Excellence in Compliance Testing

Certification Test Report

Digital Transmission System Transmitter

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

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

ACS Report Number: 07-0272-2400-DTS

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: September 6, 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 24 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 2400 MHz Zigbee radio only and a separate report, 07-0272-900-DSS, will be issued for the 900 MHz 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:

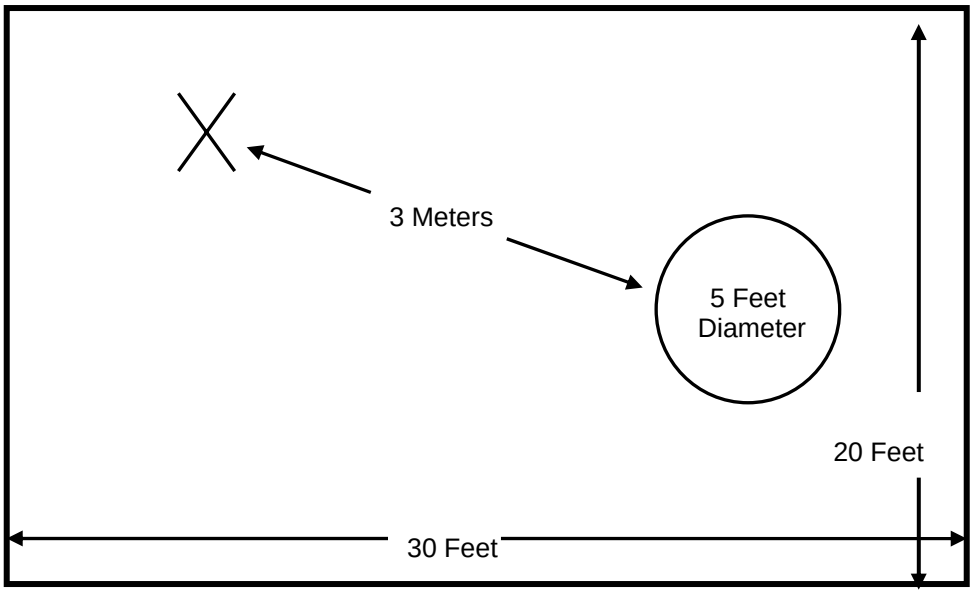

Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

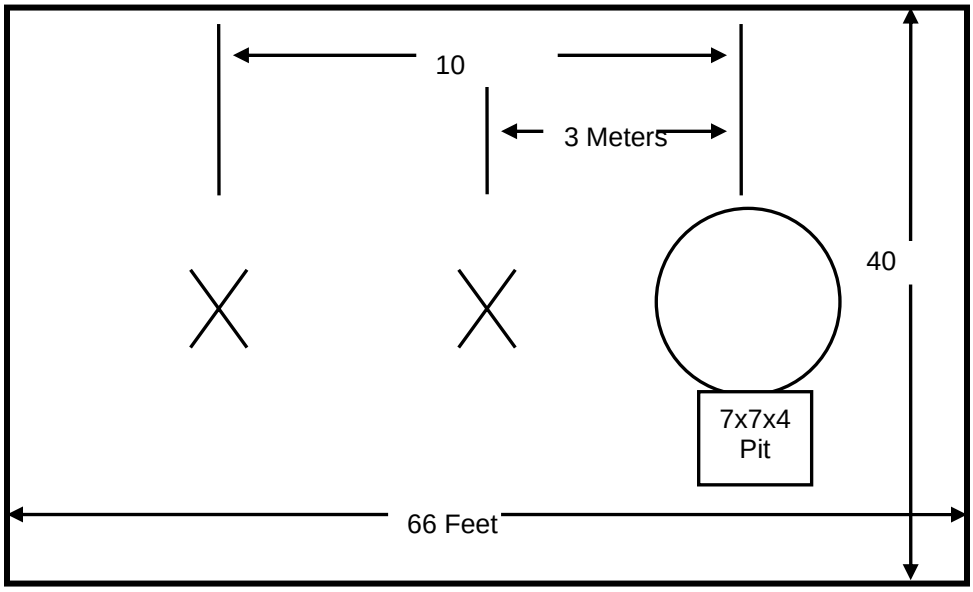

Figure 2.3-2: Open Area Test Site

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:

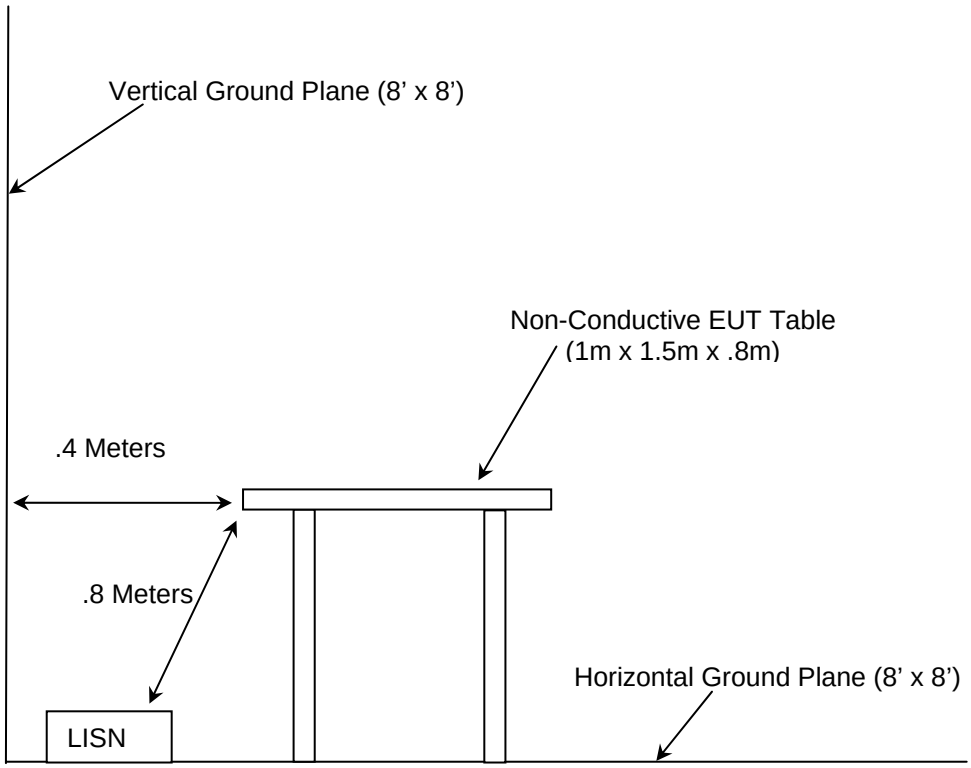

Figure 2.4-1: AC Mains Conducted EMI Site

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 KDB Publication No. 558074 - Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247), March 2005
- 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

