MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
914 WEST PATAPSCO AVENUE ● BALTIMORE, MARYLAND 21230-3432 ● PHONE (410) 354-3300 ● FAX (410) 354-3313
33439 WESTERN AVENUE ● UNION CITY, CALIFORNIA 94587 ● PHONE (510) 489-6300 ● FAX (510) 489-6372
3162 BELICK STREET ● SANTA CLARA, CALIFORNIA 95054 ● PHONE (408 748-3585 ● FAX (510) 489-6372

December 24, 2009

Fortress Technologies
2 Technology Park Drive
Westford, MA 01886

Dear John Pacheco,

Enclosed is the EMC Wireless Class II Permissive Change test report for compliance testing of the Fortress Technologies, ES210 as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Title 47 of the CFR, Part 15.407 and Industry Canada RSS-210, Annex 9, Issue 7, June 2007 for Intentional Radiators.

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 Sanchez
Documentation Department

Reference: (\Fortress Technologies\EMC27866A-FCC407)

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Electromagnetic Compatibility Criteria
Class II Permissive Change Test Report

for the

Fortress Technologies
Model ES210

Tested under
the Certification Rules
contained in
Title 47 of the CFR, Part 15.407
and
Industry Canada RSS-210, Annex 9
for Intentional Radiators

MET Report: EMC27866A-FCC407

December 24, 2009

Prepared For:

Fortress Technologies
2 Technology Park Drive
Westford, MA 01886

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

Electromagnetic Compatibility Criteria
Class II Permissive Change Test Report

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contained in
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Industry Canada RSS-210, Annex 9
for Intentional Radiators

Dusmantha Tennakoon, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Sanchez
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 15.407, of the FCC Rules and RSS-210 Annex 9 of the Industry Canada Rules under normal use and maintenance.

Shawn McMillen, Wireless Manager
Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	December 22, 2009	Initial Issue.
1	December 24, 2009	Final Issue

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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**lectrostatic **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**ert**z**
μH	**microh**enry
μ	**microf**arad
μs	**micros**econds
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 Fortress Technologies ES210, with the requirements of FCC Part §15.407 and Industry Canada RSS-210 Annex 9. 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 ES210. Fortress Technologies should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the ES210, 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 FCC Part §15.407 and Industry Canada RSS-210, Annex 9, in accordance with Fortress Technologies, quote number 1FOR2809R4. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference	Industry Canada Reference	Description	Results
15.203	RSS-GEN 7.1.4	Antenna Requirements	Compliant
15.207	RSS-GEN 7.2.2; RSS-210 2.2	AC Conducted Emissions 150KHz – 30MHz	Compliant
15.403 (i)	A8.2	26dB Occupied Bandwidth	Compliant
15.407 (a)(2)	A9.2(2)	Conducted Transmitter Output Power	Compliant
15.407 (a)(2)	A9.2(2)	Power Spectral Density	Compliant
15.407 (a)(6)	N/A	Peak Excursion	Compliant
15.407 (b)(2), (3)	A9.3(2)(3)	Undesirable Emissions (15.205/15.209 - General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Compliant
15.407(f)	RSS-GEN	RF Exposure	Compliant
15.407(g)	2.1	Frequency Stability	Compliant
N/A	RSS-Gen(4.8)	Receiver Spurious Emissions	Compliant
15.407 (h)(1)	A9.4	Transmit Power Control (TPC)	N/A-device operates with e.i.r.p of less than 500 mW
15.407 (h)(2)(ii)	A9.4	Channel Availability Check Time	Compliant
15.407 (h)(2)(iii)	A9.4	Channel Move Time and Channel Closing Time	Compliant
15.407 (h)(2)(iv)	A9.4	Non-Occupancy Period	Compliant
15.407 (h)(2)	A9.4	Radar Detection function of Dynamic Frequency Selection (DFS)	Compliant

Table 1. Executive Summary of EMC Part 15.407 & RSS-210 Annex 9 ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Fortress Technologies to perform testing on the ES210, under Fortress Technologies' quote number 1FOR2809R4.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Fortress Technologies ES210.

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

Model(s) Tested:	ES210	
Model(s) Covered:	ES210	
EUT Specifications:	Primary Power: 120/240VAC, 60/30mA	
	FCC ID: WYK-ES210 IC ID: 8190A-ES210	
	Type of Modulations:	OFDM
	Emission Designators:	D7D
	Equipment Code:	NII
	Peak RF Output Power:	18.6 mW
	EUT Frequency Ranges:	5260-5320MHz; 5500-5700MHz
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:	Dusmantha Tennakoon	
Report Date(s):	December 24, 2009	

Table 2. EUT Summary

B. References

RSS-210, Issue 7, June 2007	Low-power License-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment
CFR 47, Part 15, Subpart E	Unlicensed National Information Infrastructure Devices (UNII)
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
ANSI/NCSL Z540-1-1994	Calibration Laboratories and Measuring and Test Equipment - General Requirements
ANSI/ISO/IEC 17025:2000	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 Fortress Technologies ES210, is a single radio access point/bridge. It embeds a COTS high power radio and two Ethernet ports in a ruggedized enclosure. The radio operates in accordance to the 802.11a, 802.11b, and 802.11g standards.

The ES210 is intended to provided outdoor connectivity in a secure manner both wired and wirelessly. It can operate with either AC power or by a battery.

Photograph 1. Fortress Technologies ES210

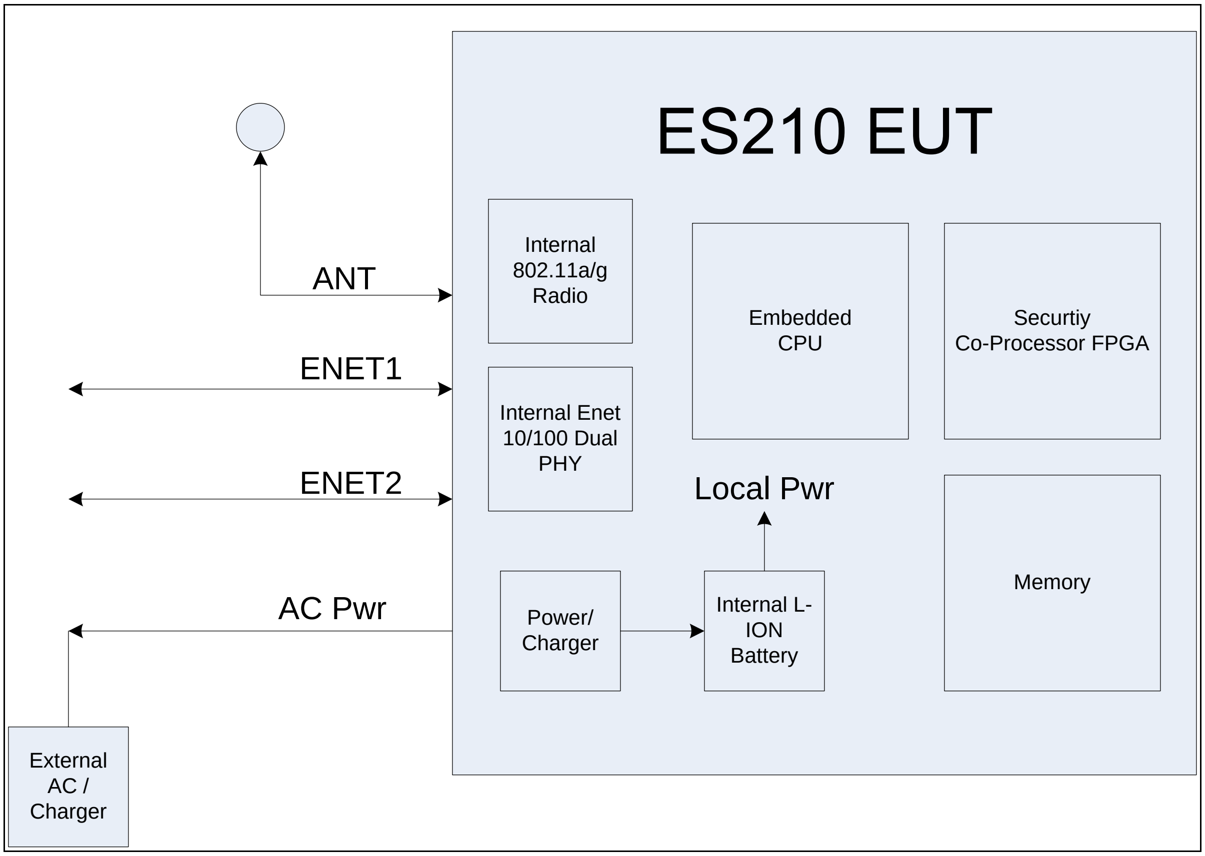


Figure 1. Block Diagram of Test Configuration

E. Equipment Configuration

All cards, racks, etc., incorporated as part of the EUT is included in the following list.

Ref. ID	Name / Description	Model Number	Serial Number
1	Fortress Secure Access Point	ES210	109160002

Table 4. Equipment Configuration

F. Support Equipment

The EUT did not require any support equipment for operation or monitoring.

G. Ports and Cabling Information

Port name on EUT	Cable Description or reason for no cable	Qty.	Termination Box ID & Port ID
Enet 1	Wired Ethernet 10/100	1	N/A
Enet 2	Wired Ethernet 10/100	1	N/A
Ant	Antenna	1	Spectrum Analyzer
AC Pwr	2-wire	1	External AC Charger

Table 5. Ports and Cabling Information

H. Mode of Operation

Test modes were entered by using ART, the Atheros Radio Test tool. This is a standard tool provide by Atheros for directly manipulating and configuring their chips during testing and manufacturing.

I. Method of Monitoring EUT Operation

A Spectrum Analyzer was used to monitor the EUT's transmitter channel and power output.

J. 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.

K. Disposition of EUT

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

III. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 Antenna Requirement

Test Requirement: **§ 15.203:** An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

The structure and application of the EUT were analyzed to determine compliance with Section 15.203 of the Rules. Section 15.203 states that the subject device must meet at least one of the following criteria:

a.) Antenna must be permanently attached to the unit.

b.) Antenna must use a unique type of connector to attach to the EUT.

c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

Results: The unit is professionally installed. Therefore, the EUT as tested is compliant with the criteria of §15.203.

Gain	Type	Model	Manufacturer
5dBi	Omni	WAE-5AG	Air Live

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 10/08/09

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.207 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 Ω 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 6. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

Test Procedure: The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber. 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 C63.4-1992 "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.

Test Results: The EUT was compliant with the Class A requirement(s) of this section. Pre-scans revealed that emissions profiles and amplitudes of emissions were similar when the EUT was transmitting on low, mid and high channels on all frequency bands supported by the EUT. Therefore, final measurements were taken when the EUT was transmitting on channel 5500 MHz

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 10/06/09

Conducted Emissions - Voltage, AC Power, (120V/60Hz)

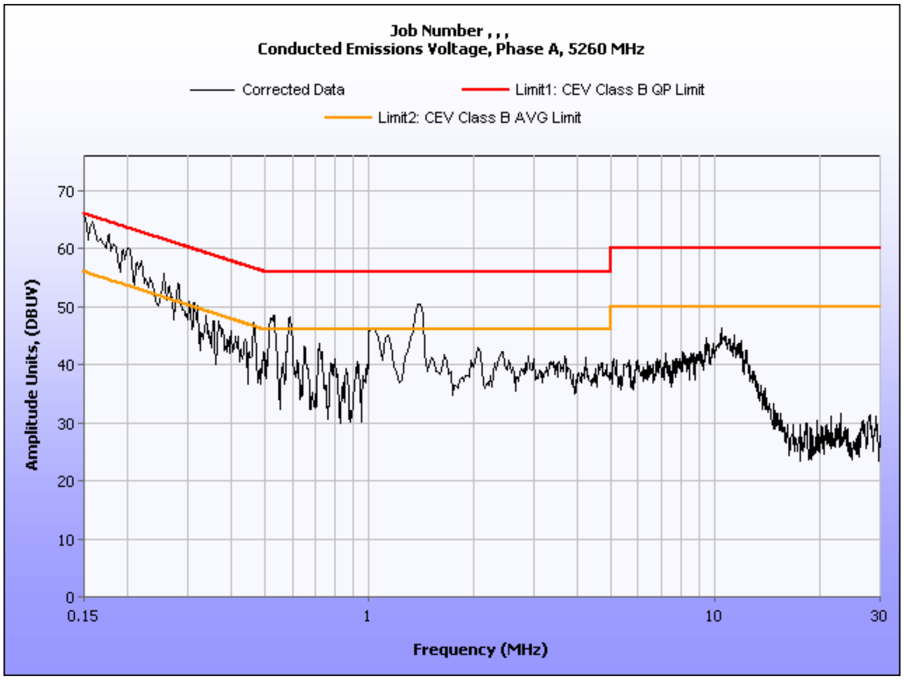
Frequency (MHz)	Uncorrected Meter Reading (dBµV) QP	Cable Loss (dB)	Corrected Measurement (dBµV) QP	Limit (dBµV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBµV) Avg.	Cable Loss (dB)	Corrected Measurement (dBµV) AVG	Limit (dBµV) AVG	Margin (dB) AVG
0.1635	45.64	0.10795	45.74795	79	-33.2521	34.02	0.10795	34.12795	66	-31.8721
0.203	39.13	0.17	39.3	79	-39.7	32.09	0.17	32.26	66	-33.74
0.5262	43.63	0.17	43.8	73	-29.2	36.28	0.17	36.45	60	-23.55
9.685	31.99	0.3132	32.3032	73	-40.6968	22.14	0.3132	22.4532	60	-37.5468
11.3	32.38	0.33	32.71	73	-40.29	21.86	0.33	22.19	60	-37.81
23.12	24.37	0.28008	24.65008	73	-48.3499	19.9	0.28008	20.18008	60	-39.8199

Table 7. Conducted Emissions - Voltage, AC Power, Phase Line (120V/60Hz)

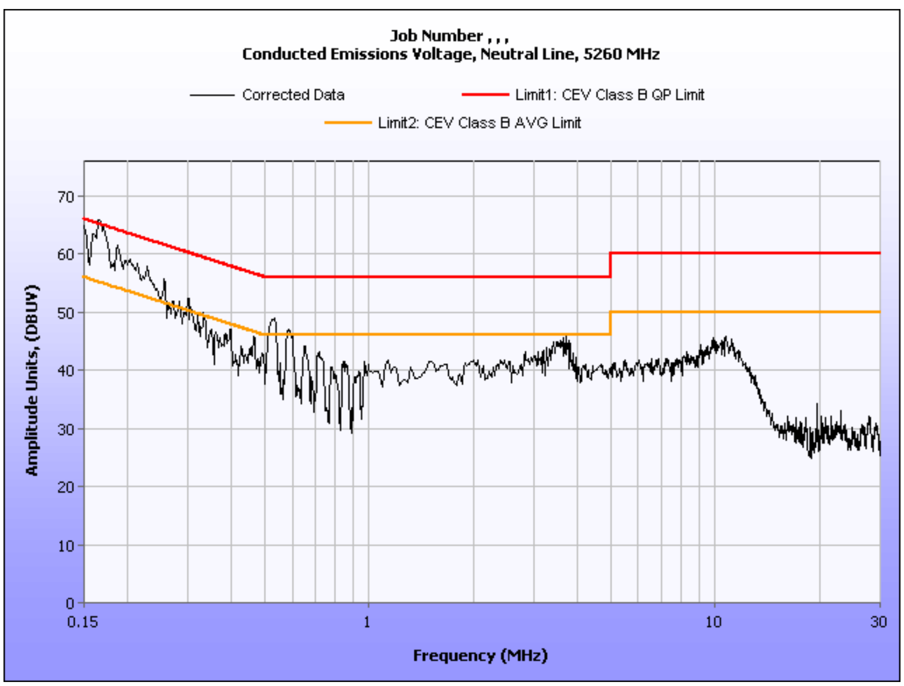
Frequency (MHz)	Uncorrected Meter Reading (dBµV) QP	Cable Loss (dB)	Corrected Measurement (dBµV) QP	Limit (dBµV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBµV) Avg.	Cable Loss (dB)	Corrected Measurement (dBµV) AVG	Limit (dBµV) AVG	Margin (dB) AVG
0.1552	52.44	0.09384	52.53384	79	-26.4662	41.89	0.09384	41.98384	66	-24.0162
0.2182	43.67	0.17	43.84	79	-35.16	33.42	0.17	33.59	66	-32.41
0.465	39.55	0.17	39.72	79	-39.28	34.58	0.17	34.75	66	-31.25
0.5888	44.4	0.17	44.57	73	-28.43	39	0.17	39.17	60	-20.83
3.61	36.85	0.17	37.02	73	-35.98	26.09	0.17	26.26	60	-33.74
10.82	34.19	0.33	34.52	73	-38.48	25.65	0.33	25.98	60	-34.02

Table 8. Conducted Emissions - Voltage, AC Power, Neutral Line (120V/60Hz)

Conducted Emissions - Voltage, Worst Case Emissions, AC Power, (120V/60Hz)

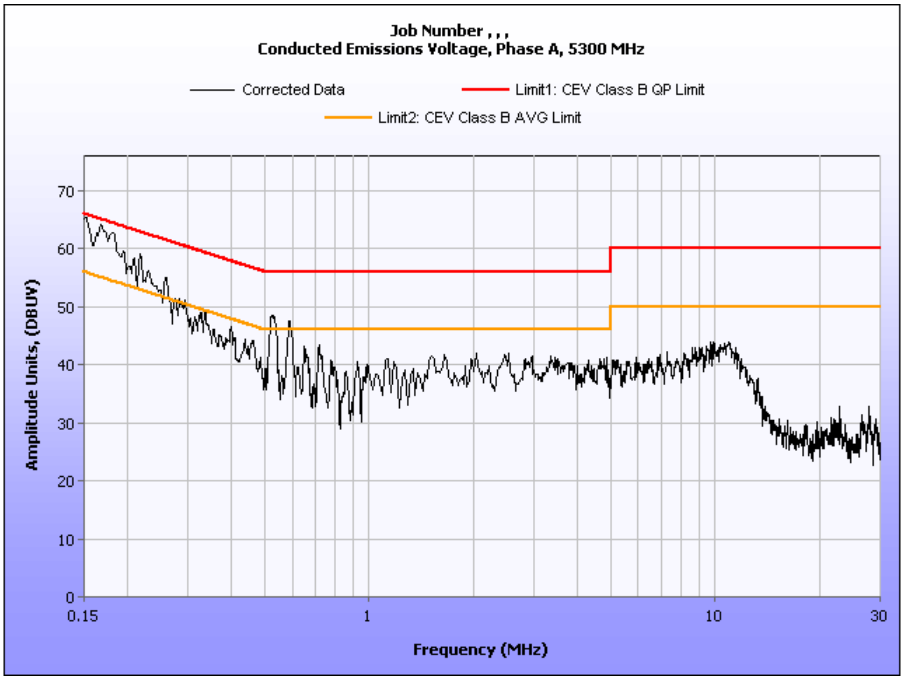


Plot 1. Conducted Emission, Phase Line Plot, 5260 MHz

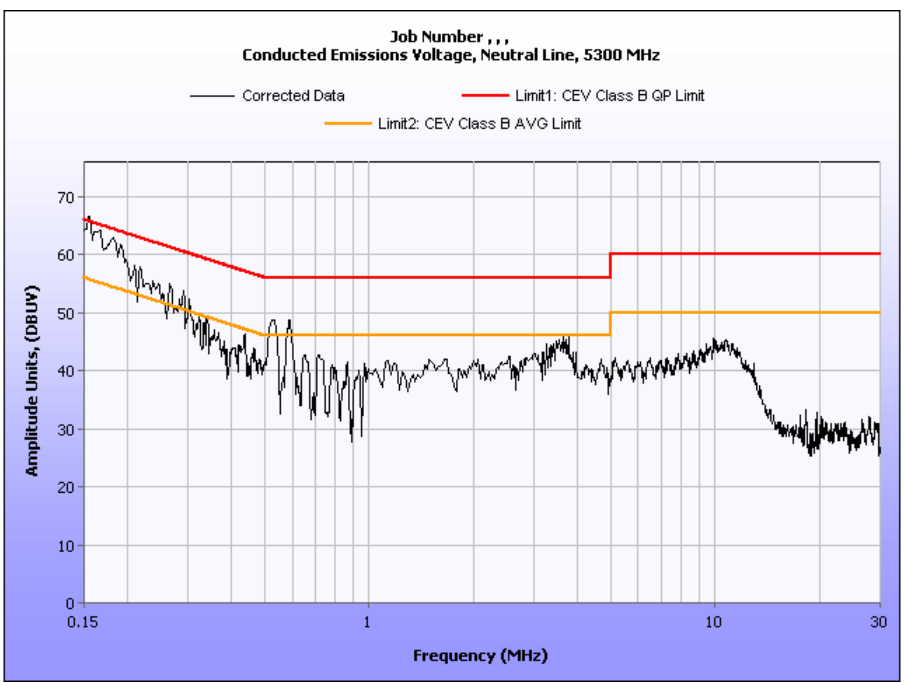


Plot 2. Conducted Emission, Neutral Line Plot, 5260 MHz

Conducted Emissions - Voltage, Worst Case Emissions, AC Power, (120V/60Hz)

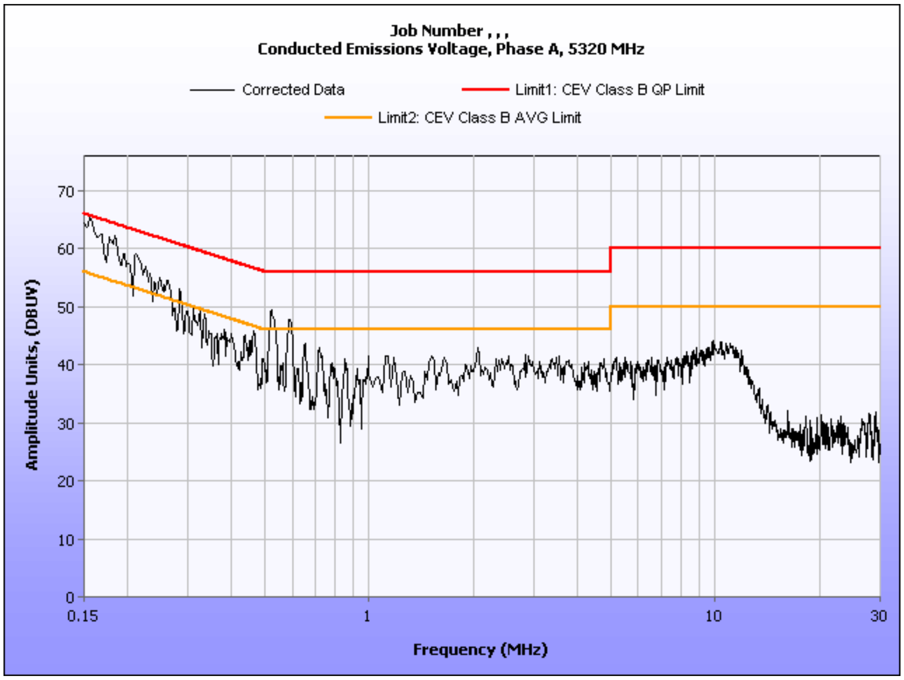


Plot 3. Conducted Emission, Phase Line Plot, 5300 MHz

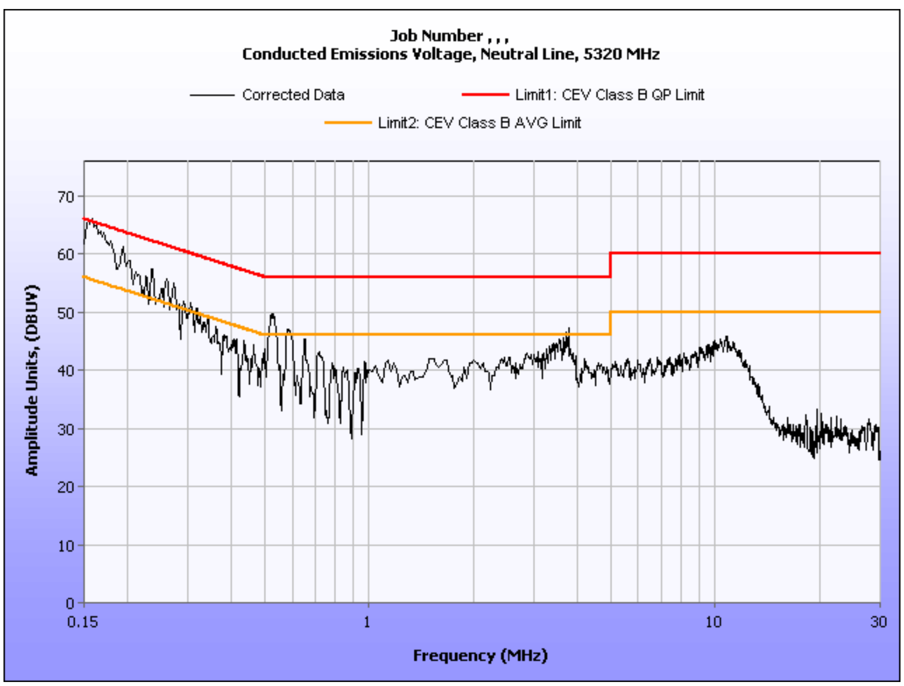


Plot 4. Conducted Emission, Neutral Line Plot, 5300 MHz

Conducted Emissions - Voltage, Worst Case Emissions, AC Power, (120V/60Hz)

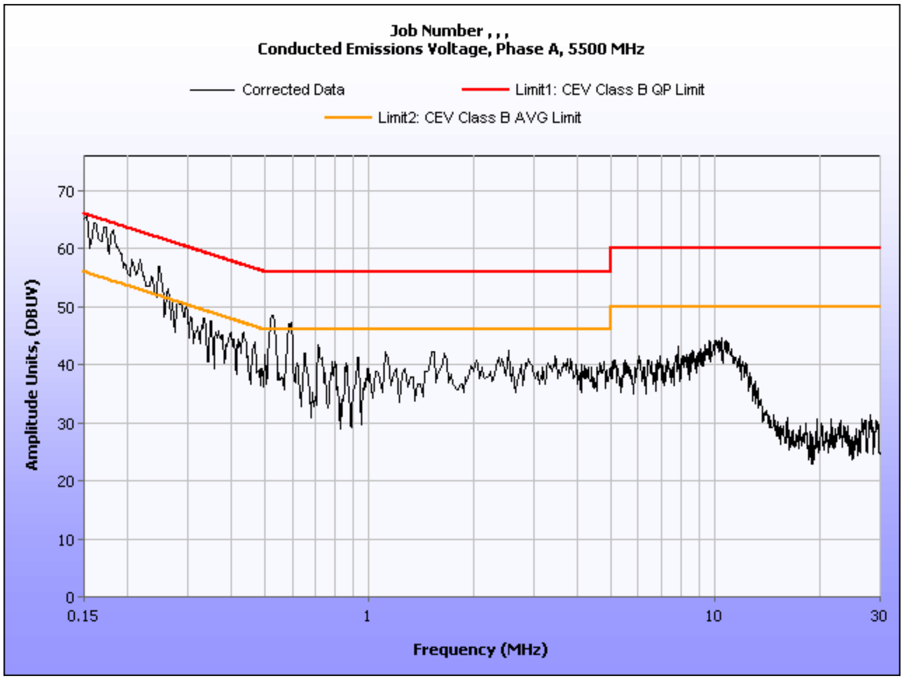


Plot 5. Conducted Emission, Phase Line Plot, 5320 MHz

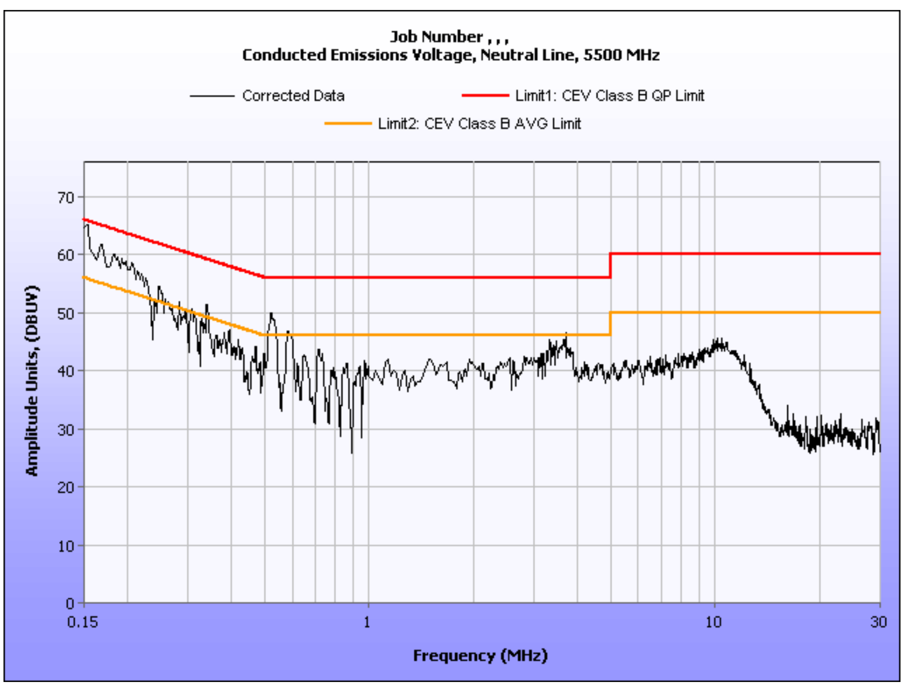


Plot 6. Conducted Emission, Neutral Line Plot, 5320 MHz

Conducted Emissions - Voltage, Worst Case Emissions, AC Power, (120V/60Hz)

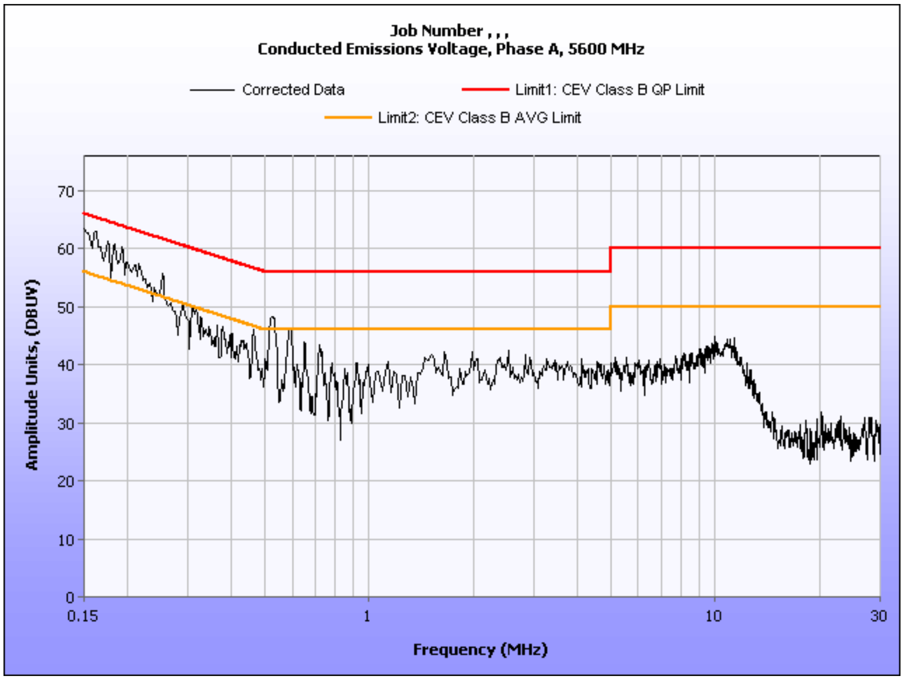


Plot 7. Conducted Emission, Phase Line Plot, 5500 MHz

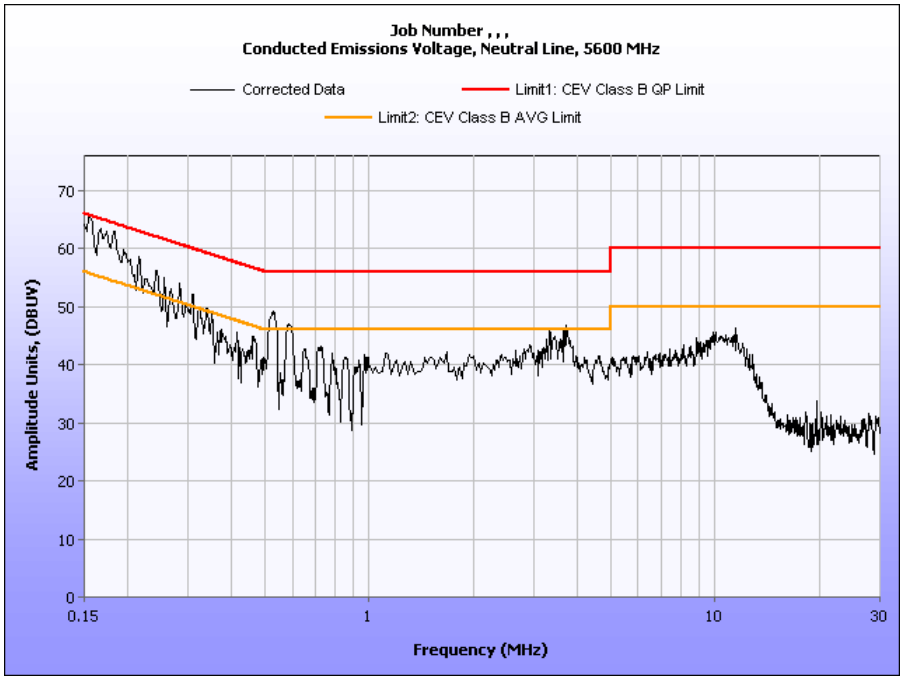


Plot 8. Conducted Emission, Neutral Line Plot, 5500 MHz

Conducted Emissions - Voltage, Worst Case Emissions, AC Power, (120V/60Hz)

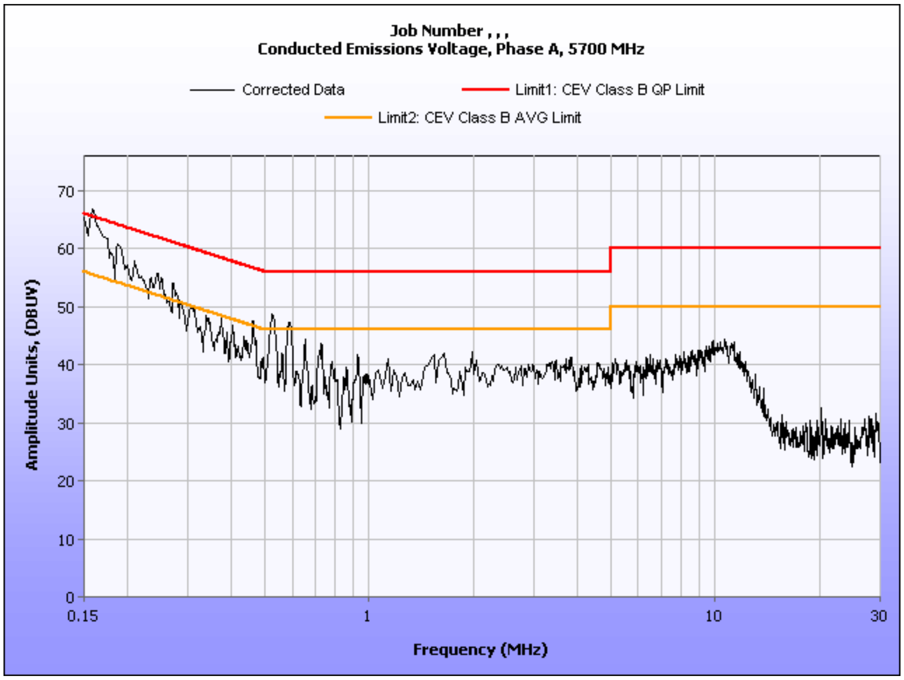


Plot 9. Conducted Emission, Phase Line Plot, 5600 MHz

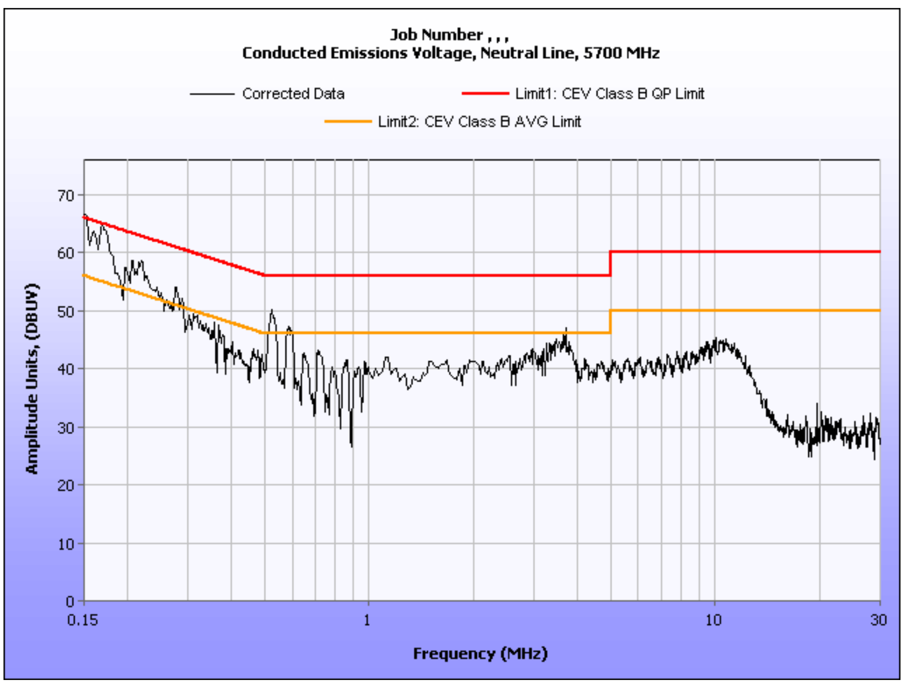


Plot 10. Conducted Emission, Neutral Line Plot, 5600 MHz

Conducted Emissions - Voltage, Worst Case Emissions, AC Power, (120V/60Hz)



Plot 11. Conducted Emission, Phase Line Plot, 5700 MHz



Plot 12. Conducted Emission, Neutral Line Plot, 5700 MHz

Conducted Emission Limits Test Setup

Photograph 2. Conducted Emissions, Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15. 403(c) 26dB Bandwidth

Test Requirements: **§ 15.403 (i):** For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

Test Procedure: The transmitter was set to low, mid and high operating frequencies at the highest output power and connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately equal to 1% of the total emission bandwidth, VBW > RBW. The 26 dB Bandwidth was measured and recorded.

Test Results The 26 dB Bandwidth was compliant with the requirements of this section and was determined from the plots on the following pages.

