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

COMPLIANCE TESTING OF:

900 MHz Mobile EZ-Com DSSS Radio Transceiver

PREPARED FOR:

Grayhill
561 Hillgrove Avenue
La Grange, IL 60525

TEST REPORT NUMBER:

303122 TX Rev. 3

TEST DATE:

February 10th – 12th and April 11th, 2003

Table of Contents

1. L. S. Compliance In Review

L. S. Compliance, Inc. is located in Cedarburg, Wisconsin – United States.

We may be contacted by:

Mail: L. S. Compliance, Inc.
W66 N220 Commerce Court
Cedarburg, Wisconsin 53012

Phone: 262-375-4400
Fax: 262-375-4248
E-mail: eng@lsr.com

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 : 2005
with Electrical (EMC) Scope of Accreditation
A2LA Certificate Number: **1255.01**

U. S. Conformity Assessment Body (CAB) Validation
Validated by the European Commission as a U. S. Conformity Assessment Body operating under the U. S. /EU, Mutual Recognition Agreement (MRA) operating under the European Union EMC Directive 89/336/EEC, Article 10.2.
Date of Validation: **January 16, 2001**

Federal Communications Commission (FCC) – USA
Listing of 3 Meter Semi-Anechoic Chamber based on 47CFR 2.948
FCC Registration Number: **90756**

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

Industry Canada
On-file, 3 Meter Semi-Anechoic Chamber based on 47CFR 2.948
File Number: **IC 3088**

On-file 3 and 10 Meter OATS based on RSS-210
File Number: **IC 3088-A**

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. Testing and calibration laboratories that comply with this International Standard also operate in accordance with ISO 9001 or ISO 9002 (1994).

Presented this 26th day of March 2003.

President
For the Accreditation Council
Certificate Number 1255.01
Valid to January 31, 2005

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

3. A2LA Scope of Accreditation

American Association for Laboratory Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025-1999

L.S. COMPLIANCE, INC.
W66 N220 Commerce Court
Cedarburg, WI 53012
James Blaha Phone: 262 375 4400

ELECTRICAL (EMC)

Valid to: January 31, 2005 Certificate Number: 1255-01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following tests:

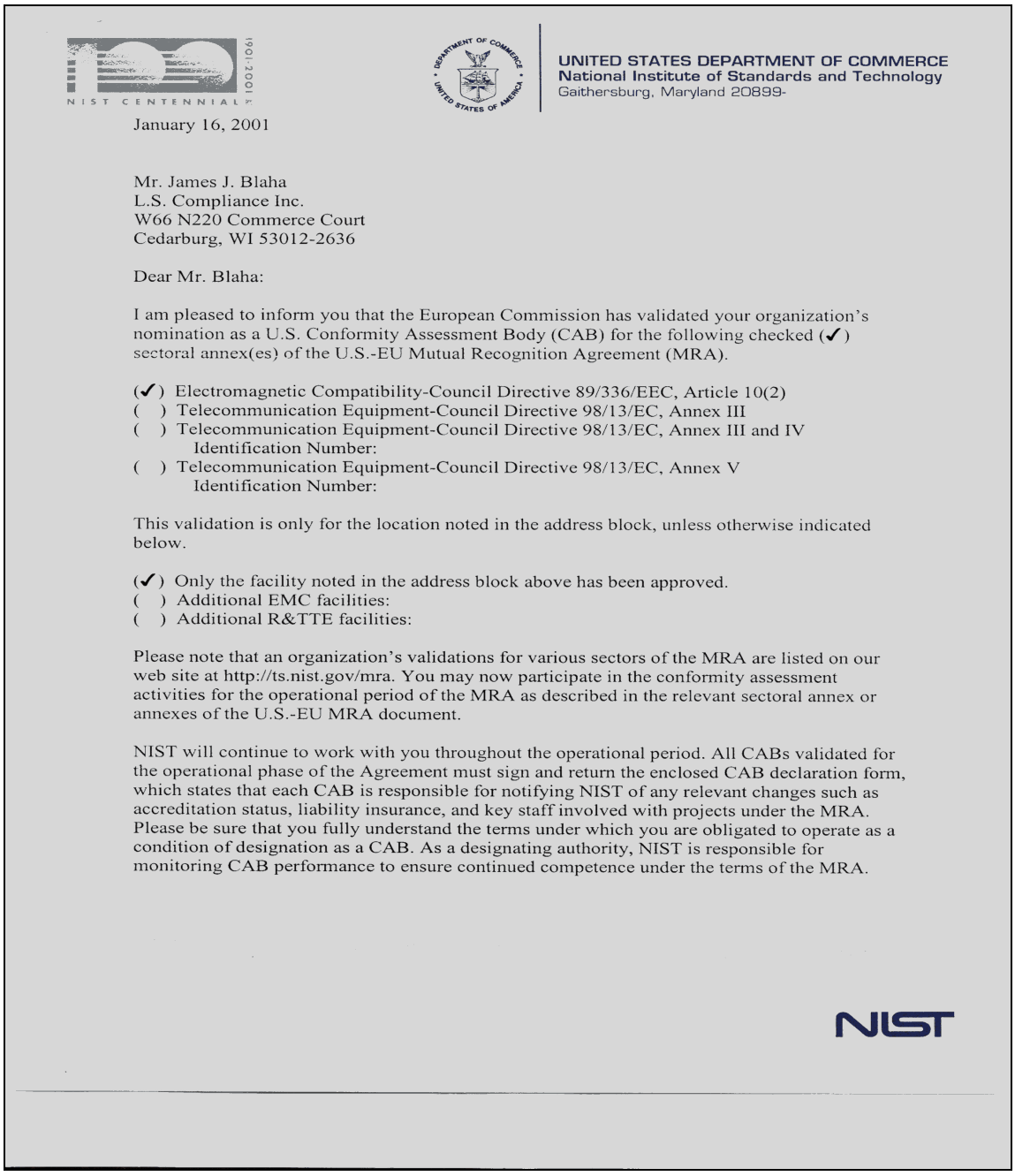
Test	Test Method(s)
Emissions	
Conducted Emissions Continuous/Discontinuous	Code of Federal Regulations (CFR) 47, FCC Method Parts 15 and 18 using ANSI C63.4; EN: 55011, 55022, 55081-1, 55081-2; CISPR: 11, 22; CNS 13438
Radiated Emissions	Code of Federal Regulations (CFR) 47, FCC Method Parts 15 and 18 using ANSI C63.4; EN: 55011, 55022, 55081-1, 55081-2; CISPR: 11,22; CNS 13438
Current Harmonics	EN 61000-3-2
Voltage Fluctuations & Flicker	EN 61000-3-3
Immunity	
Conducted Immunity Fast Transients/Burst	IEC: 1000-4-4, 801-4; EN: 61000-4-4, 50082-1, 50082-2
Surge	IEC: 1000-4-5, 801-5; ENV 50142; EN: 61000-4-5, 50082-1, 50082-2
RF Fields	IEC: 1000-4-6, 801-6; ENV 50141; EN: 61000-4-6, 50082-1, 50082-2
Voltage Dips/Interruptions	IEC 1000-4-11; EN: 61000-4-11, 50082-1, 50082-2

Susanne M. Robinson

(A2LA Cert. No. 1255.01) 03/26/03 Page 1 of 2

5301 Buckeystown Pike, Suite 350 • Frederick, MD 21704-8373 • Phone: 301-644 3248 • Fax: 301-662 2974

4. 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.

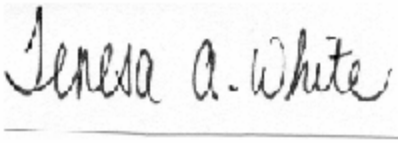
(✓) Only the facility noted in the address block above has been approved.
( ) Additional EMC facilities:
( ) Additional R&TTE facilities:

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

5. Signature Page

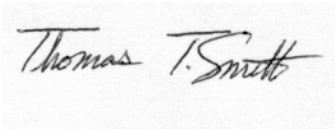


Prepared By: **March 10, 2003**

Teresa A. White, Document Coordinator **Date**

Tested By: **March 10, 2003**

Abtin Spantman, EMC Engineer **Date**



Tested By: **March 10, 2003**

Thomas T. Smith, EMC Engineer **Date**

March 10, 2003

Approved By:

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

6. Product and General Information

Manufacturer:	Grayhill
Model No.:	WLAD 1166 (Rev. A)
Serial No.:	501
Description:	902 to 928 Direct Sequence Spread Spectrum Transceiver

7. Product Description

The EZCom is DSSS Radio Transceiver is an OEM for professional installation in products or assemblies for resale. This device is not intended or marketed for installation by end users. The EUT is a 902 to 928 MHz Direct Sequence Spread Spectrum Transceiver.

