Certification Test Report

FCC ID: SK9AMI7
IC: 864G-AMI7

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

ACS Report Number: 12-0261.W04.1A

Manufacturer: Itron Electricity Metering, Inc.
Model: AMI7

Test Begin Date: June 26, 2012
Test End Date: June 26, 2012

Report Issue Date: July 5, 2012

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

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

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

This report contains 16 pages

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1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Industry Canada's Radio Standards Specification RSS-210 for a Class II Permissive Change.

This permissive change is to the limited modular approved AMI7 and addresses the addition of a RF filter and antenna for a specific host device. To accommodate the filter and antenna, the PCB was slightly extended. Changes to the AMI7 identified in this report are only applicable to and only utilized by the specific host device identified herein.

The AMI7 contains (1) 900 MHz LAN frequency hopping spread spectrum radio and (1) 2.4 GHz direct sequence spread spectrum Zigbee radio. This permissive change applies to the 900 MHz LAN radio only.

1.2 Product description

The AMI7 module is a utility module designed to be integrated into a variety of electric meter form factors and utility hardware. For the purpose of this evaluation, the AMI7 was only evaluated in, and only applicable to, the specific host device identified in this report and filing.

Technical details:

Modulation	Frequency Range (MHz)	Number of Channels	Channel Separation (kHz)	Data Rates Supported (kbps)
FSK	902.25 - 927.75	52	500	19.2
FSK	902.25 - 927.75	52	500	152.3
FSK	902.4 – 927.6	64	400	150.0
OOK	909.6 – 921.8	50	200	16.4

Antenna Type / Gain: Yagi, 8dBi (ZDA Communications US LLC. Model ZDADJ928-8YG)
Operating Voltage: 24VDC (Via Range Extender Host)

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

Test Sample Serial Number(s): 6220001431, 6220001401

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

1.3 Test Methodology and Considerations

The AMI7, as a limited modular approval, was integrated into the Itron Range Extender radiated emissions for radiated emissions.

The AMI7 was also evaluated for RF conducted characteristics affected by the addition of the RF filter and PCB extension. Only those RF characteristics affected by these changes are detailed in this report.

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

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

The Semi-Anechoic Chamber Test Site, Open Area Test Site (OATS) and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC, Industry Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

FCC Registration Number: 511277
Industry Canada Lab Code: IC 4175A-1
VCCI Member Number: 1831

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

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chases from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

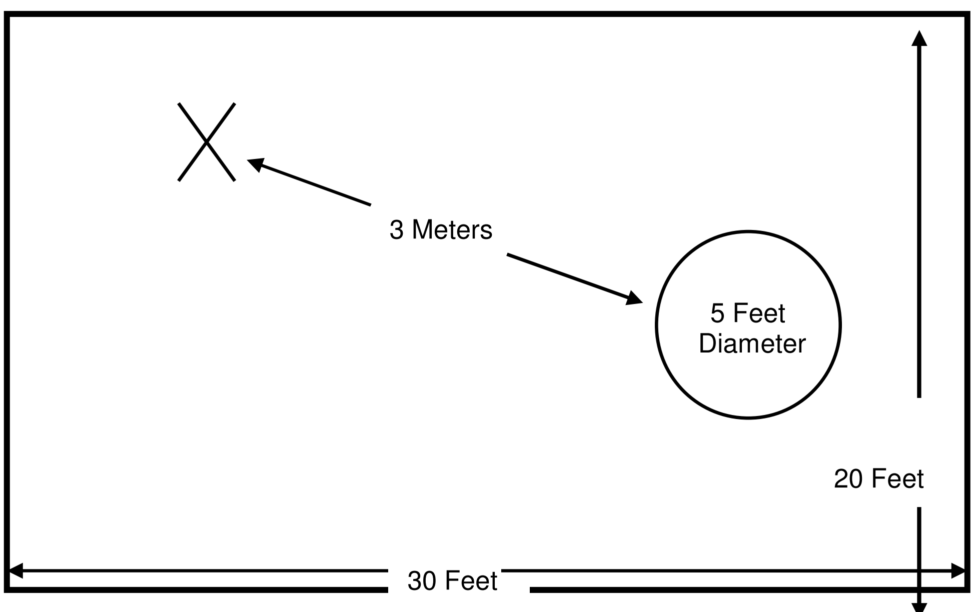

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

The open area test site consists of a 40’ x 66’ concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8” holes that are staggered every 3/16”. The individual sheets are placed to overlap each other by 1/4” and are riveted together to provide a continuous seam. Rivets are spaced every 3” in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12’ beyond the turntable edge and 16’ beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8’ copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10’ flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40’ from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7’ x 7’ square and 4’ deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4” PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 2.3-2 below:

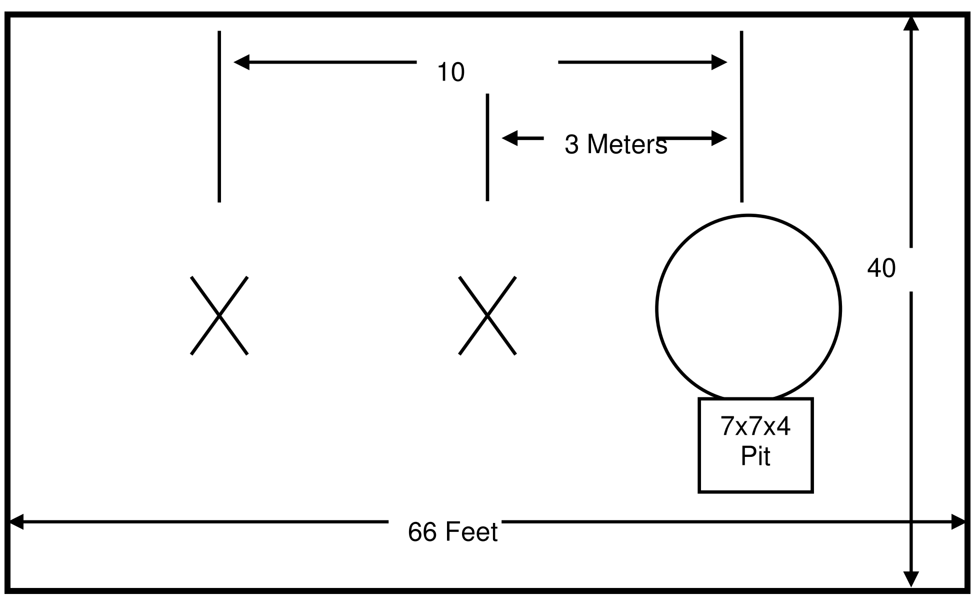

Figure 2.3-2: Open Area Test Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2009: 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, 2012
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2012
- Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 8, December 2010
- Industry Canada Radio Standards Specification: RSS-GEN – General Requirements and Information for the Certification of Radiocommunication Equipment, Issue 3 December 2010.

4 LIST OF TEST EQUIPMENT

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

Table 4-1: Test Equipment

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
1	Rohde & Schwarz	ESMI - Display	Spectrum Analyzers	833771/007	9/23/2011	9/23/2012
2	Rohde & Schwarz	ESMI-Receiver	Spectrum Analyzers	839587/003	9/23/2011	9/23/2012
30	Spectrum Technologies	DRH-0118	Antennas	970102	4/27/2011	4/27/2013
73	EMCO	3104	Antennas	3211	2/11/2011	2/11/2013
152	EMCO	3825/2	LISN	9111-1905	11/2/2010	11/2/2012
167	ACS	Chamber EMI Cable Set	Cable Set	167	12/21/2011	12/21/2012
168	Hewlett Packard	11947A	Attenuators	44829	2/1/2012	2/1/2013
283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	8/26/2011	8/26/2012
291	Florida RF Cables	SMRE-200W-12.0-SMRE	Cables	None	12/2/2011	12/2/2012
292	Florida RF Cables	SMR-290AW-480.0-SMR	Cables	None	4/2/2012	4/2/2013
324	ACS	Belden	Cables	8214	7/6/2011	7/6/2012
331	Microwave Circuits	H1G513G1	Filters	31417	7/11/2011	7/11/2012
338	Hewlett Packard	8449B	Amplifiers	3008A01111	3/1/2012	8/31/2012
340	Aeroflex/Weinschel	AS-20	Attenuators	7136	8/29/2011	8/29/2012
412	Electro Metrics	LPA-25	Antennas	1241	7/28/2010	7/28/2012
422	Florida RF	SMS-200AW-72.0-SMR	Cables	805	12/2/2011	12/2/2012
562	United Microwave Products, Inc.	AA-190-00.48.0	Cables	562	8/11/2011	8/11/2012

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	Host	Itron Electricity Metering, Inc.	Range Extender	NA

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

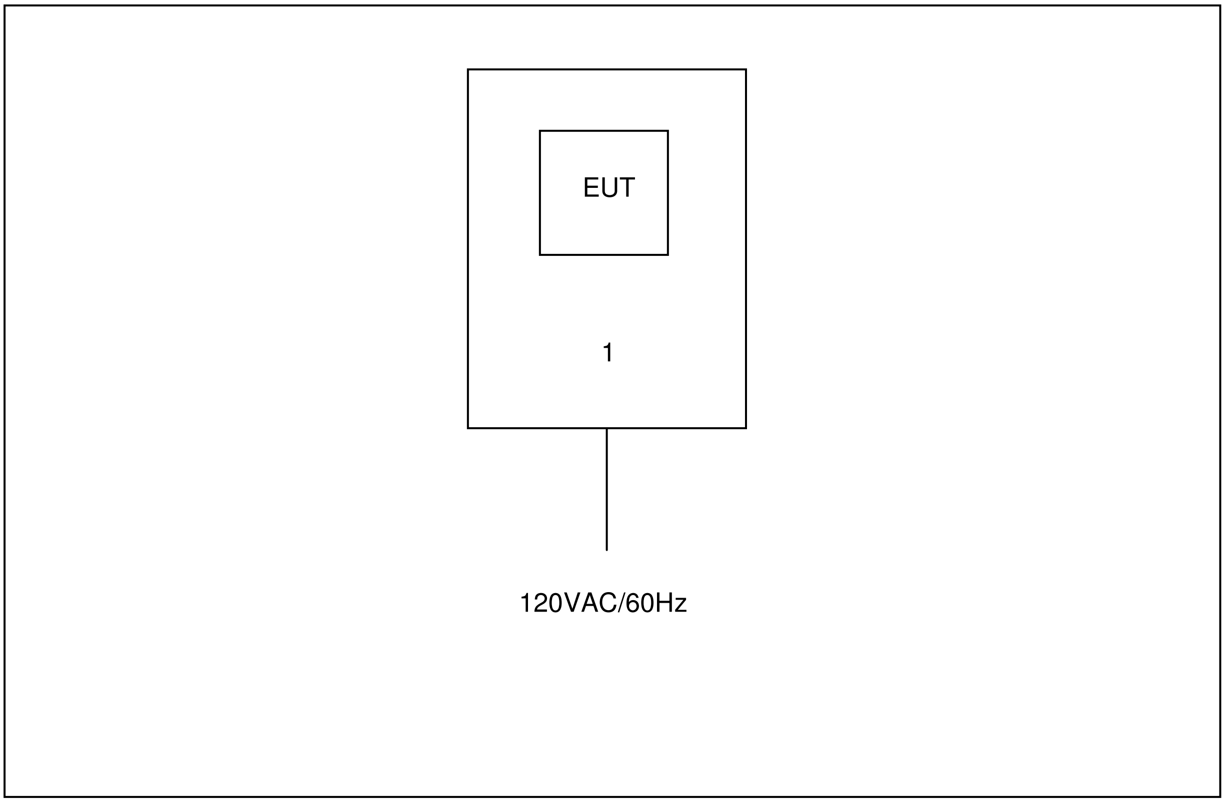

Figure 6-1: EUT Test Setup

Note: The AMI7 module was integrated into the Itron Range Extender for showing compliance.

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: Section 15.203

The antenna is a Yagi antenna with an N-Type male connector. The EUT is limited modular approved and professional installation required.

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

7.2.1 Measurement Procedure

ANSI C63.4 sections 6 and 7 were the guiding documents for this evaluation. Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

7.2.2 Measurement Results

Results of the test are shown below in and Tables 7.2.2-1 to 7.2.2-2.

Table 7.2.2-1: Conducted EMI Results – Line 1

Frequency (MHz)	Detector	Level (dBuV)	Correction Factor (dB)	Limit (dBuV)	Margin (dB)
0.174000	QP	26.90	9.9	65	37.9
0.258000	QP	23.30	10.0	62	38.2
0.330000	QP	19.30	10.0	60	40.2
0.390000	QP	16.20	10.1	58	41.9
0.462000	QP	11.70	10.0	57	45.0
0.882000	QP	10.20	10.0	56	45.8
3.672000	QP	9.50	9.9	56	46.5
4.194000	QP	9.50	9.9	56	46.5
4.488000	QP	9.40	10.0	56	46.6
6.054000	QP	9.20	10.0	73	50.8
0.198000	AV	9.40	9.9	54	44.3
0.264000	AV	8.40	10.0	51	42.9
0.330000	AV	8.00	10.0	50	41.5
0.390000	AV	7.80	10.1	48	40.3
0.456000	AV	7.60	10.0	47	39.1
0.816000	AV	7.40	10.1	46	38.6
3.642000	AV	6.80	9.9	46	39.2
4.230000	AV	6.80	9.9	46	39.2
4.500000	AV	6.80	10.0	46	39.2
6.036000	AV	6.70	10.0	50	43.3

Table 7.2.2-2: Conducted EMI Results – Line 2

Frequency (MHz)	Detector	Level (dBuV)	Correction Factor (dB)	Limit (dBuV)	Margin (dB)
0.276000	QP	20.80	10.0	61	40.1
0.330000	QP	18.50	10.0	60	41.0
0.492000	QP	12.90	10.0	56	43.2
0.516000	QP	12.30	10.0	56	43.7
0.984000	QP	10.10	10.0	56	45.9
4.194000	QP	10.10	9.9	56	45.9
4.668000	QP	9.40	10.0	56	46.6
17.256000	QP	9.10	9.8	60	50.9
27.042000	QP	11.40	9.4	60	48.6
29.556000	QP	12.50	9.2	73	47.5
0.288000	AV	8.10	10.0	51	42.5
0.330000	AV	7.90	10.0	50	41.6
0.492000	AV	7.70	10.0	46	38.4
0.534000	AV	7.50	10.0	46	38.5
0.942000	AV	7.30	10.0	46	38.7
4.170000	AV	6.80	9.9	46	39.2
4.686000	AV	6.80	10.0	46	39.2
16.938000	AV	6.70	9.8	50	43.3
26.982000	AV	7.30	9.4	50	42.7
29.514000	AV	8.50	9.2	50	41.5

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

7.3.1 Measurement Procedure (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.

FSK modulation utilizing 19.2 kbps and 152.3 kbps operate under the same mode therefore only power for the 19.2 kbps data rate is provided. Power levels between these data rates are equivalent.

7.3.2 Measurement Results

Results are shown in Table 7.3.2-1 and Figures 7.3.2-1 to 7.3.2-9 below.

Table 7.3.2-1: RF Output Power

Frequency [MHz]	Modulation	Data Rate (kbps)	Level [dBm]
902.25	FSK	19.2	24.96
914.75	FSK	19.2	25.18
927.75	FSK	19.2	25.15
902.4	FSK	150.0	24.93
915.0	FSK	150.0	25.05
927.6	FSK	150.0	25.21
909.6	OOK	16.4	25.18
916.0	OOK	16.4	25.18
921.8	OOK	16.4	25.21

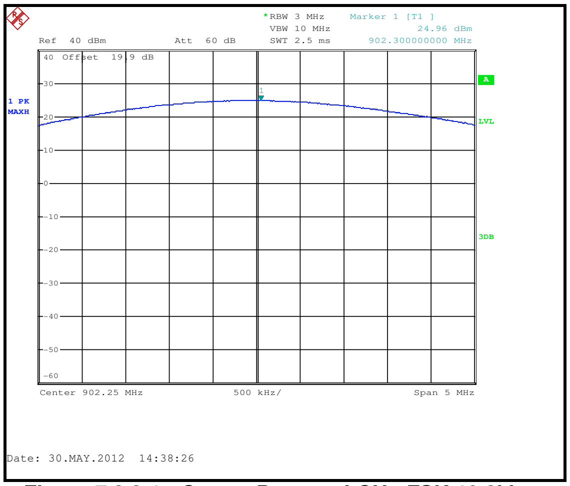

Figure 7.3.2-1: Output Power – LCH - FSK 19.2kbps

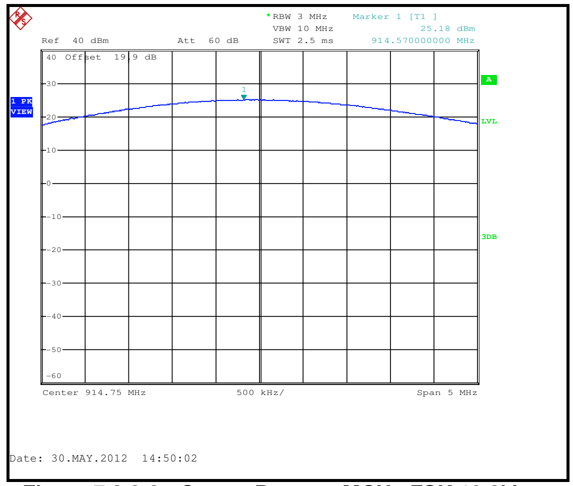

Figure 7.3.2-2: Output Power – MCH - FSK 19.2kbps

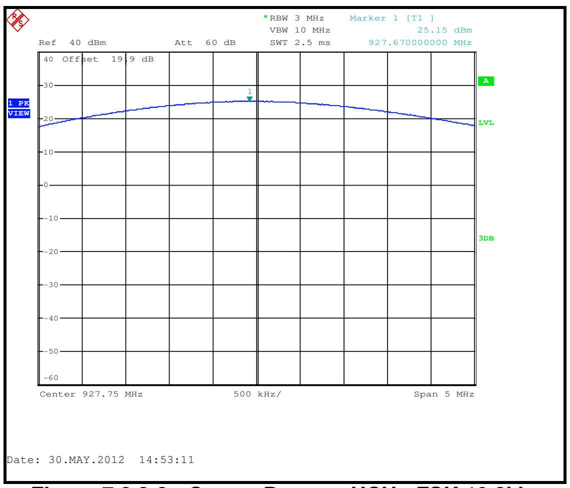

Figure 7.3.2-3: Output Power – HCH - FSK 19.2kbps

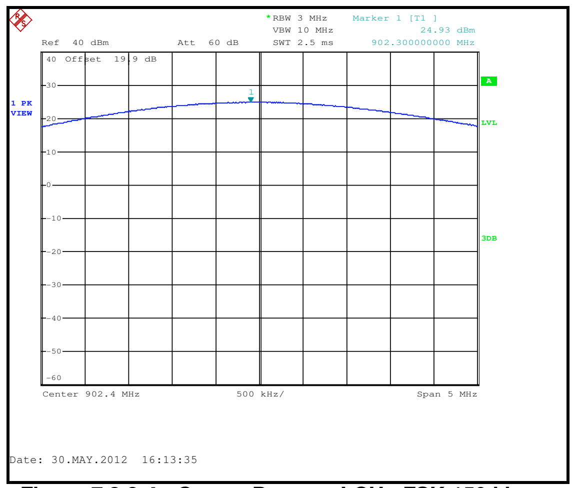

Figure 7.3.2-4: Output Power – LCH - FSK 150.kbps

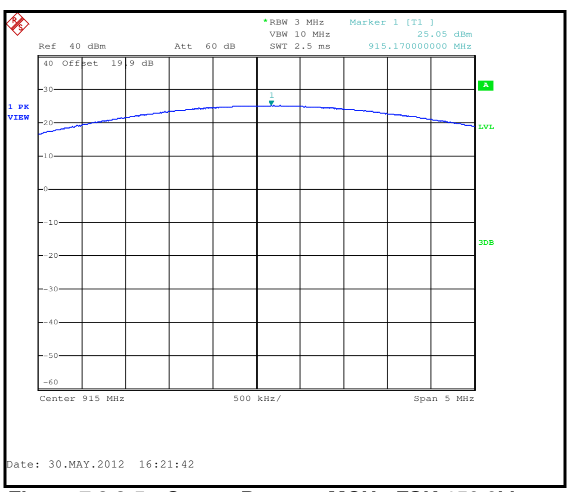

Figure 7.3.2-5: Output Power – MCH - FSK 150.0kbps

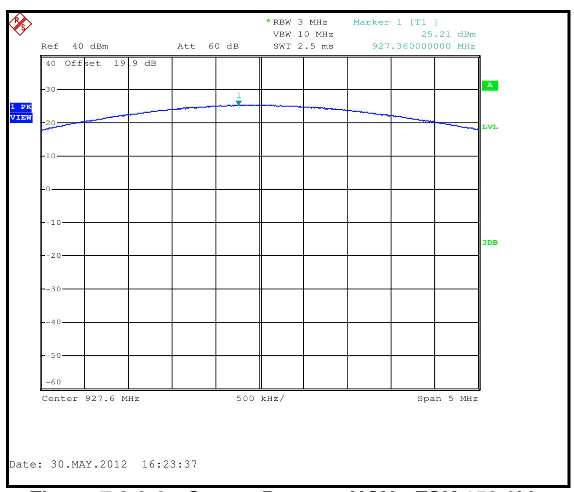

Figure 7.3.2-6: Output Power – HCH - FSK 150.0kbps

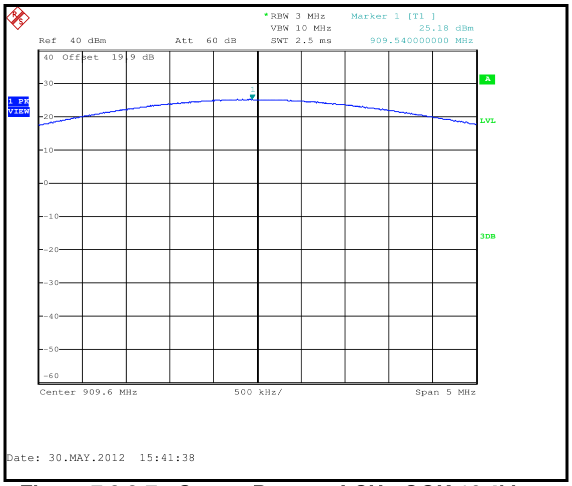

Figure 7.3.2-7: Output Power – LCH - OOK 16.4kbps

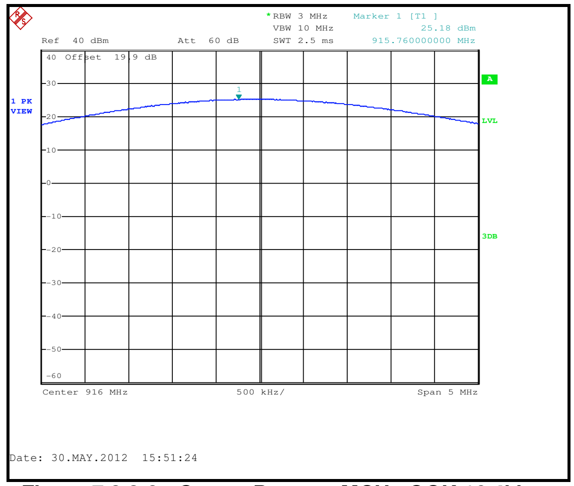

Figure 7.3.2-8: Output Power – MCH - OOK 16.4kbps

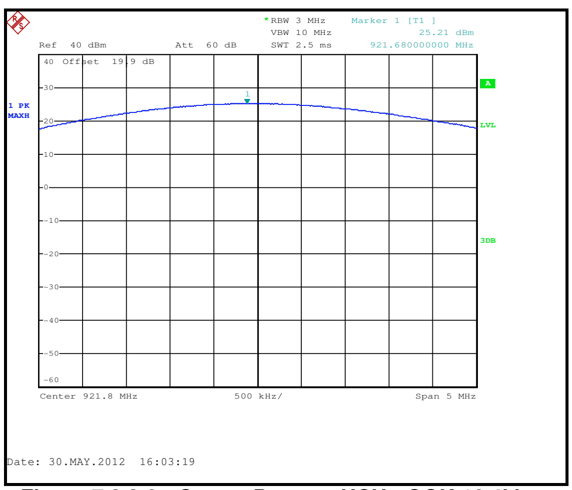

Figure 7.3.2-9: Output Power – HCH - OOK 16.4kbps

7.4 Radiated Spurious Emissions - FCC Section 15.205 IC: RSS-210 2.2

7.4.1 Measurement Procedure

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 were made with RBW and VBW of 1 MHz and 3 MHz respectively.

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

All available modulation modes and data rates were evaluated with worst case per mode presented below.

7.4.2 Measurement Results

Radiated spurious emissions found in the band of 30MHz to 10GHz are reported in the Tables 7.4.2-1 to 7.4.2-3 below.

Table 7.4.2-1: Radiated Spurious Emissions - FSK 19.2kbps
(Worst case for FSK 19.2kbps or FSK 152.3kbps - 902.25 to 927.75 MHz)

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
902.25MHz										
2706.75	51.87	46.35	H	-4.03	47.84	42.32	74.0	54.0	26.2	11.7
2706.75	52.14	47.55	V	-4.03	48.11	43.52	74.0	54.0	25.9	10.5
3609	50.11	39.47	H	-0.68	49.43	38.79	74.0	54.0	24.6	15.2
3609	49.12	39.47	V	-0.68	48.44	38.79	74.0	54.0	25.6	15.2
4511.25	48.27	38.23	H	1.39	49.66	39.62	74.0	54.0	24.3	14.4
4511.25	48.16	38.36	V	1.39	49.55	39.75	74.0	54.0	24.5	14.3
5413.5	46.11	35.16	V	3.93	50.04	39.09	74.0	54.0	24.0	14.9
914.75MHz										
979.26	------	41.51	V	1.86	------	43.37	------	54.0	------	10.6
2744.25	51.16	45.42	H	-3.93	47.23	41.49	74.0	54.0	26.8	12.5
2744.25	52.25	47.60	V	-3.93	48.32	43.67	74.0	54.0	25.7	10.3
4573.75	49.28	40.49	H	1.51	50.79	42.00	74.0	54.0	23.2	12.0
4573.75	48.13	38.64	V	1.51	49.64	40.15	74.0	54.0	24.4	13.9
927.75MHz										
2783.25	50.71	44.40	H	-3.83	46.88	40.57	74.0	54.0	27.1	13.4
2783.25	52.03	46.84	V	-3.83	48.20	43.01	74.0	54.0	25.8	11.0
4638.75	48.12	38.84	H	1.64	49.76	40.48	74.0	54.0	24.2	13.5
4638.75	49.11	40.97	V	1.64	50.75	42.61	74.0	54.0	23.3	11.4

Table 7.4.2-2: Radiated Spurious Emissions - FSK 150kbps

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
902.4MHz										
2707.2	51.16	44.37	H	-4.03	47.13	40.34	74.0	54.0	26.9	13.7
2707.2	50.72	43.79	V	-4.03	46.69	39.76	74.0	54.0	27.3	14.2
3609.6	50.31	41.28	H	-0.68	49.63	40.60	74.0	54.0	24.4	13.4
3609.6	50.22	41.61	V	-0.68	49.54	40.93	74.0	54.0	24.5	13.1
915.2MHz										
2745.6	50.51	43.64	H	-3.93	46.58	39.71	74.0	54.0	27.4	14.3
2745.6	50.91	44.20	V	-3.93	46.98	40.27	74.0	54.0	27.0	13.7
3660.8	48.05	37.26	H	-0.44	47.61	36.82	74.0	54.0	26.4	17.2
3660.8	49.21	38.84	V	-0.44	48.77	38.40	74.0	54.0	25.2	15.6
4576	47.57	37.42	H	1.51	49.08	38.93	74.0	54.0	24.9	15.1
4576	49.32	40.08	V	1.51	50.83	41.59	74.0	54.0	23.2	12.4
927.6MHz										
2782.8	50.04	43.23	H	-3.84	46.20	39.39	74.0	54.0	27.8	14.6
2782.8	50.61	43.69	V	-3.84	46.77	39.85	74.0	54.0	27.2	14.1
4638	48.18	37.42	H	1.63	49.81	39.05	74.0	54.0	24.2	14.9
4638	48.78	39.88	V	1.63	50.41	41.51	74.0	54.0	23.6	12.5

Table 7.4.2-3: Radiated Spurious Emissions - OOK 16.4kbps

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
909.6MHz										
2728.8	49.67	39.96	H	-3.97	45.70	35.99	74.0	54.0	28.3	18.0
2728.8	49.81	41.43	V	-3.97	45.84	37.46	74.0	54.0	28.2	16.5
3638.4	50.24	39.65	H	-0.55	49.69	39.10	74.0	54.0	24.3	14.9
3638.4	50.16	40.44	V	-0.55	49.61	39.89	74.0	54.0	24.4	14.1
4548	48.62	37.14	V	1.46	50.08	38.60	74.0	54.0	23.9	15.4
5457.6	48.04	37.67	V	4.10	52.14	41.77	74.0	54.0	21.9	12.2
916.0MHz										
2748	50.37	41.94	H	-3.92	46.45	38.02	74.0	54.0	27.6	16.0
2748	50.21	41.53	V	-3.92	46.29	37.61	74.0	54.0	27.7	16.4
3664	48.19	36.98	H	-0.43	47.76	36.55	74.0	54.0	26.2	17.5
3664	48.44	38.51	V	-0.43	48.01	38.08	74.0	54.0	26.0	15.9
4580	47.19	36.37	H	1.52	48.71	37.89	74.0	54.0	25.3	16.1
4580	48.13	36.45	V	1.52	49.65	37.97	74.0	54.0	24.3	16.0
921.8MHz										
2765.4	50.42	41.20	H	-3.88	46.54	37.32	74.0	54.0	27.5	16.7
2765.4	50.71	41.71	V	-3.88	46.83	37.83	74.0	54.0	27.2	16.2
3687.2	48.59	38.86	H	-0.32	48.27	38.54	74.0	54.0	25.7	15.5
3687.2	48.55	37.57	V	-0.32	48.23	37.25	74.0	54.0	25.8	16.8
4609	46.89	35.97	H	1.58	48.47	37.55	74.0	54.0	25.5	16.5
4609	48.21	37.85	V	1.58	49.79	39.43	74.0	54.0	24.2	14.6

7.4.3 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: 51.87 - 4.03 = 47.84dBuV/m
Margin: 74dBuV/m – 47.84dBuV/m = 26.2dB

Example Calculation: Average
Corrected Level: 46.35 - 4.03 – 0 = 43.32dBuV
Margin: 54dBuV – 43.32dBuV = 11.7dB

8 CONCLUSION

In the opinion of ACS, Inc. the AMI7, manufactured by Itron Electricity Metering, Inc. meets the requirements of FCC Part 15 subpart C and Industry Canada’s Radio Standards Specification RSS-210 as applicable to this Class II Permissive Change.

END REPORT