

THE VCR INTERFACE

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Abstract

The home VCR and "Video Store" are considered by many to be a prime competitive force to Cable TV. However, the VCR is here to stay and must be considered as a factor in the Cable TV system design. With proper marketing, promotion and equipment design, the VCR can be less of a problem and more of an opportunity. To accomplish this, the VCR must be integrated into the home equipment configuration as a supplement to the CATV service. Through consumer education and the installation of a user friendly interface product, the subscriber can remain satisfied that the Cable TV Company is not taking away the usefulness of his own home equipment.

This paper investigates various RF switching approaches to the VCR interface problem, analyzes their "user friendliness" and suggests a VCR-Baseband "afterburner" decoder or a novel RF frequency multiplexing device as the ultimate solution.

Introduction

Industry sources estimate that at the beginning of 1986, 28% to 30% of American homes will have VCRs. This represents a 10% increase in VCR market penetration from 1984 to 1985. It has also been reported by some Cable TV MSOs that nearly 60% of their subscribers own VCRs. A recent A. C. Nielsen study similarly showed that pay-cable subscribers are most likely to own VCRs. Clearly, the home video recorder is an important element to be dealt with in the design and marketing of a Cable TV system. Whether the VCR is a friend or a foe, an opportunity or a problem, depends on how the cable operator reacts.

For the subscriber, or potential subscriber, Cable TV is regarded as a service for which they pay depending upon its desirability, quality and usefulness. The perceived usefulness of Cable TV is largely based upon its economy,

convenience and ease of use. Cable TV's desirability stems from its providing of a greater variety of programming than is available from over-air TV or other alternate entertainment sources. Since Cable TV does provide such variety on various and sometimes conflicting schedules, the subscriber often wishes to time-shift record programs on the home VCR for later viewing. Here begins the problem.

Faced with the various interconnection possibilities of the CATV cable, Converter-Decoder, VCR and TV Receiver, the consumer often becomes frustrated and intimidated by the seemingly complicated arrangement. Once connected, the subscriber then finds that he either cannot record premium (scrambled) programming or is only able to view the program being recorded and has greatly reduced the usefulness of his own VCR's features.

In order to maintain subscriber service satisfaction, the Cable TV operator must now consider the home VCR as one of the system parameters and deal with it. A low cost, easy to use VCR interface device must be provided to help the subscriber solve his problems. For maximum utility, the ideal device should provide the following functions:

1. Simple, easy to understand operation
2. Maintain MTS Stereo compatibility
3. Maintain Performance quality
4. Maintain unattended VCR programmability
5. Allow ability to:
 - a. View recorded tape
 - b. Record Premium while viewing Premium (same)
 - c. Record Basic while viewing Basic (same)
 - d. Record Basic while viewing Basic (other)
 - e. Record Premium while viewing Basic
 - f. Record Basic while viewing Premium

Common Approaches

It seems that every technically minded individual in the Cable TV industry has thought of a different answer to the CATV-VCR interconnect problem. Some solutions appear simple and others very sophisticated. A common problem is that these devices are sometimes considered from an engineering point of view and not from the end-user's.

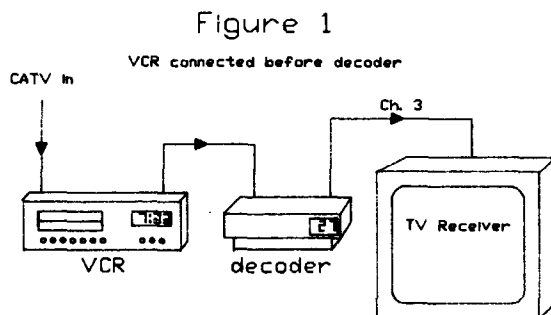
RF switching systems designed to provide for every possibility may be technically elegant and have great appeal to the Cable operator's engineering staff but can be a "head-ache" for the consumer in installation and use. Even after the device is correctly installed, the subscriber must learn which switch to turn to what position, and which channel to be tuned on both the VCR and TV for each seemingly simple desired function. Beyond this, the prospect of teaching the use of the device to other family members or an occasional babysitter becomes a monumental task.

