ADDRESSABLE CONVERTERS: WHY TAKE THEM OUT OF THE HOUSE?

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The design criteria for off-premises converters have been increased signal security and lower in-home costs. Products currently available in this market are clear channel systems selling at a premium price.

This paper questions the security of a clear channel system versus currently available scrambling techniques. It also presents an economic review of savings achieved by reducing in-home costs versus the premium price of off-premises converters. Finally, the ramifications of dedicated plant designs required by off-premises converter are discussed.

These issues must be addressed before making the decision to remove the subscriber's converter from the home and place it on the line.

Currently, six million subscribers have addressable terminals in their homes. These units convert and descramble the broadband spectrum for input to the subscriber's television set. Scrambling methods have evolved to a level of sophistication effective in preventing most theft of service. By scrambling the premium spectrum, security of signal is assured not only in the home, but also on the cable plant.

Addressable set-top units initially offered static modes of sync suppression. The industry offered either 6 dB square or sinc wave attenuation of the sync pulse of a channel. The latest offerings in RF converters provide either pseudo-random timing of sync suppression or variable levels of sync suppression with pseudo-random level change timing. These methods require the addition of encrypted data for descrambling the video signal. But the audio portion of the signal is not left alone. Attenuation of the audio and scrambled video is included in current RF converters for additional security. Baseband descramblers add video inversion and audio scrambling to the sophisticated RF scrambling techniques.

These scrambling methods were not only developed to prevent a subscriber from obtaining free service from his legal drop, but to impede the occurrence of illegal drops and taps.

Off-premises converters receive a clear channel via the cable system, convert that channel, if authorized, to a set 6MHz channel and pass it down the drop to the subscriber's home. Attenuation or off-channel tuning are utilized to prevent unauthorized premium channels from being carried on the drop. This method protects services delivered via the drop, but does not consider protection of the signal on the cable system and neighboring drops.

In addition, since the basic output of an off-premises converter is a single channel, limitations are placed on additional sets in the home. Most off-premises converter manufacturers offer a second non-adjacent channel output for second sets (2,4 or 3,5 are most popular channel allocations for dual sets). This requires either a second converter module or a single module containing dual converters. Also required is a second data path for independent communications. Currently, the second set market ranges between 10% and 50% with an average of 20%. The advent of the VCR marketplace will increase second and third set penetration levels.

An independent third set can't be supported on one drop with an off-premises converter. This requires a

third, non-adjacent channel allocation and a third data frequency pair to support a third set on one drop. The third channel allocation would have to be in the high band. Also, some markets don't have three unused frequencies in the VHF range. Therefore, a third set requires an additional port in the off-premises converter backplane, which entails additional costs per subscriber, while making plant design more difficult. A second drop must be pulled to provide a third set.

Since a broadband spectrum is available on the drop, second and third sets are easily offered in an addressable set-top system. Individual authorizations can be stored for each terminal, allowing the subscriber to add additional televisions with unique premium packaging.

Off-premises converters do offer an inexpensive in-home unit that provides all subscriber features currently available with addressable on-premises converters. If theft of equipment is a substantial issue, this reduced investment in the home can provide a savings to the operator. But off-premises converters are premium priced when compared with set-top units. So it is necessary to define a break even point. At what level of equipment theft does off-premises technology really pay?

The chart in Figure 1 sets forth capital outlay required to start up an addressable converter system and to replace stolen equipment on an annual basis. The analysis assumes a $30 price for in-home unit for off-premises converters. The theft rate reflects a system-wide average. The data indicates that an investment in off-premises converters can't be justified in the first year, even under the most severe theft conditions, that is, 20% or one in five boxes stolen per year. Even over a five-year period only lower priced off-premises converters can be justified in a system with a 10% average theft rate. This translates into theft of 5,000 converters in a 10,000 converter

(Figure 1)

CAPITAL INVESTMENTS
FOR 10,000 SUBSCRIBER SYSTEM

	ANNUAL EQUIPMENT THEFT RATE			
	2 %	5 %	10 %	20 %
ON-PREMISES $100/Unit				
Initial Investment	$ 1000K	$ 1000K	$ 1000K	$ 1000K
Replacement Costs/yr.	20K	50K	100K	200K
Total Capital - 1 yr.	1020K	1050K	1100K	1200K
Total Capital - 5 yrs.	1120K	1250K	1500K	2000K
OFF-PREMISES $130/Unit				
Initial Investment	$ 1300K	$ 1300K	$ 1300K	$ 1300K
Replacement Costs/yr.	6K	15K	30K	60K
Total Capital - 1 yr.	1306K	1315K	1330K	1360K
Total Capital - 5 yrs.	1330K	1375K	1450K	1600K
OFF-PREMISES $150/Unit				
Initial Investment	$ 1500K	$ 1500K	$ 1500K	$ 1500K
Replacement Cost/yr.	6K	15K	30K	60K
Total Capital - 1 yr.	1506K	1515K	1530K	1560K
Total Capital - 5 yrs.	1530K	1575K	1650K	1800K

system over the course of five years. While pockets of high theft do exist in some systems, especially in apartment complexes, an overall rate of 10% in a system is rare.

Off-premises converters also require additional plant investment. Since dedicated ports are required for each home passed, some additional cost is required to hook-up the first subscriber in an eight subscriber housing. With the industry's basic penetration rate standing at approximately 50% of homes passed, an additional initial investment is required to allow room for expansion. Currently, the cost of the housing and backplane will be spread over only 50% of available ports, thus increasing this initial investment.

Intricate planning is involved in system design of an off-premises converter system. Not only must an operator plan for future penetration levels and new construction, he must also dedicate his plant to the architecture required by the technology. Once deciding to build the cable plant to support off-premises converters, there is no turning back to a conventional build.

Housings for off-premises converters are larger and are spaced differently than standard taps. While the typical housing replaces an eight-way tap, it's not economical to replace two and four-way taps with an eight port housing. Because of this new spacing of eight port housings, longer drops are required to reach locations normally served by two and four-way taps.

Because of the size of these eight-way housings, splicing is required in order to return to a standard eight-way tap. The smallest off-premises housing is 15 inches in length, and the largest standard tap is six inches, obviously leaving a cable gap of nine inches. Returning to standard system architecture, therefore, would necessarily impact the signal quality.

It is also necessary to take powering of the off-premises unit into consideration. If the converters or common electronics are backpowered from the subscriber's home drop cable, loop resistance and UL specifications must be considered in the design phase. To achieve some longer drop lengths, cable loop resistance must be decreased to meet the UL specification of 21.2 VDC maximum for outdoor environments. As the IR loss specification for drop cable decreases, its price increases.

If the cost of drop cable or local fire and electrical codes prohibit carrying power over the drop, then a local power source is required. Either a dedicated power supply or 60V square wave available on the cable plant can be utilized as a power source. This also means the cable operator assumes the expense of powering the converters, a cost not traditionally incurred with on-premises converters.

Conclusion

Current addressable terminal systems achieve signal security through scrambling. This method not only protects against illegal or unauthorized reception of premium services over a legal drop, but also illegal taps and drops. Off-premises converter systems prevent only the free use of premium service over the drop.

While off-premises converters do provide a significantly reduced investment in the home, the premium price of off-premises is only justifiable where there is an inordinately high amount of equipment theft throughout the system.

Finally, making the decision to go the off-premises route must be a final one, since a dedicated plant architecture is required to support this technology. It is possible to upgrade existing set-top addressable systems without making changes to the plant design.

There's an important question cable system operators should ask in all of this: Why move the converter out of the house?

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