Excellence in Compliance Testing

Certification Test Report

Low Power Communication Device Transmitter

FCC ID: SK9AMI-2A
IC: 864G-AMI2A

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

ACS Report Number: 07-0273-2400-DXX

Manufacturer: Itron Electricity Metering Inc.
Model(s): CVSOR-A

Testing Date(s): September 21, 2006 - October 3, 2006
August 15, 2007 - August 16, 2007

Report Issue Date: September 11, 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 15 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. For the purpose of this report, only the CENTRON OpenWay CVSOR-A meter type was evaluated.

The CVSOR-A register board contains (1) 900 MHz LAN frequency hopping spread spectrum radio and (1) 2.4 GHz direct sequence spread spectrum Zigbee radio. The Cell Relay Core board, located in the meter base, contains (1) low power 2.4 GHz direct sequence spread spectrum Zigbee radio.

The CVSOR-A also incorporates a pre-approved 850/1900 GPRS modem module FCC ID: MIVGSM0108.

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
The CVSOR-A was evaluated for all modes of operation and worst case data presented in this report.

The 900 MHz LAN and Zigbee radios located on the register board can not operate simultaneously. However, the Zigbee radio located on the Cell Relay Core board and the GPRS modem module can operate simultaneously with each other and with either the 900 MHz LAN or register board Zigbee radio. Radiated inter-modulation products were evaluated where applicable.

This device is considered a composite device by definition. The 900 MHz LAN and the 2.4 GHz Zigbee radios on the register board operate under CFR 47 Part 15.247 and IC RSS-210. The 2.4 GHz Zigbee radio located on the Cell Relay Core board operates under CFR 47 Part 15.249 and IC RSS-210. This report addresses Part 15.249 and RSS 210 for the 2.4 GHz Zigbee radio located on the Cell Relay Core board only. Separate reports will be issued for Part 15.247 and RSS 210 in reference to the 900 MHz LAN and 2.4GHz Zigbee radios located on the register board.

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:

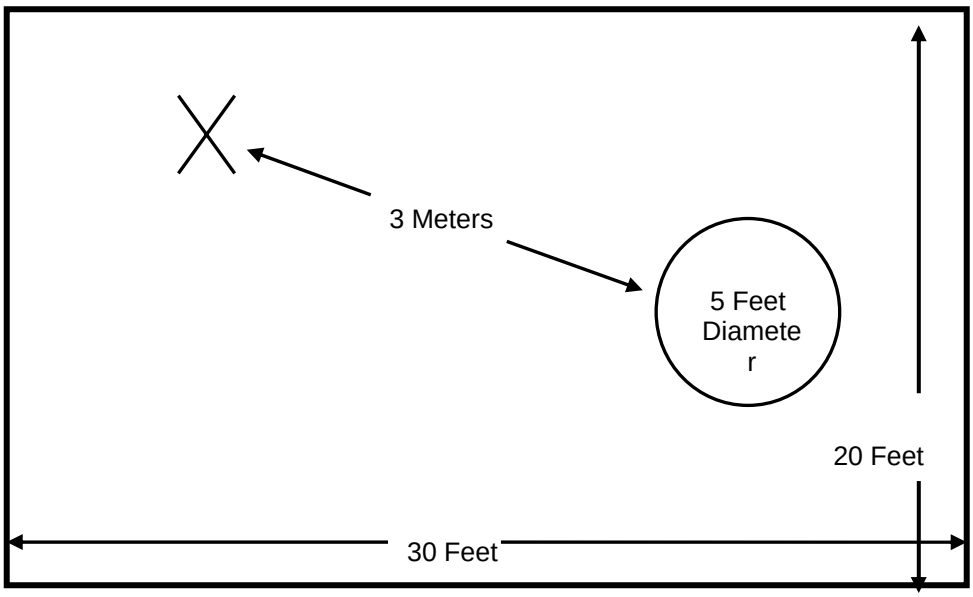

Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

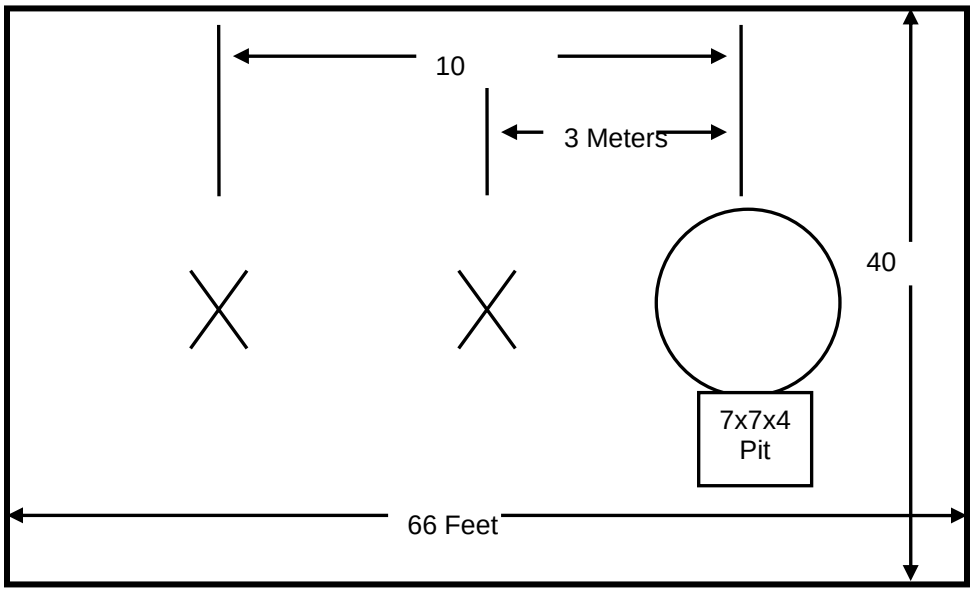

Figure 2.3-2: Open Area Test Site

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:

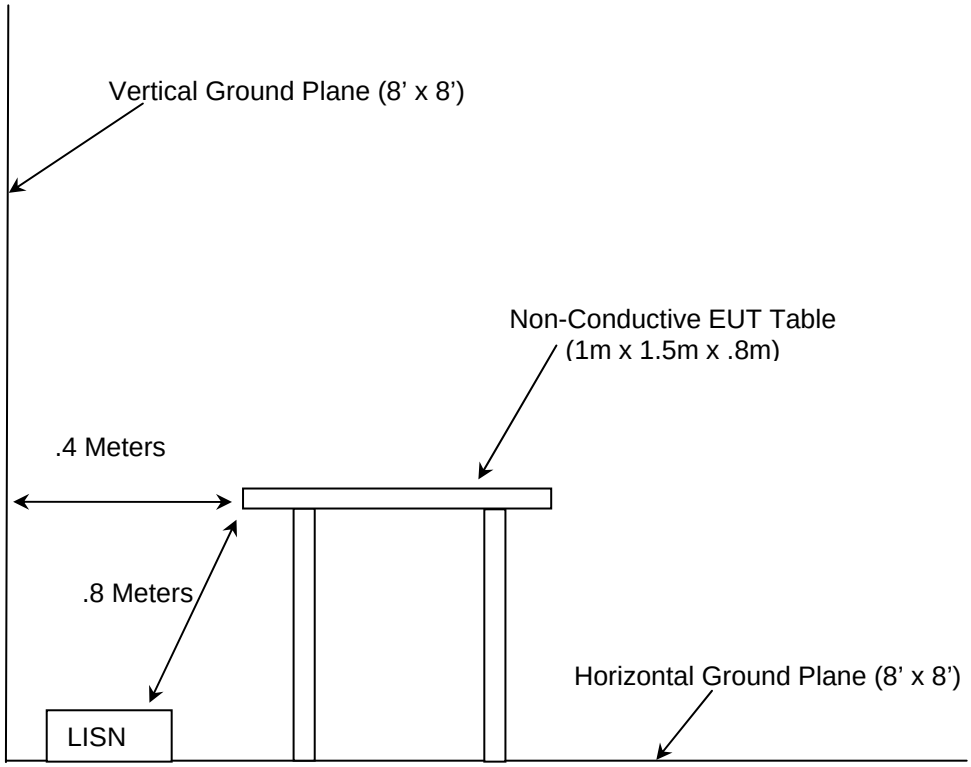

Figure 2.4-1: AC Mains Conducted EMI Site

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
- 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	7/27/2008
329	A.H.Systems	Antennas	SAS-571	721	8/13/2008
331	Microwave Circuits	Filters	H1G513G1	31417	3/24/2008
338	Hewlett Packard	Amplifiers	8449B	3008A01111	9/26/2007

5.0 SUPPORT EQUIPMENT

Table 5-3: Support Equipment

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

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

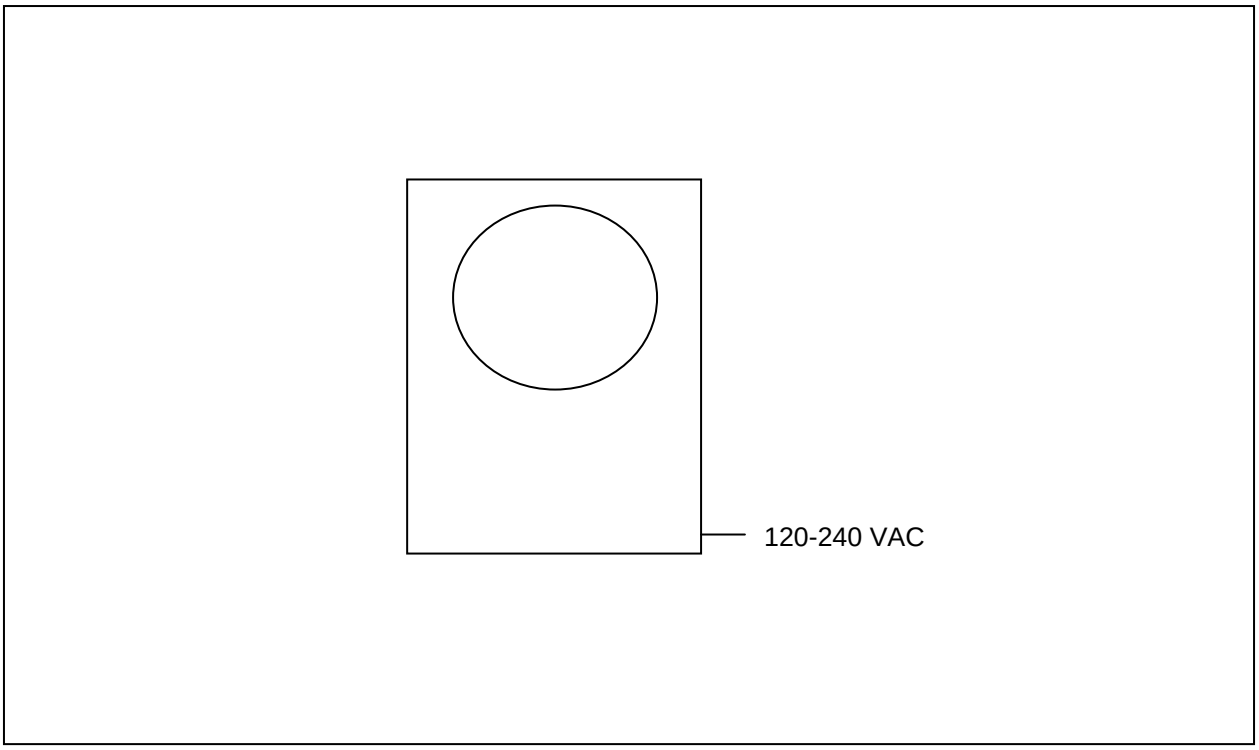

Figure 6-1: EUT Test Setup

*See Test Setup photographs for additional detail.

*Note: The meter base is auto ranging and can be used on 120 – 240V lines.

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 - FCC Section 15.203

The antennas are a PCB integrated single-band slot antenna which can not be altered without destroying the device. This device meets the requirements of CFR 47 Part 15.203. The antenna gain is 4dBi.

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 7.2.2-1.

Table 7.2.2-1: Conducted EMI Results – 240VAC

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										
0.23	35.6	33.7	9.80	45.40	43.50	62.45	52.45	17.0	8.9	FLO
1.55	24.1	20.4	9.80	33.90	30.20	56.00	46.00	22.1	15.8	FLO
2.56	29.3	24.2	9.80	39.10	34.00	56.00	46.00	16.9	12.0	FLO
2.97	22.8	18.5	9.80	32.60	28.30	56.00	46.00	23.4	17.7	FLO
9.08	14.7	10.3	9.90	24.60	20.20	60.00	50.00	35.4	29.8	FLO
26	19.8	13.8	10.10	29.90	23.90	60.00	50.00	30.1	26.1	FLO
Line 2										
0.23	35.1	33.8	9.80	44.90	43.60	62.45	52.45	17.5	8.8	FLO
0.46	24.9	23.6	9.80	34.70	33.40	56.69	46.69	22.0	13.3	FLO
1.32	18.1	21.4	9.80	27.90	31.20	56.00	46.00	28.1	14.8	FLO
2.25	26.3	20.5	9.80	36.10	30.30	56.00	46.00	19.9	15.7	FLO
2.43	28	23.8	9.80	37.80	33.60	56.00	46.00	18.2	12.4	FLO
22.75	27.7	7.2	10.21	37.91	17.41	60.00	50.00	22.1	32.6	FLO

7.3 Radiated Emissions - (Unintentional Radiation)

7.3.1 Test Methodology

Radiated emissions tests were performed over the frequency range of 30MHz to 12.5 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 Table 7.3.2-1 below:

Table 7.3.2-1: Radiated Emissions Tabulated Data – 240VAC

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
35.388	---------	26.71	H	-9.39	---------	17.32	--------	40.0	---------	22.68
82.947	---------	30.42	H	-17.73	---------	12.69	--------	40.0	---------	27.31
95.504	---------	42.76	H	-15.65	---------	27.11	--------	43.5	---------	16.39
110.599	---------	42.56	H	-14.06	---------	28.50	--------	43.5	---------	15.00
249.99	---------	37.25	H	-11.80	---------	25.45	--------	46.0	---------	20.55
278.961	---------	41.64	V	-11.98	---------	29.66	--------	46.0	---------	16.34
368.617	---------	39.84	V	-8.71	---------	31.13	--------	46.0	---------	14.87
591.248	---------	35.69	H	-3.69	---------	32.00	--------	46.0	---------	14.00
595.746	---------	33.98	H	-3.64	---------	30.34	--------	46.0	---------	15.66
956.888	---------	25.73	V	3.18	---------	28.91	--------	46.0	---------	17.09
1316	34.00	22.00	V	-6.37	27.63	15.63	74.0	54.0	46.37	38.37
2603	32.00	20.00	V	-0.74	31.26	19.26	74.0	54.0	42.74	34.74
5260	39.40	34.61	H	7.52	46.92	42.13	74.0	54.0	27.08	11.87

* Note: All emissions above 5260 MHz were attenuated below the permissible limit.

7.4 Occupied Bandwidth – 20dB

7.4.1 Test Methodology

ANSI C63.4 Annex H was the guiding document for this evaluation. Radiated measurements were made with the Spectrum Analyzer's resolution bandwidth set to 100kHz.

Intentional radiators operating under the alternative provisions to the general emission limits as contained in Sec. Sec. 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

7.4.2 Test Results

The maximum 20dB bandwidth was determined to be 2.66 MHz. The frequency band designated under Part 15.249 is 2400-2483.5 MHz, therefore the 20dB bandwidth is contained within the frequency band designated under this rule part. Test results are shown in Figure 7.4.2-1 to 7.4.2-3 below.

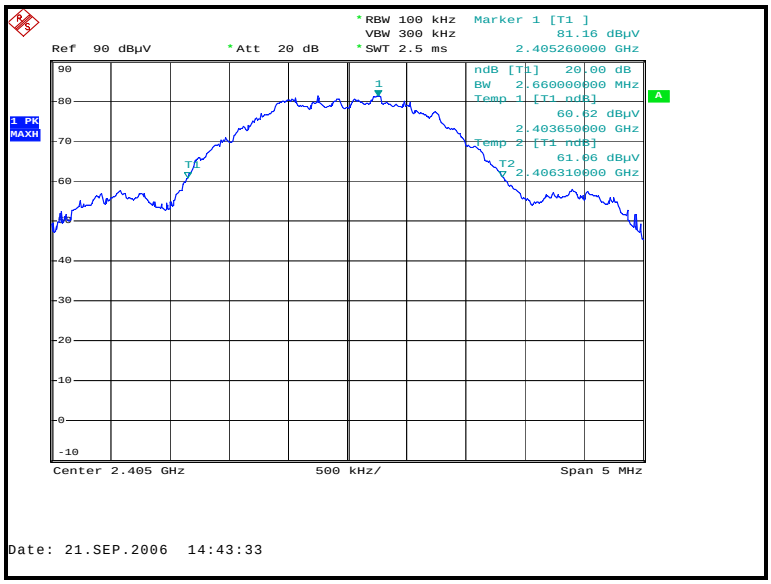

Figure 7.4.2-1 – Low Channel

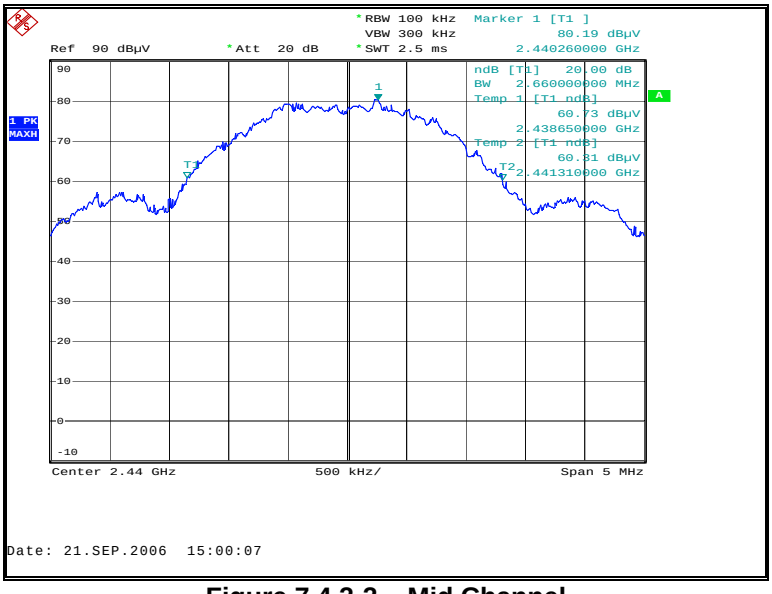

Figure 7.4.2-2 – Mid Channel

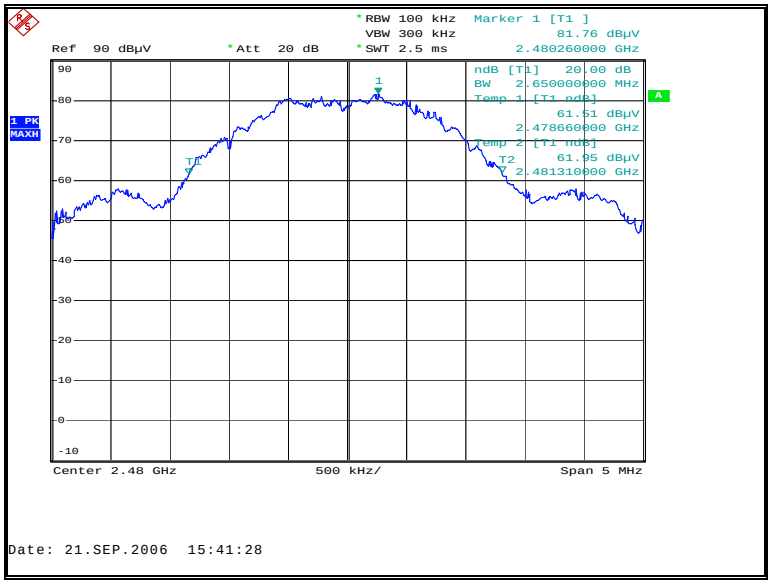

Figure 7.4.2-3 – High Channel

7.5 Band-Edge Compliance and Spurious Emissions

7.5.1 Band-Edge Compliance

7.5.1.1 Test Methodology

The EUT was investigated at the low and high channels of operation 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.

7.5.1.2 Duty Cycle Correction

For average radiated measurements, the measured level was reduced by a factor 37.1dB to account for the duty cycle of the EUT. The duty cycle was determined to be 1.4% or 1.4ms with a 100ms period. The duty cycle correction factor is determined using the formula: 20log (0.014) = -37.1dB. The duty cycle is displayed below in Figure 7.5.1.2-1.

