THE CASE AGAINST OFF-PREMISES CONVERTERS

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ABSTRACT

Off-Premises converters are being developed to solve problems that are better solved by subscriber ownership of cable television terminal equipment. Cable systems should move toward less equipment, located in the harsh external environment, being owned by the cable system, rather than more. The principal barrier to subscriber ownership is the lack of low cost "fool-proof" video/audio coding technology. This technology is in prospect and should be encouraged as a necessary basis for subscriber ownership of terminal equipment. Subscribers will benefit from a competitive market in terminal equipment, as in telephone equipment.

PERCEIVED PROBLEMS

The present interest in off-premises converters appears to have arisen from several concerns of cable system operators:-

- o The high cost of Pay-TV control - particularly the high cost of secure descramblers.
- o The high risk of "security compromise", i.e. the risk that theft of service will become rampant.
- o The high cost of home terminal "asset control", i.e. the risk that subscriber terminal equipment (converter/descramblers) will not be recovered from subscribers' homes.
- o The high cost of home subscriber terminal maintenance.

Cable system operators see off-premises converters as a cost effective solution to these problems:-

- o Off-premises converters do not need descramblers since unauthorized services do not enter the home. This saves the cost of descramblers.
- o High-value services are contained within the trunks and do not enter subscribers' homes where they might be subject to "theft".
- o Only a low-cost, low value, remote control unit is placed in subscribers' homes.
- o Most terminal equipment is outside subscribers' homes where maintenance is presumed to be easier and cheaper.

I recognize and acknowledge the problems but I disagree with the off-premises converter as a desirable solution to the problems. I am opposed to "off-premises" systems of this kind for several reasons:-

- o They place complex equipment in a hostile outside environment with consequent design and operating problems.
- o They are inevitably more costly than the present subscriber terminal equipment.
- o Their placement outside the home creates new maintenance access problems. The problem of maintaining additional equipment outside the home in hard to get to kiosks and/or pole mounted housings should not be underestimated. There is also a problem in providing power for these outside devices.
- o The required outside housings are bulky and create an aesthetic problem.
- o There is a serious problem with multiset households. The systems being demonstrated require a separate drop line for each TV set in the home. There will no doubt be multiplexing of multiple outside converters and remote control links onto a single drop cable, but the requirement for multiple outside terminal equipment for multi-set households aggravates the previously cited problems.
- o These systems do nothing to solve the problem of the costly functional redundancy inherent in duplicating the tuning function in both the cable system and the subscriber's TV receiver.

It is my view, however, that all of these problems would be solved by subscriber ownership of terminal equipment. The issue is the "dividing line" between the distribution system and the subscriber. Many engineers believe that investment in terminal equipment should be increased and that the "terminal" function should be more extensively integrated with the distribution system. They want to bring the program selection function out of the home and integrate it with the distribution system. I want to rid myself completely of "terminal" functions and make the subscriber responsible for the provision, maintenance and operation of terminal equipment. I don't want to buy, own, maintain and keep track of subscriber terminal equipment. I believe that the public would be best served by technology which allows individual subscriber ownership of this terminal equipment. The cable

systems business is be best served by technology which allows us to conserve these capital and operating resources and use them for additional distribution plant and subscriber services.

THE SHIFTING "DIVIDING LINE"

We are seeing at this time a "tug-of-war" between receiver manufacturers and cable systems as to where the dividing line of equipment ownership would be. Receiver manufacturers would like maximum ownership by subscribers, thus maximizing their own participation in the business of supplying this equipment. Cable system operators want the technical flexibility and the increased profit potential of supplying as much of the subscriber terminal equipment as possible. For this, and the other reasons I have cited, there is a growing interest among cable system operators in moving the subscriber terminal equipment outside the home so as to maintain better control of it.

There obviously has to be a change of interface. I don't think that anyone in the cable industry is willing yet to completely standardize the channeling of cable systems. The matter of cable tuning can best be handled by moving the interface from the subscriber tuner input to the demodulator output. Cable subscribers are now able to buy video/audio "monitors". Video/audio interfaces can be readily standardized. The standard input to the subscriber owned equipment should now be baseband composite video (with baseband audio) with RGB optional. Appropriate tuner/ demodulators could be supplied by the cable system or could be purchased by the subscriber. Manufacturers could decide whether and which tuners they wish to make and sell. "Off-air" tuners could be offered, as well as tuners for the more popular cable channeling ranges and plans. Tuners might optionally offer RGB outputs as well as standard composite video baseband. New TV broadcast services with stereo audio would require new demodulators with baseband stereo audio output. Further extensions of cable system operating bandwidth would obsolete earlier tuners, but it would be cheaper for a subscriber to replace his tuner with a newer model than to replace the whole TV set just because of an inadequacy in tuning range. These tuners could alternatively be provided by the cable system who could themselves purchase these units from various receiver manufacturers or from specialized manufacturers. Manufacturers of video devices such as VCR's, video disc systems, video games, home computers, etc. would also benefit since they could then feed the user's video/audio monitor directly, without an RF interface.

