



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

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September 23, 2008

Linear Technology Corporation
1630 McCarthy Blvd.
Milpitas, CA 95035

Dear David Ng,

Enclosed is the EMC test report for compliance testing of the Linear Technology Corporation, LTM8032, 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.

Mae Ramirez
Documentation Department

Reference: (\Linear Technology Corporation\EMCS81043-EURO)

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The Nation's First Licensed Nationally Recognized Testing Laboratory



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**Electromagnetic Compatibility
Test Report**

for the

**Linear Technology Corporation
LTM8032**

Tested under

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

MET Report: EMCS81043-EURO

September 23, 2008

Prepared for:

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

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



Electromagnetic Compatibility Test Report

For the

**Linear Technology Corporation
LTM8032**

Tested under

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

MET Report: EMCS81043-EURO

Charles Huang
Test Engineer, Electromagnetic Compatibility Lab

Mae Ramirez
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.

Asad Bajwa
Manager, Electromagnetic Compatibility Lab



Linear Technology Corporation
LTM8032

Electromagnetic Compatibility
EN 55022: 2006

Report Status Sheet

| Revision | Report Date | Reason for Revision |
|----------|--------------------|---------------------|
| Ø | September 23, 2008 | 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 |
| dBμA | Decibels above one microamp |
| dBμV | Decibels above one microvolt |
| dBμA/m | Decibels above one microamp per meter |
| dBμV/m | Decibels above one microvolt per meter |
| 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 |
| μH | microhenry |
| μF | microfarad |
| μs | microseconds |
| PRF | Pulse Repetition Frequency |
| RF | Radio Frequency |
| RMS | Root-Mean-Square |
| V/m | Volts per meter |
| VCP | Vertical Coupling Plane |



1.0 Testing Summary

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

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

Table 1. Summary of EMC EN 55022: 2006 Compliance Testing



2.0 Equipment Configuration

2.1 Overview

MET Laboratories, Inc. was contracted by Linear Technology Corporation to perform testing on the LTM8032, under Linear Technology Corporation purchase order number X5485Y.

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, LTM8032 with the requirements of EN 55022 limits and Methods of Radio Disturbance characteristic of Information Technology Equipment.

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

| | |
|----------------------------|------------------------------|
| Model(s) Tested: | LTM8032 |
| Model(s) Covered: | LTM8032 |
| EUT Specifications: | Primary Power: DC |
| | Equipment Emissions Class: B |
| Evaluated by: | Charles Huang |
| Date(s): | September 23, 2008 |

2.2 Test Site

All testing was performed at MET Laboratories, Inc., 3162 Belick St., 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 LTM8032, Equipment Under Test (EUT) is a 2A switching dc/dc converter equipped with an EMI input filter. It is intended for use in systems that have loads as large as 2A and require low radiated electromagnetic emissions.

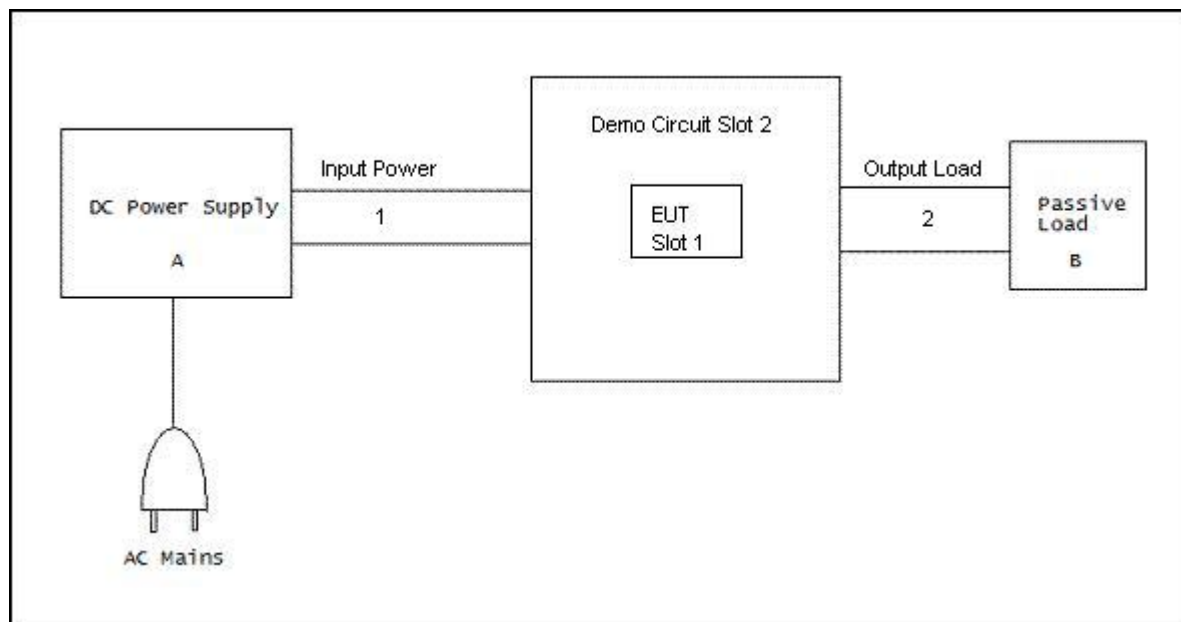


Figure 1. Block Diagram of Test Configuration



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. # |
|---------|--------|--|--------------|-------------|---------------|-----------------|
| 0831 | 1 | EMC Compliant 36V, 2A Buck Converter | LTM 8032EV | LTM8032EV | N/A | N/A |
| - | 2 | LTM8032 EMC Compliant 36V, 2A DC/DC Step-Down Power uModule Demo Circuit | - | DC1386A | N/A | Initial Release |

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 | DC Power Supply | Power Designs | TP343B | None – output is verified by measurement for each configuration. |
| B | Passive Load | Customer supplied | - | - |

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 power | 22 AWG wire | 2 | 2 | | No | None |
| 2 | Output load | 18 AWG wire | 2 | 0.1 | | No | None |

Table 4. Ports and Cabling Information



2.7 Mode of Operation

The LTM8032 was powered from a DC power source up to 36V, and can support loads as high as 2A. It regulates its output to a predetermined DC voltage. No controls were exercised during test.

2.8 Method of Monitoring EUT Operation

The EUT was performing its intended function when the output was in regulation. The test was performed on three LTM8032 samples – one set to regulate at 2.5V, another to 5V, and another to 10V.

The EUT was not performing its intended function if the output of any sample is significantly above or below its regulation point.

2.9 Modifications To 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: 2006
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 μ V/m) | Class B Quasi-Peak limits 10 m measurement distance (dB μ 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 0.8m-high wooden table located 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: | 24 °C |
| Relative Humidity: | 42 % |

Test Results: The EUT was **compliant** with the requirement(s) of this section. Measured emissions were below applicable limits.



Linear Technology Corporation
LTM8032

Electromagnetic Compatibility
Emission Criteria
EN 55022: 2006

Test Engineer(s): Charles Huang

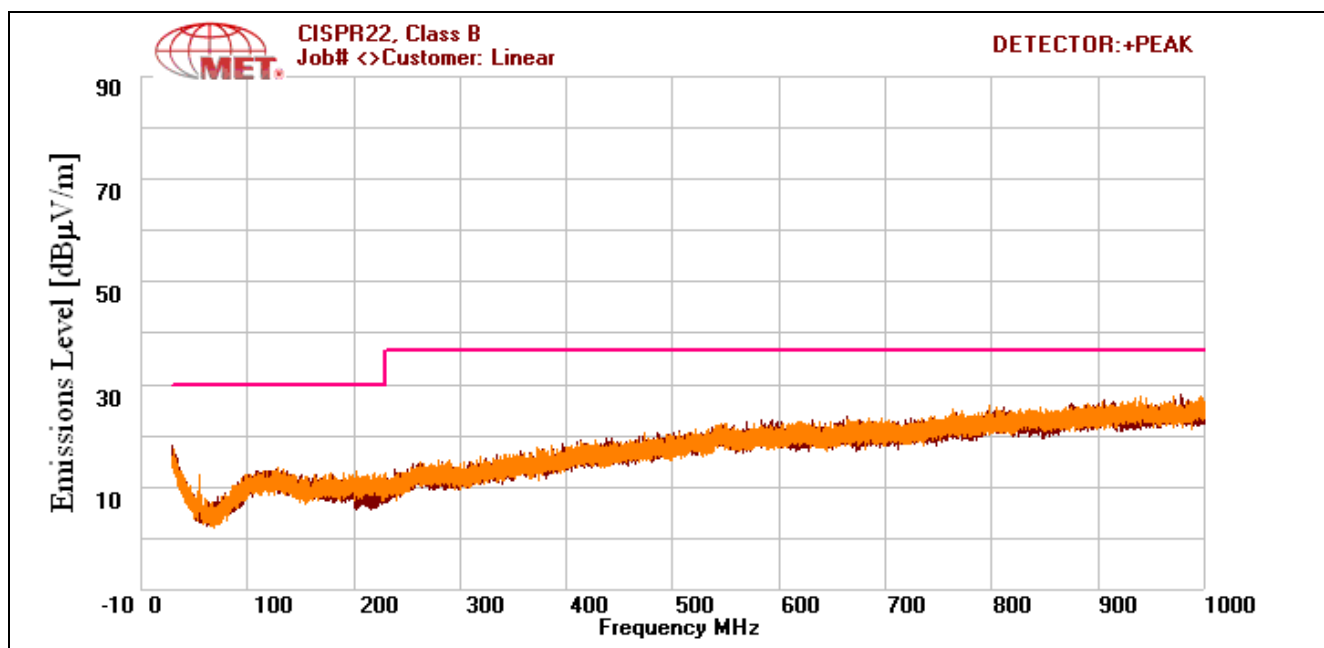
Test Date(s): 7/30/2008



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) | Corrected Amplitude (dBuV) | Limit (dBuV) | Margin (dB) |
|-----------------|------------------|-----------------------|---------------------|------------------------------|------------|-------------------|----------|----------------------------|--------------|-------------|
| 55.3 | V | 110 | 100 | 1.36 | 6.87 | 0 | 1.175 | 9.405 | 30 | -20.595 |
| 180 | H | 0 | 100 | -4.35 | 9.3 | 0 | 2.223 | 7.173 | 30 | -22.827 |
| 524 | V | 0 | 100 | -4.66 | 17.56 | 0 | 3.839 | 16.739 | 37 | -20.261 |
| 586 | H | 0 | 100 | -4.66 | 18.9 | 0 | 4.072 | 18.312 | 37 | -18.688 |
| 932 | V | 0 | 100 | -4.05 | 21.34 | 0 | 5.156 | 22.446 | 37 | -14.554 |
| 981 | H | 0 | 100 | -4.2 | 21.08 | 0 | 5.314 | 22.194 | 37 | -14.806 |

Table 6. Radiated Emission Test Results (3.6in – 2.5out)

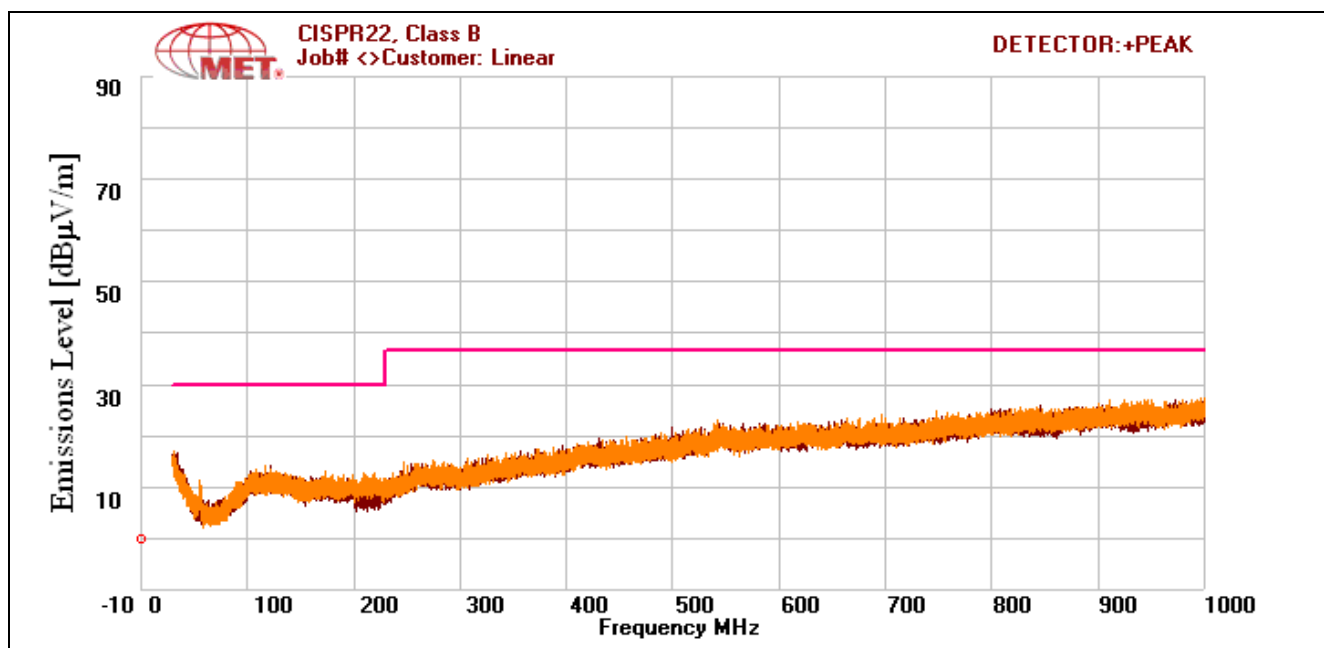




Radiated Emission: Limits of Electromagnetic Radiation Disturbance, Test Results

| Frequency (MHz) | Antenna Polarity | EUT Azimuth (Degrees) | Antenna Height (cm) | Uncorrected Amplitude (dBuV) | ACF (dB/m) | Pre Amp Gain (dB) | CBL (dB) | Corrected Amplitude (dBuV) | Limit (dBuV) | Margin (dB) |
|-----------------|------------------|-----------------------|---------------------|------------------------------|------------|-------------------|----------|----------------------------|--------------|-------------|
| 40.76 | H | 0 | 100 | -5.39 | 12.42 | 0 | 0.982 | 8.012 | 30 | -21.988 |
| 55.4 | V | 102 | 100 | 1.3 | 6.86 | 0 | 1.175 | 9.335 | 30 | -20.665 |
| 203.68 | V | 0 | 100 | -4.92 | 10.321 | 0 | 2.34 | 7.741 | 30 | -22.259 |
| 318.9 | H | 0 | 100 | -5.82 | 13.578 | 0 | 2.943 | 10.701 | 37 | -26.299 |
| 767 | H | 0 | 100 | -4.66 | 19.42 | 0 | 4.67 | 19.43 | 37 | -17.57 |
| 871.7 | V | 0 | 100 | -4.52 | 20.734 | 0 | 4.979 | 21.193 | 37 | -15.807 |

Table 7. Radiated Emission Test Results (7Vin – 5Vout)

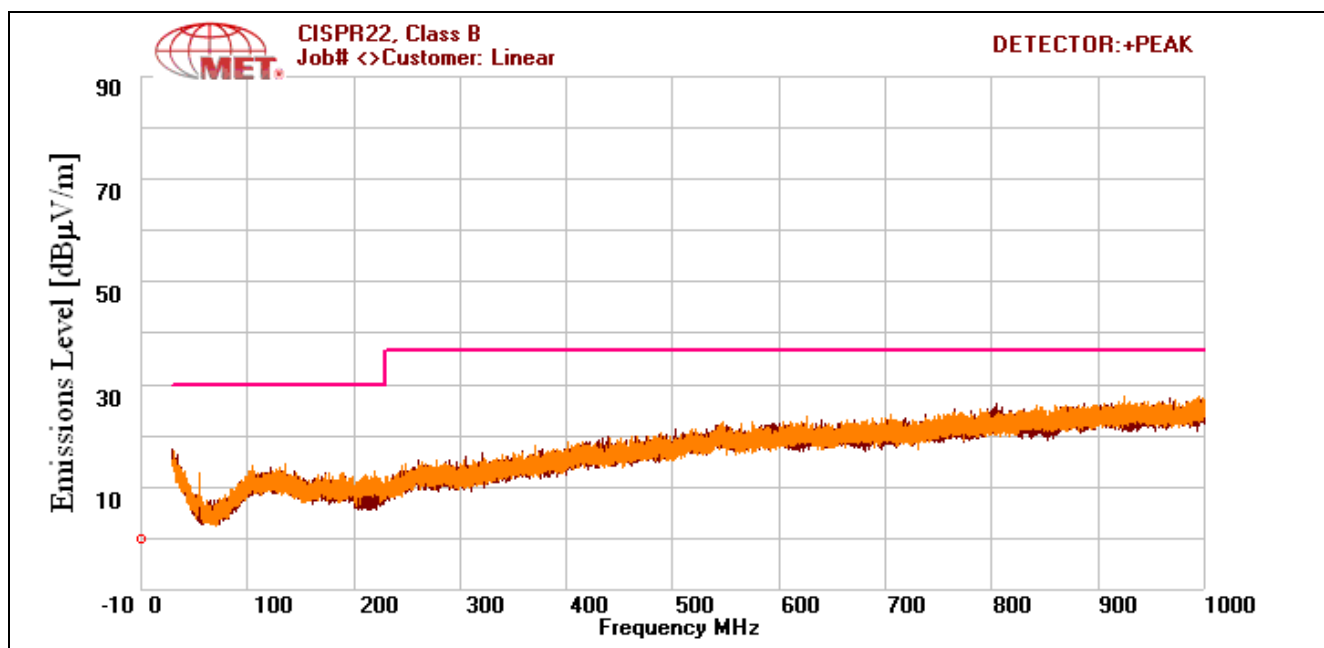




Radiated Emission: Limits of Electromagnetic Radiation Disturbance, Test Results

| Frequency (MHz) | Antenna Polarity | EUT Azimuth (Degrees) | Antenna Height (cm) | Uncorrected Amplitude (dBuV) | ACF (dB/m) | Pre Amp Gain (dB) | CBL (dB) | Corrected Amplitude (dBuV) | Limit (dBuV) | Margin (dB) |
|-----------------|------------------|-----------------------|---------------------|------------------------------|------------|-------------------|----------|----------------------------|--------------|-------------|
| 54.76 | V | 54 | 100 | 0.82 | 6.924 | 0 | 1.169 | 8.913 | 30 | -21.087 |
| 198.8 | H | 0 | 100 | -4.2 | 9.2 | 0 | 2.341 | 7.341 | 30 | -22.659 |
| 513.8 | V | 0 | 100 | -4.74 | 17.508 | 0 | 3.758 | 16.526 | 37 | -20.474 |
| 577.9 | H | 0 | 100 | -4.82 | 18.39 | 0 | 4 | 17.57 | 37 | -19.43 |
| 906 | V | 0 | 100 | -4.28 | 20.88 | 0 | 5.061 | 21.661 | 37 | -15.339 |
| 907 | H | 0 | 100 | -4.28 | 20.92 | 0 | 5.062 | 21.702 | 37 | -15.298 |

Table 8. Radiated Emission Test Results (13Vin – 10Vout)

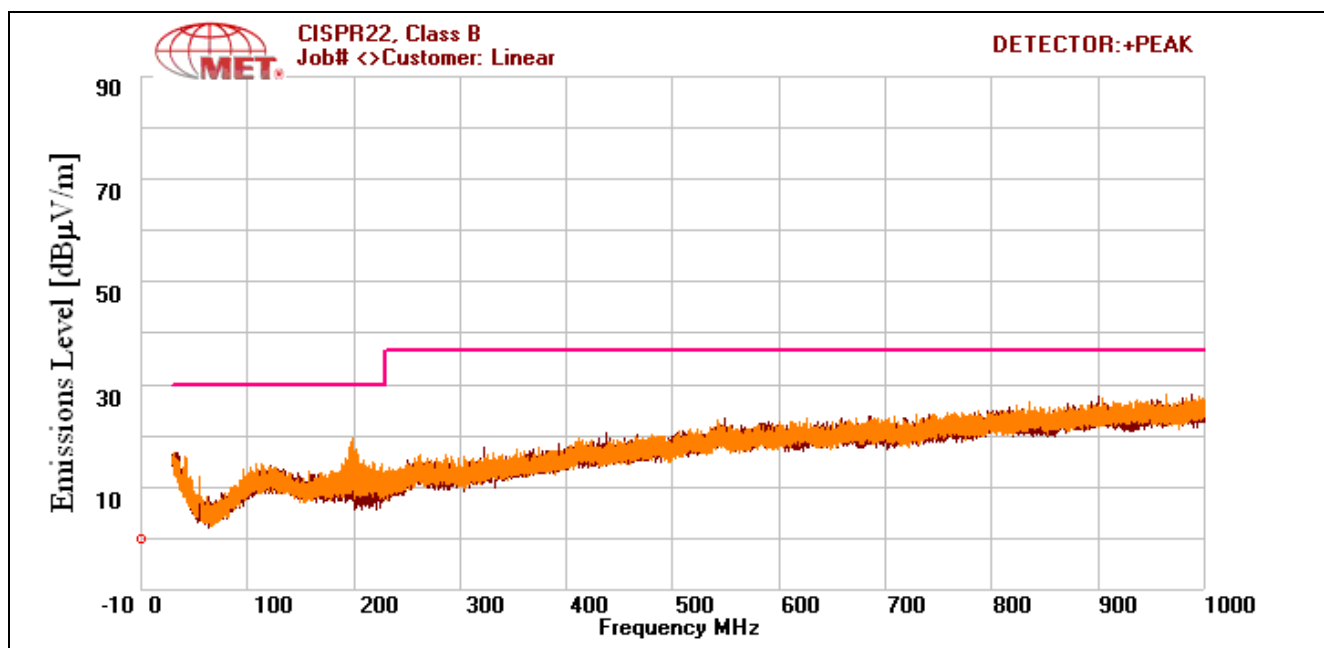




Radiated Emission: Limits of Electromagnetic Radiation Disturbance, Test Results

| Frequency (MHz) | Antenna Polarity | EUT Azimuth (Degrees) | Antenna Height (cm) | Uncorrected Amplitude (dBuV) | ACF (dB/m) | Pre Amp Gain (dB) | CBL (dB) | Corrected Amplitude (dBuV) | Limit (dBuV) | Margin (dB) |
|-----------------|------------------|-----------------------|---------------------|------------------------------|------------|-------------------|----------|----------------------------|--------------|-------------|
| 41.3 | V | 220 | 100 | 2.07 | 11.35 | 0 | 0.987 | 14.407 | 30 | -15.593 |
| 55.36 | V | 230 | 100 | 1.21 | 6.864 | 0 | 1.175 | 9.249 | 30 | -20.751 |
| 166.2 | H | 0 | 100 | -4.5 | 9.876 | 0 | 2.148 | 7.524 | 30 | -22.476 |
| 197.9 | V | 172 | 100 | 6.69 | 9.974 | 0 | 2.344 | 19.008 | 30 | -10.992 |
| 546 | H | 0 | 100 | -4.66 | 18.94 | 0 | 3.931 | 18.211 | 37 | -18.789 |
| 861 | H | 0 | 100 | -4.28 | 19.62 | 0 | 4.956 | 20.296 | 37 | -16.704 |

Table 9. Radiated Emission Test Results (36Vin – 2.5Vout)

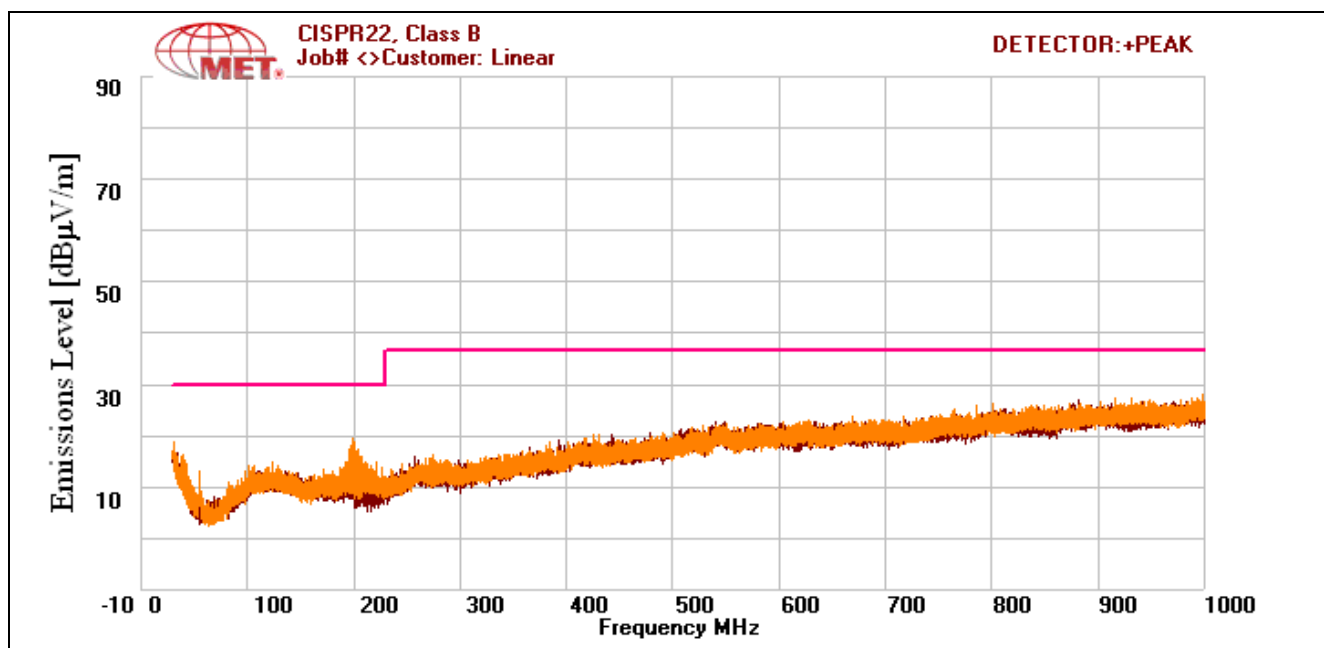




Radiated Emission: Limits of Electromagnetic Radiation Disturbance, Test Results

| Frequency (MHz) | Antenna Polarity | EUT Azimuth (Degrees) | Antenna Height (cm) | Uncorrected Amplitude (dBuV) | ACF (dB/m) | Pre Amp Gain (dB) | CBL (dB) | Corrected Amplitude (dBuV) | Limit (dBuV) | Margin (dB) |
|-----------------|------------------|-----------------------|---------------------|------------------------------|------------|-------------------|----------|----------------------------|--------------|-------------|
| 41.72 | V | 200 | 100 | 1.56 | 11.14 | 0 | 0.991 | 13.691 | 30 | -16.309 |
| 55.44 | V | 0 | 100 | 0.54 | 6.856 | 0 | 1.175 | 8.571 | 30 | -21.429 |
| 199.6 | V | 170 | 100 | 6.74 | 10.076 | 0 | 2.339 | 19.155 | 30 | -10.845 |
| 515.6 | H | 0 | 100 | -4.82 | 17.488 | 0 | 3.768 | 16.436 | 37 | -20.564 |
| 787.2 | V | 161 | 100 | -4.43 | 19.688 | 0 | 4.701 | 19.959 | 37 | -17.041 |
| 959 | H | 0 | 100 | -4.28 | 20.62 | 0 | 5.258 | 21.598 | 37 | -15.402 |

Table 10. Radiated Emission Test Results (36Vin – 5Vout)

