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

COMPLIANCE TESTING OF:

Dentsply SPS RF Footswitch

Prepared For:

Dentsply International
Attention: Mr. Kevin Lint
1301 Smile Way
York, PA 17404-0807

Test Report Number:

305306-Tx-v0

Test Dates:

June 16H through August 16TH, 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

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 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

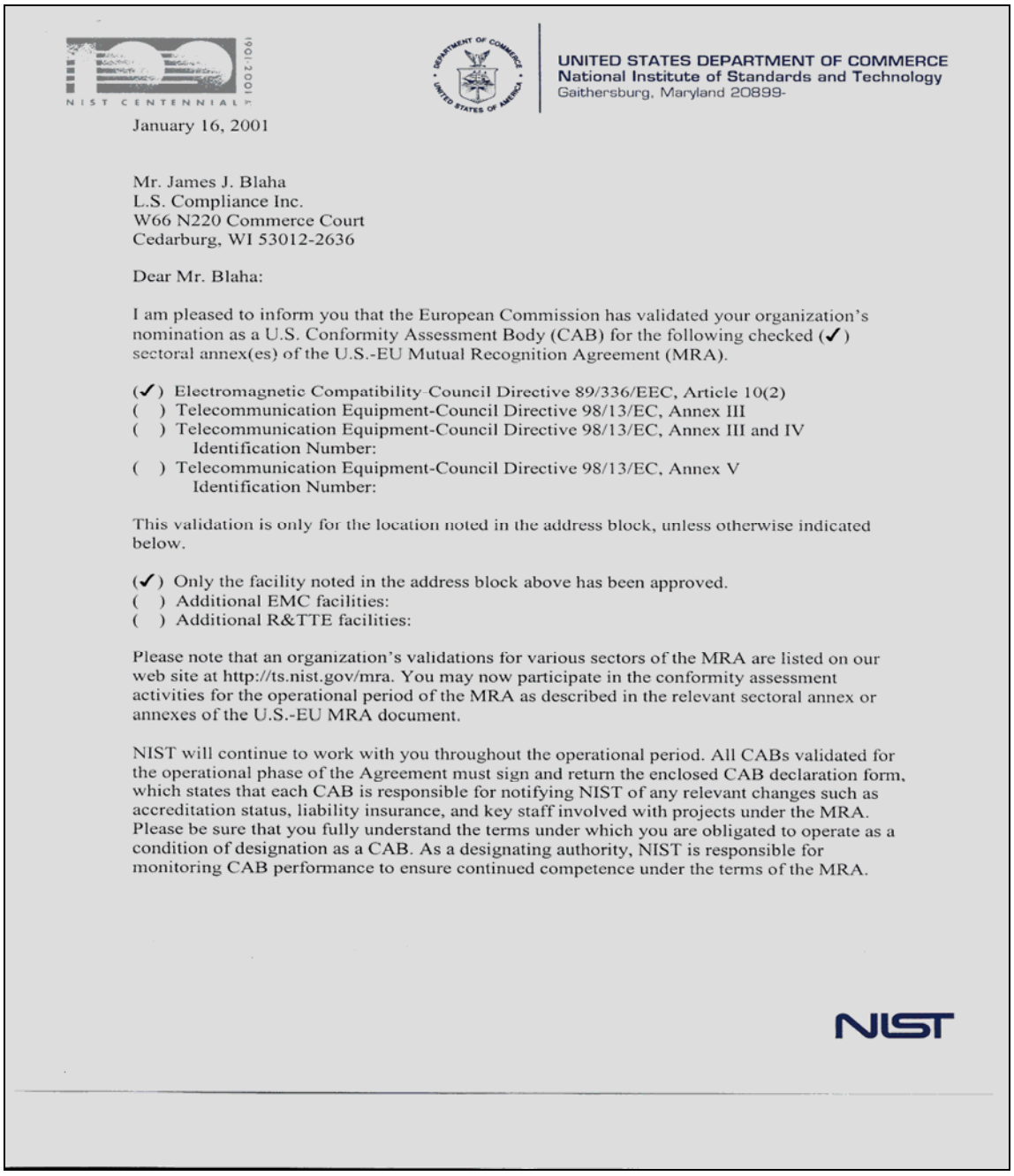
The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified 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 89/336/EEC



NIST CENTENNIAL 1901-2001

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.

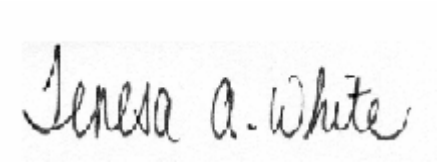
(✓) Only the facility noted in the address block above has been approved.
( ) Additional EMC facilities:
( ) Additional R&TTE facilities:

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: August 17, 2005

Teresa A. White, Document Coordinator Date

Tested By: August 17, 2005

Abtin Spantman, EMC Engineer Date

Approved By: August 17, 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:	Dentsply International					
Date(s) of Test:	June 16th through August 16th , 2005					
Test Engineer(s):		Tom Smith	√	Abtin Spantman		Ken Boston
Model #:	SPS RF Footswitch					
Serial #:	Engineering Sample					
Voltage:	3.0 VDC					
Operation Mode:	Normal, and continuous transmit with modulation					

6. Introduction

Between June 16th and August 16th, 2005, a series of Conducted and Radiated Emission tests were performed on one sample of the Dentsply Internationals' SPS RF Footswitch, 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 47 CFR Part 15 (Industry Canada RSS-210) for a low power transmitter. These tests were performed, in part, for demonstration of compliance to the aforementioned standards. These tests, along with further testing, as carried out by Underwriters Laboratories, Incorporated (UL), and covered in the UL report for project number: "05ME06294", File: "E175103", demonstrates the complete suite of testing carried out on these products. The test results presented here, along with testing performed at UL serves to demonstrate compliance for the Dentsply Remote RF Footswitch product. The radio testing on the Dentsply Cavitron Base Unit, considered as a host device to the Footswitch unit, is covered in LS Compliance report number 305305-nn-vn. The tests at L.S. Compliance were performed by Abtin Spantman, EMC Engineer of L.S. Compliance, Inc. and witnessed, in part, by Mr. Kevin Lint of Dentsply International.

All Radiated and Conducted 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, 15.207, 15.209, 15.249 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.

7. Product Description

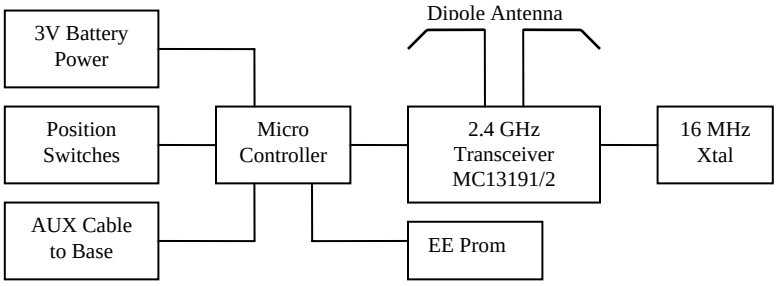
General Description
The Dentsply SPS RF Footswitch is used in conjunction with the Cavitron SPS RF magnetostrictive ultrasonic Scaling system. The remote footswitch is designed to allow remote operation of the Cavitron system, by one of two modes of communication. The Footswitch can communicate with the Cavitron Base unit through a special hard-wired harness, or by means of RF transmissions. The RF characteristics of the Footswitch are tested and covered in this report.

The Cavitron is a device intended for counter top use to mechanically debride (remove tartar) from human dentition. The scaling system shall drive an ultra sonic insert designed with a resonate frequency near 30kHz to produce mechanical vibration at the distal end of the insert tip. The systems provide a means for control of power (tip stroke) and lavage flow rates. The system shall be activated by a footswitch which can communicate through an RF link or through an auxiliary hardwired cable. The footswitch has two positions.

Radio Communication Specifications
The SPS RF Footswitch system uses the Freescale MC1319x transceiver chip with IEEE 802.15.4 compatible protocol. The transceiver system can operate at one of 16 possible channels in the 2.4 GHz band starting at 2405 MHz and ending at 2480 MHz. The system deploys a Direct Spread Spectrum (DSSS) with Offset – Quadurature Phase Shift Keying modulation (O-QPSK). The transceiver chip has a nominal output power at 0 dBm (1mW), using an integrated PC-Board trace antenna. The system uses a chirp mode of communication to transfer footswitch position and footswitch status to the main unit. The information communicated includes switch closure of position 1 and position 2, battery voltage, channel information, channel quality, channel energy, and address information. When the footswitch switch is not activated for several seconds, the footswitch will enter a sleep mode until it is pressed. The main unit remains in receive mode waiting for a footswitch "awake" signal. Once the footswitch is pressed a signal will be transmitted from the footswitch to the base unit. The transmission time for this signal is approximately one millisecond. The base unit will acknowledge the footswitch with another approximately one millisecond signal. If the footswitch switch conditions do not change the next chirp signal will be sent in approximately 250 milliseconds to reestablish communication between the base unit and the footswitch.

The SPS RF Footswitch operates on 3.0 VDC as provided by two standard "AA" type batteries.

Block Diagram Cavitron SPS RF Footswitch



8. Test Requirements

The above mentioned tests were performed in order to determine the compliance of the Dentsply Internationals' "SPS RF Footswitch" with limits contained in various provisions of Title 47 CFR, FCC Part 15, including:

15.31	15.205
15.33	15.207
15.35	15.209
15.37	15.249

9. Summary of Test Report

DECLARATION OF CONFORMITY

The Dentsply Internationals' "SPS RF Footswitch" was found to **MEET** the requirements as described within the specification of Title 47 CFR FCC, Part 15.249, Subpart (a); and Industry Canada RSS-210, Section 6.2 for a *'Non-Momentarily Operated Transmitting Device'*.

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.

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.

10. Radiated Emissions Test

Test Setup

The test setup was assembled in accordance with Title 47, CRF 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 the 3 Meter Semi-Anechoic, FCC listed Chamber located at L. S. Compliance, Inc., Cedarburg, Wisconsin. The EUT was operated in continuous transmit mode, modulated with typical data, using 3.0 VDC power as provided by two standard "AA" type batteries. The unit has the capability to operate on 16 channels within the 2400-2483.5 MHz band. During testing, a special interface fixture was used, along with a Lap-top PC, to select channels and control the appropriate test modes. The applicable RF emission limits apply at a 3 meter distance. Measurements above 5 GHz were performed at a 1.0 meter separation distance with appropriate limits adjusted for this distance. The calculations to determine these limits are detailed in the following pages. Please refer to Appendix A for a list of the test equipment. The test sample was operated on one of three (3) standard channels: Low (Ch:00 at 2405 MHz), Medium (Ch:08 at 2445 MHz) and High (Ch:15 at 2480 MHz) to comply with FCC Part 15.35. The channels and operating modes were changed using a terminal program on a Lap-top PC, along with a special interface fixture to connect with the EUT. The battery voltage was monitored and the batteries were replaced as needed during the testing process.

Test Procedure

Radiated RF measurements were performed on the EUT in the 3 Meter Semi-Anechoic, FCC listed Chamber, located at L. S. Compliance, Inc. in Cedarburg, Wisconsin. The frequency range from 25 MHz to 25000 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 the 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. From 18 GHz to 24 GHz, the EUT was measured at a 0.3 meter separation, using a standard gain Horn antenna and pre-amplifier. 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.

The EUT was measured for radiated RF emissions between the bands of 30 MHz to 25000 MHz to assess conformance with 47CFR Part 15.249. The above measurements were performed and RF emissions levels investigated in various EUT modes, with and without the wired link between the Cavitron host and the footswitch unit, with and without the RF link active between the Cavitron host and the footswitch unit. The data presented in this report is a combination of the worst case emissions observed among all of the modes previously described.

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 E4407 Spectrum Analyzer and an EMCO Horn Antenna were used. From 18 GHz to 25 GHz, the HP E4407B with a standard gain horn antenna, and preamp were used.

Test Results

The EUT was found to **MEET** the Radiated Emissions requirements of Title 47 CFR, FCC Part 15.249 for a transmitter (Canada RSS-210). The frequencies with significant signals were recorded and plotted as shown in the Data Charts and Graphs.

CALCULATION OF RADIATED EMISSIONS LIMITS:

The Field Strength of Fundamental Frequencies for the RF Transceiver:
The fundamental emissions for an intentional radiator in the 2400-2483.5 MHz band, operating under FCC part 15.249 limits, must have electric field strength of no greater than 50 mV/m, for the fundamental frequency, when measured at 3 meters, and harmonic field strength of no greater than 500 μV/m, when measured at 3 meters. Spurious emissions outside the 2400-2483.5 MHz band shall be attenuated by at least 50 dB below the level of the fundamental, or meet the limits expressed in FCC part 15.209 under general emission limits.
Field Strength of Fundamental Frequencies is Limited to 50,000 μV/m, or 94 dBμV/m.

Field Strength of Harmonic and Spurious Frequencies is Limited by FCC 15.249(d).
The harmonic limit of –50 dBc with respect to the fundamental limit would be:

94 dBμV/m – 50 dB = 44 dBμV/m,

with the exception of where FCC 15.209 allows for a higher limit to be used.

Frequency (MHz)	3 m Limit (μV/m)	3 m Limit (dBμV/m)
2400-2483.5	50,000	94.0
30-88 ; 88-216	159	44.0
216-902 ; 928-960	500	46.0*
960-40,000	500	54.0*

The following table depicts the general radiated emission limits obtained from Title 47 CFR, part 15.209a, for radiated emissions measurements, including restricted band limits as expressed in 47 CFR, part 15.205.

Frequency (MHz)	3 m Limit (μV/m)	3 m Limit (dBμV/m)
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
960-40,000	500	54.0

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

$dB\mu V/m = 20 \log_{10}$ (3m limit)

from 30 - 88 MHz for example: $dB\mu V/m = 20 \log_{10} (100)$

$40.0\ dB\mu V/m = 20 \log_{10} (100)$

For measurements made at 1 meter instead of 3 meter separation, a 9.5 dB correction may be been invoked.

$9.54dB = 20 \log_{10} (3m / 1m)$

From 960 - 40,000 MHz for example: 500 μV/m or 54.0 dBμV/m at 3 meters

54.0 + 9.5 = 63.5 dBμV/m at 1 meter

Note: Limits are conservatively rounded to the nearest tenth of a whole number.
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Radiated Emissions Data Chart

3 Meter Measurements of Electromagnetic Radiated Emissions

Test Standard: Title 47CFR 15.249

Frequency Range Inspected: 30 MHz to 25000 MHz

Manufacturer:	Dentsply International							
Date(s) of Test:	June 16th through August 16th , 2005							
Test Engineer(s):		Tom Smith	√	Abtin Spantman		Ken Boston		
Model #:	SPS RF Footswitch							
Serial #:	Engineering Sample							
Voltage:	3.0 VDC							
Operation Mode:	Normal, and continuous transmit with modulation							
EUT Power:		Single Phase ___VAC				3 Phase ___VAC		
	√	Battery				Other:		
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 table depicts the level of significant radiated emissions found:

Frequency (MHz)	Antenna Polarity	Channel	Height (meters)	Azimuth (0° - 360°)	EMI Meter Reading (dBμV/m)	15.249 Limit (dBμV/m)	Margin (dB)
(Notes 2)							

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.

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 00:

Frequency (MHz)	Antenna Polarity	Height (meters)	Azimuth (0° - 360°)	Measured ERP (dBμV/m)	15.249 Limit (dBμV/m)	Margin (dB)
2405	H	1.15	175	(4)85.5	94.0	8.5
4810	V	1.05	60	53.2	54.0	0.8
7215	V	1.20	270	(2)62.3	63.5	1.2
9620	V	1.20	130	(2)51.2	63.5	12.3
12025	V	1.10	0	(2,3)38.4	63.5	25.1
14430	V	1.10	0	(2,3)41.8	63.5	21.7
16835	V	1.10	0	(2,3)45.0	63.5	18.5
19240						
21645						
24050						

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 08:

Frequency (MHz)	Antenna Polarity	Height (meters)	Azimuth (0° - 360°)	Measured ERP (dBμV/m)	15.249 Limit (dBμV/m)	Margin (dB)
2445	H	1.00	145	(4)85.1	94.0	8.9
4890	V	1.00	45	50.7	54.0	3.3
7335	V	1.20	265	(2)62.4	63.5	1.1
9780	V	1.15	10	(2)51.6	63.5	11.9
12225	V	1.10	0	(2,3)39.4	63.5	24.1
14670	V	1.10	0	(2,3)41.1	63.5	22.4
17115	V	1.10	0	(2,3)44.6	63.5	18.9
19560						
22005						
24450						

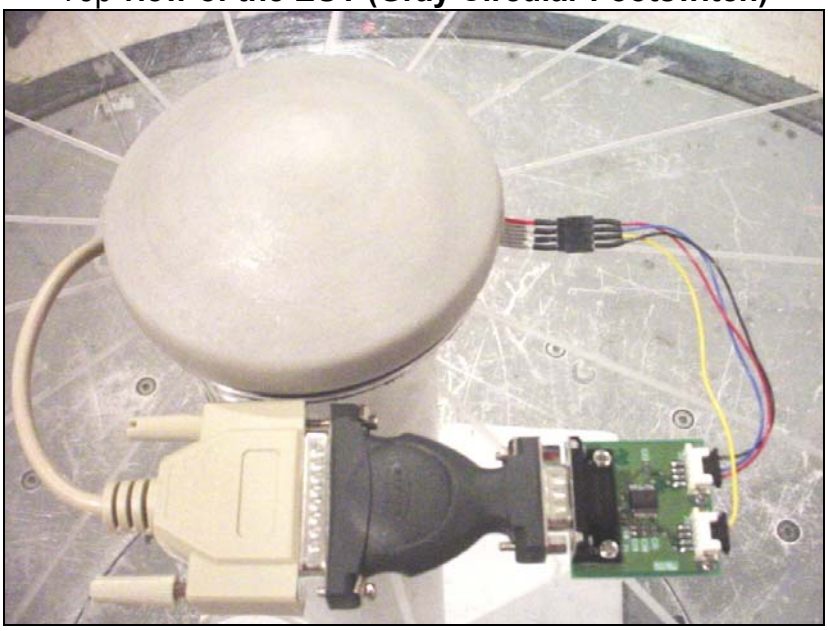
The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 15:

Frequency (MHz)	Antenna Polarity	Height (meters)	Azimuth (0° - 360°)	Measured ERP (dBμV/m)	15.249 Limit (dBμV/m)	Margin (dB)
2480	H	1.15	175	(4)83.3	94.0	10.7
4960	H	1.65	40	53.7	54.0	0.3
7440	V	1.20	260	(2)62.9	63.5	0.6
9920	V	1.15	5	(2)54.3	63.5	9.2
12400	V	1.10	0	(2,3)39.6	63.5	23.9
14880	V	1.10	0	(2,3)41.0	63.5	22.5
17360	V	1.10	0	(2,3)44.1	63.5	19.4
19840						
22320						
24800						

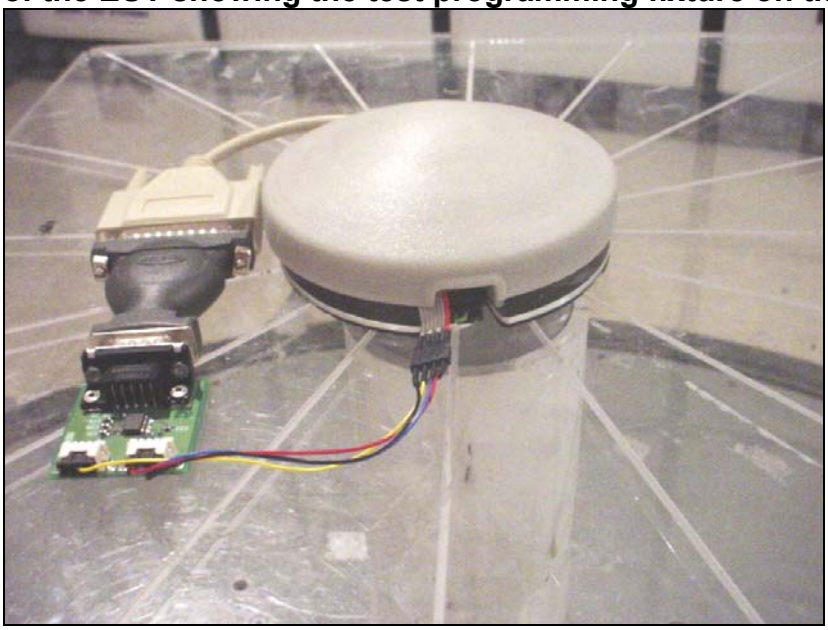
Notes:

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 0.3 m separation for frequencies between 18 – 25 GHz.
3) Measurement at receiver system noise floor.
4) For measurements of the fundamental power, because of spectral bandwidth, the receiver was set to RBW=VBW=3 MHz.
5) Emission falls within a restricted band of operation as defined in 47CFR 15.205 and is subject to part 15.205 limits.

Top v**iew of the EUT (Gray Circular Footswitch)**

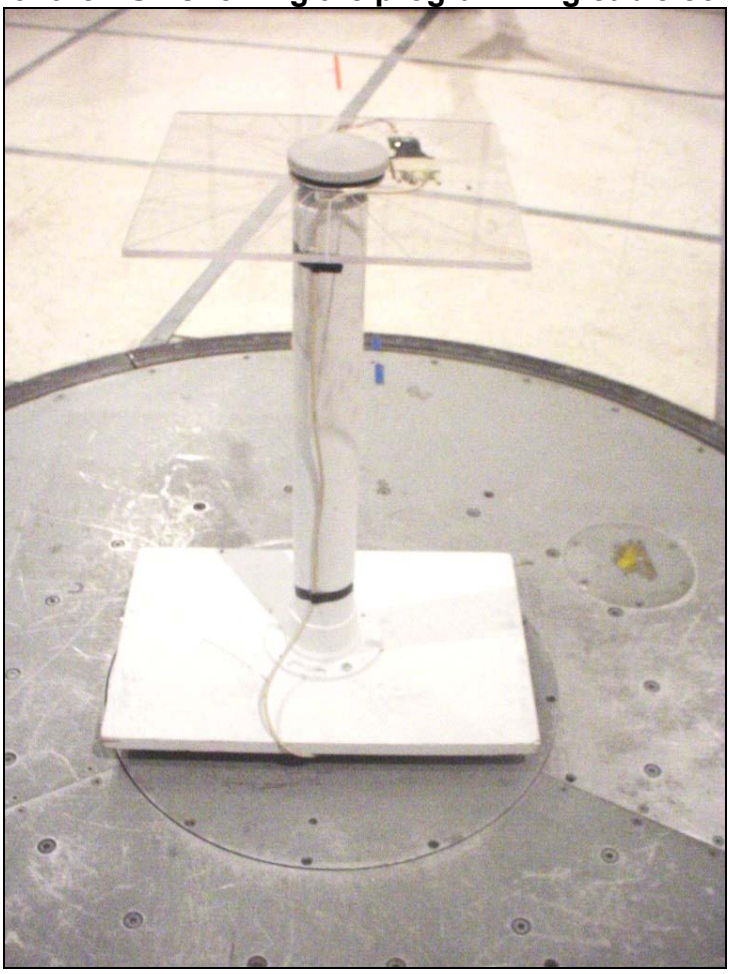


Front v**iew of the EUT showing the test programming fixture on the left side.**



View of the EUT showing the setup on a pedestal during radiated emissions testing

Rear view of the EUT showing the programming cable connections.



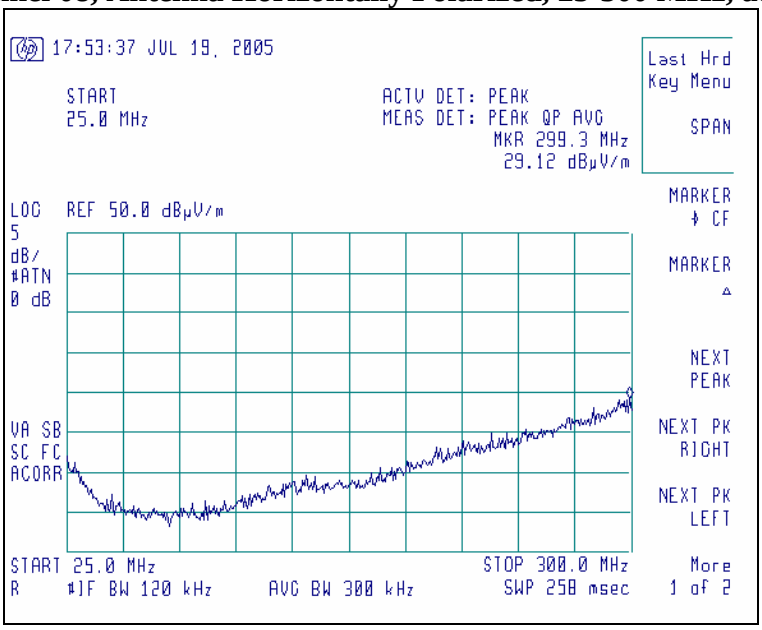
Graphs made during Radiated Emission Testing

Screen Captures of Radiated RF Emissions:

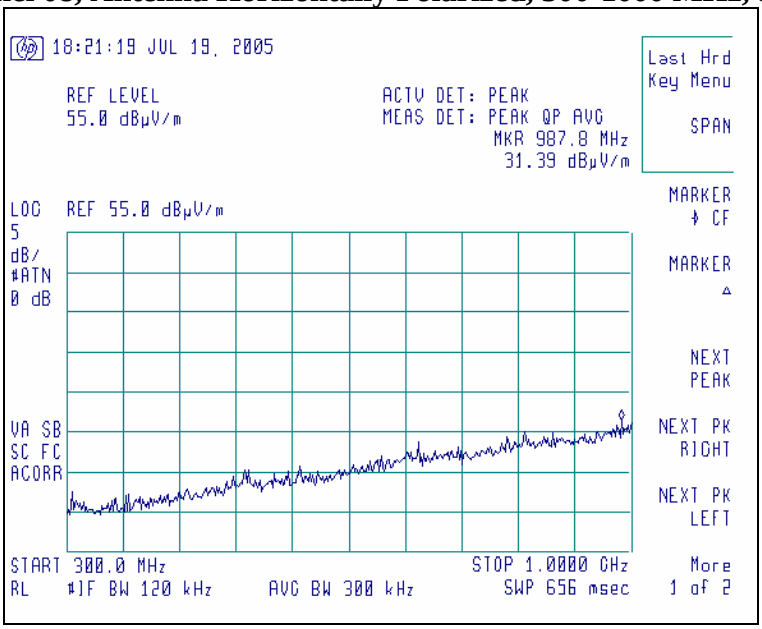
Please note these screen captures represent Peak Emissions. For radiated emission measurements, we utilize a Quasi-Peak detector function when measuring frequencies below 1 GHz, and an Average detector function when measuring frequencies above 1 GHz.

The signature scans shown here are from worst-case emissions, as measured on channels 00, 08, or 15, with the sense and EUT antennas both in vertical polarity for worst case presentations.

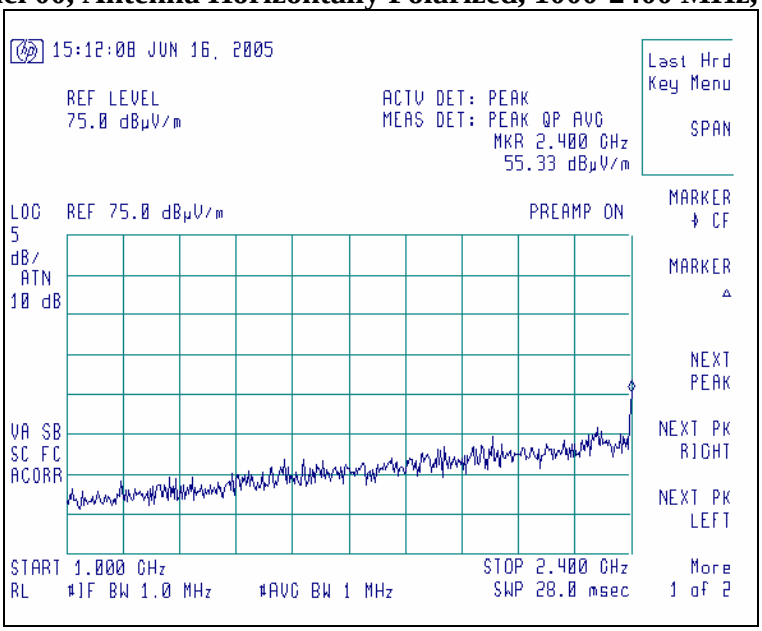
Channel 08, Antenna Horizontally Polarized, 25-300 MHz, at 3m.



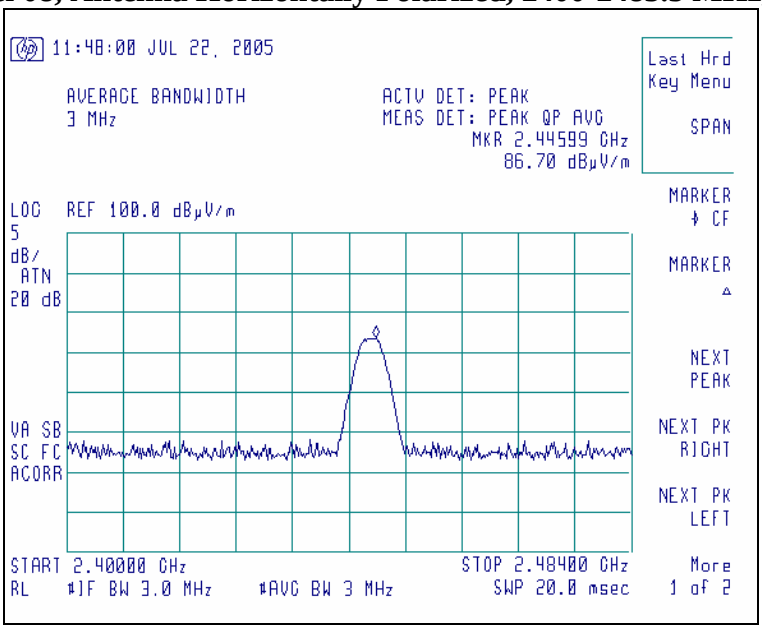
Channel 08, Antenna Horizontally Polarized, 300-1000 MHz, at 3m.



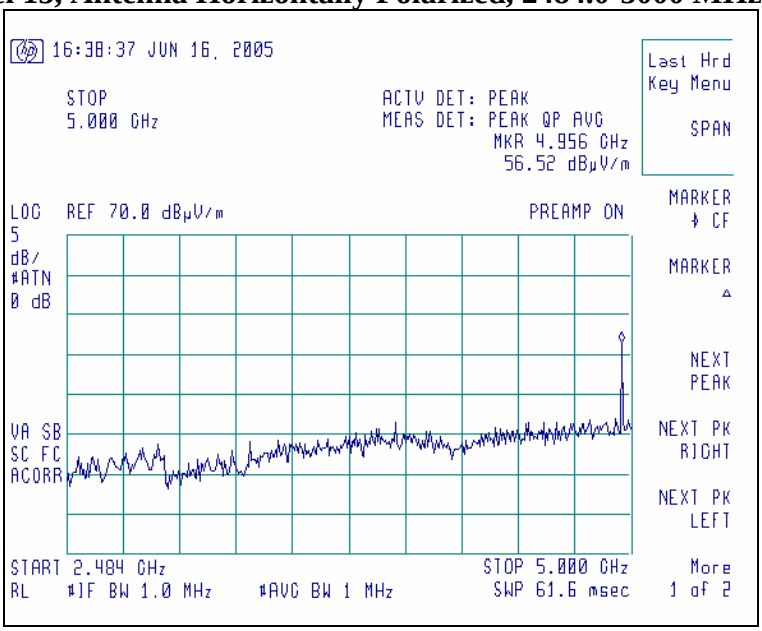
Channel 00, Antenna Horizontally Polarized, 1000-2400 MHz, at 3m.



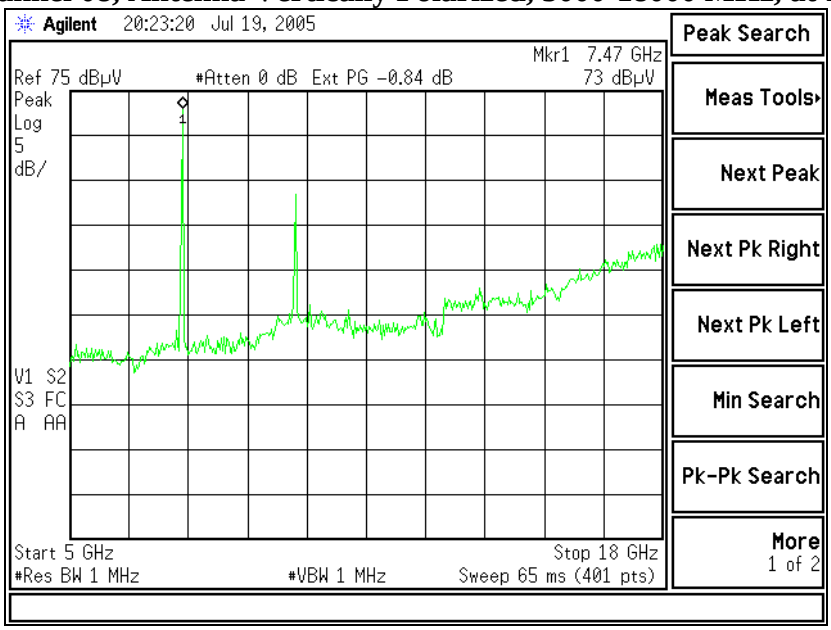
Channel 08, Antenna Horizontally Polarized, 2400-2483.5 MHz, at 3m.



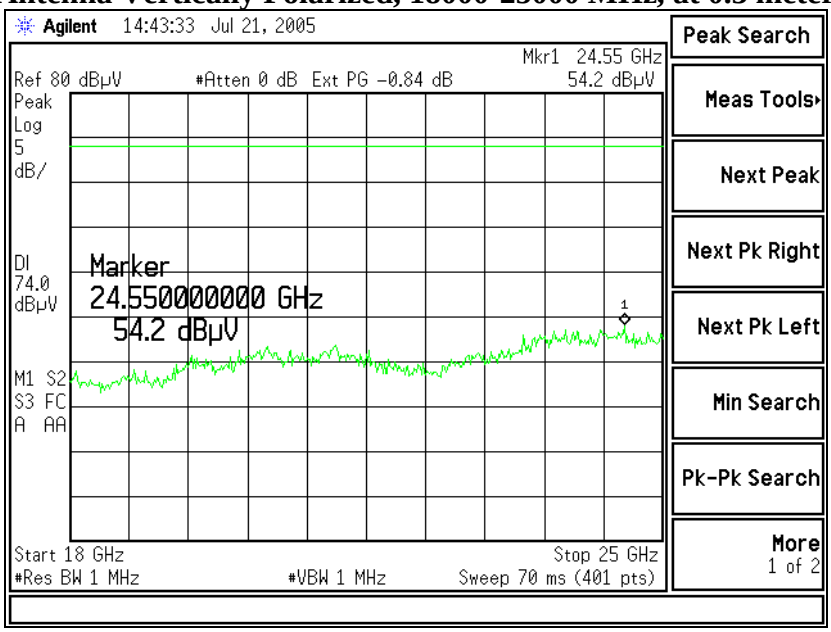
Channel 15, Antenna Horizontally Polarized, 2484.0-5000 MHz, at 3m.



Channel 08, Antenna Vertically Polarized, 5000-18000 MHz, at 1m.



Channel 08, Antenna Vertically Polarized, 18000-25000 MHz, at 0.3 meters separation.



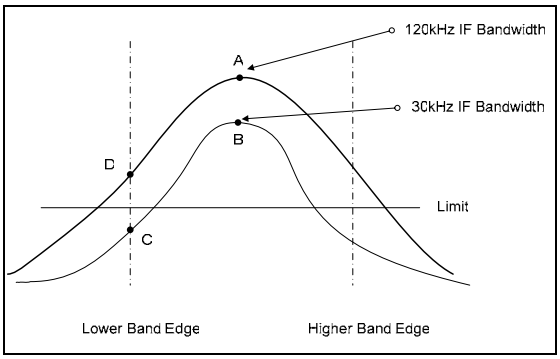
11. Conducted RF Emissions onto AC Power Line

This device is battery operated and does not have any facilities for connecting to AC Mains. No tests were performed for Conducted RF Emissions onto AC Mains.

12. Band-Edge Measurements

FCC 15.209(b) and 15.249(d) require a measurement of spurious emission levels, in particular at the band-edges where the intentional radiator operates. The following screen captures demonstrate compliance of the intentional radiator at the 2400-2483.5 MHz band-edges with emissions meeting the – 50 dBc limit, as well as the general emission limits. The EUT was operated at the lowest channel, with continuous modulation, for the investigation of the lower band-edge, and at the highest channel for the investigation of the higher band-edge.

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 3 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:

$$A - B = \Delta$$

$$\Delta + C = D$$

The Band Edge limit, in this case, would be D = 54.0 dBµV/m.

The measurements and calculations are as follows:

At the Lower Band-edge:

$A - B = \Delta$; $85.7 dB\mu V/m - 69.4 dB\mu V/m = 16.3 dB$

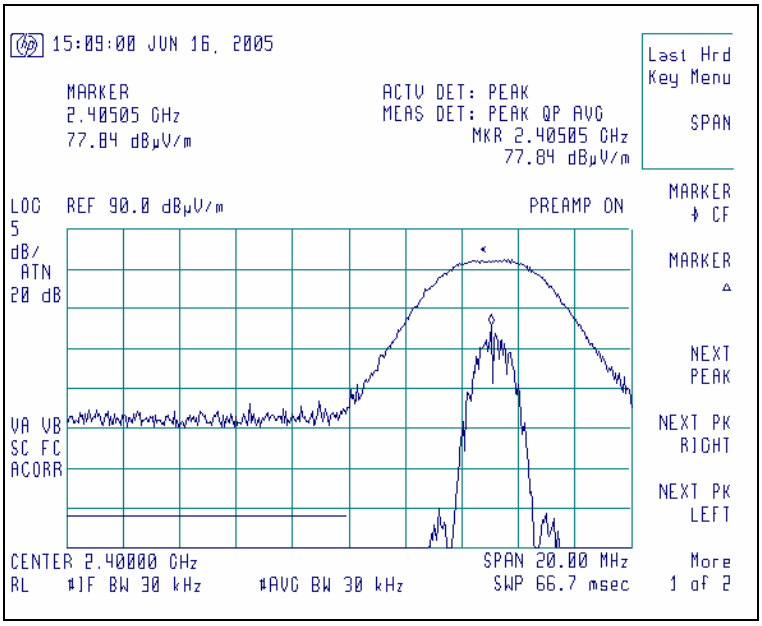
$\Delta + C = D$; $16.3 dB + 27.8 dB\mu V/m = 44.1 dB\mu V/m$ Showing compliance at Lower Band-Edge

At the Upper Band-edge:

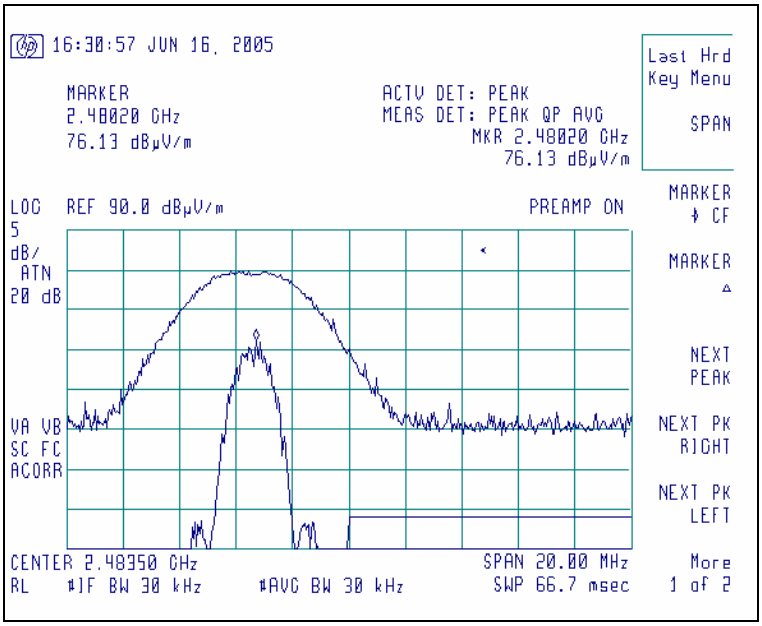
$A - B = \Delta$; $84.0 dB\mu V/m - 67.9 dB\mu V/m = 16.1 dB$

$\Delta + C = D$; $16.1 dB + 27.8 dB\mu V/m = 43.9 dB\mu V/m$ Showing compliance at Upper Band-Edge

Screen Capture demonstrating compliance at the Lower Band-Edge
Top trace shows spectral signature using RBW=3 MHz,
while lower trace uses RBW=30 kHz



Screen Capture demonstrating compliance at the Higher Band-Edge
Top trace shows spectral signature using RBW=3 MHz,
while lower trace uses RBW=30 kHz



13. Frequency and Power Stability requirements

For measurements of the frequency and voltage stability, the transmitter was placed inside a temperature controlled environmental chamber (Thermotron S-8C). A Spectrum Analyzer was used to measure the frequency at the appropriate frequency markers. For this test, the EUT was place inside a temperature chamber, with the transmitter portion of the EUT placed in continuous CW transmit mode. Power was supplied by an external bench-type variable DC power supply, and the frequency of operation was monitored using the spectrum analyzer, with a generic sense antenna placed inside the chamber. The power supply and spectrum analyzer were located outside the temperature chamber. The frequency was measured with a receiver resolution bandwidth of 100 Hz, and video bandwidth of 100 Hz. The data presented below is at room temperature of +25 ^{o}C, and the data is normalized to 3.00 VDC as reference.

Relative Variation in RF Power, with varying input voltage at DC power supply.

	DC Voltage Source		
	2.55 VDC	3.00 VDC	3.45 VDC
Channel 00	+ 0.0 (dB)	+ 0.0 (dB)	- 0.3 (dB)
Channel 08	+ 0.1 (dB)	+ 0.0 (dB)	+ 0.1 (dB)
Channel 15	+ 0.0 (dB)	+ 0.0 (dB)	+ 0.1 (dB)

Relative Variation in Transmit Frequency, with varying input voltage at DC power supply.

	DC Voltage Source		
	2.55 VDC	3.00 VDC	3.45 VDC
Channel 00	- 125 (kHz)	+ 0 (kHz)	- 124 (kHz)
Channel 08	+ 1 (kHz)	+ 0 (kHz)	+ 0 (kHz)
Channel 15	+ 0 (kHz)	+ 0 (kHz)	- 1 (kHz)

The power was then cycled On/Off to observe system response. No unusual response was observed, the emission characteristics were well behaved.

No anomalies were noted, in the measured transmit power, varying less than 0.5 dB, during the voltage variation tests.

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