



Nemko Test Report: 2014 1247315 FCC

Applicant: Linear LLC
1950 Camino Vida Roble
Carlsbad, CA 92008
USA

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

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:

A handwritten signature in black ink, appearing to read 'David Light'.

David Light, Wireless Engineer

DATE: 15 January 2014

APPROVED BY:

A handwritten signature in blue ink, appearing to read 'Alan Laudani'.

Alan Laudani
Senior RF/EMC Engineer
Test Report Verificator

DATE:

22 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



Class II Permissive Change



Pre-Production Unit

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.

Section 3. Transmission Requirements

NAME OF TEST: Transmission Requirements	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 transmissions such as voice, video or data transmissions are not permitted.

15.231(a)(1) / A1.1.1(a) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds after being released.

15.231(a)(2) / A1.1.1(b) A transmitter activated automatically shall cease transmission within 5 seconds of activation.

15.231(a)(3) / A1.1.1(c) Periodic transmissions at regular pre-determined intervals are not permitted. However polling or supervisory transmissions to determine system integrity of transmitters used in security or safety applications are allowed if the periodic rate of transmission does not exceed one transmission of not more than one second duration per hour for each transmitter.

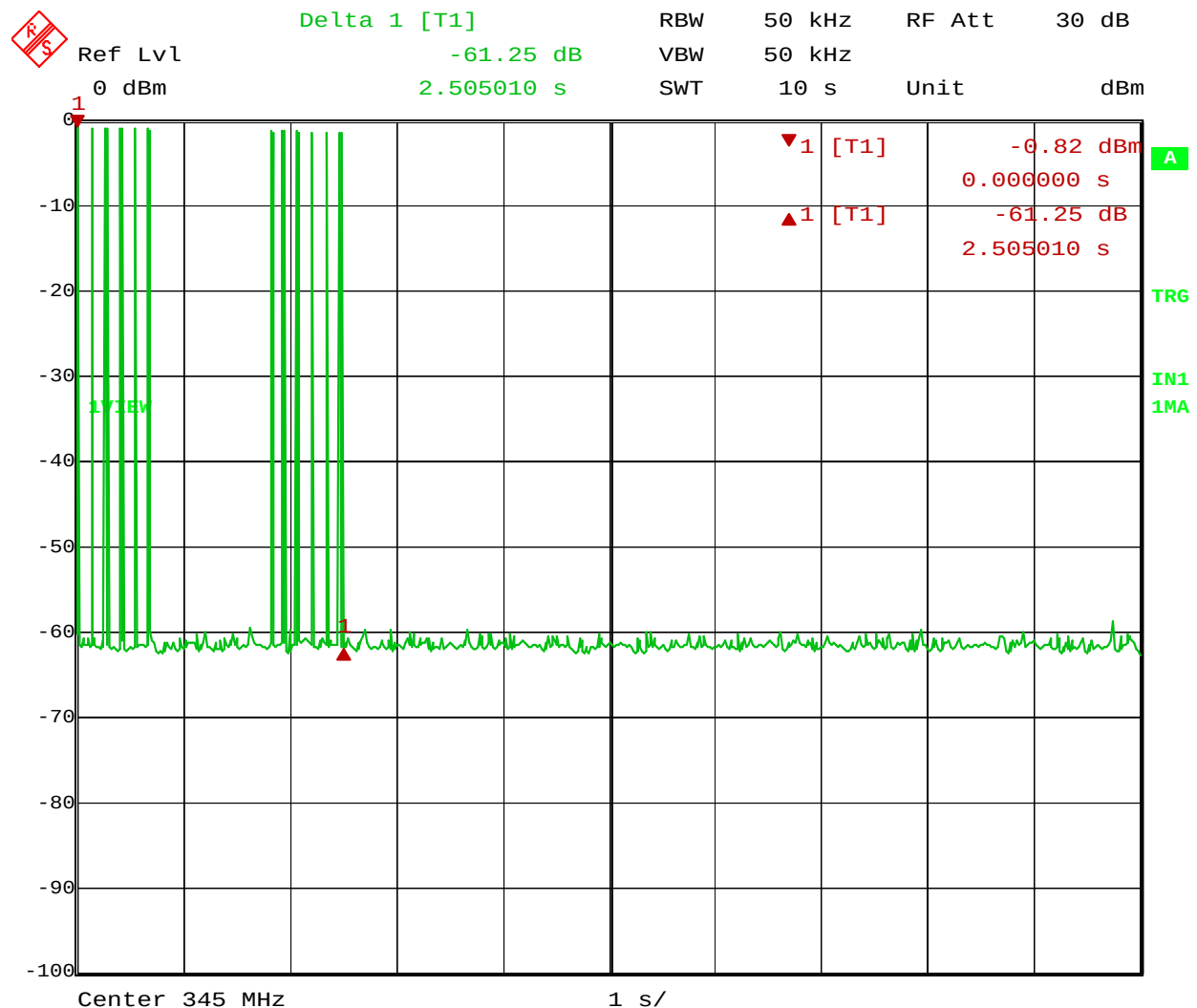
15.231(a)(4) / A1.1.1(d) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm.

