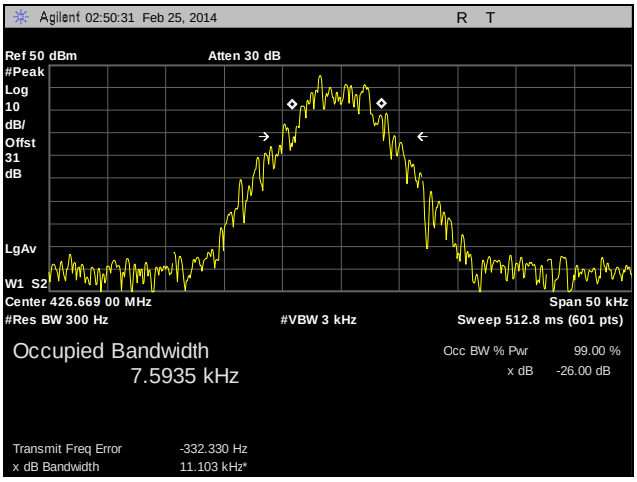
Plot 28. Occupied Bandwidth, 423 MHz, C4FM



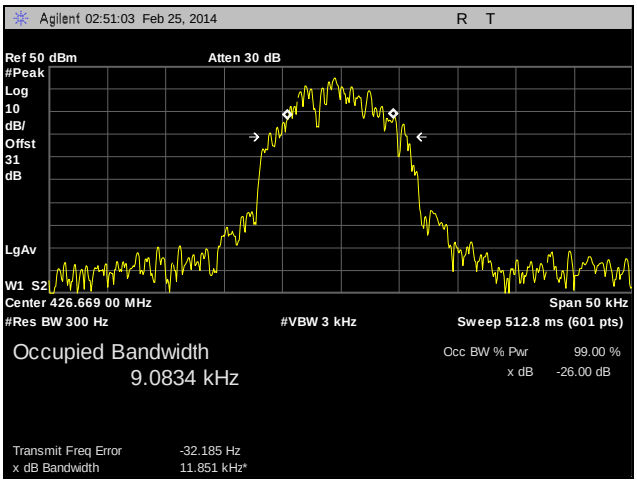
Plot 29. Occupied Bandwidth, 423 MHz, CQPSK



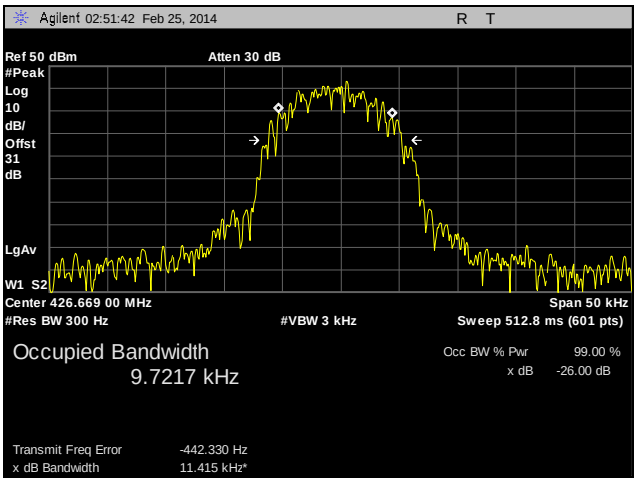
Plot 30. Occupied Bandwidth, 423 MHz, HDQPSK



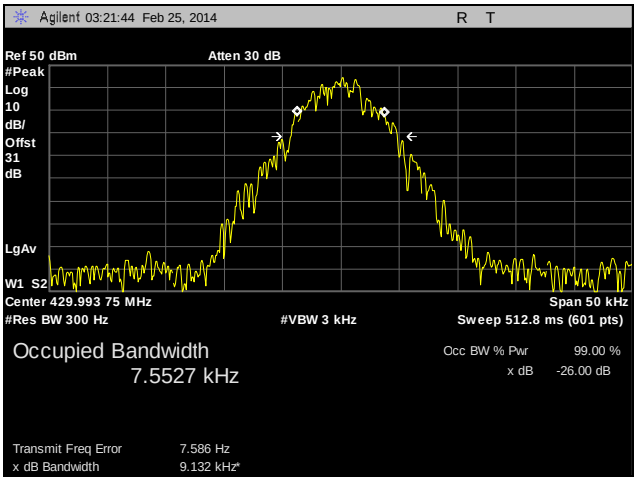
Plot 31. Occupied Bandwidth, 426 MHz, C4FM



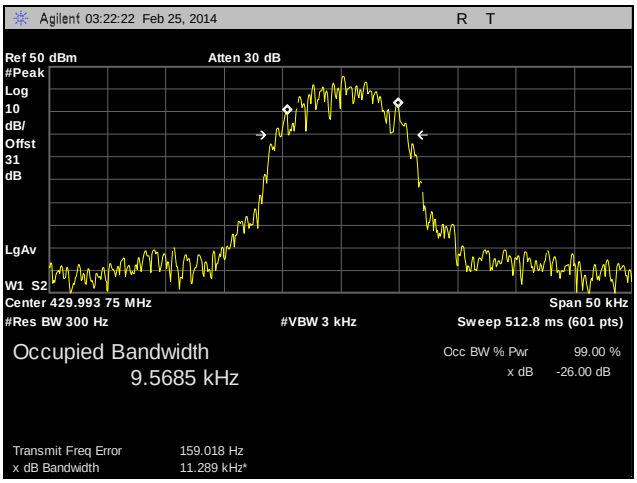
Plot 32. Occupied Bandwidth, 426 MHz, CQPSK



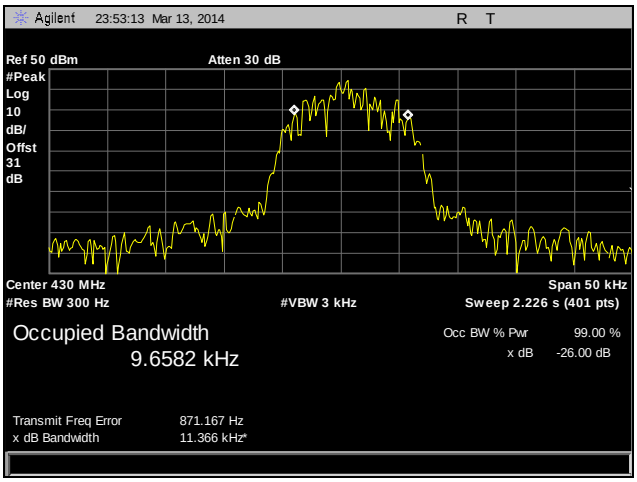
Plot 33. Occupied Bandwidth, 426 MHz, HDQPSK



Plot 34. Occupied Bandwidth, 430 MHz, C4FM



Plot 35. Occupied Bandwidth, 430 MHz, CQPSK



Plot 36. Occupied Bandwidth, 430 MHz, HDQPSK

3.3. §90.210 Conducted Spurious Emissions and Emissions Mask at Antenna Terminals

Test Requirement(s): **§2.1049 and §90.210 with FCC 04-265 (Emissions Mask D)**

Test Procedures: The EUT was connected to a spectrum analyzer through an RF attenuator. The EUT was set to transmit a CW signal on the low, mid, and high channels. The RBW of the spectrum analyzer was set to 100 kHz and the trace was set to max hold. The peak of the unmodulated carrier was then set as the reference level and another trace was turned on. The modulation was turned on and the RBW was reduced to 100 Hz, the trace was set to max hold, and the in-band emissions were compared to the emission mask. This was repeated for low, mid, and high channels for each modulation.

Test Results: Equipment complies with Section 2.1049 and 90.210(D) with FCC 04-265 (*Equipment designed to operate with a 12.5 kHz channel bandwidth must meet the requirements of Emission Mask D.*). The EUT does not exceed the Emission Masks limit.

The following pages show measurements of Emission Mask plots:

Test Engineer(s): Benjamin Taylor

Test Date(s): 03/13/14

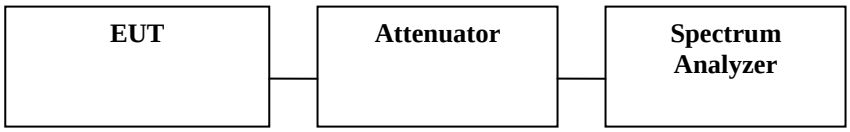
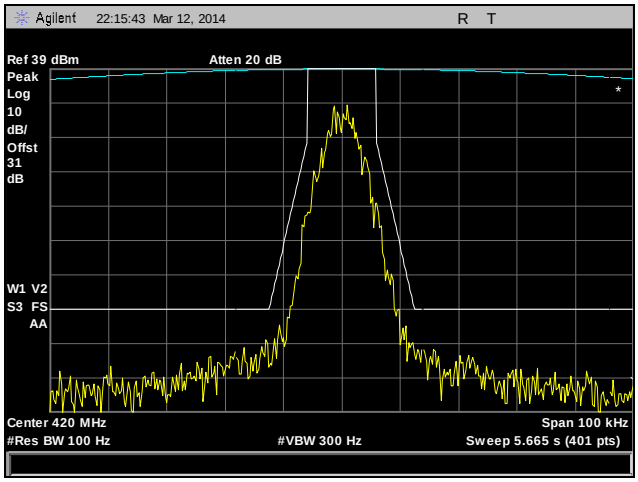
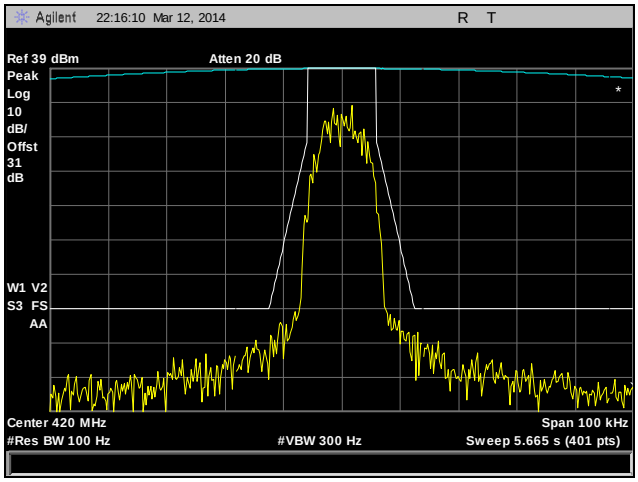


Figure 1. Emission Mask Test Setup

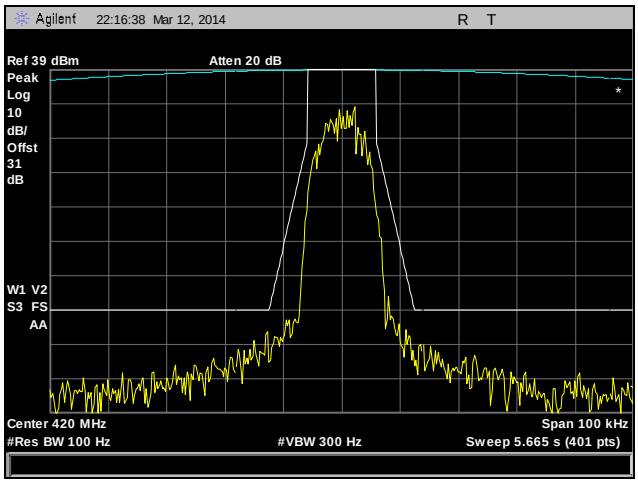
Emission Mask



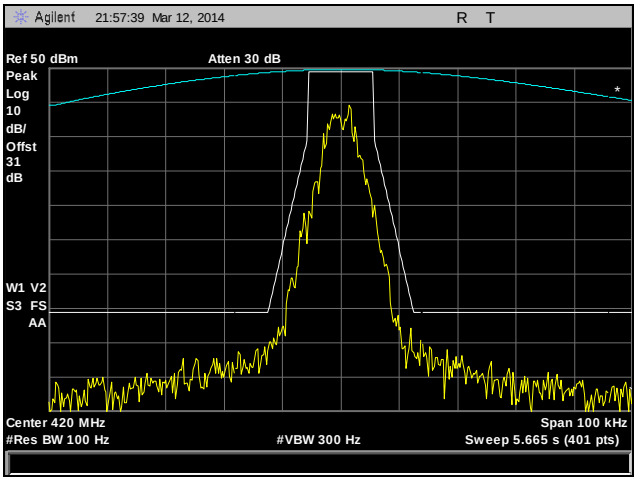
Plot 37. Part 90, Emission Mask, 420 MHz, C4FM, 10 W



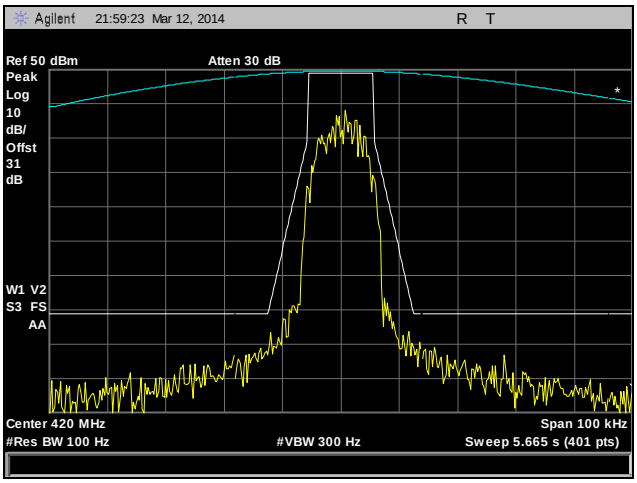
Plot 38. Part 90, Emission Mask, 420 MHz, CQPSK, 10 W



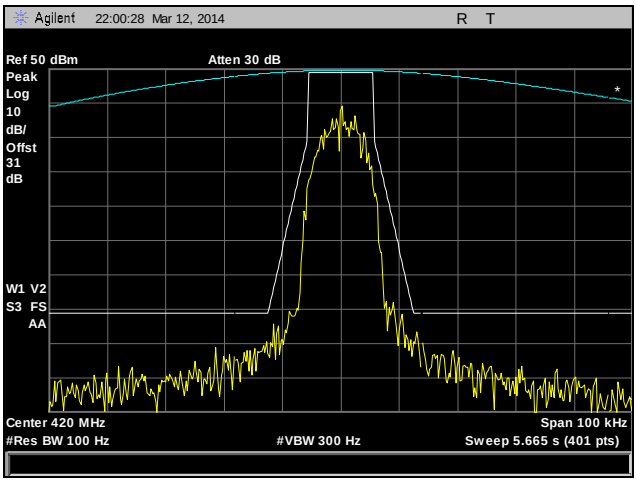
Plot 39. Part 90, Emission Mask, 420 MHz, HDQPSK, 10 W



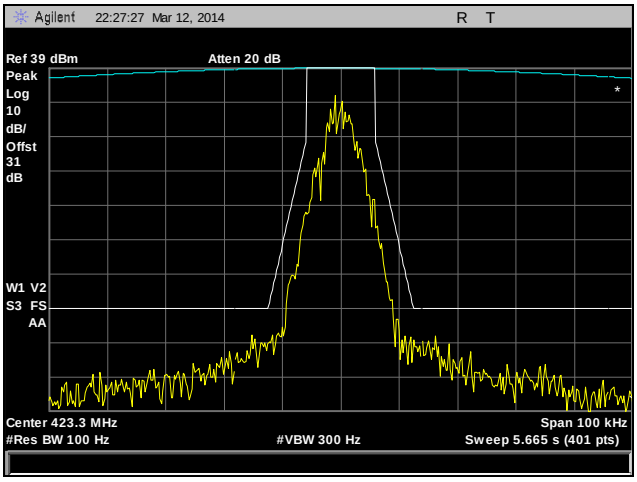
Plot 40. Part 90, Emission Mask, 420 MHz, C4FM, 100 W



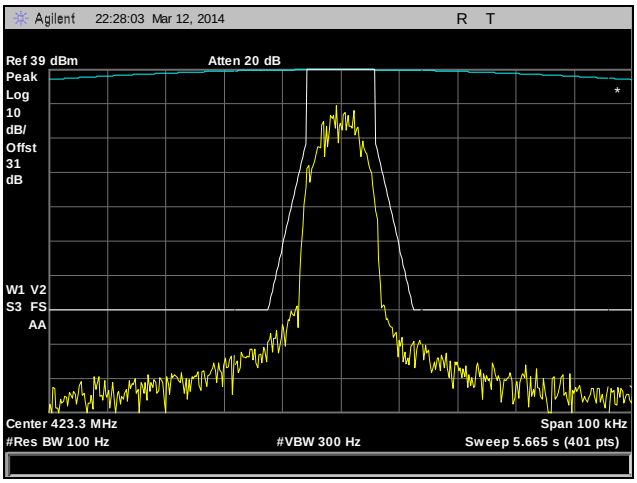
Plot 41. Part 90, Emission Mask, 420 MHz, CQPSK, 100 W



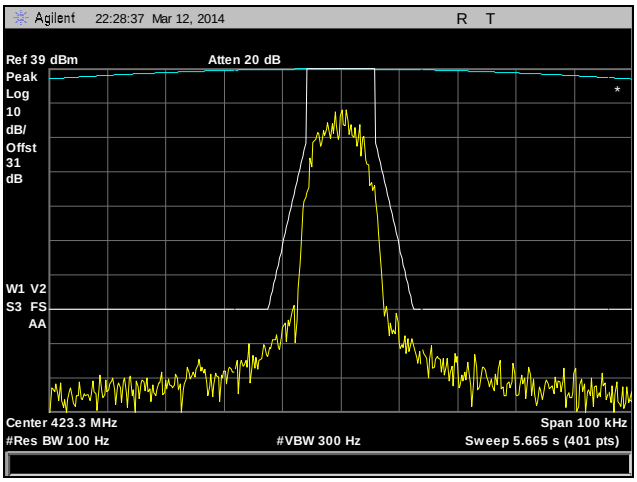
Plot 42. Part 90, Emission Mask, 420 MHz, HDQPSK, 100 W



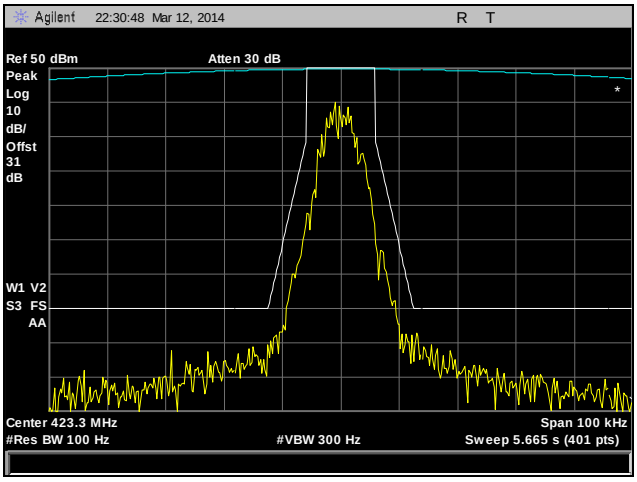
Plot 43. Part 90, Emission Mask, 423 MHz, C4FM, 10 W



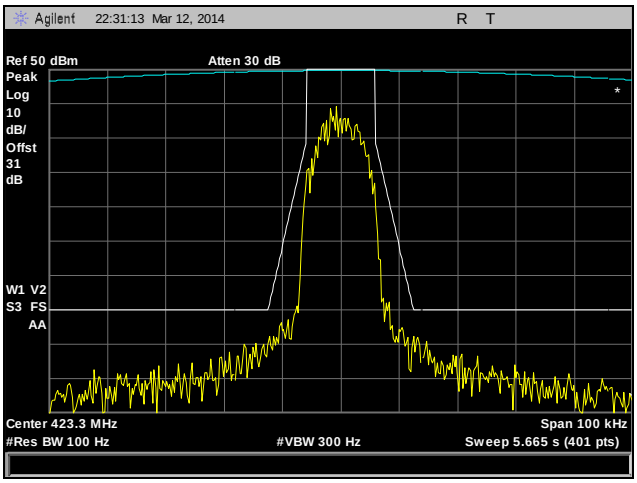
Plot 44. Part 90, Emission Mask, 423 MHz, CQPSK, 10 W



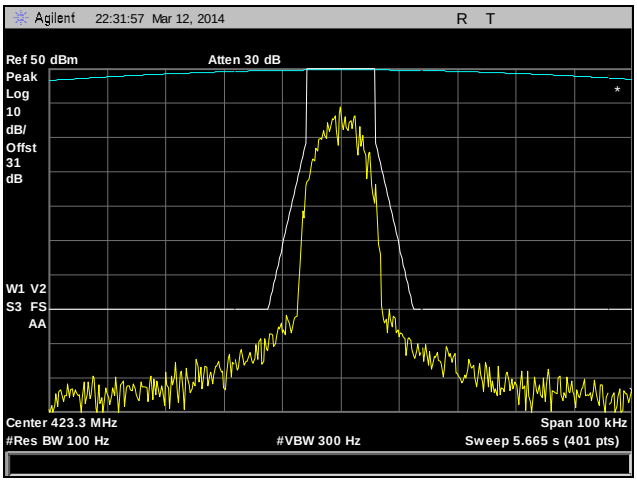
Plot 45. Part 90, Emission Mask, 423 MHz, HDQPSK, 10 W



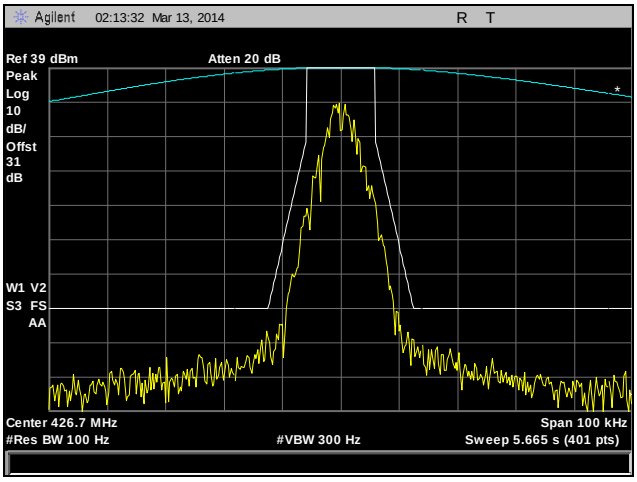
Plot 46. Part 90, Emission Mask, 423 MHz, C4FM, 100 W



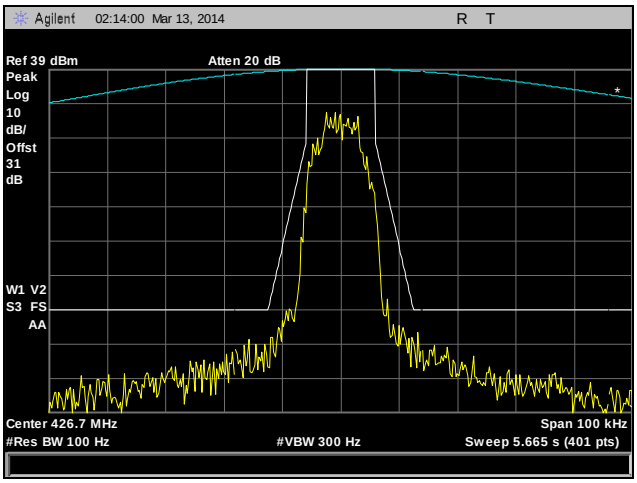
Plot 47. Part 90, Emission Mask, 423 MHz, CQPSK, 100 W



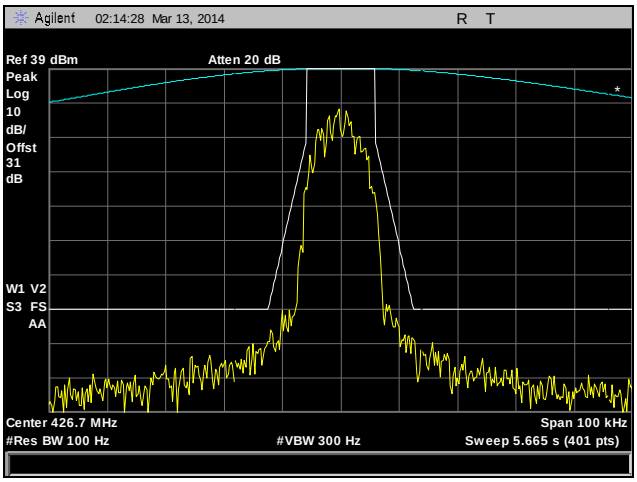
Plot 48. Part 90, Emission Mask, 423 MHz, HDQPSK, 100 W



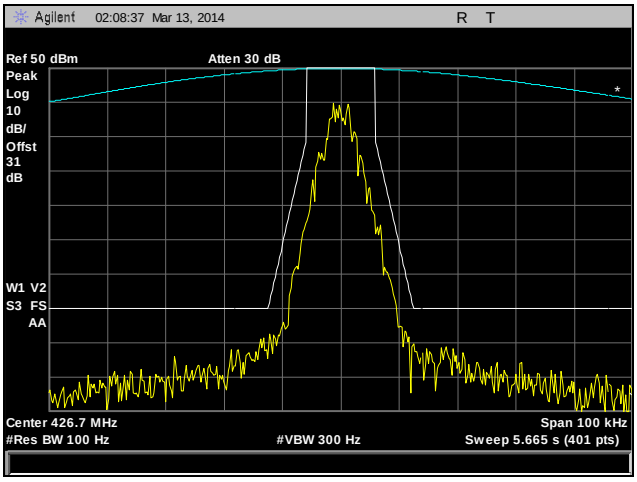
Plot 49. Part 90, Emission Mask, 426 MHz, C4FM, 10 W



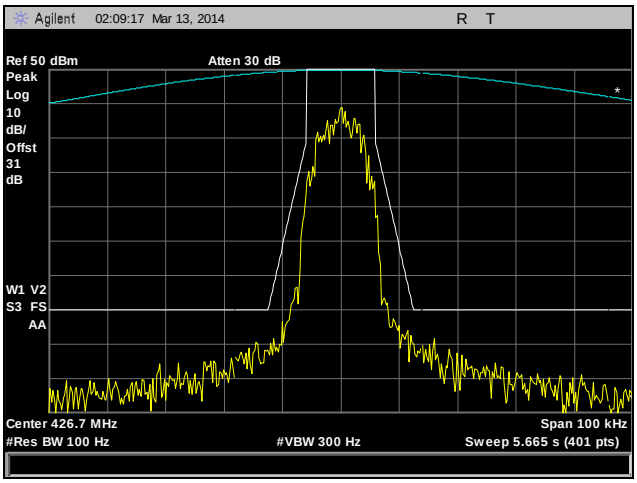
Plot 50. Part 90, Emission Mask, 426 MHz, CQPSK, 10 W



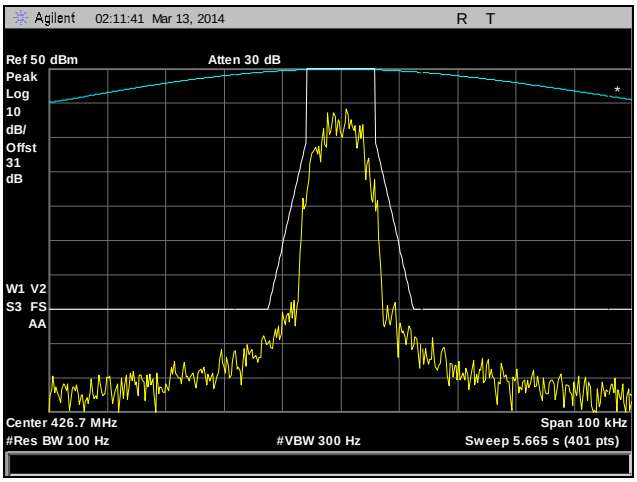
Plot 51. Part 90, Emission Mask, 426 MHz, HDQPSK, 10 W



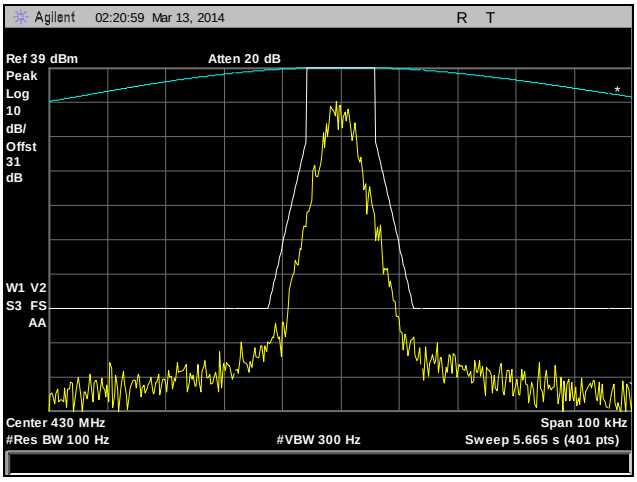
Plot 52. Part 90, Emission Mask, 426 MHz, C4FM, 100 W



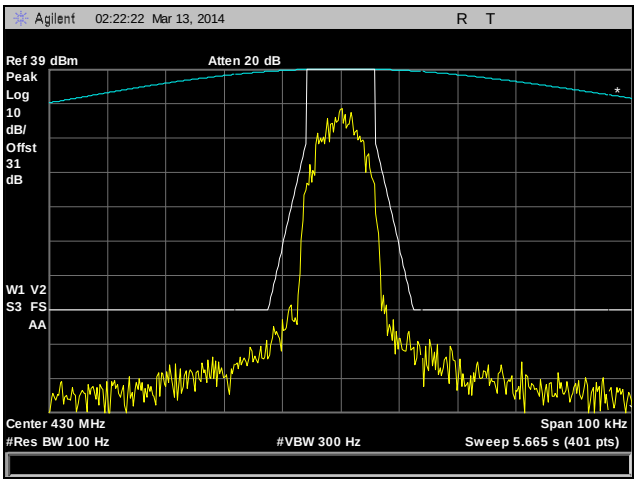
Plot 53. Part 90, Emission Mask, 426 MHz, CQPSK, 100 W



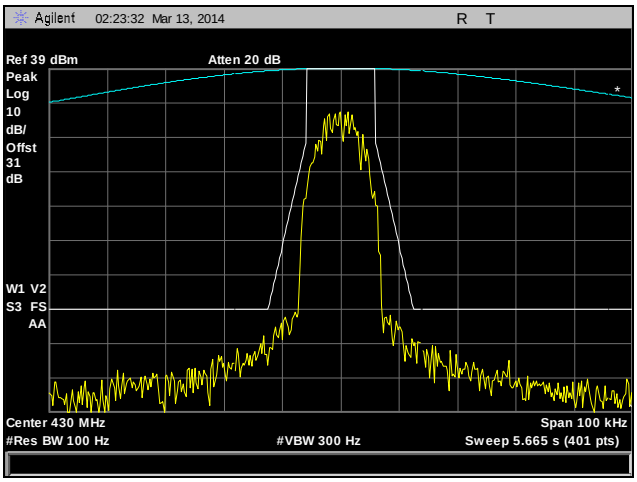
Plot 54. Part 90, Emission Mask, 426 MHz, HDQPSK, 100 W



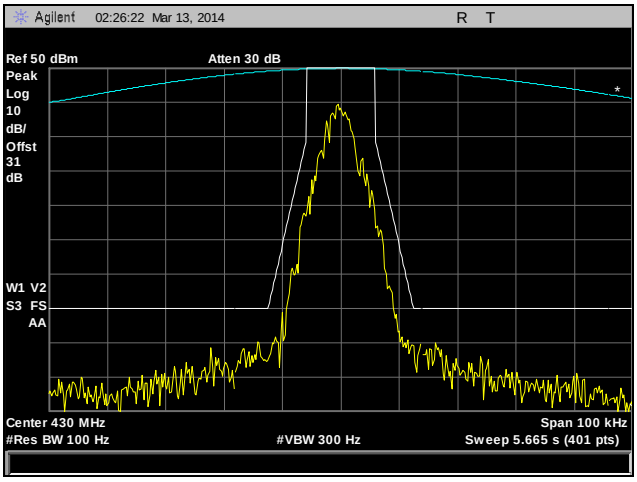
Plot 55. Part 90, Emission Mask, 430 MHz, C4FM, 10 W



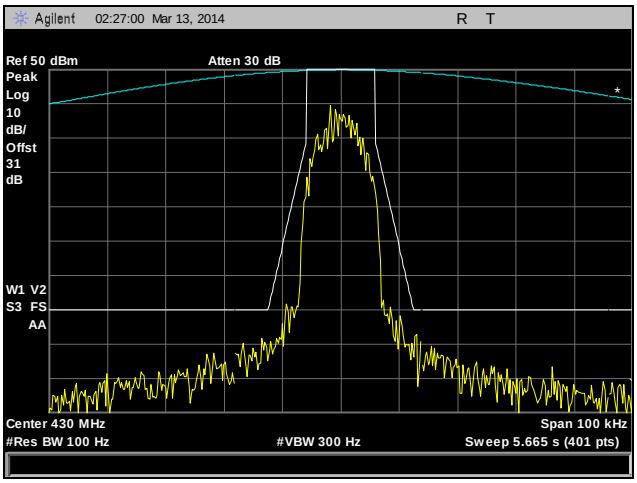
Plot 56. Part 90, Emission Mask, 430 MHz, CQPSK, 10 W



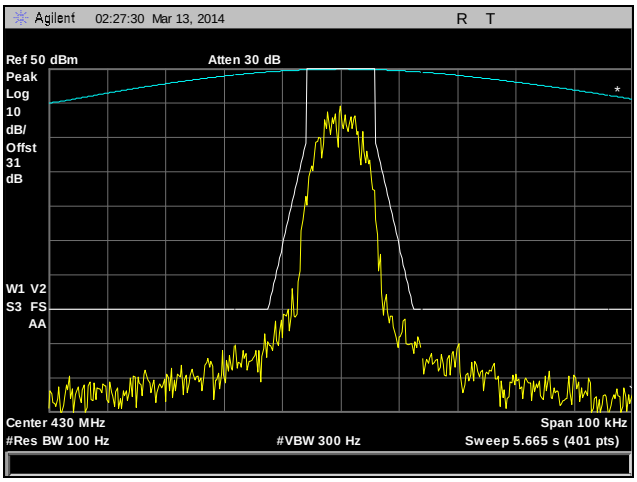
Plot 57. Part 90, Emission Mask, 430 MHz, HDQPSK, 10 W



Plot 58. Part 90, Emission Mask, 430 MHz, C4FM, 100 W

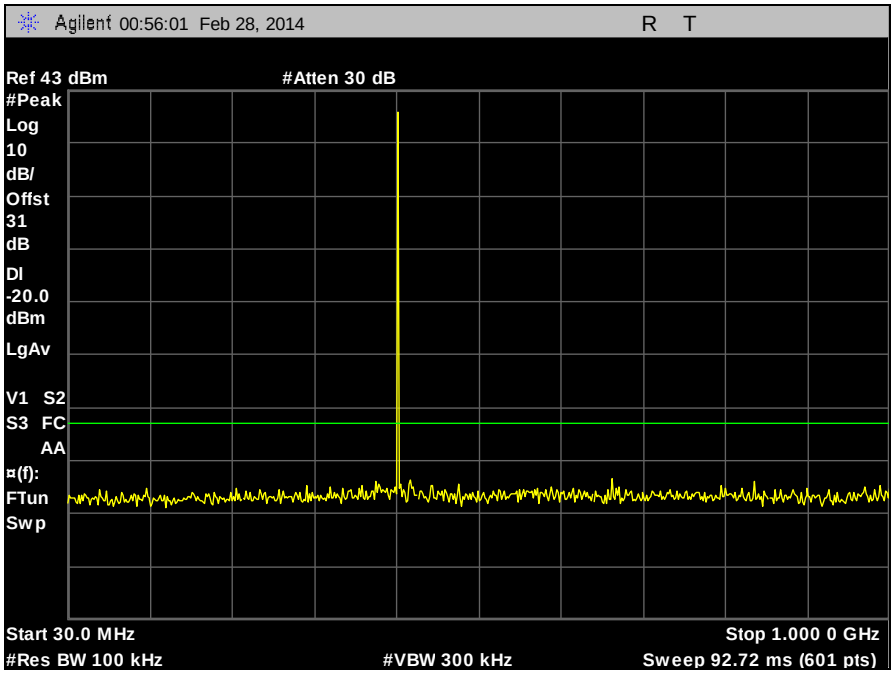


Plot 59. Part 90, Emission Mask, 430 MHz, CQPSK, 100 W

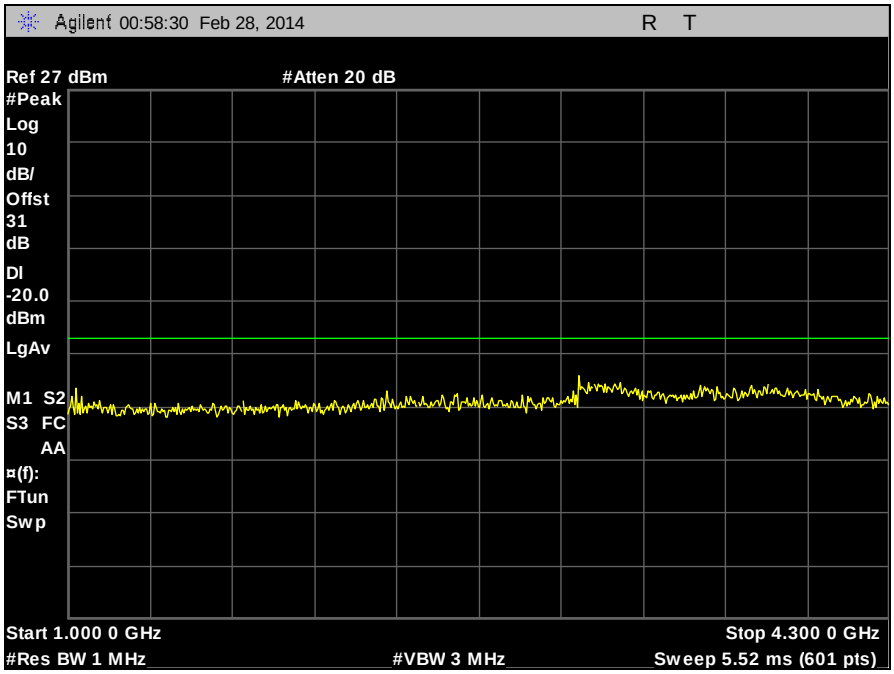


Plot 60. Part 90, Emission Mask, 430 MHz, HDQPSK, 100 W

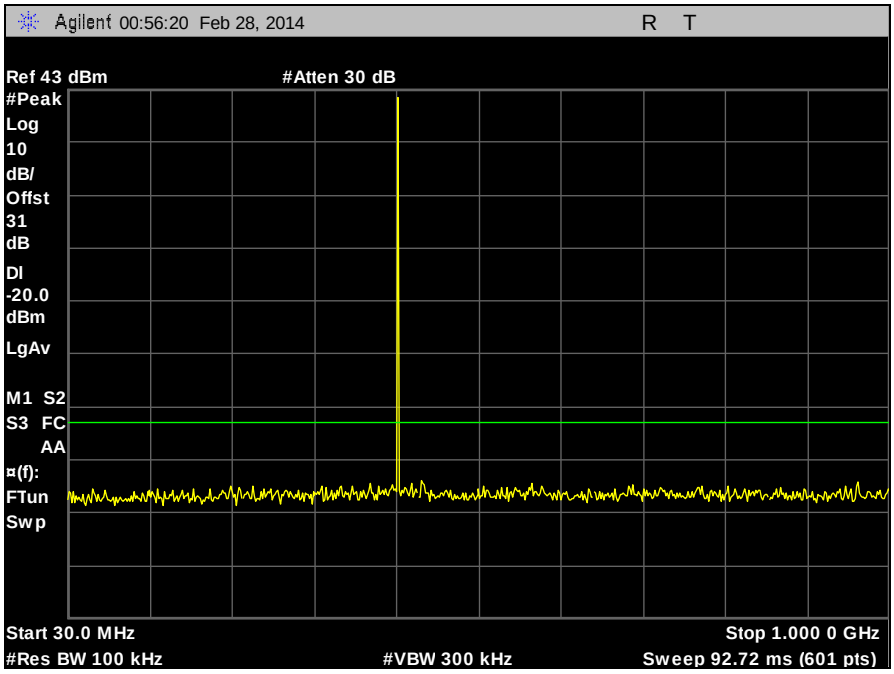
Conducted Spurious Emissions



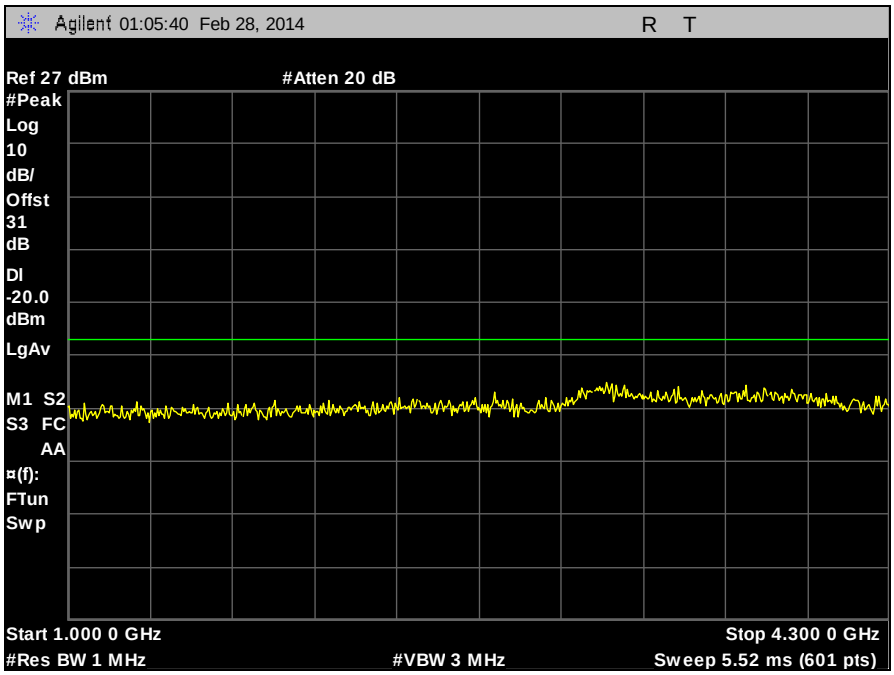
Plot 61. Part 90, Conducted Spurious Emissions, 420 MHz, C4FM, 10 W, 30 MHz – 1 GHz



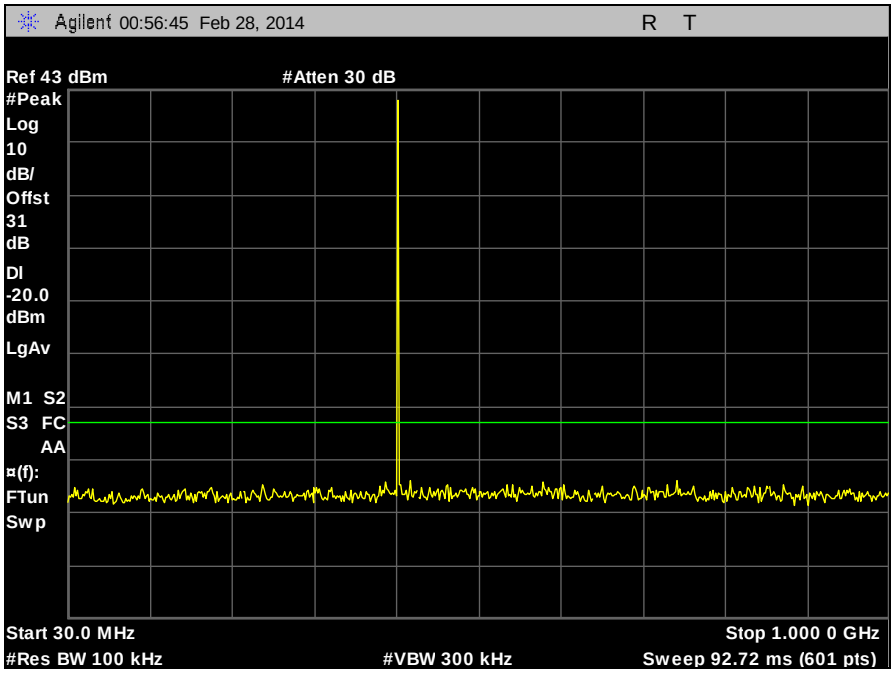
Plot 62. Part 90, Conducted Spurious Emissions, 420 MHz, C4FM, 10 W, 1 GHz – 4.3 GHz



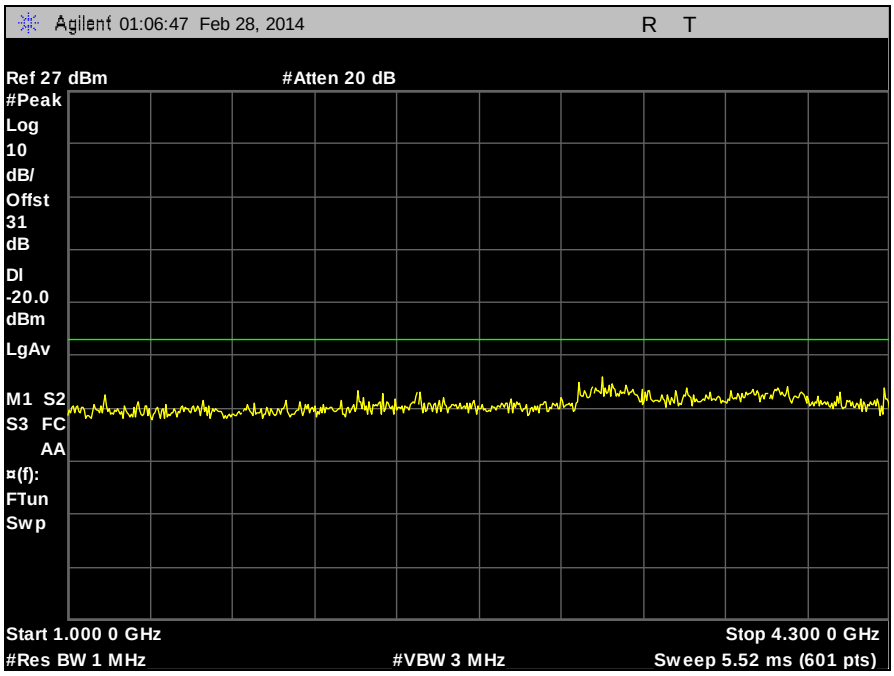
Plot 63. Part 90, Conducted Spurious Emissions, 420 MHz, CQPSK, 10 W, 30 MHz – 1 GHz



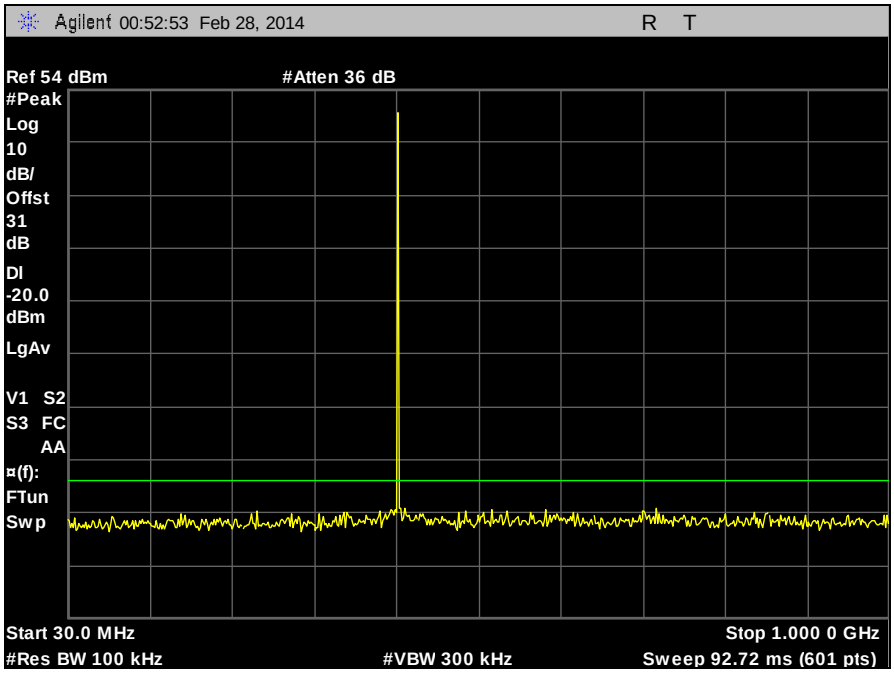
Plot 64. Part 90, Conducted Spurious Emissions, 420 MHz, CQPSK, 10 W, 1 GHz – 4.3 GHz



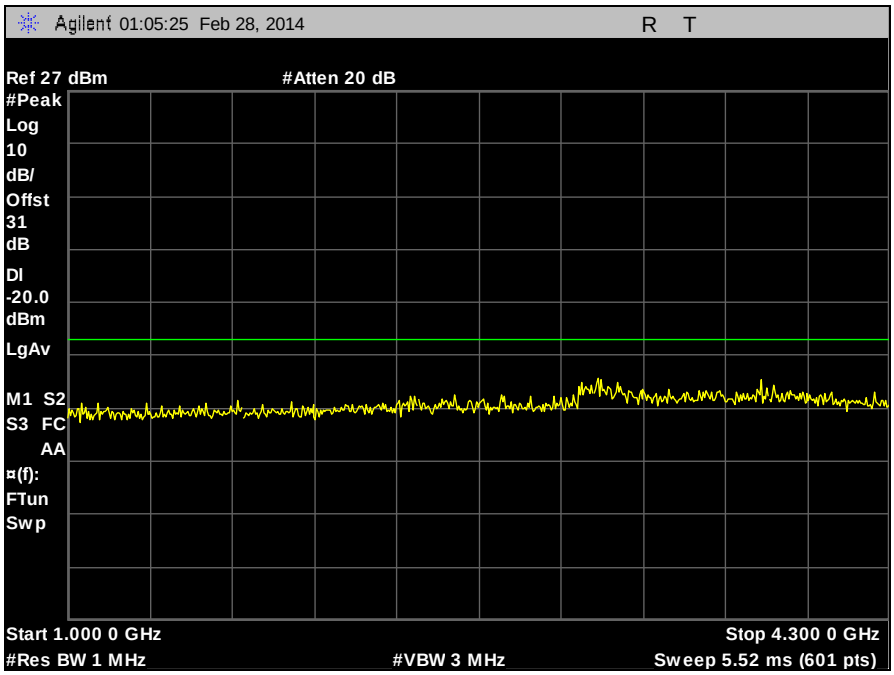
Plot 65. Part 90, Conducted Spurious Emissions, 420 MHz, HDQPSK, 10 W, 30 MHz – 1 GHz



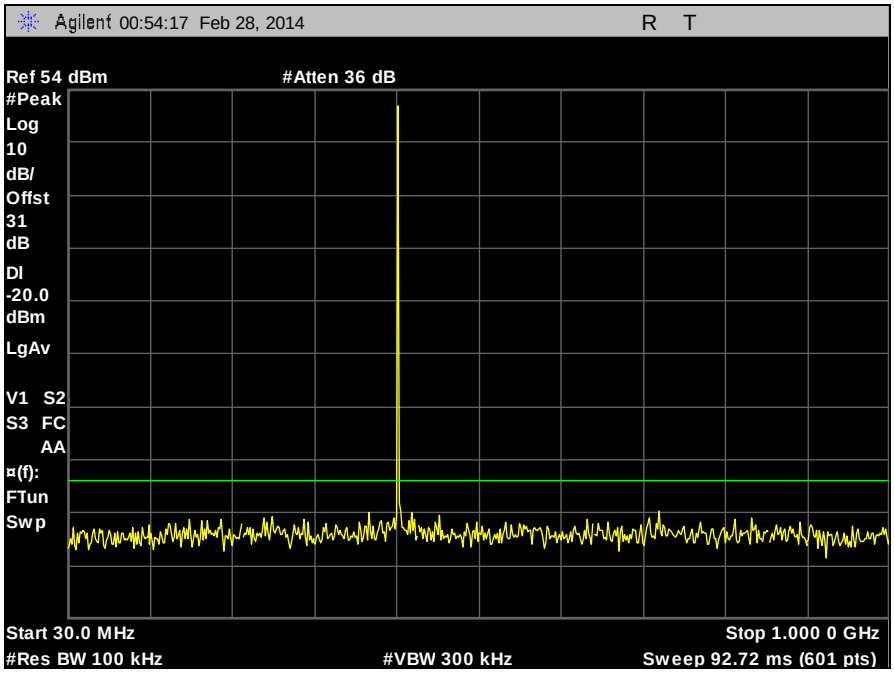
Plot 66. Part 90, Conducted Spurious Emissions, 420 MHz, HDQPSK, 10 W, 1 GHz – 4.3 GHz



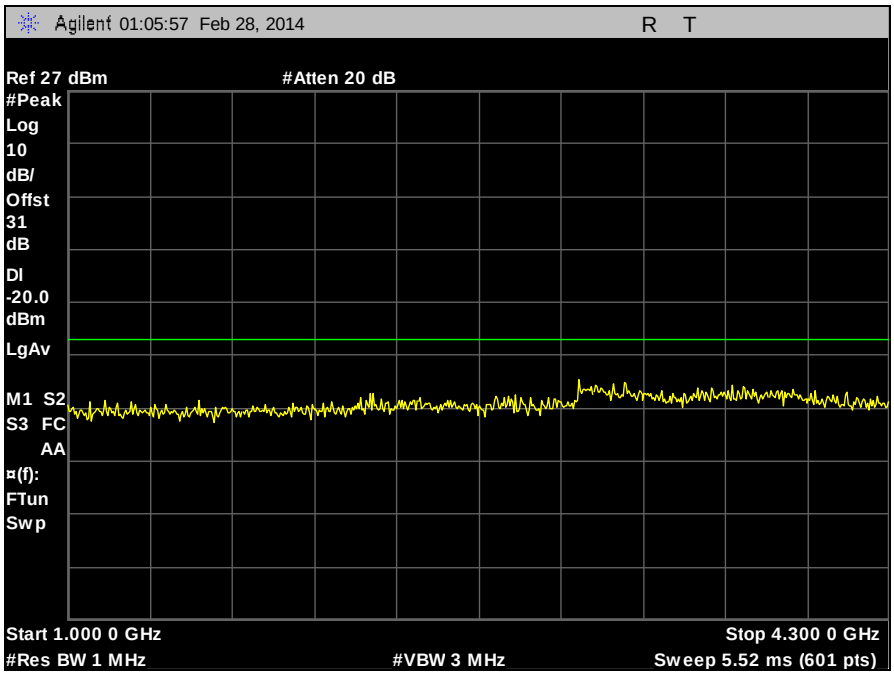
Plot 67. Part 90, Conducted Spurious Emissions, 420 MHz, C4FM, 100 W, 30 MHz – 1 GHz



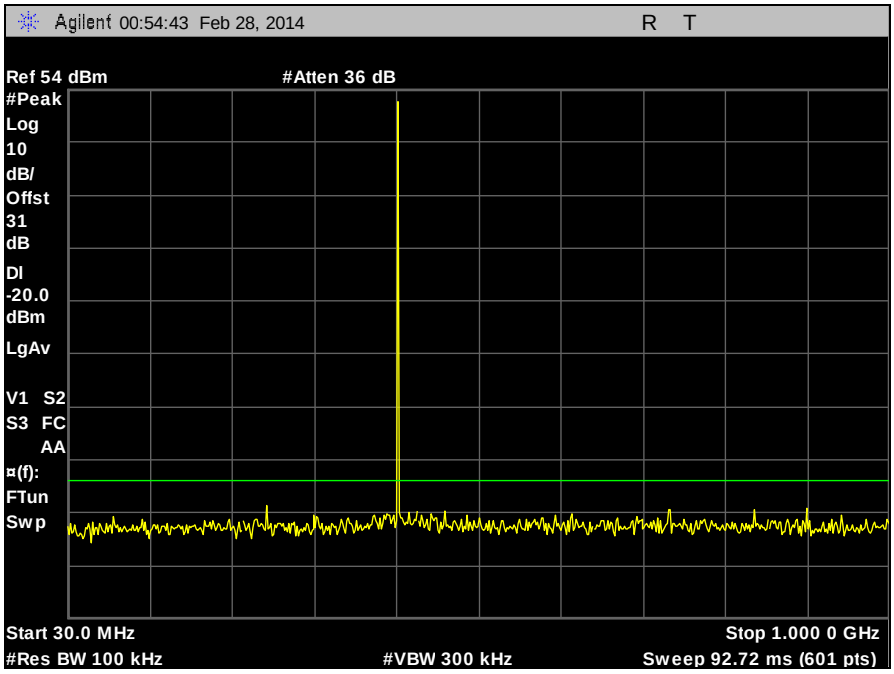
Plot 68. Part 90, Conducted Spurious Emissions, 420 MHz, C4FM, 100 W, 1 GHz – 4.3 GHz



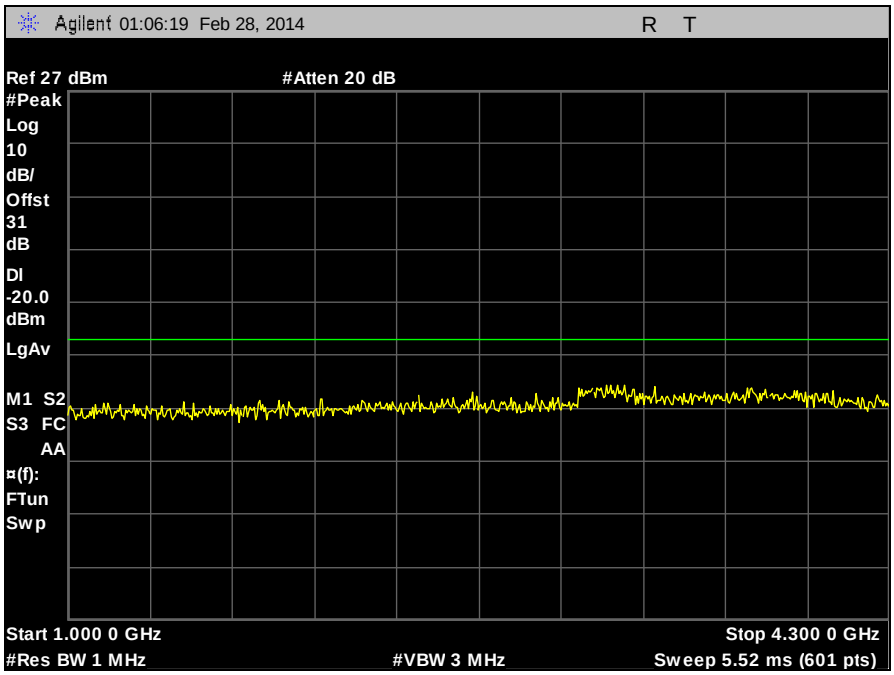
Plot 69. Part 90, Conducted Spurious Emissions, 420 MHz, CQPSK, 100 W, 30 MHz – 1 GHz



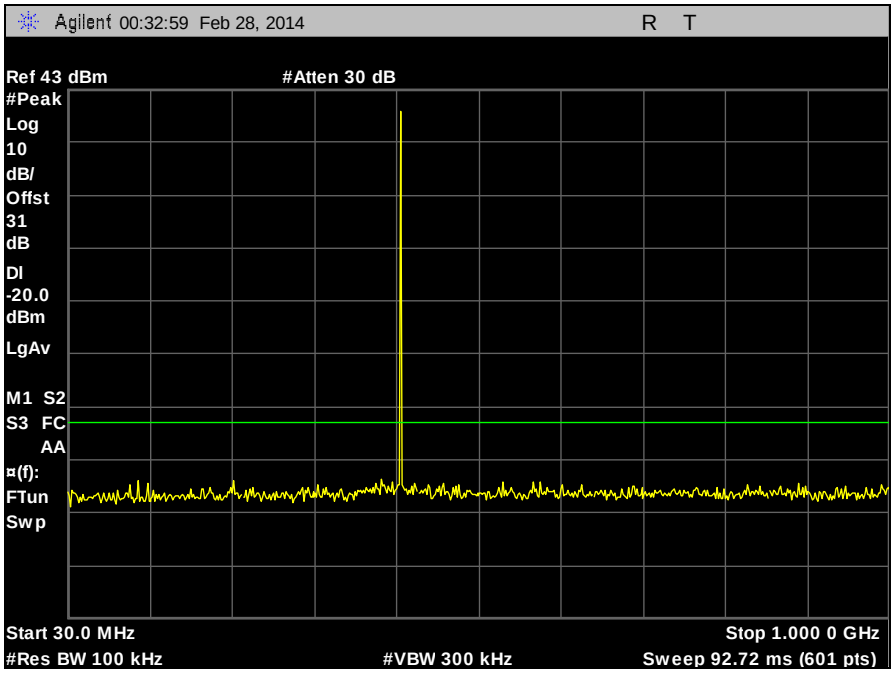
Plot 70. Part 90, Conducted Spurious Emissions, 420 MHz, CQPSK, 100 W, 1 GHz – 4.3 GHz



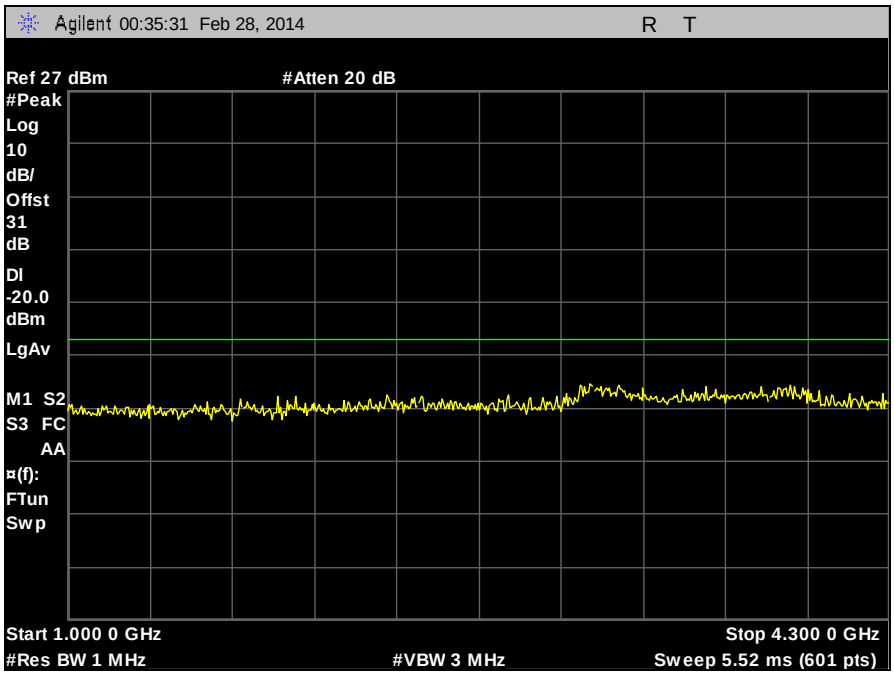
Plot 71. Part 90, Conducted Spurious Emissions, 420 MHz, HDQPSK, 100 W, 30 MHz – 1 GHz



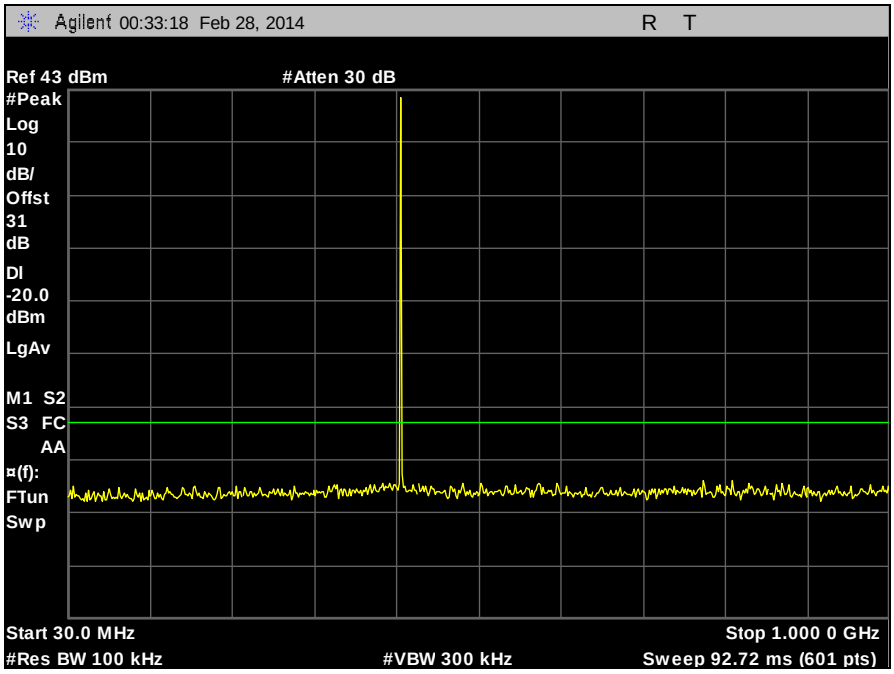
Plot 72. Part 90, Conducted Spurious Emissions, 420 MHz, HDQPSK, 100 W, 1 GHz – 4.3 GHz



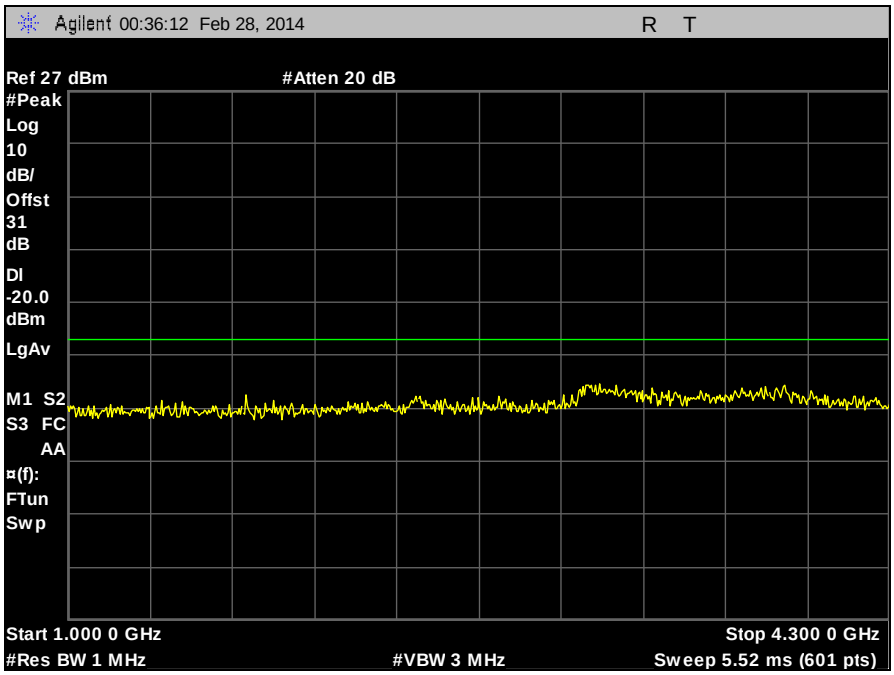
Plot 73. Part 90, Conducted Spurious Emissions, 423 MHz, C4FM, 10 W, 30 MHz – 1 GHz



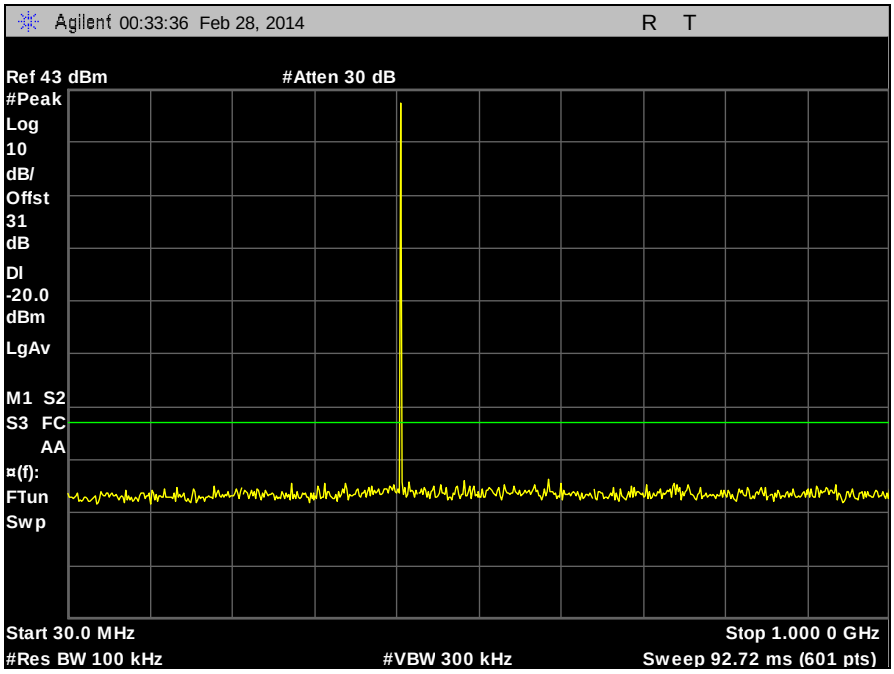
Plot 74. Part 90, Conducted Spurious Emissions, 423 MHz, C4FM, 10 W, 1 GHz – 4.3 GHz



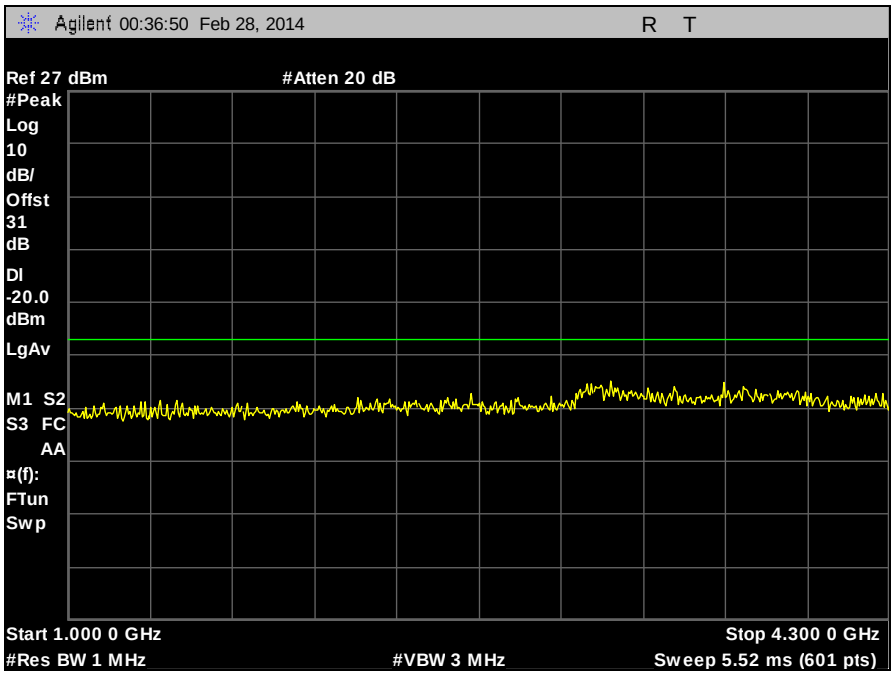
Plot 75. Part 90, Conducted Spurious Emissions, 423 MHz, CQPSK, 10 W, 30 MHz – 1 GHz



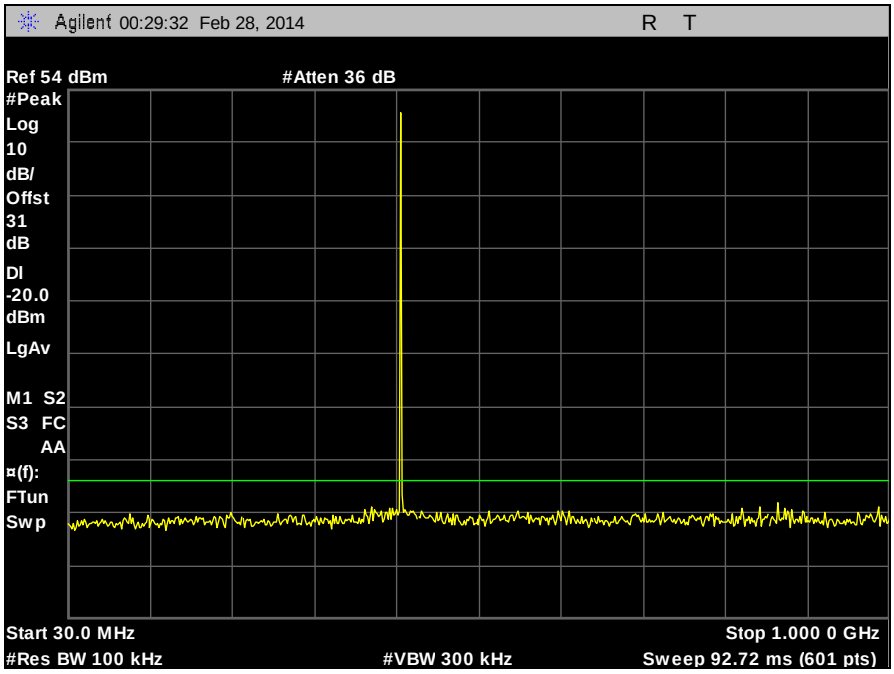
Plot 76. Part 90, Conducted Spurious Emissions, 423 MHz, CQPSK, 10 W, 1 GHz – 4.3 GHz



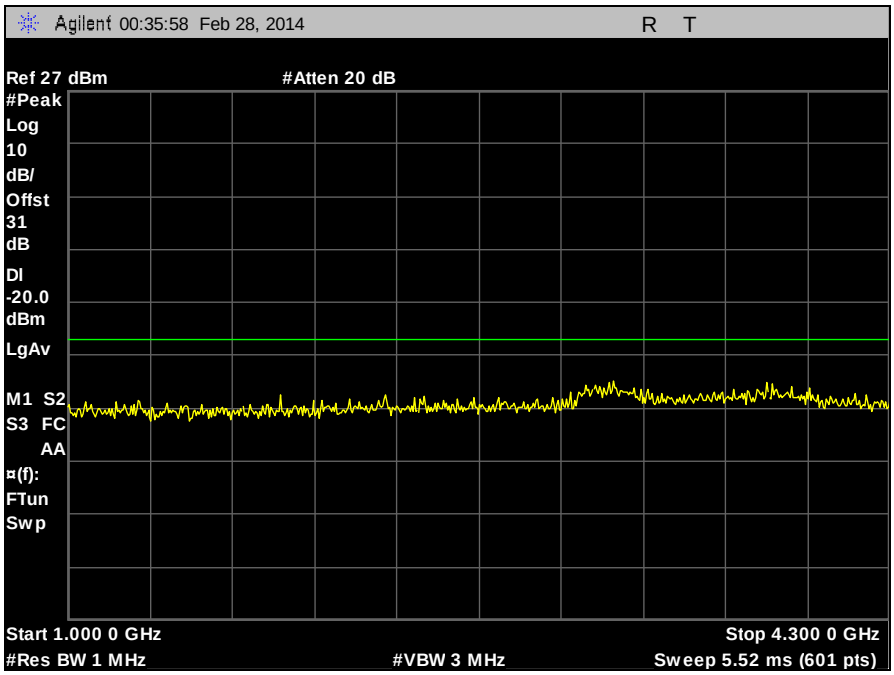
Plot 77. Part 90, Conducted Spurious Emissions, 423 MHz, HDQPSK, 10 W, 30 MHz – 1 GHz



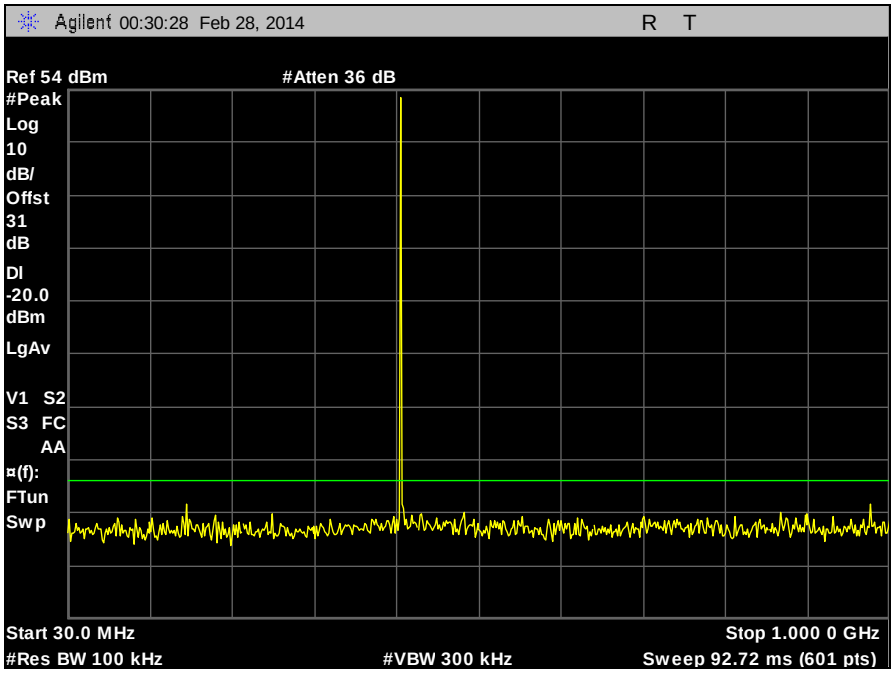
Plot 78. Part 90, Conducted Spurious Emissions, 423 MHz, HDQPSK, 10 W, 1 GHz – 4.3 GHz



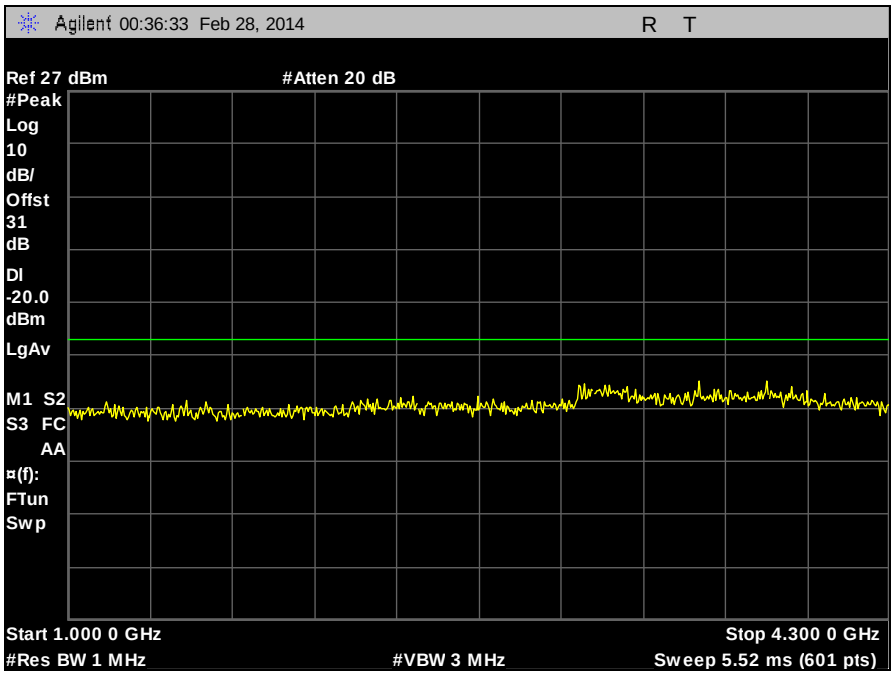
Plot 79. Part 90, Conducted Spurious Emissions, 423 MHz, C4FM, 100 W, 30 MHz – 1 GHz



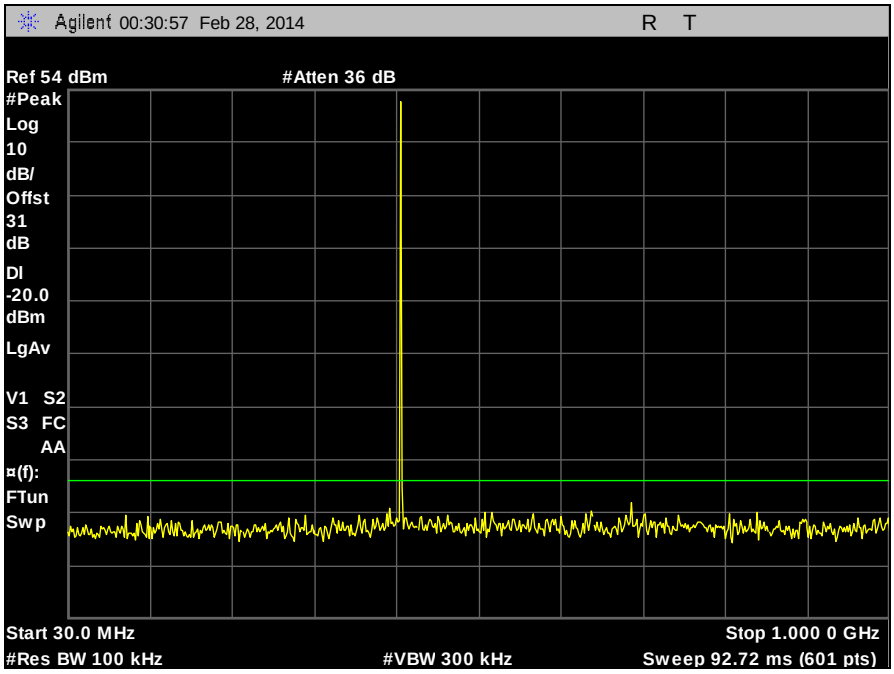
Plot 80. Part 90, Conducted Spurious Emissions, 423 MHz, C4FM, 100 W, 1 GHz – 4.3 GHz



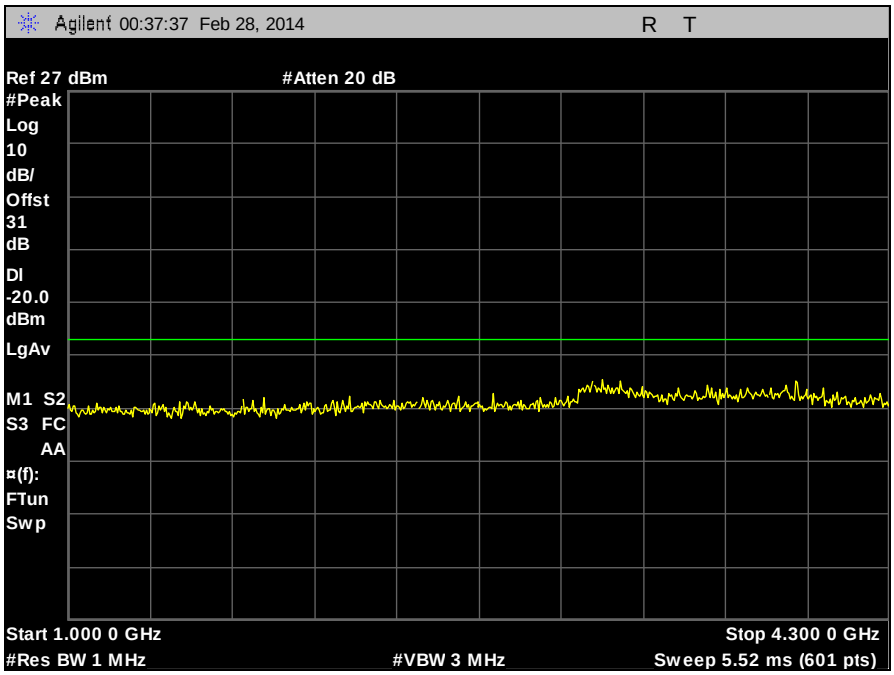
Plot 81. Part 90, Conducted Spurious Emissions, 423 MHz, CQPSK, 100 W, 30 MHz – 1 GHz



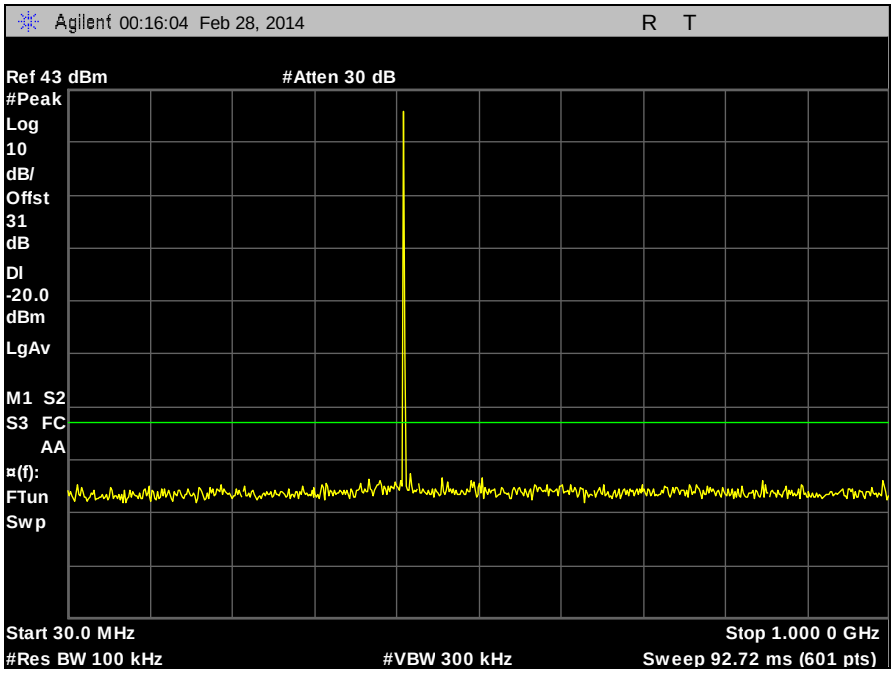
Plot 82. Part 90, Conducted Spurious Emissions, 423 MHz, CQPSK, 100 W, 1 GHz – 4.3 GHz



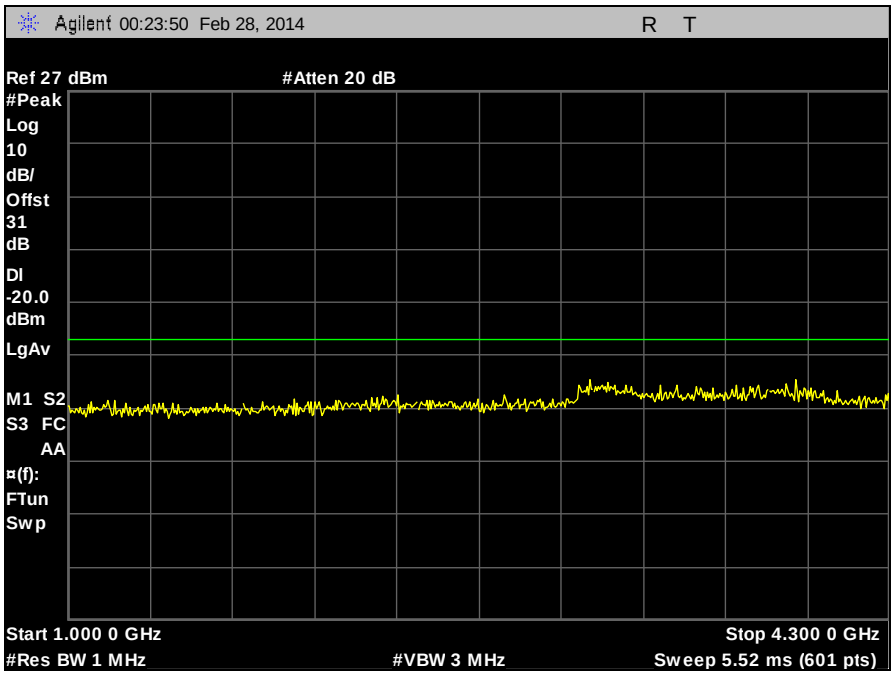
Plot 83. Part 90, Conducted Spurious Emissions, 423 MHz, HDQPSK, 100 W, 30 MHz – 1 GHz



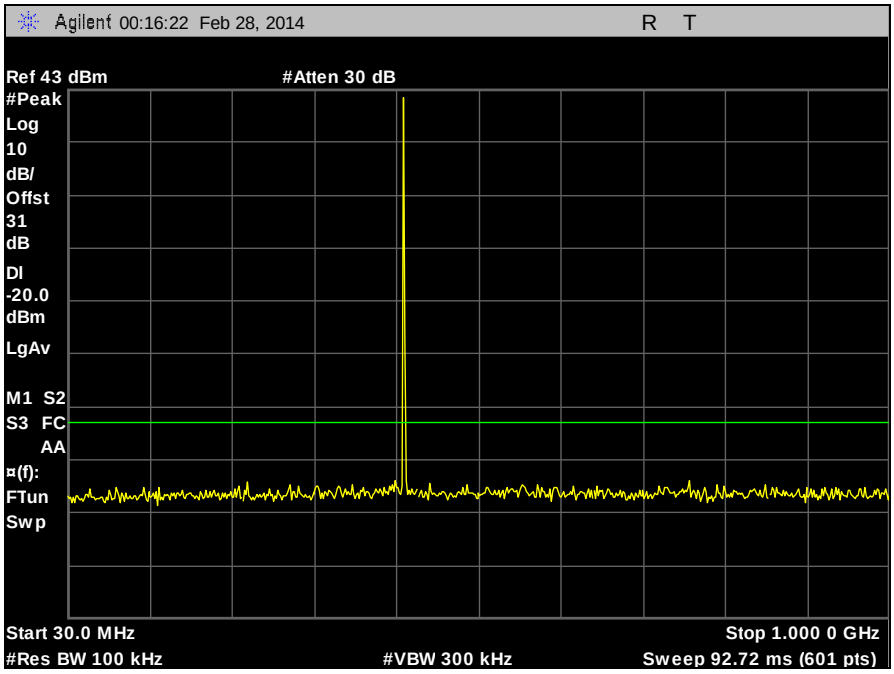
Plot 84. Part 90, Conducted Spurious Emissions, 423 MHz, HDQPSK, 100 W, 1 GHz – 4.3 GHz



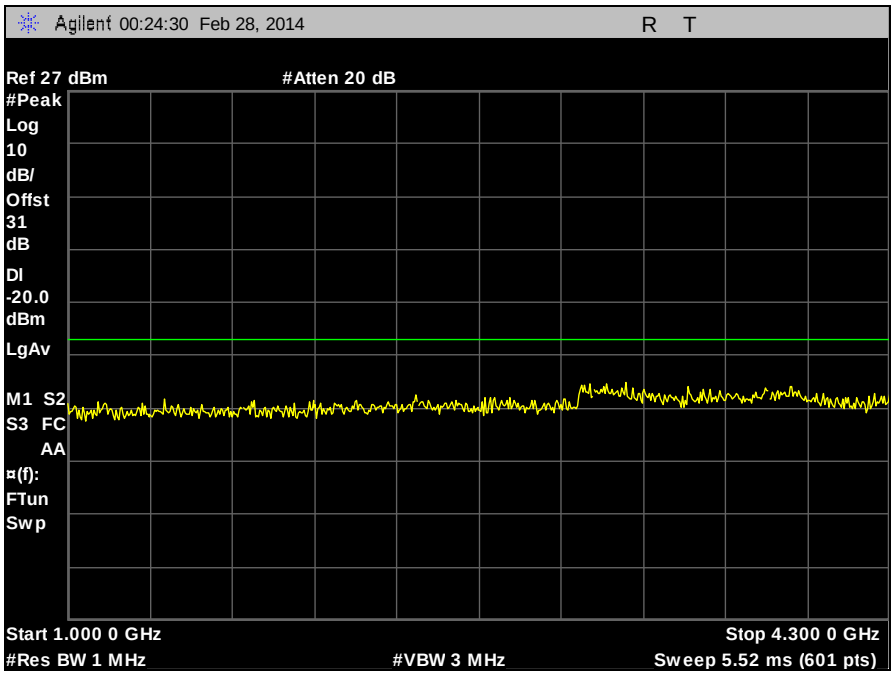
Plot 85. Part 90, Conducted Spurious Emissions, 426 MHz, C4FM, 10 W, 30 MHz – 1 GHz