Frequency (MHz)	99% Bandwidth (MHz)	26 dB Bandwidth (MHz)
5265	16.60	21.36
5300	16.57	22.04
5320	16.57	22.11
5500	17.56	33.67
5600	19.84	39.16
5700	16.86	32.71

Table 9. Occupied Bandwidth, Test Results

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 10/15/09

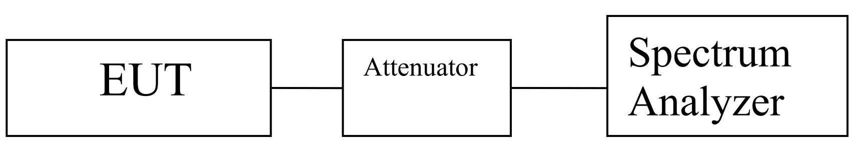
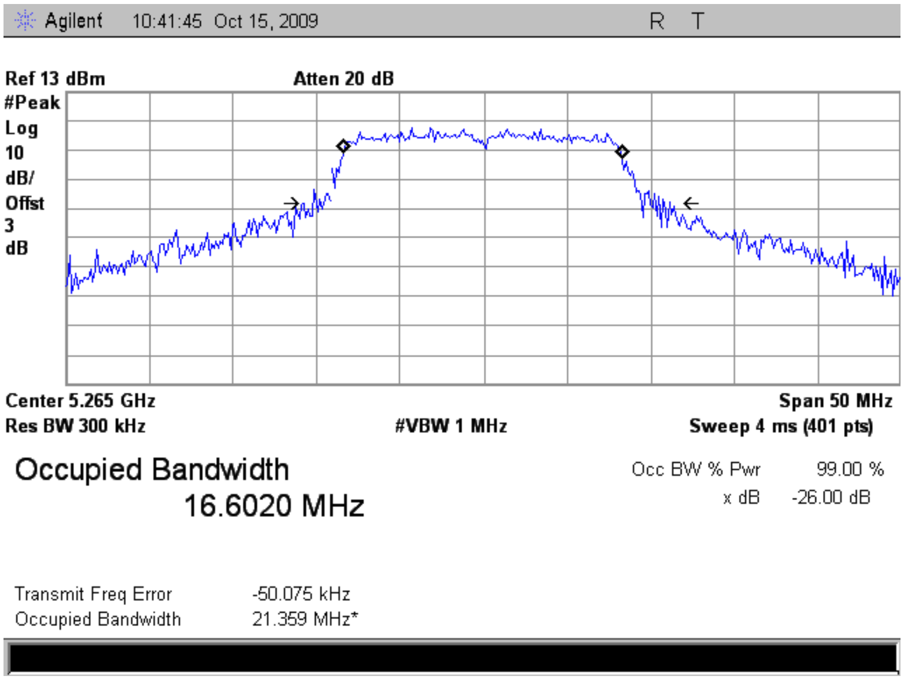
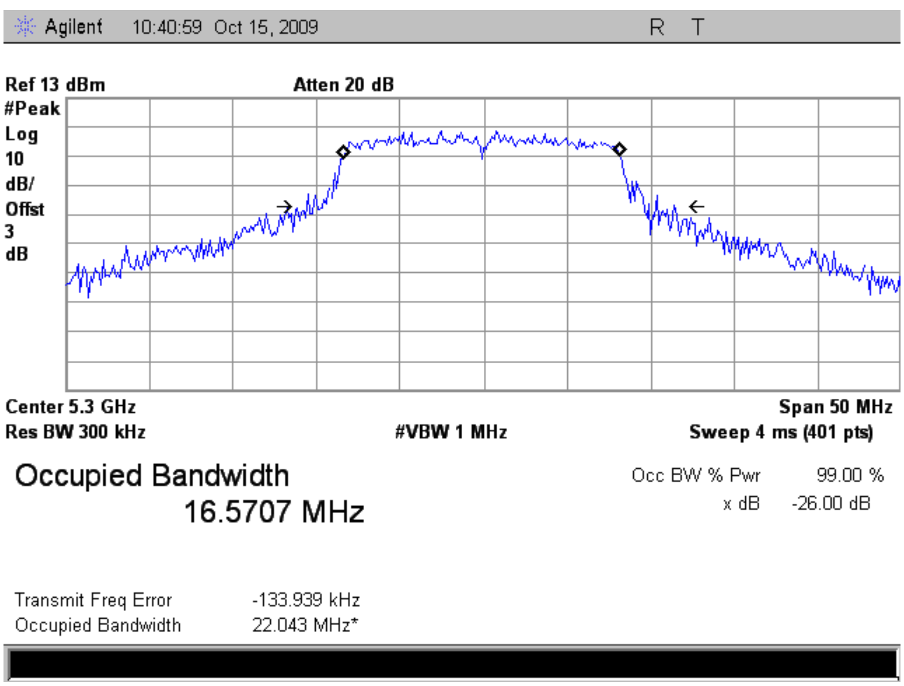


Figure 2. Occupied Bandwidth, Test Setup

Occupied Bandwidth Test Results

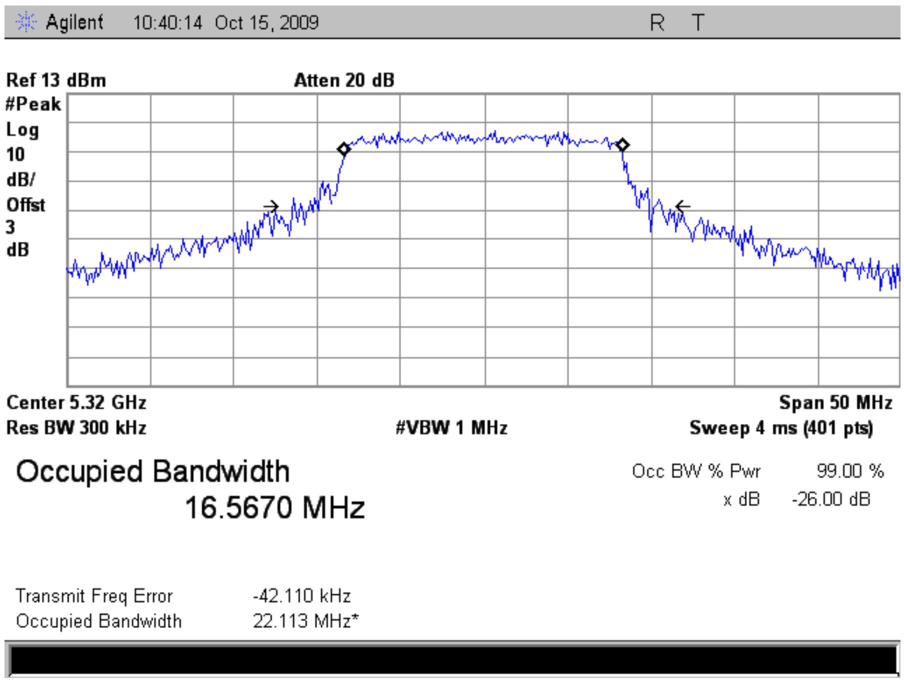


Plot 13. Occupied Bandwidth, 5265 MHz

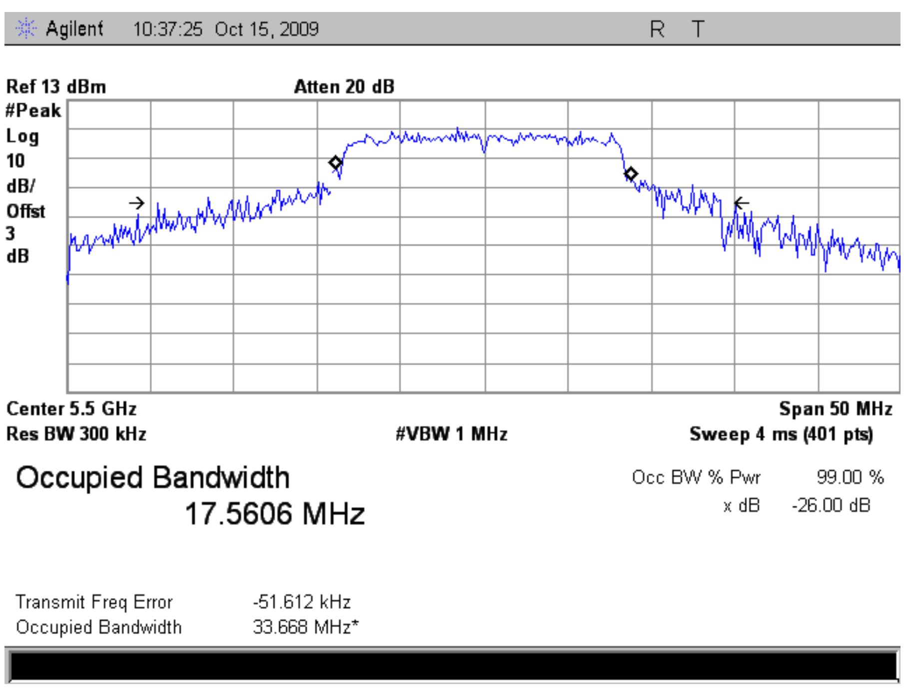


Plot 14. Occupied Bandwidth, 5300 MHz

Occupied Bandwidth Test Results

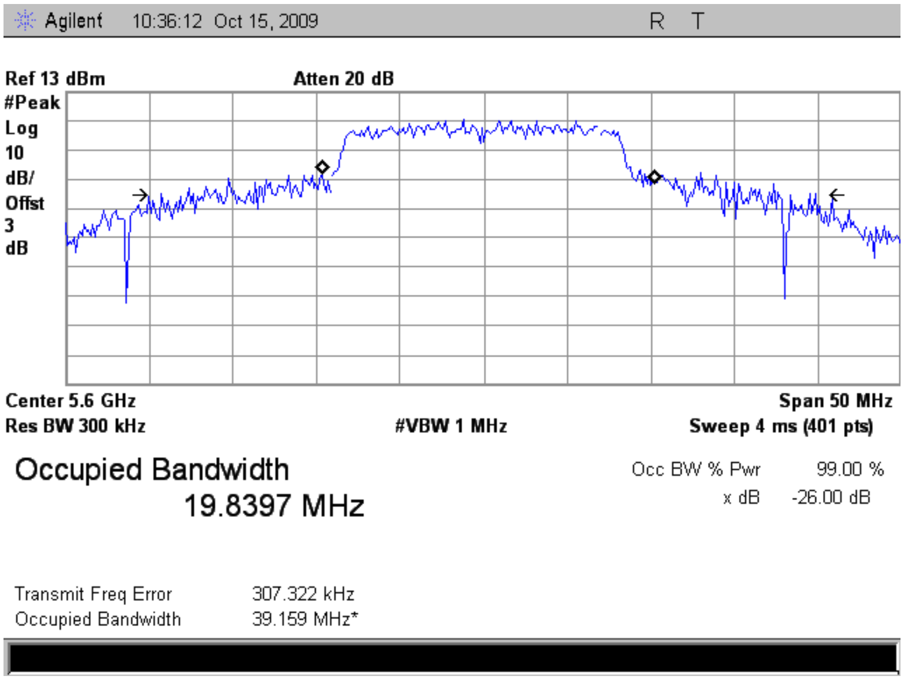


Plot 15. Occupied Bandwidth, 5320 MHz

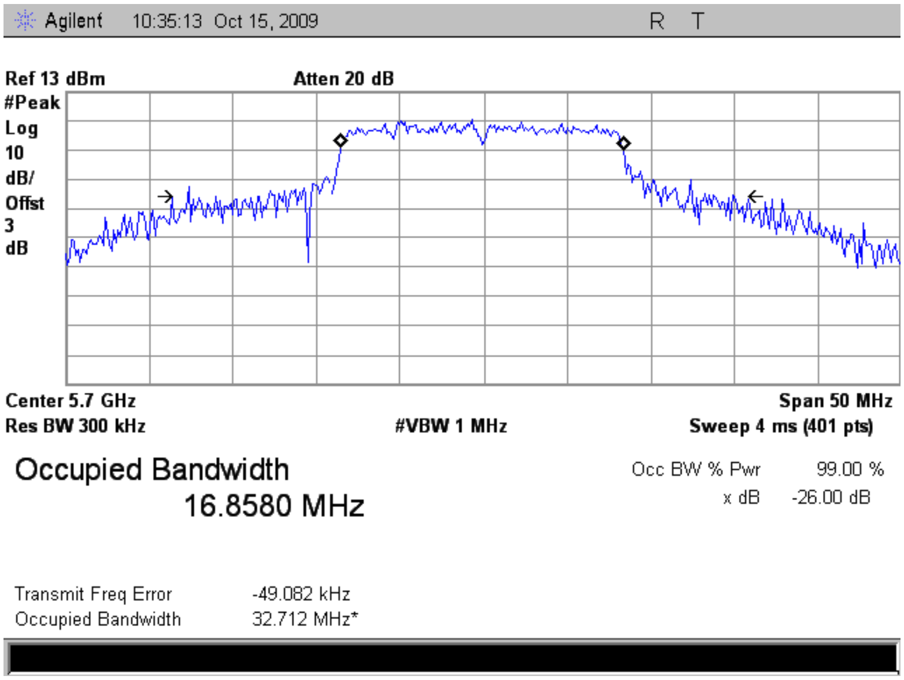


Plot 16. Occupied Bandwidth, 5500 MHz

Occupied Bandwidth Test Results



Plot 17. Occupied Bandwidth, 5600 MHz



Plot 18. Occupied Bandwidth, 5700 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15. 407(a)(2) RF Power Output

Test Requirements: **§15.407(a) (2):** The maximum output power of the intentional radiator shall not exceed the following:

Digital Transmission Systems (MHz)	Output Limit
5150-5250	50mW
5250-5350	250mW
5470–5725	250mW
5725–5825	1W

Table 10. Output Power Requirements from §15.407

§15.407(a) (2): For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10log B, where B is the 26 dB emission bandwidth in megahertz.

Test Procedure: The EUT was connected to a Spectrum Analyzer. The power was measured on three channels for each band.

Test Results: Equipment was compliant with the Peak Power Output limits of **§ 15.407(a)(2)**.

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 11/20/09

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (mW)	Limit (W)
5260	10.89	12.27	250mW
5300	11.43	13.89	250mW
5320	12.38	17.29	250mW
5500	11.80	15.13	250mW
5600	12.71	18.66	250mW
5700	11.78	15.06	250mW

Table 11. RF Power Output, Test Results

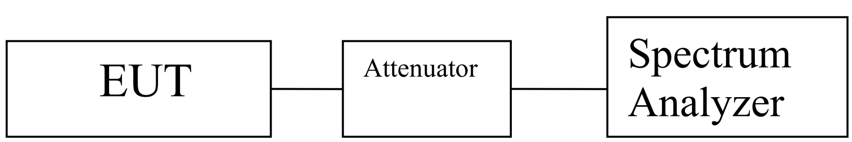
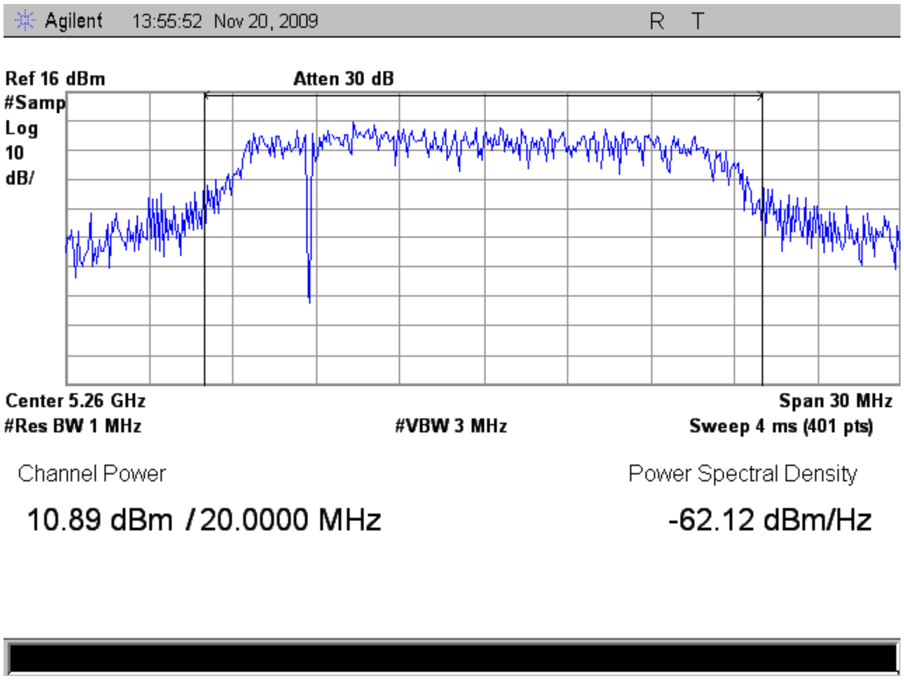
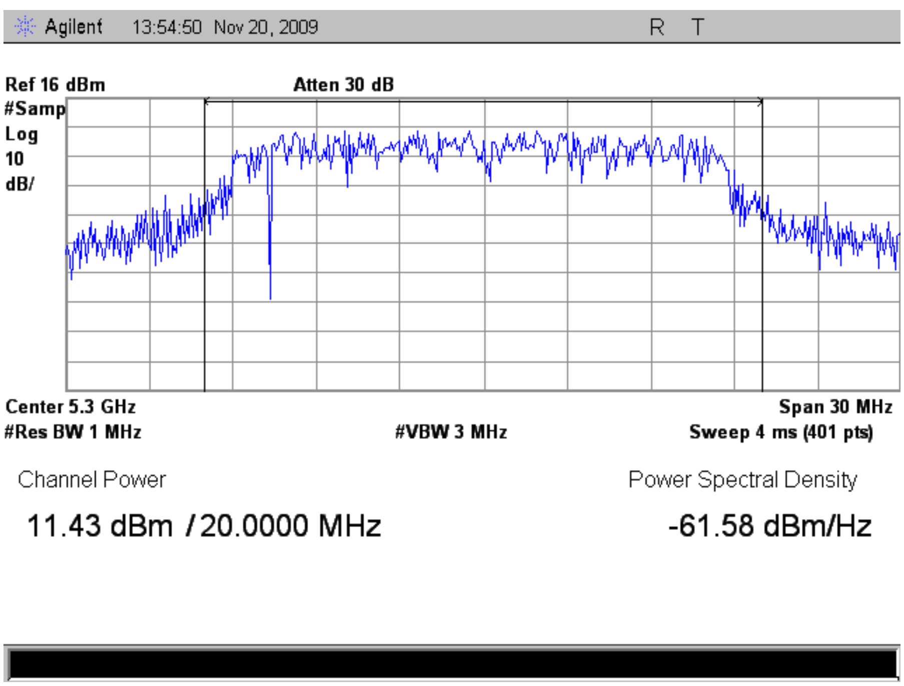


Figure 3. Power Output Test Setup

RF Output Power Test Results

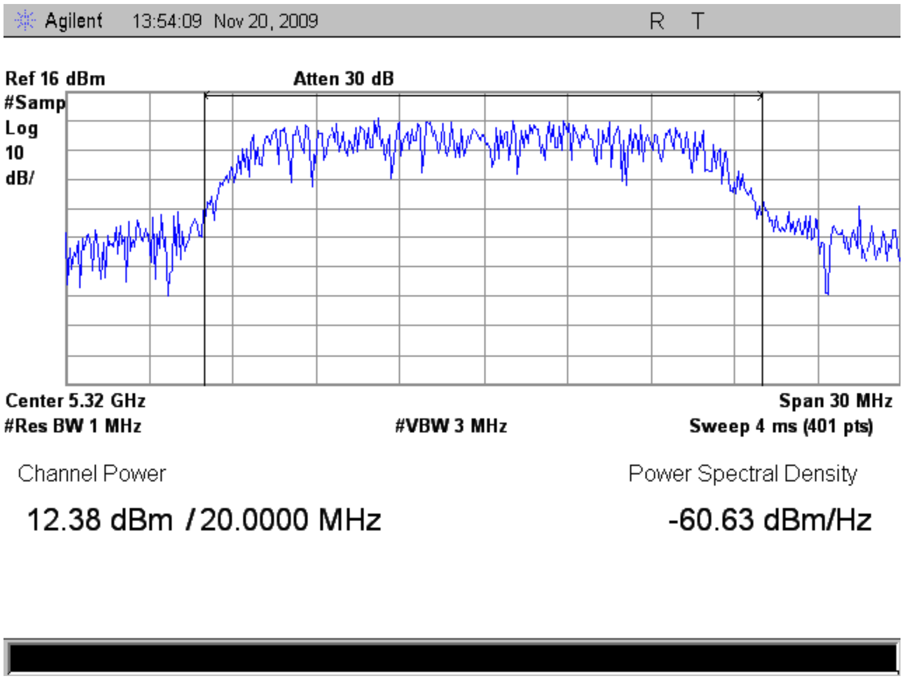


Plot 19. RF Power Output, 5260 MHz

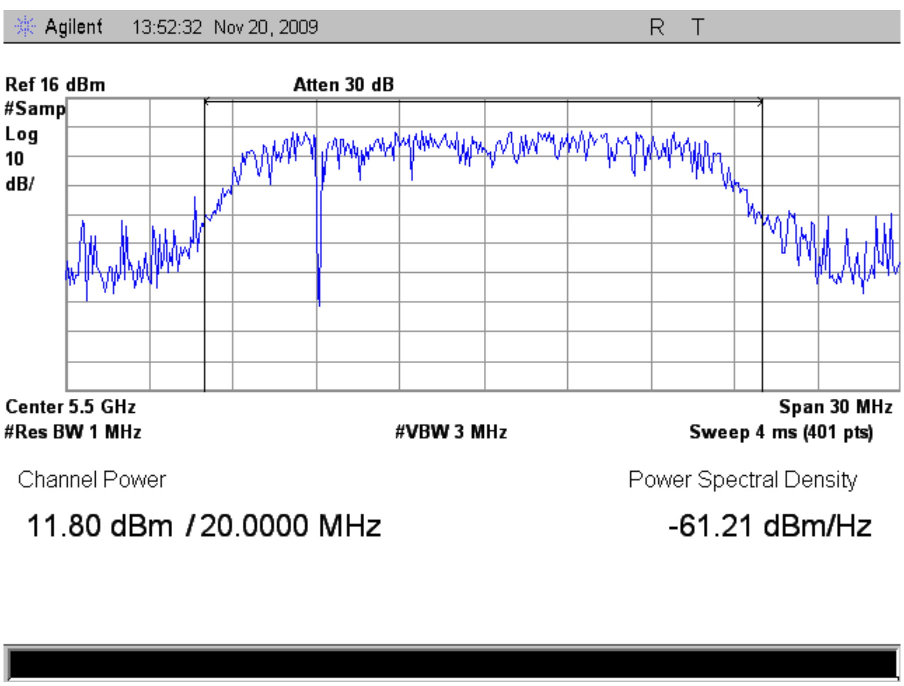


Plot 20. RF Power Output, 5300 MHz

RF Output Power Test Results

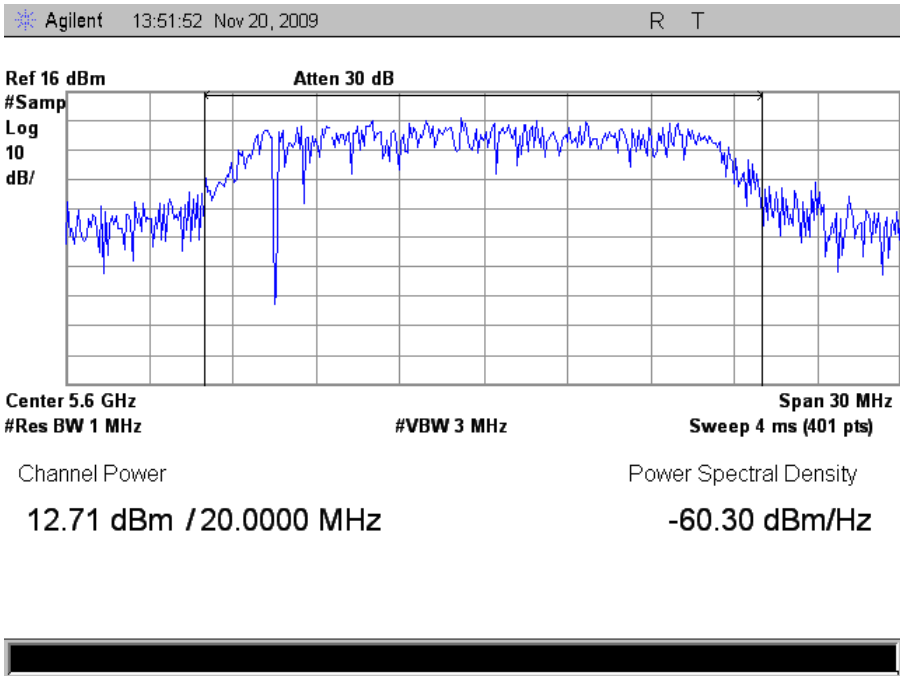


Plot 21. RF Power Output, 5320 MHz

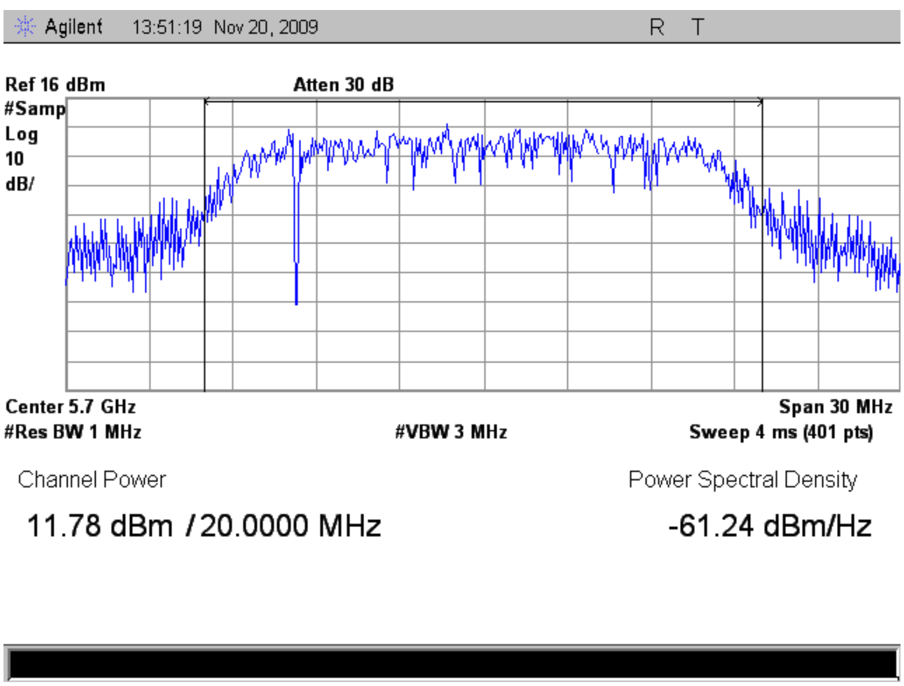


Plot 22. RF Power Output, 5500 MHz

RF Output Power Test Results



Plot 23. RF Power Output, 5600 MHz



Plot 24. RF Power Output, 5700 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(a)(2) Peak Power Spectral Density

Test Requirements: **§ 15.407(a)(2):** In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band.

Test Procedure: The transmitter was connected directly to a Spectrum Analyzer through an attenuator. The power level was set to the maximum level on the EUT. The RBW was set to 1MHz and the VBW was set to 3MHz. The method of measurement #2 from the FCC Public Notice DA 02-2138 was used.

Test Results: Equipment was compliant with the peak power spectral density limits of **§ 15.407 (a)(2).** The peak power spectral density was determined from plots on the following page(s).

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 11/20/09

Frequency (MHz)	PSD (dBm)
5260	10.18
5300	10.54
5320	10.24
5500	10.4
5600	10.77
5700	10.35

Table 12. Power Spectral Density, Test Results

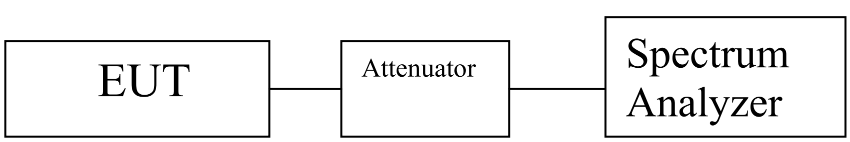
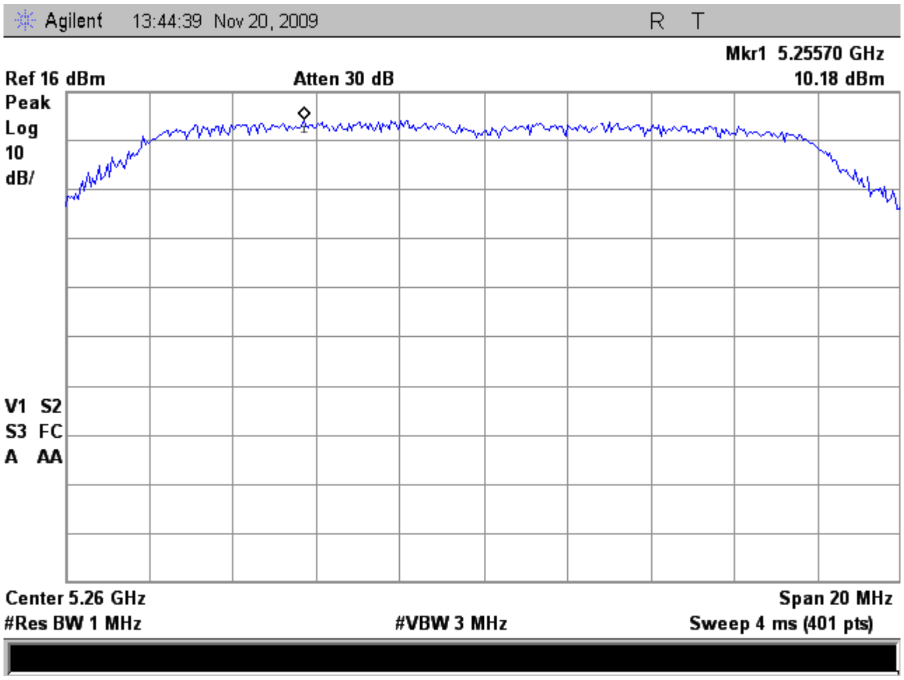
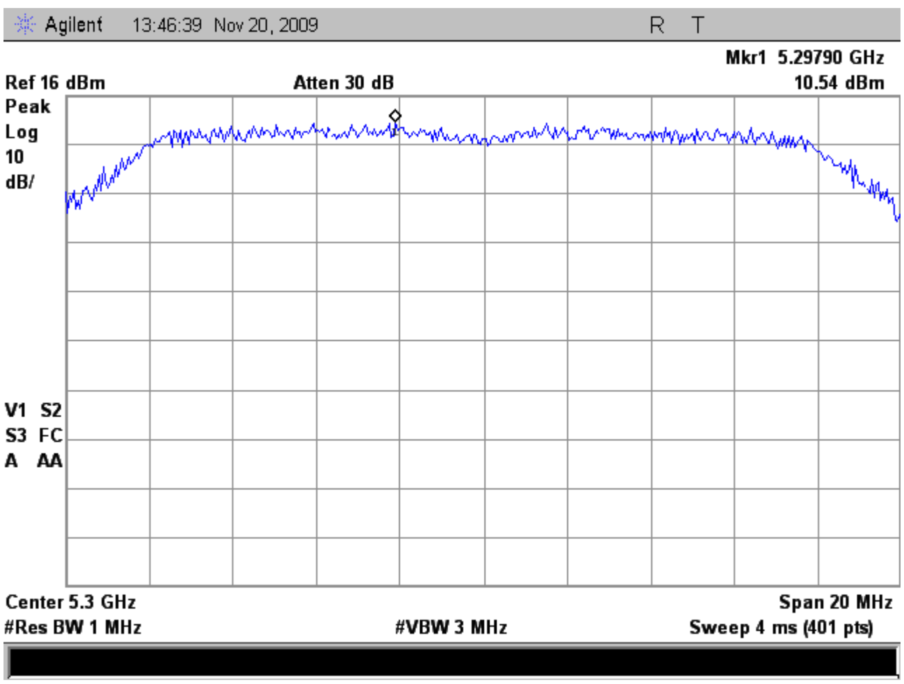


Figure 4. Power Spectral Density Test Setup

Power Spectral Density Test Results

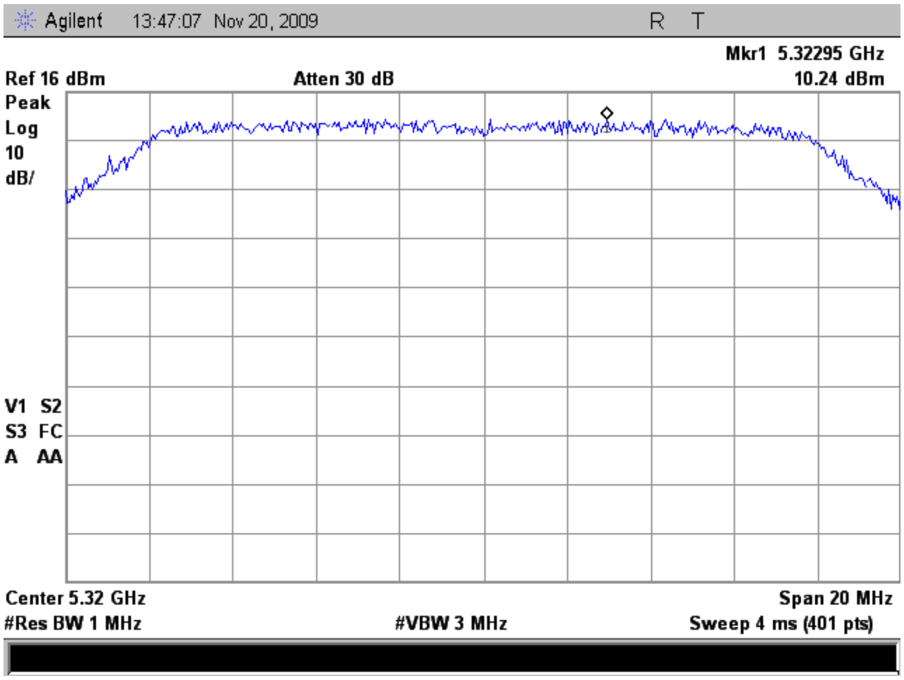


Plot 25. Power Spectral Density, 5260 MHz

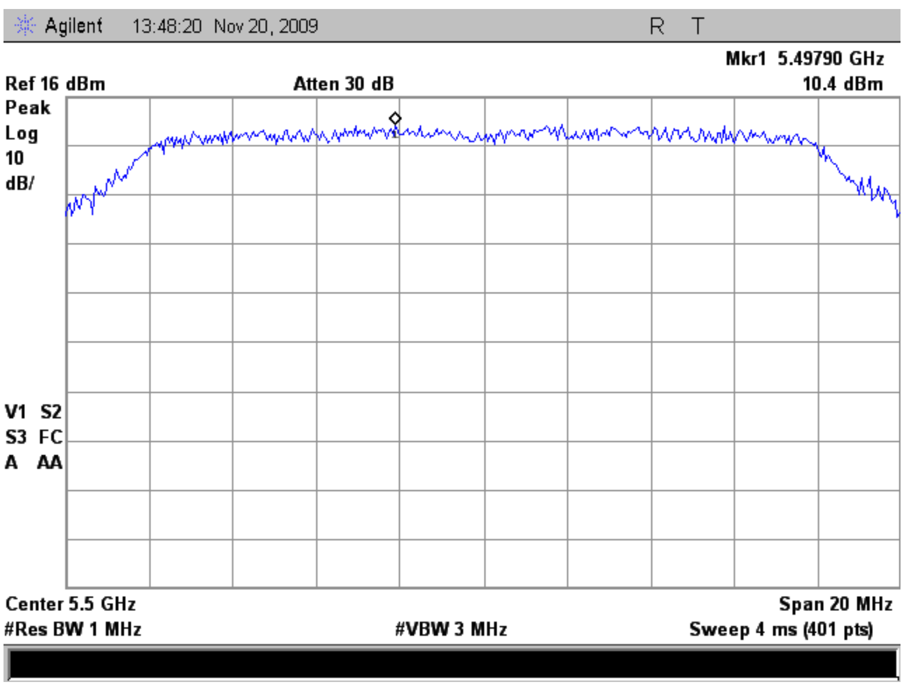


Plot 26. Power Spectral Density, 5300 MHz

Power Spectral Density Test Results

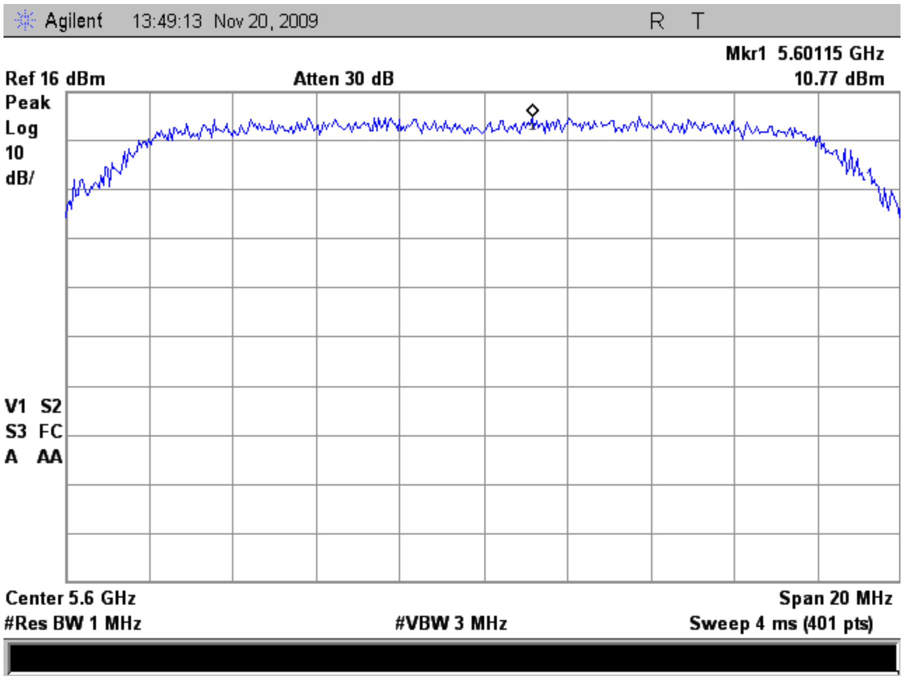


Plot 27. Power Spectral Density, 5320 MHz

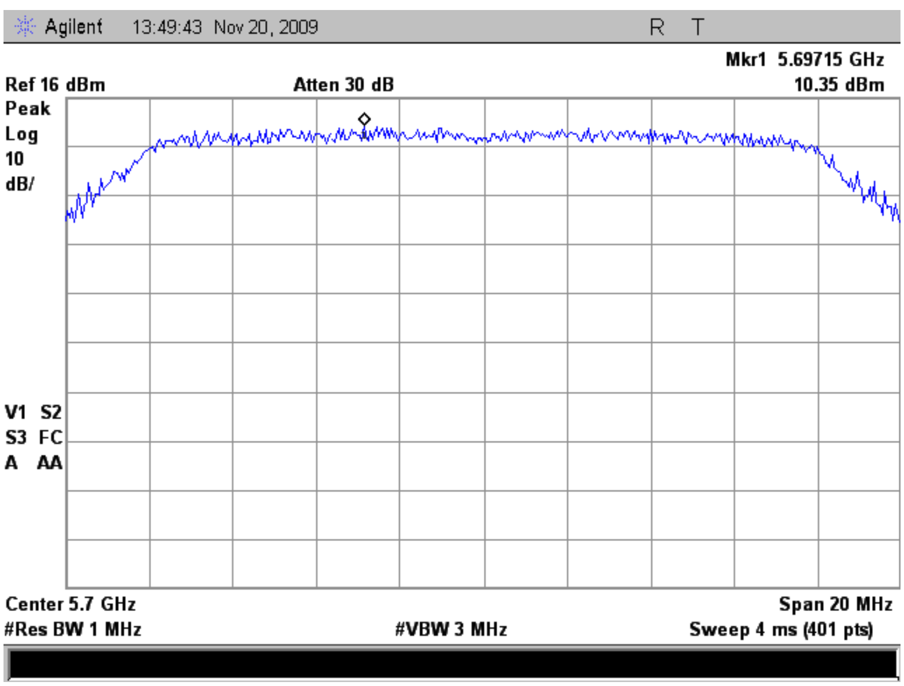


Plot 28. Power Spectral Density, 5500 MHz

Power Spectral Density Test Results



Plot 29. Power Spectral Density, 5600 MHz



Plot 30. Power Spectral Density, 5700 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(a)(6) Peak Excursion Ratio

Test Requirements: **§ 15.407(a)(6):** 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. The 1st trace on the spectrum analyzer was set to RBW=1MHz, VBW=3MHz. The peak detector mode was used and the trace max held. The 2nd trace on the spectrum analyzer was set according to measurement method #1 from the FCC Public Notice DA 02-2138 for making conducted power measurements.

Test Results: Equipment was compliant with the peak excursion ratio limits of **§ 15.407(a)(6).** The peak excursion ratio was determined from plots on the following page(s).

