MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
914 W. PATAPSCO AVENUE ● BALTIMORE, MARYLAND 21230 ● PHONE (410) 354-3300 ● FAX (410) 354-3313

August 24, 2011

DMT, LLC
45180 Business Court, Suite 500
Sterling, VA 20166

Dear James Byrne,

Enclosed is the EMC Wireless test report for compliance testing of the DMT, LLC, AIMS Fast Scan Radar System, tested to the requirements of Title 47 of the Code of Federal Regulations (CFR), Part 15 Subpart B for a Class A Digital Device, Part 80, and Part 90.

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: (\DMT, LLC\EMC28832-FCC80_90 Rev. 1)

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Electromagnetic Compatibility Criteria Test Report

For the

DMT, LLC
Model AIMS Fast Scan Radar System

Tested under

The FCC Verification Rules
Contained in Title 47 of the CFR, Part 15, Subpart B,
Part 80, and Part 90

MET Report: EMC28832-FCC80_90 Rev. 1

August 24, 2011

Prepared For:
DMT, LLC
45180 Business Court, Suite 500
Sterling, VA 20166

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

Electromagnetic Compatibility Criteria
Test Report

For the

DMT, LLC
Model AIMS Fast Scan Radar System

Tested under

The FCC Verification Rules
Contained in Title 47 of the CFR, Part 90
Contained in Title 47 of the CFR, Part 15, Subpart B,
Part 80, and Part 90

MET Report: EMC28832-FCC80_90 Rev. 1

Dusmantha Tennakoon
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 15, Subpart B, Part 80, and Part 90 of the FCC Rules under normal use and maintenance.

Shawn McMillen, Wireless Manager
Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	July 6, 2011	Initial Issue.
1	August 24, 2011	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

List of Figures

List of Photographs

List of Plots

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
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**ert**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**ert**z**
kPa	**k**ilo**pa**scal
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µ**H**	**microh**enry
µ	**microf**arad
µ**s**	**micros**econds
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

1. 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 from ANSI TIA/EIA-603-A-2004 and ANSI C63.4-2003 as appropriate.

Title 47 of the CFR, Part 15B, 80, and 90	Results
47 CFR Part 15.107 (a) Conducted Emission Limits for a Class A Digital Device	Compliant
47 CFR Part 15.109 (a) Radiated Emission Limits for a Class A Digital Device	Compliant.
Pulse Width and PRF	Compliant
2.1046/80.215/90.205 RF Power Output	Compliant
2.1051/80.211(f)/90.210 Conducted Spurious Emissions	Compliant
80.211(f)/90.210(b) Emission Mask	Compliant
2.1053/90.210 Field Strength of Spurious Emissions	Compliant
2.1055/90.213 Frequency Stability	Compliant
2.1049 Occupied Bandwidth	Compliant
2.1091 RF Exposure	Compliant

2. Equipment Configuration

2. Equipment Configuration

2.1 Overview

MET Laboratories, Inc. was contracted by DMT, LLC to perform testing on the AIMS Fast Scan Radar System under quote number 1DMT2502R1.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the DMT, LLC., AIMS Fast Scan Radar System.

An EMC evaluation to determine compliance of the MASV-700M1 with the requirements of Part 80 and 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 MASV-700M1. DMT, LLC. 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.

Product Name:	AIMS Fast Scan Radar System	
Model(s) Tested:	AIMS Fast Scan Radar System	
EUT Specifications:	Primary Power Source: 115 – 230 VAC	
	FCC ID: YR6-AIMSFS-05X	
	Type of Modulations:	GATED CW RADAR
	Equipment Code:	MRD
	EUT Frequency Ranges:	9.25 GHz
Analysis:	The results obtained relate only to the item(s) tested.	
Evaluated by:	Dusmantha Tennakoon	
Report Date(s):	August 24, 2011	

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 DMT, LLC AIMS Fast Scan Radar System, is a pulsed Doppler radar-based area intrusion monitoring system (AIMS)

2.4 Equipment Configuration

The EUT was set up as outlined in Figure 1, Block Diagram of Test Setup. All cards, racks, etc., incorporated as part of the EUT are included in the following section.

Ref. ID	Name / Description	Model Number	Serial Number
001	RADAR ASSEMBLY	AIMSFS-05X-0707V-E01	08118
002	UNIVERSAL COMM MODULE (UCM)	UCM	08114

Table 1. Equipment Configuration

2.5 Support Equipment

DMT, LLC supplied support equipment necessary for the operation and testing of the AIMS Fast Scan Radar System. All support equipment supplied is listed in the following Support Equipment List.

Ref. ID	Name / Description	Manufacturer	Model Number
003	LAPTOP	DELL	ATGD630
	TRIPOD	QUICKSET	GIBRALTAR

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
001	UMBILICAL CONN.	UMBILICAL CABLE	1	3	Y	-
001	CAMERA CONN.	- NO CAMERA -	-	-	-	-
002	AC POWER IN	AC POWER CABLE	1	2.5	N	-
002	UMBILICAL	(SEE ITEM #1, ABOVE)	-	-	-	-
002	CCTV	- NO CAMERA -	-	-	-	-
002	ETHERNET #1	CAT5E CABLE	1	1	N	-
002	ETHERNET #2	- SPARE -	-	-	-	-

Table 3. Ports and Cabling Information

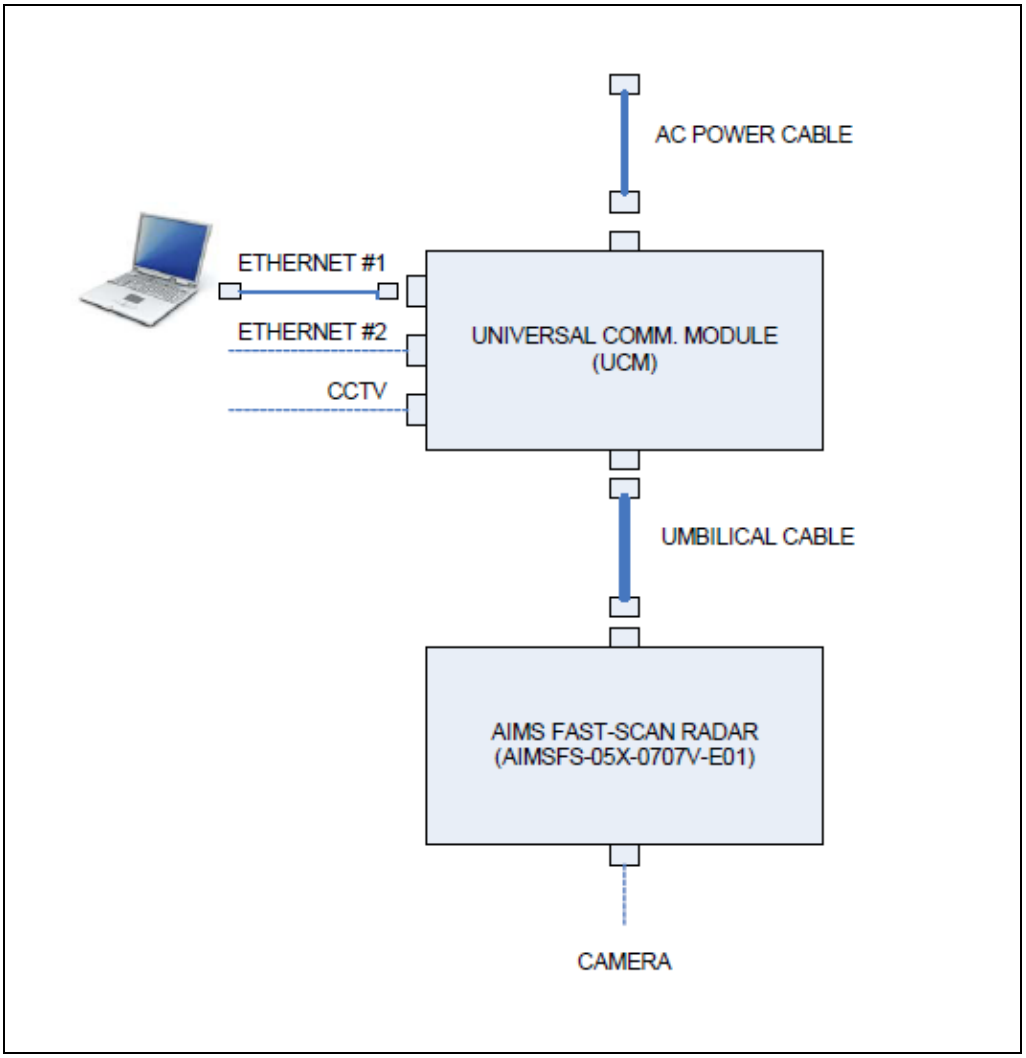


Figure 1. Block Diagram of Test Configuration

2.7 Mode of Operation

Pulse width and repetition frequency are menu selectable through Ethernet connection.

PW: 80NS – 1050NS (80, 96, 152, 200, 280, 350, 400, 519, 780, 1050)
PRF: 4KHZ – 16KHZ (4, 8, 16)

2.8 Modifications

2.8.1 Modifications to EUT

In order to pass radiated emissions two ferrites needed to be placed on the following cables:

1. A ferrite (FAIR-RITE 0446167251) on EL Home detect relay output and EL Home sensor cables.
2. A ferrite (FAIR-RITE 0431176451) on AZ motor power & serial I/O comms, AZ home detect relay output and AZ home sensor cables.

2.8.2 Modifications to Test Standard

No modifications were made to the test standard.

2.9 Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to DMT, LLC upon completion of testing.

3. Electromagnetic Compatibility Criteria for Unintentional Radiators

3. Electromagnetic Compatibility Criteria for Unintentional Radiators

3.1. Conducted Emissions Limits

Test Requirement(s): **15.107 (a)** "Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 4. 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 4. 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)	15.107(b), Class A Limits (dBμV)		15.107(a), Class B Limits (dBμV)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.15- 0.5	79	66	66 - 56	56 - 46
0.5 – 5.0	73	60	56	46
5.0 - 30	73	60	60	50
Note — The lower limit shall apply at the transition frequencies.				

Table 4. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Section 15.107(a) (b)

Test Procedures: The EUT was placed on a 0.8m-high wooden table inside a shielded chamber. The method of testing, test conditions, and test procedures of ANSI C63.4 were used. The EUT was powered through a 50Ω/50μH LISN. An EMI receiver, connected to the measurement port of the LISN, scanned the frequency range from 150 kHz to 30 MHz in order to find the peak conducted emissions. Multiple scans were performed with various loading. Peak emissions were compared to a quasi-peak and average limit line.

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

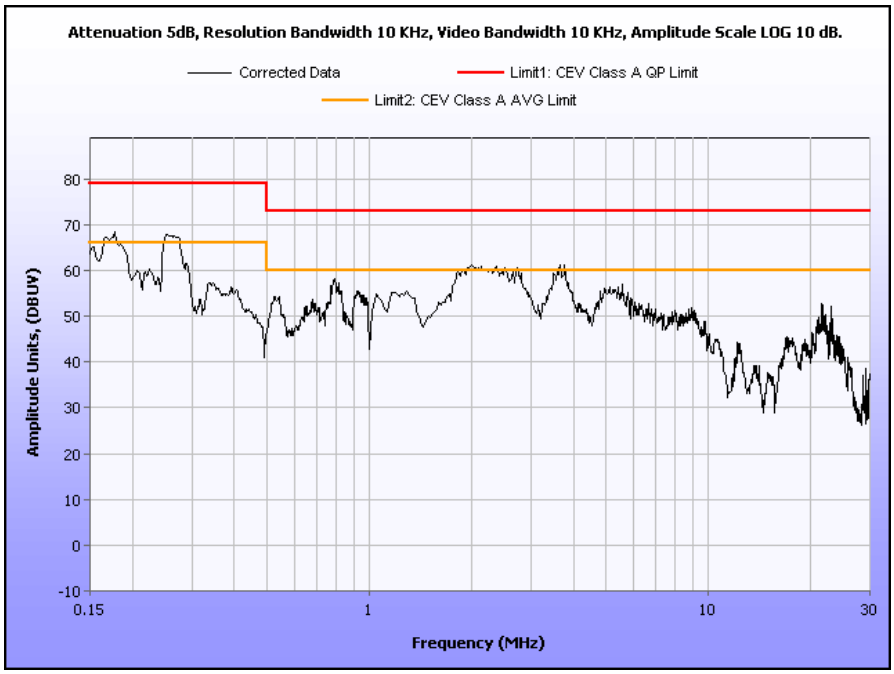
Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 03/19/10

Conducted Emissions - Voltage, AC Power

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
0.2611	59.98	0.10387	60.08387	79	-18.9161	49.01	0.10387	49.11387	66	-16.8861
0.2608	59.57	0.10336	59.67336	79	-19.3266	48.85	0.10336	48.95336	66	-17.0466
0.81	47.27	0.17	47.44	73	-25.56	34.29	0.17	34.46	60	-25.54
2.643	49.86	0.17	50.03	73	-22.97	37.63	0.17	37.8	60	-22.2
10.05	33.16	0.1708	33.3308	73	-39.6692	25.55	0.1708	25.7208	60	-34.2792
21.68	41.36	0.27456	41.63456	73	-31.3654	35.94	0.27456	36.21456	60	-23.7854

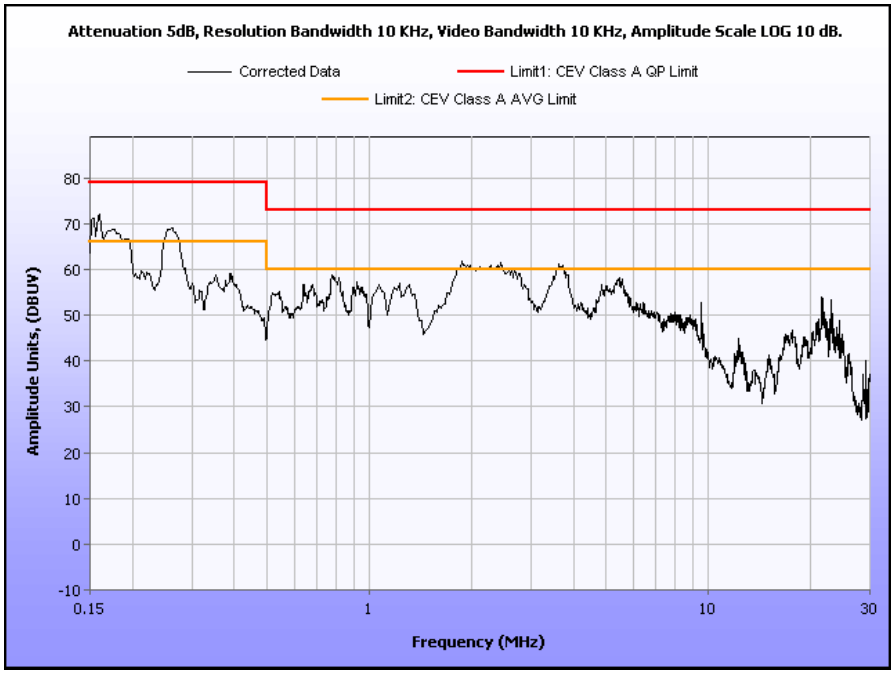
Table 5. Conducted Emissions, Phase Line, Test Results



Plot 1. Conducted Emissions, Phase Line

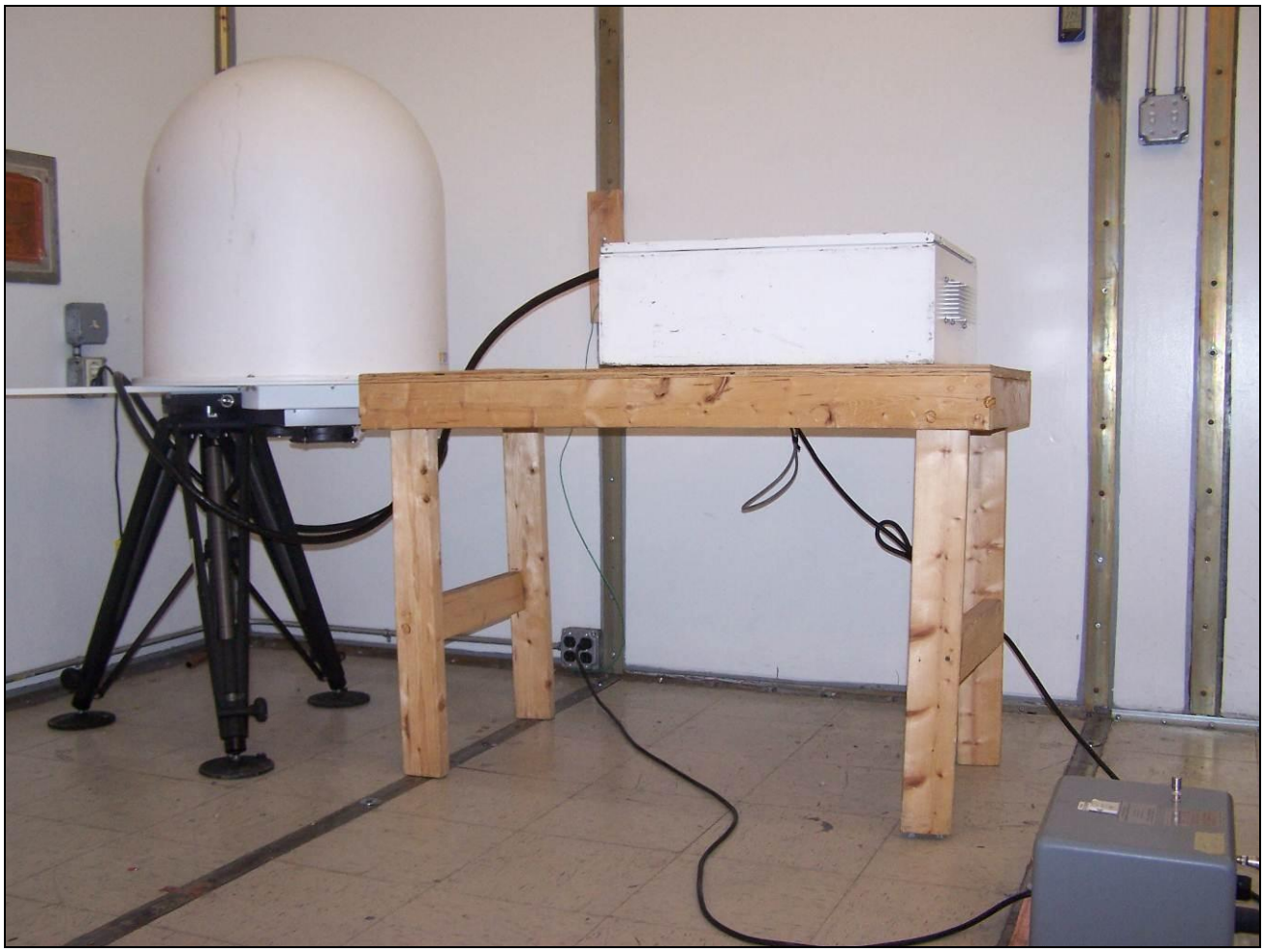
Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.1776	63.41	0	63.41	79	-15.59	56.58	0	56.58	66	-9.42
0.26	61.46	0.102	61.562	79	-17.438	53.75	0.102	53.852	66	-12.148
0.77	48.43	0.17	48.6	73	-24.4	41.49	0.17	41.66	60	-18.34
3.632	52.77	0.17	52.94	73	-20.06	41.73	0.17	41.9	60	-18.1
17.48	36.41	0.28968	36.69968	73	-36.3003	27.05	0.28968	27.33968	60	-32.6603
23.13	49.8	0.22671	50.02671	73	-22.9733	47.57	0.22671	47.79671	60	-12.2033

Table 6. Conducted Emissions, Neutral Line, Test Results



Plot 2. Conducted Emissions, Neutral Line

Conducted Emission Limits Test Setup



Photograph 1. Conducted Emissions, Test Setup

3.2. Radiated Emissions Limits

Test Requirement(s): **15.109 (a)** Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the Class A limits expressed in Table 7.

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 7.

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

Test Procedures: The EUT was placed on a 0.8m-high non-conductive table 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. Plot 4 shows the emissions between 1-5 GHz and has been corrected for cable loss, antenna correction factor and distance.

