

CFR Title 47 Parts
15.249 Certification

FCC ID: OFY-ACM-0001

EMI TEST REPORT

on

Audit Tire Survey Tools

Prepared For

Advanced Concepts Manufacturing Inc.

325 Paul Avenue Suite 80

St. Louis, MO 63135

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Prepared by

Electronic Compliance Laboratories, Inc.

Test Report Number: A901007

Date of Test: April 1, 1998

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1.0 Certification of Compliance

Description: **Audit Tire Survey Tools** – Tire inspection system consisting of:

- Air Audit Tool
- Data Audit Tool
- Tread Audit Tool

Serial Number: Prototype

Applicant: Advanced Concepts Manufacturing, Inc.

Type of Test: FCC-15, Class A (Certification) part 15.249

Date of Test: January 11 and 26th, 1999

Tested By: Suresh Kondapalli

The above equipment was tested by Electronic Compliance Laboratories, Inc. and found to be in compliance with the requirements set forth in the FCC Rules and Regulations, Part 15, Subpart C (15.203, 15.205, 15.209, 15.249). The equipment, in the configuration described in this report, shows that the maximum emission levels emanating from this equipment are within the compliance requirements.

Chris Byleckie
Technical Director

Date

2.0 General Information

Applicant: Advanced Concepts Manufacturing, Inc.
325 Paul Ave. Suite 80
St. Louis, MO 63135

Contact Person: Tim Pace

Equipment Under Test: Audit Tire Survey Tolls

Serial Number: Prototype

FCC ID#: **OFY-ACM-0001**

Report Number: A901007

Date of Test: January 11 and 26, 1999

Manufacturer: Advanced Concepts Manufacturing, Inc.

Type of Test: FCC part 15, Subpart C, (15.203, 15.205, 15.209, 15.247), Class A Digital Device.

Frequency Range: 30 MHz to 1000 MHz - Radiated Emissions, Class A
902 MHz to 928 MHz - part 15.249
Up to the 10th harmonic of the fundamental (9270 MHz) part 15.35(a)

Summary

Pass/Fail: Passed

15.209 Radiated Emissions:

The Audit Tire Survey Tools met all the requirements for Part 15.209 Class A limit. **See Appendix D for Data Sheet and plots.**

15.249 Operation within the 902 - 928 MHz band:

The Audit Tire Survey Tools met all the requirements for 15.249. **See attached data and plots in Appendix A and Appendix B.**

3.0 Test Facility

Name: Electronic Compliance Laboratories
Location: 1249 Birchwood Drive
Sunnyvale, CA 94089
Site Filing: A site description is on file at the Federal Communications Commission
P.O. Box 429
Columbia, MD 21045

Types of Sites: Open Field Radiated and Indoor (Screen Room).
Line Conducted: All sites are constructed and calibrated to meet ANSI C63.4-1994 requirements.
Test facility is recognized by the National Voluntary Laboratory Accreditation Program for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations.

NVLAP Code: 20089 effective through: March 31, 1999

4.0 Test Equipment

The following list contains equipment used at EC Laboratories, Inc. for compliance testing. The equipment conforms to the American National Standard Specifications for Electromagnetic Interference and Field Strength Instrumentation from 10 kHz to 1000 MHz.

Description	Manufacturer	S/N	Model No.	Cal. Due Date
EMI Receiver	HP	3325A00137	8456A	5/3/99
Pre-amp	HP	313A06829	8447F	5/10/99
Pre-amp	HP	3008A00527	8449B	4/5/99
LISN	EM	2532	ANS-25/2	6/12/99
Spectrum Analyzer	HP	3137A01183	8563A	5/22/99
Plotter	HP	2644V00365	7470A	N/A
Power Meter	HP	2342A07307	435B	4/4/99
Power Sensor	HP	N/A	8482A	4/12/99
Biconical Antenna	EM	677	EM-6912	3/3/99
Log-Periodic Antenna	EM	858	EM-6950	4/18/99
Horn Antenna	EM	6231	RGA-60	6/6/98
1.2 - 4GHz Filter	FSY	001	HM1160-11SS	3/25/99
4 - 10 GHz Filter	FSY	001	HM2950-15SS	3/25/99
10 - 18 GHz Filter	FSY	001	HP8601-7SS	3/25/99

HP = Hewlett Packard

EM = Electro Metrics

The antenna used at the time the data was taken is indicated on each data page. The antenna height and polarization are also noted on the data pages.