8. Test Requirements

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

15.207	15.247b	15.247e
15.205	15.247c	15.209
15.247a2	15.247d	

All radiated emissions tests were performed to measure the emissions in the frequency bands described by the above sections, and to determine whether said emissions are below the limits established by the above sections. These tests were performed in accordance with the procedure 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 C63.4-2001). Another document used as reference for the EMI receiver specification was the International Special Committee on Radio Interference CISPR 16-1 (2002). Measurement technique guidelines found in Appendix C to FCC 97-114 were also consulted. During all tests, the transceiver was operated in a continuous data transmit mode, on various channels.

9. Summary of Test Report

DECLARATION OF CONFORMITY

The Grayhill Receiver was found to **MEET** the requirements as described within the specification of Title 47 CFR FCC, Part 15.247, Subpart c; and I.C. RSS-210, Section 7 for an intentional radiator.

10. Introduction

On February 10th – 13th and April 11th, 2003 a series of Radiated Emission tests were performed on one sample of the Receiver, Model Number WLAD 1166 (Rev. A), Serial Number 501, here forth referred to as the "*Equipment Under Test*" or "*EUT*". These tests were performed using the procedures outlined in ANSI C63.4-2001 for low power transmitters, and in accordance with the limits set forth in FCC Part 15.109 (Industry Canada RSS-210) for a receiver or digital device. These tests were performed by Thomas T. Smith, EMC Engineer and Abtin Spantman, EMC Engineer of L.S. Compliance, Inc.

11. Purpose

All Radiated and Conducted Emission tests upon the EUT were performed to measure the emissions in the frequency bands described in Title 47 CFR, FCC Part 15, including 15.35, 15.207, 15.209a 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 procedure 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 C63.4-2001). Another document used as a reference for the EMI Receiver specification was the Comite International Special Des Perturbations Radioelelectriques CISPR 16-1, 2002

12. Radiated Emissions Test

Test Setup

The test setup was assembled in accordance with Title 47, CRF FCC Part 15 and ANSI C63.4-2001. The EUT was placed on an 80cm high non-conductive table 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 automatic mode, using a DC power supply set to supply 12 volts DC. The applicable limits for spurious signals seen within the 15.205 restricted bands apply at a 3 meter distance, and are found on Page 12. All other spurious radiated emissions were compared to the level of the fundamental signal, less 20 dB, to insure compliance with 15.247c. (115.6 dBµV/m – 20 dB = 95.6 dBµV/m at Channel 8). Measurements above 5 GHz were also performed at a 1 meter separation distance, and the calculation can also be found on Page 12. 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 standard channels: low (0), medium (4) and high (8) to comply with FCC Part 15.35.

Test Procedure

Preliminary radiation 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 30 MHz to 10,000 MHz was pre-scanned, and 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 table in the 3 Meter Semi-Anechoic Chamber, with the antenna mast placed such that the antenna was 3 meters from the test object. 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 10 GHz. The maximum radiated 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 operated in a continuous running mode during the test.

The EUT was tested with two samples of the model of antennas that are specified for use with this device. Antenna case #1 is a 9 dBd Yagi, a model # YB8966 by Antenex; Antenna case #2 is a 7 dBd collinear vertical array, model # MFB9157 by Maxrad.

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 a N.I.S.T. traceable site. In addition, the Connecting Cables were measured for losses using a calibrated Signal Generator and a HP 85462A EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the HP 85462A EMI Receiver database. As a result, the data taken from the HP 85462A 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 85462A EMI Receiver was operated with a bandwidth of 120 kHz for measurements below 1 GHz. Both the Peak and Quasi-Peak Detector functions were utilized. From 5 GHz to 10 GHz, an HP E4407B Spectrum Analyzer and an EMCO Horn Antenna were used.

Test Results

The EUT was found to **MEET** the Radiated Emissions requirements of Title 47 CFR, FCC Parts 15.207 and 15.209 for an low power 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 (15.205)

The following table depicts the emission limits for a low power transmitter. These limits are obtained from Title 47 CFR, Parts 15.205 and 15.209, for radiated emissions measurements, in the restricted bands.

Frequency (MHz)	3 m Limit mV/m	3 m Limit dBmV/m
30-88	100	40
88-216	150	43.5
216-960	200	46.0
960-10,000	500	54.0

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

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

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

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

Sample conversion of limits between 3 meters and 1 meter:

3m limit (dBµV/m) + $20 \log_{10}$ (3m/10m) = 10m limit (dBµV/m)

or:

3m limit (dBµV/m) = 10m limit (dBµV/m) - $20 \log_{10}$ (1m/3m)

from 960 – 10,000 MHz for example: 1m limit (dBµV/m) = 54.0 dBµV/m + 9.54 dB

63.5 dBµV/m = 54.0 dBµV/m + 9.54 dB

Summary of Results and Conclusions

Based on the procedures outlined in this report, and the test results, it can be determined that the EUT does **MEET** the emission requirements of Title 47 CFR, FCC Part 15, (Industry Canada RSS-210) for a low power transmitter.

The enclosed test results pertain to the samples of the test item listed, and only for the tests performed per 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.

Measurement of Electromagnetic Radiated Emissions
Within the 3 Meter FCC Listed Chamber

Frequency Range Inspected: 30 MHz - 10,000 MHz

Manufacturer: Grayhill
Date of Test: February 10th – 12th, 2003
Model No.: 900 MHz Mobile EZ-Com DSSS Radio Transceiver
Serial No.: 501
Test Requirements: 15.247(c), 15.209(a) and 15.205(c)

Distance: 3 Meters	**Frequency Range Inspected:** 30 to 10,000 MHz
Configuration: Continuous Data Transmit	

Test Equipment Used:

EMI Receiver: HP 85462A	Biconical Antenna: EMCO 93110B
Double-Ridged Wave Guide/Horn Antenna: EMCO 3115	Log Periodic Antenna: EMCO 93146

Detector(s) Used:		Peak	v	Quasi-Peak	v	Average	

The following table depicts the level of significant radiated emissions found:

Frequency (MHz)	Antenna Polarity	Channel	Height (meters)	Azimuth (0° - 360°)	EMI Meter Reading (dBmV/m)	15.209 Limit (dBmV/m)	Margin (dB)
74.6	H	0	1.8	0	25.4	40.0	14.6
130.0	H	* 4	1.25	80.0	39.7	43.5	3.8
983.9	V	0	2.15	0	40.8	54.0	13.2
2711	H	0	2.0	15	47.8	54.0	6.2
3614	V	0	1.15	130	40.9	54.0	13.1
4518	H	0	1.65	0	39.1	54.0	14.9
5425	V	0	1.0	122	45.0	54.0	9.0
1124	V	4	2.1	75	35.4	54.0	18.6
1609	H	* 4	1.1	230	46.1	54.0	7.9
2745	H	4	1.05	115	46.4	54.0	7.6
3658	H	4	1.4	15	41.3	54.0	12.7
4576	H	4	1.15	350	38.5	54.0	15.5
1139	V	8	1.9	115	34.7	54.0	19.3
2779	V	8	1.6	120	45.8	54.0	8.2
3705	V	8	1.0	220	38.8	54.0	15.2
4630	V	8	1.0	0	38.2	54.0	15.8

Note: 1) A Quasi-Peak Detector was used in measurements below 1 GHz, and both a peak and an Average Detector were used in measurements above 1 GHz. All peak emissions were greater than 20 dB below the 74 dBμV/m limit.

2) Any radiated spurious emissions seen that were not in a 15.205 band seen were well below the -20 dBc limit specification of 15.247C.

3) Most emissions described above, were taken using Antenna #1 (Yagi); the asterisk in the channel column indicates higher emission level seen with Antenna #2.

