1601 North A.W. Grimes Blvd., Suite B
Round Rock, TX 78665
e-mail: info@ptitest.com
(512) 244-3371 Fax: (512) 244-1846

December 9, 2014

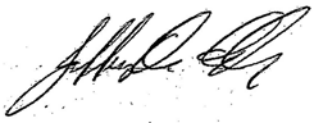
William Anderson
TowMate
15827 Serenity Point Lane
Rogers, Arkansas 72756

Mr. Anderson:

Thank you for allowing Professional Testing (EMI), Inc. an opportunity to perform testing for TowMate. Enclosed is the Wireless Certification Report for the 4L-3600-4. This report can be used to demonstrate compliance with the regulatory requirements for wireless devices in North America.

If you have any questions, please contact me.

Sincerely,



Jeffrey A. Lenk
President

Attachment

Project 16162-15

Model 4L-3600-4

Wireless Certification Report

Prepared for:

TowMate
15827 Serenity Point Lane
Rogers, Arkansas 72756
By

Professional Testing (EMI), Inc.
1601 North A.W. Grimes Blvd., Suite B
Round Rock, Texas 78665

December 9, 2014

Reviewed by	Written by
	
Larry Finn Chief Technology Officer	Eric Lifsey Test Engineer

Revision History

Revision Number	Description	Date
00	Initial draft.	2014-12-01
01	Final. Revised with client and internal comments.	2014-12-08
02	Final. Revised to remove modular references.	2015-01-09

Table of Contents

Certificate of Compliance

Applicant	Device & Test Identification	
TowMate (William Anderson)	FCC ID:	UZVTM500
15827 Serenity Point Lane	Industry Canada ID:	Not Applicable
Rogers, Arkansas 72756	Model(s):	4L-3600-4
Certificate Date: December 2, 2014	Laboratory Project ID:	16162-15

The device model(s) listed above were tested utilizing the following documents and found to be in compliance with the required criteria.

47 CFR (USA) | Industry Canada RSS-210 & RSS-Gen	
Section Reference FCC | IC	**Parameter**
15.231(a) | RSS-210 Is. 8 A1.1, Table A	Fundamental Field Strength
15.231(a) | RSS-210 Is. 8 A1.1, Table A	Harmonic & Spurious Emissions
15.231(a)(1) | RSS-210 Is. 8 A1.1.1	Maximum Transmit Time
15.231(c) | RSS-210 Is. 8 A1.1.3	Bandwidth
15.203 | RSS-Gen Is. 3	Antenna Requirements

I, Eric Lifsey, for Professional Testing (EMI), Inc., being familiar with the above rules and test procedures have reviewed the test setup, measured data, and this report. I believe them to be true and accurate.

Eric Lifsey
EMC Engineer

This report has been reviewed and accepted by the Applicant. The undersigned is responsible for ensuring that this device will continue to comply with the rules listed above.

_____

Representative of Applicant

1.0 Introduction

1.1 Scope

This report describes the extent to which the equipment under test (EUT) conformed to the intentional radiator requirements of North America.

Professional Testing (EMI), Inc., (PTI) follows the guidelines of National Institute of Standards and Technology (NIST) for all uncertainty calculations, estimates, and expressions thereof for electromagnetic compatibility testing. The procedures of ANSI C63.4: 2009 were used for making all radiated enclosure and mains emission measurements.

1.2 EUT Description

This device is part of a wireless extension of the rear signal lights of a towing vehicle. It will be used in multiple products by the manufacturer on a limited-modular basis; it is not intended for sale to other parties.

Table 1.2.1: Equipment Under Test

Manufacturer	Model	Serial #	Description
TowMate	4L-3600	Sample B Green Dot	Transmitter

The device is composed of an approximately square circuit board 3.3 x 4.3 cm and typically housed in a rigid plastic case or in a plastic connector of the style used to connect a towed vehicle to the towing vehicle. As tested it was circuit board only.

In operation the device is activated/powered by the usual rear signal lights from the towing vehicle and transmits this information to a separate device attached to the towed vehicle and replicates the light signals for other traffic to observe. When no vehicle lamps are powered, the transmitter is also not powered.

1.3 EUT Operation

The EUT was exercised in a manner consistent with normal operations.

1.4 Modifications to Equipment

The EUT transmit power was reduced, and duty cycle extended, during the performance of the test program.

1.5 Radiated Measurement Calculation

Raw Measured Level + Antenna Factor + Cable Losses – Amplifier Gain = Corrected Level

2.0 Applicable Documents and Clauses

Table 2.0.1: Applicable Documents	
Document	**Title/Description**
47 CFR (USA)	Part 15 – Section 15.231
ANSI C63.4 2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment
RSS-Gen Issue 3	General Requirements and Information for the Certification of Radio Apparatus
RSS-210 Issue 8	Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

Table 2.0.2: Applicable Clauses	
47 CFR (USA) | Industry Canada RSS-210 & RSS-Gen	
Section Reference FCC | IC	**Parameter**
15.231(a) | RSS-210 A1.1, Table A	Fundamental Field Strength
15.231(a) | RSS-210 A1.1, Table A	Harmonic & Spurious Emissions
15.231(a)(1) | RSS-210 A1.1.1	Maximum Transmit Time
15.231(c) | RSS-210 A1.1.3	Bandwidth
15.203 | RSS-Gen	Antenna Requirements

Table 2.0.3: Supplemental Statements		
Section Number FCC **Section Number IC**	**Clause Subject**	**Statement**
FCC 15.231(a)(3) RSS-210 A1.1.1(c)	Periodic Transmissions	The EUT makes no periodic transmission and is strictly activated by the vehicle lighting/indicator including brake and turn signals. Transmission only occurs while the lights are engaged and ceases immediately when light power is removed.

2.1 Test Site

Measurements were made at the PTI semi-anechoic facility designated Site 45 (FCC 459644, IC 3036B-1) in Austin, Texas. The site is registered with the FCC under Section 2.948 and Industry Canada per RSS-GEN, and is subsequently confirmed by laboratory accreditation (NVLAP). The test site is located at 11400 Burnet Road, Austin, Texas 78758, while the main office is located at 1601 North A.W. Grimes Boulevard, Suite B, Round Rock, Texas, 78665.

3.0 Fundamental Field Strength

3.1 Test Procedure

EUT is placed on a non-conductive surface 80 cm above a reference plane and measurements of emissions are made to find maximum emission level.

3.2 Test Criteria

Section Reference FCC | IC	Parameter	Date(s)
15.231(a) | RSS210 A1.1	Radiated Output Power, 10,333.33µV/m @ 3 m Restated as 80.28 dBµV/m @ 3 m Or extrapolated as 69.8 dBµV/m @ 10 m	2014-11-16

3.3 Test Results

Table 3.3.1: Field Strength at 10 Meters

Frequency MHz	Antenna Polarity	Corrected Level (Measured Peak Level) dBµV/m	Detector Mode
418	V	72.9	Peak
418	H	77.1	Peak

Resolution bandwidth 120 kHz. Video bandwidth 120 kHz. Detector mode is peak.

Duty cycle is such that the emission average level is calculated as 20 dB below the peak level.

