



## Compliance Testing, LLC

Previously Flom Test Lab

EMI, EMC, RF Testing Experts Since 1963

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### Test Report

Prepared for: Garmin International

Model: O5AHNH00

Description: Wireless Dog Trainer

Serial Number: 43T000000

FCC ID: IPH-02670

IC: 1792A-02670

To

FCC Part 95

Date of Issue: June 6, 2015

On the behalf of the applicant:

Garmin International  
1200 East 151<sup>st</sup> Street  
Olathe, KS 66062

Attention of:

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Project No: p1410007

Alex Macon  
Project Test Engineer

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All results contained herein relate only to the sample tested.

### Test Report Revision History

| Revision | Date         | Revised By | Reason for Revision                     |
|----------|--------------|------------|-----------------------------------------|
| 1.0      | May 29, 2015 | Alex Macon | Original Document                       |
| 2.0      | Jun 6, 2015  | Alex Macon | Removed unneeded bandwidth calculations |
|          |              |            |                                         |
|          |              |            |                                         |



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## ILAC / A2LA

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF Communiqué dated January 2009).

The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

Please refer to <http://www.compliancetesting.com/labscope.html> for current scope of accreditation.

Testing Certificate Number: **2152.01**



FCC Site Reg. #349717

IC Site Reg. #2044A-2

**Non-accredited tests contained in this report:**

N/A

**The Applicant has been cautioned as to the following:**

**15.21: Information to the User**

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

**15.27(a): Special Accessories**

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

## Test and Measurement Data

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II, Part 2, Subpart J, Sections 2.947, 2.1033(c), 2.1041, 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, and the following individual Parts 95.

## Standard Test Conditions and Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing.

In accordance with ANSI/TIA 603C, and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specify testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

| Environmental Conditions |                 |                    |
|--------------------------|-----------------|--------------------|
| Temp<br>(°C)             | Humidity<br>(%) | Pressure<br>(mbar) |
| 23.2 – 25.4              | 31.2 – 35.7     | 967.8 – 969.2      |

Measurement results, unless otherwise noted, are worst-case measurements.

## EUT Description

**Model:** O5AHNH00

**Description:** Wireless Dog Trainer

### Additional Information:

The EUT is a wireless handheld transmitter. The EUT is an R/C device transmitting in the 27 MHz band to a wireless dog training collar.

## EUT Operation during Tests

EUT was continuous transmit mode during all tests and receiver collar was turned on.

**Accessories:** None

**Cables:** None

**Modifications:** None



## Test Result Summary

| Specification    | Test Name                                   | Pass,<br>Fail, N/A | Comments |
|------------------|---------------------------------------------|--------------------|----------|
| 2.1046<br>95.639 | Carrier Output Power (Conducted)            | Pass               |          |
| 2.1053<br>95.635 | Field Strength of Spurious Radiation        | Pass               |          |
| 90.635<br>2.1049 | Emission Masks (Occupied Bandwidth)         | Pass               |          |
| 95.623           | Frequency Stability (Temperature Variation) | Pass               |          |
| 95.623           | Frequency Stability (Voltage Variation)     | Pass               |          |
| RSS-Gen          | Receiver Spurious Emissions                 | Pass               |          |
| 2.202            | Necessary Bandwidth Calculation             | Pass               |          |

### Carrier Output Power (Conducted)

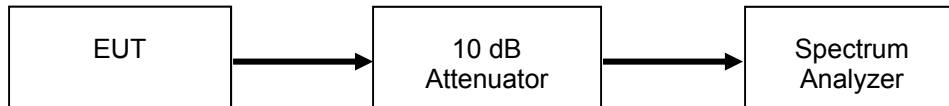
**Name of Test:** Carrier Output Power (Conducted)  
**Test Equipment Utilized:** i00379

**Engineer:** Alex Macon  
**Test Date:** 5/27/15

### Measurement Procedure

The Equipment Under Test (EUT) was connected to a spectrum analyzer through a 10 dB Power attenuator. All cable and attenuator losses were input into the spectrum analyzer as a reference level offset to ensure accurate readings were obtained.

