MEASUREMENT/TECHNICAL REPORT

DIGIGRAM - LCM440/LCM220A/LCM220B

FCC ID: IGTLCM

April 22, 1998

This report concerns : Original grant___X___ Class II change _____

*Class B verification_____ *Class A verification_____ *Class I change _____

Equipment type: Audio PC Board

Request issue of grant :

_ X __Immediately upon completion of review.

_____ Defer grant per 47 CFR 0.457(d)(1)(ii) until _____date____. Company Name agrees to notify the Commission by ____date____ of the intended date of announcement of the product so that the grant can be issued on that date.

Confidentiality of grant:

_____Applicant requests the existence of this grant to be kept confidential until ___date__. The announcement of this product before this date via freedom of information would be detrimental to Company Name, and therefore must be considered a business secret. Public announcement of this product will not be made prior to this date. *(Max. 60 days after grant issued).*

Limits used: *(check one)*

CISPR 22 _____X_____ Part 15_____

Measurement procedure used is ANSI C63.4-1992 unless another is specified.

Other test procedure: _____

Application for Certification prepared by:	Applicant for this device:
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**Not to be filed with Equipment Authorization Branch of FCC unless requested.*

Report format prepared by the Information Technology Industry Council (ITI) ESC-5 and reviewed by FCC staff in 1994.

Table of Contents

1 GENERAL INFORMATION

1.1 Product Description

LCM440 is a PCI bus PC-Card intended for professional sound recording and editing application on a personal computer.
The LCM440 provides four mono inputs and four mono outputs audio signals. A combination of four streams may only be used at the same time.
It provides recording, processing and playback functionality.
The main processing functions are :
.....- Simulatneaous real-time MPEG audio compression/decompression
.....- Simultaneaous record/playback in PCM mode
.....- Real time mixing of several PCM or MPEG audio files on one or several outputs.

LCM220B is the same board than LCM440 with only two mono inputs and two mono outputs, and without SPDIF digital input and output.
LCM220A is the same board than LCM220B with unbalanced analog inputs and outputs.
All the measurments have been performed on LCM440 board, which is the most complete product.

See Attachment A for further description and technical features of the submitted product.

1.2 Related Submittal(s)/Grant(s)

All host equipment used in the test configuration are FCC granted, when relevant.

1.3 Tested System Details

The FCC IDs for all equipment, plus descriptions of all cables used in the tested system (including inserted cards, which have grants) are:

Model Number (Serial Number)	FCC ID	Description	Cable Description
LCM440 card (1) 975003610	IGTLCM	Audio PC board	Shielded signal cable.
VECTRA VL Series 3 5/75 FR53352782	K4UVECTRAVL5	Personal Computer	Unshielded power cord.
HP D2846 (JP74001005)	N/A - Déclaration of Conformity	21" Video monitor	Shielded video cable
HP C3751B LCA52435792	DZL210582	Mouse	Shielded cable
HP C3757A (F62008)	CIGE03614	Keyboard	Shielded cable
HP C2145A (US5301105F)	B94C2145X	Printer, Parrallel I/F Deskjet 850C	HP24542D - Shielded cable
HP7475A (2807L77281)	BSD4TE7475A	Serial plotter	HP24542G - Shielded cable

(1) EUT submitted for grant.
N/A = Not Applicable

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4-1992, CISPR 22-1993/A1:1995 and EN55022:1994/A1:1995.
Radiated testing was performed at an antenna to EUT distance of 10 meters. During testing, all equipments and cables were moved relative to each other in order to identify the worst case set up.

1.5 Test Facility

The test facility used to collect the radiated and conducted data is the Hewlett Packard Quality Engineering Test Center B10 EMI facility located 5 Avenue Raymond Chanas - EYBENS, 38053 GRENOBLE, FRANCE. This test facility has been fully described in a report and accepted by the FCC as compliant with the radiated and AC line conducted test site criteria in ANSI C63.4-1992 in a letter dated August 19, 1996 (31040/SIT, 1300F2). This test facility has also been accredited by COFRAC (french accreditation authority for european union test lab accreditation organization), accreditation number 1-0199 as compliant with test site criteria and competence in EN 55022 / CISPR22 norms for 89/336/EEC European EMC Directive application. All pertinent data for this test facility remains unchanged.

2 PRODUCT LABELING

Figure 2.1 FCC ID Label

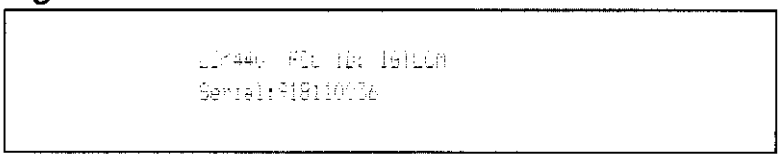


Figure 2.2 Location of Label on EUT

Label is sticked on the board, foil side. (See photo of board in this file).

3 SYSTEM TEST CONFIGURATION

3.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it). It has been tested with a Vectra VL Series 3 5/75 Personal Computer. Each audio input / output is connected on a "load box" simulating a user environment. The LCM440 board has been tested with SPDIF option, as it's the worst case found during preliminary tests among LCM440, LCM220A, and LCM220B. Speed selection at 8 Mhz has been performed, but the highest emission was found for the high speed selection. Exercise software running under Windows 95 system, the screen definition used was 640 x 480 pixels.

3.2 EUT Exercise Software

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. The test software has been designed in order to exercise each part of the PC involved in a typical use. Data are transmitted on each output.

3.3 Special Accessories

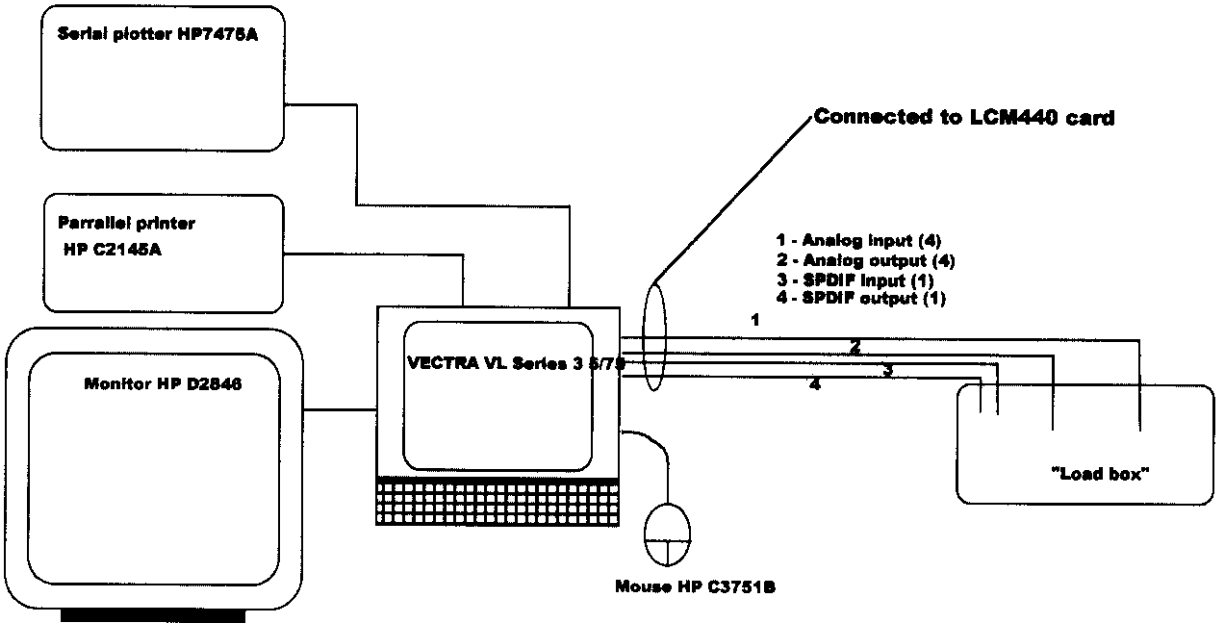
As shown in Figure 3.1, all interface cables used for compliance testing are shielded as normally supplied. All these cable are normally recommended to be used with the product.

3.4 Equipment Modifications

No equipment modification has been necessary during testing to achieve compliance to Class B levels. The unit tested was a production unit.

3.5 Configuration of Tested System

Figure 3.1 Configuration of Tested System



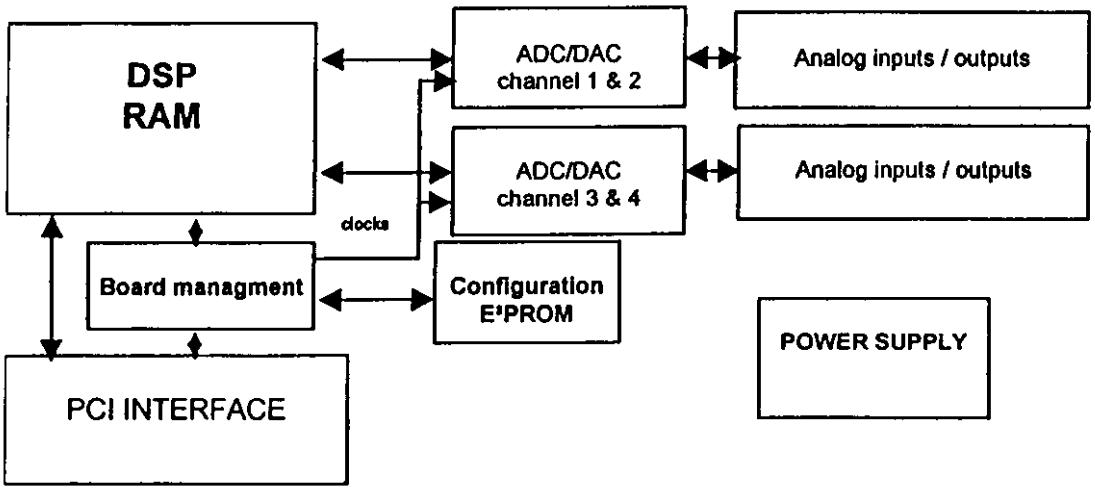
4 BLOCK DIAGRAM(S) OF EQUIPMENT

4.1 Clock schematics of LCM440 board

Crystal and oscillators :.....66 Mhz (DSP 56002 Motorola)
....24.576 Mhz (Sampling frequency)
....22.5792 Mhz (Sampling frequency)

BLOCK DIAGRAMS

General block diagram



6 CONDUCTED EMISSION DATA

6.1 Test Procedure

The product has been tested according to ANSI C63.4-1992, CISPR 22-1993/A1:1995 and EN55022:1994/A1:1995.

The product has been tested with 120V / 60Hz power line voltage and compared to the CISPR 22 Class B limits. Measurement bandwidth was 9 KHz from 150 KHz to 30 MHz.

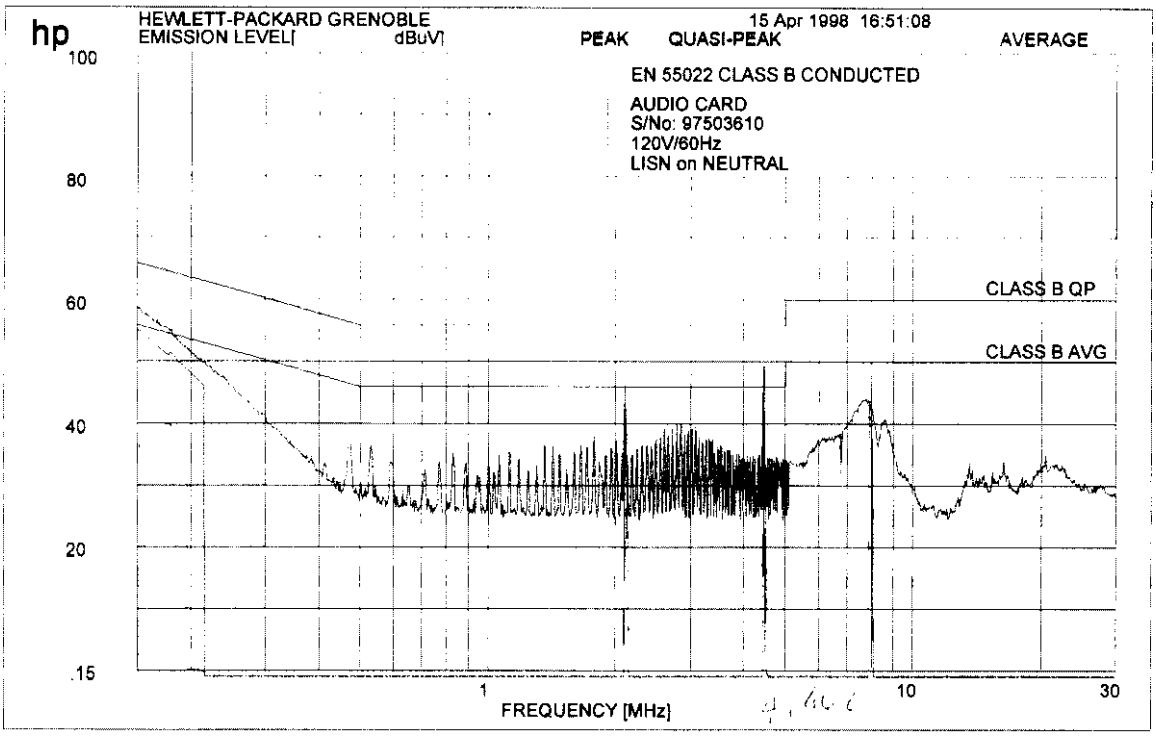
Measurement was initially made with an HP-8568B Spectrum Analyzer in peak mode. This was followed by a Quasi-Peak, i.e. CISPR measurement with the HP-85650A Quasi-Peak Adapter on the analyzer for any strong signal. If the average limit is met when using a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with the average detector is unnecessary.

Both the Peak and Quasi-Peak data are shown on the following plots. Where a Quasi-Peak measurement has been performed, a Quasi-Peak trace has been added under the Peak trace in order to show the QP level. Area where Quasi-Peak measurement were performed and other points of interest are detailed in a table with frequencies and levels measured.

Interconnecting cables and equipment's were moved to position that maximized emission. A summary of the worst case emissions found in all test configurations and modes is shown on the following page.

Test equipment :
HP 8568B Analyzer
HP 85650A Quasi Peak adapter
Rhode & Schwarz ESH2-Z5, LISN N° 1
Rhode & Schwarz ESH2-Z5, LISN N° 2

6.2 Neutral conducted emission data



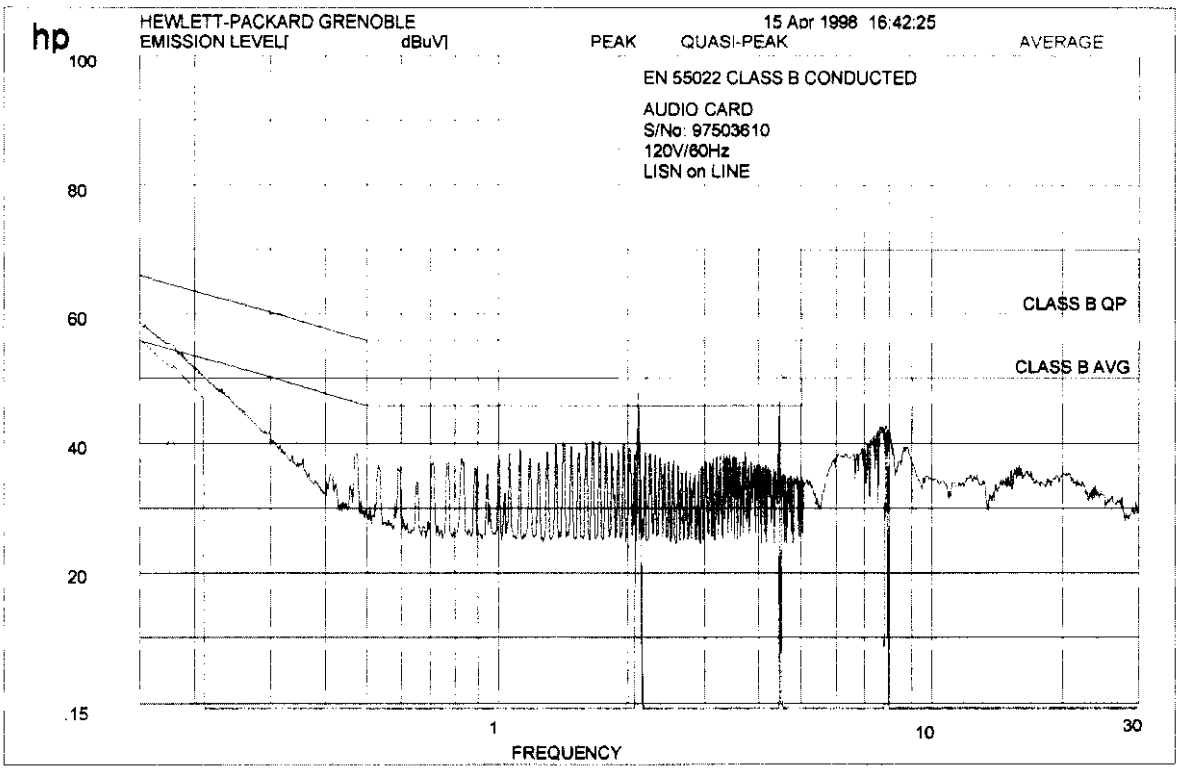
Quasi peak:

```
=========================================================
HEWLETT-PACKARD GRENOBLE          15 Apr 1998  16:51:08
=========================================================
 1. CONDUCTED
    1.2  EN55022/CISPR 22 CLASS B S2 JAN97
=========================================================
Quasi-Peaks above -30 dB of Limit Line #1
  peak criteria = 6 dB

PEAK#     FREQ (MHz)        (dBuV)         DELTA
  1         4.462            45.2         -10.8
  2         2.105            42.4         -13.6
  3         7.904            43.1         -16.9
```

- Average:

```
=========================================================
HEWLETT-PACKARD GRENOBLE          15 Apr 1998  16:51:08
=========================================================
 1. CONDUCTED
    1.2  EN55022/CISPR 22 CLASS B S2 JAN97
=========================================================
Avg Peaks above -30 dB of Limit Line #2
  peak criteria = 6 dB

PEAK#     FREQ (MHz)        (dBuV)         DELTA
  1         7.904            40.5          -9.5
  2          .1815           40.1         -14.3
  3         4.462            31.5         -14.5
  4         4.51             30.7         -15.3
  5         2.138            29.1         -16.9
```

6.3 Line conducted emission data



- Quasi peak:

```
=======================================================
HEWLETT-PACKARD GRENOBLE          15 Apr 1998  16:42:25
=======================================================
 1. CONDUCTED
    1.2  EN55022/CISPR 22 CLASS B S2 JAN97
=======================================================
Quasi-Peaks above -30 dB of Limit Line #1
  peak criteria = 6 dB

PEAK#     FREQ (MHz)        (dBuV)         DELTA
  1         4.462            45.8          -10.2
  2         2.105            42            -14.0
  3         7.904            41.7          -18.3
  4         2.082            36.9          -19.1
```

- Average:

```
=======================================================
HEWLETT-PACKARD GRENOBLE          15 Apr 1998  16:42:25
=======================================================
 1. CONDUCTED
    1.2  EN55022/CISPR 22 CLASS B S2 JAN97
=======================================================
Avg Peaks above -30 dB of Limit Line #2
  peak criteria = 6 dB

PEAK#     FREQ (MHz)        (dBuV)         DELTA
  1         2.127            35.2          -10.8
  2         7.904            39.1          -10.9
  3          .1796           40.9          -13.6
  4         4.462            32            -14.0
  5         4.51             31.2          -14.8
```

7 RADIATED EMISSION DATA

7.1 Test Procedure

The product has been tested according to ANSI C63.4-1992, CISPR 22-1993/A1:1995 and EN55022:1994/A1:1995.

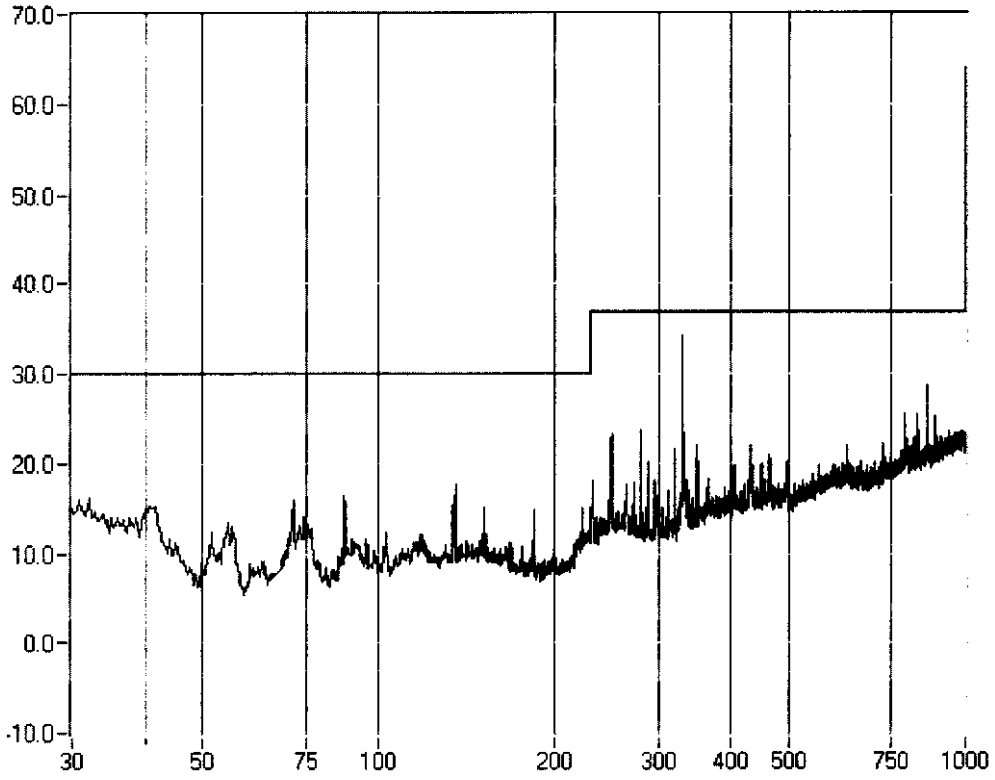
The product has been tested with 230V / 50Hz power line voltage, at a distance of 10 meters from the antenna and compared to the CISPR 22 Class B limits. Measurement bandwidth was 120 KHz from 30 MHz to 1 GHz.

Antenna height search was performed from 0.9m to 4m for both horizontal and vertical polarization. Continuous linear turntable azimuth search was performed with 360 degrees range.

Interconnecting cables and equipment's were moved to position that maximized emission. A summary of the worst case emissions found in all test configurations and modes is shown on the following page.

Test Equipment:
HP 8546A E.M.I Receiver
HP 85460A RF Filter section
CHASE Bilog Antenna CBL 6112 / 26-2000 MHz

7.2 Radiated Emission data



Final result:

Frequency (MHz)	QPeak Lmt (dBuV/m)	QPeak (dBuV/m)	Peak (dBuV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)
330.00	37.00	33.34	34.15	-3.66	78	H	299	15.81
792.01	37.00	30.25	30.97	-6.75	235	H	293	22.64
825.00	37.00	31.49	33.49	-5.51	16	V	240	22.91
858.01	37.00	33.42	34.34	-3.58	329	V	201	23.11

7.3 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

Assume a receiver reading of 52.5 dBuV is obtained. The Antenna Factor of 7.4 and a Cable Factor of 1.1 is added. The Amplifier Gain of 29 dB is subtracted, giving a field strength of 32 dBuV/m.

FS = 52.5 + 7.4 + 1.1 - 29 = 32 dBuV/m

The 32 dBuV/m value can be mathematically converted to its corresponding level in uV/m.

Level in uV/m = Common Antilogarithm [(32 dBuV/m)/20]= 39.8 uV/m

8 PHOTOS OF TESTED EUT

The following photos are attached:

Attachment A. Product Data Sheet

Digigram
Products

LCM440

Innovative PCI audio card with dynamically assignable inputs/outputs

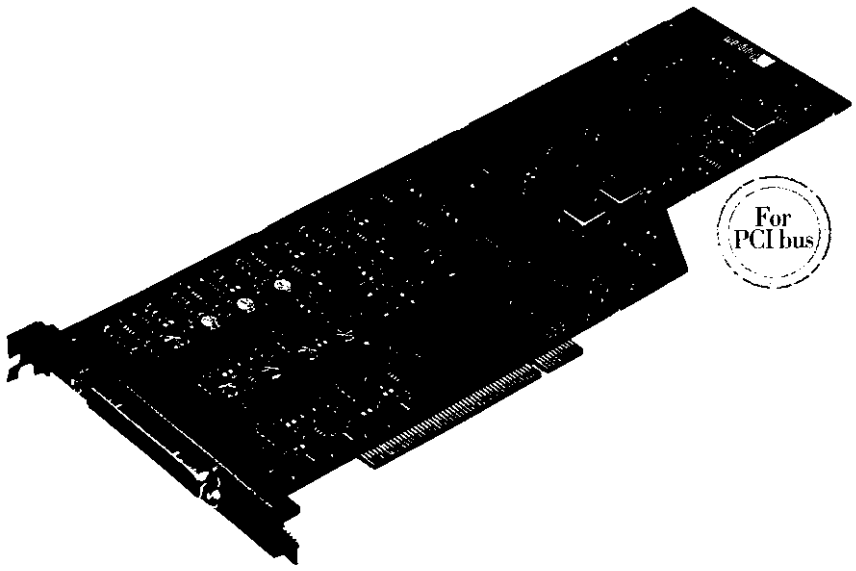
The LCM440 for PCI bus offers duplex operation with any combination of up to four active balanced mono inputs and outputs among the eight audio channels that can be connected to the board. Balanced analog hardware connections are provided for all inputs and outputs. Software controls the card's configuration.

In many applications, the LCM440 can perform tasks that previously required two separate sound cards. For example, the LCM440 can be used in two-stereo-channel playback configuration and then as a record and playback stereo audio card. The LCM440 operates on the PCI bus in slave mode and takes advantage of Digigram's enhanced np driver.

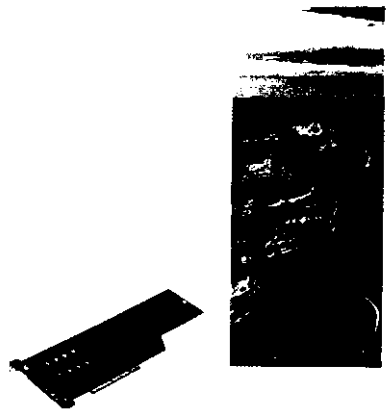
The LCM440 manages both PCM (linear) and MPEG Audio (compressed) digital audio data with professional audio quality. Featuring the ability to mix up to eight stereo files to its outputs and simultaneous MPEG encoding and decoding, the LCM440 is suitable for a wide range of applications.

Other useful functions include real-time sampling frequency conversions and processing functions such as time-stretching and pitch-shifting.

The LCM440 is available with a complete set of development tools, Xtrack multitrack editor and a wide range of applications.



FCC ID: IGTLCM



LCM440
Technical features

Principal features
- Four-channel PC sound card for PCI bus (slave mode)
- Dynamic assignable inputs and outputs on four mono channels among the eight mono channels connectable to the board
- Recording, processing and playback of professional-quality sound
- Analog audio input/outputs

Processing power
- Motorola-56002 DSP
- Clock frequency: 66 MHz

Audio specifications
- Two-channel analog inputs/outputs (18-bit A/D-D/A conversion)
- Programmable sampling frequency among the following values :48, 44.1, 32, 24, 22.05, 16, 11.025, 8 kHz*
- Balanced line inputs
- Balanced line outputs
- Frequency response at 48 kHz (record + play): 20 Hz – 20 kHz: ± 0.5 dB
- Signal/noise ratio (record + play): > 84 dB
- Distortion + noise at 1 kHz (record + play): <-82 dB
- Phase difference between channels (record + play): 20 Hz – 20 kHz: 1° / 5°
- Programmable digital gain
- Input/output level: maximum +22 dBu

**The 8 kHz frequency is handled, but the audio quality isn't optimum*

Processing functions*
- Simultaneous real-time MPEG Audio compression/ decompression, professional audio quality. This format reduces disk storage requirements in a programmable ratio of 1:4 to 1:48. At 128 kbps (1:6 compression at 48 kHz), one minute of mono sound (or 30 seconds of stereo sound) takes up only 960 Kbytes. LCM440 supports Layers I and II of the MPEG Audio standard (ISO 11172-3) and the low sampling frequencies of the MPEG2 Audio standard (ISO 13818-3)
- Simultaneous record/playback in PCM mode (no compression)
- Real-time mixing of several PCM or MPEG Audio files:
  - up to 8 stereo MPEG Audio Layer II tracks at 256 kbps mixed on one stereo physical channel without simultaneous record
  - up to 6 stereo MPEG Audio Layer II tracks at 256 kbps mixed on two stereo physical channels without simultaneous record
  - up to 4 stereo MPEG Audio Layer II tracks at 256 kbps mixed on one stereo physical channel with simultaneous record on one stereo physical channel
  - up to 6 stereo PCM tracks mixed on one stereo physical channel without simultaneous record
- A wide range of software functions:
  - Time-stretching (in real time and offline)
  - Pitch-shifting
  - Scrubbing
  - Panning
  - Format conversion
  - Sampling frequency conversion

**Performance in PCM depends on the PC used*

Physical format and connections
- PCI bus board (slave mode), 1 slot, half-length format (180 mm x 99 mm)
- Connections:
  - one 62-pin SUB-D connector for analog inputs/outputs

Driver
LCM440 is managed by the np driver

Available on request
- PCXtools — development tools
- WAVE driver

Options
- PCX Designer Kit (Windows)
- Application software