Engineering and Testing for EMC and Safety Compliance

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FCC Part 15.231 Certification Application Report

Test Lab:	Applicant:
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FCC ID	V4X-EXTX01	**Test Report Date**	March 24, 2008
Platform	N/A	**RTL Work Order Number**	2008040
Model #	STPF-EXT	**RTL Quote Number**	QRTL08-147

FCC Classification	DSC – Part 15 Security/Remote Control Transmitter
FCC Rule Part(s)	Part 15.231: Periodic operation in the band 40.66 – 40.70 MHz and above 70 MHz (10-01-07)
Digital Interface Information	Digital Interface was found to be compliant
Receiver Information	Receiver was found to be compliant

Frequency Range (MHz)	Output Power (W)	Frequency Tolerance	Emission Designator
319.5 and 345.0	N/A	N/A	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: March 24, 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

N/A

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 STPF-EXT, FCC ID: V4X-EXTX01.

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 10th 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 2nd 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 15.207	AC Conducted Emissions	Pass
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

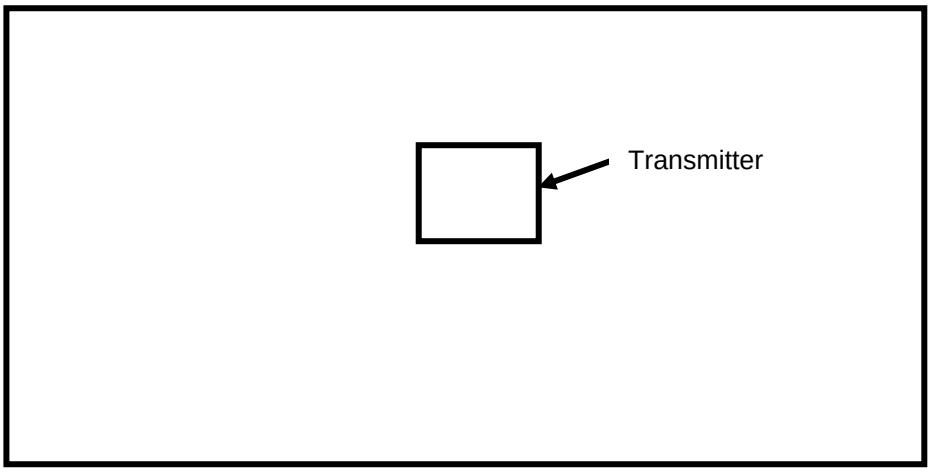
The test sample was received by RTL on March 3, 2008. The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system, are shown in the following table.

Table 2-2: Equipment Under Test (EUT)

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
Transmitter	Sequel Technologies	STPF-EXT	N/A	V4X-EXTX01	N/A	18349

2.5 Configuration of Tested System

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

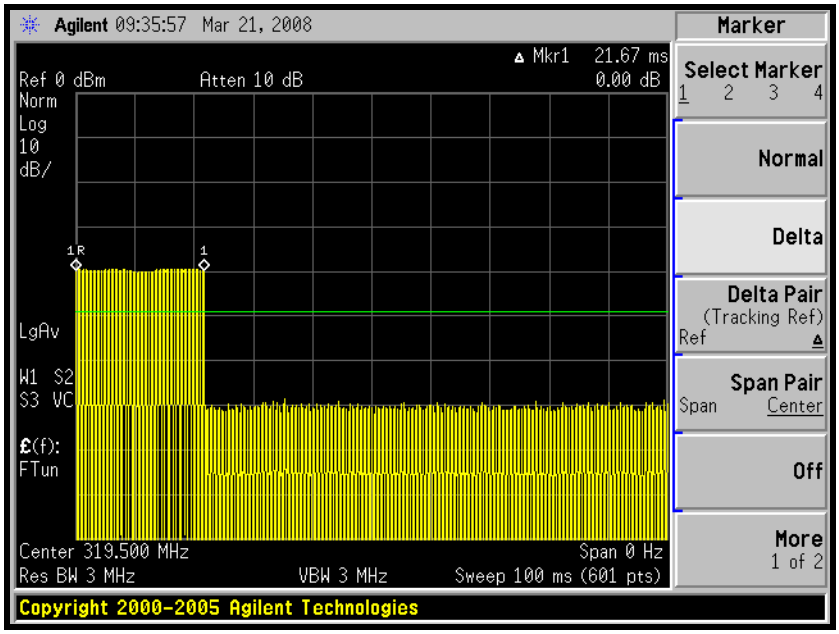


3 Duty Cycle Calculation - FCC §15.35(c)

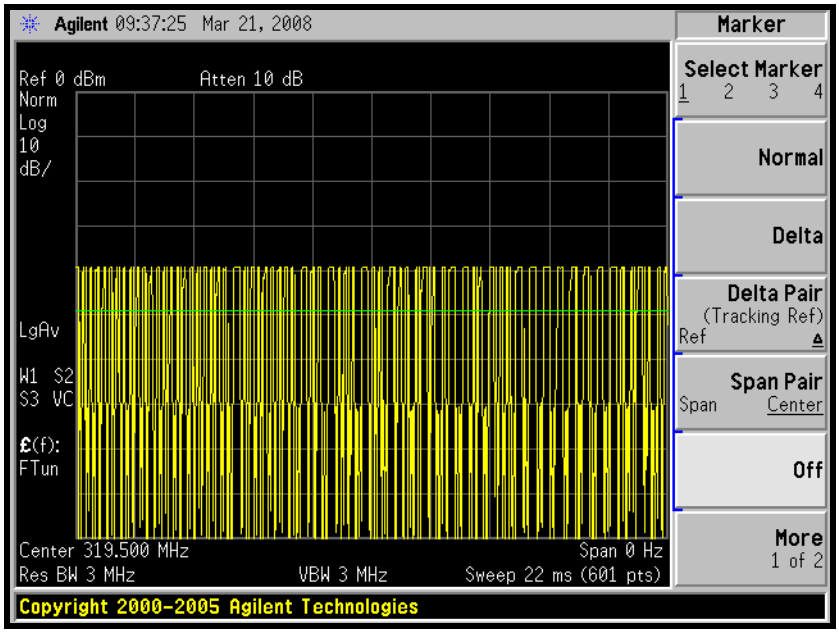
A standard transmission consists of firmware limiting the timing to a 10ms pulse within a 100ms timeframe.

20 log (10/100) = -20 dB

Plot 3-1: Total Pulse Train Length – 21.67 ms



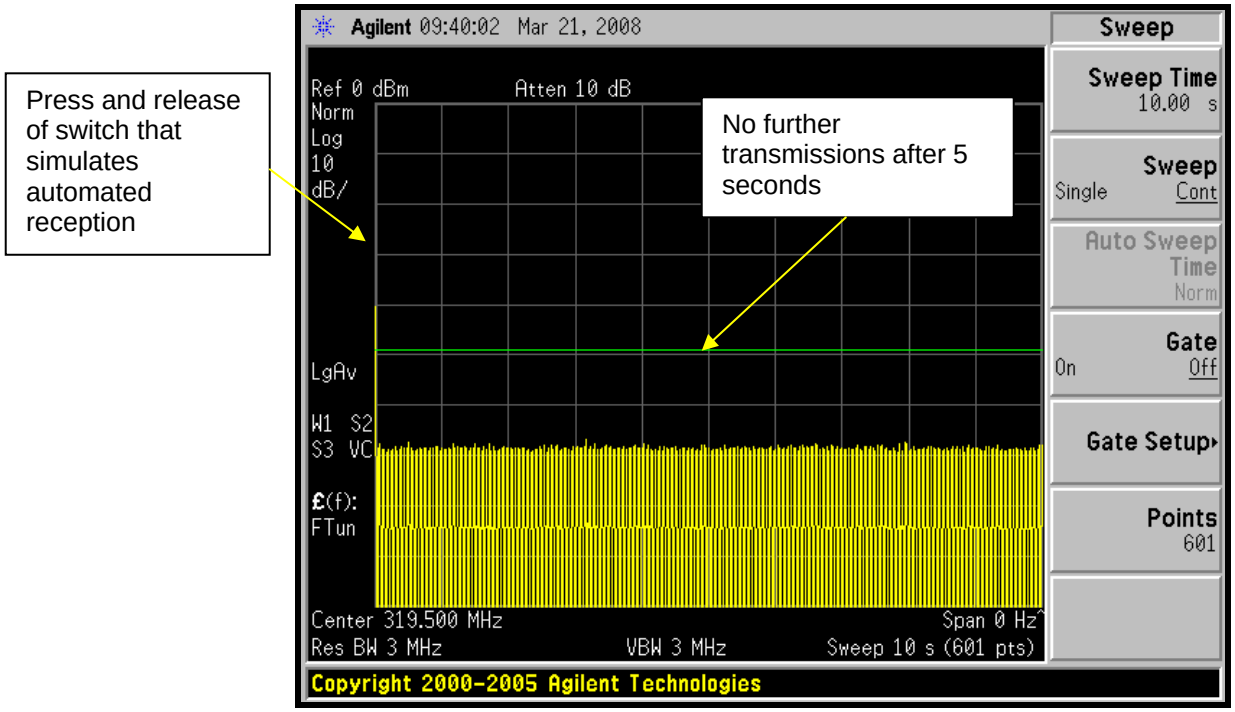
Plot 3-2: Total Pulse on Time within 21.67 ms Pulse Train Less than 47%



4 Transmitter Deactivation – FCC §15.231(a)(2)

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

Plot 4-1: Transmitter Deactivation



5 Modulated Bandwidth – FCC §15.231(c)

5.1 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.

5.2 FCC §15.231(c) Limits

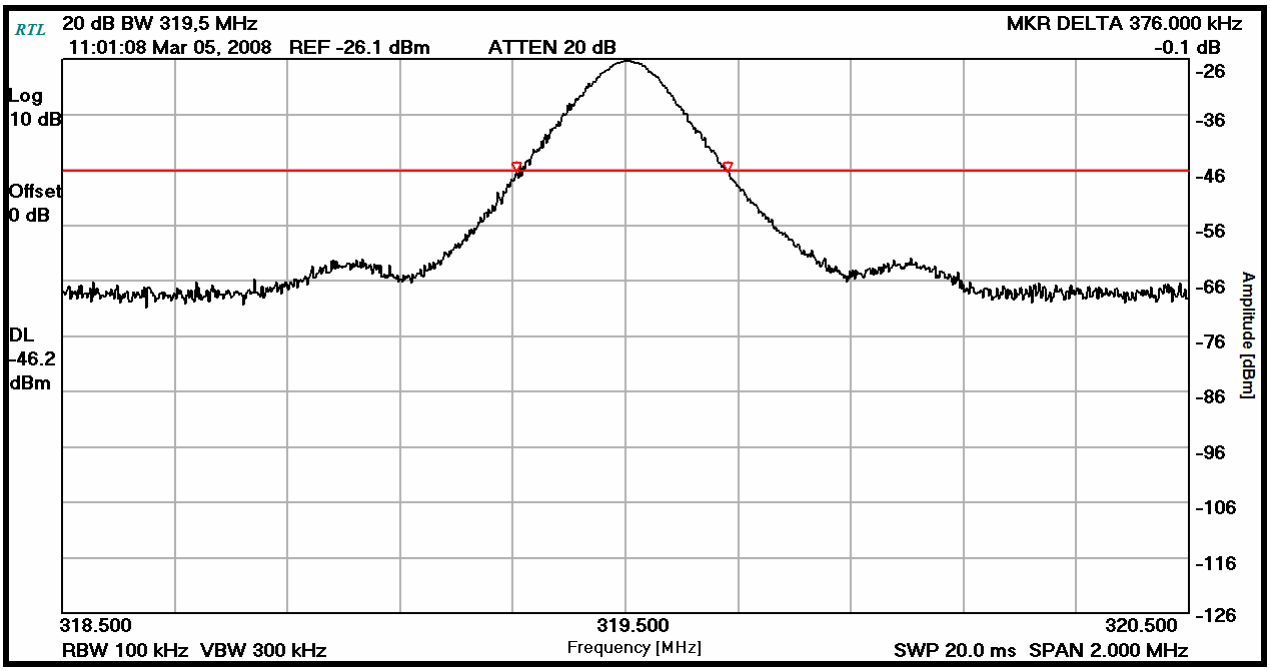
The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated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

5.3 Modulated Bandwidth Test Data

Table 5-1: 20 dB Modulated Bandwidths

Frequency (MHz)	20 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)
319.5	376	0.25% of 319500 = 798.75	422.75
345.0	376	0.25% of 345000 = 862.5	486.5

Plot 5-1: Modulated Bandwidth – 319.5 MHz



Plot 5-2: Modulated Bandwidth – 345.0 MHz

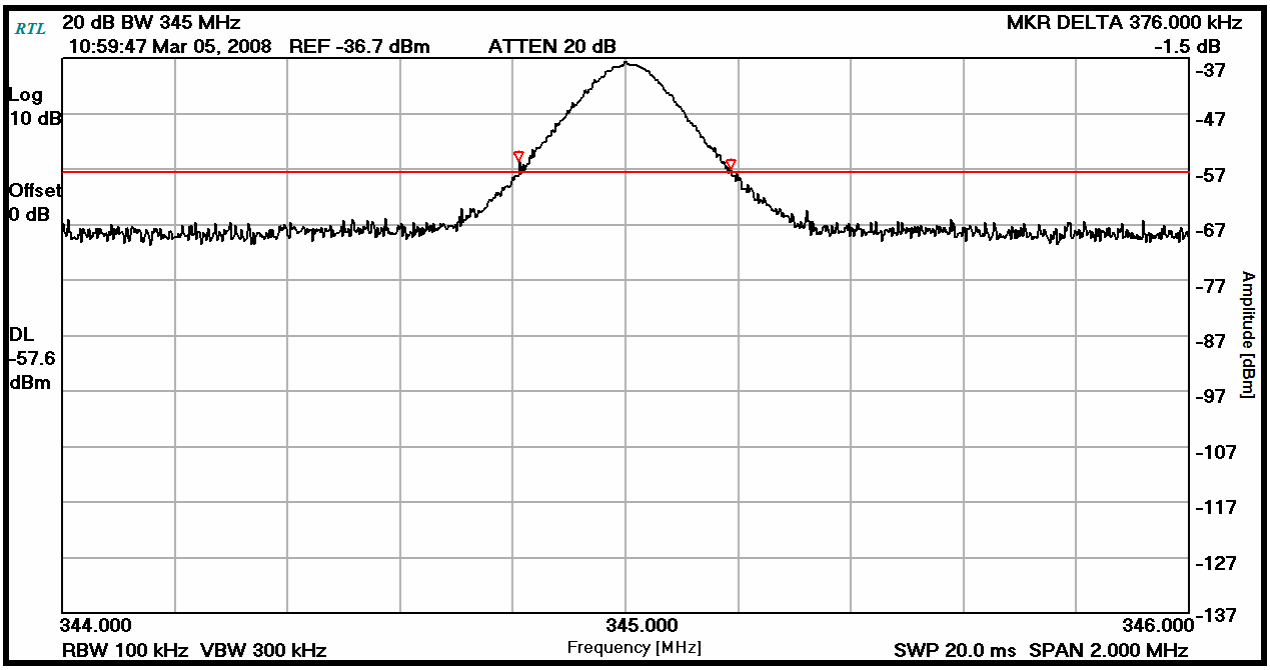


Table 5-2: Modulated Bandwidth Test Equipment

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		March 5, 2008
Test Engineer	Signature	Date of Test

6 Radiated Emissions – FCC §15.209, §15.231

6.1 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 CISPR quasi-peak detector and compared to the average limit as per 15.231(b).

6.1.1 Radiated Fundamental Emissions Limits Test Data

Table 6-1: 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	77.3	H	17.3	94.6	95.9	-1.3	-20.0	74.6	75.9	-1.3
319.5	71.8	V	17.3	89.1	95.9	-6.8	-20.0	69.1	75.9	-6.8
345.0	67.2	H	18.1	85.3	97.3	-12.0	-20.0	65.3	77.3	-12.0
345.0	64.4	V	18.1	82.5	97.3	-14.8	-20.0	62.5	77.3	-14.8

6.2 Radiated Harmonics/Spurious Emissions – FCC §15.231

6.2.1 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.

6.2.2 Radiated Harmonics/Spurious Emissions Test Data

Table 6-2: 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	63.3	V	-8.1	55.2	75.9	-20.7	-20.0	35.2	55.9	-20.7
639.0	68.6	H	-8.1	60.5	75.9	-15.4	-20.0	40.5	55.9	-15.4
958.0	51.0	V	-3.5	47.5	75.9	-28.4	-20.0	27.5	55.9	-28.4
958.5	64.8	H	-3.5	61.3	75.9	-14.6	-20.0	41.3	55.9	-14.6
1278.0	42.3	H	-1.0	41.3	75.9	-34.6	-20.0	21.3	55.9	-34.6
1917.0	53.8	V	4.2	58.0	75.9	-17.9	-20.0	38.0	55.9	-17.9

