Excellence in Compliance Testing

Certification Test Report

Frequency Hopping Spread Spectrum Transmitter

FCC ID: SK9AMI-1A
IC: 864G-AMI1A

FCC Rule Part: 15.247
IC Radio Standards Specification: RSS-210

ACS Report Number: 07-0272-900-DSS

Manufacturer: Itron Electricity Metering Inc.
Model(s): CVSO-A, CVSOD-A

Test Begin Date: June 27, 2007
Test End Date: July 3, 2007

Report Issue Date: August 13, 2007

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 23 pages

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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 CENTRON OpenWay meter is used for measuring electrical energy consumption. The CENTRON OpenWay meter incorporates a two-piece design combining a base metrology with a variety of OpenWay registers or options. The metrology portion of the meter contains all measurement circuitry and calibration information, while the personality modules contain the register functionality and communication mediums.

Each version of the meter is distinguished by the various personality modules or option boards that mount to the standard meter metrology base. The CENTRON OpenWay meter is also available with a remote disconnect which is located in the bottom of the meter housing. The CENTRON OpenWay meter is available in the following model types:

- Standard – CVSO-A
- Integrated disconnect/reconnect – CVSOD-A

For all model types, the register boards contain (1) 900 MHz LAN frequency hopping spread spectrum radio and (1) 2.4 GHz direct sequence spread spectrum Zigbee radio. These transmitters can not operate simultaneously. Regardless of the meter model type and sub assembly, the register boards are electrically identical.

Manufacturer Information:
Itron Electricity Metering, Inc.
313 North Highway 11
West Union, SC 29696

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

1.2.2 Intended Use

The CENTRON OpenWay meter is used for measuring electrical energy consumption.

1.3 Test Methodology and Considerations

Considering that the RF portion (register boards) are electrically identical between all models and subassemblies, the CVSO-A and CVSOD-A were tested and submitted under one FCC ID. Radiated emissions for all transmitters were performed on all models and sub assemblies and the worst case data presented in this report. Receiver radiated emissions and AC power line conducted emissions were also tested for all models and sub assemblies and operating voltages and the worst case data presented in this report.

This device is considered a composite device by definition. The 900 MHz LAN radio and the 2.4 GHz Zigbee radio operate under CFR 47 Part 15.247 and IC RSS-210. This report addresses the 900 MHz radio only and a separate report, 07-0272–2400-DTS, will be issued for the 2.4 GHz Zigbee radio.

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:

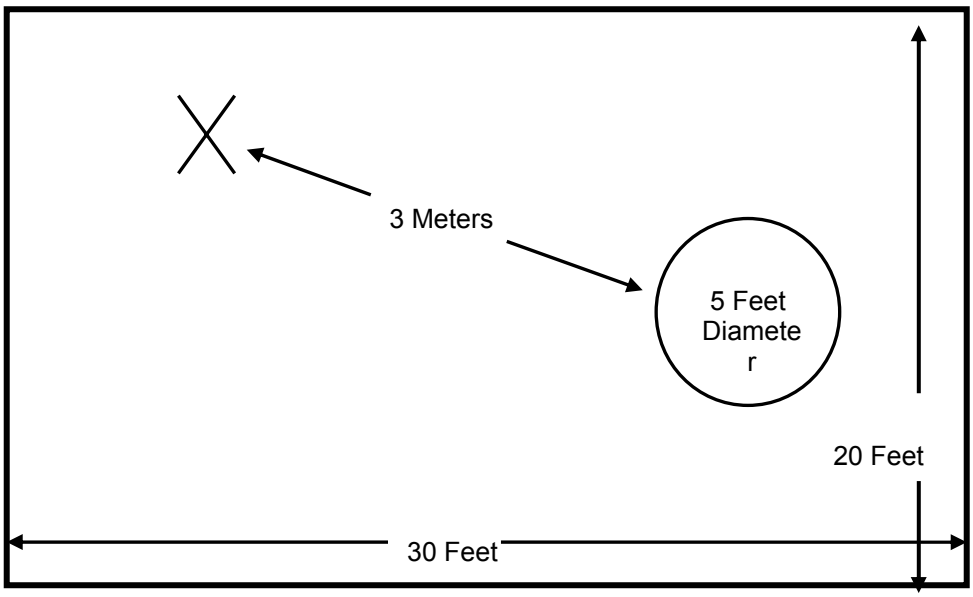

Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

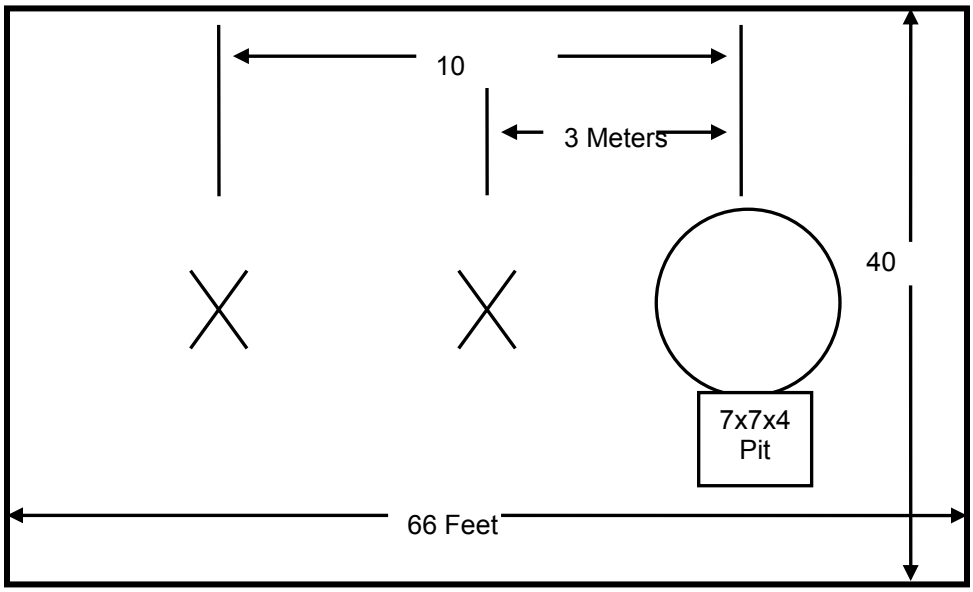

Figure 2.3-2: Open Area Test Site

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:

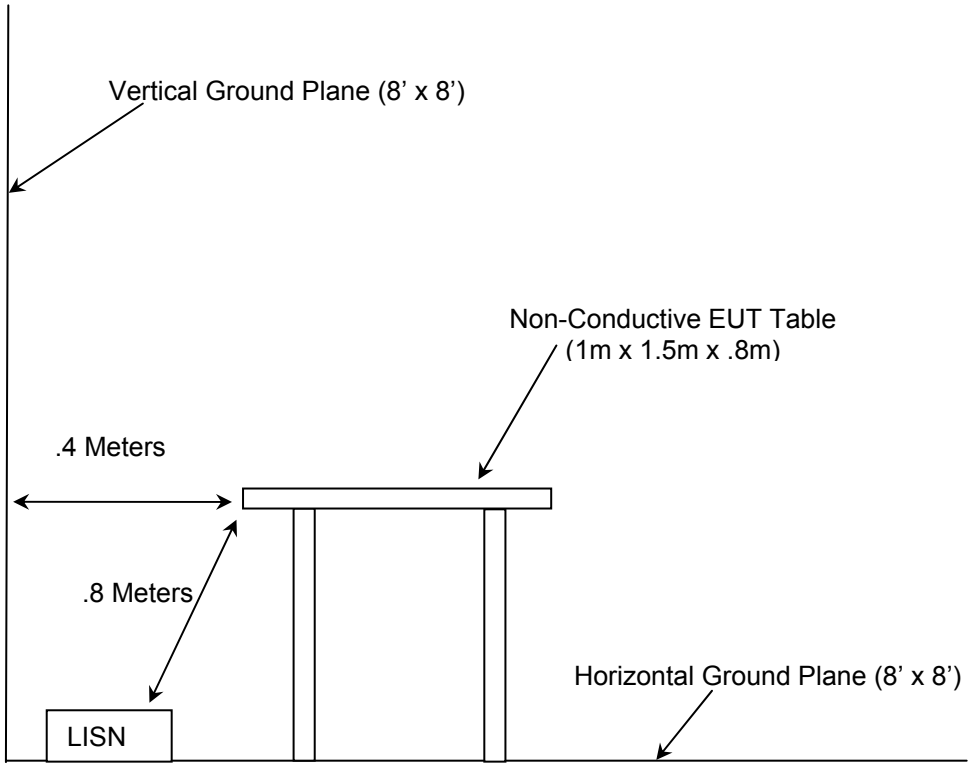

Figure 2.4-1: AC Mains Conducted EMI Site

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 C: Radio Frequency Devices, Intentional Radiators, 2006
- FCC OET Bulletin 65 Appendix C - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, 2001
- FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems, March 30, 2000
- 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 4.0-1: Test Equipment

Equipment Calibration Information					
ACS#	**Mfg.**	**Eq. type**	**Model**	**S/N**	**Cal. Due**
1	Rohde & Schwarz	Spectrum Analyzers	ESMI - Display	833771/007	3/5/2008
2	Rohde & Schwarz	Spectrum Analyzers	ESMI-Receiver	839587/003	3/5/2008
16	ACS	Cables	Cable	16	5/21/2008
22	Agilent	Amplifiers	8449B	3008A00526	4/10/2008
25	Chase	Antennas	CBL6111	1043	6/6/2008
30	Spectrum Technologies	Antennas	DRH-0118	970102	5/10/2008
152	EMCO	LISN	3825/2	9111-1905	2/20/2008
153	EMCO	LISN	3825/2	9411-2268	11/16/2007
167	ACS	Cables	Chamber EMI Cable Set	167	1/5/2008
267	Agilent	Meters	N1911A	MY45100129	10/26/2007
268	Agilent	Sensors	N1921A	MY45240184	10/26/2007
282	Microwave Circuits	Filters	H2G020G4	74541	3/9/2008
283	Rohde & Schwarz	Spectrum Analyzers	FSP40	1000033	11/9/2008
290	Florida RF Cables	Cables	SMSE-200-72.0-SMRE	None	5/15/2008
291	Florida RF Cables	Cables	SMRE-200W-12.0-SMRE	None	5/15/2008
292	Florida RF Cables	Cables	SMR-290AW-480.0-SMR	None	5/24/2008
321	Hewlett Packard	Amplifiers	HPC 8447D	1937A02809	7/27/2007
329	A.H.Systems	Antennas	SAS-571	721	8/24/2007
331	Microwave Circuits	Filters	H1G513G1	31417	8/29/2007
338	Hewlett Packard	Amplifiers	8449B	3008A01111	9/26/2007
340	Aeroflex/Weinschel	Attenuators	AS-20	7136	8/29/2007

5.0 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Manufacturer	Equipment Type	Model Number	Serial Number	FCC ID
EUT Was Self Supporting				

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

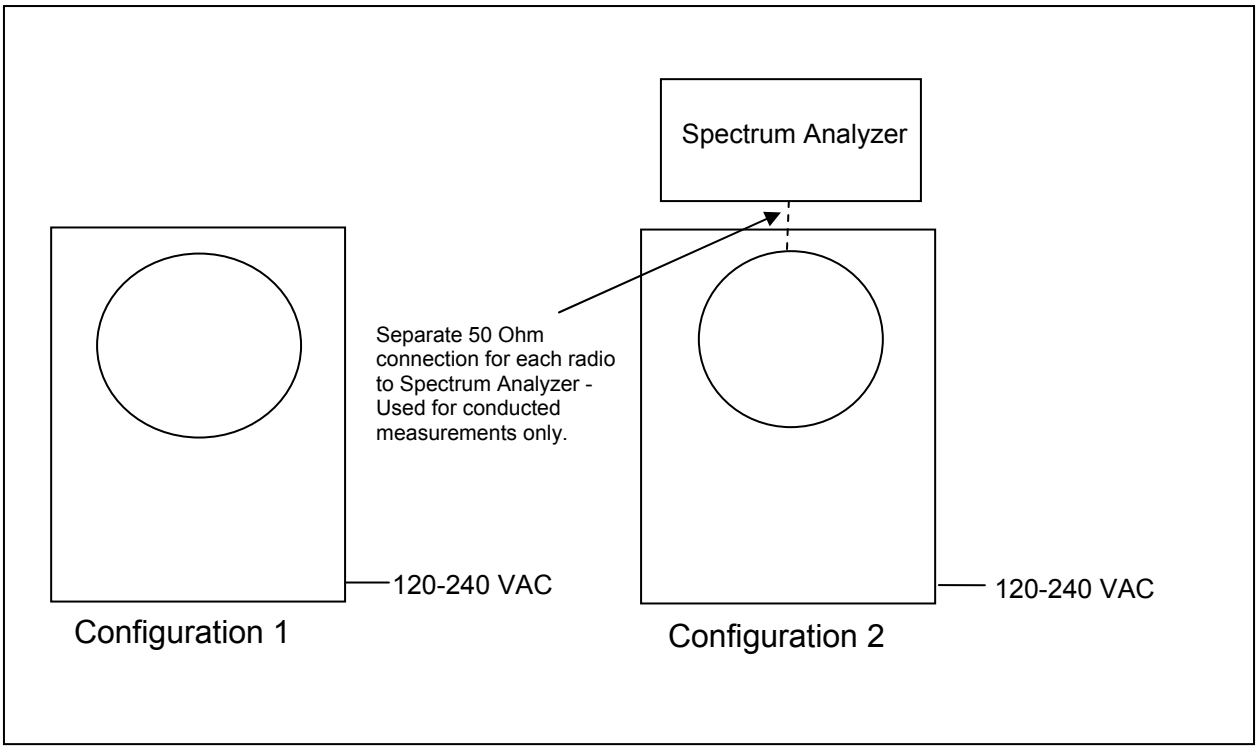

Figure 6-1: EUT Test Setup

*See Test Setup photographs for additional detail.

Configuration 1: Used for radiated emissions and AC power line conducted emissions.
Configuration 2: Used for RF conducted measurements. The EUT was configured with 50 Ohm temporary RF output ports for conducted measurements to facilitate a direct connection to a spectrum analyzer.

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 antenna is an integrated single-band patch antenna which can not be altered without destroying the device. This device is also professionally installed therefore meeting the requirements of CFR 47 Part 15.203. The antenna gain is 3dBi.

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 Tables 7.2-1 through 7.2-2.

Table 7.2-1: Conducted EMI Results – CVSO-A

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	40.9	36.1	9.80	50.70	45.90	64.49	54.49	13.8	8.6	GND
0.24	40.9	35.9	9.80	50.70	45.70	62.10	52.10	11.4	6.4	GND
0.34	38.7	33.3	9.80	48.50	43.10	59.20	49.20	10.7	6.1	GND
0.5	35.7	30.4	9.80	45.50	40.20	56.00	46.00	10.5	5.8	GND
0.6	33	27.8	9.80	42.80	37.60	56.00	46.00	13.2	8.4	GND
27.14	13.7	9.1	10.20	23.90	19.30	60.00	50.00	36.1	30.7	GND
Line 2										
0.18	41	36.5	9.80	50.80	46.30	64.49	54.49	13.7	8.2	GND
0.27	39.8	35.5	9.80	49.60	45.30	61.12	51.12	11.5	5.8	GND
0.36	38.3	33	9.80	48.10	42.80	58.73	48.73	10.6	5.9	GND
0.45	36.6	31.5	9.80	46.40	41.30	56.88	46.88	10.5	5.6	GND
0.54	34.5	29.1	9.80	44.30	38.90	56.00	46.00	11.7	7.1	GND
0.8	28.7	23.5	9.80	38.50	33.30	56.00	46.00	17.5	12.7	GND

Table 7.2-2: Conducted EMI Results – CVSOD-A

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	43	38.9	9.80	52.80	48.70	64.49	54.49	11.7	5.8	GND
0.23	42.7	38.5	9.80	52.50	48.30	62.45	52.45	9.9	4.1	GND
0.29	41.9	37.9	9.80	51.70	47.70	60.52	50.52	8.8	2.8	GND
0.46	39.5	35.5	9.80	49.30	45.30	56.69	46.69	7.4	1.4	GND
0.56	37.7	33.6	9.80	47.50	43.40	56.00	46.00	8.5	2.6	GND
1.69	26.2	21.7	9.80	36.00	31.50	56.00	46.00	20.0	14.5	GND
Line 2										
0.2	42.8	39.4	9.80	52.60	49.20	63.61	53.61	11.0	4.4	GND
0.24	42.3	38.7	9.80	52.10	48.50	62.10	52.10	10.0	3.6	GND
0.34	40.8	36.4	9.80	50.60	46.20	59.20	49.20	8.6	3.0	GND
0.42	39.9	36	9.80	49.70	45.80	57.45	47.45	7.7	1.6	GND
0.53	38.6	34.6	9.80	48.40	44.40	56.00	46.00	7.6	1.6	GND
1.53	27.1	22.6	9.80	36.90	32.40	56.00	46.00	19.1	13.6	GND

7.3 Radiated Emissions - (Unintentional Radiation)

7.3.1 Test Methodology

Radiated emissions tests were performed over the frequency range of 30MHz to 10 GHz. 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 were made with the Spectrum Analyzer's resolution bandwidth set to 120 KHz for measurements above 30MHz. Average measurements are taken with the RBW and VBW were set to 1MHz and 10 Hz respectively for measurements above 1000MHz.

7.3.2 Test Results

Results represent the worst case data from all models and operating voltages. Results of the test are given in Tables 7.3-1 and 7.3-2 below:

Table 7.3-1: Radiated Emissions Tabulated Data – CVSO-A

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
110.83	---------	41.85	V	-13.55	---------	28.30	--------	43.5	---------	15.20
115.14	---------	38.37	V	-13.29	---------	25.08	--------	43.5	---------	18.42
120.53	---------	41.06	H	-13.40	---------	27.66	--------	43.5	---------	15.84
136.7	---------	40.93	V	-12.83	---------	28.10	--------	43.5	---------	15.40
396.44	---------	36.44	V	-8.37	---------	28.07	--------	46.0	---------	17.93
572.12	---------	34.81	V	-3.64	---------	31.17	--------	46.0	---------	14.83
609.84	---------	34.53	V	-3.40	---------	31.13	--------	46.0	---------	14.87
663.73	---------	32.63	H	-2.29	---------	30.34	--------	46.0	---------	15.66
700.37	---------	34.23	H	-1.40	---------	32.83	--------	46.0	---------	13.17
841.56	---------	21.20	H	0.94	---------	22.14	--------	46.0	---------	23.86
1315	51.94	43.82	H	-12.56	39.38	31.26	74.0	54.0	34.62	22.74
1315	51.94	43.24	V	-12.58	39.36	30.66	74.0	54.0	34.64	23.34
2630	56.27	53.60	H	-5.27	51.00	48.33	74.0	54.0	23.00	5.67
2630	52.03	45.75	V	-5.21	46.82	40.54	74.0	54.0	27.18	13.46
3950	44.09	33.56	H	-1.45	42.64	32.11	74.0	54.0	31.36	21.89
3950	45.01	33.49	V	-1.37	43.64	32.12	74.0	54.0	30.36	21.88
5260	45.92	33.46	H	1.87	47.79	35.33	74.0	54.0	26.21	18.67
5260	46.62	33.52	V	2.06	48.68	35.58	74.0	54.0	25.32	18.42
6575	50.17	44.61	H	4.63	54.80	49.24	74.0	54.0	19.20	4.76
6575	50.32	44.56	V	4.52	54.84	49.08	74.0	54.0	19.16	4.92
10520	49.11	45.76	H	14.65	63.76	60.41	83.5	63.5	19.78	3.13
10520	47.18	42.1	V	14.65	61.83	56.75	83.5	63.5	21.71	6.79

* Note: All emissions above 10520 MHz were attenuated below the permissible limit.

Table 7.3-2: Radiated Emissions Tabulated Data – CVSOD-A

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
37.54	---------	34.94	V	-12.12	---------	22.82	--------	40.0	---------	17.18
42.93	---------	31.28	V	-14.61	---------	16.67	--------	40.0	---------	23.33
110.83	---------	38.29	H	-14.05	---------	24.24	--------	43.5	---------	19.26
136.7	---------	35.73	V	-12.83	---------	22.90	--------	43.5	---------	20.60
167.95	---------	37.25	H	-14.98	---------	22.27	--------	43.5	---------	21.23
271.42	---------	38.70	H	-11.49	---------	27.21	--------	46.0	---------	18.79
342.55	---------	37.40	H	-9.45	---------	27.95	--------	46.0	---------	18.05
469.73	---------	35.22	V	-6.41	---------	28.81	--------	46.0	---------	17.19
497.75	---------	27.53	V	-5.59	---------	21.94	--------	46.0	---------	24.06
839.41	---------	21.30	H	0.99	---------	22.29	--------	46.0	---------	23.71
1315	54.72	50.76	H	-12.56	42.16	38.20	74.0	54.0	31.84	15.80
1315	54.87	50.66	V	-12.58	42.29	38.08	74.0	54.0	31.71	15.92
2630	51.82	45.98	H	-5.27	46.55	40.71	74.0	54.0	27.45	13.29
2630	50.02	42.73	V	-5.21	44.81	37.52	74.0	54.0	29.19	16.48
5260	49.01	41.31	H	1.87	50.88	43.18	74.0	54.0	23.12	10.82
5260	49.75	41.56	V	2.06	51.81	43.62	74.0	54.0	22.19	10.38
6575	50.10	44.00	H	4.63	54.73	48.63	74.0	54.0	19.27	5.37
6575	49.57	41.82	V	4.52	54.09	46.34	74.0	54.0	19.91	7.66

* Note: All emissions above 6575 MHz were attenuated below the permissible limit.

7.4 Peak Output Power

7.4.1 Test Methodology (Conducted Method)

The 20dB bandwidth of the EUT was within the resolution bandwidth of spectrum analyzer, therefore the power measurement was made using the spectrum analyzer method. The resolution and video bandwidth were set to > 20 dB bandwidth of the emission measured. The device employs >50 channels therefore the power is limited to 1 Watt.

7.4.2 Test Results

Results are shown below in table 7.4-1 and the worst case was plotted and shown in figure 7.4-1 to 7.4-3 below:

Table 7.4-1: RF Output Power

Frequency [MHz]	Level [dBm]
902.25	21.92
914.75	21.70
927.75	21.10

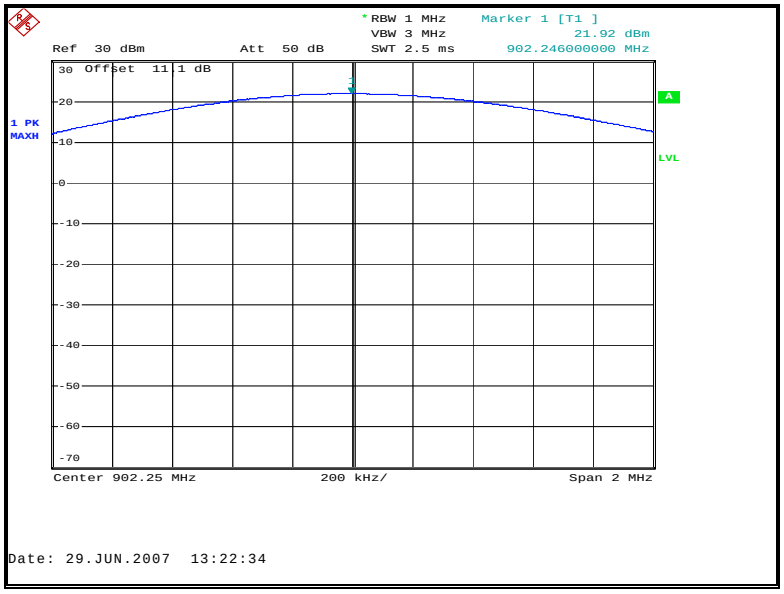

Figure 7.4-1: Output power – Low Channel

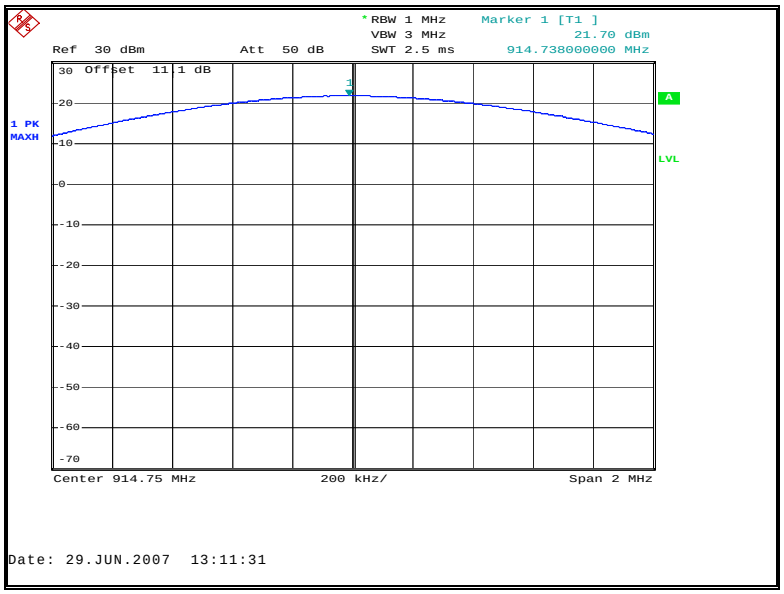

Figure 7.4-2: Output power – Mid Channel

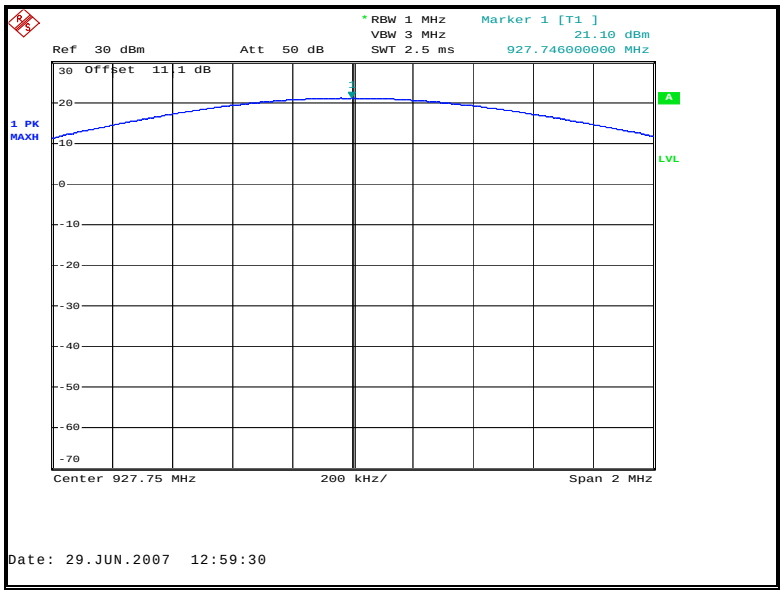

Figure 7.4-3: Output power – High Channel

7.5 Channel Usage Requirements

15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

15.247(a) (1) (i): For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

7.5.1 Carrier Frequency Separation

7.5.1.1 Test Methodology

The span of the spectrum analyzer was set wide enough to capture two adjacent peaks and the RBW and VBW were set to ≥ 1% of the span.

7.5.1.2 Test Results

The maximum 20dB bandwidth of the hopping channel was measured to be 148.2kHz (See figure 7.5.4-1 to 7.5.4-3 below). The adjacent channel separation was measured to be 500kHz. Results are shown in figure 7.5.1-1 below:

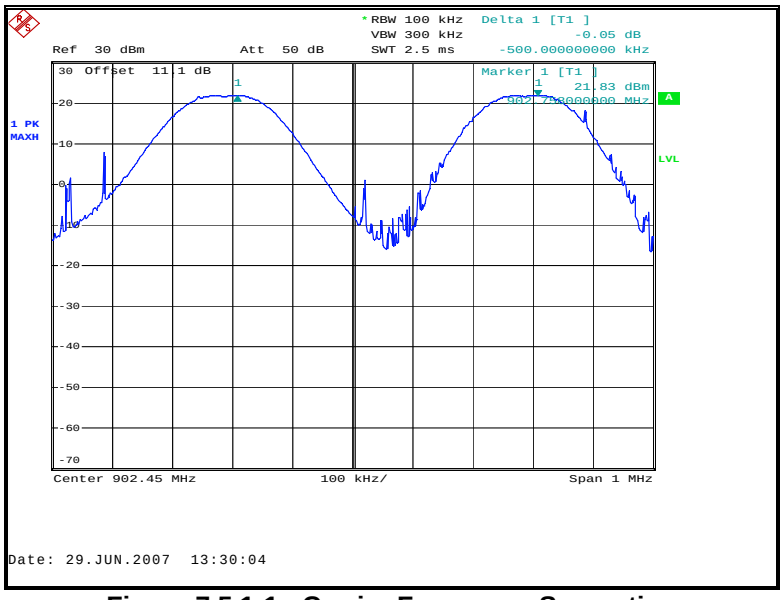

Figure 7.5.1-1: Carrier Frequency Separation

7.5.2 Number of Hopping Channels

The 20dB bandwidth of the device is less than 250 kHz. The device employs 52 hopping channels as required. Results are shown in Figure 7.5.2-1 below:

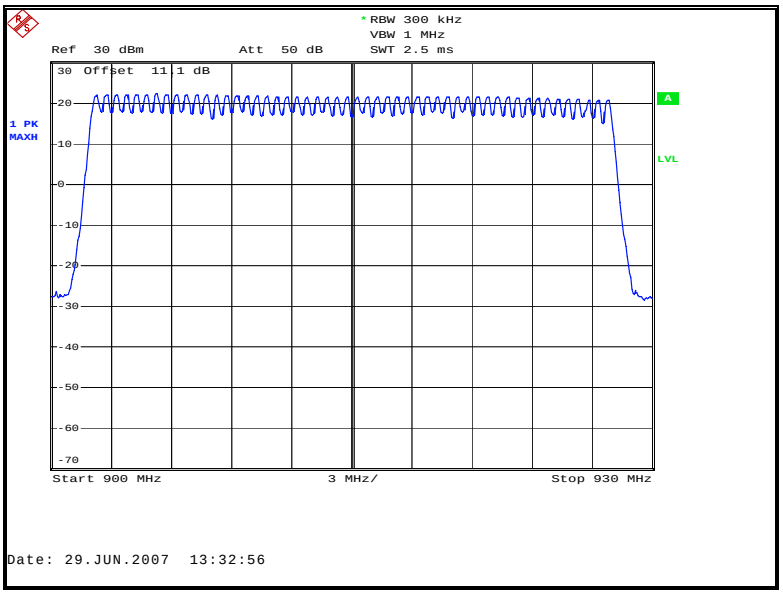

Figure 7.5.2-1: Number of Hopping Channels

7.5.3 Channel Dwell Time

7.5.3.1 Test Methodology

The emission measured centered on the analyzer and the span set to 0 Hz. The RBW was set to 1 MHz and the VBW to 3 MHz. Sweep time was set to 200 ms to capture the burst duration of the emission. The marker –delta function of the analyzer was employed to measure the burst duration.

7.5.3.2 Test Results

The duration of the RF transmission is 123 ms. There is a minimum 7.8 second period before the device transmits on the same channel. Therefore the average time of occupancy on any channel in a 20 second period is 369ms.

A single transmission is shown in figure 7.5.3-1 below:

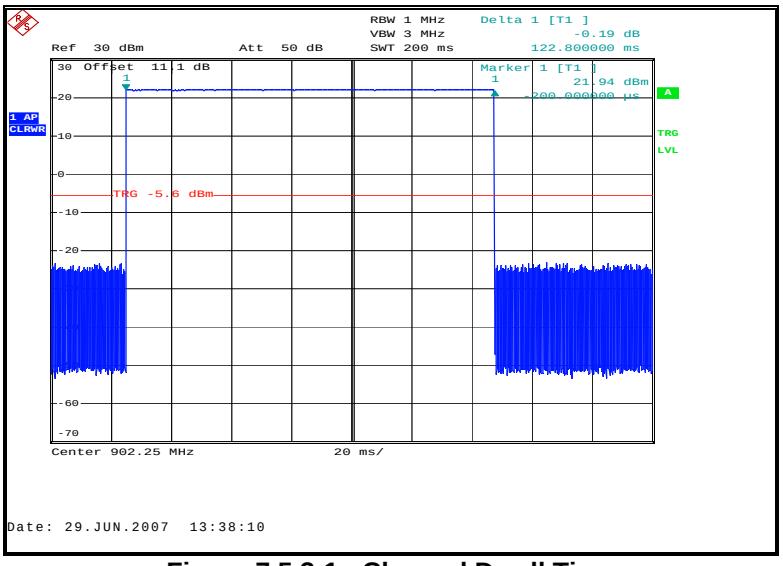

Figure 7.5.3-1: Channel Dwell Time

7.5.4 20dB Bandwidth

7.5.4.1 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. The span and RBW were examined and re-adjusted if necessary to meet the requirements of 2 to 3 times the 20 bandwidth for the span and ≥ 1% of the 20 dB bandwidth for the RBW.

7.5.4.2 Test Results

The maximum 20dB bandwidth was found to be a maximum of 148.2kHz. Results are shown below in Table 7.5.4-1 and Figures 7.5.4-1 through 7.5.4-3.

Table 7.5.4-1

Channel	Frequency (MHz)	20dB Bandwidth (kHz)
Low	902.25	148.2
Mid	914.75	148.2
High	927.75	148.2

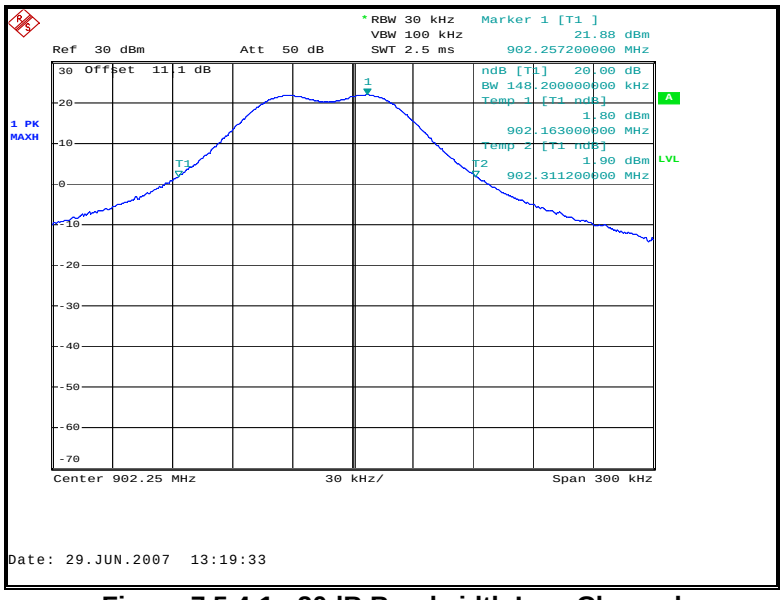

Figure 7.5.4-1: 20dB Bandwidth Low Channel

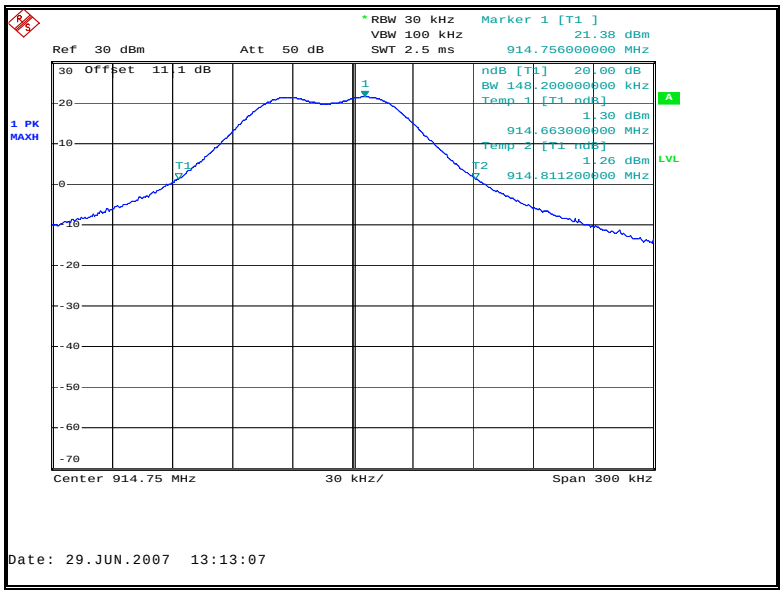

Figure 7.5.4-2: 20dB Bandwidth Mid Channel

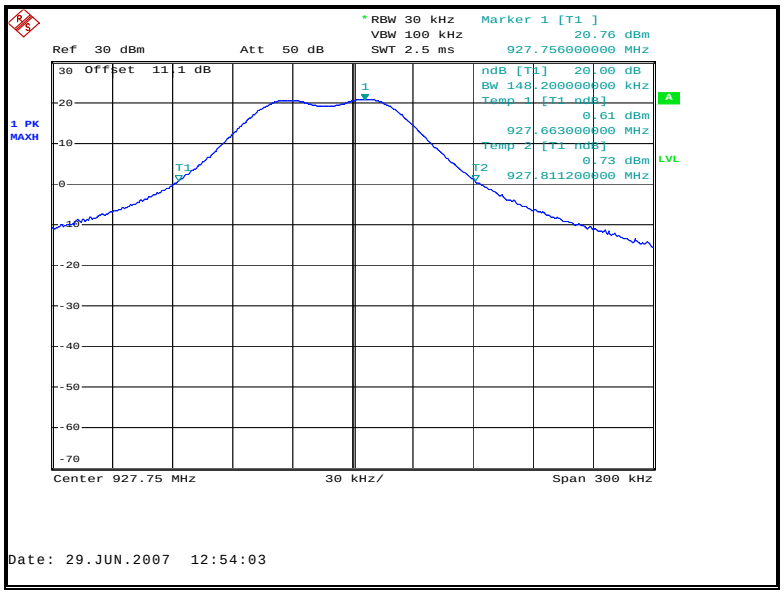

Figure 7.5.4-3: 20dB Bandwidth High Channel

7.6 Band-Edge Compliance and Spurious Emissions

7.6.1 Band-Edge Compliance of RF Conducted Emissions

7.6.1.1 Test Methodology

The EUT was investigated at the lowest and highest channel available to determine band-edge compliance. For each measurement the spectrum analyzer's RBW was set to 100 kHz, which is ≥ 1% of the span, and the VBW was set to 300kHz. The hopping function was enabled.

7.6.1.2 Test Results

In a 100 kHz bandwidth at the lower and upper band-edge, the radio frequency power that was produced by the EUT is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power. Band-edge compliance is displayed in Figures 7.6.1-1 and 7.6.2-2

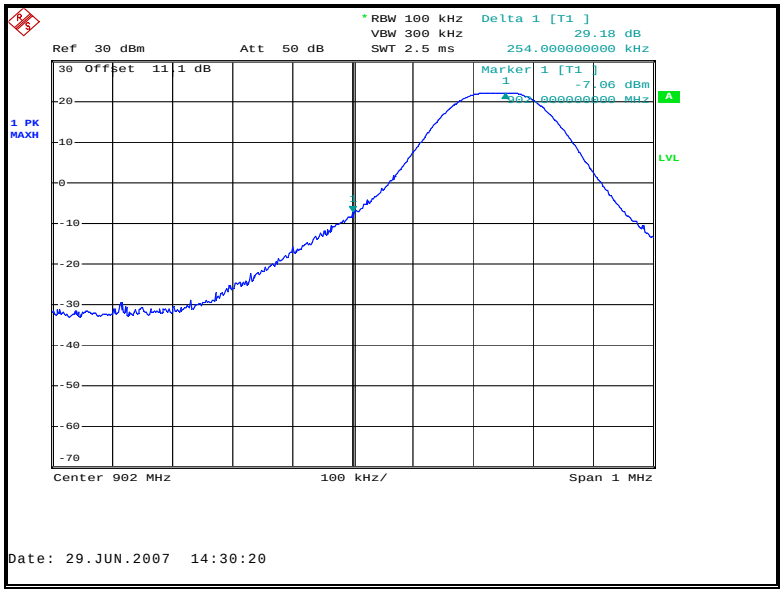

Figure 7.6.1-1: Lower Band-edge

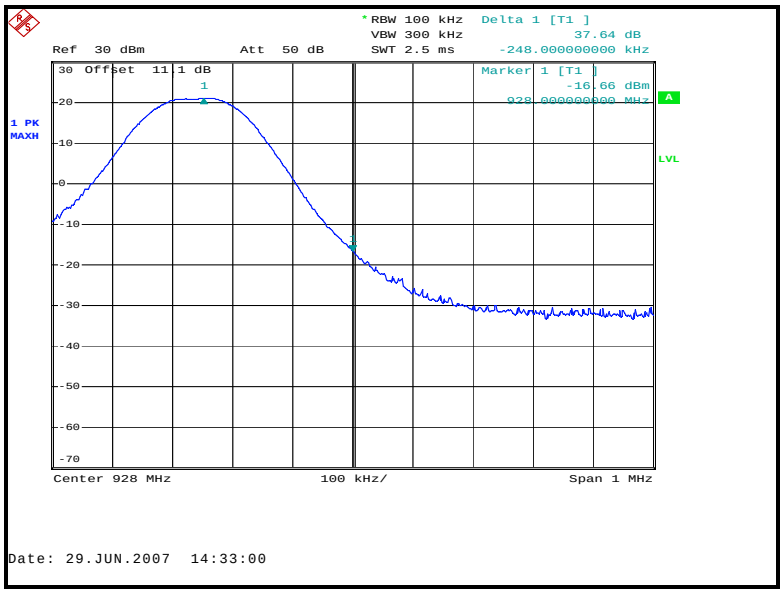

Figure 7.6.1-2: Upper Band-edge

7.6.2 RF Conducted Spurious Emissions

7.6.2.1 Test Methodology

The EUT was investigated for conducted spurious emissions from 30MHz to 10GHz, 10 times the highest fundamental frequency. Measurements were made at the low, center and high channels of the EUT. For each measurement, the spectrum analyzer's RBW was set to 100kHz. A peak detector function was used with the trace set to max hold.

7.6.2.1 Test Results

All emissions found were greater than 20dB down from the fundamental carrier. The RF conducted spurious emissions were measured in the band of 30MHz to 10GHz. Results are shown below in Figures 7.6.2-1 through 7.6.2-6.

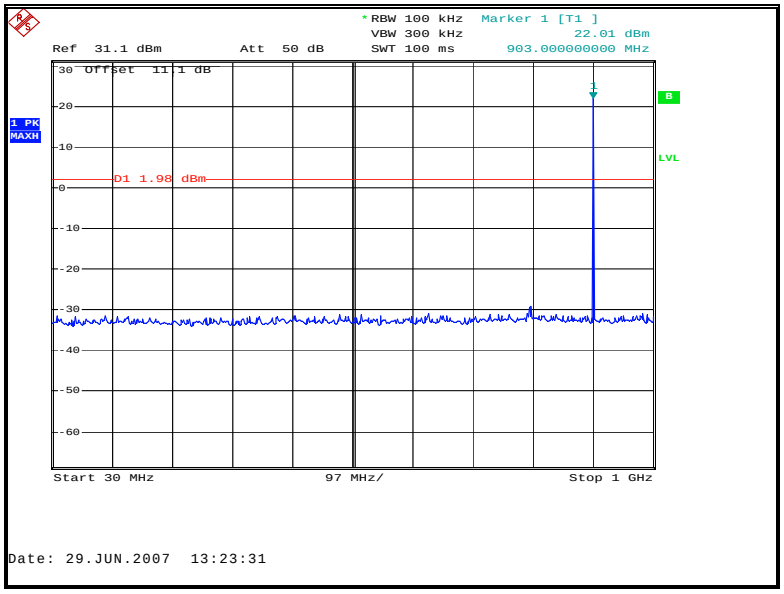

Figure 7.6.2-1 RF Conducted Spurious Emissions – Low Channel

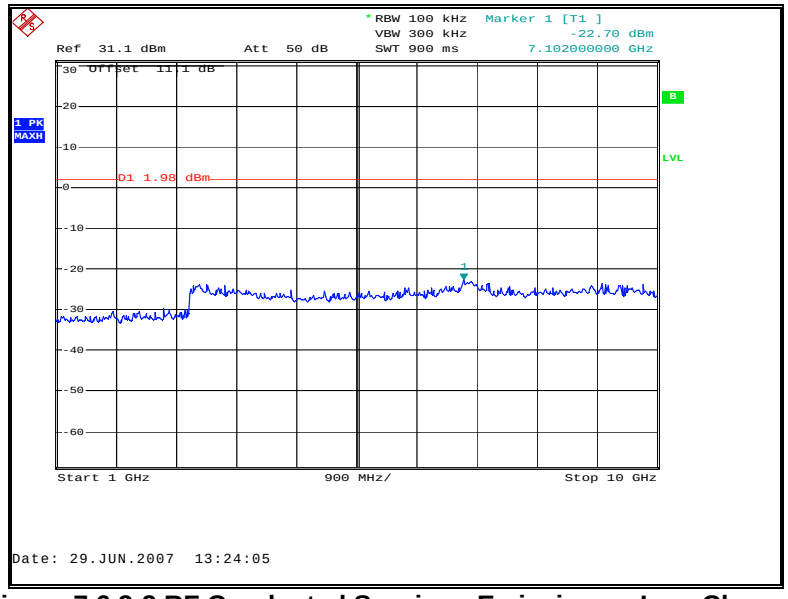

Figure 7.6.2-2 RF Conducted Spurious Emissions – Low Channel

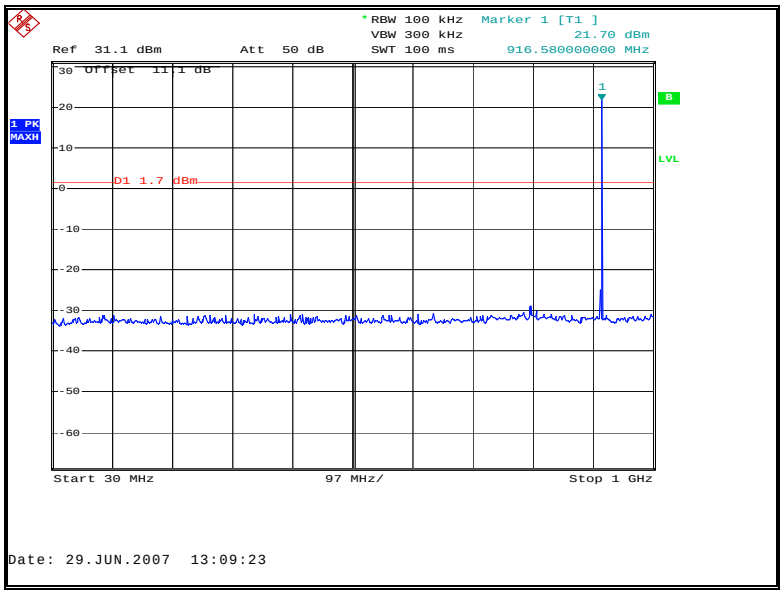

Figure 7.6.2-3 RF Conducted Spurious Emissions – Mid Channel

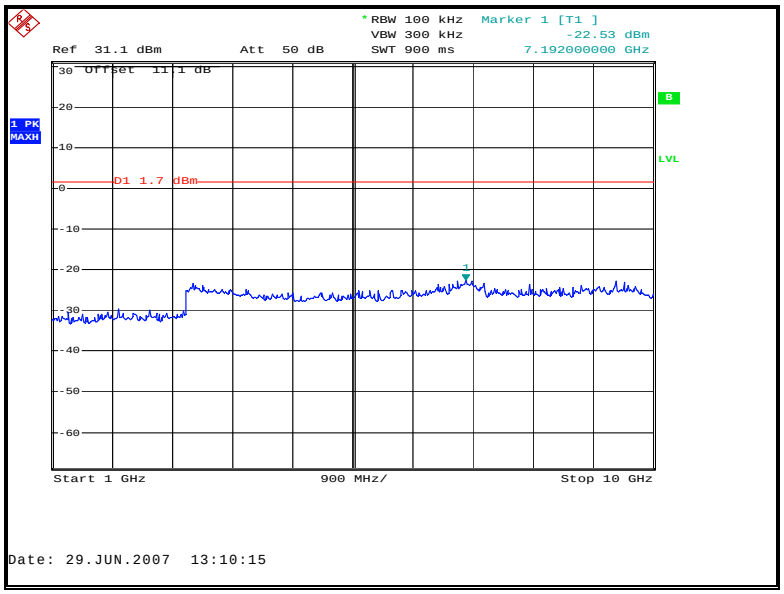

Figure 7.6.2-4 RF Conducted Spurious Emissions – Mid Channel

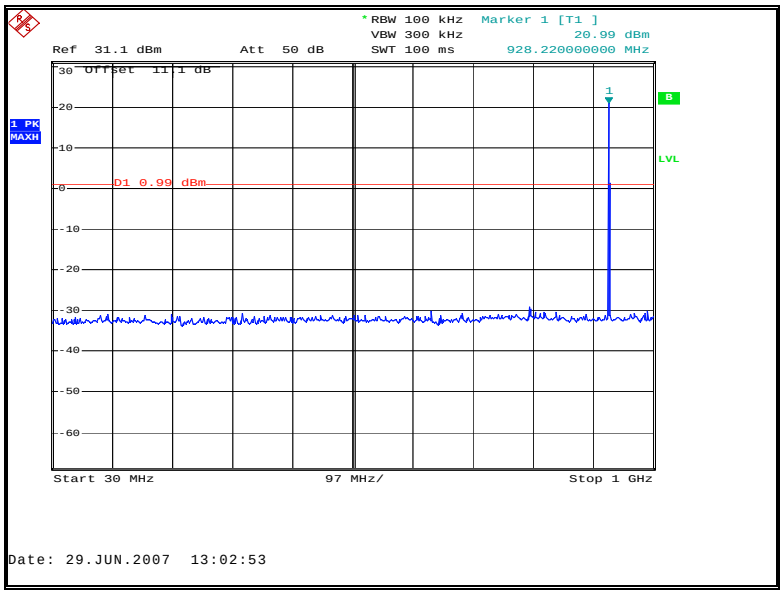

Figure 7.6.2-5 RF Conducted Spurious Emissions – High Channel

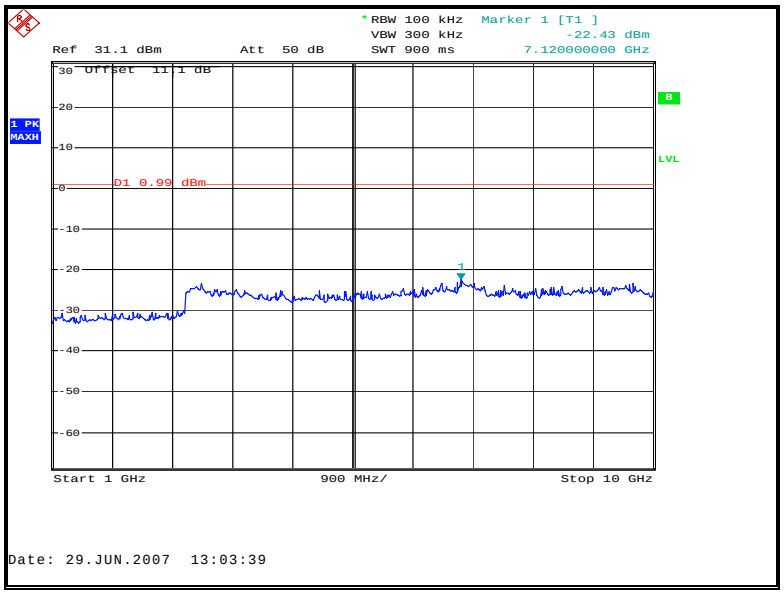

Figure 7.6.2-6 RF Conducted Spurious Emissions – High Channel

7.6.3 Radiated Spurious Emissions (Transmitter)

7.6.3.1 Test Methodology

Radiated emissions tests were made over the frequency range of 30MHz to 10GHz, 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, average measurements were made using an RBW of 1 MHz and a VBW of 10 Hz and peak measurements were made with RBW of 1 MHz and a VBW of 1 MHz.

The EUT was caused to generate a continuous carrier signal on the hopping channel.

This device contains two transmitters, as described in section 1.0. These transmitters can not operate simultaneously therefore inter-modulation products where not evaluated.

7.6.3.2 Test Results

Radiated spurious emissions found in the band of 30MHz to 10GHz are reported in Tables 7.6.3-1 and 7.6.3-2. Each emission found to be in a restricted band as defined by section 15.205, was compared to the radiated emission limits as defined in section 15.209.

Table 7.6.3-1: Radiated Spurious Emissions – CVSO-A

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 - 902.25 MHz										
2706.75	55.98	52.62	H	0.54	56.52	53.16	74.0	54.0	17.48	0.84
2706.75	51.96	48.89	V	0.28	52.24	49.17	74.0	54.0	21.76	4.83
3609	46.83	39.87	H	3.45	50.28	43.32	74.0	54.0	23.72	10.68
3609	46.83	39.04	V	3.47	50.30	42.51	74.0	54.0	23.70	11.49
4511.25	46.98	40.79	H	5.78	52.76	46.57	74.0	54.0	21.24	7.43
4511.25	47.62	41.17	V	5.69	53.31	46.86	74.0	54.0	20.69	7.14
5413.5	48.31	40.00	H	8.04	56.35	48.04	74.0	54.0	17.65	5.96
5413.5	48.03	38.60	V	8.23	56.26	46.83	74.0	54.0	17.74	7.17
8120.25	45.05	31.67	H	12.45	57.50	44.12	74.0	54.0	16.50	9.88
8120.25	45.03	32.54	V	12.53	57.56	45.07	74.0	54.0	16.44	8.93
9022.5	44.34	30.22	V	13.15	57.49	43.37	74.0	54.0	16.51	10.63
Spurious Emissions - 914.75 MHz										
2744.25	51.27	46.93	H	0.67	51.94	47.60	74.0	54.0	22.06	6.40
2744.25	50.89	45.02	V	0.42	51.31	45.44	74.0	54.0	22.69	8.56
Spurious Emissions - 927.75 MHz										
2783.25	51.04	46.45	H	0.81	51.85	47.26	74.0	54.0	22.15	6.74
2783.25	51.12	46.62	V	0.56	51.68	47.18	74.0	54.0	22.32	6.82
4638.75	48.91	40.50	H	6.07	54.98	46.57	74.0	54.0	19.02	7.43
4638.75	47.13	37.86	V	6.03	53.16	43.89	74.0	54.0	20.84	10.11
7422	46.52	33.70	H	12.51	59.03	46.21	74.0	54.0	14.97	7.79
7422	46.12	32.51	V	12.60	58.72	45.11	74.0	54.0	15.28	8.89

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

Table 7.6.3-2: Radiated Spurious Emissions – CVSOD-D

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 - 902.25 MHz										
2706.75	54.04	51.07	H	0.54	54.58	51.61	74.0	54.0	19.42	2.39
2706.75	53.59	50.74	V	0.28	53.87	51.02	74.0	54.0	20.13	2.98
3609	46.81	38.17	H	3.45	50.26	41.62	74.0	54.0	23.74	12.38
3609	46.98	38.66	V	3.47	50.45	42.13	74.0	54.0	23.55	11.87
4511.25	50.03	44.22	H	5.78	55.81	50.00	74.0	54.0	18.19	4.00
4511.25	49.40	43.33	V	5.69	55.09	49.02	74.0	54.0	18.91	4.98
5413.5	46.25	35.10	H	8.04	54.29	43.14	74.0	54.0	19.71	10.86
5413.5	45.87	36.01	V	8.23	54.10	44.24	74.0	54.0	19.90	9.76
Spurious Emissions - 914.75 MHz										
2744.25	48.10	42.03	H	0.67	48.77	42.70	74.0	54.0	25.23	11.30
2744.25	49.22	44.01	V	0.42	49.64	44.43	74.0	54.0	24.36	9.57
4573.75	46.93	36.93	H	5.93	52.86	42.86	74.0	54.0	21.14	11.14
4573.75	45.89	36.04	V	5.85	51.74	41.89	74.0	54.0	22.26	12.11
7318	45.28	32.15	H	12.42	57.70	44.57	74.0	54.0	16.30	9.43
7318	45.66	32.76	V	12.48	58.14	45.24	74.0	54.0	15.86	8.76
Spurious Emissions - 927.75 MHz										
2783.25	45.97	37.64	H	0.81	46.78	38.45	74.0	54.0	27.22	15.55
2783.25	47.72	41.02	V	0.56	48.28	41.58	74.0	54.0	25.72	12.42
3711	45.49	33.27	H	3.91	49.40	37.18	74.0	54.0	24.60	16.82
3711	45.38	32.43	V	3.95	49.33	36.38	74.0	54.0	24.67	17.62
4638.75	47.11	38.63	H	6.07	53.18	44.70	74.0	54.0	20.82	9.30
4638.75	46.30	37.64	V	6.03	52.33	43.67	74.0	54.0	21.67	10.33
7422	45.61	33.68	H	12.51	58.12	46.19	74.0	54.0	15.88	7.81
7422	45.00	33.15	V	12.60	57.60	45.75	74.0	54.0	16.40	8.25

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

7.6.3.3 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: 55.98+ 0.54= 56.52dBuV
Margin: 74dBuV – 56.52dBuV = 17.48dB

AVERAGE:
Corrected Level: 52.62+ 0.54-0= 53.16dBuV
Margin: 54dBuV – 53.16dBuV = 0.84dB

8.0 CONCLUSION

In the opinion of ACS, Inc. the CVSO-A and CVSOD-A, manufactured by Itron Electricity Metering Inc., meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT