Excellence in Compliance Testing

Certification Test Report

FCC ID: TEB-HUNTGS10122
IC: 5931A-HUNTGS10122

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

ACS Report Number: 11-0031.W06.22.A

Manufacturer: Hunt Technologies, Inc.
Model: 10122

Test Begin Date: February 1, 2011
Test End Date: February 24, 2011

Report Issue Date: October 4, 2011

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 13 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 of a single modular approval.

1.2 Product description

This device is a daughter board module, manufactured by Hunt Technologies, Inc. that plugs into a GE KV2C metrology circuit board. The daughter board contains two separate radios: a 900 MHz ISM band frequency-hopping spread spectrum (FHSS) transceiver and a 2.4 MHz ISM band transceiver employing 802.15.4/ZigBee.

The 10122 module collects metering data from the meter module and transmits it to electric utility companies. It can also receive and repeat data from other similar modules or a central collector module. The 10122 module will be transmitting and receiving over 2400-2483.5 MHz ISM band for in-home "Personal Energy Management" applications.

The 10122 module is a composite device by definition. The 900 MHz LAN radio and the 2.4 GHz Zigbee radio operate under CFR 47 Part 15.247 and IC RSS-210. This report addresses the 2.4 MHz ZigBee radio only. A separate report will be issued to address the 900 MHz LAN radio.

Band of operation: 2405 – 2475 MHz
Number of hopping channels: 15
Channel spacing 5 MHz
Modulation format: O-QPSK
Antenna Type / Gain: PCB inverted-F / 5.15dBi
Operating Voltage: 28VDC

Manufacturer Information:
Hunt Technologies, Inc.
6436 County Rd 11
Pequot Lakes, MN 56472

Test Sample Serial Number(s): 810C000

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

1.3 Test Methodology and Considerations

The 10122 module was tested standalone only using a composite meter face plate to support the module and 900MHz antenna. The configuration represents the module in final installation.

For AC power line conducted emissions, the 10122 module was installed in a typical host utility meter. Further details are provided in sections 5 and 6 of this report.

For radiated emissions both antennas were evaluated.

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 2.3.1-1 below:

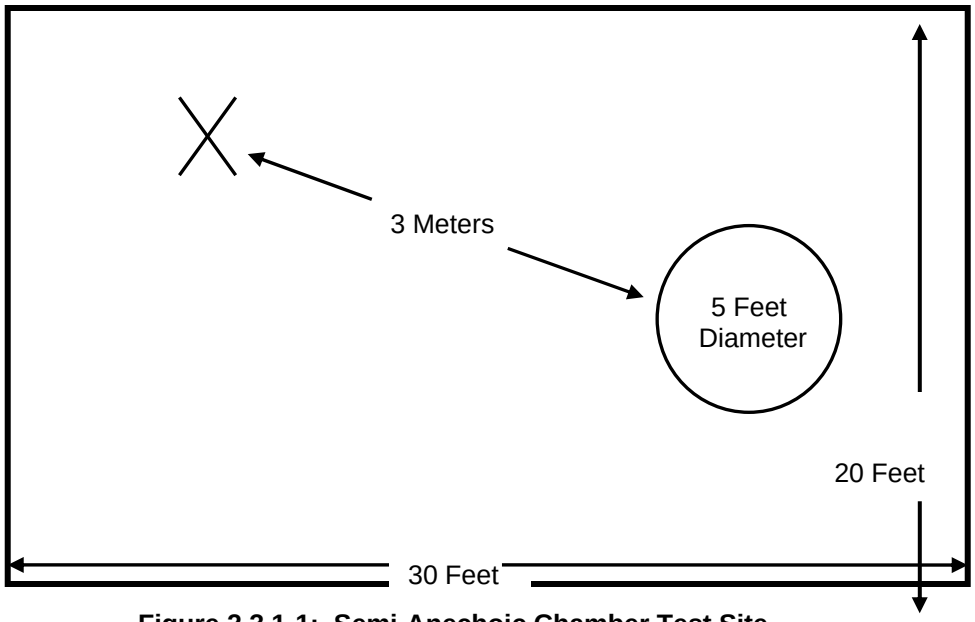

Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

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 2.3.2-1 below:

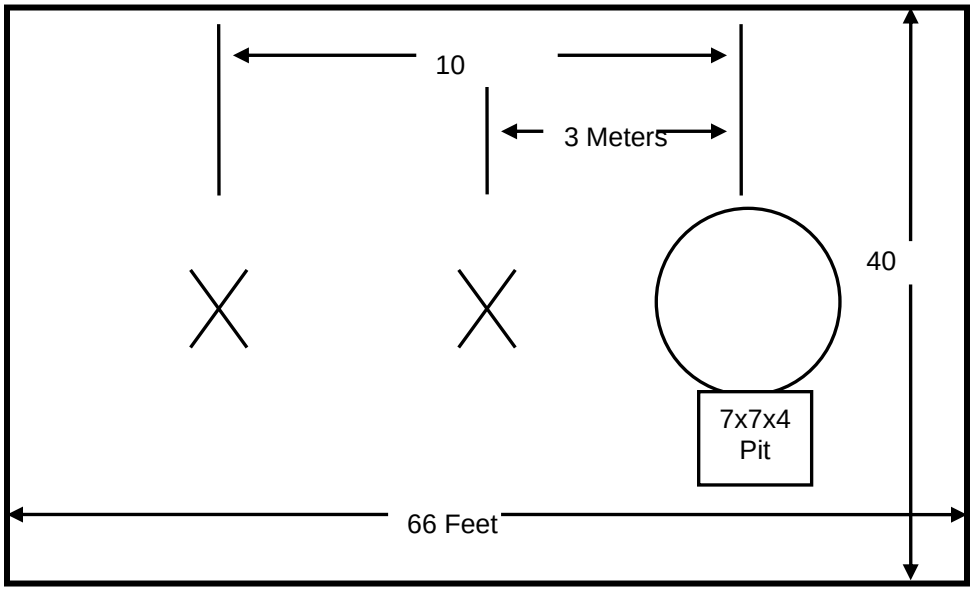

Figure 2.3.2-1: Open Area Test Site

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 2.4-1:

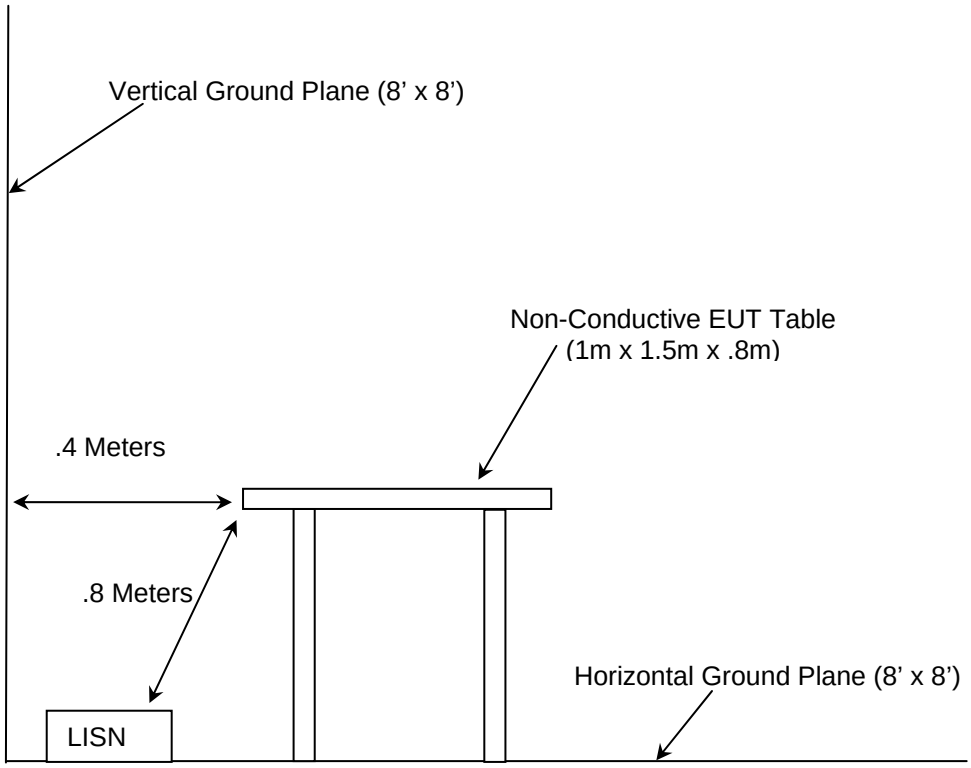

Figure 2.4-1: AC Mains Conducted EMI Site

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, 2010
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2010
- FCC KDB Publication No. 558074 - Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247), March 2005
- 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, Issue3, 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	ESVI - Display	Spectrum Analyzers	833771/007	9/23/2010	9/23/2012
2	Rohde & Schwarz	ESVI-Receiver	Spectrum Analyzers	839687/003	9/23/2010	9/23/2012
25	Chase	CBL6111	Antennas	1043	9/13/2010	9/13/2012
30	Spectrum Technologies	DRH-0118	Antennas	970102	5/8/2009	5/8/2011
73	Agilent	8447D	Amplifiers	2727A06624	5/26/2010	5/26/2011
152	EMCO	3825/2	LISN	9111-1905	11/2/2010	11/2/2011
167	ACS	Chamber EMI Cable Set	Cable Set	167	1/26/2011	1/26/2012
168	Hewlett Packard	11947A	Attenuators	44829	2/4/2011	2/4/2012
291	Florida RF Cables	SMRE-200W-120-SMRE	Cables	None	12/7/2010	12/7/2011
292	Florida RF Cables	SMR-290AW-480-0-SMR	Cables	None	12/7/2010	12/7/2011
324	ACS	Belden	Cables	8214	7/9/2010	7/9/2011
334	Rohde&Schwarz	3160-10	Antennas	45576	11/4/2010	NCR
335	Suhner	SF-102A	Cables	882/2A	10/29/2010	10/29/2011
338	Hewlett Packard	8449B	Amplifiers	3008A01111	10/29/2010	10/29/2011
345	Suhner Sucoflex	102A	Cables	1077/2A	10/29/2010	10/29/2011
422	Florida RF	SMS-200AW-72-0-SMR	Cables	805	12/29/2010	12/29/2011
432	Microwave Circuits	H-BG020G4	Filters	264066	7/16/2010	7/16/2011

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	DC Supply	Hewlett Packard	E3620A	KR41200402
2	Electricity meter	Landis + Gyr	GE KV2C	NA

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

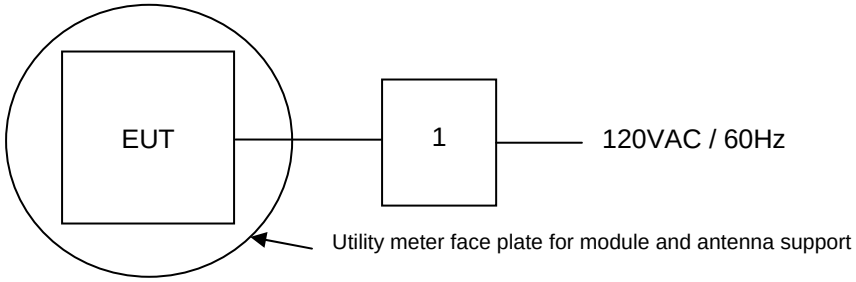

Figure 6-1: Radiated Emissions Test Setup

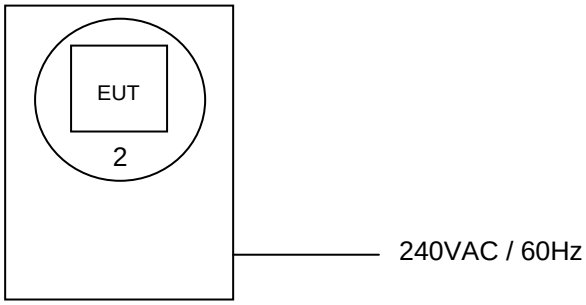

Figure 6-2: AC Power Line Conducted Emissions Test Setup

Figure 6-1: EUT Test Setup

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 transmitter antennas are PCB inverted-F antennas integral to the circuit board, and therefore comply with the requirement that no other antenna shall be used with the device.

7.2 Power Line Conducted Emissions – FCC: Section 15.207 IC: RSS-Gen 7.2.4

7.2.1 Measurement Procedure

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 Measurement Results

Results of the test are shown below in and Tables 7.2.2-1 to 7.2.2-2.

Table 7.2.2-1: Line 1 Conducted EMI Results

Frequency (MHz)	Level (dBuV)	Transducer (dB)	Limit (dBuV)	Margin (dB)	Line	PE	Detector
0.264	38.2	10	61	23.1	L1	GND	QP
0.462	36	10	57	20.7	L1	GND	QP
0.516	38.3	10	56	17.7	L1	GND	QP
0.708	40.3	10.1	56	15.7	L1	GND	QP
0.792	33.5	10.1	56	22.5	L1	GND	QP
0.99	27.1	10	56	28.9	L1	GND	QP
1.302	29.8	10	56	26.2	L1	GND	QP
1.452	31.2	10	56	24.8	L1	GND	QP
1.644	32.2	10	56	23.8	L1	GND	QP
0.258	35.4	10	52	16.1	L1	GND	AVG
0.462	30.6	10	47	16	L1	GND	AVG
0.516	32.2	10	46	13.8	L1	GND	AVG
0.708	35.4	10.1	46	10.6	L1	GND	AVG
0.714	35	10.1	46	11	L1	GND	AVG
0.81	26	10.1	46	20	L1	GND	AVG
0.972	24	10	46	22	L1	GND	AVG
1.284	23.4	10	46	22.6	L1	GND	AVG
1.506	24.4	10	46	21.6	L1	GND	AVG
1.656	26.3	10	46	19.7	L1	GND	AVG

Table 7.2.2-2: Line 2 Conducted EMI Results

Frequency (MHz)	Level (dBuV)	Transducer (dB)	Limit (dBuV)	Margin (dB)	Line	PE	Detector
0.51	45.4	10	56	10.6	L2	GND	QP
0.708	48.4	10.1	56	7.6	L2	GND	QP
0.714	48.3	10.1	56	7.7	L2	GND	QP
1.65	40.8	10	56	15.2	L2	GND	QP
1.842	41	10	56	15	L2	GND	QP
2.784	40.5	10	56	15.5	L2	GND	QP
2.844	40.4	10	56	15.6	L2	GND	QP
3.906	41.3	9.9	56	14.7	L2	GND	QP
3.954	41	9.9	56	15	L2	GND	QP
4.998	41	10	56	15	L2	GND	QP
0.51	38.7	10	46	7.3	L2	GND	AVG
0.708	43.9	10.1	46	2.1	L2	GND	AVG
0.714	43.1	10.1	46	2.9	L2	GND	AVG
1.656	34.5	10	46	11.5	L2	GND	AVG
1.848	35.2	10	46	10.8	L2	GND	AVG
2.73	35.1	10	46	10.9	L2	GND	AVG
2.844	35	10	46	11	L2	GND	AVG
3.9	35.9	9.9	46	10.1	L2	GND	AVG
4.008	35.2	9.9	46	10.8	L2	GND	AVG
4.998	35.6	10	46	10.4	L2	GND	AVG

7.3 Radiated Spurious Emissions (Restricted Bands) - FCC Sec. 15.205 IC: RSS-210 2.6

7.3.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 30MHz to 25 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.

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.

Because the upper band-edge coincides with a restricted band, band-edge compliance for the upper band-edge was also evaluated and shown below.

7.3.2 Duty Cycle Correction

The device operates with a 42% duty cycle, therefore for average radiated measurements the measured level was reduced by a factor 7.54dB. The duty cycle correction factor is determined using the formula: 20log (42/100) = -7.54dB.

A detailed analysis of the duty cycle timing is provided in the Theory of Operation accompanying this report.

7.3.3 Measurement Results

Radiated spurious emissions found in the band of 30MHz to 25GHz are reported in the table 7.3.3-1 to 7.3.3-2 below.

Table 7.3.3-1: Radiated Spurious Emissions – ANT1

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										
4810	53.77	45.29	H	1.90	55.67	39.66	74.0	54.0	18.3	14.3
4810	51.07	41.66	V	1.90	52.97	36.03	74.0	54.0	21.0	18.0
12025	61.82	54.33	H	15.06	76.88	61.86	83.5	63.5	6.6	1.7
12025	60.58	52.33	V	15.06	75.64	59.86	83.5	63.5	7.9	3.7
Middle Channel										
7335	56.61	48.52	H	7.56	64.17	48.54	74.0	54.0	9.8	5.5
7335	52.01	42.40	V	7.56	59.57	42.42	74.0	54.0	14.4	11.6
12225	54.99	45.82	H	16.46	71.45	54.75	83.5	63.5	12.0	8.8
12225	54.66	45.88	V	16.46	71.12	54.81	83.5	63.5	12.4	8.7
High Channel										
2483.5	69.54	59.38	H	-4.85	64.69	46.99	74.0	54.0	9.3	7.0
2483.5	72.26	62.05	V	-4.85	67.41	49.66	74.0	54.0	6.6	4.3
7425	50.78	41.15	H	7.67	58.45	41.28	74.0	54.0	15.6	12.7
7425	49.13	38.54	V	7.67	56.80	38.67	74.0	54.0	17.2	15.3

Table 7.3.3-2: Radiated Spurious Emissions – ANT2

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										
4810	46.77	36.61	H	8.15	54.92	37.23	74.0	54.0	19.1	16.8
4810	47.97	38.54	V	8.15	56.12	39.16	74.0	54.0	17.9	14.8
12025	53.37	45.82	H	22.72	76.09	61.00	83.5	63.5	7.4	2.5
12025	54.23	46.71	V	22.72	76.95	61.89	83.5	63.5	6.6	1.6
Middle Channel										
4890	47.32	38.13	H	8.37	55.69	38.97	74.0	54.0	18.3	15.0
4890	48.47	40.01	V	8.37	56.84	40.85	74.0	54.0	17.2	13.2
7335	54.46	47.12	H	13.50	67.96	53.09	74.0	54.0	6.0	0.9
7335	55.25	47.96	V	13.50	68.75	53.93	74.0	54.0	5.2	0.1
12225	48.57	40.26	H	24.17	72.74	56.89	83.5	63.5	10.8	6.6
12225	50.42	42.68	V	24.17	74.59	59.31	83.5	63.5	8.9	4.2
High Channel										
2483.5	59.71	52.43	H	0.92	60.63	45.82	74.0	54.0	13.4	8.2
2483.5	59.74	52.35	V	0.92	60.66	45.74	74.0	54.0	13.3	8.3
7425	51.49	43.54	H	13.61	65.10	49.61	74.0	54.0	8.9	4.4
7425	52.12	44.28	V	13.61	65.73	50.35	74.0	54.0	8.3	3.6

7.3.4 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T = Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U = Uncorrected Reading
R_C = Corrected Level
AF = Antenna Factor
CA = Cable Attenuation
AG = Amplifier Gain
DC = Duty Cycle Correction Factor

Example Calculation: Peak

Corrected Level: 53.77 + 1.90 = 55.67dBuV/m
Margin: 74dBuV/m – 55.67dBuV/m = 18.3dB

Example Calculation: Average

Corrected Level: 45.29 + 1.90 - 7.54 = 39.66dBuV
Margin: 54dBuV – 39.66dBuV = 14.3dB

8 CONCLUSION

In the opinion of ACS, Inc. the 10122, manufactured by Hunt Technologies, Inc. meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT