MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
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January 31, 2011

Ubiquiti Networks
91 E. Tasman
San Jose, CA 95134

Dear Robert Pera,

Enclosed is the EMC Wireless test report for compliance testing of the Ubiquiti Networks, XR5i as tested to the requirements for Indian Market.

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,
MET LABORATORIES, INC.

Jennifer Warnell
Documentation Department

Reference: (\Ubiquiti Networks\EMC30485-IND)

Electromagnetic Compatibility Criteria
Test Report

for the

Ubiquiti Networks
XR5i

Tested under
Class A Digital Devices
&
Intentional Radiators

MET Report: EMC30485-IND

January 31, 2011

Prepared For:

Ubiquiti Networks
91 E. Tasman
San Jose, CA 95134

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

Electromagnetic Compatibility Criteria
Test Report

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Tested under
Class A Digital Devices
&
Intentional Radiators

Manasi Bhandiwad, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Warnell
Documentation Department

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

Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	January 31, 2011	Initial 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**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**ert**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**ert**z**
kPa	**k**ilo**pa**scal
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µH	**microh**enry
µ	**microf**arad
µs	**micros**econds
NEBS	**N**etwork **E**quipment-**B**uilding **S**ystem
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
TWT	**T**raveling **W**ave **T**ube
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane

I. Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Ubiquiti Networks XR5i, with the requirements for Digital Devices and Intentional Radiators. All references are to the most current version. The following data is presented in support of the Certification of the XR5i. Ubiquiti Networks should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the XR5i, has been **permanently** discontinued.

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance, in accordance with Ubiquiti Networks, purchase order number US100110. All tests were conducted using measurement procedure ANSI C63.4-2003.

Description	Compliance
Conducted Emission Limits for a Class A Digital Device	Compliant
Radiated Emission Limits for a Class A Digital Device	Compliant
Conducted Emission Voltage	Compliant
Occupied Bandwidth	Compliant
RF Output Power	Compliant
Radiated Spurious Emissions	Compliant
Emissions at Restricted Band	Compliant
Conducted Spurious Emissions	Compliant
Power Spectral Density	Compliant
Maximum Permissible Exposure	Compliant
Frequency Stability	Compliant

Table 1. Executive Summary of EMC ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Ubiquiti Networks to perform testing on the XR5i, under Ubiquiti Networks's purchase order number US100110.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Ubiquiti Networks, XR5i.

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

Model(s) Tested:	XR5i	
Model(s) Covered:	XR5i	
EUT Specifications:	Primary Power: 120 VAC, 60 Hz	
	Type of Modulations:	OFDM
	Peak RF Output Power:	12.29 dBm
	EUT Frequency Ranges:	5.825 – 5.875 GHz
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature: 15-35° C	
	Relative Humidity: 30-60%	
	Barometric Pressure: 860-1060 mbar	
Evaluated by:	Manasi Bhandiwad	
Report Date(s):	January 31, 2011	

Table 2. EUT Summary Table

B. References

CFR 47, Part 15, Subpart C	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: General Rules and Regulations, Allocation, Assignment, and Use of Radio Frequencies
CFR 47, Part 15, Subpart B	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
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
ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices

Table 3. References

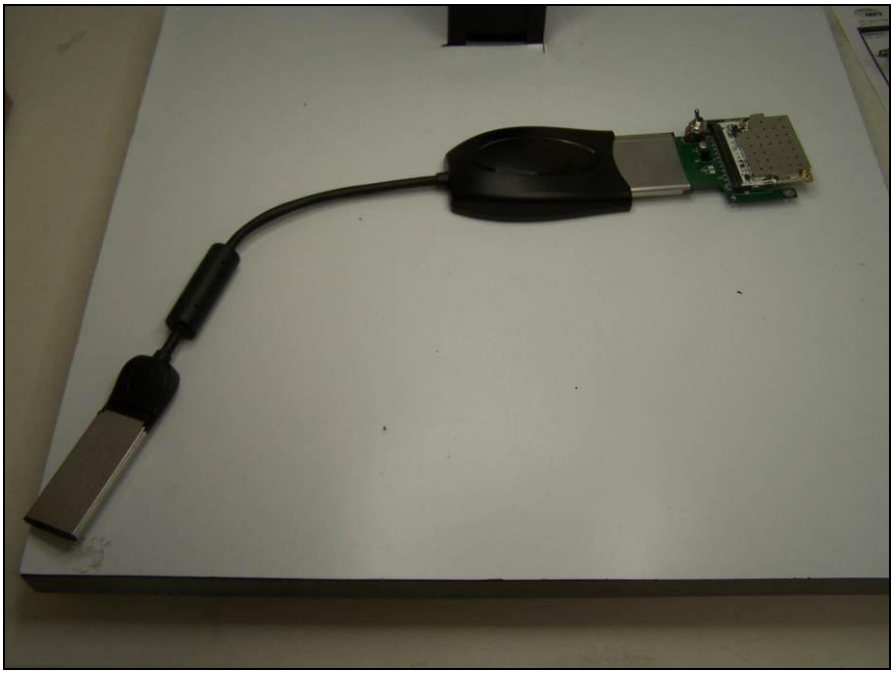
C. Test Site

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 Ubiquiti Networks XR5i, Equipment Under Test (EUT), is a modular mini-PCI radio to be installed and controlled by a host computer.



Photograph 1. Ubiquiti Networks XR5i

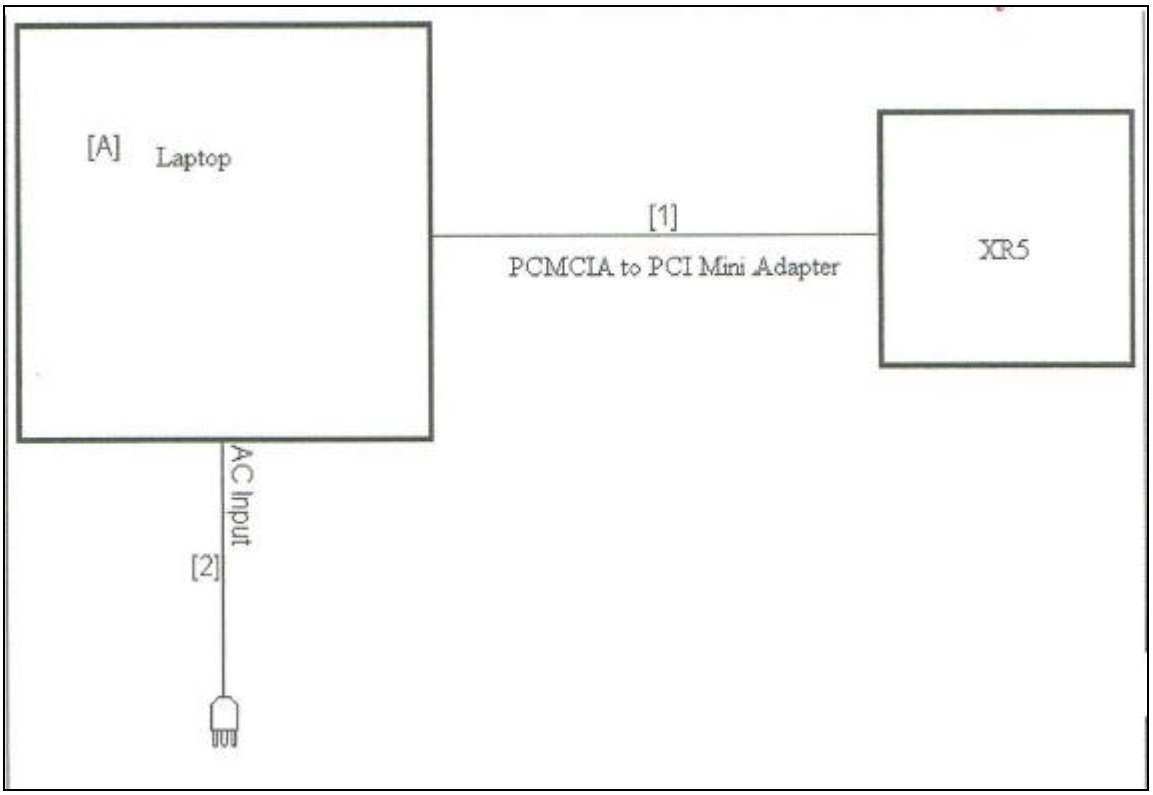


Figure 1. Block Diagram of Test Configuration

E. Equipment Configuration

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

Ref. ID	Name / Description	Model Number	Manufacturer
B	XR5 with 23dBi Panel Antenna	XR5-I	Ubiquiti

Table 4. Equipment Configuration

F. Support Equipment

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

Ref. ID	Name / Description	Manufacturer	Model Number
A	Laptop	Dell	Vostro 1510
1	PCMCIA to PCI mini adapter	Duel Adapter	DA-001

Table 5. Support Equipment

G. Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Point
2	AC Input	3 conductor, 18 awg	1	2	N	(120v/60hz)

Table 6. Ports and Cabling Information

H. Mode of Operation

The XR5i is an 802.11a radio and will be used in point-to-point scenarios.

I. Method of Monitoring EUT Operation

When the EUT is operating as intended, an LED will be lit. Once powered on, the software program ART may be used on the house computer to control the EUT.

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 Ubiquiti Networks upon completion of testing.

III. Electromagnetic Compatibility Criteria for Unintentional Radiators

Electromagnetic Compatibility Criteria

Conducted Emissions Limits

Test Requirement(s): Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 7. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 7. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

Except as shown in paragraphs (b) and (c) of this section*, charging, AC adapters or battery eliminators the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the Table 7, as measured using a 50 μH/50 ohms 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 frequencies ranges.

Frequency range (MHz)	Class A Conducted Limits (dBμV)		*Class B Conducted Limits (dBμV)	
	Quasi-Peak	Average	Quasi-Peak	Average
* 0.15- 0.45	79	66	66 - 56	56 - 46
0.45 - 0.5	79	66	56	46
0.5 - 30	73	60	60	50
Note 1 — The lower limit shall apply at the transition frequencies. Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz. * -- Limits per Subsection 15.207(a).				

Table 7. Conducted Limits for Radio Frequency Devices

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

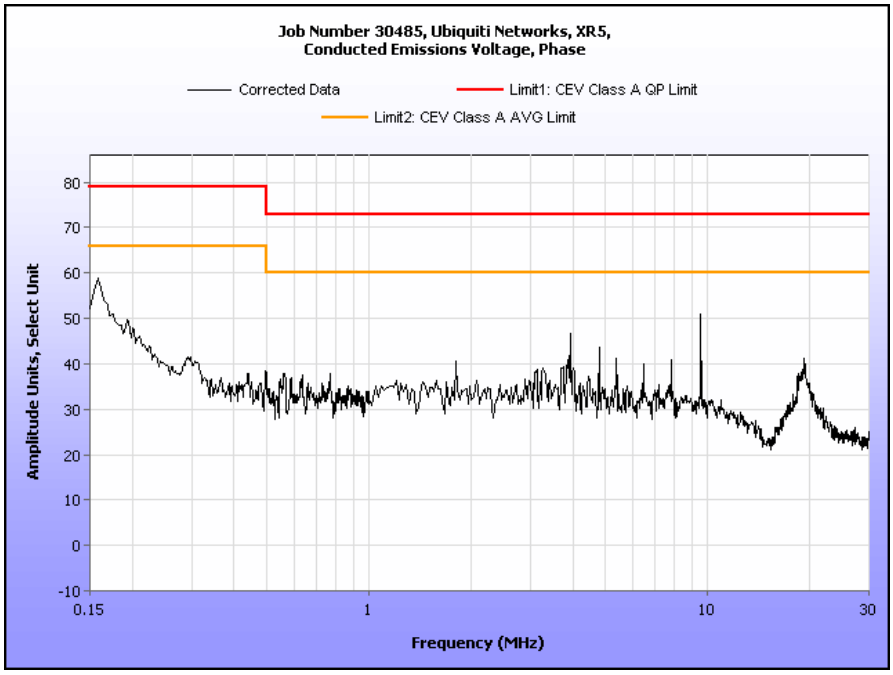
Test Engineer(s): Manasi Bhandiwad

Test Date(s): 01/14/11

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

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.15	56.95	0.07	57.02	79	-21.98	41.38	0.07	41.45	66	-24.55
0.1835	43.18	0.1	43.28	79	-35.72	17.1	0.1	17.2	66	-48.8
0.215	44.11	0.1	44.21	79	-34.79	18.32	0.1	18.42	66	-47.58
3.92	28.94	0.1	29.04	73	-43.96	23.39	0.1	23.49	60	-36.51
9.553	46.01	0.11	46.12	73	-26.88	21.05	0.11	21.16	60	-38.84
19	30.37	0.07	30.44	73	-42.56	22.17	0.07	22.24	60	-37.76

Table 8. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz)

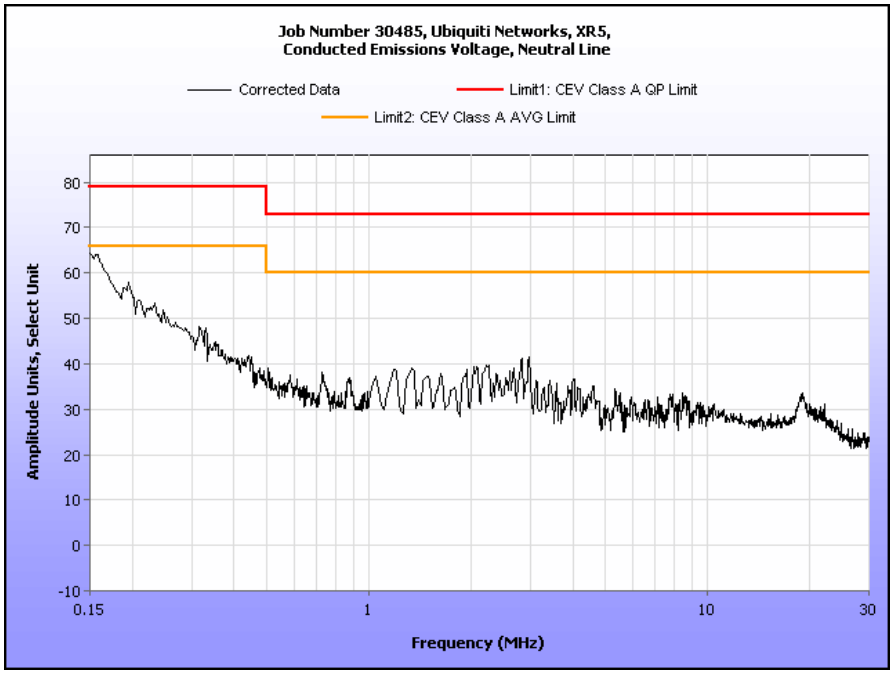


Plot 1. Conducted Emission, Phase Line Plot

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

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.1555	57.63	0.07	57.7	79	-21.3	35.27	0.07	35.34	66	-30.66
0.184	55.08	0.1	55.18	79	-23.82	24.01	0.1	24.11	66	-41.89
0.2	51.11	0.11	51.22	79	-27.78	23.74	0.11	23.85	66	-42.15
0.322	40.46	0	40.46	79	-38.54	28.65	0	28.65	66	-37.35
1.337	36.8	0.06	36.86	73	-36.14	35.71	0.06	35.77	60	-24.23
2.822	26.28	0.06	26.34	73	-46.66	32.5	0.06	32.56	60	-27.44

Table 9. Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz)



Plot 2. Conducted Emission, Neutral Line Plot

Conducted Emission Limits Test Setup

Photograph 2. Conducted Emissions, Test Setup

Radiated Emission Limits

Radiated Emissions Limits

Test Requirement(s): Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the Class B limits expressed in Table 10.

The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the Class A limits expressed in Table 10.

Frequency (MHz)	Field Strength (dBµV/m)	
	Class A Limit (dBµV) @ 10m	Class B Limit (dBµV) @ 3m
30 - 88	39.00	40.00
88 - 216	43.50	43.50
216 - 960	46.40	46.00
Above 960	49.50	54.00

Table 10. Radiated Emissions Limits

Test Procedures: The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.4 were used. An antenna was located 3 m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1 m and 4 m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. Unless otherwise specified, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

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

Test Engineer(s): Manasi Bhandiwad

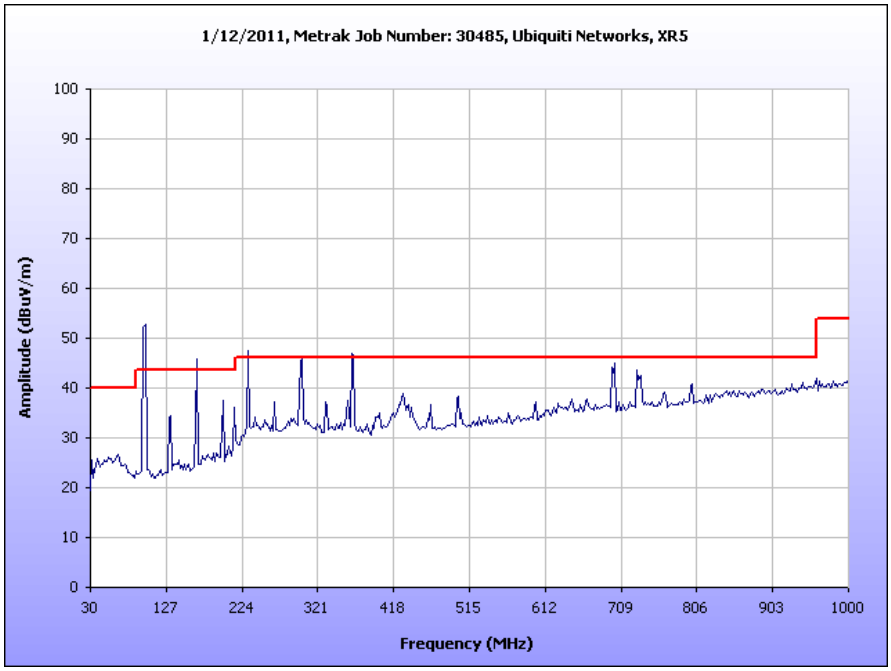
Test Date(s): 12/29/10

Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
99.97996	84	H	3.02	37.97	10.39	0.23	10.46	38.13	43.50	-5.37
99.97996	28	V	1.01	33.86	10.39	0.23	10.46	34.02	43.50	-9.48
166.01703	234	H	1.85	34.26	12.50	0.23	10.46	36.53	43.50	-6.97
166.01703	182	V	1.00	30.14	12.50	0.23	10.46	32.41	43.50	-11.09
233.18245	225	H	1.29	34.34	11.83	0.32	10.46	36.03	46.40	-10.37
233.18245	212	V	1.00	26.78	11.83	0.32	10.46	28.47	46.40	-17.93
299.7996	245	H	1.01	30.58	14.10	0.83	10.46	35.05	46.40	-11.35
299.7996	241	V	1.00	19.40	14.10	0.83	10.46	23.87	46.40	-22.53
365.9476	77	H	1.23	23.99	15.42	0.83	10.46	29.78	46.40	-16.62
365.9476	342	V	1.34	18.24	15.42	0.83	10.46	24.03	46.40	-22.37
492.52505	317	H	1.32	13.06	17.95	1.00	10.46	21.55	46.40	-24.85
492.52505	186	V	1.32	13.38	17.95	1.00	10.46	21.87	46.40	-24.53

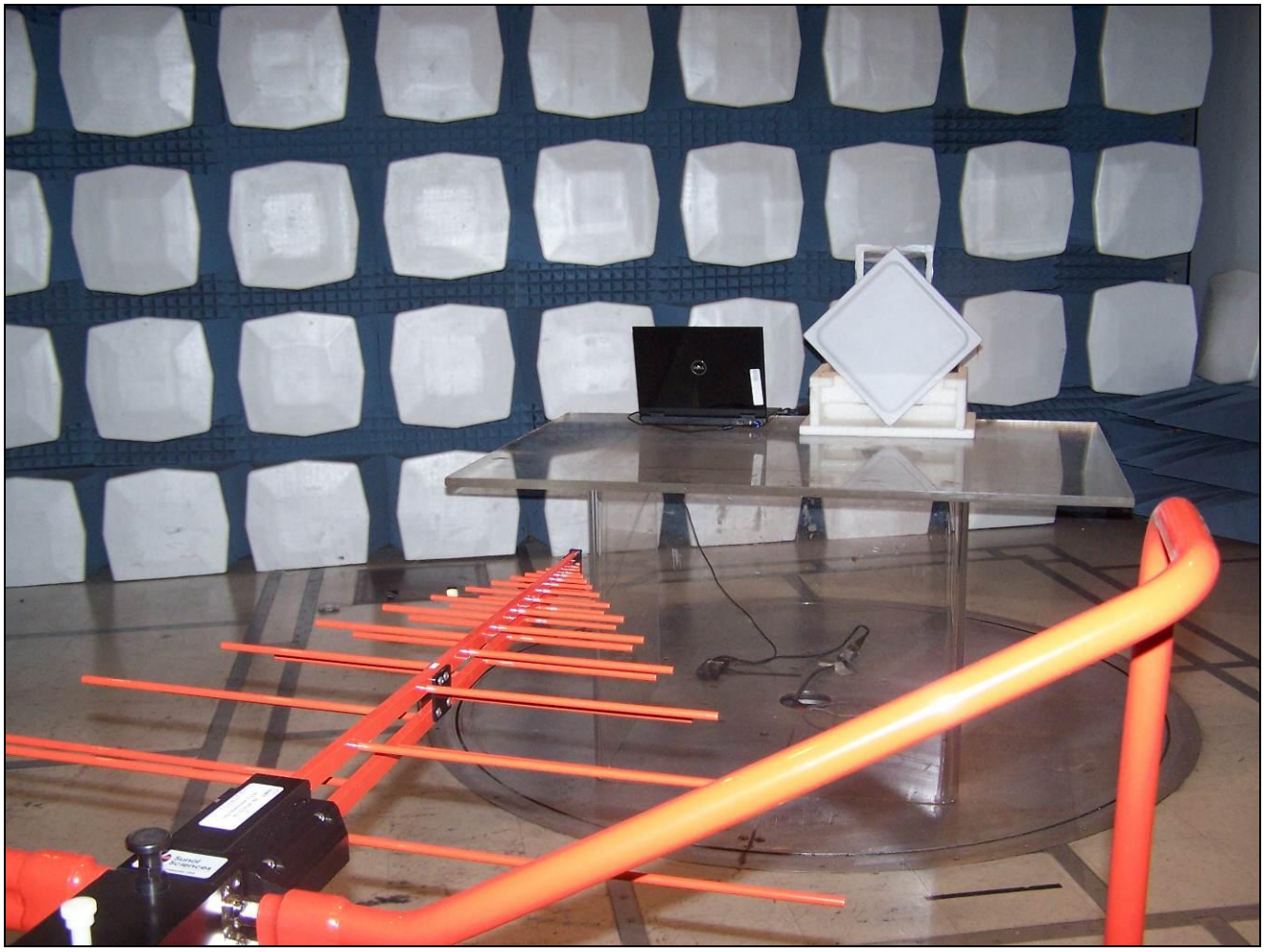
Table 11. Radiated Emissions Limits, Test Results

Note: The EUT was tested at 3 m.



Plot 3. Radiated Emissions, Pre-Scan

Radiated Emission Limits Test Setup



Photograph 3. Radiated Emission, Test Setup

IV. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

Conducted Emissions Limits

Test Requirement(s): 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)	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 12. Conducted Limits for Intentional Radiators

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

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

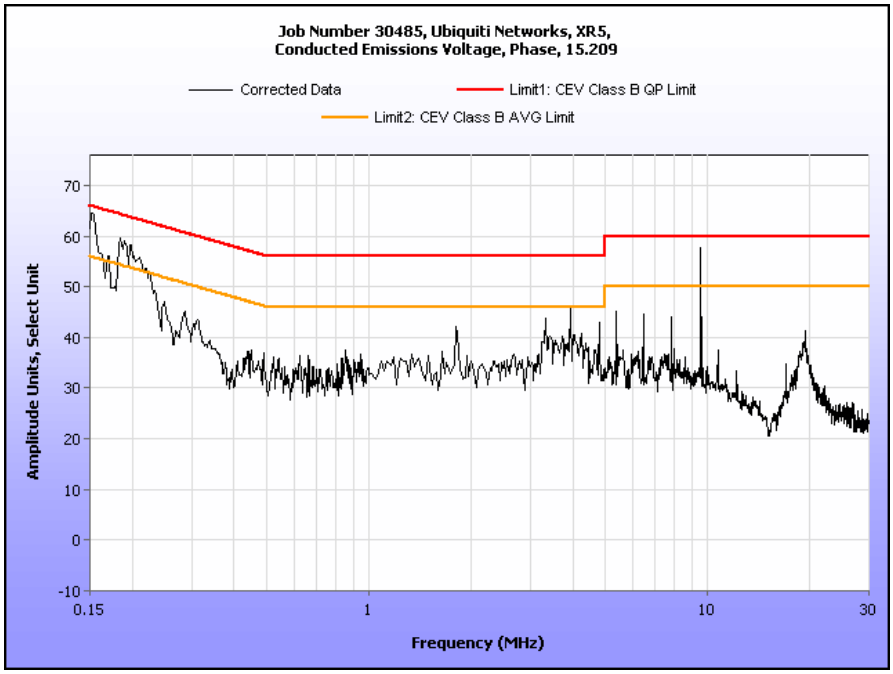
Test Engineer(s): Manasi Bhandiwad

Test Date(s): 01/14/11

Conducted Emissions Test Results

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.151	54.8	0	54.8	65.95	-11.15	38.22	0	38.22	55.95	-17.73
0.1936	54.59	0.02	54.61	63.88	-9.27	23	0.02	23.02	53.88	-30.86
0.273	38.34	0	38.34	61.03	-22.69	17.15	0	17.15	51.03	-33.88
1.812	29.38	0	29.38	56	-26.62	13	0	13	46	-33
3.928	41.08	0.01	41.09	56	-14.91	20.42	0.01	20.43	46	-25.57
9.553	49.6	0.03	49.63	60	-10.37	24.17	0.03	24.2	50	-25.8
19.57	31.08	0	31.08	60	-28.92	20.56	0	20.56	50	-29.44

Table 13. Conducted Emissions, Phase Line, Test Results

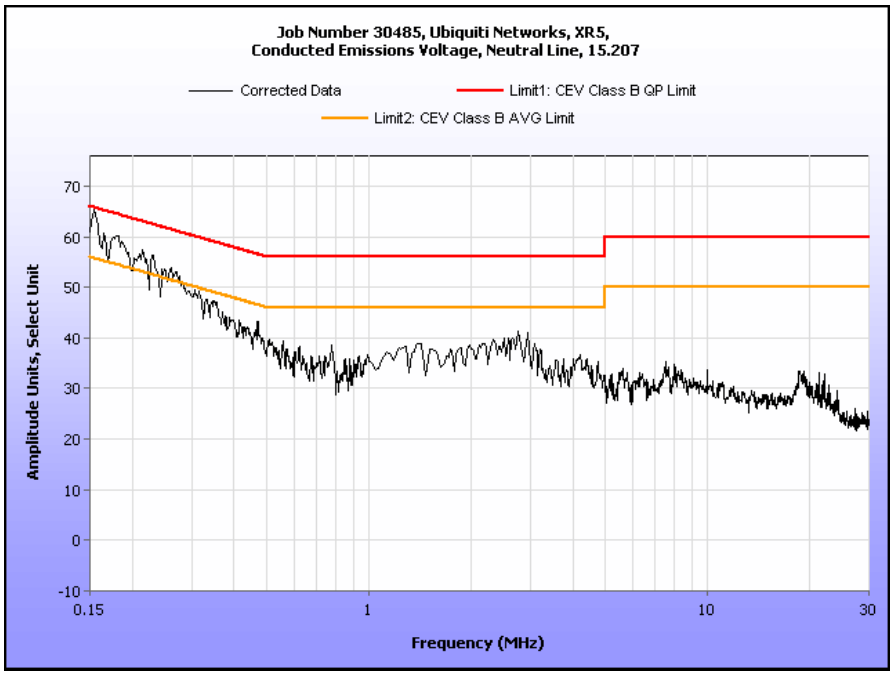


Plot 4. Conducted Emissions, Phase Line

Conducted Emissions Test Results

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.151	58.64	0	58.64	65.95	-7.31	35.5	0	35.5	55.95	-20.45
0.1755	54.02	0.01	54.03	64.7	-10.67	26.57	0.01	26.58	54.7	-28.12
0.212	49.22	0.01	49.23	63.13	-13.9	22.45	0.01	22.46	53.13	-30.67
0.467	36.23	0	36.23	56.57	-20.34	33.62	0	33.62	46.57	-12.95
1.978	32.91	0	32.91	56	-23.09	22.64	0	22.64	46	-23.36
2.5	35.18	0	35.18	56	-20.82	27.5	0	27.5	46	-18.5

Table 14. Conducted Emissions, Neutral Line, Test Results



Plot 5. Conducted Emissions, Neutral Line

Conducted Emissions Test Setup Photo

Photograph 4. Conducted Emissions, Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

6 dB and 99% Bandwidth

Test Requirements: Operation under the provisions of this section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

For systems using digital modulation techniques, the EUT may operate in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

Test Procedure:

6 dB Occupied Bandwidth:
The transmitter was on and transmitting at the highest output power. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately 1% of the total emission bandwidth, VBW > RBW. The 6 dB Bandwidth was measured and recorded. The measurements were performed on the low, mid and high channels. Peak detector was used.

99% Occupied Bandwidth:
The transmitter was on and transmitting at the highest output power. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately 1% of the span, VBW > RBW. The 99% Bandwidth was measured and recorded. The measurements were performed on the low, mid and high channels. Sample detector was used.

Test Results The EUT was compliant with this requirement.

The 6 dB and 99% Bandwidth was determined from the plots on the following pages.

Test Engineer(s): Manasi Bhandiwad

Test Date(s): 12/29/10 - 01/03/11

Figure 2. Block Diagram, Occupied Bandwidth Test Setup

Occupied Bandwidth Test Results

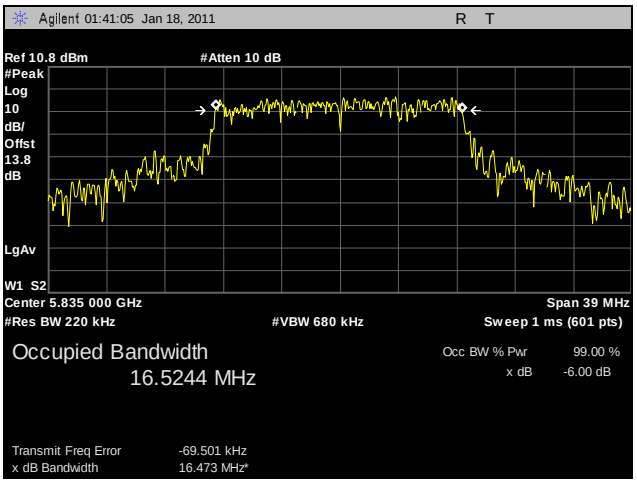
Occupied Bandwidth		
Carrier Channel	**Frequency (MHz)**	**Measured 6 dB Bandwidth (MHz)**
Low	5835	16.473
Mid	5850	16.204
High	5865	16.359

Table 15. 6 dB Occupied Bandwidth, Test Results

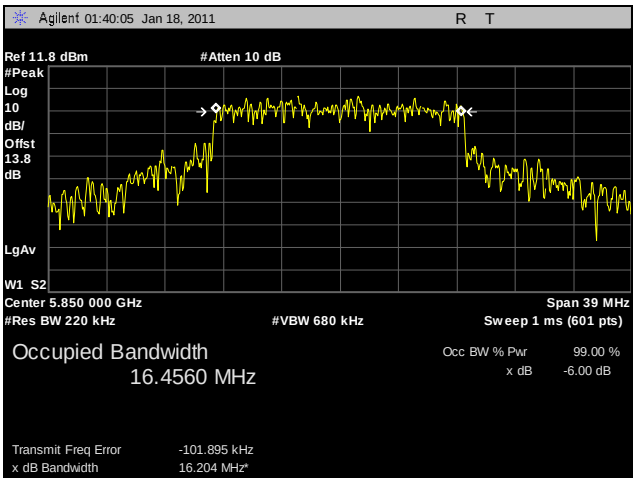
Occupied Bandwidth		
Carrier Channel	**Frequency (MHz)**	**Measured 99% Bandwidth (MHz)**
Low	5835	16.642
Mid	5850	16.732
High	5865	16.616

Table 16. 99% Occupied Bandwidth, Test Results

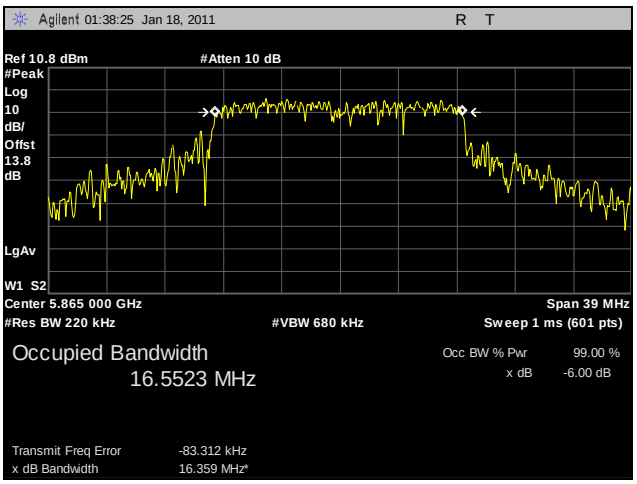
Occupied Bandwidth Test Results



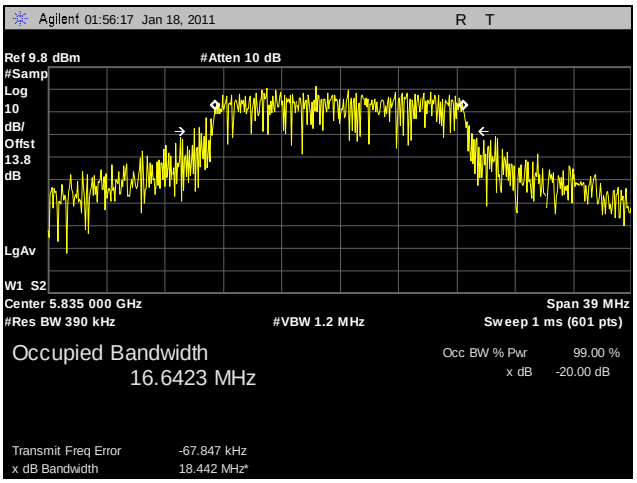
Plot 6. 6 dB Occupied Bandwidth, Low Channel



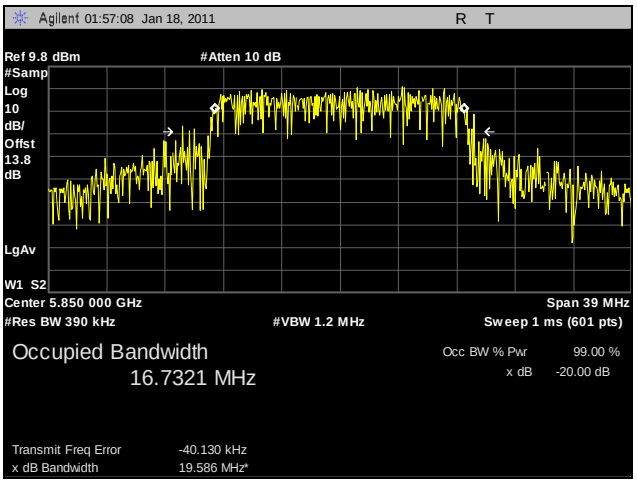
Plot 7. 6 dB Occupied Bandwidth, Mid Channel



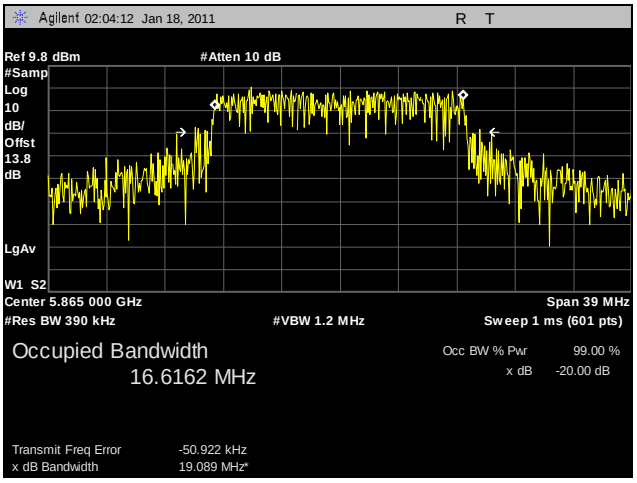
Plot 8. 6 dB Occupied Bandwidth, High Channel



Plot 9. 99% Occupied Bandwidth, Low Channel



Plot 10. 99% Occupied Bandwidth, Mid Channel



Plot 11. 99% Occupied Bandwidth, High Channel

Electromagnetic Compatibility Criteria for Intentional Radiators

Peak Power Output and Peak Excursion

Test Requirements: The maximum peak 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 17. Output Power Requirements

For the band 5.725–5.825 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 1 W or 17 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz.

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

Test Results: The EUT was compliant with the Peak Power Output limits.

Test Engineer(s): Manasi Bhandiwad

Test Date(s): 12/29/10 - 01/03/11

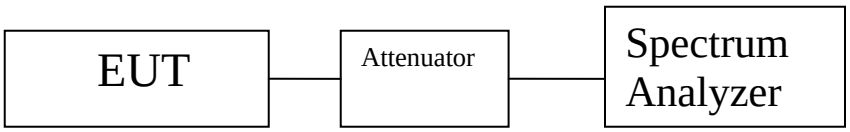


Figure 3. Peak Power Output Test Setup

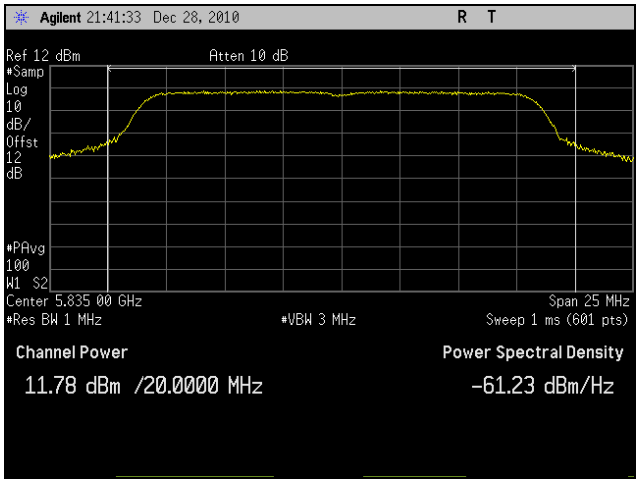
RF Power Output Test Results

Peak Conducted Output Power		
Carrier Channel	**Frequency (MHz)**	**Measured Peak Output Power dBm**
Low	5835	11.78
Mid	5850	12.29
High	5865	11.91

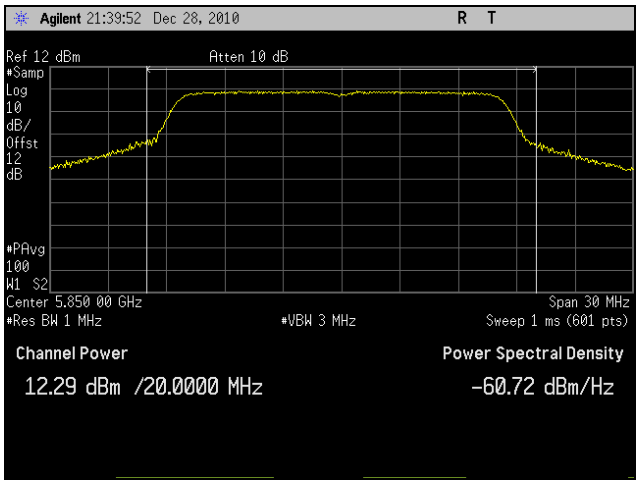
Table 18. RF Output Power, Test Results

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 1 MHz and VBW was set to 3 MHz. The method of measurement number from the FCC public notice DA 02-2138 was used.

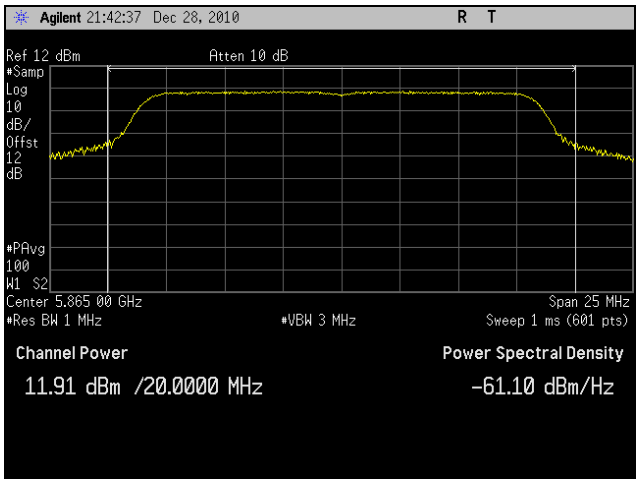
RF Output Power Test Results



Plot 12. Peak Output Power, Low Channel, 5835 MHz



Plot 13. Peak Output Power, Mid Channel, 5850 MHz



Plot 14. Peak Output Power, High Channel, 5865 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

Peak Excursion Ratio

Test Requirements: 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 an attenuation. The span was set to view the entire emission bandwidth. Since method #1 of FCC public notice DA 02-2138 was used for peak conducted output transmit power, the second trace was created using method #1.

Test Results: Equipment was compliant with the peak excursion ratio limits.

Test Engineer(s): Manasi Bhandiwad

Test Date(s): 12/29/10

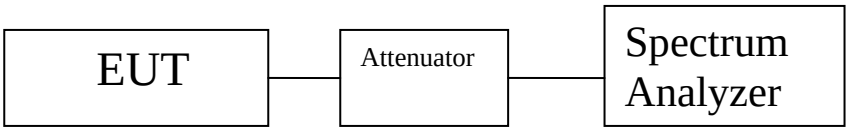
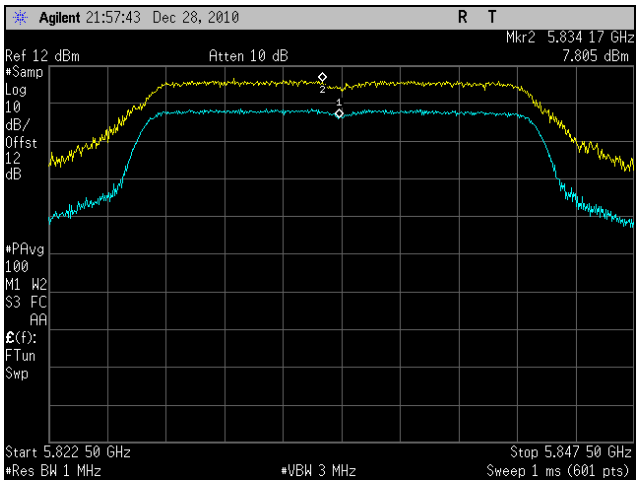
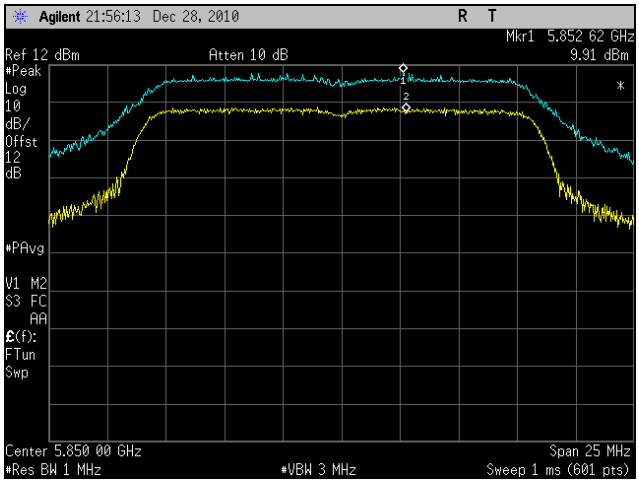


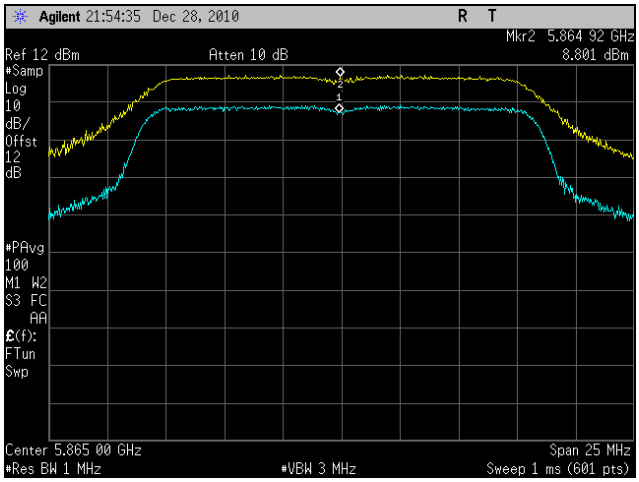
Figure 4. Peak Excursion Ration Test Setup



Plot 15. Peak Excursion, Low Channel



Plot 16. Peak Excursion, Mid Channel



Plot 17. Peak Excursion, High Channel

Electromagnetic Compatibility Criteria for Intentional Radiators

RF Exposure

RF Exposure Requirements: 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: 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, except in the case of portable devices which shall be evaluated.

Max Antenna Gain- 23dBi

Limit for uncontrolled exposure = $1 mW/cm^2$

$S = PG / 4\pi R^2$

$S = 0.6707 mW/cm^2$

Electromagnetic Compatibility Criteria for Intentional Radiators

Radiated Spurious Emissions Requirements and Band Edge

Test Requirements: Emissions outside the frequency band.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified is not required. In addition, radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits.

Test Requirement(s): Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in Table 19.

Frequency (MHz)	Radiated Emission Limits (dBµV) @ 3m
30 - 88	40.00
88 - 216	43.50
216 - 960	46.00
Above 960	54.00

Table 19. Radiated Emissions Limits

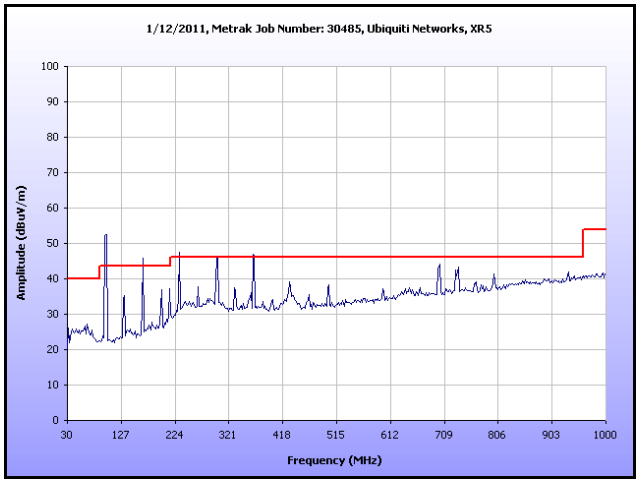
Test Procedures: The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line. Only noise floor was measured above 18 GHz.

Test Results: The EUT was compliant with the Radiated Spurious Emission limits. In the 30 MHz – 1 GHz range, the emissions on all the channels – low, mid, and high are over the limits. However, it has been identified that these emissions which exceed the limits are digital emissions. This is further evident from the 30 MHz – 1 GHz plots for the low, mid and high channel in the receiver mode.

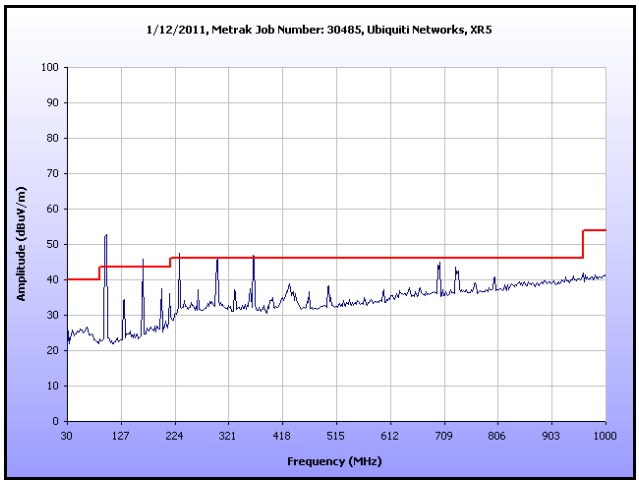
Test Engineer(s): Manasi Bhandiwad

Test Date(s): 01/05/11 - 01/14/11

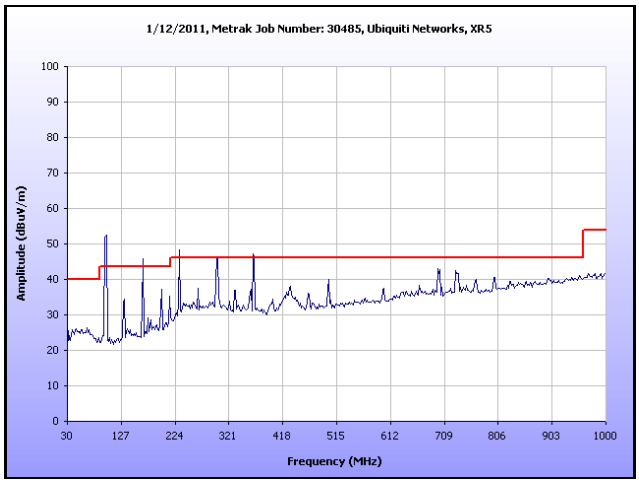
Radiated Spurious Emissions Test Results



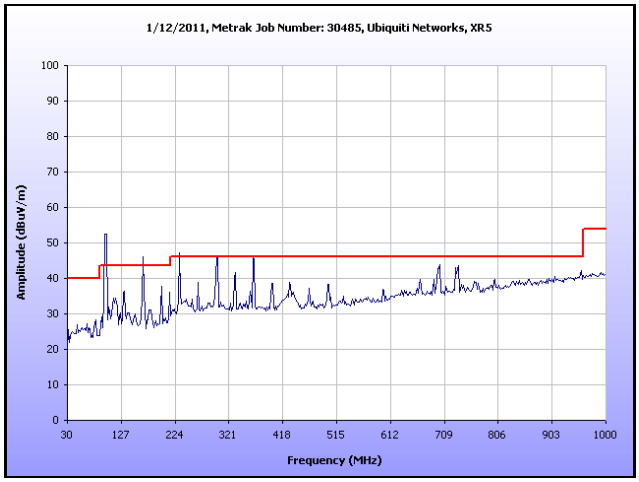
Plot 18. Radiated Spurious Emissions, Low Channel, Receive



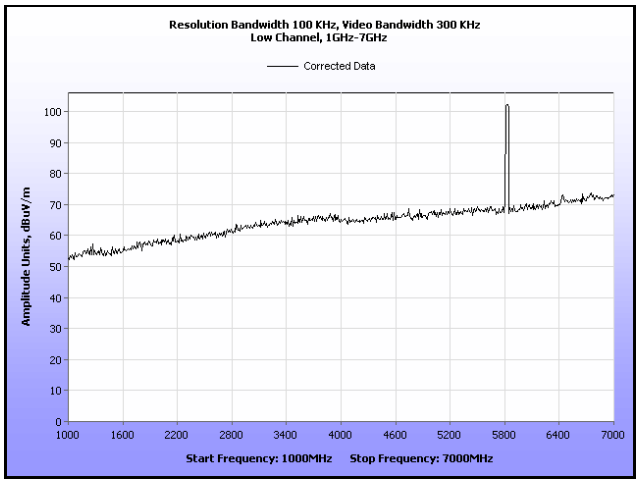
Plot 19. Radiated Spurious Emissions, Mid Channel Receive



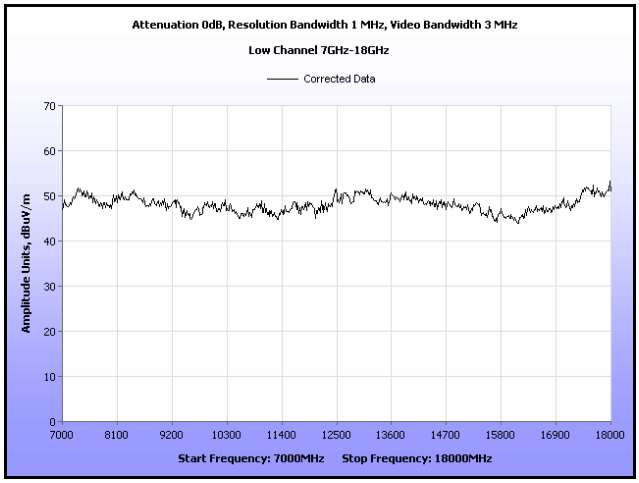
Plot 20. Radiated Spurious Emissions, High Channel, Receive



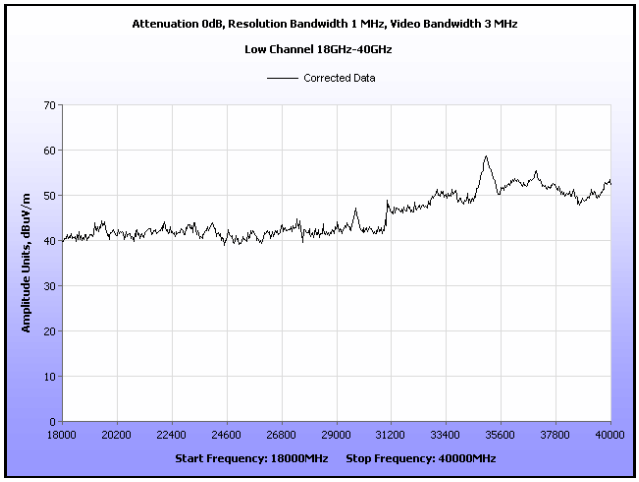
Plot 21. Radiated Spurious Emissions, Low Channel 30 MHz – 1 GHz



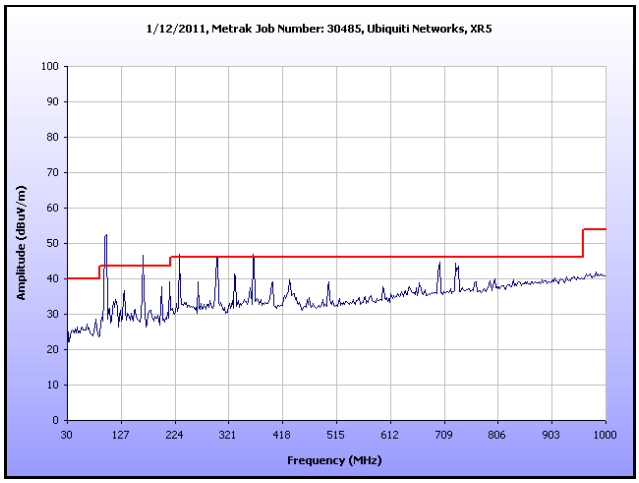
Plot 22. Radiated Spurious Emissions, Low Channel, 1 GHz – 7 GHz



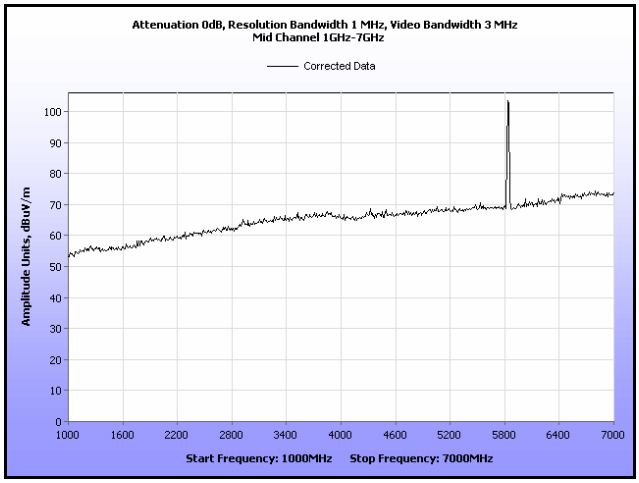
Plot 23. Radiated Spurious Emissions, Low Channel, 7 GHz – 18 GHz



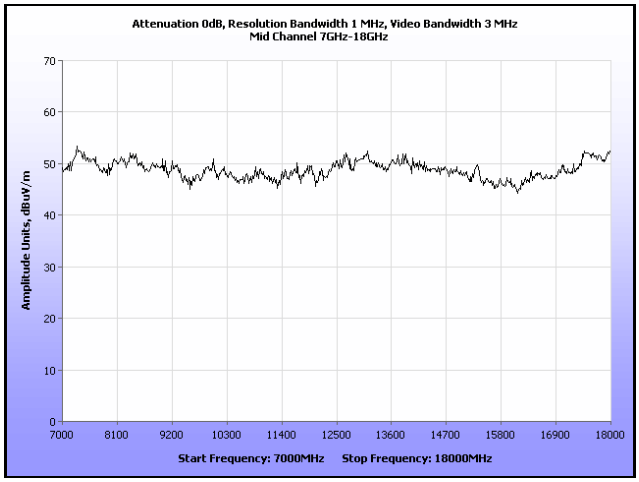
Plot 24. Radiated Spurious Emissions, Low Channel, 18 GHz – 40 GHz



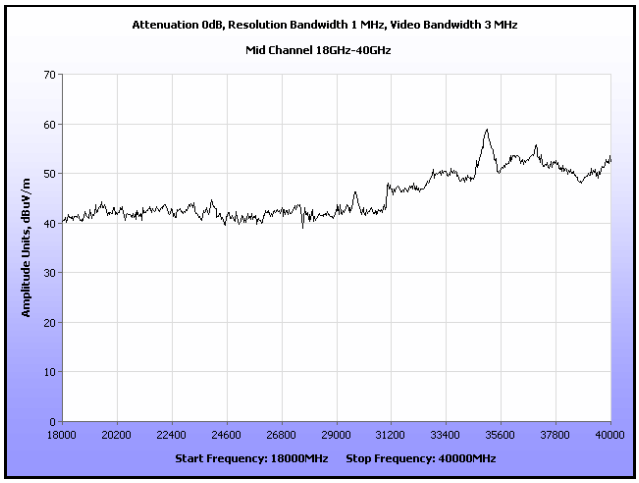
Plot 25. Radiated Spurious Emissions, Mid Channel, 30 MHz – 1 GHz



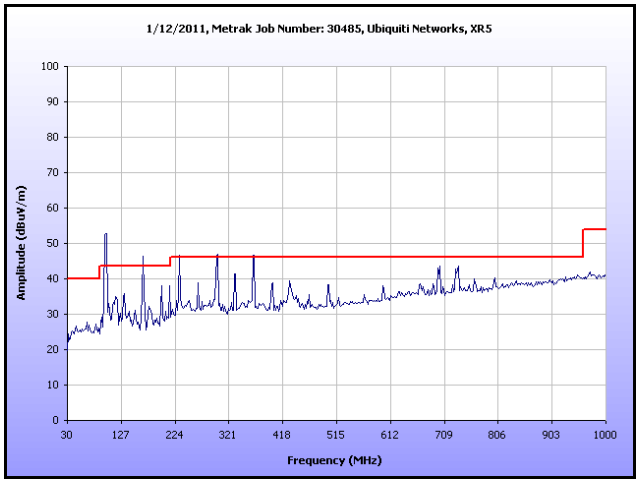
Plot 26. Radiated Spurious Emissions, Mid Channel, 1 GHz – 7 GHz



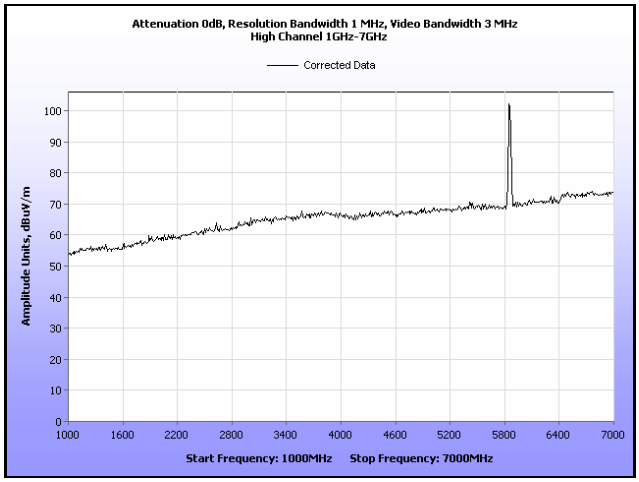
Plot 27. Radiated Spurious Emissions, Mid Channel, 7 GHz – 18 GHz



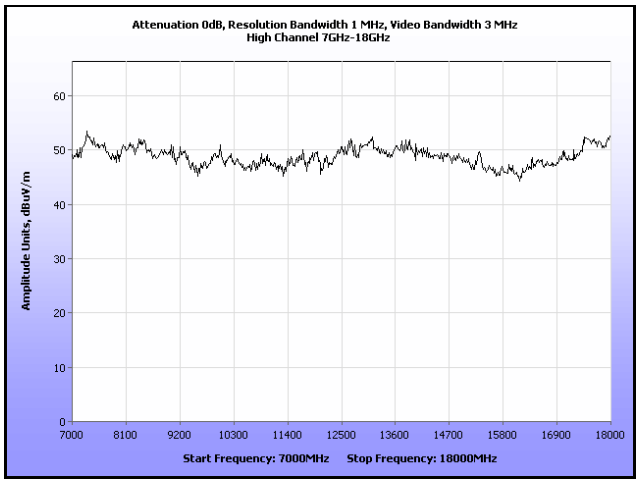
Plot 28. Radiated Spurious Emissions, Mid Channel 18 GHz – 40 GHz



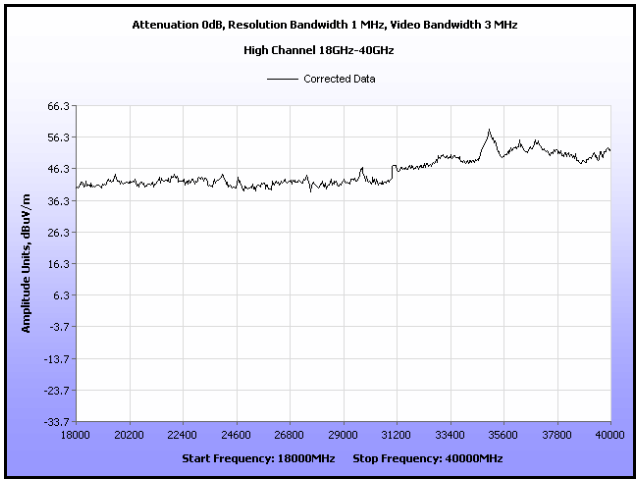
Plot 29. Radiated Spurious Emissions, High Channel, 30 MHz – 1 GHz



Plot 30. Radiated Spurious Emissions, High Channel, 1 GHz – 7 GHz



Plot 31. Radiated Spurious Emissions, High Channel, 7 GHz – 18 GHz



Plot 32. Radiated Spurious Emissions, High Channel, 18 GHz – 40 GHz

Electromagnetic Compatibility Criteria for Intentional Radiators

RF Conducted Spurious Emissions Requirements and Band Edge

Test Requirement: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Test Procedure: For intentional radiators with a digital device portion which operates below 10 GHz, the spectrum was investigated; i.e., the lowest RF signal generated or used in the device up to the 10^{th} harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

Since the EUT had an integral antenna, conducted measurements could not be performed. Measurements needed to be taken radiated. An antenna was located 3 m away from the EUT and plots were taken. The EUT was rotated through all three orthogonal axes. The plots were corrected for both antenna correction factor and cable lost.

See following pages for detailed test results with RF Conducted Spurious Emissions.

Test Results: The EUT was compliant with the Conducted Spurious Emission limits. Measured emissions were below applicable limits.

Test Engineer(s): Manasi Bhandiwad

Test Date(s): 12/29/10 - 01/03/11

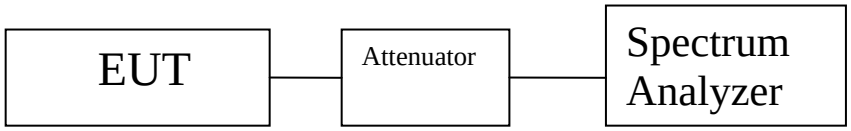
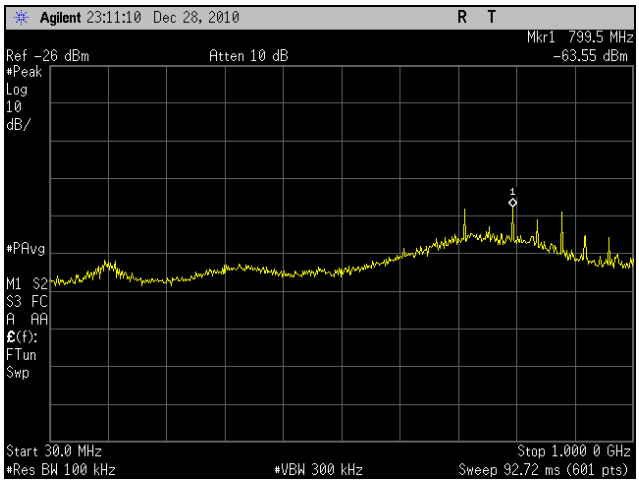
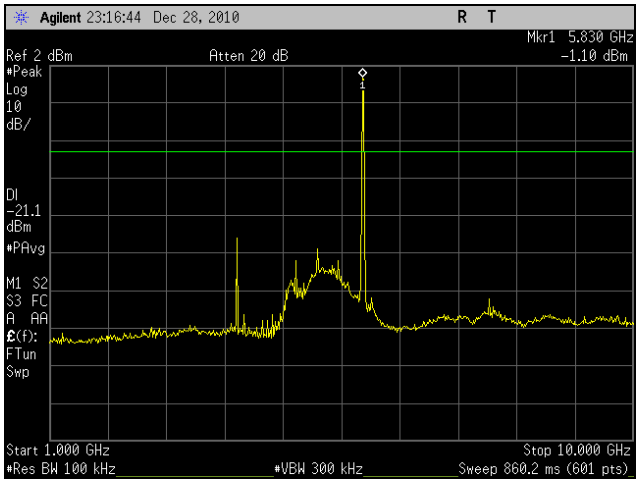


Figure 5. Block Diagram, Conducted Spurious Emissions Test Setup

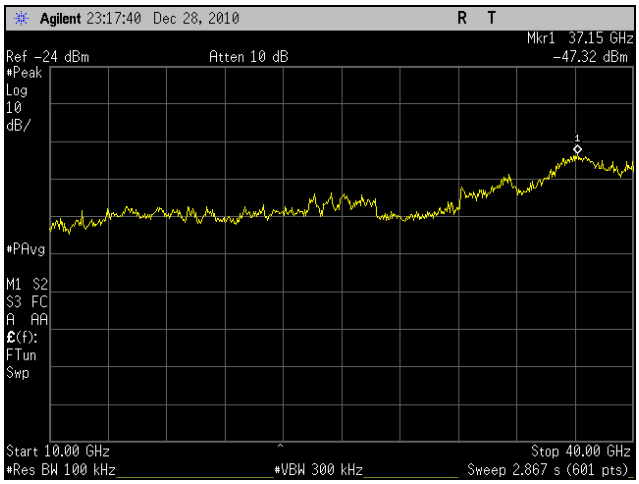
Conducted Spurious Emissions Test Results



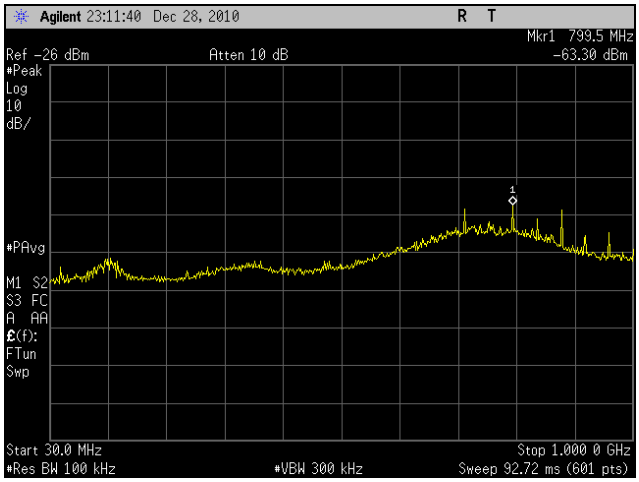
Plot 33. Conducted Spurious Emissions, Low Channel, 30 MHz – 1 GHz



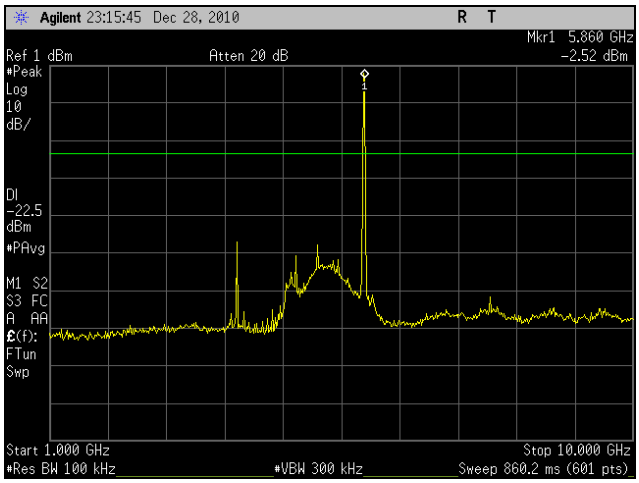
Plot 34. Conducted Spurious Emissions, Low Channel, 1 GHz – 10 GHz



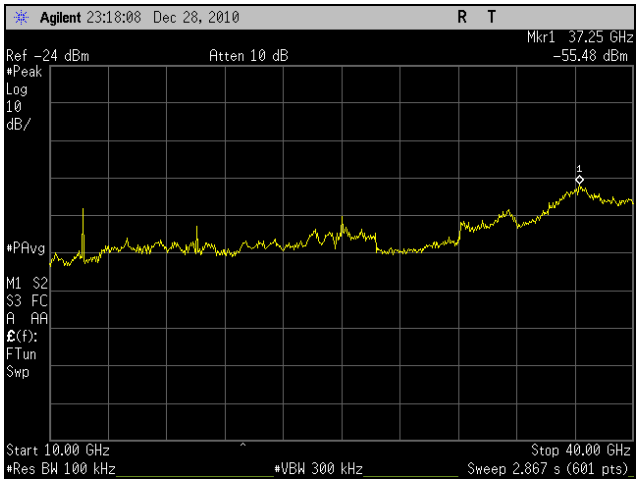
Plot 35. Conducted Spurious Emissions, Low Channel, 10 GHz – 40 GHz



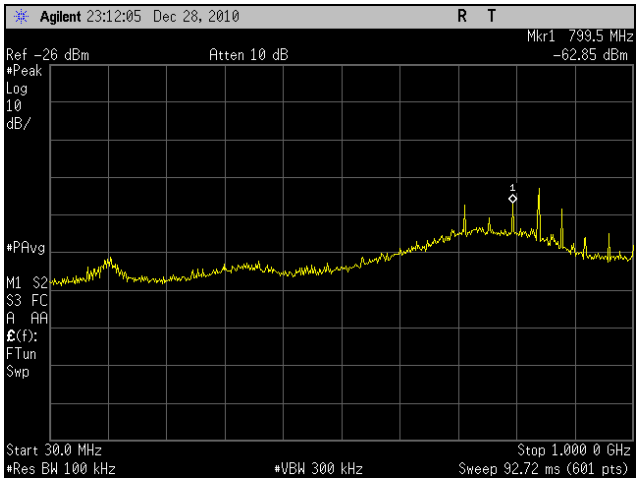
Plot 36. Conducted Spurious Emissions, Mid Channel, 30 MHz – 1 GHz



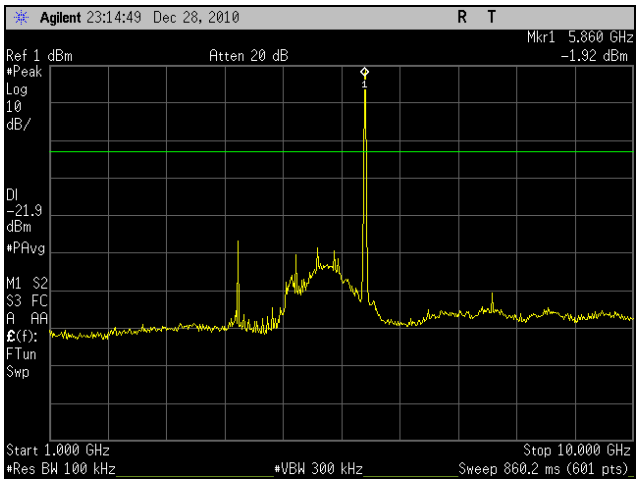
Plot 37. Conducted Spurious Emissions, Mid Channel, 1 GHz – 10 GHz



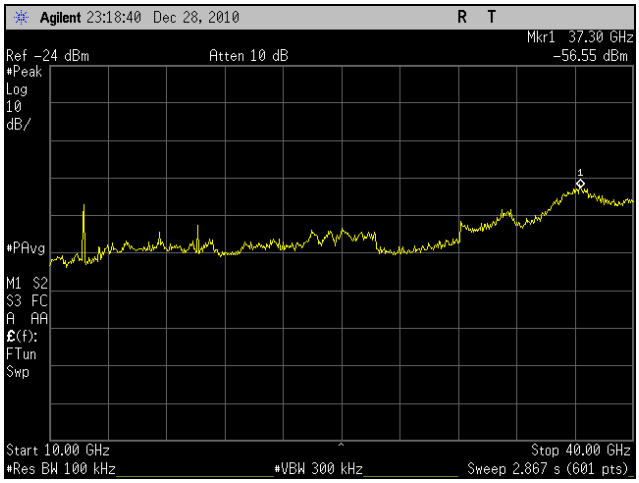
Plot 38. Conducted Spurious Emissions, Mid Channel, 10 GHz – 40 GHz



Plot 39. Conducted Spurious Emissions, High Channel, 30 MHz – 1 GHz

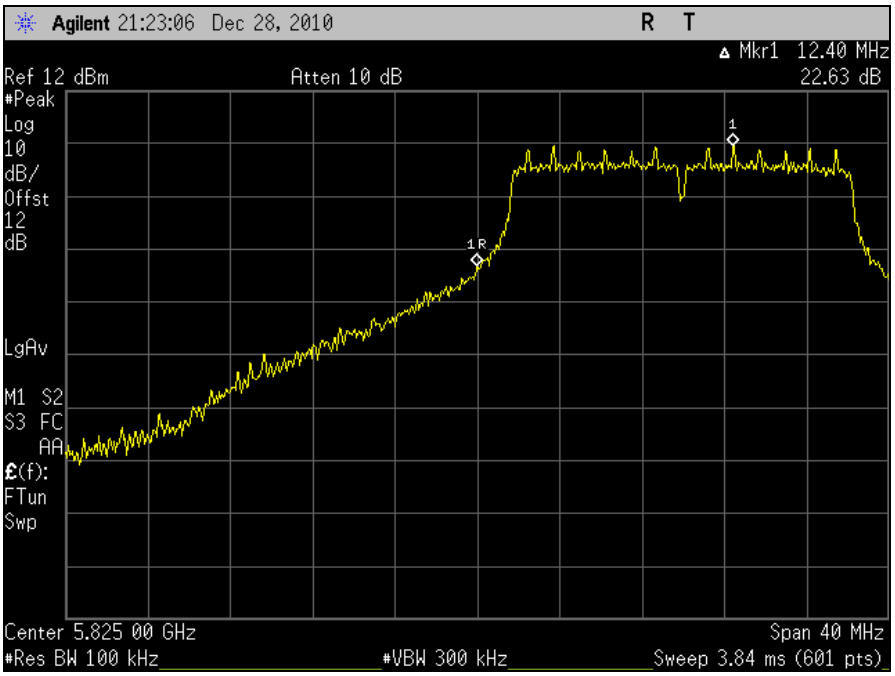


Plot 40. Conducted Spurious Emissions, High Channel, 1 GHz – 10 GHz

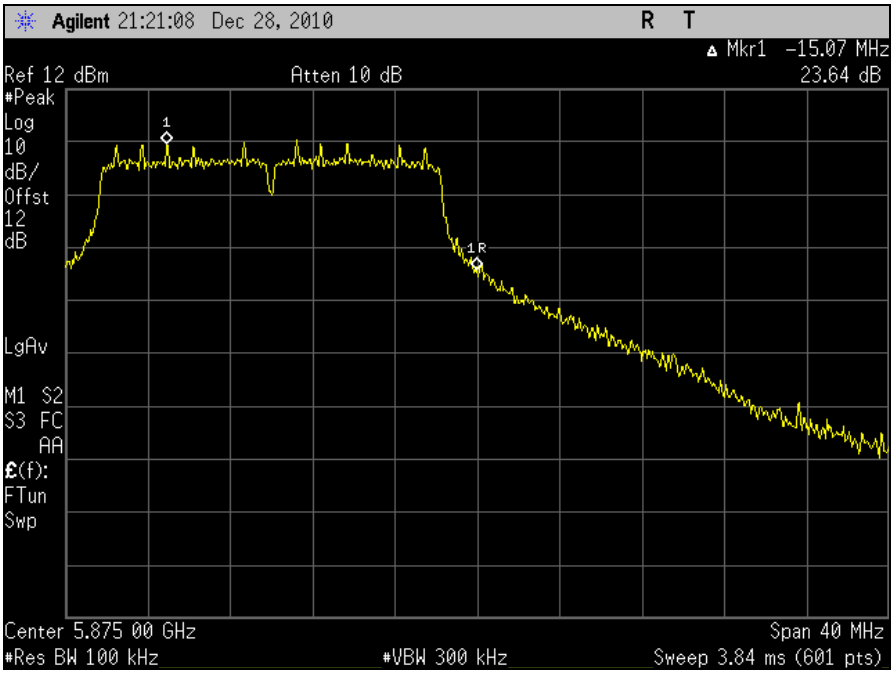


Plot 41. Conducted Spurious Emissions, High Channel, 10 GHz – 40 GHz

Conducted Band Edge Test Results



Plot 42. Conducted Spurious Emissions, Low Channel, 20 dBc



Plot 43. Conducted Spurious Emissions, High Channel, 20 dBc

Electromagnetic Compatibility Criteria for Intentional Radiators

Peak Power Spectral Density

Test Requirements: For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

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: The EUT was compliant with the peak power spectral density limits.

The peak power spectral density was determined from plots on the following page(s).

Test Engineer: Manasi Bhandiwad

Test Date: 12/29/10 - 01/03/11

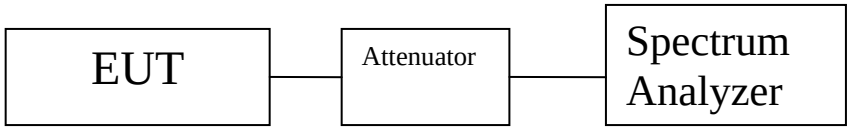


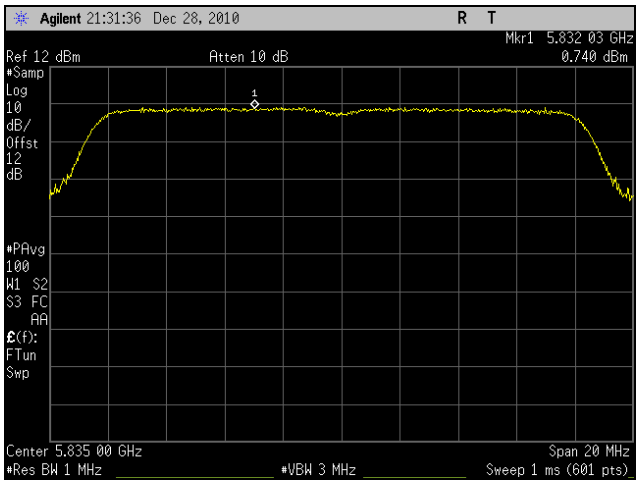
Figure 6. Block Diagram, Peak Power Spectral Density Test Setup

Peak Power Spectral Density Test Results

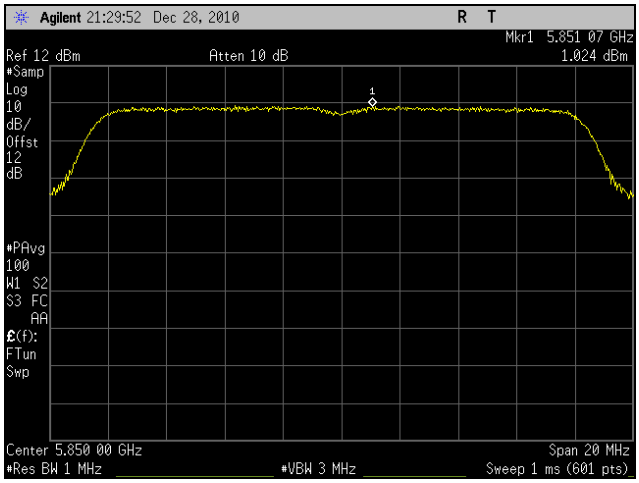
Peak Power Spectral Density				
Carrier Channel	**Frequency (MHz)**	**Measured PPSD (dBm)**	**Limit (dBm)**	**Margin (dB)**
Low	5835	0.740	8	8.740
Mid	5850	1.024	8	9.024
High	5865	1.228	8	9.228

Table 20. Spectral Density, Test Results

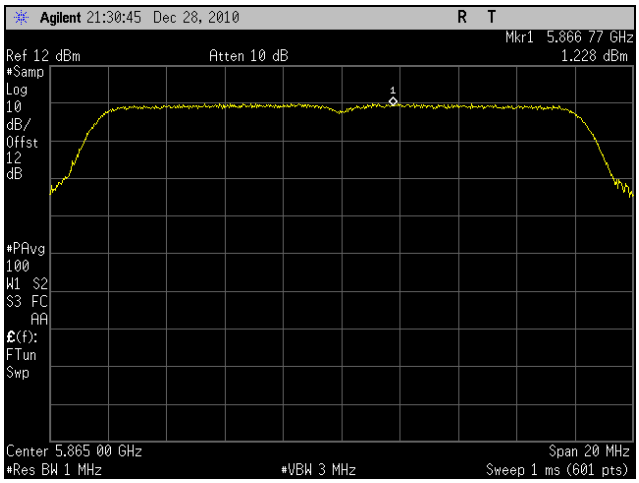
Peak Power Spectral Density



Plot 44. Peak Power Spectral Density, Low Channel



Plot 45. Peak Power Spectral Density, Mid Channel



Plot 46. Peak Power Spectral Density, High Channel

Electromagnetic Compatibility Criteria for Intentional Radiators

Frequency Stability

Test Requirements: 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 user's manual.

Test Procedure: The unit was operated in the CW mode. The reference carrier frequency measurement was made at the ambient temperature. From this reference, the carrier frequency delta was recorded over the range of -30C to 50C.

Test Results: The EUT was compliant with the requirements.

Test Engineer(s): Manasi Bhandiwad

Test Date(s): 01/17/11

Reference Peak Frequency at 5835MHz, 50C = 5.8349564 GHz	Frequency deviation in kHz	Frequency stability in PPM (Limit <20)
Frequency deviation at 40C	6.7	1.14
Frequency deviation at 30C	6.7	1.14
Frequency deviation at 20C	4.2	0.719
Frequency deviation at 10C	13.4	2.29
Frequency deviation at 0C	10.9	1.86
Frequency deviation at -10C	1.7	0.29
Frequency deviation at -20C	15.1	2.58
Frequency deviation at -30C	42.8	7.33
Frequency deviation at ambient, Low Voltage	0	0
Frequency deviation at ambient , High Voltage	0	0

Table 21. Frequency Stability, Test Results

Note: The EUT was set to operate at the low channel - 5835 MHz.

IV. 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 Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4503	SHIELDED ROOM	UNIVERSAL SHIELDING CORP	N/A	06/01/2006	06/01/2007
1T4568	RADIATING NOISE SOURCE	MET LABORATORIES	N/A	SEE NOTE	
1T4621	ESA-E SERIES SPECTRUM ANALYZER	AGILENT	E4402B	05/10/2010	05/10/2011
1T4502	COMB GENERATOR	COM-POWER	CGC-255	10/06/2010	10/06/2011
1T4564	LISN (24 AMP)	SOLAR ELECTRONICS	9252-50-R-24-BNC	10/06/2010	10/06/2011
1T4627	THERMO/HYGROMETER	CONTROL COMPANY	S6-627-9	10/09/2009	10/09/2011
1T4300	SEMI-ANECHOIC CHAMBER # 1	EMC TEST SYSTEMS	NONE	08/23/2010	08/23/2013
1T4751	ANTENNA - BILOG	SUNOL SCIENCES	JB6	11/03/2010	11/03/2011
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	05/25/2010	05/25/2011

Table 22. Test Equipment List

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

End of Report

