



Certification Test Report

In Accordance With: FCC Part 15 Subpart C, 15.231
RSS-210 Issue 8, December 2010

Applicant: Linear
1950 Camino Vida Roble
Carlsbad, CA 92003

Equipment Under Test (EUT): Security Door/Window Transmitter
Model: DWA01

FCC ID: EF4-DW319
IC ID: 1078A-DW319

Tested By: Nemko USA Inc.
2210 Faraday Avenue, Suite 150
Carlsbad, CA 92008

Test Report Number: 2013 07241877 FCC
Date: July 31, 2013
Project Number: 10248553
NEX Number: 241877

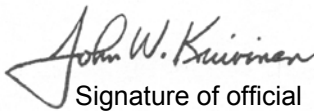
Total Number of Pages: 25

Applicant Affirmation

John Kuivinen representing Linear 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

July 31, 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.

Section 1. Summary of Test Results

1.1 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. Radiated tests were conducted in accordance with 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.

The assessment summary is as follows:

Apparatus Assessed: Security Door/Window Transmitter

Model: DWA01

Specification: FCC Part 15 Subpart C, 15.231
RSS-210 Issue 8, December 2010

Date Received in Laboratory: July 31, 2013

Compliance Status: Complies

Exclusions: None

Non-compliances: None

1.2 Report Release History

REVISION	DATE	COMMENTS
-	July 31, 2013	Prepared By: A. Laudani
-	July 31, 2013	Initial Release: Alan Laudani

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

Nemko USA Inc. authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko USA Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.



Alan Laudani, Test Report Verificator
Senior RF/EMC Engineer



TABLE OF CONTENTS

Applicant Affirmation	1
Section 1. Summary of Test Results	2
1.1 General	2
1.2 Report Release History	3
Section 2: Equipment Under Test	5
2.1 Theory of Operation	5
2.2 Technical Specifications of the EUT	5
Section 3: Test Conditions	6
3.1 Specifications	6
3.2 Test Environment	6
3.3 Test Equipment	7
Section 4: Observations	7
4.1 Modifications Performed During Assessment	7
4.2 Record Of Technical Judgements	7
4.3 EUT Parameters Affecting Compliance	7
4.4 Tests Deleted	7
4.5 Additional Observations	7
4.6 Deviations From Laboratory Test Procedures	7
Section 5: Results Summary	8
5.1 Test Results	8
Appendix A: Test Results	A9
Conducted Emissions	A9
Occupied Bandwidth	A10
Frequency Stability	A13
Types of Momentary Signals	A14
Field Strength and Radiated Spurious Emissions	A16
Conducted Emissions Test Data—Receive Mode	A19
Radiated Emissions Test Data—Receive Mode	A20
APPENDIX B	B1
B. Radiated Emissions Measurement Uncertainties	B1
APPENDIX C	C1
C. Nemko USA, Inc. Test Equipment & Facilities Calibration Program	C1





Section 2: Equipment Under Test

2.1 Theory of Operation

The DWA01 is a Security Door/Window Transmitter. The operating frequency is 319.5 MHz and it is a small, battery operated device that is designed to be placed in doors and windows. When the window or door is opened, a switch or magnetically activated switch sets off the transmitter to relay the alarm to the security control. This device does not have any adjustments which can be changed by the user and the DWA01 has no software.

The EUT's performance during test was evaluated against the performance criterion specified by applicable test standards. Performance results are detailed in the test results section of this report.

Highest frequency generated or used: 315 MHz

2.2 Technical Specifications of the EUT

Manufacturer:	Linear
Operating Frequency:	319.5 MHz
Measured Power:	5036 uV/m @ 3m
Modulation:	On-Off Keying OOK
Emissions Designator:	155KA1D
Antenna Data:	integral circuit board trace
Antenna Connector:	NONE
Power Source:	3V Battery (CR 2032)





Section 3: Test Conditions

3.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.231
Periodic operation in the band 40.66–40.70 MHz and above 70 MHz.

RSS-210 Issue 8 December 2010
Annex 1 - Momentarily Operated Devices and Remote Control

15.231 Periodic operation in the band 40.66–40.70 MHz and above 70 MHz.

(a) The provisions of this section are restricted to periodic operation within the band 40.66–40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

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

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

3.2 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	14 – 22 °C
Humidity range	:	32--76 %
Pressure range	:	102.0 kPa





3.3 Test Equipment

Nemko ID	Device	Manufacturer	Model	Serial Number	Cal Date	Cal Due Date
111	Antenna, LPA	EMCO	3146	1382	09-Jan-2013	09-Jan-2014
529	Antenna, DRWG	EMCO	3115	2505	31-Oct-2012	31-Oct-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
E1046	Biconical Antenna	A.H. Systems Inc.	SAS-540	736	22-Apr-2013	22-Apr-2014

Registrations of the 10m Semi-Anechoic Chamber are on file with the Federal Communications Commission and Industry Canada under Site Numbers 2040B-3.

