Excellence in Compliance Testing

Certification Test Report

FCC ID: ZNR-CU3000
IC: 9675A-CU3000

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

ACS Report Number: 10-0364.W06.13.A

Manufacturer: Proventix Systems, Inc.
Model: CU3000

Test Begin Date: October 18, 2010
Test End Date: February 3, 2011

Report Issue Date: June 22, 2011

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Reviewed by:
Kirby Munroe
Director, Wireless Certifications
ACS, Inc.

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This report contains 17 pages

TABLE OF CONTENTS

1 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

The CU3000 device is intended to be used by Health Care, Restaurants, Schools, and other bodies desiring to monitor Hand Hygiene Compliance in their facilities. The CU3000 is installed adjacent to Hand Soap or Hand Sanitizer Dispensers where device utilization is to be monitored. The CU3000 is powered from a Class 2 low voltage power supply.

The CU3000 contains two RF transceivers. The main radio communicates to the Ethernet bridge unit and the tag radio communicates with an asset tag (FCC ID: ZNR-TG3000). This report addresses the CU3000 tag radio. Report number 10-0364.W06.23.A addresses the CU3000 main radio and report number.

Technical Information:

Band of operation:	2405 – 2480 MHz
Number of channels:	16
Modulation format:	O-QPSK
Antenna Type/Gain:	Directional Patch / 0dBi
Operating Voltage:	120 VAC (9V Adaptor)

Manufacturer Information:
Proventix Systems, Inc.
4518 Valleydale Rd, Suite 201
Birmingham, AL 35242
USA

Test Sample Serial Number(s): FFA129

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

1.3 Test Methodology and Considerations

The CU3000 was tested in an orientation representative of final installation for radiated and conducted emissions. Two (2) distinct power supplies where provided with both potentially to be marketed with the CU3000 device. Both supplies were evaluated for radiated and conducted emissions where applicable. See sections 5.0 – 6.0 for additional details.

2 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

ACS is accredited to ISO/IEC 17025 by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 200612-0. Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

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.

FCC Registration Number: 511277
Industry Canada Lab Code: IC 4175A
VCCI Member Number: 1831

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

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:

