L.S. Compliance, Inc.
W66 N220 Commerce Court
Cedarburg, WI 53012
262-375-4400 Fax: 262-375-4248

COMPLIANCE TESTING OF:

WLAN 3100

Prepared For:

SIEMENS BUILDING TECHNOLOGIES, INC

Test Report Number:

305181

Test Dates:

August, September of 2005

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1. L. S. Compliance In Review

L.S. Compliance - Accreditations and Listing's

As an EMC Testing Laboratory, our Accreditation and Assessments are recognized through the following:

A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025 : 1999
with Electrical (EMC) Scope of Accreditation
A2LA Certificate Number: 1255.01

Federal Communications Commission (FCC) – USA

Listing of 3 Meter Semi-Anechoic Chamber based on Title 47 CFR – Part 2.948
FCC Registration Number: 90756

Listing of 3 and 10 meter OATS based on Title 47CFR – Part 2.948
FCC Registration Number: 90757

Industry Canada

On file, 3 Meter Semi-Anechoic Chamber based on RSS-212 – Issue 1
File Number: **IC 3088-A**

On file, 3 and 10 Meter OATS based on RSS-212 – Issue 1
File Number: **IC 3088**

U. S. Conformity Assessment Body (CAB) Validation

Validated by the European Commission as a U. S. Competent Body operating under the U. S. /EU, Mutual Recognition Agreement (MRA) operating under the European Union Electromagnetic Compatibility –Council Directive 2004/108/EC (formerly 89/336/EEC, Article 10.2).
Date of Validation: January 16, 2001

Validated by the European Commission as a U.S. Notified Body operating under the U.S./EU, Mutual Recognition Agreement (MRA) operating under the European Union Telecommunication Equipment – Council Directive 99/5/EC, Annex V.

Date of Validation: November 20, 2002
Notified Body Identification Number: 1243

2. A2LA Certificate of Accreditation

THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

L.S. COMPLIANCE, INC.
Cedarburg, WI

for technical competence in the field of

Electrical Testing

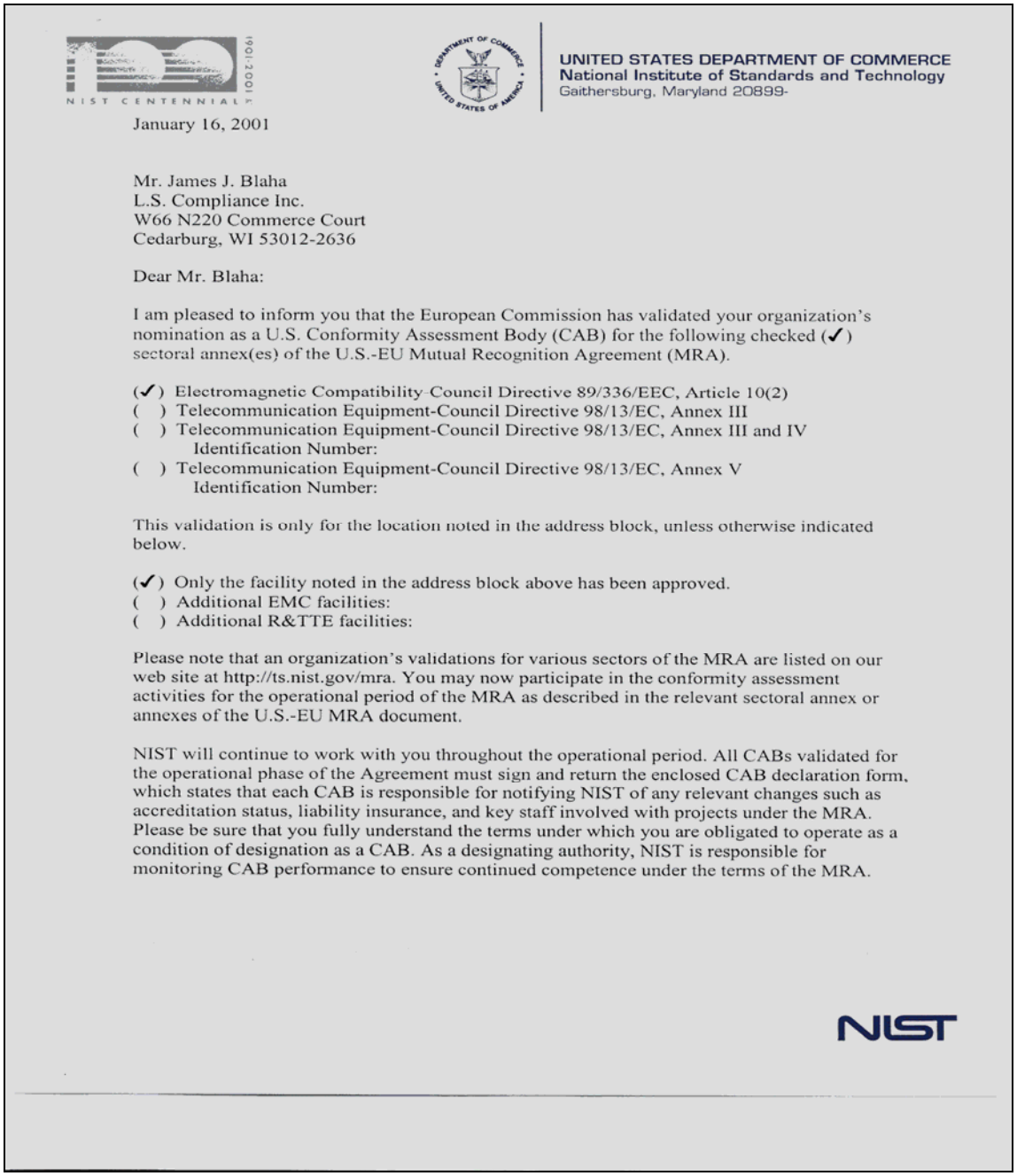
The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing.

Presented this 29th day of April 2005.

President
For the Accreditation Council
Certificate Number 1255.01
Valid to January 31, 2007

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

3. Validation Letter – U.S. Competent Body for EMC Directive 2004/108/EC (formerly 89/336/EEC)



UNITED STATES DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
Gaithersburg, Maryland 20899-

January 16, 2001

Mr. James J. Blaha
L.S. Compliance Inc.
W66 N220 Commerce Court
Cedarburg, WI 53012-2636

Dear Mr. Blaha:

I am pleased to inform you that the European Commission has validated your organization's nomination as a U.S. Conformity Assessment Body (CAB) for the following checked (✓) sectoral annex(es) of the U.S.-EU Mutual Recognition Agreement (MRA).

(✓) Electromagnetic Compatibility–Council Directive 89/336/EEC, Article 10(2)
( ) Telecommunication Equipment-Council Directive 98/13/EC, Annex III
( ) Telecommunication Equipment-Council Directive 98/13/EC, Annex III and IV
Identification Number:
( ) Telecommunication Equipment-Council Directive 98/13/EC, Annex V
Identification Number:

This validation is only for the location noted in the address block, unless otherwise indicated below.

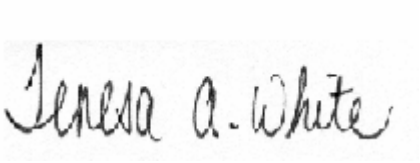
(✓) Only the facility noted in the address block above has been approved.
( ) Additional EMC facilities:
( ) Additional R&TTE facilities:

Please note that an organization's validations for various sectors of the MRA are listed on our web site at http://ts.nist.gov/mra. You may now participate in the conformity assessment activities for the operational period of the MRA as described in the relevant sectoral annex or annexes of the U.S.-EU MRA document.

NIST will continue to work with you throughout the operational period. All CABs validated for the operational phase of the Agreement must sign and return the enclosed CAB declaration form, which states that each CAB is responsible for notifying NIST of any relevant changes such as accreditation status, liability insurance, and key staff involved with projects under the MRA. Please be sure that you fully understand the terms under which you are obligated to operate as a condition of designation as a CAB. As a designating authority, NIST is responsible for monitoring CAB performance to ensure continued competence under the terms of the MRA.

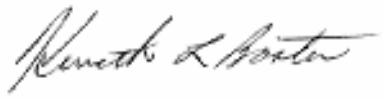
NIST

4. Signature Page



Prepared By: September 21, 2005

Teresa A. White, Document Coordinator Date



Tested and Approved By: September 21, 2005

Kenneth L. Boston, EMC Lab Manager Date
PE #31926 Licensed Professional Engineer
Registered in the State of Wisconsin, United States

5. Product and General Information

Manufacturer:	Siemens Building Technology					
Date(s) of Test:	August 29-31, 2005; September 8, 9, 12, 20, 2005					
Test Engineer(s):		Tom Smith		Abtin Spantman	X	Ken Boston
Model #:	WLAN 3100					
Serial #:	'beta 003'					
Voltage:	24 VAC via a wall plug transformer run on 115 VAC					
Operation Mode:	Continuous modulated transmit on selected channels					

6. Introduction

During August and September of 2005, a series of Conducted and Radiated RF Emission tests were performed on one sample of the Wireless LAN, Model Number WLAN 3100, Serial Number beta 003, here forth referred to as the "*Equipment Under Test*" or "*EUT*". These tests were performed using the procedures outlined in ANSI C63.4-2003 for intentional radiators, and in accordance with the limits set forth in FCC Part 15.247 (Industry Canada RSS-210) for a low power transmitter. These tests were performed by Kenneth L. Boston, EMC Lab Manager, at L.S. Compliance, Inc.

All Radiated and Conducted RF Emission tests were performed upon the EUT to measure the emissions in the frequency bands described in FCC Title 47 CFR, Part 15, including 15.35, 15.205, 15.247 and Industry Canada RSS-210 to determine whether these emissions are below the limits expressed within the standards. These tests were performed in accordance with the procedures described in the American National Standard for methods of measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2003). Another document used as a reference for the EMI Receiver specification was the Comite International Special Des Perturbations Radioelelectriques (CISPR) Number 16-1, 2003.

All tests were performed at L.S. Compliance, Inc., in Cedarburg, Wisconsin, unless otherwise noted.

7. Product Description

The WLAN 3100 is a 2.4 GHz digital spread spectrum low power transceiver that is used as a node in the following system.

The Siemens APOGEE Insight Wireless Floor Level Network (WFLN) allows the Floor Level Network (FLN) communication cable to be replaced by a wireless mesh network. A wireless mesh network consists of a collection of nodes that communicate to each other via wireless links without being routed through a central switch.

A grid-like topology enables the signal to “multihop” among different paths in order to circumvent obstructions as it seeks and ultimately finds its target device. These redundant communication paths provide a very high level of reliability to the network. Because multiple signal paths exist, the network is able to adjust to communication link disruptions due to changes in the environment.

To implement the WFLN, radio transceivers (FLNX p/n 563-004) are mounted at both the Insight System Field Device and the Insight System Field Panel (FPX p/n 563-005). Both need to be line powered. The radio’s antenna can either be direct-mounted to the radio, or in cases where the radio’s mounting location would cause the antenna to be shielded, remotely mounted away from the radio.

Once installed, the fact the FLN is utilizing wireless mesh communications is virtually transparent to the system and end user.

An optional radio tool (TLX p/n 563-006) is available which interfaces with a PC’s HyperTerminal to perform remote diagnostics and troubleshooting of the wireless mesh network.

8. Test Requirements

The above mentioned tests were performed in order to determine the compliance of the WLAN 3100 with limits contained in various provisions of Title 47 CFR, FCC Part 15, including:

15.31	15.247a	15.247d
15.205	15.247b	15.247e
15.207	15.247c	

9. Summary of Test Report

DECLARATION OF CONFORMITY

The WLAN 3100 was found to **MEET** the requirements as described within the specification of Title 47 CFR FCC, Part 15.247, and Industry Canada RSS-210, Section 6.2.2(o) for a Digital Spread Spectrum (DTS) Transmitter.

The enclosed test results pertain to the sample(s) of the test item listed, and only for the tests performed on the data sheets. Any subsequent modification or changes to the test items could invalidate the data contained herein, and could therefore invalidate the findings of this report.

