FCC Part 15.247
Transmitter Certification

Frequency Hopping Spread Spectrum Transmitter

Test Report

FCC ID: SK9C3A-1L

FCC Rule Part: 15.247

ACS Report Number: 06-0013-15C

Manufacturer: Itron Electricity Metering Inc.
Trade name: CENTRON® IMAGE
Model: C3A1L

Test Begin Date: October 11 2005
Test End Date: January 20, 2006

Report Issue Date: February 27, 2006

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612

Prepared by: ________________________
Ken Rivers
Engineering Technician
ACS, Inc.

Reviewed by: ________________________
Kirby Munroe
Manager Wireless Certifications
ACS, Inc.

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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.

1.2 Product Description

1.2.1 General
The CENTRON® IMAGE is an electricity meter that is capable of being deploying in both C&I and residential services. This is possible due to the IMAGE personality register being capable of supporting both polyphase and monophase metrology bases. The meter supports advance metering functions such as Demand, Time Of Use, Load Profile, KY and KYZ Outputs, SiteScan, Option Boards, and RF. Time Of Use, Load Profile, and RF features require the use of a soldered in battery. The meter is configurable with PC Pro+ Advanced software with device types that are distinguished and separately service polyphase and monophase CENTRON® IMAGE meters.

There are two versions of the IMAGE personality registers available (high power and low power). Some documents and information provided is generic and general in nature and may reference both versions of the IMAGE but the purpose of this report and the data contained within is in reference to the low power version only. The high power version will be addressed in a separate test report and filing under a separate FCC ID.

1.2.2 Manufacturer
Itron Electricity Metering, Inc.
West Union, South Carolina 29696
313 North Highway 11

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:

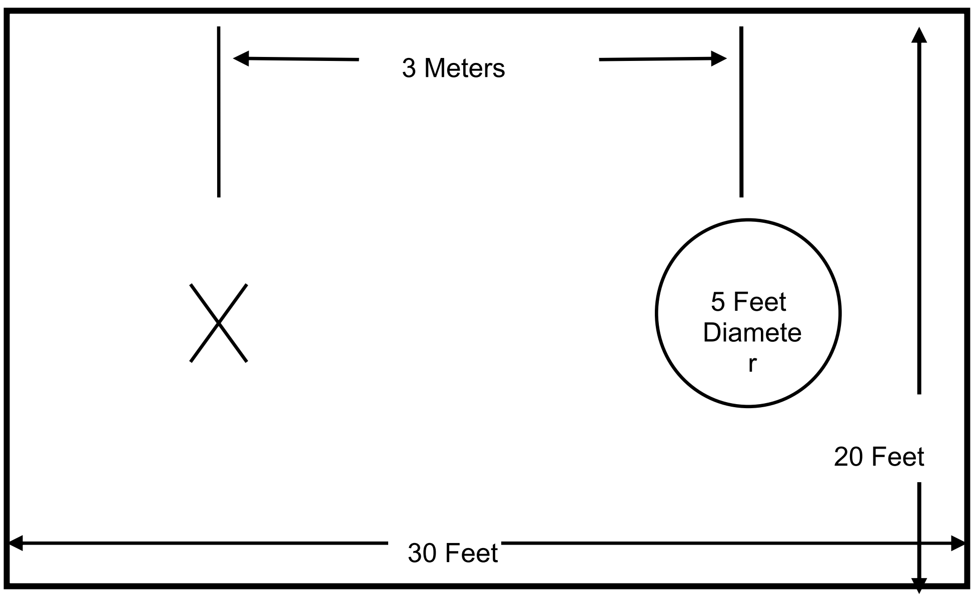

Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

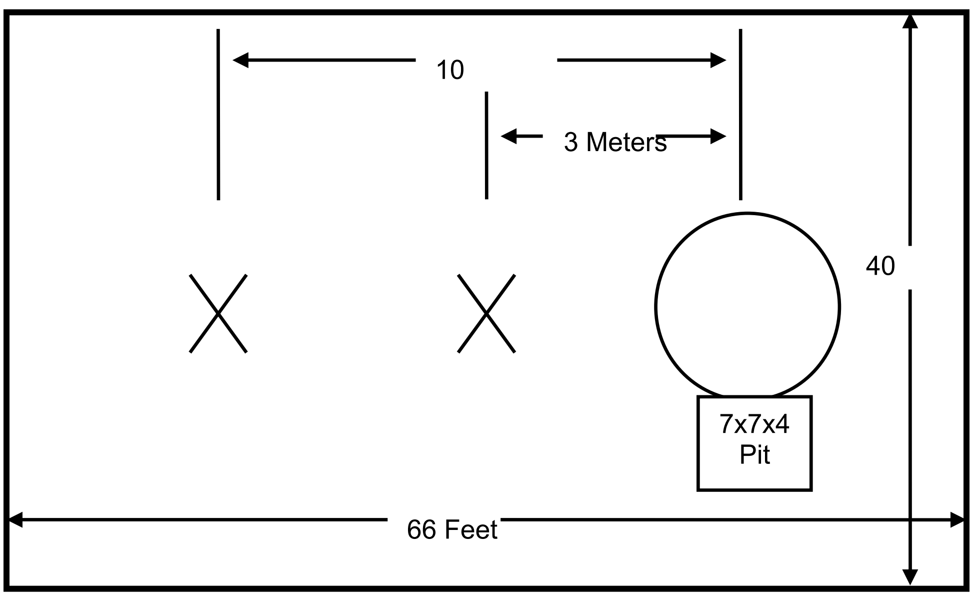

Figure 2.3-2: Open Area Test Site

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:

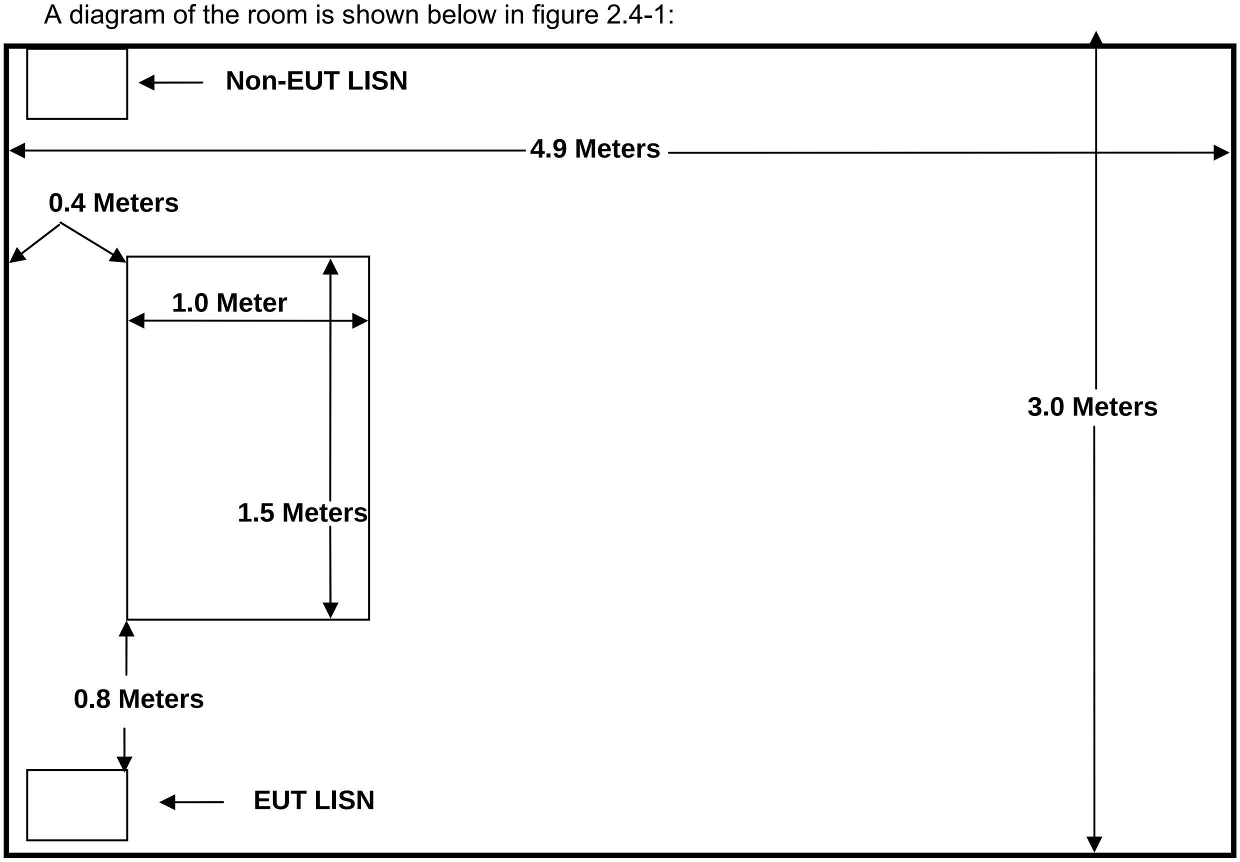

Figure 2.4-1: AC Mains Conducted EMI Site

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
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators
- FCC OET Bulletin 65 Appendix C - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

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**
☐ 25	Chase	Bi-Log Antenna	CBL6111	1043	5/23/06
☐ 268	Agilent	Sensor	N1921A	MY45240184	10/10/06
☐ 152	EMCO	LISN	3825/2	9111-1905	1/18/06
☐ NA	Solar	LISN	9408-50-R-24-BNC	018821	12/22/06
☐ 165	ACS	Conducted EMI Cable Set	RG8	165	1/06/06
☐ 22	Agilent	Pre-Amplifier	8449B	3008A00526	5/06/06
☐ 73	Agilent	Pre-Amplifier	8447D	272A05624	5/18/06
☐ 30	Spectrum Technologies	Horn Antenna	DRH-0118	970102	5/09/06
☐ 105	Microwave Circuits	High Pass Filter	H1G810G1	2123-01 DC0225	9/13/06
☐ 1	Rohde & Schwarz	Receiver Display	804.8932.52	833771/007	3/07/06
☐ 2	Rohde & Schwarz	ESMI Receiver	1032.5640.53	839587/003	3/07/06
☐ 3	Rohde & Schwarz	Receiver Display	804.8932.52	839379/011	11/02/06
☐ 4	Rohde & Schwarz	ESMI Receiver	1032.5640.53	833827/003	11/02/06
☐ ---	Agilent	Spectrum Analyzer	E7405A	US39110103	6/6/06
☐ 213	Test Equipment Corp.	Pre-Amplifier	PA-102	44927	12/5/06
☐ 168	Hewlett Packard	Pulse Limiter	11947A	3107A02268	3/2/06
☐ 204	ACS	Cable	RG8	204	3/16/06
☐ 6	Harbour Industries	HF RF Cable	LL-335	00006	3/16/06
☐ 7	Harbour Industries	HF RF Cable	LL-335	00007	3/16/06
☐ 208	Harbour Industries	HF RF Cable	LL142	00208	6/24/06
☐ 167	ACS	Chamber EMI Cable Set	RG6	167	1/7/07
☐ 237	Gigatronics	Signal Generator	900	282706	1/10/07
☐ 267	Agilent	Power Meter	N1911A	MY45100129	10/30/06

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

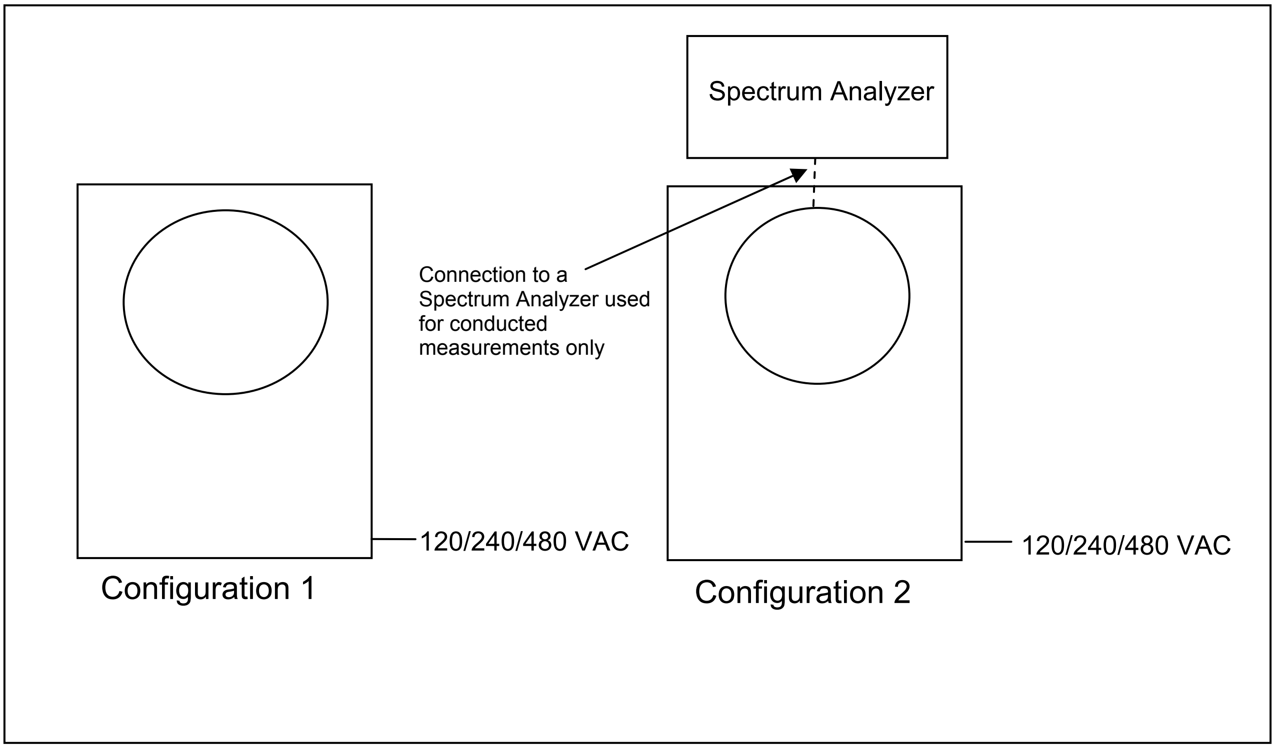

Figure 6-1: EUT Test Setup

Configuration 1: Used for radiated emissions and AC power line conducted emissions.
Configuration 2: Used for RF conducted measurements. The EUT was configured with a 50 Ohm temporary RF output port for conducted measurements to facilitate a direct connection to a spectrum analyzer.

Note: The radio module can be installed in 120-480V auto ranging meter base, 120V meter base, or 240V meter base. Testing performed on all meter bases for AC power line conducted emissions and radiated emissions.

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 IMAGE circuit board uses a slot antenna design. The slot is set in length for the quarter wavelength of 915 MHz which can not be altered without destroying the device. This device meets the requirements of CFR 47 Part 15.203. The antenna gain is 3.5dBi.

7.2 Power Line Conducted Emissions - FCC Section 15.207

7.2.1 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 = Applicable Limit - Corrected Reading

7.2.2 Test Results

Results of the test are shown below in and Tables 7.2-1 through 7.2-16 and Figure 7.2-1 through 7.2-8. The Polyphase meter base is auto ranging from 120VAC to 480VAC therefore data was collected at both voltage extremes to show compliance.

<u>120V Monophase Configuration:</u>

Table 7.2-1: Line 1 Conducted EMI Results (Quasi-Peak)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.246	43.6	9.7	61.8	18.2	L1	GND
0.396	25.0	9.7	57.9	32.8	L1	GND
0.492	43.9	9.7	56.1	12.2	L1	GND
0.738	50.7	9.7	56.0	5.2	L1	GND
0.978	35.0	9.7	56.0	20.9	L1	GND
1.224	31.8	9.7	56.0	24.1	L1	GND
1.470	29.9	9.7	56.0	26.0	L1	GND
1.962	22.4	9.7	56.0	33.5	L1	GND
4.194	21.6	9.6	56.0	34.3	L1	GND

Table 7.2-2: Line 1 Conducted EMI Results (Average)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.246	35.2	9.7	51.8	16.6	L1	GND
0.378	14.4	9.7	48.3	33.9	L1	GND
0.492	36.1	9.7	46.1	9.9	L1	GND
0.738	35.4	9.7	46.0	10.5	L1	GND
0.978	27.9	9.7	46.0	18.0	L1	GND
1.224	27.0	9.7	46.0	18.9	L1	GND
1.470	24.6	9.7	46.0	21.3	L1	GND
1.962	18.5	9.7	46.0	27.4	L1	GND
4.194	21.0	9.6	46.0	24.9	L1	GND

Table 7.2-3: Line 2 Conducted EMI Results (Quasi-Peak)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.246	50.0	9.7	61.8	11.8	L2	GND
0.462	29.5	9.7	56.6	27.1	L2	GND
0.492	44.6	9.7	56.1	11.4	L2	GND
0.732	49.7	9.7	56.0	6.2	L2	GND
0.978	36.9	9.7	56.0	19.0	L2	GND
1.218	30.6	9.7	56.0	25.4	L2	GND
1.230	23.8	9.7	56.0	32.1	L2	GND
1.464	30.6	9.7	56.0	25.4	L2	GND
1.956	26.3	9.7	56.0	29.6	L2	GND
4.194	21.8	9.6	56.0	34.1	L2	GND

Table 7.2-4: Line 2 Conducted EMI Results (Average)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.246	36.0	9.7	51.8	15.8	L2	GND
0.408	14.1	9.7	47.6	33.5	L2	GND
0.492	34.6	9.7	46.1	11.5	L2	GND
0.732	38.1	9.7	46.0	7.8	L2	GND
0.978	29.2	9.7	46.0	16.7	L2	GND
1.218	26.4	9.7	46.0	19.5	L2	GND
1.230	14.1	9.7	46.0	31.8	L2	GND
1.464	27.4	9.7	46.0	18.6	L2	GND
1.956	23.8	9.7	46.0	22.1	L2	GND
4.194	21.1	9.6	46.0	24.8	L2	GND

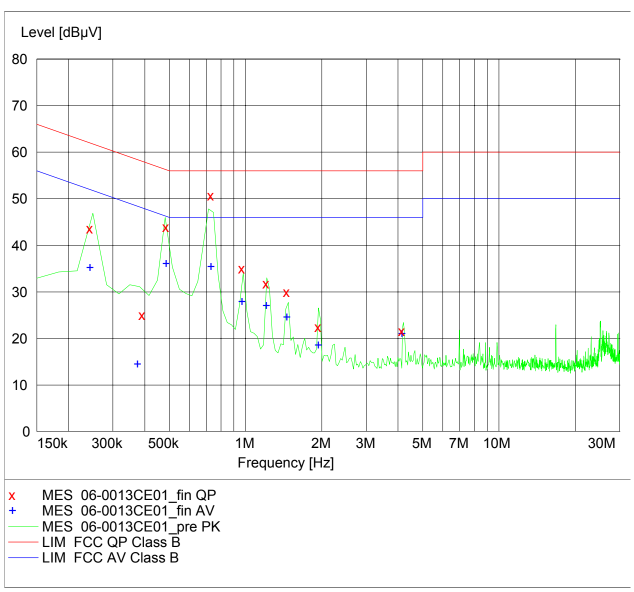

Figure 7.2-1: Conducted Emissions Graph – Line 1

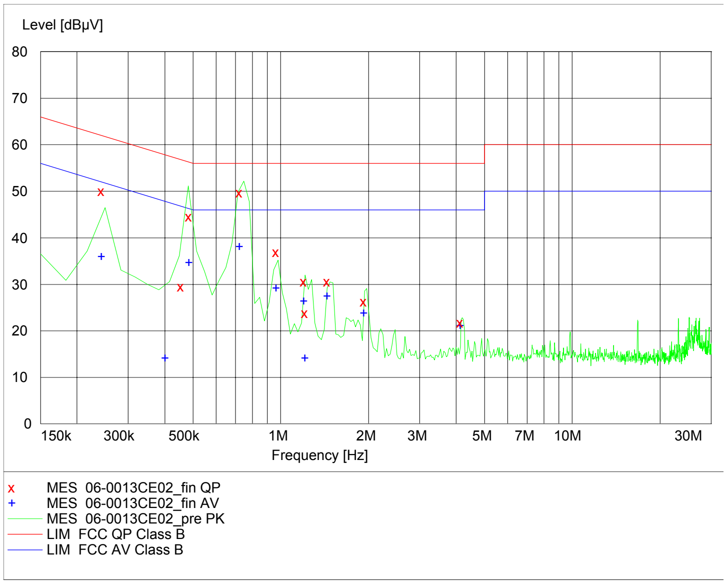

Figure 7.2-2: Conducted Emissions Graph – Line 2

240V Monophase Configuration:

Table 7.2-5: Line 1 Conducted EMI Results (Quasi-Peak)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.252	40.6	9.7	61.6	21.0	L1	GND
0.330	32.0	9.7	59.4	27.3	L1	GND
0.498	34.7	9.7	56.0	21.2	L1	GND
0.588	29.9	9.7	56.0	26.0	L1	GND
0.750	32.8	9.7	56.0	23.1	L1	GND
1.458	24.0	9.7	56.0	31.9	L1	GND
1.806	24.0	9.7	56.0	31.9	L1	GND
4.194	30.5	9.6	56.0	25.4	L1	GND
16.776	30.1	9.3	60.0	29.8	L1	GND
25.164	32.2	8.8	60.0	27.7	L1	GND

Table 7.2-6: Line 1 Conducted EMI Results (Average)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.246	33.9	9.7	51.8	17.9	L1	GND
0.330	26.9	9.7	49.4	22.4	L1	GND
0.492	31.3	9.7	46.1	14.8	L1	GND
0.576	23.4	9.7	46.0	22.5	L1	GND
0.738	26.6	9.7	46.0	19.3	L1	GND
1.458	20.6	9.7	46.0	25.3	L1	GND
1.800	19.6	9.7	46.0	26.3	L1	GND
4.194	30.4	9.6	46.0	15.5	L1	GND
16.776	30.1	9.3	50.0	19.9	L1	GND
25.164	32.2	8.8	50.0	17.7	L1	GND

Table 7.2-7: Line 2 Conducted EMI Results (Quasi-Peak)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.246	37.9	9.7	61.8	23.9	L2	GND
0.330	31.8	9.7	59.4	27.6	L2	GND
0.648	31.6	9.7	56.0	24.3	L2	GND
0.738	39.3	9.7	56.0	16.6	L2	GND
1.224	21.4	9.7	56.0	34.5	L2	GND
1.470	17.0	9.7	56.0	38.9	L2	GND
4.194	30.3	9.6	56.0	25.6	L2	GND
16.776	30.6	9.3	60.0	29.3	L2	GND
25.164	31.2	8.8	60.0	28.7	L2	GND

Table 7.2-8: Line 2 Conducted EMI Results (Average)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.246	33.9	9.7	51.8	17.9	L2	GND
0.330	26.2	9.7	49.4	23.2	L2	GND
0.648	26.0	9.7	46.0	19.9	L2	GND
0.732	25.5	9.7	46.0	20.4	L2	GND
1.224	19.0	9.7	46.0	26.9	L2	GND
1.470	13.7	9.7	46.0	32.2	L2	GND
4.194	30.2	9.6	46.0	15.7	L2	GND
16.776	30.6	9.3	50.0	19.3	L2	GND
25.164	31.2	8.8	50.0	18.7	L2	GND

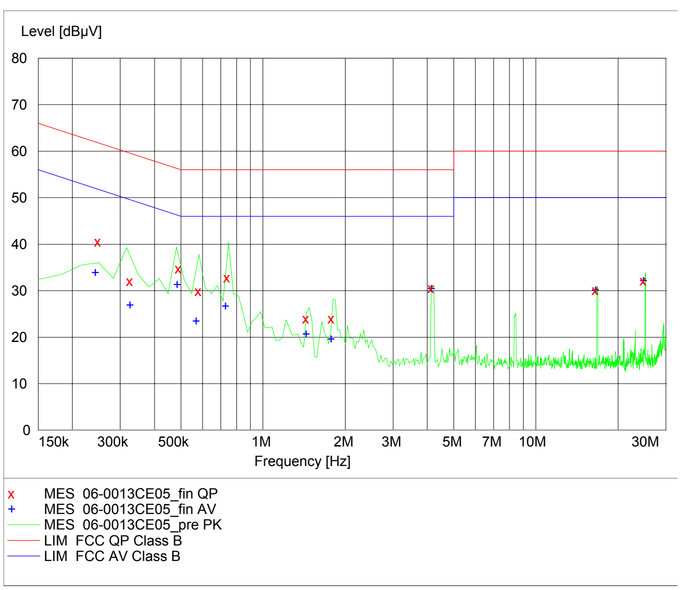

Figure 7.2-3: Conducted Emissions Graph – Line 1

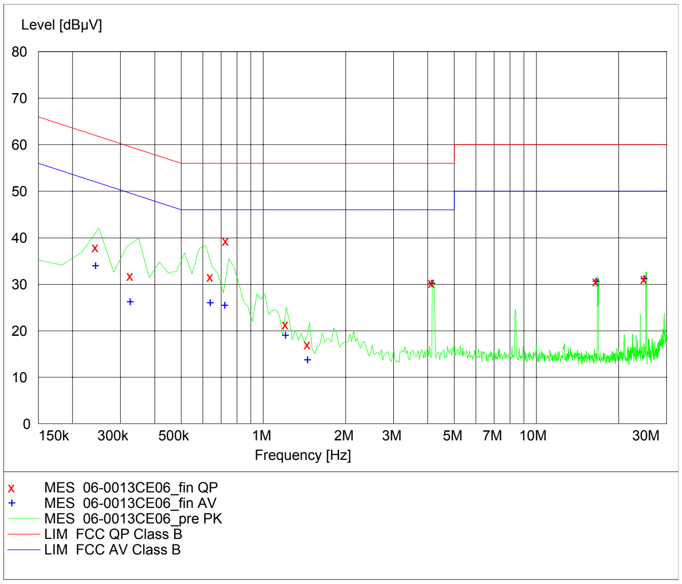

Figure 7.2-4: Conducted Emissions Graph – Line 2

120V Polyphase Configuration:

Table 7.2-9: Line 1 Conducted EMI Results (Quasi-Peak)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.156	41.7	9.8	65.6	23.9	L1	GND
0.276	46.3	9.7	60.9	14.6	L1	GND
0.414	44.0	9.7	57.5	13.4	L1	GND
0.546	41.9	9.7	56.0	14.0	L1	GND
0.69	38.0	9.7	56.0	17.9	L1	GND
1.242	35.5	9.7	56.0	20.4	L1	GND
1.374	33.3	9.7	56.0	22.6	L1	GND
2.508	28.6	9.6	56.0	27.3	L1	GND
4.176	28.1	9.6	56.0	27.8	L1	GND

Table 7.2-10: Line 1 Conducted EMI Results (Average)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.15	31.6	9.8	56.0	24.3	L1	GND
0.27	35.7	9.7	51.1	15.3	L1	GND
0.276	35.5	9.7	50.9	15.4	L1	GND
0.408	32.8	9.7	47.6	14.8	L1	GND
0.552	32.6	9.7	46.0	13.3	L1	GND
0.69	29.1	9.7	46.0	16.9	L1	GND
1.236	26.0	9.7	46.0	19.9	L1	GND
1.368	25.2	9.7	46.0	20.7	L1	GND
2.46	21.0	9.6	46.0	25.0	L1	GND
4.158	20.0	9.6	46.0	25.9	L1	GND

Table 7.2-11: Line 2 Conducted EMI Results (Quasi-Peak)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.276	44.8	9.7	60.9	16.0	L2	GND
0.414	40.0	9.7	57.5	17.5	L2	GND
0.552	36.6	9.7	56.0	19.3	L2	GND
0.96	25.6	9.7	56.0	30.3	L2	GND
1.104	26.6	9.7	56.0	29.3	L2	GND
1.938	23.0	9.7	56.0	32.9	L2	GND
3.522	23.3	9.6	56.0	32.6	L2	GND
4.158	24.7	9.6	56.0	31.2	L2	GND

Table 7.2-12: Line 2 Conducted EMI Results (Average)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.276	31.8	9.7	50.9	19.0	L2	GND
0.414	27.8	9.7	47.5	19.7	L2	GND
0.552	25.5	9.7	46.0	20.4	L2	GND
0.918	16.4	9.7	46.0	29.5	L2	GND
1.086	14.9	9.7	46.0	31.0	L2	GND
1.914	13.8	9.7	46.0	32.1	L2	GND
3.6	14.7	9.6	46.0	31.2	L2	GND
4.182	16.7	9.6	46.0	29.2	L2	GND

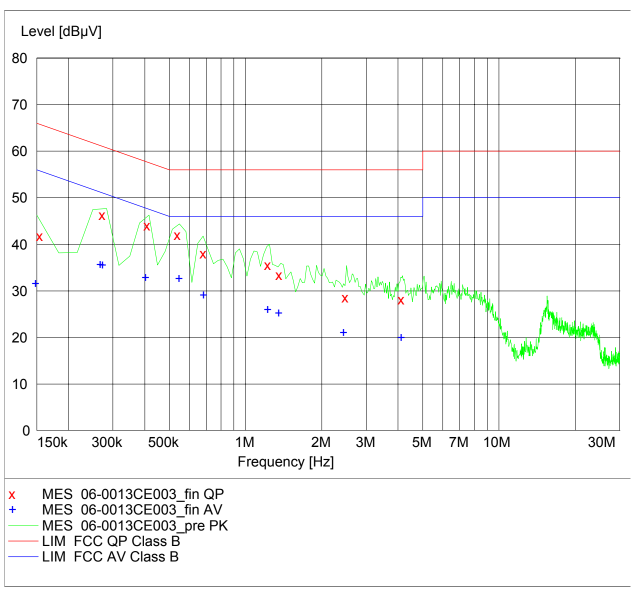

Figure 7.2-5: Conducted Emissions Graph – Line 1

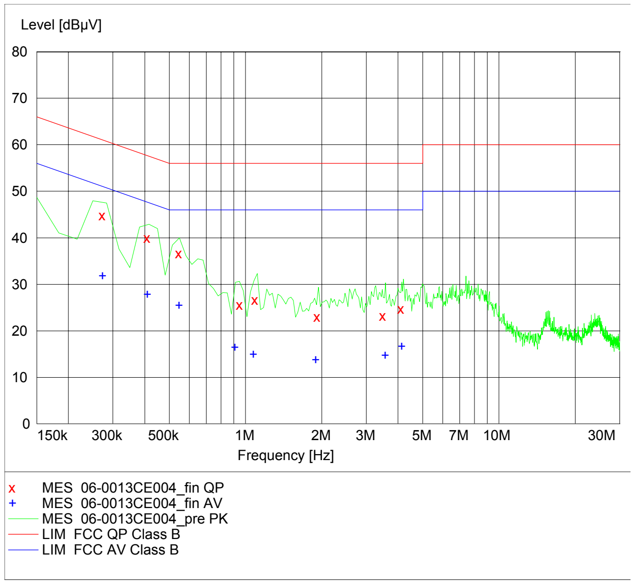

Figure 7.2-6: Conducted Emissions Graph – Line 2

480V Polyphase Configuration:

Table 7.2-13: Line 1 Conducted EMI Results (Quasi-Peak)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.156	44.4	9.8	65.6	21.2	L1	GND
0.282	42.6	9.7	60.7	18	L1	GND
0.69	43	9.7	56	12.9	L1	GND
0.834	41.8	9.7	56	14.1	L1	GND
1.35	37.7	9.7	56	18.2	L1	GND
2.856	34.5	9.6	56	21.4	L1	GND
4.65	31.1	9.7	56	24.8	L1	GND
6.558	27.1	9.5	60	32.8	L1	GND
8.046	24.5	9.6	60	35.5	L1	GND
9.342	21.7	9.6	60	38.2	L1	GND

Table 7.2-14: Line 1 Conducted EMI Results (Average)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.15	33.6	9.8	56	22.3	L1	GND
0.294	30.4	9.7	50.4	19.9	L1	GND
0.678	35.4	9.7	46	10.5	L1	GND
0.834	33.6	9.7	46	12.3	L1	GND
1.35	29.6	9.7	46	16.3	L1	GND
2.868	27	9.6	46	18.9	L1	GND
4.668	23.6	9.7	46	22.3	L1	GND
6.576	19.6	9.5	50	30.3	L1	GND
8.016	17.3	9.6	50	32.6	L1	GND
9.378	15.2	9.6	50	34.7	L1	GND

Table 7.2-15: Line 2 Conducted EMI Results (Quasi-Peak)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.162	43.9	9.8	65.3	21.4	L2	GND
0.288	40.7	9.7	60.5	19.8	L2	GND
0.558	35.8	9.7	56	20.1	L2	GND
1.08	33.7	9.7	56	22.2	L2	GND
1.356	29.2	9.7	56	26.7	L2	GND
2.898	28.4	9.6	56	27.5	L2	GND
4.65	27.4	9.7	56	28.6	L2	GND
6.384	26.1	9.5	60	33.8	L2	GND
8.034	24.3	9.6	60	35.7	L2	GND
9.294	18.3	9.6	60	41.6	L2	GND

Table 7.2-16: Line 2 Conducted EMI Results (Average)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.15	31.5	9.8	56	24.4	L2	GND
0.3	26	9.7	50.2	24.2	L2	GND
0.558	25.1	9.7	46	20.8	L2	GND
1.086	23.8	9.7	46	22.1	L2	GND
1.368	19.8	9.7	46	26.1	L2	GND
2.922	20.6	9.6	46	25.3	L2	GND
4.626	20.3	9.7	46	25.6	L2	GND
6.366	18.7	9.5	50	31.2	L2	GND
7.986	17	9.6	50	32.9	L2	GND
9.312	12.6	9.6	50	37.3	L2	GND

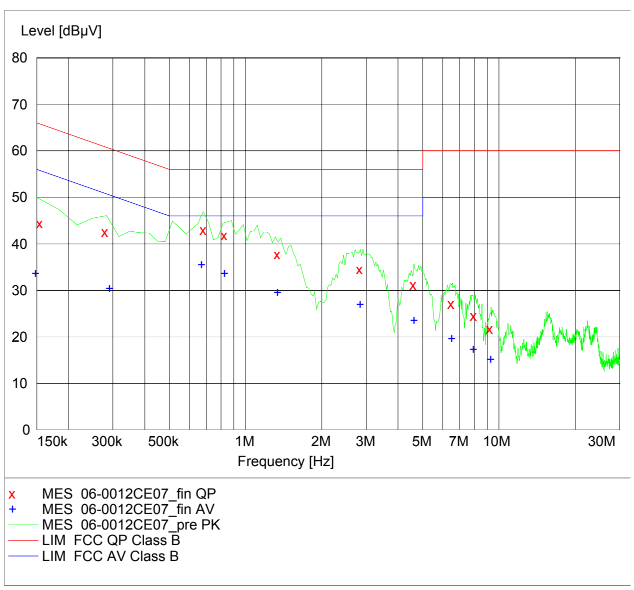

Figure 7.2-7: Conducted Emissions Graph – Line 1

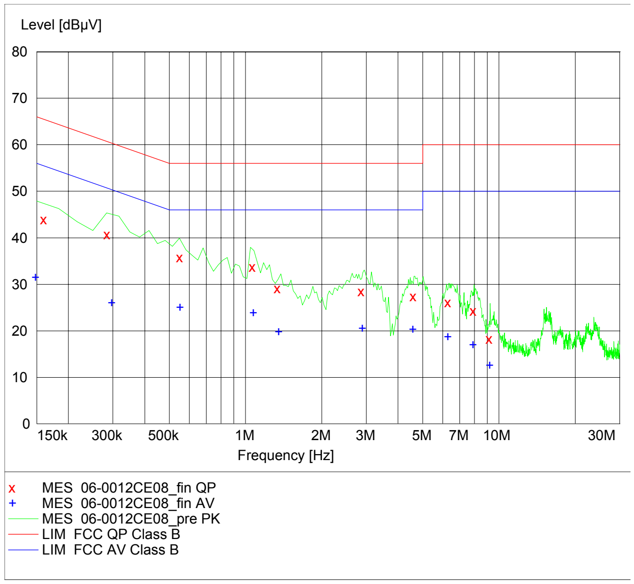

Figure 7.2-8: Conducted Emissions Graph – Line 2

7.3 Radiated Emissions - FCC Section 15.109(Unintentional Radiation)

7.3.1 Test Methodology

Radiated emissions tests were performed over the frequency range of 30MHz to 1 GHz. Measurements of the radiated field strength were made at a distance of 3m from the boundary of the equipment under test (EUT) and the receiving antenna. The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. Radiated measurements were made with the Spectrum Analyzer's resolution bandwidth set to 120 KHz for measurements above 30MHz. Average measurements are taken with the RBW and VBW were set to 1MHz and 10 Hz respectively for measurements above 1000MHz.

7.3.2 Test Results

Results of the test are given in Table 7.3-1 below:

Table 7.3-1: Radiated Emissions Tabulated Data

Frequency **(MHz)**	Polarization	Height **(cm)**	Azimuth **(deg)**	Level **(dBµV/m)**	Limit **(dBµV/m)**	Margin **(dB)**
MHz	VERTICAL	105	211	28.4	40.0	11.6
55.84	VERTICAL	110	332	26.1	40.0	13.9
60.72	VERTICAL	170	322	41.5	43.5	2.0
95.12	HORIZONTAL	190	86	28.5	43.5	15.0
151.04	HORIZONTAL	100	274	13.4	46.0	32.6
336.56	HORIZONTAL	190	197	15.9	46.0	30.1
405.52	VERTICAL	150	9	32.4	46.0	13.6
645.12	VERTICAL	110	167	18.3	46.0	27.7
650.08	HORIZONTAL	105	1	31.7	46.0	14.3
663.52	HORIZONTAL	298	75	24.6	46.0	21.4

* Note: All emissions above 663.52 MHz were attenuated below the permissible limit.

7.4 Peak Output Power – FCC Section 15.247(b)(2)

7.4.1 Test Methodology (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 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.

7.4.2 Test Results

Results are shown below in table 7.4-1 and the worst case was plotted and shown in figure 7.4-1 to 7.4-3 below:

Table 7.4-1: RF Output Power

Frequency [MHz]	Level [dBm]
909.506	13.25
916.040	12.62
921.773	12.15

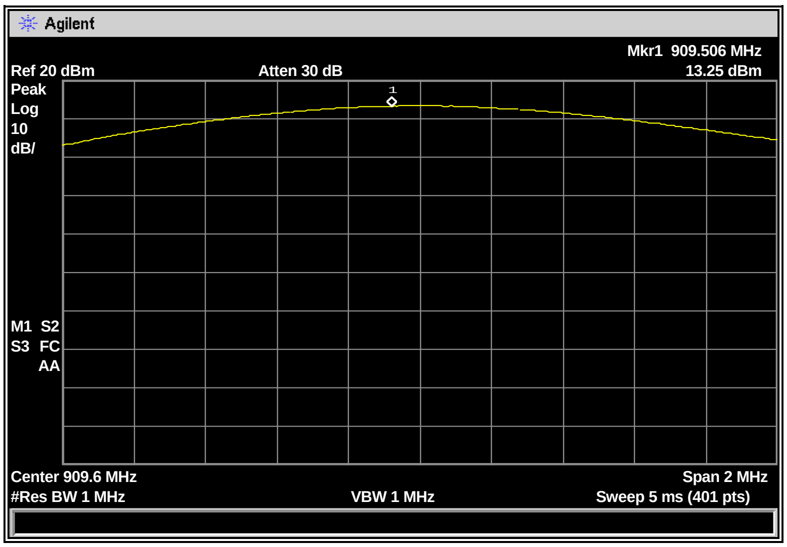

Figure 7.4-1: Output power – Low Channel

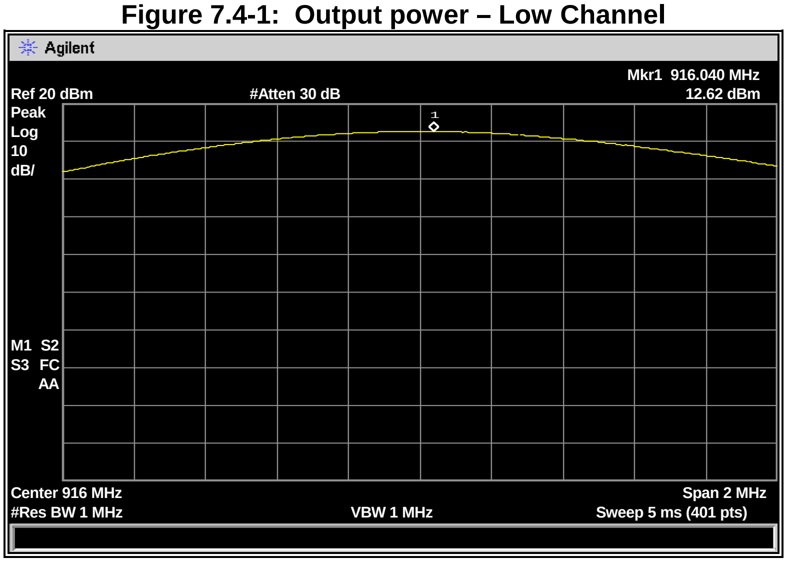

Figure 7.4-2: Output power – Mid Channel

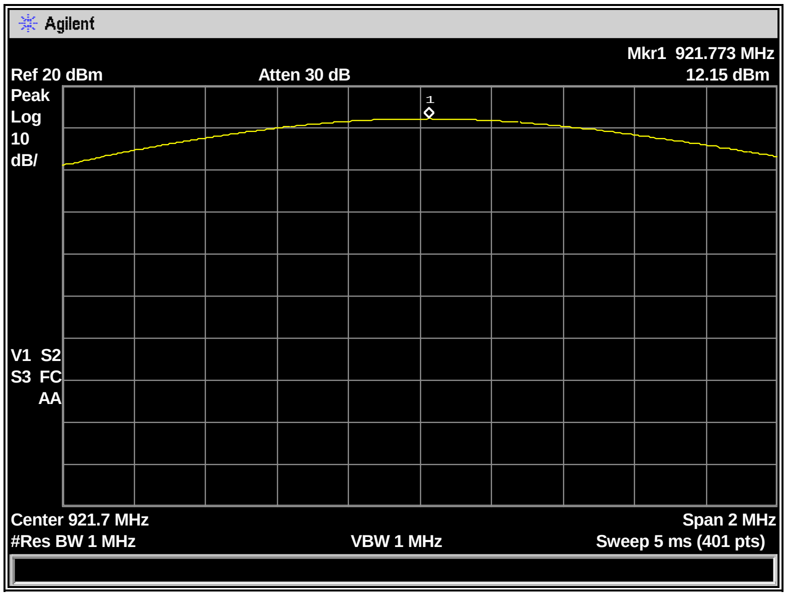

Figure 7.4-3: Output power – High Channel

7.5 Channel Usage Requirements - FCC Section 15.247(a) (1)

15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

15.247(a) (1) (i): For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

7.5.1 Carrier Frequency Separation

7.5.1.1 Test Methodology
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.

7.5.1.2 Test Results
The maximum 20dB bandwidth of the hopping channel was measured to be 114.5 kHz (See figure 7.5.4-1 to 7.5.4-3 below). The adjacent channel separation was measured to be 196.2 kHz. Results are shown in figure 7.5.1-1 below:

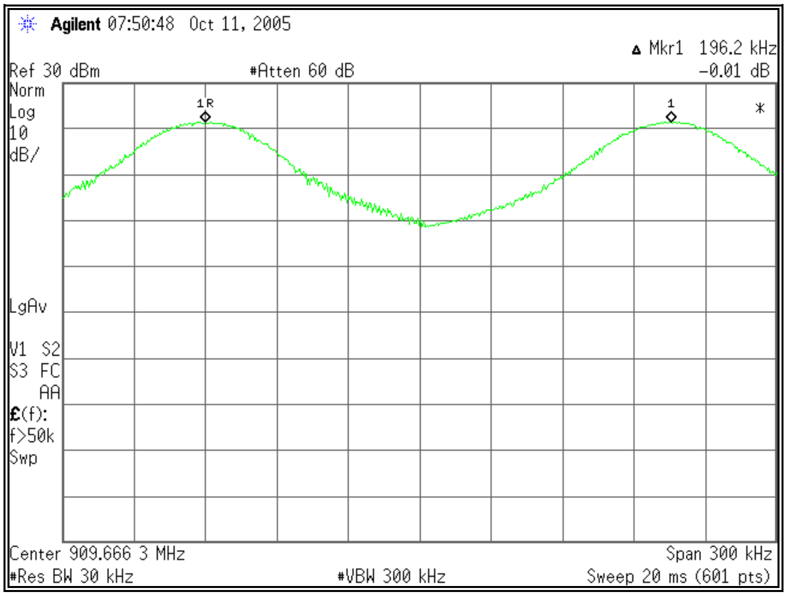

Figure 7.5.1-1: Carrier Frequency Separation

7.5.2 Number of Hopping Channels
The 20dB bandwidth of the device is less than 250 kHz. The device employs 50 hopping channels as required. Results are shown in Figure 7.5.2-1 below:

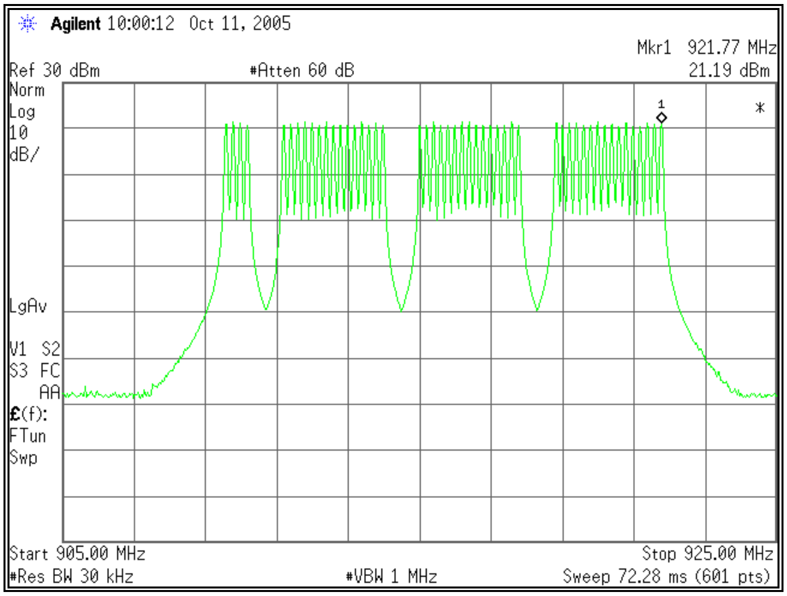

Figure 7.5.2-1: Number of Hopping Channels

7.5.3 Channel Dwell Time

The worse case with regards to RF dwell time on C3A1H that can occur is when the SCM burst of messages and IDM message happen to occur back to back on the same channel. This will give you a worst case dwell time of 115.23 msec with is the combined transmission times of the two message types. This dwell time is less than 400 msec and this channel would not be transmitted upon until 50 channel hops later. With transmission rates set to 30 sec, this means that this channel would not be used until 25 minutes later. This is obviously less than 20 sec and hence the RF dwell time meets the less than 400 msec within a 20 sec criteria.

A more detailed description of dwell time can be found attached to the Theory of Operations.

7.5.4 20dB Bandwidth

7.5.4.1 Test Methodology

The spectrum analyzer span was set to 2 to 3 times the estimated 20 dB bandwidth of the emission. The RBW was to ≥ 1% of the estimated 20 dB bandwidth. The trace was set to max hold with a peak detector active. The span and RBW were examined and re-adjusted if necessary to meet the requirements of 2 to 3 time the 20 bandwidth for the span and ≥ 1% of the 20 dB bandwidth for the RBW.

7.5.4.2 Test Results

The maximum 20dB bandwidth was found to be approximately 114.5 kHz. Results are shown below in Table 7.5.4-1and Figures 7.5.4-1 through 7.5.4-3.

Table 7.5.4-1: 20dB Bandwidth

Channel	Frequency (MHz)	20dB Bandwidth (kHz)
Low	909.6	110.0
Mid	916.0	114.0
High	921.8	114.5

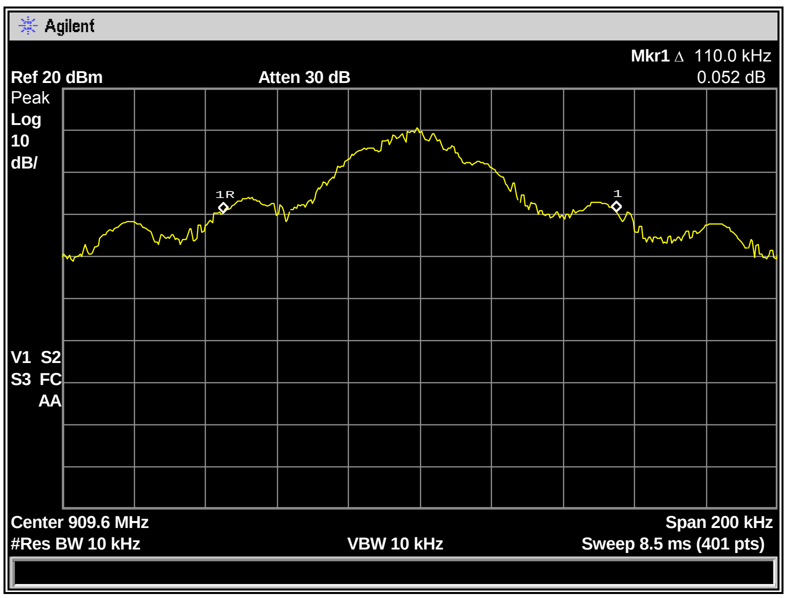

Figure 7.5.4-1: 20dB Bandwidth Low Channel

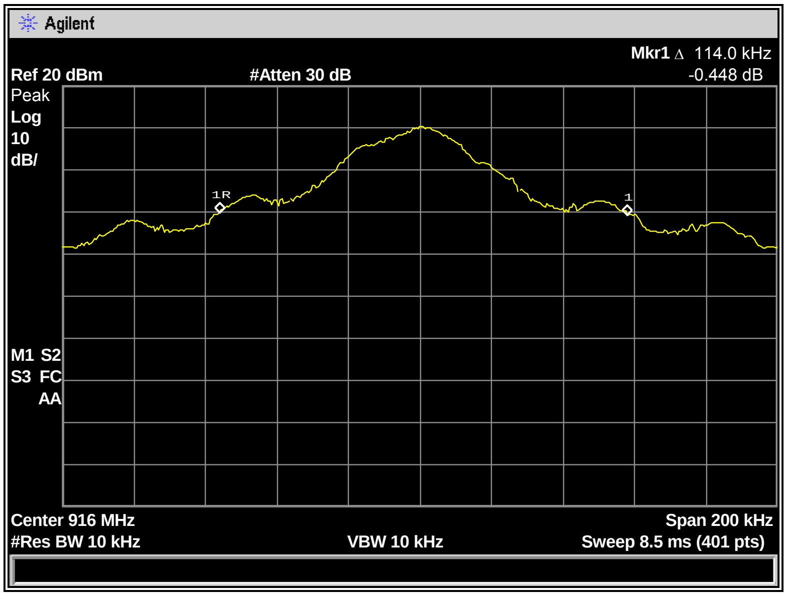

Figure 7.5.4-2: 20dB Bandwidth Mid Channel

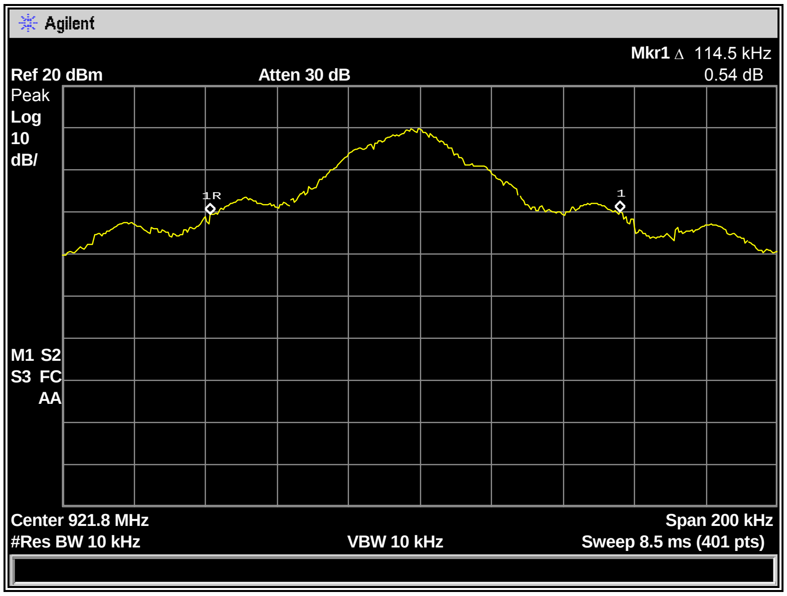

Figure 7.5.4-3: 20dB Bandwidth High Channel

7.6 Band-Edge Compliance and Spurious Emissions - FCC Section 15.247(c)

7.6.1 Band-Edge Compliance of RF Conducted Emissions

7.6.1.1 Test Methodology

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 100 kHz, which is ≥ 1% of the span.

7.6.1.2 Test Results

In a 100 kHz bandwidth at the lower and upper band-edge, the radio frequency power that was produced by the EUT is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power. Band-edge compliance is displayed in Figures 7.6.1-1 and 7.6.2-2

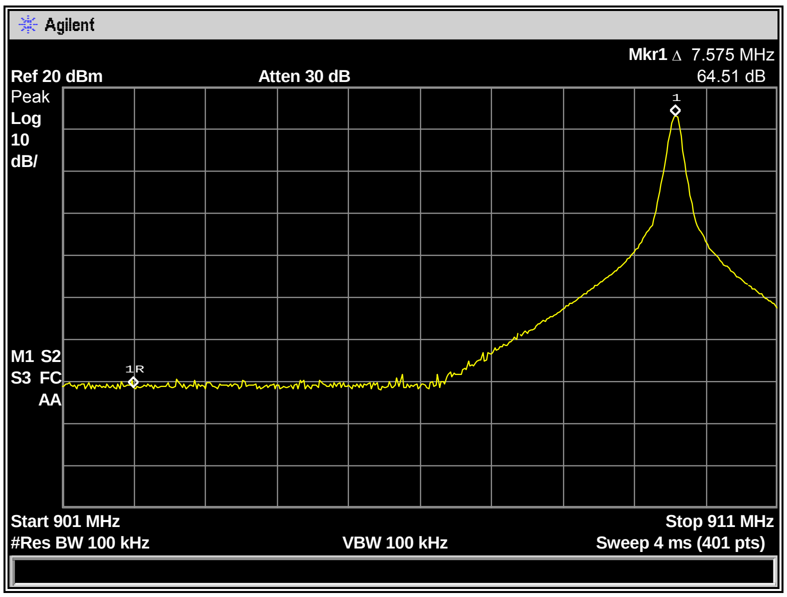

Figure 7.6.1-1: Lower Band-edge

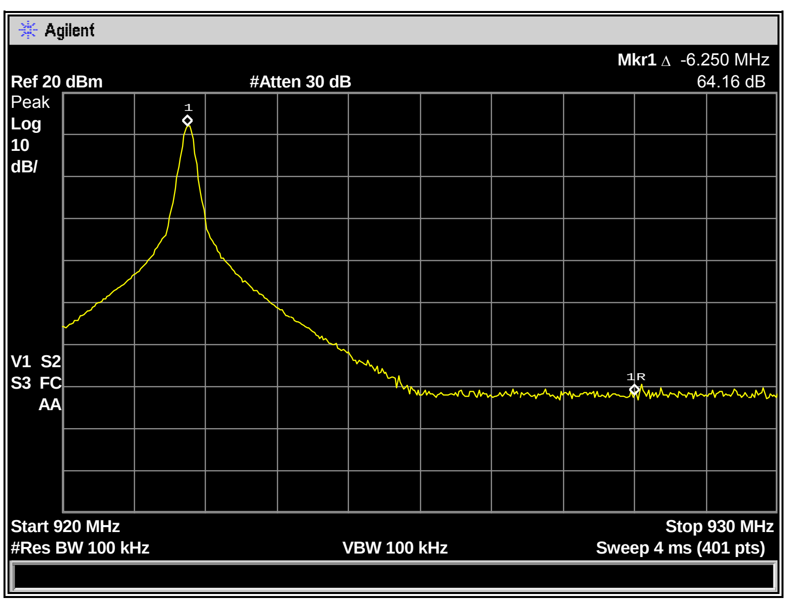

Figure 7.6.1-2: Upper Band-edge

7.6.2 RF Conducted Spurious Emissions

7.6.2.1 Test Methodology
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 VBW was set to 100kHz and the RBW was set to 100kHz. A peak detector function was used with the trace set to max hold.

7.6.2.1 Test Results
All emission found were greater than 20dB down from the fundamental carrier. The RF conducted spurious emissions were measured in the band of 30MHz to 10GHz. Results are shown below in Figure 7.6.2-1 through 7.6.2-6.

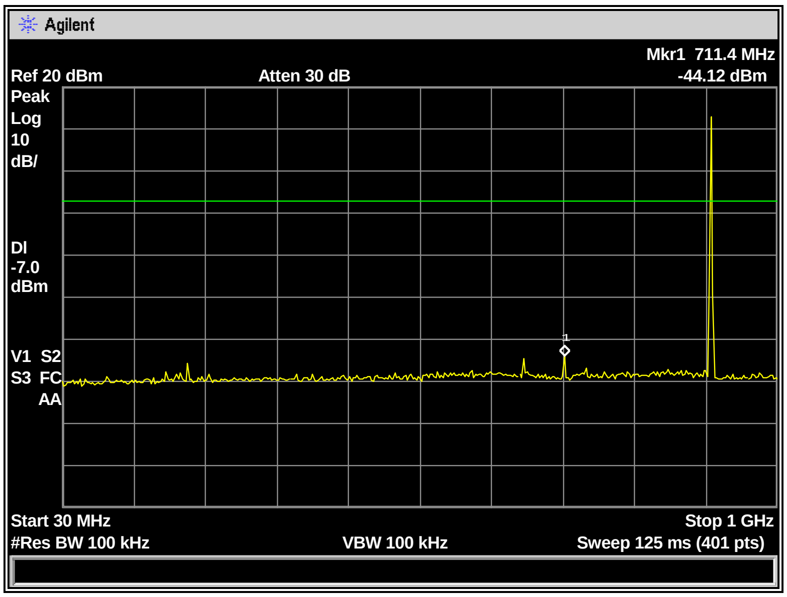

Figure 7.6.2-1 RF Conducted Spurious Emissions – Low Channel

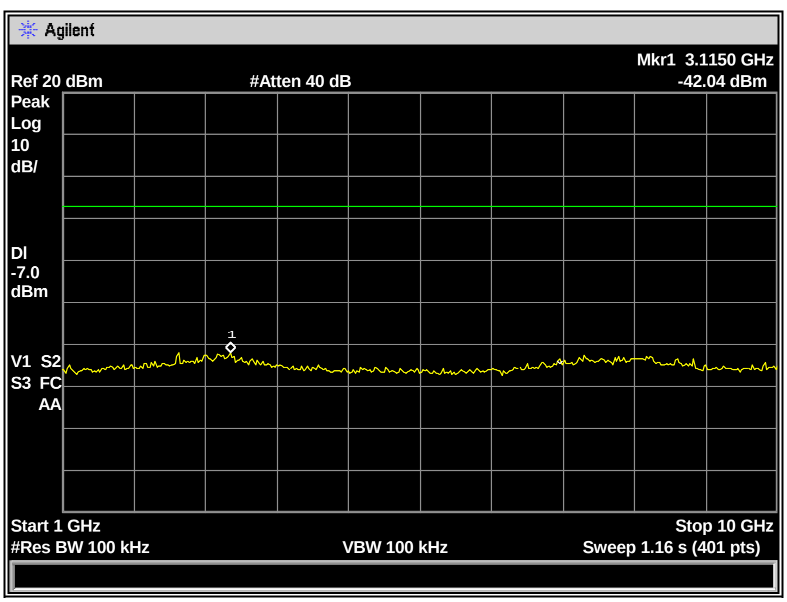

Figure 7.6.2-2 RF Conducted Spurious Emissions – Low Channel

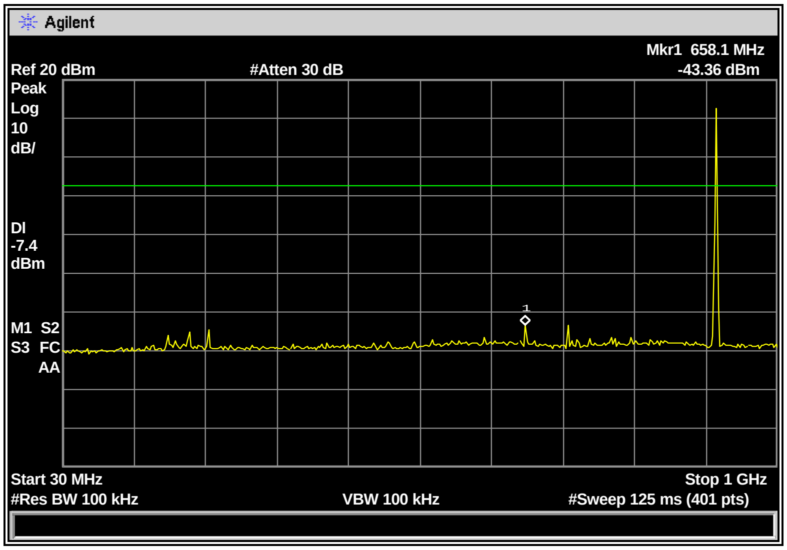

Figure 7.6.2-3 RF Conducted Spurious Emissions – Mid Channel

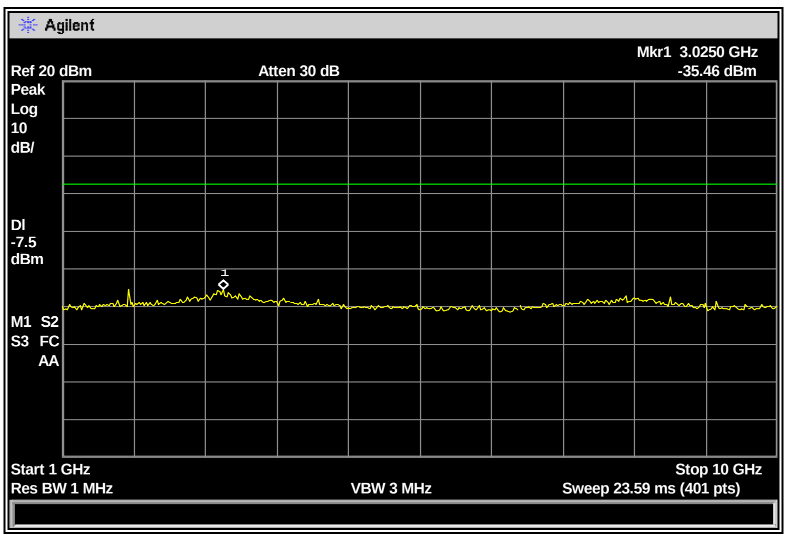

Figure 7.6.2-4 RF Conducted Spurious Emissions – Mid Channel

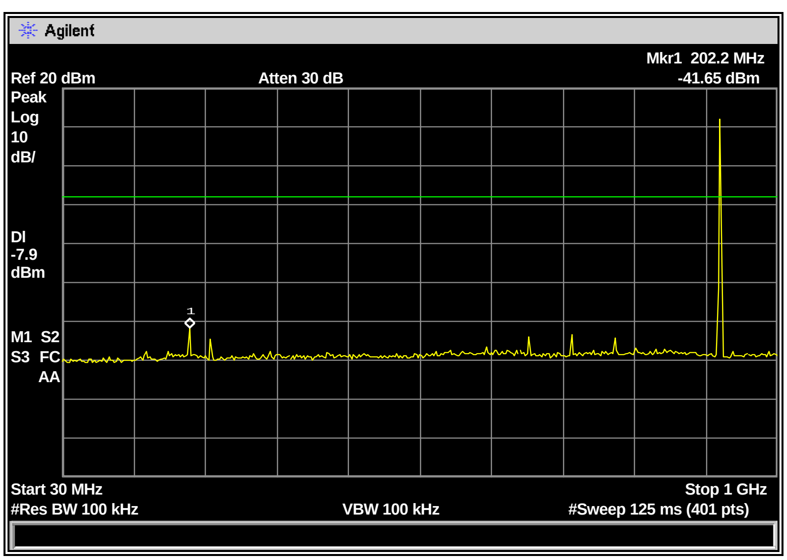

Figure 7.6.2-5 RF Conducted Spurious Emissions – High Channel

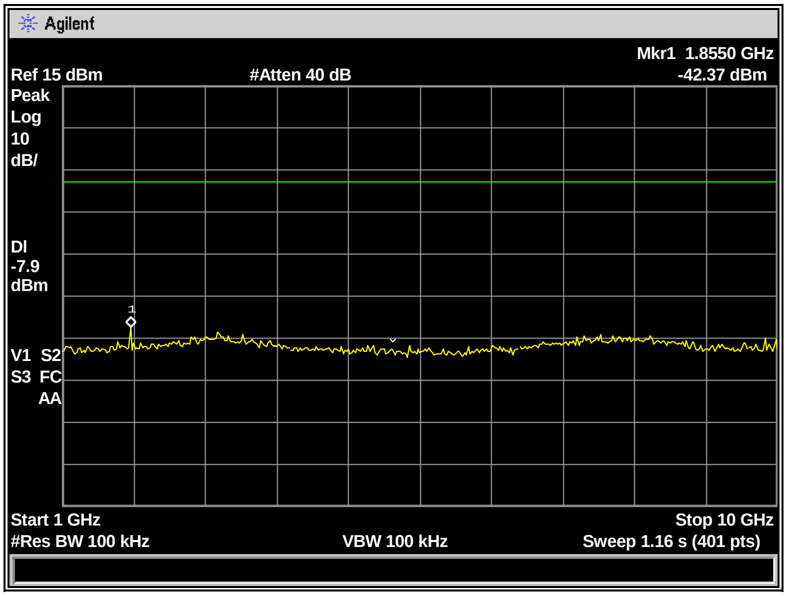

Figure 7.6.2-6 RF Conducted Spurious Emissions – High Channel

7.6.3 Radiated Spurious Emissions (Restricted Bands) - FCC Section 15.205

7.6.3.1 Test Methodology

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, average measurements were made using an RBW of 1 MHz and a VBW of 10 Hz and peak measurements were made with RBW of 1 MHz and a VBW of 1 MHz.

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

7.6.3.2 Duty Cycle Correction

For average radiated measurements, the measured level was reduced by a factor 6.9dB to account for the duty cycle of the EUT. Referencing the dwell time justification in section 7.5.3 above the worst case duty cycle within 100ms is 45% or 45ms for the IDM message type. The duty cycle correction factor is determined using the formula: 20log (0.45)=-6.9dB.

The more detailed justification of duty cycle can be found in the dwell time justification attached to the Theory of Operations.

7.6.3.3 Test Results

Radiated spurious emissions found in the band of 30MHz to 10GHz are reported in Table 7.6.3-1. through 7.6.3-3. Each emission found to be in a restricted band as defined by section 15.205, was compared to the radiated emission limits as defined in section 15.209.

Table 7.6.3-1: Radiated Spurious Emissions – Monophase 120V Meter Base

Frequency	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
(MHz)	pk	avg	(H/V)	(dB)	pk	avg	pk	avg	pk	avg
Spurious Emissions - Low Channel										
2728.77	49.95	49.95	H	2.31	52.26	45.33	74	54	21.74	8.67
2728.77	50.86	50.86	V	2.31	53.17	46.24	74	54	20.83	7.76
4547.95	45.33	45.33	H	7.81	53.14	46.20	74	54	20.86	7.80
4547.95	44.14	44.14	V	7.81	51.95	45.01	74	54	22.05	8.99
Spurious Emissions - Mid Channel										
2748.021	48.66	48.66	H	2.38	51.04	44.10	74	54	22.96	9.90
2748.021	50.43	50.43	V	2.38	52.81	45.87	74	54	21.19	8.13
Spurious Emissions - High Channel										
2765.319	52.52	52.52	H	2.43	54.95	48.02	74	54	19.05	5.98
2765.319	49.95	49.95	V	2.43	52.38	45.45	74	54	21.62	8.55

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

Table 7.6.3-2: Radiated Spurious Emissions – Monophase 240V Meter Base

Frequency	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
(MHz)	pk	avg	(H/V)	(dB)	pk	avg	pk	avg	pk	avg
Spurious Emissions - Low Channel										
2728.77	50.59	50.59	H	2.31	52.90	45.97	74	54	21.10	8.03
2728.77	50.43	50.43	V	2.31	52.74	45.81	74	54	21.26	8.19
3638.36	43.15	43.15	H	5.79	48.94	42.00	74	54	25.06	12.00
4547.95	44.97	44.97	H	7.81	52.78	45.84	74	54	21.22	8.16
4547.95	44.69	44.69	V	7.81	52.50	45.56	74	54	21.50	8.44
Spurious Emissions - Mid Channel										
2748.021	52.36	52.36	H	2.38	54.74	47.80	74	54	19.26	6.20
2748.021	48.66	48.66	V	2.38	51.04	44.10	74	54	22.96	9.90
4580.035	43.86	43.86	H	7.95	51.81	44.87	74	54	22.19	9.13
4580.035	42.56	42.56	V	7.95	50.51	43.57	74	54	23.49	10.43
Spurious Emissions - High Channel										
2765.319	54.70	54.70	H	2.43	57.13	50.20	74	54	16.87	3.80
2765.319	52.01	52.01	V	2.43	54.44	47.51	74	54	19.56	6.49
3687.092	42.66	42.66	H	5.97	48.63	41.69	74	54	25.37	12.31
3687.092	42.84	42.84	V	5.97	48.81	41.87	74	54	25.19	12.13
4608.865	44.08	44.08	H	8.07	52.15	45.22	74	54	21.85	8.78
4608.865	43.37	43.37	V	8.07	51.44	44.51	74	54	22.56	9.49

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

Table 7.6.3-3: Radiated Spurious Emissions –Polyphase Meter Base

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	avg			pk	avg	pk	avg	pk	avg
Spurious Emissions - Low Channel										
2728.758	51.37	51.37	H	2.31	53.68	46.75	74	54	20.32	7.25
2728.758	54.04	54.04	V	2.31	56.35	49.42	74	54	17.65	4.58
3638.344	45.38	45.38	H	5.79	51.17	44.23	74	54	22.83	9.77
3638.344	45.00	45.00	V	5.79	50.79	43.85	74	54	23.21	10.15
4547.93	50.18	50.18	H	7.81	57.99	51.05	74	54	16.01	2.95
4547.93	50.46	50.46	V	7.81	58.27	51.33	74	54	15.73	2.67
Spurious Emissions - Mid Channel										
2748.021	54.45	54.45	H	2.38	56.83	49.89	74	54	17.17	4.11
2748.021	53.10	53.10	V	2.38	55.48	48.54	74	54	18.52	5.46
4580.035	48.33	48.33	H	7.95	56.28	49.34	74	54	17.72	4.66
4580.035	49.21	49.21	V	7.95	57.16	50.22	74	54	16.84	3.78
Spurious Emissions - High Channel										
2765.319	55.72	55.72	H	2.43	58.15	51.22	74	54	15.85	2.78
2765.319	54.45	54.45	V	2.43	56.88	49.95	74	54	17.12	4.05
4608.865	48.45	48.45	H	8.07	56.52	49.59	74	54	17.48	4.41
4608.865	50.41	50.41	V	8.07	58.48	51.55	74	54	15.52	2.45

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

7.6.3.3 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: 49.95 + 2.31 = 52.26 dBuV
Margin: 74dBuV – 52.26 dBuV = 21.74 dB

AVERAGE:
Corrected Level: 49.95 + 2.31 -6.92 = 45.34 dBuV
Margin: 54dBuV – 45.34 dBuV = 8.66 dB

8.0 CONCLUSION

In the opinion of ACS, Inc. the C3A1L, manufactured by Itron Electricity Metering Inc., meets the requirements of FCC Part 15 subpart C.