APPLICANT	MANUFACTURER
X-10 USA, Inc. 19823, 58th Place S. Kent, WA 98032	X-10 Electronics Shenzhen Co. Ltd. X-10 Building Labour Industrial District Shenzhen, Xixiang, Bao An Guang Dong, China, 518102

TEST SPECIFICATION: FCC Rules and Regulations Part 15, Subpart C, Para. 15.231

TEST PROCEDURE: ANSI C63.4:2001

TEST SAMPLE DESCRIPTION

BRANDNAME: X-10 MODEL: KR31A

TYPE: Pulsed Transmitter

POWER REQUIREMENTS: 6 VDC via (2) CR2016 Lithium Batteries

FREQUENCY OF OPERATION: 310 MHz

TESTS PERFORMED

Para. 15.231(a), Radiated Emissions, Fundamental and Harmonics

Para. 15.231(b), Radiated Emissions, Spurious Case

Para. 15.231(b), Duty Cycle Determination

Para. 15.231(c), Occupied Bandwidth

REPORT OF MEASUREMENTS

Applicant: X-10 (USA), Inc.

Device: Pulsed Transmitter

FCC ID: B4S-KR31A

Power Requirements: 6 VDC via (2) CR2016 Lithium Batteries

Applicable Rule Section: Part 15, Subpart C, Section 15.231

REPORT OF MEASUREMENTS (continued)

TEST RESULTS

15.231 (a):	This device is used as a Remote Control/Security device.
15.231 (a)(1) &	The transmitter is manual operated.
15.231 (a)(3):	The transmitter does not perform periodic transmissions.
15.231 (b):	The fundamental field strength did not exceed 5833 ☞V/M (Average) at a test distance of 3 meters. In addition, the requirements of section 15.35 for averaging pulsed emissions and for limiting peak emissions were met. The field strength of harmonic and spurious emissions did not exceed 583 ☞V/M (AVERAGE).

DETERMINATION OF FIELD STRENGTH LIMITS

The field strength limits shown below are found in Section 15.231.

Frequency			Limit		
F1	=	260	3750	=	L1
Fo	=	310		Lo	
F2	=	470	12500	=	L2

The formula below was utilized to determine the limits:

Limit = L1 + [(Fo-F1)(L2-L1)/(F2-F1)]

Solving yields:

Fundamental Limit = 5833 ☞V/M (AVERAGE) @ 3 Meters

Harmonic Limit = 583 ☞V/M (AVERAGE) @ 3 Meters

DUTY CYCLE DETERMINATION

The unit's RF output was directly coupled to the input of the spectrum analyzer. The analyzer was set for a frequency span of 0Hz. The sweep time was then adjusted in order to display one full pulse train. The transmitter on time was then summed and compared to the time for one full cycle in order to obtain the duty cycle. (See plots for additional information)

Transmitter On Time	=	30 milliseconds (maximum)
Transmitter Cycle Time	=	121.2 milliseconds
Transmitter Duty Cycle	=	30 %

CALCULATION:

1 Large Pulse	=	9.0 milliseconds
42 x 500 ☞s (small pulse)	=	21.0 milliseconds
21+9	=	30 milliseconds
Cycle Time	=	121.2 milliseconds
Duty Cycle (30/100)	=	30 %
Correction Factor = 20 log(0.30)	=	-10.4 dB

SPECTRUM ANALYZER DESENSITIZATION CONSIDERATIONS

Due to the nature of the emissions being measured, care was taken to ensure that the resolution bandwidth of the spectrum analyzer was adequate to provide accurate measurements. The following formula was utilized:

Setting pulse desensitization equal to zero and utilizing the minimum observed pulse width of 500 ☞s yields a minimum required bandwidth of 1333 Hz. FCC specified bandwidths of 100 kHz and 1MHz were utilized below and above 1GHz, respectively.

GENERAL NOTES

1. All readings were taken utilizing a peak detector function at a test distance of 3 meters.

2. The duty cycle was applied to the peak readings in order to determine the average value of the emissions.

3. The frequency range was scanned from 30 MHz to 3.1 GHz. All emissions not reported were more than 20 dB below the specified limit.

Equipment List

FCC 15.231 Transmitter Testing

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due
067	Open Area Test Site	Retlif	3 Meter	RNY	10/1/2003	10/1/2006
128	Double Ridged Guide	Electro-Mechanics	1 GHz - 18 GHz	3105	6/13/2003	6/13/2004
133	Broadband Pre-Amplifier	Electro-Metrics	10 kHz - 1 GHz, 26dB	BPA-1000	6/12/2003	6/12/2004
141	Spectrum Analyzer	Hewlett Packard	100 Hz - 40 GHz	8566B	1/26/2004	7/26/2004
141A	Graphics Plotter	Hewlett Packard	N/A	7470A	2/9/2004	2/9/2005
141B	Quasi-Peak Adaptor	Hewlett Packard	100 Hz - 1 GHz	85650A	1/26/2004	7/26/2004
206B	6.0 dB Attenuator	Texscan	0 - 1.0 GHz	FP-50 - 6 dB	6/12/2003	6/12/2004
543	Preamplifier	Hewlett Packard	1.0 GHz - 26.5 GHz	8449B	7/24/2003	7/24/2004
617	Interference Analyzer	Electro-Metrics	10 kHz - 1 GHz	EMC-30	9/30/2003	9/30/2004

FCC 15.231(b)

RADIATED EMISSIONS, FUNDAMENTAL & SPURIOUS CASE

(See separate e-file named Refundharm.pdf and REspur.pdf)

FCC 15.231(c)

OCCUPIED BANDWIDTH

(See separate e-file named occbw.pdf)

FCC 15.231(c)

DUTY CYCLE

(See separate e-file named dutycycle.pdf)

Test Setup Photograph