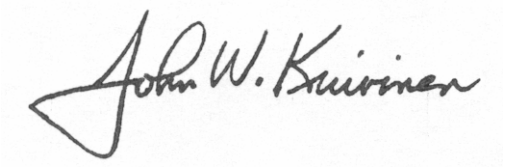
Summary of Test Results
in accord with FCC Rules Part 15 and C63.4-2001

Equipment Model:	SHA24711
Transmitter Tested to C63.4-2001 Section:	FCC Rules 15.231
Field Strength at a distance of 3 meters:	4570 uV/Mtr (-2.1 dB below limit) @ 310 MHz
Peak to Average Ratio:	11.3 dB - Fixed Duty Cycle
Test Conditions:	Radiated (Sections 11 & 13)
Transmitter:	
Transmitter Frequency:	310 MHz Nominal (Factory Tuned Only)
Bandwidth (20 dB down)	< 0.010% of Center Freq.
Frequency Tolerance:	N/A (Nominal +/- 0.5 MHz)
Frequency Stability:	N/A (Nominal +/- 0.5 MHz)
Transmitter Spurious at 3 meters: (Worst Harmonic)	447 uV/Mtr (-2.3 dB below limit)
Frequency:	620 MHz
Momentary Operation (Yes/No)	Yes
Holdover time after manual release:	0.0 seconds
Duration of transmission after activation:	20 seconds maximum on any single manual activation

Attestation:

The radio apparatus identified in the application has been subject to all the applicable test conditions specified in FCC Rules Part 15 and all of the requirements of the Standard have been met.

Regulatory Compliance Engineer



John W. Kuivinen, P.E. _____ Date: July 17, 2002

LINEAR CORPORATION
FCC ID: EF4 SHA24711

Radio Standard Specification
Low Power Communication Devices
C63.4-2001 and FCC Rules Part 15

1.0 General:

1.2, Exclusions to TV Broadcast Freq.	Complies

2.0 Related Documents:

Reference Documents for Application:	CFR 47, FCC Rules Part 15

3.0 Test Equipment:

Supply Voltage:	Two #2016 3 volt lithium batteries
Test Equipment List	See Section 6
Signal Detector:	Peak with 11.3 dB peak to average conversion.

4.0 Certification and Test Results:

Summary of Results per	See Page 1 of this Report

5.0 General Technical Requirements:

5.1 Testing Methods:	Peak Signal pulse position modulated A1D signal.
5.1 Reference Standard:	C63.4-2001 (FCC Procedure)
5.2 Modulation:	Pulse Position 40K0 A1D, AM Modulation
5.3 Type of Antenna:	Integral to Transmitter Case - Tuned Loop
5.4 External Controls:	Push Buttons No user serviceable parts except for replacement of batteries.
5.5 Accessories:	NONE
5.6 TX Bandwidth:	<0.020 % (See Section 8)
5.7 Equipment Labels:	See Section 2
5.8 Manual Disclaimer:	See attached draft copy of manual
5.9 Usage Restrictions:	Digital Pulse Code Only

6.0 Transmitter Characteristics and Tests:

6.1 Momentary Operated Devices:	Complies
6.1(a) Types of Signals:	Manual Push to Transmit
6.1(a) Automatic Activation:	N/A
6.1(a) Five Second Max. upon release:	Complies
6.1(b) Field Strengths:	Table 1 310 MHz = 5833 uV/Mtr maximum at 3 meters.
6.1(c) Bandwidth (20 dB down)	<0.010 % Complies
6.1(d) Frequency Stability	N/A per regulations +/- 0.500 MHz Maximum Error
6.1(e) Reduced Field Strength	N/A
6.2 Non-Momentary Operated Devices:	N/A
6.2.1 Frequency Bands:	Refer to Table 1
6.3 Restricted Bands:	Complies
6.5 Pulsed Operation:	Complies (11.3 dB Peak/Average) See Section 8
6.6 Wireline Conducted Emissions:	N/A
7.0 Receivers	N/A
8.0 Self Certification:	N/A
9.0 AC Wireline Conducted Emissions:	N/A
10.0 Terminated Measurement Method:	N/A
11.0 Radiated Measurement Method:	See Section 8
11.1 Measuring Distance:	Complies
11.2 Open Field Test Site:	Complies, C63.4-2001
11.3 Equipment Test Platform:	See Section 8
11.4 Measurement Method:	Complies, See Section 8
12.0 DC Power Consumption Methods:	N/A
13.0 Near Field Measurement for < 30 MHz:	N/A

14.0 Test Report Submission: See Attached

REPORT OF MEASUREMENTS

LINEAR CORPORATION
FCC ID: EF4 SHA24711
Model: SR5909 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, 2001 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.

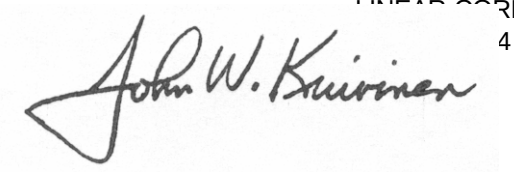
Test Procedure C63.4-2001, Section 13, Measurement of Intentional Radiators was used for the testing of this device.

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 23, 2001 (File 90767) 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.

_____ __ July 17, 2002

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



DURATION OF RF TRANSMISSIONS

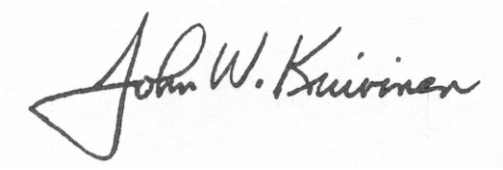
SR5909

REMOTE CONTROL TRANSMITTER

This transmitter is manually activated. It is used only for remote control of a garage door operator. 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 20 seconds.

When the push button is released the transmitter ceases transmitting immediately. FCC Rules 15.231 (a)(1) allows no longer than 5 seconds upon the release of a manually activated transmitter.

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	12/01	
		Due	12/02	

ANTENNAS:

(2)	Ailtech DM105A T1	20-200 MHz		Tuned Dipole
	S/N 93412-105 and 93412-114	Calibrated 3/02	Due:	3/03
(2)	Ailtech DM105A T2	140-400 MHz	Tuned Dipole	
	S/N 93413-113 and 93413-117	Calibrated 3/02	Due:	3/03
(2)	Ailtech DM105A T3	400-1000 MHz	Tuned Dipole	
	S/N 93413-105 and 93414-111	Calibrated 3/02	Due	3/03
(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 - 99O MHz	
	S/N A4229590	Calibrated	3/02
		Due	3/03
Solar Electronics Line Impedance Stabilization Network, Type			
	8012-50-R-24-BNC	Calibrated:	3/02
	S/N 8379585	Due:	3/03
HP 8447D	Broadband preamplifier, 0.1-1300 MHz		
	S/N 2443A03660	Calibrated: 3/02	
		Due: 3/03	
Mini-Circuits	ZFL-2000 broadband preamplifier, 10-3000 MHz		
	S/N Lin 001	Calibrated: 3/02	
		Due: 3/03	

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: 3/02
Due: 3/03

(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.

LINEAR CORPORATION
FCC ID: EF4 SHA24711

MEASUREMENT OF RADIO FREQUENCY EMISSION
OF CONTROL AND SECURITY ALARM DEVICES
FCC RULES PART 15, C63.4-2001 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 1.3 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 1.3 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

Transmitter Duty Cycle Calculations and Time Domain Information

Rolling Code Data Format

Worst case duty cycle is computed because binary-coded pulse width type A1D modulation is used. Data rate is assumed to be 200 uSec (=1) and 400 uSec (=0) pulses in any 600 uSec data pulse time window.

Modulation rate is fixed at 1670 bits per second.

During transmission, the transmitter sequentially emits a group of 12 preamble pulses and 66 data pulses in the form of a pulse keyed carrier. The data stream consists of preamble, header, encoded data string, fixed data string and interword pause.

The preamble and header are fixed by the manufacture of the IC. The preamble consists of a serial string of 12 bits of 50% duty cycle pulses. The on and off times are each 200 uSec. The 12 bit header is followed by one long pause of 2.0 mSec in duration.

The data string utilizes a 66 bit encoded data stream that sequentially generates a 32 bit pseudo-random rotating code with an additonal 34 bits of fixed code.

The rotating code structure has a capability of over 4000 million possible code sequences. This code structure is specifically selected such that the 32 bit pseudo-random code can never be equal to all ones or all zeroes and that on average a 50/50 mix of 1s and 0s are generated.

The fixed code is programmed by the manufacturer to represent device serialization. It consists of a serial number code, button pressed information and battery status code (optional).

REAL TIME ANALYSIS:

Each of the 34 information data pulses occupy a maximum 400 uSec duration position within a 600 uSec wide bit frame. The fixed code elapsed time equals 20.4 mSec.

WORST CASE ANALYSIS:
The serial data stream is dependent on the clocking speed of the microprocessor controller. Proportionately, as the clock speed slows or speeds up, the on/off timing ratio will remain the same. As a nominal single data word is 56.4 milli-seconds long and the worst case timing cycle is ±10% or 50.8 - 62 milli-seconds (much less than the FCC's maximum timing window of 100 milli-seconds), the nominal timing diagram is also representative of the "worst case" on/off ratio.

DUTY CYCLE ANALYSIS (Single Data Word):

Description	Total Time	"On" Time
Preamble	4.8 mSec	2.4 E-3 Sec
Header	2.0 mSec	0 Sec
Hopping Sequence	19.2 mSec	8.1 E-3 Sec
Fixed Sequence	20.4 mSec	4.8 E-3 Sec
Inter Word Pause	10 mSec	0 Sec.
Total Transmission	56.4 mSec	15.3 E-3 Sec

In compliance with FCC Rules 15.35(c) the following duty cycle factor is used for all field strength calculations. A 56.4 mSec time window is selected with the on time ratio.

$\frac{\text{15.3 E-3 on time}}{\text{56.4 E-3 total time}} = 0.271$ On time to FCC reference limit

20 log (0.271) = - 11.3 dB Duty Cycle Ratio

TABLE8-3: ACCHARACTERISTICS

		StandardOperatingConditions(unlessotherwisespecified): Commercial(C): 0°C≤TA ≤+70°C Industrial(I): -40°C≤ TA≤ +85°C				
Symbol	**Parameters**	**Min**	**Typ**	**Max**	**Units**	**Conditions**
TBP	Timetosecondbuttonpress	10+Code WordTime	—	26+Code WordTime	ms	(Note1)
TTD	Transmitdelayfrombuttondetect	12	—	26	ms	
TDB	Debouncedelay	6	—	20	ms	
TTO	Auto-shutofftime-outperiod	—	27	—	s	(Note2)
TS	Startpulsedelay	—	4.5	—	ms	
fSTEP	Stepperoutputfrequency	125	200	250	kHz	
VSTEP	Stepperreferencevoltage	6.0	6.5	7	V	

Note1: T BPisthetimeinwhichasecondbuttoncanbepressedwithoutcompletionofthefirstcodewordandthe intentionwastopressthecombinationofbuttons.
2: Theautoshutofftimeoutperiodisnottested.
3: Theseparametersarecharacterizedbutnottested.

FIGURE8-1: POWERUPANDTRANSMITTIMING

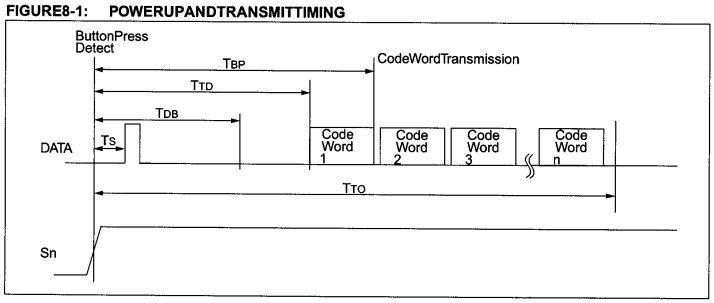


FIGURE8-2: PWMFORMAT

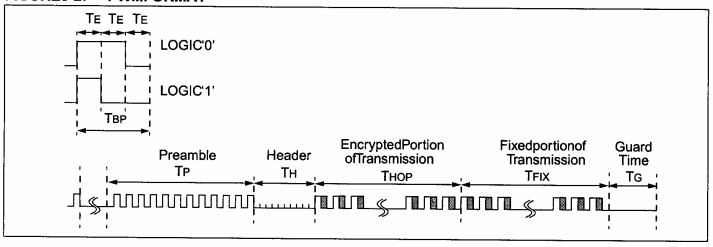


FIGURE8-3: PREAMBLE/HEADERFORMAT(XSER=0)

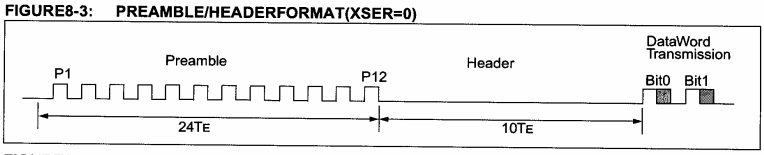


FIGURE8-4: DATAWORDFORMAT(XSER=0)

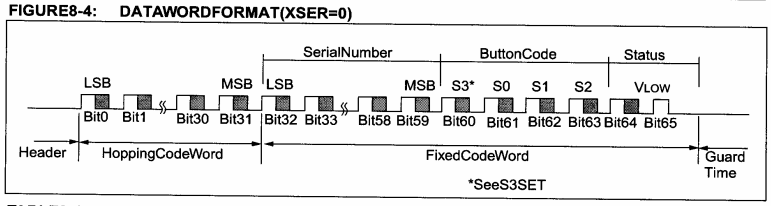


TABLE8-4: CODEWORDTRANSMISSIONTIMINGREQUIREMENTS

VDD=+3.5to6.0V Commercial (C): Tamb=0 °Cto+70°C Industrial (I): Tamb=-40°Cto+85 °C			CodeWordsTransmitted						
			All			1outof2			
Symbol	**Characteristic**	**Number ofTE**	**Min.**	**Typ.**	**Max.**	**Min.**	**Typ.**	**Max.**	**Units**
TE	Basicpulseelement	1	360	400	440	180	200	220	µs
TBP	PWMbitpulsewidth	3	1.08	1.2	1.32	0.54	0.6	0.66	ms
TP	Preambleduration	24	8.64	9.6	10.56	4.32	4.8	5.28	ms
TH	Headerduration	10	3.6	4.0	4.4	1.8	2.0	2.2	ms
THOP	Hoppingcodeduration	96	34.56	38.4	42.24	17.28	19.2	21.12	ms
TFIX	Fixedcodeduration	102	36.72	40.8	44.88	18.36	20.4	22.44	ms
TG	GuardTime	39	14.04	15.6	17.16	7.02	7.8	8.58	ms
—	TotalTransmitTime	271	97.56	108.4	119.2	48.78	54.2	59.62	ms
—	PWMdatarate	—	925	833	757	1851	1667	1515	bps

Note: Thetimingparametersarenottestedbutderivedfromtheoscillatorclock.

REPORT OF MEASUREMENTS

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

Description: 310.0 MHz Rolling Code Transmitter

DATE:

ITEM TESTED: DOOR TRANSMITTER
MANUFACTURER: Linear Corporation
TRADE NAME: Stanley Rolling Code
PRODUCT ID: EF4 SHA24711

DISTANCE AT WHICH MEASURED: 3 meters, DUT 0.8 meter above ground
REFERENCE: 15.231(a,b,c)
MEASUREMENT PROCEDURE: C63.4-2001

RADIATION: 15.201

A	B	C		D		E	G	H	I	J	K	L	M	N	O	P	Q
Tuned Frequency MHz	Emission Frequency MHz	Ambient Level dBm		FCC Limit dBm		Meter Reading dBm	Antenna Factor dB	Cable Loss dB	Amp Gain dB	Dist Fac dB	Duty Cycle dB	Field Strength dBm/mtr	dBuV/mtr	uV/M	FCC Limit uV/M	dB:FCC	FREQ. MHz
310.00	310.00	-98.60		-12.78		-14.90	18.4	1.2	27.2	0.00	11.3	-33.80	73.20	4570.88	5833.00	-2.12	310.00
	620.00	-90.00		-41.39		-43.70	25.8	1.7	26.5	0.00	11.3	-54.00	53.00	446.68	583.00	-2.31	620.00
	930.00	-85.80		-45.59		-52.80	29.3	2.2	26.3	0.00	11.3	-58.90	48.10	254.10	583.00	-7.21	930.00
	1240.00	-82.10		-49.29		-52.30	26.7	2.6	20.4	0.00	11.3	-54.70	52.30	412.10	583.00	-3.01	1240.00
	1550.00	-88.94	*	-42.45	*	-75.10	28.4	3.0	19.8	9.54	11.3	-84.34	22.66	13.58	583.00	-32.65	1550.00
	1860.00	-86.94	*	-44.45	*	#N/A	29.8	3.3	19.5	9.54	11.3	#N/A	#N/A	#N/A	583.00	#N/A	1860.00
	2170.00	-85.14	*	-45.75	*	#N/A	30.8	3.6	19.5	9.54	11.3	#N/A	#N/A	#N/A	583.00	#N/A	2170.00
	2480.00	-84.04	*	-66.35	*	#N/A	31.7	3.8	0.0	9.54	11.3	#N/A	#N/A	#N/A	583.00	#N/A	2480.00
	2790.00	-82.94	*	-67.45	*	#N/A	32.4	4.2	0.0	9.54	11.3	#N/A	#N/A	#N/A	583.00	#N/A	2790.00
	3100.00	-82.04	*	-68.35	*	#N/A	33.1	4.4	0.0	9.54	11.3	#N/A	#N/A	#N/A	583.00	#N/A	3100.00

The spectrum was searched from 25 to 3500 MHz per 15.33(a).
No other emissions were observed except those shown on this page.

* NOTE: 1 meter measurement corrected to 3 meters

15.207 Not Applicable- Battery Powered

TESTED BY DATE

ENGINEER DATE 7/16/02

FILE NAME: DNT17A_1.XLS DISK NAME: FCC DATA

LINEAR CORPORATION
FCC ID: EF4 SHA24711