Excellence in Compliance Testing

Certification Test Report

Test Report

FCC ID: OUECSXCVR1
IC: 6866A-CSXCVR1

FCC Rule Part: 15.249
IC Radio Standards Specification: RSS-210

ACS Report Number: 08-0097-15C

Manufacturer: Paul C. Buff, Inc.
Model: CyberSync Transceiver 1

Test Begin Date: March 25, 2008
Test End Date: April 4, 2008

Report Issue Date: April 11, 2008

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

This report is not be used to claim certification, approval, or endorsement by NVLAP, NIST or any government agency.

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This report contains 16 pages

Table of Contents

Additional Exhibits Included In Filing

Internal Photographs
External Photographs
Test Setup Photographs
Product Labeling
Schematics
Installation/Users Guide
Theory of Operation
BOM (Parts List)
System Block Diagram

1.0 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Industry Canada's Radio Standards Specification RSS-210.

1.2 Product Description

1.2.1 General

The CyberSync Transceiver 1 module is a 2.4 GHz transceiver that is used as a plug in module to provide wireless connectivity between a family of components in a professional photographic flash system. This provides wireless command and control functionality for each component in the system.

Manufacturer Information:
Paul C. Buff, Inc.
2725 Bransford Avenue
Nashville, TN 37204

Test Sample Condition:
The test samples were provided in good working order with no visible defects.

Detailed photographs of the EUT are filed separately with this filing.

1.2.2 Intended Use

The intended use is a plug-in module to provide wireless command and control functionality in a professional photographic flash system.

1.3 Test Methodology and Considerations

The CyberSync Transceiver 1 module was tested stand alone but did utilize a support PCB for power and programming functionality.

2.0 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

The Semi-Anechoic Chamber Test Site, Open Area Test Site (OATS) and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC, Industry Canada and the Japanese Voluntary Control Council for Interference by information technology equipment. In addition, ACS is compliant to ISO 17025 as certified by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program. The following certification numbers have been issued in recognition of these accreditations and certifications:

FCC Registration Number: 894540
Industry Canada Lab Code: IC 4175
VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

NVLAP Lab Code: 200612-0

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chases from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

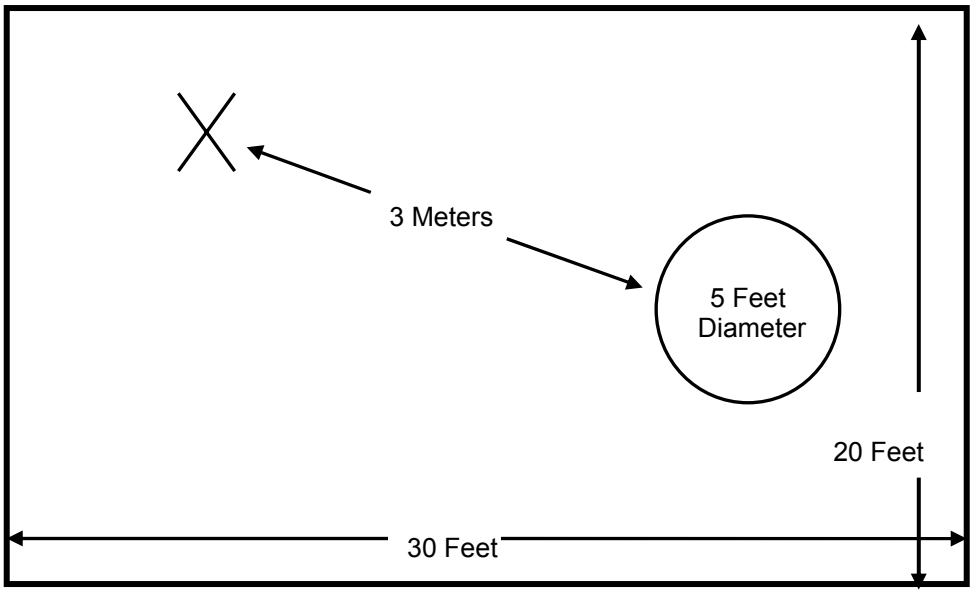

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 2.3-2 below:

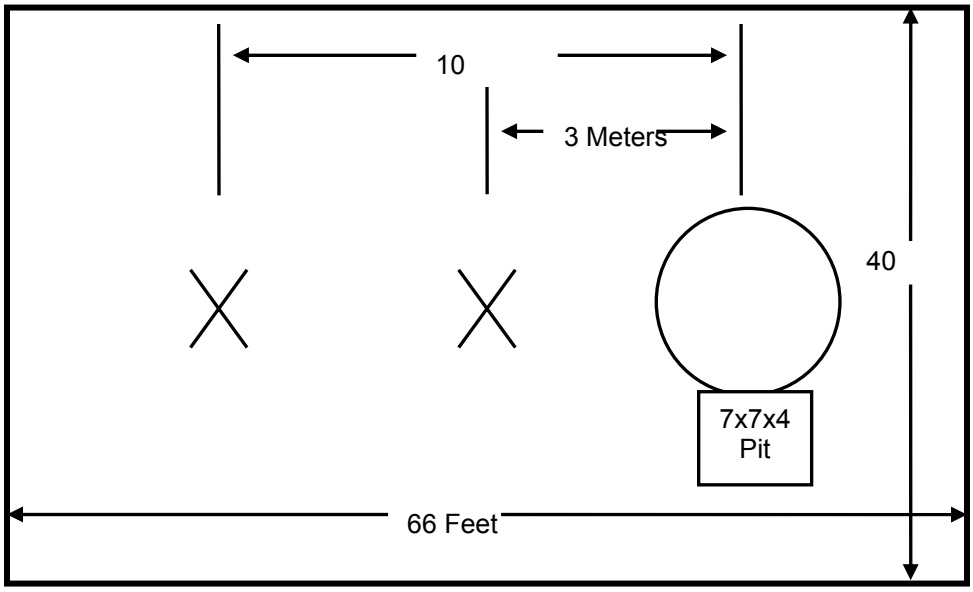

Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 8' solid aluminum horizontal group reference plane (GRP) bonded every 3" to an 8' X 8' vertical ground plane.

The site is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4.

A diagram of the room is shown below in figure 4.1.3-1:

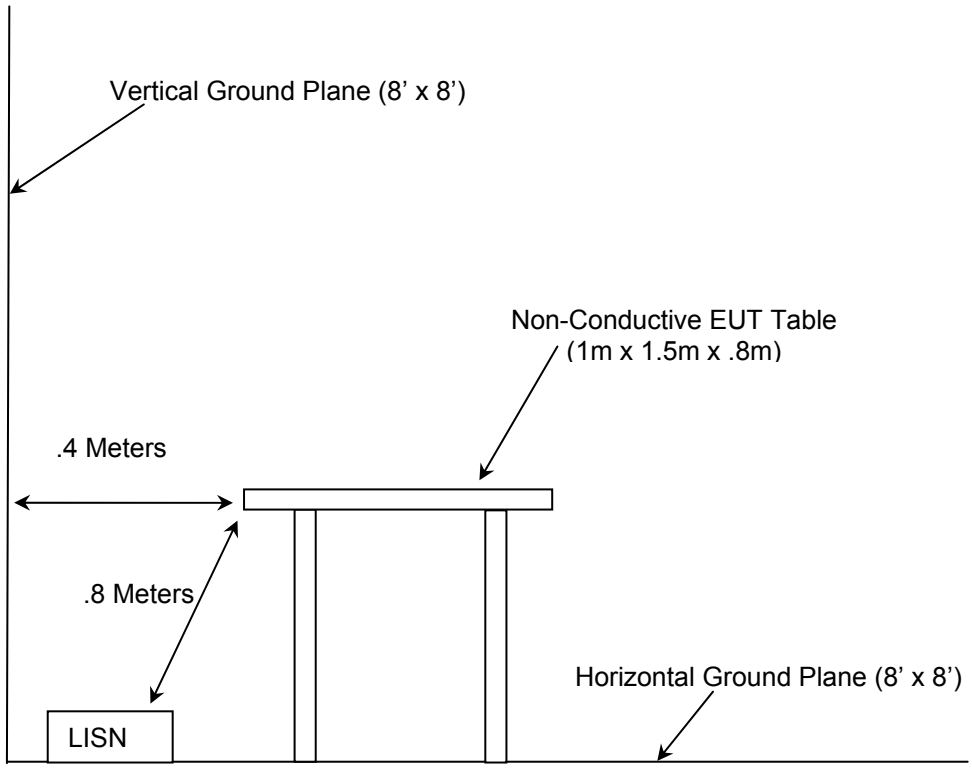

Figure 2.4-1: AC Mains Conducted EMI Site

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2006
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart B: Radio Frequency Devices, Unintentional Radiators, 2006
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2006
- Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 7 June 2007

4.0 LIST OF TEST EQUIPMENT

All test equipment used for regulatory testing is calibrated yearly or according to manufacturer's specifications.

Table 4-1: Test Equipment

Equipment Calibration Information					
ACS#	**Mfg.**	**Eq. type**	**Model**	**S/N**	**Cal. Due**
1	Rohde & Schwarz	Spectrum Analyzers	ESMI - Display	833771/007	10-26-2008
2	Rohde & Schwarz	Spectrum Analyzers	ESMI-Receiver	839587/003	10-26-2008
16	ACS	Cables	Cable	16	05-21-2008
22	Agilent	Amplifiers	8449B	3008A00526	10-25-2008
25	Chase	Antennas	CBL6111	1043	06-06-2008
30	Spectrum Technologies	Antenna	DRH-0118	970102	05-10-2008
73	Agilent	Amplifiers	8447D	2727A05624	12-19-2008
153	EMCO	LISN	3825/2	9411-2268	11-27-2008
167	ACS	Cables	Chamber EMI Cable Set	167	01-04-2009
168	Hewlett Packard	Attenuators	11947A	44829	02-18-2009
282	Microwave Circuits	Filters	H2G020G4	74541	02-25-2009
283	Rohde & Schwarz	Spectrum Analyzers	FSP40	1000033	11-09-2008
291	Florida RF Cables	Cables	SMRE-200W-12.0-SMRE	None	11-21-2008
292	Florida RF Cables	Cables	SMR-290AW-480.0-SMR	None	11-21-2008
321	Hewlett Packard	Amplifiers	HPC 8447D	1937A02809	07-17-2008
338	Hewlett Packard	Amplifiers	8449B	3008A01111	10-24-2008
422	Florida RF Cables	Cables	SMS-200AW-72.0-SMR	0805	02-25-2009

5.0 SUPPORT EQUIPMENT

Table 5-3: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	EUT	Paul C. Buff	CyberSync Transceiver 1	1
2	Support Board	Paul C. Buff	PWB-0084-1	2
3	AC Adapter	CUI Inc.	EPS030100	NA

