Exhibit 1114

A HIGH SPEED TELECOMMUNICATIONS INTERFACE FOR DIGITAL AUDIO TRANSMISSION AND RECEPTION

2143 (D-2)

Hyun Heinz Sohn
CompuSonics Corporation
Cambridge, Massachusetts

Presented at the 76th Convention 1984 October 8-11 New York

AES

This preprint has been reproduced from the author's advance manuscript, without editing, corrections or consideration by the Review Board. The AES takes no responsibility for the contents.

Additional preprints may be obtained by sending request and remittance to the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165 USA.

AN AUDIO ENGINEERING SOCIETY PREPRINT

A HIGH SPEED TELECOMMUNICATIONS INTERFACE FOR DIGITAL AUDIO TRANSMISSION AND RECEPTION

by

Hyun Heinz Sohn
Shugart Corporation
475 Oakmead Parkway, MS 4-1
Sunnyvale, CA 94086
(415) 969-7743

for

CompuSonics Corporation
1 Arnold Circle
Cambridge, MA 02139
(617) 354-0050

ABSTRACT

A high speed digital interface for the transmission and reception of digital audio signals over AT&T's Accunet was designed and implemented to operate in a MultiBus based microcomputer. This interface will transmit and receive digital data at 56,000 bits per second. Such a capability will allow the distribution of recordings in digital format from central databases which can be accessed by conventional telephone over the Accunet.

INTRODUCTION

Much of the audio industry is devoted to using, refining, and developing new methods of storing, retrieving, transmitting, and receiving sound information. A great deal of effort has been directed at reducing as much as possible the introduction of noise and distortion to the audio signal path. Until recently, all stages of signal processing have been analog. These systems have undergone continuous improvements that reduce the noise and distortion in small but usually measurable increments.

The introduction of digital systems has resulted in significant performance improvements in terms of frequency response, background noise, and distortion. There are still some skeptics who claim that "breaking up of the sound" into finite numbers result in losses of the original audio signal, leading to "impure" sound, causing listener fatigue and stress, among other pychoacoustical aberrations. It is not the intention of the author to defend digital audio technology. It is sufficient to say that with the proper application of mathematics and signal processing theory, the process of digitizing and recovering audio signals is nondestructive and clean.

Conventional analog signals require careful modulation and demodulation in any storage or transmission process. In fact, by definition, analog techniques hinge on modulating some physical property of a medium to carry or store the desired signal. The vinyl record has modulated grooves; radio transmission is modulated electromagnetic radiation. The fact that the signal is intimately related to the medium makes it dependent wholly on the purity and quality of that medium. The introduction of "audiophile quality virgin vinyl" recordings is ample evidence of this dependence.

A digital system encourages a modular approach to signal processing. Cascading of functional modules in the digital domain is equivalent to routing patch cords through various mixers, recorders, and equalizers. Once sound (or any analog signal) has been digitized into a series of bits (contraction for Binary digIT), it can not be distinguished from ordinary computer data. At this point, the strength of digital processing becomes apparent: the signal has been separated from the medium. Since a representation of the signal in the form of a sequence of numbers is manipulated, as long as the numbers are not corrupted, the original signal can be recovered. This means that the signal can be processed in any convenient manner without fear of adding noise.

It is because of this property of digital signals that high quality audio signals can be transmitted over such bandwidth limited medium as a phone line. The AT&T Accune+ high speed digital link is intended for communications between computers at a rate of 56,000 BPS (bits per second). This service uses conventional phone lines with special interface equipment. Since high quality ADCs (analog to digital converters) exist, the missing link is an interface to the phone line that will allow the "pumping" of the sound data to a suitable interface at the other end of the line.

This paper will describe the design and implementation of such a link, the Digital Audio Transceiver Interface (DATI), which enables two Intel MultiBus based microcomputers to exchange audio signals over the Accunet.

SYSTEM DESCRIPTION

DESIGN PHILOSOPHY AND OVERVIEW

As this project bridges two previously unrelated technologies, many issues were encountered in the initial product definition. It was felt that in order to be effective as a first generation design, it had to be a modular, generic design. Transmitting digital audio with computers over phone lines had not been performed before (to the knowledge of the author), so the design had to be flexible to in order to accommodate unforeseen situations.

In keeping with the modular approach consistent in digital systems, the Digital Audio Transceiver Interface (DATI) was designed as a computer peripheral with only digital circuits. Such an approach may be counter-intuitive, but computers are much more sensitive to data errors than human ears, so this results in a system more than adequate to handle audio data. The DATI only handles digital data, thus may be effectively used to transmit and receive computer data as well.

The design goals included: 1) simplest possible interface to the host computer and its software environment, 2) use conventional, readily available components, and 3) short development cycle. Once a market and host product is targeted, a simplified, low cost version can be implemented in custom chip sets. To keep the development time to a minimum, no microprocessor was used. This had two effects: 1) there was no lengthy software development, and 2) significantly increased bandwidth as a result of using a microsequencer, or microcoded control module. A microsequencer is, in short, a very stripped down microprocessor that can only perform a few tasks, but at very high speeds because of its simplicity. Even a high speed microprocessor implementation of the DATI would be able to operate at only 30% speed of the current design. Of course, the current capacity is not fully utilized through the Accunet, so absolute speed is not as great a concern as the development and debugging cycle.

The entire DATI is built using industry standard transistor-transistor logic (TTL) and complementary metal oxide silicon (CMOS) devices. Functionally, the interface is a 16 bit to 8 bit converting transceiver buffer. The 16 bit level is at the host computer level, where the data bus can handle 16 bits at a time most efficiently. The 8 bit level is the connection to other equipment, such as other DATIs and AT&T Accunet terminals.

The configuration diagram of a system is shown in Fig. 1. The analog signal can be from any source; it does not matter once it has been digitized.

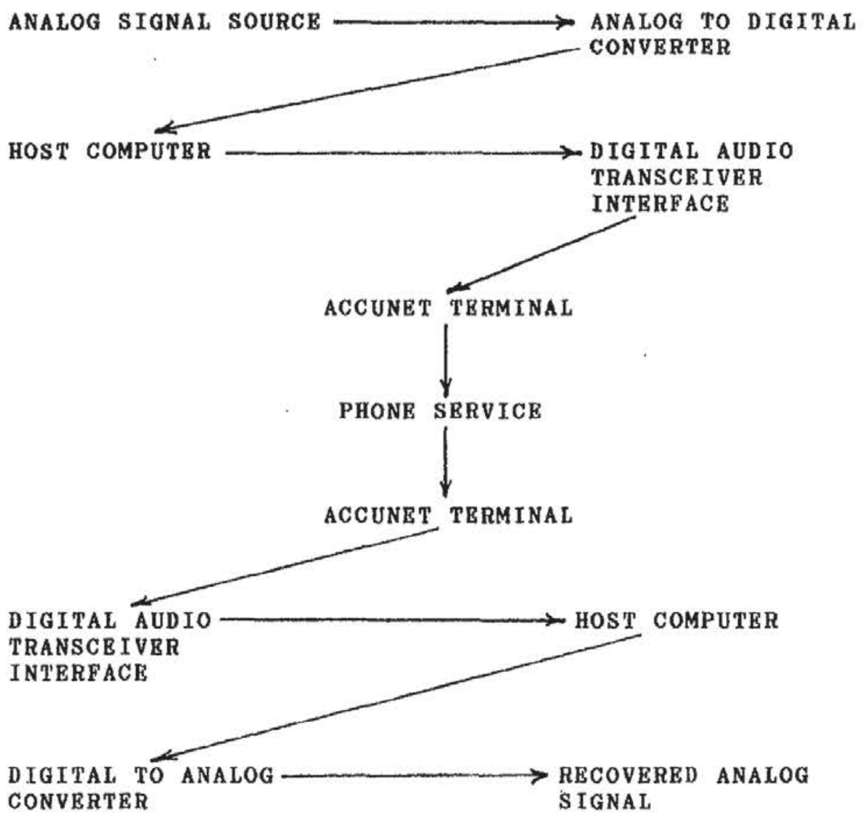

Fig. 1. System configuration diagram.

The functional modules of the DATI are:

- Intel MultiBus Interface
- Buffer Memory Module
- Command and Status Registers
- Transceiver Protocol Module
- Microcoded Control Module

The functional block diagram of the DATI is shown in Fig. 2.

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.

WHAT WILL YOU BUILD? | **sales@docketalarm.com** | **1-866-77-FASTCASE**

fastcase® Smarter legal research.