MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
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August 6, 2014

Fluidmesh Networks
1359 Barclay Blvd.
Buffalo Grove, Illinois 60089

Dear Alessandro Erta,

Enclosed is the EMC Wireless test report for compliance testing of the Fluidmesh Networks, FM1200V as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 90 Subpart Y for Land Mobile Radio Services and RSS-111, Issue 4, January 2012.

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: (\Fluidmesh Networks\EMC40369-FCC90Y Rev. 3)

Electromagnetic Compatibility Criteria
Test Report

for the

Fluidmesh Networks
FM1200V

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Part 90, Subpart Y
for Private Land Mobile Radio Services
and
RSS-111, Issue 4, January 2012

MET Report: EMC40369-FCC90Y Rev. 3

August 6, 2014

Prepared For:

Fluidmesh Networks
1359 Barclay Blvd.
Buffalo Grove, Illinois 60089

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

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for Private Land Mobile Radio Services
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RSS-111, Issue 4, January 2012

Surinder Singh, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Warnell
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 90, Subpart Y of the FCC Rules and Industry Canada standard RSS-111, Issue 4, January 2012 under normal use and maintenance.

Asad Bajwa,
Director, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	February 10, 2014	Initial Issue.
1	June 26, 2014	RF Exposure Section Added to the Report
2	June 27, 2014	Corrections Made to Report During TCB Application Process
3	August 6, 2014	Radiated Spurious Emission Mask L Plots Updated

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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

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Fluidmesh Networks FM1200V, with the requirements of Part 90Y. 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 FM1200V. Fluidmesh Networks should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the FM1200V, has been **permanently** discontinued.

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 90Y, in accordance with Fluidmesh Networks, purchase order number 4. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference 47 CFR Part 90Y	IC Reference RSS-111, Issue 4, January 2012	Description	Compliance
Title 47 of the CFR, Part 15 §15.207(a)	RSS-GEN (7.2.4)	Conducted Emission Limits	Compliant
Title 47 of the CFR, Part 15 §15.209	RSS-210(A8.5)	Radiated Spurious Emissions Requirements	Compliant
Title 47 of the CFR, Part 90 §2.1049; §90.210(M)	RSS-111, Section 5.3	Emission Bandwidth	Compliant
Title 47 of the CFR, Part 90 §2.1046; §90.1215(a)	RSS-111, Section 5.3	Peak Power Output	Compliant
Title 47 of the CFR, Part 90 §2.1046; §90.1215(a)	RSS-111, Section 4.2	Peak Power Spectral Density	Compliant
Title 47 of the CFR, Part 90 §§90.210(l)	RSS-111, Section 5.4	Emission Mask and Conducted Spurious Emissions	Compliant
Title 47 of the CFR, Part 90 §2.1055(a)(1) (d)(2); §90.213	RSS-111, Section 5.2	Frequency Stability	Compliant
Title 47 of the CFR, Part 90 §§90.1215(e)	NA	Peak Excursion	Compliant
Title 47 of the CFR, Part 90 §90.1215(a)	RSS-Gen(5.6)	Maximum Permissible Exposure (MPE)	Compliant

Table 1. Executive Summary of EMC Part 15.247 ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Fluidmesh Networks to perform testing on the FM1200V, under Fluidmesh Networks's purchase order number 4.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Fluidmesh Networks, FM1200V.

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

Model(s) Tested:	FM1200V	
Model(s) Covered:	FM1200V	
EUT Specifications:	Primary Power: 120 VAC, 60 Hz	
	FCC ID: R5S-VOLO IC: 10745A-FV	
	Type of Modulations:	BPSK/QPSK/16-QAM/64-QAM
	Equipment Code:	TNB
	Peak RF Output Power:	16.46dBm
	EUT Frequency Ranges:	4945 – 4985 MHz (10 MHz channels) 4950 – 4980 MHz (20 MHz channels)
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:	Surinder Singh	
Report Date(s):	August 6, 2014	

Table 2. EUT Summary Table

B. References

CFR 47, Part 90 Subpart Y	Regulations Governing Licensing and Use of Frequencies in the 4940 – 4990 MHz Band
RSS-111, Issue 4, Jan. 2012	Broadband Public Safety Equipment Operating in the Band 4940 – 4990 MHz
RSS-GEN, Issue 3, Dec. 2010	General Requirements and Information for the Certification of Radio Apparatus
ANSI C63.4:2003	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ISO/IEC 17025:2005	General Requirements for the Competence of Testing and Calibration Laboratories

Table 3. References

C. Test Site

All testing was performed at MET Laboratories, Inc., 914 W. Patapsco Ave., Baltimore, MD 21230. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a 3 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

D. Description of Test Sample

The Fluidmesh Networks FM1200V, Equipment Under Test (EUT), is an WiFi AP with built-in 4.9GHz & 5GHz WLAN transceiver.

Photograph 1. Fluidmesh Networks FM1200V

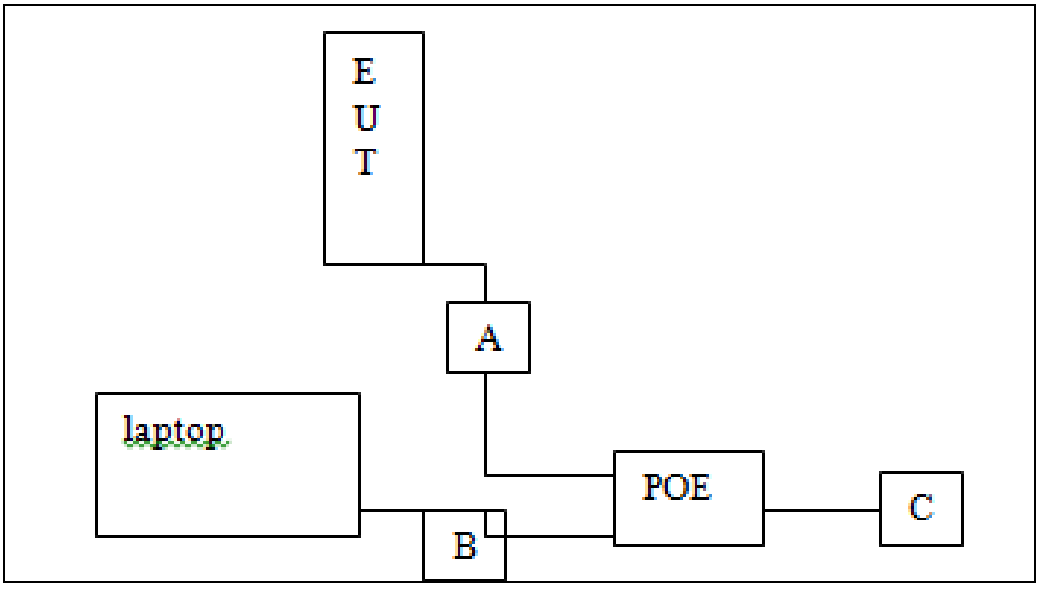


Figure 1. Block Diagram of Test Configuration

E. 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 is included in the following list.

Ref. ID	Name / Description	Model Number	Part Number	Serial Number	Revision
NA	FM1200V	NA	NA	NA	NA

Table 4. Equipment Configuration

F. Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

Ref. ID	Name / Description	Manufacturer	Model Number
NA	PoE Adapter	NA	NA
NA	Notebook PC	NA	NA

Table 5. Support Equipment

G. Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Point
A	POE	Ethernet	1	NA	Y	NA
B	LAN	Ethernet	1	NA	Y	NA
C	NA	Power Cord	1	NA	N	NA

Table 6. Ports and Cabling Information

H. Mode of Operation

Refer to FM1200V Continuous transmission manual.pdf.
Modulations: BPSK, QPSK, 16-QAM, 64-QAM.
Data Rates: 20MHz/40MHz.

I. Modifications

a) Modifications to EUT

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

J. Disposition of EUT

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

III. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.207(a) Conducted Emissions Limits

Test Requirement(s): **§ 15.207 (a):** For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 Σ line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency range (MHz)	§ 15.207(a), Conducted Limit (dBμV)	
	Quasi-Peak	Average
* 0.15- 0.45	66 - 56	56 - 46
0.45 - 0.5	56	46
0.5 - 30	60	50

Table 7. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

Test Procedure: The EUT was placed on a 0.8 m-high wooden table inside a screen room. The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a 50 Ω/50 μH Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.4-2003 "Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz"*. The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω/50 μH LISN as the input transducer to an EMC/field intensity meter. For the purpose of this testing, the transmitter was turned on. Scans were performed with the transmitter on.

Test Results: The EUT was compliant with this requirement. Measured emissions were below applicable limits.

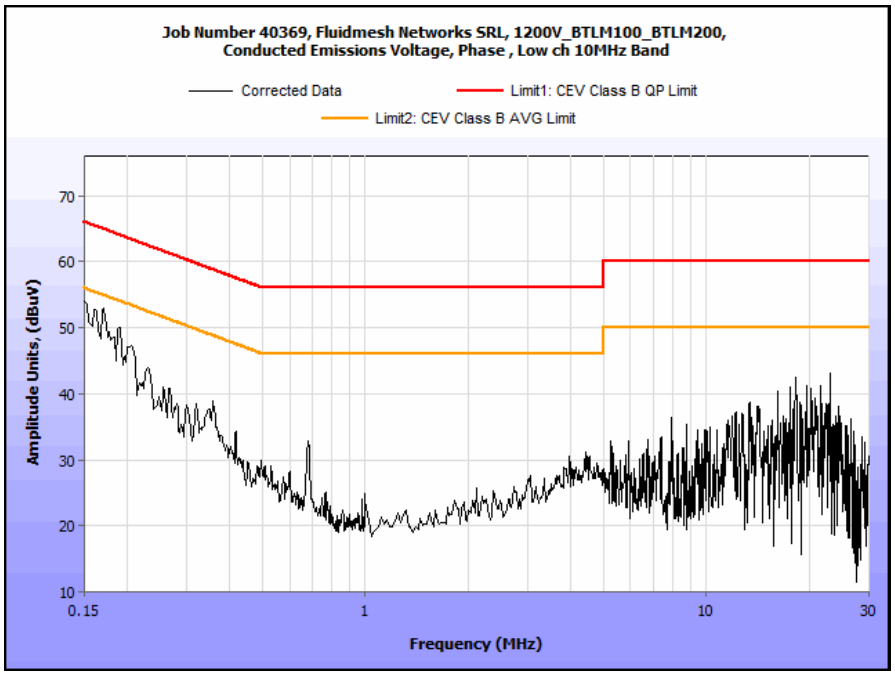
Test Engineer(s): Surinder Singh

Test Date(s): 01/03/14

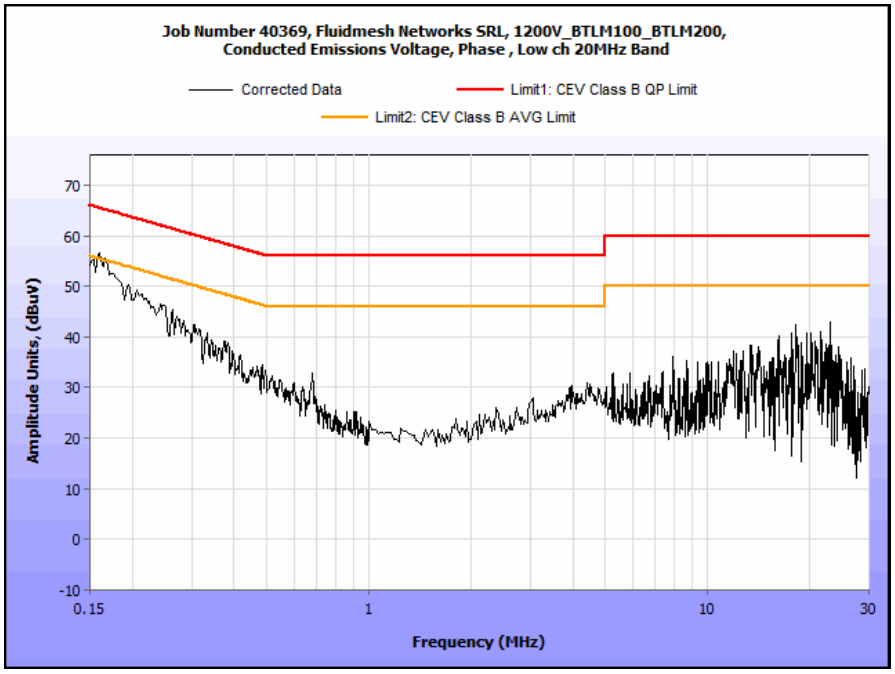
20MHz Band								
Quasi Peak and Average measurement for data point that were failing during Pre-Scan of Conducted Emission Test								
Line	**Device Channel/Mode**	**Frequency(MHz)**	**Quasi Peak**	**Average Peak**	**Quasi Peak Limit**	**Average Peak Limit**	**Margin QP**	**Margin Avg.**
Phase	Low	0.17	27.34	17.38	64.96	54.96	-37.62	-37.58
Phase	Mid	0.16	24.92	13.93	65.46	55.46	-40.54	-41.53
Phase	High	0.18	21.39	14.78	64.49	54.49	-43.1	-39.71
Neutral	Low	0.16	18.27	12.84	65.46	55.46	-47.19	-42.62
Neutral	Mid	0.16	23.45	13.88	65.46	55.46	-42.01	-41.58
Neutral	High	0.16	22.19	11.98	65.46	55.46	-43.27	-43.48

Table 8. Conducted Emissions, Test Results

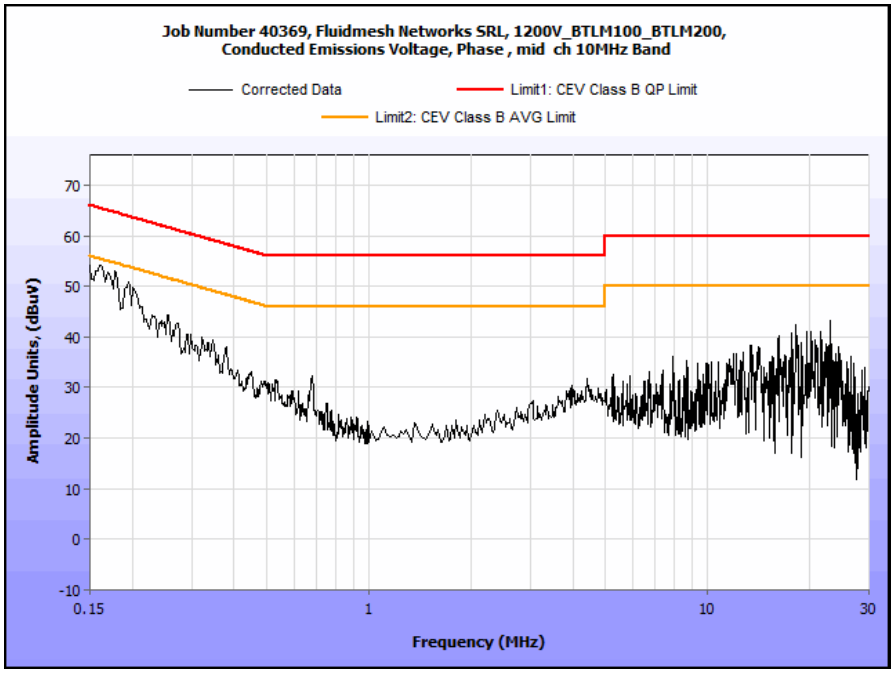
15.207(a) Conducted Emissions Test Results



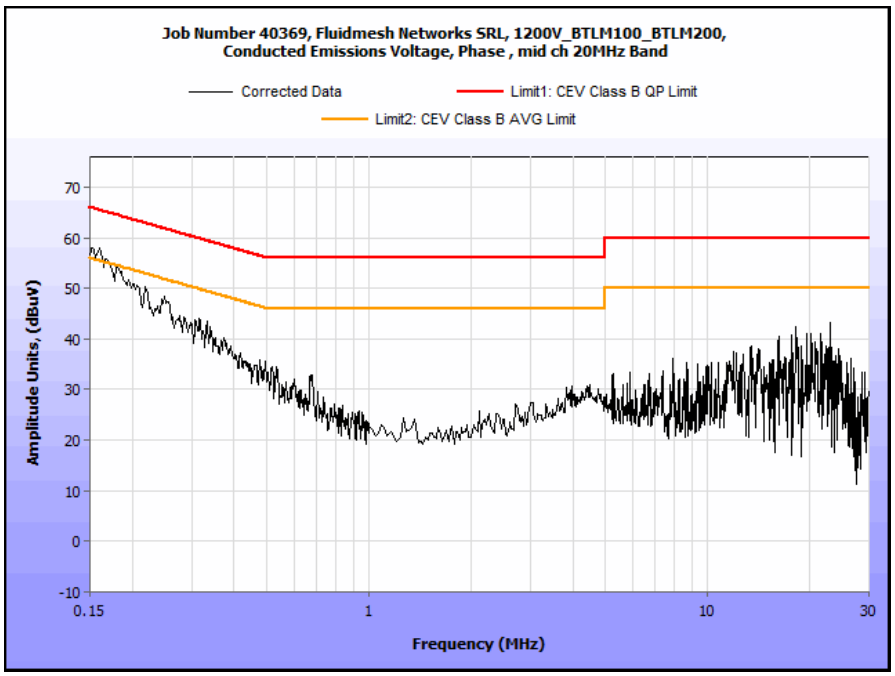
Plot 1. Conducted Emissions, Low Channel, 10 MHz, Phase Line



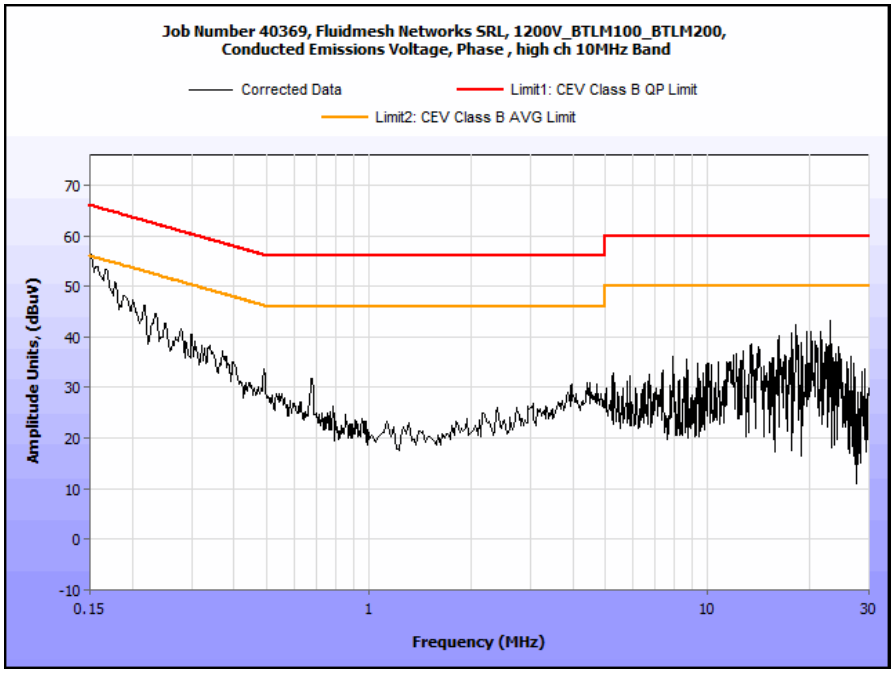
Plot 2. Conducted Emissions, Low Channel, 20 MHz, Phase Line



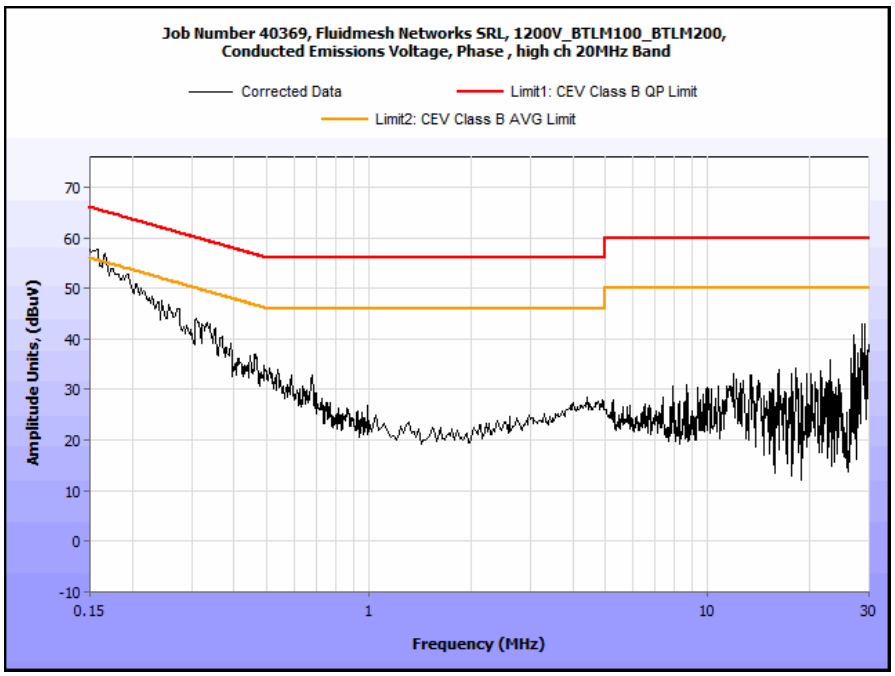
Plot 3. Conducted Emissions, Mid Channel, 10 MHz, Phase Line



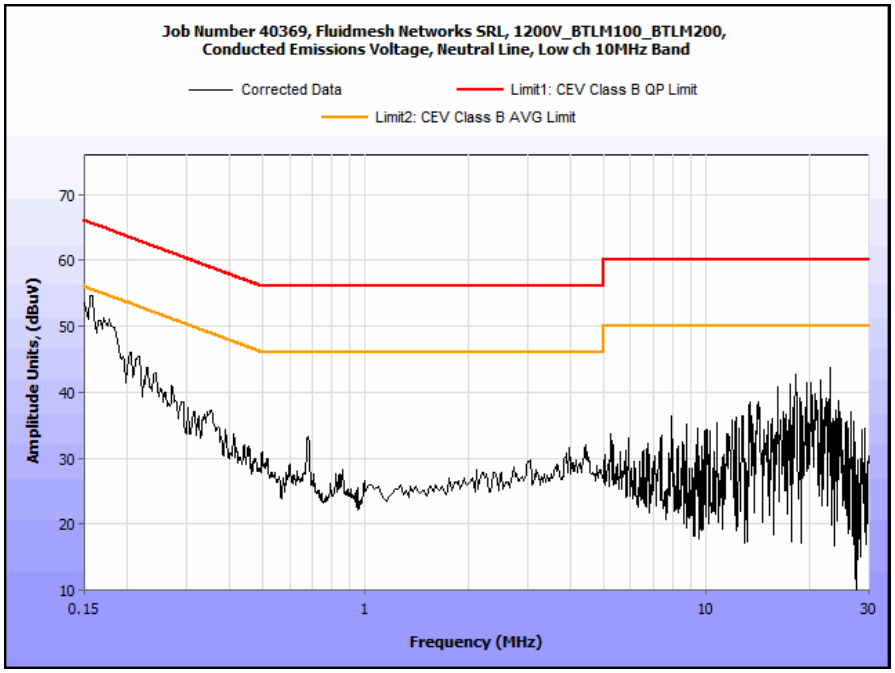
Plot 4. Conducted Emissions, Mid Channel, 20 MHz, Phase Line



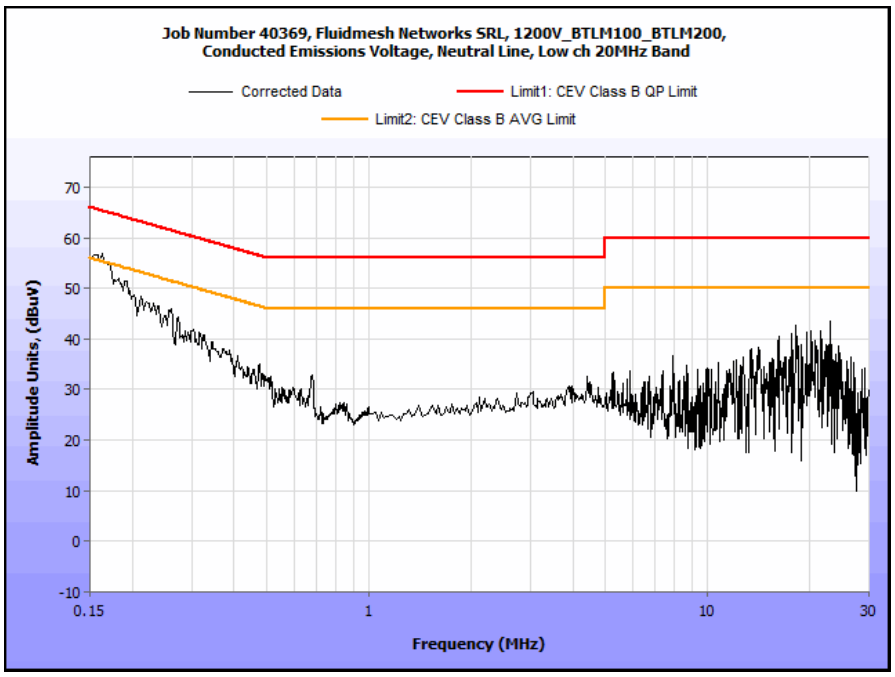
Plot 5. Conducted Emissions, High Channel, 10 MHz, Phase Line



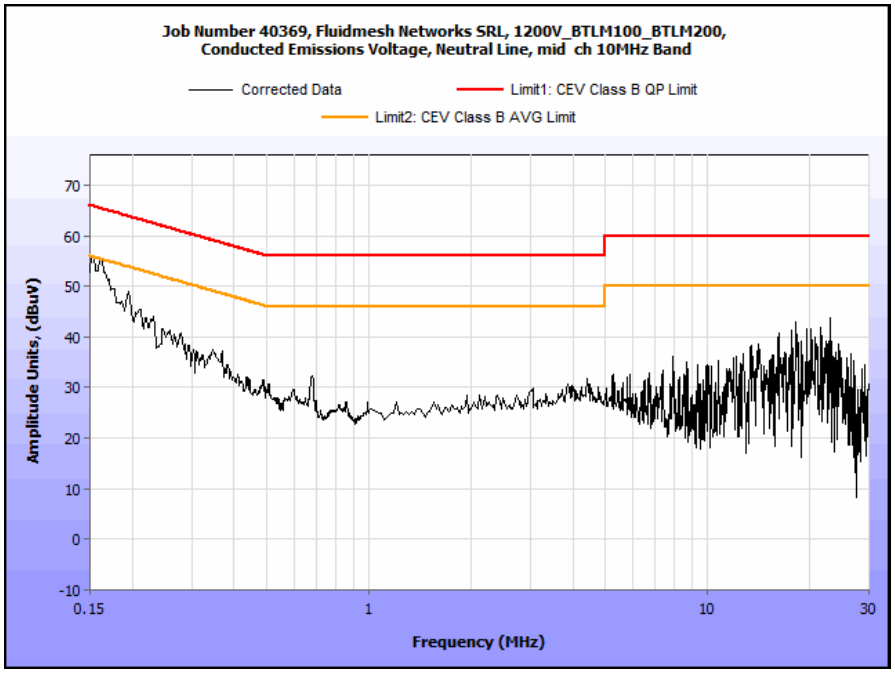
Plot 6. Conducted Emissions, High Channel, 20 MHz, Phase Line



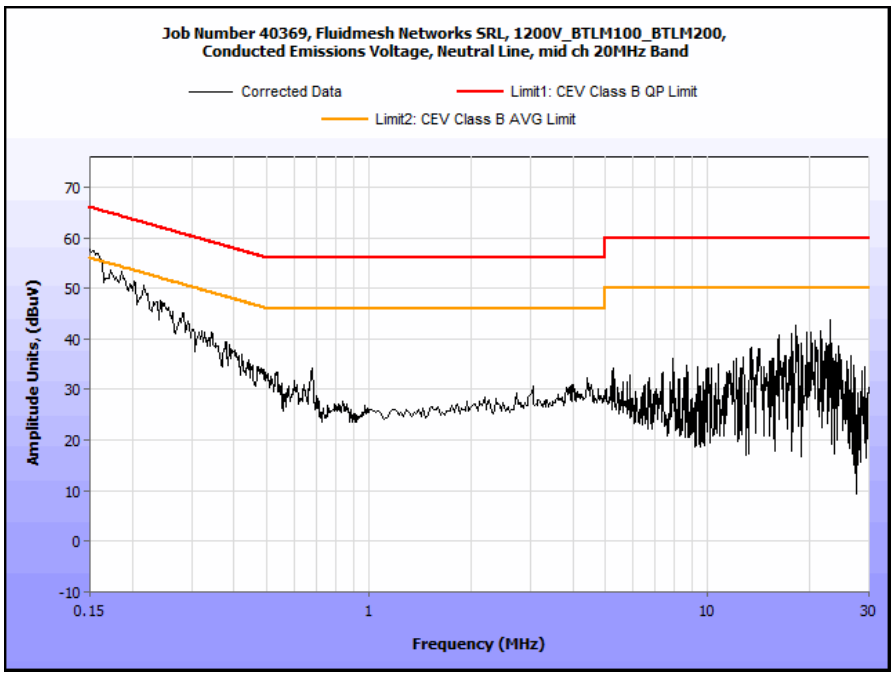
Plot 7. Conducted Emissions, Low Channel, 10 MHz, Neutral Line



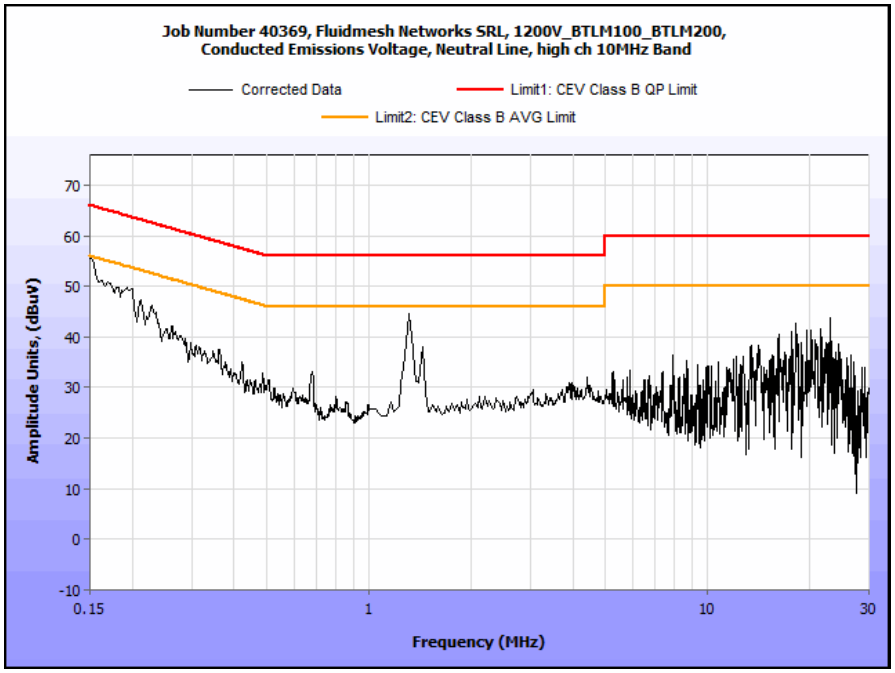
Plot 8. Conducted Emissions, Low Channel, 20 MHz, Neutral Line



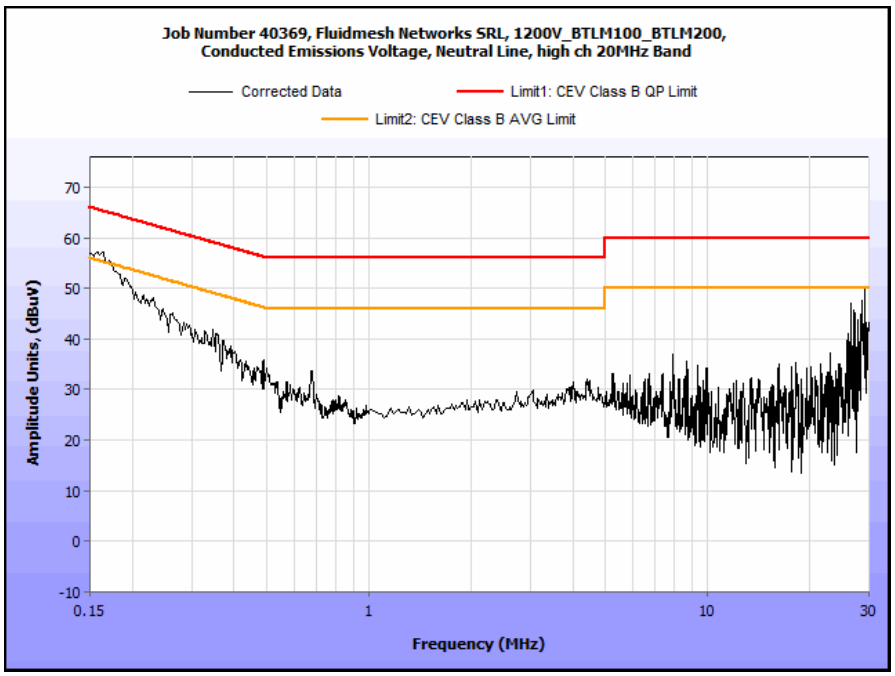
Plot 9. Conducted Emissions, Mid Channel, 10 MHz, Neutral Line



Plot 10. Conducted Emissions, Mid Channel, 20 MHz, Neutral Line

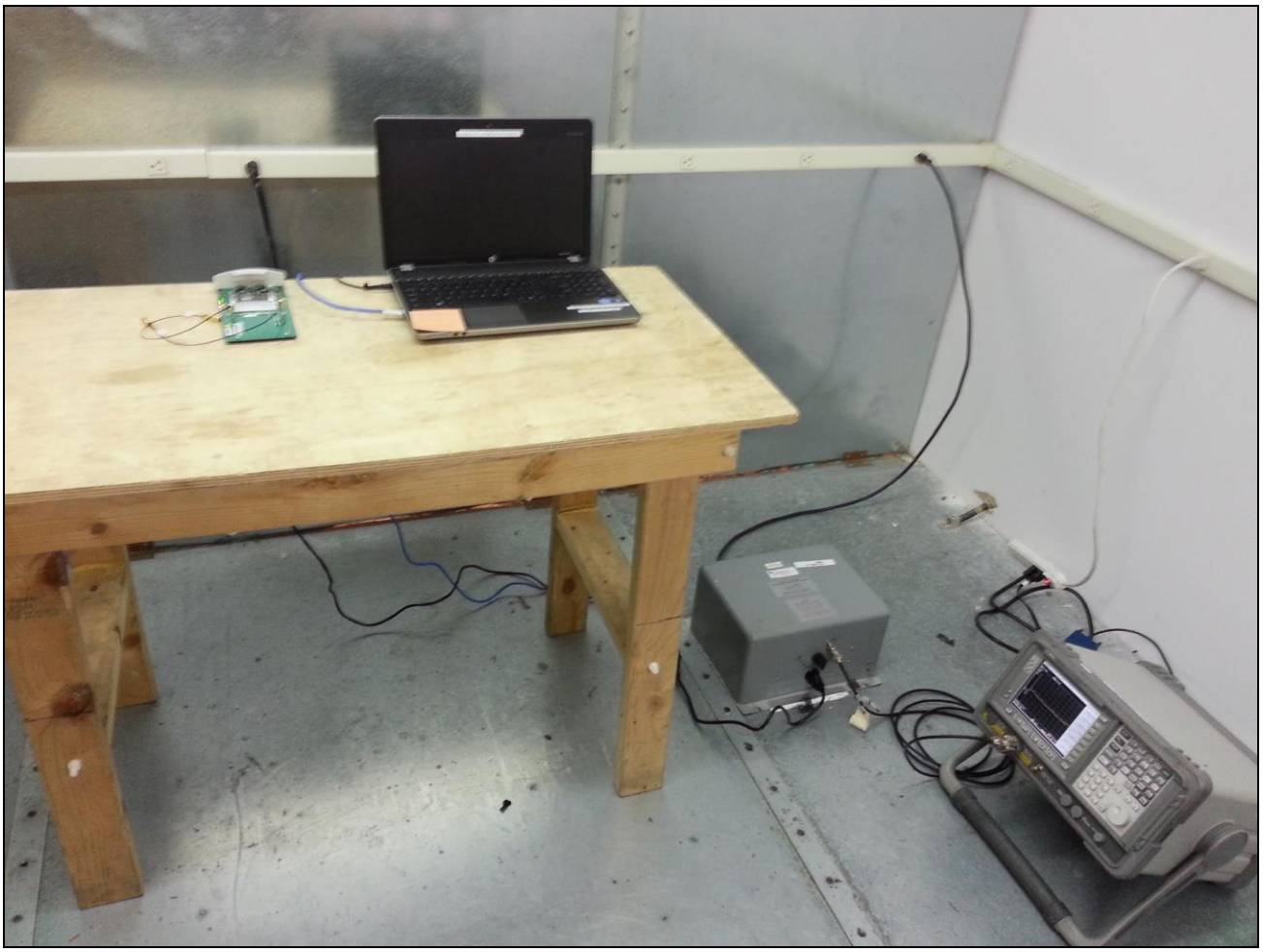


Plot 11. Conducted Emissions, High Channel, 10 MHz, Neutral Line



Plot 12. Conducted Emissions, High Channel, 20 MHz, Neutral Line

15.207(a) Conducted Emissions Test Setup Photo



Photograph 2. Conducted Emissions, Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

§90.210 Radiated Spurious Emissions Mask L

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-A-2001 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards".

Radiated emission measurements were performed inside a 3 meter semi-anechoic chamber. The EUT 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 the low, mid and high 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. A calibrated antenna source was positioned in place of the EUT and the previously recorded signal was duplicated. The maximum EIRP of the emission was calculated by adding the forward power to the calibrated source plus its appropriate gain value. 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.

As per section 90.210, limit was calculated based upon the transmitter power within each band i.e. radiated emission outside 150% of Band shall be attenuated by 40dB below the peak EIRP value. Lowest power channel was selected in order to get one stringent limit applicable to low, mid and high channel. Antenna port was terminated with 50OHm load.

Lowest conducted power in 10MHz Band (P 10MHz) = 13.65dBm
Lowest conducted power in 20MHz Band (P 20MHz) = 16.28dBm

Electric Field strength (10MHz Band) @ 1 meter = (P 10MHz)+Antenna Gain (dBi) +104.77
Electric Field strength (20MHz Band) @ 1 meter = (P 20MHz)+ Antenna Gain (dBi) +104.77
(P 10MHz) = 13.65dBm, (P 20MHz) = 16.28dBm, Antenna Gain=12 dBi
Electric Field strength (10MHz Band) @ 1 meter = 130.42 dBuV/m
Electric Field strength (20MHz Band) @ 1 meter = 133.05 dBuV/m

Limit 10MHz Band shall be attenuated by 40dB from Electric Field strength (10MHz Band) value= 130.42-40 = 90.42dBuV/m
Limit 20MHz Band shall be attenuated by 40dB from Electric Field strength (20MHz Band) value= 133.05-40 = 93.05dBuV/m

Note: Signal substitution was not performed due to the fact that only noise floor was detected from 30 MHz – 18 GHz.

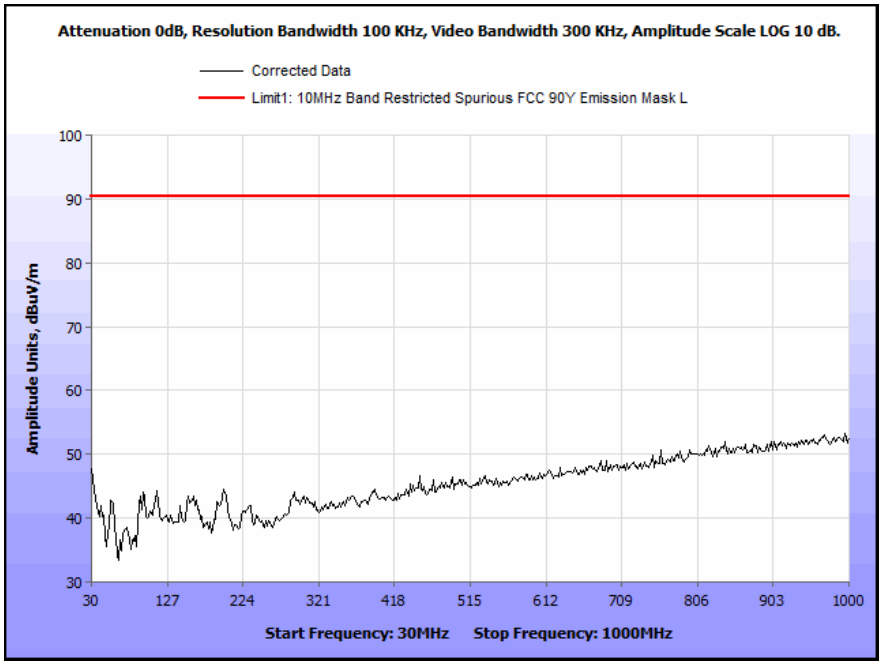
Note: Only noise floor was measurable above 18GHz.

Test Results: Equipment is compliant with Section 2.1053 and 90.210.

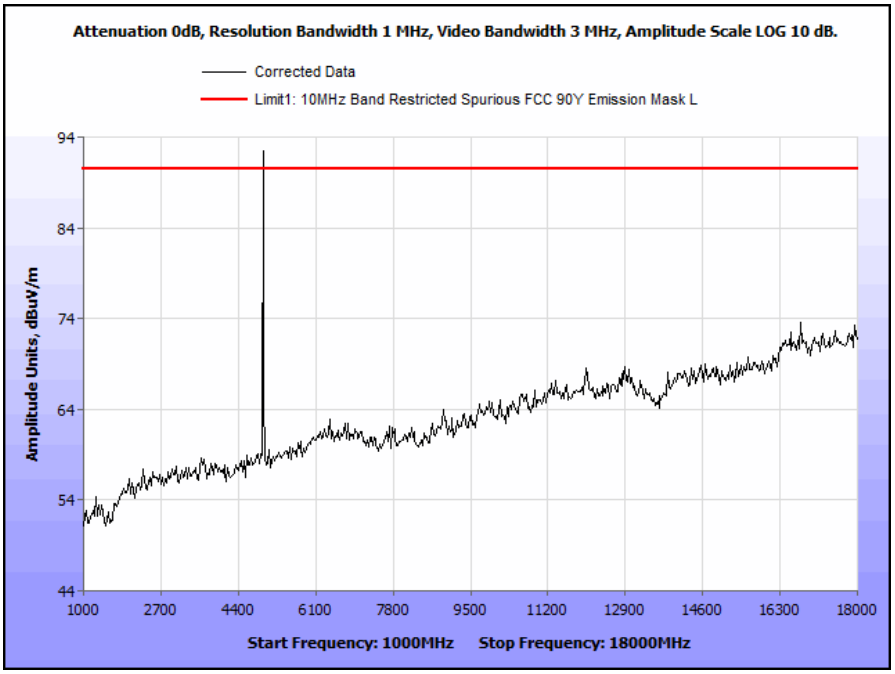
Test Engineer(s): Surinder Singh

Test Date(s): 01/02/14

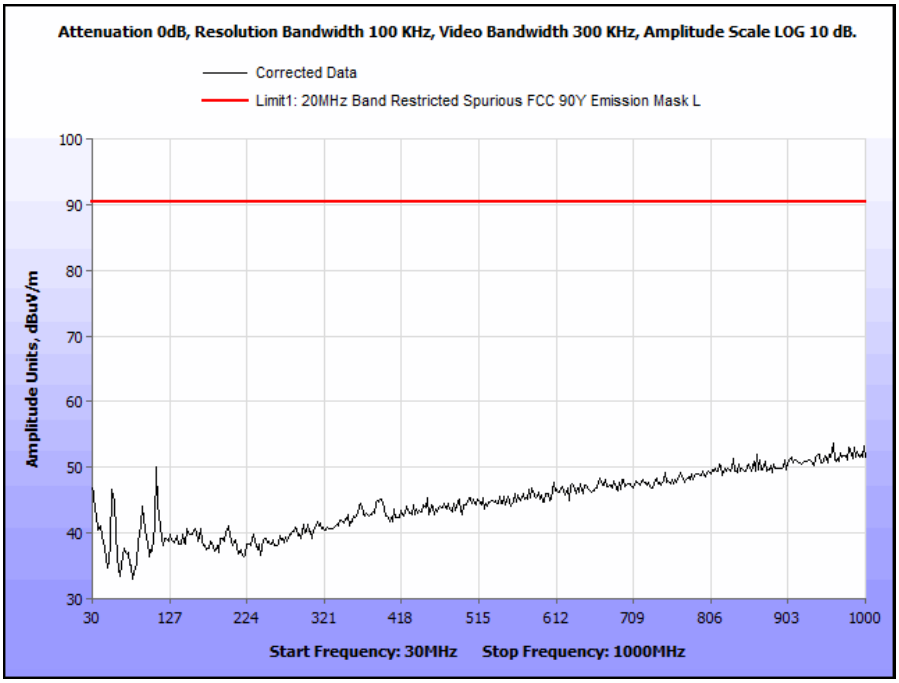
Radiated Spurious Emissions Test Results



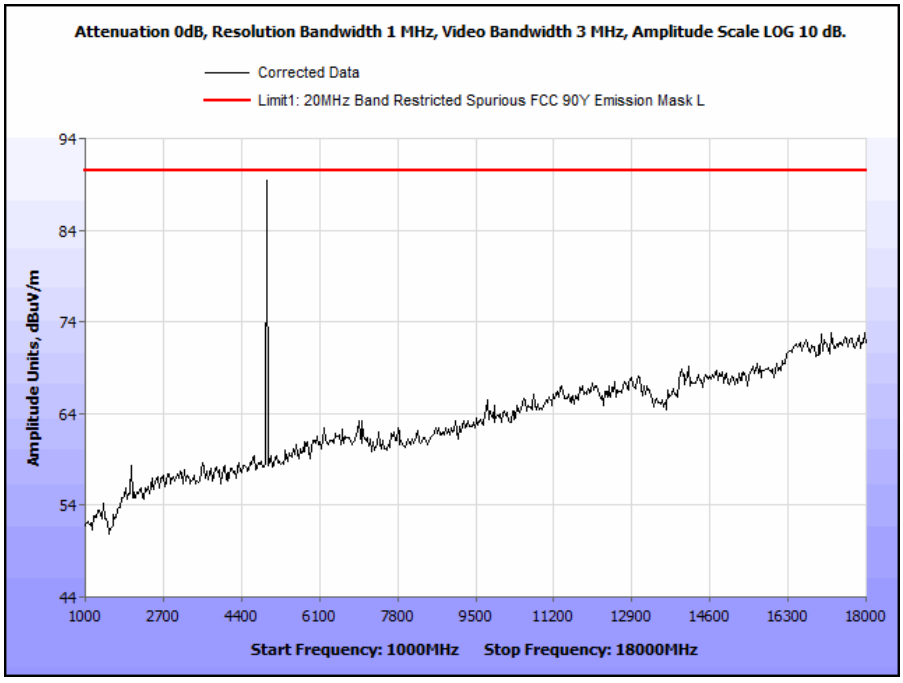
Plot 13. Radiated Spurious Emissions, Low Channel, 10 MHz, 30 MHz – 1 GHz



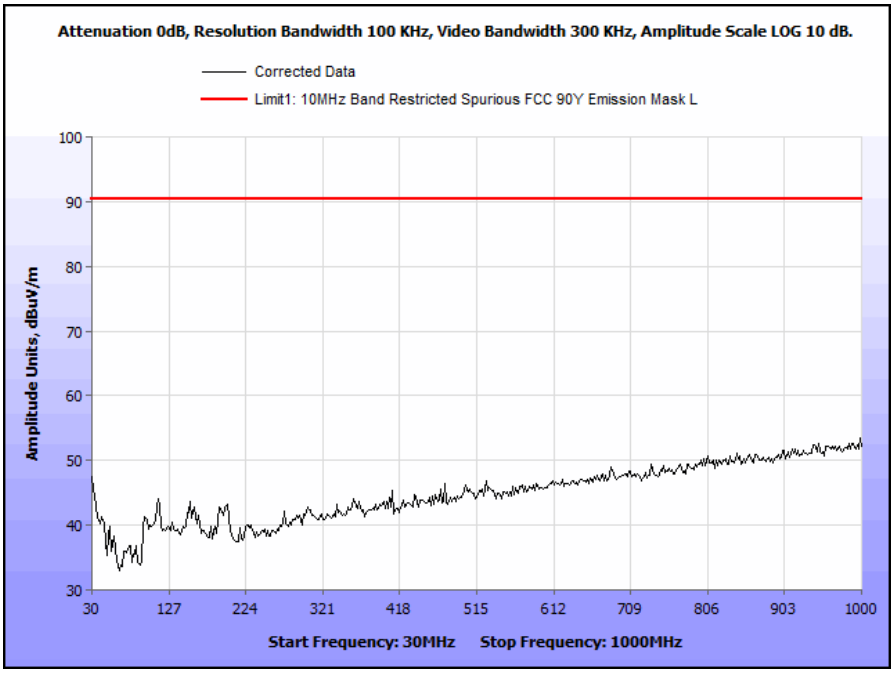
Plot 14. Radiated Spurious Emissions, Low Channel, 10 MHz, 1 GHz – 18 GHz



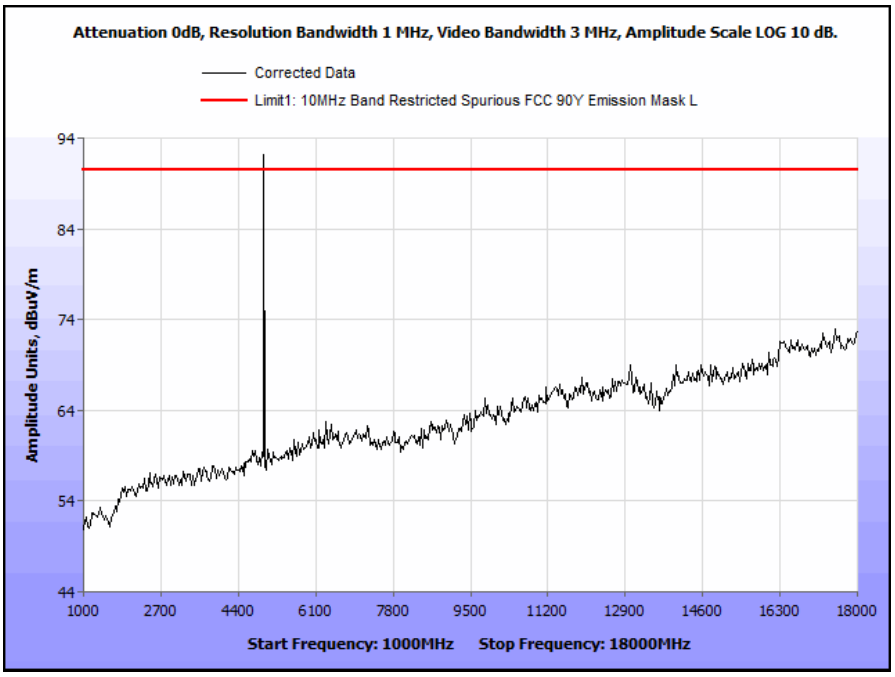
Plot 15. Radiated Spurious Emissions, Low Channel, 20 MHz, 30 MHz – 1 GHz



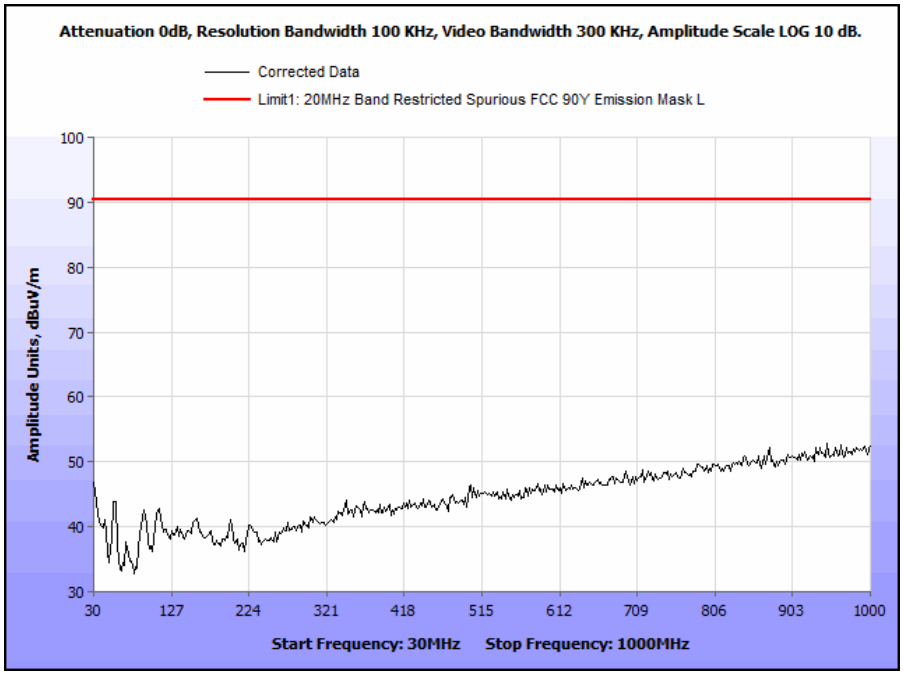
Plot 16. Radiated Spurious Emissions, Low Channel, 20 MHz, 1 GHz – 18 GHz



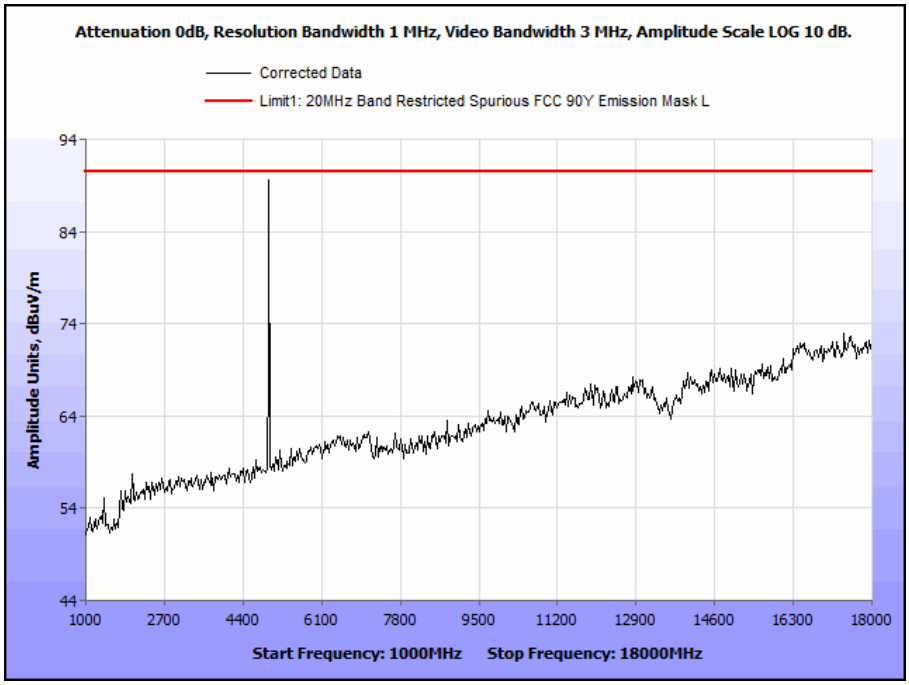
Plot 17. Radiated Spurious Emissions, Mid Channel, 10 MHz, 30 MHz – 1 GHz



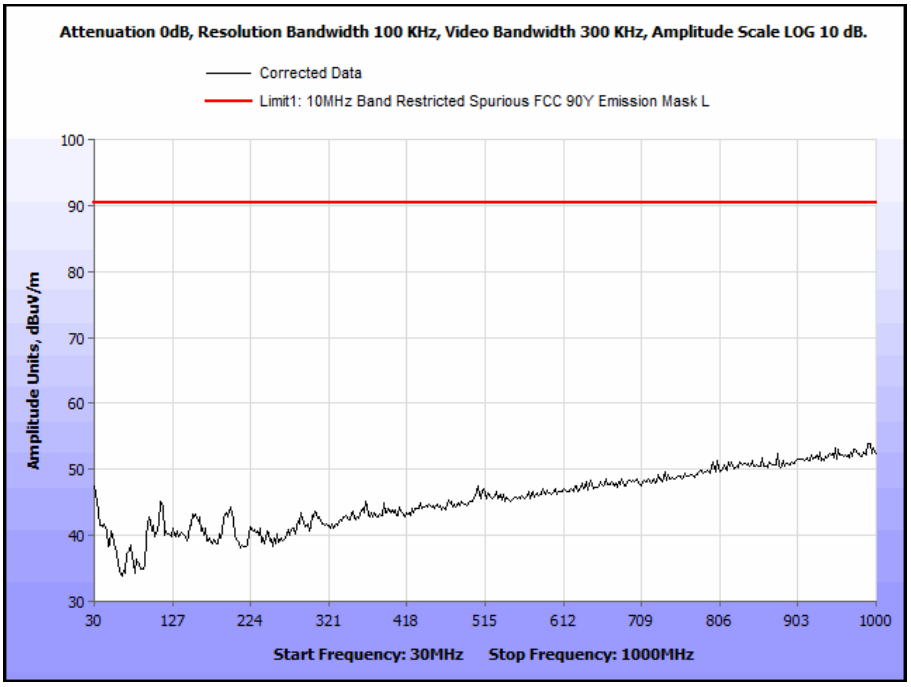
Plot 18. Radiated Spurious Emissions, Mid Channel, 10 MHz, 1 GHz – 18 GHz



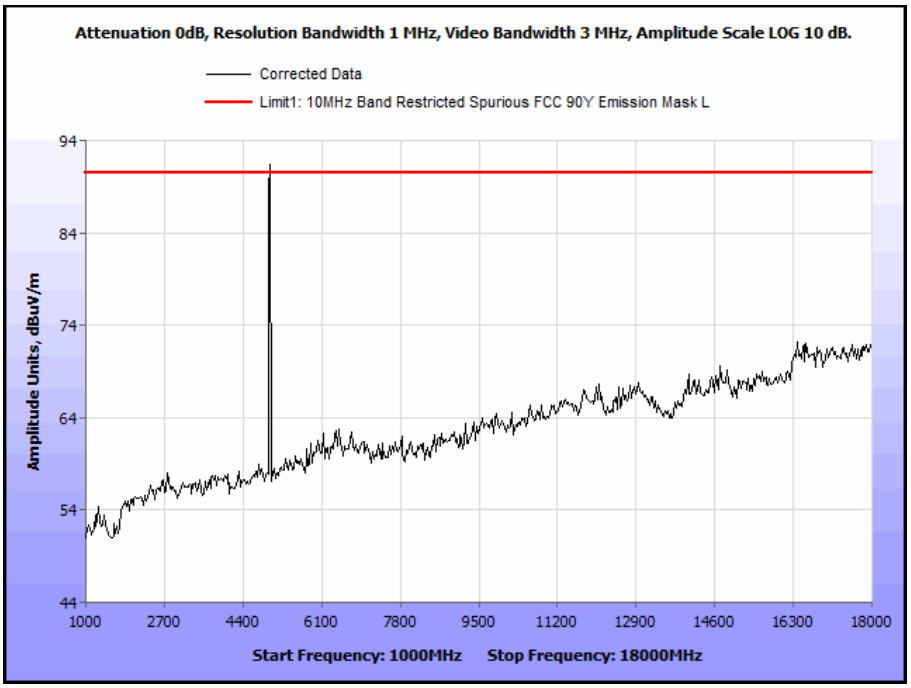
Plot 19. Radiated Spurious Emissions, Mid Channel, 20 MHz, 30 MHz – 1 GHz



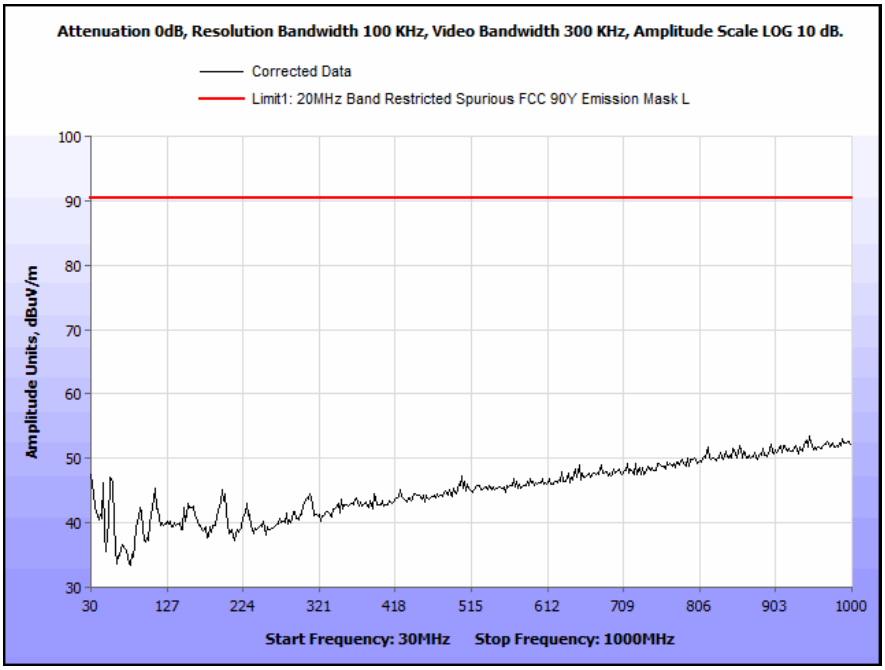
Plot 20. Radiated Spurious Emissions, Mid Channel, 20 MHz, 1 GHz – 18 GHz



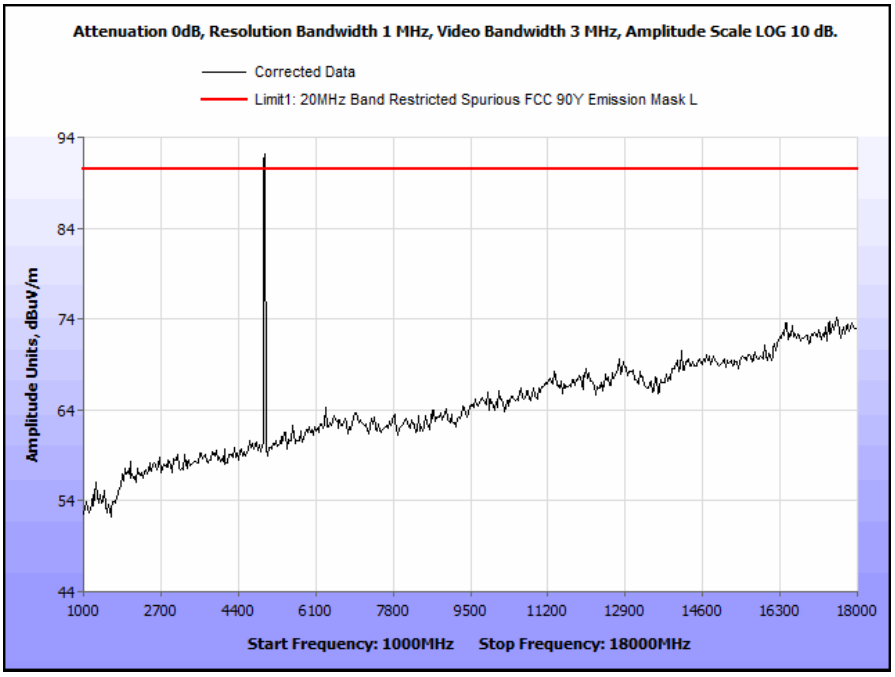
Plot 21. Radiated Spurious Emissions, High Channel, 10 MHz, 30 MHz – 1 GHz



Plot 22. Radiated Spurious Emissions, High Channel, 10 MHz, 1 GHz – 18 GHz

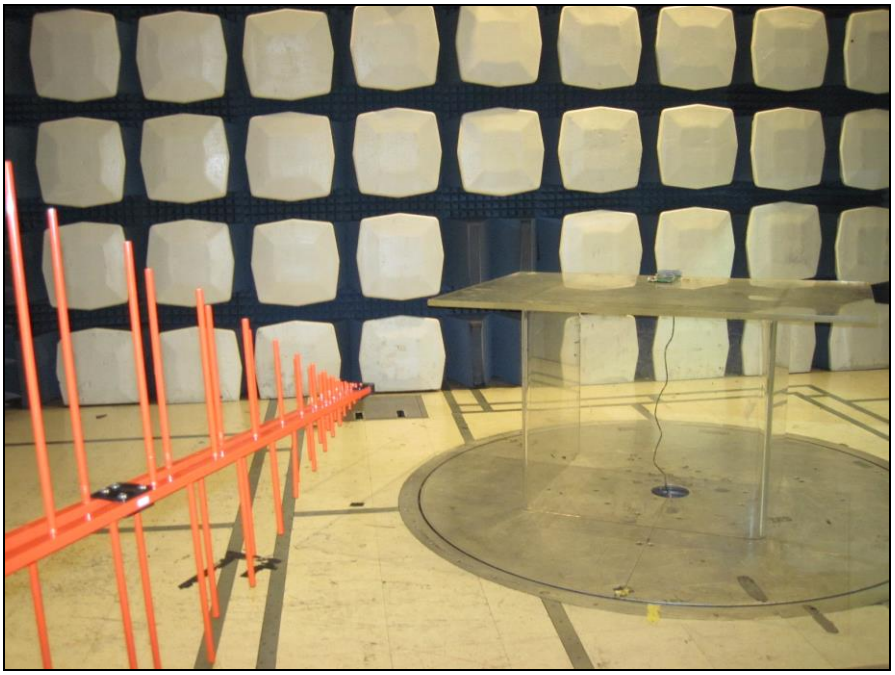


Plot 23. Radiated Spurious Emissions, High Channel, 20 MHz, 30 MHz – 1 GHz

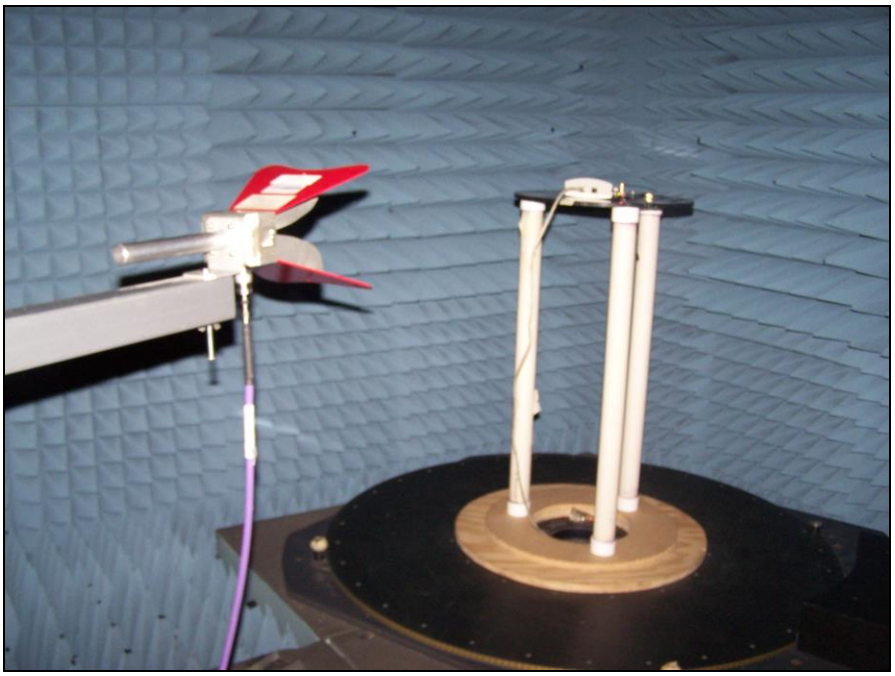


Plot 24. Radiated Spurious Emissions, High Channel, 20 MHz, 1 GHz – 18 GHz

Radiated Spurious Emissions Test Setup



Photograph 3. Radiated Spurious Emissions, Test Setup, 30 MHz – 1 GHz



Photograph 4. Radiated Spurious Emissions, Test Setup, 1 GHz – 18 GHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§90.210 Occupied Bandwidth (Emission Mask)

Test Requirement(s): **§2.1049 and §90.210 (L) with FCC** KDB 971168 **(Emissions Mask L)**

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

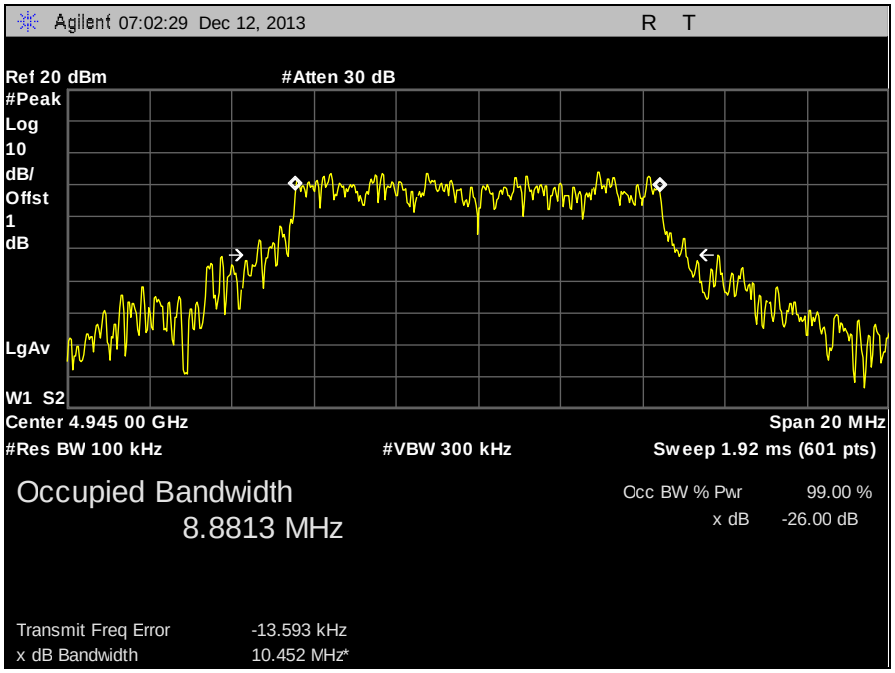
A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected to a Spectrum Analyzer via attenuator. The measured highest Average Power was set relative to zero dB reference. The RBW of the Spectrum Analyzer was set to at least 1% of the channel bandwidth. The EUT power was adjusted at the maximum output power level. Measurements were carried out at the low, mid and high channels of the TX band.

Test Results: Equipment complies with Section 2.1049 and 90.210(L) with FCC KDB 971168 (Emission Mask L). The EUT does not exceed the Emission Masks limit.

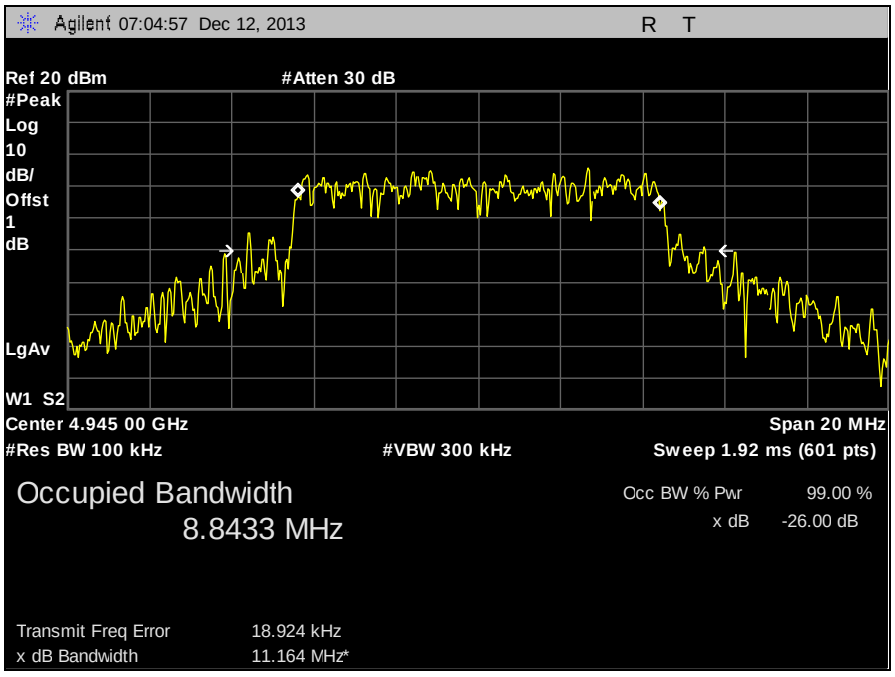
The following pages show measurements of Emission Mask plots:

Test Engineer(s): Surinder Singh

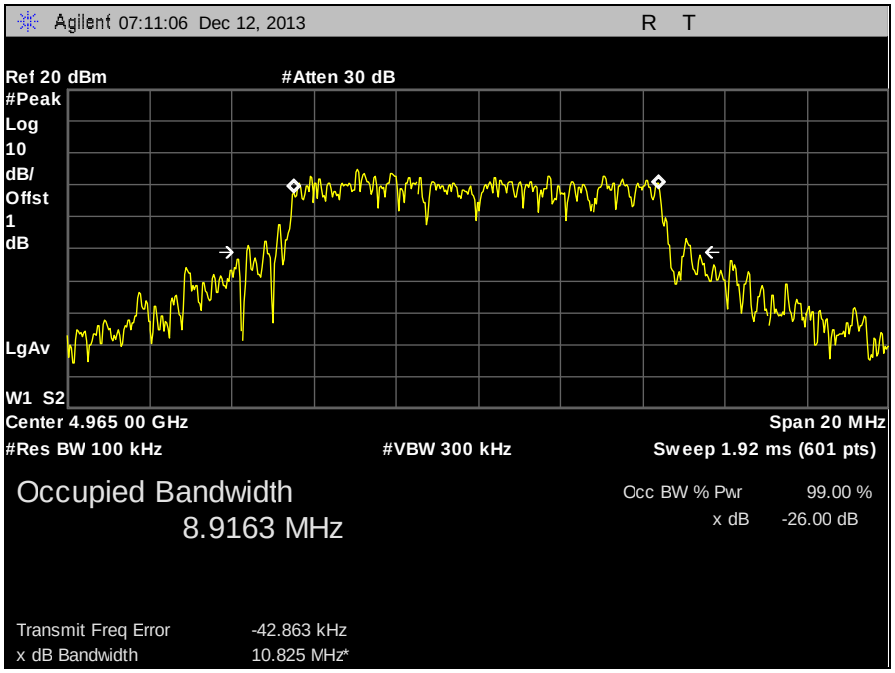
Test Date(s): 01/02/14



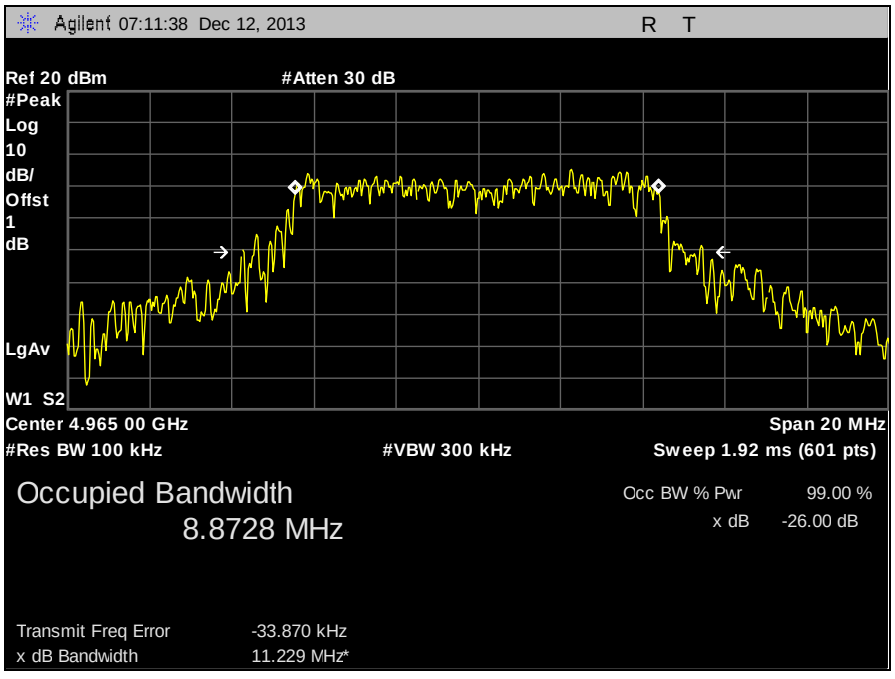
Plot 25. 26 dB Bandwidth, 4945 MHz, 10 MHz Band, Antenna 0



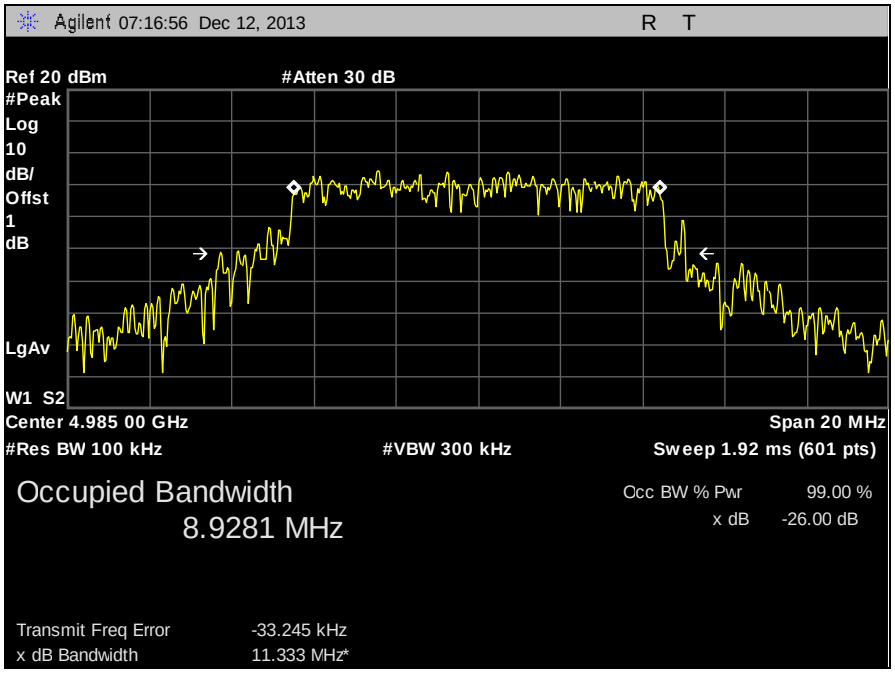
Plot 26. 26 dB Bandwidth, 4945 MHz, 10 MHz Band, Antenna 1



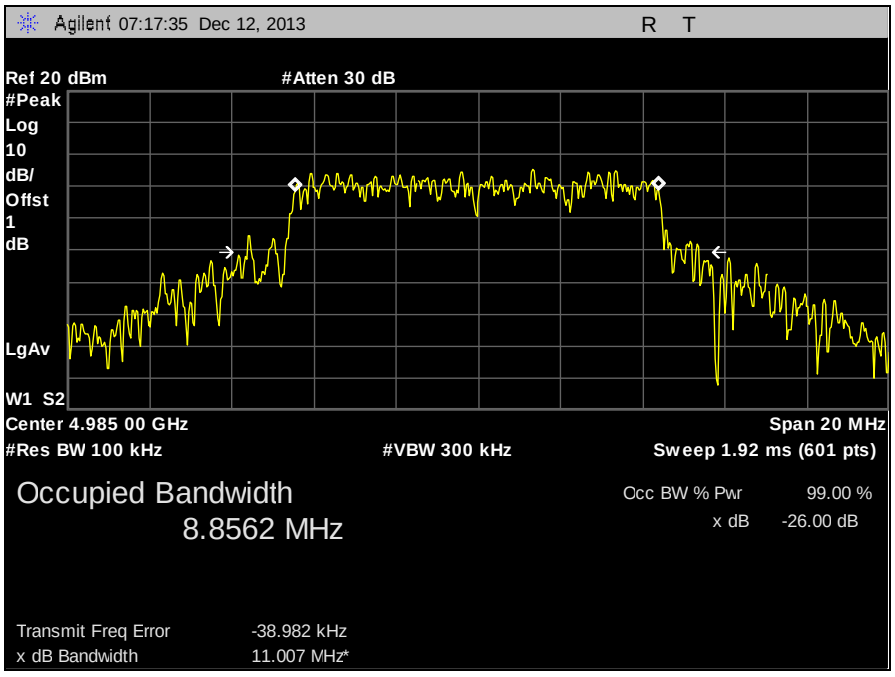
Plot 27. 26 dB Bandwidth, 4965 MHz, 10 MHz Band, Antenna 0



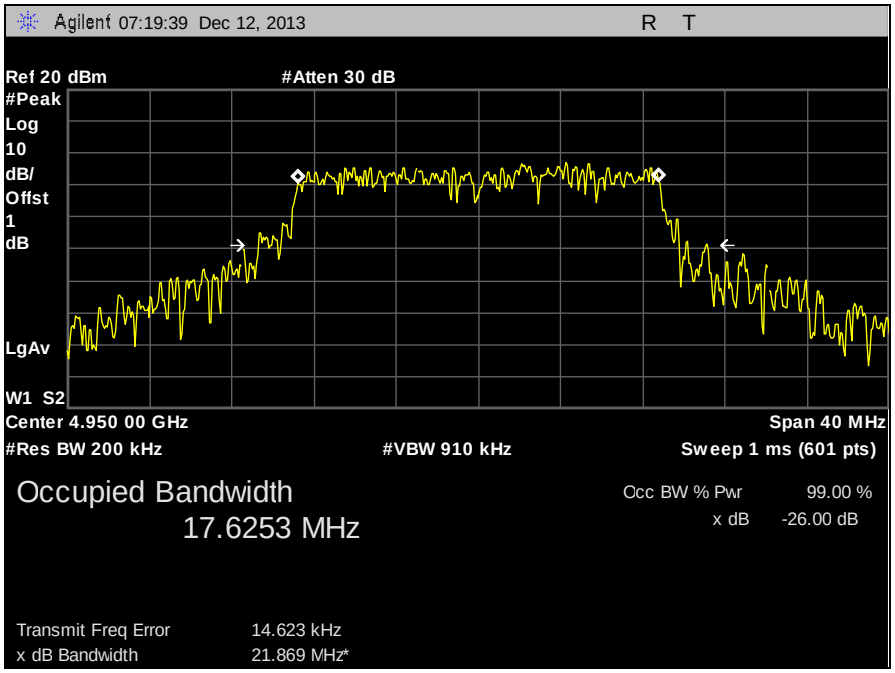
Plot 28. 26 dB Bandwidth, 4965 MHz, 10 MHz Band, Antenna 1



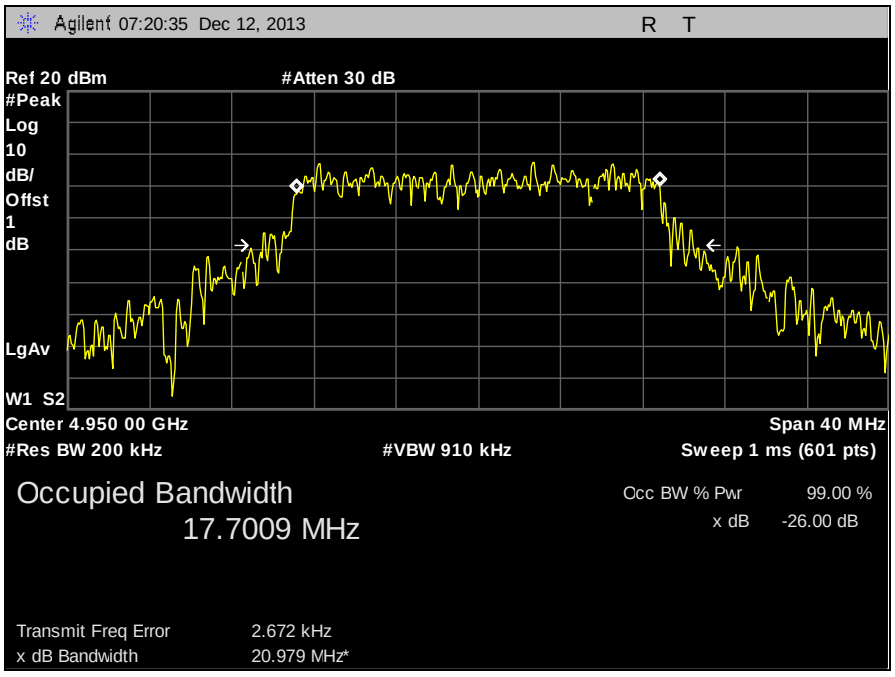
Plot 29. 26 dB Bandwidth, 4985 MHz, 10 MHz Band, Antenna 0



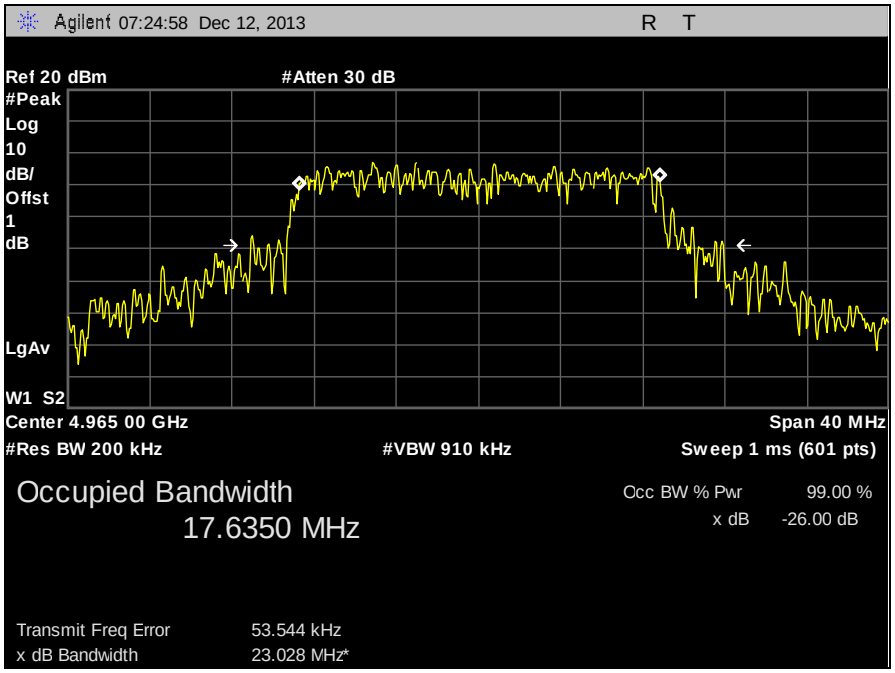
Plot 30. 26 dB Bandwidth, 4985 MHz, 10 MHz Band, Antenna 1



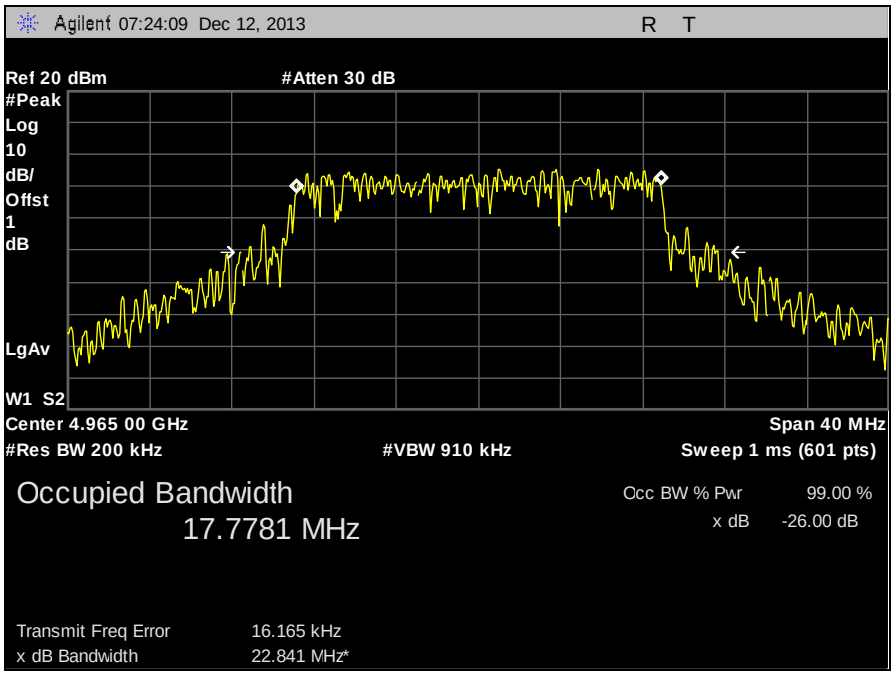
Plot 31. 26 dB Bandwidth, 4950 MHz, 20 MHz Band, Antenna 0



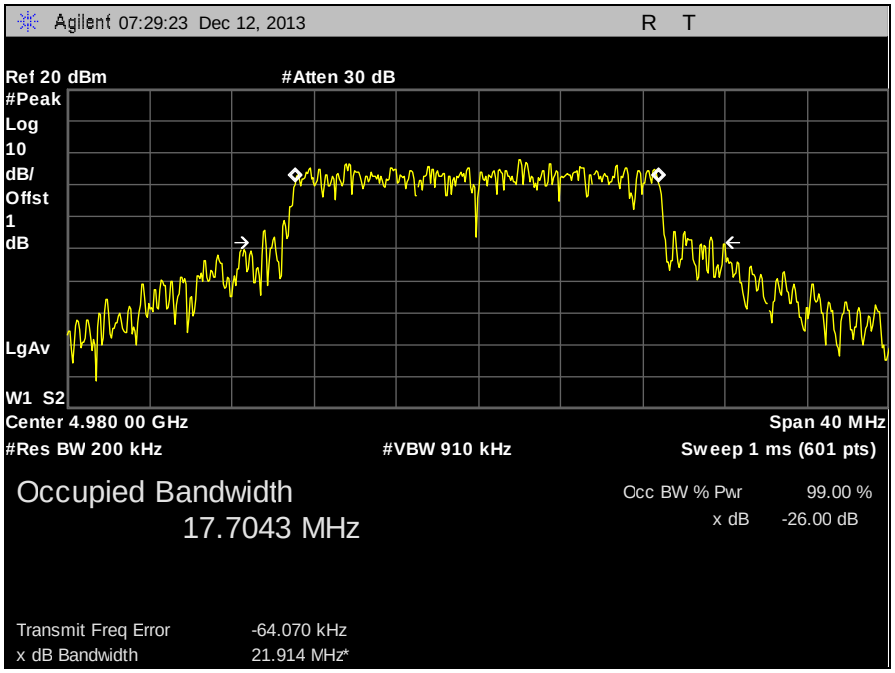
Plot 32. 26 dB Bandwidth, 4950 MHz, 20 MHz Band, Antenna 1



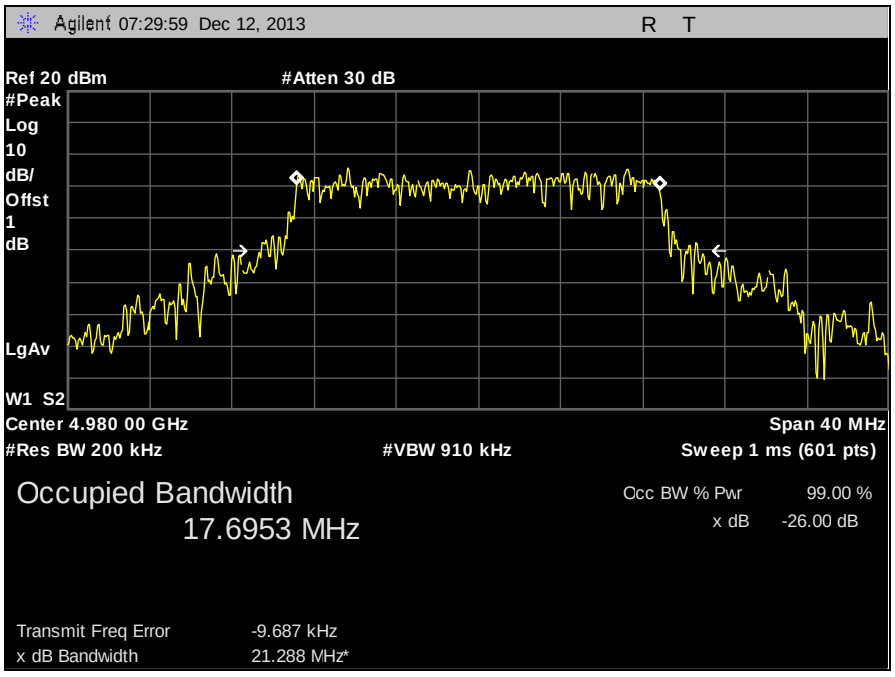
Plot 33. 26 dB Bandwidth, 4965 MHz, 20 MHz Band, Antenna 0



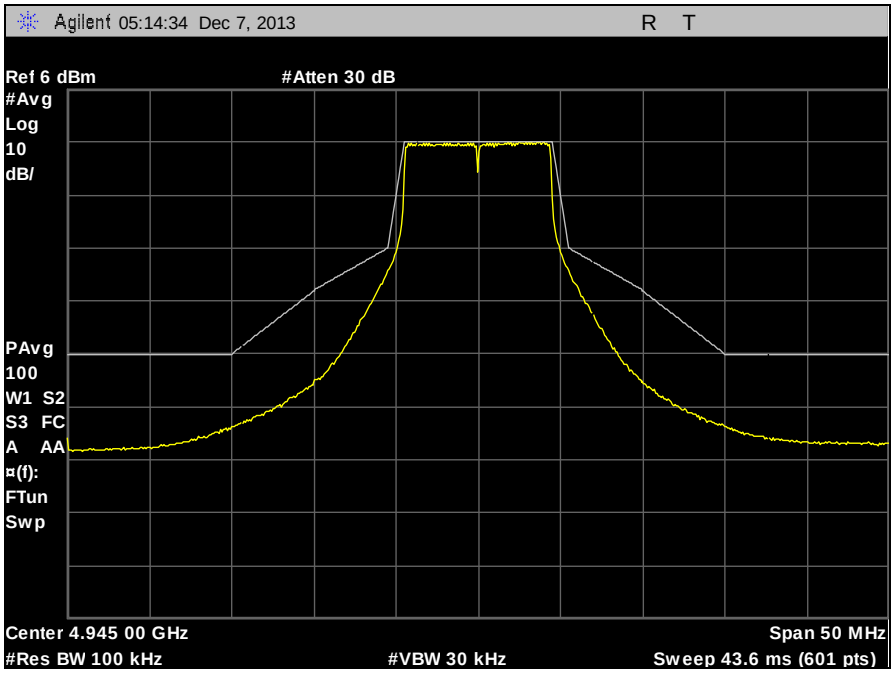
Plot 34. 26 dB Bandwidth, 4965 MHz, 20 MHz Band, Antenna 1



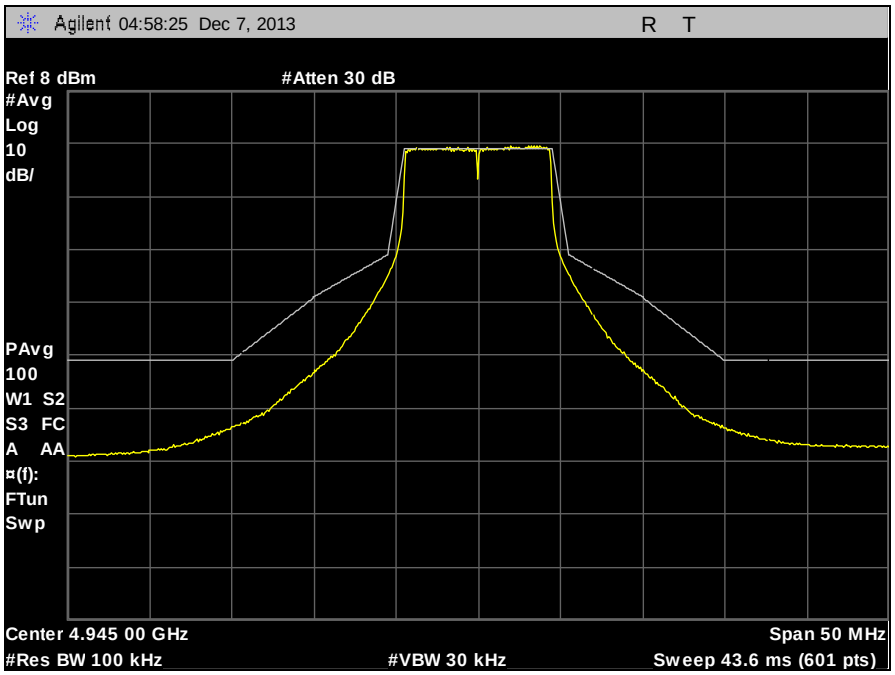
Plot 35. 26 dB Bandwidth, 4980 MHz, 20 MHz Band, Antenna 0



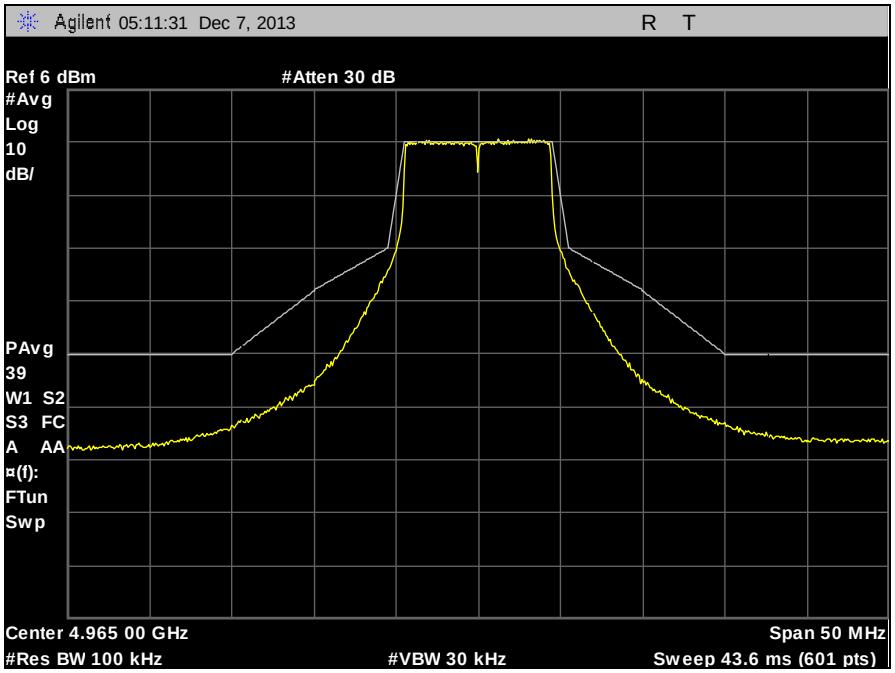
Plot 36. 26 dB Bandwidth, 4980 MHz, 20 MHz Band, Antenna 1



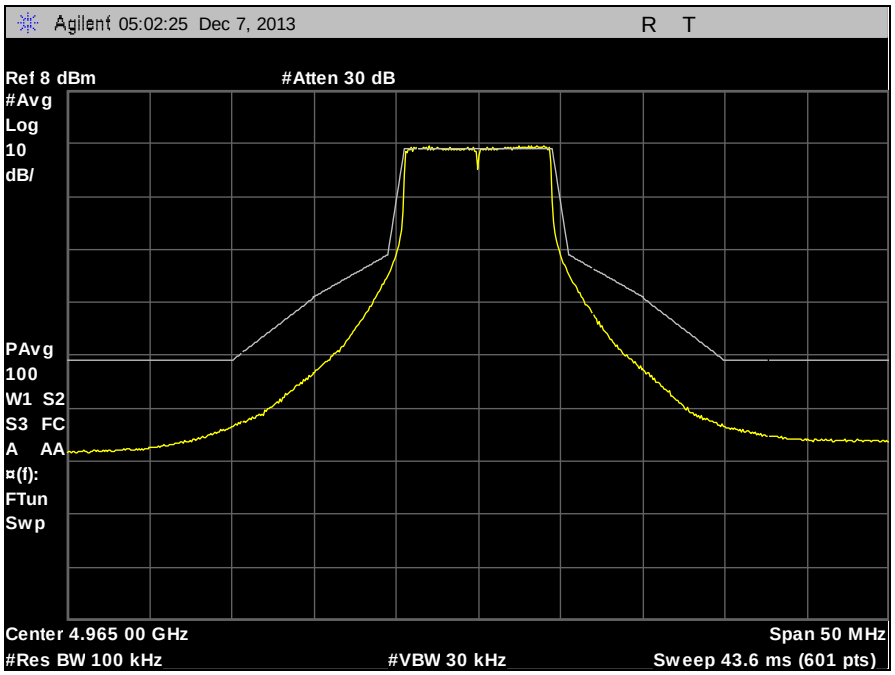
Plot 37. Emission Mask L, 4945 MHz, 10 MHz Band, Antenna 0



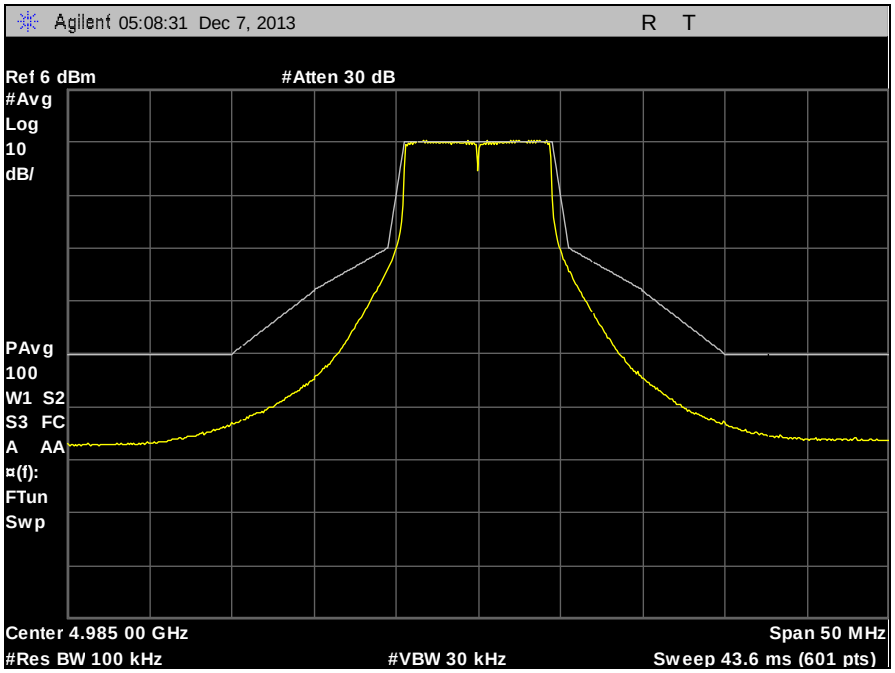
Plot 38. Emission Mask L, 4945 MHz, 10 MHz Band, Antenna 1



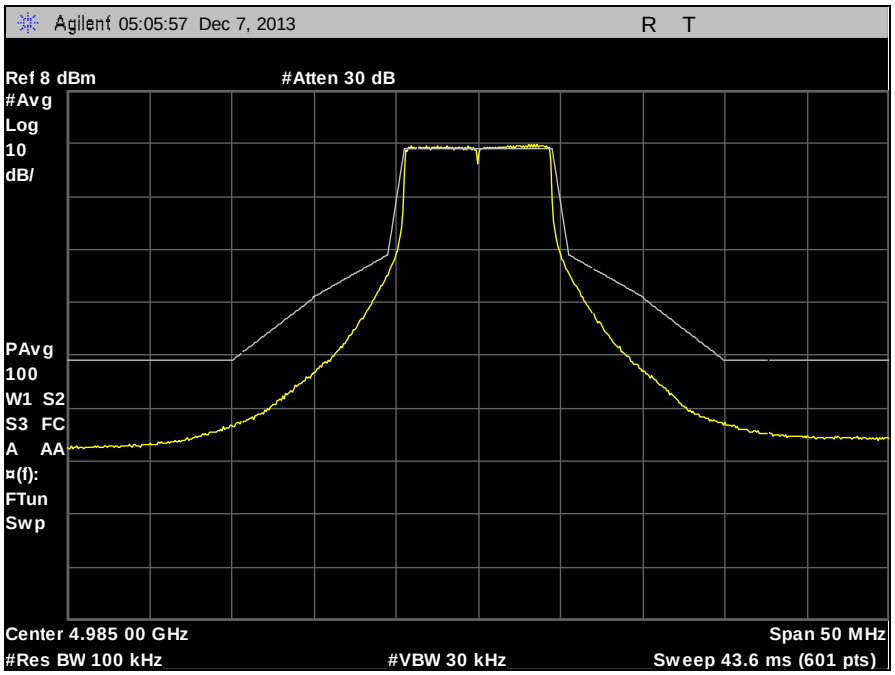
Plot 39. Emission Mask L, 4965 MHz, 10 MHz Band, Antenna 0



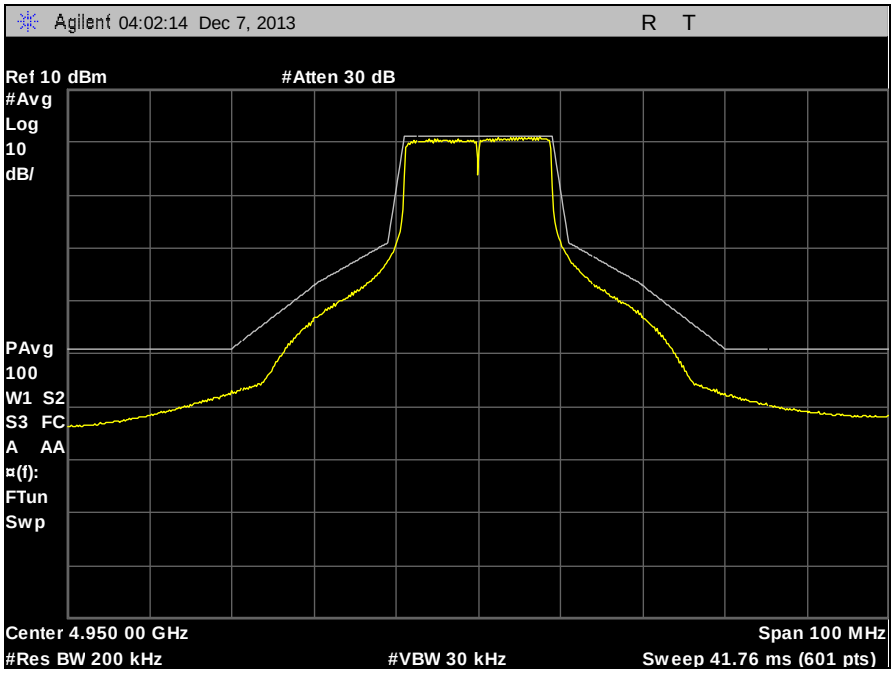
Plot 40. Emission Mask L, 4965 MHz, 10 MHz Band, Antenna 1



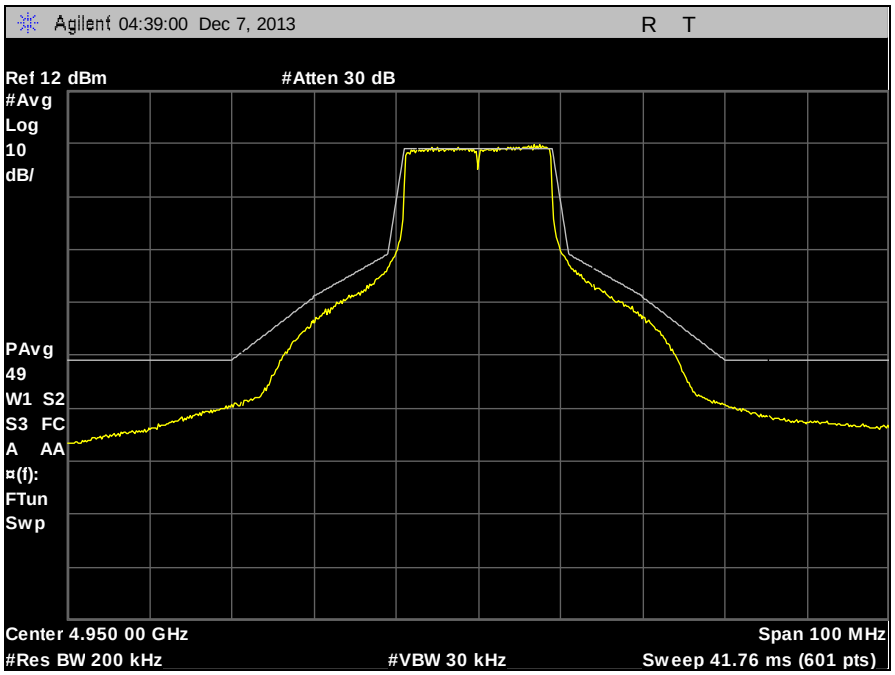
Plot 41. Emission Mask L, 4985 MHz, 10 MHz Band, Antenna 0



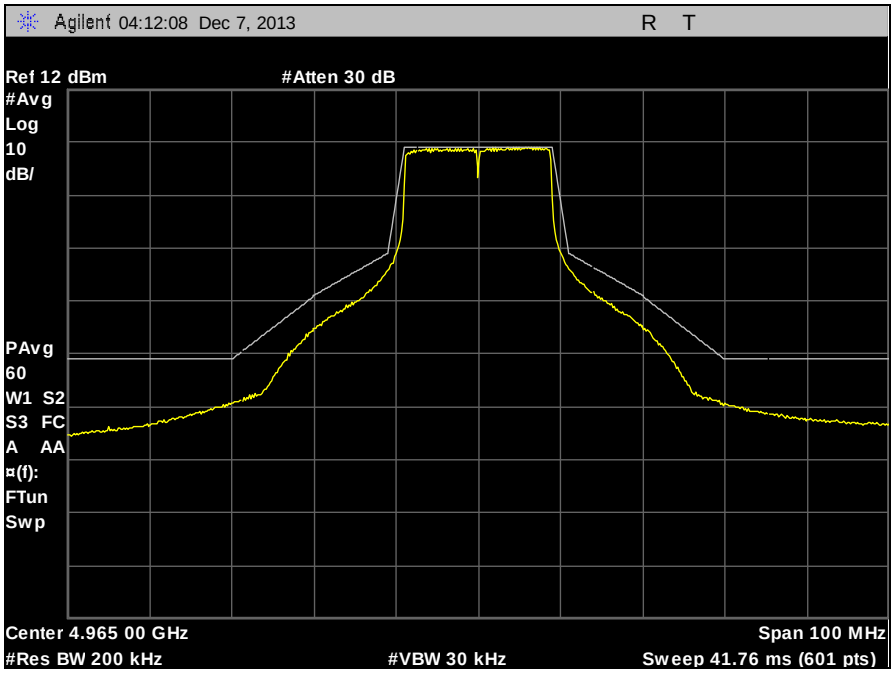
Plot 42. Emission Mask L, 4985 MHz, 10 MHz Band, Antenna 1



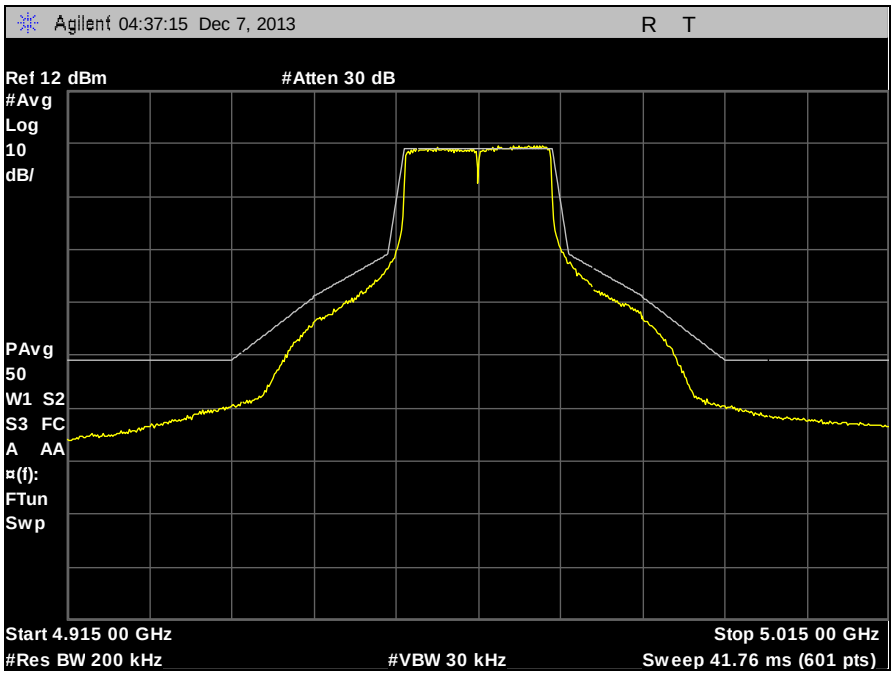
Plot 43. Emission Mask L, 4950 MHz, 20 MHz Band, Antenna 0



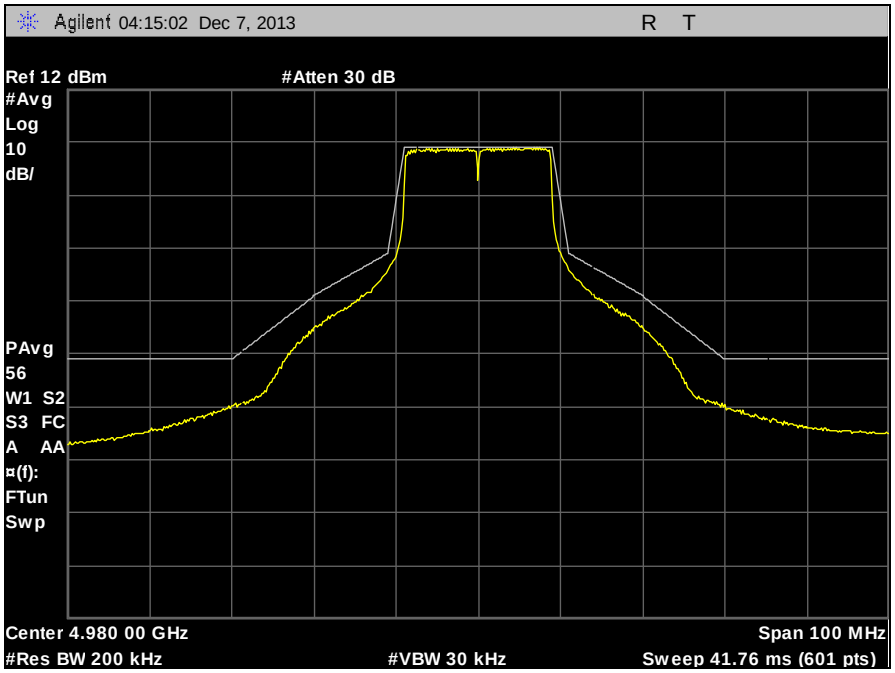
Plot 44. Emission Mask L, 4950 MHz, 20 MHz Band, Antenna 1



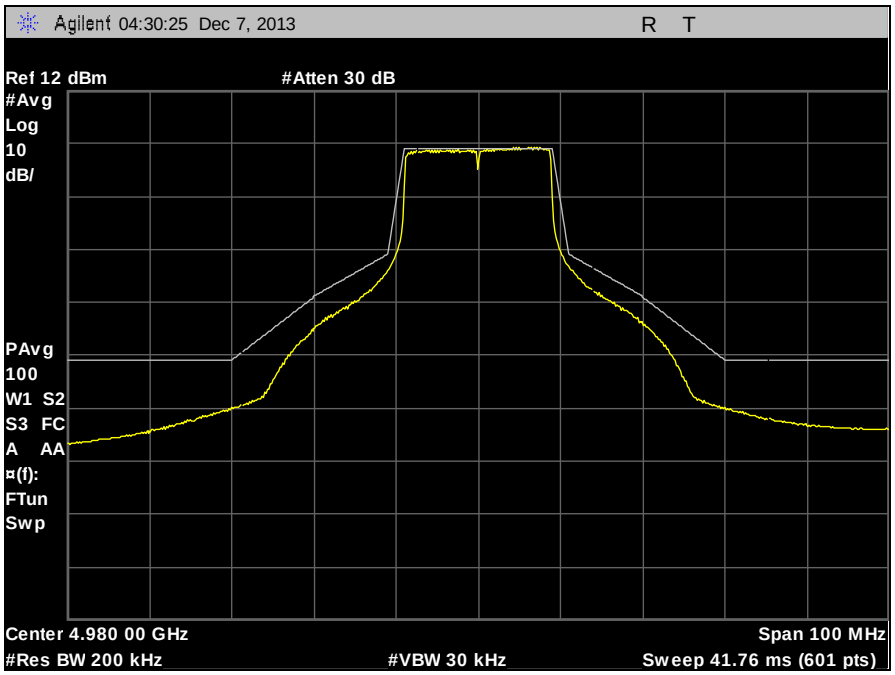
Plot 45. Emission Mask, 4965 MHz, 20 MHz Band, Antenna 0



Plot 46. Emission Mask, 4965 MHz, 20 MHz Band, Antenna 1



Plot 47. Emission Mask, 4980 MHz, 20 MHz Band, Antenna 0



Plot 48. Emission Mask, 4980 MHz, 20 MHz Band, Antenna 1

Electromagnetic Compatibility Criteria for Intentional Radiators

§90.1215(a) Peak Power Output

Test Requirement(s): **§2.1046 and §90.1215(a) with FCC** KDB 971168

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 Peak power. The EUT power was adjusted enough to produce maximum output power as specified in the owner's manual. The output power was then recorded with peak reading. Measurements were made at the low, mid and high channels.

If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi.

EUT Antenna Gain: 12 dBi
Peak Power Limit (10MHz Band): 17dBm/MHz- (EUT Antenna Gain above 9dBi) = 14dBm/MHz
Peak Power Limit (20MHz Band): 20dBm/MHz- (EUT Antenna Gain above 9dBi) = 17dBm/MHz

Test Results: Equipment complies with 47CFR 2.1046 and 90.1215(a) with FCC KDB 971168.

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

Test Engineer(s): Surinder Singh

Test Date(s): 01/02/14

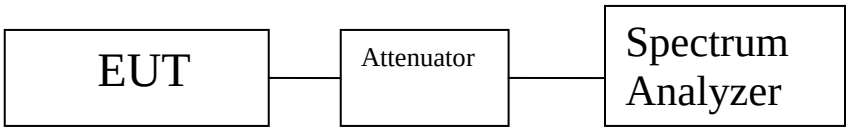


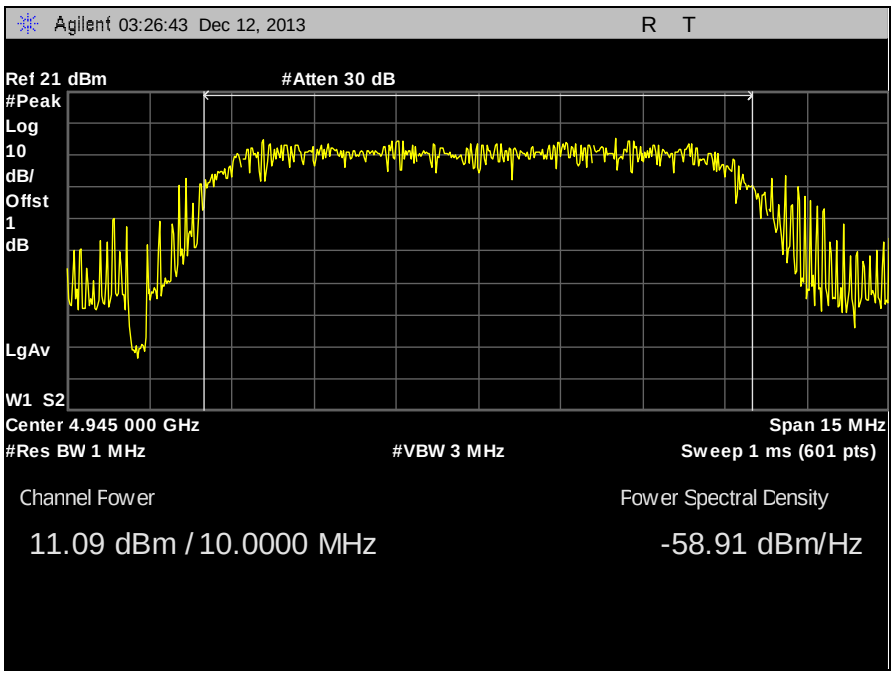
Figure 2. Peak Power Output Test Setup

Peak Conducted Output Power 10MHz Band							
Chanel Carrier	**Frequency GHz**	**Measured Peak Output Power (dBm) Port 0**	**Measured Peak Output Power (dBm) Port 1**	**Total Output Power dBm**	**Antenna Gain dBi**	**Power Limit dBm**	**Margin dB**
Low	4.945	11.09	10.77	13.94	12	14	-0.05
Mid	4.965	10.78	10.82	13.81	12	14	-0.18
High	4.985	10.77	10.52	13.65	12	14	-0.34

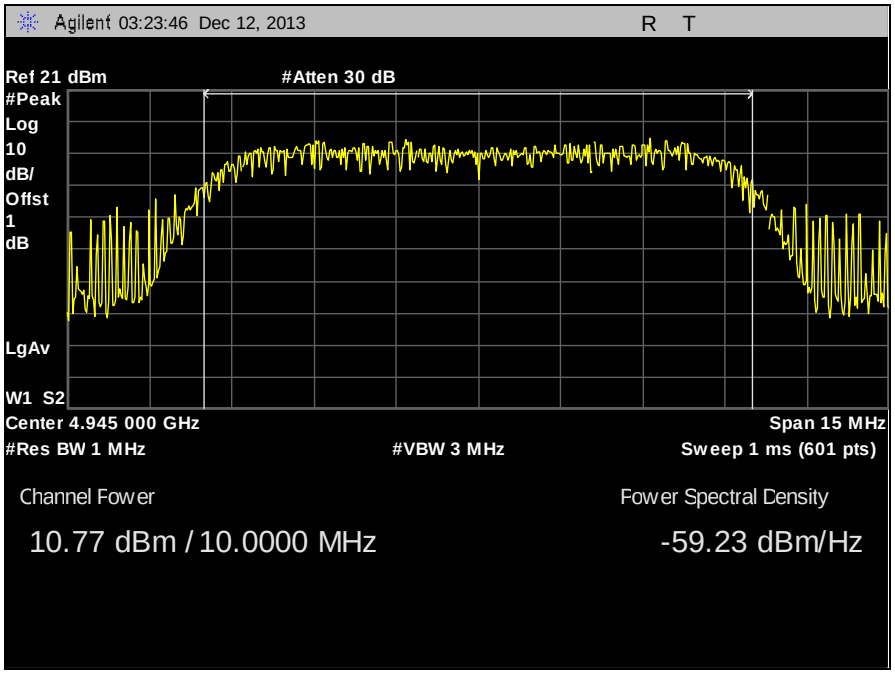
Table 9. Peak Output Power, 10 MHz Band

Peak Conducted Output Power 20MHz Band							
Chanel Carrier	**Frequency GHz**	**Measured Peak Output Power (dBm) Port 0**	**Measured Peak Output Power (dBm) Port 1**	**Total Output Power dBm**	**Antenna Gain dBi**	**Power Limit dBm**	**Margin dB**
Low	4.950	13.83	12.9	16.40	12	17	-0.59
Mid	4.965	13.84	12.95	16.42	12	17	-0.57
High	4.980	13.78	12.7	16.28	12	17	-0.71

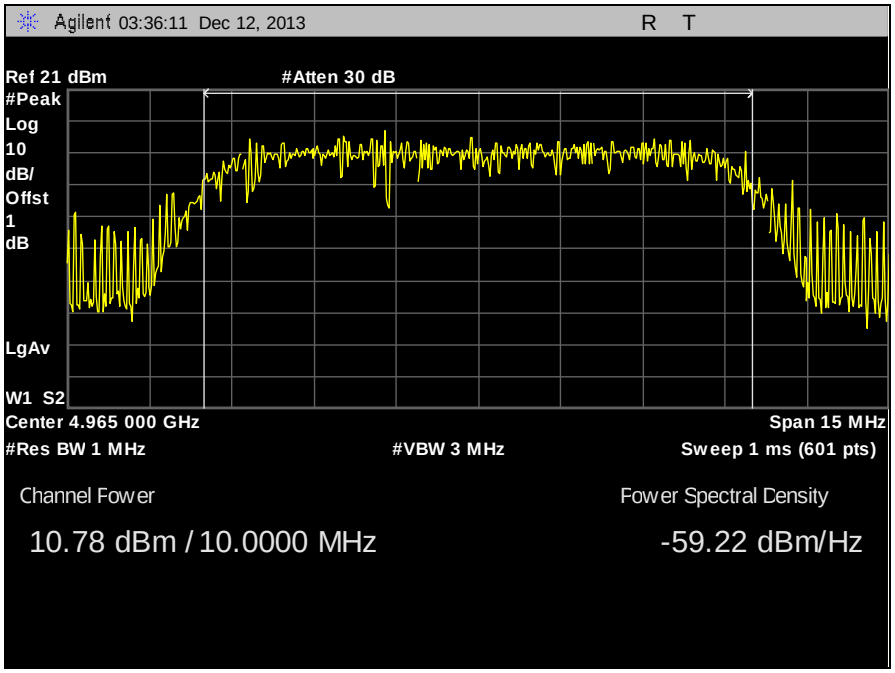
Table 10. Peak Output Power, 20 MHz Band



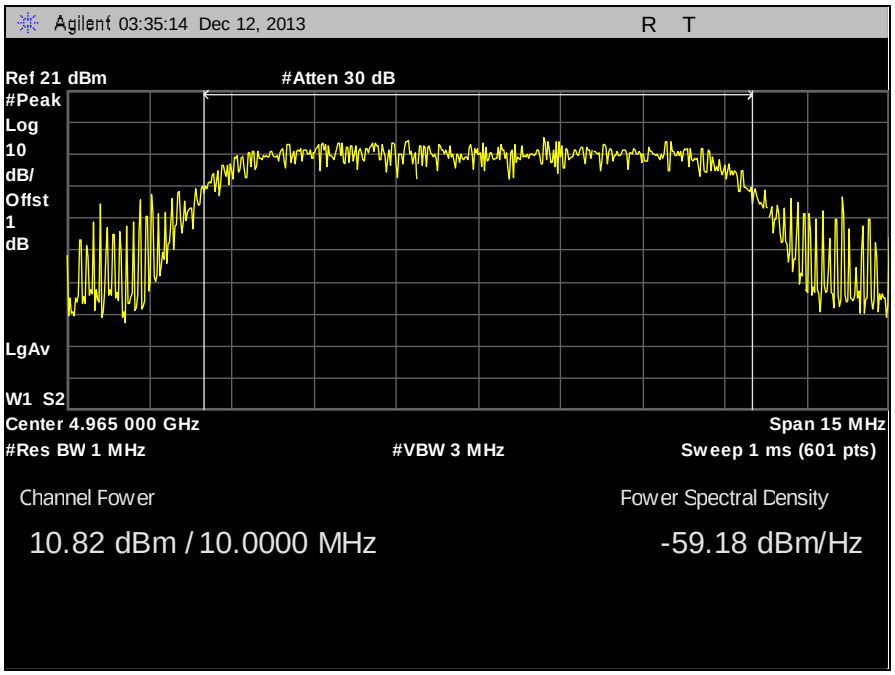
Plot 49. Peak Power Output, 4945 MHz, 10 MHz Band, Antenna 0



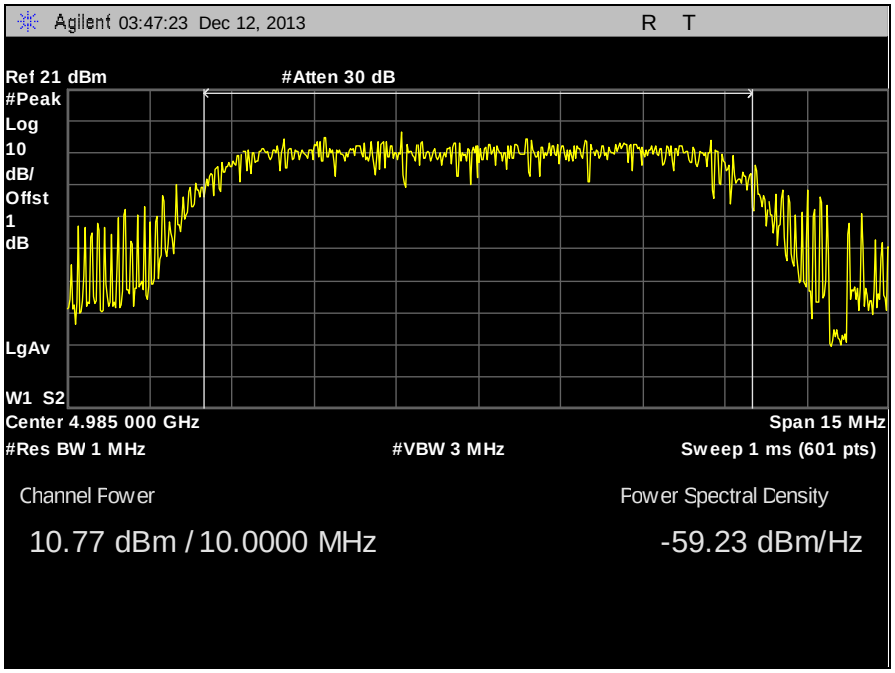
Plot 50. Peak Power Output, 4945 MHz, 10 MHz Band, Antenna 1



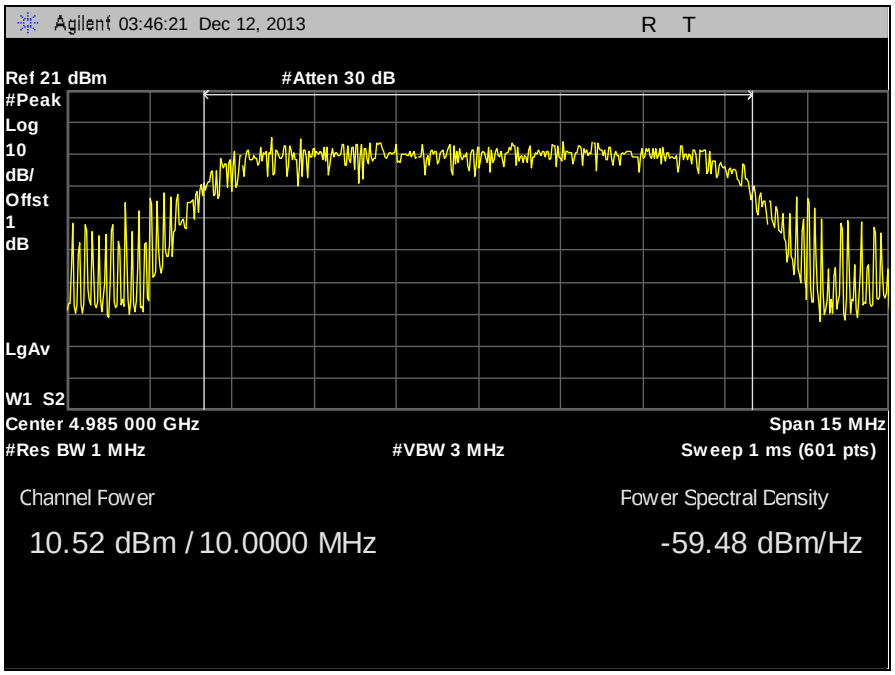
Plot 51. Peak Power Output, 4965 MHz, 10 MHz Band, Antenna 0



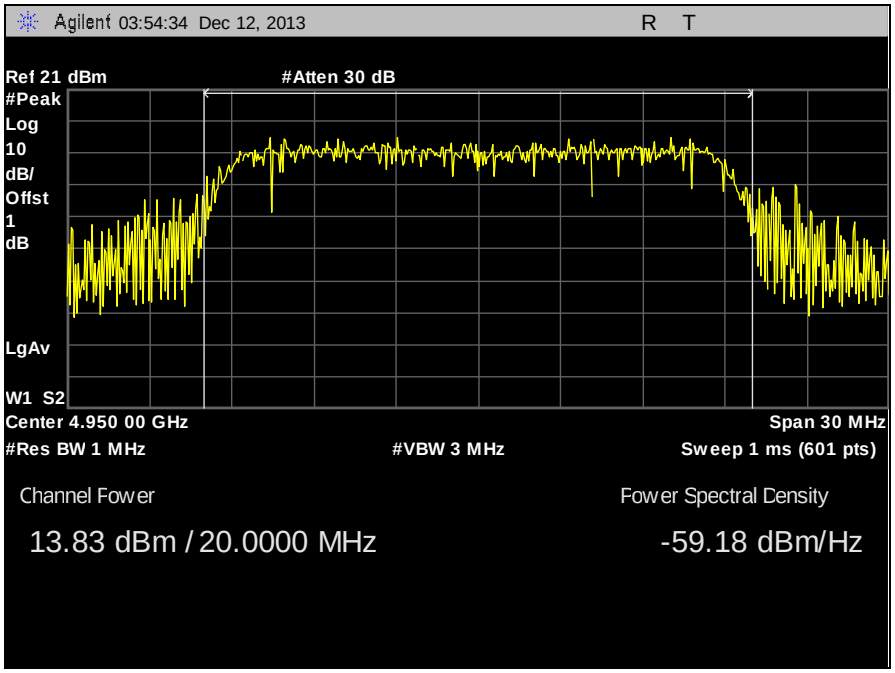
Plot 52. Peak Power Output, 4965 MHz, 10 MHz Band, Antenna 1



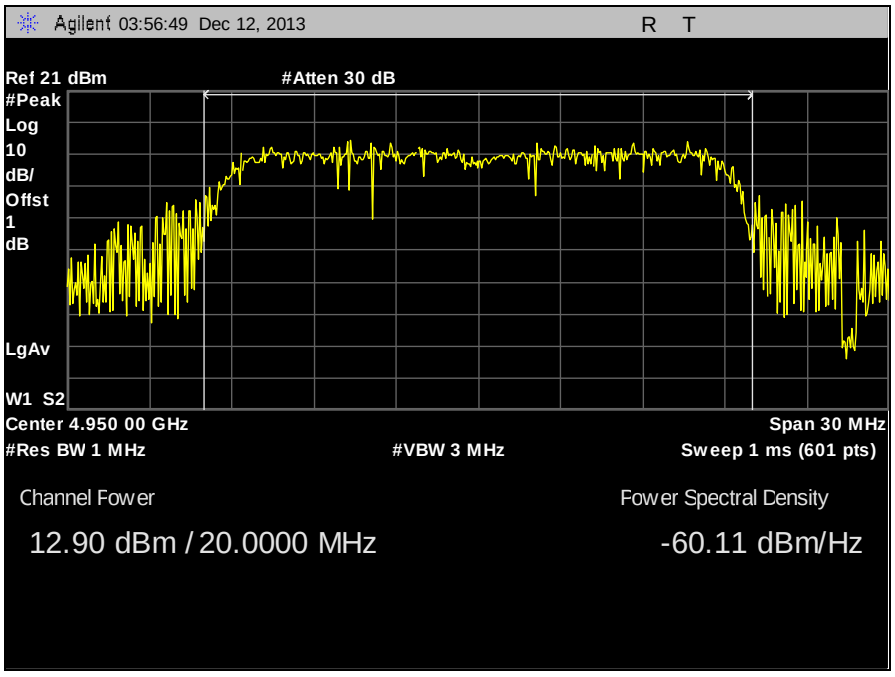
Plot 53. Peak Power Output, 4985 MHz, 10 MHz Band, Antenna 0



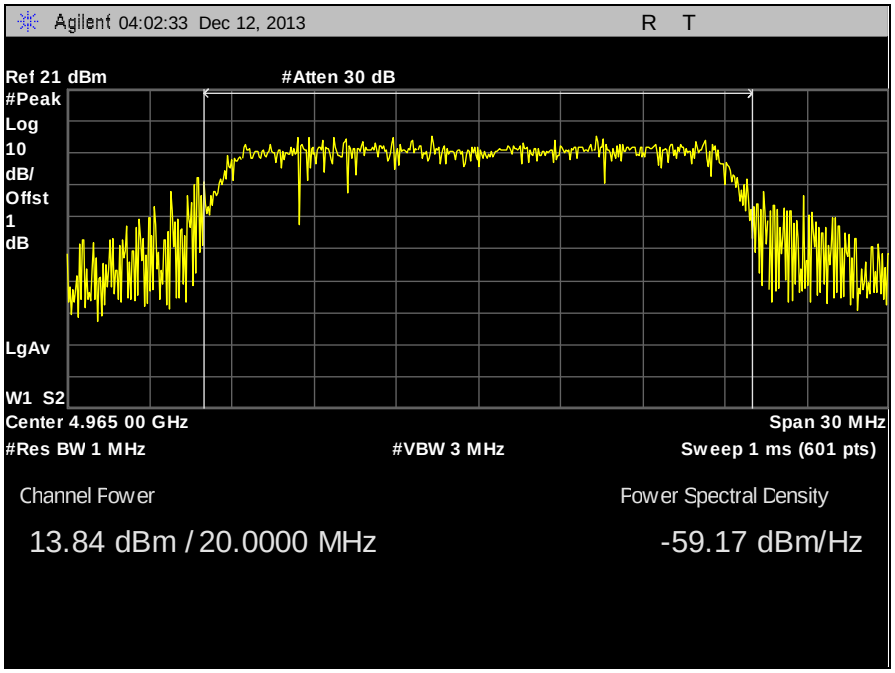
Plot 54. Peak Power Output, 4985 MHz, 10 MHz Band, Antenna 1



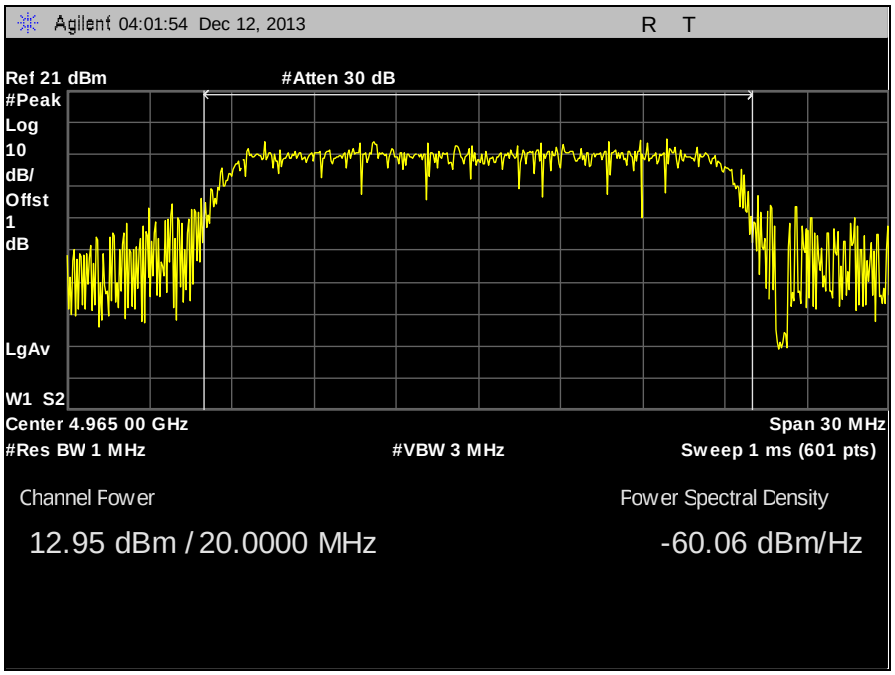
Plot 55. Peak Power Output, 4950 MHz, 20 MHz Band, Antenna 0



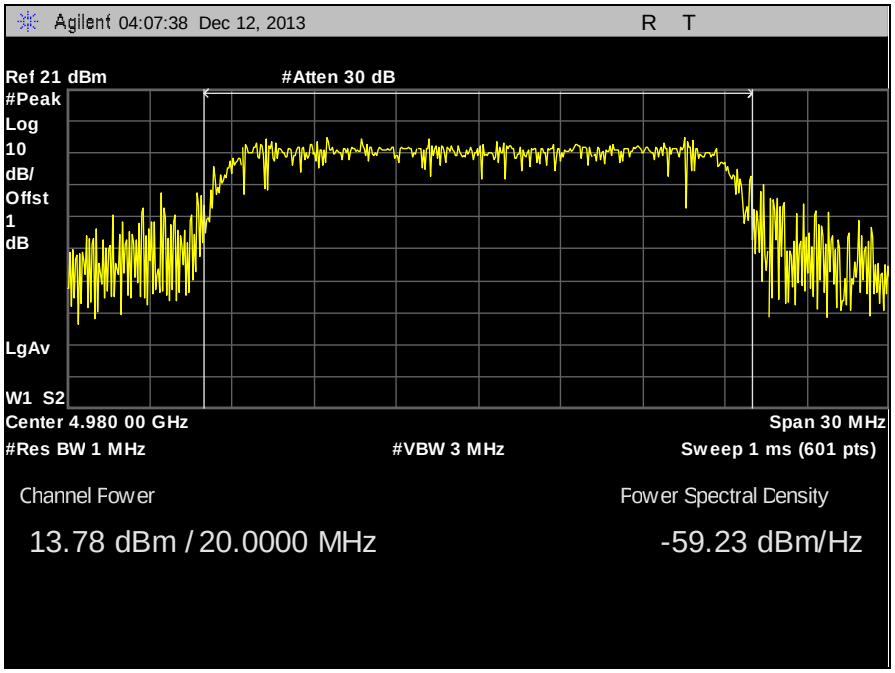
Plot 56. Peak Power Output, 4950 MHz, 20 MHz Band, Antenna 1



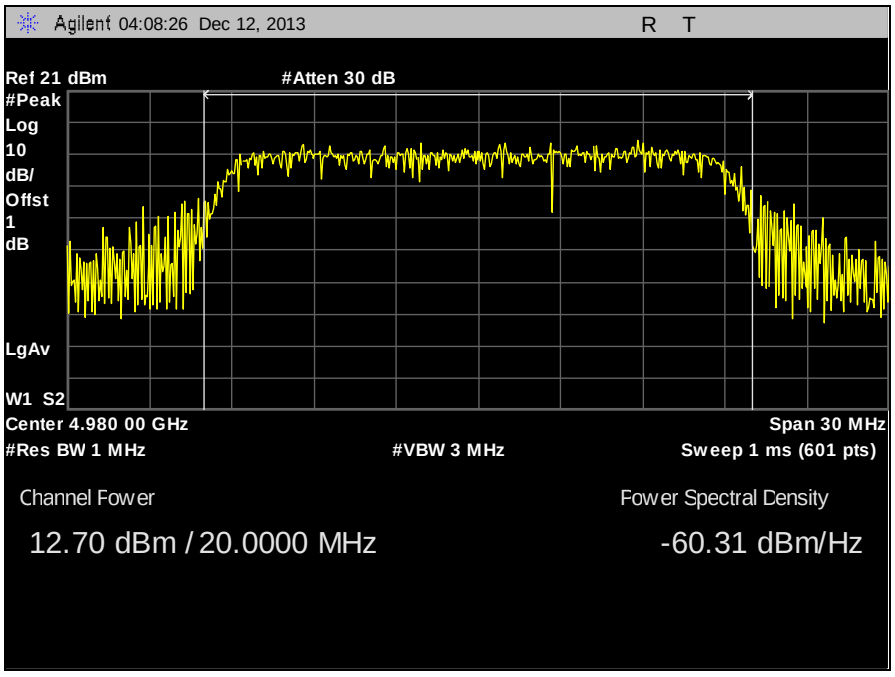
Plot 57. Peak Power Output, 4965 MHz, 20 MHz Band, Antenna 0



Plot 58. Peak Power Output, 4965 MHz, 20 MHz Band, Antenna 1



Plot 59. Peak Power Output, 4980 MHz, 20 MHz Band, Antenna 0



Plot 60. Peak Power Output, 4980 MHz, 20 MHz Band, Antenna 1

Electromagnetic Compatibility Criteria for Intentional Radiators

§90.1215(a) Peak Power Spectral Density

Test Requirement(s): **§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 Directional Coupler through a Spectrum Analyzer and Power Meter.

A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected to a Spectrum Analyzer in order to measure the power level. The Spectrum Analyzer was set to a RBW = 1 & VBW = 3 MHz. The EUT power was adjusted at the maximum output power level. The max hold key from the Spectrum Analyzer was activated capturing the modulated envelope of the EUT. The Peak Power Spectral Density was then recorded. Measurements were made at the low, mid and high channels.

Low power devices are limited to a peak power spectral density of 8 dBm/MHz if transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi.

EUT Antenna Gain: 12 dBi
PSD Limit: 8dBm/MHz-(EUT Antenna Gain above 9dBi) = 5dBm/MHz

Test Results: Equipment complies with 47 CFR 2.1046 and 90.1215(a) with FCC KDB 971168 (Low Power devices). The EUT does not exceed 8dBm/MHz peak power spectral density at the carrier frequency.

The following pages show measurements of Peak Power Spectral Density plots which is recorded below:

Test Engineer(s): Surinder Singh

Test Date(s): 01/02/14

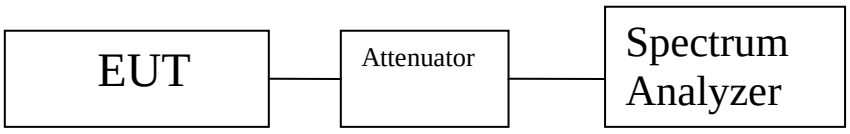


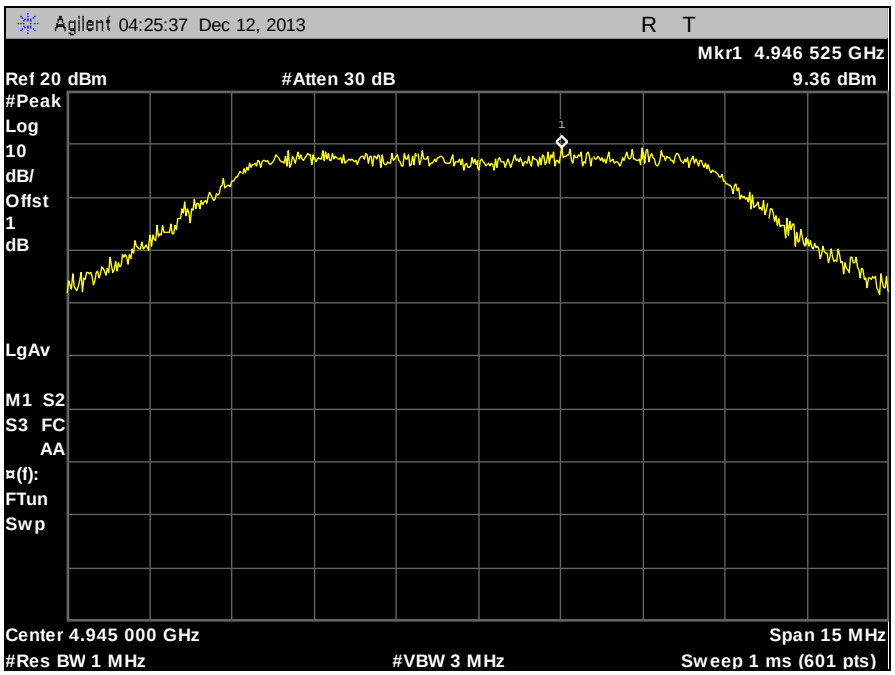
Figure 3. Block Diagram, Conducted Spurious Emissions Test Setup

Peak PSD 10MHz Band						
Frequency GHz	**Measured Peak Output Power (dBm)/1MHz Port 0**	**Measured Peak Output Power (dBm)/1MHz Port 1**	**Total Output Power**	**Antenna Gain**	**Power Limit**	**Margin**
4.945	-0.93	-0.73	2.18	12	5	-2.81
4.965	-0.95	-0.32	2.38	12	5	-2.61
4.985	-0.83	-0.92	2.13	12	5	-2.86

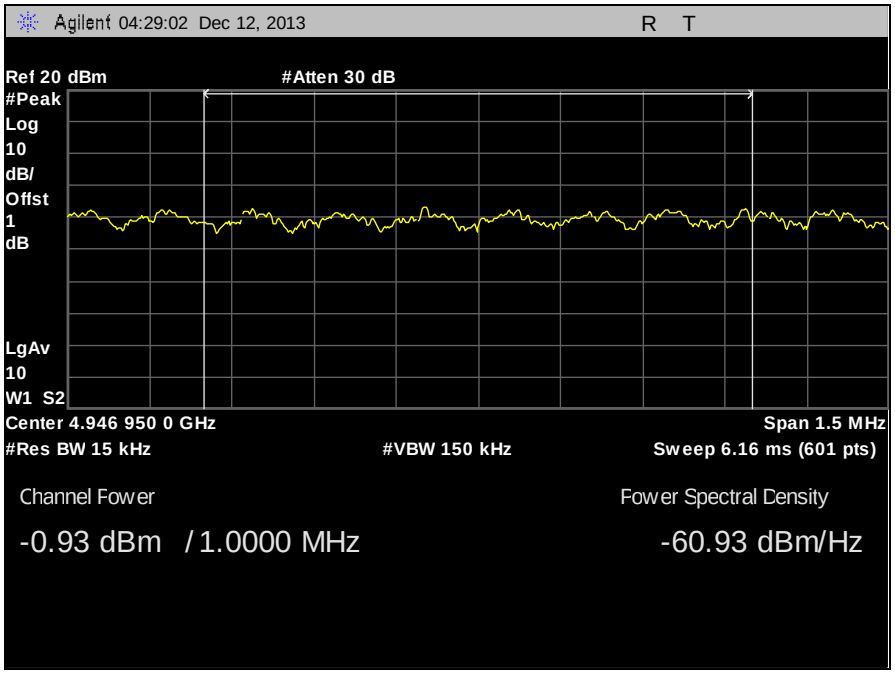
Table 11. Peak Power Spectral Density, 10 MHz Band

Peak PSD 20MHz Band						
Frequency GHz	**Measured Peak Output Power (dBm)/1MHz Port 0**	**Measured Peak Output Power (dBm)/1MHz Port 1**	**Total Output Power**	**Antenna Gain**	**Power Limit**	**Margin**
4.95	-0.96	-1.4	1.83	12	5	-3.16
4.965	-0.95	-1.48	1.80	12	5	-3.19
4.98	-1.03	-1.88	1.57	12	5	-3.42

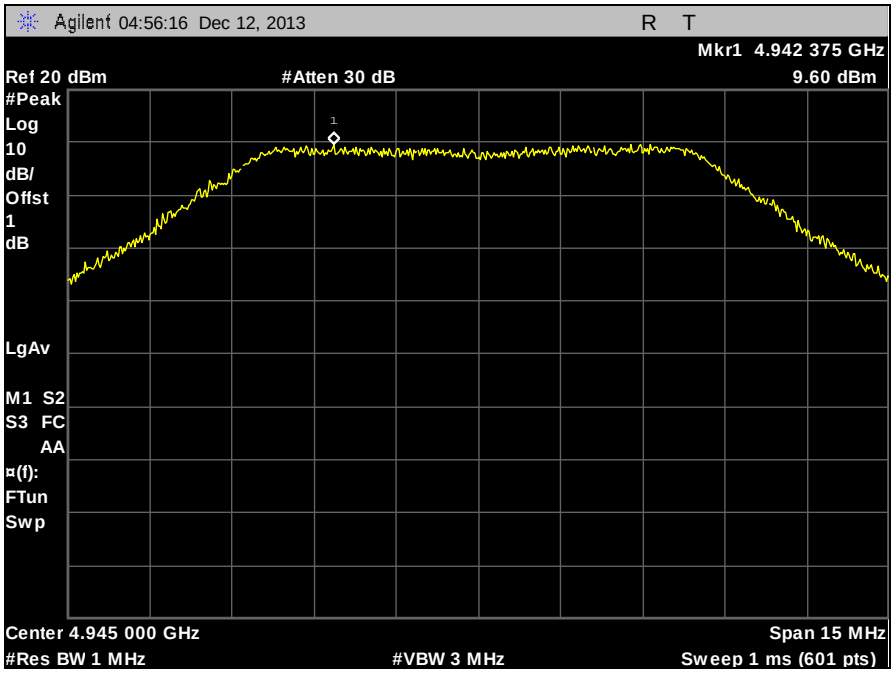
Table 12. Peak Power Spectral Density, 20 MHz Band



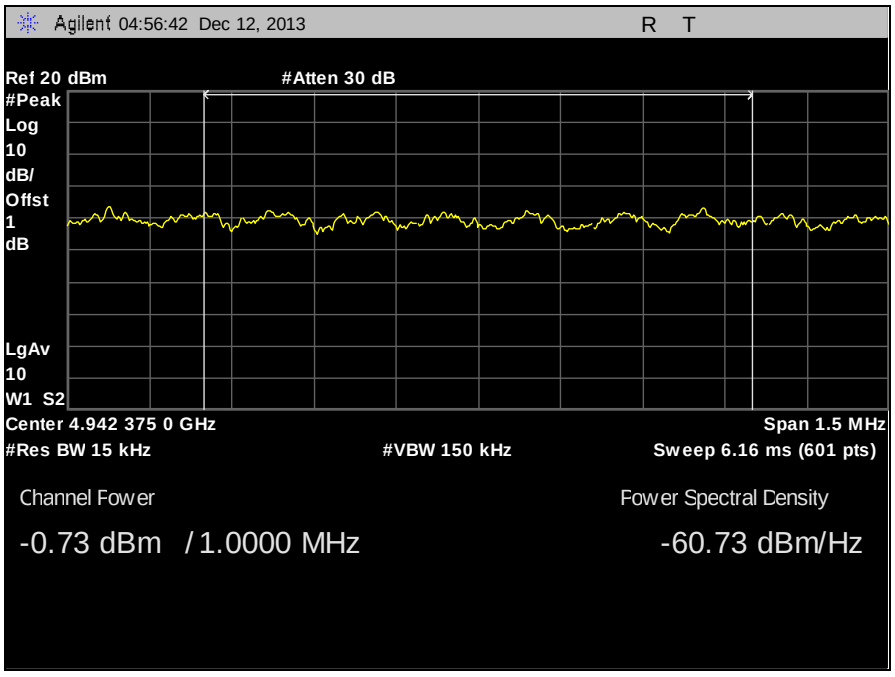
Plot 61. Peak Power Spectral Density, Peak Determination, 4945 MHz, 10 MHz Band, Antenna 0



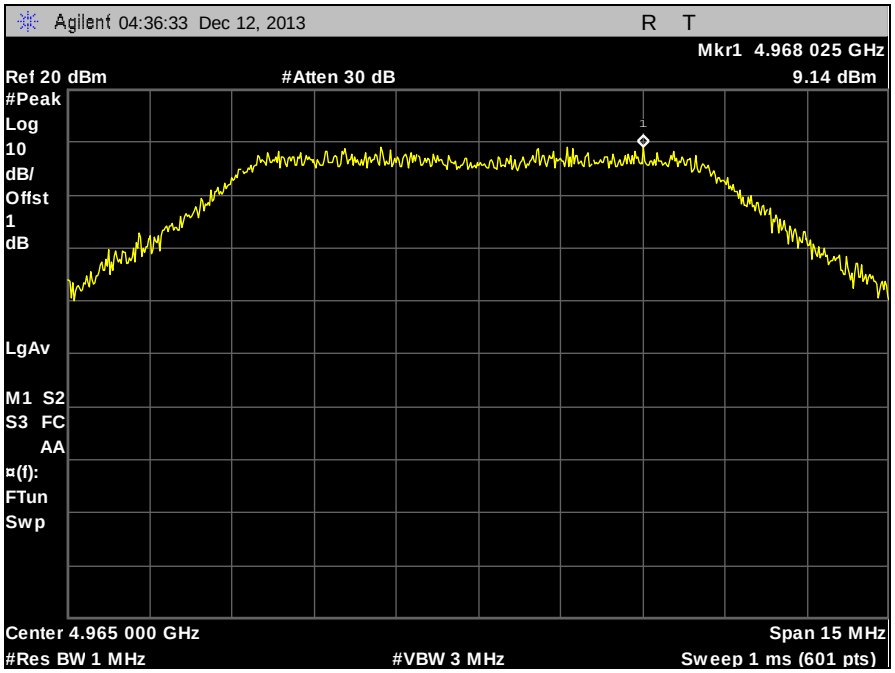
Plot 62. Peak Power Spectral Density, 4945 MHz, 10 MHz Band, Antenna 0



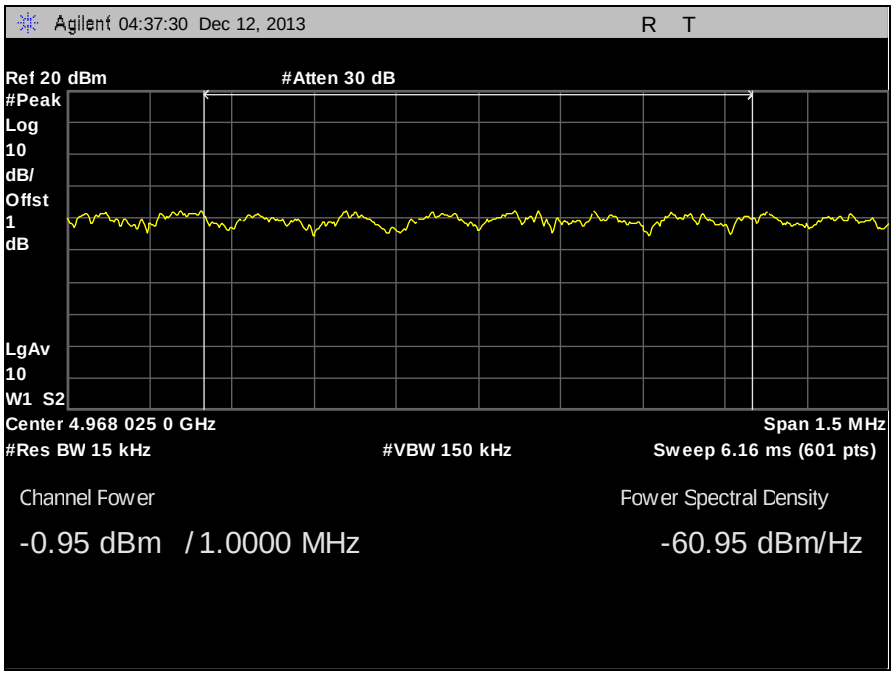
Plot 63. Peak Power Spectral Density, Peak Determination, 4945 MHz, 10 MHz Band, Antenna 1



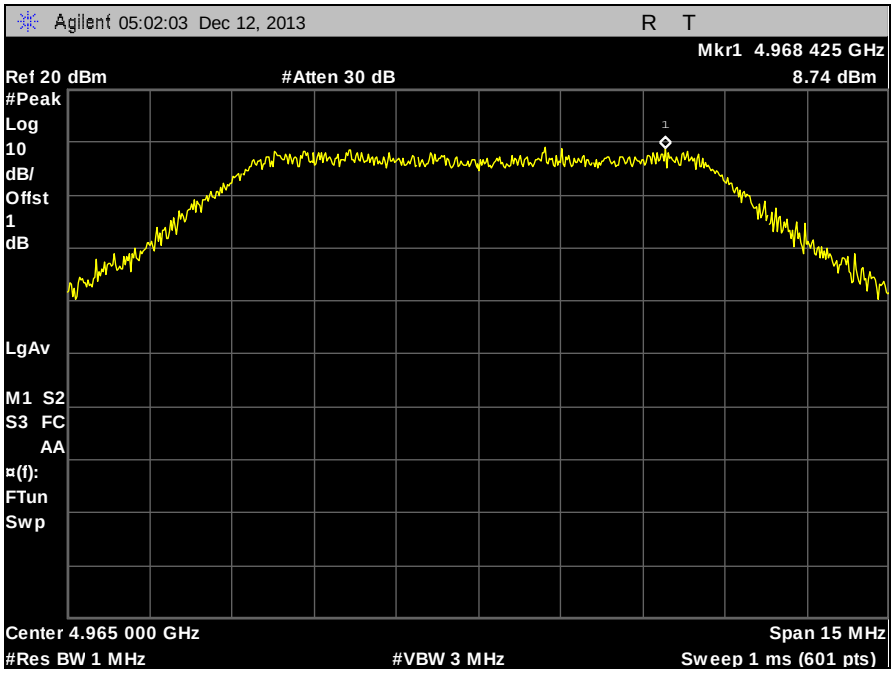
Plot 64. Peak Power Spectral Density, 4945 MHz, 10 MHz Band, Antenna 1



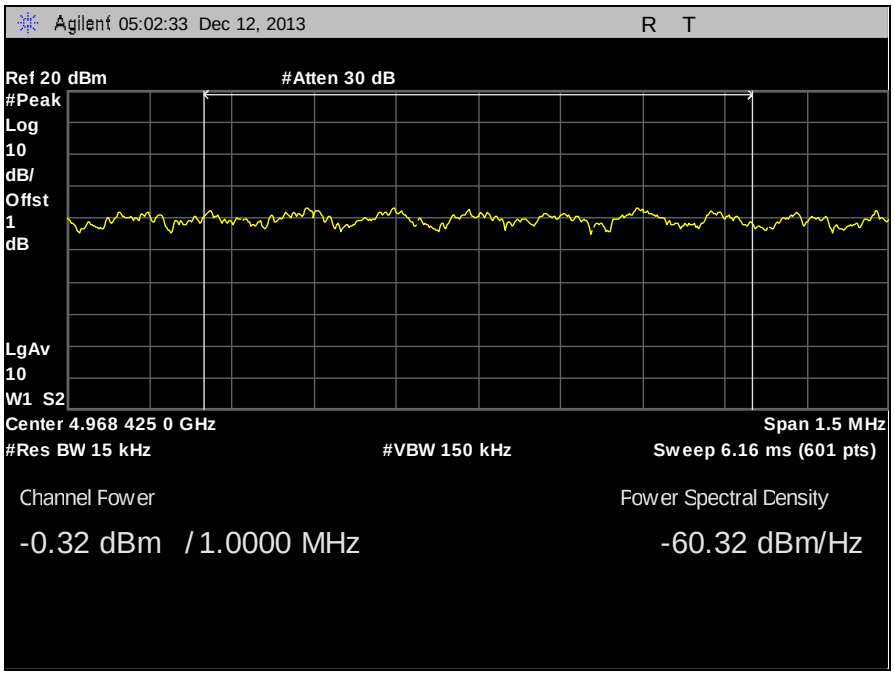
Plot 65. Peak Power Spectral Density, Peak Determination, 4965 MHz, 10 MHz Band, Antenna 0



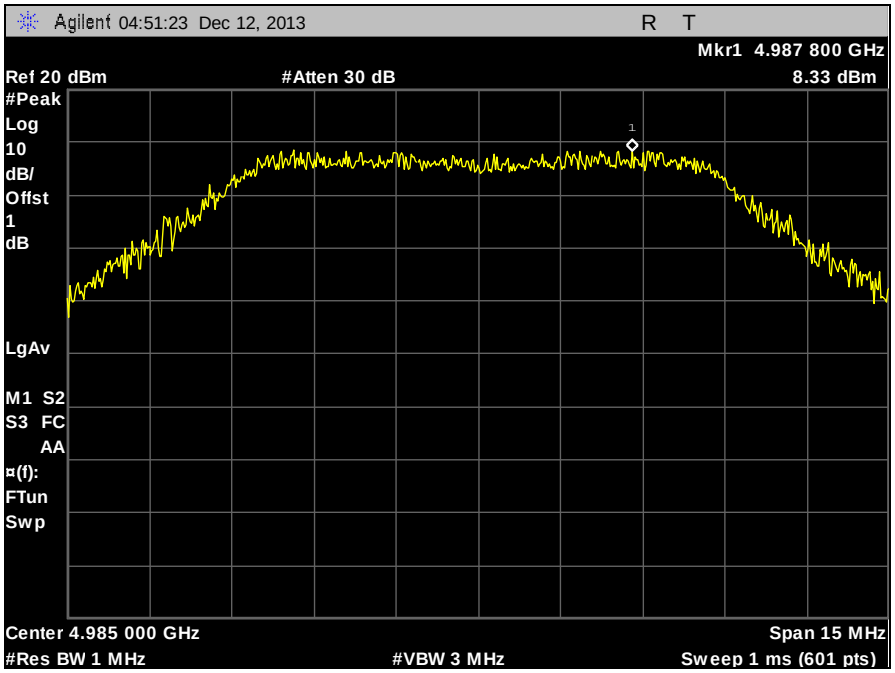
Plot 66. Peak Power Spectral Density, 4965 MHz, 10 MHz Band, Antenna 0



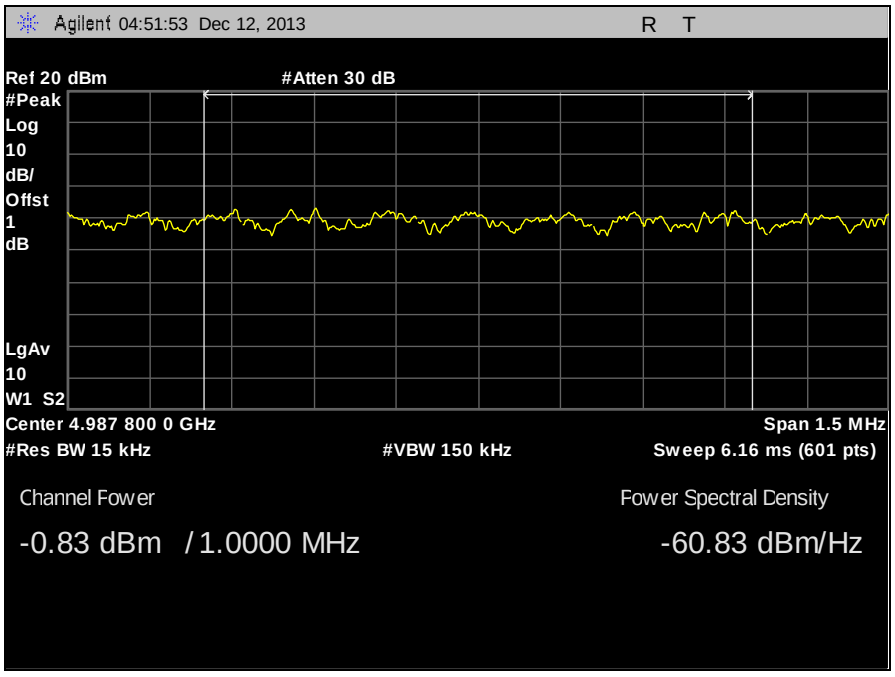
Plot 67. Peak Power Spectral Density, Peak Determination, 4965 MHz, 10 MHz Band, Antenna 1



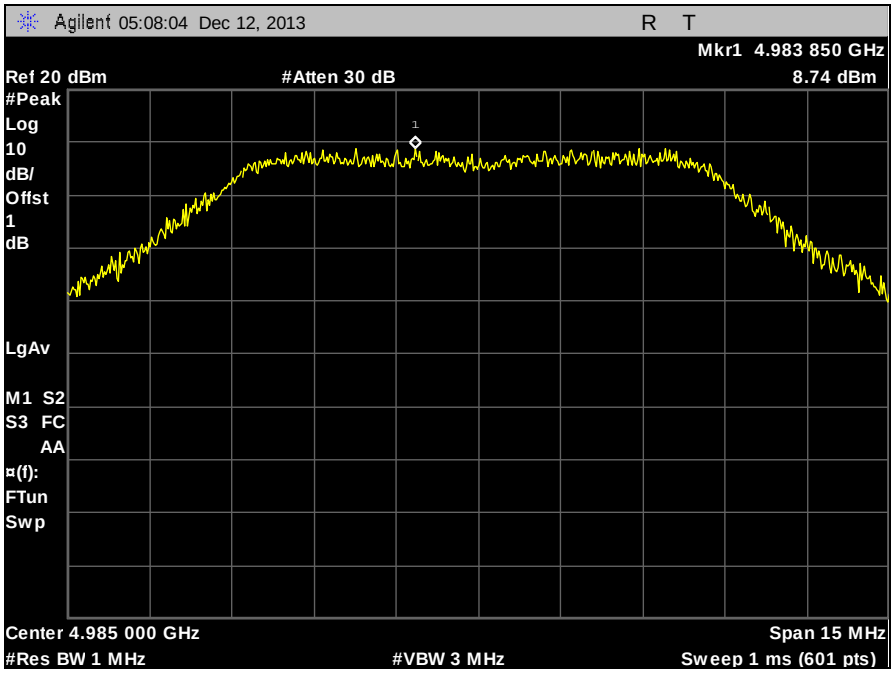
Plot 68. Peak Power Spectral Density, 4965 MHz, 10 MHz Band, Antenna 1



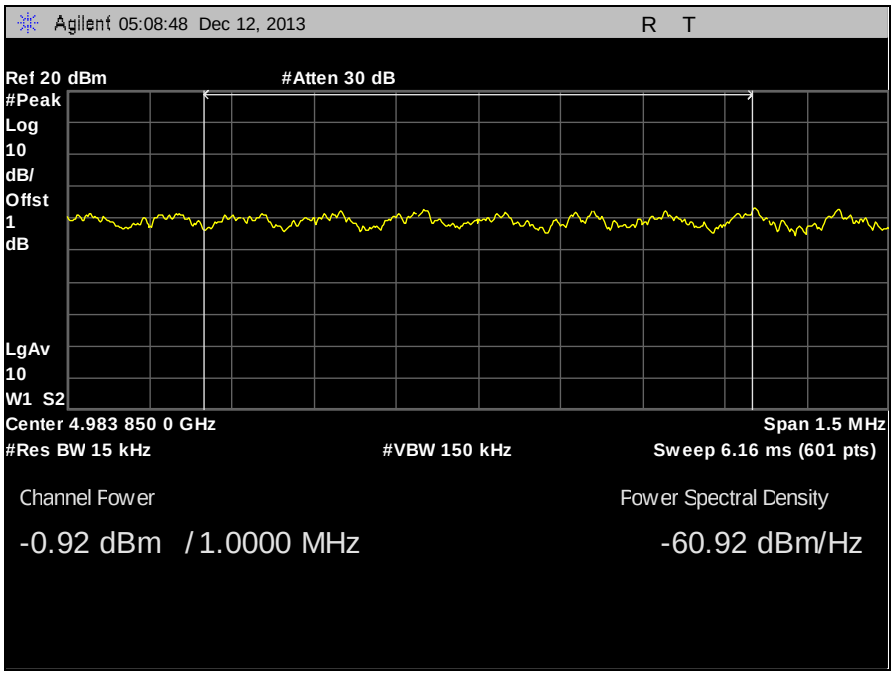
Plot 69. Peak Power Spectral Density, Peak Determination, 4985 MHz, 10 MHz Band, Antenna 0



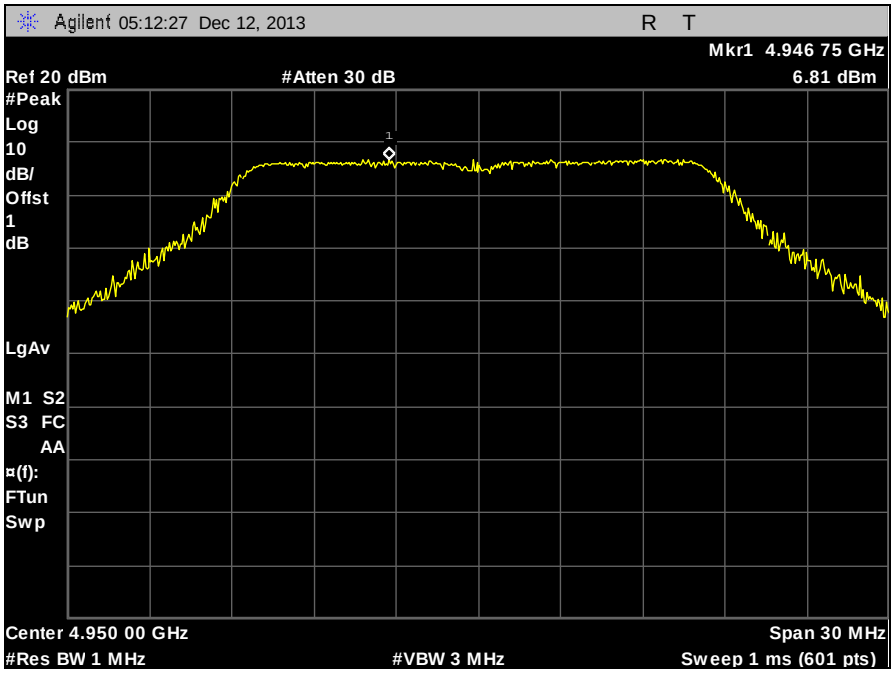
Plot 70. Peak Power Spectral Density, 4985 MHz, 10 MHz Band, Antenna 0



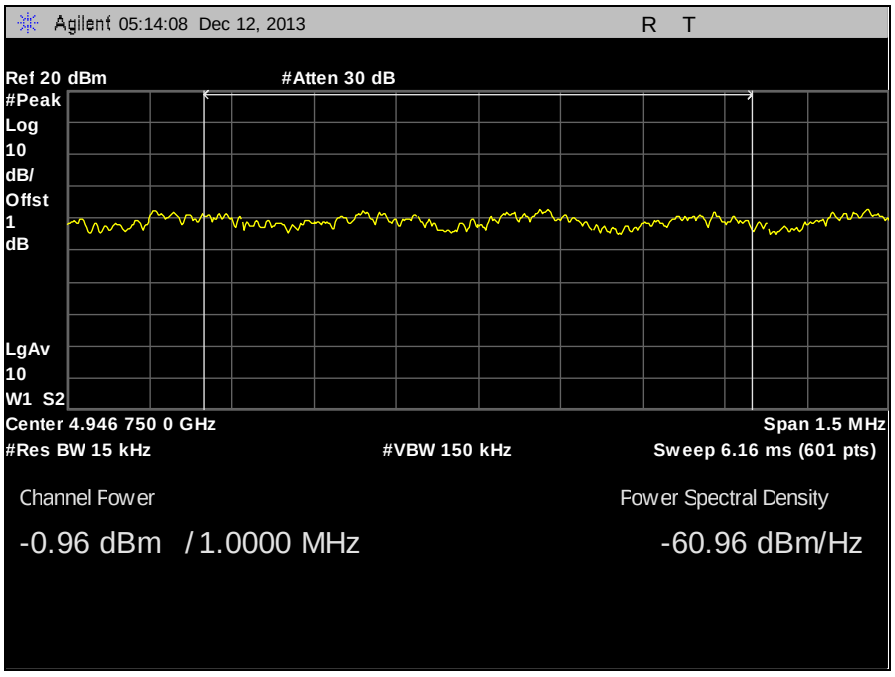
Plot 71. Peak Power Spectral Density, Peak Determination, 4985 MHz, 10 MHz Band, Antenna 1



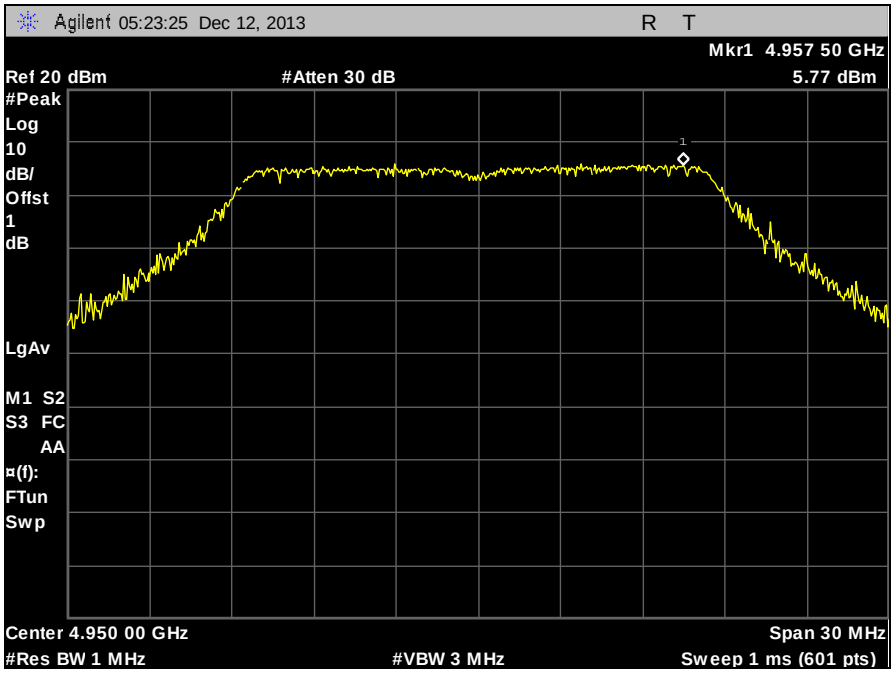
Plot 72. Peak Power Spectral Density, 4985 MHz, 10 MHz Band, Antenna 1



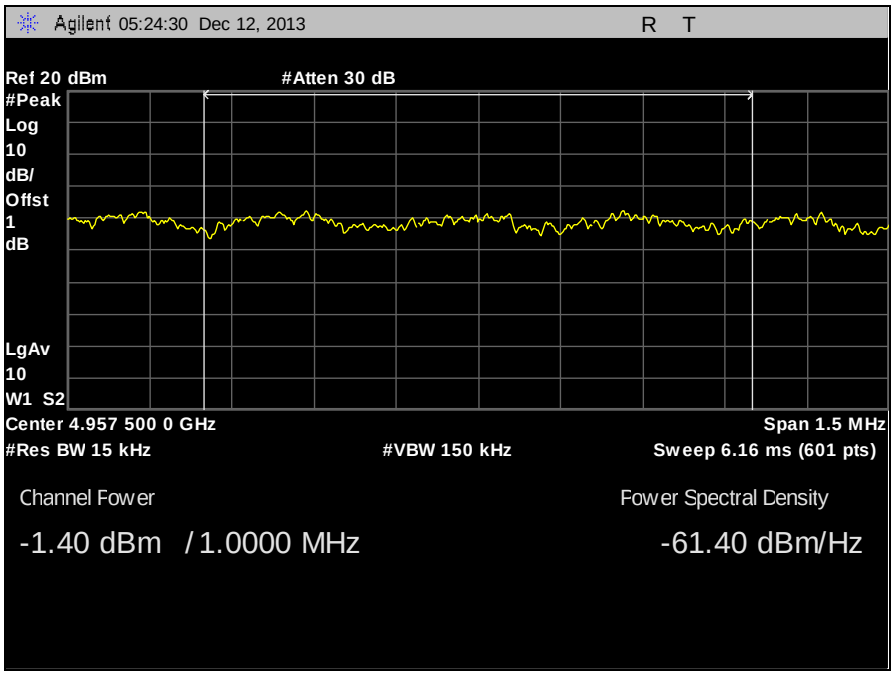
Plot 73. Peak Power Spectral Density, Peak Determination, 4950 MHz, 20 MHz Band, Antenna 0



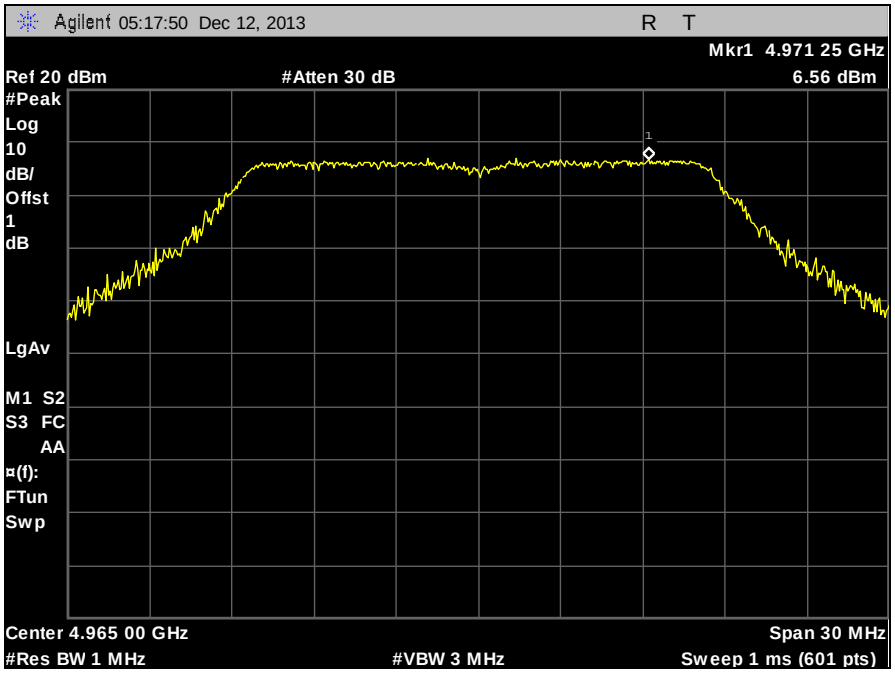
Plot 74. Peak Power Spectral Density, 4950 MHz, 20 MHz Band, Antenna 0



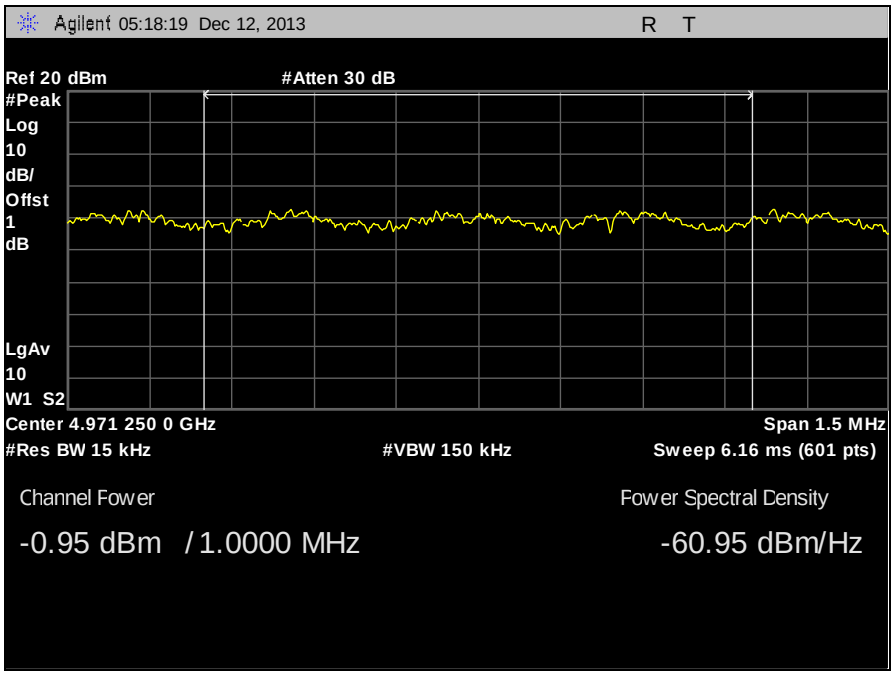
Plot 75. Peak Power Spectral Density, Peak Determination, 4950 MHz, 20 MHz Band, Antenna 1



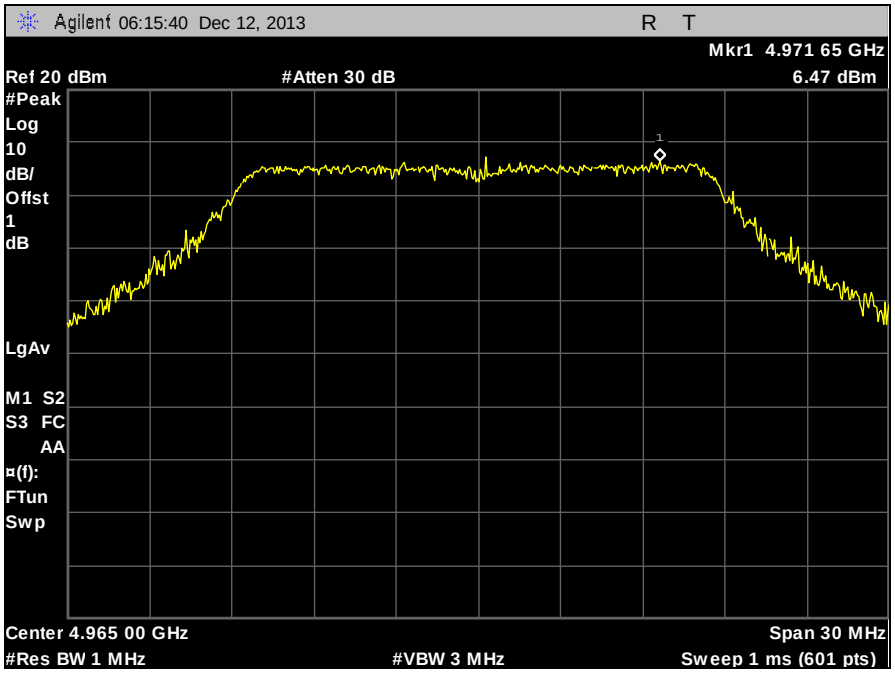
Plot 76. Peak Power Spectral Density, 4950 MHz, 20 MHz Band, Antenna 1



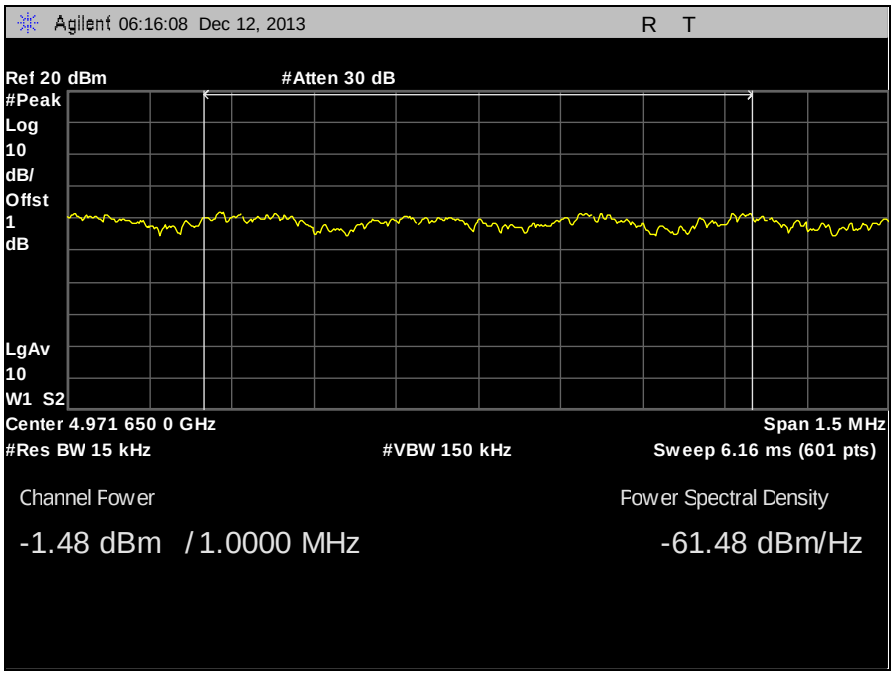
Plot 77. Peak Power Spectral Density, Peak Determination, 4965 MHz, 20 MHz Band, Antenna 0



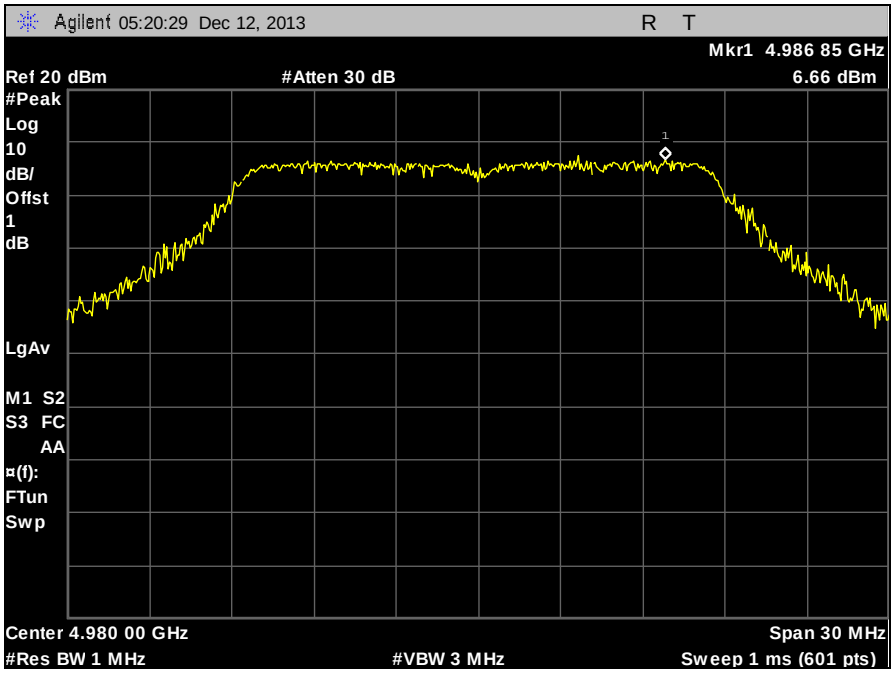
Plot 78. Peak Power Spectral Density, 4965 MHz, 20 MHz Band, Antenna 0



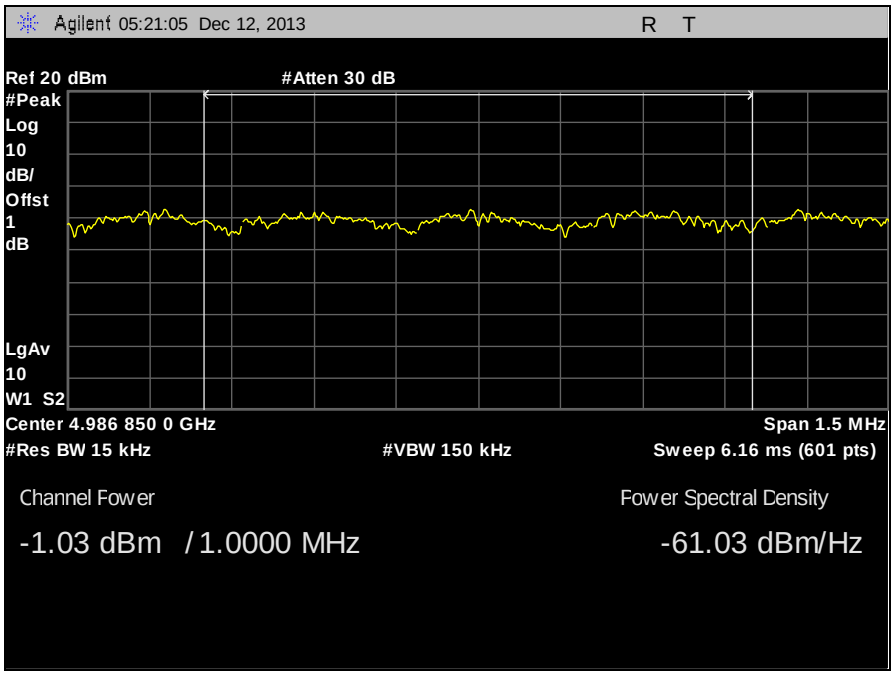
Plot 79. Peak Power Spectral Density, Peak Determination, 4965 MHz, 20 MHz Band, Antenna 1



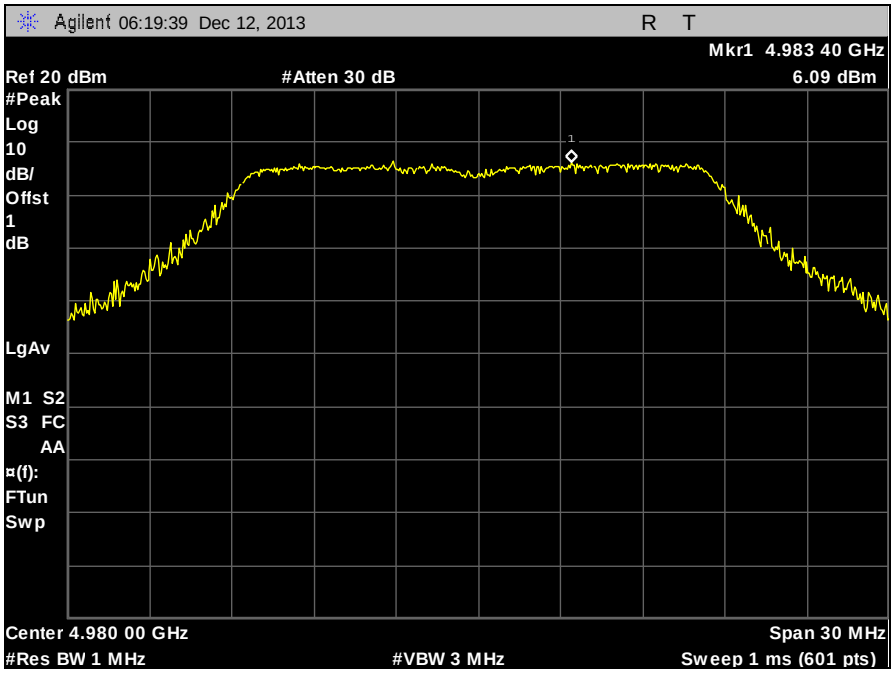
Plot 80. Peak Power Spectral Density, 4965 MHz, 20 MHz Band, Antenna 1



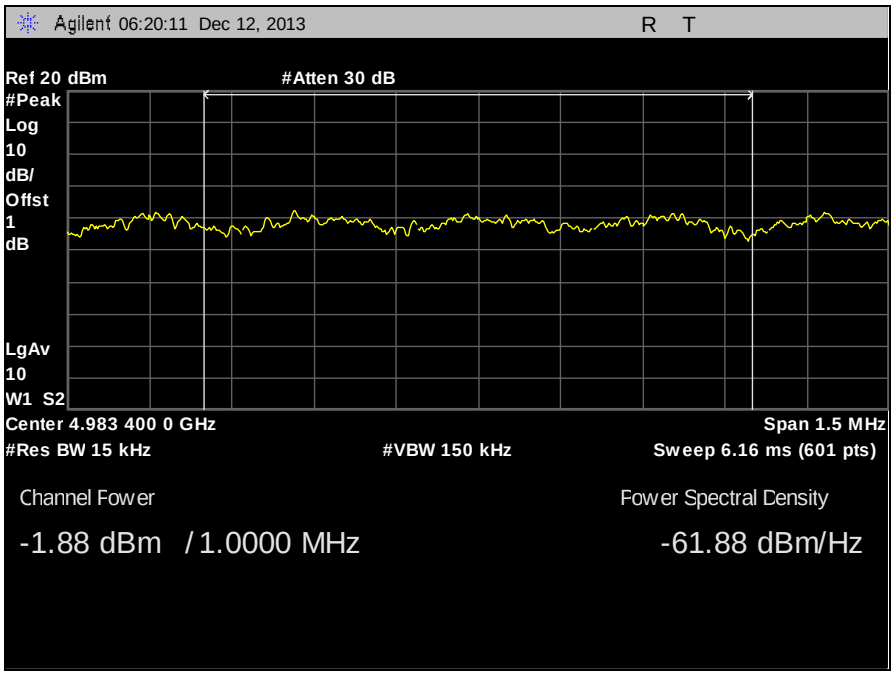
Plot 81. Peak Power Spectral Density, Peak Determination, 4980 MHz, 20 MHz Band, Antenna 0



Plot 82. Peak Power Spectral Density, 4980 MHz, 20 MHz Band, Antenna 0



Plot 83. Peak Power Spectral Density, Peak Determination, 4980 MHz, 20 MHz Band, Antenna 1



Plot 84. Peak Power Spectral Density, 4980 MHz, 20 MHz Band, Antenna 1

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 90.210(l) Spurious Emissions at Antenna Terminals

Test Requirement(s): **§2.1051 and §90.210(L) with FCC** KDB 971168.

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.

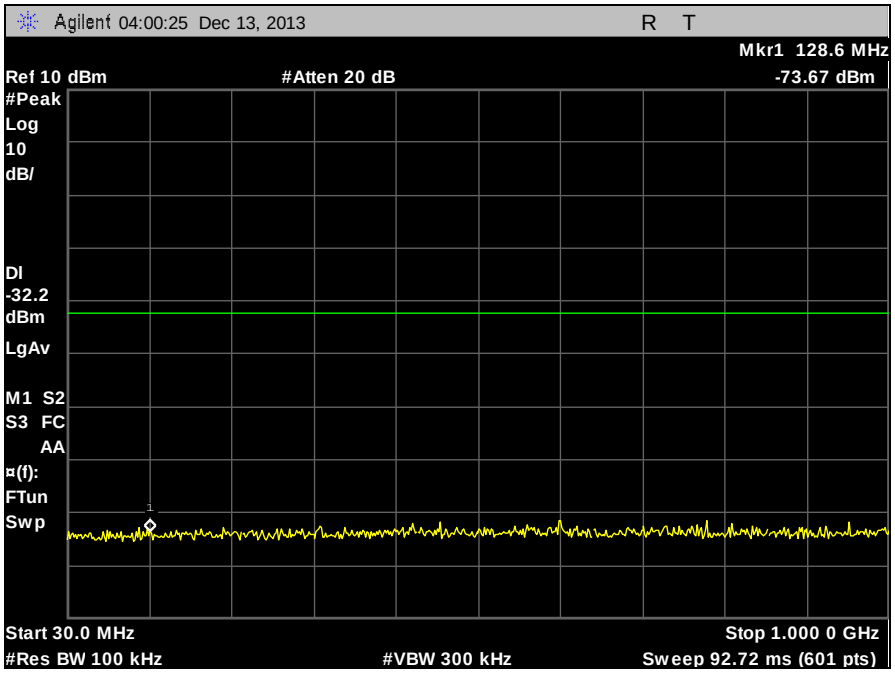
A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected to a Spectrum Analyzer and a Power Meter to monitor the output power level. The Spectrum Analyzer was set to sweep 30 MHz and up to 10^{th} harmonic of the fundamental or 40GHz whichever is the lesser. Measurements were made at the low, mid and high channels.

The Conducted Spurious Emissions *Limit* is obtained from §90.210 (l) (6)
On any frequency removed from the assigned frequency above 150% of the authorized bandwidth: 40dB below the output power spectral density of the transmitter.

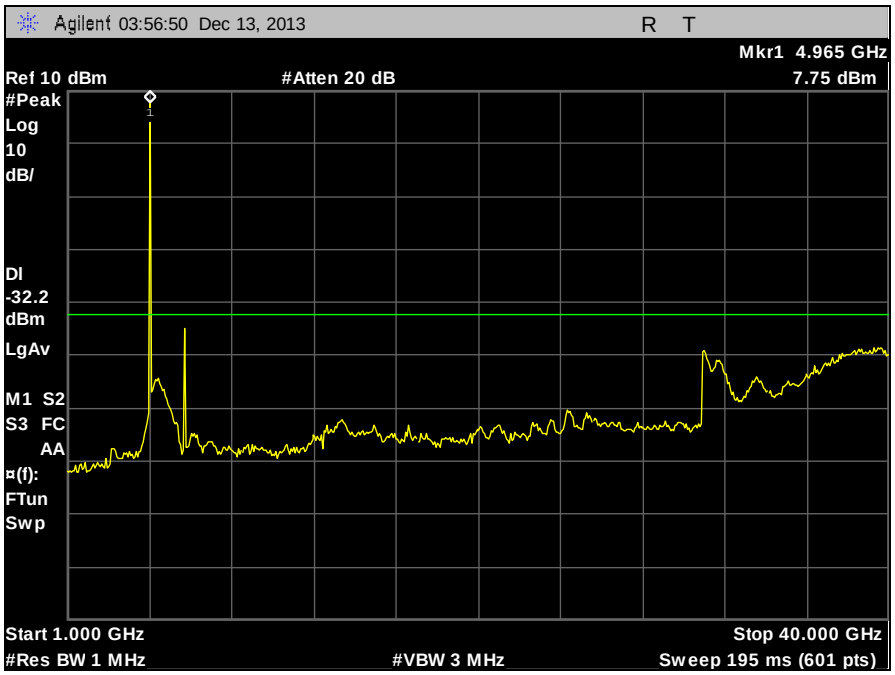
Test Results: Equipment complies with Section 2.1051 and 90.210(L) with FCC KDB 971168.

Test Engineer(s): Surinder Singh

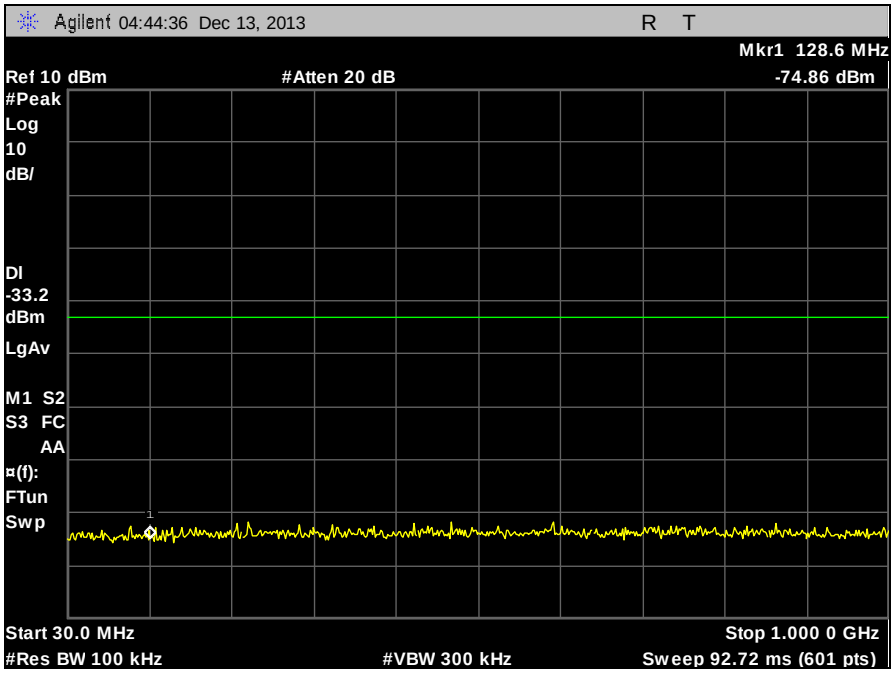
Test Date(s): 01/02/14



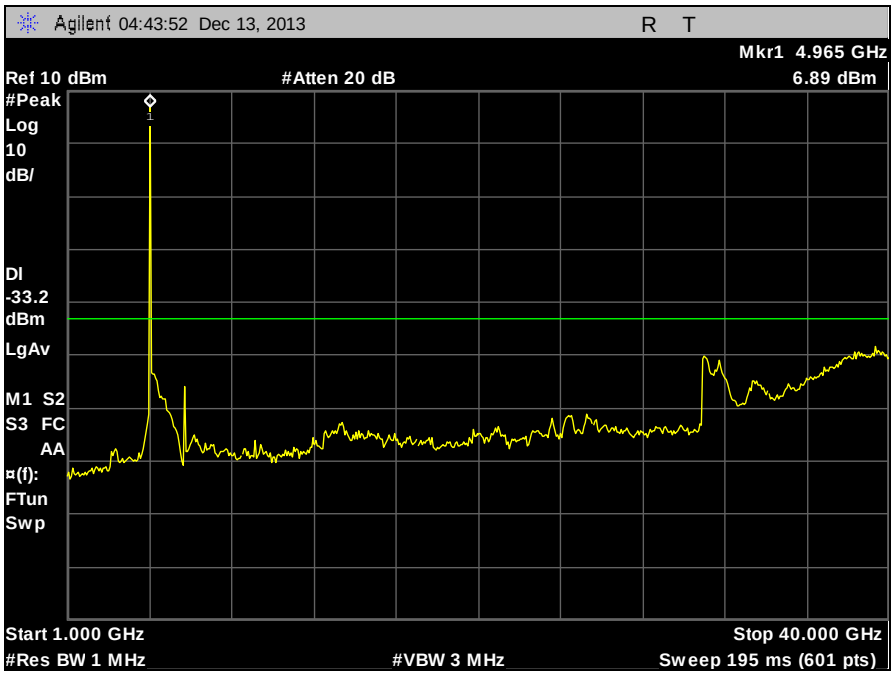
Plot 85. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 10 MHz Band, Antenna 0



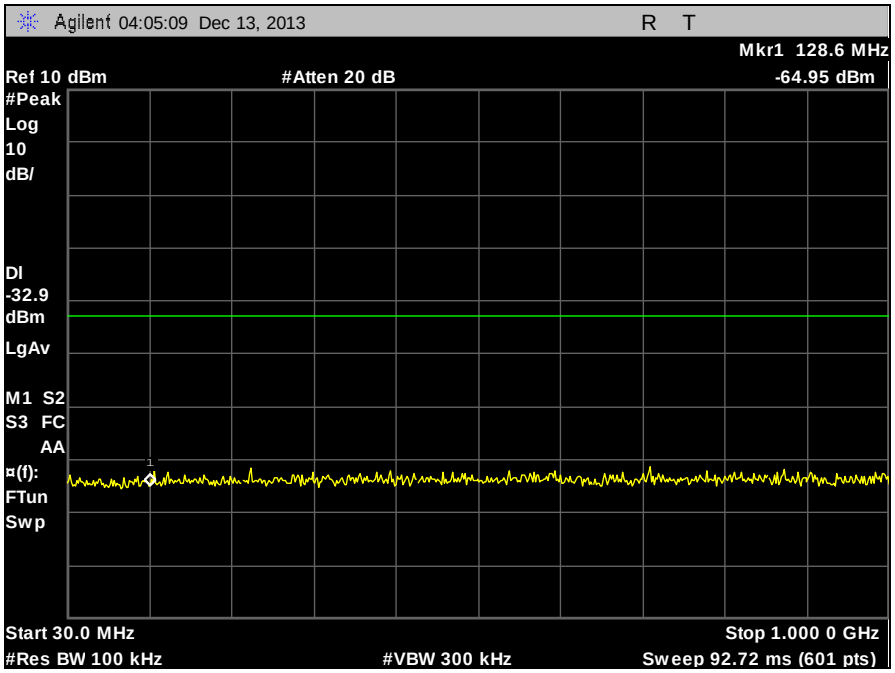
Plot 86. Conducted Spurious Emissions, Low Channel, 1 GHz – 40GHz, 10 MHz Band, Antenna 0



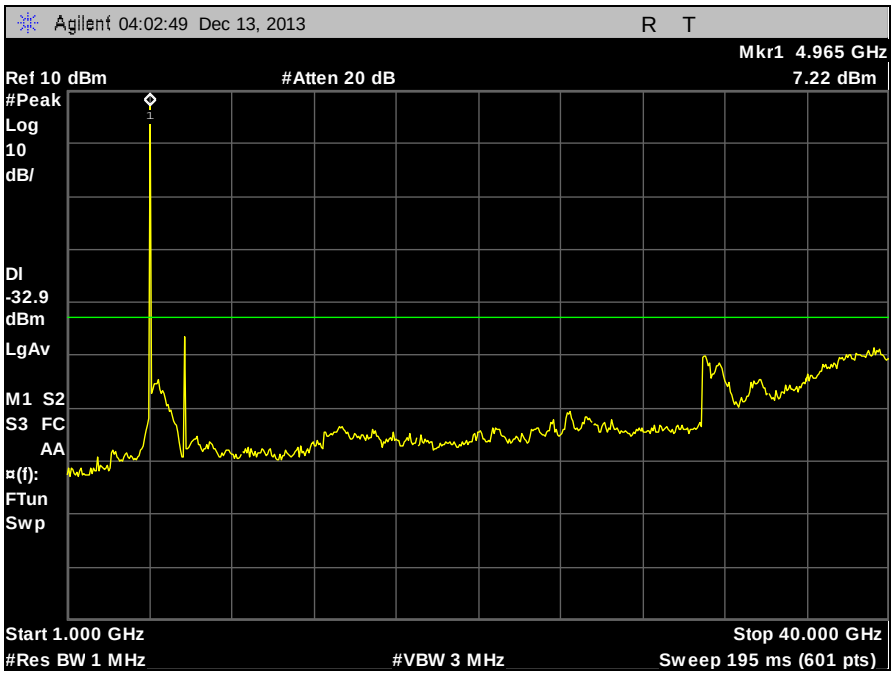
Plot 87. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 10 MHz Band, Antenna 1



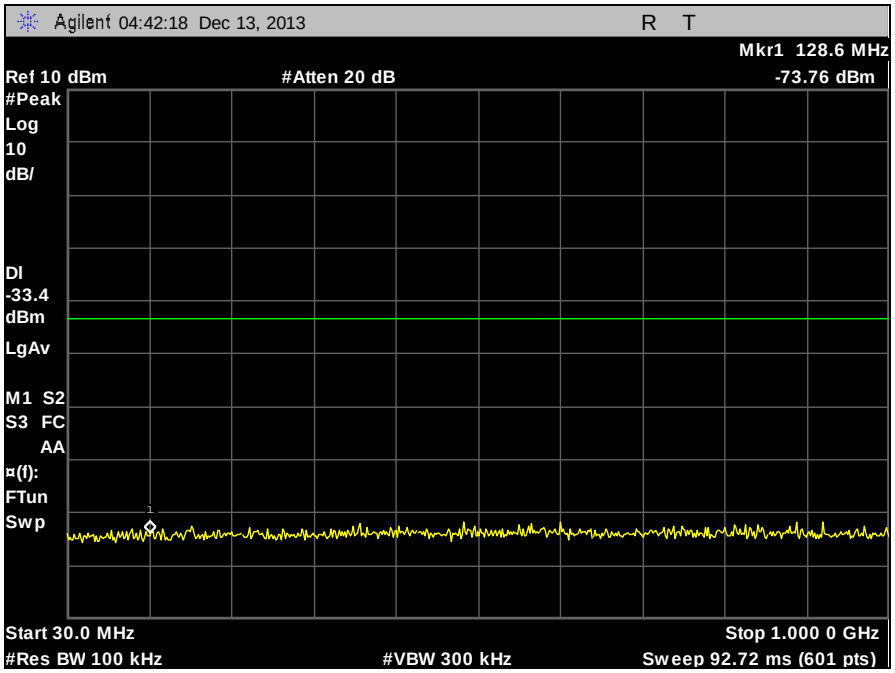
Plot 88. Conducted Spurious Emissions, Low Channel, 1 GHz – 40GHz, 10 MHz Band, Antenna 1



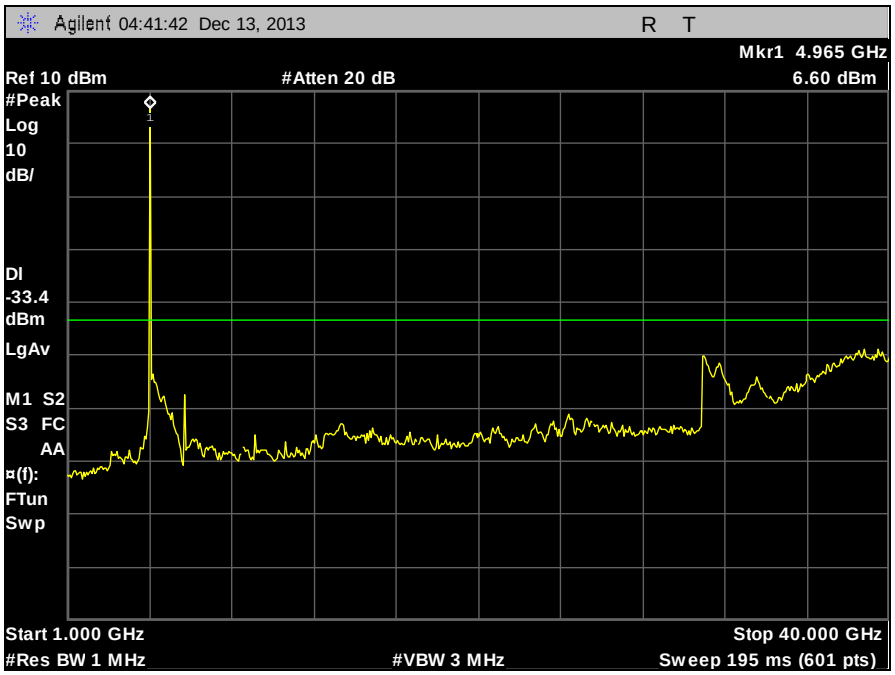
Plot 89. Conducted Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 10 MHz Band, Antenna 0



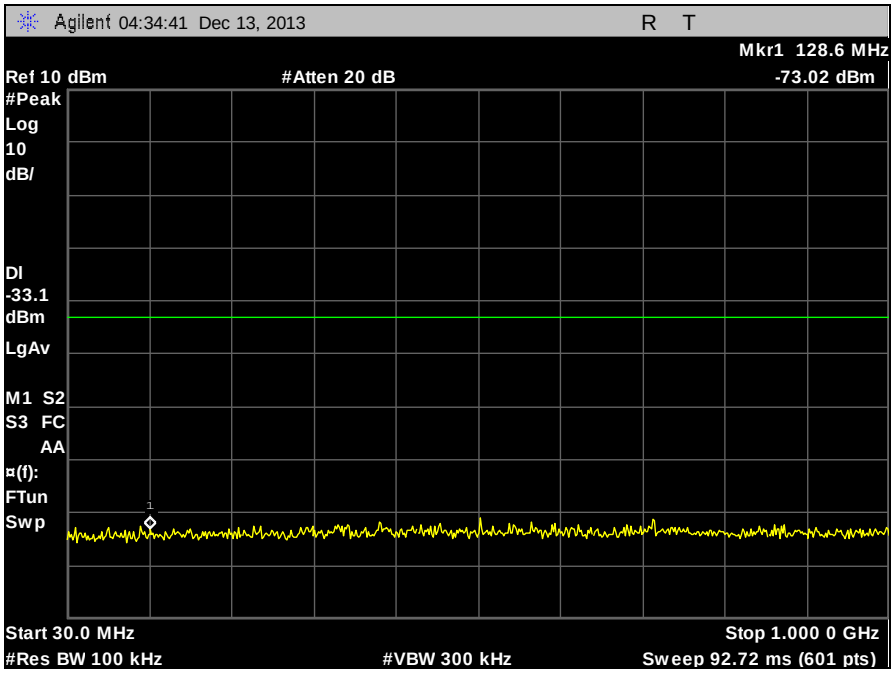
Plot 90. Conducted Spurious Emissions, Mid Channel, 1 GHz – 40 GHz, 10 MHz Band, Antenna 0



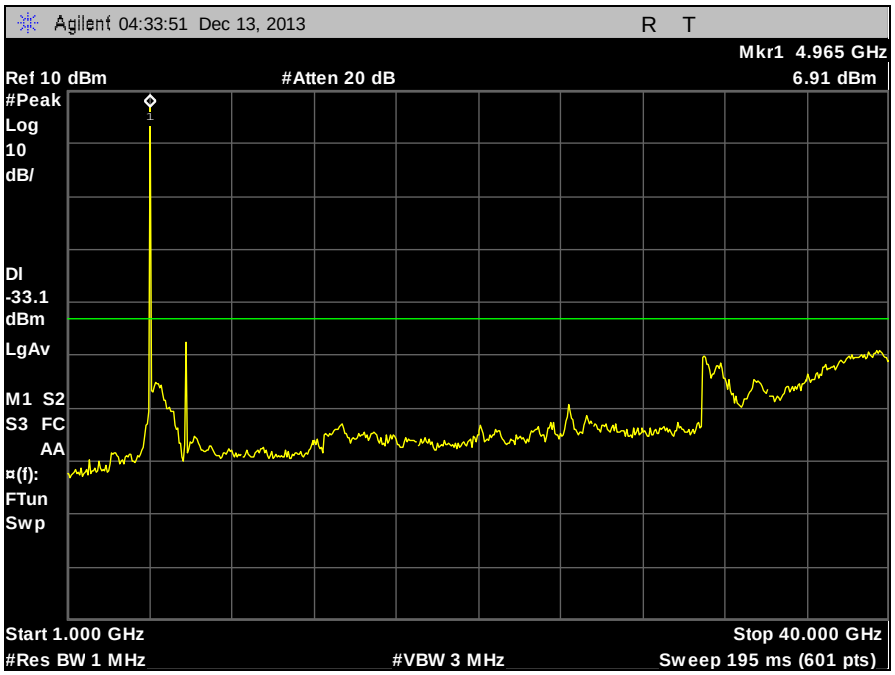
Plot 91. Conducted Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 10 MHz Band, Antenna 1



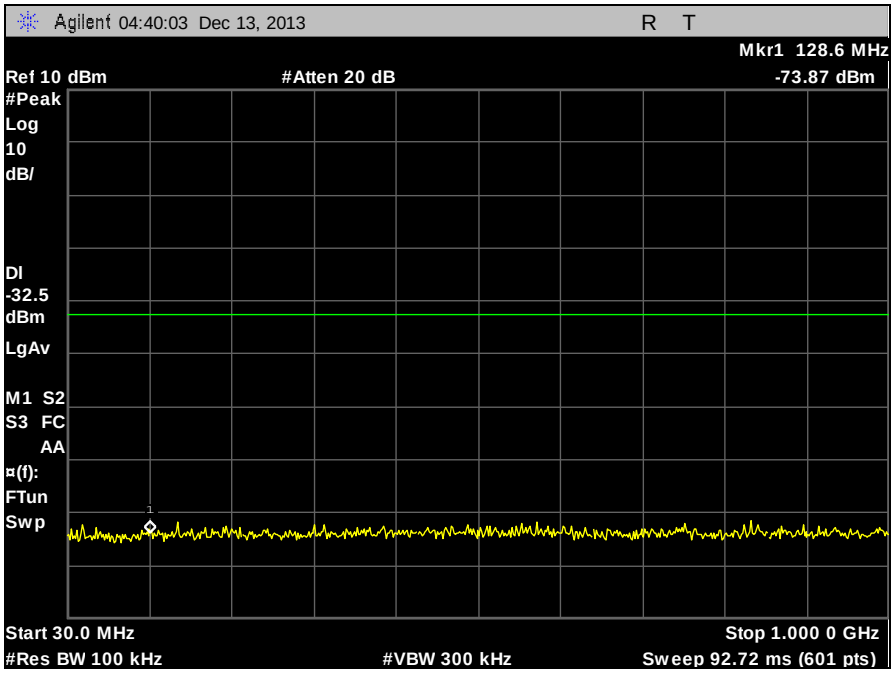
Plot 92. Conducted Spurious Emissions, Mid Channel, 1 GHz – 40 GHz, 10 MHz Band, Antenna 1



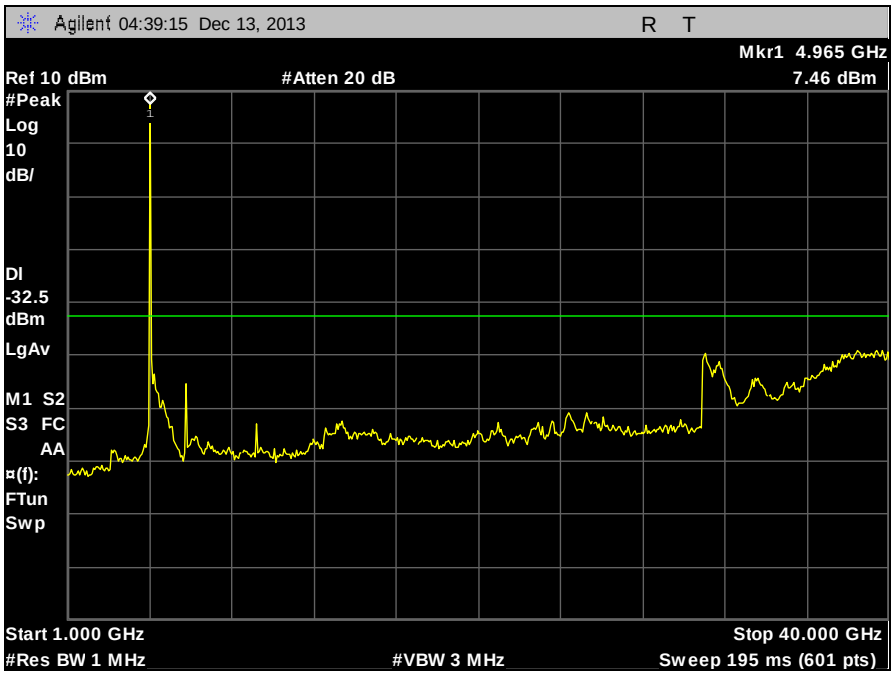
Plot 93. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz, 10 MHz Band, Antenna 0



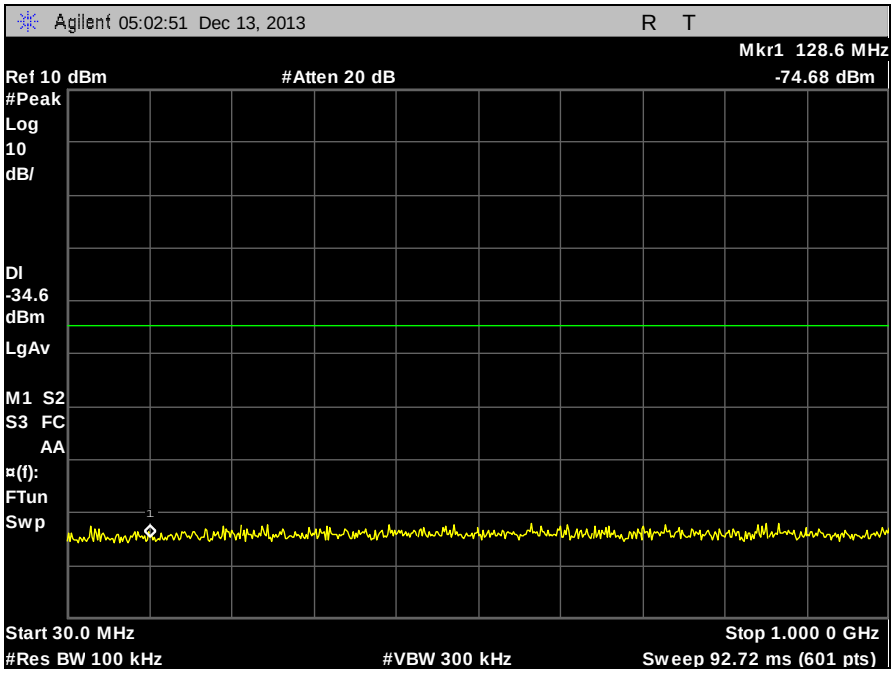
Plot 94. Conducted Spurious Emissions, High Channel, 1 GHz – 40 GHz, 10 MHz Band, Antenna 0



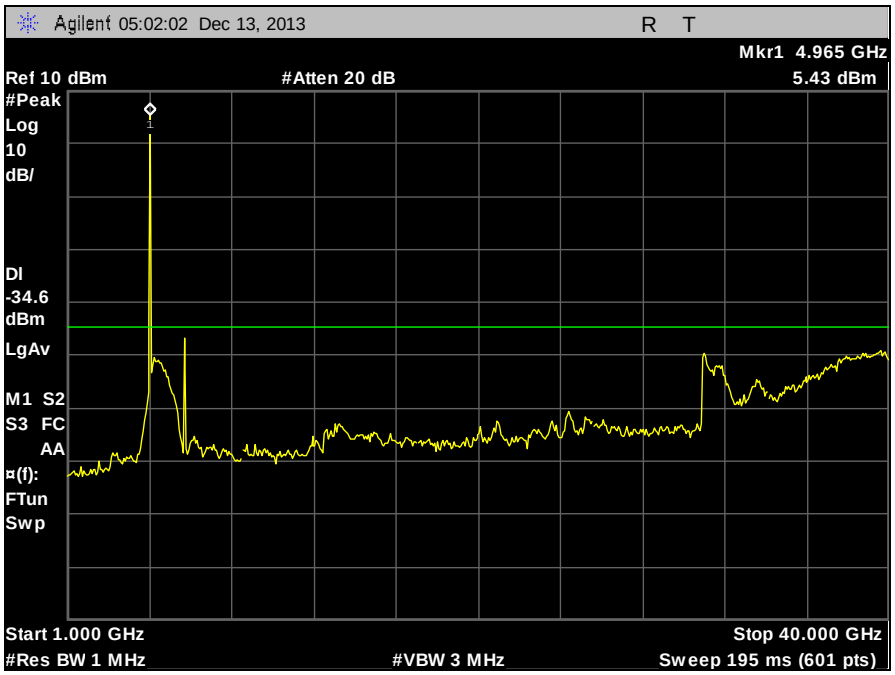
Plot 95. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz, 10 MHz Band, Antenna 1



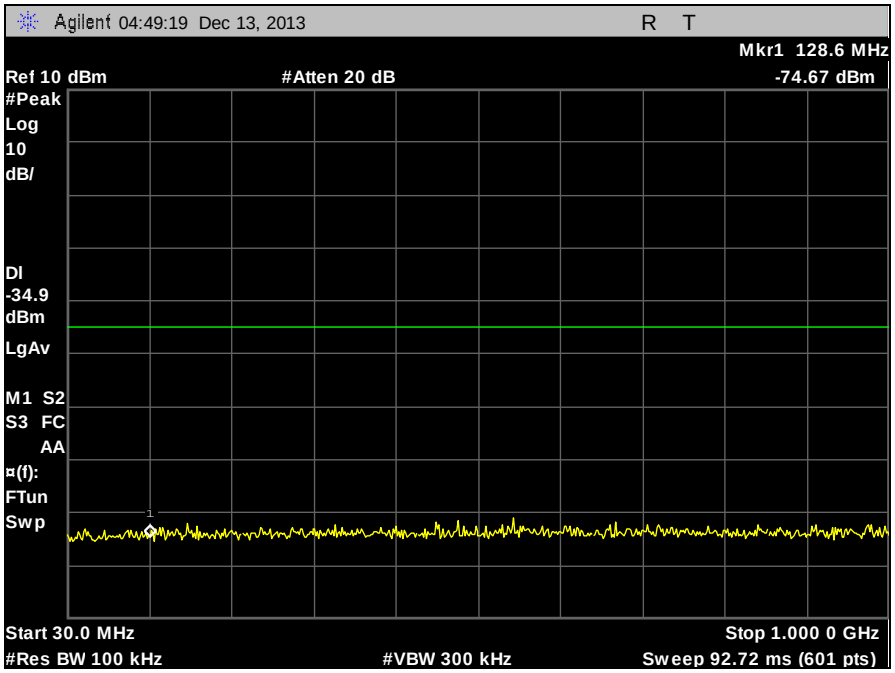
Plot 96. Conducted Spurious Emissions, High Channel, 1 GHz – 40 GHz, 10 MHz Band, Antenna 1



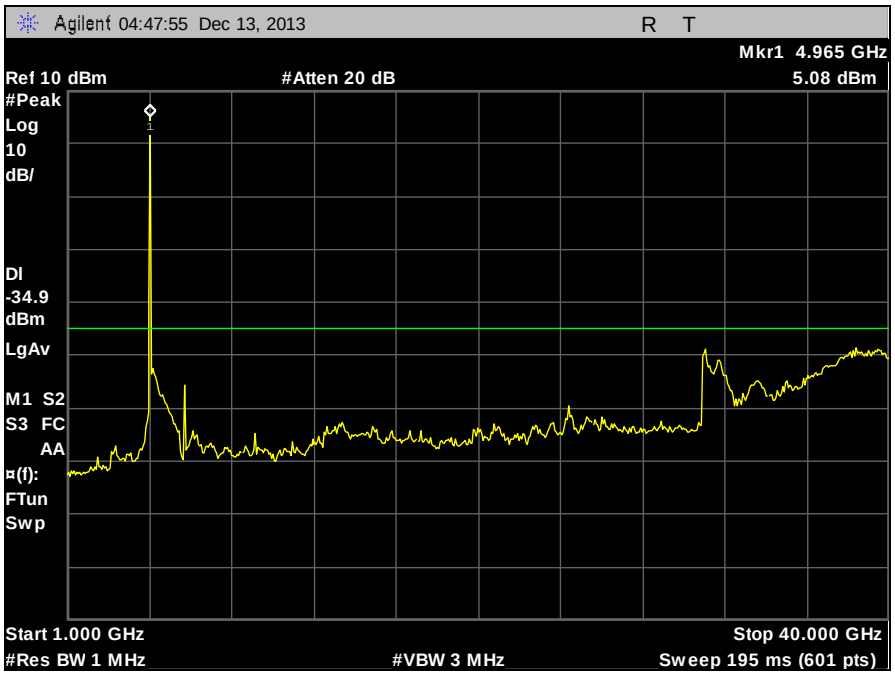
Plot 97. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 20 MHz Band, Antenna 0



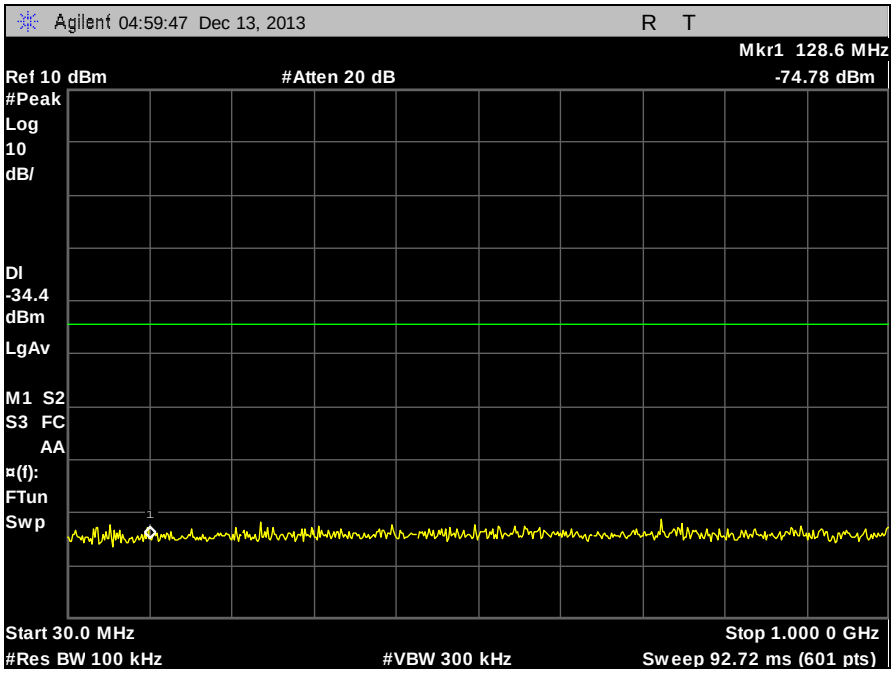
Plot 98. Conducted Spurious Emissions, Low Channel, 1 GHz – 40GHz, 20 MHz Band, Antenna 0



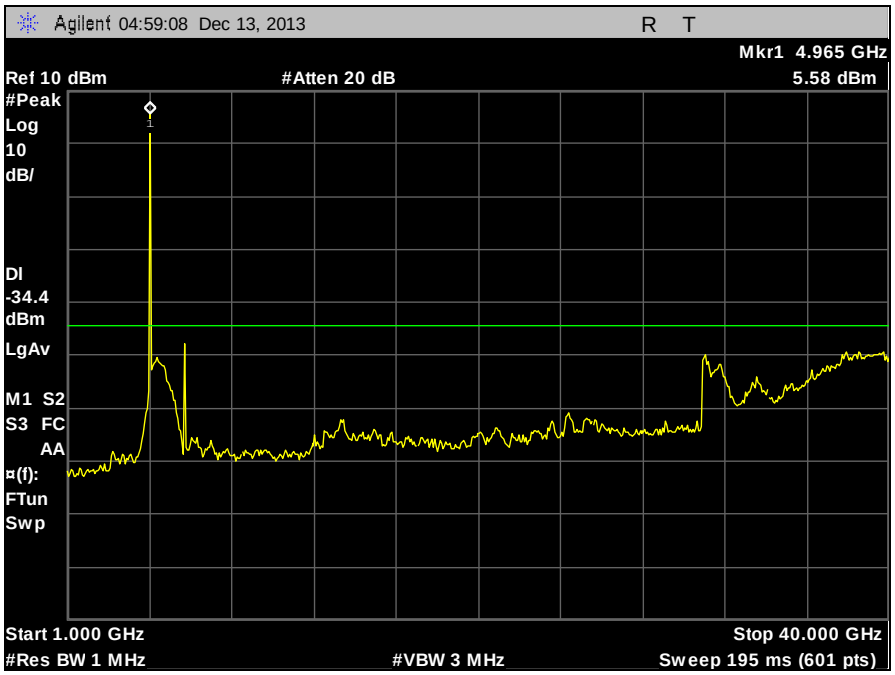
Plot 99. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz, 20 MHz Band, Antenna 1



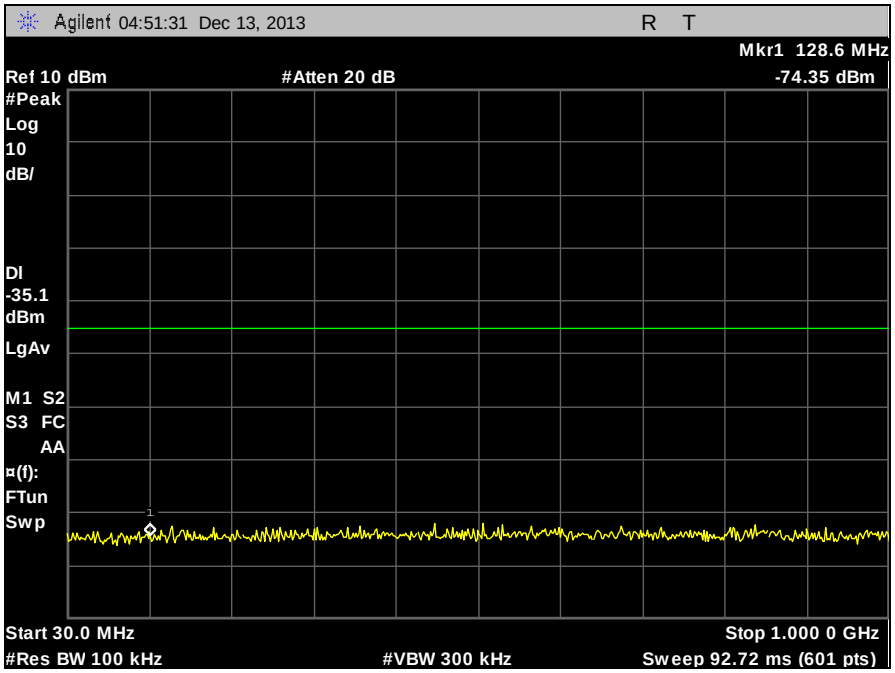
Plot 100. Conducted Spurious Emissions, Low Channel, 1 GHz – 40GHz, 20 MHz Band, Antenna 1



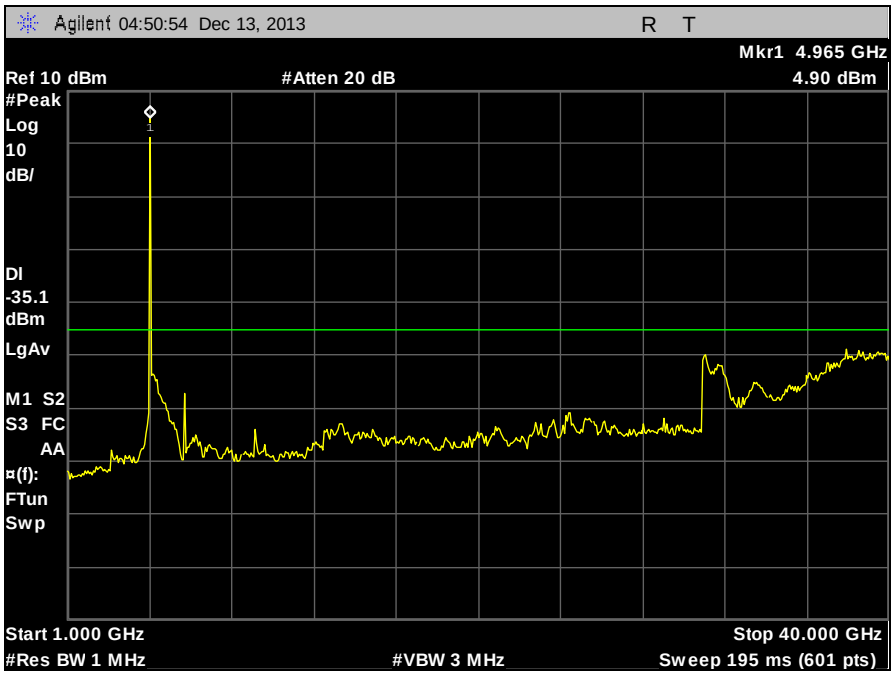
Plot 101. Conducted Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 20 MHz Band, Antenna 0



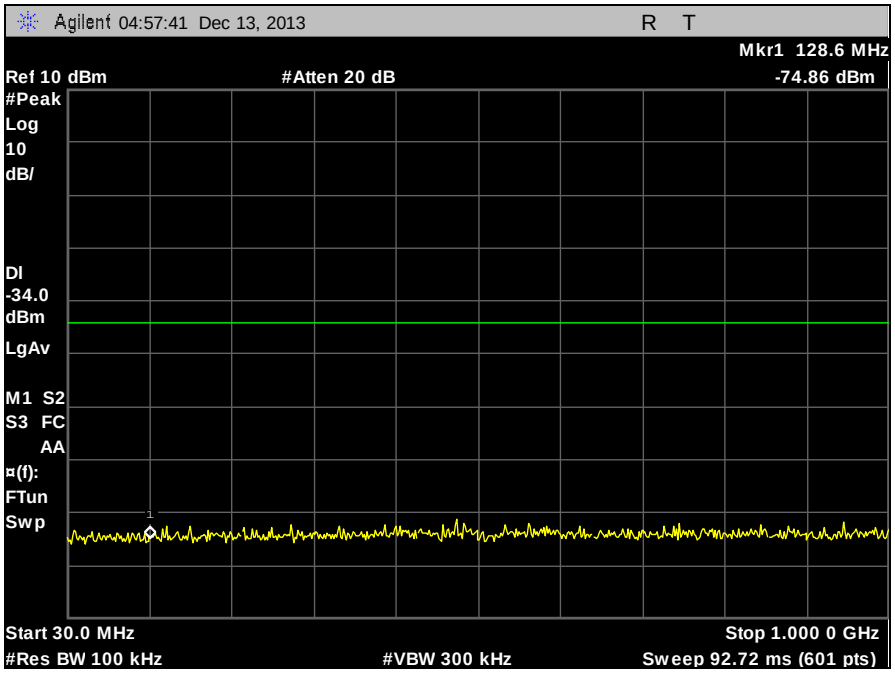
Plot 102. Conducted Spurious Emissions, Mid Channel, 1 GHz – 40 GHz, 20 MHz Band, Antenna 0



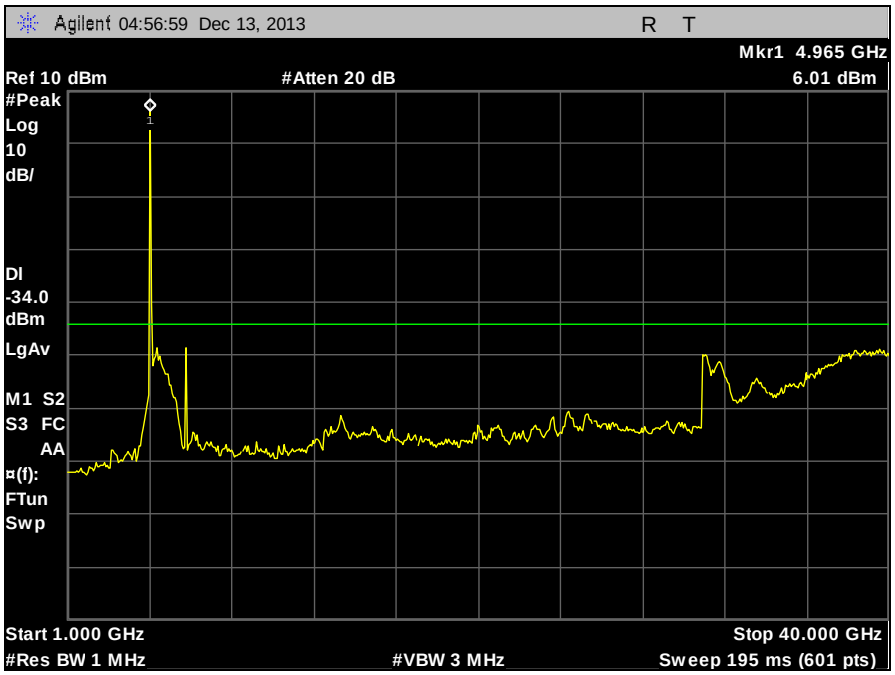
Plot 103. Conducted Spurious Emissions, Mid Channel, 30 MHz – 1 GHz, 20 MHz Band, Antenna 1



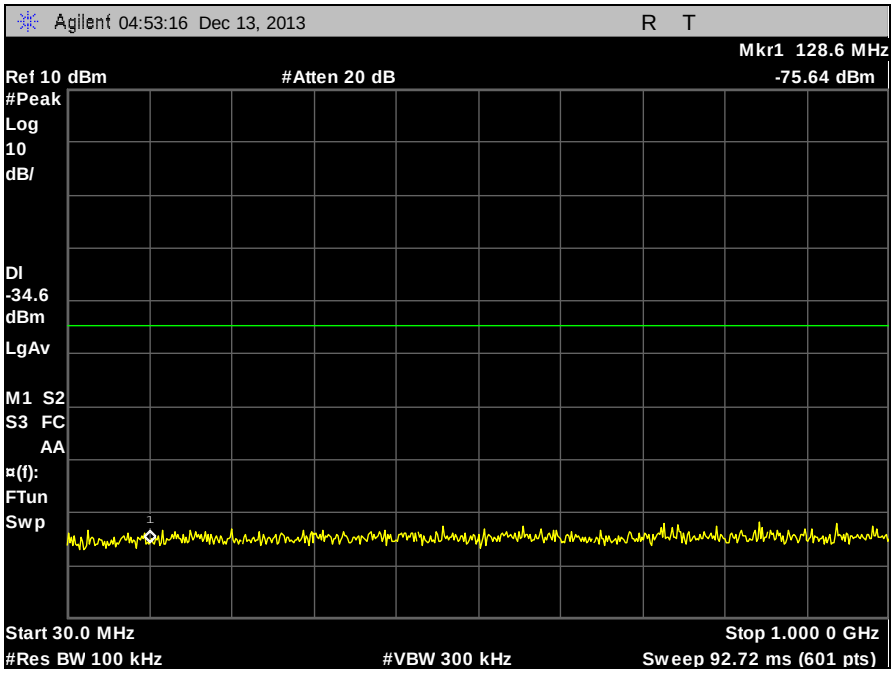
Plot 104. Conducted Spurious Emissions, Mid Channel, 1 GHz – 40 GHz, 20 MHz Band, Antenna 1



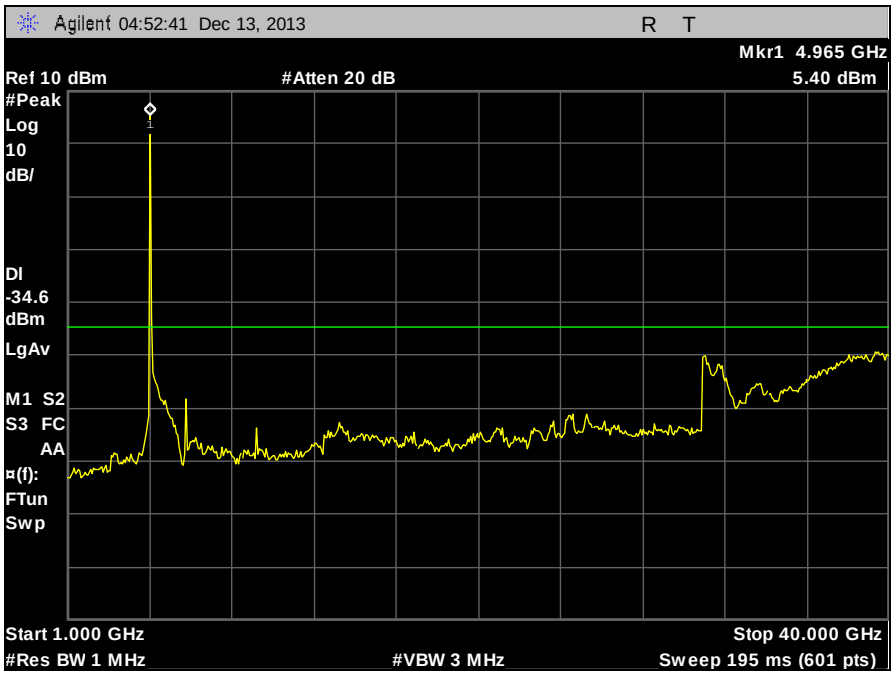
Plot 105. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz, 20 MHz Band, Antenna 0



Plot 106. Conducted Spurious Emissions, High Channel, 1 GHz – 40 GHz, 20 MHz Band, Antenna 0



Plot 107. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz, 20 MHz Band, Antenna 1



Plot 108. Conducted Spurious Emissions, High Channel, 1 GHz – 40 GHz, 20 MHz Band, Antenna 1

Electromagnetic Compatibility Criteria for Intentional Radiators

§90.213 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 a Directional Coupler through a Spectrum Analyzer and Power Meter.

The EUT was placed in the Environmental Chamber and support equipment's were outside the chamber on a table. The EUT was set to transmit a modulated signal corresponding to the low, mid and high Channels for 10 & 20MHz Bandwidths. The frequency counter option on the Spectrum Analyzer was used to measure frequency deviations. The frequency drift was investigated for every 10^{C} increment until the unit is stabilized then recorded the reading in tabular format with the temperature range of -30 to 50^{C}.

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

Test Results: Equipment complies with Section 2.1055 and 90.213.

Test Engineer: Surinder Singh

Test Date: 01/06/14

Low channel 4945MHz chain 0 10MHz Band					
	Voltage	**Temperature**	**Frequency**	**Delta (MHz)**	**Drift (ppm)**
Reference:120V @ 20C	120	50	4944.979825	-0.011325	-2.290201457
	120	40	4944.98475	-0.0064	-1.294240594
	120	30	4944.987165	-0.003985	-0.805866601
	120	20	4944.99115	0	0
	120	10	4944.99875	0.0076	1.536906354
4944.99115	120	0	4945.00475	0.0136	2.750250139
	120	-10	4945.00755	0.0164	3.316476231
	120	-20	4944.9925	0.00135	0.273003448
	120	-30	4944.99175	0.0006	0.121334884
	102	20	4945.00035	0.0092	1.860464985
	138	20	4944.98455	-0.0066	-1.334685666

Table 13. Frequency Stability, Low Channel, 4950 MHz, 10 MHz Band, Antenna 0

High channel 4985MHz Chain 0 10MHz Band					
	Voltage	**Temperature**	**Frequency**	**Delta (MHz)**	**Drift (ppm)**
Reference:120V @ 20C	120	50	4985.00725	0.0065	1.303909839
	120	40	4985.0005	-0.00025	-0.050150446
	120	30	4985.00875	0.008	1.604811626
	120	20	4985.00075	0	0
	120	10	4984.99775	-0.003	-0.601805688
4985.00075	120	0	4985.004985	0.004235	0.849547796
	120	-10	4985.00685	0.0061	1.223669331
	120	-20	4985.00495	0.0042	0.842526746
	120	-30	4984.99125	-0.0095	-1.905720497
	102	20	4984.99745	-0.0033	-0.661986297
	138	20	4985.00785	0.0071	1.424270576

Table 14. Frequency Stability, High Channel, 4980 MHz, 10 MHz Band, Antenna 0

Low channel 4945MHz chain 1 10MHz Band					
	Voltage	**Temperature**	**Frequency**	**Delta (MHz)**	**Drift (ppm)**
Reference:120V @ 20C	120	50	4945.0007	0.01345	2.719918725
	120	40	4944.976	-0.01125	-2.27503632
	120	30	4944.9795	-0.00775	-1.567246133
	120	20	4944.98725	0	0
	120	10	4944.99875	0.0115	2.325581983
4944.98725	120	0	4945.00625	0.019	3.842260058
	120	-10	4945.008	0.02075	4.196150947
	120	-20	4945.006	0.01875	3.791704196
	120	-30	4944.99025	0.003	0.60180608
	102	20	4944.98725	0	0
	138	20	4944.987	-0.00025	-0.05055625

Table 15. Frequency Stability, Low Channel, 4950 MHz, 10 MHz Band, Antenna 1

High channel 4985MHz Chain 1 10MHz Band					
	Voltage	**Temperature**	**Frequency**	**Delta (MHz)**	**Drift (ppm)**
Reference:120V @ 20C	120	50	4984.987	0.00025	0.050150582
	120	40	4984.97575	-0.011	-2.206630594
	120	30	4984.979	-0.00775	-1.554670541
	120	20	4984.98675	0	0
	120	10	4984.999725	0.012975	2.602808569
4984.98675	120	0	4985.005	0.01825	3.660979277
	120	-10	4985.006	0.01925	3.861580106
	120	-20	4985.00575	0.019	3.811429907
	120	-30	4984.9945	0.00775	1.554665707
	102	20	4984.98675	0	0
	138	20	4984.98675	0	0

Table 16. Frequency Stability, High Channel, 4980 MHz, 10 MHz Band, Antenna 1

Low channel 4950MHz chain 0 20MHz Band					
	Voltage	**Temperature**	**Frequency**	**Delta (MHz)**	**Drift (ppm)**
Reference:120V @ 20C	120	50	4949.98725	-0.0006	-0.121212433
	120	40	4949.99875	0.0109	2.202020758
	120	30	4949.9865	-0.00135	-0.272728017
	120	20	4949.98785	0	0
	120	10	4950.0025	0.01465	2.959594465
4949.98785	120	0	4950.00685	0.019	3.838378527
	120	-10	4950.008	0.02015	4.070700492
	120	-20	4950.00825	0.0204	4.121205252
	120	-30	4949.99225	0.0044	0.888890281
	102	20	4949.98725	-0.0006	-0.121212433
	138	20	4949.99025	0.0024	0.48484944

Table 17. Frequency Stability, Low Channel, 4950 MHz, 20 MHz Band, Antenna 0

High channel 4980MHz Chain 0 20MHz Band					
	Voltage	**Temperature**	**Frequency**	**Delta (MHz)**	**Drift (ppm)**
Reference:120V @ 20C	120	50	4979.99625	0.01	2.008033641
	120	40	4979.97825	-0.008	-1.606432719
	120	30	4979.99125	0.005	1.004017828
	120	20	4979.98625	0	0
	120	10	4980.0005	0.01425	2.861445496
4979.98625	120	0	4980.00995	0.0237	4.759026636
	120	-10	4980.009	0.02275	4.568264836
	120	-20	4980.00575	0.0195	3.91565813
	120	-30	4979.99175	0.0055	1.1044195
	102	20	4979.99125	0.005	1.004017828
	138	20	4979.99335	0.0071	1.425704715

Table 18. Frequency Stability, High Channel, 4980 MHz, 20 MHz Band, Antenna 0

Low channel 4950MHz chain 1 20MHz Band					
	Voltage	**Temperature**	**Frequency**	**Delta (MHz)**	**Drift (ppm)**
Reference:120V @ 20C	120	50	4950.0005	0.0045	0.909090817
	120	40	4949.97575	-0.02025	-4.090929132
	120	30	4949.98225	-0.01375	-2.777787739
	120	20	4949.996	0	0
	120	10	4950.00395	0.00795	1.606059324
4949.996	120	0	4950.00825	0.01225	2.47474335
	120	-10	4950.009	0.013	2.626257851
	120	-20	4950.00625	0.01025	2.070704456
	120	-30	4949.99175	-0.00425	-0.85858729
	102	20	4949.99	-0.006	-1.212123661
	138	20	4949.989	-0.007	-1.414144557

Table 19. Frequency Stability, Low Channel, 4950 MHz, 20 MHz Band, Antenna 1

High channel 4980MHz Chain 1 20MHz Band					
	Voltage	**Temperature**	**Frequency**	**Delta (MHz)**	**Drift (ppm)**
Reference:120V @ 20C	120	50	4980.0002	0.01245	2.4999999
	120	40	4979.97575	-0.012	-2.409650288
	120	30	4979.97975	-0.008	-1.606432235
	120	20	4979.98775	0	0
	120	10	4980.00745	0.0197	3.955817375
4979.98775	120	0	4980.007	0.01925	3.865456414
	120	-10	4980.009	0.02125	4.267060561
	120	-20	4980.00625	0.0185	3.714854776
	120	-30	4979.998	0.01025	2.058233758
	102	20	4979.9875	-0.00025	-0.050200929
	138	20	4979.98725	-0.0005	-0.100401863

Table 20. Frequency Stability, High Channel, 4980 MHz, 20 MHz Band, Antenna 1

Photograph 5. Frequency Stability, Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

§90.1215(e) Peak Excursion

Test Requirements: **§90.1215(e):** The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

Test Procedure: The EUT was connected directly to the spectrum analyzer through cabling and attenuation. Measure the total peak power and record as PPk. Measure the total average power and record as PAvg. Both the peak and average power levels must be expressed in the same logarithmic units (*e.g.*, dBm)
Determine the PAPR from:
PAPR (dB) = PPk (dBm) - PAvg (dBm).

Test Results: Equipment was compliant with the peak excursion ratio limits of this section**.**

Test Engineer(s): Surinder Singh

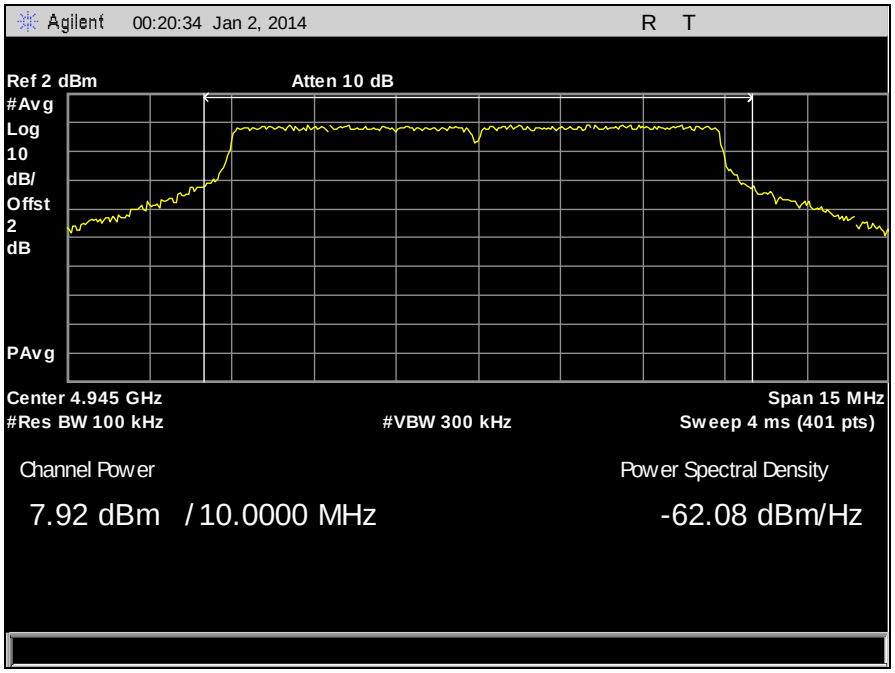
Test Date(s): 01/02/14

Peak Conducted Output Power 10MHz Band							
Chanel Carrier	**Frequency GHz**	**Measured Peak Output Power (dBm)/20MHz Port 0**	**Measured Average Output Power (dBm)/20MHz Port 0**	**Measured Peak Output Power (dBm)/20MHz Port 1**	**Measured Average Output Power (dBm)/20MHz Port 1**	**Peak Excursion Ratio Port 0**	**Peak Excursion Ratio Port 1**
Low	4.945	11.09	7.92	10.77	8.72	3.17	2.05
Mid	4.965	10.78	8.69	10.82	8.2	2.09	2.62
High	4.985	10.77	8.63	10.52	8.23	2.14	2.29

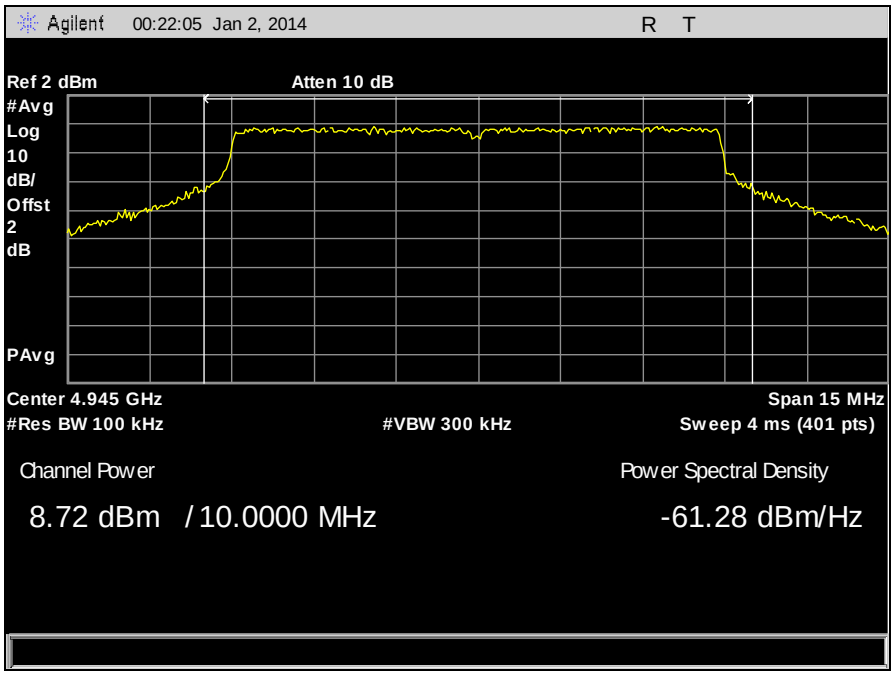
Table 21. Peak Excursion, 10 MHz Band

Peak Conducted Output Power 20MHz Band							
Chanel Carrier	**Frequency GHz**	**Measured Peak Output Power (dBm)/20MHz Port 0**	**Measured Average Output Power (dBm)/20MHz Port 0**	**Measured Peak Output Power (dBm)/20MHz Port 1**	**Measured Average Output Power (dBm)/20MHz Port 1**	**Peak Excursion Ratio Port 0**	**Peak Excursion Ratio Port 1**
Mid	4.95	13.83	7.42	12.9	10.71	6.41	2.19
Mid	4.965	13.84	11.69	12.95	10.8	2.15	2.15
Mid	4.98	13.78	11.54	12.7	10.83	2.24	1.87

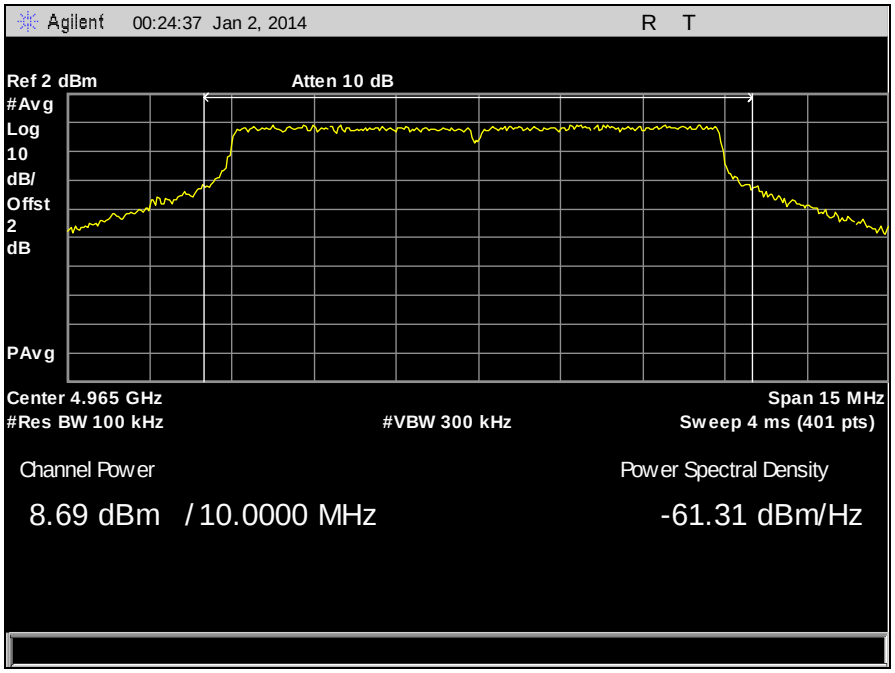
Table 22. Peak Excursion, 20 MHz Band



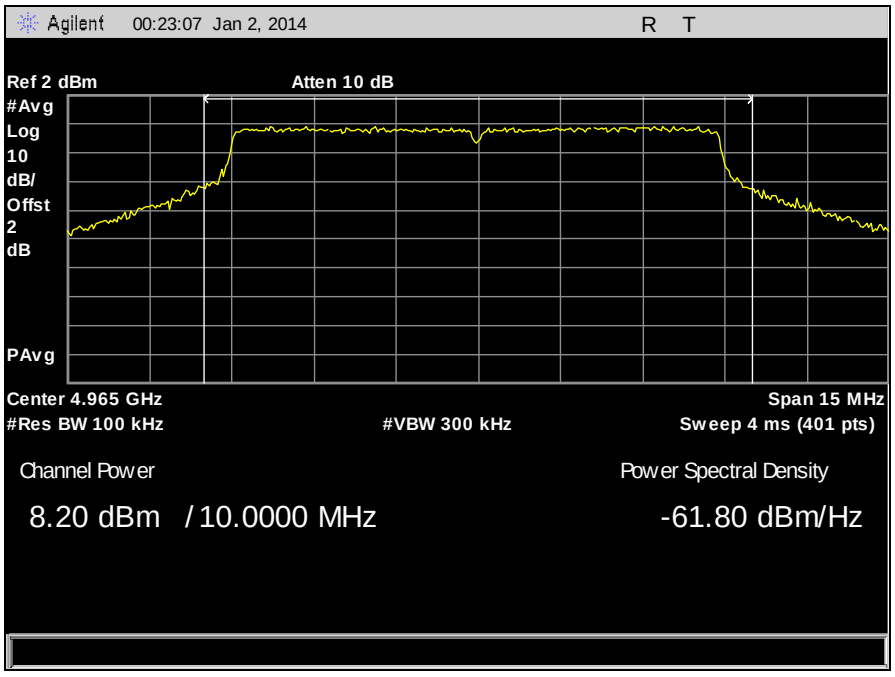
Plot 109. Peak Excursion, Low Channel, 4945 MHz, Average, 10 MHz Band, Port 0



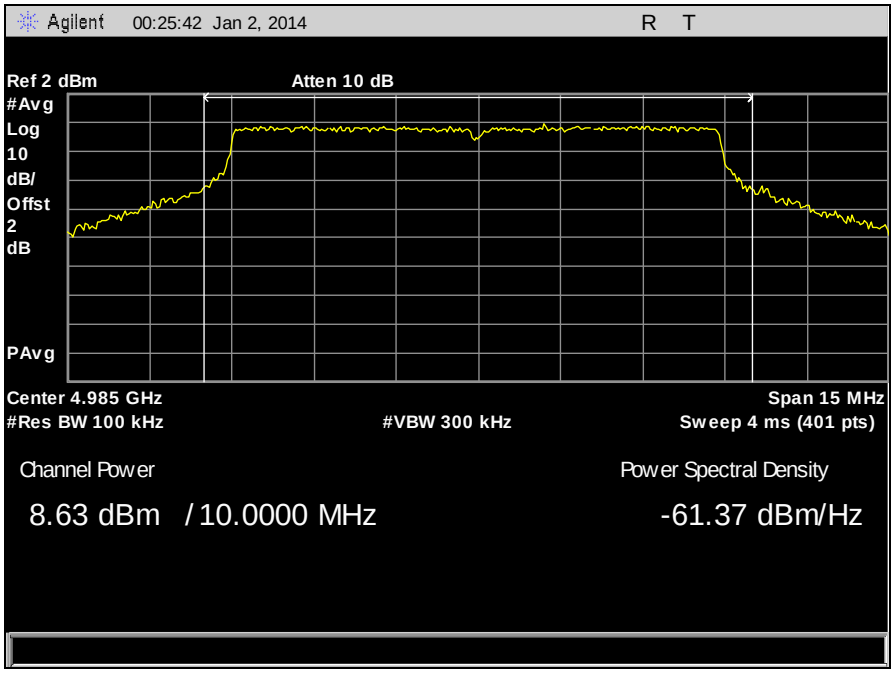
Plot 110. Peak Excursion, Low Channel, 4945 MHz, Average, 10 MHz Band, Port 1



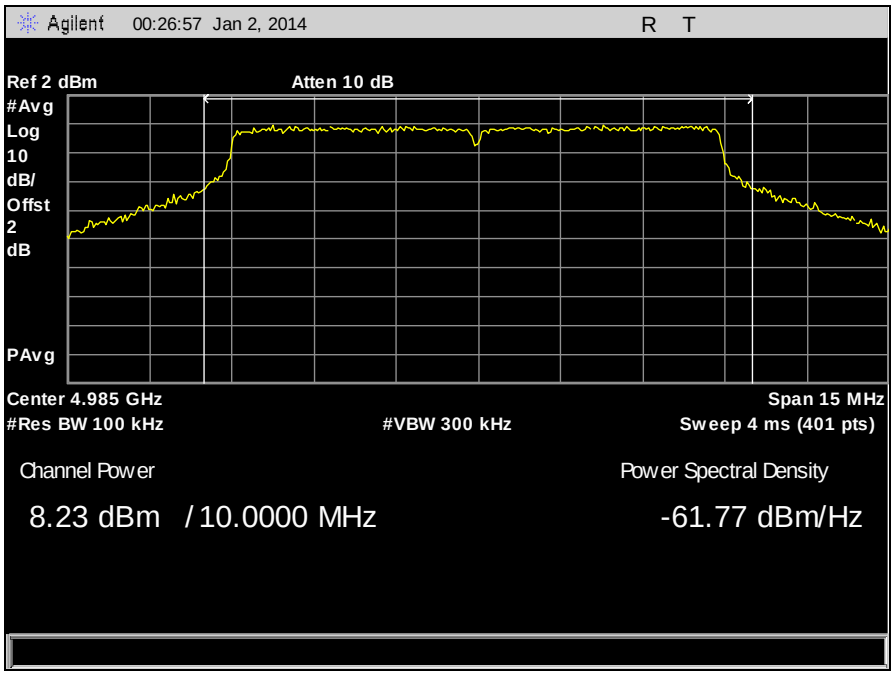
Plot 111. Peak Excursion, Mid Channel, 4965 MHz, Average, 10 MHz Band, Port 0



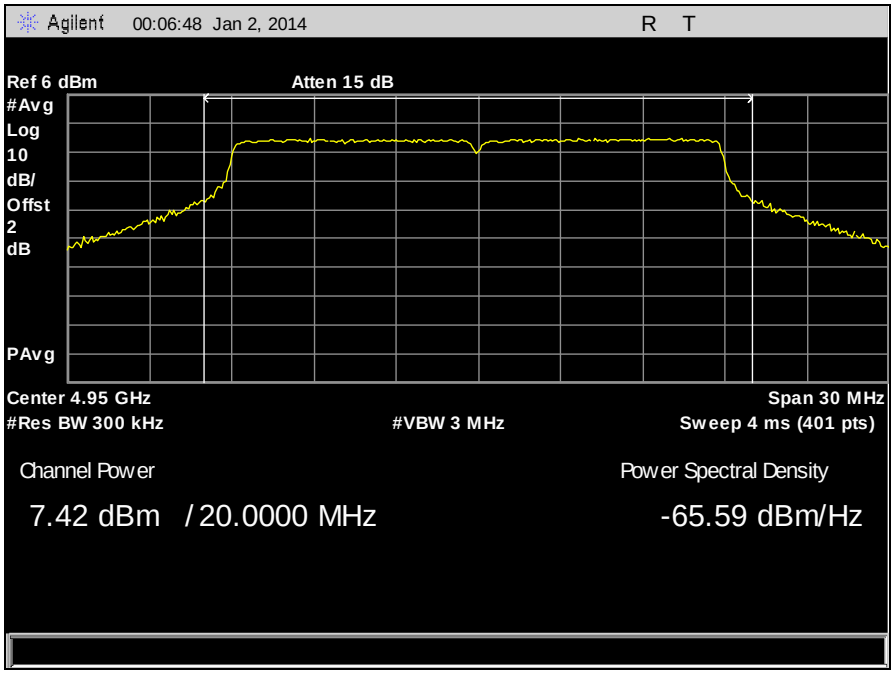
Plot 112. Peak Excursion, Mid Channel, 4965 MHz, Average, 10 MHz Band, Port 1



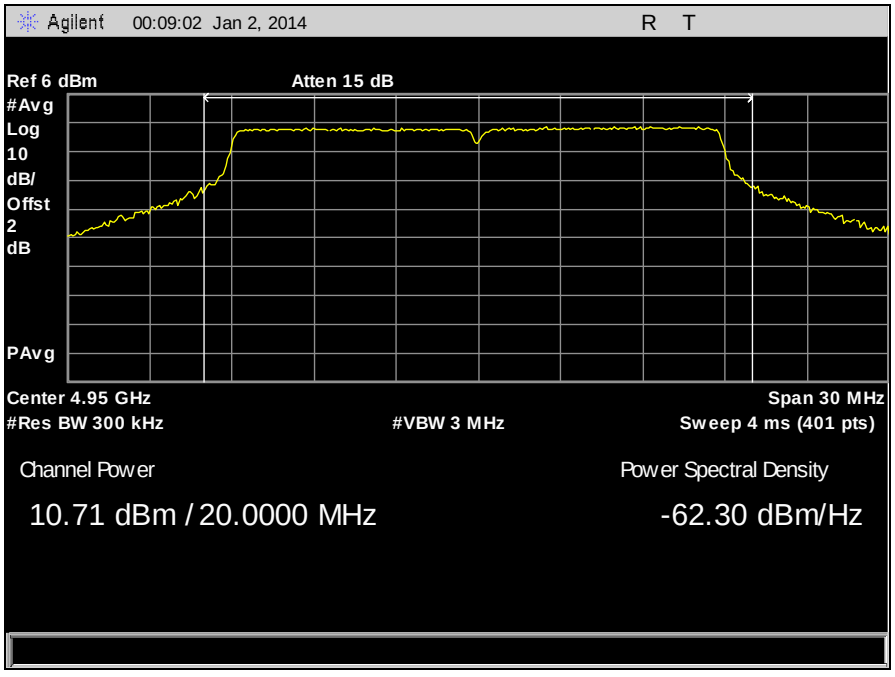
Plot 113. Peak Excursion, High Channel, 4985 MHz, Average, 10 MHz Band, Port 0



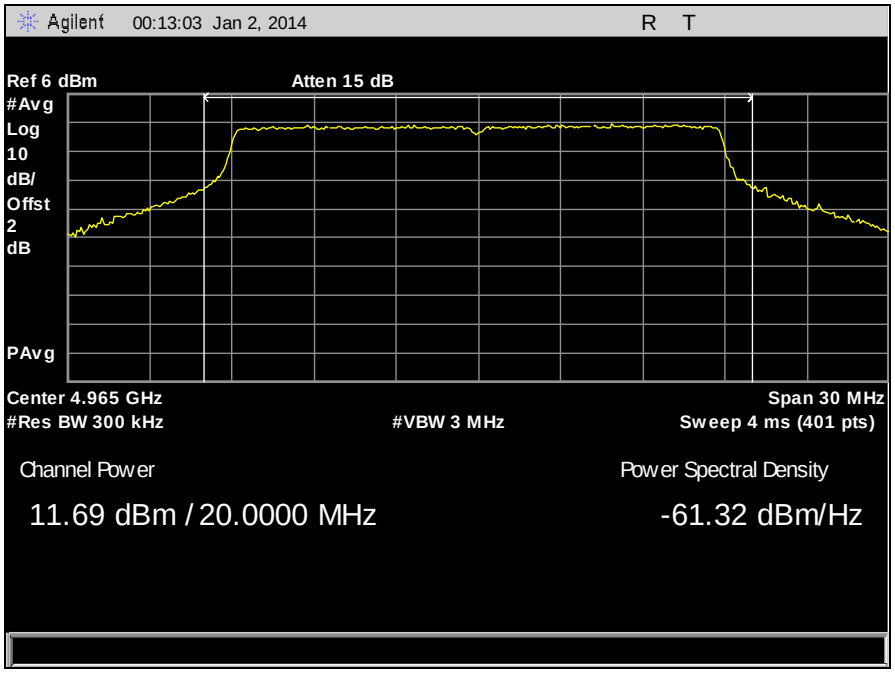
Plot 114. Peak Excursion, High Channel, 4985 MHz, Average, 10 MHz Band, Port 1



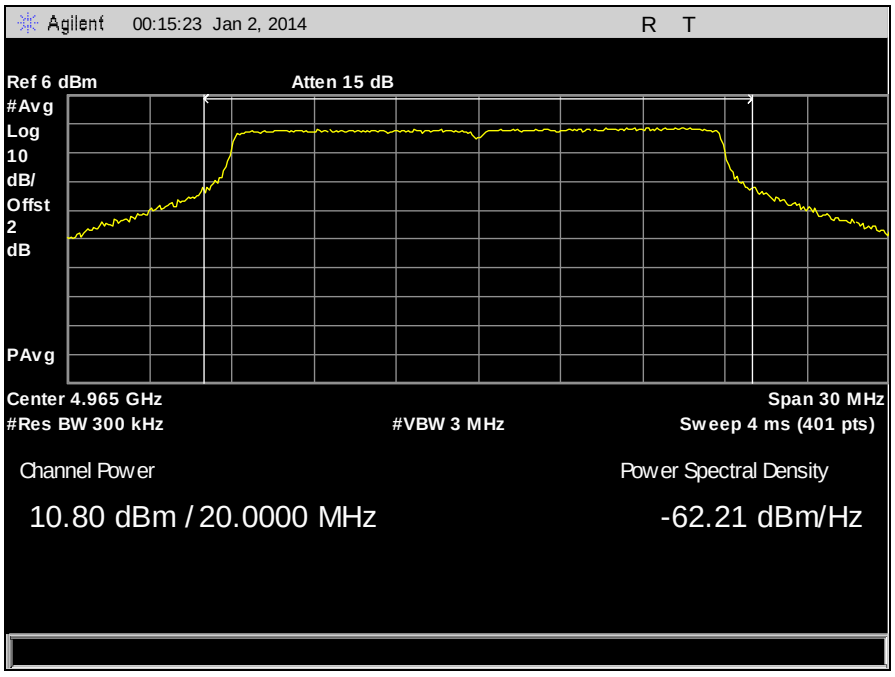
Plot 115. Peak Excursion, Low Channel, 4950 MHz, Average, 20 MHz Band, Port 0



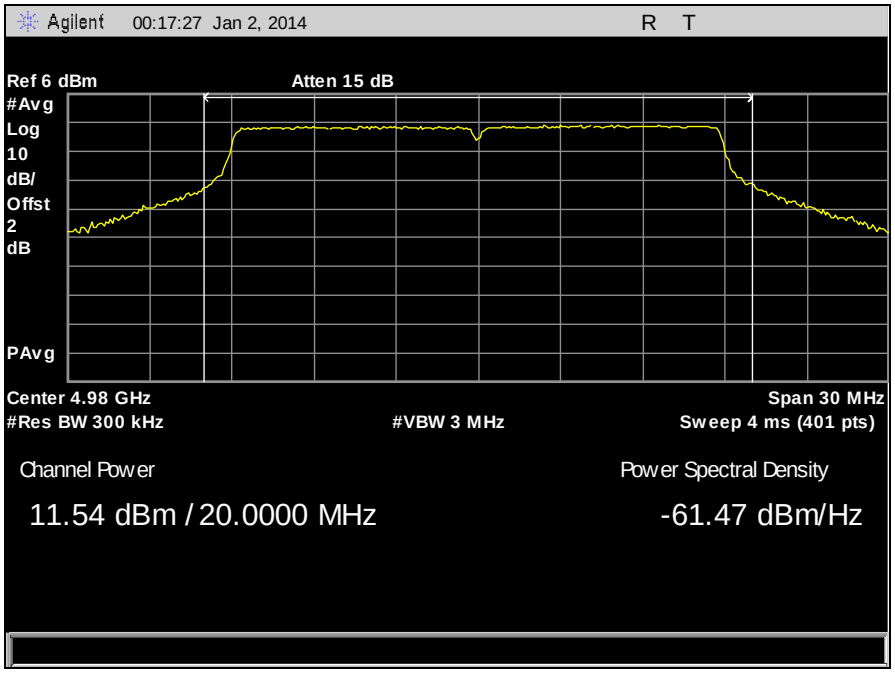
Plot 116. Peak Excursion, Low Channel, 4950 MHz, Average, 20 MHz Band, Port 1



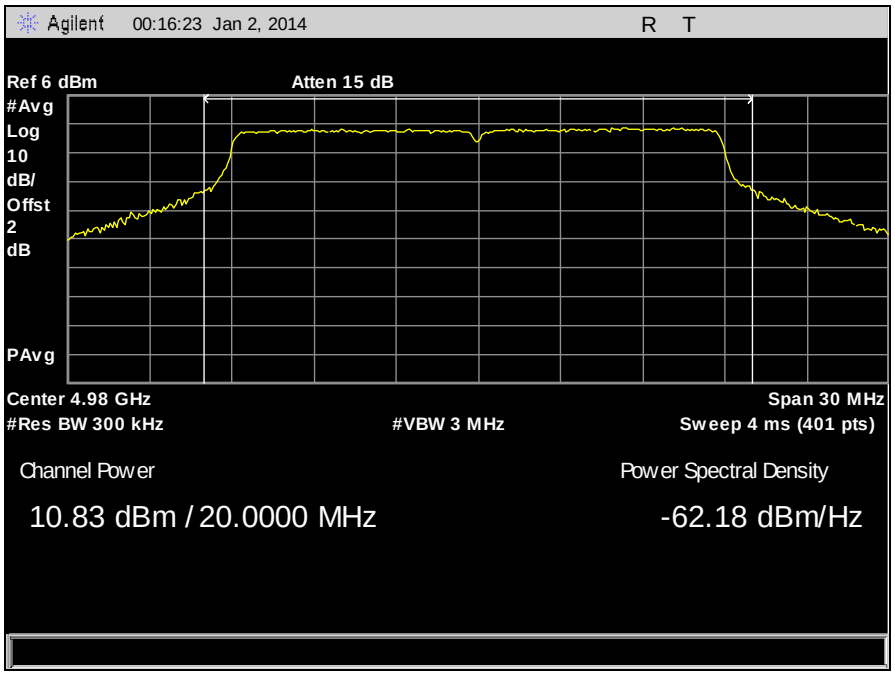
Plot 117. Peak Excursion, Mid Channel, 4965 MHz, Average, 20 MHz Band, Port 0



Plot 118. Peak Excursion, Mid Channel, 4965 MHz, Average, 20 MHz Band, Port 1



Plot 119. Peak Excursion, High Channel, 4980 MHz, Average, 20 MHz Band, Port 0



Plot 120. Peak Excursion, High Channel, 4980 MHz, Average, 20 MHz Band, Port 1

Electromagnetic Compatibility Criteria for Intentional Radiators

§1.1307(b)(1) and §1.1307(b)(2) RF Exposure Requirements

RF Exposure Requirements: **§1.1307(b)(1) and §1.1307(b)(2):** Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

RF Radiation Exposure Limit: **§1.1310:** As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

Peak Conducted Power of Transceiver= 16.46dBm = 44.26mW
The limit for maximum RF exposure for 4.9GHz device is 1mW/cm^2
The formula for calculating RF exposure is given as $S= \frac{PG}{4\pi R^2}$
P=16.46mW, G=12dBi = 15.85 (Linear) & R=20cm, then S comes out to be 0.0519mW/cm^2

IV. Test Equipment

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2005.

MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4751	ANTENNA - BILOG	SUNOL SCIENCES	JB6	1/8/2013	7/8/2014
1T4300	SEMI-ANECHOIC CHAMBER # 1 (NSA)	EMC TEST SYSTEMS	NONE	7/24/2012	7/24/2015
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	7/16/2012	7/16/2014
1T4548	AC POWER SOURCE	CALIFORNIA INSTRUMENTS	1251P	SEE NOTE	
1T4505	TEMPERATURE CHAMBER	TEST EQUITY	115	12/2/2012	12/2/2014
1T4483	ANTENNA; HORN	ETS-LINDGREN	3117	8/6/2012	2/6/2014
1T4818	COMB GENERATOR	COM-POWER	CGO-520	SEE NOTE	
1T4442	PRE-AMPLIFIER, MICROWAVE	MITEQ	AFS42-01001800-30-10P	SEE NOTE	
1T4771	PSA SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4446A	2/15/2013	8/15/2014

Table 23. Test Equipment List

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

V. Certification & User's Manual Information

Certification & User's Manual Information

A. Certification Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart I — Marketing of Radio frequency devices:

§ 2.801 Radio-frequency device defined.

As used in this part, a radio-frequency device is any device which in its operation is capable of Emitting radio-frequency energy by radiation, conduction, or other means. Radio- frequency devices include, but are not limited to:

(a) The various types of radio communication transmitting devices described throughout this chapter.

(b) The incidental, unintentional and intentional radiators defined in Part 15 of this chapter.

(c) The industrial, scientific, and medical equipment described in Part 18 of this chapter.

(d) Any part or component thereof which in use emits radio-frequency energy by radiation, conduction, or other means.

§ 2.803 Marketing of radio frequency devices prior to equipment authorization.

(a) Except as provided elsewhere in this chapter, no person shall sell or lease, or offer for sale or lease (including advertising for sale or lease), or import, ship or distribute for the purpose of selling or leasing or offering for sale or lease, any radio frequency device unless:

(1) In the case of a device subject to certification, such device has been authorized by the Commission in accordance with the rules in this chapter and is properly identified and labeled as required by §2.925 and other relevant sections in this chapter; or

(2) In the case of a device that is not required to have a grant of equipment authorization issued by the Commission, but which must comply with the specified technical standards prior to use, such device also complies with all applicable administrative (including verification of the equipment or authorization under a Declaration of Conformity, where required), technical, labeling and identification requirements specified in this chapter.

(d) Notwithstanding the provisions of paragraph (a) of this section, the offer for sale solely to business, commercial, industrial, scientific or medical users (but not an offer for sale to other parties or to end users located in a residential environment) of a radio frequency device that is in the conceptual, developmental, design or pre-production stage is permitted prior to equipment authorization or, for devices not subject to the equipment authorization requirements, prior to a determination of compliance with the applicable technical requirements *provided* that the prospective buyer is advised in writing at the time of the offer for sale that the equipment is subject to the FCC rules and that the equipment will comply with the appropriate rules before delivery to the buyer or to centers of distribution.

(e)(1) Notwithstanding the provisions of paragraph (a) of this section, prior to equipment authorization or determination of compliance with the applicable technical requirements any radio frequency device may be operated, but not marketed, for the following purposes and under the following conditions:

(i) Compliance testing;

(ii) Demonstrations at a trade show provided the notice contained in paragraph (c) of this section is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iii) Demonstrations at an exhibition conducted at a business, commercial, industrial, scientific or medical location, but excluding locations in a residential environment, provided the notice contained in paragraphs (c) or (d) of this section, as appropriate, is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iv) Evaluation of product performance and determination of customer acceptability, provided such operation takes place at the manufacturer's facilities during developmental, design or pre-production states; or

(v) Evaluation of product performance and determination of customer acceptability where customer acceptability of a radio frequency device cannot be determined at the manufacturer's facilities because of size or unique capability of the device, provided the device is operated at a business, commercial, industrial, scientific or medical user's site, but not at a residential site, during the development, design or pre-production stages.

(e)(2) For the purpose of paragraphs (e)(1)(iv) and (e)(1)(v) of this section, the term *manufacturer's facilities* includes the facilities of the party responsible for compliance with the regulations and the manufacturer's premises, as well as the facilities of other entities working under the authorization of the responsible party in connection with the development and manufacture, but not the marketing, of the equipment.

(f) For radio frequency devices subject to verification and sold solely to business, commercial, industrial, scientific and medical users (excluding products sold to other parties or for operation in a residential environment), parties responsible for verification of the devices shall have the option of ensuring compliance with the applicable technical specifications of this chapter at each end user's location after installation, provided that the purchase or lease agreement includes a proviso that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.

Certification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart J — Equipment Authorization Procedures:

§ 2.901 Basis and Purpose

(a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service wherein the equipment is to be operated.[1] *In addition to the technical standards provided, the rules governing the service may require that such equipment be verified by the manufacturer or importer*, be authorized under a Declaration of Conformity, or receive an equipment authorization from the Commission by one of the following procedures: certification or registration.

(b) The following sections describe the verification procedure, the procedure for a Declaration of Conformity, and the procedures to be followed in obtaining certification from the Commission and the conditions attendant to such a grant.

§ 2.907 Certification.

(a) Certification is an equipment authorization issued by the Commission, based on representation and test data submitted by the applicant.

(b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

[1] In this case, the equipment is subject to the rules of Part 15. More specifically, the equipment falls under Subpart B (of Part 15), which deals with unintentional radiators.

Certification & User's Manual Information

§ 2.948 Description of measurement facilities.

(a) Each party making measurements of equipment that is subject to an equipment authorization under Part 15 or Part 18 of this chapter, regardless of whether the measurements are filed with the Commission or kept on file by the party responsible for compliance of equipment marketed within the U.S. or its possessions, shall compile a description of the measurement facilities employed.

(1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.

(i) If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the Commission by that laboratory. In this situation, the party responsible for the verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.

(ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.

(2) If the equipment is to be authorized by the Commission under the certification procedure, the description of the measurement facilities shall be filed with the Commission's Laboratory in Columbia, Maryland. The data describing the measurement facilities need only be filed once but must be updated as changes are made to the measurement facilities or as otherwise described in this section. At least every three years, the organization responsible for filing the data with the Commission shall certify that the data on file is current.

Certification & User's Manual Information

1. 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 user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Verification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart B — Unintentional Radiators:

§ 15.105 Information to the user.

(a) For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at own expense.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

– Reorient or relocate the receiving antenna.

– Increase the separation between the equipment and receiver.

– Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

– Consult the dealer or an experienced radio/TV technician for help.

ICES-003 Procedural & Labeling Requirements

From the Industry Canada Electromagnetic Compatibility Advisory Bulletin entitled, "Implementation and Interpretation of the Interference-Causing Equipment Standard for Digital Apparatus, ICES-003" (EMCAB-3, Issue 2, July 1995):

> "At present, CISPR 22: 2002 and ICES technical requirements are essentially equivalent. Therefore, if you have CISPR 22: 2002 approval by meeting CISPR Publication 22, the only additional requirements are: to attach a note to the report of the test results for compliance, indicating that these results are deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations; to maintain these records on file for the requisite five year period; and to provide the device with a notice of compliance in accordance with ICES-003."

Procedural Requirements:

According to Industry Canada's Interference Causing Equipment Standard for Digital Apparatus ICES-003 Issue 5 August 2012:

Section 6.1: A record of the measurements and results, showing the date that the measurements were completed, shall be retained by the manufacturer or importer for a period of at least five years from the date shown in the record and made available for examination on the request of the Minister.

Section 6.2: A written notice indicating compliance must accompany each unit of digital apparatus to the end user. The notice shall be in the form of a label that is affixed to the apparatus. Where because of insufficient space or other constraints it is not feasible to affix a label to the apparatus, the notice may be in the form of a statement in the users' manual.

Labeling Requirements:

The suggested text for the notice, in English and in French, is provided below, from the Annex of ICES-003:

> This Class [2] digital apparatus complies with Canadian ICES-003.
>
> Cet appareil numérique de la classe [1] est conforme à la norme NMB-003 du Canada.

[2] Insert either A or B but not both as appropriate for the equipment requirements.

End of Report

