MEASUREMENT/TECHNICAL REPORT

DIGIGRAM - PCX440np

FCC ID: IGT440NP

April 24, 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   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.

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1 GENERAL INFORMATION

1.1 Product Description

PCX440np is a PCI bus PC-Card intended for professional sound recording and editing application on a personal computer.

The PCX440np provides two stereo or four mono input channels and two stereo or four mono outputs channels, balanced analog audio inputs/outputs, wordclock synchronization input, and two optional boards :

........................- MIDI/SMPTE time code on additional PC slot

........................- AES/EBU inputs and outputs on daughter board.

It provides recording, processing and playback functionality.

The main processing functions are :

........................- Simulatneaous real-time MPEG audio compression and decompression

........................- Simultaneaous record/playback in PCM mode

........................- Real time mixing of several PCM or MPEG audio files on one or several outputs.

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
PCX440np card (1) 98503840	IGT440NP	Audio PC board	Shielded signal cable.
VECTRA VL Series 3 5/75 FR53352782	K4UVECTRAVL5	Personal Computer	Unshielded power cord.
HP D2846 (JP740010013)	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, with AES/EBU and MIDI/SMPTE options
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.
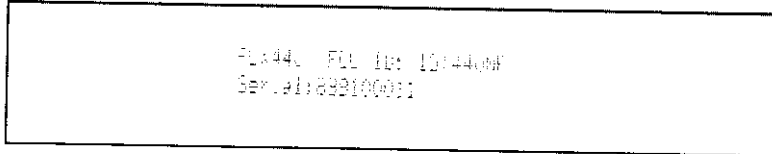
2 PRODUCT LABELING

Figure 2.1 FCC ID Label

FL44_ FCC ID: IG?44oNP
Serial:893100;1

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 board PCX440np has been tested with AES/EBU and MIDI/SMPTE options, as it's the worst case found during preliminary tests.
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

Serial plotter HP7475A

Parrallel printer HP C2145A

Monitor HP D2846

VECTRA VL Series 3 5/7S

Mouse HP C3751B

Connected to PCX440np card

1 - Analog input (4)
2 - Analog output (4)
3 - AES/EBU input (3)
4 - AES/EBU output (2)
5 - Wordclock input (1)
6 - MIDI input (1)
7 - MIDI output (1)
8 - SMPTE input (1)

"Load box"
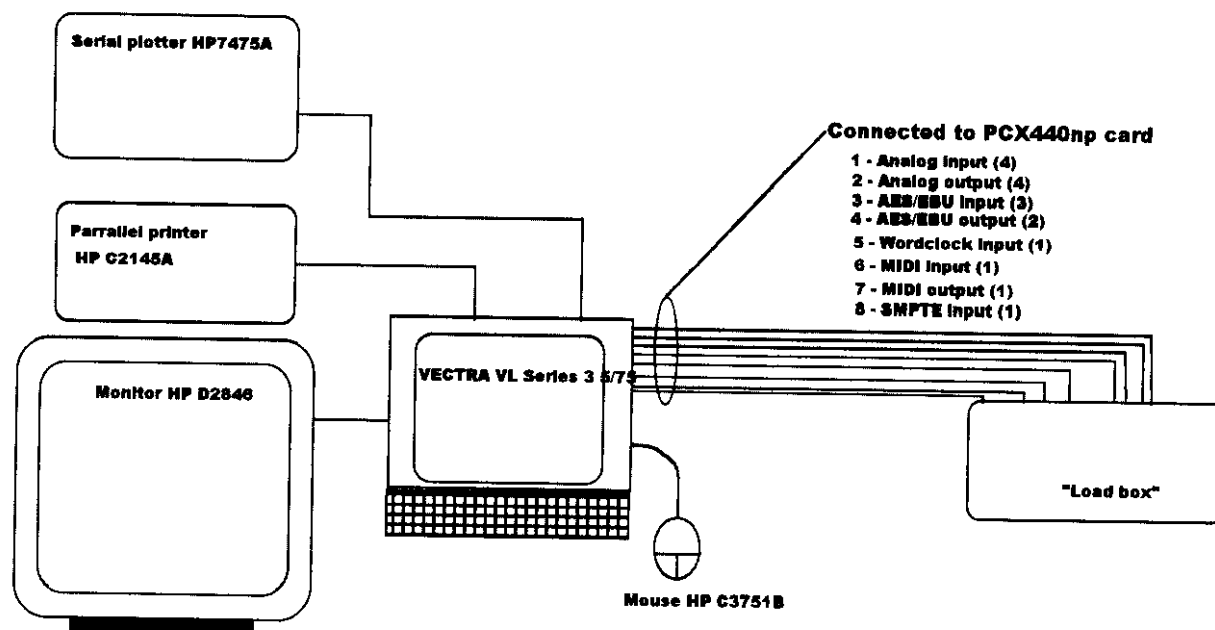
4   BLOCK DIAGRAM(S) OF EQUIPMENT