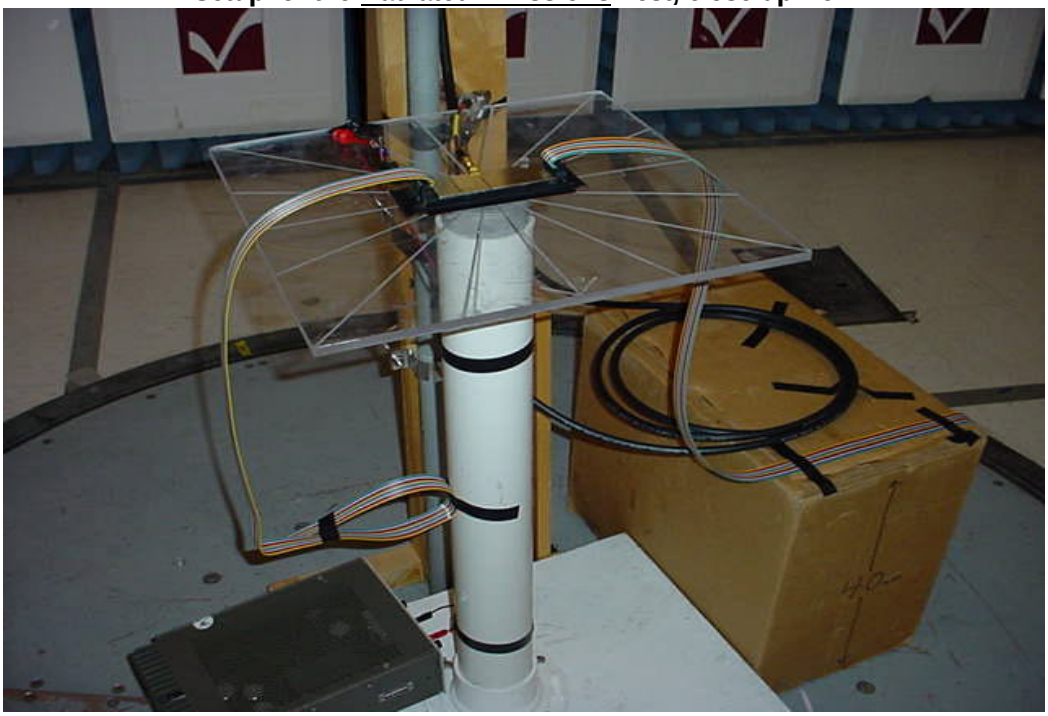
Photos Taken During Radiated Emission Testing

Setup for the Radiated Emissions Test, view with yagi transmit antenna (Case #1)

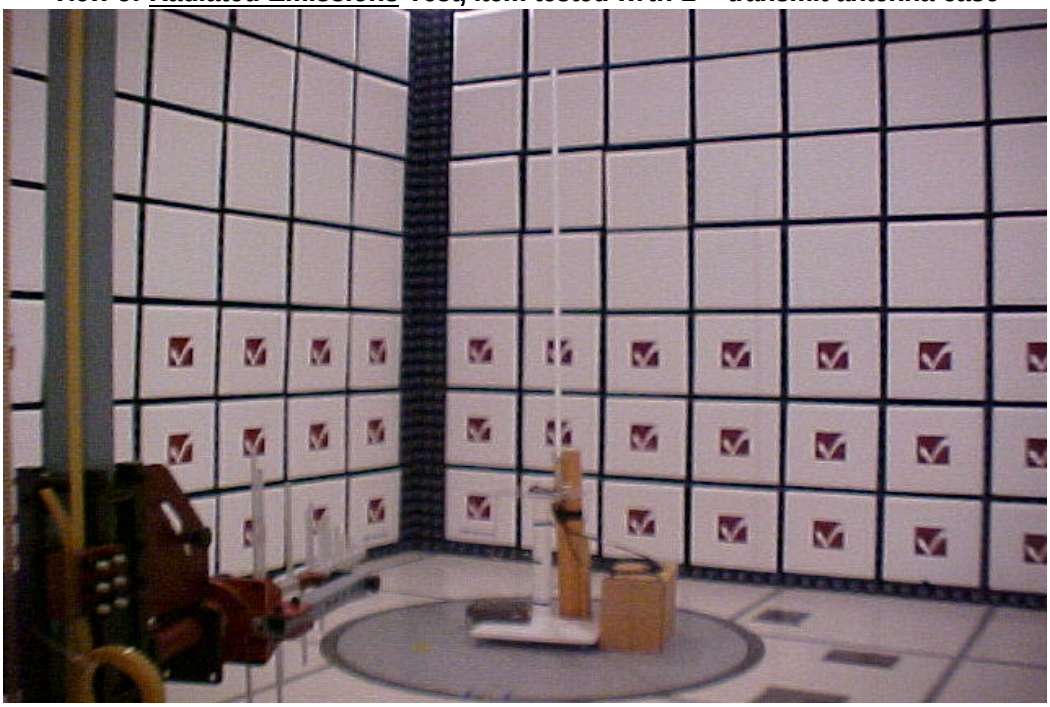
View of the EUT during Radiated Emission Testing in the 3 Meter FCC Listed Chamber

Photos Taken During Radiated Emission Testing

Setup for the Radiated Emissions Test, close-up view

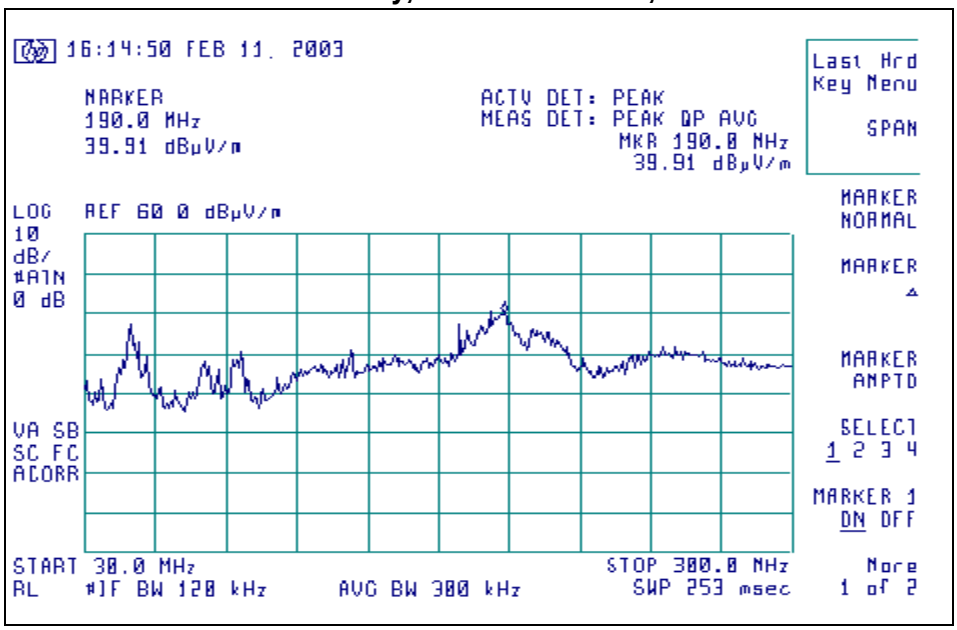


View of Radiated Emissions Test, item tested with 2nd transmit antenna case

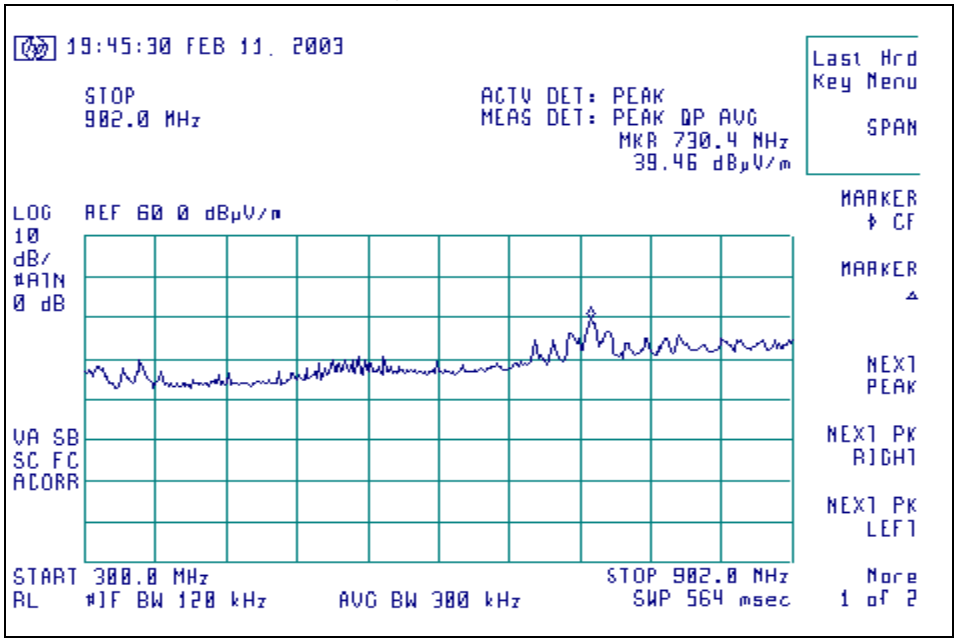


Graphs made during Radiated Emission Testing

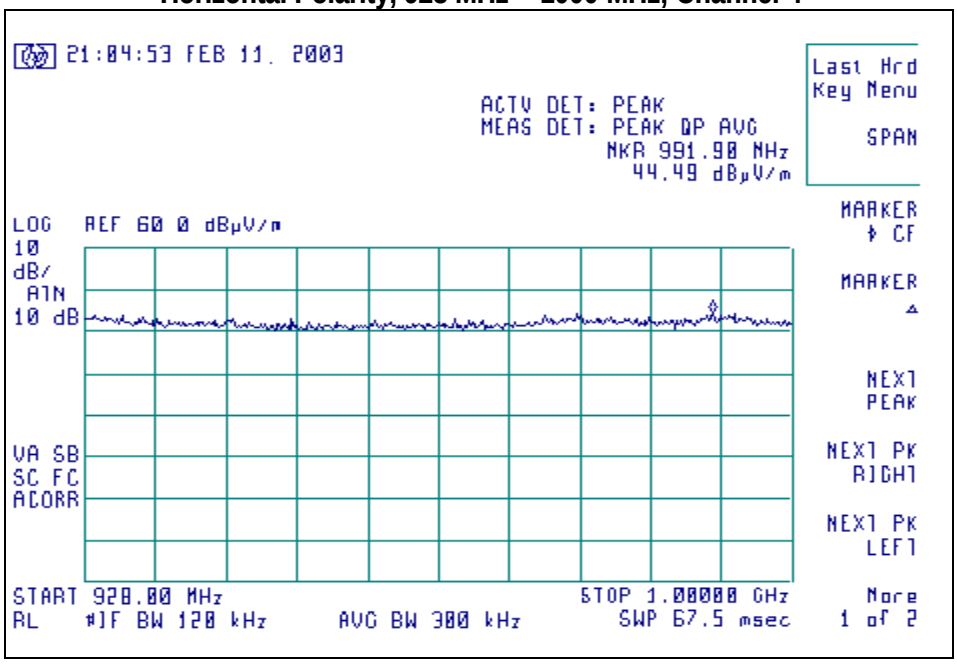
Signature Scan of Radiated Emissions
Horizontal Polarity, 30 MHz – 300 MHz, Channel 4



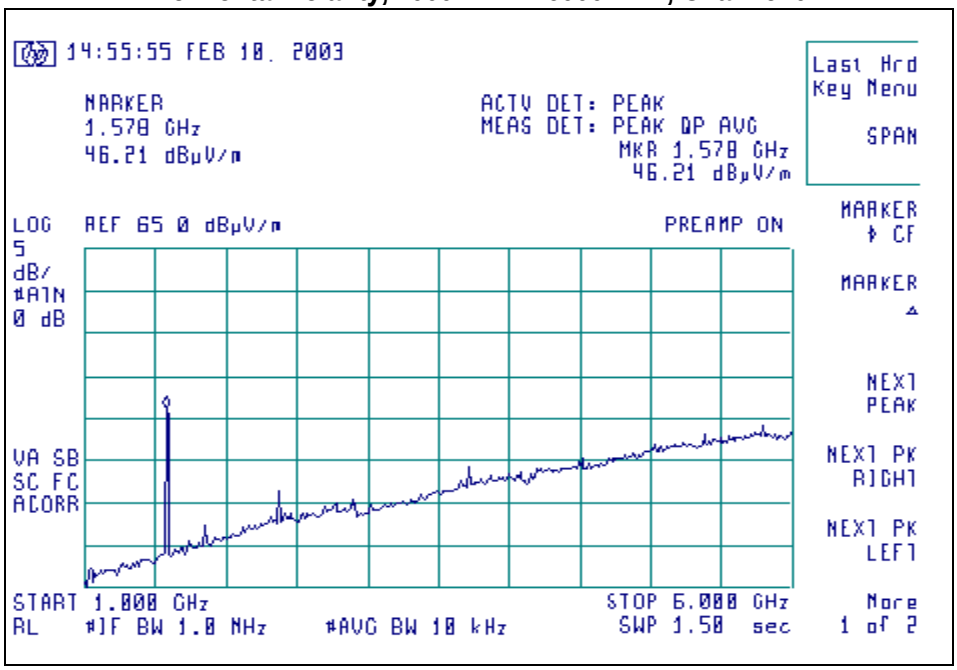
Signature Scan of Radiated Emissions
Horizontal Polarity, 300 MHz – 902 MHz, Channel 4



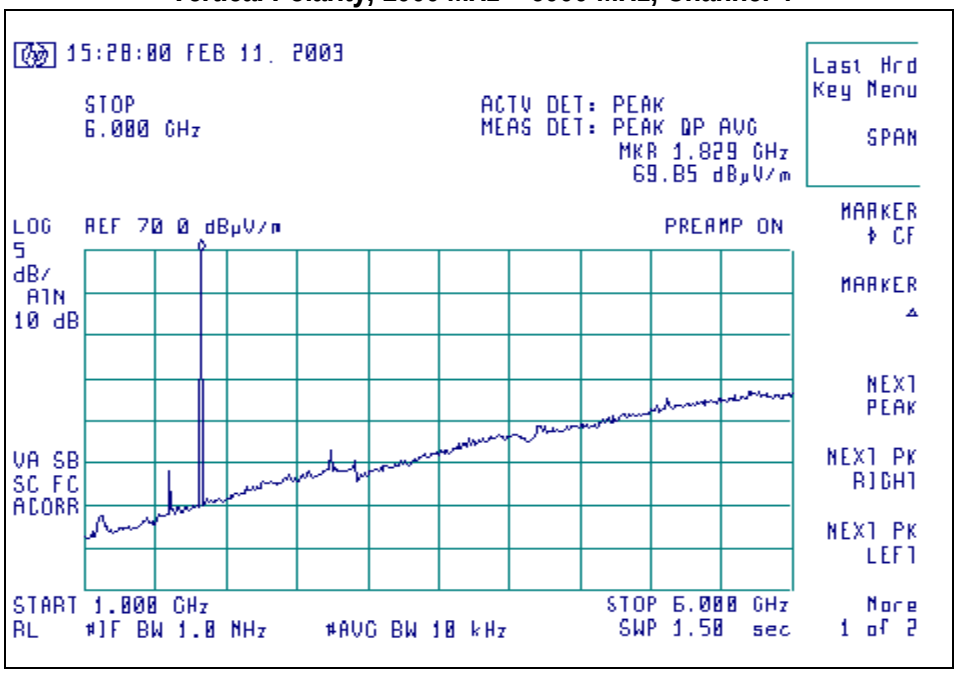
Signature Scan of Radiated Emissions
Horizontal Polarity, 928 MHz – 1000 MHz, Channel 4



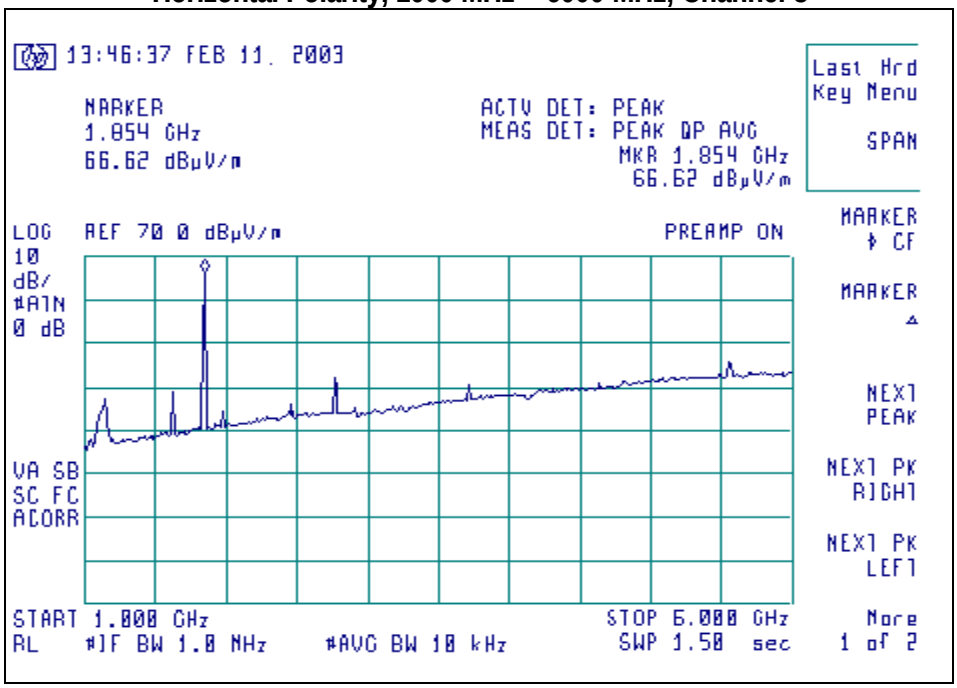
Signature Scan of Radiated Emissions
Horizontal Polarity, 1000 MHz – 6000 MHz, Channel 0



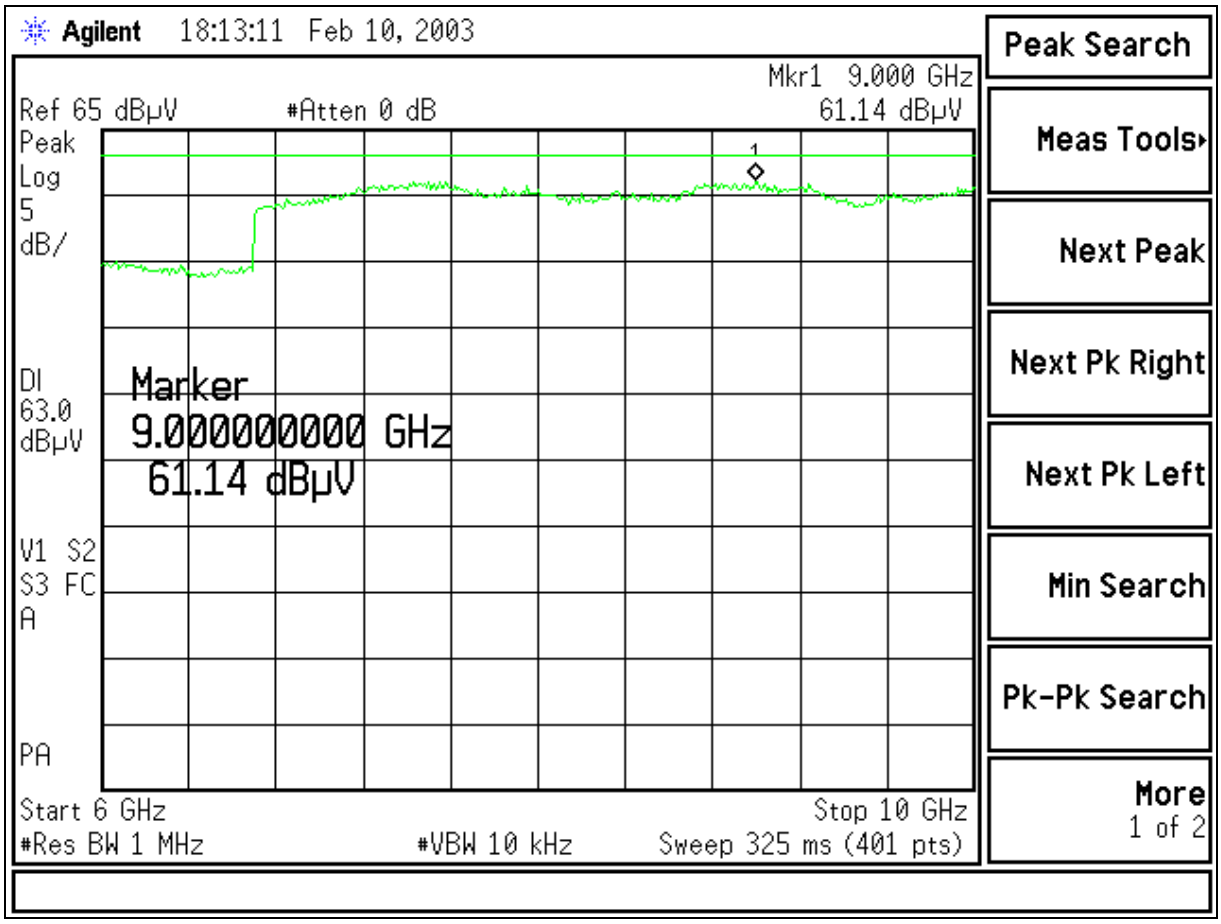
Signature Scan of Radiated Emissions
Vertical Polarity, 1000 MHz – 6000 MHz, Channel 4



Signature Scan of Radiated Emissions
Horizontal Polarity, 1000 MHz – 6000 MHz, Channel 8



Signature Scan of Radiated Emissions
Vertical Polarity, 6 GHz – 10 GHz, Channel 0



13. Conducted Emissions Test (AC Line)

Test Setup

The Conducted Emissions test was performed within an FCC listed Shielded Room located at L.S. Compliance, Inc. in Cedarburg, Wisconsin. The test area and setup are in accordance with ANSI C63.4-2001 and with Title 47 CFR, FCC Part 15, Subpart B (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, which was powered by a 5 volt DC wall plug-in source, was plugged into a 50Ω (ohm), 50/250 µH Line Impedance Stabilization Network (LISN). The AC power supply of 115V was fed into the FCC listed Shielded Room 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 in the FCC listed Shielded Room and connected to the LISN, the RF Sampling Port of the LISN was cabled to a 10 dB Attenuator-Limiter, and then to the HP 85462A 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 appropriate frequency range and bandwidths were entered into the EMI Receiver, and measurements were made. The bandwidth used for these measurements is 9 kHz, as specified in CISPR 16-1 (2002), 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 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. 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 85462A 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, Conducted Emissions for an Intentional Radiator. See the Data Charts and Graphs for more details of the test results.

Notes:

Measurement of Electromagnetic Conducted Emission
In the Shielded Room

Frequency Range Inspected 150 KHz to 30 MHz

Manufacturer: Grayhill
Date of Test: February 10th – 12th, 2003
Model No.: 900 MHz Mobile EZ-Com DSSS Radio Transceiver w/OEM Model AD-051AR 5VDC Wall Supply
Serial No.: 501
Test Requirements: **FCC 15.207a**

Distance: 80 cm				**Frequency Range Inspected:** 0.15 MHz to 30 MHz		
Configuration:						
Detector(s) Used:		Peak	v	Quasi-Peak	v	Average

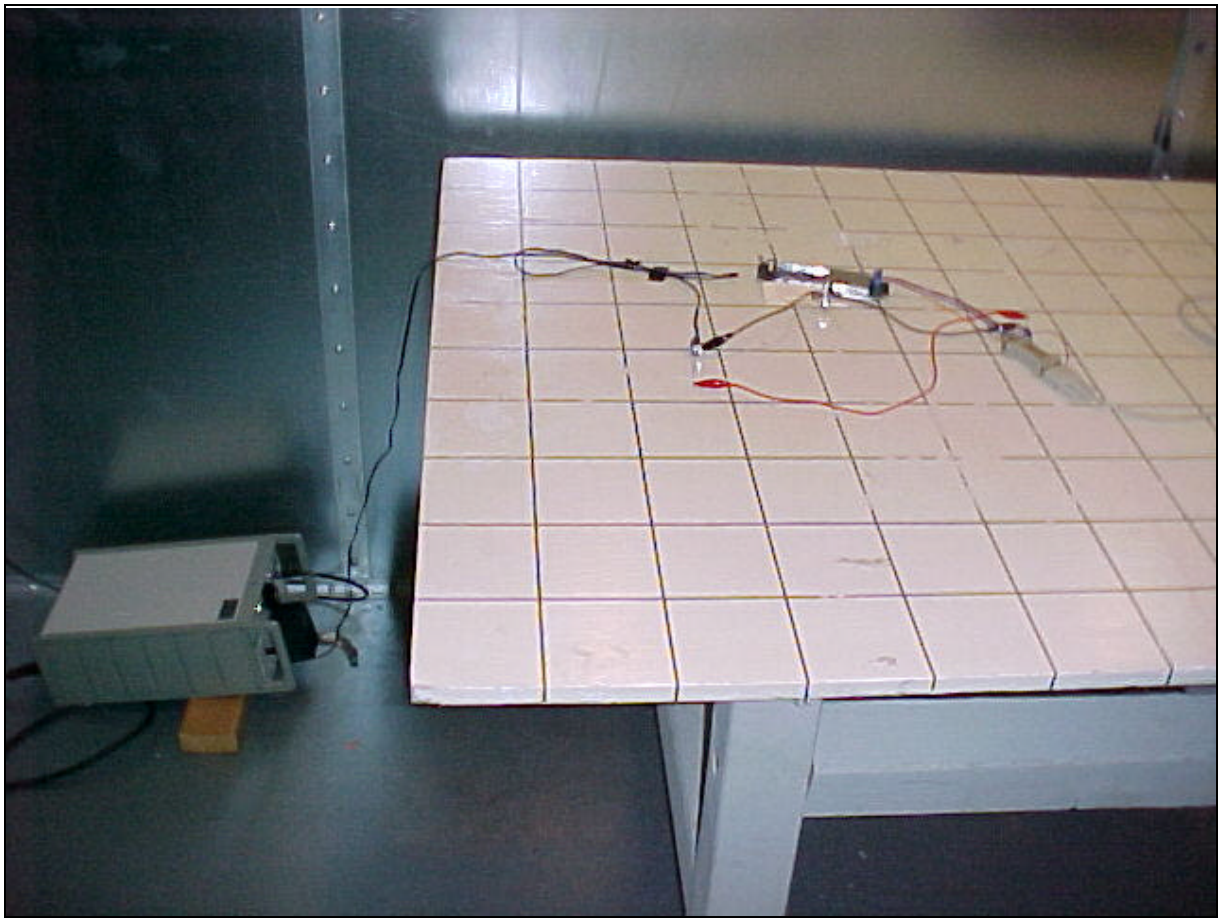
Test Equipment Used:

