

**FCC PART 15, SUBPART B and C  
TEST REPORT***for***POOL / SPA CONTROLLER – HAND HELD REMOTE  
MODEL: LENNOVATOR**

Prepared for

ALLIED INNOVATIONS, LLC  
7215 BERMUDA ROAD  
LAS VEGAS, NEVADA 89119-4303

Prepared by: \_\_\_\_\_

KYLE FUJIMOTO

Approved by: \_\_\_\_\_

MICHAEL CHRISTENSEN

COMPATIBLE ELECTRONICS INC.  
114 OLINDA DRIVE  
BREA, CALIFORNIA 92823  
(714) 579-0500

DATE: AUGUST 08, 2002

	REPORT BODY	APPENDICES					TOTAL
		A	B	C	D	E	
PAGES	15	2	2	2	10	9	40

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## GENERAL REPORT SUMMARY

This electromagnetic emission test report is generated by Compatible Electronics Inc., which is an independent testing and consulting firm. The test report is based on testing performed by Compatible Electronics personnel according to the measurement procedures described in the test specifications given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced without the written permission of Compatible Electronics, unless done so in full.

This report must not be used to claim product endorsement by NVLAP or any other agency of the U.S. Government.

Device Tested: Pool / Spa Controller – Hand Held Remote  
Model: Lennovator  
S/N: N/A

Product Description: See Expository Statement.

Modifications: The EUT was modified during the testing. Please see the list located in Appendix B.

Manufacturer: Allied Innovations, LLC  
7215 Bermuda Road  
Las Vegas, Nevada 89119-4304

Test Dates: August 6 and 7, 2002

Test Specifications: EMI requirements  
CFR Title 47, Part 15 Subpart B; and Subpart C, Sections 15.205, 15.209, and 15.249

Test Procedure: ANSI C63.4: 1992

Test Deviations: The test procedure was not deviated from during the testing.

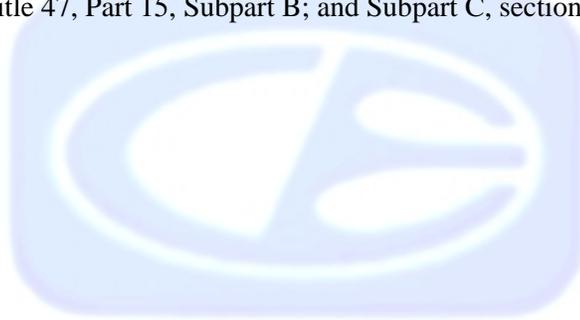
## SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 450 kHz - 30 MHz	This test was not performed because the EUT operates on battery power only and cannot be plugged in to the AC public mains.
2	Radiated RF Emissions, 10 kHz - 4300 MHz	Complies with the Class B limits of CFR Title 47, Part 15, Subpart B; and Subpart C, sections 15.205, 15.209, and 15.249



**1. PURPOSE**

This document is a qualification test report based on the Electromagnetic Interference (EMI) tests performed on the Pool / Spa Controller – Hand Held Remote Model: Lennovator. The EMI measurements were performed according to the measurement procedure described in ANSI C63.4: 1992. The tests were performed in order to determine whether the electromagnetic emissions from the equipment under test, referred to as EUT hereafter, are within the Class B specification limits defined by CFR Title 47, Part 15, Subpart B; and Subpart C, sections 15.205, 15.209, and 15.249.



## 2. ADMINISTRATIVE DATA

### 2.1 Location of Testing

The EMI tests described herein were performed at the test facility of Compatible Electronics, 114 Olinda Drive, Brea, California 92823.

### 2.2 Traceability Statement

The calibration certificates of all test equipment used during the test are on file at the location of the test. The calibration is traceable to the National Institute of Standards and Technology (NIST).

### 2.3 Cognizant Personnel

Allied Innovations, LLC

Brooks Bishofberger    Engineer

Compatible Electronics, Inc.

Kyle Fujimoto            Test Engineer

Michael Christensen    Test Engineer

### 2.4 Date Test Sample was Received

The test sample was received on August 06, 2002.

### 2.5 Disposition of the Test Sample

The sample was returned to Allied Innovations, LLC on August 07, 2002.

### 2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

RF	Radio Frequency
EMI	Electromagnetic Interference
EUT	Equipment Under Test
P/N	Part Number
S/N	Serial Number
HP	Hewlett Packard
ITE	Information Technology Equipment
CML	Corrected Meter Limit
LISN	Line Impedance Stabilization Network



### 3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this EMI Test Report.

<b>SPEC</b>	<b>TITLE</b>
CFR Title 47, Subpart C	FCC Rules – Radio frequency devices – Intentional Radiators
ANSI C63.4 1992	Methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz.
EN 55022: 1998	Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
CISPR 22: 1997	Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement



#### **4. DESCRIPTION OF TEST CONFIGURATION**

##### **4.1 Description of Test Configuration - EMI**

Setup and operation of the equipment under test.

Specifics of the EUT and Peripherals Tested

The Pool / Spa Controller – Hand Held Remote Model: Lennovator (EUT) was tested as a stand-alone unit. The EUT was tested in three orthogonal axis. The EUT was continuously transmitting and receiving.

The final radiated data was taken in the mode above. Please see Appendix E for the data sheets.



#### 4.1.1 Cable Construction and Termination

No external cables were connected to the EUT.



**5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT****5.1 EUT and Accessory List**

<b>EQUIPMENT</b>	<b>MANUFACTURER</b>	<b>MODEL NUMBER</b>	<b>SERIAL NUMBER</b>	<b>FCC ID</b>
POOL / SPA CONTROLLER – HAND HELD REMOTE (EUT)	ALLIED INNOVATIONS, LLC	LENNOVATOR	N/A	<b>QLSLNVTRHHR102</b>



## 5.2 EMI Test Equipment

EQUIPMENT TYPE	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
Radiated Emissions Manual Test – Radiated	Compatible Electronics	N/A	N/A	N/A	N/A
Spectrum Analyzer – Main Section	Hewlett Packard	8566B	3638A08768	June 21, 2002	June 21, 2003
Spectrum Analyzer – Display Section	Hewlett Packard	85662A	3701A22262	June 21, 2002	June 21, 2003
Spectrum Analyzer – Quasi-Peak Adapter	Hewlett Packard	85662A	2811A01363	June 21, 2002	June 21, 2003
Preamplifier	Com Power	PA-102	1017	Dec. 31, 2001	Dec. 31, 2002
Biconical Antenna	Com Power	AB-100	1548	Oct. 11, 2001	Oct. 11, 2002
Log Periodic Antenna	Com Power	AL-100	16089	Oct. 11, 2001	Oct. 11, 2002
Computer	Hewlett Packard	D5251A 888	US74458128	N/A	N/A
Printer	Hewlett Packard	C5886A	SG7CM1P090	N/A	N/A
Monitor	Hewlett Packard	D5258A	DK74889705	N/A	N/A
Loop Antenna	Com-Power	AL-130	17070	June 19, 2002	June 19, 2003
Horn Antenna	Antenna Research	DRG-118/A	1053	Jan. 13, 2002	Jan. 13, 2003
Microwave Preamplifier	Com-Power	PA-122	25195	Jan. 7, 2002	Jan. 7, 2003



**6. TEST SITE DESCRIPTION****6.1 Test Facility Description**

Please refer to section 2.1 and 7.1 of this report for EMI test location.

**6.2 EUT Mounting, Bonding and Grounding**

The EUT was mounted on a 1.0 by 1.5 meter non-conductive table 0.8 meters above the ground plane.

The EUT was not grounded.



## 7. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

### 7.1 Radiated Emissions (Spurious and Harmonics) Test

The spectrum analyzer was used as a measuring meter along with the quasi-peak adapter. Amplifiers were used to increase the sensitivity of the instrument. The Com Power Preamplifier Model: PA-102 was used for frequencies from 30 MHz to 1 GHz, and the Com-Power Microwave Preamplifier Model: PA-122 was used for frequencies above 1 GHz. The spectrum analyzer was used in the peak detect mode with the "Max Hold" feature activated. In this mode, the spectrum analyzer records the highest measured reading over all the sweeps.

For the peak readings below 1000 MHz that were within 3 dB of the spec limit or higher, the quasi-peak adapter was used.

For the peak readings above 1000 MHz that were within 3dB of the spec limit or higher, the readings were averaged manually by narrowing the video filter down to 10 Hz and slowing the sweep time to keep the amplitude reading calibrated.

The measurement bandwidths and transducers used for the radiated emissions test were:

<b>FREQUENCY RANGE</b>	<b>EFFECTIVE MEASUREMENT BANDWIDTH</b>	<b>TRANSDUCER</b>
9 kHz to 150 kHz	200 Hz	Active Loop Antenna
150 kHz to 30 MHz	9 kHz	Active Loop Antenna
30 MHz to 300 MHz	120 kHz	Biconical Antenna
300 MHz to 1 GHz	120 kHz	Log Periodic Antenna
1 GHz to 9.3 GHz	1 MHz	Horn Antenna

The open field test site of Compatible Electronics, Inc. was used for radiated emission testing. This test site is set up according to ANSI C63.4: 1992. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength). The gunsight method was used when measuring with the horn antenna in order to ensure accurate results. The loop antenna was also rotated in the horizontal and vertical axis in order to ensure accurate results.



### **Radiated Emissions (Spurious and Harmonics) Test (con't)**

The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT. The EUT was tested at a 3 meter test distance to obtain final test data. The final qualification data sheets are located in Appendix E.



**8. CONCLUSIONS**

The Pool / Spa Controller – Hand Held Remote Model: Lennovator meets all of the Class B specification limits defined in CFR Title 47, Part 15, Subpart B; and Subpart C, sections 15.205, 15.209, and 15.249.



**APPENDIX A**

***LABORATORY RECOGNITIONS***



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## ***LABORATORY RECOGNITIONS***

### **Compatible Electronics has the following agency accreditations:**

National Voluntary Laboratory Accreditation Program - Lab Code: 200063-0

Voluntary Control Council for Interference - Registration Numbers: R-983, C-1026, R-984 and C-1027

Bureau of Standards and Metrology Inspection - Reference Number: SL2-IN-E-1031

Conformity Assessment Body for the EMC Directive Under the US/EU MRA Appointed by NIST

### **Compatible Electronics is recognized or on file with the following agencies:**

Federal Communications Commission

Industry Canada

Radio-Frequency Technologies (Competent Body)



**APPENDIX B**

***MODIFICATIONS TO THE EUT***



## MODIFICATIONS TO THE EUT

The modifications listed below were made to the EUT to pass FCC 15.249 specifications.

All the rework described below was implemented during the test in a method that could be reproduced in all the units by the manufacturer.

- 1) Add a 1Kohm resistor in parallel with a 10Kohm resistor at R3. This makes the effective resistance at R3 to be 909.09 ohms. A 910 ohm resistor will be placed at R3 instead.



**APPENDIX C**

***ADDITIONAL MODELS COVERED  
UNDER THIS REPORT***



## **ADDITIONAL MODELS COVERED UNDER THIS REPORT**

USED FOR THE PRIMARY TEST

Pool / Spa Controller – Hand Held Remote  
Model: Lennovator  
S/N: N/A

There were no additional models covered under this report.



**APPENDIX D**

***DIAGRAMS, CHARTS, AND PHOTOS***





COM-POWER AB-100

BICONICAL ANTENNA

S/N: 01548

CALIBRATION DATE: OCTOBER 11, 2001

<b>FREQUENCY (MHz)</b>	<b>FACTOR (dB)</b>	<b>FREQUENCY (MHz)</b>	<b>FACTOR (dB)</b>
30	13.70	120	11.00
35	13.70	125	11.20
40	11.80	140	12.50
45	12.30	150	13.20
50	11.00	160	13.50
60	10.40	175	14.60
70	8.60	180	14.40
80	8.30	200	15.90
90	8.30	250	17.60
100	8.80	300	19.90



COM-POWER AL-100

LOG PERIODIC ANTENNA

S/N: 16089

CALIBRATION DATE: OCTOBER 11, 2001

<b>FREQUENCY (MHz)</b>	<b>FACTOR (dB)</b>	<b>FREQUENCY (MHz)</b>	<b>FACTOR (dB)</b>
300	14.10	700	20.60
400	15.10	800	22.40
500	16.60	900	22.70
600	19.90	1000	26.50



**COM-POWER PA-102****PREAMPLIFIER**

S/N: 1017

CALIBRATION DATE: DECEMBER 31, 2001

<b>FREQUENCY (MHz)</b>	<b>FACTOR (dB)</b>	<b>FREQUENCY (MHz)</b>	<b>FACTOR (dB)</b>
30	38.5	300	38.5
40	38.5	350	38.4
50	38.5	400	38.2
60	38.5	450	37.8
70	38.5	500	38.0
80	38.5	550	38.2
90	38.3	600	38.2
100	38.3	650	38.0
125	38.6	700	38.1
150	38.5	750	37.7
175	38.4	800	37.4
200	38.5	850	37.9
225	38.5	900	37.2
250	38.4	950	36.8
275	38.4	1000	37.3



**COM-POWER PA-122****MICROWAVE PREAMPLIFIER**

S/N: 25195

CALIBRATION DATE: JANUARY 7, 2002

<b>FREQUENCY (GHz)</b>	<b>FACTOR (dB)</b>	<b>FREQUENCY (GHz)</b>	<b>FACTOR (dB)</b>
1.0	33.7	9.5	31.8
1.1	33.4	10.0	32.2
1.2	33.1	11.0	31.4
1.3	33.1	12.0	30.2
1.4	33.2	13.0	32.9
1.5	32.5	14.0	33.9
1.6	32.7	15.0	32.4
1.7	32.3	16.0	32.2
1.8	32.3	17.0	31.5
1.9	31.4	18.0	32.2
2.0	32.8	19.0	31.2
2.5	33.3	20.0	31.3
3.0	31.7	21.0	31.7
3.5	31.6	22.0	29.7
4.0	31.2		
4.5	31.2		
5.0	31.0		
5.5	31.3		
6.0	32.1		
6.5	32.1		
7.0	31.8		
7.5	32.0		
8.0	33.1		
8.5	32.0		
9.0	30.8		



**ANTENNA RESEARCH DRG-118/A****HORN ANTENNA**

S/N: 1053

CALIBRATION DATE: JANUARY 13, 2002

<b>FREQUENCY (GHz)</b>	<b>FACTOR (dB)</b>	<b>FREQUENCY (GHz)</b>	<b>FACTOR (dB)</b>
1.0	25.5	9.5	39.1
1.5	26.6	10.0	39.7
2.0	29.4	10.5	40.9
2.5	30.4	11.0	40.7
3.0	31.2	11.5	42.4
3.5	32.3	12.0	42.6
4.0	32.9	12.5	42.4
4.5	33.0	13.0	41.5
5.0	34.8	13.5	41.0
5.5	35.2	14.0	40.5
6.0	36.4	14.5	43.6
6.5	36.6	15.0	43.7
7.0	38.8	15.5	43.3
7.5	38.8	16.0	42.8
8.0	38.0	16.5	43.0
8.5	38.1	17.0	42.7
9.0	39.9	17.5	44.0
		18.0	41.8



**COM-POWER AL-130****LOOP ANTENNA**

S/N: 17070

CALIBRATION DATE: JUNE 19, 2002

<b>FREQUENCY (MHz)</b>	<b>MAGNETIC (dB/m)</b>	<b>ELECTRIC (dB/m)</b>
0.009	-40.4	11.1
0.01	-40.3	11.2
0.02	-41.2	10.3
0.05	-41.6	9.9
0.07	-41.4	10.1
0.1	-41.7	9.8
0.2	-44.0	7.5
0.3	-41.6	9.9
0.5	-41.3	10.2
0.7	-41.4	10.1
1	-40.9	10.6
2	-40.6	10.9
3	-40.5	11.0
4	-40.8	10.7
5	-40.2	11.3
10	-40.7	10.8
15	-41.4	10.1
20	-41.6	9.9
25	-41.7	9.8
30	-42.9	8.6





**FRONT VIEW**

ALLIED INNOVATIONS, LLC  
POOL / SPA CONTROLLER – HAND HELD REMOTE  
MODEL: LENNOVATOR  
FCC SUBPART B AND C - RADIATED EMISSIONS – 08-06-02 and 08-07-02

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION  
FOR MAXIMUM EMISSIONS**



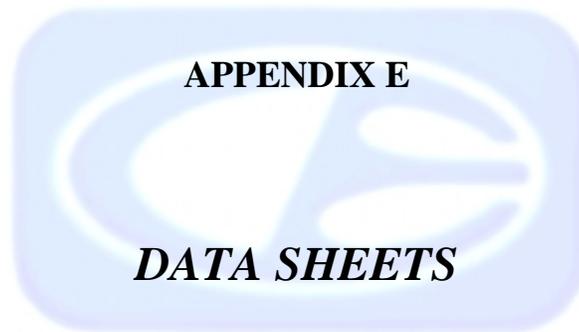


**REAR VIEW**

ALLIED INNOVATIONS, LLC  
POOL / SPA CONTROLLER – HAND HELD REMOTE  
MODEL: LENNOVATOR  
FCC SUBPART B AND C - RADIATED EMISSIONS – 08-06-02 and 08-07-02

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION  
FOR MAXIMUM EMISSIONS**

















Page: 1 of 1

Test location: Compatible Electronics  
Customer : ALLIED INNOVATIONS Date : 8/ 7/2002  
Manufacturer : ALLIED INNOVATIONS Time : 10.59  
EUT name : POOL / SPA CONTROLLER – HAND HELD REMOTE  
Model : LENNOVATOR  
Specification: Fcc\_B Test distance: 3.0 mtrs Lab: D  
Distance correction factor( $20 \cdot \log(\text{test}/\text{spec})$ ) : 0.00  
Test Mode : HAND HELD REMOTE  
1Kohm RESISTOR IN PARALLEL WITH 10Kohm at R3  
SPURIOUS EMISSIONS 10 kHz TO 30 MHz  
TEMPERATURE 75 DEGREES F., RELATIVE HUMIDITY 56%  
TESTED BY: KYLE FUJIMOTO

NO EMISSIONS FOUND FROM 10 kHz TO 30 MHz IN EITHER POLARIZATION  
FOR THE EUT



Page: 1 of 1

Test location: Compatible Electronics  
 Customer : ALLIED INNOVATIONS Date : 8/ 7/2002  
 Manufacturer : ALLIED INNOVATIONS Time : 10.37  
 EUT name : POOL / SPA CONTROLLER - HAND HELD REMOTE  
 Model : LENNOVATOR  
 Specification: Fcc\_B Test distance: 3.0 mtrs Lab: D  
 Distance correction factor(20\*log(test/spec)) : 0.00  
 Test Mode : HAND HELD REMOTE  
 1Kohm RESISTOR IN PARALLEL WITH 10Kohm at R3  
 SPURIOUS EMISSIONS 30 MHz TO 9300 MHz  
 TEMPERATURE 75 DEGREES F., RELATIVE HUMIDITY 56%  
 TESTED BY: KYLE FUJIMOTO

Pol	Freq MHz	Rdng dBuV	Cable loss dB	Ant factor dB	Amp gain dB	Cor'd rdg = R dBuV	limit = L dBuV/m	Delta R-L dB
HORIZONTAL POLARIZATION								
1H	32.09	39.50	0.74	13.70	38.50	15.44	40.00	-24.56
2H	36.09	47.80	0.82	13.29	38.50	23.41	40.00	-16.59
3H	44.09	50.50	0.98	12.21	38.50	25.19	40.00	-14.81
4H	48.09	43.90	1.06	11.50	38.50	17.96	40.00	-22.04
5H	52.09	39.50	1.12	10.87	38.50	13.00	40.00	-27.00
6H	64.09	38.30	1.24	9.66	38.50	10.71	40.00	-29.29
7H	80.09	47.00	1.50	8.30	38.50	18.30	40.00	-21.70
8H	331.89	41.80	3.33	14.42	38.44	21.11	46.00	-24.89
9H	351.87	37.40	3.41	14.62	38.39	17.04	46.00	-28.96
10H	355.87	26.30	3.44	14.66	38.38	6.02	46.00	-39.98
11H	360.09	42.80	3.46	14.70	38.36	22.60	46.00	-23.40
12H	400.09	36.40	3.70	15.10	38.20	17.00	46.00	-29.00
13H	902.15	41.00	5.04	22.78	37.18	31.64	46.00	-14.36
VERTICAL POLARIZATION								
14V	64.89	45.20	1.25	9.52	38.50	17.47	40.00	-22.53
15V	206.78	34.50	2.43	16.13	38.50	14.56	43.50	-28.94
16V	903.75	38.20	5.08	22.84	37.17	28.95	46.00	-17.05