Table 3.3.2: Corrected Field Strength

Limit At **10** meters dBµV/m (Average Detection)	Corrected Level (Measured Peak Level) dBµV/m	Duty Cycle Factor dB	Corrected Level dBµV/m	Margin dB
69.8	77.1	20	57.1	-12.7

The EUT was found to be in compliance with the applicable criteria.

4.0 Transmitter Duty Cycle and Shutoff Time

4.1 Test Procedure

EUT is placed into normal transmit operation to observe and record transmitter time domain performance.

4.2 Test Criteria

Measurement is based on intervals not to exceed 100 msec. Maximum transmitter on time is divided by the lesser of 100 msec or the actual measured minimum transmitter interval time. The result is converted to dB and applied as needed to peak measurements of transmitter artifacts to determine average power. This is not a pass/fail measurement.

Section Reference FCC | IC	Parameter	Date(s)
15.231(a)(1) | RSS210 A1.1.1	Maximum Transmit Time	2014-09-16 2014-10-14

4.3 Test Results

Table 4.3.1 Duty Cycle Results and Average Duty Cycle Factor Result

Measured On Time (msec)	Measured Time Interval (msec)	Duty Cycle Factor Calculation	Result (dB)	Duty Cycle Factor Allowed (dB)
9.0513	91.4438	= 20 * Log_{10} (9.0513 msec / 91.4438 msec)	-20.08	-20

Table 4.3.2 Exposure Source Duty Cycle Results

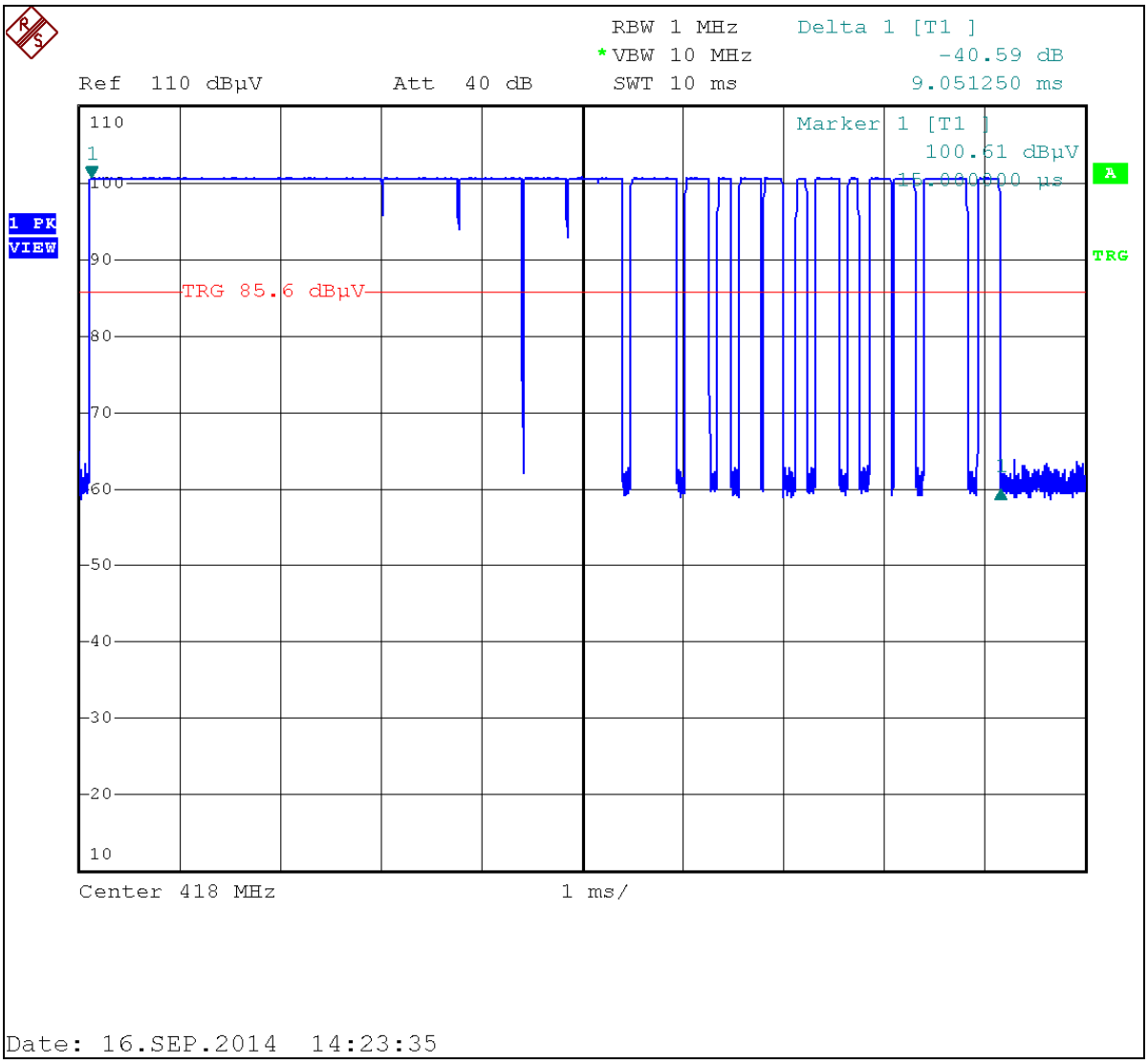
Measured On Time (msec)	Measured Time Interval (msec)	Exposure Duty Cycle Factor Calculation	Result (dB)	Duty Cycle Factor Allowed (dB)
9.0513	91.4438	= 10 * Log_{10} (9.0513 msec / 91.4438 msec)	-10.04	-10.04

Table 4.3.3: Maximum Transmit Shutoff Time, Limit and Measured

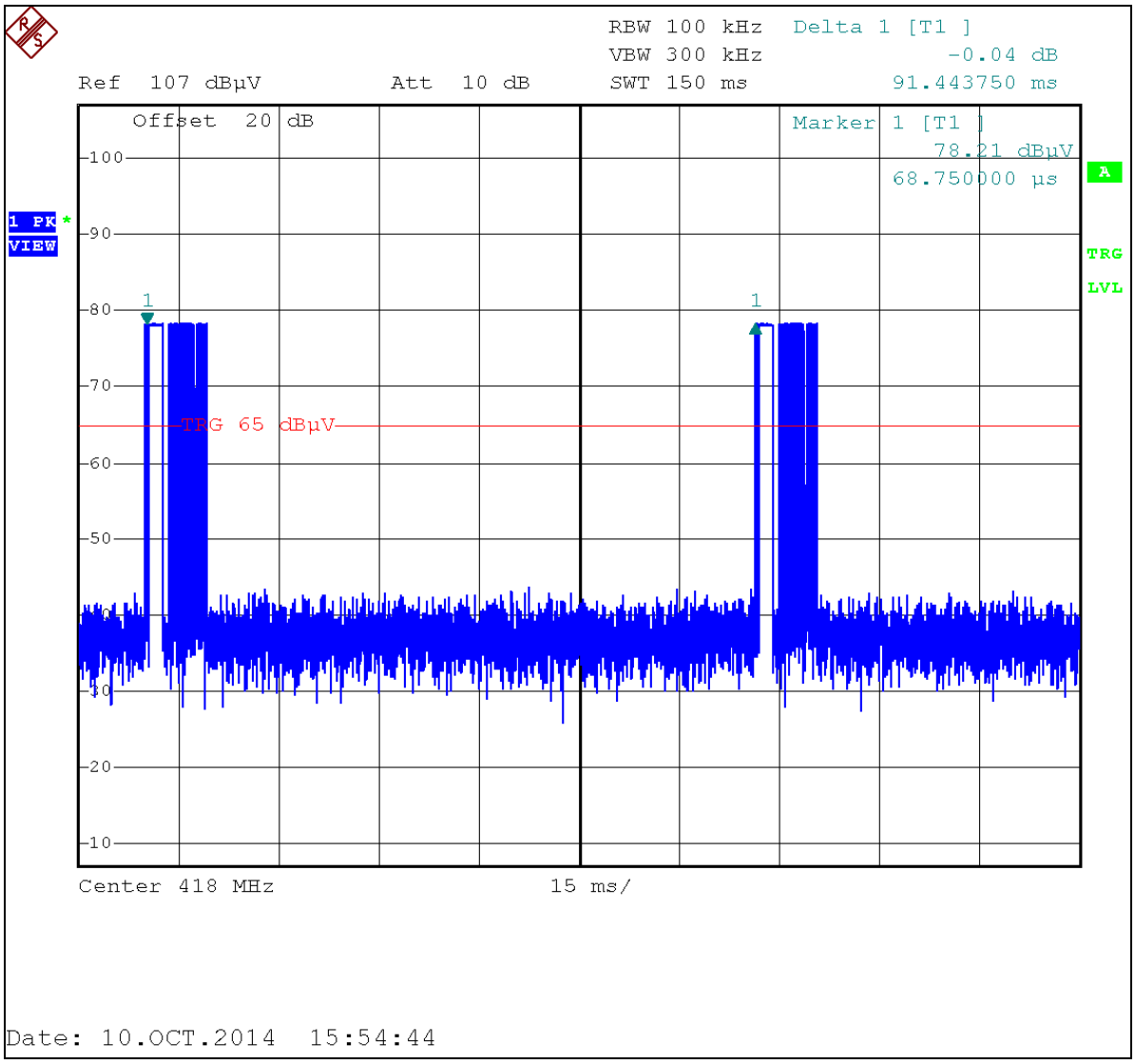
Limit Transmit Time	Maximum Measured Transmit Time
5 seconds	Immediate cessation as all power is removed, no measurement required.

See plotted results of duty cycle time appear below.

4.3.1 Transmitter On Time



4.3.2 Transmitter On Time



5.0 Occupied Bandwidth

5.1 Test Procedure

The EUT is configured for best signal/power and the bandwidth then is measured. A recording of the results is included.

5.2 Test Criteria

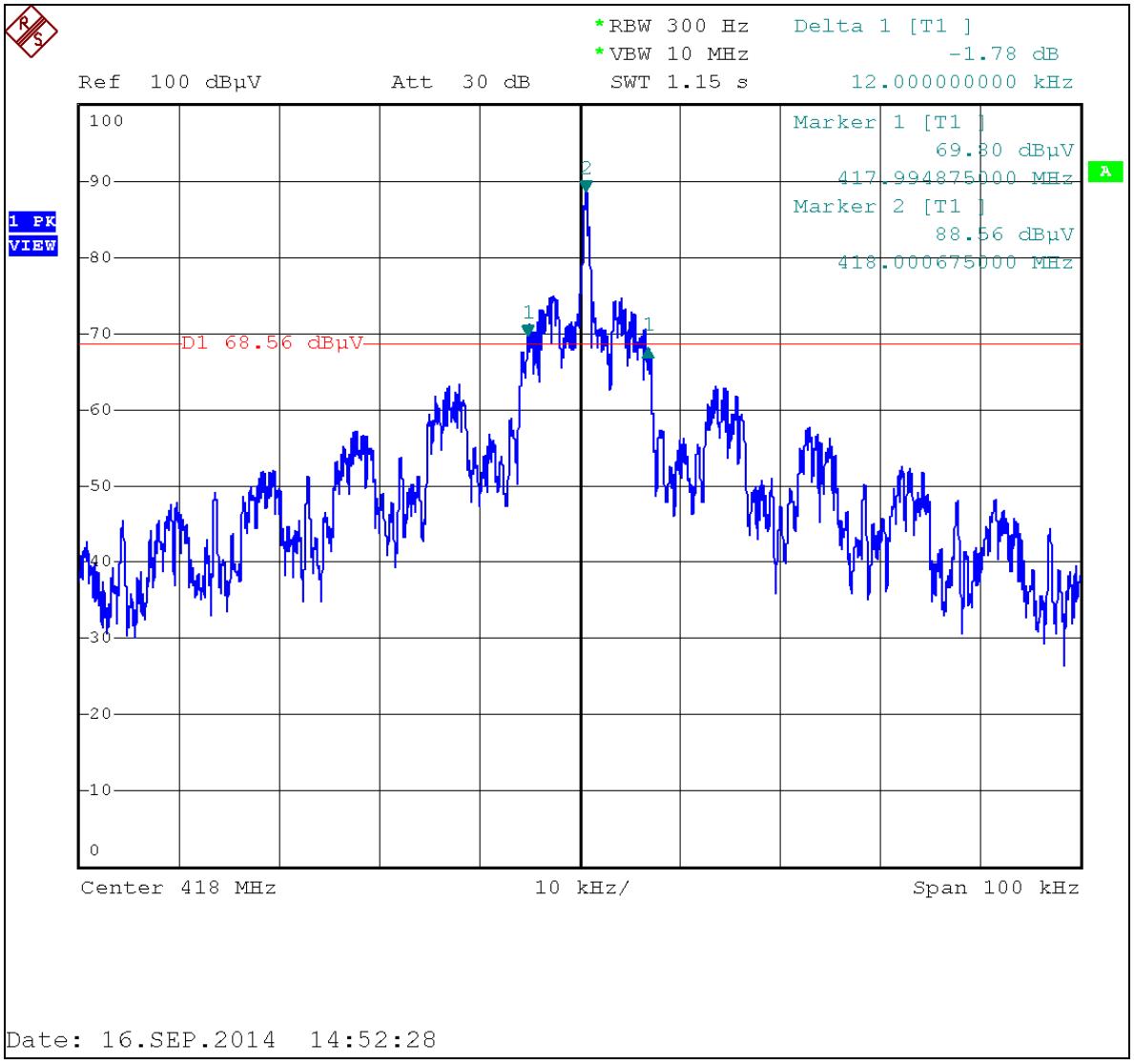
Section Reference FCC|IC	Parameter	Date(s)
15.231(c), 2.1049 | RSS210 A1.1.3	Bandwidth, 20 dB	2014-09-16

5.3 Test Results

Table 5.3.1: Bandwidth Limit and Measurement	
Limit 15.231(c) 20 dB BW For Fundamental = 418 MHz 0.25% of Fundamental kHz	**Measured BW 20 dB kHz**
1045	12.0

EUT was found to be in compliance with applicable requirements.

5.3.1 Bandwidth Plot

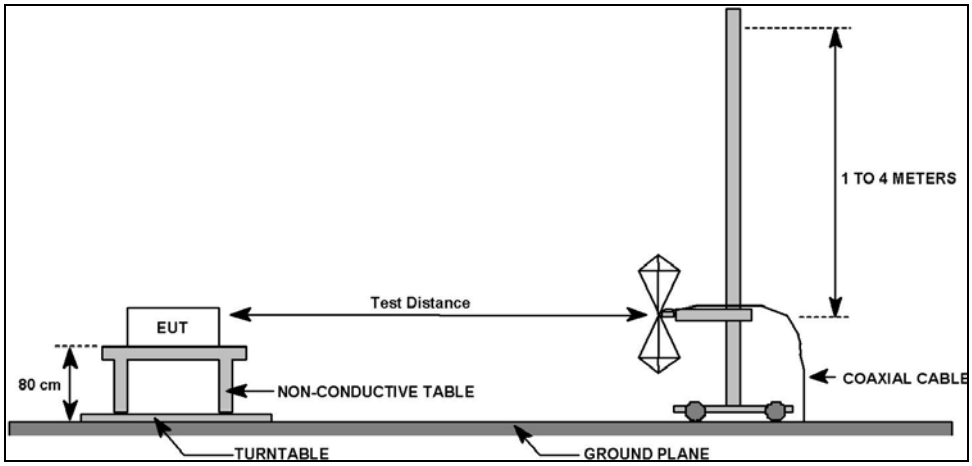


6.0 Radiated Spurious Emissions Below 1 GHz

6.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a rotating turntable at a distance of 10 meters from the measurement antenna.

Spurious emissions below 1 GHz were measured with quasi-peak detection with a resolution bandwidth of 120 kHz. A diagram showing the test setup is given in the figure below.



Field Strength of Spurious Emissions Test Setup

6.2 Test Criteria

Section Number FCC | IC	Clause Subject	Date
15.231(a), 15.209 | RSS-210 A1.1 Table A	Field Strength of Radiated Spurious/Harmonic Emissions	2014-09-21 2014-11-16

6.3 Test Results

The fundamental signal also appears in the measurements taken.

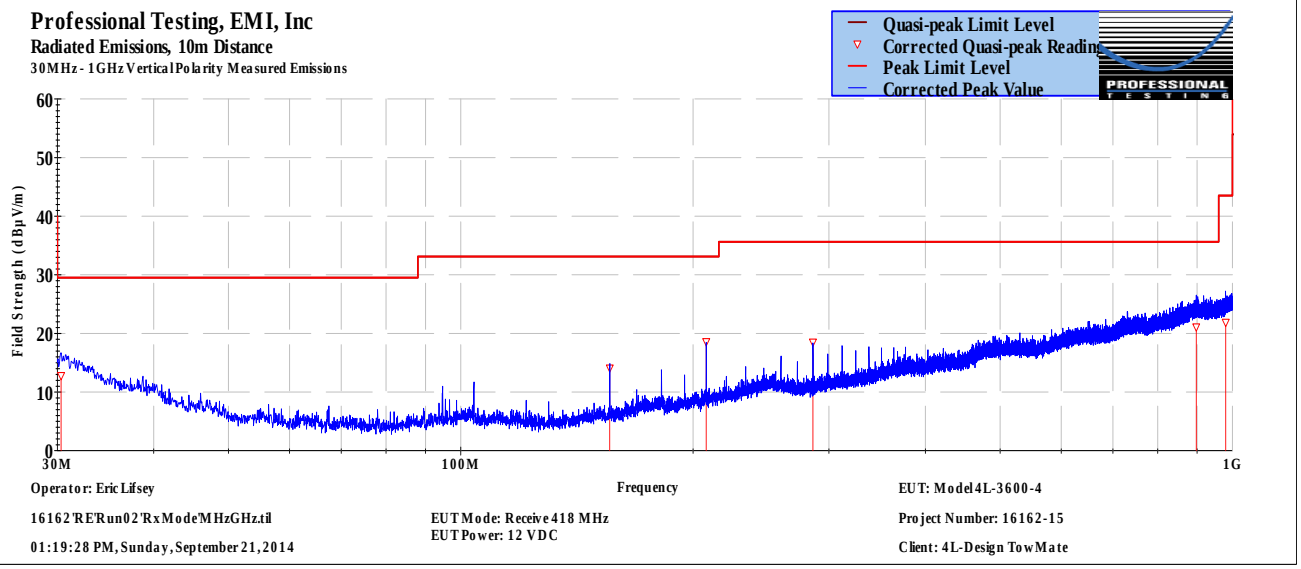
The EUT satisfied the criteria. Recorded data is presented below.

6.3.1 Receive Mode, Vertical Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/21/2014	EUT Serial #:	None
Customer:	4L-Design Towmate	EUT Part #:	None
Project Number:	16162-15	Test Technician:	Eric Lifsey
Purchase Order #:	Not Listed	Supervisor:	Lisa Arndt
Equip. Under Test:	4L-3600-4	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	12 VDC	EUT Power Frequency:	- N/A
Antenna Orientation:	Vertical	Frequency Range:	30MHz to 1GHz
EUT Mode of Operation:		Receive Mode	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
30.3357	10	74	3.78	Quasi-peak	24	12.786	29.5	-16.7	Pass
156.007	10	308	1.79	Quasi-peak	33.5	14.071	33.1	-19.0	Pass
208.018	10	229	1.68	Quasi-peak	35	18.576	33.1	-14.5	Pass
286.007	10	332	1.18	Quasi-peak	32.4	18.504	35.6	-17.1	Pass
897.592	10	351	2.36	Quasi-peak	21.4	21.092	35.6	-14.5	Pass
980.215	10	242	2.96	Quasi-peak	21.1	21.883	43.5	-21.6	Pass



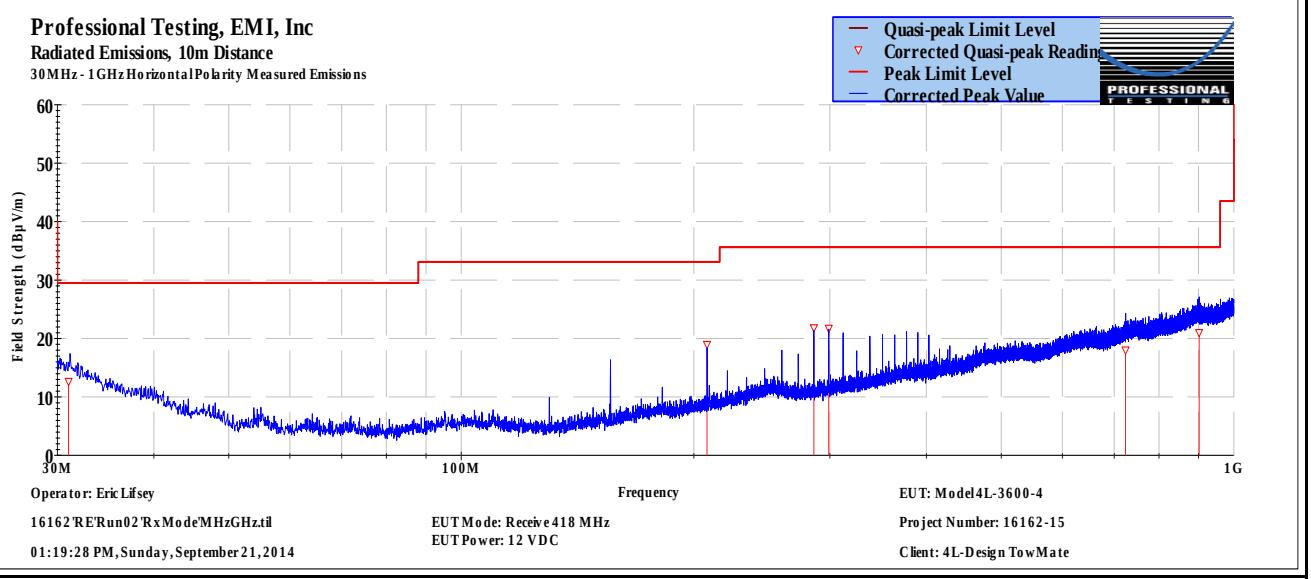
≤ 1GHz Vertical Antenna Polarity Measured Emissions

6.3.2 Receive Mode, Horizontal Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/21/2014	EUT Serial #:	None
Customer:	4L-Design Towmate	EUT Part #:	None
Project Number:	16162-15	Test Technician:	Eric Lifsey
Purchase Order #:	Not Listed	Supervisor:	Lisa Arndt
Equip. Under Test:	4L-3600-4	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	12 VDC	EUT Power Frequency:	- N/A
Antenna Orientation:	Horizontal	Frequency Range:	30MHz to 1GHz
EUT Mode of Operation:		Receive Mode	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
31.0163	10	83	2.46	Quasi-peak	24.2	12.659	29.5	-16.8	Pass
208.007	10	243	3.71	Quasi-peak	35.4	18.998	33.1	-14.1	Pass
286.012	10	251	2.83	Quasi-peak	35.7	21.824	35.6	-13.8	Pass
299.003	10	230	2.29	Quasi-peak	35.2	21.744	35.6	-13.9	Pass
724.303	10	148	1.43	Quasi-peak	21.8	18.025	35.6	-17.6	Pass
901.847	10	80	2.54	Quasi-peak	21.2	21.007	35.6	-14.6	Pass



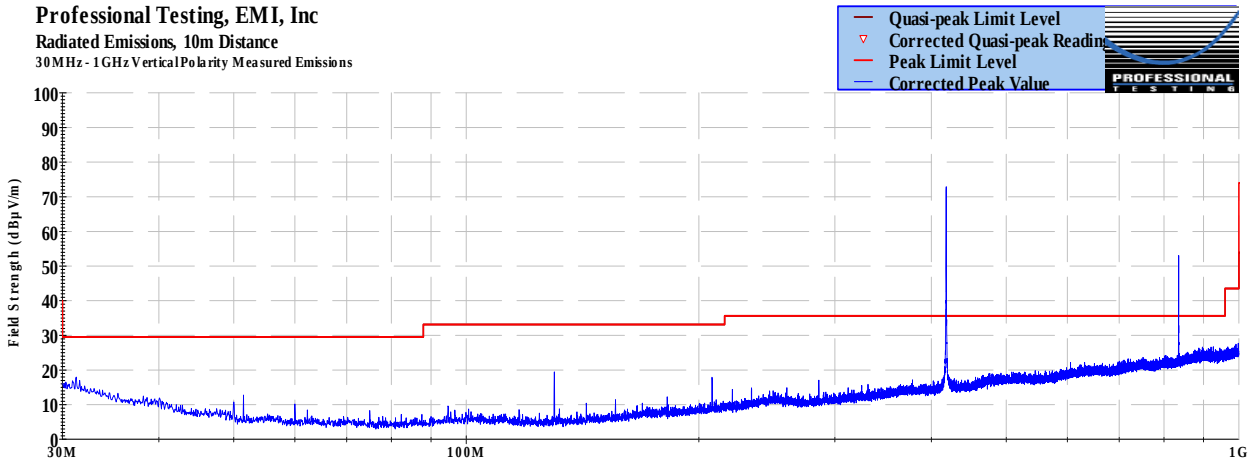
≤ 1GHz Horizontal Antenna Polarity Measured Emissions

6.3.3 Transmit Mode, Vertical Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/16/2014	EUT Serial #:	Sample B.GreenDot
Customer:	4L-Design Towmate	EUT Part #:	None
Project Number:	16162-15	Test Technician:	Eric Lifsey
Purchase Order #:	Not Listed	Supervisor:	Lisa Arndt
Equip. Under Test:	4L-3600-4	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	12 VDC	EUT Power Frequency:	- N/A
Antenna Orientation:	Vertical	Frequency Range:	30MHz to 1GHz
EUT Mode of Operation:		Transmit Mode, Unmodulated, Fund & Spur	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
418	10	0	4	Peak	72.9	72.9	89.8	-16.9	Pass
836	10	0	4	Peak	53	53	80.2	-27.2	Pass
418	10	0	4	average	72.9	52.9	69.8	-16.9	Pass
836	10	0	4	average	53	33	60.2	-27.2	Pass



≤ 1GHz Vertical Antenna Polarity Measured Emissions

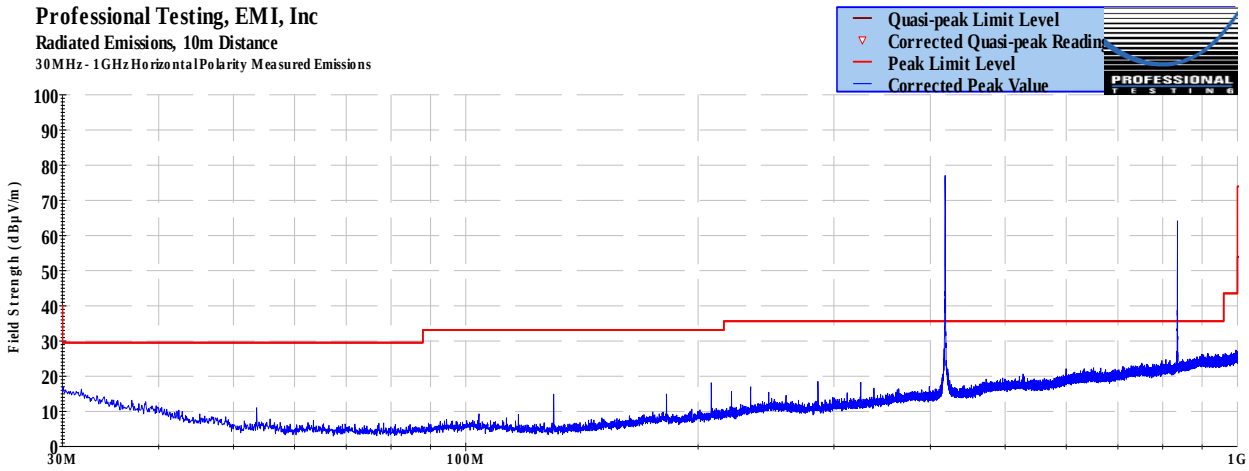
6.3.4 Transmit Mode, Horizontal Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/16/2014	**EUT Serial #:**	Sample B.GreenDot
Customer:	4L-Design Towmate	**EUT Part #:**	None
Project Number:	16162-15	**Test Technician:**	Eric Lifsey
Purchase Order #:	Not Listed	**Supervisor:**	Lisa Arndt
Equip. Under Test:	4L-3600-4	**Witness' Name:**	None

Radiated Emissions Test Results Data Sheet — Page: 1 of 1

EUT Line Voltage:	12 VDC	**EUT Power Frequency:**	- N/A
Antenna Orientation:	Horizontal	**Frequency Range:**	30MHz to 1GHz
EUT Mode of Operation:		Transmit Mode, Unmodulated, Fund & Spur	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
418	10	0	4	Peak	77.1	77.1	89.8	-12.7	Pass
836	10	0	4	Peak	64.1	64.1	80.2	-16.1	Pass
418	10	0	4	average	77.1	57.1	69.8	-12.7	Pass
836	10	0	4	average	64.1	44.1	60.2	-16.1	Pass



≤ 1GHz Horizontal Antenna Polarity Measured Emissions

7.0 Radiated Spurious Emissions Above 1 GHz

7.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a rotating turntable at a distance of 1 meter from the measurement antenna.

Harmonic emissions above 1 GHz peak were measured with peak detection, a resolution bandwidth of 1 MHz, and at a distance of 3 meters. If peak measurements exceeded average limits, the peak limit was applicable and duty cycle factor was then applied for average level calculation. Emissions were investigated up to at least the 10^{th} harmonic of the transmitter fundamental.

Non-harmonic spurious emissions must satisfy the average limit and the peak limit (20 dB above average).

7.2 Test Criteria

Section Number FCC | IC	Clause Subject	Date
15.231(a), 15.209 | RSS-210 A1.1 Table A	Field Strength of Radiated Spurious/Harmonic Emissions	2014-09-21 2014-11-16

7.3 Test Results

Emissions were measured in peak detection mode. All recorded emissions were harmonics of the fundamental. For each emission the average duty cycle factor (-20 dB) would apply. Therefore, the emissions must remain under the peak limit of 74 dBµV/m to also satisfy the average limit. All emissions remained under the peak limit.

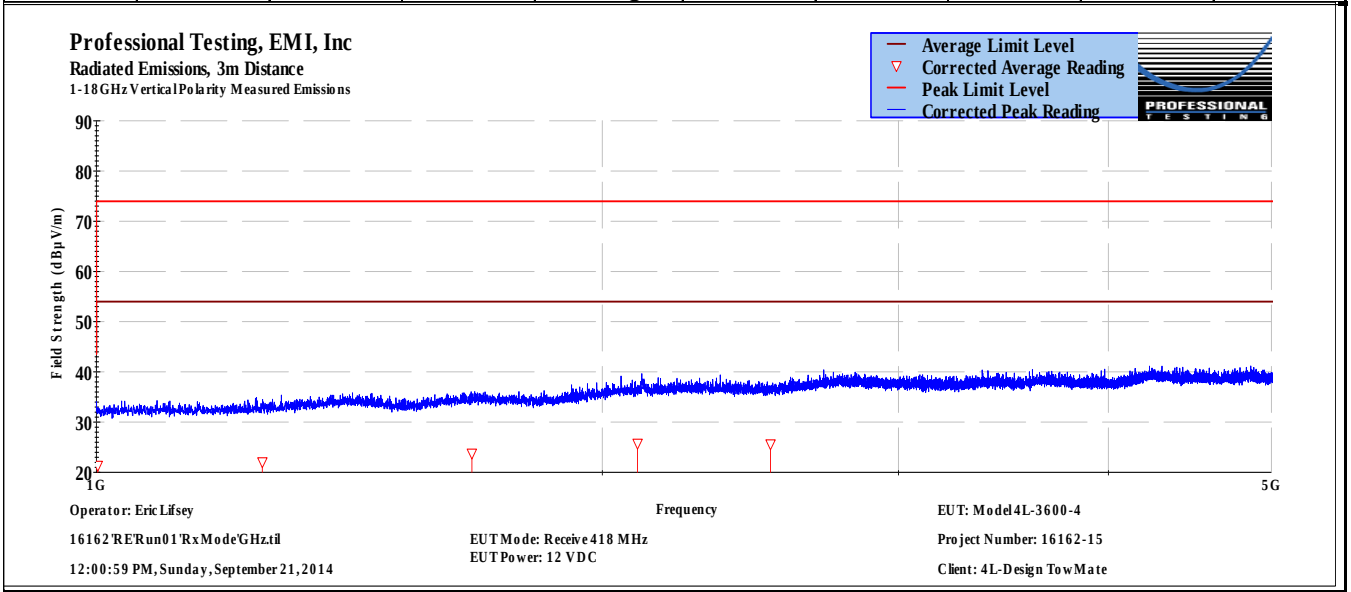
The EUT satisfied the criteria. Recorded data is presented below.

7.3.1 Receive Mode, Vertical Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/21/2014	EUT Serial #:	None
Customer:	4L-Design Towmate	EUT Part #:	None
Project Number:	16162-15	Test Technician:	Eric Lifsey
Purchase Order #:	Not Listed	Supervisor:	Lisa Arndt
Equip. Under Test:	4L-3600-4	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	12 VDC	EUT Power Frequency:	- N/A
Antenna Orientation:	Vertical	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Receive Mode	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1002.02	3	279	1	Average	35	21.362	54.0	-32.6	Pass
1255.42	3	80	1	Average	34.4	22.076	54.0	-31.9	Pass
1672.75	3	330	1	Average	35.4	23.775	54.0	-30.2	Pass
2098.68	3	146	1	Average	35.3	25.732	54.0	-28.2	Pass
2517.84	3	65	1	Average	34.5	25.621	54.0	-28.3	Pass



> 1GHz Vertical Antenna Polarity Measured Emissions

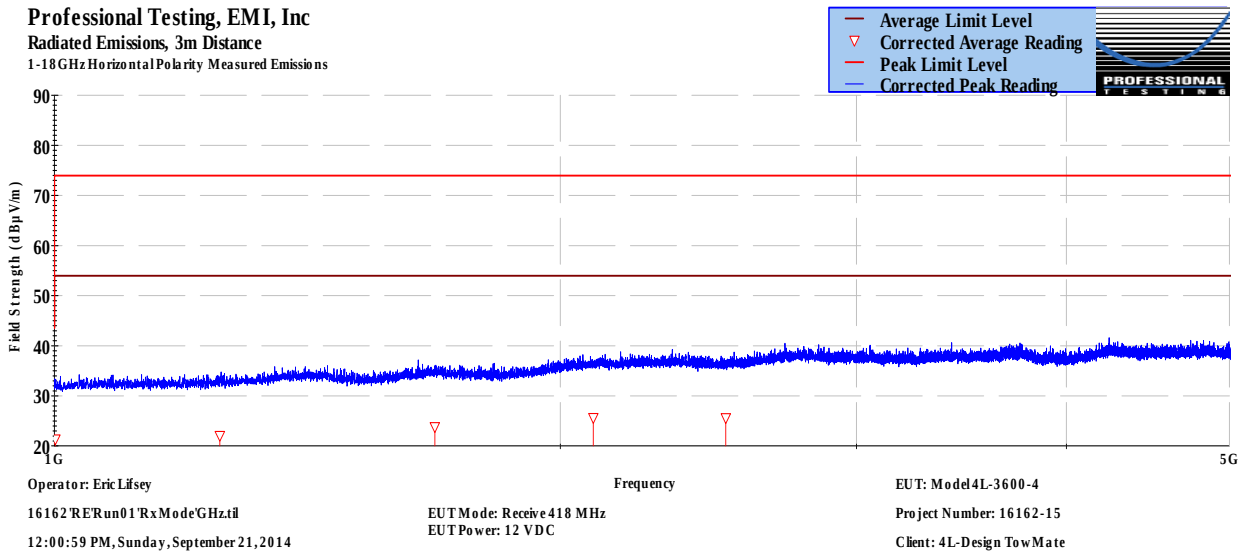
Detector mode peak. Resolution bandwidth 1 MHz. Video bandwidth 3 MHz.

7.3.2 Receive Mode, Horizontal Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/21/2014	EUT Serial #:	None
Customer:	4L-Design Towmate	EUT Part #:	None
Project Number:	16162-15	Test Technician:	Eric Lifsey
Purchase Order #:	Not Listed	Supervisor:	Lisa Arndt
Equip. Under Test:	4L-3600-4	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	12 VDC	EUT Power Frequency:	- N/A
Antenna Orientation:	Horizontal	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Receive Mode	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1001.54	3	181	1	Average	35	21.358	54.0	-32.6	Pass
1254.48	3	166	1	Average	34.4	22.074	54.0	-31.9	Pass
1684.1	3	50	1	Average	35.3	23.814	54.0	-30.1	Pass
2092.18	3	285	1	Average	35.2	25.621	54.0	-28.3	Pass
2508.78	3	209	2	Average	34.5	25.592	54.0	-28.4	Pass



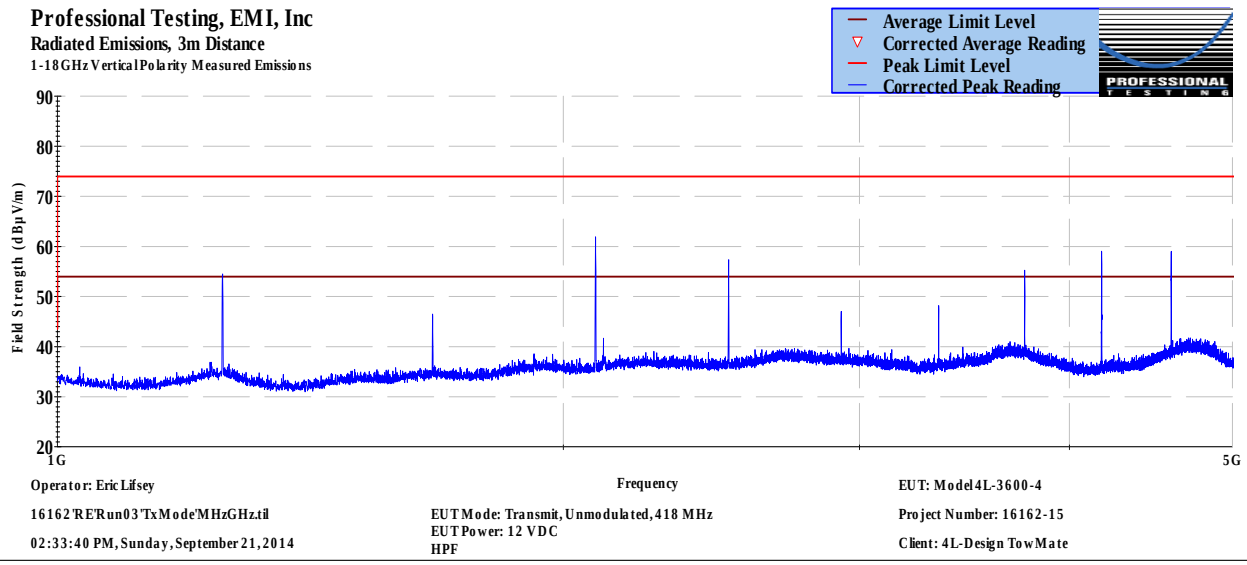
> 1GHz Horizontal Antenna Polarity Measured Emissions

Detector mode peak. Resolution bandwidth 1 MHz. Video bandwidth 3 MHz.

7.3.3 Transmit Mode, Vertical Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/21/2014	EUT Serial #:	None
Customer:	4L-Design Towmate	EUT Part #:	None
Project Number:	16162-15	Test Technician:	Eric Lifsey
Purchase Order #:	Not Listed	Supervisor:	Lisa Arndt
Equip. Under Test:	4L-3600-4	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page:	1	of	1
EUT Line Voltage:	12	VDC	EUT Power Frequency:	-	N/A	
Antenna Orientation:	Vertical		Frequency Range:	Above 1GHz		
EUT Mode of Operation:	Transmit Mode, Unmodulated					



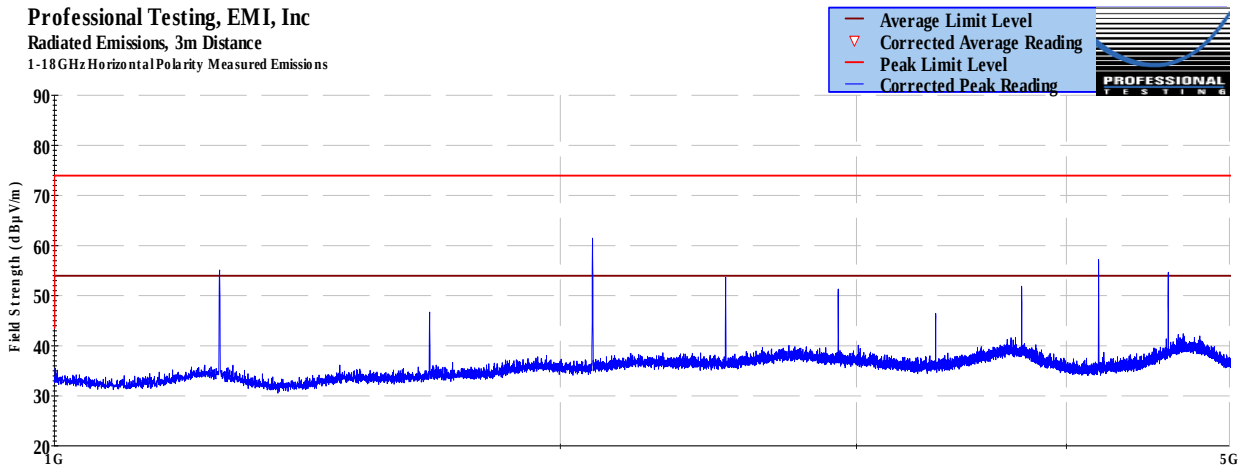
> 1GHz Vertical Antenna Polarity Measured Emissions

Detector mode peak. Resolution bandwidth 1 MHz. Video bandwidth 3 MHz.
(Note that average duty cycle factor is -20 dB and the peaks shown above result in passing averages.)

7.3.4 Transmit Mode, Horizontal Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	9/21/2014	EUT Serial #:	None
Customer:	4L-Design Towmate	EUT Part #:	None
Project Number:	16162-15	Test Technician:	Eric Lifsey
Purchase Order #:	Not Listed	Supervisor:	Lisa Arndt
Equip. Under Test:	4L-3600-4	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page:	1	of	1
EUT Line Voltage:	12	VDC	EUT Power Frequency:	-	N/A	
Antenna Orientation:	Horizontal		Frequency Range:	Above 1GHz		
EUT Mode of Operation:			Transmit Mode, Unmodulated			



> 1GHz Horizontal Antenna Polarity Measured Emissions

Detector mode peak. Resolution bandwidth 1 MHz. Video bandwidth 3 MHz.
(Note that average duty cycle factor is -20 dB and the peaks shown above result in passing averages.)

8.0 Antenna Construction Requirements

8.1 Procedure

A direct examination of the antenna construction is performed and compared to rule criteria that prevents wireless device antennas from being modified by end users in ways that would void their authorization to use the device.

8.2 Criteria

Section Number FCC | IC	Clause Subject	Date
15.203 | RSS-Gen	Antenna Construction	2014-11-30

8.3 Results

Antenna Manufacturer, Details
Manufactured by: TowMate Antenna is a fixed length of insulated wire soldered directly to the circuit board. No external connector.

The antenna is not subject to user replacement or substitution.

The antenna design satisfies the requirements of the rules.

9.0 Equipment Lists

9.1 Equipment for Fundamental Power and Spurious Radiated Emissions

Professional Testing, EMI, Inc.			
Test Method:	**ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference,**		
In accordance with:	**FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits**		
Section:	**15.209**		
Test Date(s):	**9/21/2014 - 11/16/2014**	**EUT Serial #:**	**None**
Customer:	**4L-Design Towmate**	**EUT Part #:**	**None**
Project Number:	**16162-15**	**Test Technician:**	**Eric Lifsey**
Purchase Order #:	**Not Listed**	**Supervisor:**	**Lisa Arndt**
Equip. Under Test:	**4L-3600-4**	**Witness' Name:**	**None**

Radiated Emissions Test Equipment List	
Tile! Software Version:	**4.2.A, May 23, 2010, 08:38:52 AM**
Test Profile:	**Radiated Emissions_Profile Version October 12, 2011**

Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1509A	Braden	N/A	TDK 10M Chamber, NSA < 1 GHz	DAC-012915-005	11/29/2014
1890	HP	8447F	Preamp/Amp, 9kHz-1300MHz, 28/25dB	3313A05298	1/22/2015
1937	Agilent	E4440A	Spectrum Analyzer, 3 Hz - 26.5 GHz	MY44303298	12/2/2015
1926	ETS-Lindgren	3142D	Antenna, Biconilog, 26 MHz - 6 GHz	00135454	12/29/2014
C027	N/A	RG214	Cable Coax, N-N, 25m	none	10/22/2015
1327	EMCO	1050	Controller, Antenna Mast	none	N/A
0942	EMCO	11968D	Turntable, 4ft.	9510-1835	N/A
1969	HP	11713A	Attenuator/Switch Driver	3748A04113	N/A
1509B	Braden	N/A	TDK 10M Chamber, VSWR > 1 GHz	DAC-012915-005	11/16/2014
2004	Miteq	AFS44-00101800-2S-10P-44	Amplifier, 40dB, .1-18GHz	0	11/19/2014
C030	N/A	0	Cable Coax, N-N, 30m	none	10/10/2015
1780	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	00110313	1/21/2015
1325	EMCO	1050	Controller, Antenna Mast	9003-1461	N/A

9.2 Equipment for Timings and Bandwidth

Asset #	Manufacturer	Model #	Description	Calibration Due
1486	EMCO	3147	Log Periodic Antenna	Not Required
1342	Rohde & Schwarz	FSP-30	Spectrum Analyzer	2015-01-29

Appendix: Policy, Rationale, and Evaluation of EMC Measurement Uncertainty

All uncertainty calculations, estimates and expressions thereof shall be in accordance with NIST policy. Since PTI operates in accordance with NIST (NVLAP) Handbook 150-11: 2007, all instrumentation having an effect on the accuracy or validity of tests shall be periodically calibrated or verified traceable to national standards by a competent calibration laboratory. The certificates of calibration or verification on this instrumentation shall include estimates of uncertainty as required by NIST Handbook 150-11.

1. Rationale and Summary of Expanded Uncertainty.

Each piece of instrumentation at PTI that is used in making measurements for determining conformance to a standard (or limit), shall be assessed to evaluate its contribution to the overall uncertainty of the measurement in which it is used. The assessment of each item will be based on either a type A evaluation or a type B evaluation. Most of the evaluations will be type B, since they will be based on the manufacturer's statements or specifications of the calibration tolerances, or uncertainty will be stated along with a brief rationale for the type of evaluation and the resulting stated uncertainties.

The individual uncertainties included in the combined standard uncertainty for a specific test result will depend on the configuration in which the item of instrumentation is used. The combination will always be based on the law of propagation of uncertainty. Any systematic effects will be accommodated by including their uncertainties, in the calculation of the combined standard uncertainty; except that if the direction and amount of the systematic effect cannot be determined and separated from its uncertainty, the whole effect will be treated as uncertainty and combined along with the other elements of the test setup.

Type A evaluations of standard uncertainty will usually be based on calculating the standard deviation of the mean of a series of independent observations, but may be based on a least-squares curve fit or the analysis of variance for unusual situations. Type B evaluations of standard uncertainty will usually be based on manufacturer's specifications, data provided in calibration reports, and experience. The type of probability distribution used (normal, rectangular, a priori, or u-shaped) will be stated for each Type B evaluation.

In the evaluation of the uncertainty of each type of measurement, the uncertainty caused by the operator will be estimated. One notable operator contribution to measurement uncertainty is the manipulation of cables to maximize the measured values of radiated emissions. The operator contribution to measurement uncertainty is evaluated by having several operators independently repeat the same test. This results in a Type A evaluation of operator-contributed measurement uncertainty.

A summary of the expanded uncertainties of PTI measurements is shown as Table 1. These are the worst-case uncertainties considering all operative influence factors.

Table 1: Summary of Measurement Uncertainties for Site 45

Type of Measurement	Frequency Range	Meas. Dist.	Expanded Uncertainty U, dB (k=2)
Mains Conducted Emissions	150 kHz to 30 MHz	N/A	2.9
Telecom Conducted Emissions	150 kHz to 30 MHz	N/A	2.8
Radiated Emissions	30 to 1,000 MHz	10 m	4.8
	1 to 18 GHz	3 m	5.7

End of Report

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