

JAMMING TECHNIQUES FOR OFF-PREMISES ADDRESSABILITY

by

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A great deal of attention is being given to off-premises control of premium cable services. Off-premises devices have usually taken the form of either "pole-mounted converters" or hybrid systems involving fiber optics. This paper presents a description of an off-premises premium entertainment control technique employing jamming signals to render unauthorized channels unintelligible. This approach offers some major features and provides many operational and economic advantages. A description of this product and its operational effectiveness will be presented in this paper.

RATIONALE FOR EMPLOYMENT OF OFF-PREMISES JAMMING TECHNIQUES

Since major revenues in CATV systems are produced by premium services, it is no wonder that an enormous amount of effort has been devoted to protection of these services from unauthorized viewing. Many manufacturers offer scrambler/descrambler systems for this purpose.

It is very difficult, however, to build a high security scrambling system which must both work in a broadcast mode and employ a relatively inexpensive decoder. As a result the security of most scrambler/descrambler systems is not high, and the business of selling "simple fixes" to defeat these scrambling systems and provide the means to illegally view premium services continues to grow.

As the number of premium services has increased, addressability of converters and the ability to control multiple individual services have become very important. These requirements have increased the complexity of the converter/descrambler and, in turn, have produced other areas of vulnerability that have also been exploited by the "Pay TV Underground". There is an ever-growing list of "fixes" ranging from a \$5.00 set of parts that will allow

reception of suppressed sync scrambling, to all types of schemes to remove or falsify data carriers, in some way defeat the addressability, or modify it to provide the desired end. Stolen converters are often altered (if necessary) and sold as "lifetime subscriptions" to one or more premium services.

Unfortunately, the equipment that controls the decoding of both the addressing and the scrambled signals is continually in front of the user in the privacy of his residence, thereby inviting experimentation and tampering or at least inspiring him to purchase a "bootleg box".

One approach designed to alleviate this problem is the "pole-mounted converter" where the entire converter is removed from the premises and only a low cost control device is required within the residence. The "mini-hub" approach using fiber optics uses somewhat different technology, although its operational features are much the same as those of the pole-mounted converter. Both approaches all but eliminate direct tampering with critical hardware since it is no longer in the residence.

The pole-mounted converter, however, has some practical shortcomings. A major one is the fact that (in the basic implementation) only one channel is transmitted down the drop cable to the TV receiver. As a result, a separate outside converter is necessary for each TV set in the dwelling and additional drops are necessary for additional sets. The pole-mounted converter requires that the television receiver be tuned to the single output channel of the converter, thereby excluding the expensive channelization and remote control features of the often-encountered "cable-compatible TV".

In an effort to cope with these problems and gain other advantages, jamming techniques have been developed. The basic concept of jamming is to render unauthorized channels unviewable by the use of interfering signals. The jamming device is mounted on the strand in order to reduce tampering. The specific jamming required for each drop is under the positive control of a one-or two-way data system thereby achieving "addressability". When off-premises jamming is used, all signals come down the drop as with a standard CATV system configuration, except that those signals that are not authorized are unviewable. Commands are given to

remove the jamming only from those programs that are authorized for the specific drop. Once in the home, since it is academic which set or how many sets receive the authorized programming, the drop may be split as required using standard CATV practice.

Plain, non-addressable converters of any type can be employed as well as direct (no converter) input to cable-ready TV sets. Since any standard converter may be used, converter changes or substitutions become routine. Since ownership of standard converters is not a threat to other cable systems the sale of converters to subscribers is quite practical and can greatly decrease operator capital and cash needs. Program authorizations can be changed very quickly via the data system allowing phone-in ordering of special events. Where two-way transmission is employed, an ordering device (keypad) can be provided for impulse-pay-per-view, opinion polling and the like. Other economic advantages which stem from the specific configurations of the jammer will be discussed later in this paper.

Security of the pay TV product in such a system is greatly enhanced due first to the virtual impregnability of the strand-mounted unit, and second to the irreversible destruction of visual and aural information by the jamming signals. In addition, when the jamming is removed, there is no degradation of the television image, as there may be in scrambler/descrambler systems, since a clean signal without additional processing is presented to the viewer.

TECHNICAL CONFIGURATION OF THE JAMMING MODULE

The E-COM Tier-Guard System implements premium TV control with jamming techniques. The jamming module was originally designed as part of the E-COM TRU-NET 500 Multiservice Communications System. The TRU-NET 500 is a comprehensive, high capacity, low cost communication system which offers interface units to implement a wide range of residential services such as security, energy management, meter reading, premium service control, home computer interconnect, and videotex. Any service addressed by the TRU-NET 500 can be installed individually or in concert with one or more other services. Control of premium TV is provided by what is known as the Tier-Guard Tap (TGT) which is but one element in the TRU-NET 500 system. TGTs are employed in place of normal subscriber taps. A network of TGTs is controlled by the System Communication Controller (SCC) usually located at the cable system headend. A 38 kilobit/second data stream is used to communicate with the TGTs on either a one-way or two-way basis (two-way hardware is supplied allowing subsequent hands-off upgrading when desired).

The jamming signals are provided by an internal frequency-agile system allowing up to 16

tiers of service. In the initial product, each tier may be selected under system control to consist of either one channel or three contiguous channels and may be assigned at will over the highest octave of frequencies available in the cable system, i.e., 120 to 240 MHz, 150 to 300 MHz, 225 to 450 MHz, etc. Channel assignments may be IRC or HRC systems. The TGT also includes a remote disconnect feature for each drop that, when initiated, blocks all television service but allows on-going communication with security, meter reading and other interfaces when installed within the residence.

Since suppression of the aural information is often deemed as important as control of the visual, the jamming signals are injected in a way that drastically effects both elements of the TV signal. The traditional method of inserting interfering carriers has been to inject the carrier midway between the aural and visual carriers and provide a positive trap to remove the interfering signal. In the TGT jamming system, such traps are unnecessary since the jamming is completely controlled at the tap via the data channel. In order to make it virtually impossible to effectively remove the jamming signal the interfering signals are injected in close proximity to the TV carrier frequencies. Any attempt to trap the interfering signals will destroy the desired TV information in the process.

Considering reliability, loss of the jamming signal will allow receipt of unauthorized premium product (an event we doubt the average customer would report as a service call). For this reason certain critical parameters of the jamming system are continually monitored by the system. Failure to sense proper operation of the circuitry as indicated by these "flags" will cause a fault signal which completely shuts-off the unit in a one-way system. The shut off of the unit will obviously precipitate a service call. In a two-way system this information is returned to the headend where it initiates a service call and allows discretionary action.

The system described above is extremely secure. The one obvious way to defeat it is the application of a "pressure tap" on the distribution cable where the signal is clean. This "fix" is visually auditable and provides prima facie evidence of the attempted theft of service.

The TGTs are installed in place of the normal subscriber taps. Units are available with 4, 6, and 8 outputs. Economies achieved by the use of a higher number of output ports are quite substantial and often warrant the installation of longer drop cables to take advantage of this feature.

The TGT modules have another important characteristic. Regardless of the tap value the through loss is minimal (0.5 dB). As a matter of fact, discrete tap values are not supplied since this parameter is field adjustable. The installer or serviceman need only stock a single part for replacement of, say, all 4-way taps and set the specific tap value required at time of installation.

Due to the reduced through loss of the TGT, spans between amplifiers can be longer. Studies have

shown that a 15 percent reduction in line equipment costs is possible where TGTs are included in the original design. In rebuilds, it is often possible to replace normal taps with TGTs and thereby increase the high frequency response of the system and therefore the number of cable channels carried without costly physical respacing of the amplifiers or replacement of the cable.

JAMMING EFFECTIVENESS

The effect of the jamming varies with each type of TV receiver. In general, it is possible to jam vertical sync, horizontal sync, and AGC action of TV receivers. In addition, the injection of a pulsed interfering carrier, as employed by the TGT system, tends to "chop up" the picture to the point of unviewability. The TGT jamming algorithms have been optimized to achieve multimode jamming on all types of TVs. It can be appreciated that the synchronizing functions in newer TVs with countdown sync circuits are more difficult to disrupt. However, all TVs are to some degree susceptible to sync jamming. Various TVs have grossly different responses to pulsed interference in the AGC circuits. In some sets, total obliteration of the picture is achieved by blocking only the AGC, while in others the effect is only partial. All sets, of course, are susceptible to chopping up of the picture. As a result, at least two jamming modes are effective on all old and current production TV receivers.

Obviously, the bottom line in evaluating a product like this is the performance (effectiveness of jamming). Some advocate only partial jamming of program material in order to make enough of the picture viewable to act as a teaser. For other programming, extra effectiveness is required for both audio and video information. The TGT system offers variable jamming options which are all under the control of the system operator. The jamming algorithms of the TGT are altered by changing the number of jamming impulses per second. Channels requiring higher levels of protection can be given greater disruption by increasing this pulse rate.

The illustrations accompanying this paper attempt to show by still photographs (which hardly portray the dynamics of the process) the effects of jamming upon the visual information as experienced by various television receivers. The aural information is obscured by various pulses and modulations that produce extremely loud and annoying sounds to mask the aural content.

SUMMARY

The off-premises jamming approach to pay TV security is an extremely attractive one. It eliminates the problems of multiple sets and cable-ready receivers. It is very effective and virtually tamperproof and provides tiering and intensity options under the cable operator's immediate control. This technique provides an economical means of pay TV product protection plus yields substantial advantages in cost and maintenance savings when included in new cable systems and rebuild applications.

TYPICAL RESULTS OF TIER-GUARD JAMMING
SHOWN ON FOUR TV RECEIVER TYPES

