FCC Part 15.247
Transmitter Certification

Frequency Hopping Spread Spectrum Transmitter

Test Report

FCC ID: R7PIWRP1

FCC Rule Part: 15.247

ACS Report Number: 06-0394-15C

Manufacturer: Cellnet Technology, Inc.
Model: Utilinet PCMCIA Radio

Test Begin Date: October 11, 2006
Test End Date: January 30, 2007

Report Issue Date: February 19, 2007

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 23 pages

Table of Contents

Additional Exhibits Included In Filing

Internal Photographs
External Photographs
Test Setup Photographs
Product Labeling
RF Exposure – MPE Calculations
Installation/Users Guide
Theory of Operation
BOM (Parts List)
System Block Diagram
Schematics

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 UtiliNet PCMCIA IWR Card is Cellnet's latest embedded communication module product targeting advanced RF communications for residential metering needs. The UtiliNet PCMCIA is designed to be used for two primary applications:

- In conjunction with a Laptop Computer, appropriate drivers and Radio Shop or other Cellnet software products to monitor or configure UtiliNet networks.
- In conjunction with a handheld computer, appropriate drivers and Endpoint Implementation Manager as a meter installation tool.

General	Specification
Number of Channels (max)	259
Channel Spacing	100 KHz
Modulation Type	Direct 2-FSK
Baud Rate	9600
FCC Operation	Part 15.247 Spread Spectrum
Spreading Technique	Frequency Hopping
Hopping Technique	Pseudo Random Asynchronous
Hopping Patterns	65,536 (Unique per network)
Turn-Around Time	100[uS] max

Manufacturer Information:
Cellnet
30000 Mill Creek Avenue
Suite 100
Alpharetta, GA 30022
USA

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

1.2.2 Intended Use
The UtiliNet PCMCIA Card is used for Network monitoring and Endpoint installations.

1.3 Test Methodology and Considerations
The UtiliNet PCMCIA is designed to be used for two primary applications (hosts) by the manufacturer as stated in section 1.2.1. Testing was performed with the module in those specific applications/hosts that represent the final configurations. The representative host devices used for testing are detailed as follows:

Handheld Computer Terminal:
Manufacturer: DAP
Model: MicroFlex CE5320
S/N: FW01824
FCC ID: NA

Laptop Computer:
Manufacturer: DELL
Model: Latitude D620
S/N: 43253504029
FCC ID: E2KWM3945ABG

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: 200612-0

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:

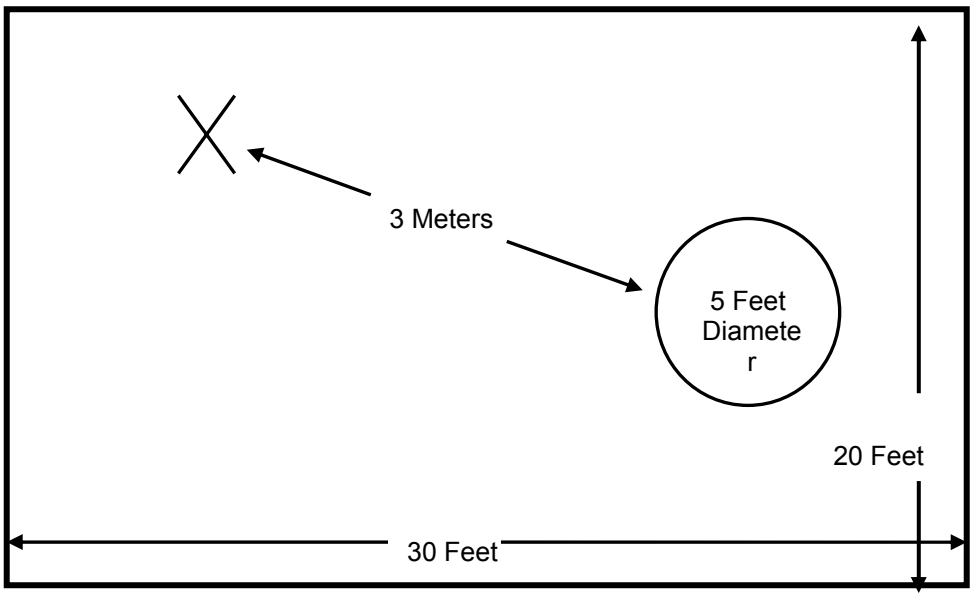

Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

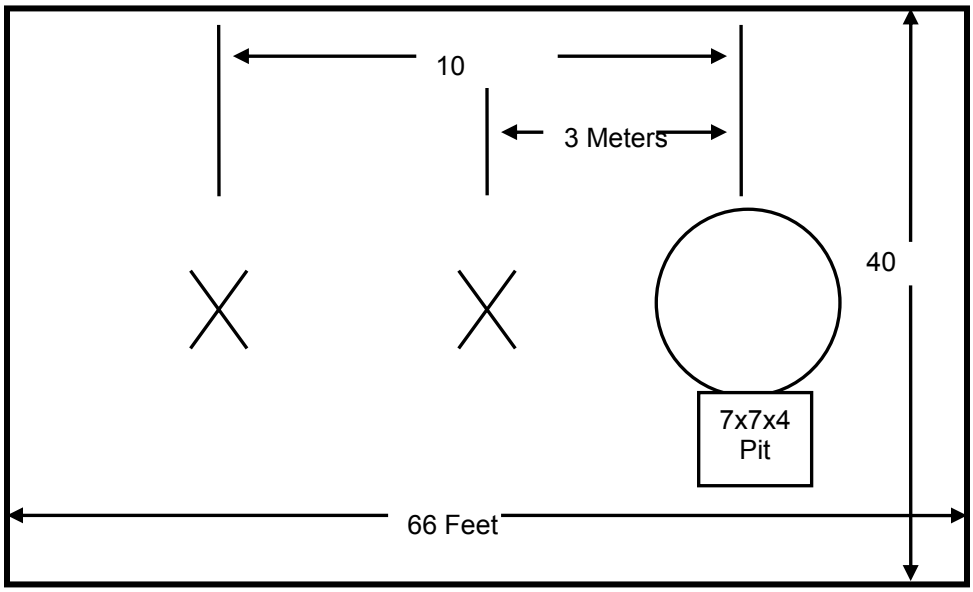

Figure 2.3-2: Open Area Test Site

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:

