ADDRESSABLE CONTROL

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ABSTRACT

This paper presents a marketing oriented view of addressable control for cable systems. "Addressable control" deals with the ability of a cable system to deliver specific tiers of program material to specific subscribers.

With the spread of premium programming (pay TV) in the cable market, the CATV businessman is confronted with two problems. He must be able to deliver specific kinds of premium programs to subscribers who desire the service. Secondly, he must protect his investment in premium program material from theft. The techniques which will accomplish these two tasks are available today.

A key element in this system is a home terminal that has a unique and unchangeable identity. The terminal responds to commands from the headend. The terminal can be preauthorized to descramble programs that have a tag identity which corresponds to those tiers of programs that the subscriber has ordered.

A small computer stores all information which pertains to the addressable system. The preauthorization data is sent to each terminal during a global address of the system. A program tag identification is sent with the program itself.

Addressable control also allows for future premium service requirements.

INTRODUCTION

This paper describes a system to add headend control to cable television operations. Today, the cable television industry is presented with new opportunities. These opportunities lie in the distribution of multi-tiered premium services to subscribers. In order to deliver these multi-tiered services, newer techniques in program security, delivery and control must be employed.

Premium entertainment programs are the first of a number of services that the cable system will handle before the end of the decade. Text information services, electronic funds transfer are examples of future services that will also require addressable control.

This paper will consider the problems which confront the CATV operator. Then, the addressable system will be treated in a general descriptive manner. Next, we will consider the hardware, the data requirements and the software. Finally, we will consider some trade-offs involved with addressable control.

THE NEED FOR ADDRESSABLE CONTROL

The cable television industry is experiencing a new business climate. As the product being distributed increases in premium content, greater investment in program material is required. The product increases in value to those who want to view the programs. The CATV operator must be able to deliver specific programs from his multi-tier offerings to the subscribers who desire them. He will also have to protect these programs from theft by those who are unwilling to pay for value received.

As the variety and value of premium programming increases, the problems confronting the cable operator will also increase. He must be able to deal with more than one premium channel of information. Efforts to steal the program often lead to theft of or tampering with the home terminal.

Some older problems intensify as a result of the greater premium content. The operator must be able to collect for services, but with the improved services he will be collecting a larger bill. He must be able to efficiently terminate a delinquent subscriber should it become necessary to do so.

Opportunity also increases as a result of the growth of premium services. You have a greater variety of premium and special event material to sell to your subscribers. But first you must be able to protect the material and deliver it to specific subscribers.

In short as premium content increases, so does the need for headend addressable control.

SYSTEM OVERVIEW

Mature addressability techniques are available and are being applied in the industry today. These techniques were originally developed and applied in STV (over-the-air subscription television). Since any broadcast TV receiver could

receive the UHF frequency of the STV station, it was necessary to scramble the premium program prior to transmission. Viewers who wished to subscribe to the premium service were equipped with a decoder. When properly addressed and authorized, the decoder descrambled the picture. These techniques have been utilized in STV for the last four years. Today, they deliver premium STV services to over one-half million subscribers.

These techniques were refined for the cable industry. The ability to offer a number of tiers of service, reflecting the broader capability of cable TV, was added. Today 12 major cable systems are delivering multi-tiered addressable services to their subscribers. More than 120,000 addressable home terminals are in service today.

SECURITY

Addressable control has two dimensions, delivery and denial. One must be able to withhold the premium service from those who are unwilling to pay for it. Since security is one element of addressable control, it is appropriate to review various methods of withholding programs.

Security techniques have been classified by our industry as "soft" or "hard" depending on the degree of difficulty required to defeat them. Soft security usually leaves program material intact but attempts to deny non-subscribers access to it. Hard security, on the other hand, makes the program material unintelligent before it leaves the headend and allows the scrambled picture to come through.

Examples of soft security are negative traps, positive traps, and the use of converters.

Soft security arrangements have provided an adequate degree of premium program protection for some systems in the past. However, for addressability it is necessary to be able to control the security or program accessability from the headend. Soft security arrangements lack the headend "controllability" required for an addressable system.

Hard security arrangements in use today involve encoding or scrambling of the picture so that it cannot be received by a normal television receiver. Two methods in use today are gated sync supression (Figure 1) and sine wave sync supression (Figure 2).

In both cases, the horizontal sync pulse is supressed about 6 dB. The television receiver horizontal phase locked loop then keys on random video peaks and the picture is not started properly. The resultant picture is unwatchable. The function of the decoder is to restore the horizontal sync pulse to its proper relative amplitude. In the sine wave sync supression arrangement, the descrambling signal is a sine wave that is sent through as part of the program material. When properly applied, this cancels the scrambling wave form and the subscriber receives a correct picture.

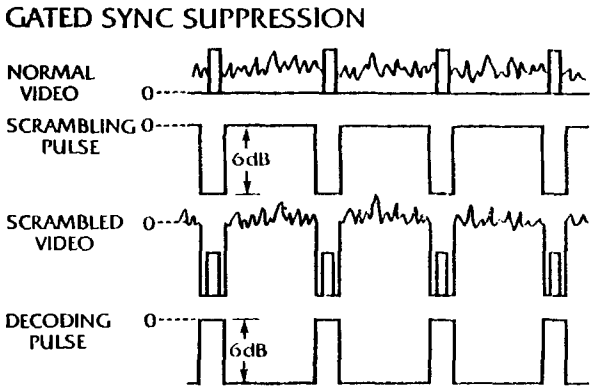


FIGURE 1

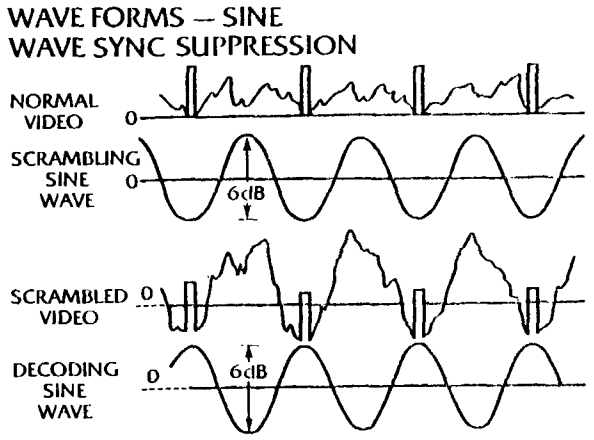


FIGURE 2

Both methods of sync supression scrambling provide effective hard security and can be controlled from the headend. The sine wave type of sync supression is totally "in-channel." It can be used with broadcast transmission and also is applicable through all elements of a cable system.

We have retained the reliable time tested techniques of sync supression scrambling for the addressable system. We have added a time varying element so that home terminals from a previous period cannot descramble an addressable program.

One additional word about program security is in order. One needs to attain a degree of security that is "commercial" rather than perfect. A "commercial" degree of security is one that will support a profitable business. "Perfect" security, if achievable, is expensive.

THE SYSTEM

Now we turn our attention to the addressable system itself. We will describe the general system operation. Consider the hardware required, then the software, and finally the trade-offs for addressable control.

A Key element in the addressable system is a home terminal containing a microprocessor which can respond to orders from the computer at the headend. This home terminal has a unique identity which it was given when it was built. It can be addressed and will react as an individual unit in the system. Control center, headend components and software are elements of this addressable system. The system is one-way and is applicable in existing one-way cable plants. The addressable information can be passed through all elements of the cable plant.

Two kinds of data are involved in the addressable system. They are address data and tag data. The address data is generated by a CRT terminal and is stored in the computer in the control center. The computer periodically cycles through the address information and feeds it to a controller.

When an individual home terminal receives address information, corresponding to its unique address, it does two things. It enables the terminal to operate and it preauthorizes descrambling of programs with certain tag identification.

The second kind of data required is the program tag information. The tag identifies the specific program category or channel. When the program being offered contains a tag identification that the decoder is preauthorized to descramble, the viewer will receive the unscrambled picture. The program tag information is conveyed in-channel on the audio RF carrier.

The individual home terminal must receive these two kinds of data before it knows what to do. The address and tag preauthorization must be included in the authorization information from the computer. The program tag is transmitted with the program.

If the subscriber is delinquent or if the box was reported stolen, it is so identified. Authorization is withheld in the "global" address (the periodic address of the entire system) and the terminal does not function.

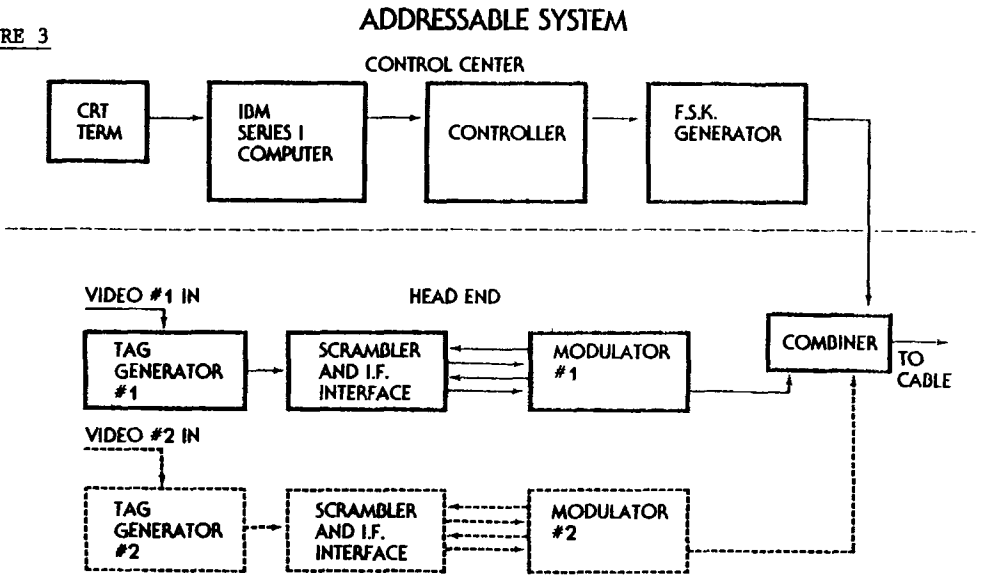
HARDWARE

The hardware required for an addressable system is in three equipment groups. These are: the control center, the headend and the home terminal. The control center and the headend are diagramed in Figure 3. The control center consists of a computer, one or more CRT entry terminals and may include a printer for hard copy. Also, at the control center is a CATV controller and a FSK generator. The computer stores and furnishes the address and tag level preauthorization. It also stores the customer file. The customer file ties individual box, address and serial number to customer name and physical address. The CATV controller converts the data from the computer into pulse width modulated serial data. The FSK generator provides the medium for transmission of this serial data stream over the cable system.

The computer is an IBM Series I. This computer is configured with 64 megabytes of hard disk memory and 128K of volatile memory. The computer allows up to 20 asynchronous I/O ports for CRT operator terminals. Other peripherals may include a line printer and a bar code reader. Our IAS software program provides for handshaking between the addressable system computer and the cable system's host computer.

The second equipment group is the headend, which may be remote to the control center. If remotely located, the headend and control center are linked by coaxial cable. Each scrambled channel has a tag generator, a scrambler, an IF interface and a modulator. The tag generator adds the tag level identification to the program material. The scrambler generates the hard

FIGURE 3



security for premium channel protection. The hard security employed is sine wave sync supression with a time varying element. The IF interface imposes the scrambler signal, the authorization data and the tag information on the carriers for the specific channel. The modulator performs the normal modulation function.

The home terminal is a keyboard controlled unit with infrared wireless remote option. (See Figure 4). The model currently in service is an addressable converter/decoder. It will control 16 tiers of premium programming. The remote transmitter has the same keyboard control as the main unit.

On terminals with keyboard channel selection, the parental keylock option allows up to 10 permitted channels to be locked into the program recall sequence.

The address data itself is a formal 32 bit self-clocking word. The computer sends out each address word twice and moves on. The data rate is 15.7 KHz. Therefore, a total of 12,500 subscribers are addressed each minute. The address data carrier is 104.75 or 112.7 MHz in the FM band. The data bit error rate is 10^{-7}. This means that about one data error may occur per day in a 100,000 subscriber system and it would be corrected with the next data transmission.

FIGURE 4

The home terminal has an on/off function as instructed by the control center. This assures that a floating terminal, such as one that has been stolen, will not function. Publication of this fact, especially at the time of installation, will decrease box theft. Also, the terminal must receive data regularly in order to retain its authorization, if the data stream is interrupted, by disconnecting the input for more than 10 seconds, authorization is lost. If the box has a legal, paid-up status, it is automatically reauthorized by the receipt of authorization data after reconnection.

In the event of a power loss, the unit retains authorization from 3 to 10 minutes. When power is restored or when the unit is plugged in again, the box is reauthorized when its address is included in information sent from the headend. A parental keylock option is operable on program level 8 or can be applied to 2 levels - 7 and 8.

SOFTWARE

A complete software program exists and is illustrated by the menu as follows:

"Enter Boxes" The terminal serial number, address and run number is entered. The cable operator receives this information by means of a diskette packed with the shipment.

"Customer File" Includes a customer name, account number, home address, billing address and authorization level desired.

"Install Customer" Links the customer and the box. This also enables the installer to run an "in-home" test for proper box function.

"Unsuccessful Install" Clears certain records in the event that the box is performing improperly.

"Reauthorize Customer" Sends a single message to an individual box to reauthorize that box.

"Hold/Release" Is used to withhold service when a subscriber is delinquent. Releasing puts the customer back into the currently active status.

"Stolen Box" Suspends service to a box that has been reported stolen. It places the box address in the global file to deauthorize the box.

"Found Box" Reactivates the terminal in the system if certain other conditions are met.

"Disconnect Customer" Cancels the service permanently. It also changes the status of the box from "installed" to "in stock."

"Display/Alter Customer Box" Changes certain customer data but leaves box data unaltered.

"Box Test" Allows either the data entry clerk or the installer in the home to run a test of box functions while checking a customer complaint.

"Assign Channel Authorization" Allows the tagging of certain channels to be done remotely at the headend.

The IAS program with its handshaking capability between the addressable system computer and the host computer provides for interfacing billing and business functions. The capability to control special event programming is also built into the software.

TRADE-OFFS

A thorough financial analysis must be made by the cable operator who is considering an addressable system for premium TV. Comparison should be made between a system with headend addressable control as opposed to just adding security to premium channels. The question to be answered is primitive. "Will I make more money with headend addressable control or without it?"

When compared to a non-addressable system, there are added costs due to the mini computer, added headend components, and the more sophisticated home terminal. However, there are offsetting factors. These include the added revenue from the sale of additional tiers of entertainment which were added as modest incremental system costs. The addressable control also facilitates the sale of special event programming for increased revenue.

Another trade-off is the increased operating efficiency due to improved headend control as opposed to requiring service calls to change subscriber program tiers.

The addition of addressable control will minimize and perhaps prevent some problems associated with premium TV. Program security is improved by the "hard security" scrambling. Box theft is minimized when it is publicized that the stolen and unauthorized terminals do not operate. Tampering and attempts to relocate equipment decline when it is demonstrated that an interruption of data flow deauthorizes the terminal. Accounts receivable become more current once the operator demonstrates the ability to suspend all service from the headend.

On a more positive note, addressable control provides the cable operator with the ability to offer an improved level of service to his customer. He can deliver the selection of program tiers that the specific subscriber wants. He can change the program quickly with little cost. With mail or telephone prearrangement, he can offer special events to his subscriber. Many marketing tools are available to the cable operator. He only needs to apply his own creativity.

When considering an addressable system today, the cable operator is faced with several options. He may choose to extend his bandwidth channel capability and utilize fairly fixed soft security. Or he may choose to add several tiers of hard security that will provide program selection from today's choices. He may intend to include headend addressable control at a later date. But why wait?

The premium entertainment market is developed and available for exploitation now. An adequate number of premium programs exist. The industry is on the threshold of another expansion of these programs. Why install a system that will require a service call to change out a box or to revise a trap when the subscriber wants a new program? It could be done quickly by a data entry clerk who would simply type the information into the CRT entry terminal.

This same addressable capability will allow the cable operator to increase both subscriber satisfaction as well as his own revenue by offering special event programming.

THE FUTURE OF ADDRESSABILITY

The 80's will present many challenges and opportunities to the cable system operator. Headend addressable control is an essential element to help the CATV industry meet these future challenges and exploit resultant opportunities.