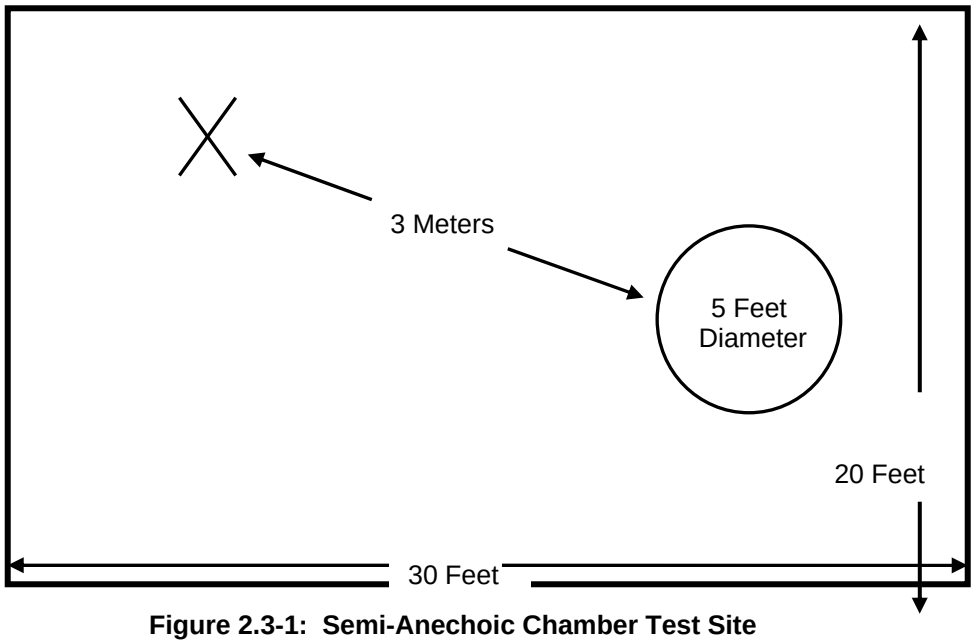


Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

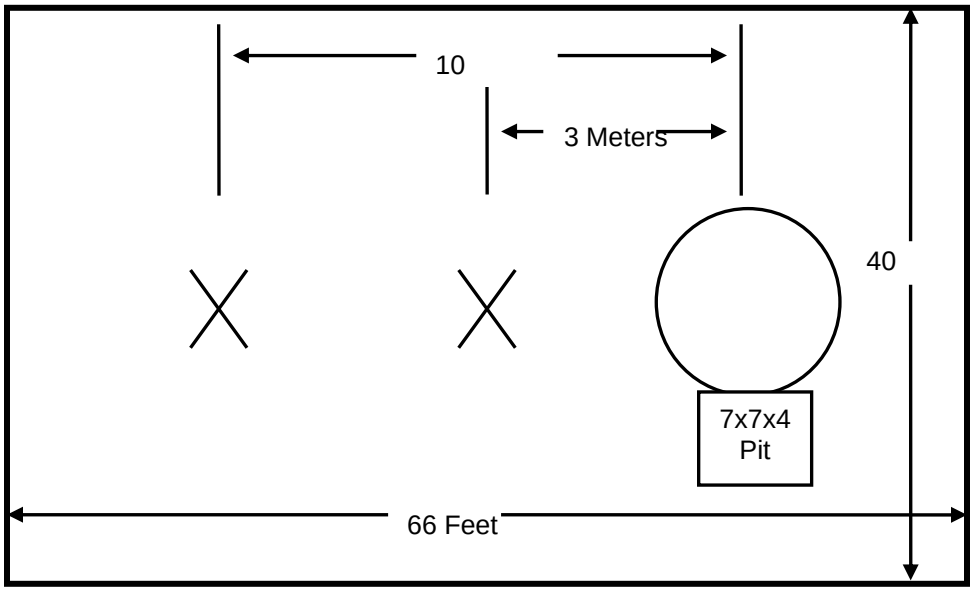


Figure 2.3-2: Open Area Test Site

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:

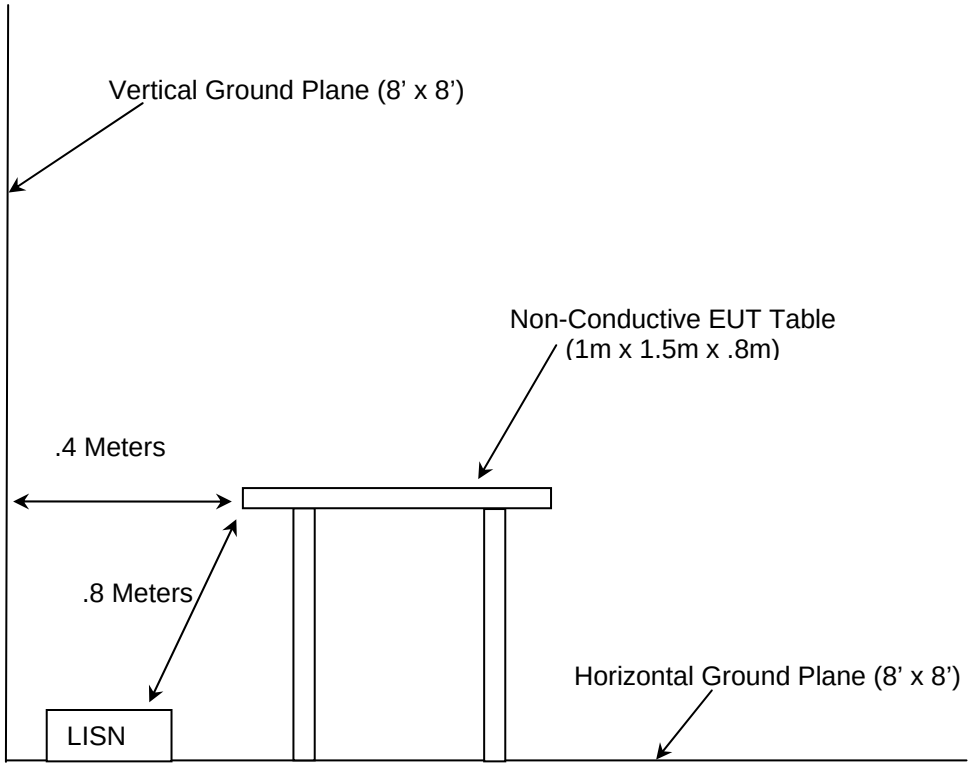


Figure 2.4-1: AC Mains Conducted EMI Site

3 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, 2010
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2010
- Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 8, December 2010
- Industry Canada Radio Standards Specification: RSS-GEN – General Requirements and Information for the Certification of Radiocommunication Equipment, Issue 3, December 2010.

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

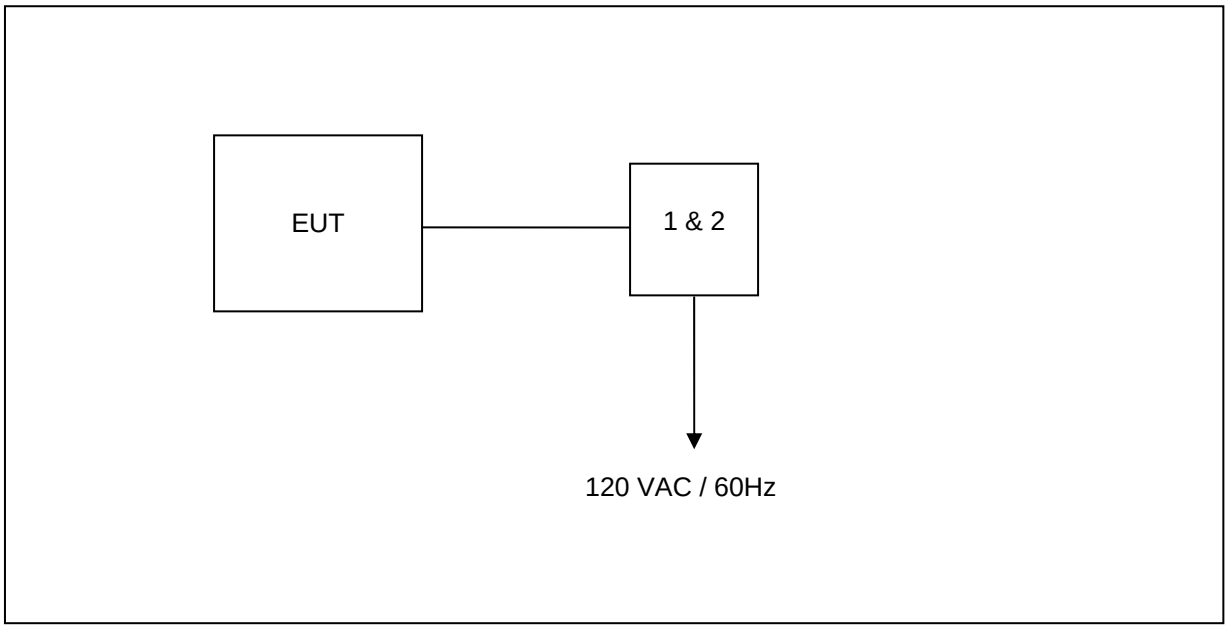
AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
1	Rohde & Schwarz	ESMI - Display	Spectrum Analyzers	833771/007	9/23/2010	9/23/2012
2	Rohde & Schwarz	ESMI-Receiver	Spectrum Analyzers	839587/003	9/23/2010	9/23/2012
3	Rohde & Schwarz	ESMI - Display	Spectrum Analyzers	839379/011	5/26/2011	5/26/2013
4	Rohde & Schwarz	ESMI - Receiver	Spectrum Analyzers	833827/003	5/26/2011	5/26/2013
22	Agilent	8449B	Amplifiers	3008A00526	9/2/2010	8/30/2011
25	Chase	CBL6111	Antennas	1043	9/13/2010	9/13/2012
30	Spectrum Technologies	DRH-0118	Antennas	970102	4/27/2011	4/27/2013
73	Agilent	8447D	Amplifiers	2727A05624	3/21/2011	3/21/2012
153	EMCO	3825/2	LISN	9411-2268	1/13/2011	1/13/2012
167	ACS	Chamber EMI Cable Set	Cable Set	167	1/26/2011	1/26/2012
168	Hewlett Packard	11947A	Attenuators	44829	2/4/2011	2/4/2012
283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	8/31/2010	8/31/2011
291	Florida RF Cables	SMRE-200W-12.0-SMRE	Cables	None	12/7/2010	12/7/2011
292	Florida RF Cables	SMR-290AW-480.0-SMR	Cables	None	4/11/2011	4/11/2012
324	ACS	Belden	Cables	8214	7/9/2010	7/9/2011
329	AH Systems	SAS-571	Antennas	721	8/4/2009	8/4/2011
334	Rohde&Schwarz	3160-10	Antennas	45576	11/4/2010	NCR
335	Suhner	SF-102A	Cables	882/2A	10/29/2010	10/29/2011
338	Hewlett Packard	8449B	Amplifiers	3008A01111	3/24/2011	3/24/2012
340	Aeroflex/Weinschel	AS-20	Attenuators	7136	10/5/2010	10/5/2011
345	Suhner Sucoflex	102A	Cables	1077/2A	10/29/2010	10/29/2011
422	Florida RF	SMS-200AW-72.0-SMR	Cables	805	12/29/2010	12/29/2011
432	Microwave Circuits	H3G020G4	Filters	264066	7/16/2010	7/16/2011

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	9V DC Power Supply	GTE	ADP2108GT(64-23170)	NA
2	9V DC Power Supply	V-INFINITY	EPS090066-P5RP	NA

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM



7 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 – FCC: Section 15.203

The antenna used for the CU3000 tag radio is an integral patch antenna, and therefore meets the requirements of Section 15.203.

7.2 Power Line Conducted Emissions – FCC: Section 15.207 IC: RSS-Gen 7.2.4

7.2.1 Measurement Procedure

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 Measurement Results

Results of the test are shown below in and Table 7.2.2-1 to 7.2.2-4.

Table 7.2.2-1: Line 1 Conducted EMI Results – GTE ADP2108GT(64-23170)

Frequency (MHz)	Level (dBuV)	Transducer (dB)	Limit (dBuV)	Margin (dB)	Line	PE	Detector
0.222	32.1	9.9	63	30.7	L1	FLO	QP
0.324	28.6	10	60	31	L1	FLO	QP
0.426	25.3	10	57	32.1	L1	FLO	QP
0.486	23.1	10	56	33.1	L1	FLO	QP
0.678	21.5	10	56	34.5	L1	FLO	QP
0.768	21.8	10.1	56	34.2	L1	FLO	QP
0.84	21.4	10	56	34.6	L1	FLO	QP
0.924	21	10	56	35	L1	FLO	QP
1.056	20	10	56	36	L1	FLO	QP
1.152	19	10	56	37	L1	FLO	QP
0.228	10.3	9.9	53	42.2	L1	FLO	AVG
0.33	9.3	10	50	40.1	L1	FLO	AVG
0.426	8.6	10	47	38.8	L1	FLO	AVG
0.48	8.3	10	46	38.1	L1	FLO	AVG
0.666	8	10	46	38	L1	FLO	AVG
0.822	8	10	46	38	L1	FLO	AVG
0.924	7.7	10	46	38.3	L1	FLO	AVG
0.99	7.8	10	46	38.2	L1	FLO	AVG
1.02	7.7	10	46	38.3	L1	FLO	AVG
1.176	7.7	10	46	38.3	L1	FLO	AVG

Table 7.2.2-2: Line 2 Conducted EMI Results – GTE ADP2108GT(64-23170)

Frequency (MHz)	Level (dBuV)	Transducer (dB)	Limit (dBuV)	Margin (dB)	Line	PE	Detector
0.216	32.5	9.9	63	30.4	L2	FLO	QP
0.324	29	10	60	30.6	L2	FLO	QP
0.42	25.6	10	57	31.8	L2	FLO	QP
0.51	22.1	10	56	33.9	L2	FLO	QP
0.582	20.8	10	56	35.2	L2	FLO	QP
0.696	21.1	10.1	56	34.9	L2	FLO	QP
0.774	21.1	10.1	56	34.9	L2	FLO	QP
0.954	18.7	10	56	37.3	L2	FLO	QP
1.074	17.8	10	56	38.2	L2	FLO	QP
1.146	17.3	10	56	38.7	L2	FLO	QP
0.228	10.4	9.9	53	42.1	L2	FLO	AVG
0.33	9.4	10	50	40.1	L2	FLO	AVG
0.408	8.8	10.1	48	38.8	L2	FLO	AVG
0.492	8.3	10	46	37.9	L2	FLO	AVG
0.576	7.9	10	46	38.1	L2	FLO	AVG
0.738	8.1	10.1	46	37.9	L2	FLO	AVG
0.81	8	10.1	46	38	L2	FLO	AVG
0.954	7.7	10	46	38.3	L2	FLO	AVG
1.05	7.6	10	46	38.4	L2	FLO	AVG
1.086	7.5	10	46	38.5	L2	FLO	AVG

Table 7.2.2-3: Line 1 Conducted EMI Results – V-INFINITY EPS090066-P5RP

Frequency (MHz)	Level (dBuV)	Transducer (dB)	Limit (dBuV)	Margin (dB)	Line	PE	Detector
0.478	45.19	10	56.37	11.2	L1	FLO	QP
0.952	43.52	10	56	12.5	L1	FLO	QP
1.07	46.11	10	56	9.9	L1	FLO	QP
1.18	46.29	10	56	9.7	L1	FLO	QP
25.89	19.16	10.97	60	40.8	L1	FLO	QP
21.19	20.17	11.08	60	39.8	L1	FLO	QP
0.478	32.9	10	46.37	13.5	L1	FLO	AVG
0.952	24.24	10	46	21.8	L1	FLO	AVG
1.07	27.25	10	46	18.8	L1	FLO	AVG
1.18	26.98	10	46	19	L1	FLO	AVG
25.89	11.34	10.97	50	38.7	L1	FLO	AVG
21.19	11.27	11.08	50	38.7	L1	FLO	AVG

Table 7.2.2-4: Line 2 Conducted EMI Results - V-INFINITY EPS090066-P5RP

Frequency (MHz)	Level (dBuV)	Transducer (dB)	Limit (dBuV)	Margin (dB)	Line	PE	Detector
0.477	37.89	10	56.39	18.5	L2	FLO	QP
0.95	37.64	10	56	18.4	L2	FLO	QP
1.07	40.3	10	56	15.7	L2	FLO	QP
1.19	33.54	10	56	22.5	L2	FLO	QP
21	20.06	11.08	60	39.9	L2	FLO	QP
26.4	19.6	10.98	60	40.4	L2	FLO	QP
0.477	26.93	10	46.39	19.5	L2	FLO	AVG
0.95	15.7	10	46	30.3	L2	FLO	AVG
1.07	21.13	10	46	24.9	L2	FLO	AVG
1.19	16.49	10	46	29.5	L2	FLO	AVG
21	11.21	11.08	50	38.8	L2	FLO	AVG
26.4	11.74	10.98	50	38.3	L2	FLO	AVG

7.3 20dB / 99% Bandwidth – FCC: Section 15.215, IC: RSS-Gen 4.6.1

7.3.1 Measurement Procedure

The span of the spectrum analyzer display was set between two times and five times the occupied bandwidth (OBW) of the emission. The RBW of the spectrum analyzer was set to approximately 1 % to 5 % of the OBW. The 20dB bandwidth was measured between the lower and upper points on the emission which correspond to 20dB below the modulated carrier.

The occupied bandwidth measurement function of the analyzer was used for the 99% bandwidth.

7.3.2 Measurement Results

Results are shown below in table 7.3.2-1 and figure 7.3.2-1 to 7.3.2-6:

Table 7.3.2-1: 20dB / 99% Bandwidth

Frequency (MHz)	20dB Bandwidth (MHz)	99% OBW (MHz)
2405	2.50	2.33
2440	2.59	2.39
2480	2.65	2.44

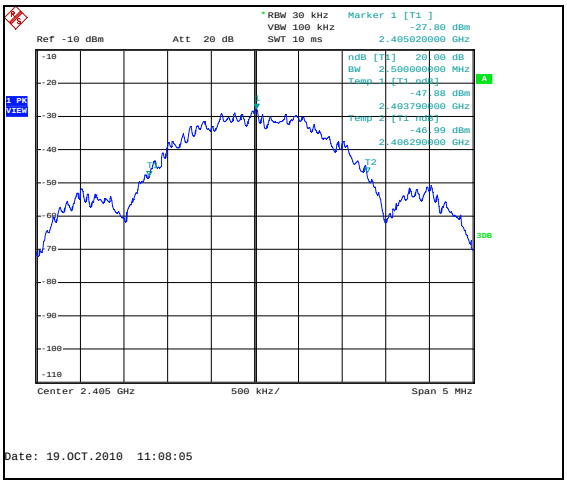


Figure 7.3.2-1: 20dB – Low Channel

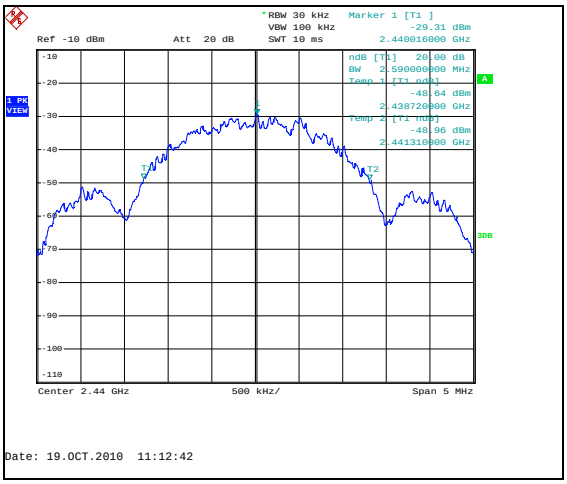


Figure 7.3.2-2: 20dB – Mid Channel

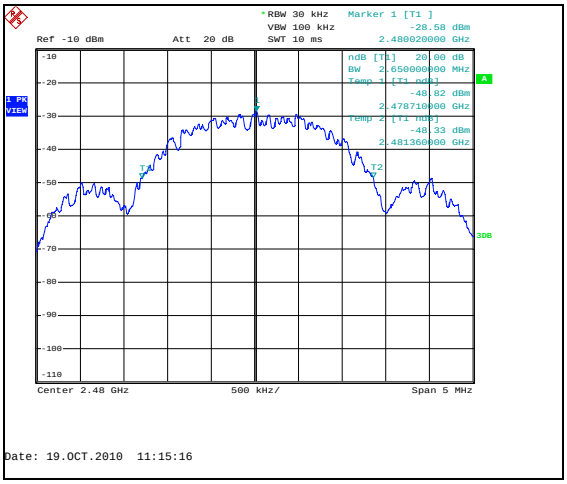


Figure 7.3.2-3: 20 dB – High Channel

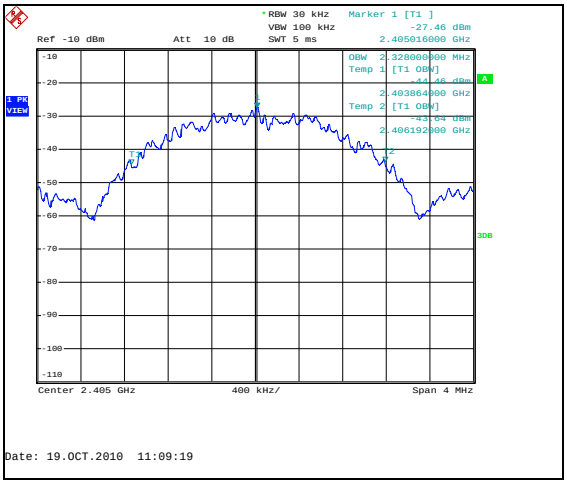


Figure 7.3.2-4: 99% – Low Channel

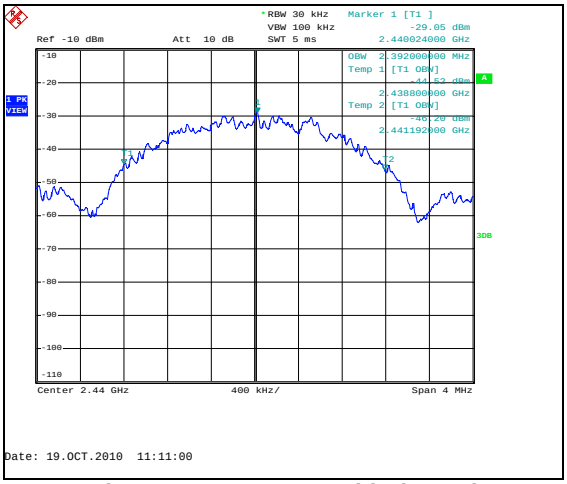


Figure 7.3.2-5: 99% – Mid Channel

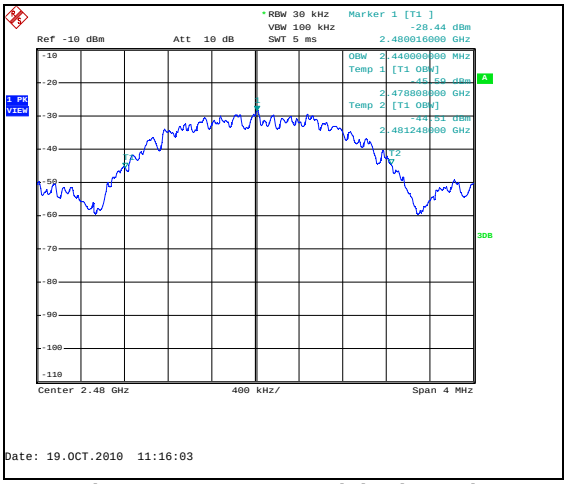


Figure 7.3.2-6: 99% – High Channel

7.4 Fundamental Field Strength – FCC: Section 15.249(a) IC: RSS-210 A2.9(a)

7.4.1 Measurement Procedure

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 fundamentals below 1GHz, quasi-peak measurements were made using a resolution bandwidth (RBW) of 120 kHz and a video bandwidth (VBW) of 300 kHz. For fundamentals above 1GHz, peak and average measurements were made using a resolution bandwidth (RBW) of 1 MHz and a video bandwidth (VBW) of 3 MHz. See section 7.6.2 for use of the duty cycle correction.

7.4.2 Measurement Results

Results are shown below in Table 7.4.2-1.

Table 7.4.2-1: Fundamental Field Strength

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
2405	92.76	86.59	H	0.59	93.35	70.17	114.0	94.0	20.6	23.8
2405	92.64	85.91	V	0.59	93.23	69.49	114.0	94.0	20.8	24.5
2440	95.79	89.87	H	0.78	96.57	73.63	114.0	94.0	17.4	20.4
2440	92.99	86.69	V	0.78	93.77	70.45	114.0	94.0	20.2	23.5
2480	94.58	90.57	H	0.99	95.57	74.54	114.0	94.0	18.4	19.5
2480	94.69	90.34	V	0.99	95.68	74.31	114.0	94.0	18.3	19.7

7.5 Radiated Spurious Emissions - FCC: Section 15.249(a)(d)(e); IC:RSS-210 A2.9(a)(b)

7.5.1 Measurement Procedure

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

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 and average measurements were made with RBW and VBW of 1 MHz and 3 MHz respectively. The average emissions were further corrected by applying the duty cycle correction of the EUT for comparison to the average limit.

7.5.2 Duty Cycle Correction

For average radiated measurements, using a 14.1% duty cycle, the measured level was reduced by a factor 17.02dB. The duty cycle correction factor is determined using the formula: 20log (14.1/100) =
-17.02dB.

A detailed analysis of the duty cycle timing is provided in the Theory of Operation accompanying this report.

7.5.3 Measurement Results

Radiated spurious emissions found in the band of 30MHz to 25GHz are reported in the tables below.

Table 7.5.2.3-1: Radiated Spurious Emissions – Low Channel

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
7215	42.29	31.02	V	13.15	55.44	27.15	74.0	54.0	18.6	26.8

Table 7.5.2.3-2: Radiated Spurious Emissions – Mid Channel

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
4880	43.52	33.20	H	8.53	52.05	24.72	74.0	54.0	21.9	29.3
7320	42.86	31.68	H	13.27	56.13	27.94	74.0	54.0	17.9	26.1
7320	43.66	32.69	V	13.27	56.93	28.95	74.0	54.0	17.1	25.1

Table 7.5.2.3-3: Radiated Spurious Emissions – High Channel

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
2483.5	64.46	54.93	H	1.00	65.46	38.92	74.0	54.0	8.5	15.1
2483.5	64.65	55.05	V	1.00	65.65	39.04	74.0	54.0	8.3	15.0
4960	47.01	37.11	H	8.77	55.78	28.86	74.0	54.0	18.2	25.1
4960	44.10	33.20	V	8.77	52.87	24.95	74.0	54.0	21.1	29.0
7440	43.71	32.54	H	13.42	57.13	28.94	74.0	54.0	16.9	25.1
7440	50.14	41.23	V	13.42	63.56	37.63	74.0	54.0	10.4	16.4

***** *The magnitude of all emissions not reported were below the noise floor of the measurement system*

7.5.4 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: 42.29+ 13.15 = 55.44dBuV/m
Margin: 74dBuV/m – 55.44dBuV/m = 18.6dB

Example Calculation: Average

Corrected Level: 31.02 + 13.05 – 17.02 = 27.15dBuV
Margin: 54dBuV – 27.15dBuV = 26.8dB

8 CONCLUSION

In the opinion of ACS, Inc. the CU3000, manufactured by Proventix Systems, Inc. meet the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT