Excellence in Compliance Testing

Certification Test Report

FCC ID: SDBLGZ1000
IC: 2220A-LGZ1000

FCC Rule Part: Part 101 Subpart C
IC Radio Standards Specification: RSS 119

ACS Report Number: 13-2003.W04.1A

Applicant: Sensus Metering Systems, Inc.
Model: 560 Xz

Test Begin Date: January 12, 2013
Test End Date: January 24, 2013

Report Issue Date: February 6, 2013

ACLASS ACCREDITED TESTING

For The Scope of Accreditation Under Certificate Number AT-1533

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

Project Manager:

Thierry Jean-Charles
EMC Engineer
Advanced Compliance Solutions, Inc.

Reviewed by:

Kirby Munroe
Director, Wireless Certifications
Advanced Compliance Solutions, Inc.

This report contains 16 pages

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1.0 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 2 Subpart J, Part 101 Subpart C of the FCC's Code of Federal Regulations, and Industry Canada Radio Standards Specifications RSS-119 for a Class 2 Permissive Change.

The objective of the Class 2 Permissive Change is to decrease the 959.85 MHz – 959.95625 MHz range of operation from the original filing to 959.85 MHz – 959.94375 MHz. There are no hardware or power changes to the unit since the original filing.

1.2 Product Description

The 560 Xz is a printed circuit board that can be installed within a Landis and Gyr (L+G) electric meter to facilitate wireless communication capability between the meter and a back-end system. The radio can also form a ZigBee home area network (HAN). The combination of the two radios provides a utility with the means to communicate between a back-end system and individual devices (e.g. in-premise display) on the HAN.

Manufacturer Information:
Sensus Metering Systems, Inc.
639 Davis Drive
Morrisville, NC 27560

Test Sample Serial Numbers: 0810917003865152001D230100236BB1,
0810917003865117001D230100236B8E

Test Sample Condition: The unit was in good operating conditions with no physical damages.

1.3 Test Methodology

1.3.1 Configurations and Justification

The module was evaluated for the Flexnet radio operating in the 900 MHz band. The since there is no hardware or power changes to the unit, the evaluation was limited to RF output power, occupied bandwidth, spurious emissions at the antenna port as well as radiated spurious emissions at the newly defined upper frequency of operation (959.94375 MHz).

The 560 Xz is a module designed to be integrated into a host device therefore testing was performed on the module in a stand-alone configuration.

The 560 Xz utilizes non-detachable antennas for normal operation but for RF conducted testing the antennas were disconnected and a 50-Ohm test cable soldered (with the appropriate ground connection) to the PCB.

1.3.2 In-Band Testing Methodology

The EUT is designed to operate in multiple bands under the requirements of CFR 47 Parts 24 and 101. The following is a list of the frequency bands of operation sorted based on the FCC rule parts in which the band is associated.

CFR Title 47 Rule Part	Frequency Band of Operation (MHz)
24D	901.0 - 902.0
24D	930.0 - 931.0
24D	940.0 - 941.0
101	928.85 - 929.0
101	932.0 - 932.5
101	941.0 - 941.5
101	959.85 – 959.94375

For the purpose of the Class 2 Permissive Change, the product was evaluated at the high channel of the 959.85 – 959.94375 MHz band.

CFR Title 47 Rule Part	Approx. Test Freq. (MHz)
101	959.94375

1.4 Emission Designators

The 560 Xz transmitter produces six distinct modulation formats. The emissions designators for the modulation types used by the 560 Xz transmitter are as follows:

EMISSIONS DESIGNATORS:

Normal Mode:	9K60F2D (7-FSK)
Double Density Mode:	9K60F2D (13-FSK)
C&I Mode (Half-Baud):	4K80F2D (7-FSK)
Priority Mode:	4K80F2D (13-FSK)
Boost Mode:	1K10F2D (7-FSK)
MPass Mode (5 kbps):	5K90F1D (2-GFSK)
MPass Mode (10 kbps):	11K8F1D (2-GFSK)

For the frequency range of 959.85 MHz – 959.94375 MHz, the model 560 Xz only utilizes the mPass 5 kbps and mPass 10 kbps modes of operation. Where applicable, results are provided for the data rate leading to the highest readings.

2.0 TEST FACILITIES

2.1 Location

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

Advanced Compliance Solutions, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
www.acstestlab.com

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS, Boca Raton, Florida, is accredited to ISO/IEC 17025 by ANSI-ASQ National Accreditation Board under their ACLASS program and has been issued certificate number AT-1533 in recognition of this accreditation. Unless otherwise specified, all test methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

2.3 Radiated & Conducted Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl floor.

The turntable is driven by pneumatic motor, which is capable of supporting a 2000 lb. load. The turntable is flushed with the chamber floor which it is connected to, around its circumference, with metallic loaded springs. An EMCO Model 1051 Multi-device Controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

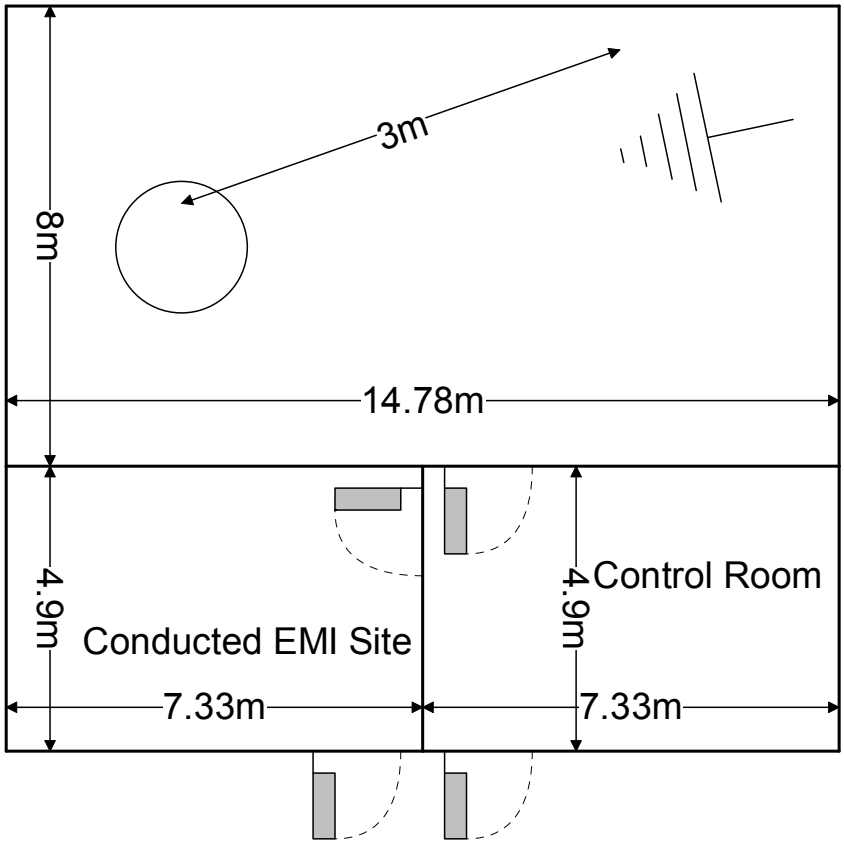

Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 m^3. As per ANSI C63.4 2003 requirements, the data were taken using two LISNs; a Solar Model 8028-50 50 Ω/50 µH and an EMCO Model 3825, which are installed as shown in Photograph 3. For 220 V, 50 Hz, a Polarad LISN (S/N 879341/048) is used in conjunction with a 1 kVA, 50 Hz/220 V EDGAR variable frequency generator, Model 1001B, to filter conducted noise from the generator.

A diagram of the room is shown below in figure 2.3.2-1:

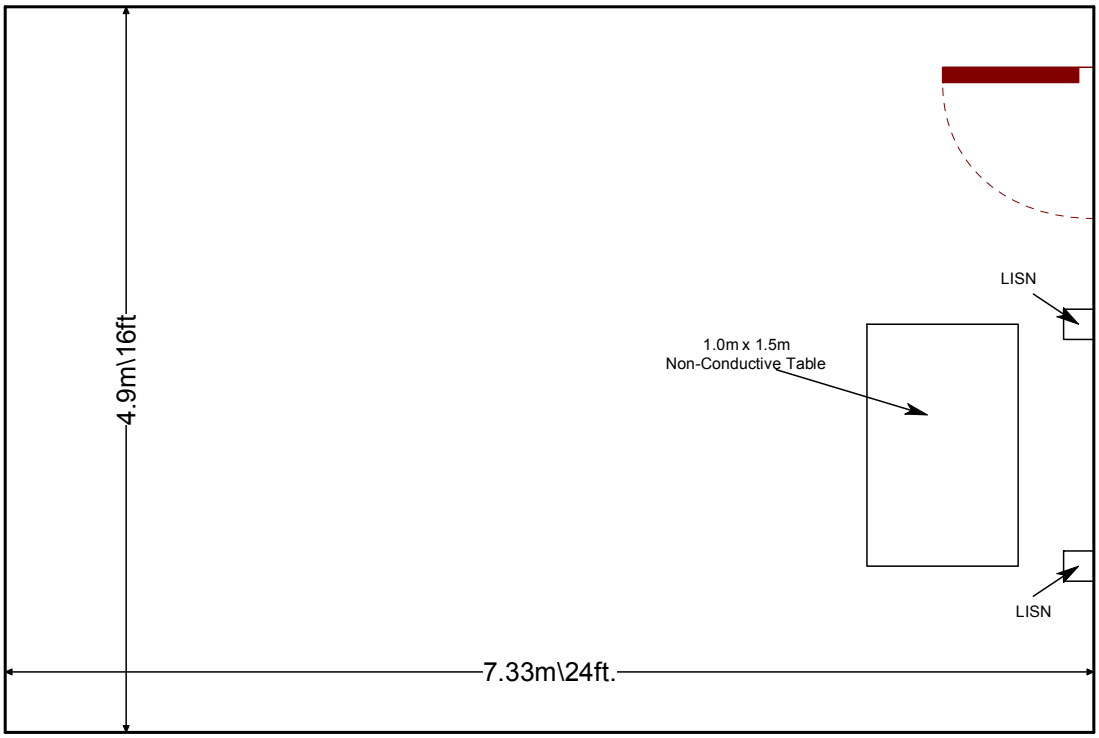

Figure 2.3.2-1: AC Mains Conducted EMI Site

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

1 - ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9 kHz to 40GHz - 2003
2 - US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures - 2012
3 - US Code of Federal Regulations (CFR): Title 47, Part 101, Subpart C: Fixed Microwave Services - 2012
4 – TIA-603-C: Land Mobile FM or PM - Communications Equipment - Measurement and Performance Standards – 2004
5 – Industry Canada Radio Standards Specification: RSS-119 - Radio Transmitters and Receivers Operating in the Land Mobile and Fixed Services in the Frequency Range 27.41-960 MHz, Issue 11, June 2011

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

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
523	Agilent	E7405	Spectrum Analyzers	MY45103293	1/8/2013	1/8/2015
2006	EMCO	3115	Antennas	2573	3/2/2011	3/2/2013
2007	EMCO	3115	Antennas	2419	1/18/2012	1/18/2014
2037	ACS Boca	Chamber EMI Cable Set	Cable Set	2037	1/1/2013	1/1/2014
2071	Trilithic, Inc.	4HC1400-1-KK	Filter	9643263	12/31/2012	12/31/2013
2075	Hewlett Packard	8495B	Attenuators	2626A11012	12/31/2012	12/31/2013
2078	ACS Boca	Substitution Cable Set	Cable Set	2078	1/1/2013	1/1/2014
2082	Teledyne Storm Products	90-010-048	Cables	2082	5/31/2012	5/31/2013
2089	Agilent Technologies, Inc.	83017A	Amplifiers	3123A00214	12/20/2012	12/20/2013
2091	Agilent Technologies, Inc.	8573A	Spectrum Analyzers	2407A03233	12/12/2011	12/12/2013
RE563	Hewlett Packard	8673D	Signal Generators	3034A01078	2/22/2011	2/22/2013
RE587	Fairview Microwave Inc.	SA3N511-15	Attenuators	RE587	4/18/2012	4/18/2013

NCR=No Calibration Required

5.0 SUPPORT EQUIPMENT

Table 5-1: EUT and Support Equipment

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Sensus Metering Systems, Inc.	560 Xz	081091700386515200 1D230100236BB1, 081091700386511700 1D230100236B8E
2	DC Power Supply	Lambda	LPD-422A-FM	A82600

Table 5-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	2 Wire Conductor	1.75 m	No	EUT to Power Supply
B	Single Wire	1.75 m	No	EUT to Power Supply
C	Power Cord	1.8 m	No	Power Supply to AC Mains

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

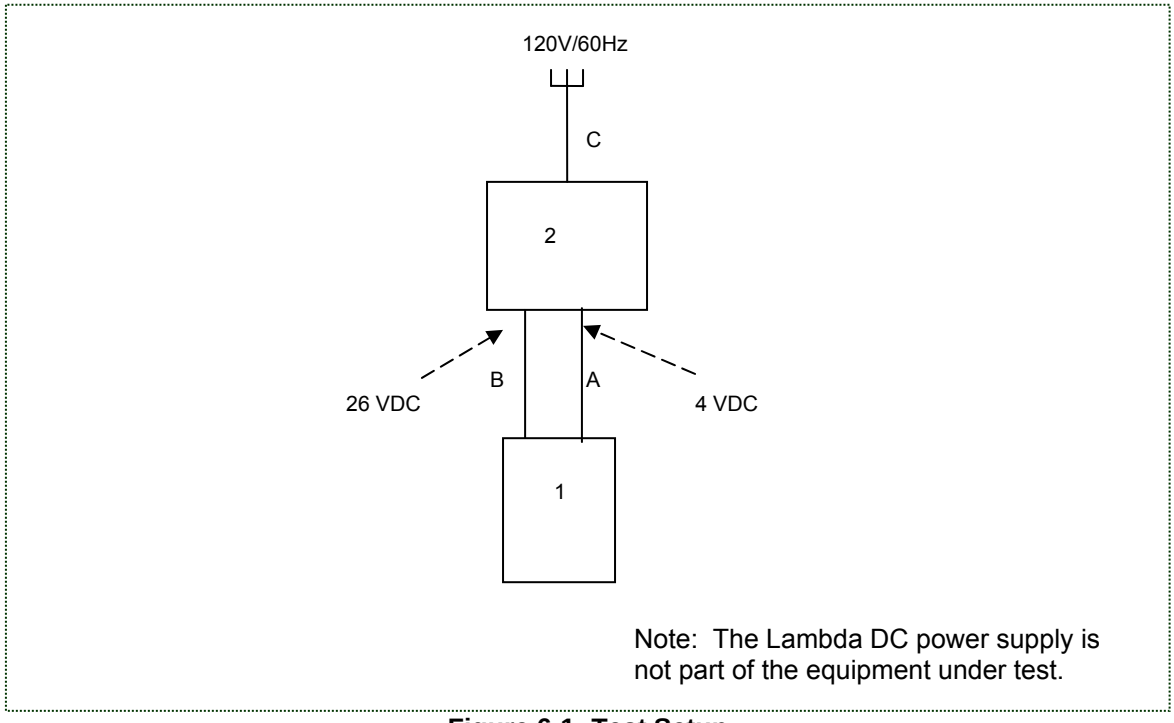

Figure 6-1: Test Setup

7.0 SUMMARY OF TESTS

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

Table 7-1: Test Results Summary

Test Parameter	Test Summary
RF Power Output	Pass
Occupied Bandwidth (Emissions Limits)	Pass
Spurious Emissions at Antenna Terminals	Pass
Field Strength of Spurious Emissions	Pass

7.1 RF Power Output

7.1.1 Measurement Procedure

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer through a 35 dB passive attenuator. The resolution and video bandwidths of the spectrum analyzer were set at sufficient levels, >> signal bandwidth, to produce accurate results. The internal correction factors of the spectrum analyzer were employed to correct for any cable or attenuator losses. Results are shown below.

7.1.2 Measurement Results

Table 7.1.2-1: Peak Output Power

Frequency (MHz)	FCC Rule Part	Output Power (dBm)
959.94375	101	29.17

Part 101.113(a) / RSS-119 5.41

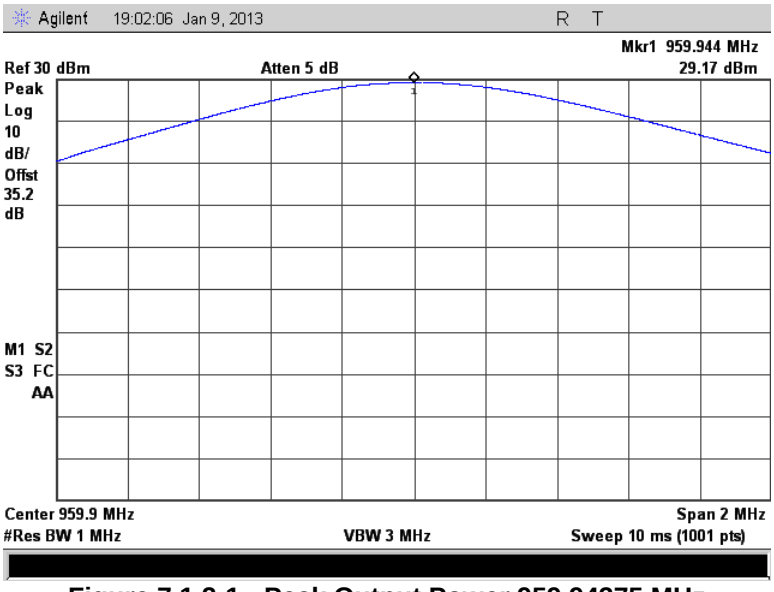

Figure 7.1.2-1: Peak Output Power 959.94375 MHz

7.2 Occupied Bandwidth (Emission Limits)

7.2.1 Measurement Procedure

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer through a 35 dB passive attenuator. The spectrum analyzer resolution and video bandwidths were set to 300 Hz and 3000 Hz respectively. The internal correction factors of the spectrum analyzer were employed to correct for any cable or attenuator losses. Results of the test are shown below for all modes of operation.

7.2.2 Measurement Results

Part 101.111 a(6), RSS-119 5.8.6 (FCC Part 101.11a(6) provides worst case)

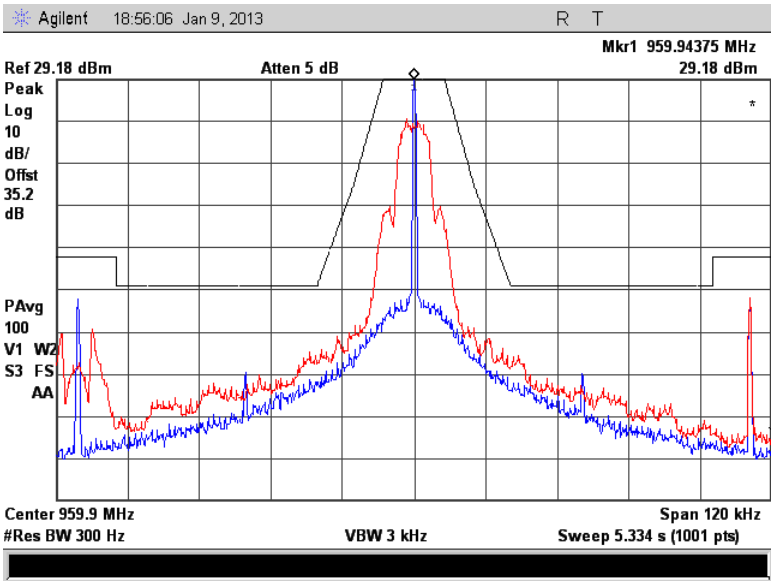

Figure 7.2.2-1: 959.94375 MHz – mPass 5k Mode

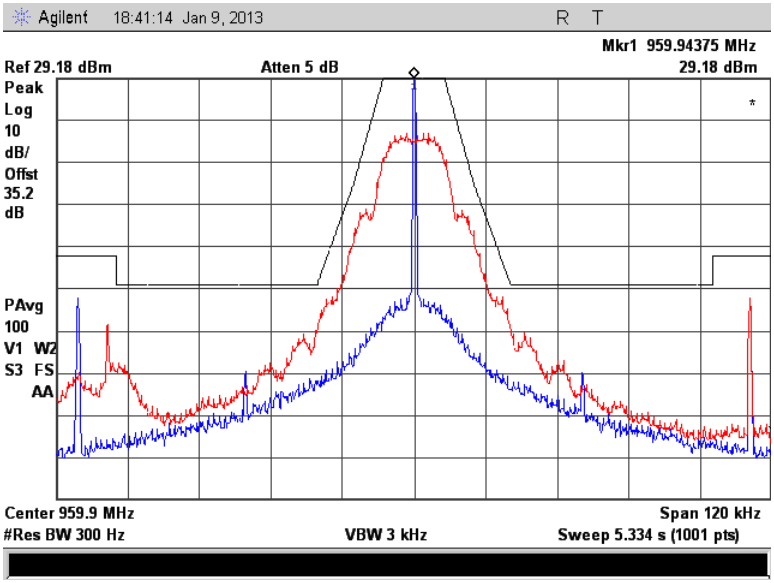

Figure 7.2.2-2: 959.94375 MHz – mPass 10k Mode

7.3 Spurious Emissions at Antenna Terminals

7.3.1 Measurement Procedure

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer through a 35 dB passive attenuator. The spectrum analyzer resolution bandwidth was set to 100 kHz below 1000 MHz and 1 MHz above 1000 MHz. The internal correction factors of the spectrum analyzer were employed to correct for any cable, attenuator or filter losses. The spectrum was investigated in accordance to CFR 47 Part 2.1057. Results are shown below.

7.3.2 Measurement Results

Part 101.111 a(6), RSS-119 5.8.6

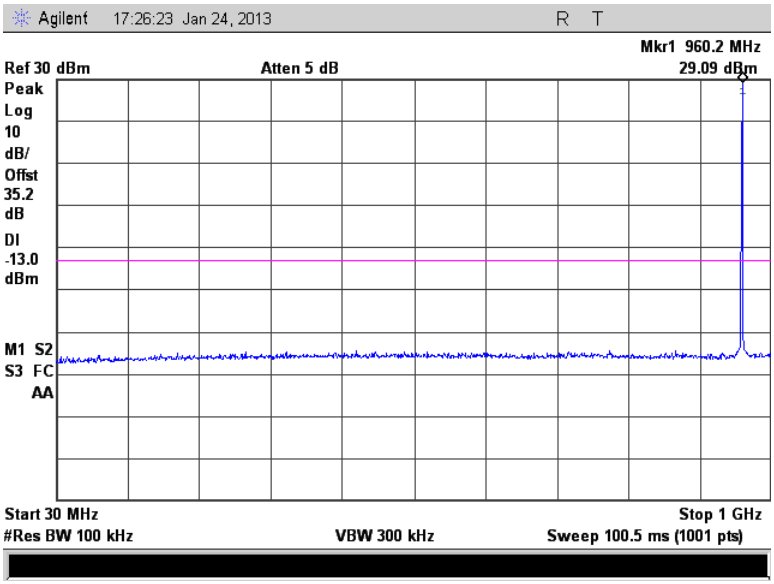

Figure 7.3.2-1: 959.94375 MHz – 30MHz to 1GHz

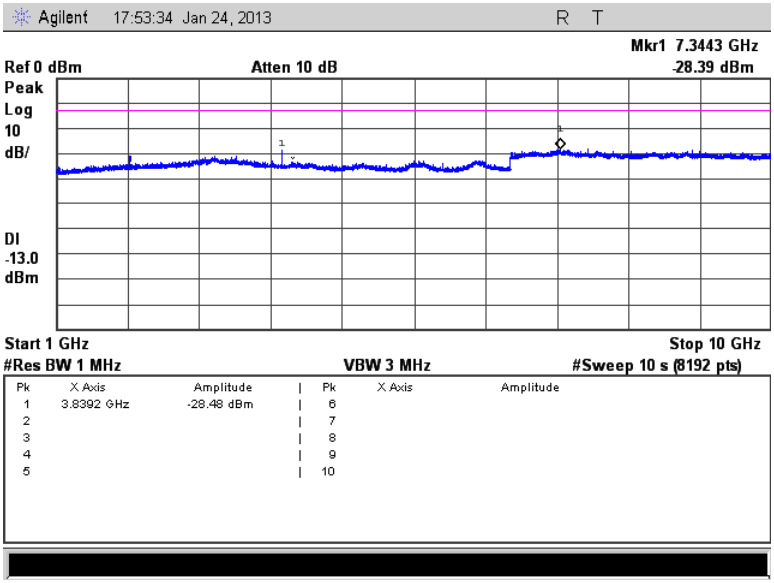

Figure 7.3.2-2: 959.94375 MHz – 1GHz to 10GHz

7.4 Field Strength of Spurious Emissions

7.4.1 Measurement Procedure

The equipment under test is placed in the Semi-Anechoic Chamber (described in section 2.3.1) on a wooden table at the turntable center. For each spurious emission, the antenna mast is raised and lowered from one (1) to four (4) meters and the turntable is rotated 360º and the maximum reading on the spectrum analyzer is recorded. This was repeated for both horizontal and vertical polarizations of the receive antenna.

The equipment under test is then replaced with a substitution antenna fed by a signal generator. The signal generator's frequency is set to that of the spurious emission recorded from the equipment under test. The antenna mast is raised and lowered from one (1) to four (4) meters to obtain a maximum reading on the spectrum analyzer. The output of the signal generator is then adjusted until the reading on the spectrum analyzer matches that obtained from the equipment under test. The signal generator level is recorded. The power in dBm of each spurious emission is calculated by correcting the signal generator level for the cable loss and gain of the substitution antenna referenced to a dipole. The spectrum was investigated in accordance to CFR 47 Part 2.1057.

The magnitude of all spurious emissions not reported were attenuated below the noise floor of the measurement system and therefore not specified in this report. Results are shown below.

7.4.2 Measurement Results

Part 101.111 a(6), RSS-119 5.8.6

Table 7.4.2-1: Field Strength of Spurious Emissions – 959.94375 MHz – MPass 5k Mode

Frequency (MHz)	Spectrum Analyzer Level (dBm)	Antenna Polarity (H/V)	Spurious ERP (dBm)	Limit (dBm)	Margin (dB)
1919.8875	-54.15	H	-54.25	-13.00	41.25
2879.83125	-56.05	H	-54.76	-13.00	41.76
3839.775	-54.25	H	-45.35	-13.00	32.35
5759.6625	-59.40	H	-48.04	-13.00	35.04
6719.60625	-54.65	H	-36.09	-13.00	23.09
7679.55	-55.85	H	-36.83	-13.00	23.83
1919.8875	-54.25	V	-54.70	-13.00	41.70
2879.83125	-57.80	V	-57.31	-13.00	44.31
3839.775	-58.95	V	-53.35	-13.00	40.35
5759.6625	-60.20	V	-50.49	-13.00	37.49
6719.60625	-55.45	V	-38.69	-13.00	25.69
7679.55	-58.10	V	-43.83	-13.00	30.83
8639.49375	-58.75	V	-43.61	-13.00	30.61

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

8.0 CONCLUSION

In the opinion of ACS, Inc. the model 560 Xz, manufactured by Sensus Metering Systems, Inc., meets all the requirements of FCC Part 101 as well as Industry Canada RSS-119 where applicable.

End Report