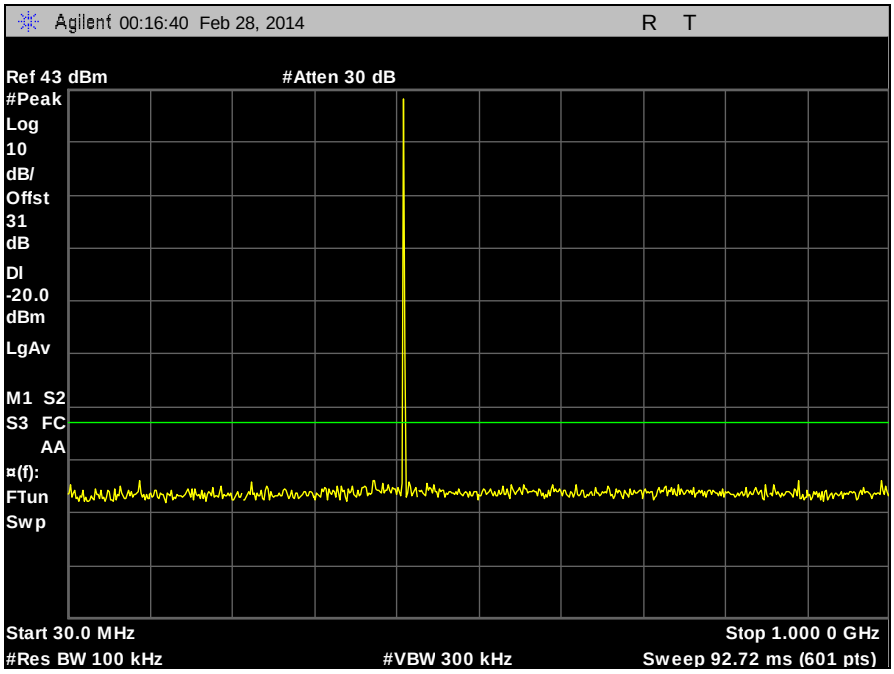
Plot 86. Part 90, Conducted Spurious Emissions, 426 MHz, C4FM, 10 W, 1 GHz – 4.3 GHz



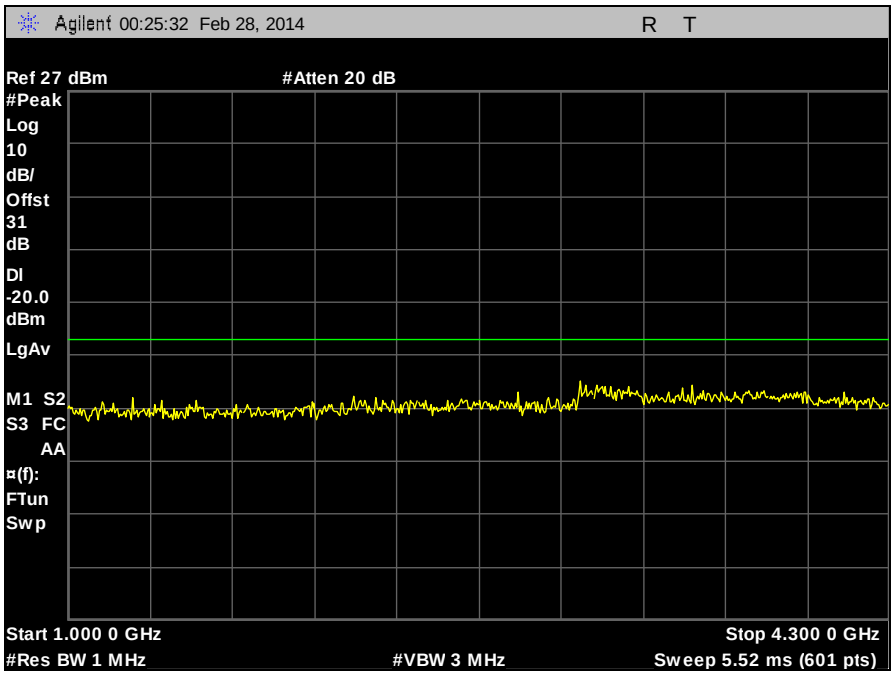
Plot 87. Part 90, Conducted Spurious Emissions, 426 MHz, CQPSK, 10 W, 30 MHz – 1 GHz



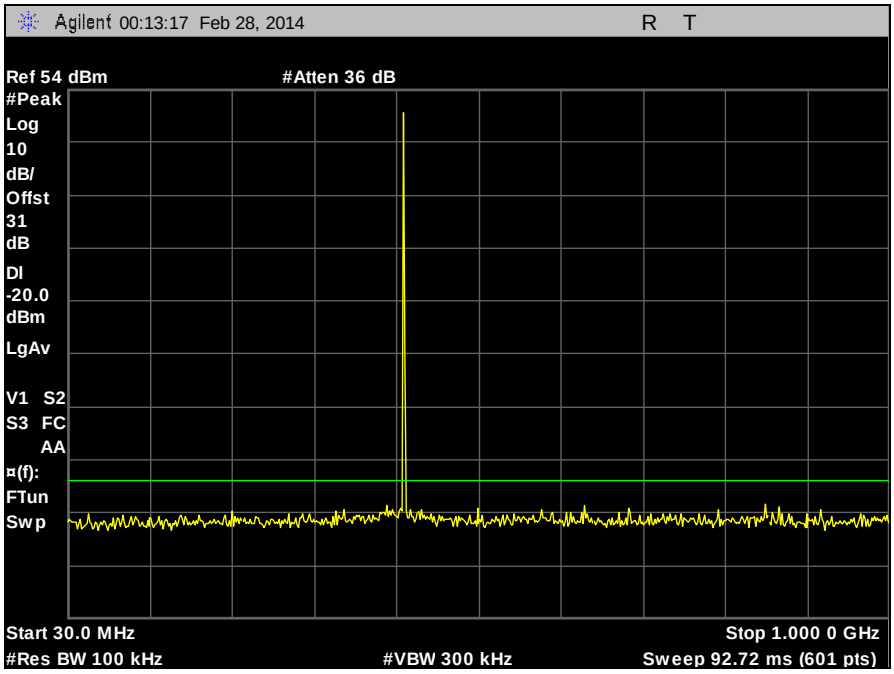
Plot 88. Part 90, Conducted Spurious Emissions, 426 MHz, CQPSK, 10 W, 1 GHz – 4.3 GHz



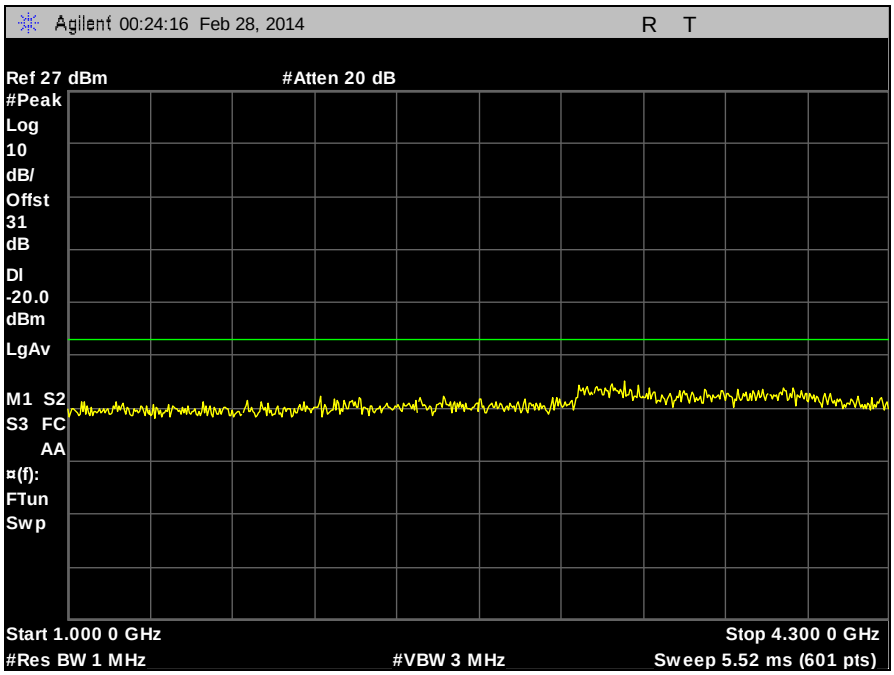
Plot 89. Part 90, Conducted Spurious Emissions, 426 MHz, HDQPSK, 10 W, 30 MHz – 1 GHz



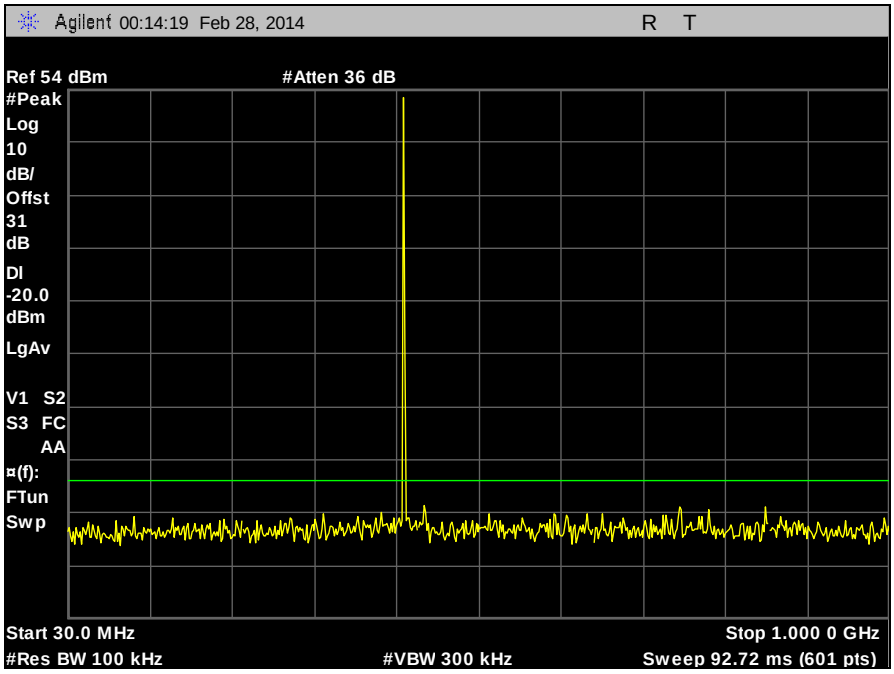
Plot 90. Part 90, Conducted Spurious Emissions, 426 MHz, HDQPSK, 10 W, 1 GHz – 4.3 GHz



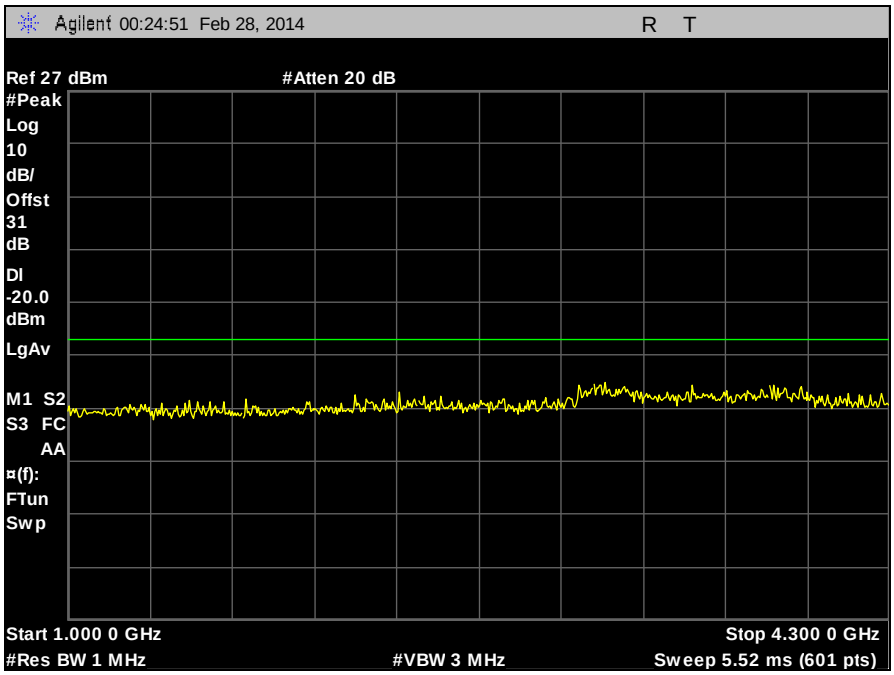
Plot 91. Part 90, Conducted Spurious Emissions, 426 MHz, C4FM, 100 W, 30 MHz – 1 GHz



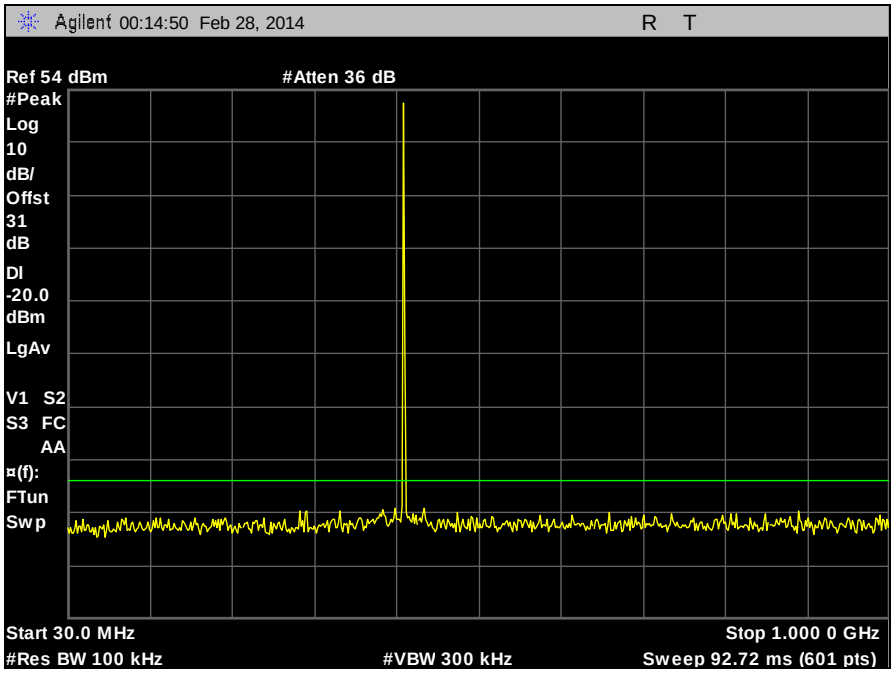
Plot 92. Part 90, Conducted Spurious Emissions, 426 MHz, C4FM, 100 W, 1 GHz – 4.3 GHz



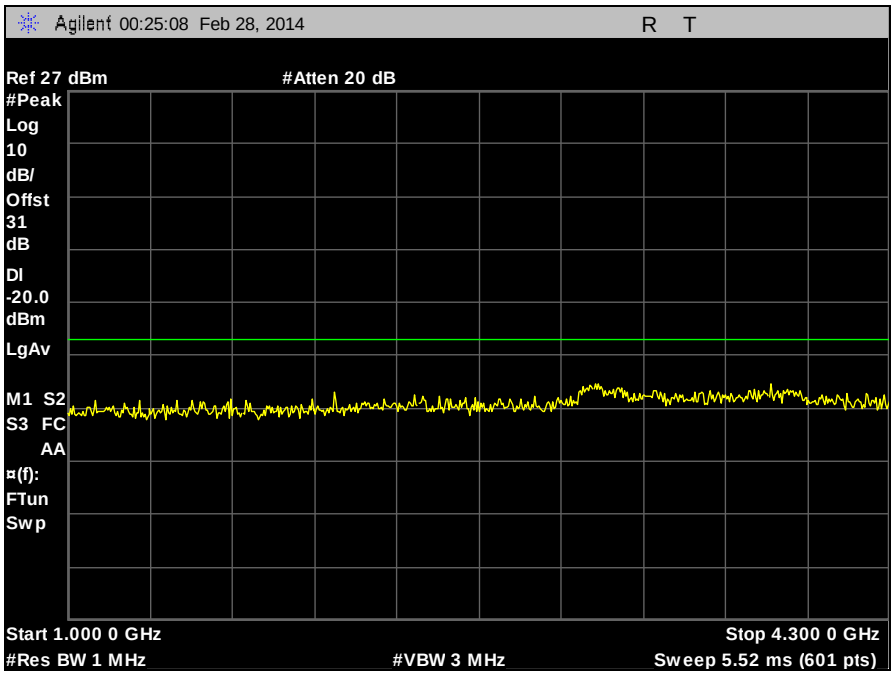
Plot 93. Part 90, Conducted Spurious Emissions, 426 MHz, CQPSK, 100 W, 30 MHz – 1GHz



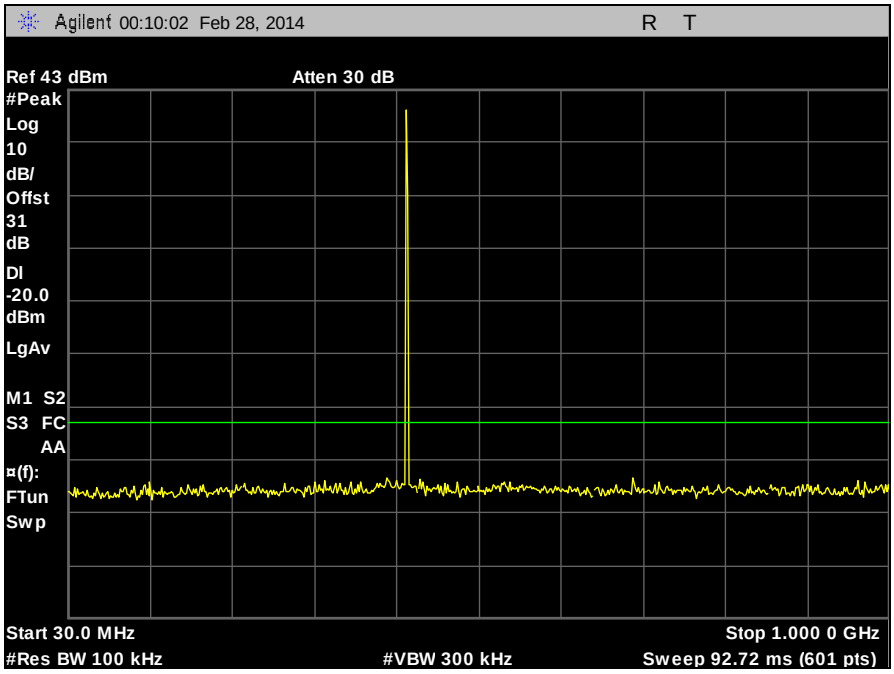
Plot 94. Part 90, Conducted Spurious Emissions, 426 MHz, CQPSK, 100 W, 1GHz – 4.3 GHz



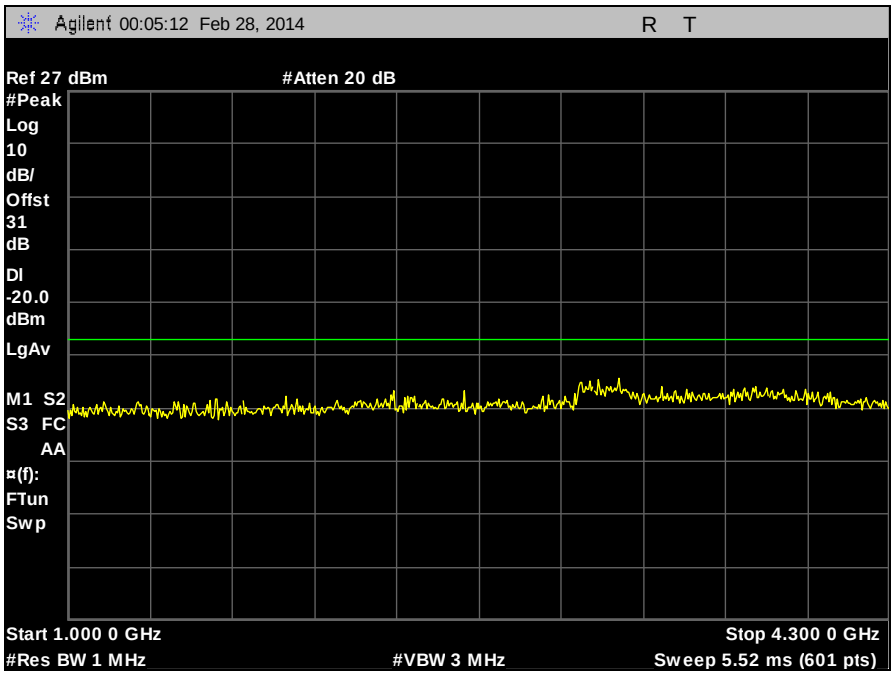
Plot 95. Part 90, Conducted Spurious Emissions, 426 MHz, HDQPSK, 100 W, 30 MHz – 1 GHz



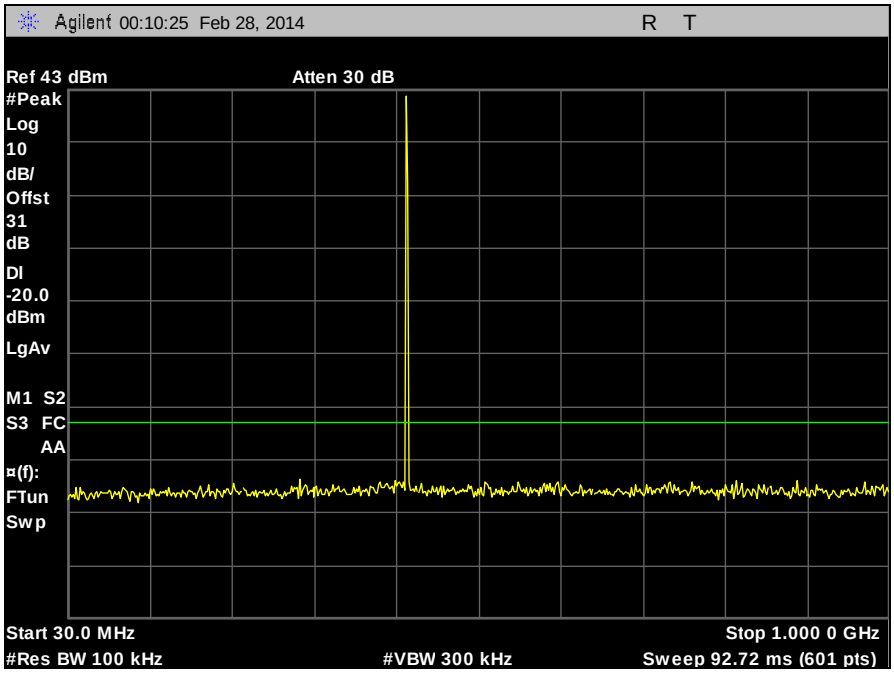
Plot 96. Part 90, Conducted Spurious Emissions, 426 MHz, HDQPSK, 100 W, 1 GHz – 4.3 GHz



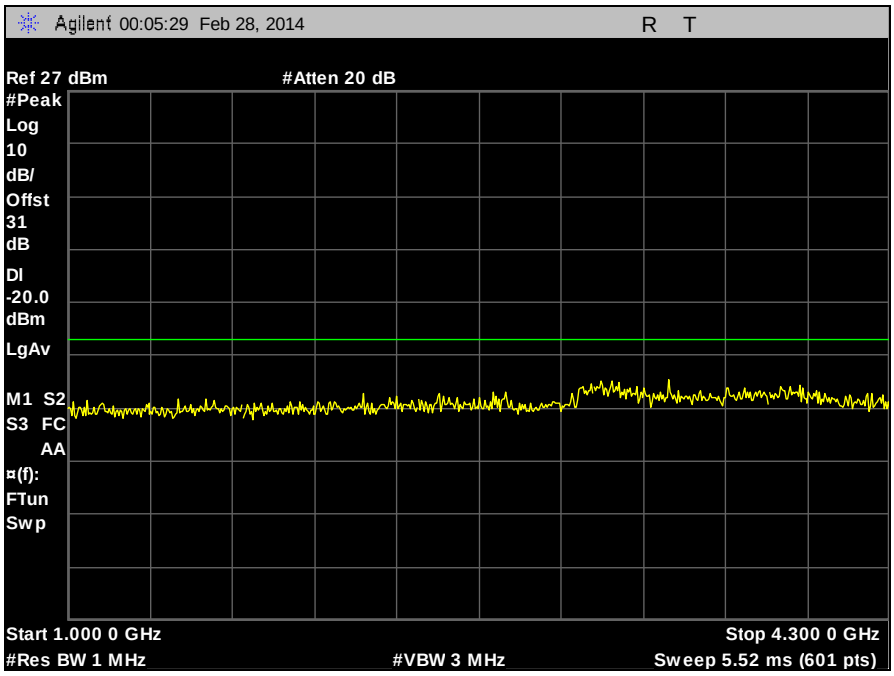
Plot 97. Part 90, Conducted Spurious Emissions, 430 MHz, C4FM, 10 W, 30 MHz – 1 GHz



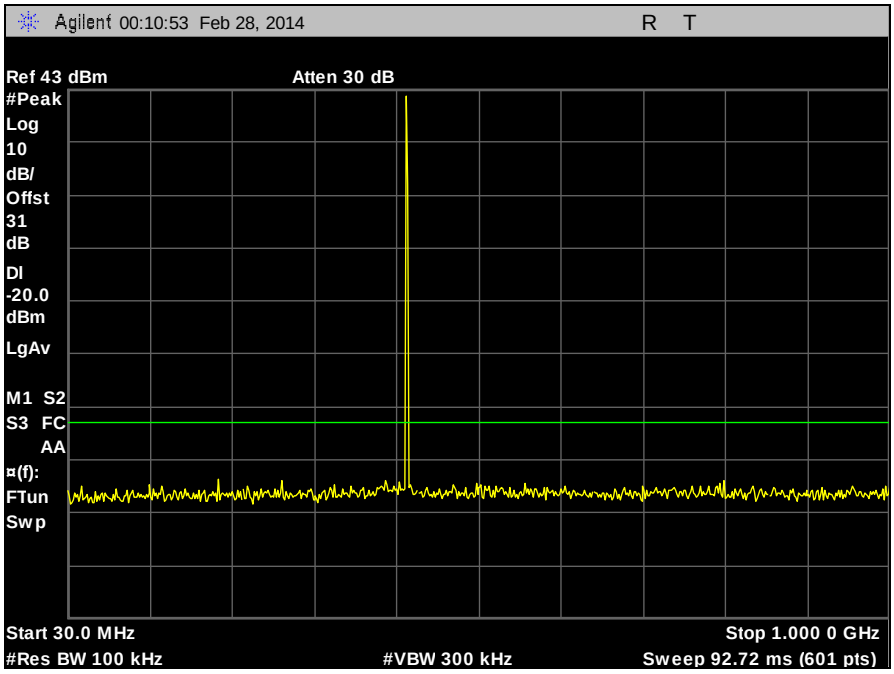
Plot 98. Part 90, Conducted Spurious Emissions, 430 MHz, C4FM, 10 W, 1 GHz – 4.3 GHz



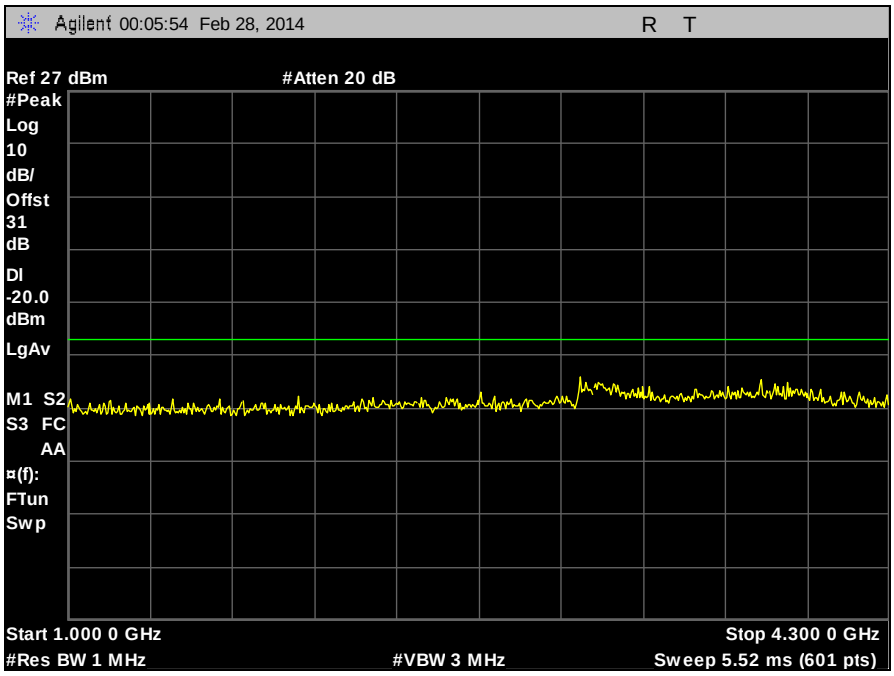
Plot 99. Part 90, Conducted Spurious Emissions, 430 MHz, CQPSK, 10 W, 30 MHz – 1 GHz



