

TEST REPORT

Report No.: HK09101151-1

Vornado Air LLC

Application
For
Certification
(Original Grant)
(FCC ID: WOTTVH600-2)

Transmitter

Prepared and Checked by:



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Approved by:



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Date: November 17, 2009

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GENERAL INFORMATION

Vornado Air LLC
BRAND NAME: Vornado, MODEL: TVH600

FCC ID: WOTTVH600-2

Grantee:	Vornado Air LLC
Grantee Address:	415 East 13 th Street Andover, KS67002, USA.
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Manufacturer:	N/A
Manufacturer Address:	N/A
Brand Name:	Vornado
Model:	TVH600
Type of EUT:	Transmitter
Description of EUT:	Fan Heater
Serial Number:	N/A
FCC ID	WOTTVH600-2
Date of Sample Submitted:	October 31, 2009
Date of Test:	November 2, 2009 - November 06, 2009
Report No.:	HK09101151-1
Report Date:	November 17, 2009
Environmental Conidtions:	Temperature: +10 to 40°C Humidity: 10 to 90%

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SUMMARY OF TEST RESULT

Vornado Air LLC
BRAND NAME: Vornado, MODEL: TVH600

FCC ID: WOTTVH600-2

TEST SPECIFICATION	REFERENCE	RESULTS
Maximum Peak Output Power	15.247(b), (c) / RSS-210 A8.4	N/A
Hopping Channel Carrier Frequencies Separation	15.247(e) / RSS-210 A8.1	N/A
20dB Bandwidth of the Hopping Channel	15.247(a) / RSS-210 A8.1	N/A
Number of Hopping Frequencies	15.247(e) / RSS-210 A8.1	N/A
Average Time of Occupancy of Hopping Frequency	15.247(e) / RSS-210 A8.1	N/A
Antenna Conducted Spurious Emissions	15.247(d) / RSS-210 A8.5	N/A
Radiated Spurious Emissions	15.247(d) / RSS-210 A8.5	N/A
RF Exposure Compliance	15.247(i) / RSS-Gen 5.5	N/A
Transmitter Power Line Conducted Emissions	15.207 / RSS-Gen 7.2.2	N/A
Transmitter Field Strength	15.227 / RSS-310 3.8	N/A
Transmitter Field Strength	15.229 / RSS-210 A2.7	N/A
Transmitter Field Strength, Bandwidth and Timing Requirement	15.231(a) / RSS-210 A1.1.1	Pass
Transmitter Field Strength, Bandwidth and Timing Requirement	15.231(e) / RSS-210 A1.1.5	Pass
Transmitter Field Strength and Bandwidth Requirement	15.239 / RSS-210 A2.8	N/A
Transmitter Field Strength and Bandwidth Requirement	15.249 / RSS-210 A2.9	N/A
Receiver / Digital Device Radiated Emissions	15.109 / ICES-003	N/A
Digital Device Conducted Emissions	15.107 / ICES-003	N/A

- Note: 1. The EUT uses a permanently attached antenna which, in accordance to section 15.203, is considered sufficient to comply with the provisions of this section.
2. Pursuant to FCC part 15 Section 15.215(c), the 20 dB bandwidth of the emission was contained within the frequency band designated (mentioned as above) which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over expected variations in temperature and supply voltage were considered.

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1.0 General Description

1.1 Product Description

The Equipment Under Test (EUT) is a Remote control of Fan Heater (transmitter) Operating at 315 MHz. The EUT is powered by 3Vd.c. (2 x 1.5V "AA" Batteries). Function of the Remote control includes turning the Fan Heater On and Off, setting mode, timer and temperature of the Fan Heater. The transmitter will cease transmission within about 182.5 ms of being released the keys. And the remote control will continuously monitor the temperature. This temperature reading is transmitted back to the base unit every 125.4 s. And each transmission is about 173.6 ms.

Antenna Type : Internal, Integral

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

1.2 Related Submittal(s) Grants

The receiver for this transmitter has been authorized by Declaration of the Conformity procedure.

1.3 Test Methodology

Radiated emission measurements was performed according to the procedures in ANSI C63.4 (2003). All radiated measurements were performed in an Open Area Test Site. Preliminary scans were performed in the Open Area Test Site only to determine worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at Garment Centre, 576 Castle Peak Road, Kowloon, Hong Kong. This test facility and site measurement data have been placed on file with the FCC.

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2.0 System Test Configuration

2.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.4 (2003).

The device was powered from 3VDC (2 x 1.5V "AA" batteries).

For maximizing emissions, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data reported in Exhibit 3.0.

The unit was operated standalone and placed in the center of the turntable.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was mounted to a plastic stand if necessary and placed on the wooden turntable, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

2.2 EUT Exercising Software

There was no special software to exercise the device. Once the unit enters test mode, it transmits the RF signal continuously.

2.3 Special Accessories

There are no special accessories necessary for compliance of this product.

2.4 Equipment Modification

Any modifications installed previous to testing by Vornado Air LLC will be incorporated in each production model sold/leased in the United States.

No modifications were installed by Intertek Testing Services Hong Kong Ltd.

2.5 Measurement Uncertainty

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

2.6 Support Equipment List and Description

N/A.

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3.0 Emission Results

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

3.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any), Average Factor (optional) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG - AV$$

where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB
- AV = Average Factor in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

$$FS = RR + LF$$

where

- FS = Field Strength in dB μ V/m
- RR = RA - AG - AV in dB μ V
- LF = CF + AF in dB

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB are added. The amplifier gain of 29 dB and average factor of 5 dB are subtracted, giving a field strength of 27 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V/m	
AF = 7.4 dB	RR = 18.0 dB μ V
CF = 1.6 dB	LF = 9.0 dB
AG = 29.0 dB	
AV = 5.0 dB	
FS = RR + LF	
FS = 18 + 9 = 27 dB μ V/m	

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm} [(27 \text{ dB}\mu\text{V/m})/20] = 22.4 \mu\text{V/m}$$

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3.2 Radiated Emission Configuration Photograph

The worst case in radiated emission was found at 314.95 MHz.

For electronic filing, the worst case radiated emission configuration photographs are saved with filename: radiated photos.pdf.

3.3 Radiated Emission Data

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgment: Passed by 0.1 dB margin.

3.4 Conducted Emission Configuration Photograph

Not Applicable.

3.5 Conducted Emission Data

Not Applicable.

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Applicant: Vornado Air LLC

Date of Test: November 06, 2009

Model: TVH600

Worst-case Operating Mode: Remote control mode

Table 1

**Radiated Emissions
Pursuant to FCC Part 15 Section 15.231(a) Requirement**

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp (dB)	Antenna factor (dB)	Average Factor (dB)	Net at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
H	314.950	66.0	16	23.0	4.6	68.4	75.6	-7.2
H	629.900	32.3	16	29.0	4.6	40.7	55.6	-14.9
V	944.850	32.0	16	33.0	4.6	44.4	55.6	-11.2
V	1259.800	45.1	33	26.1	4.6	33.6	55.6	-22.0
H	*1574.750	49.7	33	27.2	4.6	39.3	54.0	-14.7
V	1889.700	52.4	33	27.2	4.6	42.0	55.6	-13.6
H	*2204.650	52.7	33	29.4	4.6	44.5	54.0	-9.5
H	2519.600	47.6	33	30.4	4.6	40.4	55.6	-15.2
H	*2834.550	59.6	33	30.4	4.6	52.4	54.0	-1.6
H	3149.500	46.4	33	31.9	4.6	40.7	55.6	-14.9

NOTES: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative sign in the column shows value below limit.
4. Horn antenna is used for the emission over 1000MHz.
5. Emissions within restricted band fulfil the requirement of Section 15.209.

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Applicant: Vornado Air LLC
Model: TVH600

Date of Test: November 06, 2009

Worst-case Operating Mode: Temperature update mode

Table 2

**Radiated Emissions
Pursuant to FCC Part 15 Section 15.231(e) Requirement**

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp (dB)	Antenna factor (dB)	Average Factor (dB)	Net at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
H	314.950	66.0	16	23.0	5.4	67.6	67.7	-0.1
H	629.900	32.3	16	29.0	5.4	39.9	47.7	-7.8
V	944.850	32.0	16	33.0	5.4	43.6	47.7	-4.1
V	1259.800	45.1	33	26.1	5.4	32.8	54.0	-21.2
H	1574.750	49.7	33	27.2	5.4	38.5	54.0	-15.5
V	1889.700	52.4	33	27.2	5.4	41.2	54.0	-12.8
H	2204.650	52.7	33	29.4	5.4	43.7	54.0	-10.3
H	2519.600	47.6	33	30.4	5.4	39.6	54.0	-14.4
H	2834.550	59.6	33	30.4	5.4	51.6	54.0	-2.4
H	3149.500	46.4	33	31.9	5.4	39.9	54.0	-14.1

NOTES: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative sign in the column shows value below limit.
4. Horn antenna is used for the emission over 1000MHz.

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4.0 **Equipment Photographs**

For electronic filing, the photographs are saved with filename: external photos.pdf and internal photos.pdf.

5.0 **Product Labelling**

For electronics filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

6.0 **Technical Specifications**

For electronic filing, the block diagram and schematic of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

7.0 **Instruction Manual**

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

8.0 **Miscellaneous Information**

The miscellaneous information includes details of the test procedure and calculation of factor such as pulse desensitization and averaging factor (calculation and timing diagram).

8.1 Measured Bandwidth

For electronic filing, the plot shows the fundamental emission when modulated is saved with filename: bw.pdf. From the plot, the bandwidth is observed to be 604kHz, at 20dBc where the bandwidth limit is 787.375Hz.

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8.2 Discussion Pulse Desensitvity

Pulse desnesitivity is not applicable for this device. The effective period (Teff) is approximately 1ms for a digital "1" bit which illustrated on technical specification, with a resolution bandwidth (3dB) of 100KHz, so the pulse desnesitivity factor is 0dB.

8.3 Calculation of Average Factor

The duty cycle is simply the on-time divided by the period:

The duration of one cycle = 100ms

Effective period of the cycle (Remote control mode) = 59ms

Effective period of the cycle (Temperature update mode) = 54ms

DC of Remote control mode = $59\text{ms} / 100\text{ms} = 0.59$

DC of Temperature update mode = $54\text{ms} / 100\text{ms} = 0.54$

Therefore, the averaging factor of Remote control mode is found by $20\log 0.59 = -4.6\text{dB}$. And the averaging factor of temperature update mode is found by $20\log 0.54 = -5.4\text{dB}$.

8.4 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under Part 15, Subpart C rules.

The test set-up and procedures described below are designed to meet the requirements of ANSI C63.4 - 2003.

The transmitting equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately one meter in height above the ground plane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjusted through all three orthogonal axes to obtain maximum emission levels. The antenna height and polarization are varied during the testing to search for maximum signal levels. The height of the antenna is varied from one to four meters.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in Exhibit 8.3.

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8.4 Emissions Test Procedures (cont'd)

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements are made as described in ANSI C63.4 - 2003.

The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater when frequency is below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to whether pulse desensitization is applicable to this unit is included in this report (See Exhibit 8.2). Above 1000 MHz, a resolution bandwidth of 1 MHz is used.

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the forbidden bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, unless otherwise reported. Measurements taken at a closer distance are so marked.

9.0 **Confidentiality Request**

Not Applicable.

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10.0 Equipment List

1) Radiated Emissions Test

Equipment	EMI Test Receiver	Biconical Antenna	Log Periodic Antenna
Registration No.	EW-0014	EW-0954	EW-0446
Manufacturer	R&S	EMCO	EMCO
Model No.	ESVS30	3104C	3146
Calibration Date	Jun. 01, 2009	Sep. 30, 2008	Oct. 02, 2008
Calibration Due Date	Jun. 01, 2010	Mar. 30, 2010	Apr. 02, 2010

Equipment	Spectrum Analyzer	Spectrum Analyzer
Registration No.	EW-2188	EW-2249
Manufacturer	AGILENTTECH	R&S
Model No.	E4407B	FSP30
Calibration Date	Dec. 18, 2008	Jun. 25, 2009
Calibration Due Date	Dec. 18, 2009	Jun. 25, 2010