

Certification Test Report

For a

Fan-Tastic Vent Ventilation Fan System for RV's

Manufacturer:

KIB Enterprises
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Elkhart, Indiana 46514
United States of America

Testing Laboratory:

F-Squared Laboratories
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Middlefield, Ohio 44062
United States of America

The Fan-Tastic Vent Ventilation Fan System model 6600R for RV's consists of hand-held control transceiver model 417 and fan unit model 6600. This certification report specifically assesses the transmitter portion of the fan unit. The Fan Unit was found to comply with the requirements of the Federal Communications Commission outlined in the Federal Register CFR 47, Part 15.249.

The products were received on March 21, 2006 and the testing was completed on March 24, 2006.

Evaluation Conducted By:

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1. ENGINEERING STATEMENT

This report has been prepared on behalf of KIB Enterprises to provide documentation for the testing described herein. The test results found in this test report relate only to the items tested.

1.1 Equipment Under Test: KIB Enterprises Fan Unit Transmitter

FCC ID: T5N6600

1.2 Trade Name:

Fan-Tastic Vent

1.3 Model:

KIB Enterprises
Model: 6600

1.4 Power Supply:

12VDC (connects to RV 12 Volt supply)

1.5 Applicable Rules:

CFR 47, Part 15.249, subpart C

1.6 Equipment Category:

Radio Transmitter-Control

1.7 Operating Frequency:

2.405 GHz

1.8 Antenna:

Printed Circuit Board Strip Line (Internal)

1.9 Measurement Location:

F-Squared Laboratories in Middlefield, Ohio. Site description and attenuation data are on file with the FCC's Sampling and Measurement Branch at the FCC Laboratory in Columbia, MD.

1.10 Measurement Procedure:

All measurements were performed according to the 2003 version of ANSI C63.4 and recommended practices of FCC 15.35.

1.11 Uncertainty Budget:

Radiated Emissions - Combined Uncertainty ± 2.24 dB; Extended Uncertainty ± 4.48 dB.

1.12 Engineering Certification:

The undersigned of this report hereby state that the measurements shown in this application were made in accordance with the procedures indicated, and that the energy emitted by this equipment was found to be within the limits. The undersigned assume full responsibility for the accuracy and completeness of these measurements and further state that, on the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 15.249 of the FCC Rules under normal use and maintenance.

2. LIST OF MEASUREMENT INFORMATION

Equipment Type	Manufacturer	Model	Serial Number	Calibration Due Date
Thermohygrometer	Oakton	32230-80	001	June 7, 2006
OATS	Compliance Labs	N/A	001	Aug. 24, 2006
Receiver	Rohde & Schwarz	Display, EASI-0-804-8932-52; RF Unit, ESMI-RF 1032-5640-53	84982/015; 849152/005	Mar. 31, 2006
Antenna 2-OATS	Sunol Sciences	JB1	A101101	Apr. 15, 2006
Horn Antenna	Emco	3115	9809-5580	Apr. 6, 2006
Pre-Amplifier	Hewlett Packard	83006A	310A00500	Oct. 20, 2006

3. EQUIPMENT UNDER TEST (EUT) INFORMATION AND DATA

3.1 Test Item Condition:

The equipment to be tested was received in good condition.

3.2 Testing Algorithm:

The Fan Unit is designed for operation on a single frequency (2.405 GHz). Ultimately, the unit will transmit only four pulse groups spaced at approximately 450mS intervals, under certain error conditions (note, the Fan Unit transmission is not currently supported in firmware; thus, current units do not transmit). The manufacturer indicates that the same pulse transmission characteristic will be implemented as used in the Hand-Held Control. The Fan Unit will generate a pulse grouping as shown in the Spectral Plot in Figure 1). The Fan Unit RF components are based on the Freescale (Motorola) MC13191 chip.

For testing purposes, modified Fan Units were supplied that transmit a continuous pulse train spaced at intervals of approximately 100mS (see Spectral Plot in Figure 2). Two modified units were supplied:

- 3.2.a. A unit equipped with a BNC connector for direct connection to the measuring receiver (used to determine the significant harmonic and spurious frequencies for examination on the Open Area Test Site).
- 3.2.b A unit using the standard Printed Circuit Strip Line Antenna for final measurements on the Open Area Test Site (OATS).

3.3 Radiated Emission Testing on Open Area Test Site (OATS):

The EUT was tested at a distance of 1.0 or 3.0 meters. The emissions were maximized by rotating the table and raising/lowering the antenna mounted on a 4.0 meter mast.* Both horizontal and vertical field components were measured. The output of the antenna was connected to the input of the receiver and emissions were measured in the range 30MHz to 25 GHz. At frequencies below 1GHz, a resolution bandwidth of 120 kHz was used employing quasi-peak and peak detector functions. At frequencies 1 GHz and beyond, a 1 MHz resolution bandwidth was used with average and peak detector functions. The raw measurements were corrected for antenna factor, cable loss and preamplifier gain. Peak readings above 1 GHz for devices employing pulsed operation were also corrected to read the average value of the emission within the 20dB peak to average limits per FCC Part 15.35(b).