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 06/16/11

Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
99.963	0	H	1.00	41.71	10.39	0.23	10.46	41.87	43.50	-1.63
99.963	0	V	1.00	37.36	10.39	0.23	10.46	37.52	43.50	-5.98
33.18	360	H	1.50	10.72	19.36	0.23	10.46	19.85	39.00	-19.15
33.318	0	V	1.00	26.21	19.25	0.23	10.46	35.23	39.00	-3.77
308	280	H	1.00	12.42	14.26	0.83	10.46	17.05	46.40	-29.35
308.29	0	V	2.00	15.40	14.27	0.83	10.46	20.04	46.40	-26.36

Table 8. Radiated Emissions Limits, Test Results

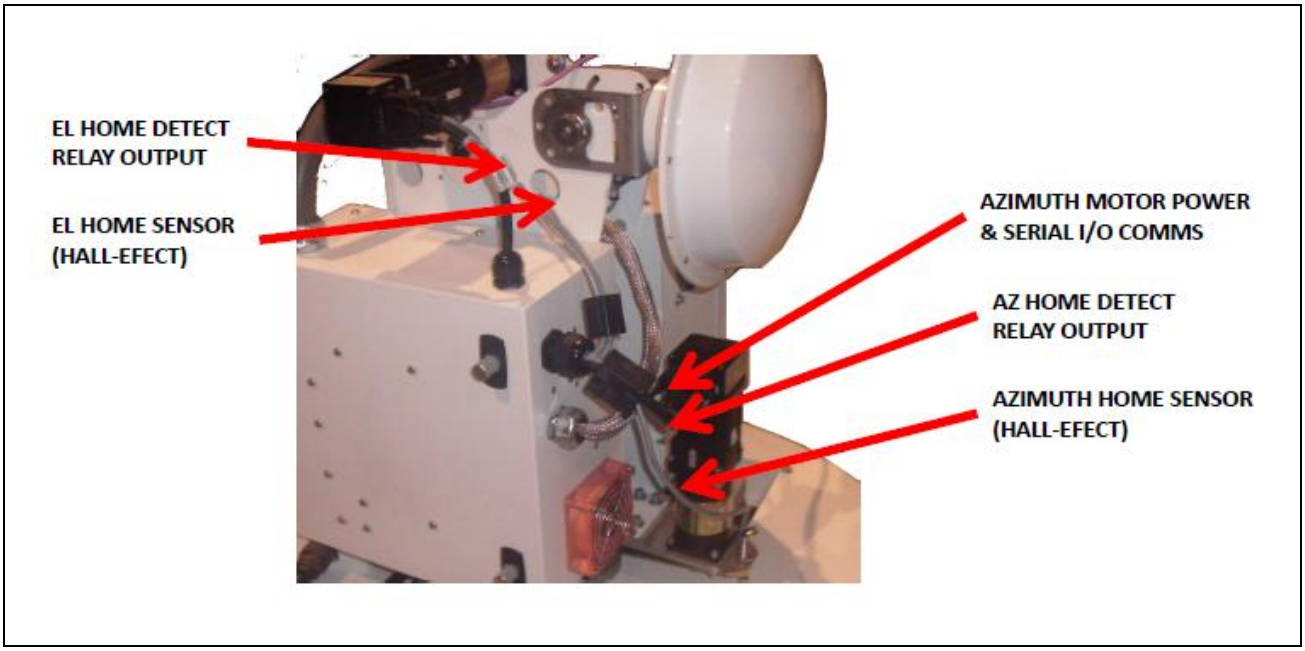
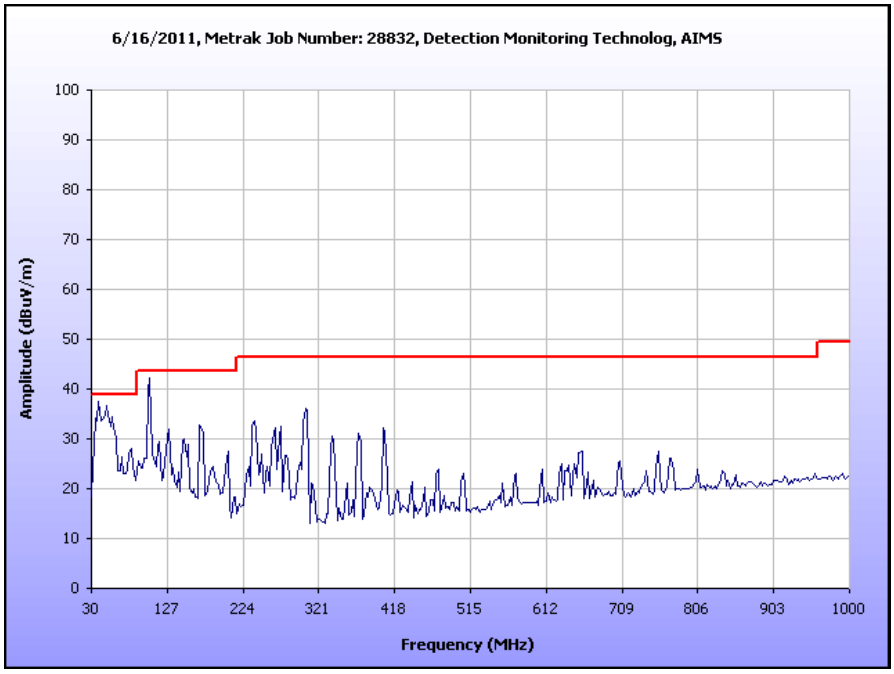
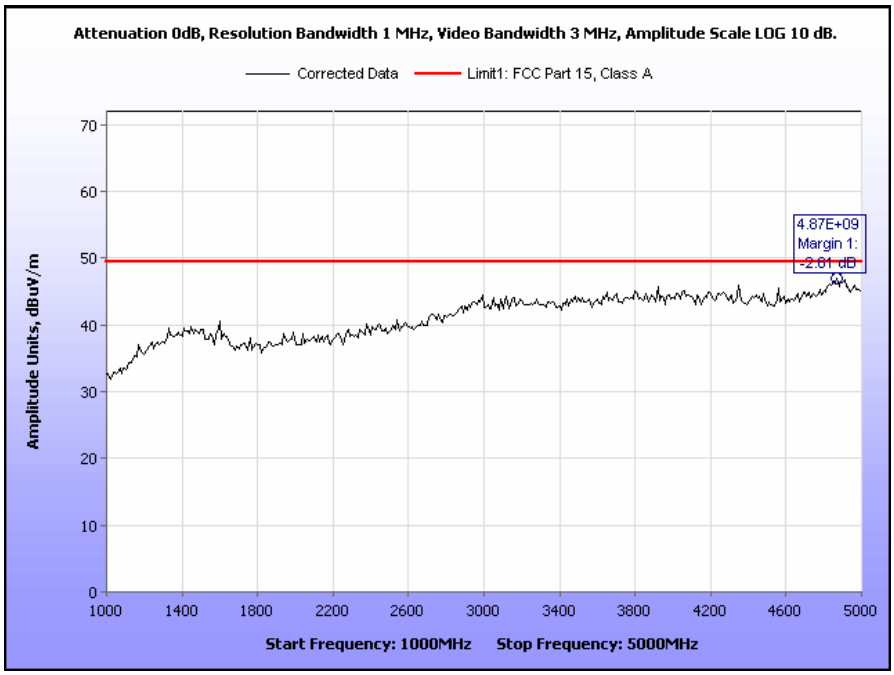


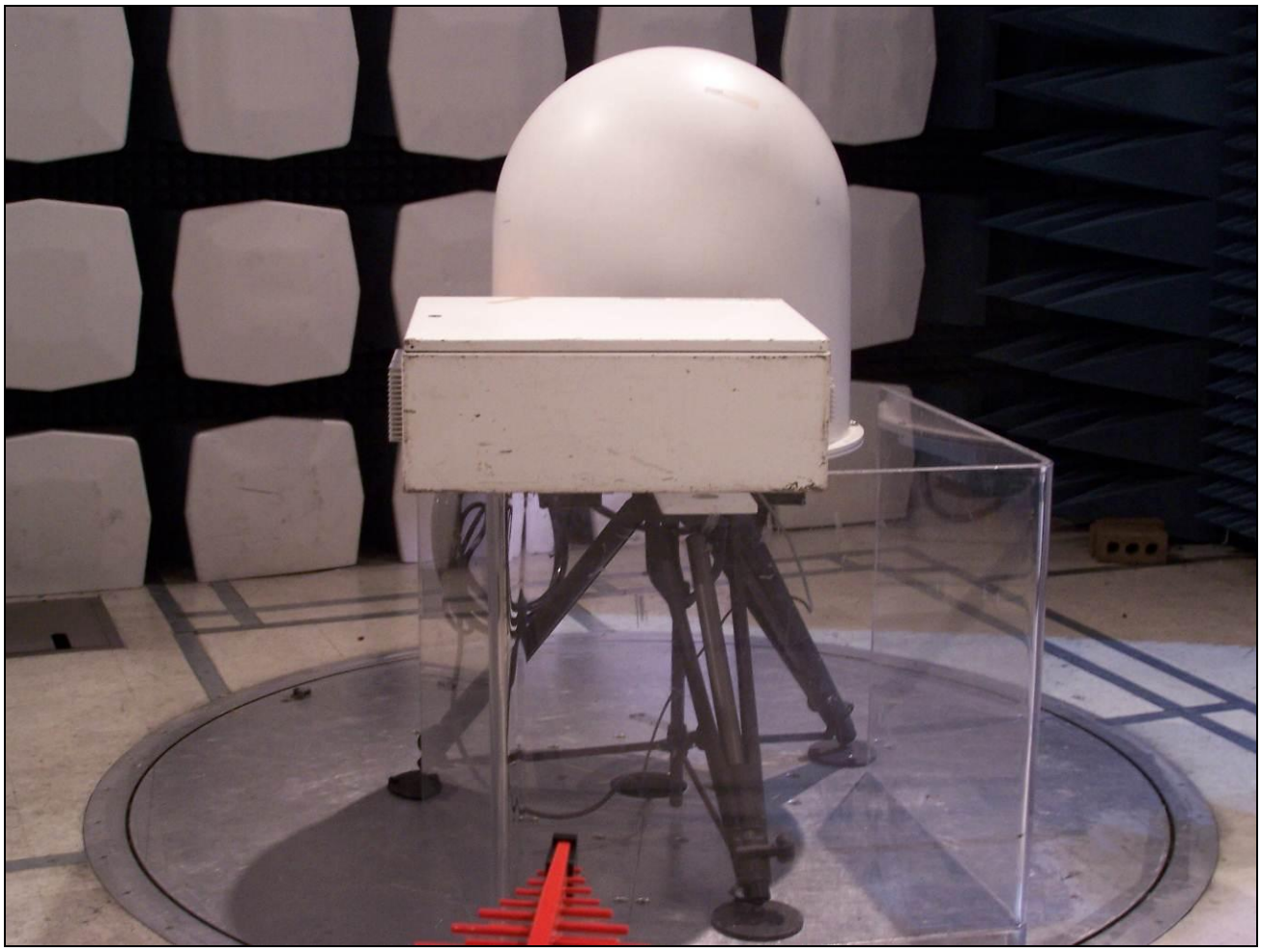
Figure 2. Cables with Ferrites



Plot 3. Radiated Emissions, Pre-Scan, Ferrites



Plot 4. Radiated Emissions, Pre-Scan, 1 GHz – 5 GHz



Photograph 2. Radiated Emission Limits, Test Setup

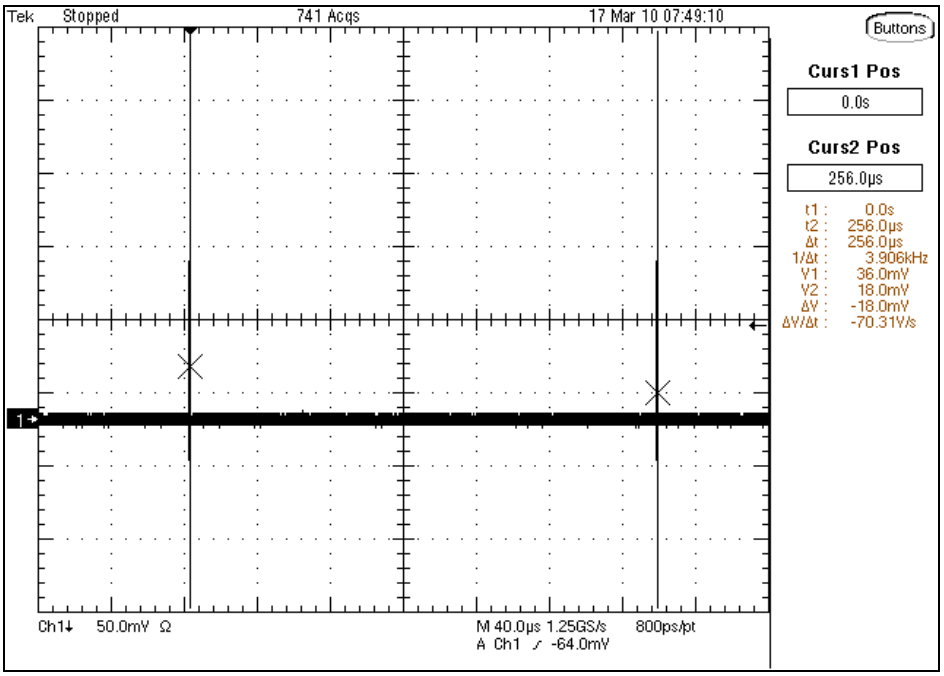
4. Electromagnetic Compatibility Criteria for Intentional Radiators

4. Electromagnetic Compatibility Criteria for Intentional Radiators

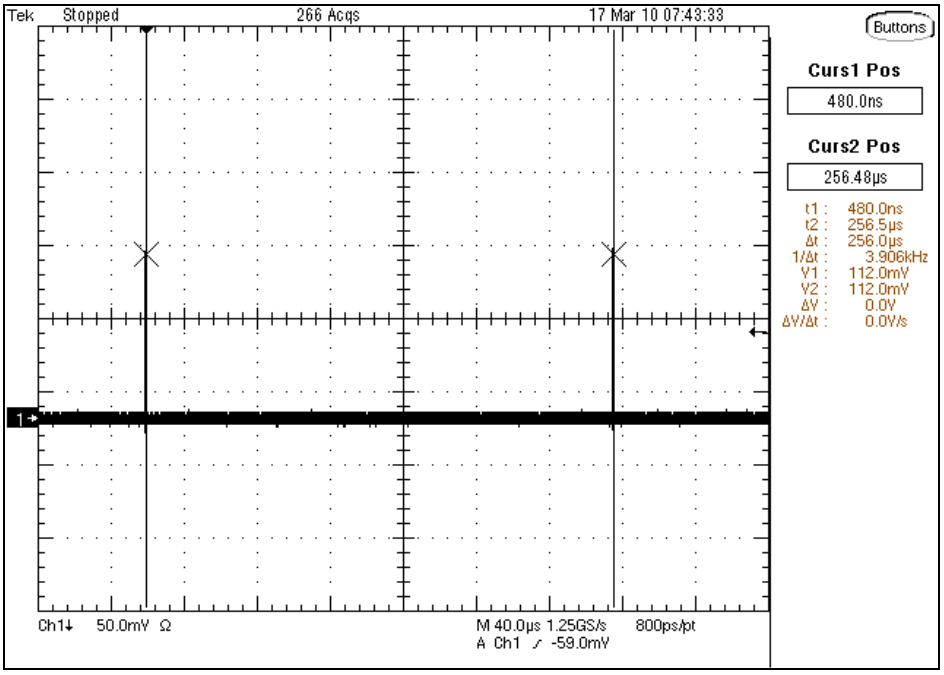
4.1. Modulation Characteristics (Pulse Width and PRF)

Test Engineer(s): Dusmantha Tennakoon

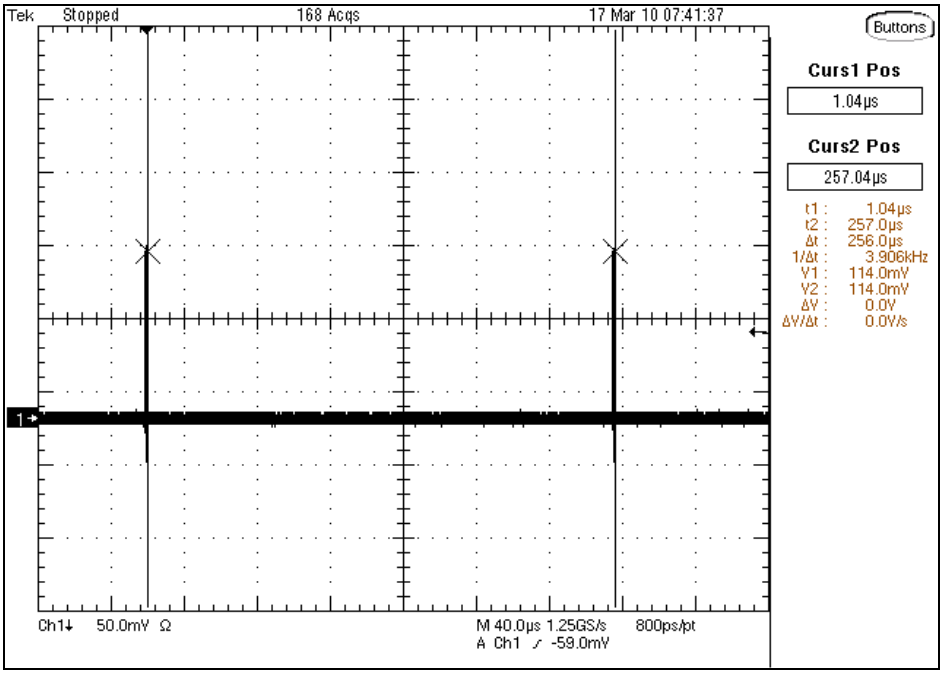
Test Date(s): 03/29/10



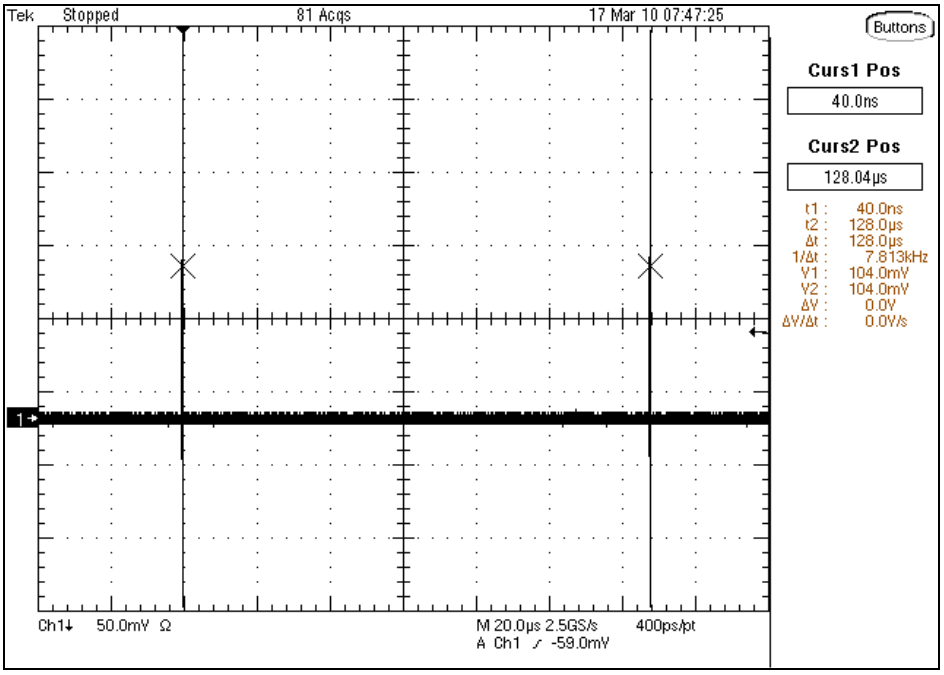
Plot 5. PRF 4k (80 ns)



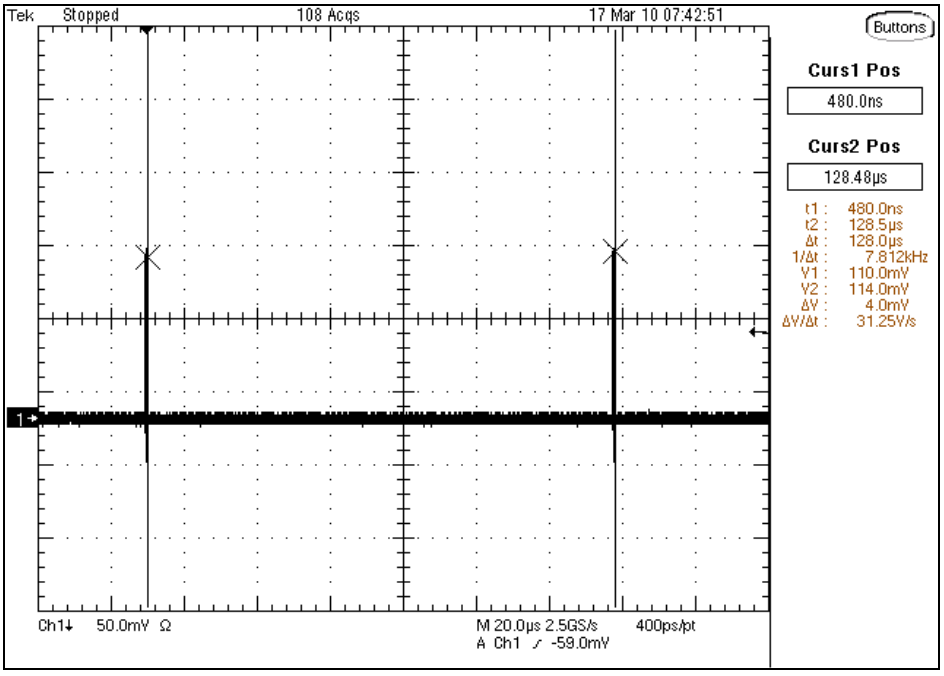
Plot 6. PRF 4k (519 ns)



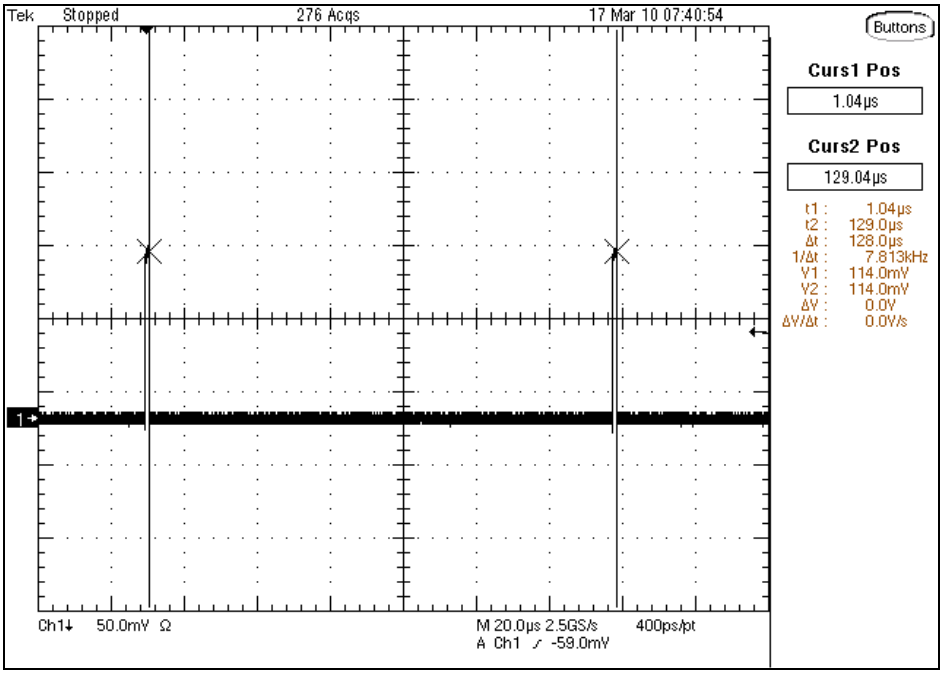
Plot 7. PRF 4k (1050ns)



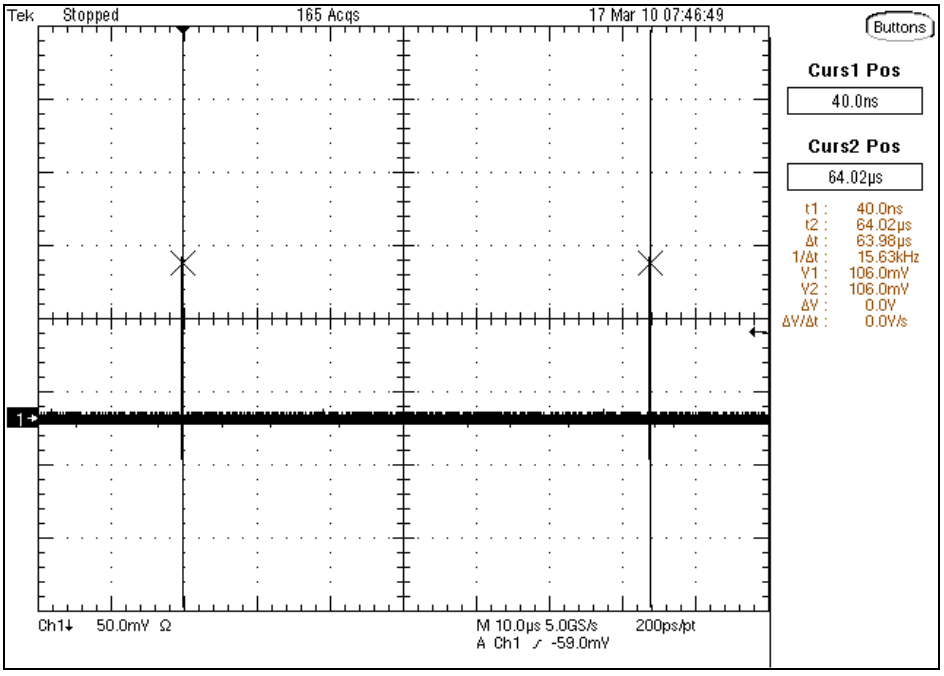
Plot 8. PRF 8k (80ns)



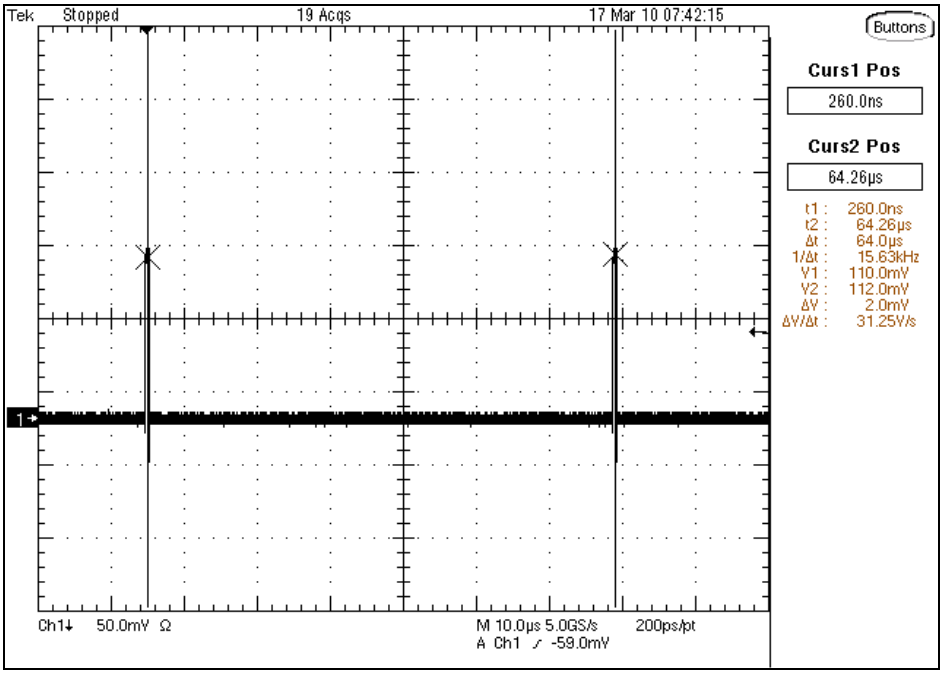
Plot 9. PRF 8k (519ns)



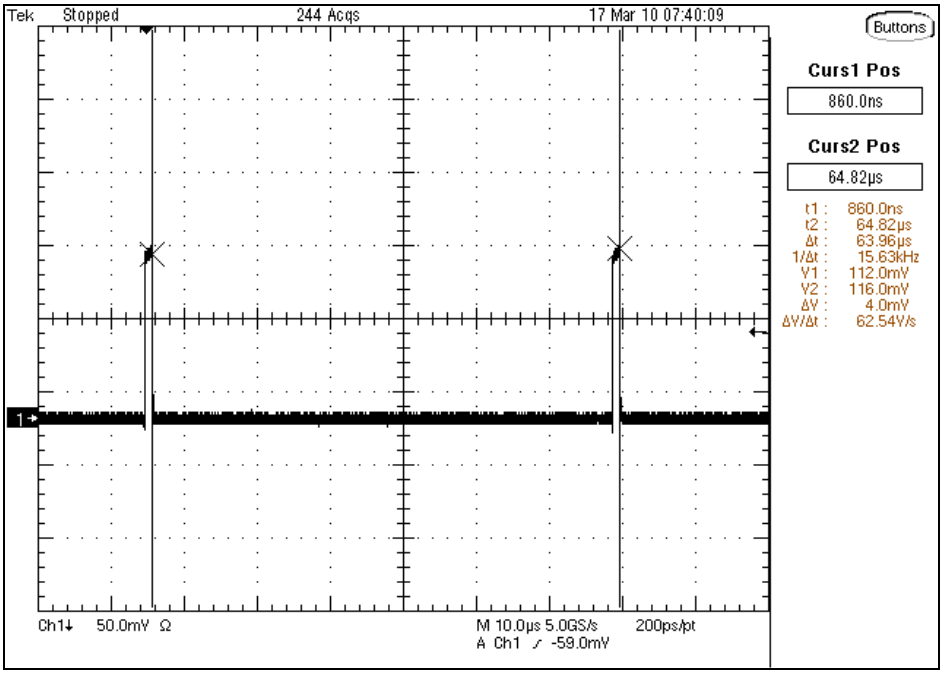
Plot 10. PRF 8k (1050ns)



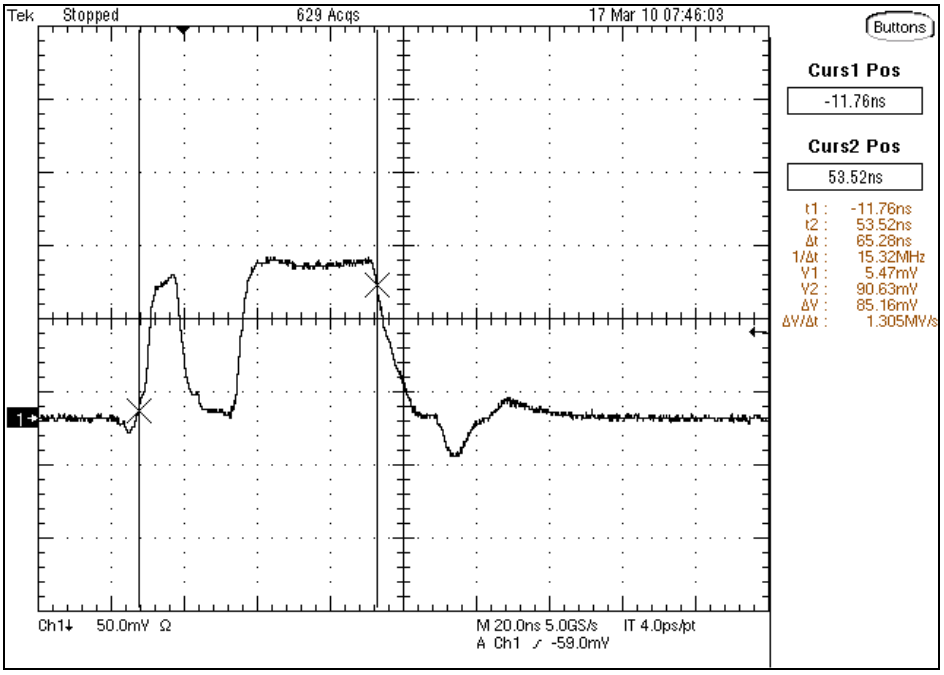
Plot 11. PRF 16k (80ns)



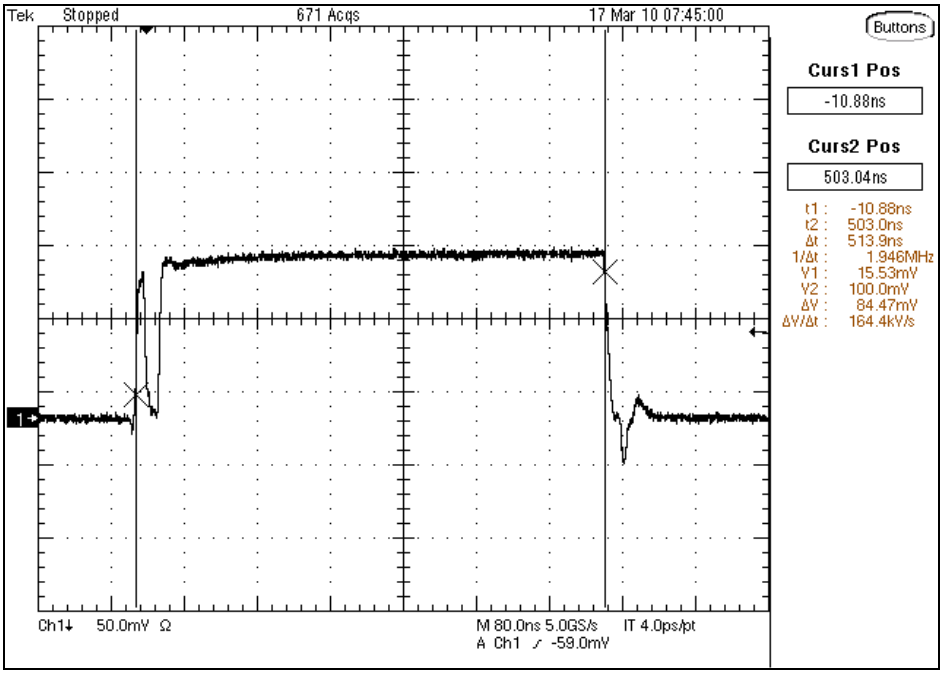
Plot 12. PRF 16k (519ns)



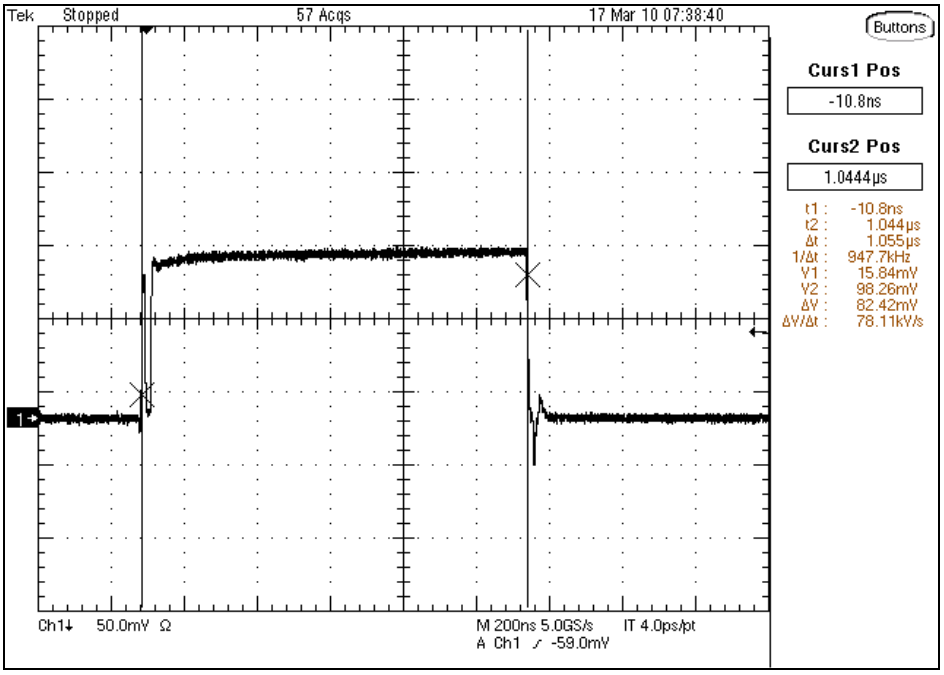
Plot 13. PRF 16k (1050ns)



Plot 14. Width 80ns



Plot 15. Width 519ns



Plot 16. Width 1050ns

4.2. RF Power Output

Test Requirement(s): **§2.1046, §80.215, and §90.205**

Test Procedures: As required by 47 CFR 2.1046, *RF power output measurements* were made at the RF output terminals of the EUT.

Conducted power measurements made were average. A laptop was connected to EUT to control the RF power output, modulation, and frequency channel. The EUT was connected through an attenuator to a Spectrum Analyzer capable of making power measurements. The EUT power was adjusted enough to produce maximum output power as specified in the owner's manual.

Test Results: Equipment complies with 47CFR 2.1046, 80.215 and 90.205.

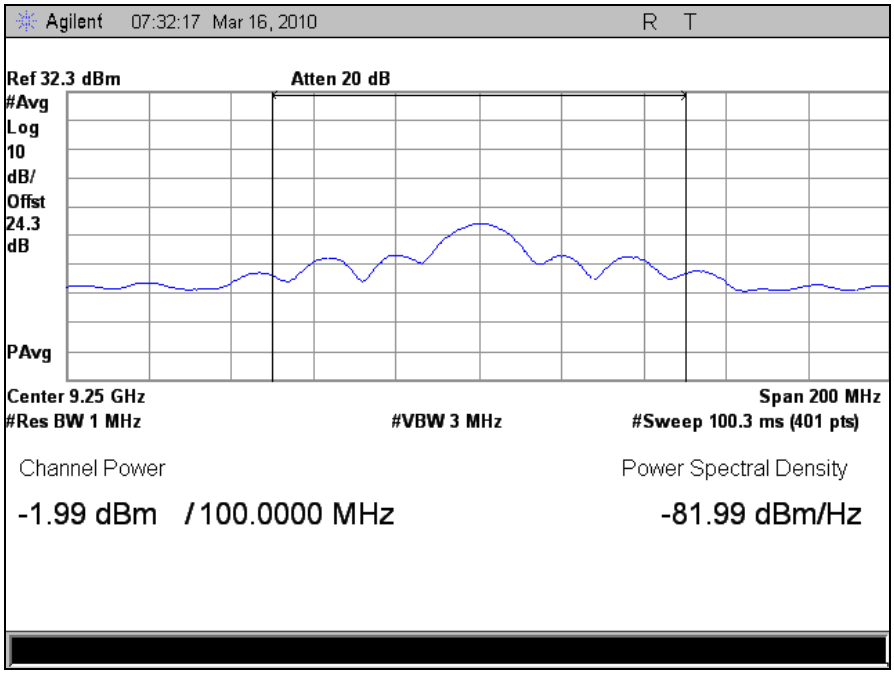
Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 03/17/10 – 03/29/10

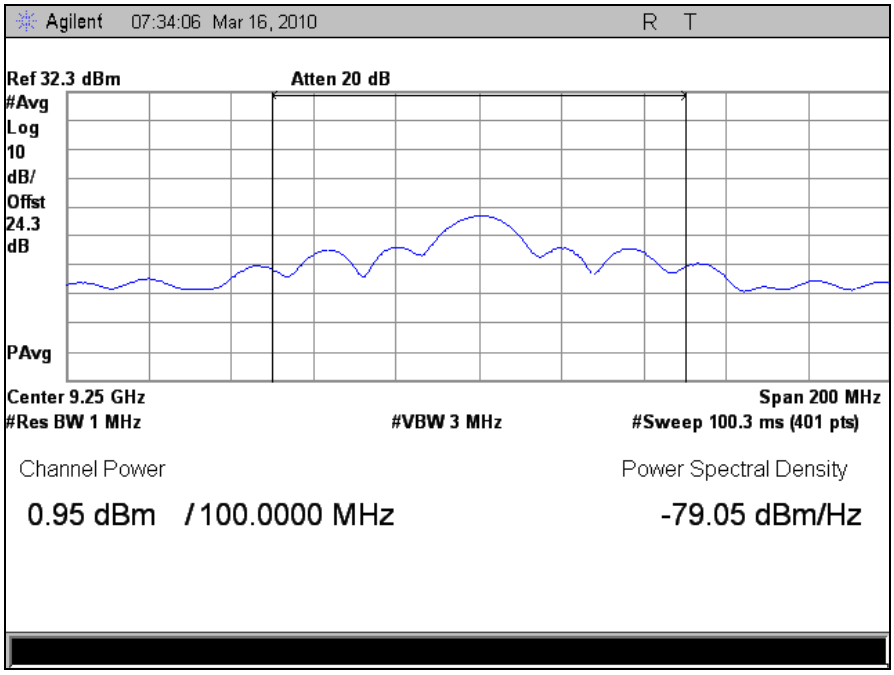
PRF (kHz)	Pulse Width (nS)	Duty Cycle	Avg Power (mW)	Peak Power (W)
3.906	65.28	0.00025498	0.6324	2.48
3.906	513.90	0.00200729	8.6500	4.31
3.906	1055.00	0.00412083	19.7700	4.80
7.813	65.28	0.00051003	1.2440	2.44
7.812	513.90	0.00401459	17.2580	4.30
7.813	1055.00	0.00824272	39.2640	4.76
15.63	65.28	0.00102033	2.4600	2.41
15.63	513.90	0.00803226	34.5140	4.30
15.63	1055.00	0.01648965	79.6160	4.83

Table 9. RF Power, Test Results

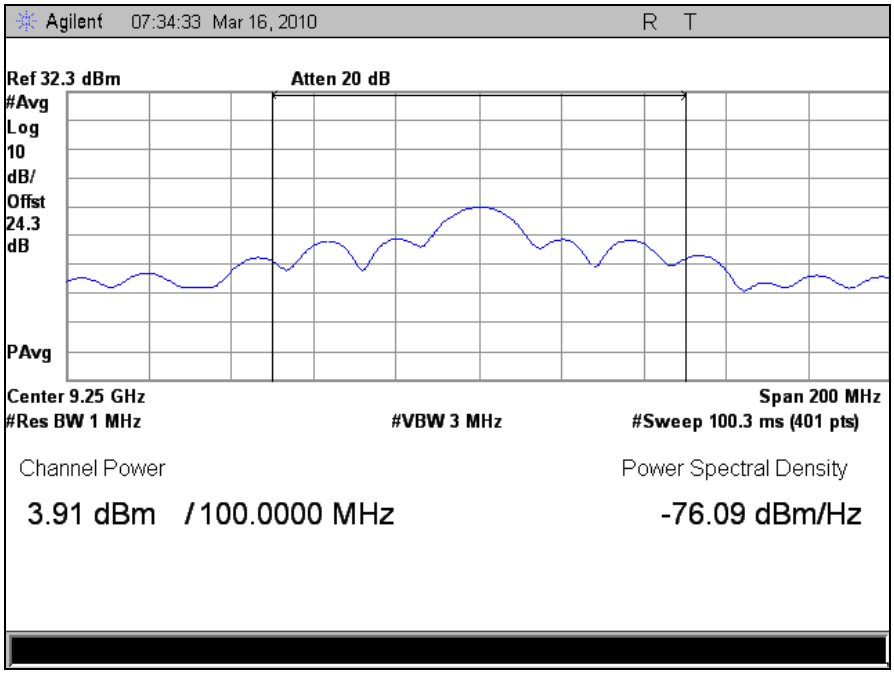
Duty Cycle = PRF * Pulse width
Peak Power = Avg power / Duty Cycle



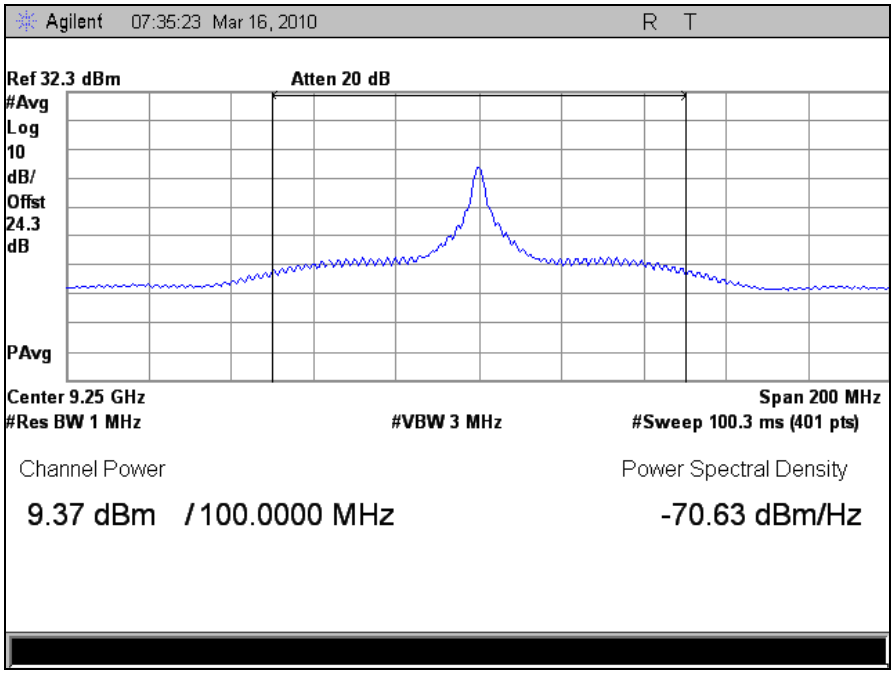
Plot 17. RF Power Output, 80ns, 4 kHz, Average



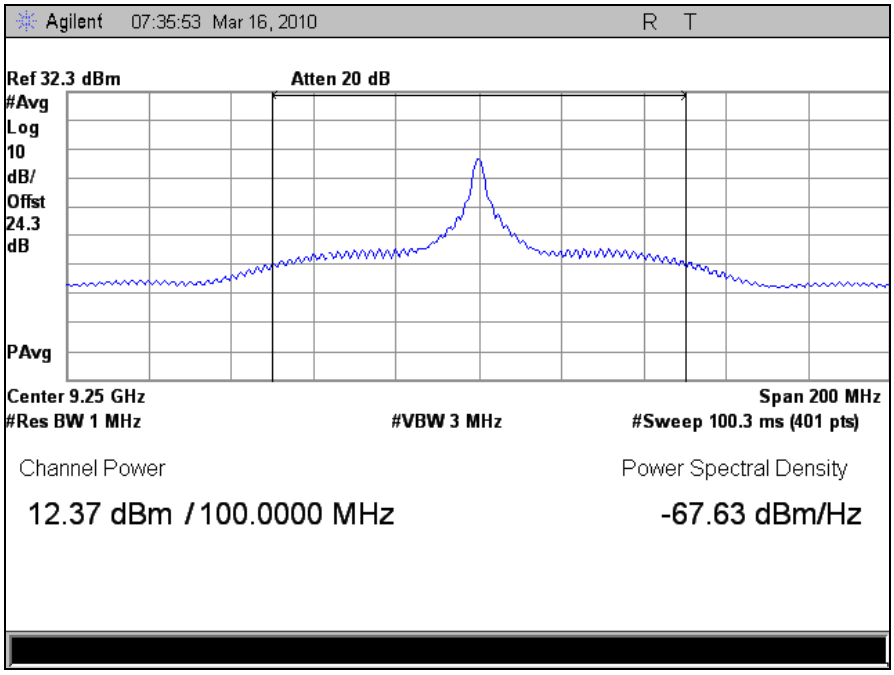
Plot 18. RF Power Output, 80ns, 8 kHz, Average



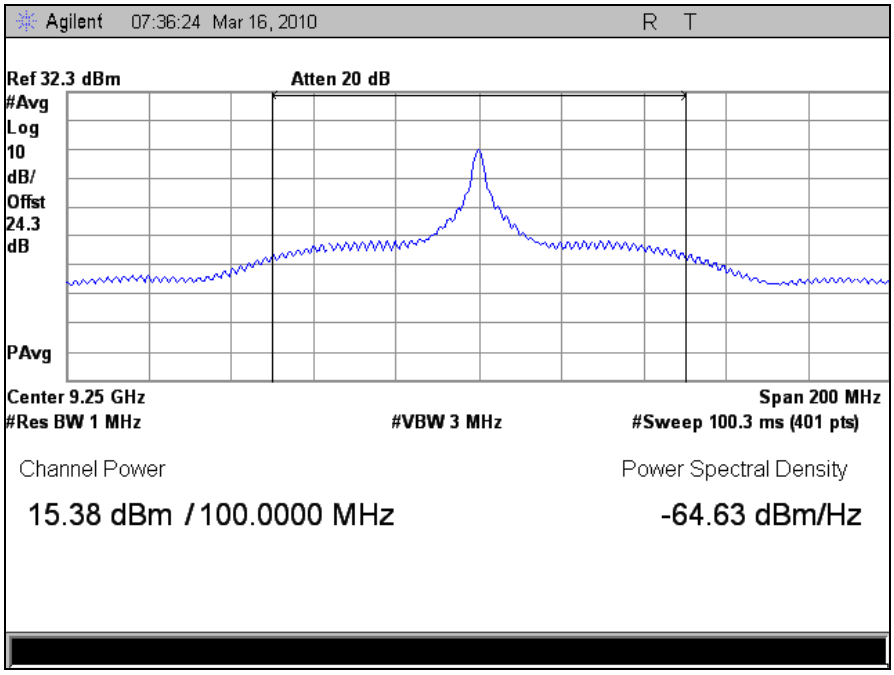
Plot 19. RF Power Output, 80ns, 16 kHz, Average



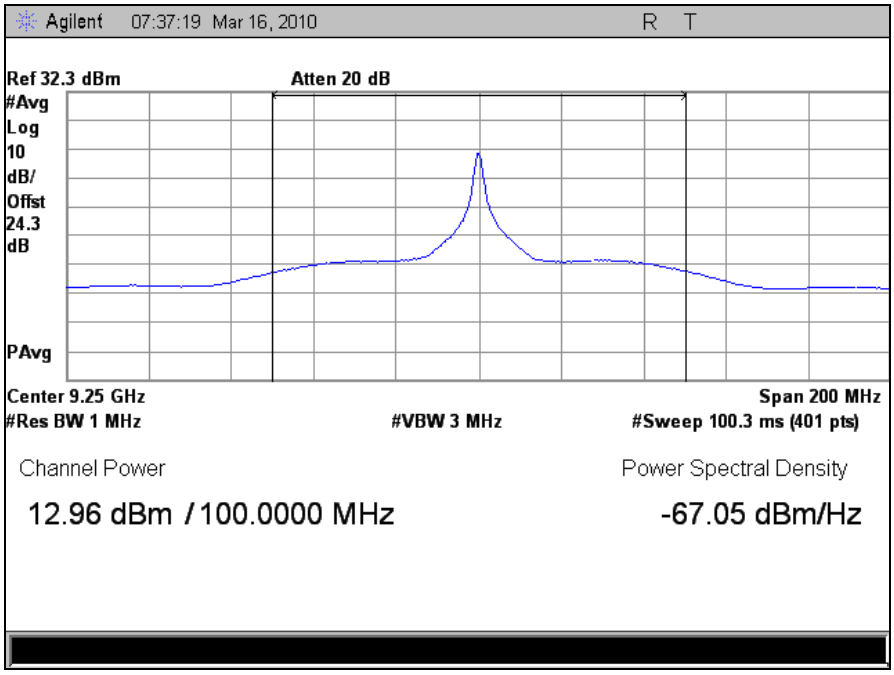
Plot 20. RF Power Output, 519ns, 4 kHz, Average



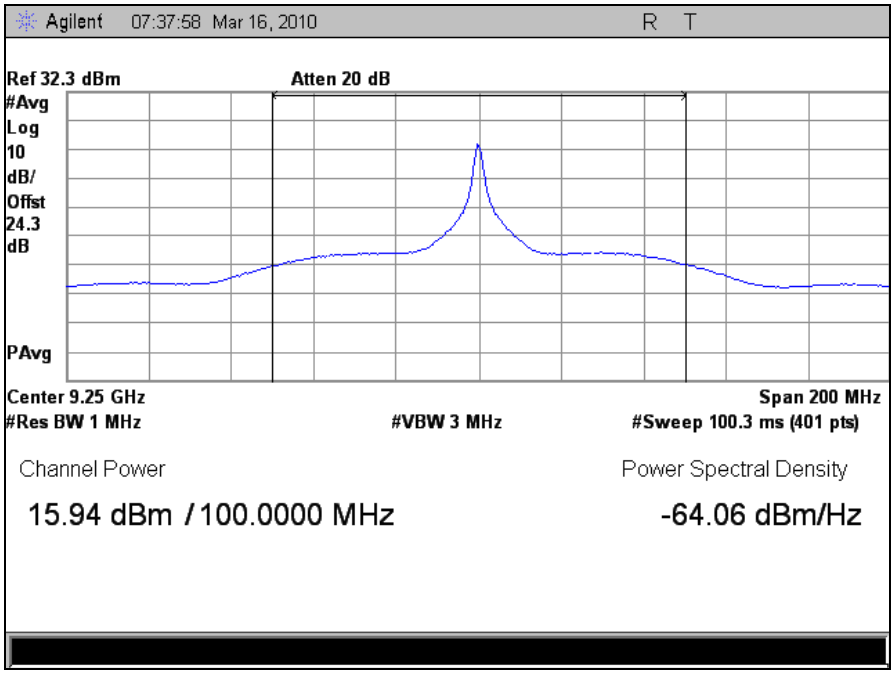
Plot 21. RF Power Output, 519ns, 8 kHz, Average



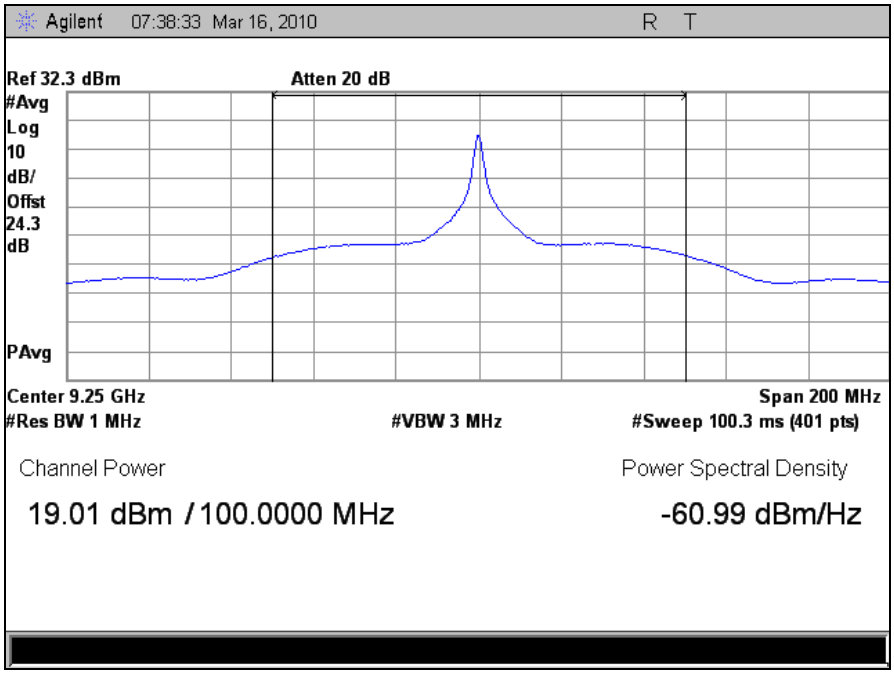
Plot 22. RF Power Output, 519ns, 16 kHz, Average



Plot 23. RF Power Output, 1050ns, 4 kHz, Average



Plot 24. RF Power Output, 1050ns, 8 kHz, Average



Plot 25. RF Power Output, 1050ns, 16 kHz, Average

4.3. Conducted Spurious Emissions

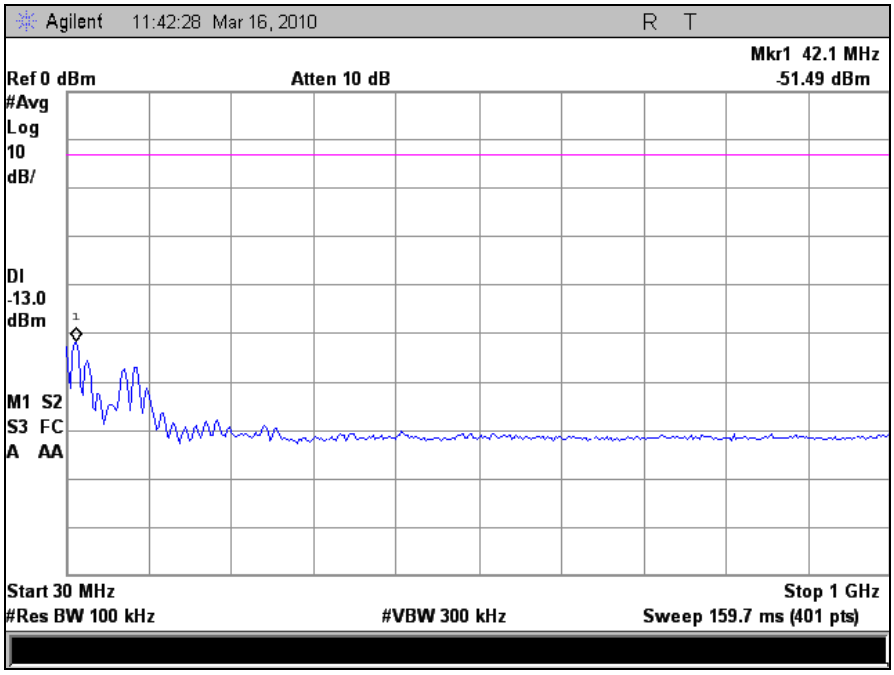
Test Requirement(s): **§2.1051, §80.211(f), and §90.210**

Test Procedures: The spurious emissions shall be less than -13 dBm.

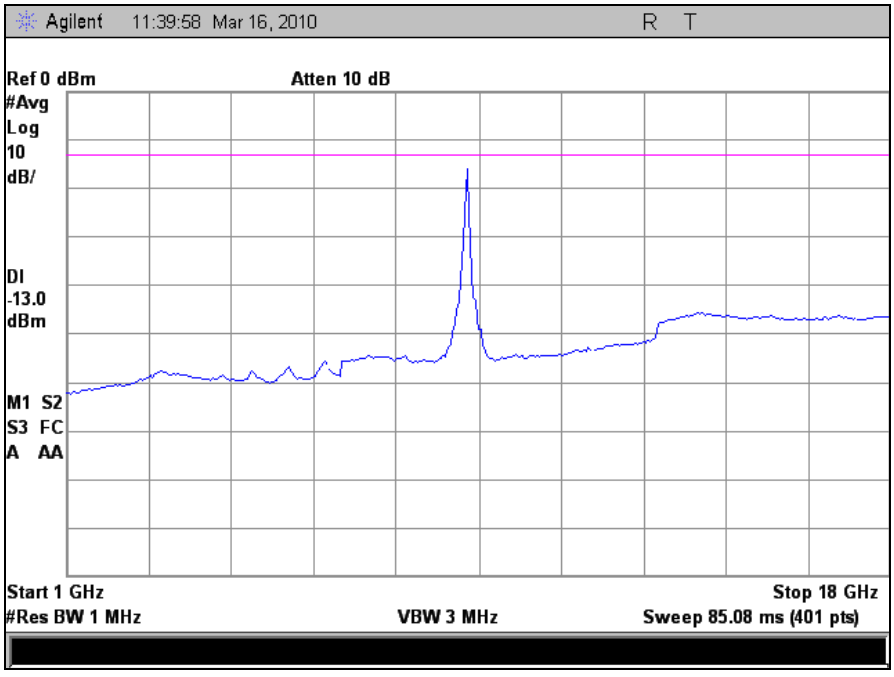
Test Results: The EUT was compliant with this requirement. All plots have been corrected for cable loss.

Test Engineer(s): Dusmantha Tennakoon

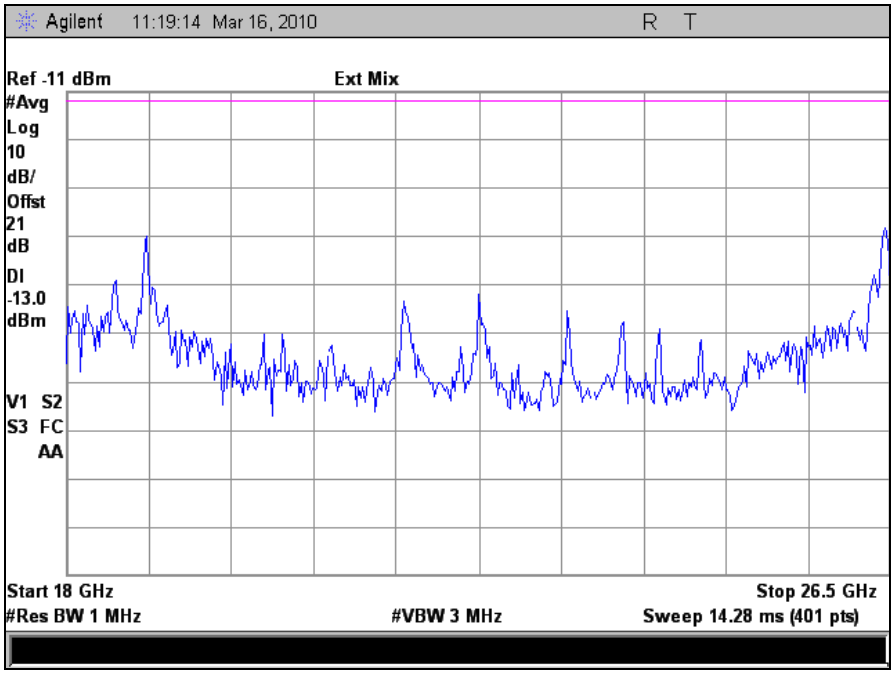
Test Date(s): 03/17/10 – 03/29/11



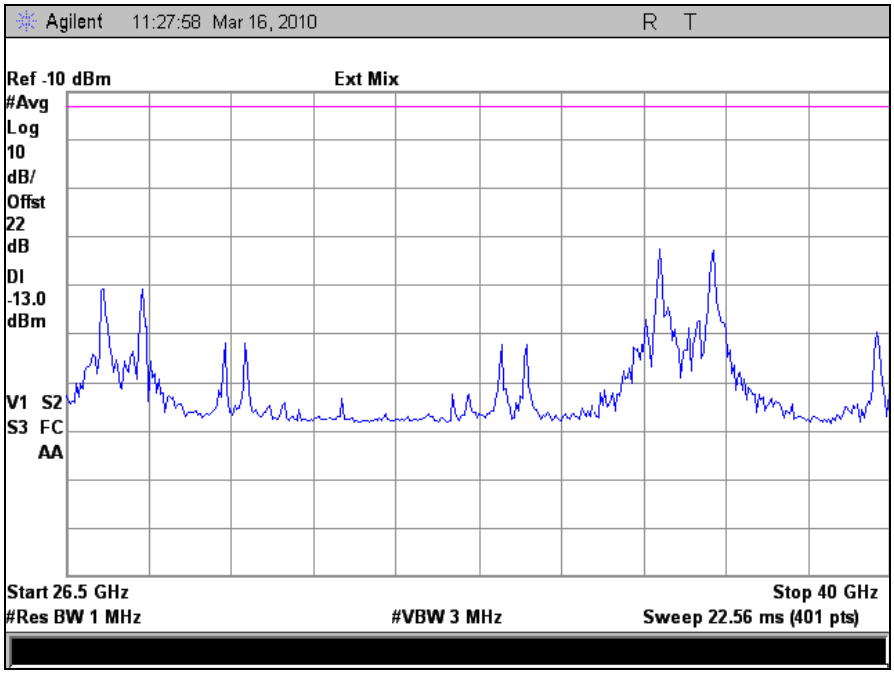
Plot 26. Conducted Spurious Emissions, 80ns, 4 kHz, 30 MHz – 1 GHz



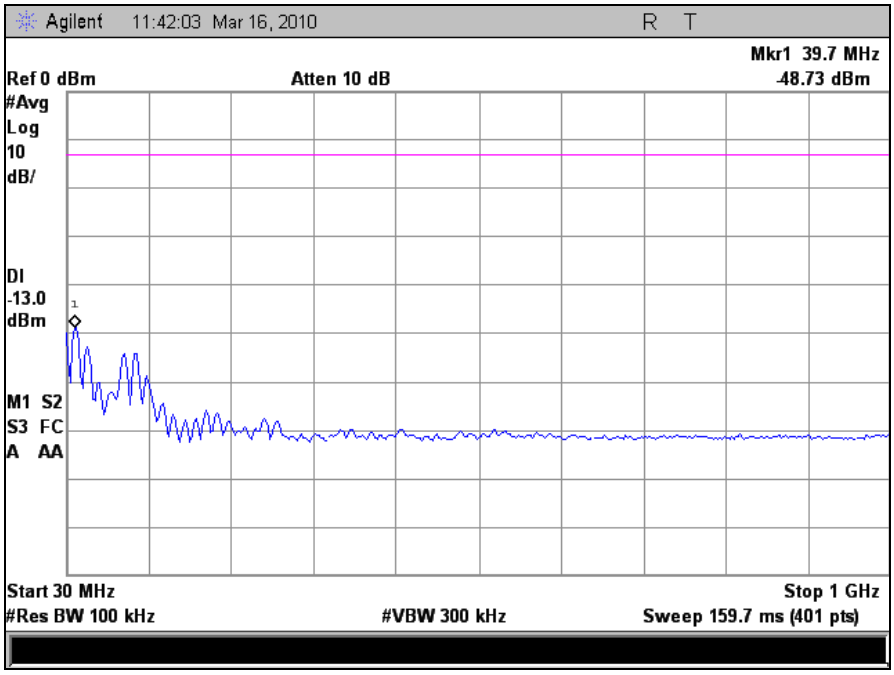
Plot 27. Conducted Spurious Emissions, 80ns, 4 kHz, 1 GHz – 18 GHz



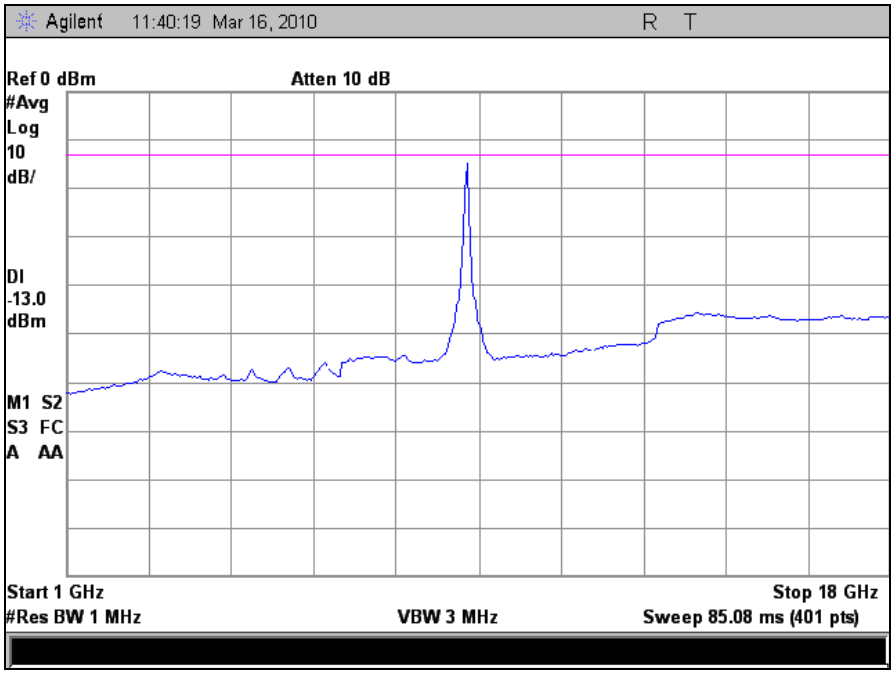
Plot 28. Conducted Spurious Emissions, 80ns, 4 kHz, 18 GHz – 26.5 GHz



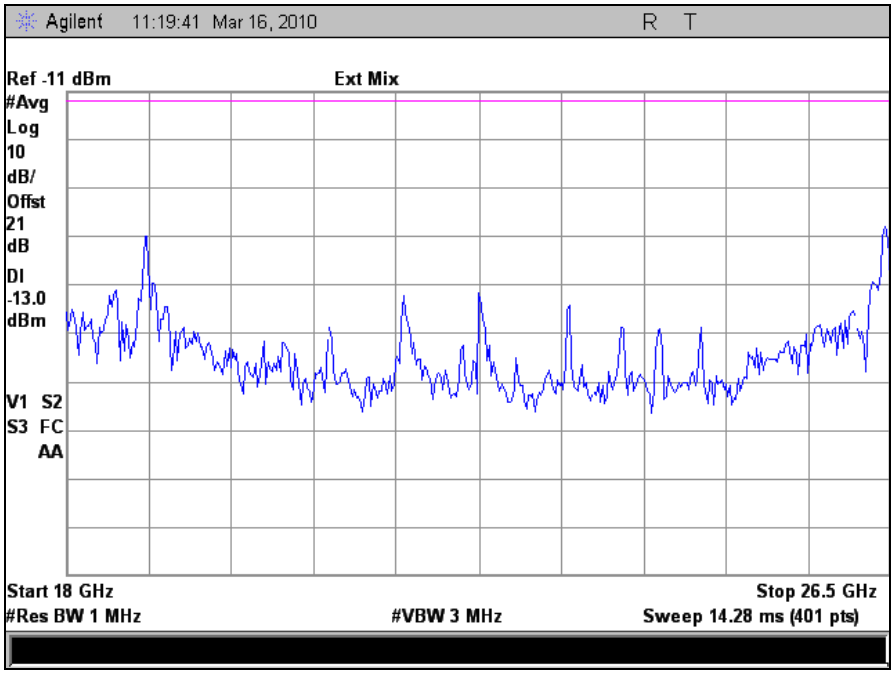
Plot 29. Conducted Spurious Emissions, 80ns, 4 kHz, 26.5 GHz – 40 GHz



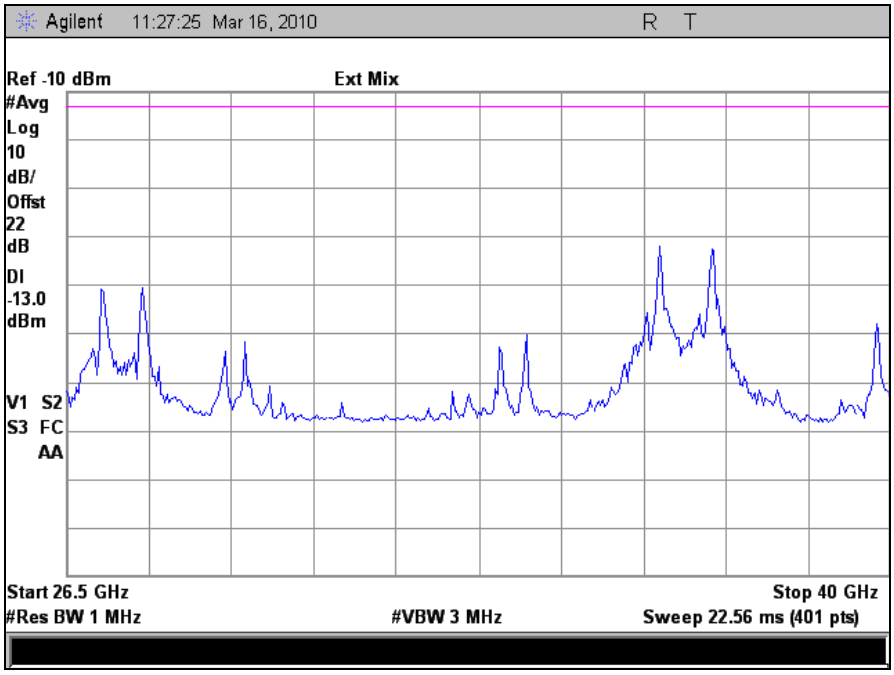
Plot 30. Conducted Spurious Emissions, 80ns, 8 kHz, 30 MHz – 1 GHz



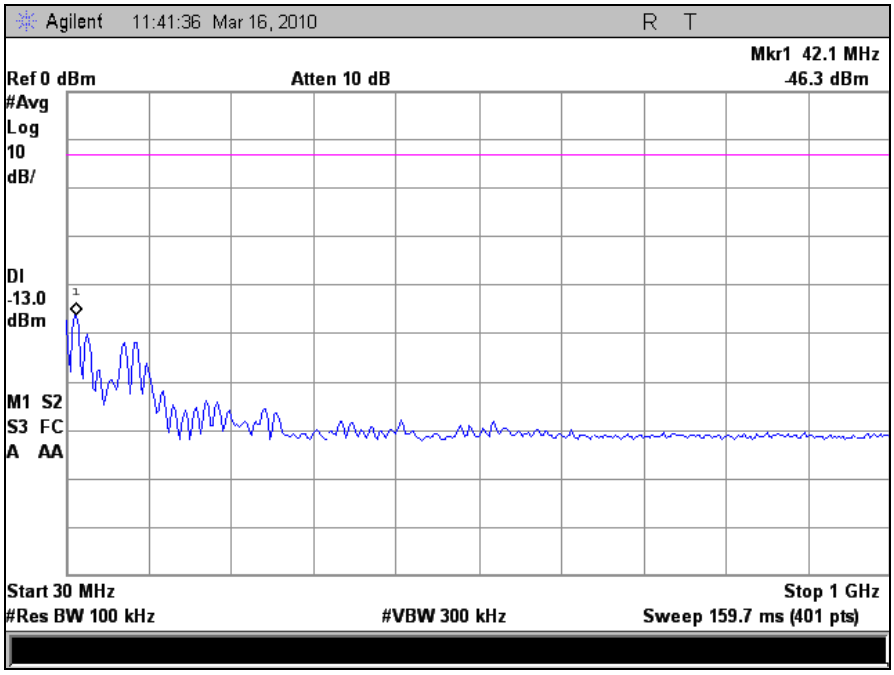
Plot 31. Conducted Spurious Emissions, 80ns, 8 kHz, 1 GHz – 18 GHz



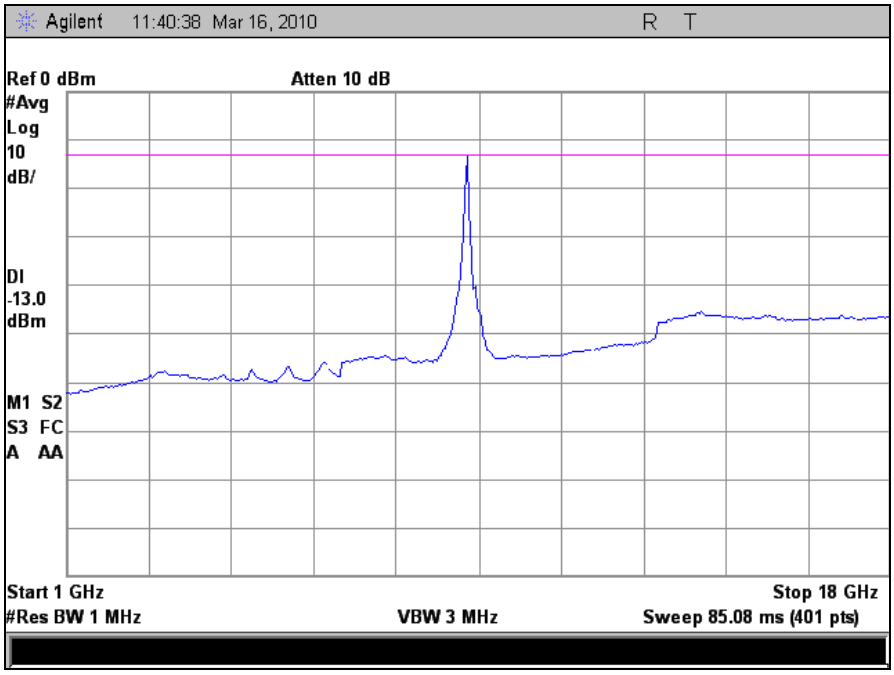
Plot 32. Conducted Spurious Emissions, 80ns, 8 kHz, 18 GHz – 26.5 GHz



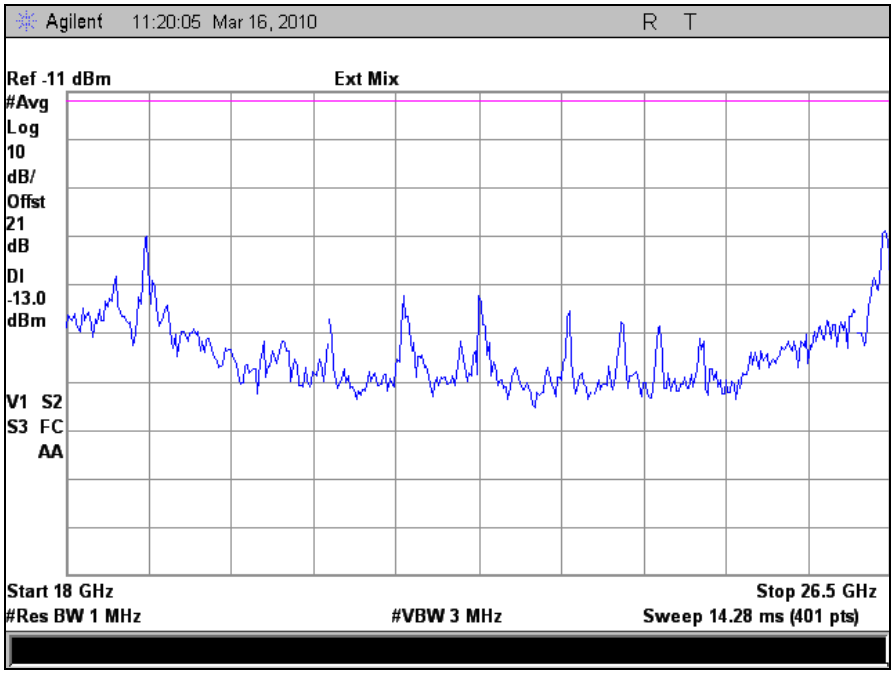
Plot 33. Conducted Spurious Emissions, 80ns, 8 kHz, 26.5 GHz – 40 GHz



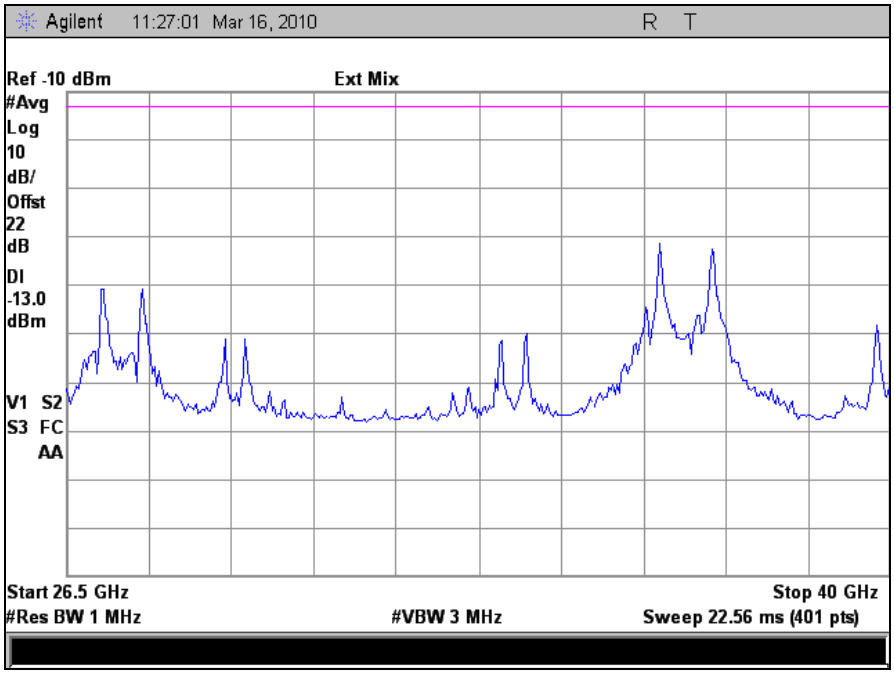
Plot 34. Conducted Spurious Emissions, 80ns, 16 kHz, 30 MHz – 1 GHz



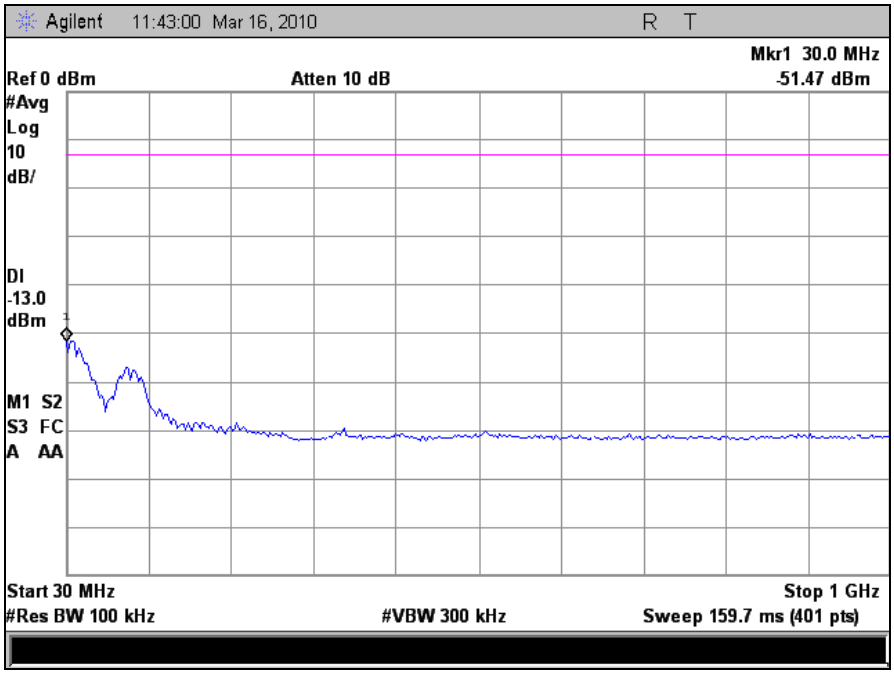
Plot 35. Conducted Spurious Emissions, 80ns, 16 kHz, 1 GHz – 18 GHz



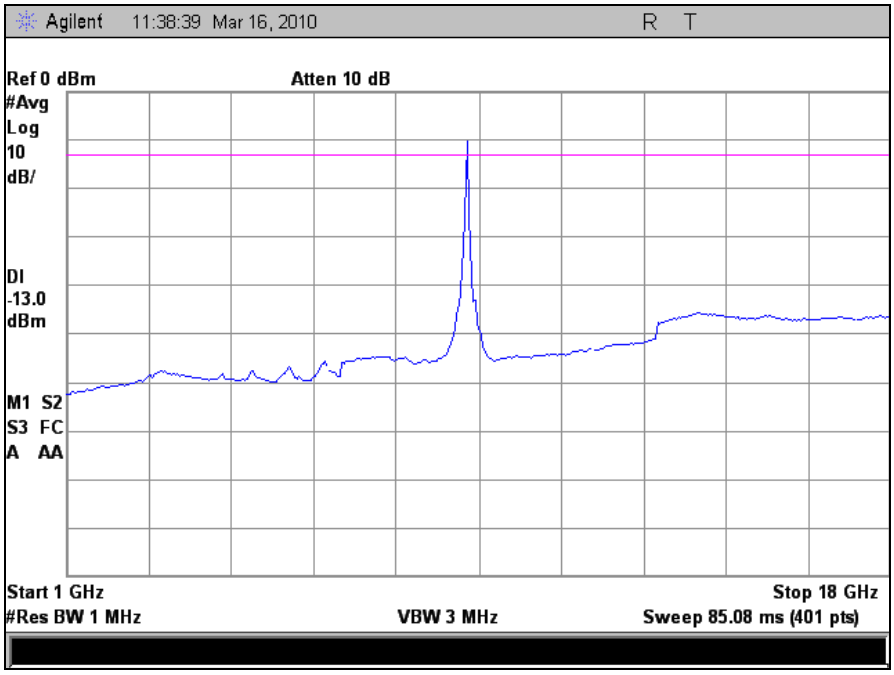
Plot 36. Conducted Spurious Emissions, 80ns, 16 kHz, 18 GHz – 26.5 GHz



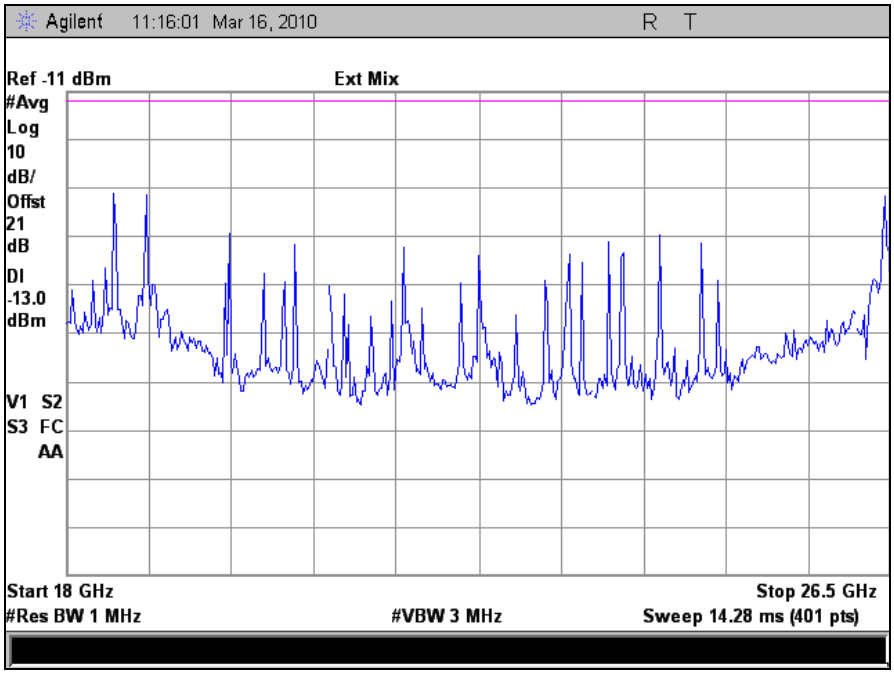
Plot 37. Conducted Spurious Emissions, 80ns, 16 kHz, 26.5 GHz – 40 GHz



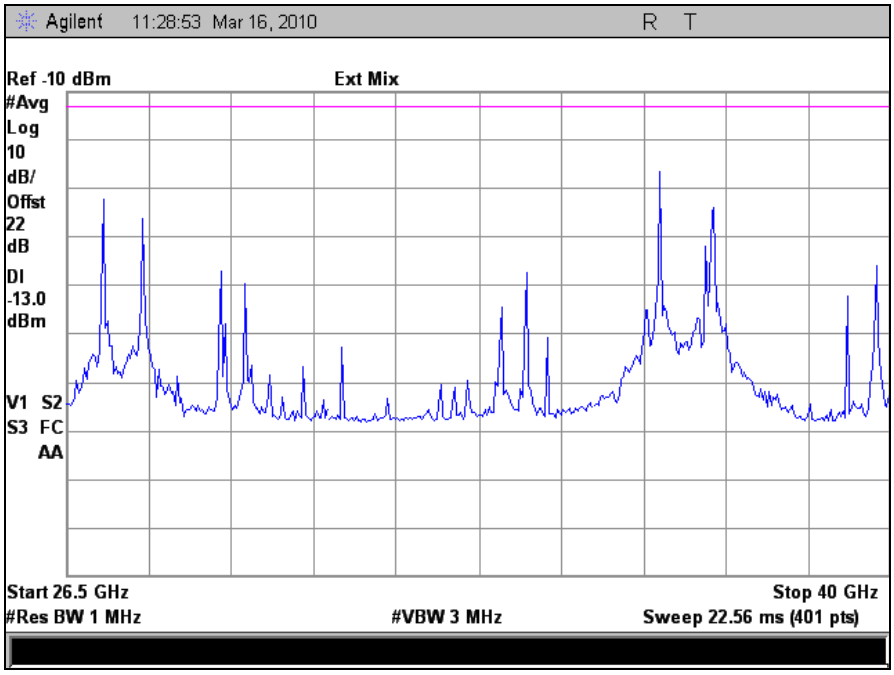
Plot 38. Conducted Spurious Emissions, 519ns, 4 kHz, 30 MHz – 1 GHz



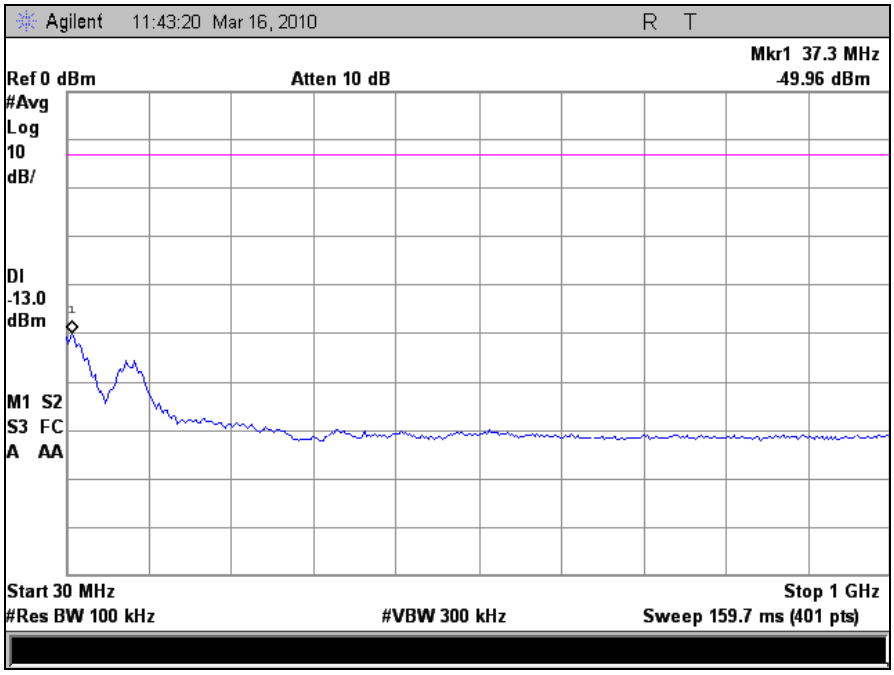
Plot 39. Conducted Spurious Emissions, 519ns, 4 kHz, 1 GHz – 18 GHz



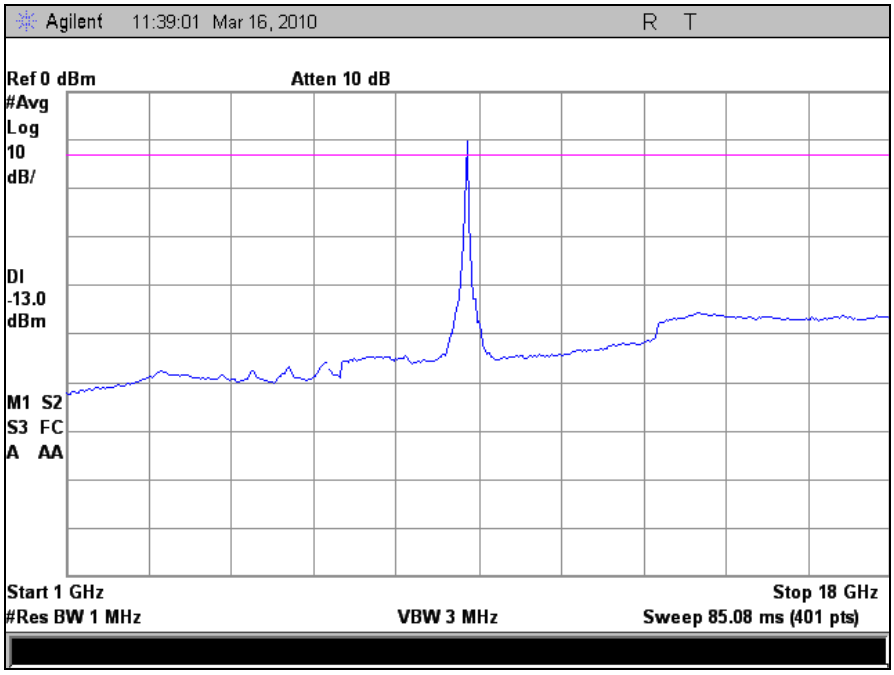
Plot 40. Conducted Spurious Emissions, 519ns, 4 kHz, 18 GHz – 26.5 GHz



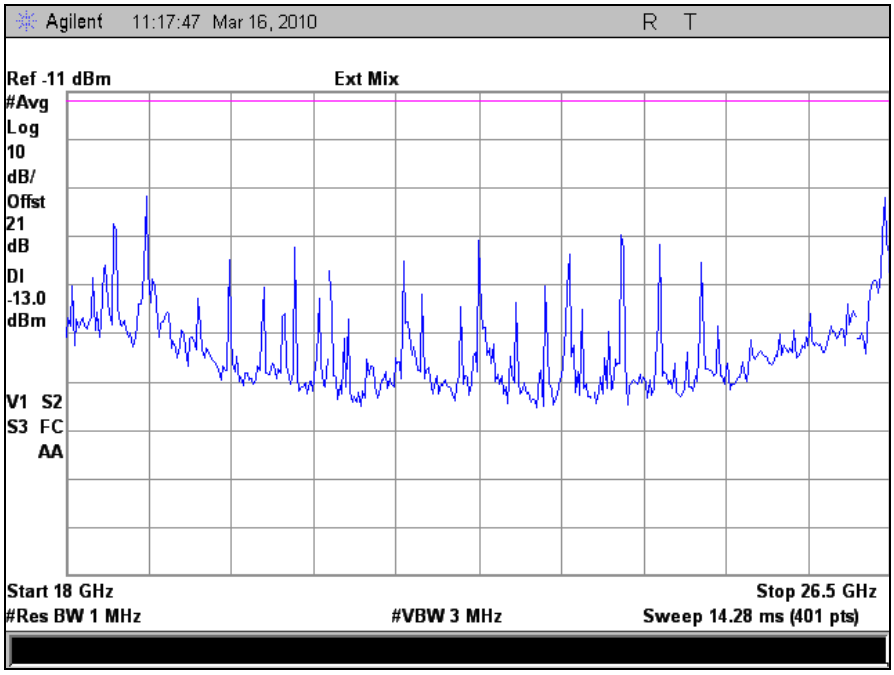
Plot 41. Conducted Spurious Emissions, 519ns, 4 kHz, 26.5 GHz – 40 GHz



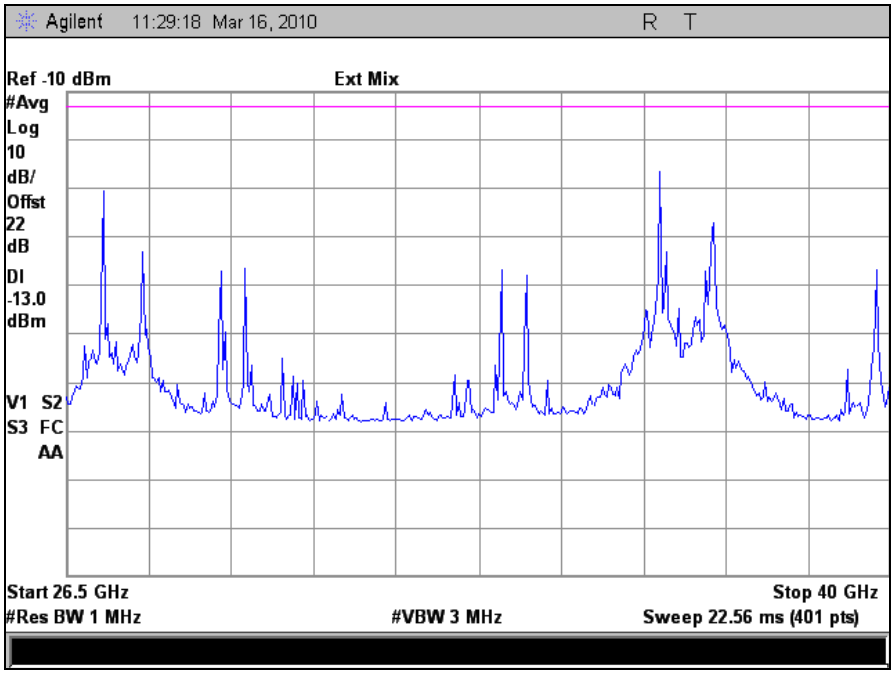
Plot 42. Conducted Spurious Emissions, 519ns, 8 kHz, 30 MHz – 1 GHz



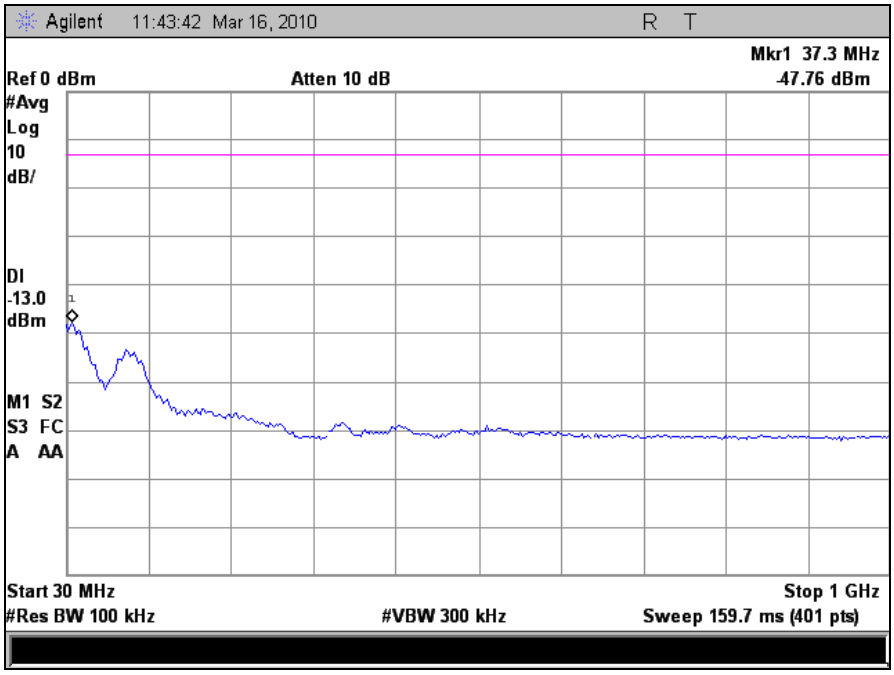
Plot 43. Conducted Spurious Emissions, 519ns, 8 kHz, 1 GHz – 18 GHz



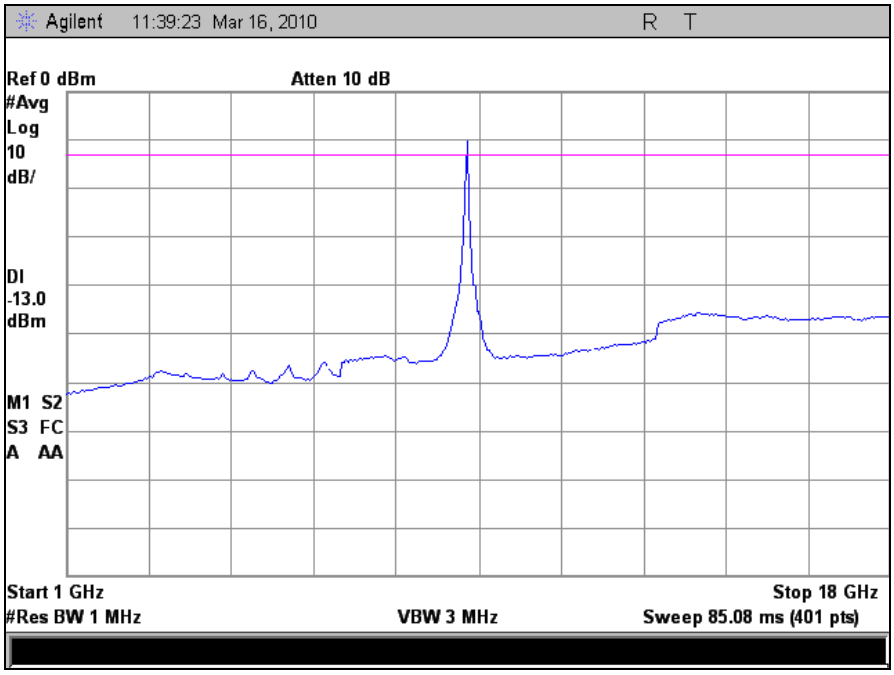
Plot 44. Conducted Spurious Emissions, 519ns, 8 kHz, 18 GHz – 26.5 GHz



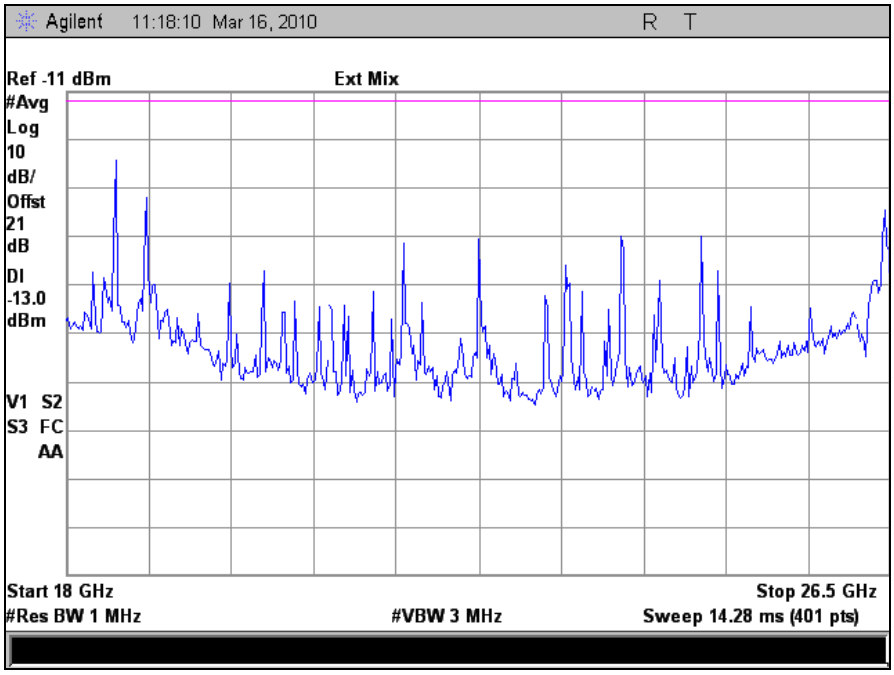
Plot 45. Conducted Spurious Emissions, 519ns, 8 kHz, 26.5 GHz – 40 GHz



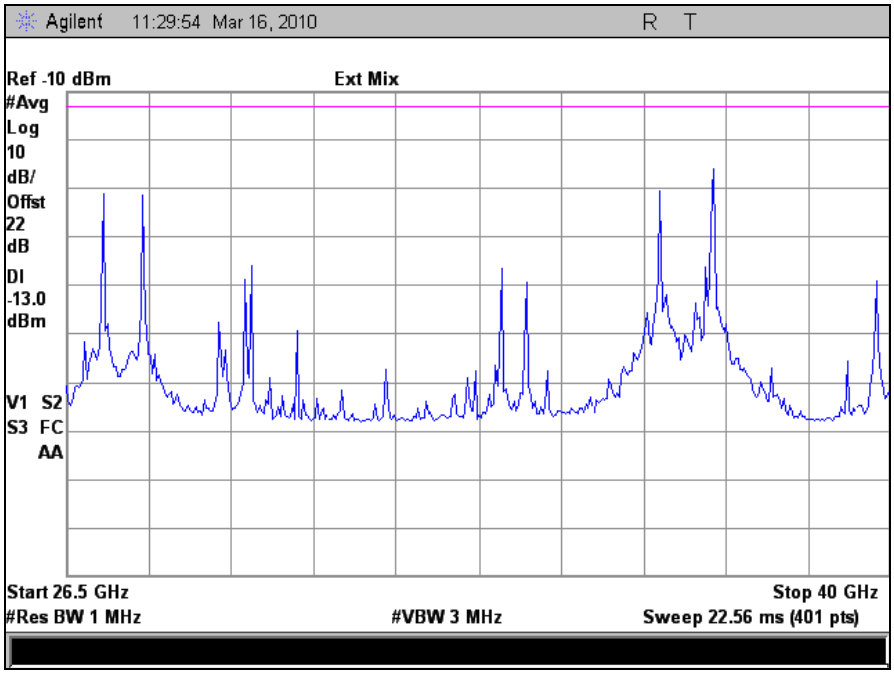
Plot 46. Conducted Spurious Emissions, 519ns, 16 kHz, 30 MHz – 1 GHz



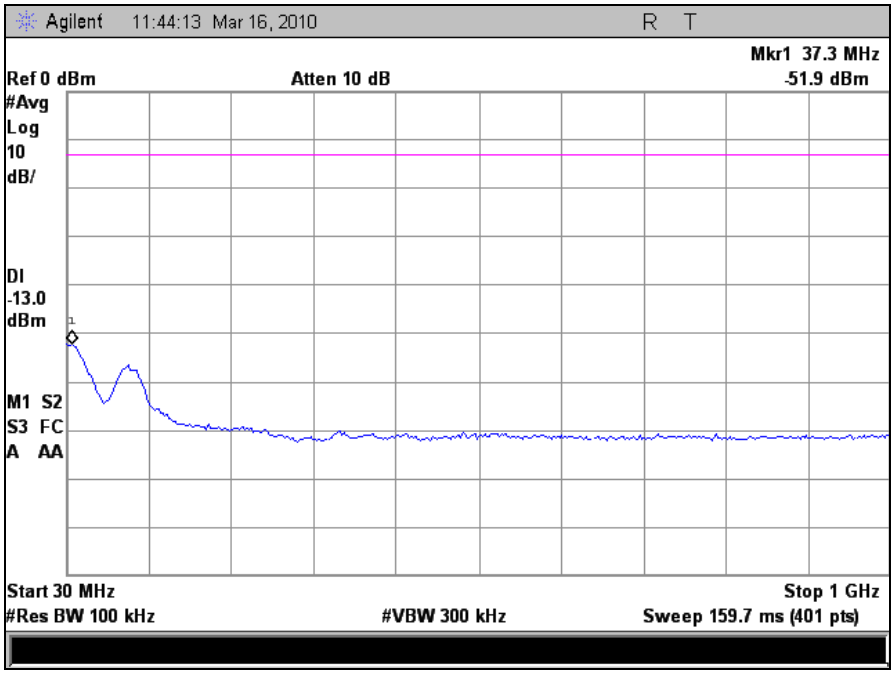
Plot 47. Conducted Spurious Emissions, 519, 16 kHz, 1 GHz – 18 GHz



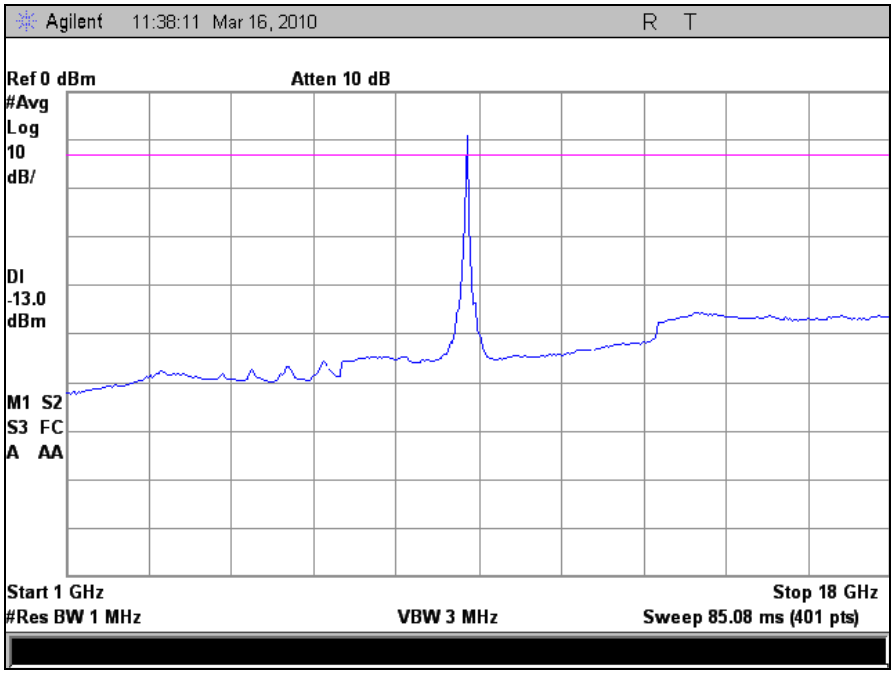
Plot 48. Conducted Spurious Emissions, 519, 16 kHz, 18 GHz – 26.5 GHz



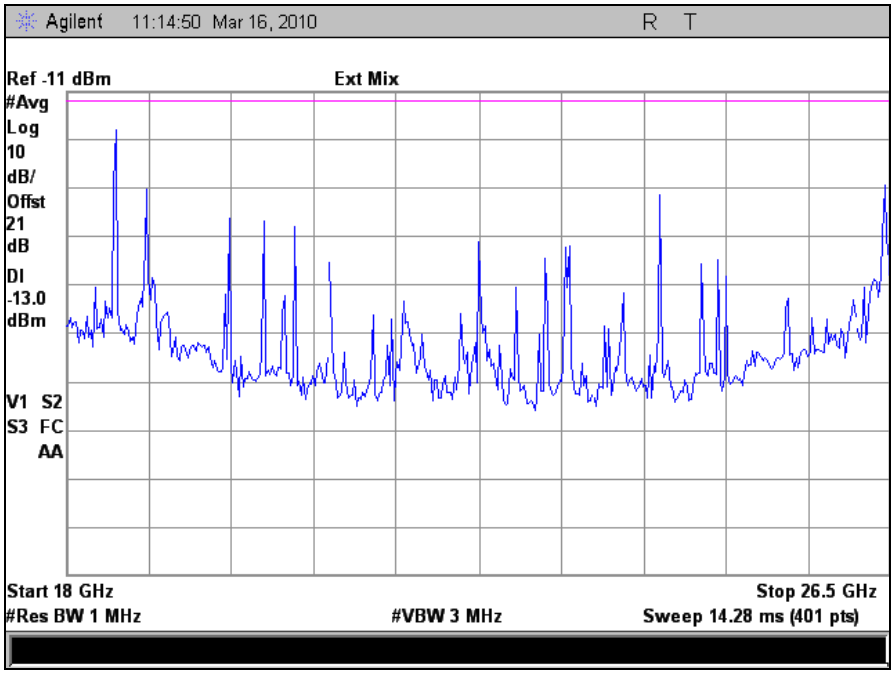
Plot 49. Conducted Spurious Emissions, 519, 16 kHz, 26.5 GHz – 40 GHz



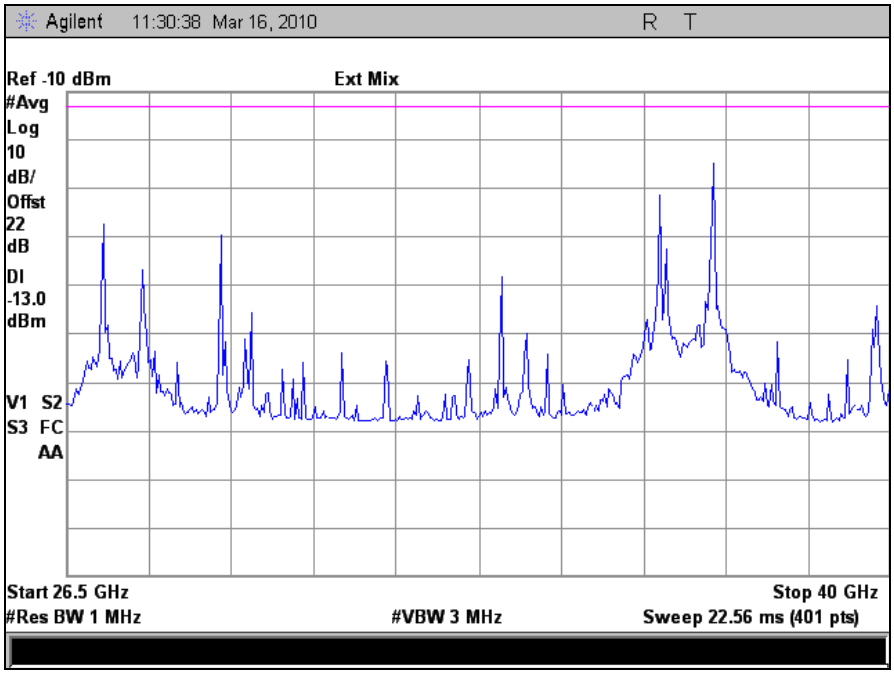
Plot 50. Conducted Spurious Emissions, 1050, 4 kHz, 30 MHz – 1 GHz



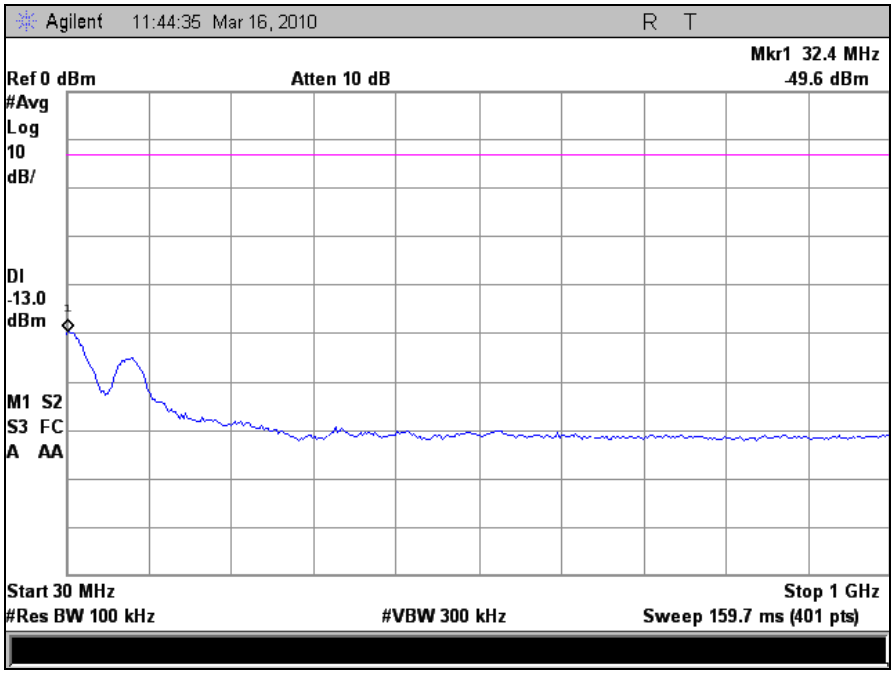
Plot 51. Conducted Spurious Emissions, 1050, 4 kHz, 1 GHz – 18 GHz



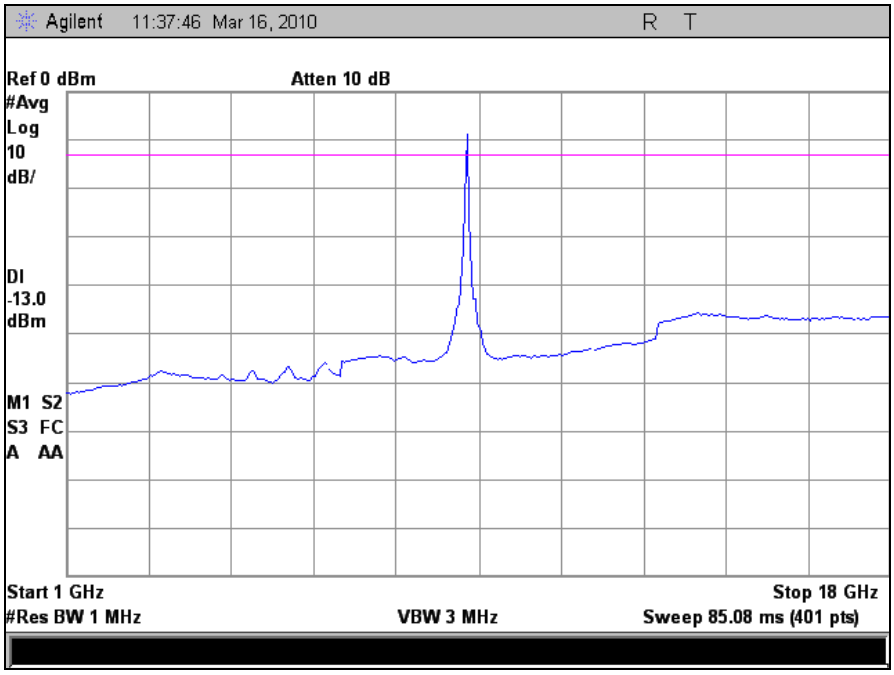
Plot 52. Conducted Spurious Emissions, 1050, 4 kHz, 18 GHz – 26.5 GHz



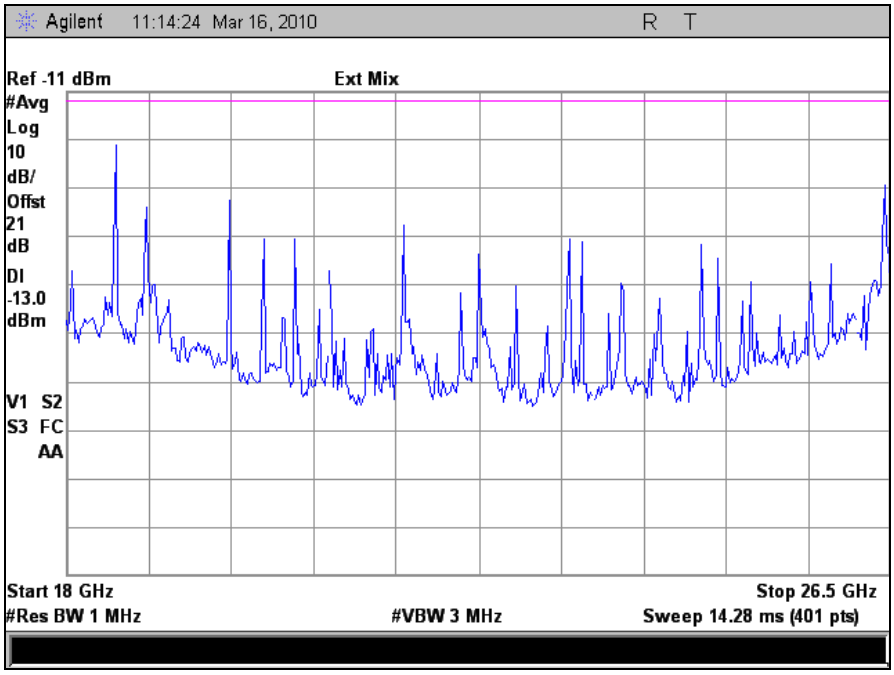
Plot 53. Conducted Spurious Emissions, 1050, 4 kHz, 26.5 GHz – 40 GHz



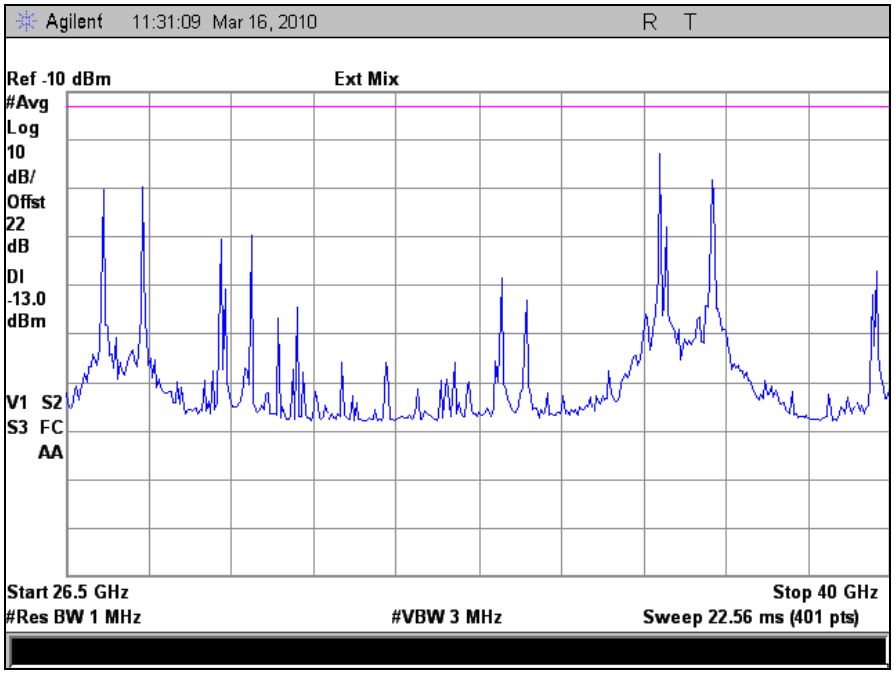
Plot 54. Conducted Spurious Emissions, 1050, 8 kHz, 30 MHz – 1 GHz



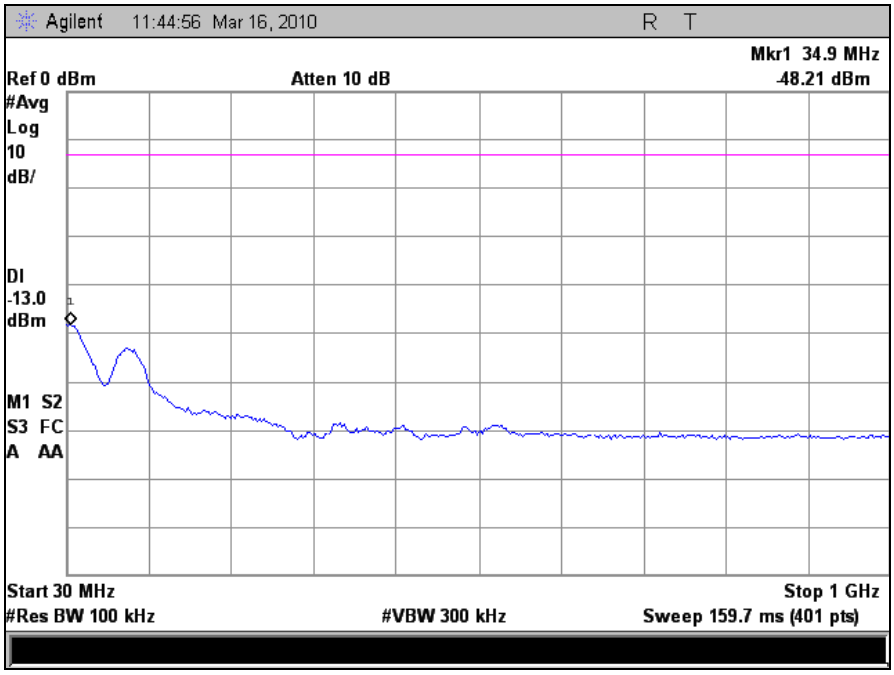
Plot 55. Conducted Spurious Emissions, 1050, 8 kHz, 1 GHz – 18 GHz



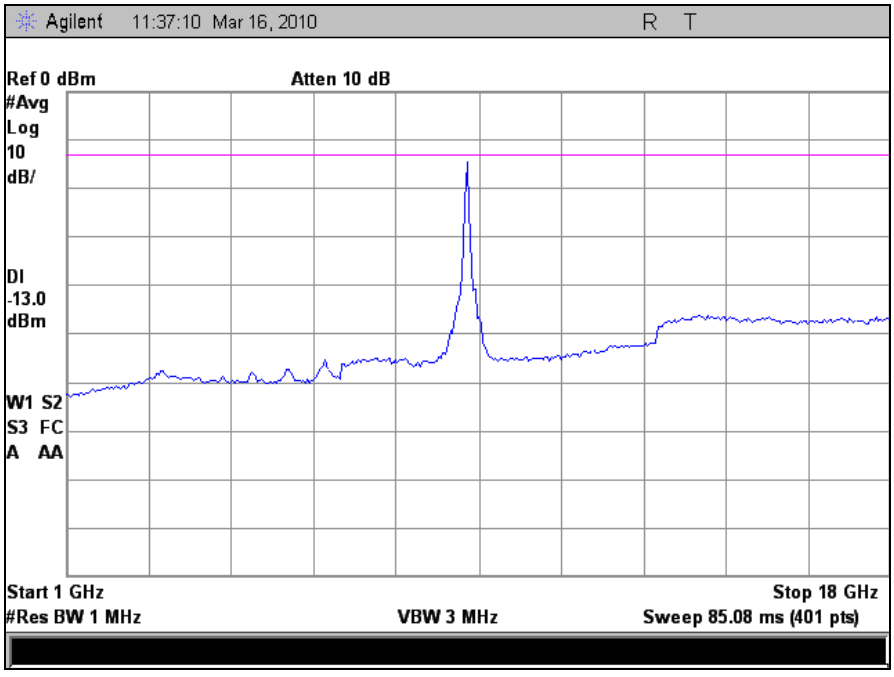
Plot 56. Conducted Spurious Emissions, 1050, 8 kHz, 18 GHz – 26.5 GHz



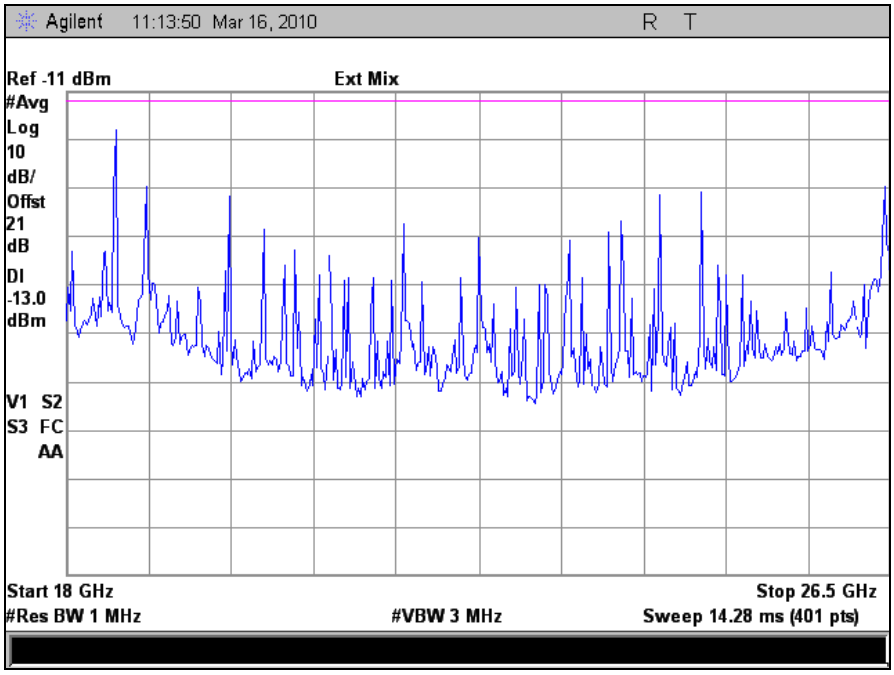
Plot 57. Conducted Spurious Emissions, 1050, 8 kHz, 26.5 GHz – 40 GHz



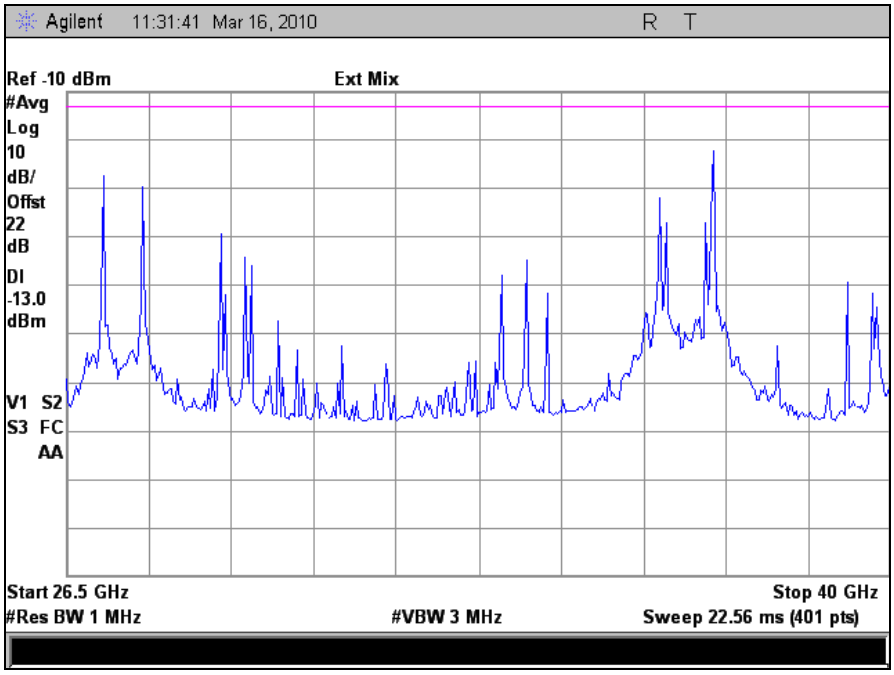
Plot 58. Conducted Spurious Emissions, 1050, 16 kHz, 30 MHz – 1 GHz



Plot 59. Conducted Spurious Emissions, 1050, 16 kHz, 1 GHz – 18 GHz



Plot 60. Conducted Spurious Emissions, 1050, 16 kHz, 18 GHz – 26.5 GHz



Plot 61. Conducted Spurious Emissions, 1050, 16 kHz, 26.5 GHz – 40 GHz

4.4. Emission Mask

Test Requirement(s): **§80.211(f) and §90.210(b) Emission Mask**

80.211(f) – The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:

1. On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;
2. On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and
3. On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus 10log(mean power in watts) dB.

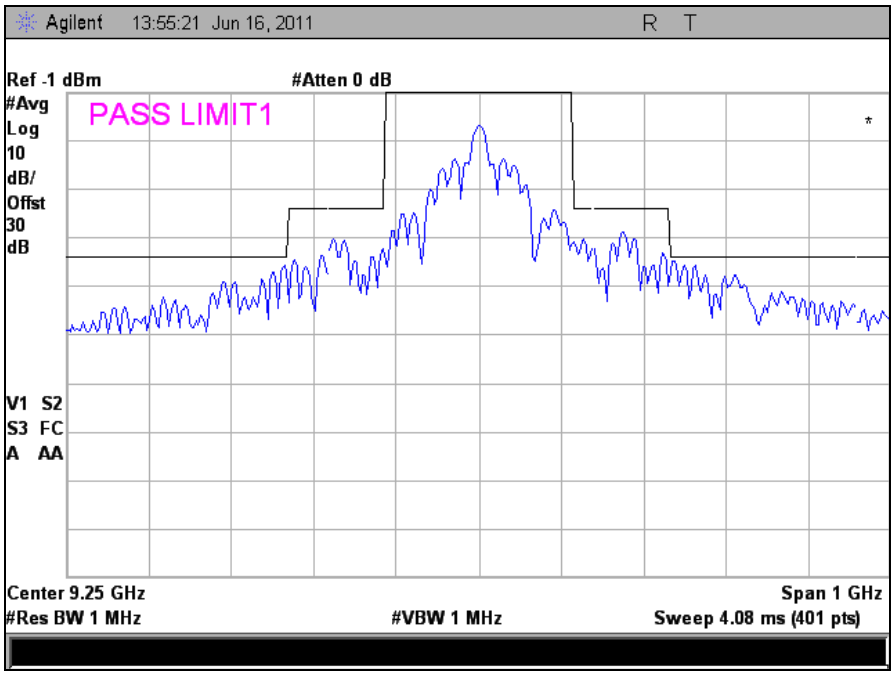
90.210 – Although the device does not have an audio low pass filter, mask B was used since mask C is for very narrowband applications and is not suited for radar devices operating above 9 GHz.

Test Procedures: A laptop was connected to EUT to control the RF power output, m and frequency channel. The EUT was connected through an attenuator to a Spectrum Analyzer. The measured highest Average Power was set relative to zero dB reference. The RBW of the Spectrum Analyzer was set to at least 1% of the channel bandwidth. The EUT power was adjusted at the maximum output power level.

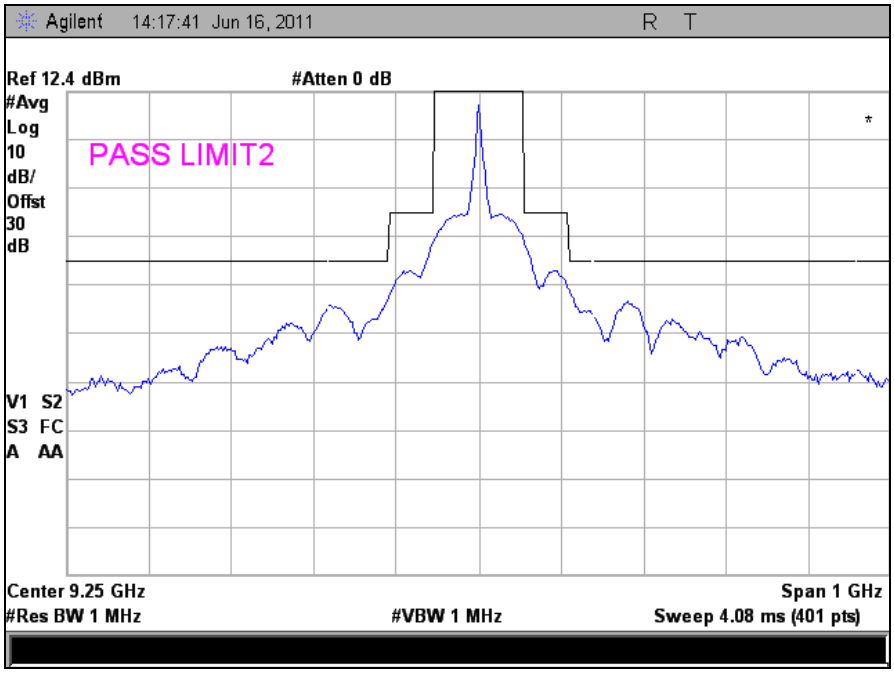
Test Results: The EUT was compliant with this requirement.

Test Engineer(s): Dusmantha Tennakoon

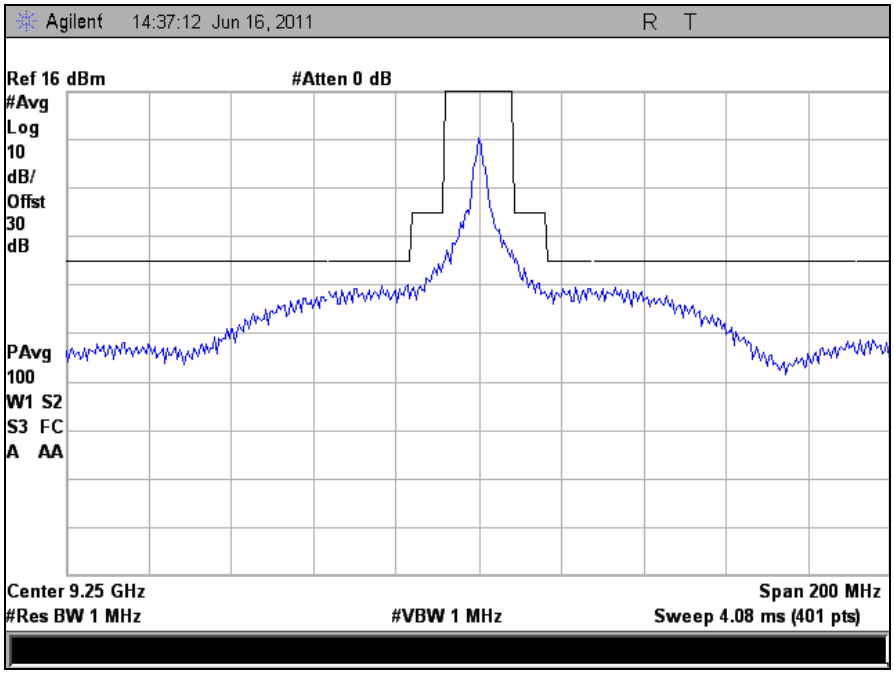
Test Date(s): 03/17/10 – 03/29/10



Plot 62. Emission Mask, 80ns, 4 kHz



Plot 63. Emission Mask, 519ns, 8 kHz



Plot 64. Emission Mask, 1050ns

4.5. Field Strength of Spurious 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".

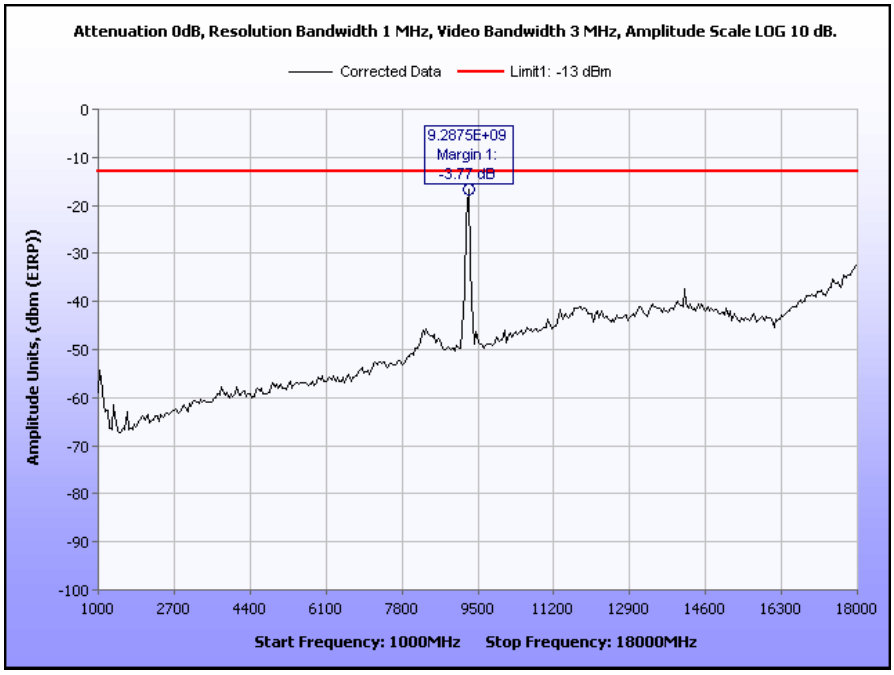
Radiated emission measurements were performed inside a 3 meter semi-anechoic chamber. The EUT was set at a distance of 3m from the receiving antenna. The EUT's RF ports were terminated to 50 ohm loads. The EUT was set to transmit at its maximum power level. The EUT was rotated about 360^0 and the receiving antenna scanned from 1-4m in order to capture the maximum emission. The transmitter was modulated using WCQPSK since that proved to be the highest power level.

Plots were captured and corrected for antenna correction factor and cable loss. The strength of the harmonics were measured using the antenna substitution method.

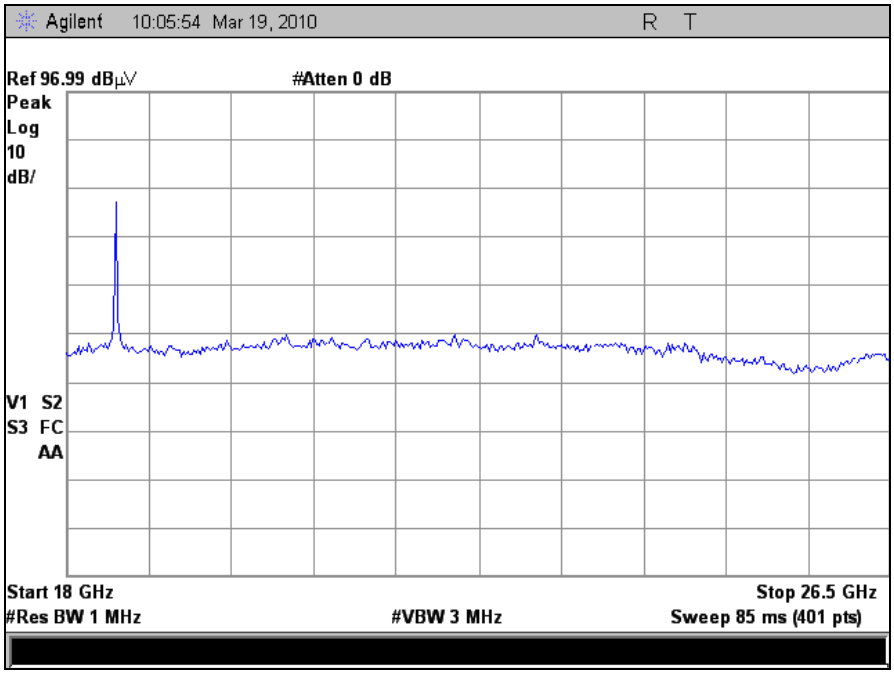
Test Results: The EUT was compliant with this requirement. See the following plots. The field strength of the 2^{nd} harmonic = 73.01 dBuV/m. The following equation was used to convert this to a EIRP number: EIRP = field strength – Preamp + ACF + 20log(D) – 104.8. The measurement was made at 1m and therefore the 20log(D) falls off.
EIRP = 73.01 – 17 + 33.92 – 104.8 = -14.87 dBm.
Measurements were only made on the highest output mode.

Test Engineer(s): Dusmantha Tennakoon

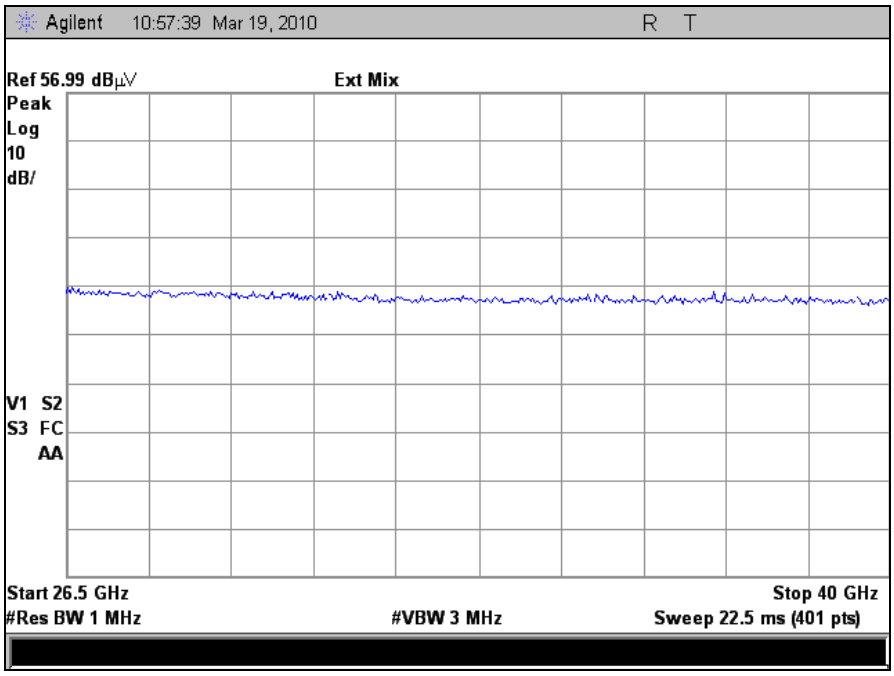
Test Date(s): 03/29/10



Plot 65. Field Strength of Spurious Emissions, 1 GHz – 18 GHz



Plot 66. Field Strength of Spurious Emissions, 18 GHz – 26.5 GHz



Plot 67. Field Strength of Spurious Emissions, Channel 26.5 GHz – 40 GHz

Photograph 3. Field Strength of Spurious Emissions, Test Setup

Electromagnetic Compatibility Radiated Emissions Requirements

4.6. 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 of the EUT.

The EUT was placed in an Environmental Chamber with all support equipments are outside of the chamber on a table. The EUT was set to transmitter an un-modulated carrier. The reference frequency at 20°C was observed and put on 'view' under Trace 1 of the Spectrum Analyzer. As temperature or voltage was varied, the drift in frequency was observed in Trace 2. The frequency error was measured using delta markers between Trace 1 and 2. The frequency drift was investigated for every 10°C increment until the unit was stabilized then recorded the reading in tabular format with the temperature range of -30 to 60°C.

Voltage supplied to the EUT was 120 VAC reference temperature was at 20°C. The voltage was varied by ± 15 % of nominal

Test Results: Equipment complies with Section 2.1055 and 90.213. No drift was recorded.

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 03/29/10

Frequency Stability Test Results

Temperature (centigrade)	Drift (ppm)
50	< 1ppm
40	< 1ppm
30	< 1ppm
20	< 1ppm
10	< 1ppm
0	< 1ppm
-10	< 1ppm
-20	< 1ppm
-30	< 1ppm

Voltage variation

Voltage (VAC)	Drift (ppm)
102	< 1ppm
138	< 1ppm

Table 10. Frequency Stability, Test Results

Photograph 4. Frequency Stability, Test Setup

Electromagnetic Compatibility Radiated Emissions Requirements

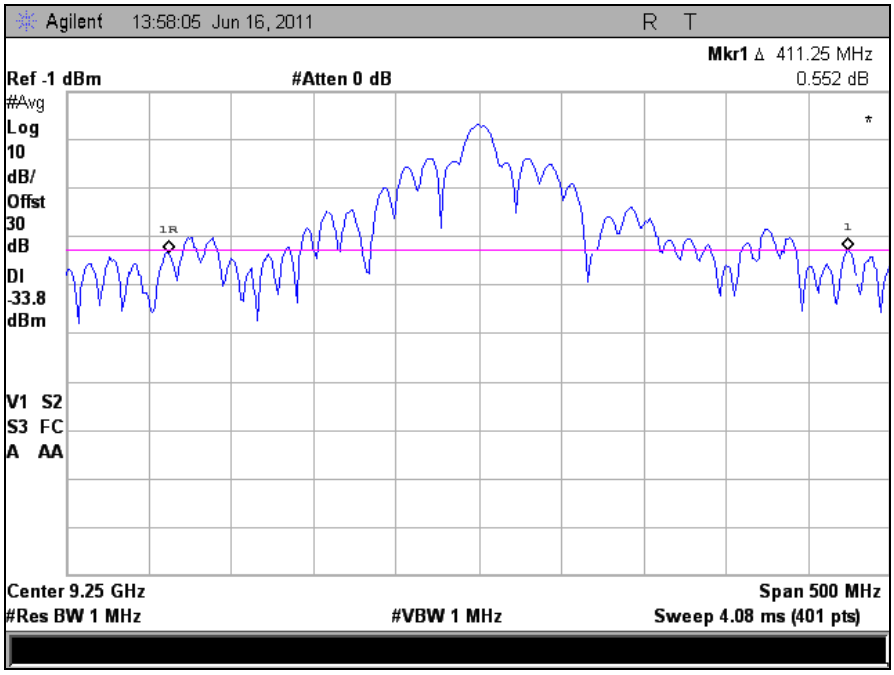
4.7. Occupied Bandwidth

Test Requirement(s): **§2.1049**

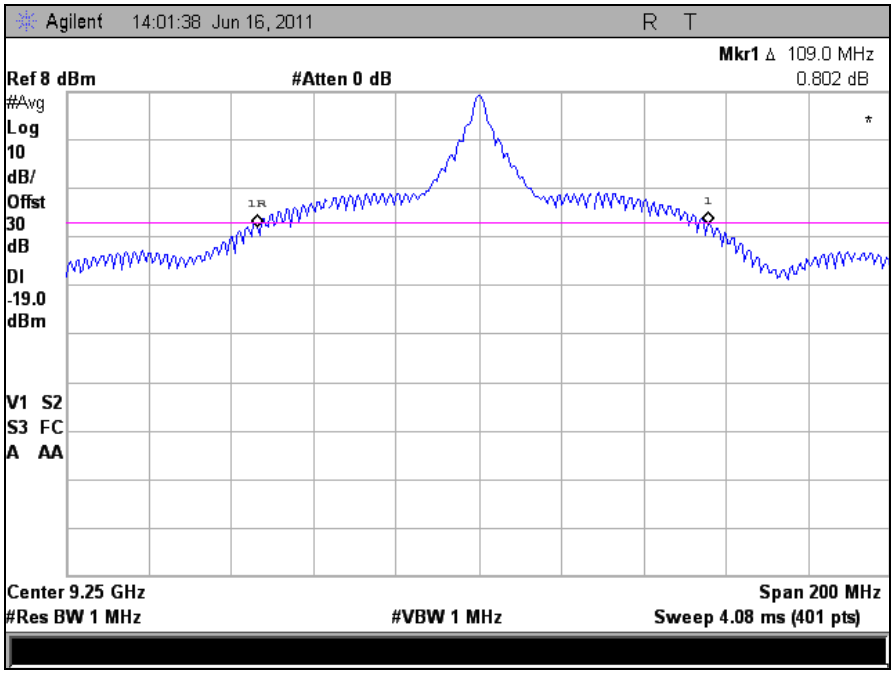
Test Results: Equipment complies with Section 2.1049

Test Engineer(s): Dusmantha Tennakoon

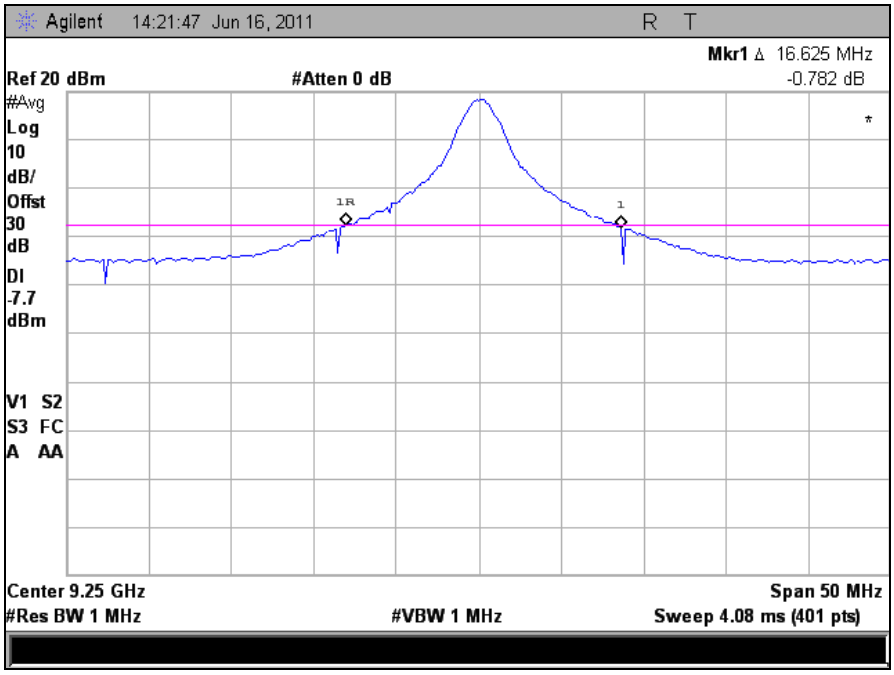
Test Date(s): 03/29/10



Plot 68. Occupied Bandwidth, 80ns



Plot 69. Occupied Bandwidth, 519ns



Plot 70. Occupied Bandwidth, 1050ns

5. Test Equipment

5. Test Equipment

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

MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
2T5915	TEMPERATURE CHAMBER/ ALARM/ CONTROLLER	ENVIROTRONICS	F-70-2-30/ TEMP SENTRY 0120011/ SYSTEMS PLUS 386 (T)	09/27/2009	11/27/2010
1T4601	TRUE RMS MULTIMETER	FLUKE	87V	11/13/2009	11/13/2010
1T4612	ESA-E SERIES SPECTRUM ANALYZER	AGILENT	E4407B	09/09/2009	09/09/2010
1T4492	AC POWER SUPPLY	CALIFORNIA INSTRUMENTS	1501TC	SEE NOTE	
1T4378	ARBITRARY WAVEFORM GENERATOR	AGILENT	33120A	SEE NOTE	
1T4300	SEMI-ANECHOIC CHAMBER	EMC TEST SYSTEMS	NONE	8/23/2010	8/23/2013
1T2511	HORN ANTENNA	EMCO	3115	7/29/2009	7/29/2010
1S2109	SPECTRUM ANALYZER	HP	8546A	1/7/2011	1/7/2012

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

6. 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