The calibration of the measuring instruments, including any accessories that may effect such calibration, are checked frequently to assure their accuracy. Adjustments are made and correction factors applied in accordance with instructions contained in the manual for the measuring instrument.

5.0 Data Reporting Format

The measurement results are expressed in accordance with FCC Part-15, Subpart B Class A limits, where applicable, are presented in tabular or graphical form.

6.0 Detector Functions

On any frequency or frequencies below or equal to 1000 MHz, the limits shown below are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths.

On any frequency or frequencies above 1000 MHz, the radiated limits shown below are based on the use of measuring equipment employing an average detector function.

EC Laboratories uses the Peak detection mode for normal testing and initial screening of the Audit Tire Survey Tools. The Peak detection mode will produce a measurement value that is always greater than, or equal to, the quasi-peak or average detection mode. Whenever the measurement value is 6 dB below the applicable limit or greater, the appropriate detector function will be employed and recorded.

7.0 Frequency Range of Investigation

The spectrum was investigated up to the frequency specified in the following table according to the highest clock frequency generated in the device.

<u>Highest Frequency Used (Clock)</u>	<u>Upper Limit of Range Measured</u>
Below 1.705 MHz	30 MHz
1.705 to 108 MHz	1000 MHz
108 to 500 MHz	2000 MHz
500 to 1000 MHz	5000 MHz
Above 1000 MHz	5th Harmonic or 40 GHz (Whichever is Lower)

8.0 FCC Class Types

Class A Digital Device

A digital device that is marketed for use in a commercial, industrial or business environment, exclusive of a device which is marketed for use by the general public or is intended to be used in the home.

Class B Digital Device

A digital device that is marketed for use in a residential environment notwithstanding use in a commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public.

Note: The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as a Class B device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a device a Class B digital device, regardless of its intended use.

(Code of Federal Regulations, 47, Part 15, Subpart A, Sect. H&I)

(CFR 47, Parts 0 TO 19, Revised as of October 1, 1990)

9.0 FCC Limits

9.1 Conducted Emission Limits

For a digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back into the AC power line on any frequency or frequencies within the band 450 kHz to 30 MHz shall not exceed the limits in the following table for the appropriate class. Compliance shall be based on the measurement of the Radio Frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

<u>Frequency</u> (MHz)	<u>Class A Limit</u> (μ V)	<u>Class A Limit</u> (dB μ V)	<u>Class B Limit</u> (μ V)	<u>Class B Limit</u> (dB μ V)
0.45 to 1.705	1000	60.0	250	48.0
1.705 to 30.0	3000	69.5	250	48.0

9.2 Radiated Emission Limits

The field strength of radiated emissions for a Class A Digital Device, when measured at a distance of 10 meters, shall not exceed the limits given in the table below. The lower limit applies at the band edge.

The field strength of radiated emissions for a Class B Digital Device, when measured at a distance of 3 meters, shall not exceed the limits given in the table below. The lower limit applies at the band edge.

<u>Frequency</u> (MHz)	<u>Class A</u> <u>(3m) Limit</u> (μ V/m)	<u>Class A</u> <u>(3m) Limit</u> (dB μ V/m)	<u>Class A</u> <u>(10m) Limit</u> (μ V/m)	<u>Class A</u> <u>(10m) Limit</u> (dB μ V/m)	<u>Class B</u> <u>(3m)</u> <u>Limit</u> (μ V/m)	<u>Class B</u> <u>(3m)</u> <u>Limit</u> (dB μ V/m)
30-88	300	49.6	90	39.1	100	40.0
88-216	500	54.0	150	43.5	150	43.5
216-960	700	56.0	210	46.4	200	46.0
Above 960	1000	60.0	300	49.5	500	54.0

10.0 Test Methods

10.1 Line Conducted Emissions Test Procedure

1. EUT and any other equipment and cables were placed on a wood table one meter above a ground screen.
2. The EUT's Input Power line cord was connected to a Line Impedance Stabilization Network (LISN) under the table.
3. All other (Non-EUT) equipment received power from a separate AC Power Source. The LISN assembly has two monitoring points: Line 1 (AC-Hot) and Line 2 (AC-Neutral). Each monitoring point was scanned by the measuring equipment (the other point was terminated in 50 ohms) over the frequency range of 450 kHz to 30 MHz for conducted emissions.
4. When an emission is found, the following takes place:
 - a. The emission levels are maximized by equipment/cable placement.
 - b. Frequency and emission level data are entered into computer in dBm.
 - c. The monitoring point (Line 1 or 2) is entered into the computer.
 - d. The computer converts dBm to micro volts and uses a look-up table to find cable losses (in dB) at that frequency, calculates a corrected emission level, and compares the corrected emission level to the appropriate limit. The data is then printed out in tabular form.

An example of the printout and definitions follows below.

10.1 Line Conducted Emissions Test Example

	Site	FCC Limit		EUT Level (L1)	
Freq.	Reading	A	B	A	B
(MHz)	(dBμV)	(dBμV)		(dB)	
1.85	-57	69.5	48.0	-4.5	+17

Freq. = Frequency of emission in MHz

Reading dBμV = Reading at Spectrum Analyzer (Uncorrected)

FCC Limit A/B = Conducted Emission level limit in dBμV

EUT Level A* = Emission relative to the FCC Class A Limit

EUT Level B* = Emission relative to the FCC Class B Limit

Note = L1 is AC-Hot, L2 is AC-Neutral

QP is a Quasi-Peak value

AV is an average value

*A negative value indicates that the emission is below (or meets) the limit and a positive value indicates that the emission is above (or exceeds) the limit.

10.3 Radiated Emissions Test Procedure

1. EUT and any other equipment and cables used with the EUT were placed on a wood table one-meter above a ground screen.
2. The EUT receives the normal AC Power at the base of the table.
3. All equipment and cables are placed in a manner which tends to maximize their emission characteristics in a typical application.
4. The table was rotated 360 degrees to determine the maximum radial emissions.
5. The antenna was varied in height between 1 meter and 4 meters above the ground plane to determine the maximum emissions. Various antennas are used during the test in both the vertical and horizontal polarization.
6. The Spectrum Analyzer is scanned from 30 MHz to 1000 MHz for emissions. The applicable spectrum analyzer settings are:
 - a. Resolution Bandwidth = 100 kHz,
 - b. Normal Detector Mode = Peak (The Quasi-Peak is used when the emissions are near, or over the limit).
7. When an emission is found and maximized, the following actions are performed:
 - a. The emission frequency is entered into the computer.
 - b. The emission level is read from the spectrum analyzer in dBm and entered into the computer.
 - c. The antenna polarization is entered into the computer.
 - d. The computer converts the level in dBm to dBμV and uses lookup tables to determine the coax cable loss, antenna factor, and pre-amp gain. A site correction factor is calculated for that particular frequency, and the data is printed out in tabular form.

10.4 Radiated Test Example

	Site	FCC Limit		EUT Level (QP)	
Freq.	Reading	A	B	A	B
(MHz)	(dBμV)	(dBμV)		(dB)	
65.4	-58	39.1	40.0	-4.6	-5.5

Freq. = Frequency of emission in MHz.

Reading dBμV = Reading at Spectrum Analyzer (Uncorrected)

FCC Limit A/B = Limit in dBμV as stated in Part-15, Subpart B

EUT Level A* = Emission level relative to the FCC Class A limit

EUT Level B* = Emission level relative to the FCC Class B limit.

Note = V/H is the antenna polarization (Vertical or Horizontal)

PK indicates a Peak Value

QP indicates the Quasi-Peak value.

*A negative value indicates that the emission is below (or meets) the limit and a positive value indicates that the emission is above (or exceeds) the limit.