Up until now, the two major approaches to the VCR-CATV interconnect problem have been as follows:

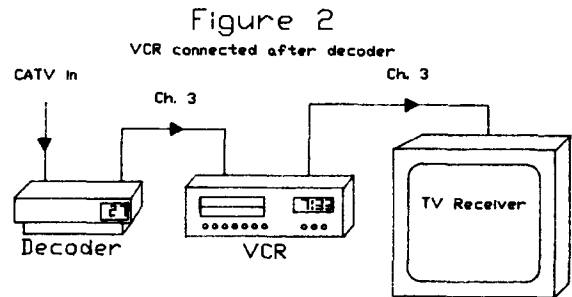
1. Hard-wire interconnect
2. RF Switching

Hard-Wire Interconnect

Figures 1 and 2 show the two possible methods to interconnect a CATV cable, converter-decoder, VCR and TV receiver without extra devices. In Figure 1, the CATV decoder is connected between the VCR and the TV. This arrangement allows the full use of the VCR's features to record any Basic program while viewing any program, Basic or Premium. The VCR's programmability for unattended channel change is retained, but Premium programs cannot be recorded since the signal does not pass through the decoder until after it has passed through the VCR.

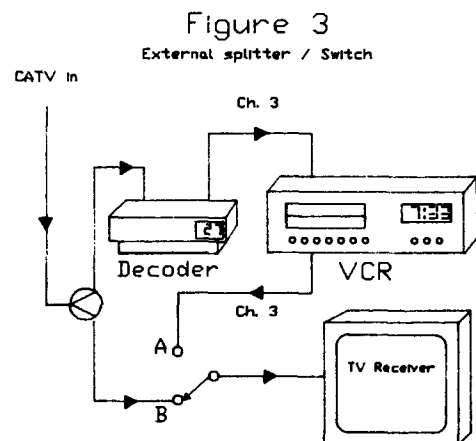


In order to record Premium programs, the VCR must follow the Decoder as shown in Figure 2. This arrangement renders most of the VCR's tuner features useless, however, since the VCR can only receive the output channel of the CATV decoder.

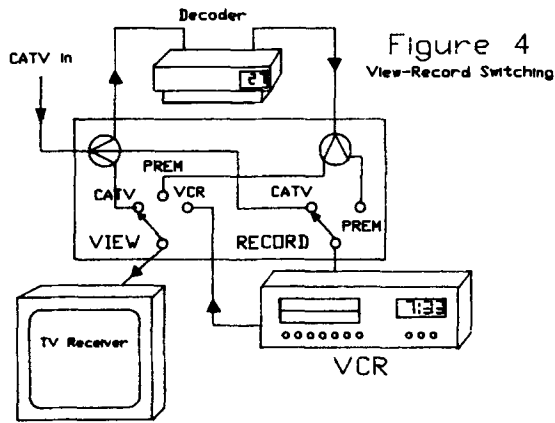


RF Switching

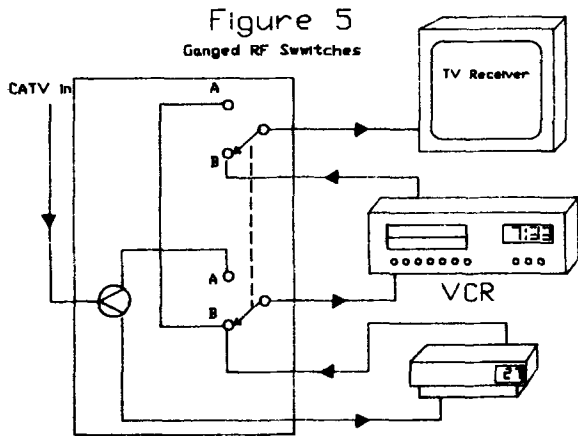
An alternate approach, designed to recover some of the VCR features lost in the hard-wire interconnection is shown in Figure 3. This system uses an external splitter and RF A/B switch arranged in such a way that while any program (Basic or Premium) is being recorded, any Basic program can be viewed. The VCR, however, is still only capable of receiving the CATV decoder's output channel and is incapable of programmable channel change. Operation of the system now begins to become complicated due to the addition of the manually operated A/B switch.



As an attempt to recover more of the functionality of the VCR, an RF switching product incorporating multiple ports, switches and splitters can be used. Figure 4 describes a typical product incorporating two separate switches, one for viewing (three positions: CATV, Premium, VCR) and one for recording (two positions: CATV, Premium). Although this approach does seem to provide for all of the most desired options, it does not allow a programmable unattended VCR to record a premium program followed sequentially by recording a basic program since the VCR has no control over the switching. Additionally, the manual switching is more complicated and might tend to intimidate many high-tech shy subscribers.



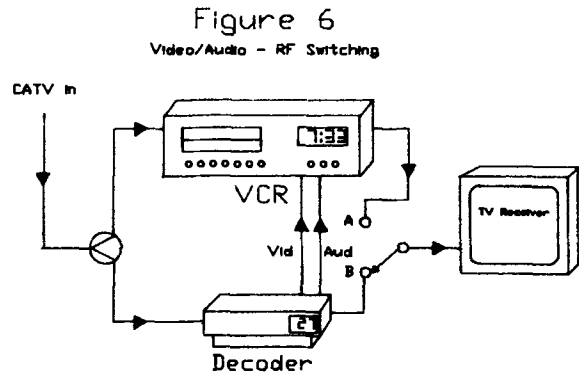
In an effort to simplify the switching device operation, the RF switches could be ganged together, as shown in Figure 5. This arrangement is designed to reduce the possible switch positions, and consequently the number of decisions the user must make.



This example shows a product with only two positions. Position A allows the viewing of any (Basic or Premium) program through the use of the CATV decoder tuner, while recording any Basic program through the VCR tuner. Position B allows the viewing of the VCR output or any (Basic or Premium) channel tuned by the CATV decoder tuner, while recording the same program being viewed. A third switch position could be added, with only a small increase in complexity of operation, to further allow the recording of a Premium program while viewing a Basic program.

Even though these solutions appear to simplify operation, switch position and channel selection decisions still have to be made depending upon what the subscriber desires to do. In some switch positions, checking what the VCR is recording is impossible since switching to the "VCR view" mode disconnects the desired signal from the VCR input. Similarly, care must be taken not to change switch positions for viewing alternate programming while VCR recording is in progress.

Figure 6 shows a novel approach using both a two position RF switch device and the Video/Audio outputs of a baseband CATV decoder through the VCR's built in Tuner/Aux. input selector. Some new VCRs even allow the unattended selection of "Tuner" or "Auxiliary" inputs as part of the multi-event programming. With such a VCR, this system allows for all of the desired functions. In operation, however, it is not as simple as it looks. Although there is apparently only one two-position RF switch to be concerned with, there are two more two-position switches in the VCR (TV/VCR switch and Tuner/Aux. switch) which must be manipulated.



Alternate Approaches

RF switching systems really have one common drawback - the complicated installation and various switch positions make them difficult to use. What really is necessary is a system which does not require the subscriber to think about what he is trying to do.

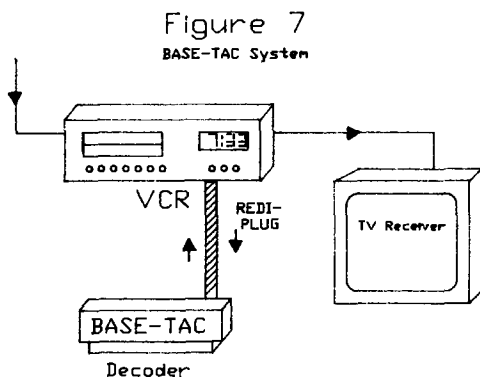
In an effort to provide the most user utility, while providing simplicity of operation, two alternate approaches to the VCR-CATV interconnection problem are suggested:

1. VCR "afterburner" baseband decoder ("BASE-TAC")
2. RF Frequency Multiplexing ("VCR Interface")

BASE-TAC

Perhaps the ultimate and lowest cost VCR-Cable interface is the "Afterburner" approach. This system is so named because the premium program descrambling is performed after the subscriber receiving equipment's tuner-IF, and demodulation stages. The system depends upon Baseband scrambling techniques, in-band addressing data, and home equipment capable of being adapted. The Zenith BASE-TAC product is a good example of this technique and is compatible with Zenith's Z-TAC SSAVI scrambling.

Figure 7 shows a VCR equipped with a BASE-TAC decoder. All Zenith VCR models since 1984 have been adaptable to a BASE-TAC decoder through a field installable REDI-PLUG. Similarly, a VCR designed with a CENELEC connector for the NTSC Television Receiver Baseband Audio/Video Interface Standard could be used. The REDI-PLUG on the back of the VCR contains all of the necessary interconnects in a single multi-wire cable between the VCR and the BASE-TAC pay TV decoder.



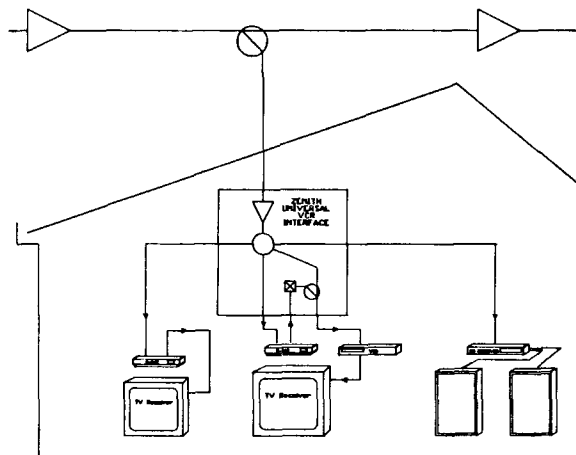
In this approach there is no CATV converter (only the BASE-TAC decoder), there is no splitter, there are no RF switches to be concerned with. The CATV RF signals can be directly connected to the VCR and from the VCR to the TV receiver as in a normal setup. The VCR tunes and demodulates the encoded channel into a baseband signal. The encoded video and addressing data are then routed to the external BASE-TAC decoder through the REDI-PLUG. The decoder, if previously addressed and authorized for the tuned program, will decode the signal and return it to the VCR.

Channel selection for the VCR is accomplished through its own tuner, manually or via its programmable VCR timer. The VCR and TV receiver operate normally without complicated switching and retain all of their features including BTSC stereo compatibility.

The "VCR Interface"

Since the BASE-TAC system relies upon baseband scrambling and adaptable home equipment, it may not be a universally acceptable solution to the CATV-VCR problem at this time. A more general approach is needed to deal with the variety of equipment now in use. The Zenith "VCR Interface" was conceived to provide a simple, low cost universal solution to the Cable TV - VCR interconnection problem. The device does not require manual or automatic switching but supplies all of the functions normally associated with such switchers.

FIGURE 8
UNIVERSAL VCR INTERFACE



The application block diagram of the system is shown in Figure 8. With this approach, instead of switch/time multiplexing the RF signals through a diffi-

cult to learn switching system, the signals are **Frequency Multiplexed**. The incoming cable signals are amplified (to compensate for later losses) and split four ways: to a secondary RF output, to the input of the primary pay TV decoder, to an FM receiver output, and to a signal combiner. The Ch 2 or 3 pay TV decoder RF output is fed to an up-converter (mixer - local oscillator) where it is converted to a channel not used on the CATV system. This decoded and up-converted channel is now re-combined with all the signals on the Cable TV system in the signal combiner and passed on to the subscriber's VCR and TV receiver.

With this arrangement, the subscriber operates his VCR and TV normally, in the same familiar fashion he would without a CATV converter. No confusing RF switching is necessary. No extra thought is necessary to perform the desired viewing and recording functions. Once connected, the "VCR Interface" does not have to be worried about, it can be left out of sight.

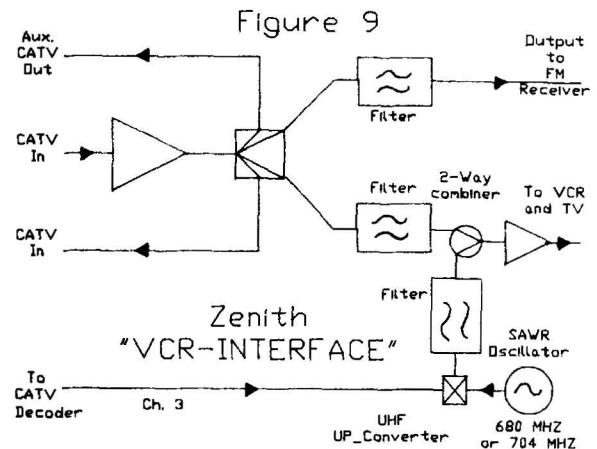
Channel selection for viewing or recording is accomplished with the TV's and/or the VCR's tuner. With the TV or VCR tuned to the decoded up-converted channel, channel selection is performed through the CATV converter-decoder. Viewing of one channel while recording another is now possible as well as unattended programmed VCR channel switching from premium to basic programs. By interconnecting several TVs or VCRs, a subscriber could be viewing a premium program, recording a basic program, while others in the home are viewing or recording other basic programs.

A major decision is the choice made for the up-converted output channel. For economical mass-production, a common, standardized output channel must be selected. Ideally an unused CATV band channel would be chosen but due to the lack of standardized channel usage among Cable TV systems, a common channel cannot be identified.

An alternate method is to up-convert to a UHF channel. This serves a dual purpose, it provides a guaranteed unused channel for use and it becomes useful with older non-CATV compatible TVs and VCRs.

Figure 9 shows a detailed block diagram of the VCR Interface. A SAW resonator oscillator (for stability) is used to up-convert the decoder output channel to a UHF output frequency. Two models are made available depending upon the UHF output channel required in the user's area. A 680 MHz oscillator is

used for up-conversion from Ch 3 (VHF) to Ch 59 (UHF). Similarly, a 704 MHz oscillator is used to up-convert from Ch 3 (VHF) to Ch 63 (UHF). In either case, the converted decoder output signal is summed with the CATV RF spectrum for delivery to the subscriber's VCR and TV.



In application, the TV and VCR are placed in the "TV" mode (as opposed to the "CATV" mode) to select VHF basic channels or UHF CATV programs (as tuned through the CATV decoder). Viewing or recording other CATV channels while the CATV decoder is otherwise being used, requires switching the TV or VCR to their "CATV" modes.

Figure 10 shows the complete VCR Interface connected to a VCR and TV receiver. Figure 11 describes the input spectrum to the VCR Interface and Figure 12 shows the output spectrum including the additional UHF channel.

FIGURE 10

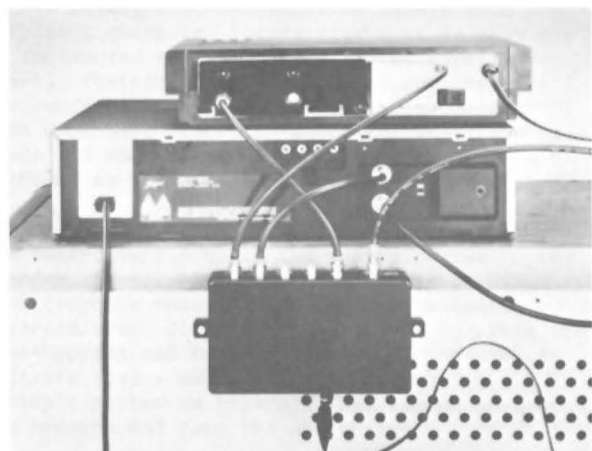


FIGURE 11

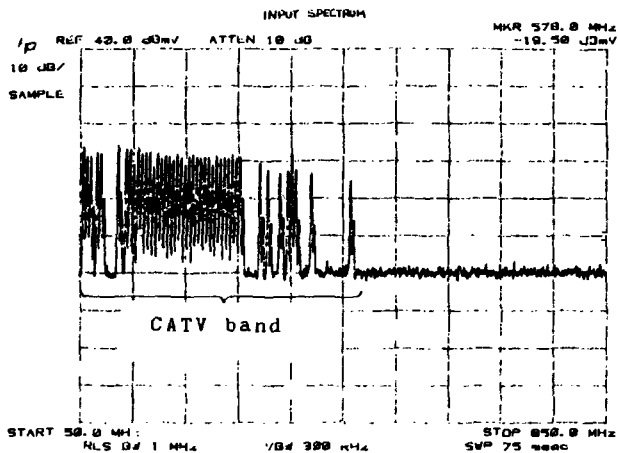
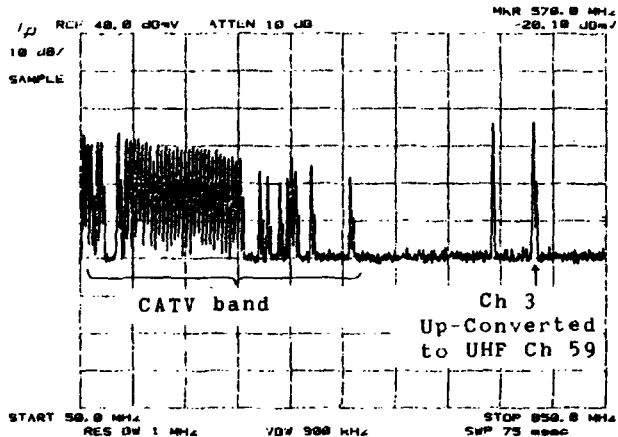


FIGURE 12
Output Spectrum



Conclusion

Several approaches to the problem of interfacing CATV, converter-decoders, VCRs and TV receivers have been described. In an effort to simplify user operation, two new approaches to the solution have been presented: the BASE-TAC "afterburner" approach, and the "VCR Interface" RF Frequency Multiplexing system.

Acknowledgements

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