RHEIN TECH LABORATORIES, INC.

Engineering Solutions & Electromagnetic Compatibility Services

Class 2 Permissive Change Report
FCC Part 15.247 & Industry Canada RSS-210

Test Lab:	Applicant:
Rhein Tech Laboratories, Inc. Phone: 703-689-0368 360 Herndon Parkway Fax: 703-689-2056 Suite 1400 Web: www.rheintech.com Herndon, VA 20170 E-Mail: ATCBINFO@rheintech.com	Hayward Industries, Inc. Contact: John O'Hare 620 Division Street Elizabeth, NJ 07201 E-Mail: johare@haywardnet.com

FCC ID/ IC ID:	RNW-MD-FH-09-01/ 5110A-MDFH0901	**Test Report Date:**	March 14, 2014
Platform:	N/A	**RTL Project Number:**	2013308
Model Name/ Model Number:	G1-011024 (Base Station) G1-011029 (Remote – subset of Base Station)	**RTL Quote Number:**	QRTL13-308
American National Standard Institute:	ANSI C63.4-2003 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz		
FCC Classification:	DSS – Part 15 Spread Spectrum Transmitter		
FCC Rule Part(s):	FCC Rules Part 15.247: Operation within the bands 920-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz Direct Sequence System 10-01-13		
Industry Canada:	RSS-210: Low-power License-exempt Radiocommunication Devices Issue 8		

Frequency Range (MHz)	Output Power (W)	Frequency Tolerance	Emission Designator
903-927	0.006	N/A	280KFXD

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the applicable parts of FCC Part 2, FCC Part 15, FCC 97-114, ANSI C63.4, and Industry Canada RSS-210.

Signature: _____ Date: March 14, 2014

Typed/Printed Name: Desmond A. Fraser Position: President

These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANSI-ASQ National Accreditation Board/ACLASS. Refer to certificate and scope of accreditation AT-1445.

Table of Contents

Figure Index

Table Index

Appendix Index

Photograph Index

1 General Information

1.1 Scope

Applicable Standards:

- FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.
- Industry Canada RSS-210: Low-power License-exempt Radiocommunication Devices

1.2 Description of EUT

Equipment Under Test	Generation 2 FHSS Radio	
Model	G1-011024 / G1-011029	
Power Supply	3V DC	
Modulation Type	FHSS	
Frequency Range	903 – 927 MHz	
Antenna Connector Type	None	
Antenna Types	Trace	-0.7 dBi

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 2003).

1.4 Related Submittal(s)/Grant(s)

This is a Class 2 Permissive Change based on an new microwave absorbing material configuration (WDNRC-0.020-1PA) for **Hayward Industries, Inc.** Model Name: Generation 2 FHSS Radio, Model #: G1-011024 (Base Station), G1-011029 (Remote – Subset of Base Station) FCC ID: RNW-MD-FH-09-01, IC: 5110A-MDFH0901.

1.5 Modifications

No modifications were required for compliance.

2 Test Information

2.1 Description of Test Modes

In accordance with FCC 15.31(m), and because the EUT utilizes an operating band greater than 10 MHz, the following frequencies were tested:

Table 2-1: Channels Tested for FHSS

Channel	Frequency
0	903
37	915
74	927

2.2 Exercising the EUT

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The EUT was provided with software to continuously transmit during testing. The carrier was also checked to verify that information was being transmitted. There were no deviations from the test standard(s) and/or methods. The test results reported relate only to the item tested.

2.3 Test Result Summary

Table 2-2: Test Result Summary – FCC Part 15, Subpart C (Section 15.247)

Standard	Test	Pass/Fail or N/A
FCC 15.209	Radiated Emissions	Pass

2.4 Test System Details

The test sample was received on January 9, 2014. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following tables.

Table 2-3: Equipment Under Test

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
9V AC Adapter	CUI Inc.	DVR090-3512	N/A	N/A	1.7m unshielded power	21317
Controller Module	Hayward Industries, Inc.	N/A	N/A	N/A	0.2m unshielded I/O	21375
Radio Board	Hayward Industries, Inc.	G1-011024B-1T	G1-015038A-1 3010 29461(104)	N/A	N/A	21377

2.5 Configuration of Tested System

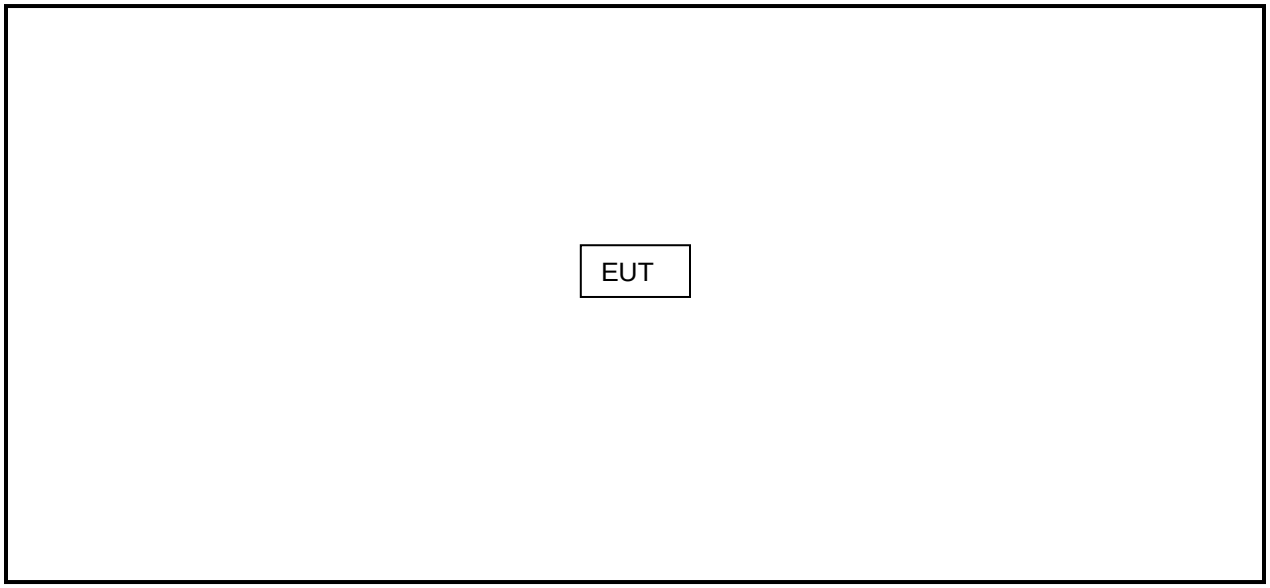

Figure 2-1: Configuration of System Under Test

3 Radiated Emissions – FCC §15.209; RSS-210 §A8.5 and RSS-Gen

3.1 Limits of Radiated Emissions Measurement

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009-0.490	2400/f (kHz)	300
0.490-1.705	2400/f (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

As shown in 15.35(b), for frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any circumstances of modulation.

3.2 Radiated Emissions Measurement Test Procedure

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to the 10^{th} harmonic of the highest fundamental transmitter frequency. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Table 3-1: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900151	Rohde and Schwarz	HFH2-Z2	Antenna (Loop, 9 kHz - 30 MHz)	827525/019	3/4/15
900724	Antenna Research Associates, Inc.	LPB-2520	BiLog Antenna (25-1000MHz)	1037	4/19/14
900932	Hewlett Packard	8449B OPT H02	Preamplifier 1-26.5 GHz	3008A00505	8/27/14
900878	Rhein Tech Labs	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901592	Insulated Wire Inc.	KPS-1503-3600-KPR	SMK RF Cables 20'	NA	8/27/14
901593	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36"	NA	8/27/14
901242	Rhein Tech Labs	WRT-000-0003	Wood rotating table	N/A	Not Required
900772	EMCO	3161-02	Horn Antenna 2 - 4 GHz	9804-1044	4/19/14
900321	EMCO	3161-03	Horn Antenna 4.0-8.2 GHz	9508-1020	4/19/14
900323	EMCO	3160-07	Horn Antenna 8.2-12.4 GHz	9605-1054	4/19/14
901629	Teledyne Cougar	A4C2123	Amplifer	003-003	9/4/14

3.3 Radiated Emissions Test Results

3.3.1 Radiated Emissions Harmonics/Spurious Test Data

Table 3-2: Radiated Emissions Harmonics/Spurious (TX Frequency: 903 MHz) Average

Emission Frequency (MHz)	Average Analyzer Reading (dBuV) (1 MHz RBW/10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
2709.0	49.1	-9.1	40.0	54.0	-14.0
3612.0	48.3	-5.7	42.6	54.0	-11.4
4515.0	40.9	-1.5	39.4	54.0	-14.6
5418.0	50.3	-0.8	49.5	54.0	-4.5
8127.0	37.1	5.8	42.9	54.0	-11.1
9030.0	39.1	6.4	45.5	54.0	-8.5

Table 3-3: Radiated Emissions Harmonics/Spurious (TX Frequency: 903 MHz) Peak

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Site Correction Factor (dB/m)	Peak Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
2709.0	52.4	-9.1	43.3	74.0	-30.7
3612.0	49.8	-5.7	44.1	74.0	-29.9
4515.0	45.8	-1.5	44.3	74.0	-29.7
5418.0	52.9	-0.8	52.1	74.0	-21.9
8127.0	45.5	5.8	51.3	74.0	-22.7
9030.0	46.8	6.4	53.2	74.0	-20.8

Table 3-4: Radiated Emissions Harmonics/Spurious (TX Frequency: 915 MHz); Average

Emission Frequency (MHz)	Average Analyzer Reading (dBuV) (1 MHz RBW/10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
2745.0	49.6	-9.1	40.5	54.0	-13.5
3660.0	49.0	-5.2	43.8	54.0	-10.2
4575.0	40.4	-1.4	39.0	54.0	-15.0
7320.0	46.1	0.9	47.0	54.0	-7.0
8235.0	34.3	6.0	40.3	54.0	-13.7
9150.0	39.4	6.4	45.8	54.0	-8.2

Table 3-5: Radiated Emissions Harmonics/Spurious (TX Frequency: 915 MHz); Peak

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Site Correction Factor (dB/m)	Peak Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
2745.0	53.3	-9.1	44.2	74.0	-29.8
3660.0	52.4	-5.2	47.2	74.0	-26.8
4575.0	46.7	-1.4	45.3	74.0	-28.7
7320.0	48.7	0.9	49.6	74.0	-24.4
8235.0	43.6	6.0	49.6	74.0	-24.4
9150.0	47.1	6.4	53.5	74.0	-20.5

Table 3-6: Radiated Emissions Harmonics/Spurious (TX Frequency: 927 MHz); Average

Emission Frequency (MHz)	Average Analyzer Reading (dBuV) (1 MHz RBW/10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
2781.0	49.0	-9.1	39.9	54.0	-14.1
3708.0	49.3	-4.7	44.6	54.0	-9.4
4635.0	42.7	-1.3	41.4	54.0	-12.6
7416.0	45.3	1.1	46.4	54.0	-7.6
8343.0	34.0	6.2	40.2	54.0	-13.8

Table 3-7: Radiated Emissions Harmonics/Spurious (TX Frequency: 927 MHz); Peak

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Site Correction Factor (dB/m)	Peak Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
2781.0	52.2	-9.1	43.1	74.0	-30.9
3708.0	52.5	-4.7	47.8	74.0	-26.2
4635.0	48.4	-1.3	47.1	74.0	-26.9
7416.0	48.0	1.1	49.1	74.0	-24.9
8343.0	44.9	6.2	51.1	74.0	-22.9

Test Personnel:

Dan Baltzell		March 5, 2014
Test Engineer	Signature	Date Of Tests

4 Conclusion

The data in this measurement report shows that the EUT as tested, **Hayward Industries, Inc.** Model #'s G1-011024 and G1-011029, FCC ID: RNW-MD-FH-09-01, IC: 5110A-MDFH0901, complies with the applicable requirements of Parts 2 and 15 of the FCC Rules and Regulations, and Industry Canada RSS-210.