Section 4: Observations

4.1 Modifications Performed During Assessment

No modifications were performed during assessment.

4.2 Record Of Technical Judgements

No technical judgements were made during the assessment.

4.3 EUT Parameters Affecting Compliance

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

4.4 Tests Deleted

No Tests were deleted from this assessment.

4.5 Additional Observations

There were no additional observations made during this assessment.

4.6 Deviations From Laboratory Test Procedures

No deviations from Laboratory Test Procedure





Section 5: Results Summary

This section contains the following:

FCC Part 15 Subpart C: Test Results.
RSS-210 Issue 8 December 2010
RSS-Gen Issue 3 December 2010

The column headed "Required" indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

- N No: not applicable / not relevant
- Y Yes: Mandatory i.e. the apparatus shall conform to these tests.
- N/T Not Tested, mandatory but not assessed. (See section 4.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

5.1 Test Results

Part 15	RSS	Test Description	Required	Result
15.231 (b)	A1.1.2	Field Strengths and Frequency Bands	Y	Pass
15.231 (e)	A1.1.5	Reduced Field Strengths	N	NA
15.215(c)	A1.1.3	Occupied Bandwidth/ 99% Bandwidth	Y	Pass
15.231(c)				
15.231 (a)	A1.1 Table A RSS-Gen 7.2.2	Types of Momentary Signals	Y	Pass
15.231 (d)	A1.1.4	Frequency Stability	N	NA**
15.231 (b)	A1.1.2	Spurious Emissions	Y	Pass
15.231 (e)	A1.1.5	Spurious Emissions (reduced field strengths)	N	NA
15.207 (a)	RSS-Gen 7.2.4	Power line Conducted Emissions	N	NA*
15.107 (a)	RSS-Gen 7.2.4	Receiver Spurious Conducted Emissions	N	NA*
15.109 (a)	RSS-Gen 6.1	Receiver Spurious Radiated Emissions	Y	Pass***

* Battery Powered

** Not transmitting in band requiring Frequency Stability

*** Does not have a Receiver, Stand-by compliant.



Appendix A: Test Results

Conducted Emissions

Client	Linear Corporation	Temperature	°C
Nex #	241877	Relative Humidity	%
EUT Name	Security Door/Window Transmitter	Barometric Pressure	kPa
EUT Model	ITIDWA01	Test Location	
Governing Doc	CFR 47, Part 15B	Test Engineer	
Basic Standard	Sec. 15.207 Transmit RSS-Gen 7.2.4	Date of test	
Test Parameters	Peak RBW: 100kHz VBW: 100kHz Quasi-Peak: RBW 9kHz, VBW 30 kHz Average: RBW 9kHz, VBW 30 kHz Quasi-Peak Limit Blue Line, Average Limit Green Line		
Not tested; not applicable as EUT is battery powered.			



Occupied Bandwidth

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.

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.

15.215(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in Sec. Sec. 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Test Conditions:

Client	Linear Corporation	Temperature	23	°C
Nex #	241877	Relative Humidity	60	%
EUT Name	Security Door/Window Transmitter			
EUT Model	DWA01	Test Location	10m SAC at 3m	
Governing Doc	CFR 47, Part 15C	Test Engineer	A. Laudani	
Basic Standard	Sec. 15.231 Transmit	Date of test	July 31, 2013	

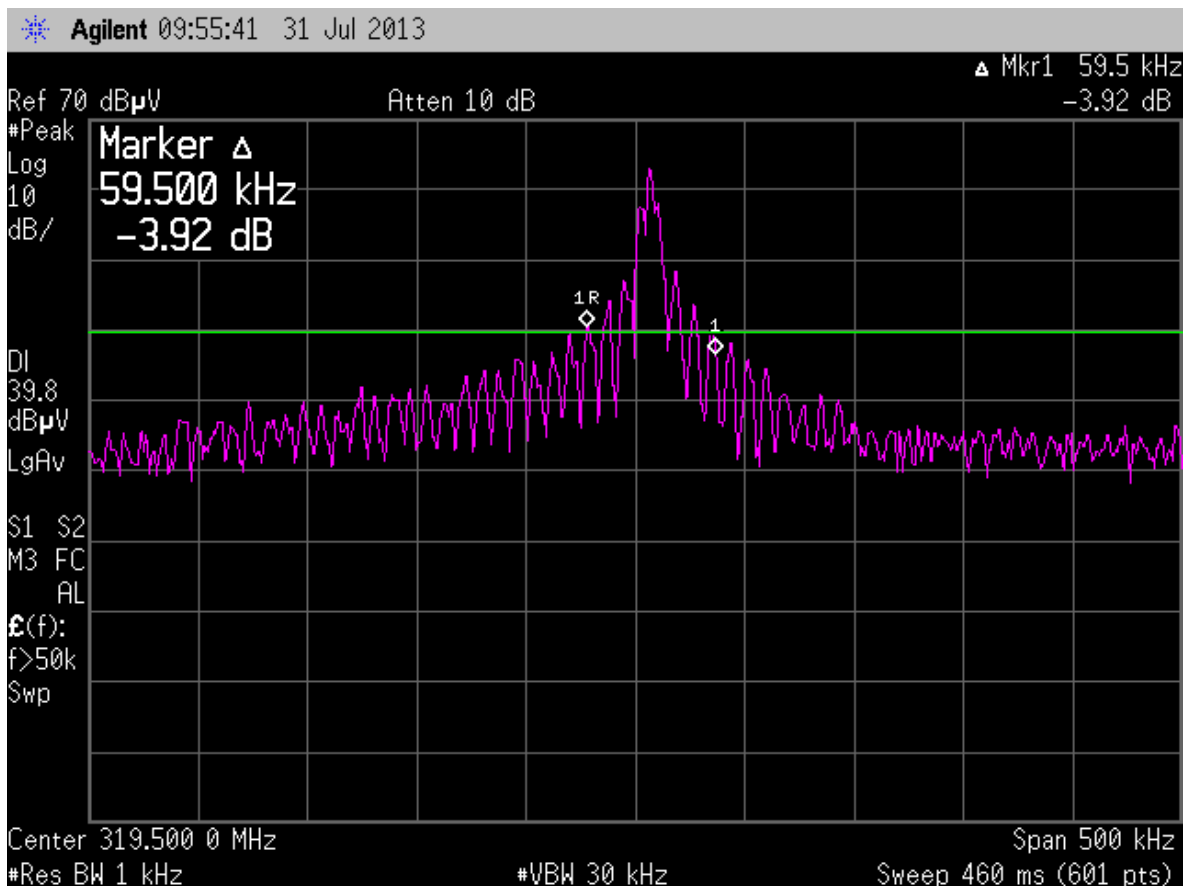
Test Results:

Measured Occupied Bandwidth: 60 kHz
Measured 99% Bandwidth = 155 kHz

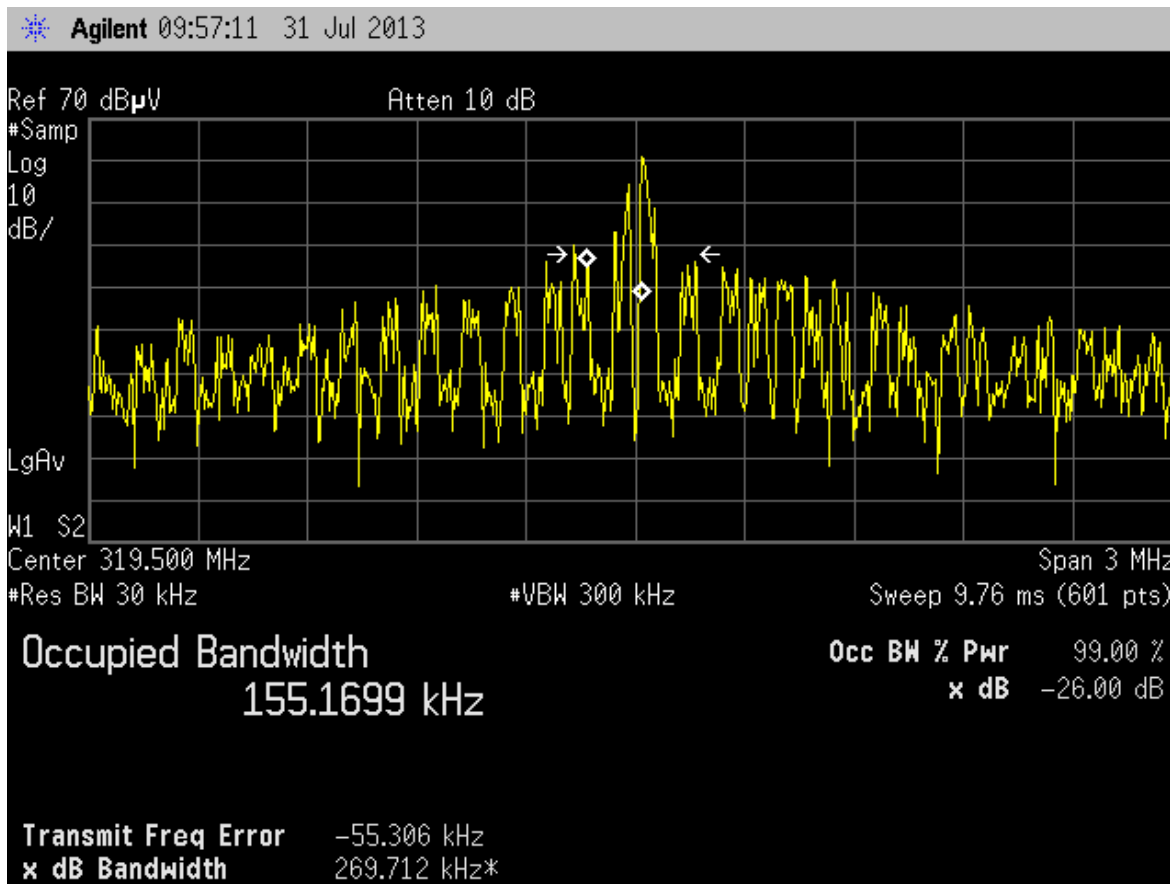
25% of 319.5 MHz = 79.875 kHz



20dB BW



99% BW





Frequency Stability

A1.1.4 Carrier frequency stability of devices momentarily operated in the band 40.66-40.70 MHz shall be maintained to $\pm 0.01\%$ (± 100 ppm).

15.231(d) For devices operating within the frequency band 40.66–40.70 MHz, the bandwidth of the emission shall be confined within the band edges and the frequency tolerance of the carrier shall be $\pm 0.01\%$. This frequency tolerance shall be maintained for a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltages at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Test Conditions:

Client	Linear Corporation	Temperature		°C
Nex #	241877	Relative Humidity		%
EUT Name	Security Door/Window Transmitter			
EUT Model	DWA01	Test Location		
Governing Doc	CFR 47, Part 15C	Test Engineer		
Basic Standard	Sec. 15.231 Transmit	Date of test		

Test Results:

Not tested; the EUT does not transmit within the 40.66—40.70 MHz band, therefore this test is not applicable.





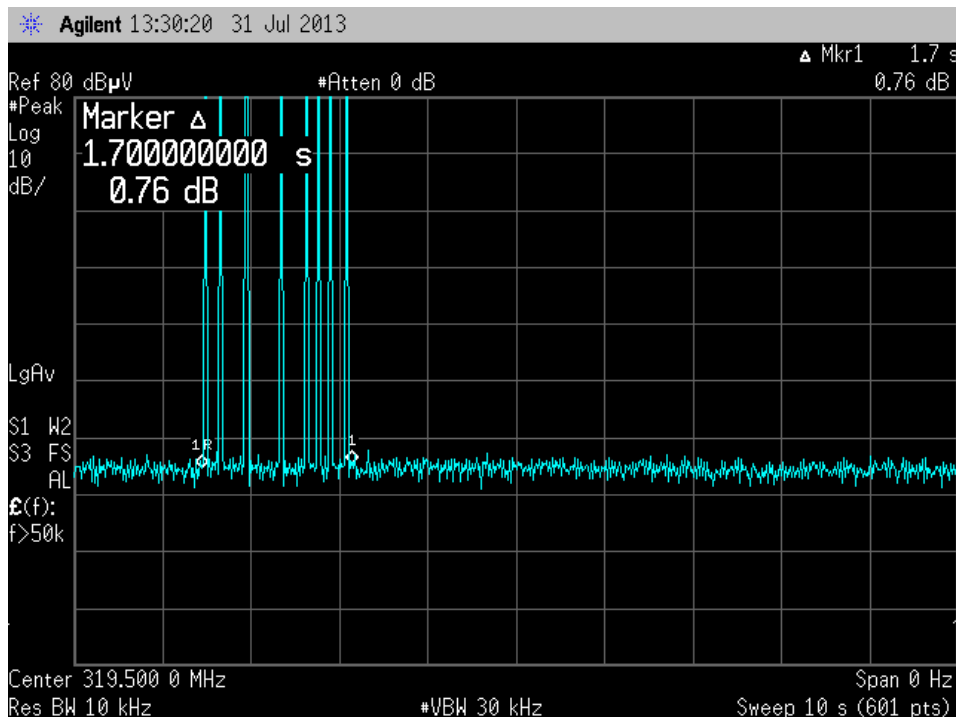
Types of Momentary Signals

RSS A1.1.1(c) Periodic transmissions at regular predetermined intervals are not permitted, except as provided in A.1.1.5. However, polling or supervision transmissions, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmission does not exceed 2 seconds per hour for each transmitter.

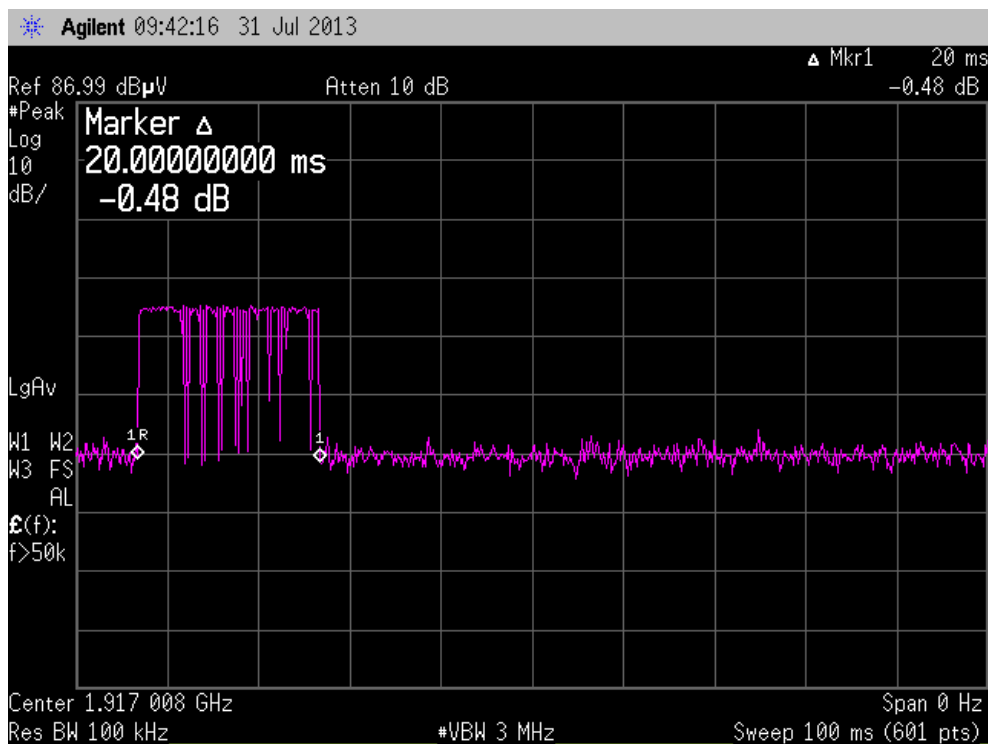
15.231(a)(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation

Client	Linear Corporation	Temperature	23	°C
Nex #	241877	Relative Humidity	60	%
EUT Name	Security Door/Window Transmitter			
EUT Model	DWA01	Test Location	10m SAC at 3m	
Governing Doc	CFR 47, Part 15C	Test Engineer	A. Laudani	
Basic Standard	Sec. 15.231 Transmit	Date of test	July 31, 2013	

This plot shows the transmitter stops within 5 seconds of activation. (Time between ON activated by presence of magnet and end of transmission is 1700 ms)



Duty Cycle Correction Factor



This plot shows all packets of transmissions in 100ms.
Total time that packet group is on equals 20 ms (off time with group not measured)

$$20 \times \log(20/100 \text{ ms}) = -14.0 \text{ dB}$$



Field Strength and Radiated Spurious Emissions

RSS210 Annex 1

A1.1.2 (1) The field strength of emissions from momentarily operated intentional radiators shall not exceed the limits in Table A.

Fundamental Frequency (MHz), excluding restricted band frequencies of Table 1	Field Strength of Fundamental ^(Note 1) microvolts/m at 3 metres, (watts, e.i.r.p.)	Field Strength of Unwanted Emissions ^(Note 1) microvolts/m at 3 metres
40.66-40.70	See Section A2.7	
70-130	1,250 (470 nW)	125
130-174	1,250 to 3,750*	125 to 375
174-260 ^(Note 2)	3,750 (4.2 µW)	375
260-470 ^(Note 2)	3,750 to 12,500*	375 to 1,250
Above 470	12,500 (47 µW)	1,250

15.231(b) In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66–40.70	2,250	225
70–130	1,250	125
130–174	¹ 1,250 to 3,750	¹ 125 to 375
174–260	3,750	375
260–470	¹ 3,750 to 12,500	¹ 375 to 1,250
Above 470	12,500	1,250

¹Linear interpolations.

Limit paragraph 213(b) 6005uV/m

(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. ... If average emission measurements are employed, the provisions in § 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of § 15.205 shall be demonstrated using the measurement instrumentation specified in that section.

At Unwanted emissions above or FCC15.209/RSS Table 2, whatever is higher.



Client	Linear Corporation	Temperature	23	°C
Nex #	241877	Relative Humidity	60	%
EUT Name	Security Door/Window Transmitter			
EUT Model	DWA01	Test Location	10m SAC at 3m	
Governing Doc	CFR 47, Part 15C	Test Engineer	A. Laudani	
Basic Standard	Sec. 15.231 Transmit	Date of test	July 31, 2013	

Test Results:

See Table. EUT complies for fundamental power and spurious emissions.

Additional Observations:

The Spectrum was searched from 9 kHz to the 10th Harmonic (3195 MHz).

The EUT was investigated with fresh batteries. The emissions were measured with a test mode that repeats the emission so measurements could be maximized for the rotation of the sample and height and polarity of the measurement antenna.

All Measurements below 1GHz were performed at 3m employing a peak detector. Peak measurements were done utilizing RBW of 1MHz and VBW of 3MHz. Average = peak plus duty cycle factor.

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.

All other emissions were found to be more than 20dB below the limit and have not been reported per FCC rule 15.31(o).

Emissions were measured on a 80cm (height) table

Since the EUT is defined as a wall mounted device: emissions measured in the vertical plane vertically are worst case.

Note: Corrected Reading Computations

Peak Maximum Meter Reading + Antenna Factor + Path Loss -DCCF

74.0 = 68.7 + 16.0 + 3.3 - 14.0

Limit paragraph 213(b) for 319.5 MHz = 6229 uV/m

$$10^{(74.0/20)} = 5036 \text{ uV/m} \text{ --- EUT passes}$$

www.nemko.com

Radiated Emissions Data

Job # :	<u>10248553</u>	Date :	<u>7/31/2013</u>	Page	<u>1</u>	of	<u>1</u>
NEX#:	<u>241877</u>	Time :	<u>8:30</u>				
		Staff :	<u>AAL</u>				
Client Name :	<u>Linear LLC</u>	EUT Voltage :	<u>3</u>				
EUT Name :	<u>Security Door/Window Transmitter</u>	EUT Frequency :	<u>N/A</u>				
EUT Model # :	<u>DWA01</u>	Phase:	<u>N/A</u>				
EUT Serial # :	<u></u>						
EUT Config. :	<u>Transmit continuous sample</u>						
	<u>No receive mode</u>						
Specification :	<u>CFR47 Part 15, Subpart C</u>	<u>15.231</u>					
Loop Ant. #:	<u>133</u>						
Bicon Ant.#:	<u>E1046</u>	Temp. (°C) :	<u>23</u>				
Log Ant.#:	<u>111_3m</u>	Humidity (%) :	<u>60</u>				
DRG Ant. #	<u>529</u>	Spec Analyzer #:	<u>911</u>				
Cable LF#:	<u>SAC10m</u>	Analyzer Display #:	<u>911</u>				
Cable HF#:	<u>WCC</u>	Quasi-Peak Detector #:	<u>911</u>				
Preamp LF#:	<u>901</u>	Duty Cycle (%):	<u>20.00</u>				
Preamp HF#	<u>1029</u>						

Funamental	RBW: 100 kHz
	Video Bandwidth 300 kHz
Harmonics	RBW: 1 MHz
	Video Bandwidth 3 MHz
Average = Peak + Duty Cycle Factor	
DCF = 20 x log(duty cycle)	

Meas. Freq. (MHz)	Meter Reading Vertical	Meter Reading Horizontal	Det.	EUT Side DEG	Ant. Height cm	Max. Reading (dBµV)	Corrected Reading dBm	Spec. limit dBm	CR/SL Diff. (dB)	Pass Fail	Comment
319.5	66.0	66.0	A			66.0	71.3	74.9	-3.6	Pass	Lying down
319.5	67.4	68.7	A	111	157	68.7	74.0	75.9	-1.9	Pass	Standing
1597.5	53.6	54.7	P	191	124	54.7	47.1	74.0	-26.9	Pass	
1597.5	53.6	54.7	A			54.7	33.1	54.0	-20.9	Pass	
1917.0	52.7	54.8	P	177	125	54.8	49.6	74.0	-24.4	Pass	
1917.0	52.7	54.8	A			54.8	35.6	54.0	-18.4	Pass	
2236.5	56.7	49.8	P	161	191	56.7	51.7	74.0	-22.2	Pass	
2236.5	56.7	49.8	A			56.7	37.8	54.0	-16.2	Pass	
2556.0	55.4	60.4	P	164	136	60.4	56.7	74.0	-17.3	Pass	
2556.0	55.4	60.4	A			60.4	42.7	54.0	-11.3	Pass	
2875.5	52.3	57.2	P	236.0	142.0	57.2	55.5	74.0	-18.5	Pass	
2875.5	52.3	57.2	A			57.2	41.5	54.0	-12.5	Pass	
3195.0	46.4	48.4	P	196.0	134.0	48.4	47.8	74.0	-26.1	Pass	
3195.0	46.4	48.4	A			48.4	33.9	54.0	-20.1	Pass	



Conducted Emissions Test Data—Receive Mode

Part 15.207(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

7.2.2 The purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network. Except when the requirements applicable to a given device state otherwise, for any license-exempt radiocommunication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown below. The tighter limit applies at the frequency range boundaries. The conducted emissions shall be measured with a 50 ohm/50 microhenry line impedance stabilization network Frequency Range

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

Client	Linear Corporation	Temperature	°C
Nex #	241877	Relative Humidity	%
EUT Name	Security Door/Window Transmitter		
EUT Model	DWA01	Test Location	
Governing Doc	CFR 47, Part 15B	Test Engineer	
Basic Standard	Sec. 15.107 Class "B"	Date of test	
Test Parameters	Peak RBW: 100kHz VBW: 100kHz Quasi-Peak: RBW 9kHz, VBW 30 kHz Average: RBW 9kHz, VBW 30 kHz Quasi-Peak Limit Blue Line, Average Limit Green Line		
Not tested; EUT does not have need for AC power as it is battery powered.			





Radiated Emissions Test Data—Receive Mode

The following receiver spurious emission limits shall be complied with:

(a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 1.

Table 1 - Spurious Emission Limits for Receivers

Spurious Frequency (MHz)	Field Strength (microvolt/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960	500

Client	Linear Corporation	Temperature	23	°C
Nex #	241877	Relative Humidity	60	%
EUT Name	Security Door/Window Transmitter			
EUT Model	DWA01	Test Location	10m SAC at 3m	
Governing Doc	CFR 47, Part 15B	Test Engineer	A. Laudani	
Basic Standard	Sec. 15.207 Class "B"	Date of test	July 31, 2013	

EUT does not have a receive mode.
No emissions evident while in standby mode





APPENDIX B

B. Radiated Emissions Measurement Uncertainties

1. Introduction

ISO/IEC 17025:2005 and ANSI/NC SL Z540.3: 2006 require that all measurements contained in a test report be "traceable". "Traceability" is defined in the *International Vocabulary of Basic and General Terms in Metrology* (ISO: 1993) as: "the property of the result of a measurement... whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons, *all having stated uncertainties*".

The purposes of this Appendix are to "state the *Measurement Uncertainties*" of the conducted emissions and radiated emissions measurements contained in Section 5 of this Test Report, and to provide a practical explanation of the meaning of these measurement uncertainties.

2. Statement of the Worst-Case Measurement Uncertainties for the Conducted and Radiated Emissions Measurements Contained in This Test Report

Table 1: Worst-Case Expanded Uncertainty "U" of Measurement for a k=2 Coverage Factor

Radiated Emissions Measurement Detection Systems	Applicable Frequency Range	"U" for a k=2 Coverage Factor
Spectrum Analyser with QPA & Preamplifier	30 MHz - 200 MHz	+3.9 dB, -4.0 dB
Spectrum Analyser with QPA & Preamplifier	200 MHz-1000 MHz	+/- 3.5 dB
Spectrum Analyser with Preamplifier	1 GHz - 18 GHz	+2.5 dB, -2.6 dB
Spectrum Analyser with Preamplifier	18 GHz - 40 GHz	+/- 3.4 dB

NOTES:

1. Applies to 3 and 10 meter measurement distances
2. Applies to all valid combinations of Transducers (i.e. LISNs, Line Voltage Probes, and Antennas, as appropriate)
3. Excludes the Repeatability of the EUT



3. Practical Explanation of the Meaning of Radiated Emissions Measurement Uncertainties

In general, a "Statement of Measurement Uncertainty" means that with a certain (specified) confidence level, the "true" value of a measurand will be between a (stated) upper bound and a (stated) lower bound.

In the specific case of EMC Measurements in this test report, the measurement uncertainties of the conducted emissions measurements and the radiated emissions measurements have been calculated in accordance with the method detailed in the following documents:

- o *ANSI Z540.2 (2002) Guide to the Expression of Uncertainty in Measurement*
- o NIS 81:1994, *The Treatment of Uncertainty in EMC Measurements* (NAMAS, 1994)
- o NIST Technical Note 1297(1994), *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results* (NIST, 1994)

The calculation method used in these documents requires that the stated uncertainty of the measurements be expressed as an "expanded uncertainty", U , with a $k=2$ coverage factor. The practical interpretation of this method of expressing measurement uncertainty is shown in the following example:

EXAMPLE: Assume that at 39.51 MHz, the (measured) radiated emissions level was equal to +26.5 dBuV/m, and that the +/- 2 standard deviations (i.e. 95% confidence level) measurement uncertainty was +/- 3.4 dB.

APPENDIX C

C. Nemko USA, Inc. Test Equipment & Facilities Calibration Program

Nemko USA, Inc. operates a comprehensive Periodic Calibration Program in order to ensure the validity of all test data. Nemko USA's Periodic Calibration Program is fully compliant to the requirements of NVLAP Policy Guide PG-1-1988, ANSI/NCSL Z540.3: 2006, ISO 10012:2003, ISO/IEC 17025:2005, and ISO-9000: 2000. Nemko USA, Inc.'s calibrations program therefore meets or exceeds the US national commercial and military requirements [N.B. ANSI/NCSL Z540.1-1994 replaced MIL-STD-45662A].

Specifically, all of Nemko USA's *primary reference standard devices* (e.g. vector voltmeters, multimeters, attenuators and terminations, RF power meters and their detector heads, oscilloscope mainframes and plug-ins, spectrum analysers, RF preselectors, quasi-peak adapters, interference analysers, impulse generators, signal generators and pulse/function generators, field-strength meters and their detector heads, etc.) and certain *secondary standard devices* (e.g. RF Preamplifiers used in CISPR 11/22 and FCC Part 15/18 tests) are periodically recalibrated by:

- A Nemko USA-approved independent (third party) metrology laboratory that uses NIST-traceable standards and that is ISO Guide 25-accredited as a calibration laboratories by NIST; or,
- A Nemko USA-approved independent (third party) metrology laboratory that uses NIST-traceable standards and that is ISO Guide 25-accredited as a calibration laboratory by another accreditation body (such as A2LA) that is mutually recognized by NIST; or,
- A manufacturer of Measurement and Test Equipment (M&TE), if the manufacturer uses NIST-traceable standards and is ISO Guide 25-accredited as calibration laboratory either by NIST or by another accreditation body (such as A2LA) that is mutually recognized by NIST; or
- A manufacturer of M&TE (or by a Nemko USA-approved independent third party metrology laboratory) that is not ISO Guide 25-accredited. (In these cases, Nemko USA conducts an annual audit of the manufacturer or metrology laboratory for the purposes of proving traceability to NIST, ensuring that adequate and repeatable calibration procedures are being applied, and verifying conformity with the other requirements of ISO Guide 25).

In all cases, the entity performing the Calibration is required to furnish Nemko USA with a calibration test report and/or certificate of calibration, and a "calibration sticker" on each item of M&TE that is successfully calibrated.

Calibration intervals are normally one year, except when the manufacture advises a shorter interval or if US Government directives or client requirements demand a shorter interval. Items of instrumentation/related equipment which fail during routine use, or which suffer visible mechanical damage (during use or while in transit) are side-lined pending repair and recalibration. (Repairs are carried out either in-house [if minor] or by a Nemko USA-approved independent [third party] metrology laboratory, or by the manufacturer of the item of M&TE).

Each antenna used for CISPR 11 and CISPR 22 and FCC Part 15 and Part 18 radiated emissions testing (and for testing to the equivalent European Norms) is calibrated annually by either a NIST (or A2LA) ISO Standard 17025-Accredited third-party Antenna Calibration Laboratory or by the antenna's OEM if the OEM is NIST or A2LA ISO Standard 17025-accredited as an antenna calibration laboratory. The antenna calibrations are performed using the methods specified in Annex G.5 of CISPR 16-1(2003) or ANSI C63.5-2004, including the "Three-Antenna Method". Certain other kinds of antennas (e.g. magnetic-shielded loop antennas) are calibrated annually by either a NIST (or A2LA) ISO Standard 17025-accredited third-party antenna calibration laboratory, or by the antenna's OEM if the OEM is NIST or A2LA ISO Standard 17025-accredited as an antenna calibration laboratory using the procedures specified in the latest version of SAE ARP-958.

In accordance with FCC and other regulations, Nemko USA recalibrates its suite of antennas used for radiated emissions tests on an annual basis. These calibrations are performed as a precursor to the FCC-required annual revalidation of the Normalized Site Attenuation properties of Nemko USA's Open Area Test Site. Nemko USA, Inc. uses the procedures given in both Sub clause 16.6 and Annex G.2 of CISPR 16-1 (2003), and, ANSI C63.4-2003 when performing the normalized site attenuation measurements.