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

December 11, 2012

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

Dear James McIntyre,

Enclosed is the EMC Wireless test report for compliance testing of the Harris RF Communications, MASTR V, SV-WTXMV (Station, MASTR V, 494 -512 MHz), tested to the requirements of Title 47 of the Code of Federal Regulations (CFR), 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: (\Harris RF Communications\EMC34536B-FCC90 Rev. 5)

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Electromagnetic Compatibility Criteria Test Report

For the

Harris RF Communications
MASTR V, SV-WTXMV (Station, MASTR V, 494 -512 MHz)

Tested under

The FCC Verification Rules
Contained in Title 47 of the CFR, Part 90

for Private Land Mobile Radio Services

MET Report: EMC34536B-FCC90 Rev. 5

December 11, 2012

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: EMC34536B-FCC90 Rev. 5

Jeff Pratt, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Warnell
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is / is not capable of operation in accordance with the requirements of Part 90 of the FCC Rules under normal use and maintenance.

Dusmantha Tennakoon,
Wireless Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	September 5, 2012	Initial Issue.
1	October 15, 2012	Revised to reflect engineer corrections.
2	October 29, 2012	Revised to reflect engineer corrections.
3	November 20, 2012	Revised to reflect engineer corrections.
4	November 29, 2012	Revised to reflect engineer corrections.
5	December 11, 2012	Revised to reflect customer corrections.

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List of Terms and Abbreviations

AC	**A**lternating **C**urrent
ACF	**A**ntenna **C**orrection **F**actor
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci**b**els
dBµA	**D**eci**b**els above one **micro**amp
dBµV	**D**eci**b**els above one **micro**volt
dBµA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBµV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**ert**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**ert**z**
kPa	**k**ilo**pa**scal
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
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.

Title 47 of the CFR, Part 90, and FCC 04-265 Reference and Test Description	Conformance			Comments
	Yes	No	N/A	
	Yes - Equipment complies with the Requirement *No - Equipment does not comply with the Requirement* *N/A - Not applicable to the equipment under tests*			
47 CFR Part 15.107 (a)	✓			Measured emissions below applicable limits.
47 CFR Part 15.109 (a)	✓			Measured emissions below applicable limits.
2.1046; 90.1215(a) Peak Power Output	✓			Measured emissions below applicable limits.
2.1047(a) Modulation Characteristics			✓	The EUT has no audio low pass filter.
2.1049; 90.210(D) Emission Mask	✓			Measured emissions below applicable limits.
2.1051; 90.210(D) Spurious Emissions at Antenna Terminals	✓			Measured emissions below applicable limits.
2.1053; 90.210(D) Radiated Spurious Emissions	✓			Measured emissions below applicable limits.
2.1055(a) (1); 90.213 Frequency Stability over Temperature Variations	✓			Measured emissions below applicable limits.
2.1055(d) (2) Frequency Stability over Voltage Variations	✓			Measured emissions below applicable limits.
90.214 Transient Frequency Behavior			✓	EUT is not a keyed transmitter.

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, SV-WTXMV (Station, MASTR V, 494 -512 MHz) under quote number 1109592.

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, SV-WTXMV (Station, MASTR V, 494 -512 MHz).

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, SV-WTXMV (Station, MASTR V, 494 -512 MHz)	
Model(s) Covered:	MASTR V, SV-WTXMV (Station, MASTR V, 494 -512 MHz)	
EUT Specifications:	Primary Power Source: 110 VAC, 60 Hz	
	FCC ID: OWDTR-0101-E IC: 3636B-0101	
	Type of Modulations:	C4FM, CQPSK, HDQPSK
	Max Peak and Output Power:	49.77 dBm
	Equipment Code:	TNB
	EUT Frequency Ranges:	494.00625 – 511.99375 MHz
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature (15-35º C):	
	Relative Humidity (30-60%):	
	Barometric Pressure (860-1060 mbar):	
Evaluated by:	Jeff Pratt	
Report Date(s):	December 11, 2012	

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 Harris RF Communications MASTR V, SV-WTXMV (Station, MASTR V, 494 -512 MHz), Equipment Under Test (EUT), is Radio Base Station/Repeater designed for communications in the Land Mobile Radio environment. The primary communication users are Public Safety, Utility and Military Commercial Of The Shelf.

2.4. Equipment Configuration

Ref. ID *	Name / Description	Model Number	Serial Number
Tx #1	Transmit Module #1	EA-555008-009	EP5930300056
Tx #2	Transmit Module #2	EA-555008-009	EP5930300053
Tx #3	Transmit Module #3	EA-555008-010	EP5930300051
Tx #4	Transmit Module #4	EA-555008-010	EP5930300049
PA #1	Power Amplifier #1	EA-555010-009	CR0009389522
PA #2	Power Amplifier #2	EA-555010-009	CR0009389524
PA #3	Power Amplifier #3	EA-555010-009	CR0009389520
PA #4	Power Amplifier #4	EA-555010-009	CR0009389519
Rx #1	Receive Module #1	EA-555007-009	EP5630200139
Rx #2	Receive Module #2	EA-555007-009	EP5630200135
Rx #3	Receive Module #3	EA-555007-010	EP5931200104
Rx #4	Receive Module #4	EA-555007-010	EP5931200110
BB #1	Baseband Module #1	EA-555005	EP5199D03340
BB #2	Baseband Module #2	EA-555005	EP5199D03335
TC #1	Traffic Controller #1	EA-555004	EP5197E04439
TC #2	Traffic Controller #2	EA-555004	EP5197E04443
TC #3	Traffic Controller #3	EA-555004	EP5197E04331
TC #4	Traffic Controller #4	EA-555004	EP5197E04444
ES #1	E-Switch (Primary)	EA-555012	EP5198C01707
ES #2	E-Switch (Redundant)	EA-555012	EP5198C01705
PS #1	Power Supply #1	EA-555011-001	XE80582
PS #2	Power Supply #2	EA-555011-001	XE80605
PS #3	Power Supply #3	EA-555011-001	XE80595
PS #4	Power Supply #4	EA-555011-001	XE80584

Table 1. Equipment Configuration

Note: * - See Figure 1

2.5. Support Equipment

Harris RF Communications supplied support equipment necessary for the operation and testing of the MASTR V, SV-WTXMV (Station, MASTR V, 494 -512 MHz). All support equipment supplied is listed in the following Support Equipment List.

Ref. ID	Name / Description	Manufacturer	Model Number	Serial Number
--	Handheld Barcode Scanner	HP	LS2208-SR20361RSBRE	None
--	100 Watt Dummy Load (qty 4)	--	--	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 (m)	Shielded? (Y/N)	Termination Box ID & Port ID
Tx #1	RF Out	Coaxial Cable	1	1	Y	PA #1 RF In
Tx #2	RF Out	Coaxial Cable	1	1	Y	PA #2 RF In
Tx #3	RF Out	Coaxial Cable	1	1	Y	PA #3 RF In
Tx #4	RF Out	Coaxial Cable	1	1	Y	PA #4 RF In
PA #1	RF In	Coaxial Cable	1	1	Y	Tx #1 RF Out
PA #1	Control	15 Conductor	1	1	Y	Backplane, J21
PA #2	RF In	Coaxial Cable	1	1	Y	Tx #2 RF Out
PA #2	Control	15 Conductor	1	1	Y	Backplane, J22
PA #3	RF In	Coaxial Cable	1	1	Y	Tx #3 RF Out
PA #3	Control	15 Conductor	1	1	Y	Backplane, J23
PA #4	RF In	Coaxial Cable	1	1	Y	Tx #4 RF Out
PA #4	Control	15 Conductor	1	1	Y	Backplane, J24
PS #1	HPA	28 VDC Power	1	0.5	N	PA #1, POWER
PS #1	Shelf	5V/12V DC Power	1	1	N	Backplane, J30
PS #2	HPA	28 VDC Power	1	0.5	N	PA #2, POWER
PS #2	Shelf	5V/12V DC Power	1	1	N	Backplane, J31
PS #3	HPA	28 VDC Power	1	0.5	N	PA #3, POWER
PS #4	HPA	28 VDC Power	1	0.5	N	PA #4, POWER

Table 3. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty.	Length (m)	Shielded? (Y/N)	Termination Box ID & Port ID
PA #1	RF Out	Coaxial Cable	1	3	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	none, terminated	1	-	Y	50Ω Dummy Load
Rx #1	Audio	none, bench test only	0	-	-	-
Rx #2	RF In	none, terminated	1	-	Y	50Ω Dummy Load
Rx #2	Audio	none, bench test only	0	-	-	-
Rx #3	RF In	none, terminated	1	-	Y	50Ω Dummy Load
Rx #3	Audio	none, bench test only	0	-	-	-
Rx #4	RF In	none, terminated	1	-	Y	50Ω Dummy Load
Rx #4	Audio	none, bench test only	0	-	-	-
BB #1	M-LAN	Ethernet Cable, CAT5	1	3	N	none
BB #1	Simulcast	15-Conductor Cable	2	3	Y	none
BB #1	COMM	none, test/local control	0	-	-	-
BB #1	Ref In	none, terminated	1	-	Y	50Ω Dummy Load
BB #2	M-LAN	Ethernet Cable, CAT5	1	3	N	none
BB #2	Simulcast	15-Conductor Cable	2	3	Y	none
BB #2	COMM	none, test/local control	0	-	-	-
BB #2	Ref In	none, terminated	1	-	Y	50Ω Dummy Load
TC #1	M-LAN	Ethernet Cable, CAT5	1	3	N	none
TC #1	P-LAN	Ethernet Cable, CAT5	1	3	N	none
TC #1	COMM	none, test/local prog	0	-	-	-
TC #2	M-LAN	Ethernet Cable, CAT5	1	3	N	none
TC #2	P-LAN	Ethernet Cable, CAT5	1	3	N	none
TC #2	COMM	none, test/local prog	0	-	-	-
TC #3	M-LAN	Ethernet Cable, CAT5	1	3	N	none
TC #3	P-LAN	Ethernet Cable, CAT5	1	3	N	none
TC #3	COMM	none, test/local prog	0	-	-	-
TC #4	M-LAN	Ethernet Cable, CAT5	1	3	N	none
TC #4	P-LAN	Ethernet Cable, CAT5	1	3	N	none
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 4. External Ports and Cabling

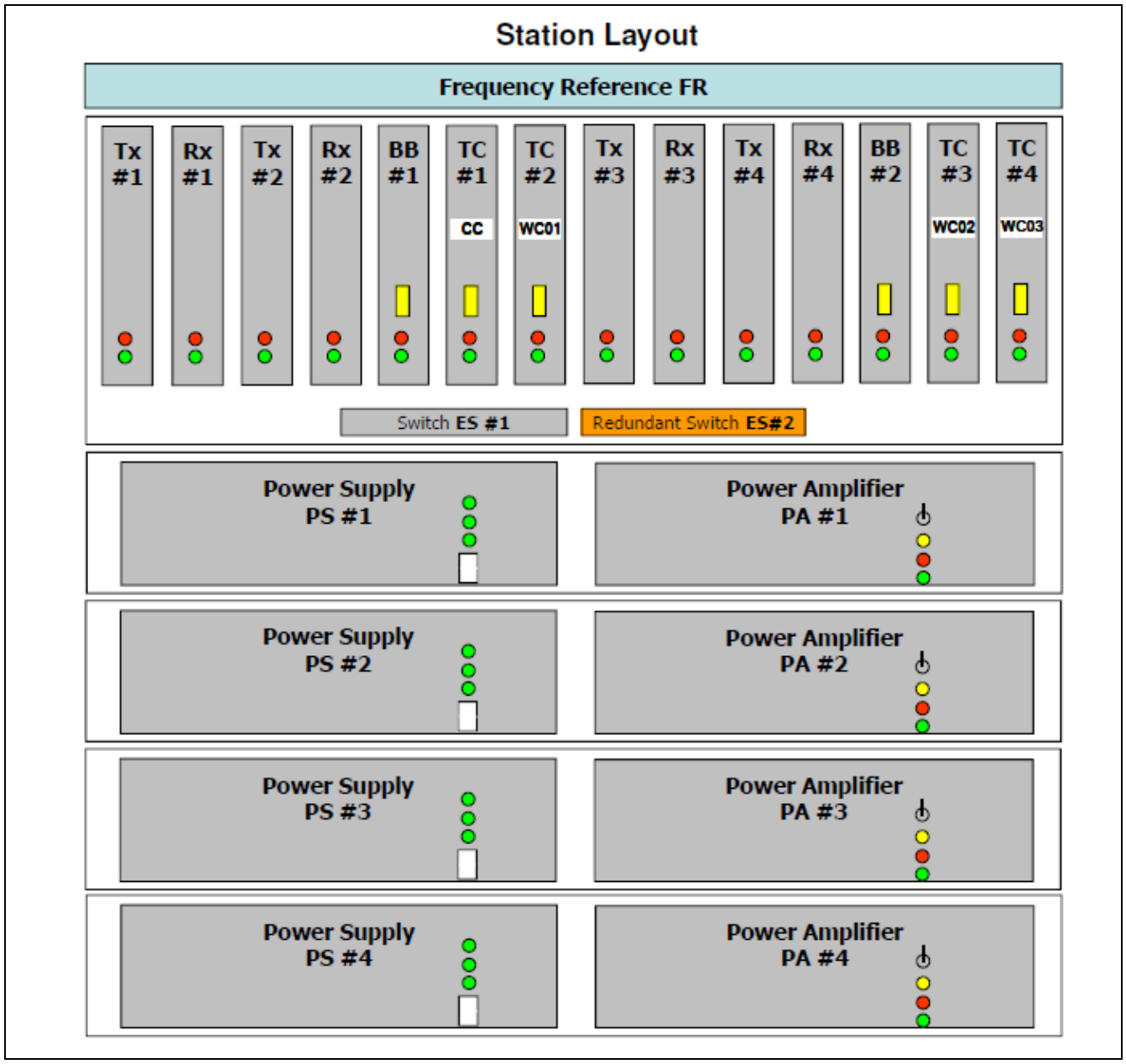


Figure 1. Station Layout

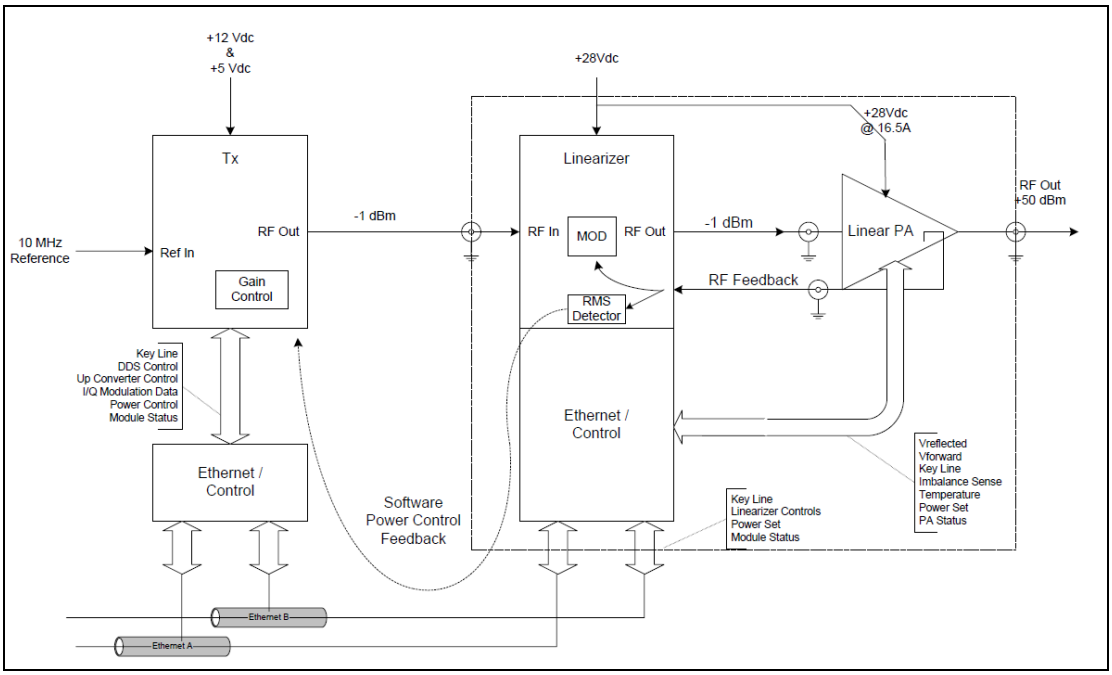


Figure 2. Transmitter Lineup Block Diagram

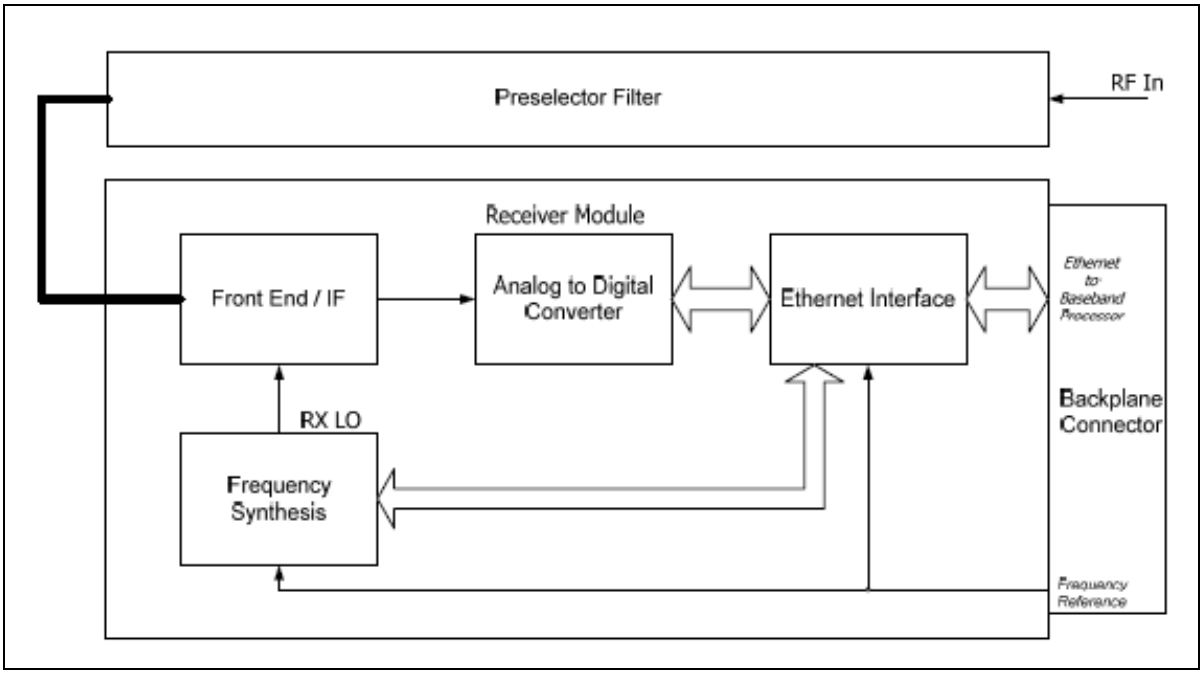


Figure 3. Block Diagram, Overall Receiver Module

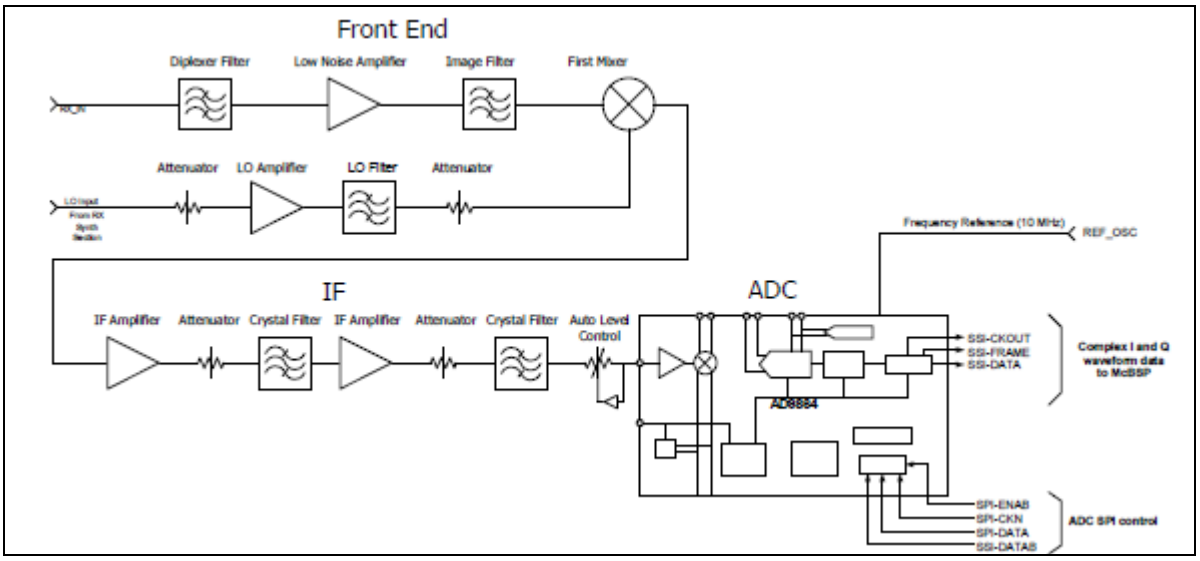


Figure 4. Block Diagram, Front End, IF, and Analog to Digital Converter

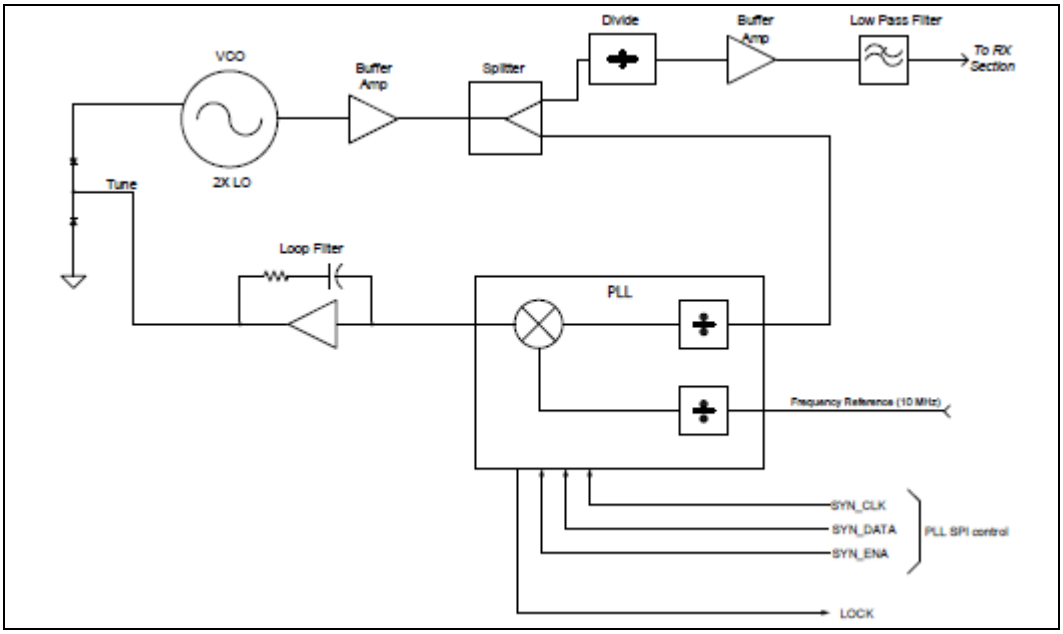


Figure 5. Block Diagram, Frequency Synthesis

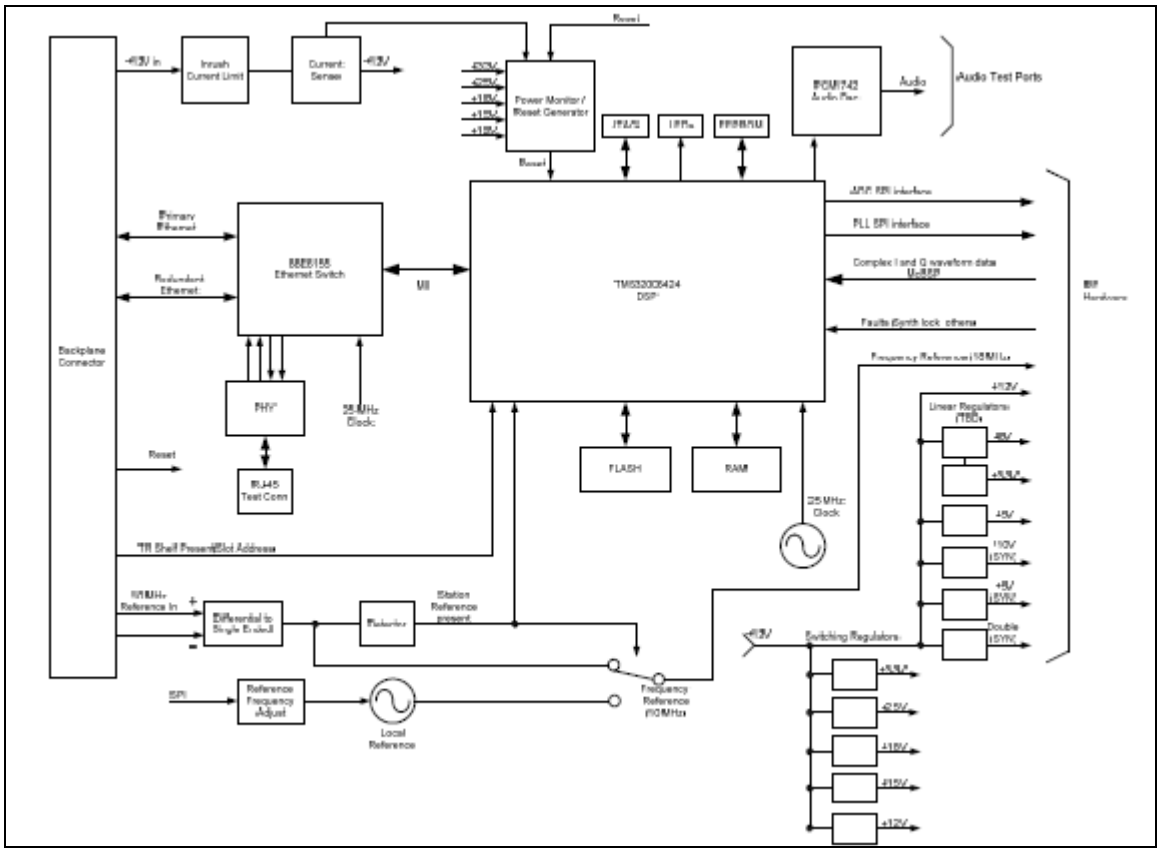


Figure 6. Ethernet Interface Section

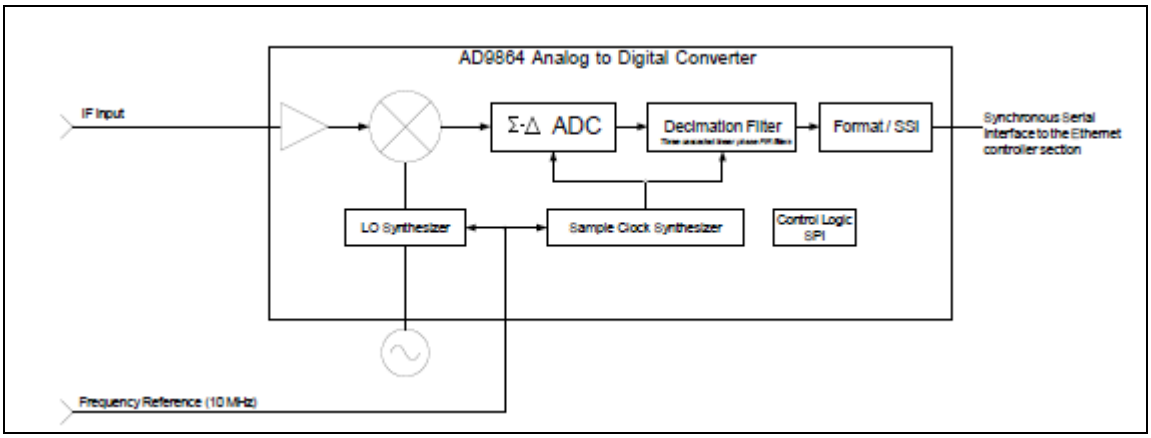


Figure 7. Functional Diagram of the ADC

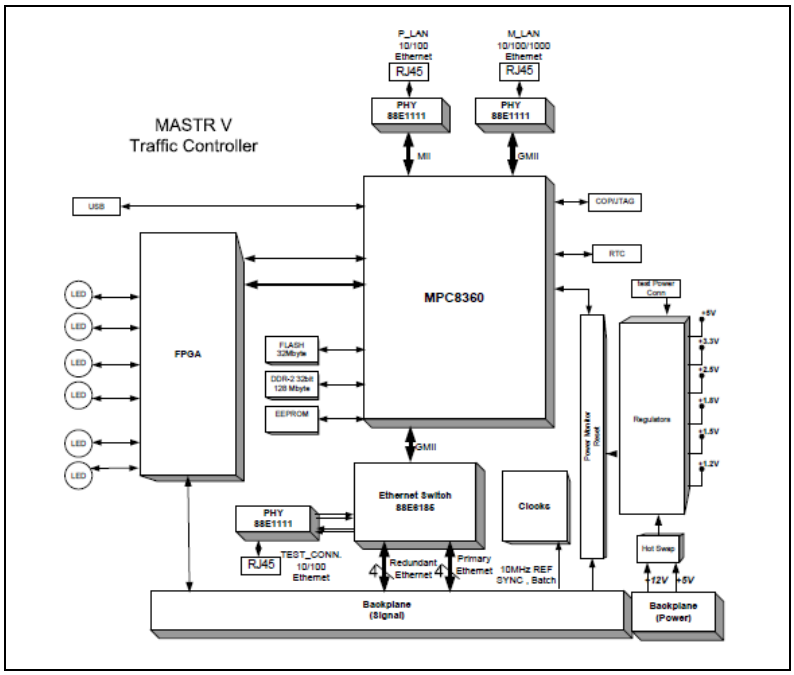


Figure 8. Traffic Controller Block Diagram

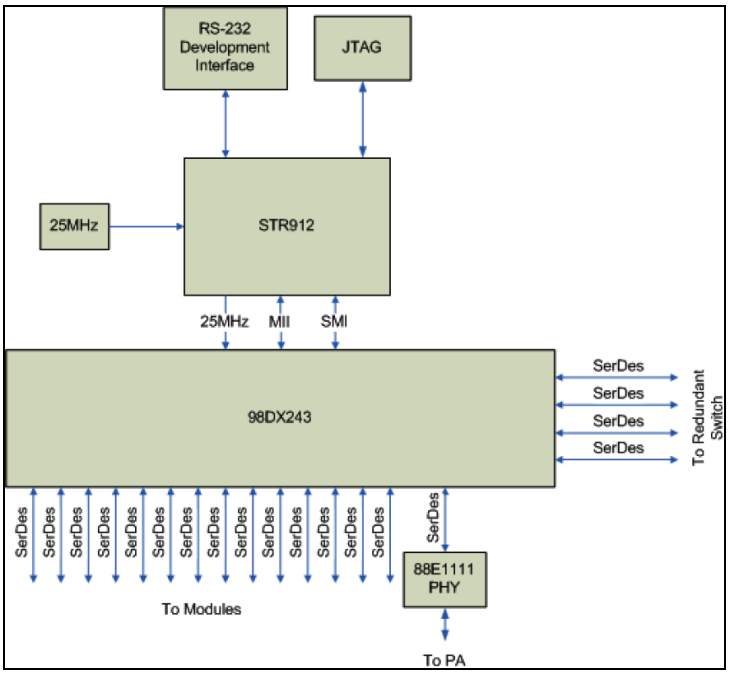
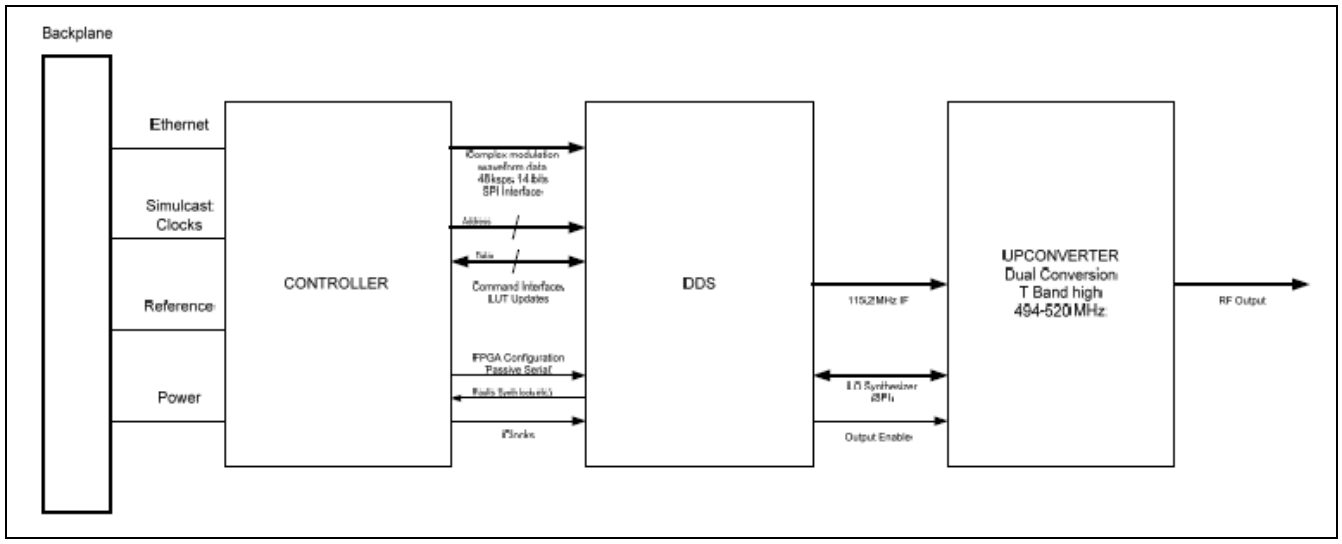
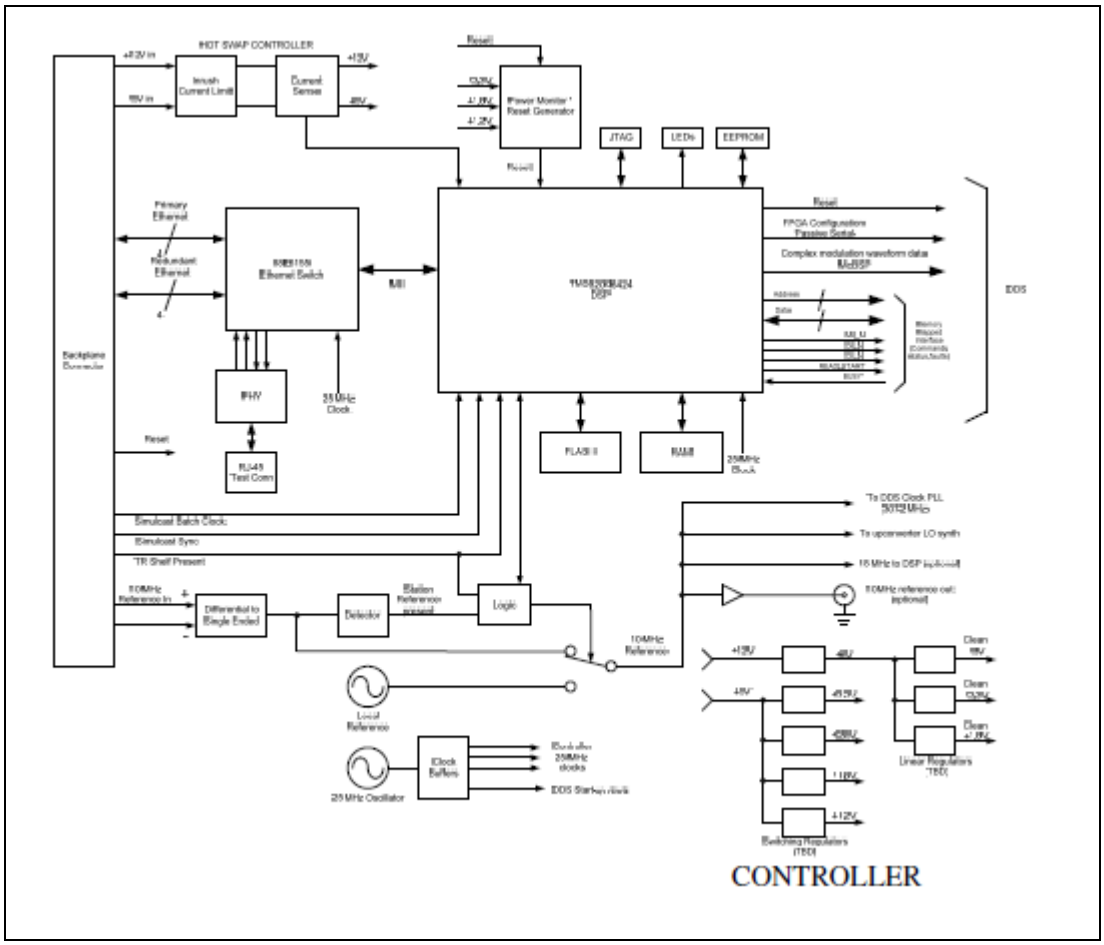
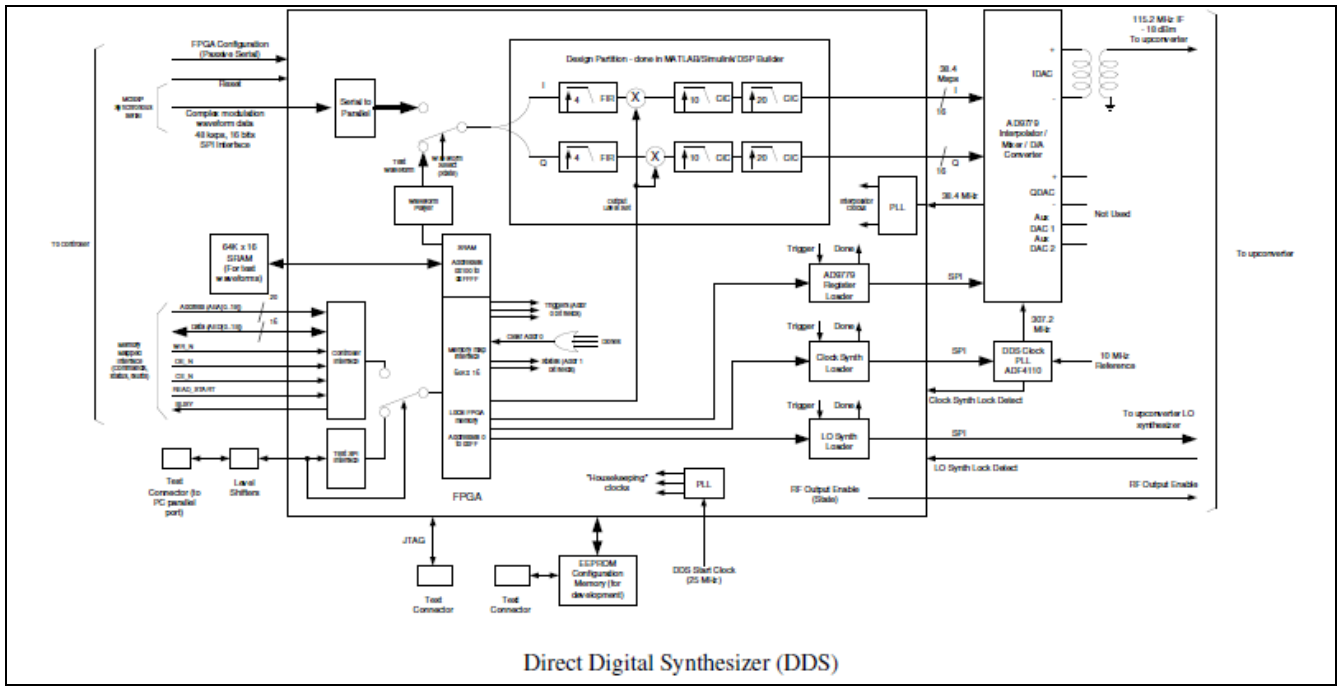


Figure 9. Ethernet Switch Block Diagram







Direct Digital Synthesizer (DDS)

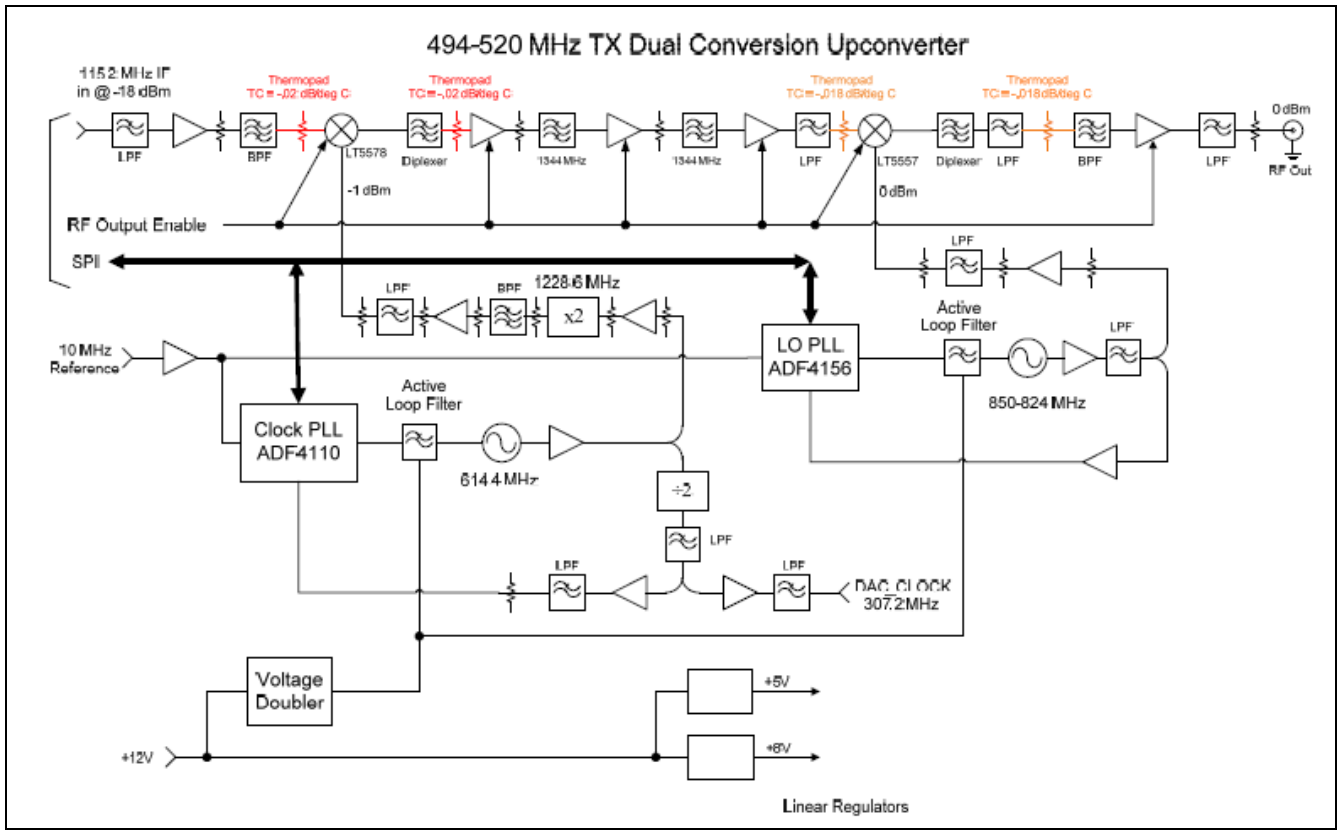


Figure 10. Transmit Module Block Diagram, 494-512 MHz

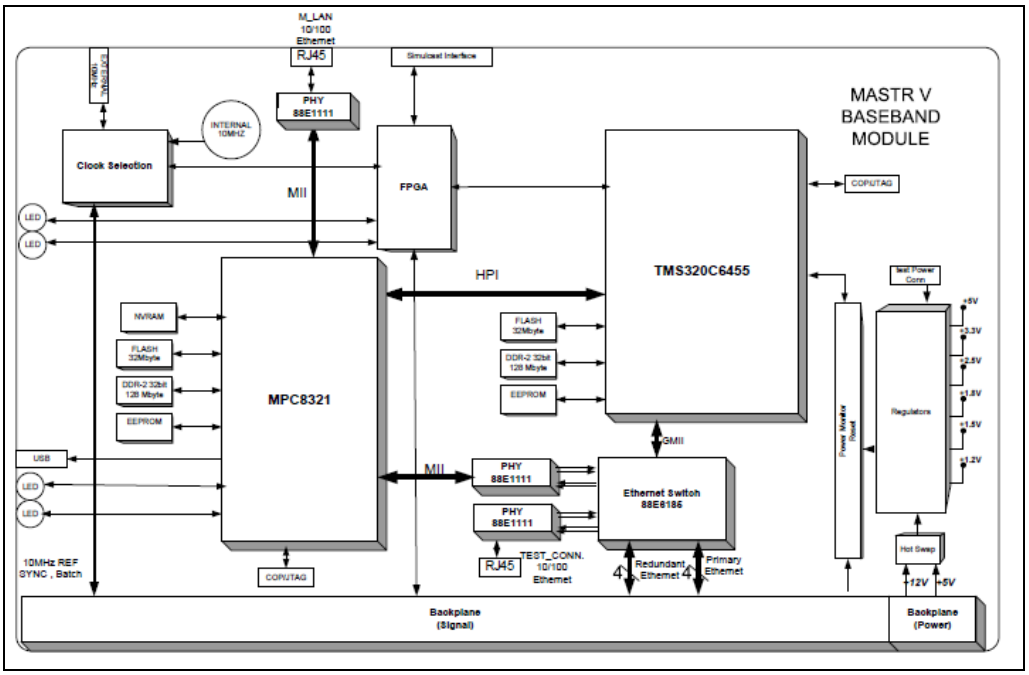


Figure 11. Baseband Module Block Diagram

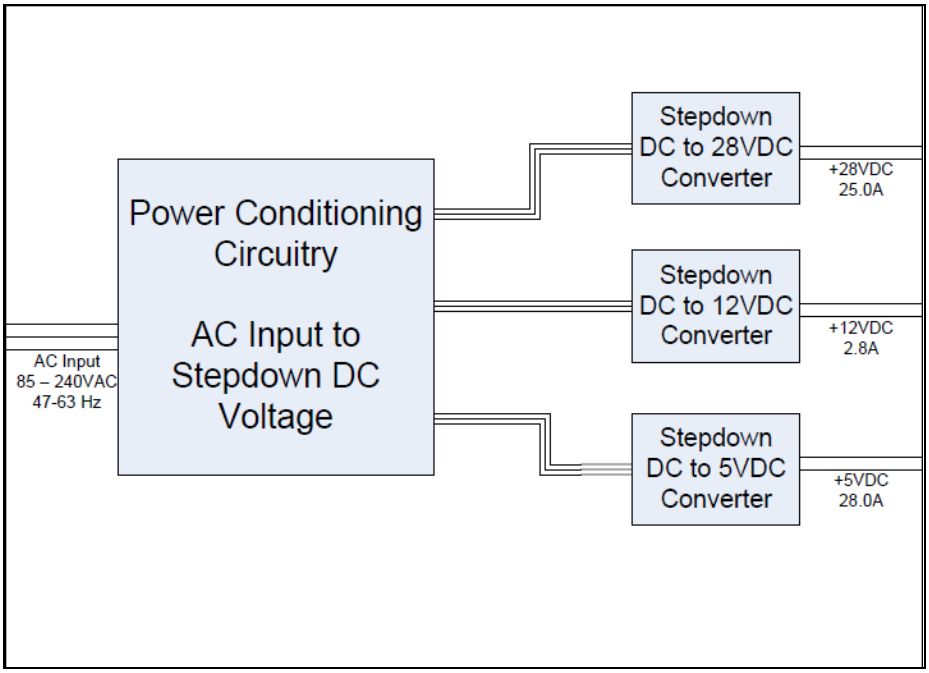


Figure 12. Power Supply Block Diagram

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 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 Unintentional Radiators

3. Electromagnetic Compatibility Criteria

3.1. § 15.107 Conducted Emissions Limits

Test Requirement(s): **15.107 (a)** Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 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- 0.45	79	66	66 - 56	56 - 46
0.45 - 0.5	79	66	56	46
0.5 - 30	73	60	60	50
Note 1 — The lower limit shall apply at the transition frequencies. Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz. * -- Limits per Subsection 15.207(a).				

Table 5. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Subsections 15.107(a) (b) and 15.207(a)

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

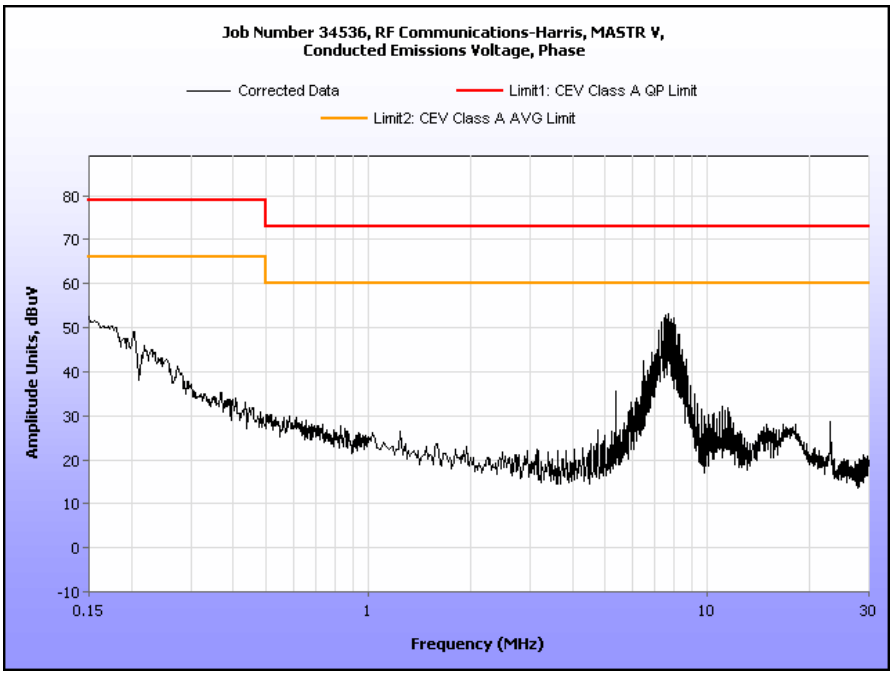
Test Engineer(s): Jeff Pratt

Test Date(s): 04/10/12

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

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.5004	25.39	0.01	25.4	73	-47.6	14.47	0.01	14.48	60	-45.52
5.383	33.69	0.33	34.02	73	-38.98	15.5	0.33	15.83	60	-44.17
6.4598	41.45	0.32	41.77	73	-31.23	22.72	0.32	23.04	60	-36.96
7.5569	51.74	0.35	52.09	73	-20.91	49	0.35	49.35	60	-10.65
11.3183	30.73	0.42	31.15	73	-41.85	26.41	0.42	26.83	60	-33.17
22.4143	23.31	0.58	23.89	73	-49.11	16.41	0.58	16.99	60	-43.01

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

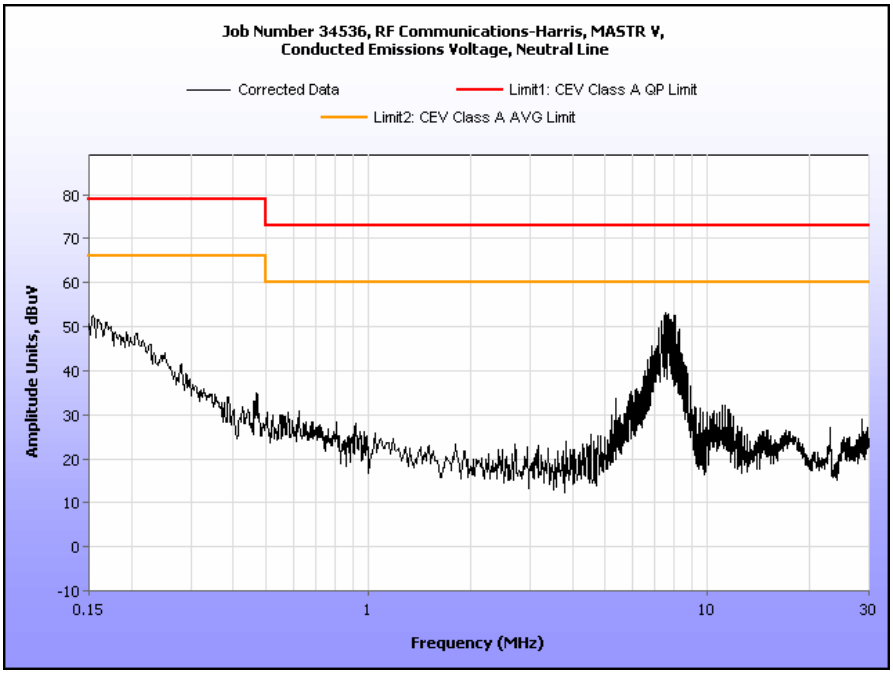


Plot 1. Conducted Emission, Phase Line Plot

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

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
1.25	15.27	0.1	15.37	73	-57.63	5.33	0.1	5.43	60	-54.57
7.6517	51.9	0.35	52.25	73	-20.75	47.17	0.35	47.52	60	-12.48
11.0933	29.78	0.42	30.2	73	-42.8	24.09	0.42	24.51	60	-35.49
17.1933	23.27	0.49	23.76	73	-49.24	16.8	0.49	17.29	60	-42.71
22.6549	21.43	0.59	22.02	73	-50.98	14.66	0.59	15.25	60	-44.75
29.6648	22.18	0.69	22.87	73	-50.13	15.52	0.69	16.21	60	-43.79

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



Plot 2. Conducted Emission, Neutral Line Plot

Conducted Emission Limits Test Setup

Photograph 1. Conducted Emissions, Test Setup

3.2. § 15.109 Radiated Emissions Limits

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

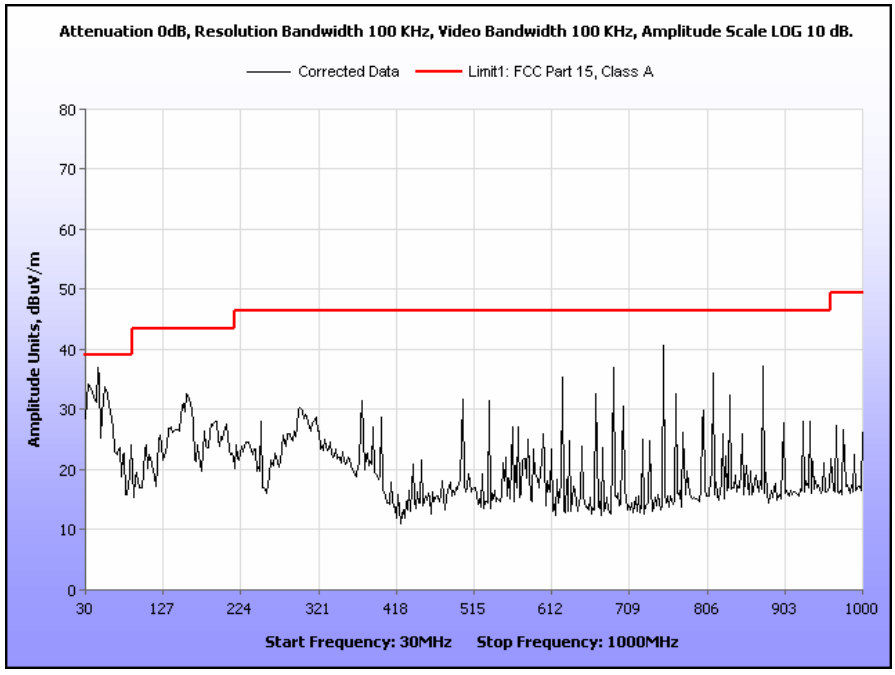
Test Date(s): 06/21/12

Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
34.219439	138	H	1.00	5.18	18.78	0.38	10.46	13.88	39.00	-25.12
34.219439	138	V	1.00	19.49	18.78	0.38	10.46	28.19	39.00	-10.81
47.372094	171	H	1.01	7.42	9.71	0.46	10.46	7.13	39.00	-31.87
47.372094	171	V	1.01	32.85	9.71	0.46	10.46	32.56	39.00	-6.44
56.532064	-1	H	1.00	16.14	7.50	0.52	10.46	13.70	39.00	-25.30
56.532064	353	V	1.00	29.20	7.50	0.52	10.46	26.76	39.00	-12.24
157.41583	323	H	1.52	15.46	12.90	0.95	10.46	18.85	43.50	-24.65
157.41583	180	V	1.00	24.45	12.90	0.95	10.46	27.84	43.50	-15.66
687.5124	366	H	1.00	23.12	20.75	2.25	10.46	35.66	46.40	-10.74
687.5124	361	V	1.76	24.03	20.75	2.25	10.46	36.57	46.40	-9.83
750.01227	51	H	1.01	28.06	21.30	2.41	10.46	41.31	46.40	-5.09
750.01227	226	V	1.84	25.78	21.30	2.41	10.46	39.03	46.40	-7.37

Table 9. Radiated Emissions Limits, Test Results, FCC Limits

Note: The EUT was tested at 3 m.



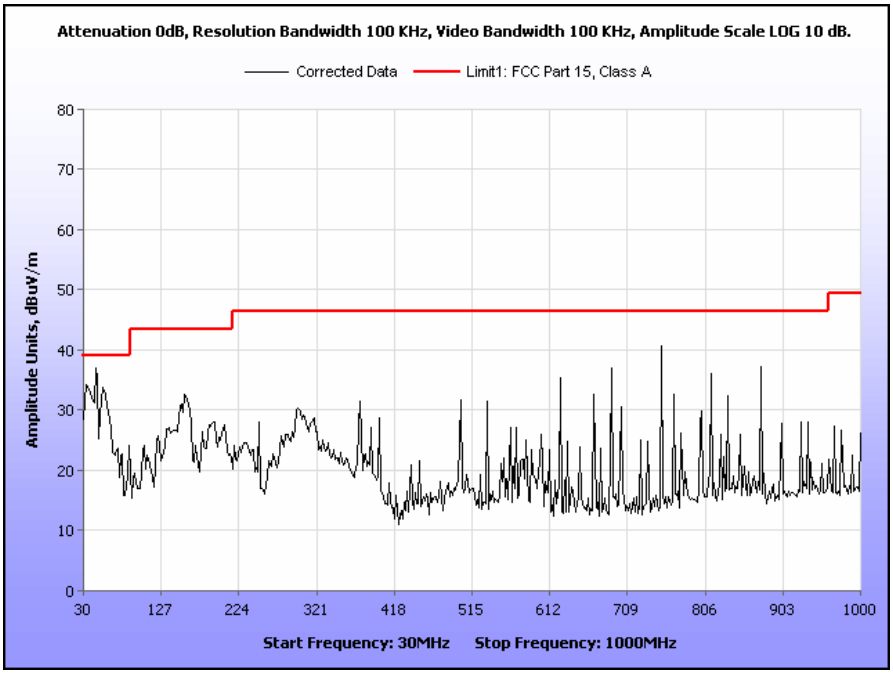
Plot 3. Radiated Emissions, 30 MHz - 1 GHz, FCC Limits

Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
34.219439	138	H	1.00	5.18	18.78	0.38	10.46	13.88	40.00	-26.12
34.219439	138	V	1.00	19.49	18.78	0.38	10.46	28.19	40.00	-11.81
47.372094	171	H	1.01	7.42	9.71	0.46	10.46	7.13	40.00	-32.87
47.372094	171	V	1.01	32.85	9.71	0.46	10.46	32.56	40.00	-7.44
56.532064	-1	H	1.00	16.14	7.50	0.52	10.46	13.70	40.00	-26.30
56.532064	353	V	1.00	29.20	7.50	0.52	10.46	26.76	40.00	-13.24
157.41583	323	H	1.52	15.46	12.90	0.95	10.46	18.85	40.00	-21.15
157.41583	180	V	1.00	24.45	12.90	0.95	10.46	27.84	40.00	-12.16
687.5124	366	H	1.00	23.12	20.75	2.25	10.46	35.66	47.00	-11.34
687.5124	361	V	1.76	24.03	20.75	2.25	10.46	36.57	47.00	-10.43
750.01227	51	H	1.01	28.06	21.30	2.41	10.46	41.31	47.00	-5.69
750.01227	226	V	1.84	25.78	21.30	2.41	10.46	39.03	47.00	-7.97

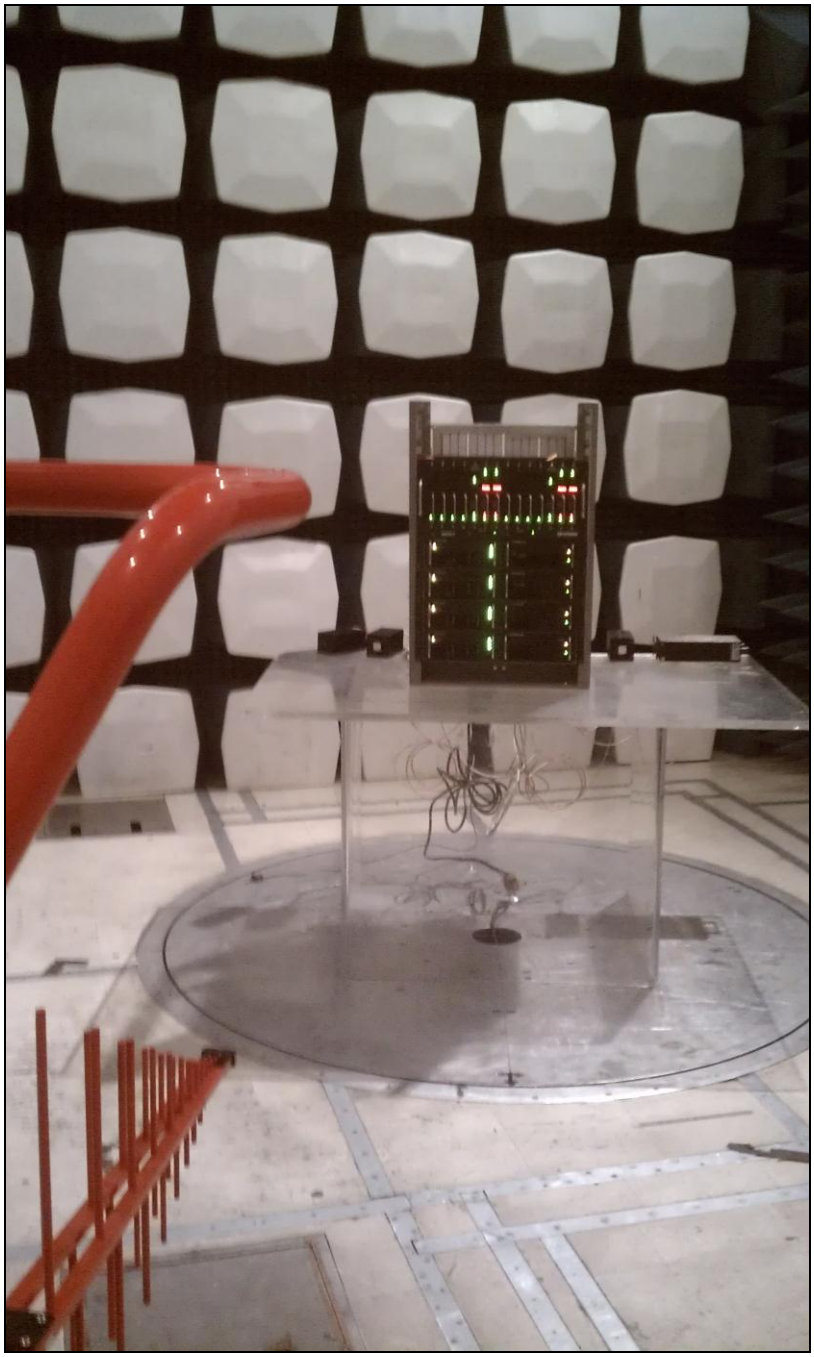
Table 10. Radiated Emissions Limits, Test Results, ICES-003 Limits

Note: The EUT was tested at 3 m.



Plot 4. Radiated Emissions, 30 MHz – 1 GHz, ICES-003 Limits

Radiated Emission Limits Test Setup



Photograph 2. Radiated Emission, Test Setup

IV. Electromagnetic Compatibility Criteria for Intentional Radiators

4. Electromagnetic Compatibility RF Power Output Requirements

4.1. RF Power Output

Test Requirement(s): **§2.1046 and §90.1215(a) with FCC 04-265**

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 the conducted output power. The EUT power was adjusted enough to produce maximum output power as specified in the owner's manual. The EUT has both a 10 Watt mode and a 100 Watt mode. The output power was then recorded as an average power. Measurements were made at the all four frequencies possible by the EUT sample.

Test Results: Equipment complies with 47CFR 2.1046 and 90.1215(a) with FCC 04-265.

Test Engineer(s): Jeff Pratt

Test Date(s): 04/05/12

Frequency (MHz)	Modulation	Power (dBm)	
		10 Watt	100 Watt
494.00625	C4FM	39.09	49.68
	CQPSK	39.48	49.41
	HDQPSK	39.67	49.77
497.99375	C4FM	40.24	50.13
	CQPSK	39.52	50.71
	HDQPSK	39.67	49.74
511.99375	C4FM	39.95	49.99
	CQPSK	39.63	50.32
	HDQPSK	40.03	50.64

Table 11. RF Power Output, Test Results

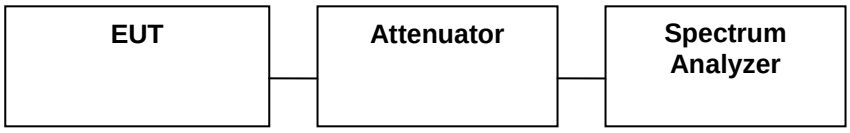
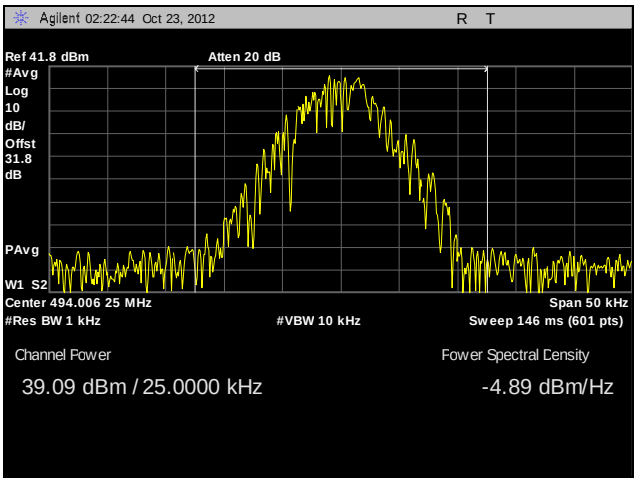
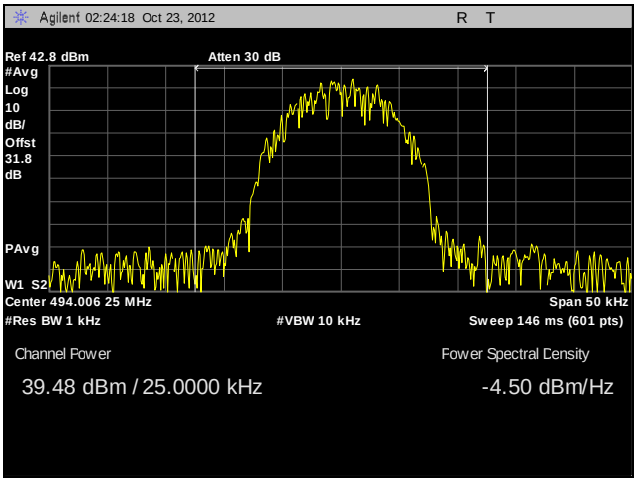


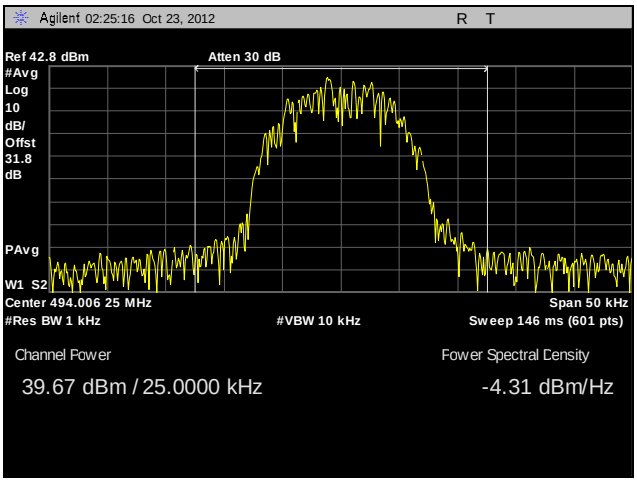
Figure 13. RF Power Output Test Setup



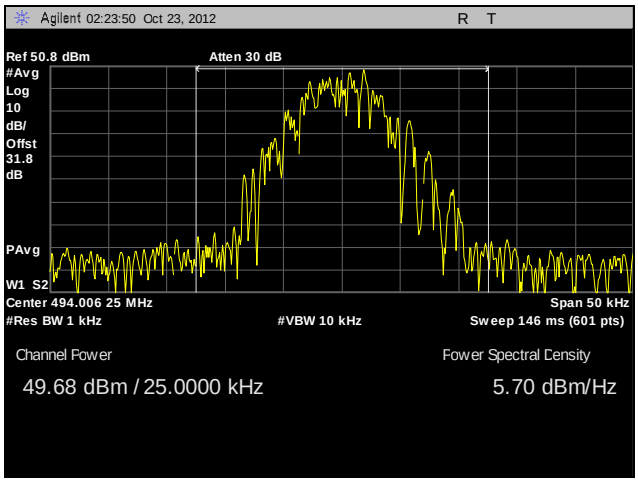
Plot 5. RF Power Output, 494.00625 MHz, 10W, C4FM



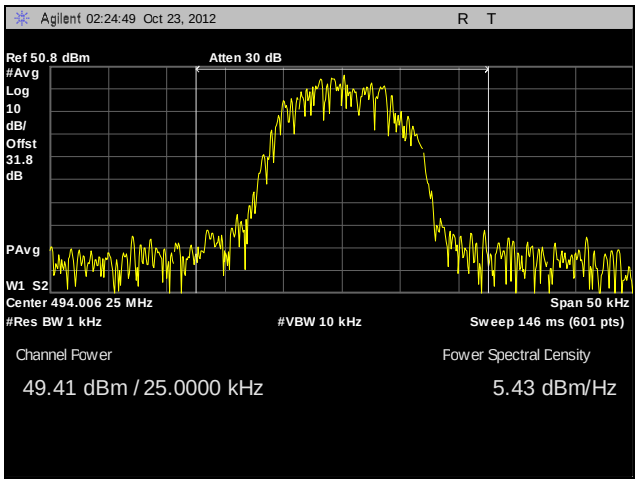
Plot 6. RF Power Output, 494.00625 MHz, 10W, CQPSK



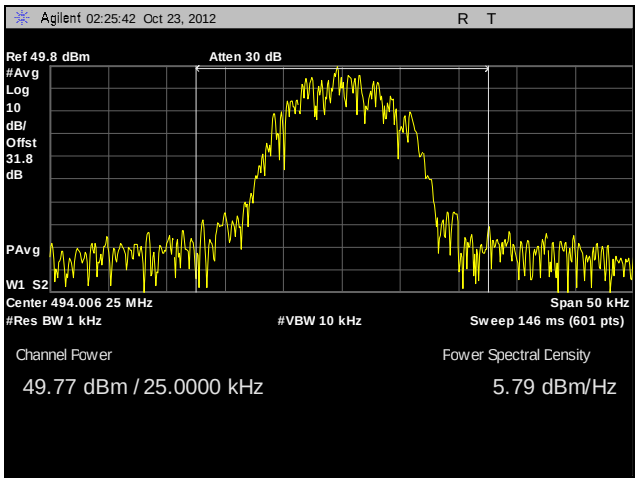
Plot 7. RF Power Output, 494.00625 MHz, 10W, HDQPSK