**The Fan Unit was examined in three orthogonal positions to ensure maximization of emissions.*

3.4 Determination of Average Field Strength from Peak Readings:

Per FCC Part 15.35(b), any frequency or frequencies above 1000 MHz, the radiated limits are based on measurements employing an average detector function. Additionally, there is a limit on the radiated emissions measured using a peak detector function of 20dB above the maximum permitted average limit specified in FCC Part 15.249(a).

To determine the maximum peak to average correction factor allowed for the Fan Unit, the recommendations of FCC Part 15.35(c) are used:

The Fan Unit transmits four RF pulse groups when operating (see Figure 1). The pulses are separated by at least 400mS. The pulse group consists of two pulses (see Figure 3) having a total transmit time of 1.324mS (0.662mS each pulse).^{*} Hence, over any 100mS time period of maximum transmitted field strength, the peak to average ratio is:

$$\text{Peak to Average Ratio} = \frac{1.324\text{mS}}{100\text{mS}} = 0.01324$$

Thus, the average field strength is reduced from the peak value by:

$$\text{Peak to Average Correction Factor (dB)} = 20 \log (0.01324) = -37.6\text{dB}$$

This result indicates that direct measurement of the emitted field strength of the Fan Unit using an average detector would yield field intensities 37.6dB below that found using a peak detector. Since FCC Part 15.35(b) limits peak to average excursions to 20dB, average measurements cannot be employed to determine compliance to FCC Part 15.249.

Compliance measurements to FCC Part 15.249 made on the Fan Unit will be based on peak measurements less a 20dB peak to average correction factor per FCC Part 15.35(b).

**The pulses were verified and found to be identical to that generated by the Hand-Held Control.*

4. EUT CONFIGURATION AND CABLES

4.1 Equipment Under Test (EUT):

Device	Manufacturer	Model Number	Serial Number
Fan Unit	KIB Enterprises	6600	Sample 07*
Fan Unit	KIB Enterprises	6600	Sample 04**

* *Modified control for continuous transmission, used on OATS, using internal Printed Circuit Strip Line Antenna.*

***Modified control for continuous transmission supplied with BNC connection to antenna port for frequency identification.*

4.2 Accessories (Support Equipment):

Device	Manufacturer	Model Number	Serial Number
Car Battery (12VDC)	Everstart	24-5	Not Specified

4.3 Cables:

Cable Function	Length	Shielded (Yes/No)
DC Power	1.0 meter	No

5. FCC PART 15.249

5.1. Determination of Emission Frequencies

The Fan Unit (Sample 04) was supplied with a BNC connector to permit direct (conducted) connection to the Rohde & Schwarz receiver.

All significant emissions generated by the control were measured between 30 MHz to 25 GHz. All harmonics and spurs were measured from the authorized band (2.4-2.4835 GHz) through the tenth harmonic, using a 100 kHz impulse bandwidth (video bandwidth set at 3 MHz). The occupied bandwidth was checked to investigate band edge compliance.

5.1.1. Results

The direct (conducted antenna port) measurements yielded the following significant emissions from the control:

Frequency (GHz)	Harmonic Order
2.406	f_0
4.810	f_2
7.215	f_3

The occupied bandwidth measurements (see Figure 4) exhibit good engineering design. The 20dB down points are at 2.4037 and 2.4064 GHz.

5.2. Radiated Emissions Measurements on Open Area Test Site (OATS)

The Fan Unit with the Printed Circuit Strip Line Antenna (Sample 07) was examined on the Open Area Test Site (OATS). All emissions, including the fundamental were measured to the limits of FCC Part 15.249(a) and (d) and FCC Part 15.205/15.209(a) (Restricted Bands).

5.2.1. Requirements

All emissions shall not exceed the maximum field strength specified in FCC Part 15.249(a) and FCC Part 15.209(a).

5.2.2. Results

The measurement results are contained in the table on the following page.

The Hand-Held Control meets FCC Part 15.249(a) and FCC Part 15.209(a) restrictions on field intensity. Hence, the Fan Unit satisfied FCC Part 15.249(a) and (d) and FCC Part 15.209(a) requirements regarding radiated emissions.

Fan Unit
Harmonics & Spurious Emissions: Operating Frequency – 2.405 GHz

Frequency (GHz)		Antenna Polarization	Reading (dBμV)		Antenna Factor (dB) (+)	Coax Factor (dB) (+)	Preamp Gain (dB) (-)	Peak to Avg Correction Factor (dB) (-)	Measurement Distance Correction Factor (dB) (-)	Emission Level @ 3m (dBμV/m)	3m Limit (dBμV/m)	Margin (dB)
2.400	¹	V	38.7	Pk	28.2	5.0	27.3	20	0.0	24.6	54.0	-29.4
	²		23.6	Avg	28.2	5.0	27.3		0.0	29.5		
2.405	²	V	64.5	Pk	28.2	5.0	27.3	20	0.0	50.4	94.0	-43.6
			28.4	Avg	28.2	5.0	27.3		0.0	34.3		
4.809	²	V	44.2	Pk	32.1	7.6	28.6	20	0.0	35.3	54.0	-18.7
			24.3	Avg	32.1	7.6	28.6		0.0	35.4		
7.213	³	H	48.8	Pk	37.8	10.2	27.9	20	9.5	39.4	54.0	-14.6
	⁴		24.7	Pk	37.8	10.2	27.9		9.5	35.3		

Notes: All measurements performed at 1 MHz (Imp) RBW using peak and average detectors.

¹Lower band edge.

²Maximum emissions level found on upright #1 orthogonal position.

³Maximum emissions level found on upright #2 orthogonal position.

⁴Measurement distance of 1 meter.

Noise Floors:

Frequency (GHz)	Level (dBμV)
2.400	34.8 Pk/23.4 Avg
2.405	36.9 Pk/24.0 Avg
4.809	36.3 Pk/24.0 Avg
7.213	36.5 Pk/24.2 Avg

6. FIGURES – SPECTRAL DATA PLOTS

Figure 1: RF Pulse Train*

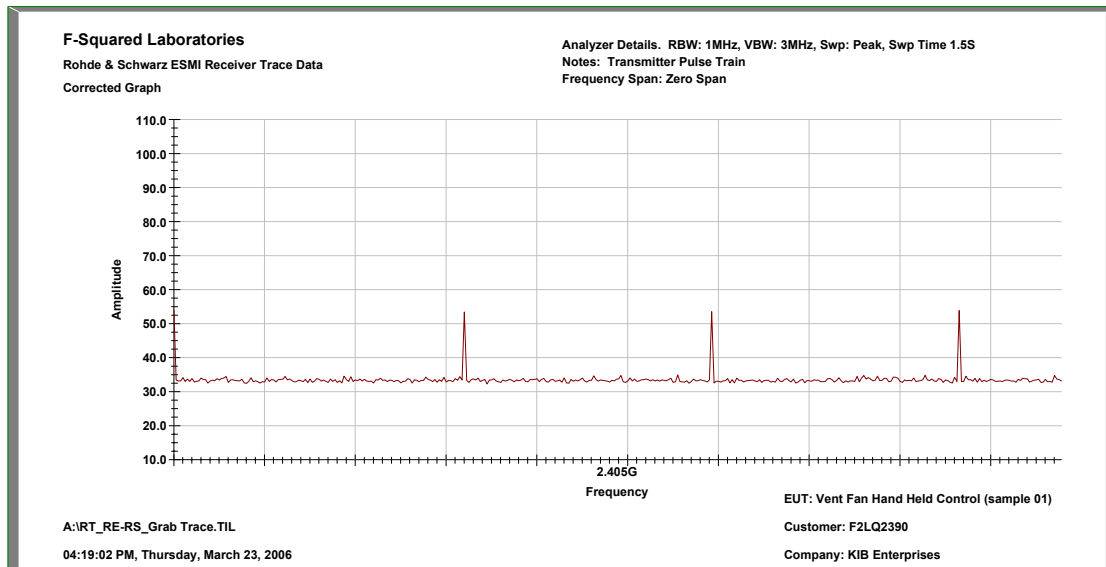
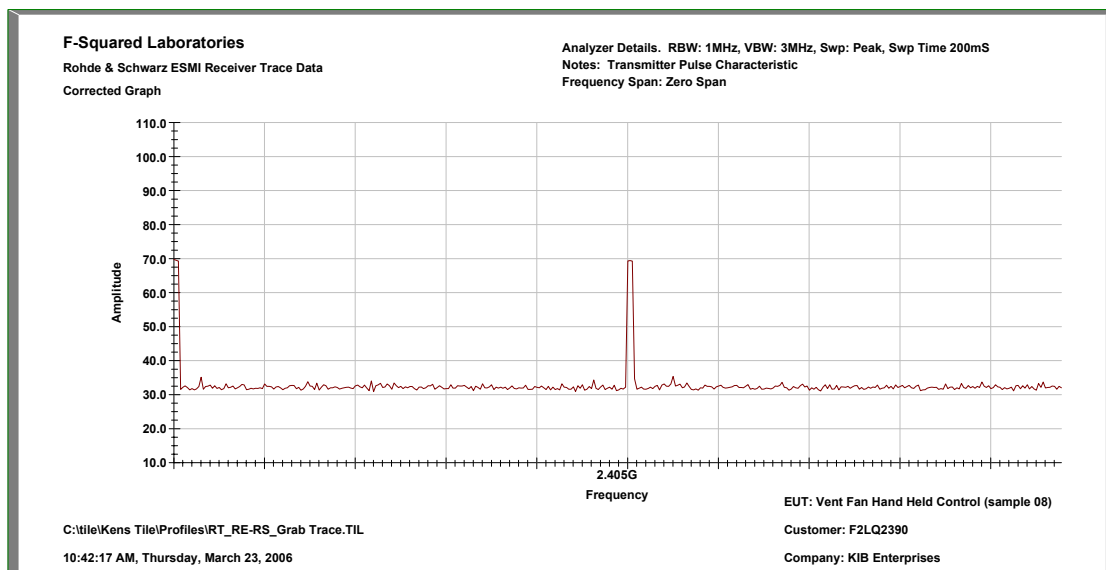


Figure 2: RF Pulse Train of Modified Unit *



**Representative data from Hand-Held Control; Fan Unit will generate identical signature with transmission implemented in firmware.*

Figure 3: RF Pulse Group Characteristic of Unit*

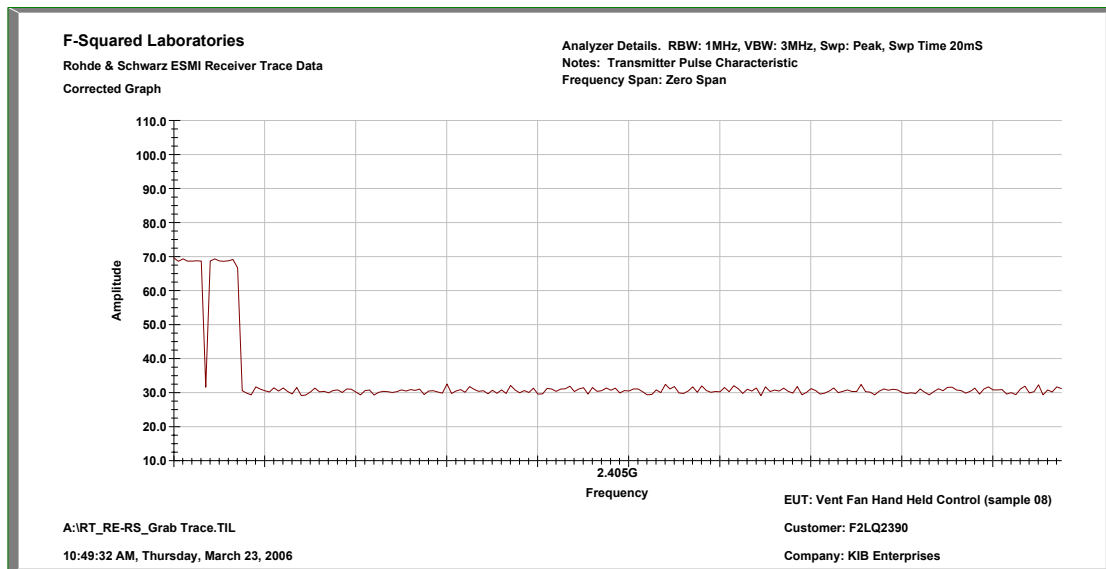
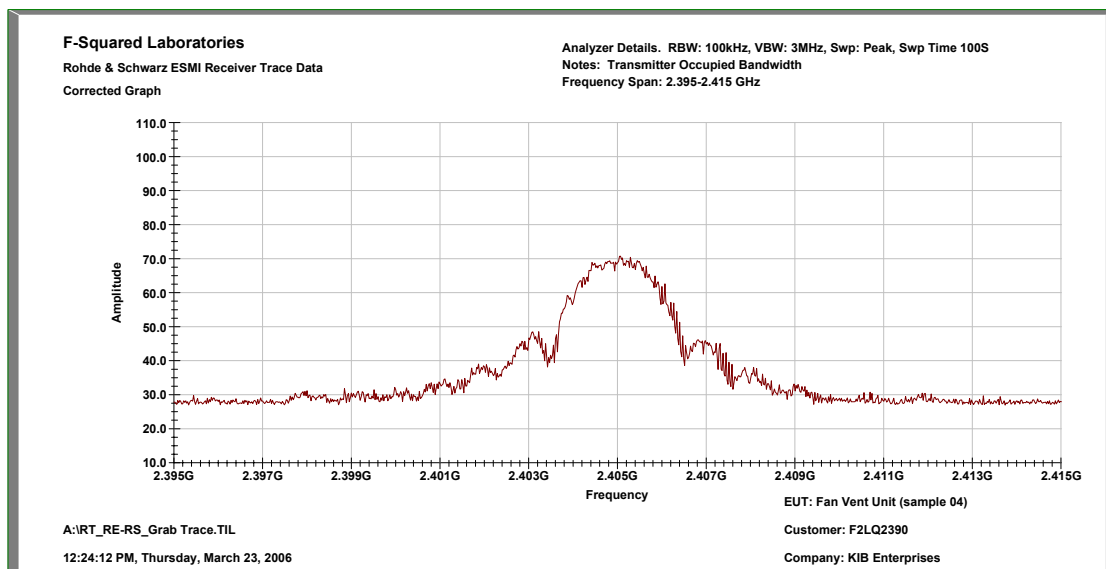


Figure 4: Occupied Bandwidth Characteristic



**Representative data from Hand-Held Control; Fan Unit will generate identical signature with transmission implemented in firmware.*

7. PHOTOGRAPHS/EXHIBITS – PRODUCT PHOTOS, TEST SETUPS

Fan Unit: External View of Fan Cover (top)



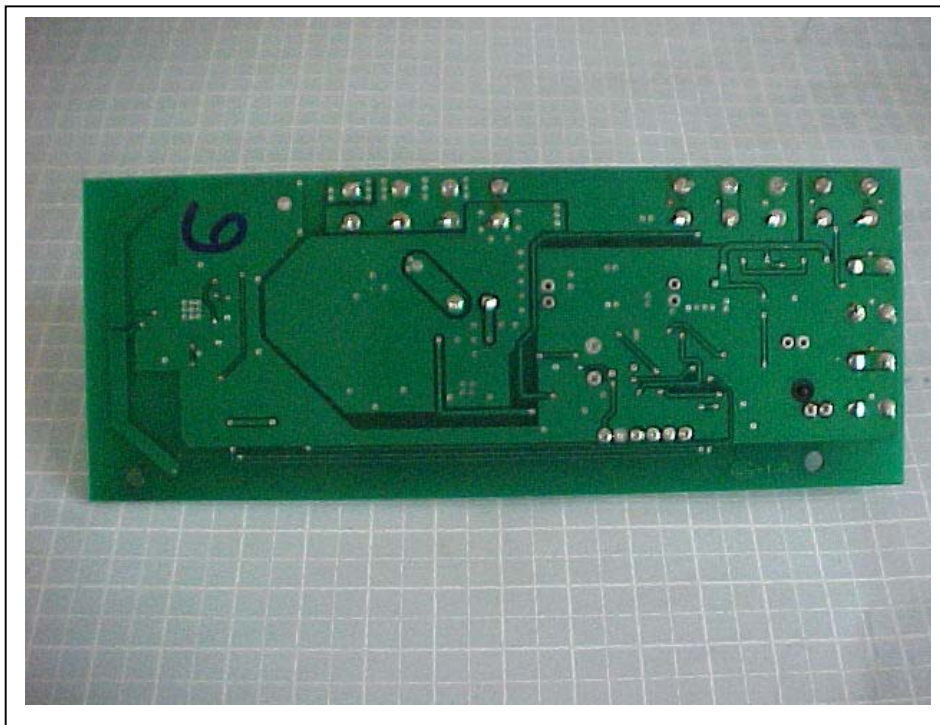
Fan Unit: External View – Interior of RV (fan bottom)



