



Excellence in Compliance Testing

Certification Test Report

**FCC ID: SK9AMI-4
IC: 864G-AMI4**

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

ACS Report Number 08-0431-15C-DSS

Manufacturer: Itron Electricity Metering, Inc.
Model(s): AMI4

Test Begin Date: November 5, 2008
Test End Date: November 12, 2008

Report Issue Date: November 17, 2008



FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

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

Prepared by: Ken Rivers

Ken Rivers
Wireless Certifications Technician
ACS, Inc.

Reviewed by: _____


Kirby Munroe
Director, Wireless Certifications
ACS, Inc.

This test report shall not be reproduced except in full. This report may be reproduced in part with prior written consent of ACS, Inc. The results contained in this report are representative of the sample(s) submitted for evaluation.

This report contains 24 pages

Table of Contents

1.0 General	3
1.1 Purpose	3
1.2 Product Description	3
1.2.1 General	3
1.2.2 Intended Use	3
1.3 Test Methodology and Considerations	3
2.0 Test Facilities	4
2.1 Location	4
2.2 Laboratory Accreditations/Recognitions/Certifications	4
2.3 Radiated Emissions Test Site Description	5
2.3.1 Semi-Anechoic Chamber Test Site	5
2.3.2 Open Area Tests Site (OATS)	6
2.4 Conducted Emissions Test Site Description	7
3.0 Applicable Standards and References	7
4.0 List of Test Equipment	8
5.0 Support Equipment	9
6.0 EUT Setup Block Diagram	9
7.0 Summary of Tests	10
7.1 Antenna Requirement	10
7.2 Power Line Conducted Emissions	10
7.2.1 Test Methodology	10
7.2.2 Test Results	10
7.3 Radiated Emissions	11
7.3.1 Test Methodology	11
7.3.2 Test Results	11
7.4 Peak Output Power	12
7.4.1 Test Methodology	12
7.4.2 Test Results	12
7.5 Channel Usage Requirements	14
7.5.1 Carrier Frequency Separation	14
7.5.1.1 Test Methodology	14
7.5.1.2 Test Results	14
7.5.2 Number of Hopping Channels	14
7.5.3 Channel Dwell Time	15
7.5.3.1 Test Methodology	15
7.5.3.2 Test Results	15
7.5.4 20dB / 99% Bandwidth	16
7.5.4.1 Test Methodology	16
7.5.4.2 Test Results	16
7.6 Band-Edge Compliance and Spurious Emissions	19
7.6.1 Band-edge Compliance of RF Conducted Emissions	19
7.6.1.1 Test Methodology	19
7.6.1.2 Test Results	19
7.6.2 RF Conducted Spurious Emissions	20
7.6.2.1 Test Methodology	20
7.6.2.2 Test Results	20
7.6.3 Radiated Spurious Emissions	23
7.6.3.1 Test Methodology	23
7.6.3.2 Test Results	23
7.6.3.3 Sample Calculations	24
8.0 CONCLUSION	24

Additional Exhibits Included In Filing

Internal Photographs	Manual
External Photographs	Theory of Operation
Test Setup Photographs	System Block Diagram
Label information	Schematics
RF Exposure	

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 AMI4 module is a utility meter register board designed to be integrated into a variety of electric meter form factors. The AMI4 contains (1) 900 MHz LAN frequency hopping spread spectrum radio and (1) 2.4 GHz direct sequence spread spectrum Zigbee radio.

Manufacturer Information:

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

Test Sample Serial Number(s):

4110000453 (RF Conducted Measurements)
4110000454 (Radiated & AC Power line Conducted Emissions)
4110000647 (Radiated & AC Power line Conducted Emissions)

Test Sample Condition:

The test samples were provided in good working order with no visible defects.

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

1.2.2 Intended Use

The AMI4 module is intended to be used in electric utility meters to provide automated meter reading capabilities.

1.3 Test Methodology and Considerations

This AMI4 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. Line conducted, unintentional and intentional radiated emissions were measured in 2S and 12S meter types. This report addresses the 900 MHz LAN radio only. A separate report will be issued to address the 2.4 GHz Zigbee radio.

For the purpose of RF conducted measurements, the AMI4 module was modified with a temporary 50 ohm antenna port.

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:

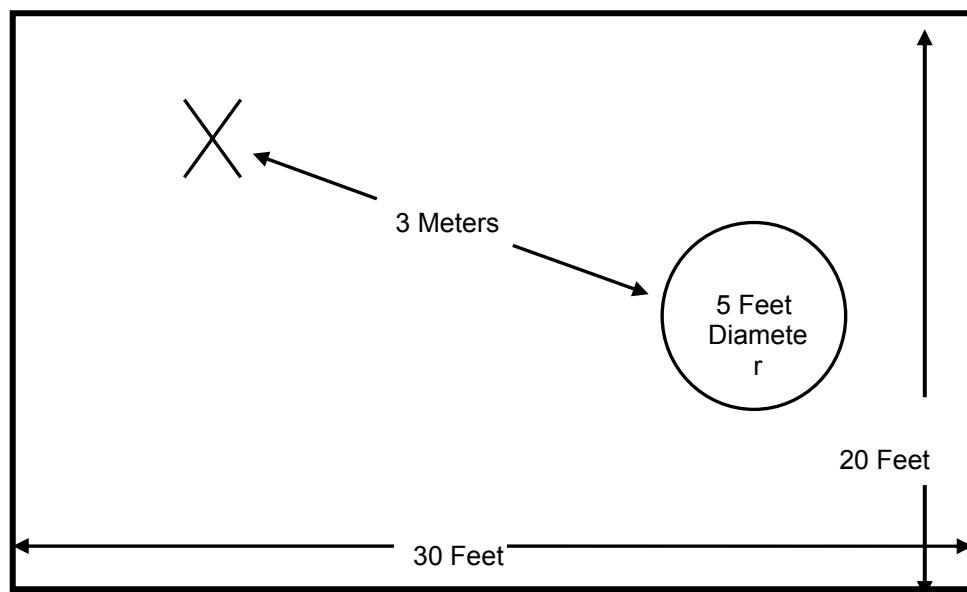


Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

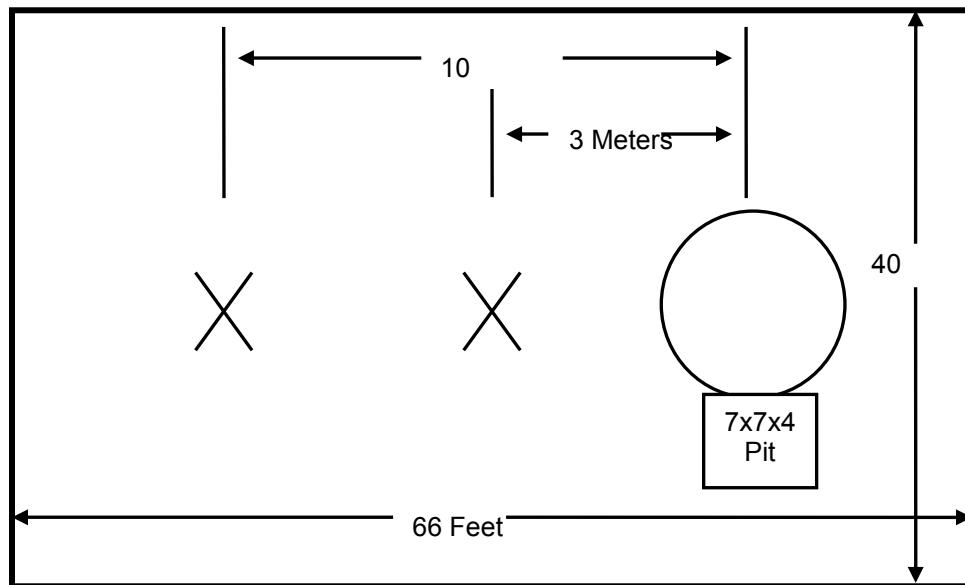


Figure 2.3-2: Open Area Test Site

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:

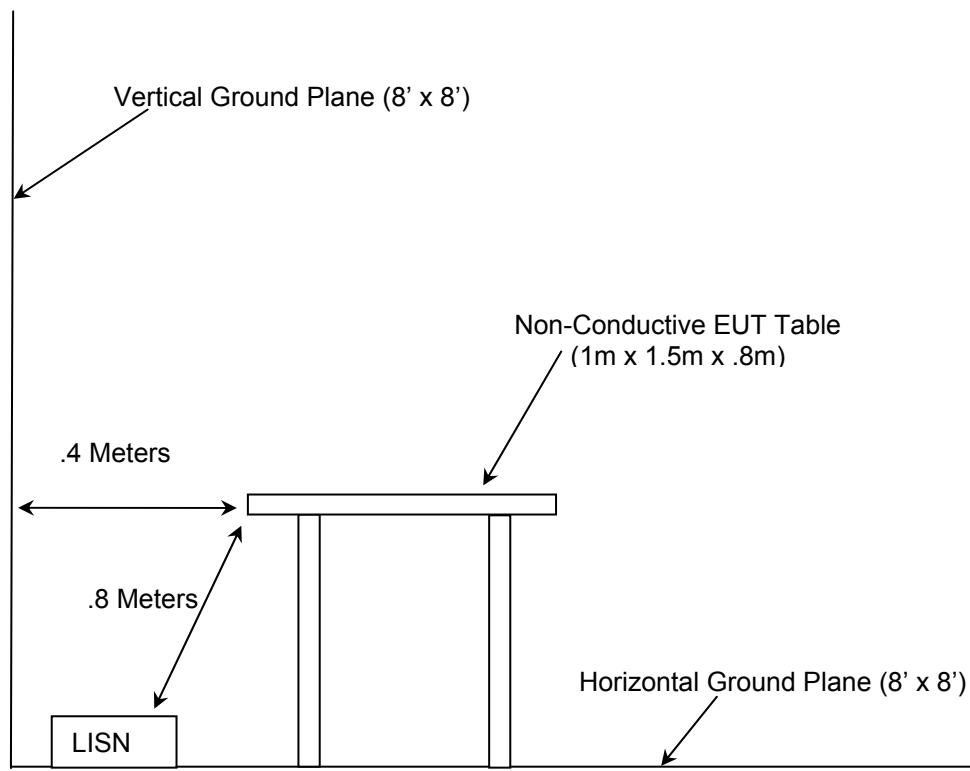


Figure 2.4-1: AC Mains Conducted EMI Site

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, 2008
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2008
- ❖ 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
- ❖ Industry Canada Radio Standards Specification: RSS-GEN – General Requirements and Information for the Certification of Radiocommunication Equipment, Issue2, June 2007.

4.0 LIST OF TEST EQUIPMENT

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

Table 4-1: Test Equipment

Equipment Calibration Information					
ACS#	Mfg.	Eq. type	Model	S/N	Cal. Due
1	Rohde & Schwarz	Spectrum Analyzers	ESMI - Display	833771/007	09-19-2009
2	Rohde & Schwarz	Spectrum Analyzers	ESMI-Receiver	839587/003	09-19-2009
22	Agilent	Amplifiers	8449B	3008A00526	10-22-2009
25	Chase	Antennas	CBL6111	1043	08-22-2009
30	Spectrum Technologies	Antennas	DRH-0118	970102	05-07-2009
40	Electro-Metrics	Antennas	3104	3211	01-10-2009
152	EMCO	LISN	Feb-25	9111-1905	03-26-2009
167	ACS	Cable Set	Chamber EMI Cable Set	167	01-04-2009
168	Hewlett Packard	Attenuators	11947A	44829	02-18-2009 (See Note2)
193	ACS	Cable Set	OATS cable Set	193	01-04-2009
211	Eagle	Filters	C7RFM3NFM	HLC-700	01-04-2009
213	TEC	Amplifiers	PA 102	44927	12-19-2008
277	Emco	Antennas	93146	9904-5199	09-09-2009
282	Microwave Circuits	Filters	H2G020G4	74541	02-25-2009 (See Note1)
283	Rohde & Schwarz	Spectrum Analyzers	FSP40	1000033	09-19-2009
291	Florida RF Cables	Cables	SMRE-200W-12.0-SMRE	None	11-21-2008 (See Note1)
292	Florida RF Cables	Cables	SMR-290AW-480.0-SMR	None	11-21-2008 (See Note1)
321	Hewlett Packard	Amplifiers	HPC 8447D	1937A02809	10-08-2009
324	ACS	Cables	Belden	8214	07-28-2009
331	Microwave Circuits	Filters	H1G513G1	31417	07-28-2009 (See Note1)
337	Microwave Circuits	Filters	H1G513G1	282706	04-08-2009 (See Note1)
338	Hewlett Packard	Amplifiers	8449B	3008A01111	10-22-2009
339	Aeroflex/Weinschel	Attenuators	AS-18	7142	07-08-2009 (See Note2)
422	Florida RF	Cables	SMS-200AW-72.0-SMR	805	02-25-2009 (See Note1)

Note1: Items characterized on an annual cycle. The date shown indicates the next characterization due date.

Note2: Items verified on an annual cycle. The date shown indicates the next verification due date.

5.0 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	Meter Base Enclosure	Durham Company	UT-RS101B-SQD	NA
2	CENTRON II meter	Itron Electricity Metering	C2SOD (2S)	57 906 168
3	CENTRON II meter	Itron Electricity Metering	C2SOD (2S)	57 906 185
4	CENTRON II meter	Itron Electricity Metering	CN2SOD (12S)	58 034 947
5	Transformer	Sagamo Weston	Type T-6A	325827 002

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

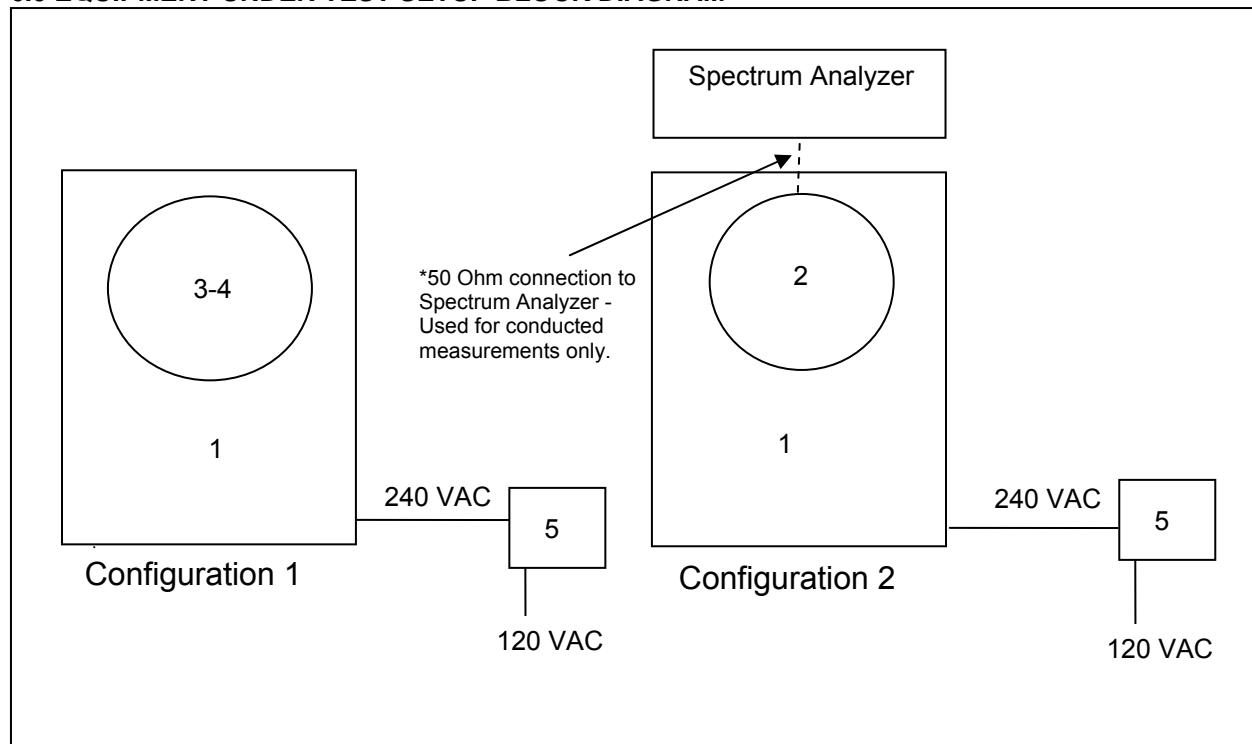


Figure 6-1: EUT Test Setup

Note1: The 2S and 12S meter forms were utilized to power the AMI4 modules for RF conducted measurements. The AMI4 was also integrated into the 2S and 12S meter forms for showing compliance for radiated emissions and AC power line conducted emissions.

Note2: 12S meter form connects directly to 120vAC and did not use a transformer.

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 quarter wave embedded slot antenna in the ground plane with a measured gain of 2.2dBi

7.2 Power Line Conducted Emissions – FCC: Section 15.207 IC: RSS-Gen 7.2.2

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 and 1.2-2.

Table 7.2-1: Line 1 Conducted EMI Results - 2S

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										
0.15	37.1	6.3	9.81	46.91	16.11	66.00	56.00	19.1	39.9	GND
0.28	27.2	2.5	9.82	37.02	12.32	60.82	50.82	23.8	38.5	GND
0.49	14.5	5.7	9.90	24.40	15.60	56.17	46.17	31.8	30.6	GND
2.55	17.8	16.8	9.90	27.70	26.70	56.00	46.00	28.3	19.3	GND
4.19	26.9	24.6	9.90	36.80	34.50	56.00	46.00	19.2	11.5	GND
20.97	22.2	22.5	10.33	32.53	32.83	60.00	50.00	27.5	17.2	GND
Line 2										
0.15	36.8	6.4	9.81	46.61	16.21	66.00	56.00	19.4	39.8	GND
0.28	27	2.3	9.82	36.82	12.12	60.82	50.82	24.0	38.7	GND
0.5	14.5	6.1	9.90	24.40	16.00	56.00	46.00	31.6	30.0	GND
4.39	0.5	-2.5	9.90	10.40	7.40	56.00	46.00	45.6	38.6	GND
5.61	1.3	-2	9.91	11.21	7.91	60.00	50.00	48.8	42.1	GND
20.97	21.8	22.2	10.33	32.13	32.53	60.00	50.00	27.9	17.5	GND

Table 7.2-2: Line 1 Conducted EMI Results - 12S

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	24.7	21.8	9.82	34.52	31.62	64.49	54.49	30.0	22.9	GND
0.29	8.9	-0.9	9.82	18.72	8.92	60.52	50.52	41.8	41.6	GND
0.42	7.4	3.8	9.90	17.30	13.70	57.45	47.45	40.1	33.7	GND
1.02	2	-1.3	9.90	11.90	8.60	56.00	46.00	44.1	37.4	GND
1.2	22.4	19	9.90	32.30	28.90	56.00	46.00	23.7	17.1	GND
4.19	32.4	26.8	9.90	42.30	36.70	56.00	46.00	13.7	9.3	GND
Line 2										
0.18	22.5	14.2	9.82	32.32	24.02	64.49	54.49	32.2	30.5	GND
0.28	12.8	0.6	9.82	22.62	10.42	60.82	50.82	38.2	40.4	GND
0.53	1.2	-1.2	9.90	11.10	8.70	56.00	46.00	44.9	37.3	GND
0.71	5.7	0.7	9.90	15.60	10.60	56.00	46.00	40.4	35.4	GND
4.2	32.4	25.9	9.90	42.30	35.80	56.00	46.00	13.7	10.2	GND
12.58	16.1	12.2	10.02	26.12	22.22	60.00	50.00	33.9	27.8	GND

7.3 Radiated Emissions – FCC: Section 15.109(Unintentional Radiation) IC: RSS-210 2.6

7.3.1 Test Methodology

Radiated emissions tests were performed over the frequency range of 30MHz to 5GHz. Measurements of the radiated field strength were made at a distance of 3m from the boundary of the equipment under test (EUT) and the receiving antenna. The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. Radiated measurements above 30MHz and below 1GHz were made with the Spectrum Analyzer's resolution bandwidth set to 120 KHz using a Quasi-peak detector. Above 1GHz, peak and average measurements are taken with the RBW and VBW were set to 1MHz.

7.3.2 Test Results

Results of the test are given in Tables 7.3-1 and 7.3-2 below:

Table 7.3-1: Radiated Emissions Tabulated Data – 2S

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
35.9492	-----	44.11	V	-13.46	-----	30.65	-----	40.0	-----	9.35
138.4137	-----	25.23	V	-10.70	-----	14.53	-----	43.5	-----	28.97
146.8086	-----	22.55	V	-9.55	-----	13.00	-----	43.5	-----	30.50
257.6862	-----	22.57	H	-9.66	-----	12.91	-----	46.0	-----	33.09
478.1472	-----	33.05	V	-4.08	-----	28.97	-----	46.0	-----	17.03
494.0005	-----	42.00	H	-3.32	-----	38.68	-----	46.0	-----	7.32
546.0005	-----	32.96	V	-3.30	-----	29.66	-----	46.0	-----	16.34

* Note: All emissions above 546.0005 MHz were attenuated below the permissible limit.

Table 7.3-2: Radiated Emissions Tabulated Data – 12S

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
230.46	-----	33.31	V	-13.66	-----	19.65	-----	46.0	-----	26.35
236.93	-----	40.07	V	-13.15	-----	26.92	-----	46.0	-----	19.08
267.11	-----	39.56	H	-11.48	-----	28.08	-----	46.0	-----	17.92
306.98	-----	40.01	H	-10.93	-----	29.08	-----	46.0	-----	16.92
316.68	-----	35.90	H	-10.50	-----	25.40	-----	46.0	-----	20.60
332.85	-----	39.94	H	-9.89	-----	30.05	-----	46.0	-----	15.95
342.55	-----	37.53	H	-9.47	-----	28.06	-----	46.0	-----	17.94
499.91	-----	39.86	V	-5.80	-----	34.06	-----	46.0	-----	11.94
840.48	-----	20.77	V	0.88	-----	21.65	-----	46.0	-----	24.35
848.03	-----	24.58	V	0.58	-----	25.16	-----	46.0	-----	20.84

* Note: All emissions above 848.03 MHz were attenuated below the permissible limit.

7.4 Peak Output Power - FCC Section 15.247(b)(2) IC: RSS-210 A8.4(1)

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 RF output port of the EUT was directly connected to the input of the spectrum analyzer. 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	24.07
914.74	24.27
927.75	23.37

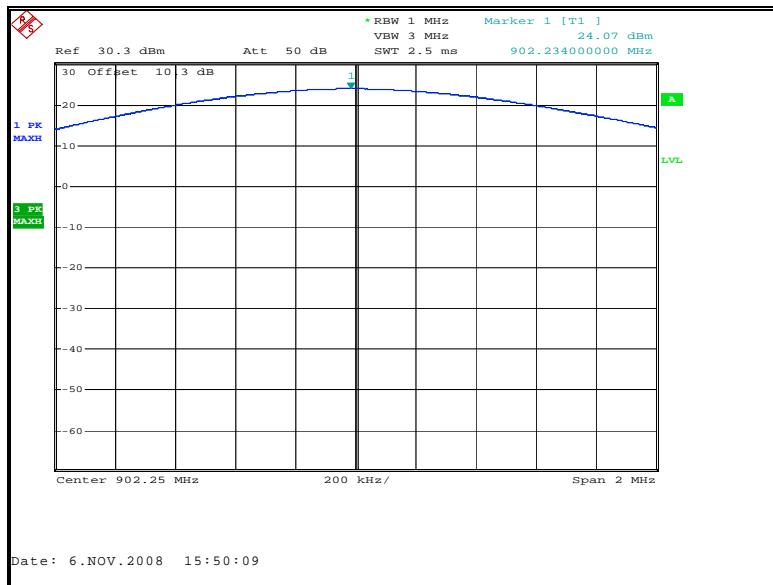


Figure 7.4-1: Output power – Low Channel

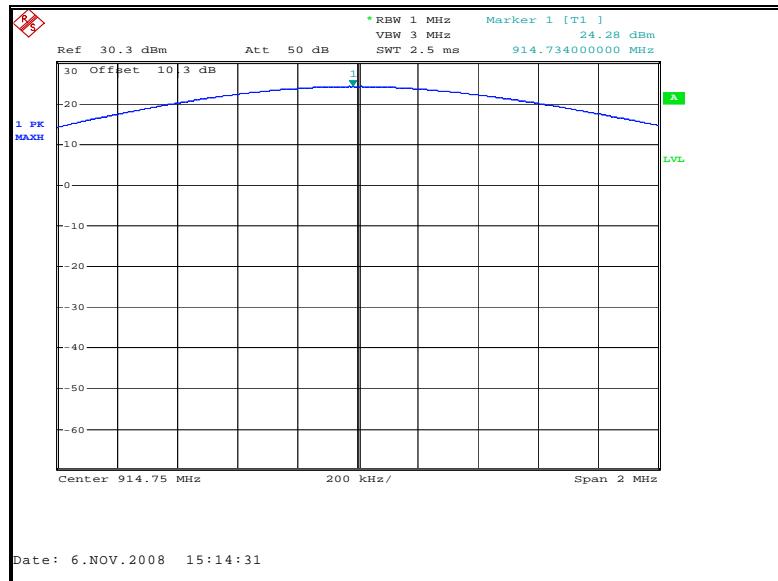


Figure 7.4-2: Output power – Mid Channel

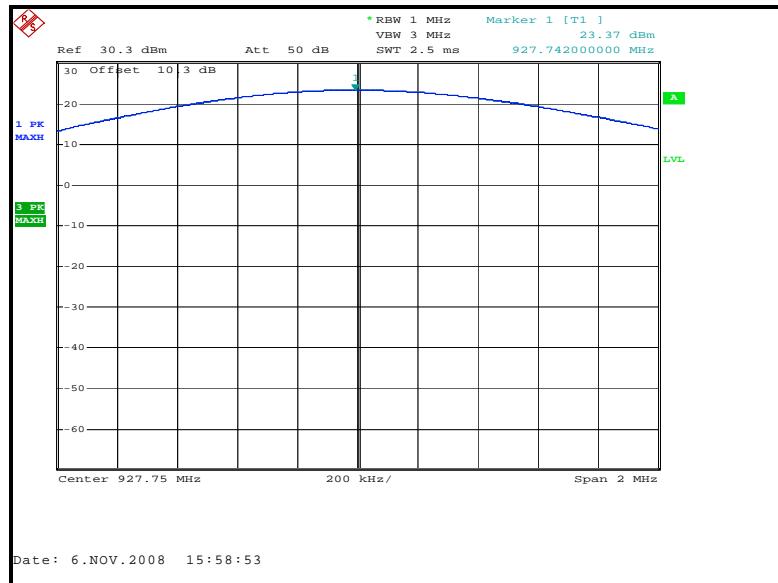


Figure 7.4-3: Output power – High Channel

7.5 Channel Usage Requirements

7.5.1 Carrier Frequency Separation – FCC: Section 15.247(a)(1) IC: RSS-210 A8.1(b)

7.5.1.1 Test Methodology

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The span of the spectrum analyzer was set wide enough to capture two adjacent peaks and the RBW and VBW were set to $\geq 1\%$ of the span.

7.5.1.2 Test Results

The maximum 20dB bandwidth of the hopping channel was measured to be 140kHz (See figure 7.5.4-1 to 7.5.4-3 below). The adjacent channel separation was measured to be 499.8kHz. Results are shown in figure 7.5.1-1 below:

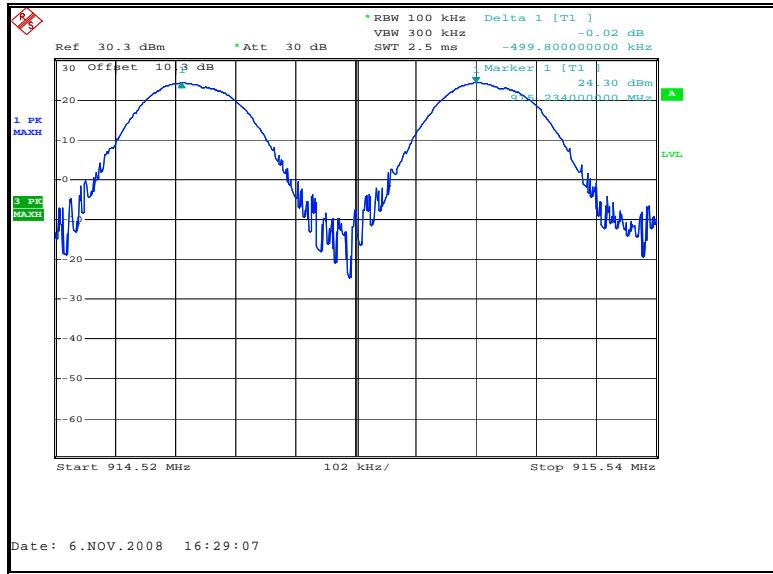


Figure 7.5.1-1: Carrier Frequency Separation

7.5.2 Number of Hopping Channels – FCC: Section 15.247(a)(1)(i) IC: RSS-210 A8.1(c)

The 20dB bandwidth of the device is less than 250 kHz. The device employs 50 hopping channels as required. Results are shown in Figure 7.5.2-1 below:

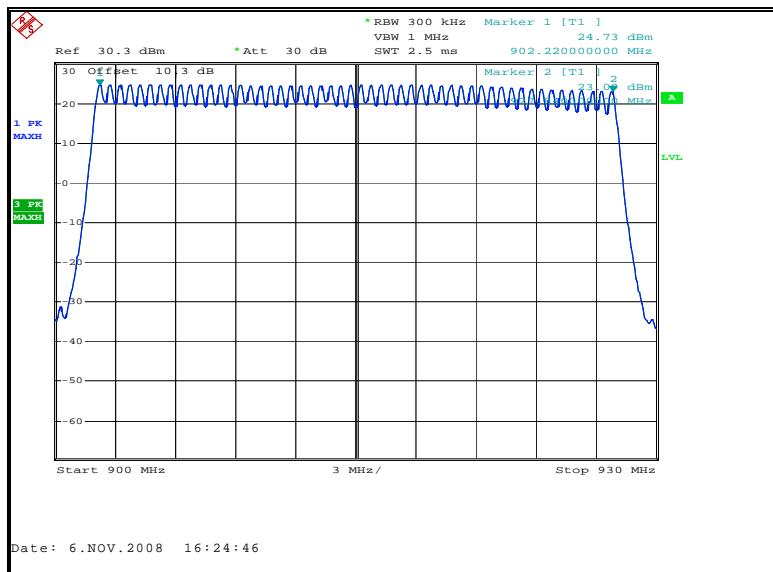


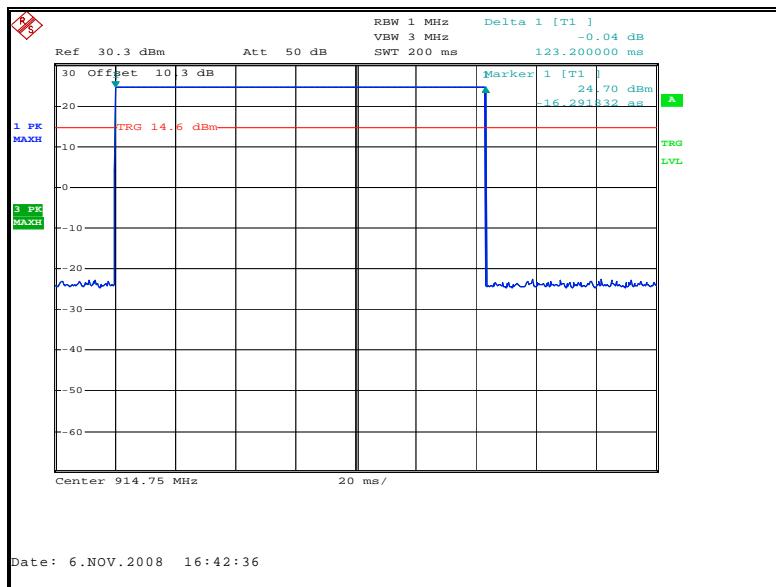
Figure 7.5.2-1: Number of Hopping Channels

7.5.3 Channel Dwell Time – FCC: Section 15.247(a)(1)(i) IC: RSS-210 A8.1(c)**7.5.3.1 Test Methodology**

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The hopping channel is 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 123.2 ms. There is a minimum 7.8 second rest period in which the device hops to another channel according to the pseudorandom frequency table before transmitting another 123.2ms burst. Therefore the average time of occupancy on any channel in a 20 second period is 123.2ms. A single transmission is shown in figure 7.5.3-1 below:

**Figure 7.5.3-1: Channel Dwell Time**

7.5.4 20dB / 99% Bandwidth - FCC: Section 15.247(a)(1)(i) IC: RSS-210 A8.1(c)

7.5.4.1 Test Methodology

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The spectrum analyzer span was set to 2 to 3 times the estimated bandwidth of the emission. The RBW was to $\geq 1\%$ of the estimated emission 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 and the occupied bandwidth measurement function of the analyzer used for the 99% bandwidth.

7.5.4.2 Test Results

The maximum 20dB bandwidth was found to be approximately 140.0kHz and maximum 99% bandwidth 121.0kHz. Results are shown below in Table 7.5.4-1 and Figures 7.5.4-1 through 7.5.4-6.

Table 7.5.4-1: 20dB / 99% Bandwidth

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
902.25	139.0	121.0
914.75	139.0	121.0
927.75	140.0	121.0

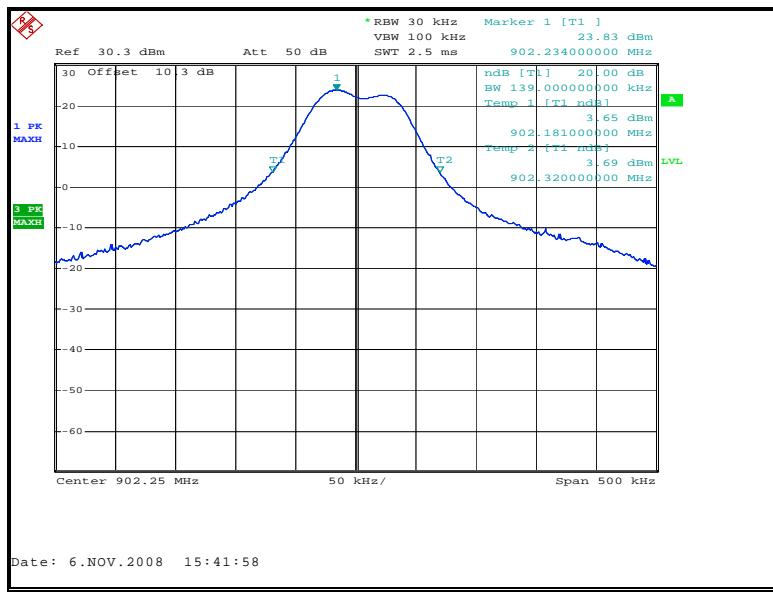


Figure 7.5.4-1: 20dB Bandwidth Low Channel

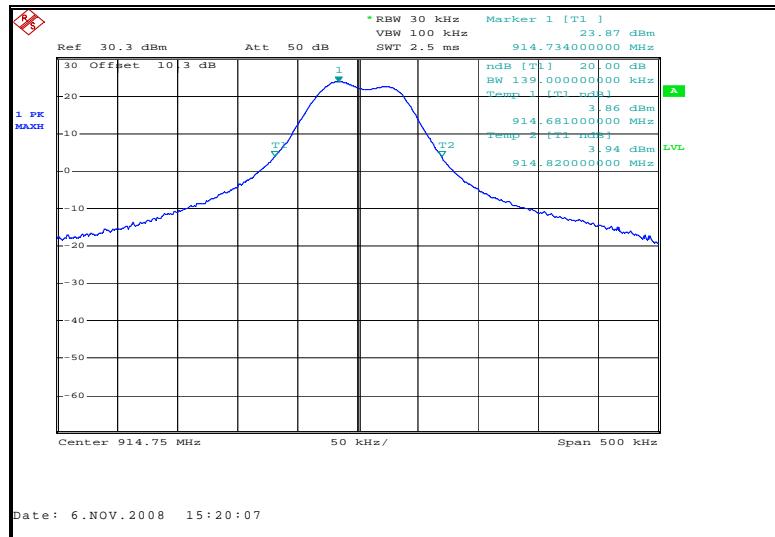


Figure 7.5.4-2: 20dB Bandwidth Mid Channel

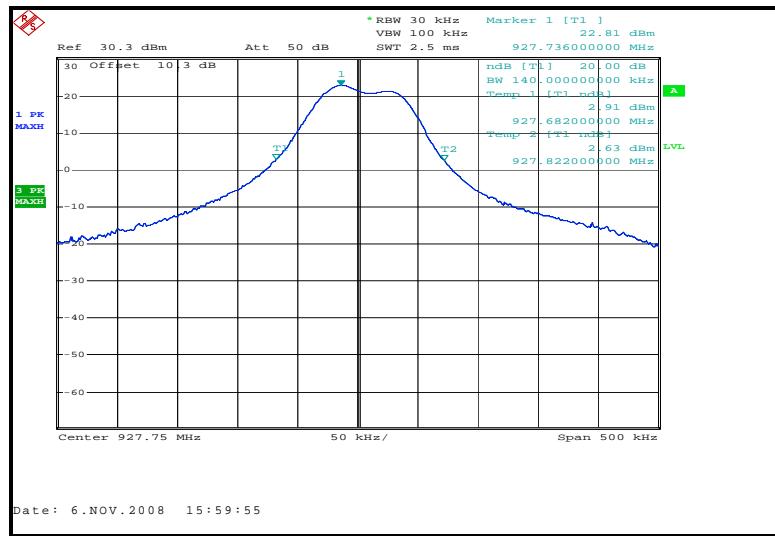


Figure 7.5.4-3: 20dB Bandwidth High Channel

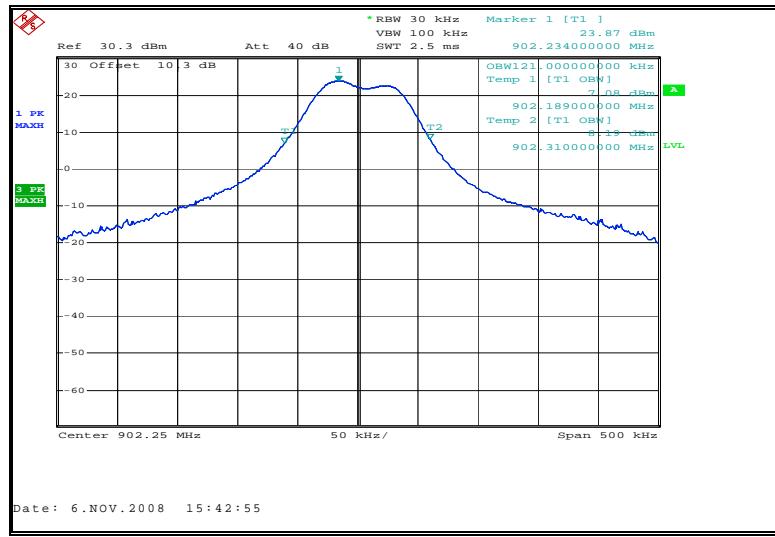


Figure 7.5.4-4: 99% Bandwidth Low Channel

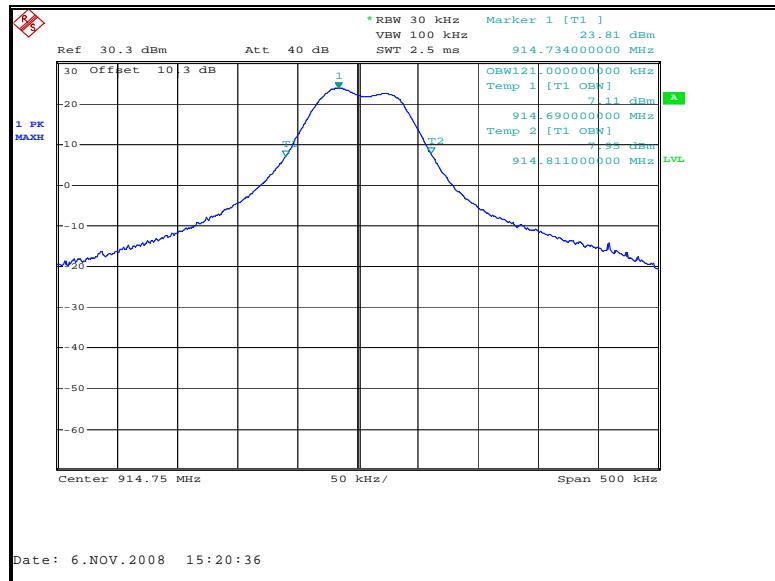


Figure 7.5.4-5: 99% Bandwidth Mid Channel

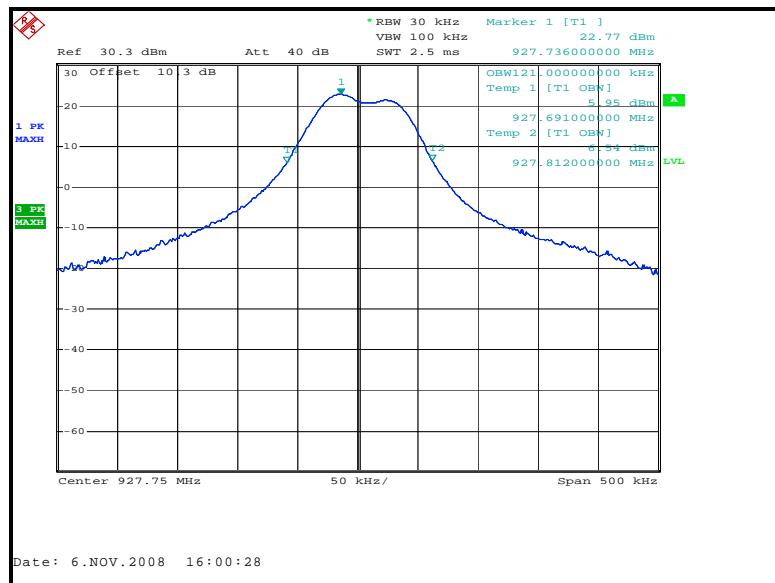


Figure 7.5.4-6: 99% Bandwidth High Channel

7.6 Band-Edge Compliance and Spurious Emissions - FCC Section 15.247(d) IC: RSS-210 2.6, A8.5

7.6.1 Band-Edge Compliance of RF Conducted Emissions

7.6.1.1 Test Methodology

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. 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 30 kHz, which is $\geq 1\%$ of the span, and the VBW was set to 100 kHz.

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 7.6.2-4

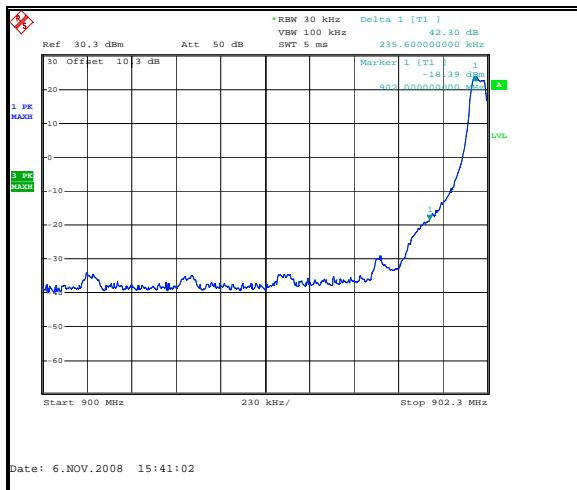


Figure 7.6.1-1: Lower Band-edge

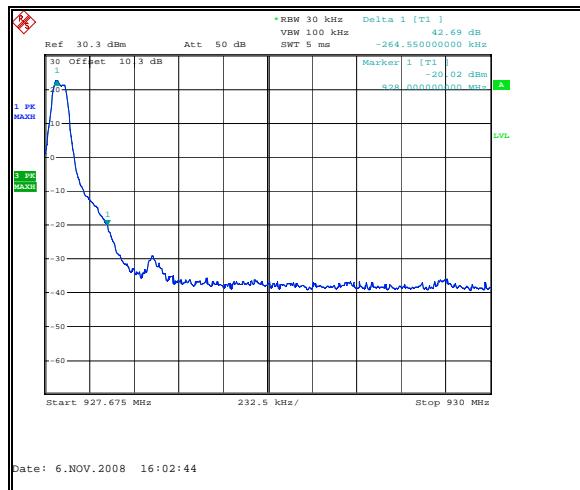


Figure 7.6.1-2: Upper Band-edge

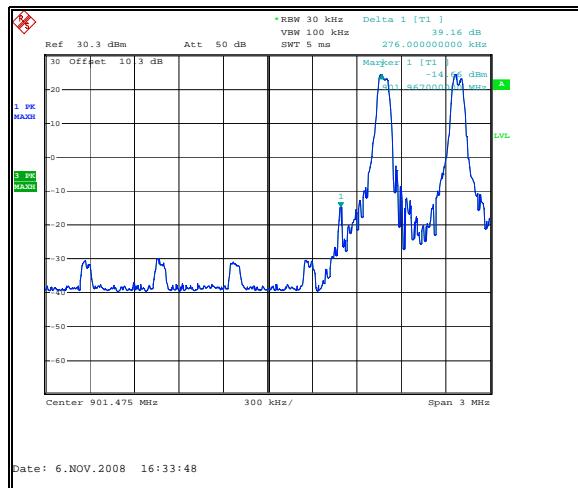


Figure 7.6.1-3: Lower Band-edge - Hopping

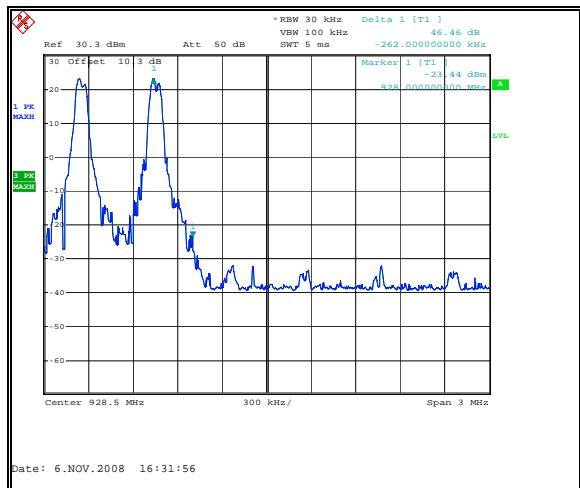


Figure 7.6.1-4: Upper Band-edge - Hopping

7.6.2 RF Conducted Spurious Emissions

7.6.2.1 Test Methodology

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. 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.

7.6.2.2 Test Results

All emission 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 Figure 7.6.2-1 through 7.6.2-6.

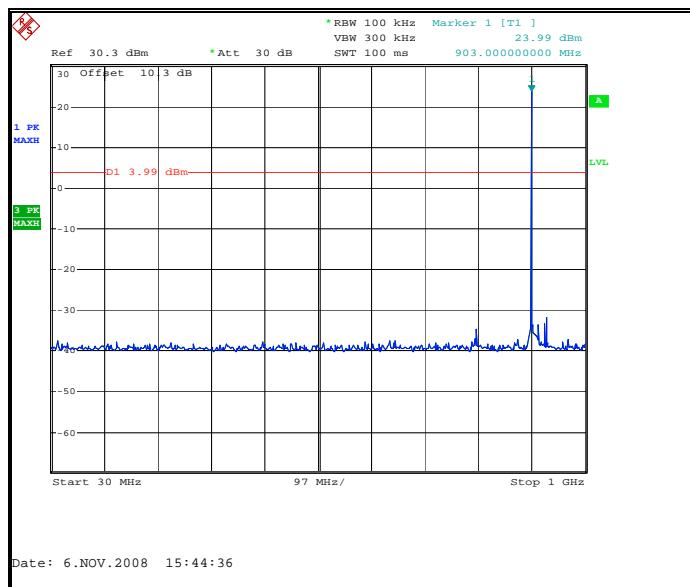


Figure 7.6.2.2-1: 30 MHz – 1 GHz – Low Channel

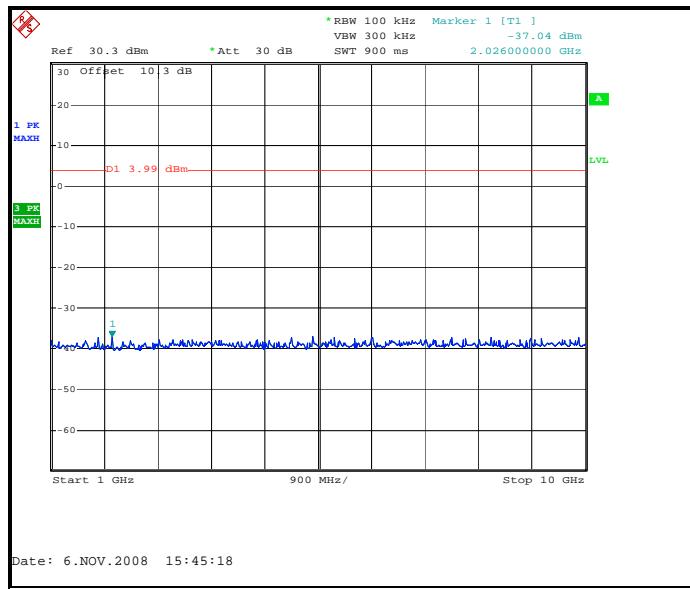


Figure 7.6.2.2-2: 1 GHz – 10 GHz – Low Channel

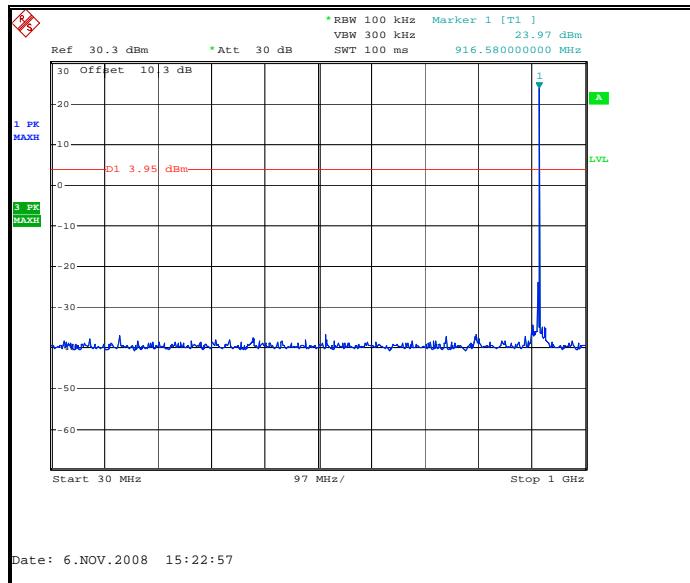


Figure 7.6.2.2-3: 30 MHz – 1 GHz – Mid Channel

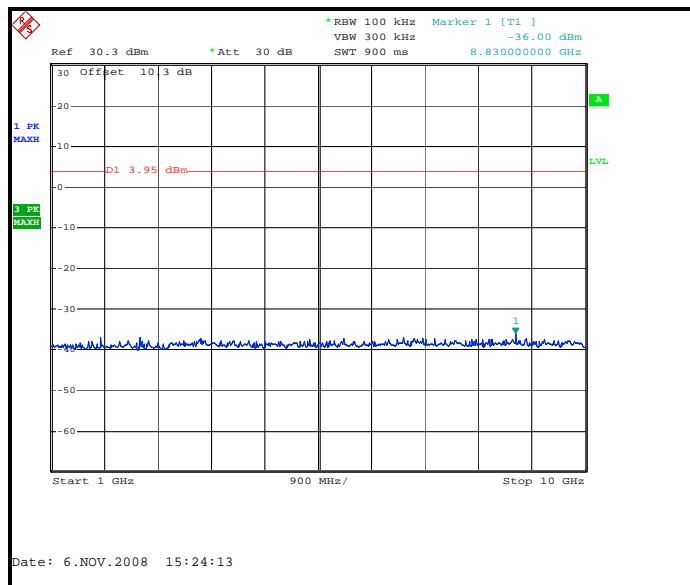


Figure 7.6.2.2-4: 1 GHz – 10 GHz – Mid Channel

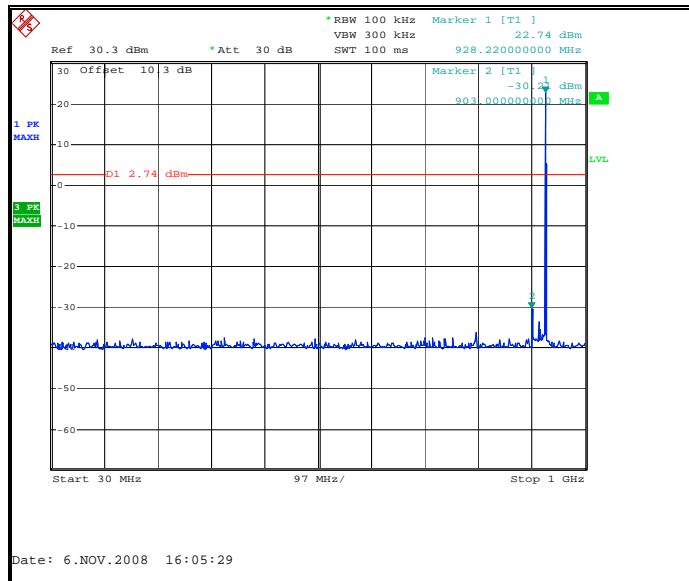


Figure 7.6.2.2-5: 30 MHz – 1 GHz – High Channel

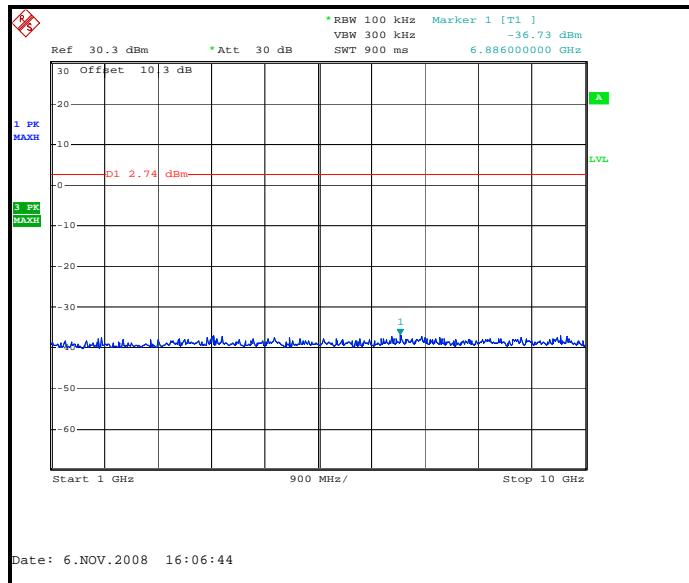


Figure 7.6.2.2-6: 1 GHz – 10 GHz – High Channel

7.6.3 Radiated Spurious Emissions - FCC Section 15.205 IC: RSS-210 2.6

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, peak and average measurements made with RBW and VBW of 1 MHz.

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

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

7.6.3.2 Test Results

Radiated spurious emissions found in the band of 30MHz to 10GHz for meter forms 2S and 12S are reported in Tables 7.6.2-1 and 6.6.2-2.

Table 7.6.2-1: Radiated Spurious Emissions – 2S

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel										
2706.3	46.36	40.01	H	0.55	46.91	40.56	74.0	54.0	27.09	13.44
Middle Channel										
2744.25	45.04	36.53	H	0.69	45.73	37.22	74.0	54.0	28.27	16.78
High Channel										
2783.25	46.79	37.02	H	0.83	47.62	37.85	74.0	54.0	26.38	16.15
2783.25	44.89	34.09	V	0.63	45.52	34.72	74.0	54.0	28.48	19.28

Table 7.6.2-2: Radiated Spurious Emissions – 12S

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel										
2706.3	46.59	39.68	H	0.74	47.33	40.42	74.0	54.0	26.67	13.58
Middle Channel										
2744.25	50.30	46.18	H	0.80	51.10	46.98	74.0	54.0	22.90	7.02
2744.25	46.66	37.82	V	0.60	47.26	38.42	74.0	54.0	26.74	15.58
High Channel										
2783.25	43.24	33.91	V	0.65	43.89	34.56	74.0	54.0	30.11	19.44

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: $46.36 + 0.55 = 46.91 \text{ dBuV/m}$

Margin: $74 \text{ dBuV/m} - 46.91 \text{ dBuV/m} = 27.09 \text{ dB}$

Example Calculation: Average

Corrected Level: $40.01 + 0.55 - 0 = 40.56 \text{ dBuV}$

Margin: $54 \text{ dBuV} - 40.56 \text{ dBuV} = 13.44 \text{ dB}$

8.0 CONCLUSION

In the opinion of ACS, Inc. the AMI4, 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