"Component" TV sets with separate "tuners" and "monitors" are now available from several manufacturers.

THE PAY-TV CONTROL PROBLEM

Subscriber ownership of terminal equipment requires a major improvement in video and audio security. We must develop a standardized coding and addressing system for controlling premium TV services. This would allow all the tuning and premium control functions to be owned by the subscriber as part the subscriber's own television receiver, while full control over premium services is retained by the cable system.

Let us distinguish between "scrambling" and "coding" of television signals. "Scrambling" merely modifies the signals so they cannot be received and/or displayed on a conventional TV receiver. Sync' suppression is a common form of scrambling. Video polarity inversion, FM transmission and "jamming signals" are other forms of scrambling. Knowledge of the technique allows "descrambling". You can build a descrambler that will work if you know the scrambling technique. Some systems use very sophisticated scrambling techniques that required more sophisticated descramblers, reducing considerably the risk that average individuals will reproduce or otherwise acquire the required descrambler. There is still very little protection from determined efforts to breach such a security system on a large scale. Another deficiency of such systems is the fact that mere possession of a descrambler often defeats the system. Some systems can address such "lost" descramblers "OFF", receiving some degree of protection, but there are still significant economic problems associated with the loss of descrambling equipment and the theft of services.

"Coding" modifies the signal in such a way that decoding needs both knowledge of the technique and the particular code or cypher that has been used to encode the signal. The technique is analogous to the encryption of high security message traffic. The coding techniques are usually digital but they do not always require digitizing the signal. Coding techniques appeal because they would allow the subscriber to own the decoding equipment. Nationally standardized decoders could be built into new TV sets. We can then sell the subscriber the decoding equipment because it won't work until we sell him the code required to make the box work right. The code would be unique to a particular program service and a particular subscriber decoder. We can change the code every day, every week, every month or for every program. The code supplied to the subscriber to operate the box won't work in his neighbor's box for the same program, nor will knowledge of the codes supplied to a large number of subscribers provide a decoding "key".

A national standard is probably an unrealistic expectation. Interim company-wide or regional standards can be implemented by the "component" approach. Suitable tuner/demodulator/decoder "components" can be made available for whatever channeling and coding standard a particular cable system chooses to use. Video/Audio monitor componenets would continue to have a high degree of national standardization, although cable systems might choose to introduce improved color coding technology. In this case the tuner/demodulator/decoder module would have RGB outputs for monitors having this capability and would include color re-encoding to standard NTSC for those that don't.

"Addressing" has been shown to be a very useful adjunct in subscriber terminal equipment. A nationally standardized addressing scheme would also be desirable, but subject to the same practicality problems that I have discussed for video/audio coding.

SOME CODING TECHNIQUES

Several coding systems have been developed and demonstrated. One such system inverts the video polarity of the signal in a pseudo-random line sequence, i.e. the number of scan lines in each polarity group is changed in a pseudo-random way. I was impressed with the effectiveness of coding as an alternative to scrambling, but I was not enthusiastic about alternating video polarity as a means of concealing the signal. I believe that there are problems in matching the "positive" and "negative" video channels in the decoder. The gain of the video polarity inverter must be closely controlled and problems of transmission linearity arise.

I have also seen demonstrations of "line shuffling". I believe that this technique is the most promising and very worthy of consideration as a national standard. Conventional video is read into a digital frame store in regular scan sequence. The lines are read out for transmission in a pseudo-random sequence. A similar store at the decoder reads in the lines as received and then, knowing the code, reads them out of the store in the proper sequence for display. The earliest demonstrations that I saw (by Anderson Labs, a manufacturer of digital frame stores), used a full frame digital store (525 lines of storage). This is obviously a very expensive system since decoding requires a similar store. I believe that a system using as few as eight lines of storage would be adequate. I believe that the prospect for developing low cost consumer versions of such a decoder using either digital or analog storage is very good. "Professional users" could use digital storage for decoding. "Consumer users" could use lower cost CCD's or similar analog video storage devices.

I consider "line shuffling" to be an ideal video encoding technique. The advent of low cost digital video signal processing, now being introduced by some TV receiver manufacturers, will make "line shuffling" a practical video coding technique for consumer level application.

It is now quite practical to handle audio in digitized form, using available encrypting systems. I believe that a suitable digital system can be made to fit within the available aural subcarrier bandwidth without causing impairment of the video transmission. Digital audio transmission will benefit from the current introduction of digital audio disc systems. This makes low cost digital audio "chips" available.

The cable system operating industry must go to "coding" instead of "scrambling". Ideally we would decide on a particular coding system as a national standard so that the decoders can be built into TV sets and so that low cost decoders can be made available to subscribers on a competitive basis. A nationally standardized addressing system is also important. I believe that subscriber terminal equipment is best made and distributed by the consumer electronics industry. Cable subscribers would enjoy a substantial benefit from a competitive market in subscriber terminal equipment. The beneficial experience with subscriber ownership of telephone terminal equipment has shown that a competitive market-place reduces costs to the user, increases variety and utility of equipment, and creates a wider opportunity for manufacturing and distribution entrepreneurship.