4.1   Clock schematics of PCX440np board

Crystal and oscillators : .... 66 Mhz (Sampling frequency)
.... 10 Mhz (DSP 56300 Motorola)

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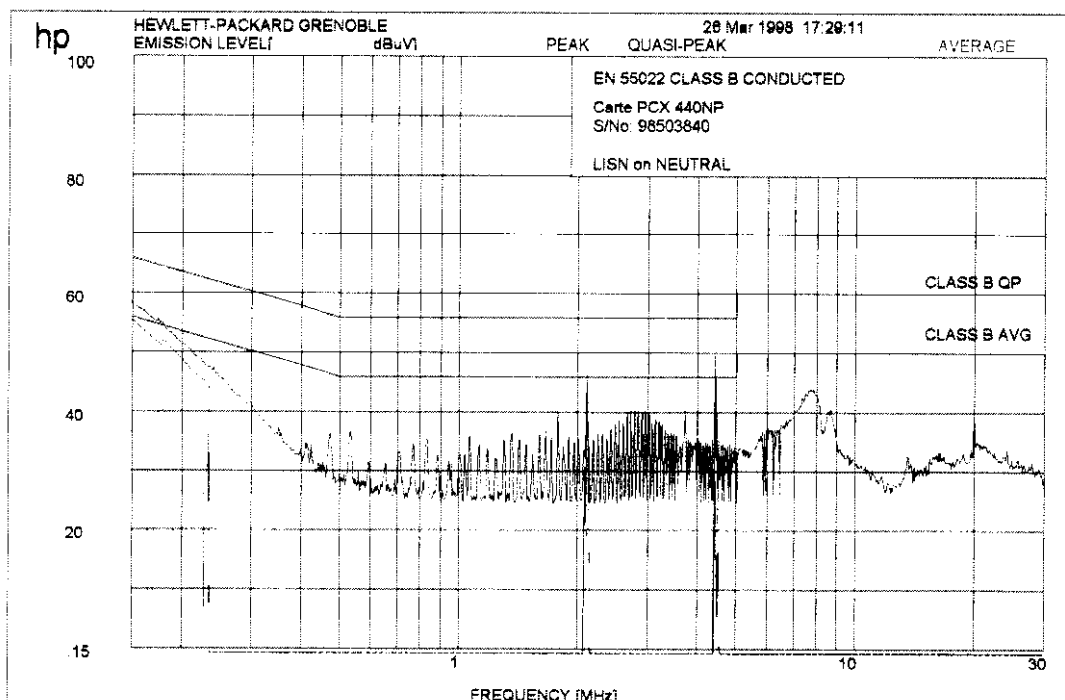
Test equipment :
HP 8568B Analyzer
HP 85650A Quasi Peak adapter
Rhode & Schwarz ESH2-Z5, LISN N° 1
Rhode & Schwarz ESH2-Z5, LISN N° 2

6.2 Neutral conducted emission data

- **Quasi peak:**

```
========================================================
HEWLETT-PACKARD GRENOBLE           26 Mar 1998   17:29:11
========================================================
 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           45.6           -10.4
  2       2.116           42             -14.0
  3       2.082           30.7           -25.3
```

- **Average:**

```
========================================================
HEWLETT-PACKARD GRENOBLE           26 Mar 1998   17:29:11
========================================================
 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        .1796          40.2           -14.3
  2       4.439           30.6           -15.4
  3       2.138           30.5           -15.5
  4        .2352          33.2           -19.0
  5        .2138          28.7           -24.3
  6       4.51            21.3           -24.7
```
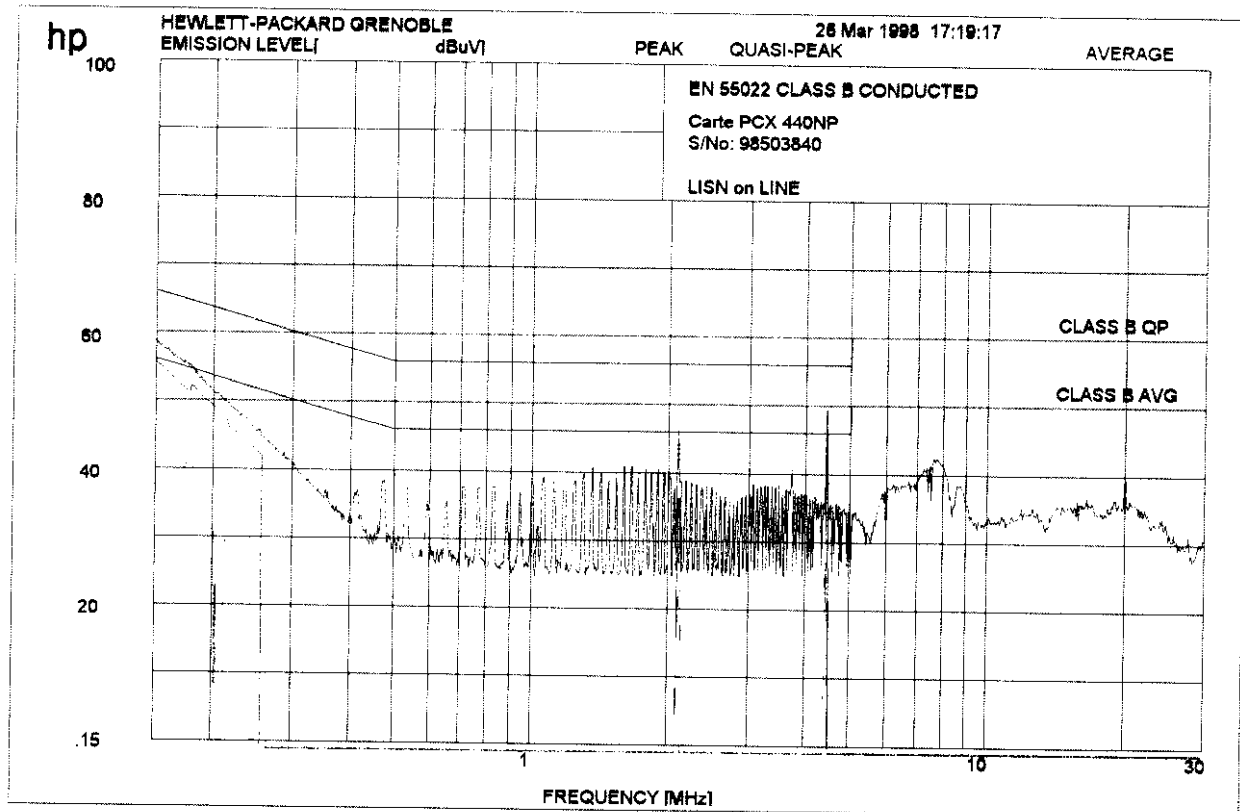
6.3 Line conducted emission data

- Quasi peak:

```
=================================================================
HEWLETT-PACKARD GRENOBLE           26 Mar 1998  17:19:17
=================================================================
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          45.7           -10.3
  2          2.105          36.3           -19.7
```

- Average:

```
=================================================================
HEWLETT-PACKARD GRENOBLE           26 Mar 1998  17:19:17
=================================================================
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          2.138          36.4            -9.6
  2           .1796         41.3           -13.2
  3          4.439          32.1           -13.9
  4           .2403         34.7           -17.3
  5           .205          30.7           -22.7
```

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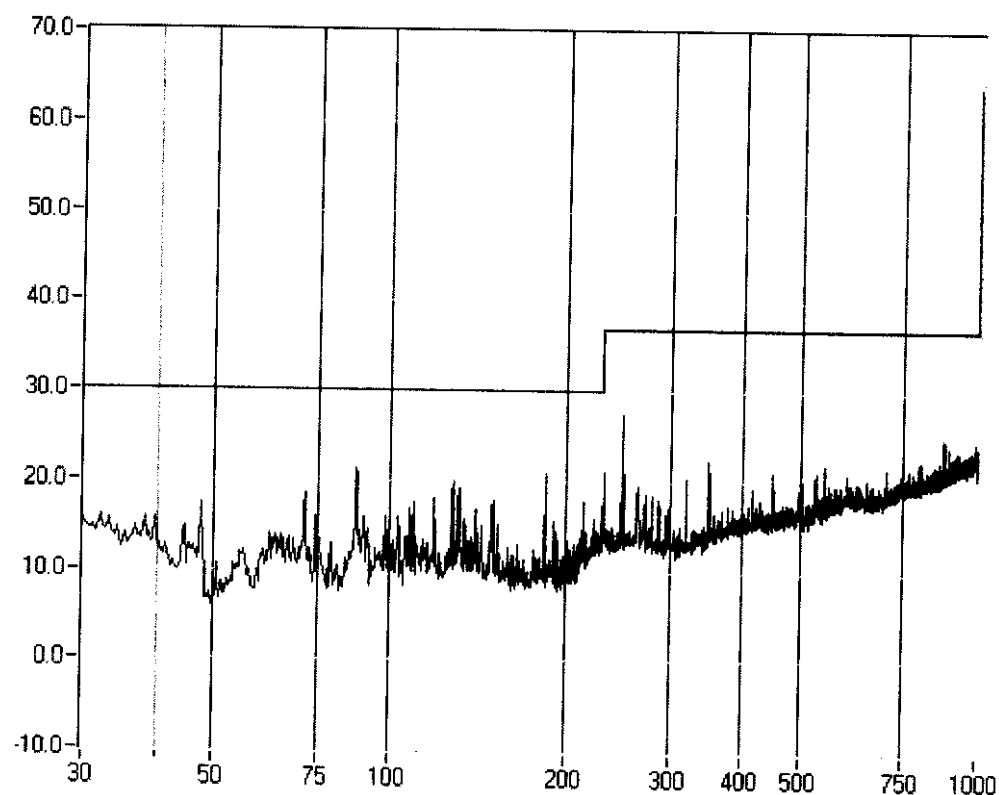
Test Equipment:
HP 8546A E.M.I Receiver
HP 85460A RF Filter section
CHASE Bilog Antenna CBL 6112 / 26-2000 MHz

7.2 Radiated Emission data

Final result:

Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	Peak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)
72.10	30.00	23.34	25.41	-6.66	208	V	233	6.80
88.13	30.00	26.98	29.05	-3.02	335	V	199	10.47
129.02	30.00	24.29	25.37	-5.71	264	V	106	12.13
132.09	30.00	20.09	22.77	-9.91	264	V	150	12.13
184.29	30.00	20.75	22.12	-9.25	84	H	288	11.02
250.10	37.00	30.39	30.61	-6.61	223	H	396	15.38

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:

Figure 8.1 ... PCX440np Board and optional boards, Foil Side

Figure 8.2 ...... PCX440np Board and optional boards, component side

Attachment A. Product Data Sheet

Digigram Products

PCX440np
New performance PCX audio board
for multi-channel recording and playback

Two balanced analog stereo inputs/outputs (or four audio analog mono balanced inputs/outputs) offer professional level 20-bit quality, synchronization capabilities and digital stereo I/O option, making the PCX440np* an optimal price/performance solution for production and post-production.

A new generation np driver enhances the power and performance of the entire PCXnp range while delivering excellent value. PCX440np operates on the PCI bus and implements a new DSP more powerful than the previous generation's.

A high level of processing power allows the card to handle both PCM (linear mode) and MPEG Audio (compressed mode) data. Real-time processing operations such as simultaneous coding/decoding and mixing of several tracks may be carried out in both modes.

A programmable clock can generate precise sampling frequencies that, when used with the time-code input, facilitates video synchronization. A digital option, which does not require an additional PC slot, accommodates two AES/EBU stereo inputs and two AES/EBU stereo outputs and an AES/EBU synchronization input.

PCX440np is available with a complete set of development tools, Xtrack multitrack editor and a wide range of applications developed by Digigram's OEMs.

np. new performance
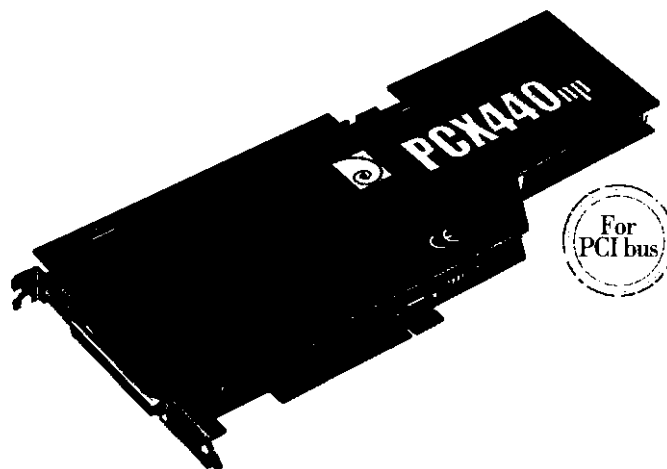
For PCI bus

PCX440np
Technical features

Principal features
- Two-stereo or four-mono-channel record/playback PC sound card for PCI bus (master mode)
- Recording, processing and playback of professional-quality sound
- Balanced analog audio inputs/outputs
- Wordclock synchronization input
- Interboard synchronization for multi-channel applications
- Daughterboard for SMPTE (LTC) time-code input
- Programmable clock

Processing power
- Motorola-56301 DSP
- Clock frequency: 66 MHz
- RAM: 256 kwords

Audio specifications
- Four-analog-mono inputs/outputs (20-bit A/D and D/A conversion)
- Programmable sampling frequency from 6 kHz to 50 kHz by step of 0.01 Hz
- Frequency response at 48 kHz (record + play): 20 Hz – 20 kHz: ± 0.2 dB
- Signal/noise ratio (record + play): > 90 dB
- Distortion + noise at 1 kHz (record + play): < -87 dB
- Phase difference between channels: 20 Hz – 20 kHz: 0.5° / 1°
- Balanced or unbalanced line inputs: impedance 600 Ω or > 15 kOhms
- Balanced or unbalanced line outputs low impedance
- Programmable inputs and output levels: maximum input +26 dBu, maximum output +22 dBu

Processing functions*
- Real-time MPEG Audio compression/decompression (four mono channels) 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), 1 minute of mono sound (or 30 seconds of stereo sound) takes up only 960 Kbytes. PCX440np 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 on one or several outputs: up to 14 stereo MPEG Audio Layer II tracks at 256 kbps, or up to 10 stereo PCM tracks on two stereo channels
- 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, one slot, half-length format (265 mm x 99 mm)
- Connections:
  - one high density 62-pin SUB-D connector for analog and digital inputs/outputs and synchronization inputs
  - one connector for interboard synchronization

Driver
PCX440np is managed by the np driver.

Available on request
- PCXtools — development tools
- WAVE driver

Options
- Two inputs/outputs daughterboard in AES/EBU or SPDIF format with separate AES/EBU synchronization input that does not require an additional PC slot
- PCX Designer Kit (Windows)
- Application software