Test Results: [Complies.](#)

Test Data: [Compliance was determined by verification of technical specifications and a functional test on the equipment.](#)

Rationale for Compliance with Transmission Requirements

15.231(a)(1)	☐ Manual activation	TX deactivation time: 2.5 seconds
15.231(a)(2) :	☒ Automatic activation	
15.231(a)(3) :	☐ Regular, predetermined transmissions ☐ Polling or supervisory transmissions	TX rate and duration:
15.231(a)(4) :	☐ Alarm device operating during the pendency of alarm condition	
	☒ Non-alarm device	



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Section 4. Radiated Emissions

NAME OF TEST: Radiated Emissions	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: $FS \text{ (microvolts/m)} = (56.82 \times F) - 6136$
* Linear interpolation with frequency F in MHz	For 260 - 470 MHz: $FS \text{ (microvolts/m)} = (41.67 \times F) - 7083$

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

Frequency (MHz)	Field Strength ($\mu\text{V/m}$ @ 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 $\mu\text{V/m}$ @ 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.

Test Data - Radiated Emissions (Horizontal)

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

Test Data - Radiated Emissions (Vertical)

Meas. Freq. (MHz)	Ant. Pol. (H/V)	Duty Cycle (dB)	Meter Reading (dBuV)	Antenna Factor (dB)	Path Loss (dB)	RF Gain (dB)	Corrected Reading (dBuV/m)	Spec. limit (dBuV/m)	CR/SL Diff. (dB)	Pass Fail 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

