



**MET Laboratories, Inc.** *Safety Certification - EMI - Telecom Environmental Simulation*

914 WEST PATAPSCO AVENUE ! BALTIMORE, MARYLAND 21230-3432 ! PHONE (410) 354-3300 ! FAX (410) 354-3313

August 07, 2009

Linear Technology Corporation  
1630 McCarthy Blvd.  
Milpitas, CA 950357417

Dear David Ng,

Enclosed is the EMC test report for compliance testing of the Linear Technology Corporation, LTM8021, tested to the requirements of EN 55022: 2006 for a Class B Device.

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,  
MET LABORATORIES, INC.

Kanesa Pogi  
Documentation Department

Reference: (\Linear Technology Corporation\EMCS81657-EURO)

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914 WEST PATAPSCO AVENUE ! BALTIMORE, MARYLAND 21230-3432 ! PHONE (410) 354-3300 ! FAX (410) 354-3313

## **Electromagnetic Compatibility Test Report**

for the

**Linear Technology Corporation  
LTM8021**

Tested under

**EN 55022: 2006  
For a Class B Device**

**MET Report: EMCS81657-EURO**

August 07, 2009

**Prepared for:**

**Linear Technology Corporation  
1630 McCarthy Blvd.  
Milpitas, CA 950357417**

**Prepared by:**  
**MET Laboratories, Inc.**  
33439 Western Avenue  
Union City, California 94587



Linear Technology Corporation  
LTM8021

Electromagnetic Compatibility  
EN 55022: 2006

## Electromagnetic Compatibility Test Report

For the

**Linear Technology Corporation  
LTM8021**

Tested under

**EN 55022: 2006  
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**MET Report: EMCS81657-EURO**

Asad Bajwa, Manager  
Electromagnetic Compatibility Lab

Kanesa Pogi  
Documentation Department

**Engineering Statement:** The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the applicable limits. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of EN 55022: 2006 under normal use and maintenance.

Randy Hoopai  
Electromagnetic Compatibility Lab



Linear Technology Corporation  
LTM8021

Electromagnetic Compatibility  
EN 55022: 2006

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## Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	August 07, 2009	Initial Issue.



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## List of Terms and Abbreviations

AC	Alternating Current
ACF	Antenna Correction Factor
Cal	Calibration
<i>d</i>	Measurement Distance
dB	Decibels
dB $\mu$ A	Decibels above one <b>microamp</b>
dB $\mu$ V	Decibels above one <b>microvolt</b>
dB $\mu$ A/m	Decibels above one <b>microamp per meter</b>
dB $\mu$ V/m	Decibels above one <b>microvolt per meter</b>
DC	Direct Current
E	Electric Field
ESD	Electrostatic Discharge
EUT	Equipment Under Test
<i>f</i>	Frequency
CISPR	Comite International Special des Perturbations Radioelectriques (International Special Committee on Radio Interference)
GRP	Ground Reference Plane
H	Magnetic Field
HCP	Horizontal Coupling Plane
Hz	Hertz
IEC	International Electrotechnical Commission
kHz	kilohertz
kPa	kilopascal
kV	kilovolt
LISN	Line Impedance Stabilization Network
MHz	Megahertz
$\mu$ H	<b>microhenry</b>
$\mu$ F	<b>microfarad</b>
$\mu$ s	<b>microseconds</b>
PRF	Pulse Repetition Frequency
RF	Radio Frequency
RMS	Root-Mean-Square
V/m	Volts <b>per meter</b>
VCP	Vertical Coupling Plane





## 1.0 Testing Summary

The following tests specified by EN 55022 and EN 55024 were performed with the following results.

Specification	Test Description	Compliance
EN 55022: 2006	Radiated Emissions - Class B	Compliant

**Table 1. Executive Summary of EN 55022 / EN 55024 Compliance Testing**



## 2.0 Equipment Configuration

### 2.1 Overview

MET Laboratories, Inc. was contracted by Linear Technology Corporation to perform testing on the LTM8021, under Linear Technology Corporation purchase order number X14282T.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Linear Technology Corporation, LTM8021 with the requirements of EN 55022 limits and Methods of Radio Disturbance characteristic of Information Technology Equipment and EN 55024 Information Technology Equipment – Immunity Characteristics.

The results obtained relate only to the item(s) tested.

<b>Model(s) Tested:</b>	LTM8021
<b>Model(s) Covered:</b>	LTM8021
<b>EUT Specifications:</b>	Primary Power: 3 to 36V
	Equipment Emissions Class: B
<b>Evaluated by:</b>	Randy Hoopai
<b>Date(s):</b>	August 07, 2009

## 2.2 Test Site

All testing was performed at MET Laboratories, Inc., 3162 Belick Street Santa Clara, CA 95054. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

## 2.3 Description of Test Sample

The LTM8021, Equipment Under Test (EUT) is a 36Vin, 500mA step down switching power converter. It was mounted to the DC1238A demonstration board.

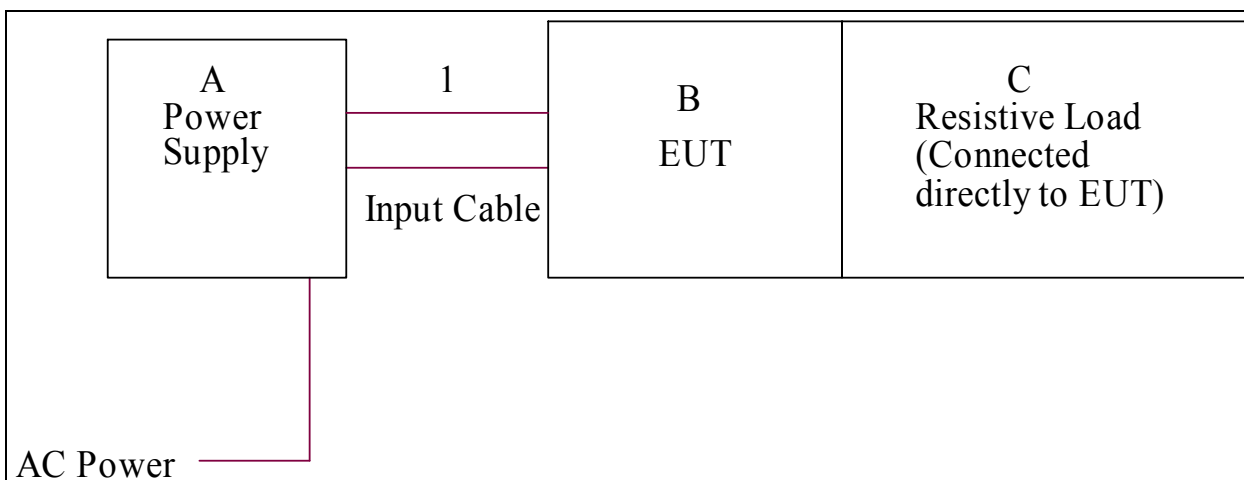


Figure 1. Block Diagram of Test Configuration



## 2.4 Equipment Configuration

The EUT was set up as outlined in Figure 1. All equipment incorporated as part of the EUT is included in the following list.

Ref. ID	Slot #	Name / Description	Model Number	Part Number	Serial Number	Rev. #
B	N/A	36Vin, 500mA, Step Down μModule DC/DC Converter	LTM8021	LTM8021EV	N/A	--

Table 2. Equipment Configuration

## 2.5 Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

Ref. ID	Name / Description	Manufacturer	Model Number	Customer Supplied Calibration Data
A	Power Supply	Power Designs	TPS343B	--
C	Resistive Load	N/A	N/A	--

Table 3. Support Equipment

## 2.6 Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty	Length as tested (m)	Max Length (m)	Shielded? (Y/N)	Termination Box ID & Port Name
1	Input	2 conductor, 18 AWG (3 conductor for 1.25Vout configuration)	1	2	--	No	Vin

Table 4. Ports and Cabling Information



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## 2.7 Mode of Operation

The EUT will continuously be powered from 36Vin lab grade power supply. There will be three configurations tested:

1. 1.25Vout loaded to 500mA (3V will be applied to the BIAS pin of the LTM8021; this is the only configuration where BIAS power is applied).
2. 2.5Vout loaded to 500mA
3. 5Vout loaded to 500mA – this is maximum output power configuration

## 2.8 Method of Monitoring EUT Operation

1. The output voltage will be in regulation.
2. The output voltage will be significantly above or below its regulation point.

## 2.9 Modifications to the EUT

No modifications were made to the EUT.

## 2.10 Disposition of EUT

The test sample including all support equipment (if any), submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Linear Technology Corporation upon completion of testing.



### 3.0 Electromagnetic Compatibility Emission Criteria

#### 3.1 Radiated Emission: Limits of Electromagnetic Radiation Disturbance

**Test Method:** EN 55022:1994 + A1:1995 + A2:1997  
Limits and Methods of Measurement of Radio Disturbance Characteristics of  
Information Technology Equipment.

