

# Electromagnetic Compatibility Test Report

*Prepared in accordance with*

**EN 55022:2006+A1:2007**

On

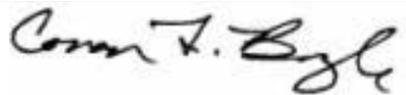
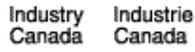
**DC DC Converter  
LTM4612**

For

**Linear Technology Corporation  
1630 McCarthy Blvd.  
Milpitas, CA 95035  
U.S.A.**

Prepared by:

**TUV Rheinland of North America, Inc.  
2305 Mission College Blvd., Suite 105  
Santa Clara, CA 95054  
U.S.A.**

<b>Auftraggeber:</b> <i>Client:</i>		Linear Technology Corporation 1630 McCarthy Blvd. Milpitas, CA 95035		Eddie Beville Main (408) 432-1900 Ext. 3007 Fax (408)-434-0507 ebeville@linear.com	
<b>Bezeichnung:</b> <i>Identification:</i>	DC DC Converter		<b>Serien-Nr.:</b> <i>Serial No.</i>	None	
<b>Gegenstand der Prüfung:</b> <i>Test item:</i>	LTM4612		<b>Prüfdatum:</b> <i>Date tested:</i>	February 12 <sup>th</sup> , 2011	
<b>Prüfört:</b> <i>Testing location:</i>	TUV Rheinland of North America 2305 Mission College Blvd., Suite 105 Santa Clara, CA 95054 U.S.A.			Tel: (925) 249-9123 Fax: (925) 249-9124	
<b>Prüfgrundlage:</b> <i>Test specification:</i>	Emissions: EN 55022:2006+A1:2007				
<b>Prüfergebnis:</b> <i>Test Result:</i>	<b>Der vorstehend beschriebene Prüfgegenstand wurde geprüft und entspricht oben genannter Prüfgrundlage. The above product was found to be Compliant to the above test standard(s)</b>				
<b>geprüft / tested by:</b> Jack Plotner			<b>kontrolliert / reviewed by:</b> Conan Boyle		
					
February 14, 2011			March 2, 2011		
<b>Datum</b> <i>Date</i>	<b>Name</b> <i>Name</i>	<b>Unterschrift</b> <i>Signature</i>	<b>Datum</b> <i>Date</i>	<b>Name</b> <i>Name</i>	<b>Unterschrift</b> <i>Signature</i>
<b>Sonstiges:</b> <i>Other Aspects:</i>		None			
Abkürzungen: OK, Pass, Compliant, Complies = entspricht Prüfgrundlage Fail, Not Compliant, Does not Comply = entspricht nicht Prüfgrundlage N/A = nicht anwendbar			Abbreviations: OK, Pass, Compliant, Complies = passed Fail, Not Compliant, Does Not Comply = failed N/A = not applicable		
					
US5251	NVLAP LAB CODE 100411-0	2932D-1		1097	

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## **1 General Information**

### **1.1 Scope**

This report is intended to document the status of conformance with the requirements of EN 55022:2006+A1:2007 based on the results of testing performed on February 12th, 2011, on the DC DC Converter, Model No. LTM4612, manufactured by Linear Technology. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

### **1.2 Purpose**

Testing was performed to evaluate the EMC performance of the EUT (Equipment Under Test) in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

**1.3 Summary of Test Results**

<b>Applicant</b>	Linear Technology Corporation 1630 McCarthy Blvd. Milpitas, CA 95035	<b>Tel</b>	(408) 432-1900	<b>Contact</b>	Eddie Beville
		<b>Fax</b>	(408)-434-0507	<b>e-mail</b>	ebeville@linear.com
<b>Description</b>	DC DC Converter	<b>Model Number</b>	LTM4612		
<b>Serial Number</b>	None	<b>Test Voltage/Freq.</b>	5 - 36 Vdc		
<b>Test Date Completed:</b>	February 12th, 2011	<b>Test Engineer</b>	Jack Plotner		
<b>Standards</b>	<b>Description</b>	<b>Severity Level or Limit</b>		<b>Criteria</b>	<b>Test Result</b>
EN 55022:2006+A1:2007 Product Family Standard Emissions	Information Technology Equipment – Radio Disturbance	See called out basic standards below		See Below	Complies
EN 55022:2006+A1:2007	Radiated Emissions	Class B, 30 - 1000 MHz		Limit	Complies

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## 2 Laboratory Information

### 2.1 Accreditations & Endorsements

#### 2.1.1 US Federal Communications Commission

 TUV Rheinland of North America located at 2305 Mission College Blvd, Suite 105, Santa Clara, CA 95054, is recognized by the commission for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No US5251). The laboratory scope of accreditation includes: Title 47 CFR Parts 15 and 18. The accreditation is updated every 3 years.

#### 2.1.2 NIST / NVLAP

 TUV Rheinland of North America is accredited by the National Voluntary Laboratory Accreditation Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Standard 17025:2005 (Lab Code: 100411-0). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

#### 2.1.3 Industry Canada

 **Industry Canada** / **Industrie Canada** Registration No.: 2932D-1. The 10 meter Semi-Anechoic Chamber has been accepted by Industry Canada to perform testing to 3 and 10 meters based on the test procedures described in ANSI C63.4-2003.

#### 2.1.4 Japan – VCCI

 The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland of North America at 1279 Quarry Ln, Pleasanton, CA 94566 has been assessed and approved in accordance with the Regulations for Voluntary Control Measures. (Registration Nos. R-2366, C-2585, C-2586, T-1635).

#### 2.1.5 Acceptance by Mutual Recognition Arrangement

 The United States has an established agreement with specific countries under the Asia Pacific Laboratory Accreditation Corporation (APLAC) Mutual Recognition Arrangement. Under this agreement, all TUV Rheinland at 1279 Quarry Lane, Pleasanton, CA 94566 test results and test reports within the scope of the laboratory NIST / NVLAP accreditation will be accepted by each member country.

## 2.2 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2005. Equipment calibration records are kept on file at the test facility.

## 2.3 Measurement Equipment Used

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal dd/mm/yy	Next Cal dd/mm/yy	Test
EMI Receiver (Receiver Section)	HP	85462A	3807A00445	12/03/2010	12/03/2011	RE
EMI Receiver (RF Filter Section)	HP	85460A	3704A00407	12/03/2010	12/03/2011	RE
9 kHz – 1 GHz Ant. Preamplifier	HP	8447D	2944A07486	1/17/2011	1/17/2012	RE
Bilog Antenna Emissions	EMCO	3142	9701-1117	07/14/2010	07/14/2011	RE

Notes: CE = Conducted Emissions, CI= Conducted Immunity, DP=Disturbance Power, EFT=Electrical Fast Transients, ESD = Electrostatic Discharge, FLI=Flicker, HAR=Harmonics, MF=Magnetic Field Immunity, RE=Radiated Emissions, RI=Radiated Immunity, SI=Surge Immunity, VDSI=Voltage Dips and Short Interruptions

### **3 Product Information**

#### **3.1 Product Description**

See Section 5.4.

#### **3.2 Equipment Modifications and Test Setup**

None.

#### **3.3 Test Plan**

The EUT product information, test configuration, mode of operation, test types, test procedures, test levels, pass/failure criteria, in this report were carried out per the product test plan located in Appendix A of this report

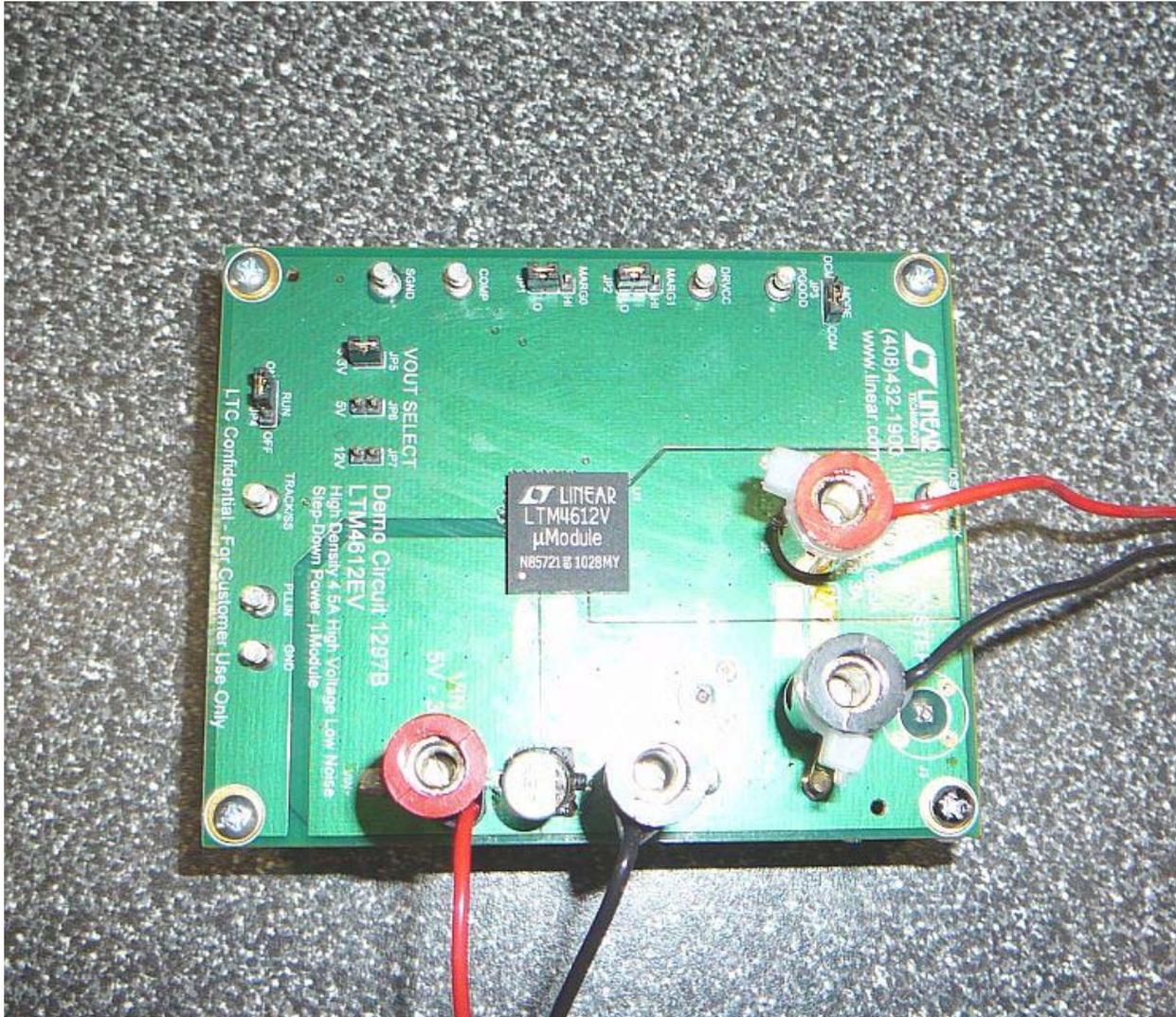


Figure 1 – Photo of EUT with Fixture – Front

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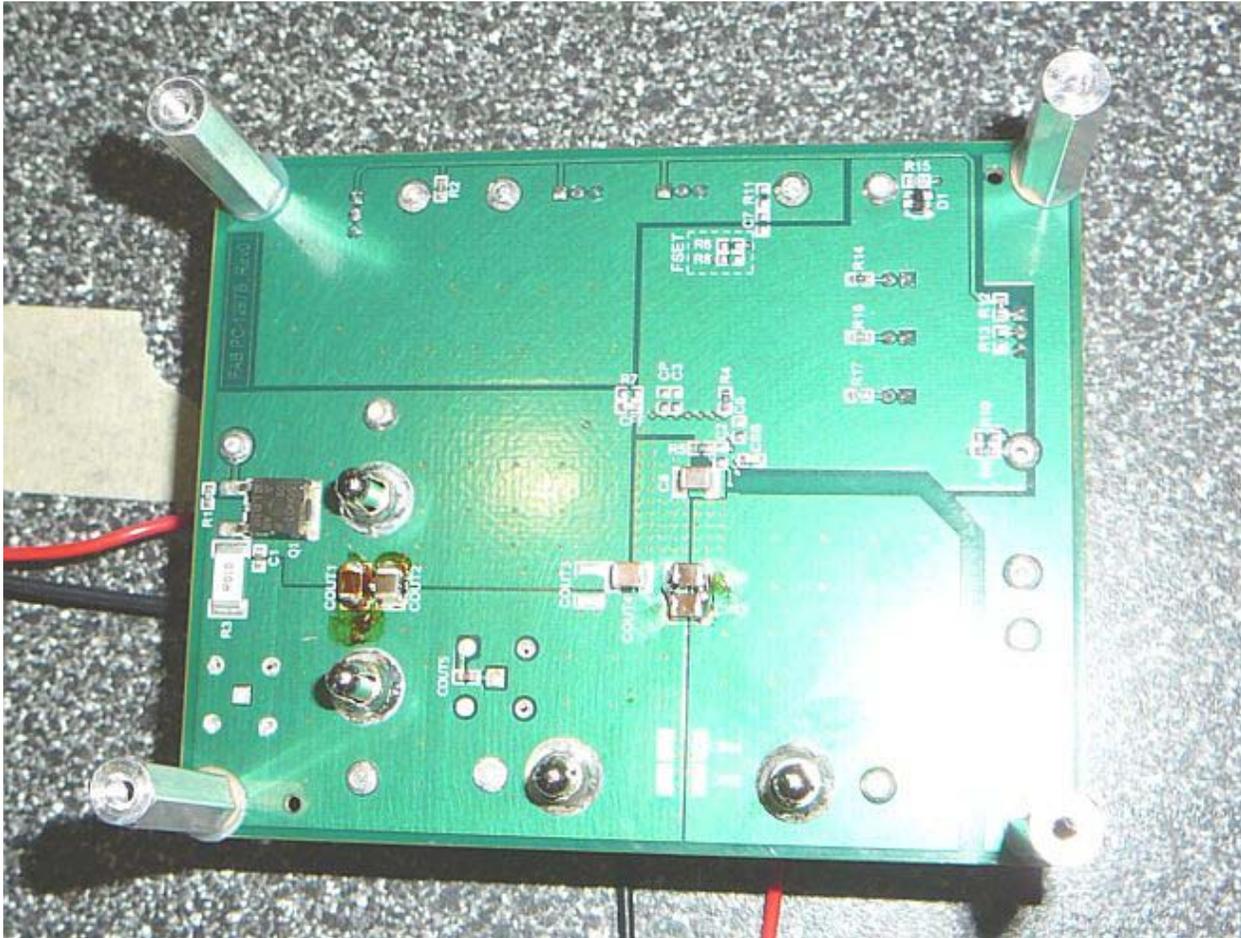


Figure 2 – Photo of EUT with Fixture – Back

## 4 Emissions

### 4.1 Radiated Emissions

This test measures the electromagnetic levels of spurious signals generated by the EUT that radiated from the EUT and may affect the performance of other nearby electronic equipment.

#### 4.1.1 Overview of Test

<b>Results</b>	<b>Complies</b> (as tested per this report)	<b>Date</b>	February 12 <sup>th</sup> , 2011
<b>Standard</b>	EN 55022:2006+A1:2007		
<b>Product Model</b>	LTM4612	<b>Serial#</b>	None
<b>Configuration</b>	See test plan for details.		
<b>Test Setup</b>	Tested in 10 meter chamber, placed on turntable, see test plan for details.		
<b>EUT Powered By</b>	5 - 36 Vdc		
<b>Frequency Range</b>	30 - 1000 MHz @ 10m		
<b>Perf. Criteria</b>	Class B (Below Limit)	<b>Perf. Verification</b>	Readings Under Limit
<b>Mod. to EUT</b>	None	<b>Test Performed By</b>	Jack Plotner

#### 4.1.2 Test Procedure

Radiated emissions tests were performed using the procedures of ANSI C63.4 including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration.

The frequency range from 30 - 1000 MHz was investigated for radiated emissions on all configurations.

#### 4.1.3 Deviations

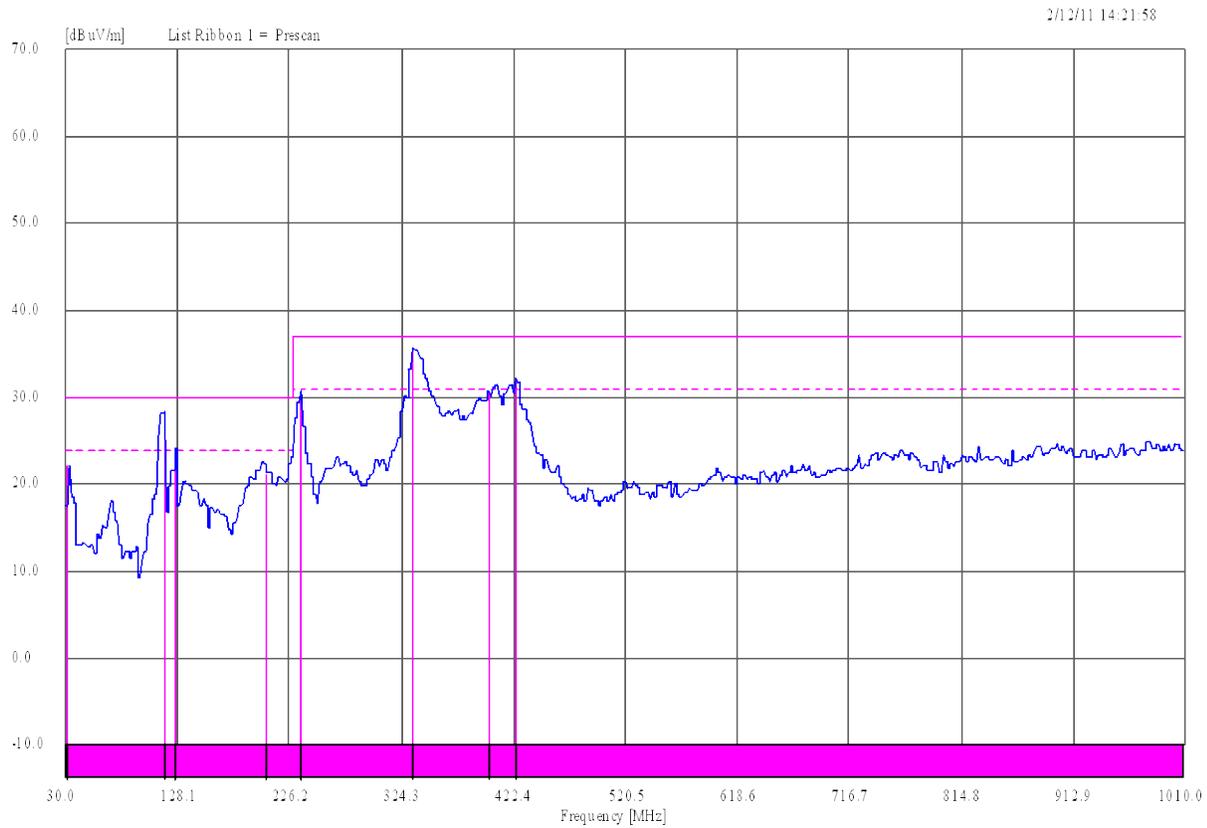
There were no deviations from the test methodology listed in the test plan for the radiated emission test.

#### 4.1.4 Final Test

All final radiated emissions measurements were below (in compliance) the limits.

### 4.1.5 Final Graphs

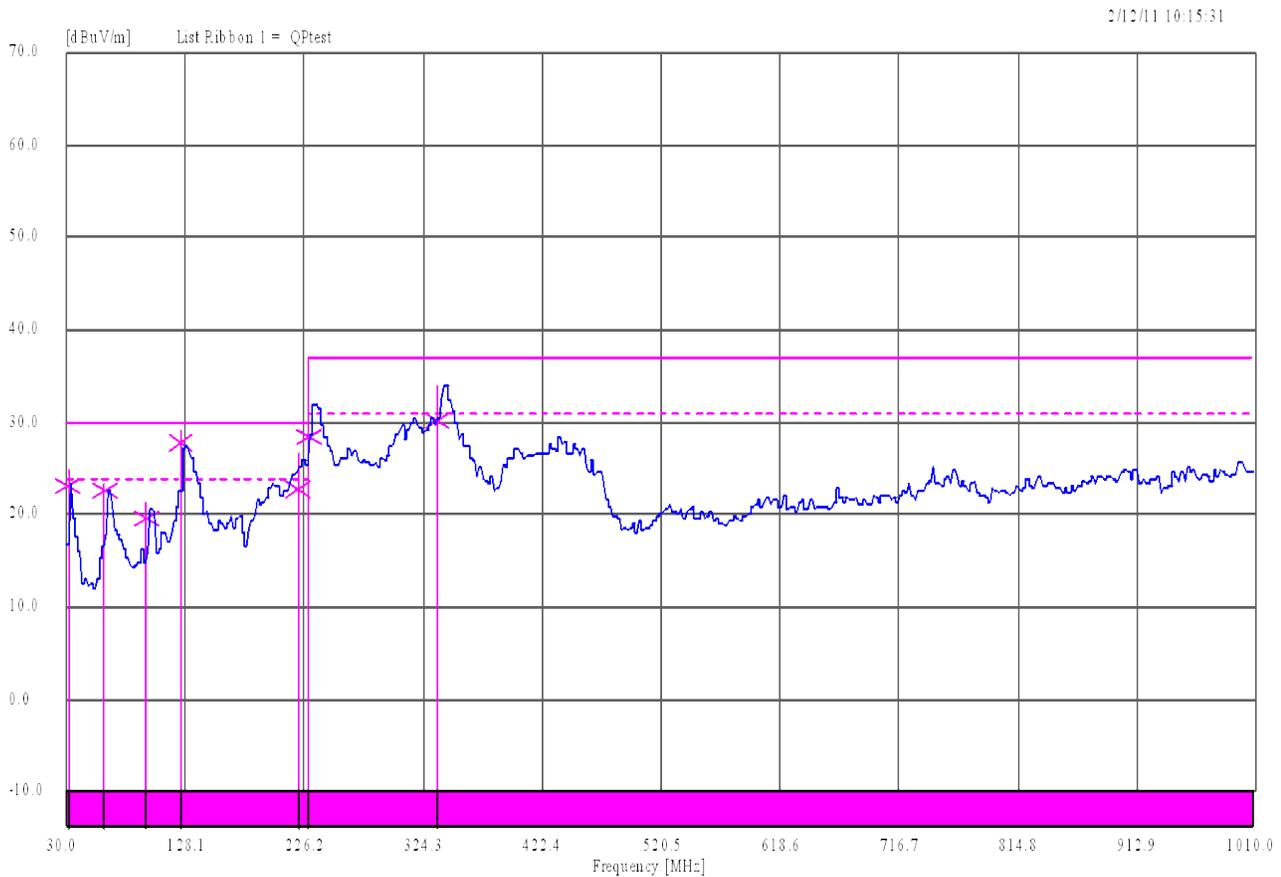
NOTES: 32 V Input / 12 V Output @ 3 Amps  
**Radiated Emissions 30 – 1000 MHz**  
Vertical / Horizontal



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NOTES: 24 V Input / 12 V Output @ 3 Amps

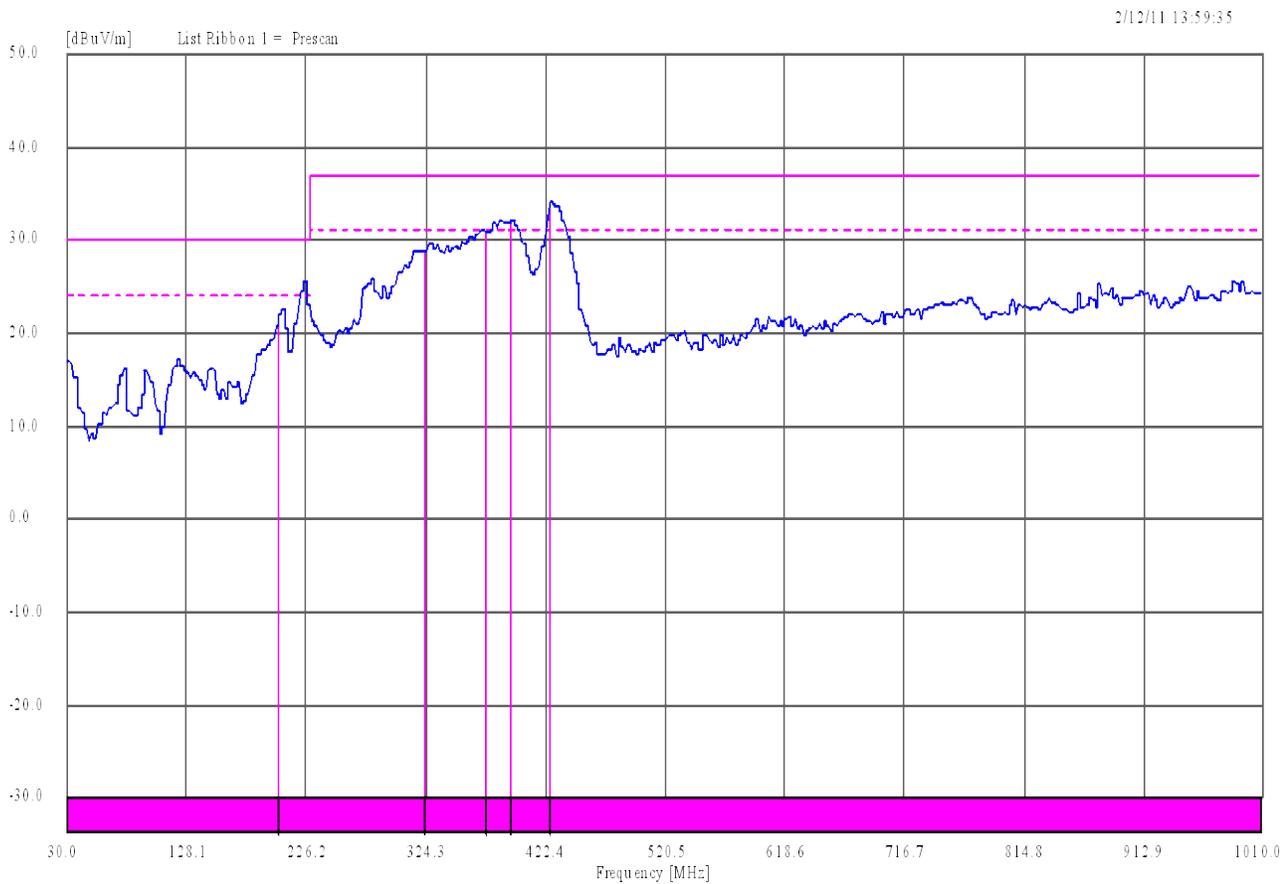
**Radiated Emissions 30 – 1000 MHz**  
Vertical / Horizontal



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NOTES: 32 V Input / 5 V Output @ 5 Amps

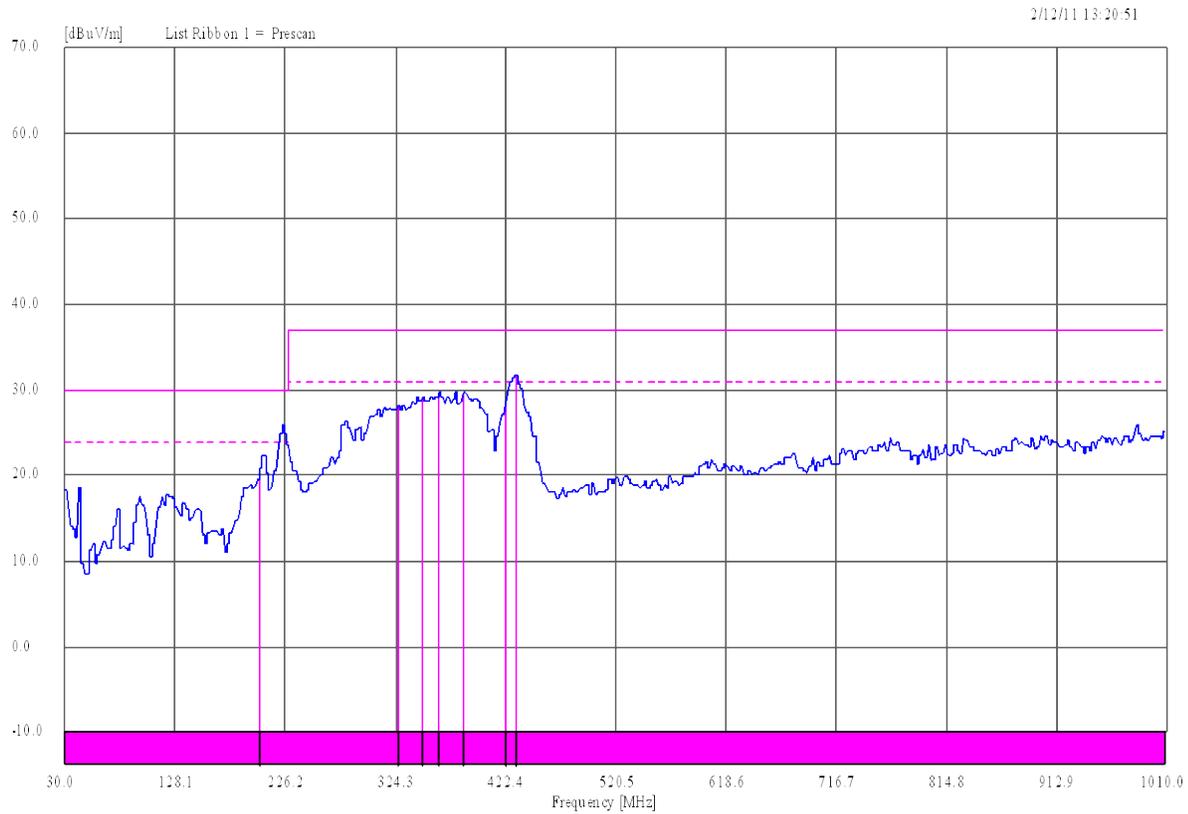
**Radiated Emissions 30 – 1000 MHz**  
Vertical / Horizontal



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NOTES: 24 V Input / 5 V Output @ 5 Amps

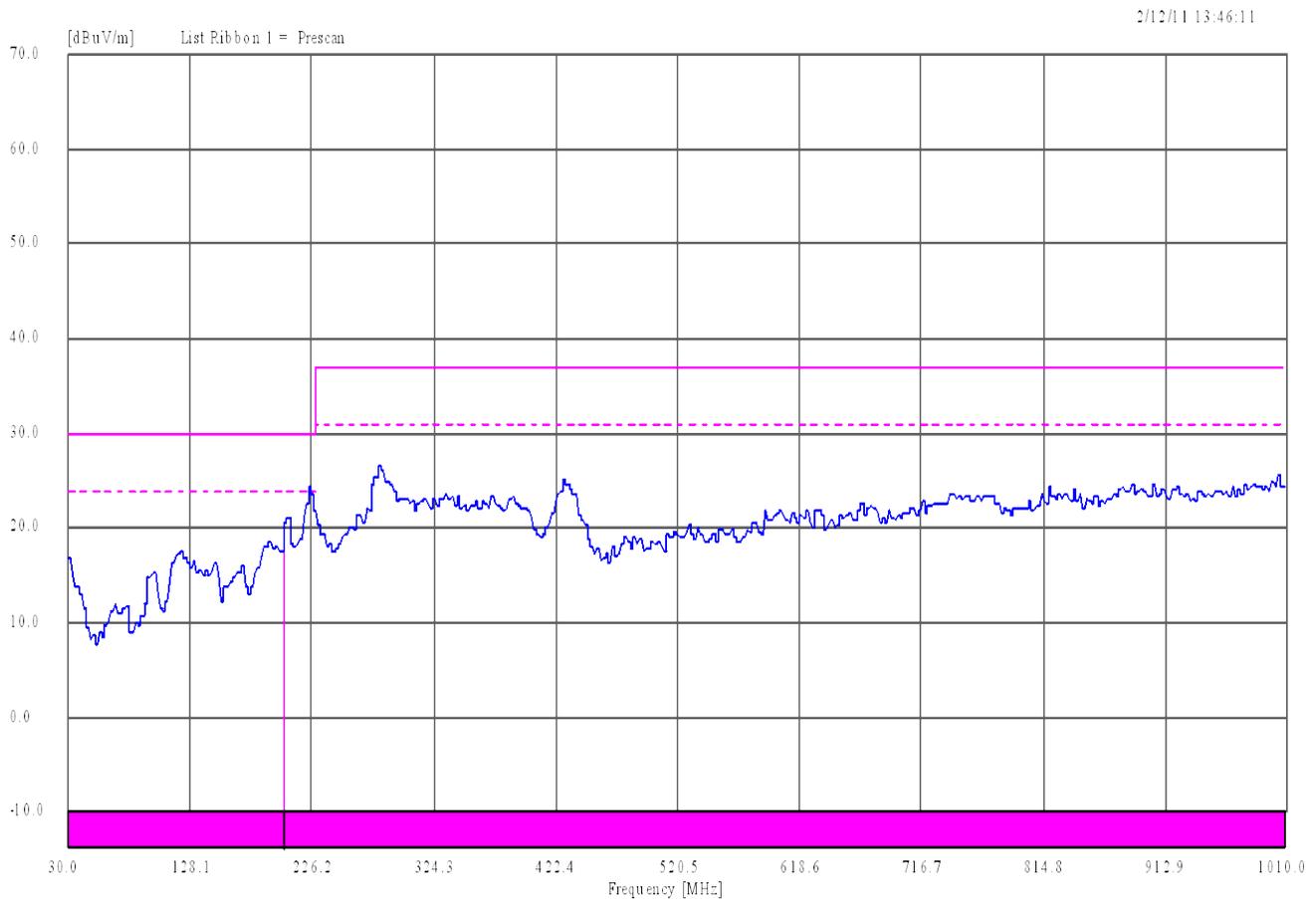
**Radiated Emissions 30 – 1000 MHz**  
**Vertical / Horizontal**



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NOTES: 12 V Input / 5 V Output @ 5 Amps

**Radiated Emissions 30 – 1000 MHz**  
Vertical / Horizontal

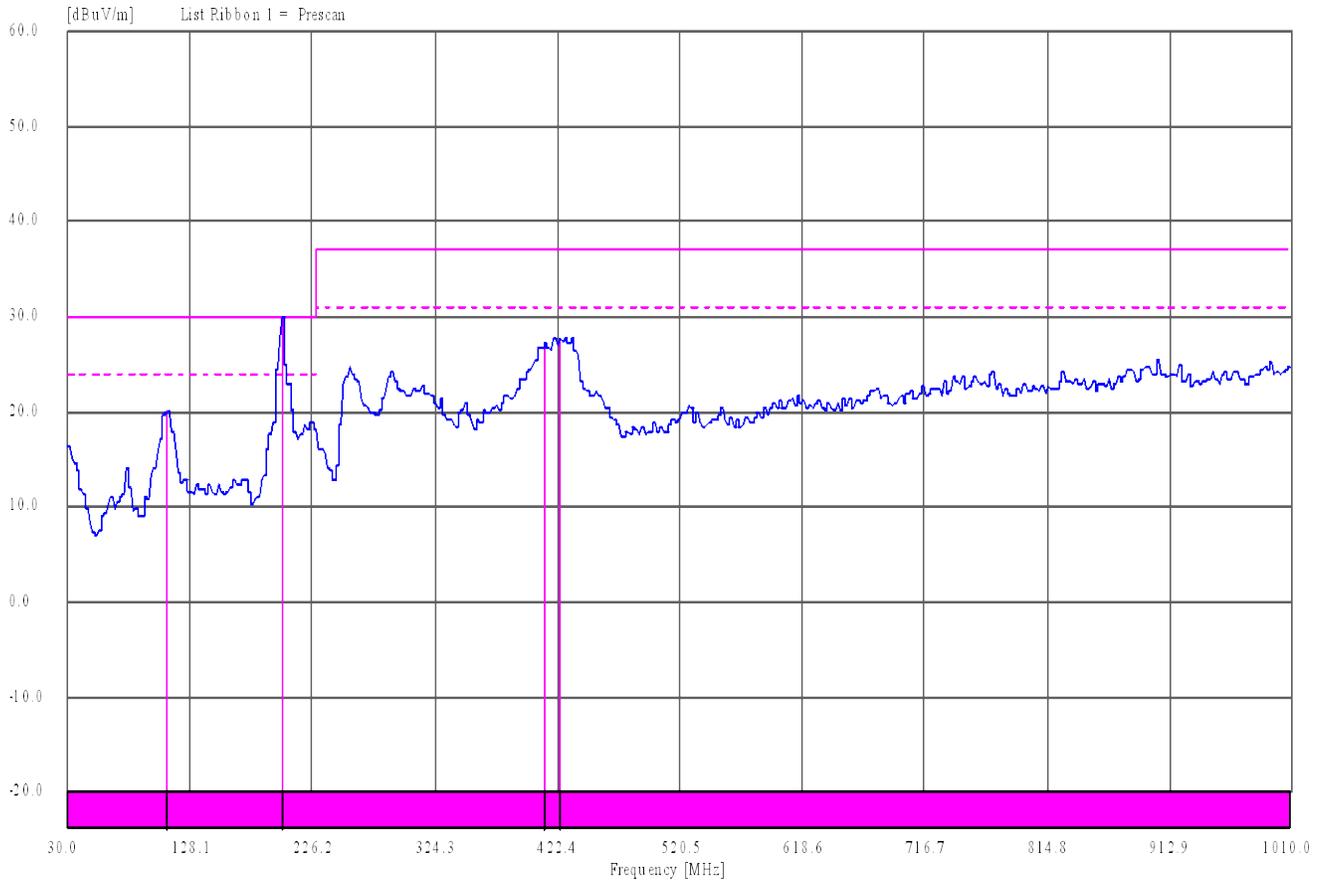


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NOTES: 32 V Input / 3.3 V Output @ 5 Amps

**Radiated Emissions 30 – 1000 MHz**  
Vertical / Horizontal

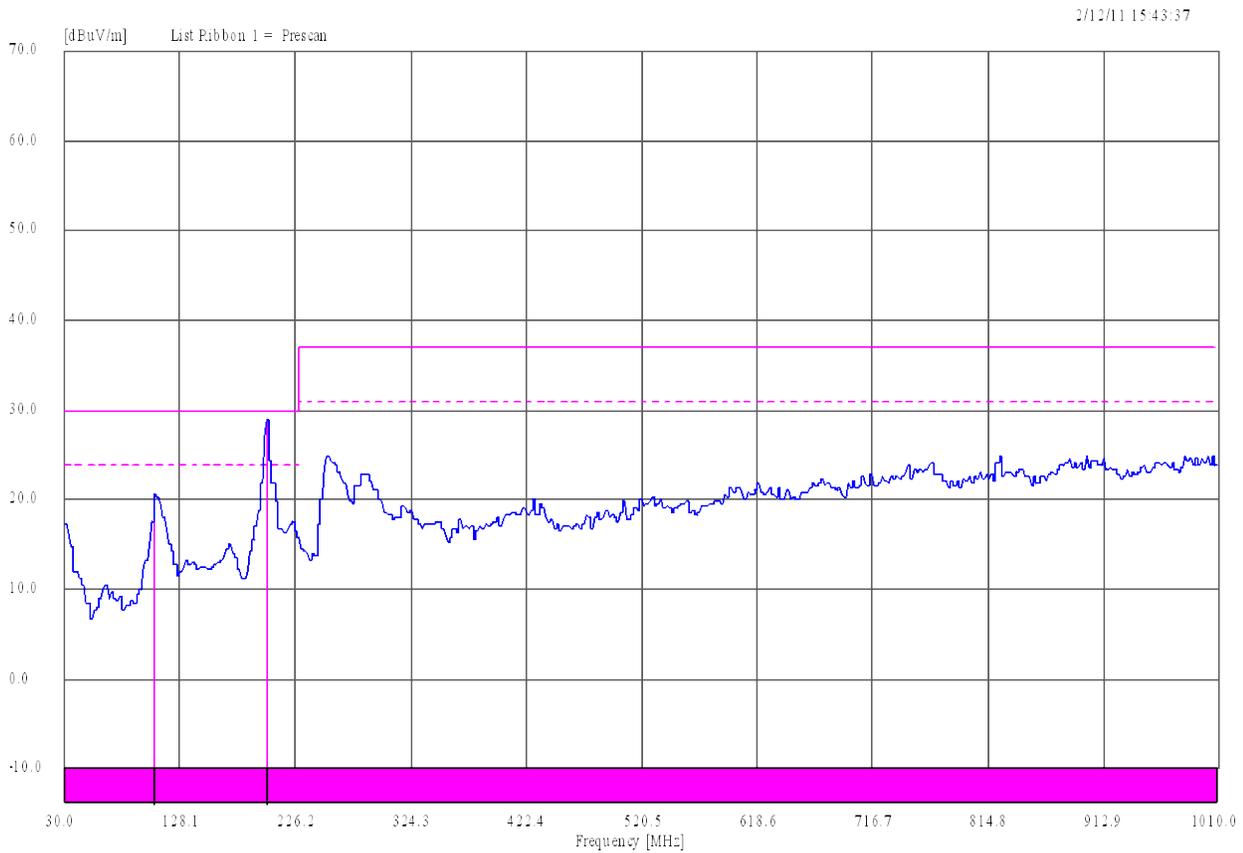
2/12/11 15:19:16



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NOTES: 12 V Input / 3.3 V Output @ 5 Amps

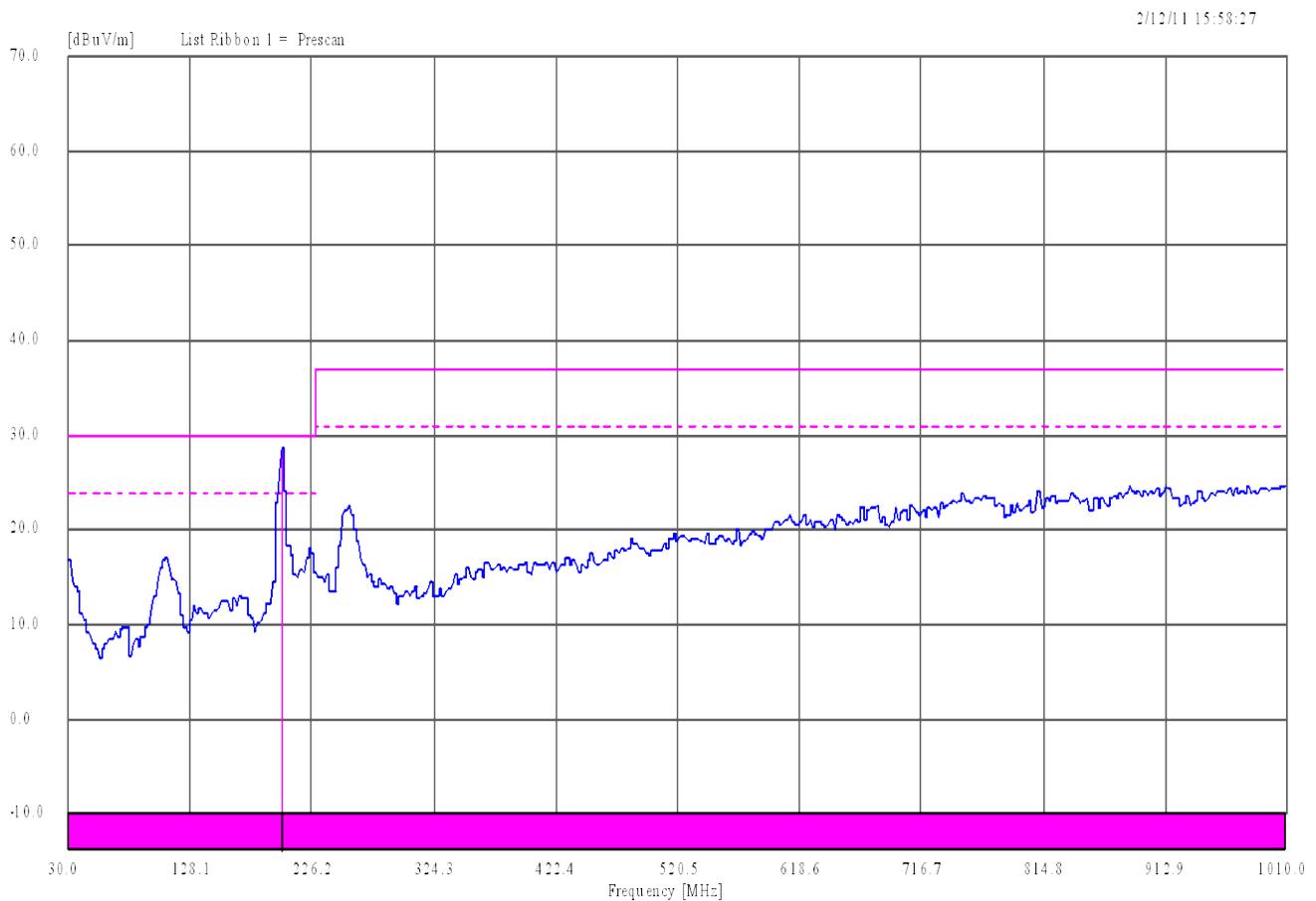
**Radiated Emissions 30 – 1000 MHz**  
Vertical / Horizontal



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NOTES: 5 V Input / 3.3 V Output @ 5 Amps

**Radiated Emissions 30 – 1000 MHz**  
**Vertical / Horizontal**



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#### 4.1.6 Radiated Emissions Scan Tabulated Data

32 V Input / 5 V Output @ 5 Amps

Frequency	Peak	QP	QP Lmt	QP Margin	Angle	Hgt	Pol	Total Correction
MHz	dBuV/m	dBuV/m	dBuV/m	dB	deg	cm		Factor
108.898899	29.91	26.06	30.00	-3.94	282	100	Vert	-17.88
121.084527	24.45	20.54	30.00	-9.46	245	177	Vert	-18.61
203.411574	21.94	17.70	30.00	-12.30	288	396	Vert	-14.25
330.633078	38.52	34.16	37.00	-2.84	328	279	Horz	-9.72
391.729178	33.76	29.96	37.00	-7.04	223	162	Horz	-7.45
414.367077	34.81	30.81	37.00	-6.19	226	207	Horz	-7.84

24 V Input / 12 V Output @ 3 Amps

Frequency	Peak	QP	QP Lmt	QP Margin	Angle	Hgt	Pol	Total Correction
MHz	dBuV/m	dBuV/m	dBuV/m	dB	deg	cm		Factor
31.101770	24.86	23.15	30.00	-6.85	108	98	Vert	-9.38
61.313193	23.48	22.61	30.00	-7.39	252	200	Vert	-18.98
96.067932	21.44	19.67	30.00	-10.33	240	200	Vert	-17.90
124.446286	29.25	27.81	30.00	-2.19	221	257	Vert	-18.67
221.292567	26.69	22.74	30.00	-7.26	149	393	Horz	-13.46
229.608718	31.85	28.46	30.00	-1.54	185	375	Horz	-12.80
335.781641	34.08	30.21	37.00	-6.79	352	306	Horz	-9.61

## 32 V Input / 5 V Output @ 5 Amps

Frequency	Peak	QP Lmt	QP Margin	Angle	Hgt	Pol
MHz	dBuV/m	dBuV/m	dB	deg	cm	
203.950000	22.00	30.00	-8.00	328	298	Horz
324.000000	28.96	37.00	-8.04	303	298	Horz
373.000000	30.77	37.00	-6.23	178	199	Horz
395.050000	32.07	37.00	-4.93	178	199	Horz
426.900000	33.53	37.00	-3.47	178	199	Horz

## 24 V Input / 5 V Output @ 5 Amps

Frequency	Peak	QP	QP Lmt	QP Margin	Angle	Hgt	Pol	Total Correction
MHz	dBuV/m	dBuV/m	dBuV/m	dB	deg	cm		Factor
199.928336	22.78	20.15	30.00	-9.85	167	344	Horz	-14.50
325.636743	28.84	25.89	37.00	-11.11	299	282	Horz	-9.74
361.139510	29.71	26.80	37.00	-10.20	150	330	Horz	-7.79
383.330254	30.13	27.52	37.00	-9.48	154	205	Horz	-7.53
422.096764	31.68	29.00	37.00	-8.00	174	202	Horz	-7.66
426.084531	31.67	29.09	37.00	-7.91	166	200	Horz	-7.61

## 12 V input / 5 V Output @ 5 Amps

Frequency	Peak	QP Lmt	QP Margin	Angle	Hgt	Pol
MHz	dBuV/m	dBuV/m	dB	deg	cm	
203.950000	20.62	30.00	-9.38	326	398	Horz

## 32 V Input / 3.3 V Output @ 5 Amps

Frequency	Peak	QP	QP Lmt	QP Margin	Angle	Hgt	Pol	Total Correction
MHz	dBuV/m	dBuV/m	dBuV/m	dB	deg	cm		Factor
103.648944	21.09	19.05	30.00	-10.95	261	140	Vert	-17.54
196.324394	30.34	28.47	30.00	-1.53	282	358	Horz	-14.53
255.400298	18.73	15.02	37.00	-21.98	1	209	Horz	-11.88
289.655966	21.07	17.99	37.00	-19.01	8	261	Horz	-11.73
406.335104	28.04	25.83	37.00	-11.17	158	205	Horz	-8.04
423.077369	28.19	25.83	37.00	-11.17	18	213	Horz	-7.64

## 12 V input / 3.3 V Output @ 5 Amps

Frequency	Peak	QP	QP Lmt	QP Margin	Angle	Hgt	Pol	Total Correction
MHz	dBuV/m	dBuV/m	dBuV/m	dB	deg	cm		Factor
195.799231	30.25	28.46	30.00	-1.54	275	347	Horz	-14.53

## 5 V input / 3.3 V Output @ 5 Amps

Frequency	Peak	QP	QP Lmt	QP Margin	Angle	Hgt	Pol	Total Correction
MHz	dBuV/m	dBuV/m	dBuV/m	dB	deg	cm		Factor
195.277234	28.74	26.36	30.00	-3.64	272	361	Horz	-14.53

#### 4.1.7 Photos

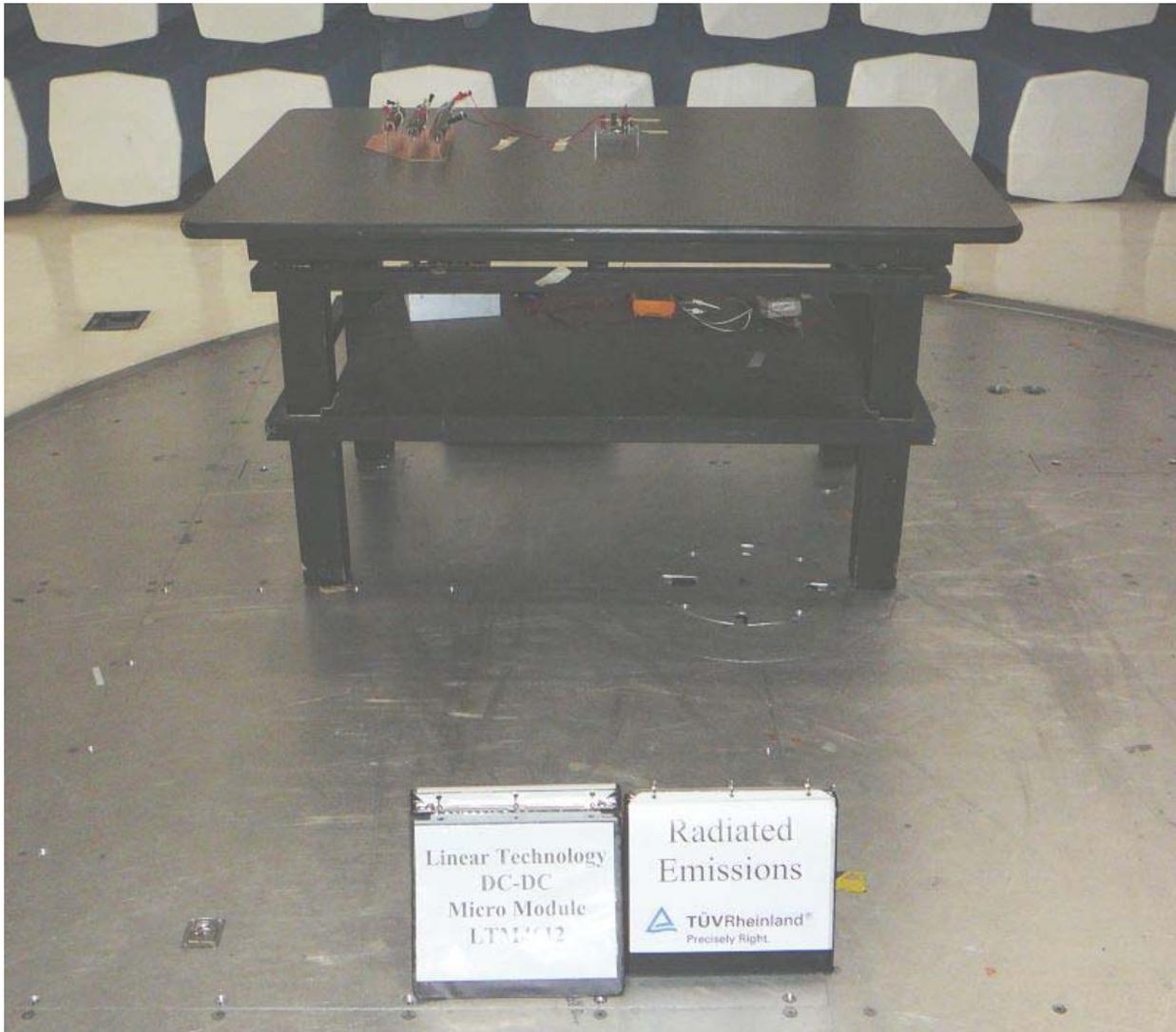


Figure 3 – Radiated Emissions Test Setup – Load 1 – Front

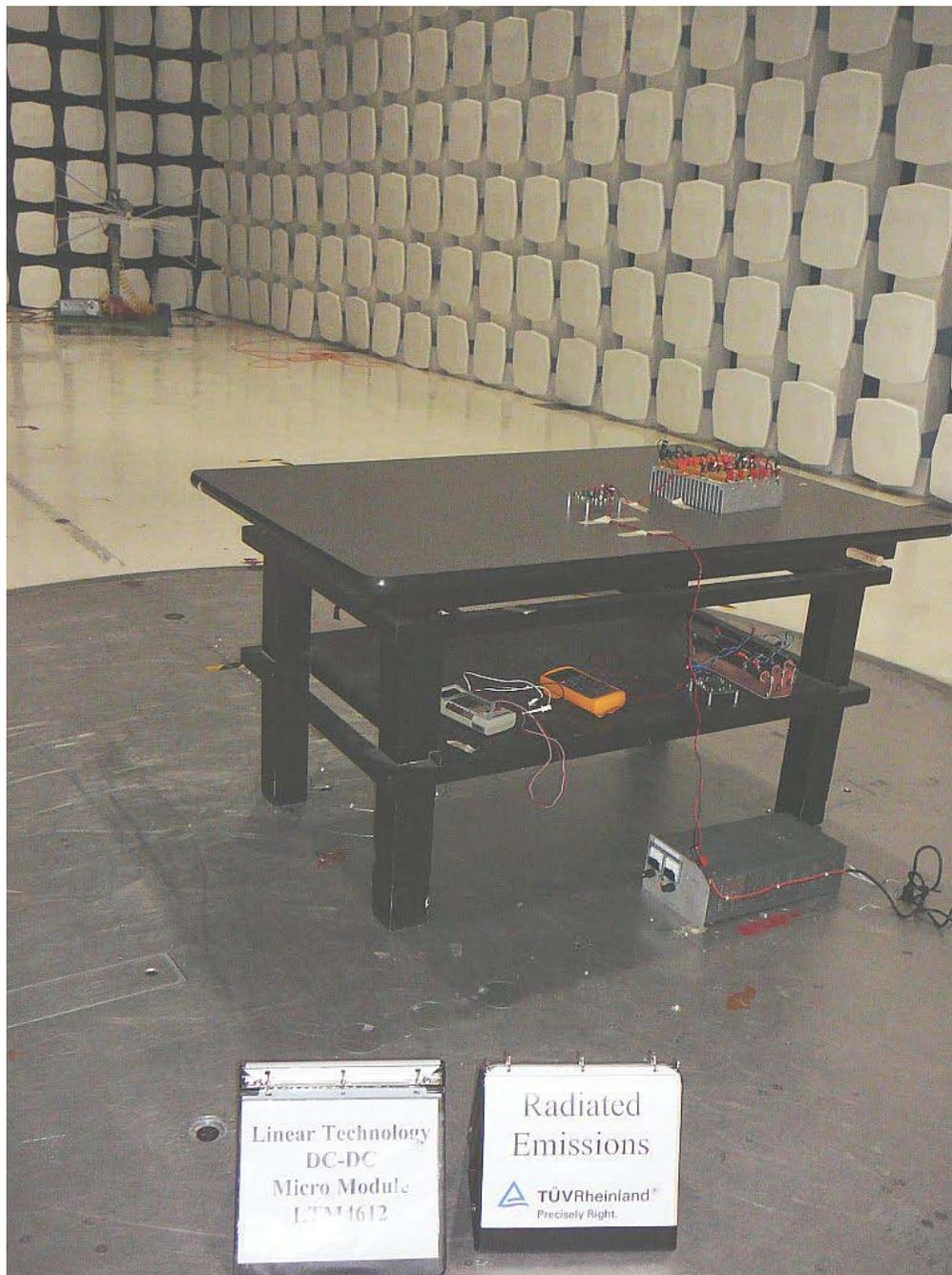


Figure 4 – Radiated Emissions 30 - 1000 MHz Test Setup – Load 2 – Back

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Figure 5 – Radiated Emissions 30 - 1000 MHz Test Setup – Load 2 – Front

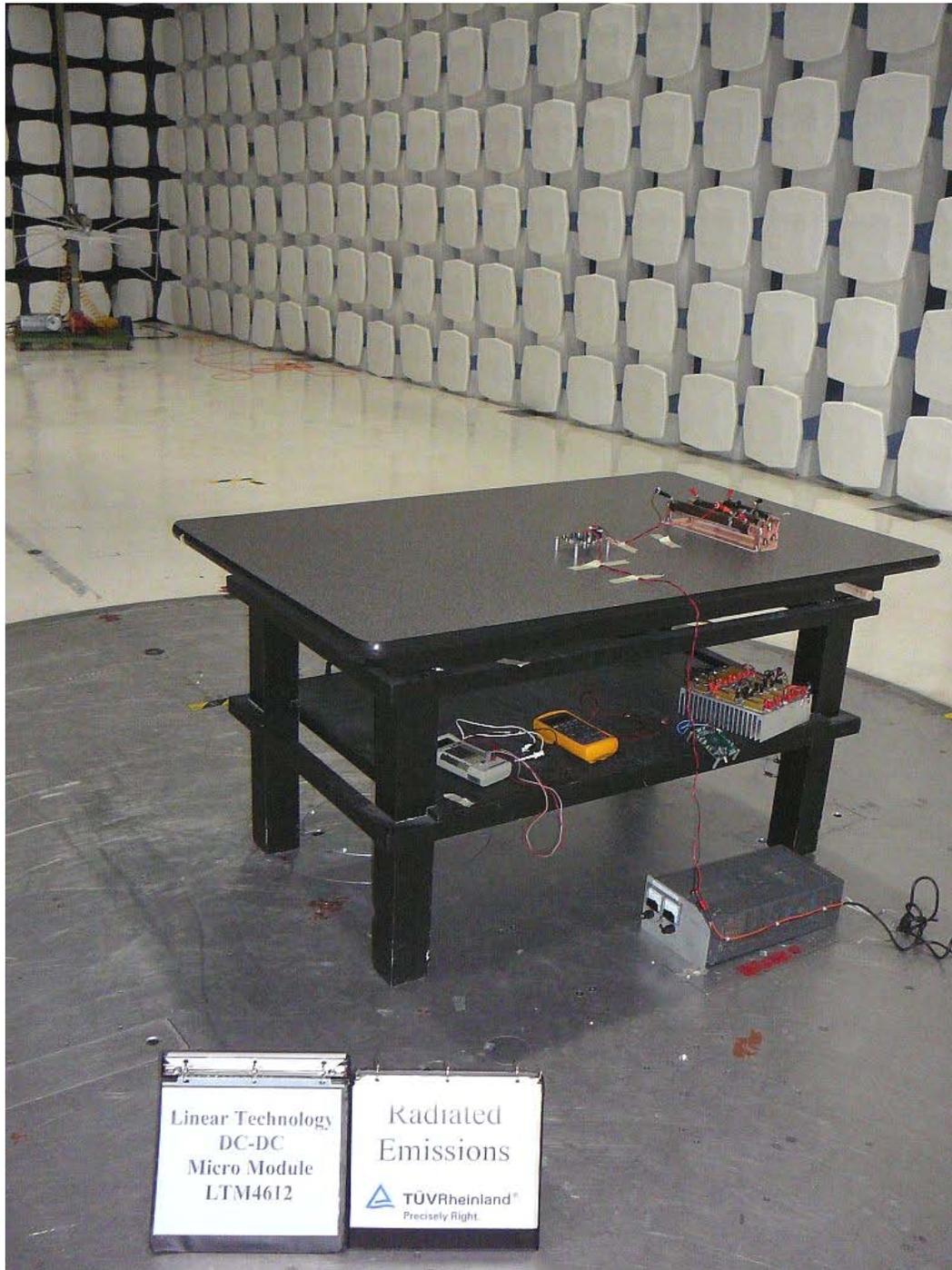


Figure 5 – Radiated Emissions 30 - 1000 MHz Test Setup – Load 1 – Back

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. This report must not be used by the applicant to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

## Appendix A

### 5 Test Plan

This test report is intended to follow this test plan outlined here in unless other wise stated in this here report. The following test plan will give details on product information, standards to be used, test set ups and refer to TUV test procedures. The test procedures will give the steps to be taken when performing the stated test. The product information below came via client, product manual, product itself and or the internet.

#### 5.1 General Information

<b>Client</b>	Linear Technology Corporation.
<b>Address</b>	1630 McCarthy Blvd.
<b>Address</b>	Milpitas, CA 95035
<b>Contact Person</b>	Eddie Beville
<b>Telephone</b>	(408) 432-1900, Ext. 3007
<b>Fax</b>	(408) 434-0507
<b>e-mail</b>	ebeville@linear.com

#### 5.2 Model(s) Name

LTM4612

#### 5.3 Type of Product

DC DC Converter

#### 5.4 Equipment Under Test (EUT) Description

The LTM@4612s an ultra low noise high voltage 6 A switching mode DC/DC power supply. The onboard input filter and noise cancellation circuits achieve low noise operation, thus effectively reducing the electromagnetic interference (EMI).

#### 5.5 Modifications

None

#### 5.6 Product Environment

<input checked="" type="checkbox"/>	<b>Residential</b>	<input type="checkbox"/>	<b>Hospital</b>
<input checked="" type="checkbox"/>	<b>Light Industrial</b>	<input type="checkbox"/>	<b>Small Clinic</b>
<input checked="" type="checkbox"/>	<b>Industrial</b>	<input type="checkbox"/>	<b>Doctor's office</b>
<input type="checkbox"/>	<b>Other</b>		

\*Check all that apply

#### 5.7 Countries

<input type="checkbox"/>	<b>USA</b>
<input type="checkbox"/>	<b>Taiwan</b>
<input type="checkbox"/>	<b>Japan</b>
<input checked="" type="checkbox"/>	<b>Europe</b>

\*Check all that apply

#### 5.8 Applicable Documents

<b>Standards</b>	<b>Description</b>
EN 55022:2006+A1:2007	Radiated Emissions

## 5.9 EUT Electrical Powered Information

### 5.9.1 Electrical Power Type

<input type="checkbox"/>	AC	<input checked="" type="checkbox"/>	DC	<input type="checkbox"/>	Batteries	<input type="checkbox"/>	Host -
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### 5.9.2 Electrical Power Information

Name	Type	Voltage		Frequency	Current	Notes
		min	max			
DC Input	DC	5	36	800 kHz	Load Dependant	
DC Output	DC	3.3	15	800 kHz	5A Max	
Notes	None					

## 5.10 EUT Modes of Operation

One.

**5.11 EUT Clock/Oscillator Frequencies**

<input checked="" type="checkbox"/>	Less than 108 MHz	FCC – scan up to 1 GHz
<input type="checkbox"/>	Less than 500 MHz	FCC – scan up to 2 GHz
<input type="checkbox"/>	Less than 1000 MHz	FCC – scan up to 5 GHz
<input type="checkbox"/>	Greater than 1000 MHz	FCC – scan up to 5 <sup>th</sup> Harmonic or 40 GHz

**5.12 Electrical Support Equipment**

Type	Manufacture	Model	Connected To
Power Supply	Lambda	LP532-FM	EUT input
Load Resistors	N/A	N/A	EUT Output

**5.13 EUT Equipment/Cabling Information**

EUT Port	Connected To	Location	Cable Type		
			Length	Shielded	Bead
VIN	Power Supply	Inside Chamber	1 meter	No	No
VOUT	Resistive load	Inside Chamber	0.2 meters	No	No

#### **5.14 EUT Test Program**

None

#### **5.15 Monitoring of EUT during Testing**

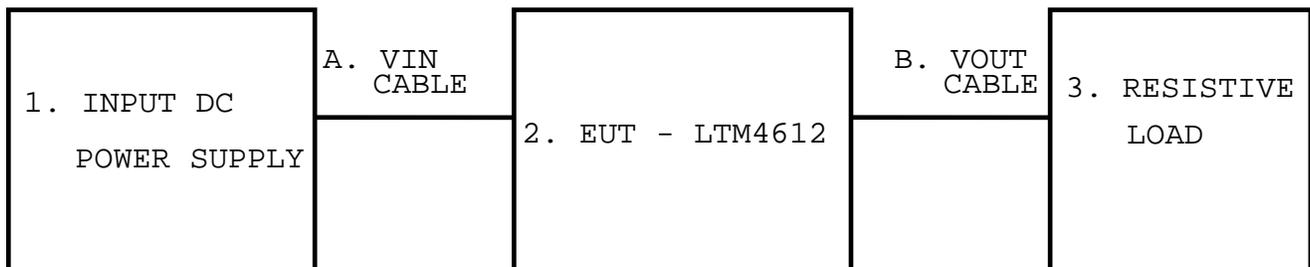
For Emissions testing, the EUT output voltage is monitored during the test.

#### **5.16 EUT Configuration**

##### **5.16.1 Description**

<b>Configuration</b>	<b>Description</b>
One Only	LTM4612 Installed on demo board 1297B.
<b>Notes</b>	All configurations tested with a resistive load.

### 5.16.2 Block Diagram



## 5.17 Emissions

### 5.17.1 Radiated Emissions

#### 5.17.1.1 Final Radiated Emissions Test Setup

<b>Standard</b>	EN 55022:2006 +A1:2007		<b>TUV Test Procedure</b>		QP093006
<b>Limit</b>	Class B	<b>Emissions Verification</b>		Emissions Under Limit	
<b>Frequency Range</b>	30 – 1000 MHz	<b>Ant Dist</b>	10m	<b>Det</b>	QP 30 – 1000 MHz,
<b>Scan #1</b>	Configuration 1 (30 – 1000 MHz)				
<b>Configuration</b>	See Section 5.16				

**END OF REPORT**