

Nemko Test Report:

2014 1247315 FCC

Applicant:

Linear LLC 1950 Camino Vida Roble Carlsbad, CA 92008 USA

Equipment Under Test: TILT 345 (E.U.T.)

FCC Identifier: EF400118

Industry Canada Identifier: 1078A-00118

In Accordance With:

FCC Part 15, Subpart C and Industry Canada RSS-210 Issue 8 For Low Power Transmitters Operating Periodically In The Band 40.66 - 40.77 MHz and Above 70 MHz

Tested By:

Nemko USA, Inc. 2210 Faraday Ave. Suite 150 Carlsbad, CA 92008

TESTED BY:

David Light, Wireless Engineer

anda

APPROVED BY:

DATE:

DATE:

Alan Laudani Senior RF/EMC Engineer Test Report Verificator

22 January 2014

15 January 2014

Total Number of Pages:

19

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Section 1. Summary of Test Results

Manufacturer: Linear Corporation

Model No.: Tilt 345

General: All measurements are traceable to national standards.

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C, Paragraph 15.231 and Industry Canada RSS-210 Issue 8. All tests were conducted using measurement procedure ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC and Industry Canada.



New Submission

Production Unit

Pre-Production Unit

Class II Permissive Change

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE. See "Summary of Test Data".

NVLAP Lab Code 200116-0

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This report applies only to the items tested.

Summary Of Test Data

Name of Test	Paragraph No.	Results
Transmission Requirements	15.231(a) / A1.1.1	Complies
Radiated Emissions	15.231(b) / A1.1	Complies
Occupied Bandwidth	15.231(c) / A1.1.3	Complies
Frequency Tolerance	15.231(d) / A1.1.4	NA
Alternate Field Strength Requirements	15.231(e) / A1.1.5	NA
Powerline Conducted Emissions	15.207 / RSS-Gen 7.2.4	NA
Receiver Spurious Emissions	RSS-Gen 6.1	NA

Footnotes:

- 1) The device does not operate between 40.66 to 40.70 MHz
- 2) The device is battery powered.
- 3) The device is not a receiver.

Section 2. Equipment Under Test (E.U.T.)

General Equipment Information

Frequency Range:	345.0 MHz
Operating Frequency(ies) of Sample:	345.0 MHz
Type of Emission:	ASK
Supply Power Requirement:	3 Vdc battery (Lithium Ion battery)
Antenna Requirement:	Antenna fixed wire on PCB

Description of E.U.T.

The tilt sensor TILT 345 is a low power wireless entry detection device which operates on a single fixed frequency of 345 MHz. The device operates from a single 3V lithium battery.

Nemko USA, Inc.	FCC Part 15, Subpart C and
,	Industry Canada RSS-210 Issue 8
PERIODICALL	Y OPERATED LOW POWER TRANSMITTERS
FCC ID: EF400118 IC: 1078A-00118	REPORT NO.: 2014 1247315 FCC

Section 3. Transmission Requirements

NAME OF TEST: Transm	PARA. NO.: FCC 15.231(a)	
	RSS-210 A1.1.1	
TESTED BY: David Light	DATE: 16 December 2013	
Minimum Standard:	15.231(a) Continuous transmiss data transmissions are not pern	sions such as voice, video or nitted.
	15.231(a)(1) / A1.1.1(a) A manus shall employ a switch that will a transmitter within not more than released.	ually operated transmitter utomatically deactivate the 5 seconds after being
	15.231(a)(2) / A1.1.1(b) A trans shall cease transmission within	mitter activated automatically 5 seconds of activation.
	15.231(a)(3) / A1.1.1(c) Periodic pre-determined intervals are no or supervisory transmissions to of transmitters used in security allowed if the periodic rate of tra one transmission of not more the hour for each transmitter.	c transmissions at regular t permitted. However polling determine system integrity or safety applications are ansmission does not exceed an one second duration per
	15.231(a)(4) /A1.1.1(d) Intention employed for radio control purp involving fire, security, and safe signal an alarm, may operate du alarm.	nal radiators which are oses during emergencies ety of life, when activated to uring the pendency of the
Test Results:	Complies.	
Test Data:	Compliance was determined by specifications and a functional t	verification of technical test on the equipment.



Rationale for Compliance with Transmission Requirements



Section 4. Radiated Emissions

NAME OF TEST: R	adiated Emissions
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PARA. NO.: FCC 15.231(b) RSS-210 A1.1

TESTED BY: David Light

DATE: 16 December 2013

Minimum Standard:

Permissible Field Strength Limits (Momentarily Operated Devices

Fundamental Frequency (MHz)	Field Strength of Fundamental Microvolts/Meter at 3 meters; (watts)	Field Strength of Unwanted Emissions Microvolts/Meter at 3 meters; (watts)
40.66 - 40.70	2,250	225
70-130	1, 250	125
130-174	1,250 to 3,750*	125 to 375
174-260 (note 1)	3,750	375
260-470 (note 1)	3,750 to 12,500*	375 to 1,250
Above 470	12,500	1,250

Notes:

# Use quasi-peak or averaging meter.	For 130 - 174 MHz: FS (microvolts/m) = (56.82 x F) -
* Linear interpolation with frequency F in MHz	6136
	For 260 - 470 MHz: FS (microvolts/m) = (41.67 x F) - 7083

Any emissions that fall within the restricted bands of 15.205 shall not exceed the following limits:

Frequency (MHz)	Field Strength (μV/m @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

Test Results:

Complies. The worst-case emission level is 52.6 dB μ V/m @ 3m at 2760 MHz. This is 1.4 dB below the specification limit.

Test Data: See attached table.

Above 1 GHz a spectrum analyzer and low noise amplifier are used to measure emission levels. The spectrum analyzer resolution bandwidth was set to 1 MHz and video bandwidth was 3 MHz.

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PERIODICALLY OPERATED LOW POWER TRANSMITTERS
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Test Data - Radiated Emissions (Horizontal)

Meas.	Ant.	Duty	Meter	Antenna	Path	RF	Corrected	Spec.	CR/SL	Pass	
Freq.	Pol.	Cycle	Reading	Factor	Loss	Gain	Reading	limit	Diff.	Fail	
(MHz)	(H/V)	(dB)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	Unc.	Comment
345	Н	0	71.4	14.2	3.5	0.0	89.1	97.2	-8.1	Pass	
345	Н	-15.5	71.4	14.2	3.5	0.0	73.6	77.2	-3.6	Pass	
690	Н	0	45.9	20.8	5.2	35.0	36.9	77.2	-40.3	Pass	
690	Н	-15.5	45.9	20.8	5.2	35.0	21.4	57.2	-35.8	Pass	
1035	Н	0	46.5	24.2	4.6	28.8	46.5	74.0	-27.5	Pass	
1035	Н	-15.5	46.5	24.2	4.6	28.8	31.0	54.0	-23.0	Pass	
1380	Н	0	66	25.4	6.2	31.0	66.6	74.0	-7.4	Pass	
1380	Н	-15.5	66	25.4	6.2	31.0	51.1	54.0	-2.9	Pass	
1725	Н	0	44.8	25.5	7.6	31.5	46.4	77.2	-30.8	Pass	
1725	Н	-15.5	44.8	25.5	7.6	31.5	30.9	57.2	-26.3	Pass	
2070	Н	0	53.3	27.5	8.3	31.5	57.6	77.2	-19.6	Pass	
2070	Н	-15.5	53.3	27.5	8.3	31.5	42.1	57.2	-15.1	Pass	
2415	Н	0	47.7	28.2	8.9	31.8	53.0	77.2	-24.2	Pass	
2415	Н	-15.5	47.7	28.2	8.9	31.8	37.5	57.2	-19.7	Pass	
2760	Н	0	54.4	28.9	10.2	30.8	62.7	74.0	-11.3	Pass	
2760	Н	-15.5	54.4	28.9	10.2	30.8	47.2	54.0	-6.8	Pass	
3105	Н	0	60.3	30.3	10.4	31.8	69.2	77.2	-8.0	Pass	
3105	Н	-15.5	60.3	30.3	10.4	31.8	53.7	57.2	-3.5	Pass	
3450	Н	0	57.1	31.3	10.6	31.7	67.3	77.2	-9.9	Pass	
3450	Н	-15.5	57.1	31.3	10.6	31.7	51.8	57.2	-5.4	Pass	

Test Data - Radiated Emissions (Vertical)

Meas.	Ant.	Duty	Meter	Antenna	Path	RF	Corrected	Spec.	CR/SL	Pass	
Freq.	Pol.	Cycle	Reading	Factor	Loss	Gain	Reading	limit	Diff.	Fail	
(MHz)	(H/V)	(dB)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	Unc.	Comment
											CX-65
345	V	0	67.4	14.2	3.5	0.0	85.1	97.2	-12.1	Pass	Peak
345	V	-15.5	67.4	14.2	3.5	0.0	69.6	77.2	-7.6	Pass	Peak
690	V	0	38.6	20.8	5.2	35.0	29.6	77.2	-47.6	Pass	Peak
690	V	-15.5	38.6	20.8	5.2	35.0	14.1	57.2	-43.1	Pass	Peak
1035	V	0	42.7	24.2	4.6	28.8	42.7	74.0	-31.3	Pass	Peak
1035	V	-15.5	42.7	24.2	4.6	28.8	27.2	54.0	-26.8	Pass	Peak
1380	V	0	59.3	25.4	6.2	31.0	59.9	74.0	-14.1	Pass	Peak
1380	V	-15.5	59.3	25.4	6.2	31.0	44.4	54.0	-9.6	Pass	Peak
1725	V	0	53	25.5	7.6	31.5	54.6	77.2	-22.6	Pass	Peak
1725	V	-15.5	53	25.5	7.6	31.5	39.1	57.2	-18.1	Pass	Peak
2070	V	0	60.2	27.5	8.3	31.5	64.5	77.2	-12.7	Pass	Peak
2070	V	-15.5	60.2	27.5	8.3	31.5	49.0	57.2	-8.2	Pass	Peak
2415	V	0	51.8	28.2	8.9	31.8	57.1	77.2	-20.1	Pass	Peak
2415	V	-15.5	51.8	28.2	8.9	31.8	41.6	57.2	-15.6	Pass	Peak
2760	V	0	59.8	28.9	10.2	30.8	68.1	74.0	-5.9	Pass	Peak
2760	V	-15.5	59.8	28.9	10.2	30.8	52.6	54.0	-1.4	Pass	Peak
3105	V	0	57.5	30.3	10.4	31.8	66.4	77.2	-10.8	Pass	Peak
3105	V	-15.5	57.5	30.3	10.4	31.8	50.9	57.2	-6.3	Pass	Peak
3450	V	0	60.1	31.3	10.6	31.7	70.3	77.2	-6.9	Pass	Peak
3450	V	-15.5	60.1	31.3	10.6	31.7	54.8	57.2	-2.4	Pass	Peak

This device was tested with a fresh battery.

This device was tested on three orthogonal axes.

This device was tested from 30 MHz to the tenth harmonic of the carrier.

Asset Tag	Description	Manufacturer	Model	Serial #	Last Cal	Next Cal
752	Antenna,	EMCO	3115	4943	03-Jan-2013	03-Jan-2014
	DRWG					
827	Preamplifier	Com-Power	PA-103	161032	14-Jul-2013	14-Jul-2014
E1030	10 Meter Low	A.H. Systems,	SAC-18G-10	1096	23-Dec-2012	23-Dec-2013
	Loss Cable	Inc.				
1763	Antenna,	Schaffner	CBL 6111D	22926	07-Mar-2013	07-Mar-2014
	Bilog					
1016	Preamplifier	Hewlett	8449A	2749A00159	20-Aug-2013	20-Aug-2014
		Packard				
1036	Spectrum	Rohde &	FSEK30	830844/006	15-Jul-2013	15-Jul-2015
	Analyzer	Schwartz				

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Test Data - Radiated Emissions (Duty Cycle Correction)

Duty Cycle Correction = 20 log (16.66/100) = -15.5 dB

Section 5. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth		PARA. NO.: FCC 15.231(c)	
		RSS-210 1.1.3	
TESTED BY: David Light		DATE: 16 December 2013	
Minimum Standard:	15.231(c) The bandwidth of the than 0.25% of the center free above 70 MHz and below 900 above 900 MHz, the emission set the center frequency. Bandwid 20 dB down from the modulated	the emission shall be no wider quency for devices operating MHz. For devices operating shall be no wider than 0.5% of th is determined at the points d carrier.	
Test Results:	Complies.		
Test Data:	See attached graph.		

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Test Data – Occupied Bandwidth (99%)

0.655/345 = 0.19%



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Test Data - Occupied Bandwidth (20 dB)



Limit = 862.5 kHz

Section 6. Block Diagrams

Conducted Emissions



Occupied Bandwidth, Duty Cycle





Test Site For Radiated Emissions



Radiated Emissions 30 MHz - 18 GHz

The spectrum was searched up to the 10th harmonic of the fundamental frequency of operation.

ANNEX A - RESTRICTED BANDS

Annex A Restricted Bands of Operation

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.15
0.49 - 0.51	16.69475-16.69525	608-614	5.35-5.46
2.1735 - 2.1905	16.80425-16.80475	960-1240	7.25-7.75
3.020 - 3.026	25.5-25.67	1300-1427	8.025-8.5
4.125 - 4.128	37.5-38.25	1435-1626.6	9.0-9.2
4.17725 - 4.17775	73-74.6	1645.5-1646.5	9.3-9.5
4.20725 - 4.20775	74.8-75.2	1660-1710	10.6-12.7
6.215 - 6.218	108-121.94	1718.8-1722.2	13.25-13.4
6.31175 - 6.31225	123-138	2220-2300	14.47-14.5
8.291 - 8.294	149.9-150.05	2310-2390	15.35-16.2
8.362 - 8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625 - 8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425 - 8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29 - 12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975 - 12.52025	240-285	3345.8-3358	36.43-36.5
12.57675 - 12.57725	322-335.4	3600-4400	Above 38.6
13.36 - 13.41			