REPORT OF MEASUREMENTS

LINEAR CORPORATION
FCC ID: EF4 SST00100
Model : DXS-32 Door / Window Alarm 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, 1997 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 C63.4-1992, 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 dated January 24, 1995 is on file with the Commission and a Letter of Acceptance dated January 27, 1995 (File 31040/SIT) is a portion of the Commission's records.

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

REGISTERED PROFESSIONAL ENGINEER
JOHN W. KUIVINEN
No. E019909
Exp. 6/00
ELECTRICAL
STATE OF CALIFORNIA

Jan 14, 1999
Date

Reference: Application EF4 SST00100

Door / Window Supervised Transmitter

The status or manually activated alarm transmissions of the SST00100 supervised door / window transmitters are limited to 8 data words of 100 mSec. each. The status transmissions occur every 1.2 hours. If an alarm transmission is sent, then the status timer is reset and a status transmission will not be sent again for 1.2 hours. This is done to conserve battery power and insure that even in the presence of heavy interference at least one status word every 8 hours will be received by the supervised receiver.

From first data bit to the last data bit of a status or alarm transmission, the total time is 785 mSec. or 0.785 seconds. FCC Rules 15.231(a)(3) permits regular status transmissions of no longer than 1 second every hour.

The transmitter is normally manually activated. It is used only for the open / closed indication of a physical object (door or window).

Signed:

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

TESTING INSTRUMENTATION AND EQUIPMENT LIST

SPECTRUM ANALYZERS:

H.P.	HP8562A	1KHz to 22GHz		
	S/N 2913A03742	Calibrated	4/98	
		Due	4/99	

ANTENNAS:

(2)	Ailtech DM105A T1	20-200 MHz		Tuned Dipole
	S/N 93412-105 and 93412-114	Calibrated 1/98	Due:	1/99
(2)	Ailtech DM105A T2	140-400 MHz	Tuned Dipole	
	S/N 93413-113 and 93413-117	Calibrated 1/98	Due:	1/99
(2)	Ailtech DM105A T3	400-1000 MHz	Tuned Dipole	
	S/N 93413-105 and 93414-111	Calibrated 1/98	Due	1/99
(2)	AH Systems SAS-200/511	1-12.4 GHz		Log Periodic
	S/N 118 and 124, P/Ns 2069			
(1)	AH Systems SAS-200/540	20-330 MHz		Biconical
	S/N 367 P/N 2052			

INSTRUMENTATION:

H.P.	HP8656B RF Generator	100 KHz - 990 MHz	
	S/N A4229590	Calibrated	1/98
		Due	1/99
Solar Electronics Line Impedance Stabilization Network, Type			
	8012-50-R-24-BNC	Calibrated:	1/98
	S/N 8379585	Due:	1/99
HP 8447D	Broadband preamplifier, 0.1-1300 MHz		
	S/N 2443A03660	Calibrated: 4/98	
		Due: 4/99	
Mini-Circuits	ZFL-2000 broadband preamplifier, 10-3000 MHz		
	S/N Lin 001	Calibrated: 4/98	
		Due: 4/99	

ACCESSORIES:

(2) Ailtech Rulers calibrated in MHz
4 Meter ABS Antenna Mast and Trolley
Tektronix C5C Scope Camera
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: 1/98
Due: 1/99

(2) 3' RG-55/U Low-loss Coaxial Cable, calibarated 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, C63.4-1992 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 Corporation, 2055 Corte del Nogal, Carlsbad, California 92009.

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 an 8562A 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.

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 supervised

DATE: 12/23/98

ITEM TESTED: Alarm Transmitter
MANUFACTURER: Linear Corporation
TRADE NAME:
PRODUCT ID: EF4 SST00100

DISTANCE AT WHICH MEASURED: 3 meters, DUT 0.8 meters above ground
REFERENCE: 15.231
MEASUREMENT PROCEDURE: C63.4-1992

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. os.**	Antenna Factor dB	Cable Loss dB	Amp Gain dB	Dist Fac dB	Duty Cycle dB	Emission Data dBm/mtr	Emission Data dBuV/mtr	uV/M	FCC Limit uV/M	dB:FCC	FREQ. MHz
315.00	315.00	-98.40		-3.98		-6.0	H H	18.6	1.2	27.2	0.00	20.0	-33.40	73.60	4786.30	6042.00	-2.02	315.00
	630.00	-89.80		-32.58		-53.3	H H	26.0	1.7	26.5	0.00	20.0	-72.10	34.90	55.59	604.00	-20.72	630.00
	945.00	-85.90		-36.48		-38.8	H H	29.4	2.2	26.5	0.00	20.0	-53.70	53.30	462.38	604.00	-2.32	945.00
	1260.00	-82.00		-40.38		-41.5	H H	26.8	2.6	20.4	0.00	20.0	-52.50	54.50	530.88	604.00	-1.12	1260.00
	1575.00	-79.10		-43.28		-56.2	H H	28.7	3.0	19.8	0.00	20.0	-64.30	42.70	136.46	604.00	-12.92	1575.00
	1890.00	-77.40		-44.98		-58.9	H H	30.0	3.3	19.7	0.00	20.0	-65.30	41.70	121.62	604.00	-13.92	1890.00
	2205.00	-85.14	*	-37.92	*	#N/A	H H	30.8	3.6	18.3	9.54	20.0	#N/A	#N/A	#N/A	605.00	#N/A	2205.00
	2520.00	-84.04	*	-43.14	*	#N/A	H H	31.7	3.8	14.2	9.54	20.0	#N/A	#N/A	#N/A	604.00	#N/A	2520.00
	2835.00	-82.94	*	-46.94	*	#N/A	H H	32.4	4.2	11.5	9.54	20.0	#N/A	#N/A	#N/A	604.00	#N/A	2835.00
	3150.00	-82.04	*	-59.34	*	#N/A	H H	33.1	4.4	0.0	9.54	20.0	#N/A	#N/A	#N/A	604.00	#N/A	3150.00

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.

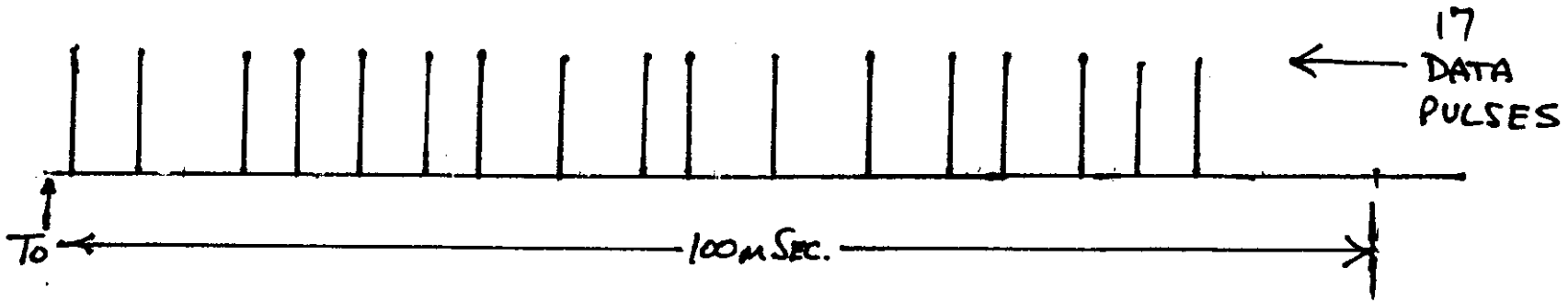
15.207 Conducted Emissions Not Applicable- Battery Powered

TESTED BY _____ DATE _____

John W Kuzzen Jan 14, 1999

ENGINEER DATE

FILE NAME:SST00100.XLS DISK NAME: FCC DATA



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.

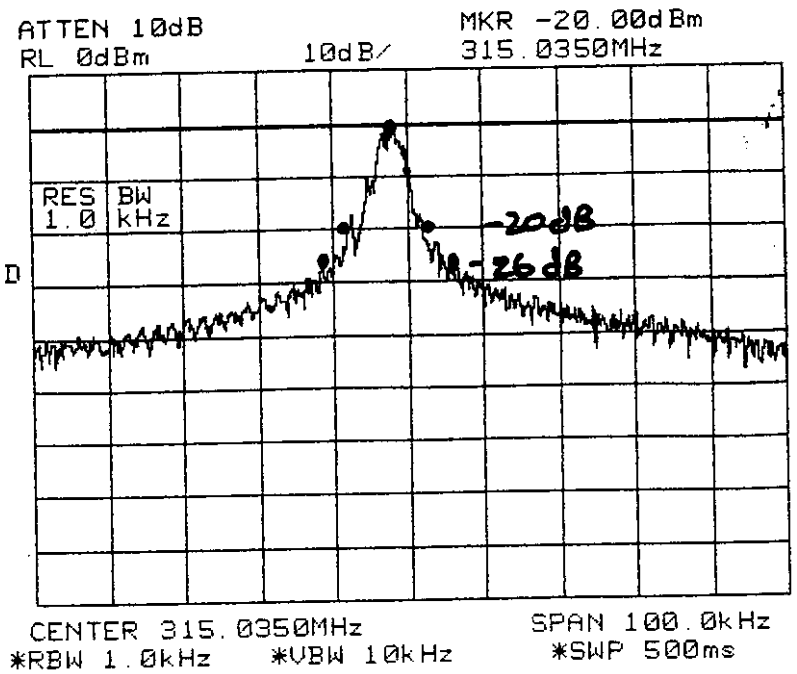
REAL TIME ANALYSIS:

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.

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

20 log (8.5E-2) = -21.4 dB Duty Cycle Ratio (Per FCC Rules)



DEVICE: DXS-32 Door / Window Alarm Transmitter

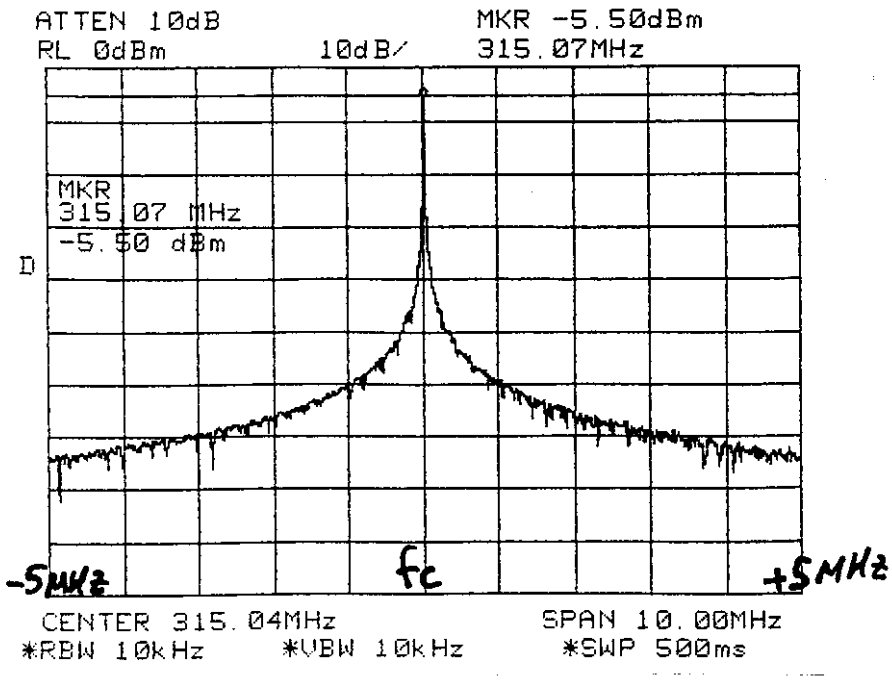
PHOTOGRAPH: Occupied Bandwidth

CONDITIONS: Transmitter Fundamental. A1D Modulation - Pulse Position Modulation. Fixed Duty Cycle. SAW Resonator Frequency Determining Element.

SPECTRUM ANALYZER CONTROL SETTINGS

CENTER FREQUENCY:	315.00 MHz	INPUT ATTENUATION:	-10 dB
SCAN WIDTH:	2.0 KHz/ DIV.	PREAMPLIFIER GAIN:	0 dB
SCAN TIME:	500 mSEC/DIV.	LOG REF. LEVEL:	-20 dBm
RF BANDWIDTH:	300 Hz		
ANTENNA:	9" Whip on Analyzer Input	TUNED TO:	N/A MHz
ANTENNA DISTANCE:	0.25 Meters	ANTENNA HEIGHT:	N/A
SYSTEM NOISE FLOOR:	N/A		

NOTES: Per 15.231(c), Occupied Bandwidth (20 dB down) is less than +/- 7 KHz. This is less than 0.005% 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-32 Door / Window Alarm Transmitter

PHOTOGRAPH: Transmitter Spurious Emissions +/- 5 MHz of the center freq.

CONDITIONS: Transmitter Fundamental. A1D Modulation, SAW Resonator Frequency Determining Element.

SPECTRUM ANALYZER CONTROL SETTINGS

CENTER FREQUENCY:	315.00 MHz	INPUT ATTENUATION:	-10 dB
SCAN WIDTH:	1.0 MHz/ DIV.	PREAMPLIFIER GAIN:	0 dB
SCAN TIME:	100 mSEC/DIV.	LOG REF. LEVEL:	-20 dBm
RF BANDWIDTH:	10 KHz		
ANTENNA:	9" Whip on Analyzer Input	TUNED TO:	N/A MHz
ANTENNA DISTANCE:	0.25 Meters	ANTENNA HEIGHT:	N/A
SYSTEM NOISE FLOOR:	N/A		

No fundamental emissions occur outside of the of the rated center freq. The oscillator is locked to the SAW stabilized frequency determining element.