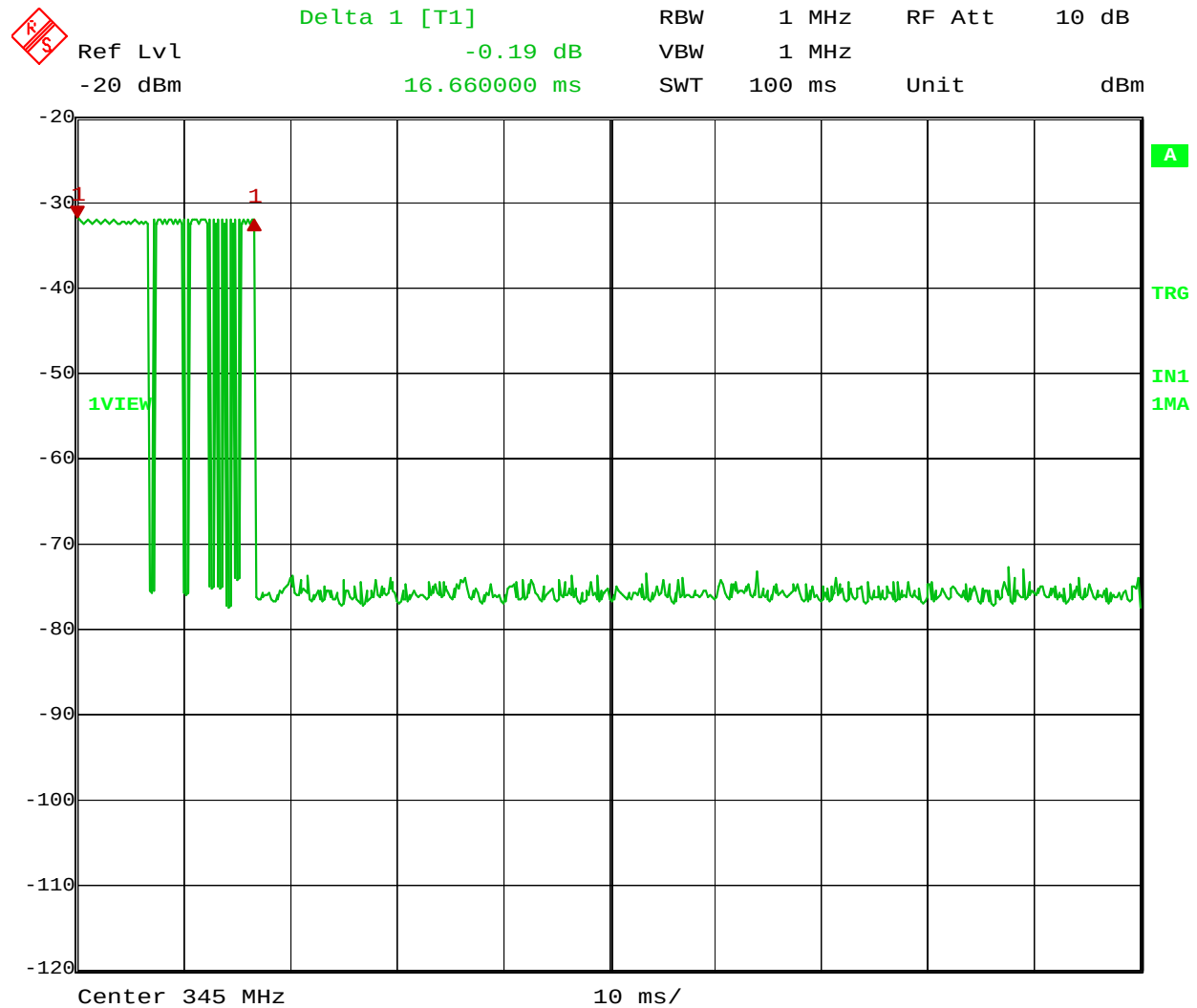
This device was tested with a fresh battery.

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

Test Data - Radiated Emissions (Duty Cycle Correction)



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$$\text{Duty Cycle Correction} = 20 \log (16.66/100) = -15.5 \text{ dB}$$

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

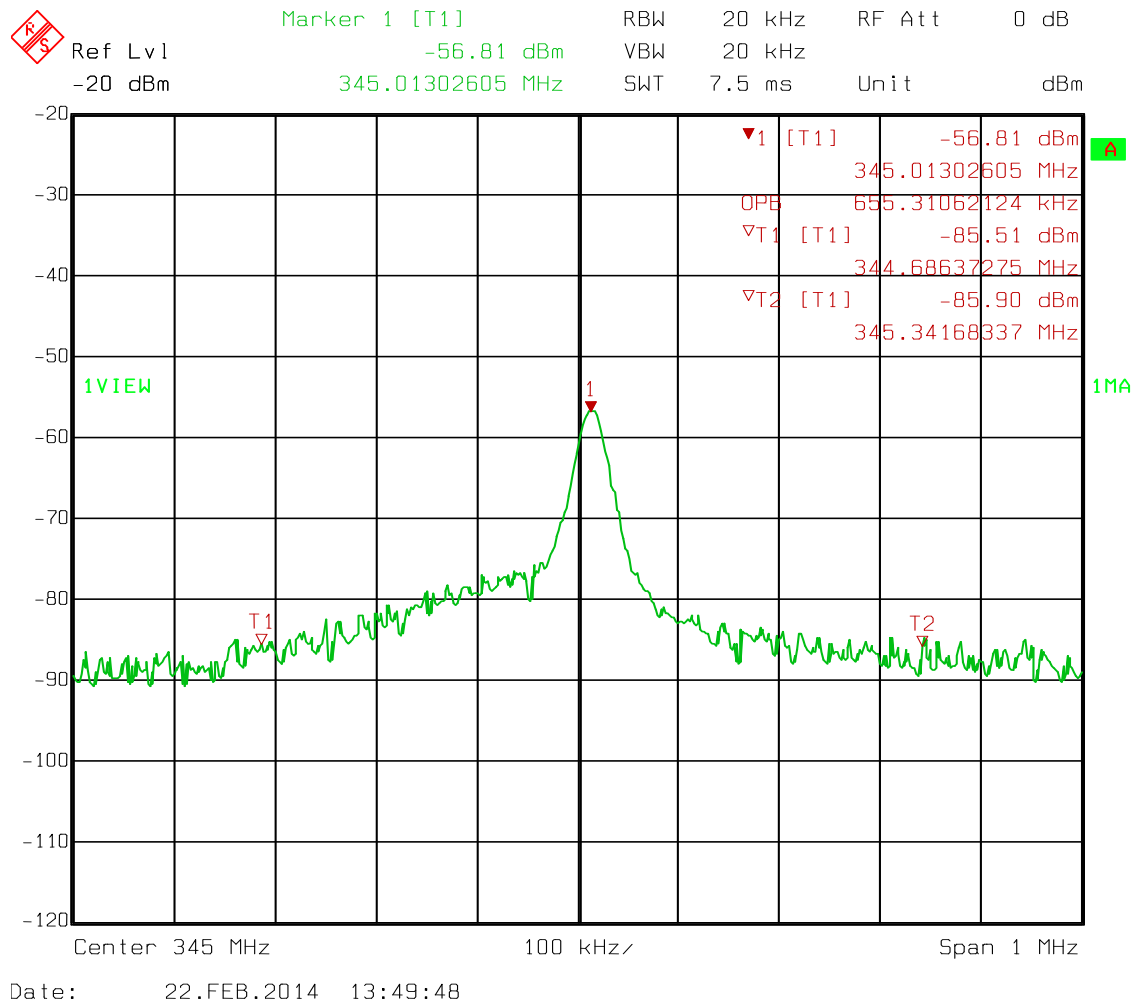
Minimum Standard: 15.231(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