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

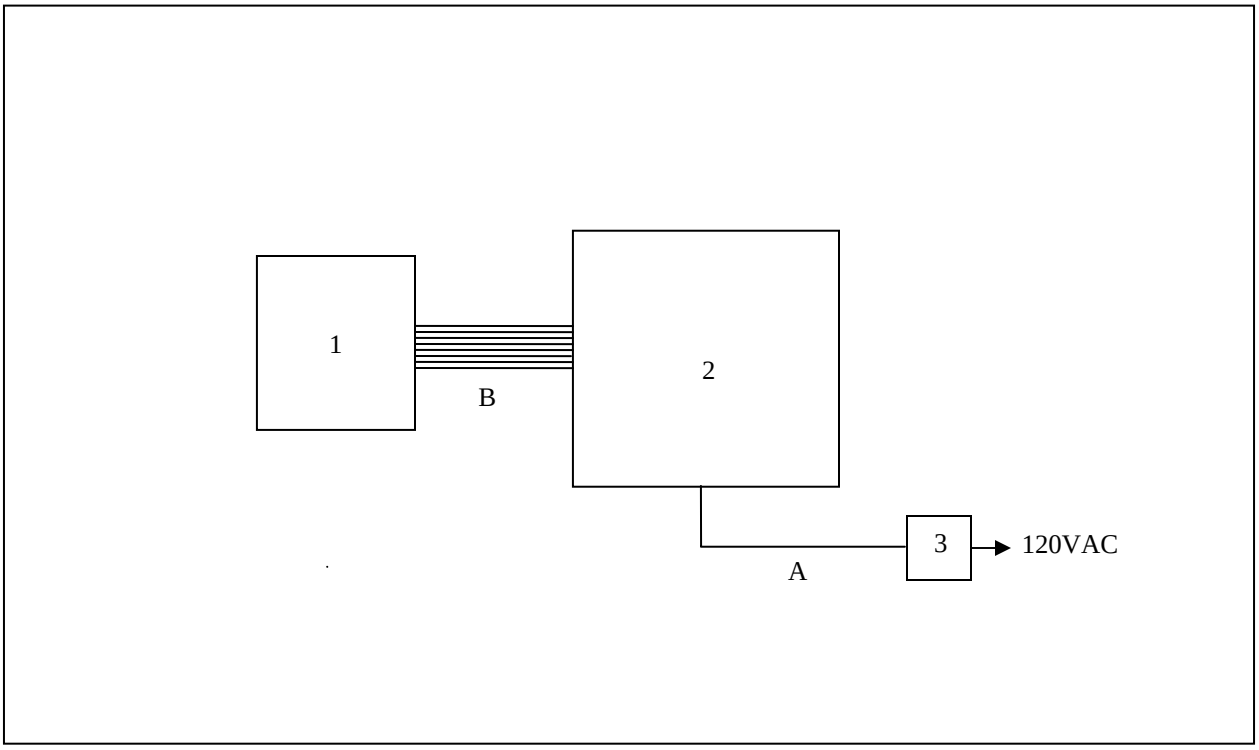

Figure 6-1: EUT Test Setup

Table 6-2: Cable Description

Item #	Type	Length(ft)	Shielded
A	AC Adaptor Cable	6	No
B	(8) unshielded #20 – power and control wire harness	0.5	No

*See Test Setup photographs for additional detail.

7.0 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement

The CyberSync Transceiver 1 uses a PCB trace antenna configured as a quarter wavelength monopole antenna. The estimated gain is 0dBi.

7.2 Power Line Conducted Emissions

7.2.1 Test Methodology

ANSI C63.4 sections 6 and 7 were the guiding documents for this evaluation. Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

7.2.2 Test Results

Results of the test are shown below in and Table 7.2-1.

Table 7.2-1: Conducted EMI Results

Frequency (MHz)	Uncorrected Reading (dBuV)		Total Correction Factor (dB)	Corrected Level (dBuV)		Limit (dBuV)		Margin (dB)		Line
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average	
Line 1										
0.18	38.3	32.5	9.80	48.10	42.30	64.49	54.49	16.4	12.2	FLO
0.37	35.6	28.7	9.80	45.40	38.50	58.50	48.50	13.1	10.0	FLO
0.46	33.8	28	9.80	43.60	37.80	56.69	46.69	13.1	8.9	FLO
0.92	31.3	26	9.80	41.10	35.80	56.00	46.00	14.9	10.2	FLO
1.38	6	-0.7	9.80	15.80	9.10	56.00	46.00	40.2	36.9	FLO
7.26	2.7	-1.6	9.91	12.61	8.31	60.00	50.00	47.4	41.7	FLO
Line 2										
0.18	40	25.5	9.80	49.80	35.30	64.49	54.49	14.7	19.2	FLO
0.37	31.3	22.6	9.80	41.10	32.40	58.50	48.50	17.4	16.1	FLO
0.46	30.4	21.7	9.80	40.20	31.50	56.69	46.69	16.5	15.2	FLO
0.74	24.4	14.4	9.80	34.20	24.20	56.00	46.00	21.8	21.8	FLO
1.11	23.3	14.3	9.80	33.10	24.10	56.00	46.00	22.9	21.9	FLO
1.39	25.1	16.5	9.80	34.90	26.30	56.00	46.00	21.1	19.7	FLO

7.3 Radiated Emissions - Unintentional Radiation

7.3.1 Test Methodology

Radiated emissions tests were performed over the frequency range of 30MHz to 12.5GHz. Measurements of the radiated field strength were made at a distance of 3m from the boundary of the equipment under test (EUT) and the receiving antenna. The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. Radiated measurements above 30MHz and below 1GHz were made with the Spectrum Analyzer's resolution bandwidth set to 120 KHz using a Quasi-peak detector. Above 1GHz, peak and average measurements are taken with the RBW and VBW set to 1MHz and 3MHz for peak and 1MHz and 10Hz for average.

7.3.2 Test Results

Results of the test are given in Table 7.3-1 below:

Table 7.3-1: Radiated Emissions Tabulated Data

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
34.313	---------	16.80	H	-9.66	---------	7.14	--------	40.0	---------	32.86
42.934	---------	17.24	H	-13.87	---------	3.37	--------	40.0	---------	36.63
84.966	---------	15.06	V	-17.81	---------	-2.75	--------	40.0	---------	42.75
119.823	---------	17.89	V	-13.81	---------	4.08	--------	43.5	---------	39.42
129.146	---------	17.46	V	-13.73	---------	3.73	--------	43.5	---------	39.77
197.057	---------	16.89	H	-15.69	---------	1.20	--------	43.5	---------	42.30
331.777	---------	17.95	H	-10.95	---------	7.00	--------	46.0	---------	39.00
489.157	---------	19.22	V	-7.03	---------	12.19	--------	46.0	---------	33.81
703.502	---------	24.56	H	-2.44	---------	22.12	--------	46.0	---------	23.88
942.734	---------	18.99	V	1.76	---------	20.75	--------	46.0	---------	25.25
1500	35.56	24.93	H	-10.09	25.47	14.84	74.0	54.0	48.53	39.16
2800	34.44	23.36	V	-3.82	30.62	19.54	74.0	54.0	43.38	34.46
5470	32.78	21.86	V	4.54	37.32	26.40	74.0	54.0	36.68	27.60
9940	34.89	23.89	V	10.54	45.43	34.43	74.0	54.0	28.57	19.57

* Note: All emissions above 9940 MHz were attenuated below the permissible limit.

7.4 20dB Bandwidth

7.4.1 Test Methodology

The spectrum analyzer span was set to 2 to 3 times the estimated 20 dB bandwidth of the emission. The RBW was to ≥ 1% of the estimated 20 dB bandwidth. The trace was set to max hold with a peak detector active. The Delta function of the analyzer was utilized to determine the 20 dB bandwidth of the emission.

7.4.2 Test Results

The maximum 20dB bandwidth was determined to be 1.12 MHz. The frequency band designated under Part 15.249 is 2400 - 2483.5MHz, therefore the 20dB bandwidth is contained within the frequency band designated under this rule part. Results are shown below in Table 7.4.2-1 and Figures 7.4.2-1 through 7.4.2-3.

Table 7.4.2-1

Frequency (MHz)	20dB Bandwidth (MHz)
2427	1.12
2441	1.12
2457	1.12

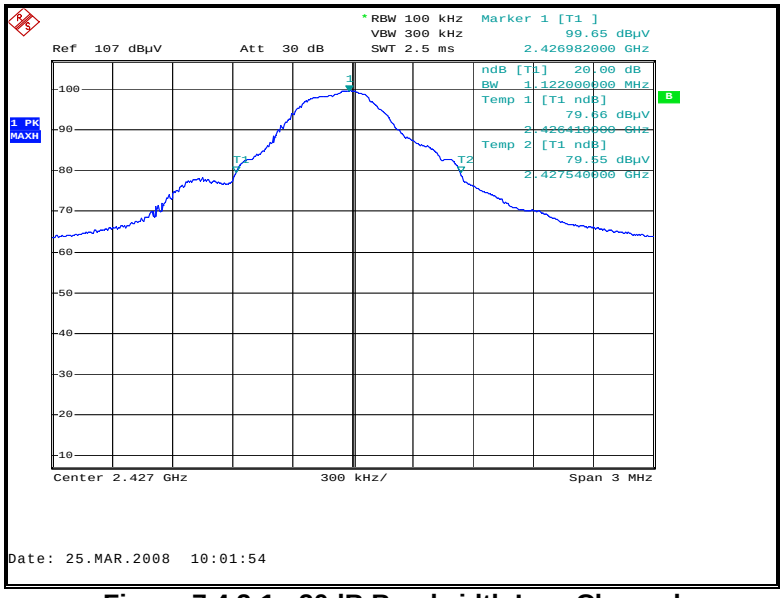

Figure 7.4.2-1: 20dB Bandwidth Low Channel

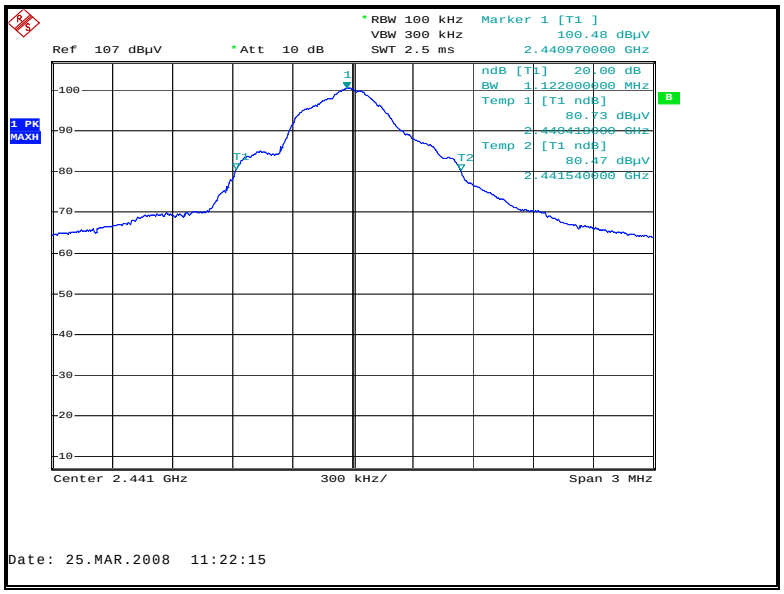

Figure 7.4.2-2: 20dB Bandwidth Mid Channel

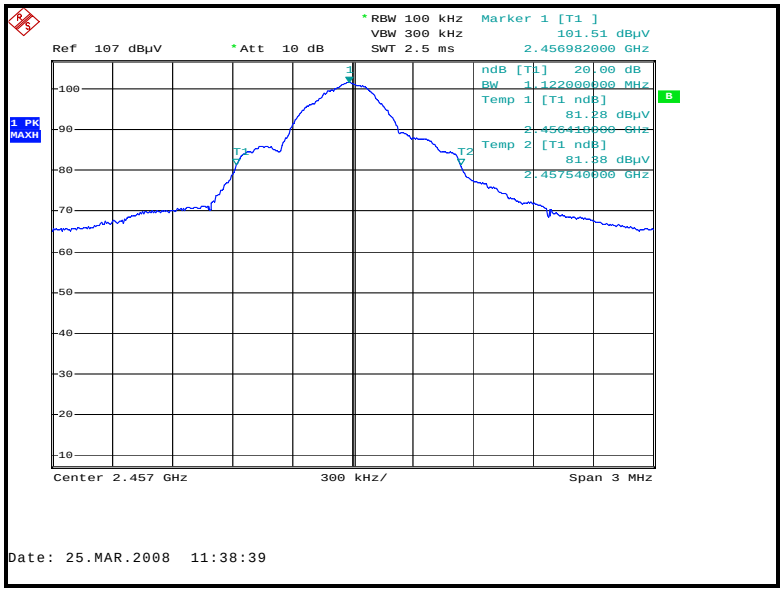

Figure 7.4.2-3: 20dB Bandwidth High Channel

7.5 Fundamental Field Strength

7.5.1 Test Methodology

Radiated measurements of the fundamental field strength were made at the fundamental frequency for low, middle, and high channels.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. Peak measurements were made using an RBW of 1 MHz and a VBW of 3 MHz. The average emissions were determined by correcting the peak emissions for the duty cycle of the EUT. The duty cycle correction and calculation is further described in section 7.6.3.2.

7.5.2 Test Results

Results are shown below in Table 7.5.2-1.

Table 7.5.2-1: Fundamental Field Strength

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel										
2427	92.95	92.95	H	-0.76	92.19	76.27	114.0	94.0	21.79	17.71
2427	99.92	99.92	V	-1.03	98.89	82.97	114.0	94.0	15.09	11.01
Mid Channel										
2441	91.57	91.57	H	-0.70	90.87	74.96	114.0	94.0	23.11	19.02
2441	100.62	100.62	V	-0.97	99.65	83.73	114.0	94.0	14.33	10.25
High Channel										
2457	93.09	93.09	H	-0.62	92.47	76.55	114.0	94.0	21.51	17.43
2457	101.70	101.70	V	-0.90	100.80	84.88	114.0	94.0	13.18	9.10

Sample calculations are provided in Section 7.6.2.4.

7.6 Band-Edge Compliance and Spurious Emissions

7.6.1 Band-Edge Compliance of RF Emissions

7.6.1.1 Test Methodology

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

The EUT was investigated to determine band-edge compliance. Band-edge compliance for the lower and upper band-edge was determined using the radiated mark-delta method as outlined in FCC DA 00-705. The radiated field strength of the fundamental emission was first determined and then the mark-delta method was used to determine the field strength of the band-edge emissions as compared to the emission limits of 15.209.

7.6.1.2 Test Results

Band-edge compliance is displayed in Tables 7.6.1.2-1 – 7.6.1.2-2 and Figures 7.6.1.2-1 – 7.6.1.2-2.

Table 7.6.1.2-1: Lower Band-edge Marker Delta Method

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Fundamental Field Strength (dBuV/m)		Delta-Marker (dB)	Band-edge Field Strength (dBuV/m)		Margin to Limit (dBuV/m) 74	54
	pk	avg	(H/V)	(dB)	pk	avg		pk	avg	pk	avg
Fundamental Frequency											
2427	99.92	99.92	V	-1.03	98.89	82.97	38.82	60.07	44.15	13.93	9.85

Table 7.6.1.2-2: Upper Band-edge Marker Delta Method

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Fundamental Field Strength (dBuV/m)		Delta-Marker (dB)	Band-edge Field Strength (dBuV/m)		Margin to Limit (dBuV/m) 74	54
	pk	avg	(H/V)	(dB)	pk	avg		pk	avg	pk	avg
Fundamental Frequency											
2457	101.70	101.7	V	-0.90	100.80	84.88	40.84	59.96	44.04	14.04	9.96

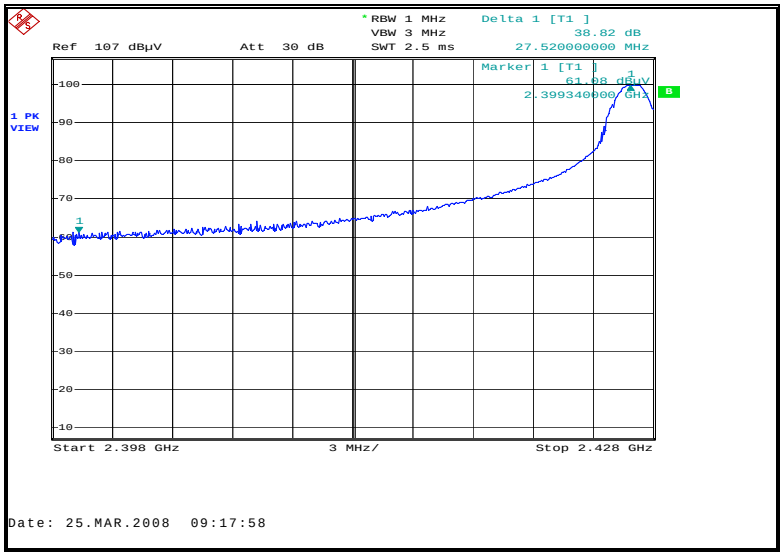

Figure 7.6.1.2-1: Lower Band-edge

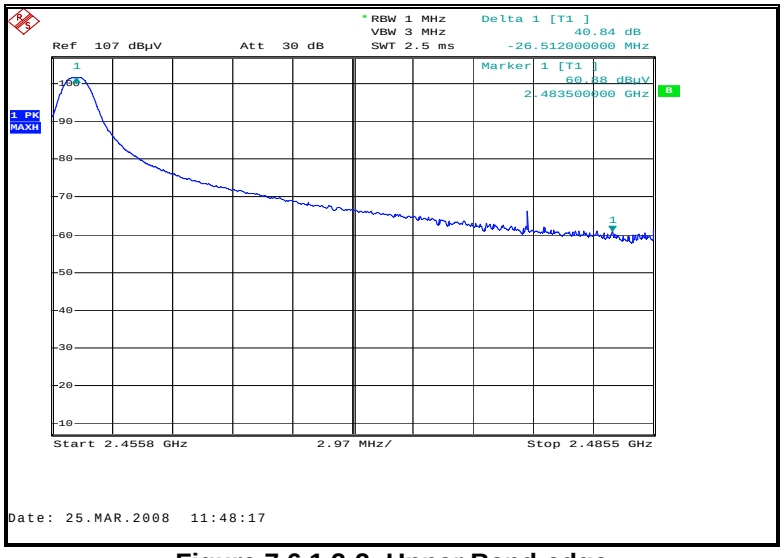

Figure 7.6.1.2-2: Upper Band-edge

7.6.2 Radiated Spurious Emissions – Intentional Radiation

7.6.2.1 Test Methodology

Radiated emissions tests were made over the frequency range of 30MHz to 25GHz, 10 times the highest fundamental frequency.

Measurements of the radiated field strength were made at a distance of 3m from the boundary of the equipment under test (EUT) and the receiving antenna. The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth (RBW) of 120 kHz and a video bandwidth (VBW) of 300 kHz. For frequencies above 1000MHz, peak measurements were made using an RBW of 1 MHz and a VBW of 3 MHz. The average emissions were determined by correcting for the duty cycle of the EUT.

7.6.2.2 Duty Cycle Correction

For average radiated measurements, the measured level was reduced by a factor 15.92dB to account for the duty cycle of the EUT. The duty cycle correction factor is determined using the formula: 20log (16/100) = -15.92dB.

A detailed analysis of the duty cycle timing is provided in the Theory of Operation contained in this filing.

7.6.2.3 Test Results

Results are shown below in Table 7.6.2.3-1. Emissions not reported were below the noise floor of the measurement system.

Table 7.6.2.3-1 - Radiated Spurious Emissions

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Spurious Emissions Low Channel										
4854	55.66	55.66	H	7.12	62.78	46.87	74.0	54.0	11.22	7.13
4854	61.17	61.17	V	7.12	68.29	52.38	74.0	54.0	5.71	1.62
7281	53.15	53.15	H	12.23	65.38	49.46	74.0	54.0	8.62	4.54
7281	54.31	54.31	V	12.29	66.60	50.68	74.0	54.0	7.40	3.32
Spurious Emissions Mid Channel										
4882	54.18	54.18	H	7.21	61.39	45.47	74.0	54.0	12.61	8.53
4882	60.17	60.17	V	7.21	67.38	51.46	74.0	54.0	6.62	2.54
7323	54.55	54.55	H	12.28	66.83	50.91	74.0	54.0	7.17	3.09
7323	54.70	54.70	V	12.34	67.04	51.13	74.0	54.0	6.96	2.87
Spurious Emissions High Channel										
4914	55.11	55.11	H	7.30	62.41	46.49	74.0	54.0	11.59	7.51
4914	60.69	60.69	V	7.30	67.99	52.07	74.0	54.0	6.01	1.93
7371	54.86	54.86	H	12.33	67.19	51.28	74.0	54.0	6.81	2.72
7371	54.02	54.02	V	12.41	66.43	50.51	74.0	54.0	7.57	3.49

7.6.2.4 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation:

PEAK:
Corrected Level: 55.66 + 7.12 = 62.78dBuV
Margin: 74dBuV – 62.78dBuV = 11.22dB

AVERAGE:
Corrected Level: 55.66 + 7.12 - 15.92 = 46.87dBuV
Margin: 54dBuV – 46.87dBuV = 7.13dB

8.0 CONCLUSION
In the opinion of ACS, Inc. the CyberSync Transceiver 1, manufactured by Paul C. Buff, Inc. meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT