Excellence in Compliance Testing

Certification Test Report

FCC ID: SK9AMI7
IC: 864G-AMI7

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

ACS Report Number: 12-0181.W04.1A

Manufacturer: Itron Electricity Metering, Inc.
Model: AMI7

Test Begin Date: May 8, 2012
Test End Date: May 10, 2012

Report Issue Date: May 22, 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 18 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 add a new OOK modulation mode which allows for the use of 50 hopping channels out of a possible 80 available across the frequency range 908.0 – 923.8 MHz. The data rate is also slightly decreased to 16.384 kbps. There are no changes to the hardware or maximum power settings.

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 meter module designed to be integrated into a variety of electric meter form factors.

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	902.4 – 927.6	64	400	150.0
FSK	902.25 - 927.75	52	500	152.3
OOK	909.6 – 921.8	50	200	16.4
*OOK	908.0 – 923.8	50	200	16.384

* Applicable to this class II permissive change only. All other modes are covered under previous certifications.

Antenna Type / Gain: PCB quarter wave embedded slot antenna, 2.2dBi
Operating Voltage: 24VDC

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

Test Sample Serial Number(s): 6210524257 (Conducted); 6210521084 (Radiated)

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 a 1S meter form for radiated emissions. The 1S meter form represents a worst case host configuration for all available meter forms.

For the purpose of RF conducted measurements, the AMI7 module was modified with a temporary 50 ohm antenna port.

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:

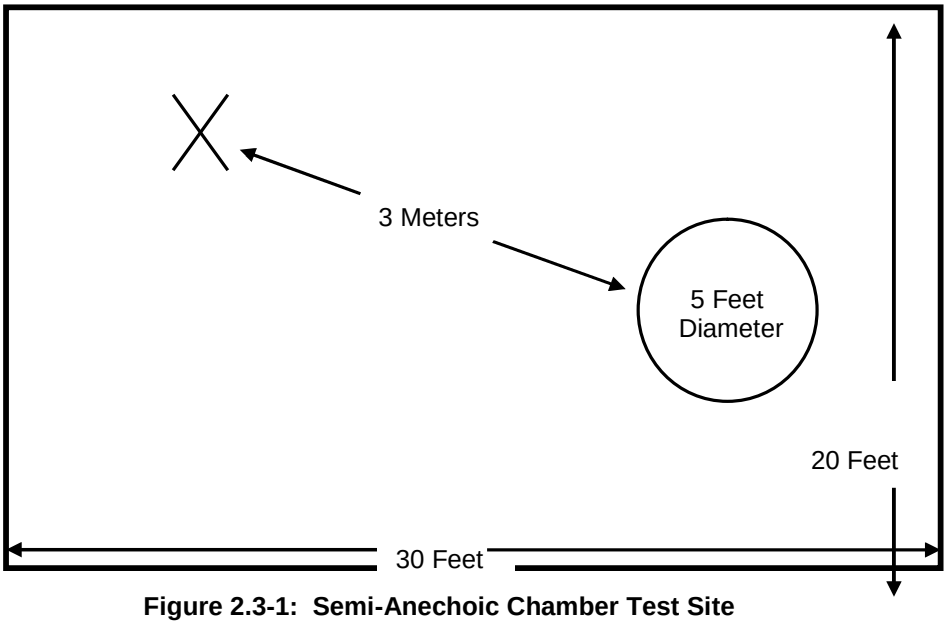

Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

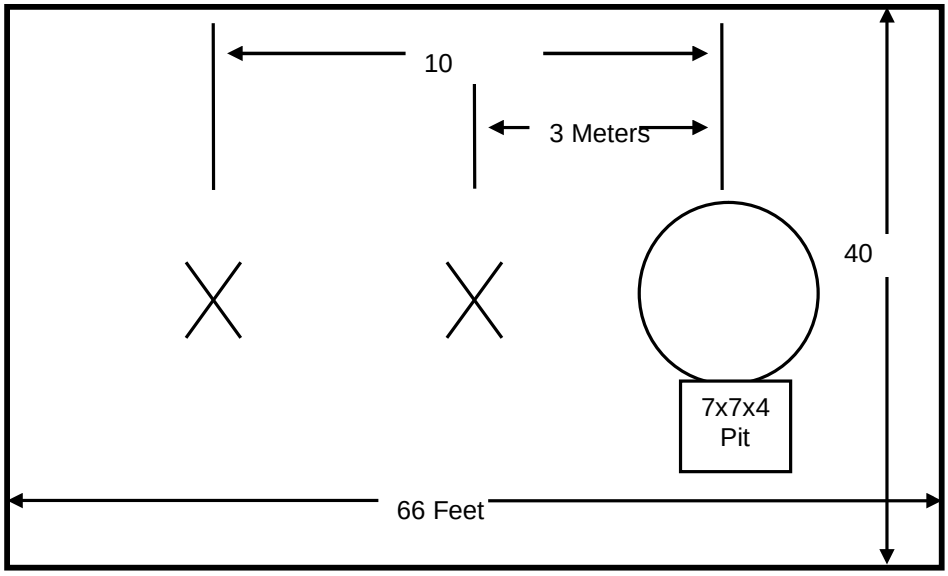

Figure 2.3-2: Open Area Test Site

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
- 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 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
40	EMCO	3104	Antennas	3211	2/11/2011	2/11/2013
73	Agilent	8447D	Amplifiers	2727A05624	9/30/2011	9/30/2012
167	ACS	Chamber EMI Cable Set	Cable Set	167	12/21/2011	12/21/2012
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
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

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	Form 1S Electric Utility Meter	Itron	C2SOD	300 307 221
2	Form 2S Electric Utility Meter	Itron	C2SOD	302 575 120
3	Step-up Transformer	Sangamo Weston	T7R	88547576

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

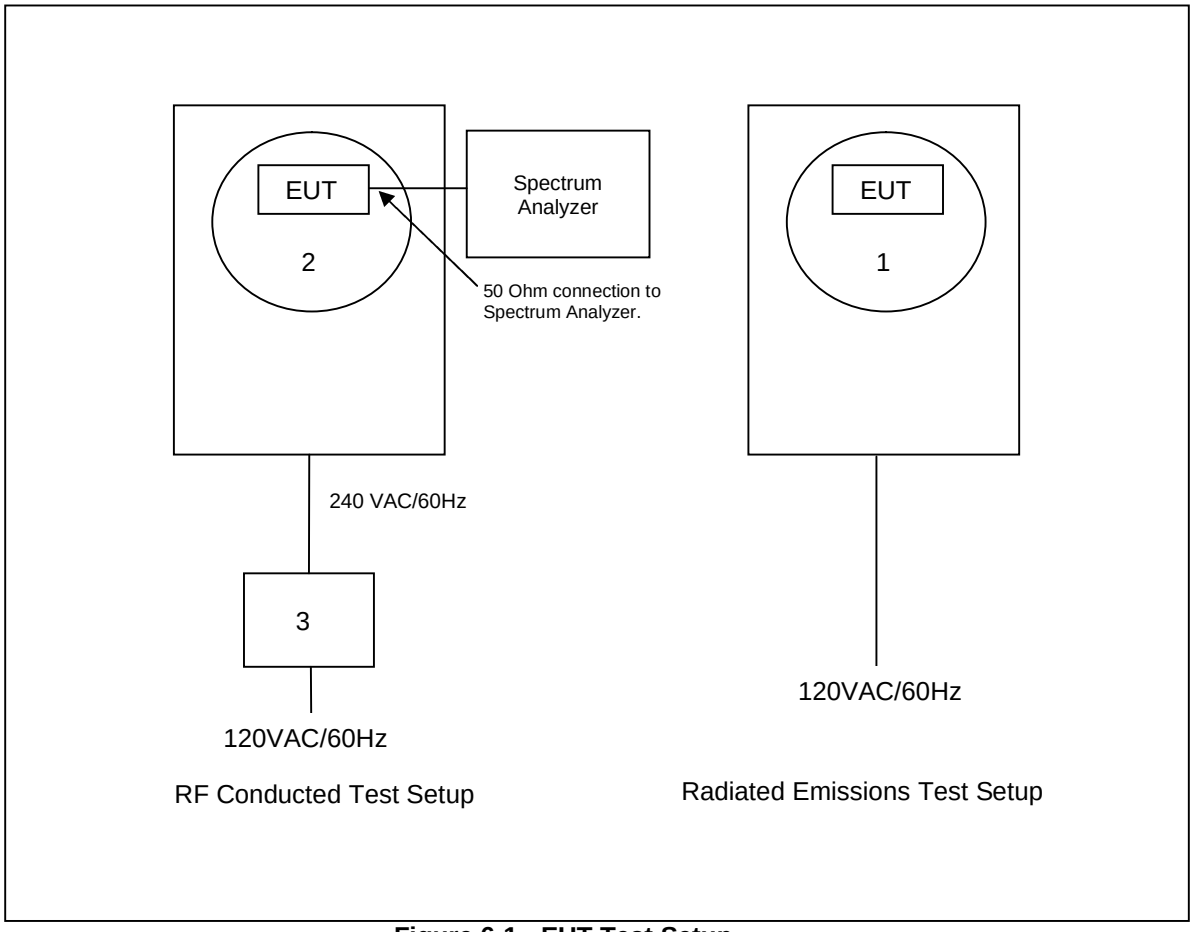

Figure 6-1: EUT Test Setup

Note: The AMI7 module was integrated into the 1S meter form for showing compliance for radiated emissions and a 2S meter for RF conducted measurements. The 1S meter form was worst case compared to all available forms for radiated emissions.

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

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

7.2.1 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 bandwidth (RBW) was set to >> the emission bandwidth. The video bandwidth was set to ≥ 3x RBW.

7.2.2 Measurement Results

Results are shown in Table 7.2.2-1 and Figures 7.2.2-1 to 7.2.2-3 below.

Table 7.2.2-1: RF Output Power

Frequency [MHz]	Level [dBm]
908.0	24.37
915.8	22.96
923.8	24.52

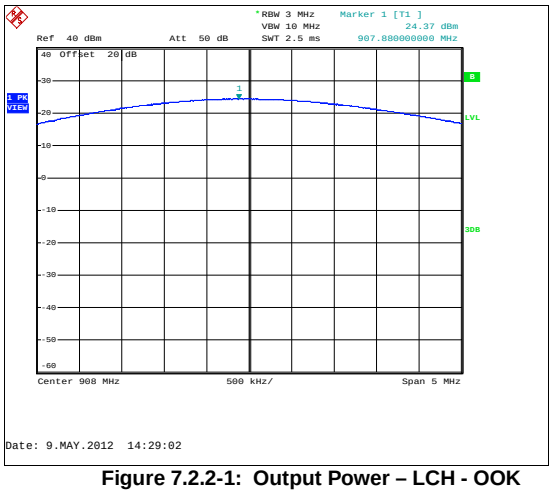

Figure 7.2.2-1: Output Power – LCH - OOK

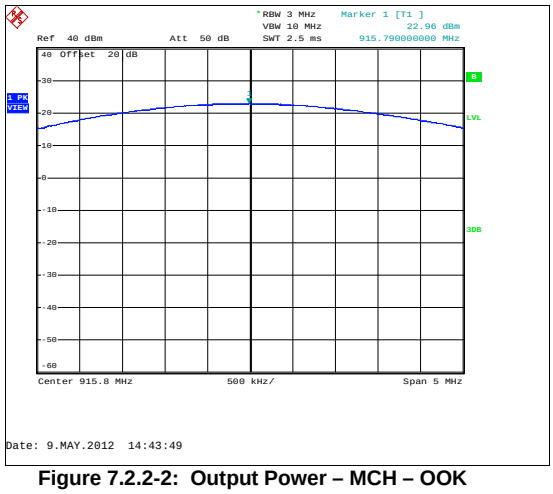

Figure 7.2.2-2: Output Power – MCH – OOK

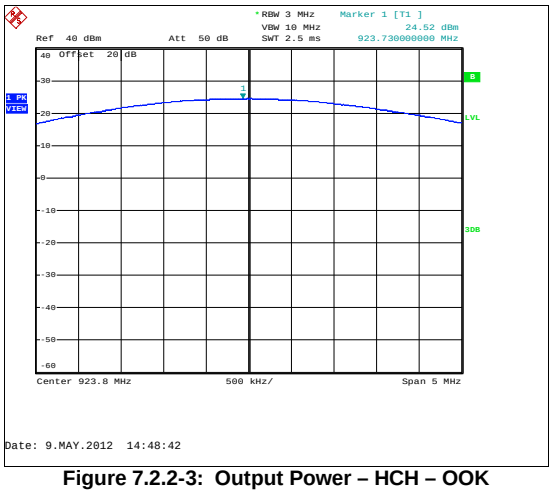

Figure 7.2.2-3: Output Power – HCH – OOK

7.3 Channel Usage Requirements

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

7.3.1.1 Measurement Procedure

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 ≥ 1% of the span.

7.3.1.2 Measurement Results

The adjacent channel separation was measured to be 200 kHz. Results are shown below in Figure 7.3.1.2-1.

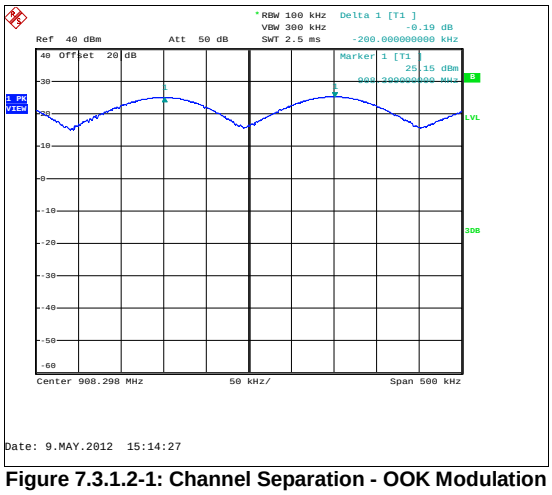

Figure 7.3.1.2-1: Channel Separation - OOK Modulation

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

The device employs 50 hopping channels. Results are shown below in Figure 7.3.2-1.

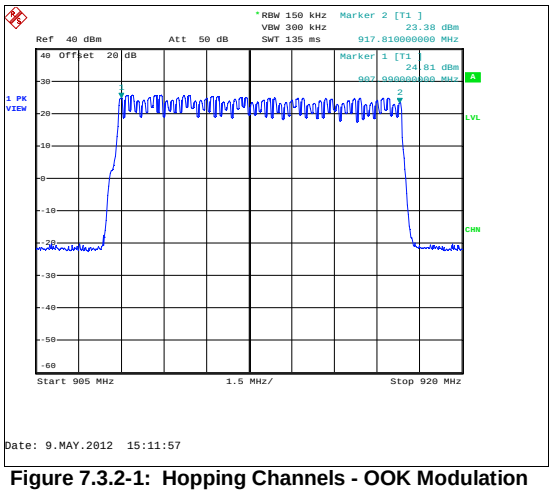

Figure 7.3.2-1: Hopping Channels - OOK Modulation

Note: The above hopping channel plot represents one hopping sequence. The EUT is capable of utilizing any combination of 50 channels out of a possible 80 available channels in the range 908 MHz to 923.8 MHz.

7.3.3 Channel Dwell Time – FCC: Section 15.247(a)(1)(i) IC: RSS-210 A8.1(c)

The maximum possible channel dwell time on a single channel is 293mS within a 20 second period. The channel dwell time is detailed in the theory of operation accompanying this report.

7.3.4 20dB / 99% Bandwidth - FCC: Section 15.247(a)(1)(i) IC: RSS-210 A8.1(c)

7.3.4.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The span of the spectrum analyzer display was set between two times and five times the occupied bandwidth (OBW) of the emission. The RBW of the spectrum analyzer was set to approximately 1 % to 5 % of the OBW. The trace was set to max hold with a peak detector active. The Delta function of the analyzer was utilized to determine the 20 dB bandwidth of the emission.

The occupied bandwidth measurement function of the analyzer was used for the 99% bandwidth. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. A sampling detector was used.

7.3.4.2 Measurement Results

Results are shown below in Table 7.3.4.2-1 and Figures 7.3.4.2-1 through 7.3.4.2-6.

Table 7.3.4.2-1: 20dB / 99% Bandwidth

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
908.0	169.0	252.0
915.8	170.0	280.0
923.8	199.0	292.0

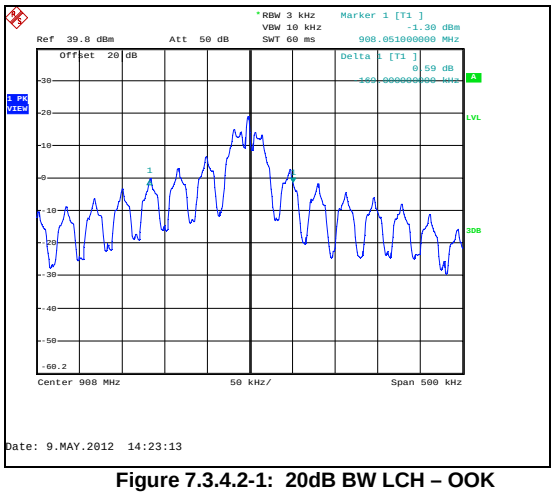

Figure 7.3.4.2-1: 20dB BW LCH – OOK

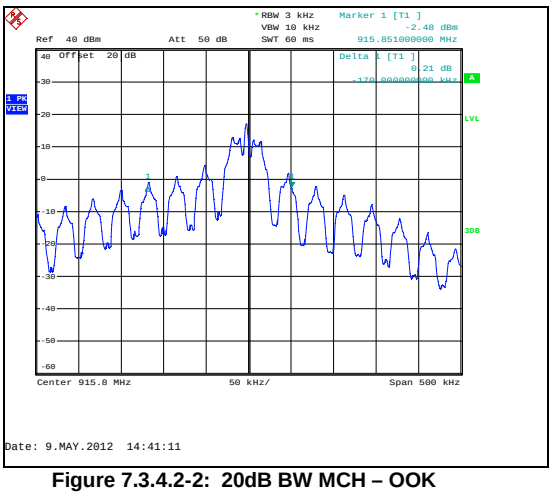

Figure 7.3.4.2-2: 20dB BW MCH – OOK

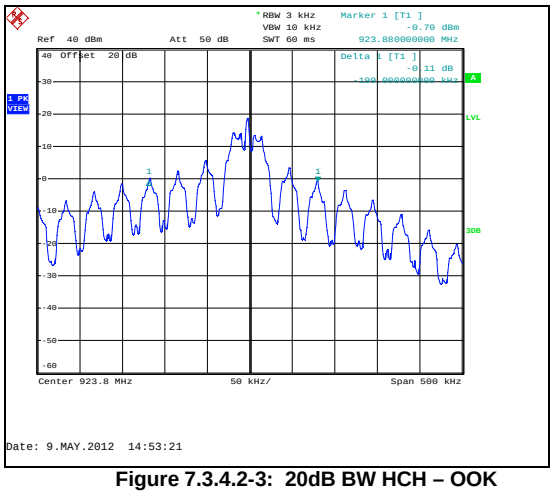

Figure 7.3.4.2-3: 20dB BW HCH – OOK

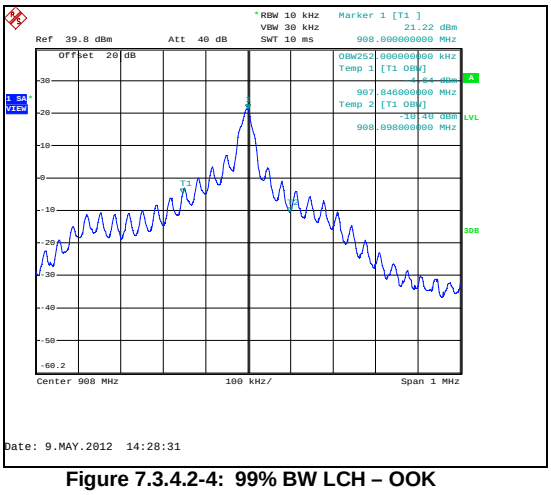

Figure 7.3.4.2-4: 99% BW LCH – OOK

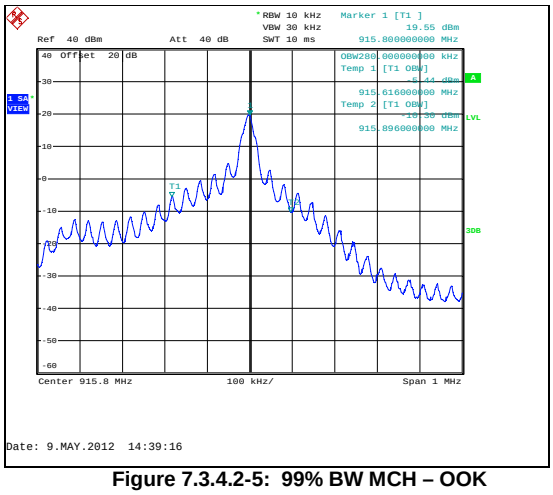

Figure 7.3.4.2-5: 99% BW MCH – OOK

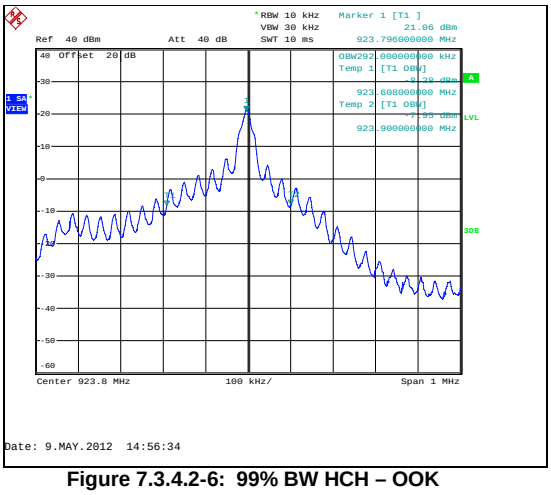

Figure 7.3.4.2-6: 99% BW HCH – OOK

7.4 Band-Edge Compliance and Spurious Emissions-FCC 15.247(d) IC:RSS-210 2.2, A8.5

7.4.1 Band-Edge Compliance of RF Conducted Emissions

7.4.1.1 Measurement Procedure

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 ≥ 1% of the span, and the VBW was set to ≥ 3 times RBW.

7.4.1.2 Measurement Results

Results are shown in the figures 7.4.1.2-1 to 7.4.1.2-4 below.

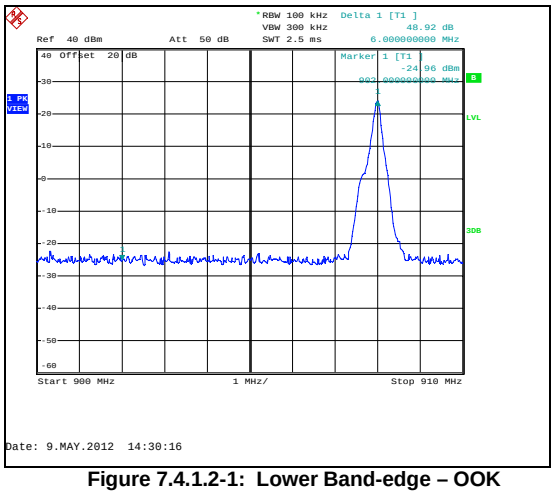

Figure 7.4.1.2-1: Lower Band-edge – OOK

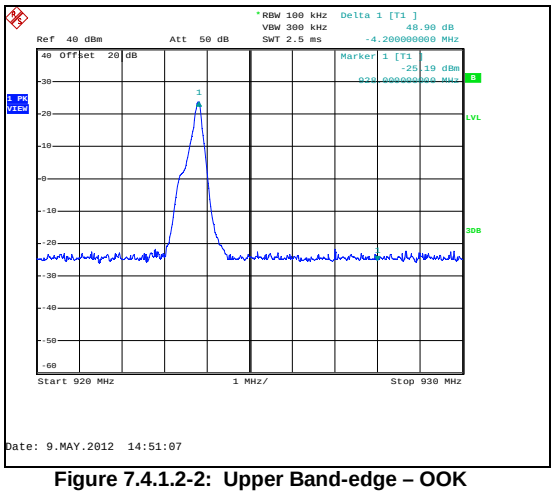

Figure 7.4.1.2-2: Upper Band-edge – OOK

HOPPING MODE:

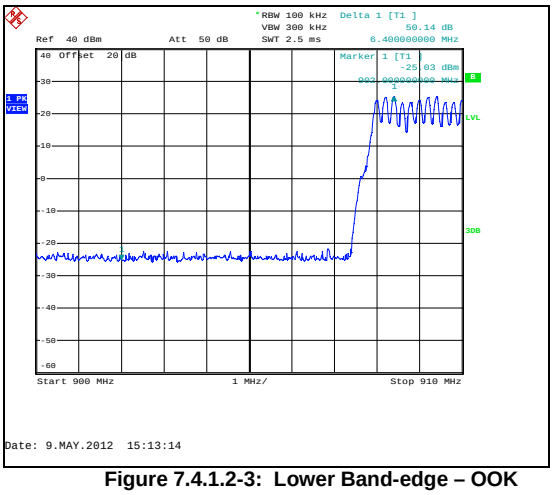

Figure 7.4.1.2-3: Lower Band-edge – OOK

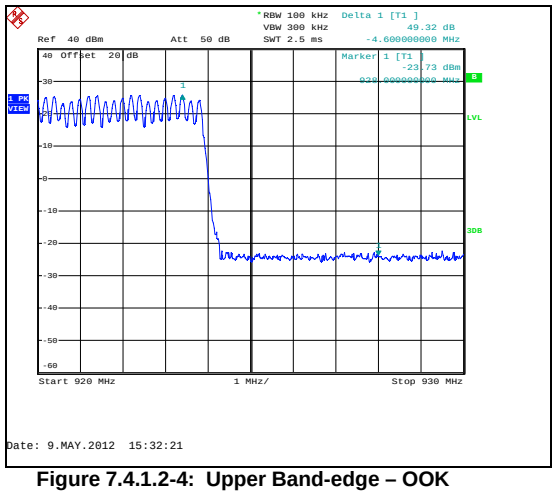

Figure 7.4.1.2-4: Upper Band-edge – OOK

7.4.2 RF Conducted Spurious Emissions

7.4.2.1 Measurement Procedure

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.

7.4.2.2 Measurement Results

Results are shown below in Figures 7.4.2.2-1 to 7.4.2.2-6:

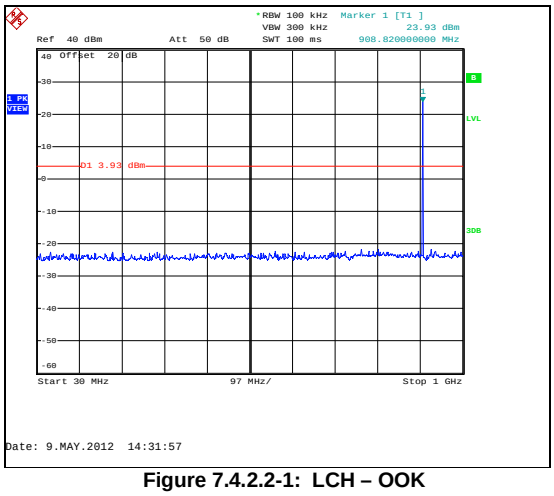

Figure 7.4.2.2-1: LCH – OOK

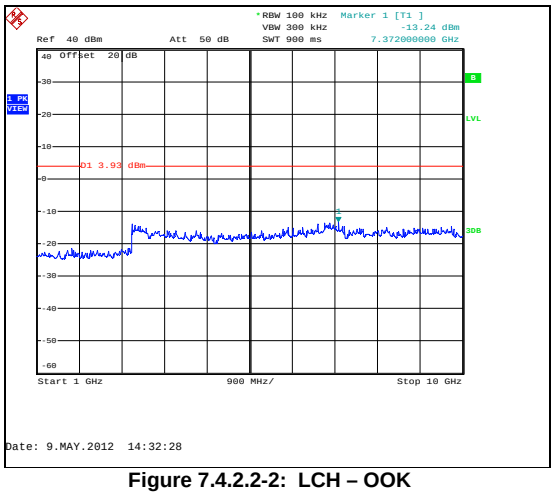

Figure 7.4.2.2-2: LCH – OOK

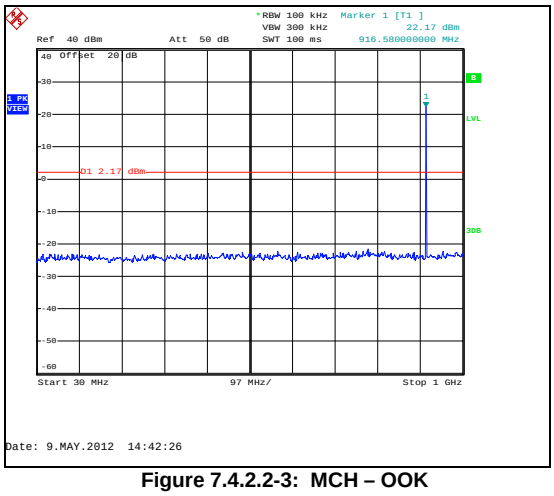

Figure 7.4.2.2-3: MCH – OOK

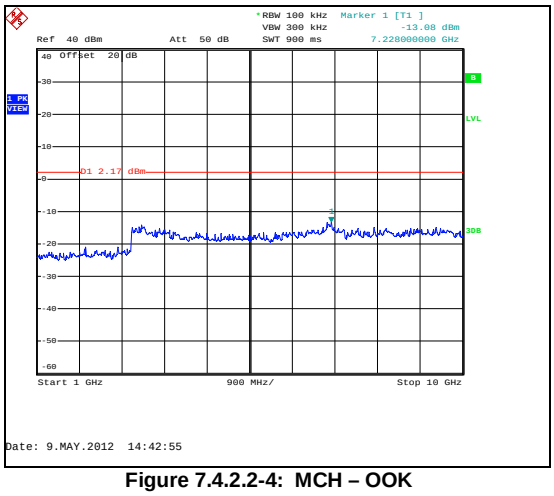

Figure 7.4.2.2-4: MCH – OOK

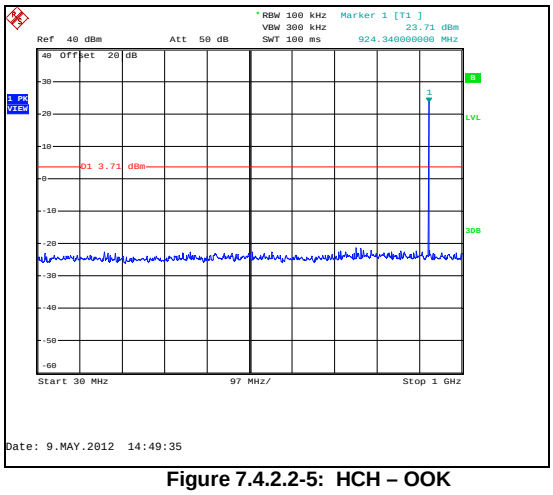

Figure 7.4.2.2-5: HCH – OOK

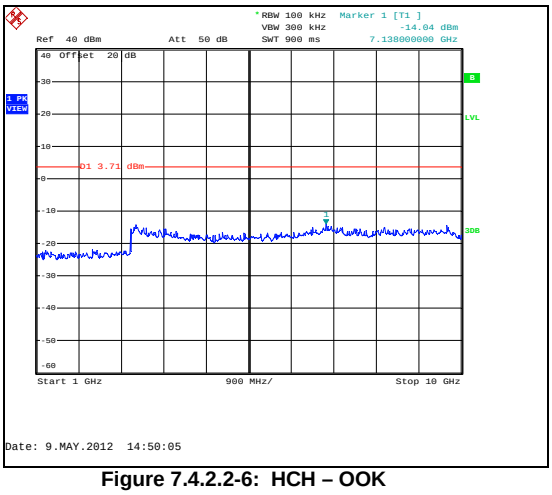

Figure 7.4.2.2-6: HCH – OOK

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

7.4.3.1 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.

7.4.3.2 Measurement Results

Radiated spurious emissions found in the band of 30MHz to 10GHz are reported in the Table 7.4.3.2-1 below.

Table 7.4.3.2-1: 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
908.0MHz										
1307.89	48.27	36.32	H	-11.12	37.15	25.20	74.0	54.0	36.9	28.8
1307.89	50.16	41.11	V	-11.12	39.04	29.99	74.0	54.0	35.0	24.0
2724	56.93	42.95	H	-3.99	52.94	38.96	74.0	54.0	21.1	15.0
2724	53.96	39.98	V	-3.99	49.97	35.99	74.0	54.0	24.0	18.0
3632	53.25	36.48	H	-0.58	52.67	35.90	74.0	54.0	21.3	18.1
3632	53.60	36.81	V	-0.58	53.02	36.23	74.0	54.0	21.0	17.8
4540	49.11	38.64	H	1.44	50.55	40.08	74.0	54.0	23.4	13.9
4540	48.22	35.97	V	1.44	49.66	37.41	74.0	54.0	24.3	16.6
915.8MHz										
1315.68	57.42	49.02	H	-11.07	46.35	37.95	74.0	54.0	27.6	16.0
1315.68	51.24	40.87	V	-11.07	40.17	29.80	74.0	54.0	33.8	24.2
2747.4	54.69	39.83	H	-3.93	50.76	35.90	74.0	54.0	23.2	18.1
2747.4	52.10	39.04	V	-3.93	48.17	35.11	74.0	54.0	25.8	18.9
3663.2	48.45	35.16	H	-0.43	48.02	34.73	74.0	54.0	26.0	19.3
3663.2	50.19	35.44	V	-0.43	49.76	35.01	74.0	54.0	24.2	19.0
4579	47.19	36.22	H	1.52	48.71	37.74	74.0	54.0	25.3	16.3
923.8MHz										
1323.66	50.23	42.42	H	-11.01	39.22	31.41	74.0	54.0	34.8	22.6
1323.66	50.44	41.23	V	-11.01	39.43	30.22	74.0	54.0	34.6	23.8
2771.4	51.86	35.79	H	-3.87	47.99	31.92	74.0	54.0	26.0	22.1
2771.4	49.70	35.18	V	-3.87	45.83	31.31	74.0	54.0	28.2	22.7
3695.2	49.67	35.36	V	-0.29	49.38	35.07	74.0	54.0	24.6	18.9
4619	48.78	37.37	H	1.60	50.38	38.97	74.0	54.0	23.6	15.0
4619	47.30	35.74	V	1.60	48.90	37.34	74.0	54.0	25.1	16.7

7.4.3.3 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: 48.27 - 11.12 = 37.15dBuV/m
Margin: 74dBuV/m – 37.15dBuV/m = 36.9dB

Example Calculation: Average
Corrected Level: 36.32 - 11.12 – 0 = 25.20dBuV
Margin: 54dBuV – 25.20dBuV = 28.8dB

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