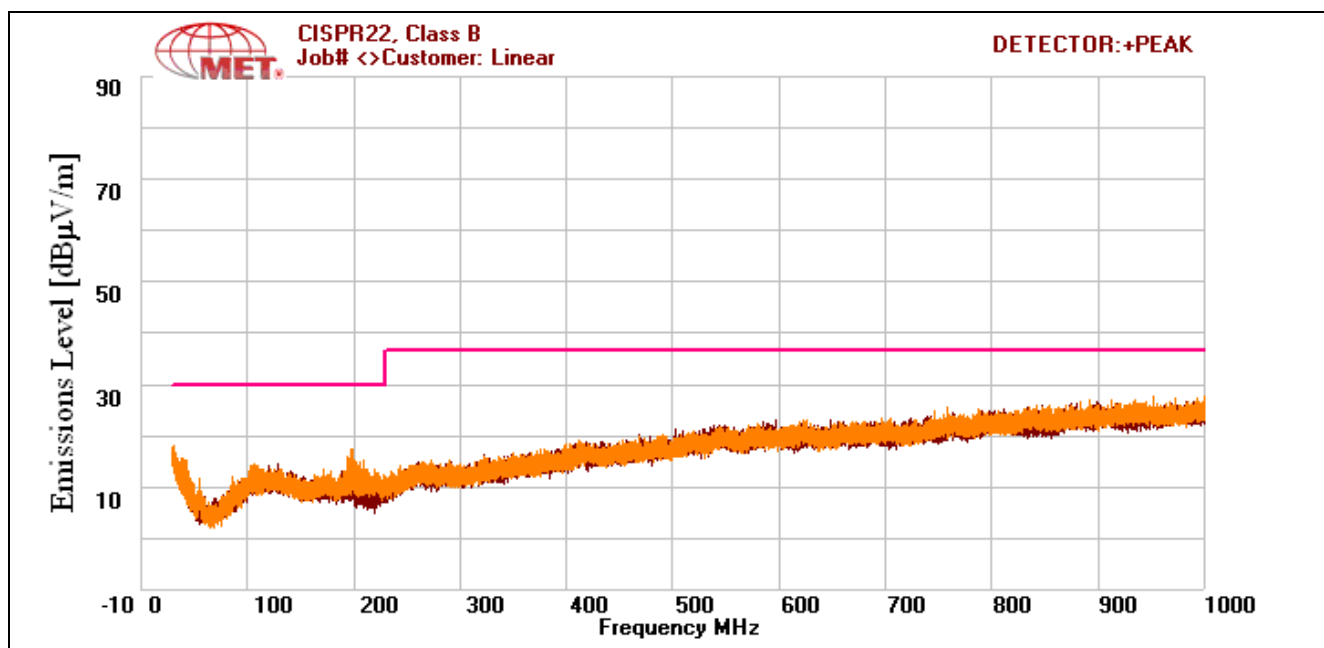




Radiated Emission: Limits of Electromagnetic Radiation Disturbance, Test Results

| Frequency (MHz) | Antenna Polarity | EUT Azimuth (Degrees) | Antenna Height (cm) | Uncorrected Amplitude (dBuV) | ACF (dB/m) | Pre Amp Gain (dB) | CBL (dB) | Corrected Amplitude (dBuV) | Limit (dBuV) | Margin (dB) |
|-----------------|------------------|-----------------------|---------------------|------------------------------|------------|-------------------|----------|----------------------------|--------------|-------------|
| 55.06 | V | 64 | 100 | 1.3 | 6.894 | 0 | 1.172 | 9.366 | 30 | -20.634 |
| 188.8 | H | 0 | 100 | -3.98 | 9.176 | 0 | 2.297 | 7.493 | 30 | -22.507 |
| 198.2 | V | 162 | 100 | 4.21 | 9.992 | 0 | 2.343 | 16.545 | 30 | -13.455 |
| 515 | H | 0 | 100 | -4.74 | 17.5 | 0 | 3.765 | 16.525 | 37 | -20.475 |
| 832.9 | V | 0 | 100 | -4.35 | 20.716 | 0 | 4.867 | 21.233 | 37 | -15.767 |
| 920 | H | 0 | 100 | -4.2 | 20.3 | 0 | 5.118 | 21.218 | 37 | -15.782 |

Table 11. Radiated Emission Test Results (36Vin – 10Vout)



Radiated Emission: Limits of Electromagnetic Radiation Disturbance, Test Setup



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



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):2006 Radiated Emissions Electric Field | | | Test Date(s): 7/30/2008 | | |
|---|-------------------------------|-----------------|-------------------------|---------------|--------------|
| MET Asset # | Nomenclature | Manufacturer | Model | Last Cal Date | Cal Due Date |
| 1S2421 | EMI Test Receiver | Rohde & Schwarz | ESIB 7 | 4/18/2008 | 4/18/2009 |
| 1S2481 | 10 Meter Chamber | ETS-Lingren | DKE- 8X8 DBL | 12/26/2007 | 12/26/2008 |
| 1S2483 | 10 Meter Chamber Control Room | ETS-Lingren | DKE-4X7 RH | See Note | |
| 1S2185 | Bilog Antenna | CHASE | CBL 6111 | 7/17/2008 | 7/17/2009 |

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.