FCC Part 15.247
Transmitter Certification

Frequency Hopping Spread Spectrum Transmitter

Test Report

FCC ID: SK9C3A-1H

FCC Rule Part: 15.247

ACS Report Number: 06-0012-15C

Manufacturer: Itron Electricity Metering Inc.
Trade name: CENTRON® IMAGE
Model: C3A1H

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

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This report contains 29 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.

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 high power version only. The low 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:

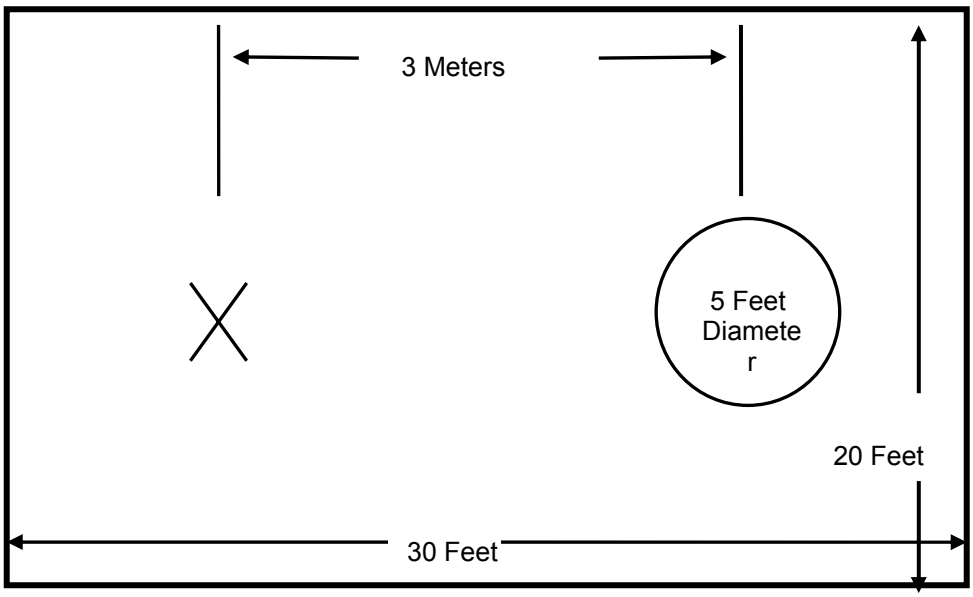

Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

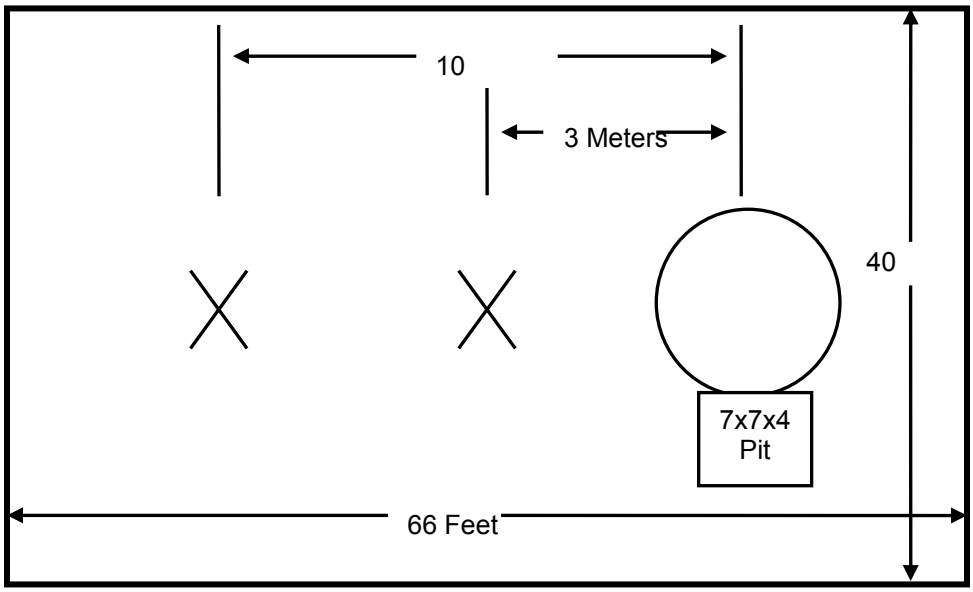

Figure 2.3-2: Open Area Test Site

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:

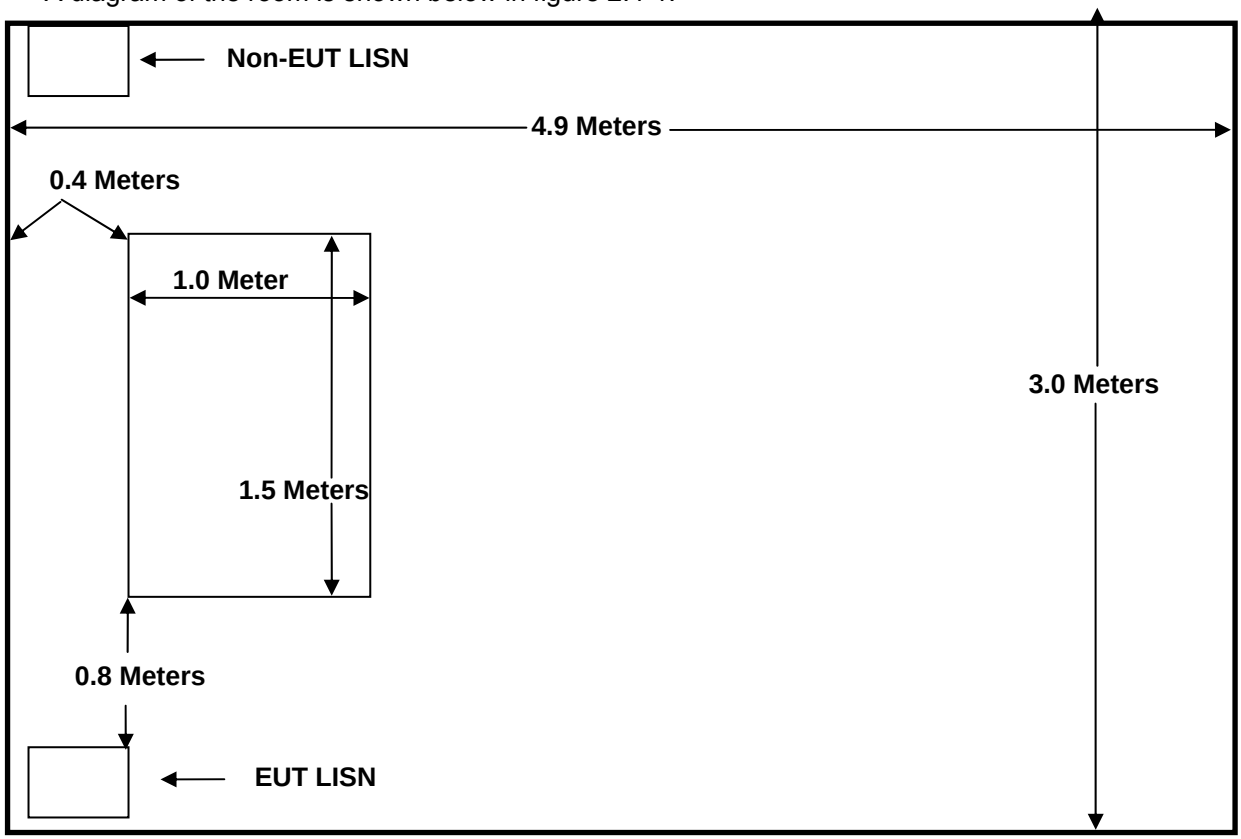

Figure 2.4-1: AC Mains Conducted EMI Site

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

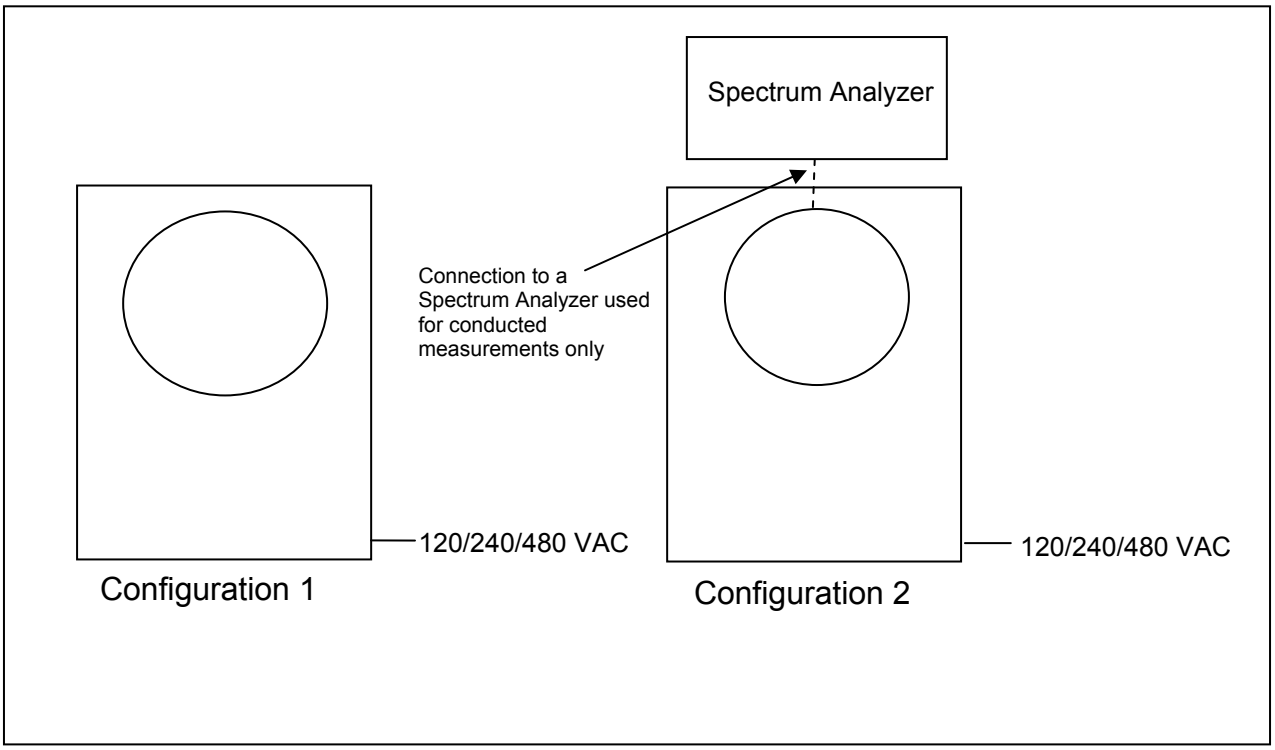

Figure 6-1: EUT Test Setup

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.

120V Monophase Configuration:

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

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.462	31.2	9.7	56.6	25.4	L1	GND
0.468	39.5	9.7	56.5	16.9	L1	GND
0.702	42.3	9.7	56.0	13.6	L1	GND
1.026	25.2	9.7	56.0	30.7	L1	GND
4.590	37.9	9.7	56.0	18.0	L1	GND
5.970	11.6	9.6	60.0	48.3	L1	GND
8.004	17.4	9.6	60.0	42.5	L1	GND
22.212	14.8	8.9	60.0	45.1	L1	GND
26.328	17.9	8.8	60.0	42.0	L1	GND

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

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.462	26.3	9.7	46.6	20.3	L1	GND
0.468	31.0	9.7	46.5	15.4	L1	GND
0.702	30.5	9.7	46.0	15.5	L1	GND
1.020	16.6	9.7	46.0	29.3	L1	GND
4.542	11.5	9.7	46.0	34.4	L1	GND
6.000	7.0	9.6	50.0	42.9	L1	GND
7.914	7.1	9.6	50.0	42.8	L1	GND
22.398	9.6	8.9	50.0	40.3	L1	GND
26.190	7.6	8.8	50.0	42.3	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
0.234	42.6	9.7	62.3	19.6	L2	GND
0.378	32.6	9.7	58.3	25.6	L2	GND
0.558	33.2	9.7	56	22.7	L2	GND
0.696	44.1	9.7	56	11.8	L2	GND
0.792	31	9.7	56	24.9	L2	GND
0.93	33.1	9.7	56	22.8	L2	GND
1.020	26.3	9.7	56	29.6	L2	GND
1.164	26.6	9.7	56	29.3	L2	GND
1.398	22.2	9.7	56	33.7	L2	GND
4.194	20.3	9.6	56	35.6	L2	GND

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

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.234	31.5	9.7	52.3	20.7	L2	GND
0.372	21.2	9.7	48.4	27.2	L2	GND
0.558	22.1	9.7	46.0	23.8	L2	GND
0.696	29.1	9.7	46.0	16.9	L2	GND
0.792	18.2	9.7	46.0	27.7	L2	GND
0.930	24.2	9.7	46.0	21.7	L2	GND
1.020	17.8	9.7	46.0	28.1	L2	GND
1.164	21.3	9.7	46.0	24.6	L2	GND
1.398	18.4	9.7	46.0	27.5	L2	GND
4.194	19.3	9.6	46.0	26.6	L2	GND

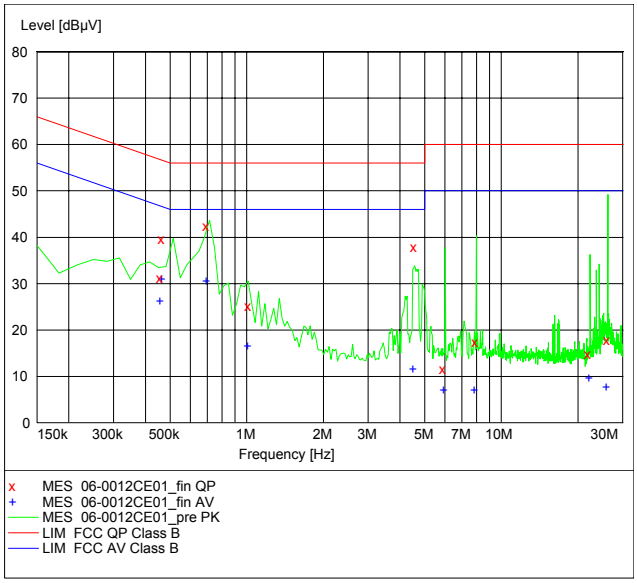

Figure 7.2-1: Conducted Emissions Graph – Line 1

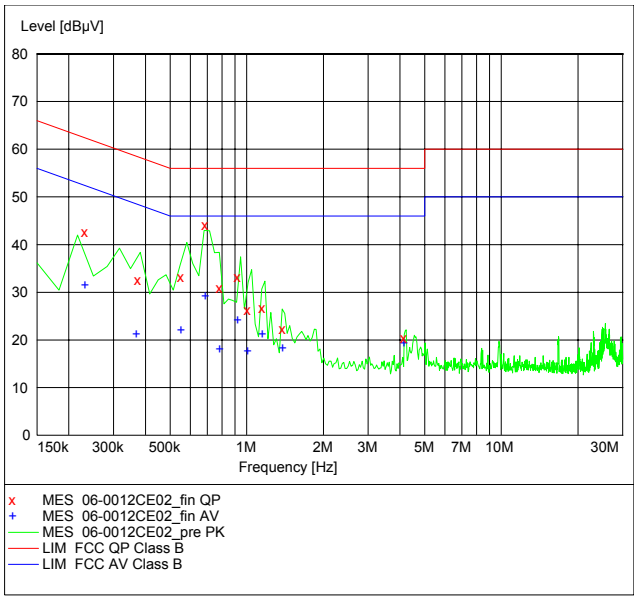

Figure 7.2-2: Conducted Emissions Graph – Line 2

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
0.246	50.1	9.7	61.8	11.7	L1	GND
0.330	35.5	9.7	59.4	23.8	L1	GND
0.486	38.7	9.7	56.2	17.5	L1	GND
0.726	42.4	9.7	56.0	13.5	L1	GND
0.882	24.9	9.7	56.0	31.0	L1	GND
1.056	24.0	9.7	56.0	31.9	L1	GND
1.212	26.2	9.7	56.0	29.8	L1	GND
1.458	25.6	9.7	56.0	30.3	L1	GND
4.194	31.1	9.6	56.0	24.8	L1	GND
25.164	31.3	8.8	60.0	28.6	L1	GND

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

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.240	30.9	9.7	52.0	21.1	L1	GND
0.330	25.4	9.7	49.4	24.0	L1	GND
0.486	31.5	9.7	46.2	14.6	L1	GND
0.726	31.2	9.7	46.0	14.7	L1	GND
0.882	17.0	9.7	46.0	28.9	L1	GND
1.056	18.7	9.7	46.0	27.2	L1	GND
1.212	22.2	9.7	46.0	23.7	L1	GND
1.458	20.6	9.7	46.0	25.3	L1	GND
4.194	31.1	9.6	46.0	14.8	L1	GND
25.164	31.3	8.8	50.0	18.6	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	39.4	9.7	61.8	22.4	L2	GND
0.336	33.1	9.7	59.3	26.1	L2	GND
0.486	38.9	9.7	56.2	17.3	L2	GND
0.726	42.5	9.7	56.0	13.4	L2	GND
0.966	31.8	9.7	56.0	24.1	L2	GND
1.212	24.4	9.7	56.0	31.6	L2	GND
4.194	31.1	9.6	56.0	24.8	L2	GND
25.164	30.2	8.8	60.0	29.7	L2	GND

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

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.240	31.6	9.7	52.0	20.4	L2	GND
0.336	23.3	9.7	49.3	25.9	L2	GND
0.486	31.9	9.7	46.2	14.3	L2	GND
0.726	30.8	9.7	46.0	15.1	L2	GND
0.966	24.5	9.7	46.0	21.4	L2	GND
1.206	19.8	9.7	46.0	26.1	L2	GND
4.194	31.0	9.6	46.0	14.9	L2	GND
25.164	30.2	8.8	50.0	19.7	L2	GND

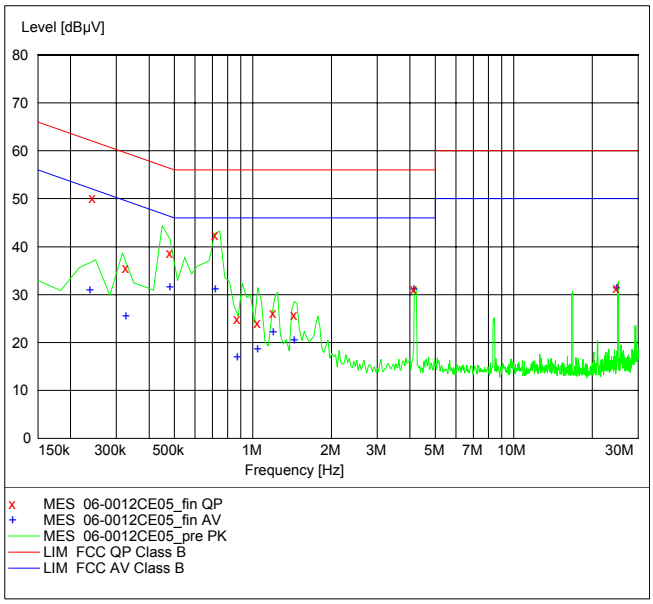

Figure 7.2-3: Conducted Emissions Graph – Line 1

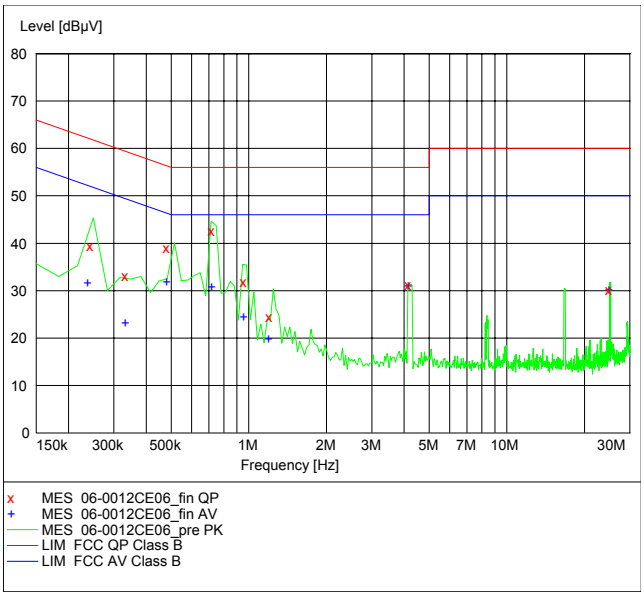

Figure 7.2-4: Conducted Emissions Graph – Line 2

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
0.150	44.1	9.8	66.0	21.8	L1	GND
0.264	47.3	9.7	61.3	13.9	L1	GND
0.396	44.8	9.7	57.9	13.0	L1	GND
0.528	45.1	9.7	56.0	10.8	L1	GND
1.050	37.8	9.7	56.0	18.1	L1	GND
1.182	35.8	9.7	56.0	20.1	L1	GND
1.314	34.3	9.7	56.0	21.6	L1	GND
2.358	26.4	9.6	56.0	29.5	L1	GND
4.266	21.5	9.6	56.0	34.4	L1	GND
15.960	23.9	9.3	60.0	36.0	L1	GND

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

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.150	34.4	9.8	56.0	21.5	L1	GND
0.264	39.0	9.7	51.3	12.2	L1	GND
0.390	35.6	9.7	48.0	12.4	L1	GND
0.522	35.6	9.7	46.0	10.3	L1	GND
1.038	26.3	9.7	46.0	19.6	L1	GND
1.170	25.8	9.7	46.0	20.1	L1	GND
1.314	26.3	9.7	46.0	19.6	L1	GND
2.376	18.8	9.6	46.0	27.1	L1	GND
4.266	14.2	9.6	46.0	31.7	L1	GND
15.888	16.0	9.3	50.0	33.9	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
0.960	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
0.276	44.8	9.7	60.9	16.0	L2	GND
0.414	40.0	9.7	57.5	17.5	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
3.600	14.7	9.6	46.0	31.2	L2	GND
4.182	16.7	9.6	46.0	29.2	L2	GND
0.276	31.8	9.7	50.9	19.0	L2	GND
0.414	27.8	9.7	47.5	19.7	L2	GND

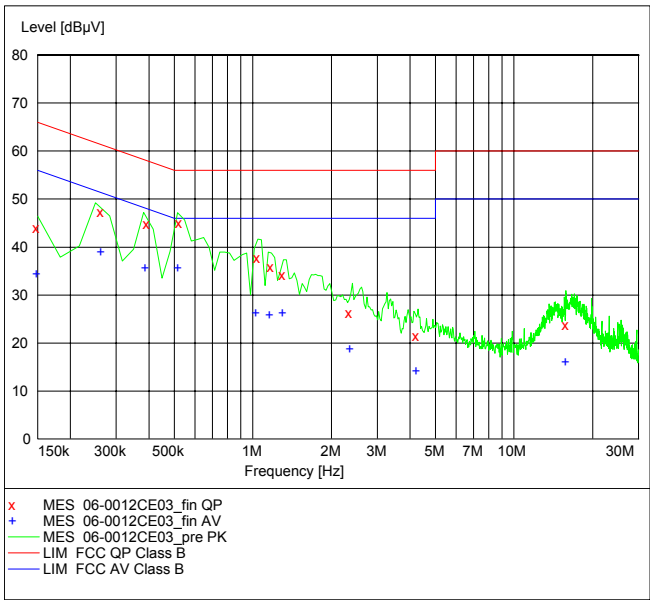

Figure 7.2-5: Conducted Emissions Graph – Line 1

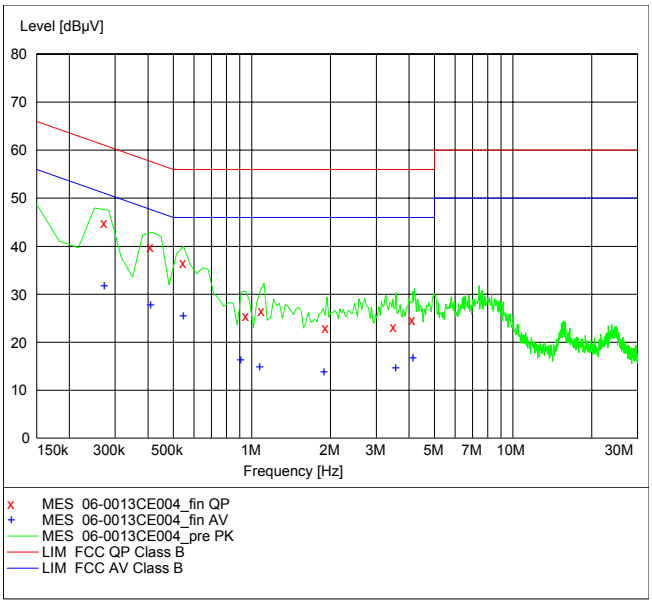

Figure 7.2-6: Conducted Emissions Graph – Line 2

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
0.264	44.6	9.7	61.3	16.6	L1	GND
0.396	43.9	9.7	57.9	13.9	L1	GND
0.522	45.3	9.7	56.0	10.6	L1	GND
0.786	45.0	9.7	56.0	10.9	L1	GND
1.296	38.4	9.7	56.0	17.5	L1	GND
2.772	31.4	9.6	56.0	24.5	L1	GND
4.392	27.7	9.7	56.0	28.2	L1	GND
6.066	24.0	9.6	60.0	35.9	L1	GND
6.180	24.5	9.5	60.0	35.4	L1	GND
18.432	30.3	9.3	60.0	29.6	L1	GND

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

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.270	34.1	9.7	51.1	16.9	L1	GND
0.396	35.0	9.7	47.9	12.8	L1	GND
0.522	37.7	9.7	46.0	8.2	L1	GND
0.786	37.5	9.7	46.0	8.4	L1	GND
1.320	30.6	9.7	46.0	15.3	L1	GND
2.766	24.2	9.6	46.0	21.8	L1	GND
4.398	19.8	9.7	46.0	26.2	L1	GND
6.006	16.6	9.6	50.0	33.3	L1	GND
6.108	17.0	9.5	50.0	32.9	L1	GND
18.432	27.8	9.3	50.0	22.1	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
0.270	42.3	9.7	61.1	18.7	L2	GND
0.396	40.3	9.7	57.9	17.6	L2	GND
0.522	41.1	9.7	56.0	14.8	L2	GND
0.654	41.2	9.7	56.0	14.7	L2	GND
0.792	40.6	9.7	56.0	15.3	L2	GND
1.296	34.3	9.7	56.0	21.6	L2	GND
2.628	32.6	9.6	56.0	23.4	L2	GND
4.494	29.3	9.7	56.0	26.6	L2	GND
5.970	24.7	9.6	60.0	35.2	L2	GND
18.432	30.4	9.3	60.0	29.5	L2	GND

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

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.276	31.7	9.7	50.9	19.1	L2	GND
0.390	32.5	9.7	48.0	15.5	L2	GND
0.522	33.8	9.7	46.0	12.1	L2	GND
0.654	34.1	9.7	46.0	11.8	L2	GND
0.786	33.5	9.7	46.0	12.4	L2	GND
1.314	26.9	9.7	46.0	19.0	L2	GND
2.676	24.5	9.6	46.0	21.4	L2	GND
4.524	21.2	9.7	46.0	24.7	L2	GND
5.976	17.3	9.6	50.0	32.6	L2	GND
18.432	27.9	9.3	50.0	22.0	L2	GND

