Nemko USA, Inc.
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Carlsbad, CA 92008
Phone (760) 444-3500 Fax (760) 444-3005

CERTIFICATION TEST REPORT

Report Number:	2012 10221062 EMC
Project Number:	10231107
Nex Number:	221062
Applicant:	LINEAR LLC 1950 CAMINO VIDA ROBLE Carlsbad, CA 92008
Equipment Under Test (EUT):	DEVICE CONTROLLER
Model:	SW-ATT-DC
FCC ID: IC:	QNP915DC 4676A-915DC
In Accordance With:	FCC Part 15 Subpart C, 15.249 IC RSS-210 Issue 8 December 2010 IC RSS-Gen Issue 3 December 2010
Tested By:	Nemko USA Inc. 2210 Faraday Avenue, Suite 150 Carlsbad, CA 92008
Authorized By:	 Alan Laudani, EMC/RF Test Engineer
Date:	OCTOBER 5, 2012
Total Number of Pages:	26

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1 Applicant Affirmation

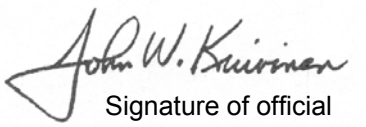
John Kuivinen representing Linear LLC hereby affirms:

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

October 5, 2012
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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Section1: Summary of Test Results

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 FCC Part 15; Subpart C and IC RSS-210. Radiated tests were conducted is accordance with ANSI C63.4-2003. Radiated emissions are made in a 10m semi-anechoic chamber. A description of the test facility is on file with the FCC and IC.

The assessment summary is as follows:

Apparatus Assessed:	Device Controller
Model:	SW-ATT-DC
Specification:	FCC Part 15 Subpart C, 15.249 IC RSS-210 Issue 8 December 2010
Date Received in Laboratory:	September 24, 2011
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None

1.1 Report Release History

REVISION	DATE	COMMENTS
-	October 5, 2012	Prepared By: Mark Phillips
-	October 5, 2012	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.

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TESTED BY:  Date: October 5, 2012
Mark Phillips, EMC Test Engineer

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Section 2: Equipment Under Test

2.1 Product Identification

The Equipment Under Test was identified as follows:

Linear LLC SW-ATT-DC Device Controller

2.2 Samples Submitted for Assessment

The following sample of the apparatus has been submitted for type assessment:

Sample No.	Description	Serial No.
221062-1	SW-ATT-DC DEVICE CONTROLLER	050001FC

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2.3 Theory of Operation

The SW-ATT-DC is a Device Controller. Its function is to provide secure access control.

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.

2.4 Technical Specifications of the EUT

Manufacturer:	Linear LLC
Operating Frequency:	911.78 MHz, 913.28MHz,,918.78 MHz 919.78MHz in the 902 – 928 MHz Band
Number of Operating Frequencies:	4
Rated Field Strength:	92.6 dBµV/m @ 3 meters Or 40 mV/m
Modulation:	
Antenna Type:	Integral
Antenna Connector:	None
Power Source:	120VAC 60Hz (2ea. CR123A Lithium Battery Backup)

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Section 3: Test Conditions

3.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.249
Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz and 24.0-24.25 GHz bands.

IC RSS-210 Issue 8 December 2010
Low-power Licence-exempt Radio-communication Devices (All Frequency Bands): Category I Equipment. Annex 8 - Frequency Hopping and Digital Modulation Systems Operating in the Bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

IC RSS-Gen Issue 3 December 2010
General Requirements and Information for the Certification of Radio-communication Equipment

3.2 Deviations From Laboratory Test Procedures

No deviations from Laboratory Test Procedure

3.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	20-25 ^{o}C
Humidity range	50-60%

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3.4 Test Equipment

Nemko ID	Device	Manufacturer	Model	Serial Number	Cal Date	Cal Due Date
E1018	9kHz to 7GHz Spectrum Analyzer	Rohde & Schwarz	FSP7	835363/0003	2-23-12	2-23-13
752	Antenna, DRWG	EMCO	3115	4943	6-11-12	6-11-13
133	Antenna, Loop	Electrometrics	ALR-25M	678	7/18/11	7/18/13
317	Preamplifier	HP	8449A	2749A00167	12-2-11	12-2-12
128	Antenna, Bicon	EMCO	3104	2882	3-21-12	3-21-13
110	Antenna, LPA	Electrometrics	LPA-25	1217	4-1-12	4-1-13
911	Spectrum Analyzer	Agilent	E4440A	US41421266	10-27-11	10-27-12
E1018	9kHz to 7GHz Spectrum Analyzer	Rohde & Schwarz	FSP7	835363/0003	2-23-12	2-23-13
E1020	Two Line V-Network	Rohde & Schwarz	ENV216	101044	4-6-12	4-6-13

Registration of the 10m Semi-anechoic chamber is on file with the Federal Communications Commission and with Industry Canada under Site Number 2040B-3.

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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 Test Deleted

No Tests were deleted from this assessment.

4.5 Additional Observations

There were no additional observations made during this assessment.

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Section 5: Results Summary

This section contains the following:

FCC Part 15 Subpart C: §15.249
IC RSS-210 Issue 8 December 2010 Annex A2.9
IC 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 15C	Industry Canada	Test Description	Required	Result
15.207 (a)	RSS-Gen 7.2.4	Conducted Emission Limit	Y	Pass
15.215(c)	RSS-Gen 4.6.3	20 dB Bandwidth	Y	Pass
15.249(a)	A2.9	Field Strength of Emissions	Y	Pass
15.249(a)	A2.9	Spurious Emissions Outside of the band	Y	Pass
15.109 (a)	RSS-Gen 4.10 & RSS-Gen 6.1	Receiver Spurious Emissions	Y	Pass

Appendix A: Test Results

Section 15.215(c) – Occupied Bandwidth

(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§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 a 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.

RSS-Gen Section 4.6.1 – Occupied Bandwidth

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual.

The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded.

The span between the two recorded frequencies is the occupied bandwidth.

Test Conditions:

Sample Number:	SW-ATT-DC	Temperature:	24°C
Date:	9-27-12	Humidity:	56%
Modification State:	Low and High Channel	Tester:	Mark Phillips
		Laboratory:	Nemko

Test Results:

See attached plots

Additional Observations:

- Span is wide enough to capture the channel transmission
- RBW is 1% of the span or worst case
- VBW is 3X RBW

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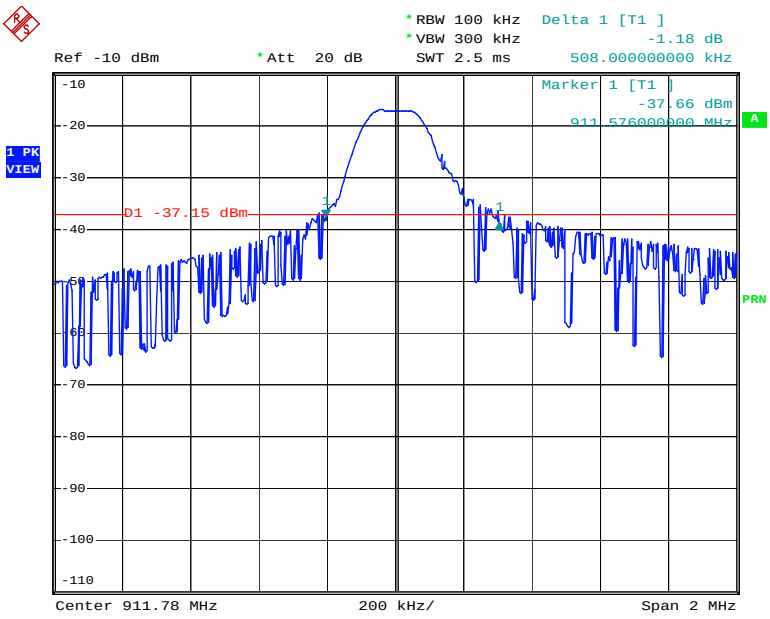
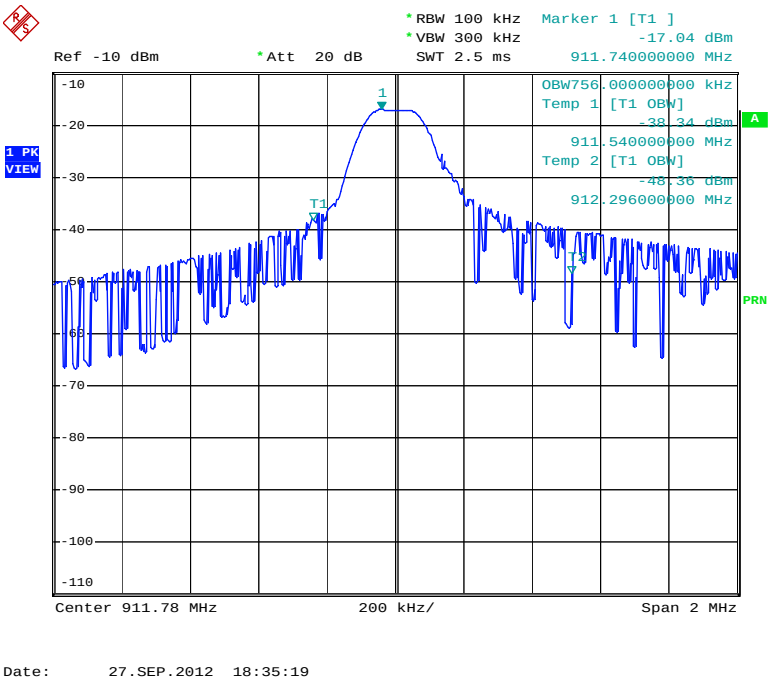
- Sweep is auto
- Detector is Peak
- Trace is Max Hold
- A peak output max hold reading was taken; a display line was drawn 20 dB lower than peak level. The 20 dB bandwidth was determined from where the channel output spectrum intersected the display line.
- Per Industry Canada requirement, another measurement was made using the built-in OBW measuring feature of the spectrum analyzer with power BW of 99%.
- 911.28 MHz – 508/2 kHz = 911.026 MHz (within the frequency band)
- 919.78 MHz + 480/2 kHz = 920.020 MHz (within the frequency band)

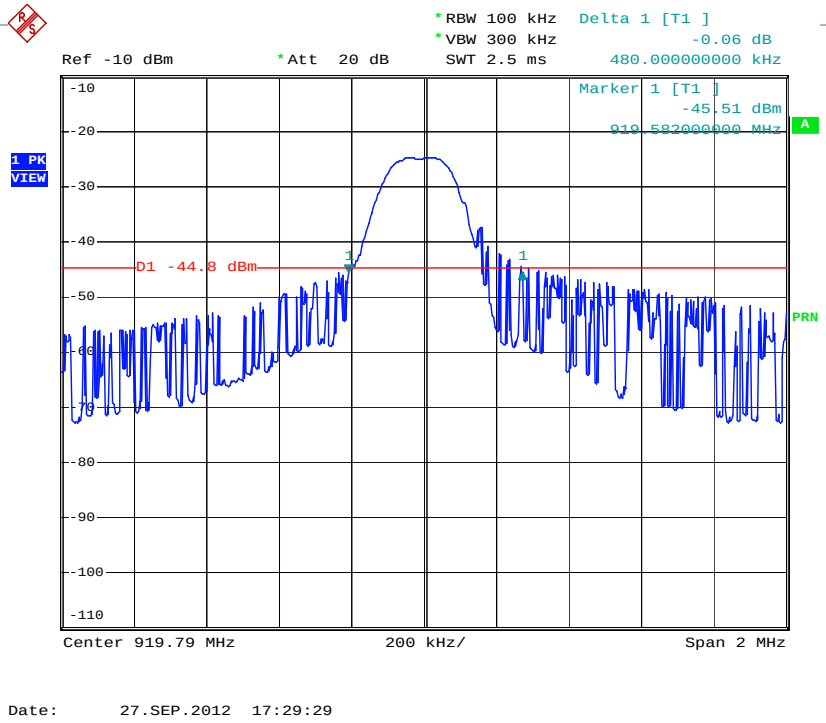
Frequency	20dB band width	99% band width
911.78 MHz	508 kHz	756 kHz
919.78 MHz	480 kHz	616 kHz



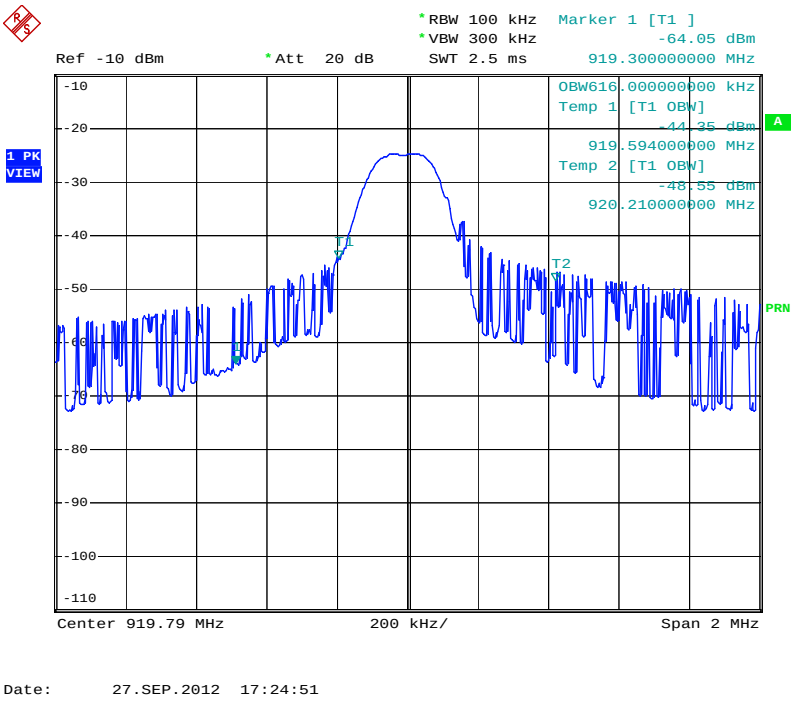
Low Channel (911.78 MHz) 20dB Occupied Bandwidth is 508kHz



Low Channel (911.78 MHz) 99% Occupied Bandwidth is 756kHz



High Channel (919.78MHz) 20dB Occupied Bandwidth is 480kHz



High Channel (919.78 MHz) 99% Occupied Bandwidth is 616kHz

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Section 15.249(a) – Field Strength of Emissions

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

RSS-210 A2.9 – Field Strength of Emissions

This section provides standards for low-power devices that can be used for any application provided the following conditions are met:
(a) The field strengths measured at 3 metres shall not exceed the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (millivolts/meter)
902–928 MHz	50(Note 1)	0.5
2400–2483.5 MHz	50(Note 1)	0.5
5725–5875 MHz	50(Note 1)	0.5

Note 1: Equivalent to 0.75 mW e.i.r.p.

(b) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to Table 2 limits, whichever is the less stringent.

Section 4.4 of RSS-Gen (Pulsed Operation) does not apply to CISPR measurement for the band 902-928 MHz.

Test Conditions:

Sample Number:	SW-ATT-DC	Temperature:	25°C
Date:	9/26/12	Humidity:	56%
Modification State:	Low and High Channel	Tester:	Mark Phillips
		Laboratory:	

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Additional Observations:

- All measurements were performed using a peak detector.
- RBW is 1MHz while VBW is 3MHz.
- Spectrum was investigated up to 10.0GHz
- There are no emissions other than the fundamental
- Average data are calculated from Peak measurements plus Duty Cycle Correction Factor (DCCF).

Sample Computation (Radiated Emissions Data Sheet):

Correction factor	
@ 911.78MHz	= 63.0 dBµV/m
	= Antenna factor + Cable loss – Preamp gain
	= 23.5 + 6.1 – 0
Corrected reading	= Max. reading + Correction factor
	= 63.0 + 29.6
	= 92.6 dBµV/m

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Test Results:

Radiated Emissions Data

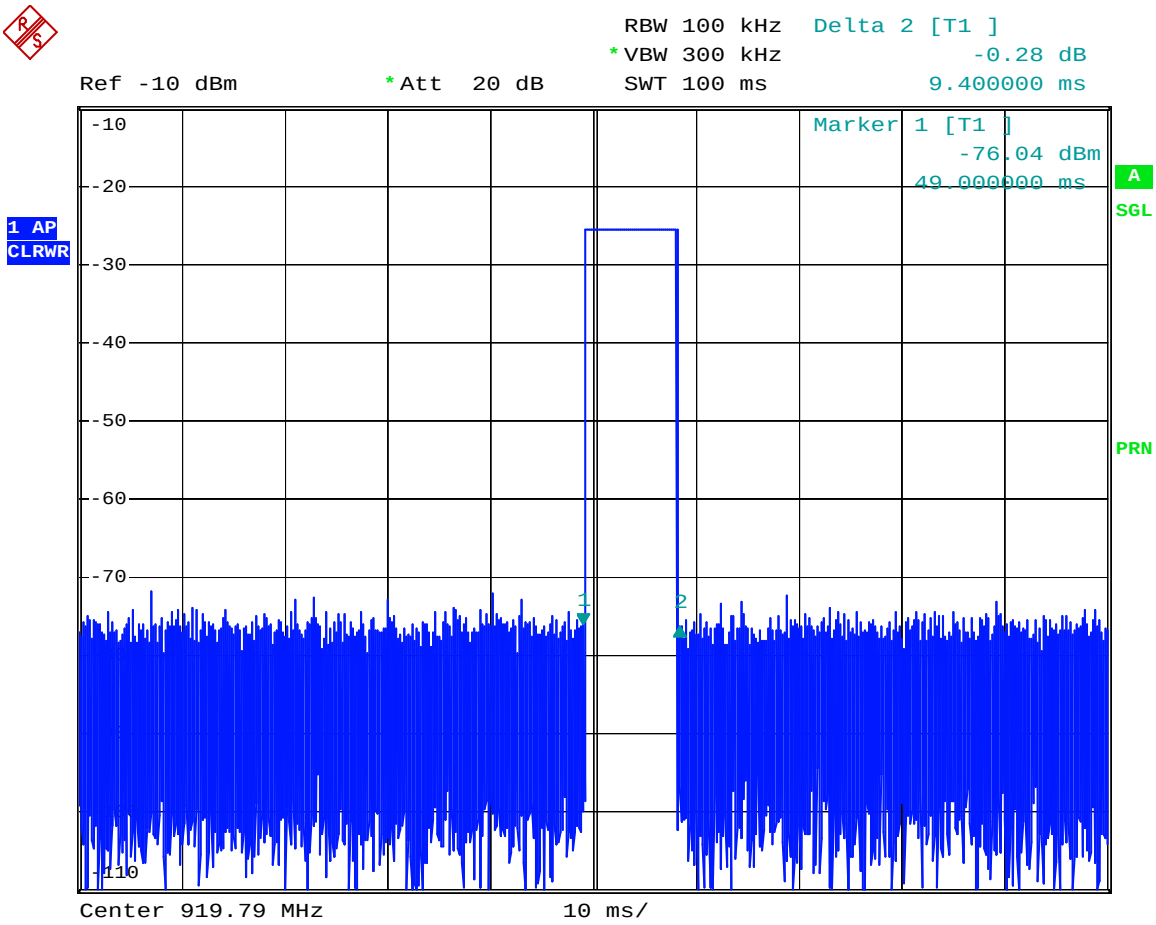
Job # :	10231107	Date :	9/26/12	Page 1 of 1	
NEX #:	221062	Time :	2100		
		Staff :	MP		
Client Name :	Linear LLC			EUT Voltage :	120VAC
EUT Name :	Device Controller			EUT Frequency :	60Hz
EUT Model # :	SW-ATT-DC			Phase:	1
EUT Serial # :	050001FC				
EUT Config. :	Transmitting				
				Distance < 1000 MHz:	3 m
				Distance > 1000 MHz:	3 m
Specification :	CFR47 Part 15.249				
Loop Ant. #:	NA				
Bicon Ant.#:	NA	Temp. (°C) :	24		
Log Ant.#:	110_3m	Humidity (%) :	56		
DRG Ant. #	877	Spec Analyzer #:	911		
Cable LF#:	SAC_10m	Analyzer Display #:	911		
Cable HF#:	WCC	Quasi-Peak Detector #:	911		
Preamp LF#:	902	Duty Cycle (%):	9.40		
Preamp HF#	317				

Quasi-Peak RBW:	120 kHz
Video Bandwidth	300 kHz
Peak RBW:	1 MHz
Video Bandwidth	3 MHz
Average = Peak + Duty Cycle Factor	
DCF = 20 x log(duty cyle)	

Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated.
Measurements above 1 GHz are Average values, unless otherwise stated.

Meas. Freq. (MHz)	Meter Reading **Vertical**	Meter Reading **Horizontal**	Det.	EUT Side DEG	Ant. Height cm	Max. Reading (dBµV)	Corrected Reading (dBµV)	Spec. limit (dBµV)	CR/SL Diff. (dB)	Pass Fail	Comment
911.780	59.2	63.0	P	68.0	100.0	63.0	92.6	114.0	-21.4	Pass	Low
911.780	59.2	63.0	A	68.0	100.0	63.0	72.1	94.0	-21.9	Pass	
919.780	58.0	61.9	P	75.0	100.0	61.9	91.5	114.0	-22.5	Pass	High
919.780	58.0	61.9	A	75.0	100.0	61.9	71.0	94.0	-23.0	Pass	

Duty Cycle Correction Factor Calculations



One (1) set of data packets in 100ms sweep

Each data packet is 9.4mS long

Duty Cycle = 9.4ms x 1
= 9.4 ms/100 ms
= 0.094

DCCF = 20 log (0.094)
= -20.4

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Section 15.249 (d) – Spurious Emissions Outside of the band

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

RSS-210 A2.9 – Spurious Emissions Outside of the band

(b) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to Table 2 limits, whichever is the less stringent.

Section 4.4 of RSS-Gen (Pulsed Operation) does not apply to CISPR measurement for the band 902-928 MHz.

Test Conditions:

Sample Number:	SW-ATT-DC	Temperature:	25°C
Date:	9-26-12	Humidity:	56%
Modification State:	Low and High Channel	Tester:	Mark Phillips
		Laboratory:	Nemko

Test Results:

No emissions found.

Additional Observations:

- All measurements below 1 GHz were performed at 3m employing a CISPR quasi-peak detector.
- Peak measurements above 1 GHz utilize a RBW of 1 MHz and a VBW of 3 MHz
- The Spectrum was searched from 9 kHz to 10 GHz. No emissions found within 20 dB of the limit.
- Emissions were investigated in Transmit and Receive modes.
- There were no emissions found other than the fundamental (Section 15.249(a)).

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RSS-Gen 4.10 – Receiver Spurious Emissions

6.1 Radiated Limits
Radiated spurious emission measurements shall be performed with the receiver antenna connected to the receiver antenna terminals.

Table 2: Radiated Limits of Receiver Spurious Emissions

Frequency (MHz)	Field Strength (microvolts/m at 3 meters)*
30-88	100
88-216	150
216-960	200
Above 960	500

*Measurements for compliance with limits in the above table may be performed at distances other than 3 metres, in accordance with Section 7.2.7.

Test Conditions:

Sample Number:	SW-ATT-DC	Temperature:	25°C
Date:	9-26-12	Humidity:	55%
Modification State:	Mid Channel	**Tester:**	**Mark Phillips**
		Laboratory:	

Additional Observations:

For either method, the search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is higher, to at least 3 times the highest tunable or local oscillator frequency, whichever is higher, without exceeding 40 GHz.

For emissions below 1000 MHz, measurements shall be performed using a CISPR quasi-peak detector and the related measurement bandwidth. As an alternative to CISPR quasi-peak measurement, compliance with the emission limit can be demonstrated using measuring equipment employing a peak detector function properly adjusted for factors such as pulse desensitization as required, with an equal or greater measurement bandwidth relative to the applicable CISPR quasi-peak bandwidth.
Above 1000 MHz, measurements shall be performed using an average detector with a minimum resolution bandwidth of 1 MHz.

- All measurements below 1 GHz were performed at 3m employing a CISPR quasi-peak detector.
- Peak measurements above 1 GHz utilize a RBW of 1 MHz and a VBW of 3 MHz
- The Spectrum was searched from 9 kHz to 5.0 GHz.

Test Results:

No emissions found.

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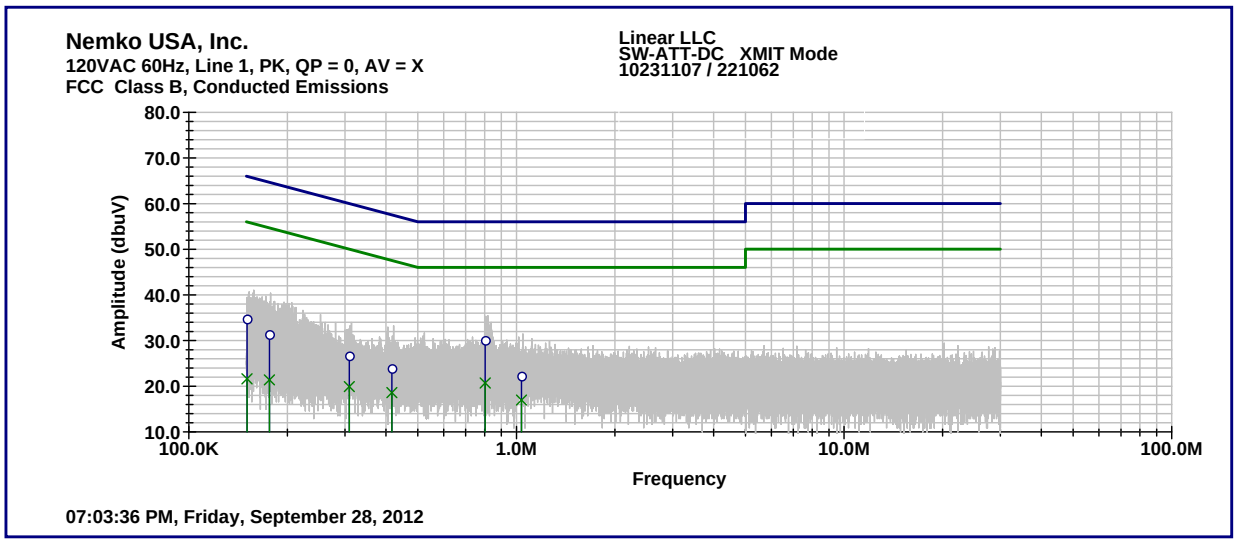
Conducted Emissions

Client	Linear LLC	Temperature	24	°C
NEx #:	221062	Relative Humidity	54	%
EUT Name	Device Controller	Barometric Pressure	100.4	kPa
EUT Model	SW-ATT-DC	Test Location	Ground Plane	
Governing Doc	CFR 47, Part 15B, Sec. 15.107	Test Engineer	Mark Phillips	
Basic Standard	ANSI C63.4	Date	9-28-12	
Voltage:	120 Vac Line 1 Transmit Mode			



Frequency	Measured		Limit		Margin	
(kHz)	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
150.6	34.7	21.6	66.0	56.0	-31.3	-34.4
176.3	31.4	21.4	64.7	54.7	-33.3	-33.3
309.0	26.7	19.9	60.0	50.0	-33.3	-30.1
416.6	23.9	18.6	57.5	47.5	-33.6	-28.9
802.7	30.1	20.7	56.0	46.0	-25.9	-25.3
1036.1	22.2	17.0	56.0	46.0	-33.8	-29.0

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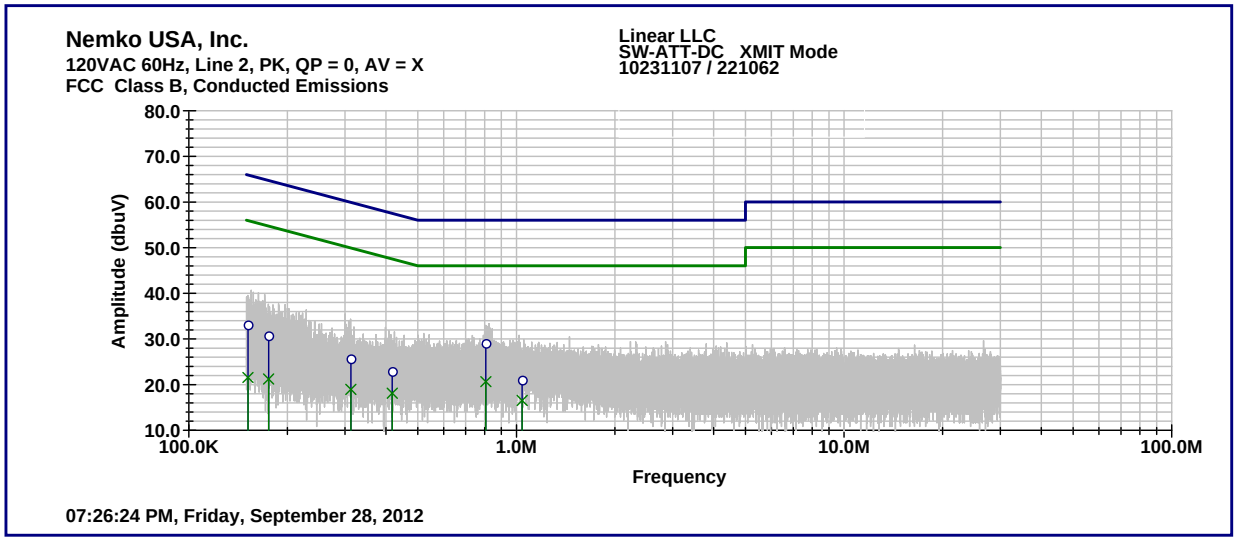
Client	Linear LLC	Temperature	24	°C
NEx #:	221062	Relative Humidity	54	%
EUT Name	Device Controller	Barometric Pressure	100.4	kPa
EUT Model	SW-ATT-DC	Test Location	Ground Plane	
Governing Doc	CFR 47, Part 15B, Sec. 15.107	Test Engineer	Mark Phillips	
Basic Standard	ANSI C63.4	Date	9-28-12	
Voltage:	120 Vac Line 2 Transmit Mode			



Frequency	Measured		Limit		Margin	
(kHz)	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
151.6	33.1	21.5	65.9	55.9	-32.8	-34.4
175.2	30.7	21.2	64.7	54.7	-34.0	-33.5
312.4	25.7	19.0	59.9	49.9	-34.2	-30.9
417.9	22.9	18.1	57.5	47.5	-34.6	-29.4
806.6	29.1	20.6	56.0	46.0	-26.9	-25.4
1041.0	21.0	16.5	56.0	46.0	-35.0	-29.5

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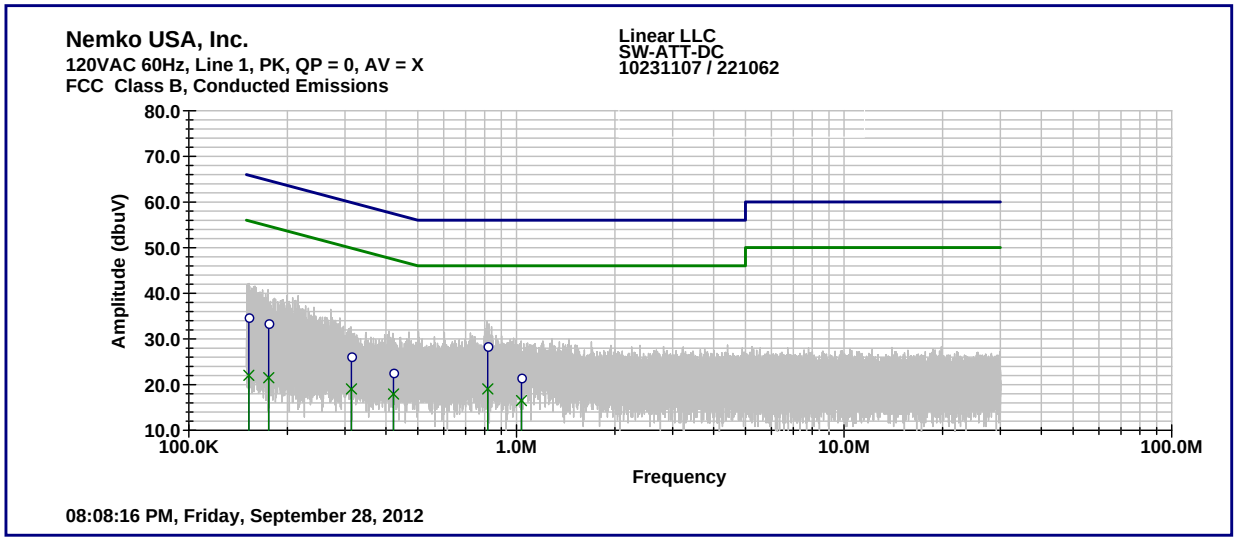
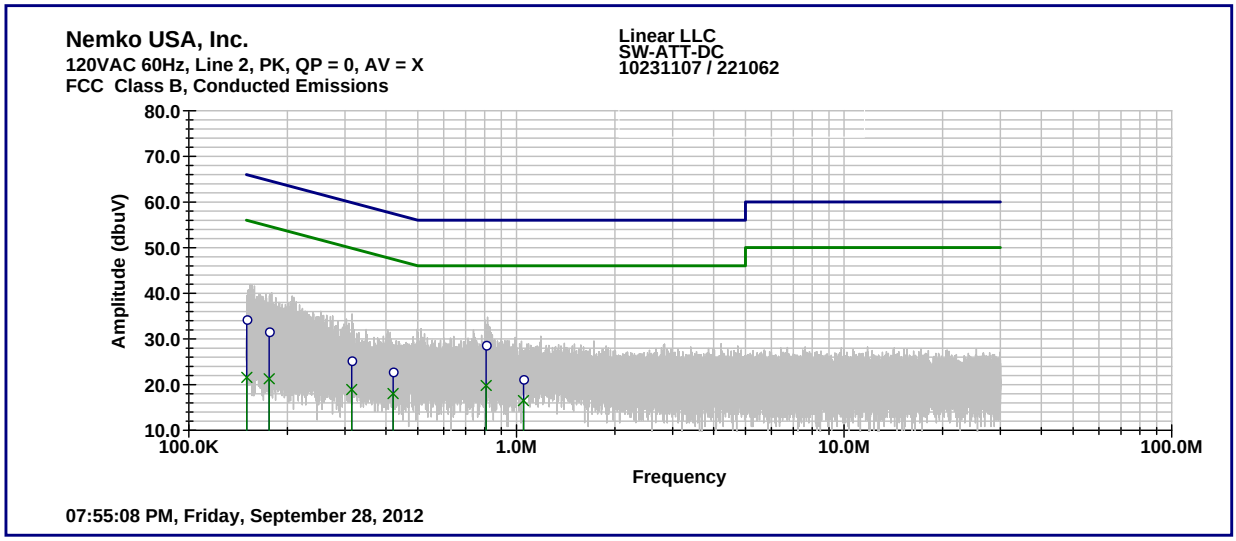
Client	Linear LLC	Temperature	24	°C
NEx #:	221062	Relative Humidity	54	%
EUT Name	Device Controller	Barometric Pressure	100.4	kPa
EUT Model	SW-ATT-DC	Test Location	Ground Plane	
Governing Doc	CFR 47, Part 15B, Sec. 15.107	Test Engineer	Mark Phillips	
Basic Standard	ANSI C63.4	Date	9-28-12	
Voltage:	120 Vac Line 1 Receive Mode			



Frequency	Measured		Limit		Margin	
(kHz)	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
152.5	34.7	22.0	65.9	55.9	-31.2	-33.9
175.4	33.4	21.5	64.7	54.7	-31.3	-33.2
313.6	26.1	19.0	59.9	49.9	-33.8	-30.9
421.5	22.6	17.9	57.4	47.4	-34.8	-29.5
817.9	28.4	19.1	56.0	46.0	-27.6	-26.9
1035.9	21.5	16.5	56.0	46.0	-34.5	-29.5

2210 Faraday Avenue, Suite 150, Carlsbad, CA 92008
Phone (760) 444-3500 Fax (760) 444-3005

Client	Linear LLC	Temperature	24	°C
NEx #:	221062	Relative Humidity	54	%
EUT Name	Device Controller	Barometric Pressure	100.4	kPa
EUT Model	SW-ATT-DC	Test Location	Ground Plane	
Governing Doc	CFR 47, Part 15B, Sec. 15.107	Test Engineer	Mark Phillips	
Basic Standard	ANSI C63.4	Date	9-28-12	
Voltage:	120 Vac Line 2 Receive Mode			



Frequency	Measured		Limit		Margin	
(kHz)	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
150.3	34.3	21.6	66.0	56.0	-31.7	-34.4
176.0	31.6	21.3	64.7	54.7	-33.1	-33.4
314.3	25.3	18.9	59.9	49.9	-34.6	-31.0
420.5	22.8	18.0	57.4	47.4	-34.6	-29.4
808.5	28.6	19.8	56.0	46.0	-27.4	-26.2
1050.8	21.2	16.5	56.0	46.0	-34.8	-29.5