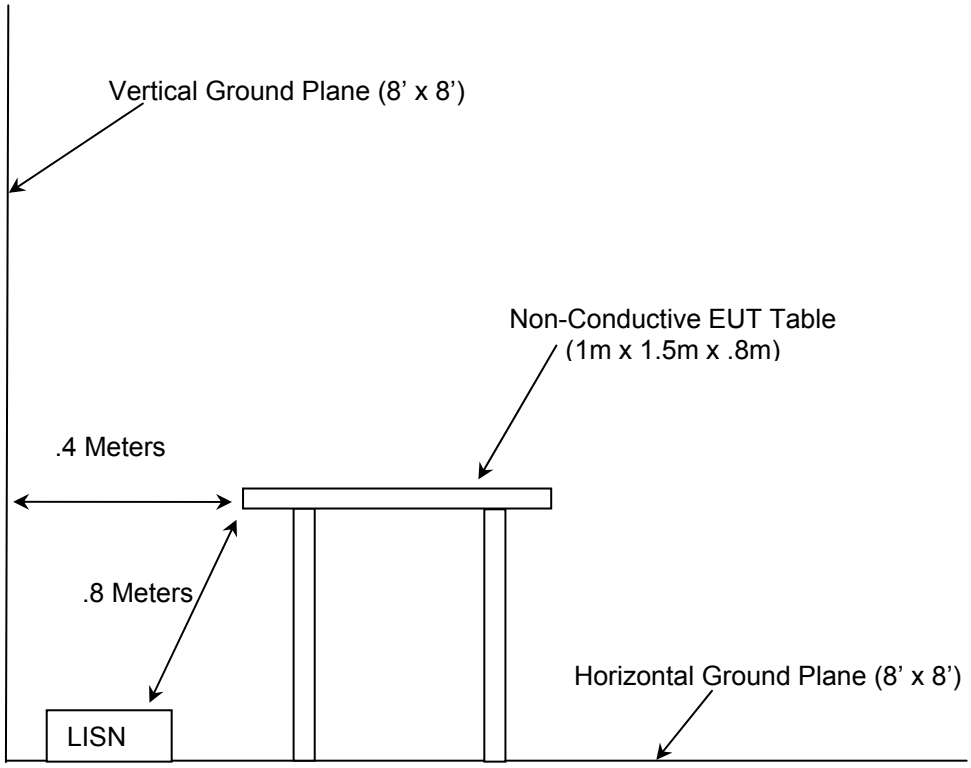

Figure 2.4-1: AC Mains Conducted EMI Site

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, 2006
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2006
- FCC OET Bulletin 65 Appendix C - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, 2001
- FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems, March 30, 2000

4.0 LIST OF TEST EQUIPMENT

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

Table 4.0-1: Test Equipment

Equipment Calibration Information					
ACS #	**Mfg.**	**Model**	**S/N**	**Equipment Type**	**Cal. Due**
1	Rohde & Schwarz	ESMI - Display	833771/007	Spectrum Analyzers	01-Mar-07
2	Rohde & Schwarz	ESMI-Receiver	839587/003	Spectrum Analyzers	01-Mar-07
22	Agilent	8449B	3008A00526	Amplifiers	07-Apr-07
25	Chase	CBL6111	1043	Antennas	30-May-07
30	Spectrum Technologies	DRH-0118	970102	Antennas	09-May-07
40	EMCO	3104	3211	Antennas	02-Jan-08
41	Electro-Metrics	BIA-25	2925	Antennas	16-May-07
73	Agilent	8447D	2727A05624	Amplifiers	10-May-07
78	EMCO	6502	9104-2608	Antennas	15-Jan-08
90	Electro-Metrics	LPA25	1476	Antennas	17-May-07
167	ACS	Chamber EMI Cable Set	167	Cables	05-Jan-08
193	ACS	OATS cable Set	0193	Cable Set	16-Feb-08
211	Eagle	C7RFM3NFNM	HLC-700	Filters	08-Jan-08
213	TEC	PA 102	44927	Amplifiers	28-Feb-07
253	Florid RF Labs	Lab-Flex 290	253	Cables	01-Aug-07
283	Rohde & Schwarz	FSP40	1000033	Spectrum Analyzers	24-Mar-07
290	Florida RF Cables	SMSE-200-72.0-SMRE	None	Cables	03-May-07
291	Florida RF Cables	SMRE-200W-12.0-SMRE	None	Cables	03-May-07
292	Florida RF Cables	SMR-290AW-480.0-SMR	None	Cables	24-May-07
329	A.H.Systems	SAS-571	721	Antennas	24-Aug-07
331	Microwave Circuits	H1G513G1	31417	Filters	29-Aug-07
338	Hewlett Packard	8449B	3008A01111	Amplifiers	26-Sep-07
343	Florida RF Cables	SMRE-200W-12.0-SMRE	N/A	Cables	01-Sep-07
344	Florida RF Cables	SMS-290AW-480.0-SMR	N/A	Cables	01-Sep-07

5.0 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number	FCC ID
1	Laptop Computer	DELL	Latitude D620	43253504029	E2KWM3945ABG
2	Handheld computer	DAP	MicroFlex CE5320	FW01824	NA

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

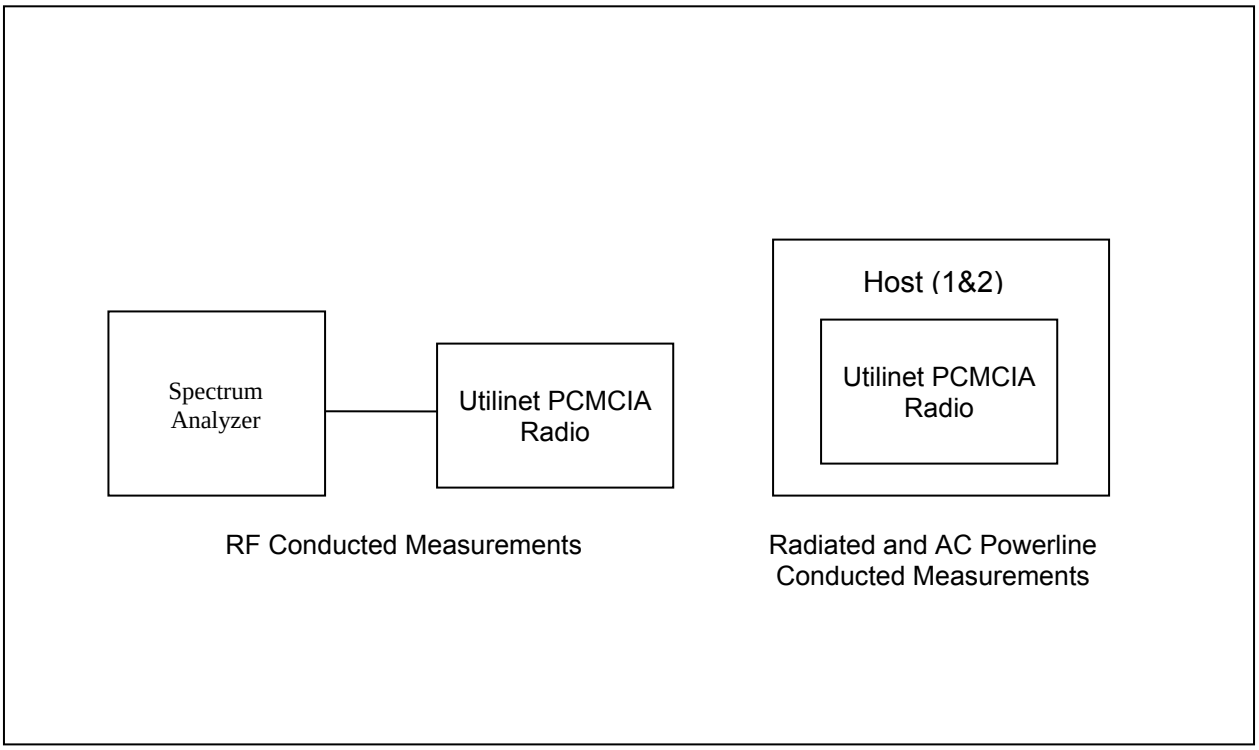

Figure 6-1: EUT Test Setup

The EUT was integrated into each representative host for the purpose of radiated emissions. For the RF conducted measurements the Utilinet PCMCIA Radio was modified with a temporary 50 Ohm antenna connector. Measurements were made by direct connection to a spectrum analyzer.

*See Test Setup photographs for additional detail.

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 Utilinet PCMCIA Radio uses an integrated "Bent Monopole" PCB trace antenna. This antenna has a gain of -1dBi.

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 Table 7.2-1.

Table 7.2-1: Conducted EMI Results

Frequency (MHz)	Uncorrected Reading (dBuV)		Total Correction Factor (dB)	Corrected Level (dBuV)		Limit (dBuV)		Margin (dB)	
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
Line 1									
0.17	40.3	25.5	9.80	50.10	35.30	64.96	54.96	14.9	19.7
0.22	33.2	20.9	9.80	43.00	30.70	62.82	52.82	19.8	22.1
2.13	19.6	21.5	9.80	29.40	31.30	56.00	46.00	26.6	14.7
3.81	30.4	19.8	9.80	40.20	29.60	56.00	46.00	15.8	16.4
4.15	20.1	9.8	9.80	29.90	19.60	56.00	46.00	26.1	26.4
9.68	23.3	19.1	9.91	33.21	29.01	60.00	50.00	26.8	21.0
26.94	14.5	7.8	10.12	24.62	17.92	60.00	50.00	35.4	32.1
Line 2									
0.15	38.6	14.7	9.80	48.40	24.50	66.00	56.00	17.6	31.5
0.33	21.3	12.2	9.80	31.10	22.00	59.45	49.45	28.4	27.5
0.5	17.6	7.1	9.80	27.40	16.90	56.00	46.00	28.6	29.1
2.17	18.8	10.9	9.80	28.60	20.70	56.00	46.00	27.4	25.3
3.67	27.1	9.8	9.80	36.90	19.60	56.00	46.00	19.1	26.4
5.23	25.9	9.5	9.80	35.70	19.30	60.00	50.00	24.3	30.7
9.51	19.1	6.7	9.91	29.01	16.61	60.00	50.00	31.0	33.4

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 5 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)	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
30		44.97	V	-8.50	---------	36.47	--------	40.0	---------	3.53
48.32		51.98	V	-17.36	---------	34.62	--------	40.0	---------	5.38
83.88		55.74	H	-17.80	---------	37.94	--------	40.0	---------	2.06
100.05		56.07	V	-13.80	---------	42.28	--------	43.5	---------	1.23
125.92		46.42	V	-13.08	---------	33.34	--------	43.5	---------	10.16
300.52		52.99	H	-10.29	---------	42.70	--------	46.0	---------	3.30
400.75		38.44	V	-8.07	---------	30.37	--------	46.0	---------	15.63
500.98		45.09	V	-5.88	---------	39.21	--------	46.0	---------	6.79
566.73		48.32	V	-4.23	---------	44.09	--------	46.0	---------	1.91
800.61		44.41	V	-0.48	---------	43.93	--------	46.0	---------	2.07
1001	49.11	33.77	V	-5.47	43.64	28.30	74.0	54.0	30.36	25.70
1034	48.68	37.05	V	-5.23	43.45	31.82	74.0	54.0	30.55	22.18
1067	45.86	33.47	V	-4.99	40.87	28.48	74.0	54.0	33.13	25.52
1101	50.68	38.47	V	-4.74	45.94	33.73	74.0	54.0	28.06	20.27
1166	45.73	33.26	V	-4.27	41.46	28.99	74.0	54.0	32.54	25.01
1201	48.07	45.12	V	-4.02	44.05	41.10	74.0	54.0	29.95	12.90
1333	50.30	37.73	V	-3.06	47.24	34.67	74.0	54.0	26.76	19.33
1232	47.99	35.78	V	-3.79	44.20	31.99	74.0	54.0	29.80	22.01
1443	49.89	45.27	V	-2.25	47.64	43.02	74.0	54.0	26.36	10.98

* Note: All emissions above 1443 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]
902.1	12.39
915.0	11.93
927.9	11.88

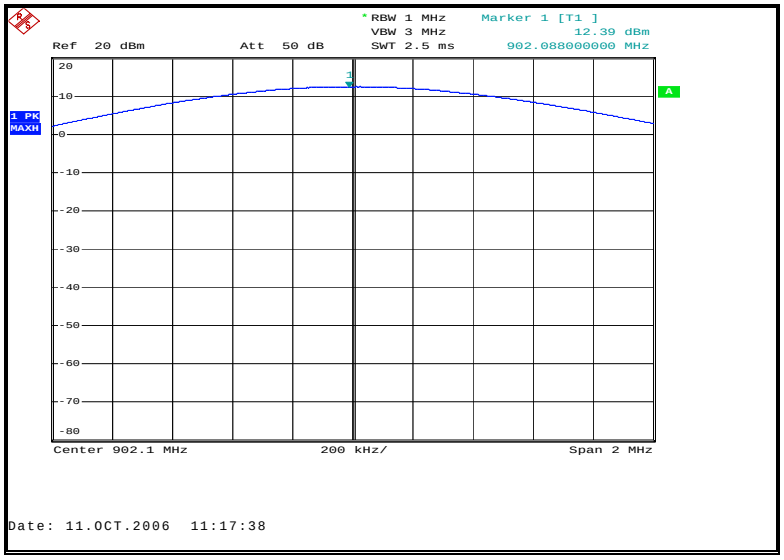

Figure 7.4-1: Output power – Low Channel

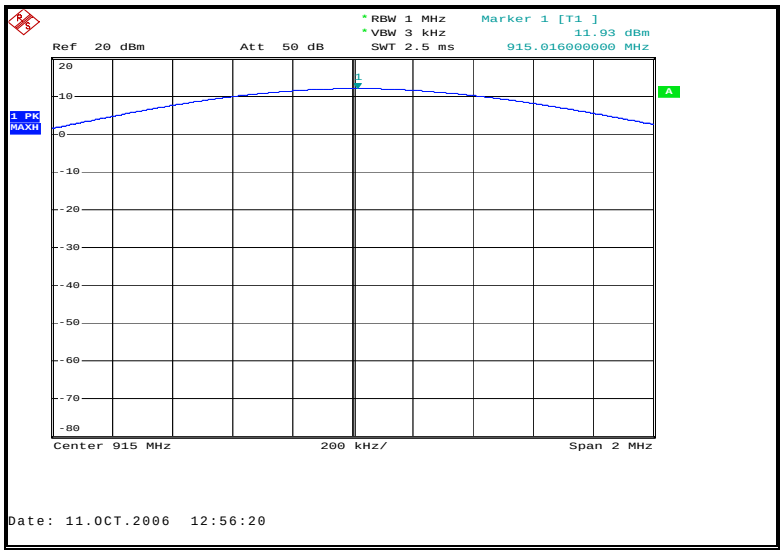

Figure 7.4-2: Output power – Mid Channel

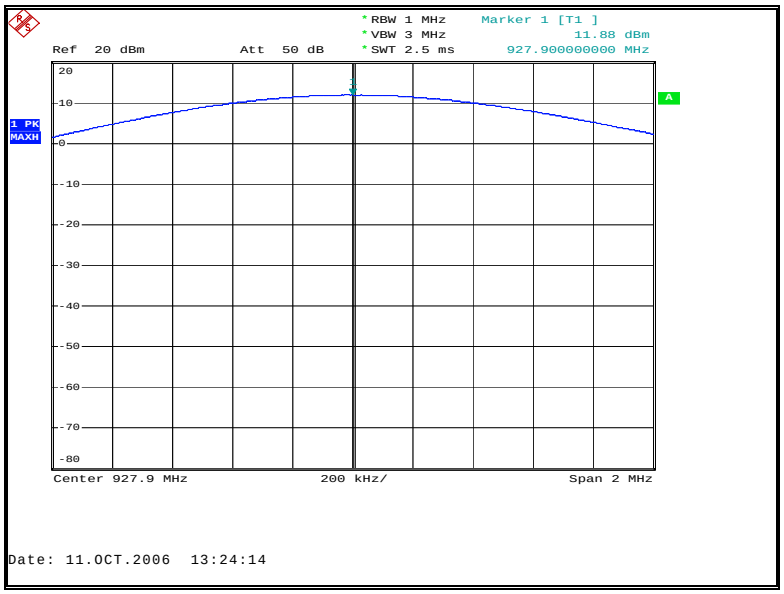

Figure 7.4-3: Output power – High Channel

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 29.7kHz (See figure 7.5.4-1 to 7.5.4-3). The adjacent channel separation was measured to be 102.7kHz. Results are shown in figure 7.5.1-1 below:

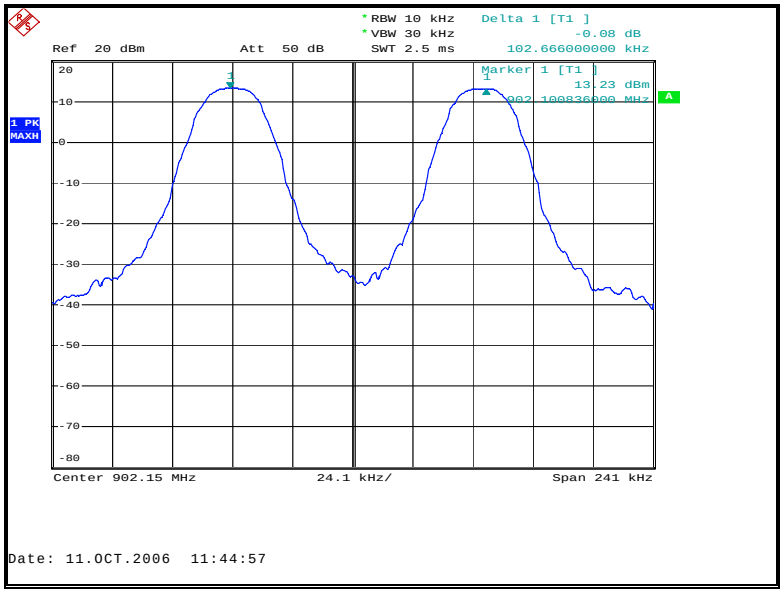

Figure 7.5.1-1: Carrier Frequency Separation

7.5.2 Number of Hopping Channels

The 20dB bandwidth of the device is less than 250 kHz. The device employs a minimum of 50 hopping channels as required. A sample Frequency Hopping table is shown in Table 7.5.2-1 below:

Table 7.5.2-1: Channel Hopping Sequence

UtiliNet 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

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

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 Delta 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 29.7kHz. 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

Frequency (MHz)	20dB Bandwidth (kHz)
902.1	27.7
915	25.4
927.9	29.7

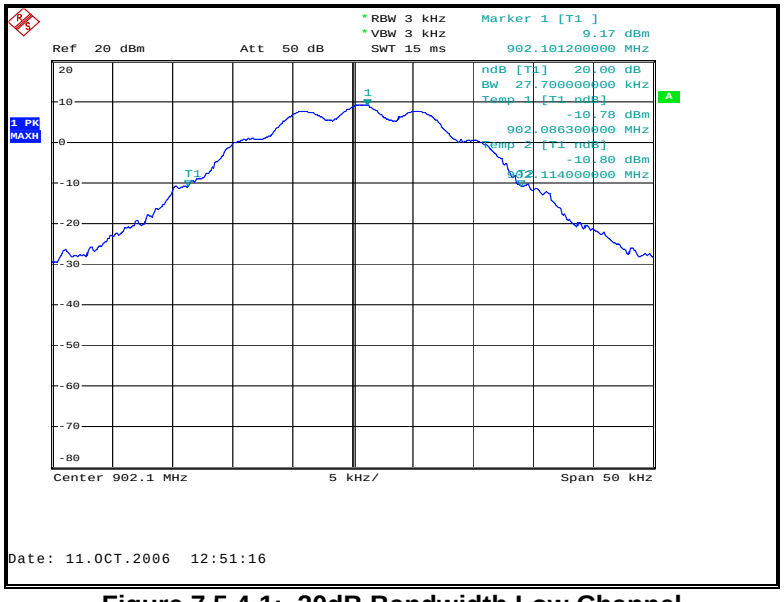

Figure 7.5.4-1: 20dB Bandwidth Low Channel

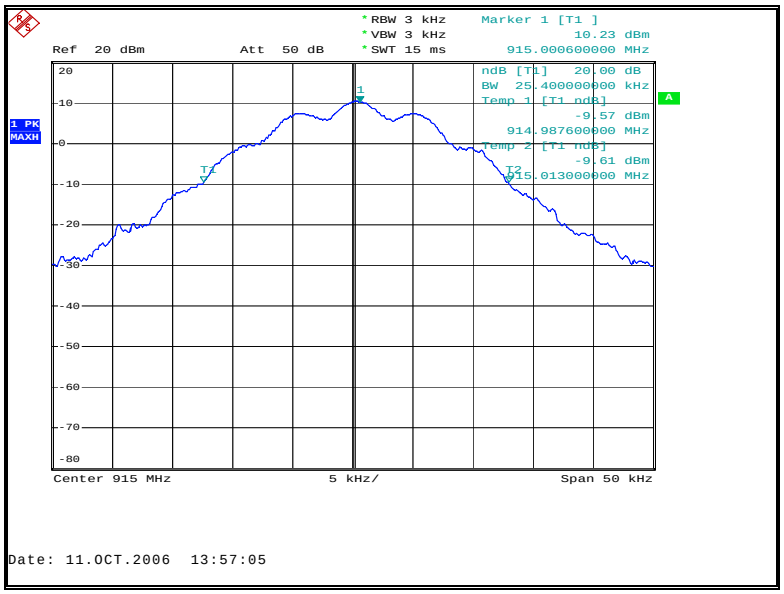

Figure 7.5.4-2: 20dB Bandwidth Mid Channel

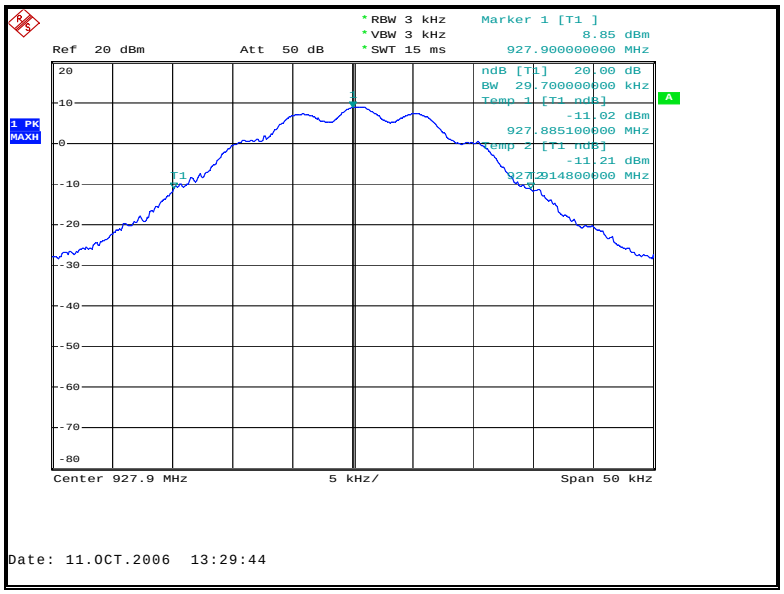

Figure 7.5.4-3: 20dB Bandwidth High Channel

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 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 7.6.2-2

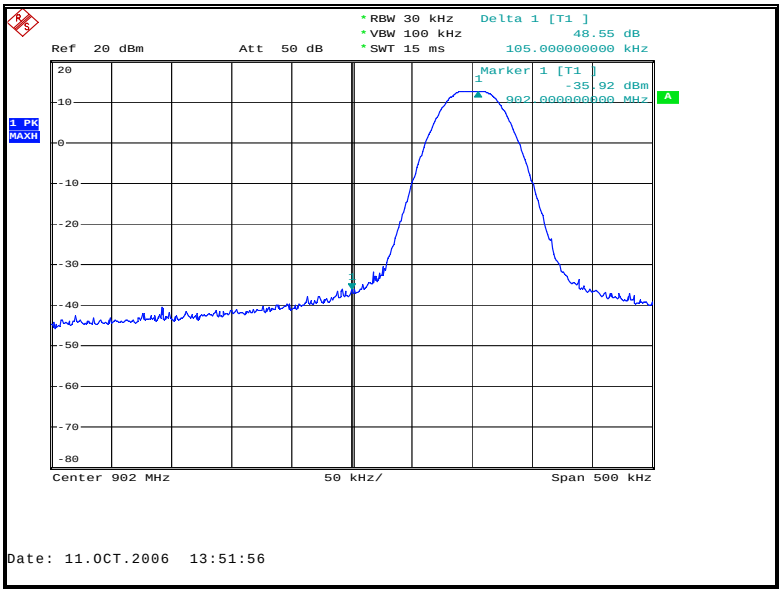

Figure 7.6.1-1: Lower Band-edge

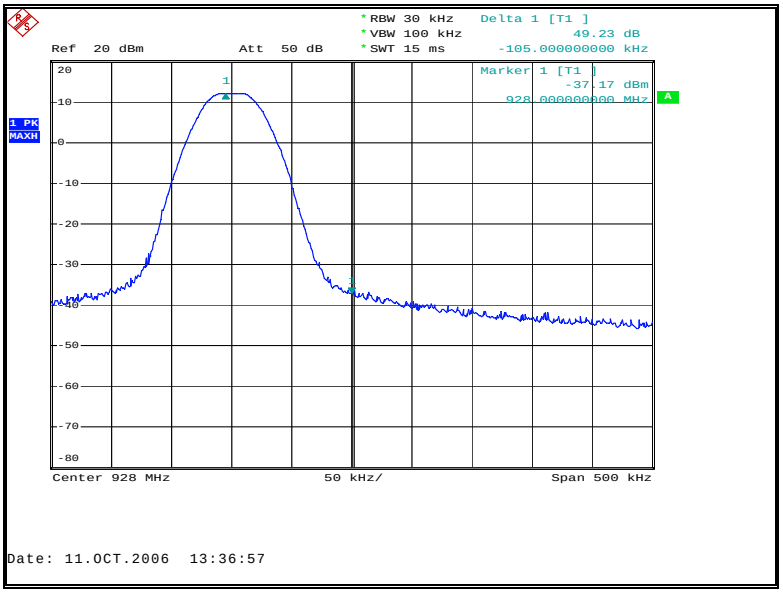

Figure 7.6.1-2: Upper Band-edge

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. Results are shown below in Figures 7.6.2-1 through 7.6.2-6.

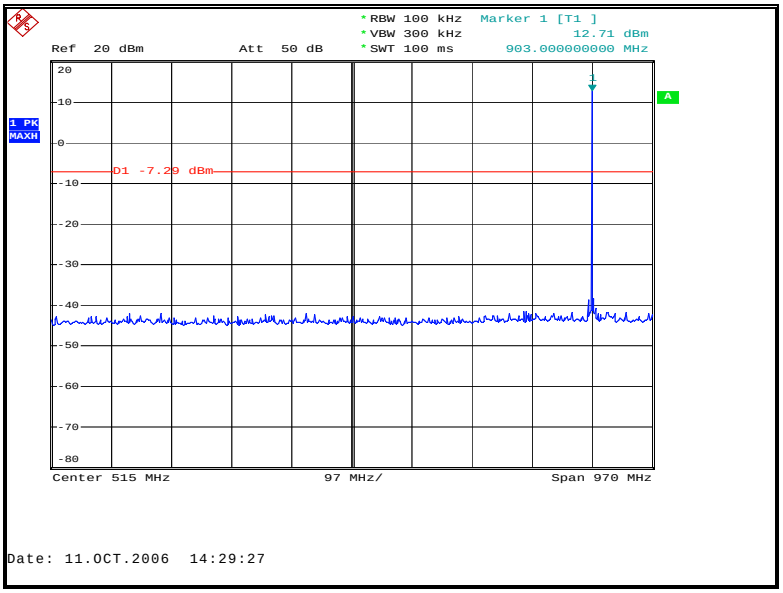

Figure 7.6.2-1 RF Conducted Spurious Emissions – Low Channel

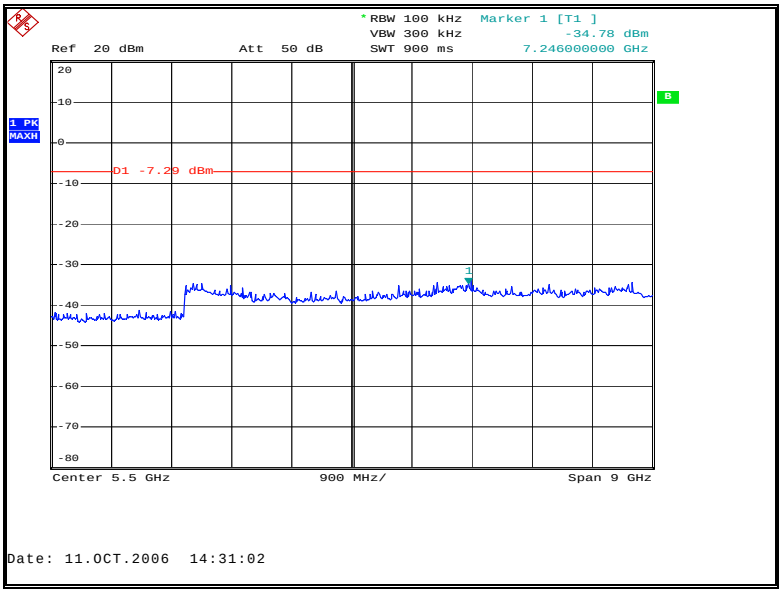

Figure 7.6.2-2 RF Conducted Spurious Emissions – Low Channel

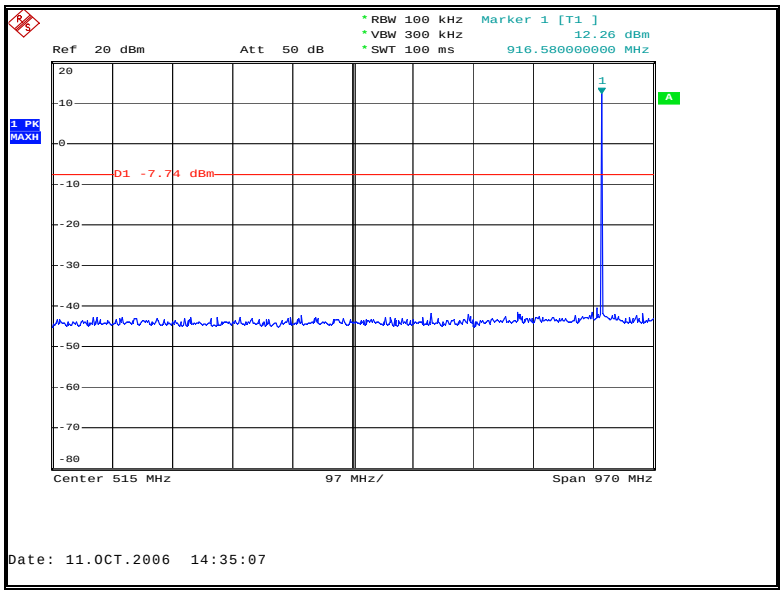

Figure 7.6.2-3 RF Conducted Spurious Emissions – Mid Channel

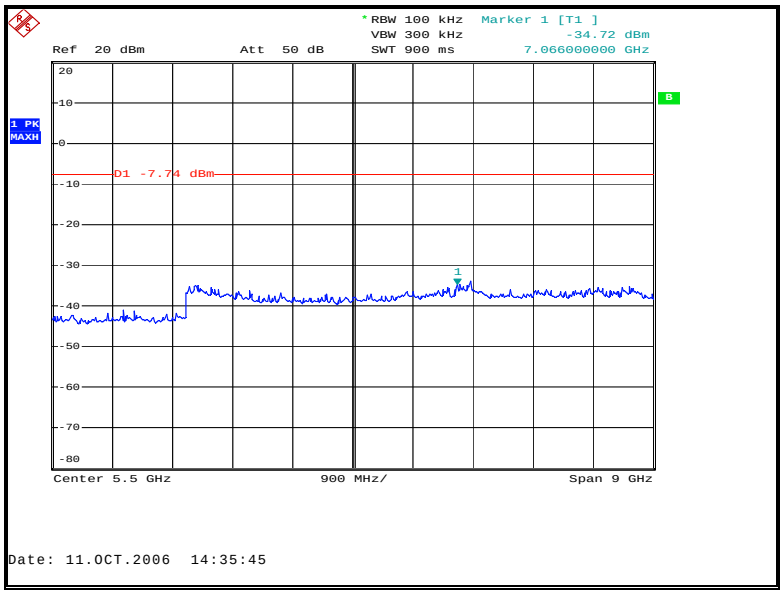

Figure 7.6.2-4 RF Conducted Spurious Emissions – Mid Channel

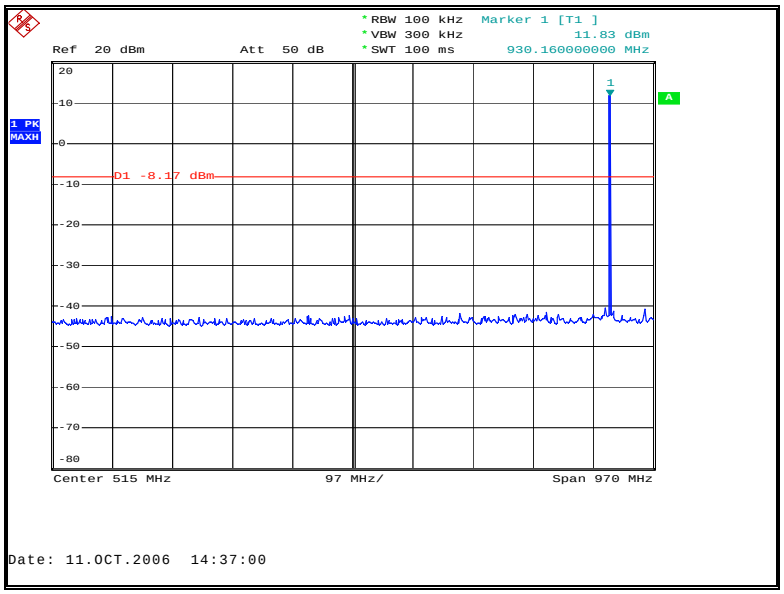

Figure 7.6.2-5 RF Conducted Spurious Emissions – High Channel

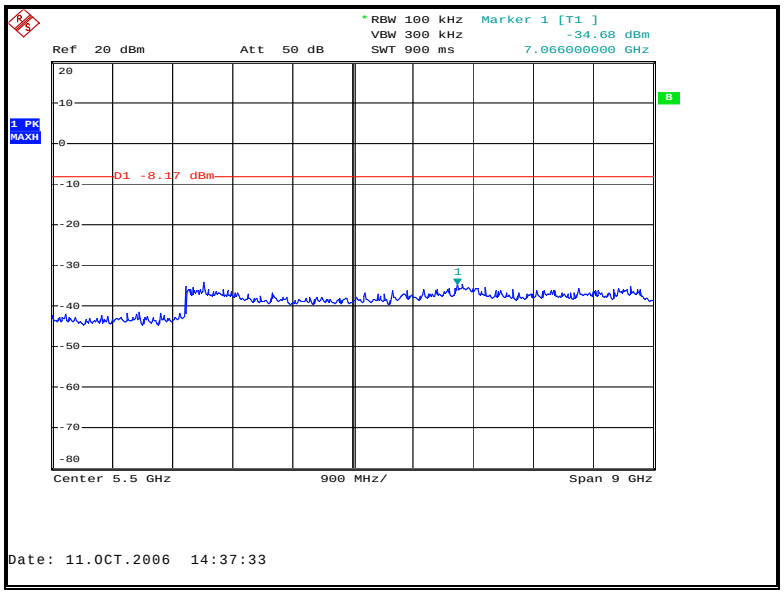

Figure 7.6.2-6 RF Conducted Spurious Emissions – High Channel

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 for each representative host device as detailed in section 1.3.

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 Test Results

Radiated spurious emissions found in the band of 30MHz to 10GHz are reported in Tables 7.6.3-1. through 7.6.3-2. 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 – Handheld Computer Terminal

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
Spurious Emissions - Low Channel										
3608.4	52.56	39.18	H	-2.40	50.16	36.78	74.0	54.0	23.84	17.22
3608.4	50.99	38.28	V	-2.44	48.55	35.84	74.0	54.0	25.45	18.16
Spurious Emissions - Mid Channel										
2745	50.25	37.73	V	-5.30	44.95	32.43	74.0	54.0	29.05	21.57
3660	52.38	40.33	H	-2.19	50.19	38.14	74.0	54.0	23.81	15.86
3660	51.94	40.23	V	-2.19	49.75	38.04	74.0	54.0	24.25	15.96
7320	52.00	40.04	H	5.34	57.34	45.38	74.0	54.0	16.66	8.62
7320	52.31	40.35	V	5.28	57.59	45.63	74.0	54.0	16.41	8.37
Spurious Emissions - High Channel										
2783.7	49.79	37.51	V	-5.18	44.61	32.33	74.0	54.0	29.39	21.67
3711.6	52.06	39.28	H	-1.97	50.09	37.31	74.0	54.0	23.91	16.69
7423.2	52.73	40.30	H	5.36	58.09	45.66	74.0	54.0	15.91	8.34
7423.2	53.64	42.47	V	5.28	58.92	47.75	74.0	54.0	15.08	6.25

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

Table 7.6.3-2: Radiated Spurious Emissions – Laptop Computer

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
Spurious Emissions - Low Channel										
2706.3	51.45	49.93	H	1.49	52.94	51.42	74.0	54.0	21.06	2.58
2706.3	47.67	44.37	V	1.26	48.93	45.63	74.0	54.0	25.07	8.37
3608.4	44.04	36.52	H	4.24	48.28	40.76	74.0	54.0	25.72	13.24
3608.4	46.27	41.17	V	4.20	50.47	45.37	74.0	54.0	23.53	8.63
4510.5	47.16	43.02	H	6.51	53.67	49.53	74.0	54.0	20.33	4.47
4510.5	49.73	46.60	V	6.62	56.35	53.22	74.0	54.0	17.65	0.78
Spurious Emissions - Mid Channel										
2745	51.25	49.52	H	1.61	52.86	51.13	74.0	54.0	21.14	2.87
2745	48.43	44.88	V	1.40	49.83	46.28	74.0	54.0	24.17	7.72
3660	46.38	37.74	H	4.47	50.85	42.21	74.0	54.0	23.15	11.79
3660	47.44	39.77	V	4.47	51.91	44.24	74.0	54.0	22.09	9.76
4575	47.70	40.84	H	6.75	54.45	47.59	74.0	54.0	19.55	6.41
4575	49.52	45.77	V	6.87	56.39	52.64	74.0	54.0	17.61	1.36
Spurious Emissions - High Channel										
2783.7	52.37	50.36	H	1.72	54.09	52.08	74.0	54.0	19.91	1.92
2783.7	48.71	45.77	V	1.55	50.26	47.32	74.0	54.0	23.74	6.68
3711.6	46.55	40.26	H	4.71	51.26	44.97	74.0	54.0	22.74	9.03
3711.6	47.31	42.90	V	4.73	52.04	47.63	74.0	54.0	21.96	6.37
4639.5	45.87	38.05	H	6.99	52.86	45.04	74.0	54.0	21.14	8.96
4639.5	47.57	44.17	V	7.11	54.68	51.28	74.0	54.0	19.32	2.72

*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: 52.56 + 2.40 = 50.16dBuV
Margin: 74dBuV – 50.16dBuV = 23.84dB

AVERAGE:
Corrected Level: 39.18 + 2.40 - 0 = 36.78dBuV
Margin: 54dBuV – 36.78dBuV = 17.22dB

8.0 CONCLUSION
In the opinion of ACS, Inc. the Utilinet PCMCIA Radio, manufactured by Cellnet Technology, Inc. meets the requirements of FCC Part 15 subpart C.

END REPORT