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

COMPLIANCE TESTING OF:

HOMEheartbeat-Whole Home Awareness System
Base Station

Prepared For:
Eaton Corporation
Attn.: Mr. Richard Harwell
170 Industry Drive
Pittsburgh, PA 15275

Test Report Number:
305494 TX

Test Dates:
November 21st through December 2nd, 2005

Table of Contents

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

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

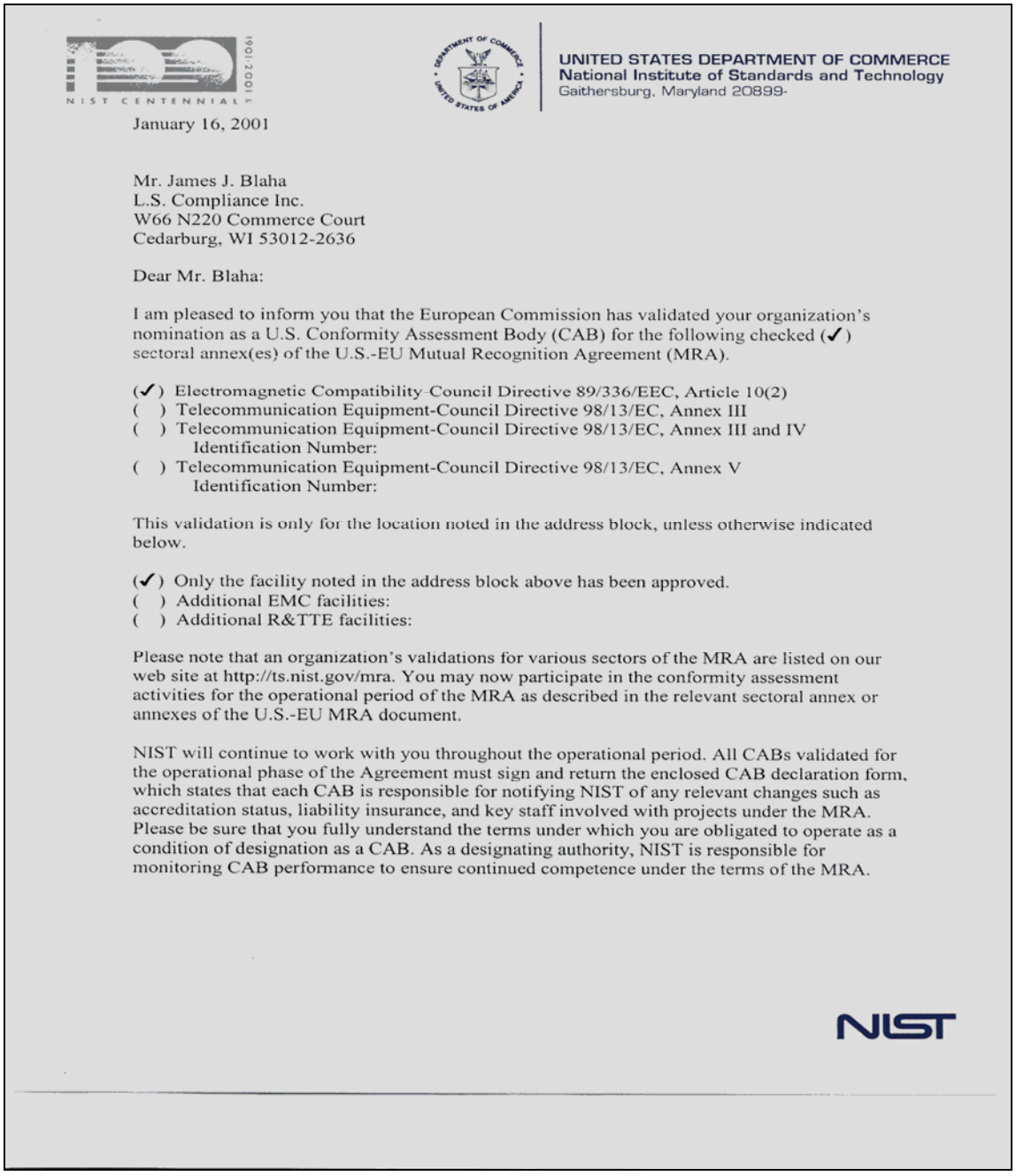
The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified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

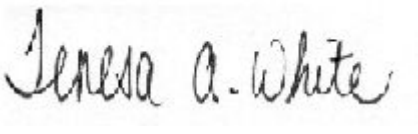
(✓) Only the facility noted in the address block above has been approved.
( ) Additional EMC facilities:
( ) Additional R&TTE facilities:

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

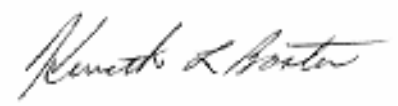
4. Signature Page



Prepared By: December 12, 2005

Teresa A. White, Document Coordinator Date

Tested and



Approved By: December 12, 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:	Eaton Corporation					
Date(s) of Test:	November 21st through December 2nd, 2005					
Test Engineer(s):		Tom Smith		Abtin Spantman	√	Ken Boston
Model #:	Base Station					
Serial #:	Prototype					
Voltage:	DC from either battery or a 9 VDC Wall Supply					
Operation Mode:	Continuous Transmit					

6. Introduction

Between November 21st through December 2nd, 2005, a series of Conducted and Radiated RF Emission tests were performed on one sample of the Eaton Corporation's HOMEheartbeat-Whole Home Awareness System Base Station, 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 of 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

This is a home security system comprised of a Base Station transceiver and numerous remote sensors. A portable display unit, shaped like an oversize key and called a fob, attaches to the base unit and provides system personalization and display/alarm capabilities. The base station may be line or battery powered. (the internal voltages are regulated such that the voltage internally is fixed regardless as to whether AC mains or the internal batteries are used.)

Remote battery operated sensors are employed in such functions as magnetic sensors to detect the open or closed state of windows and doors. Other sensors include fluid sensors which can detect rising water levels, as for example for a flooding basement. Another module provides for a water valve actuator (line powered) which can shut-off the flow of water if flooding is taking place.

The Base Station is comprised of an RF transceiver, an RF power amplifier, a telephone interface, a wall adapter power connector and a host processor. The RF Section (transceiver and power amplifier) operate in the 2.400 to 2.4835 GHz ISM band fixed channel communications with digital modulation. The RF transceiver is the Ember EM2420 (based on the Chipcon CC2420).

The unit is powered from a AC wall adapter and uses a 2.5mm coaxial power jack on the rear panel of the device. The telephone connection is an RJ-11 phone jack also on the back panel. For testing purposes, a USB port is provided on the side of the device.

8. Test Requirements

The above mentioned tests were performed in order to determine the compliance of the EUT 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 Eaton Corporation HOMEheartbeat-Whole Home Awareness System Base Station 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 full data rate modulated mode, using power as provided by a 9 VDC wall supply. The unit has the capability to operate on 15 channels, controllable via a test program 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: Channel 0 (2405 MHz), Channel 7 (2440 MHz) and Channel E (2475 MHz) to comply with FCC Part 15.35. The channels and operating modes were changed using a PC running a downloadable firmware package.

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 (1 meter above 5 GHz). 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 25 GHz, the EUT was measured at a 1.0 meter separation, using a standard gain Horn Antenna (18 – 26 GHz) and pre-amplifier.

The EUT was operated while in its normal position.

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 DTS 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 2400 – 2483.5 MHz 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 general radiated emission limits above 30 MHz. 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

For measurements made at 0.3 meter, a 20 dB correction has been invoked.

960 MHz to 10,000 MHz

500μV/m or 54.0 dB/μV/m at 3 meters

54.0 + 20 = 74 dB/μV/m at 0.3 meters

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 25,000 MHz

Manufacturer:	Eaton Corporation							
Date(s) of Test:	November 21st, 22nd, 23rd and 28th, 2005							
Test Engineer(s):		Tom Smith		Abtin Spantman	√	Ken Boston		
Model #:	Base Station							
Serial #:	Prototype							
Voltage:	DC from either battery or a 9 VDC Wall Supply							
Operation Mode:	Continuous Transmit							
EUT Power:		Single Phase ___VAC				3 Phase ___VAC		
		Battery			√	Other: AC Wall Adaptor		
EUT Placement:	√	80cm non-conductive table				10cm Spacers		
EUT Test Location:	√	3 Meter Semi-Anechoic FCC Listed Chamber				3/10m OATS		
Measurements:		Pre-Compliance		Preliminary		√	Final	
Detectors Used:		Peak	√	Quasi-Peak	√	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 WHA6224
Standard Gain Horn: EMCO 3160-09

The following tables depict the level of significant spurious radiated RF emissions found:

Frequency (MHz)	Polarity	Channel	Height (m)	Azimuth (Degree)	Q-Peak Reading (dBμ V/m)	Q-Peak Limit (dBμ V/m)	Margin (dB)
966.6	V	E	1.0	180	33.9	54.0	20.1
974.9	H	E	1.35	170	34.6	54.0	19.4
999.4	V	E	1.0	180	35.5	54.0	18.5

Frequency (MHz)	Polarity	Channel	Height (m)	Azimuth (Degree)	Average Reading (dBμ V/m)	Average Limit (dBμ V/m)	Margin (dB)
2256.9	V	0	1.0	343	50.7	54.0	3.3
2261.4	V	0	1.0	343	50.5	54.0	3.5
2288.0	V	7	1.17	75	44.1	54.0	9.9
2323.0	V	E	1.0	324	51.2	54.0	2.8
2388.5	V	0	1.12	60	48.2	54.0	5.8
4809.0	V	0	1.16	197	49.9	54.0	4.1
4809.0	H	0	1.10	280	52.6	54.0	1.4
4881.0	V	7	1.18	347	44.7	54.0	9.3
4949.0	V	E	1.10	30	46.7	54.0	7.3
4949.0	H	E	1.18	336	50.1	54.0	3.9
7216.1	H	0	1.0	0	58.8	63.5	4.7
7318.5	H	7	1.0	10	55.0	63.5	8.5
7423.5	H	E	1.0	180	54.2	63.5	9.3
9617.6	H	0	1.0	45	54.2	63.5	9.3
9757.7	H	7	1.20	200	52.2	63.5	11.3
9898.0	H	E	1.0	160	50.4	63.5	13.1
12027.2	H	0	1.05	270	47.0	63.5	16.5
12197.2	H	7	1.05	30	46.6	63.5	16.9
12377.0	H	E	1.05	240	46.0	63.5	17.5

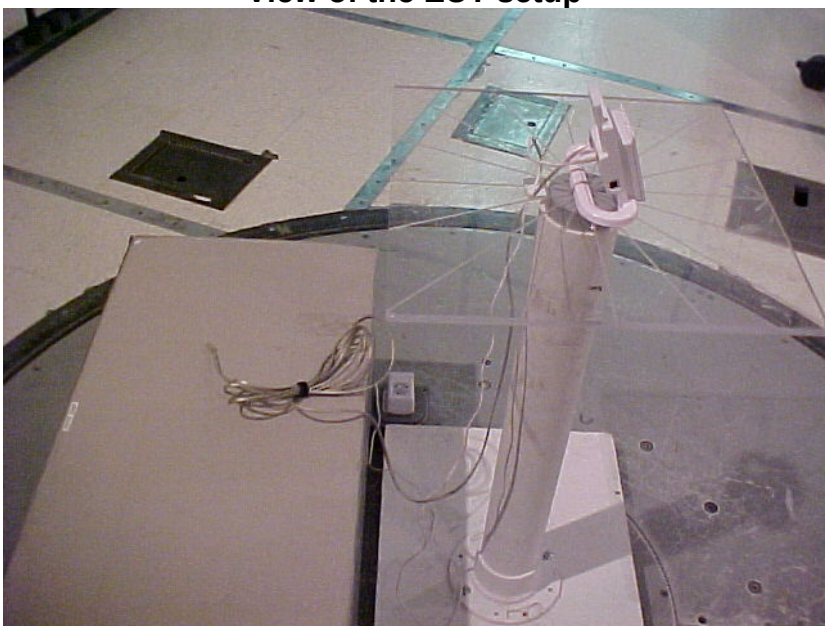
Notes:

1) A Quasi-Peak Detector was used in measurements below 1 GHz, and 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. The peak detector was used to ensure the peak emissions did not exceed 20 dB above the limits.
2) Measurements above 5 GHz were made at 1 meters of separation from the EUT, and at 1.0 m separation for frequencies between 18 – 25 GHz.

Photos Taken During Radiated Emission Testing

View of the EUT setup

View of the EUT setup

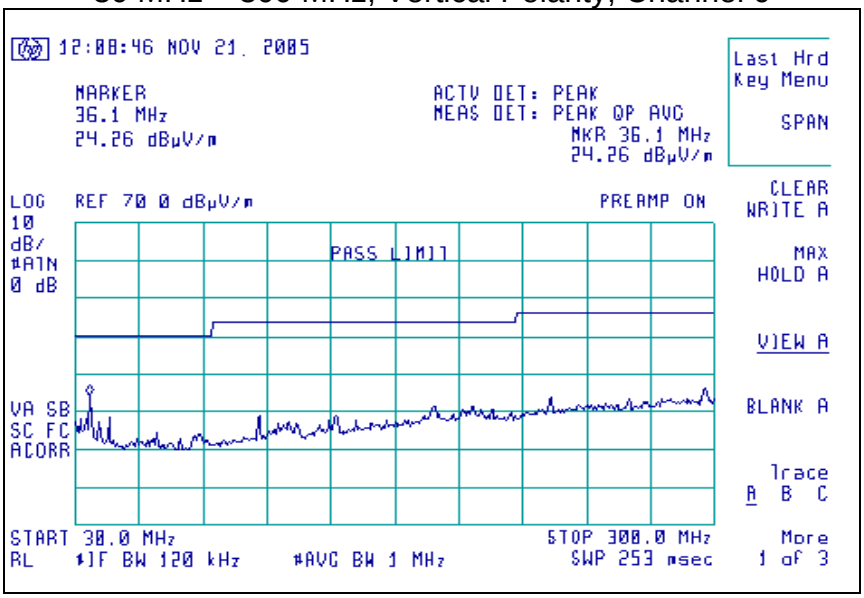


Graphs made during Radiated Emission Testing

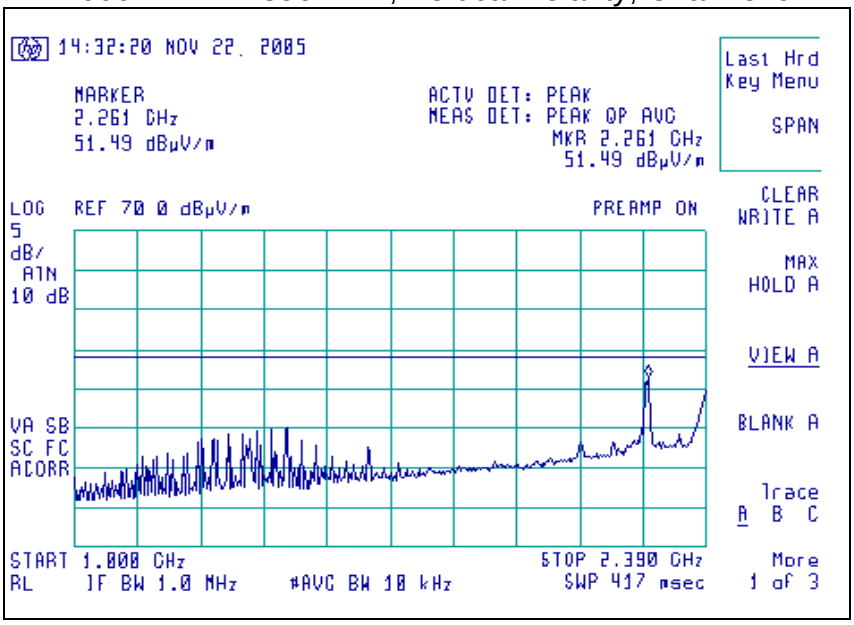
Screen Captures of Radiated RF Emissions:

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.

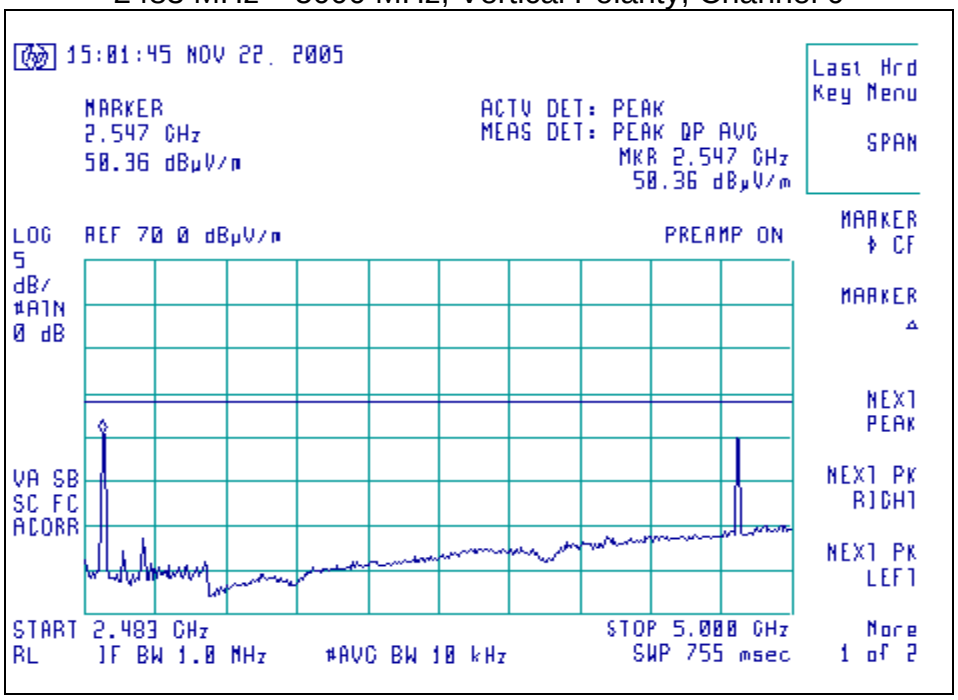
30 MHz – 300 MHz, Vertical Polarity, Channel 0



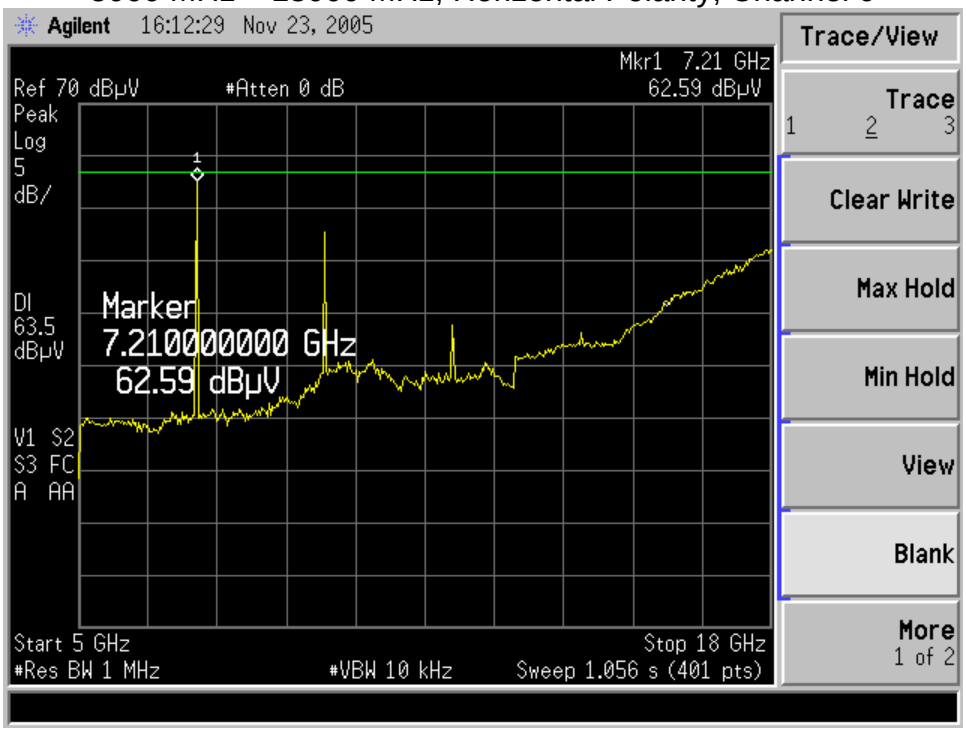
1000 MHz – 2390 MHz, Vertical Polarity, Channel 0



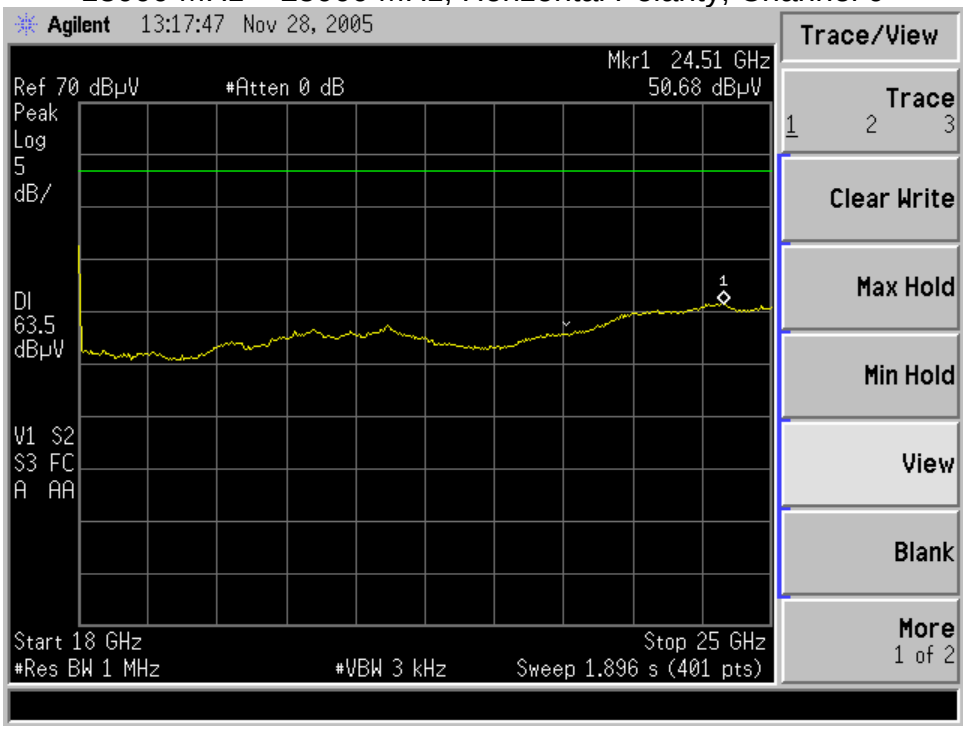
2483 MHz – 5000 MHz, Vertical Polarity, Channel 0



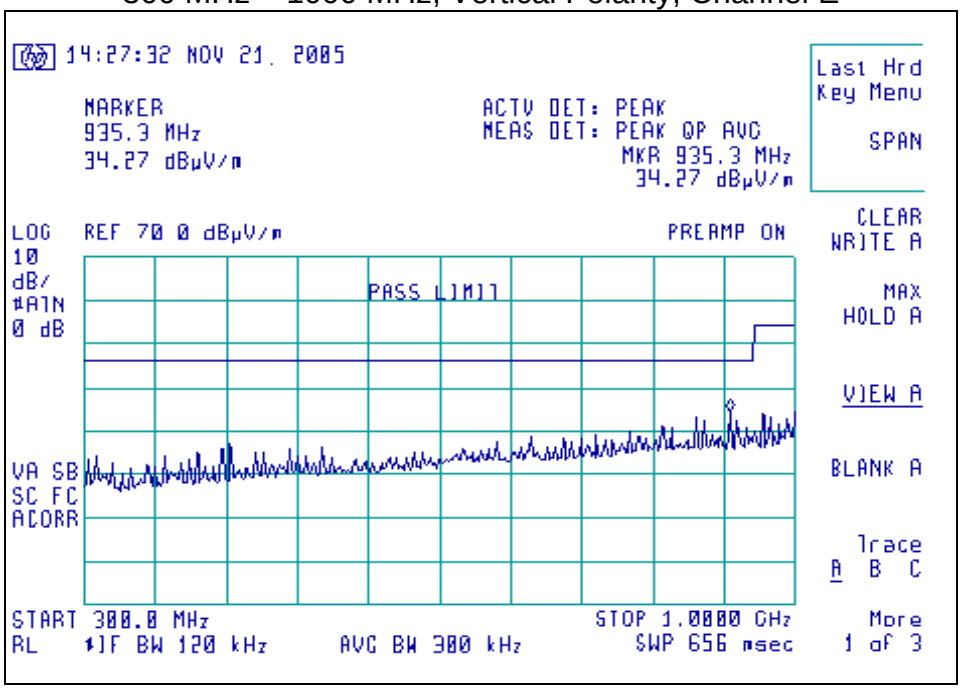
5000 MHz – 18000 MHz, Horizontal Polarity, Channel 0



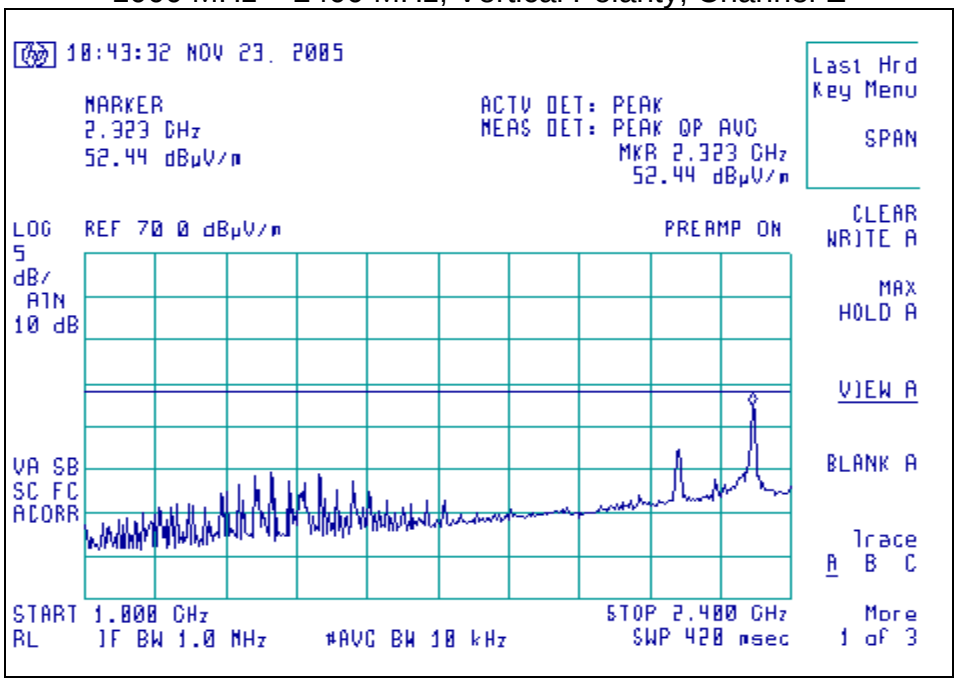
18000 MHz – 25000 MHz, Horizontal Polarity, Channel 0



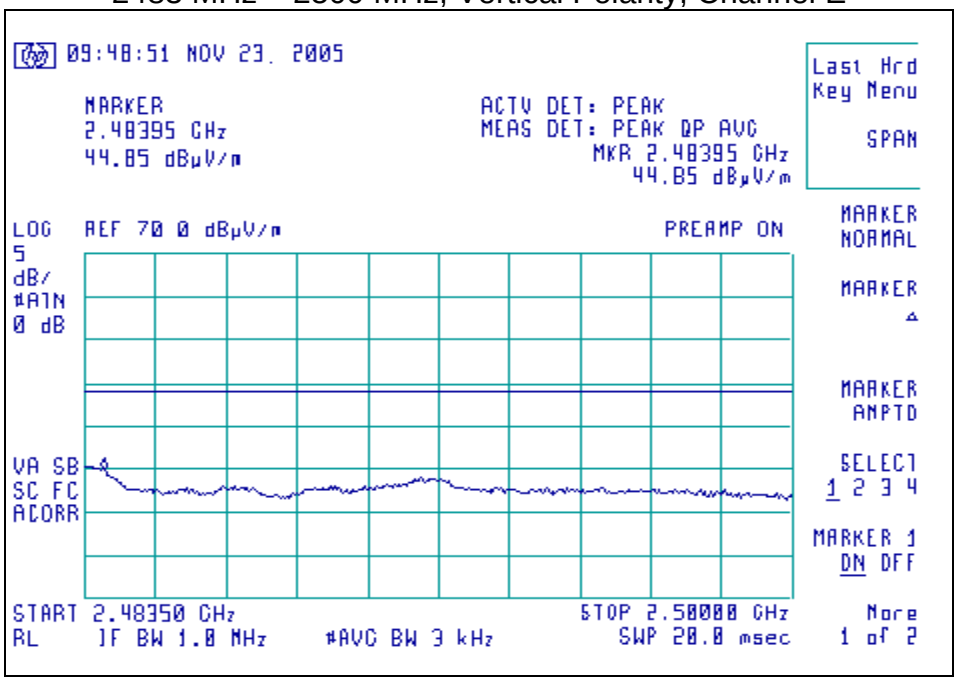
300 MHz – 1000 MHz, Vertical Polarity, Channel E



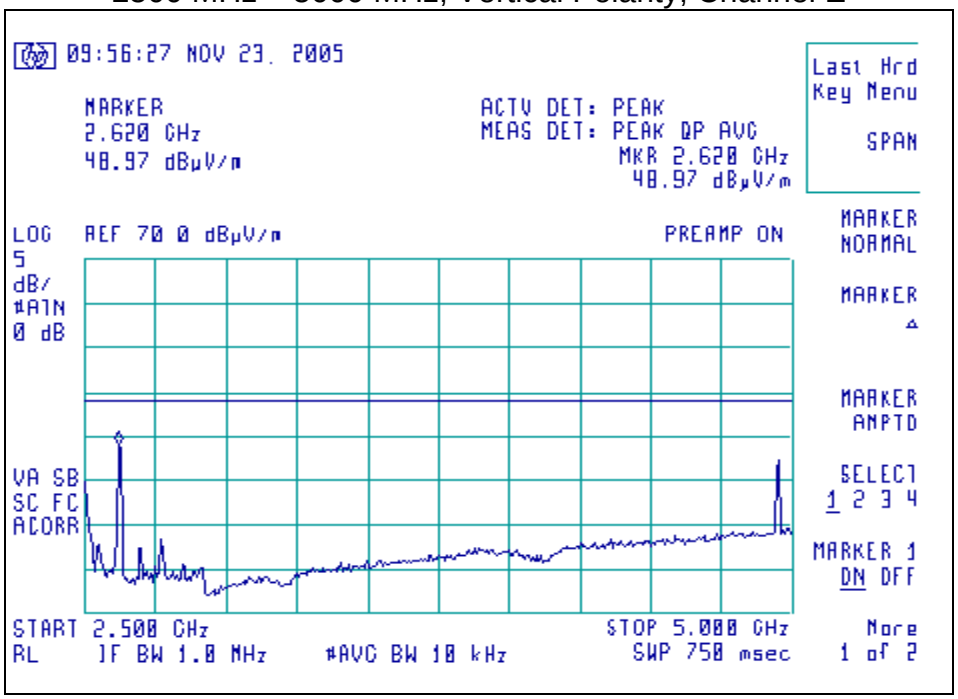
1000 MHz – 2400 MHz, Vertical Polarity, Channel E



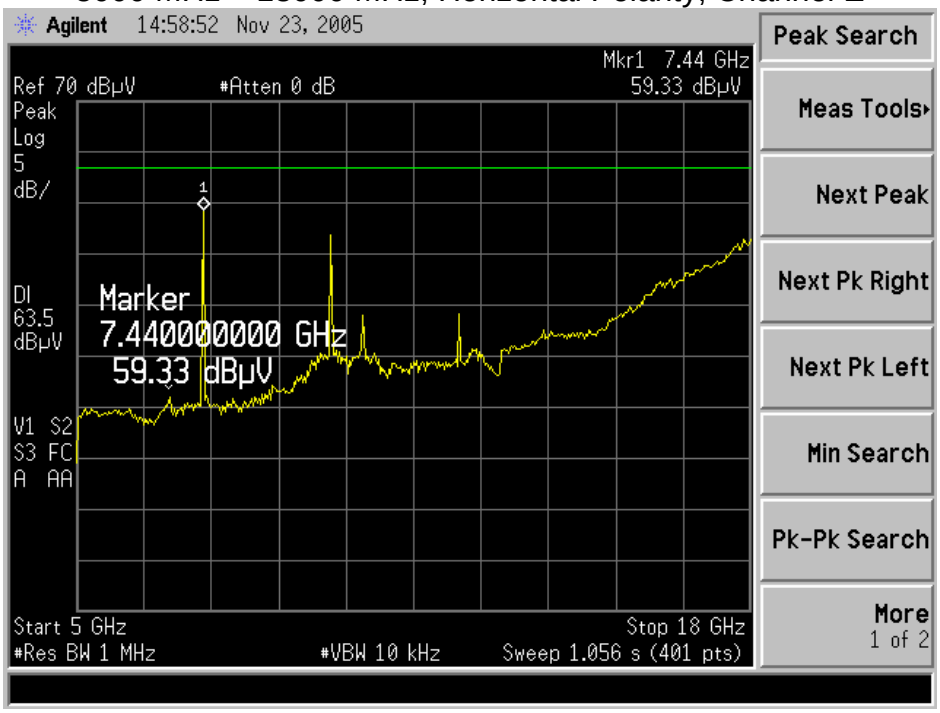
2483 MHz – 2500 MHz, Vertical Polarity, Channel E



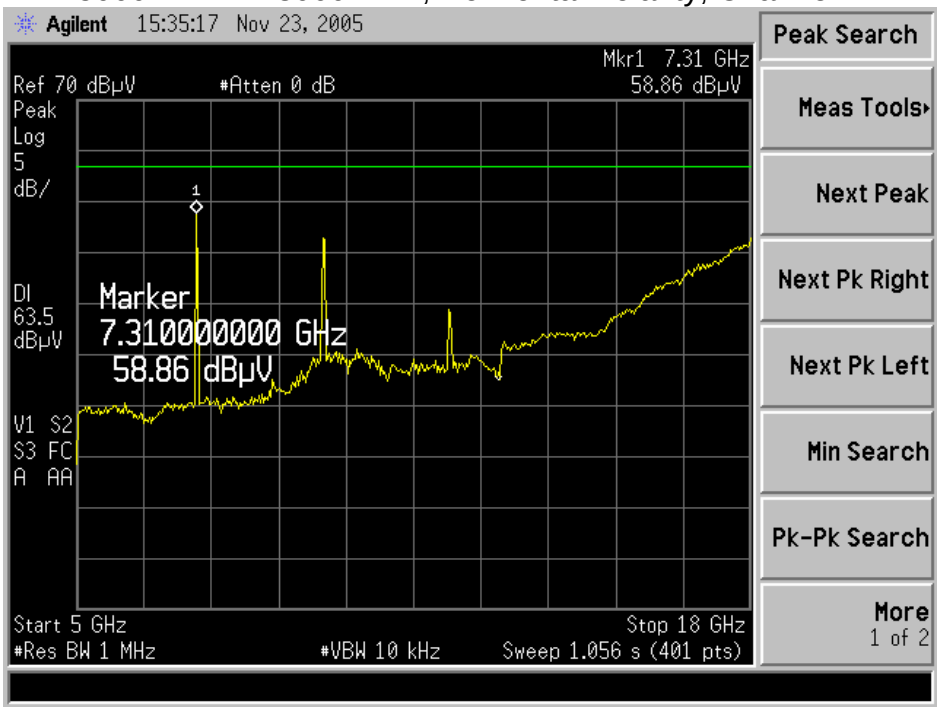
2500 MHz – 5000 MHz, Vertical Polarity, Channel E



5000 MHz – 18000 MHz, Horizontal Polarity, Channel E



5000 MHz – 18000 MHz, Horizontal Polarity, Channel 7



11. 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 wooden table, with a height of 80 cm above the reference ground plane. The EUT's power cable was plugged into a 50Ω (ohm), 50/250 μH Line Impedance Stabilization Network (LISN). The AC power supply of 120V was provided to the Conducted Emissions test site 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 15.207 (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:	Eaton Corporation					
Date(s) of Test:	December 1st, 2005					
Test Engineer:		Tom Smith		Abtin Spantman	√	Ken Boston
Model #:	Base Station					
Serial #:	Prototype					
Voltage:	DC from either battery or a 9 VDC Wall Supply					
Operation Mode:	Continuous Transmit					
Test Location:	√	Conducted Emissions Site				Chamber
EUT Placed On:	√	40cm from Vertical Ground Plane				10cm Spacers
	√	80cm above Ground Plane				Other:
Measurements:		Pre-Compliance		Preliminary	√	Final
Detectors Used:		Peak	√	Quasi-Peak	√	Average

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

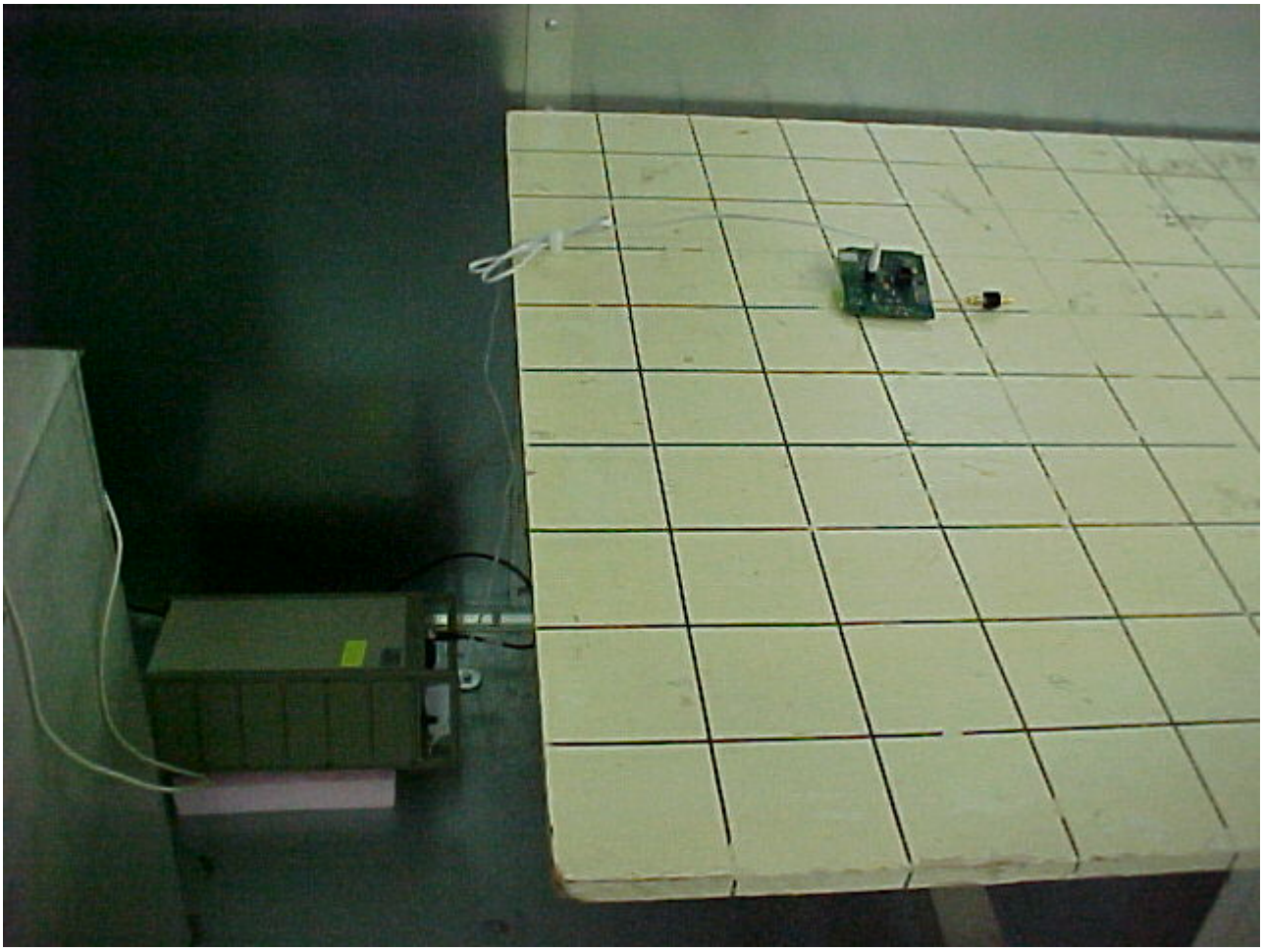
Test Equipment Utilized:
EMI Receiver: HP 8546A
LISN: EMCO 3816/2NM
Transient Limiter: HP 119474A

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

Notes:
1) 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

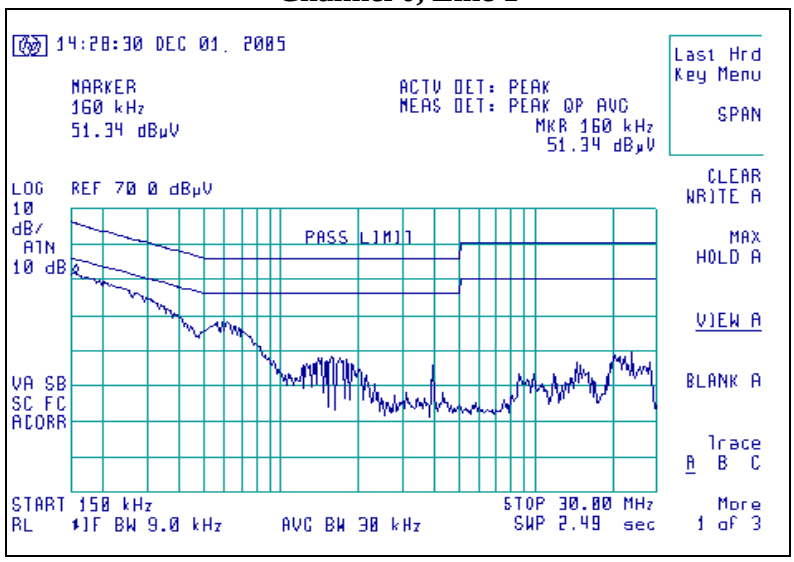


Screen Captures of Conducted AC Mains Emissions:

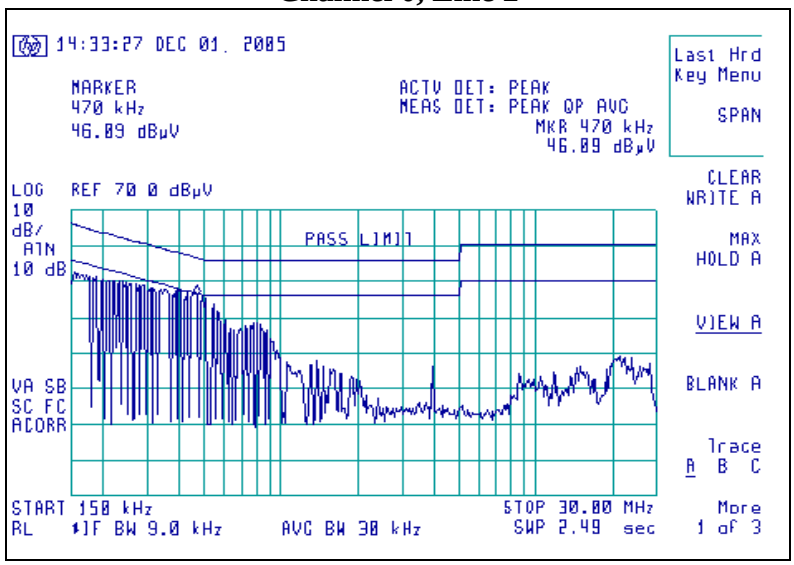
Please note these screen captures represent Peak Emissions. For conducted emission measurements, we utilize both a Quasi-Peak detector function as well as the Average detector function for measurements as described in 47 CFR 15.209.

The signature scans shown here are from channel 0, chosen as being a good representative of all channels.

Channel 0, Line 1



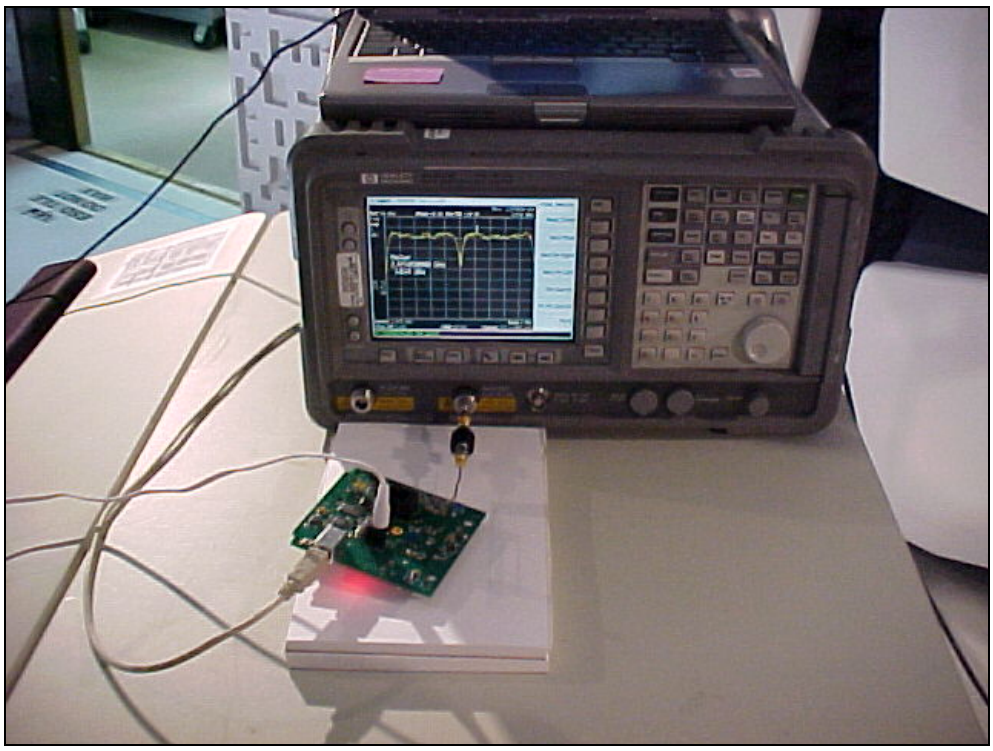
Channel 0, Line 2



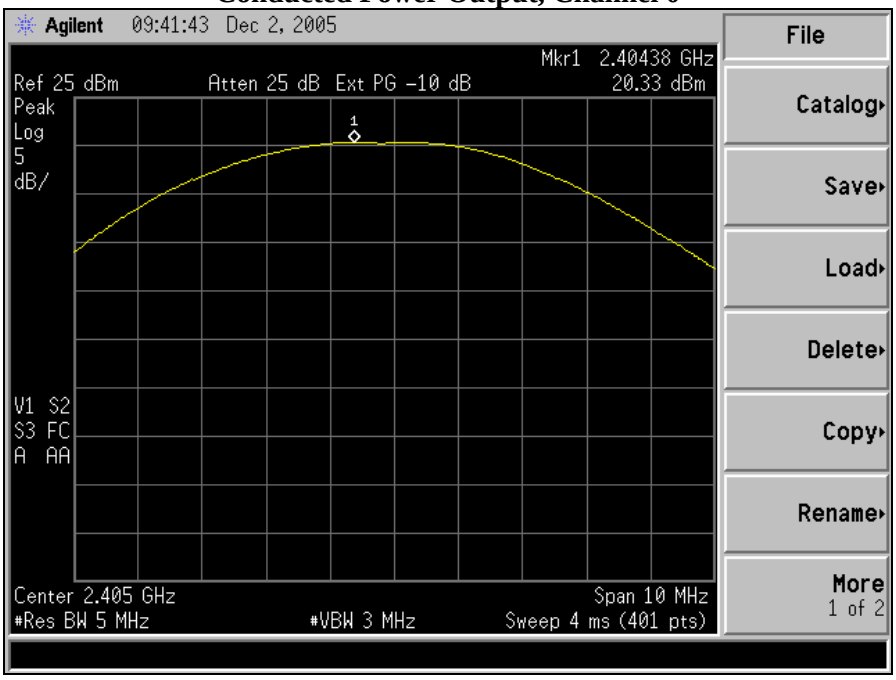
12. Power Output 15.247(b)