Some emissions are seen to be within 3dB of their respective limits. As these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

10. Radiated Emissions Test

Test Setup

The test setup was assembled in accordance with Title 47, CFR FCC Part 15 and ANSI C63.4-2003. The EUT was placed on an 80cm high non-conductive pedestal, centered on a flush mounted 2-meter diameter turntable inside a 3 meter Semi-Anechoic, FCC listed Chamber. The EUT was operated in continuous modulated modes, and final testing was performed using a test modulation mode, using power as provided by a 24 VAC transformer. The unit has the capability to operate on 16 channels, controllable via test software available on a laptop PC.

The applicable limits apply at a 3 meter distance. Measurements above 5 GHz were performed at a 1.0 meter separation distance. The calculations to determine these limits are detailed in the following pages. Please refer to Appendix A for a complete list of test equipment. The test sample was operated on one of three (3) standard channels: ch 0 (2405 MHz), ch 7 (2440 MHz) and ch E (2475 MHz) to comply with FCC Part 15.35. Additional testing at the highest channel, ch F (2480 MHz) was also performed, but since this channel has a reduced power output, the primary data collected was to show compliance with the band edge performance at the upper band edge, adjacent to the 15.205 assignment starting at 2483.5 MHz. The channels and operating modes were changed using a laptop PC to set channels and power levels. The software power settings used for channels 0, 7, and E was P=-1 dBm, and channel F was P= -8 dBm. These power settings are controlled by Siemens, at the manufacturing level, and are unable to be changed by the end user.

Test Procedure

Radiated RF measurements were performed on the EUT in a 3 meter Semi-Anechoic, FCC listed Chamber. The frequency range from 30 MHz to 25,000 MHz was scanned and investigated. The radiated RF emission levels were manually noted at the various fixed degree settings of azimuth on the turntable and antenna height. The EUT was placed on a non-conductive pedestal in the 3 meter Semi-Anechoic Chamber, with the antenna mast placed such that the antenna was 3 meters from the EUT. A Biconical Antenna was used to measure emissions from 30 MHz to 300 MHz, and a Log Periodic Antenna was used to measure emissions from 300 MHz to 1000 MHz. A Double-Ridged Waveguide Horn Antenna was used from 1 GHz to 18 GHz. The maximum radiated RF emissions were found by raising and lowering the antenna between 1 and 4 meters in height, using both horizontal and vertical antenna polarities. From 18 GHz to 24 GHz, the EUT was measured at a 1.0 meter separation, using a standard gain Horn Antenna and pre-amplifier.

The EUT (circuit board) was rotated along three orthogonal axes during the investigations to find the highest emission levels. Two styles of the antenna were also investigated, with the majority of the tests performed with the “fixed” dipole, and verification scans re-investigated with the flexible cable dipole.

Test Equipment Utilized

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at an N.I.S.T. traceable site. In addition, the Connecting Cables were measured for losses using a calibrated Signal Generator and a HP 8546A EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the HP 8546A EMI Receiver database. As a result, the data taken from the HP 8546A EMI Receiver accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected meter reading. The HP 8546A EMI Receiver was operated with a resolution bandwidth of 120 kHz for measurements below 1 GHz (video bandwidth of 300 kHz), and a bandwidth of 1 MHz for measurements above 1 GHz (video bandwidth of 1 MHz From 5 GHz to 18 GHz, an HP E4407B Spectrum Analyzer and an EMCO Horn Antenna were used. From 18 GHz to 25 GHz, the HP E4407B Spectrum Analyzer with a standard gain horn, and preamp were used.

Test Results

The EUT was found to **MEET** the Radiated Emissions requirements of Title 47 CFR, FCC Part 15.247 for a FHSS transmitter [Canada RSS-210, Clause 6.2.2(o)]. The frequencies with significant RF signal strength were recorded and plotted as shown in the Data Charts and Graphs.

CALCULATION OF RADIATED EMISSIONS LIMITS

The maximum peak output power of an intentional radiator in the 2.4 to 2.483 GHz band, as specified in Title 47 CFR 15.247 (b)(3), is 1 Watt. The harmonic and spurious RF emissions, as measured in any 100 kHz bandwidth, as specified in 15.247 (d), shall be at least 20 dB below the measured power of the desired signal, and must also meet the requirements described in 15.205(c).

The following table depicts the Class B limits for an unintentional radiator. These limits are obtained from Title 47 CFR, Part 15.209, for radiated emissions measurements. These limits were applied to any signals found in the 15.205 restricted bands.

Frequency (MHz)	3 m Limit μV/m	3 m Limit (dBμV/m)	1 m Limit (dBμV/m)
30-88	100	40.0	-
88-216	150	43.5	-
216-960	200	46.0	-
960-24,000	500	54.0	63.5

Sample conversion from field strength μV/m to dBμV/m:

$dB\mu V/m = 20 \log_{10} (100)$

= 40 dBμV/m (from 30-88 MHz)

For measurements made at 1.0 meter, a 9.5 dB correction has been invoked.

960 MHz to 10,000 MHz

500μV/m or 54.0 dB/μV/m at 3 meters

54.0 + 9.5 = 63.5 dB/μV/m at 1 meter

Radiated Emissions Data Chart

3 Meter Measurements of Electromagnetic Radiated Emissions
Test Standard: 47CFR, Part 15.205 and 15.247(DTS)
Frequency Range Inspected: 30 MHz to 25000 MHz

Manufacturer:	Siemens Building Technology									
Date(s) of Test:	August 29-31, 2005; September 8,9, 2005									
Test Engineer(s):		Tom Smith		Abtin Spantman		X	Ken Boston			
Model #:	WLAN 3100									
Serial #:	Beta 003									
Voltage:	24 VAC, from a transformer supplied by 115 VAC									
Operation Mode:	Continuous modulated transmit on selected channels									
EUT Power:	X	Single Phase 115 VAC		3 Phase ___VAC						
		Battery		Other:						
EUT Placement:	X	80cm non-conductive table		10cm Spacers						
EUT Test Location:	X	3 Meter Semi-Anechoic FCC Listed Chamber		3/10m OATS						
Measurements:		Pre-Compliance		Preliminary		X	Final			
Detectors Used:	X	Peak	X	Quasi-Peak		X	Average			

Environmental Conditions in the Lab:
Temperature: 20 – 25°C
Relative Humidity: 30 – 60 %

Test Equipment Used:
EMI Measurement Instrument: HP8546A and Agilent E4407B
Log Periodic Antenna: EMCO #93146
Horn Antenna: EMCO #3115
Biconical Antenna: EMCO 93110
Pre-Amp: Advanced Microwave WHA624
Standard Gain Horn: EMCO 3160-09

The following table depicts the level of significant spurious radiated RF emissions found:
Channels 0, 7, E tested

Frequency (MHz)	Antenna Polarity	EUT orient	Height (meters)	Azimuth (0° - 360°)	Measured ERP (dBμV/m)	15.205 Limit (dBμV/m)	Margin (dB)
328.0	H	Flat	1.0	330	25.4	46.0	20.6
608.0	H	Flat	1.25	100	29.5	46.0	16.5
2323.0 *	V	vert	1.0	97	31.5	54.0	22.5
2623.0 *	V	vert	1.3	274	41.4	54.0	12.6

Notes:

1) A Quasi-Peak Detector was used in measurements below 1 GHz, and an Average Detector was used in measurements above 1 GHz. The Peak detector was also use to ensure that the emission levels do not exceed 20 dB beyond the Average limits.

2) *No significant spurious emissions observed. All spurious emissions were better than 20 dB below the limits*

3) ** seen while transmitting on channel E.*

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 0:

Frequency (MHz)	Antenna Polarity	EUT orient	Height (meters)	Azimuth (0° - 360°)	Measured ERP (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)
2405	H	Flat	1.0	265	93.0	---	---
4810	V	Vert	1.37	160	44.2	54.0	9.8
4810	H	Flat	1.0	153	44.5	54.0	9.5
4810	H	Side	1.08	297	47.3	54.0	6.7
7215	H	Flat	1.0	148	41.3	63.5	22.2
7215	H	Side	1.03	336	41.5	63.5	22.0

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 7:

Frequency (MHz)	Antenna Polarity	EUT Orient	Height (meters)	Azimuth (0° - 360°)	Measured ERP (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)
2440	V	Vert	1.0	278	93.9	---	---
4880	V	Vert	1.56	141	45.0	54.0	9.0
4880	H	Flat	1.09	148	47.2	54.0	6.8
4880	H	Side	1.2	297	49.2	54.0	4.8
7320	H	Flat	1.0	151	40.6	63.5	22.9

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel E:

Frequency (MHz)	Antenna Polarity	Host Mode	Height (meters)	Azimuth (0° - 360°)	Measured ERP (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)
2475	H	Flat	1.02	272	92.5	---	---
4950	V	Vert	1.68	226	47.3	54.0	6.7
4950	H	Flat	1.07	157	51.8	54.0	2.2
4950	H	Side	1.05	302	52.2	54.0	1.8
7426	H	Flat	1.03	152	43.8	63.5	19.7
7426	H	Side	1.0	309	44.5	63.5	19.0

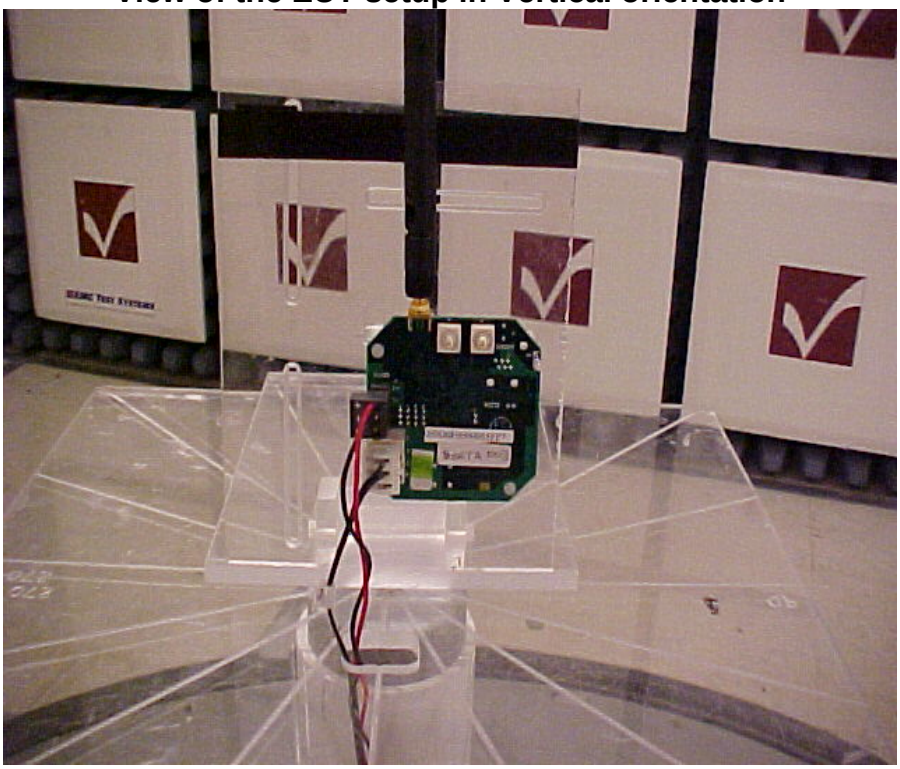
The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel F:

Frequency (MHz)	Antenna Polarity	Host Mode	Height (meters)	Azimuth (0° - 360°)	Measured ERP (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)
2480	V	Vert	1.0	270	85.8	---	---
4960	V	Vert	1.72	260	44.3	54.0	9.7
4962	H	Flat			50.5	54.0	3.5

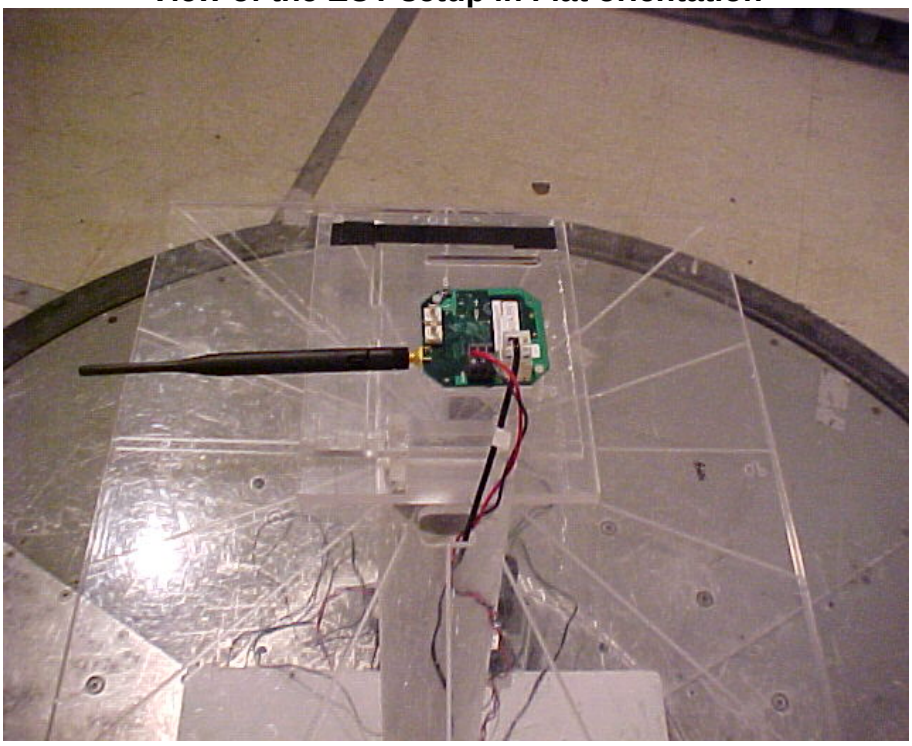
Notes: A Peak as well as an Average Detector was used in measurements above 1 GHz. Only the results from the Average detector are published in the table above. All PEAK emissions were well within the 74 or 83.5 dBuV limit . Measurements above 5 GHz were made at 1 meters of separation from the EUT, .

Photos Taken During Radiated Emission Testing

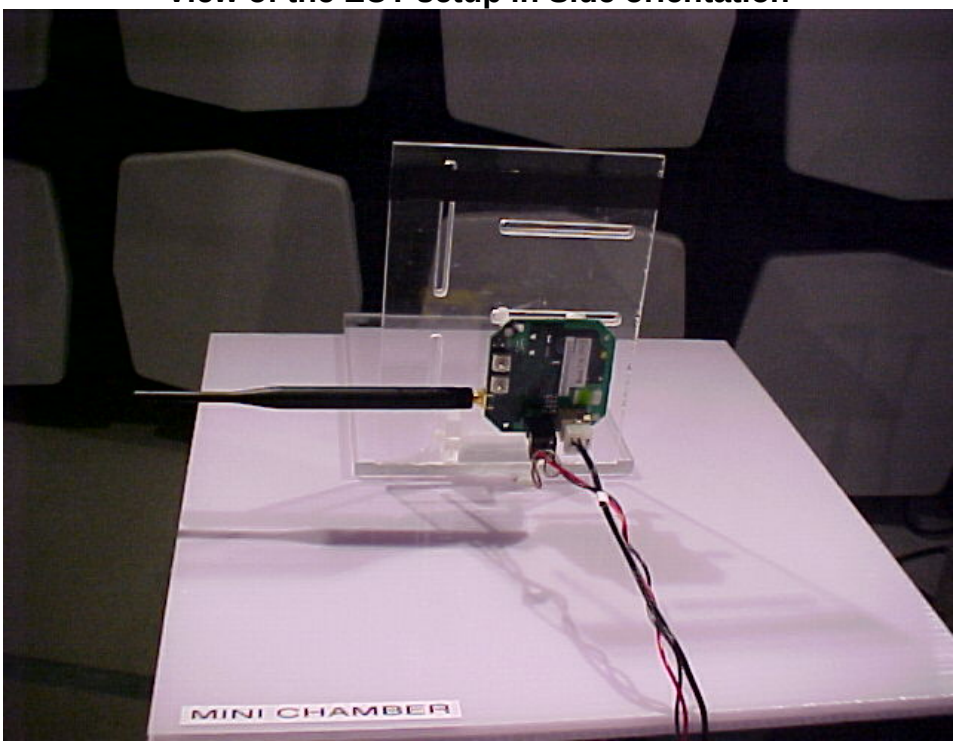
View of the EUT setup in Vertical orientation



View of the EUT setup in Flat orientation



View of the EUT setup in Side orientation

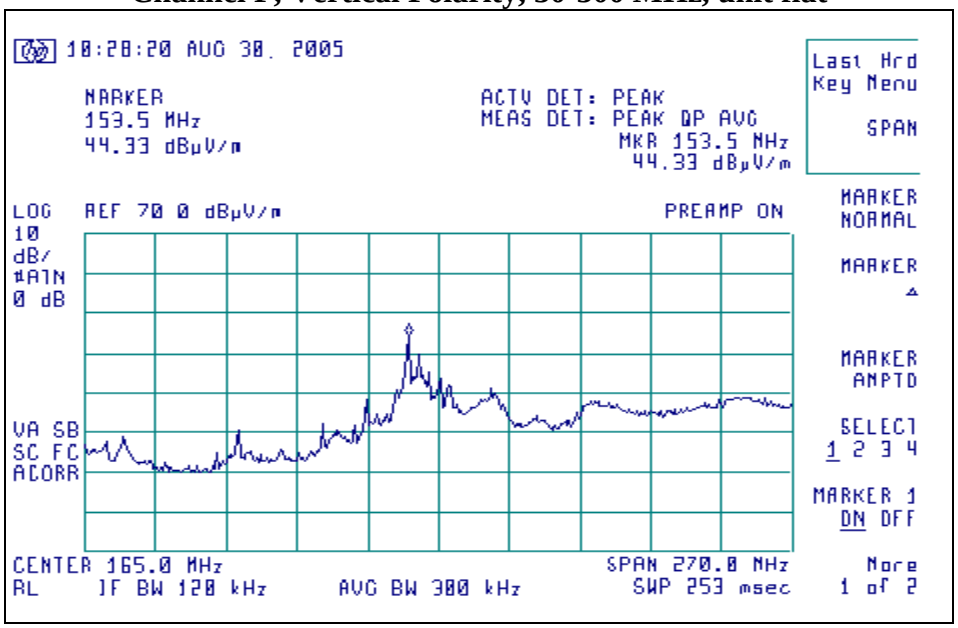


Graphs made during Radiated Emission Testing

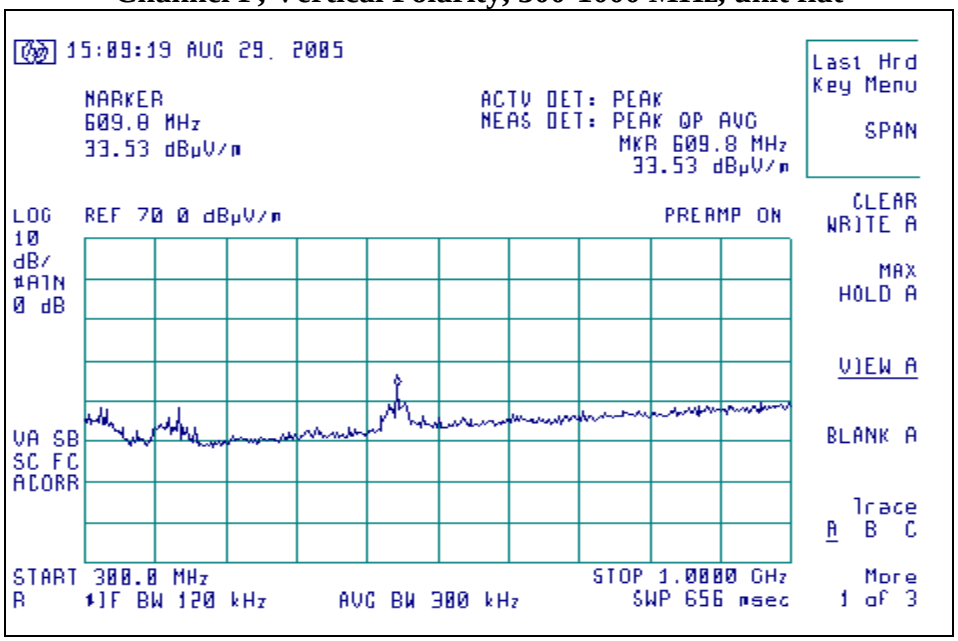
Screen Captures of Radiated RF Emissions:

Please note these screen captures represent Peak Emissions. For radiated emission measurements, we utilize a Quasi-Peak detector function when measuring frequencies below 1 GHz, and an Average detector function when measuring frequencies above 1 GHz.

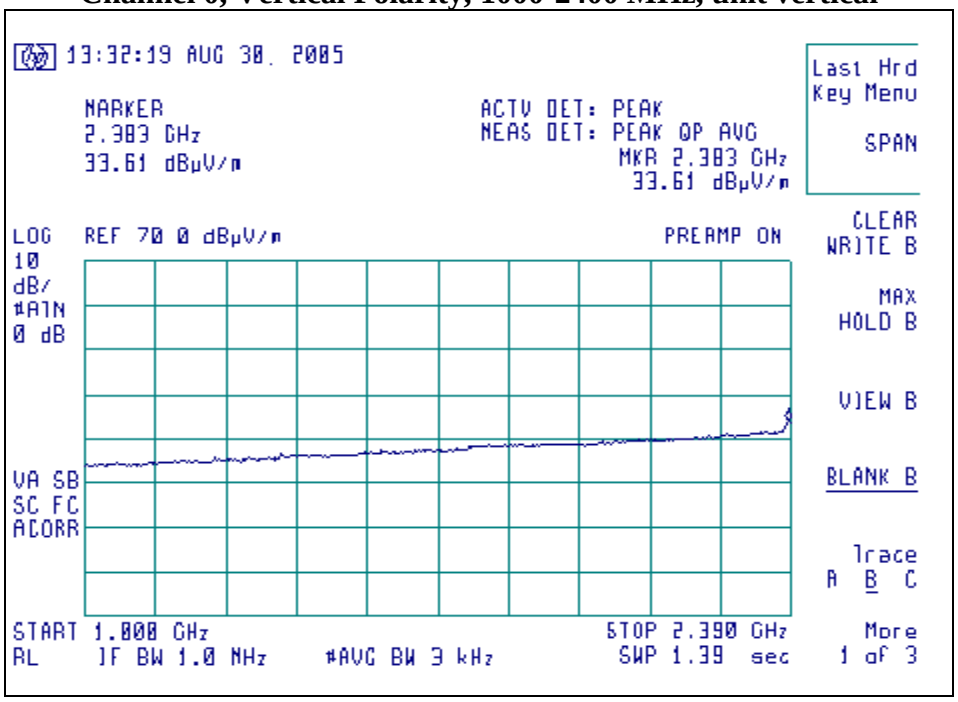
Channel F, Vertical Polarity, 30-300 MHz, unit flat



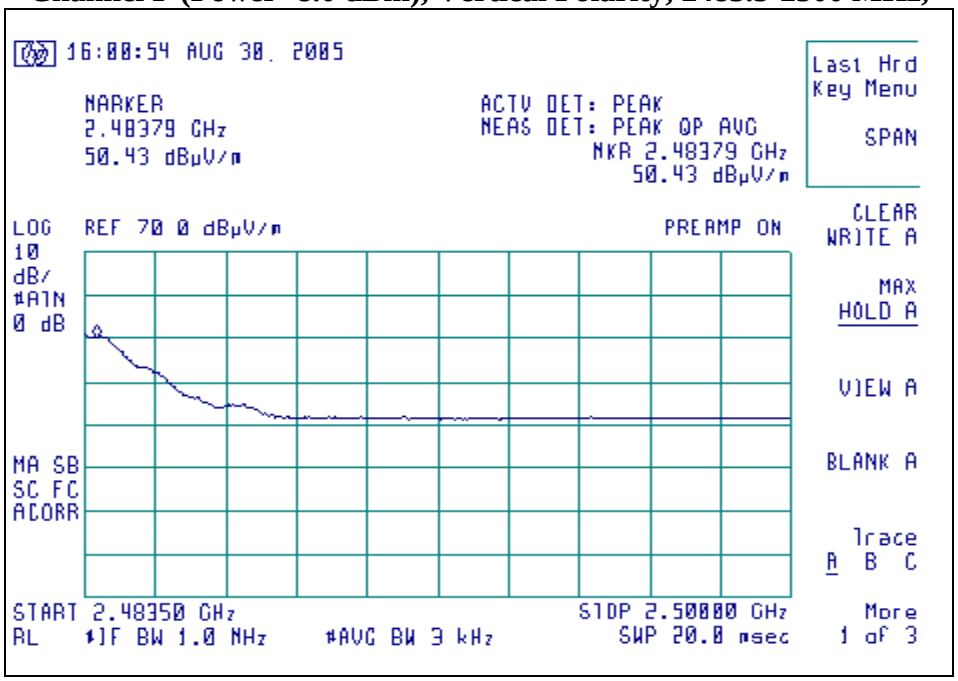
Channel F, Vertical Polarity, 300-1000 MHz, unit flat



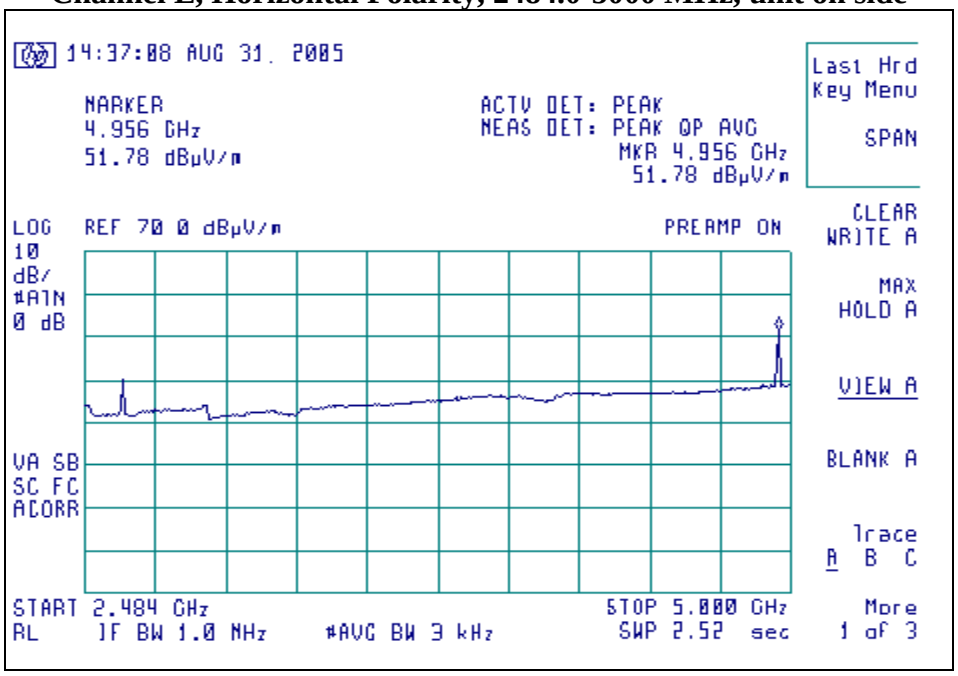
Channel 0, Vertical Polarity, 1000-2400 MHz, unit vertical



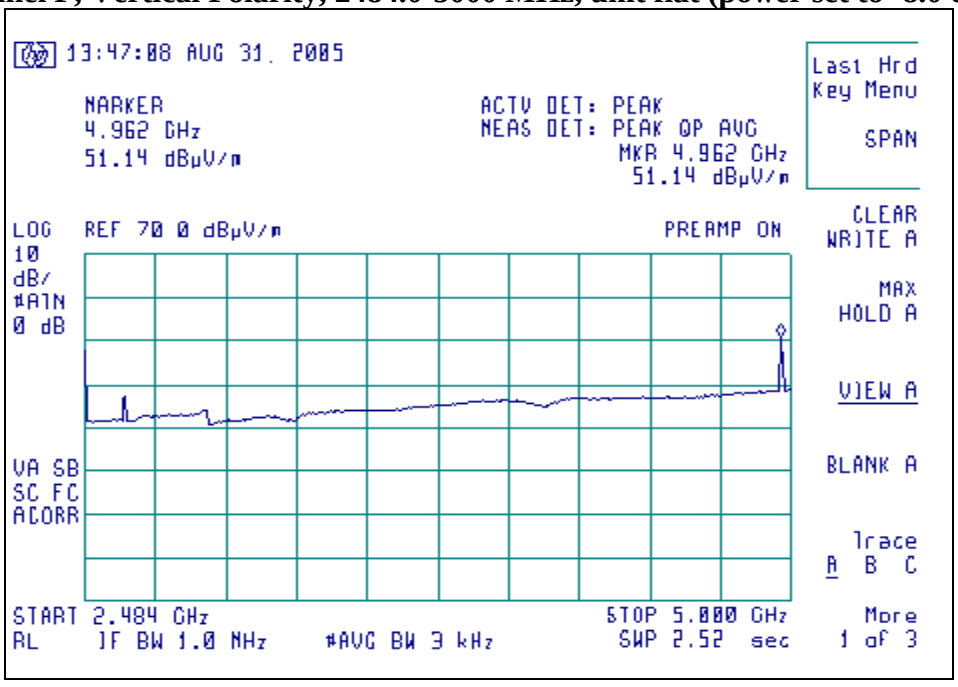
Channel F (Power -8.0 dBm), Vertical Polarity, 2483.5-2500 MHz,



Channel E, Horizontal Polarity, 2484.0-5000 MHz, unit on side

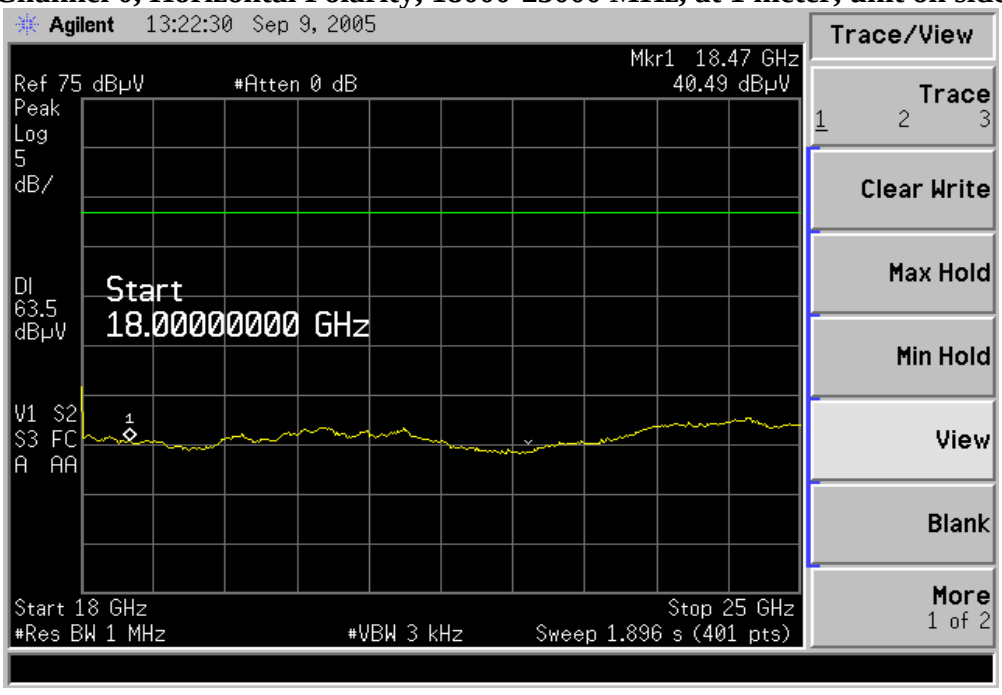


Channel F, Vertical Polarity, 2484.0-5000 MHz, unit flat (power set to -8.0 dBm)



Channel E, Vertical Polarity, 5000-18000 MHz, at 1meter, unit on side

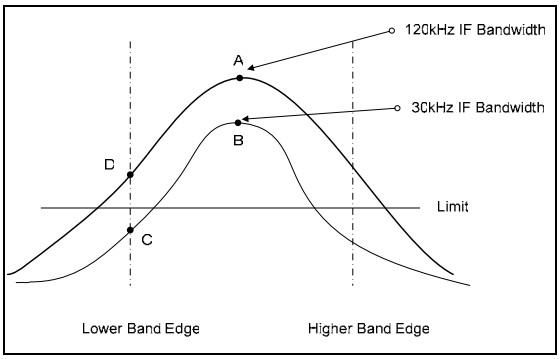
Channel 0, Horizontal Polarity, 18000-25000 MHz, at 1 meter, unit on side



11. Band-Edge Measurements

FCC 15.209(b) and 15.247(d) require a measurement of spurious emission levels to be at least 20 dB lower than the fundamental emission level, in particular at the band-edges where the intentional radiator operates, and to meet the 54 dBuV/m radiated limit in the 15.205 bands adjacent to the 2.4 GHz ISM band. The following screen captures demonstrate compliance of the intentional radiator at the upper 2483.5 MHz band-edge. The EUT was operated in continuous transmit mode with continuous modulation, with internally generated data as the modulating source. The EUT was operated at the lowest channel for the investigation of the lower band-edge, and at the highest channel for the investigation of the higher band-edge. No problems were noted at the lower band edge, while on the channel 0.

The bandwidth of the modulated signal is measured using a marker delta method, to ensure that the modulated signal does not exceed the emission limits outside of the operational band. The EUT was placed in continuous transmit mode with internal typical data as the source of modulation. The emissions were then measured at the operational band edges to ensure compliance. The following diagram and formula illustrates how the band edge measurements were taken.



Measurement A is taken using a 1 MHz IF Bandwidth at the Center Frequency.
Measurement B is taken using a 30kHz IF Bandwidth at the Center Frequency.
Measurement C is taken using a 30kHz IF Bandwidth at the lower Band Edge Frequency

To Calculate the Value for lower Band Edge Frequency at Point D: Upper band edge measurements are similar.

$$A - B = \Delta$$
$$\Delta + C = D$$

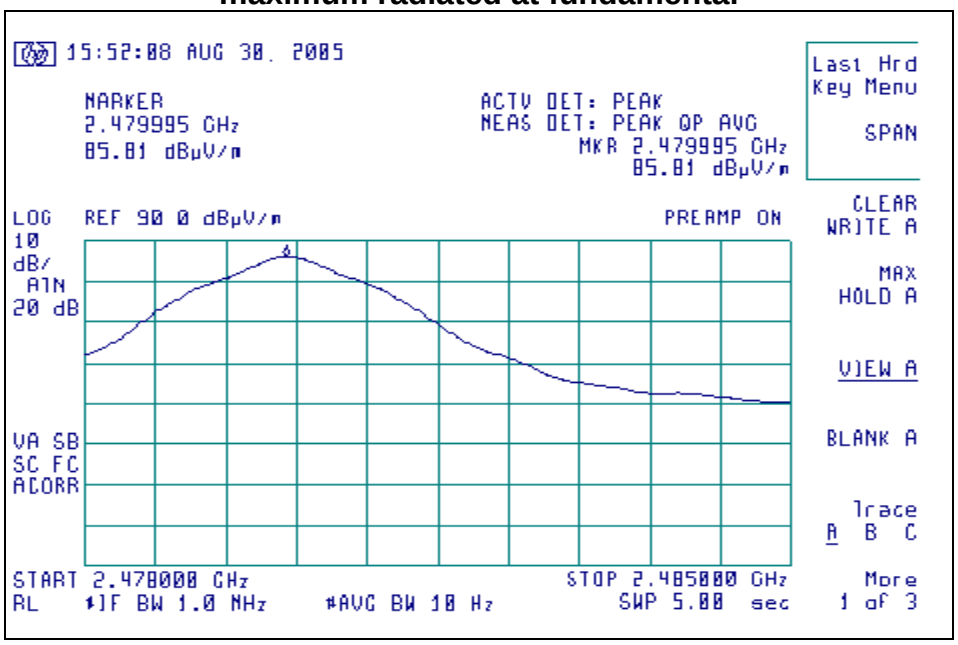
The Upper Band-Edge limit, in this case, would be D < 54 dB.

The measurements and calculations are as follows:

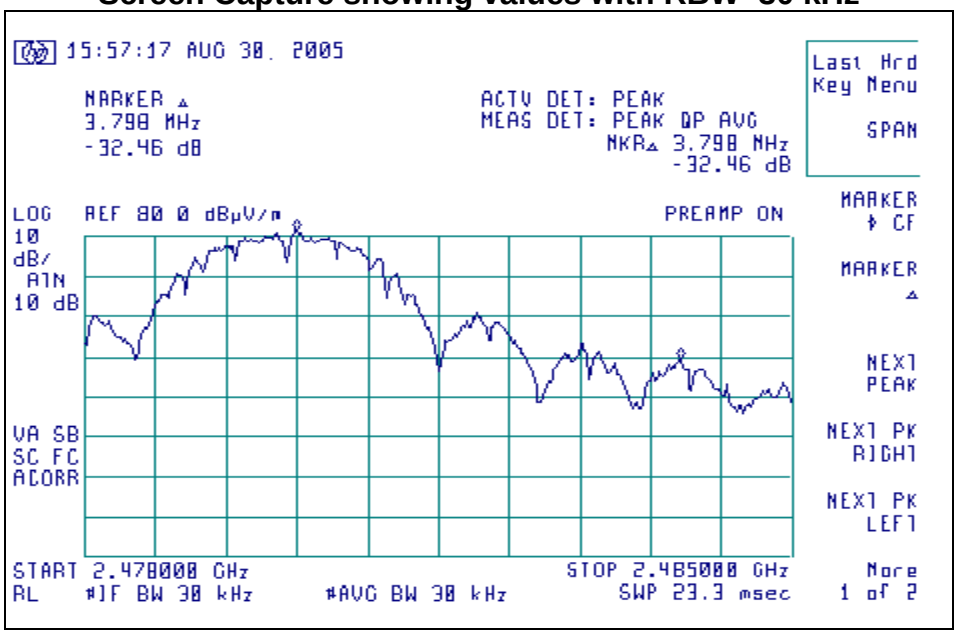
At the Upper Band-edge, while transmitting channel F:

$A - B = \Delta$; 85.81 dBuV/m (at 2480 MHz, average) - 81.66 dBuV/m (2480.1 MHz at 30khz BW)= 4.15 dB
$\Delta + C = D$; 4.15 dB + 49.20 dBuV/m (2483.8975 MHz at 30 kHz BW) **= 53.35** dBuV/m Showing compliance at Upper Band-Edge

Channel F, vertical polarity, unit vertical, (-8.0 dBm), maximum radiated at fundamental



Screen Capture showing values with RBW=30 kHz



12. Conducted RF Emissions Test on AC Power Line

Test Setup

The Conducted Emissions test was performed at L.S. Compliance, Inc. in Cedarburg, Wisconsin. The test area and setup are in accordance with ANSI C63.4-2003 and with Title 47 CFR, FCC Part 15 (Industry Canada RSS-210). The EUT was placed on a non-conductive Styrofoam platform, with a height of 80 cm above the reference ground plane. The EUT's wall transformer was plugged into a 50Ω (ohm), 50/250 μH Line Impedance Stabilization Network (LISN). The AC power supply of 115V was provided to the Conducted emissions ground planes via an appropriate broadband EMI Filter, and then to the LISN line input. Final readings were then taken and recorded. After the EUT was setup and connected to the LISN, the RF Sampling Port of the LISN was connected to a 10 dB Attenuator-Limiter, and then to the HP 8546A EMI Receiver. The EMCO LISN used has the ability to terminate the unused port with a 50Ω (ohm) load when switched to either L1 (line) or L2 (neutral).

Test Procedure

The EUT was investigated in continuous modulated transmit mode for this portion of the testing. The appropriate frequency range and bandwidths were selected on the EMI Receiver, and measurements were made. The bandwidth used for these measurements is 9 kHz, as specified in CISPR 16-1 (2003), Section 1, Table 1, for Quasi-Peak and Average detectors in the frequency range of 150 kHz to 30MHz. Final readings were then taken and recorded.

Test Equipment Utilized

A list of the test equipment and accessories utilized for the Conducted Emissions test is provided in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. Calibrations of the LISN and Limiter are traceable to N.I.S.T. All cables are calibrated and checked periodically for conformance. The emissions are measured on the HP 8546A EMI Receiver, which has automatic correction for all factors stored in memory and allows direct readings to be taken.

Test Results

The EUT was found to **MEET** the Conducted Emission requirements of FCC Part 15.207 Conducted Emissions for an Intentional Radiator. See the Data Charts and Graphs for more details of the test results.

Calculation of Conducted Emissions Limits

The following table describes the Class B limits for an unintentional radiator. These limits are obtained from Title 47 CFR, Part 15.107 (a) for Conducted Emissions.

Frequency (MHz)	Quasi-Peak Limit (dBµV)	Average Limit (dBµV)
0.15 – 0.5	66 – 56 *	56 - 46
0.5 – 5.0	56	46
5.0 – 30.0	60	50

* Decreases with the logarithm of the frequency.

Sample calculation for the limits in the 0.15 to 0.5 MHz:

$$\text{Limit} = -19.12 \left(\text{Log}_{10} \left(F[\text{MHz}] / 0.15 [\text{MHz}] \right) \right) + 66.0 \text{ dB}\mu\text{V}$$

For a frequency of 200 kHz for example:

$$\text{Quasi-Peak Limit (F = 200kHz)} = -19.12 \left(\text{Log}_{10} \left(0.2[\text{MHz}] / 0.15 [\text{MHz}] \right) \right) + 66.0 \text{ dB}\mu\text{V}$$

$$\text{Quasi-Peak Limit (F = 200kHz)} = 63.6 \text{ dB}\mu\text{V}$$

$$\text{Average Limit (F=200kHz)} = -19.12 \left(\text{Log}_{10}(0.2[\text{MHz}]/0.15[\text{MHz}]) \right) + 56.0 \text{ dB}\mu\text{V}$$

$$\text{Average Limit (F = 200 kHz)} = 53.6 \text{ dB}\mu\text{V}$$

Measurement of Electromagnetic Conducted Emission

Frequency Range inspected: 150 KHz to 30 MHz

Test Standard: FCC 15.207 (a)

Manufacturer:	Siemens Building Technology					
Date(s) of Test:	September 20, 2005					
Test Engineer:		Tom Smith		Abtin Spantman	X	Ken Boston
Model #:	WLAN 3100					
Serial #:	Beta 003					
Voltage:	24 VAC via a wall transformer operating from the 115 VAC source					
Operation Mode:	Continuous modulated transmit.					
Test Location:	X	Conducted emissions site				Chamber
EUT Placed On:	X	40cm from Vertical Ground Plane				10cm Spacers
	X	80cm above Ground Plane				Other:
Measurements:		Pre-Compliance		Preliminary	X	Final
Detectors Used:		Peak	X	Quasi-Peak	X	Average

Environmental Conditions in the Lab:
Temperature: 20 – 25° C
Atmospheric Pressure: 86 kPa – 106 kPa
Relative Humidity: 30 – 60%

Test Equipment Utilized:
EMI Receiver: HP 8546A
LISN: EMCO 3816/2NM
Transient Limiter: HP 119474A

		QUASI-PEAK			AVERAGE		
Frequency (MHz)	Line	Q-Peak Reading (dBµV/m)	Q-Peak Limit (dBµ V/m)	Quasi-Peak Margin (dB)	Average Reading (dBµV/m)	Average Limit (dBµ V/m)	Average Margin (dB)

Notes:

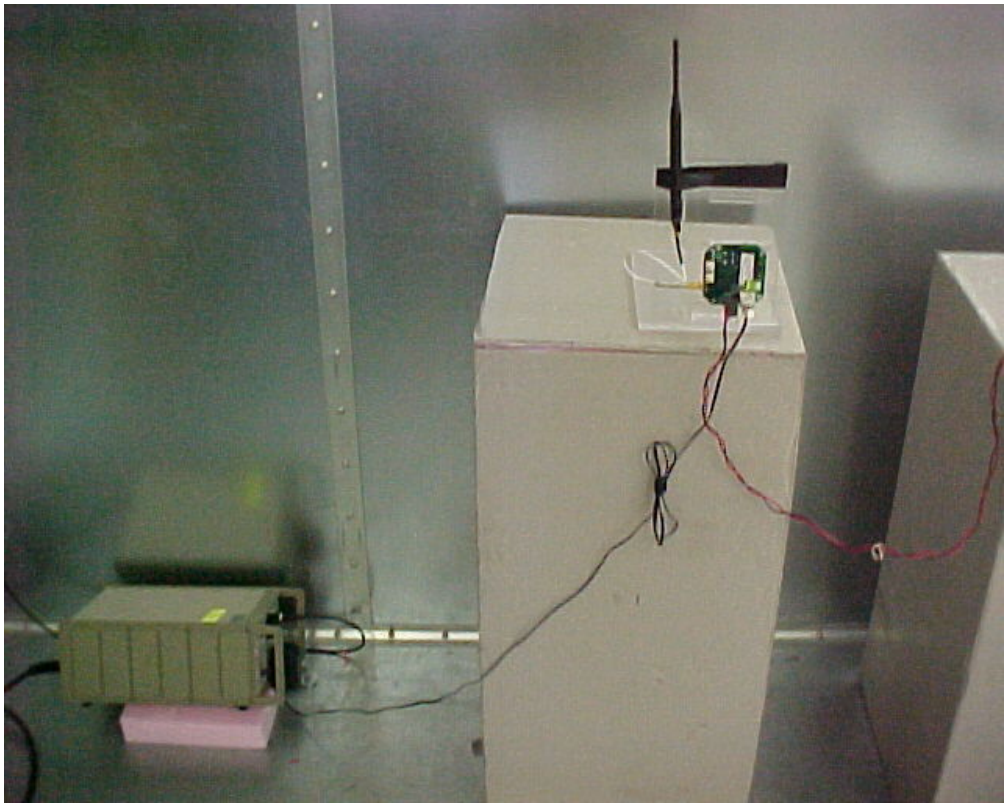
1) The emissions listed are characteristic of the power supply used, and did not change by the EUT.

2) All emissions seen were better than 20 dB below the limits.

3) The EUT exhibited similar emissions in transmit and receive modes, and across the Low, Middle and High channels tested.

Photo(s) Taken During Conducted Emission Testing

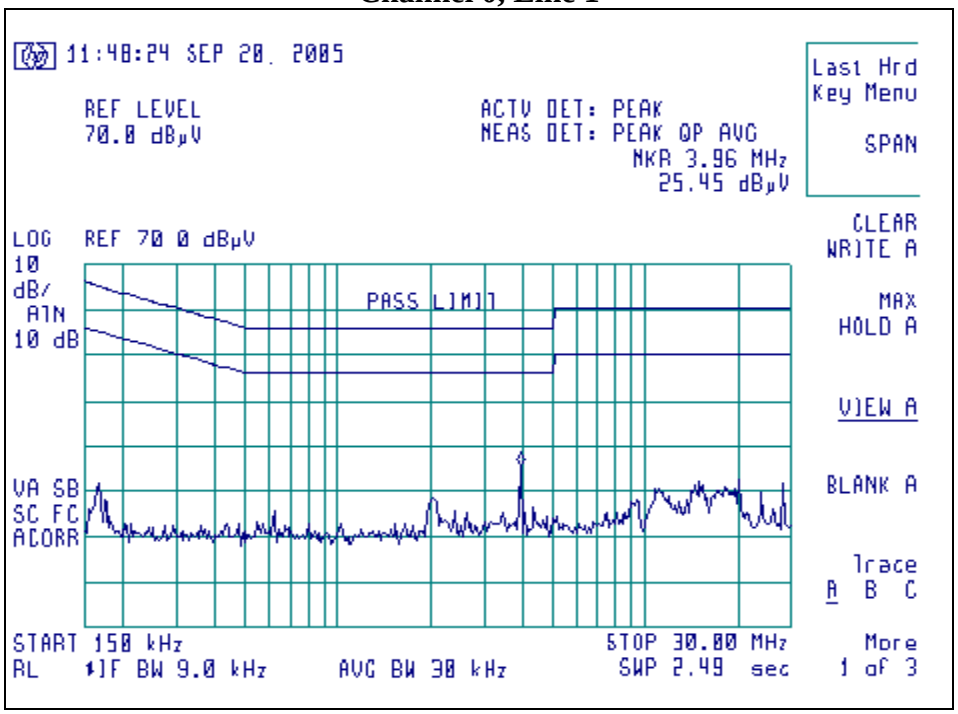
Setup for the Conducted Emissions Test



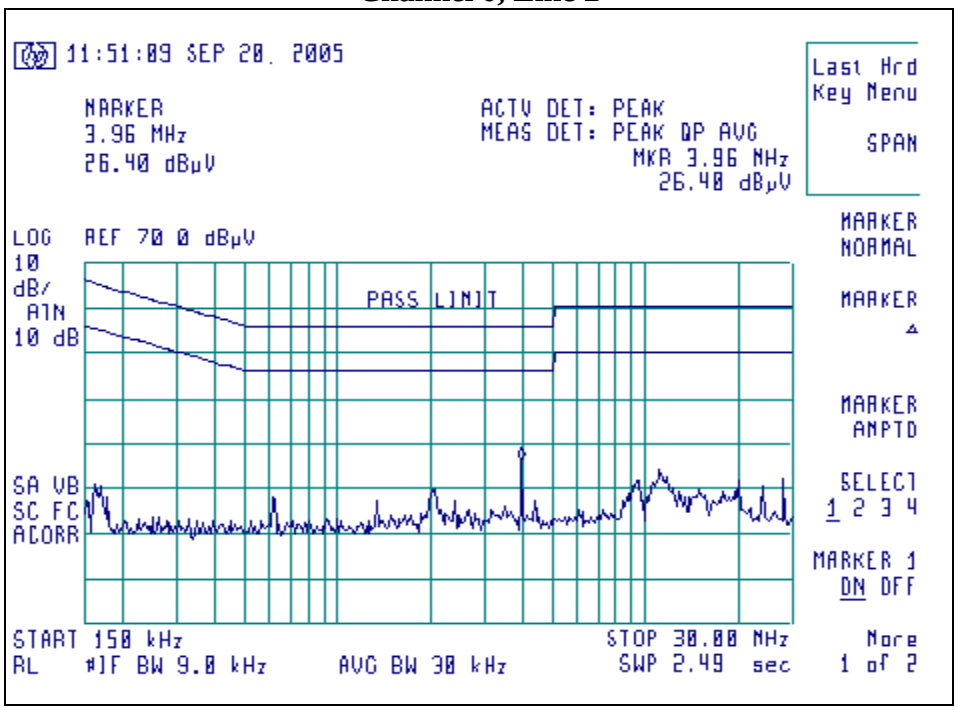
Screen Captures of Conducted AC Mains Emissions:

Please note these screen captures represent Peak Emissions. For conducted emission measurements, we utilize both a Quasi-Peak detector function as well as the Average detector function for measurements as described in Title 47 CFR 15.209.

Channel 0, Line 1



Channel 0, Line 2



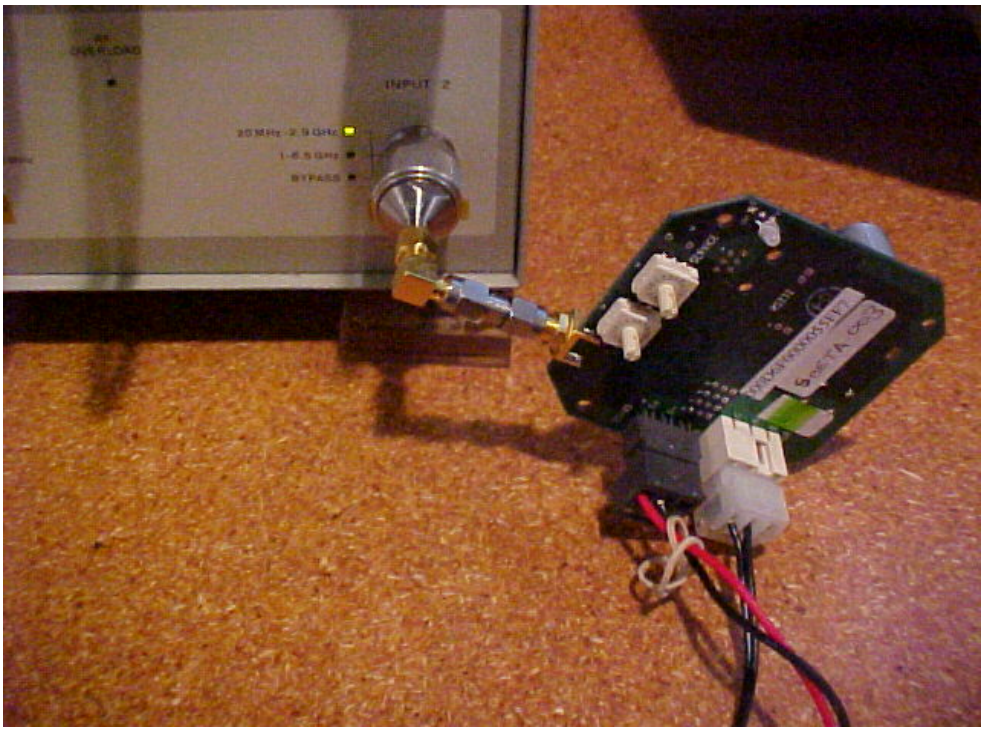
13. Power Output 15.247(b)

The conducted RF output power of the EUT was measured at the antenna port using a short RF connection directly to the spectrum analyzer. The unit was configured to run in a continuous transmit mode, while being supplied with a random data stream internally created by test software. The spectrum analyzer was used with resolution and video bandwidths set to 3 MHz, and a span of 6 MHz, with measurements from a peak detector presented in the chart below. RF Power Output was also monitored while varying the AC voltage as sourced by an AC bench type power supply.

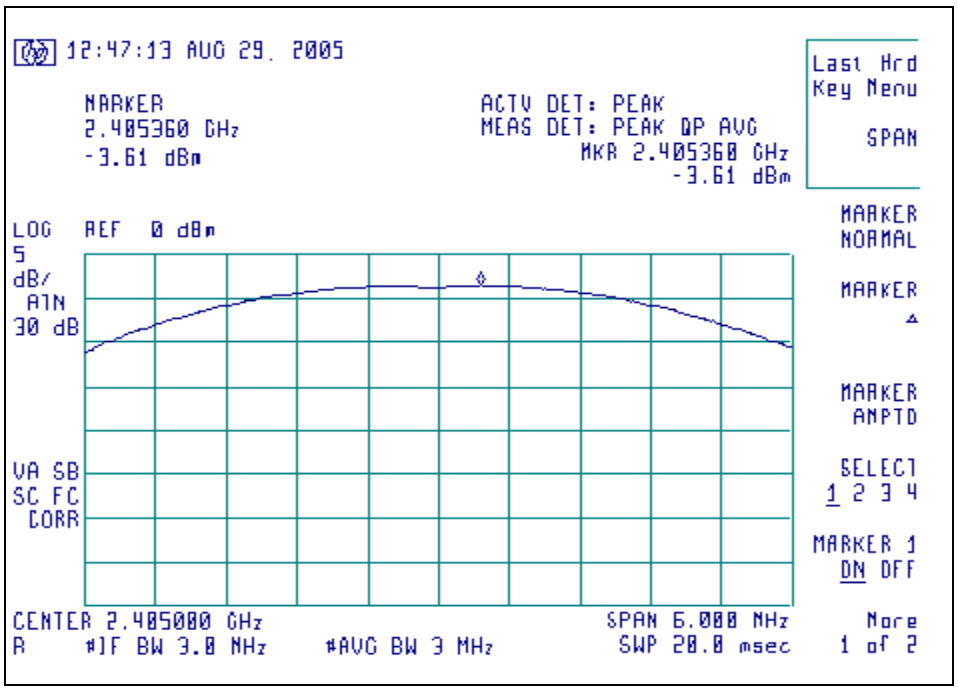
No variation in output power was seen while setting the AC voltage to 98 VAC (-15%) or to 132 VAC (+15%) as a change in input voltage to the step down transformer that supplies 24 VAC to the circuit board.

CHANNEL	CENTER FREQ (MHz)	LIMIT (dBm)	MEASURED POWER (dBm)	MARGIN (dB)
0	2405	30 dBm	-3.6	33.6
7	2440	30 dBm	-3.1	33.1
F *	2480	30 dBm	-2.0	32.0

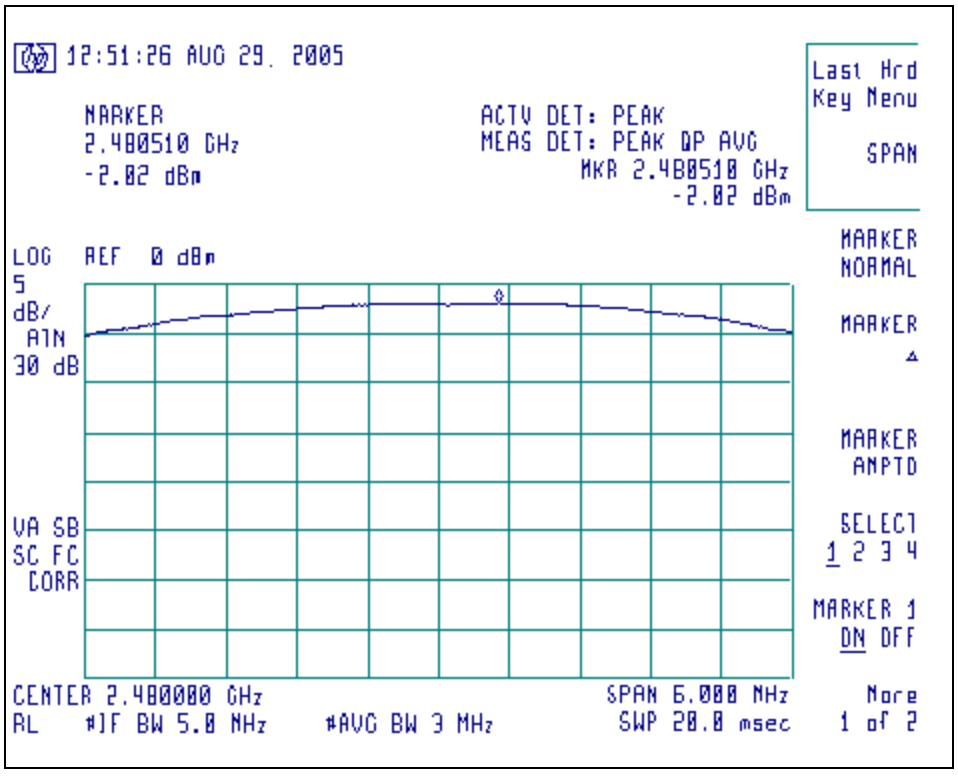
***Channel F was set to the -1 dBm power level for this test; during radiated testing, and for subsequent production, the power setting is reduced to -8 dBm**



Channel 0 Conducted Power Output



Channel F Conducted Power Output



14. Spurious Emissions 15.247(d)

FCC Part 15.247(d) requires a measurement of conducted harmonic and spurious RF emission levels, as reference to the carrier level when measured in a 100 kHz bandwidth. For this test, the spurious and harmonic RF emissions from the EUT were measured at the EUT antenna port using a short RF cable along with an attenuator as protection for the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, there by allowing direct readings of the measurements made without the need for any further corrections. A Hewlett Packard model E4407B spectrum analyzer was used with the resolution bandwidth set to 100 kHz for this portion of the tests. The unit was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used with measurements from a peak detector presented in the chart below. Screen captures were acquired and any noticeable spurious and harmonic signals were identified and measured.

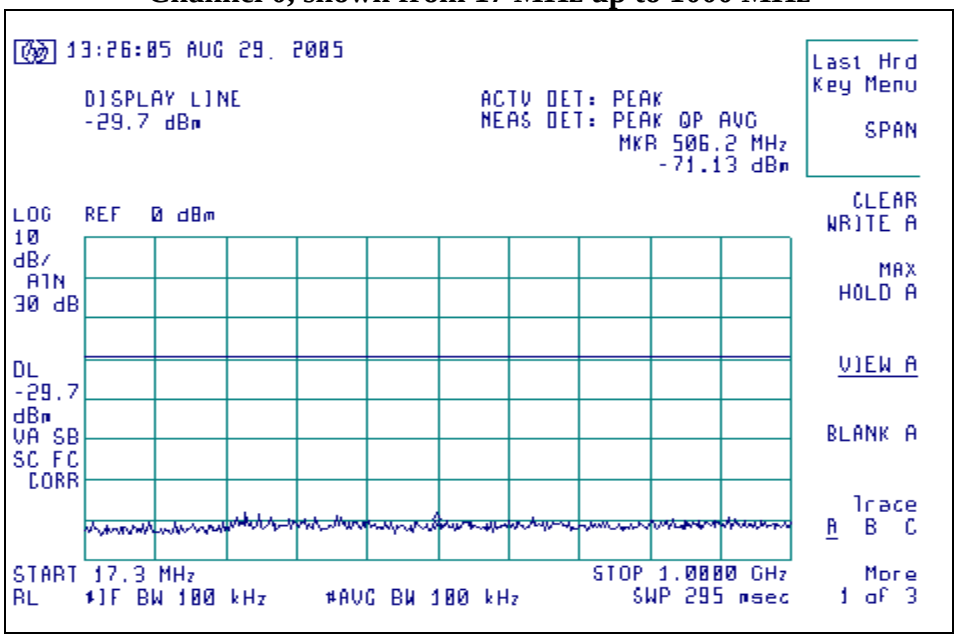
No significant emissions could be noted within -50 dBc of the fundamental level for this product.

	Channel 0	Channel 7	Channel E
Fundamental	- 8.18 (dBm)	- 7.66 (dBm)	- 7.60 (dBm)
2nd Harmonic	- 50.97 (dBm)	- 50.98 (dBm)	- 49.68 (dBm)
3rd Harmonic	- 63.19 (dBm)	- 66.50 (dBm)	- 68.34 (dBm)
4th Harmonic	- 73.06 (dBm)	- 74.07 (dBm)	- 74.03 (dBm)
5th Harmonic	Note (1)	Note (1)	Note (1)
6th Harmonic	Note (1)	Note (1)	Note (1)
7th Harmonic	Note (1)	Note (1)	Note (1)
8th Harmonic	Note (1)	Note (1)	Note (1)
9th Harmonic	Note (1)	Note (1)	Note (1)
10th Harmonic	Note (1)	Note (1)	Note (1)
2548.8 MHz	- 59.03 (dBm)	------	------
2626.8 MHz	------	------	- 58.70 (dBm)

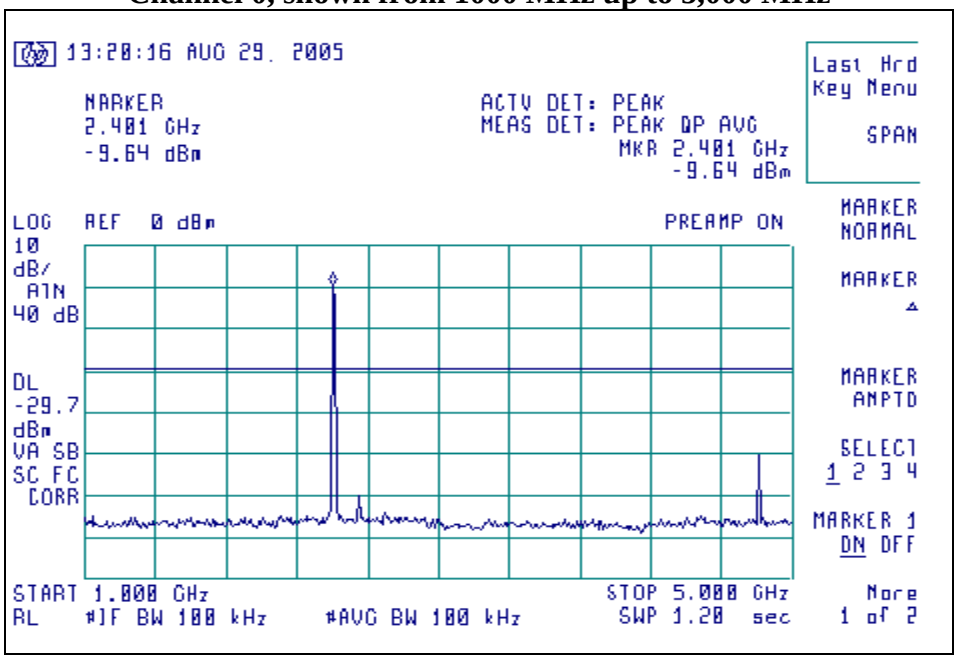
Notes:
(1) Measurement at system noise floor.

Plots of Conducted Spurious and Fundamental Levels

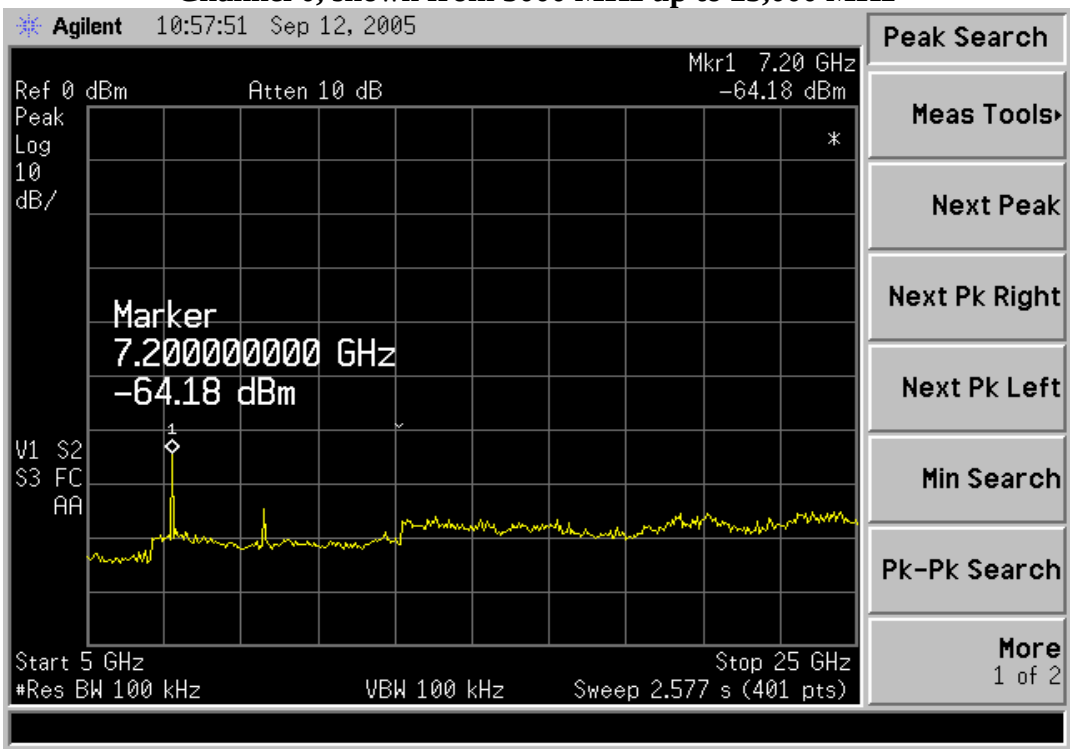
Channel 0, shown from 17 MHz up to 1000 MHz



Channel 0, shown from 1000 MHz up to 5,000 MHz



Channel 0, shown from 5000 MHz up to 25,000 MHz



15. Occupied Bandwidth

The 20 dB bandwidth requirement found in FCC Part 15.247(a)(2) requires a minimum -6dBc occupied bandwidth of 500 kHz. For this portion of the tests, a direct measurement of the transmitted signal was performed at the antenna port of the EUT, via a short connection to the HP 8546A EMI/spectrum analyzer.

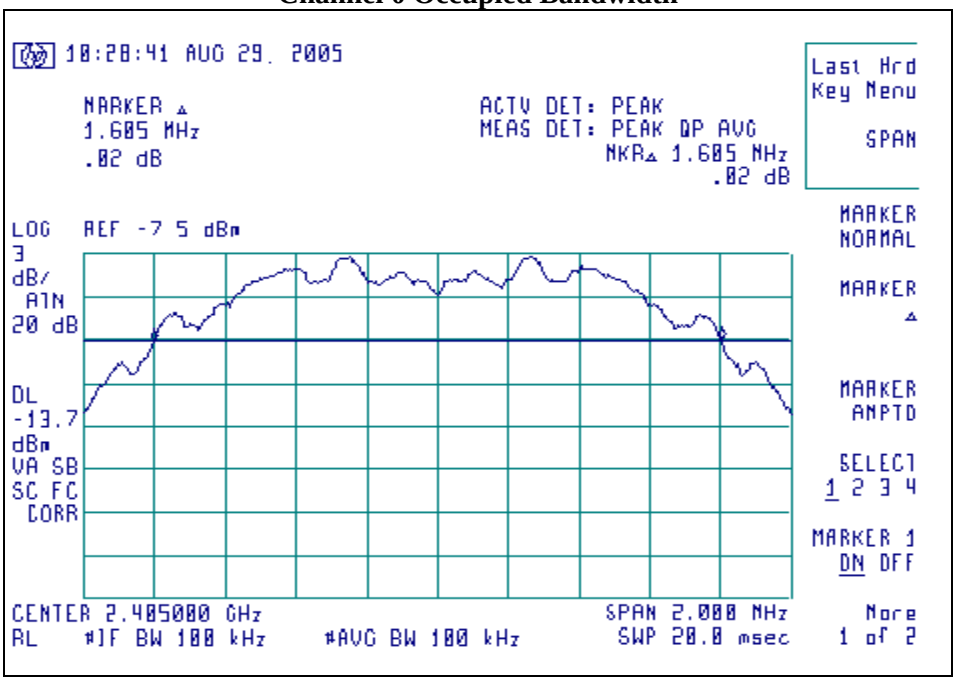
A Hewlett Packard model 8546A EMI/spectrum analyzer was used with the resolution bandwidth set to 100 kHz for this portion of the tests. The EUT was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used in peak-hold mode while measurements were made, as presented in the chart below.

From this data, the closest measurement when compared to the specified limit, is 1605 kHz, which is above the minimum of 500 kHz.

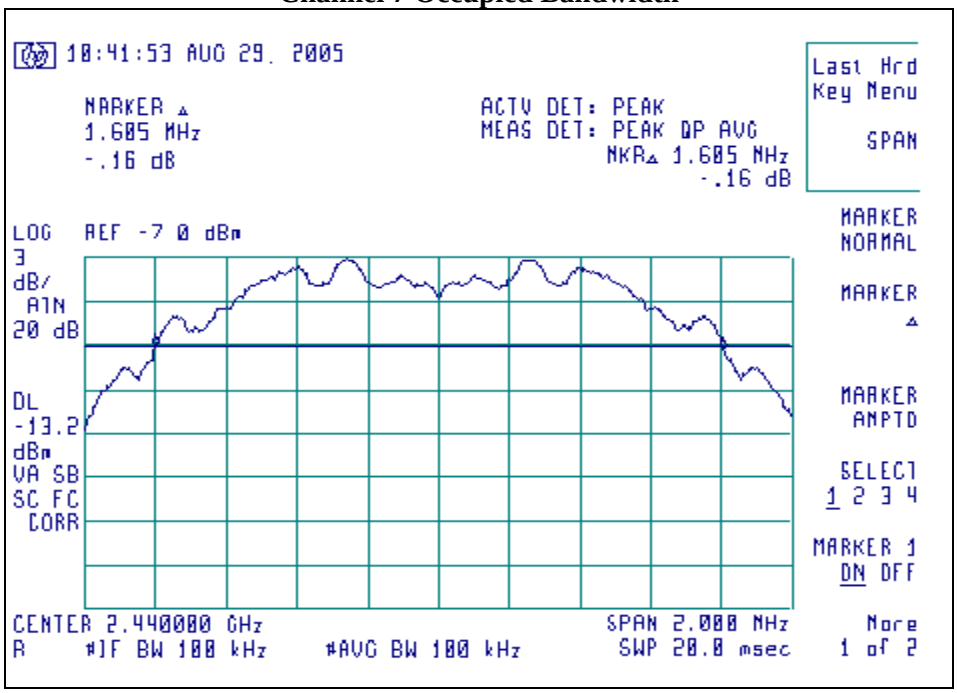
Channel	Center Frequency (MHz)	Measured 6 dB BW (kHz)	Minimum Limit (kHz)
0	2405	1,605	500
7	2440	1,605	500
E	2475	1,610	500

Plots of Occupied Bandwidth

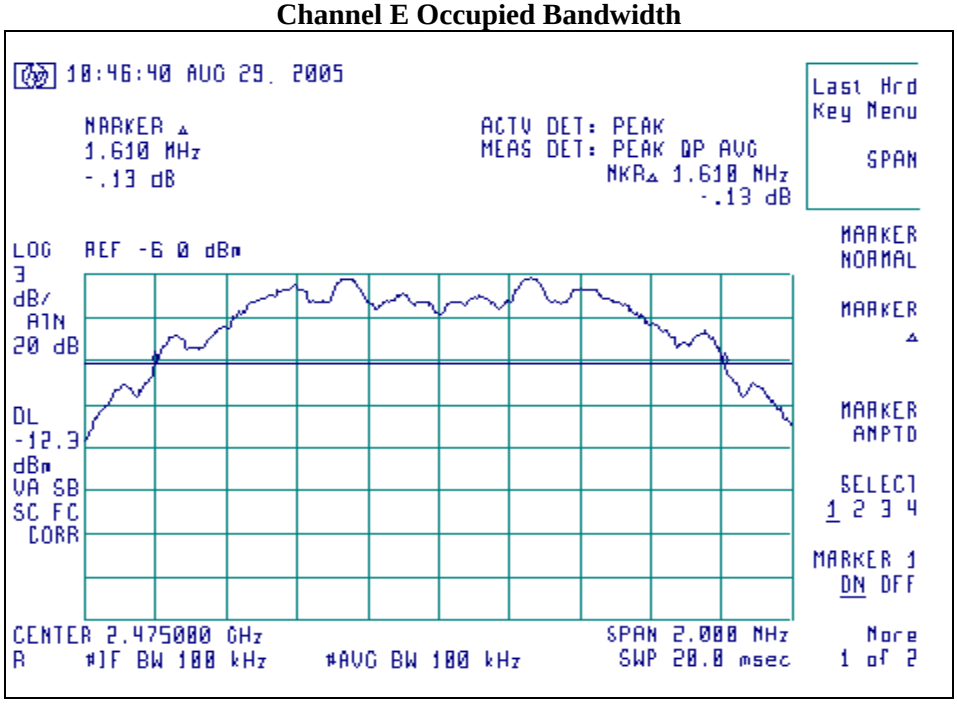
Channel 0 Occupied Bandwidth



Channel 7 Occupied Bandwidth



Channel E Occupied Bandwidth

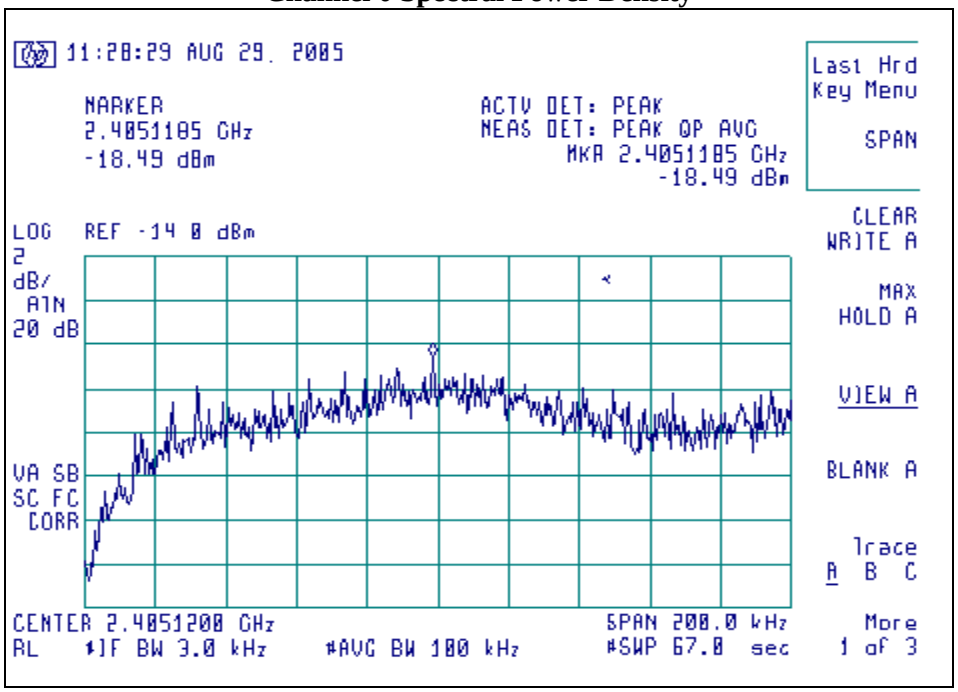


16. Spectral Density

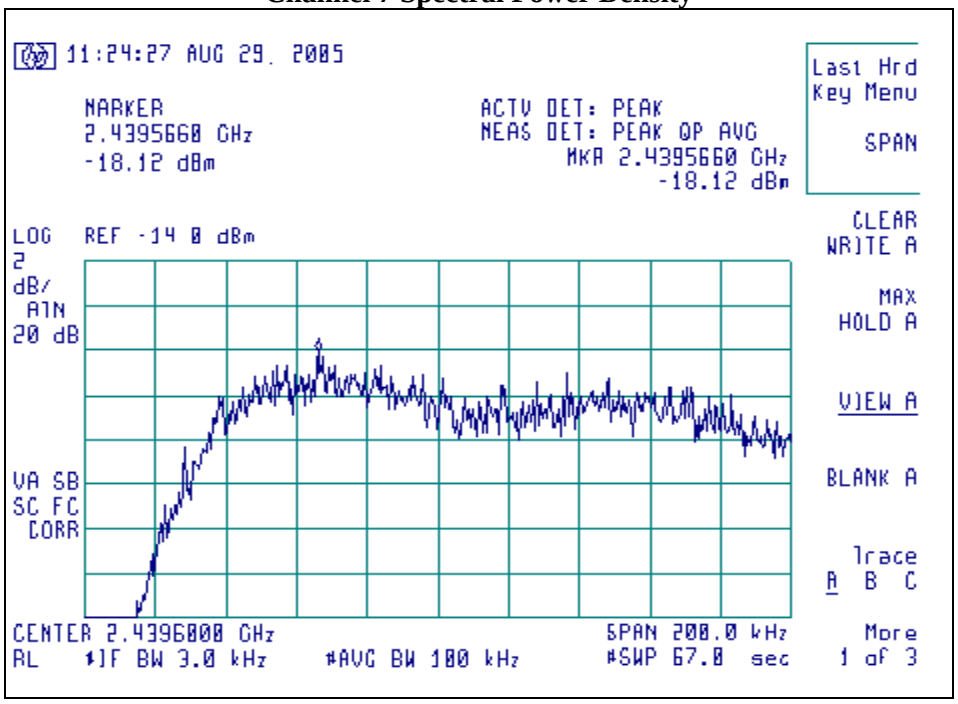
In accordance with FCC Part 15.247(e), the peak power spectral density should not exceed +8 dBm in any 3 kHz band. This measurement was performed along with the conducted power output readings performed as described in previous sections. The peak output frequency for each representative frequency was scanned, with a narrow bandwidth, and reduced sweep, and a power density measurement was performed by direct inspection of the HP EMI/SA while in a 3 kHz bandwidth. The highest density was found to be no greater than
-17.3 dBm, which is under the allowable limit by 25 dB.

Channel	Center Frequency (MHz)	Measured Channel Power (dBm)	Limit (dBm)	Margin (dB)
0	2405	-18.5	+8.0	26.5
7	2440	-18.1	+8.0	26.1
E	2475	-17.3	+8.0	25.3

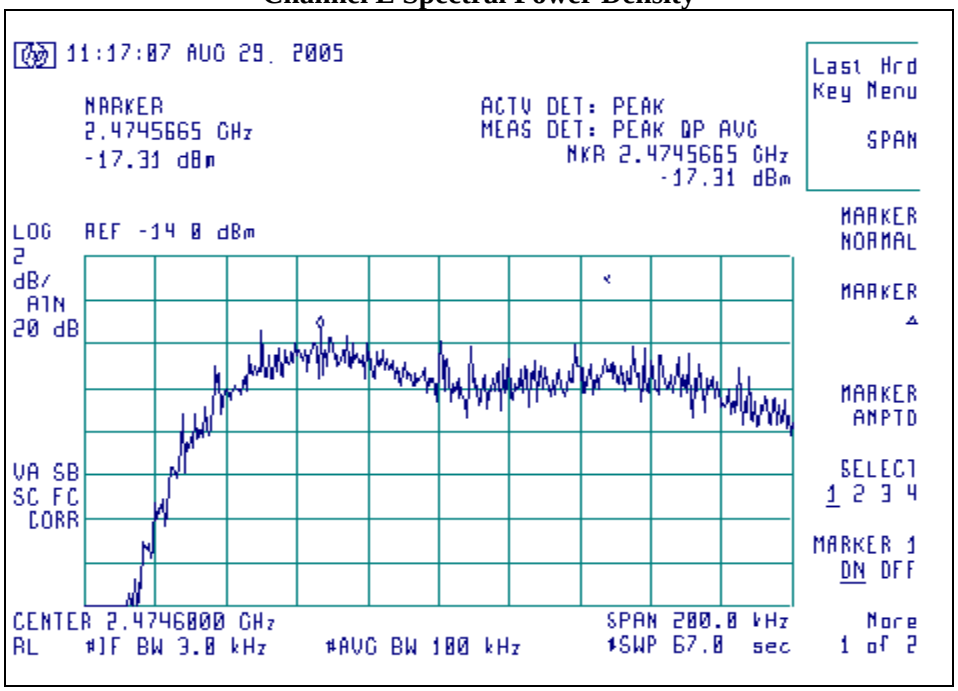
Channel 0 Spectral Power Density



Channel 7 Spectral Power Density



Channel E Spectral Power Density



19. MPE Calculations

2.4 GHz node Transceiver
MPE Calcluation

Prediction of MPE limit at a given distance

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

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	-2.00	(dBm)
Maximum peak output power at antenna input terminal:	0.631	(mW)
Antenna gain(typical):	5	(dBi)
Maximum antenna gain:	3.162	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2400	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.000397	(mW/cm^2)
Maximum allowable antenna gain:	39.0	(dBi)
Margin of Compliance at 20 cm =	34.0	dB

Appendix A

Test Equipment List

Asset #	Manufacturer	Model #	Serial #	Description	Date	Due
AA960008	EMCO	3816/2NM	9701-1057	Line Impedance Stabilization Network	9/15/04	9/15/05
AA960031	HP	119474A	3107A01708	Transient Limiter	Note 1	Note 1
AA960077	EMCO	93110B	9702-2918	Biconical Antenna	9/16/04	9/16/05
AA960078	EMCO	93146	9701-4855	Log-Periodic Antenna	9/16/04	9/16/05
AA960081	EMCO	3115	6907	Double Ridge Horn Antenna	12/07/04	12/07/05
CC00221C	Agilent	E4407B	US39160256	Spectrum Analyzer	12/06/04	12/06/05
EE960004	EMCO	2090	9607-1164	Device Controller	N/A	N/A
EE960013	HP	8546A	3617A00320	Receiver RF Section	9/16/04	9/16/05
EE960014	HP	85460A	3448A00296	Receiver Pre-Selector	9/16/04	9/16/05
N/A	LSC	Cable	0011	3 Meter ½" Armored Cable	Note 1	Note 1
N/A	LSC	Cable	0038	1 Meter RG 214 Cable	Note 1	Note 1
N/A	LSC	Cable	0050	10 Meter RG 214 Cable	Note 1	Note 1
N/A	Pasternack	Attenuator	N/A	10 dB Attenuator	Note 1	Note 1

Note 1 - Equipment calibrated within a traceable system.

Uncertainty Statement

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level, using a coverage factor of k=2.

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	Particular Configuration	Uncertainty Values
Radiated Emissions	3 – Meter chamber, Biconical Antenna	4.24 dB
Radiated Emissions	3-Meter Chamber, Log Periodic Antenna	4.8 dB
Radiated Emissions	10-Meter OATS, Biconical Antenna	4.18 dB
Radiated Emissions	10-Meter OATS, Log Periodic Antenna	3.92 dB
Conducted Emissions	Shielded Room/EMCO LISN	1.60 dB
Radiated Immunity	3 Volts/Meter in 3-Meter Chamber	1.128 Volts/Meter
Conducted Immunity	3 Volts level	1.0 V