RF CONVERTERS ARE ALIVE AND WELL!

A Technical Update

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With the advent of multi-level pay services, the incidence of theft of service has begun to rise. The Cable Operator in pursuit of a higher degree of security of his services from theft has turned to baseband scrambling techniques. Does this increased popularity of baseband units mean that RF scrambling techniques are a thing of the past? I believe the answer to this is NO! RF has some basic advantages over baseband and its past weaknesses have been overcome.

One of the key advantages which RF conversion and scrambling tecniques have is that they are less costly. Not only are we further down the learning curve in economic manufacturing RF converters, but they are also inherently less costly as they contain fewer components. The costs of manufacturing are not the only costs which are lower with the RF converter. The costs of training technicians to repair baseband converters, the cost of test equipment, the actual cost of repair and the cost of carrying inventory are all areas where RF has an advantage over baseband. In all areas of cost, it can be shown that RF converters with RF scrambling techniques are inherently less expensive.

The perceived downfall of RF converters has been in the area of signal security. At the time that the present sync suppression scrambling methods were developed, multi-level pay and potential $50 monthly fees to subscribers were not even considered. However, as the popularity of cable TV and a proliferation of pay services has occurred, the motivation to steal these signals has increased significantly.

But in order to understand the strengths or weaknesses of a given signal security system, we must understand the methods by which the services are stolen. There are really three categories of theft of cable services.
They are:

1. Subscriber Tampering - This is where a Subscriber gains access to the inside of the box himself and makes minor modifications to the electronic circuitry.

2. Simple Pirate Boxes - These are boxes purchased by the Subscriber which are already capable of receiving pay signals. Typically they are boxes manufactured by legitimate cable TV equipment manufacturers but which contain minor modifications to the electronic circuitry made by the pirate box manufacturer.

3. Custom Pirate Boxes - These are boxes manufactured from beginning to end by illegitimate equipment manufacturers for the sole purpose of stealing cable TV signals.

These three types of signal theft can be looked at from a different perspective. The weaknesses in the scrambling system can be grouped into three classifications which are:

1. Mechanical Security
2. Electrical Security
3. Scrambling Security

Subscriber Tampering involves weaknesses in both electrical and mechanical security. That is, the Subscriber is capable of getting into the box (Mechanical Security) and is able to make a minor modification to get the pay services (Electrical Security). This type of tampering will not be prevented by even the most complex scrambling technique if the mechanical and electrical security aren't there. The same can be said of the simple pirate boxes which are modified by a pirate box manufacturer. The only type of theft of service which is scrambling dependent is the manufacture of a custom pirate box.

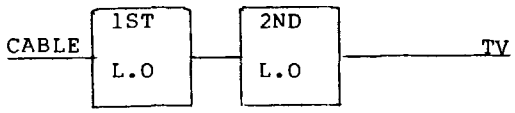
There are presently several methods on the market for preventing access to the box by the Subscriber, but there is only one method which I am aware of which prevents access to the sensitive circuitry by anyone, and that is the potting method used by Jerrold. The potting material is extremely hard and requires a special tool in order to penetrate it. In addition it is impervious to solvents and hence thoroughly protects the electronic circuitry from modification by either the Subscriber or a pirate box manufacturer. Thus we can see that we can solve the problem of mechanical and electrical security with RF converters. The final question we must answer then is can we develop a scrambling method which is secure enough to be very difficult to overcome by a black box manufactured by a pirate box manufacturer.

It is generally acknowledged that a dynamic scrambling system would be most secure. In addition, if the data for properly descrambling that system were encoded, it would become very difficult to defeat the system. A dynamic sync suppression system with encoded descrambling information would be very difficult to beat. The system which we developed at Jerrold for our STARCOM 450 converters meets both of these criteria. We randomly switch between two modes of sync suppression to scramble the picture. The data as to what the next mode will be and when it will occur is encoded. In addition, in our encoder we provide the capability of sending the signal in the clear as a third level of scrambling. Thus we can switch between three modes of sync suppression.

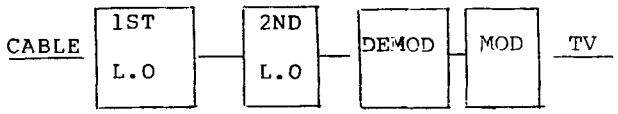
With this type of sync suppression an existing 6 dB descrambler would see a picture only a portion of the time. The rest of the time the picture would look scrambled just as it does on a plain box on the 6 dB scrambling system today. If the box were modified to some other static descrambling level, there would be at best tremendous changes in the brightness of the picture. We believe that the general public would not pay very much for a pirate box of this type and hence no one would supply this type of box. As a result, we believe that an RF scrambling system can be made very secure.

But this is not the whole story. RF has other advantages over baseband which argue for its use. An RF converter with RF scrambling by nature has better performance than a baseband unit, especially a baseband unit with video inversion. As we can see from the block diagram in Figure 1, the baseband converter has inherently more signal processing circuitry. In fact, the RF descrambler is merely a passive device which does not affect linearity. Thus differential phase and differential gain are maintained. In addition, the picture is free of 920 KHz beats formed as a result of the demodulation/modulation process. Because there are no inter-carrier spacing problems no FCC waiver is required as with some baseband converters (the Jerrold STARCOM V does not require this waiver). Because AGC is not required in the RF converter it has better overload characteristics. For a scrambled signal, the switched passive system of the RF converter introduces no additional non linearities and hence is superior. It might be noted also that sync suppression when done on all blanking intervals as done by Jerrold, reduces the total power of the system by about 3 dB. Thus the overall performance capability of RF converter with descrambling is superior to a baseband converter.

FIGURE 1



RF CONVERTER



BASEBAND CONVERTER

Last, but by far not least, is the inherent reliability of the RF converter. With the new digital designs being implemented on RF converters, the reliability has been greatly enhanced. In addition, we are well down the learning curve in the manufacture of the RF converter. As a result, testing processes, component selection, mechanical design and all the other parameters contributing to reliability of the product have been thoroughly engineered. Because of the prevalence of the RF converter, they are much easier to get fixed. There are many more technicians trained in the repair of RF converters and there are many more companies and repair centers that are capable of repairing the RF converters. Finally, because there are fewer parts in an RF converter there are fewer things to go wrong.

The question implied in the title of my paper has been answered. RF converters will continue to be a viable approach to signal delivery for Cable Operators. RF Converters are the most cost effective approach to video tuning and signal descrambling. With the new dynamic sync suppression systems, signal security is much improved and should take us forward through the multi-level pay area of CATV. In spite of the hype on the high technology baseband converters, it can be seen that RF converters have inherently better performance and are more reliable. Therefore, I believe that the RF converter remains the most cost effective approach for the Cable Operator to offer pay services to his Subscriber today.