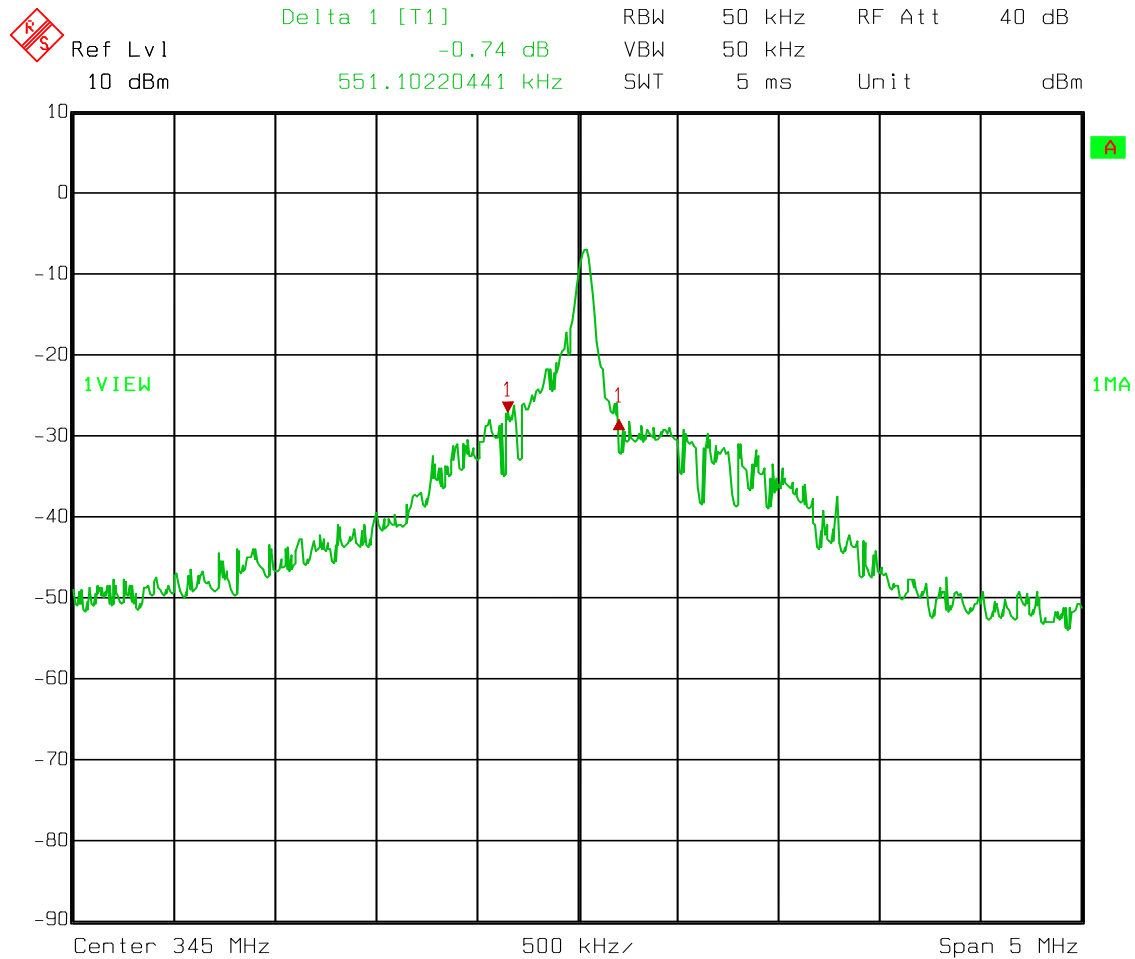
Test Results: Complies.

Test Data: See attached graph.

Test Data – Occupied Bandwidth (99%)

0.655/345 = 0.19%



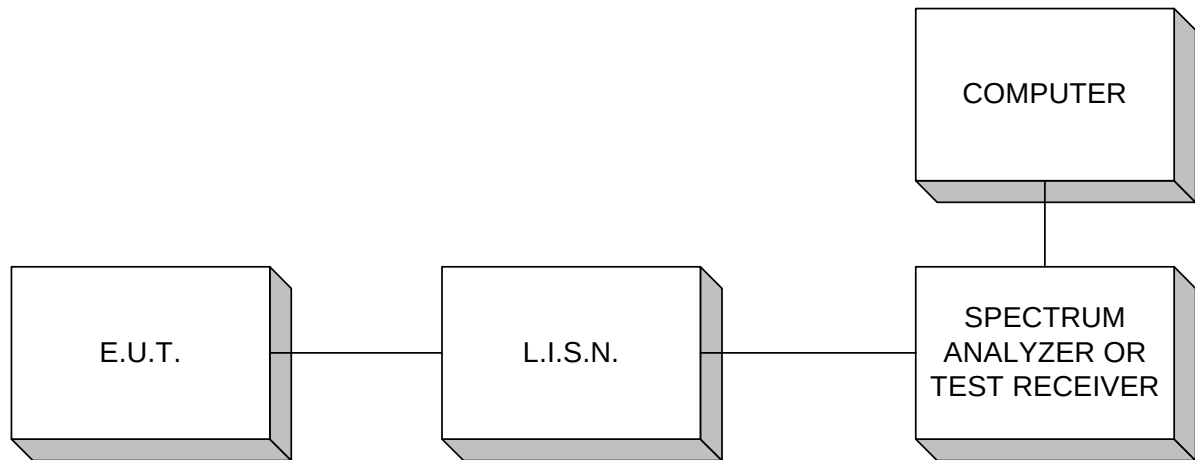
Test Data – Occupied Bandwidth (20 dB)

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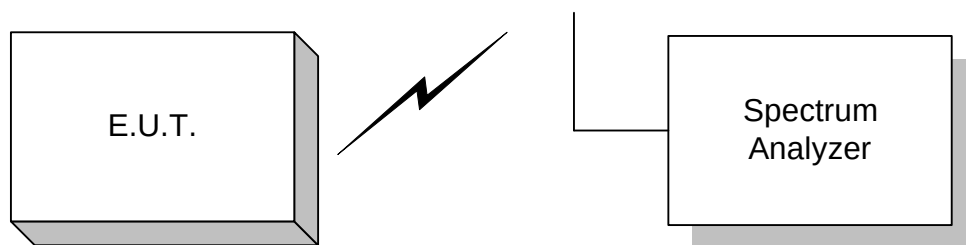
Limit = 862.5 kHz

Section 6. Block Diagrams

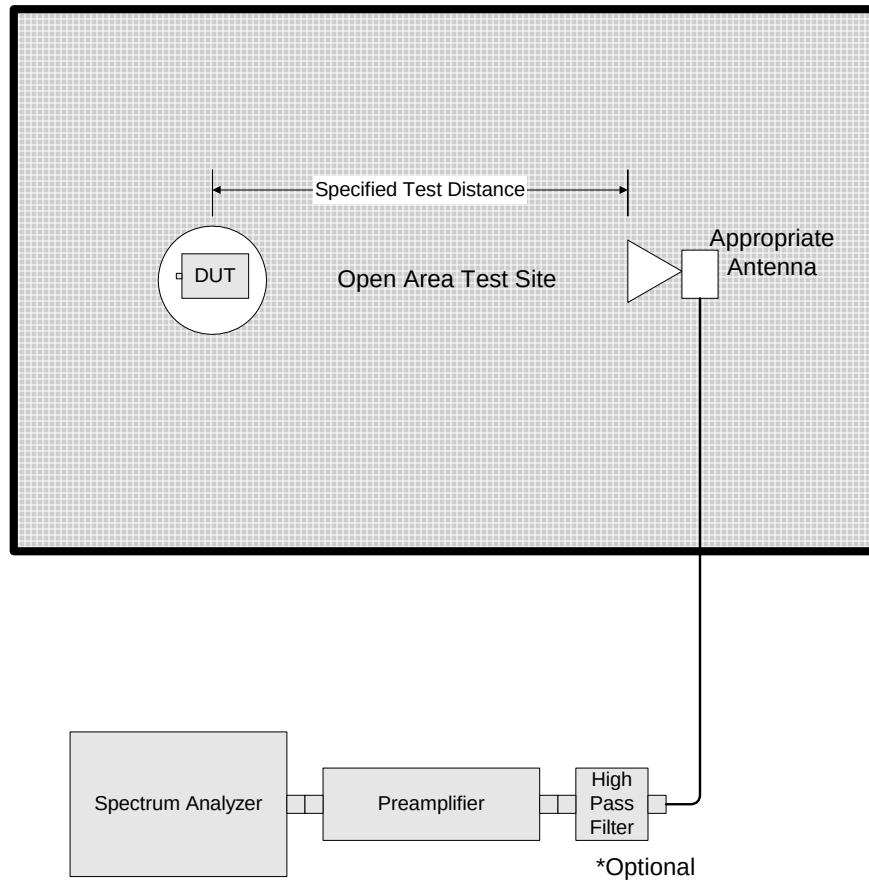
Conducted Emissions



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			