The conducted RF output power of the EUT was measured at the 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. The unit was configured to run in a continuous transmit mode, while being supplied with test data from a laptop as a modulation source. The spectrum analyzer was used with resolution and video bandwidths set to 5 MHz, and a span of 10 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 a AC bench type power supply. No variation in output power was seen while setting the AC voltage to 98 VAC (-15%) or to 133 VAC (+15%).

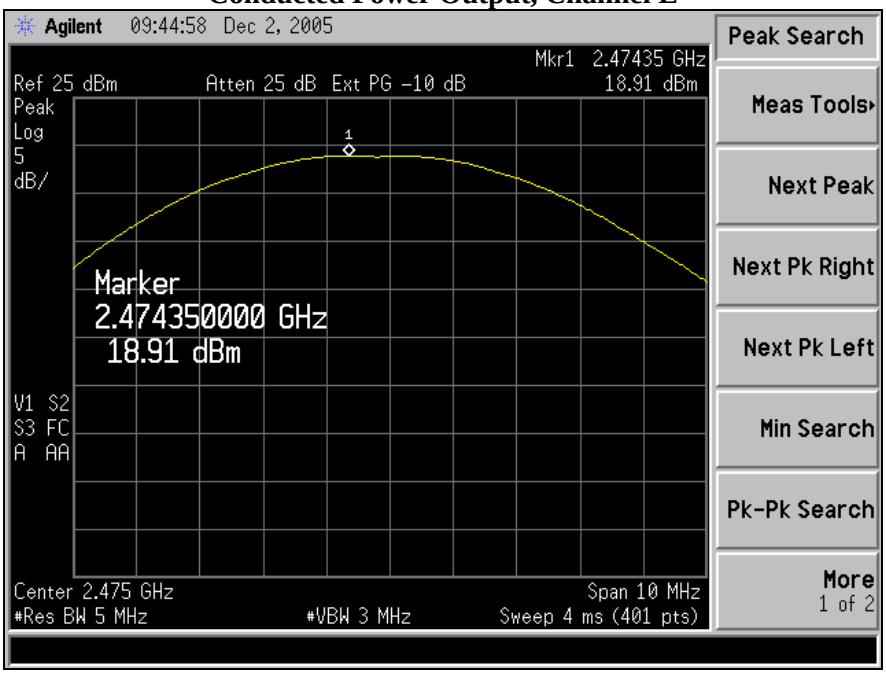
CHANNEL	CENTER FREQ (MHz)	LIMIT (dBm)	MEASURED POWER (dBm)	MARGIN (dB)
0	2405	30 dBm	20.3	9.7
7	2440	30 dBm	19.6	10.4
E	2475	30 dBm	18.9	11.1



Conducted Power Output, Channel 0



Conducted Power Output, Channel E



13. 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 a full data rate 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, and channel E data is presented.

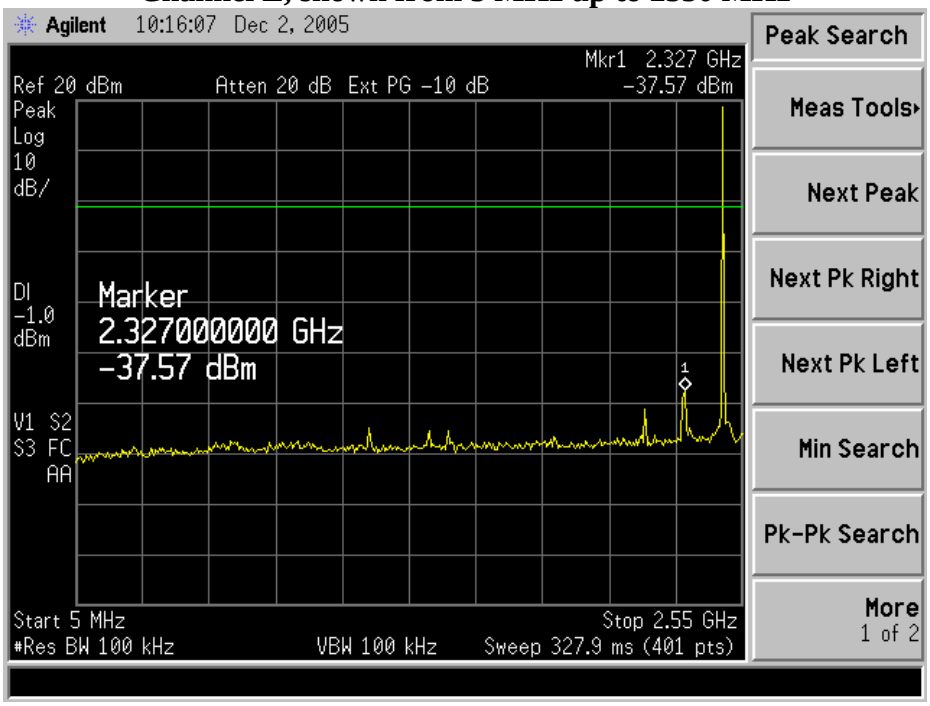
No emissions could be noted within -50 dBc of the fundamental level for this product, at any harmonic or spurious product.

	Channel 0	Channel 7	Channel E
Fundamental	+ 20.0 (dBm) Note (1)	+19.5 (dBm) Note (1)	+ 19.0 (dBm) Note (1)
2nd Harmonic	Note (1)	Note (1)	Note (1)
3rd Harmonic	Note (1)	Note (1)	Note (1)
4th Harmonic	Note (1)	Note (1)	Note (1)
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)

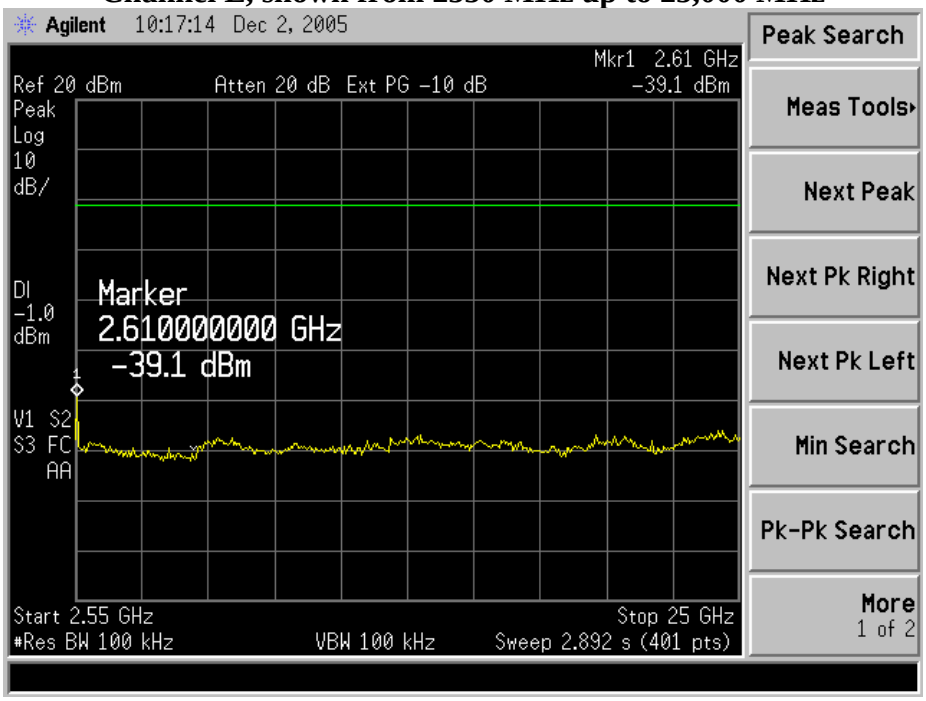
Notes:
(1) Measurement at system noise floor.

Plots of Conducted Spurious and Fundamental Levels

Channel E, shown from 5 MHz up to 2550 MHz



Channel E, shown from 2550 MHz up to 25,000 MHz



14. 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 cable connection to the HP E4407B spectrum analyzer. An attenuator was placed in series with the cable to protect 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.

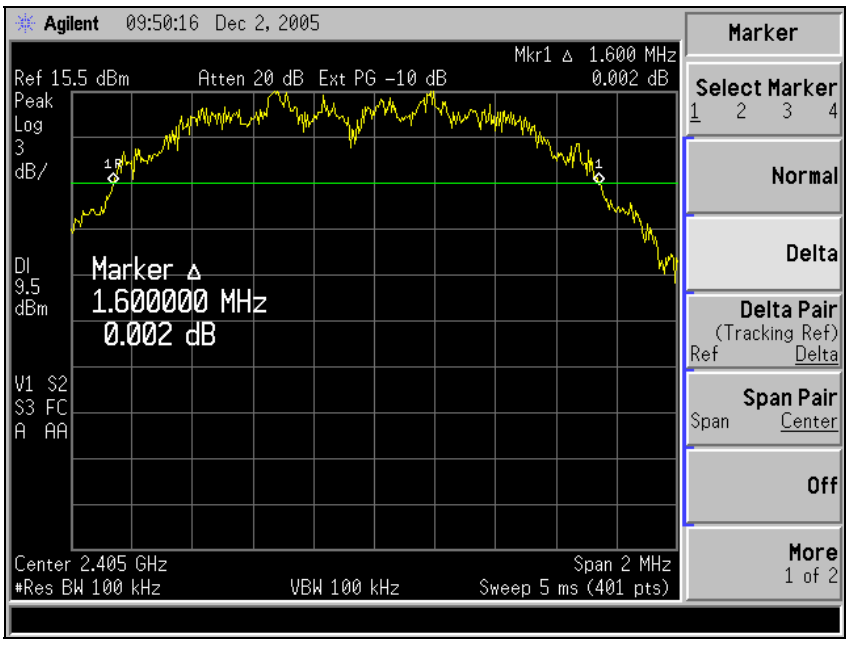
A Hewlett Packard model E4407B spectrum analyzer was used with the resolution bandwidth set to 100 kHz for this portion of the tests. The EUT was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used in peak-hold mode while measurements were made, as presented in the chart below.

From this data, the closest measurement when compared to the specified limit, is 1600 kHz, which is above the minimum of 500 kHz.

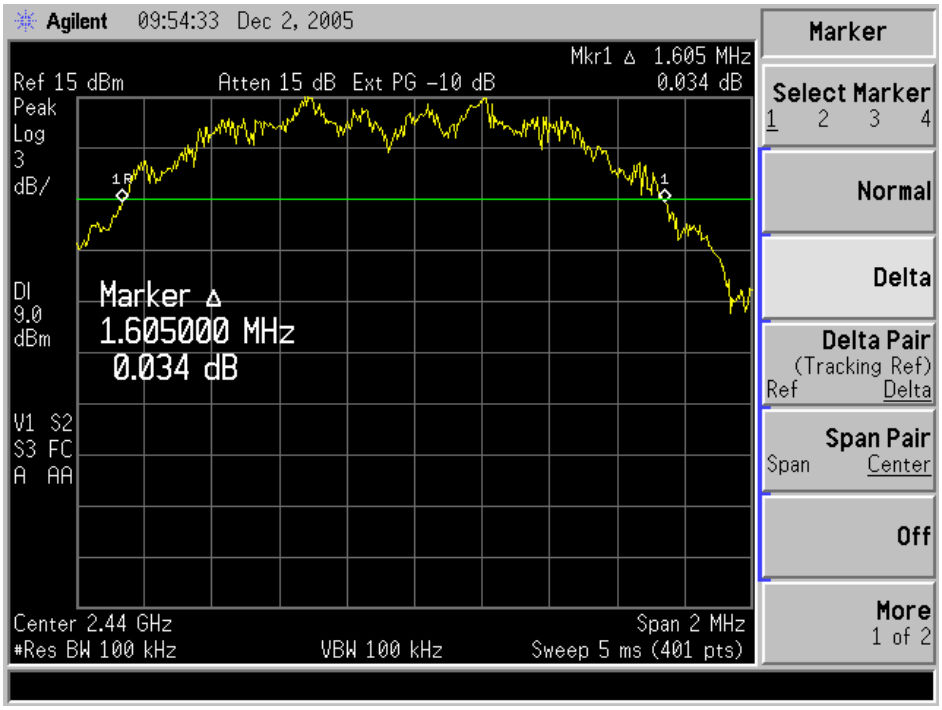
Channel	Center Frequency (MHz)	Measured 6 dB BW (kHz)	Minimum Limit (kHz)
0	2405	1600	500
7	2440	1608	500
E	2475	1610	500

Plots of Occupied Bandwidth

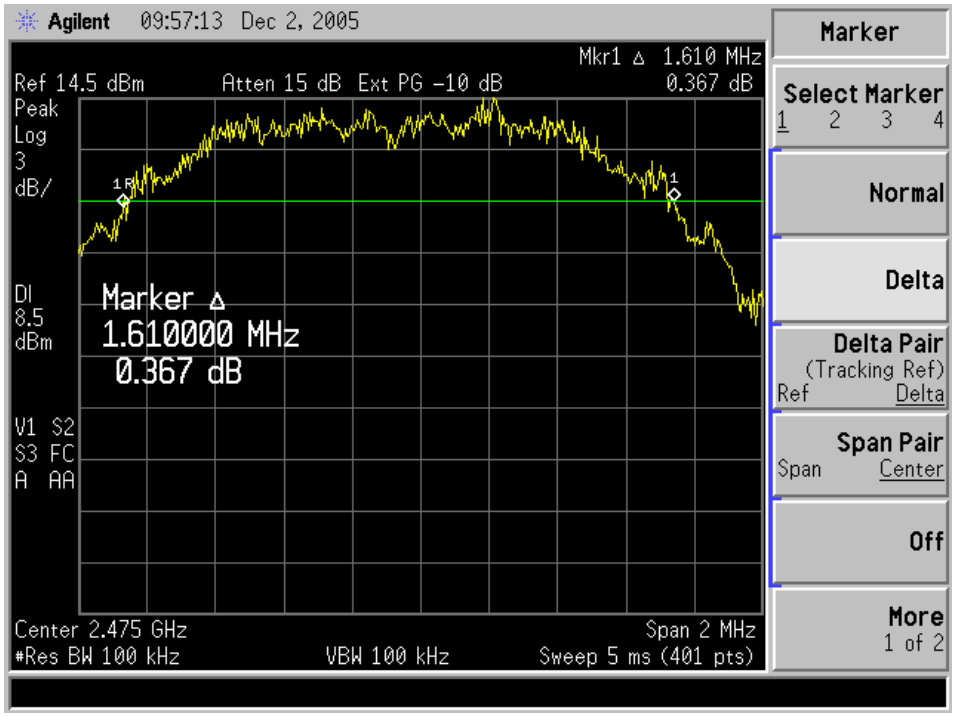
Channel 0 Occupied Bandwidth



Channel 7 Occupied Bandwidth



Channel E Occupied Bandwidth

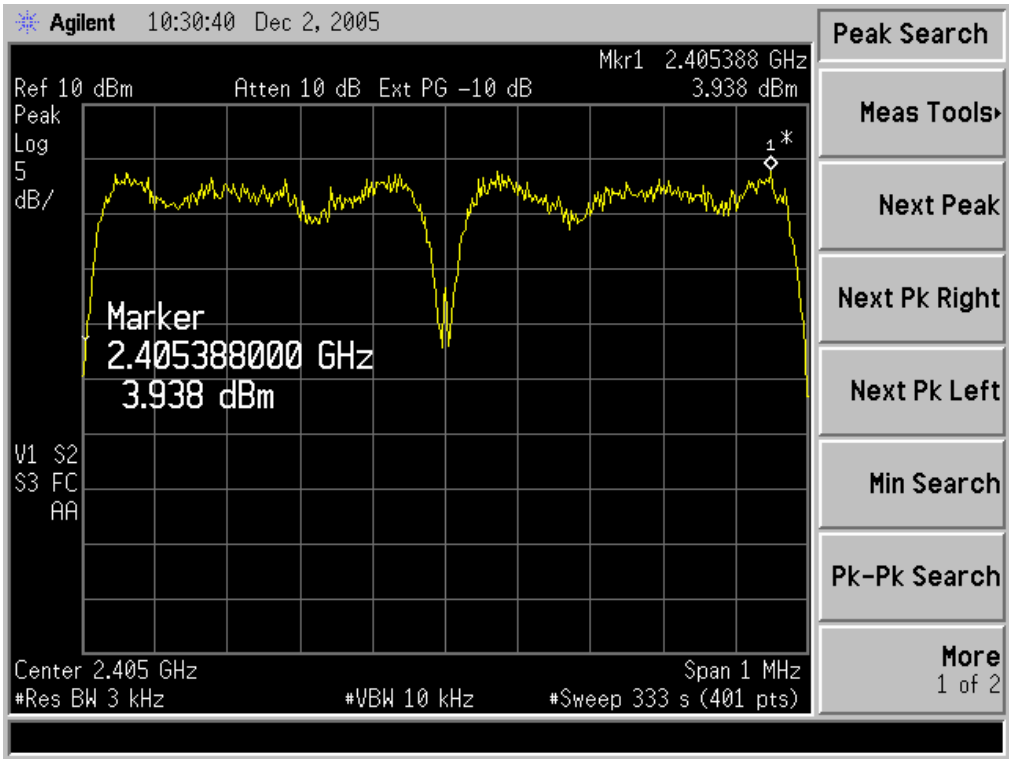


15. Spectral Density

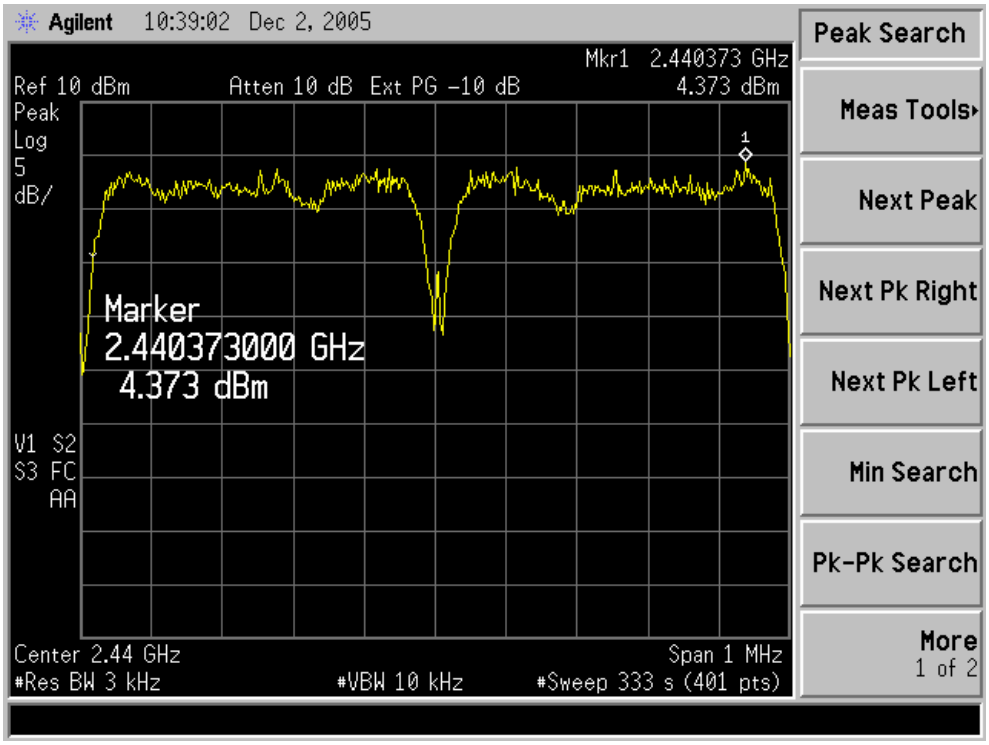
In accordance with FCC Part 15.247(e), the peak power spectral density should not exceed +8 dBm in any 3 kHz band. This measurement was performed along with the conducted power output readings performed as described in previous sections. The peak output frequency for each representative frequency was scanned, with a narrow bandwidth, and reduced sweep, and a power density measurement was performed read directly. The resultant density was then corrected to a 3 kHz bandwidth. The highest density was found to be no greater than 4.4 dBm, which is under the allowable limit by 3.6 dB.

Channel	Measurement Frequency (MHz)	Measured Channel Power (dBm)	Limit (dBm)	Margin (dB)
0	2405.39	3.9	8.0	4.1
7	2440.37	4.4	8.0	3.6
E	2475.05	3.8	8.0	4.2

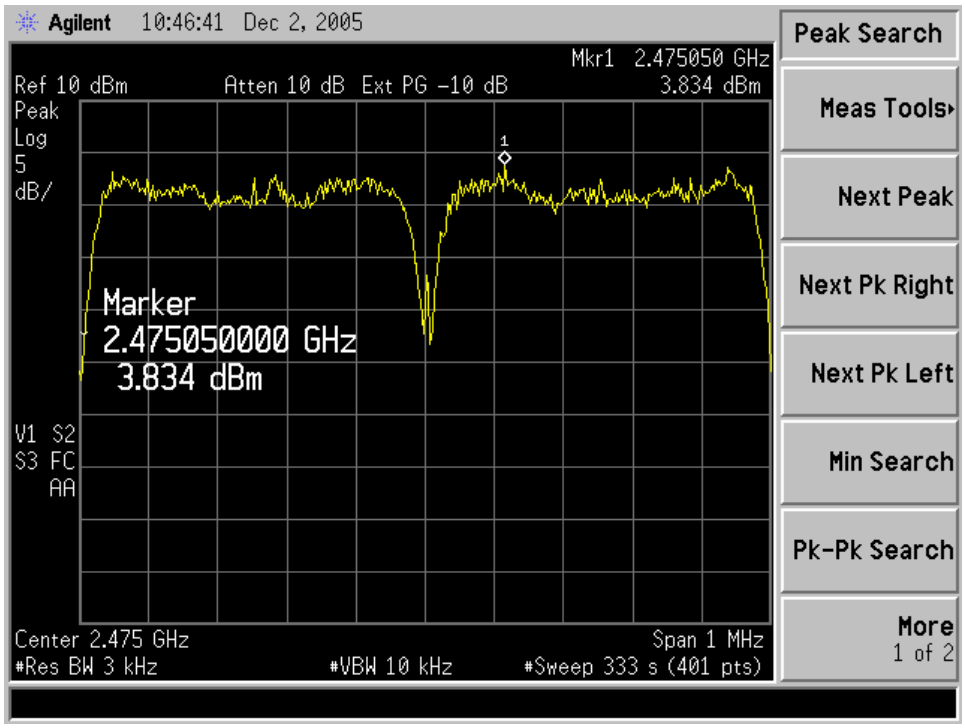
Channel 0 Spectral Power Density



Channel 7 Spectral Power Density

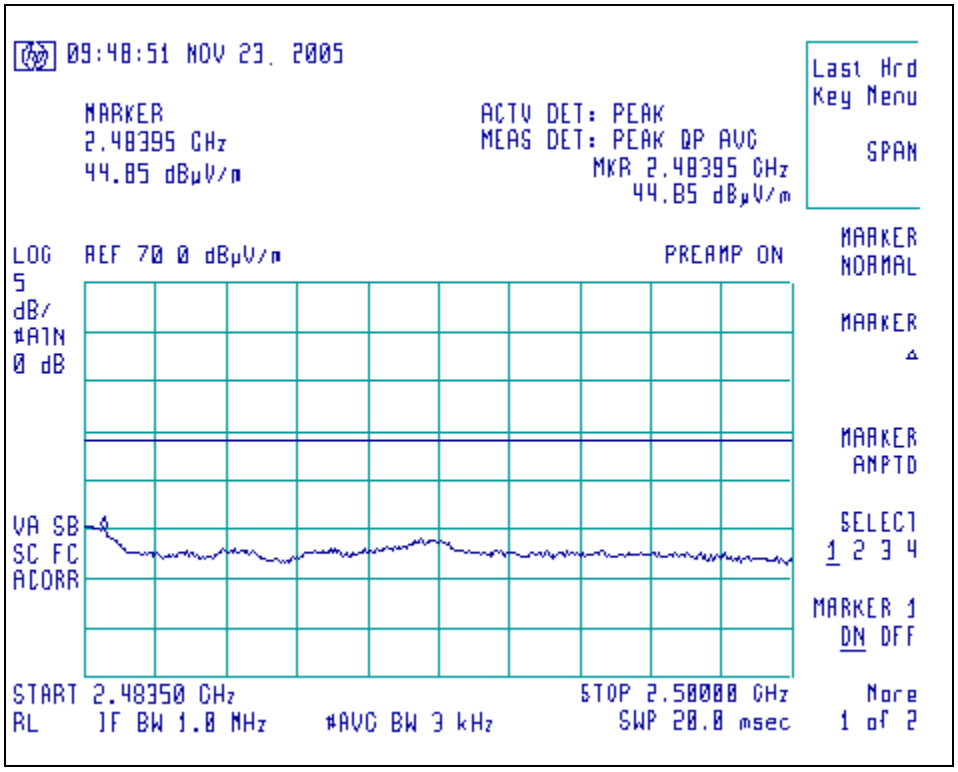


Channel E Spectral Power Density



16. 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. In addition, a spurious emission at the upper band edge of the 2400 – 2483.5 MHz band must meet the stricter limit imposed by the presence of the 15.205 band immediately adjacent to the ISM band. The following screen capture demonstrates compliance of the intentional radiator at the 2483.5 MHz band-edge while transmitting on the highest selected channel: Channel E (2475 MHz). 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 highest channel for the investigation of the higher band-edge. The marker-delta method was not needed to demonstrate compliance. Lower band edge compliance at 2400 MHz, while transmitting on Channel 0 (2405 MHz) was also seen to meet the -20 dB requirement.



17. MPE Calculations

Base Station Transceiver
MPE Calculation

Enter data only in yellow cells

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:	20.00	(dBm)
Maximum peak output power at antenna input terminal:	100.000	(mW)
Antenna gain(typical):	0	(dBi)
Maximum antenna gain:	1.000	(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:	0.019894	(mW/cm^2)
Maximum allowable antenna gain:	17.0	(dBi)
Margin of Compliance at 20 cm =	17.0	dB

Appendix A

Test Equipment List

Asset #	Manufacturer	Model #	Serial #	Description	Date	Due
AA960008	EMCO	3816/2NM	9701-1057	Line Impedance Stabilization Network	9/27/05	9/27/06
AA960031	HP	119474A	3107A01708	Transient Limiter	Note 1	Note 1
AA960077	EMCO	93110B	9702-2918	Biconical Antenna	9/27/05	9/27/06
AA960078	EMCO	93146	9701-4855	Log-Periodic Antenna	9/27/05	9/27/06
AA960081	EMCO	3115	6907	Double Ridge Horn Antenna	12/06/04	12/06/05
CC00221C	Agilent	E4407B	US39160256	Spectrum Analyzer	12/07/04	12/07/05
EE960004	EMCO	2090	9607-1164	Device Controller	N/A	N/A
EE960013	HP	8546A	3617A00320	Receiver RF Section	9/29/05	9/29/06
EE960014	HP	85460A	3448A00296	Receiver Pre-Selector	9/29/05	9/29/06
N/A	LSC	Cable	0011	3 Meter ½" Armored 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