



Engineering and Testing for EMC and Safety Compliance



Accredited under A2LA Testing Certificate # 2653.01

### FCC Part 15.231 Certification Application Report

<b>Test Lab:</b> Rhein Tech Laboratories, Inc. Phone: 703-689-0368 360 Herndon Parkway Fax: 703-689-2056 Suite 1400 Web: <a href="http://www.rheintech.com">www.rheintech.com</a> Herndon, VA 20170 Email: <a href="mailto:atcbinfo@rheintech.com">atcbinfo@rheintech.com</a>		<b>Applicant:</b> Sequel Technologies, LLC Phone: 651-342-0390 8014 Olson Memorial Highway Suite 401 Golden Valley, MN 55427 Contact: Ted Nesse	
<b>FCC ID</b>	V4X-SMKX01	<b>Test Report Date</b>	April 10, 2008
<b>Platform</b>	N/A	<b>RTL Work Order Number</b>	2008058
<b>Model #</b>	STWS-SMK	<b>RTL Quote Number</b>	QRTL08-169
<b>FCC Classification</b>			
DSC – Part 15 Security/Remote Control Transmitter			
<b>FCC Rule Part(s)</b>			
Part 15.231: Periodic operation in the band 40.66 – 40.70 MHz and above 70 MHz (10-01-07)			
<b>Procedure or Other Guidance</b>			
ANSI C63.4-2003 Standard for Methods of Measurement of Radio-Noise Emissions			
<b>Digital Interface Information</b>			
Digital Interface was found to be compliant			
<b>Receiver Information</b>			
Receiver was found to be compliant			
<b>Frequency Range (MHz)</b>			
319.5 and 345.0		<b>Output Power (W)</b>	N/A
		<b>Frequency Tolerance</b>	N/A
		<b>Emission Designator</b>	N/A

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. Modifications made to the equipment during testing in order to achieve compliance with these standards are listed in the report.

Furthermore, there was no deviation from, additions to, or exclusions from the applicable parts of FCC Part 2, FCC Part 15 and ANSI C63.4.

Signature: 

Date: April 10, 2008

Typed/Printed Name: Desmond A. Fraser

Position: President

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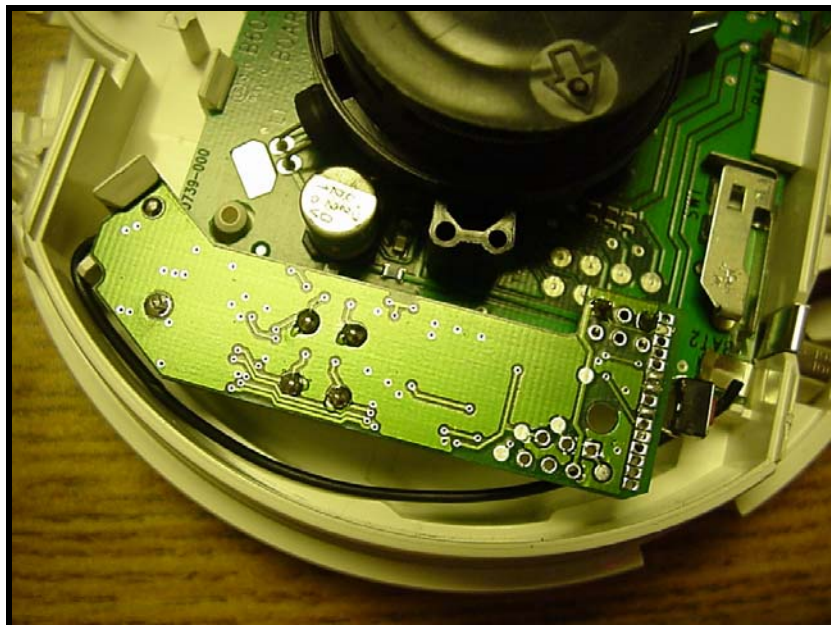
## **1 General Information**

### **1.1 Scope**

FCC Rules Part 15.231: Periodic operation in the band 40.66–40.70 MHz and above 70 MHz.

### **1.2 Modifications**

The wire antenna had to be reoriented to mitigate failing emissions. It was moved such that the end was tucked under and in towards the board as shown below. The manufacturer was informed of this fact and understands that all production units must have the antenna oriented in the exact same way to have a compliant device.



