

Certification Test Report: 2013 11245966 FCC

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

Equipment Under Test: Body Worn Emergency Alarm Transmitter
(E.U.T.)

Model: CX-LRC
FCC ID: EF4CRX
IC: 1078A-CRX

In Accordance With: FCC Part 15, Subpart C 15.247 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

DATE: 19 November 2013

APPROVED BY: 
Senior RF/EMC Engineer

DATE: 21 November 2013

Total Number of Pages: 19

Nemko USA, Inc.

FCC ID: EF4CRX
IC: 1078A-CRX

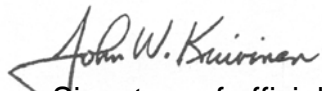
2210 Faraday Avenue, Suite 150, Carlsbad, CA 92008
Phone (760) 444-3500 Fax (760) 444-3005
FCC Part 15, Subpart C
Industry Canada RSS-210 Issue 8
REPORT NO.:2013 11245966 FCC

Applicant Affirmation

John Kuivinen representing Linear Corporation hereby affirms:

- a) That he/she has reviewed and concurs that the test shown in this report are reflective of the operational characteristics of the device for which certification is sought;
- b) That the device in this test report will be representative of production units;
- c) That all changes (in hardware and software/firmware) to the subject device will be reviewed.
- d) That any changes impacting the attributes, functionality or operational characteristics documented in this report will be communicated to the body responsible for approving (certifying) the subject equipment.

John Kuivinen
Printed name of official


Signature of official

1950 Camino Vida Roble
Address

March 8, 2013
Date

760-438-7138
Telephone number

johnk@linearcorp.com
Email address of official

NOTE—This affirmation must be signed by the responsible party before it is submitted to a regulatory body for approval.

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Section 1. Summary of Test Results

Manufacturer: Linear Corporation

Model No.: CX-LRC

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.

- | | | | |
|-------------------------------------|----------------------------|-------------------------------------|---------------------|
| <input checked="" type="checkbox"/> | New Submission | <input checked="" type="checkbox"/> | Production Unit |
| <input type="checkbox"/> | Class II Permissive Change | <input type="checkbox"/> | 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".



This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government. Nemko USA, Inc. is a NVLAP accredited laboratory.

Organization	Registration and Recognition numbers
Federal Communications Commission	0013750831 / US5058
Industry Canada	2040B-3

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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 Conducted Emissions	15.107 (a) / RSS-Gen 7.2.4	NA
Receiver Radiated Emissions	15.109 (a) / 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 does not receive.

Observations

No modifications were performed during assessment.

No technical judgements were made during the assessment.

The user of the apparatus could not alter parameters that would affect compliance.

No Tests were deleted from this assessment.

There were no additional observations made during this assessment.

No deviations from Laboratory Test Procedures

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

General Equipment Information

Frequency Range:	433.92 MHz
Operating Frequency(ies) of Sample:	433.92 MHz
Type of Emission:	OOK
Supply Power Requirement:	3.0 Vdc batteries (Lithium ion)
Emissions Designator:	45KA1D
Antenna Data:	integral circuit board trace
Antenna Connector:	NONE

Description of E.U.T.

The CX-LRC is a body worn alarm transmitter.

Section 3. Transmission Requirements

NAME OF TEST: Transmission Requirements	PARA. NO.: FCC 15.231(a) RSS-210 A1.1.1
Temperature	22 °C
Relative Humidity	35 %
Test Location	Semi Anechoic Chamber
TESTED BY: David Light	DATE: 18 November 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.

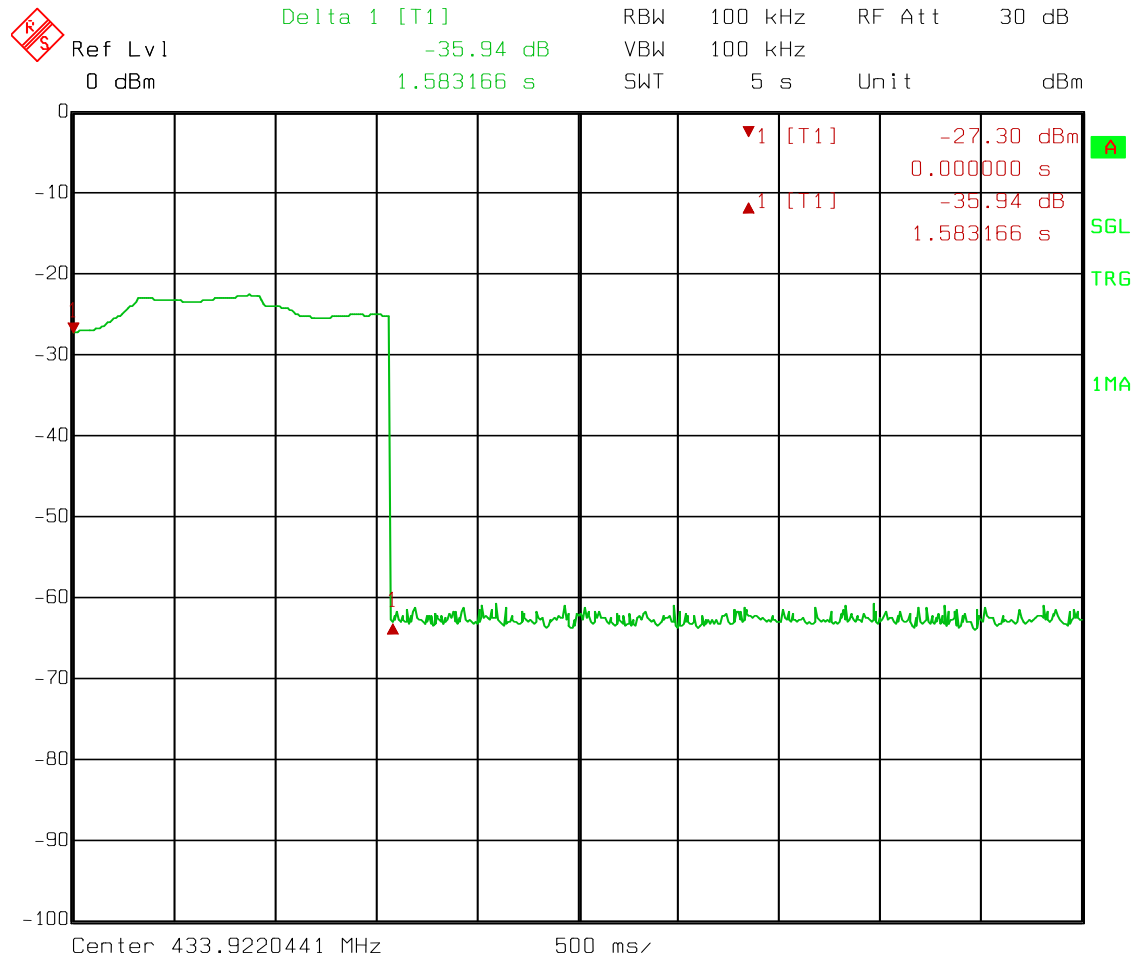
15.231(a)(4) /A1.1.1(d) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm.

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)	<input type="checkbox"/> Manual activation	TX deactivation time: 1.58 s
15.231(a)(2) :	<input checked="" type="checkbox"/> Automatic activation	
15.231(a)(3) :	<input type="checkbox"/> Regular, predetermined transmissions <input type="checkbox"/> Polling or supervisory transmissions	TX rate and duration:
15.231(a)(4) :	<input checked="" type="checkbox"/> Alarm device operating during the pendency of alarm condition <input type="checkbox"/> Non-alarm device	



Date: 22.NOV.2013 15:29:01

Section 4. Radiated Emissions

NAME OF TEST: Radiated Emissions	PARA. NO.: FCC 15.231(b) RSS-210 A1.1
Temperature	22 °C
Relative Humidity	35 %
Test Location	Semi Anechoic Chamber
TESTED BY: David Light	DATE: 18 November 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 74.9 dB $\mu\text{V/m}$ @ 3m at 433.9 MHz. This is 5.9 dB below the specification limit.

Test Data: See attached table.

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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 8 MHz.

This device was tested with a fresh battery. Emissions were measured on a 80cm (height) table.

This device was tested on three orthogonal axes. Worst case axis shown.

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

The emissions were measured with a test mode to repeat the emission so measurements could be maximized for the rotation of the sample and height and polarity of the measurement antenna.

Measurements made at the 3 meter distance of the 10m Semi-anechoic chamber, all measurements max hold after peaking for EUT rotation and antenna height from 1 to 4 meters.

Fundamental power was measured at 1 MHz RBW, 3 MHz VBW to ensure capture of entire emissions envelope. Average reading of Fundamental power therefore was peak + duty cycle factor.

