PENTAIR POOL PRODUCTS TEST REPORT

FOR THE

RF2000 TRANSMITTER AND RF2000 RECEIVER

FCC PART 15 SUBPART C SECTION 15.231
FCC PART 15 SUBPART B SECTIONS 15.107 & 15.109

COMPLIANCE

DATE OF ISSUE: DECEMBER 7, 2001

PREPARED FOR:

Pentair Pool Products, Inc.
10951 W. Los Angeles Ave.
Moorpark, CA 93021

W.O. No.: 77929

PREPARED BY:

Joyce Walker
CKC Laboratories, Inc.
5473A Clouds Rest
Mariposa, CA 95338

Date of test: December 5 & 6, 2001

Report No.: FC01-088

TABLE OF CONTENTS

Administrative Information 4
Summary of Results 5
Modifications Required for Compliance 5
Approvals 5
Equipment Under Test (EUT) Description 6
Equipment Under Test 6
Peripheral Devices 6
Mode of Operation 7
15.33 Frequency Range Tested 7
    15.231 Radiated Emissions 7
    15.109 Radiated Emissions 7
    15.107 Conducted Emissions 7
EUT Operating Frequency 7
Temperature and Humidity During Testing 7
Report of Measurements 8
    Table 1: Transmitter Fundamental Radiated Emission Levels 8
    Table 2: Transmitter Six Highest Radiated Emission Levels: 4MHz-5GHz 9
    Table 3: Receiver Six Highest Radiated Emission Levels: 30MHz-2.2GHZ 10
    Table 4: Receiver Six Highest Conducted Emission Levels: 450kHz-30MHz 11
Measurement Uncertainty 12
EUT Setup 12
Correction Factors 12
    Table A: Sample Calculations 12
Test Instrumentation and Analyzer Settings 13
    Table B: 15.35 Analyzer Bandwidth Settings Per Frequency Range 14
    Spectrum Analyzer Detector Functions 14
        Peak 14
        Quasi-Peak 14
        Average 14
EUT Testing 15
    Radiated Emissions 15
    Mains Conducted Emissions 15
Transmitter Characteristics 16
    15.203 Antenna Requirements 16
    15.205 Restricted Bands 16
    15.231(c) Bandwidth 16
Appendix A: Test Setup Photos 17
    Transmitter Photograph Showing Radiated Emissions 18
    Transmitter Photograph Showing Radiated Emissions 19
    Transmitter Photograph Showing Radiated Emissions 20

Transmitter Photograph Showing Radiated Emissions 21
Receiver Photograph Showing Radiated Emissions..... 22
Receiver Photograph Showing Radiated Emissions..... 23
Receiver Photograph Showing Mains Conducted Emissions 24
Receiver Photograph Showing Mains Conducted Emissions 25
Appendix C: Measurement Data Sheets..... 26
15.231(a) On Time Pulse Width..... 27
15.231(a) Burst Rate..... 28
15.231(c) Occupied Bandwidth Plot 29
15.231(b) Peak Output Power 30
15.231(b) Spurious Emissions..... 32
15.109 Receiver Radiated Emissions 34
15.107 Receiver Conducted Emissions 35
15.107 Receiver Conducted Emissions 38

ADMINISTRATIVE INFORMATION

DATE OF TEST:	December 5 & 6, 2001
DATE OF RECEIPT:	December 5, 2001
PURPOSE OF TEST:	To demonstrate the compliance of the RF2000 Transmitter and RF2000 Receiver with the requirements for FCC Part 15 Subpart C Section 15.231 and FCC Part 15 Subpart B Sections 15.107 & 15.109 devices.
TEST METHOD:	ANSI C63.4 (1992)
MANUFACTURER:	Pentair Pool Products, Inc. 10951 W. Los Angeles Ave. Moorpark, CA 93021
REPRESENTATIVE:	Dennis Dunn
TEST LOCATION:	CKC Laboratories, Inc. 22105 Wilson River Hwy Tillamook, OR 97141

SUMMARY OF RESULTS

As received, the Pentair Pool Products, Inc. RF2000 Transmitter and RF2000 Receiver was found to be fully compliant with the following standards and specifications:

United States

- FCC Part 15 Subpart C Section 15.231
- FCC Part 15 Subpart B Sections 15.107 & 15.109 Class B
- ANSI C63.4 (1992) method

Canada

RSS-210 using:

- FCC Part 15 Subpart C Section 15.231
- FCC Part 15 Subpart B Sections 15.107 & 15.109 Class B
- ANSI C63.4 (1992) method

Industry of Canada File No. IC 3172-A

The results in this report apply only to the items tested, as identified herein.

MODIFICATIONS REQUIRED FOR COMPLIANCE

Added a 0.1 uF cap from data out pin of MCU to ground and changed R-29 to 220 Ω in order to obtain compliance.

APPROVALS

QUALITY ASSURANCE:

Dennis Ward, Quality Manager

Ron Dulmage, Chief Operations Officer

TEST PERSONNEL:

Mike Wilkinson, Test Engineer

EQUIPMENT UNDER TEST (EUT) DESCRIPTION

Swimming pool light remote control consisting of one 9V battery operated transmitter and one 120V receiver. The EUTs tested by CKC Laboratories were representative of how production units will be manufactured.

During testing CKC testing the EUTs were identified as the following:

- Swimming Pool Light Remote Control (Transmitter), RF2000TX
- Swimming Pool Light Remote Control (Receiver), RF2000RX
- Swimming Pool Light, PG2000

Since testing, Pentair Pool Products, Inc. has modified the names of the EUT. Only the name has changed and the EUTs are identical electronically to the ones tested by CKC Laboratories. The following are the new names:

- RF2000 Transmitter
- RF2000 Receiver
- PG2000 Fiber Optic Illuminator

EQUIPMENT UNDER TEST

RF2000 Transmitter

Manuf:	Pentair Pool Products, Inc.
Model:	RF2000
Serial:	None
FCC ID:	R4HRF2000 (pending)

RF2000 Receiver

Manuf:	Pentair Pool Products, Inc.
Model:	RF2000
Serial:	None
FCC ID:	DoC

PERIPHERAL DEVICES

The receiver was tested with the following peripheral device(s):

Fiber Optic Illuminator

Manuf:	Pentair Pool Products, Inc.
Model:	PG2000
Serial:	C01032
FCC ID:	DoC

RF2000 Transmitter

Manuf:	Pentair Pool Products, Inc.
Model:	RF2000
Serial:	None
FCC ID:	Pending

MODE OF OPERATION

The EUT was configured by the manufacturer to operate in a continuous transmit mode for testing purposes. The EUT is normally in an idle state and is activated by the user.

15.33 FREQUENCY RANGE TESTED

15.231 Radiated:	4 MHz – 5 GHz
15.109 Radiated Emissions:	30 MHz – 2.2 GHz
15.107 Conducted:	450 kHz – 30 MHz

EUT OPERATING FREQUENCY

The RF200 Transmitter was operating at 433.98 MHz.

TEMPERATURE AND HUMIDITY DURING TESTING

The temperature during testing was within +15°C and + 35°C.
The relative humidity was between 20% and 75%.

REPORT OF MEASUREMENTS

The following tables report the worst case emissions levels recorded during the tests performed on the RF2000 Transmitter and RF2000 Receiver. All readings taken were peak readings unless otherwise stated. The data sheets from which the emissions tables were compiled are contained in Appendix C.

Table 1: Transmitter Fundamental Radiated Emission Levels

FREQUENCY MHz	METER READING dBµV	CORRECTION FACTORS Ant dB	Amp dB	Cable dB	8.6d dB	CORRECTED READING dBµV/m	SPEC LIMIT dBµV/m	MARGIN dB	NOTES
433.978	95.3	16.7	-27.9	4.5	-8.6	80.0	80.8	-0.8	VA-1
433.981	94.5	16.7	-27.9	4.5	-8.6	79.2	80.8	-1.6	HA-2
433.981	87.9	16.7	-27.9	4.5	-8.6	72.6	80.8	-8.2	VA-2
433.981	79.8	16.7	-27.9	4.5	-8.6	64.5	80.8	-16.3	HA-1
433.984	91.8	16.7	-27.9	4.5	-8.6	76.5	80.8	-4.3	HA-3
433.984	83.7	16.7	-27.9	4.5	-8.6	68.4	80.8	-12.4	VA-3

Test Method: ANSI C63.4 (1992)
Spec Limit: FCC Part 15 Subpart C Section 15.231(b)
Test Distance: 3 Meters

NOTES:
H = Horizontal Polarization
V = Vertical Polarization
A = Average Reading
1-Vertical Position
2-Side Position
3-Horizontal Position

COMMENTS: EUT has been modified to transmit continuously. Average readings were based on measured RF on time of 37 mSec in 100 mSec. 20 Log .37 = -8.6 dB correction factor to the peak reading. This is based on a measured On Time pulse width of 1.68 mSec and the worst case number of pules in 100 mSec is 22. EUT orthogonal is as indicated for each reading. EUT is battery operated only. The temperature was 65°F and the humidity was 55%. EUT R-29 changed to 220 Ohms. Added a 0.1 uF cap from data out pin of MCU to ground.

Table 2: Transmitter Six Highest Radiated Emission Levels: 4MHz-5GHz									
	METER	CORRECTION FACTORS				CORRECTED	SPEC		
FREQUENCY MHz	READING dBµV	Ant dB	Amp dB	Cable dB	8.6d dB	READING dBµV/m	LIMIT dBµV/m	MARGIN dB	NOTES
867.966	48.5	22.9	-28.0	7.1	0.0	50.5	60.8	-10.3	H
867.968	51.7	22.9	-28.0	7.1	0.0	53.7	60.8	-7.1	V
1301.933	42.6	27.5	-26.4	8.9	-8.6	44.0	54.0	-10.0	VA
1301.945	45.9	27.5	-26.4	8.9	-8.6	47.3	54.0	-6.7	HA
1735.830	40.6	29.0	-23.7	10.9	-8.6	48.2	60.8	-12.6	H
1735.861	38.7	29.0	-23.7	10.9	0.0	54.9	60.8	-5.9	V

Test Method: ANSI C63.4 (1992)
Spec Limit: FCC Part 15 Subpart C Section 15.231(b)
Test Distance: 3 Meters

NOTES: H = Horizontal Polarization
V = Vertical Polarization
A = Average Reading

COMMENTS: EUT has been modified to transmit continuously. Average readings were based on measured RF on time of 37 mSec in 100 mSec. 20 Log .37 = -8.6 dB correction factor to the peak reading. This is based on a measured On Time pulse width of 1.68 mSec and the worst case number of pules in 100 mSec is 22. EUT orthogonal is vertical which is worst case based on preliminary investigation. EUT is battery operated only. The temperature was 65°F and the humidity was 55%. EUT R-29 changed to 220 Ohms. Added a 0.1 uF cap from data out pin of MCU to ground. Frequency range investigated was 4 MHz to 5.0 GHz.

Table 3: Receiver Six Highest Radiated Emission Levels: 30MHz-2.2GHZ									
	METER	CORRECTION FACTORS				CORRECTED	SPEC		
FREQUENCY MHz	READING dBµV	Ant dB	Amp dB	Cable dB	Dist dB	READING dBµV/m	LIMIT dBµV/m	MARGIN dB	NOTES
33.733	33.1	17.0	-27.8	0.9		23.2	40.0	-16.8	V
84.008	33.0	8.1	-27.7	1.5		14.9	40.0	-25.1	V
420.900	28.6	16.4	-27.8	4.4		21.6	46.0	-24.4	V
831.000	30.4	22.4	-28.1	6.7		31.4	46.0	-14.6	V
1155.000	26.8	25.5	-27.0	8.9		34.2	54.0	-19.8	V
1888.000	26.0	31.5	-22.4	11.5		46.6	54.0	-7.4	V

Test Method: ANSI C63.4 (1992)
Spec Limit: FCC Part 15 Subpart B Section 15.109 Class B
Test Distance: 3 Meters

NOTES: V = Vertical Polarization

COMMENTS: EUT is installed into the host Pool Light and the support transmitter is continuously operating from a remote location 10 meters to the side of the test site. EUT receives 433.9 MHz only. AC input to the EUT is 120V, 60 Hz. The temperature was 60°F and the humidity was 60%. Frequency range investigated was 30 MHz to 2.2 GHz.

Table 4: Receiver Six Highest Conducted Emission Levels: 450kHz-30MHz									
FREQUENCY MHz	METER READING dBµV	CORRECTION FACTORS Lisn dB	dB	Cable dB	dB	CORRECTED READING dBµV	SPEC LIMIT dBµV	MARGIN dB	NOTES
4.185875	33.2	0.1		0.3		33.6	48.0	-14.4	B
5.499687	32.7	0.1		0.3		33.1	48.0	-14.9	B
6.284562	33.0	0.1		0.3		33.4	48.0	-14.6	B
7.035312	33.0	0.1		0.3		33.4	48.0	-14.6	B
21.663750	43.4	1.0		0.5		44.9	48.0	-3.1	B
21.674900	42.2	1.0		0.5		43.7	48.0	-4.3	BQ

Test Method: ANSI C63.4 (1992)
Spec Limit: FCC Part 15 Subpart B Section 15.107 Class B

NOTES: Q = Quasi Peak Reading
B = Black Lead

COMMENTS: EUT is installed into the host Pool Light and the support transmitter is continuously operating from a remote location 10 meters to the side of the test site. EUT receives 433.9 MHz only. AC input to the EUT is 120V, 60 Hz. The temperature was 60°F and the humidity was 60%. Frequency range investigated was 450 kHz - 30 MHz.

MEASUREMENT UNCERTAINTY

Associated with data in this report is a ± 4dB measurement uncertainty.

EUT SETUP

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the photographs in Appendix A. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables. The corrected data was then compared to the applicable emission limits to determine compliance.

The radiated and conducted emissions data of the RF2000 Transmitter and RF2000 Receiver was taken with the HP Spectrum Analyzer. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in Table A.

Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula in Table A. This reading was then compared to the applicable specification limit to determine compliance.

TABLE A: SAMPLE CALCULATIONS

	Meter reading	(dBµV)
+	Antenna Factor	(dB)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBµV/m)

A typical data sheet will display the following in column format:

#	Freq	Rdng	Amp-C	Bilog	cb10c	T3 co	Corr	Spec	Margin	Polar
			8.6d	Horn	L373b	L373w	Mag L	Dist		

means reading number.
Freq is the frequency in MHz of the obtained reading.
Rdng is the reading obtained on the spectrum analyzer in dBµV.
Amp-C is the preamplifier factor or gain in dB.
Bilog is the biconilog antenna factor in dB.
Horn is the horn antenna factor in dB.
Mag L is the magnetic loop antenna factor in dB.
cb10c and T3 co are the cable losses in dB of the coaxial cable on the OATS.
Dist is the distance factor in dB used when testing at a different test distance than the one stated in the spec.
Corr is the corrected reading in dBµV/m (field strength).
Spec is the specification limit (dB) stated in the FCC regulations.
Margin is the closeness to the specified limit in dB; + is over and - is under the limit.
Polar is the polarity of the antenna with respect to earth.
L373b & L373w are the line impedance stabilization network factor in dB for conducted emissions.
8.6d is the 20 Log .37 correction factor to the peak reading.

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed on the individual data sheets were used to collect both the radiated and conducted emissions data for the RF2000 Transmitter and RF2000 Receiver. The magnetic loop antenna was used for measurements below 30 MHz. For frequencies from 30 to 1000 MHz, the biconilog antenna was used. The horn antenna was used for frequencies above 1000 MHz. Conducted emissions tests required the use of the FCC type LISNs.

The HP spectrum analyzer was used for all measurements. Table B shows the analyzer bandwidth settings that were used in designated frequency bands. For conducted emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used. A 10 dB external attenuator was also used during conducted tests, with internal offset correction in the analyzer. During radiated testing, the measurements were made with 0 dB of attenuation, a reference level of 97 dBµV, and a vertical scale of 10 dB per division.

FCC SECTION 15.35: TABLE B: ANALYZER BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	450 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	4 MHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	5 GHz	1 MHz

SPECTRUM ANALYZER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the Tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "Peak" mode. Whenever a "Quasi-Peak" or "Average" reading is listed as one of the six highest readings, this is indicated as a "Q" or an "A" in the appropriate table. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data for the RF2000 Transmitter and RF2000 Receiver.

Peak

In this mode, the Spectrum Analyzer or test engineer recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature of the analyzer called "peak hold," the analyzer had the ability to measure transients or low duty cycle transient emission peak levels. In this mode the analyzer made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

When the true peak values exceeded or were within 2 dB of the specification limit, quasi-peak measurements were taken using the HP Quasi-Peak Adapter for the HP Spectrum Analyzer. The detailed procedure for making quasi peak measurements contained in the HP Quasi-Peak Adapter manual were followed.

Average

For certain frequencies, average measurements may be made using the spectrum analyzer. To make these measurements, the test engineer reduces the video bandwidth on the analyzer until the modulation of the signal is filtered out. At this point the analyzer is set into the linear mode and the scan time is reduced.

EUT TESTING

Radiated Emissions

The EUT was mounted on a nonconductive, rotating table 80 cm above the conductive grid. The nonconductive table dimensions were 1 meter by 1.5 meters.

During the preliminary radiated scan, the EUT was powered up and operating in its defined FCC test mode. The magnetic loop antenna was used for measurements below 30 MHz. The frequency range of 30 MHz to 1000 MHz was scanned with the biconilog antenna located about 1.5 meter above the ground plane in the vertical polarity. During this scan, the turntable was rotated and all peaks at or near the limit were recorded. A scan of the FM band from 88 to 110 MHz was then made using a reduced resolution bandwidth and frequency span. The biconilog antenna was changed to the horizontal polarity and the above steps were repeated. For frequencies exceeding 1000 MHz, the horn antenna was used. Care was taken to ensure that no frequencies were missed within the FM and TV bands. An analysis was performed to determine if the signals that were at or near the limit were caused by an ambient transmission. If unable to determine by analysis, the equipment was powered down to make the final determination if the EUT was the source of the emission.

A thorough scan of all frequencies was made manually using a small frequency span, rotating the turntable as needed. The test engineer maximized the readings with respect to the table rotation and configuration of EUT. Maximizing of the EUT was achieved by monitoring the spectrum analyzer on a closed circuit television monitor. Photographs showing the final worst case configuration of the EUT are contained in Appendix A.

Mains Conducted Emissions

During conducted emissions testing, the EUT was located on a wooden table measuring approximately 80 cm high, 1 meter deep, and 1.5 meters in length. One wall of the room where the EUT was located has a minimum 2 meter by 2 meter conductive plane. The EUT was mounted on the wooden table 40 cm away from the conductive plane, and 80 cm from any other conductive surface.

The vertical metal plane used for conducted emissions was grounded to the earth. Power to the EUT was provided through a LISN. The LISN was grounded to the ground plane. All other objects were kept a minimum of 80 cm away from the EUT during the conducted test.

For conducted emissions testing, a 30 to 50 second sweep time was used for automated measurements in the frequency bands of 450 kHz to 1.705 MHz, 1.705 MHz to 3 MHz, and 3 MHz to 30 MHz. All readings within 20 dB of the limit were recorded. At frequencies where the recorded emissions were close to the limit, further investigation was performed manually at a slower sweep rate.

TRANSMITTER CHARACTERISTICS

15.203 Antenna Requirements

The antenna is NON-Removable; therefore the EUT complies with Section 15.203 of the FCC rules.

15.205 Restricted Bands

Operating frequency:

The fundamental operating frequency lies outside the restricted bands and therefore complies with the requirements of Section 15.205 of the FCC rules.

Any spurious emission coming from the EUT was investigated to determine if any portion lies inside the restricted band. If any portion of a spurious emissions signal was found to be within a restricted band, investigation was performed to ensure compliance with Section 15.209.

15.231(c) Bandwidth

The bandwidth of the emission was no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down form the modulated carrier.

APPENDIX A

TEST SETUP PHOTOS

TRANSMITTER PHOTOGRAPH SHOWING RADIATED EMISSIONS

Radiated Emissions - Front View in Vertical Position

TRANSMITTER PHOTOGRAPH SHOWING RADIATED EMISSIONS

Radiated Emissions - Front View in Side Position

TRANSMITTER PHOTOGRAPH SHOWING RADIATED EMISSIONS

Radiated Emissions - Front View in Horizontal Position

TRANSMITTER PHOTOGRAPH SHOWING RADIATED EMISSIONS

Radiated Emissions - Back View in the Vertical Position

RECEIVER PHOTOGRAPH SHOWING RADIATED EMISSIONS

Radiated Emissions - Front View of Receiver

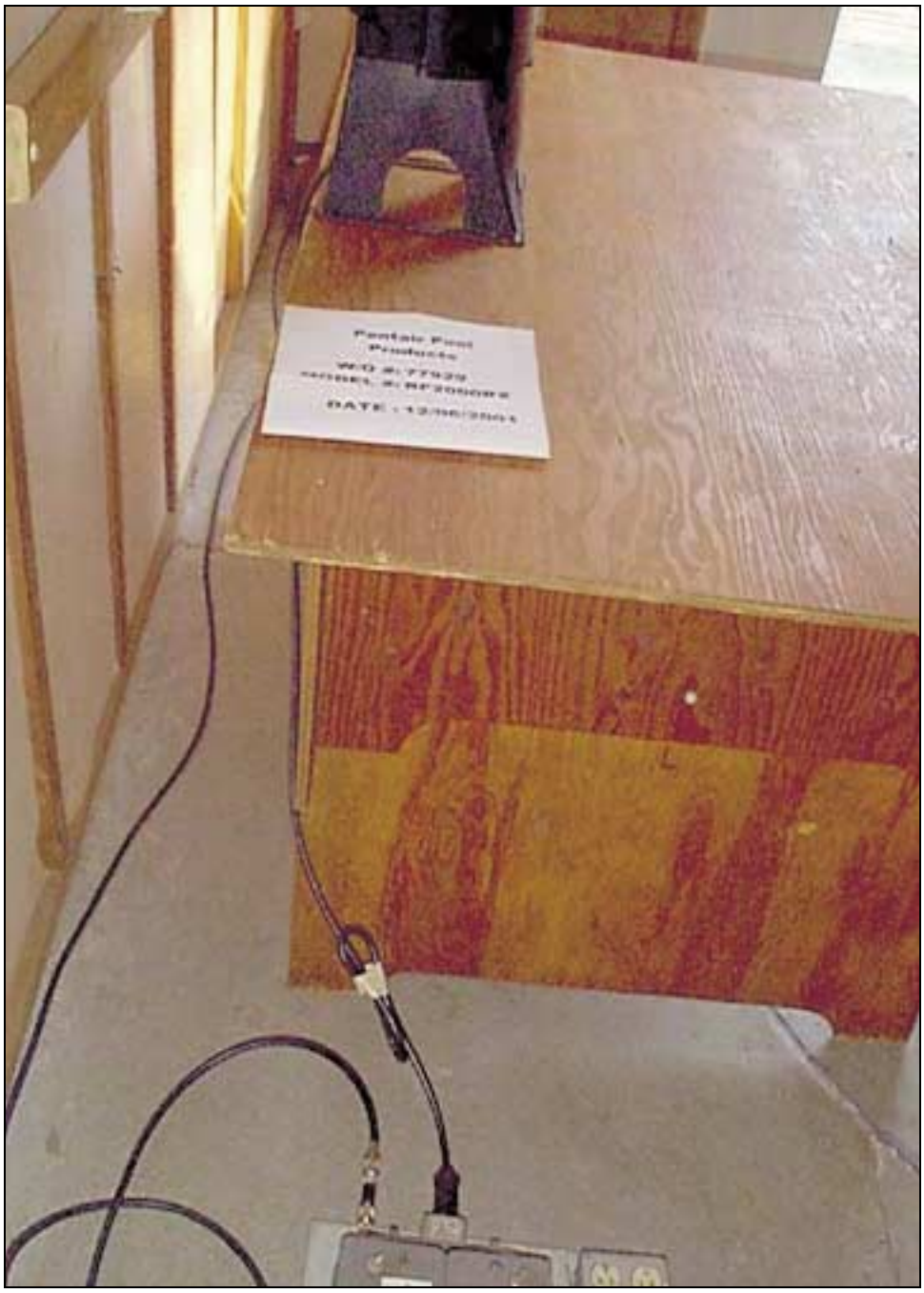
RECEIVER PHOTOGRAPH SHOWING RADIATED EMISSIONS

Radiated Emissions - Back View of Receiver

RECEIVER PHOTOGRAPH SHOWING MAINS CONDUCTED EMISSIONS

Mains Conducted Emissions - Front View of Receiver

RECEIVER PHOTOGRAPH SHOWING MAINS CONDUCTED EMISSIONS

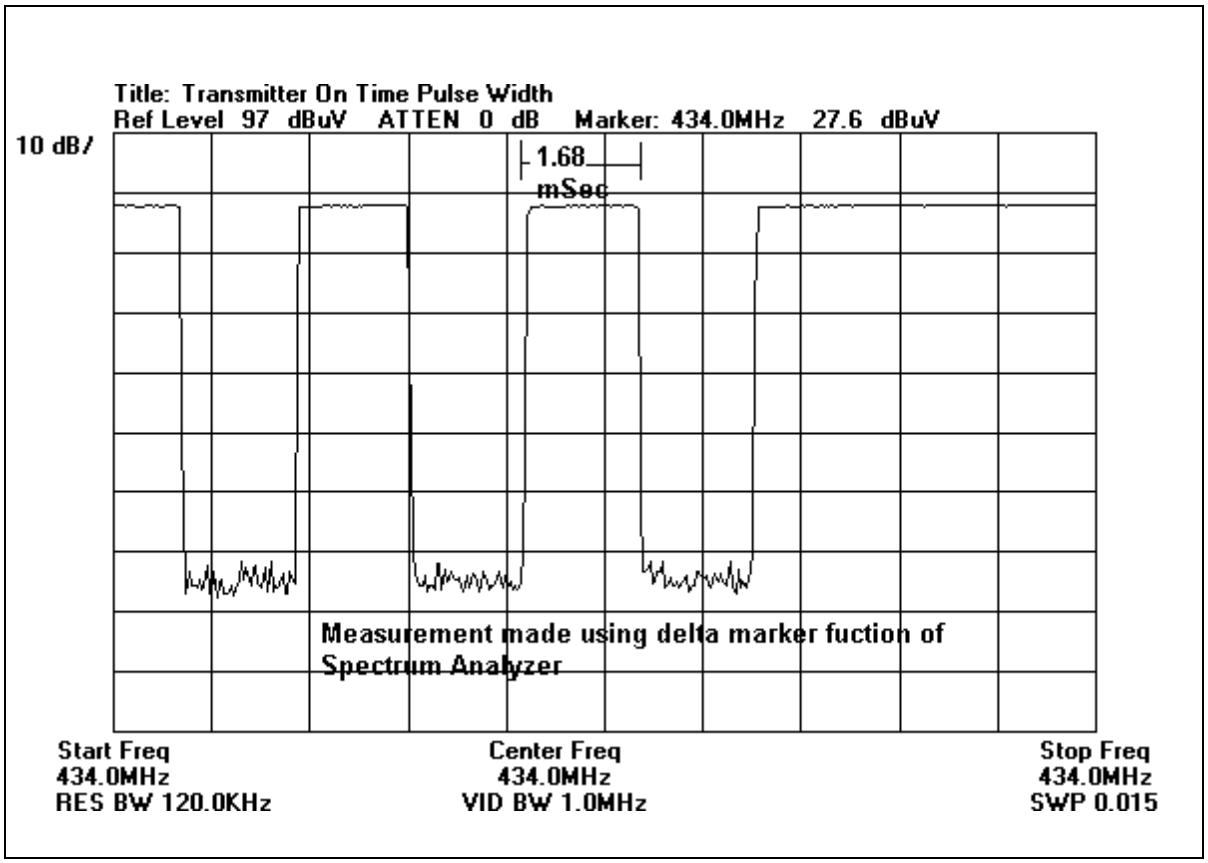


Mains Conducted Emissions - Side View of Receiver

APPENDIX B

MEASUREMENT DATA SHEETS

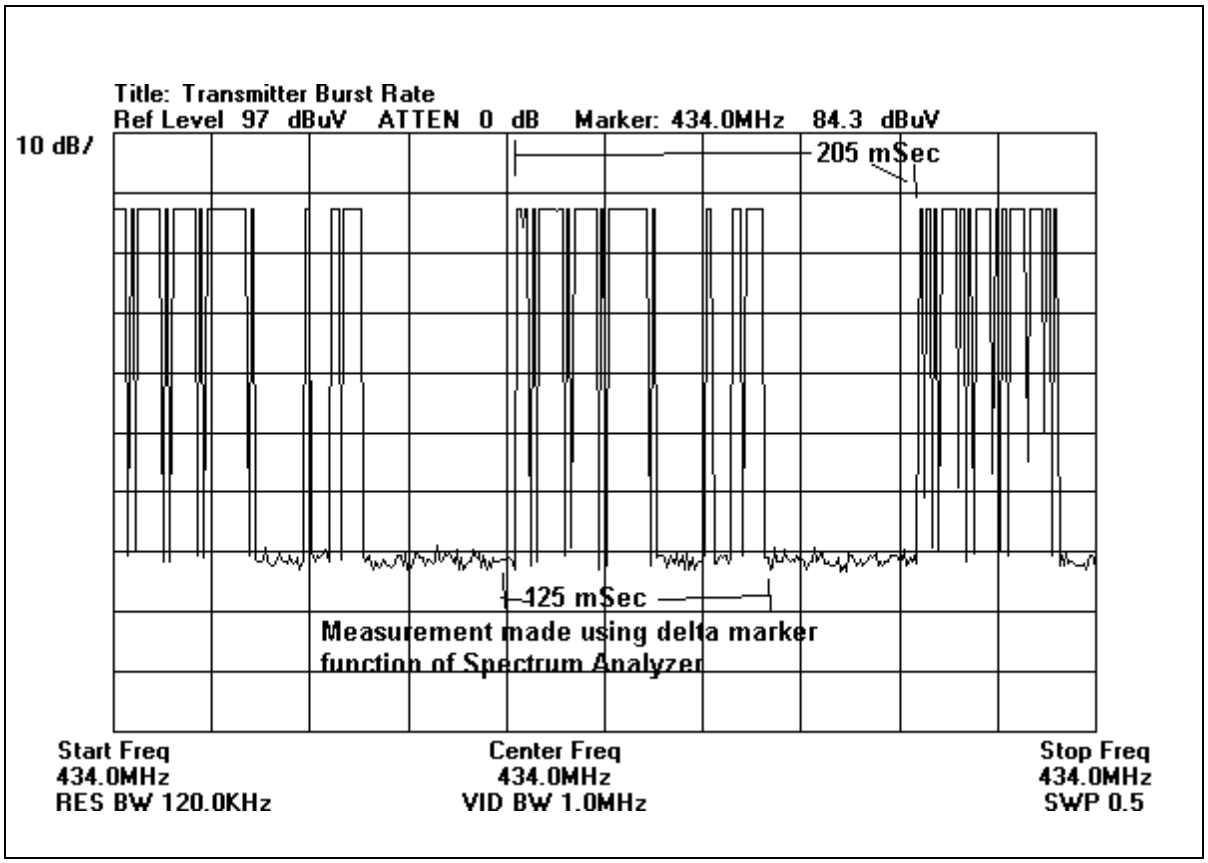
15.231(a) ON TIME PULSE WIDTH



***Test Equipment*:**

Function	S/N	Calibration Date	Cal Due Date	Asset #
HP 8593EM EMC Analyzer	3624A00159	09/21/2001	09/21/2002	2111
HP 8447D Amplifier	2727A05432	08/17/2001	08/17/2002	282
Chase CBL6111C Bilog Antenna	2456	02/10/2001	02/10/2002	1991

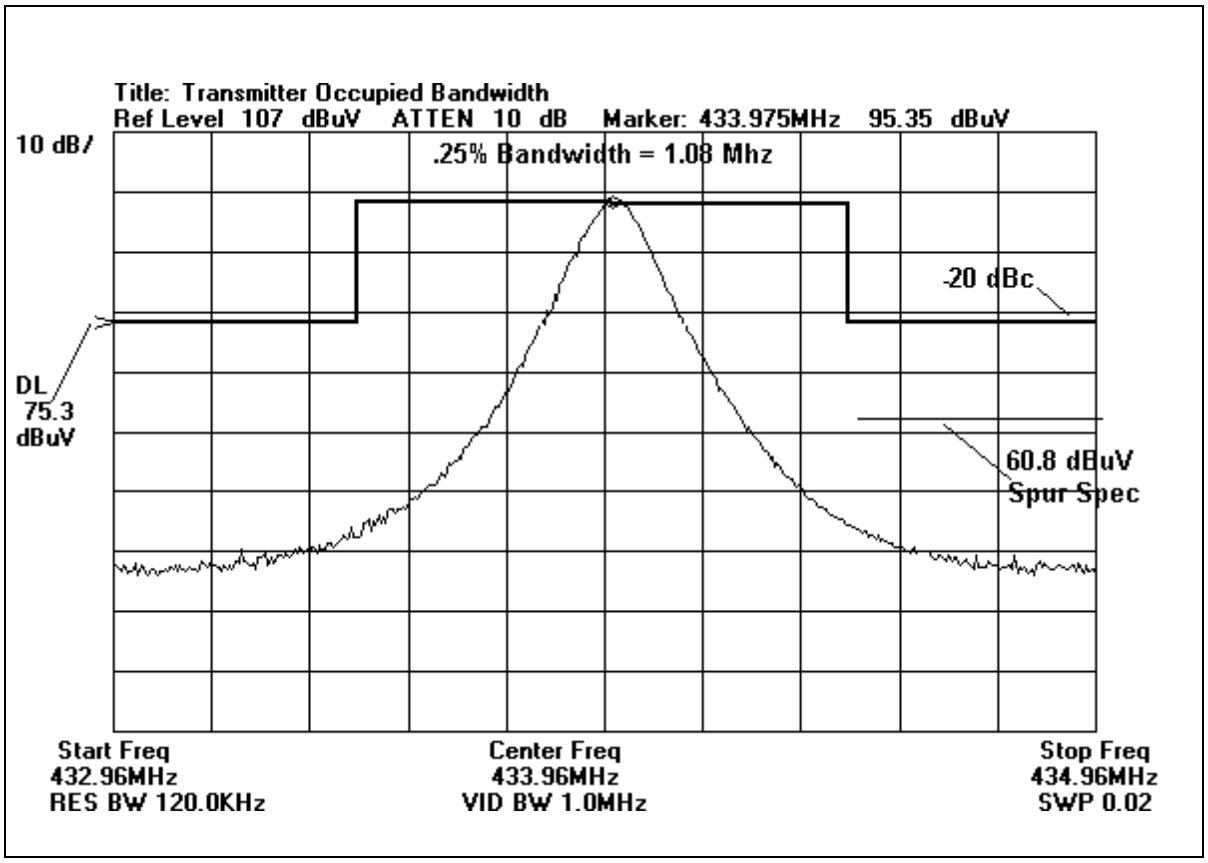
15.231(a) BURST RATE



***Test Equipment*:**

Function	S/N	Calibration Date	Cal Due Date	Asset #
HP 8593EM EMC Analyzer	3624A00159	09/21/2001	09/21/2002	2111
HP 8447D Amplifier	2727A05432	08/17/2001	08/17/2002	282
Chase CBL6111C Bilog Antenna	2456	02/10/2001	02/10/2002	1991

15.231(c) OCCUPIED BANDWIDTH PLOT



***Test Equipment*:**

Function	S/N	Calibration Date	Cal Due Date	Asset #
HP 8593EM EMC Analyzer	3624A00159	09/21/2001	09/21/2002	2111
HP 8447D Amplifier	2727A05432	08/17/2001	08/17/2002	282
Chase CBL6111C Bilog Antenna	2456	02/10/2001	02/10/2002	1991

15.231(b) PEAK OUTPUT POWER

Test Location: CKC Laboratories. Inc. • 22105 Wilson River Hwy • Tillamook, OR 97141 • 800 500-4EMC

Customer: **Pentair Pool Products**
Specification: **15.231 433 MHz Fundamental**
Work Order #: **77929** Date: 12/5/2001
Test Type: **Radiated Scan** Time: 15:03:13
Equipment: **Swimming Pool Light Remote Control (Transmitter)** Sequence#: 1
Manufacturer: Pentair Pool Products Tested By: Mike Wilkinson
Model: RF2000TX
S/N: None

***Test Equipment*:**

Function	S/N	Calibration Date	Cal Due Date	Asset #
HP 8593EM EMC Analyzer	3624A00159	09/21/2001	09/21/2002	2111
HP 8447D Amplifier	2727A05432	08/17/2001	08/17/2002	282
Chase CBL6111C Bilog Antenna	2456	02/10/2001	02/10/2002	1991

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Swimming Pool Light Remote Control (Transmitter)*	Pentair Pool Products	RF2000TX	None

Support Devices:

Function	Manufacturer	Model #	S/N

Test Conditions / Notes:

EUT has been modified to transmit continuously. Average readings were based on measured RF on time of 37 mSec in 100 mSec. 20 Log .37 = -8.6 dB correction factor to the peak reading. This is based on a measured On Time pulse width of 1.68 mSec and the worst case number of pules in 100 mSec is 22 EUT orthogonal is as indicated for each reading. EUT is battery operated only. The temperature was 65°F and the humidity was 55%. EUT R-29 changed to 220 Ohms. Added a 0.1 uF cap from data out pin of MCU to ground.

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	Amp-C	Bilog	cb10c	8.6 d	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	433.978M	95.3	-27.9	+16.7	+4.5	-8.6	+0.0	80.0	80.8	-0.8	Vert
	Ave								Vertical Position		
^	433.978M	95.3	-27.9	+16.7	+4.5	+0.0	+0.0	88.6	80.8	+7.8	Vert
									Vertical Position		
^	433.981M	87.9	-27.9	+16.7	+4.5	+0.0	+0.0	81.2	80.8	+0.4	Vert
									Side Position		
^	433.984M	83.7	-27.9	+16.7	+4.5	+0.0	+0.0	77.0	80.8	-3.8	Vert
									Horizontal Position		
5	433.981M	94.5	-27.9	+16.7	+4.5	-8.6	+0.0	79.2	80.8	-1.6	Horiz
	Ave								Side Position		
^	433.981M	94.5	-27.9	+16.7	+4.5	+0.0	+0.0	87.8	80.8	+7.0	Horiz
									Side Position		
^	433.984M	91.8	-27.9	+16.7	+4.5	+0.0	+0.0	85.1	80.8	+4.3	Horiz
									Horizontal Position		
^	433.981M	79.8	-27.9	+16.7	+4.5	+0.0	+0.0	73.1	80.8	-7.7	Horiz
									Vertical Position		
9	433.984M	91.8	-27.9	+16.7	+4.5	-8.6	+0.0	76.5	80.8	-4.3	Horiz
	Ave								Horizontal Position		

10	433.981M Ave	87.9	-27.9	+16.7	+4.5	-8.6	+0.0	72.6	80.8	-8.2	Vert Side Position
11	433.984M Ave	83.7	-27.9	+16.7	+4.5	-8.6	+0.0	68.4	80.8	-12.4	Vert Horizontal Position
12	433.981M Ave	79.8	-27.9	+16.7	+4.5	-8.6	+0.0	64.5	80.8	-16.3	Horiz Vertical Position

15.231(b) SPURIOUS EMISSIONS

Test Location: CKC Laboratories. Inc. • 22105 Wilson River Hwy • Tillamook, OR 97141 • 800 500-4EMC

Customer: **Pentair Pool Products**
Specification: **15.231 433 MHz spurs**
Work Order #: **77929** Date: 12/06/2001
Test Type: **Radiated Scan** Time: 09:04:06
Equipment: **Swimming Pool Light Remote Control (Transmitter)** Sequence#: 2
Manufacturer: Pentair Pool Products Tested By: Mike Wilkinson
Model: RF2000TX
S/N: None

***Test Equipment*:**

Function	S/N	Calibration Date	Cal Due Date	Asset #
HP 8593EM EMC Analyzer	3624A00159	09/21/2001	09/21/2002	2111
HP 8447D Amplifier	2727A05432	08/17/2001	08/17/2002	282
Chase CBL6111C Bilog Antenna	2456	02/10/2001	02/10/2002	1991
EMCO 3115 1-18 GHz Horn Antenna	9006-3413	06/07/2001	06/07/2002	327
HP 83017A Amplifier 26GHz	0000009002	01/18/2001	01/18/2002	2114
EMCO 6502 Mag Loop Antenna	2156	01/16/2001	01/16/2002	52
HP 84300-80037 1.5 GHz High Pass Filter	3643A00027	06/08/2001	06/08/2002	2116

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Swimming Pool Light Remote Control (Transmitter)*	Pentair Pool Products	RF2000TX	None

Support Devices:

Function	Manufacturer	Model #	S/N

Test Conditions / Notes:

EUT has been modified to transmit continuously. Average readings were based on measured RF on time of 37 mSec in 100 mSec. 20 Log .37 = -8.6 dB correction factor to the peak reading. This is based on a measured On Time pulse width of 1.68 mSec and the worst case number of pules in 100 mSec is 22 EUT orthogonal is vertical which is worst case based on preliminary investigation. EUT is battery operated only. The temperature was 65°F and the humidity was 55%. EUT R-29 changed to 220 Ohms. Added a 0.1 uF cap from data out pin of MCU to ground. Frequency range investigated was 4 MHz to 5.0 GHz.

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	Amp-C Horn dB	Bilog Mag L dB	cb10c dB	8.6 d dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	1735.861M	38.7	-23.7 +29.0	+0.0 +0.0	+10.9	+0.0	+0.0	54.9	60.8	-5.9	Vert
2	1301.945M Ave	45.9	-26.4 +27.5	+0.0 +0.0	+8.9	-8.6	+0.0	47.3	54.0	-6.7	Horiz
3	867.968M	51.7	-28.0 +0.0	+22.9 +0.0	+7.1	+0.0	+0.0	53.7	60.8	-7.1	Vert
4	1301.933M Ave	42.6	-26.4 +27.5	+0.0 +0.0	+8.9	-8.6	+0.0	44.0	54.0	-10.0	Vert
5	867.966M	48.5	-28.0 +0.0	+22.9 +0.0	+7.1	+0.0	+0.0	50.5	60.8	-10.3	Horiz
6	1735.830M	40.6	-23.7 +29.0	+0.0 +0.0	+10.9	-8.6	+0.0	48.2	60.8	-12.6	Horiz

7	19.995M	30.3	+0.0 +0.0	+0.0 +10.0	+0.7	+0.0	+0.0	41.0	60.8	-19.8	None
8	16.000M	27.8	+0.0 +0.0	+0.0 +11.2	+0.6	+0.0	+0.0	39.6	60.8	-21.2	None
9	36.014M	33.0	-27.8 +0.0	+15.8 +0.0	+0.9	+0.0	+0.0	21.9	60.8	-38.9	Vert
10	40.014M	34.4	-27.8 +0.0	+13.8 +0.0	+1.0	+0.0	+0.0	21.4	60.8	-39.5	Vert

15.109 RECEIVER RADIATED EMISSIONS

Test Location: CKC Laboratories. Inc. • 22105 Wilson River Hwy • Tillamook, OR 97141 • 800 500-4EMC

Customer: **Pentair Pool Products**
Specification: **15.109 Class B**
Work Order #: **77929** Date: 12/6/2001
Test Type: **Radiated Scan** Time: 11:54:43
Equipment: **Swimming Pool Light Remote Control (Receiver)** Sequence#: 3
Manufacturer: Pentair Pool Products Tested By: Mike Wilkinson
Model: RF2000RX
S/N: None

***Test Equipment*:**

Function	S/N	Calibration Date	Cal Due Date	Asset #
HP 8593EM EMC Analyzer	3624A00159	09/21/2001	09/21/2002	2111
HP 8447D Amplifier	2727A05432	08/17/2001	08/17/2002	282
Chase CBL6111C Bilog Antenna	2456	02/10/2001	02/10/2002	1991
EMCO 3115 1-18 GHz Horn Antenna	9006-3413	06/07/2001	06/07/2002	327

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Swimming Pool Light Remote Control (Receiver)*	Pentair Pool Products	RF2000RX	None

Support Devices:

Function	Manufacturer	Model #	S/N
Swimming Pool Light Remote Control (Transmitter)	Pentair Pool Products	RF2000TX	None
Swimming Pool Light	Pentair Pool Products	PG2000	C01032

Test Conditions / Notes:

EUT is installed into the host Pool Light and the support transmitter is continuously operating from a remote location 10 meters to the side of the test site. EUT receives 433.9 MHz only. AC input to the EUT is 120V, 60 Hz. The temperature was 60°F and the humidity was 60%. Frequency range investigated was 30 MHz to 2.2 GHz.

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	Amp-C dB	Bilog dB	cb10c dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	1888.000M	26.0	-22.4	+31.5	+11.5		+0.0	46.6	54.0	-7.4	Vert
2	831.000M	30.4	-28.1	+22.4	+6.7		+0.0	31.4	46.0	-14.6	Vert
3	33.733M	33.1	-27.8	+17.0	+0.9		+0.0	23.2	40.0	-16.8	Vert
4	1155.000M	26.8	-27.0	+25.5	+8.9		+0.0	34.2	54.0	-19.8	Vert
5	420.900M	28.6	-27.8	+16.4	+4.4		+0.0	21.6	46.0	-24.4	Vert
6	84.008M	33.0	-27.7	+8.1	+1.5		+0.0	14.9	40.0	-25.1	Vert
7	285.400M	27.8	-26.9	+13.0	+3.5		+0.0	17.4	46.0	-28.6	Vert

15.107 RECEIVER CONDUCTED EMISSIONS

Test Location: CKC Laboratories. Inc. • 22105 Wilson River Hwy • Tillamook, OR 97141 • 800 500-4EMC

Customer: **Pentair Pool Products**
Specification: **15.107 Class B COND**
Work Order #: **77929** Date: 12/06/2001
Test Type: **Conducted Emissions** Time: 12:21:45
Equipment: **Swimming Pool Light Remote Control (Receiver)** Sequence#: 4
Manufacturer: Pentair Pool Products Tested By: Mike Wilkinson
Model: RF2000RX
S/N: None

***Test Equipment*:**

Function	S/N	Calibration Date	Cal Due Date	Asset #
HP 8593EM EMC Analyzer	3624A00159	09/21/2001	09/21/2002	2111
Solar/Fischer LISN	none	11/14/2001	11/14/2002	373

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Swimming Pool Light Remote Control (Receiver)*	Pentair Pool Products	RF2000RX	None

Support Devices:

Function	Manufacturer	Model #	S/N
Swimming Pool Light Remote Control (Transmitter)	Pentair Pool Products	RF2000TX	None
Swimming Pool Light	Pentair Pool Products	PG2000	C01032

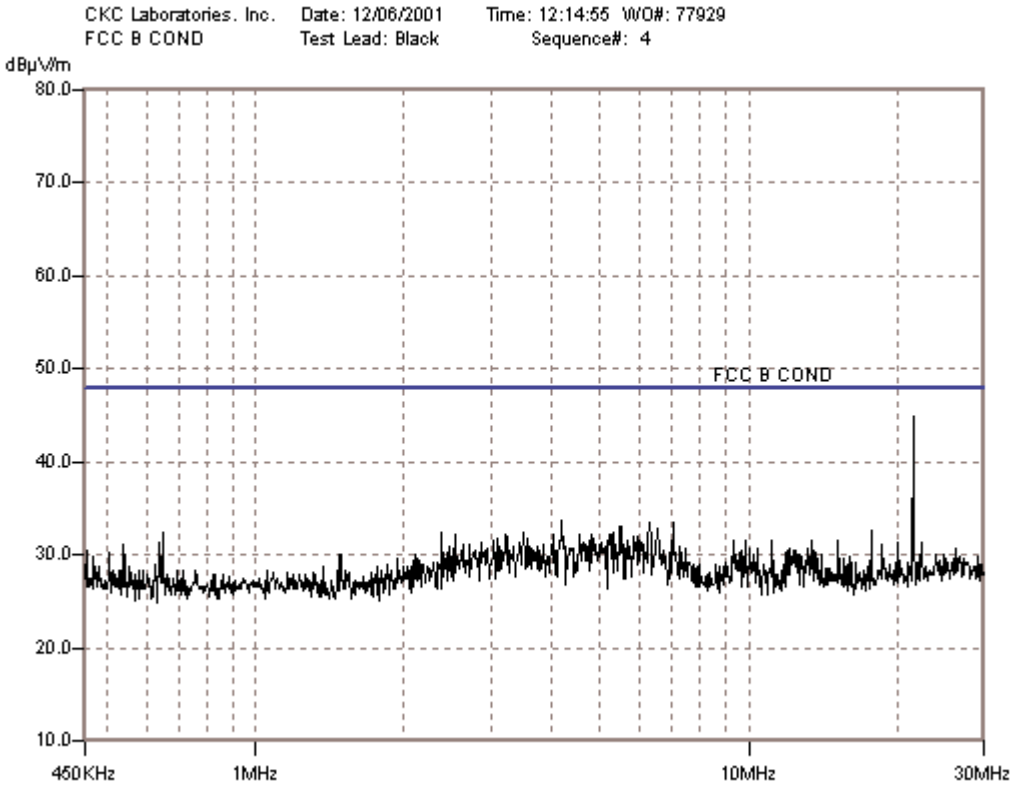
Test Conditions / Notes:

EUT is installed into the host Pool Light and the support transmitter is continuously operating from a remote location 10 meters to the side of the test site. EUT receives 433.9 MHz only. AC input to the EUT is 120V, 60 Hz. The temperature was 60°F and the humidity was 60%. Frequency range investigated was 450 kHz - 30 MHz.

Measurement Data: Reading listed by margin. Test Lead: Black

#	Freq MHz	Rdng dBµV	T3 co dB	L373b dB	dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	21.664M	43.4	+0.5	+1.0			+0.0	44.9	48.0	-3.1	Black
2	21.675M QP	42.2	+0.5	+1.0			+0.0	43.7	48.0	-4.3	Black
3	4.186M	33.2	+0.3	+0.1			+0.0	33.6	48.0	-14.4	Black
4	7.035M	33.0	+0.3	+0.1			+0.0	33.4	48.0	-14.6	Black
5	6.285M	33.0	+0.3	+0.1			+0.0	33.4	48.0	-14.6	Black
6	5.534M	32.7	+0.3	+0.1			+0.0	33.1	48.0	-14.9	Black
7	5.500M	32.7	+0.3	+0.1			+0.0	33.1	48.0	-14.9	Black
8	6.558M	32.4	+0.3	+0.1			+0.0	32.8	48.0	-15.2	Black
9	17.715M	31.7	+0.4	+0.6			+0.0	32.7	48.0	-15.3	Black

10	5.346M	32.2	+0.2	+0.1	+0.0	32.5	48.0	-15.5	Black
11	648.503k	32.4	+0.1	+0.0	+0.0	32.5	48.0	-15.5	Black
12	3.495M	32.0	+0.3	+0.1	+0.0	32.4	48.0	-15.6	Black
13	2.390M	32.1	+0.2	+0.1	+0.0	32.4	48.0	-15.6	Black
14	4.544M	32.0	+0.2	+0.1	+0.0	32.3	48.0	-15.7	Black
15	3.232M	32.0	+0.2	+0.1	+0.0	32.3	48.0	-15.7	Black
16	2.540M	31.9	+0.2	+0.1	+0.0	32.2	48.0	-15.8	Black


CKC Laboratories. Inc.
Date: 12/06/2001
Time: 12:14:55 WO#: 77929
FCC B COND
Test Lead: Black
Sequence#: 4
dBµV/m
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
FCC B COND
450KHz
1MHz
10MHz
30MHz

15.107 RECEIVER CONDUCTED EMISSIONS

Test Location: CKC Laboratories. Inc. • 22105 Wilson River Hwy • Tillamook, OR 97141 • 800 500-4EMC

Customer: **Pentair Pool Products**
Specification: **15.107 B COND**
Work Order #: **77929** Date: 12/06/2001
Test Type: **Conducted Emissions** Time: 12:29:20 PM
Equipment: **Swimming Pool Light Remote Control (Receiver)** Sequence#: 5
Manufacturer: Pentair Pool Products Tested By: Mike Wilkinson
Model: RF2000RX
S/N: None

***Test Equipment*:**

Function	S/N	Calibration Date	Cal Due Date	Asset #
HP 8593EM EMC Analyzer	3624A00159	09/21/2001	09/21/2002	2111
Solar/Fischer LISN	none	11/14/2001	11/14/2002	373

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Swimming Pool Light Remote Control (Receiver)*	Pentair Pool Products	RF2000RX	None

Support Devices:

Function	Manufacturer	Model #	S/N
Swimming Pool Light Remote Control (Transmitter)	Pentair Pool Products	RF2000TX	None
Swimming Pool Light	Pentair Pool Products	PG2000	C01032

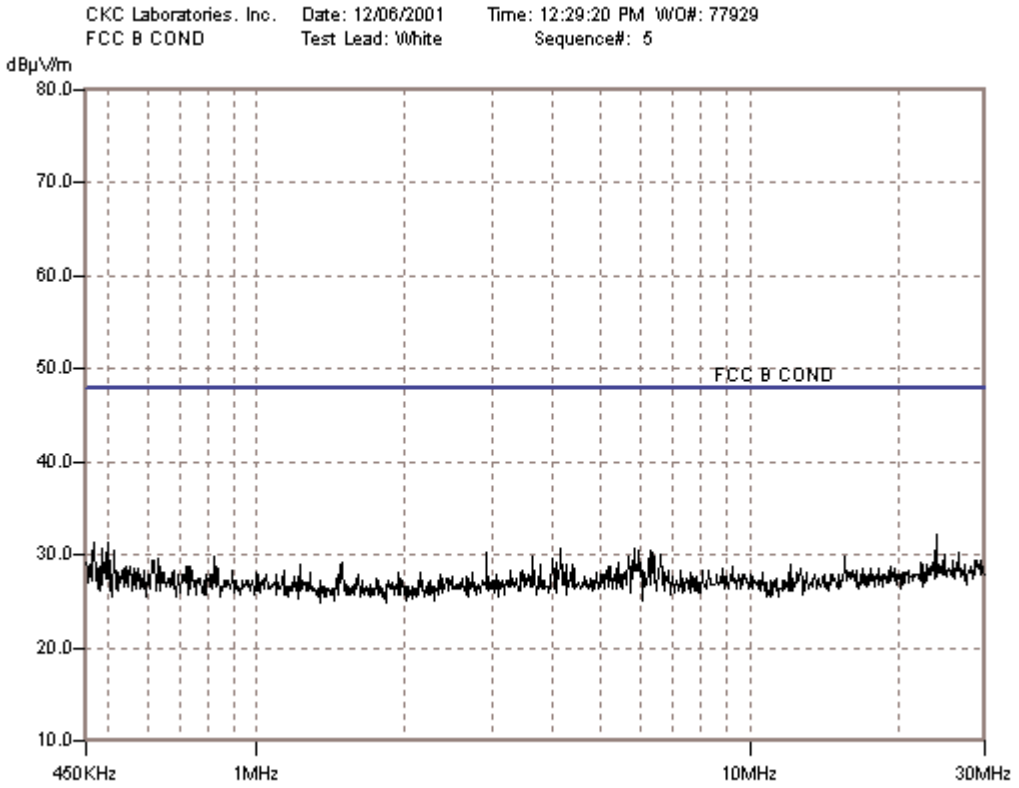
Test Conditions / Notes:

EUT is installed into the host Pool Light and the support transmitter is continuously operating from a remote location 10 meters to the side of the test site. EUT receives 433.9 MHz only. AC input to the EUT is 120V, 60 Hz. The temperature was 60°F and the humidity was 60%. Frequency range investigated was 450 kHz - 30 MHz.

Measurement Data: Reading listed by margin. Test Lead: White

#	Freq MHz	Rdng dBµV	T3 co dB	dB	L373w dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	24.004M	30.3	+0.5		+1.3		+0.0	32.1	48.0	-15.9	White
2	468.806k	31.3	+0.1		+0.0		+0.0	31.4	48.0	-16.6	White
3	498.059k	31.2	+0.1		+0.0		+0.0	31.3	48.0	-16.7	White
4	4.152M	30.5	+0.3		+0.0		+0.0	30.8	48.0	-17.2	White
5	5.824M	30.3	+0.3		+0.1		+0.0	30.7	48.0	-17.3	White
6	487.611k	30.6	+0.1		+0.0		+0.0	30.7	48.0	-17.3	White
7	6.285M	30.0	+0.3		+0.2		+0.0	30.5	48.0	-17.5	White
8	512.685k	30.4	+0.1		+0.0		+0.0	30.5	48.0	-17.5	White
9	5.977M	30.0	+0.3		+0.1		+0.0	30.4	48.0	-17.6	White

10	464.627k	30.3	+0.1	+0.0	+0.0	30.4	48.0	-17.6	White
11	26.588M	28.3	+0.5	+1.5	+0.0	30.3	48.0	-17.7	White
12	2.928M	30.1	+0.2	+0.0	+0.0	30.3	48.0	-17.7	White
13	6.353M	29.7	+0.3	+0.2	+0.0	30.2	48.0	-17.8	White
14	24.833M	28.1	+0.5	+1.4	+0.0	30.0	48.0	-18.0	White
15	6.609M	29.5	+0.3	+0.2	+0.0	30.0	48.0	-18.0	White


CKC Laboratories. Inc.
Date: 12/06/2001
Time: 12:29:20 PM
WO#: 77929
FCC B COND
Test Lead: White
Sequence#: 5
dBµV/m
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
FCC B COND
450KHz
1MHz
10MHz
30MHz