AN OFF-PREMISES CONVERTER WITH MULTIPLE SIGNAL PATHS

Charles M. Palmer
Engineering Manager of Digital Products Group

C-COR ELECTRONICS, INC.
State College, Pennsylvania

ABSTRACT

An off-premises converter with controllable multiple signal paths fixes the problems inherent with the simple off-premises converter. The unconverted path solves the additional set problem. The reverse path allows for future two-way communications. These with the converted path provides an off-premises unit that meets the needs of todays cable systems.

INTRODUCTION

Several years ago, C-COR managers decided to fill a large market niche existing for off-premises addressable converters. These units, we believed, would solve many problems plaguing the converter market. Signal and equipment theft; equipment access and control; these were to be wiped out in one fell swoop.

Our orginal design was a simple off-premises converter consisting of a box on a pole. The box contained a power supply, tuner, microcomputer controller, and data link for addressable control.

The road to this basic converter was rocky and seemingly endless. Meeting tuner and other component specifications in temperature extremes of −40 to 60 C wasn't easy. Keeping the electronics protected against Mother Nature's tricks of moisture and lightning was just as difficult. Designing a highly reliable product that functions under widely varying operating conditions, while satisfying the Underwriters Laboratory, is an experience that I wish on no one.

Problems With Off-Premises Converters

Meeting UL codes and coping with the weather were solvable problems; the technology was at hand. But that didn't help us. We had the wrong product for the market. People wanted choice, and our simple off-premises converters delivered only one channel at a time to all sets of a multiple-set customer (the "additional set" problem). To solve this problem, we could put additional converters on the pole. Sounds simple, but the additional wiring needed for each pole-mounted converter and the extra converters themselves boosts costs to unrealistic heights. That wasn't all. The simple off-premises connverter had no reverse path (5 – 30 MHz), and that was unacceptable.

A SOLUTION

We chose to employ multiple signal paths into and out of the home on one cable drop. The design included: The converted (to Channel 3 or 4) signal path into the home, the unconverted signal path for additional sets, and the reverse signal path for future two-way operation. All paths are controlled by the off-premises unit (Figure 1). A description of our system follows.

A Component Overview

The system consists of four components. These are the SCAT-TAP, the SCAT-CAN Series 10, the Power Pack, and the Keypod. The SCAT-TAP is a tap unit — a mounting fixture for four SCAT-CANs — and provides some signal security. The SCAT-CAN Series 10 is the addressable off-premises unit that contains the converter and controls all signal paths into and out of the home. The Power Pack provides AC power to the SCAT-CAN and DC power to the Keypod; it also passes the low-frequency control signal from the Keypod onto the coax and up the drop to the SCAT-CAN. The Keypod is a requesting device that the customer uses to select a channel. The SCAT-TAP and SCAT-CAN are on the pole; the Power Pack and Keypod are in the home.

The Converted Signal Path

The converted signal path operation begins as the customer selects a channel on the Keypod. The Keypod then transmits the channel request to the SCAT-CAN using a 40 kHz carrier with on/off keying (OOK) modulation. A microcomputer in the SCAT-CAN receives the carrier and digitally demodulates it (Figure 2 — line type 6). The microcomputer looks in the customer authorization table in nonvolatile RAM to see if the customer may watch the requested channel. Assuming that the customer is cleared, the microcomputer looks in a ROM table to locate the required frequency and cable for this channel. The microcomputer then tunes the converter using a digital phase-locked loop control circuit and selects the appropriate cable (Figure 3 — line type 7). As with set-top converters, the converted signal must be viewed by tuning the set to Channel 3 (Figure 2 — line type 5). If the customer is not permitted to watch the requested channel, a promotional channel will be tuned. The authorization table is sent by the control computer via an RF data carrier with frequency-shift-keying (FSK) modulation (Figure 2 — line type 4). The data signal is always on cable A.

This operation is similar to the original simple off-premises converter.