EMI Receiver: HP 8546A	L.I.S.N: EMCO 3816
Transient Limiter: HP 11947A	

Frequency (MHz)	Line	EMI Reading (dBmV/m)		Limit (dBmV/m)		Margin (dB)	
		Q-Peak	Average	Q-Peak	Average	Q-Peak	Average
0.161	L1	47.3	17.3	65.4	55.4	18.1	38.1
0.168	L1	47.1	19.1	65.0	55.0	17.9	35.9
0.224	L1	44.8	15.8	62.6	52.6	17.8	36.8
0.236	L2	44.0	14.1	62.2	52.2	18.2	38.1
0.349	L2	40.8	11.4	58.9	48.9	18.1	37.5
0.427	L1	39.8	11.6	57.3	47.3	17.5	35.7
0.442	L2	39.0	9.7	57.0	47.0	18.0	37.3
0.458	L1	39.3	10.0	56.7	46.7	17.4	36.7
0.495	L1	38.6	9.3	56.1	46.1	17.5	36.8
0.502	L2	37.5	9.6	56.0	46.0	18.5	36.4
0.514	L1	38.1	9.0	56.0	46.0	17.9	37.0

Photos Taken During Conducted Emission Testing

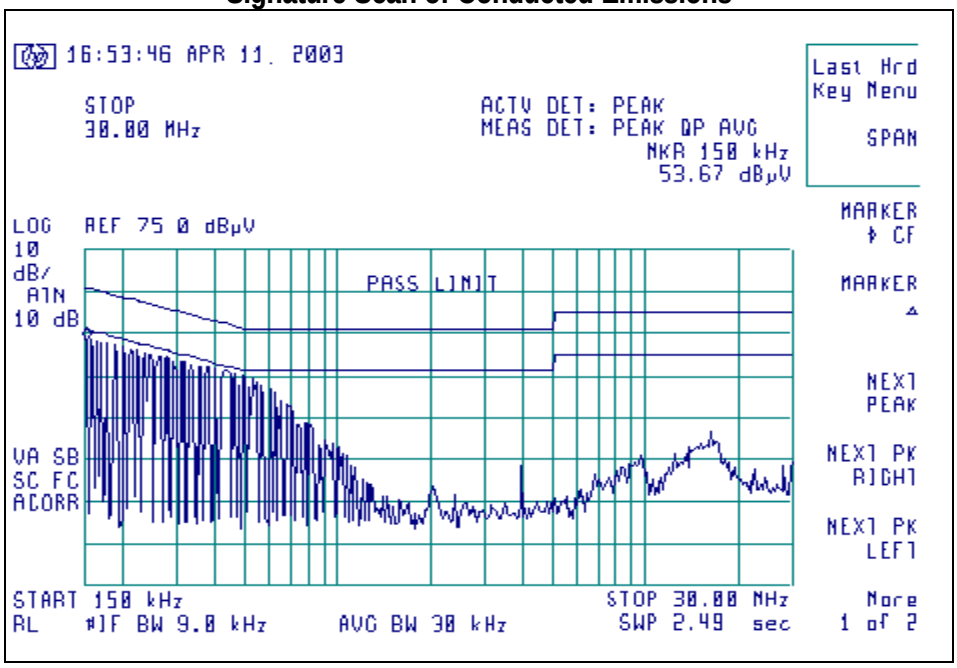
Setup for the Conducted Emissions Test



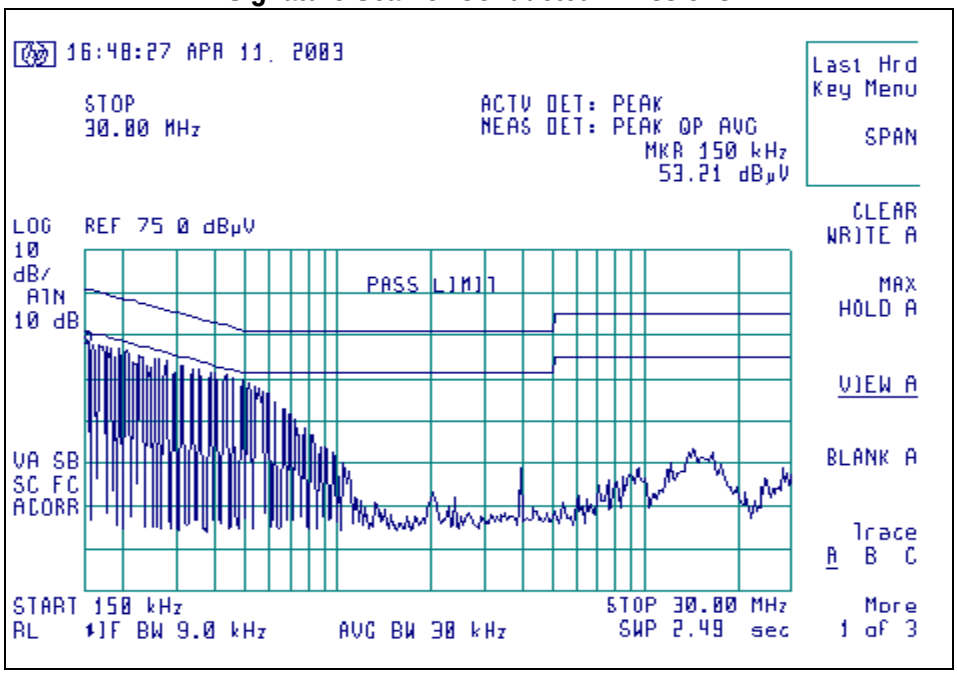
View of the EUT during Conducted Emissions Testing

Graphs made during Conducted Emission Testing

Signature Scan of Conducted Emissions



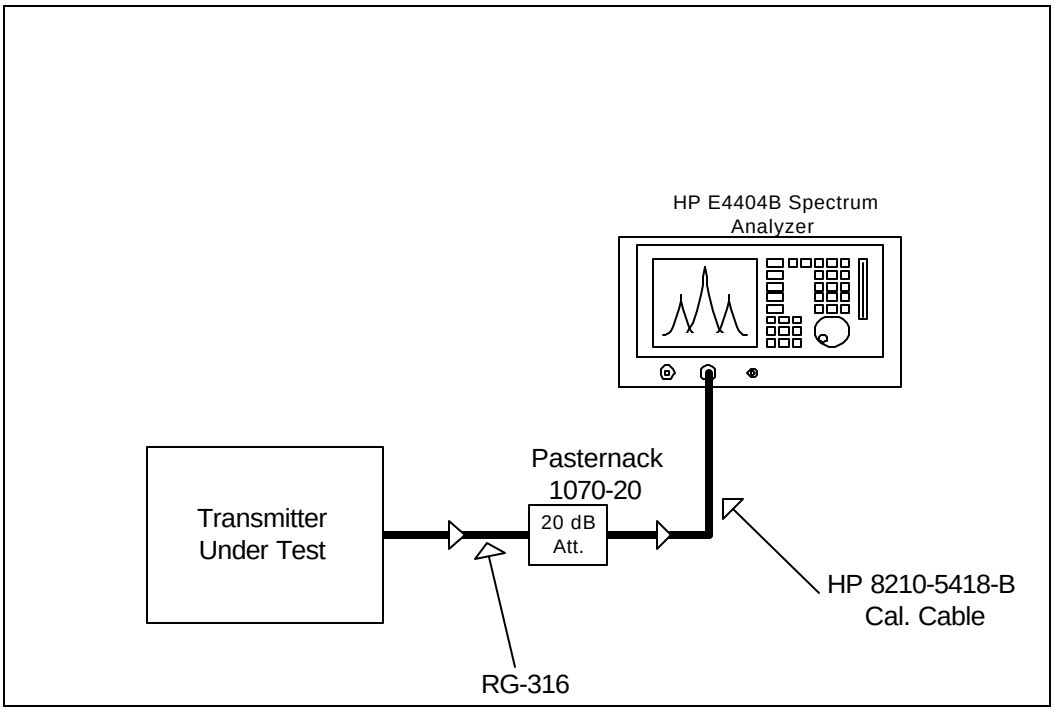
Signature Scan of Conducted Emissions



14. Conducted Emissions Test, Power Output

For the FCC Part 15.247b measurement, the output of the transceiver (Serial Number 501) was connected via a short jumper cable created only for this measurement, into the input of the HP E4407B Spectrum Analyzer. The unit was configured to run in a normal transmit mode, while being supplied with a test program as a modulation source. The HP receiver was set to a 5 MHz Bandwidth, and the transmit signal was then stored, with the peak signal level stored. This power level was collected for three channels and can be seen in the chart presented below. Power output was also inspected while setting the power supply to 10.2 VDC and 13.8 VDC in order to satisfy 15.31e; no variation in power output or frequency was observed.

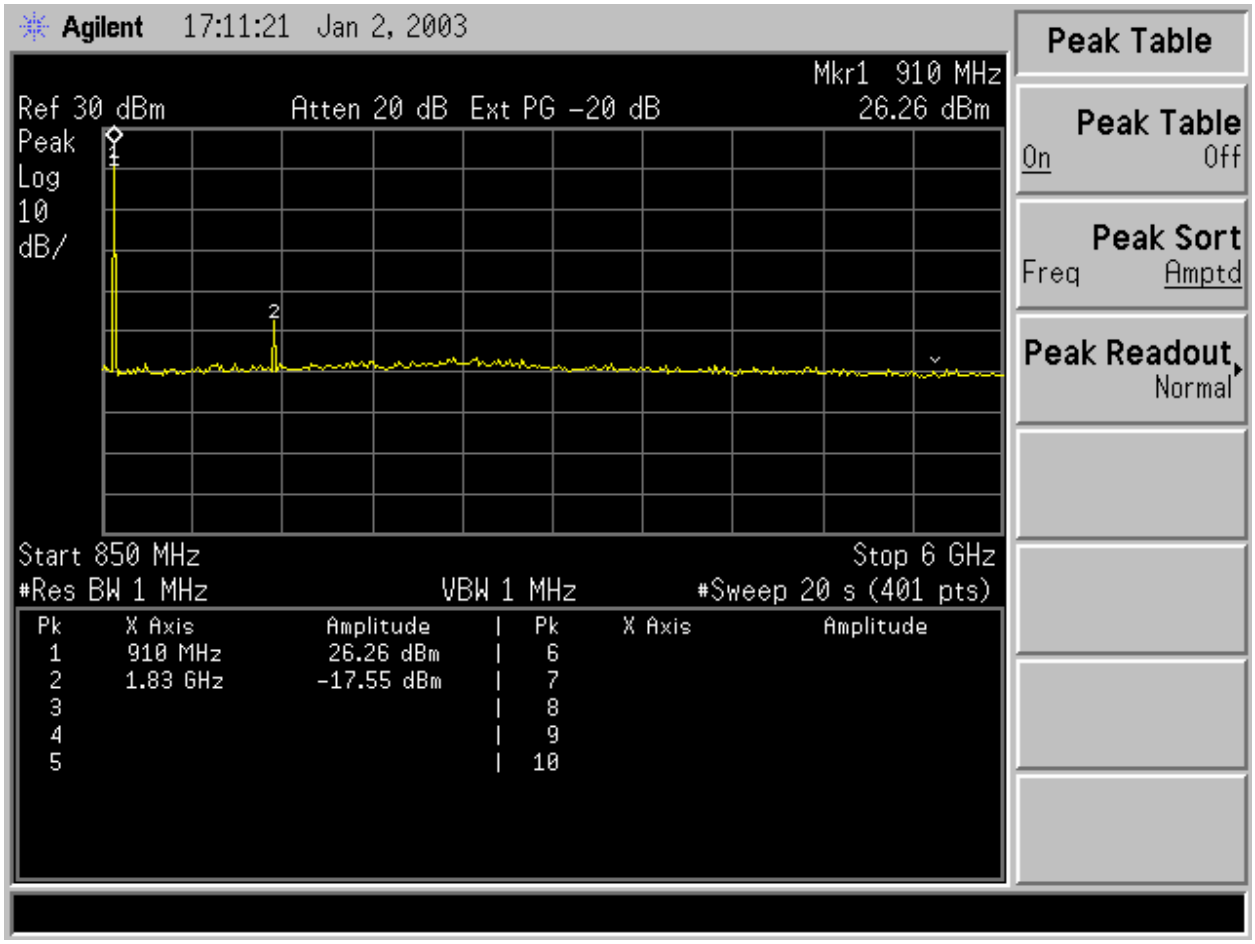
CHANNEL	CENTER FREQ (MHz)	LIMIT (dBm)	MEASURED POWER (dBm)	MARGIN (dB)
0	903.838	30 dBm	26.5	3.5
4	914.897	30 dBm	26.0	4.0
8	925.957	30 dBm	25.5	4.5



15. Conducted Emissions Test, Spurious Emissions

FCC Part 15.247 I requires an antenna conducted measurement of conducted harmonic and spurious levels, as referenced to the carrier frequency in a 100 kHz bandwidth. For this test, the mobile transceiver was directly connected to the HP E4407B Spectrum Analyzer, through a very short Coaxial Cable and a 20 dB Attenuator. Plots were then taken, with any noticeable spurious or harmonic signals identified. No significant levels at any spurious products could be found within 20 dB of the -20 dBc specification of the fundamental transmitter. Signals that were observed were greater than 40 dB down (in the 100 kHz, or greater, bandwidth).

Plot of Conducted Spurious and Fundamental Levels, Channel 4 shown



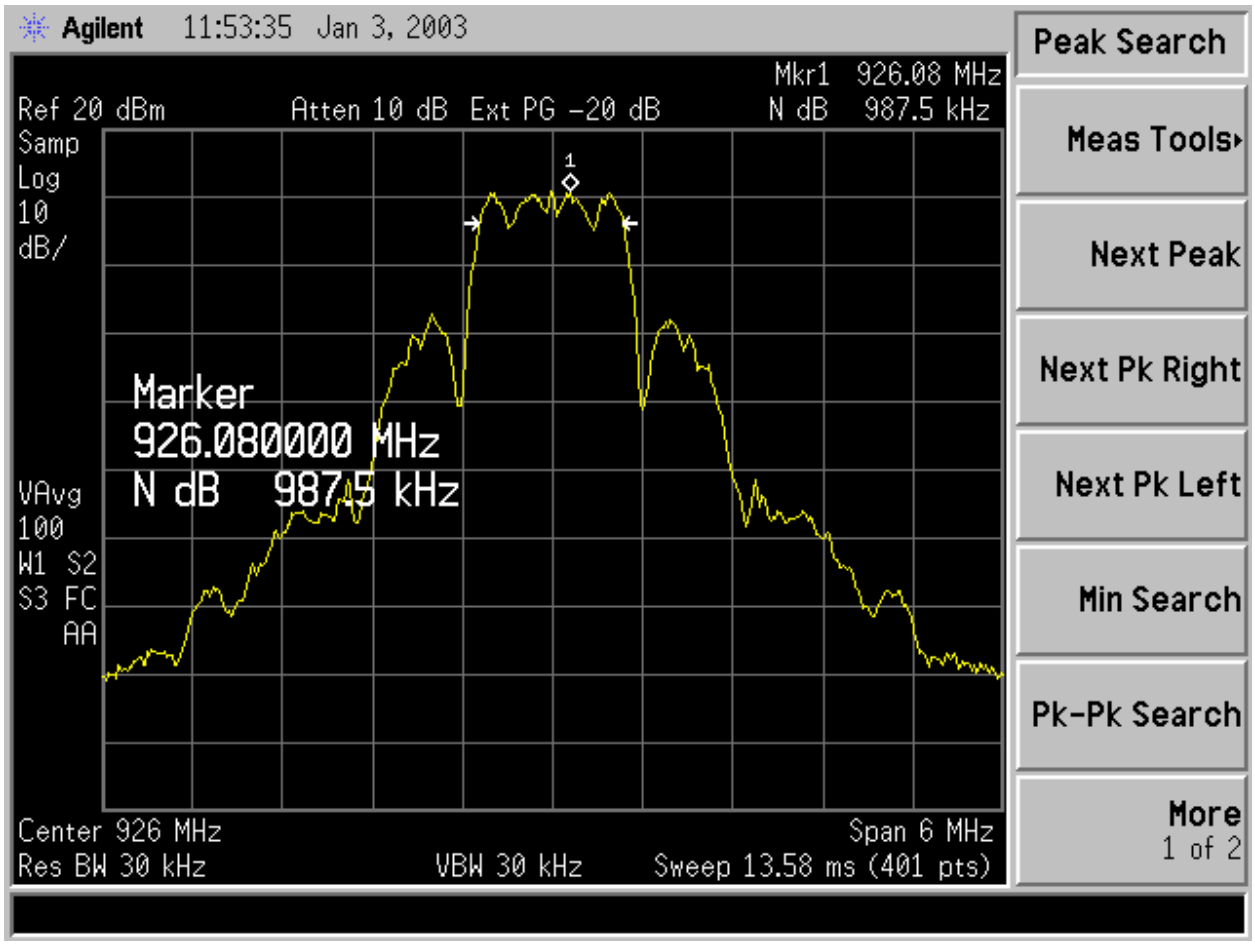
16. Conducted Emissions Test, Occupied Bandwidth

