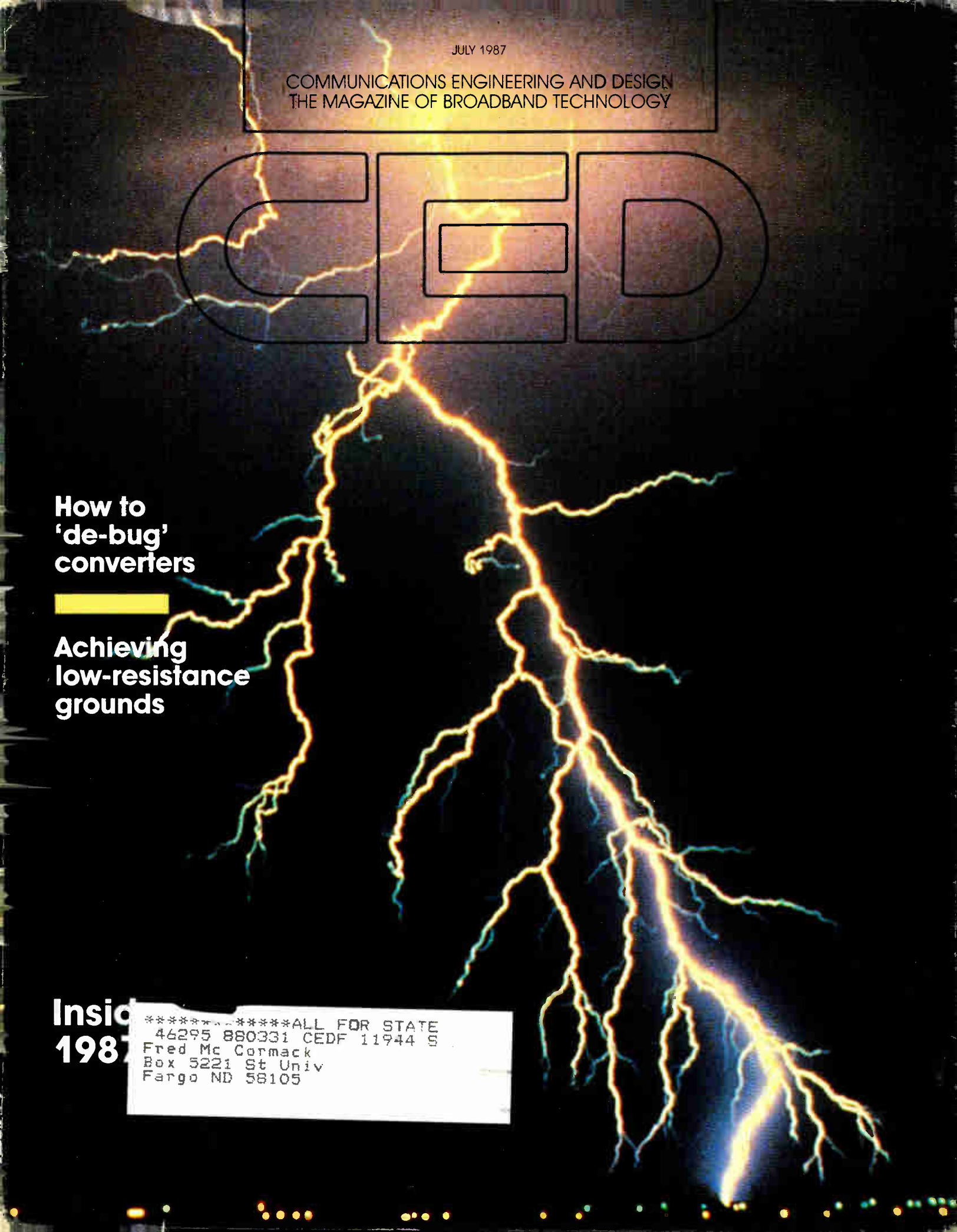
JULY 1987

COMMUNICATIONS ENGINEERING AND DESIGN
THE MAGAZINE OF BROADBAND TECHNOLOGY

CED



How to 'de-bug' converters

Achieving low-resistance grounds

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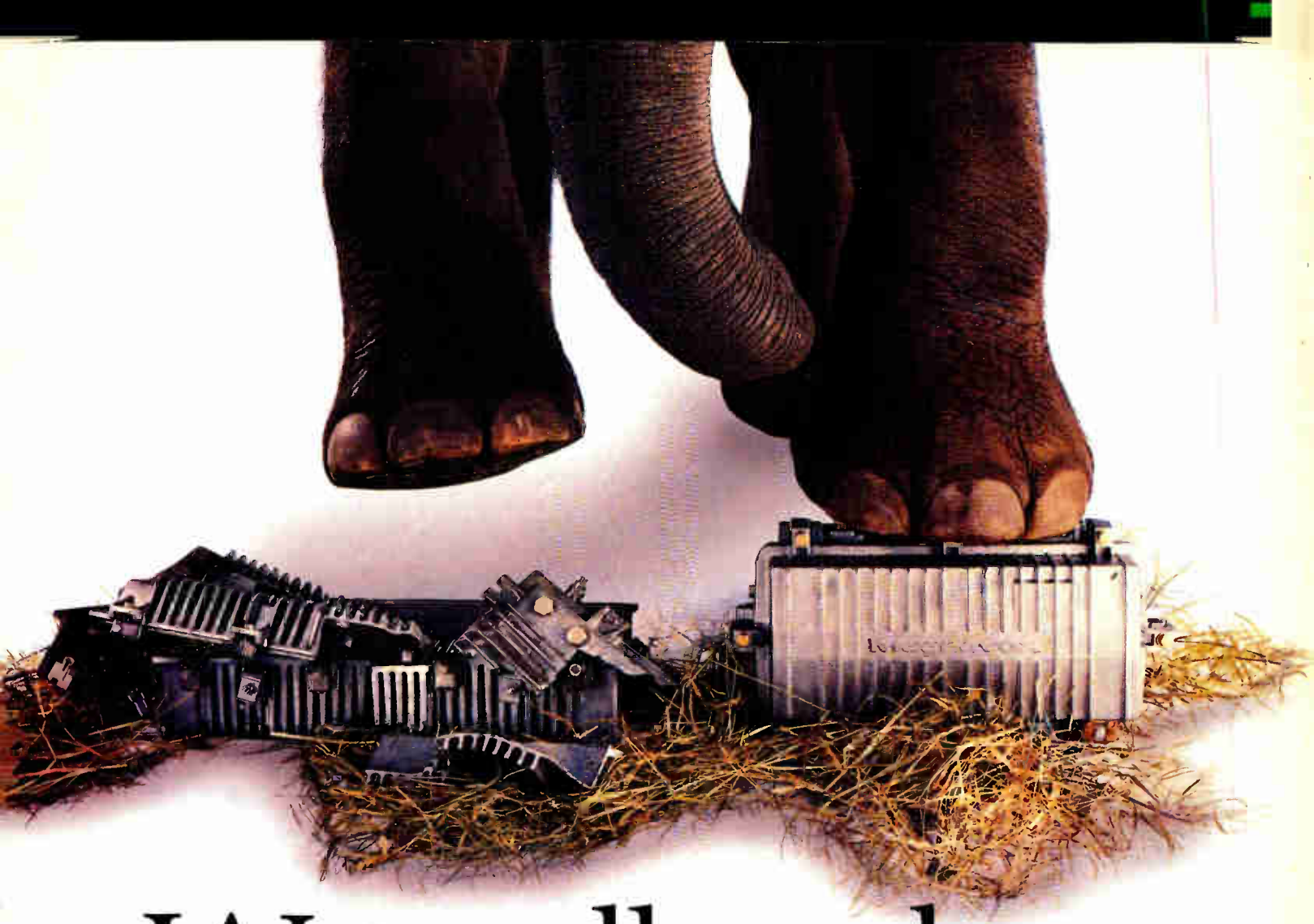

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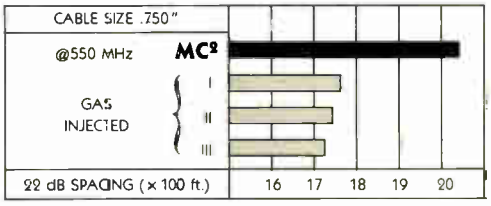

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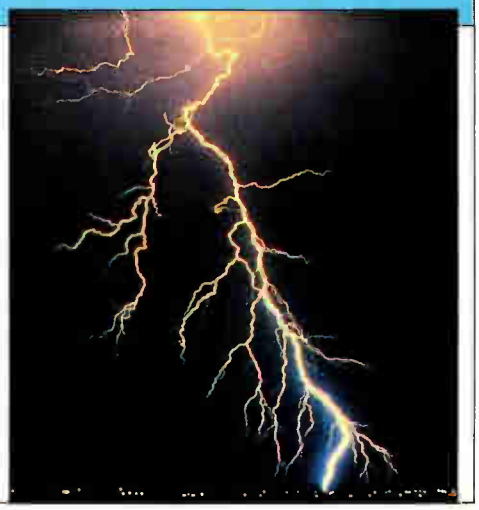
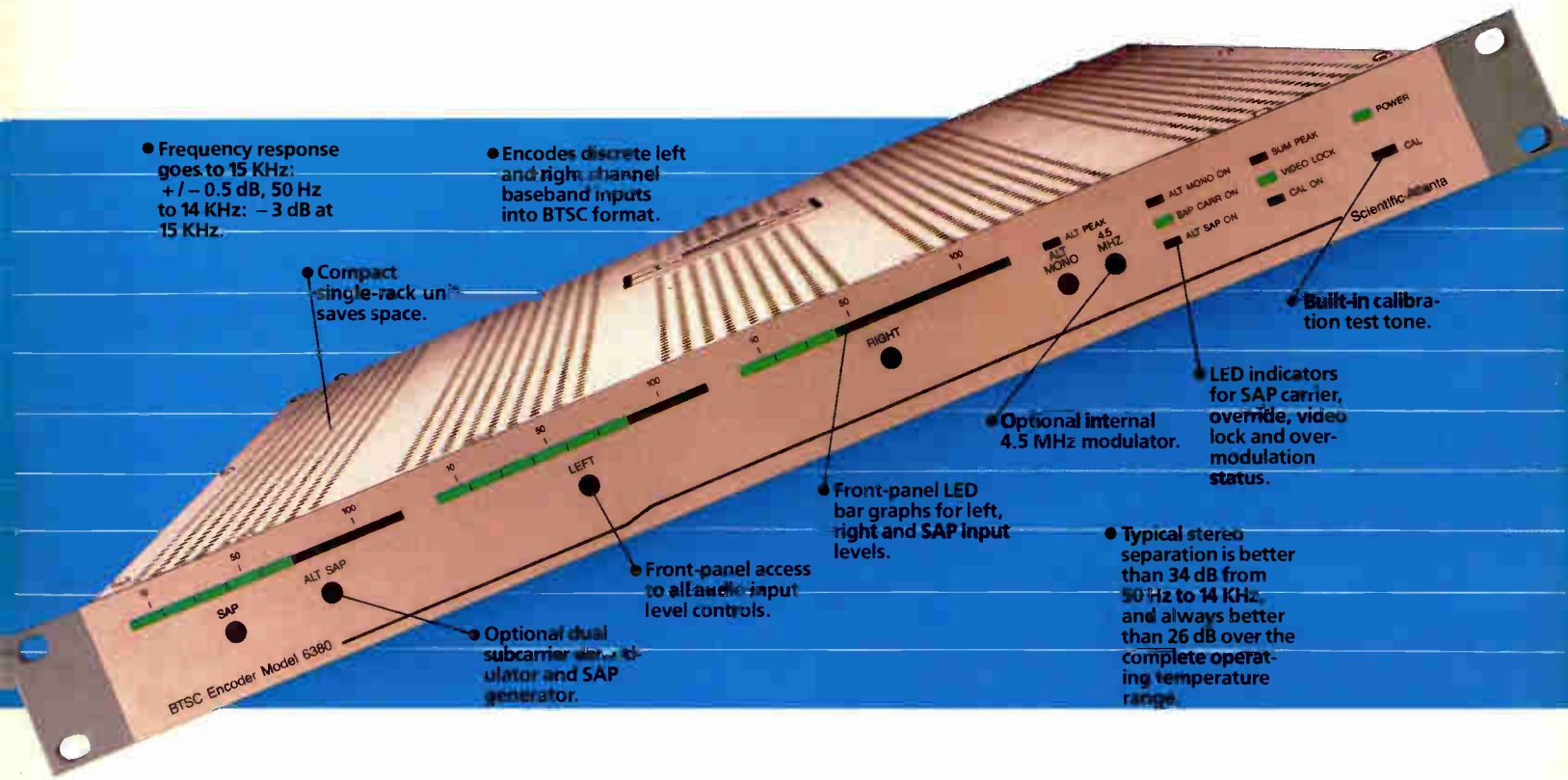
About the cover
With the lightning season upon us, cable operators need to heed warnings of protecting their plants. Cover photo provided by Dr. Rodney Bent, Atlantic Scientific Corp.



THE STEREO ENCODER SO ADVANCED, IT SOUNDS GOOD EVEN IN PRINT.



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Scientific Atlanta

Bob Mathews

Mathews dies with dreams unfulfilled

"I can still remember Bob, with his drill press, files and hammer, putting together machines that would fold, staple and stack the bills we had to send out." That recollection, provided by Gerald Knapp, president of CableData, perhaps sums up Robert Mathews' persona better than any other words: a man so committed to his ideas that he'd do most anything to make them work.

The 49-year-old Mathews died May 18 after a year-long battle with cancer. And although he was somewhat of an enigma and possibly even a paradox, it's clear he was the kind of entrepreneur that kept the cable industry viable and exactly the kind of influence the industry will sorely miss.

Born in Duquesne, Pa., but reared in California, Mathews never stopped working toward his dream. At the age of 15, he was already showing business savvy when he opened an automobile upholstery company. After graduating from high school, he worked at Aerojet General's machine shop in Sacramento to earn money for college. In 1962, he graduated from Heald College in San Francisco with a mechanical engineering degree.

From there it was back to Aerojet for a year before he left to start U.S. Computer Systems, his own computer programming firm. Renting computer time, Mathews wrote programs for service stations, keeping a list of customers and sending reminder maintenance notices and billing. He actively pursued other markets and in 1968 signed on to provide billing services for Lodi Cable, a new cable TV franchise.

It wasn't much later when he met Dave Williams, presently CableData's senior vice president. At that time Williams was managing the computer company where Mathews was renting time. "We'd often meet for breakfast at 3 a.m., which was when the computer was usually available," remembers Williams.

In 1971, Mathews took a significant financial risk and bought his own computer. Although the company was still fledgling, the recently married Williams was convinced of its eventual success and signed on with Mathews. "I trusted Bob and the exuberant feelings he gave off enough to cut my income in half to go to work for him as a swing shift computer operator."

Williams wasn't the only one affected by Mathews' personality. Those who knew him best noticed the pride he took in helping people recognize their potential, even though they weren't sure of their own talents. "He encouraged people to extend their thinking to the very limits," says Knapp. "He always pushed people to explore everything."

By allowing his employees to imagine, dream and get things done, Mathews took his fledgling company to the top of the cable industry. In 1968, U.S. Cablesystems (which later became CableData) moved into its first official offices. Two years later, the company served 300,000 subscribers. By 1975 the number soared to 3 million. Presently, CableData serves 22 million subscribers (52 percent of the total), generates $80 million in revenue and employs more than 1,100 persons.

During that time, a number of firsts were achieved. In 1972, CableData introduced microfiche and electronic batch processing through the Datapoint 1500 product. With the advent of sophisticated satellite service packaging, CableData launched on-line services in 1979, using Tandem computers.

Mathews' engineering education, combined with his innate business acumen, gave him the ability to break complex problems down to a series of simple challenges, which he solved one at a time. If the answer didn't come easily, he worked on it until a solution was found. "I've never met anybody who had the ability to concentrate on very complex problems for as long as he could," recalls Knapp. For instance, Knapp notes, portions of the QBS software now implemented for use with QuickData, took years for Mathews to write. But he saw it through until its end.

Despite the fact his instincts were often right, his exuberant confidence often turned off potential customers. "He was a visionary who was driven by his view of what the industry needed, whether or not other people agreed with him," says Paul Case, vice president of information services at United Cable, a CableData customer. "He followed his own instincts and time after time he was right."

As Mathews got older, the scope of his efforts broadened. Knapp and Williams note that he became alarmed at the decline of American productivity and the erosion of the work ethic. Both men said that Mathews' driving force was a desire to leave a permanent, positive contribution to the world and, more specifically, the United States. "Bob was always very patriotic and he wanted to prove that Americans could produce products as well or better than foreign countries could," says Knapp.

His wish to better the world around him became more focused when his cancer was diagnosed. After the extent of his illness became apparent, Mathews suggested that he combine his data processing knowhow to help diagnose and treat other cancer patients. "I've never met a man who made such an impact on cancer research in such a short period of time," says Dr. De Vere White, one of Mathews' doctors.

"This industry is going to miss that guy," says Case. "He was terrific to work with and I enjoyed his honesty. I'm afraid he was one of a kind."

He leaves his wife, Susan, a son Shawn and daughters Laura and Shannon.

—Roger Brown

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Numbers: where do they come from?

We use many numbers in our engineering work, usually without even wondering why.

Why, for example, are 75-ohm coaxial cables used for cable TV and baseband video, rather than 50 ohms, or some other number?

Why did coaxial lines used for AM, FM, and TV broadcasting have 51.5 ohms characteristic impedance?

Why is most RF test equipment designed for 50 ohms; and, video test equipment, 75 ohms?

Why 525 lines in North America and Japan, and 625 lines almost everywhere else? Why 405 lines in the old British monochrome system, 441 in the old pre-1941 American system, and 819 lines in a now obsolete French system?

In looking for answers to such questions, I find that even the giant pioneers in broadcast engineering do not know for sure. It seems that there may be a logical rationale in some cases. However, it appears that convenience probably played a significant part, with round integral numbers preferred, or numbers chosen so that devices could be constructed with readily available materials of conventional dimension.

Theoretical analysis shows that the lowest attenuation in a coaxial transmission line occurs when the characteristic impedance is equal to 76.6 ohms, divided by the velocity factor. (V = square root of the reciprocal of the relative dielectric constant.) The minimum loss criteria for several different cable types is shown in Table 1.

The minimum is quite broad. Apparently, the 75 ohm criteria was selected because of its lower attenuation.

Another interesting, and possibly relevant, fact is that the resistance component of the center impedance of a thin, half wave dipole is 70.1 ohms, balanced. In the late '30s, I recall using a twisted pair cable that was called "72 ohm" transmission line for connecting to a dipole. I have since learned that the hams used a cable, meeting that description, called "EO-1."

One old-timer suggested that EO-1 may have originated with some ham operator who simply tried a piece of old lamp cord (the kind with a fabric cover over wires individually insulated with rubber), and it worked. Later, it was found to have surge impedance of about 72 ohms. Loss at "ultra-high frequency" (i.e. 75 MHz in 1937) was tolerable.

Virtually all rigid coaxial transmission line used for many years for feeding RF power to broadcasting antennas, AM, FM or TV, had surge impedance of 51.5 ohms. Part of the answer to this question is the following:

Impedance for maximum breakdown voltage is 59.93 ohms; impedance for minimum temperature rise is 36.38 ohms; and impedance for maximum power handling capacity is 29.94 ohms.

Thus, one may presume that something in the range of 50 ohms may have been chosen for reasons of breakdown voltage and power handling. However, these criteria are subject to a variety of conditional assumptions including the temperature, pressure, dryness and composition of the air dielectric, the size of the cable, VSWR, the type and depth of modulation, and the safety factor allowed. Therefore, something in the neighborhood of 50 ohms may well have appeared to some anonymous pioneer (at Communications Products, or RCA, or Prodelin, or some other) as an appropriate compromise. Besides, 50 is a neat, round number.

But why 51.5 ohms? The precision of that number is astonishing, yet that was the rated characteristic impedance of rigid transmission lines sold for radio and TV broadcast until about 1960 when RS-225 was adopted, specifying 50 ohm line. Research among some old timers indicates that 51.5 ohms was dictated by the size of the ceramic discs (steatite), that were available only from France at the time.

The horizontal TV scanning rate is simply the product of the total lines per frame (525) and the number of frames per second (30). The arithmetic is simple enough: 525 × 30 = 15,750 lines per second. Right?

Wrong. There are only 29.97 frames per second, not 30. The horizontal line rate, therefore, is 15,734.26 Hz. But why?

As you know, third order intermodulation generates a spurious frequency above the visual carrier by an amount equal to the difference between the aural and chrominance subcarriers. Thus, 4.50 - 3.58 = 0.92 MHz. Because of line interlace and frequency interleaving, this 920 kHz beat appears as a small checkerboard pattern moving slowly along certain color edges. Back in the early 1950s, the NTSC (National Television Systems Committee), in order to minimize the visibility of this beat, decided to choose frequencies such that it would appear (on a spectrum analyzer) midway between the line frequency sidebands. To do this, the beat should be an odd harmonic of half the line rate.

However, since the chrominance sub carrier frequency is also an odd harmonic, of half the line rate, the aural subcarrier must be an even harmonic, actually 572, so that the difference will be an odd harmonic. Therefore, the aural subcarier must be 572 × line rate/2.

As to the magic 525 lines, I was told on excellent authority that two well-known engineers, in a casual telephone conversation, picked an odd number, virtually at random, out of a range that would meet the general criteria. One criterion was that adjacent lines would subtend an arc of about 1.5 minute at optimum viewing distance. Viewing at 4.5 feet, 1.5 minute of arc represents about 42 lines per inch. For 12-inch TV screen height, this would mean 504 picture lines. Adding 4 percent for flyback gives 524.

The European 625-line standard is easily related to our 525-line, since 625 × 50 = 31,250, while 525 × 60 = 31,500, for almost the same horizontal scan frequency. ■

By Archer S. Taylor, Senior Vice President, Engineering, Malarkey-Taylor Associates Inc.

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4	13	22	31	40	49	58	67	76	85	94	103	112	121
5	14	23	32	41	50	59	68	77	86	95	104	113	122
6	15	24	33	42	51	60	69	78	87	96	105	114	123
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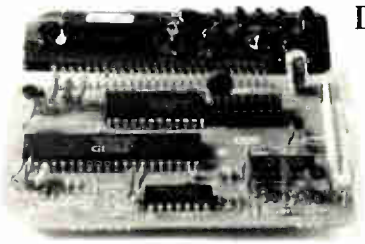

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Prompt service easier said than done

Have you ever listened to a telephone ring? Have you ever thought, for instance, how long you would have to hear it ring before your frustration level begins to rise? In case you've never noticed, a ringing telephone has a particular cycle to it. The vast majority of telephones, in this country at least, ring at the rate of two seconds of ringing followed by four seconds of silence.

Six short seconds and yet you don't have to listen to too many rings before your blood pressure begins to rise. True? Consider what happens to yourself as a customer for any business when you dial that all-important customer service number and hear it ring, ring, ring, ring, ring...

A few things are known about what happens. Number one, if the line is answered promptly, and by promptly I mean *before* the beginning of the third ring, the frustration level does not begin to rise. If a call is not answered promptly, there is a creeping level of frustration.

This frustration manifests itself in latent anger and it gets greater and greater until the consumer hangs up. Even assuming the phone is eventually answered, callers will only put their anger on hold momentarily while they see what sort of reaction they get while delivering their message to the party who answered.

If the party is completely cooperative and not only offers immediate help, but in fact provides that help, the majority of the anger dissipates, but not all of it. A certain residual anger remains and will attach itself to the beginning of the next call this caller makes for service.

Now, let's see what happens if the service organization answers the call promptly but is too busy to deal with the caller. First, remember, if the call is answered promptly, the potential build-up of frustration and anger is short-circuited. Believe it or not, the caller is willing to suspend any further build-up of frustration and anger for a reasonably long period of time if they are dealt with properly.

If the person who answers the call, for instance, states upfront that they would like to help but have several other calls waiting and would be pleased to call back and talk with the customer further, the customer will suspend judgment for quite a long time. It is good practice, however, to call back within the first 30 minutes even if it's only to tell the customer that you still can't get to them right away but you haven't forgotten them.

While the customer cannot be put on hold this way indefinitely, the fact is that the biggest frustration factor for people who call in is the distinct impression that someone has forgotten about them. Just one call back to a complainant with the fact that you still can't get to them but haven't forgotten them creates more good will for that instance than you can imagine.

If this is followed by reasonably prompt action, that is to say, calling the customer back, finding out what his or her problem is and promising to get on it, you will have done almost everything you can to diffuse this customer's ill will toward your organization.

If you then actually fix the problem, promptly notify the customer (with a smile in your voice or on your face), you will have completely erased the original frustration felt by the customer when their service had a problem which prompted them to call in the first place.

I can almost hear somebody reading this article say, "Well, that's easy to say but you ought to hear the phones ringing around here, we can't possibly answer them before they begin the third ring." I've been in many offices where there were people answering phones and where there were telephones ringing at an alarming rate. There is a simple fact, however, that should tell you how to deal with this. If you're on the phone talking to one person while a telephone rings nearby, consider the opportunity you have to say to the person you're talking to, "may I put you on hold for a moment, please." The fact is that the person who is calling in has no idea whether you're alive or dead or whether the office is staffed or not. If they hear a phone ring eight or 10 times and they abandon that call a likely conclusion is that the office is not staffed or, if staffed, is not responsive.

I guarantee you that this will be communicated to any friends or neighbors who ask what's it like to deal with your company. The person you're talking to, however, is perfectly capable of being told that another call is coming in and you will excuse yourself for one moment. If you make sure that it is, in fact, a mere moment before you get back to the first person, you would be surprised at the amount of good you can do.

Now I realize that this isn't always completely possible in an overload situation, but study after study by telephone companies of abandoned calls into cable front offices has shown without a doubt that merely adding people and telephone lines does not always result in a great improvement in the response to trouble calls of that organization. Having a lot of lines but not having them answered is just as bad, and maybe worse, than having the customers receive a busy signal when they call.

Now, I think a busy signal is an absolute abomination for a consumer to run into except in extremely rare circumstances. In the AT&T test room, where I first started my career, the telephone system was connected to a Klaxon horn. At the beginning of the third ring the Klaxon was activated. This got the complete and rapt attention of the techs as well as the manager. For all of the abuse that AT&T took in the press before, during and immediately after the break-up of the Bell System, I can tell you that in seven years in the test room, I only remember hearing that horn a handful of times.

Think about it.

By Wendell H. Bailey, NCTA, Vice President, Science and Technology

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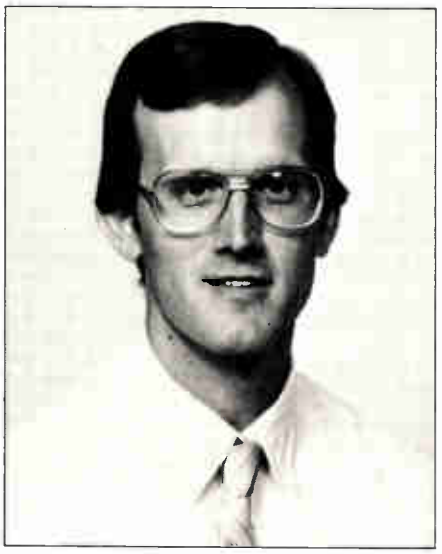
Reader Service Number 6

Merging theory and application aim of new monthly columnist



Chris Bowick

Have you ever wondered why certain equipment is specified the way it is? Have you ever looked at a manufacturer's product specification and wondered about the practical considerations and relevance of all of the information provided? Are you convinced that much of the technical information provided on data sheets is impractical and, for the most part completely irrelevant? Are you (or more appropriately is your boss) one of those individuals who "hooks it up"and says, "Well, it looks good and it sounds good, so it must be good." If any of the above describes how you may have felt at some time in your career, then From the Headend is for you.

In the coming months, this column will attempt to merge theory with practical application as they relate to headend performance. We'll be exploring the background, mystique and theory surrounding headend performance while at the same time applying that knowledge through practical examples. The knowledge to be gained should be useful to you in any of several ways. First, the theory will help to expand your knowledge of the CATV environment and should therefore help to prepare you, in a roundabout way, for SCTE certification as an engineer or technician. Second, From the Headend should offer you some ammunition against the "it looks and sounds good" syndrome. And finally, the knowledge gained through this column should help you to provide the best possible audio and video performance to your customers, or , in some cases, at least help you to understand why you can't.

Now let me tell you a little bit about what From the Headend isn't going to be. It will not be a controversial presentation comparing the performance of one manufacturer's equipment with that of another. There is no room in a column of this nature for that kind of presentation. Also, it will not be a column which ignores the wishes of its readership. If you have an idea or a subject you would like to see discussed, let me know and I'll do my best to see that it is included at some point in the future; especially if it is a popular subject. Another thing this column will not be is "too technical." I don't intend to get into higher order mathematics to explain the intricacies of a particular theory, but instead, intend only to touch upon the mathematics, and then only when necessary, while concentrating on the intuitive and practical approach to the theory where possible.

Future topics for From the Headend will, to a large degree, address those subjects in which the readership indicates interest. In the next couple of months however, From the Headend will address several topics which I have selected because of their relative obscurity in the overall scheme of headend performance requirements. Or, to put it another way, they are subjects which are often ignored, but could easily "jump up and bite you" at precicely the wrong moment if you're not careful. This month, for example, we'll attack the subject of return loss. Boring, right? Wrong! After all, all manufacturers specify input and output return loss (or VSWR) for their equipment, but what does it mean and why should you care? Could there possibly be a practical reason for specifying return loss? Next month I'll attack the subject of noise figure as it relates to the headend. In the months following, I'd like your feedback on subjects that you would like to see. Listed below are some ideas for From the Headend which could take us well into 1989. I'd like your help in prioritizing the list:

Video performance—NTSC video primer, the video waveform; Video performance—differential gain and differential phase; Video performance—C/L delay, C/L gain, frequency response; Video performance—line time and field time distortion; and Video performance—chrominance non-linear gain and C/L intermod.

C/N ratio; Off-air antennas and sight surveys; Video signal-to-noise ratio; Threshold extension; Video depth of modulation and sync buzz; and Audio deviation and BTSC stereo.

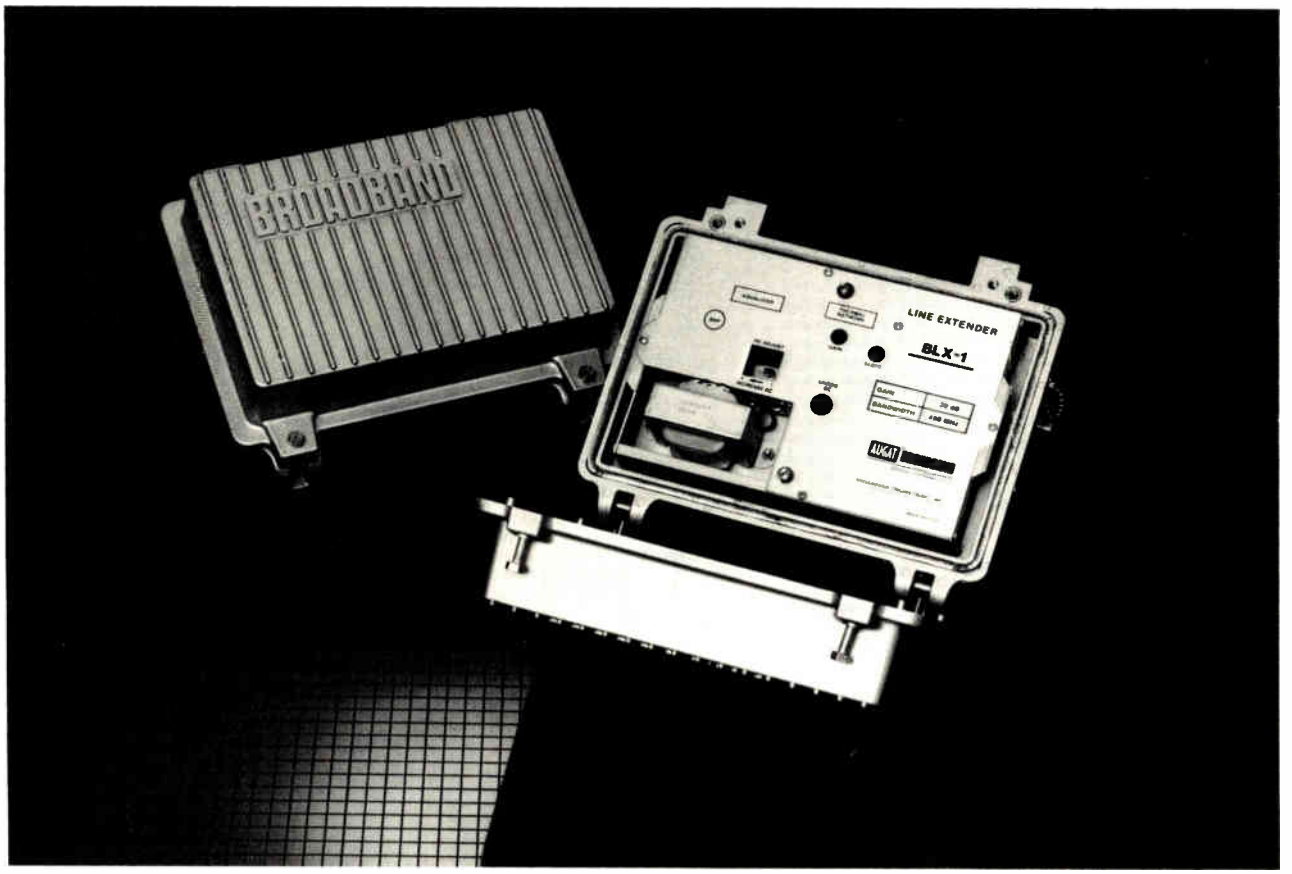
Earth station system G/T—satellite link analysis; Frequency modulation—modulation index and deviation; BTSC stereo—the format; BTSC stereo—the receiver/encoder interface; BTSC stereo—The encoder/modulator interface; BTSC stereo—listening tests; and BTSC stereo—proof of performance tests.

I'm looking forward to writing From the Headend. Let me know what you think. Call or write Chris Bowick, in care of *CED*, Roger Brown, 600 Grant St., Suite 600, Denver, CO 80203, (303) 860-0111.

Return loss not always a boring topic

Return loss is one of those obscure specifications that all manufacturers publish for just about every input and output port on their equipment. But why? I'm sure many of you tend to ignore the spec, or at the very least, you would claim that it couldn't possibly have any affect on system operation, especially in the headend. Well, in reality, there are several input/output ports in the headend where return loss is very critical to system operation. In this month's column, we'll take a brief look at the definition of return loss and then we'll apply the information that we've learned to one of those key interfaces where return loss is critical—the interconnect between the LNB and video receiver.

The IEEE Standard Dictionary of



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Reader Service Number 7

So don't automatically point your finger at the video receiver or modulator.

TABLE 1

Video Specification	Before Mismatch	After Mismatch
Differential Gain	2%	10%
Differential Phase	⅛.¼⅝°	2.5°

Electrical and Electronics Terms defines return loss as: "At a discontinuity in a transmission system, the ratio in decibels of the power incident upon the discontinuity to the power reflected from the discontinuity." What does that mean?

Figure 1 depicts a "generic" CATV interface between any two pieces of equipment that are separated by a long cable run. One piece of equipment, operating as a source of signal power (an LNB for example) supplies that power to a transmission medium (coax) which transports that signal to a load (video receiver or splitter). Ideally, in a perfect system with lossless coax, where the output impedance of the source (typically 75 ohms) is perfectly matched to the characteristic impedance of the coaxial cable, which in turn is perfectly matched to the input impedance of the load, all of the signal power transmitted from the source would be fully absorbed in the load. Thus, in the ideal case, maximum signal power would be transferred from the LNB to the receiver.

In reality however, a perfect match never occurs. Thus, when the signal traveling from the LNB hits the discontinuity in impedance at the receiver end of the coax, some of the signal is reflected back "up" the cable toward the LNB. If the LNB's output impedance were perfectly matched to the coax, then the reflected signal from the receiver would be totally absorbed in the LNB, thus ending the cycle. However, in reality, the LNB does not present a perfect match either, and the reflected signal from the receiver meets another discontinuity in impedance at the LNB. Again, a portion of this reflected signal is re-reflected back toward the receiver and the cycle continues.

The amount of signal that is reflected rather than absorbed at each port is a function of the amount of mismatch that exists between the source (LNB), the transmission medium (coax), and the load (receiver or splitter). The return loss of a device is simply a method of specifying how much signal will be reflected back away from the port when it is imbedded in a transmission medium of a certain characteristic impedance. Specifically,

$$\text{Return loss} = 10 \text{ Log} \left(\frac{\text{Incident Voltage}}{\text{Reflected Voltage}} \right)^2$$

Thus, if the reflected signal is 20 percent of the incident signal, the device is said to have a return loss of 14 dB.

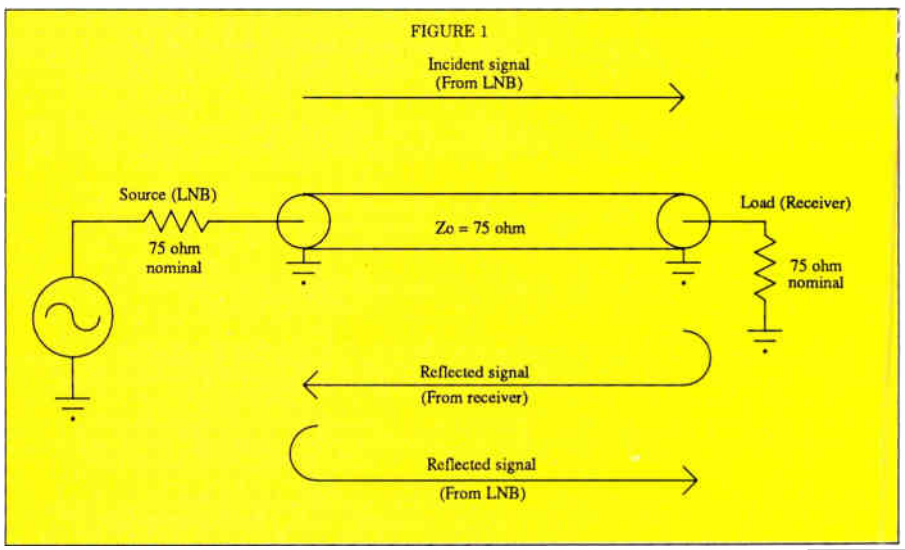
The interesting part about all of this is that not only do devices with poor input/output return loss fail to transfer maximum signal power from source to load, they will also cause the load (receiver) to receive multiple reflections of the original signal which are delayed in time (by the length and velocity factor of the coax) and attenuated in amplitude (by the return loss of the LNB and receiver and by the loss of the coax). These delayed reflections will add vectorially with the original signal, producing a resultant which has both amplitude and phase distortions. These "echo" distortions will show up as amplitude and group delay ripple on the input signal to your receiver, which in turn can produce degradation in baseband video performance. More specifically, the group delay ripple present at the input to the receiver can cause a significant degradation in the differential gain and phase of the baseband video signal. For example, a simple experiment was set up in the lab in which both ends of a 125-foot cable run beween an LNB and a receiver were deliberately mismatched from its nominal 75-ohm (return loss = 14 dB minimum) termination to a poorer termination with a return loss of 5 dB. Table 1 shows the results.

Note that while the performance of the receiver did not change, the group delay ripple present on the coaxial cable, due to the impedance mismatch on both ends, has caused differential gain to increase dramatically, and has caused differential phase to double!

So the next time you're having trouble with your headend's overall video performance, don't automatically point your finger at the video receiver or modulator. Take a look at the interface between your LNA/LNB and receiver. Return loss could be the culprit. But it might not be a problem with either the LNB or receiver. It might, believe it or not, simply be a corroded connector on either end of the cable.

Chris Bowick is an engineering department manager with Scientific-Atlanta. He has been with S-A for six years.

FIGURE 1



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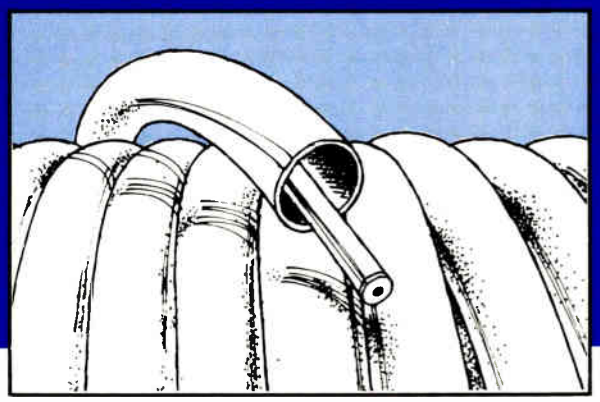

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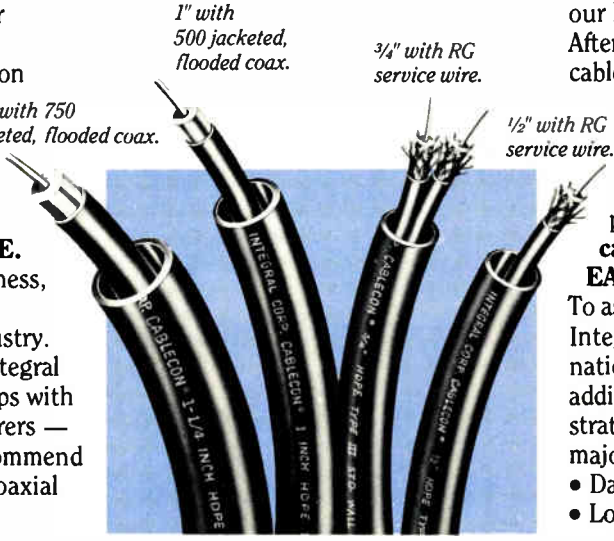

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Reader Service Number 8

A look into the problem of character generator ringing...

...or second image on cable systems.

Waveform testing is performed on a CATV modulator-home receiver modem to investigate the problem of "ringing" or "second images" which sometimes occur when video signals having non-standard baseband formats such as alphanumerics are carried on the cable system.

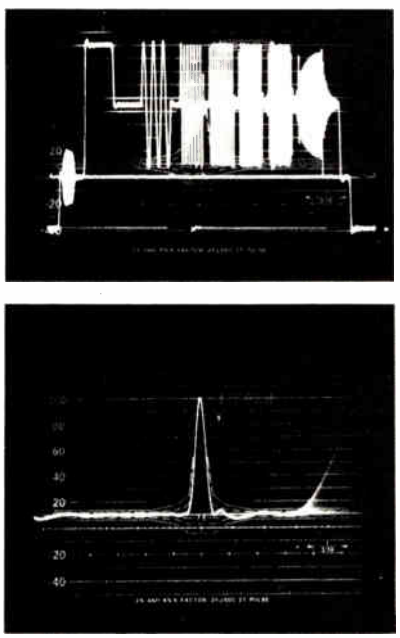
Past attempts to solve the problem through the use of data filters is discussed as well as a different approach utilizing the technique of time domain correction. A block diagram of the time domain correction scheme is given along with a discussion of its operation.

This new technique is applied to the modulator-home receiver modem and waveform testing is once again performed indicating the degree of improvement that might be achieved using this scheme.

Introduction

The increased use of alphanumerics on cable systems the past few years has brought with it an increase in the number of complaints describing a second image following the characters as viewed on the home receiver. The majority of character generators on the market today produce white displays on a dark or multi-colored background and all are capable of excellent sharpness and legibility when viewed on a wide bandwidth video monitor. However, when this same information is converted to a standard television-type RF signal in a CATV modulator and ultimately viewed on the home receiver, the legibility may be impaired, the worst situation being when the white characters are followed by a distinct second image of the character and this second image is also lighter than the surrounding background. In many cases, this second image has all the characteristics of a ghost; however, as we shall see later, no reflections due to poor return loss are necessary to create the problem. Attempts in the past to solve this problem have taken the form of phase-equalized 4.2 MHz low pass filters placed on the output of the character generators as well as various types of data filter modules placed at the input to the modulator.

FIGURE 1



Multiburst and 2T Pulse Response – 6300 Modulator - 6250 Demodulator

It is the purpose of this paper to determine why these past attempts to solve the problem have proved only marginally successful and finally to consider an entirely different approach to solve the problem utilizing the technique of time-domain video waveform correction.

Waveform testing of a CATV modulator

In an attempt to determine the cause of the second-image problem, a CATV modulator was carefully checked for proper alignment and then subjected to video waveform testing when operated back-to-back with a precision television demodulator. The particular modulator used contained both the pre-distortion delay equalizer required by the FCC for color transmission on broadcast stations as well as baseband delay correction circuits to compensate for delay errors generated in the vestigial filter.

The results of this back-to-back test are shown in Figure 1. The test waveforms chosen for these tests were the multiburst signal because of its obvious sensitivity to response flatness and the 2T pulse signal because of its sensitivity to delay errors.

From the photographs it can be seen that the overall amplitude response is flat to within a few tenths of a dB and the units produced a "K" factor of approximately 3 percent. The purpose of this exercise is to convince the reader that although the modulator is not perfect it certainly would be considered to be of good quality and at least typical of many modulators in operation in cable systems throughout the country.

The output of the modulator was disconnected from the input to the demodulator and then fed into the input of a home TV receiver. The home

By Alex B. Best, Scientific-Atlanta

Cable Classics

Have you ever wondered why character generator displays or captions are sometimes subject to second images or shadows when transmitted as RF signals and then viewed on a television receiver? Do you know how a 2T pulse is used? Or do you understand the difference between "time domain" and "frequency domain" analysis?

This 10-year-old paper by Alex Best provides a careful description of the investigation of a problem which puzzled many engineers then, and probably frustrates many even now.

The paper is a study in careful analysis and measurement of a problem, developing an understanding of the underlying cause, and of then proposing (and confirming) a solution which is not at first obvious. More than its value in treating the specific problem of character generator ringing, this paper is a good example of "first-class" investigative engineering methods at work.

Graham S. Stubbs
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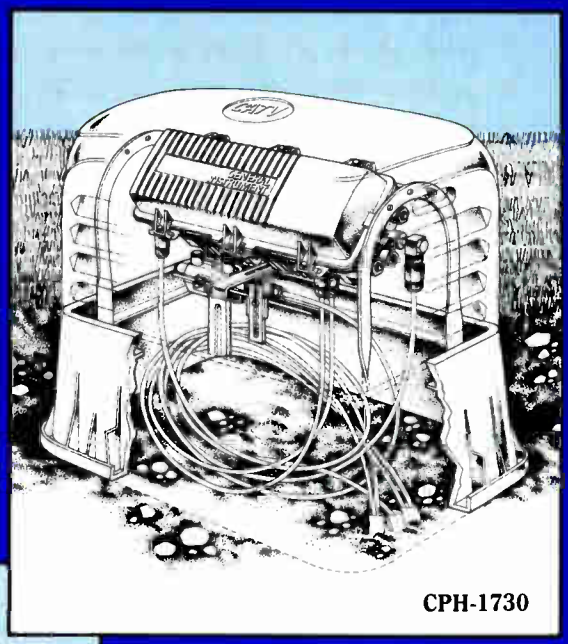

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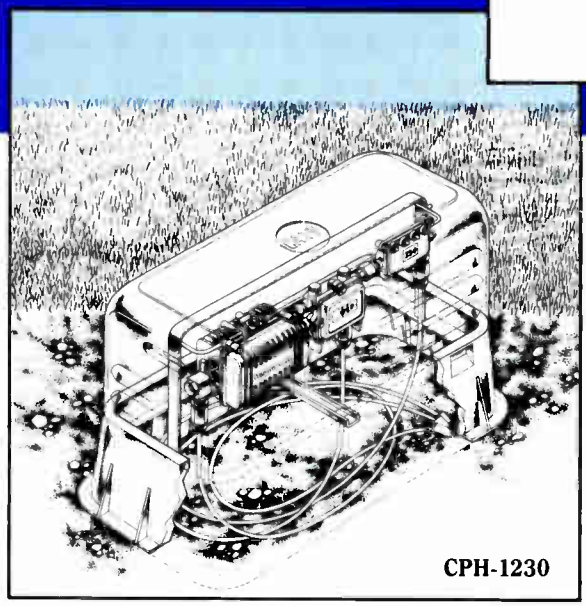

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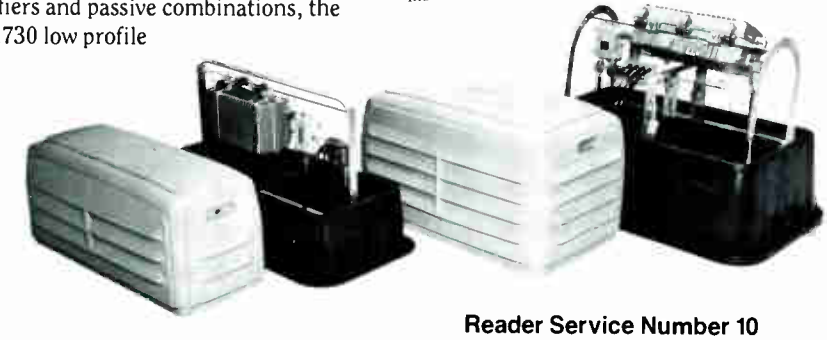

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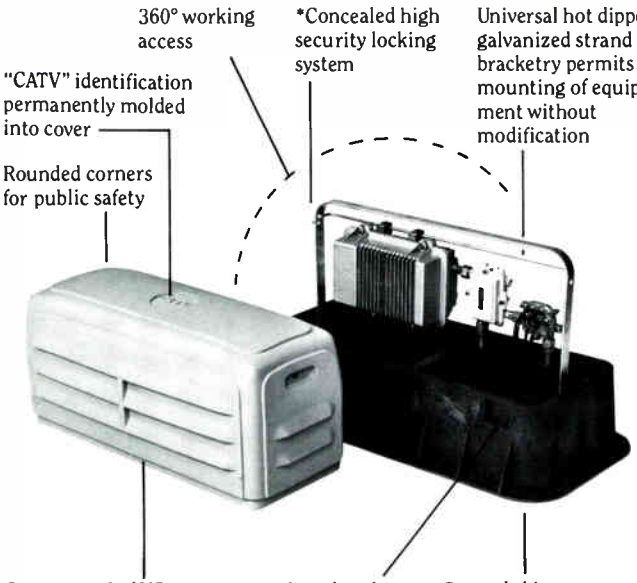

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(Trunk amplifier application not shown)

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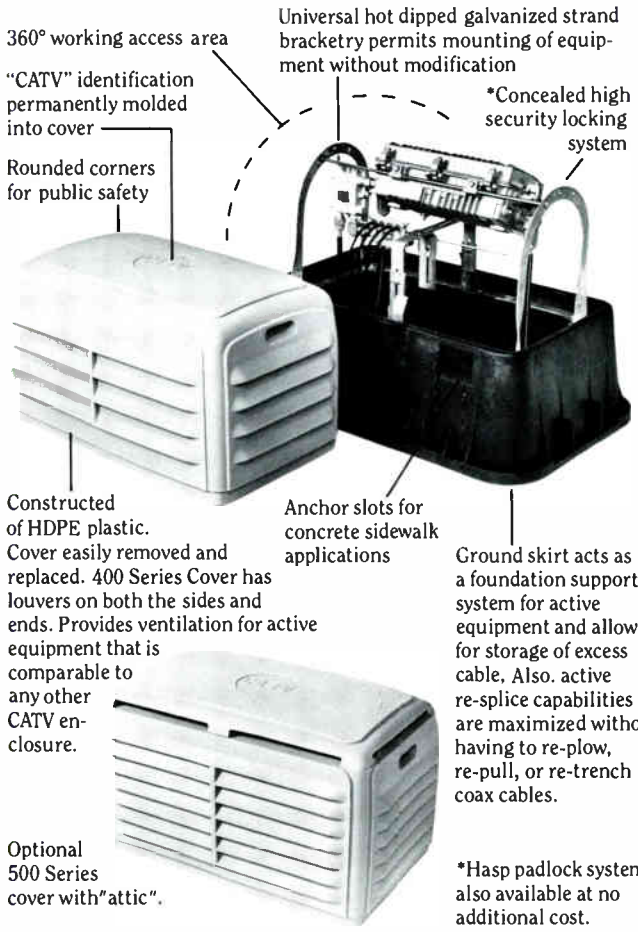

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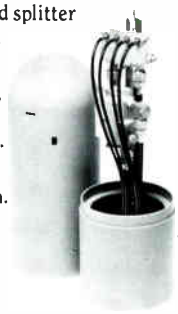

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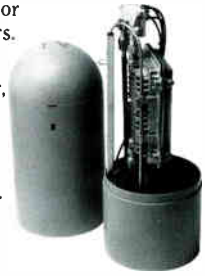

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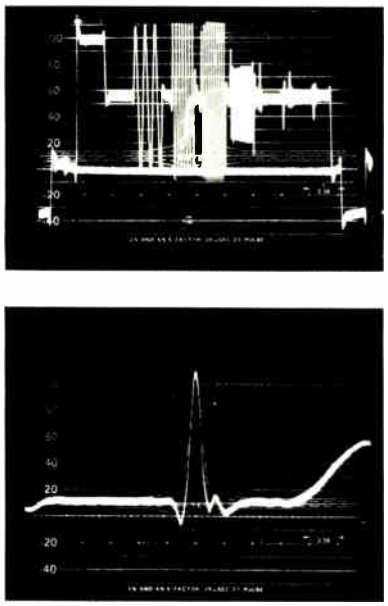
Careful viewing of even the 2T pulse on this receiver begins to show a trailing second image.

FIGURE 2



Multiburst and 2T Pulse Response – 6300 Modulator – TV Receiver

receiver used in these tests was a popular model of recent vintage. Although it certainly can't be argued that his particular receiver is the "average home receiver" it should at least be representative of the units in the field. To perform waveform testing on the TV receiver the back cover was removed and a buffer amplifier exhibiting a high input impedance and a 75-ohm output impedance was placed between the receiver luminance signal prior to being fed to the kinescope and the input to a waveform monitor. The receiver channel selector was set to be the same as the output of the modulator and then carefully fine tuned while feeding the receiver the modulator channel plus a lower adjacent channel sound carrier. The sound carrier was then removed and this modulator—"demodulator" pair was subjected to the same waveform testing as described for the modulator—precision demodulator pair. The results are shown in Figure 2.

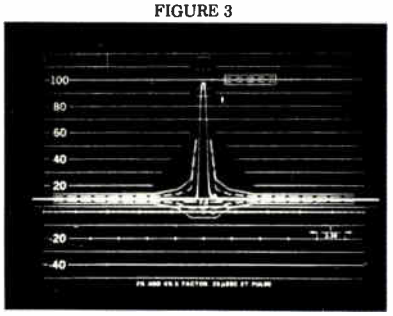
The multiburst response indicates a gradual peaking of about 1.5 dB from low frequencies to 2 MHz and a sharp cutoff between 2 MHz and 3 MHz. The 2T pulse response shows a leading undershoot and trailing overshoot giving a "K" factor of approximately 5 percent. Had the overall modulator-demodulator delay response been flat we would have expected fairly symmetrical ringing on either side of the 2T pulse having peaks displaced from the 2T pulse maximum amplitude by 1/cutoff frequency or about 400 nanoseconds. The combination of non-flat delay plus to a lesser degree some quadrature distortion has produced un-symmetrical ringing at the cutoff frequency. Careful viewing of even the 2T pulse on this receiver begins to show a trailing second image. As is well known, the shape of the 2T pulse is carefully controlled to produce an energy distribution vs. frequency which is approximately 6 dB down at 2 MHz and essentially zero above 4 MHz.

Consider the results of replacing the 2T pulse with one representative of those produced in some character generators. Such a pulse is shown in Figure 3. This pulse has rise and fall times of 15 nanoseconds and a width of 75 nanoseconds. It was produced by feeding the output of a Hewlett-Packard Model 214A Pulse Generator into the External Video In of a Telemet Model 3508 Test Signal Generator. It has an energy distribution which is flat across the 4.2 MHz video bandwidth of the modulator.

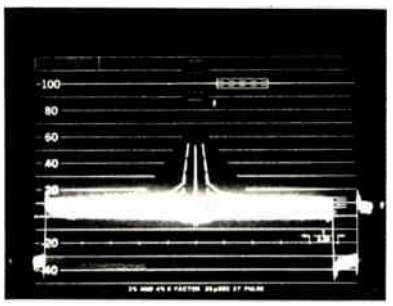
The results of feeding this character generator pulse through the CATV modulator-home receiver is shown in Figure 4. In many respects it is similar to the 2T pulse response except the amplitude of the undesired trailing transient response is a much larger percentage of the desired response. This increased amplitude of the second image is due to the larger energy content of the character generator pulse at the cutoff frequency of the system. Before we are too quick to judge the home receiver at fault, let's replace it with the precision demodulator used to produce Figure 1. The results of passing the simulated character generator pulse through this pair is shown in Figure 5.

As expected, we have a more symmetrical ringing on either side of the desired response, producing multiple images both proceeding and following the desired image. These undesired images are displaced from the desired one by 1/cutoff freq. = 1/4.2 MHz = 238

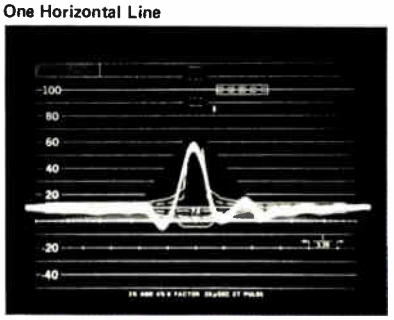
FIGURE 3



"Character Generator Pulse" – 75 Nanosec Wide – 15 Nanoseconds Rise and Fall Times

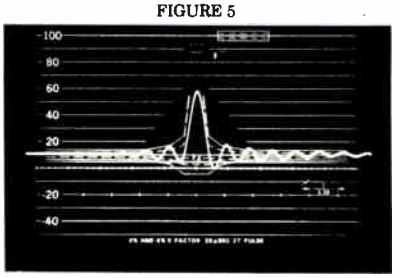


One Horizontal Line



Expanded View of Pulse
"Character Generator Pulse" – CATV Modulator –

FIGURE 5



"Character Generator Pulse" – CATV Modulator – Precision Demodulator

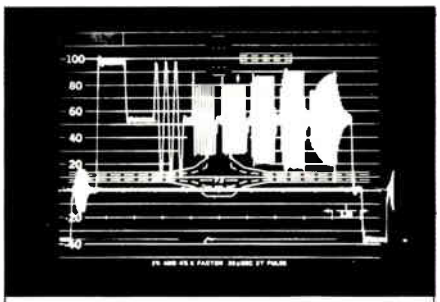
In the case of bandwidth limited television channels, past attempts to solve the problem have taken various forms.

nanosec. Viewing the output of this demodulator on a high quality video monitor will produce multiple images which are even more difficult to read than when viewed on the home receiver. If we conclude that the modulator is not at fault and the demodulator is not at fault we must ultimately arrive at the conclusion that the problem is one that can best be described by theh Theory of Information Rates. Simply stated: When the transmission bandwidth is less than the signal bandwidth some degradation of the signal always results. This degradation may or may not, however, result in the loss of information depending upon how the information is ultimately utilized. One solution to the problem would be to slow the rise and fall times and lengthen the width of the pulses produced by the character generators. This obviously would reduce the number of characters that can be displayed at any given instant and is highly unlikely since in many instances the character generators are fed directly to video monitors where the bandwidths, and therefore information rates, are not nearly so restrictive.

Frequency

In the case of bandwidth limited television channels, past attempts to solve the problem have taken various forms. One such attempt was to remove the unusable high frequency energy content of character generators by placing a phase equalized 4.2 MHz low pass filter on their output. This solution can have little or no effect on the problem because, as shown in Figure 2, signal frequencies above 2.5 MHz are not passed by the luminance channel of the home receiver.

There have also been developed by some modulator manufacturers a variety of data filters which basically was some form of low pass filter placed at the input to the modulator in an attempt to roll-off the high frequency energy content of the character generator signals. Usually their effect was only minimal or, if anything, produced a smearing effect as viewed on the home receiver. Later when colored backgrounds became popular, these filters were rendered useless because of the loss of color saturation they produced. Further attempts to design data filters produced results such as that shown in Figure 7.



Data Filter Multiburst Response

This filter was designed to produce a more gradual system cutoff response but yet not reduce the color saturation of the background. The results of this filter proved to be more beneficial than that of the low pass type.

Television transmitters, to a large extent, have identically the same problems in producing high quality alphanumerics on the home receiver as we do in cable systems. Their use, however, has been limited to producing station call letters, emergency messages, sports scores, etc. To provide improved legibility for these applications of alphanumerics as well as improve their overall transient response to normal video signals, transmitter engineers have been utilizing a tool which we basically have overlooked in CATV. This tool is the Video Time—Domain Waveform Corrector. The time—domain approach to waveform correction aims directly at restoring a particular point in a waveform at a given time to the amplitude level it should be at that time, without recourse to frequency—domain considerations.[1] Normally these devices were designed to correct distortions which had occurred in processing the video signal prior to being modulated on the RF carrier. To do so, a correction signal is generated from the incoming distorted signal and then added to the distorted signal to produce a corrected outgoing signal. There is nothing, however, to prevent these devices from taking a correct input signal and producing a distorted output signal to correct for errors generated elsewhere in the system.[2] One reason such techniques have not found widespread use in the CATV industry is their excessive price, usually costing many times more than the modulator itself. It should be pointed out that these machines provide a variety of signal conditioning functions and the use of such a device to produce increased legibility of alphanumerics in cable systems would be an

FIGURE 7

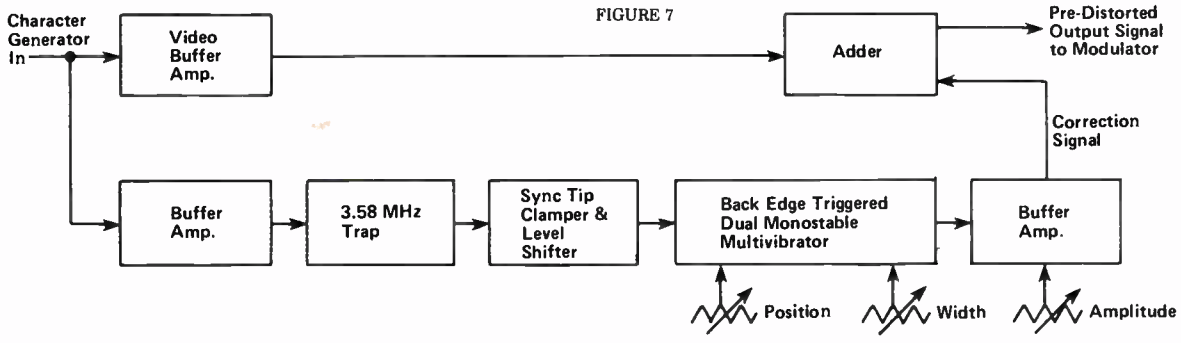
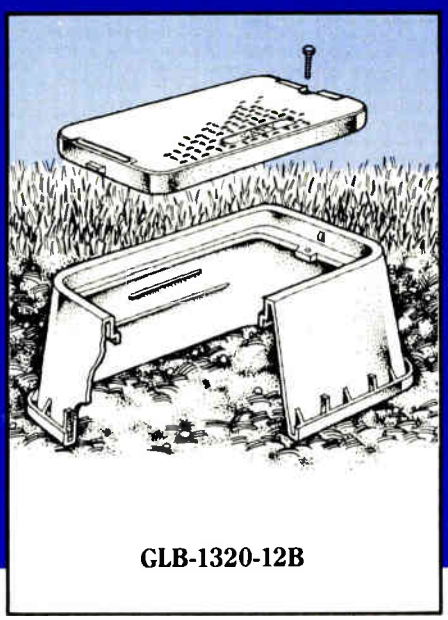
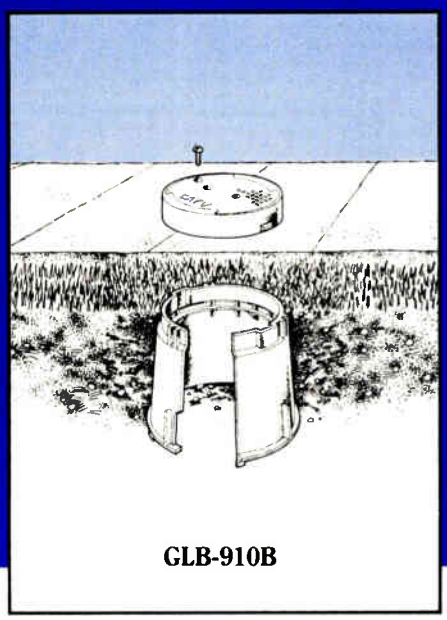


Figure 7. Block Diagram of Time Domain Character Generator Pre-Distortion Waveform Corrector

Carson Grade Level Boxes...



GLB-1320-12B



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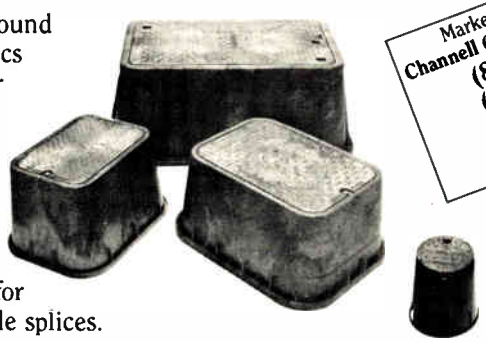

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Reader Service Number 9

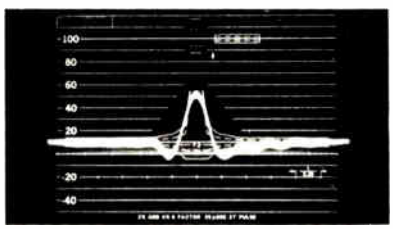
The system will only work with character generators producing white letters on a dark, colored or multi-colored background.

inefficient use of its overall capability.

Novel approach

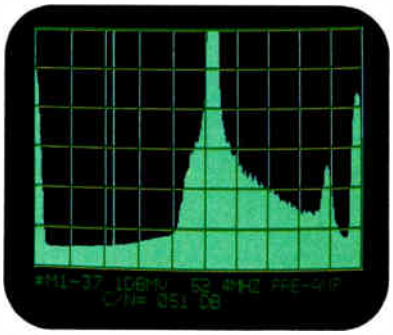
I would now like to describe what I consider to be a novel approach to a solution of the problem utilizing time—domain pre-distortion techniques as described before, but at a fraction of the cost. The system will only work with character generators producing white letters on a dark, colored or multi-colored background. It will not function with normal transmitted video signals. Such is not the case for the more expensive machines described above. The block diagram of the character generator pre-distortion waveform corrector is shown in Figure 7. The input video signal from the character generator takes two paths. One path is through a buffer amplifier and finally an added circuit where it appears at the output. This path provides no signal conditioning of any form to the input signal. The second path passes the input signal through a second buffer amplifier and then a 3.58 MHz notch filter which removes any color subcarrier energy which may be present on the signal. The sync negative video signal is then clamped at the sync tips to a positive DC level set to cause the dual monostable multivibrator to be triggered only by the pulses which produce the alphanumerics. The dual monostable multivibrator is configured to produce an output pulse every time a negative transition occurs on its input waveform. This output pulse is variable in its position, width and amplitude relative to the pulse which triggered its initiation. This output pulse is added to the unaltered character generator output signal to form the pre-distorted signal.

FIGURE 8

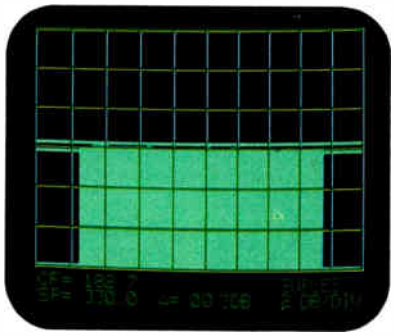


75 Nanosecond Pulse – Character Generator Waveform Corrector – CATV Modulator – Home Receiver

To gain a better understanding of how such a system might operate in actual practice, consider the problem indicated in Figure 4 which shows a distinct second image. If we now feed the character generator pulse through the time—domain pre-distortion waveform corrector before going into the modulator, careful adjustments of its controls would allow almost complete elimination of the second image. Examination of Figure 8 which is the demodulated output of the home receiver under these conditions indicates a much improved transient response with



Improve picture quality.



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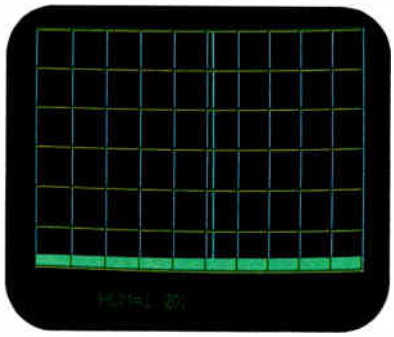
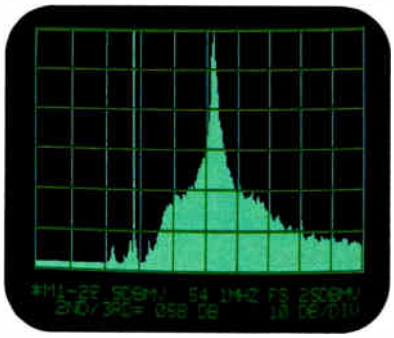
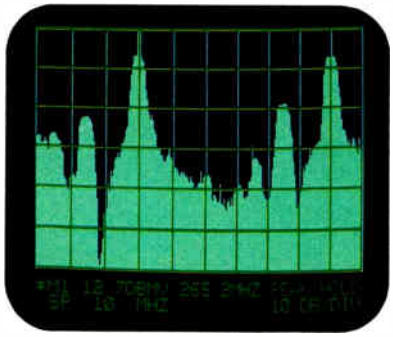


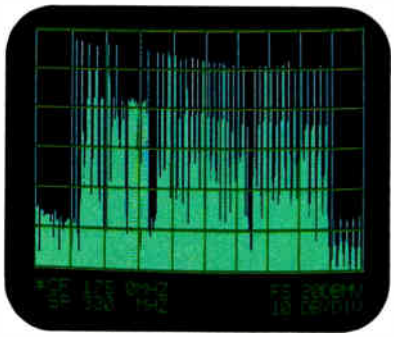
Minimize hum.



Pinpoint distortion problems.



Peak RMS of suppressed sync.



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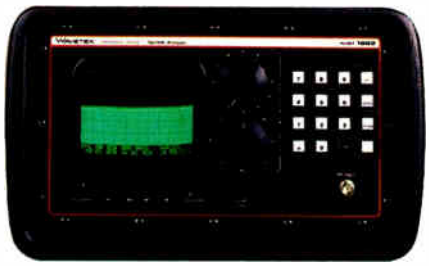

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Attempts to improve the system transient response operate by altering the system in the frequency—domain.

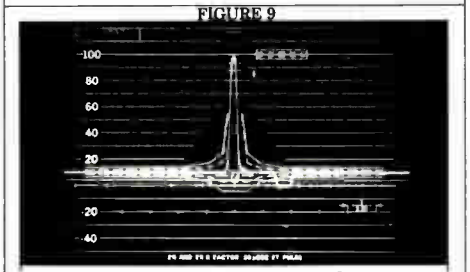
a complete elimination of the trailing second image response. Shown in Figure 9 is the pre-distorted output of the time—domain waveform corrector under these conditions.

The correction pulse follows the main pulse by about 400 nanoseconds and is opposite in polarity to the main pulse. Its width is about 100 nanoseconds. This correction pulse is generated each time during the scanning of a horizontal line that a pulse is produced by the character generator. Since the correction pulse is initiated by the negative transition of the character generator pulse, its position relative to the back edge of this pulse will not vary, regardless of its width.

Conclusions

Past attempts at improving the legibility of alphanumerics being viewed on home receivers fed from CATV modulators have generally been in the form of data filters. These attempts to improve the system transient response operate by altering the system in the frequency—domain.

FIGURE 9



75 Nanosecond Pulse – Character Generator Waveform Corrector – Waveform Monitor

This paper describes a technique whereby the overall system transient response is improved by altering the system characteristics in the time—domain. In our example, the output of the character generator has been pre-distorted before going to the modulator by adding in a correction signal which ultimately cancelled the second image. It may be argued that the receiver used here was not an "average home receiver," and that different receivers would require a different amount of pre-distortion correction. This may well be the case. However, my experience with this form of correction has indicated that receivers with greatly impaired legibility of alphanumerics are much improved whereas receivers which had good legibility to start with have not been impaired.

The real advantage of this technique may well lie not in its ability to compensate for the "average home receiver" as indicated here, but its ability to compensate for errors generated within the cable system itself. Differences in performance between character generators, CATV modulators, as well as system configurations which may include sub-lo runs from office to headend plus reprocessing all enter into the system performance. ■

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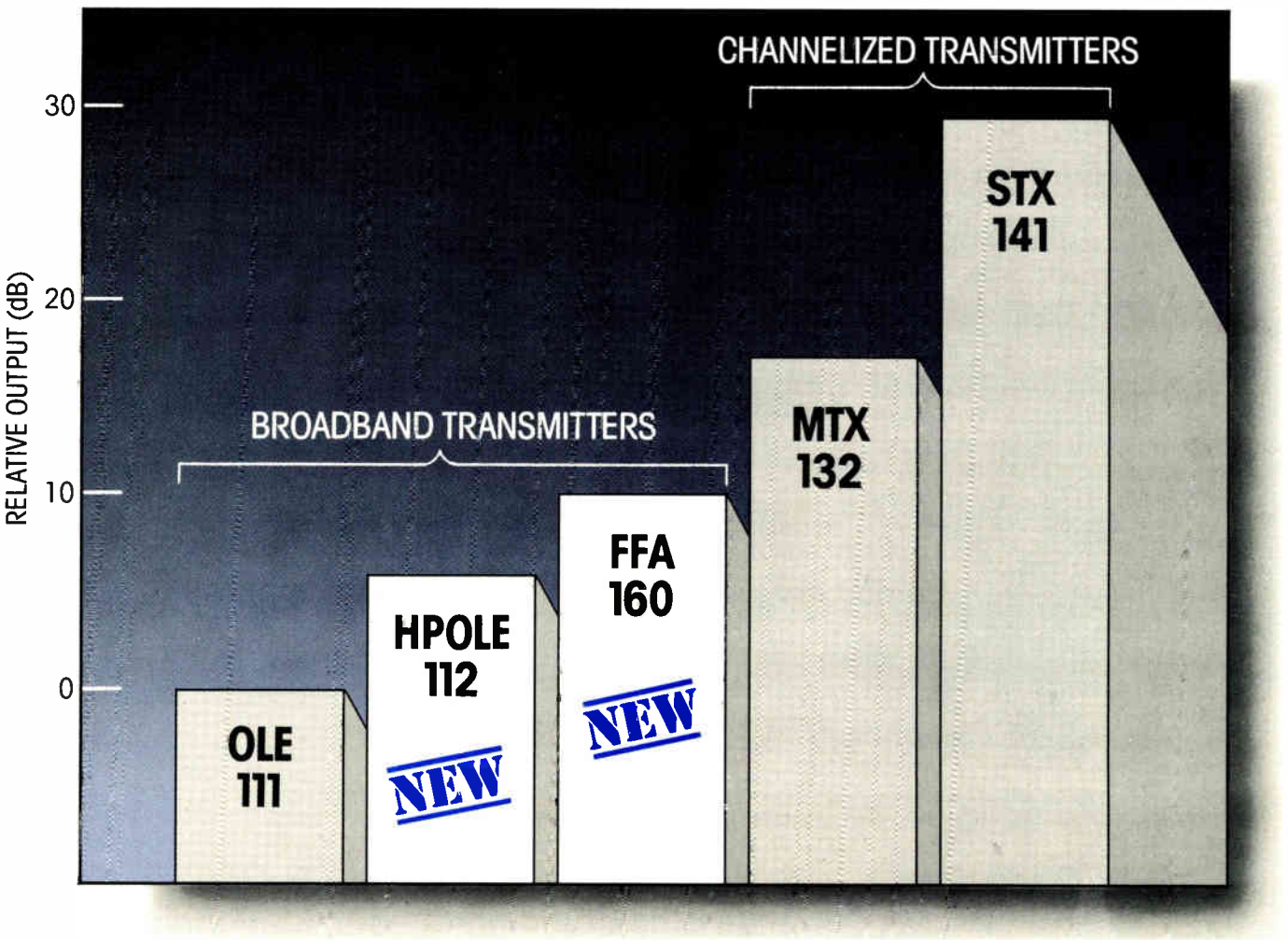

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How to achieve low resistance grounds...

It is well known that the soil resistivity and area availability for the grounding system are two constraining factors that limit the grounding resistivity for a given site. There is a trade-off between length of rods used, and the number used; however, after the optimum combination has been selected, the resistivity is then fixed at some value.

...under poor soil conditions.

That value cannot be appreciably influenced by more or longer rods. Only more area or lower soil resistivity can improve the rod-to-earth resistance. Where the area is fixed, soil resistivity must be lowered.

Soil resistivity is known to vary significantly with composition and state. Specifically, factors such as soil type, compactness, temperature, moisture content, and chemical or mineral content, etc., influence the measured value. Of these factors, two or three (depending on the site location) seem to exercise the most significant influence: the mineral content and the moisture. Temperature is significant only in areas that freeze.

Soil resistivities have been found to vary from lows of less than 5 ohm-meters to highs of more than 10,000 ohm-meters (too high to measure). In areas where permafrost exists, resistivities have been found to be too high to measure accurately.

It has been known for many years that the addition of ordinary table salt (NaCl) to soil will decrease its resistivity. This is best illustrated by Figure 1, which indicates that when the moisture in the soil is at the correct level (between 4 percent and 12 percent), and 10 percent of that is salt, the soil resistivity can be reduced from a high of 10,000 ohm-meters to less than 100 ohm-meters.

However, as Figure 2 illustrates, time and rain exercise a degrading influence. Subsequent resalting never seems to reproduce the initial results. Eventually, the soil resistivity returns to its original value. There is, therefore, a requirement for some form of conditioning that does not degrade with time.

During the past 12 years or so, various attempts have been made to develop a grounding electrode that would provide automated conditioning of the soil within the area of concern. These devices varied in configuration and operational concept. The most successful was an air breathing rod that has been on the market for more than 15 years. However, it is limited in application to areas where the air moisture content was high.

Within the past two years, a chemically activated grounding electrode known as Chem-Rod was introduced to the market. In contrast to other chemical rods offered, the Chem-Rod assembly conditions a much larger percentage of the soil, within the interfacing hemisphere. Figure 3 illustrates the principle of operation. Moisture is absorbed from the soil (and rain) through the ports. The delequessent metallic salts absorb the moisture and form a saturated solution of those salts.

The salt solution seeps out the many ports provided for that purpose and infiltrates the surrounding soil by osmosis. That soil then becomes very conductive, because the mineral content is increased, and its sensitivity to moisture has thereby decreased.

Note: The higher the mineral content in soil, the less its sensitivity to moisture content.

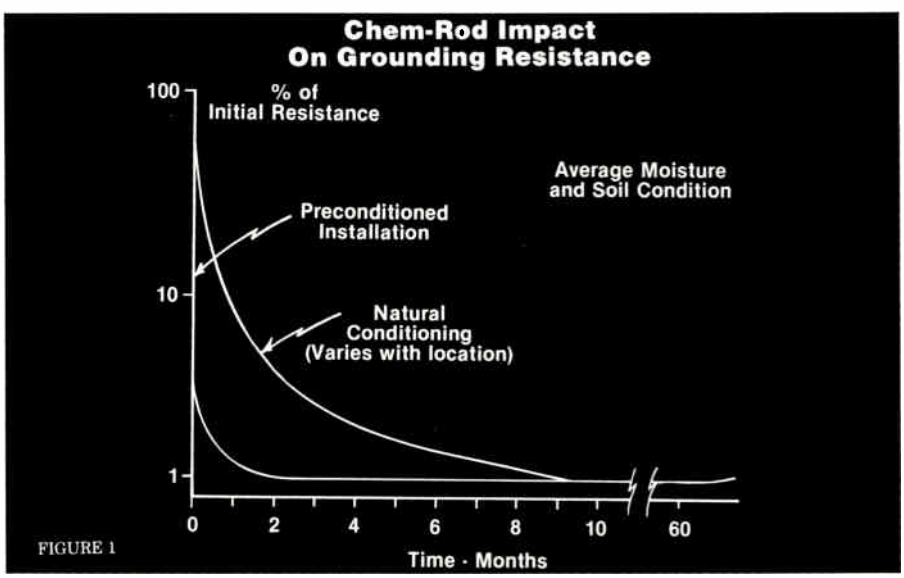

FIGURE 1

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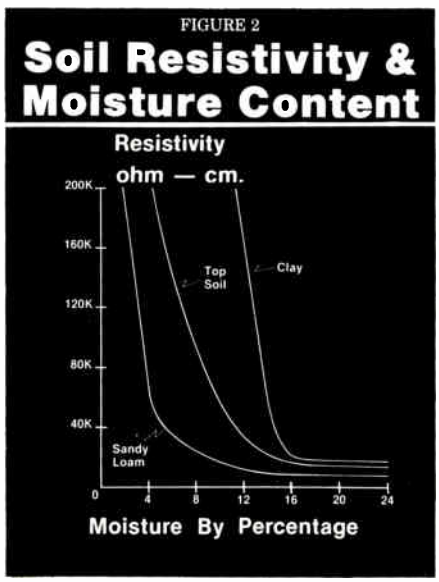
Reader Service Number 15

To determine when to use the various rod types, it is necessary to know how they compare in various environments.

FIGURE 2



Dramatic results

The resultant impact on grounding resistance for that electrode is dramatic. As illustrated by Figure 4, if the moisture content is within the required range, the resistivity to earth will be reduced by as much as 100 to 1, possibly more.

The rod assemblies may be deployed in any number of configurations. They are rechargeable so that they are not life limited; and the disolution rate may be increased for areas where higher mineral content is required. The average recharging time is approximately 10 years.

To determine when to use the various rod types, it is necessary to know how they compare in various environments; specifically, in a range of soil resistives. Such a comparison is presented in Table 1, which is a summary of tests performed by an independent agent. These test data present a very clear picture:

1. A conventional rod seldom provides a satisfactory earth interface.
2. Treated soil always provides improved earth contact.
3. The chemically activated electrodes always provide lower resistivities than the conventional rods; in treated or untreated soil.
4. Chemical rods always provide a more stable grounding resistance.

The 9 ohm-meter soil contained a high volume of moisture. The others may have been drier. It is often true that the higher the soil resistivity, the drier the soil condition.

Five different soil conditions and five different grounding electrode situations were evaluated. Each rod was 10 feet long. The first was a conventional ¾ inch by 10 foot copper clad rod, driven in untreated soil. The second and third were the same rod in a salt treated soil, after one year and after three years, respectively. The fourth was an air breathing rod and the fifth, a preliminary model of the Chem-Rod.

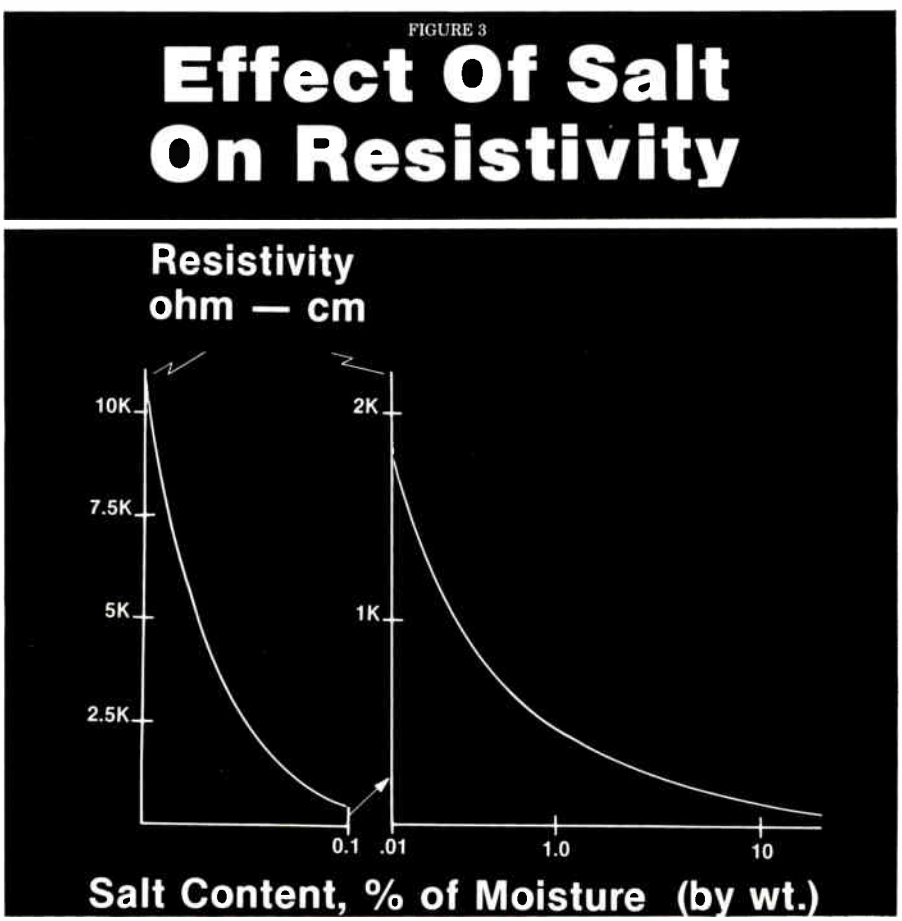
Finally, the stability factor is of significant interest. It is the measure of the variation in grounding resistance throughout the year, i.e., between wet and dry, or hot and cold. Where all other concepts had factors of 2.0 or more, the Chem-Rod factor was only 0.4. That is, the other rod resistances more than doubled at times, where the Chem-Rod varied by only 40 percent. Even that variation could have been minimized through use of automated moisturizing.

Automated moisture enhancement

Moisture content is perhaps the single most influential factor in a grounding system. Without it, there is no soil contact. It is the media that forms the electrolyte in soil, and brings out the true conductive character of that soil. No moisture, no significant earth contact. Therefore, there is no conventional grounding system that will function satisfactorily in dry desert areas, without treatment. It is therefore obvious that some form of moisturization system is mandatory.

In conclusion, the following steps are recommended for the design process and as a logical path toward the design of a low resistance grounding interface:

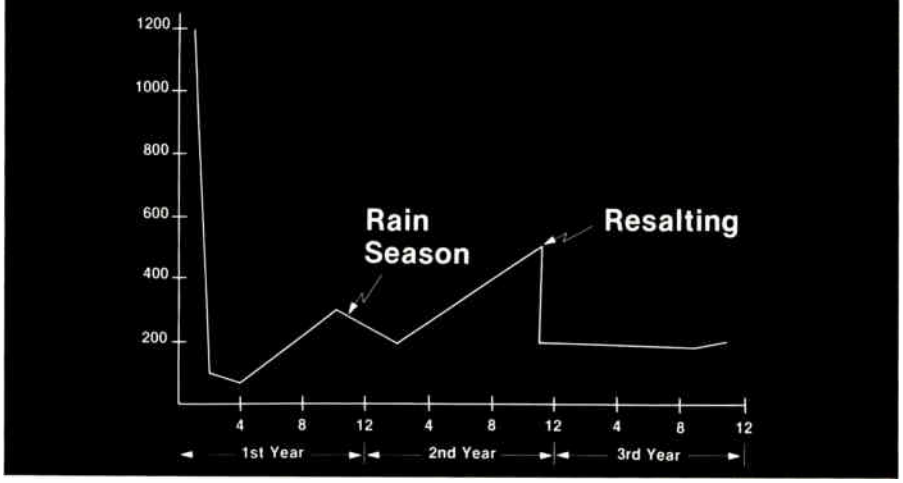
FIGURE 3



Outage control marketplace

Where the resistivity is still too high, plan for moisture enhancement.

FIGURE 4
Soil Salting Impact On Grounding Resistance With Time



1. Determine the state and variations within the state of the soil conditions; and determine the lowest practical resistivity that those conditions will permit, using the foregoing data. This identifies the limit for conventional technology.
2. Conduct "trade off" studies between long and short rods, in both vertical and horizontal deployment patterns; always providing for correct spacing of rods.
3. Determine the impact of seasonal variations; expect variations of at least 250 percent for conventional systems.
4. Replace conventional technology with more advanced technology and re-estimate the seasonal resistives (first without moisture enhancement). The expected variation should average 40 percent within the U.S.
5. Where the resistivity is still too high, plan for moisture enhancement (of the electrode interface hemisphere only). ■

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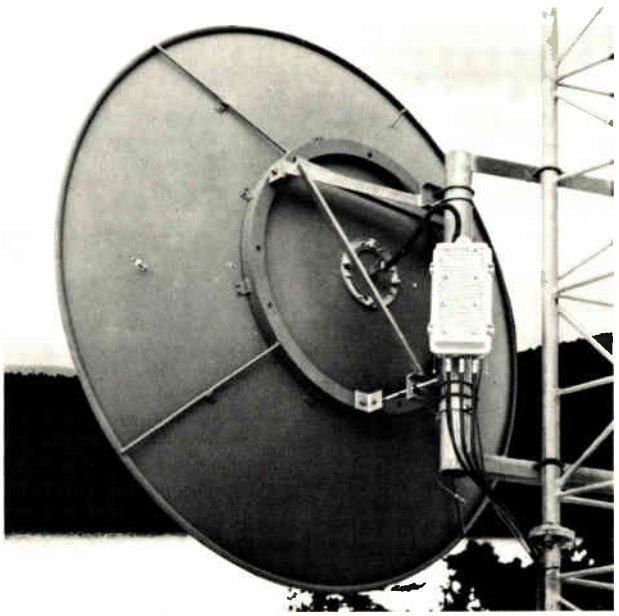

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Two New Microwave Products

Channel Master® has added a new microwave repeater and microwave multiplier to its line of CATV equipment products for even greater CARS—band system expansion.

The new **Repeater**, available in 1 and 5 watts, is a low noise amplifier designed to consolidate transmitter and receiver functions, allowing microwave links to be cascaded or hopped without down-converting and then up-converting the signal.

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36-Channel 300 MHz System

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Sample Applications:

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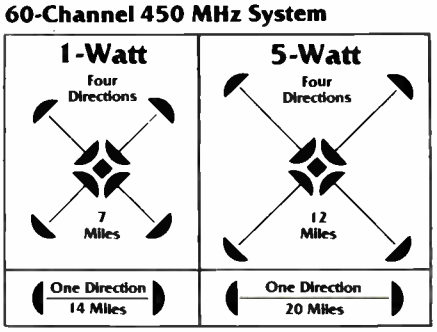

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Roaches: a pesky problem for cable operators

Converters *are* cable. They are the most visible sign of system services. The proper presentation of conveters is critical for the public to feel that cable is an entertainment value. A rather sticky problem occurs in system operations, relating to converters, that has to be handled in a discrete and non-traditional manner: Roaches!

Non-traditional methods are needed to combat the roach problem in converters.

The problem

When roaches are present in a customer's home, there is a good chance the pesty creatures will move into the converter, making it their new home after cable is installed. Converters are warm, cozy living quarters and viewed as high-class condominiums in the roach world. The special red bedrooms with built-in lighting is especially sought after by bachelor roaches looking for just the right atmosphere to complement their wild and crazy lifestyle.

This presents a big problem for cable systems in urban areas and an annoying problem in the surrounding operations. Roaches living in converters can feed on PC boards and other electronic components. Their feces and other debris they create change the characteristics of sophisticated RF circuits. They can cause shorts, opens or intermittents in a subscriber's converter, leading to problems with the cable service. Service calls for box swamps are expensive for system operators and annoying to cable subscribers.

Another problem is the possibility of infesting a subscriber's home by installing a converter filled with roaches, or worse yet, eggs. In addition, the infestation of roaches in business offices, customer service areas, warehouses and trucks is unhealthy and demoralizing.

The traditional means for controlling roaches such as clean work areas do not work for cable operations. Systems collect, store and issue converters every day. The converters that comes out of the Jones' household, infested with roaches, comes back to the warehouse and system office at night. If the converter was removed because of a disconnect or service change, there is a good chance it will go into the Smith's home a couple of days or weeks later. Roaches brought back in converters often find a new home in the cable system's offices and warehouses. Urban systems regularly have their offices and warehouses treated with pesticides to control the roach problem in their work areas, let alone in converters. Cable operators have a truly unique problem in controlling and eliminating roaches.

By Peter J. Sclafani, Cable Resources Inc.

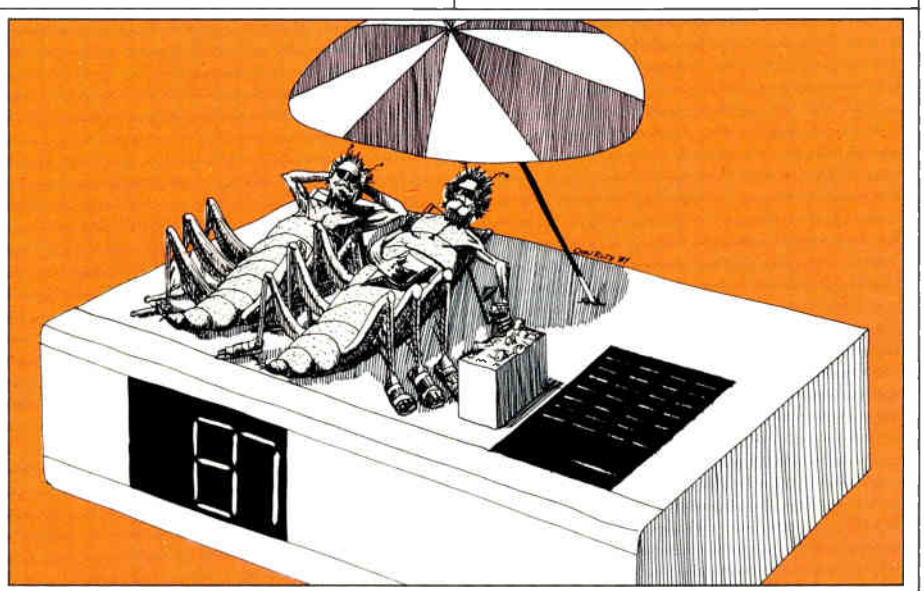
Roach facts

Looking closer at the problem, we find that the German cockroach is the big inhabitant of inner cities in North America. The Brownbanded cockroach is the second-most prevalent and found mainly in southern parts of the country.

Cockroaches look for warm, dark areas to live in—near food and water supplies. They are nocturnal, spending daylight hours hidden in the dark. They come out at night to eat and drink. Roaches like to have their bodies touching other surfaces while waiting for darkness. They can be found in crevices, cracks and voids between walls or behind refrigerators, stoves and kitchen cabinets.

German roaches are the biggest problem in North America because they reproduce faster than any other species and they are found throughout the country. The female roach drops egg cases three or four times a year, with each case holding 24 to 48 eggs. She will drop the case anywhere she happens to be a day or two before they are ready to hatch. Each egg capsule is about the size of a small mint with brown stripes or a zipper-like pattern running across it. They are easy to see with the human eye. Each female roach will lay four to eight sets of egg cases during their 100- to 200-day lifespan. This means rapid expansion of a roach family once they are established. The capsules have a strong skin that protects the eggs from insecticides, except professional contact sprays and highly poisonous fumigants.

The Brownbanded roach's lifespan runs from 120 to 300 days. The egg cases are dropped by the female in groups of 10 to 15 with each case holding 10 to 18 eggs. The incubation period for these eggs can run from one to three months. Brownbanded roaches love heat and are likely to lay eggs in converters. Because of the long incubation period, there is a good chance the eggs will be transported to cable office



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Reader Service Number 27

When a converter is changed out, the roaches are usually not notified in advance.

and other subscribers.

TV sets and cable converters offer warm, dark areas to live in. In addition to the edible glues used in manufacuring, people often eat in front of the TV, leaving small scraps or crumbs that feed large groups of cockroaches. The converter's transformer generates a large amount of heat while the circuit boards, with lots of components on them, create the perfect sun deck for roaches to relax on. The high temperature, relative darkness and abundance of crevices make the inside of a converter a great place to live.

When a converter is changed out, the roaches are usually not notified in advance. This means they leave the subscriber's home under the arm, or at arm's length, of a service technician. They roaches usually stay in the converter while it is being handled and end up in the service truck. If it is warm and dry, the cockroaches will be active and probably infest the truck. Or they may wait to get to the warehouse to come out for food and water, starting a new life in the warehouse or business office.

Roaches will move out of the unplugged, cold converter and begin looking for new, warm living quarters. The temperature drop and their daily need for moisture makes them move. Sometimes they find their way into converters being issued to subscribers, creating an expensive public relations nightmare.

Solutions

One way to deal with the problem is to purchase potentially dangerous and expenisve fumigation systems. This requires involvement with a licensed pest control operator a large amount of unproductive labor. For this sytem to work, all converters are placed in a tomb-like sealed container and a deadly gas is released, killing all the roaches and their eggs. One problem with fumigation is that the converters have been in trucks and warehouses for some time without being sealed. This gives roaches time to escape and infest surrounding areas. Another unknown is the corrosive action of the gas on electronic components and boards. Most gases available today advise of this potential problem, with a few claiming no damage to equipment.

Insecticides, in general, are not recommended for use in electrical products. Many aerosols attack plastic, while powder and dusts can become airborne, interfering with relays and contacts. All insecticides corrode circuits and components to some extent and may cause unknown problems down the road. In fact, the use of insecticides is not recommended by manufacturers of most electronic equipment such as computers and VCRs.

For any solution to be effective, each converter has to be handled as if infested. Cable operators need a system to deal with the problem that should meet the following criteria:

1. Seal all converters received back from customers in a container. This controls the spread of roaches 100 percent simply and effectively.

2. Infested converters, still in a container, have to be easy to identify. This allows infested converters to be dealt with one way while the majority of converters go through standard channels of operation.

3. A simple, safe method for the disposal of the roaches and their eggs without using insecticides. No matter how weak, the insecticide is dangerous and opens the door to trouble for system operators.

New Idea

A plan that is efficient and requires no poisonous insecticides, deodorants or gases is as follows: Step 1. All converters go directly into a sealed bag in the customer's home or at the front office. A small container of silica gel goes into each bag to prevent the bag from sweating and providing moisture for the roaches. This insures total control of roaches in all the converters that come back from the field.

Step 2. When the converters are returned to the warehouse, they are placed in a warm, dry holding area. (A minimum temperature of 70 degrees is recommended.) The need for water will bring the bugs out of the converter and make them easily visible, still trapped in the bag. The amount of time required to bring the bugs out depends upon the temperature and humidity level of the holding area—it can be as short as two hours in a very dry room where temperatures are in the 80- to 90-degree range.

Step 3. The next day, the converters are inspected for bugs. Clean, defective converters go on to the repair or handling centers for their normal routine.

Step 4. The infested converters are put into quarantine for two days. If the humidity is low and temperature is kept up, all the roaches will die from lack of water and will be laying at the bottom of each bag.

Step 5. Remove the converter from the infested bag and dispose of the bag with dead bugs in a proper manner. A separate garbage bag with a plastic liner that is sealed at the end of each day and disposed of in conventional ways is recommended.

Step 6. The converter should be opened in a controlled area to check and remove roach feces and eggs. As stated, the eggs and feces are visible to the naked eye. Using compressed air in a closed area, like the bottom of an open box, to blow the waste off the circuit boards is recommended. The debris in the box should be swept up, put into a bag and disposed of in a conventional manner.

This method for handling, controlling and disposing of roaches is efficient and safe. It requires no insecticides or hard-to-get chemicals. Silica does not act on metals or plastics, it is used to keep electronics dry when shipped by the original manufacturer. The key to instituting the program is the use of a strong, easy-to-seal container, sized for converters. Cable Resources Inc. offers the Secure-Seal Converter Bag.

Bags are mounted 100 or 50 bags on a white board and each bag is perforated so individual bags pull off as needed. A tube of plastic, or "tie strip" is attached to the bag to tightly seal the bag after placing the converter in it. The bags are available in three sizes and can be purchased with custom copy and graphics to enhance awareness of your system.

In addition to providing the vehicle to institute a comprehensive roach control program, the bags protect converters from scratches and dents while insuring that the proper paperwork stays with the converter all the way back to the repair center. ■

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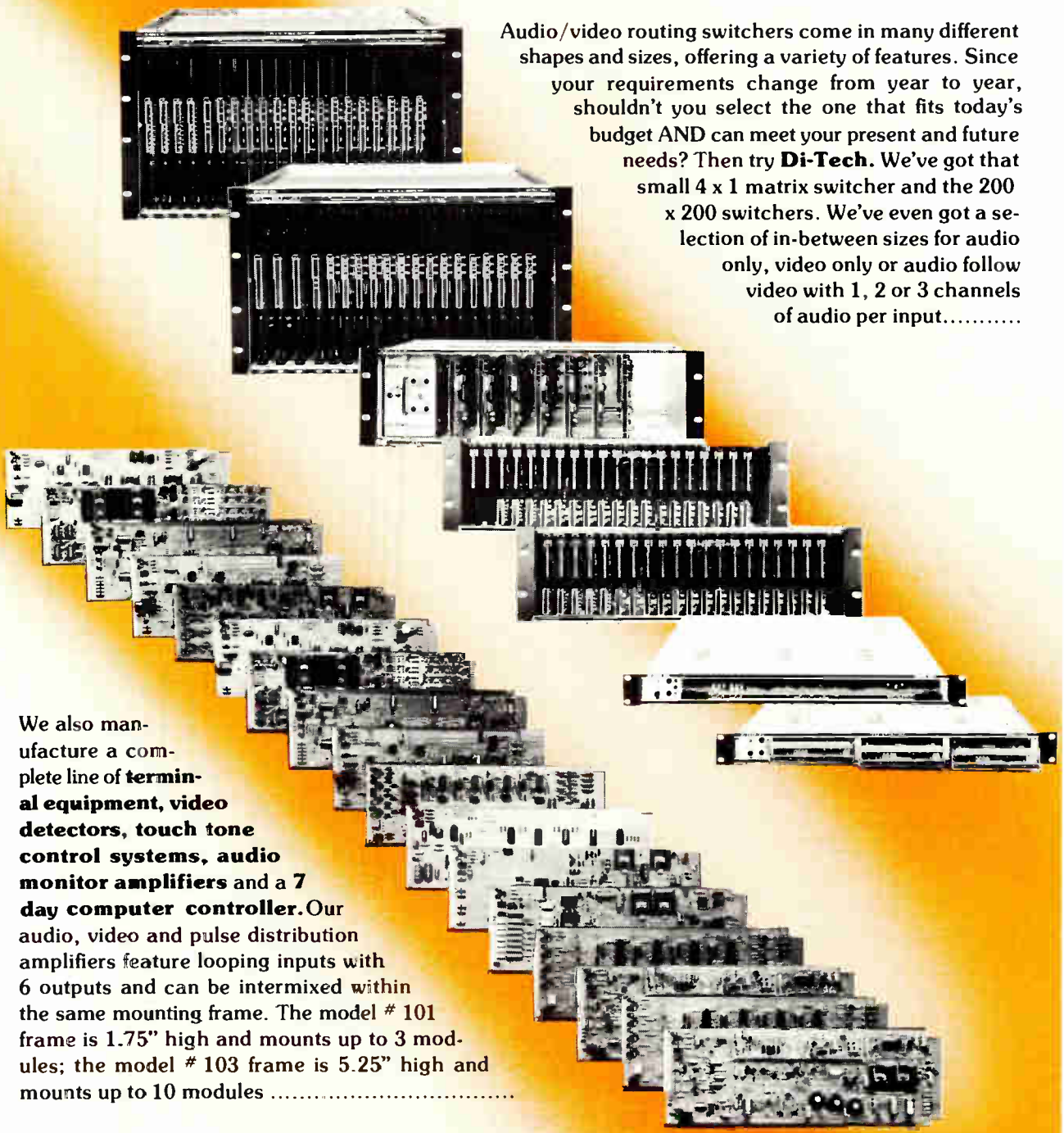

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Reader Service Number 28

Headend noise and multiple agile modulators

Extensive research conducted by Channel Master concerning the subject of picture quality in CATV systems has resulted in the following test information and subsequent conclusions. Primarily, the subject of agile modulators will be addressed, with focus on their usefulness in a CATV headend, and the noise problems associated with multiple unit applications in a system.

Throughout this report, references will be made to in-channel noise, measured within each CATV channel between video and audio carriers. In this case, video must be removed to make an in-channel measurement. Out-of-channel noise is measured outside the active channel of interest; below video or above audio carriers. All carrier-to-noise (C/N) measurements stated are standard 4 MHz CATV measurements.

Of interest is the discovery that agile modulators produce large amounts of broadband noise. This noise power is increased when more than one agile unit is used, degrading the overall headend quality. The information presented is neither a recommendation nor a condemnation of any manufacturer or equipment, as only standard measurements and theories will be quoted.

By Randy Karr, Applications Engineer, Channel Master

Channel Master test provides interesting conclusions.

Test

1. A Jerrold Commander IV modulator was tested. At 60 dBmV output, the in-channel (4 MHz) C/N ratio measured 64 dB. The out-of-channel C/N ratio was unmeasurable, but greater than 100 dB. This is understandable since the output of this modulator is filtered by an internal bandpass filter.

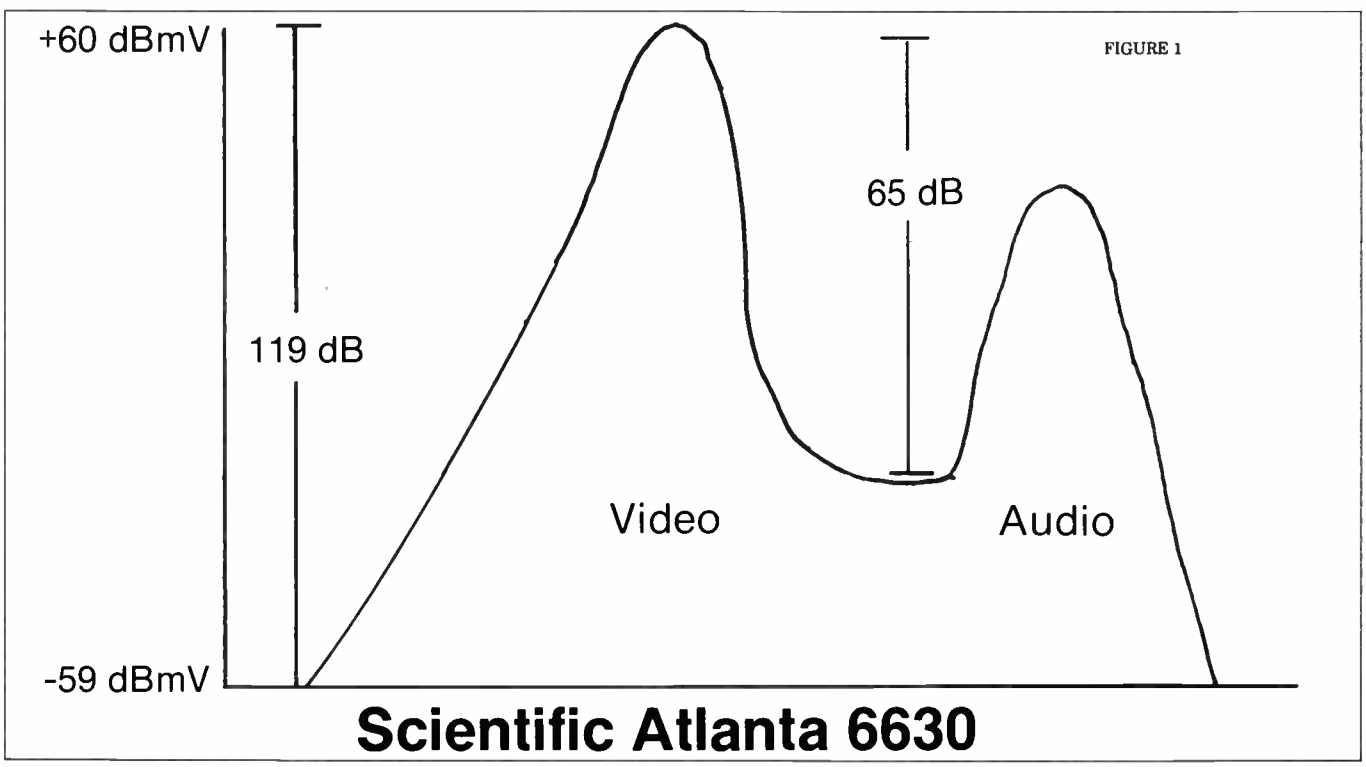
2. A Scientific-Atlanta modulator Model 6330 was tested at +60 dBmV output. The in-channel C/N ratio was 65 dB. The out-of-channel C/N was in excess of 100 dB. This out-of-channel ratio is also due to a good internal bandpass filter.

3. An Electrohome Model SM-36 agile modulator was tested at +60 dBmV output. The in-channel C/N ratio was 57 dB. The out-of-channel C/N was 68 dB. This amount of noise is understandable since the output stage of the Electrohome is a broadband amplifier and not a bandpass filter.

A C/N ratio of 57 dB is below the NCTA recommended headend ratio of 60 dB. However, it is good enough to deliver pictures with a very low amount of visible noise. Tests at the Channel Master Engineering Lab showed very slight noise on color test bars using all three modulators.

In addition to standard spectrum analyzer tests, the Electrohome modulator was checked on a standard CATV field strength meter. With the modulator output on CATV channel 7, a channel 11 bandpass filter was hooked to the output (to prevent overload), which was input to a SAM III field strength meter. The SAM showed a noise floor on channel 11 of -15 dBmV

FIGURE 1



Of primary interest was the -8 dBmV broadband noise floor of the Electrohome model.

and -8 dBmV when the C/N switch (4 MHz correction) was used. Therefore, the output minus the noise floor equals the C/N; +60 - (-8) = 68 dB C/N verified earlier tests.

Discussion

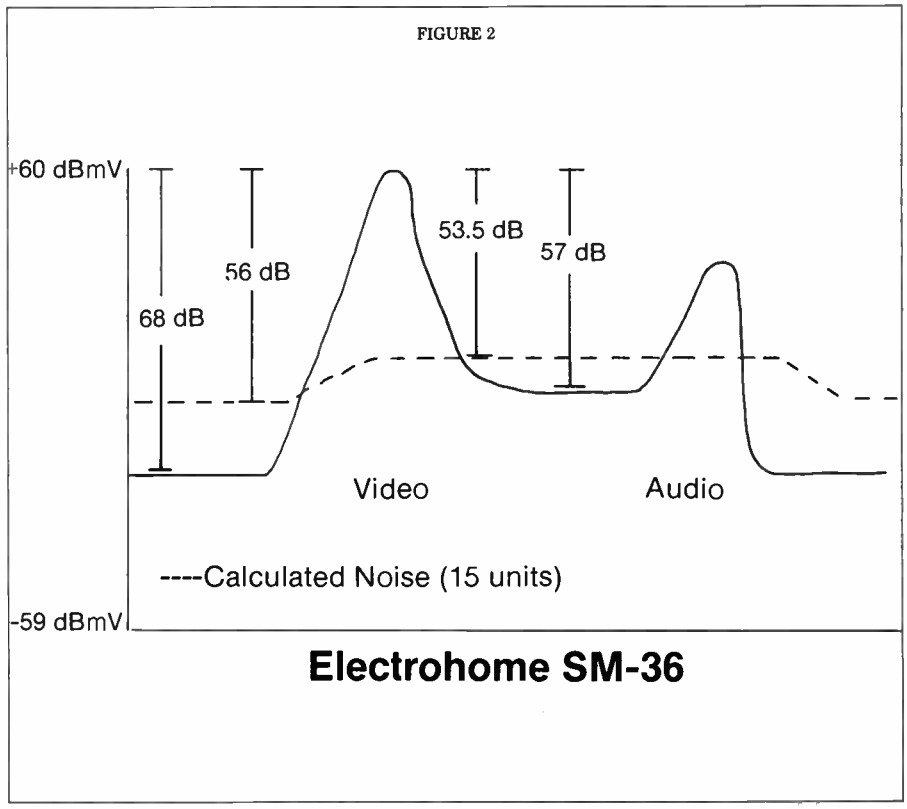
Typical headend quality C/N ratios (4 MHz) are in excess of 60 dB. This is the ratio of the output of any video carrier, to any place on the noise floor (either in-channel or out-of-channel). This is a direct result of using processors and modulators with reasonable noise figures and excellent output bandpass filters. Single feed satellite signals from a 5-meter earth station combined with 60 dB C/N ratios will provide excellent picture quality.

Of primary interest was the -8 dBmV broadband noise floor of the Electrohome model. This noise was measured from 50 MHz to 350 MHz. The Electrohome modulator was found to be adding broadband noise to every channel checked. The amount of noise added would not be a problem in the event only one Electrohome modulator was used.

However, the noise output of braodband amplifiers will add together as power or 10 log addition. Consider this example: 15 broadband amplifiers (or modulators) hooked to a combining network (10 log(15) = 11.8 dB of added noise and 68 dB - 12 dB = 56 dB). This concludes that no channel in the headend can be better than 56 dB C/N. This 56 dB broadband C/N will add to each channel's in-channel C/N ratio. The 57 dB in-channel C/N ratio of the agile modulator will combine with this 56 dB broadband noise to yield a 53.5 dB in-channel C/N.

The 53.5 dB headend C/N ratio is 6.5 dB below NCTA recommendations and becomes noticeably noisy on color bars. All of these calculations assume the video signal-to-noise ratio provided by the satellite receivers to be high enough to provide noise-free video.

FIGURE 2



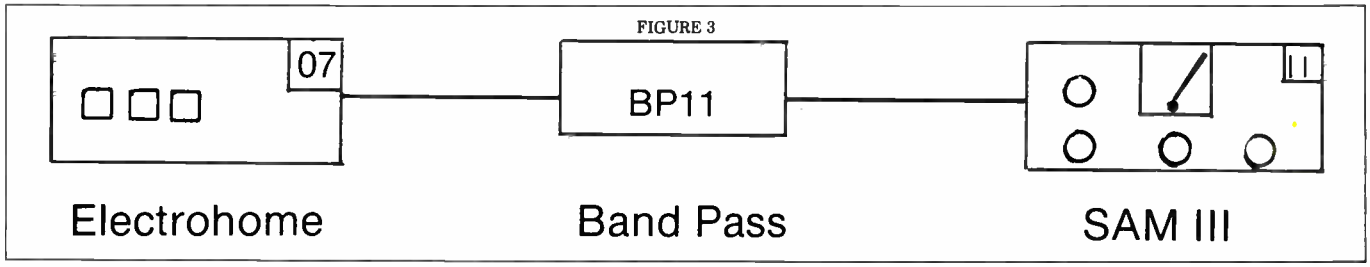
Recommendations

In order to reduce the broadband noise contributed by multiple agile modulators, bandpass filters could be added to each output. This would eliminate the 12 dB of combined noise and preserve the 57 dB C/N ratio of each agile modulator.

NOTE: Utilizing an A-B comparison of equipment is an unfair test as long as the broadband noise source of several agile modulators is present. A simple method of checking noise degradation would be to look at a high quality off-air signal; perhaps a live feed or color bars, and then turn off all of the agile modulators at once. This would have the same effect as adding the bandpass filters.

Finally, the quality of the video output from the satellite receivers should be checked. Many systems are now utilizing multi-feeds from one satellite dish. Not only do multi-feeds drain the C/N and signal-to-noise ratio, they are also likely to have cross-polarity and even adjacent satellite interference. These combined effects result in poor video signal-to-noise, causing streaks and even sparklies to appear in the picture. ■

FIGURE 3



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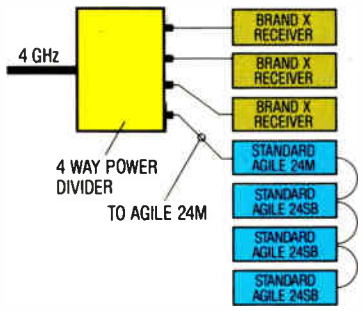

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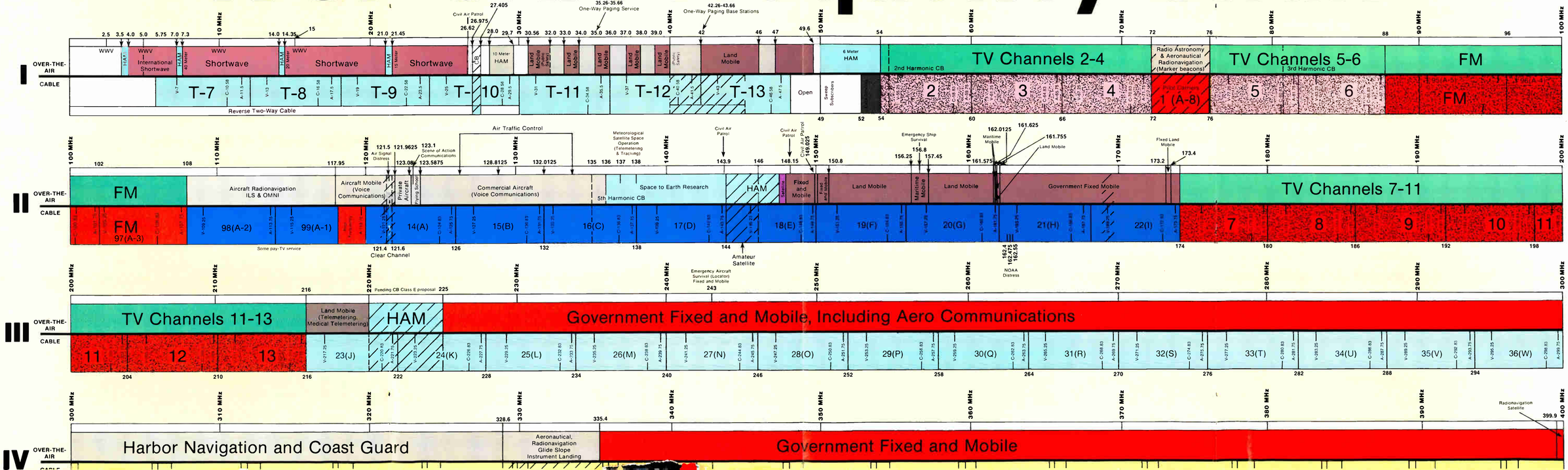
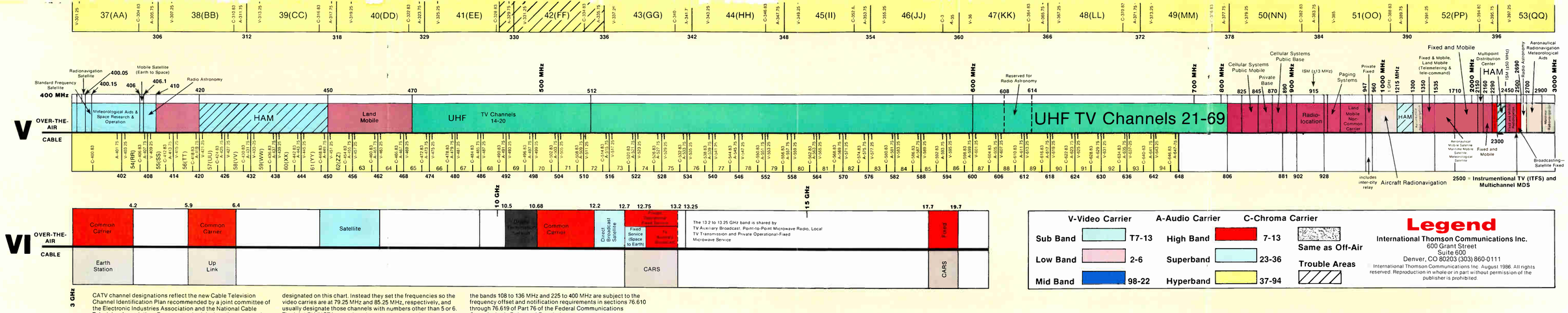
1987 CATV Frequency Chart



1987 CATV Frequency Allocation Chart

Special Pull-out Section



CATV channel designations reflect the new Cable Television Channel Identification Plan recommended by a joint committee of the Electronic Industries Association and the National Cable Television Association. Former standard designations appear in parentheses. It should be noted that some manufacturers using phaselock IRC channel spacing avoid using Channels 5 and 6 as designated on this chart. Instead they set the frequencies so the video carries are at 79.25 MHz and 85.25 MHz, respectively, and usually designate those channels with numbers other than 5 or 6. The joint EIA/NCTA committee has not chosen to give these channel spacings any numerical designation.

Also note that CATV channel designated carrier frequencies in the bands 108 to 136 MHz and 225 to 400 MHz are subject to the frequency offset and notification requirements in sections 76.610 through 76.619 of Part 76 of the Federal Communications Commission's Rules and Regulations.

V-Video Carrier		A-Audio Carrier		C-Chroma Carrier	
Sub Band	T7-13	High Band	7-13		Same as Off-Air
Low Band	2-6	Superband	23-36		Trouble Areas
Mid Band	98-22	Hyperband	37-94		

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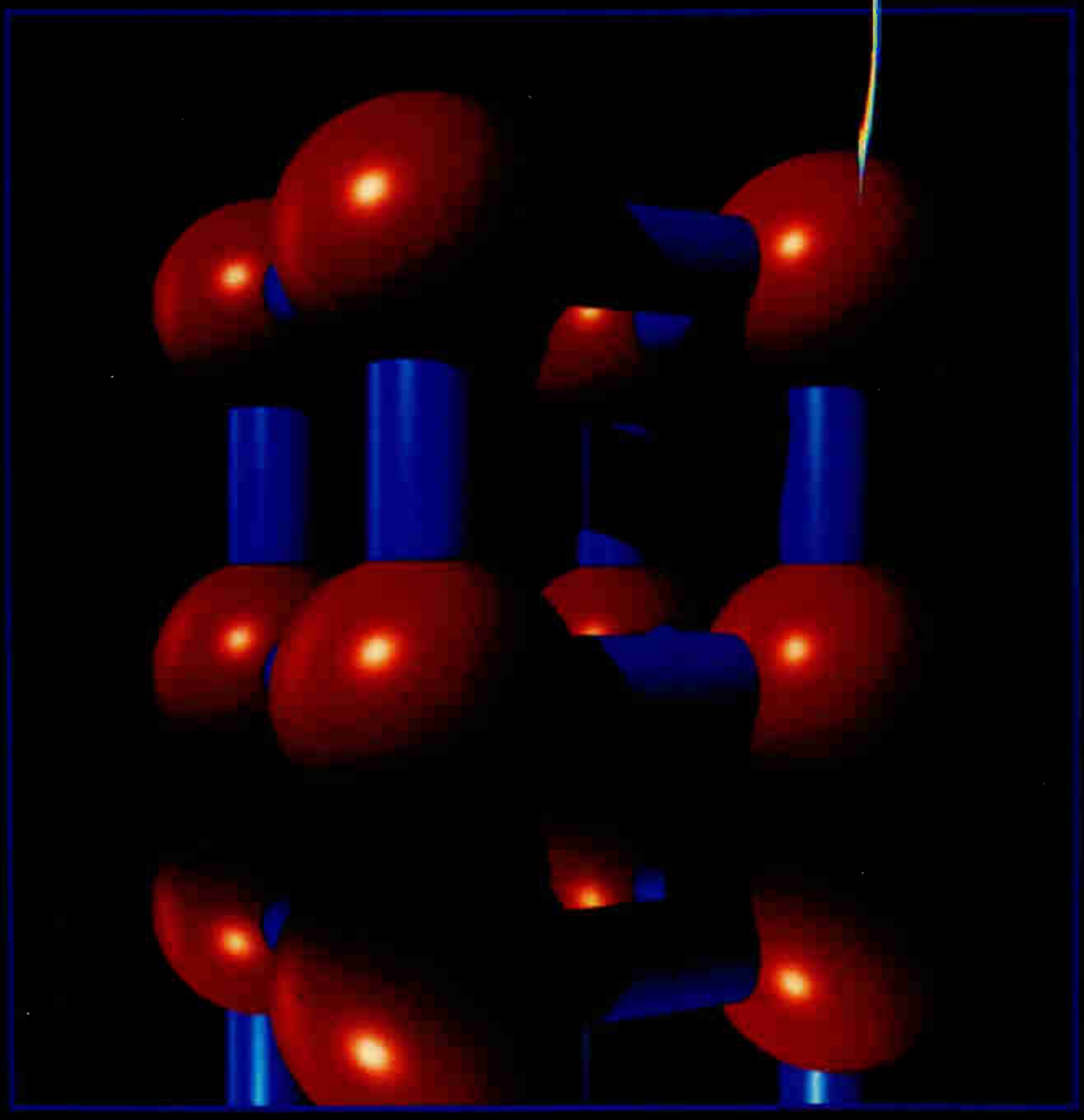


Broadband cabling suppliers

Here's a roundup of LAN cabling suppliers and their products.

Broadband LAN trunk cables range in size from 0.412 to 1.000 inch in diameter and, generally speaking, cables 0.500 inch or larger are used for LAN trunks. Feeder cables commonly are jacketed or unjacketed 0.500-inch aluminum. Drop cables typically are RG-11, RG-6 or RG-59 and have foil and braid shielding to prevent egress or ingress of RF energy. Keep in mind that current National Electrical Code rules recommend the use of flame retardant and low smoke producing jackets such as Teflon or conduit for plenum or riser applications inside buildings. Actual regulations will vary from locality to locality and are subject to the local electrical inspector's interpretation of those codes.

Trunk cables are available in five typical categories. Plain cables have no PVC jacketing over the aluminum sheath. Jacketed cables add a PVC layer for protection. Jacketed cables designed for burial in the ground would add a flooding compound to reject moisture. For aerial applications, an integral support cable (messenger) would be added. When ruggedness is a primary concern, armored and jacketed cables are available.

Most trunk cables use foam as a dielectric. Trilogy Communications, however, uses air as the dielectric material. Capscan (a division of Burnup & Sims), Times Fiber and General Instrument/Network Cabling Division manufacture trunk, feeder and drop cables. Trilogy makes trunk and feeder cable. Belden specializes in drop cabling.

The bending radius of unarmored foam dielectric trunk cables ranges from about 6 to 14 inches. Armored versions will run between 9 and 17 inches. Air dielectric cable is insensitive to the effects of armoring and jacketing. Bending radius for air dielectric cable runs from 5 to 13 inches. The velocity of propagation for foam cabling is about 87 percent. Air dielectric provides about 93 percent.

Drop cable specifications normally include provisions for a high degree of shielding to prevent signal ingress or egress. Basically, four types of drop shielding are used: braids, laminate foil tapes with a braid on one side of the tape, laminate foil tape with a sheath on both sides of the tape, and what Times Fiber calls Quadshield (a tape-braid-tape-braid shielding).

Transfer impedance, one measure of shielding effectiveness, relates a current on one surface of the shield to the voltage drop generated by this current on the opposite side of the shield. The lower the impedance value, the better the shielding. At 100 MHz, for example, values can run between 48 and 0.1 miliohms per meter. RG-59 cable with a 96 percent braid, at 300 MHz, has a transfer impedance about 1,000 times greater than a cable with sealed foil of 60 percent, braid foil of 40 percent, according to Times Fiber.

The quality of shielding is especially important as frequency increases from 300 MHz to 400 MHz because shielding effectiveness decreases as frequency increases. Times Fiber once conducted a study on outdoor drop cables, some of which had been in continuous use for 23 years. The most significant aging effect noticed was a deterioration of shielding effectiveness. Foil-braid-foil had the lowest leakage and the best shielding performance.

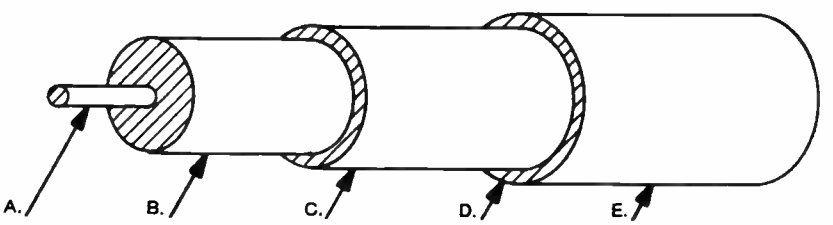
Center conductor materials typically are copper-clad aluminum, although solid copper conductors are available. Above 5 MHz, both exhibit equal electrical properties. Copper-clad aluminum is lighter, cheaper and has better structural return loss characteristics, though.

Suppliers

General Instrument's Network Cable Division is a major manufacturer of 75-ohm, 50-ohm, 93-ohm and 100-ohm cabling and makes them in four major categories. Its RG spec cables are based on military specifications, but modified. Its commercial cables use reduced braid. Its Mil-Spec Type cables are made to full military standards but not fully QPL tested. The Mil-Spec cables meet all government QPL standards.

Its broadband product line includes both trunk/feeder and drop cable. Drop products come in plenum and standard, single and dual (two drops connected by a web) versions. Trunk cables come in jacketed and unjacketed versions in

FIGURE 1



A. CENTER CONDUCTOR: Centermost feature of coaxial cable, it consists of solid cooper or copper clad aluminum wire.

B. DIELECTRIC: Electrical insulation utilized to maintain position of the center conductor. It is composed of foamed polyethylene. This insulator/positioner may also be evenly spaced polyethylene discs.

C. OUTER CONDUCTOR: Is constructed of an aluminum tube. The cable size (412, 500, 750 & 1000) is derived from its outside diameter.

D. FLOODING COMPOUND: (OPTIONAL) A viscous substance placed between the outer conductor C and the jacket E to maintain a protective seal should the jacket E contain or develop any cuts or openings.

E. JACKET: (OPTIONAL) A black polyethylene coating over the aluminum outer conductor to provide a weather-tight seal.

Terminology for Coaxial Trunk Cable

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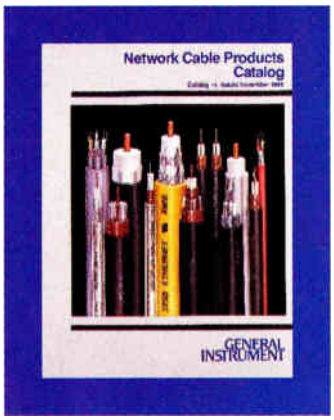

Data and computer interconnect cables for most applications are also readily available. New introductions include trunk and distribution cables for the fast expanding MAPS (factory networks) market and carrier band applications. Most cables are stocked in standard PVC or high temperature plenum designs. So get cable ready. Contact the company that is ready to meet your cable requirements —General Instrument. Call or write today for a free *cable ready* catalog or for distribution information.

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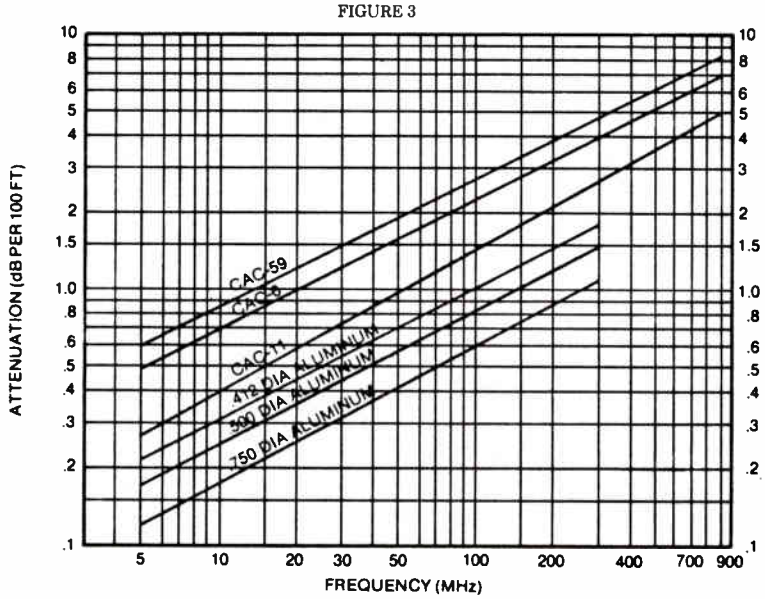
Reader Service Number 34

Special corrosion resistant or armored trunk and feeder cables are also made by General Instrument.

FIGURE 3



Cable Attenuation Versus Frequency for Various Sizes of Coaxial Cable

0.500- and 0.750-inch versions. Drop cable comes in braid, foil-braid, Trishield and Quadshield construction, in RG-59, RG-6, RG-11 and video broadcast versions. Special corrosion resistant or armored trunk and feeder cables are also made by the company.

The company also is emphasizing Manufacturing Automation Protocol (MAP) and Technical and Office Protocol (TOP) applications for its cabling, in particular recommending RG-6 and RG-11 spec cables for MAP or TOP networks. Quad RG-6 and Plenum Quad RG-6, as well as Quad RG-11, Plenum Quad RG-11 and Armored Quad RG-11 are available. These cables use copper clad steel center conductors, quad shielding, and meet all industry crush, twist and bend standards. Contact Network Cable Division, (800) 982-1708 or (704) 324-2200.

Times Fiber Communications makes three families of cable. The T4 family of trunk and feeder cables runs from 0.412 to 1.000 inch; the Drop Series

Structural return loss testing, a measurement of cable integrity, normally is done to cabling prior to shipping.

includes RG-59, RG-6, RB-611, RG-11 and headend cable; and plenum drop cables (59, 6 and 11). The TX series is designed for very low loss applications, and includes 0.565, 0.840 and 1.160 cables in jacketed, jacketed and flooded, armored versions.

T-4 trunk and feeder cables are available in aluminum sheath, jacketed, jacketed and messengered (0.412, 0.500 and 0.625 inch), jacketed for burial and jacketed and armored versions.

The RG-59 and RG-6 Standard and Premium drop cables use foil and braid shielding. The Trishield versions use tape-braid-tape construction. The Quadshield versions use tape-braid-tape-braid construction. The 611 and 11 series of drop cables come in two versions: Standard with foil-braid shielding and Quadshield. Single, messengered, flooded, Siamese (two cables attached by a web) and Siamese messengered (two cables attached by a web and including a messenger) versions are available. The Siamese versions are particularly good for dual cable plant. Contact, (203) 265-8500.

