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

COMPLIANCE TESTING OF:

Boomerang Tracking Beacon
(915.035 – 916.750 MHz)

PREPARED FOR:

Boomerang Tracking Corporation
Attn.: Andre Boulay
9280, Boulevard De L'Acadie
Montreal, Quebec H4N 3C5
Canada

TEST REPORT NUMBER:

302383 - TX

TEST DATES:

December 20th, 2002 and January 8th & 9th, 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 : 2001
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 (EMC) Testing

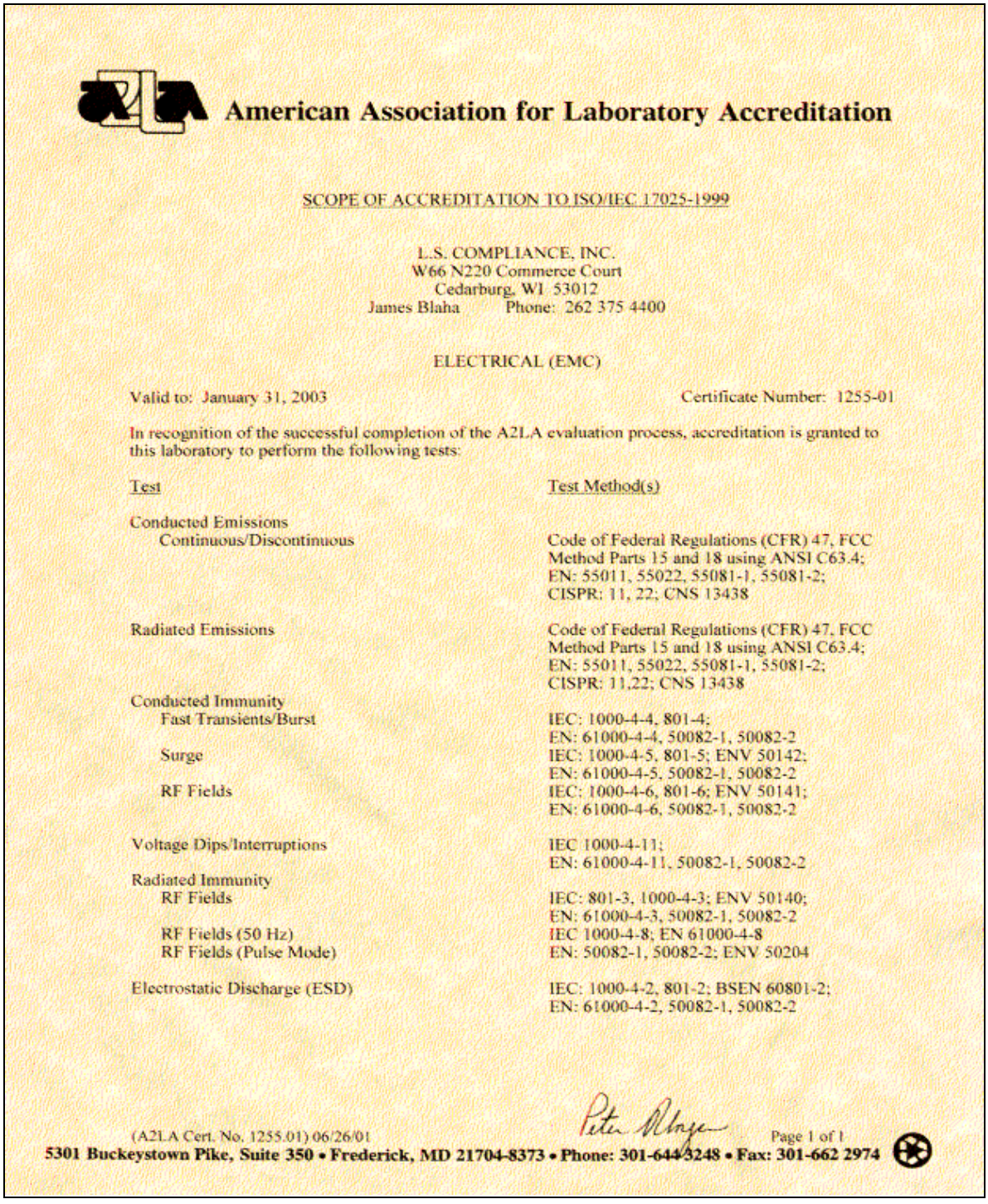
The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing. Testing and calibration laboratories that comply with this International Standard also operate in accordance with ISO 9001 or ISO 9002.

Presented this 26th day of June, 2001.

President
For the Accreditation Council
Certificate Number 1255.01
Valid to January 31, 2003

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical (EMC) 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, 2003 Certificate Number: 1255-01

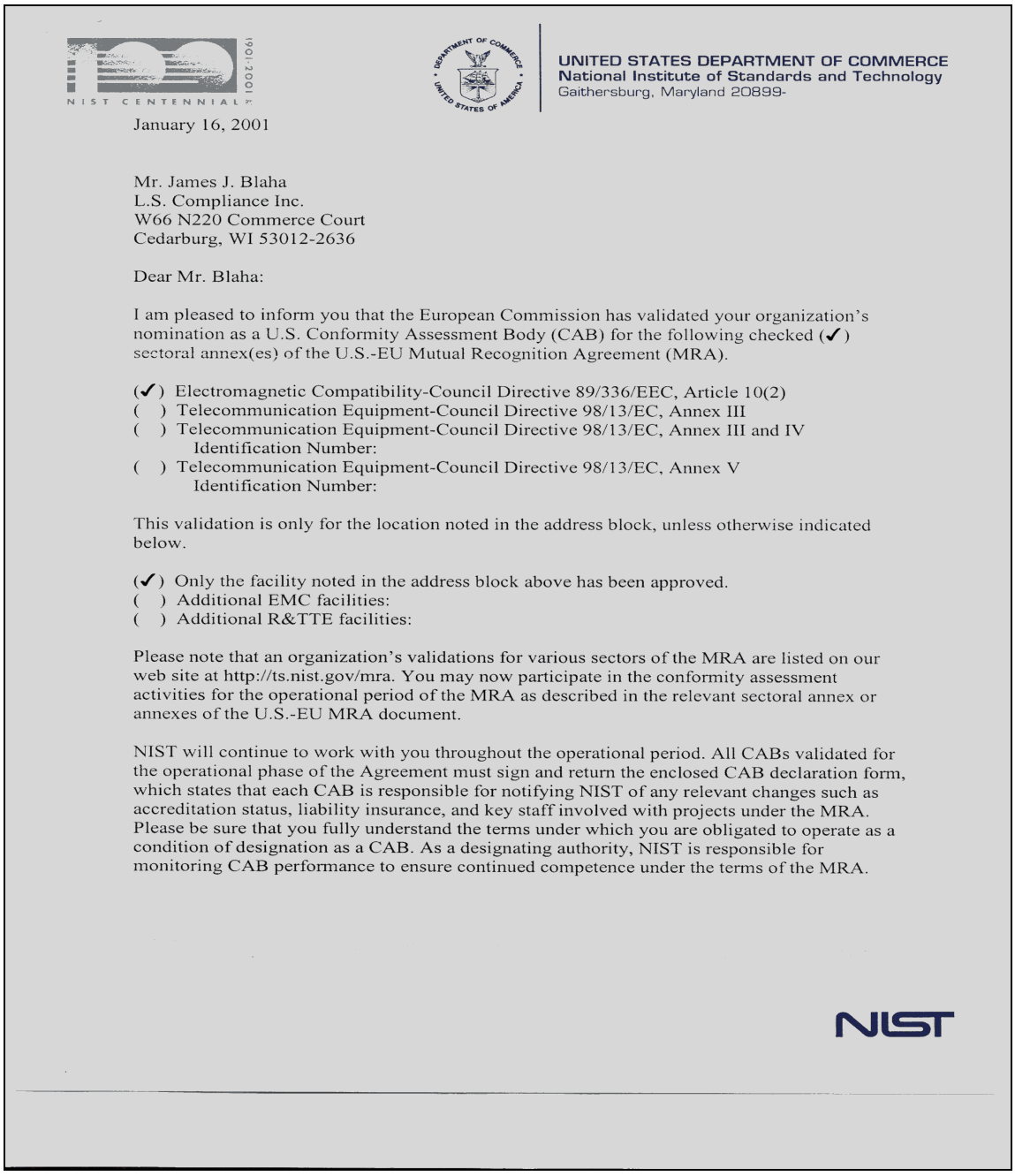
In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following tests:

Test	Test Method(s)
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
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
Radiated Immunity RF Fields	IEC: 801-3, 1000-4-3; ENV 50140; EN: 61000-4-3, 50082-1, 50082-2
RF Fields (50 Hz)	IEC 1000-4-8; EN 61000-4-8
RF Fields (Pulse Mode)	EN: 50082-1, 50082-2; ENV 50204
Electrostatic Discharge (ESD)	IEC: 1000-4-2, 801-2; BSEN 60801-2; EN: 61000-4-2, 50082-1, 50082-2

(A2LA Cert. No. 1255.01) 06/26/01 Page 1 of 1

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.

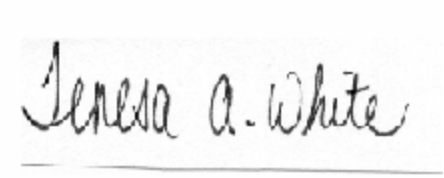
(✓) Only the facility noted in the address block above has been approved.
( ) Additional EMC facilities:
( ) Additional R&TTE facilities:

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

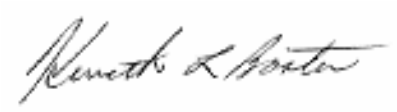


Prepared By: **April 10, 2003**

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

Tested By: **April 10, 2003**

Abtin Spantman, EMC Engineer **Date**



Tested By: **April 10, 2003**

Kenneth. L. Boston, EMC Engineer **Date**

Approved By: **April 10, 2003**

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:	Boomerang Tracking Corporation
Model No.:	Boomerang Tracking Beacon
Serial No.:	Beta Unit #8
Description:	900-928 MHz Frequency Hopping Spread Spectrum Transmitter

7. Product Description

The Boomerang Tracking Beacon (915.035 – 916.750 MHz) is part of an automotive vehicle recovery system, which contains a 303 MHz receiver, used to verify if the owner is in the car; a GSM transceiver, which allows communication via the cellular phone network; and a 915 MHz F.H.S.S. transmitter, which serves as a tracking beacon. This report deals with the Tracking Beacon section of the system.

8. Test Requirements

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

15.207	15.247b	15.247f
15.205	15.247c	15.209
15.247a	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) Number 16-1 (2002). Measurement technique guidelines found in Appendix C to FCC 97-114 were also consulted. During all tests a representative random data stream was used for modulation of the test transmitter output.

9. Summary of Test Report

DECLARATION OF CONFORMITY

The Boomerang III Tracking Beacon was found to **MEET** the requirements as described within the specification of Title 47 CFR FCC, Part 15.247, Subpart C; and Industry Canada RSS-210, Section 6.2.2(o) for a Frequency Hopping Spread Spectrum Transmitter.

10. Introduction

On January 3, 2003 a series of Radiated Emission tests were performed on one sample of the Boomerang Tracking Beacon, Serial Number Beta #8, 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 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 Abtin Spantman, EMC Engineer of L.S. Compliance, Inc.

11. Purpose

All Radiated and Conducted Emission tests upon the Boomerang III Tracking Beacon were performed to measure the emissions in the frequency bands described in Title 47 CFR, FCC Part 15, including 15.35, 15.209, 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 C63.4-2001). Another document used as a reference for the EMI Receiver specification was the Comite International Special Des Perturbations Radioelelectriques (CISPR) Number 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 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 one of several test modes and powered via a 12 volt DC supply. The test sample has a test program installed in firmware, which was activated to either transmit on a fixed channel (1 or 50) or to hop through 50 channels, while modulated with a representative data packet. The applicable limits apply at a 3 meter distance, and are found on Page 12. Measurements above 5 GHz were also performed at a 1.0 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 two (2) standard channels: low (01) and high (50) to comply with FCC Part 15.35.

Test Procedure

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 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 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.

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 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 E4407 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 Part 15.247 for a FHSS 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 following table depicts the general limits for an intentional radiator. These limits are obtained from Title 47 CFR, Part 15.209, for radiated emissions measurements. These limits were applied to any signals found in the 15.205 restricted bands.

Frequency (MHz)	**μV/m**	**3 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

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 1.0 meters

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, Subpart C (Industry Canada RSS-210) for an intentional radiator.

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: Boomerang Tracking Corporation
Date of Test: January 8th and 9th, 2003
Model No.: Boomerang Tracking Beacon
Serial No.: Beta Unit #8
Test Requirements: 15.247, 15.205 and 15.209

Distance: 3 Meters. 0.3 meters	**Frequency Range Inspected:** 30 to 10,000 MHz
Configuration: Continuous Data Transmit; test message; fixed hop channel	

Test Equipment Used:

EMI Receiver: HP 8546A	Biconical Antenna: EMCO 3110
Double-Ridged Wave Guide/Horn Antenna: EMCO 3115	Log Periodic Antenna: EMCO 43146A
Standard Gain Horn: EMCO 3160-09	PreAmp: Advanced Microwave WHA6224

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

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

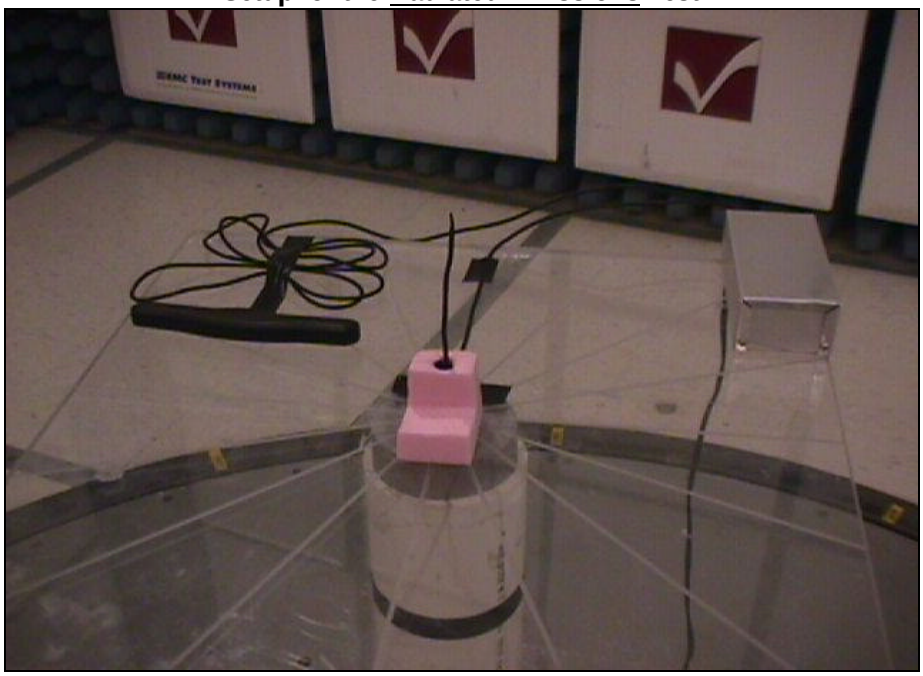
Frequency (MHz)	Antenna Polarity	Channel	Height (meters)	Azimuth (0° - 360°)	EMI Meter Reading (dBmV/m)	15.209 Limit (dBmV/m)	Margin (dB)
2745	V	1	1.0	285	53.0	54.0	1.0
2750	V	50	1.0	285	53.1	54.0	0.9

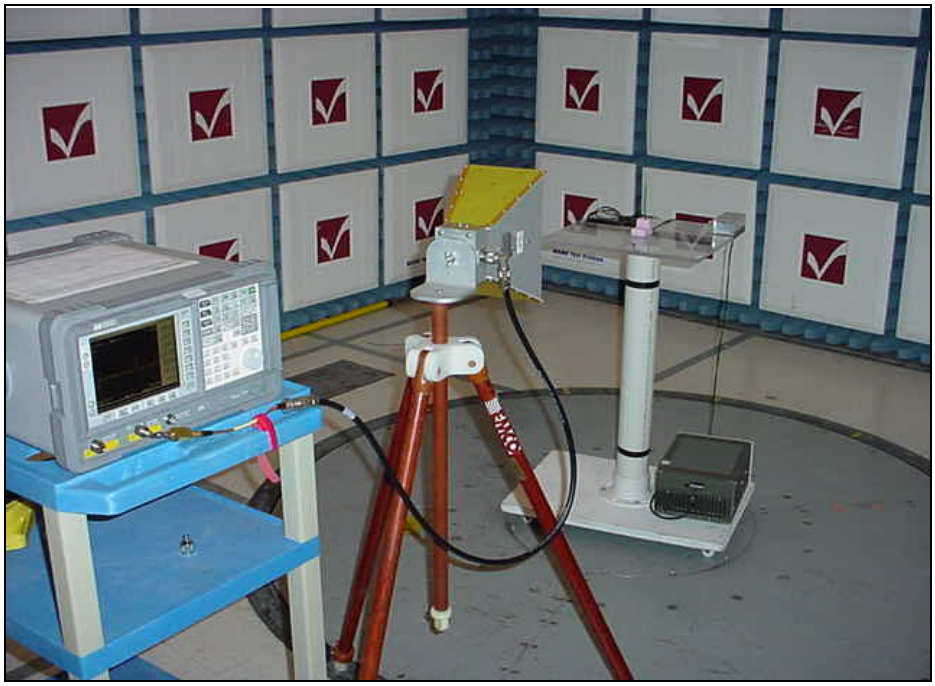
Notes: 1) A Quasi-Peak Detector was used in measurements below 1 GHz; a Peak and an Average Detector were used in measurements above 1 GHz. All Peak measurements were seen to be well below the Peak limit of 74.0 dBµVm.

2) Any radiated spurious emissions seen that were not in a 15.205 band were well below the -20dBc limit specification of 15.247(c) (emissions seen at points between 837 MHz to 956 MHz, and at 1.8 GHz).

Photos Taken During Radiated Emission Testing

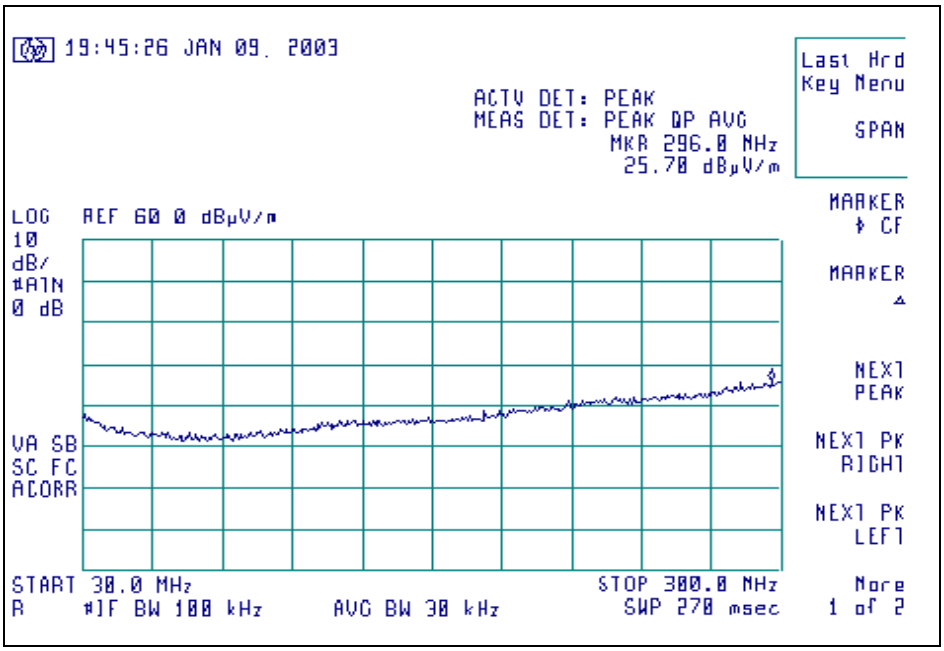
Setup for the Radiated Emissions Test



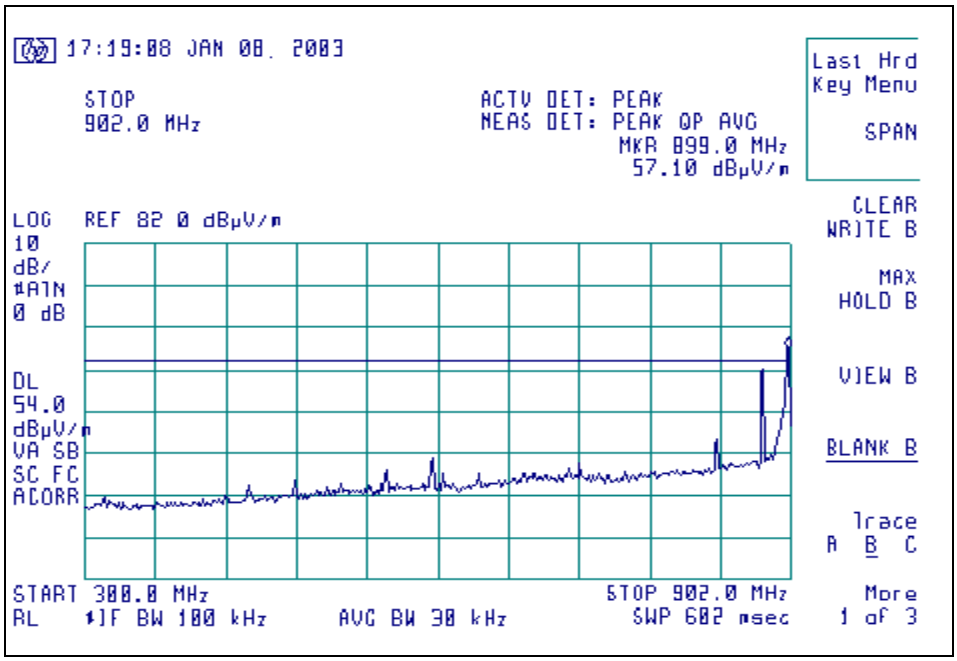


Graphs made during Radiated Emission Testing

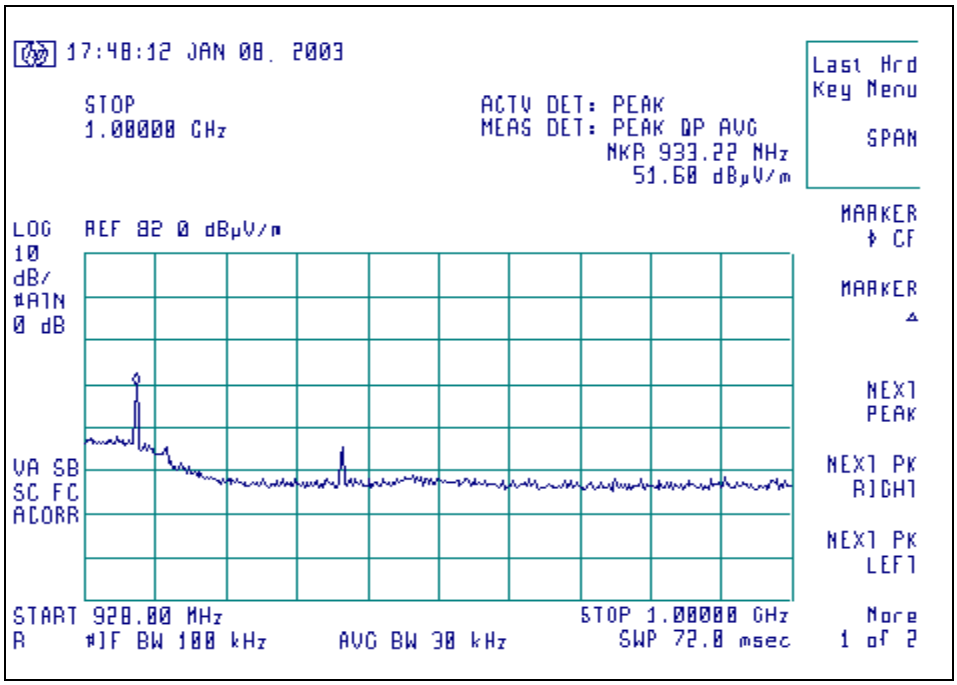
Signature Scan of Radiated Emissions
30 MHz – 300 MHz



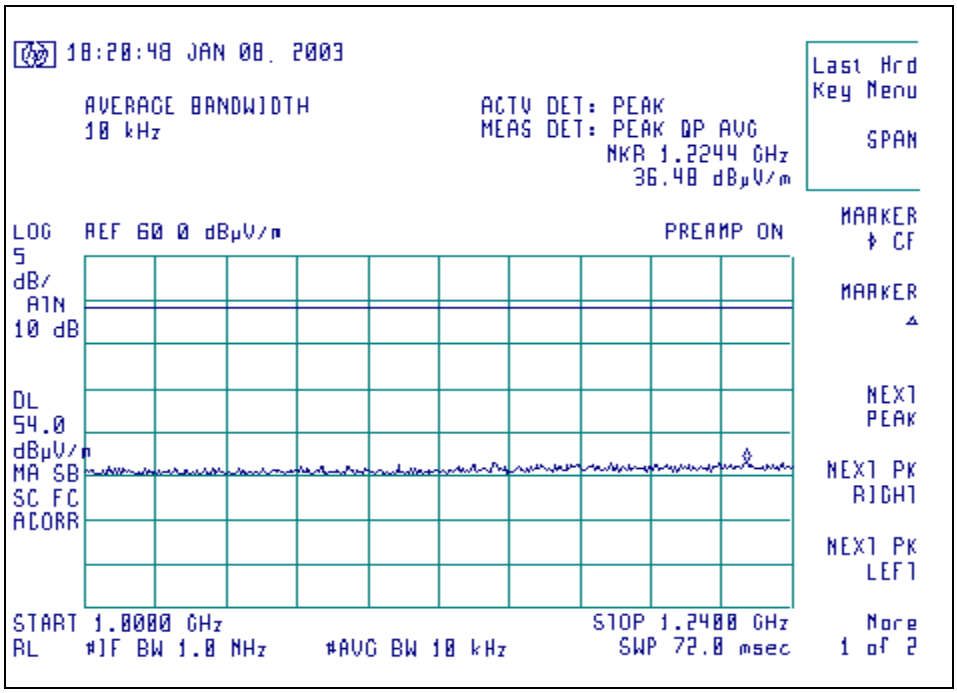
Signature Scan of Radiated Emissions
300 MHz – 902 MHz



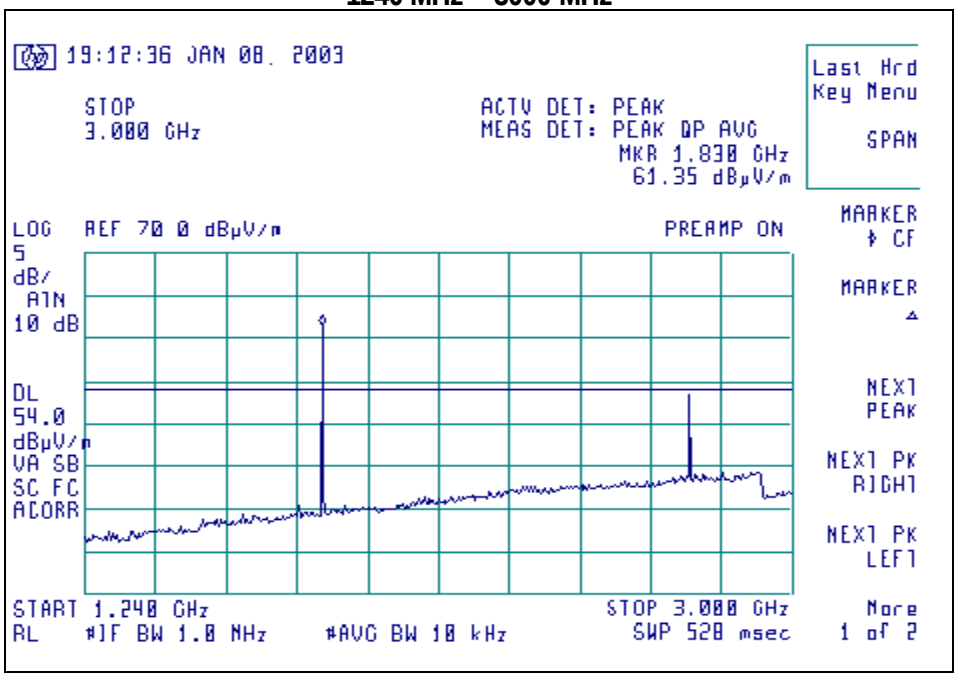
Signature Scan of Radiated Emissions
928 MHz – 1000 MHz



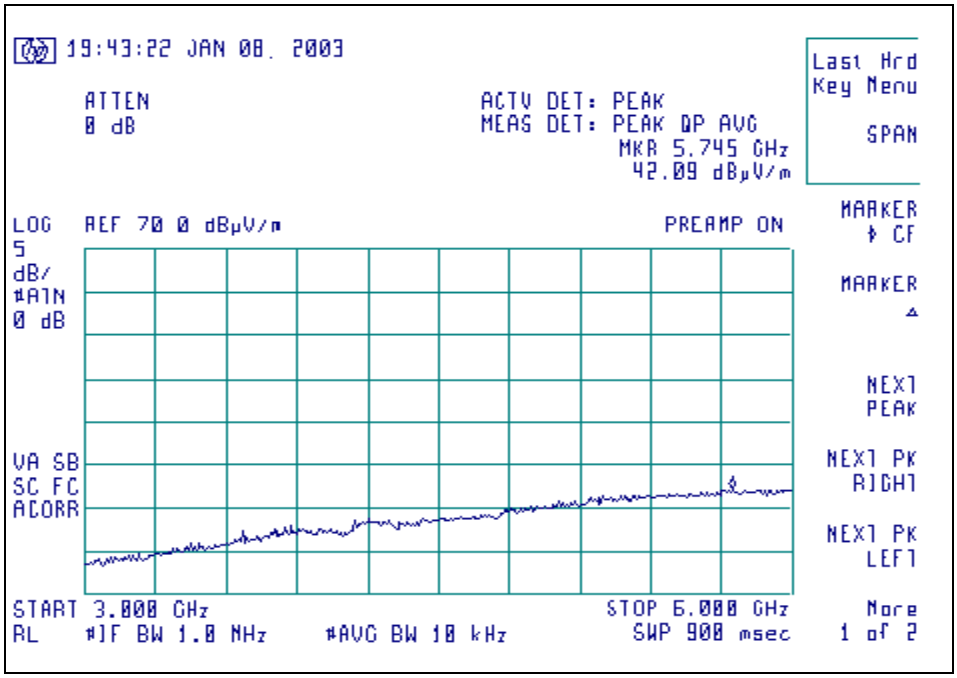
Signature Scan of Radiated Emissions
1000 MHz – 1240 MHz



Signature Scan of Radiated Emissions
1240 MHz – 3000 MHz



Signature Scan of Radiated Emissions
3000 MHz – 6000 MHz



13. Conducted Emissions Test (AC Line)

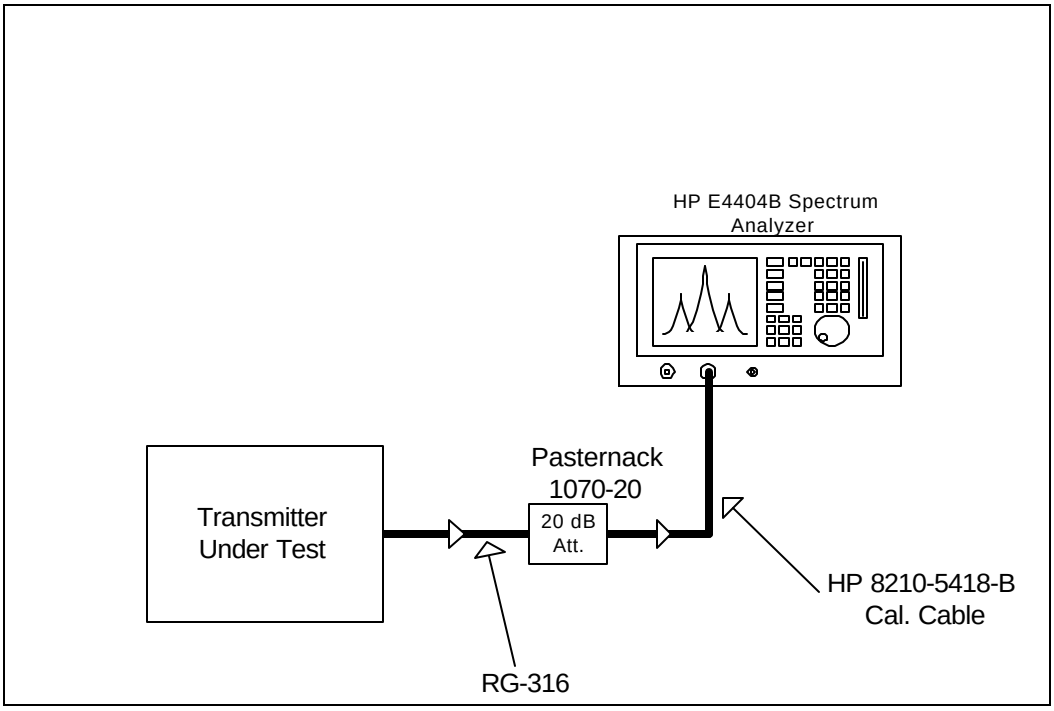
Note:

No testing of AC Conducted Emissions was required, due to the device operating on a 12 Volt DC supply (automotive).

14. Power Output Test Performed, 15.247 (b)

For the FCC Part 15.247b measurement, the output of the Boomerang III 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 continuous transmit mode, while being modulated with a representative data packet resident in firmware in the test sample. The HP 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 all four 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.

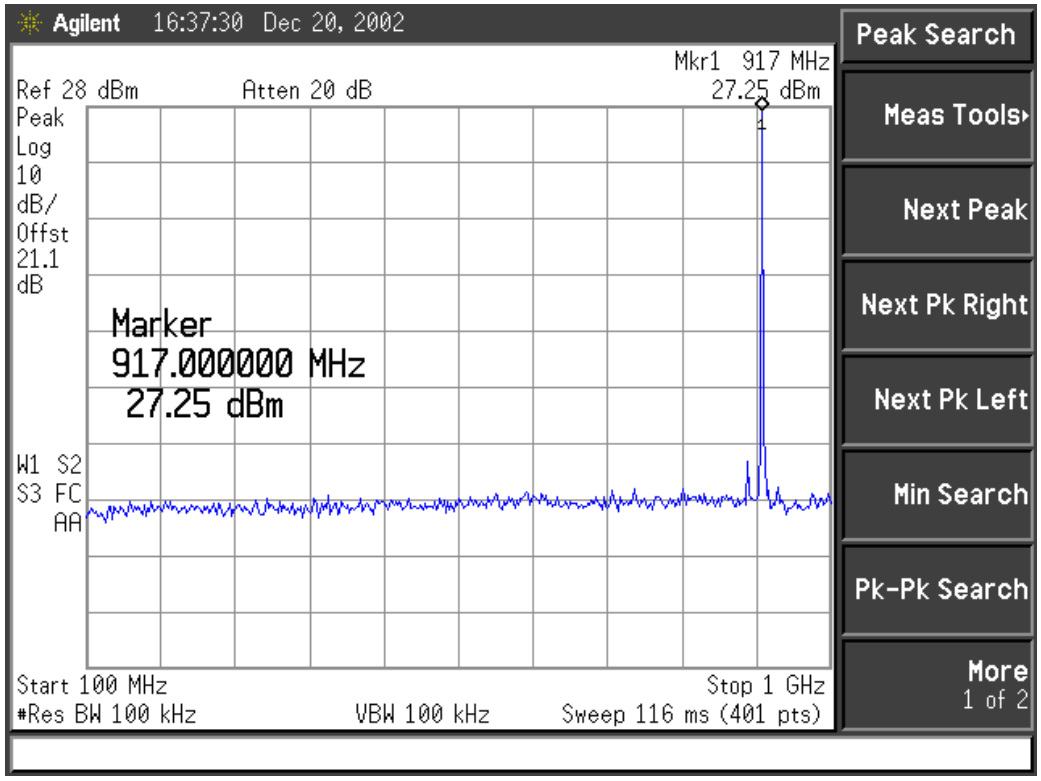
CHANNEL	CENTER FREQ (MHz)	LIMIT (dBm)	(dB/m)	MARGIN (dB)
1	915.035	30 dBm	27.1	2.9
50	916.750	30 dBm	27.4	2.6

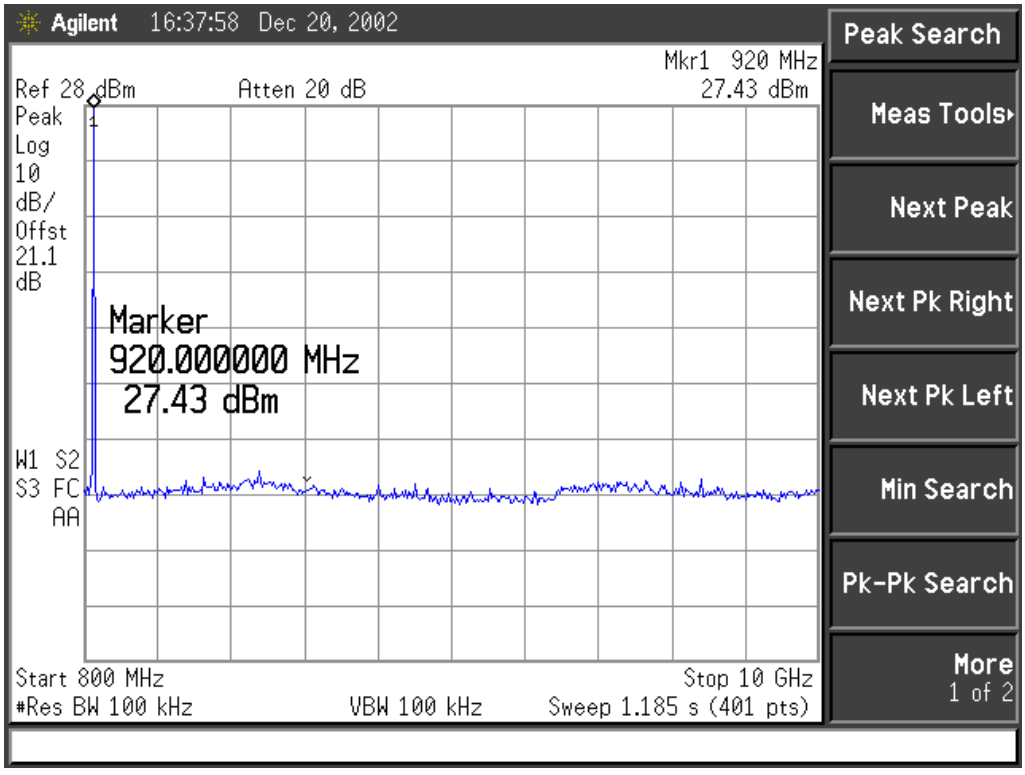


15. Conducted RF Test Setup and Measurements, 15.247 (c)

FCC Part 15.247(c) requires an antenna conducted measurement of conducted harmonic and spurious levels, as reference to the carrier frequency in a 100 kHz bandwidth. For this test, the video transmitter module was directly connected to the HP E4407B Spectrum Analyzer, through a very short Coaxial Cable and a 10 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 dBc of the fundamental of the transmitter. Signals that were observed were greater than 50 dB down. (In the 100 kHz bandwidth)

Plots of Conducted Spurious and Fundamental Levels



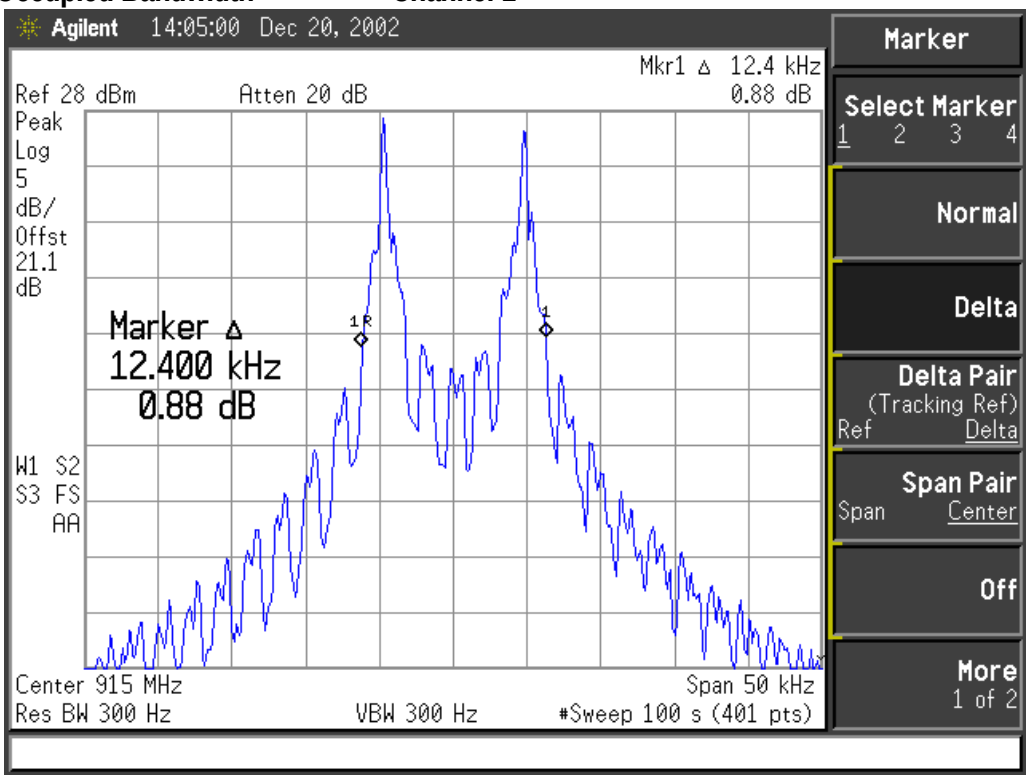


16. Occupied Bandwidth Measurements, 15.247 (a)

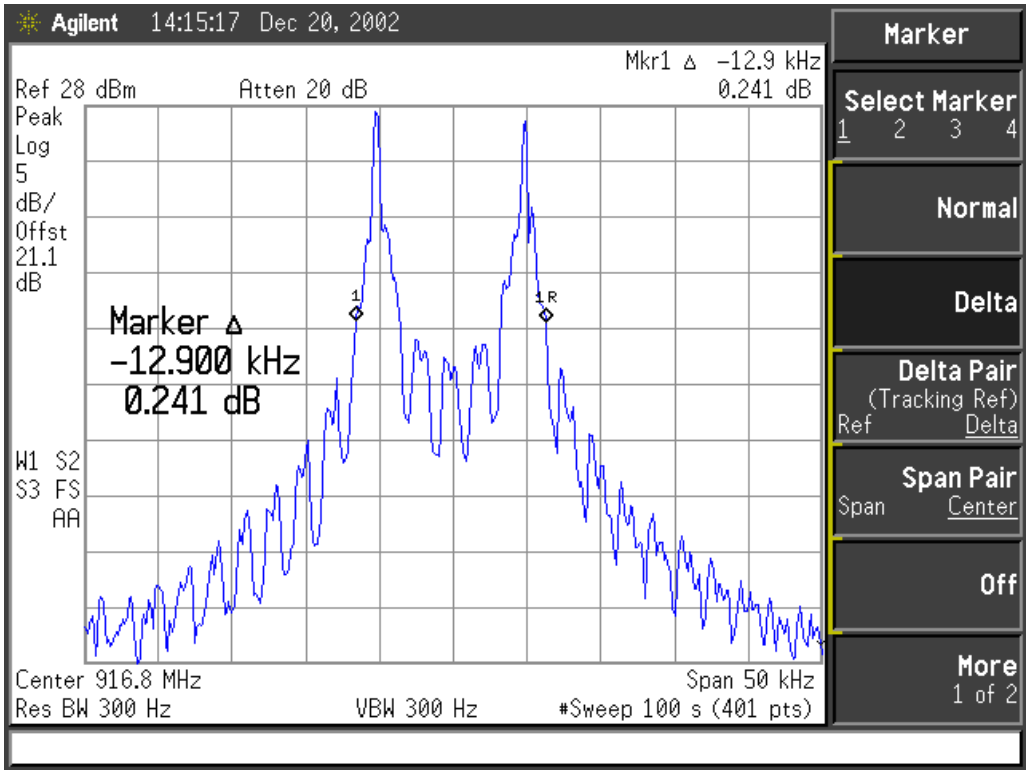
The 6 dB bandwidth requirement found in FCC Part 15.247.a (1) i is a minimum of 250 kHz or less, with 50 channels. Direct measurement of the transmitted signal, via a direct cabled connection to the HP E4407B Spectrum Analyzer, was then used to determine the signal bandwidth. For each of the representative channels, refer to the graphs found in Appendix C.

CHANNEL	CENTER FREQ (MHz)	MEASURED 20 dB BW (kHz)
1	915.035	12.4
50	916.750	12.9

Plots of Occupied Bandwidth **Channel 1**

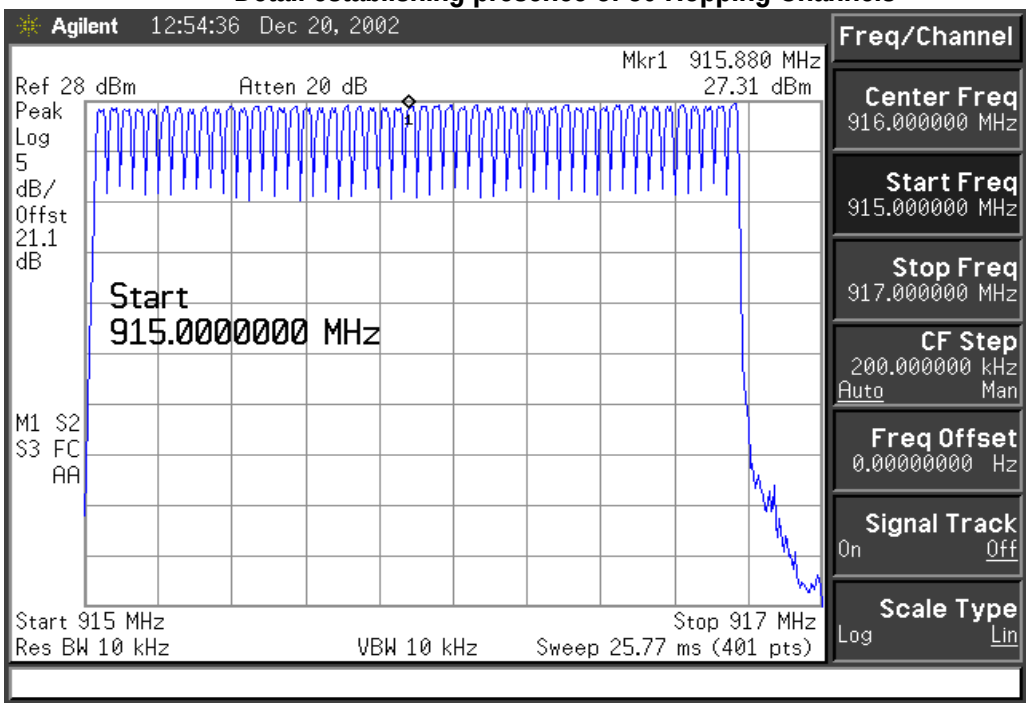


Channel 50

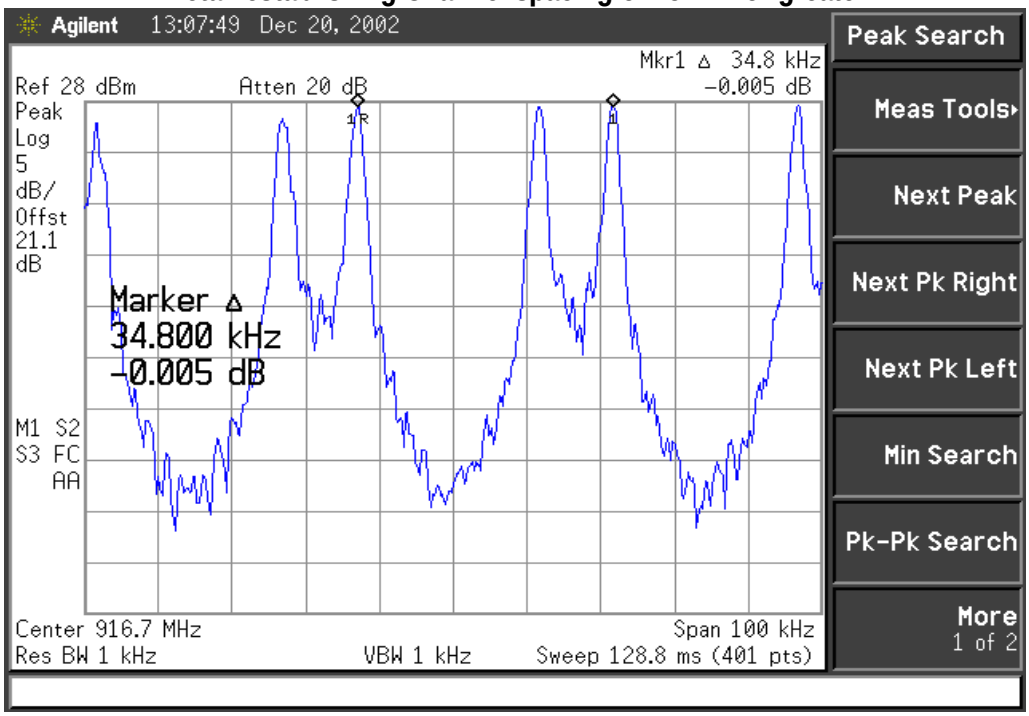


17. Channel Number, Channel Spacing, Channel Occupancy, 15.247(a)(1)

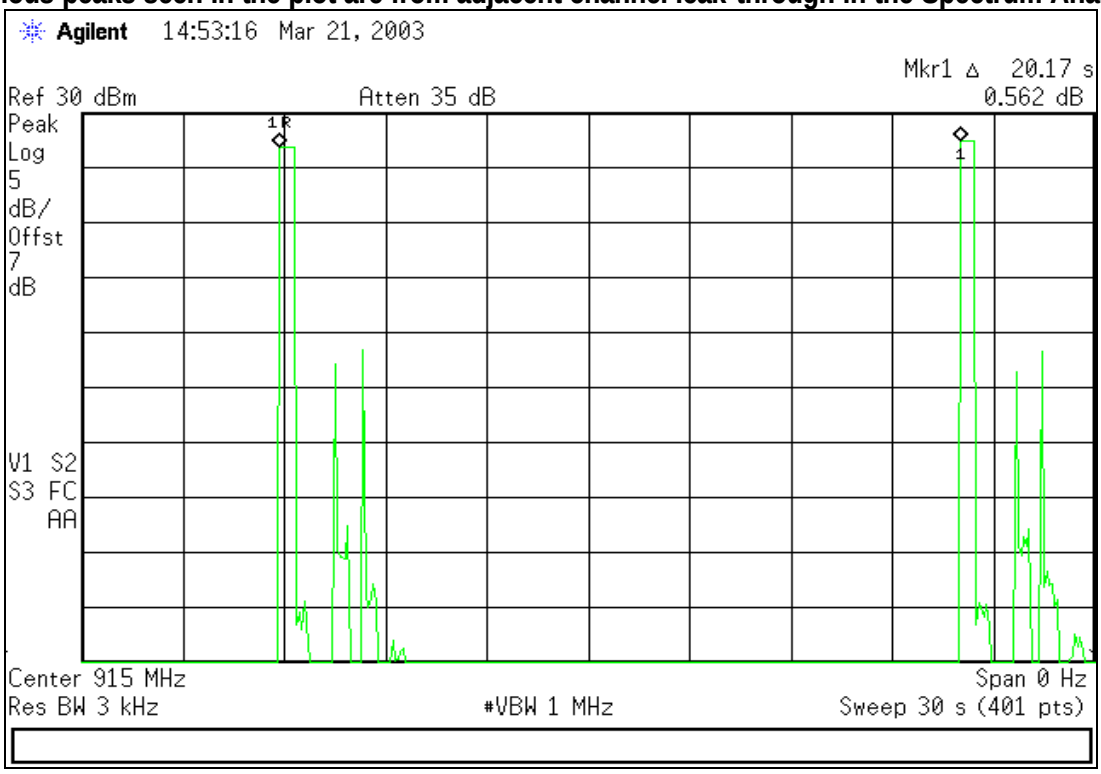
Detail establishing presence of 50 Hopping Channels



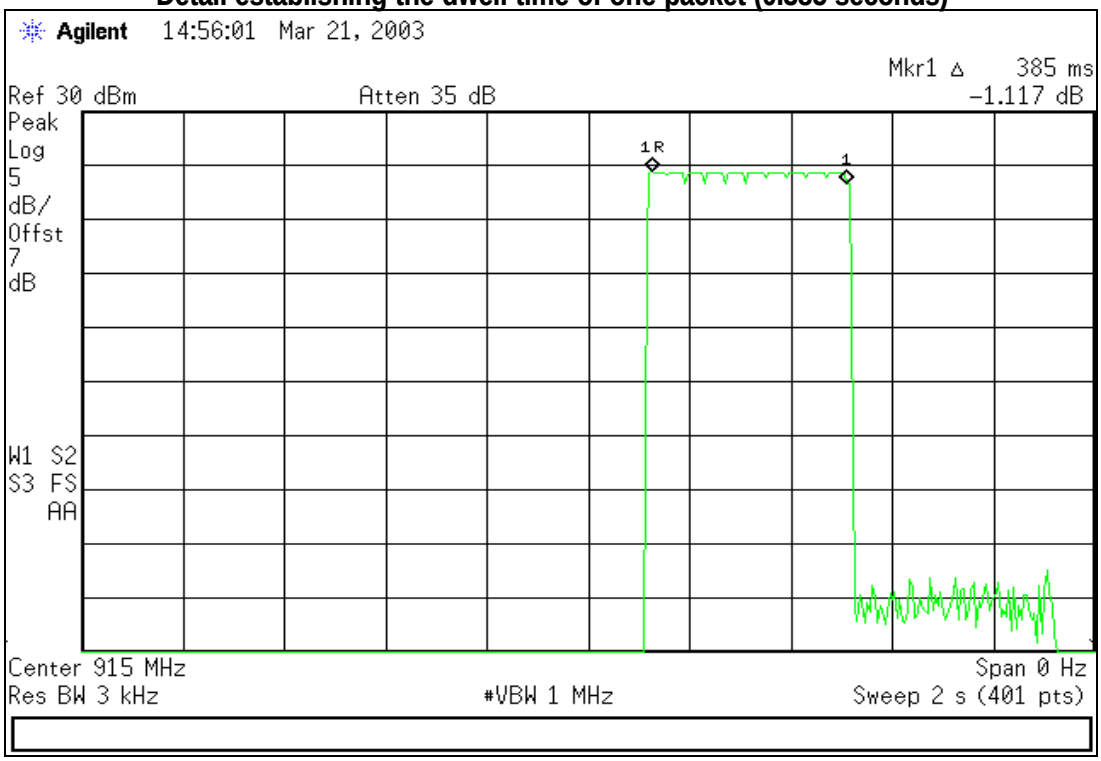
Detail establishing Channel spacing of 25 kHz or greater



Detail establishing occupancy in a 20 second window of one packet
(spurious peaks seen in the plot are from adjacent channel leak-through in the Spectrum Analyzer)



Detail establishing the dwell time of one packet (0.385 seconds)



Appendix A

Test Equipment List

Asset #	Manufacturer	Model #	Serial #	Description	Calibration Information	
					Date	Due Date
AA960007	EMCO	3115	99111-4198	Double Ridge Horn Antenna	12-06-03	12-06-03
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	8546A	3617A00320	Receiver RF Section	09-20-02	09-20-03
EE960014	HP	85460A	3448A00296	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	LSC	Attenuator		10 db Attenuator	N/A	N/A

Note 1* - Equipment calibrated within a traceable system.

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