11.0 Labeling Requirements

Product Label:

A Class A Digital Device subject to Certification by the FCC shall bear the following statement in a conspicuous location on the device.

(Name of Grantee)

FCC ID:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The label is to be located in a "conspicuous location". This is any location readily visible to the user of the device without the use of tools.

The label is to be permanently attached to the equipment in such a manner that the label can normally be expected to remain fastened and legible during the equipment's expected useful life.

Where the device is constructed in two or more sections connected by wires and marketed together, the statement specified in this section is required to be affixed only to the main control unit.

When the device is so small or for such use that it is not practicable to place the statement specified above on it, this required information shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier must be displayed on the device.

Users Manual Statement:

For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the user's operation manual.

NOTE: This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense:

12.0 Summary of Measurements

CFR Title 47, Part 15.249

Manufacturer: Advanced Concepts Manufacturing, Inc.
325 Paul Ave. Suite 80
St. Louis, MO 63135
Contact: Tim Pace
FCC ID: **OFY-ACM-0001**
Test Report Number: A901007

The Audit Tire Survey Tools is a low-power FM transmitter that operates in the ISM 902-928 MHz frequency band. The transmit frequency is fixed at 916 MHz. Since the Air Audit and the Data Audit both use identical transmitters only the Data Audit transmitter was tested for compliance with the 15.249 rules

15.249 (a) Maximum Peak Output Power

The Audit Data and Air Audit tools have an antenna that is an integral part of the output circuit and cannot be removed without affecting the conducted output power. The EUT , constantly transmitting, was placed on the OATS with the receive antenna 3 meters away.

Frequency (MHz)	Field Strength (dBuV)	15.249 Limit (dBuV)	Delta (dB)
916	91.0	93.9	-3.1

15.249 (c) Out Of Band Emissions (Not Falling within Restricted Bands)

The EUT was placed in transmit mode . The frequency spectrum was analyzed from 1 to 10 GHz. Out of Band emissions were investigated and found to be better than 20 dB (in power) below the highest in-band emission. In addition, out of band emissions (radiated) were below the limits specified in 15.209.

15.205 Restricted Bands - Emissions Within Restricted Bands

The Air system was placed on a wooden table resting on a turntable. The wooden table was approximately 1 meter above the ground plane of the 3 meter portion of the 10 meter OATS test site.

The search antenna was located 3 meters from the DUT . With the Air system in the TRANSMIT mode and transmitting continuously, with the spectrum analyzer in the MAX HOLD mode, the turntable was rotated and the search antenna was raised and lowered in an attempt to maximize the received radiated emissions level. The DUT was set to continuously transmit at 916 MHz. The attached chart entitled "FCC Radiated Data Sheet" shows that emissions falling into restricted bands are below the limit of 54 dB_{UV} V/m. Peak measurements were made using RBW = VBW = 1MHz. Avg measurements were made with an RBW = 1MHz and VBW=10Hz. **Data Sheets are in Appendix B**

15.209 Radiated Emissions

The data shows that the Class A radiated limits from 30 - 1000 MHz are not exceeded by the Air system. The DUT was operating normally during this test. The DUT was placed near one edge of a wooden table resting on a turntable. The wooden table was approximately 1 meter above the groundplane of the 3 meter test site. The search antennas were located at 3 meters. Measurements were made in accordance with ANSI C63.4-1994. **Test Data is in Appendix C.**

15.203 Antenna Connector

The Data Audit and Air Audit tools use an antenna that is soldered to the PC board and is not removable. **Manufacturers drawing for the antenna is in Appendix E.**

APPENDIX A

15.205 Restricted Band Data

FCC RADIATED DATA SHEET

EUT:	Air Audit Data / Tread	DATE:	Jan 25 1999
S/N:	prtotype	CUSTOMER NAME:	ACM Inc
RULE PART:	15.249	WORK ORDER:	9011102a
		FILE:	9011102a.xls
ANTENNA:	Log Periodic / Horn	OTHER CAL FACTORS:	ATTN dB: 0
MODULATION TYPE:			DUTY dB: 0
TESTED BY	SURESH		HP IL dB: 0
COMMENTS:	Single transmit frequency		DIST dB: 0

FREQ.	READING	Pk, QP,	A.F.	Cable loss	AMP	O.C.F.	TOTAL,	LIMIT	DELTA
MHz	dB(uV)	or Av	dB	dB	dB	dB	dB(uV/m)	dB(uV/m)	dB
Fund = 916.0									
916	90.0	Pk	23.0	4.0	26.0	0.0	91.0	94.0	-3.1
Harmonics									
1832	53.5	Pk	27.4	6.3	35.0	0.0	52.2	74.0	-21.8
1832	34.3	Avg	27.4	6.3	35.0	0.0	33.1	54.0	-20.9
2748	49.0	Pk	30.6	7.8	35.0	0.0	52.4	74.0	-21.6
2748	32.0	Avg	30.6	7.8	35.0	0.0	35.4	54.0	-18.6
3664	54.5	Pk	32.5	9.5	35.0	0.0	61.5	74.0	-12.5
3664	32.5	Avg	32.5	9.5	35.0	0.0	39.5	54.0	-14.5
4580	45.2	Pk*	34.2	11.2	35.0	0.0	55.5	74.0	-18.5
4580	32.2	Avg	34.2	11.2	35.0	0.0	42.5	54.0	-11.5
5496	41.8	Pk	34.8	13.0	35.0	0.0	54.6	74.0	-19.4
5496	31.7	Avg	34.8	13.0	35.0	0.0	44.5	54.0	-9.5
6412	44.0	Pk	37.3	14.4	35.0	0.0	60.7	74.0	-13.3
6412	31.6	Avg	37.3	14.4	35.0	0.0	48.3	54.0	-5.7
7328	36.3	Pk	36.8	16.0	35.0	0.0	54.1	74.0	-19.9
7328	26.7	Avg	36.8	16.0	35.0	0.0	44.5	54.0	-9.5
8244	36.2	Pk	38.4	16.8	35.0	0.0	56.3	74.0	-17.7
8244	27.2	Avg	38.4	16.8	35.0	0.0	47.3	54.0	-6.7
9160	36.0	Pk	40.4	17.9	35.0	0.0	59.3	74.0	-14.7
9160	26.3	Avg	40.4	17.9	35.0	0.0	49.6	54.0	-4.4

APPENDIX B

15.209 Radiated Emissions Data

Electronic Compliance Laboratories, Inc.
1249 Birchwood Ave.
Sunnyvale, CA
Radiated Emissions
Frequency range: 30MHz-1000MHz

10 Meter Open Site
Site Calibrated: June 1997

Government Agency and Limit: FCC Class A

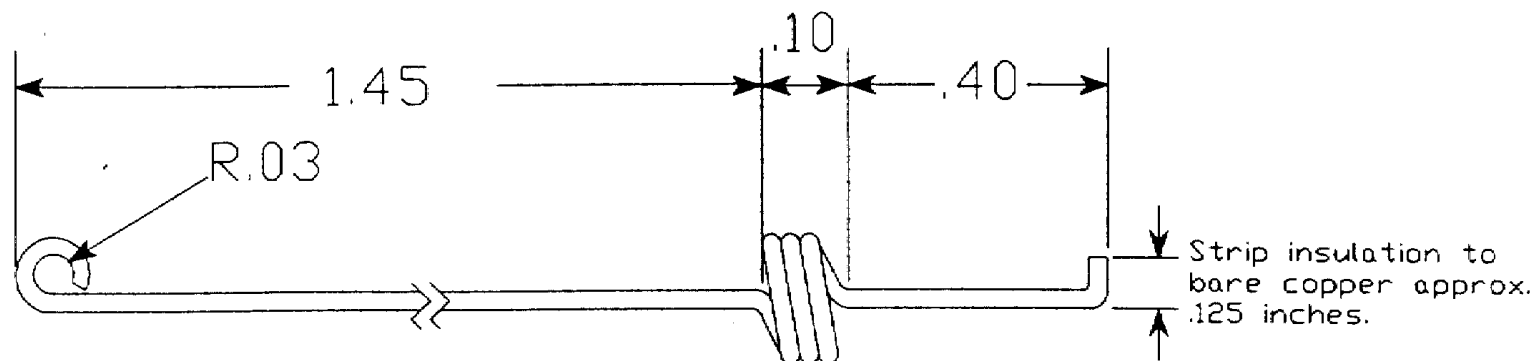
QP = Quasi-Peak Note: Ignore peak readings when Quasi-Peak reading exists
PK = Peak
Customer: ACM Operator: SHAWN
Date: 01-25-1999 Time: 15:33:12
Temperature Range: 58 Deg F Percent Humidity: 60
E.U.T.: DATA/TREAD AUDIT
Serial Number: PROTO
Modifications: None
Report File Name: F:\TESTDATA\9011102A.RF

Antenna Type: LOG PERIODIC

TEST FREQ =====	TEST dBuV =====	ACTUAL dBuV/m =====	CLASS A LIMIT =====	VERSUS A LIMIT =====	TABLE DEGREES =====	ANTENNA HEIGHT =====	POLAR- IZATION =====	DETECTOR Type =====
424.00	28.6	21.3	46.4	-25.1	90	1.5	H	PK
384.00	43.0	34.8	46.4	-11.6	90	2.0	H	PK
368.00	32.0	23.4	46.4	-23.0	150	2.0	H	PK
352.00	35.5	26.6	46.4	-19.8	180	2.0	H	PK
336.00	33.3	24.1	46.4	-22.3	180	2.5	H	PK
319.00	33.9	24.5	46.4	-21.9	150	2.0	H	PK
304.00	32.0	23.0	46.4	-23.4	120	2.0	H	PK
344.00	31.9	22.9	46.4	-23.5	90	2.0	V	PK
336.00	31.0	21.8	46.4	-24.6	90	2.0	V	PK
352.00	35.2	26.3	46.4	-20.1	90	2.0	V	PK
360.00	30.0	21.3	46.4	-25.1	120	2.0	V	PK
368.00	30.0	21.4	46.4	-25.0	90	2.0	V	PK
384.00	36.3	28.1	46.4	-18.3	150	2.0	V	PK
CHANGED ANTENNA TO BICONICAL								
32.00	35.2	26.9	39.0	-12.1	90	2.0	V	PK
112.00	39.1	27.7	43.5	-15.8	0	2.0	V	PK
128.00	37.1	27.1	43.5	-16.4	90	2.0	V	PK
144.00	34.5	25.3	43.5	-18.2	90	2.0	V	PK

TEST FREQ	TEST dBuV	ACTUAL dBuV/m	CLASS A LIMIT	VERSUS A LIMIT	TABLE DEGREES	ANTENNA HEIGHT	POLAR- IZATION	DETECTOR Type
=====	=====	=====	=====	=====	=====	=====	=====	=====
224.00	32.5	24.6	46.4	-21.8	150	2.0	V	PK
272.00	30.7	24.4	46.4	-22.0	0	2.0	V	PK
288.00	35.2	30.2	46.4	-16.2	120	1.5	V	PK
288.00	32.6	27.6	46.4	-18.8	0	1.5	H	PK
256.00	30.5	23.1	46.4	-23.3	0	1.5	H	PK
240.00	36.0	28.2	46.4	-18.2	45	2.0	H	PK
112.00	32.3	20.9	43.5	-22.6	0	2.0	H	PK
32.00	29.6	21.3	39.0	-17.7	0	2.0	H	PK

APPENDIX C
Antenna Drawing



Not drawn to scale. Units in inches.
 22 AWG insulated wire.
 3 turns close wound on .130 in. dia.

916.5 MHZ ANT
 4/04/96 LAM
 (c) 1997 RFM

APPENDIX D

SET- UP PHOTOGRAPHS



Air Audit
FCC B 15.209 Radiated Emissions



Data / Tread Audit
FCC 15.205 Restricted Band Emissions



FCC 15.205 Restricted Band Emissions