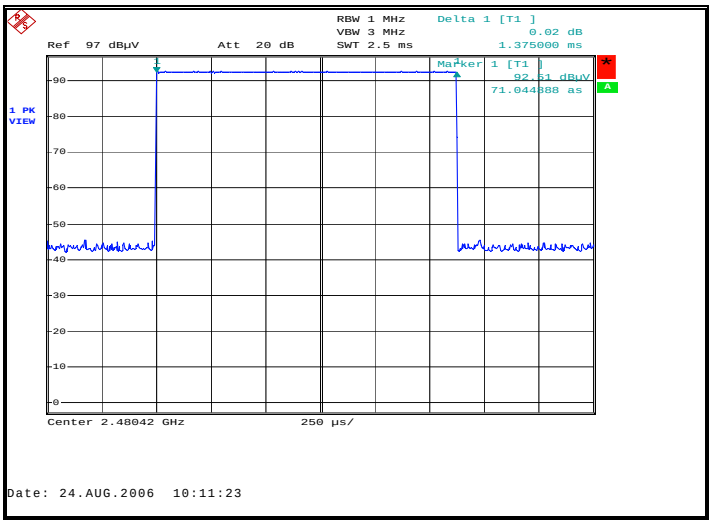

Figure 7.5.1.2-1: Duty Cycle

7.5.1.3 Test Results

Band-edge compliance is displayed in Tables 7.5.1.3-1 to 7.5.1.3-2 and Figures 7.5.1.3-1 – 7.5.1.3-2. The fundamental field strength measurements are displayed in section 7.5.2.2.

Table 7.5.1.3-1: 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)		Band-edge Margin to Limit (dBuV/m)	
	pk	avg	(H/V)	(dB)	pk	avg		pk	avg	pk	avg
Fundamental Frequency											
2405	84.70	84.70	H	0.21	84.91	47.83	39.51	45.40	8.32	28.60	45.68

Table 7.5.1.3-2: 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)		Band-edge Margin to Limit (dBuV/m)	
	pk	avg	(H/V)	(dB)	pk	avg		pk	avg	pk	avg
Fundamental Frequency											
2480	84.71	84.71	H	0.53	85.24	48.16	40.96	44.28	7.20	29.72	46.80

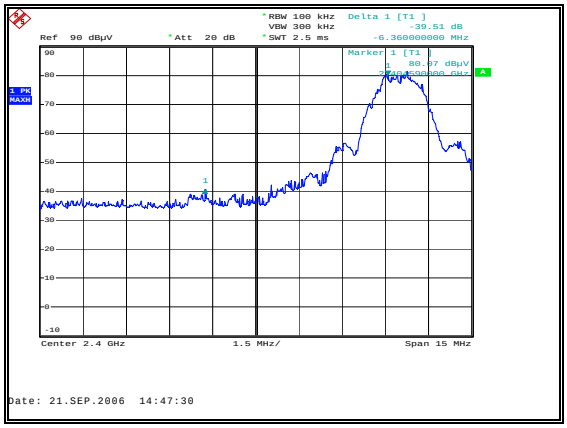

Figure 7.5.1.3-1: Lower Band-edge

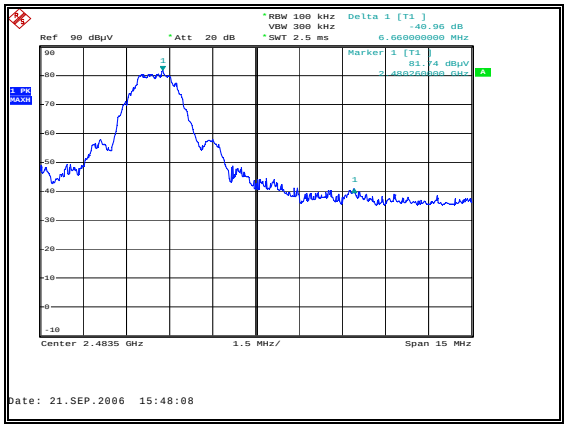

Figure 7.5.1.3-2: Upper Band-edge

7.5.2 Fundamental Field Strength and Radiated Spurious Emissions

7.5.2.1 Test Methodology

Radiated emissions tests were made over the frequency range of 30MHz to 25GHz, 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 calculated based on the peak measurements made with RBW of 1 MHz and a VBW of 1 MHz. The average emissions were calculated by applying the duty cycle correction of the EUT to the peak measurements for comparison to the average limit.

This device contains multiple transmitters, as described in section 1.0, some of which can operate simultaneously. Although these transmitters do not share the same antenna, Inter-modulation products were examined where applicable.

7.5.2.2 Test Results

The fundamental field strength and radiated spurious emissions found in the band of 30MHz to 25GHz are reported in Table 7.5.2.2-1.

Inter-modulation products were examined with the transmitter combinations described in Section 1.0 operating simultaneously. Inter-modulation products were found to be in compliance.

Table 7.5.2.2-1: Fundamental Field Strength and 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
Low Channel										
2405	84.70	84.70	H	0.21	84.91	47.83	114.0	94.0	29.07	46.15
2405	80.39	80.39	V	-0.12	80.27	43.19	114.0	94.0	33.71	50.78
4810	55.76	55.76	H	7.92	63.68	26.60	74.0	54.0	10.32	27.40
4810	57.93	57.93	V	7.92	65.85	28.77	74.0	54.0	8.15	25.23
Mid Channel										
2440	83.20	83.20	H	0.36	83.56	46.48	114.0	94.0	30.42	47.50
2440	81.10	81.10	V	0.01	81.11	44.03	114.0	94.0	32.87	49.95
4880	55.57	55.57	H	8.15	63.72	26.64	74.0	54.0	10.28	27.36
4880	56.88	56.88	V	8.15	65.03	27.95	74.0	54.0	8.97	26.05
High Channel										
2480	84.71	84.71	H	0.53	85.24	48.16	114.0	94.0	28.74	45.82
2480	77.60	77.60	V	0.15	77.75	40.67	114.0	94.0	36.23	53.31
4960	53.57	53.57	H	8.23	61.80	24.72	74.0	54.0	12.20	29.28
4960	53.73	53.73	V	8.42	62.15	25.07	74.0	54.0	11.85	28.93

7.5.2.3 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: Fundamental
Corrected Level: 84.70+ 0.21= 84.91dBuV
Margin: 114dBuV – 84.91dBuV = 29.09dB

AVERAGE: Fundamental
Corrected Level: 84.70+ 0.21-37.1= 47.83dBuV
Margin: 94dBuV – 47.83dBuV = 46.17dB

8.0 CONCLUSION

In the opinion of ACS, Inc. the CVSOR-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