Exhibit B: Test Report
DLP Design
RF1 Transceiver

Project Number: 05335-10

Prepared for:
DLP Design.
1605 Roma Lane
Allen, TX 75013

By

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January 2005

CERTIFICATION
Electromagnetic Interference Test Report
DLP Design
RF1 Transceiver

Table Of Contents

Applicant:	DLP Design
Applicant's Address:	1605 Roma Lane
	Allen, TX 75013
FCC ID:	SX9000RF1
IC Number:	5675A-000RF1
Project Number:	05335-10
Test Dates:	January 24-27, February 23-25, 2005

The **, DLP Design RF1 Transceiver** was tested to and found to be in compliance with FCC 47 CFR Part 15, Subpart C for a transmitter.

The highest emissions generated by the above equipment are listed below:

	Frequency (MHz)	Level	Limit	Margin (dB)
Conducted (Tx)	0.256	40.5 dBuV	51.5 dBuV	-11.0
Conducted (Rx)	0.150	59.2 dBuV	66 dBuV	-6.8
Spurious (Tx)	4810	47.6 dBuV/m	54.0 dBuV/m	-6.4
Spurious (Rx)	132.85	34.6 dBuV/m	43.5 dBuV/m	-8.9
Peak Power	2440	-3.20 dBm	+30 dBm	-33.20
Occupied Bandwidth	1.64 MHz			
Emission Designator	1M64G1D			

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

Michael A. Royer, BSEE, NCE
EMC Department Manager

This report has been reviewed and accepted by **DLP Design**. The undersigned is responsible for ensuring that**, DLP Design RF1 Transceiver** will continue to comply with the FCC and IC rules.

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1.0 Introduction

1.1 Scope

This report describes the extent of the Equipment Under Test (EUT) conformance to the Electromagnetic Compatibility requirements of FCC 47 CFR Part 15 Subpart C and Industry Canada RSS-210 Issue 5 for a modular approval.

1.2 EUT Description

The **DLP Design RF1** combines a USB interface, Freescale™ MC13192 2.4GHz Direct-Sequence Spread Spectrum RF Transceiver IC and Freescale MC9S08GT60 microcontroller to form an IEEE 802.15.4 compliant, ZigBee™ ready, short-range transceiver module.

The MC9S08GT60 microcontroller is preprogrammed with DLP Design's Serial Interface Packet Processor (SIPP™ firmware) for accessing the transceiver functions via simple serial calls. The application programming required for accessing the module via USB is functionally identical to that used to access the RS232C ports on a standard Windows/Linux/Mac PC via the use of royalty-free Virtual COM Port (VCP) drivers. (No USB driver development is required for most applications.) The SIPP firmware in the DLP-RF1 resides at the application layer and is based on Freescale's SMAC. The SIPP firmware provides basic access to DLP-RF1 functionality: packet receive and transmit, transceiver settings, EEPROM access, etc.

1.3 EUT Operation

The **DLP Design RF1** was tested while in a continuous transmit mode. The EUT was tuned to a low, middle, and high channel to perform power, occupied bandwidth, and spurious/harmonic tests. For conducted emissions the device was tuned to its center frequency. The EUT continuously transmitted a pulsed, DSSS modulated packet with a 125 byte payload. While transmitting the EUT was setup to operate at max power. The system tested consisted of the following:

Manufacturer & Model	Description
DLP Design RF1 Transceiver	Zigbee Ready Transceiver
Dell Inspiron PP08L (Serial: CN-0W0941-12961-36Q-2697)	Laptop
AC Adapter PA-1131-02D (Serial: CN-09Y819-48010-377--07EE)	Power Supply

The following guidelines apply to the operation of the EUT:

Guidelines	FCC Rule Parts Part 15	IC Rule Parts RSS-210 Issue 5
Transmitter Characteristics	15.247	6.2.2(o)
Spurious Radiated Power	15.205, 15.209, 15.247	6.2.2(o), 6.3
Antenna Requirements	15.203	5.5
Power line Conducted Limits	15.207	6.6
Receiver Requirements	15.105, 15.107, 15.109	7.3, 7.4

2.0 Power Line Conducted Emissions

Conducted emissions measurements were made on the Class II Power Supply mains terminals of the **DLP Design RF1** to determine the line-to-ground radio noise emitted from each power-input terminal. Conducted emissions measurements on the mains terminals were performed at Professional Testing, located in Round Rock, Texas.

2.1 Test Procedure

The EUT was configured and operated in a manner consistent with typical applications. The EUT power cord in excess of one meter was folded back and forth forming a bundle 30 to 40 cm long in the approximate center of the cable. Power supply cords for the peripheral equipment were powered from an auxiliary LISN. Excess interface cable lengths were separately bundled in a non-inductive arrangement at the approximate center of the cable with the bundle 30 to 40 centimeters in length. The conducted emissions were maximized, by varying the operating states and configuration of the EUT.

The tests were performed in a 12' x 16' RayProof modular shielded room. The EUT was placed on a non-metallic table 0.4 meters from a vertical metal reference plane and 0.8 meters from a horizontal metal reference plane.

The measurements were taken using a Line Impedance Stabilization Network (LISN). A Spectrum Analyzer and Quasi-Peak adapter with a measurement bandwidth of 9 kHz was used to record the conducted emissions measurements. The configuration of the shielded room showing the location of the EUT and the measurement equipment is given in Appendix A.

2.2 Test Criteria

The FCC 15.207 and RSS-210 6.6 conducted emissions limits are given below.

Frequency (MHz)	Conducted Limits (dBuV)	
	Average	Quasi-Peak
0.15 – .50	66-56	56 - 46
.50 - 5	56	46
5 – 30	60	50

The lower limit shall apply at the transition frequency.

2.3 Test Results

The conducted emissions data is included in Appendix B. The conducted emissions generated by the **DLP Design RF1** as measured on the Class II Power Supply mains terminals were found to be below FCC 15.207 and RSS-210 6.6 maximum emissions criteria.

3.0 Peak Output Power

Peak power measurements were made on the fundamental transmit frequencies for the **DLP Design RF1**. Measurements of the maximum emission levels for the fundamental of the EUT were made at the Professional Testing "Open Field" Site 3, located in Round Rock, Texas. A "Description of Measurement Facilities" has been submitted to the FCC and approved pursuant to Section 2.948 of CFR 47 of the FCC rules.

Tests of the fundamental emissions of the EUT were made to determine the worse case polarization of the device. The emissions of the device were measured with the EUT in three orthogonal axes.

3.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable, which allows 360-degree rotation. For measurements of the fundamental signal, a measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT. Rotating the EUT maximized the emissions.

A spectrum analyzer with peak detection was used to find the maximum field strength during the variability testing. A calculation was then made to determine the peak power at the antenna terminal. A drawing showing the test setup is given in Appendix A.

3.2 Test Criteria

The maximum peak output power is 30 dBm for DSSS devices operating in the frequency range 2400-2483.5 MHz according to FCC 15.247(b)(3)and RSS-210 6.2.2(o).

3.3 Test Results

Peak field strengths for three frequencies and associated calculations are given in Appendix B. The peak power found was -3.20 dBm which is below the 30 dBm limit. The **DLP Design RF1** complies with FCC 15.247(b)(3)and RSS-210 6.2.2(o).

4.0 Minimum 6 dB Occupied Bandwidth

Occupied bandwidth measurements were performed on the **DLP Design RF1** to determine compliance with FCC 15.247(a)(2)and RSS-210 6.2.2(o). Measurements of the occupied bandwidth of the EUT were made at the Professional Testing "Open Field" Site 3, located in Round Rock, Texas.

4.1 Test Procedure

The occupied bandwidth was measured with a spectrum analyzer connected to a double-ridged guide horn while the EUT was operating in continuous transmit mode at the appropriate center frequency. The analyzer center frequency was set to the EUT carrier frequency. Display line and marker delta functions were used to measure the 6 dB occupied bandwidth of the EUT. Measurements were made at three frequencies. A drawing showing the test setup is given in Appendix A.

4.2 Test Criteria

The minimum 6 dB occupied bandwidth for the EUT is 500 kHz as stated in 15.247(a)(2)and RSS-210 6.2.2(o).

4.3 Test Results

Occupied bandwidths for three frequencies are given in Appendix B. All occupied bandwidth measurements were above the 500 kHz limit. The **DLP Design RF1** complies with 15.247(a)(2)and RSS-210 6.2.2(o).

5.0 Power Spectral Density

Power spectral density measurements were performed on the **DLP Design RF1** to determine compliance with FCC 15.247(d) and RSS-210 6.2.2(o). Measurements of the power spectral density of the EUT were made at the Professional Testing "Open Field" Site 3, located in Round Rock, Texas.

5.1 Test Procedure

The fundamental emission of the EUT is maximized and the spectrum analyzer is tuned to the highest point. The analyzer is then set with the following parameters: RBW=3kHz, VBW>RBW, span=300kHz, and sweep=100s. The peak level is obtained after the sweep completes. The test setup is included in Appendix A.

5.2 Test Criteria

According to section FCC 15.247(d) and RSS-210 6.2.2(o) the maximum power spectral density is +8 dBm in any 3 kHz bandwidth.

5.3 Test Results

A data table showing the power spectral density for three transmit frequencies is given in Appendix B. All power spectral density measurements were below the +8 dBm limit and the **DLP Design RF1 is** therefore compliant with FCC 15.247(d) and RSS-210 6.2.2(o).

6.0 Band Edge Spurious Emissions

Band edge spurious emissions measurements were performed on **DLP Design RF1** to determine compliance to FCC 15.247(c) and RSS-210 6.2.2(o). Measurements of the band edge spurious emissions of the EUT were made at the Professional Testing "Open Field" Site 3, located in Round Rock, Texas.

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 motorized turntable, which allows 360-degree rotation. For measurements of the fundamental signal, a measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT. Rotating the EUT maximized the emissions.

The spectrum analyzer was set for peak detection using a 100 kHz resolution bandwidth. The span is set to 10 MHz with the center of the display at the frequency of the band edge. Measurement is made at the band edge using the marker delta method while transmitting on the

channels nearest the band edge to determine if the EUT meets the test criteria. The test setup is included in Appendix A.

6.2 Test Criteria

According to FCC 15.247(c) and RSS-210 6.2.2(o) the band edge spurious emissions must be 20 dB below the highest peak in the operating band in any 100 kHz bandwidth. If the frequency falls in the restricted bands of 15.205 the maximum permitted average must be below the field strength listed in 15.209.

Alternatively, the band edge spurious emissions will meet criteria if they are attenuated below the limits specified in FCC 15.209 or RSS-210 Table 3.

6.3 Test Results

Plots and associated data sheets are included in Appendix B. The peak and average band edge spurious emissions fall below the limits of FCC 15.209 and RSS-210 Table 3. The **DLP Design RF1** is compliant with FCC 15.247(c) and RSS-210 6.2.2(o).

7.0 Out of Band Spurious Emissions

Out of band spurious/harmonic emissions measurements were performed on **DLP Design RF1** to determine compliance to FCC 15.247(c), 15.209and RSS-210 6.3. Measurements of the spurious emissions of the EUT were made at the Professional Testing "Open Field" Site 3, located in Round Rock, Texas.

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 motorized turntable, which allows 360-degree rotation. For measurements of the fundamental signal, a measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT. Rotating the EUT maximized the emissions.

For spurious emissions below 1 GHz quasi-peak detection is used with a resolution bandwidth of 120 kHz. For spurious/harmonic emissions above 1 GHz peak detection with a resolution bandwidth of 1 MHz. Average detection above 1 GHz is used to determine compliance of the EUT if the peak does not meet the average limit. A resolution bandwidth of 1 MHz and video bandwidth of (1/transmitter “on-time”) Hz is used for average detection of pulsed emissions. A peak to average calculation is also employed for averaging pulsed emissions. The test setup is included in Appendix A.

Testing was completed at 3 frequencies to determine compliance.

7.2 Test Criteria

The radiated limits of FCC 15.209 and RSS-210 Table 3 are shown below. The limits specified are at 3 meters. The limits are quasi-peak for emissions below 1 GHz and average for emissions above 1 GHz. Also above 1 GHz the peak limit is 20 dB above the average limit.

Frequency MHz	Test Distance (Meters)	Field Strength (uV/m)	(dBuV/m)
30 to 88	3	100	40.0
88 to 216	3	150	43.5
216 to 960	3	200	46.0
Above 960	3	500	54.0

Note: Emissions above 1 GHz were measured at a distance of 1 meter. The limit was increased by 9.5 dB. Emissions above 18 GHz were measured at a distance of 10 cm and the limit increased by 29.5 dB.

7.3 Test Results

Data sheets are included in Appendix B. The peak and average out of band spurious/harmonic emissions fall below the limits of FCC 15.209 and RSS-210 Table 3. The **DLP Design RF1** is compliant with FCC 15.247(c), 15.209and RSS-210 6.3.

8.0 Antenna Requirements

An antenna evaluation was performed on the **DLP Design RF1** determine compliance with FCC 15.203, 15.247(b) and RSS-210 5.5. Evaluation of the antenna requirements of the EUT were made at the Professional Testing "Open Field" Site 3, located in Round Rock, Texas.

8.1 Evaluation Procedure

The antenna of the EUT is analyzed with respect to the rules of FCC 15.203 and RSS-210 5.5. Gain of the antenna is assessed by reviewing the manufacturer's data sheet.

8.2 Evaluation Criteria

Section 15.203 and RSS-210 5.5 of the rules states that the subject device must meet at least one of the following criteria:

a) Antenna be permanently attached to the unit.
b) Antenna must use a unique type of connector to attach to the EUT.
c) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

Section 15.247(b)(4)(i) states that if the transmitting antenna has a directional gain greater than 6 dBi the power shall be reduced the amount in dB that the directional gain is greater than 6 dBi.

8.3 Evaluation Results

The transmitting antenna is an F type antenna that is a trace on the printed circuit board. The antenna does not exhibit a gain greater than 6 dBi. The **DLP Design RF1** is compliant with 15.203, 15.247(b)(4)(i)and RSS-210 5.5.

9.0 Timing Assessment

The timing between transmissions and duration of each transmission on the **DLP Design RF1** was assessed to determine an appropriate peak to average correction factor for typical operation.

9.1 Test Procedure

Using a spectrum analyzer set in zero span two pulses are captured on the screen. The ratio of on-time to off-time is calculated and converted to the dB scale. The test setup is included in Appendix A.

9.2 Test Criteria

There is no criteria associated with this assessment. This correction factor is used to determine the average value of an emission if the peak exceeds the average limit for the emission being measured.

9.3 Test Results

Results are included in Appendix B. To generate a worst case timing plot, a test program from the host computer was created. The program generated data for the RF1 using the largest packet size possible and no delay between packets. A correction factor of 4.1 dB was calculated using the transmitter ‘on-time’ duty cycle.

10.0 Radio Frequency Exposure

Radio Frequency exposure was evaluated on the **DLP Design RF1** to determine compliance with FCC 15.247(b)(5)and RSS-210 14. Evaluation of the radio frequency exposure of the EUT was made at the Professional Testing "Open Field" Site 3, located in Round Rock, Texas.

10.1 Evaluation Procedure

The friis transmission formula was applied to the peak power measurements obtained in section 2. The minimum distance from the body is obtained where radio frequency exposure reaches the limit. The distance is compared with the normal distance of operation from the body.

10.2 Evaluation Criteria

According to FCC 1.1307(b) the limits for maximum permissible exposure (MPE) from 1.1310 must be used to evaluate the impact of human exposure to radio frequency radiation. The limits from 1.1310 are listed below:

Frequency MHz	Power Density (mW/cm^2)	Average Time (Minutes)
(B) Limits for Occupational / Controlled Exposures		
30-300	1.0	6
300-1500	f/300	6
1500-100,000	5	6
(B) Limits for General Population / Uncontrolled Exposures		
30-300	0.2	30
300-1500	f/1500	30
1500-100,000	1.0	30

10.3 Evaluation Results

Calculations are included in Appendix B. The RF exposure for the EUT falls below the limits in 1.1310. The **DLP Design RF1** is compliant with FCC 15.247(b)(5) and RSS-210 14.

11.0 Receiver Requirements

Emissions measurements were mad with the **DLP Design RF1** in a receive/standby mode to show compliance with the complete set of rules. Receivers operating above 960 MHz are only subject to verification by FCC part 15 and Industry Canada RSS-210. The FCC Class B limits and RSS-210 Category II limits for receivers are the same and will be applied to receiver measurements.

11.1 Power line Conducted Emissions

Conducted emissions measurements were made on the Class II Power Supply mains terminals of the **DLP Design RF1** to determine the line-to-ground radio noise emitted from each power-input terminal. Conducted emissions measurements on the mains terminals were performed at Professional Testing, located in Round Rock, Texas.

11.1.1 Test Procedure

The procedure here is consistent with the procedure stated in section 2.1 for Power line Conducted Emissions except the EUT is operated in a receive/standby mode.

11.1.2 Test Criteria

The FCC 15.107 and RSS-210 7.4 conducted emissions limits are given below.

Frequency (MHz)	**Conducted Limits (dBuV)**	
	Average	**Quasi-Peak**
0.15 – .50	66-56	56 - 46
.50 - 5	56	46
5 – 30	60	50

The lower limit shall apply at the transition frequency.

11.1.3 Test Results

The conducted emissions data is included in Appendix B. The conducted emissions generated by the **DLP Design RF1** as measured on the Class II Power Supply mains terminals were found to be below FCC 15.207 and RSS-210 7.4 maximum emissions criteria.

11.2 Spurious Radiated Emissions

Radiated emission measurements were made of the spurious emission levels for the **DLP Design RF1** receiver portion**.**

Measurements of the maximum emission levels for the spurious emissions of the **DLP Design RF1** were made at the Professional Testing "Open Field" Site 3, located in Austin, Texas to determine the radio noise radiated from the EUT.

Tests of the device were performed to determine the worst case polarization of the devices. The spurious emissions of the device were measured with the EUT in the three orthogonal axes

11.2.1 Test Procedure

The procedure here is consistent with the procedure stated in section 7.1 for Spurious Radiated Emissions except the EUT is operated in a receive/standby mode.

11.2.2 Test Criteria

The radiated limits of FCC 15.109 and RSS-210 7.3 are shown below. The limits specified are at 3 meters. The limits are quasi-peak for emissions below 1 GHz and average for emissions above 1 GHz. Also above 1 GHz the peak limit is 20 dB above the average limit.

Frequency MHz	Test Distance (Meters)	Field Strength (uV/m)	(dBuV/m)
30 to 88	3	100	40.0
88 to 216	3	150	43.5
216 to 960	3	200	46.0
Above 960	3	500	54.0

Note: Emissions above 1 GHz were measured at a distance of 1 meter. The limit was increased by 9.5 dB. Emissions above 18 GHz were measured at a distance of 10 cm and the limit increased by 29.5 dB

11.2.3 Test Results

Data sheets are included in Appendix B. The spurious emissions fall below the limits above. The **DLP Design RF1** is compliant with FCC 15.109 and RSS-210 7.3.

12.0 Modifications

RF shielding was added to isolate the RF portion of the device. The device was modified to ensure compliance with the modular approval requirements. A photo of the modification is included in Exhibit E.

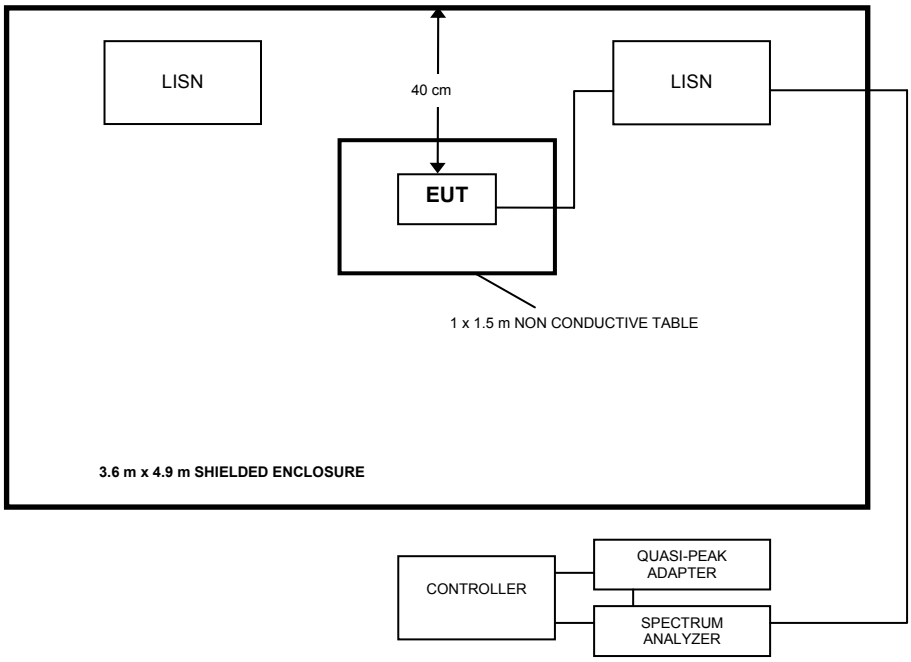
13.0 Test Equipment Used

Test equipment used to complete the testing included in this report is listed below.

Electromagnetic Emissions Test Equipment			
Asset	**Model**	**Description**	**Cal Date**
0978	HP 8568B	Spectrum Analyzer	11/03/2005
0275	HP 85650A	Quasi-Peak Adapter	02/19/2005
0238	HP 85685A	RF Preselector	02/19/2005
0483	HP 8447D	Preamp	01/12/2006
0950	HP 8566B	Spectrum Analyzer	04/08/2005
0897	Miteq	30 dB Preamp	05/13/2005
0582	EMCO 3115	DRG Horn	07/31/2005
0237	HP 8568B	Spectrum Analyzer	12/10/2005
0239	HP 85650A	Quasi-Peak Adapter	12/13/2005
0990	HP 85685A	RF Preselector	01/06/2006
0543	PTI 0543	Conducted EMI Cable	01/10/2006
0474	PTI L/A	3 dB Limiter/Attenuator	01/10/2006
0759	Solar 8012-50-R-24-BNC	LISN	01/10/2006
0572	PTI HPF	CISPR 16 High Pass Filter	01/10/2006
0754	Compliance Design B-100	Biconical Antenna	01/12/2006
0755	EMCO 3146	Log Periodic Antenna	07/22/2005
0747	Advantest R3265	Spectrum Analyzer	11/12/2005
0989	MicroTronics HPM50111	2.5 GHz High Pass Filter	CBU

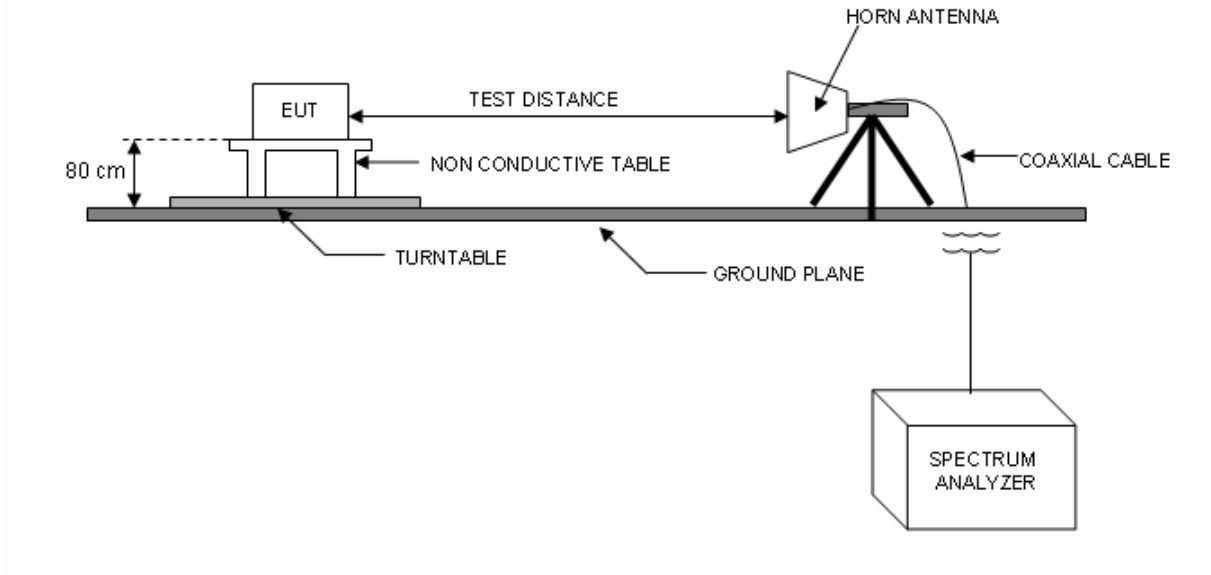
Appendix A Test Setup Diagrams

Conducted Test Setup

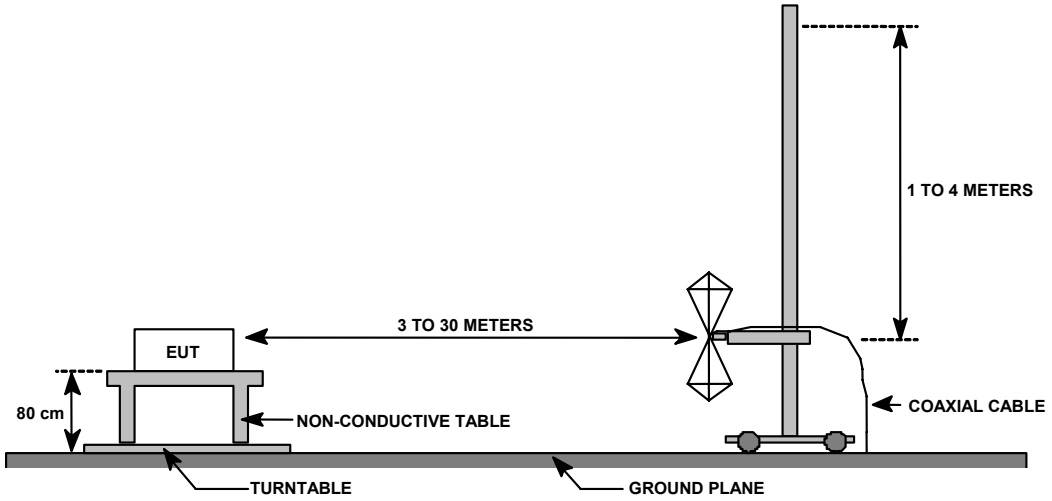


Radiated Test Setup

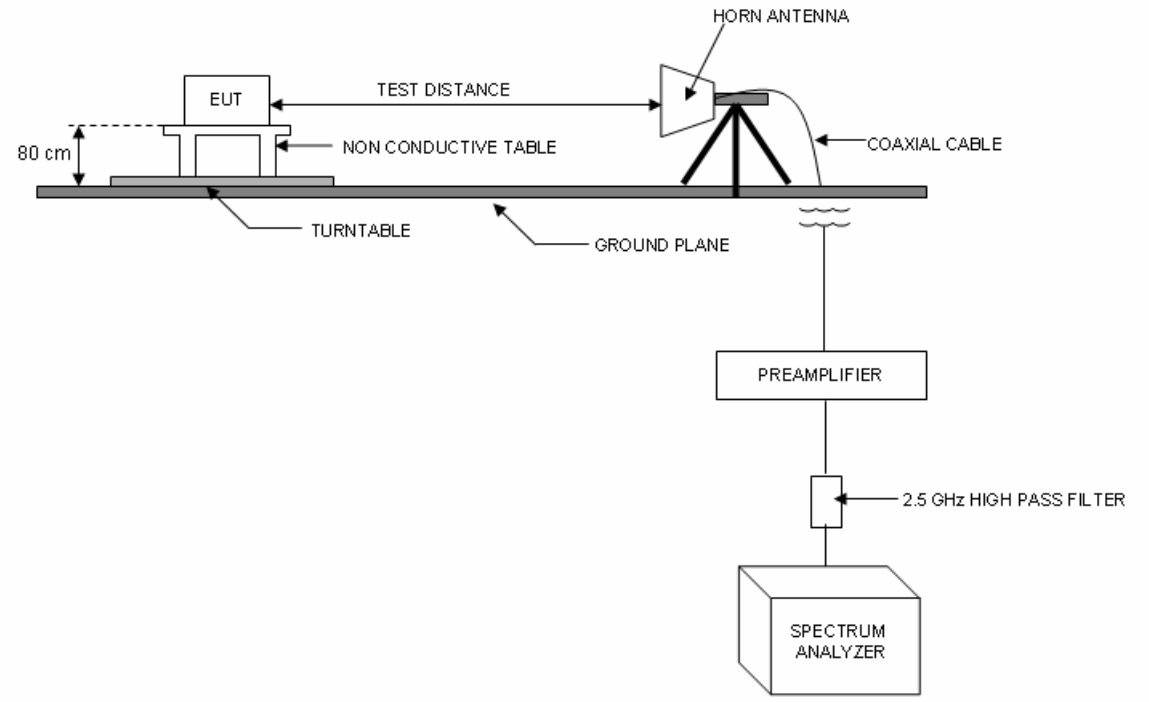
Peak Power, Occupied Bandwidth, Power Spectral Density, Timing Assessment, Band Edge Spurious



Radiated Test Setup
Spurious



Radiated Test Setup
Harmonics



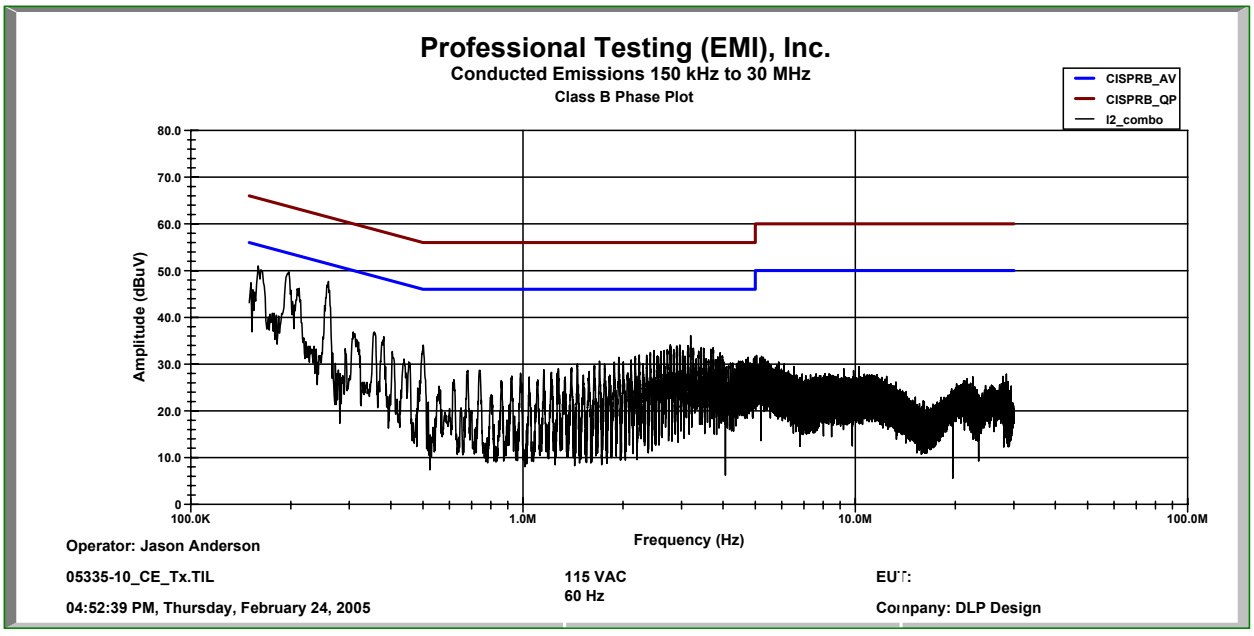
Appendix B Data Sheets and Calculations

Power line Conducted Emissions
DLP Design RF1
Quasi-Peak Detection, RBW = 9 kHz

Test Date: February 24, 2005

Line Selection: Phase

Frequency Reading (MHz)	Quasi-peak Reading (dBuV)	Average Reading (dBuV)	Quasi-peak Limit (dBuV)	Quasi-peak Margin (dB)	Average Limit (dBuV)	Average Margin (dB)	Test Results
0.16723	35.8	28.9	65.1	-29.3	55.1	-26.2	Within Limits
0.17108	34.3	22.7	64.9	-30.6	54.9	-32.2	Within Limits
0.19612	48.7	42.7	63.8	-15.1	53.8	-11.1	Within Limits
0.19725	49.1	42.6	63.7	-14.6	53.7	-11.1	Within Limits
0.25261	41.2	34.6	61.7	-20.5	51.7	-17.1	Within Limits
5.04879	30.1	26.9	60.0	-29.9	50.0	-23.1	Within Limits
5.17068	28.8	23.4	60.0	-31.2	50.0	-26.6	Within Limits
5.23228	30.1	26.1	60.0	-29.9	50.0	-23.9	Within Limits
5.29101	30.2	27	60.0	-29.8	50.0	-23.0	Within Limits
5.35075	29	24.2	60.0	-31.0	50.0	-25.8	Within Limits



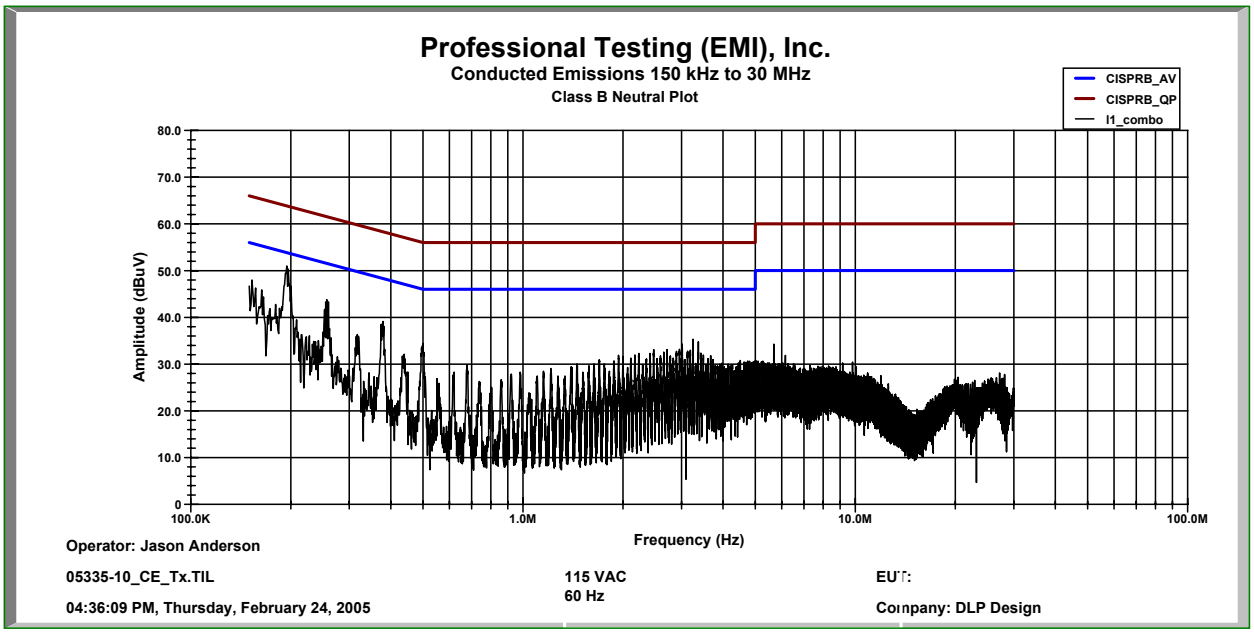
The data presented here in graphical form is for overview only. Detailed and precise data is in the table above.

Power line Conducted Emissions
DLP Design RF1
Quasi-Peak Detection, RBW = 9 kHz

Test Date: February 24, 2005

Line Selection: Neutral

Frequency Reading (MHz)	Quasi-peak Reading (dBuV)	Average Reading (dBuV)	Quasi-peak Limit (dBuV)	Quasi-peak Margin (dB)	Average Limit (dBuV)	Average Margin (dB)	Test Results
0.155	38.4	30.4	65.7	-27.3	55.7	-25.3	Within Limits
0.1597	45.7	44.3	65.5	-19.8	55.5	-11.2	Within Limits
0.16286	45.7	44.4	65.3	-19.6	55.3	-10.9	Within Limits
0.2019	36.8	25.5	63.5	-26.7	53.5	-28.0	Within Limits
0.25636	44.9	40.5	61.5	-16.6	51.5	-11.0	Within Limits
5.04359	28.3	23.2	60.0	-31.7	50.0	-26.8	Within Limits
5.10381	28	22.4	60.0	-32.0	50.0	-27.6	Within Limits
5.28401	29.3	23.2	60.0	-30.7	50.0	-26.8	Within Limits
5.69679	25.5	20.7	60.0	-34.5	50.0	-29.3	Within Limits
6.16015	17	7	60.0	-43.0	50.0	-43.0	Within Limits



The data presented here in graphical form is for overview only. Detailed and precise data is in the table above.

Peak Power
DLP Design RF1
Peak Detection, RBW = 1 MHz
Test Distance 1 meters

Test Date: February 23, 2005

All Orientations

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)
2405	max	1	70.7	0.0	28.2	0.6	99.5
2440	max	1	72.7	0.0	28.2	0.6	101.5
2480	max	1	72.7	0.0	28.3	0.6	101.6

Calculations

$$P = \frac{(E * d)^2}{30 * G}$$

P=Power in watts, E=measured maximum field strength in V/m, d=distance in meters,
G=numeric gain of transmitting antenna

Distance=1 meters
Gain=0 dBi

Calculated Result

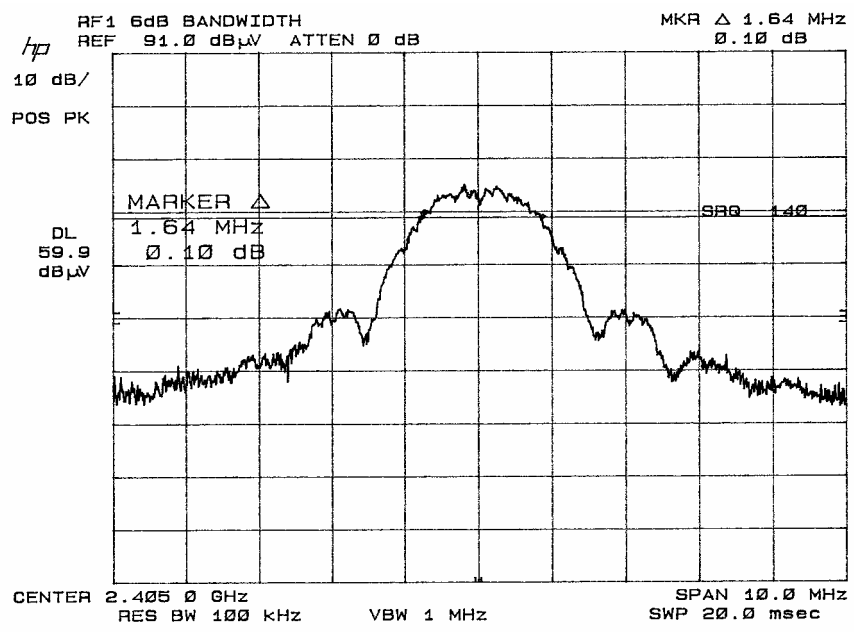
Frequency (MHz)	Field Strength (dB/uV)	E.I.R.P (dBm)	Limit (dBm)
2405	99.5	-5.30	30
2440	101.5	-3.26	30
2480	101.6	-3.20	30

Result: PASS

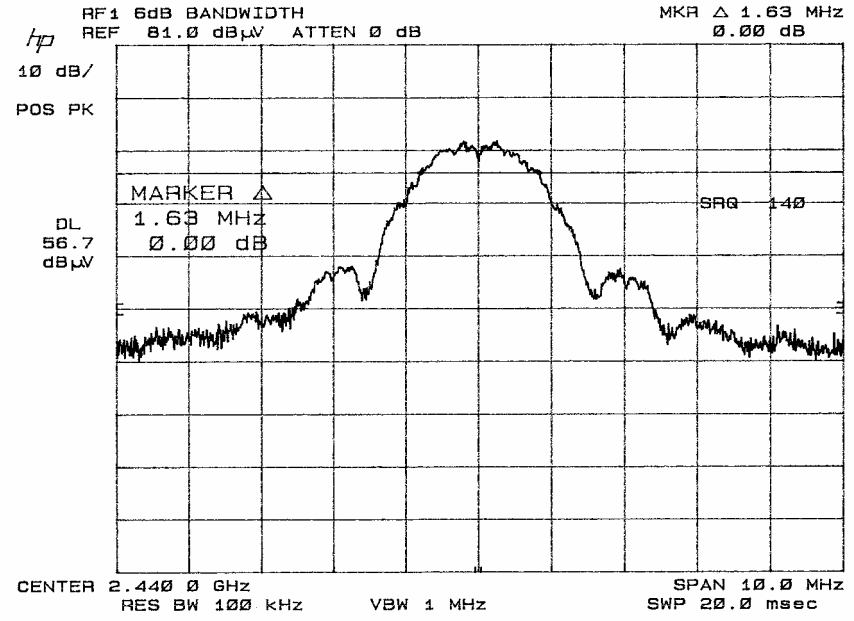
Occupied Bandwidth
DLP Design RF1
Peak Detection, RBW = 100 kHz

Test Date: February 23, 2005

Low Channel



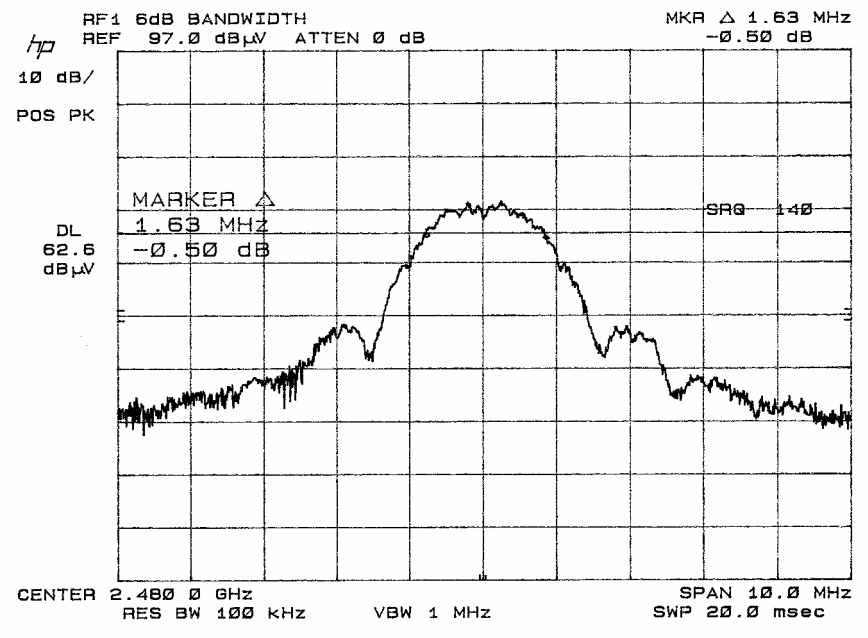
Middle Channel



Occupied Bandwidth
DLP Design RF1
Peak Detection, RBW = 100 kHz

Test Date: February 23, 2005

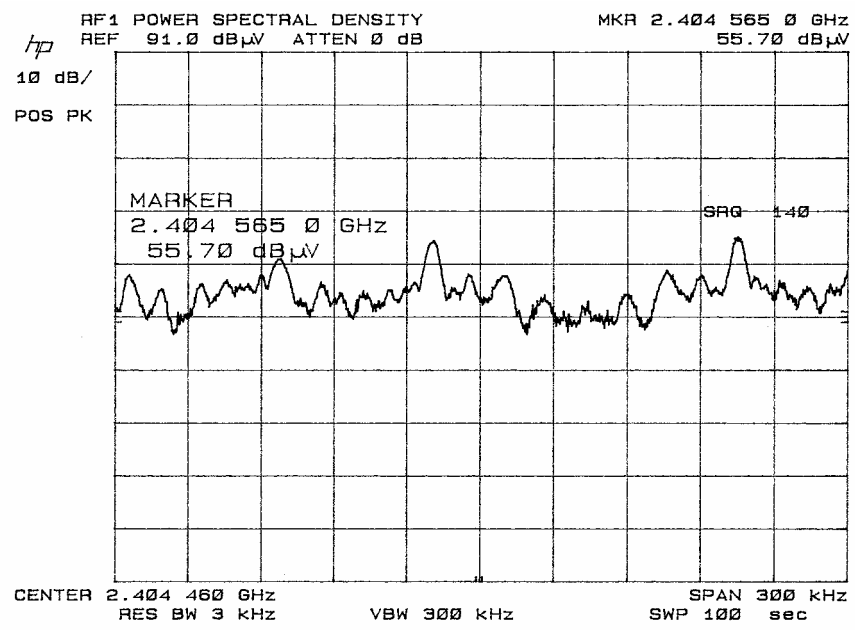
High Channel



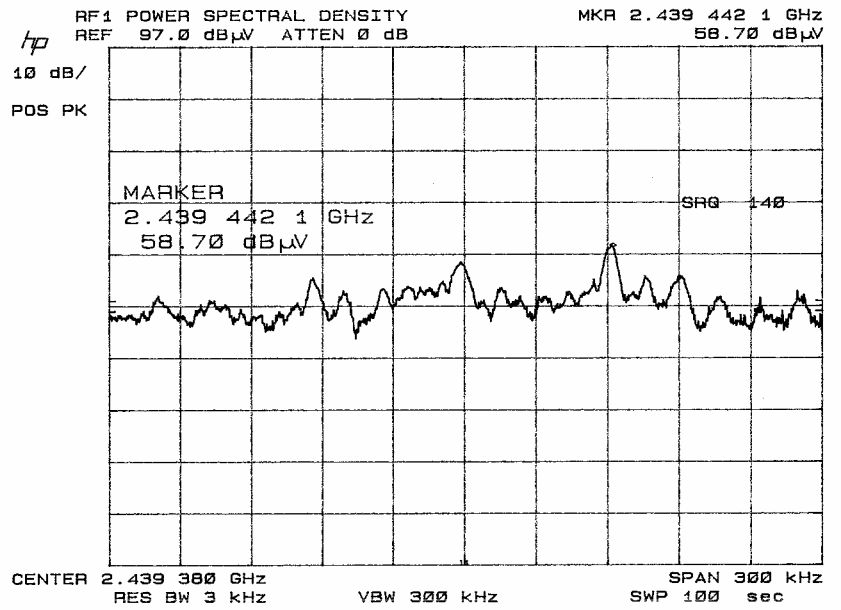
Power Spectral Density
DLP Design RF1
Peak Detection, RBW = 3 kHz
Test Distance 1 meters

Test Date: February 23, 2005

Low Channel



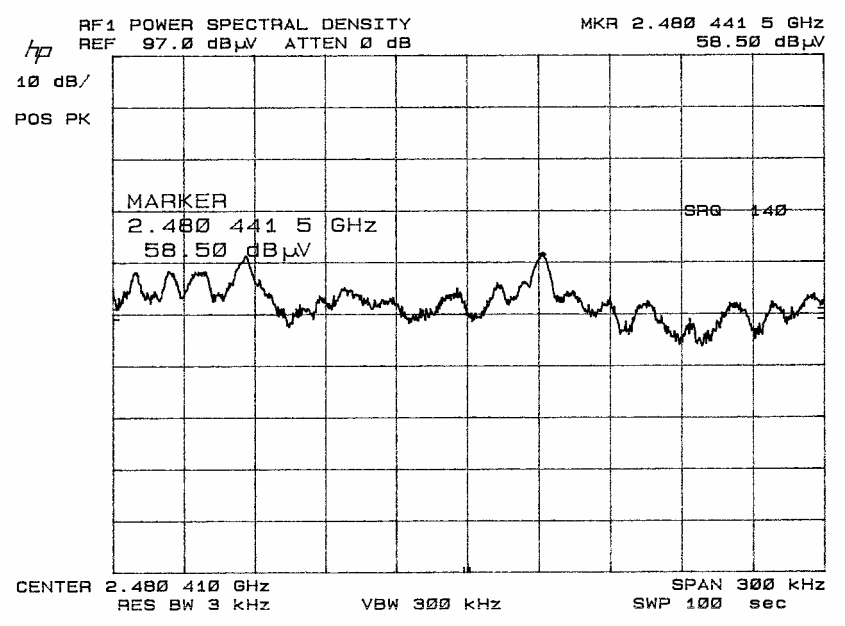
Middle Channel



Power Spectral Density
DLP Design RF1
Peak Detection, RBW = 3 kHz
Test Distance 1 meters

Test Date: February 23, 2005

High Channel



Power Spectral Density
DLP Design RF1
Peak Detection, RBW = 3 kHz
Test Distance 1 meters

Test Date: February 23, 2005

All Orientations

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)
2405	max	1	55.7	0.0	28.2	0.6	84.5
2440	max	1	58.7	0.0	28.2	0.6	87.5
2480	max	1	58.5	0.0	28.3	0.6	87.4

Calculations

$$P = \frac{(E * d)^2}{30 * G}$$

P=Power in watts, E=measured maximum field strength in V/m, d=distance in meters,
G=numeric gain of transmitting antenna

Distance=1 meters
Gain=0 dBi

Calculated Result

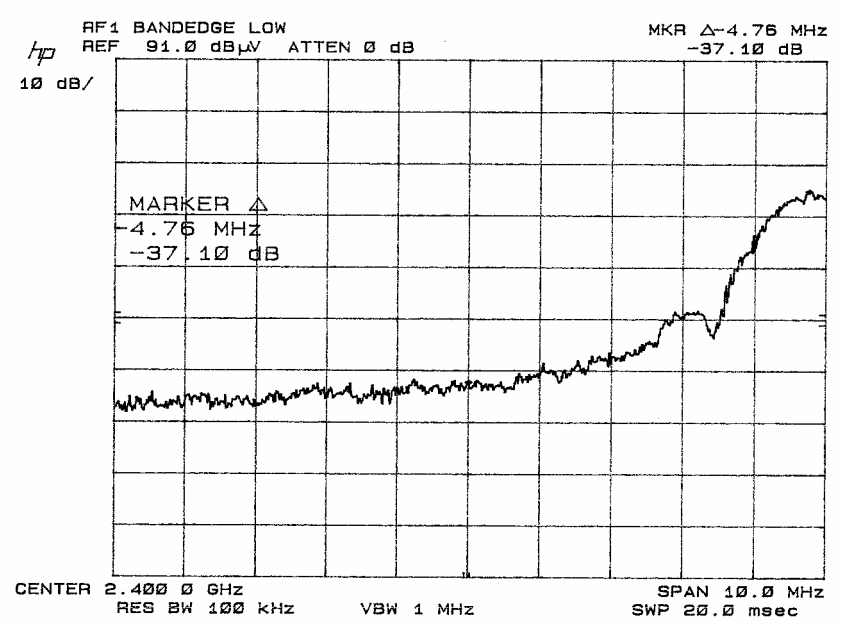
Frequency (MHz)	Field Strength (dB/uV)	E.I.R.P (dBm/3kHz)	Limit (dBm/3kHz)
2405	84.5	-20.27	8
2440	87.5	-17.27	8
2480	87.4	-17.37	8

Result: PASS

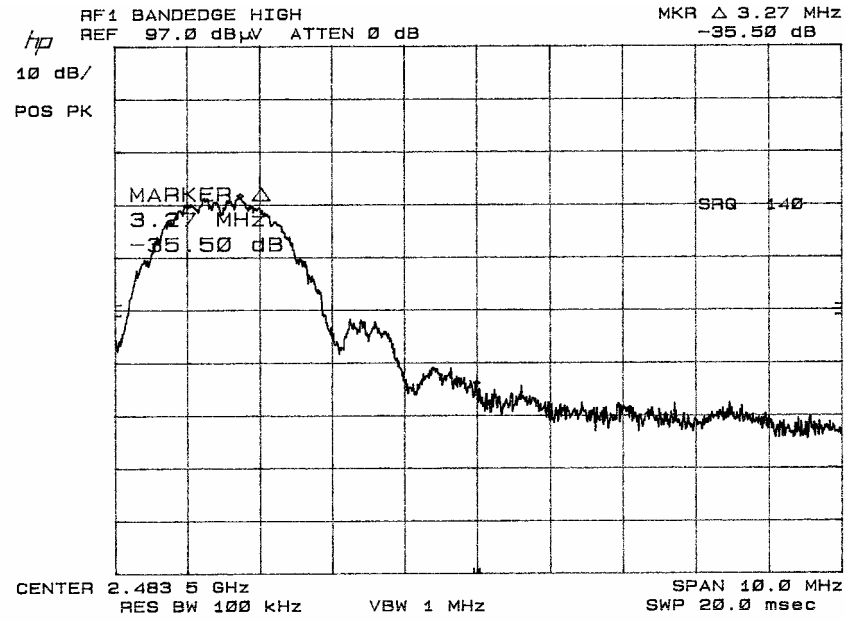
Band Edge Spurious Emissions
DLP Design RF1
Peak Detection, RBW = 100 kHz
Test Distance 1 meters

Test Date: February 23, 2005

Band Edge Plot (Low Channel)



Band Edge Plot (High Channel)



Band Edge Spurious Emissions
DLP Design RF1
Peak Detection, RBW = 100 kHz
Test Distance 1 meters

Test Date: February 23, 2005

Band Edge Data

Freq. (MHz)	Detector Function	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/M)	Cable Loss (dB)	Distance Correction (dB)	Corrected Level (dBuV/M)	Limit 3 Meters (dBuV)	Margin (dB)
2400	peak	1	33.6	34.7	28.2	3.6	9.5	21.2	54	-32.8
2483.5	peak	1	37.2	34.9	28.3	3.6	9.5	24.7	54	-29.3

Note: To measure the band edge at 2400 MHz the device was tuned to the lowest channel. To measure the band edge at 2483.5 MHz the device was tuned to the highest channel. The marker delta method was used to determine the level at the band edge. The EUT meets the general emission limits from 15.209

Out of Band Spurious/Harmonic Emissions
DLP Design RF1
Quasi-Peak Detection, RBW = 120 kHz
Test Distance 3 meters

Test Date: February 25, 2005

30-1000 MHz Vertical

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
66	noise	floor	32.9	26.7	7.3	2.2	15.7	40	-24.3
260	30	2	43.2	27.0	12.6	4.5	33.3	46	-12.7
350	noise	floor	36.5	27.3	15.0	5.5	29.7	46	-16.3
570	noise	floor	34.3	27.1	18.6	7.3	33.1	46	-12.9
725	noise	floor	34.6	26.2	21.6	8.5	38.5	46	-7.5
910	noise	floor	35.1	26.2	22.6	10.7	42.2	46	-3.8

30-1000 MHz Horizontal

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
66	noise	floor	32.9	26.7	7.3	2.2	15.7	40	-24.3
260	60	1.5	47.3	27.0	12.6	4.5	37.4	46	-8.6
350	noise	floor	36.5	27.3	15.0	5.5	29.7	46	-16.3
570	noise	floor	34.3	27.1	18.6	7.3	33.1	46	-12.9
725	noise	floor	34.6	26.2	21.6	8.5	38.5	46	-7.5
910	noise	floor	35.1	26.2	22.6	10.7	42.2	46	-3.8

Out of Band Spurious/Harmonic Emissions
DLP Design RF1
Peak/Average Detection, RBW = 1 MHz
Test Distance 1 meter

Test Date: February 24, 2005

1-25 GHz Vertical (Low Channel)

Freq. (MHz)	Detector Function	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/M)	Cable Loss (dB)	Distance Correction (dB)	Corrected Level (dBuV/M)	Limit (dBuV/M)	Margin (dB)
4810	peak	1	57.2	31.3	34.0	3.8	9.5	54.3	74	-19.7
7215	peak	1	46.3	31.0	36.7	4.4	9.5	47.0	74	-27.0
9620	peak	1	48.4	30.9	37.8	4.5	9.5	50.3	74	-23.7
12025	noise	floor	28.9	30.4	39.1	5.0	9.5	33.1	54	-20.9
14430	noise	floor	30	29.6	41.2	4.8	9.5	36.9	54	-17.1
16835	noise	floor	29.3	31.5	41.4	5.1	9.5	34.9	54	-19.1
19240	noise	floor	41.6	0.0	37.0	0.0	29.5	49.1	54	-4.9
21645	noise	floor	41.4	0.0	37.0	0.0	29.5	48.9	54	-5.1
24050	noise	floor	41.3	0.0	37.0	0.0	29.5	48.8	54	-5.2
4810	avg	1	46.3	31.3	34.0	3.8	9.5	43.4	54	-10.6
7215	avg	1	34.4	31.0	36.7	4.4	9.5	35.1	54	-18.9
9620	avg	1	36.2	30.9	37.8	4.5	9.5	38.1	54	-15.9

1-25 GHz Horizontal (Low Channel)

Freq. (MHz)	Detector Function	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/M)	Cable Loss (dB)	Distance Correction (dB)	Corrected Level (dBuV/M)	Limit 3 Meters (dBuV)	Margin (dB)
4810	peak	1	60.5	31.3	34.0	3.8	9.5	57.6	74	-16.4
7215	peak	1	46.6	31.0	36.7	4.4	9.5	47.3	74	-26.7
9620	peak	1	49.4	30.9	37.8	4.5	9.5	51.3	74	-22.7
12025	noise	floor	28.9	30.4	39.1	5.0	9.5	33.1	54	-20.9
14430	noise	floor	30	29.6	41.2	4.8	9.5	36.9	54	-17.1
16835	noise	floor	29.3	31.5	41.4	5.1	9.5	34.9	54	-19.1
19240	noise	floor	41.6	0.0	37.0	0.0	29.5	49.1	54	-4.9
21645	noise	floor	41.4	0.0	37.0	0.0	29.5	48.9	54	-5.1
24050	noise	floor	41.3	0.0	37.0	0.0	29.5	48.8	54	-5.2
4810	avg	1	50.5	31.3	34.0	3.8	9.5	47.6	54	-6.4
7215	avg	1	35.3	31.0	36.7	4.4	9.5	36.0	54	-18.0
9620	avg	1	37.3	30.9	37.8	4.5	9.5	39.2	54	-14.8

Note: Average was measured using 300 Hz Video bandwidth, then reduced 4.1 dB further according to the duty cycle calculation and timing assessment.

Out of Band Spurious/Harmonic Emissions
DLP Design RF1
Peak/Average Detection, RBW = 1 MHz
Test Distance 1 meter

Test Date: February 24, 2005

1-25 GHz Vertical (Middle Channel)

Freq. (MHz)	Detector Function	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/M)	Cable Loss (dB)	Distance Correction (dB)	Corrected Level (dBuV/M)	Limit (dBuV/M)	Margin (dB)
4880	peak	1	55.7	31.1	34.2	3.8	9.5	53.1	74	-20.9
7320	peak	1	45.8	30.9	36.9	4.4	9.5	46.7	74	-27.3
9760	peak	1	51.8	30.8	37.9	4.5	9.5	53.9	74	-20.1
12200	noise	floor	28.9	30.4	39.4	5.0	9.5	33.3	54	-20.7
14640	noise	floor	30	29.3	40.5	4.8	9.5	36.5	54	-17.5
17080	noise	floor	29.3	31.3	42.7	5.2	9.5	36.4	54	-17.6
19520	noise	floor	41.6	0.0	37.0	0.0	29.5	49.1	54	-4.9
21960	noise	floor	41.4	0.0	37.0	0.0	29.5	48.9	54	-5.1
24400	noise	floor	41.3	0.0	37.0	0.0	29.5	48.8	54	-5.2
4880	avg	1	47.6	31.1	34.2	3.8	9.5	45.0	54	-9.0
7320	avg	1	34.5	30.9	36.9	4.4	9.5	35.4	54	-18.6
9760	avg	1	40.7	30.8	37.9	4.5	9.5	42.8	54	-11.2

1-25 GHz Horizontal (Middle Channel)

Freq. (MHz)	Detector Function	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/M)	Cable Loss (dB)	Distance Correction (dB)	Corrected Level (dBuV/M)	Limit 3 Meters (dBuV)	Margin (dB)
4880	peak	1	57.7	31.1	34.2	3.8	9.5	55.1	74	-18.9
7320	peak	1	46.3	30.9	36.9	4.4	9.5	47.2	74	-26.8
9760	peak	1	51.5	30.8	37.9	4.5	9.5	53.6	74	-20.4
12200	noise	floor	28.9	30.4	39.4	5.0	9.5	33.3	54	-20.7
14640	noise	floor	30	29.3	40.5	4.8	9.5	36.5	54	-17.5
17080	noise	floor	29.3	31.3	42.7	5.2	9.5	36.4	54	-17.6
19520	noise	floor	41.6	0.0	37.0	0.0	29.5	49.1	54	-4.9
21960	noise	floor	41.4	0.0	37.0	0.0	29.5	48.9	54	-5.1
24400	noise	floor	41.3	0.0	37.0	0.0	29.5	48.8	54	-5.2
4880	avg	1	44.8	31.1	34.2	3.8	9.5	42.2	54	-11.8
7320	avg	1	33.7	30.9	36.9	4.4	9.5	34.6	54	-19.4
9760	avg	1	41.4	30.8	37.9	4.5	9.5	43.5	54	-10.5

Note: Average was measured using 300 Hz Video bandwidth, then reduced 4.1 dB further according to the duty cycle calculation and timing assessment.

Out of Band Spurious/Harmonic Emissions
DLP Design RF1
Peak/Average Detection, RBW = 1 MHz
Test Distance 1 meter

Test Date: February 24, 2005

1-25 GHz Vertical (High Channel)

Freq. (MHz)	Detector Function	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/M)	Cable Loss (dB)	Distance Correction (dB)	Corrected Level (dBuV/M)	Limit 3 Meters (dBuV)	Margin (dB)
4960	peak	1	55.9	31.0	34.4	3.8	9.5	53.6	74	-20.4
7440	peak	1	48.8	30.9	37.1	4.4	9.5	49.9	74	-24.1
9920	peak	1	52.1	30.8	38.0	4.5	9.5	54.3	74	-19.7
12400	noise	floor	28.9	30.5	39.7	4.9	9.5	33.5	54	-20.5
14880	noise	floor	30	29.4	39.4	4.9	9.5	35.4	54	-18.6
17360	noise	floor	29.3	31.5	44.6	5.0	9.5	37.9	54	-16.1
19840	noise	floor	41.6	0.0	37.0	0.0	29.5	49.1	54	-4.9
22320	noise	floor	41.4	0.0	37.0	0.0	29.5	48.9	54	-5.1
24800	noise	floor	41.3	0.0	37.0	0.0	29.5	48.8	54	-5.2
4960	avg	1	45.5	31.0	34.4	3.8	9.5	43.2	54	-10.8
7440	avg	1	36.8	30.9	37.1	4.4	9.5	37.9	54	-16.1
9920	avg	1	41.2	30.8	38.0	4.5	9.5	43.4	54	-10.6

1-25 GHz Horizontal (High Channel)

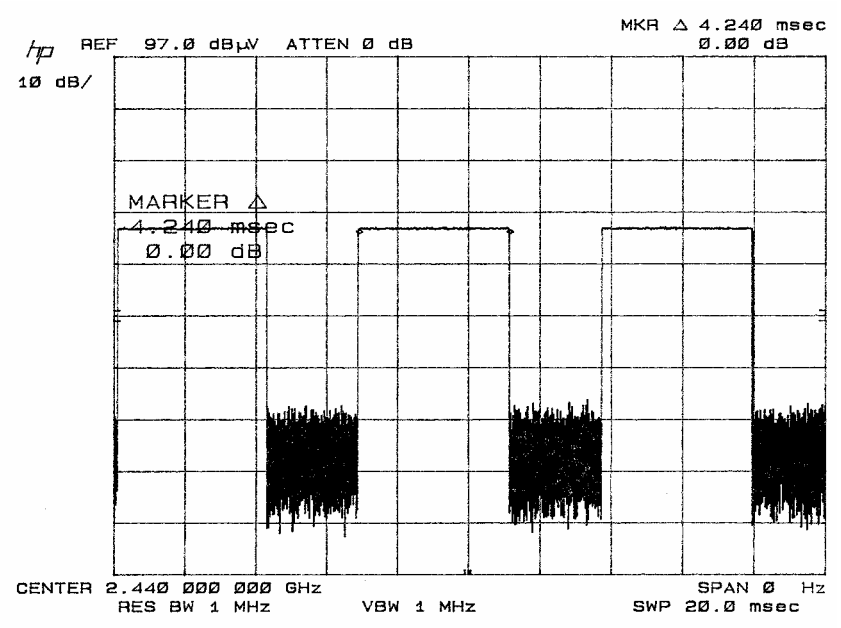
Freq. (MHz)	Detector Function	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/M)	Cable Loss (dB)	Distance Correction (dB)	Corrected Level (dBuV/M)	Limit 3 Meters (dBuV)	Margin (dB)
4960	peak	1	56.6	31.0	34.4	3.8	9.5	54.3	74	-19.7
7440	peak	1	47.1	30.9	37.1	4.4	9.5	48.2	74	-25.8
9920	peak	1	52.4	30.8	38.0	4.5	9.5	54.6	74	-19.4
12400	noise	floor	28.9	30.5	39.7	4.9	9.5	33.5	54	-20.5
14880	noise	floor	30	29.4	39.4	4.9	9.5	35.4	54	-18.6
17360	noise	floor	29.3	31.5	44.6	5.0	9.5	37.9	54	-16.1
19840	noise	floor	41.6	0.0	37.0	0.0	29.5	49.1	54	-4.9
22320	noise	floor	41.4	0.0	37.0	0.0	29.5	48.9	54	-5.1
24800	noise	floor	41.3	0.0	37.0	0.0	29.5	48.8	54	-5.2
4960	avg	1	47	31.0	34.4	3.8	9.5	44.7	54	-9.3
7440	avg	1	34.8	30.9	37.1	4.4	9.5	35.9	54	-18.1
9920	avg	1	42.4	30.8	38.0	4.5	9.5	44.6	54	-9.4

Note: Average was measured using 300 Hz Video bandwidth, then reduced 4.1 dB further according to the duty cycle calculation and timing assessment.

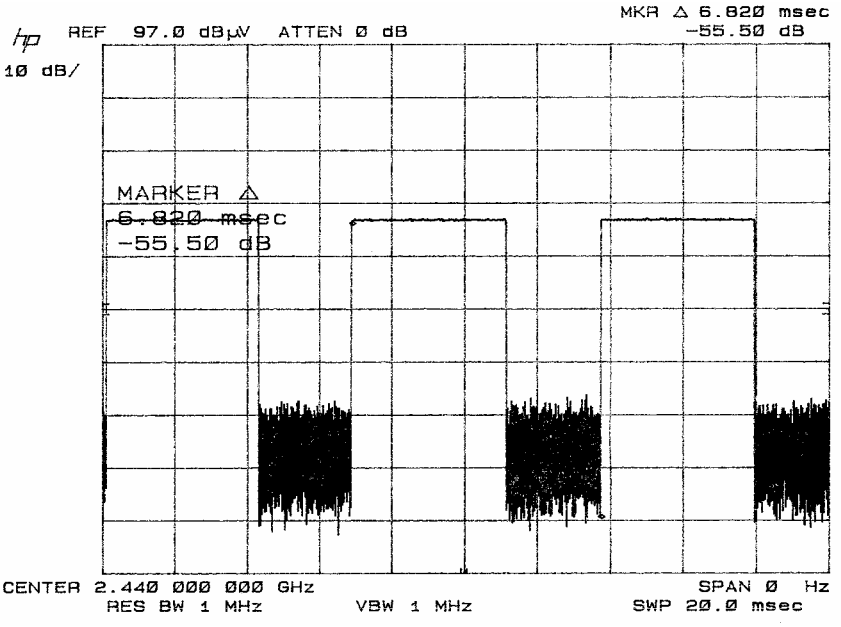
Timing Assessment
DLP Design RF1
Peak Detection, RBW = 1 MHz

Test Date: February 24, 2005

Pulse Duration



Total Time



Timing Assessment
DLP Design RF1
Calculations

Test Date: January 27, 2005

Duty Cycle

$$DutyCycle = \frac{PulseDuration}{TotalTime}$$

$$DutyCycle = \frac{4.24mS}{6.82mS} = 62.2\%$$

Peak to Average Correction

$$CorrFact = 20 * \log(DutyCycle)$$

$$CorrFact = 20 * \log(.622) = -4.1dB$$

Radio Frequency Exposure
DLP Design RF1
Calculations

Test Date: January 26, 2005

Friis Transmission Formula

$$PowerDensity = \frac{P_t * G}{4 * \pi * r^2}$$

Results Table

Frequency (MHz)	Power (dBm)	Gain (dBi)	Distance (cm)	Power Density (mW/cm²)	Limit (mW/cm²)
2405	-5.30	0	1	0.023	1.0
2440	-3.26	0	1	0.038	1.0
2480	-3.20	0	1	0.038	1.0

Result: The EUT meets the Maximum Permissible Exposure Limits.

Limits for Waiver of SAR Evaluation

Tunable Range		Center of Band (GHz)	60/f SAR Limit (mW)
Low (GHz)	High (GHz)		
2405	2480	2442.5	24.56

Maximum Transmitter Output Power

Field Strength (dB/uV)	E.I.R.P (dBm)	E.I.R.P (mW)
99.5	-5.30	0.295
101.5	-3.26	0.472
101.6	-3.20	0.479

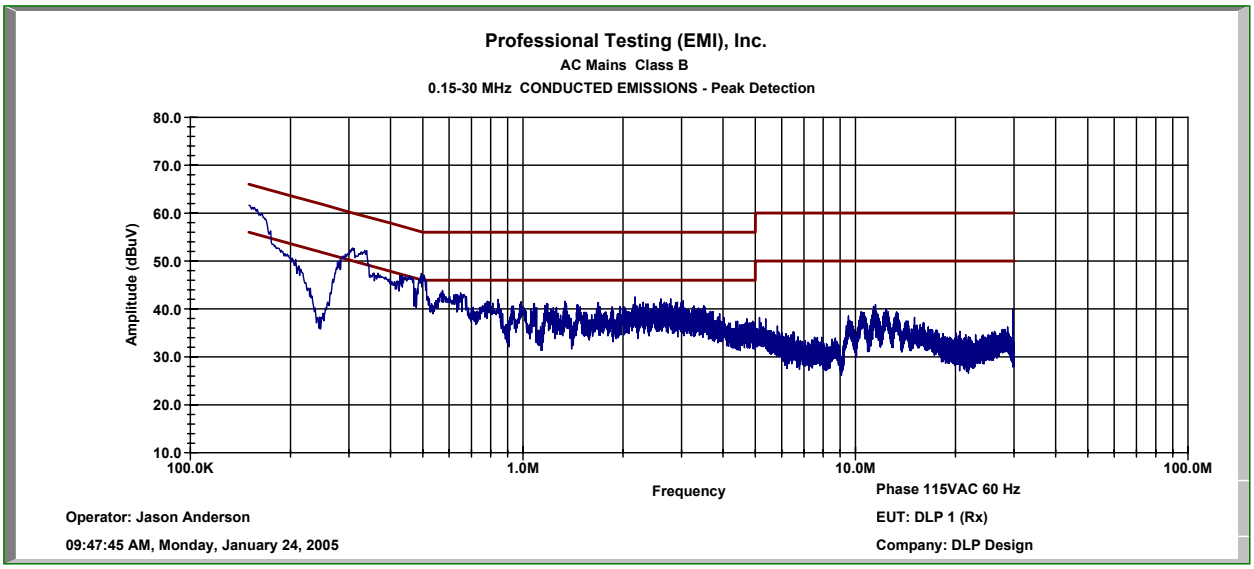
Result: The Threshold for no SAR evaluation is 24.56 mW. The EUT exhibited a maximum output power of 0.479 mW. No SAR evaluation is required since the maximum EIRP is below the threshold.

Receiver Power line Conducted Emissions
DLP Design RF1
Quasi-Peak Detection, RBW = 9 kHz

Test Date: January 24, 2005

Line Selection: Phase

FREQ INPUT (MHz)	READING INPUT (dBuV)	CORR FACTOR (dB)	CORR READING (dBuV)	Limit (dBuV)	Margin (dB)	Detector Function
0.15	56.1	3.1	59.2	66.0	-6.8	Quasi-peak
0.15	40.3	3.1	43.4	56.0	-12.6	Average
0.32	42.9	3.1	46.0	59.7	-13.7	Quasi-peak
0.32	19.9	3.1	23.0	49.7	-26.7	Average
0.565	36.7	3.2	39.9	56.0	-16.1	Quasi-peak
0.565	16.9	3.2	20.1	46.0	-25.9	Average
2.3	31.1	3.3	34.4	56.0	-21.6	Quasi-peak
2.3	20.8	3.3	24.1	46.0	-21.9	Average
10.5	30.6	3.8	34.4	60.0	-25.6	Quasi-peak
10.5	23.3	3.8	27.1	50.0	-22.9	Average
29.5	20.4	4.6	25.0	60.0	-35.0	Quasi-peak
29.5	13.1	4.6	17.7	50.0	-32.3	Average



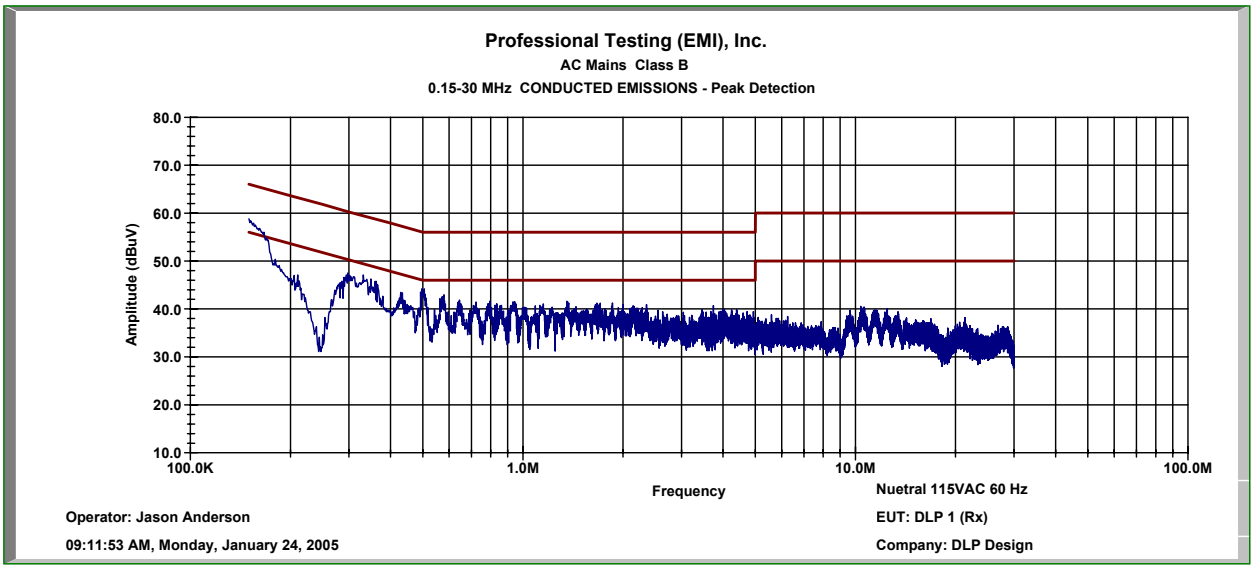
The data presented here in graphical form is for overview only. Detailed and precise data is in the table above.

Receiver Power line Conducted Emissions
DLP Design RF1
Quasi-Peak Detection, RBW = 9 kHz

Test Date: January 24, 2005

Line Selection: Neutral

FREQ INPUT (MHz)	READING INPUT (dBuV)	CORR FACTOR (dB)	CORR READING (dBuV)	Limit (dBuV)	Margin (dB)	Detector Function
0.15	52.4	3.1	55.5	66.0	-10.5	Quasi-peak
0.15	36.9	3.1	40.0	56.0	-16.0	Average
0.288	38.3	3.1	41.4	60.6	-19.2	Quasi-peak
0.288	29.4	3.1	32.5	50.6	-18.1	Average
0.5	35.6	3.2	38.8	56.0	-17.2	Quasi-peak
0.5	30.1	3.2	33.3	46.0	-12.7	Average
1.85	30.8	3.3	34.1	56.0	-21.9	Quasi-peak
1.85	22.3	3.3	25.6	46.0	-20.4	Average
4.9	25.3	3.5	28.8	56.0	-27.2	Quasi-peak
4.9	17.4	3.5	20.9	46.0	-25.1	Average
20.7	24.9	4.1	29.0	60.0	-31.0	Quasi-peak
20.7	24.9	4.1	29.0	50.0	-21.0	Average



The data presented here in graphical form is for overview only. Detailed and precise data is in the table above.

Receiver Spurious Emissions
DLP Design RF1
Quasi-Peak Detection, RBW = 120 kHz
Test Distance 3 meters

Test Date: January 25, 2005

30-1000 MHz Vertical

Freq. (MHz)	EUT Dir (Deg.)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
132.85	270	1	39.9	26.7	11.4	3.3	27.8	43.5	-15.7
219	noise	floor	23.5	26.8	11.3	4.1	12.1	46	-33.9
441	noise	floor	23.8	27.4	16.4	6.3	19.2	46	-26.8
611	noise	floor	23.1	27.0	19.1	7.6	22.9	46	-23.1
833	noise	floor	22.2	26.2	22.3	9.7	28.0	46	-18.0
905	noise	floor	22.4	26.2	22.4	10.6	29.3	46	-16.7
980	noise	floor	22.7	26.6	24.2	11.6	31.9	54	-22.1

30-1000 MHz Horizontal

Freq. (MHz)	EUT Dir (Deg.)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
132.85	30	3	46.7	26.7	11.4	3.3	34.6	43.5	-8.9
219	noise	floor	23.5	26.8	11.3	4.1	12.1	46	-33.9
441	noise	floor	23.8	27.4	16.4	6.3	19.2	46	-26.8
611	noise	floor	23.1	27.0	19.1	7.6	22.9	46	-23.1
833	noise	floor	22.2	26.2	22.3	9.7	28.0	46	-18.0
905	noise	floor	22.4	26.2	22.4	10.6	29.3	46	-16.7
980	noise	floor	22.7	26.6	24.2	11.6	31.9	54	-22.1

Receiver Spurious Emissions
DLP Design RF1
Peak Detection, RBW = 1 MHz
Test Distance 1 meter

Test Date: January 25, 2005

1-25 GHz Vertical

Freq. (MHz)	Detector (Peak Avg)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/M)	Cable Loss (dB)	Corrected Level (dBuV/M)	Limit (dBuV/M)	Margin (dB)
1220	peak	1	40.9	29.0	24.3	0.5	36.7	63.5	-26.8
2440	noise	floor	32.6	34.8	28.2	0.6	26.6	63.5	-36.9
4880	noise	floor	26.9	31.1	34.2	0.8	30.8	63.5	-32.7
7320	noise	floor	28.3	30.9	36.9	1.4	35.7	63.5	-27.8
9760	noise	floor	28.2	30.8	37.9	1.5	36.8	63.5	-26.7
12200	noise	floor	28.7	30.4	39.4	2.0	39.6	63.5	-23.9

1-25 GHz Horizontal

Freq. (MHz)	Detector (Peak Avg)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/M)	Cable Loss (dB)	Corrected Level (dBuV/M)	Limit (dBuV/M)	Margin (dB)
1220	peak	1	39.7	29.0	24.3	0.5	35.5	63.5	-28.0
2440	noise	floor	32.6	34.8	28.2	0.6	26.6	63.5	-36.9
4880	noise	floor	26.9	31.1	34.2	0.8	30.8	63.5	-32.7
7320	noise	floor	28.3	30.9	36.9	1.4	35.7	63.5	-27.8
9760	noise	floor	28.2	30.8	37.9	1.5	36.8	63.5	-26.7
12200	noise	floor	28.7	30.4	39.4	2.0	39.6	63.5	-23.9