CABLE INTERFACE AND DECODER INTERFACE WORKING GROUP PROGRESS REPORT

Walter S. Ciciora

AMERICAN TELEVSION & COMMUNICATIONS CORPORATION

INTRODUCTION

Standards committee progress is often painfully slow. To a newcomer, especially someone accustomed to the "fast lane," this activity can be quite frustrating. There are several points to be made about this. Firstly, if cable interface and decoder interface standards were easy to achieve, they'd have been agreed to a long time ago. Secondly, the issues being settled are delicate points involving trade-offs which impact the economics and performance of two industries. These two industries have a history short on cooperation and long on animosity. Fortunately, the trend toward cooperation is on the up swing.

At first blush, it would seem difficult to find two industries with more reason to cooperate than the Cable Television Industry and the Consumer Electronics Industry. Better pictures should enhance satisfaction in cable service and better choice should increase the desire for quality images. I believe that most of the difficulties are due to a lack of information and misunderstanding. Open, honest, and frank contacts should be helpful to all. That is the purpose of this discussion.

STRUCTURE

In 1982, the NCTA and the Electronic Industries Association, EIA, formed a Joint Engineering Committee to discuss technical issues which impact both industries. The first order of business of that committee was to create a channelization standard for frequency assignment. After considerable debate, the committee recommended the plan which became an EIA Interim Standard for one year. It has recently emerged from this probationary phase to become an official recommended standard.

It is important to note that these standards are voluntary standards. Neither the NCTA nor the EIA have enforcement powers. Adherence to the standard depends on the good faith of the companies involved.

After the channelization standard, two Working Groups were formed to consider a cable interface standard and a decoder interface standard. Shortly after formation of the Decoder Interface Working Group, it was discovered that the EIA R-4 Group had its own decoder interface group. Seeing little point in duplication of effort, the Joint Committee Working Group disbanded.

ATTITUDES

An important reason for the successes of the Joint Committee has been a change of attitude on the part of the participants. In the past, cable/consumer electronics relations were marked with finger pointing and name calling. Very important technical trade-offs were the focus of arguments which had significant economic impact. Now a realization has been achieved of the importance of customer satisfaction. The customer/subscriber must be satisfied if the two industries are to prosper. It is pointless to try to shift blame. The customer/subscriber demands satisfaction from both industries.

A significant step in the right direction has been the relaxation of what has been called the 70dB syndrome. In the past, the cable industry has tended to demand that any potentially harmful phenomenon be suppressed by 70dB. The consumer electronics industry has become offended by this approach since this degree of suppression is difficult to measure for most parameters and impossible to achieve in practice. The result has been near zero progress.

The 70dB syndrome has been replaced with a much more reasoned discussion of actual problems. A phased approach has been recommended which sets achievable targets, timed to cover frequencies ranges as they are implemented in the cable practice over time.

The defensive guards are down and technical people are listening to one another in open dialog. People are trying to understand each others problems and accommodate.

Occasionally, a new member joins the committee and makes moves in the old ways. The committee brings the newcomer in line and progress resumes.

THE CABLE READY TV

A subject of intense discussion in the cable industry today is the "cable ready" or "cable compatible" television set. Much of this debate applies to other consumer products such as VCR's. But first a couple of comments. It is a fact of life that nothing is every really ready. If, by chance, it comes close to being ready, something will change to make it less ready. A second fact of life is that "compatible" is a rubber word which is stretched to meet the needs of the moment. In the strict sense, compatible means

that two things, like a TV set and a cable system, work perfectly together without any loss of functionality of either. In the loose sense, compatible means that they both run on electricity. "Compatible" is used in the loose sense more often than in the strict sense.

Cable ready TV is a receiver with a premium tuner, the correct 75 ohm connector and, usually, remote control. The customer's benefits in selecting such a model include convenience features and substantially increased reliability due to the electronic (versus mechanical) tuner. Under certain circumstances, the customer may also enjoy the ability to connect directly to cable.

Let's investigate the requirements for full cable compatibility. There are only two: 1) The channels the subscriber is interested in receiving must be available without the need of having a tuner ahead of the television receiver. 2) TV signals must not be directly picked up off-air by the television's internal circuits. This potential problem is called DPU for direct pick-up. The first requirement can be satisfied in several ways: a) The cable system uses traps for signal security. b) The subscriber is not interested in the channels which are scrambled and is satisfied with those which are in the clear. However, the trend will be towards more scrambling for purposes of tiering. c) A decoder and a television receiver which interfaces to the decoder are used. At the present time, the only example of this are recent Zenith receivers and a version of the Zenith cable descrambler. The second requirement is satisfied if: a) The subscriber is fortunate to not live near broadcast antennas, or b) The receiver's internal shielding is adequate to protect against DPU.

When the above requirements are not satisfied, a cable operator supplied converter must be placed ahead of the TV receiver. It should be emphasized that this represents a capital investment and the placing of property at risk of loss. The cable operator would much prefer to avoid these negatives. The cable business is a service business selling programming. The cable operator is better off using his limited capital to build more miles of plant so he can hook-up more subscribers, than in putting that capital in the homes of existing subscribers. The investment and maintenance of hardware, particularly in-home hardware, is a necessary evil.

Several problems arise when a cable ready receiver is connected to a set top converter. The most severe is that the channel changing feature of the receiver's remote control is lost. Most set top converters include a switched convenience power receptacle. Unfortunately, nearly all modern remote control receivers behave in an incompatible manner when plugged into these switched power outlets. When power is removed from the line cord of these modern receivers, they go off but will not come back on when power is applied. Thus, the subscriber must separately turn the receiver on.

Additionally, the receivers usually revert to channel 2 and forget their previous volume setting. Since the output of most set top units is on channel 3, 4, or occasionally 5, the subscriber must retune the set.

The cable operator's objection to the sale of cable ready TV is the frustration his subscriber feels when the promise of cable ready is not realized. Often the subscriber feels that the cable operator should somehow share in the responsibility for this disappointment. In the extreme, the subscription is cancelled. This is a life and death matter for the cable operator, and he has no logical choice but to do all he can to overcome these problems.

In those cable systems where cable ready TV receivers function satisfactorily, multiple TV receivers can be connected without the need for cable converters. There are several potential hazards centered around unauthorized connection of these receivers. The most obvious potential problem is splitting the signal too many times, resulting in snowy pictures. Both the cable company and the TV dealer will likely receive complaints. But this is not the only problem. There is a more serious reason for controlling multi-set hook-ups. When the do-it-yourselfer makes these hook-ups, cable signal quality usually suffers. Often he will use TV twin wire or even lamp cord. Even when the proper cable is used, the connections are usually not tight. Signals are picked up and injected into the cable affecting the reception of other cable subscribers. A more severe consequence is that these improper connections will radiate signals which may interfere with other services. Of particular concern is radiation in aircraft navigation and communication frequencies. The cable operator has a responsibility to control illegal connections which violate Federal Communication Commission rules.

THE CABLE INTERFACE WORKING GROUP

The Cable Interface Working Group's major concern is the Cable Compatible Consumer Product, such as the Cable Ready TV. The committee very quickly got over the issues of converter type, impedance, and signal levels. A more serious problem has been DPU.

The committee has taken voluntarily committed receivers and measured them in a T.E.M. (Transverse ElectraMagnetic) cell. The tests were funded by the EIA, and each manufacturer received data on his products. However, a non-identified table of data was supplied for committee use. Sets ranged in performance from satisfactory behavior in fields of a couple of volts per meter, to sets with considerably lower levels of tolerance. Manufacturers have been carefully considering the art of radiation immunity as it applies to their products. Progress has been made.

A next step is the measurement of cable converter product in T.E.M. cells. The goals will be to understand techniques for implementing converter's seemingly better performance.

Measurement procedures and acceptable parameters are currently under investigation.

A reoccurring problem is the separation of performance standards from interference standards. It is felt that the regulation of performance is best left to the market place. However, the control of interference is a standards matter. Three kinds of interference have been considered in order of increasing severity: 1) Interference with the product's own performance 2) Interference with other products in the same home 3) Interference with other subscribers' reception.

THE LONG TERM FUTURE

The logical conclusion for the trends in CATV home terminals is for subscriber ownership. This is the best outcome for nearly all concerned. The subscriber has his favorite hardware relationship, ownership. Unlike his European cousin, the US TV receiver user has always preferred ownership to rental. The same should apply to the decoder hardware. This will especially be the case if he can own the tuner, remote control, and other convenience features as part of the bargain. These later goals are achieved by having the descrambler come after the TV receiver's tuner. There are two ways of accomplishing this. One way has a "decoder interface plug" on the back of the TV receiver (or VCR, etc.) into which the subscriber owned (or leased) descrambler fits. The second method is to build the decoder directly into the receiver by the receiver manufacturer. The latter will happen if there is a de facto or actual decoder standard which would permit free movement from cable system to cable system. If this is not achieved for what ever reason, then plug-in, re-sell, or swap devices will be required.

The principal entity which is disturbed by this approach is the manufacturer of home terminals who doesn't also make TV receivers. He sees more than half of his "value added" eliminated. But from the bigger picture, the waste and inefficiency of having a tuner, remote control circuits, and related components in the home terminal, only to have them duplicated in the TV receiver, is undesirable.

From the cable operators' point of view, the program protection method must insure that subscribers cannot defeat the system and receive the programming for free. Another interested party in all this is the programming producers. If they believe their product can be stolen, they will not make it available to the cable operator. The cable operator realizes that the would-be pirate has nearly unlimited time and resources at his disposal. Engineers will use their employers equipment and facilities to try to meet the intellectual challenge. Some would try to convert this mental exercise into a financial advantage. The system which meets this test will be robust indeed. It can be predicted that the US National Bureau of Standards Data Encyrption Standard, DES, will be required to yield adequate confidence. Once this assurance is obtained, the cable operator will gladly give up the capital requirements caused by the need to supply the descramblers. The money would be better invested in more programming, service-enhancing facilities, or home terminals that provide new services to subscribers.

THE DECODER INTERFACE WORKING GROUP

The Decoder Interface Working Group is not a Joint Committee effort, rather it is entirely an EIA activity. In spite of this, there has been significant friendly dialog between the two industries. Specifically, there have been cable industry contributions to the design and testing of the interface plug.

The Interface Plug is also called the Cenelec 20 pin plug. Even with twenty pins, the committee wished it had more! Red, Green, and Blue, RGB, as well as composite video in and out are provided. A data line pair to communicate logical instructions such as EIA Homebus signals, has been provided. At some day in the future, it will be possible to connect consumer electronics products to a master home system. Fast blank for text insertion and decoder restored sync input pins are provided. Devices with the interface plug are intended to be "daisy chained." That is, devices may be designed in such a matter as to be connected in series, allowing interaction between devices and an extension of product into an easy to use, consumer friendly system.

The most serious and controversial issue regarding the interface plus is automatic gain control, AGC, design philosophy. AGC has two modes of operation with strongly conflicting demands, acquisition and stable operation. The circuit time constants must be different for these two modes. Additionally, the AGC time constants of the cable converter and television receiver must be significantly different so one is dominated by the other. If the two time constants are close together in value, oscillations may result. The problem is that some receiver manufacturers are using long time constants while others have decided upon short time constants. An important difficulty to appreciate is the fact that in scrambled mode, most systems suppress horizontal sync pulses. For decades, television AGC design philosophy has depended on finding and accurately measuring sync pulse parameters. The two processes are fundamental conflict. Without sync pulses, there is a tendency for the amplifiers to increase gain and saturate. This crushes the signal and insures that sync pulses will never be found. This "lock-out" condition is a disaster which must be avoided. It is most complicated in systems which suppress sync pulses in the vertical interval as well. This phenomenon is extremely non-linear and not well understood. Some engineers insist that there is no theoretical basis for these systems to ever work! They claim that each time the system achieves synchronization and decoding, it is simply a fortunate electrical accident!

One serious complication is the fact that AGC expertise in television receivers is a scarce commodity. There are probably less than twenty experts in the entire world. The subject is very complex with almost no published technical literature. Engineers become experts in this field through years of apprenticeship to an existing expert. A second complication is that competitive performance between manufacturers' products is largely determined by AGC characteristics. To

someone who appreciates this, the committee interactions take on a whole new dimension. There is the careful guarding of secrets, the pained release of just enough information to make the interface plug system work, but the anxiety that too much may have been revealed to a competitor.

The committee has a life cycle of its own. At first there is a small group of attendees trying to make it happen. Slowly the group expands until so many attend that it's difficult to get anything done. After several months, those low on patience cease to attend. Decision-making picks up. Then some dramatic event such as a field trial takes place. Once again, attendance soars. A new danger to progress takes place. New members attend for the first time. They start questioning the fundamental philosophy. Old ground is revisited. The skillful chairman must maintain progress, yet not turn off the new attendees. The new attendees will have their say in the final standards approval process. They must not be alienated. As the committee reaches the end of its work, two forces come to conflict. Those who have put in years of work want to bring it to a close. Others who have been alerted to the committees work by the expected issue of a new standard become alarmed. They see all kinds of threats to their interests and, of course, better ways to do the job, usually using advanced technology which wasn't available when the committee started its work. The committee chairman must manage these forces or total grid lock will result.

Another committee practical difficulty is the fact that the most likely contributors are industry experts and industry decision-makers. By definition, these individuals are very busy and in demand by their company's engineering departments and by other committees. Getting the right people involved is critical to success. Occasionally, a company's management's view of committee work is too parochial. Important contributors are denied permission to attend, or are not supported in this activity.

The Decoder Interface Working Group had a field test in ATC's Mile-High cable system in Denver. Several TV receiver manufacturers and several decoder manufacturers participated with varying results. The level of success exceeded expectations and re-energized the committee. At least one receiver manufacturer's engineers formed a strong alliance with a decoder manufacturer's engineers. Extensive cooperation and mutual sharing of information has resulted in a raising of the potential for success of these two companies. At least one other manufacturer took a very unfriendly, parochial approach which offended the other participants. This manufacturer has gained an unfortunate reputation as a bad citizen in the community. This has caused embarrassment to others at that company who have worked long and hard at trying to establish a record of cooperation and leadership.

The best indication of the success of the field test is the lively interchange that took place afterwards, resulting in significant improvements in the proposed standard. The most interesting improvement at the time of this writing is the proposal of an AGC time constant control pin which would yield control of the time constant to the decoder. A second field test is currently scheduled for mid-June in Denver.

CONCLUSION

Progress is being made on two fronts, the cable interface and the decoder interface. Progress is slow and painful but essential if the customer/subscriber is to be provided with the maximum utility potential of the technology. These are long term solutions. But they will never arrive without heavy investment of energy and time in current committee work.