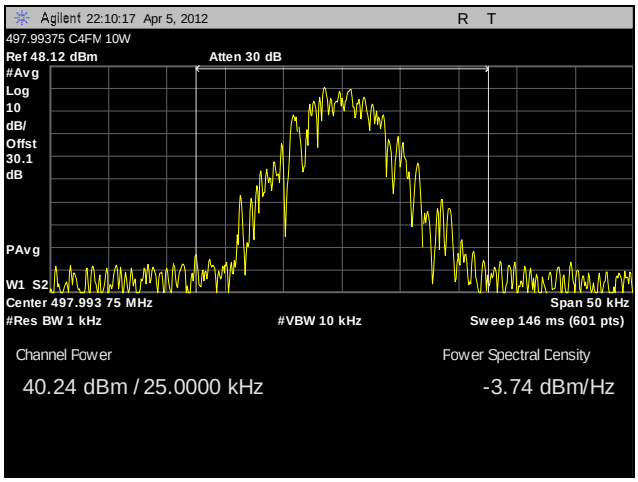
Plot 8. RF Power Output, 494.00625 MHz, 100W, C4FM



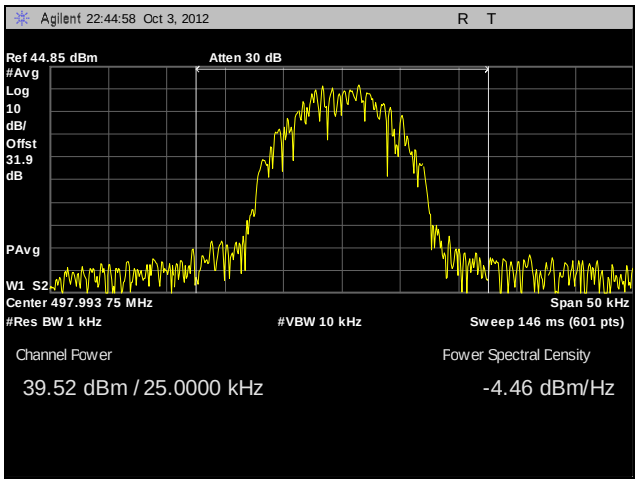
Plot 9. RF Power Output, 494.00625 MHz, 100W, CQPSK



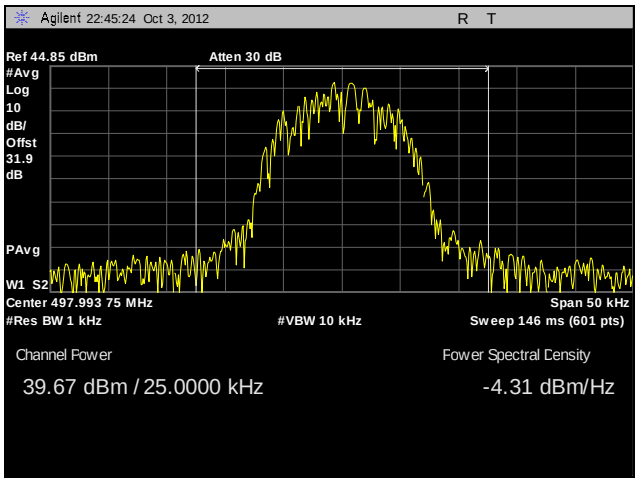
Plot 10. RF Power Output, 494.00625 MHz, 100W, HDQPSK



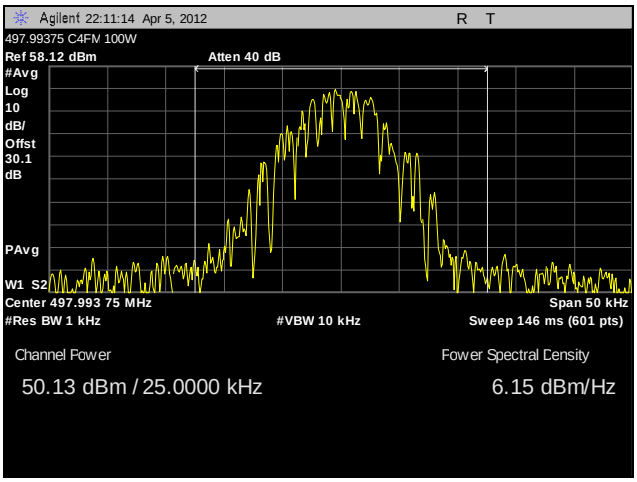
Plot 11. RF Power Output, 497.99375 MHz, 10W, C4FM



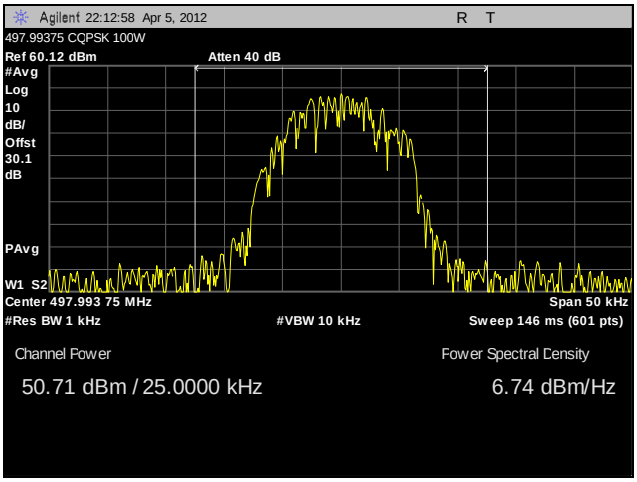
Plot 12. RF Power Output, 497.99375 MHz, 10W, CQPSK



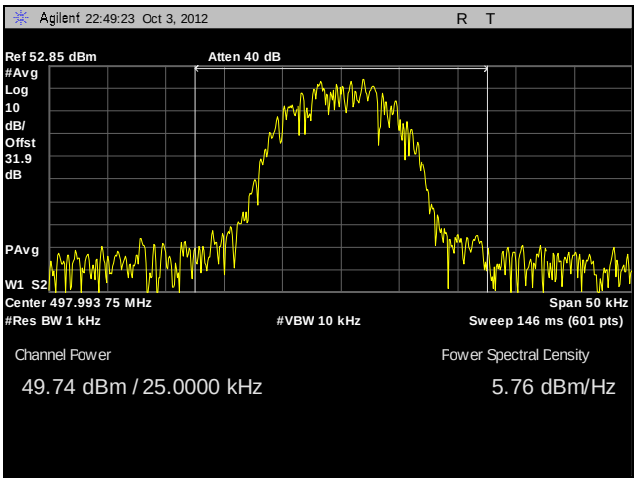
Plot 13. RF Power Output, 497.99375 MHz, 10W, HDQPSK



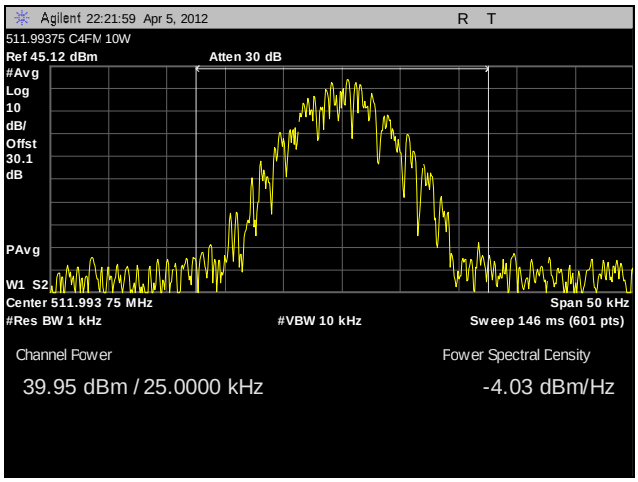
Plot 14. RF Power Output, 497.99375 MHz, 100W, C4FM



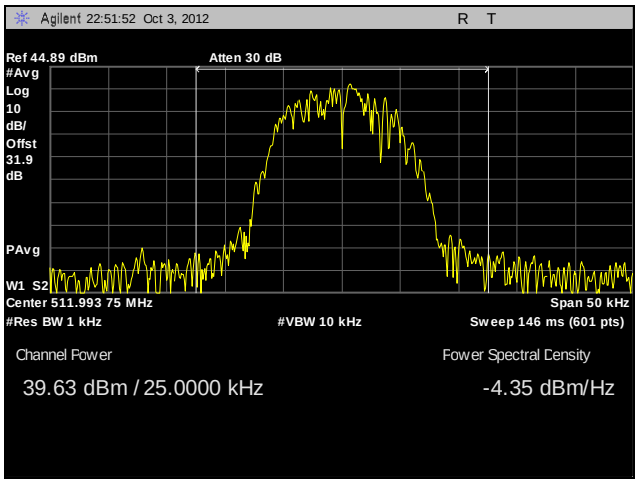
Plot 15. RF Power Output, 497.99375 MHz, 100W, CQPSK



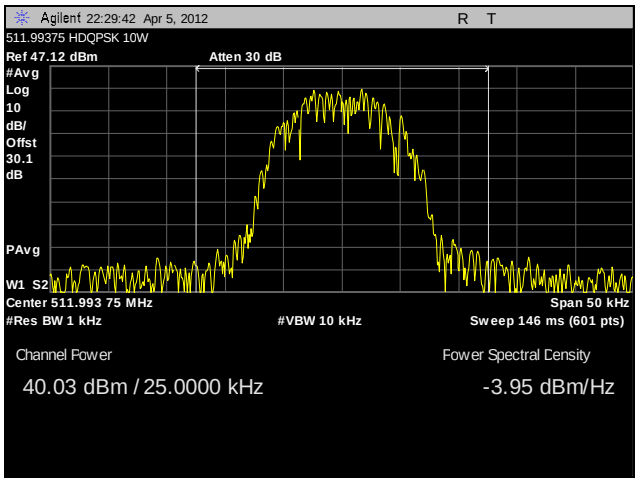
Plot 16. RF Power Output, 497.99375 MHz, 100W, HDQPSK



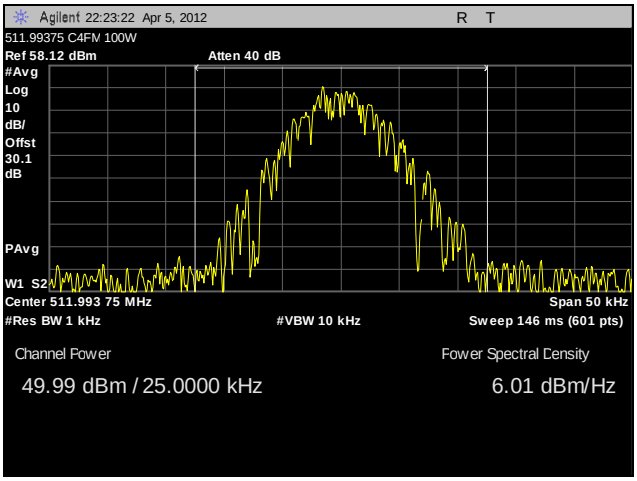
Plot 17. RF Power Output, 511.99375 MHz, 10W, C4FM



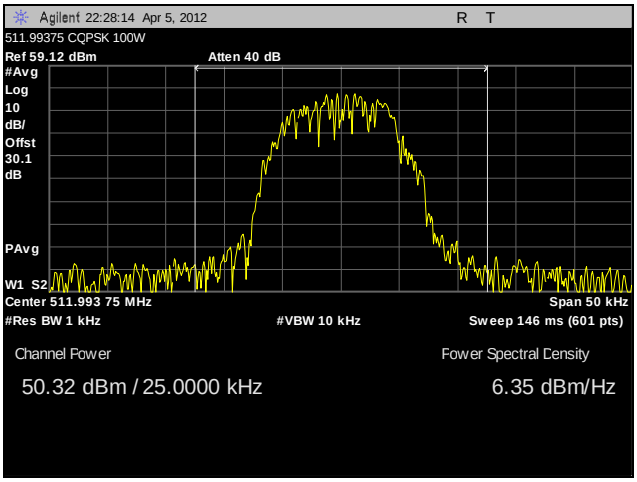
Plot 18. RF Power Output, 511.99375 MHz, 10W, CQPSK



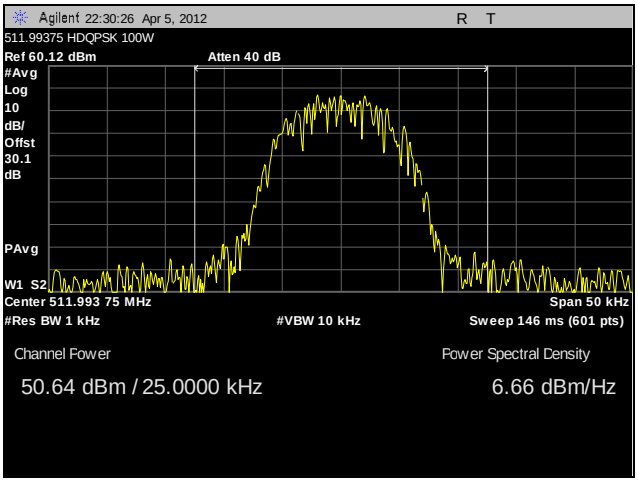
Plot 19. RF Power Output, 511.99375 MHz, 10W, HDQPSK



Plot 20. RF Power Output, 511.99375 MHz, 100W, C4FM



Plot 21. RF Power Output, 511.99375 MHz, 100W, CQPSK



Plot 22. RF Power Output, 511.99375 MHz, 100W, HDQPSK

Photograph 3. Conducted RF Power, Test Setup

4.2. Emission Mask

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.

Waveform	Bitrate (R)	Peak Dev (D)	Factor (K)	BW
C4FM (8K00F1D)	9.6 kbs	1800	0.89	8K00
WCQPSK (9K80D7D)	9.6 kbs	1800	1.39	9K80
HDQPSK (9K70D1W)	12 kbs	2250	0.822	9K70

For each emission designator, data was collected from MATLAB's DDS simulation and from lab measurements to verify the occupied bandwidth as a function of peak deviation. K was determined by a quadratic fit that confirmed the necessary bandwidth values.

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): Jeff Pratt

Test Date(s): 04/05/12

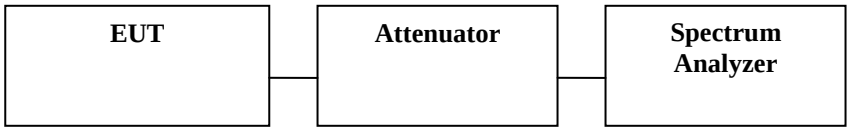
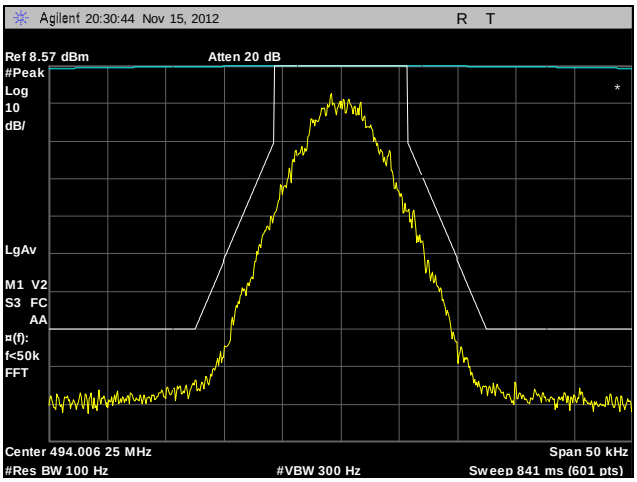
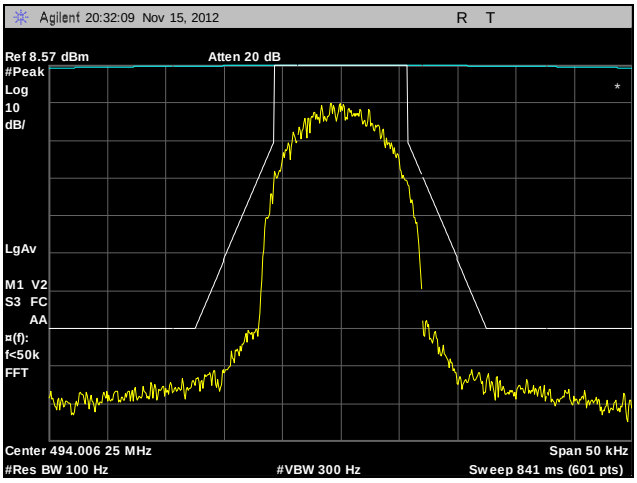


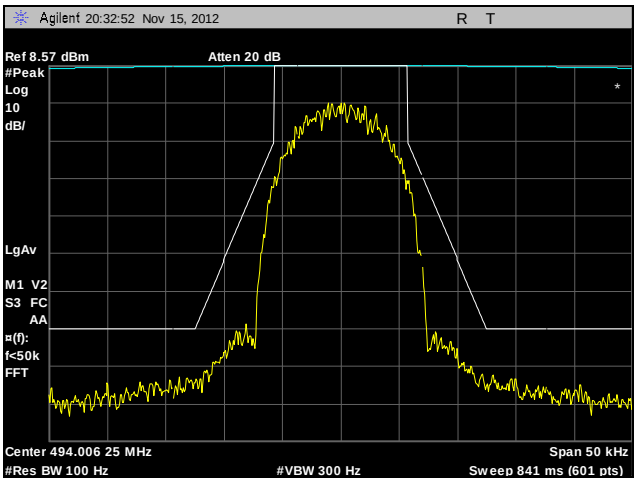
Figure 14. Emission Mask Test Setup



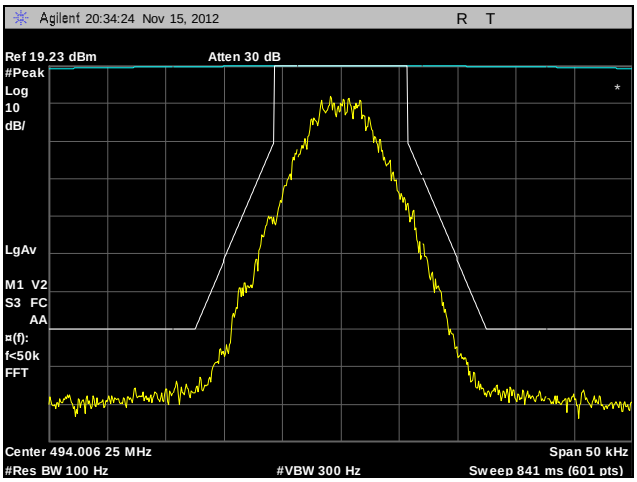
Plot 23. Emission Mask, 494.00625 MHz, C4FM, 10 W



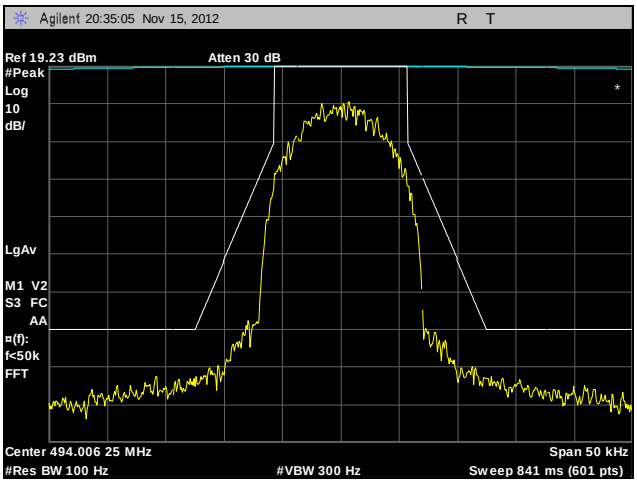
Plot 24. Emission Mask, 494.00625 MHz, CQPSK, 10 W



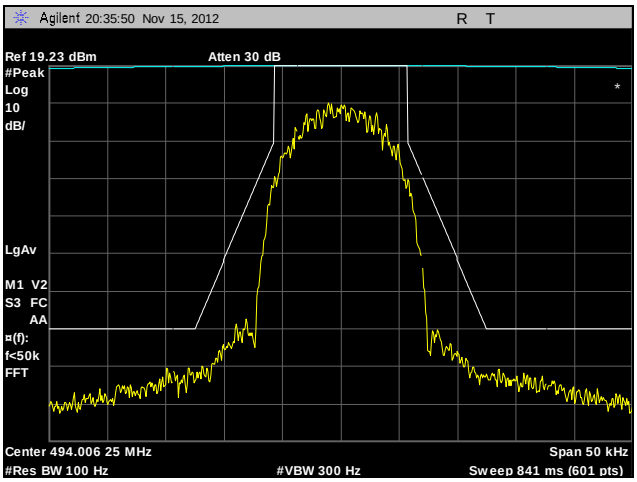
Plot 25. Emission Mask, 494.00625 MHz, HDQPSK, 10 W



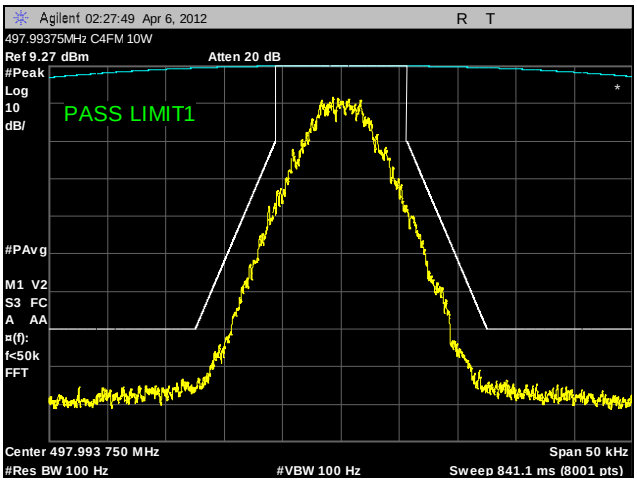
Plot 26. Emission Mask, 494.00625 MHz, C4FM, 100 W



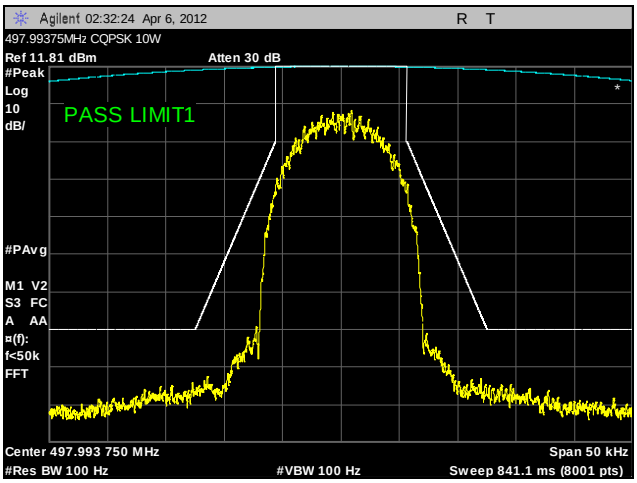
Plot 27. Emission Mask, 494.00625 MHz, CQPSK, 100 W



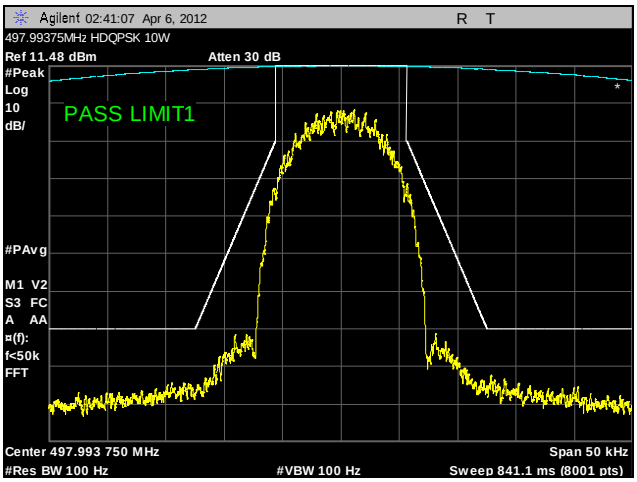
Plot 28. Emission Mask, 494.00625 MHz, HDQPSK, 100 W



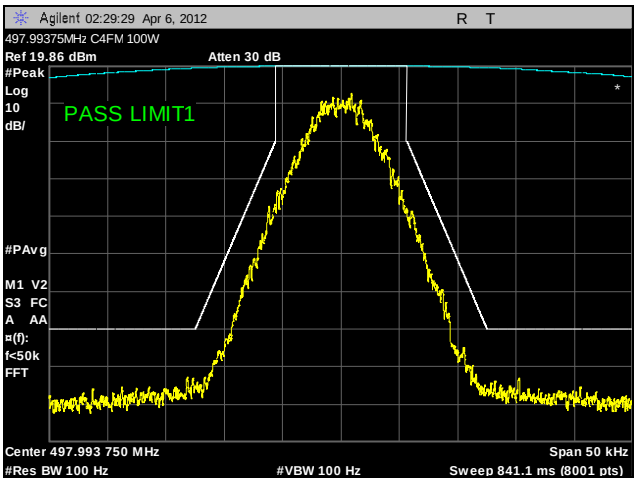
Plot 29. Emission Mask, 497.99375 MHz, C4FM, 10 W



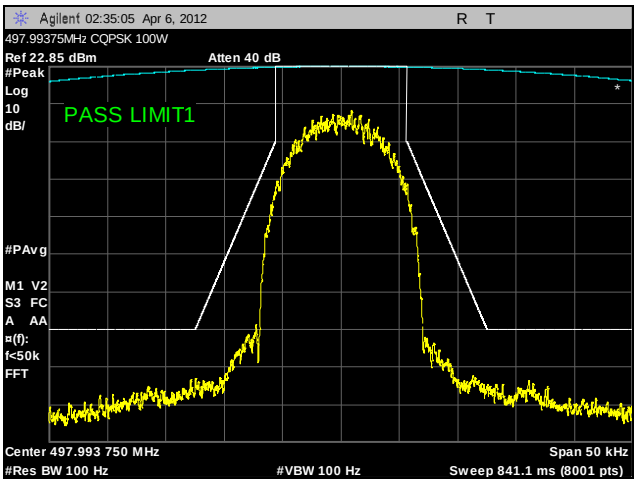
Plot 30. Emission Mask, 497.99375 MHz, CQPSK, 10 W



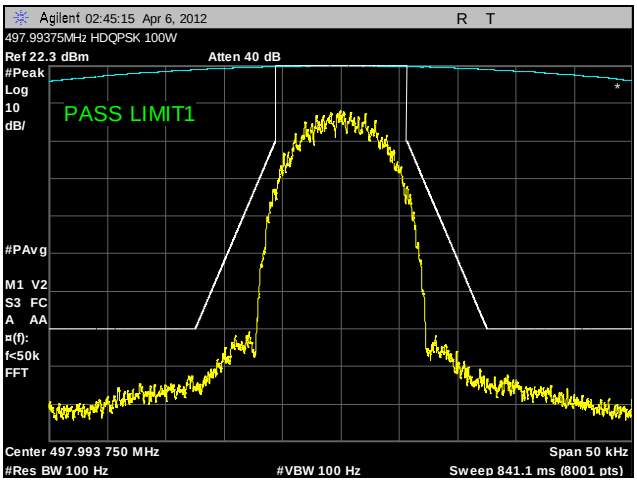
Plot 31. Emission Mask, 497.99375 MHz, HDQPSK, 10 W



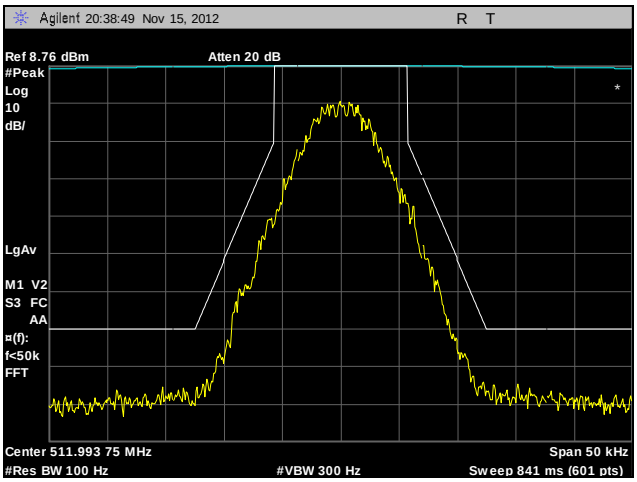
Plot 32. Emission Mask, 497.99375 MHz, C4FM, 100 W



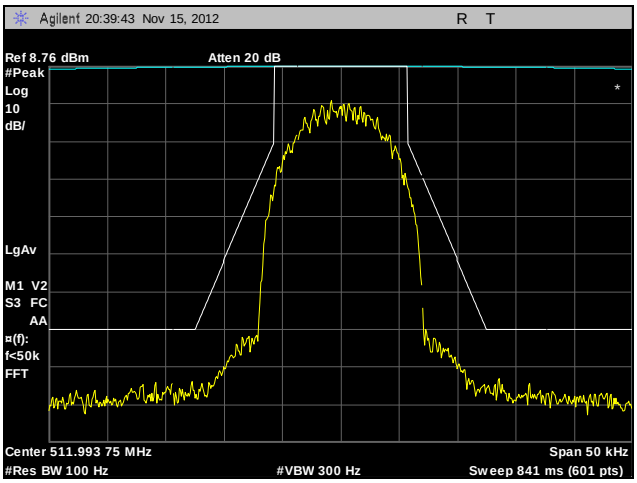
Plot 33. Emission Mask, 497.99375 MHz, CQPSK, 100 W



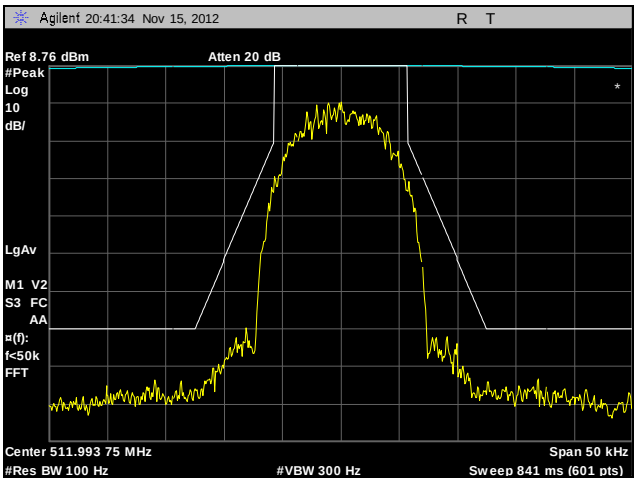
Plot 34. Emission Mask, 497.99375 MHz, HDQPSK, 100 W



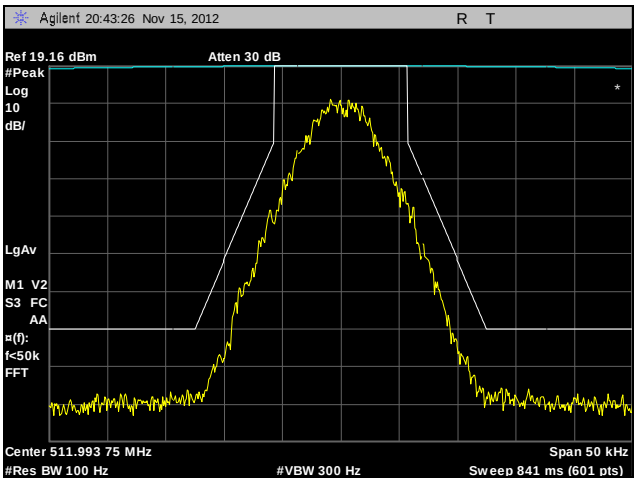
Plot 35. Emission Mask, 511.99375 MHz, C4FM, 10 W



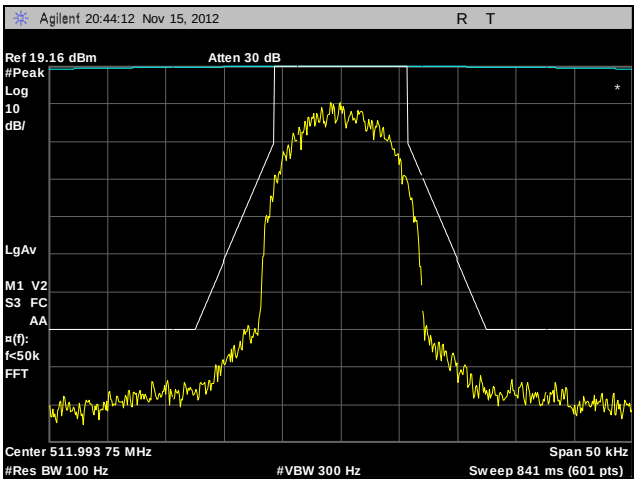
Plot 36. Emission Mask, 511.99375 MHz, CQPSK, 10 W



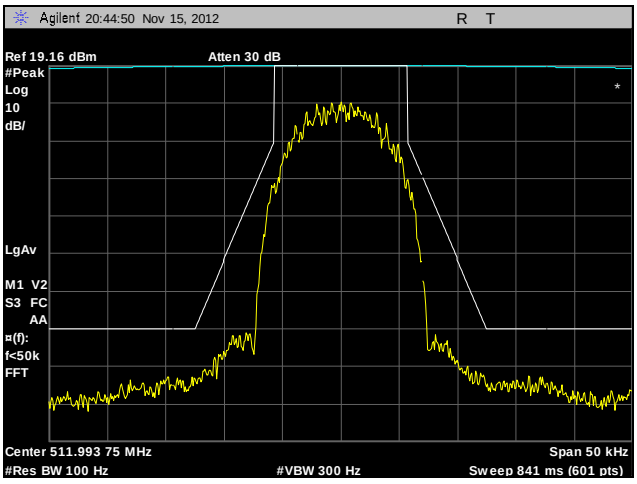
Plot 37. Emission Mask, 511.99375 MHz, HDQPSK, 10 W



Plot 38. Emission Mask, 511.99375 MHz, C4FM, 100 W



Plot 39. Emission Mask, 511.99375 MHz, CQPSK, 100 W



Plot 40. Emission Mask, 511.99375 MHz, HDQPSK, 100 W

4.3. Spurious Emissions at Antenna Terminals

Test Requirement(s): **§2.1051 and §90.210(D) with FCC 04-265**

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 40GHz whichever is the lesser. Measurements were made at all four frequencies and at all three modulations. Emissions approaching the limit were re-measured using an attenuator and a tunable bandpass filter which was centered on the harmonics in question. Their power was recorded and compared to limits of 90.210.

Test Results: Equipment complies with Section 2.1051 and 90.210(D) with FCC 04-265.

Test Engineer(s): Jeff Pratt

Test Date(s): 04/05/12

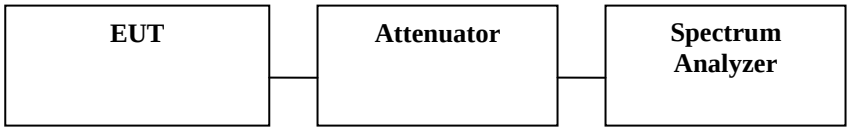
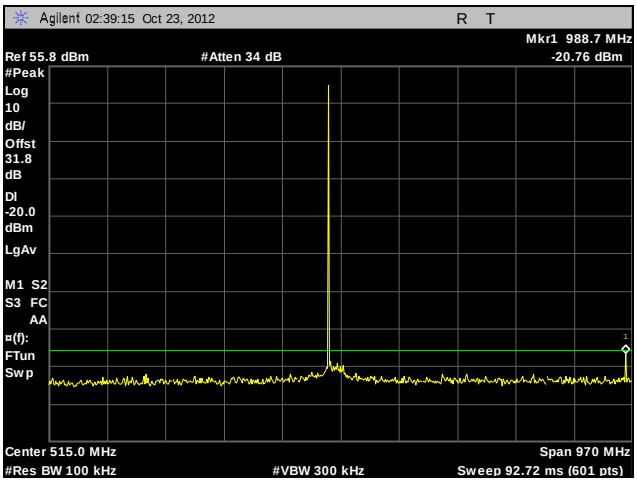


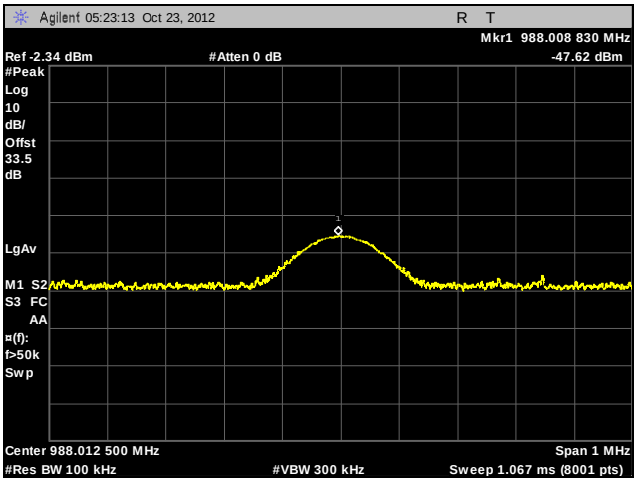
Figure 15. Spurious Emissions at Antenna Terminals Test Setup

Fundamental Frequency (MHz)	Modulation	2nd Harmonic Frequency (MHz)	Attenuation at Frequency of 2nd Harmonic (dB)	Corrected Power (dBm)	Limit (dBm)	Margin (dB)
494.00625	C4FM	988.0125	33.46	-47.62	-20	-27.62
494.00625	CQPSK	988.0125	33.46	-43.25	-20	-23.25
494.00625	HDQPSK	988.0125	33.46	-44.38	-20	-24.38
497.99375	C4FM	995.9875	33.9	-49.34	-20	-29.34
497.99375	CQPSK	995.9875	33.9	-46.36	-20	-26.36
497.99375	HDQPSK	995.9875	33.9	-47.41	-20	-27.41
511.99375	C4FM	1023.9875	34	-48.389	-20	-28.389
511.99375	CQPSK	1023.9875	34	-46.711	-20	-26.711
511.99375	HDQPSK	1023.9875	34	-47.182	-20	-27.182

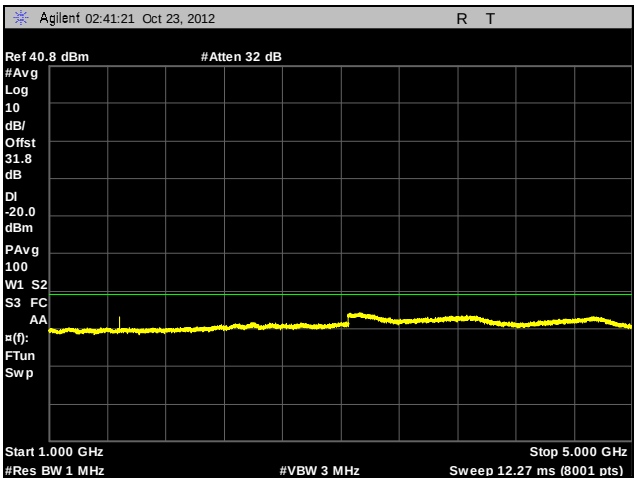
Table 12. Conducted Spurious Emissions, Test Results



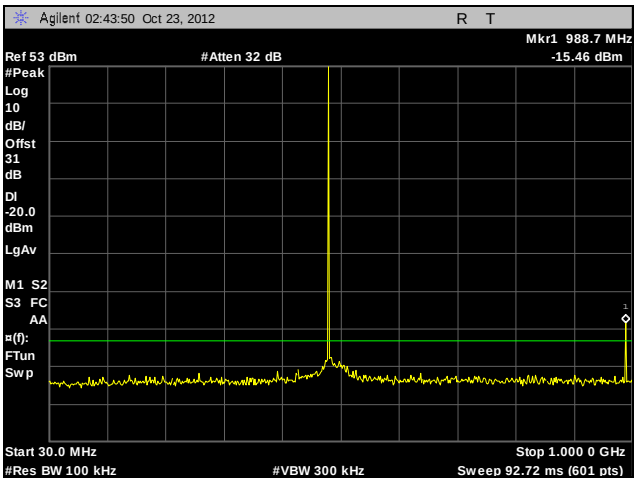
Plot 41. Conducted Spurious Emissions, 494.00625 MHz, C4FM, 30 MHz – 1 GHz



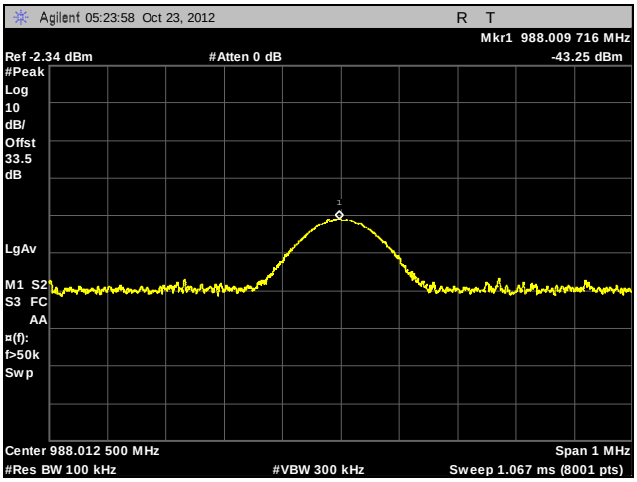
Plot 42. Conducted Spurious Emissions, 494.00625 MHz, C4FM, 2nd Harmonic



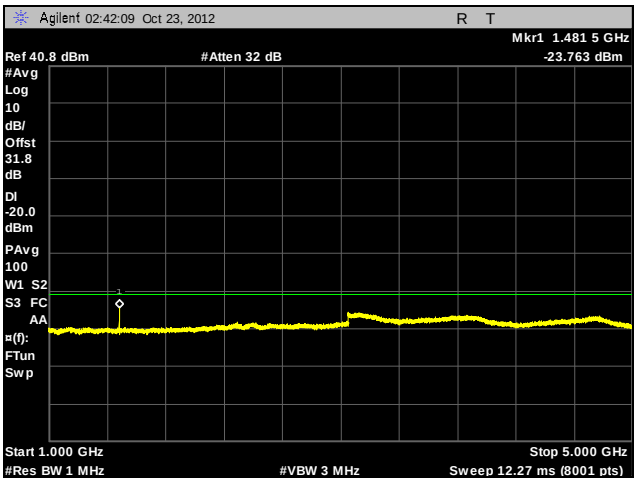
Plot 43. Conducted Spurious Emissions, 494.00625 MHz, C4FM, 1 GHz – 5 GHz



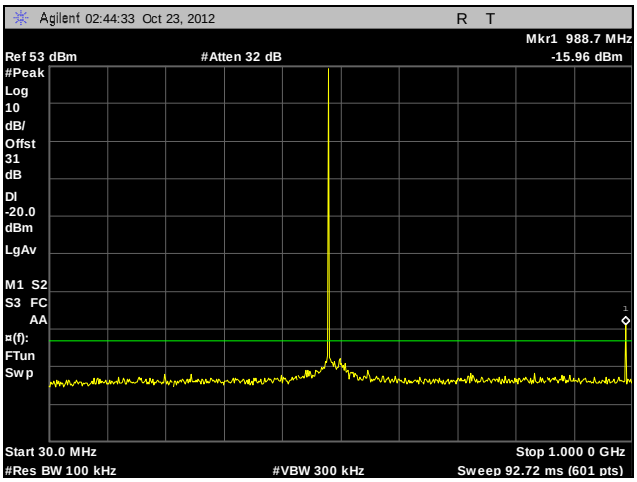
Plot 44. Conducted Spurious Emissions, 494.00625 MHz, CQPSK, 30 MHz – 1 GHz



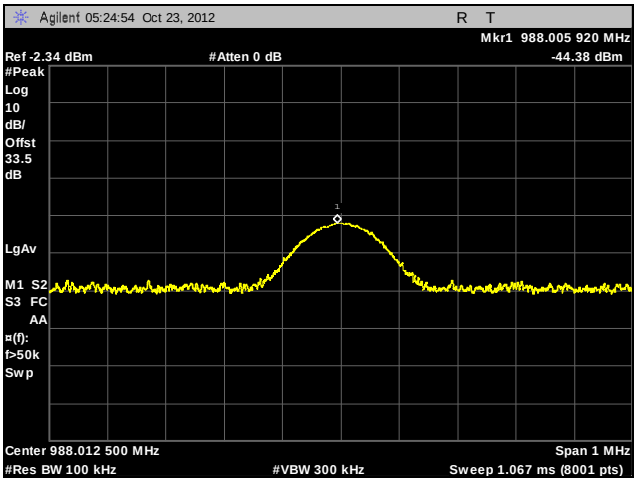
Plot 45. Conducted Spurious Emissions, 494.00625 MHz, CQPSK, 2nd Harmonic



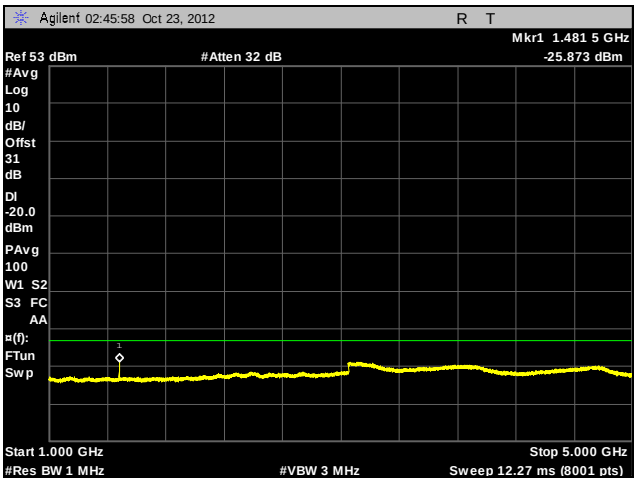
Plot 46. Conducted Spurious Emissions, 494.00625 MHz, CQPSK, 1 GHz – 5 GHz



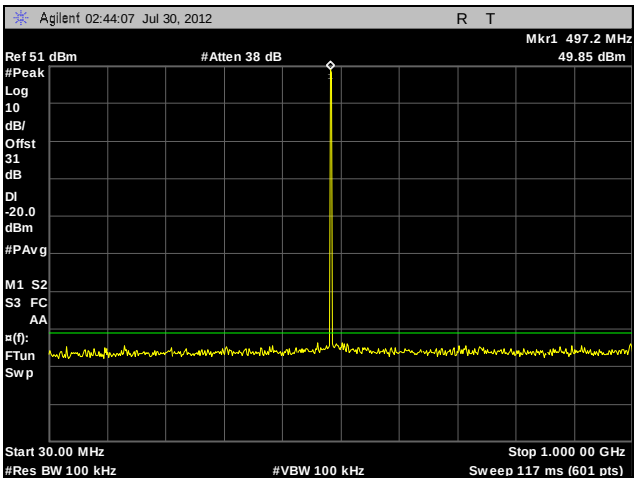
Plot 47. Conducted Spurious Emissions, 494.00625 MHz, HDQPSK, 30 MHz – 1 GHz



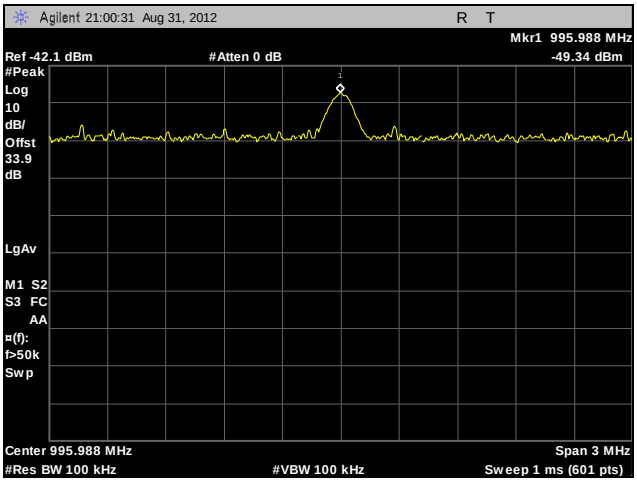
Plot 48. Conducted Spurious Emissions, 494.00625 MHz, HDQPSK, 2nd Harmonic



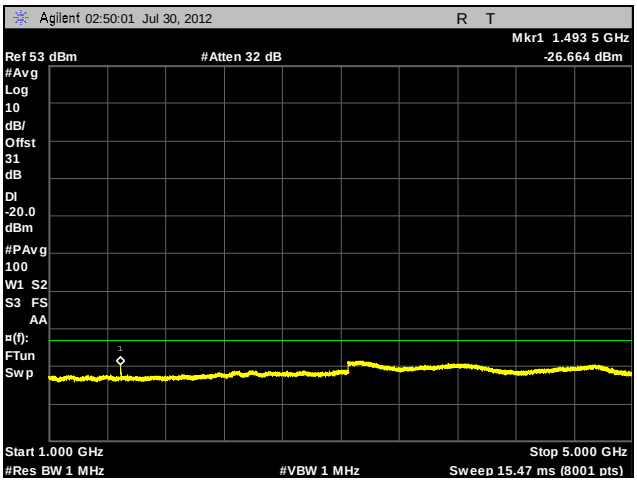
Plot 49. Conducted Spurious Emissions, 494.00625 MHz, HDQPSK, 1 GHz – 5 GHz



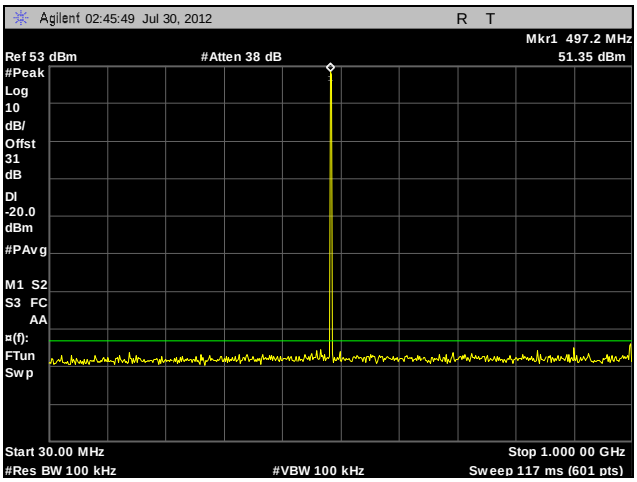
Plot 50. Conducted Spurious Emissions, 497.99375 MHz, C4FM, 30 MHz – 1 GHz



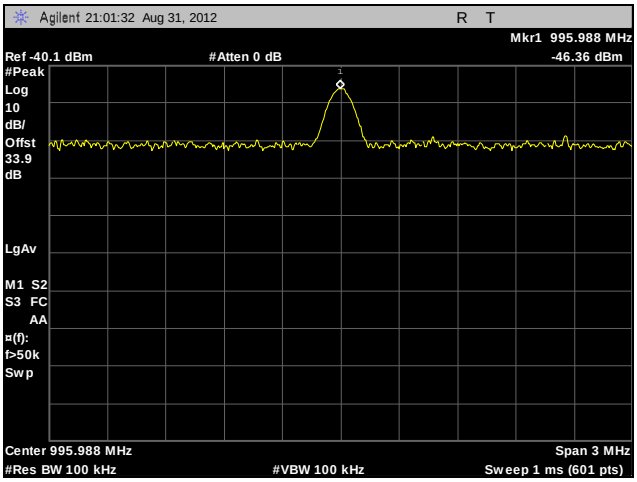
Plot 51. Conducted Spurious Emissions, 497.99375 MHz, C4FM, 2nd Harmonic



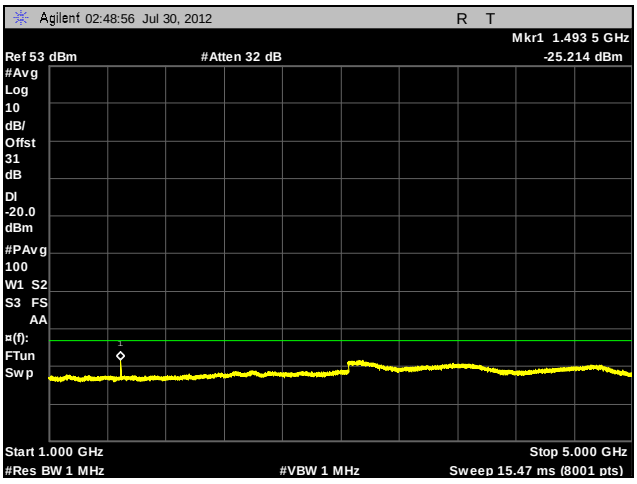
Plot 52. Conducted Spurious Emissions, 497.99375 MHz, C4FM, 1 GHz – 5 GHz



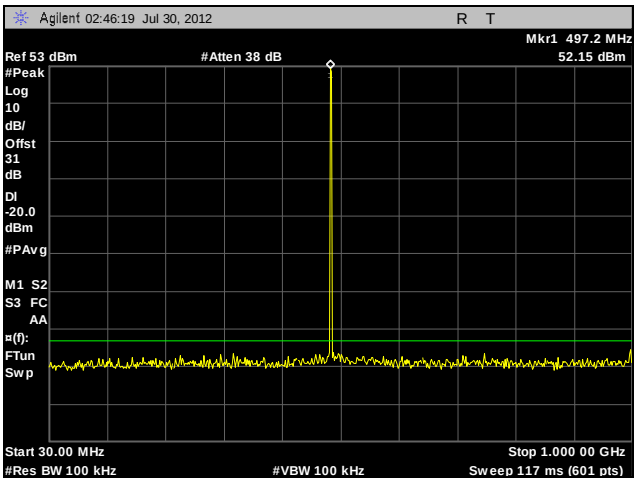
Plot 53. Conducted Spurious Emissions, 497.99375 MHz, CQPSK, 30 MHz – 1 GHz



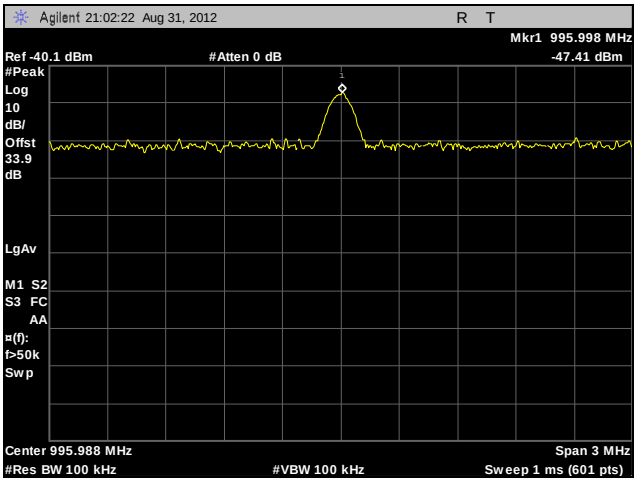
Plot 54. Conducted Spurious Emissions, 497.99375 MHz, CQPSK, 2nd Harmonic



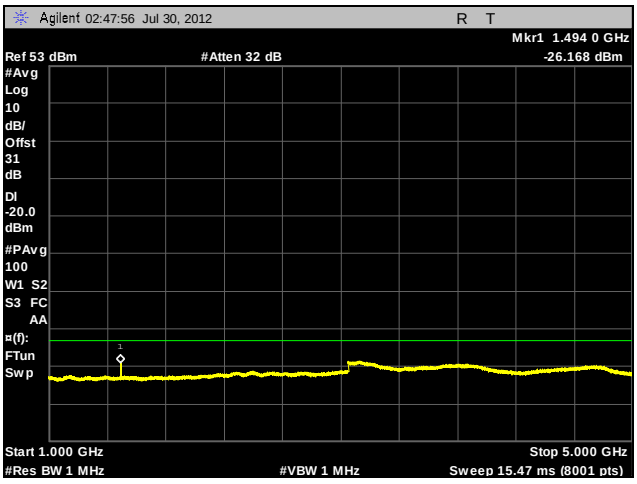
Plot 55. Conducted Spurious Emissions, 497.99375 MHz, CQPSK, 1 GHz – 5 GHz



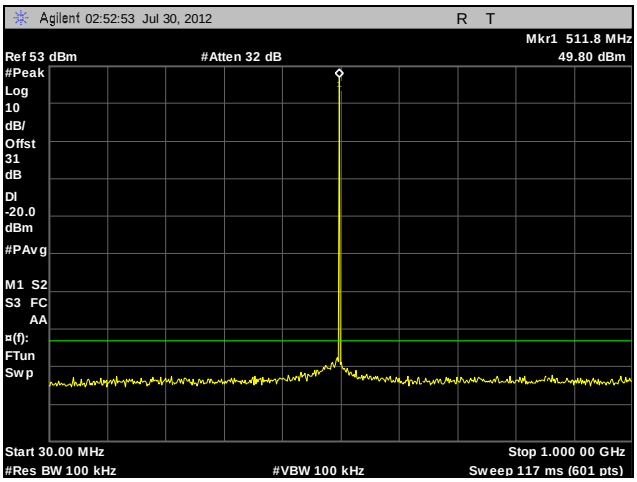
Plot 56. Conducted Spurious Emissions, 497.99375 MHz, HDQPSK, 30 MHz – 1 GHz



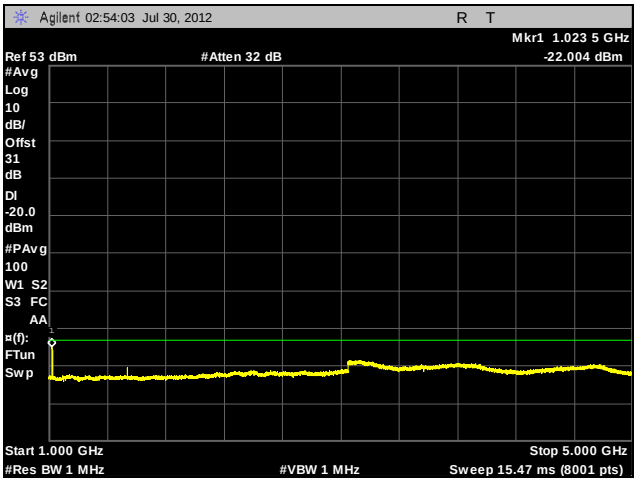
Plot 57. Conducted Spurious Emissions, 497.99375 MHz, HDQPSK, 2nd Harmonic



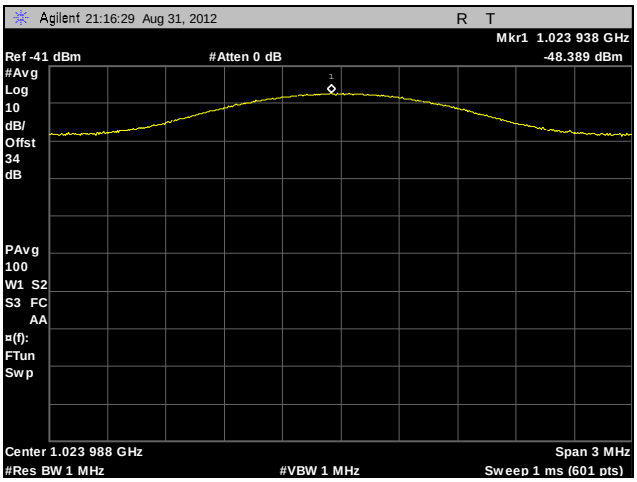
Plot 58. Conducted Spurious Emissions, 497.99375 MHz, HDQPSK, 1 GHz – 5 GHz



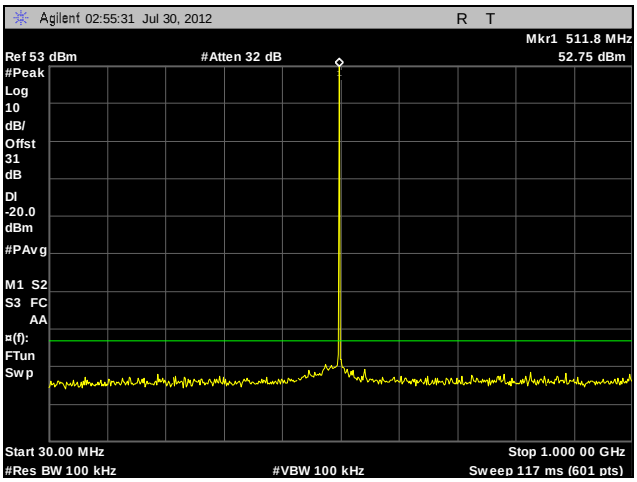
Plot 59. Conducted Spurious Emissions, 511.99375 MHz, C4FM, 30 MHz – 1 GHz



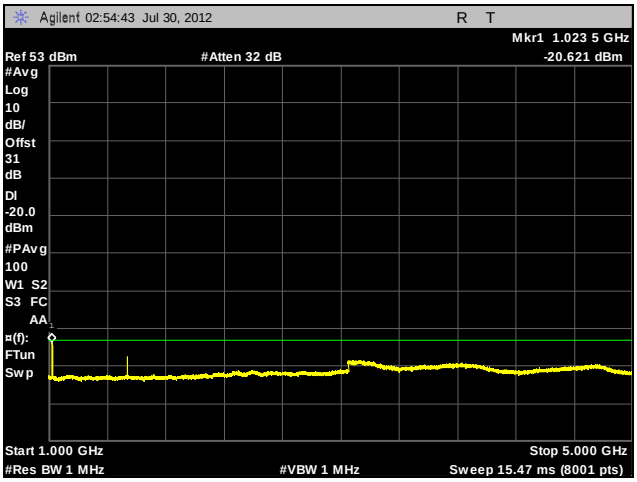
Plot 60. Conducted Spurious Emissions, 511.99375 MHz, C4FM, 1 GHz – 5 GHz



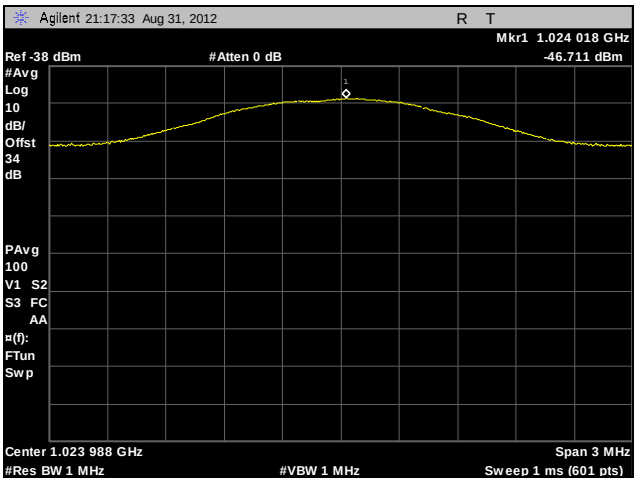
Plot 61. Conducted Spurious Emissions, 511.99375 MHz, C4FM, 2nd Harmonic



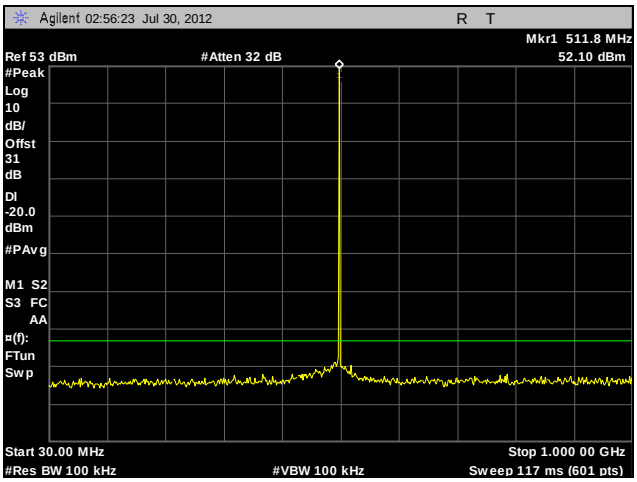
Plot 62. Conducted Spurious Emissions, 511.99375 MHz, CQPSK, 30 MHz – 1 GHz



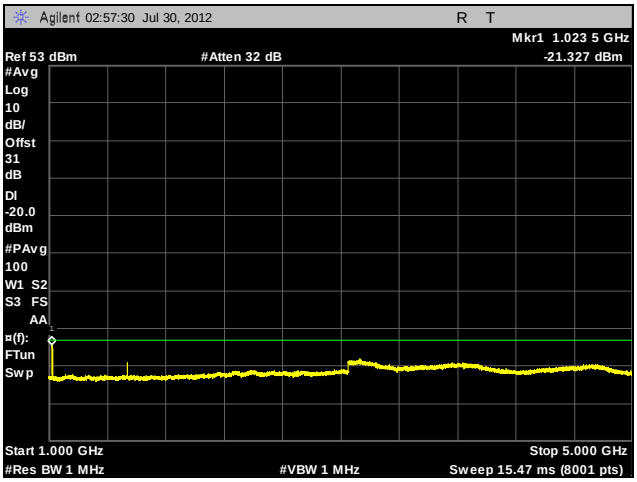
Plot 63. Conducted Spurious Emissions, 511.99375 MHz, CQPSK, 1 GHz – 5 GHz



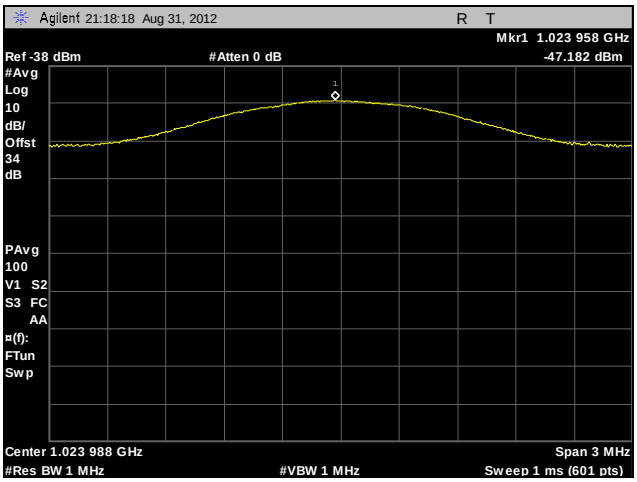
Plot 64. Conducted Spurious Emissions, 511.99375 MHz, CQPSK, 2nd Harmonic



Plot 65. Conducted Spurious Emissions, 511.99375 MHz, HDQPSK, 30 MHz – 1 GHz



Plot 66. Conducted Spurious Emissions, 511.99375 MHz, HDQPSK, 1 GHz – 5 GHz



Plot 67. Conducted Spurious Emissions, 511.99375 MHz, HDQPSK, 2nd Harmonic

4.4. Radiated Emissions

Test Requirement(s): **§2.1053 and §90.210**

Test 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".

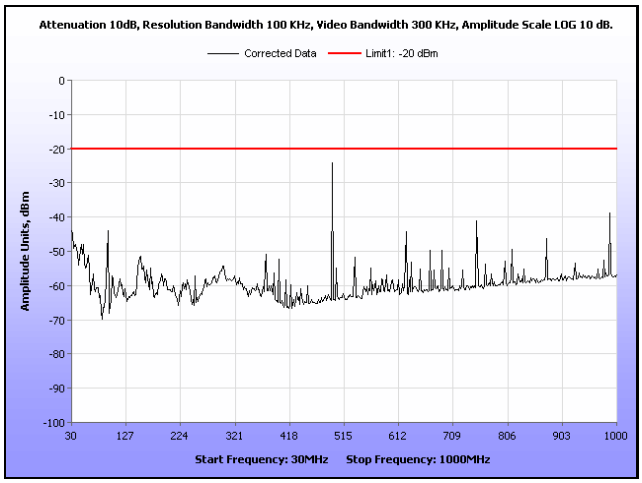
Radiated emission measurements were performed inside a 3 meter semi-anechoic chamber. The EUT was set at a distance of 3m from the receiving antenna. The EUT's RF ports were terminated to 50ohm load. The EUT was set to transmit at all four channels of the transmitter frequency range at its maximum power 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: Equipment complies with Section 2.1053 and 90.210.

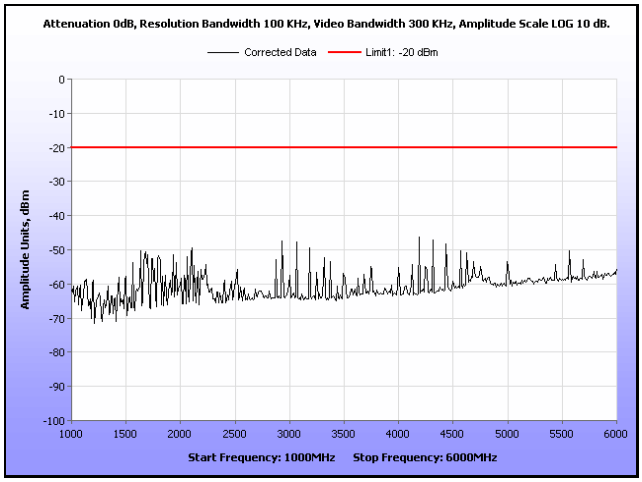
Test Engineer(s): Jeff Pratt

Test Date(s): 04/12/12

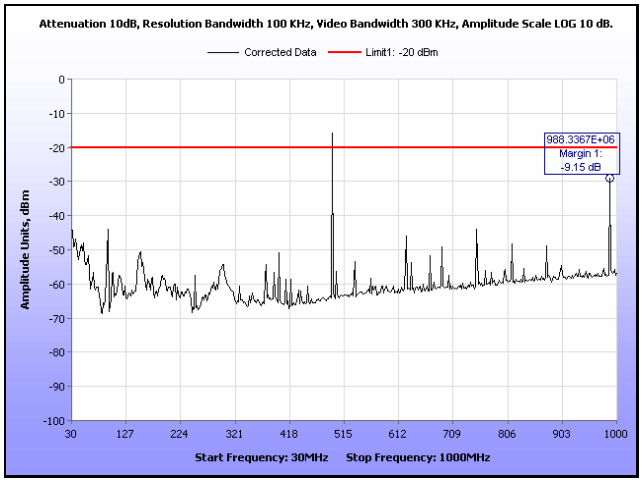
Radiated Emissions Test Results



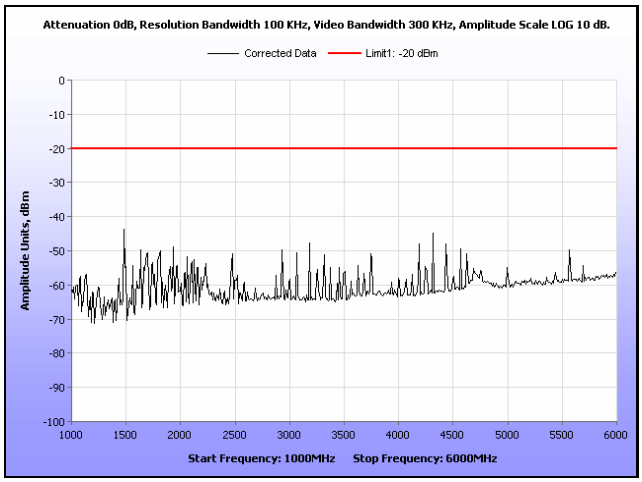
Plot 68. Radiated Spurious Emissions, 494.00625 MHz, C4FM, 30 MHz – 1 GHz, 10 W



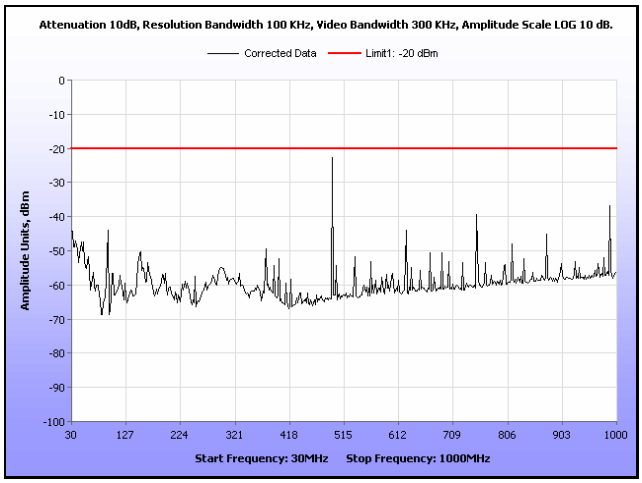
Plot 69. Radiated Spurious Emissions, 494.00625 MHz, C4FM, 1 GHz – 6 GHz, 10 W



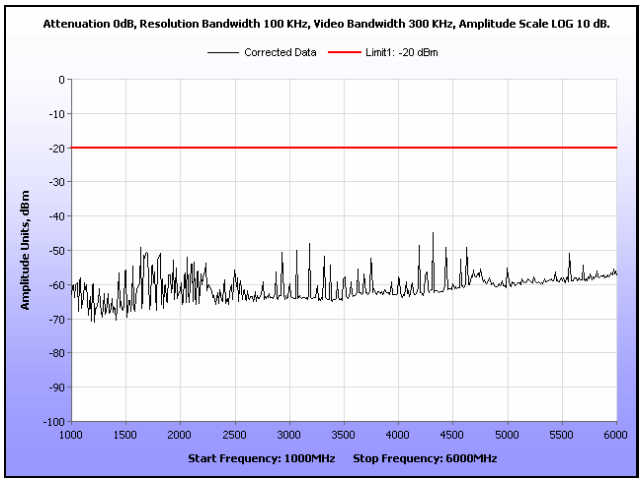
Plot 70. Radiated Spurious Emissions, 494.00625 MHz, C4FM, 30 MHz – 1 GHz, 100 W



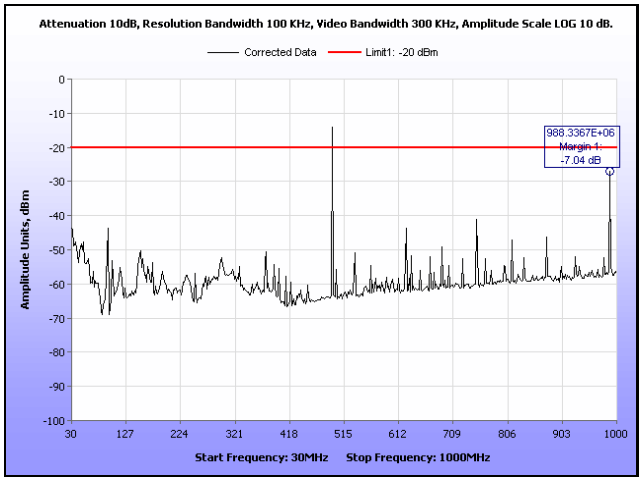
Plot 71. Radiated Spurious Emissions, 494.00625 MHz, C4FM, 1 GHz – 6 GHz, 100 W



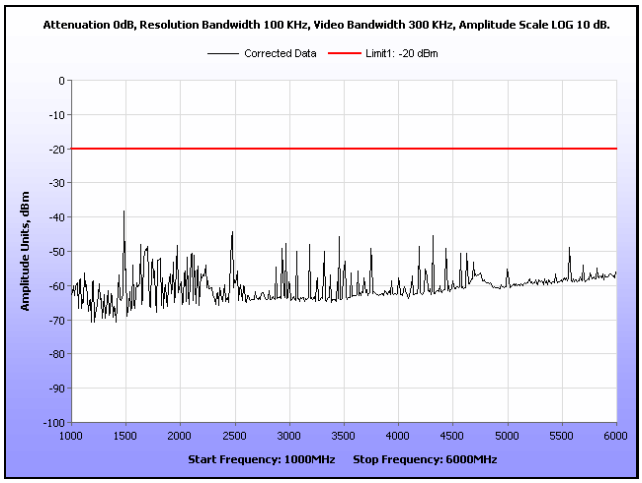
Plot 72. Radiated Spurious Emissions, 494.00625 MHz, CQPSK, 30 MHz – 1 GHz, 10 W



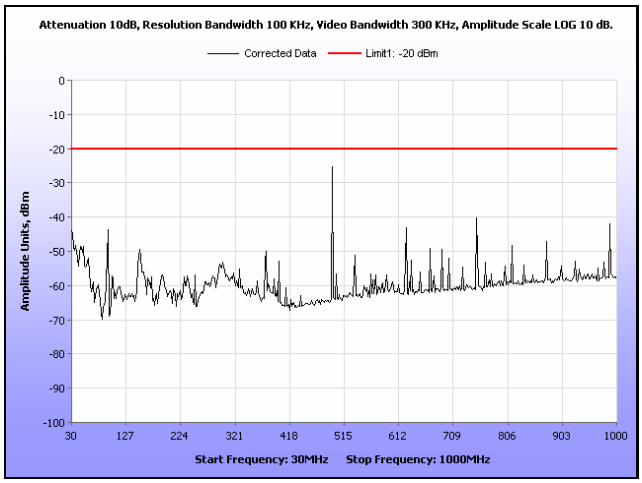
Plot 73. Radiated Spurious Emissions, 494.00625 MHz, CQPSK, 1 GHz – 6 GHz, 10 W



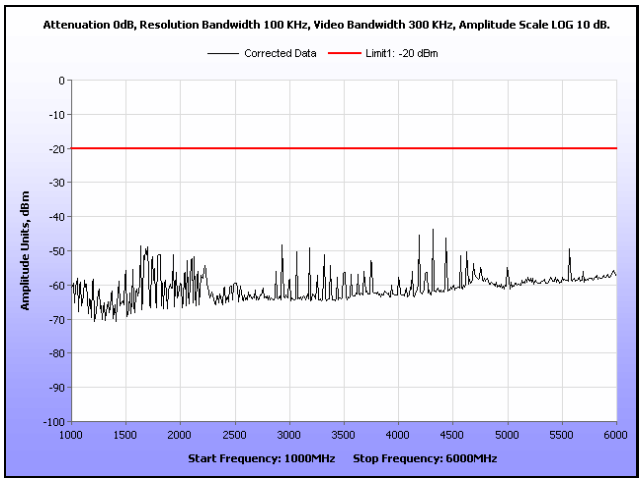
Plot 74. Radiated Spurious Emissions, 494.00625 MHz, CQPSK, 30 MHz – 1 GHz, 100 W



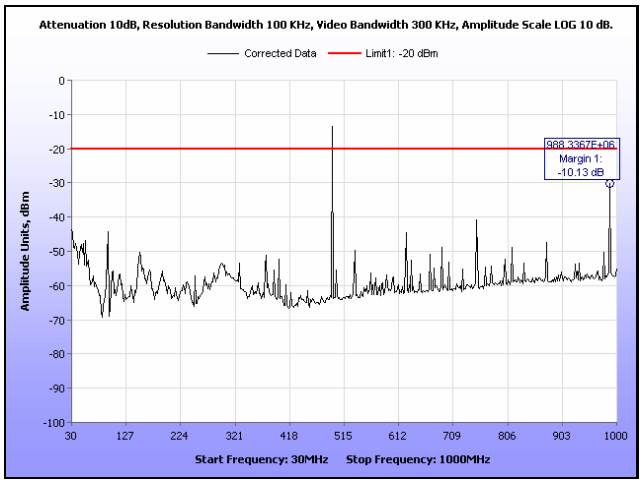
Plot 75. Radiated Spurious Emissions, 494.00625 MHz, CQPSK, 1 GHz – 6 GHz, 100 W



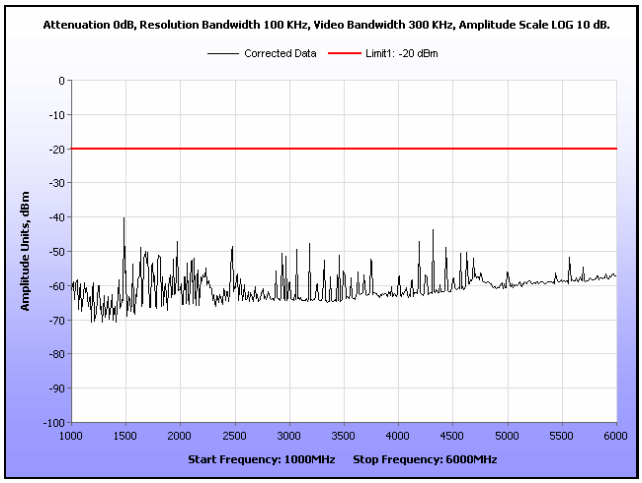
Plot 76. Radiated Spurious Emissions, 494.00625 MHz, HDQPSK, 30 MHz – 1 GHz, 10 W



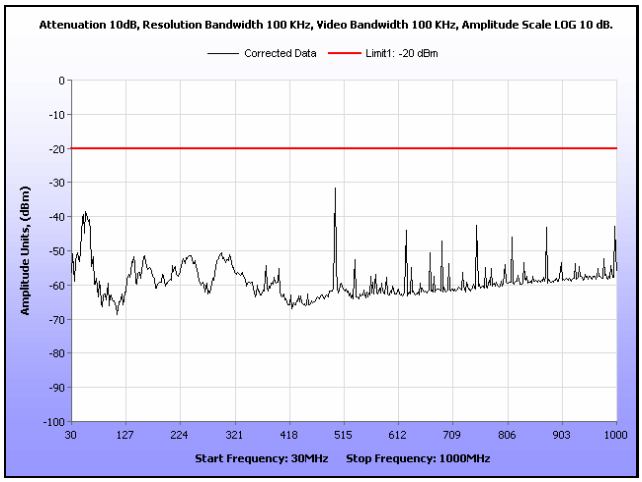
Plot 77. Radiated Spurious Emissions, 494.00625 MHz, HDQPSK, 1 GHz – 6 GHz, 10 W



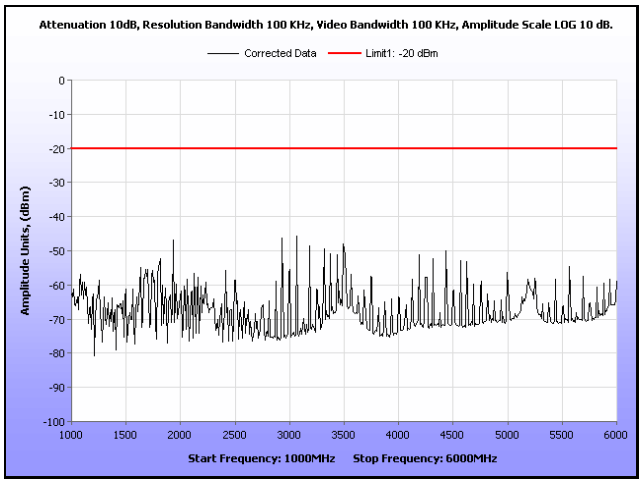
Plot 78. Radiated Spurious Emissions, 494.00625 MHz, HDQPSK, 30 MHz – 1 GHz, 100 W



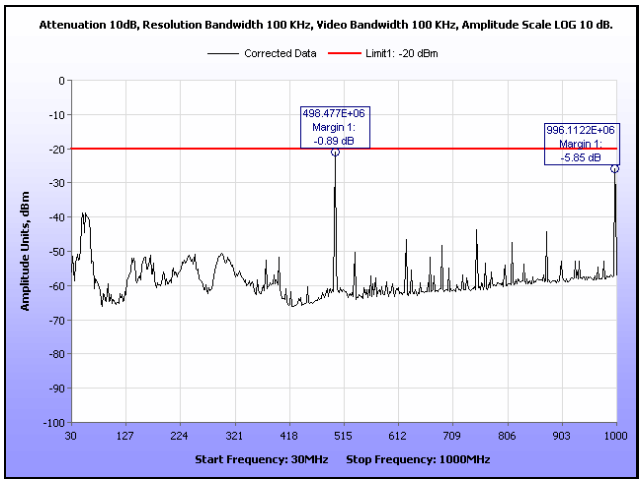
Plot 79. Radiated Spurious Emissions, 494.00625 MHz, HDQPSK, 1 GHz – 6 GHz, 100 W



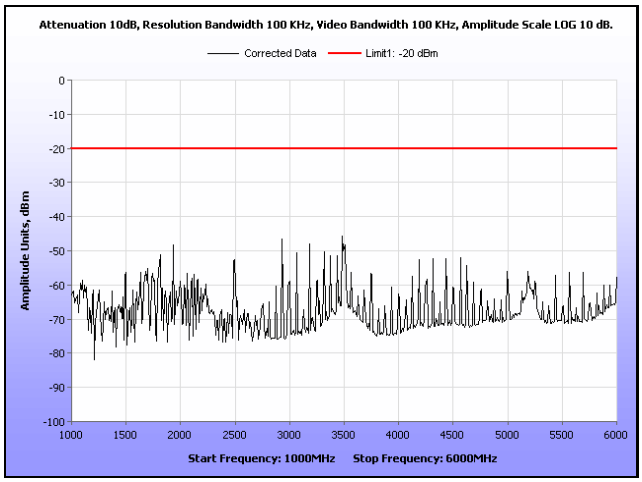
Plot 80. Radiated Spurious Emissions, Channel 3, C4FM, 30 MHz – 1 GHz, 10 W



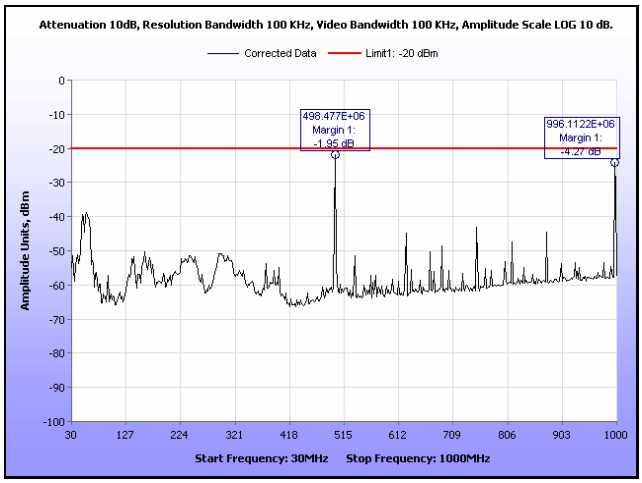
Plot 81. Radiated Spurious Emissions, Channel 3, C4FM, 1 GHz – 6 GHz, 10 W



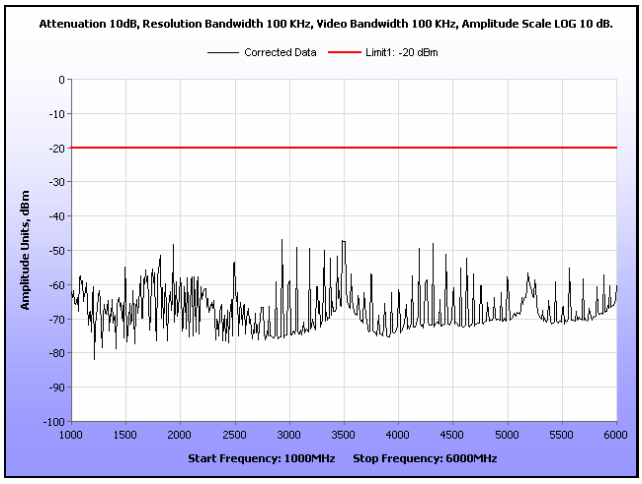
Plot 82. Radiated Spurious Emissions, Channel 3, C4FM, 30 MHz – 1 GHz, 100 W



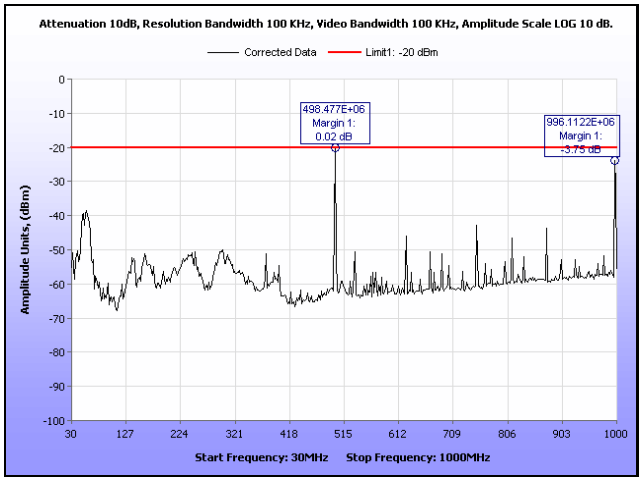
Plot 83. Radiated Spurious Emissions, Channel 3, C4FM, 1 GHz – 6 GHz, 100 W



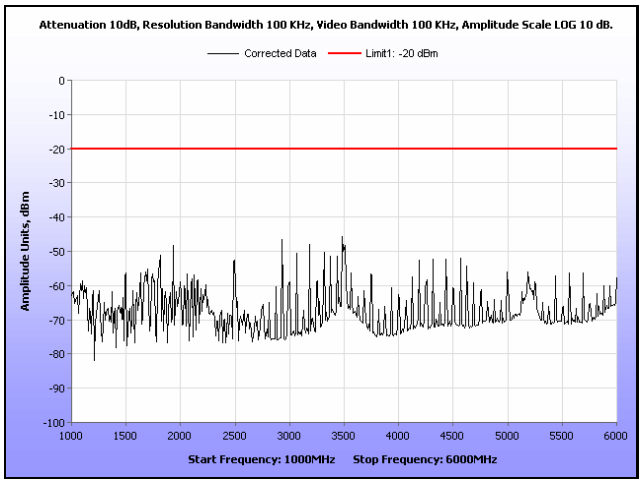
Plot 84. Radiated Spurious Emissions, Channel 3, CQPSK, 30 MHz – 1 GHz, 10 W



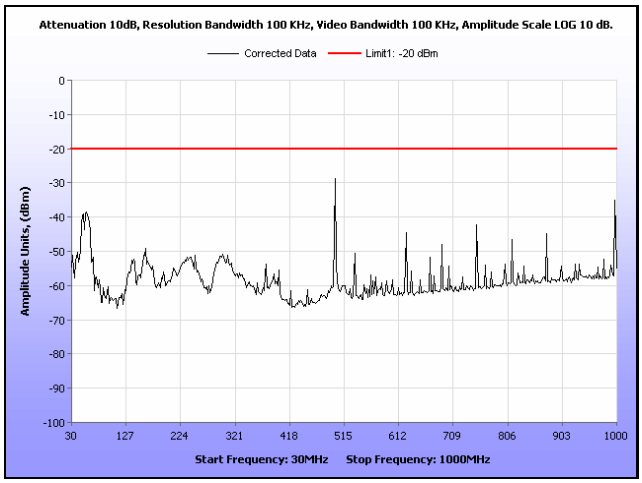
Plot 85. Radiated Spurious Emissions, Channel 3, CQPSK, 1 GHz – 6 GHz, 10 W



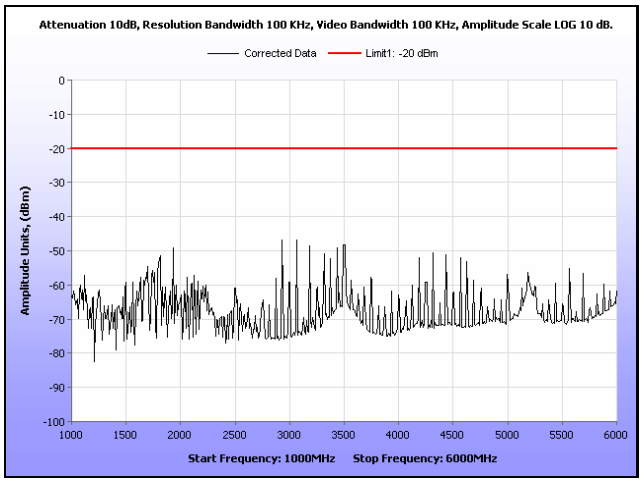
Plot 86. Radiated Spurious Emissions, Channel 3, CQPSK, 30 MHz – 1 GHz, 100 W



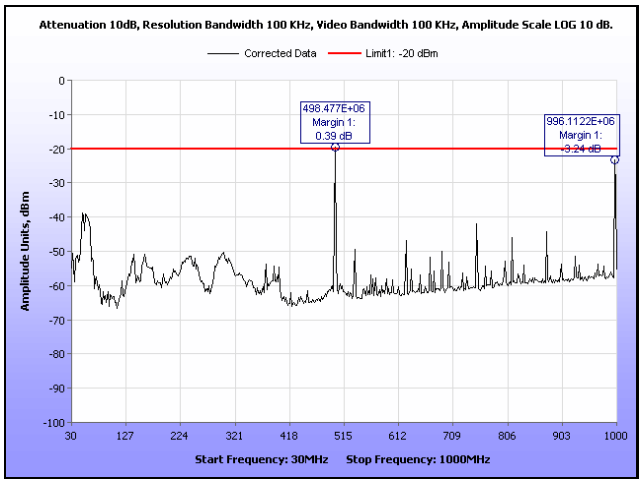
Plot 87. Radiated Spurious Emissions, Channel 3, CQPSK, 1 GHz – 6 GHz, 100 W



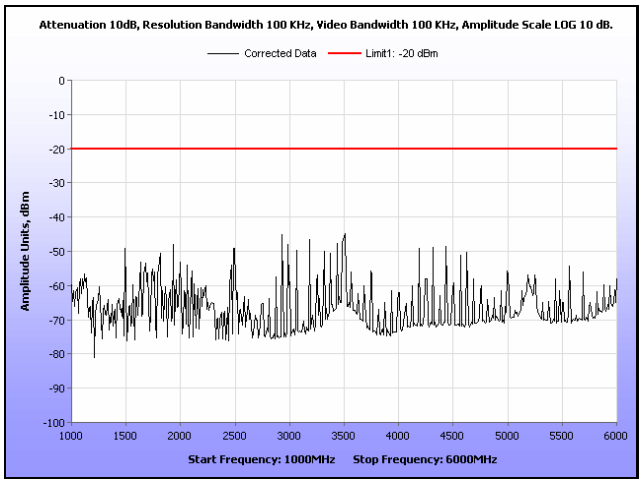
Plot 88. Radiated Spurious Emissions, Channel 3, HDQPSK, 30 MHz – 1 GHz, 10 W



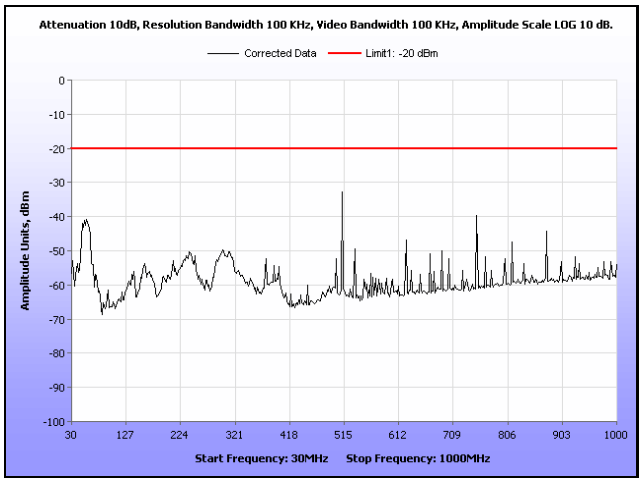
Plot 89. Radiated Spurious Emissions, Channel 3, HDQPSK, 1 GHz – 6 GHz, 10 W



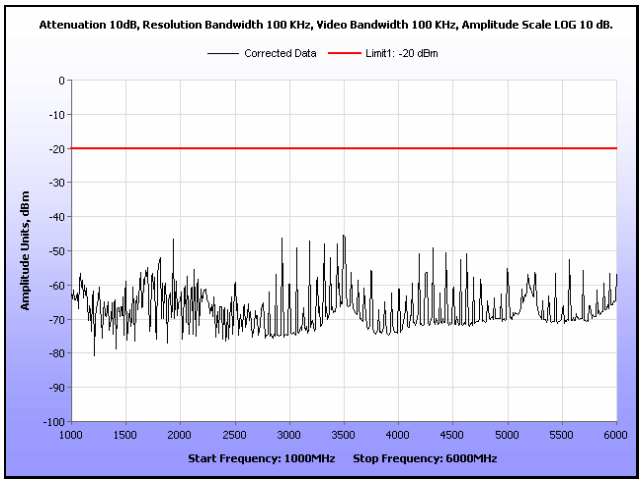
Plot 90. Radiated Spurious Emissions, Channel 3, HDQPSK, 30 MHz – 1 GHz, 100 W



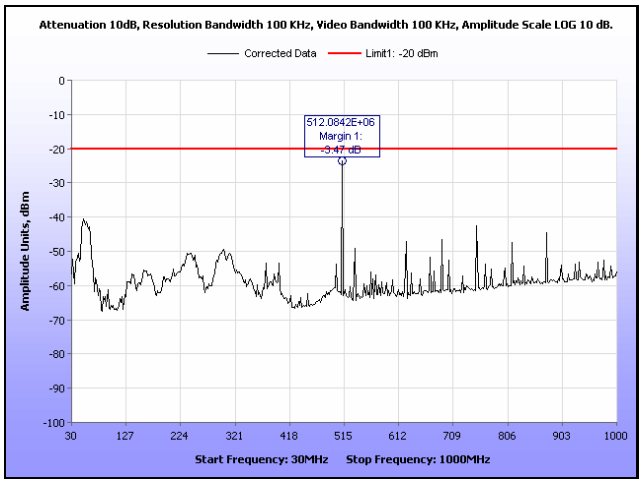
Plot 91. Radiated Spurious Emissions, Channel 3, HDQPSK, 1 GHz – 6 GHz, 100 W



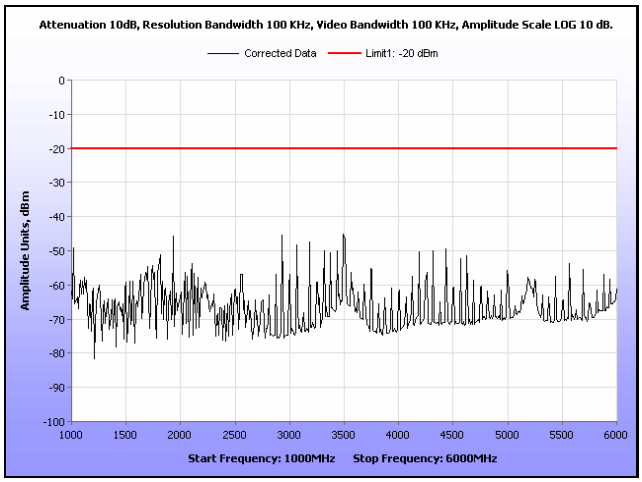
Plot 92. Radiated Spurious Emissions, Channel 4, C4FM, 30 MHz – 1 GHz, 10 W



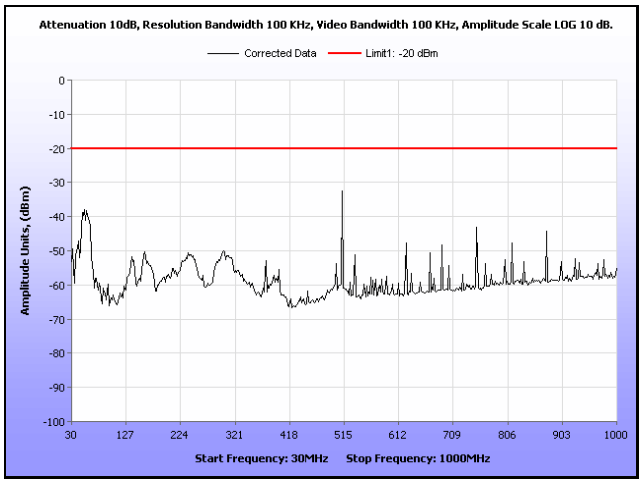
Plot 93. Radiated Spurious Emissions, Channel 4, C4FM, 1 GHz – 6 GHz, 10 W



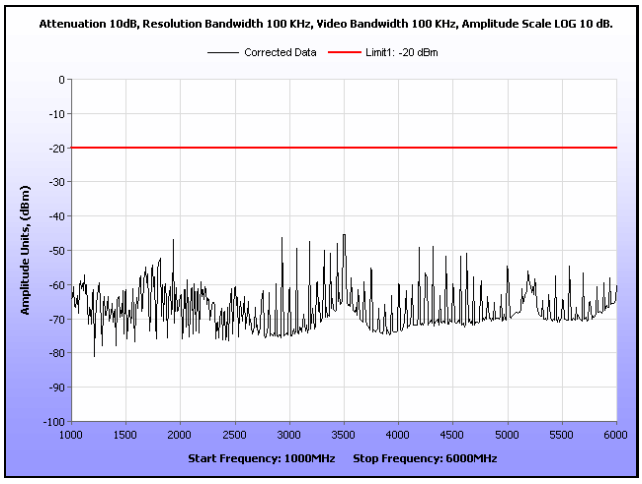
Plot 94. Radiated Spurious Emissions, Channel 4, C4FM, 30 MHz – 1 GHz, 100 W



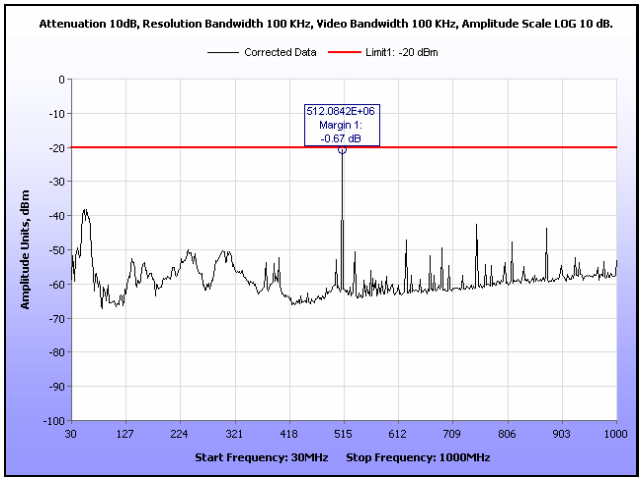
Plot 95. Radiated Spurious Emissions, Channel 4, C4FM, 1 GHz – 6 GHz, 100 W



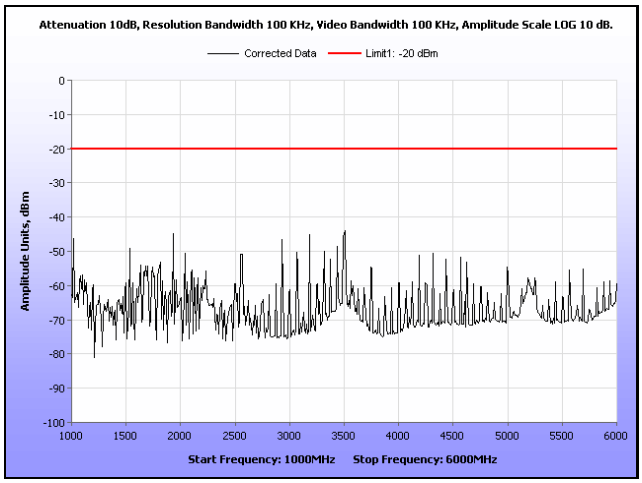
Plot 96. Radiated Spurious Emissions, Channel 4, CQPSK, 30 MHz – 1 GHz, 10 W



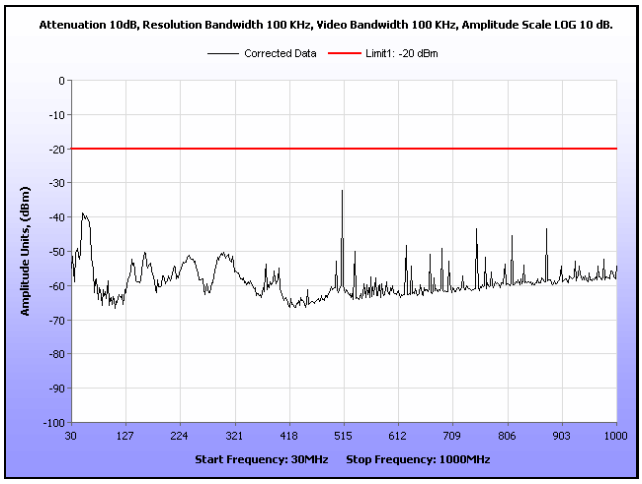
Plot 97. Radiated Spurious Emissions, Channel 4, CQPSK, 1 GHz – 6 GHz, 10 W



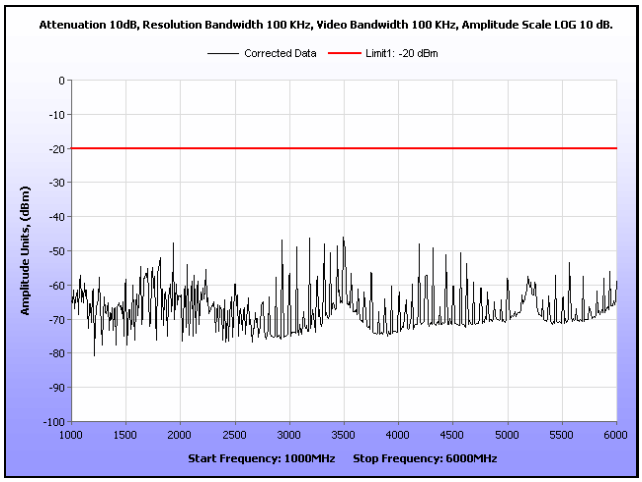
Plot 98. Radiated Spurious Emissions, Channel 4, CQPSK, 30 MHz – 1 GHz, 100 W



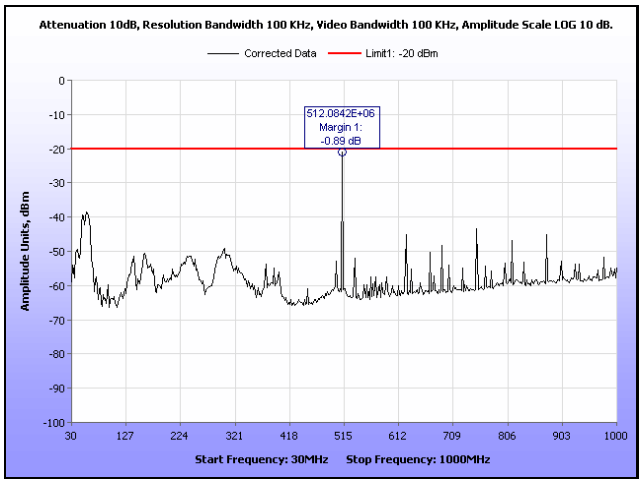
Plot 99. Radiated Spurious Emissions, Channel 4, CQPSK, 1 GHz – 6 GHz, 100 W



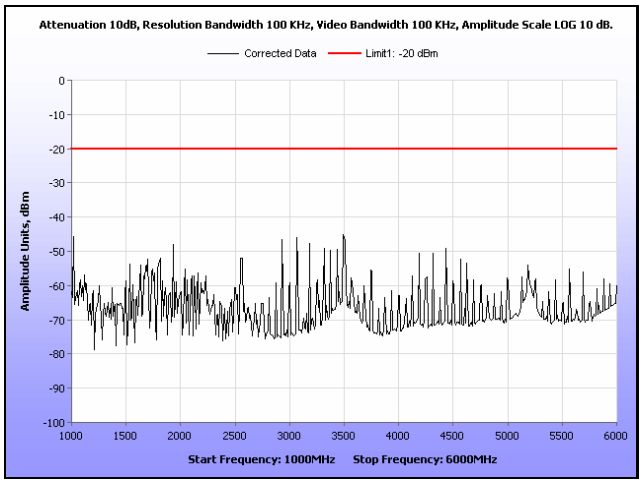
Plot 100. Radiated Spurious Emissions, Channel 4, HDQPSK, 30 MHz – 1 GHz, 10 W



Plot 101. Radiated Spurious Emissions, Channel 4, HDQPSK, 1 GHz – 6 GHz, 10 W



Plot 102. Radiated Spurious Emissions, Channel 4, HDQPSK, 30 MHz – 1 GHz, 100 W



Plot 103. Radiated Spurious Emissions, Channel 4, HDQPSK, 1 GHz – 6 GHz, 100 W

4.5. Frequency Stability

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

Test Procedures: As required by 47 CFR 2.1055, *Frequency Stability measurements* were made at the RF output terminals using an attenuator and a spectrum analyzer.

The EUT was placed in the Environmental Chamber and support equipment are outside the chamber on a table. The EUT was set to transmit a CW signal corresponding to the transmitter's low channel. 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 60°C.

Voltage supplied to EUT was 120 VAC, 60Hz. Reference temperature was 20°C. At the reference temperature, the voltage was varied by ± 15 % of nominal.

Test Results: Equipment complies with Section 2.1055 and 90.213

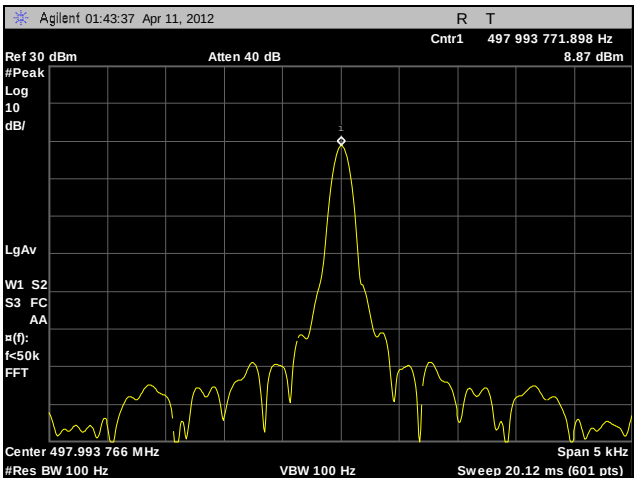
Test Engineer(s): Jeff Pratt

Test Date(s): 04/30/12

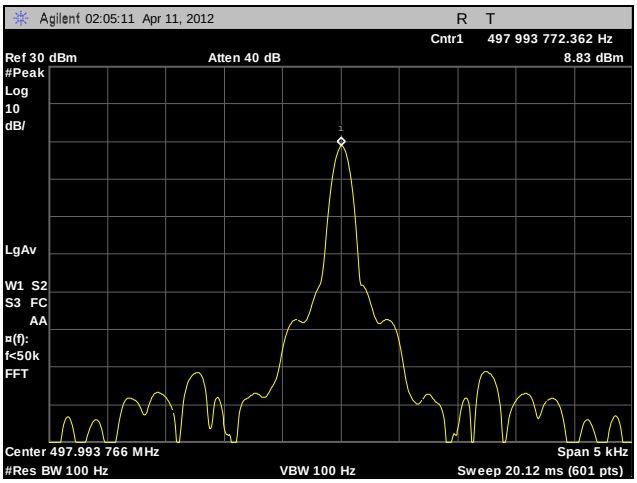
Frequency Stability Test Results

Channel 1	Temperature C)	Voltage (V)	Center Frequency (MHz)	Departure (ppm)	Limit (ppm)	Margin (ppm)
Reference @ 20C and 120V	-30	120	497.9937719	0.0190826	0.1	-0.0809174
	-20	120	497.9937724	0.0200143	0.1	-0.0799857
	-10	120	497.9937688	0.0128897	0.1	-0.0871103
	0	120	497.9937754	0.0260907	0.1	-0.0739093
	10	120	497.9937722	0.0197091	0.1	-0.0802909
	20	108		1000000	0.1	999999.9
497.9937624	20	120	497.9937624	1.004E-05	0.1	-0.09999
	20	132		1000000	0.1	999999.9
	30	120	497.9937666	0.0083475	0.1	-0.0916525
	40	120	497.993762	0.0007068	0.1	-0.0992932
	50	120	497.9937557	0.013462	0.1	-0.086538

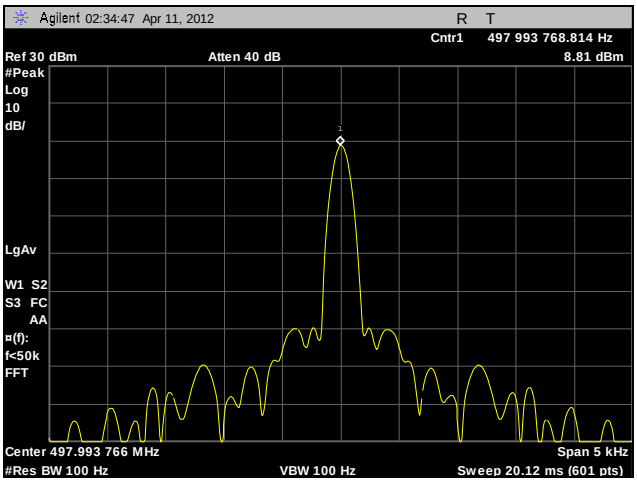
Table 13. Frequency Stability, Test Results



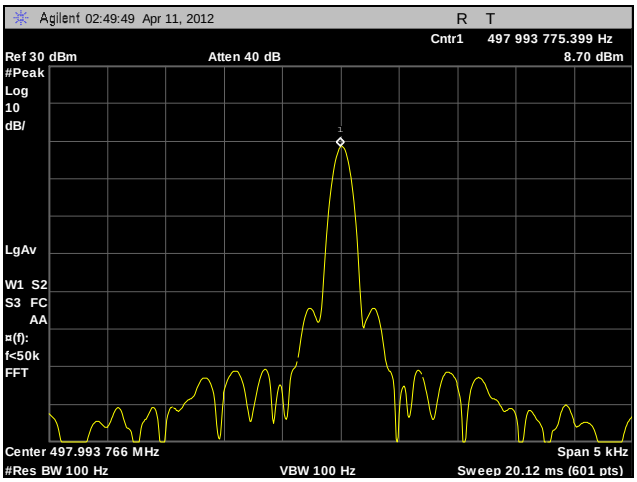
Plot 104. Frequency Stability, Channel 3, -30°C, 120 V



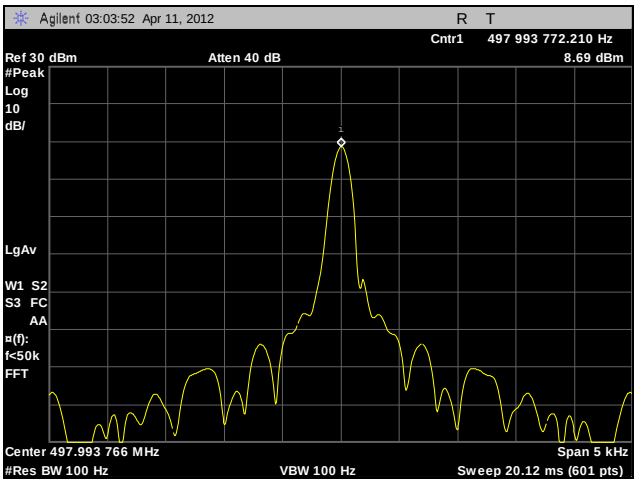
Plot 105. Frequency Stability, Channel 3, -20°C, 120 V



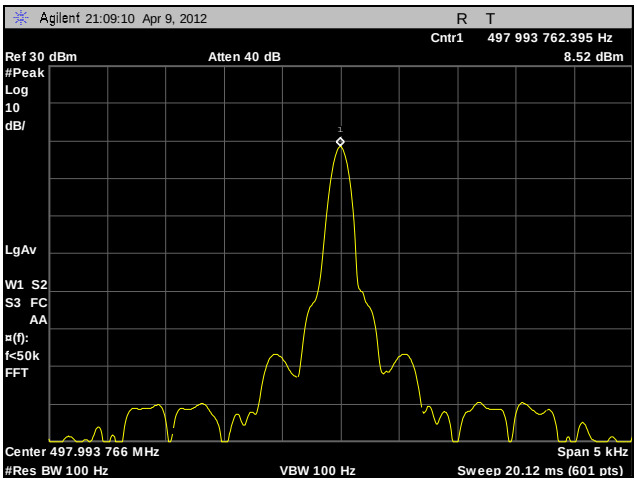
Plot 106. Frequency Stability, Channel 3, -10°C, 120 V



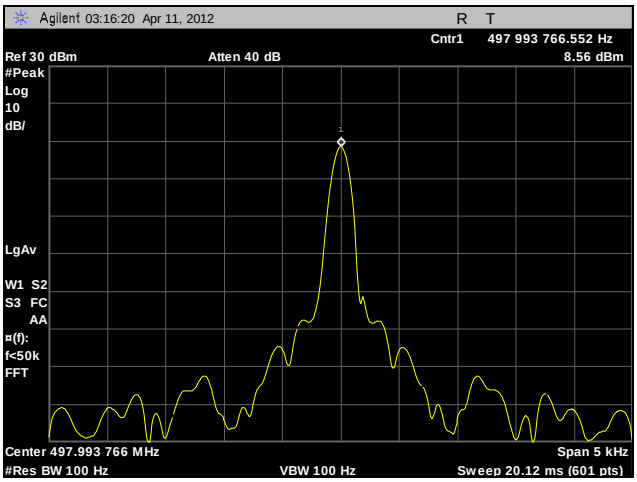
Plot 107. Frequency Stability, Channel 3, 0°C, 120 V



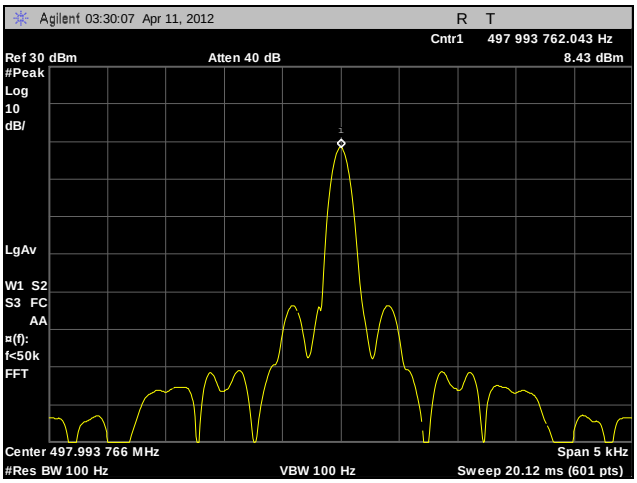
Plot 108. Frequency Stability, Channel 3, 10°C, 120 V



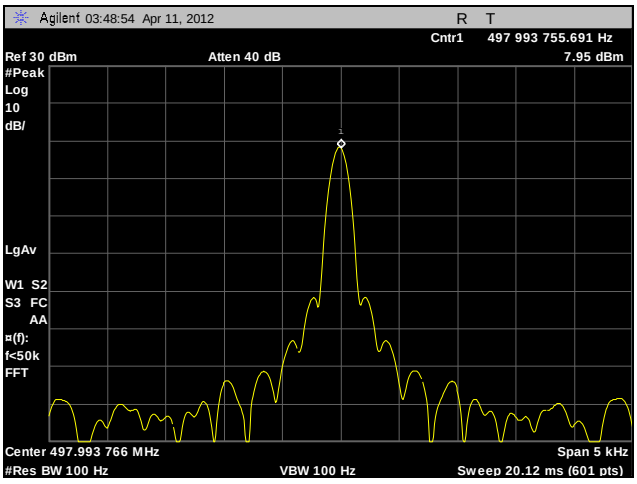
Plot 109. Frequency Stability, Channel 3, 20°C, 120 V



Plot 110. Frequency Stability, Channel 3, 30°C, 120 V



Plot 111. Frequency Stability, Channel 3, 40°C, 120 V



Plot 112. Frequency Stability, Channel 3, 50°C, 120 V

Photograph 4. Frequency Stability, Test Setup

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
1T4300	SEMI-ANECHOIC CHAMBER # 1	EMC TEST SYSTEMS	NONE	08/23/2010	08/23/2013
1T4503	SHIELDED ROOM	UNIVERSAL SHIELDING CORP	N/A	SEE NOTE	
2T5566	TEMPERATURE/HUMIDITY CHAMBER	THERMOTRON	SM-32C	12/12/2011	12/12/2012
1T4771	SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4446A	12/12/2011	12/12/2012
1T4502	COMB GENERATOR	COM-POWER	CGC-255	11/3/2011	11/3/2012
1T4751	ANTENNA – BILOG	SUNOL SCIENCES	JB6	12/7/2011	12/7/2012
1T4576	ANTENNA, ACTIVE HORN	COM-POWER	AHA-118	2/2/2012	2/2/2013
1T4568	RADIATING NOISE SOURCE	MET LABORATORIES	N/A	SEE NOTE	
1T4728	PROGRAMMABLE AC POWER SOURCE	QUADTECH	31010	SEE NOTE	
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	07/14/2011	07/14/2012
N/A	100W NON-RADIATING TEST LOAD	BIRD ELECTRONIC CORP	4240-062	SEE NOTE	
N/A	150W NON-RADIATING TEST LOAD	BIRD ELECTRONIC CORP	150-T-FN	SEE NOTE	
N/A	250W 30DB RF ATTENUATOR	WEINSCHEL CORP	45-30-33	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