### **1.3 Test Facility**

The open area test site and conducted measurement facility used to collect the radiated data is located at Rhein Tech Laboratories, Inc. (RTL), 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 2003).

### **1.4 Related Submittal(s)/Grant(s)**

This is an original certification application for Sequel Technologies, LLC Model STWS-SMK, FCC ID: V4X-SMKX01.

## 2 Test Information

### 2.1 Test Justification

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The EUT's frequencies were tested and investigated from 9 kHz to the 10<sup>th</sup> harmonic. The test results relate only to the item that was tested.

The antenna transmits, receives, and is externally attached. The IF, LO, and up to the 2<sup>nd</sup> LO, were investigated and tested, and found to be compliant for unintentional emissions compliance.

### 2.2 Exercising the EUT

The EUT was adapted to continuously transmit with a 30 ms long train of pulses within 100 ms for testing purposes. The carrier was also checked to verify that the information was being transmitted. The unit was reprogrammed for normal operation for the duty cycle plots and transmission requirement of 15.231(a)(2).

There were no deviations from the test standard(s) and/or methods.

### 2.3 Test Result Summary

**Table 2-1: Test Result Summary with FCC Rules and Regulations**

Standard	Test	Pass/Fail Or N/A
FCC 15.231(a)(2)	Transmitter Deactivation	Pass
FCC 15.231(b)	Radiated Emissions	Pass
FCC 15.231(c)	20 dB Bandwidth	Pass

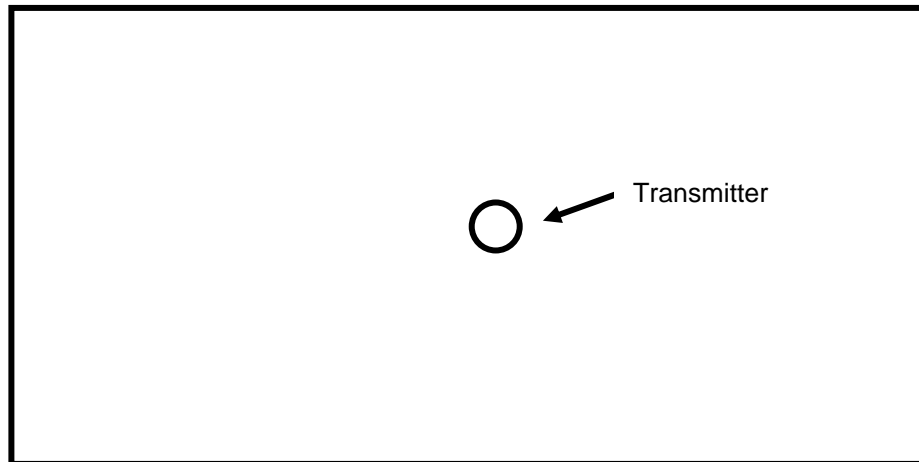
### 2.4 Test System Details

The test sample was received by RTL on March 3 and March 17, 2008. The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system, are shown in the following table.

**Table 2-2: Equipment Under Test (EUT)**

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
Transmitter	Sequel Technologies	STWS-SMK	N/A	V4X-SMKX01	N/A	18350

## 2.5 Configuration of Tested System



**Figure 2-1: Worst Case Configuration of System under Test**

## 3 Conducted Limits – FCC §15.207

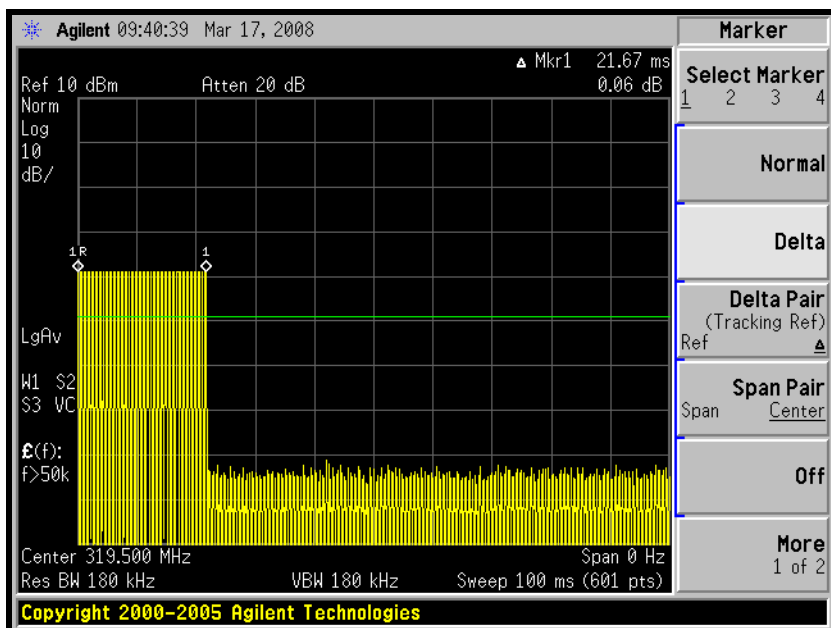
No conducted emissions were performed since the device is battery operated.

## 4 Duty Cycle Calculation - FCC §15.35(c)

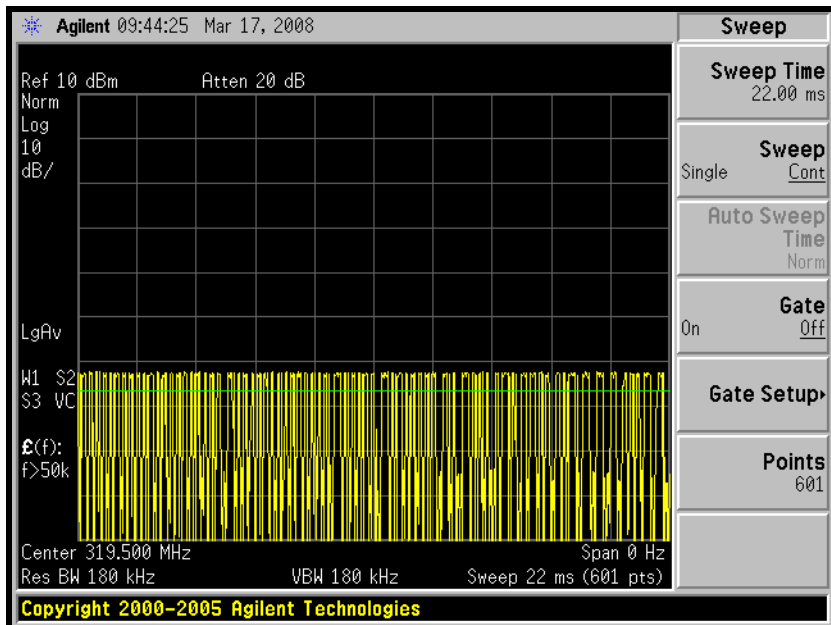
A standard transmission consists of firmware limiting the timing to a 10ms pulse within a 100ms timeframe.

$$20 \log (10/100) = -20 \text{ dB}$$

**Plot 4-1: Total Pulse Train Length – 21.67 ms**



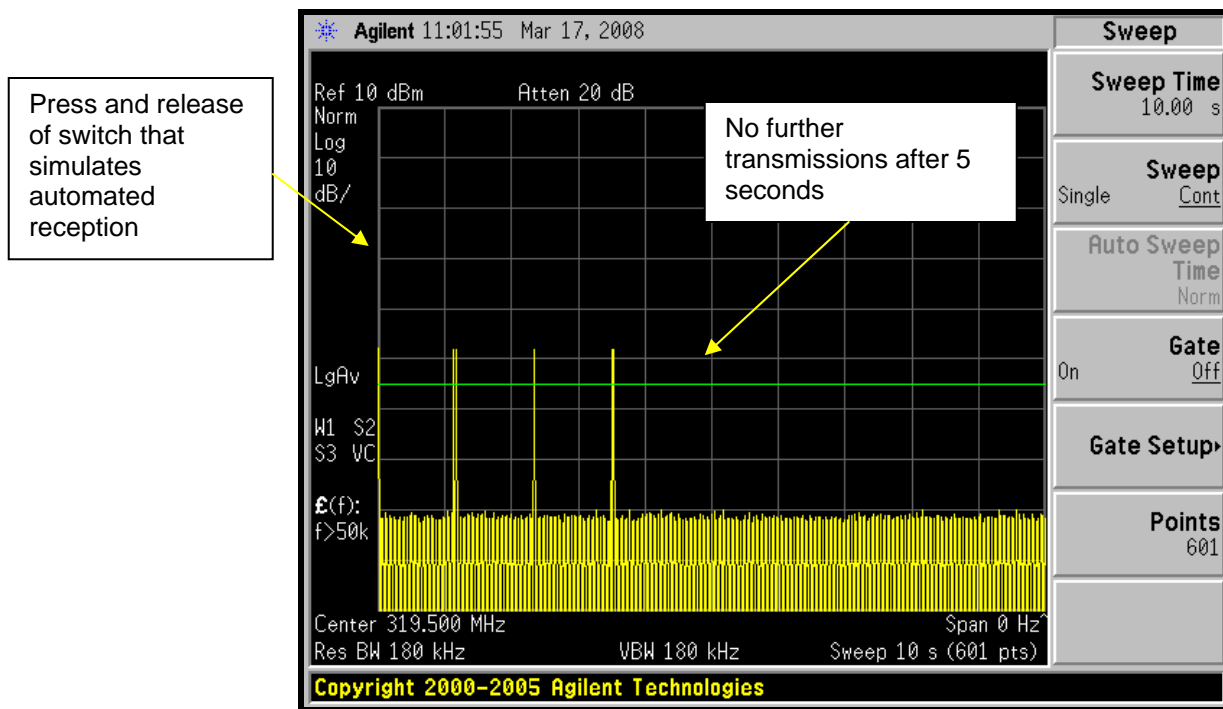
**Plot 4-2: Total Pulse on Time within 21.67 ms Pulse Train Less than 47%**



## 5 Transmitter Deactivation – FCC §15.231(a)(2)

A transmitter activated automatically shall cease transmission within 5 seconds after activation.

**Plot 5-1: Transmitter Deactivation**



## 6 Modulated Bandwidth – FCC §15.231(c)

### 6.1 Modulated Bandwidth Test Procedure

The minimum 20 dB bandwidth was measured using a 50 ohm spectrum analyzer with the resolution bandwidth set at 100 KHz, and the video bandwidth set at 1 MHz. The spectrum analyzer's display line was set to -20 dB using max hold until the spectrum was filled and a plot taken.

### 6.2 FCC §15.231(c) Limits

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

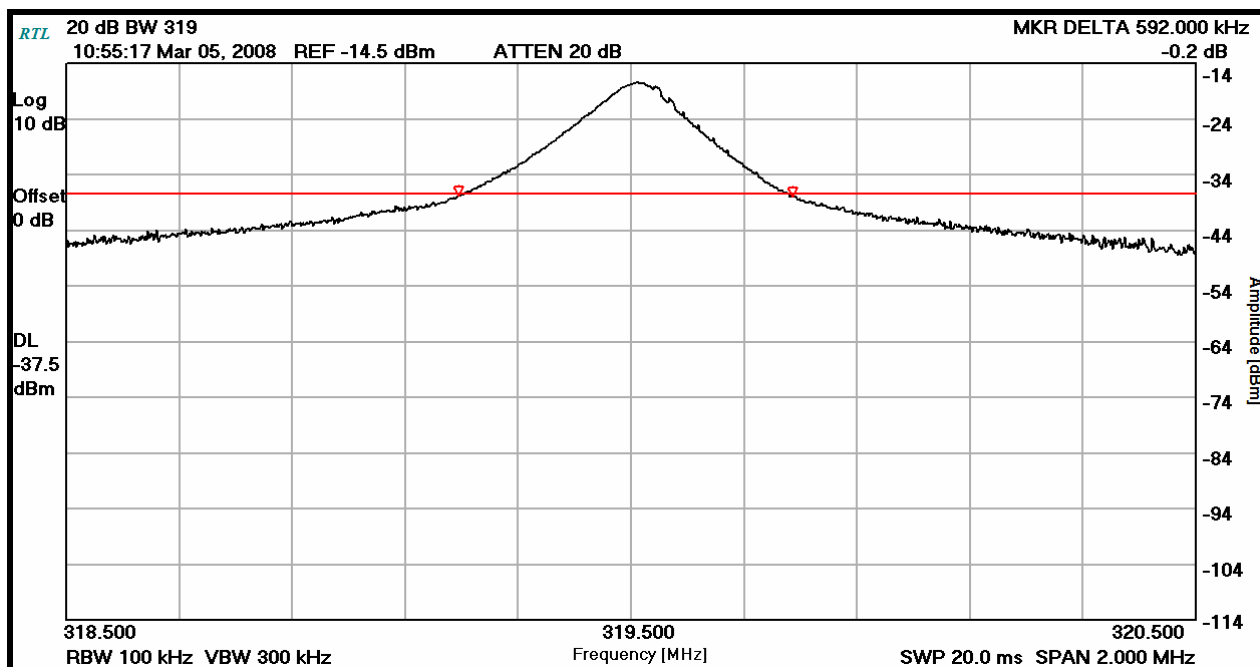


### 6.3 Modulated Bandwidth Test Data

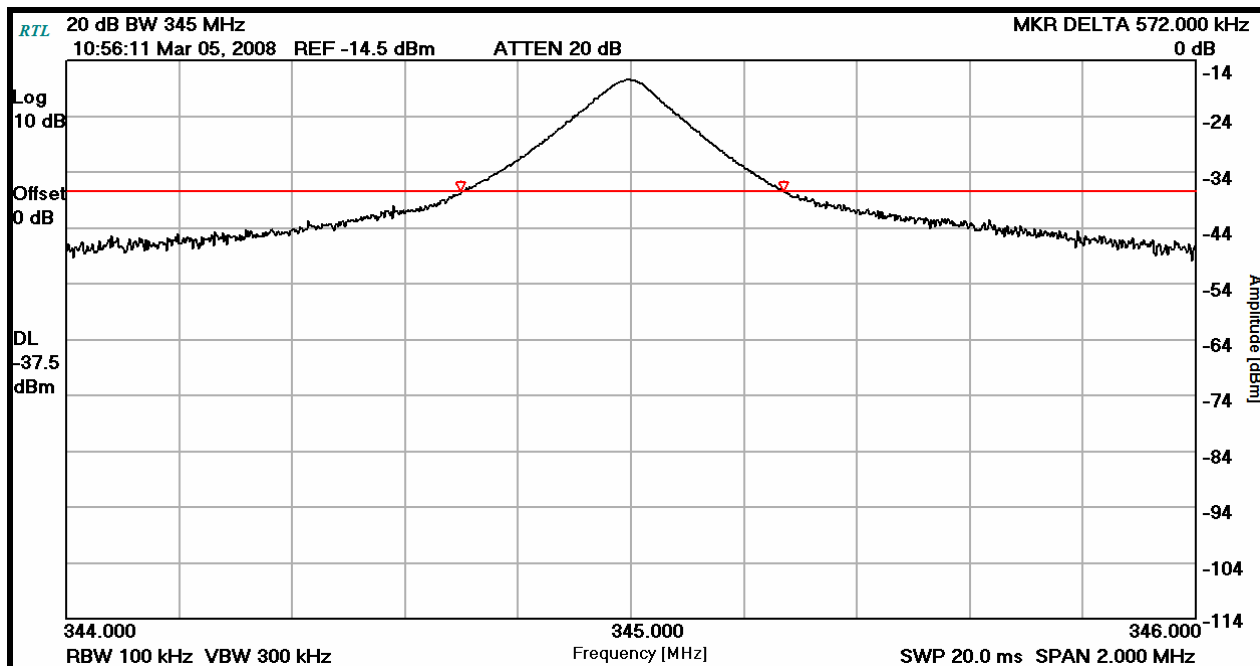
Table 6-1: 20 dB Modulated Bandwidths

Frequency (MHz)	20 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)
319.5	592	0.25% of 319500 = 798.75	206.75
345.0	572	0.25% of 345000 = 862.5	290.5

Plot 6-1: Modulated Bandwidth – 319.5 MHz




**Plot 6-2: Modulated Bandwidth – 345.0 MHz**



**Table 6-2: Modulated Bandwidth Test Equipment**

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	5/22/08

**Test Personnel:**

Daniel Baltzell Test Engineer	 Signature	March 5, 2008 Date of Test
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## 7 Radiated Emissions – FCC §15.209, §15.231

### 7.1 Radiated Fundamental Emissions Test Procedure

Radiated emissions of the fundamentals were tested at three meters, and meet the requirements of average mode, and 20 dB higher in peak mode. The limit is calculated from a linear interpolation between 3,750 and 12,500 uV/m, and from 260 - 470 MHz. The EUT was tested in all three orthogonal planes. Measurement was based on a peak detector and an average level was calculated. The average level was compared to the average limit as per 15.231(b) and the peak level was compared to the average limit + 20 dB per 15.35(b).

#### 7.1.1 Radiated Fundamental Emissions Limits Test Data

**Table 7-1: Radiated Fundamental Emissions**

Frequency (MHz)	Analyzer Reading (dBuV)	Polarity	Site Correction Factor (dBm)	Peak Level Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Duty Cycle Correction (dB)	Calculated Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
319.5	105.5	H	-10.8	94.7	95.9	-1.2	-20.0	74.7	75.9	-1.2
319.5	102.8	V	-10.8	92.0	95.9	-3.9	-20.0	72.0	75.9	-3.9
345.0	103.5	H	-10.0	93.5	97.3	-3.8	-20.0	73.5	77.3	-3.8
345.0	104.6	V	-10.0	94.6	97.3	-2.7	-20.0	74.6	77.3	-2.7

### 7.2 Radiated Harmonics/Spurious Emissions – FCC §15.231

#### 7.2.1 Radiated Emissions Harmonics/Spurious Test Procedure

Radiated emissions of the harmonics were tested at three meters. The EUT was tested in the three orthogonal planes with the receive antenna in both polarities.

## 7.2.2 Radiated Harmonics/Spurious Emissions Test Data

**Table 7-2: Radiated Harmonics/Spurious Emissions – 319.5 MHz**

Frequency (MHz)	Analyzer Reading (dBuV)	Polarity	Site Correction Factor (dBm)	Peak Level Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Duty Cycle Correction (dB)	Calculated Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
639.0	65.7	V	-8.1	57.6	75.9	-18.3	-20.0	37.6	55.9	-18.3
639.0	70.2	H	-8.1	62.1	75.9	-13.8	-20.0	42.1	55.9	-13.8
958.0	51.5	V	-3.5	48.0	75.9	-27.9	-20.0	28.0	55.9	-27.9
958.5	53.4	H	-3.5	49.9	75.9	-26.0	-20.0	29.9	55.9	-26.0
2556.0	40.6	V	-0.7	39.9	75.9	-36.0	-20.0	19.9	55.9	-36.0
2875.5	39.9	V	0.1	40.0	75.9	-35.9	-20.0	20.0	55.9	-35.9

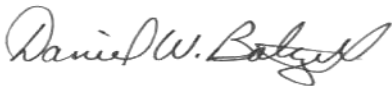
**Table 7-3: Radiated Harmonics/Spurious Emissions – 345.0 MHz**

Frequency (MHz)	Analyzer Reading (dBuV)	Polarity	Site Correction Factor (dBm)	Peak Level Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Duty Cycle Correction (dB)	Calculated Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
690.0	63.4	V	-7.6	55.8	77.3	-21.5	-20.0	35.8	57.3	-21.5
690.0	63.5	H	-7.6	55.9	77.3	-21.4	-20.0	35.9	57.3	-21.4
2070.0	56.7	V	-0.5	56.2	77.3	-21.1	-20.0	36.2	57.3	-21.1
2415.0	57.3	H	-0.9	56.4	77.3	-20.9	-20.0	36.4	57.3	-20.9
2760.0	59.3	H	-0.4	58.9	77.3	-18.4	-20.0	38.9	57.3	-18.4
2760.0	59.4	V	-0.4	59.0	77.3	-18.3	-20.0	39.0	57.3	-18.3

**Table 7-4: Radiated Emissions Test Equipment**

RTL Asset	Manufacturer	Model	Part Type	Serial Number	Calibration Date
900791	Chase	CBL6111B	Bilog Antenna (30 MHz – 2000 MHz)	N/A	9/21/08
901365	MITEQ	JS4-00102600-41-5P	Amplifier, 0.1-26 GHz, 30 dB gain	N/A	10/8/08
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	6/14/10
901215	Hewlett Packard	8596EM	Portable Spectrum Analyzer (9 kHz – 12.8 GHz)	3826A00144	10/17/08
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	10/5/08
901425	Insulated Wire Inc.	KPS-1503-2400-KPS	RF cable, 20'	NA	10/5/08
900878	Rhein Tech Laboratories	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901242	Rhein Tech Laboratories	WRT-000-0003	Wood rotating table	N/A	Not Required

**Test Personnel:**

Daniel Baltzell Test Engineer	 Signature	March 5 and 20, 2008 Dates of Tests
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**8 Conclusion**

The data in this measurement report shows that Sequel Technologies, LLC Model STWS-SMK; FCC ID: V4X-SMKX01, complies with all the applicable requirements of Parts 2 and 15 of the FCC Rules.