RHEIN TECH LABORATORIES, INC.

Engineering Solutions & Electromagnetic Compatibility Services

FCC Part 15.245 Certification Application Report

Test Lab:		Applicant:	
Rhein Tech Laboratories, Inc. Tel: 703-689-0368 360 Herndon Parkway Fax: 703-689-2056 Suite 1400 www.rheintech.com Herndon, VA 20170 E-Mail: atcbinfo@rheintech.com		FlightScope (Pty) Ltd Tel: +27 21 880 2160 10 Elektron St Fax: +27 21 880 2159 Technopark Stellenbosch South Africa 7600 Contact: Tom Johnson	
FCC ID/	QXP-32482	**Test Report Date**	July 13, 2016
Platform	N/A	**RTL Work Order #**	2015225
Model	STRIKE	**RTL Quote #**	QRTL15-225A
American National Standard Institute	ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
FCC Classification	FDS: Field Disturbance Sensor		
FCC Rule Part(s)/Guidance	FCC Rules Part 15.245: Operation within the bands 902–928 MHz, 2435–2465 MHz, 5785–5815 MHz, 10500–10550 MHz, and 24075–24175 MHz (10-01-15)		
Digital Interface Information	Digital Interface was found to be compliant		

Frequency Range (MHz)	Output Power (W)	Frequency Tolerance	Emission Designator
10500 - 10510	N/A	N/A	232KN0N

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the applicable parts of FCC Part 2, FCC Part 15, and ANSI C63.10.

Signature: _____ Date: July 13, 2016

Typed/Printed Name: Desmond A. Fraser Position: President

These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANAB. Refer to certificate and scope of accreditation AT-1445.

Table of Contents

Table of Figures

Table of Tables

Table of Plots

Table of Appendixes

Table of Appendixes

1 General Information

1.1 Scope

This is an original FCC certification application report for the FlightScope Strike Sensor Unit.

Applicable Standard:

FCC Part 15.245: Operation within the bands 902–928 MHz, 2435–2465 MHz, 5785–5815 MHz, 10500–10550 MHz, and 24075–24175 MHz

1.2 Description of EUT

Equipment Under Test	Ball Sensor
Model	STRIKE
Power Supply	120V-240 VAC adapter to 12VDC
Modulation Type	CW
Frequency Range	10.5/10.51 GHz
Antenna Connector Type	N/A
Antenna Type	Microstrip patch antenna

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia, 20170.

1.4 Related Submittal(s)/Grant(s)

This is an original application for certification for FlightScope (Pty) Ltd., Model: STRIKE, FCC ID: QXP-32482.

1.5 Modifications

No modifications were made to the equipment during testing in order to achieve compliance with these standards.

2 Test Information

2.1 Description of Test Modes

In accordance with FCC 15.31(m), because the EUT only utilizes one operating frequency, one channel was tested.

2.2 Exercising the EUT

The EUT was supplied with test firmware so that the EUT would continuously transmit during testing. The EUT was tested in all three orthogonal planes in order to determine worst-case emissions.

2.3 Test Result Summary

Table 2-1: Test Result Summary

Standard	Test	Pass/Fail or N/A
FCC 15.207	AC Power Conducted Emissions	Pass
FCC 15.209	Radiated Emissions	Pass
FCC 15.245(b)	Field Strength of Fundamental and Harmonics	Pass

2.4 Test System Details

The test samples were received on March 7, 2016. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following table.

Table 2-2: Equipment Under Test

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
Ball Sensor	FlightScope (Pty) Ltd.	STRIKE	STRIKE-00008	QXP-32482	5m Ethernet	22079
AC Adapter	Sinpro	SPU40-105	09734547 1510	N/A	1.3m unshielded	22014

2.5 Configuration of Tested System

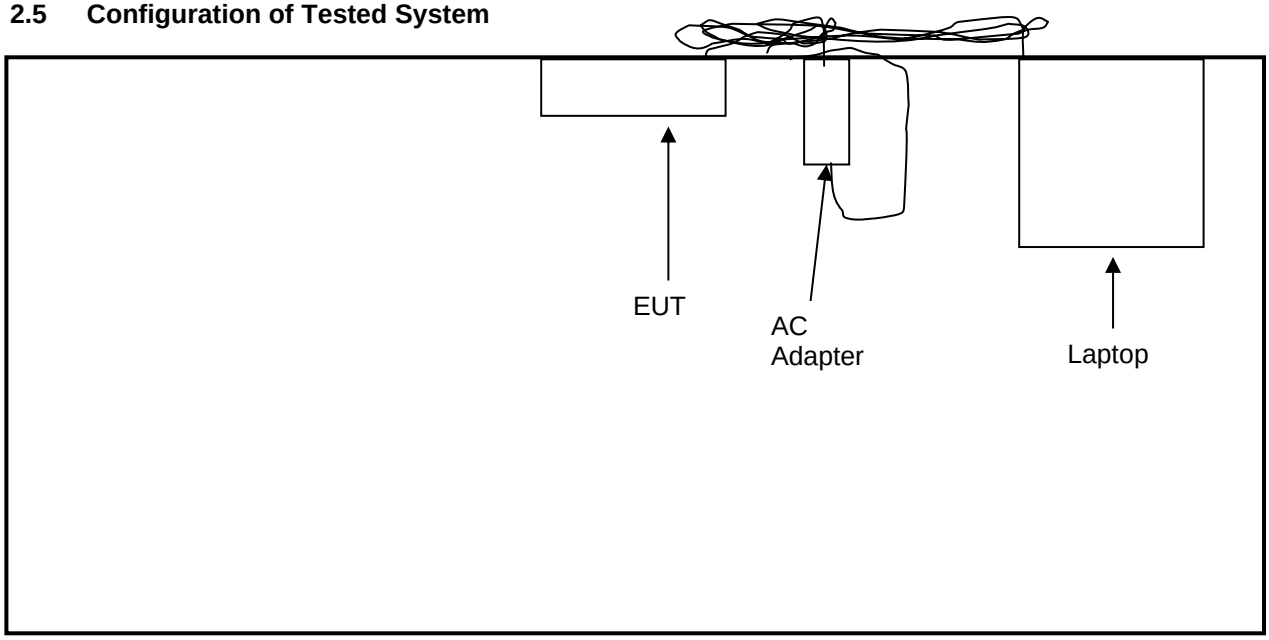


Figure 2-1: Configuration of System Under Test

3 Radiated Emissions – FCC 15.209, 15.245(b)

3.1 Limits of Radiated Emissions Measurement

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009-0.490	2400/f (kHz)	300
0.490-1.705	2400/f (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3
10,500 – 10,550 (fundamental)	2,500,000	3
harmonics	25,000	3

As shown in 15.35(b), for frequencies above 1,000 MHz, the field strength limits are based on average detector, however the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any circumstances of modulation.

3.2 Radiated Emissions Measurement Test Procedure

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to the 5^{th} harmonic of the highest fundamental transmitter frequency (52.6 GHz).

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode.

For emissions above 1000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Table 3-1: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901303	EMCO	3160-10	Horn Antenna (26.5 - 40.0 GHz) WR-28	960452-007	6/19/17
901581	Rohde & Schwarz	1166.1660.50	Spectrum Analyzer	2001006	3/22/18
900878	Rhein Tech Laboratories, Inc.	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901592	Insulated Wire Inc.	KPS-1503-3600-KPR	SMK RF Cables 20’	NA	9/4/16
901593	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36”	NA	9/4/16
901594	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36”	NA	9/4/16
901242	Rhein Tech Laboratories, Inc.	WRT-000-0003	Wood rotating table	N/A	Not Required
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	4/9/18
900321	EMCO	3161-03	Horn Antenna (4.0 - 8.2 GHz)	9508-1020	4/9/18
900323	EMCO	3160-07	Horn Antenna (8.2 - 12.4 GHz)	9605-1054	4/9/18
900356	EMCO	3160-08	Horn Antenna (12.4 - 18 GHz)	9607-1044	4/9/18
900325	EMCO	3160-9	Horn Antenna (18 - 26.5 GHz)	9605-1051	4/14/18
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 kHz – 6.5 GHz)	3325A00159	12/9/16
900914	Hewlett Packard	8546OA	RF Filter Section (100 kHz - 6.5 GHz)	3330A00107	12/9/16
900905	Rhein Tech Labs	PR-1040	OATS 1 Preamplifier 40dB (30 MHz – 2 GHz)	1006	9/10/16
900791	Schaffner Chase	CBL6112	Bilog Periodic Antenna (25 MHz - 2 GHz)	2099	6/11/17
N/A	Rhein Tech Laboratories, Inc.	Automated Emissions Tester	Emissions Testing Software	Rev. 14.0.2	N/A
900151	Rohde and Schwarz	HFH2-Z2	Loop Antenna (9 kHz - 30 MHz)	827525/019	3/4/17

3.3 Radiated Emissions Test Results

Table 3-2: Radiated Emissions Test Data (Unintentional)

Temperature: 64°F Humidity: 43%										
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/ Fail
100.001	Qp	H	120	2.0	39.0	-20.9	18.1	43.5	-25.4	Pass
102.090	Qp	V	30	1.0	30.8	-20.8	10.0	43.5	-33.5	Pass
150.047	Qp	H	120	2.0	54.1	-20.9	33.2	43.5	-10.3	Pass
150.047	Qp	V	270	1.0	50.9	-20.9	30.0	43.5	-13.5	Pass
166.684	Qp	V	225	1.0	47.5	-21.4	26.1	43.5	-17.4	Pass
200.012	Qp	V	30	1.0	47.0	-21.5	25.5	43.5	-18.0	Pass
206.448	Qp	H	120	1.0	49.5	-21.5	28.0	43.5	-15.5	Pass
206.448	Qp	V	90	1.0	46.1	-21.5	24.6	43.5	-18.9	Pass
250.018	Qp	V	120	1.0	51.5	-18.3	33.2	46.0	-12.8	Pass
250.028	Qp	H	180	1.0	57.6	-18.3	39.3	46.0	-6.7	Pass
300.018	Qp	H	180	1.0	57.5	-17.2	40.3	46.0	-5.7	Pass
300.023	Qp	V	90	2.0	49.6	-17.2	32.4	46.0	-13.6	Pass

Table 3-3: Radiated Emissions Test Data (Fundamental)

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Peak Emission Level (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)
10,500	87.8	33.5	121.3	128.0	-6.7
10,510	87.2	33.5	120.7	128.0	-7.3

Table 3-4: Radiated Emissions Harmonics/Spurious Test Data

Emission Frequency (MHz)	Analyzer Detector (1 MHz RBW/ 10 MHz VBW)	Measured Analyzer Level (dBuV/m)	Site Correction Factor (dB/m)	Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Limit (dBuV/m)	Average Margin (dB)
10,489.99	Pk	35.6	28.9	64.5	108.0	-46.5	--	--
10,489.99	Av	35.6	28.9	64.5	--	--	88.0	-23.5
10,520.00	Pk	38.5	28.9	67.4	108.0	-40.6	--	--
10,520.00	Av	38.5	28.9	67.4	--	--	88.0	-20.6
21,000.00	Pk	51.4	34.2	85.6	108.0	-22.4	--	--
21,000.00	Av	51.4	34.2	85.6	--	--	88.0	-2.4
21,020.00	Pk	51.8	34.2	86.0	108.0	-22.0	--	--
21,020.00	Av	51.8	34.2	86.0	--	--	88.0	-2.0
31,000.00	Pk	41.7	38.0	79.7	108.0	-28.3	--	--
31,000.00	Av	41.7	38.0	79.7	--	--	88.0	-8.3
31,530.00	Pk	47.0	34.0	81.0	108.0	-27.0	--	--
31,530.00	Av	47.0	34.0	81.0	--	--	88.0	-7.0
42,000.00	Pk	28.6	38.9	67.5	108.0	-40.5	--	--
42,000.00	Av	28.6	39.6	68.2	--	--	88.0	-19.8
42,050.00	Pk	27.3	46.1	73.4	108.0	-34.6	--	--
42,050.00	Av	27.3	46.1	73.4	--	--	88.0	-14.6

Test Personnel:

Daniel W. Baltzell		March 7 and June 21, 2016
Test Engineer	Signature	Dates of Test

4 AC Conducted Emissions - FCC 15.207

4.1 Test Methodology for Conducted Line Emissions Measurements

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50-ohm / 50 microhenry Line Impedance Stabilization Network (EUT LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 100 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. No video filter less than 10 times the resolution bandwidth was used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

4.2 Conducted Line Emissions Test Procedure

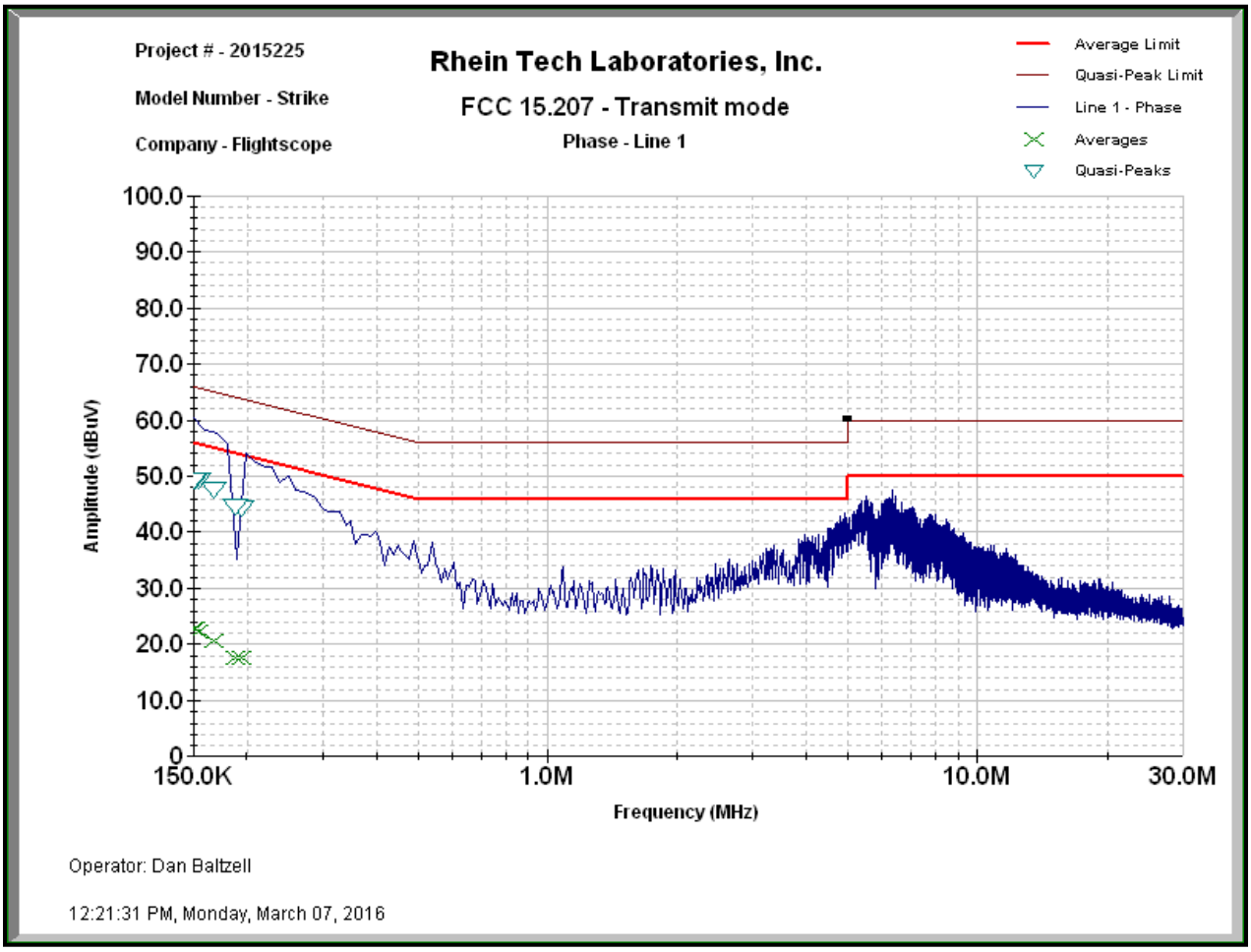
The conducted test was performed with the EUT exercise program loaded, and the emissions were scanned between 150 kHz to 30 MHz on the NEUTRAL SIDE and PHASE SIDE.

Table 4-1: Conducted Line Emissions Test Equipment

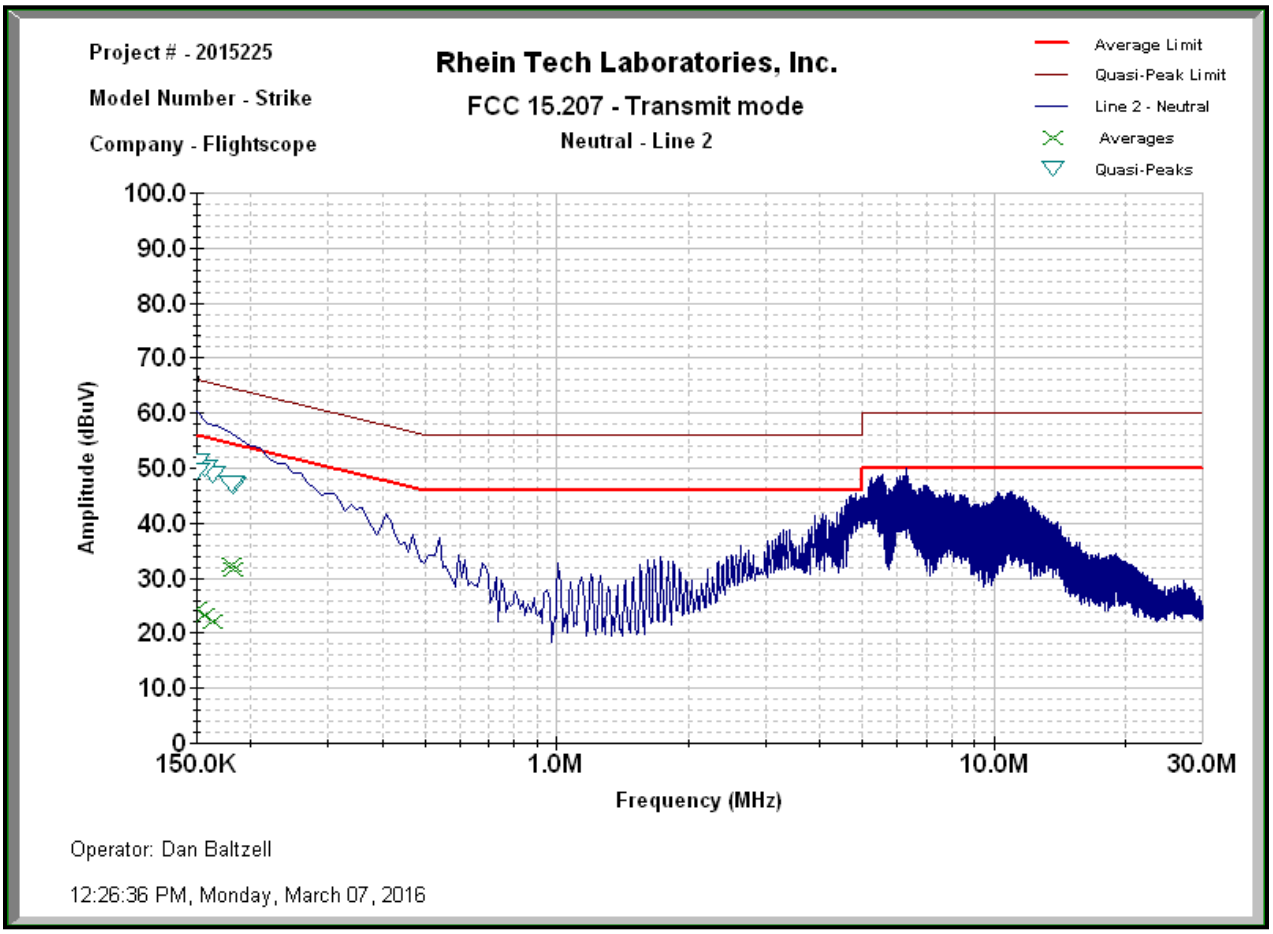
RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	4/21/17
900969	Hewlett Packard	85650A	Quasi-Peak Adapter	2412A00414	7/8/16
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	4/21/17
901083	AFJ International	LS16	16A LISN (110 V)	16010020080	3/11/17
N/A	Rhein Tech Laboratories, Inc.	Automated Emissions Tester	Emissions Testing Software Rev. 14.0.2	N/A	N/A

4.3 Conducted Line Emissions Test Data

Plot 4-1: Conducted Emissions (Phase Side)



Plot 4-2: Conducted Emissions (Neutral Side)



Test Personnel:

Daniel Baltzell		March 7, 2016
Test Engineer	Signature	Date of Test

5 Conclusion

The data in this measurement report shows that the EUT as tested, FlightScope (Pty) Ltd., Model: STRIKE, FCC ID: QXP-32482, complies with the applicable requirements of Parts 2 and 15 of the FCC rules and regulations.