### Test Setup



### High Power Transmitter Peak Output Power

| Tuned Frequency (MHz) | Recorded Measurement (dBm) | Result |
|-----------------------|----------------------------|--------|
| 27.045                | 22.74                      | Pass   |

## Field Strength of Spurious Radiation

**Name of Test:** Field Strength of Spurious Radiation  
**Test Equipment Utilized:** i00349, i00379

**Engineer:** Alex Macon  
**Test Date:** 5/29/15

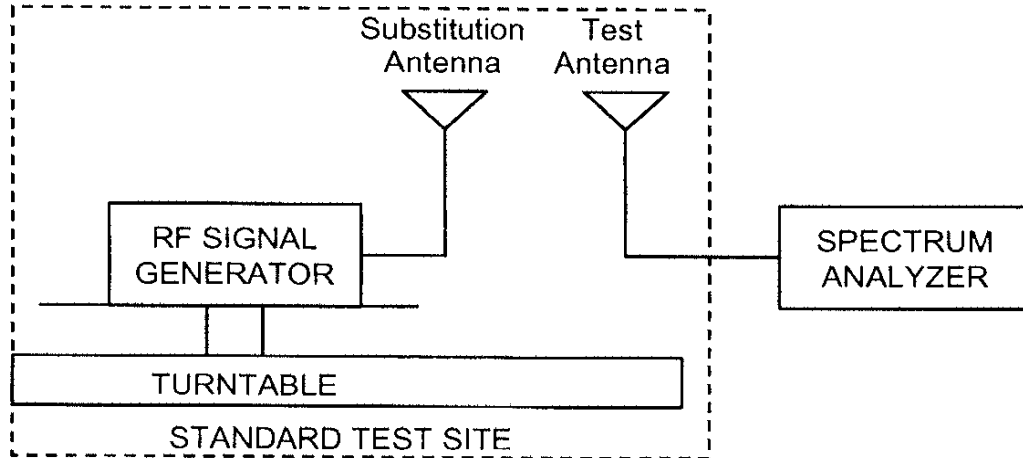
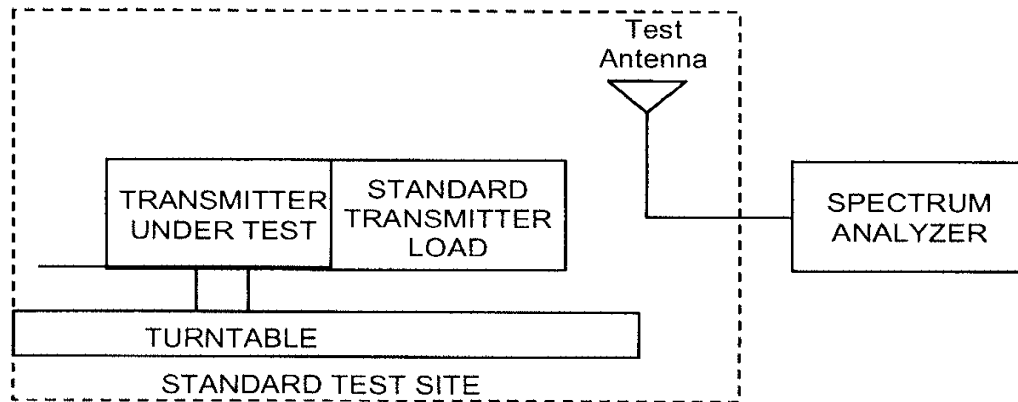
### Test Procedure

- A) Connect the equipment as illustrated below.
- B) Adjust the spectrum analyzer to the following settings:
  - 1) Resolution Bandwidth 100 kHz (< 1 GHz), 1 MHz (> 1GHz)
  - 2) Video Bandwidth  $\geq 3$  times Resolution Bandwidth, or 30 kHz
  - 3) Sweep Speed  $\leq 2000$  Hz/second
  - 4) Detector Mode = Mean or Average Power
- C) Place the transmitter to be tested on the turntable in the standard test site. The transmitter is transmitting into a non-radiating load that is placed on the turntable. The RF cable to this load should be of minimum length.
- D) For each spurious measurement the test antenna should be adjusted to the correct length for the frequency involved. This length may be determined from a calibration ruler supplied with the equipment. Measurements shall be made from the lowest radio frequency generated in the equipment to the tenth harmonic of the carrier, except for the region close to the carrier equal to  $\pm$  the test bandwidth (see Section 1.3.4.4).
- E) For each spurious frequency, raise and lower the test antenna from 1 m to 4 m to obtain a maximum reading on the spectrum analyzer with the test antenna at horizontal polarity. Repeat this procedure to obtain the highest possible reading. Record this maximum reading.
- F) Repeat Step E) for each spurious frequency with the test antenna polarized vertically.
- G) Reconnect the equipment as illustrated.
- H) Keep the spectrum analyzer adjusted as in Step B).
- I) Remove the transmitter and replace it with a substitution antenna (the antenna should be half wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. At lower frequencies, where the substitution antenna is very long, this will be impossible to achieve when the antenna is polarized vertically. In such case the lower end of the antenna should be 0.3 m above the ground.
- J) Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a non-radiating cable. With the antennas at both ends horizontally polarized and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output.
- K) Repeat Step J) with both antennas vertically polarized for each spurious frequency.
- L) Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in Steps J) and K) by the power loss in the cable between the generator and the antenna and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna.
- M) The levels recorded in Step L) are absolute levels of radiated spurious emissions in dBm. The radiated spurious emissions in dB can be calculated by the following:

$$\text{Radiated spurious emissions dB} = 10\log_{10} (\text{TX power in watts}/0.001) - \text{the levels in Step I)}$$

*NOTE: It is permissible that the other antennas provided can be referenced to a dipole.*

### Test Setup



### Test Results

| Measured Frequency<br>(MHz) | Measured Value<br>(dBm) | Limit<br>(dBm) |
|-----------------------------|-------------------------|----------------|
| 54.088                      | -78.04                  | -13            |
| 81.128                      | -70.52                  | -13            |
| 108.185                     | -83.74                  | -13            |
| 135.204                     | -85.39                  | -13            |
| 162.256                     | -86.93                  | -13            |

No other emissions were detected. All emissions were lower than -13 dBm.

## Emission Masks (Occupied Bandwidth)

**Name of Test:**

Emission Masks (Occupied Bandwidth)

**Engineer:** Alex Macon

**Test Equipment Utilized**

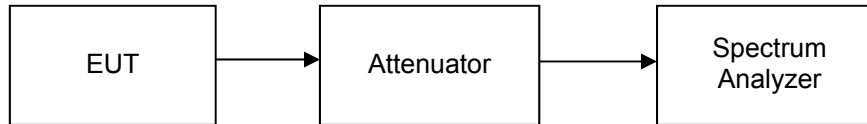
i00379

**Test Date:** 5/27/15

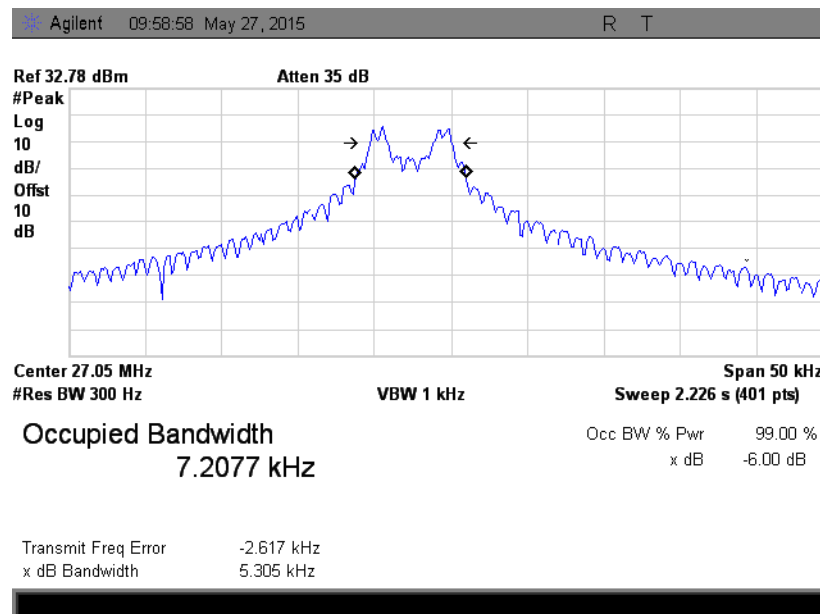
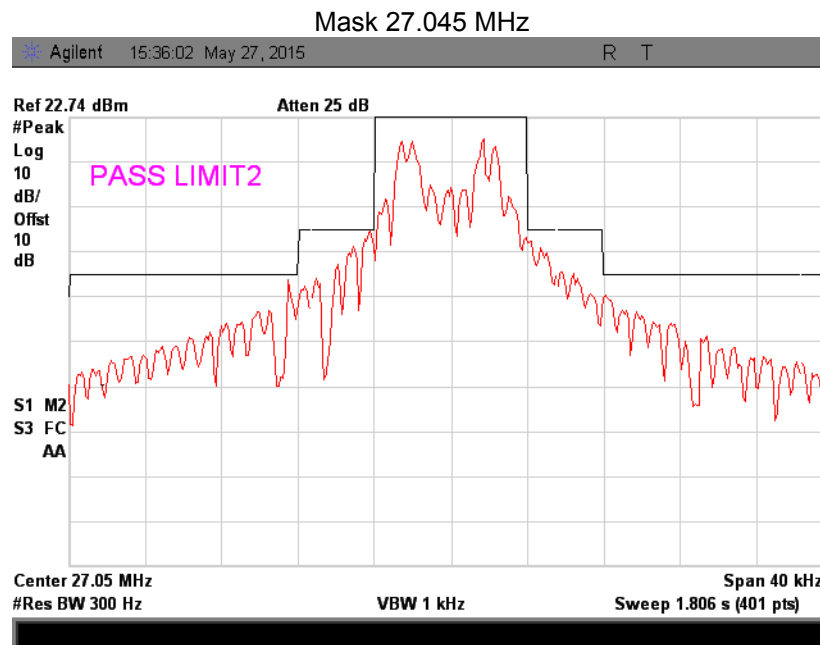
## Measurement Procedure

The EUT was connected directly to a spectrum analyzer to verify that the EUT meets the required emissions mask. This is an RC device

## Test Setup



## Occupied Bandwidth Plot



## Frequency Stability (Temperature and Voltage Variation)

**Name of Test:** Frequency Stability  
(Temperature and Voltage Variation)

**Test Equipment Utilized:** i00027, i00320, i00343

**Engineer:** Alex Macon

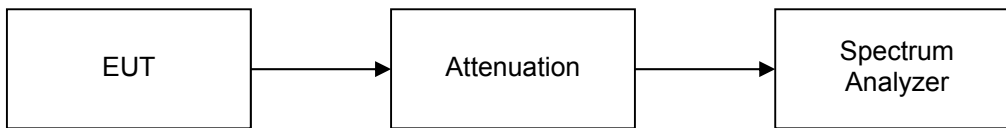
**Test Date:** 5/28/15

### Measurement Procedure

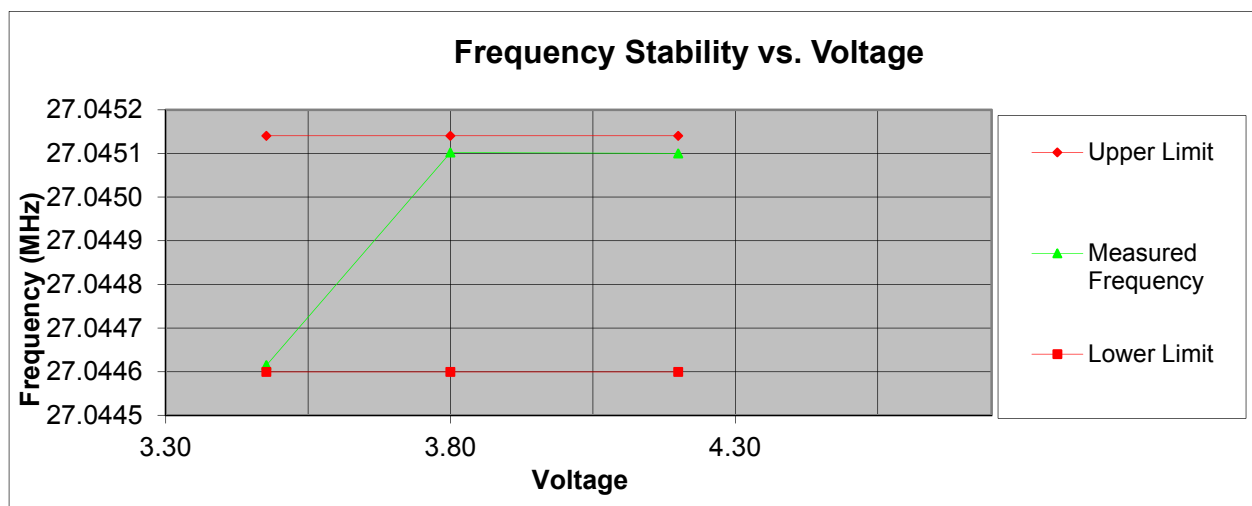
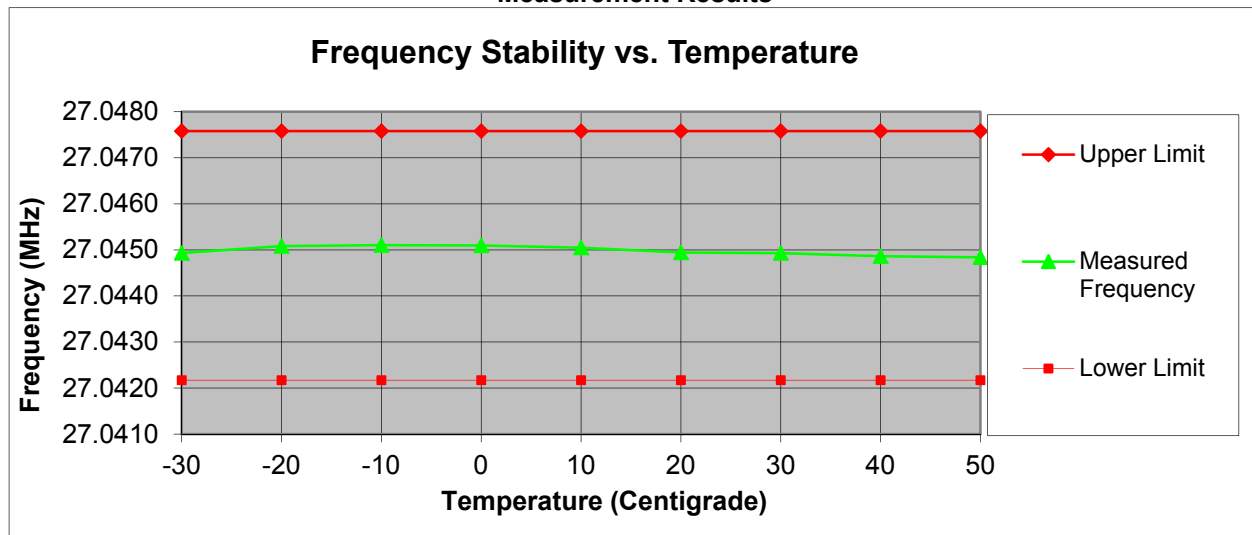
The EUT was placed in an environmental test chamber and the RF output was connected directly to a spectrum analyzer. The temperature was varied from -30°C to 50°C in 10°C increments. After a sufficient time for temperature stabilization the RF output frequency was measured. At 20°C the power supply voltage to the EUT was varied from 85% to 115% of the nominal value and the RF output was measured.

Tuned Frequency – 27.045  
 Tolerance – 100.0 ppm  
 Upper Limit – 27.047578  
 Lower Limit – 27.042170

### Measurement Setup



### Measurement Results



## Necessary Bandwidth Calculations

**Name of Test:** Necessary Bandwidth Calculations  
**Test Specification:** 2.202

**Engineer:** Alex Macon  
**Test Date:** 5/29/15

|                                         |   |               |
|-----------------------------------------|---|---------------|
| Modulation = 8K00F1D                    |   |               |
| <b>Necessary Bandwidth Calculation:</b> |   |               |
| Data Rate (R) Kbps                      | = | 2.3           |
| Maximum Deviation (D), kHz              | = | 2.5           |
| Necessary Bandwidth ( $B_N$ ), kHz      | = | $2.4D + 1.0R$ |
|                                         | = | 8.0           |

## Test Equipment Utilized

| Description                   | Manufacturer | Model #                       | CT Asset # | Last Cal Date        | Cal Due Date |
|-------------------------------|--------------|-------------------------------|------------|----------------------|--------------|
| Temperature Chamber           | Tenney       | Tenney Jr                     | i00027     | Verified on: 5/28/15 |              |
| Power Supply                  | HP           | 6286A                         | i00054     | Verified on:5/28/15  |              |
| Horn Antenna                  | EMCO         | 3115                          | i00103     | 1/20/15              | 1/20/17      |
| Voltmeter                     | Fluke        | 75III                         | i00320     | 3/24/15              | 3/24/16      |
| Spectrum Analyzer             | Agilent      | E4407B                        | i00331     | 6/13/14              | 6/13/15      |
| Data Logger                   | Fluke        | Hydra Data Bucket             | i00343     | 3/24/15              | 3/24/16      |
| Bi-Log Antenna                | Schaffner    | CBL 6111D                     | i00349     | 10/8/13              | 10/8/15      |
| EMI Analyzer                  | Agilent      | E7405A                        | i00379     | 2/5/15               | 2/5/16       |
| 3 Meter Semi-Anechoic Chamber | Panashield   | 3 Meter Semi-Anechoic Chamber | i00428     | 11/26/13             | 3/12/16      |

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT