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JAN 11 1996

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

January 11, 1996

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W.
Washington, D.C. 20554

Re: Ex Parte Presentation in MM Docket No. 95-42

Dear Mr. Caton:

On December 14, 1995, on behalf of WavePhore, Inc. ("WavePhore"), Mel Engel, Vice President of Engineering for WavePhore; Michael Werner, Consultant for WavePhore; Don Everist, Consulting Engineer with Cohen, Dippell and Everist, P.C.; and Bruce Jacobs and Jason Roberts, attorneys for Fisher Wayland Cooper Leader & Zaragoza, met with the following Commission staff to discuss the above-captioned proceeding: Gordon Godfrey; Paul Gordon; Keith Larson; Jim McNally; and Bruce Romano.

The views expressed by WavePhore's representatives were consistent with those contained in its Comments filed June 23, 1995, and Reply Comments filed July 10, 1995 in the proceeding. In addition, WavePhore distributed: a brochure describing WavePhore's current marketing activities (Exhibit A); a technical description of WavePhore's TVT1/4 system that was submitted to the National Data Broadcasting Committee (Exhibit B); the results of a study of NTSC co-channel and adjacent channel interference conducted by the Advanced Television Test Center (Exhibit C); and a videotape of the subjective quality testing of WavePhore's system that was conducted by the Communications Research Centre (Exhibit D). The testing schedule listing the order of images and time of data insertion on the videotape is also included as part of Exhibit D.

No. of Copies rec'd 0+2

Two copies of this notice are being submitted to the Secretary of the FCC in accordance with Section 1.1206(a)(2) of the Commission's Rules, 47 C.F.R. § 1.1206(a)(2). Only one videotape is being submitted herewith.

If there are any questions on this matter, please contact the undersigned.

Sincerely,

Bruce D. Jacobs
Jason S. Roberts
Counsel for WavePhore, Inc.

cc (with enclosures): Gordon Godfrey
Paul Gordon
Keith Larson
Jim McNally
Bruce Romano

EXHIBIT A

WavePhore

Multimedia

Datacasting

System

Delivering

PC-ready

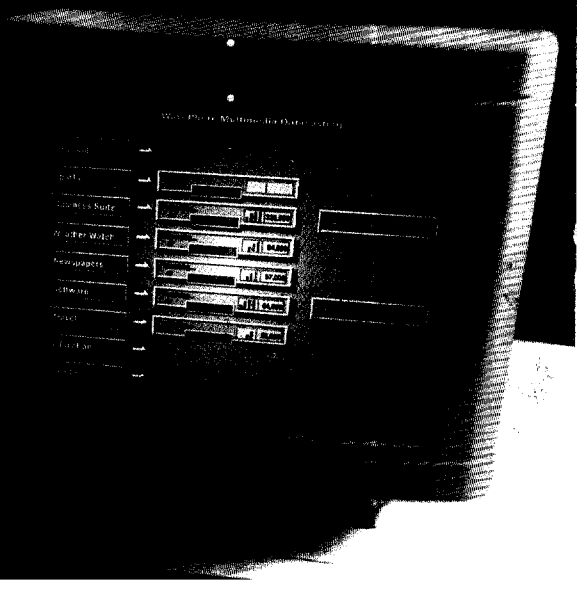
information

anywhere

within

TV's

reach



WavePhore

MULTIMEDIA DATACASTING

The WavePhore System: The Point-to-Multipoint data distribution solution for PCs

WavePhore delivers PC-ready information at speeds over 500Kbps

Multimedia Datacasting uses the existing broadcast infrastructure through wired or wireless means – via terrestrial broadcast, satellite, microwave or cable. This brings a new, high-speed, low-cost data distribution system known as The WavePhore Channel to PCs worldwide.

The WavePhore System makes Multimedia Datacasting a reality today, providing a complete end-to-end solution for both the distribution and reception of PC-ready information.

The WavePhore System can transmit any digital data – regardless of the program used to create it.

The North American Television Standards Committee (NTSC) consists of 525 lines divided into two fields, each with 262 1/2 lines. The first 21 lines of each field are "invisible" and carry the name Vertical Blanking Interval or "VBI." The television needs lines one to nine to tune each field, which leaves lines 10 to 21 to transmit information. Line 21 is already being used by closed-captioning services for the hearing-impaired.

The Multimedia Datacasting System combines both WavePhore's patented in-band technology (TVT1) and the Vertical Blanking Interval (VBI).

WavePhore's multi-line VBI products provide speeds of up to 150Kbps utilizing 10 lines of VBI. WavePhore's in-band technology inserts data into the active portion of the analog video signal (the remaining 504 lines) without interrupting the video and providing throughput of up to 384Kbps. The WavePhore System handles VBI and in-band individually or simultaneously at a collective throughput of over 500Kbps without blanking a channel. That's 225MB of data per hour and 34 times faster than a 14.4Kbps modem.

The WavePhore System provides a complete turnkey solution for Multimedia Datacasting.

Content providers send their information in a digital format to a WaveServer via leased-line, ISDN, telephone modem, internet or other source.

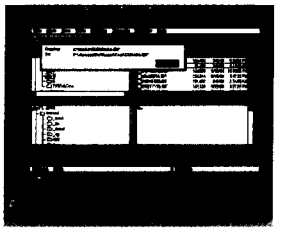
The WaveServer receives and processes the data for distribution based on customized needs. The WaveServer manages security, addressing, packeting, and prioritization of the data.

Once the data has been processed, the WaveServer sends the data to a WaveCoder at the broadcast site to be encoded and transmitted over the video signal. The data is encoded in either the VBI or in-band (TVT1), or both simultaneously.

Data is received by a WaveCoder installed on a PC and connected to a cable or antenna. The WaveCoder separates the data from the broadcast signal. WaveCeiver software then stores the data on the computer's hard drive. Received data is processed by WaveCeiver in the background, allowing the user to run other applications while receiving the data.

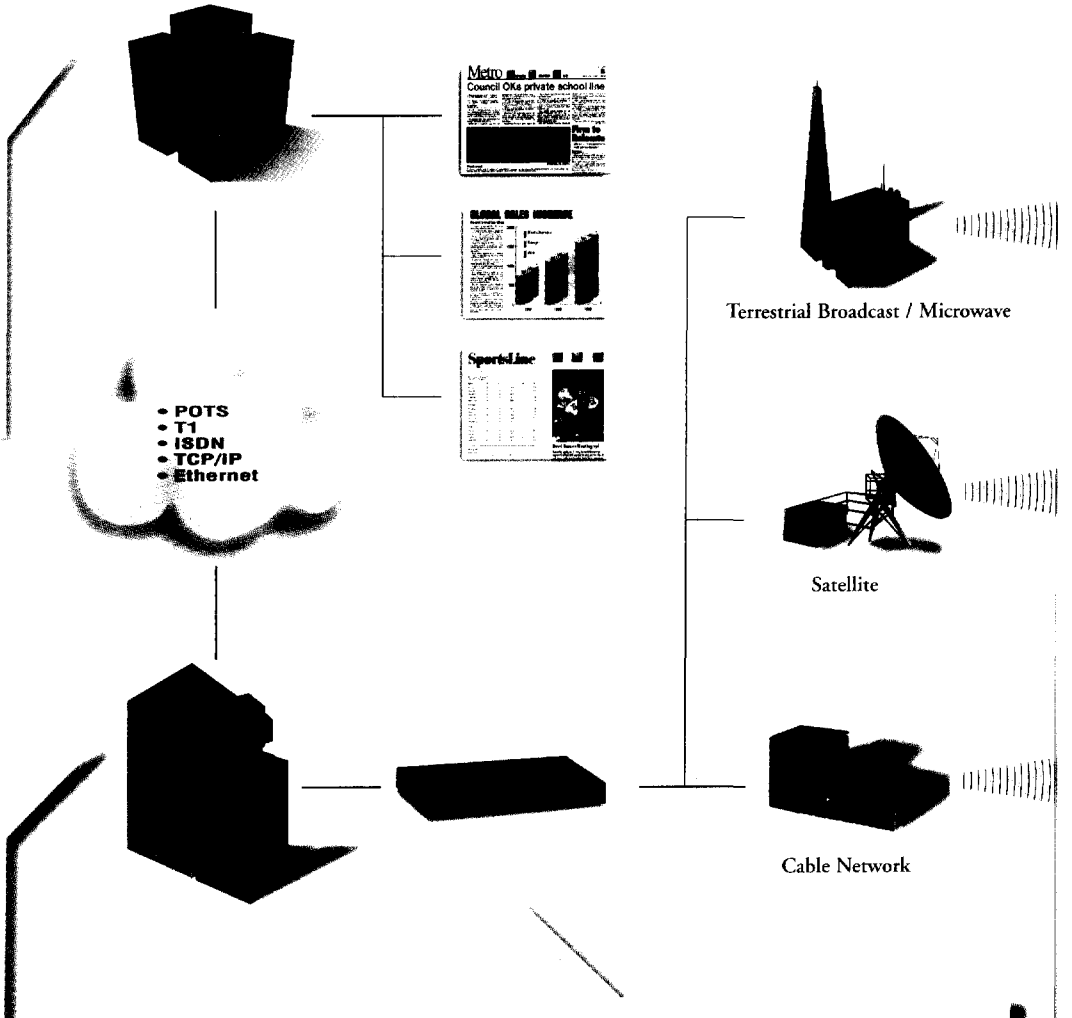
The WavePhore Multimedia Datacasting System provides the low-cost, high-speed data distribution solution today without new infrastructure costs.

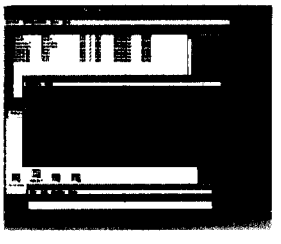
WavePhore Multi



Content Provider

Sports information, stock reports, newspapers and any other digital data, regardless of format, are created at the content provider workstation. The data files are selected and copied to a dedicated directory on the WaveServer via leased line, modems, internet or other means.

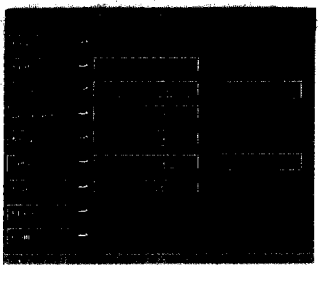




The WaveServer

The WaveServer is the heart of the Multimedia Datacasting System. It constitutes the front-end communications component of the most complete and advanced point-to-multipoint wireless data-broadcasting service available on the market today.

The WaveServer runs under Windows NT and makes optimal use of the operating system's capabilities. It features a true 32-bit, multitasking and multi-threaded architecture.



The system allows for the acquisition of data from multiple content sources simultaneously and is capable of managing up to 16 million different services. The WaveServer monitors the network and manages the scheduling, packeting, security and addressability functions of the data being transmitted on a simple-to-use Graphical User Interface (GUI).

The WaveServer is transmission method independent and can transmit data via in-band and VBI independently or simultaneously on the same video signal. The WaveServer architecture can also support the processing of data for FM-side band and satellite, and will be upwardly compatible with Advanced Television Systems (ATV) and Digital Satellite System (DSS).

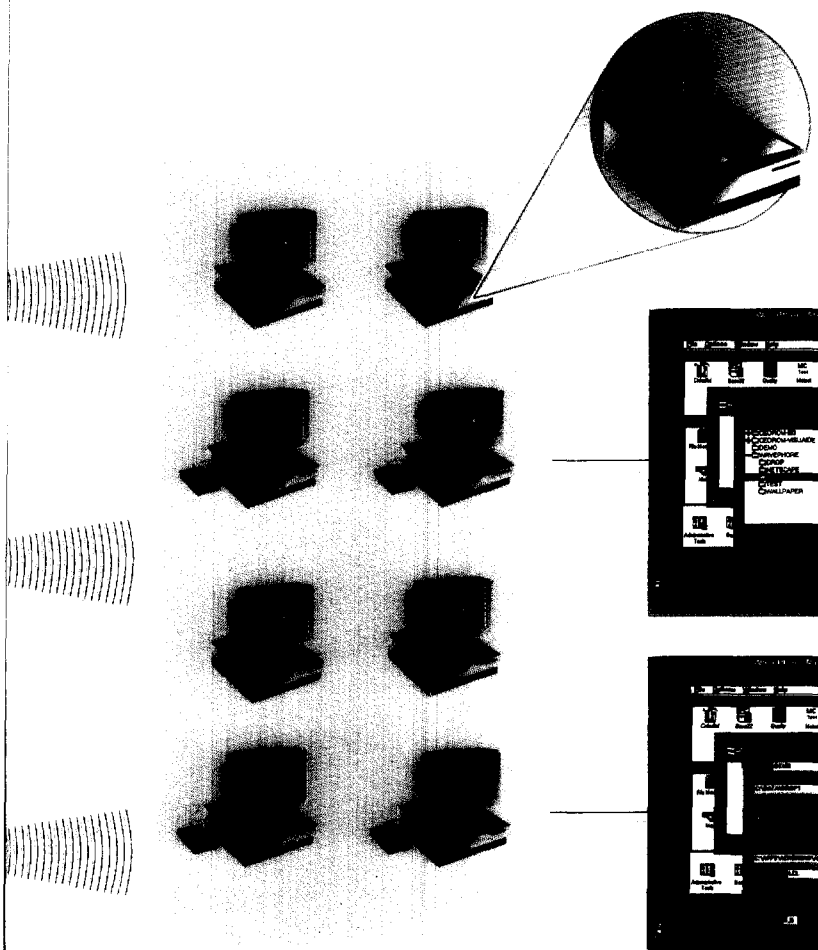
Once processed, the WaveServer presents the data via a high-speed link to a WaveCoder for distribution on the video signal being used as a carrier.

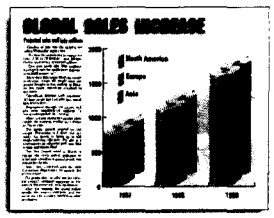
WaveCoder Encoders

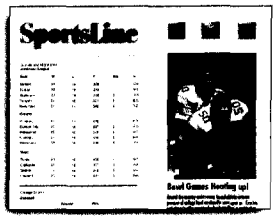
The WaveCoder inserts data into terrestrial broadcast, satellite, cable or microwave video signals. Data is inserted into the active portion of the video and the Vertical Blanking Interval at the broadcast site by either an E1000 (in-band) Encoder or an E/B 100/200 Encoder (VBI).

The E1000 is based upon WavePhore's patented method of inserting data into the active portion of the video signal. Its function is to take digital data, modulate and mix it with the base-band video. The E1000 is compatible with the NTSC video standard and works compatibly with VBI encoded data on the same signal.

media Datacasting System:







The E/B100 and E/B200 consist of two major parts: a Tektronix VITS-100 or VITS-200 and a WavePhore Piggy Back Board (PBB). The PBB adds NABTS compliant data insertion capability to the existing functionality of the Tektronix equipment. The multi-line VBI encoders also function as an intelligent data bridge.

The WavePhore System does not require any additional bandwidth other than the VBI and the active portion of the same video signal. This provides the capability of sending 2MB of data in less than 30 seconds.

WaveCoder Decoders

The WaveCoder D1000 and D100/200 are connected to a PC through an external device or an internal ISA (EISA) or PCI card. The WaveCoder receives data through an antenna or cable connection via a 181 channel tuner. The data is extracted from the video signal by the decoder and is managed by the WaveCeiver Software. Each WaveCoder is addressable, allowing data to be sent to designated customers.

WaveCeiver Software

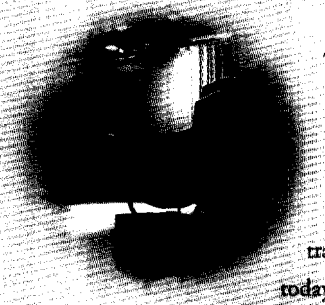
The WaveCeiver Software handles both VBI and in-band data streams and is compatible with DOS, Windows 3.x, Windows 95 and Windows NT. WaveCeiver performs forward error correction and reconstructs the information in its original format. The software allows users to receive information from several services simultaneously and can run in the background for unattended reception with optional pop-up notification or automatic launching of the associated application.

WaveCeiver also ensures data security through a dual-key encryption system.

Using WaveCeiver is as simple as turning on your computer - a television or a VCR is not needed to receive data through Multimedia Datacasting.

Multimedia Datacasting

Transition Technology to the 21st Century



The promise of the information superhighway is years and billions of dollars away. The transition system is here today. WavePhore's Multimedia Datacasting System builds the long-awaited bridge for low-cost, high-capacity data delivery to every home and business location. Utilizing the existing world-wide television infrastructure, the path is now available to meet the needs of the rapidly expanding information consumer community.

Multimedia Datacasting for Business

Businesses need the ability to distribute common data to branch offices and clients.

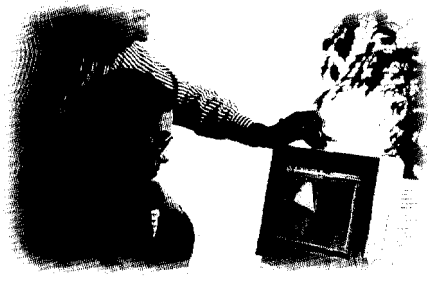
Multimedia Datacasting now makes it possible to simplify distribution of information to the people who need it most – without wasted time, shipping costs and paper waste. With their WavePhore-equipped PCs, businesses can subscribe to services from content providers or create proprietary networks of their own.

Branch offices can receive vital, time-critical information at a fraction of the cost required for conventional methods. Information can be received, viewed and used on the company's existing computer network.

Multimedia Datacasting for Content Providers

Multimedia Datacasting provides a low-cost distribution solution for newspapers, magazines and other information service providers.

WavePhore delivers the distribution technology content providers need to reach every home and business in



North America and the world. Content providers will be able to market their products through agreements with WavePhore networks that are equipped with WavePhore's Multimedia Datacasting Systems.

Multimedia Datacasting for Homes

Home uses for Multimedia Datacasting are without limit. Many home-based businesses and telecommuters are PC-equipped. Multimedia Datacasting provides a channel for content providers and broadcasters to tap into a new marketplace hungry for electronic information.

Multimedia Datacasting offers home users the ability to receive entire newspapers, magazines, computer games, music, sports information, entertainment and other services.

Multimedia Datacasting is here – ready today.

Whether you're a broadcaster, content provider, business or home user, Multimedia Datacasting promises to revolutionize your life without a huge capital investment. In fact, because Multimedia Datacasting is available through your television signal today, the industry can add this new service for just pennies per subscriber.

WavePhore, Inc., a publicly traded company (NASDAQ: "WAVO") based in Tempe, Arizona, has developed proprietary products and services for the low-cost, high-speed distribution of digital data via the existing worldwide television broadcast infrastructure. The company operates a wholly-owned subsidiary, WavePhore Canada, in Montreal, Quebec.

Contact WavePhore for more information:

WavePhore, Inc.
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Tempe, AZ 85282 USA
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WavePhore

MULTIMEDIA DATACASTING

EXHIBIT B

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	INITIAL RELEASE	4/20/95	MG

APPROVALS	DATE
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ENG	
ENG APP	4/20/95
MFG APP	

WavePhore Inc. 2601 WEST BROADWAY ROAD TEMPE, ARIZONA 85282 U.S.A.

TITLE TVT1/4 NTSC-COMPATIBLE DATA BROADCASTING SYSTEMS

SIZE	DRAWING NO.	REV
A	820-0000010-0000	A

SCALE — DATE 4-20-95 SHEET 1 OF 60

PREFACE

This document was prepared by WavePhore and contains WavePhore Confidential information.

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1. PURPOSE

Contained herein is:

(a) A narrative description of the system, explaining in detail the technical approach, the relationship to the International Standards Organization (ISO) Open Systems Interconnection (OSI) seven-layer reference model, and how to test and evaluate the system at the OSI physical and data link layers.

(b) Complete technical description of the physical layer including: signal format, transmitted bit rate, frequency spectrum and plots, modulation techniques, out-of band emission considerations, range of use, compatibility with NTSC signals, multipath mitigation techniques, minimum requirements for immunity in the presence of co- and adjacent channel NTSC signals.

(c) Data link layer performance characteristics including net bit rate, bit error rate, error correction, real-time delay, acquisition time, and recommendations for framing of data.

(d) Other information presented is: two-way transmission capability, ghost canceling considerations, intended applications, compatibility requirements between NTSC and HDTV signals, implementation of upper layers of the OSI reference model (layer 3 and above), compatibility with scrambling and compression techniques, recordability, and anticipated implementation costs.

2. INTRODUCTION

There is an increasing demand for higher capacity data pipelines than currently exist with conventional technologies. New technologies are being developed which take advantage of the excess capacity available in a 6 MHz NTSC television channel to broadcast high speed data signals.

This system is intended to provide over-the-air delivery of data-based information services to bring to the U.S. public the benefits of new broadcast technologies and services while, at the same time, preserving the public's ability to continue to receive existing services with present equipment. High-speed refers to the highest data rate attainable commensurate with robust delivery that will maintain data integrity and yet not result in the unacceptable degradation of the host NTSC signal, i.e., cause no interference to other broadcast services.

3. TVT1/4 DESCRIPTION

3.1 Narrative System Description

3.1.1 Data Broadcasting System

The TVT1/4 from WavePhore, Inc., enables high speed data transmission over conventional television networks, see Figure 1, Typical Television Station Installation. What is unique is the system's ability to insert data into the active portion of the video scan line with no noticeable effect on the television picture. The technology does not use the VBI, the front or back porch, the color burst or the band next to the audio sub-carrier. The data instead overlaps the video spectrum and becomes an inherent part of the video information. This data is combined with the composite video signal prior to modulating with the picture carrier, or, at the baseband level.

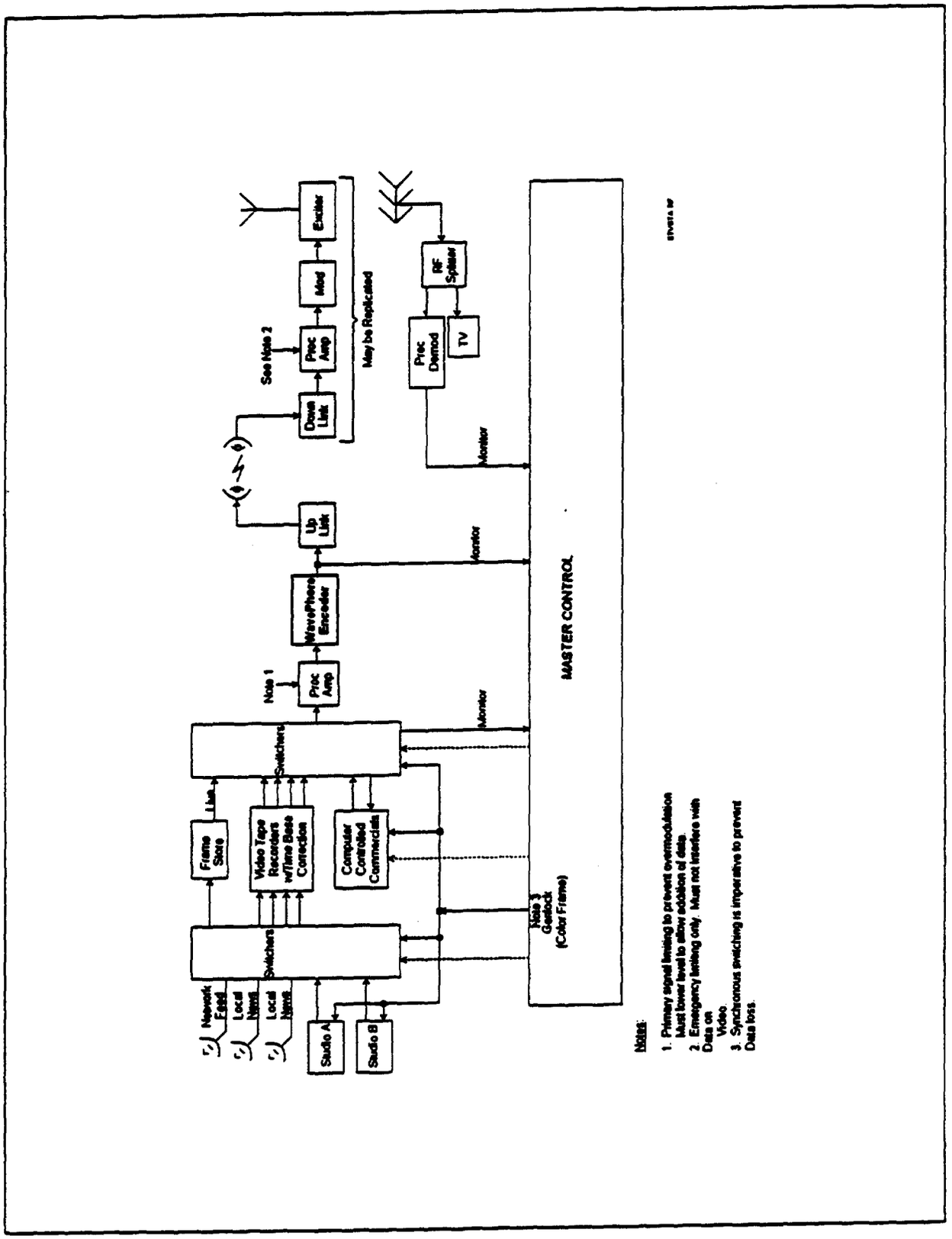

Figure 1
Typical Television Station Installation

This is successfully accomplished by observing two considerations:

1) The data amplitude is kept at a very low level, typically about 20 dB above the video noise floor. The actual level may be optimized for a given broadcast system.

2) Appropriate shaping of the data spectrum prior to insertion minimizes interferences with the luminance and the chrominance by taking advantage of the spectral properties of the video signal.

Because the data is combined with the video in baseband, it is independent of the mode of video transmission. Thus, transmission can be through direct broadcast, satellite link, microwave transmission, direct CATV cable connection, or through a combination of these.

A typical system configuration would use an NTSC TVT1/4 Encoder at the originating site of video transmission and a decoder at each remote site receiving the data broadcast, see Figure 2. The encoder has two inputs, (a) baseband video per RS170A and (b) RS-422 data. It accepts data in RS-422/449 simplex format at the Encoder/Broadcast end and reproduces data and clock in RS-422/449 format at the Decoder/Receiver end. The Encoder can either (a) provide the clock for the input data in the Master Mode, or (b) accept the clock from the source in the Slave Mode. The throughput data delay will be less in the Master Mode, as derived in 3.2.2.5.

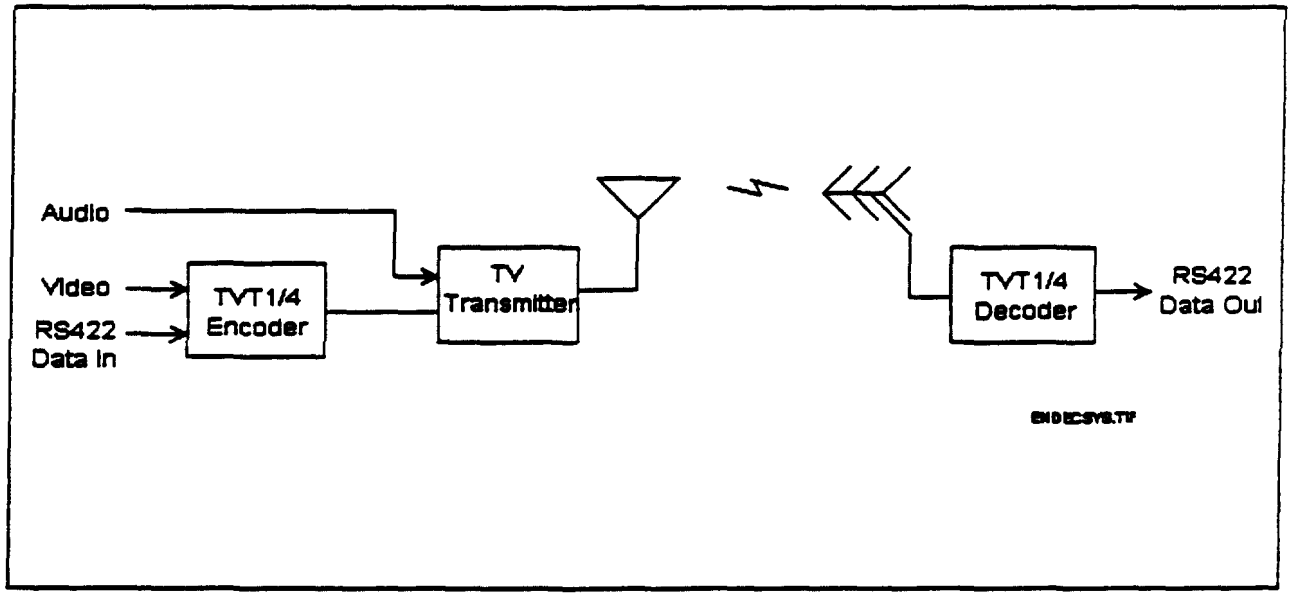

Figure 2
Video Transmission and Reception of Data

At the receiving end, a TVT1/4 Decoder picks up the RF signal, demodulates it back to its composite baseband, then separates the digital data information for further processing by a PC or any other digital processor. Depending on the application, data will be routed to the appropriate location for use or for storage.

The integrity of WavePhore's decoding process is assured when the television signal at the remote site has at least 40 dB signal-to-noise ratio when demodulated by a precision demodulator such as a Tektronix 1450, and measured by a Video Measurement Set such as a Tektronix VM700. Processing of the baseband video signal after data insertion should be closely examined to minimize distortion due to excessive group delay, clipping or, if digitized, inadequate digital resolution (less than 9 bits). Specifically, filters with a cut-off frequency less than 4.2 MHz must be avoided. Tests performed on conventional broadcast facilities did not exhibit any problems when these precautions were observed. The bit error rate is further reduced by forward error correction embedded in the TVT1/4 system hardware.

The TVT1/4 system currently accommodates an average data rate that exceeds 384,000 bits per second, a speed sufficient for transmitting larger files, images and other multi-media information. Continued development efforts are under way to extend this to T1 of 1.5 Mbps.

3.1.2 Open Systems Interconnection (OSI) Seven-Layer Reference Model

Currently the TVT1/4 system provides for the OSI Physical Layer. It accepts any input data stream and delivers it unmodified to the end user. Thus, it is presently transparent to upper OSI Protocol Layers. Future designs will incorporate the appropriate protocols that are being developed by the NDBC Data Transport Protocol Working Group when they become available.

3.2. Technical Description of System

3.2.1 TVT1/4 Encoder

Given here is a functional description of the TVT1/4 Encoder and how data is added to the TV signal. The TVT1/4 Encoder is inserted into the baseband video path at the television broadcast Studio Transmitter Link (STL), see Figure 1.

The Encoder's function is to take serialized raw digital data, modulate it and mix it with the baseband video in a way that is not noticeable on the television screen, yet fully recoverable by the TVT1/4 Decoder attached to a television receiving antenna or cable, see Figure 2. The system provides an instantaneous data bit rate (symbol rate) of 599 Kbps. This results in an average raw data rate of 431 Kbps applied to the video lines. Considering overhead processing and forward error correction used in the Encoder and Decoder, the net throughput data bit rate is 384 to 393 Kbps, depending on the mode of data clocking used.

3.2.1.1 Video Path, Encoder

If selected for data encoding in the TVT1/4 Encoder, the video signal is processed as shown in Figure 3, Encoder Functional Diagram. The video signal is selected for insertion of data when Encoder power is present and when selected by a front panel bypass switch.

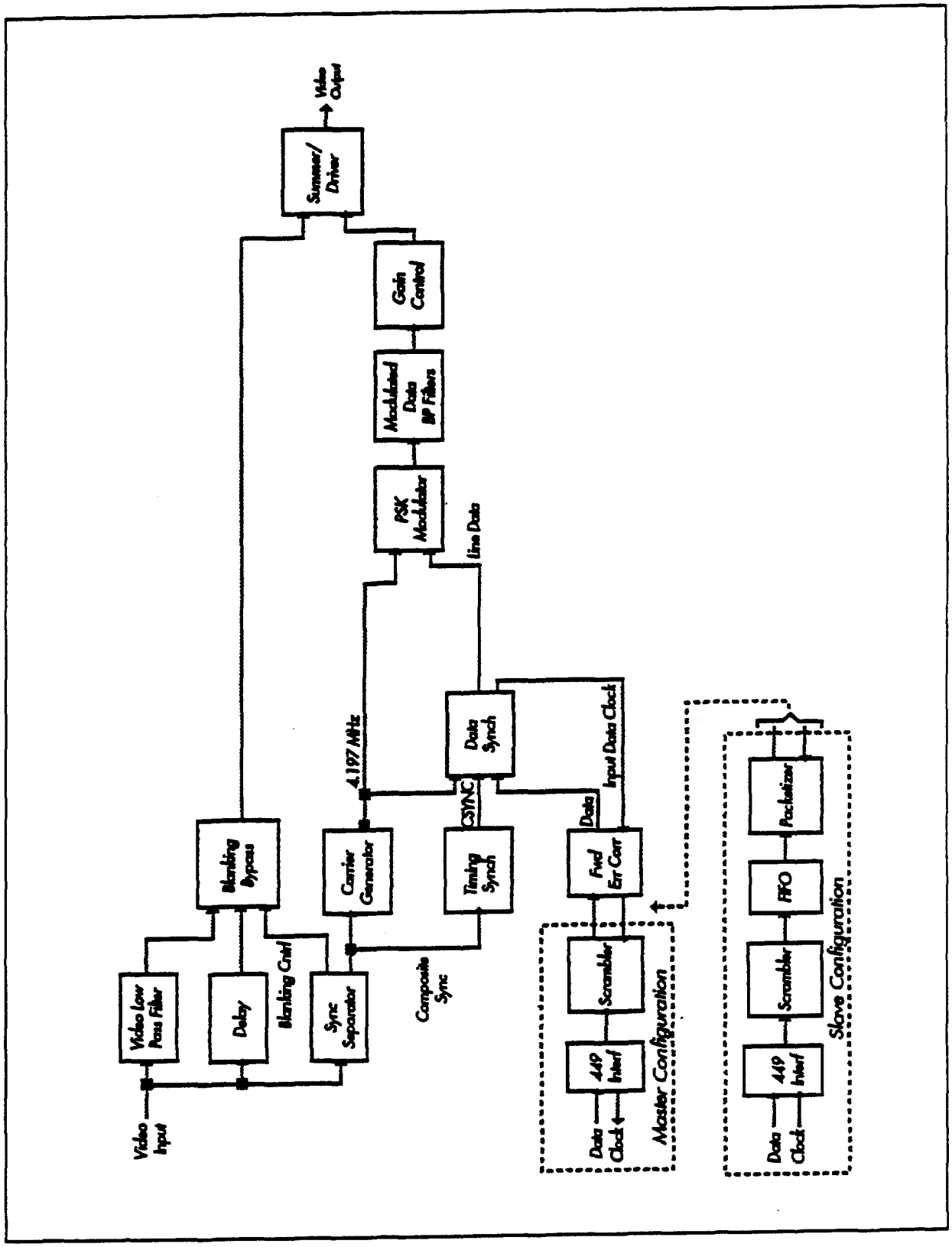

Figure 3
Encoder Functional Diagram

3.2.1.1.1 Low Pass Filter

The video signal is initially processed by a low pass filter. The Low Pass Filter conditions the video spectrum above 3.9 MHz, to make room for the data that will be summed in later and occupy this empty spectral domain.

Plots of the video spectrum are shown in Figures 4, and 5. Figure 4 shows the unmodified video spectrum, i.e., without filtering and without data. Figure 5 shows the resultant video signal that has been filtered and then data added in the filtered area. The triangle and small circle mark the data carrier frequency of 4.197 MHz. Note that most of the spectral area of the data is on the lower side of this carrier frequency, the upper side being mostly removed by filtering of the data signal prior to its being summed with the filtered video signal.

3.2.1.1.2 Delay

Due to the effects of the Low Pass Filter on the amplitude and phase of the blanking pulses, the original signal is delayed to match the delay in the Filter.

3.2.1.1.3 Blanking Bypass

The blanking pulses are then gated back into the video signal by the Blanking Bypass.

3.2.1.1.4 Summer/Driver

The signal is then summed with the modulated and scaled data. It is then buffered and routed through the selector relay to the TVT1/4 Encoder VIDEO OUTPUT where it is returned to the RF broadcast modulator.

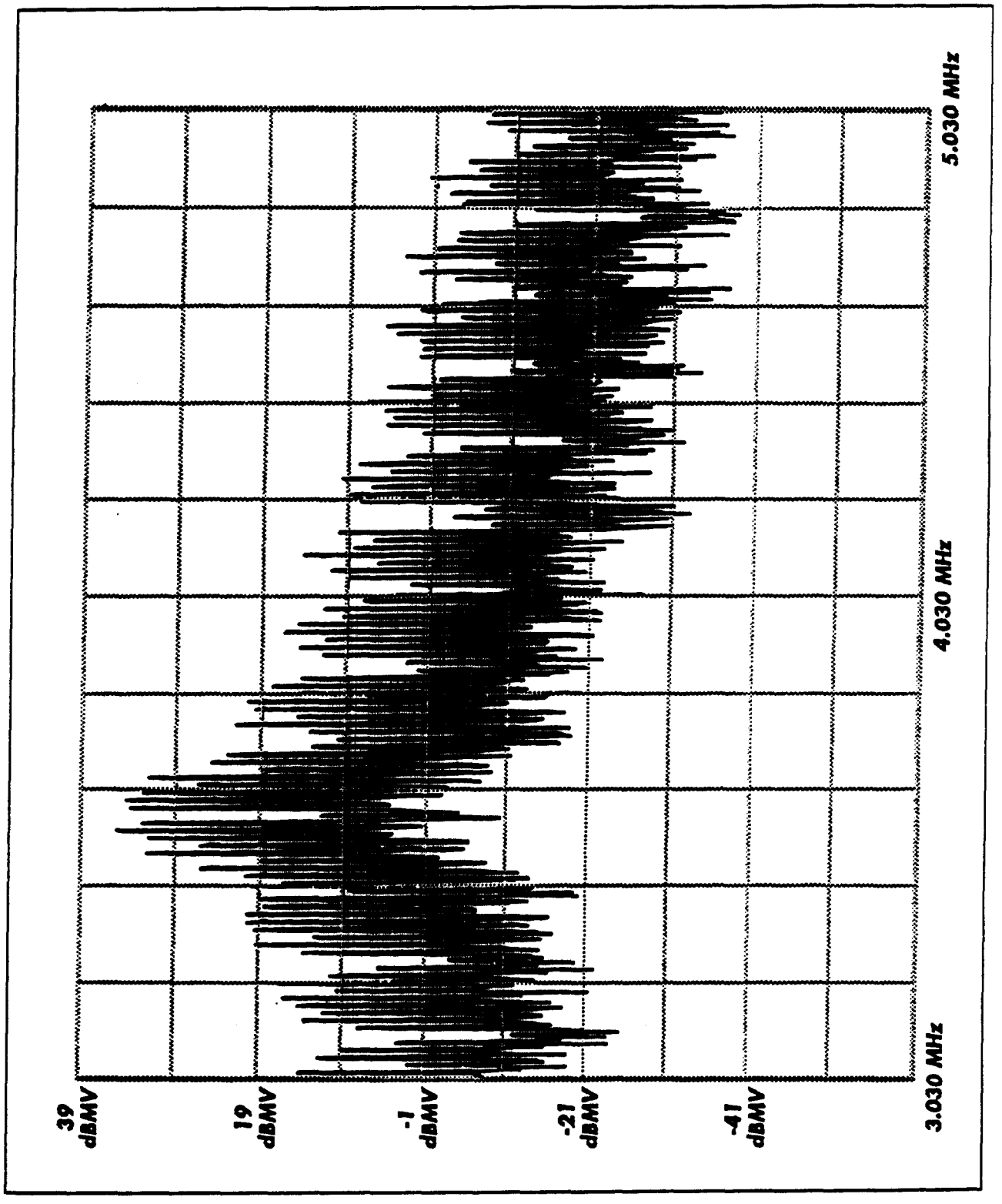

Figure 4
Video Baseband
Unfiltered and No Data