**Test Requirement(s):** EN 55022, Section 6, Limits for Radiated Disturbances:

For radiated emission in the frequency range 30 MHz - 1 000 MHz, the EUT shall meet the Class B radiated emission limits shown in Table 5.

Frequency Band (MHz)	Class A Quasi-Peak limits 10 m measurement distance (dB $\mu$ V/m)	Class B Quasi-Peak limits 10 m measurement distance (dB $\mu$ V/m)
30 to 230	40	30
230 to 1000	47	37

**Table 5. Electromagnetic Radiated Disturbance limits from Clause 6 of EN 55022**

**Test Procedure:** The EUT was placed on a 0.8 m high wooden table inside a semi-anechoic chamber. The method of testing, test conditions, and test procedures of EN 55022 were used. An antenna was located 3 m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1 m and 4 m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. Unless otherwise specified, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

Emissions measured at 3m were normalized using an inverse proportionality factor of 20dB per decade for comparison to the 10 m limit. The physical size of the EUT was taken into account as to avoid near-field effects, which could occur near 30 MHz. See Photograph 1 for a picture of the test setup.

Environmental Conditions for Radiated Emission	
Ambient Temperature:	22 °C
Relative Humidity:	49%

**Test Results:** The EUT was compliant with the requirement(s) of this section.



Linear Technology Corporation  
LTM8021

Electromagnetic Compatibility  
Immunity Criteria  
EN 55022: 2006

**Test Engineer(s):** Randy Hoopai

**Test Date(s):** 07/27/09

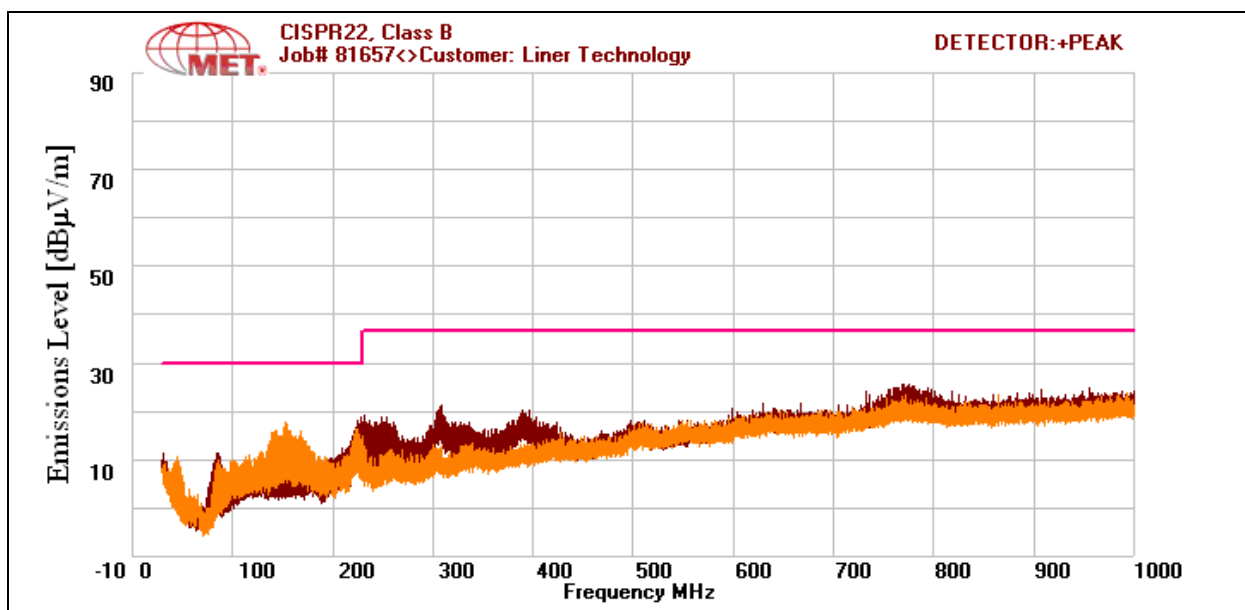


## Radiated Emission: Limits of Electromagnetic Radiation Disturbance, Test Results

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBuV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)
44	V	75	100	7.05	10	0	1.602	-10.46	8.192	30	-21.808
84.88	H	257	373	17	8.086	0	2.269	-10.46	16.895	30	-13.105
116.4	H	339	263	5	12.628	0	2.657	-10.46	9.825	30	-20.175
139.36	H	241	219	4.6	12.038	0	2.972	-10.46	9.15	30	-20.85
140.48	V	28	100	9.65	12.362	0	2.988	-10.46	14.54	30	-15.46
225.56	H	259	136	13.15	10.845	0	3.82	-10.46	17.355	30	-12.645

Table 6. Radiated Emission Test Results; Mode 1 – 36Vin, 1.25Vout @ 500mA

Note: The EUT was tested at 3 m. The data has been corrected for comparison with the 10 m limit using the formula:  $20\log(3\text{ m}/10\text{ m})$  as expressed in the 'Distance Correction' column.





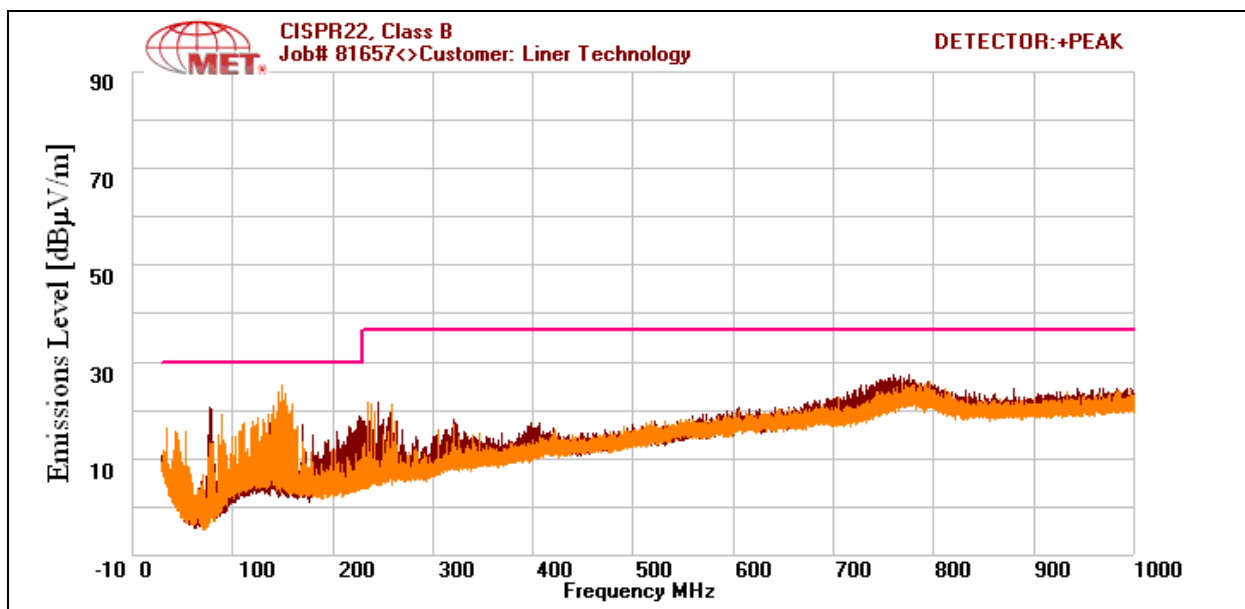


## Radiated Emission: Limits of Electromagnetic Radiation Disturbance, Test Results

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBuV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)
77.6	H	269	391	21.75	7.26	0	2.172	-10.46	20.722	30	-9.278
88.08	V	324	145	4.6	9.109	0	2.307	-10.46	5.556	30	-24.444
141.6	H	264	298	11.83	11.84	0	3.006	-10.46	16.216	30	-13.784
151	V	178	100	8.52	11.66	0	3.145	-10.46	12.865	30	-17.135
171.92	H	263	218	8.42	10.185	0	3.291	-10.46	11.436	30	-18.564
246.44	H	258	121	9.9	12.615	0	3.965	-10.46	16.02	37	-20.98

Table 7. Radiated Emission Test Results; Mode 2 – 36Vin, 2.5Vout @ 500mA

Note: The EUT was tested at 3 m. The data has been corrected for comparison with the 10 m limit using the formula:  $20\log(3\text{ m}/10\text{ m})$  as expressed in the 'Distance Correction' column.



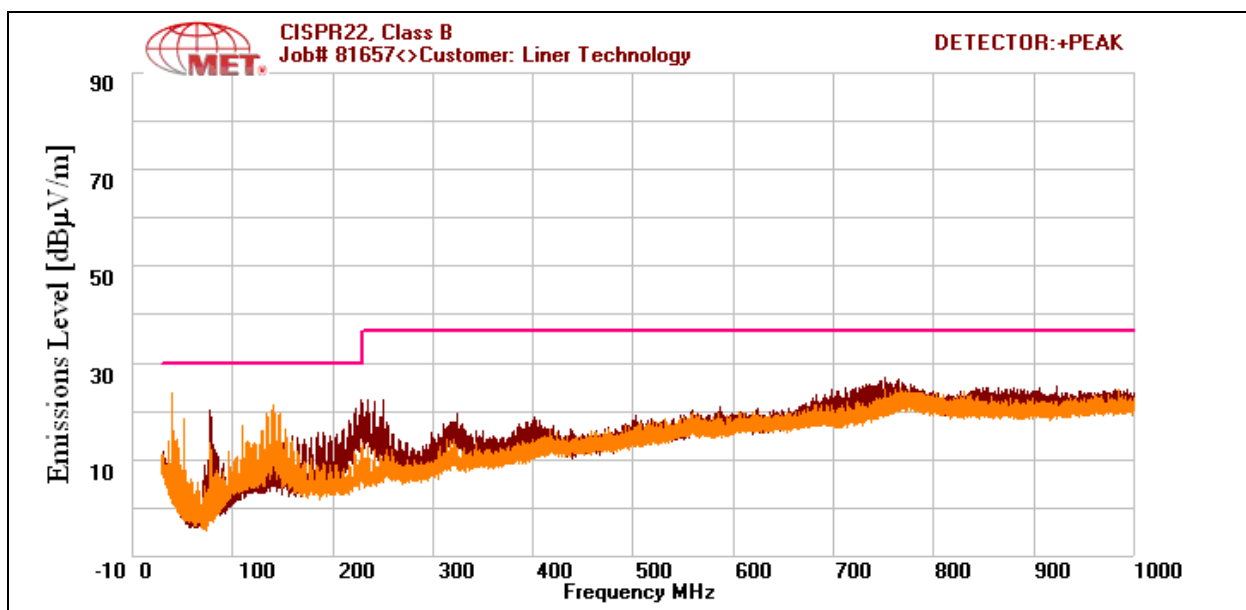


## Radiated Emission: Limits of Electromagnetic Radiation Disturbance, Test Results

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBuV)	ACF (dB/m)	Pre Amp Gain (dB)	CBL (dB)	DCF (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)
44.76	V	98	100	13.3	9.62	0	1.619	-10.46	14.079	30	-15.921
78.08	H	281	391	22.25	7.308	0	2.179	-10.46	21.277	30	-8.723
115.52	V	205	100	7.32	13.41	0	2.646	-10.46	12.916	30	-17.084
140.52	V	216	100	16.65	12.358	0	2.988	-10.46	21.536	30	-8.464
228.88	H	262	128	17.8	11.11	0	3.85	-10.46	22.3	30	-7.7
235.12	H	268	124	16.4	11.612	0	3.891	-10.46	21.443	37	-15.557

**Table 8. Radiated Emission Test Results; Mode 3 – 36 Vin, 5 Vout @ 500 mA**

Note: The EUT was tested at 3 m. The data has been corrected for comparison with the 10 m limit using the formula:  $20\log(3\text{ m}/10\text{ m})$  as expressed in the 'Distance Correction' column.



## Radiated Emission: Limits of Electromagnetic Radiation Disturbance, Test Setup



**Photograph 1. Radiated Emission: Limits of Electromagnetic Radiation Disturbance, Test Setup**



Linear Technology Corporation  
LTM8021

Electromagnetic Compatibility  
Test Equipment  
EN 55022: 2006

## 4.0 Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ANSI/NCSL Z540-1-1994 and ANSI/ISO/IEC 17025:2000.

Test Name: EN 55022 (CISPR 22):1998 Radiated Emissions Electric Field			Test Date(s): 07/27/09		
MET Asset #	Nomenclature	Manufacturer	Model	Last Cal Date	Cal Due Date
1S2482	5 Meter Chamber	Panashield	641431	11/22/2008	11/22/2009
1S2501	EMI Test Receiver	Rhode & Schwarz	ESU40	4/27/2009	4/27/2010
1S2484	Bilog Antenna	Teseq	CBL6112D	1/27/2009	1/27/2011
1S2518	Thermo-Hygrometer	Fisher Scientific	11-661-7D	11/14/2007	11/13/2009