The Unconverted Signal Path

Cable A carries the unconverted signal. It is filtered to pass only the non-premium signals (50 - 216 MHz), and is amplified to match the signal level out of the converter. This unconverted signal is controllable via the microcomputer. The microcomputer either allows this service to pass into the home or terminates this path by selecting the position of an RF switch. Unconverted and converted paths are then combined and sent down the drop into the home (Figure 2 — line type 3). Since these paths have overlapping frequency ranges, the unconverted path cannot have a signal at Channel 3. An adequate filter to remove Channel 3 from the unconverted signal path would be very expensive; therefore no signal can be carried on cable A at the Channel 3 frequency. A 20 dB Channel 3 band-stop filter in the unconverted path is added to reduce noise that might degrade the converted signal.

The unconverted signal path solves the additional set problem inherent in a simple off-premises converter. This signal path allows customers to choose different shows on different sets and carries the FM

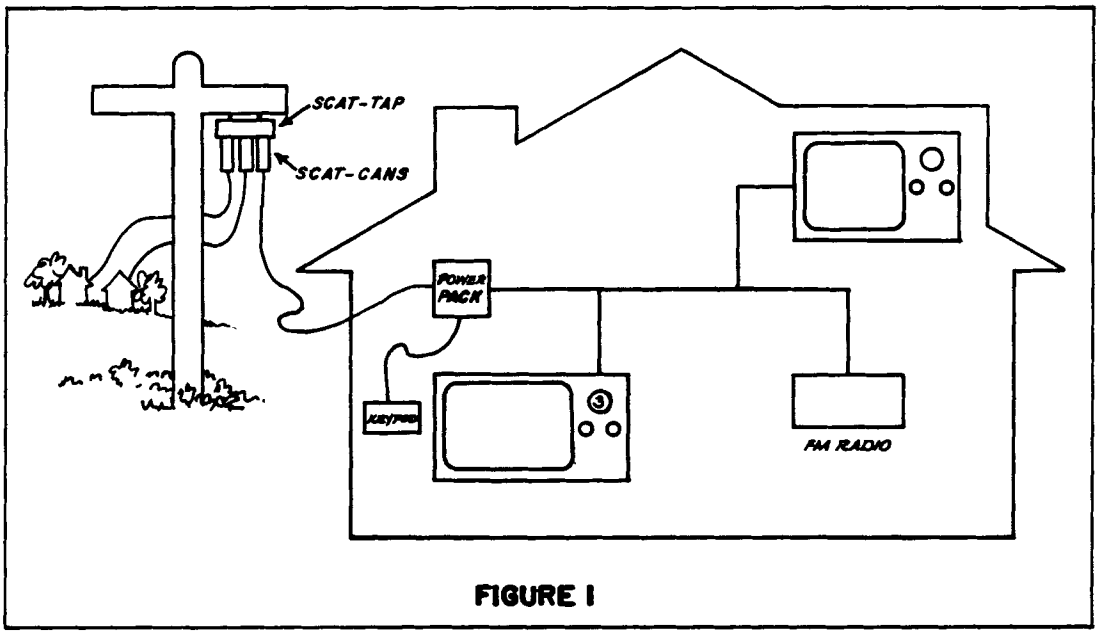

FIGURE 1

radio band. Customers may watch any of the 11 channels of unconverted signal on a normal TV set or may use a block converter or a cable-ready TV to pick from 20 channels. Unconverted signals are either on or off; there is no individual channel control. The customer may watch a converted signal (premium service) by tuning his or her TV to Channel 3 and using the Keypod to select the channel. All sets in the house may be used to view this converted signal; all sets receive the same signals. Only one converted signal may be viewed at a time.

The Reverse Signal Path

The reverse signal path comes from the house into the SCAT-CAN. This signal is separated from the forward path by a diplex filter, controlled by an RF switch, and recombined onto the cable A input using another diplex filter (Figure 2 — line type 1). The microcomputer controls the RF switch, but does not "talk" in the reverse direction (back to the controller). By controlling the reverse signal path, the system operator can turn off the reverse path where it is not needed. This helps stop ingress. The reverse signal path along with the unconverted forward path permits future two-way communications with the home, without replacing or upgrading the off-premises unit.

CONCLUSION

An off-premises addressable unit can be configured to overcome the basic conceptual problems inherent in a simple off-premises converter. An ad-

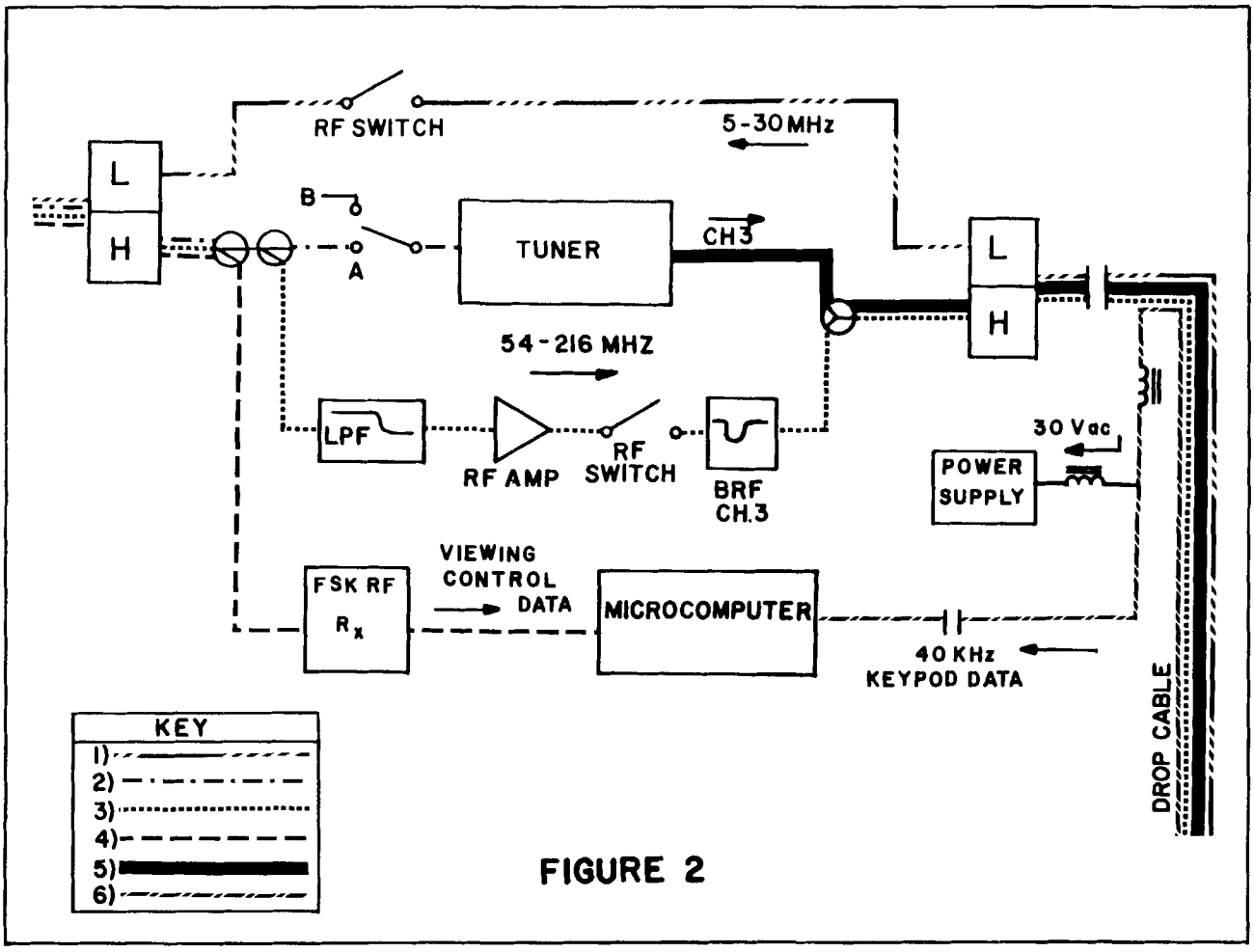

FIGURE 2

ditional path allows FM and unconverted service delivery to additional TV sets. The use of a controlled return path allows delivery of two-way service and isolates drops of non-two-way customers. The only disadvantage of this configuration is that Channel 3 may not be carried on cable A. We believe off-premises addressable converter systems presently offer the best solution to many CATV problems.

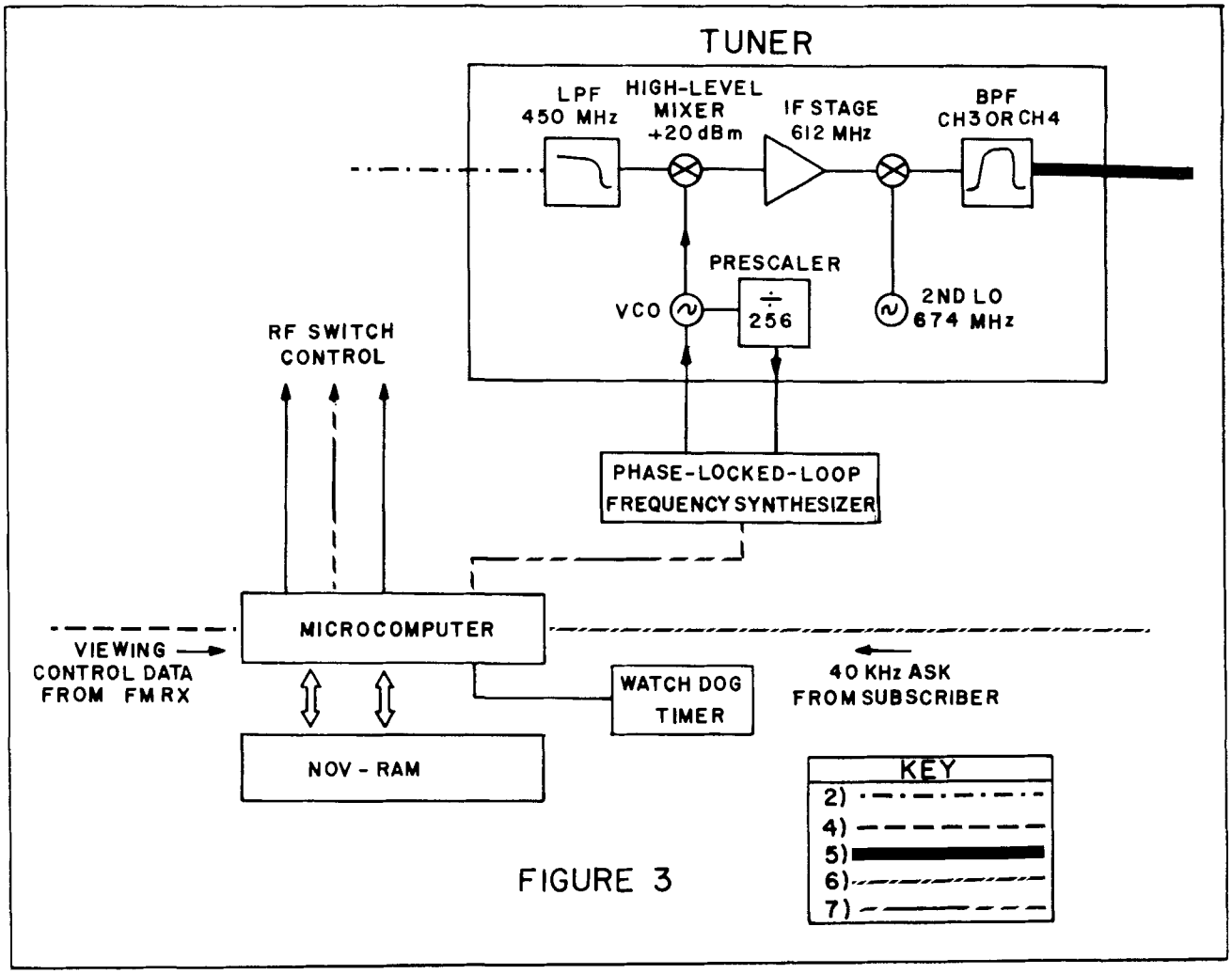

FIGURE 3