The 6 dB bandwidth requirement found in FCC Part 15.247.a.2 is a minimum of 500 kHz. Direct measurement of the transmitted signal, via a direct-cabled connection to the HP E4407B Spectrum Analyzer, was then used to determine the signal bandwidth. For each of the representative channels, refer to the graphs found in Appendix C. From this data, the bandwidth of Channel 8, which is the closest data to the specification limit, is 987 kHz, which is above the minimum of 500 kHz.

CHANNEL	CENTER FREQ (MHz)	MEASURED 6 dB BW (kHz)	MINIMUM LIMIT (kHz)
0	903.838	1002	500
4	914.897	1002	500
8	925.957	987	500
0 *	904.64	1995	500
3 *	913.36	1945	500
7 *	924.998	1970	500

* Denotes the channel assignments and center frequencies for the mobile transceiver, while configured for the high data rate communication.

Plot of Occupied Bandwidth, Channel 8, low data rate



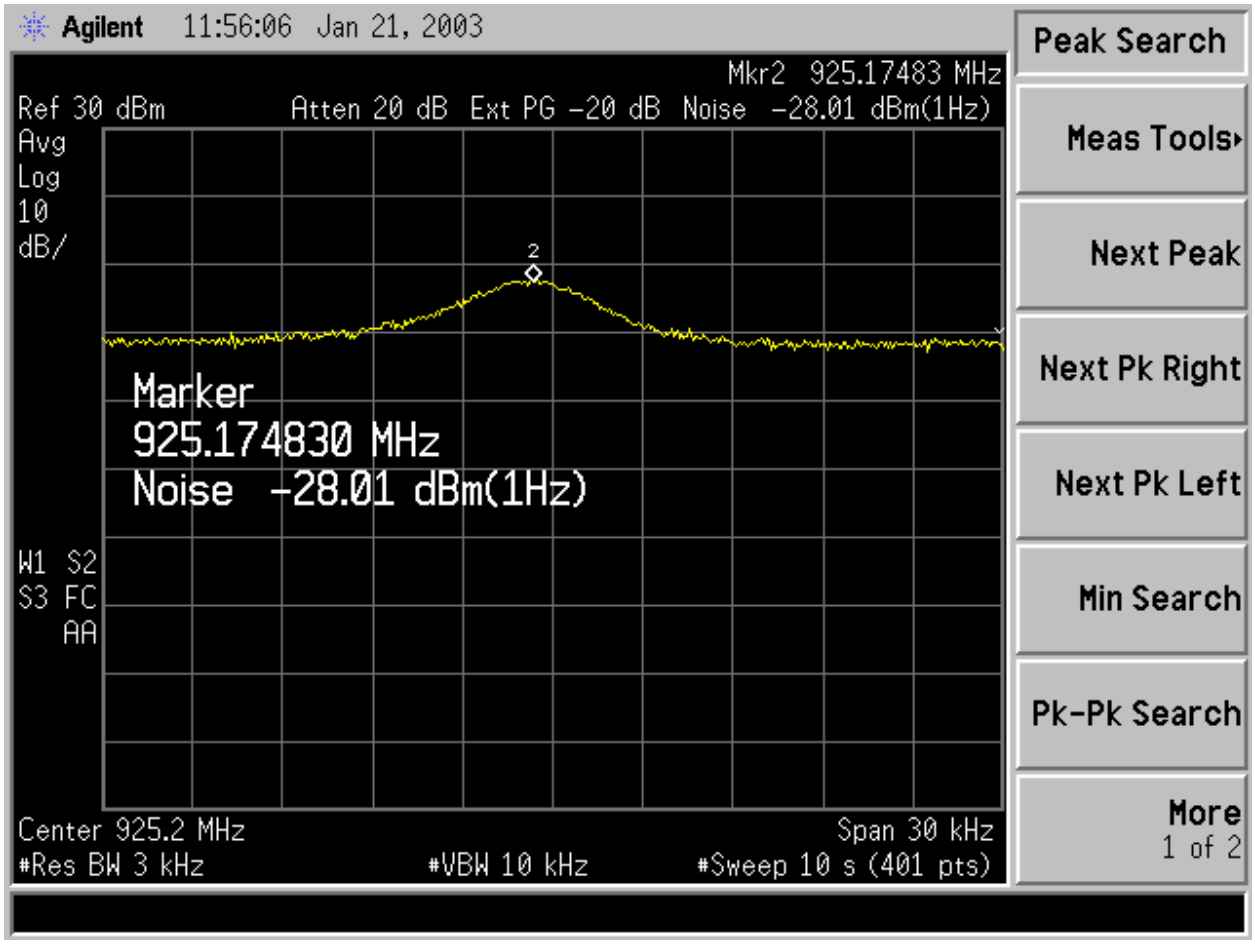
17. Conducted Emissions Test, Power Spectral Density

In accordance with FCC Part 15.247(d), 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 Section 14. The peak output frequency for each representative frequency was scanned, with a narrow bandwidth, and reduced sweep, and a power density measurement was performed at the highest observed point, using the utility built into the HP Analyzer. The resultant density was then corrected to a 3 kHz bandwidth, and can be determined by inspection of the graphs found on the following page. The highest density was found to be no greater than +6.8 dBm, which is under the allowable limit by 1.2 dB.

CHANNEL	CENTER FREQ	MEASURED P	3khz corr.	CORRECTED	SPEC	MARGIN
0	903.838	-31.6	34.8	+3.2	+8.0dBm	4.8
4	914.897	-30.0	34.8	+4.8	+8.0dBm	3.2
8	925.957	-30.3	34.8	+4.5	+8.0dBm	3.5
0 *	904.64	-29.0	34.8	+5.8	+8.0dBm	2.2
3 *	913.36	-28.6	34.8	+6.2	+8.0dBm	1.8
7 *	924.998	-28.0	34.8	+6.8	+8.0dBm	1.2

* Test was run at high data rate, with channel center frequencies assigned to keep transmitted signal within the 902-928 MHz I.S.M. band.

Plot of Power Spectral Density; highest reading, Channel 7, high data rate



Appendix A

Test Equipment List

Asset #	Manufacturer	Model #	Serial #	Description	Calibration Information	
					Date	Due Date
AA960007	EMCO	3115	99111-4198	Double Ridge Horn Antenna	12-06-02	12-06-03
AA960008	FCC	3816/2NM	9701/1057	16 AMP LISN	09-19-02	09-19-03
AA960031	HP	11947A	3107A01708	Transient Limiter	05-06-02	05-06-03
AA960077	EMCO	93110B	9702-2918	Biconical Antenna	09-19-02	09-19-03
AA960078	EMCO	93146	9701-4855	Log-Periodic Antenna	09-19-02	09-19-03
CC000221	HP	E4407B	Us39160256	26.5 GHz Spectrum Analyzer	10-28-02	10-28-03
EE960004	EMCO	2090	9607-1164	Device Controller	N/A	N/A
EE960013	HP	85462A	3617A00320	EMI Receiver RF Section	09-20-02	09-20-03
EE960014	HP	85460A	3448A00296	EMI Receiver Pre-Selector	09-20-02	09-20-03
N/A	LSC	Cable	0011	3 meter ½" Armored Cable	06-07-02	06-07-03
N/A	LSC	Cable	0038	1 meter RG 214 Cable	06-07-02	06-07-03
N/A	LSC	Cable	0050	10 meter RG 214 Cable	06-07-02	06-07-03
N/A	Pasternak	1070-20	N/A	20 db Attenuator		N/A

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	4.80 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 Meter Chamber, 3 Volts/Meter	1.128 Volts/Meter
Conducted Immunity	3 Volt level	1.0 V