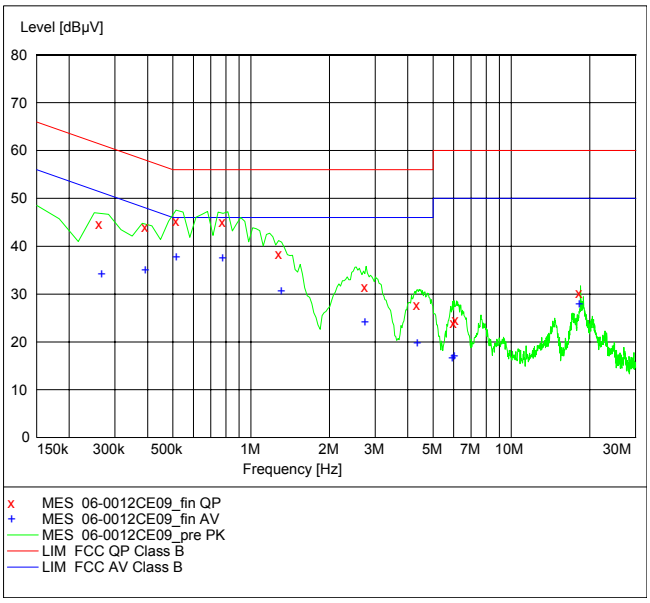

Figure 7.2-7: Conducted Emissions Graph – Line 1

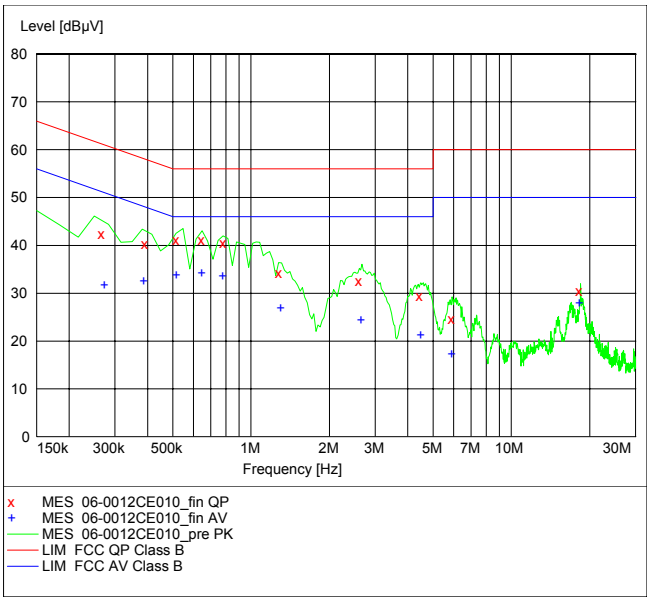

Figure 7.2-8: Conducted Emissions Graph – Line 2

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)**
39.92	VERTICAL	100	25	18.8	40.0	21.2
56.80	VERTICAL	100	211	29.5	40.0	10.5
85.44	VERTICAL	110	255	29.3	40.0	10.7
99.60	HORIZONTAL	270	111	34.0	43.5	9.5
571.44	HORIZONTAL	110	0	29.9	46.0	16.1
589.84	HORIZONTAL	110	54	33.5	46.0	12.5
608.24	HORIZONTAL	110	13	35.0	46.0	11.0
626.72	HORIZONTAL	100	0	37.8	46.0	8.2
645.12	HORIZONTAL	190	12	36.7	46.0	9.3
943.44	HORIZONTAL	250	197	23.9	46.0	22.1

* Note: All emissions above 943.44 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]
909.569	21.36
916.020	21.35
921.774	21.29

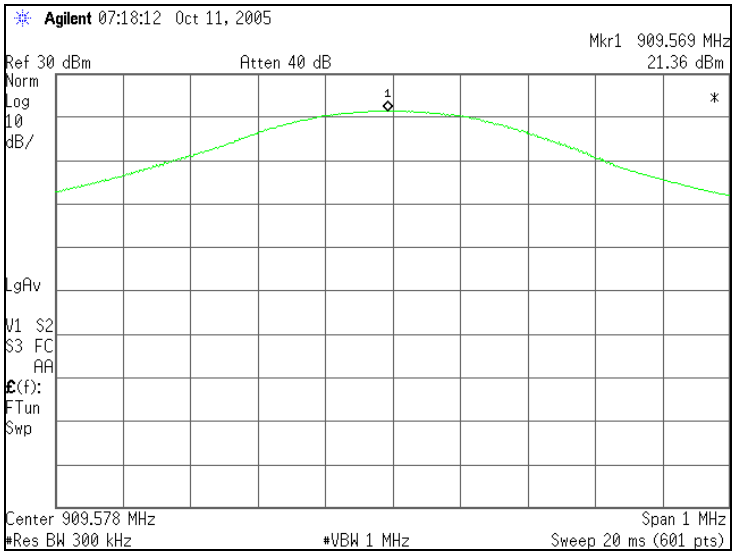

Figure 7.4-1: Output power – Low Channel

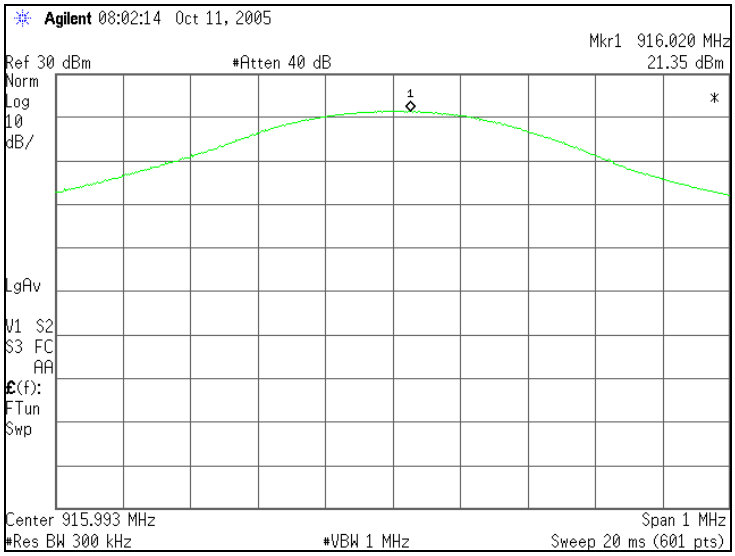

Figure 7.4-2: Output power – Mid Channel

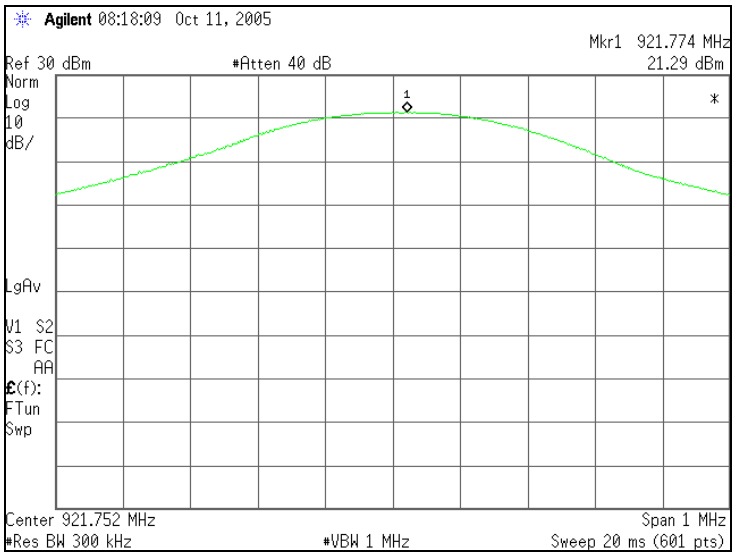

Figure 7.4-3: Output power – High Channel

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 175.269 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:

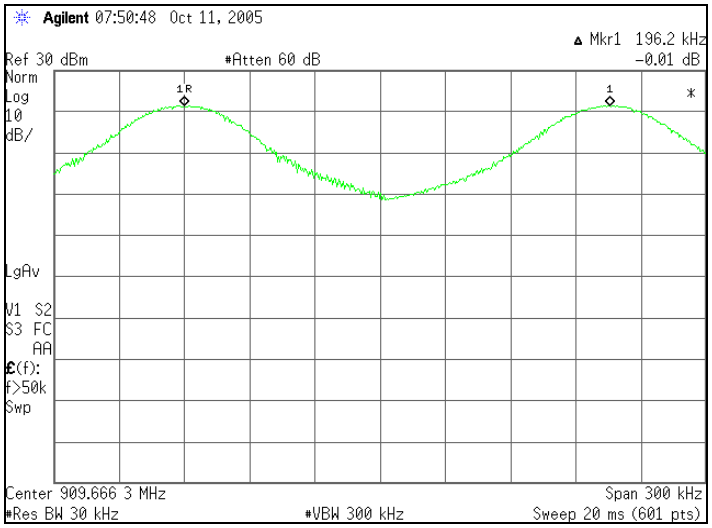

Figure 7.5.1-1: Carrier Frequency Separation

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:

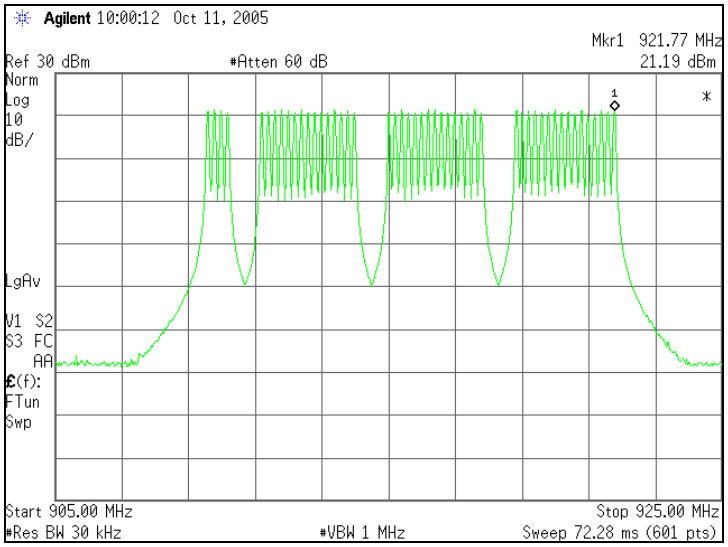

Figure 7.5.2-1: Number of Hopping Channels

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 N-dB Down function of the analyzer was utilized to determine the 20 dB bandwidth of the emission. The span and RBW were examined and re-adjusted if necessary to meet the requirements of 2 to 3 times 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 175.27 kHz. Results are shown below in Figure 7.5.4-1 through 7.5.4-3.

Channel	Frequency (MHz)	20dB Bandwidth (kHz)
Low	909.5777	159.371
Mid	915.9933	170.412
High	921.7522	175.269

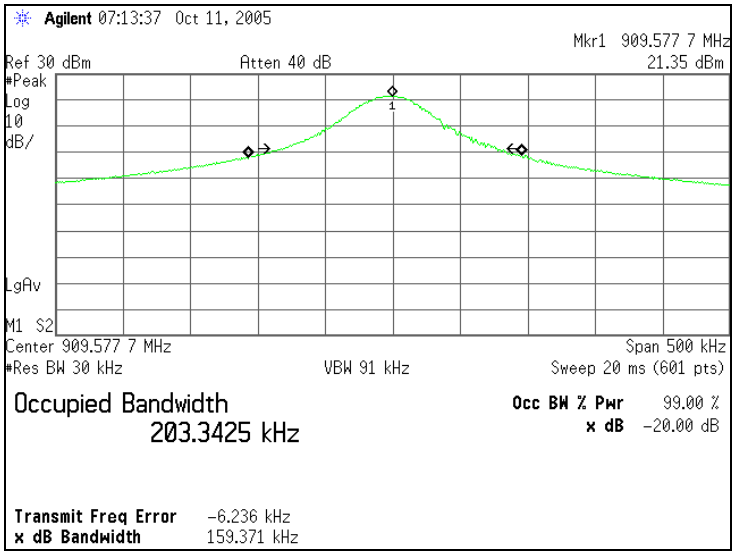

Figure 7.5.4-1: 20dB Bandwidth Low Channel

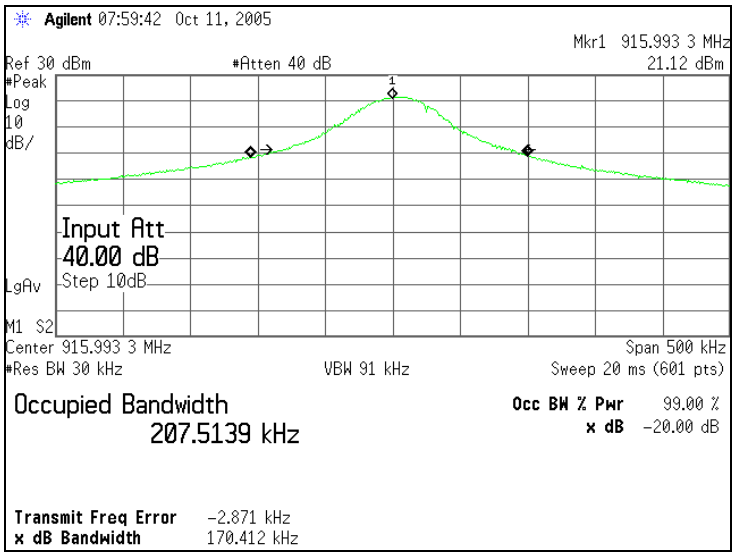

Figure 7.5.4-2: 20dB Bandwidth Mid Channel

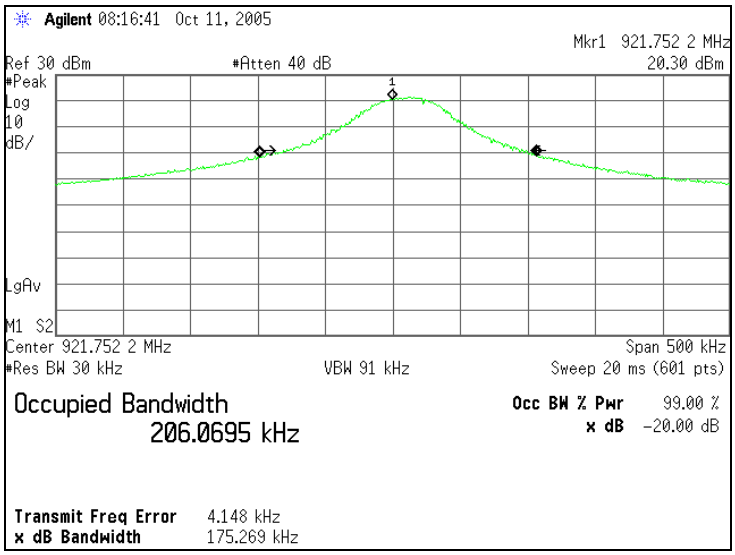

Figure 7.5.4-3: 20dB Bandwidth High Channel

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 300 kHz, which is ≥ 1% of the span, and the VBW was set to 1 MHz.

7.6.1.2 Test Results

Band-edge compliance is displayed in Figures 7.6.1-1 and 7.6.2-2

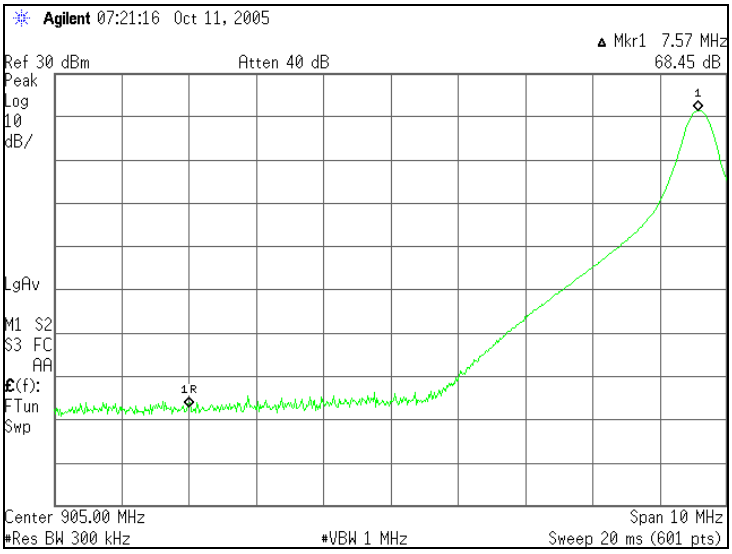

Figure 7.6.1-1: Lower Band-edge

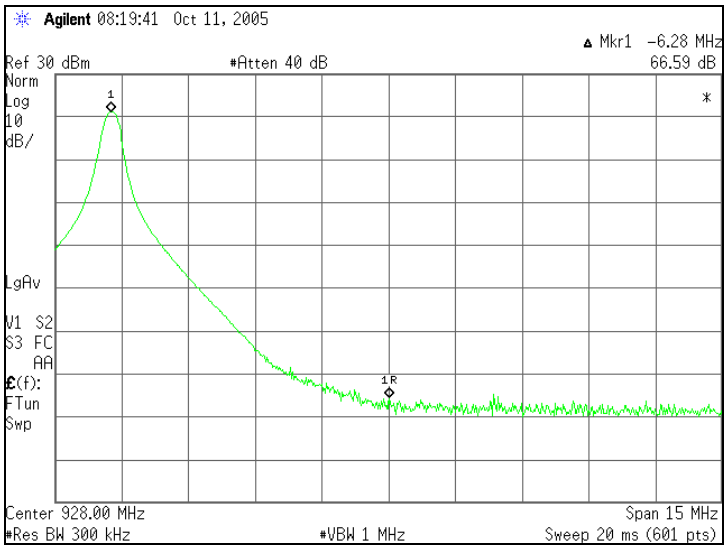

Figure 7.6.1-2: Upper Band-edge

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 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.

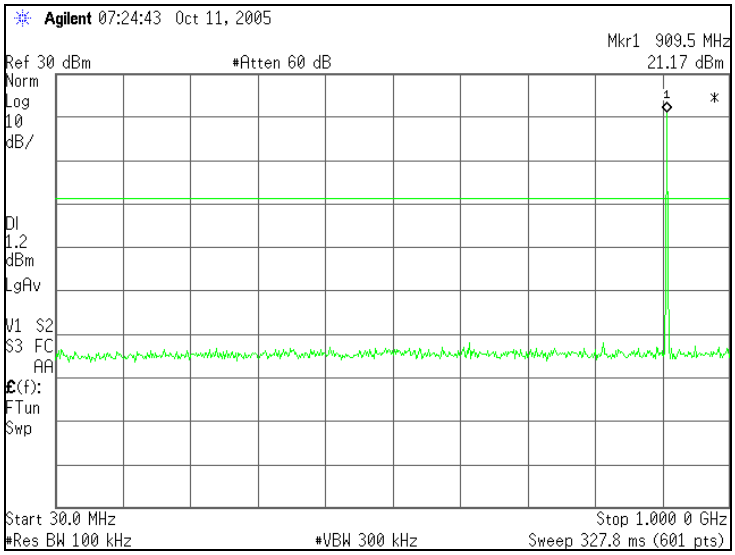

Figure 7.6.2-1 RF Conducted Spurious Emissions – Low Channel

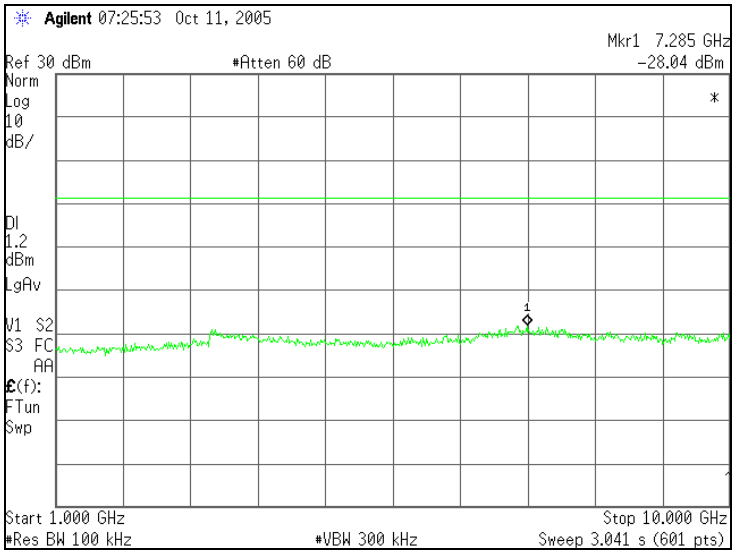

Figure 7.6.2-2 RF Conducted Spurious Emissions – Low Channel

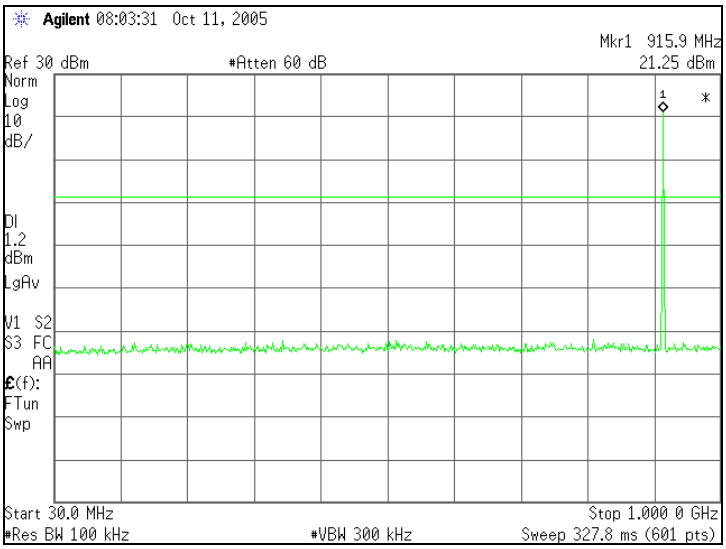

Figure 7.6.2-3 RF Conducted Spurious Emissions – Mid Channel

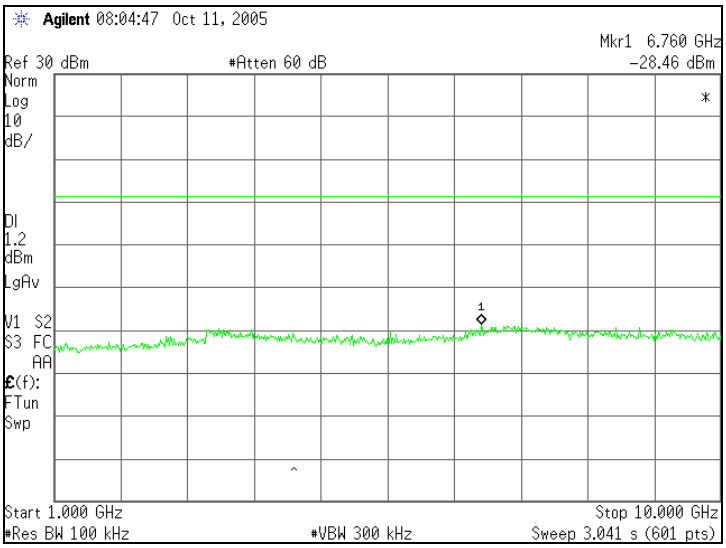

Figure 7.6.2-4 RF Conducted Spurious Emissions – Mid Channel

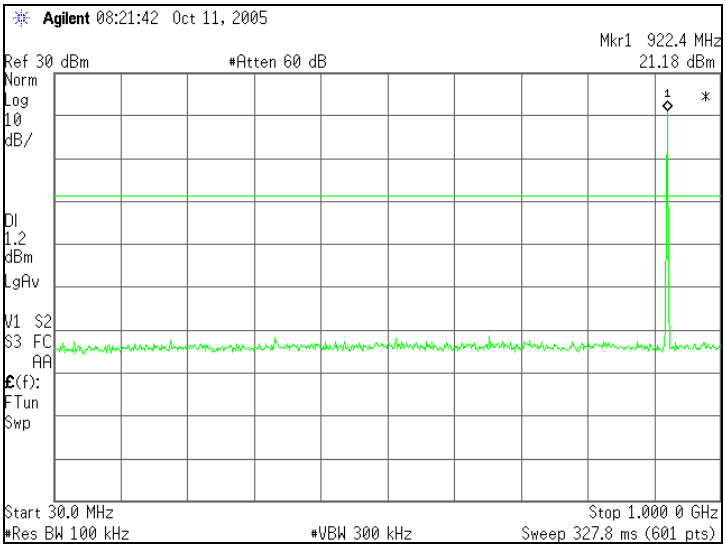

Figure 7.6.2-5 RF Conducted Spurious Emissions – High Channel

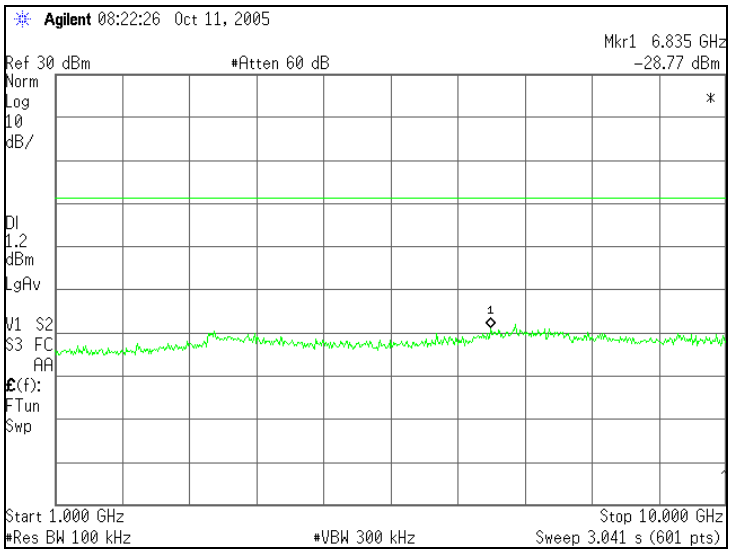

Figure 7.6.2-6 RF Conducted Spurious Emissions – High Channel

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	53.51	53.51	H	2.31	55.82	48.89	74	54	18.18	5.11
2728.77	53.12	53.12	V	2.31	55.43	48.50	74	54	18.57	5.50
Spurious Emissions - Mid Channel										
2748.021	53.25	53.25	H	2.38	55.63	48.69	74	54	18.37	5.31
2748.021	50.38	50.38	V	2.38	52.76	45.82	74	54	21.24	8.18
Spurious Emissions - High Channel										
2765.319	52.62	52.62	H	2.43	55.05	48.12	74	54	18.95	5.88
2765.319	50.71	50.71	V	2.43	53.14	46.21	74	54	20.86	7.79

***** 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										
2727	51.30	51.30	H	2.31	53.61	46.67	74	54	20.39	7.33
2727	50.00	50.00	V	2.31	52.31	45.37	74	54	21.69	8.63
3636	50.18	50.18	H	5.78	55.96	49.03	74	54	18.04	4.97
3636	50.28	50.28	V	5.78	56.06	49.13	74	54	17.94	4.87
4545	50.36	50.36	H	7.79	58.15	51.22	74	54	15.85	2.78
4545	51.17	51.17	V	7.79	58.96	52.03	74	54	15.04	1.97
Spurious Emissions - Mid Channel										
2748	49.37	49.37	H	2.38	51.75	44.81	74	54	22.25	9.19
2748	49.27	49.27	V	2.38	51.65	44.71	74	54	22.35	9.29
3664	49.37	49.37	H	5.88	55.25	48.32	74	54	18.75	5.68
3664	49.62	49.62	V	5.88	55.50	48.57	74	54	18.50	5.43
4580	50.59	50.59	H	7.95	58.54	51.60	74	54	15.46	2.40
4580	50.00	50.00	V	7.95	57.95	51.01	74	54	16.05	2.99
Spurious Emissions - High Channel										
2765	49.90	49.90	H	2.43	52.33	45.40	74	54	21.67	8.60
2765	45.96	45.96	V	2.43	48.39	41.46	74	54	25.61	12.54
3687	49.47	49.47	H	5.97	55.44	48.50	74	54	18.56	5.50
3687	48.35	48.35	V	5.97	54.32	47.38	74	54	19.68	6.62
4609	46.93	46.93	H	8.07	55.00	48.07	74	54	19.00	5.93
4609	49.67	49.67	V	8.07	57.74	50.81	74	54	16.26	3.19

***** 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	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										
2729	48.00	48.00	H	2.31	50.31	43.38	74	54	23.69	10.62
2729	49.60	49.60	V	2.31	51.91	44.98	74	54	22.09	9.02
3638	48.60	48.60	H	5.79	54.39	47.45	74	54	19.61	6.55
3638	51.32	51.32	V	5.79	57.11	50.17	74	54	16.89	3.83
4548	47.06	47.06	H	7.81	54.87	47.93	74	54	19.13	6.07
4548	46.52	46.52	V	7.81	54.33	47.39	74	54	19.67	6.61
5458	44.97	44.97	V	11.33	56.30	49.36	74	54	17.70	4.64
Spurious Emissions - Mid Channel										
2748	47.36	47.36	H	2.38	49.74	42.80	74	54	24.26	11.20
2748	49.93	49.93	V	2.38	52.31	45.37	74	54	21.69	8.63
3664	47.28	47.28	H	5.88	53.16	46.23	74	54	20.84	7.77
3664	47.47	47.47	V	5.88	53.35	46.42	74	54	20.65	7.58
4580	46.52	46.52	H	7.95	54.47	47.53	74	54	19.53	6.47
4580	47.03	47.03	V	7.95	54.98	48.04	74	54	19.02	5.96
Spurious Emissions - High Channel										
2765	49.57	49.57	H	2.43	52.00	45.07	74	54	22.00	8.93
2765	52.92	52.92	V	2.43	55.35	48.42	74	54	18.65	5.58
3687	44.49	44.49	H	5.97	50.46	43.52	74	54	23.54	10.48
3687	46.22	46.22	V	5.97	52.19	45.25	74	54	21.81	8.75

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

7.6.3.4 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: 53.51 + 2.31 = 55.82 dBuV
Margin: 74dBuV – 55.82 dBuV = 18.18 dB

AVERAGE:
Corrected Level: 53.51 + 2.31 -6.9 = 48.89 dBuV
Margin: 54dBuV – 48.89 dBuV = 5.11 dB

8.0 CONCLUSION
In the opinion of ACS, Inc. the C3A1H, manufactured by Itron Electricity Metering Inc., meets the requirements of FCC Part 15 subpart C.