FCC Part 15 Certification
Test Report

5.8 GHz Digital Transmission System
(Modular Approval)

FCC ID: HSW-5811M
FCC Rule Part: 15.247

ACS Report Number: 03-0143-15BC

Manufacturer: Cirronet, Inc.
Model: WIT5811

Test Begin Date: July 7, 2003
Test End Date: August 13, 2003

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This report contains 12 pages

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1.0 GENERAL

1.1 Introduction
The purpose of this report is to demonstrate compliance with the relevant portions of Title 47, Part 15 of the FCC's Code of Federal Regulations.

1.2 Product Description

1.2.1 General Description
The EUT, is the Cirronet Radio Module Model WIT5800, is a direct sequence radio device operating in the unlicensed band of 5725 - 5850MHz designed for data transmissions.

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

1.2.2 Intended Use
The EUT is intended to be offered to OEM manufacturers for integration into their final products. These products will be limited to mobile or fixed devices as defined by the FCC.

1.2.3 Antennas
The following antennas will be offered with the EUT:

Manufacturer	Model	Type	Gain	EIRP	Intended Operation
Mobile Mark	SCR14-5725CT	Corner Reflector	14dBi	38.0	Point-to-Point
Mobile Mark	ODN9-5725	Omni	9dBi	36.0	Point-to-Multipoint
Mobile Mark	PSTN5-5725	Omni	2dBi	26dBi	Point-to-Multipoint
Mobile Mark	PSWN3-5725	Omni	2dBi	26dBi	Point-to-Multipoint
Cirronet	A-7030-0492	Patch	14dBi	38.0	Point-to-Point

2.0 LOCATION OF TEST FACILTY
All testing was performed by qualified ACS personnel located at the following address:

ACS, Inc.
5015 B.U. Bowman Drive
Buford, GA 30518

2.1 DESCRIPTION OF TEST FACILITY
Both the 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.

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

2.1.1 Open Area Test Site

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 2.1-1 below:

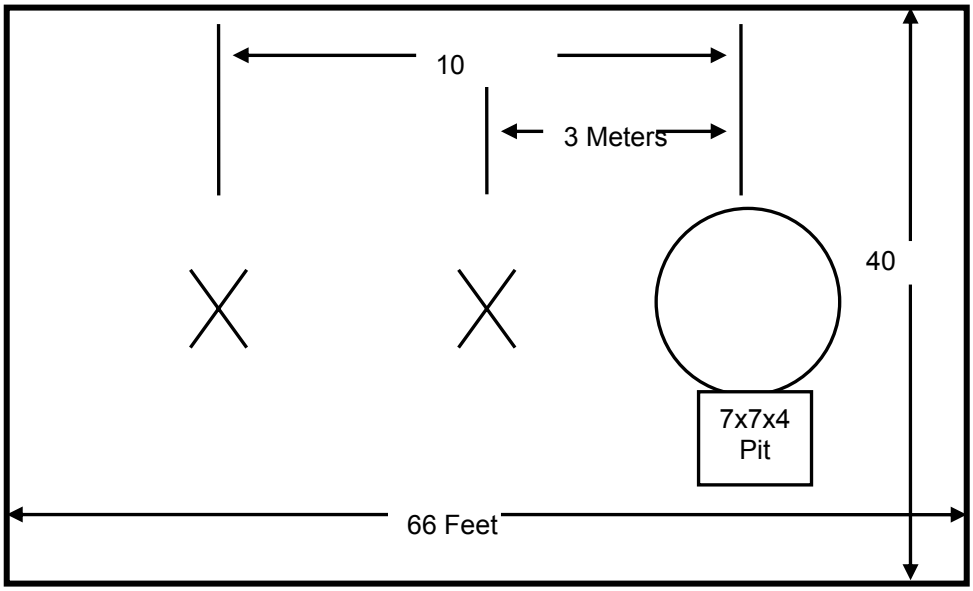


Figure 2.1-1: Open Area Test Site

2.1.2 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 2.1.2-1:

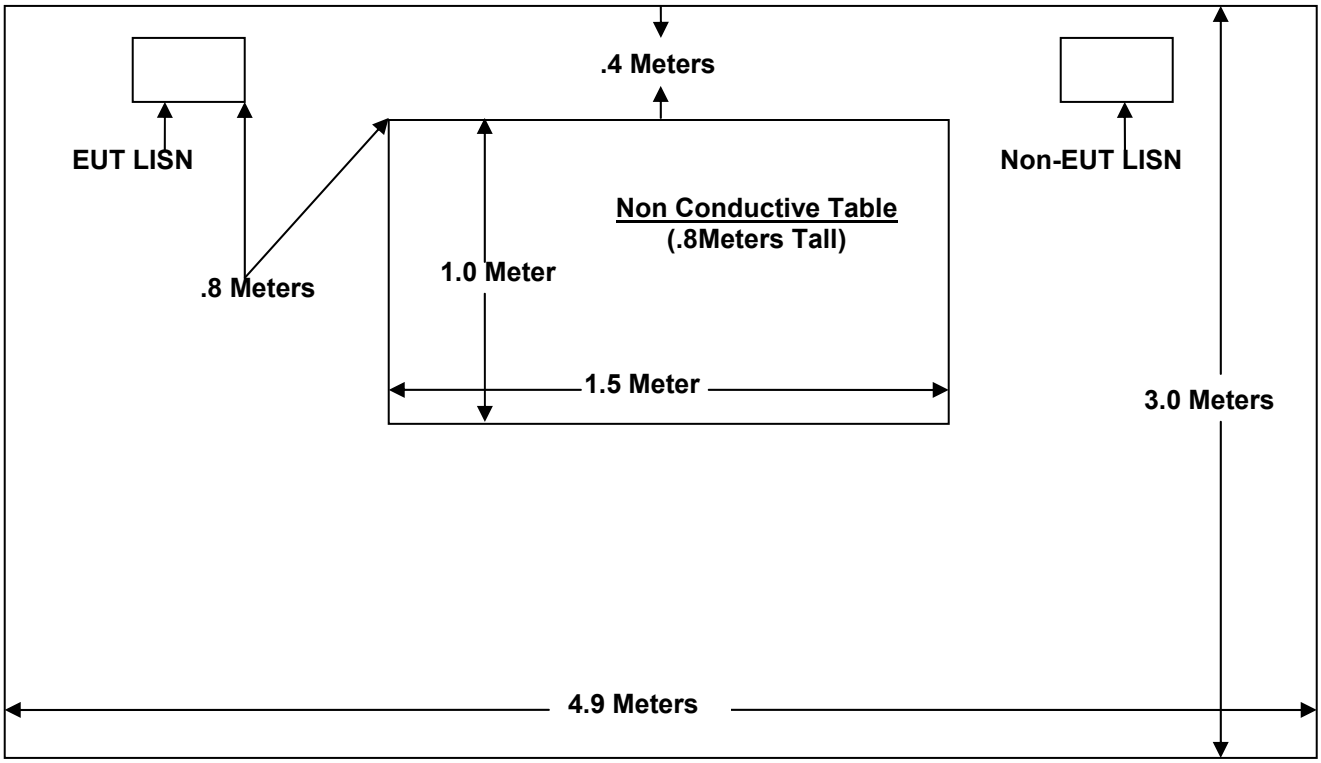


Figure 2.1.2-1: AC Mains Conducted EMI Site

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-1992: 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 (October 2002)
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators (October 2002)
- FCC OET Bulletin 65 Appendix C - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
- FCC Report and Order, No. FCC 97-114, Appendix C – Laboratory Measurement Procedure, Alternative Test Procedures

4.0 LIST OF TEST EQUIPMENT

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

Table 4-1: Test Equipment

Equipment Calibration Information					
ACS #	**Mfg.**	**Eq. type**	**Model**	**S/N**	**Cal. Due**
2	Rohde & Schwarz	Spectrum Analyzer	ESMI	839587/003	12/23/03
1	Rohde & Schwarz	Display Unit	ESDI	839379/011	12/26/03
25	Chase	Bi-Log Antenna	CBL6111	1043	9/19/03
152	EMCO	LISN	3825/2	9111-1905	12/11/03
153	EMCO	LISN	3825/2	9411-2268	12/11/03
30	Spectrum Technologies	Horn Antenna	DRH-0118	970102	9/17/03
---	EMCO	Horn Antenna 18-25 GHz	3160-09	9806-1110	6/3/04
---	EMCO	Horn Antenna 25-40 GHz	3160-10	9806-1069	6/3/04
16	ACS	Cable	RG8	16	9/17/03
23	ACS	Cable	RG8	23	1/3/04
24	ACS	Cable	Heliax	24	04/07/04
5	ACS	Cable	LL-335	None	8/20/04
6	ACS	Cable	LL-335	None	8/6/04
22	Agilent	Pre-Amplifier	8449B	3008A00526	9/21/03
73	Agilent	Pre-Amplifier	8447D	272A05624	04/15/04
---	Agilent	Pre-Amplifier	83051A	3331A00247	03/02/04
---	Weinschel Engineering	High Pass Filter	DS109L	7023	7/13/04

5.0 EUT Setup Block Diagram

Table 5.0: System Block Diagram

Diagram Number	Manufacturer	Equipment Type	Model Number	Serial Number	FCC ID
1	Cirronet	Radio Module	WIT5811	None	HSW-5811M
2	DELL	PC	Optiplex GX1	O5M7D	NA
3	Cirronet	USB Adapter	NA	NA	NA

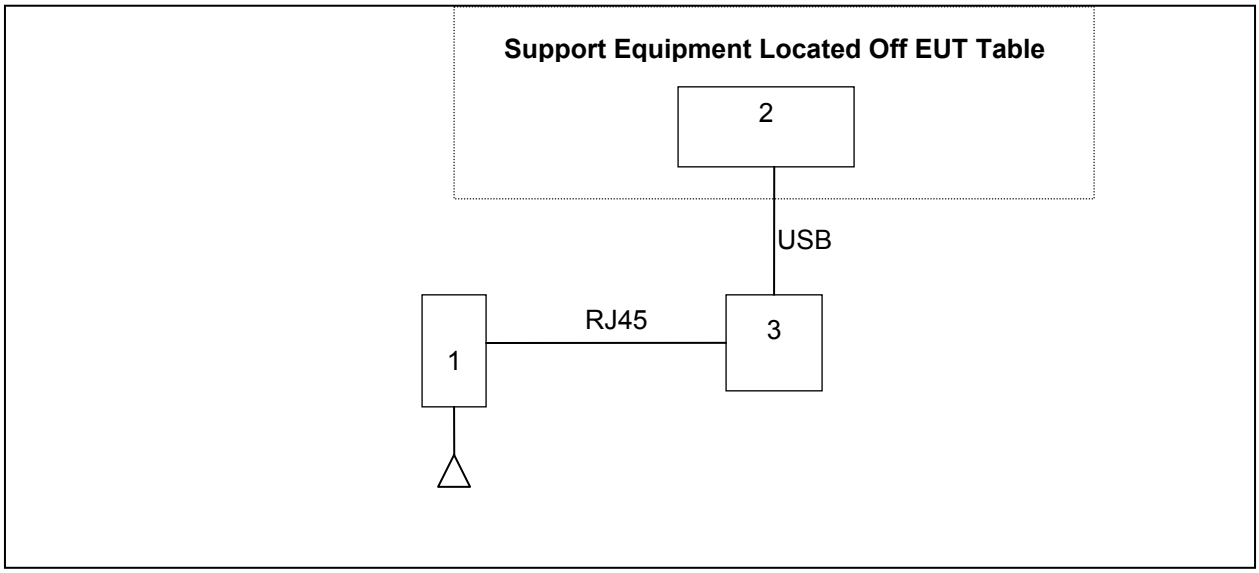


Figure 5.0-1: EUT Test Setup

6.0 SUMMARY OF TESTS

6.1 Antenna Requirement – FCC Section 15.203

The EUT employs an MMCX connector. According to FCC Public Notice, DA 00-2225, the MMCX qualifies as a unique antenna coupler.

6.2 Power Line Conducted Emissions - FCC Section 15.207

6.2.1 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.

6.2.2 Test Results

The EUT will be provided DC power by the host device in which it is installed. With no connection to the AC mains this requirement is not applicable to the EUT.

6.3 Radiated Emissions - FCC Section 15.209(Unintentional Radiation)

6.3.1 Test Methodology

ANSI C63.4 Sections 6 and 8 were the guiding documents for this evaluation. Radiated emissions tests were performed over the frequency range of 30MHz to 1000. 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 120KHz for measurements above 30MHz.

The EUT was set for an idle state where no transmissions were occurring.

6.3.2 Test Results

Results of the test are given in Table 6.2.2-1 below:

Table 6.3.2-1: Radiated Emissions Tabulated Data (Unintentional Radiators)

Frequency (MHz)	Uncorrected Reading (dBµV)	Antenna Polarity (H/V)	Antenna Height (cm)	Turntable Position (°)	Total Correction Factor (dB)	Corrected Reading (dBµV)	Limit (dBµV)	Margin (dB)	Results
39.2	14.8	H	100	0	14.70	29.50	40	10.5	**Pass**
47.62	17.62	V	100	0	10.49	28.11	40	11.9	**Pass**
64.56	15.41	H	100	0	6.98	22.39	40	17.6	**Pass**
85.2	16.85	H	100	0	9.12	25.97	40	14.0	**Pass**
100.16	26.3	H	100	0	11.01	37.31	43.5	6.2	**Pass**
126.8	25.59	V	100	269	12.90	38.49	43.5	5.0	**Pass**
201.44	17.34	H	100	0	10.99	28.33	43.5	15.2	**Pass**
481.12	23.89	V	100	0	-6.68	17.21	46	28.8	**Pass**
701.12	25.23	H	100	0	-2.32	22.91	46	23.1	**Pass**
906.56	25.77	H	100	230	0.15	25.92	46	20.1	**Pass**

6.4 Peak Output Power – FCC Section 15.247(b)(3)

6.4.1 Test Methodology (Conducted Method)

The 6dB bandwidth of the EUT was within the resolution bandwidth of the Rohde & Schwarz spectrum analyzer, therefore the power measurement was made using the spectrum analyzer method. The resolution and video bandwidth were set to 3MHz. The EUT was caused to transmit a continuous signal at the low, center and high channels.

6.4.2 Test Results

Results are shown below in table 6.4.2-1 and in figure 6.4.2-1 below:

Table 6.4.2-1: RF Output Power

Channel	Frequency [MHz]	Level [dBm]
Low	5729.49	22.77
Center	5774.97	24.04
High	5820.41	22.64

Result: PASS

6.5 6dB Bandwidth – FCC Section 15.247(a)(2)

6.5.1 Test Methodology
The 6dB bandwidth was measured in accordance with FCC 97-114 Appendix C. The EUT was caused to generate a continuous at the low, center and high channels.

6.5.2 Test Results
Results are shown below in table 6.5.2-1 and figure 6.5.2-1:

Table 6.5.2-1: 6dB Bandwidth

Channel	Center Freq. [MHz]	Bandwidth [MHz]
Low	5730.00	1.161
Center	5775.33	1.142
High	5820.77	1.153

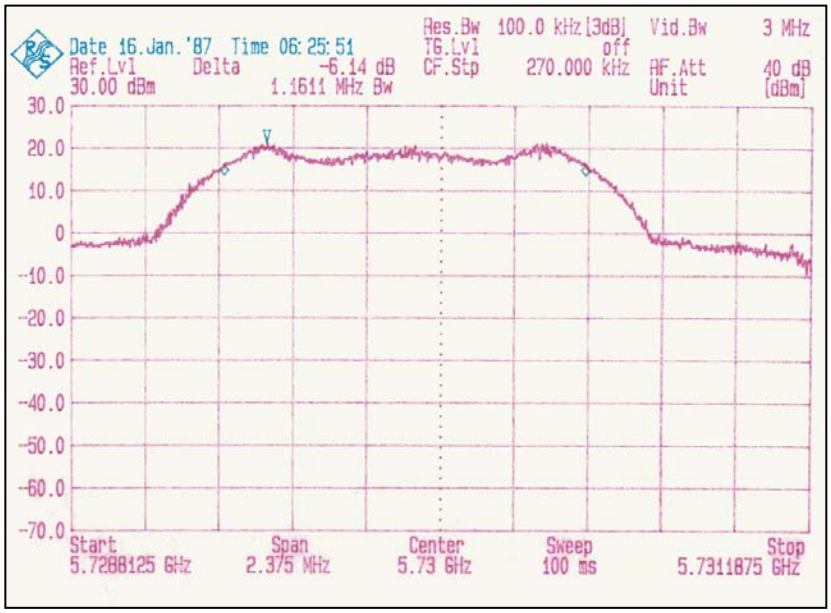


Figure 6.5.2-1: 6dB Bandwidth Plot (Worst Case)

Result: PASS

6.6 Spurious Emissions – FCC Section 15.247(c)

6.6.1 Conducted Spurious Emissions

6.6.1.1 Test Methodology
The EUT was investigated for conducted spurious emissions from 30MHz to 60GHz, 10 times the highest fundamental frequency. Measurements were made at the low, center and high channels of the EUT. For each measurement, the spectrum analyzer's VBW was set to 100kHz and the RBW was set to 1MHz.

6.6.1.2 Test Results
All emission found were greater than 20dB down from the fundamental carrier. The RF conducted spurious emissions found in the band of 30MHz to 60GHz are reported in Table 6.6.1.2 below. Plots were taken also and are filed separately with this filing in a file titled "Data Plots A.pdf".

Table 6.6.1.2: Antenna Conducted Spurious

Frequency (MHz)	Level (dBm)	Margin (dB)	Final Result (Pass/Fail)
Low Channel: 22.77dBm			
5173	-23.75	46.52	**PASS**
6287	-22.97	45.74	**PASS**
23788	-36.73	59.50	**PASS**
Center Channel: 24.04			
4045	-35.64	59.68	**PASS**
5219	-22.59	46.63	**PASS**
6331	-24.03	48.07	**PASS**
17833	-36.32	60.68	**PASS**
High Channel: 22.64			
5264	-19.77	42.41	**PASS**
6378	-25.56	48.20	**PASS**
18022	-36.42	59.06	**PASS**

6.6.2 Radiated Spurious Emissions

6.6.2.1 Test Methodology

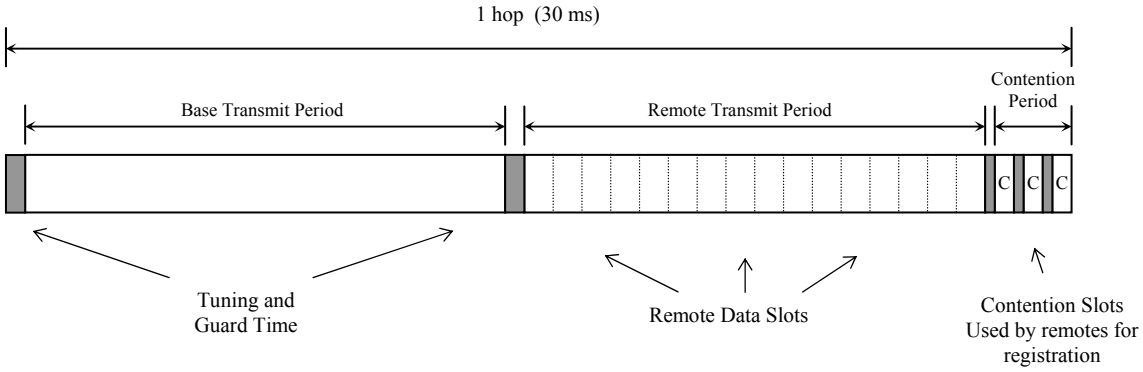
Radiated emissions tests were made over the frequency range of 30MHz to 60GHz, 10 times the highest fundamental frequency on each antenna given in section 1.2.3.

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 120kHz and a video bandwidth(VBW) of 300kHz. For frequencies above 1000MHz, average measurements were made using an RBW of 1MHz and a VBW of 10Hz and peak measurements were made with RBW of 1MHz and a VBW of 1MHz.

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

6.6.2.2 Duty Cycle Correction

The diagram shown in figure 6.6.2.2-1 illustrates the duty cycle of the EUT in either its Base or Remote operational modes.



Base Transmit Guard	0.5ms
Base Transmit Period, max.	17ms
First Remote Transmit Guard	0.5ms
Successive Remote Guard	0.15ms
Contention Guard	0.15ms
Remote Transmit Period, max.	12ms (1 Remote, no contention slots)

The worst case duty cycle of the EUT is 56.5%, or 17ms of the 30ms “on-time”. Therefore, for average measurements the measured level was reduced by a factor 4.95dB to account for the duty cycle of the EUT. The duty cycle correction factor is determined using the formula: 20log(.565)= -4.95dB.

6.6.2.3 Test Results

Radiated spurious emissions found in the band of 30MHz to 60GHz are reported in Table 6.6.2.3-1 through 6.6.2.3-4. Plots of these emissions are also presented separately in a file titled "Data Plots B". Each emission found to be in a restricted band as defined by section 15.205, was compared to the radiated emission limits for a class B device defined in section 15.209.

Table 6.6.2.3-1: Radiated Spurious Emissions – 14dBi Corner Reflector

Frequency (MHz)	Level (dBuV/m)	Detector (P/A)	Correction Factors (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Final Result (Pass/Fail)
14dBi Corner Antenna – Low Channel							
11458.88	45.59	P	18.24	63.83	74.00	10.17	**PASS**
11458.99	33.20	A	13.24	46.44	54.00	7.56	**PASS**
17192.53	44.93	P	26.27	71.20	74.00	2.80	**PASS**
17189.76	28.90	A	21.24	50.14	54.00	3.86	**PASS**
22917.95	42.82	P	26.52	69.34	74.00	4.66	**PASS**
22914.4	27.76	A	21.52	49.28	54.00	4.72	**PASS**
14dBi Corner Antenna – Center Channel							
23099.02	45.26	P	26.64	71.90	74.00	2.10	**PASS**
23101.27	28.80	A	21.64	50.44	54.00	3.56	**PASS**
11551.23	43.33	P	18.60	61.93	74.00	12.07	**PASS**
11551.35	29.08	A	13.60	42.68	54.00	11.32	**PASS**
17331.16	44.60	P	27.48	72.08	74.00	1.92	**PASS**
17324.94	28.90	A	22.42	51.32	54.00	2.68	**PASS**
14dBi Corner Antenna – High Channel							
11642.38	48.64	P	19.05	67.69	74.00	6.31	**PASS**
11642.18	37.26	A	14.05	51.31	54.00	2.69	**PASS**
17461.39	44.45	P	28.61	73.06	74.00	0.94	**PASS**
17461.57	29.03	A	23.61	52.64	54.00	1.36	**PASS**
23283.66	46.27	P	26.77	73.04	74.00	0.96	**PASS**
23286.12	28.98	A	21.77	50.75	54.00	3.25	**PASS**

Table 6.6.2.3-2: Radiated Spurious Emissions - 14dBi Patch

Frequency (MHz)	Level (dBuV/m)	Detector (P/A)	Correction Factors (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Final Result (Pass/Fail)
14dBi Patch Antenna – Low Channel							
11459.57	45.56	P	18.24	63.80	74.00	10.20	**PASS**
11459.01	34.39	A	13.24	47.63	54.00	6.37	**PASS**
17193.56	44.45	P	26.28	70.73	74.00	3.27	**PASS**
17189.6	28.88	A	21.24	50.12	54.00	3.88	**PASS**
22915.78	44.14	P	26.52	70.66	74.00	3.34	**PASS**
22914.95	27.58	A	21.52	49.10	54.00	4.90	**PASS**
14dBi Patch Antenna – Center Channel							
23100.81	44.32	P	26.64	70.96	74.00	3.04	**PASS**
23101.22	28.88	A	21.64	50.52	54.00	3.48	**PASS**
11552.49	42.13	P	18.60	60.73	74.00	13.27	**PASS**
11550.34	29.01	A	13.59	42.60	54.00	11.40	**PASS**
17325.11	42.79	P	27.42	70.21	74.00	3.79	**PASS**
17323.6	27.18	A	22.41	49.59	54.00	4.41	**PASS**
14dBi Patch Antenna – High Channel							
11642.25	47.09	P	19.05	66.14	74.00	7.86	**PASS**
11642.36	34.59	A	14.05	48.64	54.00	5.36	**PASS**
17462.92	42.69	P	28.63	71.32	74.00	2.68	**PASS**
17463.91	27.30	A	23.64	50.94	54.00	3.06	**PASS**
23283.75	44.34	P	26.77	71.11	74.00	2.89	**PASS**
23281.75	29.13	A	21.76	50.89	54.00	3.11	**PASS**

Table 6.6.2.3-3: Radiated Spurious Emissions – 9dB Omni

Frequency (MHz)	Level (dBuV/m)	Detector (P/A)	Correction Factors (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Final Result (Pass/Fail)
9dB Omni Antenna – Low Channel							
11459.25	45.74	P	18.24	63.98	74.00	10.02	**PASS**
11459.07	32.84	A	13.24	46.08	54.00	7.92	**PASS**
17280.68	42.34	P	27.04	69.38	74.00	4.62	**PASS**
17280.68	26.97	A	22.04	49.01	54.00	4.99	**PASS**
23052.83	43.61	P	26.61	70.22	74.00	3.78	**PASS**
23051.18	28.47	A	21.61	50.08	54.00	3.92	**PASS**
Large Omni Antenna – Center Channel							
11552.64	44.04	P	18.60	62.64	74.00	11.36	**PASS**
11551.61	28.14	A	13.60	41.74	54.00	12.26	**PASS**
17323.92	42.36	P	27.41	69.77	74.00	4.23	**PASS**
17326.14	26.87	A	22.43	49.30	54.00	4.70	**PASS**
23098.18	43.68	P	26.64	70.32	74.00	3.68	**PASS**
23095.84	28.85	A	21.64	50.49	54.00	3.51	**PASS**
Large Omni Antenna – High Channel							
11640.54	47.01	P	19.04	66.05	74.00	7.95	**PASS**
11641.94	35.25	A	14.05	49.30	54.00	4.70	**PASS**
17466.14	42.67	P	28.65	71.32	74.00	2.68	**PASS**
17462.51	27.38	A	23.62	51.00	54.00	3.00	**PASS**
23280.74	43.68	P	26.76	70.44	74.00	3.56	**PASS**
23279.48	28.85	A	21.76	50.61	54.00	3.39	**PASS**

Table 6.6.2.3-4: Radiated Spurious Emissions – 0dBi Omni

Frequency (MHz)	Level (dBuV/m)	Detector (P/A)	Correction Factors (dB)	Corrected Level (dBuV/m)	Limit (dBuV/)	Margin (dB)	Final Result (Pass/Fail)
0dBi Omni Antenna – Low Channel							
11459.33	45.16	P	18.24	63.40	74.00	10.60	**PASS**
11459.06	32.84	A	13.24	46.08	54.00	7.92	**PASS**
17191.49	42.08	P	26.26	68.34	74.00	5.66	**PASS**
17184.83	26.77	A	21.20	47.97	54.00	6.03	**PASS**
22921.78	44.09	P	26.52	70.61	74.00	3.39	**PASS**
22914.91	27.84	A	21.52	49.36	54.00	4.64	**PASS**
0dBi Omni Antenna – Center Channel							
11549.89	43.76	P	18.59	62.35	74.00	11.65	**PASS**
11553.07	28.09	A	13.61	41.70	54.00	12.30	**PASS**
17322.72	42.9	P	27.40	70.30	74.00	3.70	**PASS**
17320.95	26.85	A	22.39	49.24	54.00	4.76	**PASS**
23105.06	43.71	P	26.64	70.35	74.00	3.65	**PASS**
23095.25	28.68	A	21.64	50.32	54.00	3.68	**PASS**
0dBi Omni Antenna – High Channel							
11642.59	48.58	P	19.05	67.63	74.00	6.37	**PASS**
11642.39	37.44	A	14.05	51.49	54.00	2.51	**PASS**
17461.81	43.58	P	28.62	72.20	74.00	1.80	**PASS**
17457.53	27.33	A	23.58	50.91	54.00	3.09	**PASS**
23282.56	44.01	P	26.76	70.77	74.00	3.23	**PASS**
23281.87	29.08	A	21.76	50.84	54.00	3.16	**PASS**

Sample Calculations

$R_C = R_U + CF_T$

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:

Corrected Level: 32.84 + (13.24) = 46.08 dBuV

Margin: 54dBuV – 46.08 dBuV = 7.92 dB

6.7 Peak Power Spectral Density- FCC Section 15.247(d)

6.7.1 Test Methodology

The power spectral density was measured in accordance with OET bulletin 97-114, appendix C. The EUT was caused to generate a constant carrier on the low, middle and high fundamental channels. The hopping function was turned off for the measurement.

6.7.2 Test Results

Results are shown below in table 6.7.2-1 and figure 6.7.2-1.

Table 6.7.2-1: Peak Power Spectral Density

Channel	Frequency [MHz]	Level [dBm]
Low	5730.12	7.02
Center	5775.01	6.64
High	5821.36	5.55

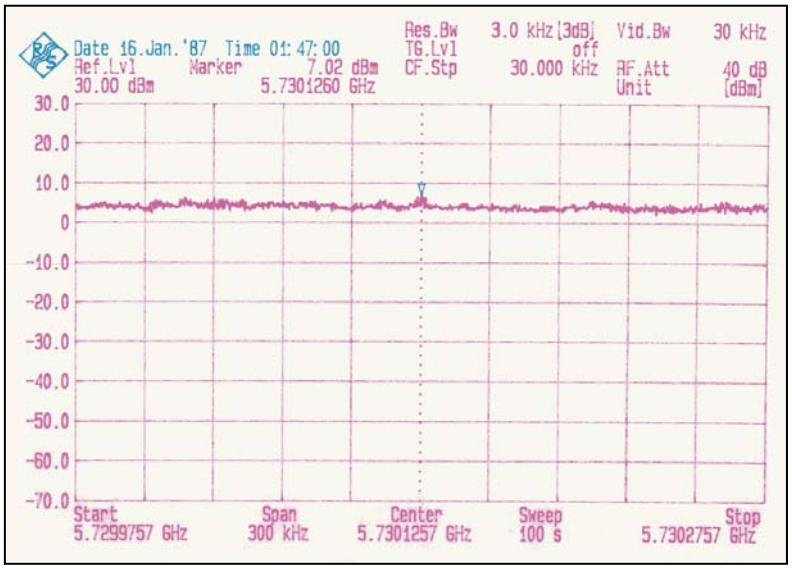


Figure 6.7.2-1: Peak Power Spectral Density

Result: PASS

7.0 MODIFICATIONS

Modifications were required in order to bring the unit into compliance with the radiated spurious emission limits.

1) The RF shield was spot soldered in places only that caused the emissions to be out of specification. Copper tape was added to seal up the aperture between the shield and the ground plane pad on the PCB all the way around the shield. See figure 7.0-1below:

Figure 7.0-1: Copper Tape Modification

2) The module is designed with mounting holes for ease of installation in any host device. Screws were placed through the mounting holes and nuts placed on the backside and tightened down to help compress the shield to the ground pad on the PCB. See Figure 7.0-2 below:

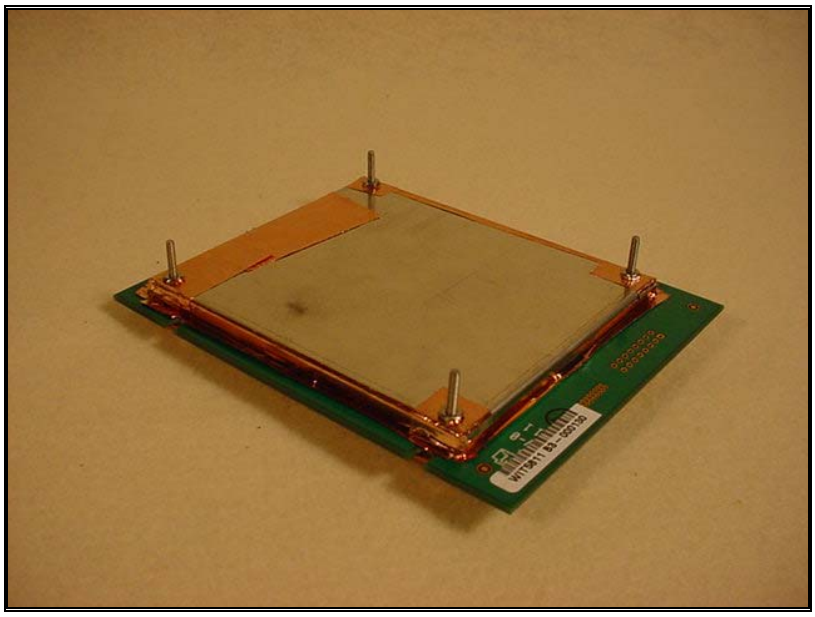


Figure 7.0-2: Screw/Nut Shield Modification

8.0 CONCLUSION

In the opinion of ACS, Inc. the WIT5811 manufactured by Cirronet Inc, meets the relevant requirements of FCC Parts 2 and 15, as required.