FCC Part 15.207
Class II Permissive Change

Test Report

FCC ID: SK9SMFMM-1

FCC Rule Part: 15.207

ACS Report Number: 05-0218-15C-SMFMM-1

Manufacturer: Itron Electricity Metering, Inc.
Model: SMFMM-1

Test Begin Date: June 8, 2005
Test End Date: June 8, 2005

Report Issue Date: June 15, 2005

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612

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This report contains 14 pages

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Test Setup Photographs
Internal Photographs

1.0 GENERAL

1.1 Purpose
The purpose of this report is to demonstrate compliance with Part 15.207 of the FCC's Code of Federal Regulations which has been harmonized with the international standards developed by the International Electrotechnical Commission (IEC), International Special Committee on Radio Interference (CISPR).

1.2 Product Description
The SENTINEL product line are solid state electricity power meters which Schlumberger currently produces. The basic meter consists of an signal input circuit board, which scales the input voltages and has a switching power supply, permanently connected to register circuit board which does calculations and the display function. The register board has a small linear power supply. There are a few different models of the SENTINAL meter, but the differences are not considered to affect the transmitter board.

The SMFMM is an RF option for the SENTINEL meter which will periodically transmit the meter reading and an ID number to utility data collectors that may be stationary, handheld, or vehicular mounted. The SMFMM board may also pass signals from the register board to an optional solid state relay output board which is not related to the RF operation. The SMFMM physically consists of one small circuit board. The RF board has a linear power supply, a microprocessor, an RF oscillator and a stripline antenna.

The EUT transmits at 917.58 MHz and does not allow for customer programming of the RF parameters of a sealed meter. All RF programming and RF tuning of the product will be done by factory trained personnel during the manufacturing process. At that time the SMFMM is tested, tuned, and programmed in non-volatile memory for operating system parameters and FCC compliance.

1.3 Intended Use
The SMFMM-1 will be a transmit-only meter module that collects and transmits metering data over the 902 - 928 MHz Industrial, Scientific and Medical (ISM) RF band for collection by electric utility companies.

1.4 Description of Changes
The previous PWB passed the FCC's Code of Federal Regulations prior to them being harmonized with the international standards developed by the International Electrotechnical Commission (IEC), International Special Committee on Radio Interference (CISPR). Once the harmonized limits were in place, this original PWB produced non-compliant emissions. The original PWB used a series RCL circuit to kill the power supply switching noise. The modification required to meet the new limits was to remove an inductor and replace with a common mode choke between a diode bridge and bulk storage capacitance.

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: 89450
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

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:

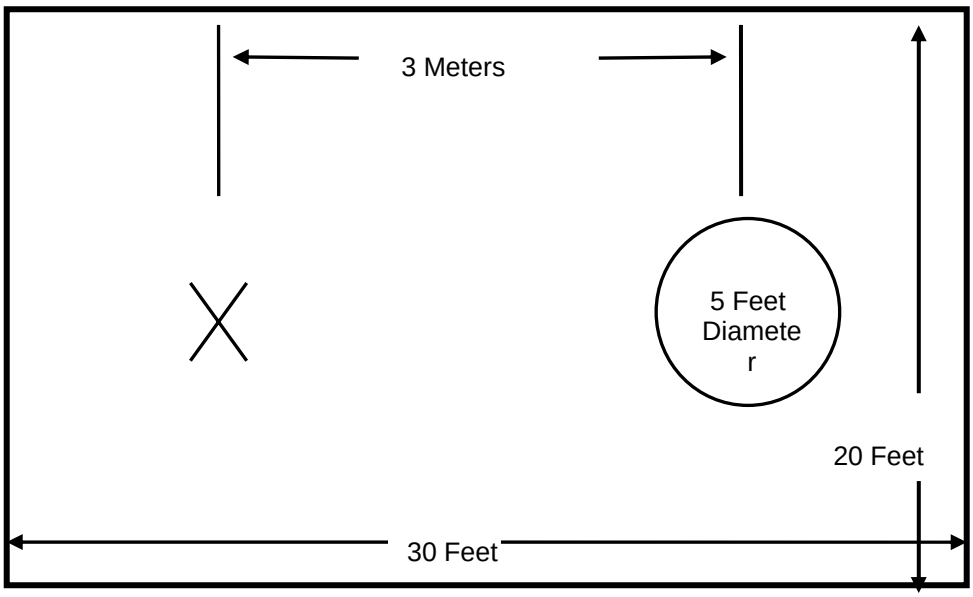

Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

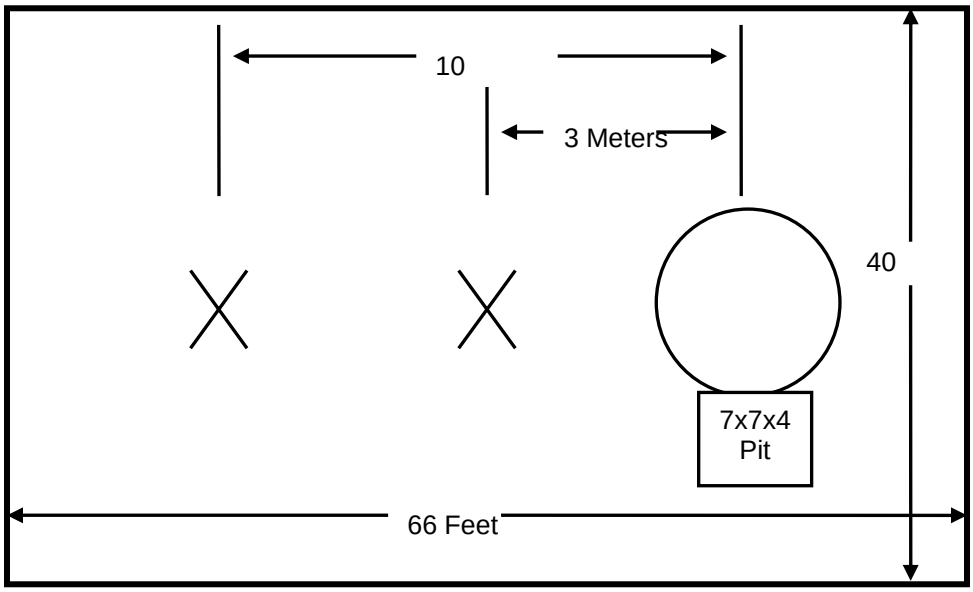

Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description
The AC mains conducted EMI site is a shielded room with the following dimensions:

- Height: 3.0 Meters
- Width: 3.6 Meters
- Length: 4.9 Meters

The room is manufactured by Rayproof Corporation and installed by Panashield, Inc. Earth ground is provided to the room via an 8' copper ground rod. Each panel of the room is connected electrically at intervals of 4".

Power to the room is filtered to prevent ambient noise from coupling to the EUT and measurement equipment. Filters are models 1B42-60P manufactured by Rayproof Corporation.

The room 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 2.4-1:

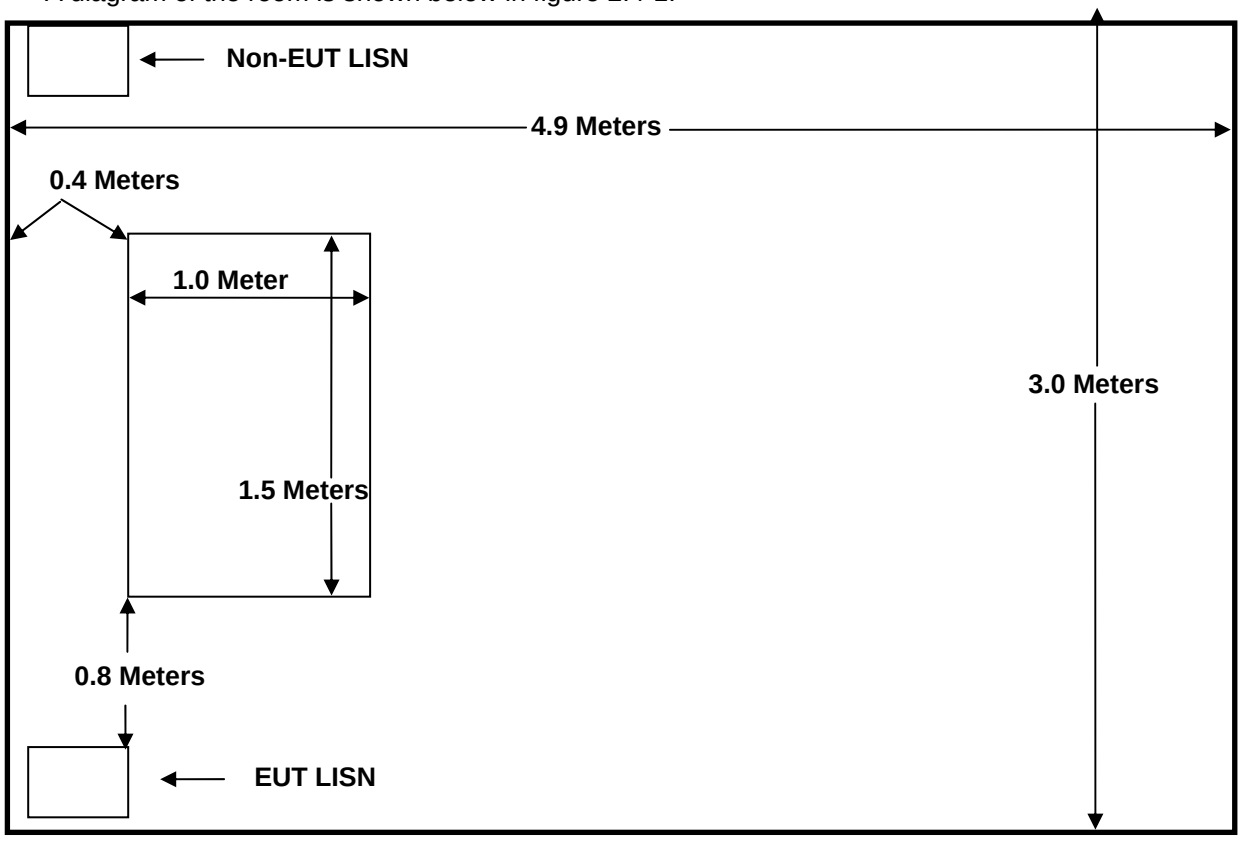

Figure 2.4-1: AC Mains Conducted EMI Site

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 (October 2004)
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators (October 2004)

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**
152	EMCO	LISN	3825/2	9111-1905	01/18/06
153	EMCO	LISN	3825/2	9411-2268	12/20/05
165	ACS	Conducted EMI Cable Set	RG8	165	01/06/06
1	Rohde & Schwarz	Receiver	804.8932.52	833771/007	02/26/06
2	Rohde & Schwarz	Receiver	1032.5640.53	839587/003	02/26/06
3	Rohde & Schwarz	ESMI Receiver	804.8932.52	839379/011	12/15/05
4	Rohde & Schwarz	ESMI Receiver	1032.5640.53	833827/003	12/15/05
168	Hewlett Packard	Pulse Limiter	11947A	3107A02268	01/06/06

5.0 SUPPORT EQUIPMENT

Table 5-3: Support Equipment

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

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

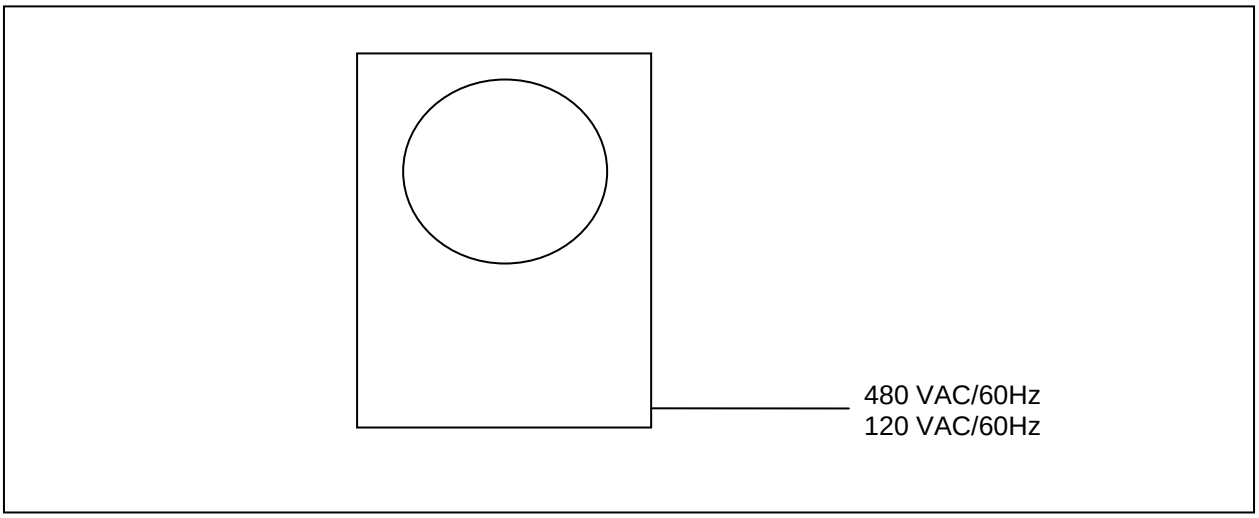

Figure 6-1: EUT Test Setup

Note: To achieve the 480 VAC/60 Hz used for testing, a 4:1 transformer was placed between the LISN and AC mains. The transformer was removed to show compliance at 120 VAC/60 Hz.

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 Power Line Conducted Emissions - FCC Section 15.207

7.1.1 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 = Corrected Reading – Applicable Limit

Testing was performed at two input levels to the device, 120 VAC and 480 VAC, to cover the entire tuning range. A 4:1 transformer was used to generate the 480 VAC needed.

7.1.2 Test Results

Results of the test are shown below in and Tables 7.1-1 through 7.1-8 and Figure 7.1-1 through 7.1-4

120 VAC

Table 7.1-1: Line 1 Conducted EMI Results (Quasi-Peak) – 120 VAC

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.186	52.9	9.9	64.2	11.2	L1	GND
0.276	46.1	9.9	60.9	14.8	L1	GND
0.642	34.8	9.9	56	21.1	L1	GND
0.828	34.1	10.0	56	21.8	L1	GND
1.014	33.3	10.0	56	22.6	L1	GND
1.152	33.7	10.0	56	22.2	L1	GND
1.338	32.8	10.0	56	23.1	L1	GND
1.566	29.7	10.0	56	26.2	L1	GND
1.704	29.3	10.0	56	26.6	L1	GND
10.482	25.0	10.1	60	35.0	L1	GND

Table 7.1-2: Line 1 Conducted EMI Results (Average) – 120 VAC

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.228	29.7	9.9	52.5	22.7	L1	GND
0.294	26.1	9.9	50.4	24.2	L1	GND
0.642	21.9	9.9	46	24.0	L1	GND
0.828	18.7	10.0	46	27.2	L1	GND
1.014	17.9	10.0	46	28.0	L1	GND
1.152	17.9	10.0	46	28.0	L1	GND
1.338	16.6	10.0	46	29.4	L1	GND
1.572	13.5	10.0	46	32.4	L1	GND
1.704	14.6	10.0	46	31.3	L1	GND
10.434	12.8	10.1	50	37.1	L1	GND

Table 7.1-3: Line 2 Conducted EMI Results (Quasi-Peak) – 120 VAC

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.186	53.0	9.9	64.2	11.1	L2	GND
0.276	46.0	9.9	60.9	14.9	L2	GND
0.462	39.2	9.9	56.6	17.3	L2	GND
0.510	36.9	9.9	56	19.0	L2	GND
0.786	36.5	10.0	56	19.4	L2	GND
1.152	34.7	10.0	56	21.2	L2	GND
1.566	32.8	10.0	56	23.1	L2	GND
1.662	32.3	10.0	56	23.6	L2	GND
2.076	21.1	10.0	56	34.8	L2	GND
10.176	25.0	10.1	60	35.0	L2	GND

Table 7.1-4: Line 2 Conducted EMI Results (Average) – 120 VAC

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.228	31.5	9.9	52.5	20.9	L2	GND
0.276	30.0	9.9	50.9	20.9	L2	GND
0.462	24.4	9.9	46.6	22.2	L2	GND
0.510	23.5	9.9	46	22.4	L2	GND
0.828	21.0	10.0	46	24.9	L2	GND
1.200	19.4	10.0	46	26.5	L2	GND
1.572	18.2	10.0	46	27.7	L2	GND
1.710	17.7	10.0	46	28.2	L2	GND
2.076	12.2	10.0	46	33.7	L2	GND
10.08	15.2	10.1	50	34.8	L2	GND

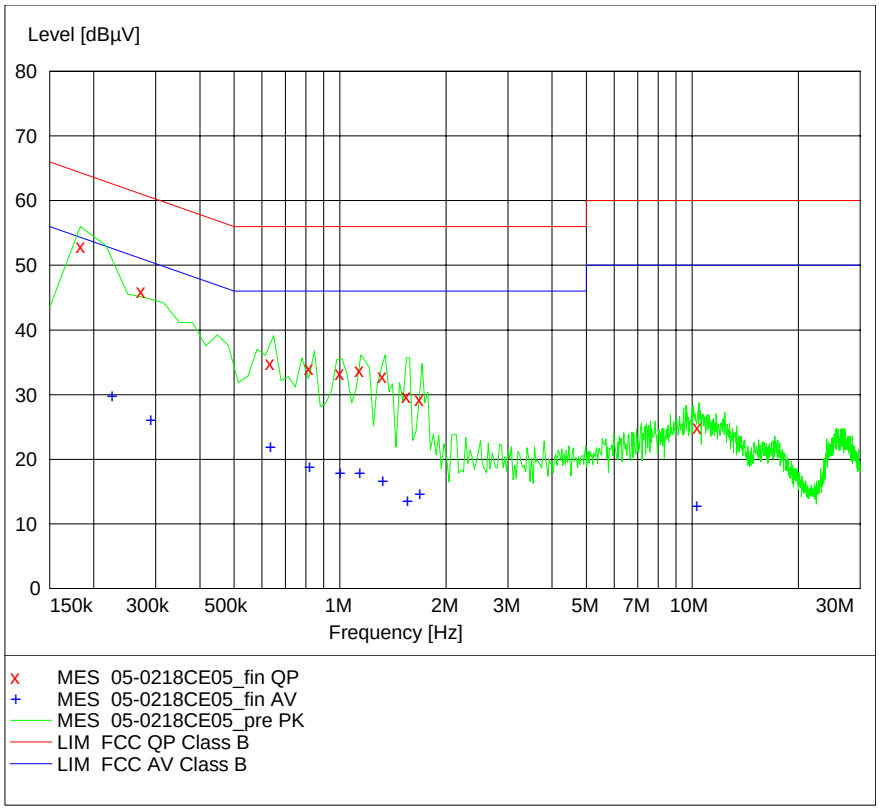

Figure 7.1-1: Conducted Emissions Graph – Line 1 - 120 VAC

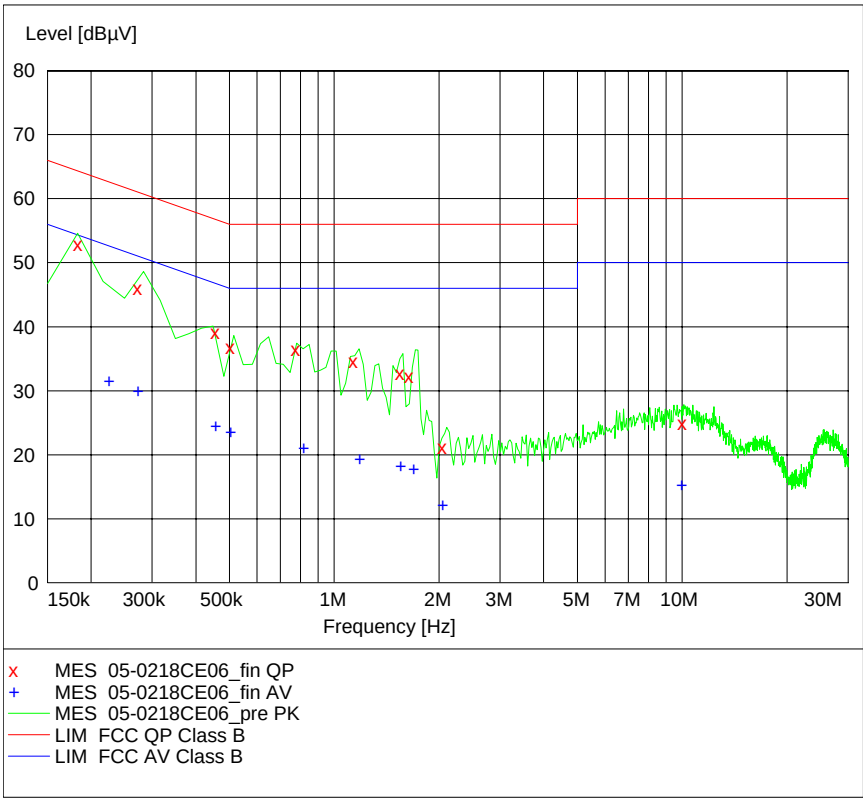

Figure 7.1-2: Conducted Emissions Graph – Line 2 - 120 VAC

480 VAC

Table 7.1-5: Line 1 Conducted EMI Results (Quasi-Peak) – 480 VAC

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.234	48.4	9.9	62.3	13.8	L1	GND
0.276	46.7	9.9	60.9	14.1	L1	GND
0.414	42.0	9.9	57.5	15.4	L1	GND
0.924	33.2	9.9	56	22.7	L1	GND
1.068	33.6	10.0	56	22.3	L1	GND
1.578	35.3	10.0	56	20.6	L1	GND
1.668	35.7	10.0	56	20.2	L1	GND
1.716	34.6	10.0	56	21.3	L1	GND
1.854	23.5	10.0	56	32.4	L1	GND
11.718	22.9	10.1	60	37.0	L1	GND

Table 7.1-6: Line 1 Conducted EMI Results (Average) – 480 VAC

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.192	29.7	9.9	53.9	24.1	L1	GND
0.288	25.0	9.9	50.5	25.5	L1	GND
0.414	19.3	9.9	47.5	28.2	L1	GND
0.912	19.2	9.9	46	26.7	L1	GND
1.050	18.1	10.0	46	27.8	L1	GND
1.524	12.4	10.0	46	33.5	L1	GND
1.668	13.3	10.0	46	32.6	L1	GND
1.716	12.9	10.0	46	33.0	L1	GND
1.860	8.8	10.0	46	37.1	L1	GND
11.634	10.6	10.1	50	39.3	L1	GND

Table 7.1-7: Line 2 Conducted EMI Results (Quasi-Peak) – 480 VAC

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.192	47.9	9.9	63.9	16.0	L2	GND
0.276	46.8	9.9	60.9	14.1	L2	GND
0.468	40.8	9.9	56.5	15.6	L2	GND
0.978	35.1	9.9	56	20.8	L2	GND
1.674	36.2	10.0	56	19.7	L2	GND
2.232	20.0	10.0	56	36.0	L2	GND
10.008	21.9	10.1	60	38.1	L2	GND
11.712	25.2	10.1	60	34.7	L2	GND
26.316	23.9	10.3	60	36.0	L2	GND

Table 7.1-8: Line 2 Conducted EMI Results (Average) – 480 VAC

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.192	29.9	9.9	53.9	24.0	L2	GND
0.288	25.4	9.9	50.5	25.1	L2	GND
0.510	30.6	9.9	46	15.3	L2	GND
0.936	13.4	9.9	46	32.5	L2	GND
1.674	13.8	10.0	46	32.1	L2	GND
1.680	13.5	10.0	46	32.5	L2	GND
2.190	9.0	10.0	46	37.0	L2	GND
10.158	10.2	10.1	50	39.7	L2	GND
11.628	11.4	10.1	50	38.5	L2	GND
26.484	10.0	10.3	50	39.9	L2	GND

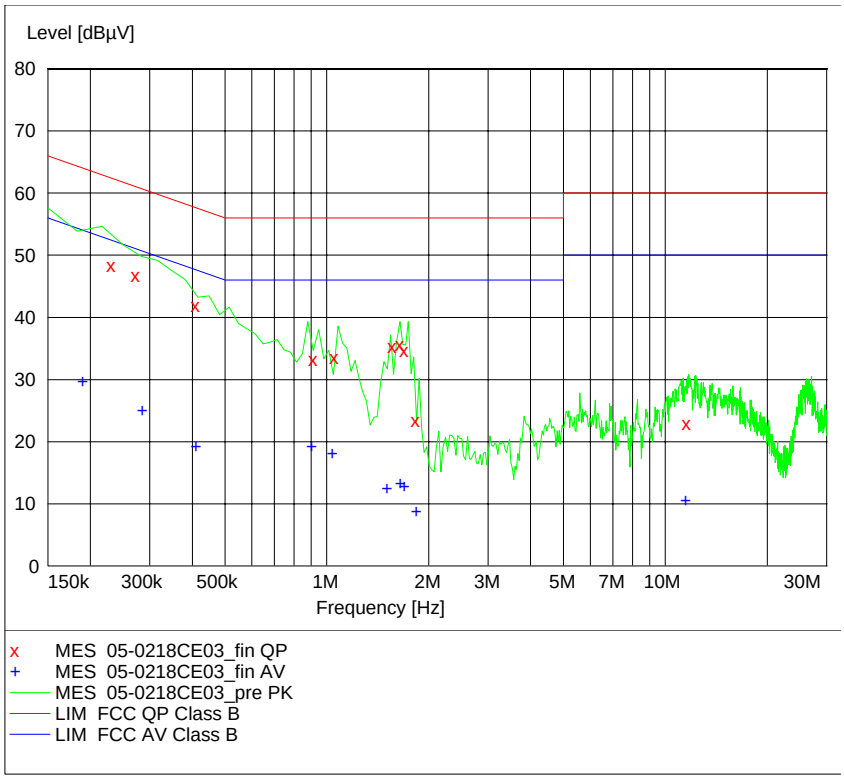

Figure 7.1-3: Conducted Emissions Graph – Line 1 - 480 VAC

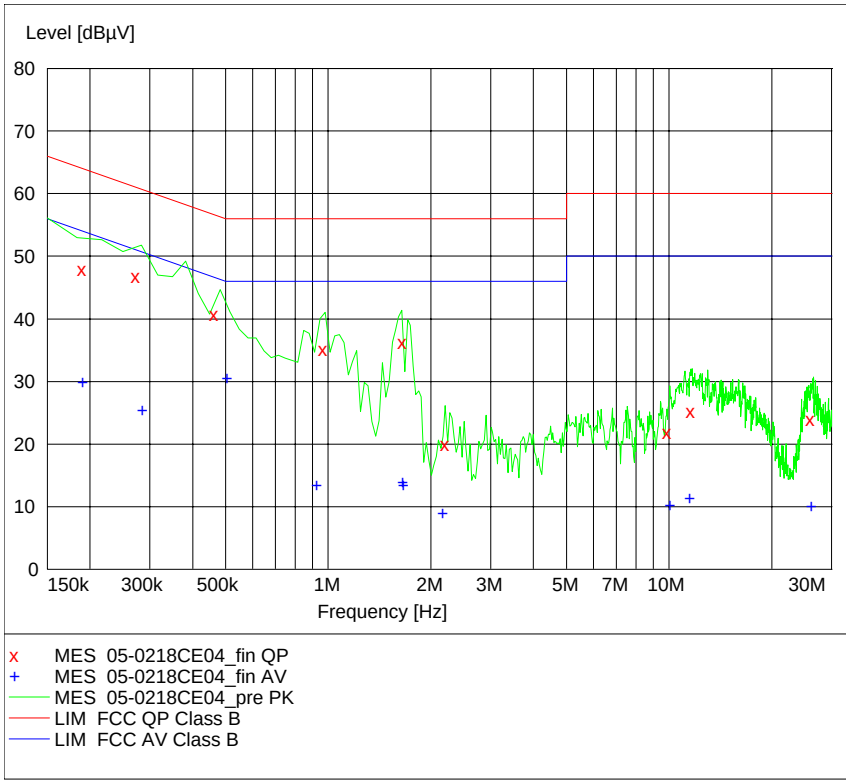

Figure 7.1-4: Conducted Emissions Graph – Line 2 - 480 VAC

8.0 CONCLUSION

In the opinion of ACS, Inc. the SMFMM-1, manufactured by Itron Electricity Metering, Inc., meets the requirements of FCC Part 15 subpart C for AC Power Line Conducted Emissions.