Excellence in Compliance Testing

Certification Test Report

FCC ID: SSDHOTRODMETALV1

FCC Rule Part: 15.249

ACS Report Number: 09-0068 - 15C

Manufacturer: Hersey Meters
Model: HOTRODMETALV1

Test Begin Date: February 23, 2009
Test End Date: February 23, 2009

Report Issue Date: April 16, 2009

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

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

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This report contains 17 pages

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1.0 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15, Subpart C of the FCC's Code of Federal Regulations for a class II permissive change. The class II permissive change is based on an increased transmitter duty cycle as well as PCB layout changes. No RF components changes were made. This permissive change also addresses the use of plastic in-ground meter pits as tested in this report.

1.2 Product Description

1.2.1 General

The HOTRODMETALV1 allows the utility to receive data from any Hersey water meter equipped with a Translator register. The transmitter collects data from the register and transmits it via radio frequency (RF) to be collected by a mobile receiver.

Manufacturer Information:
Hersey Meters
10210 Statesville Blvd.
Cleveland NC 27013
Tel: 704-278-2221
Fax: 704-278-9617

Test Sample Serial Number(s):
ACS#1

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 unit is intended to be used to transmit meter-reading data from a utility meter to a mobile data-collecting device.

1.3 Test Methodology and Considerations

The HOTRODMETALV1 utility meter transmitter is intended for meter pit installation at or below ground level. Therefore testing was performed as typically installed in meter pits described in sections 5.0 – 6.0. A 4'x4'x4' dirt filled wooden test fixture (box) was used to simulate typically in-ground in use.

For use in the plastic meter pit identified in Section 5.0, the power setting on the EUT was reduced to meet the field strength limitations of Part 15.249. In no cases did the fundamental field strength values measured exceed the values reported in the original application for certification.

See test setup photographs for additional information.

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:

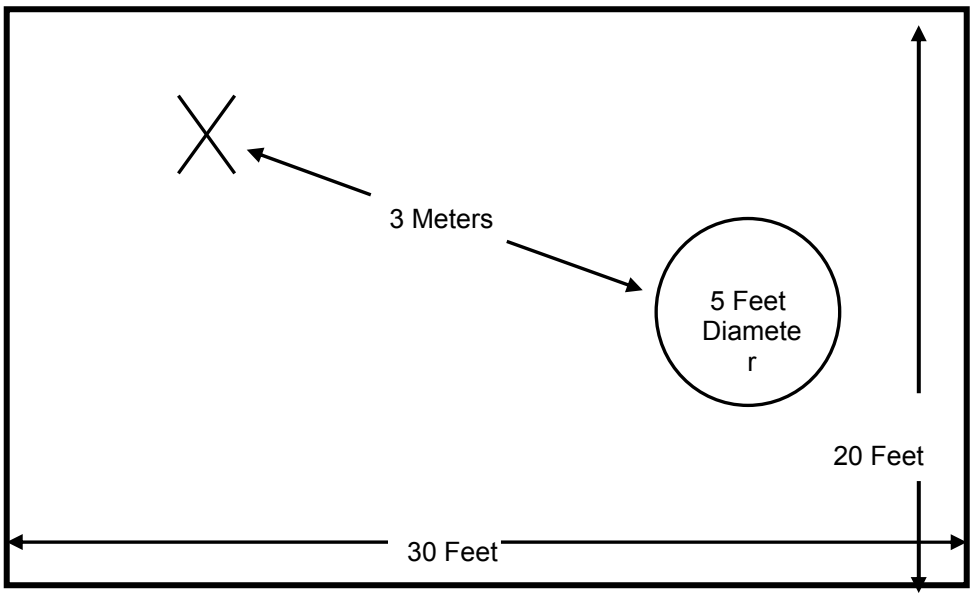

Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

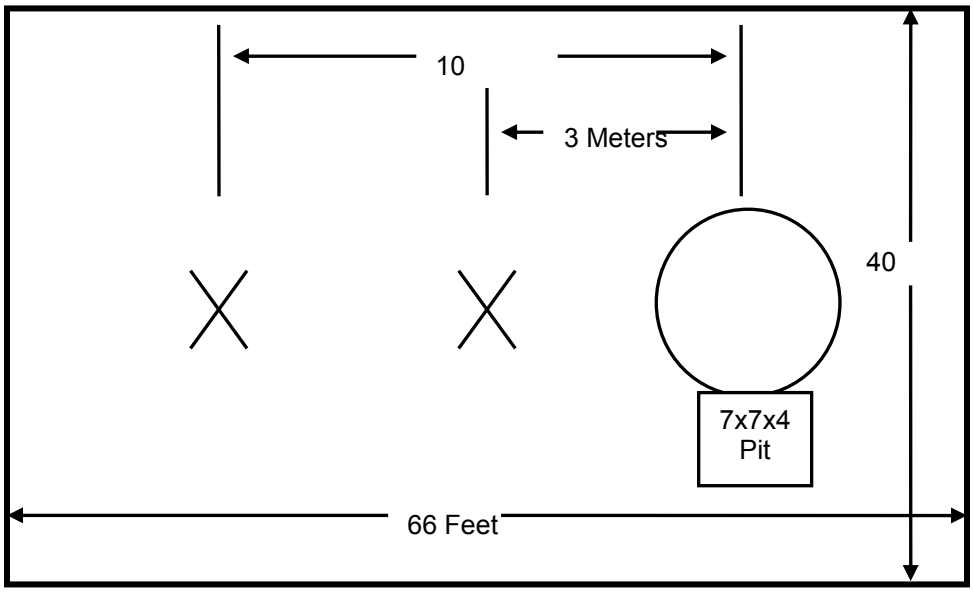

Figure 2.3-2: Open Area Test Site

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:

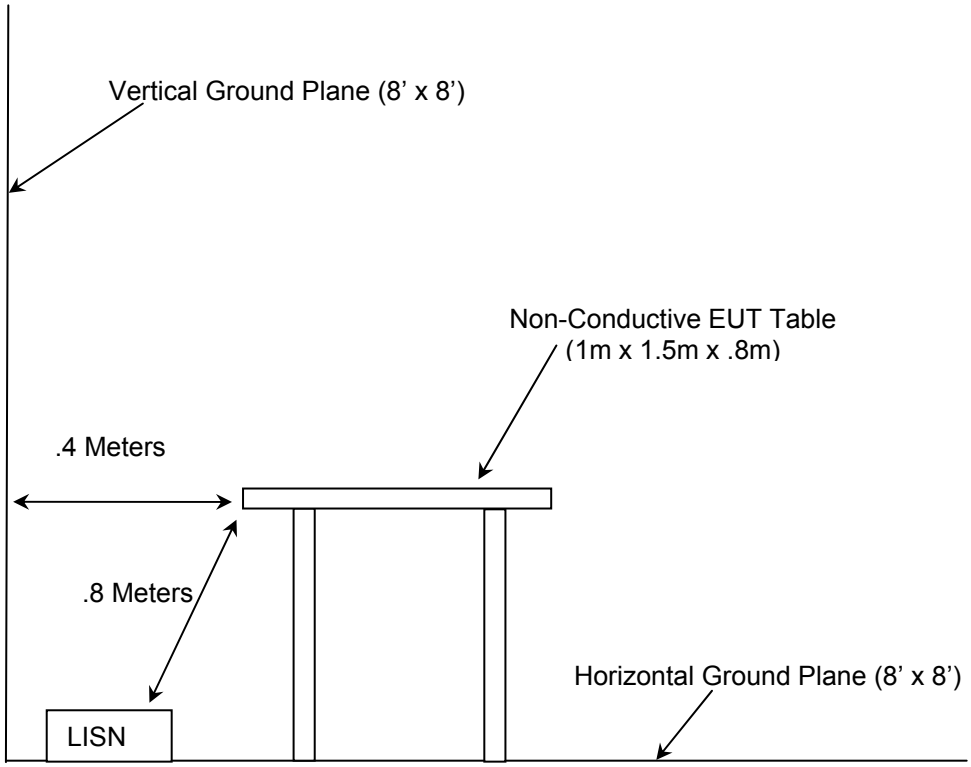

Figure 2.4-1: AC Mains Conducted EMI Site

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

4.0 LIST OF TEST EQUIPMENT

All test equipment used for regulatory testing is calibrated yearly or according to manufacturer's specifications.

Table 4-1: Test Equipment

Equipment Calibration Information					
ACS#	**Mfg.**	**Eq. type**	**Model**	**S/N**	**Cal. Due**
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
193	ACS	Cable Set	OATS cable Set	193	01-05-2010
211	Eagle	Filters	C7RFM3NFNM	HLC-700	01-05-2010
213	TEC	Amplifiers	PA 102	44927	12-22-2009
283	Rohde & Schwarz	Spectrum Analyzers	FSP40	1000033	09-19-2009
331	Microwave Circuits	Filters	H1G513G1	31417	07-28-2009
343	Florida RF Cables	Cables	SMRE-200W-12.0-SMRE	N/A	11-24-2009
430	RF Cables	Cables	SMS-290AW-480-SMS	N/A	06-09-2009

5.0 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	Cast Iron Meter Box	Ford Meter Box Co.	Standard Yokebox with center line of meter 10" below grade.	N/A
2	Cast Iron Box lid	Ford Meter Box Co.	FYLP-000	N/A
3	Plastic Enclosure - 10" Round Box	NDS	111BC	N/A
4	Plastic Enclosure Lid - Round Overlapping Cover - ICV	NDS	111BC	N/A

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAMS

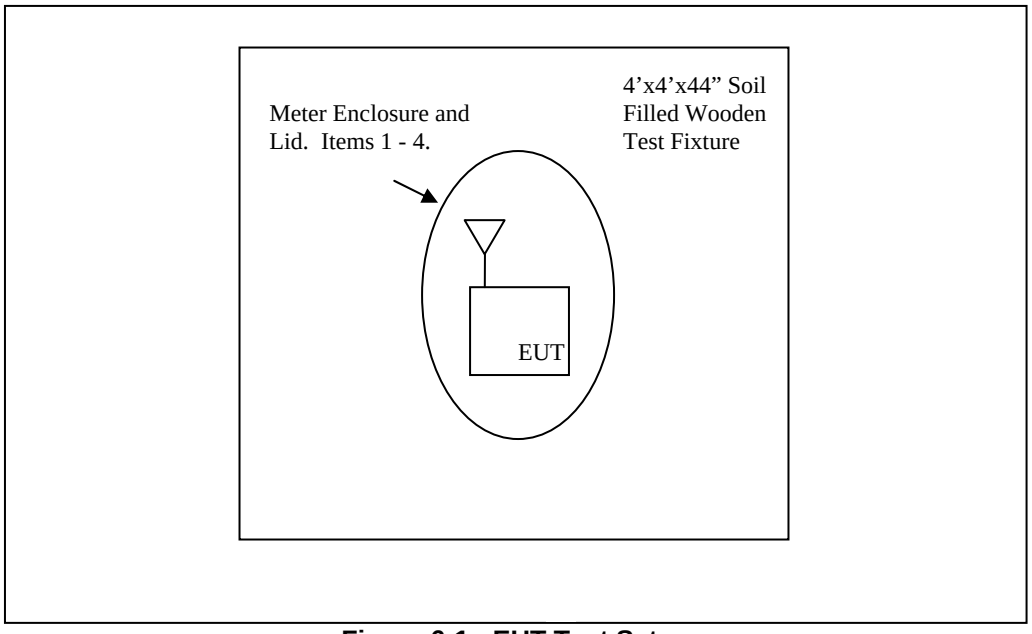

Figure 6-1: EUT Test Setup

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 EUT employs a permanently attached 1/4 wave integral wire type antenna which is not accessible to the user.

7.2 Occupied Bandwidth – FCC: Section 15.215

7.2.1 Test Methodology

The spectrum analyzer span was set to 2 to 3 times the estimated bandwidth of the emission. The RBW was to ≥ 1% of the estimated emission bandwidth. The trace was set to max hold with a peak detector active. Bandwidth is determined at the points 20 dB down from the modulated carrier. The 99% bandwidth was also measured and reported in Section 7.2.2 below.

7.2.2 Test Results

The 20dB bandwidth was determined to be 208.0 kHz. The frequency band designated under Part 15.249 is 902 - 928 MHz, therefore the 20dB bandwidth is contained within the frequency band designated under this rule part. The 99% OBW was determined to be 188.0 kHz. Results are shown below in Table 7.2.2-1 and Figures 7.2.2-1 through 7.2.2-6.

Table 7.2.2-1

Frequency (MHz)	20dB Bandwidth (kHz)	99% OBW (kHz)
905	208.0	188.0
915	205.0	177.0
925	206.0	180.0

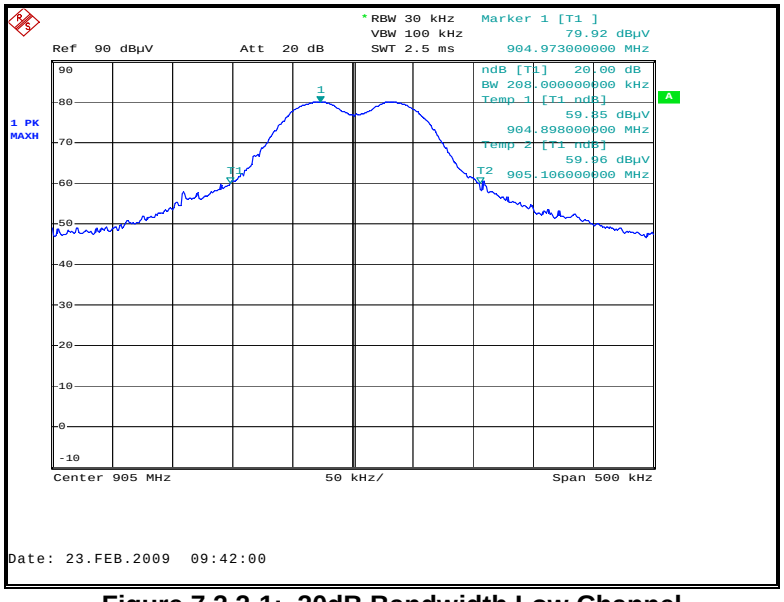

Figure 7.2.2-1: 20dB Bandwidth Low Channel

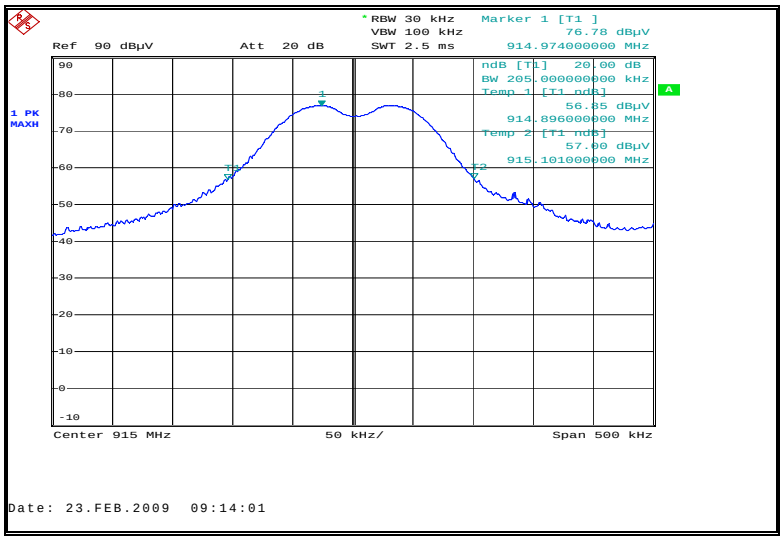

Figure 7.2.2-2: 20dB Bandwidth Mid Channel

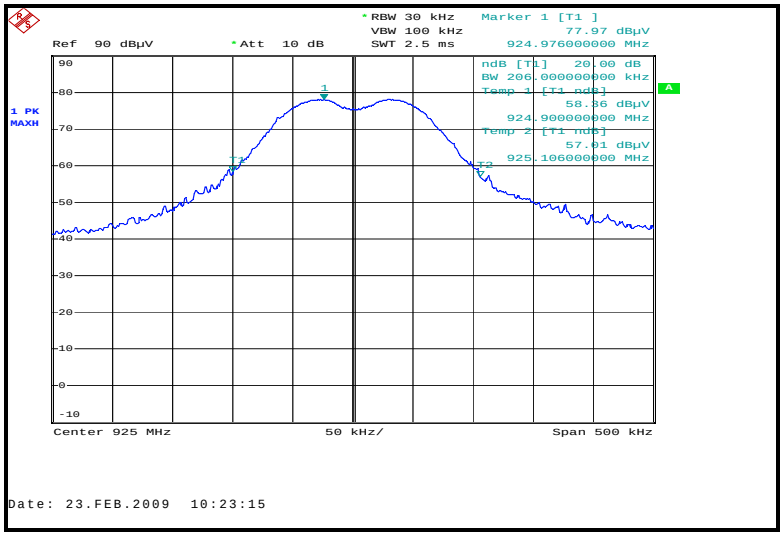

Figure 7.2.2-3: 20dB Bandwidth High Channel

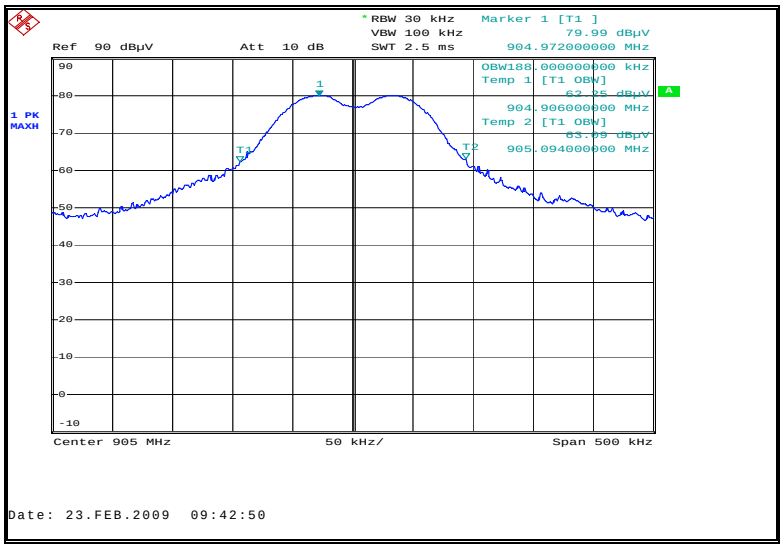

Figure 7.2.2-4: 99%OBW Low Channel

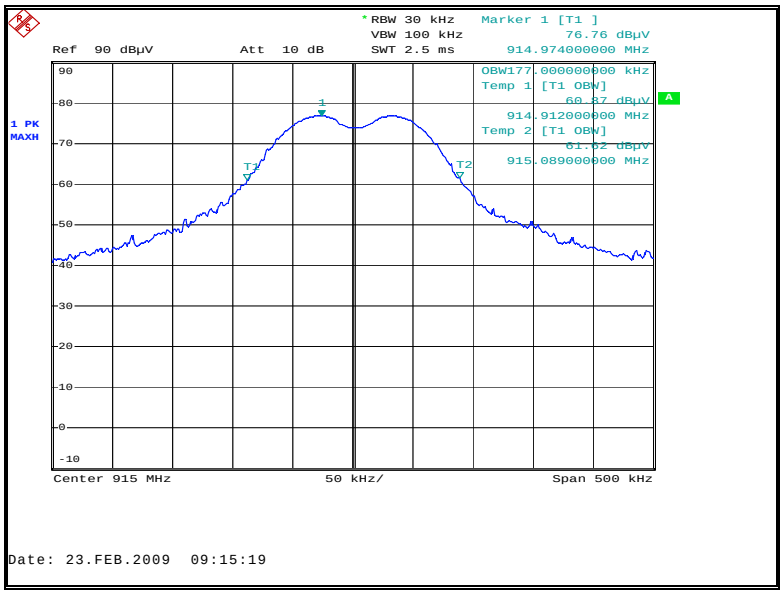

Figure 7.2.2-5: 99%OBW Mid Channel

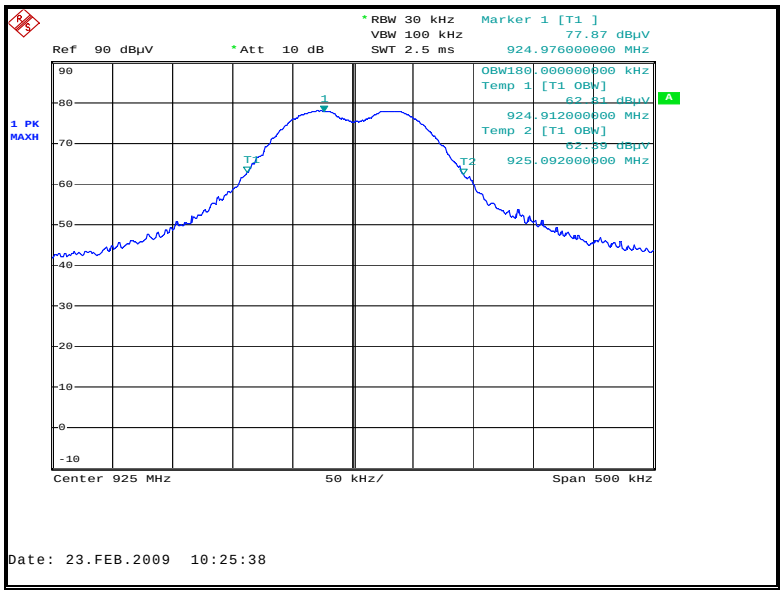

Figure 7.2.2-6: 99%OBW High Channel

7.3 Fundamental Field Strength – FCC: Section 15.249(a)

7.3.1 Test Methodology

Radiated emissions tests were made on the 3 channels in the 902MHz to 928MHz frequency range, the low channel being 905 MHz, the middle channel being 915 MHz, and the high channel being 925 MHz.

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 fundamentals below 1GHz, quasi-peak measurements were made using a resolution bandwidth (RBW) of 120 kHz and a video bandwidth (VBW) of 300 kHz.

7.3.2 Test Results

Results are shown below in table 7.3.2-1 and 7.3.2-2 below:

Table 7.3.2-1: Fundamental Field Strength – Cast Iron Meter Pit / Lid

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
Low Channel										
905	---------	73.07	H	3.00	---------	76.07	--------	94.0	---------	17.91
905	---------	81.33	V	3.20	---------	84.53	--------	94.0	---------	9.45
Mid Channel										
915	---------	69.17	H	3.20	---------	72.37	--------	94.0	---------	21.61
915	---------	78.02	V	3.50	---------	81.52	--------	94.0	---------	12.46
High Channel										
925	---------	76.88	H	3.45	---------	80.33	--------	94.0	---------	13.65
925	---------	77.98	V	3.80	---------	81.78	--------	94.0	---------	12.20

Table 7.3.2-2: Fundamental Field Strength – Plastic Meter Pit / Lid

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
Low Channel										
905	---------	73.82	H	3.30	---------	77.12	--------	94.0	---------	16.86
905	---------	81.89	V	2.55	---------	84.44	--------	94.0	---------	9.54
Mid Channel										
915	---------	73.93	H	3.45	---------	77.38	--------	94.0	---------	16.60
915	---------	82.40	V	2.70	---------	85.10	--------	94.0	---------	8.88
High Channel										
925	---------	74.63	H	3.50	---------	78.13	--------	94.0	---------	15.85
925	---------	81.86	V	2.65	---------	84.51	--------	94.0	---------	9.47

7.4 Band-Edge Compliance and Spurious Emissions – FCC: Section 15.249

7.4.1 Band-Edge Compliance – FCC: Section 15.249(d)

7.4.1.1 Test Methodology

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation. The EUT was investigated at the low and high channels of operation to determine band-edge compliance. Band-edge compliance for the lower and upper band-edge was determined using the radiated mark-delta method as outlined in FCC DA 00-705. The radiated field strength of the fundamental emission was first determined and then the mark-delta method was used to determine the field strength of the band-edge emissions as compared to the emission limits of 15.209.

7.4.1.2 Test Results

Band-edge compliance is displayed in Tables 7.4.1.2-1 to 7.4.1.2-2 and Figures 7.4.1.2-1 to 7.4.1.2-4.

Table 7.4.1.2-1: Band-edge Marker Delta Method - Cast Iron Meter Pit / Lid

Frequency (MHz)	Uncorrected Level (dBuV)		Antenna Polarity	Correction Factors	Fundamental Level (dBuV/m)		Marker-Delta	Band-Edge Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
905	--------	81.33	V	3.40	--------	84.73	53.84	--------	30.89	--------	46.0	--------	15.11
925	--------	77.98	V	3.80	--------	81.78	55.47	--------	26.31	--------	46.0	--------	19.69

Table 7.4.1.2-2: Band-edge Marker Delta Method - Plastic Meter Pit / Lid

Frequency (MHz)	Uncorrected Level (dBuV)		Antenna Polarity	Correction Factors	Fundamental Level (dBuV/m)		Marker-Delta	Band-Edge Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
905	---------	81.89	V	2.55	---------	84.44	55.15	--------	29.29	--------	46.0	--------	16.71
925	--------	81.86	V	2.65	---------	84.51	56.84	--------	27.67	--------	46.0	--------	18.33

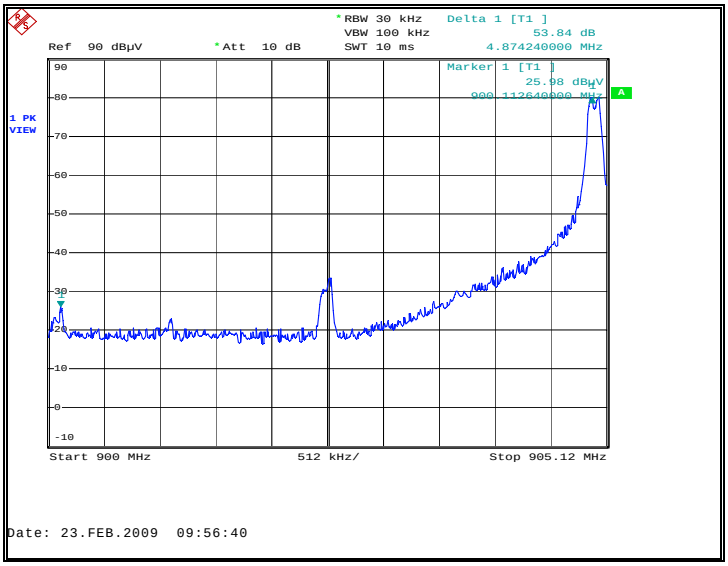

Figure 7.4.1.2-1 Lower Band-edge - Cast Iron Meter Pit / Lid

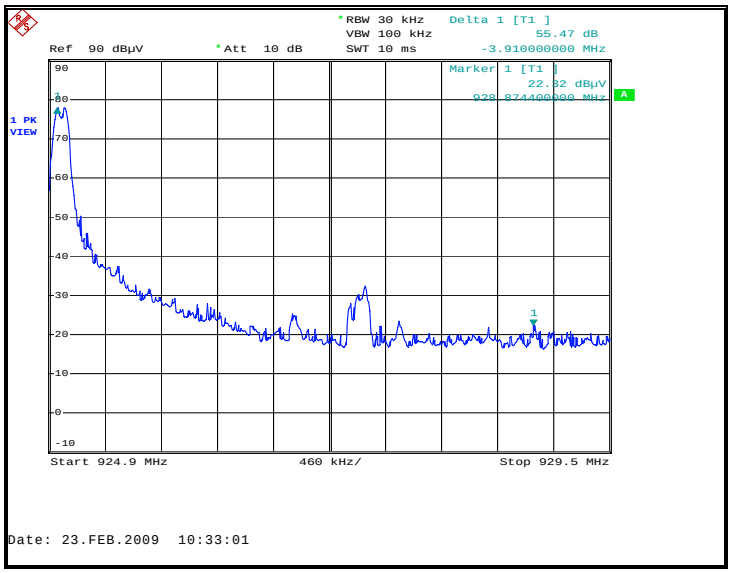

Figure 7.4.1.2-2 Upper Band-edge - Cast Iron Meter Pit / Lid

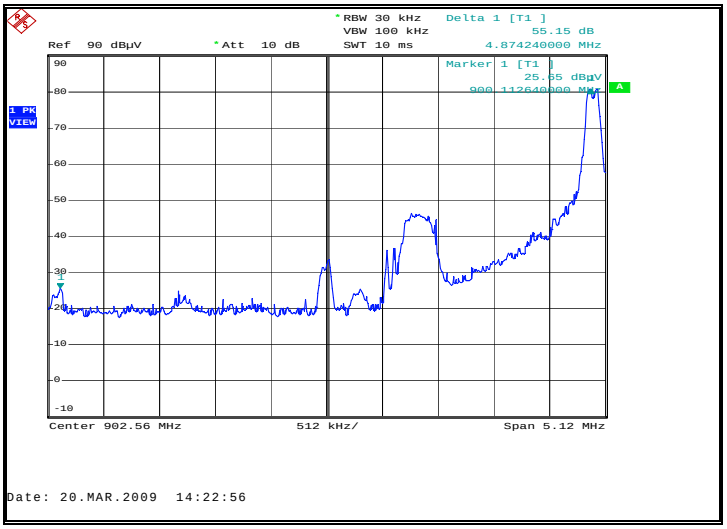

Figure 7.4.1.2-3 Lower Band-edge – Plastic Meter Pit / Lid

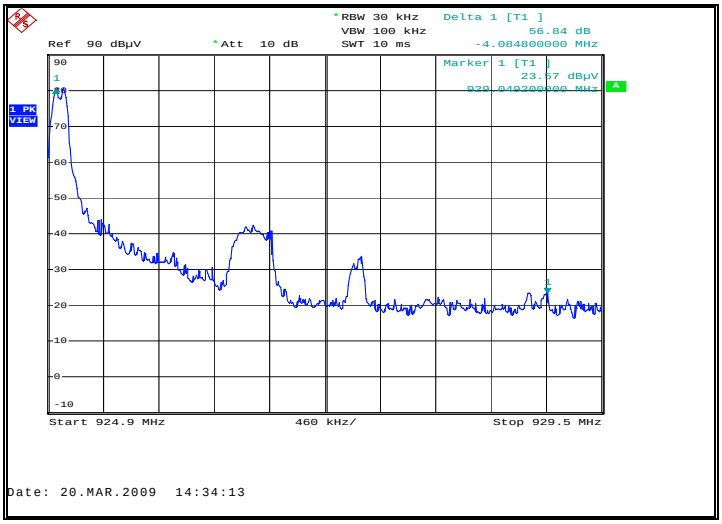

Figure 7.4.1.2-4 Upper Band-edge - Plastic Meter Pit / Lid

7.4.2 Radiated Spurious Emissions – FCC: Section 15.249(a), (c)

7.4.2.1 Test Methodology

Radiated emissions tests were made over the frequency range of 30MHz to 10 GHz, 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 using an RBW of 1 MHz and a VBW of 3MHz.

The EUT was evaluated in both cast iron and plastic meter pits as identified in sections 5.0 – 6.0. For use in plastic meter pits, a reduction in the power setting is required.

7.4.2.2 Duty Cycle Correction

For average radiated measurements, the measured level was reduced by a factor 20.0dB to account for the duty cycle of the EUT. The worst case duty cycle was determined to be 10% or 10ms with a 100ms period. The duty cycle correction factor is determined using the formula: 20log (0.10) = 20dB.

The worst case duty cycle was determined as follows and justified by figure 7.4.2.2-1. Each data packet is 368 bits in length. This results in a transmit time of 9.58333ms for each data packet with a 96 millisecond pause between data packets.

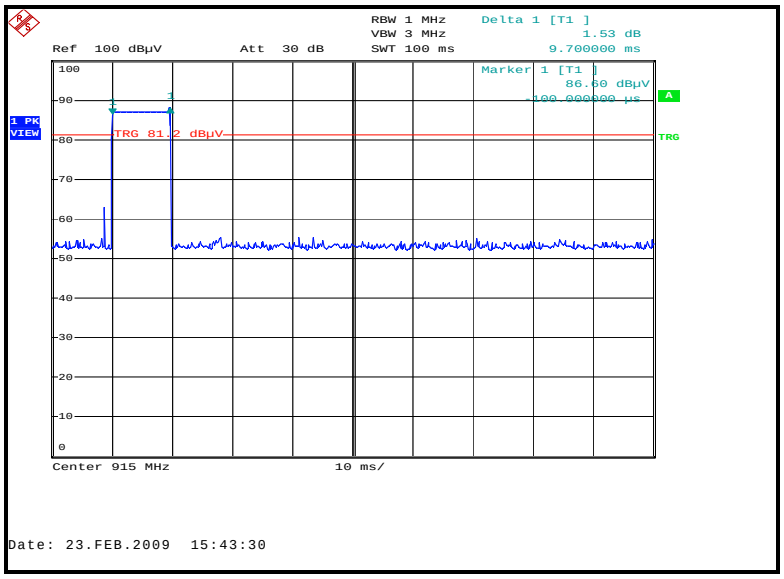

Figure 7.4.2.2-1

7.4.2.3 Test Results

Radiated spurious emissions found in the band of 30MHz to 10GHz are reported in Table 7.4.2.3-1 and 7.4.2.3-2.

Table 7.4.2.3-1: Radiated Spurious Emissions – Cast Iron Meter Pit / Lid

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
Low Channel										
1810	60.12	59.27	H	-4.15	55.97	35.12	74.0	54.0	18.03	18.88
1810	64.10	63.07	V	-4.17	59.93	38.90	74.0	54.0	14.07	15.10
2715	60.79	59.63	H	-0.59	60.20	39.04	74.0	54.0	13.80	14.96
2715	65.16	63.90	V	-0.79	64.37	43.11	74.0	54.0	9.63	10.89
3620	51.53	46.53	H	2.42	53.95	28.95	74.0	54.0	20.05	25.05
3620	56.31	53.46	V	2.44	58.75	35.90	74.0	54.0	15.25	18.10
4525	44.65	36.22	V	4.25	48.90	20.47	74.0	54.0	25.10	33.53
5430	50.18	43.43	V	6.63	56.81	30.06	74.0	54.0	17.19	23.94
6335	50.11	42.38	V	8.29	58.40	30.67	74.0	54.0	15.60	23.33
Middle Channel										
1830	60.84	60.01	H	-4.10	56.74	35.91	74.0	54.0	17.26	18.09
1830	65.26	64.60	V	-4.14	61.12	40.46	74.0	54.0	12.88	13.54
2745	56.07	53.84	H	-0.49	55.58	33.35	74.0	54.0	18.42	20.65
2745	60.68	59.31	V	-0.69	59.99	38.62	74.0	54.0	14.01	15.38
3660	51.58	44.66	V	2.57	54.15	27.23	74.0	54.0	19.85	26.77
4575	47.66	38.92	V	4.38	52.04	23.30	74.0	54.0	21.96	30.70
5490	49.15	43.05	V	6.79	55.94	29.84	74.0	54.0	18.06	24.16
6405	50.42	44.14	V	8.46	58.88	32.60	74.0	54.0	15.12	21.40
High Channel										
1850	55.13	52.78	H	-4.06	51.07	28.72	74.0	54.0	22.93	25.28
1850	62.27	61.30	V	-4.10	58.17	37.20	74.0	54.0	15.83	16.80
2775	54.26	51.71	H	-0.39	53.87	31.32	74.0	54.0	20.13	22.68
2775	56.89	54.85	V	-0.59	56.30	34.26	74.0	54.0	17.70	19.74
3700	48.25	36.79	H	2.66	50.91	19.45	74.0	54.0	23.09	34.55
3700	52.00	46.71	V	2.70	54.70	29.41	74.0	54.0	19.30	24.59
4625	49.81	44.02	V	4.51	54.32	28.53	74.0	54.0	19.68	25.47
5550	48.88	41.76	V	6.89	55.77	28.65	74.0	54.0	18.23	25.35
6475	49.92	43.45	V	8.62	58.54	32.07	74.0	54.0	15.46	21.93

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

Table 7.4.2.3-2: Radiated Spurious Emissions – Plastic Meter Pit / Lid

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
Low Channel										
1810	45.71	35.21	H	-4.15	41.56	11.06	74.0	54.0	32.44	42.94
3620	50.14	41.83	H	2.42	52.56	24.25	74.0	54.0	21.44	29.75
3620	50.05	43.69	V	2.44	52.49	26.13	74.0	54.0	21.51	27.87
Mid Channel										
3660	50.80	42.50	H	2.54	53.34	25.04	74.0	54.0	20.66	28.96
3660	49.83	41.53	V	2.57	52.40	24.10	74.0	54.0	21.60	29.90
High Channel										
1850	45.69	36.06	H	-4.06	41.63	12.00	74.0	54.0	32.37	42.00
1850	45.53	35.80	V	-4.10	41.43	11.70	74.0	54.0	32.57	42.30
3700	49.45	39.80	H	2.66	52.11	22.46	74.0	54.0	21.89	31.54
3700	50.24	42.74	V	2.70	52.94	25.44	74.0	54.0	21.06	28.56

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

7.4.2.4 Sample Calculation:
$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation
PEAK:
Corrected Level: 60.12 - 4.15 = 55.97dBuV
Margin: 74dBuV – 55.97dBuV = 18.03dB

AVERAGE:
Corrected Level: 59.27 - 4.15 -20.0= 35.12dBuV
Margin: 54dBuV – 35.12dBuV = 18.88dB

8.0 CONCLUSION
In the opinion of ACS, Inc. the HOTRODMETALV1 manufactured by Hersey Meters meets the requirements of FCC Part 15 subpart C.

END REPORT