Table 6-3: 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	53.8	V	-7.6	46.2	77.3	-31.1	-20.0	26.2	57.3	-31.1
690.0	57.2	H	-7.6	49.6	77.3	-27.7	-20.0	29.6	57.3	-27.7
1035.0	37.0	V	-2.9	34.1	77.3	-43.2	-20.0	14.1	57.3	-43.2
1035.0	44.8	H	-2.9	41.9	77.3	-35.4	-20.0	21.9	57.3	-35.4
1380.0	33.6	H	-0.3	33.3	77.3	-44.0	-20.0	13.3	57.3	-44.0
1725.0	34.7	H	2.5	37.2	77.3	-40.1	-20.0	17.2	57.3	-40.1

Table 6-4: 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		March 5 and 20, 2008
Test Engineer	Signature	Dates of Tests

7 Conducted Emissions

7.1 Site and Test Description

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 (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 100 kHz 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. Video filter less than 10 times the resolution bandwidth is not used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, 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 limits were measured and have been recorded. The limits for Class A and Class B are contained therein.

7.2 Test Limits

Class A Line-Conducted Emissions		
	Limit (dBµV)	
Frequency (MHz)	Quasi-Peak	Average
0.15 to 0.50	79	66
0.50 to 30.0	73	60

Class B Line-Conducted Emissions		
	Limit (dBµV)	
Frequency (MHz)	Quasi-Peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5.00	56	46
5.00 to 30.00	60	50

7.3 Conducted Emissions Test Results

Table 7-1: Conducted Emissions – Neutral (Line 1)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	CISPR B QP Limit (dBuV)	CISPR B QP Margin (dBuV)	CISPR B AV Limit (dBuV)	CISPR B AV Margin (dBuV)	Pass/ Fail
0.153	Pk	28.0	0.2	28.2	65.8	-37.6	55.8	-27.6	Pass
7.690	Pk	13.5	1.5	15.0	60.0	-45.0	50.0	-35.0	Pass
15.000	Pk	39.4	2.1	41.5	60.0	-18.5	50.0	-8.5	Pass
16.270	Pk	26.6	2.2	28.8	60.0	-31.2	50.0	-21.2	Pass
22.460	Pk	36.0	2.5	38.5	60.0	-21.5	50.0	-11.5	Pass
24.330	Pk	28.7	2.5	31.2	60.0	-28.8	50.0	-18.8	Pass
29.930	Pk	29.2	2.3	31.5	60.0	-28.5	50.0	-18.5	Pass

Table 7-2: Conducted Emissions – Hot (Line 2)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	CISPR B QP Limit (dBuV)	CISPR B QP Margin (dBuV)	CISPR B AV Limit (dBuV)	CISPR B AV Margin (dBuV)	Pass/ Fail
0.150	Pk	27.4	0.2	27.6	66.0	-38.4	56.0	-28.4	Pass
15.000	Pk	37.5	2.1	39.6	60.0	-20.4	50.0	-10.4	Pass
16.190	Pk	23.7	2.2	25.9	60.0	-34.1	50.0	-24.1	Pass
22.310	Pk	35.3	2.5	37.8	60.0	-22.2	50.0	-12.2	Pass
24.250	Pk	28.1	2.5	30.6	60.0	-29.4	50.0	-19.4	Pass
28.280	Pk	25.9	2.3	28.2	60.0	-31.8	50.0	-21.8	Pass
29.780	Pk	30.2	2.3	32.5	60.0	-27.5	50.0	-17.5	Pass

Table 7-3: AC Line Conducted Emissions Test Equipment

Barcode	Manufacturer	Model	Part Type	Serial Number	Calibration Due
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 KHz – 6.5 GHz)	3325A00159	3/21/2008
900914	Hewlett Packard	85460A	RF Filter Section, 100 KHz to 6.5 GHz	3330A00107	3/21/2008
901082	AFJ International	LS16	16A LISN	1.6E+10	2/4/2009
N/A	GW Instek	PSS-3203	Programmable Power Supply	B200344	N/A

Test Personnel:

Daniel Baltzell		March 20, 2008
Test Engineer	Signature	Date of Test

8 Conclusion

The data in this measurement report shows that Sequel Technologies, LLC Model STPF-EXT; FCC ID: V4X-EXTX01, complies with all the applicable requirements of Parts 2 and 15 of the FCC Rules.