Excellence in Compliance Testing

Certification Test Report

FCC ID: HSW-DNT900
IC: 4492A-DNT900

FCC Rule Part: 15.247
IC Radio Standards Specification: RSS-210

ACS Report Number: 12-0339.W04.2A

Manufacturer: Cirronet Inc.
Model(s): DNT900C, DNT900P

Test Begin Date: August 9, 2012
Test End Date: August 15, 2012

Report Issue Date: August 22, 2012

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Reviewed by:

Kirby Munroe
Director, Wireless Certifications
ACS, Inc.

This report contains 15 pages

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1 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 and Industry Canada's Radio Standards Specification RSS-210 for Certification for a class II permissive change.

The purpose of this class II permissive change is to add a new antenna.

1.2 General

The DNT900 series transceiver module is a low cost, high-power solution for point-to- I/O point and point-to-multipoint wireless systems in the 900 MHz ISM band. Two model variants of the DNT900 are available. Both model variants are electrically identical and differ only in the interface available for host integration. DNT900C radio modules are mounted by reflow soldering them to a host circuit board. DNT900P modules are mounted by plugging their pins into a set of mating connectors on the host circuit board.

Antenna Type/Gain: Printed Circuit Inverted F, 0 dBi maximum gain.

Manufacturer Information:
Cirronet, Inc.
3079 Premiere Parkway, Suite 140
Duluth, GA 30097

Test Sample Serial Number: 000B75

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

1.3 Test Methodology and Considerations

DNT900 series modules achieve regulatory certification under FHSS rules at air data rates of 38.4, 115.2 and 200 kb/s. At 500 kb/s, the DNT900 series modules achieve regulatory certification under "digital modulation" or DTS rules. At 500 kb/s DNT900 series modules still employ frequency hopping to mitigate the effects of interference and multipath fading, but hop on fewer, more widely spaced frequencies than at lower data rates.

This report covers DSS operation for 38.4, 115.2 and 200 kb/s data rates only. A separate report will be issued covering the digital transmission system (DTS) operation using the 500 kb/s data rate.

The EUT was tested for radiated emissions in multiple orientations at a data rate which produced worst case emissions.

2 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

ACS is accredited to ISO/IEC 17025 by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 200612-0. Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

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.

FCC Registration Number: 511277
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

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:

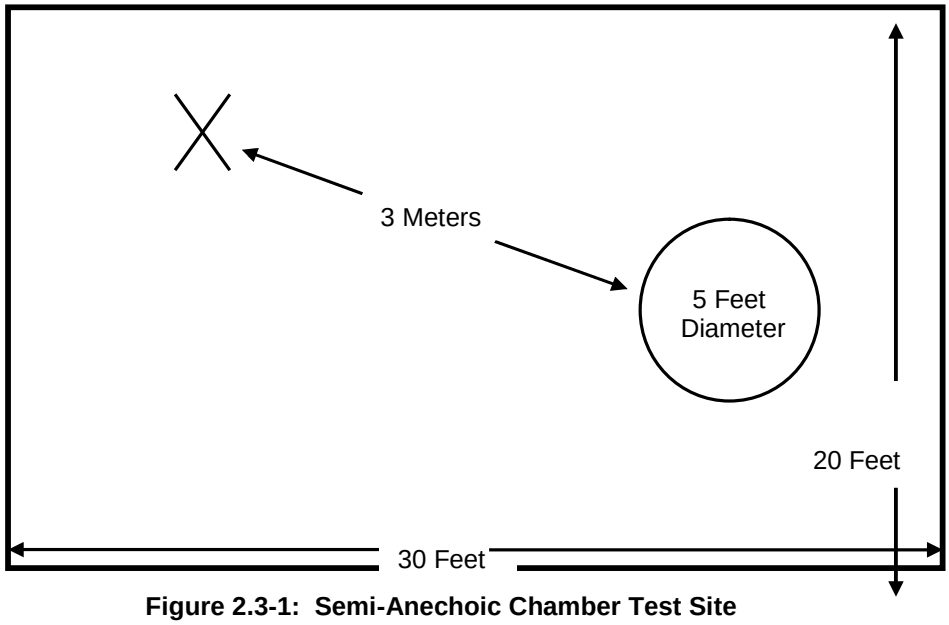


Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

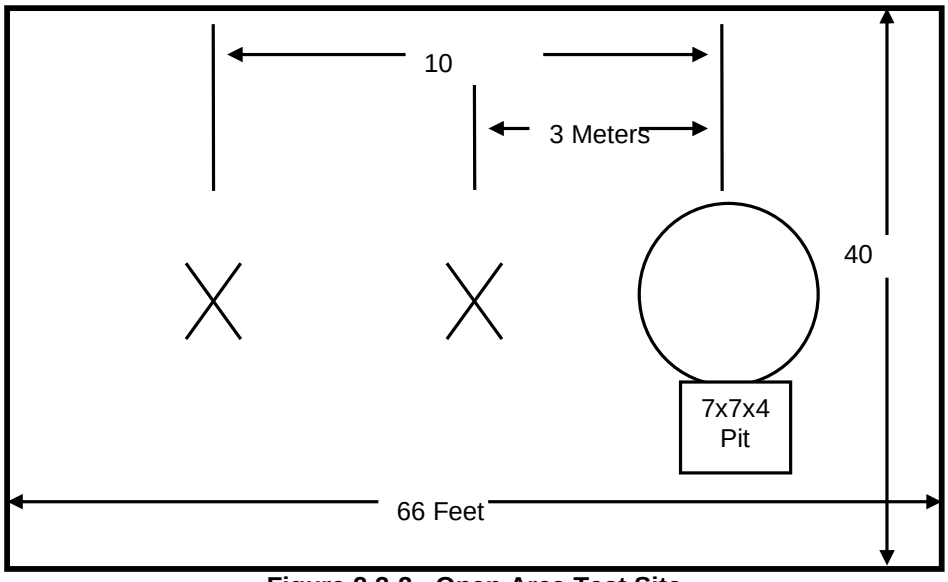


Figure 2.3-2: Open Area Test Site

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 ground 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:

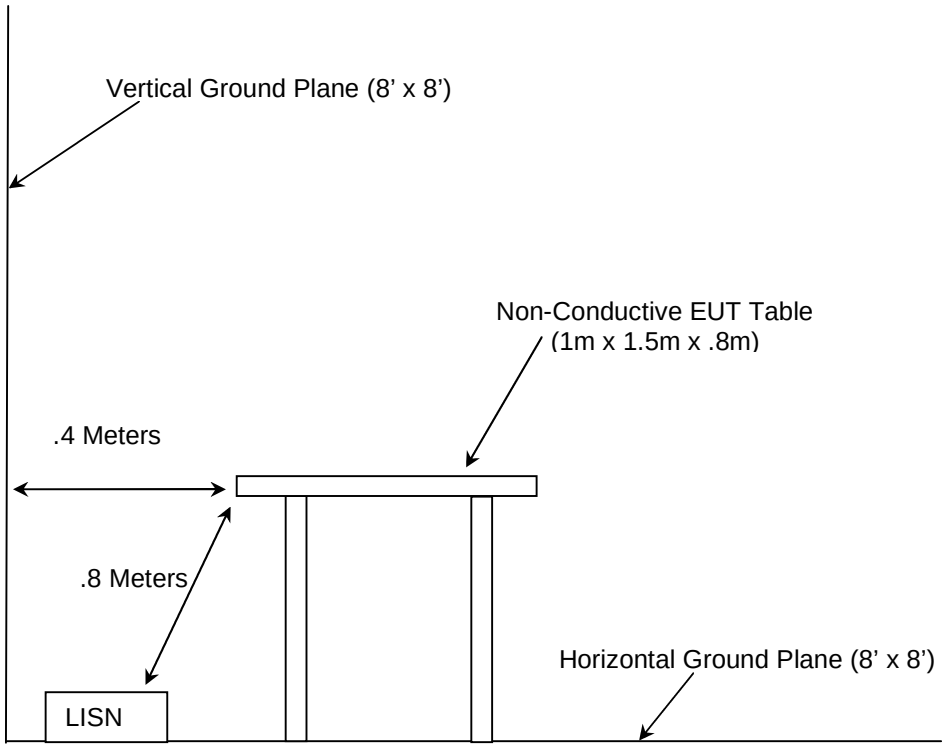


Figure 2.4-1: AC Mains Conducted EMI Site

3 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, 2012
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2012
- Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 8, Dec 2010
- Industry Canada Radio Standards Specification: RSS-GEN – General Requirements and Information for the Certification of Radiocommunication Equipment, Issue 3, Dec 2010.

4 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

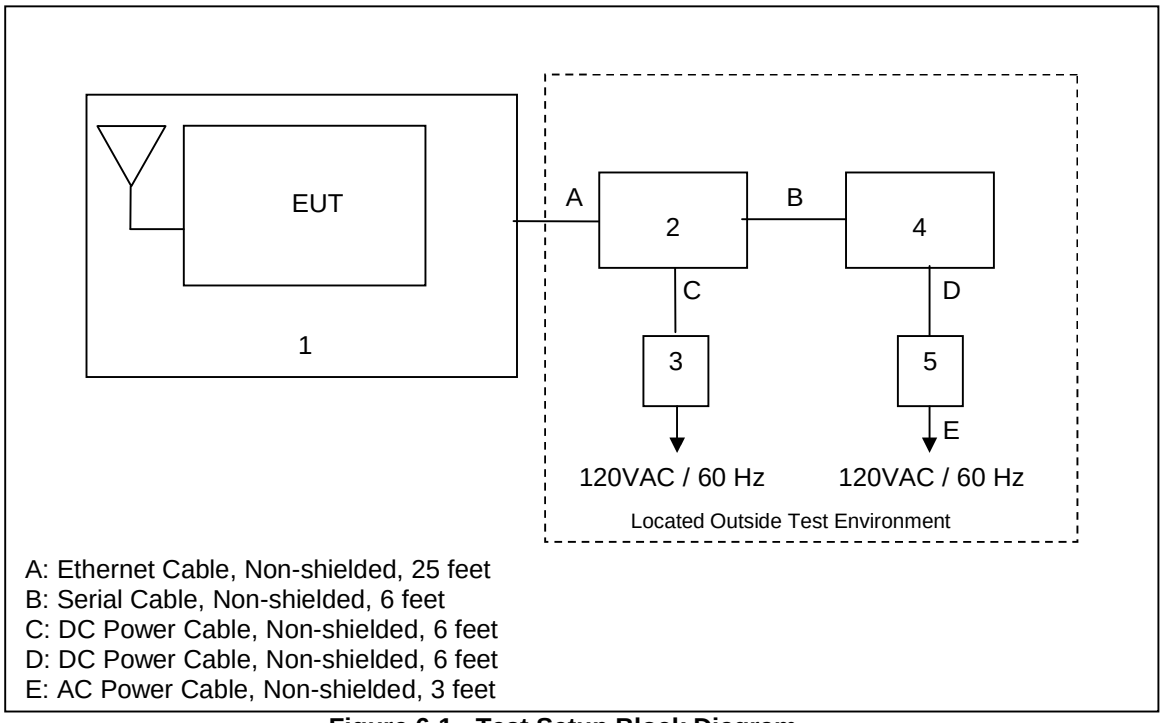
AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
1	Rohde & Schwarz	ESMI - Display	Spectrum Analyzers	833771/007	8/2/2012	8/2/2014
2	Rohde & Schwarz	ESMI-Receiver	Spectrum Analyzers	839587/003	8/2/2012	8/2/2014
30	Spectrum Technologies	DRH-0118	Antennas	970102	4/27/2011	4/27/2013
40	EMCO	3104	Antennas	3211	2/11/2011	2/11/2013
73	Agilent	8447D	Amplifiers	2727A05624	9/30/2011	9/30/2012
167	ACS	Chamber EMI Cable Set	Cable Set	167	12/21/2011	12/21/2012
291	Florida RF Cables	SMRE-200W-12.0-SMRE	Cables	None	12/2/2011	12/2/2012
292	Florida RF Cables	SMR-290AW-480.0-SMR	Cables	None	4/2/2012	4/2/2013
331	Microwave Circuits	H1G513G1	Filters	31417	7/2/2012	7/2/2013
338	Hewlett Packard	8449B	Amplifiers	3008A01111	8/2/2012	8/2/2013
412	Electro Metrics	LPA-25	Antennas	1241	7/27/2012	7/27/2014
422	Florida RF	SMS-200AW-72.0-SMR	Cables	805	12/2/2011	12/2/2012

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	Evaluation Board	RFM	Remote Radio Mother Board	N/A
2	Communication Box	N/A	N/A	N/A
3	DC Wall Wart	GlobTek, Inc.	GT-41052-1509	N/A
4	Laptop Computer	IBM	2648-PU5	78-AVPNZ
5	Laptop Power Supply	IBM	02K7006	J15JL58261J

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM



A: Ethernet Cable, Non-shielded, 25 feet
B: Serial Cable, Non-shielded, 6 feet
C: DC Power Cable, Non-shielded, 6 feet
D: DC Power Cable, Non-shielded, 6 feet
E: AC Power Cable, Non-shielded, 3 feet

Figure 6-1: Test Setup Block Diagram

7 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 PCB Inverted F type antenna with a maximum gain of 0 dBi. The antenna coupling is U.FL.

7.2 Radiated Spurious Emissions (Restricted Bands)

7.2.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 30MHz to 10 GHz, 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 were made with RBW and VBW of 1 MHz and 3 MHz respectively. The average emissions were further corrected by applying the duty cycle correction of the EUT for comparison to the average limit.

Each emission found to be in a restricted band was compared to the applicable radiated emission limits.

7.2.2 Duty Cycle Correction

For average radiated measurements, the measured level was reduced by a factor 10.83dB 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 28.75% or 28.75ms. The duty cycle correction factor is determined using the formula: 20log (0.2875)=10.83dB.

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

7.2.3 Measurement Results

Radiated spurious emissions found in the band of 30MHz to 10GHz are reported in Table 7.2.3-1 to 7.2.3-3 below.

Table 7.3.2-1: Radiated Spurious Emissions Tabulated Data – X-Position

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										
2708.25	61.43	56.03	H	-4.04	57.39	41.16	74.0	54.0	16.6	12.8
2708.25	68.86	63.43	V	-4.04	64.82	48.56	74.0	54.0	9.2	5.4
3611	52.86	42.95	H	-0.93	51.93	31.19	74.0	54.0	22.1	22.8
3611	57.35	49.68	V	-0.93	56.42	37.92	74.0	54.0	17.6	16.1
4513.75	58.14	50.39	H	1.09	59.23	40.65	74.0	54.0	14.8	13.3
4513.75	61.31	53.92	V	1.09	62.40	44.18	74.0	54.0	11.6	9.8
5416.5	55.23	44.58	H	3.79	59.02	37.54	74.0	54.0	15.0	16.5
5416.5	64.36	54.18	V	3.79	68.15	47.14	74.0	54.0	5.9	6.9
8124.75	49.64	37.95	V	8.17	57.81	35.29	74.0	54.0	16.2	18.7
9027.5	49.58	38.51	H	8.35	57.93	36.03	74.0	54.0	16.1	18.0
9027.5	49.10	37.77	V	8.35	57.45	35.29	74.0	54.0	16.6	18.7
Middle Channel										
2745.75	63.67	59.58	H	-3.91	59.76	44.84	74.0	54.0	14.2	9.2
2745.75	71.11	67.68	V	-3.91	67.20	52.94	74.0	54.0	6.8	1.1
3661	52.41	43.41	H	-0.70	51.71	31.88	74.0	54.0	22.3	22.1
3661	56.59	48.72	V	-0.70	55.89	37.19	74.0	54.0	18.1	16.8
4576.25	57.43	49.81	H	1.25	58.68	40.23	74.0	54.0	15.3	13.8
4576.25	62.53	55.24	V	1.25	63.78	45.66	74.0	54.0	10.2	8.3
7322	49.20	38.08	V	7.67	56.87	34.92	74.0	54.0	17.1	19.1
8237.25	49.41	37.47	V	8.33	57.74	34.97	74.0	54.0	16.3	19.0
9152.5	48.97	37.16	H	8.56	57.53	34.89	74.0	54.0	16.5	19.1
9152.5	48.26	37.29	V	8.56	56.82	35.02	74.0	54.0	17.2	19.0
High Channel										
2781.75	65.17	59.94	H	-3.78	61.39	45.33	74.0	54.0	12.6	8.7
2781.75	71.17	65.68	V	-3.78	67.39	51.07	74.0	54.0	6.6	2.9
3709	52.78	43.69	H	-0.48	52.30	32.39	74.0	54.0	21.7	21.6
3709	56.86	49.58	V	-0.48	56.38	38.28	74.0	54.0	17.6	15.7
4636.25	58.75	51.61	H	1.40	60.15	42.19	74.0	54.0	13.8	11.8
4636.25	65.07	57.86	V	1.40	66.47	48.44	74.0	54.0	7.5	5.6
7418	50.11	39.35	V	7.74	57.85	36.26	74.0	54.0	16.2	17.7
8345.25	47.50	36.12	V	8.48	55.98	33.77	74.0	54.0	18.0	20.2

Table 7.3.2-2: Radiated Spurious Emissions Tabulated Data – Y-Position

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										
2708.25	71.22	66.42	H	-4.04	67.18	51.55	74.0	54.0	6.8	2.4
2708.25	72.39	65.96	V	-4.04	68.35	51.09	74.0	54.0	5.7	2.9
3611	63.97	57.28	H	-0.93	63.04	45.52	74.0	54.0	11.0	8.5
3611	57.35	49.40	V	-0.93	56.42	37.64	74.0	54.0	17.6	16.4
4513.75	60.37	52.93	H	1.09	61.46	43.19	74.0	54.0	12.5	10.8
4513.75	64.74	58.39	V	1.09	65.83	48.65	74.0	54.0	8.2	5.3
5416.5	64.78	54.48	H	3.79	68.57	47.44	74.0	54.0	5.4	6.6
5416.5	54.79	45.25	V	3.79	58.58	38.21	74.0	54.0	15.4	15.8
8124.75	51.33	40.87	H	8.17	59.50	38.21	74.0	54.0	14.5	15.8
8124.75	48.43	37.05	V	8.17	56.60	34.39	74.0	54.0	17.4	19.6
Middle Channel										
2745.75	64.61	58.06	H	-3.70	60.91	43.53	74.0	54.0	13.1	10.5
2745.75	69.19	62.30	V	-3.70	65.49	47.77	74.0	54.0	8.5	6.2
3661	58.14	50.65	H	-0.47	57.67	39.36	74.0	54.0	16.3	14.6
3661	53.41	44.98	V	-0.47	52.94	33.69	74.0	54.0	21.1	20.3
4576.25	62.10	55.34	H	1.42	63.52	45.94	74.0	54.0	10.5	8.1
4576.25	62.68	55.98	V	1.42	64.10	46.58	74.0	54.0	9.9	7.4
7322	47.40	36.27	H	7.56	54.96	33.00	74.0	54.0	19.0	21.0
7322	46.29	34.85	V	7.56	53.85	31.58	74.0	54.0	20.2	22.4
8237.25	50.27	39.51	H	8.48	58.75	37.17	74.0	54.0	15.2	16.8
9152.5	50.42	38.94	H	8.83	59.25	36.94	74.0	54.0	14.8	17.1
9152.5	49.11	37.87	V	8.83	57.94	35.87	74.0	54.0	16.1	18.1
High Channel										
2781.75	71.55	65.27	H	-3.58	67.97	50.86	74.0	54.0	6.0	3.1
2781.75	67.10	60.85	V	-3.58	63.52	46.44	74.0	54.0	10.5	7.6
3709	60.29	52.65	H	-0.26	60.03	41.57	74.0	54.0	14.0	12.4
3709	55.49	46.33	V	-0.26	55.23	35.25	74.0	54.0	18.8	18.8
4636.25	62.04	55.06	H	1.57	63.61	45.81	74.0	54.0	10.4	8.2
4636.25	61.90	54.84	V	1.57	63.47	45.59	74.0	54.0	10.5	8.4
7418	47.27	36.17	H	7.72	54.99	33.06	74.0	54.0	19.0	20.9
7418	46.07	33.35	V	7.72	53.79	30.24	74.0	54.0	20.2	23.8
8345.25	50.21	38.89	H	8.63	58.84	36.70	74.0	54.0	15.2	17.3

Table 7.3.2-3: Radiated Spurious Emissions Tabulated Data – Z-Position

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										
2708.25	71.84	64.36	H	-4.04	67.80	49.49	74.0	54.0	6.2	4.5
2708.25	70.42	61.59	V	-4.04	66.38	46.72	74.0	54.0	7.6	7.3
3611	60.16	50.57	H	-0.93	59.23	38.81	74.0	54.0	14.8	15.2
3611	56.61	47.35	V	-0.93	55.68	35.59	74.0	54.0	18.3	18.4
4513.75	68.63	58.89	H	1.09	69.72	49.15	74.0	54.0	4.3	4.8
4513.75	62.19	52.35	V	1.09	63.28	42.61	74.0	54.0	10.7	11.4
5416.5	62.91	51.54	H	3.79	66.70	44.50	74.0	54.0	7.3	9.5
5416.5	60.48	48.47	V	3.79	64.27	41.43	74.0	54.0	9.7	12.6
8124.75	50.55	39.53	H	8.17	58.72	36.87	74.0	54.0	15.3	17.1
8124.75	49.22	38.21	V	8.17	57.39	35.55	74.0	54.0	16.6	18.4
9027.5	53.15	40.19	H	8.35	61.50	37.71	74.0	54.0	12.5	16.3
9027.5	47.26	34.88	V	8.35	55.61	32.40	74.0	54.0	18.4	21.6
Middle Channel										
2745.75	67.79	61.16	H	-3.70	64.09	46.63	74.0	54.0	9.9	7.4
2745.75	68.95	63.67	V	-3.70	65.25	49.14	74.0	54.0	8.8	4.9
3661	56.31	48.06	H	-0.47	55.84	36.77	74.0	54.0	18.2	17.2
3661	56.18	49.02	V	-0.47	55.71	37.73	74.0	54.0	18.3	16.3
4576.25	66.19	58.92	H	1.42	67.61	49.52	74.0	54.0	6.4	4.5
4576.25	61.69	54.71	V	1.42	63.11	45.31	74.0	54.0	10.9	8.7
7322	47.31	36.91	H	7.56	54.87	33.64	74.0	54.0	19.1	20.4
7322	49.13	38.38	V	7.56	56.69	35.11	74.0	54.0	17.3	18.9
8237.25	51.13	40.82	H	8.48	59.61	38.48	74.0	54.0	14.4	15.5
8237.25	50.97	40.56	V	8.48	59.45	38.22	74.0	54.0	14.5	15.8
9152.5	51.41	40.87	H	8.83	60.24	38.87	74.0	54.0	13.8	15.1
9152.5	47.57	36.87	V	8.83	56.40	34.87	74.0	54.0	17.6	19.1
High Channel										
2781.75	65.51	59.28	H	-3.58	61.93	44.87	74.0	54.0	12.1	9.1
2781.75	67.28	61.84	V	-3.58	63.70	47.43	74.0	54.0	10.3	6.6
3709	58.37	50.14	H	-0.26	58.11	39.06	74.0	54.0	15.9	14.9
3709	55.11	46.43	V	-0.26	54.85	35.35	74.0	54.0	19.1	18.7
4636.25	66.85	59.66	H	1.57	68.42	50.41	74.0	54.0	5.6	3.6
4636.25	60.19	52.75	V	1.57	61.76	43.50	74.0	54.0	12.2	10.5
7418	48.77	37.80	H	7.72	56.49	34.69	74.0	54.0	17.5	19.3
7418	45.25	33.15	V	7.72	52.97	30.04	74.0	54.0	21.0	24.0
8345.25	51.86	41.40	H	8.63	60.49	39.21	74.0	54.0	13.5	14.8
8345.25	49.11	38.13	V	8.63	57.74	35.94	74.0	54.0	16.3	18.1

7.2.4 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 – X Position

Corrected Level: 61.43 + -4.04 = 57.39dBuV/m
Margin: 74dBuV/m – 57.39dBuV/m = 16.6dB

Example Calculation: Average – X Position

Corrected Level: 56.03 + -4.04 - 10.83 = 41.16dBuV
Margin: 54dBuV – 41.16dBuV = 12.8dB

8 CONCLUSION

In the opinion of ACS, Inc. DNT900C and DNT900P, manufactured by Cirronet Inc. meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210 as applicable to the class II permissive change.

END REPORT