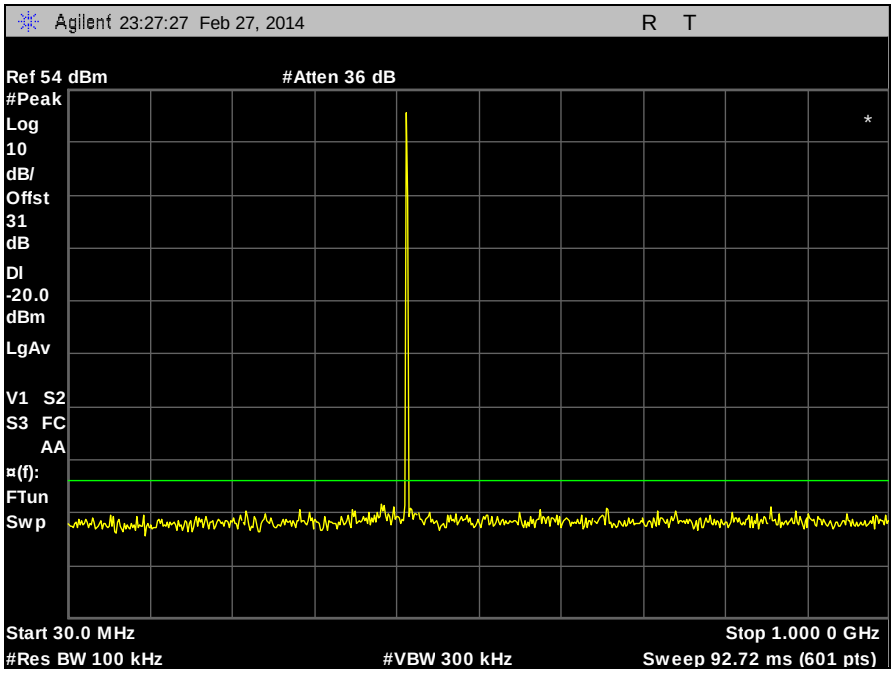
Plot 100. Part 90, Conducted Spurious Emissions, 430 MHz, CQPSK, 10 W, 1 GHz – 4.3 GHz



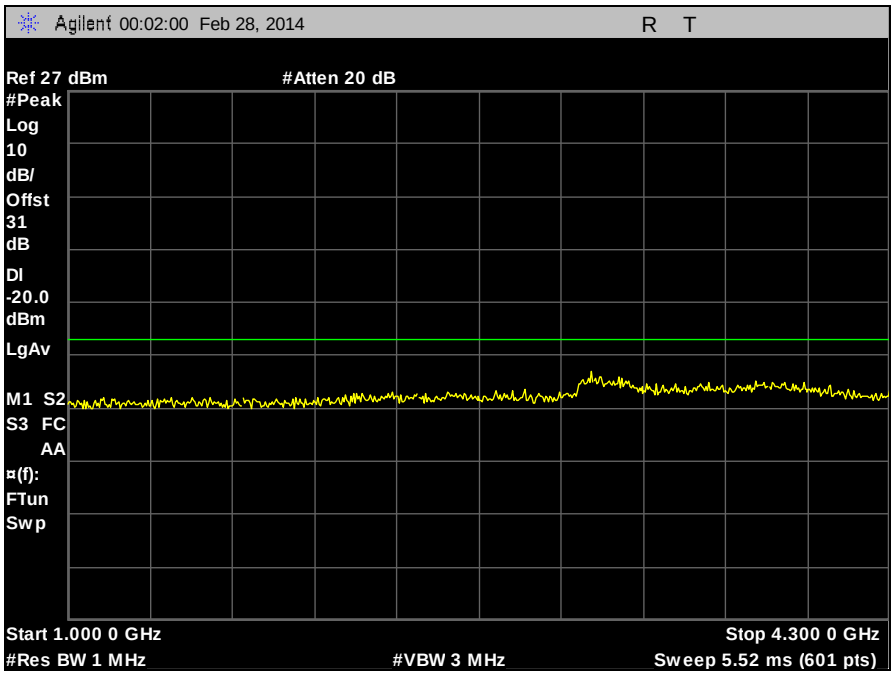
Plot 101. Part 90, Conducted Spurious Emissions, 430 MHz, HDQPSK, 10 W, 30 MHz – 1 GHz



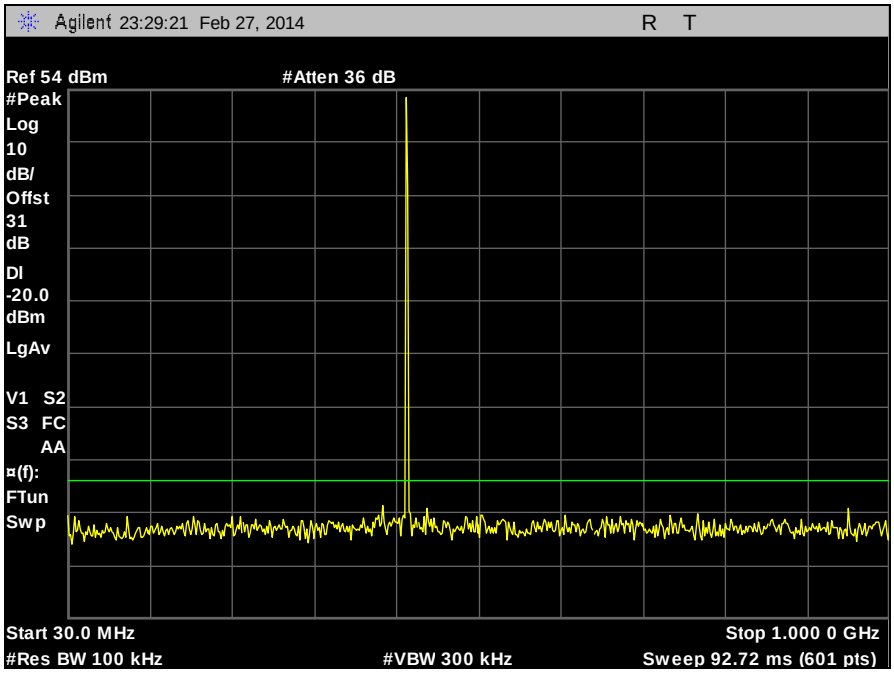
Plot 102. Part 90, Conducted Spurious Emissions, 470 MHz, HDQPSK, 10 W, 1 GHz – 4.3 GHz



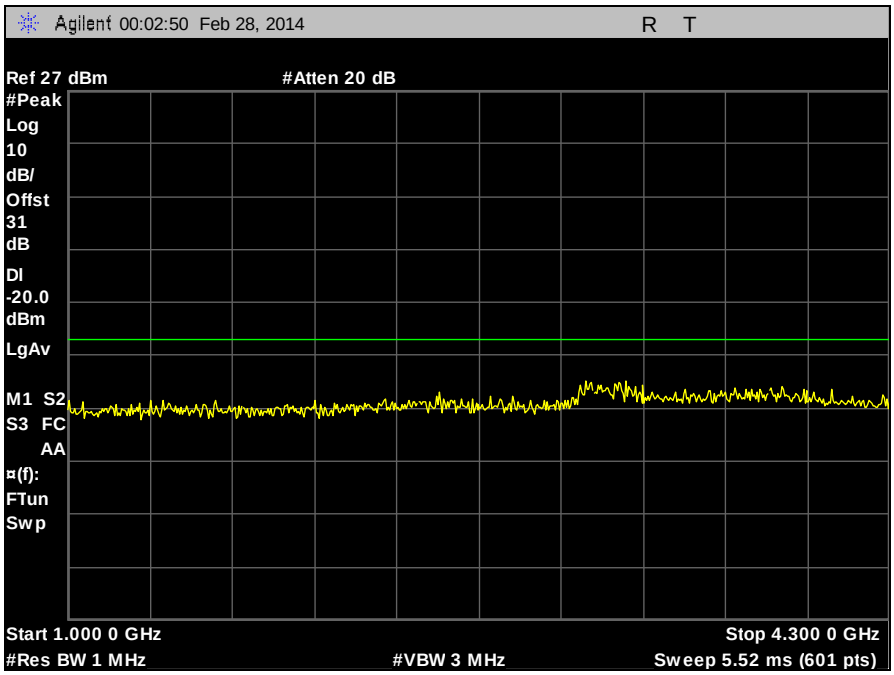
Plot 103. Part 90, Conducted Spurious Emissions, 430 MHz, C4FM, 100 W, 30 MHz – 1 GHz



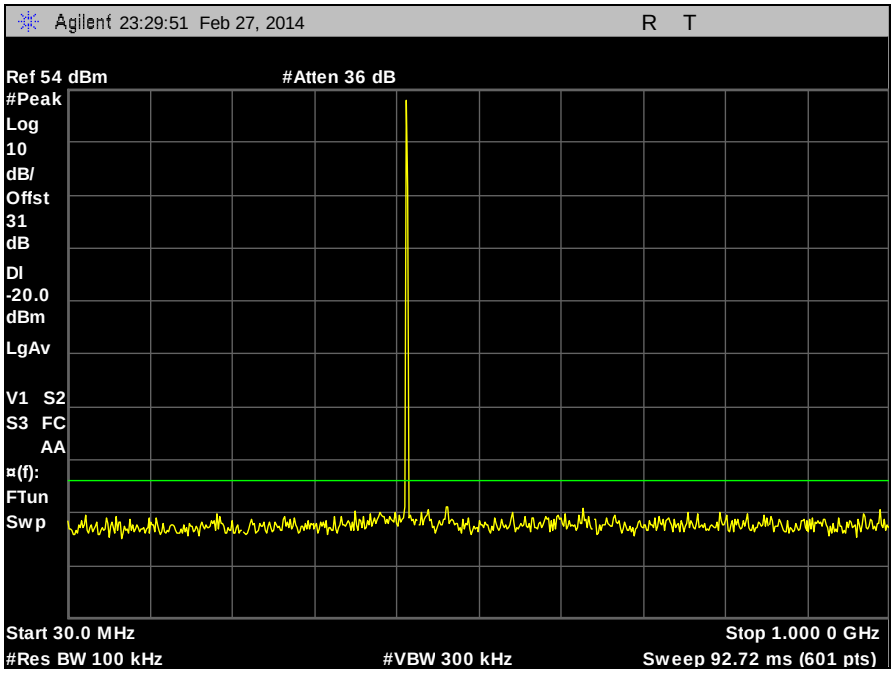
Plot 104. Part 90, Conducted Spurious Emissions, 430 MHz, C4FM, 100 W, 1 GHz – 4.3 GHz



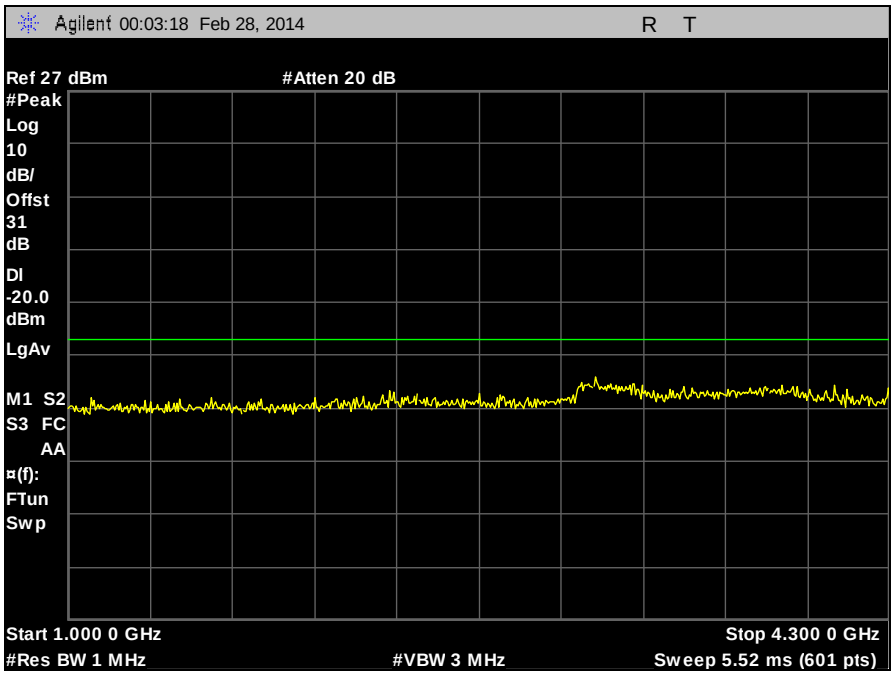
Plot 105. Part 90, Conducted Spurious Emissions, 430 MHz, CQPSK, 100 W, 30 MHz – 1 GHz



Plot 106. Part 90, Conducted Spurious Emissions, 430 MHz, CQPSK, 100 W, 1 GHz – 4.3 GHz



Plot 107. Part 90, Conducted Spurious Emissions, 430 MHz, HDQPSK, 100 W, 30 MHz – 1 GHz



Plot 108. Part 90, Conducted Spurious Emissions, 430 MHz, HDQPSK, 100 W, 1 GHz – 4.3 GHz

3.4. §2.1053 Radiated Spurious Emissions

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

est Procedures: As required by 47 CFR 2.1053, *field strength of radiated spurious measurements* were made in accordance with the procedures of TIA/EIA-603-C-2004 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards".

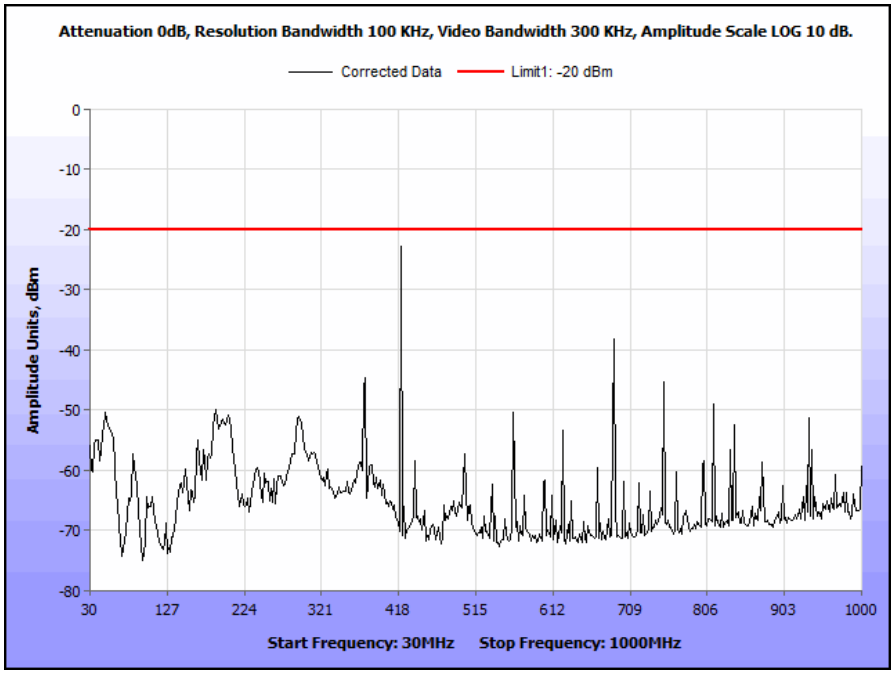
Radiated emission measurements were performed inside a 3 meter semi-anechoic chamber. The EUT was set at a distance of 3m from the receiving antenna. The EUT's RF ports were terminated to 50ohm load. The EUT was set to transmit at all four channels of the transmitter frequency range at its maximum power level. The EUT was rotated about 360^0 and the receiving antenna scanned from 1-4m in order to capture the maximum emission. These steps were carried out with the receiving antenna in both vertical and horizontal polarization. Harmonic emissions up to the 10^{th} or 40GHz, which ever was the lesser, were investigated.

Test Results: The EUT was compliant with the requirements of this section.

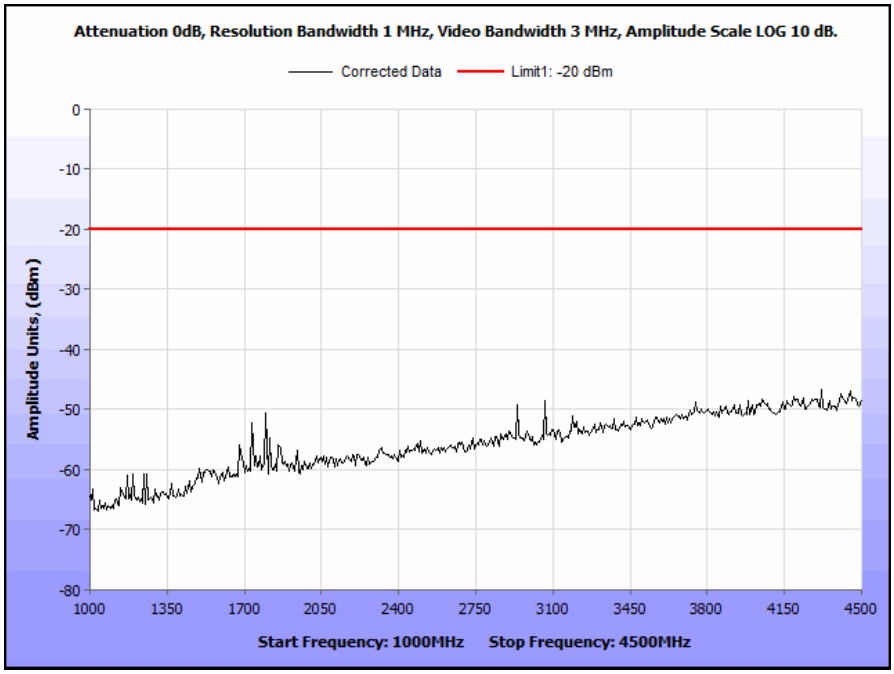
Test Engineer: Benjamin Taylor

Test Date(s): 03/21/14

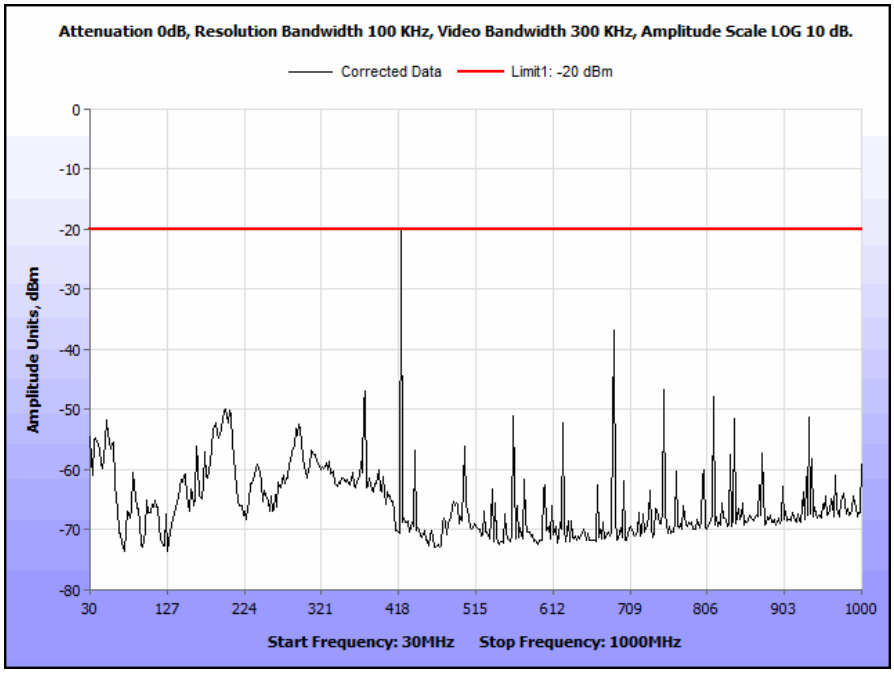
Radiated Spurious Emissions



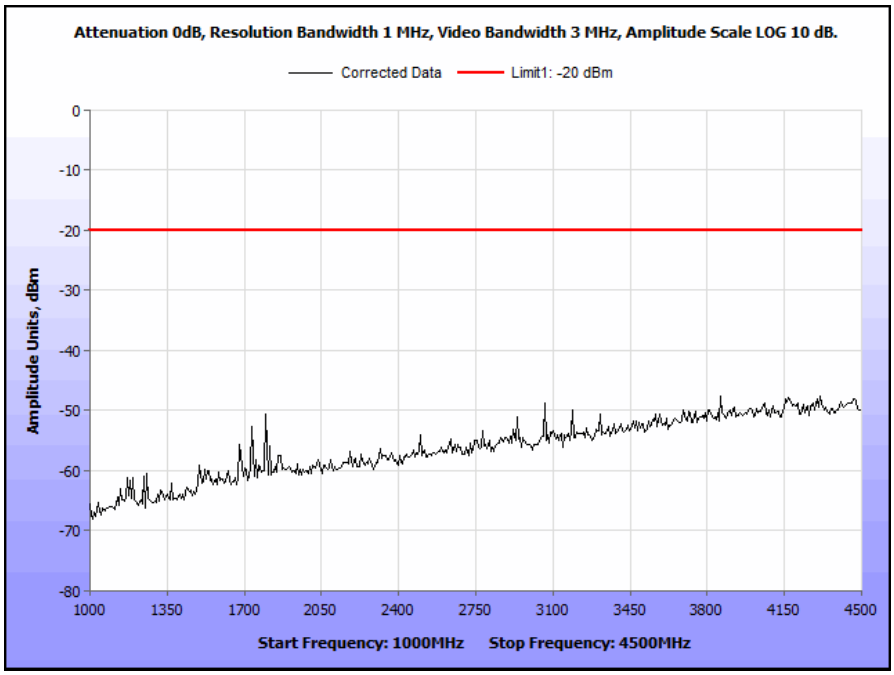
Plot 109. Part 90, Radiated Spurious Emissions, 420 MHz, C4FM, 30 MHz – 1 GHz, 10 W



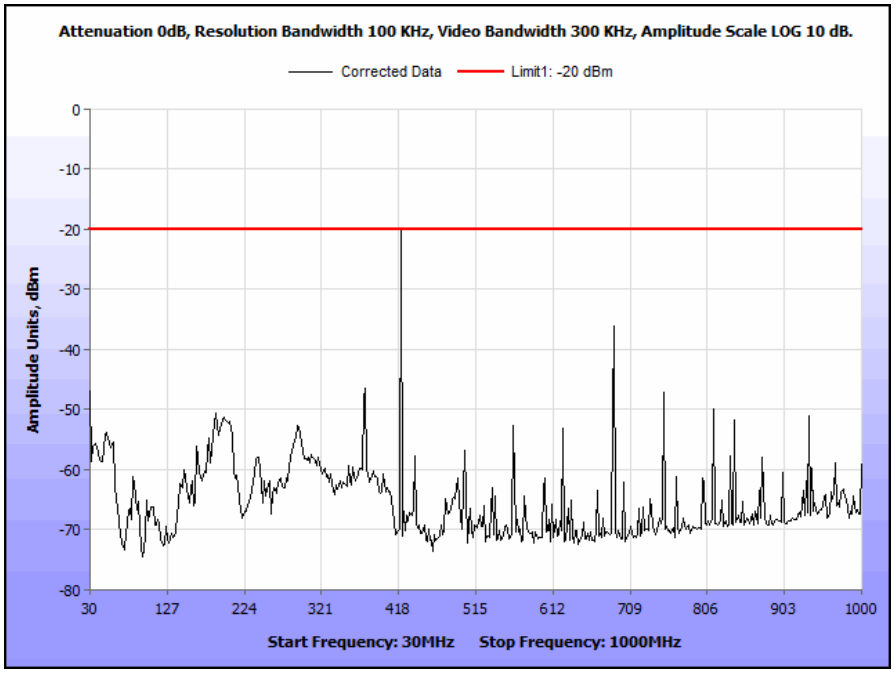
Plot 110. Part 90, Radiated Spurious Emissions, 420 MHz, C4FM, 1 GHz – 4.5 GHz, 10 W



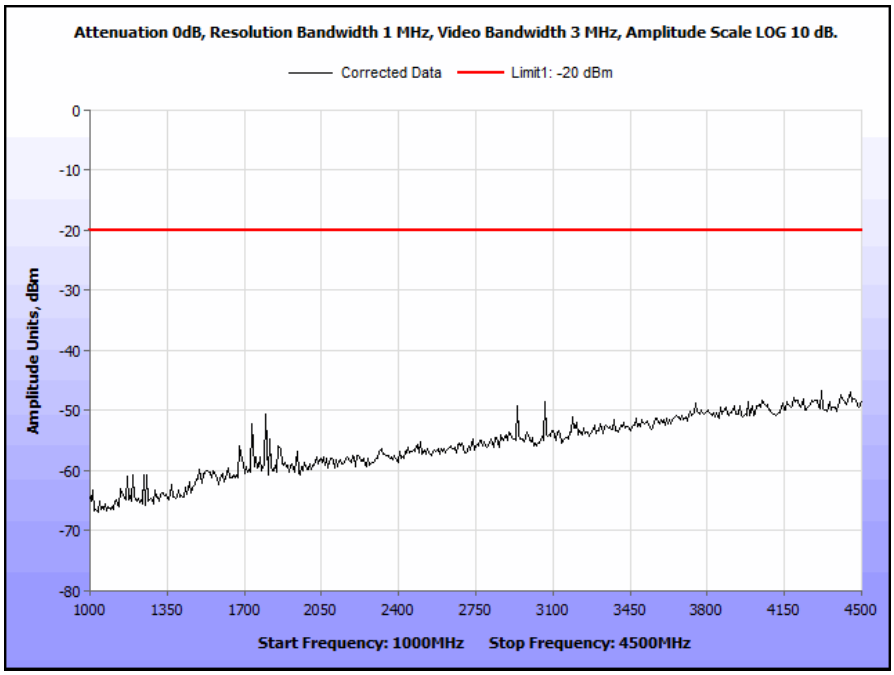
Plot 111. Part 90, Radiated Spurious Emissions, 420 MHz, CQPSK, 30 MHz – 1 GHz, 10 W



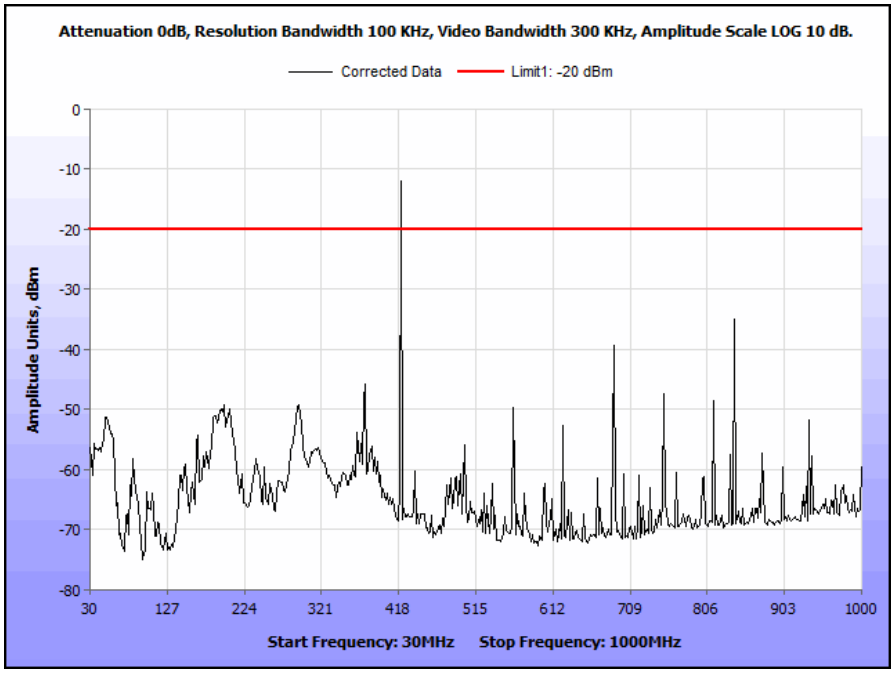
Plot 112. Part 90, Radiated Spurious Emissions, 420 MHz, CQPSK, 1 GHz – 4.5 GHz, 10 W



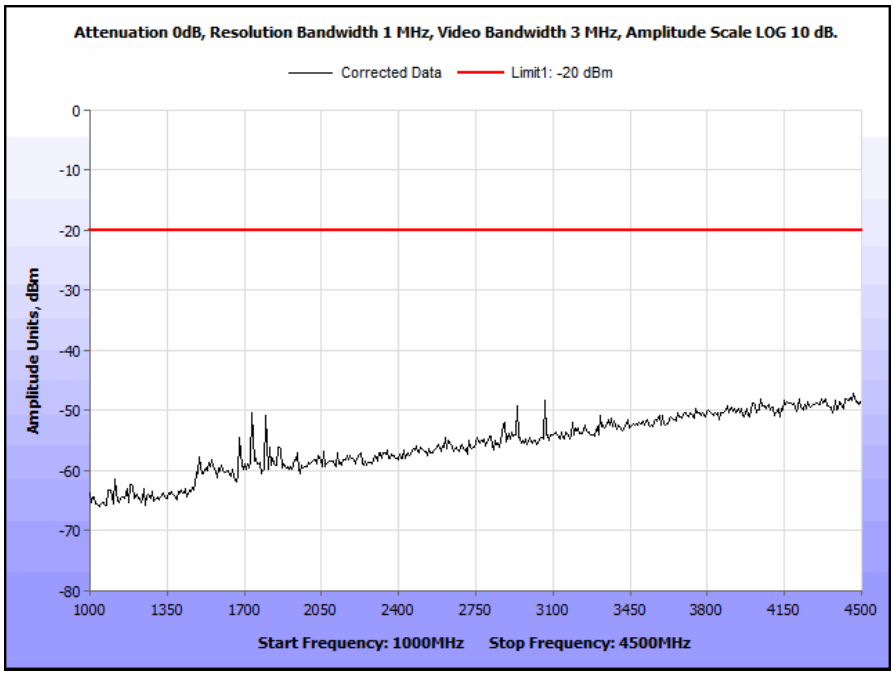
Plot 113. Part 90, Radiated Spurious Emissions, 420 MHz, HDQPSK, 30 MHz – 1 GHz, 10 W



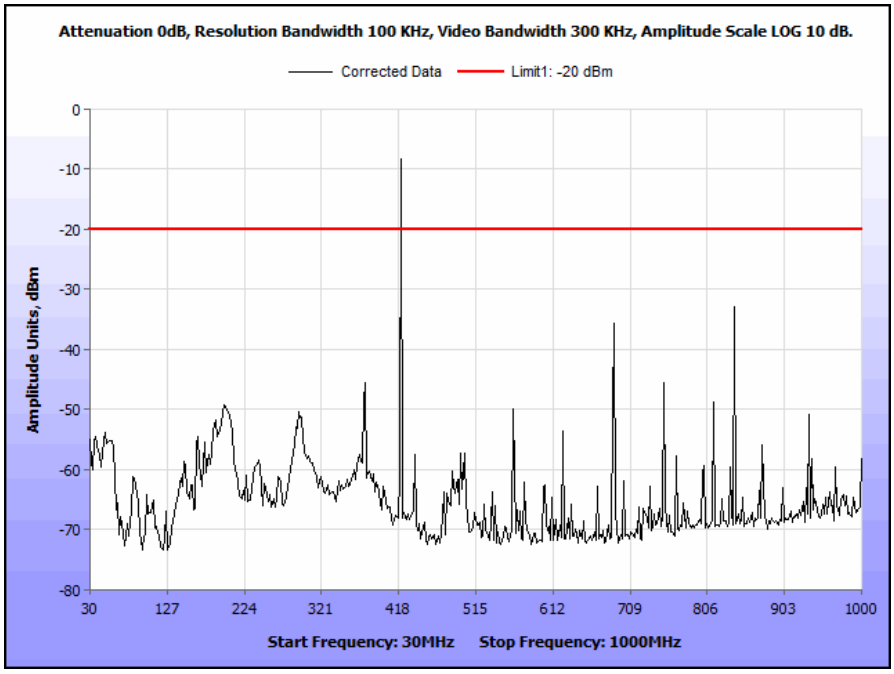
Plot 114. Part 90, Radiated Spurious Emissions, 420 MHz, HDQPSK, 1 GHz – 4.5 GHz, 10 W



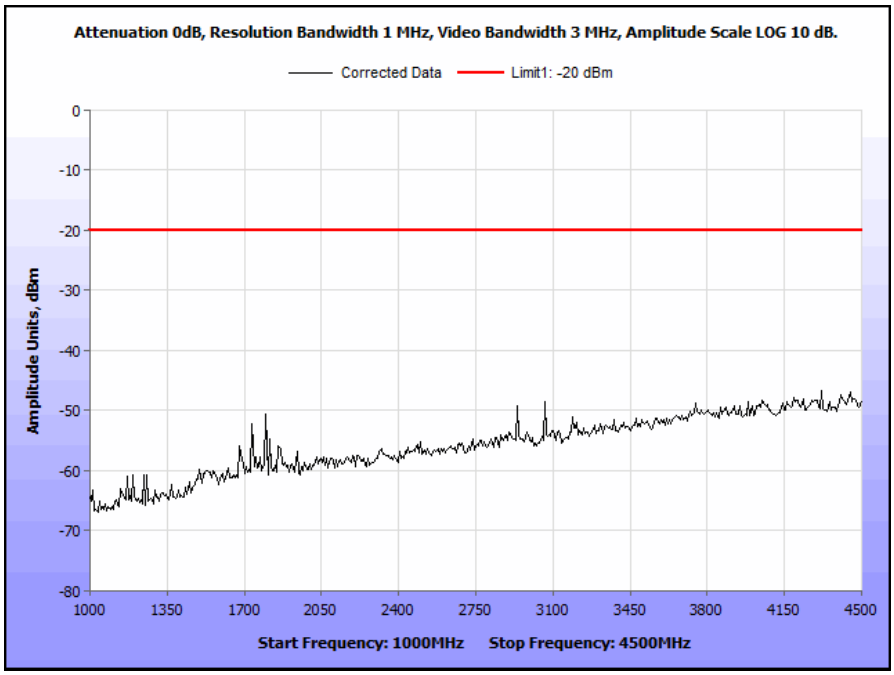
Plot 115. Part 90, Radiated Spurious Emissions, 420 MHz, C4FM, 30 MHz – 1 GHz, 100 W



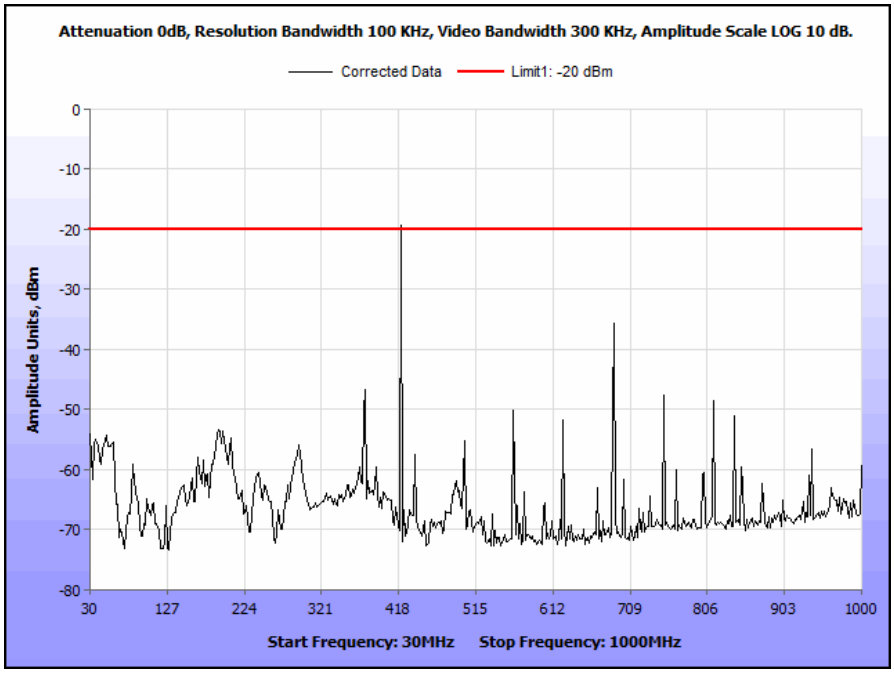
Plot 116. Part 90, Radiated Spurious Emissions, 420 MHz, C4FM, 1 GHz – 4.5 GHz, 100 W



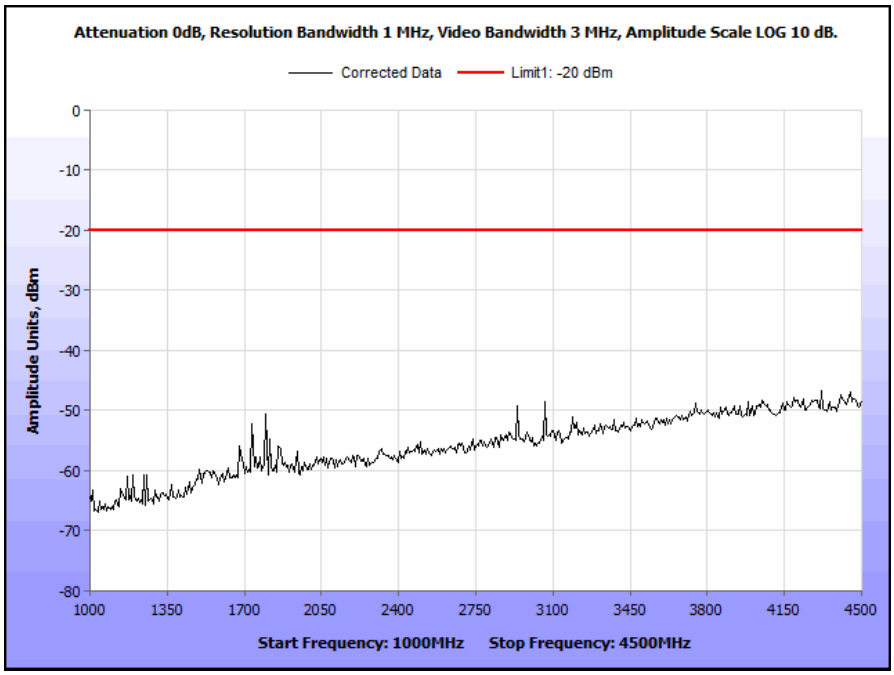
Plot 117. Part 90, Radiated Spurious Emissions, 420 MHz, CQPSK, 30 MHz – 1 GHz, 100 W



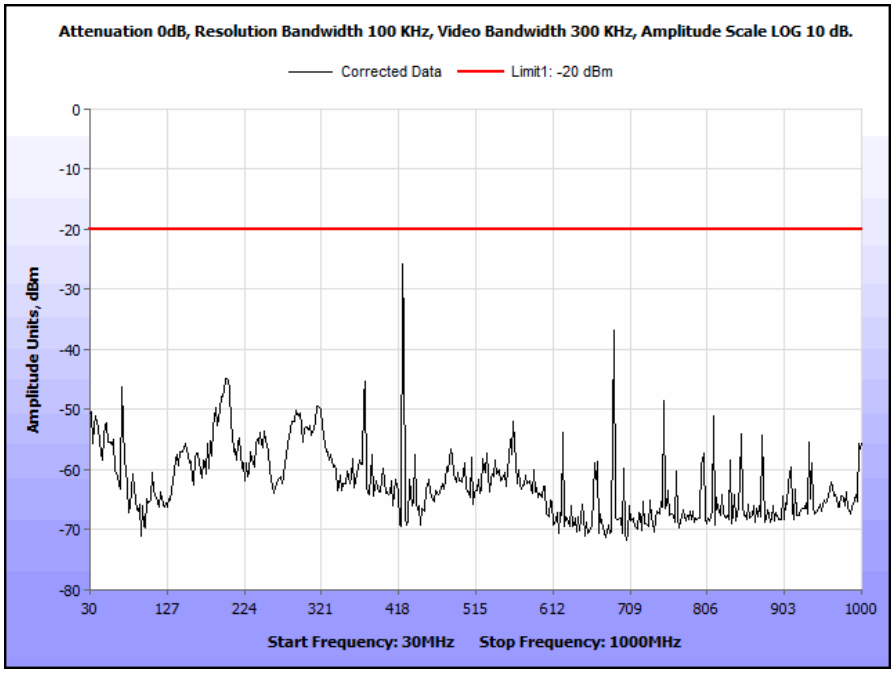
Plot 118. Part 90, Radiated Spurious Emissions, 420 MHz, CQPSK, 1 GHz – 4.5 GHz, 100 W



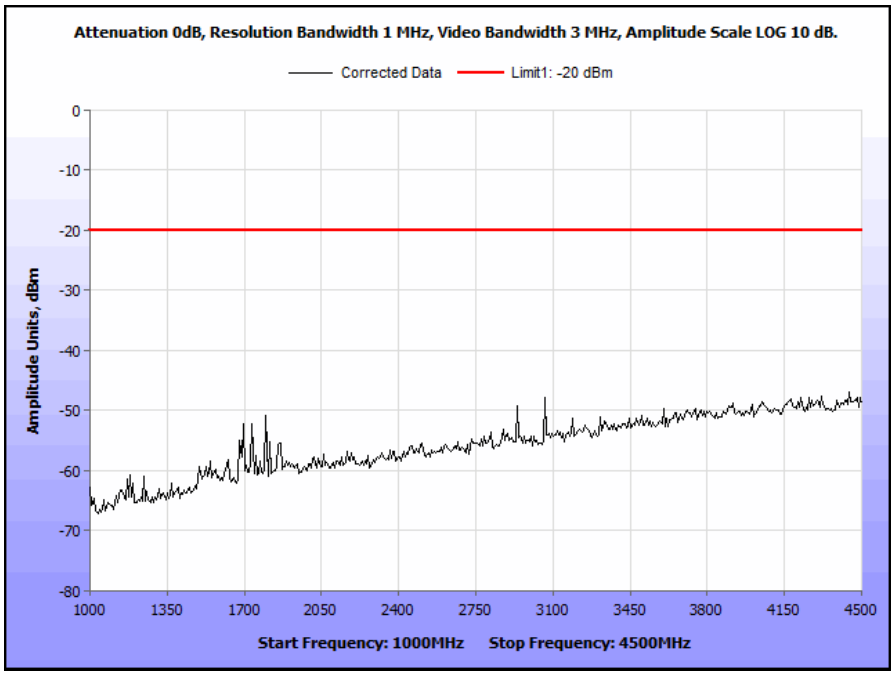
Plot 119. Part 90, Radiated Spurious Emissions, 420 MHz, HDQPSK, 30 MHz – 1 GHz, 100 W



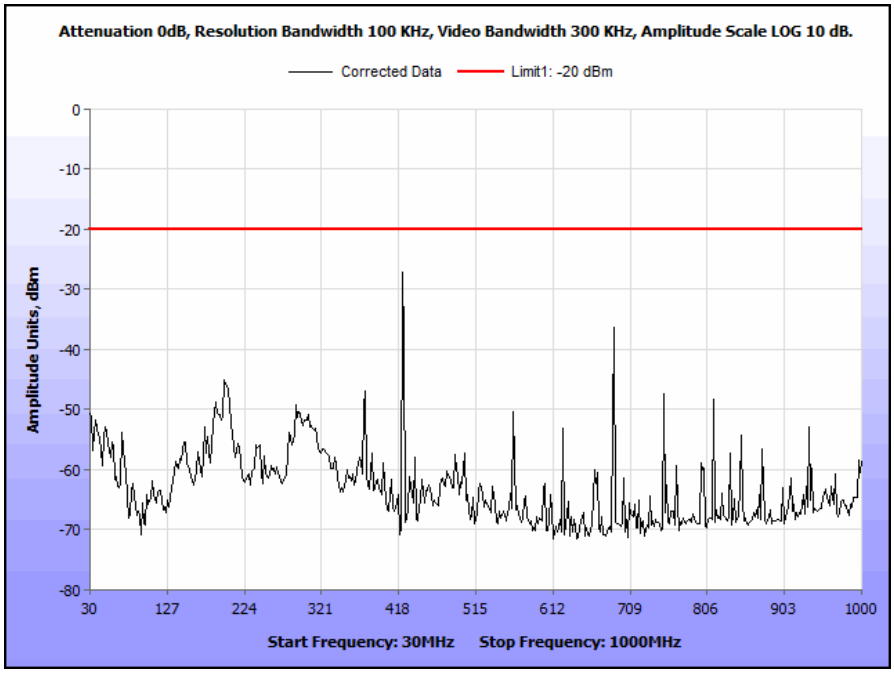
Plot 120. Part 90, Radiated Spurious Emissions, 420 MHz, HDQPSK, 1 GHz – 4.5 GHz, 100 W



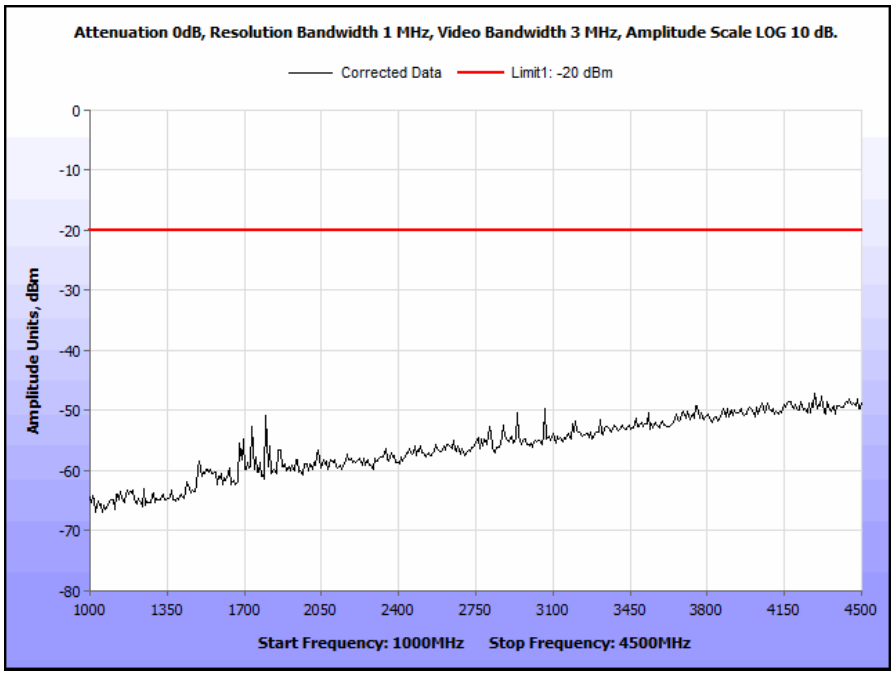
Plot 121. Part 90, Radiated Spurious Emissions, 423 MHz, C4FM, 30 MHz – 1 GHz, 10 W



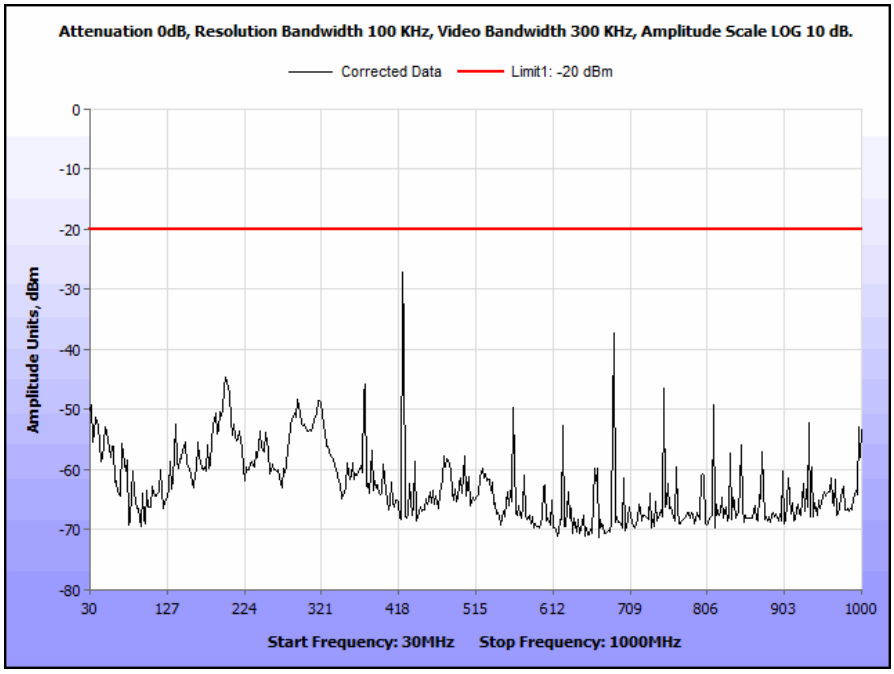
Plot 122. Part 90, Radiated Spurious Emissions, 423 MHz, C4FM, 1 GHz – 4.5 GHz, 10 W



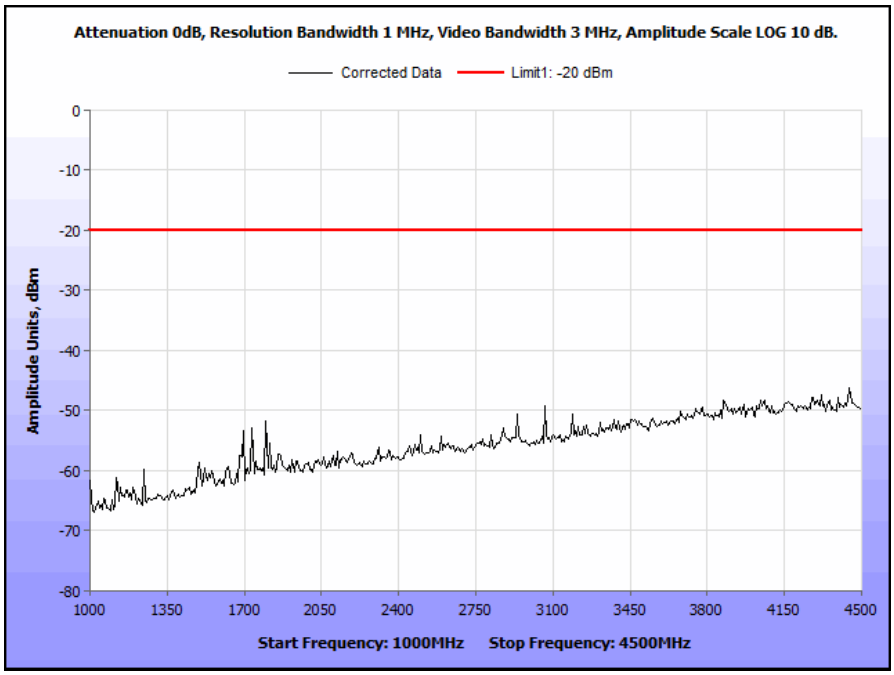
Plot 123. Part 90, Radiated Spurious Emissions, 423 MHz, CQPSK, 30 MHz – 1 GHz, 10 W



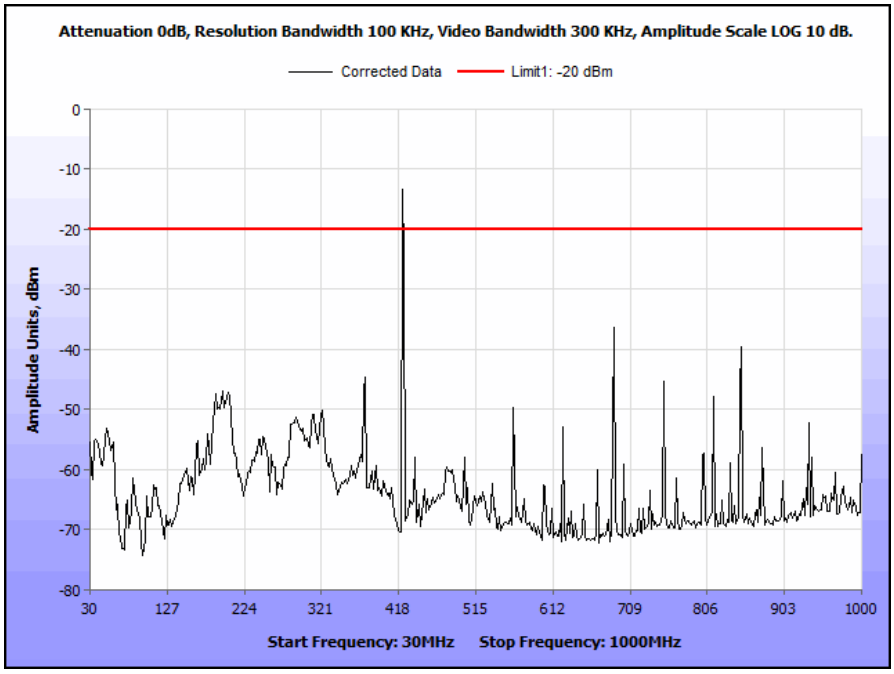
Plot 124. Part 90, Radiated Spurious Emissions, 423 MHz, CQPSK, 1 GHz – 4.5 GHz, 10 W



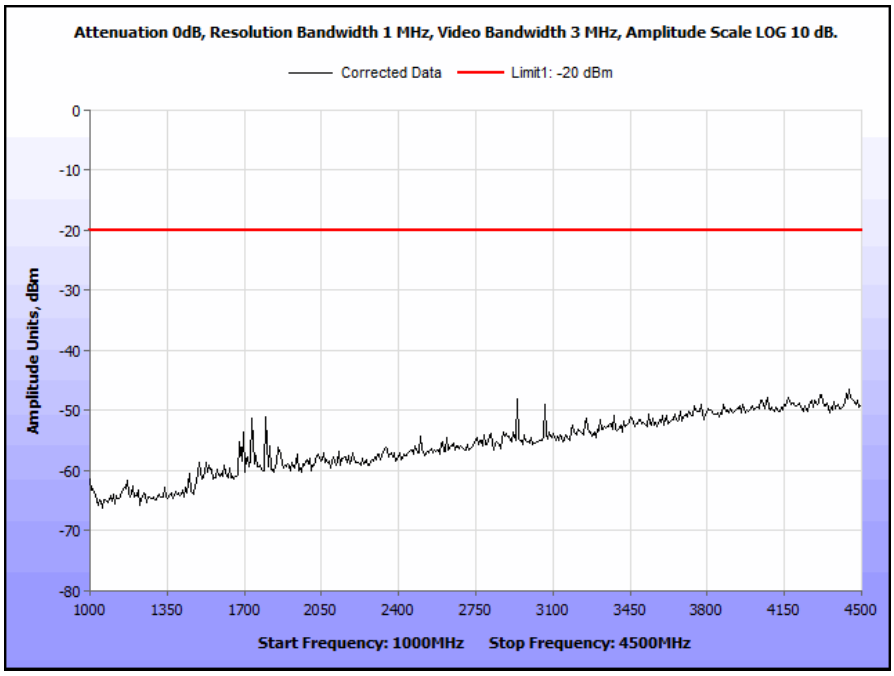
Plot 125. Part 90, Radiated Spurious Emissions, 423 MHz, HDQPSK, 30 MHz – 1 GHz, 10 W



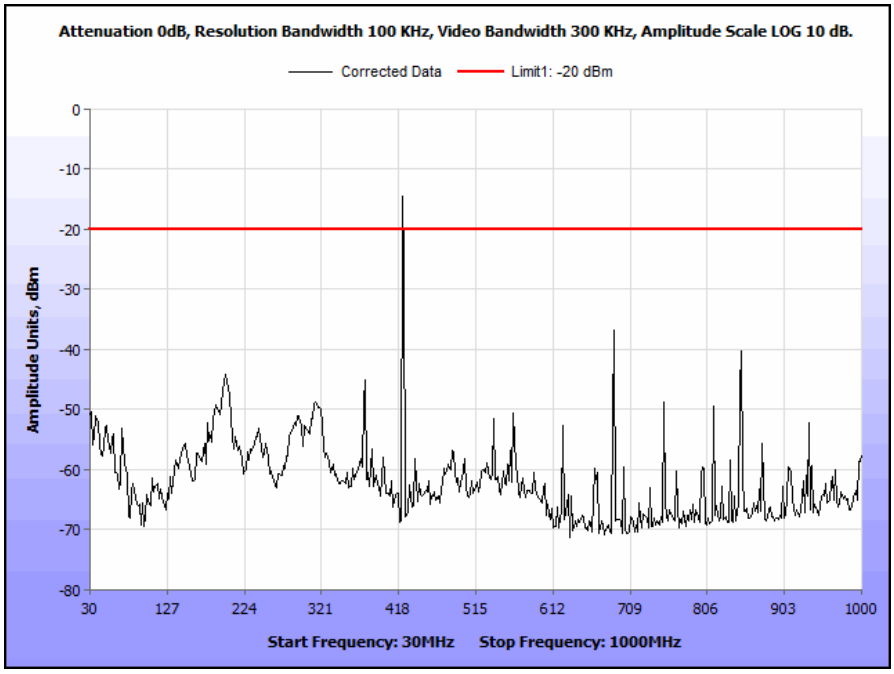
Plot 126. Part 90, Radiated Spurious Emissions, 423 MHz, HDQPSK, 1 GHz – 4.5 GHz, 10 W



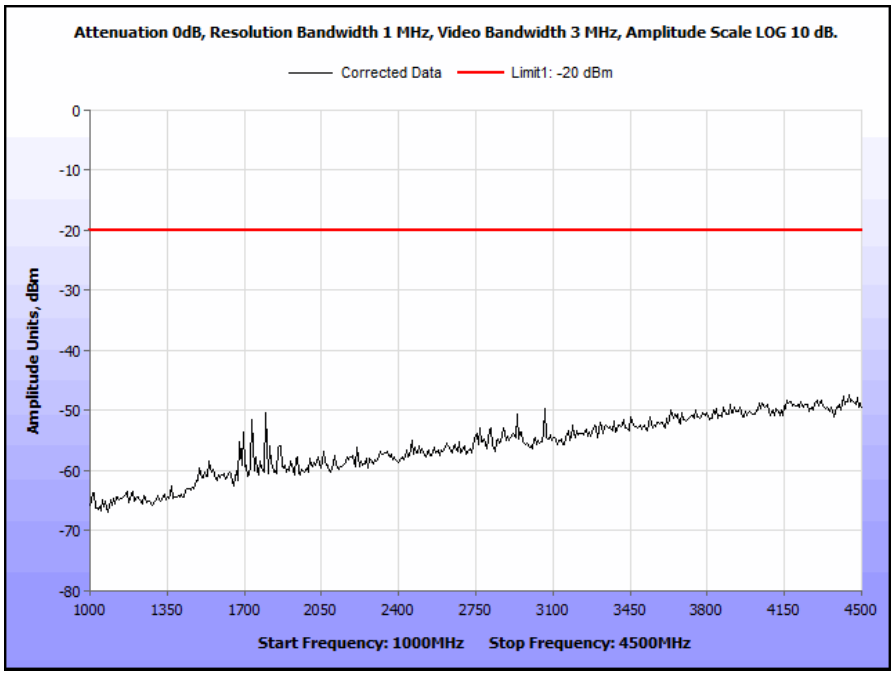
Plot 127. Part 90, Radiated Spurious Emissions, 423 MHz, C4FM, 30 MHz – 1 GHz, 100 W



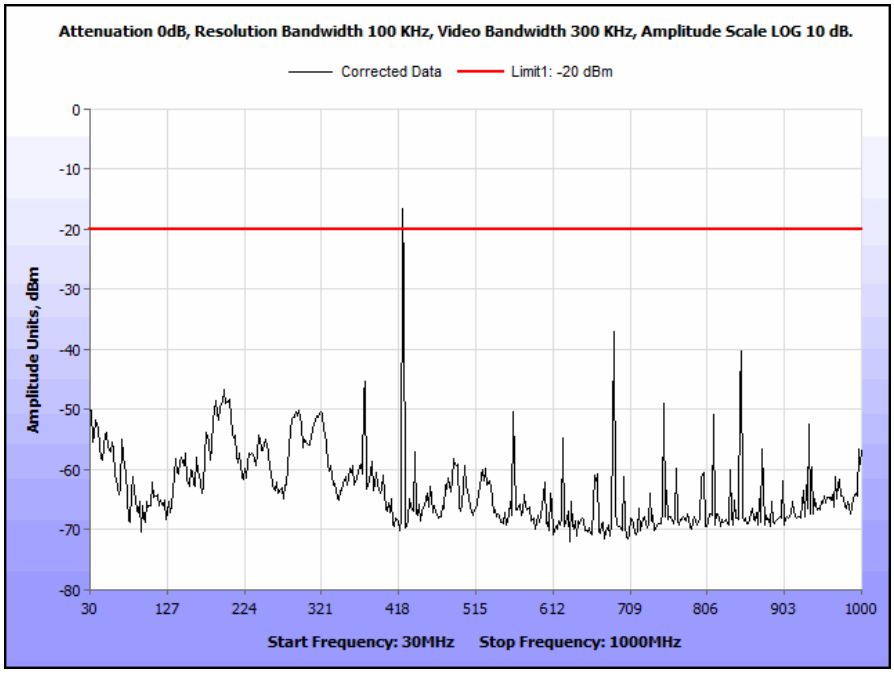
Plot 128. Part 90, Radiated Spurious Emissions, 423 MHz, C4FM, 1 GHz – 4.5 GHz, 100 W



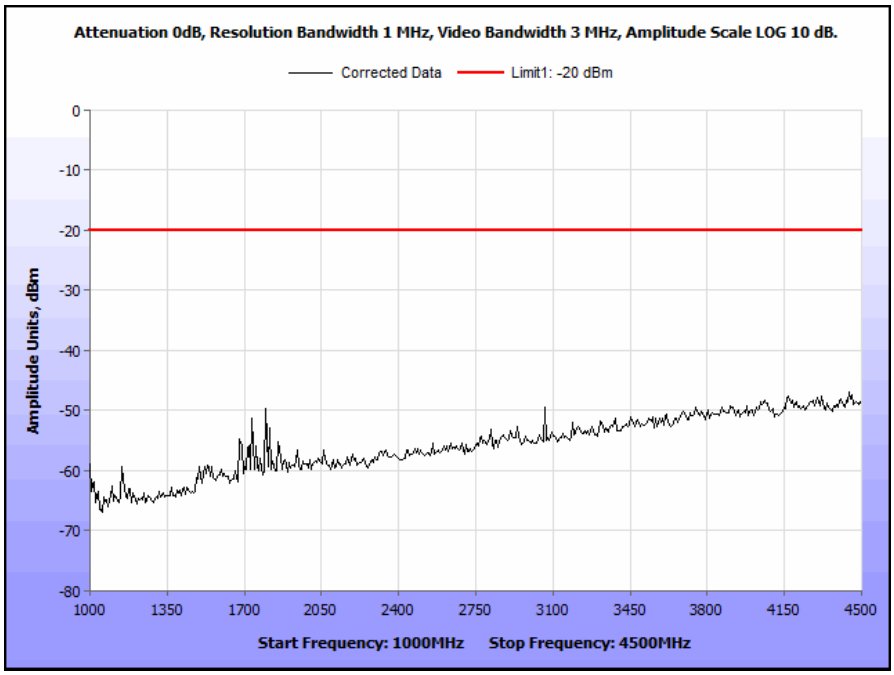
Plot 129. Part 90, Radiated Spurious Emissions, 423 MHz, CQPSK, 30 MHz – 1 GHz, 100 W



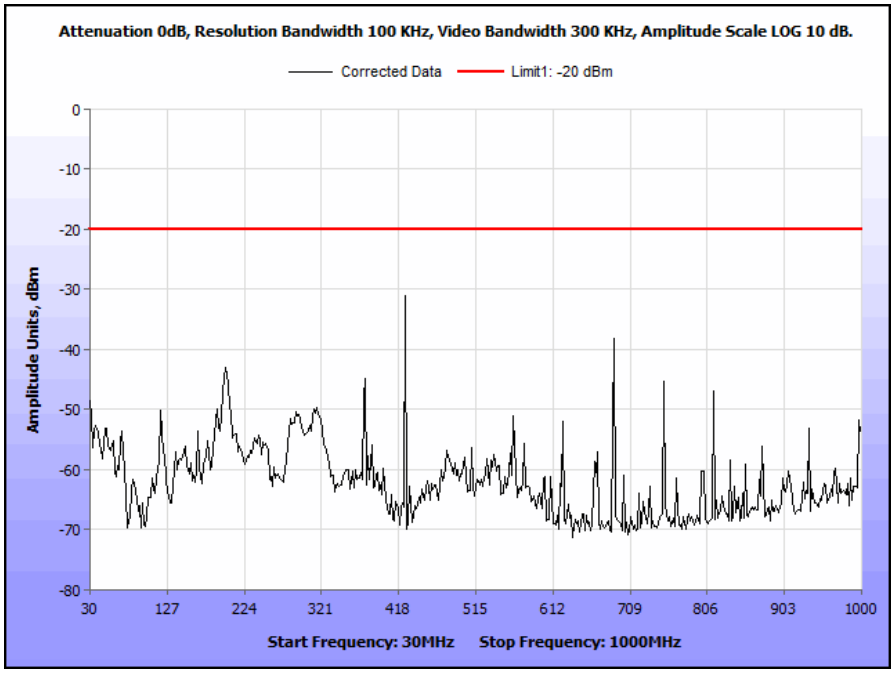
Plot 130. Part 90, Radiated Spurious Emissions, 423 MHz, CQPSK, 1 GHz – 4.5 GHz, 100 W



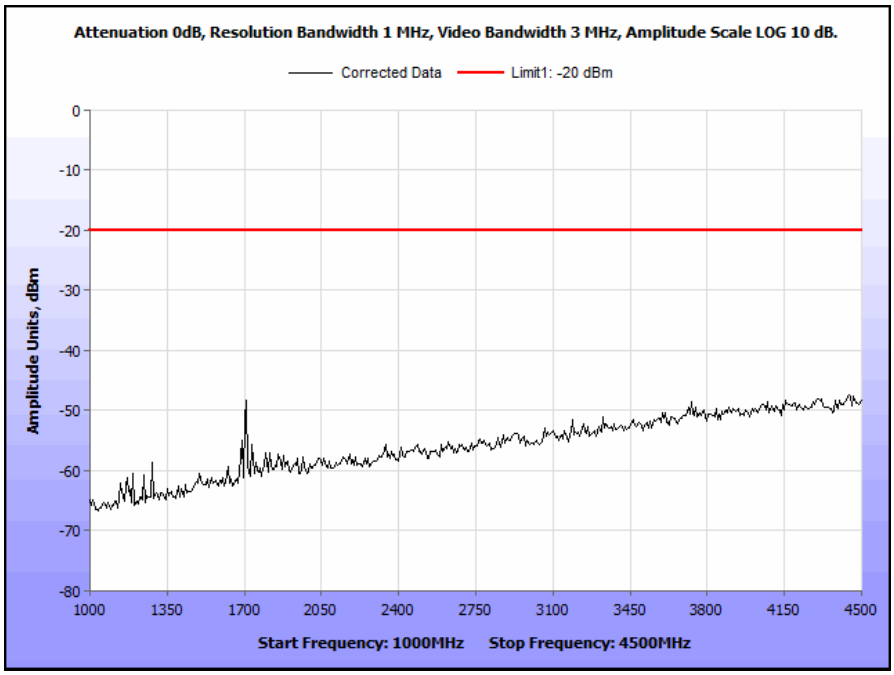
Plot 131. Part 90, Radiated Spurious Emissions, 423 MHz, HDQPSK, 30 MHz – 1 GHz, 100 W



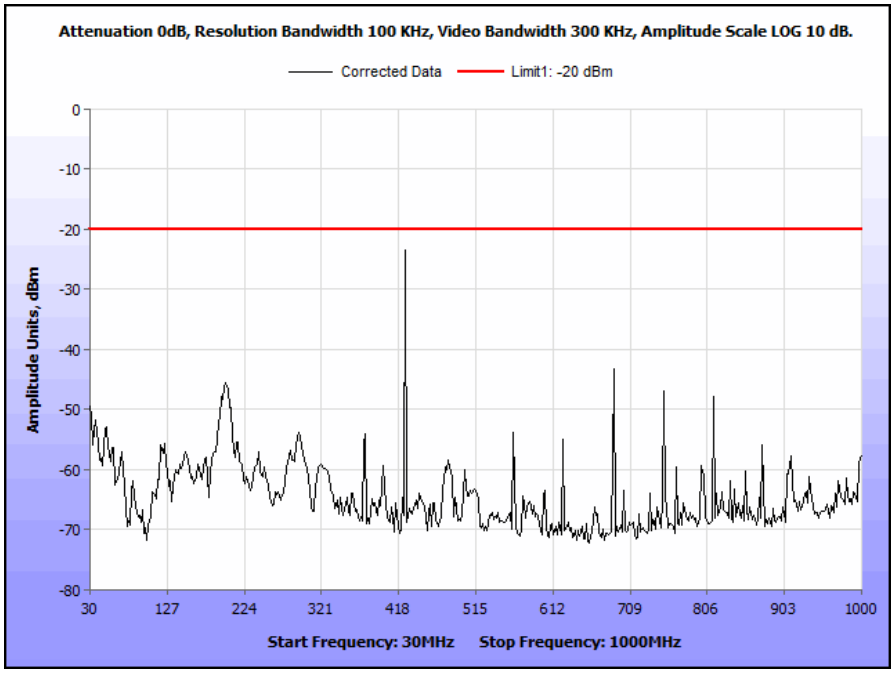
Plot 132. Part 90, Radiated Spurious Emissions, 423 MHz, HDQPSK, 1 GHz – 4.5 GHz, 100 W



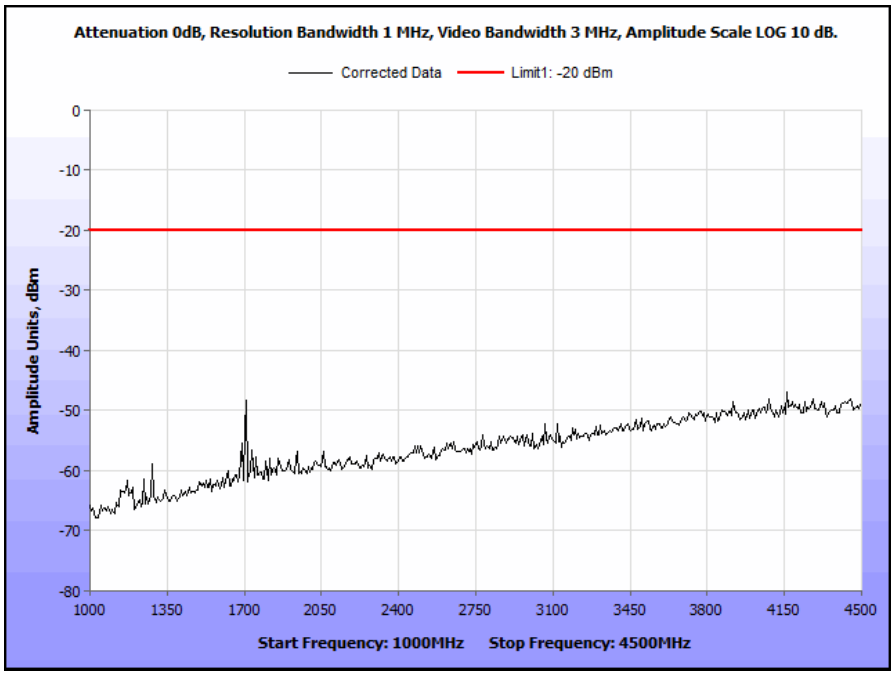
Plot 133. Part 90, Radiated Spurious Emissions, 426 MHz, C4FM, 30 MHz – 1 GHz, 10 W



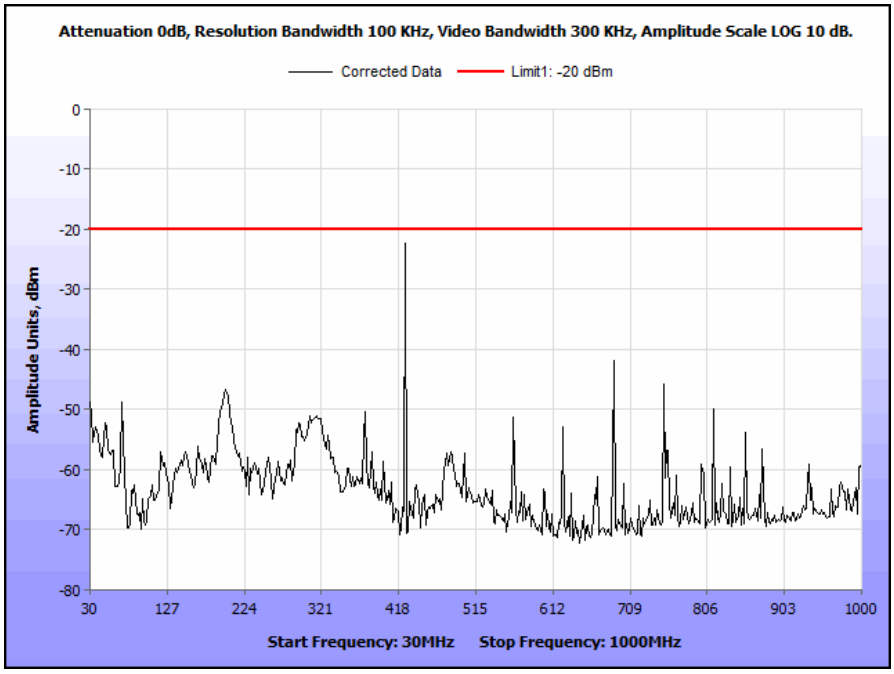
Plot 134. Part 90, Radiated Spurious Emissions, 426 MHz, C4FM, 1 GHz – 4.5 GHz, 10 W



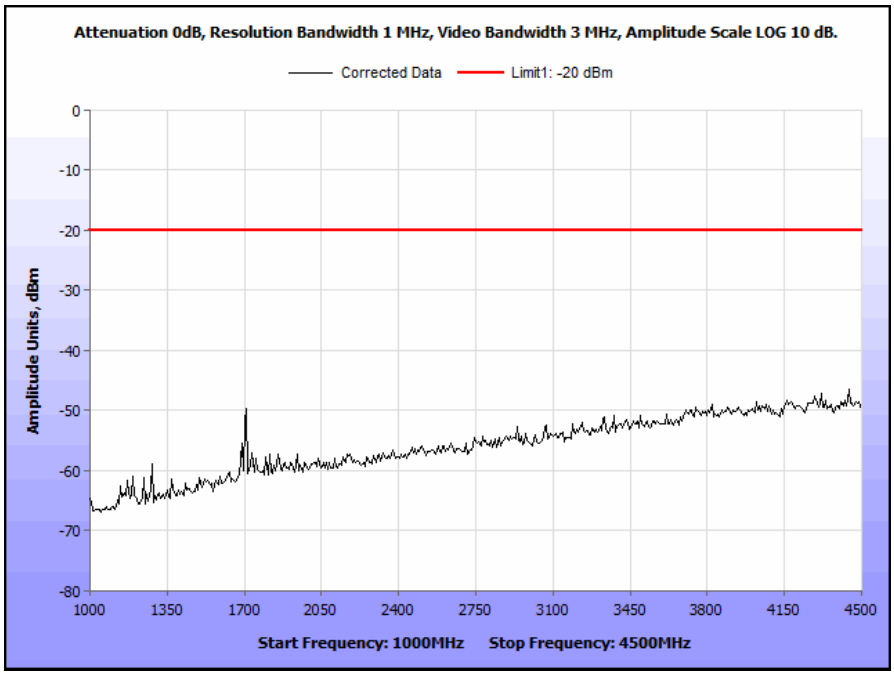
Plot 135. Part 90, Radiated Spurious Emissions, 426 MHz, CQPSK, 30 MHz – 1 GHz, 10 W



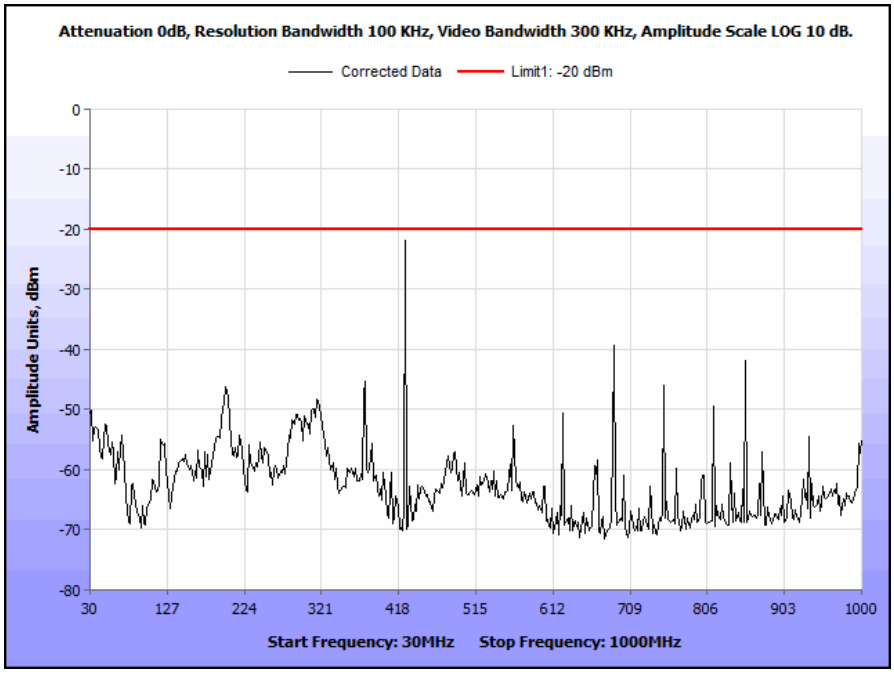
Plot 136. Part 90, Radiated Spurious Emissions, 426 MHz, CQPSK, 1 GHz – 4.5 GHz, 10 W



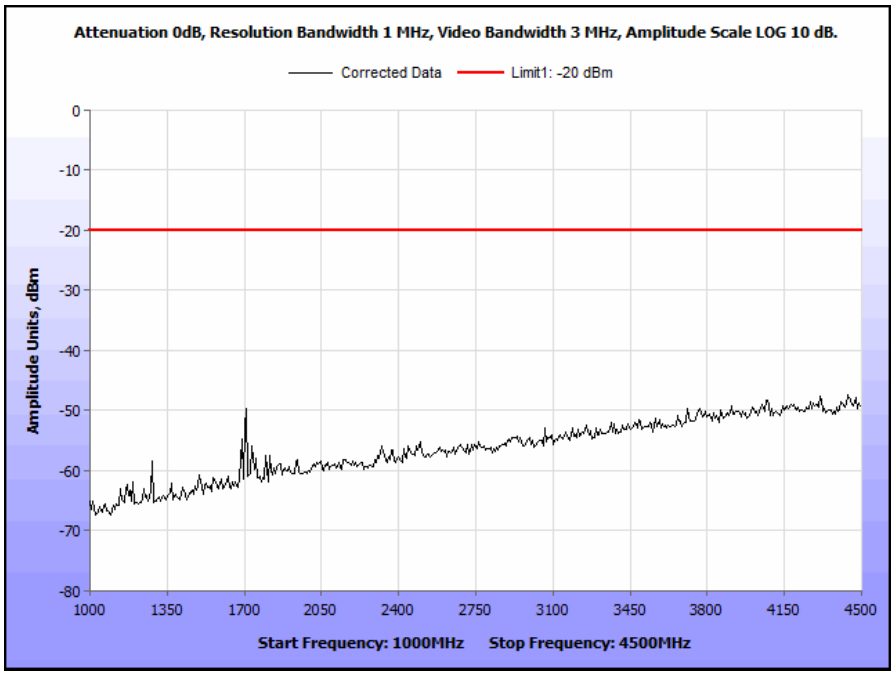
Plot 137. Part 90, Radiated Spurious Emissions, 426 MHz, HDQPSK, 30 MHz – 1 GHz, 10 W



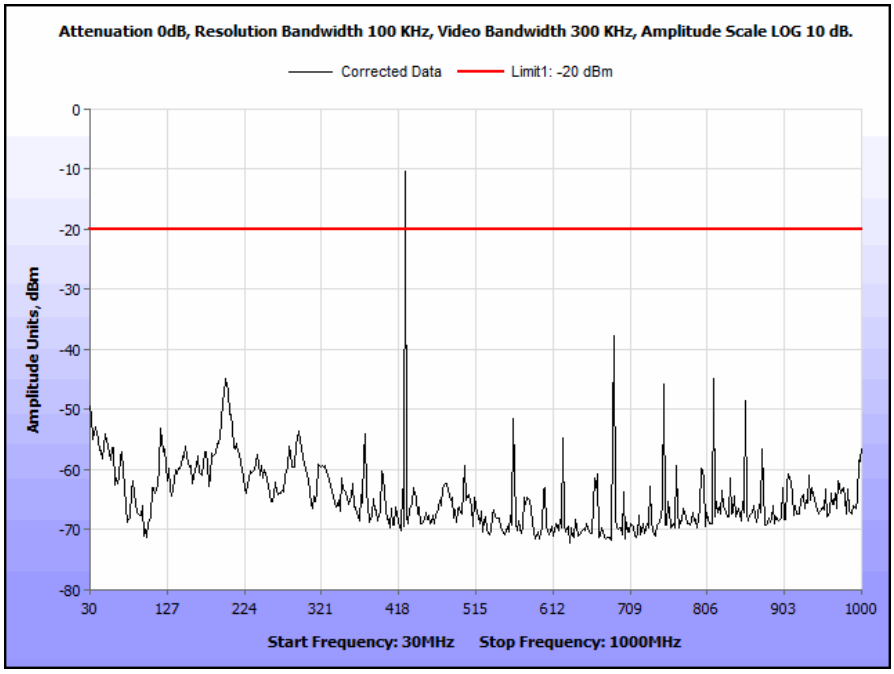
Plot 138. Part 90, Radiated Spurious Emissions, 426 MHz, HDQPSK, 1 GHz – 4.5 GHz, 10 W



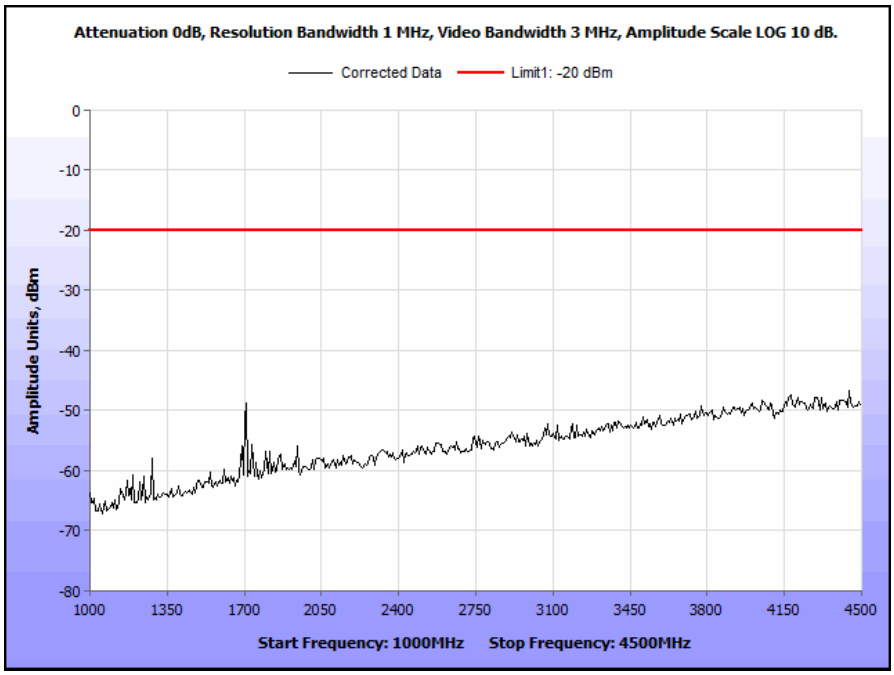
Plot 139. Part 90, Radiated Spurious Emissions, 426 MHz, C4FM, 30 MHz – 1 GHz, 100 W



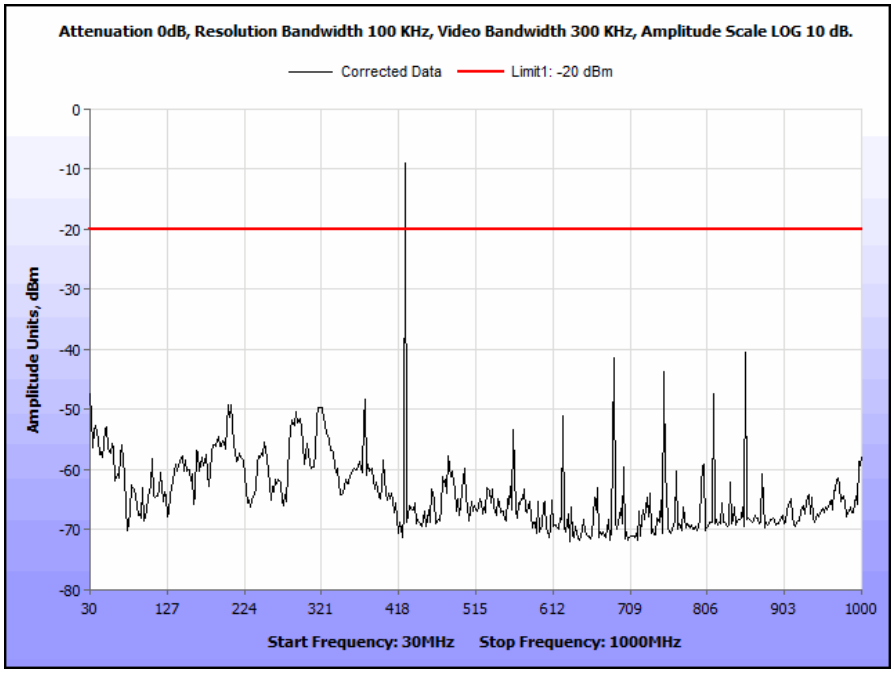
Plot 140. Part 90, Radiated Spurious Emissions, 426 MHz, C4FM, 1 GHz – 4.5 GHz, 100 W



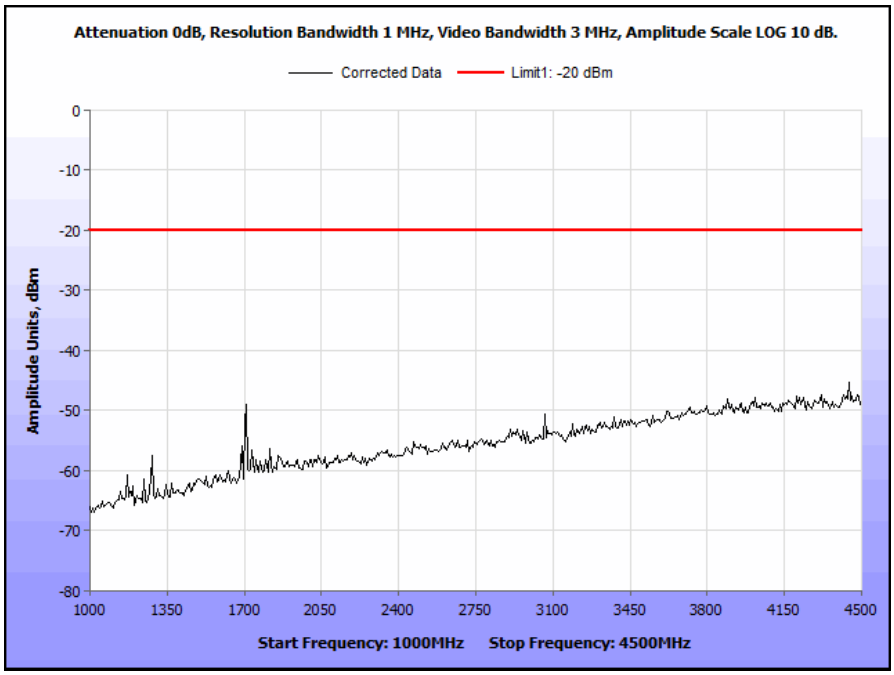
Plot 141. Part 90, Radiated Spurious Emissions, 426 MHz, CQPSK, 30 MHz – 1 GHz, 100 W



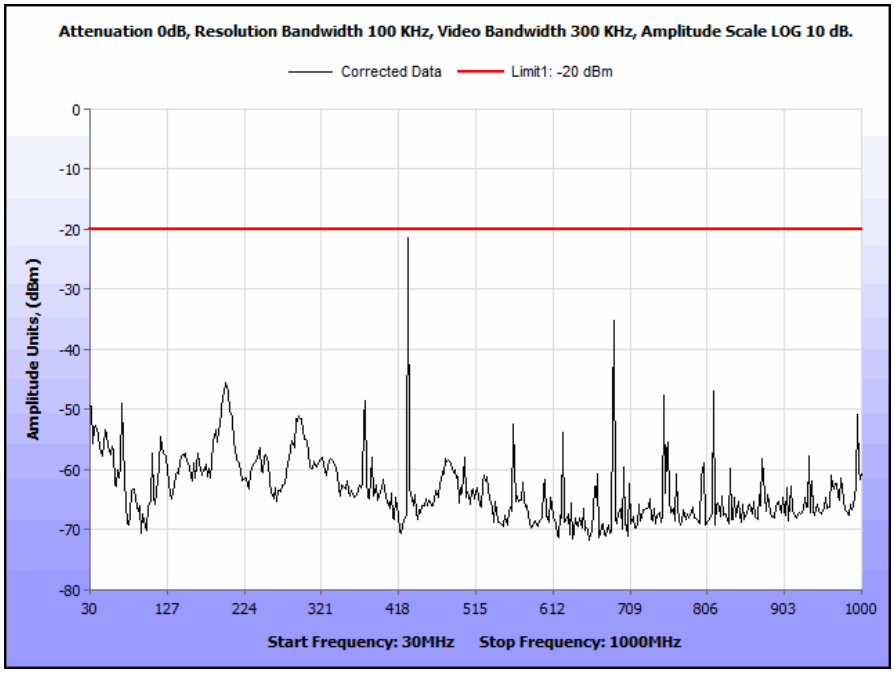
Plot 142. Part 90, Radiated Spurious Emissions, 426 MHz, CQPSK, 1 GHz – 4.5 GHz, 100 W



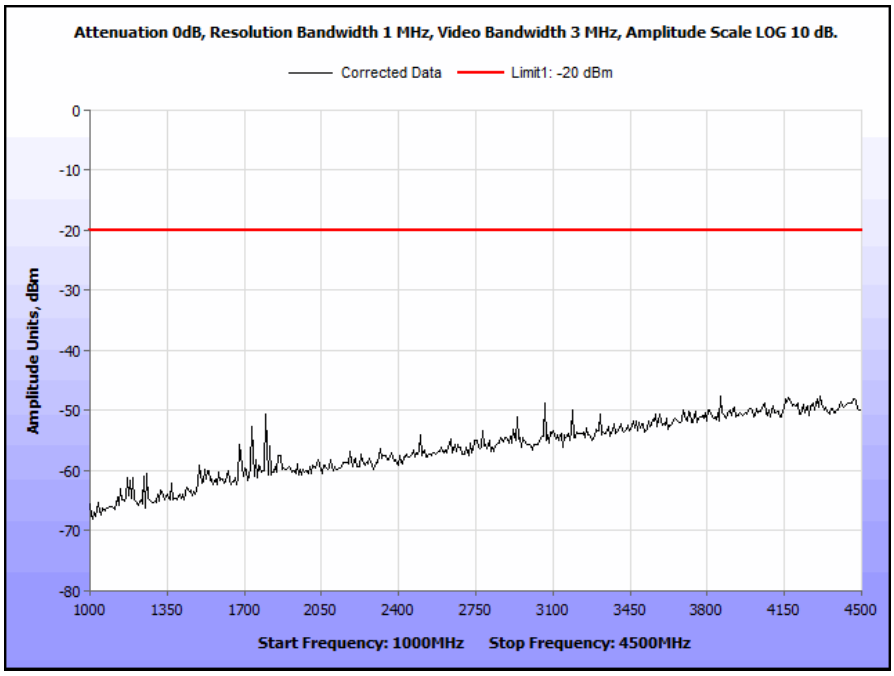
Plot 143. Part 90, Radiated Spurious Emissions, 426 MHz, HDQPSK, 30 MHz – 1 GHz, 100 W



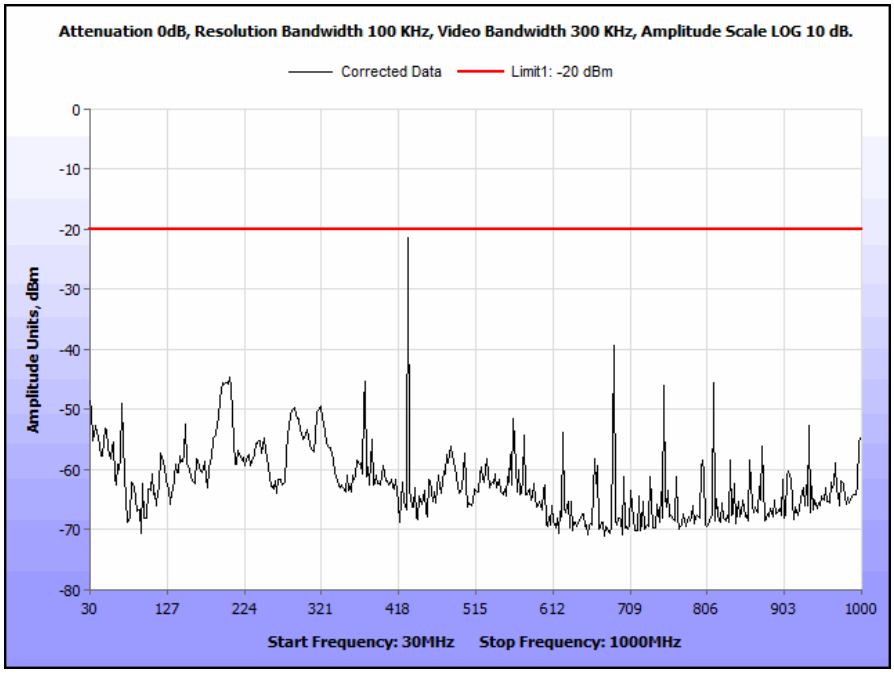
Plot 144. Part 90, Radiated Spurious Emissions, 426 MHz, HDQPSK, 1 GHz – 4.5 GHz, 100 W



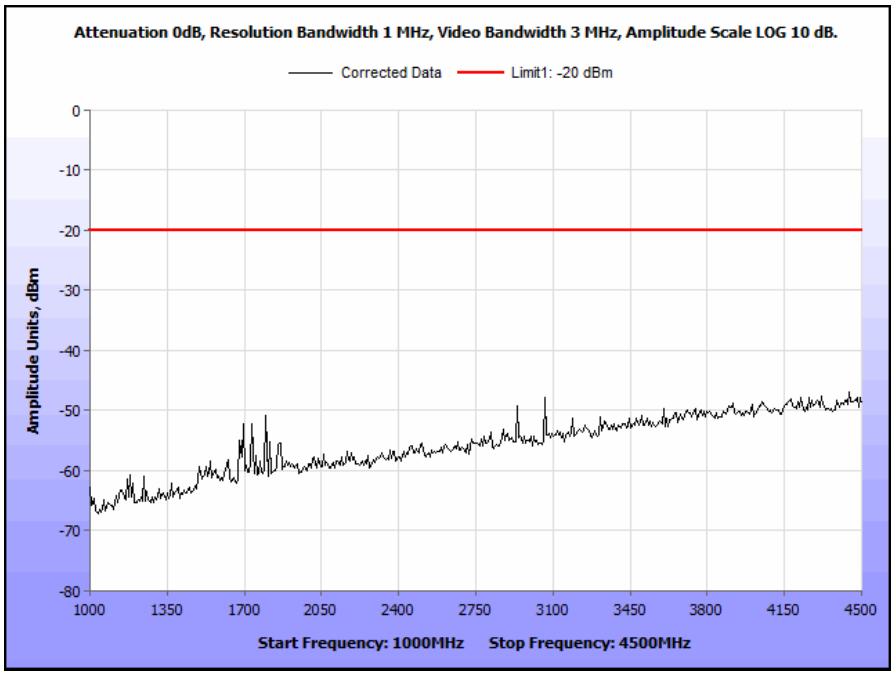
Plot 145. Part 90, Radiated Spurious Emissions, 430 MHz, C4FM, 30 MHz – 1 GHz, 10 W



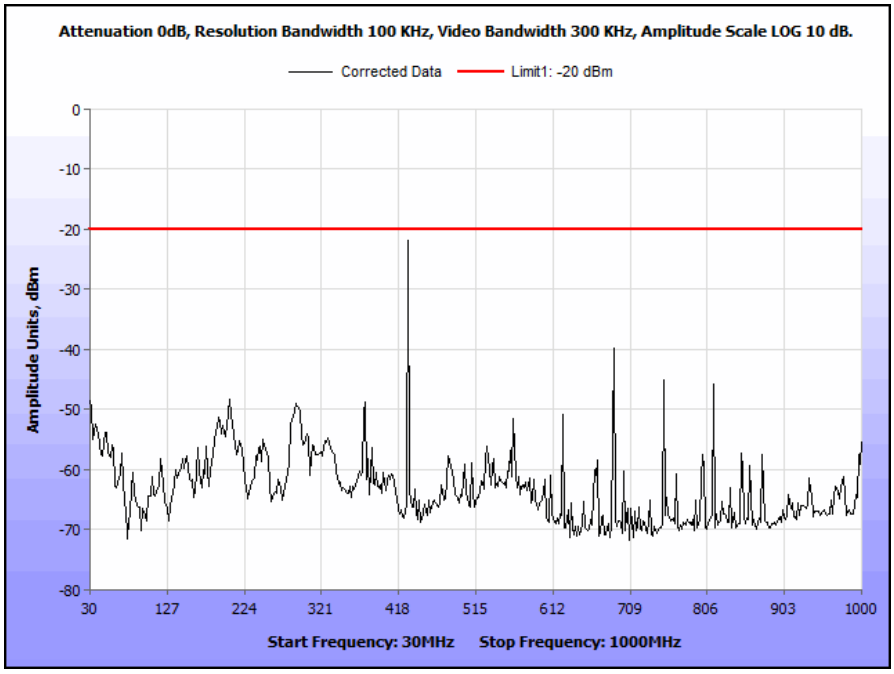
Plot 146. Part 90, Radiated Spurious Emissions, 430 MHz, C4FM, 1 GHz – 4.5 GHz, 10 W



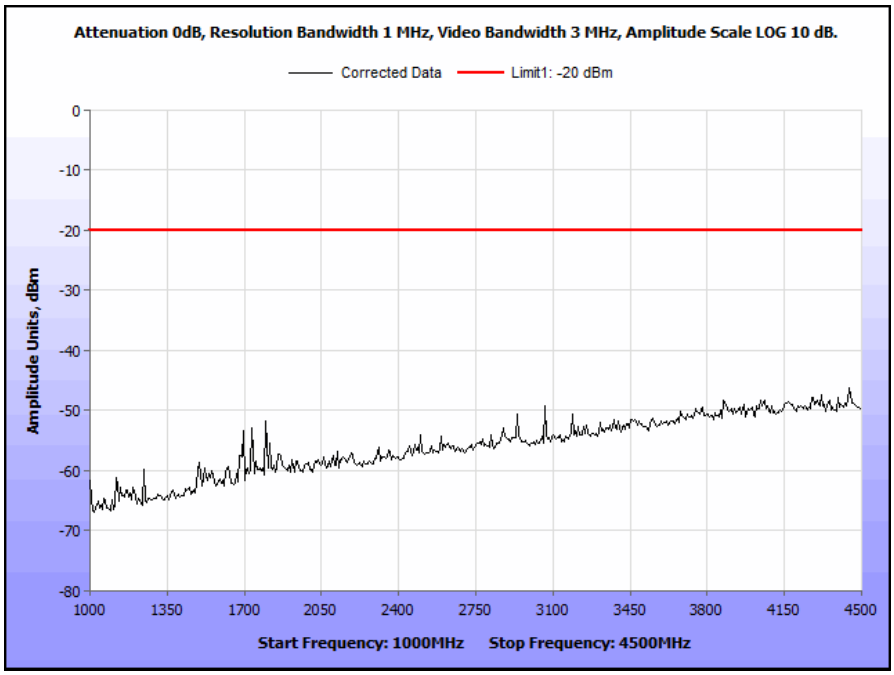
Plot 147. Part 90, Radiated Spurious Emissions, 430 MHz, CQPSK, 30 MHz – 1 GHz, 10 W



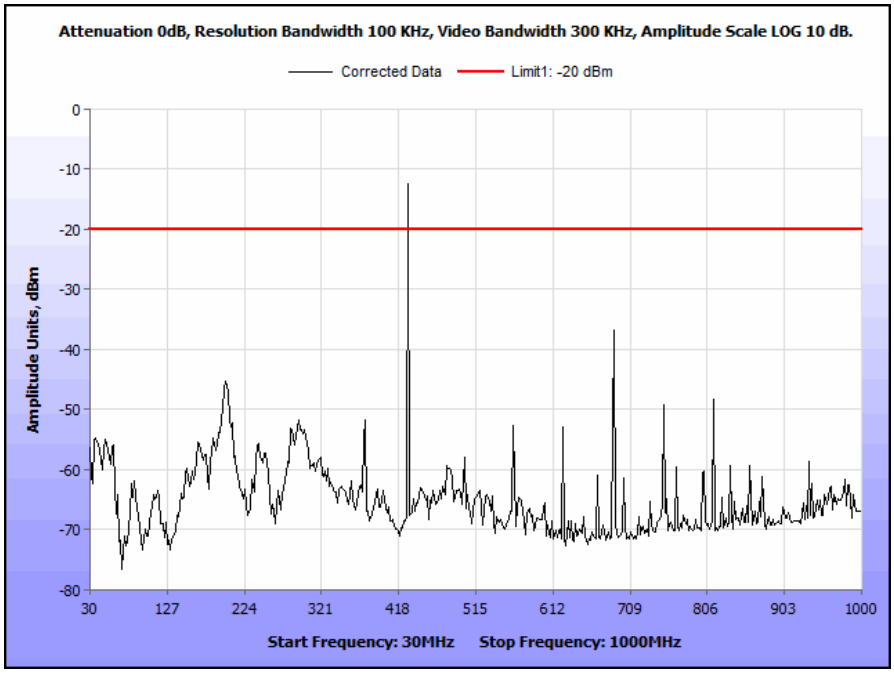
Plot 148. Part 90, Radiated Spurious Emissions, 430 MHz, CQPSK, 1 GHz – 4.5 GHz, 10 W



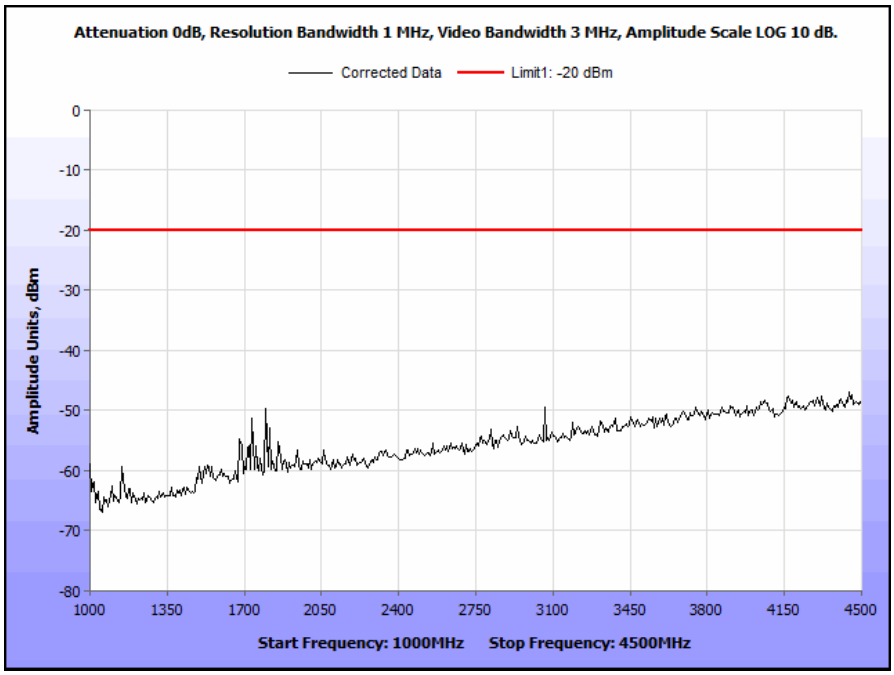
Plot 149. Part 90, Radiated Spurious Emissions, 430 MHz, HDQPSK, 30 MHz – 1 GHz, 10 W



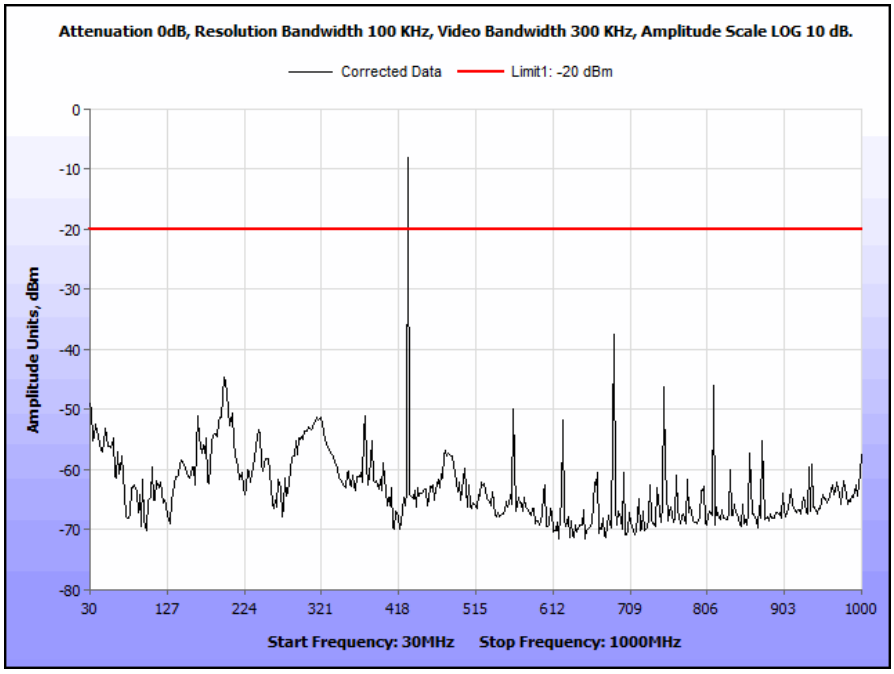
Plot 150. Part 90, Radiated Spurious Emissions, 430 MHz, HDQPSK, 1 GHz – 4.5 GHz, 10 W



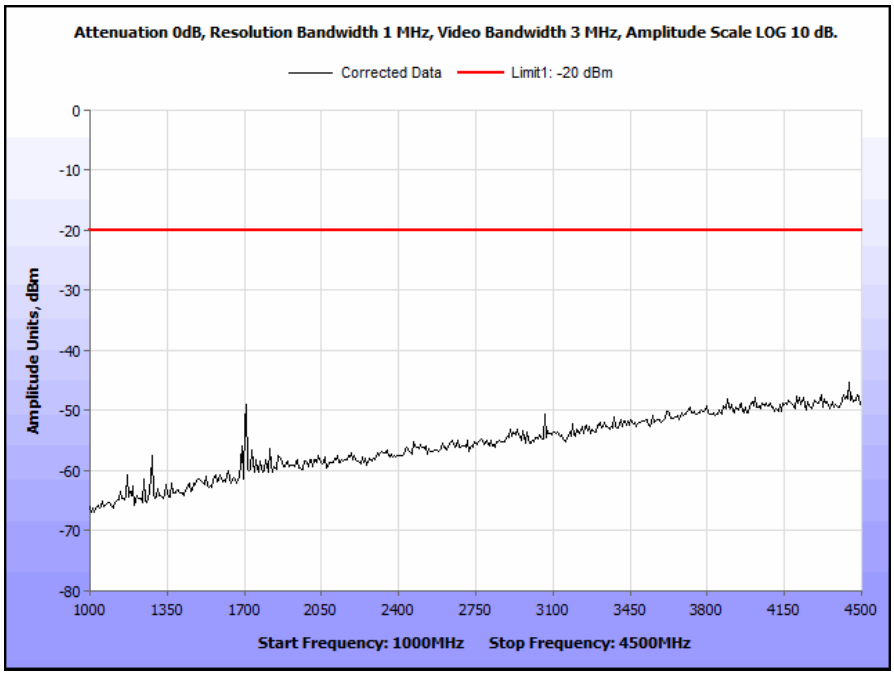
Plot 151. Part 90, Radiated Spurious Emissions, 430 MHz, C4FM, 30 MHz – 1 GHz, 100 W



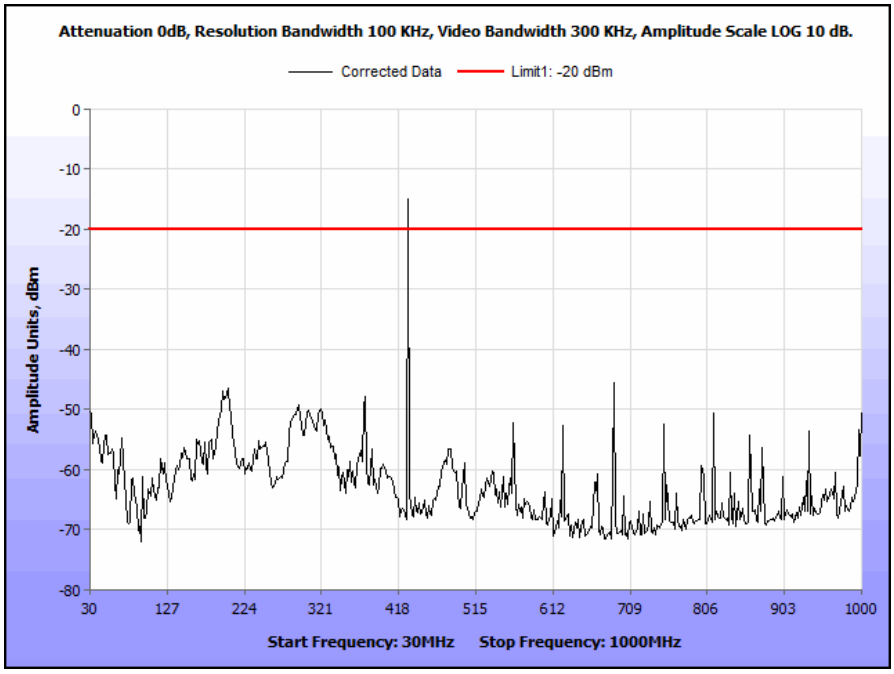
Plot 152. Part 90, Radiated Spurious Emissions, 430 MHz, C4FM, 1 GHz – 4.5 GHz, 100 W



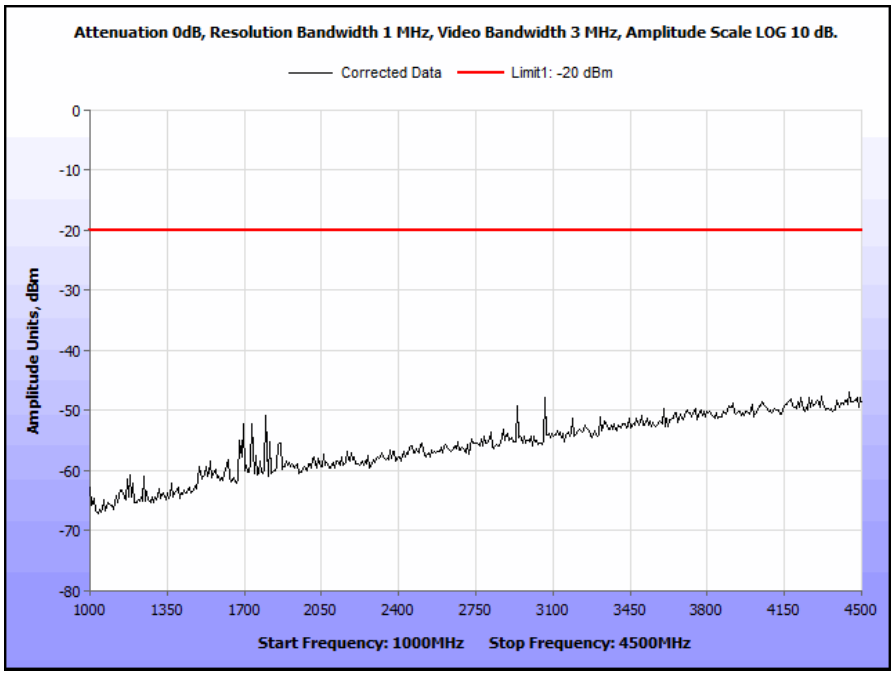
Plot 153. Part 90, Radiated Spurious Emissions, 430 MHz, CQPSK, 30 MHz – 1 GHz, 100 W



Plot 154. Part 90, Radiated Spurious Emissions, 430 MHz, CQPSK, 1 GHz – 4.5 GHz, 100 W



Plot 155. Part 90, Radiated Spurious Emissions, 430 MHz, HDQPSK, 30 MHz – 1 GHz, 100 W



Plot 156. Part 90, Radiated Spurious Emissions, 430 MHz, HDQPSK, 1 GHz – 4.5 GHz, 100 W

3.5. §2.1055 Frequency Stability over Temperature and Voltage Variations

Test Requirement(s): §2.1055(a)(1)

Test Procedures: As required by 47 CFR 2.1055, *Frequency Stability measurements* were made at the RF output terminals using a Directional Coupler through a Spectrum Analyzer and Power Meter.

The EUT was placed in the Environmental Chamber and support equipment were outside the chamber on a table. A CW signal was injected into the EUT at the appropriate RF level. The frequency counter option on the Spectrum Analyzer was used to measure frequency deviations. The frequency drift was investigated for every 10^{C} increment until the unit is stabilized then recorded the reading in tabular format with the temperature range of -30 to 50^{C}.

Voltage supplied to EUT is 120 VAC reference temperature was done at 20^{C}. The voltage was varied by ± 15 % of nominal

Test Results: Equipment was compliant with Section 2.1055

Test Engineer(s): Surinder Singh

Test Date(s): 01/29/14

Temperature (degree Celsius)	AC Voltage	Frequency Drift (ppm)	Frequency Drift (Hz)
50	120	420.0053671	5.10000001
40	120	420.0053665	4.499999989
30	120	420.0053661	4.100000012
20	102	420.0053625	0.499999999
20	120	420.005362	0
20	138	420.0053627	0.699999987
10	120	420.0053621	0.100000022
0	120	420.0053621	0.100000022
-10	120	420.005363	0.999999997
-20	120	420.005368	5.999999985
-30	120	420.005369	6.999999982

Table 4. Frequency Stability, Test Results

3.6. Transient Frequency Behavior

FCC §90.214
Test Requirement(s): **§90.214 Transient frequency behavior**

Transmitters designed to operate in the 150-174 MHz and 421-512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

Time intervals [1] [2]	Maximum frequency difference [3]	All equipment	
		150 to 174 MHz	421 to 512 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels			
t_1 [4]	±25.0 kHz	5.0 ms	10.0 ms
t_2	±12.5 kHz	20.0 ms	25.0 ms
t_3 [4]	±25.0 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels			
t_1 [4]	±12.5 kHz	5.0 ms	10.0 ms
t_2	±6.25 kHz	20.0 ms	25.0 ms
t_3 [4]	±12.5 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels			
t_1 [4]	±6.25 kHz	5.0 ms	10.0 ms
t_2	±3.125 kHz	20.0 ms	25.0 ms
t_3 [4]	±6.25 kHz	5.0 ms	10.0 ms

[1] t_{on} is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.

t_1 is the time period immediately following t_{on}.

t_2 is the time period immediately following t_1.

t_3 is the time period from the instant when the transmitter is turned off until t_{off}.

t_{off} is the instant when the 1 kHz test signal starts to rise.

[2] During the time from the end of $t_2$to the beginning of t_3, the frequency difference must not exceed the limits specified in § 90.213.

[3] Difference between the actual transmitter frequency and the assigned transmitter frequency.

[4] If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

Test Procedures: The alternate method of testing used was from TIA-603-C, section 2.2.19.2 using a Modulation Domain Analyzer.

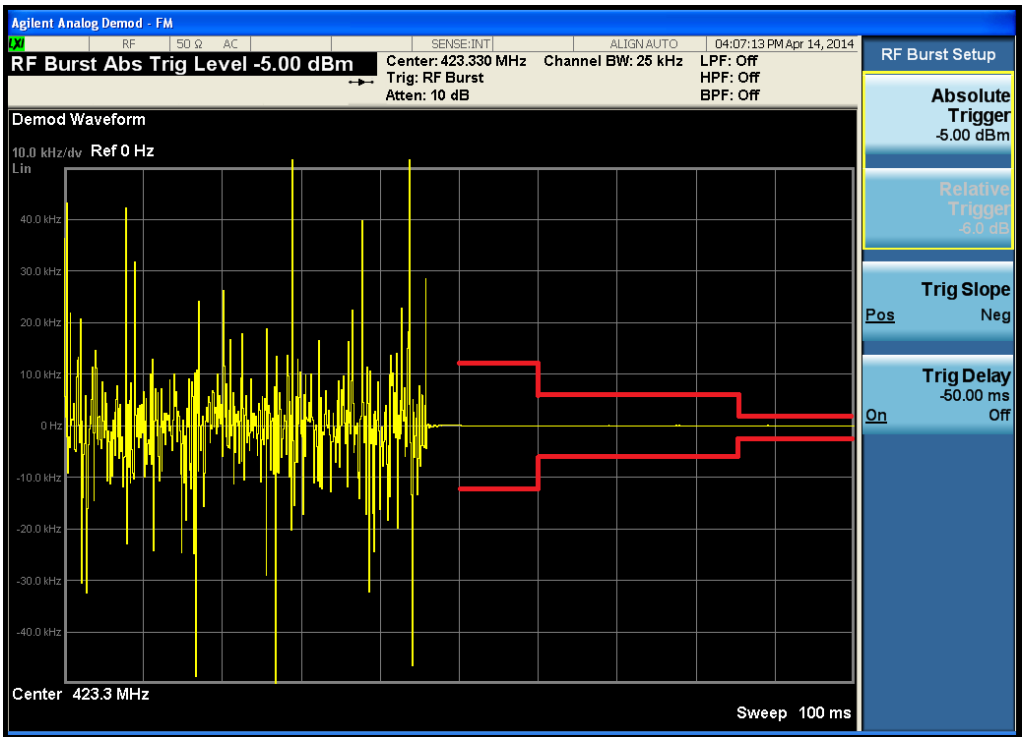
The EUT was connected to the Modulation Domain Analyzer. In order to capture a single-shot turn-on of the transmitter signal, the modulation domain analyzer was set to trigger on the rising edge of the waveform with a 50 ms delay. Plots were taken.

The modulation domain analyzer was then adjusted to trigger on the falling edge of the transmitter waveform with a 50ms delay in order to capture a single-shot turn-off transient of the transmitter signal. Plots were taken.

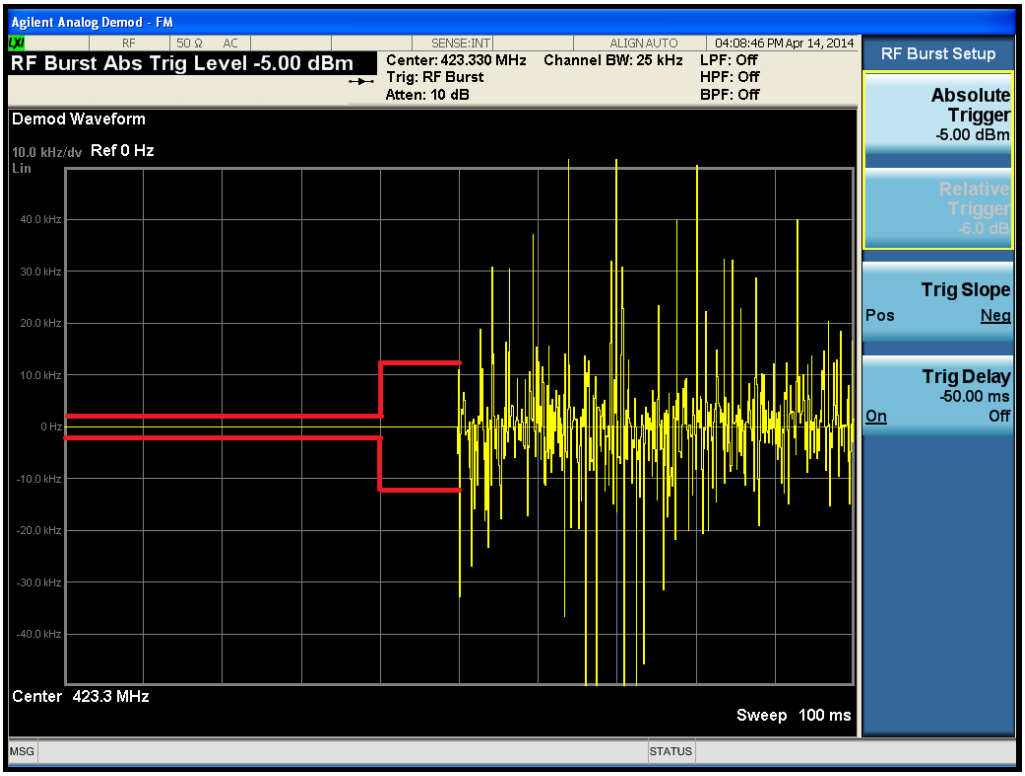
Test Results: Equipment complies with Section §90.214 and RSS-119.

Test Engineer(s): Ben Taylor

Test Date(s): 04/14/14



Plot 157. Transient Frequency Behavior, power up



Plot 158. Transient Frequency Behavior, power down

IV. Test Equipment

4. 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
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	7/16/2012	7/16/2014
1T4818	COMB GENERATOR	COM-POWER	CGO-520	SEE NOTE	
1T4787	HYGROMETER / THERMOMETER / BAROMETER / DEW POINT PEN	CONTROL COMPANY	15-078-198, FB70423, 245CD	2/15/2012	2/15/2014
1T4483	ANTENNA; HORN	EMCO	3115	9/5/2012	3/5/2014
1T4300C	SEMI-ANECHOIC 3M CHAMBER # 1 (VCCI)	EMC TEST SYSTEMS	NONE	1/31/2012	1/31/2015
1T4612	SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4407B	7/30/2013	7/30/2014
1T4751	ANTENNA - BILOG	SUNOL SCIENCES	JB6	1/8/2013	7/8/2014
1S2229	TEMPERATURE CHAMBER	TENNY ENGINEERING	T63C	9/18/2013	3/18/2015
MY49060084	SIGNAL ANALYZER	AGILENT TECHNOLOGIES	N9010A EXA	11/1/2013	11/1/2015

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

V. Certification & User's Manual Information

5. Certification Label & User's Manual Information

5.1. 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.

5.2. 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