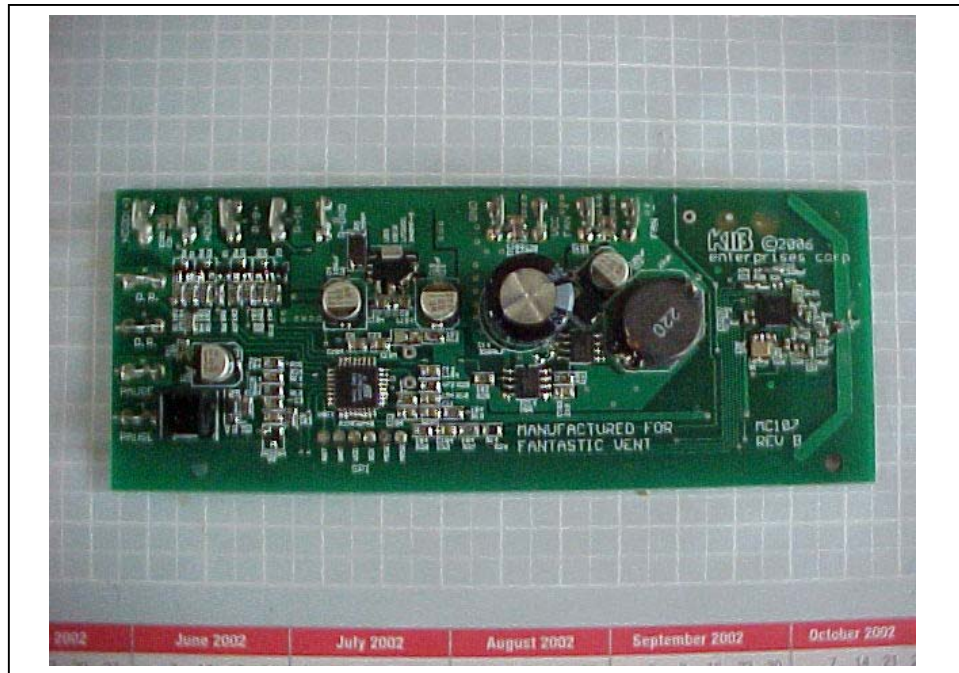
Fan Unit: Internal View – Circuit Board Exposed



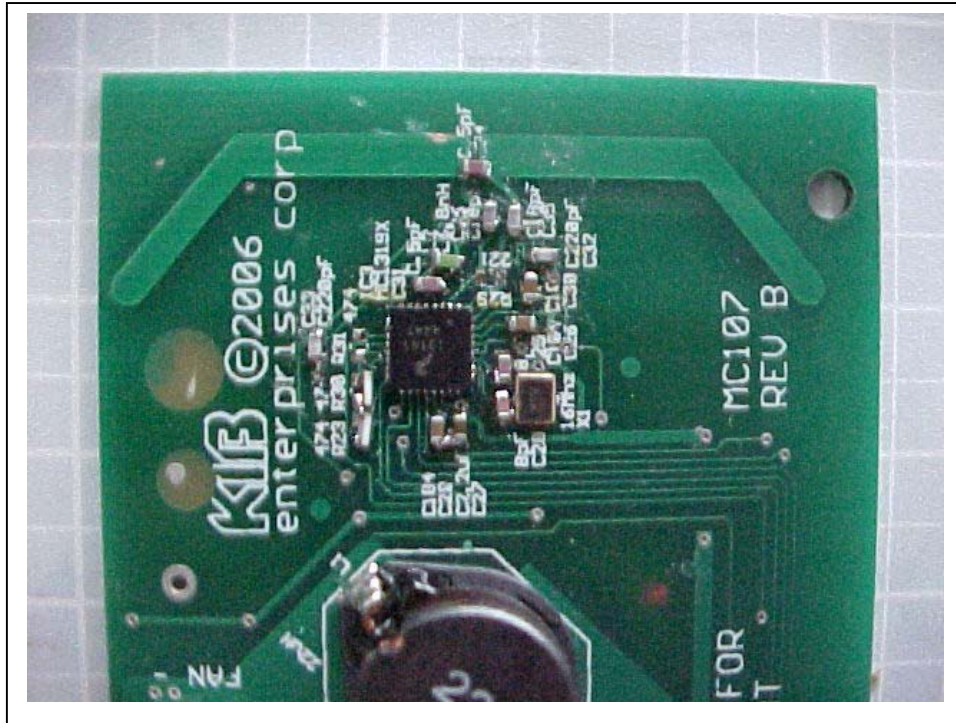
Fan Unit: Printed Circuit Board – Solder Side



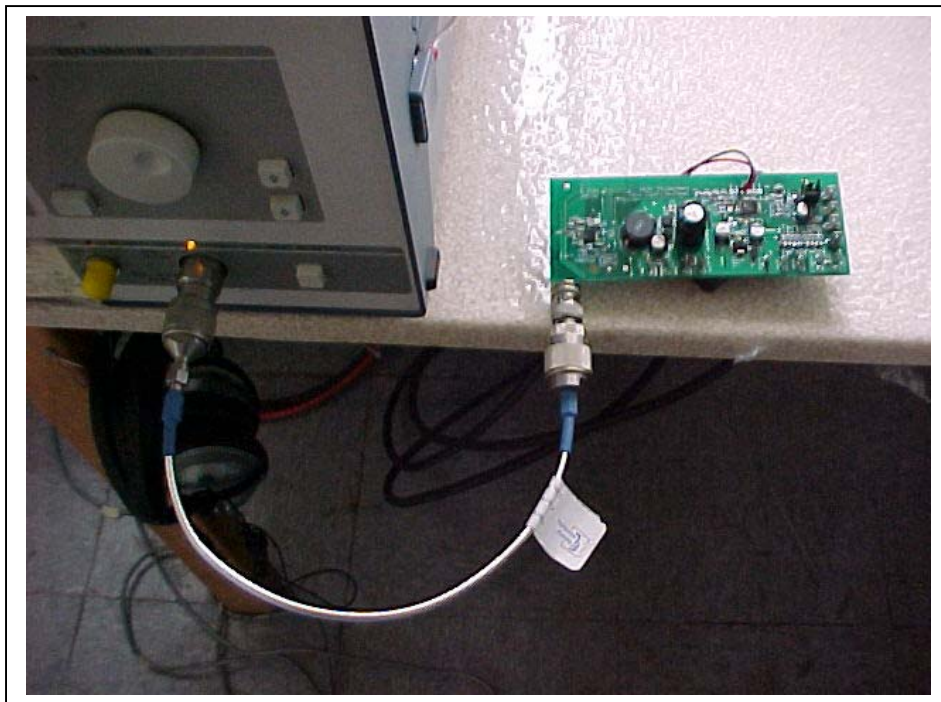
Fan Unit: Printed Circuit Board – Component Side



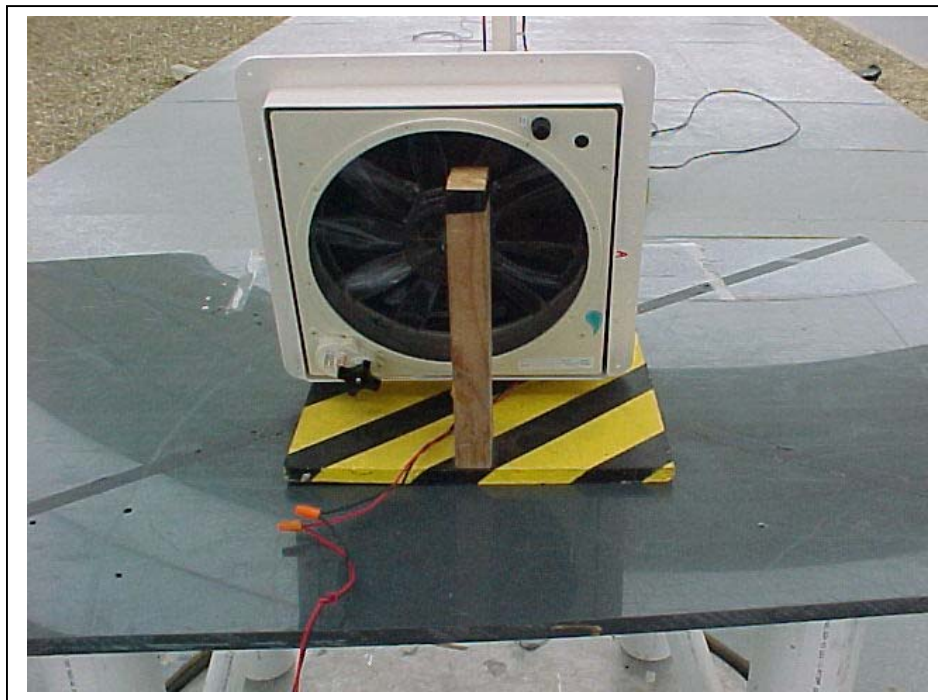
Fan Unit: Printed Circuit Board – Component Side, Close-up of RF Section



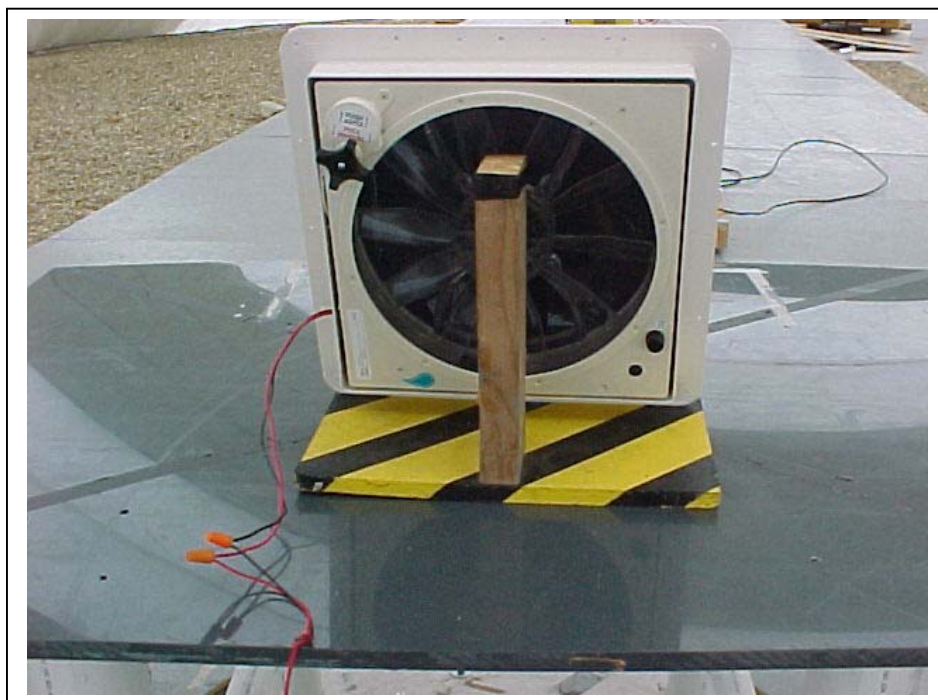
Fan Unit: Direct Connection to Receiver (RF Antenna Conducted)



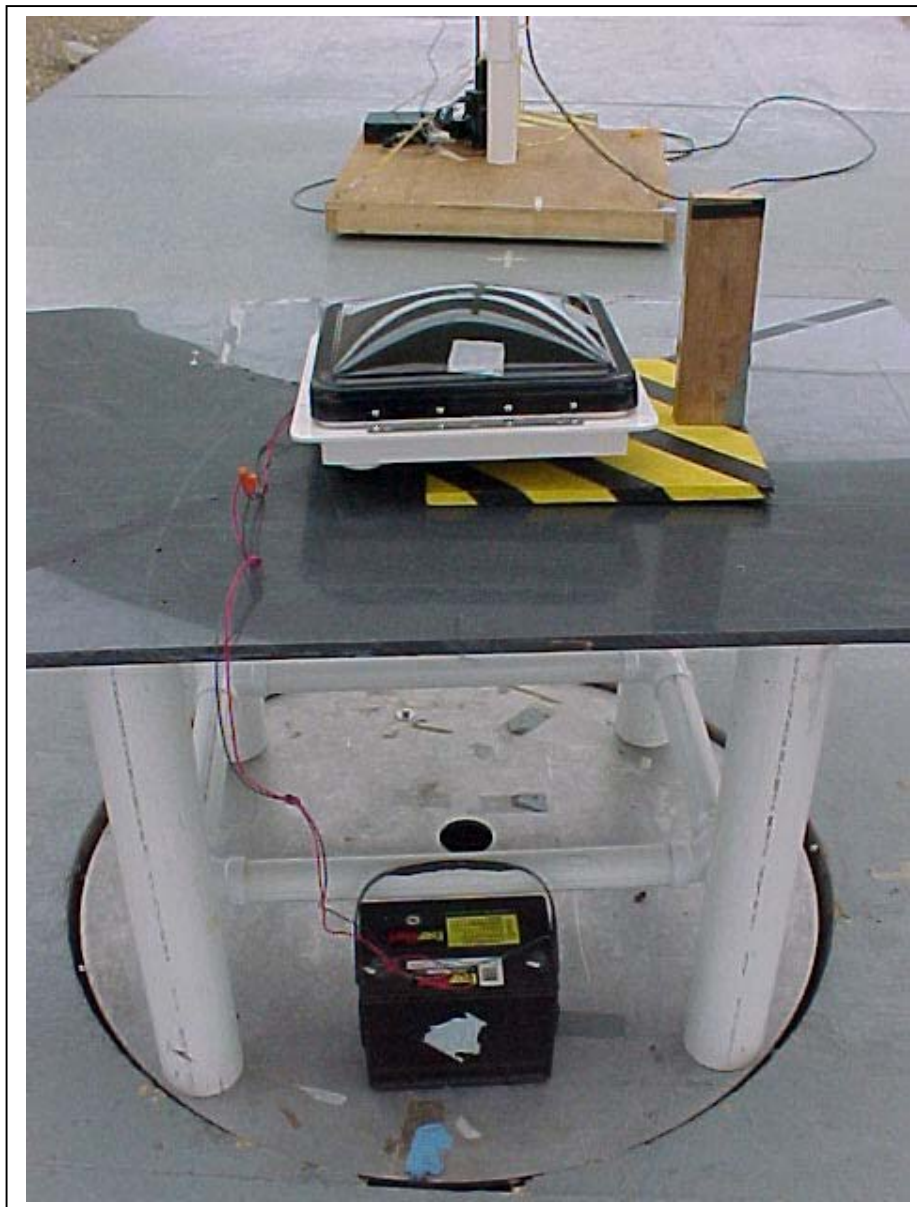
Orthogonal Positions of Fan Unit –Upright #1



Orthogonal Positions of Fan Unit – Upright #2



Orthogonal Positions of Fan Unit – On Back



Overall Test Setup on OATS