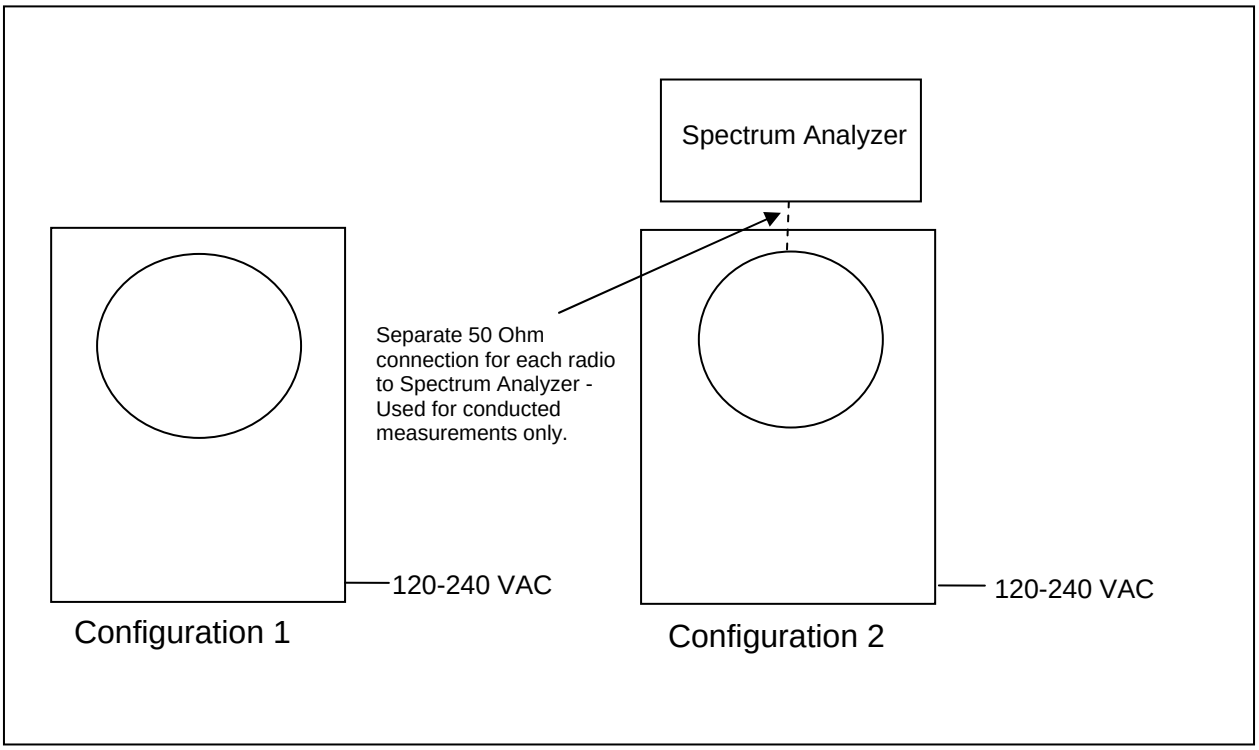

Figure 6-1: EUT Test Setup

*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 - FCC Section 15.203

The antenna is a PCB integrated half wavelength 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 1dBi.

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 6dB Bandwidth

7.4.1 Test Methodology

The 6dB bandwidth was measured in accordance with the FCC KDB Publication No. 558074 “Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)”. The RBW of the spectrum analyzer was set to 100 kHz and VBW 300 kHz. Span was set large enough to capture the entire emissions and >> RBW.

7.4.2 Test Results

Results are shown below in table 7.4.2-1 and figure 7.4.2-1 to 7.4.2-3:

Table 7.4.2-1: 6dB Bandwidth

Frequency [MHz]	Bandwidth [MHz]
2405	1.65
2440	1.59
2475	1.62

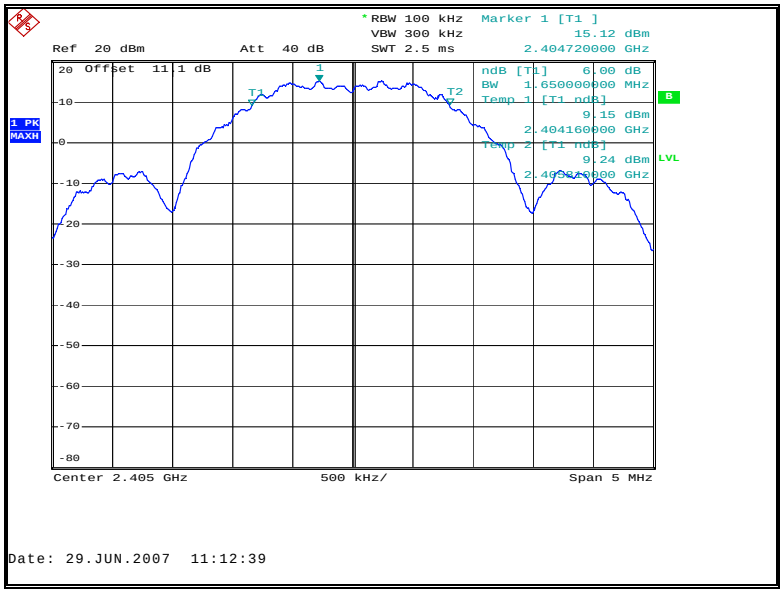

Figure 7.4.2-1: 6dB Bandwidth Plot – Low Channel

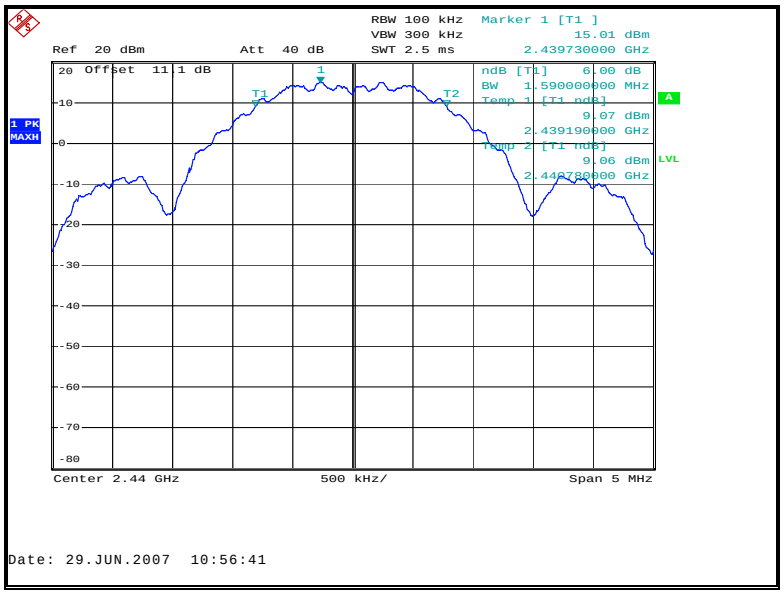

Figure 7.4.2-2: 6dB Bandwidth Plot – Mid Channel

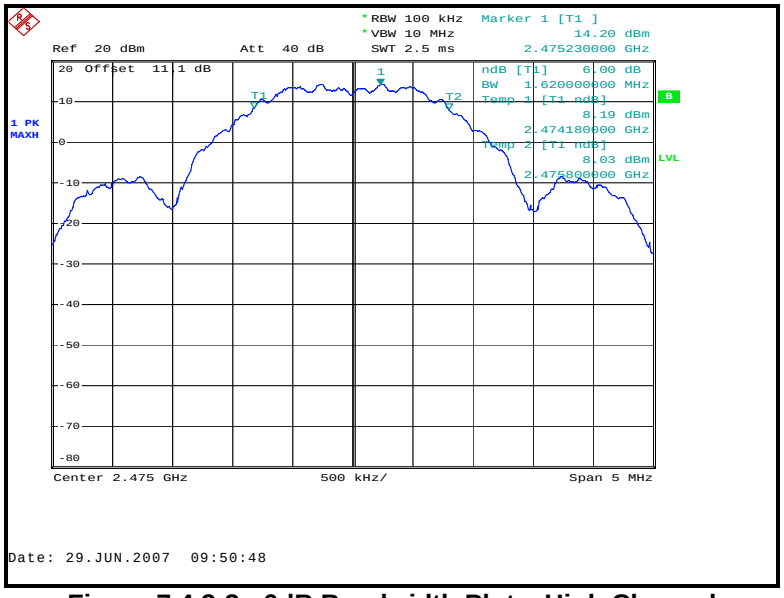

Figure 7.4.2-3: 6dB Bandwidth Plot – High Channel

7.5 Peak Output Power Requirement

7.5.1 Test Methodology

The Peak Output Power was measured in accordance with the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)" Power Option 1. The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer. The RBW was set >> than the emission bandwidth.

Data was collected with the EUT operating at maximum power.

7.5.2 Test Results

Results are shown below in Table 7.5.2-1 and Figures 7.5.2-1 to 7.5.2-3.

Table 7.5.2-1: Peak Output Power

Frequency (MHz)	Output Power (dBm)
2405	18.71
2440	18.25
2475	17.40

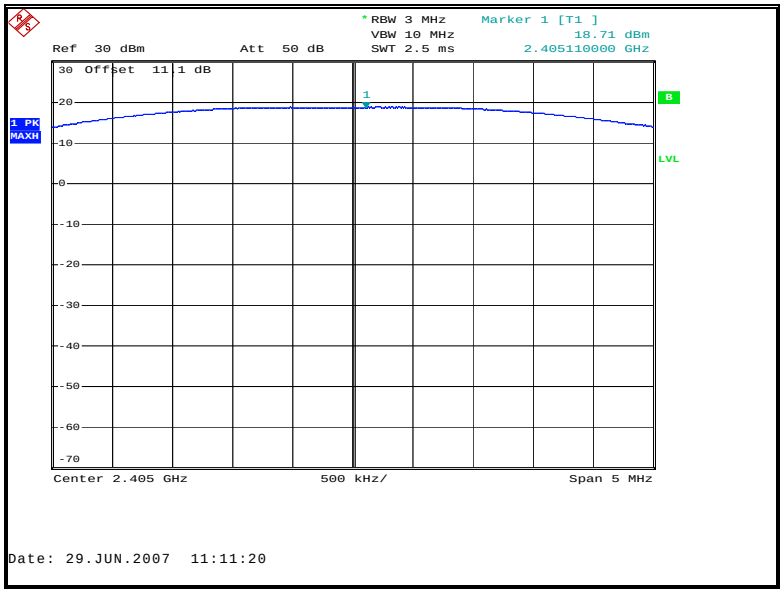

Figure 7.5.2-1: Output power – Low Channel

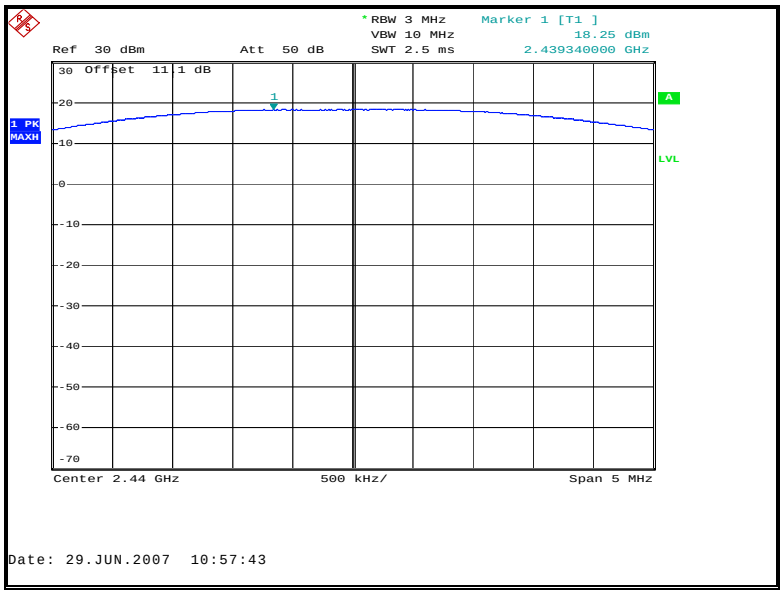

Figure 7.5.2-2: Output power – Mid Channel

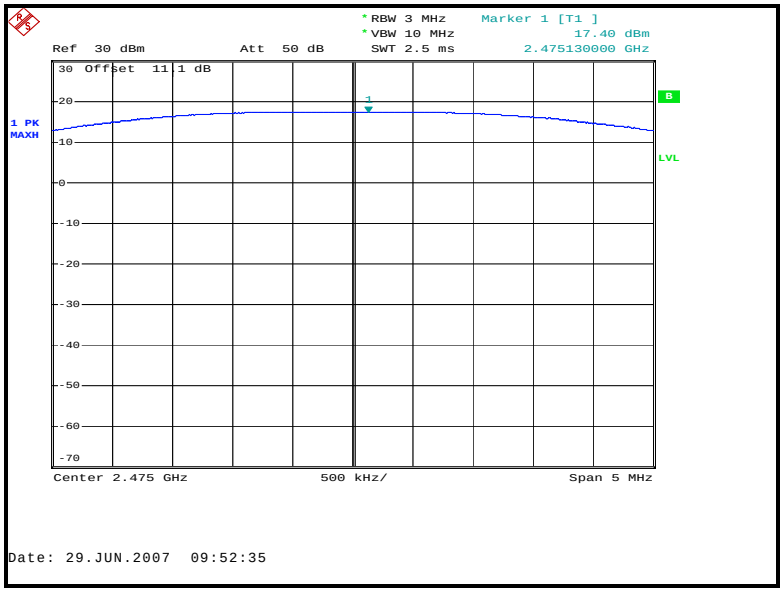

Figure 7.5.2-3: Output power – High Channel

7.6 Band-Edge Compliance and Spurious Emissions

7.6.1 Band-Edge Compliance of RF Emissions

7.6.1.1 Test Methodology

The EUT was investigated at the low and high channels of operation to determine band-edge compliance. Because the upper band-edge coincides with a restricted band, band-edge compliance for the 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.

The lower band-edge compliance was determined using the marker-delta method in which the radio frequency power that is 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.

The correction factor based on the duty cycle is detailed in section 7.6.3.2.

7.6.1.2 Test Results

Band-edge compliance is displayed in Table 7.6.1.2-1 and Table 7.6.1.2-2 and Figures 7.6.1.2-1 – 7.6.1.2-3.

Table 7.6.1.2-1: Upper Band-edge Marker Delta Method – CVSO-A

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											
2475	84.73	80.84	H	32.91	117.64	76.67	47.96	69.68	28.71	4.32	25.29

Table 7.6.1.2-2: Upper Band-edge Marker Delta Method – CVSOD-A

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											
2475	84.05	83.29	H	32.91	116.96	79.12	49.1	67.86	30.02	6.14	23.98

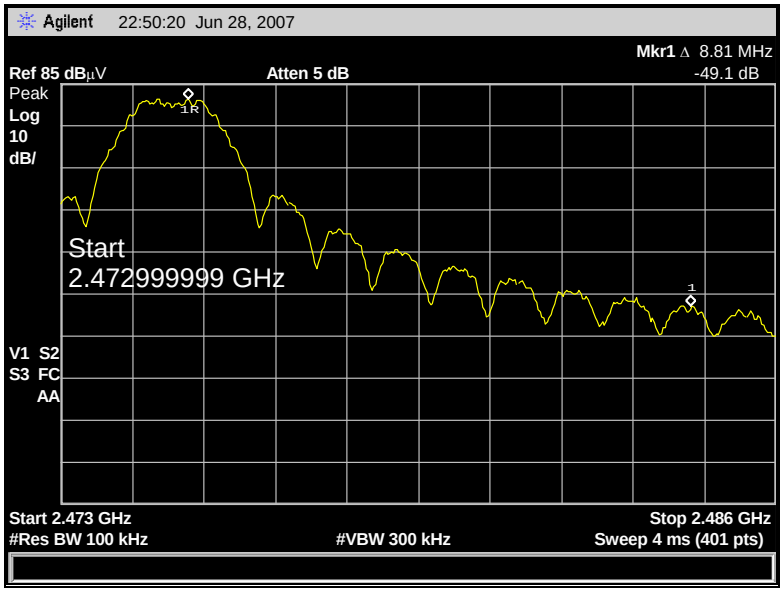

Figure 7.6.1.2-1: Upper Band-edge (Radiated) – CVSO-A

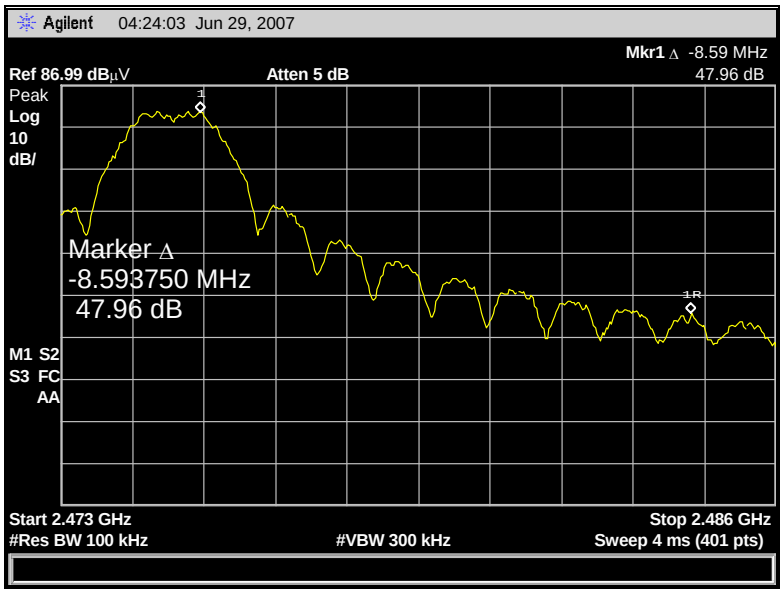

Figure 7.6.1.2-2: Upper Band-edge (Radiated) – CVSOD-A

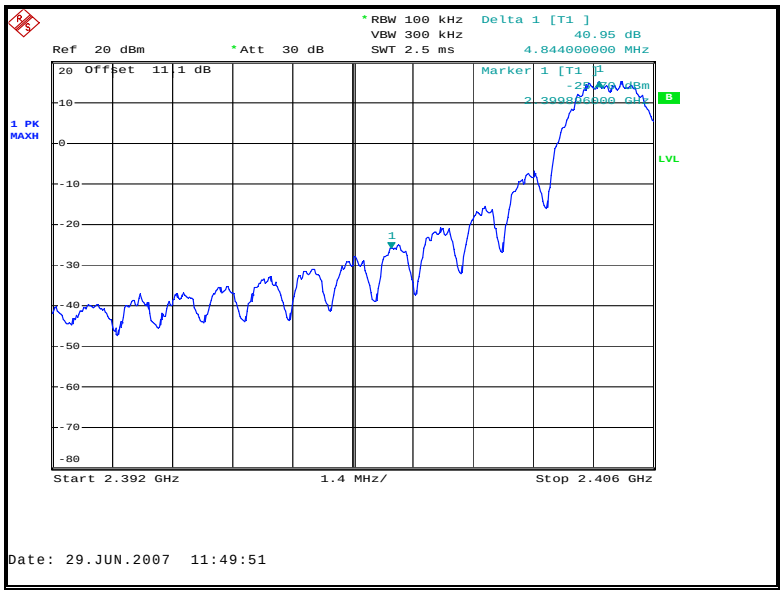

Figure 7.6.1.2-3: Lower Band-edge (Conducted)

7.6.2 RF Conducted Spurious Emissions

The RF Conducted Spurious Emissions were measured in accordance with the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)". The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer. The EUT was investigated for conducted spurious emissions from 30MHz to 26GHz, 10 times the highest fundamental frequency. For each measurement, the spectrum analyzer's RBW was set to 100 kHz and the VBW was set to 300 kHz. The peak detector and Max Hold function of the analyzer were utilized.

7.6.2.2 Test Results

In a 100 kHz bandwidth, the radio frequency power that was produced by the EUT emissions is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power. RF Conducted Emissions are displayed in Figures 7.6.2.2-1 through 7.6.2.2-6.

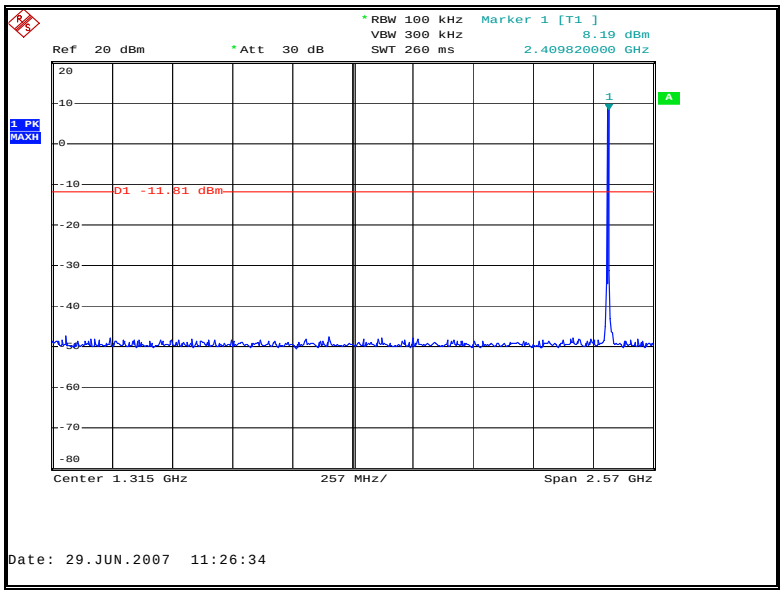

Figure 7.6.2.2-1: 30 MHz – 2.6 GHz – Low Channel

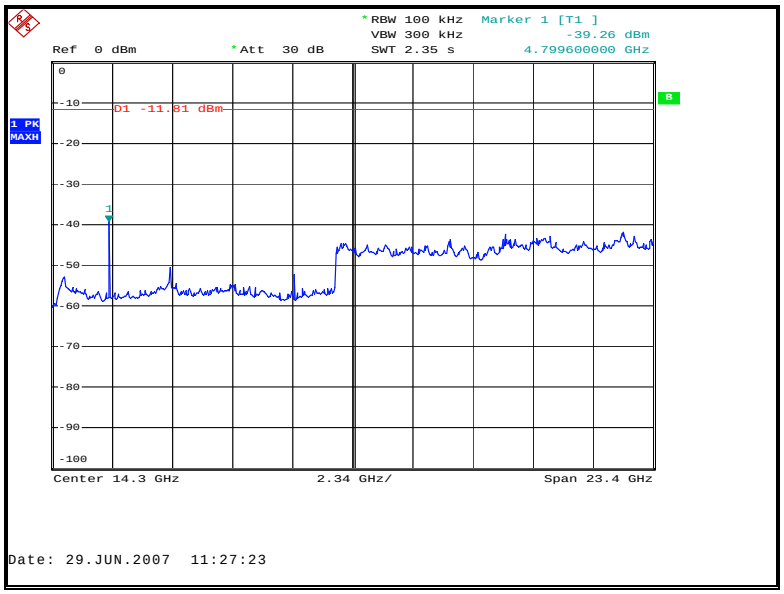

Figure 7.6.2.2-2: 2.6 GHz – 26 GHz – Low Channel

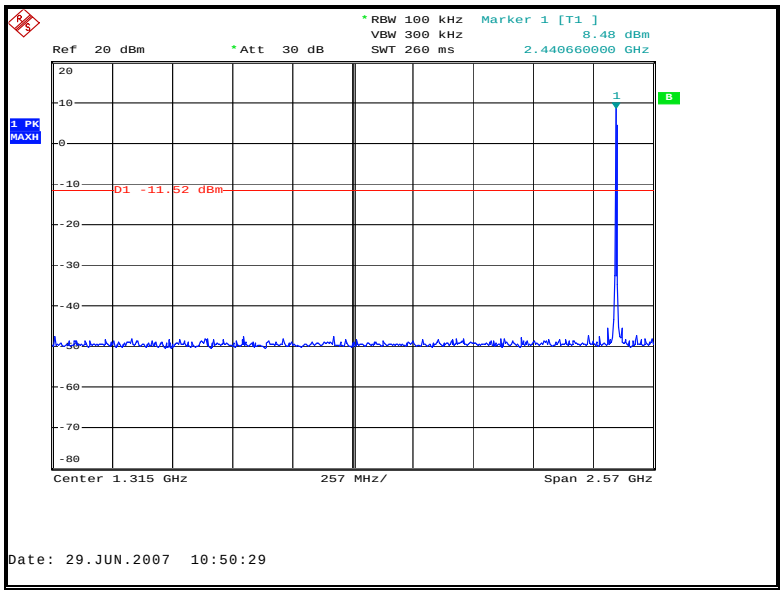

Figure 7.6.2.2-3: 30 MHz – 2.6 GHz –Mid Channel

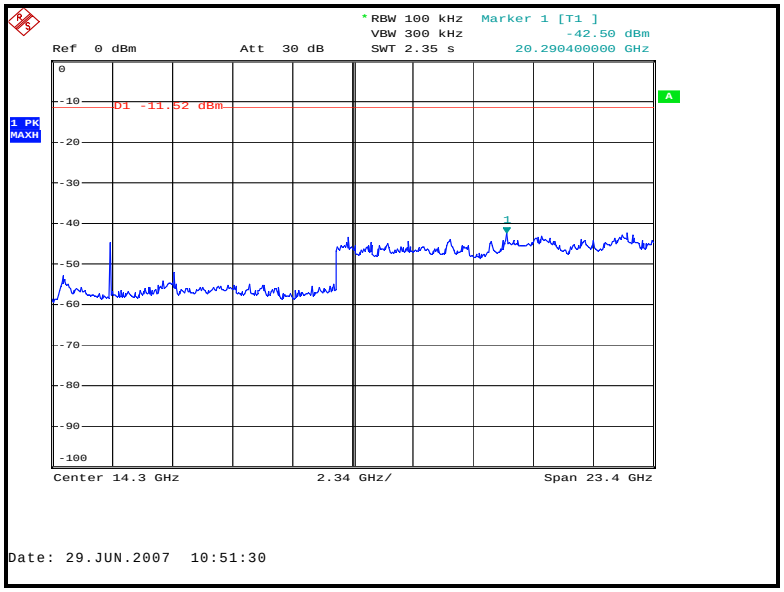

Figure 7.6.2.2-4: 2.6 GHz – 26 GHz – Mid Channel

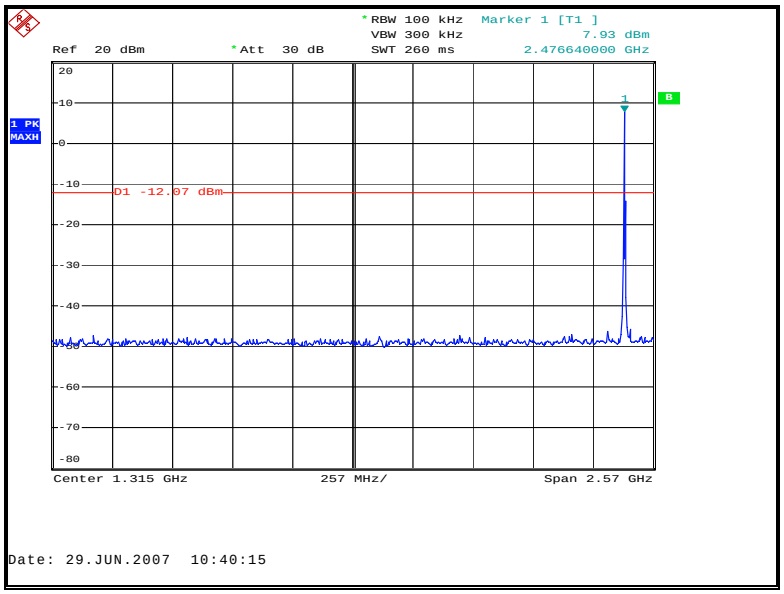

Figure 7.6.2.2-5: 30 MHz – 2.6 GHz – High Channel

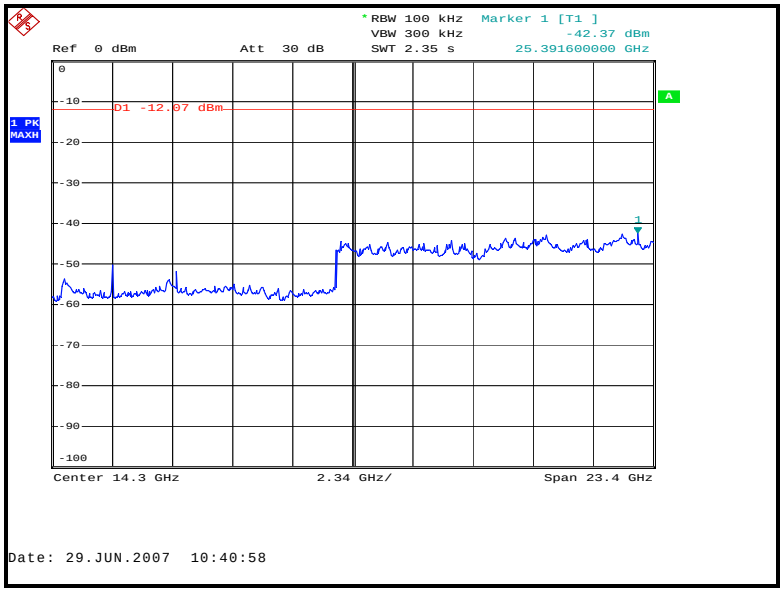

Figure 7.6.2.2-6: 2.6 GHz – 26 GHz –High Channel

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 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, peak measurements made with RBW and VBW of 1 MHz. Average measurements were made with RBW of 1MHz and a VBW of 10Hz. The average emissions were further corrected by applying the duty cycle correction of the EUT to the average measurements for comparison to the average limit.

7.6.3.2 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 timing is provided below in figure 7.6.3.3-1.

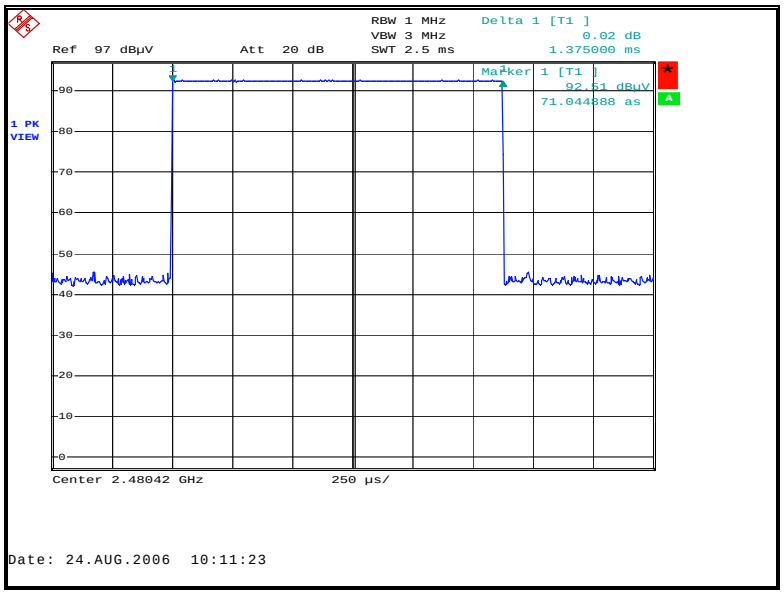

Figure 7.6.3.3-1: Duty Cycle Timing Diagram

7.6.3.3 Test Results

Using the procedures set forth in the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)", radiated spurious emissions found in the band of 30MHz to 25GHz are reported in Table 7.6.3.3-1 to 7.6.3.3-2. 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 7.6.3.3-1: 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 - Low Channel										
4810	63.45	53.32	H	6.64	70.09	22.88	74.0	54.0	3.91	31.12
4810	62.72	52.66	V	6.66	69.38	22.24	74.0	54.0	4.62	31.76
12025	44.33	30.62	H	19.83	64.16	13.37	83.5	63.5	19.39	50.17
12025	43.42	30.95	V	19.73	63.15	13.60	83.5	63.5	20.39	49.94
Spurious Emissions - Mid Channel										
4880	59.77	48.55	H	6.84	66.61	18.31	74.0	54.0	7.39	35.69
4880	60.99	49.62	V	6.89	67.88	19.43	74.0	54.0	6.12	34.57
7320	59.57	48.04	H	12.15	71.72	23.11	74.0	54.0	2.28	30.89
7320	52.41	42.00	V	12.21	64.62	17.13	74.0	54.0	9.38	36.87
Spurious Emissions - High Channel										
4950	58.96	47.74	H	7.04	66.00	17.70	74.0	54.0	8.00	36.30
4950	56.47	43.67	V	7.12	63.59	13.71	74.0	54.0	10.41	40.29
7425	54.31	42.91	H	12.20	66.51	18.04	74.0	54.0	7.49	35.96
7425	51.24	43.01	V	12.29	63.53	18.22	74.0	54.0	10.47	35.78

Table 7.6.3.3-2: Radiated Spurious Emissions – 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
Spurious Emissions - Low Channel										
4810	61.40	50.94	H	6.64	68.04	20.50	74.0	54.0	5.96	33.50
4810	64.01	54.08	V	6.66	70.67	23.66	74.0	54.0	3.33	30.34
Spurious Emissions - Mid Channel										
4880	62.79	52.46	H	6.84	69.63	22.22	74.0	54.0	4.37	31.78
4880	65.05	55.35	V	6.89	71.94	25.16	74.0	54.0	2.06	28.84
7320	57.84	46.16	H	12.15	69.99	21.23	74.0	54.0	4.01	32.77
7320	53.09	42.45	V	12.21	65.30	17.58	74.0	54.0	8.70	36.42
12200	46.57	34.40	H	21.21	67.78	18.53	83.5	63.5	15.76	45.01
12200	45.58	33.16	V	21.15	66.73	17.23	83.5	63.5	16.81	46.31
Spurious Emissions - High Channel										
4950	64.32	54.36	H	7.04	71.36	24.32	74.0	54.0	2.64	29.68
4950	61.35	50.02	V	7.12	68.47	20.06	74.0	54.0	5.53	33.94
7425	55.66	43.72	H	12.20	67.86	18.85	74.0	54.0	6.14	35.15
7425	56.88	45.17	V	12.29	69.17	20.38	74.0	54.0	4.83	33.62
12375	46.64	34.89	H	22.59	69.23	20.41	83.5	63.5	14.31	43.14
12375	44.89	32.93	V	22.57	67.46	18.42	83.5	63.5	16.08	45.12

7.6.3.4 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: 63.45+ 6.64= 70.09dBuV/m

Margin: 74dBuV/m – 70.09dBuV/m = 3.91dB

Example Calculation: Average

Corrected Level: 53.32+ 6.64-37.08= 22.88dBuV

Margin: 54dBuV – 22.88dBuV = 31.12dB

7.7 Peak Power Spectral Density- FCC Section 15.247(d)

7.7.1 Test Methodology

The power spectral density was measured in accordance with the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)". The emission peaks within the pass band were located and zoomed in on. The spectrum analyzer RBW was set to 3 kHz and VBW 10 kHz. Span was adjusted to 100 kHz and the sweep time was calculated to be 34s (Span/3 kHz).

7.7.2 Test Results

Results are shown below in table 7.7.2-1 and figures 7.7.2-1 – 7.7.2-3:

Table 7.7.2-1: Peak Power Spectral Density

Frequency [MHz]	Level [dBm]
2405	4.90
2440	3.13
2475	3.57

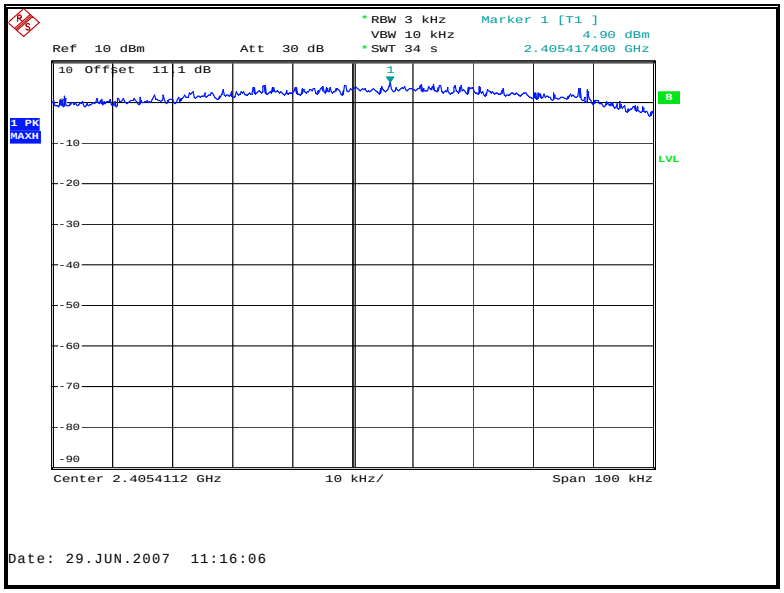

Figure 7.7.2-1: Power Spectral Density Plot – Low Channel

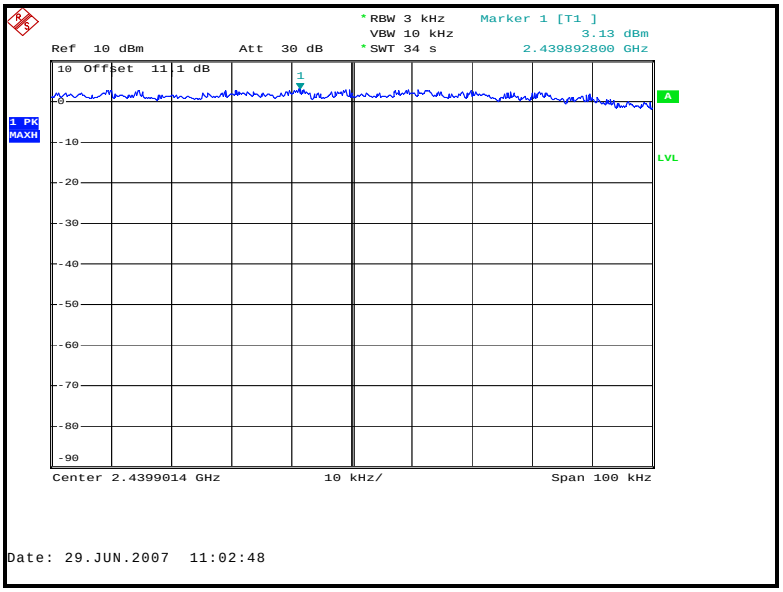

Figure 7.7.2-2: Power Spectral Density Plot – Mid Channel

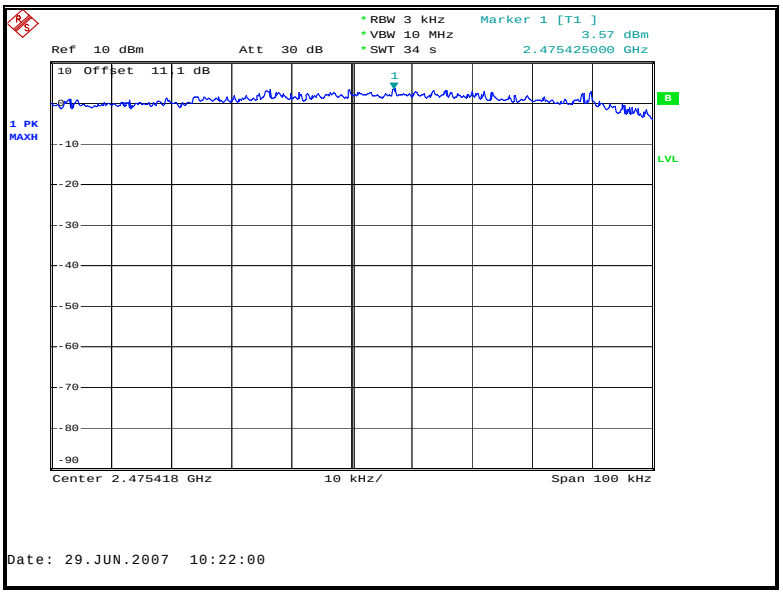

Figure 7.7.2-3: Power Spectral Density Plot – High Channel

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