No other emissions found within 20 dB of the limits.

Test Data - Radiated Emissions (Peak)

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-LRC
433.9	V	0	58.5	17	4.0	0.0	79.5	100.8	-21.3	Pass	Peak
433.9	H	0	53.8	17	4.0	0.0	74.8	100.8	-26.0	Pass	Peak
867.8	V	0	31.9	23.2	6.0	31.8	29.3	80.8	-51.5	Pass	Peak
867.8	H	0	30.4	23.2	6.0	31.8	27.8	80.8	-53.0	Pass	Peak
1301.7	V	0	44.5	25.7	6.2	40.8	35.6	74.0	-38.4	Pass	Peak
1301.7	H	0	44	25.7	6.2	40.8	35.1	74.0	-38.9	Pass	Peak
1735.6	V	0	44	26.2	7.6	40.8	37.0	80.8	-43.8	Pass	Peak
1735.6	H	0	51	26.2	7.6	40.8	44.0	80.8	-36.8	Pass	Peak
2169.5	V	0	64.5	27.4	8.3	41.3	58.9	80.8	-21.9	Pass	Peak
2169.5	H	0	63.4	27.4	8.3	41.3	57.8	80.8	-23.0	Pass	Peak
2603.4	V	0	54.5	29	9.4	41.4	51.5	80.8	-29.3	Pass	Peak
2603.4	H	0	44.5	29	9.4	41.4	41.5	80.8	-39.3	Pass	Peak
3037.3	V	0	48.7	30.2	10.3	41.8	47.4	80.8	-33.4	Pass	Peak
3037.3	H	0	40	30.2	10.3	41.8	38.7	80.8	-42.1	Pass	Peak
3471.2	V	0	50	31.2	10.6	42.1	49.7	80.8	-31.1	Pass	Peak
3471.2	H	0	40	31.2	10.6	42.1	39.7	80.8	-41.1	Pass	Peak
3905.1	V	0	46.8	32.5	10.6	42.1	47.8	74.0	-26.2	Pass	Peak
3905.1	H	0	41.9	32.5	10.6	42.1	42.9	74.0	-31.1	Pass	Peak
4339	V	0	40	32.1	11.0	42.5	40.6	74.0	-33.4	Pass	Peak
4339	H	0	39	32.1	11.0	42.5	39.6	74.0	-34.4	Pass	Peak

Example:

Corrected Reading = Meter Reading + Antenna Factor + Path Loss – RF Gain + Duty Cycle Correction Factor

$$79.5 = 58.5 + 17 + 4.0 - 0.0 + 0$$

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Test Data - Radiated Emissions (Average)

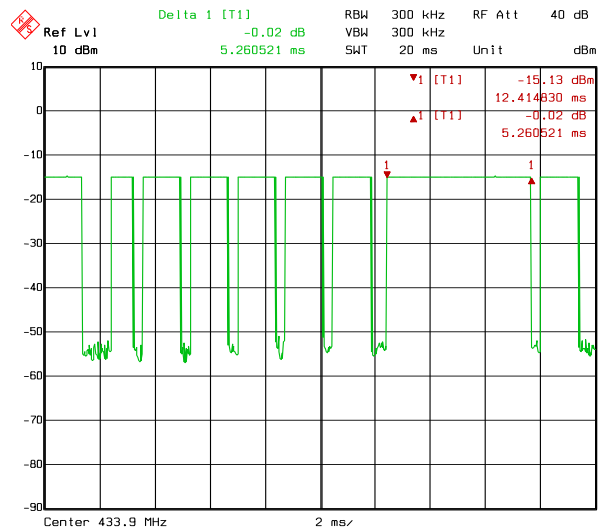
Meas. Freq. (MHz)	Ant. Pol. (H/V)	Duty Cycle (dB)	Meter Reading (dBUV)	Antenna Factor (dB)	Path Loss (dB)	RF Gain (dB)	Corrected Reading (dBUV/m)	Spec. limit (dBUV/m)	CR/SL Diff. (dB)	Pass Fail Unc.	Comment
											CX-LRC
433.9	V	-4.6	58.5	17	4.0	0.0	74.9	80.8	-5.9	Pass	Average
433.9	H	-4.6	53.8	17	4.0	0.0	70.2	80.8	-10.6	Pass	Average
867.8	V	-4.6	31.9	23.2	6.0	31.8	24.7	60.8	-36.1	Pass	Average
867.8	H	-4.6	30.4	23.2	6.0	31.8	23.2	60.8	-37.6	Pass	Average
1301.7	V	-4.6	44.5	25.7	6.2	40.8	31.0	54.0	-23.0	Pass	Average
1301.7	H	-4.6	44	25.7	6.2	40.8	30.5	54.0	-23.5	Pass	Average
1735.6	V	-4.6	44	26.2	7.6	40.8	32.4	60.8	-28.4	Pass	Average
1735.6	H	-4.6	51	26.2	7.6	40.8	39.4	60.8	-21.4	Pass	Average
2169.5	V	-4.6	64.5	27.4	8.3	41.3	54.3	60.8	-6.5	Pass	Average
2169.5	H	-4.6	63.4	27.4	8.3	41.3	53.2	60.8	-7.6	Pass	Average
2603.4	V	-4.6	54.5	29	9.4	41.4	46.9	60.8	-13.9	Pass	Average
2603.4	H	-4.6	44.5	29	9.4	41.4	36.9	60.8	-23.9	Pass	Average
3037.3	V	-4.6	48.7	30.2	10.3	41.8	42.8	60.8	-18.0	Pass	Average
3037.3	H	-4.6	40	30.2	10.3	41.8	34.1	60.8	-26.7	Pass	Average
3471.2	V	-4.6	50	31.2	10.6	42.1	45.1	60.8	-15.7	Pass	Average
3471.2	H	-4.6	40	31.2	10.6	42.1	35.1	60.8	-25.7	Pass	Average
3905.1	V	-4.6	46.8	32.5	10.6	42.1	43.2	54.0	-10.8	Pass	Average
3905.1	H	-4.6	41.9	32.5	10.6	42.1	38.3	54.0	-15.7	Pass	Average
4339	V	-4.6	40	32.1	11.0	42.5	36.0	54.0	-18.0	Pass	Average
4339	H	-4.6	39	32.1	11.0	42.5	35.0	54.0	-19.0	Pass	Average

Example:

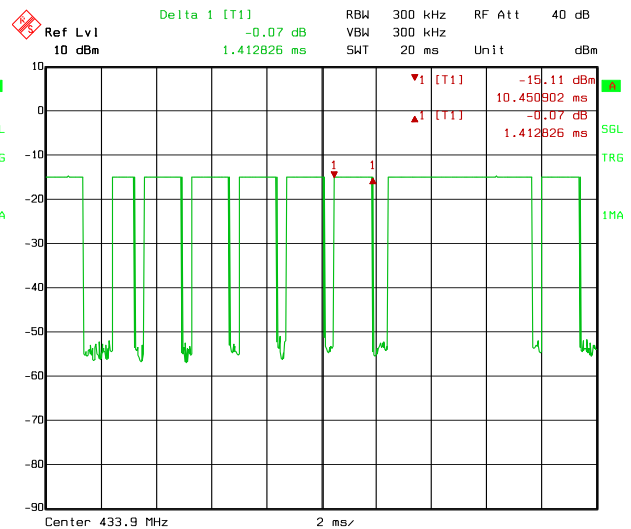
Corrected Reading = Meter Reading + Antenna Factor + Path Loss – RF Gain + Duty Cycle Correction Factor

$$74.6 = 58.5 + 17 + 4.0 - 0.0 - 4.6$$

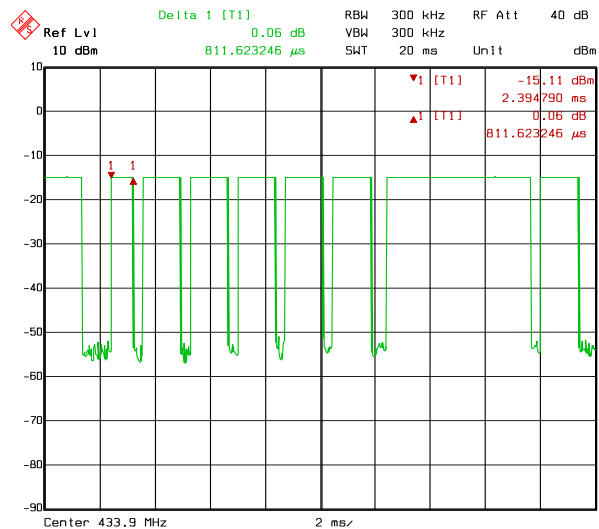
Test Data - Radiated Emissions (Duty Cycle Correction)



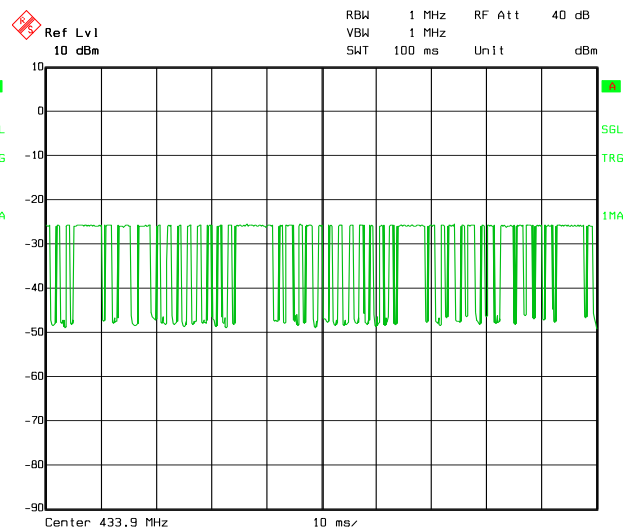
Date: 19.NOV.2013 07:43:53



Date: 19.NOV.2013 07:44:37



Date: 19.NOV.2013 07:45:37



Date: 19.NOV.2013 07:47:32

5 pulses at 5.26 ms
13 pulses at 1.41 ms
24 pulses at 0.812 ms
Total ON time in 100 ms = 58.9 ms

Duty cycle correction = $20 \log (58.9/100 \text{ ms}) = -4.6 \text{ dB}$

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Section 5. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: FCC 15.231(c) RSS-210 1.1.3
Temperature	22 °C
Relative Humidity	35 %
Test Location	Semi Anechoic Chamber
TESTED BY: David Light	DATE: 19 November 2013

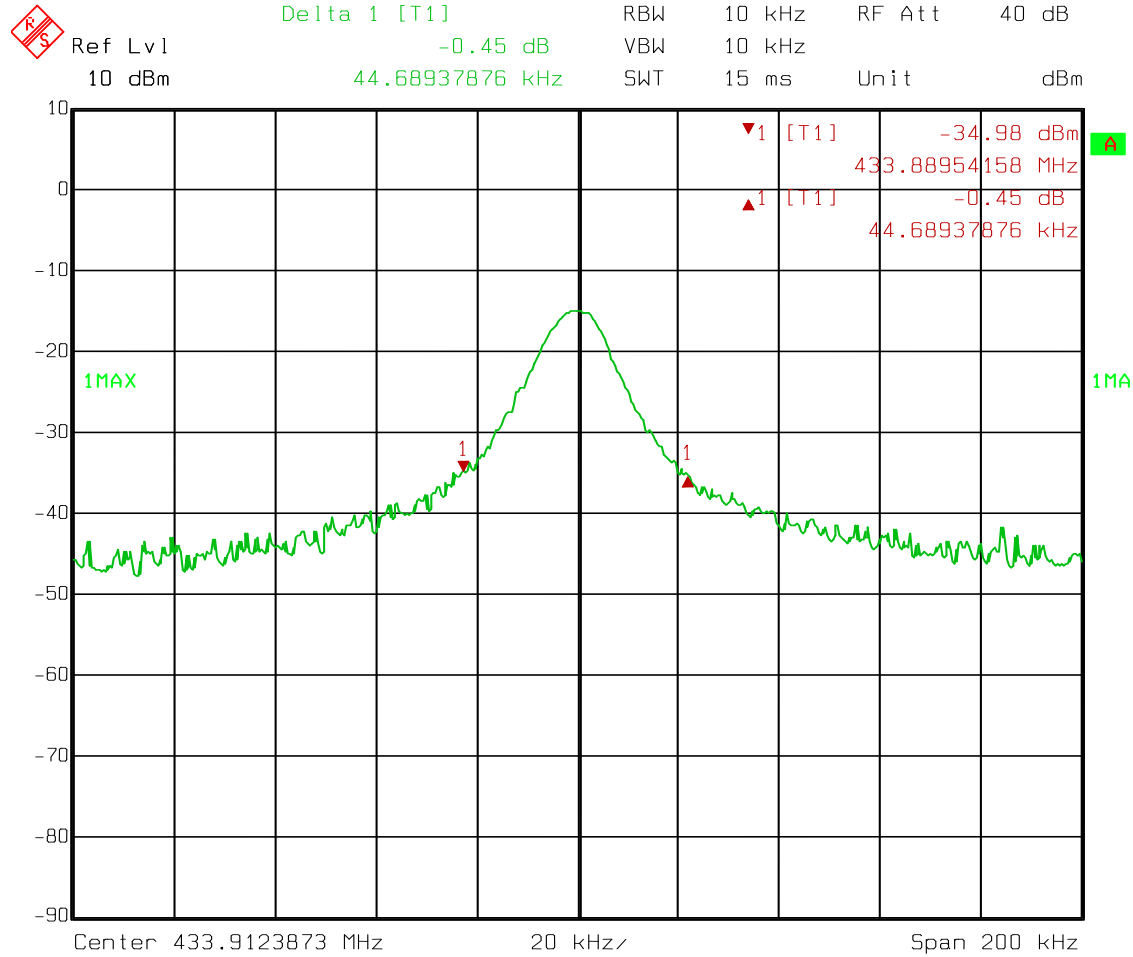
Minimum Standard: 15.231(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points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

A1.1. The 99% bandwidth shall be no wider than 0.25% of the centre frequency for devices operating between 70-900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the centre frequency.

Test Results: Complies.

Test Data: See attached graph.

Test Data – Occupied Bandwidth



Date: 19.NOV.2013 10:12:14

Limit = 1.08 MHz

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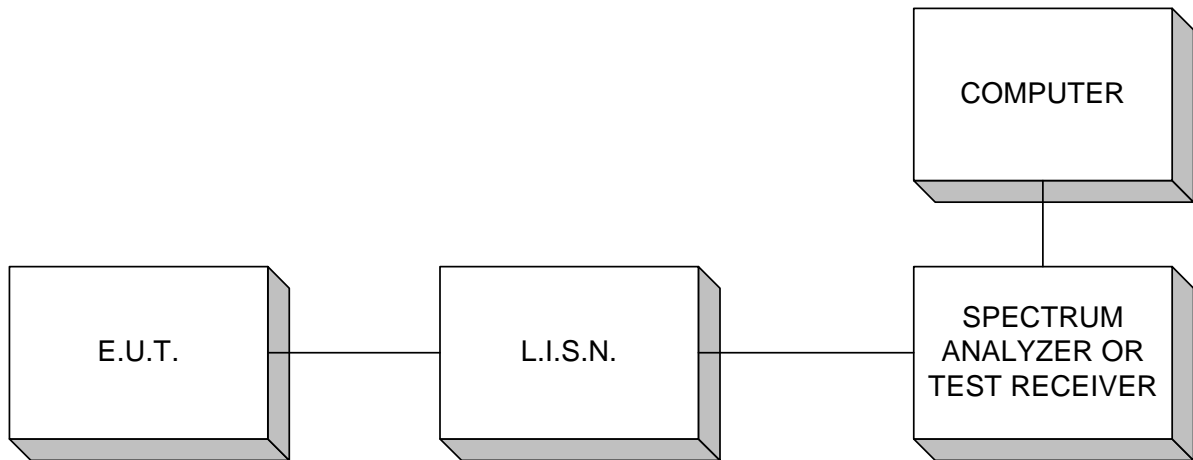
Section 6. Equipment List

Asset Tag	Description	Manufacturer	Model	Serial #	Last Cal	Next Cal
111	Antenna	EMCO	3146	1382	09-Jan-2013	09-Jan-2014
752	Antenna	EMCO	3115	4943	03-Jan-2013	03-Jan-2014
901	Preamplifier	Sonoma	310 N	130607	15-Oct-2012	15-Oct-2013*
911	Spectrum Analyzer	Agilent	E4440A	US41421266	15-Oct-2012	15-Oct-2013
E1029	Preamplifier (20MHz to 18GHz)	A.H. Systems, Inc.	PAM-0118	343	21-Jan-2013	21-Jan-2014

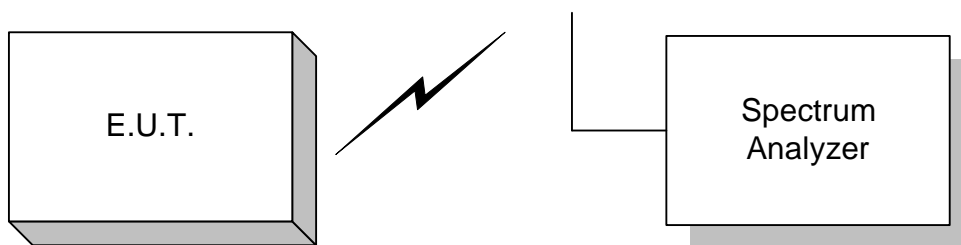
*Extended 60 day Calibration 15-Dec-2013, verified before test.

Section 7. Block Diagrams

Conducted Emissions



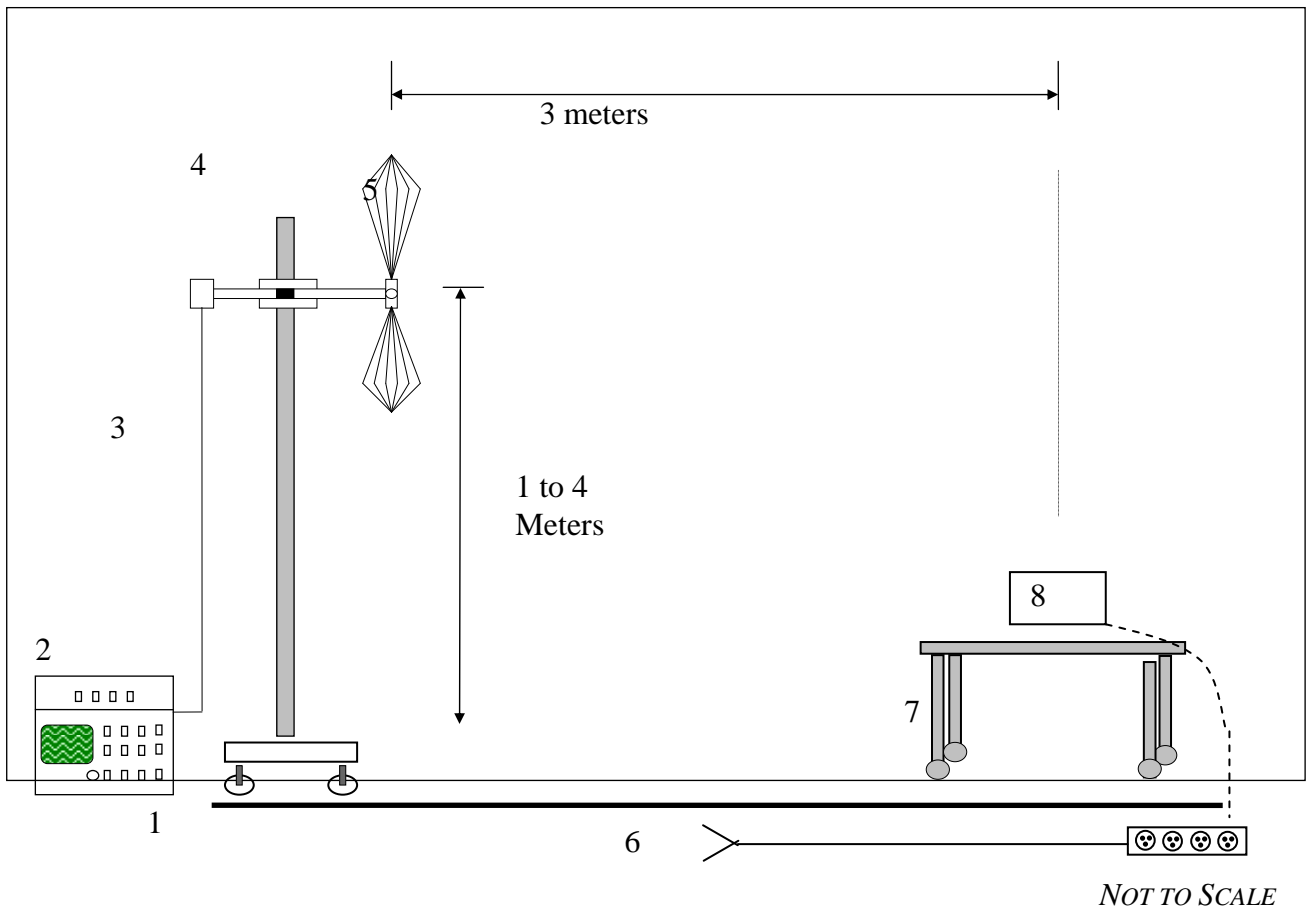
Occupied Bandwidth, Duty Cycle



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			