

## REPORT OF MEASUREMENTS

LINEAR LLC  
FCC ID:EF4LRP

Model: DXS-LRP Remote Control Transmitter

The enclosed documents reflect the requirements contained generally within the code of Federal Regulations, Title 47, Parts 2 and 15 as most recently published October 1, 2009 and all other applicable revisions made by the Commission since that time.

The specific rule sections for which the enclosed documents demonstrate compliance or rely upon to demonstrate compliance with the Commission's application and technical standards are as follows:

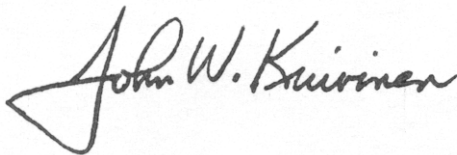
15.201-15.207, 15.231, Subpart C, Intentional Radiators.

Test Procedure C63.4-2003, Section 13, Measurement of Intentional Radiators was used for the testing of this device.

In accord with Section 2.948 of the Commission's Rules, a Test Site submittal is on file with the commission and a Letter of Acceptance dated March 31, 2009 (File 90767) is a portion of the Commission's records.

A test site submittal is on file with Industry Canada. The Industry Canada file number is 1078A-1. The file is dated August 4, 2010.

All of the information contained within this documentation is true, correct, and complete to the best of my knowledge.



\_\_\_\_\_  
John W. Kuivinen, P.E.  
Regulatory Compliance Engineer

\_\_\_ August 12, 2010 \_\_\_  
Date

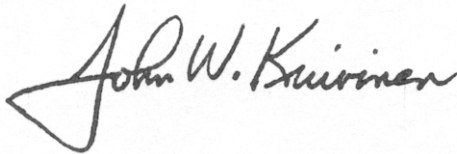
## **DURATION OF RF TRANSMISSIONS**

### **LRP**

#### **REMOTE CONTROL TRANSMITTER**

This transmitter is manually activated. Typically, it is used for remote control of a security system. As such, it may be operated continuously by the user (FCC Rules 15.231(a)(4)). However, due to battery constraints and an accidental continuous activation causing interference to the system, the maximum manually activated transmission for a single press of a pushbutton is 30 seconds.

When a push button is quickly pressed but then released, the transmitter will cease transmitting only after a minimum of 8 data words (8 words X 100 milli-second/word = 800 milli-seconds minimum transmission) have been sent. FCC Rules 15.231 (a)(1) allows no longer than 5 seconds upon the release of a manually activated transmitter.

A handwritten signature in black ink that reads "John W. Kuivinen". The signature is written in a cursive style with a large, stylized initial 'J'.

Signed:

John W. Kuivinen, P.E.  
Regulatory Compliance Engineer

## TESTING INSTRUMENTATION AND EQUIPMENT LIST

### SPECTRUM ANALYZERS:

H.P.	HP8594EM S/N 3649A00246	9 KHz to 2.9 GHz Calibrated Due	01/22/2010 01/22/2011
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H.P.	HP8562A S/N 2913A03742	1 KHz to 22GHz Calibrated Due	07/10 01/11
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(Required for emissions > 2.9 GHz)

### ANTENNAS:

(2)	Ailtech DM105A T1 S/N 93412-105 and 93412-114	20-200 MHz Calibrated 7/10	Tuned Dipole Due: 7/11
(2)	Ailtech DM105A T2 S/N 93413-113 and 93413-117	140-400 MHz Calibrated 7/10	Tuned Dipole Due: 7/11
(2)	Ailtech DM105A T3 S/N 93413-105 and 93414-111	400-1000 MHz Calibrated 7/10	Tuned Dipole Due: 7/11
(2)	AH Systems SAS-200/511 S/N 118 and 124, P/Ns 2069	1-12.4 GHz	Log Periodic
(1)	AH Systems SAS-200/540 S/N 367 P/N 2052	20-330 MHz	Biconical

### INSTRUMENTATION:

H.P.	HP8656B RF Generator S/N A4229590	100 KHz - 990 MHz Calibrated Due	7/10 7/11
	Solar Electronics Line Impedance Stabilization Network, Type 8012-50-R-24-BNC S/N 8379585	Calibrated: Due:	7/10 7/11
HP 8447D	Broadband preamplifier, 0.1-1300 MHz S/N 2443A03660	Calibrated: Due:	7/10 7/11
Mini-Circuits	ZFL-2000 broadband preamplifier, 10-3000 MHz S/N Lin 001	Calibrated: Due:	7/10 7/11

### ACCESSORIES:

(2)	Ailtech Rulers calibrated in MHz 4 Meter ABS Antenna Mast and Trolley Eighty Centimeter Tall, Motorized Wooden Turntable BNC to BNC Cables - as-required		
(2)	25' RG-214/U Low-loss Coaxial Cable S/N- LIN001 & LIN002	Calibrated: Due:	7/10 7/11

(2) 3' RG-400E Low-loss Coaxial Cable, calibrated as part of the preamplifiers.  
Automatically taken into account when used with the above itemized range preamplifiers.

## MEASUREMENT OF RADIO FREQUENCY EMISSION

## **OF CONTROL AND SECURITY ALARM DEVICES FCC RULES PART 15, C63.4-2003 TEST PROCEDURE**

### **I. INTRODUCTION**

As part of a continuing series of quality control tests to ensure compliance with all applicable Rules and Regulations, this enclosure details the test procedures for certain radio control devices. Testing was performed at a test site located on the property of Linear LLC, 1950 Camino Vida Roble, Suite 150, Carlsbad, California 92008-6517.

### **II. MEASUREMENT FACILITY DESCRIPTION**

The test facility is a specially prepared area adequately combining the desirability of an interference free location with the convenience of nearby 120 volt power outlets, thus completely eliminating the incidence of inverter hash, so often a problem with field measurements.

### **III. DESCRIPTION OF SUPPORTING STRUCTURES**

For Measuring Equipment - The antenna is supported on a trolley that can be raised and lowered on a mast by means of remote control to any level between 1 meter and 4 meters above the ground. For measurements at 3 meters, an antenna height (center of dipole) of about 1 meter generally yields the greatest field strength. For measurements at 1 meter, an antenna height equal to the device under test generally yields the greatest field strength. Usually, horizontal polarization yields the greatest field strength for both 1 and 3 meter measurements.

For Equipment Under Test (EUT): The equipment to be tested is supported by a wooden turntable at a height of eighty centimeters. A two axis swivel at the top of the turntable permits the unit under test to be manually oriented in the position of maximum received signal strength. The turntable can be rotated by remote control.

Test Configuration - All transmitters were located eighty centimeters above ground, at a distance of three meters from the antenna. They were each oriented for maximum radiation by rotating the turntable. The antenna was then moved vertically along the mast for optimum reception in both horizontal and vertical planes. Where no emissions were found, the antenna was also moved to one meter distance to improve system sensitivity.

All receivers were located eighty centimeters above ground, at a distance of three meters from the antenna. They were each oriented for maximum radiation by rotating the turntable. The antenna was then moved vertically along the mast for optimum reception in both horizontal and vertical planes. Generally, emissions were very close to the observed spectrum analyzer noise floor, making accurate measurement difficult because of the analyzer detector's characteristic of adding signal and noise. To better observe and measure emissions well above the noise floor, the antenna was moved in to one meter. This provides a theoretical 9.54 dB improvement in received field strength, but a possible shift from far field to near field antenna characteristics may introduce an unknown error in measurement.

All transmitters and receivers tested are typical of production units.

A Hewlett-Packard spectrum analyzer consisting of a HP8594EM mainframe is used for the field strength meter. A set of Ailtech DM-105 series dipoles are used for the receiving antennas up to 1 GHz. An A.H. Systems model SAS-200/511 log periodic antenna is used from 1 to 5 GHz. Since the published antenna factor includes the small amount of balun loss, this factor is not included in the equations for correcting measured values. The cable loss is added to the raw data. For measurements up to 1 GHz, a Hewlett-Packard 8447D broadband RF preamplifier is inserted between the antenna cable and spectrum analyzer input to ensure adequate system sensitivity while measuring.

For the 10<sup>th</sup> harmonic (3.15 GHz) the HP8562A was used with a short wire antenna. No emissions were found at a ½ centi-meter distance.

From 1 GHz to 3 GHz, a Mini-Circuits ZFL-2000 broadband RF preamplifier is used instead of the HP 8447D. In many cases, the antenna is moved in to a distance of 1 meter to enhance test range sensitivity after the 3 meter data is observed. A theoretical 9.54dB improvement is realized. Please see Excel data spreadsheet for details. For a particular device and frequency, the EUT to antenna distance is specified in the Report of Measurements.

Correction of Measured Values - The spectrum analyzer calibration is in units of dBm absolute. Published antenna factor, measured cable loss and preamplifier gain are in units of dB. All equipment is referenced to a 50 ohm characteristic impedance; therefore, any impedance terms will factor out of any calculations. Also, balun loss is included in the antenna factor, so this term will not appear in any calculation.

To obtain field strength, the reference (50 ohm system) 1 uV = 0 dBuV = -107 dBm is used.

For a given frequency: antenna factor, cable loss, preamplifier gain (if used) and a 9.54 dB gain factor (3 meters to 1 meter field strength conversion) when required are factored into the spectrum analyzer reading, resulting in a field strength in units of dBm.

Field strength reading (dBm) + 107 dB = dBuV, using 0 dBuV = 1 uV/meter at a specified distance as reference.

All of the equipment was calibrated to NBS-traceable factory specifications prior to the date of measurement.

#### IV MEASUREMENT PROCEDURE

##### Transmitters

1. Set the DIP-switch rockers of the transmitter (if needed) to all ON, jam the button in the ON position, and place the transmitter on the test stand.
2. Tune the antenna (if required).
3. Tune the spectrum analyzer.
4. Adjust the antenna height and polarization for peak field strength.
5. Rotate the turntable to orient the transmitter for the highest reading.
6. Record the observed peak emission.
7. Record the screen image (if required).

##### Spectrum Analyzer Control Settings:

Tuning:	As required
Bandwidth	100 KHz for Field Strength,
Scan Width:	100 KHz/div (may be different when tuning or adjusting display for photographs)
Input Attenuator:	10 dB
Scan Time:	50 msec sweep
Reference Level:	0 dBm
Display Mode:	Log 10 dB/division
Video Filter:	OFF
Scan Mode:	Internal
Scan Trigger:	Auto

# REPORT OF MEASUREMENTS

Applications for control, security alarm, door opener or remote switch

Description: 315.000 MHz transmitter DX format semi-supervised

DATE: 05 AUGUST 2010

ITEM TESTED: Alarm Transmitter, DXS-LRP SAMPLE NUMBER 1  
 MANUFACTURER: Linear Corporation  
 TRADE NAME:  
 PRODUCT ID: SST00122

DISTANCE AT WHICH MEASURE 3 meters, DUT 0.8 meters above ground  
 REFERENCE: 15.231  
 MEASUREMENT PROCEDURE: C63.4-2003

**RADIATION**

A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Q
Tuned Frequency MHz	Emission Frequency MHz	Ambient Level dBm	FCC Limit dBm	Meter Reading dBm	UUT & Ant Pos.*	Antenna Factor dB	Cable Loss dB	Ant Gain dB	Dist Fac dB	Duty Cycle	Emission Data dBm/mtr	uV/m	FCC Limit uV/m	dB:FCC	FREQ. MHz
315.00	315.00	-98.40	-3.98	-10.2	H H	18.6	1.2	27.2	0.00	20.0	-37.60	69.40	2951.21	-6.22	315.00
	630.00	-99.34	-23.04	-70.0	H H	26.0	1.7	26.5	9.54	20.0	-98.34	8.66	2.71	-46.96	630.00
	945.00	-95.44	-26.94	-63.5	H H	29.4	2.2	26.5	9.54	20.0	-87.94	19.06	8.97	-36.56	945.00
	1260.00	-80.60	-41.78	-70.0	H H	26.8	2.6	0.0	19.00	20.0	-79.60	27.40	23.44	-28.22	1260.00
	1575.00	-78.30	-44.08	#N/A	H H	28.7	3.0	0.0	19.00	20.0	#N/A	#N/A	#N/A	#N/A	1575.00
	1890.00	-76.70	-45.88	#N/A	H H	30.0	3.3	0.0	19.00	20.0	#N/A	#N/A	#N/A	#N/A	1890.00
	2205.00	-94.60	-46.76	#N/A	H H	30.8	3.6	0.0	19.00	20.0	#N/A	#N/A	#N/A	#N/A	2205.00
	2520.00	-93.50	-47.88	-66.0	H H	31.7	3.8	0.0	19.00	20.0	-69.50	37.50	74.99	-18.12	2520.00
	2835.00	-92.40	-48.98	#N/A	H H	32.4	4.2	0.0	19.00	20.0	#N/A	#N/A	#N/A	#N/A	2835.00
	3150.00	-91.50	-49.88	#N/A	H H	33.1	4.4	0.0	19.00	20.0	#N/A	#N/A	#N/A	#N/A	3150.00

**NOTES:**

The spectrum was searched from 25 to 3500 MHz  
 No other emissions were observed except those shown on this page.  
 \* 1 meter measurement corrected to 3 meters  
 \*\* Device (UUT) and antenna position = H (horizontal) or V (Vertical)

15.207 Conducted Emissions Not Applicable- Battery Powered

TESTED BY: *John K. Korman* DATE: *Aug. 6, 2010*

ENGINEER: \_\_\_\_\_ DATE: \_\_\_\_\_  
 FILE NAME: SST122\_1\_X1.XLS DISK NAME: FCC DATA

**REPORT OF MEASUREMENTS**

Applications for control, security alarm, door opener or remote switch

Description: 315.000 MHz transmitter DX format semi-supervised

DATE: 05 AUGUST 2010

ITEM TESTED: Alarm Transmitter, DXS-LRP SAMPLE NUMBER 2  
 MANUFACTURER: Linear Corporation  
 TRADE NAME:  
 PRODUCT ID: SST00122

DISTANCE AT WHICH MEASURE 3 meters, DUT 0.8 meters above ground  
 REFERENCE: 15.231  
 MEASUREMENT PROCEDURE: C63.4-2003

**RADIATION**

A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Q
Tuned Frequency MHz	Emission Frequency MHz	Ambient Level dBm	FCC Limit dBm	Meter Reading dBm	UIT & Ant Pos.*	Antenna Factor dB	Cable Loss dB	Amp Gain dB	Dist Fac dB	Duty Cycle dB	Emission Data dBm/mtr	dBuV/mtr	FCC Limit uV/M	dB:FCC	FREQ. MHz
315.00	315.00	-98.40	-3.98	-9.2	HH	18.6	1.2	27.2	0.00	20.0	70.40	3311.31	6042.00	-5.22	315.00
	630.00	-95.34	-23.04	#N/A	HH	26.0	1.7	26.5	9.54	20.0	#N/A	#N/A	604.00	#N/A	630.00
	945.00	-95.44	-26.94	-66.0	HH	29.4	2.2	26.5	9.54	20.0	-90.44	6.73	604.00	-39.06	945.00
	1260.00	-80.60	-41.78	-70.0	HH	26.8	2.6	0.0	19.00	20.0	-79.60	23.44	604.00	-28.22	1260.00
	1575.00	-78.30	-44.08	#N/A	HH	28.7	3.0	0.0	19.00	20.0	#N/A	#N/A	604.00	#N/A	1575.00
	1890.00	-76.70	-45.68	-67.1	HH	30.0	3.3	0.0	19.00	20.0	-72.80	51.28	604.00	-21.42	1890.00
	2205.00	-94.60	-46.76	-64.5	HH	30.8	3.6	0.0	19.00	20.0	-69.10	78.52	605.00	-17.74	2205.00
	2520.00	-93.50	-47.88	-65.2	HH	31.7	3.8	0.0	19.00	20.0	-68.70	36.30	604.00	-17.32	2520.00
	2835.00	-92.40	-48.98	-62.5	HH	32.4	4.2	0.0	19.00	20.0	-64.90	42.10	604.00	-13.52	2835.00
	3150.00	-91.50	-49.88	#N/A	HH	33.1	4.4	0.0	19.00	20.0	#N/A	#N/A	604.00	#N/A	3150.00

NOTES:  
 \* .1 meter measurement corrected to 3 meters  
 \*\* Device (UIT) and antenna position = H (horizontal) or V (vertical)

The spectrum was searched from 25 to 3500 MHz  
 No other emissions were observed except those shown on this page.

15.207 Conducted Emissions Not Applicable- Battery Powered

TESTED BY: *John W. Korman* DATE: Aug 6, 2010

ENGINEER: \_\_\_\_\_ DATE: \_\_\_\_\_  
 FILE NAME SST122\_2\_X1.XLS DISK NAME: FCC DATA



**REPORT OF MEASUREMENTS**

Applications for control, security alarm, door opener or remote switch

Description: 315.000 MHz transmitter DX format semi-supervised

DATE: 05 AUGUST 2010

ITEM TESTED: Alarm Transmitter, DXS-LRP SAMPLE NUMBER 3  
 MANUFACTURER: Linear Corporation  
 TRADE NAME:  
 PRODUCT ID: SST00122

DISTANCE AT WHICH MEASURE 3 meters, DUT 0.8 meters above ground  
 REFERENCE: 15.231  
 MEASUREMENT PROCEDURE: C63.4-2003

**RADIATION**

A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Q
Tuned Frequency MHz	Emission Frequency MHz	Ambient Level dBm	FCC Limit dBm	Meter Reading dBm	UUT & Ant Pos.*	Antenna Factor dB	Cable Loss dB	Amp Gain dB	Dist Fac dB	Duty Cycle	Emission Data dBm/mtr	uV/M	FCC Limit uV/M	dB-FCC	FREQ. MHz
315.00	315.00	-98.40	-3.98	-9.4	H H	18.6	1.2	27.2	0.00	20.0	-36.80	3235.94	6042.00	-5.42	315.00
	630.00	-99.34	-23.04	#N/A	H H	26.0	1.7	26.5	9.54	20.0	#N/A	#N/A	604.00	#N/A	630.00
	945.00	-95.44	-26.94	-58.3	H H	29.4	2.2	26.5	9.54	20.0	-82.74	16.33	604.00	-31.36	945.00
	1260.00	-80.60	-41.78	-70.0	H H	26.8	2.6	0.0	19.00	20.0	-79.60	23.44	604.00	-28.22	1260.00
	1575.00	-78.30	-44.08	#N/A	H H	28.7	3.0	0.0	19.00	20.0	#N/A	#N/A	604.00	#N/A	1575.00
	1890.00	-76.70	-45.68	#N/A	H H	30.8	3.3	0.0	19.00	20.0	#N/A	#N/A	604.00	#N/A	1890.00
	2205.00	-94.60	-46.76	#N/A	H H	30.8	3.6	0.0	19.00	20.0	#N/A	#N/A	605.00	#N/A	2205.00
	2520.00	-93.50	-47.86	-69.0	H H	31.7	3.8	0.0	19.00	20.0	-72.50	53.09	604.00	-21.12	2520.00
	2835.00	-92.40	-48.98	#N/A	H H	32.4	4.2	0.0	19.00	20.0	#N/A	#N/A	604.00	#N/A	2835.00
	3150.00	-91.50	-49.88	#N/A	H H	33.1	4.4	0.0	19.00	20.0	#N/A	#N/A	604.00	#N/A	3150.00

TESTED BY: *John W. Korman* DATE: Aug. 6, 2010

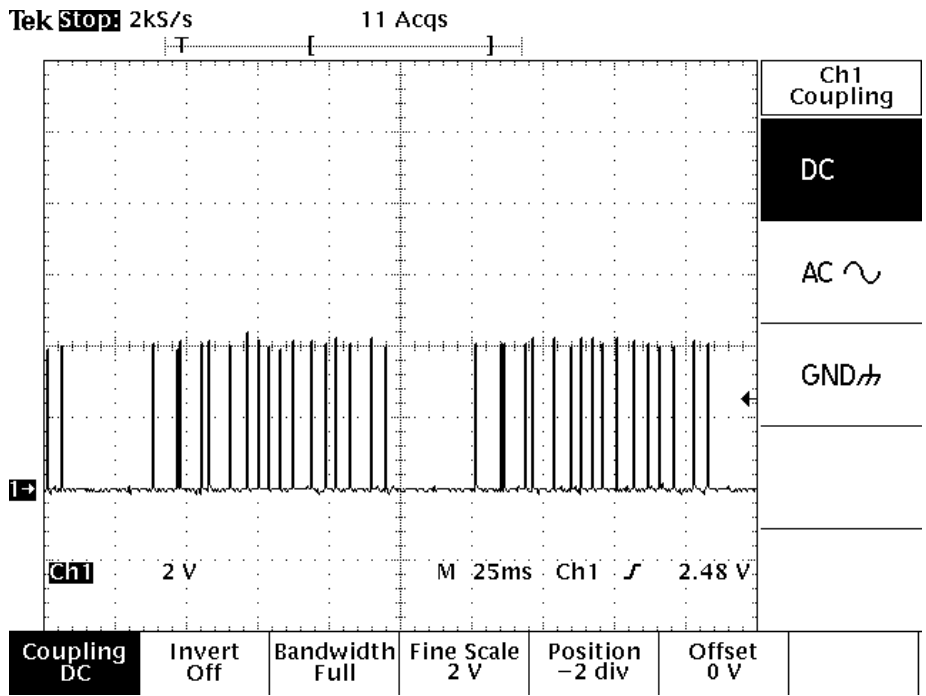
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15.207 Conducted Emissions Not Applicable- Battery Powered

NOTES:  
 \* 1 meter measurement corrected to 3 meters  
 \*\* Device (UUT) and antenna position = H (horizontal) or V (Vertical)

The spectrum was searched from 25 to 3500 MHz  
 No other emissions were observed except those shown on this page.

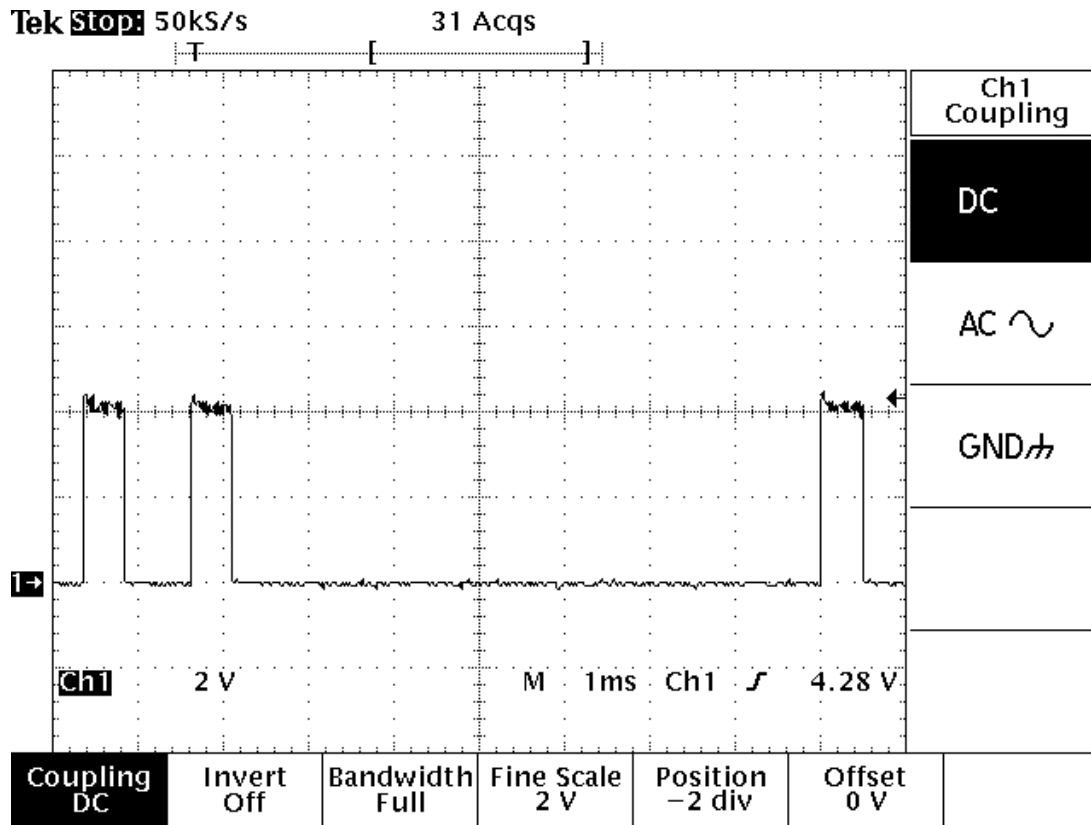




17 BITS / DATA WORD + 3 BLANK FRAMES BETWEEN WORDS

DATA WORD = 20 X 5000 USEC = 100 MILLISECONDS FOR NOMINAL DATA WORD FRAME

TWO DATA WORDS SHOWN ABOVE



INDIVIDUAL DATA PULSES, QUATERNARY ENCODED DATA FORMAT

500  $\mu$ SEC FOR EACH DATA PULSE

TIME DURATION FOR EACH PULSE IS FIXED

3 DATA PULSES SHOWN ABOVE

## Transmitter Duty Cycle Calculations and Time Domain Information

### DX Data Format

Worst case duty cycle is computed because coded pulse width type A1D modulation is used. Data rate is seventeen 500 uSec pulses in any 100 mSec. time window.

During transmission, the transmitter sequentially emits a group of 17 encoded pulses in the form of a pulse-keyed carrier. The data stream consists of preamble and encoded data string.

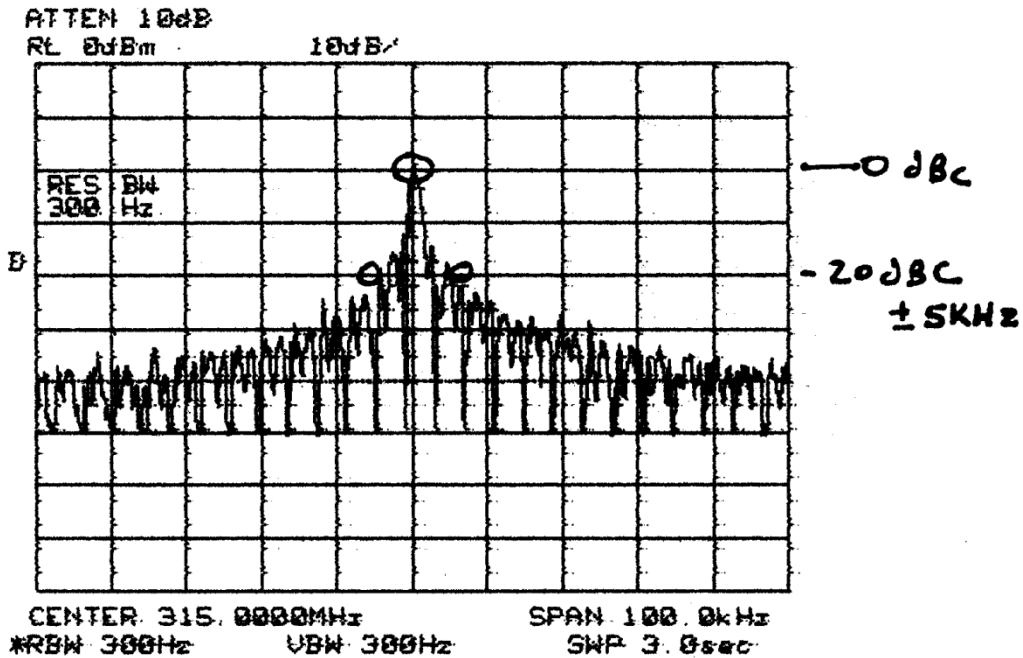
#### REAL TIME ANALYSIS:

Description	Total Time	"On" Time
Total Transmission	17 x 500 uSec.	= 8.5 E-3 Sec on time

In compliance with FCC Rules 15.35(c), the following duty cycle factor is used for all field strength calculations. A 100 mSec. full word time window is selected with the worst case programmable on time ratio.

$$\frac{8.5 \text{ E-3 On time}}{100 \text{ E-3 Total time Window}} = 8.5 \text{ E-2 on time per 100 mSec. time window}$$

$$20 \log (8.5\text{E-2}) = -21.4 \text{ dB} \qquad 20 \text{ dB Duty Cycle Ratio (Per FCC Rules)}$$



DEVICE: DXS-LRP Remote Control Transmitter

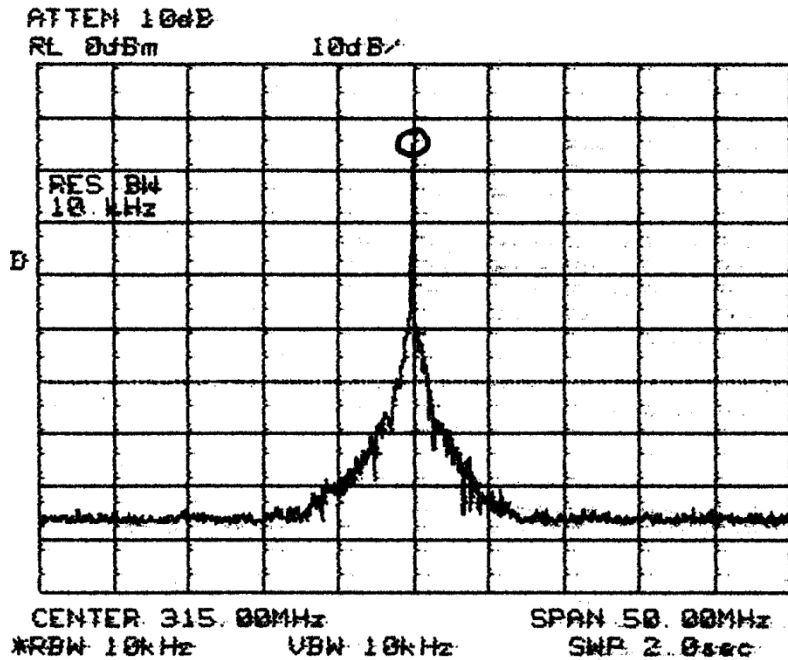
PHOTOGRAPH: Occupied Bandwidth

CONDITIONS: Transmitter Fundamental. A1D Modulation - Pulse Position Modulation. Crystal Based Frequency Determining Element.

SPECTRUM ANALYZER CONTROL SETTINGS

CENTER FREQUENCY:	315.00 MHz	INPUT ATTENUATION:	-10 dB
SCAN WIDTH:	10 KHz / Div.	PREAMPLIFIER GAIN:	0 dB
SCAN TIME:	3.0 Seconds	LOG REF. LEVEL:	0 dBm
RF BANDWIDTH:	300 Hz		
ANTENNA:	Dipole Ant. at Analyzer Input	TUNED TO:	N/A
ANTENNA DISTANCE:	0.01 Meters	ANTENNA HEIGHT:	N/A
SYSTEM NOISE FLOOR:	N/A		

NOTES: Per 15.231(c), Occupied Bandwidth (20 dB down) is +/- 5 KHz. This is less than 0.020% of the center frequency. FCC Rules, 15.231(c) devices must be less than 0.25% of center frequency. This device therefore complies with 15.231(c).



DEVICE: DXS-LRP Remote Control Transmitter

PHOTOGRAPH: Transmitter Spurious Emissions +/-25 MHz of the tuned center frequency.

CONDITIONS: Transmitter Fundamental. A1D Modulation, Crystal Frequency Determining Element.

SPECTRUM ANALYZER CONTROL SETTINGS

CENTER FREQUENCY: 315 MHz INPUT ATTENUATION: -10 dB

SCAN WIDTH: 5 MHz/ Div. PREAMPLIFIER GAIN: 0 dB

SCAN TIME: 2.0 Sec. LOG REF. LEVEL: -20 dBm

RF BANDWIDTH: 10 KHz

ANTENNA: Dipole Antenna on Analyzer Input TUNED TO: N/A

ANTENNA DISTANCE: 0.01 Meters ANTENNA HEIGHT: N/A

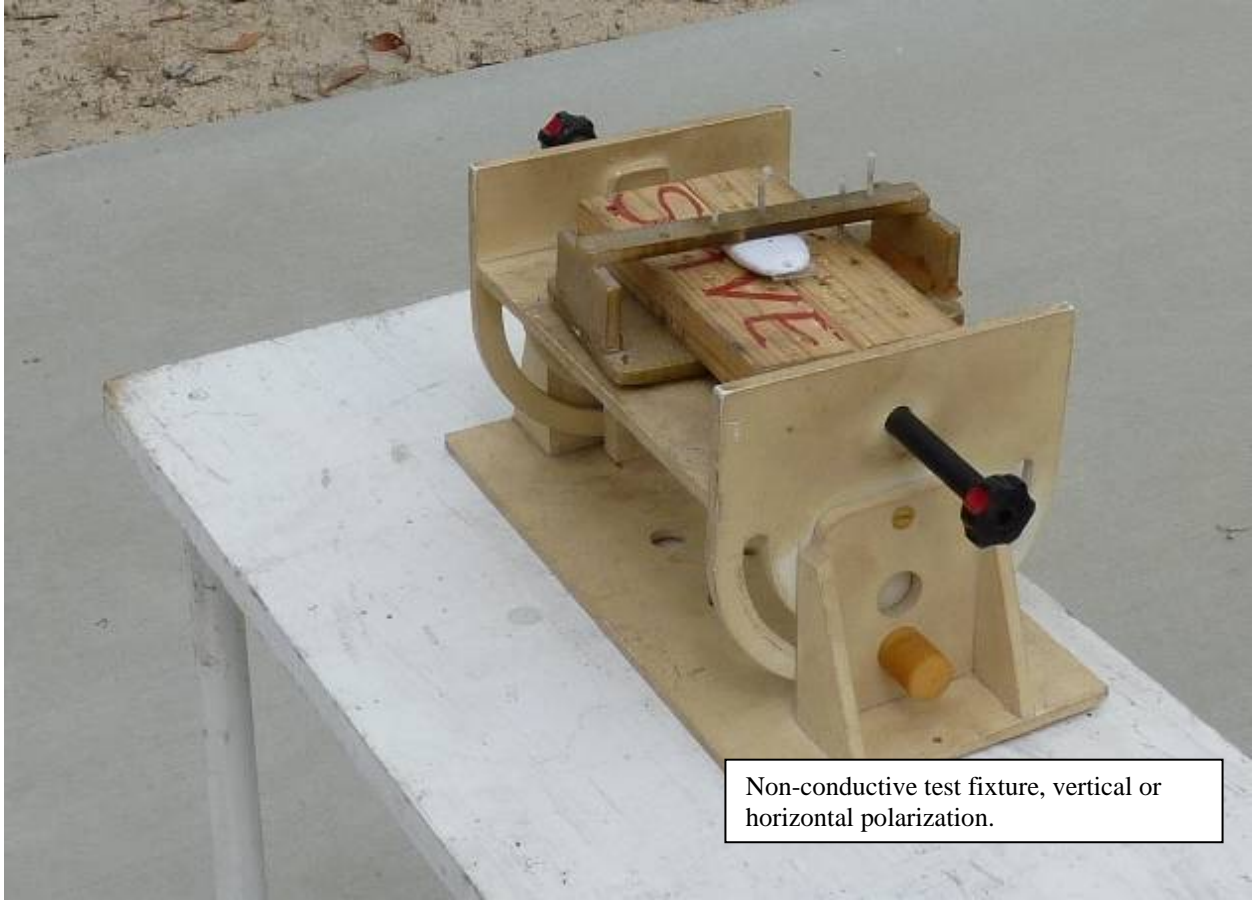
SYSTEM NOISE FLOOR: N/A

No significant emissions occur outside of the of the rated center freq. except for harmonic spurious signals.

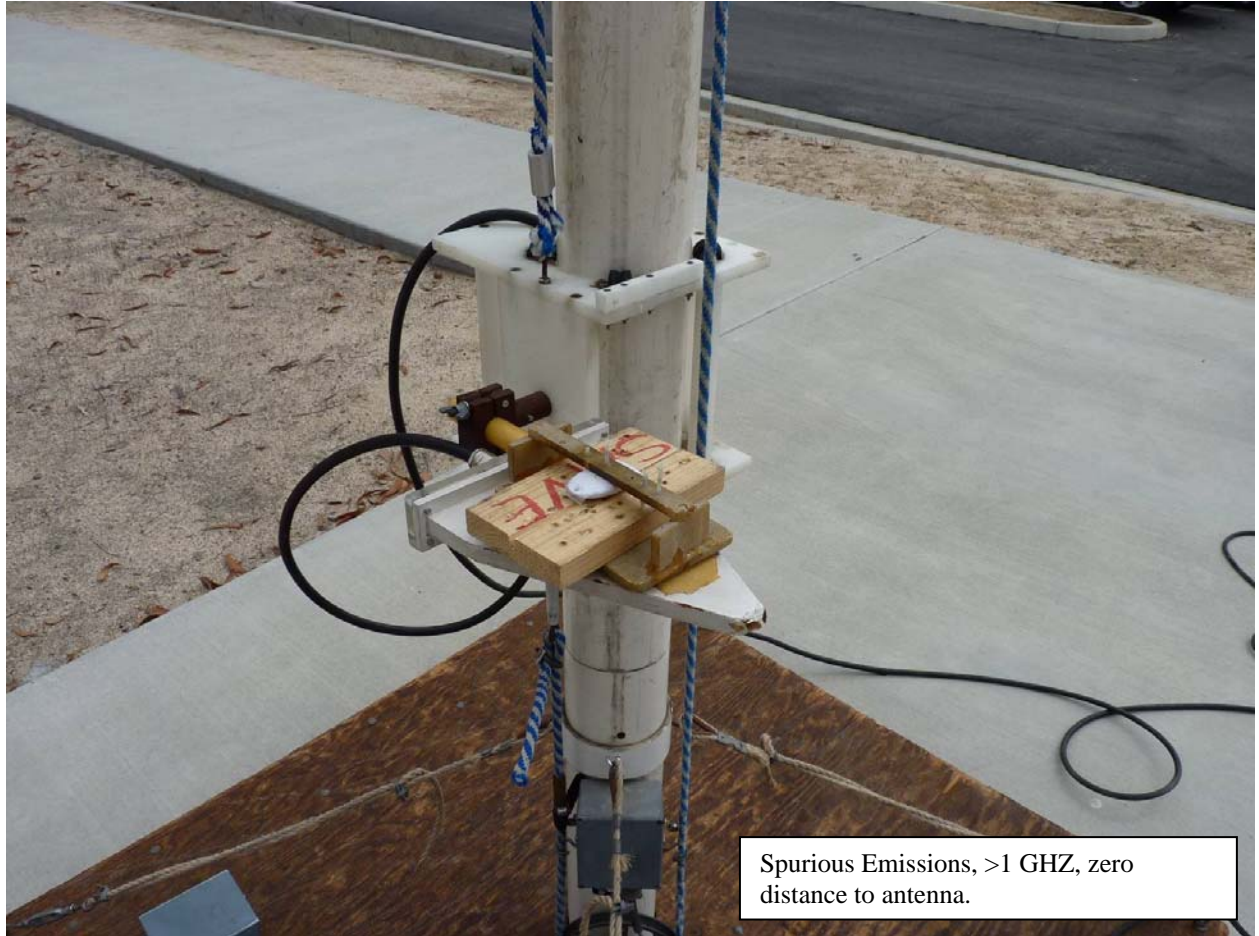


Fundamental Emissions, 3 Meters





Non-conductive test fixture, vertical or horizontal polarization.



Spurious Emissions, >1 GHz, zero distance to antenna.



630 and 945 MHz, Spurious Emissions Testing.