FCC Certification Test Report

STINGER

STINGER VIP

WLL REPORT# **12897-01 Rev 0**
December 6, 2013

Re-Issued February 27, 2014

Prepared for:

Stinger
P.O. Box 132
2160 AC Lisse
The Netherlands

Prepared By:
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Testing Certificate AT-1448

FCC Verification
Test Report

For the
STINGER
STINGER VIP

WLL REPORT# **12897-01 Rev 0**
December 6, 2013
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Prepared by:

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Reviewed by:

Steven D. Koster
Vice President

Abstract

This report has been prepared on behalf of Stinger to document compliance with the limits for a Class B digital device required under Part 15 (10/2013) of the FCC Rules and Regulations. This Federal Communication Commission (FCC) Verification Test Report documents the test configuration and test results for the Stinger Stinger VIP.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ACLASS under Certificate AT-1448 as an independent FCC test laboratory.

These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by the ANSI-ASQ National Accreditation Board/ACLASS. Refer to certificate and scope of accreditation AT-1448.

The Stinger Stinger VIP complies with the requirements for a Class B device.

Revision History	Reason	Date
Rev 0	Initial Release	December 6, 2013
Rev 1	Re-test	February 27, 2014

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1 Introduction

1.1 Compliance Statement

The Stinger Stinger VIP complied with the requirements for a Class B Radar detector device under Part 15 (10/2013) of the FCC Rules.

1.2 Test Scope Summary

Tests for radiated and conducted emissions were performed. All measurements were performed according to the 2003 version of ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

Test Specification	Specific Description	Date Completed	Result	Modifications (Y/N)
CFR47 Part 15.109 paragraph (h)	Class B Radiated Emissions	2/18/14	Complied	No

1.3 Contract Information

Customer:	Stinger P.O. Box 132 2162 AC Lisse The Netherlands
Purchase Order Number:	Deposit received via Wire Transfer
Quotation Number:	67283

1.4 Test Dates

Testing was performed on the following date(s):	12/02/2013

1.5 Test and Support Personnel

Washington Laboratories, Ltd.	John Reidell
Client Representative	Jim De Wilde

1.6 Abbreviations

A	**A**mpere
ac	**a**lternating **c**urrent
AM	Amplitude Modulation
Amps	**Amp**ere**s**
b/s	**b**its per **s**econd
BW	**B**and**W**idth
CE	**C**onducted **E**mission
cm	**c**enti**m**eter
CW	**C**ontinuous **W**ave
dB	**d**eci**B**el
dc	**d**irect **c**urrent
EMI	**E**lectro**m**agnetic **I**nterference
EUT	**E**quipment **U**nder **T**est
FM	**F**requency **M**odulation
G	**g**iga - prefix for 10^9 multiplier
Hz	**H**ertz
IF	**I**ntermediate **F**requency
k	**k**ilo - prefix for 10^3 multiplier
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
M	**M**ega - prefix for 10^6 multiplier
m	**m**eter
µ	**m**icro - prefix for 10^{-6} multiplier
NB	**N**arrow**b**and
QP	**Q**uasi-**P**eak
RE	**R**adiated **E**missions
RF	**R**adio **F**requency
rms	**r**oot-**m**ean-**s**quare
SN	**S**erial **N**umber
S/A	**S**pectrum **A**nalyzer
V	**V**olt

2 Equipment Under Test

2.1 EUT Identification

The results obtained relate only to the item(s) tested.

Table 1: Overview of Stinger VIP, Equipment Under Test

Model(s) Tested:	Stinger VIP S/N: NL005260005
EUT Specifications:	Primary Power (*as tested*): 13Vdc
	Equipment Emissions Class: B
Test Date(s):	2/18/14

2.2 EUT Description

The Stinger VIP is a radar detector system with patch technology and a unique Multi Polarity High Definition Antenna. The Stinger VIP operates in the 9.5 – 10.6 GHz (X Band), 24.05 – 24.25 GHz (K Band) and 33.6 – 36.0 GHz (Ka Band).

2.3 Test Configuration

The Stinger Stinger VIP, Equipment Under Test (EUT), was operated from a 13Vdc power supply.

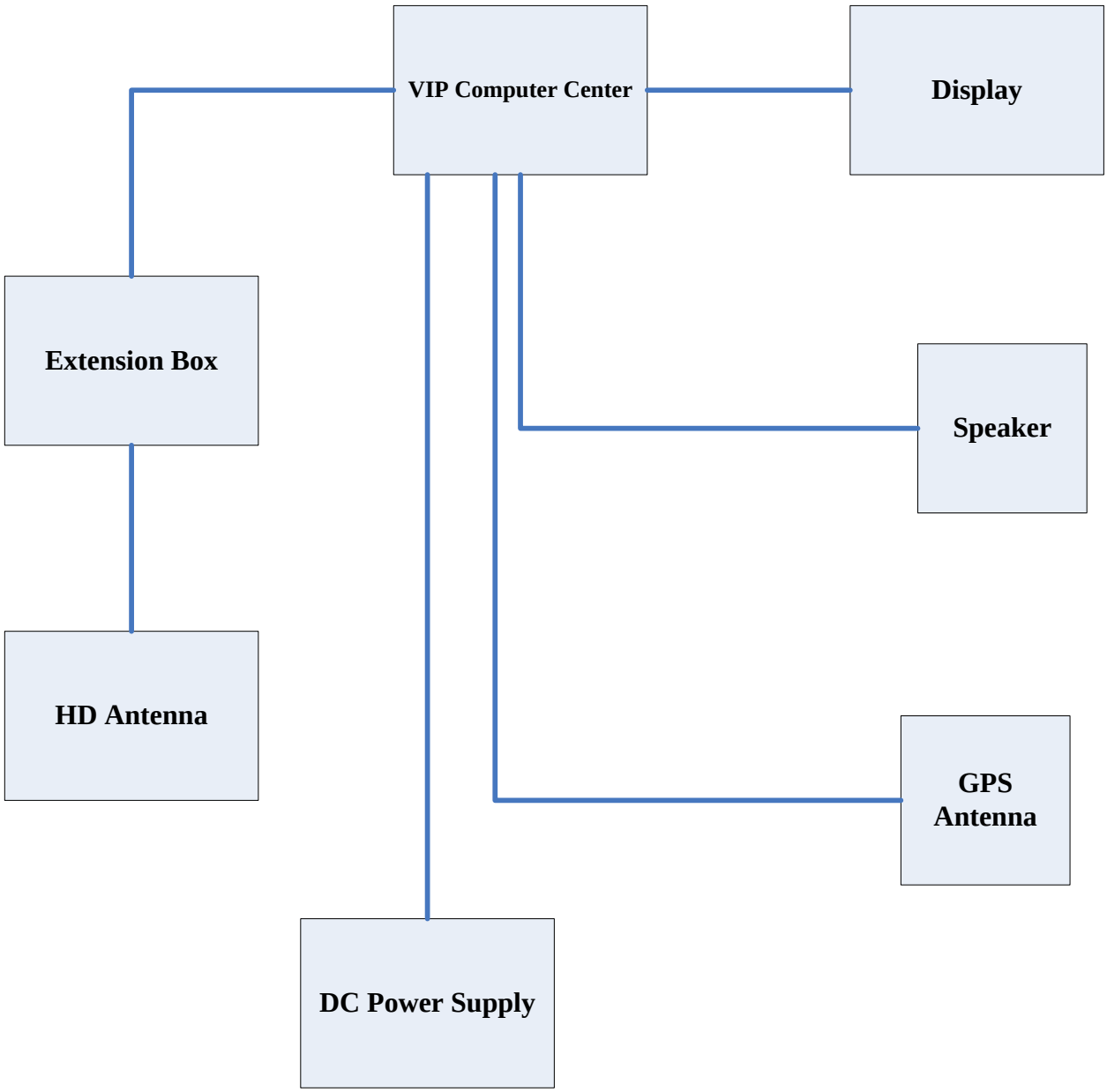

Figure 1: Test Configuration

2.4 Equipment Configuration

The EUT was set up as outlined in Figure 1. The EUT was comprised of the following equipment. (All Modules, PCBs, etc. listed were considered as part of the EUT, as tested.)

Table 2: Equipment Configuration

Name / Description	Model Number	Serial Number
VIP Computer Center	VIP CC-11	NL005260005
Extension Box	EB-02	NL007720089
HD Antenna	HD-01	NL068550001
Display	VIP D-10	NL038150071
Display Base	VIP DH-11	NL006760007
Speaker	ES-603	N/A
GPS Antenna	DAM1575A4	N/A

2.5 Support Equipment

The following support equipment was used during testing:

Table 3: Support Equipment

Item	Model/Part Number	Serial Number
DC Power Supply	Global Specialties / 1337	99503015

2.6 Interface Cables

Table 4: Interface Cables

Port Identification	Connector Type	Cable Length	Shielded (Y/N)	Termination Point
PWR	2 pin Molex	1.5m	N	DC power supply
I/O 1	8 pin Molex	1.6m	N	DC power supply
I/O 2	HDMI	5m	N	Display
MISC	Mini jack	2.2m	N	Speaker
GPS	MCX female	5m	Y	GPS Antenna
FRONT	USB Type B	1.5m	N	N/A
REAR	USB Type B	1.5m	N	N/A
AUX	USB Type A	2.2m	N	Extension Box
Display	USB Type A	1.5m	N	N/A

2.7 EUT Modifications

No modifications were performed in order to meet the test requirements:

2.8 Testing Algorithm

The Stinger VIP was operated in normal analyzing mode.

Worst case emission levels are provided in the test results data.

2.9 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ACLASS under Certificate AT-1448 as an independent FCC test laboratory.

2.10 Measurements

2.10.1 Measurement Method

All measurements herein were performed according to the 2003 version of ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation. Calibration checks are made periodically to verify proper performance of the measuring instrumentation.

2.11 Measurement Uncertainty

All results reported herein relate only to the equipment tested. The basis for uncertainty calculation uses ANSI/NCSL Z540-2-1997 with a type B evaluation of the standard uncertainty. Elements contributing to the standard uncertainty are combined using the method described in Equation 1 to arrive at the total standard uncertainty. The standard uncertainty is multiplied by the coverage factor to determine the expanded uncertainty which is generally accepted for use in commercial, industrial, and regulatory applications and when health and safety are concerned (see Equation 2). A coverage factor was selected to yield a 95% confidence in the uncertainty estimation.

Equation 1: Standard Uncertainty

$$u_c = \pm\sqrt{\frac{a^2}{div_a{}^2} + \frac{b^2}{div_b{}^2} + \frac{c^2}{div_c{}^2} + ...}$$

where u_c = standard uncertainty

a, b, c,.. = individual uncertainty elements

$div_{a,\ b,\ c}$ = the individual uncertainty element divisor based on the probability distribution

divisor = 1.732 for rectangular distribution

divisor = 2 for normal distribution

divisor = 1.414 for trapezoid distribution

Equation 2: Expanded Uncertainty

$$U = ku_c$$

where U = expanded uncertainty

k = coverage factor

$k \leq 2$ for 95% coverage (ANSI/NCSL Z540-2 Annex G)

u_c = standard uncertainty

The measurement uncertainty complies with the maximum allowed uncertainty from CISPR 16-4-2. Measurement uncertainty is not used to adjust the measurements to determine compliance. The expanded uncertainty values for the various scopes in the WLL accreditation are provided in Table 5 below.

Table 5: Expanded Uncertainty List

Scope	Standard(s)	Expanded Uncertainty
Radiated Emissions	CISPR11, CISPR22, CISPR14, FCC Part 15	4.55 dB

3 Test Results

3.1 Radiated Emissions

3.1.1 Requirements

Test Arrangement: Table Top

Compliance Standard: FCC Part 15 (10/2013), Class B (3 meter)

FCC Compliance Limits	
Frequency	**Limits**
30-88 MHz	100 µV/m
88-216 MHz	150 µV/m
216-960 MHz	200 µV/m
>960MHz (3 meters)	500 µV/m

3.1.2 Test Equipment

Test Name: **Radiated Emissions**			Test Date: **02/18/2014**
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
4	ARA - DRG-118/A	ANTENNA DRG 1-18GHZ	2/20/2015
770	MEGAPHASE - EM18-NK5S1-600	50 FT HIGH FREQUENCY CABLE 1 - 18GHZ	7/5/2014
725	B-Z TECHNOLOGIES - BZP118UD1X2	1 - 18GHZ LOW NOISE AMP	1/6/2015
825	MEGAPHASE - TM40-K1K5-36	RF CABLE - 2.9MM-2.9MM 36	1/3/2015
823	AGILENT - N9010A	EXA SPECTRUM ANALYZER	12/6/2014
382	SUNOL SCIENCES CORPORATION - JB1	ANTENNA BICONLOG	12/26/2014
69	HP - 85650A	ADAPTER QP	1/9/2015
802	HP - 8568B	SPECTRUM ANALYZER	1/9/2015
71	HP - 85685A	PRESELECTOR RF	1/9/2015

3.1.3 Test Procedure

The requirements of FCC Part 15 (10/2013) call for the EUT to be placed on an 80 cm high 1 X 1.5 meters non-conductive motorized turntable for radiated testing on a 3-meter open field test site. Tests were performed at a distance of 3-meters. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Double ridged antenna was mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. The output of the antenna was connected to the input of the spectrum analyzer and the emissions in the frequency range of 11.7 GHz to 12.2 GHz were measured. The peripherals were placed on the table in accordance with ANSI C63.4-2003. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured.

The output from the antenna was connected, via a preamplifier, to the input of the spectrum analyzer. The detector function was set to quasi-peak or peak, as appropriate. Frequencies above 1GHz were performed using a measurement bandwidth of 1MHz with a video bandwidth setting of 10 Hz for the average measurement.

3.1.4 Radiated Data Reduction and Reporting

To convert the raw spectrum analyzer radiated data into a form that can be compared with the FCC limits, it is necessary to account for various calibration factors that are supplied with the antennas and other measurement accessories. These factors are included into the antenna factor (AF) column of the table and in the cable factor (CF) column of the table. The AF (in dB/m) and the CF (in dB) is algebraically added to the raw Spectrum Analyzer Voltage in dBµV to obtain the Radiated Electric Field in dBµV/m. This logarithm amplitude is converted to a linear amplitude, then compared to the FCC limit.

Example:

Spectrum Analyzer Voltage:	VdBµV
Antenna Correction Factor:	AFdB/m
Cable Correction Factor:	CFdB
Pre-Amplifier Gain (*if applicable*):	GdB
Electric Field:	EdBµV/m = V dBµV + AFdB/m + CFdB - *GdB*
To convert to linear units of measure:	EdBV/m/20 Inv log

3.1.5 Test Data

The EUT complied with the Class B Radiated Emissions requirements. Table 6 provides the test results for radiated conducted emissions. Photograph 1 and Photograph 2 show the radiated emission test configuration.

Test Engineer(s): Steven Dovell

Test Date(s): 2/18/14

Table 6: Radiated Emission Test Data

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
11755.01	V	125.00	2.44	40.33	22.5	1390.5	5000.0	-11.1	Peak
11755.01	V	200.00	2.43	24.00	22.5	212.2	500.0	-7.4	Average
11896.93	V	200.00	2.43	38.31	23.0	1163.8	5000.0	-12.7	Peak
11896.93	V	200.00	2.43	24.91	23.0	248.8	500.0	-6.1	Average
11989.76	V	145.00	2.44	36.30	23.4	962.3	5000.0	-14.3	Peak
11989.76	V	145.00	2.44	24.70	23.4	253.1	500.0	-5.9	Average
12032.79	V	185.00	2.44	34.48	23.5	794.2	5000.0	-16.0	Peak
12032.79	V	185.00	2.44	24.56	23.5	253.6	500.0	-5.9	Average
12173.01	V	180.00	2.41	34.35	24.0	827.8	5000.0	-15.6	Peak
12173.01	V	180.00	2.41	24.98	24.0	281.5	500.0	-5.0	Average
11820.59	H	135.00	2.46	36.10	22.6	861.8	5000.0	-15.3	Peak
11820.59	H	135.00	2.46	24.73	22.6	232.8	500.0	-6.6	Average
11900.35	H	180.00	2.45	36.14	23.0	908.4	5000.0	-14.8	Peak
11900.35	H	180.00	2.45	24.72	23.0	243.9	500.0	-6.2	Average
11963.10	H	270.00	2.46	35.63	23.3	881.5	5000.0	-15.1	Peak
11963.10	H	270.00	2.46	24.73	23.3	251.3	500.0	-6.0	Average
12029.35	H	115.00	2.46	34.34	23.5	780.6	5000.0	-16.1	Peak
12029.35	H	115.00	2.46	24.56	23.5	253.2	500.0	-5.9	Average
12177.76	H	190.00	2.45	34.95	24.0	888.7	5000.0	-15.0	Peak
12177.76	H	190.00	2.45	25.09	24.0	285.7	500.0	-4.9	Average

Photograph 1: Radiated Emission Test Configuration, Front

Photograph 2: Radiated Emission Test Configuration, Back

