Excellence in Compliance Testing

Certification Test Report

FCC ID: R7PEG1R1S1

FCC Rule Part: 15.247

ACS Report Number 09-0075-15C-DSS

Manufacturer: Cellnet Technology, Inc.
Model(s): Gridstream Focus AX Integrated

Test Begin Date: June 19, 2009
Test End Date: July 6, 2009

Report Issue Date: October 19, 2009

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

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

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This report contains 25 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
The Gridstream Focus AX Integrated is an integrated solution with FOCUS AX advanced metering electronics the Gridstream AMR communication electronics combined together on a single PCB. It uses field-proven Digital Multiplication Measurement Technique to ensure a highly accurate load performance and dependability during the entire life of the product. It also offers a Service Disconnect option and ZigBee connectivity for HAN applications.

1.2.1 General

Manufacturer Information:
Cellnet Technology, Inc.
30000 Mill Creek Ave., Suite 100
Alpharetta, GA 30022

Test Sample Serial Number(s): 1191

Test Sample Condition:
The test samples were provided in good working order with no visible defects.

Detailed photographs of the EUT are filed separately with this filing.

1.2.2 Intended Use
The Gridstream Focus AX Integrated is an integrated and cost effective solution with metrology and the communications together on a single PCB. This product supports all the metrology features that are presently offered by the modular Focus AX design combining it with the Gridstream RF mesh technology.

1.3 Test Methodology and Considerations
This device is considered a composite device by definition. The 900 MHz LAN radio and the 2.4 GHz Zigbee radios operate under CFR 47 Part 15.247 and IC RSS-210. This report addresses the 900 MHz LAN radio only.

2.0 TEST FACILITIES

2.1 Location

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

Advanced Compliance Solutions
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

The Semi-Anechoic Chamber Test Site, Open Area Test Site (OATS) and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC, Industry Canada and the Japanese Voluntary Control Council for Interference by information technology equipment. In addition, ACS is compliant to ISO 17025 as certified by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program. The following certification numbers have been issued in recognition of these accreditations and certifications:

FCC Registration Number: 894540
Industry Canada Lab Code: IC 4175A-1
VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

NVLAP Lab Code: 200612-0

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chases from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

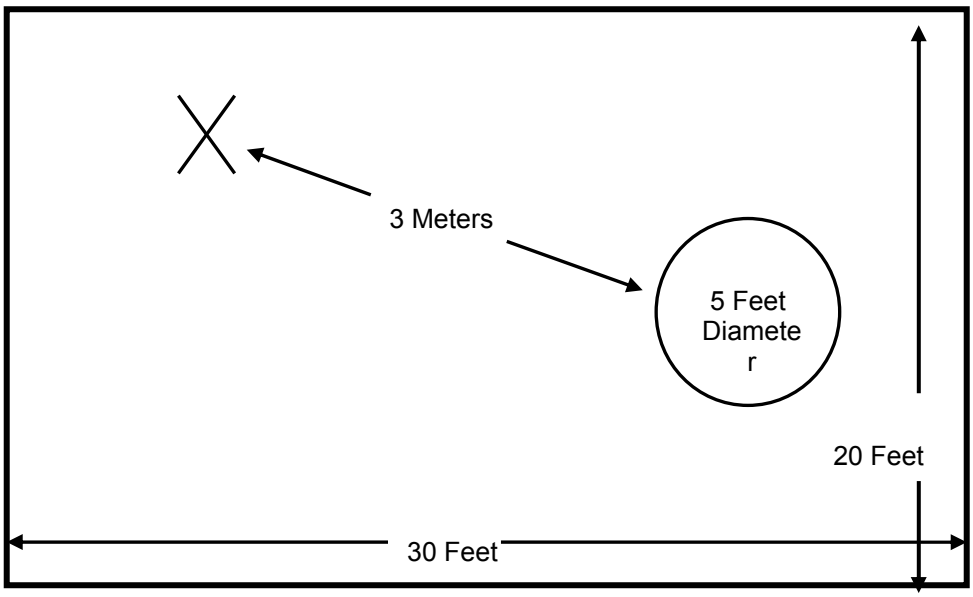

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 2.3-2 below:

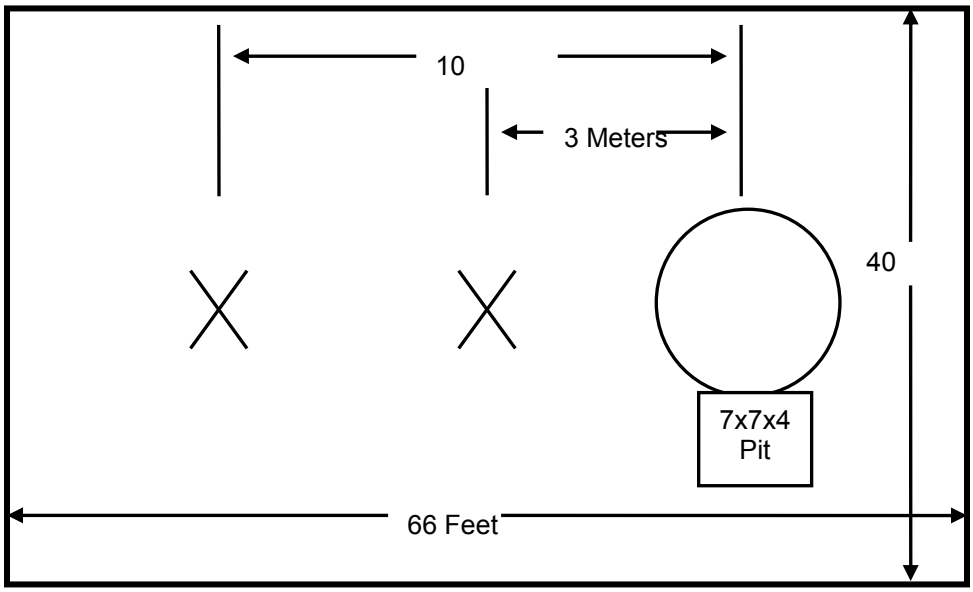

Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 8' solid aluminum horizontal group reference plane (GRP) bonded every 3" to an 8' X 8' vertical ground plane.

The site is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4.

A diagram of the room is shown below in figure 4.1.3-1:

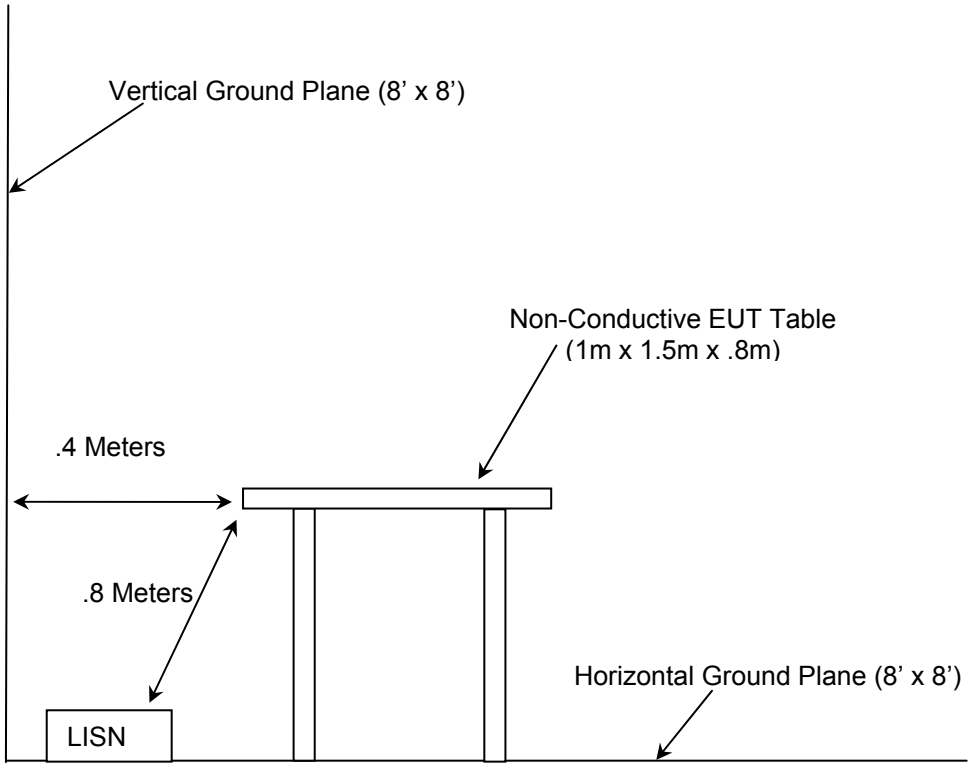

Figure 2.4-1: AC Mains Conducted EMI Site

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2009.
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2009.
- FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems, March 30, 2000

4.0 LIST OF TEST EQUIPMENT

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

Equipment Calibration Information					
ACS#	**Mfg.**	**Eq. type**	**Model**	**S/N**	**Cal. Due**
1	Rohde & Schwarz	Spectrum Analyzers	ESMI - Display	833771/007	09-19-2009
2	Rohde & Schwarz	Spectrum Analyzers	ESMI-Receiver	839587/003	09-19-2009
22	Agilent	Amplifiers	8449B	3008A00526	10-22-2009
25	Chase	Antennas	CBL6111	1043	08-22-2009
30	Spectrum Technologies	Antennas	DRH-0118	970102	05-08-2010
40	Electro-Metrics	Antennas	3104	3211	01-22-2010
152	EMCO	LISN	Feb-25	9111-1905	03-25-2010
167	ACS	Cable Set	Chamber EMI Cable Set	167	02-06-2010
168	Hewlett Packard	Attenuators	11947A	44829	02-10-2010 (See Note2)
193	ACS	Cable Set	OATS cable Set	193	01-05-2010
211	Eagle	Filters	C7RFM3NFNM	HLC-700	01-05-2010
213	TEC	Amplifiers	PA 102	44927	12-22-2009
277	Emco	Antennas	93146	9904-5199	09-09-2009
282	Microwave Circuits	Filters	H2G020G4	74541	02-04-2010 (See Note1)
283	Rohde & Schwarz	Spectrum Analyzers	FSP40	1000033	09-19-2009
291	Florida RF Cables	Cables	SMRE-200W-12.0-SMRE	None	11-24-2009 (See Note1)
292	Florida RF Cables	Cables	SMR-290AW-480.0-SMR	None	11-24-2009 (See Note1)
321	Hewlett Packard	Amplifiers	HPC 8447D	1937A02809	10-08-2009
324	ACS	Cables	Belden	8214	07-28-2009
331	Microwave Circuits	Filters	H1G513G1	31417	07-28-2009 (See Note1)
337	Microwave Circuits	Filters	H1G513G1	282706	07-17-2010 (See Note1)
338	Hewlett Packard	Amplifiers	8449B	3008A01111	10-22-2009
339	Aeroflex/Weinschel	Attenuators	AS-18	7142	07-08-2009 (See Note2)
422	Florida RF	Cables	SMS-200AW-72.0-SMR	805	02-05-2010 (See Note1)

Note1: Items characterized on an annual cycle. The date shown indicates the next characterization due date.
Note2: Items verified on an annual cycle. The date shown indicates the next verification due date.

5.0 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	Meter Base Enclosure			NA
2	EUT	Cellnet, Inc.	Gridstream Focus AX Integrated	1191
3	Transformer	Sagamo Weston	Type T-6A	325827 002

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

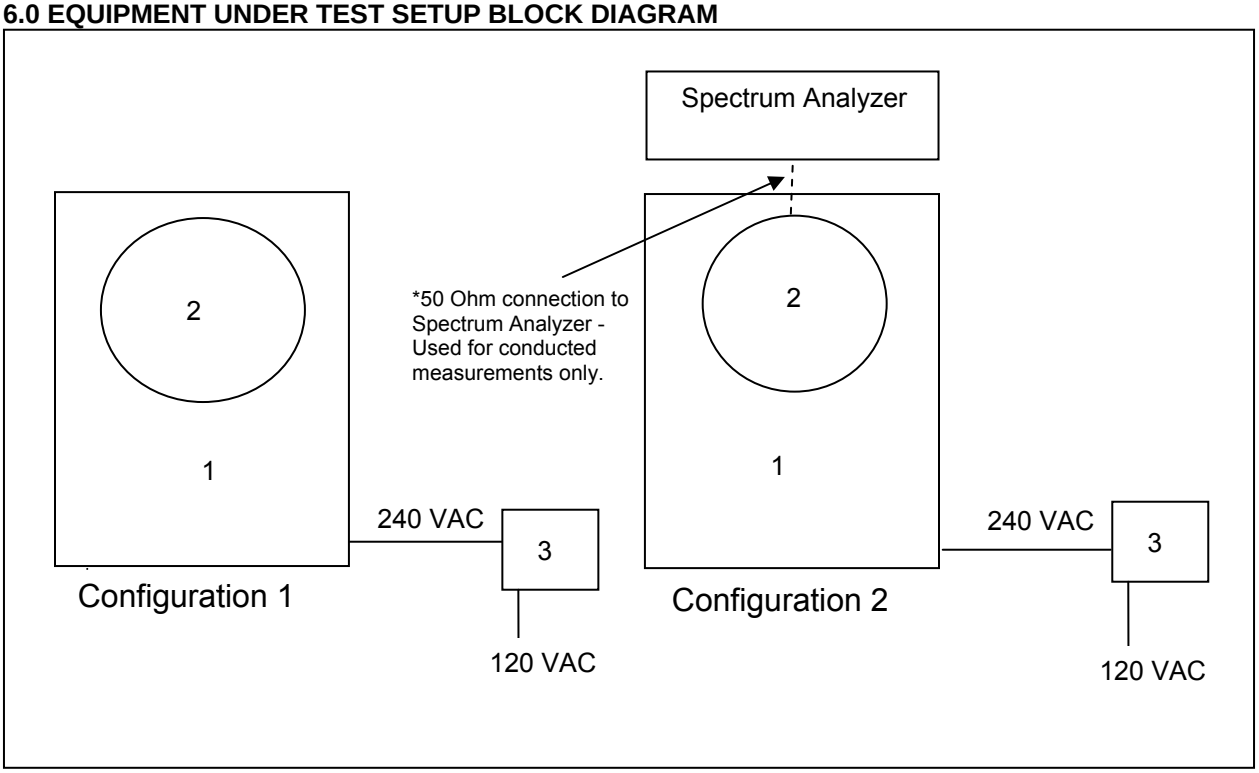

Figure 6-1: EUT Test Setup

7.0 SUMMARY OF TESTS

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

7.1 Antenna Requirement – FCC: Section 15.203

The antenna is an integrated printed Inverted F which can not be altered without destroying the device. This device is also professionally installed therefore meeting the requirements of CFR 47 Part 15.203.

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 to 7.2-8.

Table 7.2-1: Conducted EMI Results Line 1, Quasi-Peak, 240 VAC

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.270000	54.70	10.0	61	6.4	L1	FLO
0.300000	54.40	10.0	60	5.8	L1	FLO
0.756000	48.70	10.1	56	7.3	L1	FLO
0.900000	50.80	10.0	56	5.3	L1	FLO
1.524000	45.40	10.0	56	10.6	L1	FLO
1.722000	47.30	10.0	56	8.7	L1	FLO
1.956000	46.30	10.0	56	9.7	L1	FLO
2.988000	36.00	9.9	56	20.0	L1	FLO
3.204000	38.30	9.9	56	17.7	L1	FLO
3.378000	39.10	9.9	56	16.9	L1	FLO

Table 7.2-2: Conducted EMI Results Line 1, Average, 240 VAC

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.294000	36.10	10.0	50	14.3	L1	FLO
0.348000	35.50	10.0	49	13.5	L1	FLO
0.744000	25.10	10.1	46	20.9	L1	FLO
0.978000	32.30	10.0	46	13.7	L1	FLO
1.500000	23.50	10.0	46	22.5	L1	FLO
1.698000	30.90	10.0	46	15.1	L1	FLO
1.956000	28.30	10.0	46	17.7	L1	FLO
2.928000	21.20	9.9	46	24.8	L1	FLO
3.144000	18.30	9.9	46	27.7	L1	FLO
3.426000	22.10	9.9	46	23.9	L1	FLO

Table 7.2-3: Conducted EMI Results Line 2, Quasi-Peak, 240 VAC

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.294000	54.30	10.0	60	6.1	L2	FLO
0.306000	54.10	10.0	60	5.9	L2	FLO
0.726000	47.60	10.1	56	8.4	L2	FLO
0.894000	51.90	10.0	56	4.1	L2	FLO
0.906000	50.70	10.0	56	5.3	L2	FLO
1.098000	48.90	10.0	56	7.1	L2	FLO
1.512000	45.10	10.0	56	10.9	L2	FLO
1.704000	47.30	10.0	56	8.7	L2	FLO
1.734000	47.60	10.0	56	8.4	L2	FLO
1.932000	45.60	10.0	56	10.4	L2	FLO

Table 7.2-4: Conducted EMI Results Line 2, Average, 240 VAC

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.294000	36.20	10.0	50	14.2	L2	FLO
0.384000	35.10	10.1	48	13.1	L2	FLO
0.756000	25.30	10.1	46	20.7	L2	FLO
0.870000	31.00	10.0	46	15.0	L2	FLO
0.924000	32.10	10.0	46	13.9	L2	FLO
1.134000	33.80	10.0	46	12.2	L2	FLO
1.506000	23.20	10.0	46	22.8	L2	FLO
1.716000	30.00	10.0	46	16.0	L2	FLO
1.758000	30.20	10.0	46	15.8	L2	FLO
1.938000	28.90	10.0	46	17.1	L2	FLO

Table 7.2-5: Conducted EMI Results Line 1, Quasi-Peak, 120 VAC

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.192000	56.20	9.9	64	7.8	L1	GND
0.462000	52.50	10.0	57	4.2	L1	GND
0.486000	52.10	10.0	56	4.2	L1	GND
0.768000	48.20	10.1	56	7.8	L1	GND
1.176000	47.10	10.0	56	8.9	L1	GND
1.236000	47.00	10.0	56	9.0	L1	GND
1.590000	46.90	10.0	56	9.1	L1	GND
1.902000	43.50	10.0	56	12.5	L1	GND
2.004000	43.60	10.0	56	12.4	L1	GND
2.292000	42.10	10.0	56	13.9	L1	GND

Table 7.2-6: Conducted EMI Results Line 1, Average, 120 VAC

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.240000	34.80	9.9	52	17.3	L1	GND
0.462000	33.30	10.0	47	13.4	L1	GND
0.492000	33.20	10.0	46	12.9	L1	GND
0.822000	30.90	10.0	46	15.1	L1	GND
1.164000	28.30	10.0	46	17.7	L1	GND
1.242000	29.70	10.0	46	16.3	L1	GND
1.584000	28.60	10.0	46	17.4	L1	GND
1.938000	27.10	10.0	46	18.9	L1	GND
2.028000	26.40	10.0	46	19.6	L1	GND
2.292000	25.50	10.0	46	20.5	L1	GND

Table 7.2-7: Conducted EMI Results Line 2, Quasi-Peak, 120 VAC

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.192000	56.60	9.9	64	7.4	L2	GND
0.462000	52.90	10.0	57	3.7	L2	GND
0.480000	52.70	10.0	56	3.6	L2	GND
0.504000	52.10	10.0	56	3.9	L2	GND
0.828000	50.00	10.0	56	6.0	L2	GND
0.900000	48.60	10.0	56	7.4	L2	GND
1.188000	48.00	10.0	56	8.0	L2	GND
1.602000	46.50	10.0	56	9.5	L2	GND
2.028000	43.90	10.0	56	12.1	L2	GND
2.304000	44.80	10.0	56	11.2	L2	GND

Table 7.2-8: Conducted EMI Results Line 2, Average, 120 VAC

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.246000	34.80	9.9	52	17.1	L2	GND
0.456000	34.10	10.0	47	12.7	L2	GND
0.480000	34.40	10.0	46	12.0	L2	GND
0.510000	34.10	10.0	46	11.9	L2	GND
0.828000	32.00	10.0	46	14.0	L2	GND
0.912000	31.60	10.0	46	14.4	L2	GND
1.236000	30.90	10.0	46	15.1	L2	GND
1.608000	29.80	10.0	46	16.2	L2	GND
2.082000	25.50	10.0	46	20.5	L2	GND
2.280000	25.60	10.0	46	20.4	L2	GND

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 5GHz. 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 above 30MHz and below 1GHz were made with the Spectrum Analyzer's resolution bandwidth set to 120 KHz using a Quasi-peak detector. Above 1GHz, peak and average measurements are taken with the RBW and VBW were set to 1MHz and 3MHz respectively.

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)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
34.177	---------	42.47	H	-10.92	---------	31.55	--------	40.0	---------	8.45
63.85	---------	55.93	V	-20.23	---------	35.70	--------	40.0	---------	4.30
56.044	---------	51.03	V	-19.21	---------	31.82	--------	40.0	---------	8.18
80.822	---------	46.71	H	-18.59	---------	28.12	--------	40.0	---------	11.88
289.644	---------	45.32	V	-11.31	---------	34.01	--------	46.0	---------	11.99
338.661	---------	45.65	V	-9.65	---------	36.00	--------	46.0	---------	10.00

* Note: All emissions above 338.661 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 RF output port of the EUT was directly connected to the input of the spectrum analyzer. 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]
902.1	27.50
915.0	27.33
927.9	27.45

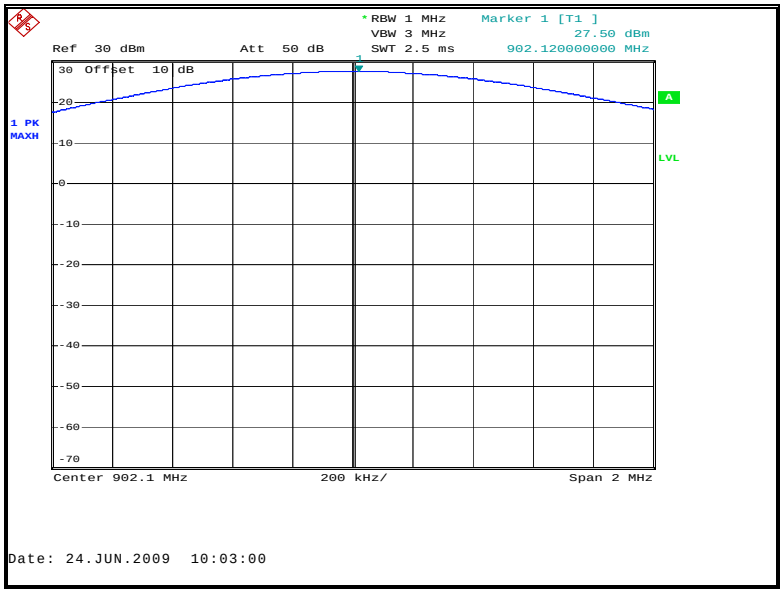

Figure 7.4-1: Output power – Low Channel

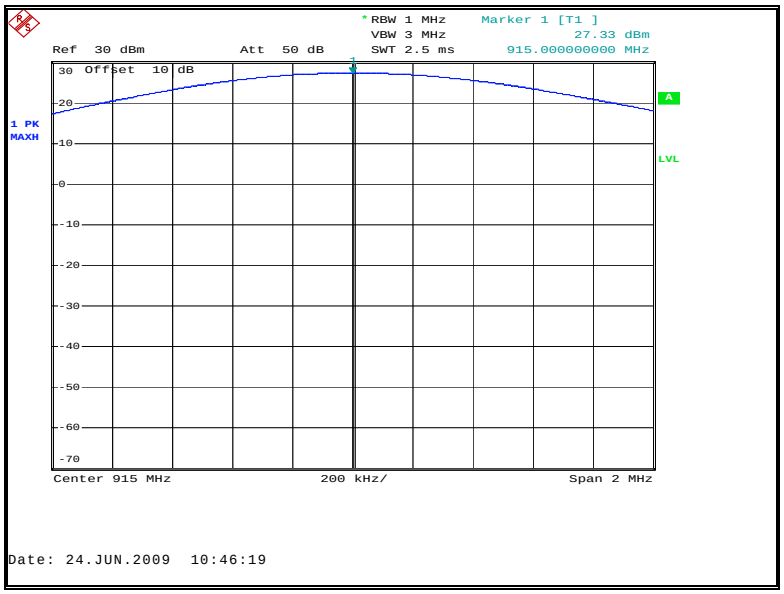

Figure 7.4-2: Output power – Mid Channel

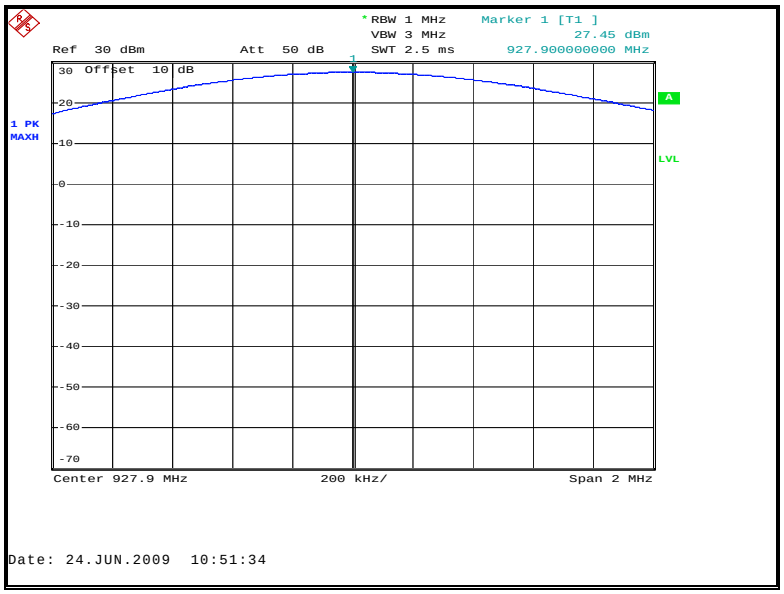

Figure 7.4-3: Output power – High Channel

7.5 Channel Usage Requirements

7.5.1 Carrier Frequency Separation – FCC: Section 15.247(a)(1)

7.5.1.1 Test Methodology

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. 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 48kHz (See figure 7.5.4-1 to 7.5.4-3 below). The adjacent channel separation was measured to be 100kHz. Results are shown in figure 7.5.1-1 below:

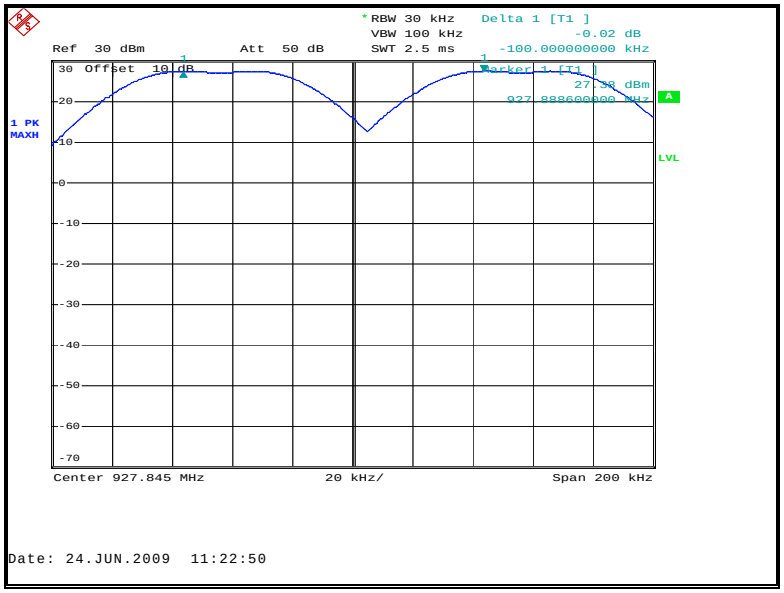

Figure 7.5.1-1: Carrier Frequency Separation

7.5.2 Number of Hopping Channels – FCC: Section 15.247(a)(1)(i)

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

Table 7.5.2-1: Number of Hopping Channels

Frequency Hopping (FHSS) - Channel Hopping Sequence									
Channel	Freq (MHz	Channel	Freq (MHz	Channel	Freq (MHz	Channel	Freq (MHz	Channel	Freq (MHz)
86	910.6	69	908.9	252	927.2	214	923.4	208	922.8
211	923.1	256	927.6	200	922	28	904.8	84	910.4
173	919.3	176	919.6	185	920.5	158	917.8	21	904.1
141	916.1	52	907.2	36	905.6	77	909.7	121	914.1
72	909.2	134	915.4	131	915.1	124	914.4	125	914.5
166	918.6	242	926.2	32	905.2	61	908.1	81	910.1
63	908.3	228	924.8	22	904.2	147	916.7	165	918.5
23	904.3	187	920.7	235	925.5	191	921.1	95	911.5
180	920	82	910.2	222	924.2	150	917	182	920.2
227	924.7	174	919.4	108	912.8	171	919.1	122	914.2
40	906	230	925	99	911.9	41	906.1	229	924.9
144	916.4	241	926.1	126	914.6	188	920.8	216	923.6
33	905.3	133	915.3	152	917.2	89	910.9	253	927.3
195	921.5	169	918.9	193	921.3	220	924	204	922.4
154	917.4	30	905	254	927.4	127	914.7	70	909
190	921	136	915.6	146	916.6	20	904	44	906.4
236	925.6	178	919.8	34	905.4	217	923.7	259	927.9
149	916.9	210	923	49	906.9	114	913.4	240	926
143	916.3	71	909.1	255	927.5	111	913.1	48	906.8
181	920.1	205	922.5	129	914.9	213	923.3	66	908.6
232	925.2	192	921.2	209	922.9	35	905.5	79	909.9
123	914.3	85	910.5	94	911.4	42	906.2	132	915.2
233	925.3	53	907.3	140	916	172	919.2	245	926.5
38	905.8	202	922.2	83	910.3	25	904.5	120	914
118	913.8	37	905.7	257	927.7	59	907.9	67	908.7
60	908	43	906.3	237	925.7	87	910.7	183	920.3
201	922.1	54	907.4	135	915.5	168	918.8	248	926.8
198	921.8	243	926.3	234	925.4	196	921.6	78	909.8
116	913.6	64	908.4	92	911.2	223	924.3	80	910
91	911.1	68	908.8	57	907.7	24	904.4	93	911.3
212	923.2	100	912	109	912.9	225	924.5	184	920.4
221	924.1	239	925.9	249	926.9	103	912.3	74	909.4
96	911.6	29	904.9	215	923.5	151	917.1	153	917.3
157	917.7	177	919.7	179	919.9	203	922.3	65	908.5
247	926.7	139	915.9	258	927.8	197	921.7	159	917.9
167	918.7	117	913.7	186	920.6	219	923.9	142	916.2
224	924.4	148	916.8	244	926.4	97	911.7	58	907.8
246	926.6	75	909.5	189	920.9	51	907.1	164	918.4
238	925.8	206	922.6	31	905.1	98	911.8	163	918.3
46	906.6	226	924.6	73	909.3	45	906.5	90	911
39	905.9	155	917.5	130	915	156	917.6	106	912.6
251	927.1	47	906.7	194	921.4	101	912.1	145	916.5
115	913.5	62	908.2	162	918.2	50	907	76	909.6
128	914.8	138	915.8	119	913.9	27	904.7	199	921.9
110	913	231	925.1	107	912.7	207	922.7		
160	918	113	913.3	88	910.8	250	927		
56	907.6	137	915.7	175	919.5	102	912.2		
26	904.6	55	907.5	170	919	112	913.2		
161	918.1	105	912.5	218	923.8	104	912.4		

7.5.3 Channel Dwell Time – FCC: Section 15.247(a)(1)(i)

The maximum duration of the RF transmission is 364ms during a 700ms channel dwell time. There is a minimum of 50 channels used during the hopping sequence therefore a channel will not be re-occupied until at least 35s. Therefore the average time of occupancy on any one channel in a 20 second period is 364ms.

A detailed description of the RF timing and a timing diagram are included in the theory of operation.

7.5.4 20dB Bandwidth - FCC: Section 15.247(a)(1)(i)

7.5.4.1 Test Methodology

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The spectrum analyzer span was set to 2 to 3 times the estimated bandwidth of the emission. The RBW was to ≥ 1% of the estimated emission bandwidth. The trace was set to max hold with a peak detector active. The Delta function of the analyzer was utilized to determine the 20 dB bandwidth of the emission.

7.5.4.2 Test Results

The maximum 20dB bandwidth was found to be approximately 48kHz. Results are shown below in Table 7.5.4-1 and Figures 7.5.4-1 through 7.5.4-3.

Table 7.5.4-1: 20dB Bandwidth

Frequency [MHz]	20dB Bandwidth [kHz]
902.1	47.6
915	47.8
927.9	48.0

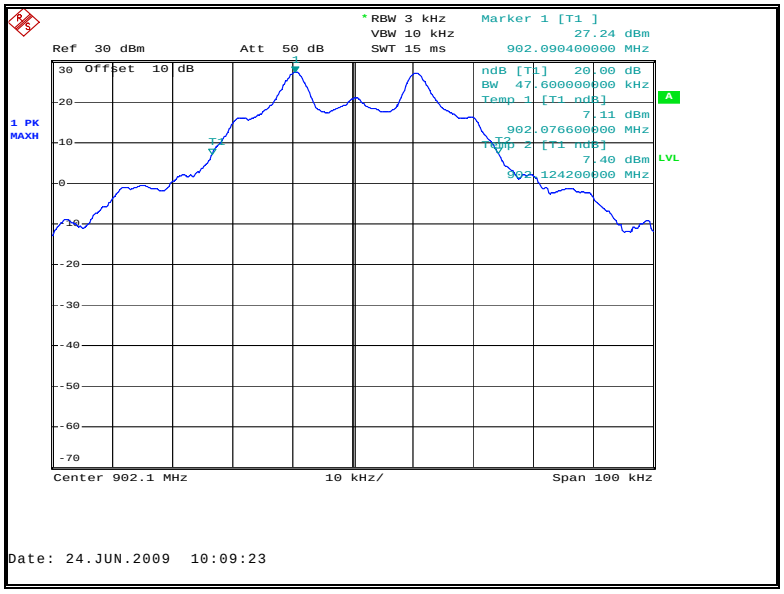

Figure 7.5.4-1: 20dB Bandwidth Low Channel

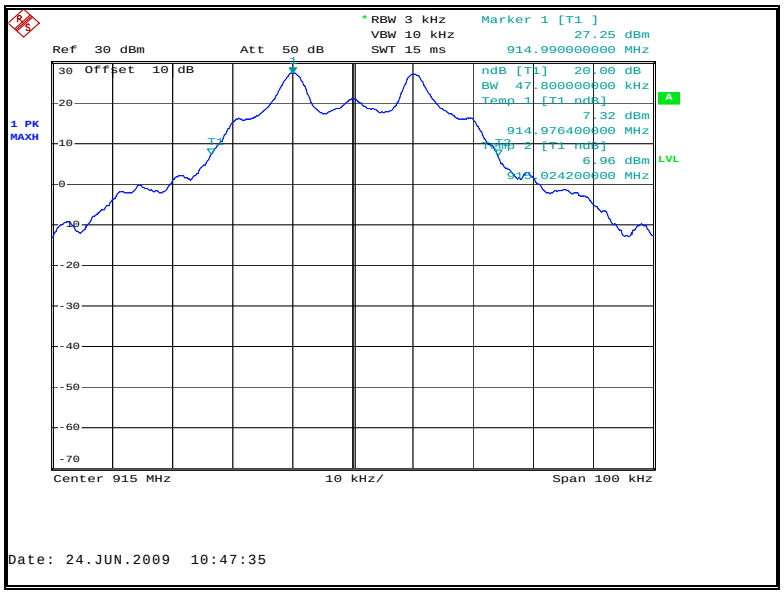

Figure 7.5.4-2: 20dB Bandwidth Mid Channel

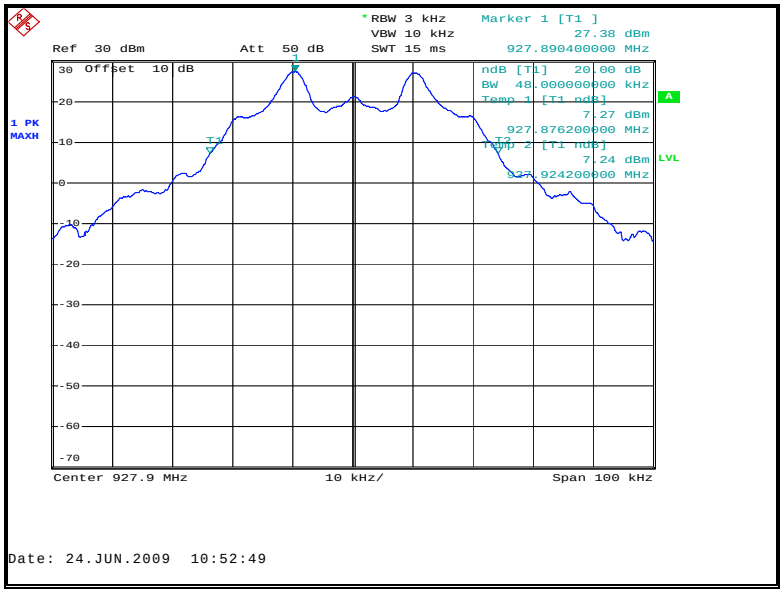

Figure 7.5.4-3: 20dB Bandwidth High Channel

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

7.6.1 Band-Edge Compliance of RF Conducted Emissions

7.6.1.1 Test Methodology

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. 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 30 kHz, which is ≥ 1% of the span, and the VBW was set to 100kHz.

7.6.1.2 Test Results

Band-edge compliance is displayed in Figures 7.6.1-1 and 7.6.2-4

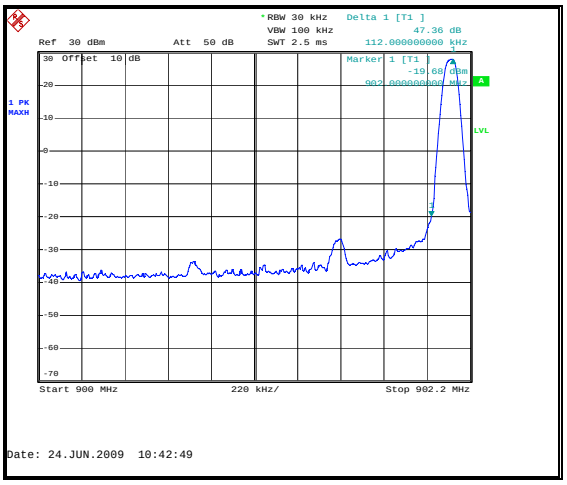

Figure 7.6.1-1: Lower Band-edge

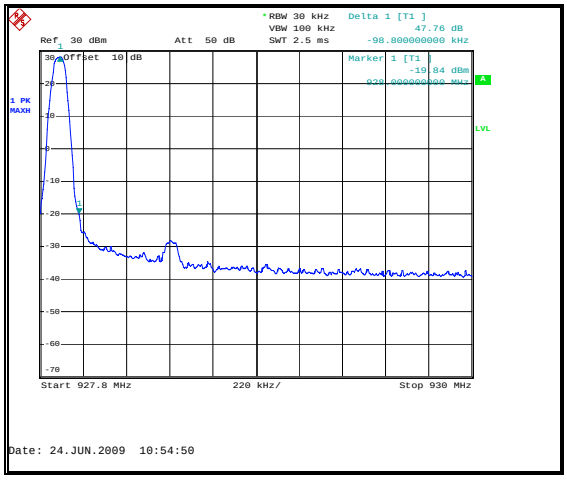

Figure 7.6.1-2: Upper Band-edge

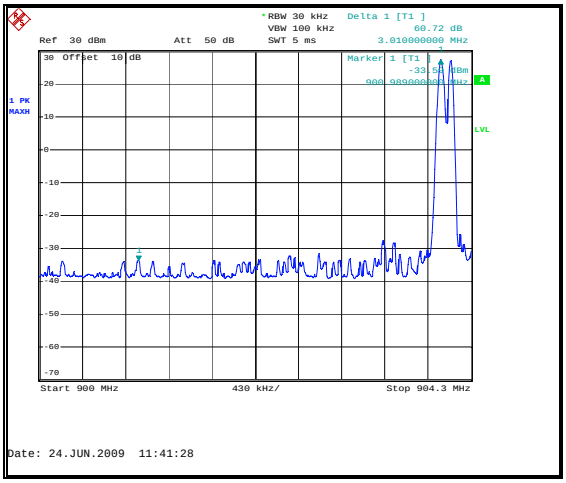

Figure 7.6.1-3: Lower Band-edge - Hopping

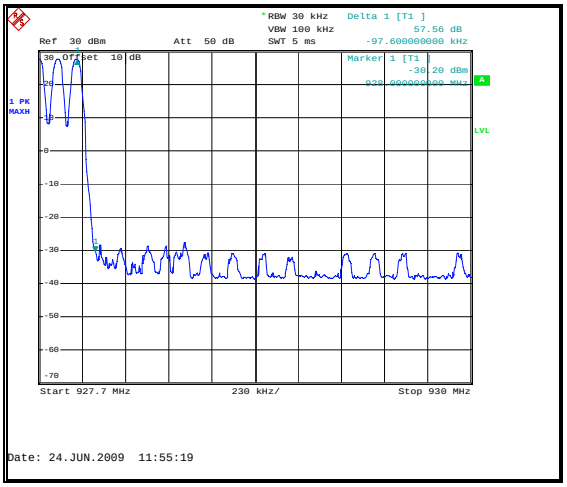

Figure 7.6.1-4: Upper Band-edge - Hopping

7.6.2 RF Conducted Spurious Emissions

7.6.2.1 Test Methodology

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. 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.

7.6.2.2 Test Results

All emissions 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.

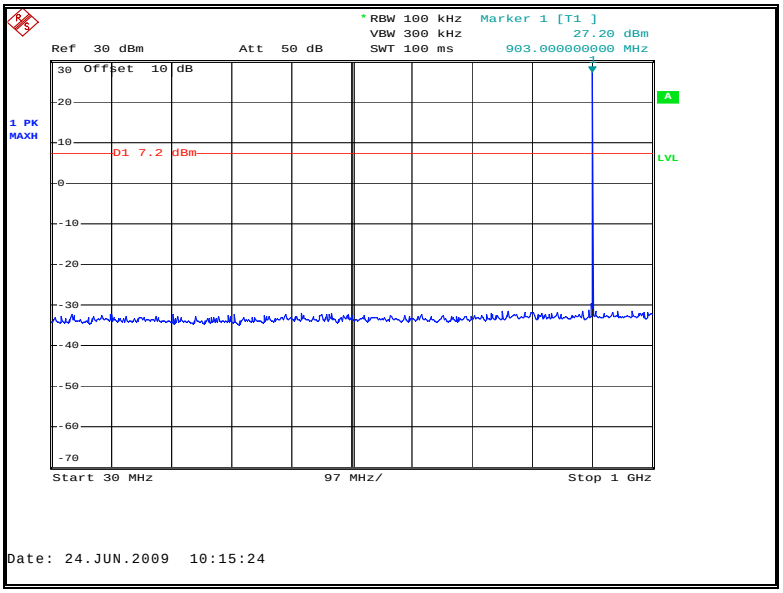

Figure 7.6.2.2-1: 30 MHz – 1 GHz – Low Channel

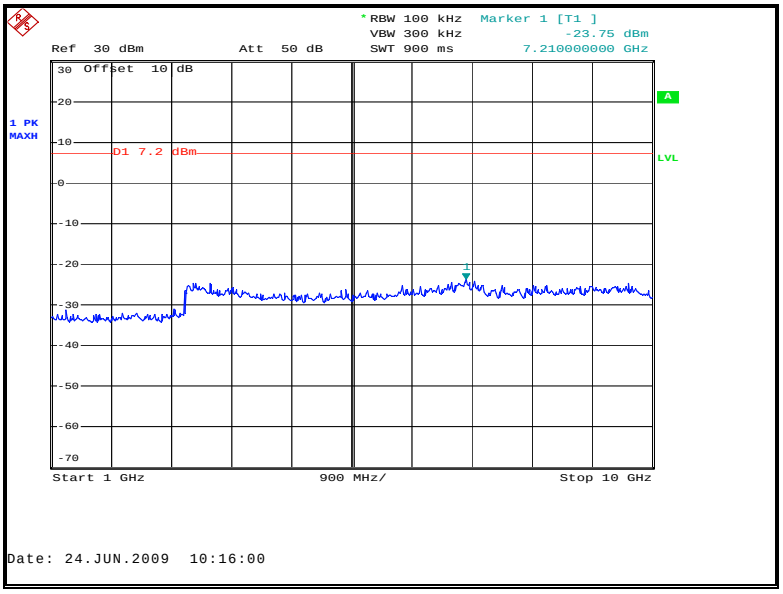

Figure 7.6.2.2-2: 1 GHz – 10 GHz – Low Channel

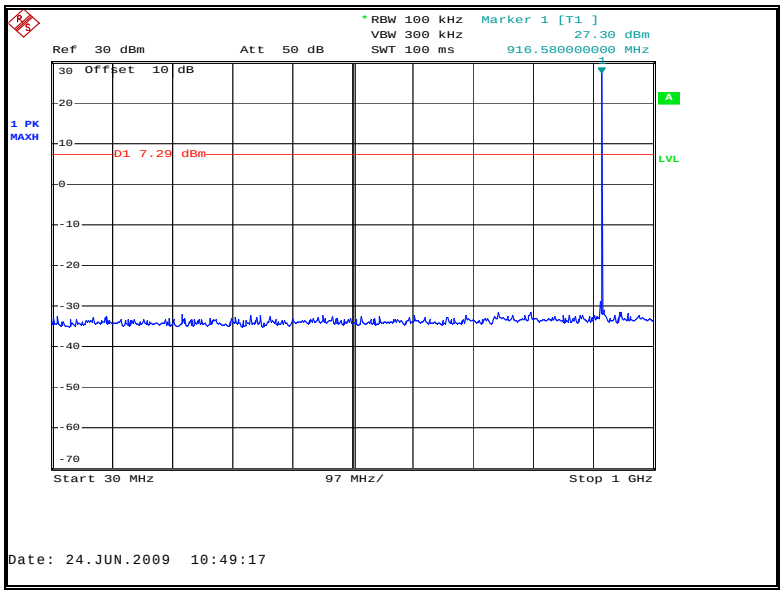

Figure 7.6.2.2-3: 30 MHz – 1 GHz –Mid Channel

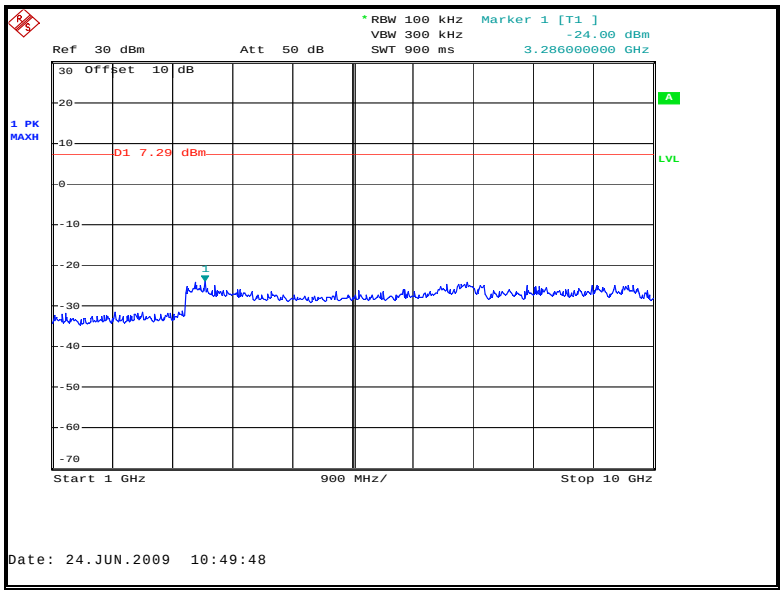

Figure 7.6.2.2-4: 1 GHz – 10 GHz – Mid Channel

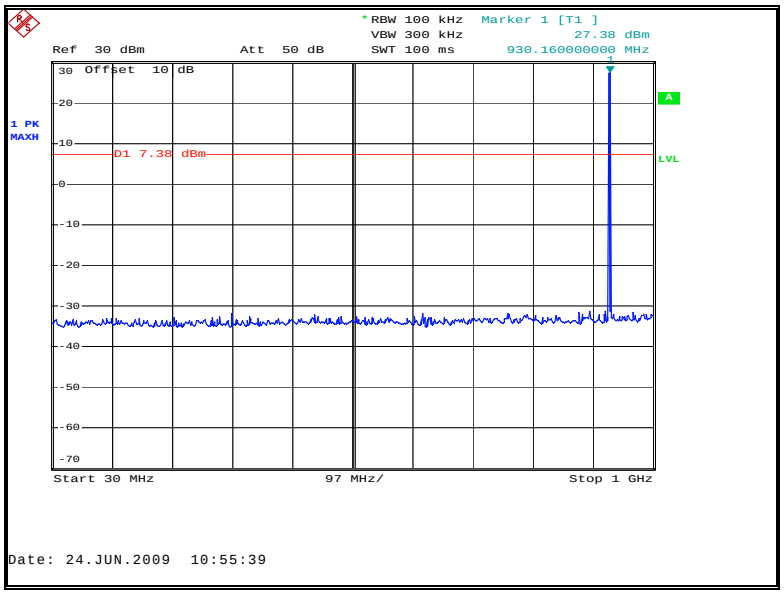

Figure 7.6.2.2-5: 30 MHz – 1 GHz – High Channel

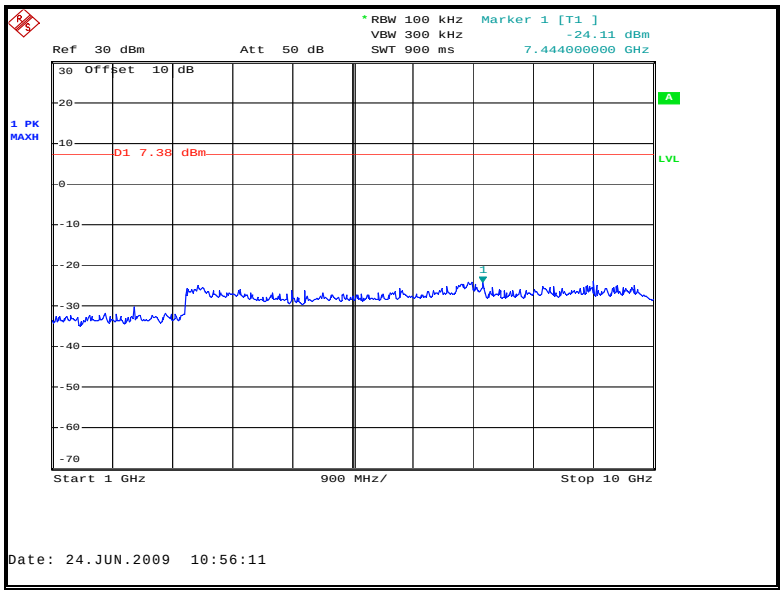

Figure 7.6.2.2-6: 1 GHz – 10 GHz –High Channel

7.6.3 Radiated Spurious Emissions - 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, peak and average measurements made with RBW and VBW of 1 MHz and 3MHz respectively.

The EUT was caused to generate a continuous modulated carrier.

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

7.6.3.2 Test Results

Radiated spurious emissions found in the band of 30MHz to 10GHz are reported in Table 7.6.2-1.

Table 7.6.2-1: Radiated Spurious Emissions

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel										
2706.3	54.45	45.72	H	-3.27	51.18	42.45	74.0	54.0	22.82	11.55
2706.3	54.83	48.49	V	-3.15	51.68	45.34	74.0	54.0	22.32	8.66
3608.4	52.11	37.62	V	-0.85	51.26	36.77	74.0	54.0	22.74	17.23
4510.5	52.95	41.20	H	1.40	54.35	42.60	74.0	54.0	19.65	11.40
4510.5	52.74	39.12	V	1.51	54.25	40.63	74.0	54.0	19.75	13.37
5412.6	52.67	38.00	H	3.76	56.43	41.76	74.0	54.0	17.57	12.24
5412.6	52.62	36.71	V	4.00	56.62	40.71	74.0	54.0	17.38	13.29
9021	51.98	39.22	H	9.96	61.94	49.18	74.0	54.0	12.06	4.82
9021	51.53	35.66	V	9.85	61.38	45.51	74.0	54.0	12.62	8.49
Middle Channel										
2745	54.12	42.01	H	-3.13	50.99	38.88	74.0	54.0	23.01	15.12
2745	55.82	50.82	V	-3.03	52.79	47.79	74.0	54.0	21.21	6.21
3660	52.44	36.91	H	-0.59	51.85	36.32	74.0	54.0	22.15	17.68
4575	53.07	43.43	H	1.66	54.73	45.09	74.0	54.0	19.27	8.91
4575	53.25	39.70	V	1.80	55.05	41.50	74.0	54.0	18.95	12.50
9150	51.80	40.51	H	10.05	61.85	50.56	74.0	54.0	12.15	3.44
9150	52.57	37.49	V	9.92	62.49	47.41	74.0	54.0	11.51	6.59
High Channel										
2783.7	55.59	51.79	H	-3.00	52.59	48.79	74.0	54.0	21.41	5.21
2783.7	57.19	52.40	V	-2.92	54.27	49.48	74.0	54.0	19.73	4.52
3711.6	52.85	41.15	H	-0.30	52.55	40.85	74.0	54.0	21.45	13.15
3711.6	52.41	38.56	V	-0.26	52.15	38.30	74.0	54.0	21.85	15.70
4639.5	53.33	41.33	H	1.91	55.24	43.24	74.0	54.0	18.76	10.76
4639.5	53.63	39.98	V	2.09	55.72	42.07	74.0	54.0	18.28	11.93
8351.1	51.09	35.71	H	9.16	60.25	44.87	74.0	54.0	13.75	9.13

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: 54.45+ -3.27 = 51.18dBuV/m
Margin: 74dBuV/m – 51.18dBuV/m = 22.82dB

Example Calculation: Average
Corrected Level: 45.72+ -3.27 - 0= 42.45dBuV
Margin: 54dBuV – 42.45dBuV = 11.55dB

8.0 CONCLUSION
In the opinion of ACS, Inc. the Gridstream Focus AX Integrated, manufactured by Cellnet Technology, Inc. meets the requirements of FCC Part 15 subpart C..

END REPORT