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 10/09/09

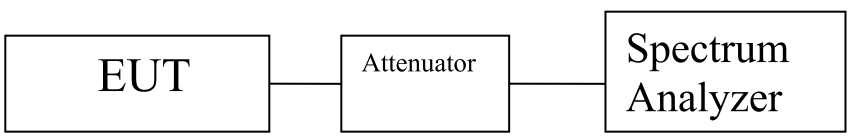
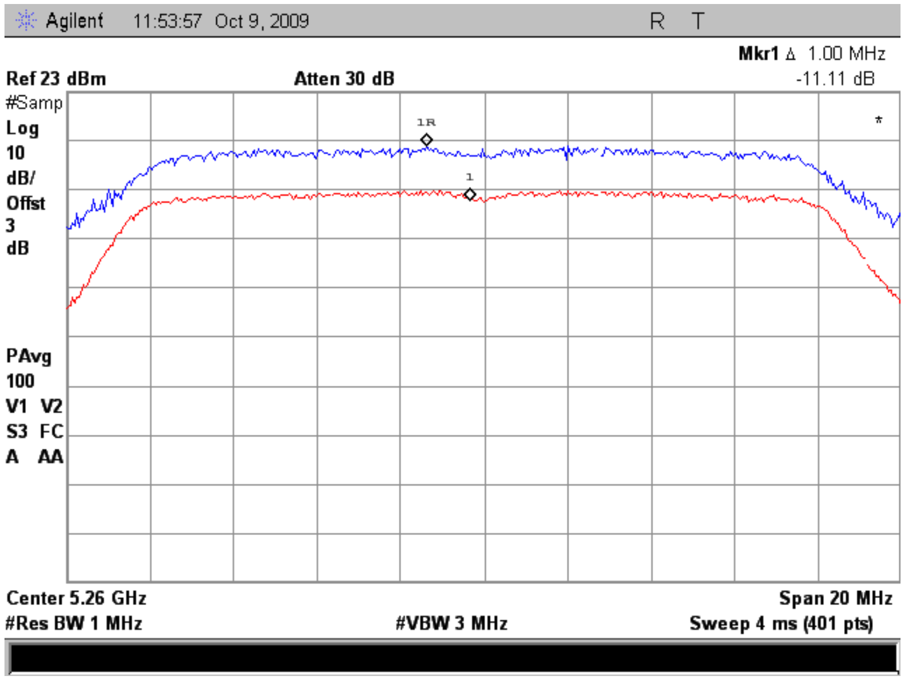
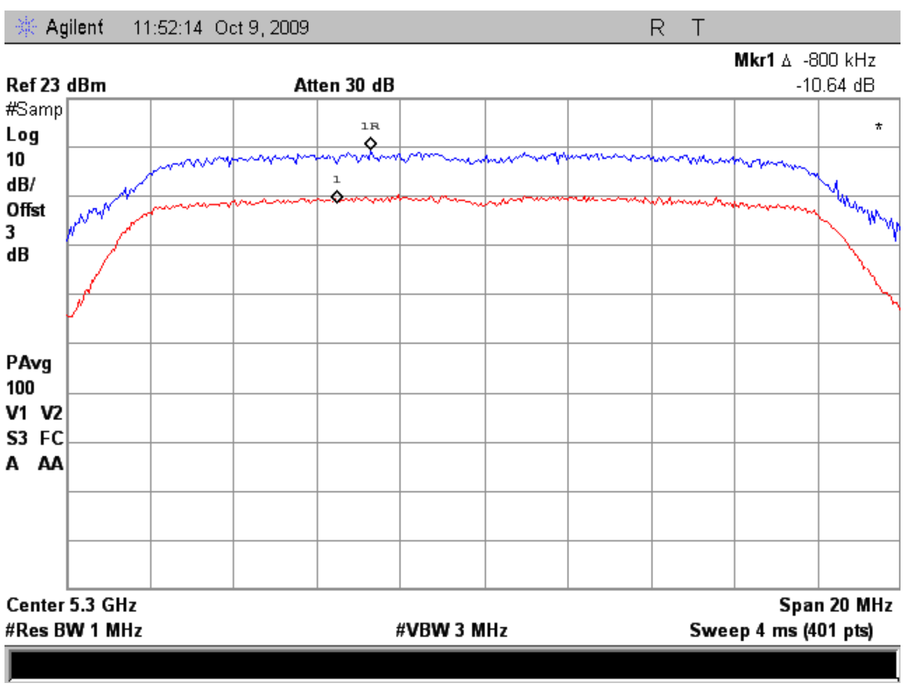


Figure 5. Peak Excursion Ration Test Setup

Peak Excursion Test Results

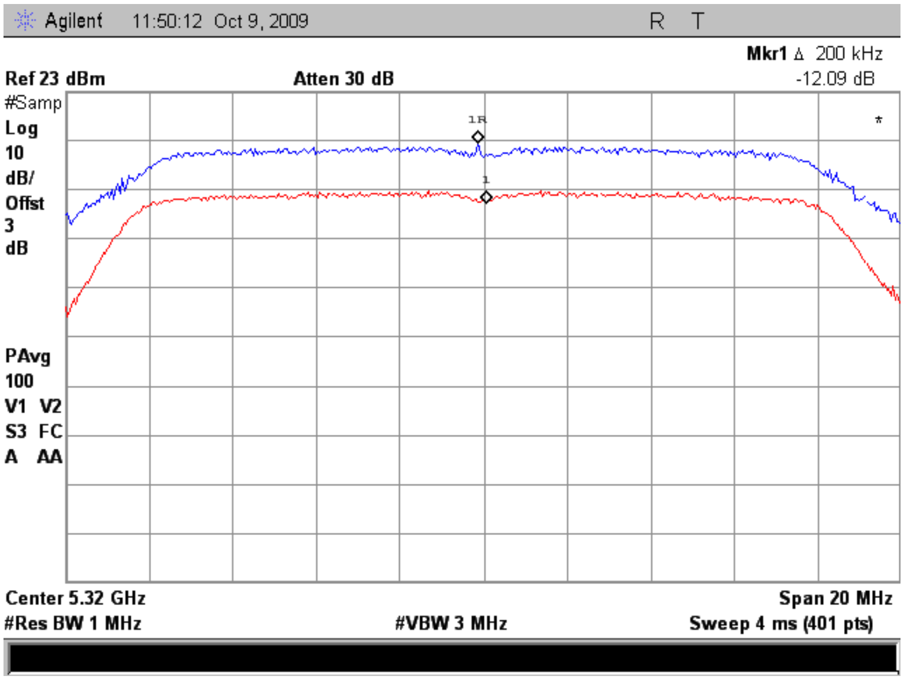


Plot 31. Peak Excursion Ratio, 5260 MHz

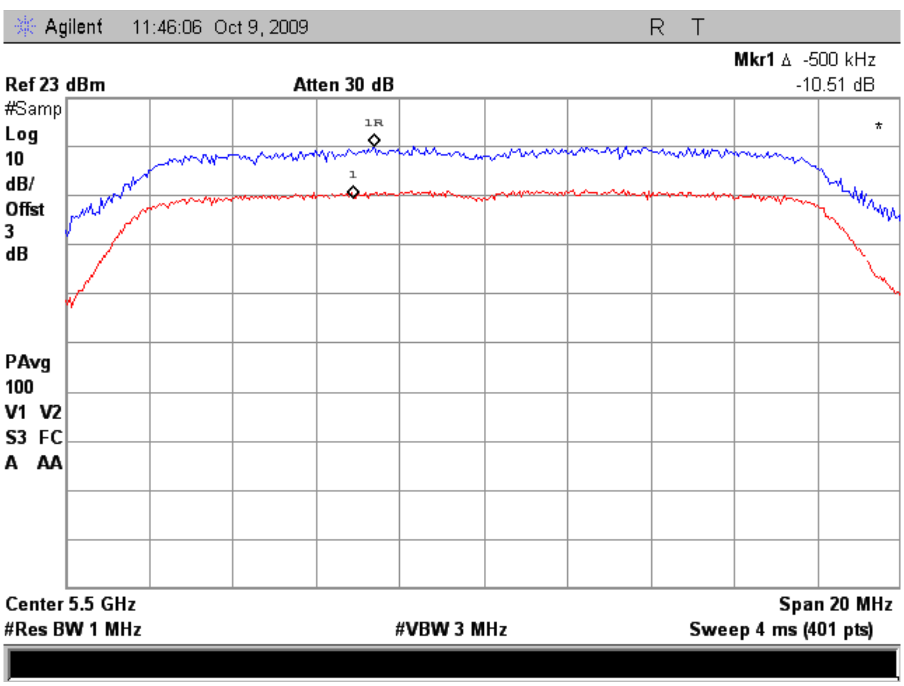


Plot 32. Peak Excursion Ratio, 5300 MHz

Peak Excursion Test Results

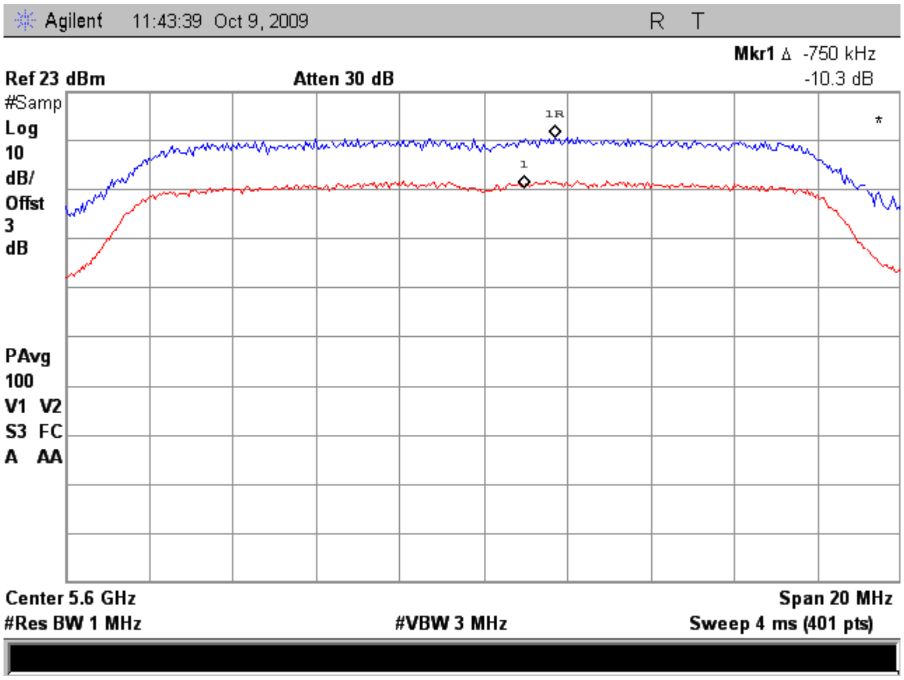


Plot 33. Peak Excursion Ratio, 5320 MHz

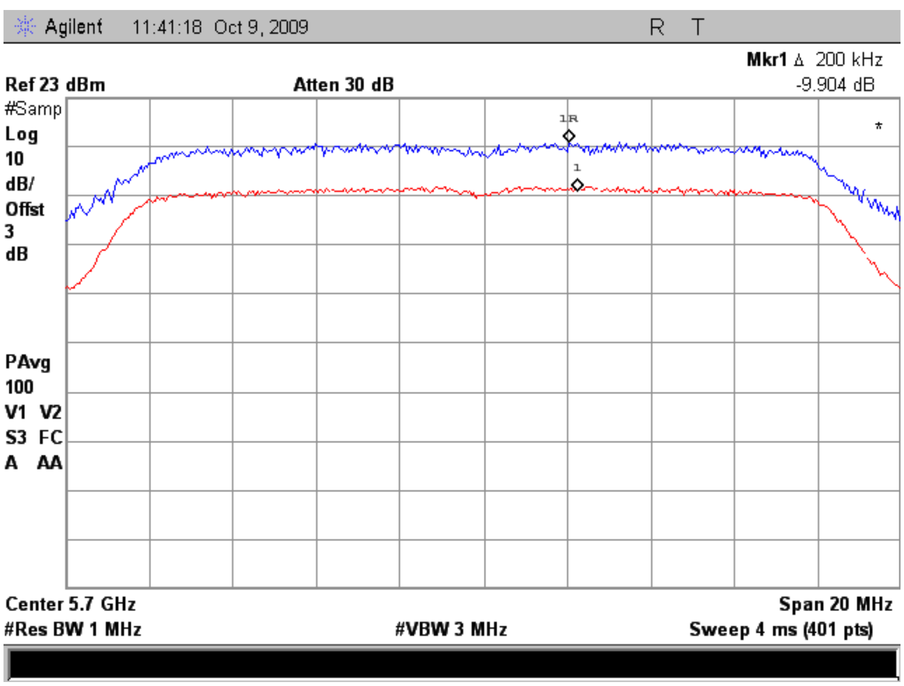


Plot 34. Peak Excursion Ratio, 5500 MHz

Peak Excursion Test Results



Plot 35. Peak Excursion Ratio, 5600 MHz



Plot 36. Peak Excursion Ratio, 5700 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(b) Undesirable Emissions

Test Requirements: **§ 15.407(b)(2), (b)(3), (b)(7):** Emissions outside the frequency band.

§ 15.407(b)(2): For transmitters operating in the 5.25–5.35 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz. Devices operating in the 5.25–5.35 GHz band that generate emissions in the 5.15–5.25 GHz band must meet all applicable technical requirements for operation in the 5.15–5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of –27 dBm/MHz in the 5.15–5.25 GHz band.

§ 15.407(b)(3): For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of −27 dBm/MHz.

§ 15.407(b)(7): The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.

Test Procedure: The transmitter was placed on a stand inside in a semi-anechoic chamber. Measurements were performed with the EUT rotated 360 degrees and varying the adjustable antenna mast height to determine worst case orientation for maximum emissions.

For frequencies from 30 MHz to 1 GHz, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

For measurements above 1 GHz, measurements were made with a Peak detector with 1 MHz resolution bandwidth. Where the spurious emissions fell into a restricted band, measurements were also made with an average detector to make sure they complied with 15.209 limits. Emissions were explored up to 40 GHz.
The equation, **EIRP= E + 20 log D – 104.8** was used to convert an EIRP limit to a field strength limit.
E = field strength (dBUv/m)
D = Reference measurement distance

Test Results: The EUT was compliant with the Radiated Emission limits for Intentional Radiators. See following pages for detailed test results.

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 10/08/09

§ 15.407(b)(4): Harmonic and Spurious Emissions Requirements – Radiated

Channel (MHz)	Frequency (GHz)	Measured value (corrected) @ 1m dBuV/m	Limit @ 1m	Margin	Remark
5260	2.9505	69.9	77.8	-7.9	Peak
	5.4531	53.07	63.5	-10.43	Avg
	5.4276	71	83.5	-12.5	Peak
	5.4651	68.33	77.8	-9.47	Peak
	7.6784	72.59	77.8	-5.21	Peak
5300	5.0878	67.01	77.8	-10.79	Peak
	5.4575	53.04	63.5	-10.46	Avg
	5.3995	67.67	83.5	-15.83	Peak
	5..4611	67.36	77.8	-10.44	Peak
	9.6036	72.33	77.8	-5.47	Peak
5320	5.15	66.47	77.8	-11.33	Peak
	5.35	57.22	63.5	-6.28	Avg
	5.35	73.01	83.5	-10.49	Peak
	5.4643	68.87	77.8	-8.93	Peak
	9.4904	72.31	77.8	-5.49	Peak
5500	5.0346	62.9	77.8	-14.9	Peak
	5.46	56.9	63.5	-6.6	Avg
	5.4589	74.17	83.5	-9.33	Peak
	5.4623	77.34	77.8	-0.46	Peak
	9.2946	67.7	77.8	-10.1	Peak
5600	5.0129	64.11	77.8	-13.69	Peak
	5.4592	53.94	63.5	-9.56	Avg
	5.4578	64.26	83.5	-19.24	Peak
	5.4601	64.58	77.8	-13.22	Peak
	8.7816	68.19	77.8	-9.61	Peak
5700	5.1108	63.63	77.8	-14.17	Peak
	5.4556	53.17	63.5	-10.33	Avg
	5.4204	63.83	83.5	-19.67	Peak
	5.4626	64.1	77.8	-13.7	Peak
	7.5994	67.94	77.8	-9.86	Peak

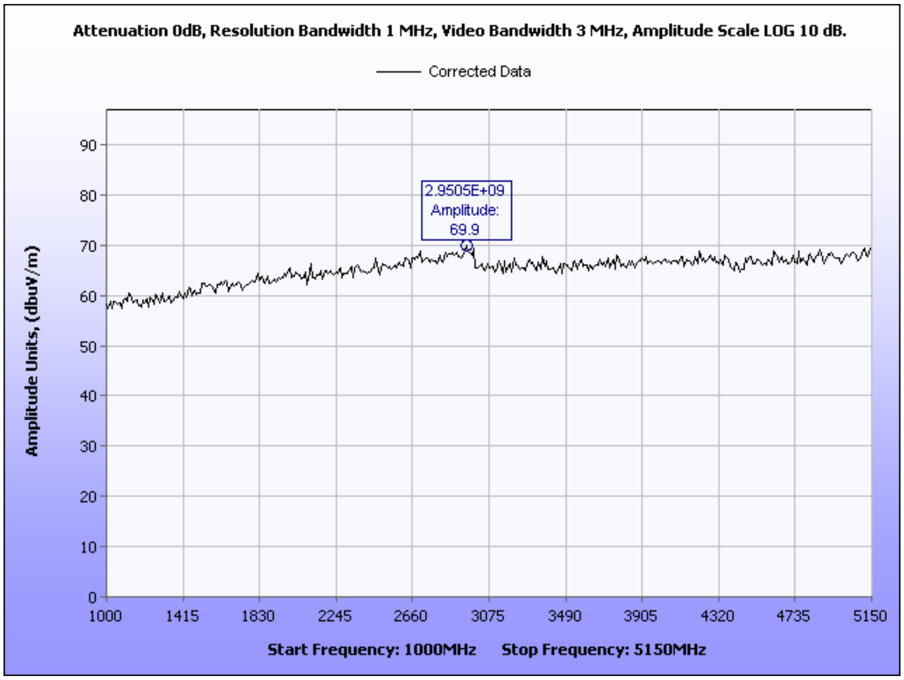
Table 13. Radiated Spurs, Test Results

Note: All other emissions were measured at the noise floor of the spectrum analyzer.

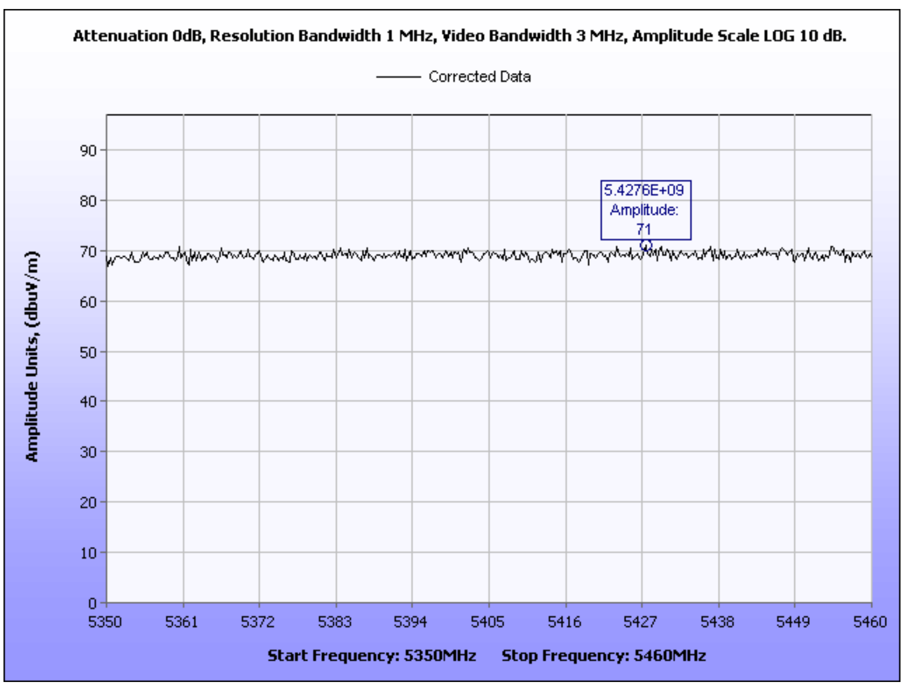
Limit Calculations:

-27 dBm/MHz
EIRP = E0 + 20log (D) – 104.8
E0 = -27+104.8 (measurements made at 1m)
E0 =77.8 dBuV/m

Radiated Spurious Emissions Test Results

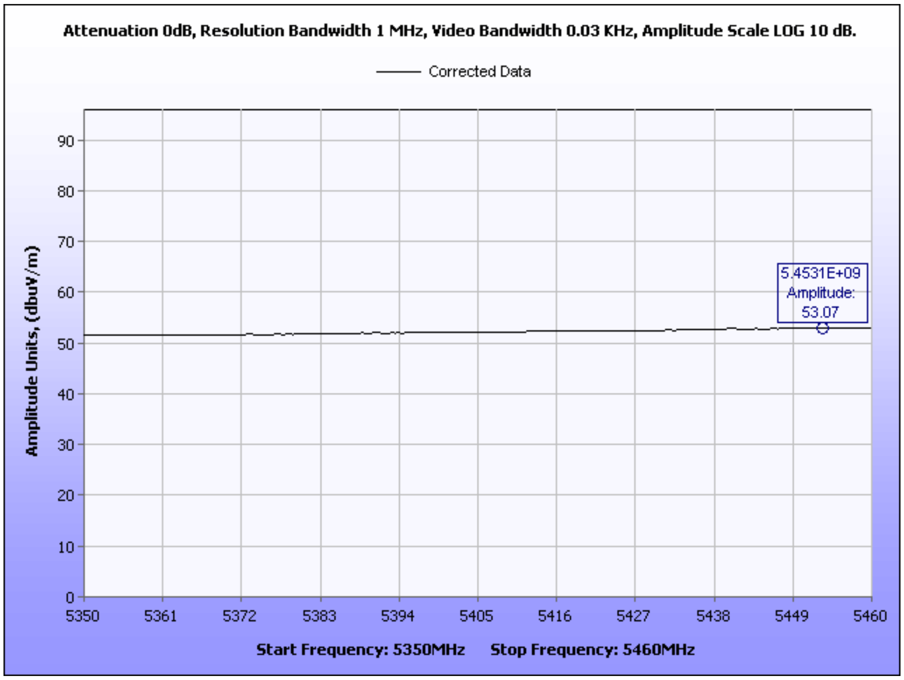


Plot 37. Radiated Spurs, 1MHz – 5.15GHz, Channel 5260 MHz

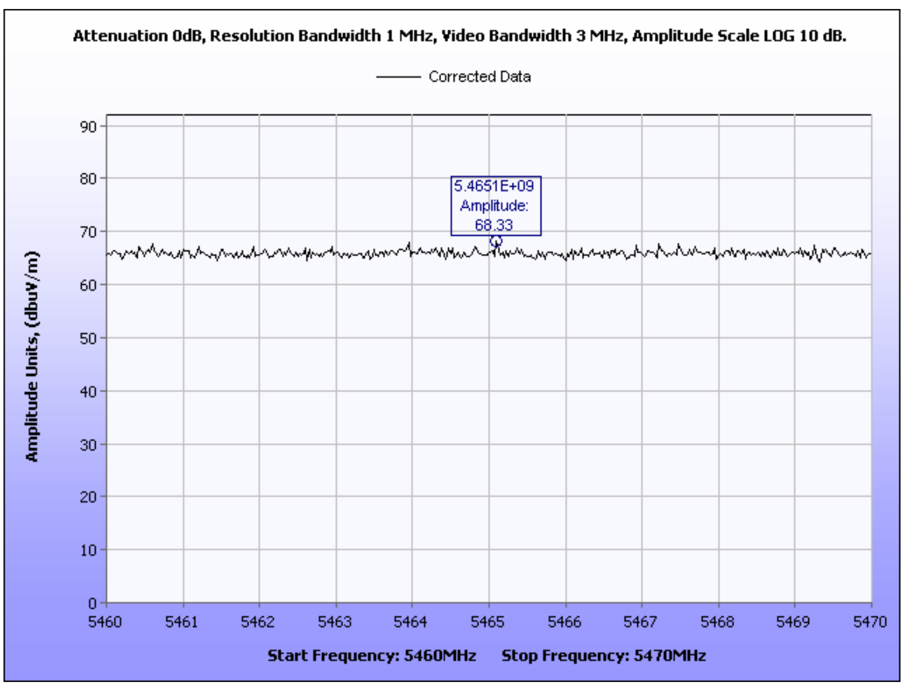


Plot 38. Radiated Spurs, 5350MHz – 5460 MHz, Peak, Channel 5260 MHz

Radiated Spurious Emissions Test Results

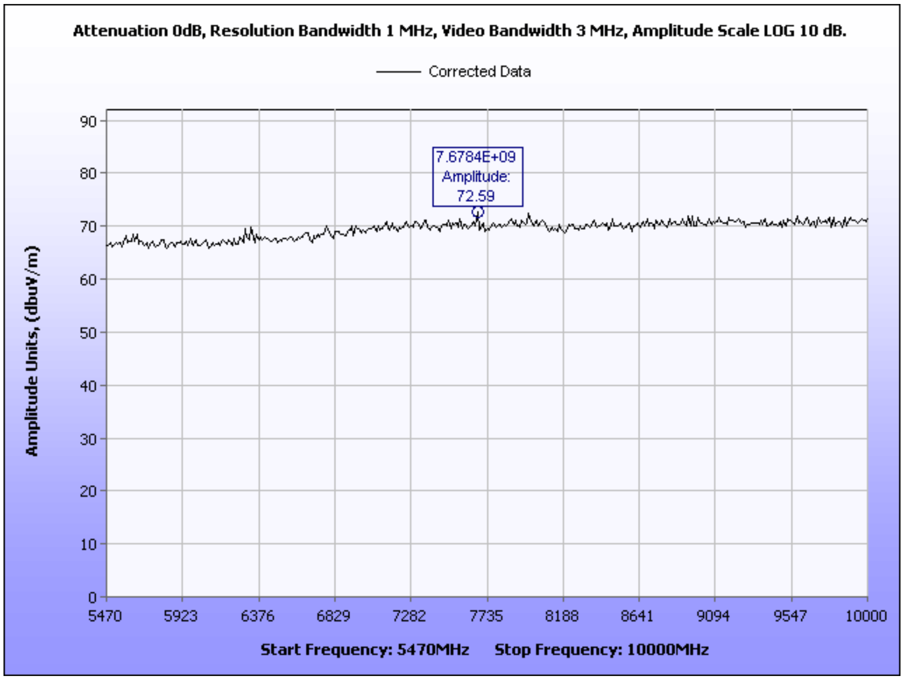


Plot 39. Radiated Spurs, 5350MHz – 5460 MHz, Avg, Channel 5260 MHz

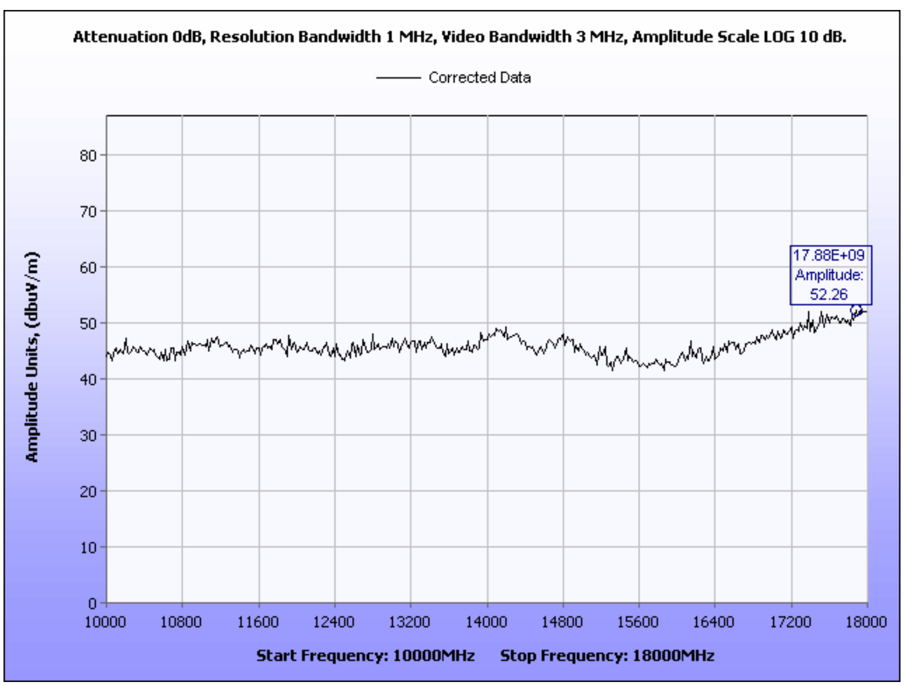


Plot 40. Radiated Spurs, 5460MHz – 5470GHz, Channel 5260 MHz

Radiated Spurious Emissions Test Results

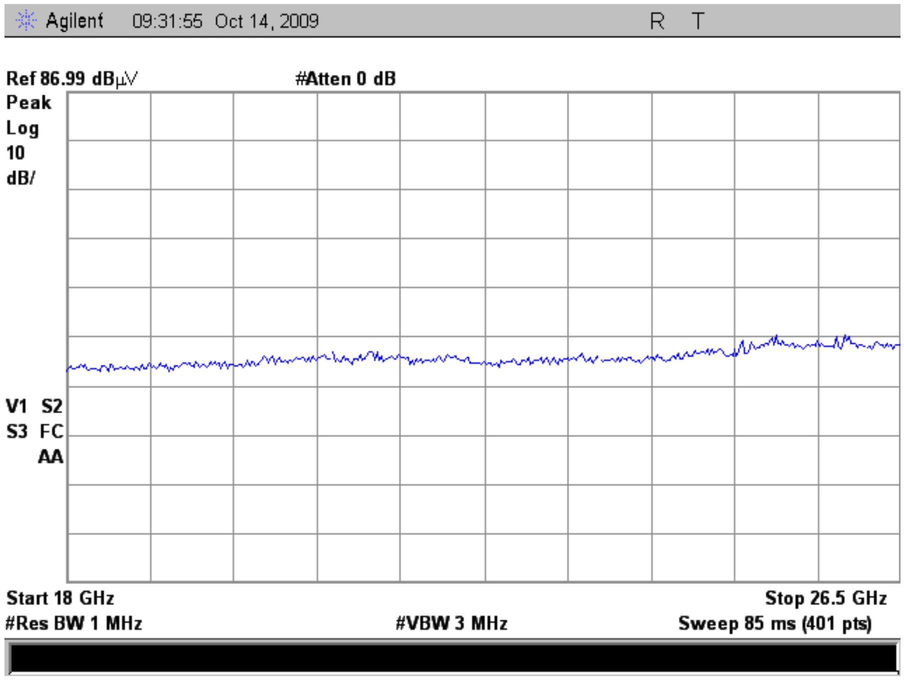


Plot 41. Radiated Spurs, 5.47GHz – 10GHz, Channel 5260 MHz

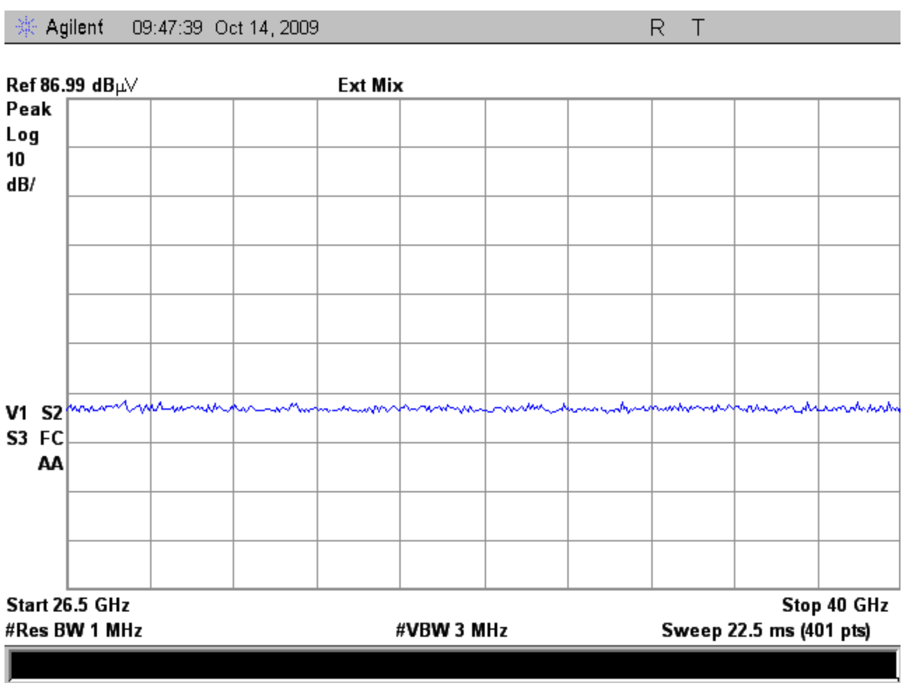


Plot 42. Radiated Spurs, 10GHz – 18GHz, Channel 5260 MHz

Radiated Spurious Emissions Test Results

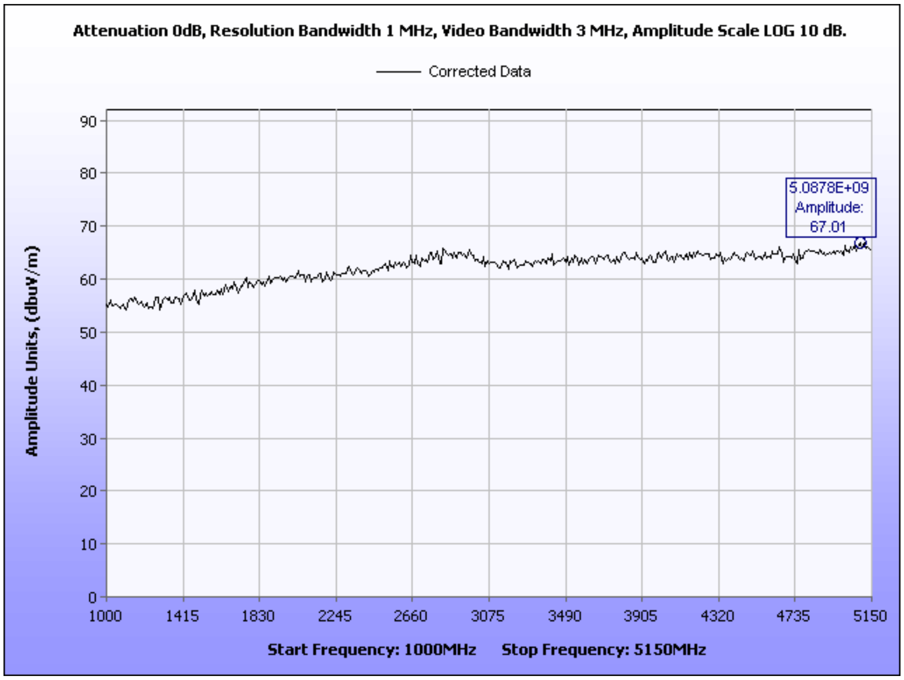


Plot 43. Radiated Spurs, 18GHz – 26.5GHz, Channel 5260 MHz

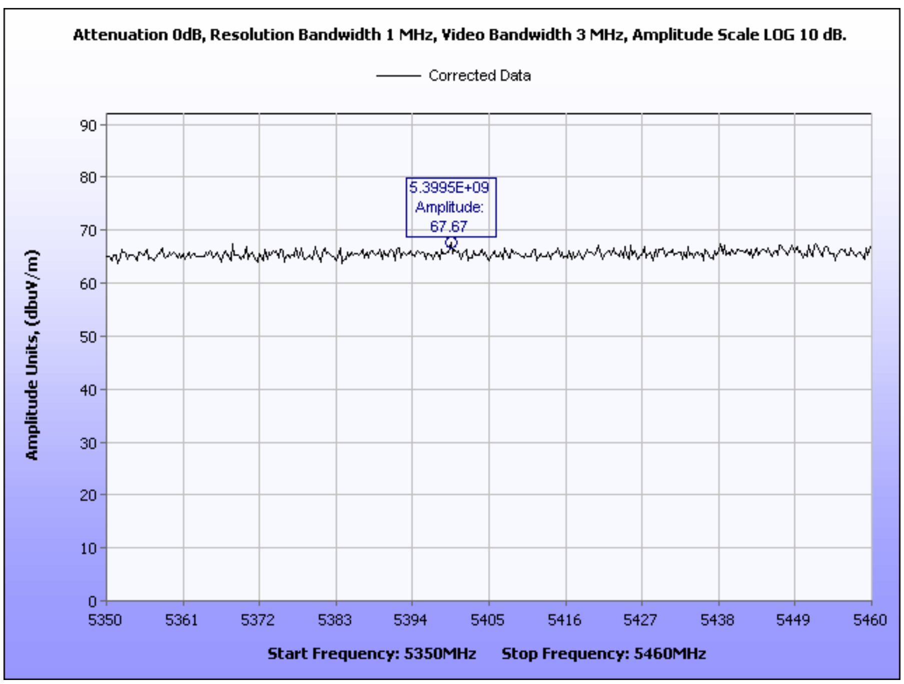


Plot 44. Radiated Spurs, 26.5GHz – 40GHz, Channel 5260 MHz

Radiated Spurious Emissions Test Results

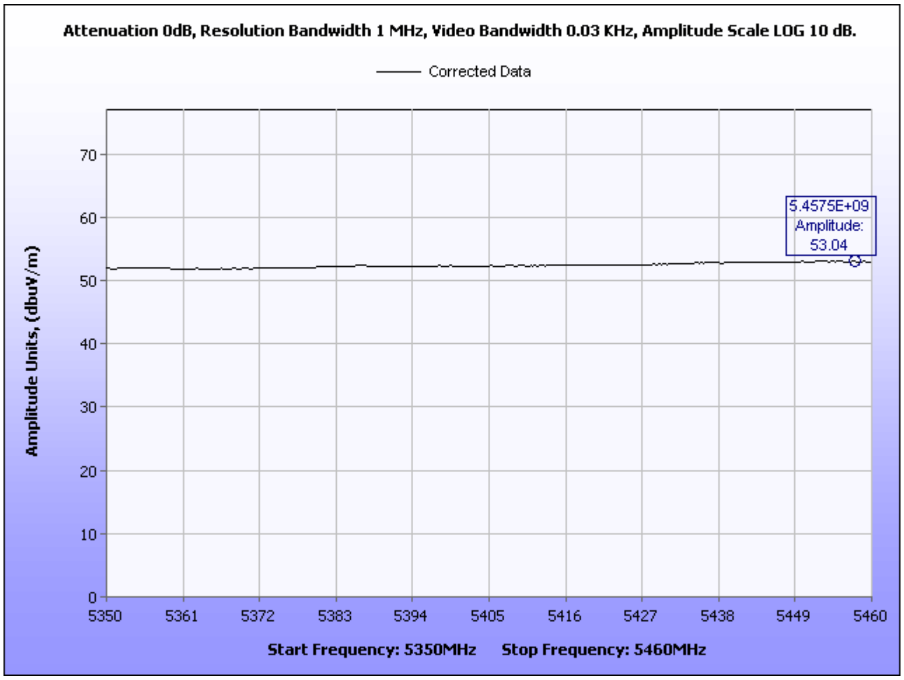


Plot 45. Radiated Spurs, 1MHz – 5.15GHz, Channel 5300 MHz

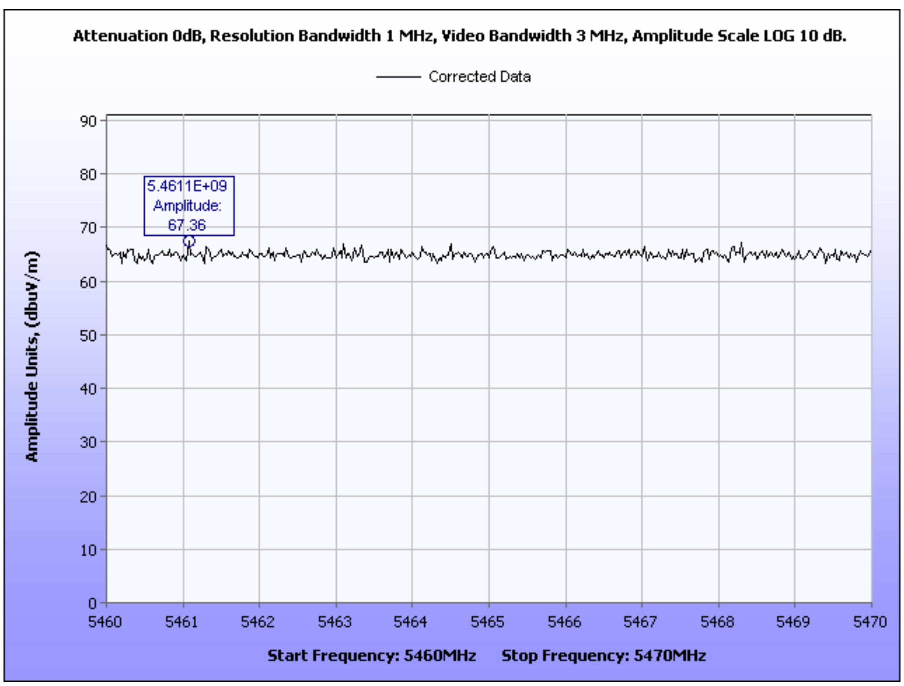


Plot 46. Radiated Spurs, 5350MHz – 5460 MHz, Peak, Channel 5300 MHz

Radiated Spurious Emissions Test Results

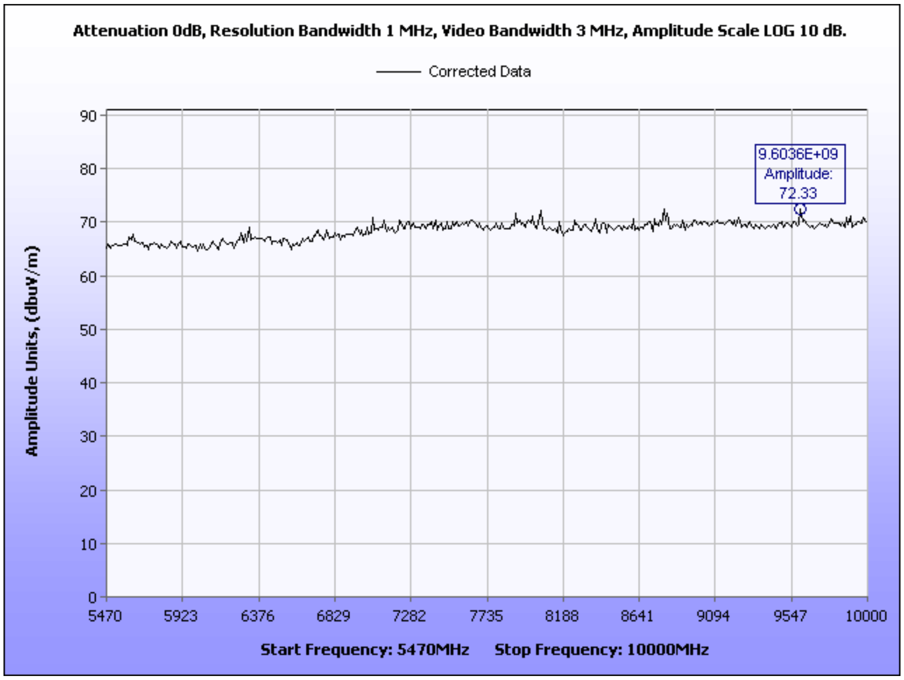


Plot 47. Radiated Spurs, 5350MHz – 5460 MHz, Avg, Channel 5300 MHz

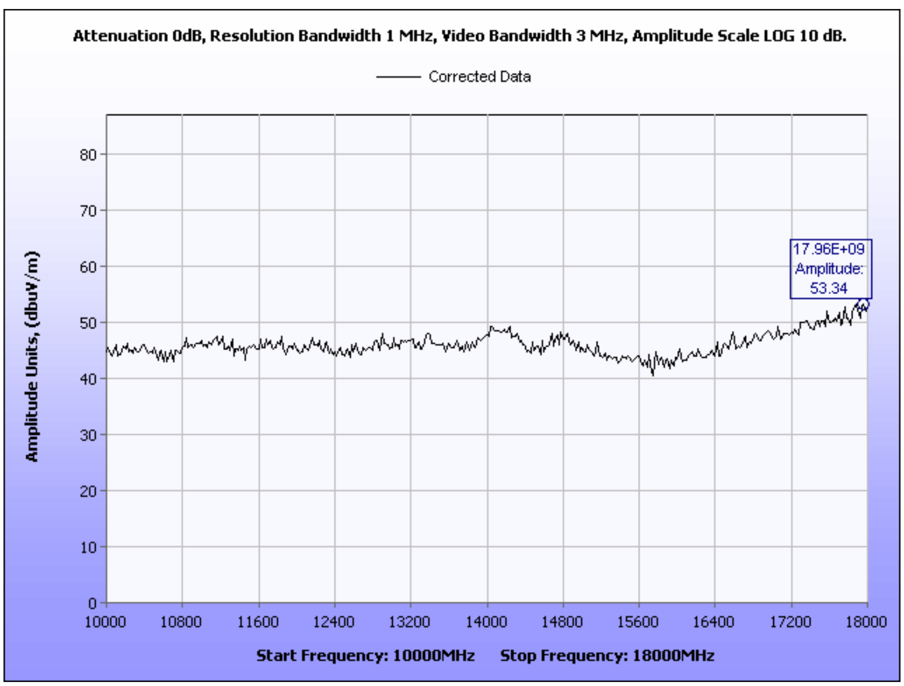


Plot 48. Radiated Spurs, 5460MHz – 5470GHz, Channel 5300 MHz

Radiated Spurious Emissions Test Results

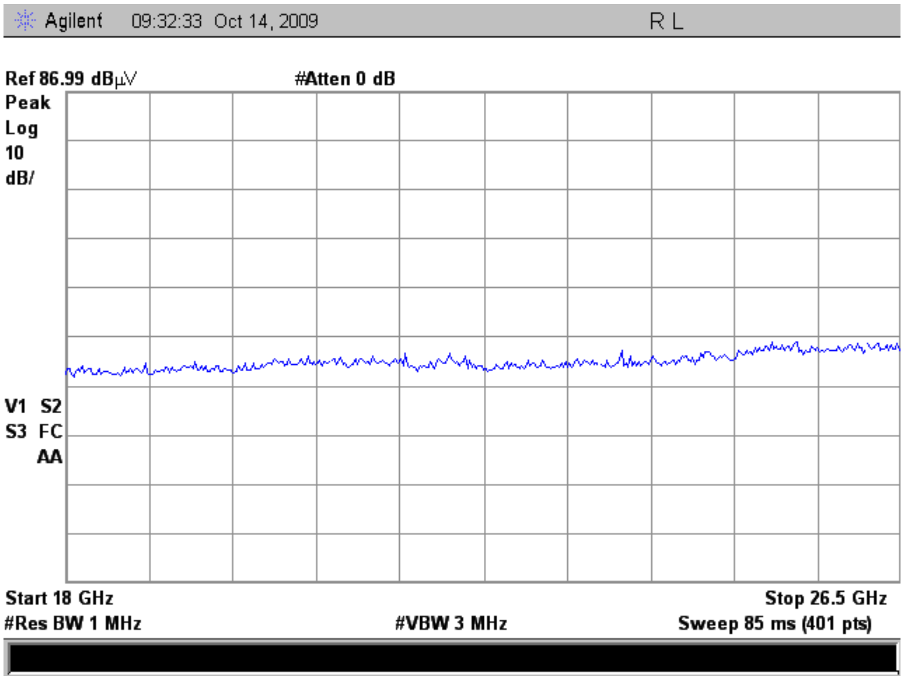


Plot 49. Radiated Spurs, 5.47GHz – 10GHz, Channel 5300 MHz

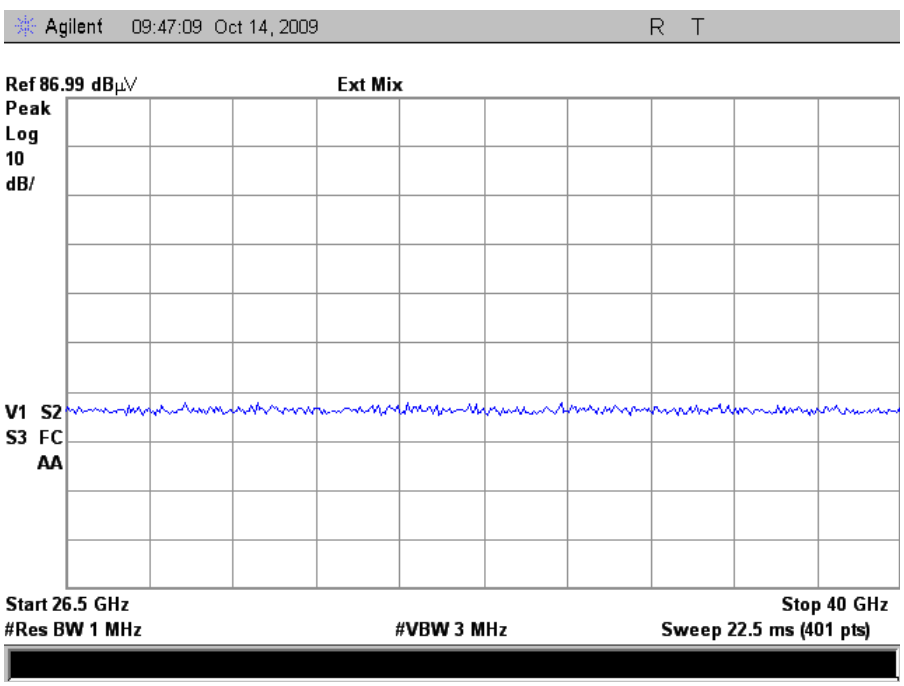


Plot 50. Radiated Spurs, 10GHz – 18GHz, Channel 5300 MHz

Radiated Spurious Emissions Test Results

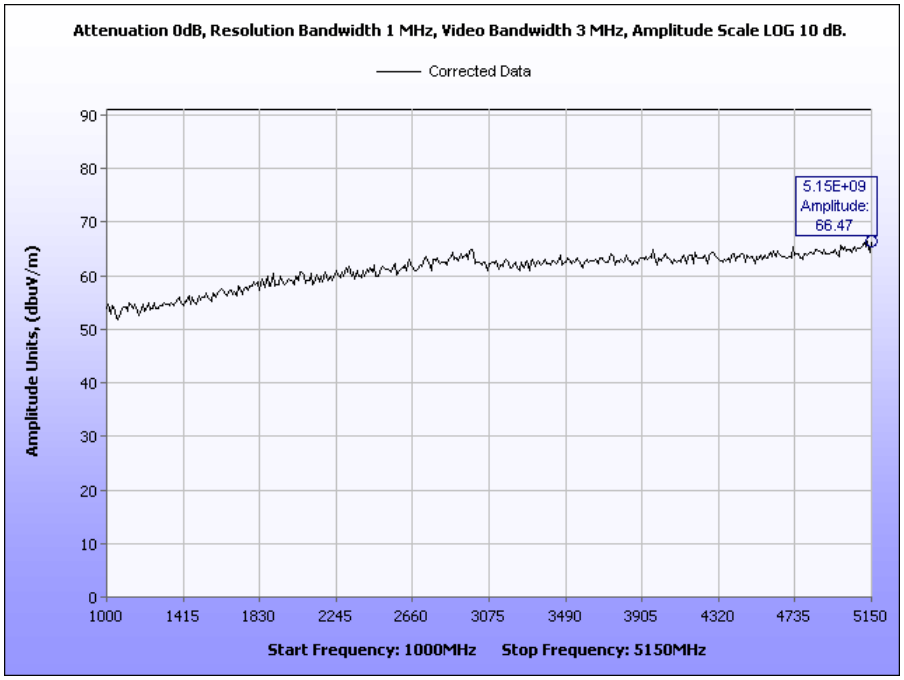


Plot 51. Radiated Spurs, 18GHz – 26.5GHz, Channel 5300 MHz

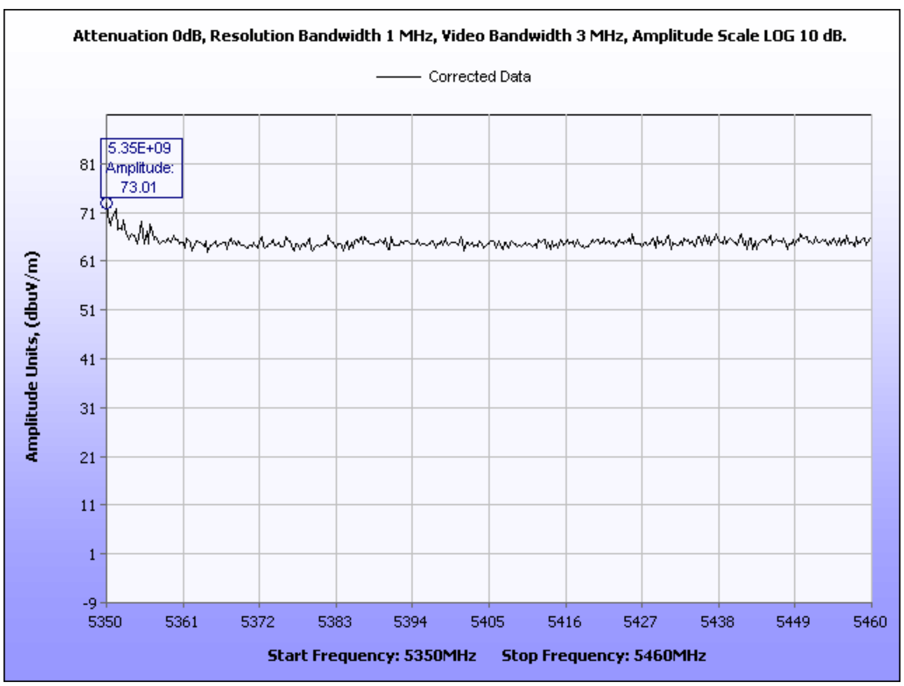


Plot 52. Radiated Spurs, 26.5GHz – 40GHz, Channel 5300 MHz

Radiated Spurious Emissions Test Results

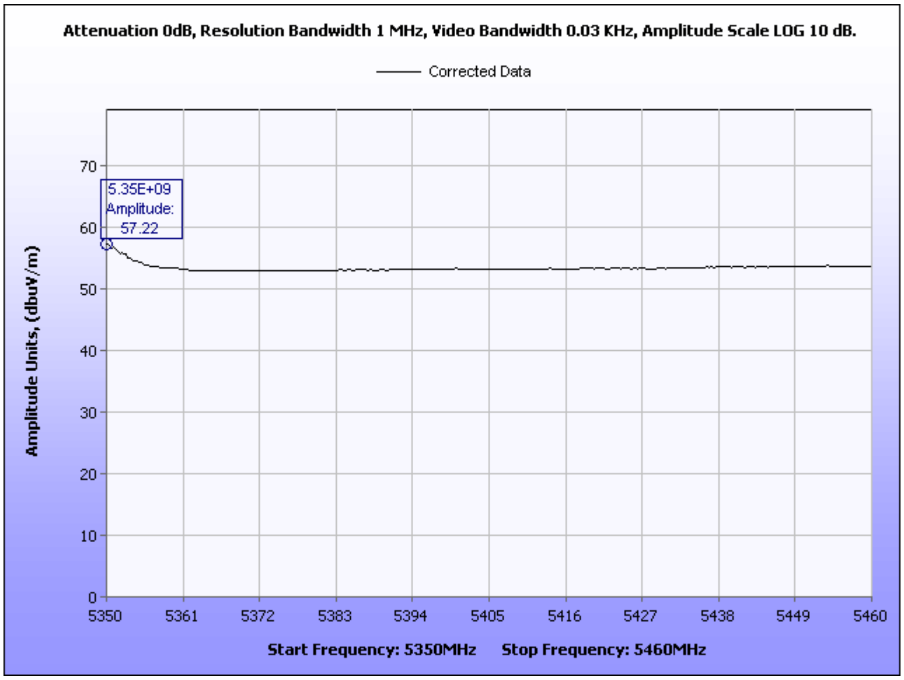


Plot 53. Radiated Spurs, 1MHz – 5.15GHz, Channel 5320 MHz

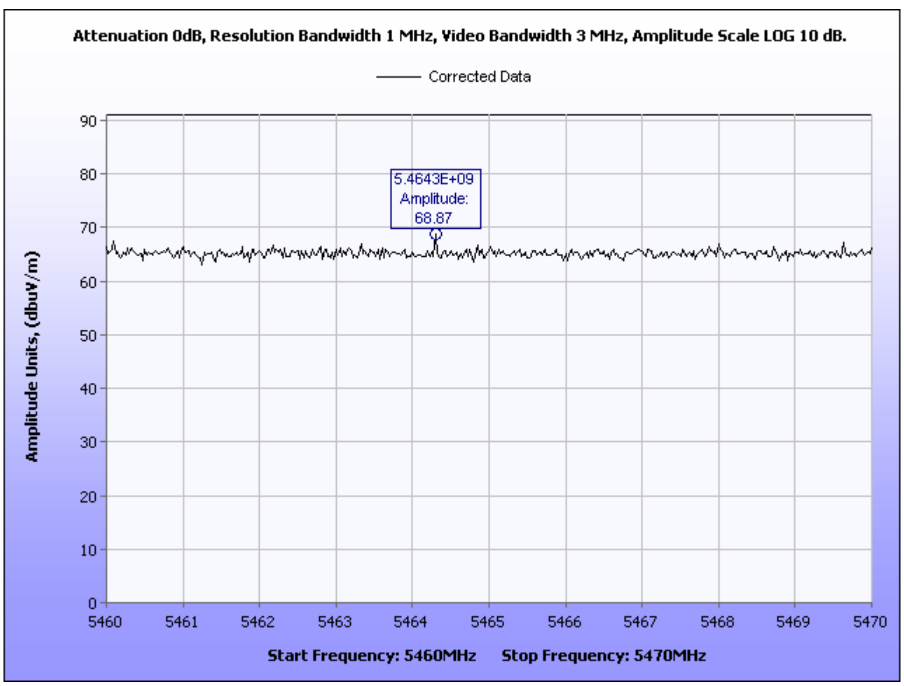


Plot 54. Radiated Spurs, 5350MHz – 5460 MHz, Peak, Channel 5320 MHz

Radiated Spurious Emissions Test Results

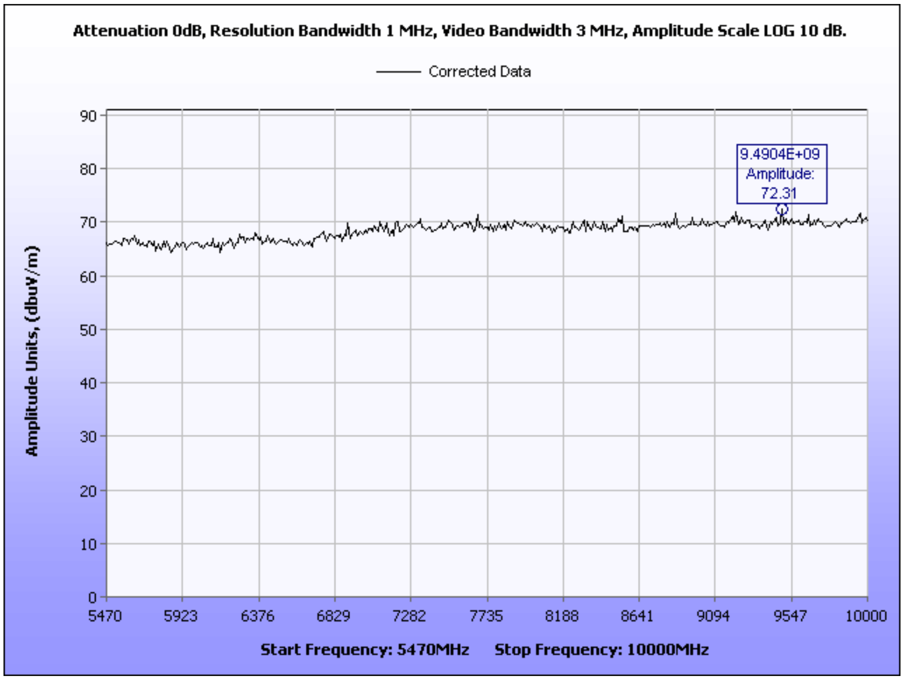


Plot 55. Radiated Spurs, 5350MHz – 5460 MHz, Avg, Channel 5320 MHz

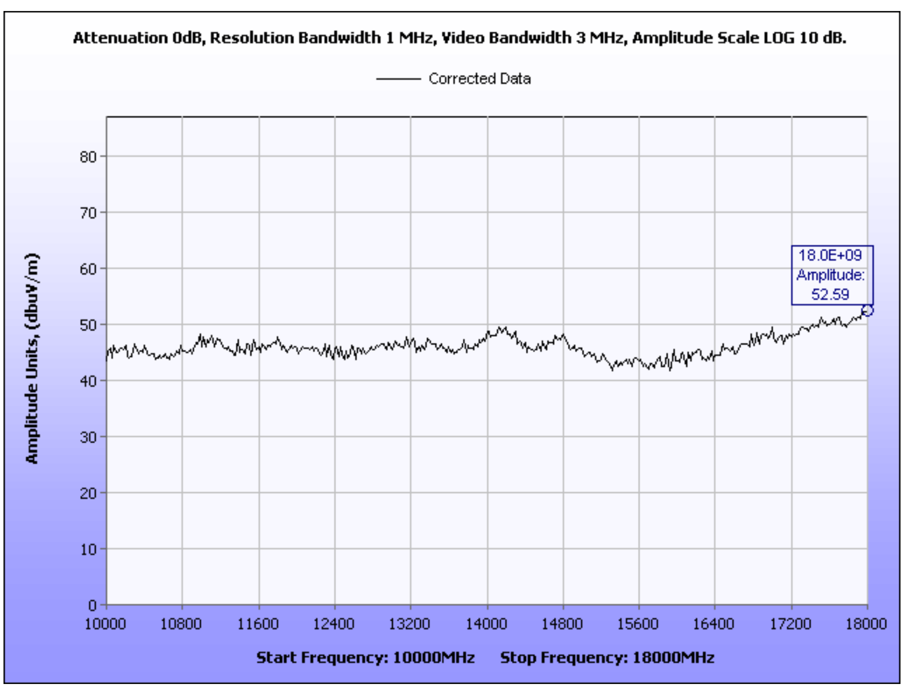


Plot 56. Radiated Spurs, 5460MHz – 5470GHz, Channel 5320 MHz

Radiated Spurious Emissions Test Results

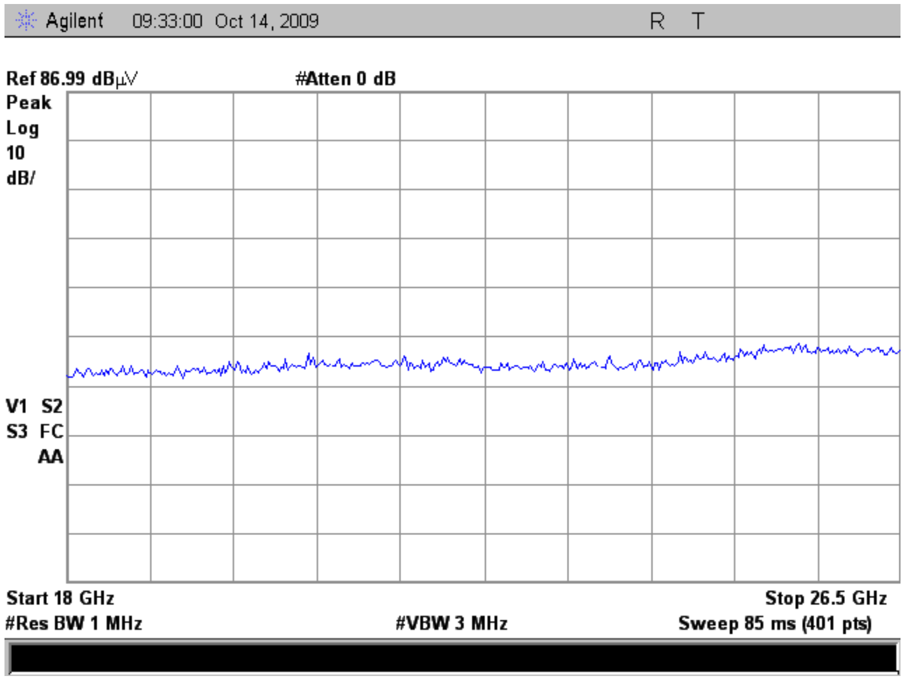


Plot 57. Radiated Spurs, 5.47GHz – 10GHz, Channel 5320 MHz

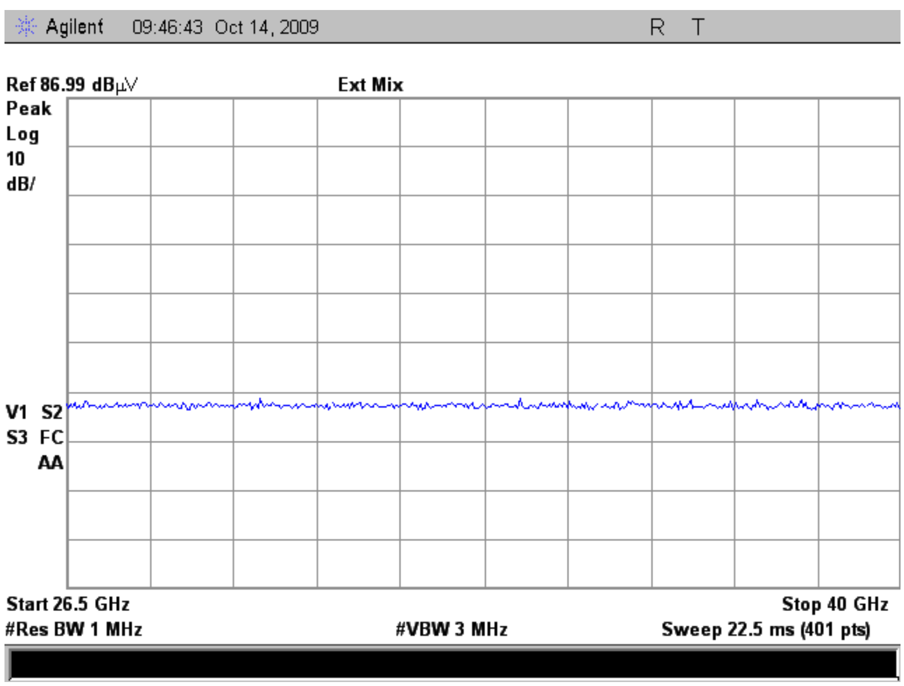


Plot 58. Radiated Spurs, 10GHz – 18GHz, Channel 5320 MHz

Radiated Spurious Emissions Test Results

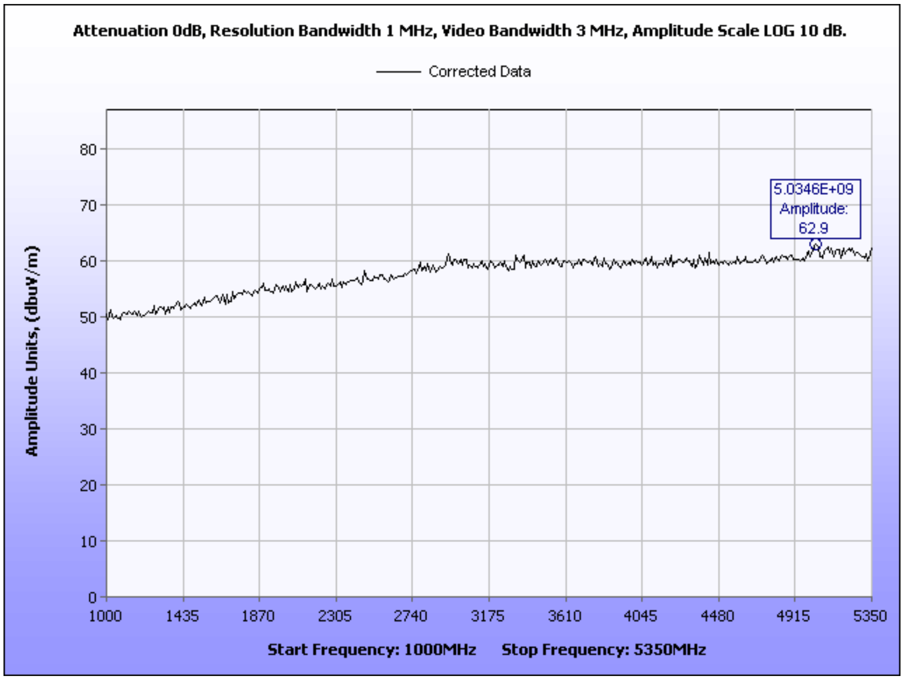


Plot 59. Radiated Spurs, 18GHz – 26.5GHz, Channel 5320 MHz

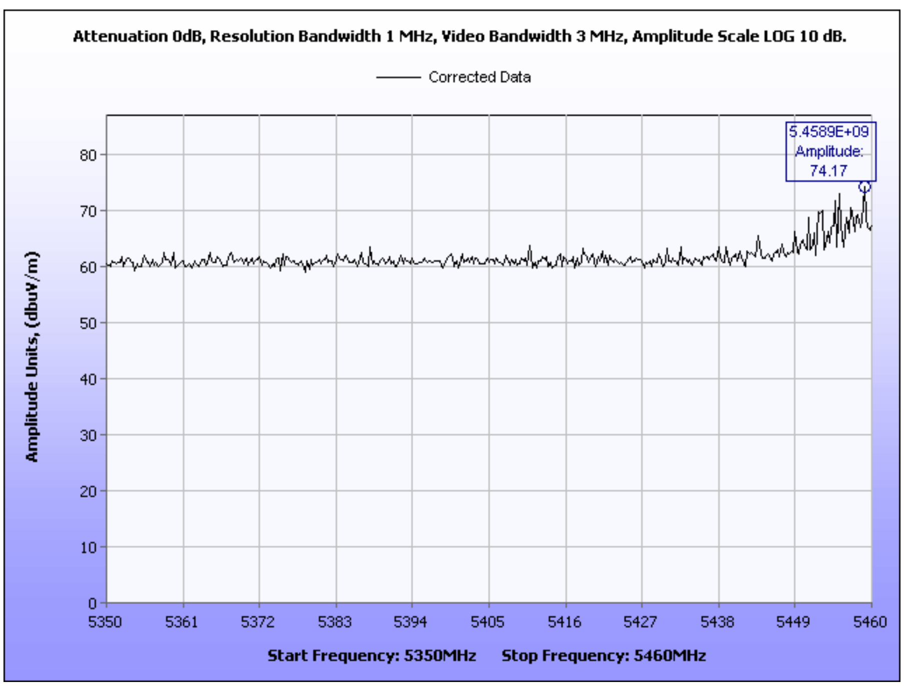


Plot 60. Radiated Spurs, 26.5GHz – 40GHz, Channel 5320 MHz

Radiated Spurious Emissions Test Results

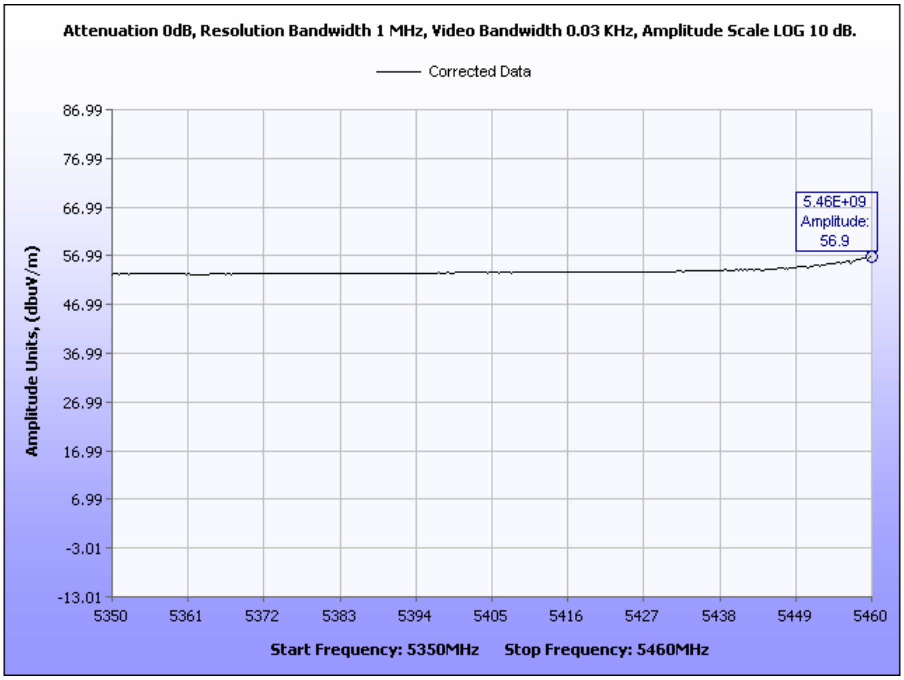


Plot 61. Radiated Spurs, 1MHz – 5.35GHz, Channel 5500 MHz

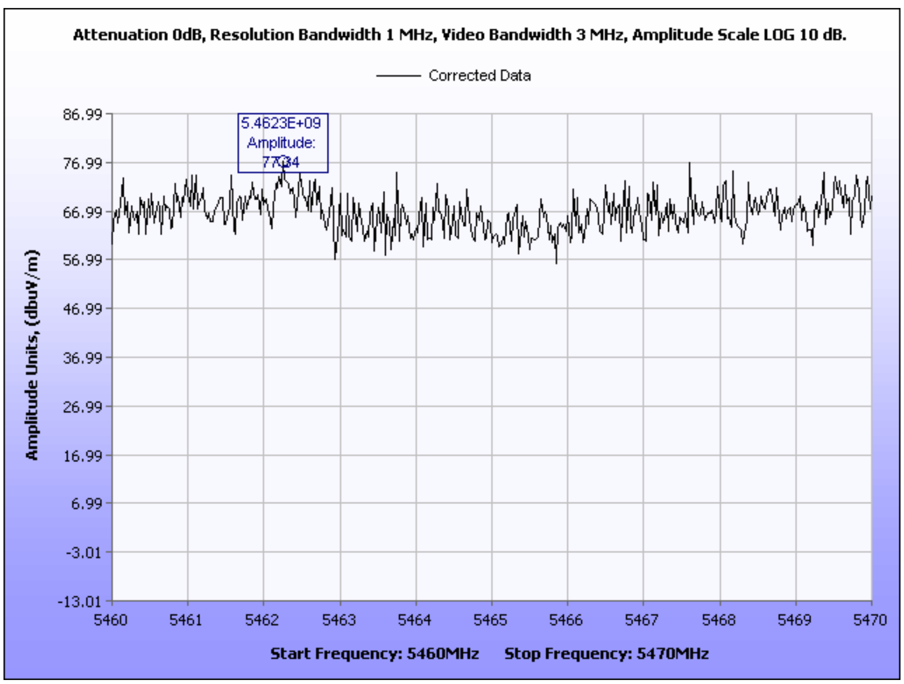


Plot 62. Radiated Spurs, 5350MHz – 5460 MHz, Peak, Channel 5500 MHz

Radiated Spurious Emissions Test Results

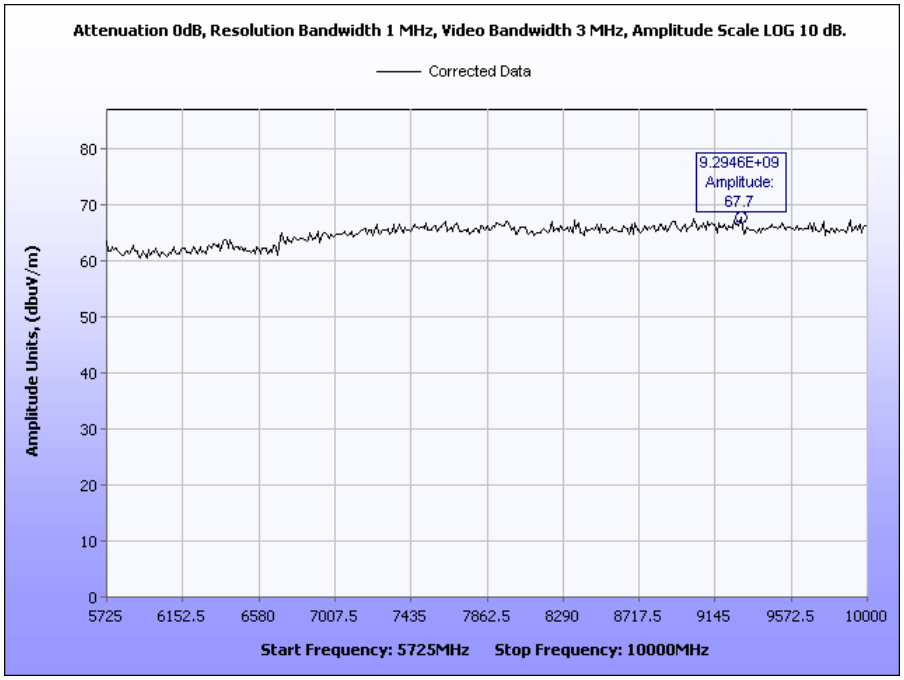


Plot 63. Radiated Spurs, 5350MHz – 5460 MHz, Avg, Channel 5500 MHz

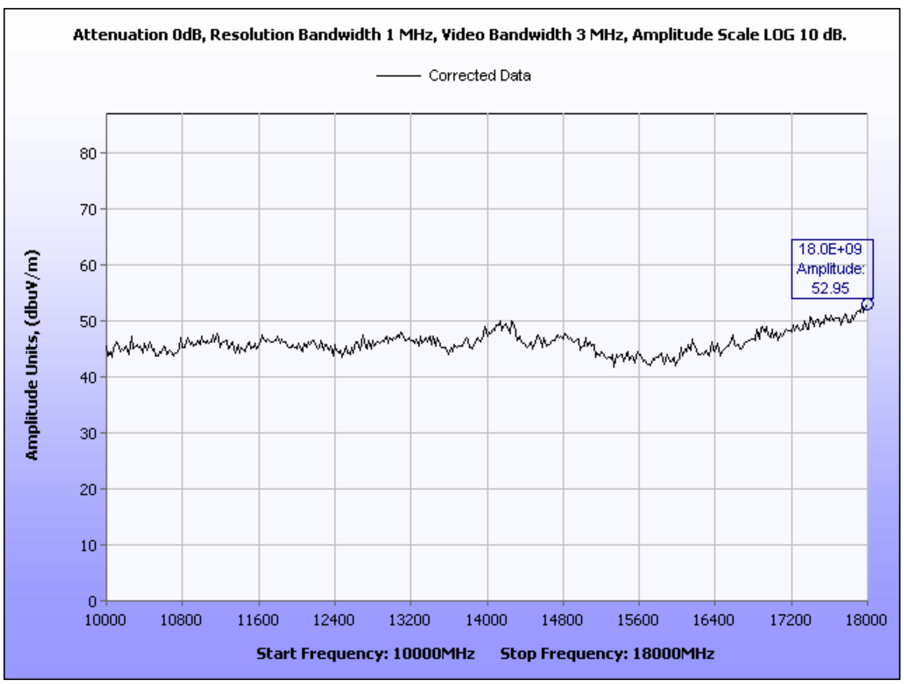


Plot 64. Radiated Spurs, 5460MHz – 5470GHz, Channel 5500 MHz

Radiated Spurious Emissions Test Results

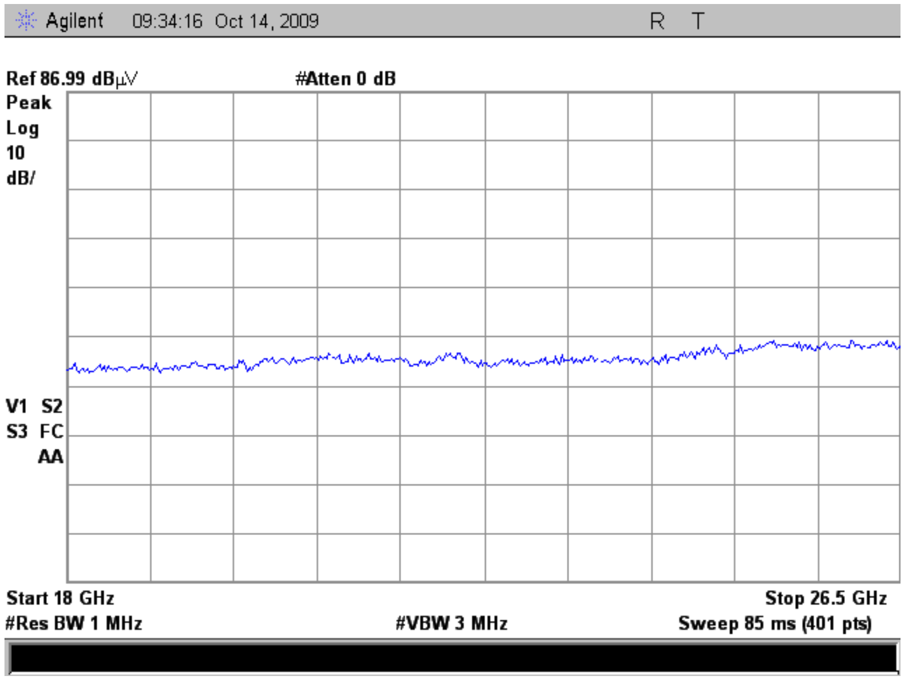


Plot 65. Radiated Spurs, 5.725GHz – 10GHz, Channel 5500 MHz

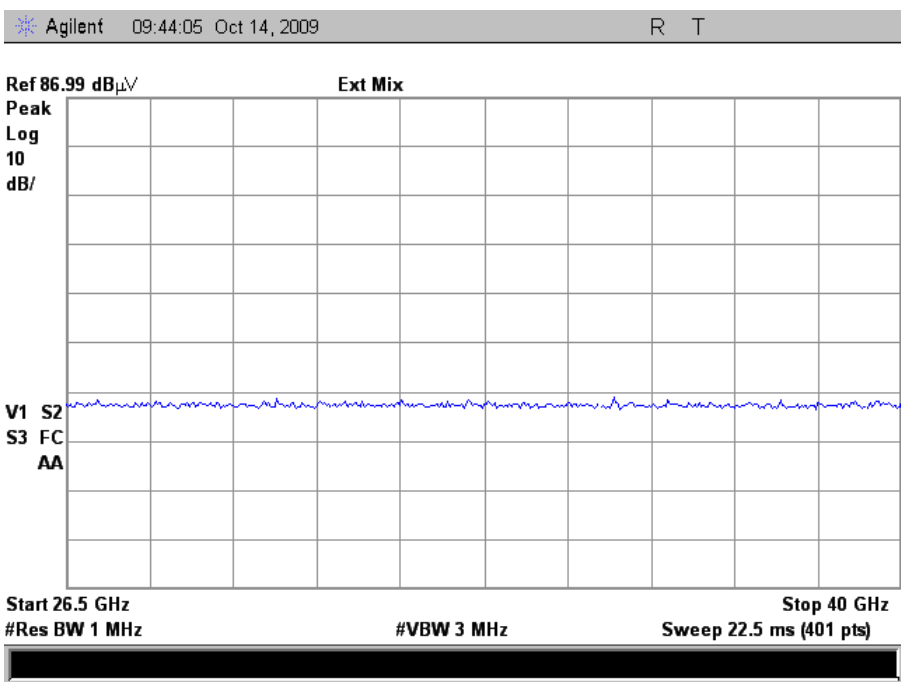


Plot 66. Radiated Spurs, 10GHz – 18GHz, Channel 5500 MHz

Radiated Spurious Emissions Test Results

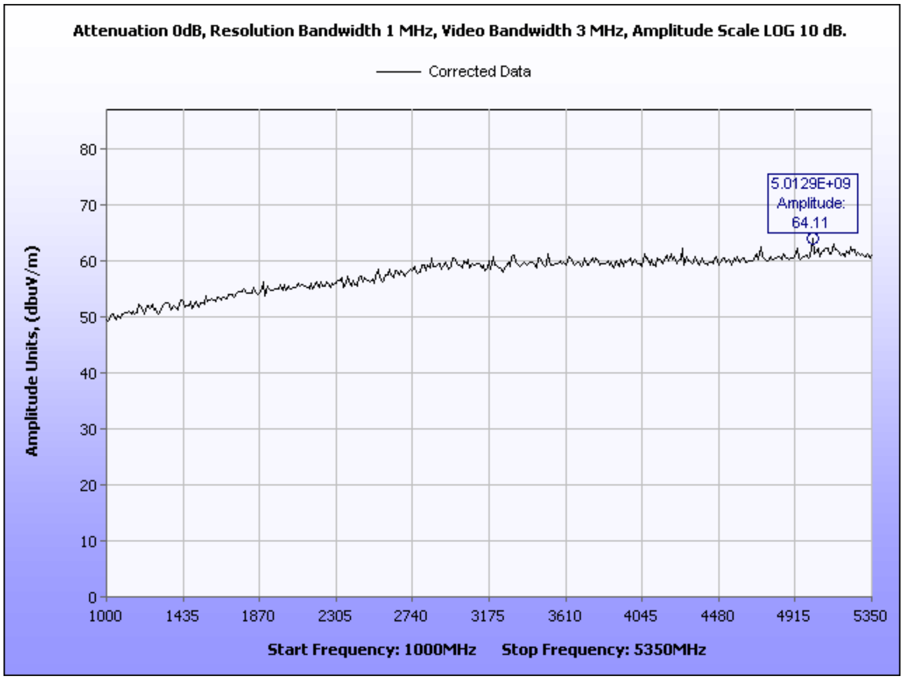


Plot 67. Radiated Spurs, 18GHz – 26.5GHz, Channel 5500 MHz

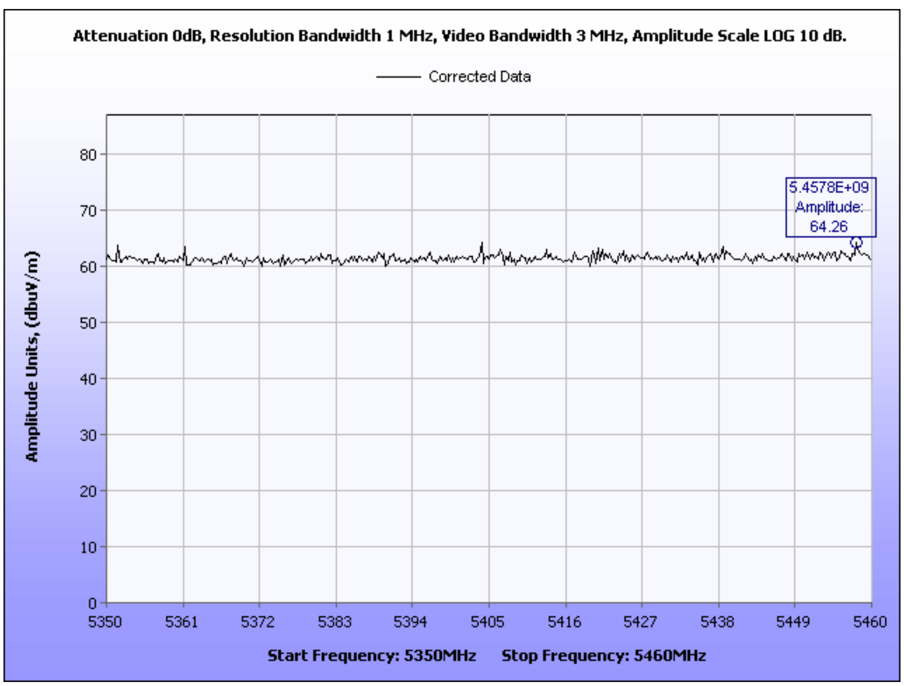


Plot 68. Radiated Spurs, 26.5GHz – 40GHz, Channel 5500 MHz

Radiated Spurious Emissions Test Results

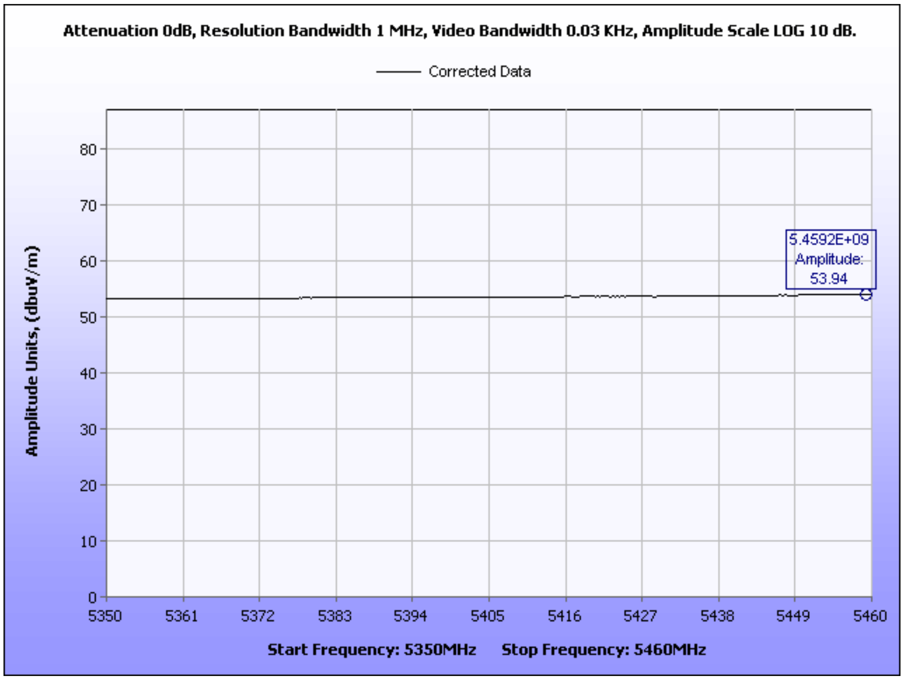


Plot 69. Radiated Spurs, 1MHz – 5.35GHz, Channel 5600 MHz

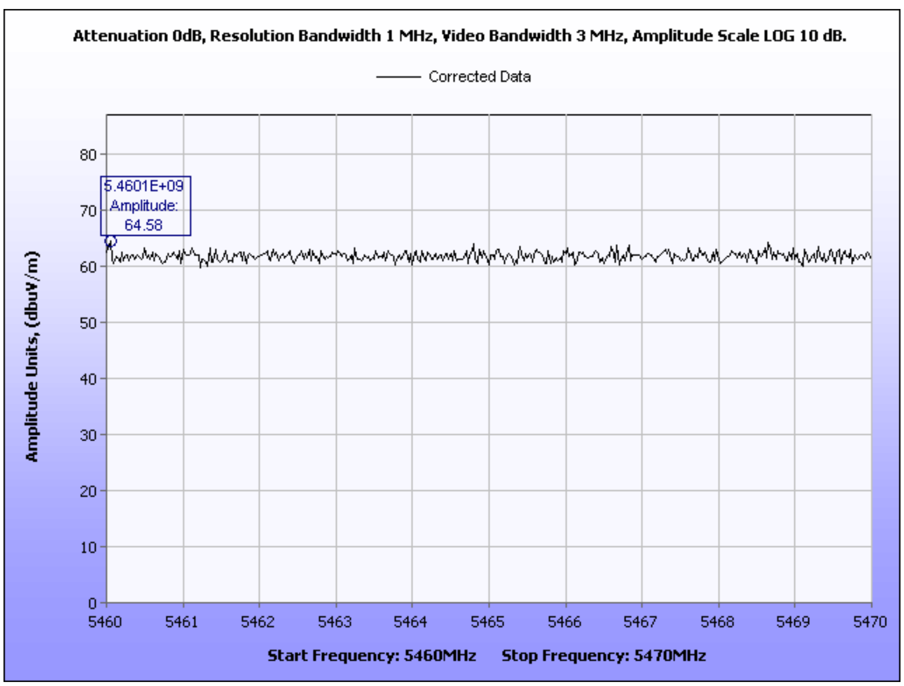


Plot 70. Radiated Spurs, 5350MHz – 5460 MHz, Peak, Channel 5600 MHz

Radiated Spurious Emissions Test Results

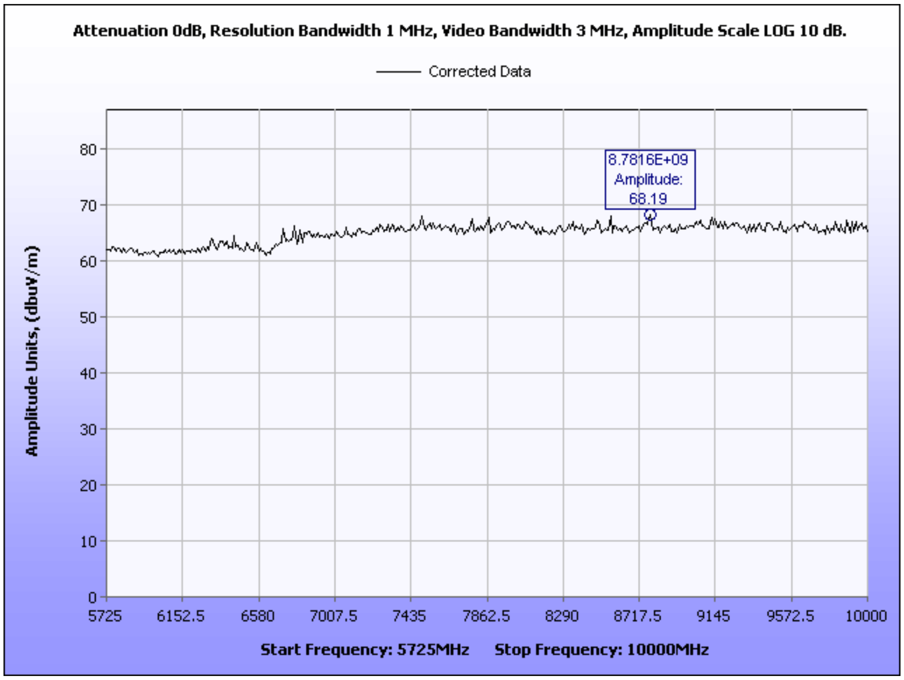


Plot 71. Radiated Spurs, 5350MHz – 5460 MHz, Avg, Channel 5600 MHz

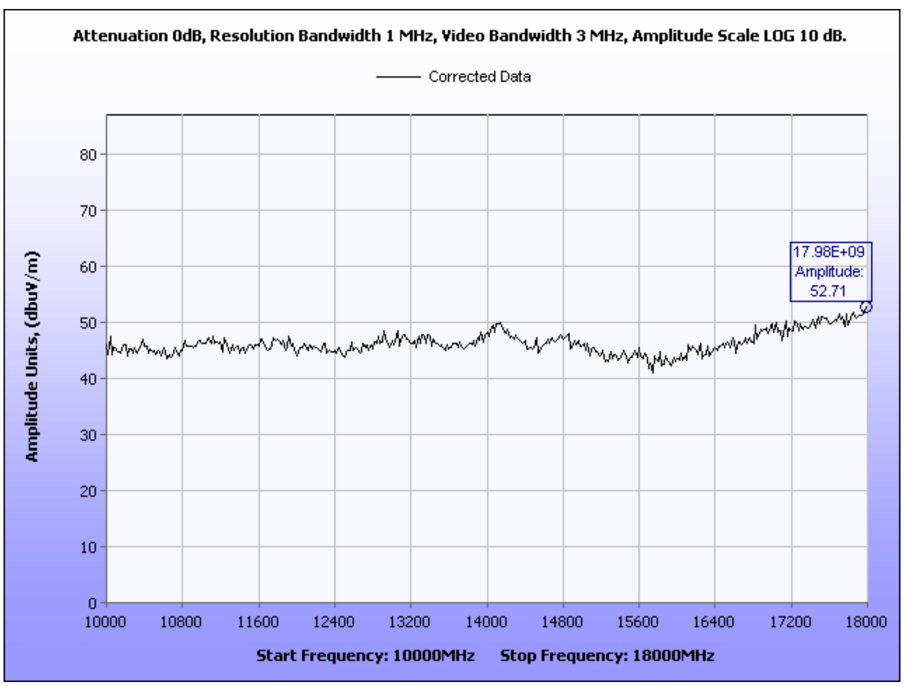


Plot 72. Radiated Spurs, 5460MHz – 5470GHz, Channel 5600 MHz

Radiated Spurious Emissions Test Results

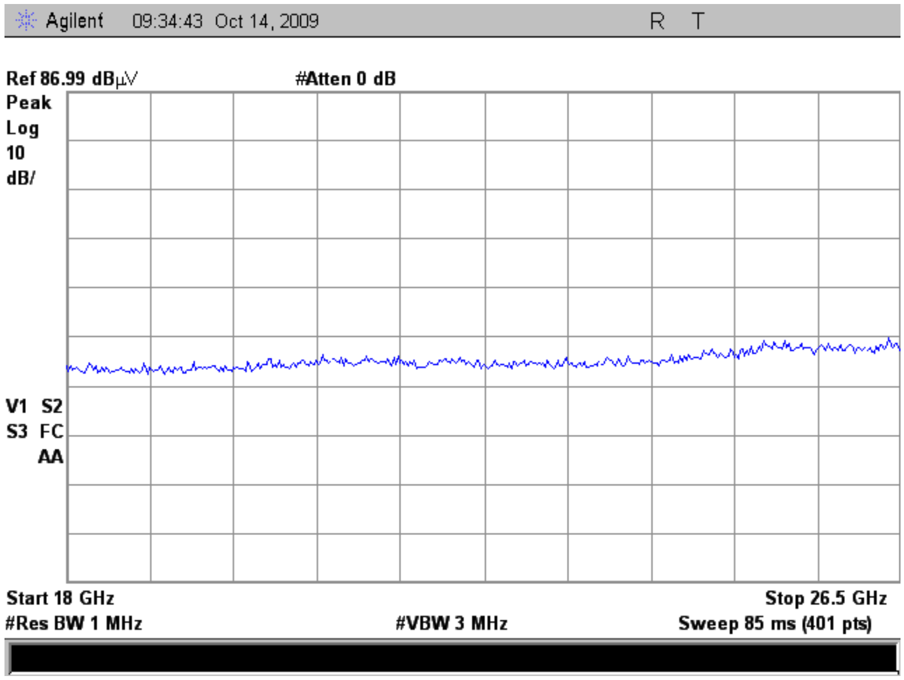


Plot 73. Radiated Spurs, 5.725GHz – 10GHz, Channel 5600 MHz

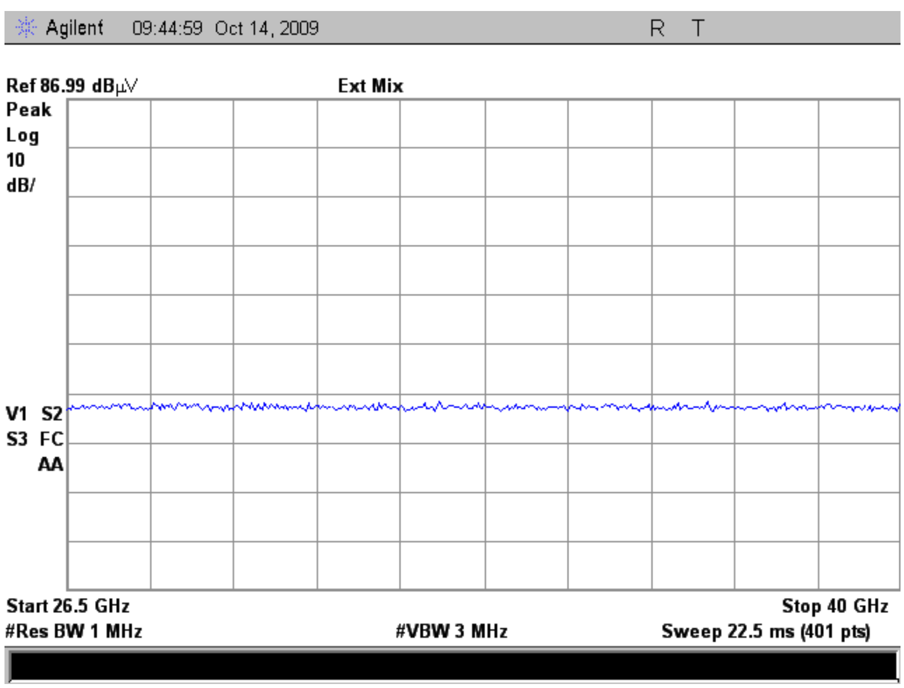


Plot 74. Radiated Spurs, 10GHz – 18GHz, Channel 5600 MHz

Radiated Spurious Emissions Test Results

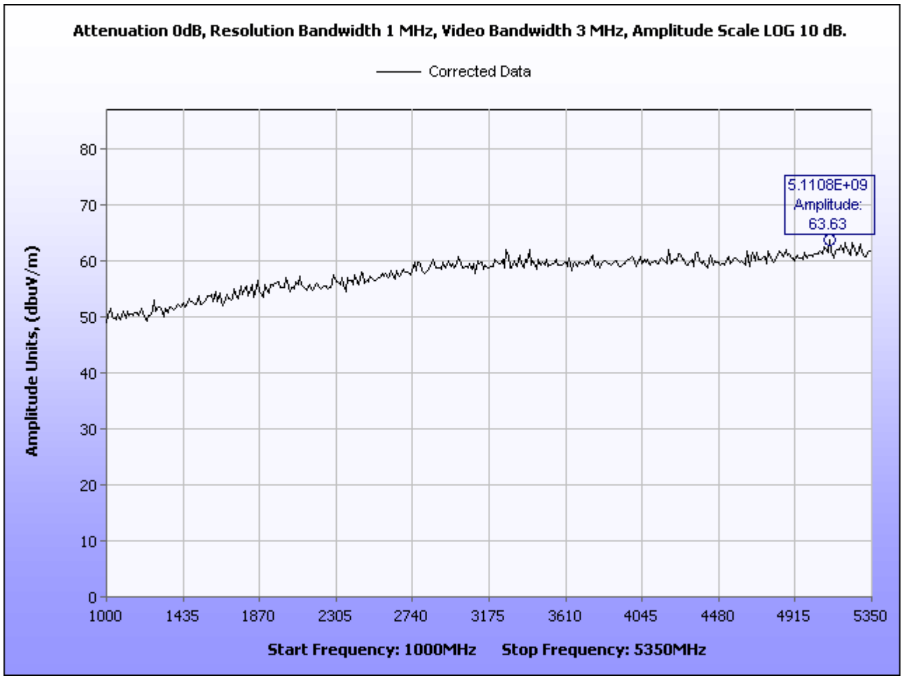


Plot 75. Radiated Spurs, 18GHz – 26.5GHz, Channel 5600 MHz

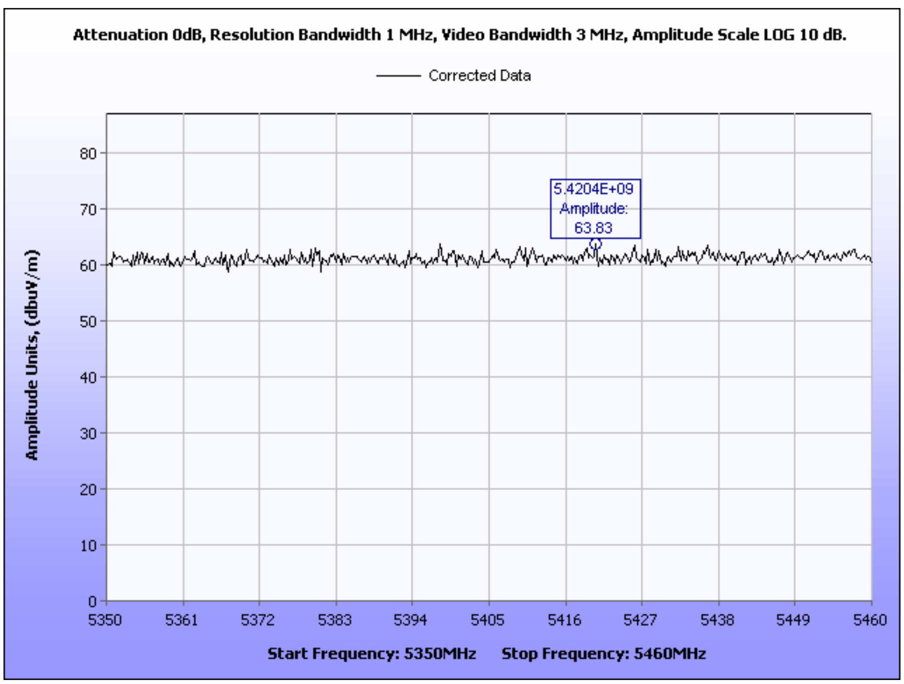


Plot 76. Radiated Spurs, 26.5GHz – 40GHz, Channel 5600 MHz

Radiated Spurious Emissions Test Results

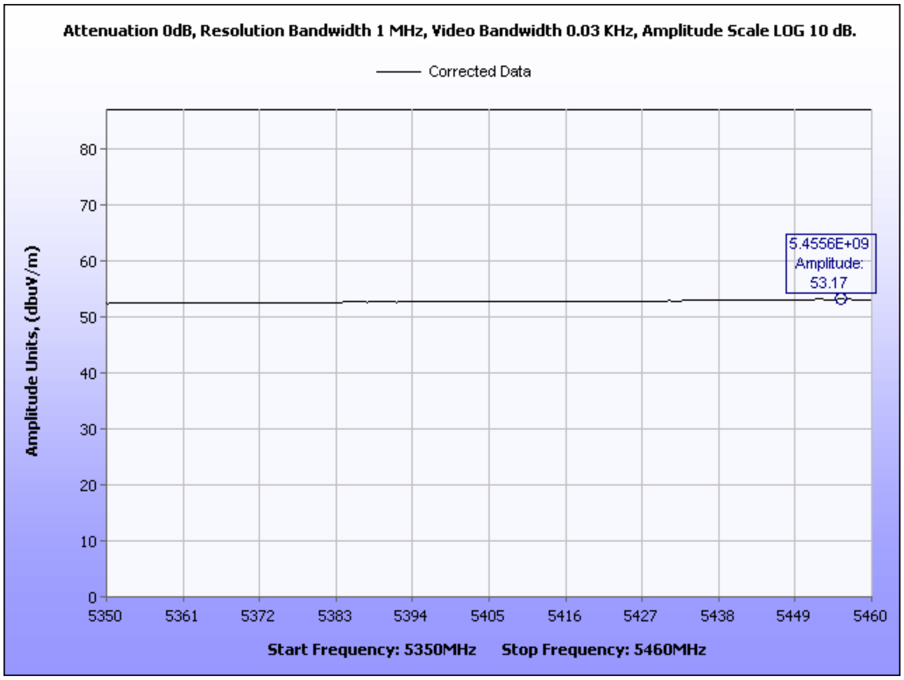


Plot 77. Radiated Spurs, 1MHz – 5.35GHz, Channel 5700 MHz

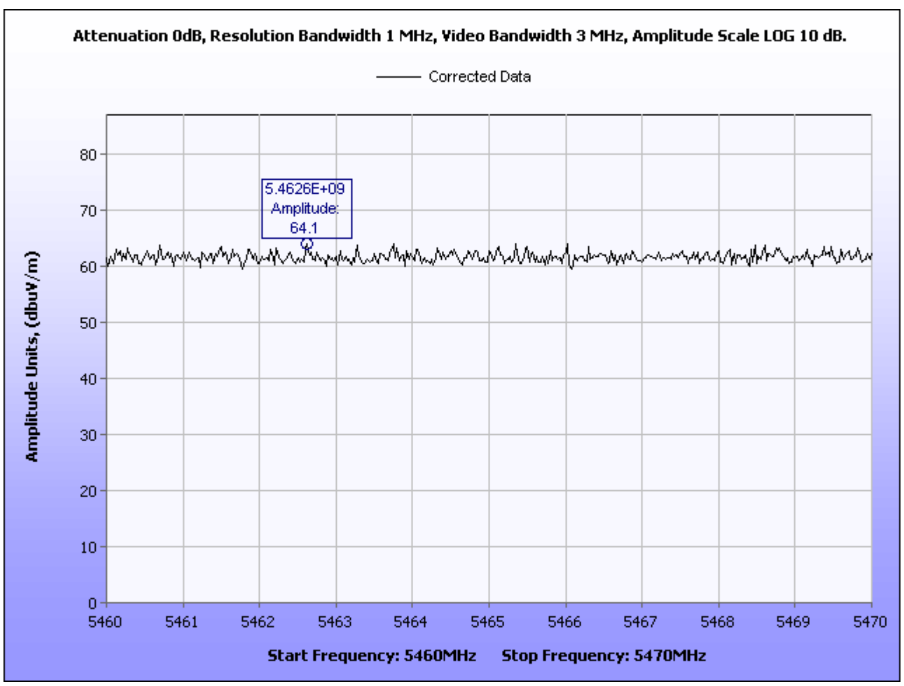


Plot 78. Radiated Spurs, 5350MHz – 5460 MHz, Peak, Channel 5700 MHz

Radiated Spurious Emissions Test Results

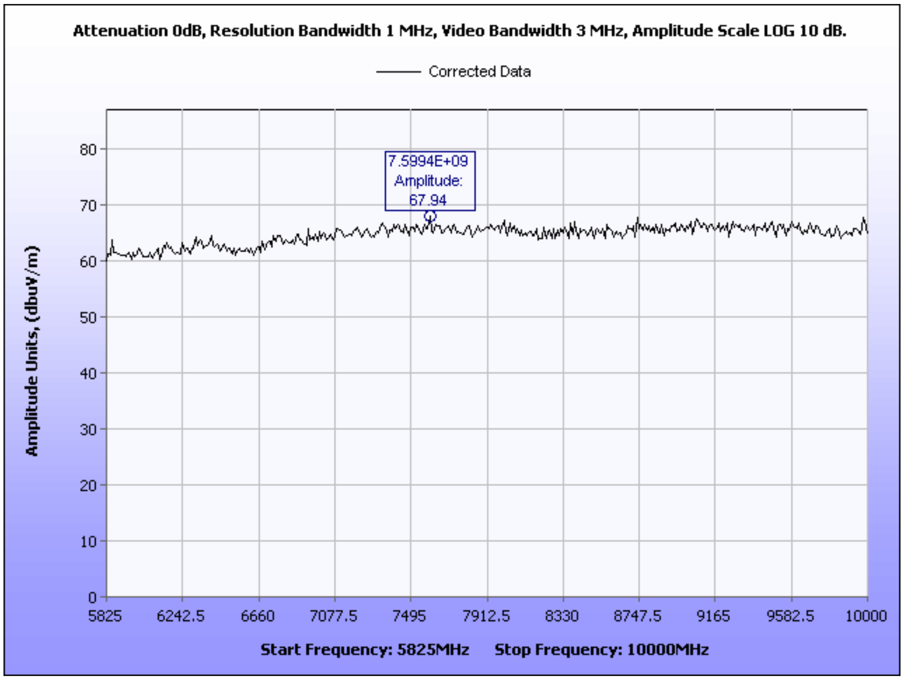


Plot 79. Radiated Spurs, 5350MHz – 5460 MHz, Avg, Channel 5700 MHz

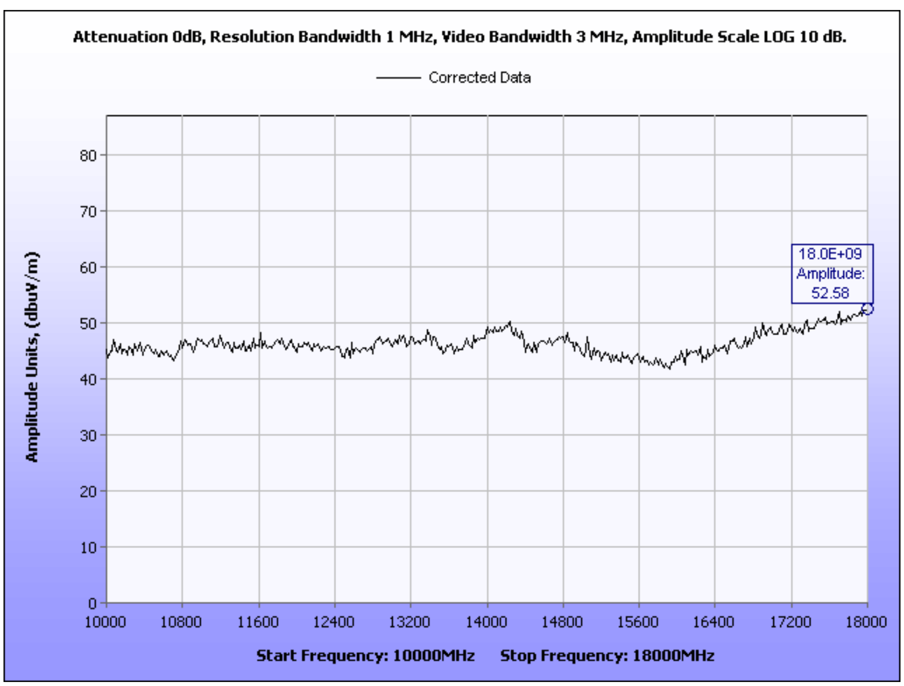


Plot 80. Radiated Spurs, 5460MHz – 5470GHz, Channel 5700 MHz

Radiated Spurious Emissions Test Results

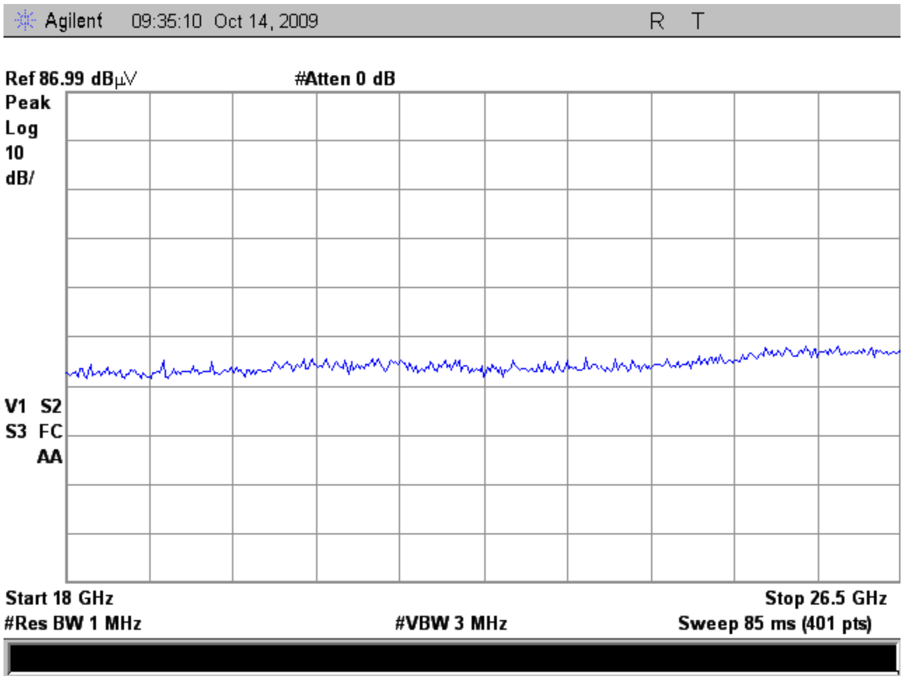


Plot 81. Radiated Spurs, 5.825GHz – 10GHz, Channel 5700 MHz

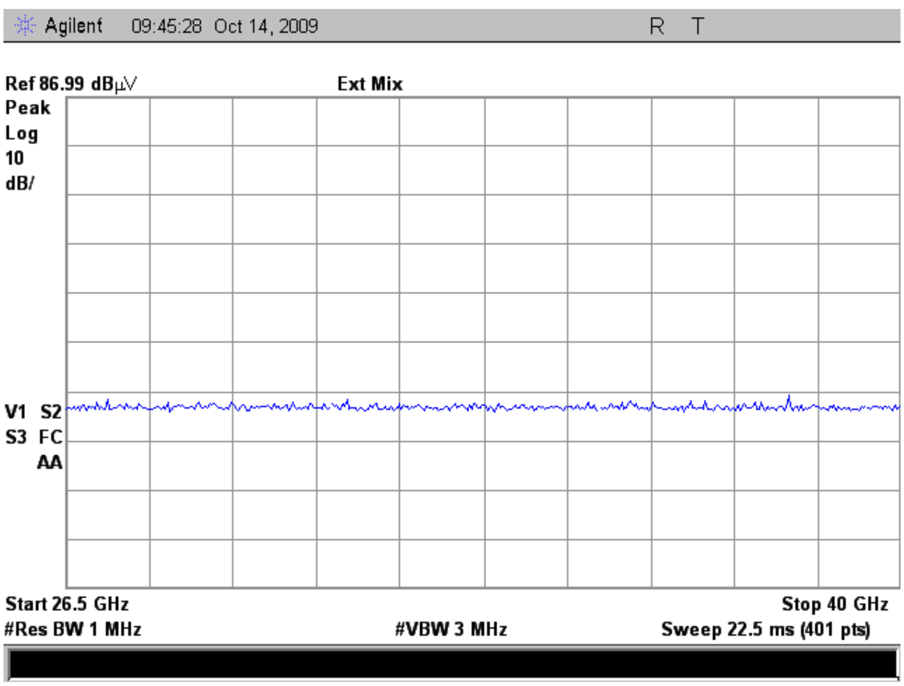


Plot 82. Radiated Spurs, 10GHz – 18GHz, Channel 5700 MHz

Radiated Spurious Emissions Test Results

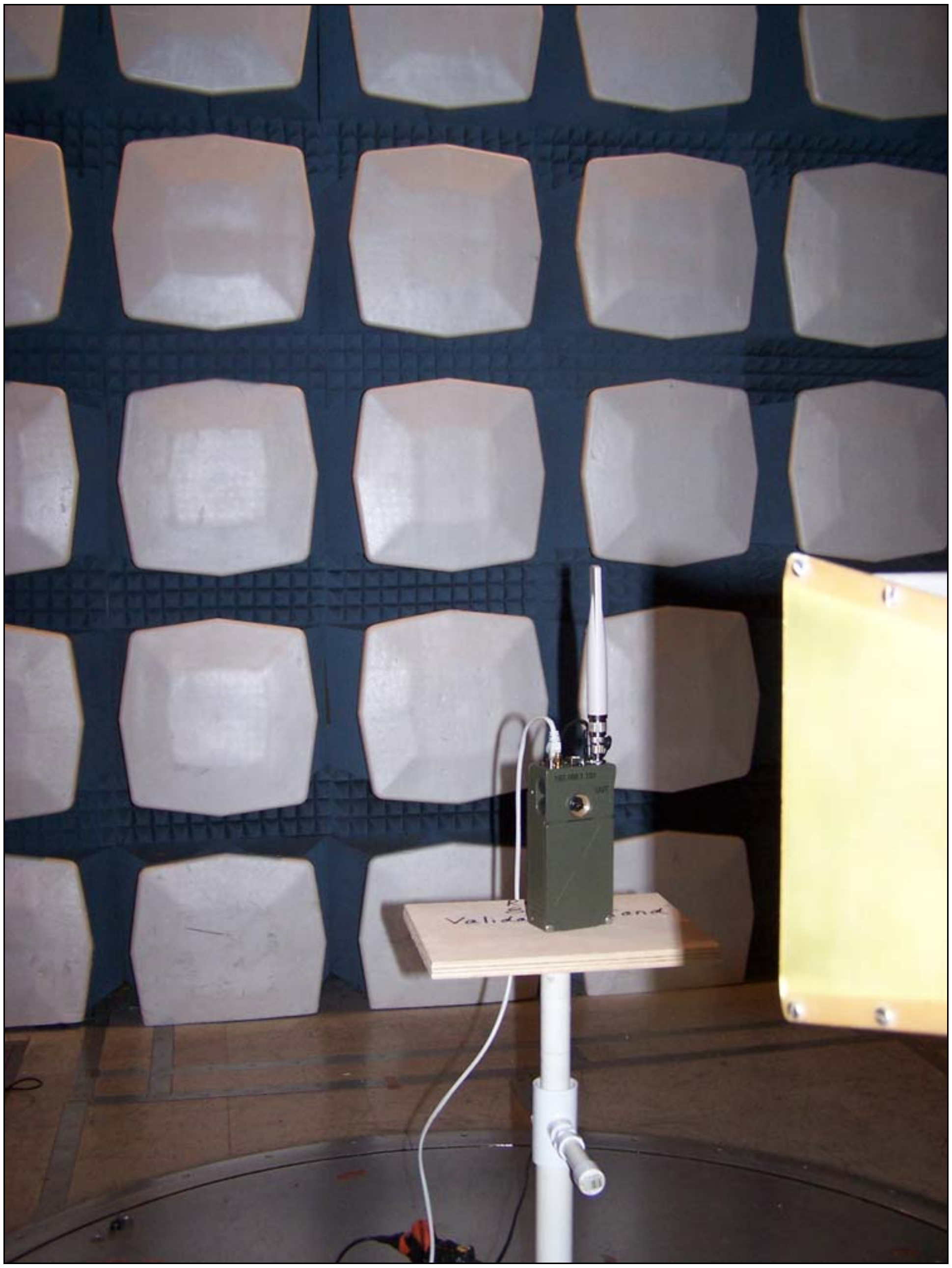


Plot 83. Radiated Spurs, 18GHz – 26.5GHz, Channel 5700 MHz



Plot 84. Radiated Spurs, 26.5GHz – 40GHz, Channel 5700 MHz

Radiated Spurious Test Setup Photograph



Photograph 3. Radiated Spurious, Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(f) RF Exposure

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.

MPE Limit Calculation: EUT's operating frequency range is 5260MHz - 5700 MHz;. Highest conducted power = 18.66 mW (i.e.12.7 dBm). Therefore, **Limit for Uncontrolled exposure: 1 mW/cm^2.**

Equation from page 18 of OET 65, Edition 97-01

$S = P\,G / 4\pi R^2$

S = Power Density mW/m^2
P = Power (mW)
R = Distance to the center of radiation of the antenna
G = Maximum antenna gain

Maximum antenna gain for EUT = 5 dBi = 3.16

P = 18.66 mW
R = 20 cm
G = 3.16

$S = 18.66*3.16 / 4(3.1416)(20)^2$

S = 0.012 mW/cm^2

Therefore, EUT meets the Uncontrolled Exposure limit at 20cm.

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(g) Frequency Stability

Test Requirements: **§ 15.407(g):** Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

Test Procedure: The EUT was connected directly to a spectrum analyzer through an attenuator. The resolution band width of the spectrum analyzer was set to 10 KHz. The 1st trace of the Spectrum Analyzer was used as a reference at 20°C. A 2nd trace was used to show the drift of the carrier at extreme conditions. A delta marker was used to find the drift at a given extreme condition. All transmit frequencies are derived from one oscillator. Therefore, only one channel was investigated for frequency stability.

Test Results: The EUT was compliant with the requirements of **§15.407(g)**.

Test Engineer(s): Len Knight

Test Date(s): 10/09/09

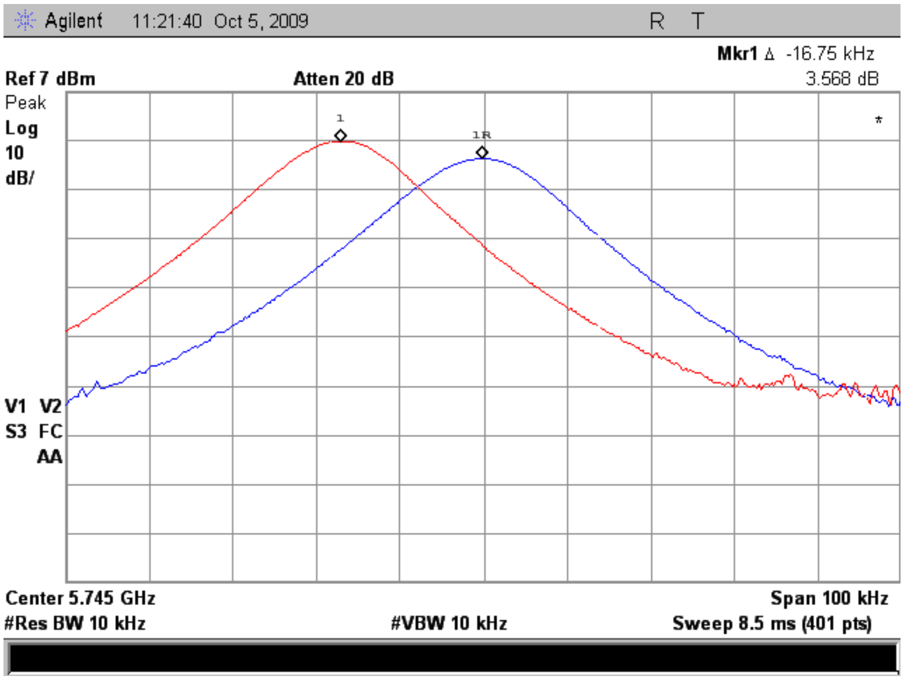
Temperature (centigrade)	Drift (kHz)	Drift (ppm)
60	169.999	295.9
50	31.75	55.27
40	13.5	23.5
30	12.5	21.76
20	ref	ref
10	-6.75	-11.75
0	-19.75	-34.38
-10	-16.75	-29.16

Table 14. Frequency Stability, Reference 5745 MHz at 23°C, Test Results

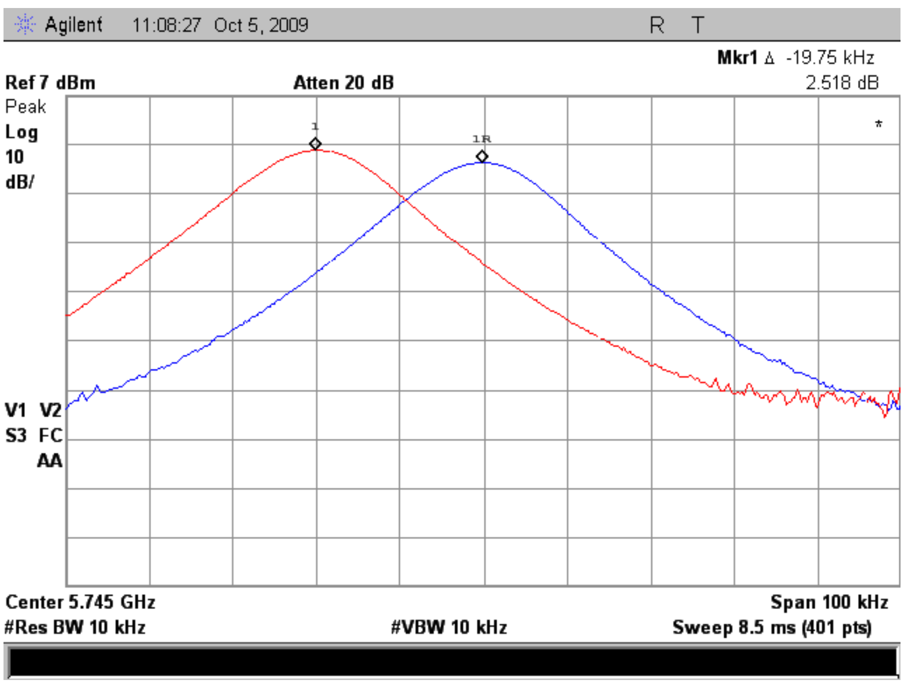
Fully charged battery to drain point.		
Temperature (centigrade)	**Drift (kHz)**	**Drift (ppm)**
20	-1.875	-3.26

Table 15. Frequency Stability, Reference 5745 MHz at 120 VAC and 20°C, Test Results

Frequency Stability Test Results

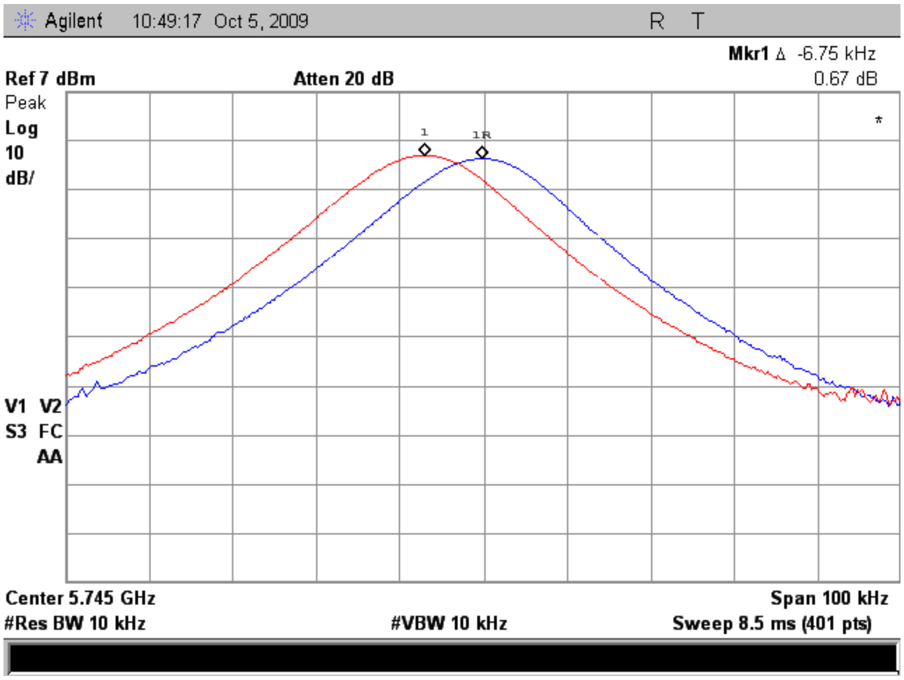


Plot 85. Frequency Stability, -10°C

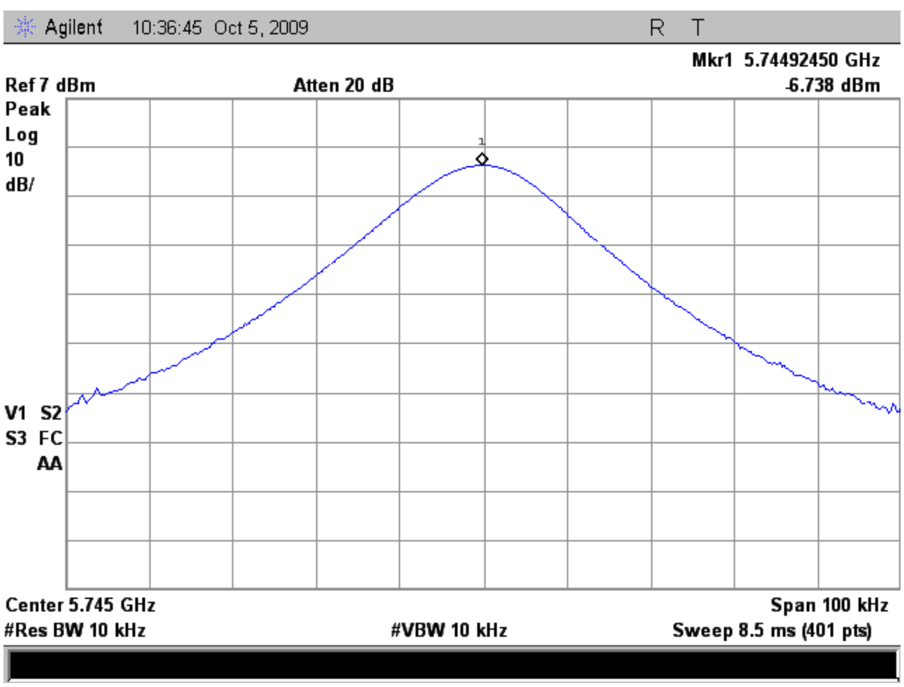


Plot 86. Frequency Stability, 0°C

Frequency Stability Test Results

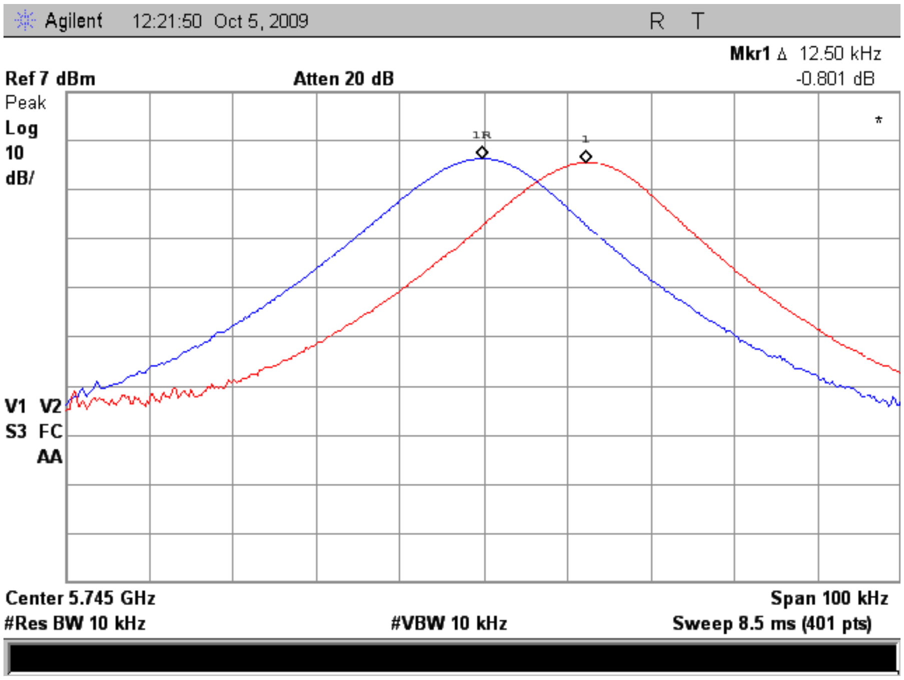


Plot 87. Frequency Stability, 10°C

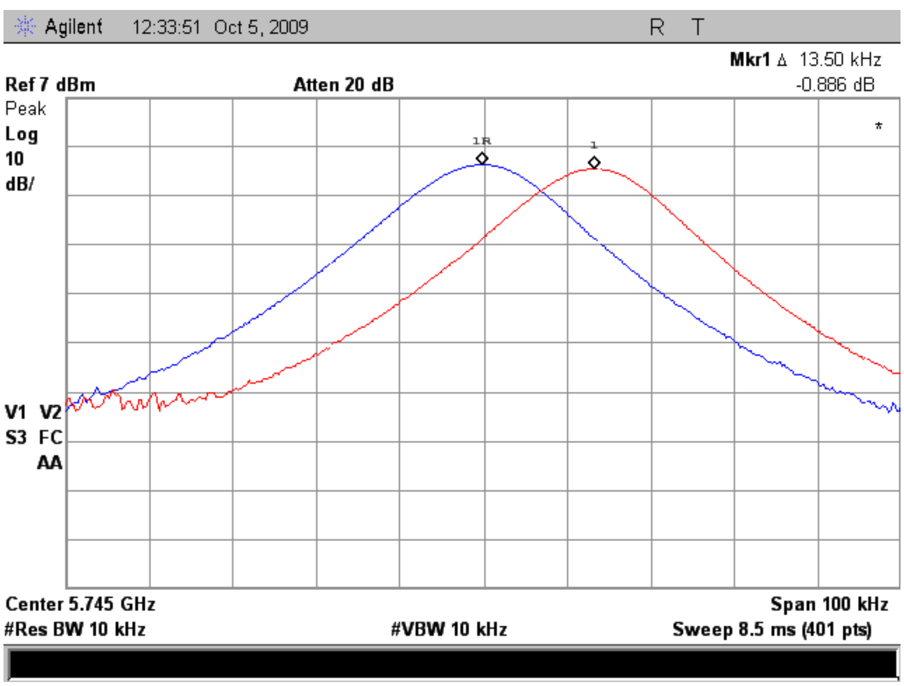


Plot 88. Frequency Stability, 20°C

Frequency Stability Test Results

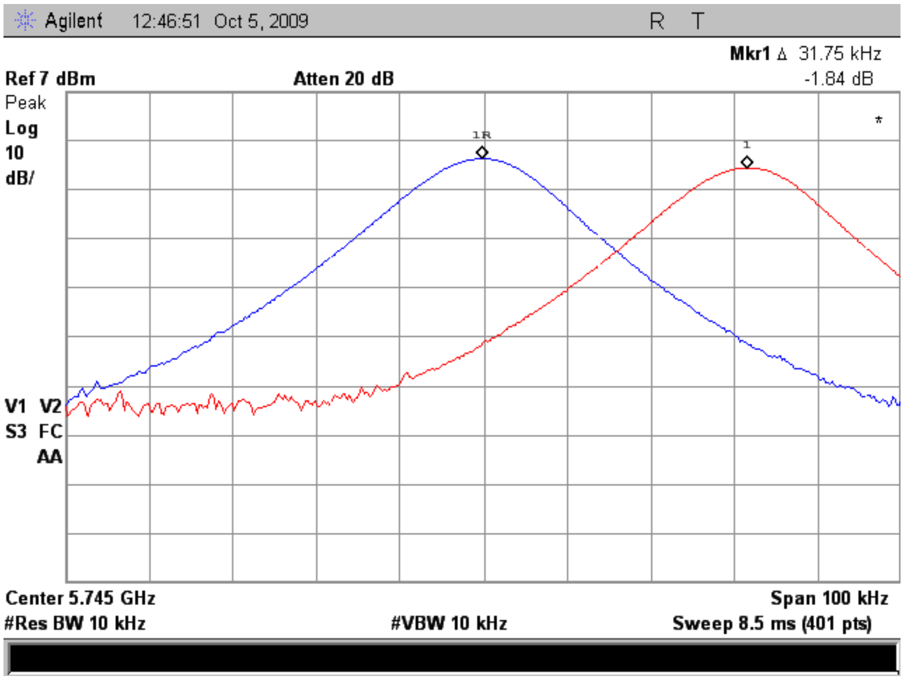


Plot 89. Frequency Stability, 30°C

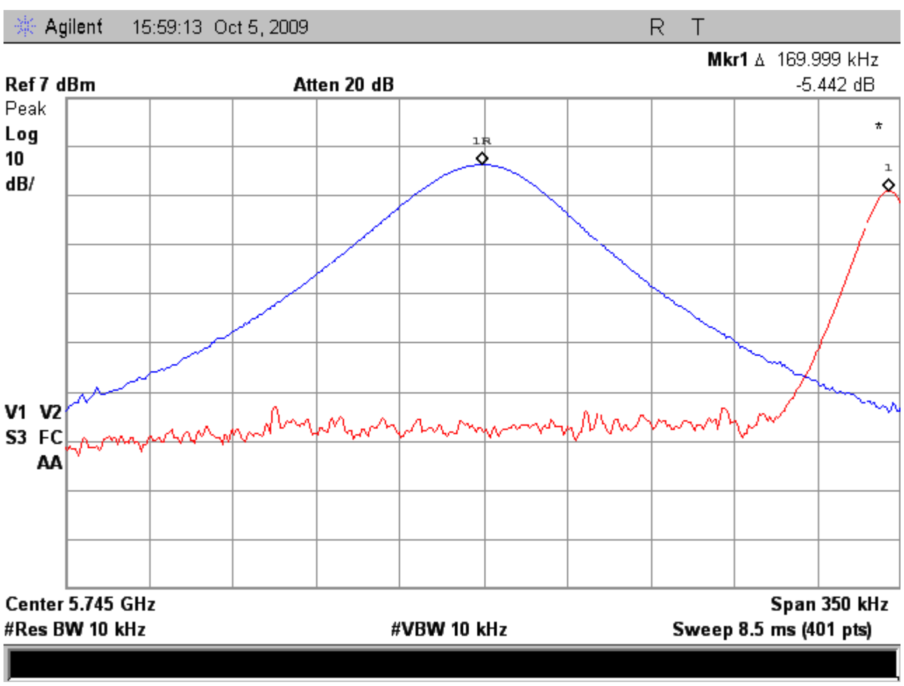


Plot 90. Frequency Stability, 40°C

Frequency Stability Test Results

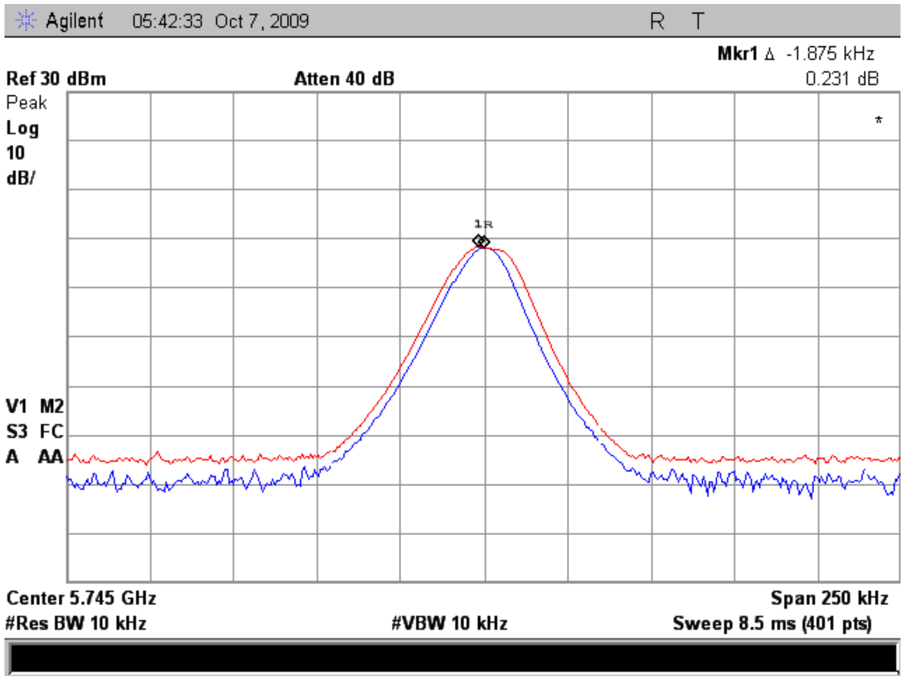


Plot 91. Frequency Stability, 50°C



Plot 92. Frequency Stability, 60°C

Frequency Stability Test Results



Plot 93. Frequency Stability, Battery Drain Test

Frequency Stability Test Photograph

Photograph 4. Frequency Stability, Test Setup

IV. DFS Requirements and Radar Waveform Description & Calibration

A. DFS Requirements

Requirement	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
Uniform Spreading	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

Table 16. Applicability of DFS Requirements Prior to Use of a Channel

Requirement	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
DFS Detection Threshold	Yes	Not required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required	Yes

Table 17. Applicability of DFS Requirements During Normal Operation

Maximum Transmit Power	Value
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna **Note 2:** Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.	

Table 18. DFS Detection Thresholds for Master or Client Devices Incorporating DFS

Parameter	**Value**
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds See Note 1
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2
U-NII Detection Bandwidth	Minimum 80% of the 99% power bandwidth. See Note 3.
Note 1: The instant that the *Channel Move Time* and the *Channel Closing Transmission Time* begins is as follows: • For the Short pulse radar Test Signals this instant is the end of the *Burst*. • For the Frequency Hopping radar Test Signal, this instant is the end of the last radar *Burst* generated. • For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission. **Note 2:** The *Channel Closing Transmission Time* is comprised of 200 milliseconds starting at the beginning of the *Channel Move Time* plus any additional intermittent control signals required facilitating *Channel* changes (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions. **Note 3:** During the *U-NII Detection Bandwidth* detection test, radar type 1 is used and for each frequency step the minimum percentage of detection is 90%. Measurements are performed with no data traffic.	

Table 19. DFS Response Requirement Values

B. Radar Test Waveforms

This section provides the parameters for required test waveforms, minimum percentage of successful detections, and the minimum number of trials that must be used for determining DFS conformance. Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms.

Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (μsec)	PRI (μsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Trials
1	1	1428	18	60%	30
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120

A minimum of 30 unique waveforms are required for each of the short pulse radar types 2 through 4. For short pulse radar type 1, the same waveform is used a minimum of 30 times. If more than 30 waveforms are used for short pulse radar types 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms. The aggregate is the average of the percentage of successful detections of short pulse radar types 1-4.

Long Pulse Radar Test Waveform

Radar Type	Pulse Width (μsec)	Chirp Width (MHz)	PRI (μsec)	Number of Pulses per Bursts	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for the Long Pulse radar test signal. If more than 30 waveforms are used for the Long Pulse radar test signal, then each additional waveform must also be unique and not repeated from the previous waveforms.

Each waveform is defined as follows:

1) The transmission period for the Long Pulse Radar test signal is 12 seconds.
2) There are a total of 8 to 20 Bursts in the 12 second period, with the number of Bursts being randomly chosen. This number is Burst_Count.
3) Each Burst consists of 1 to 3 pulses, with the number of pulses being randomly chosen. Each Burst within the 12 second sequence may have a different number of pulses.
4) The pulse width is between 50 and 100 microseconds, with the pulse width being randomly chosen. Each pulse within a Burst will have the same pulse width. Pulses in different Bursts may have different pulse widths.
5) Each pulse has a linear FM chirp between 5 and 20 MHz, with the chirp width being randomly chosen. Each pulse within a Burst will have the same chirp width. Pulses in different Bursts may have different chirp widths. The chirp is centered on the pulse. For example, with radar frequency of 5300 MHz and a 20 MHz chirped signal, the chirp starts at 5290 MHz and ends at 5310 MHz.
6) If more than one pulse is present in a Burst, the time between the pulses will be between 1000 and 2000 microseconds, with the time being randomly chosen. If three pulses are present in a Burst, the time between the first and second pulses is chosen independently of the time between the second and third pulses.
7) The 12 second transmission period is divided into even intervals. The number of intervals is equal to Burst_Count. Each interval is of length (12,000,000 / Burst_Count) microseconds. Each interval contains one Burst. The start time for the Burst, relative to the beginning of the interval, is between 1 and [(12,000,000 / Burst_Count) – (Total Burst Length) + (One Random PRI Interval)] microseconds, with the start time being randomly chosen. The step interval for the start time is 1 microsecond. The start time for each Burst is chosen independently.

A representative example of a Long Pulse radar test waveform:

1) The total test signal length is 12 seconds.
2) 8 Bursts are randomly generated for the Burst_Count.
3) Burst 1 has 2 randomly generated pulses.
4) The pulse width (for both pulses) is randomly selected to be 75 microseconds.
5) The PRI is randomly selected to be at 1213 microseconds.
6) Bursts 2 through 8 are generated using steps 3 – 5.
7) Each Burst is contained in even intervals of 1,500,000 microseconds. The starting location for Pulse 1, Burst 1 is randomly generated (1 to 1,500,000 minus the total Burst 1 length + 1 random PRI interval) at the 325,001 microsecond step. Bursts 2 through 8 randomly fall in successive 1,500,000 microsecond intervals (i.e. Burst 2 falls in the 1,500,001 – 3,000,000 microsecond range).

Graphical Representation of a Long Pulse radar Test Waveform

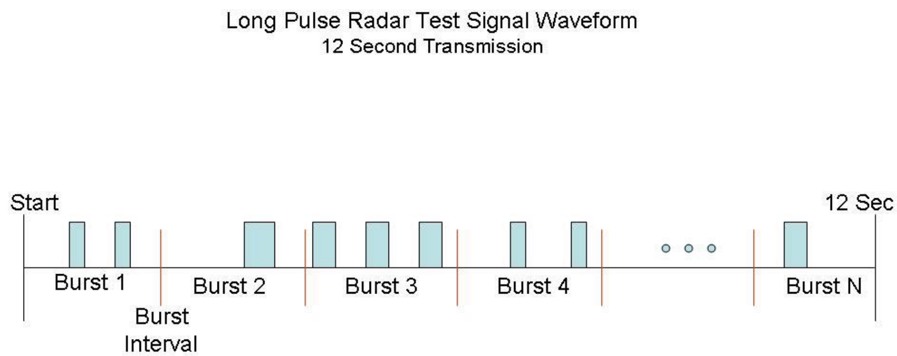


Figure 6. Long Pulse Radar Test Signal Waveform

Frequency Hopping Radar Test Waveform

Radar Type	Pulse Width (µsec)	PRI (µsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	9	.333	300	70%	30

For the Frequency Hopping Radar Type, the same *Burst* parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected1 from the hopping sequence defined by the following algorithm:

The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set. For selection of a random frequency, the frequencies remaining within the group are always treated as equally likely.

C. Radar Waveform Calibration

The following equipment setup was used to calibrate the radiated Radar Waveform. A spectrum analyzer was used to establish the test signal level for each radar type. During this process there were no transmissions by either the Master or Client Device. The spectrum analyzer was switched to the zero span (Time Domain) mode at the frequency of the Radar Waveform generator. Peak detection was utilized. The spectrum analyzer's resolution bandwidth (RBW) was set to 3 MHz and the video bandwidth (VBW) was set to 3 MHz. The calibration setup is diagrammed in Figure 7, and the radar test signal generator is shown in Photograph 5.

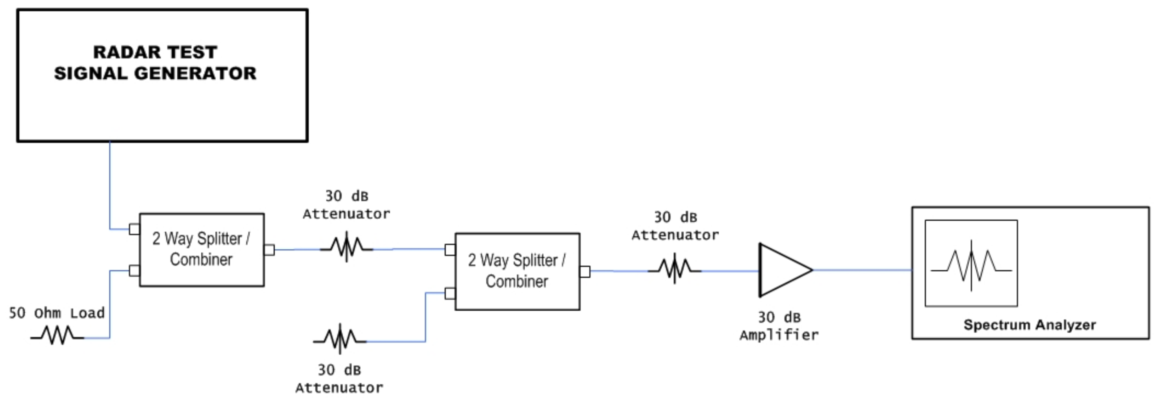
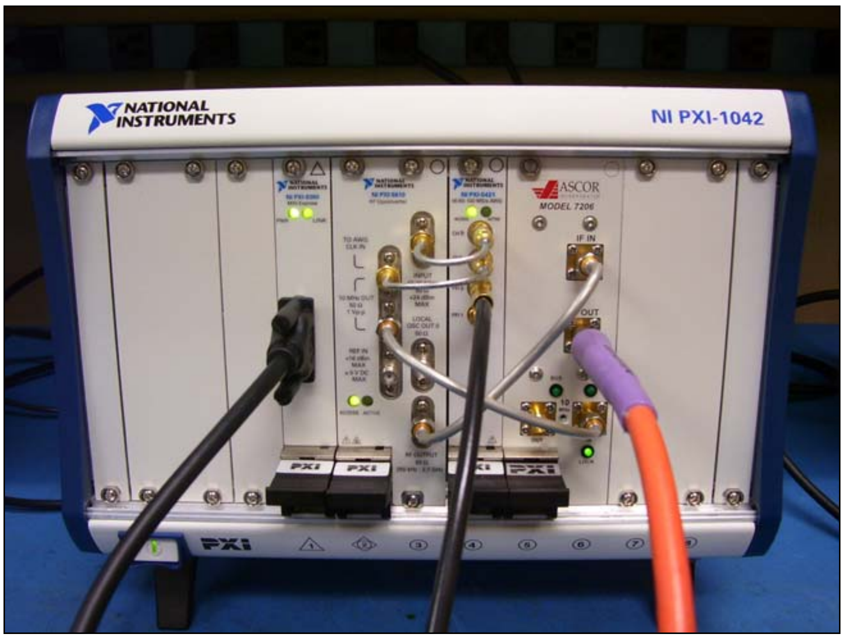
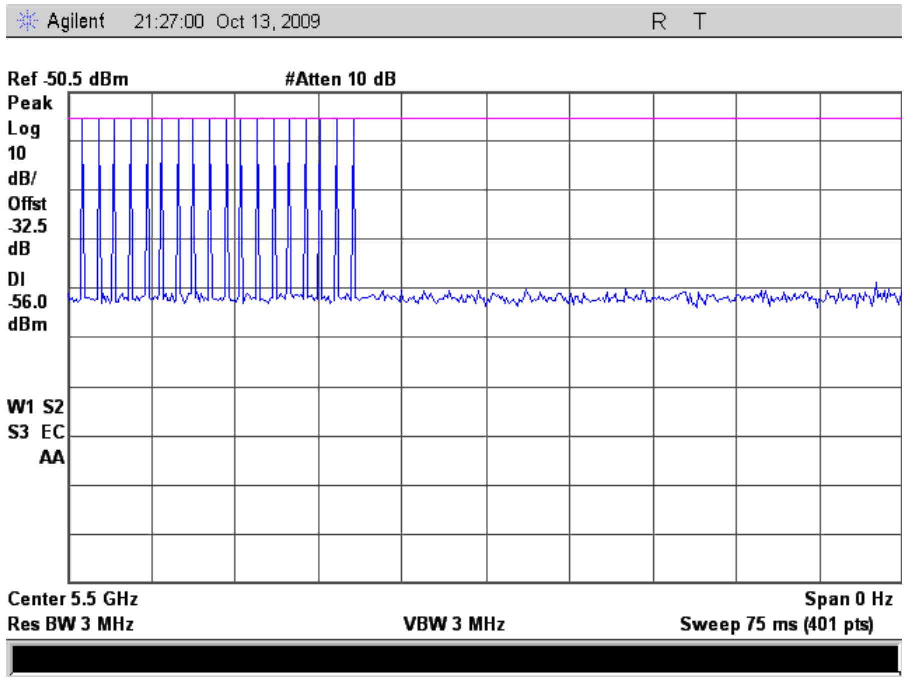


Figure 7. Calibration Test setup

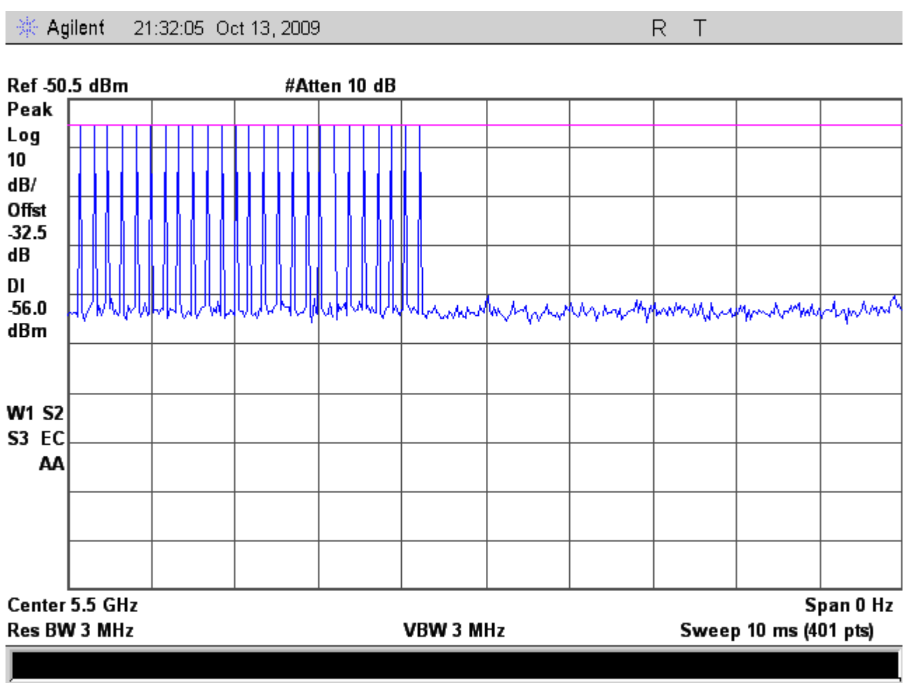


Photograph 5. DFS Radar Test Signal Generator

Radar Waveform Calibration

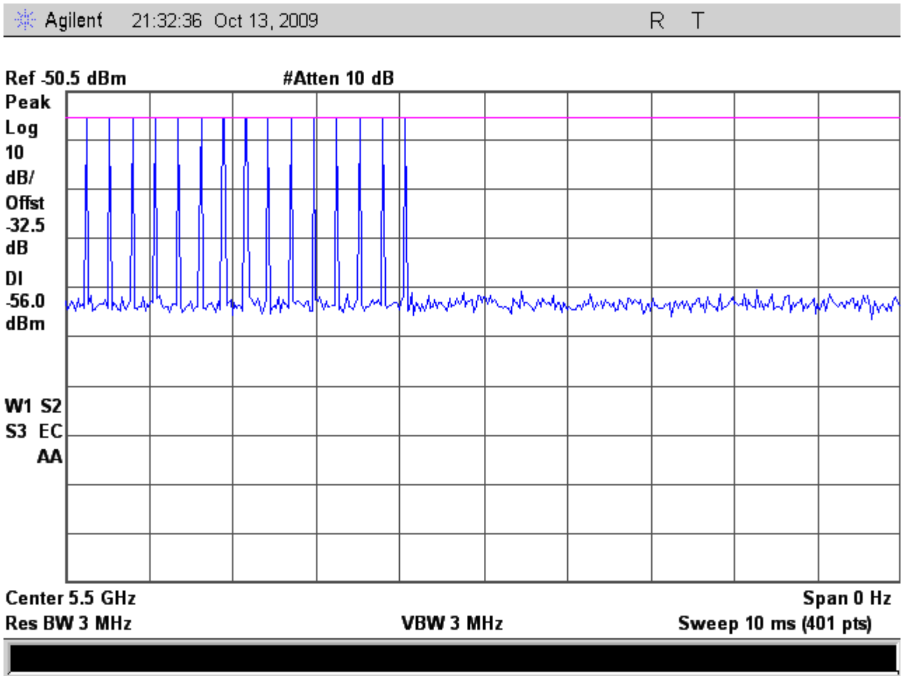


Plot 94. Radar Type 1 Calibration, 5500 MHz

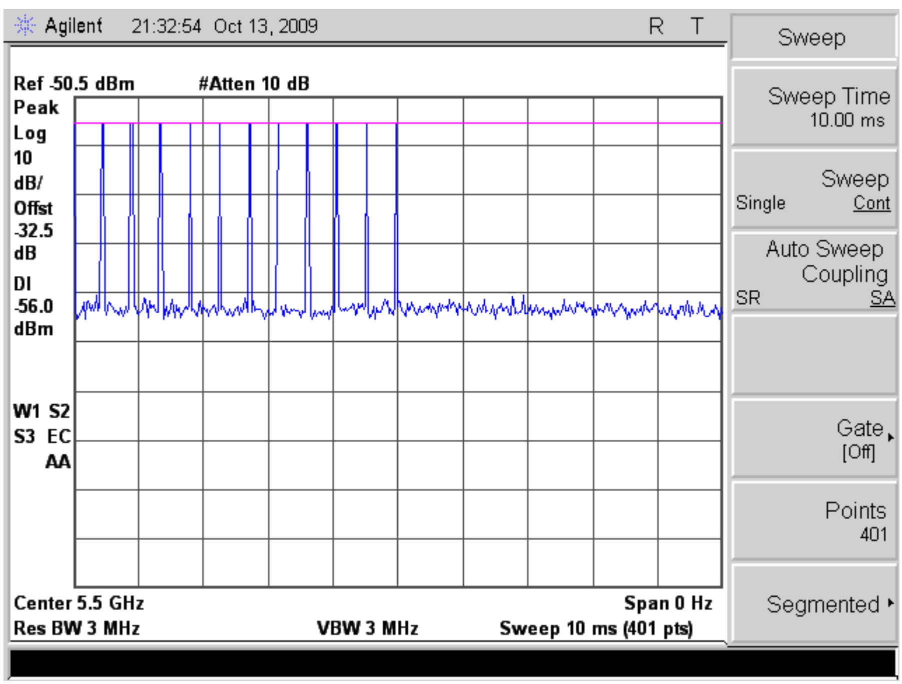


Plot 95. Radar Type 2 Calibration, 5500 MHz

Radar Waveform Calibration

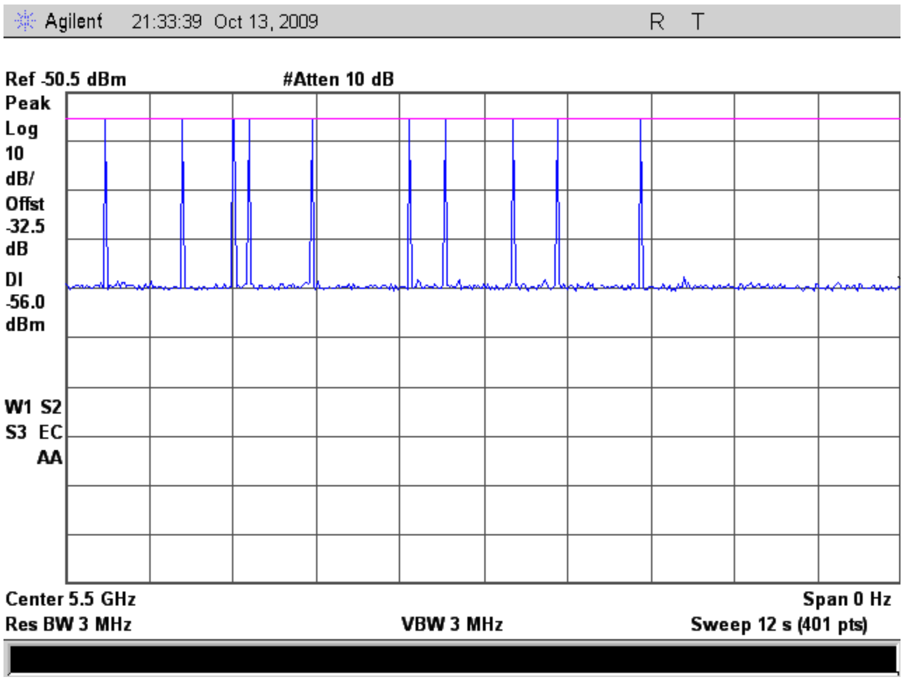


Plot 96. Radar Type 3 Calibration, 5500 MHz

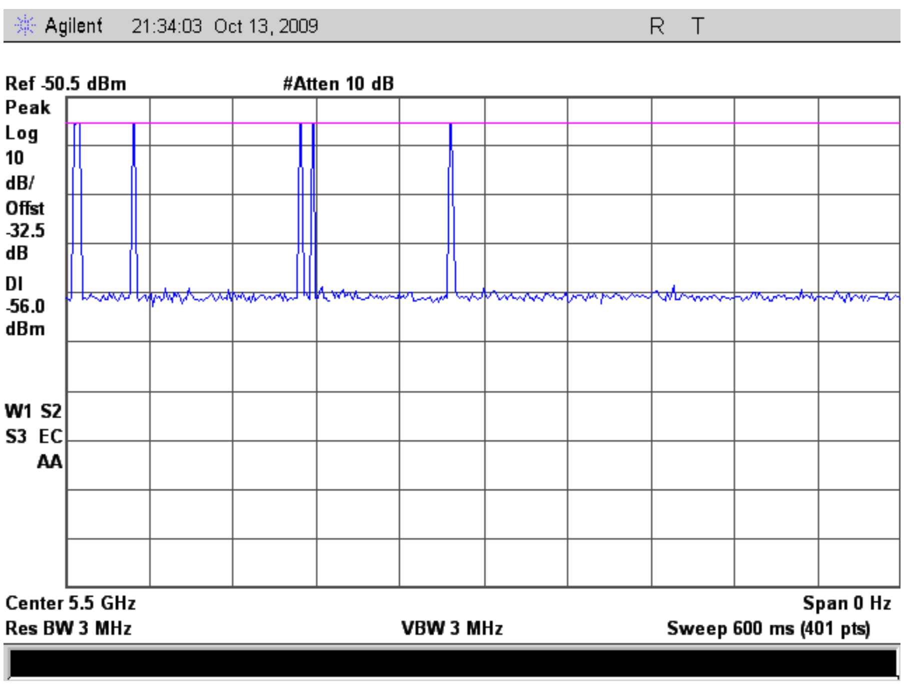


Plot 97. Radar Type 4 Calibration, 5500 MHz

Radar Waveform Calibration



Plot 98. Radar Type 5 Calibration, 5500 MHz



Plot 99. Radar Type 6 Calibration, 5500 MHz

V. DFS Test Procedure and Test Results

A. DFS Test Setup

1. A spectrum analyzer is used as a monitor to verify that the Unit Under Test (UUT) has vacated the Channel within the Channel Closing Transmission Time and Channel Move Time, and does not transmit on a Channel during the Non-Occupancy Period after the detection and subsequent Channel move. It is also used to monitor UUT transmissions during the Channel Availability Check Time.
2. The test setup, which consists of test equipment and equipment under test (EUT), is diagrammed in Figure 8 and pictured in Photograph 6

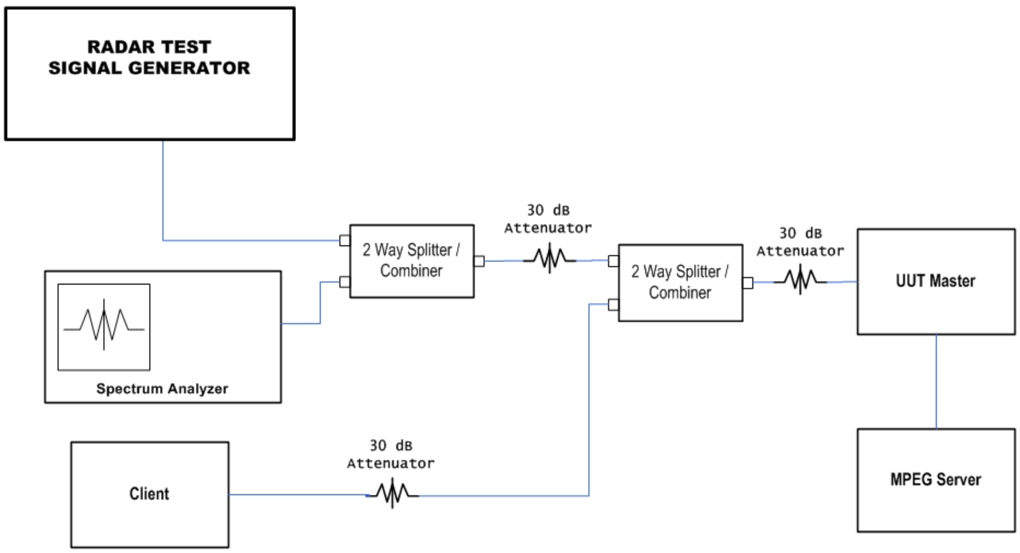
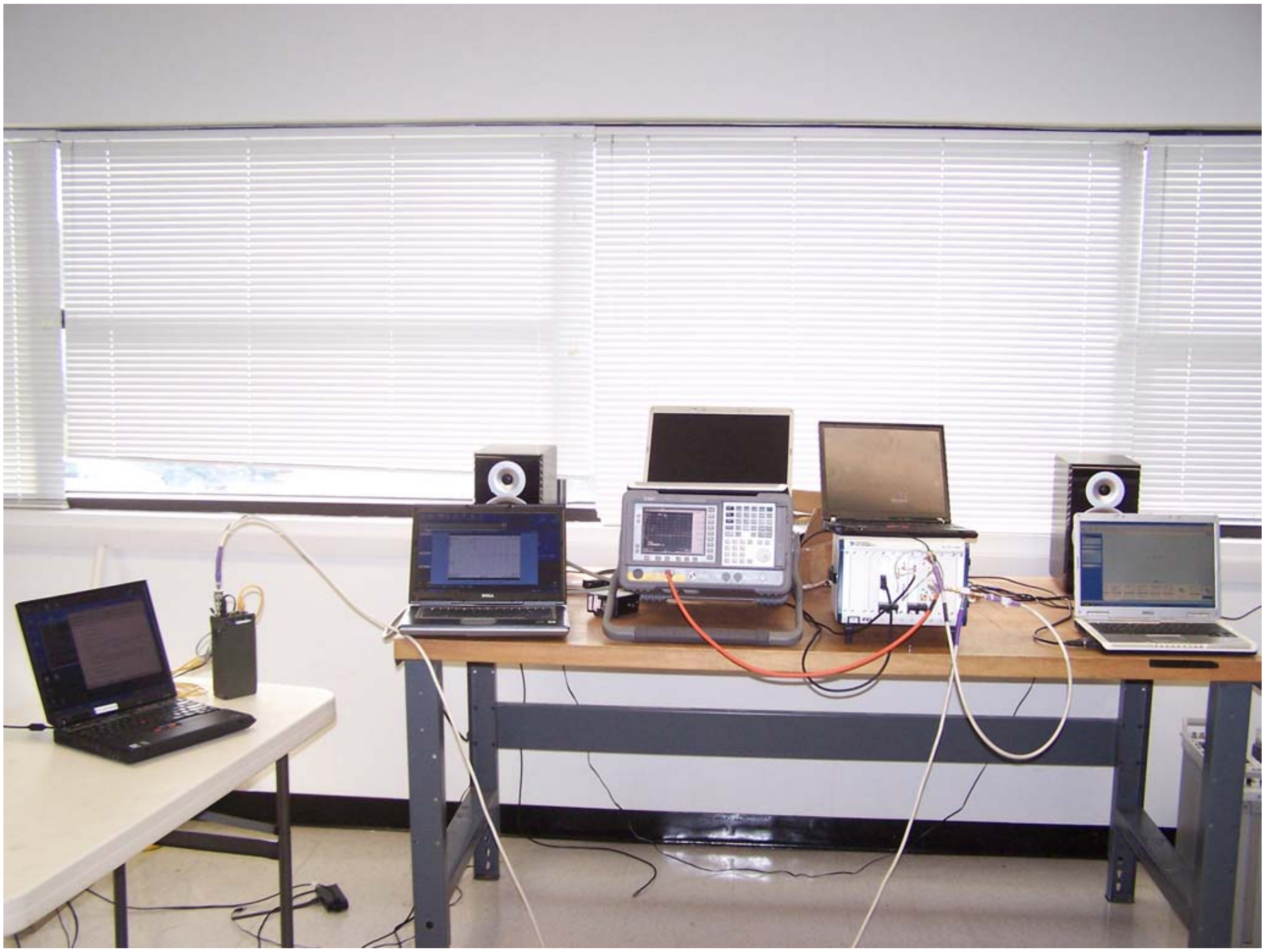


Figure 8. Test Setup Diagram



Photograph 6. Test Setup Photo

B. Description of Master Device

1. Operating Frequency Range – 5260-5320 MHz and 5500-5700 MHz
2. Modes of Operation – Master Device
3. Highest and Lowest EIRP – Highest = 17.7 dBm;
4. Antenna gain – Omni, 5dBi
5. Antenna impedance – 50 Ohms
6. Antenna gain verification – Use antenna datasheet
7. Test file that is transmitted is the designated MPEG test file that streams full motion video at 30 frames per second from the Master to the Client
8. TPC not required for UNII devices with less than 500 mW EIRP
9. Time for master to complete its power-on-cycle is about 3min
10. The EUT's uniform channel spreading is as follows: The master uses a simple incrementing algorithm: if radar is detected, the next sequential channel is used. For example, if one is on channel 100 and radar is detected, then it will be changed to 104. If radar is then detected on 104, it is changed to 108. When the last channel is reached, we start again at the beginning in a circular fashion.

C. UNII Detection Bandwidth

Test Requirement(s): **§ 15.407** A minimum 80% of the UNII 99% transmission power bandwidth is required.

Test Procedure: All UNII channels for this device have identical channel bandwidths.

A single burst of the short pulse radar type 1 is produced at 5500 MHz, at the -63dBm test level. The UUT is set up as a standalone device (no associated client, and no data traffic).

A single radar burst is generated for a minimum of 10 trials, and the response of the UUT is recorded. The UUT must detect the radar waveform 90% or more of the time.

The radar frequency is increased in 1 MHz steps, repeating the above test sequence, until the detection rate falls below 90%. The highest frequency at which detection is greater than or equal to 90% is denoted F_H.

The radar frequency is decreased in 1 MHz steps, repeating the above test sequence, until the detection rate falls below 90%. The lowest frequency at which detection is greater than or equal to 90% is denoted F_L.

The U-NII Detection Bandwidth is calculated as follows:

U-NII Detection Bandwidth = $F_H - F_L$

Test Engineer: Dusmantha Tennakoon

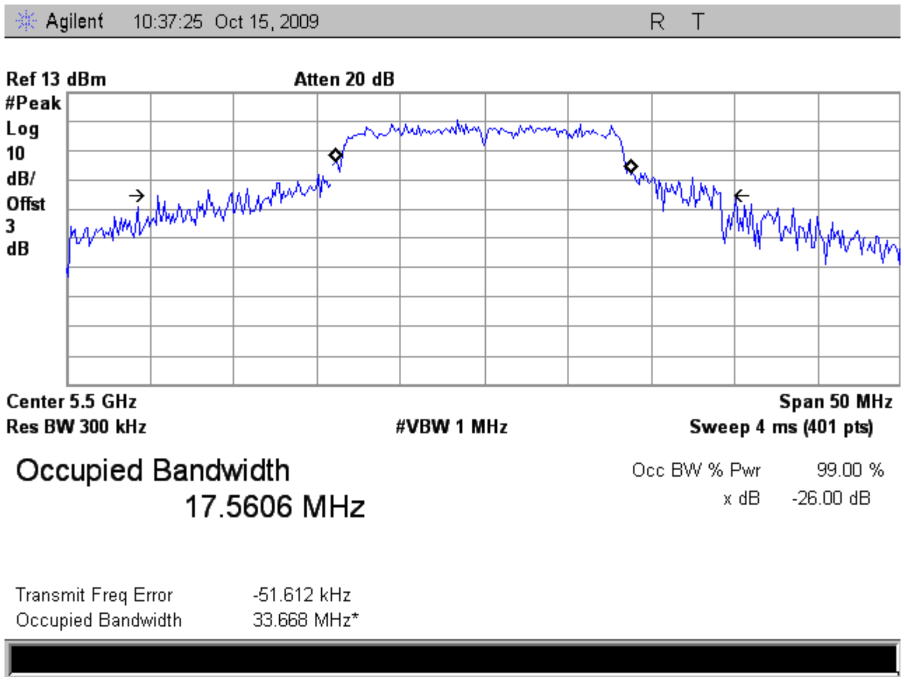
Test Date: October 15, 2009

UNII Detection Bandwidth – Test Results

EUT Frequency- 5500MHz											
	DFS Detection Trials (1=Detection, 0= No Detection)										
Radar Frequency (MHz)	1	2	3	4	5	6	7	8	9	10	Detection Rate (%)
5488	0	1	0	1	0	0	1	1	0	1	40%
5489(f_l)	1	1	1	1	1	1	1	1	0	1	90%
5490	1	1	1	1	1	1	1	1	1	1	100%
5491	1	1	1	1	1	1	1	1	1	1	100%
5492	1	1	1	1	1	1	1	1	1	1	100%
5493	1	1	1	1	1	1	1	1	1	1	100%
5494	1	1	1	1	1	1	1	1	1	1	100%
5495	1	1	1	1	1	1	1	1	1	1	100%
5496	1	1	1	1	1	1	1	1	1	1	100%
5497	1	1	1	1	1	1	1	1	1	1	100%
5498	1	1	1	1	1	1	1	1	1	1	100%
5499	1	1	1	1	1	1	1	1	1	1	100%
5500	1	1	1	1	1	1	1	1	1	1	100%
5501	1	1	1	1	1	1	1	1	1	1	100%
5502	1	1	1	1	1	1	1	1	1	1	100%
5503	1	1	1	1	1	1	1	1	1	1	100%
5504	1	1	1	1	1	1	1	1	1	1	100%
5505	1	1	1	1	1	1	1	1	1	1	100%
5506	1	1	1	1	1	1	1	1	1	1	100%
5507	0	1	1	1	1	1	1	1	1	1	100%
5508	1	1	1	1	1	1	1	1	1	1	100%
5509	1	1	1	1	1	1	1	1	1	1	100%
5510	1	1	1	1	1	1	1	1	1	1	100%
5511(f_h)	1	1	1	1	1	1	1	1	1	1	100%
5512	0	1	0	1	0	1	1	1	0	0	50%
Overall Detection Percentage											99.6 %
Detection Bandwidth = f_h - f_l = 5511 MHz - 5489 MHz = 22 MHz											
EUT 99% Bandwidth = 17.56 MHz											
17.56 MHz * 80 % = 14.05 MHz: Therefore, Detection bandwidth > 14.05 MHz											

Table 20. UNII Detection Bandwidth, Test Results, 5500 MHz

UNII Detection Bandwidth Plots



Plot 100. Occupied Bandwidth, 5500 MHz

D. Initial Channel Availability Check Time

Test Requirements: **§ 15.407** The Initial Channel Availability Check Time tests that the UUT does not emit beacon, control, or data signals on the test channel until the power-up sequence has been completed and the U-NII device has checked for radar waveforms, for one minute, on the test channel. This test does not use any of the radar waveforms and only needs to be performed once.

The UUT should not make any transmissions over the test channel, for at least 1 minute after completion of its power-on cycle.

Test Procedure: The U-NII device is powered on and instructed to operate at 5500 MHz. At the same time the UUT is powered on, the spectrum analyzer is set to 5500MHz with a zero span and a 2.5 minute sweep time. The analyzer is triggered at the same time power is applied to the U-NII device.

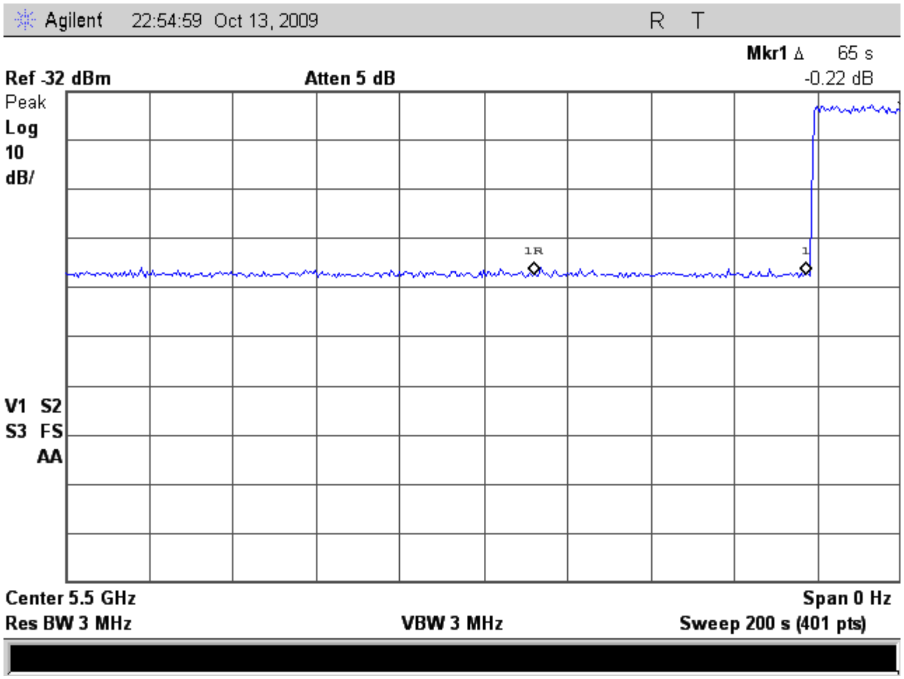
Test Results: Marker 1R on plot 101 indicates the start of the channel availability check time. Initial beacon/data transmission is indicated by marker 1.

The Equipment was compliant with § 15.407 Initial Channel Availability Check Time.

Test Engineer: Dusmantha Tennakoon

Test Date: October 13, 2009

Initial Channel Availability Check Time Test Results



Plot 101. Initial Channel Availability Check Time 60 sec

E. Radar Burst at the Beginning of Channel Availability Check Time

Test Requirements: **§ 15.407** A Radar Burst at the Beginning of the Channel Availability Check Time tests that the UUT does not emit beacon, control, or data signals on the test Channel if it has detected a radar burst during that time period until the power-up sequence has been completed and the U-NII device checks for Radar Waveforms for one minute on the test Channel. The steps below define the procedure to verify successful radar detection on the selected Channel during a period equal to the Channel Availability Check Time and avoidance of operation on that Channel when a radar Burst with a level equal to the DFS Detection Threshold + 1 dB (-63dBm) occurs at the beginning of the Channel Availability Check Time.

Test Procedure: The UUT is powered on at T0. T1 denotes the instant when the UUT has completed its power-up sequence. The Channel Availability Check Time commences at instant T1 and will end no sooner than T1 + 60 seconds.

A single Burst of short pulse radar type 1, at -63 dBm, will commence within a 6 second window starting at T1.

Visual indication of the UUT of successful detection of the radar Burst will be recorded and reported. Observation of transmission at 5500MHz will continue for 2.5 minutes after the radar Burst has been generated.

Verify that during the 2.5 minute measurement window, no UUT transmissions occur at 5500MHz.

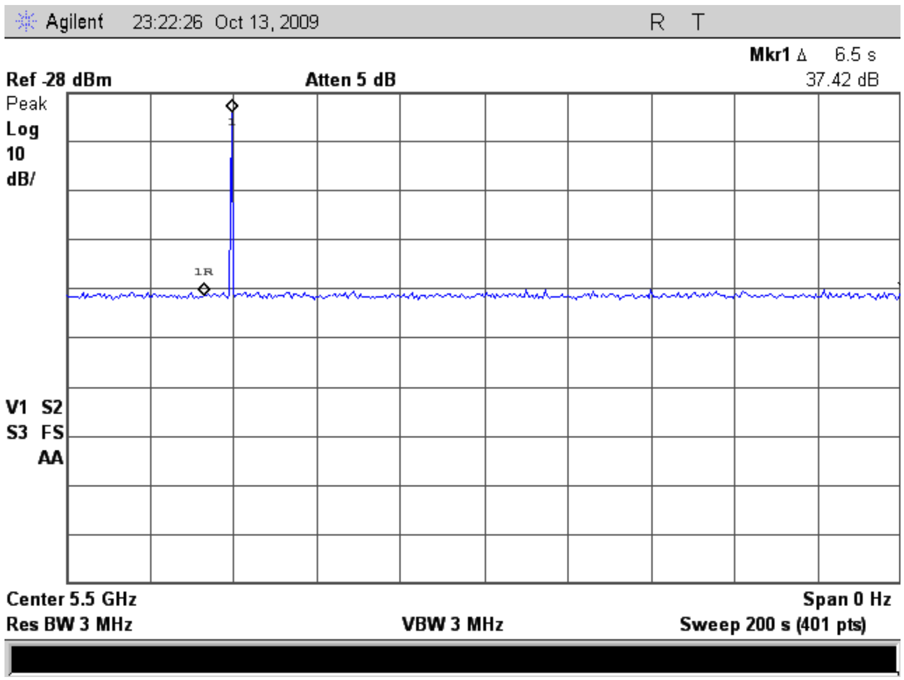
Test Results Plot 102 below indicates that there were no UUT transmissions during the 2.5 minute measurement window when a radar burst was injected 6 seconds into the CACT. Therefore, the UUT detected the presence of a radar during the CACT and moved away from that channel.

The equipment was compliant with § 15.407 Radar Burst at the Beginning of the Channel Availability Check Time.

Test Engineer: Dusmantha Tennakoon

Test Date: October 13, 2009

Radar Burst at the Beginning of Channel Availability Check Time Test Results



Plot 102. Radar Burst at the Beginning of CACT, 6 sec (5500MHz)

F. Radar Burst at the End of Channel Availability Check Time

Test Requirements: **§ 15.407** A Radar Burst at the End of the Channel Availability Check Time tests that the UUT does not emit beacon, control, or data signals on the test Channel if it has detected a radar burst during that time period until the power-up sequence has been completed and the U-NII device checks for Radar Waveforms for one minute on the test Channel. The steps below define the procedure to verify successful radar detection on the selected Channel during a period equal to the Channel Availability Check Time and avoidance of operation on that Channel when a radar Burst with a level equal to the DFS Detection Threshold + 1 dB (-63dBm) occurs at the end of the Channel Availability Check Time.

Test Procedure: The steps below define the procedure to verify successful radar detection on the selected Channel during a period equal to the Channel Availability Check Time and avoidance of operation on that Channel when a radar Burst with a level equal to the DFS Detection Threshold + 1 dB (-63dBm) occurs at the end of the Channel Availability Check Time.

The UUT is powered on at T0. T1 denotes the instant when the UUT has completed its power-up sequence. The Channel Availability Check Time commences at instant T1 and will end no sooner than T1 + 60 seconds.

A single Burst of short pulse of radar type 1 at -63 dBm will commence within a 6 second window starting at T1+ 54 seconds.

Visual indication on the UUT of successful detection of the radar Burst will be recorded and reported. Observation of emissions at 5500MHz will continue for 2.5 minutes after the radar Burst has been generated.

Verify that during the 2.5 minute measurement window no UUT transmissions occurred at 5500MHz.

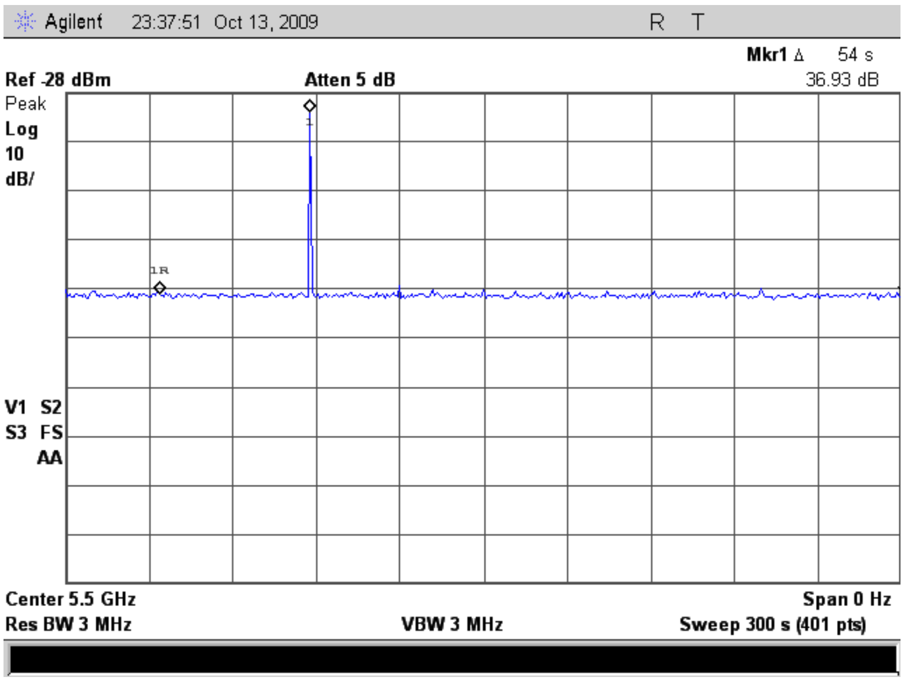
Test Results: Plot 103 indicates that no UUT transmissions occurred during the 2.5 minute measurement window when a radar burst was injected 6 seconds before the end of the CACT. Therefore, the UUT detected the presence of a radar and moved away from that channel.

The equipment was compliant with § 15.407 Radar Burst at the End of the Channel Availability Check Time.

Test Engineer: Dusmantha Tennakoon

Test Date: October 13, 2009

Radar Burst at the End of Channel Availability Check Time Test Results



Plot 103. Radar Burst at the End of CACT, 54 sec (5500MHz)

G. In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time, and Non-Occupancy Period

Test Requirements: **§ 15.407** (Refer to DFS Response Requirement Values table in section III-A of this report.) The UUT shall continuously monitor for radar transmissions in the operating test channel. When a radar burst occurs in the test channel, it has 10 seconds to move to another channel. This 10 second window is termed Channel Move Time (CMT).

When a radar burst occurs, the UUT has 200 milliseconds, plus an aggregate of 60 milliseconds, to cease transmission in the operating test channel. This 200 ms + 60 ms requirement is termed Channel Closing Transmission Time (CCT).

After radar burst and subsequent move to another channel, the UUT shall not resume transmission, on the channel it moved from, for a period of 30 minutes. This requirement is termed Non-Occupancy Period (NOP).

Test Procedure: These tests define how the following DFS parameters are verified during In-Service Monitoring: Channel Closing Transmission Time, Channel Move Time, and Non-Occupancy Period.

The steps below define the procedure to determine the above mentioned parameters when a radar Burst with a level equal to the DFS Detection Threshold + 1dB (-63dBm) is generated on the Operating Channel of the U-NII device.

A U-NII device operating as a Client Device will associate with the UUT (Master) at 5500 MHz. Stream the MPEG test file from the Master Device to the Client Device on the selected Channel for the entire period of the test.

At time T0 the Radar Waveform generator sends a Burst of pulses for each of the radar types at -63dBm.

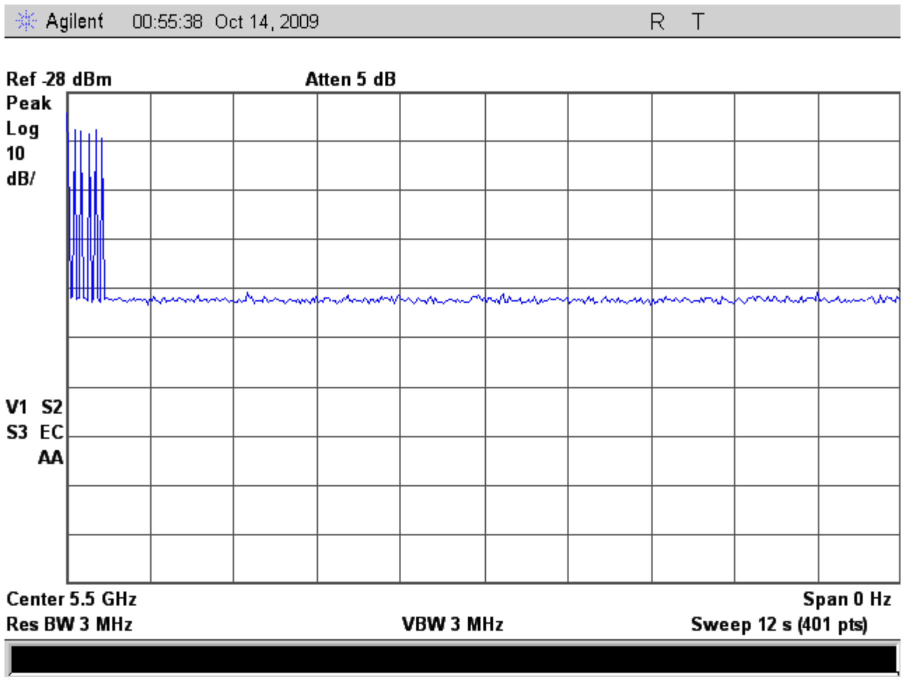
Observe the transmissions of the UUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds. Measure and record the transmissions from the UUT during the observation time (Channel Move Time). Compare the Channel Move Time and Channel Closing Transmission Time results to the limits defined in the *DFS Response Requirement Values table*.

Test Results: The EUT was compliant with § 15.407 In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time, and Non-Occupancy Period.

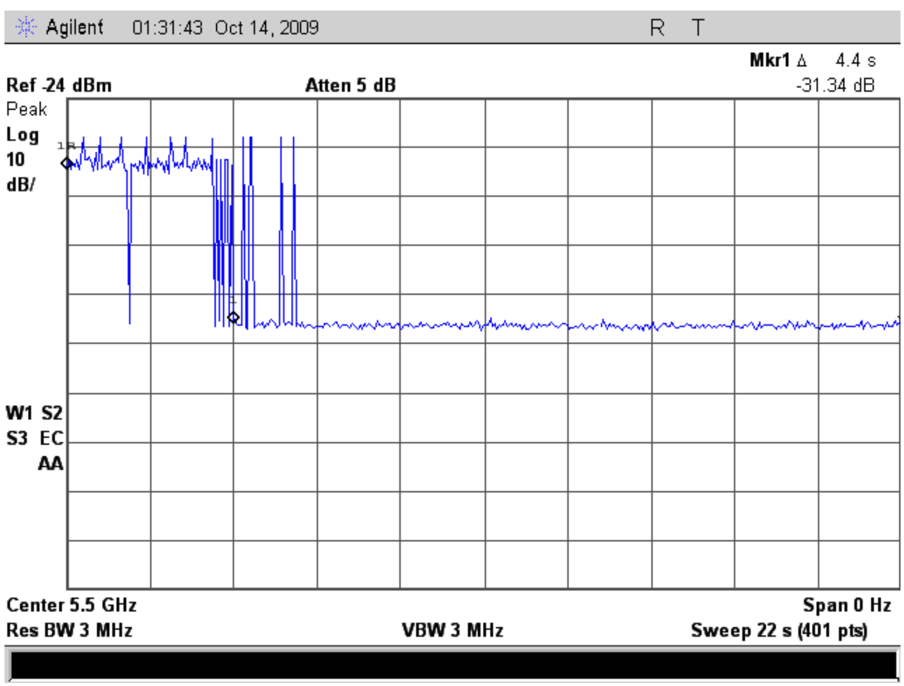
Test Engineer: Dusmantha Tennakoon

Test Date: October 14, 2009

Channel Move Time Test Results

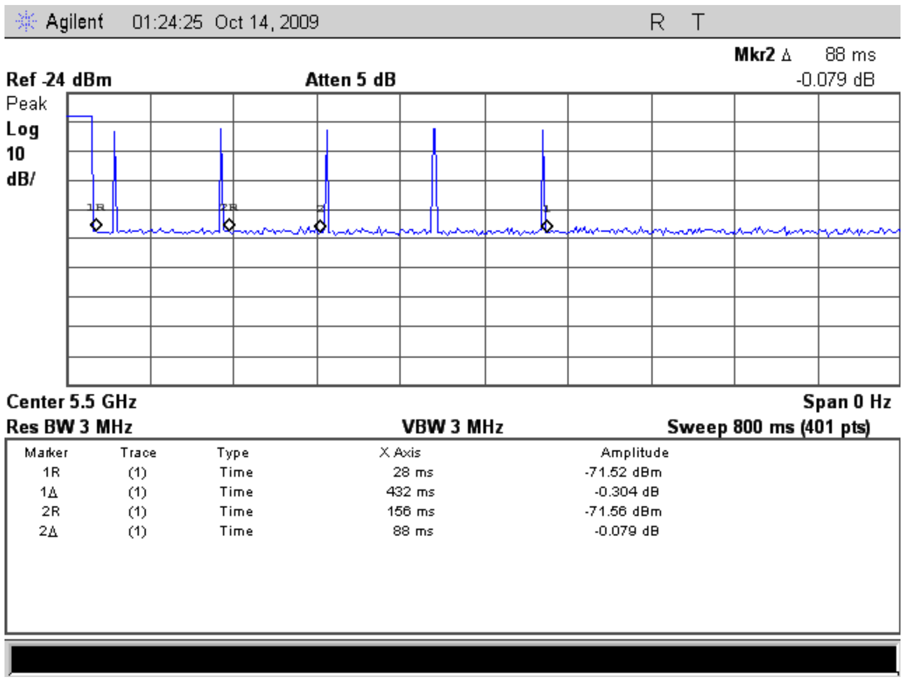


Plot 104. Channel Move Time for Radar Type 1, 12 seconds, 5500 MHz

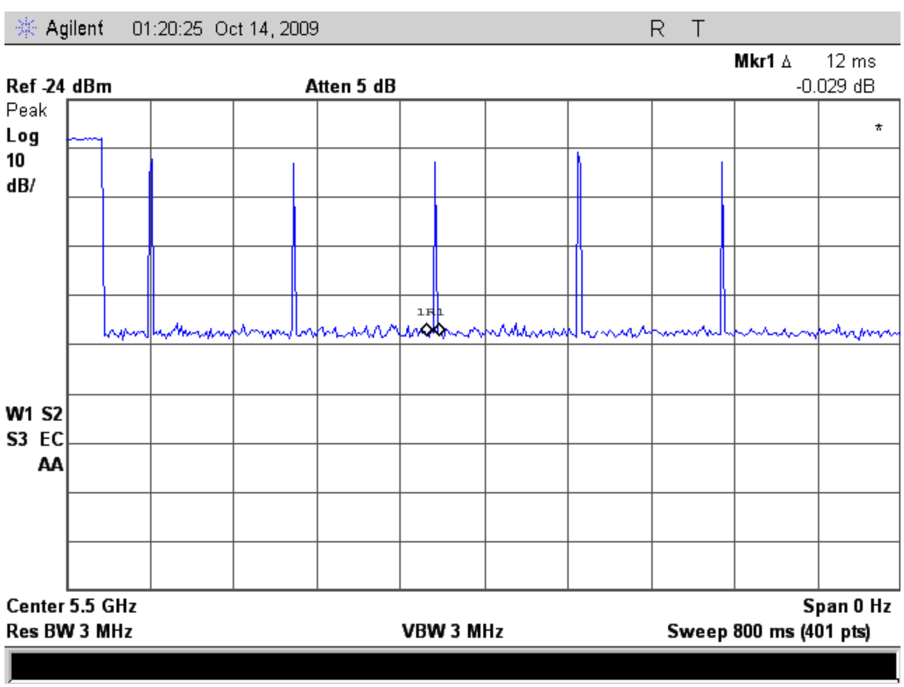


Plot 105. Channel Move Time for Radar Type 5, 22 seconds, 5500 MHz

Channel Closing Transmission Time Test Results

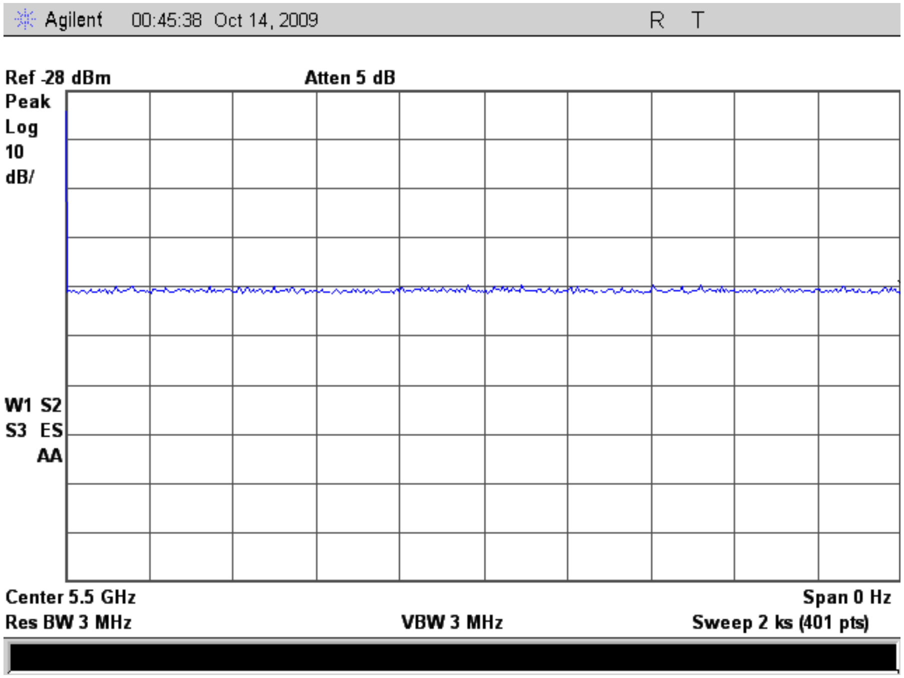


Plot 106. Channel Closing Transmission Time, 800 milliseconds, 5500 MHz



Plot 107. Channel Closing Transmission Time, 600 milliseconds, 5500 MHz

Non-Occupancy Period – Plot



Plot 108. Non-Occupancy Period, 30minutes

H. Statistical Performance Check

Test Requirements: **§ 15.407** During In-Service Monitoring, the EUT requires a minimum percentage of successful radar detections from all required radar waveforms at a level equal to the DFS Detection Threshold + 1dB.

Test Procedure: Stream the MPEG test file from the Master Device to the Client Device on the selected Channel for the entire period of the test. The Radar Waveform generator sends the individual waveform for each of the radar types 1-6 at -63dbm. Statistical data is gathered to determine the ability of the device to detect the radar test waveforms. The device can utilize a test mode to demonstrate when detection occurs to prevent the need to reset the device between trial runs. The percentage of successful detection is calculated by:

$$\frac{TotalWaveformDetections}{TotalWaveformTrials} \times 100$$

The Minimum number of trails, minimum percentage of successful detection and the average minimum percentage of successful detection are found in the Radar Test Waveforms section.

Test Results: The equipment was compliant with § 15.407 Statistical Performance Check. The aggregate detection percentage of radar types 1-4 is greater than 80% as can be seen in the following tables.

Test Engineer: Dusmantha Tennakoon

Test Date: October 13, 2009

Statistical Performance Check – Radar Type 1

Radar Type	Trial #	Pulses per Burst	Pulse Width (μsec)	PRI (μsec)	Detection 1 = Yes, 0 = No
1	1	18	1	1428	1
	2	18	1	1428	1
	3	18	1	1428	1
	4	18	1	1428	1
	5	18	1	1428	1
	6	18	1	1428	1
	7	18	1	1428	1
	8	18	1	1428	1
	9	18	1	1428	1
	10	18	1	1428	1
	11	18	1	1428	1
	12	18	1	1428	1
	13	18	1	1428	1
	14	18	1	1428	1
	15	18	1	1428	1
	16	18	1	1428	1
	17	18	1	1428	1
	18	18	1	1428	1
	19	18	1	1428	1
	20	18	1	1428	1
	21	18	1	1428	1
	22	18	1	1428	1
	23	18	1	1428	1
	24	18	1	1428	1
	25	18	1	1428	1
	26	18	1	1428	1
	27	18	1	1428	1
	28	18	1	1428	1
	29	18	1	1428	1
	30	18	1	1428	1
	Detection Percentage				**100% (> 60%)**

Table 21. Statistical Performance Check – Radar Type 1, 5500 MHz

Statistical Performance Check – Radar Type 2

Radar Type	Trial #	Pulse Width 1 to 5 µsec	PRI 150 to 230 µsec	Pulses per Burst 23 to 29	Detection 1 = Yes, 0 = No
2	1	3.3	170	26	0
	2	4.8	212	28	1
	3	1.5	167	24	1
	4	3.5	184	29	1
	5	3.5	192	25	1
	6	1.3	179	23	1
	7	3.1	183	28	1
	8	2.4	219	25	1
	9	5	220	26	1
	10	1.3	151	24	1
	11	1.7	174	23	1
	12	1.8	170	24	1
	13	2.2	212	29	1
	14	2.6	160	23	1
	15	1.4	193	23	1
	16	2.2	158	25	1
	17	1	208	24	1
	18	2.3	156	29	1
	19	1	227	27	1
	20	1.2	209	24	1
	21	4.3	199	28	1
	22	1	222	26	1
	23	3.7	195	27	1
	24	4.9	217	24	1
	25	4.4	199	26	1
	26	4.2	209	28	1
	27	3	191	24	1
	28	3.7	208	26	1
	29	2.4	198	24	1
	30	1.6	195	27	1
	Detection Percentage				**96.6% (> 60%)**

Table 22. Statistical Performance Check – Radar Type 2, 5500 MHz

Statistical Performance Check – Radar Type 3

Radar Type	Trial #	Pulse Width 6 to 10 µsec	PRI 200 to 500 µsec	Pulses per Burst 16 to 18	Detection 1 = Yes, 0 = No
3	1	7.1	273	16	0
	2	6.4	292	18	1
	3	7.1	456	16	1
	4	8.2	352	17	1
	5	6.4	484	17	0
	6	7.5	334	17	1
	7	6.7	483	18	1
	8	6.2	461	18	1
	9	6.1	445	17	1
	10	8.3	360	16	1
	11	5.9	469	16	1
	12	7.8	414	18	1
	13	9.5	277	16	1
	14	6.1	397	18	1
	15	6.4	313	18	1
	16	7	439	17	1
	17	7	343	16	1
	18	5.2	333	17	1
	19	9.5	258	17	1
	20	5.6	457	18	1
	21	6.5	481	17	1
	22	9	300	16	1
	23	7.2	298	18	1
	24	8.8	369	16	1
	25	5.3	268	17	1
	26	6.3	422	18	1
	27	6.4	408	16	1
	28	6.2	326	17	1
	29	9	329	18	1
	30	7.5	382	16	1
	Detection Percentage				**93.3% (> 60%)**

Table 23. Statistical Performance Check – Radar Type 3, 5500 MHz

Statistical Performance Check – Radar Type 4

Radar Type	Trial #	Pulse Width 11 to 20 µsec	PRI 200 to 500 µsec	Pulses per Burst 12 to 16	Detection 1 = Yes, 0 = No
4	1	17.5	454	12	1
	2	16.2	294	14	1
	3	17.8	388	15	1
	4	18.9	408	13	0
	5	18.6	293	13	1
	6	13.5	304	14	1
	7	16	342	13	1
	8	20	406	14	0
	9	15.8	363	13	1
	10	13.8	357	14	1
	11	15.6	309	13	1
	12	16.6	398	16	1
	13	10.3	339	15	1
	14	16.4	321	15	1
	15	19.5	469	15	1
	16	11.8	331	15	1
	17	11.7	442	13	0
	18	10.7	251	15	0
	19	10.6	471	12	1
	20	11.9	309	13	1
	21	14.6	312	13	1
	22	10.4	414	15	1
	23	12.1	284	13	1
	24	19.5	296	14	1
	25	12.1	389	15	1
	26	15.2	493	16	1
	27	11	302	15	1
	28	14	408	13	0
	29	10.8	433	14	1
	30	13.1	343	13	1
	Detection Percentage				**83.3% (> 60%)**

Table 24. Statistical Performance Check – Radar Type 4, 5500 MHz

Statistical Performance Check – Radar Type 5

Radar Type	Trial #	Filename*	Detection 1 = Yes, 0 = No
5	1	bin5-trial 1	1
	2	bin5-trial 2	1
	3	bin5-trial 3	1
	4	bin5-trial 4	1
	5	bin5-trial 5	1
	6	bin5-trial 6	1
	7	bin5-trial 7	1
	8	bin5-trial 8	1
	9	bin5-trial 9	1
	10	bin5-trial 10	1
	11	bin5-trial 11	1
	12	bin5-trial 12	1
	13	bin5-trial 13	1
	14	bin5-trial 14	0
	15	bin5-trial 15	1
	16	bin5-trial 16	1
	17	bin5-trial 17	1
	18	bin5-trial 18	1
	19	bin5-trial 19	1
	20	bin5-trial 20	1
	21	bin5-trial 21	0
	22	bin5-trial 22	1
	23	bin5-trial 23	1
	24	bin5-trial 24	1
	25	bin5-trial 25	1
	26	bin5-trial 26	1
	27	bin5-trial 27	1
	28	bin5-trial 28	1
	29	bin5-trial 29	1
	30	bin5-trial 30	1
	Detection Percentage		**93.3 (> 60%)**

Table 25. Statistical Performance Check – Radar Type 5, 5500 MHz

Note: See Appendix for Bin 5 test data.

Statistical Performance Check – Radar Type 6

Radar Type	Trial #	Frequency (MHz)	Pulses/Hop	Pulse Width (µsec)	PRI (µsec)	Detection
						1 = Yes, 0 = No
6	1	5580	9	1	333	1
	2	5580	9	1	333	1
	3	5580	9	1	333	1
	4	5580	9	1	333	1
	5	5580	9	1	333	0
	6	5580	9	1	333	1
	7	5580	9	1	333	1
	8	5580	9	1	333	1
	9	5580	9	1	333	1
	10	5580	9	1	333	1
	11	5580	9	1	333	1
	12	5580	9	1	333	1
	13	5580	9	1	333	1
	14	5580	9	1	333	1
	15	5580	9	1	333	1
	16	5580	9	1	333	1
	17	5580	9	1	333	1
	18	5580	9	1	333	1
	19	5580	9	1	333	1
	20	5580	9	1	333	1
	21	5580	9	1	333	1
	22	5580	9	1	333	1
	23	5580	9	1	333	1
	24	5580	9	1	333	1
	25	5580	9	1	333	1
	26	5580	9	1	333	1
	27	5580	9	1	333	1
	28	5580	9	1	333	1
	29	5580	9	1	333	1
	30	5580	9	1	333	1
	Detection Percentage					96.6 (> 60%)

Table 26. Statistical Performance Check – Radar Type 6, 5500 MHz

IV. Appendix A

Random DFS waveform parameters (NewBin5) 13-Oct-2009 09:07:02

Waveform Num = 1
Num of Bursts = 14
Burst Interval (us) = 857143.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	285302	3	14.0	89	1522	1491	1246	285302	0	857142
2	1245311	3	18.0	63	1446	1851	1153	1534872	857143	1714285
3	831935	2	10.0	87	1502	1923	0	2371257	1714286	2571428
4	494617	3	5.0	78	1170	1035	1110	2869299	2571429	3428571
5	976431	2	9.0	63	1359	1231	0	3849045	3428572	4285714
6	1060533	2	5.0	66	1882	1738	0	4912168	4285715	5142857
7	493867	2	11.0	92	1028	1311	0	5409655	5142858	6000000
8	880830	3	11.0	80	1543	1111	1943	6292824	6000001	6857143
9	711816	2	11.0	74	1669	1142	0	7009237	6857144	7714286
10	818878	1	9.0	62	1075	0	0	7830926	7714287	8571429
11	1205568	2	17.0	86	1782	1256	0	9037569	8571430	9428572
12	990693	1	17.0	78	1385	0	0	10031300	9428573	10285715
13	273559	2	15.0	86	1021	1518	0	10306244	10285716	11142858
14	1073744	2	19.0	50	1568	1354	0	11382527	11142859	12000001

Total number of pulses in waveform = 30

Waveform Num = 2
Num of Bursts = 14
Burst Interval (us) = 857143.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	570576	2	17.0	80	1886	1414	0	570576	0	857142
2	1132706	2	14.0	62	1115	1442	0	1706582	857143	1714285

3	718309	2	15.0	97	1980	1924	0	2427448	1714286	2571428
4	225882	2	20.0	96	1321	1259	0	2657234	2571429	3428571
5	904775	1	15.0	93	1249	0	0	3564589	3428572	4285714
6	1384016	3	9.0	61	1944	1347	1954	4949854	4285715	5142857
7	501709	3	6.0	98	1544	1257	1319	5456808	5142858	6000000
8	971434	3	7.0	54	1143	1207	1897	6432362	6000001	6857143
9	632232	3	14.0	95	1573	1150	1257	7068841	6857144	7714286
10	1188386	2	17.0	62	1313	1800	0	8261207	7714287	8571429
11	832372	2	17.0	98	1377	1063	0	9096692	8571430	9428572
12	956516	2	9.0	51	1145	1868	0	10055648	9428573	10285715
13	626866	1	16.0	58	1518	0	0	10685527	10285716	11142858
14	729528	1	7.0	53	1710	0	0	11416573	11142859	12000001

Total number of pulses in waveform = 29

Waveform Num = 3
Num of Bursts = 20
Burst Interval (us) = 600000.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	459934	2	16.0	50	1298	1584	0	459934	0	599999
2	198457	1	17.0	51	1017	0	0	661273	600000	1199999
3	887317	1	10.0	99	1437	0	0	1549607	1200000	1799999
4	714244	2	18.0	76	1348	1818	0	2265288	1800000	2399999
5	463662	3	5.0	89	1185	1970	1301	2732116	2400000	2999999
6	305637	2	18.0	86	1643	1806	0	3042209	3000000	3599999
7	1029314	1	17.0	54	1699	0	0	4074972	3600000	4199999
8	477892	1	19.0	81	1624	0	0	4554563	4200000	4799999

9	467132	3	16.0	72	1892	1208	1904	5023319	4800000	5399999
10	390380	1	15.0	94	1237	0	0	5418703	5400000	5999999
11	634791	1	8.0	77	1882	0	0	6054731	6000000	6599999
12	891741	2	14.0	52	1193	1827	0	6948354	6600000	7199999
13	461239	2	11.0	61	1667	1537	0	7412613	7200000	7799999
14	480415	1	9.0	98	1525	0	0	7896232	7800000	8399999
15	616576	3	17.0	95	1023	1861	1741	8514333	8400000	8999999
16	827675	2	17.0	95	1127	1415	0	9346633	9000000	9599999
17	846843	2	10.0	54	1088	1182	0	10196018	9600000	10199999
18	451700	3	18.0	65	1086	1036	1713	10649988	10200000	10799999
19	620380	1	10.0	72	1388	0	0	11274203	10800000	11399999
20	172405	2	20.0	66	1825	1534	0	11447996	11400000	11999999

Total number of pulses in waveform = 36

Waveform Num = 4
Num of Bursts = 20
Burst Interval (us) = 600000.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	448479	3	20.0	81	1024	1505	1132	448479	0	599999
2	438110	1	13.0	82	1639	0	0	890250	600000	1199999
3	557218	3	18.0	57	1875	1725	1938	1449107	1200000	1799999
4	654725	1	12.0	98	1474	0	0	2109370	1800000	2399999
5	654425	1	10.0	90	1146	0	0	2765269	2400000	2999999
6	376992	3	10.0	95	1152	1248	1790	3143407	3000000	3599999
7	710149	1	15.0	53	1384	0	0	3857746	3600000	4199999
8	857980	3	10.0	56	1435	1647	1429	4717110	4200000	4799999

9	172381	2	18.0	58	1146	1835	0	4894002	4800000	5399999
10	810263	2	7.0	78	1300	1602	0	5707246	5400000	5999999
11	304286	1	13.0	83	1674	0	0	6014434	6000000	6599999
12	937298	1	16.0	88	1522	0	0	6953406	6600000	7199999
13	450860	3	6.0	71	1185	1077	1788	7405788	7200000	7799999
14	572364	3	19.0	96	1698	1862	1404	7982202	7800000	8399999
15	428729	2	12.0	73	1304	1653	0	8415895	8400000	8999999
16	994211	3	16.0	81	1767	1760	1584	9413063	9000000	9599999
17	377657	3	9.0	62	1664	1855	1038	9795831	9600000	10199999
18	777285	3	8.0	85	1680	1493	1286	10577673	10200000	10799999
19	562093	1	7.0	63	1855	0	0	11144225	10800000	11399999
20	591644	2	18.0	88	1074	1879	0	11737724	11400000	11999999

Total number of pulses in waveform = 42

Waveform Num = 5
Num of Bursts = 12
Burst Interval (us) = 1000000.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	994766	1	11.0	55	1474	0	0	994766	0	999999
2	965068	3	17.0	100	1315	1361	1515	1961308	1000000	1999999
3	914191	3	7.0	60	1216	1954	1433	2879690	2000000	2999999
4	830116	3	19.0	77	1892	1843	1377	3714409	3000000	3999999
5	319668	2	5.0	57	1219	1761	0	4039189	4000000	4999999
6	1199327	3	6.0	75	1143	1126	1551	5241496	5000000	5999999
7	1194575	1	5.0	75	1251	0	0	6439891	6000000	6999999
8	1235063	3	7.0	71	1721	1483	1718	7676205	7000000	7999999

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
9	804258	2	12.0	56	1434	1212	0	8485385	8000000	8999999
10	869717	2	12.0	90	1396	1611	0	9357748	9000000	9999999
11	1037906	3	20.0	85	1191	1214	1438	10398661	10000000	10999999
12	1112318	3	8.0	59	1260	1524	1068	11514822	11000000	11999999

Total number of pulses in waveform = 29

Waveform Num =   6
Num of Bursts = 12
Burst Interval (us) = 1000000.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	533097	2	14.0	75	1029	1926	0	533097	0	999999
2	1148296	2	14.0	75	1908	1588	0	1684348	1000000	1999999
3	690262	3	6.0	74	1627	1652	1198	2378106	2000000	2999999
4	757730	1	17.0	72	1690	0	0	3140313	3000000	3999999
5	1286549	3	10.0	61	1430	1920	1716	4428552	4000000	4999999
6	773089	1	5.0	79	1670	0	0	5206707	5000000	5999999
7	1302205	1	9.0	57	1707	0	0	6510582	6000000	6999999
8	933856	1	10.0	93	1892	0	0	7446145	7000000	7999999
9	911129	3	9.0	93	1520	1057	1969	8359166	8000000	8999999
10	873399	1	6.0	98	1878	0	0	9237111	9000000	9999999
11	1675614	2	10.0	78	1089	1539	0	10914603	10000000	10999999
12	1015596	2	5.0	97	1091	1963	0	11932827	11000000	11999999

Total number of pulses in waveform = 22

Waveform Num =   7
Num of Bursts = 15
Burst Interval (us) =   800000.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)

1	9403	2	10.0	74	1334	1043	0	9403	0	799999
2	1281327	3	19.0	96	1363	1995	1629	1293107	800000	1599999
3	1039147	1	6.0	87	1347	0	0	2337241	1600000	2399999
4	129227	1	7.0	51	1209	0	0	2467815	2400000	3199999
5	995622	3	8.0	64	1517	1404	1675	3464646	3200000	3999999
6	1289576	2	8.0	51	1157	1235	0	4758818	4000000	4799999
7	276924	2	14.0	91	1861	1563	0	5038134	4800000	5599999
8	1050796	2	19.0	53	1039	1061	0	6092354	5600000	6399999
9	856518	2	19.0	58	1700	1255	0	6950972	6400000	7199999
10	712560	2	14.0	81	1125	1836	0	7666487	7200000	7999999
11	1024433	1	11.0	73	1634	0	0	8693881	8000000	8799999
12	372575	1	15.0	52	1203	0	0	9068090	8800000	9599999
13	1161665	1	14.0	68	1336	0	0	10230958	9600000	10399999
14	679260	3	18.0	89	1313	1884	1445	10911554	10400000	11199999
15	878313	1	6.0	56	1310	0	0	11794509	11200000	11999999

Total number of pulses in waveform = 27

Waveform Num = 8
Num of Bursts = 11
Burst Interval (us) = 1090909.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	116224	2	10.0	99	1031	1485	0	116224	0	1090908
2	1492317	1	18.0	87	1306	0	0	1611057	1090909	2181817
3	766151	1	20.0	91	1605	0	0	2378514	2181818	3272726
4	1109276	3	14.0	71	1902	1533	1409	3489395	3272727	4363635
5	1120977	2	14.0	90	1470	1607	0	4615216	4363636	5454544

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
6	1029744	1	11.0	61	1841	0	0	5648037	5454545	6545453
7	1781542	2	18.0	53	1989	1364	0	7431420	6545454	7636362
8	859616	2	9.0	58	1907	1104	0	8294389	7636363	8727271
9	784237	2	14.0	100	1369	1650	0	9081637	8727272	9818180
10	1595623	3	5.0	63	1413	1617	1365	10680279	9818181	10909089
11	473058	1	18.0	51	1574	0	0	11157732	10909090	11999998

Total number of pulses in waveform = 20

Waveform Num =   9
Num of Bursts = 10
Burst Interval (us) = 1200000.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	965616	3	20.0	50	1566	1035	1059	965616	0	1199999
2	669352	3	8.0	95	1273	1925	1145	1638628	1200000	2399999
3	1790525	2	18.0	96	1535	1010	0	3433496	2400000	3599999
4	371653	3	19.0	83	1829	1928	1239	3807694	3600000	4799999
5	1973311	3	20.0	96	1365	1801	1603	5786001	4800000	5999999
6	767846	3	18.0	53	1664	1452	1507	6558616	6000000	7199999
7	1252536	1	15.0	50	1811	0	0	7815775	7200000	8399999
8	1633351	1	5.0	90	1048	0	0	9450937	8400000	9599999
9	237631	3	7.0	81	1040	1221	1306	9689616	9600000	10799999
10	1670013	3	20.0	79	1218	1064	1734	11363196	10800000	11999999

Total number of pulses in waveform = 25

Waveform Num =   10
Num of Bursts = 20
Burst Interval (us) =   600000.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)

1	340352	1	20.0	56	1283	0	0	340352	0	599999
2	449416	2	10.0	96	1073	1412	0	791051	600000	1199999
3	554731	3	19.0	100	1211	1219	1288	1348267	1200000	1799999
4	1041620	2	12.0	87	1322	1098	0	2393605	1800000	2399999
5	77604	3	7.0	84	1987	1691	1109	2473629	2400000	2999999
6	965895	3	14.0	88	1116	1558	1364	3444311	3000000	3599999
7	430829	2	7.0	62	1869	1545	0	3879178	3600000	4199999
8	660277	3	18.0	98	1182	1085	1525	4542869	4200000	4799999
9	849642	2	5.0	66	1046	1656	0	5396303	4800000	5399999
10	389703	1	13.0	61	1174	0	0	5788708	5400000	5999999
11	444229	2	6.0	55	1663	1856	0	6234111	6000000	6599999
12	467704	3	20.0	92	1380	1987	1004	6705334	6600000	7199999
13	678625	1	11.0	90	1426	0	0	7388330	7200000	7799999
14	440070	2	14.0	53	1869	1420	0	7829826	7800000	8399999
15	657469	2	20.0	98	1477	1199	0	8490584	8400000	8999999
16	961014	3	19.0	100	1068	1667	1306	9454274	9000000	9599999
17	490306	1	16.0	56	1131	0	0	9948621	9600000	10199999
18	324513	1	10.0	64	1561	0	0	10274265	10200000	10799999
19	612028	1	19.0	76	1753	0	0	10887854	10800000	11399999
20	912534	2	9.0	86	1145	1189	0	11802141	11400000	11999999

Total number of pulses in waveform = 40

Waveform Num = 11
Num of Bursts = 13
Burst Interval (us) = 923077.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)

1	812088	3	20.0	54	1136	1591	1316	812088	0	923076
2	597930	3	5.0	65	1614	1567	1225	1414061	923077	1846153
3	619588	1	19.0	98	1913	0	0	2038055	1846154	2769230
4	900636	3	18.0	50	1627	1654	1855	2940604	2769231	3692307
5	1234475	2	10.0	72	1390	1103	0	4180215	3692308	4615384
6	1330184	2	10.0	51	1557	1917	0	5512892	4615385	5538461
7	558586	3	7.0	70	1358	1181	1637	6074952	5538462	6461538
8	1274103	1	15.0	59	1805	0	0	7353231	6461539	7384615
9	808689	2	7.0	55	1771	1768	0	8163725	7384616	8307692
10	962627	2	5.0	84	1542	1145	0	9129891	8307693	9230769
11	711273	1	19.0	85	1195	0	0	9843851	9230770	10153846
12	528336	2	5.0	82	1896	1608	0	10373382	10153847	11076923
13	1150388	1	20.0	58	1941	0	0	11527274	11076924	12000000

Total number of pulses in waveform = 26

Waveform Num = 12
Num of Bursts = 16
Burst Interval (us) = 750000.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	52518	2	10.0	75	1116	1561	0	52518	0	749999
2	1220848	3	7.0	100	1116	1423	1872	1276043	750000	1499999
3	514344	1	16.0	93	1255	0	0	1794798	1500000	2249999
4	1084288	3	8.0	86	1976	1441	1830	2880341	2250000	2999999
5	629812	3	9.0	64	1198	1900	1871	3515400	3000000	3749999
6	503024	2	11.0	58	1952	1629	0	4023393	3750000	4499999
7	630902	2	20.0	59	1621	1022	0	4657876	4500000	5249999

8	1043617	1	16.0	50	1071	0	0	5704136	5250000	5999999
9	415428	1	13.0	79	1318	0	0	6120635	6000000	6749999
10	901176	2	14.0	79	1569	1466	0	7023129	6750000	7499999
11	857629	2	18.0	95	1226	1843	0	7883793	7500000	8249999
12	799301	3	18.0	57	1886	1191	1180	8686163	8250000	8999999
13	821665	2	19.0	73	1828	1066	0	9512085	9000000	9749999
14	500565	1	15.0	62	1241	0	0	10015544	9750000	10499999
15	954439	1	17.0	56	1505	0	0	10971224	10500000	11249999
16	496312	1	15.0	92	1241	0	0	11469041	11250000	11999999

Total number of pulses in waveform = 30

Waveform Num = 13
Num of Bursts = 13
Burst Interval (us) = 923077.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	553893	2	8.0	73	1046	1114	0	553893	0	923076
2	686462	3	9.0	75	1072	1413	1713	1242515	923077	1846153
3	848358	1	8.0	85	1026	0	0	2095071	1846154	2769230
4	1065013	2	11.0	97	1633	1930	0	3161110	2769231	3692307
5	1356924	1	16.0	85	1248	0	0	4521597	3692308	4615384
6	587146	3	11.0	70	1030	1436	1185	5109991	4615385	5538461
7	906984	1	11.0	88	1552	0	0	6020626	5538462	6461538
8	1058406	3	15.0	75	1577	1010	1759	7080584	6461539	7384615
9	824286	2	19.0	64	1722	1104	0	7909216	7384616	8307692
10	1162965	2	11.0	99	1830	1310	0	9075007	8307693	9230769
11	984756	1	14.0	85	1387	0	0	10062903	9230770	10153846

	199715									
12		1	17.0	91	1064	0	0	10264005	10153847	11076923
	1508028									
13		1	6.0	96	1668	0	0	11773097	11076924	12000000

Total number of pulses in waveform = 23

Waveform Num = 14
Num of Bursts = 8
Burst Interval (us) = 1500000.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
	934590									
1		3	19.0	52	1613	1164	1819	934590	0	1499999
	819983									
2		2	8.0	72	1057	1119	0	1759169	1500000	2999999
	2279208									
3		1	18.0	80	1043	0	0	4040553	3000000	4499999
	1382385									
4		1	8.0	57	1190	0	0	5423981	4500000	5999999
	882768									
5		1	11.0	67	1605	0	0	6307939	6000000	7499999
	2352089									
6		1	16.0	70	1052	0	0	8661633	7500000	8999999
	1054035									
7		2	16.0	99	1505	1449	0	9716720	9000000	10499999
	786490									
8		1	5.0	72	1415	0	0	10506164	10500000	11999999

Total number of pulses in waveform = 12

Waveform Num = 15
Num of Bursts = 16
Burst Interval (us) = 750000.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
	230759									
1		1	9.0	95	1515	0	0	230759	0	749999
	998760									
2		2	18.0	76	1941	1176	0	1231034	750000	1499999
	901997									
3		3	6.0	65	1093	1379	1963	2136148	1500000	2249999
	830258									
4		3	12.0	73	1212	1642	1312	2970841	2250000	2999999
	208744									
5		2	17.0	83	1196	1763	0	3183751	3000000	3749999
	1214288									
6		3	20.0	62	1203	1956	1367	4400998	3750000	4499999

7	449732	3	20.0	90	1809	1777	1472	4855256	4500000	5249999
8	419908	3	13.0	62	1150	1670	1723	5280222	5250000	5999999
9	988950	1	10.0	61	1219	0	0	6273715	6000000	6749999
10	554393	2	13.0	72	1857	1866	0	6829327	6750000	7499999
11	934175	3	16.0	64	1490	1447	1791	7767225	7500000	8249999
12	1142190	3	18.0	69	1821	1843	1293	8914143	8250000	8999999
13	452913	2	12.0	58	1317	1481	0	9372013	9000000	9749999
14	1037189	3	13.0	76	1550	1981	1663	10412000	9750000	10499999
15	718504	3	18.0	95	1694	1060	1804	11135698	10500000	11249999
16	386590	2	17.0	63	1075	1581	0	11526846	11250000	11999999

Total number of pulses in waveform = 39

Waveform Num =   16
Num of Bursts = 19
Burst Interval (us) =   631579.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	213358	1	10.0	97	1576	0	0	213358	0	631578
2	942436	2	5.0	71	1149	1387	0	1157370	631579	1263157
3	654606	3	9.0	82	1125	1678	1277	1814512	1263158	1894736
4	262872	1	15.0	94	1561	0	0	2081464	1894737	2526315
5	783869	3	15.0	71	1489	1806	1771	2866894	2526316	3157894
6	609899	2	10.0	81	1661	1230	0	3481859	3157895	3789473
7	458157	1	17.0	74	1287	0	0	3942907	3789474	4421052
8	1033401	3	19.0	76	1189	1873	1313	4977595	4421053	5052631
9	638867	3	7.0	66	1949	1527	1414	5620837	5052632	5684210
10	98615	3	8.0	56	1609	1521	1819	5724342	5684211	6315789

11	861241	3	16.0	61	1234	1264	1842	6590532	6315790	6947368
12	714601	1	5.0	97	1311	0	0	7309473	6947369	7578947
13	781384	2	8.0	93	1762	1603	0	8092168	7578948	8210526
14	698463	2	20.0	52	1950	1185	0	8793996	8210527	8842105
15	390047	3	12.0	89	1608	1625	1933	9187178	8842106	9473684
16	808247	1	12.0	54	1700	0	0	10000591	9473685	10105263
17	596065	2	14.0	60	1092	1917	0	10598356	10105264	10736842
18	217250	1	13.0	74	1129	0	0	10818615	10736843	11368421
19	749006	2	20.0	96	1408	1114	0	11568750	11368422	12000000

Total number of pulses in waveform = 39

Waveform Num = 17
Num of Bursts = 16
Burst Interval (us) = 750000.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	435189	1	15.0	91	1272	0	0	435189	0	749999
2	748077	1	14.0	82	1833	0	0	1184538	750000	1499999
3	509049	2	17.0	80	1018	1737	0	1695420	1500000	2249999
4	606085	1	19.0	86	1891	0	0	2304260	2250000	2999999
5	1279451	1	19.0	57	1509	0	0	3585602	3000000	3749999
6	303988	1	8.0	86	1201	0	0	3891099	3750000	4499999
7	636443	3	14.0	68	1825	1424	1026	4528743	4500000	5249999
8	1255761	1	10.0	84	1249	0	0	5788779	5250000	5999999
9	622183	2	19.0	93	1062	1391	0	6412211	6000000	6749999
10	498945	1	8.0	67	1050	0	0	6913609	6750000	7499999
11	912126	3	19.0	95	1680	1366	1602	7826785	7500000	8249999

	746191									
12		2	15.0	68	1004	1949	0	8577624	8250000	8999999
	1034728									
13		1	10.0	81	1865	0	0	9615305	9000000	9749999
	675055									
14		2	7.0	60	1355	1509	0	10292225	9750000	10499999
	259993									
15		2	8.0	65	1400	1510	0	10555082	10500000	11249999
	1110412									
16		3	17.0	97	1946	1387	1035	11668404	11250000	11999999

Total number of pulses in waveform = 27

Waveform Num = 18
Num of Bursts = 9
Burst Interval (us) = 1333333.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
	207301									
1		2	5.0	93	1858	1675	0	207301	0	1333332
	1722191									
2		2	11.0	58	1976	1106	0	1933025	1333333	2666665
	1039115									
3		2	6.0	92	1384	1661	0	2975222	2666666	3999998
	2183220									
4		3	16.0	65	1189	1174	1639	5161487	3999999	5333331
	1039801									
5		3	16.0	97	1850	1300	1048	6205290	5333332	6666664
	1590852									
6		1	12.0	84	1999	0	0	7800340	6666665	7999997
	962668									
7		2	7.0	61	1354	1785	0	8765007	7999998	9333330
	1223210									
8		1	20.0	95	1339	0	0	9991356	9333331	10666663
	1697888									
9		3	8.0	63	1701	1832	1205	11690583	10666664	11999996

Total number of pulses in waveform = 19

Waveform Num = 19
Num of Bursts = 18
Burst Interval (us) = 666667.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
	269205									
1		2	15.0	82	1164	1171	0	269205	0	666666
	997345									
2		3	19.0	66	1676	1390	1133	1268885	666667	1333333

3	140173	1	17.0	63	1264	0	0	1413257	1333334	2000000
4	1118093	1	7.0	57	1758	0	0	2532614	2000001	2666667
5	479676	2	16.0	67	1229	1925	0	3014048	2666668	3333334
6	480862	2	8.0	86	1598	1596	0	3498064	3333335	4000001
7	1135706	2	15.0	98	1866	1050	0	4636964	4000002	4666668
8	30298	2	19.0	98	1840	1278	0	4670178	4666669	5333335
9	1079334	3	7.0	51	1822	1495	1242	5752630	5333336	6000002
10	446395	3	14.0	64	1206	1028	1678	6203584	6000003	6666669
11	712127	3	14.0	83	1483	1979	1819	6919623	6666670	7333336
12	418097	3	12.0	67	1445	1031	1943	7343001	7333337	8000003
13	817469	2	11.0	85	1800	1208	0	8164889	8000004	8666670
14	1011950	1	12.0	93	1728	0	0	9179847	8666671	9333337
15	738578	1	7.0	64	1094	0	0	9920153	9333338	10000004
16	522879	2	20.0	69	1003	1251	0	10444126	10000005	10666671
17	400503	2	14.0	56	1270	1071	0	10846883	10666672	11333338
18	764926	2	16.0	98	1749	1171	0	11614150	11333339	12000005

Total number of pulses in waveform = 37

Waveform Num =   20
Num of Bursts =   8
Burst Interval (us) = 1500000.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	1278770	3	8.0	96	1049	1216	1259	1278770	0	1499999
2	949817	2	16.0	93	1984	1038	0	2232111	1500000	2999999
3	2066069	3	7.0	75	1076	1570	1742	4301202	3000000	4499999
4	892658	1	18.0	60	1419	0	0	5198248	4500000	5999999

5	1009391	1	6.0	89	1666	0	0	6209058	6000000	7499999
6	2646560	3	11.0	92	1185	1223	1296	8857284	7500000	8999999
7	198596	1	5.0	60	1405	0	0	9059584	9000000	10499999
8	2298647	1	10.0	51	1576	0	0	11359636	10500000	11999999

Total number of pulses in waveform = 15

Waveform Num =   21
Num of Bursts = 11
Burst Interval (us) = 1090909.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	1035571	2	5.0	100	1743	1222	0	1035571	0	1090908
2	1092070	3	10.0	91	1038	1215	1446	2130606	1090909	2181817
3	1029260	3	10.0	57	1057	1955	1345	3163565	2181818	3272726
4	334326	3	17.0	81	1409	1146	1231	3502248	3272727	4363635
5	1794872	1	14.0	55	1383	0	0	5300906	4363636	5454544
6	1055224	3	10.0	91	1467	1222	1034	6357513	5454545	6545453
7	1002320	2	8.0	77	1227	1806	0	7363556	6545454	7636362
8	406387	1	14.0	93	1421	0	0	7772976	7636363	8727271
9	1883473	2	7.0	92	1852	1854	0	9657870	8727272	9818180
10	164543	3	15.0	93	1534	1812	1945	9826119	9818181	10909089
11	1590503	1	15.0	85	1489	0	0	11421913	10909090	11999998

Total number of pulses in waveform = 24

Waveform Num =   22
Num of Bursts =   8
Burst Interval (us) = 1500000.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	530545	2	9.0	88	1530	1075	0	530545	0	1499999

2	2220858	3	18.0	74	1144	1504	1382	2754008	1500000	2999999
3	1120446	3	8.0	71	1181	1326	1655	3878484	3000000	4499999
4	747605	1	8.0	89	1549	0	0	4630251	4500000	5999999
5	1907880	1	8.0	79	1736	0	0	6539680	6000000	7499999
6	1939918	3	14.0	86	1312	1837	1476	8481334	7500000	8999999
7	1391199	2	20.0	74	1300	1292	0	9877158	9000000	10499999
8	698076	3	14.0	95	1940	1044	1676	10577826	10500000	11999999

Total number of pulses in waveform = 18

Waveform Num =   23
Num of Bursts =   8
Burst Interval (us) = 1500000.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	106002	2	6.0	54	1915	1571	0	106002	0	1499999
2	2020078	3	6.0	52	1380	1080	1733	2129566	1500000	2999999
3	1003417	2	11.0	65	1358	1517	0	3137176	3000000	4499999
4	2257393	1	12.0	76	1218	0	0	5397444	4500000	5999999
5	1940381	2	11.0	72	1069	1462	0	7339043	6000000	7499999
6	1142969	2	20.0	75	1011	1034	0	8484543	7500000	8999999
7	515681	1	10.0	95	1522	0	0	9002269	9000000	10499999
8	2974613	1	5.0	58	1925	0	0	11978404	10500000	11999999

Total number of pulses in waveform = 14

Waveform Num =   24
Num of Bursts = 20
Burst Interval (us) =   600000.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	55528	1	16.0	56	1017	0	0	55528	0	599999

2	1075849	3	18.0	77	1931	1792	1806	1132394	600000	1199999
3	234851	3	17.0	55	1270	1758	1408	1372774	1200000	1799999
4	786240	1	19.0	68	1432	0	0	2163450	1800000	2399999
5	315859	1	18.0	69	1383	0	0	2480741	2400000	2999999
6	723597	1	9.0	52	1077	0	0	3205721	3000000	3599999
7	934087	3	6.0	70	1137	1313	1544	4140885	3600000	4199999
8	137802	1	13.0	65	1821	0	0	4282681	4200000	4799999
9	693566	2	9.0	53	1995	1687	0	4978068	4800000	5399999
10	624790	3	16.0	76	1112	1580	1572	5606540	5400000	5999999
11	852817	1	13.0	61	1678	0	0	6463621	6000000	6599999
12	199749	3	6.0	82	1370	1850	1074	6665048	6600000	7199999
13	556385	2	11.0	90	1289	1773	0	7225727	7200000	7799999
14	935759	1	19.0	87	1687	0	0	8164548	7800000	8399999
15	287137	1	20.0	69	1393	0	0	8453372	8400000	8999999
16	965694	2	16.0	76	1964	1709	0	9420459	9000000	9599999
17	596418	2	15.0	67	1281	1406	0	10020550	9600000	10199999
18	194577	3	8.0	74	1778	1952	1433	10217814	10200000	10799999
19	1164606	1	9.0	95	1377	0	0	11387583	10800000	11399999
20	456068	2	17.0	65	1559	1860	0	11845028	11400000	11999999

Total number of pulses in waveform = 37

Waveform Num =   25
Num of Bursts = 10
Burst Interval (us) = 1200000.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	96228	2	14.0	55	1913	1987	0	96228	0	1199999

2	1849548	3	14.0	88	1658	1099	1292	1949676	1200000	2399999
3	764220	1	6.0	81	1319	0	0	2717945	2400000	3599999
4	1686180	1	13.0	67	1729	0	0	4405444	3600000	4799999
5	1541612	2	14.0	91	1808	1459	0	5948785	4800000	5999999
6	58356	2	18.0	59	1460	1487	0	6010408	6000000	7199999
7	1394956	3	7.0	65	1589	1616	1857	7408311	7200000	8399999
8	1585171	2	14.0	94	1026	1241	0	8998544	8400000	9599999
9	902477	2	13.0	81	1086	1104	0	9903288	9600000	10799999
10	2001261	1	8.0	91	1700	0	0	11906739	10800000	11999999

Total number of pulses in waveform = 19

Waveform Num = 26
Num of Bursts = 8
Burst Interval (us) = 1500000.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	1404386	1	16.0	59	1998	0	0	1404386	0	1499999
2	186293	3	17.0	88	1820	1878	1019	1592677	1500000	2999999
3	2664650	1	12.0	75	1660	0	0	4262044	3000000	4499999
4	671583	3	9.0	95	1186	1392	1649	4935287	4500000	5999999
5	2355631	2	19.0	93	1302	1409	0	7295145	6000000	7499999
6	1686658	2	14.0	67	1573	1202	0	8984514	7500000	8999999
7	1347916	3	13.0	93	1371	1534	1951	10335205	9000000	10499999
8	1094785	3	14.0	71	1525	1671	1754	11434846	10500000	11999999

Total number of pulses in waveform = 18

Waveform Num = 27
Num of Bursts = 11
Burst Interval (us) = 1090909.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	778869	3	9.0	95	1835	1968	1685	778869	0	1090908
2	1283627	3	12.0	97	1801	1874	1671	2067984	1090909	2181817
3	746804	1	12.0	87	1127	0	0	2820134	2181818	3272726
4	513251	3	15.0	63	1754	1679	1459	3334512	3272727	4363635
5	1173134	2	17.0	94	1311	1395	0	4512538	4363636	5454544
6	991839	3	13.0	72	1847	1300	1441	5507083	5454545	6545453
7	1990262	2	18.0	60	1111	1272	0	7501933	6545454	7636362
8	383816	2	11.0	87	1072	1254	0	7888132	7636363	8727271
9	1533077	2	16.0	76	1882	1642	0	9423535	8727272	9818180
10	562167	1	9.0	89	1982	0	0	9989226	9818181	10909089
11	1397813	3	14.0	60	1320	1677	1110	11389021	10909090	11999998

Total number of pulses in waveform = 25

Waveform Num =   28
Num of Bursts =   9
Burst Interval (us) = 1333333.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	698797	2	5.0	90	1632	1511	0	698797	0	1333332
2	1559428	3	9.0	63	1402	1690	1651	2261368	1333333	2666665
3	1085018	3	20.0	83	1930	1410	1645	3351129	2666666	3999998
4	931790	2	7.0	73	1794	1626	0	4287904	3999999	5333331
5	1682241	3	17.0	91	1398	1666	1843	5973565	5333332	6666664
6	1164827	1	18.0	69	1772	0	0	7143299	6666665	7999997
7	1125451	1	15.0	63	1734	0	0	8270522	7999998	9333330
8	1424541	2	6.0	78	1195	1068	0	9696797	9333331	10666663

9	985010	1	12.0	89	1434	0	0	10684070	10666664	11999996

Total number of pulses in waveform = 18

Waveform Num =   29
Num of Bursts = 16
Burst Interval (us) =   750000.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	733237	1	15.0	61	1460	0	0	733237	0	749999
2	672618	3	5.0	99	1359	1630	1577	1407315	750000	1499999
3	592966	3	6.0	82	1441	1718	1079	2004847	1500000	2249999
4	306623	3	20.0	80	1617	1092	1286	2315708	2250000	2999999
5	753492	2	11.0	76	1908	1990	0	3073195	3000000	3749999
6	905759	3	13.0	93	1740	1368	1078	3982852	3750000	4499999
7	979900	2	19.0	50	1405	1562	0	4966938	4500000	5249999
8	468618	1	15.0	94	1355	0	0	5438523	5250000	5999999
9	953032	2	9.0	75	1639	1003	0	6392910	6000000	6749999
10	902093	3	18.0	92	1050	1655	1906	7297645	6750000	7499999
11	731444	2	18.0	60	1417	1932	0	8033700	7500000	8249999
12	937277	1	11.0	57	1313	0	0	8974326	8250000	8999999
13	345701	3	17.0	55	1589	1866	1425	9321340	9000000	9749999
14	1094125	1	16.0	69	1919	0	0	10420345	9750000	10499999
15	707488	2	16.0	66	1338	1951	0	11129752	10500000	11249999
16	310585	1	5.0	83	1356	0	0	11443626	11250000	11999999

Total number of pulses in waveform = 33

Waveform Num =   30
Num of Bursts = 14
Burst Interval (us) =   857143.0

Burst #	Off Time (us)	# Pulses	Chirp (MHz)	PW (us)	Pulse 1 Pri(us)	Pulse 2 Pri(us)	Pulse 3 Pri(us)	Start Loc (us)	Start Burst Interval(us)	End Burst Interval(us)
1	268605	1	19.0	97	1611	0	0	268605	0	857142
2	1138868	3	10.0	52	1370	1134	1169	1409084	857143	1714285
3	370070	2	18.0	85	1184	1569	0	1782827	1714286	2571428
4	985313	1	5.0	93	1113	0	0	2770893	2571429	3428571
5	1211507	1	20.0	61	1638	0	0	3983513	3428572	4285714
6	447601	3	9.0	63	1755	1172	1566	4432752	4285715	5142857
7	1027720	3	11.0	52	1783	1601	1343	5464965	5142858	6000000
8	629330	1	5.0	51	1600	0	0	6099022	6000001	6857143
9	1094789	1	7.0	99	1387	0	0	7195411	6857144	7714286
10	989174	1	16.0	59	1089	0	0	8185972	7714287	8571429
11	1093001	1	18.0	85	1594	0	0	9280062	8571430	9428572
12	548510	3	7.0	50	1130	1489	1921	9830166	9428573	10285715
13	1040393	1	12.0	98	1886	0	0	10875099	10285716	11142858
14	909586	2	14.0	55	1763	1948	0	11786571	11142859	12000001

Total number of pulses in waveform = 24

V. Test Equipment

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 #	Equipment	Manufacturer	Model#	Cal Date	Cal Due
1T4300	Semi-anechoic chamber # 1	EMC Test Systems	None	08/24/2007	08/24/2010
1T2665	Horn Antenna	EMCO	3115	07/06/2009	07/06/2010
1T4442	Pre-amplifier, Microwave	Miteq	AFS42-01001800-30-10P	See Note	
1T4592	RF Filter Kit	Various	N/A	See Note	
1T4612	ESA-E Series Spectrum Analyzer	Agilent	E4407B	09/09/2009	09/09/2010
1T4505	Temperature Chamber	Test Equity	115	10/01/2009	10/01/2010
1T4688	Horn Antenna	Custom Microwave, Inc.	HO42S	See Note	
1T4689	Horn Antenna	Custom Microwave, Inc.	HO28S	See Note	
1T4155	Harmonic Mixer 26.5 to 40 GHz	HP	11970A	See Note	

Table 27. Test Equipment List

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

VI. 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

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.

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.

End of Report