Capscan, a division of Burnup & Sims, has a CC line of Super Low-Loss trunk cables, available in aluminum sheath, jacketed, jacketed for burial, jacketed and messengered or jacketed and armored versions from 0.412 to 1.000 inch. The company's drop cable line comes in two major families, Coaxial Drop and Quad Shield. The Coaxial Drop line uses a tape-braid shielding. The Quad Shield uses tape-braid-tape-braid. Contact Capscan, (800) 222-5388 or (201) 462-8700.

Belden specializes in drop and network cables of every sort: fiber optic, Ethernet, AppleTalk, triaxial, twinaxial, CB, audio, ribbon cable, instrumentation, RS-232, RS-422, RS-423, RS-485 and military spec, for example. For broadband applications, the company is known for its high-quality drop cables. Belden uses a foil-braid-foil construction with a shorting fold in the outermost foil to provide better transfer impedance performance than some four-layer shields. In addition, Belden bonds the inner foil to the jacket, making it easier to strip and connectorize the cable. Structural return loss testing, a measurement of cable integrity, normally is done to cabling prior to shipping, typically over the entire 5 MHz to 450 MHz bandwidth. Desired specs are a minimum of 23 dB return loss for RG-59 and 26 dB for RG-6 cables. Contact Belden, (317) 983-5200.

Trilogy Communications specializes in trunk and distribution cables using air dielectric. Its MC^2 line runs from 0.440 to 1.000 inch in diameter and offers both solid copper and copper clad aluminum center conductors. New from the company is a 0.500-inch plenum cable, the Fused Disc MIII, meeting National Electrical Code guidelines for flame and smoke retardance. Contact Trilogy, (601) 932-4461.

—Gary Kim

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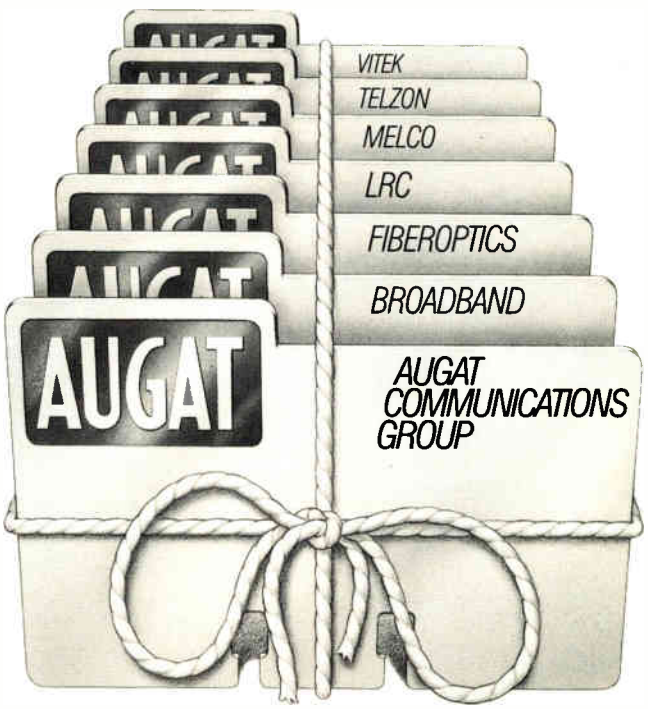


Reader Service Number 37

Ingress—sources and solutions

Signal leakage problems occur frequently, here's what to do about them.

Ingress, as far as the CATV community is concerned, is the entrance into a cable system of any undesired external radio source. Ingress will occasionally be in the form of static or electrical noise, but it is normally considered to be interference from a radio frequency signal.

Ingress is the opposite of egress, or system radiation. The principle by which both phenomena operate is the same, related by the principle of antenna reciprocity, which is that antennas transmit and receive equally well.

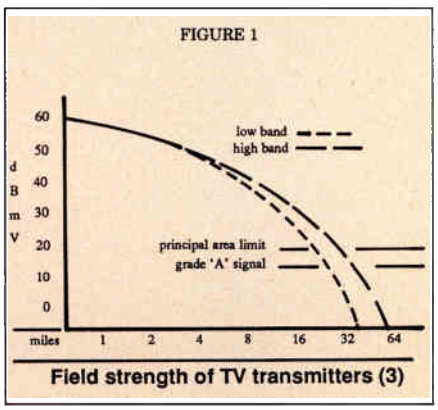
Interference due to ingress can be classified into two basic forms, either co-channel or discrete carrier. When there are one or more local VHF TV stations located near a cable system which uses a channel occupied by one of these VHF stations, there will without doubt, sooner or later, be need to correct co-channel interference between the two. Discrete carriers from communications transmitters will cause problems on mid-band and super-band cable channels. As communications transmitters include everything from car phones and personal pagers to amateurs and the National Weather Service, discrete carrier ingress can occur anywhere and often at random times.

Cable systems near the VHF TV transmitters of a large city are the systems that will likely suffer from co-channel ingress-related problems. At two to five miles from a full power TV transmitter it is not uncommon to have a field strength of 35 dBmV to 40 dBmV or more, very often 25 dB more than what is inside the cable. Levels from TV transmitters as far away as 30 miles may exceed the average levels of a CATV plant. Beyond that range, the effects of ingress-related co-channel interference become less noticeable.

How does ingress get in?

Ingress gets into the cable system by way of poor shielding and faulty connections. The cable acts as an antenna and will have currents from external radio fields induced onto its shield. Electron flow, or currents, of radio frequency energy, happens only on the surface of a conductor. Under normal conditions, the cable signal energy flows on the inside surface of the shield and broadcast radio signals flow on the outer surface of the shield.

FIGURE 1



Field strength of TV transmitters (3)

A " hole" in the shield will join the two surfaces, allowing undesired currents to flow both out and in. Unbalanced current flow between the shield and center conductor of the cable will cause the undesired signal to be added to the cable signal.

Experience has shown the most common point of ingress to be a slightly loose connector. The connection may be just loose enough to permit air molecules to permeate between the threads and, given time, form a layer of corrosion. The improperly made connector will also permit gasses to corrode the aluminum of the shield itself, forming aluminum oxide, a poor electrical conductor. Corrosion will create a point of resistive and/or capacitive nature in the shield of the cable. This breakdown of the outside conductor is the unwanted hole in the shield.

Theory and experiment show that a mismatch on the inner conductor will not permit signals to enter the cable, only the signals inside the cable already will be affected. This can be demonstrated by cutting the center conductor short at a splice in the middle of a section of drop. The isolation is as good as the shield in this experiment. It can also be demonstrated that a single crack or hole in the shield, not completely around the cable, is in itself not a significant source of ingress. However, when the small cracks are spaced at regular distances, an effective amount of energy is transferred into the cable (as well as out).

Improper handling or installation of drop cable can cause periodic cracks in several ways. One common way a flaw may arise is when a staple gun, faulty itself or improperly used, causes a severe sharp dent in a drop wire as the staple is fired. Even though the outer shield is not actually pierced by the impact, a small crack might be created. A series of a dozen or so of these, regularly spaced 18 to 20 inches apart, can reduce the shielding of a drop, down from a nominal 90 dB, to only 50 dB or 60 dB of isolation at mid-band frequencies. Periodic bumps and cracks in drop cable can also be caused by roughly pulling the wire from boxes and reels, or flexing the cable sharply around corners, although the observed occurrence of this type of failure is rare.

One way the largest amount of unwanted signals can be transferred into the cable is by a total discontinuity of the shield due to radial cracks. Faulty connections are similar to these radial cracks. A radial crack all the way around the cable shield will typically reduce the cable signals by about 10 dB to 12 dB, implying, in the worst case, as low as 3 dB isolation between the outside and inside of the cable. On the other hand, a typical "bad" connector might reduce the isolation to 40 dB, with less than 1/10 of a dB reductioin in cable signals.

Compared to defects created by bad connections, the amount of shield provided by the wire itself is of minor importance as far as ingress is concerned. With trunk and feeder lines, the shielding is complete as possible, with more than 110 dB of isolation often the case. Flexible drop wires with foil shields under a wire braid, the type used by the cable industry, typically

By John W. Ward Jr., Comcast Cablevision of Montgomery County Inc.

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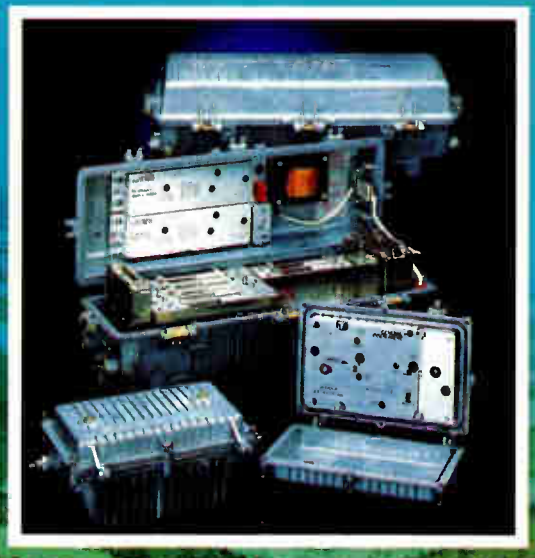

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Reader Service Number 38

It is often difficult to distinguish between faint interference and the symptoms of amplifier distortion.

are rated with 85 dB to 100 dB shield isolation.[1] The ability of the cable shielding to physically withstand handling and to survive the elements is of more importance when selecting drop cable of this quality than the shield factor itself.

The shielding factor of the drop cable becomes significant when non-standard wire is used, such as a situation in which a house has been wired by a customer using his own wire. The shield for this wire can be as low as 50 dB for wire with a heavy braid, 35 dB or so with typical 40 percent braid shield wire. Also, aside from the poor shield, it is almost impossible to make a proper connection to these wires as the dimensions vary greatly from type to type and it is next to impossible to find a proper fitting. The fitting must not only pass signals but must properly seal the shield from ingress as well as survive through time.

Other parts of the cable system responsible for ingress are loose amplifier covers and tap plates. Although experience is that an amplifier housing must be open and the amp's module cover almost off in order to get a significant amount of ingress into the cable itself, amplifier covers must not be ruled out.

Tap plates, however, especially when drops are connected to them, are crucial points of shielding breakdown in the feeder system. The RF shield around the edge of a tap plate can only work well when making a good pressure connection to the housing plate.

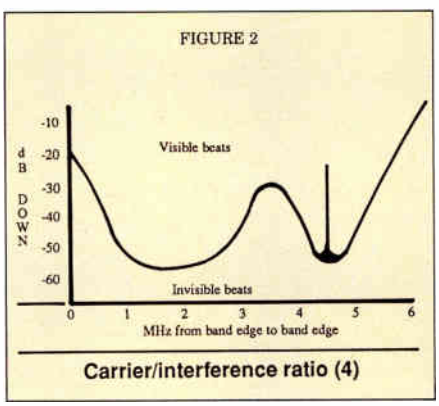
Loose tap plates, with contaminants between the plate and the housing will cause a discontinuity to occur between the drop shield and the shield and the shield of the feeder cable, allowing ingress into the drop and to a lesser extent, into the feeder itself. Even when the tap plate is tight, corrosion due to moisture is frequently a problem as the RF gasket is located at the point of maximum water accumulation as the tap hangs on the feeder line. A very thin layer of waterproofing grease will aid in preventing this problem. A word of caution is needed here: over zealous tightening of tap plate screws will lead to stripped housing threads; clutch type torque drivers are recommended.

Studies have indicated that an unterminated tap port will provide greater RF isolation than a terminated tap port.[2] The terminator itself is a connector and hence subject to the inevitable natural corrosion of the connector threads. As the outer shell loses its ground connection, the terminator becomes a stub antenna and hence a point of ingress into the cable system. The port-to-port isolation of a two-way splitter is normally about 25 dB and a stub antenna about an inch and a half long will pick up as much as 0 dBmV of signal near a high band VHF TV station. A strong to moderate interference is observed on drops connected to adjacent tap ports.

Troubleshooting

It is often difficult to distinguish between faint interference and the symptoms of amplifier distortion. However, if the interference is strong enough to cause a heavy beat, it may generally be assumed that if an amplifier was emitting a spurious product strong enough to be clearly visible, it would probably have other by-products on adjacent channels. If you have a problem with beats on one channel only, it will most probably be ingress related; a quick check of other channels will provide an answer. Also, high signal levels at a customer's set will likely indicate amplifier distortions as a cause of beats, for as the levels go up, the probability of distortion increases and problems from ingress decrease.

FIGURE 2



In an area where it is expected that there will be a sufficient number of ingress calls to warrant it (an area where there are many local TV stations, etc.), it may prove very practical to leave the channel of the station most likely to leak into the system empty. The empty channel will provide a convenient way to determine the degree of system integrity.

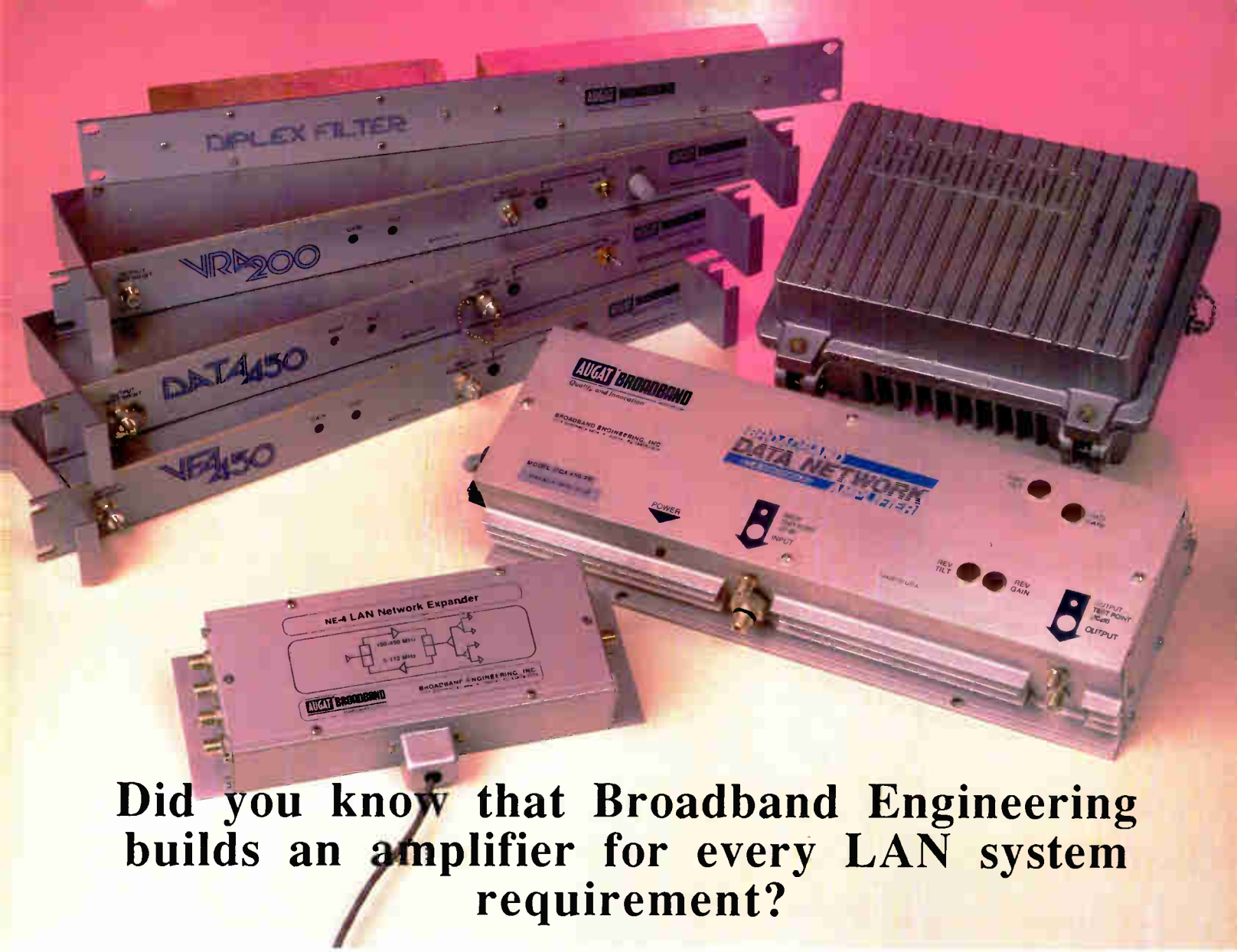
Measurements of a local station leaking into the cable on a channel not occupied by any cable channel, when compared to the levels of an adjacent cable channel, will provide a good indication of the signal-to-interference ratio between other local TV stations and cable signals. If the television set or converter is tuned to the channel of the local station not on the cable and a noisy but steady picture is present, a faint ghost or beat on another channel will almost certainly be caused by ingress.

The point at which the ingress first enters a feeder system can also be measured quickly by making signal/interference readings at taps, via the unused channel method.

If it is necessary to maintain a signal-to-interference ratio of 50 dB or more between a local transmitter and a channel used in a cable system, then the levels of the unoccupied cable channel of the local TV transmitter should be -40 to -45 dBmV at the input to the set or converter. This is near or below the lower limit a normal field strength meter can read, so any deflection of the meter scale with attenuation fully down is desirable. If the video buzz cannot be heard at all, or if system generated beats at the extreme range of the meter's sensitivity are heard instead, then the service technician can be assured the ingress problem is not coming from the upstream portion of the drop or feeder. The test becomes more valid as cable signal levels increase, and, as an aside, provide rough measurements of system noise.

Another practical troubleshooting practice is to disconnect the section of a suspected bad drop or feeder leg and measure the level of the local transmitters directly out of the downstream leg. This permits a direct comparison of the signal-to-interference ratio to be made at any frequency desired when the levels of the cable signal at that point are known.

By disconnecting different sections of a drop at a splitter and measuring ingress levels from each, a fast and sure troubleshooting decision can be made. Readings from a disconnected



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Reader Service Number 39

With this equipment, and little or no training beforehand, a technician will almost be able to walk right up to a defect causing ingress.

section of drop, terminated at the other end, will indicate if a drop is good or if it must be serviced or possibly replaced. A drop cable in service should typically be capable of 70 dB or more isolation, so any detectable levels inside the drop would indicate the necessity for service.

As the drop is connected to the field strength meter, first insert only the center conductor of the drop in the meter, then tune to the source of off-air interference and read the level (often close to or more than what is read with a dipole at the same location). If you then tighten the drop on the meter and turn the attenuator all the way down, a good indication of drop integrity can be made.

If an amplifier with a gain of 20 dB is placed between a good, terminated long length of drop and a meter, in an area where the field strength is 40 dB or more from off-air transmitters, it is just barely possible to detect the local transmitter above the noise floor, indicating a 90 dB shield or better for the drop (and the test equipment, too).

The only other practical way to detect the source of ingress is to make use of the various sensitivity radiation detectors currently available from several manufacturers. Just as ingress gets in cable, signals leak out and can be detected. With this equipment, and little or no training beforehand, a technician will almost be able to walk right up to a defect causing ingress.

Sensitive equipment capable of detecting radiation levels 15 dB to 20 dB below the FCC radiation threshold of 34 dBmV is required. A shield factor of 60 dB or more should be maintained in drops when both the field strength of the local transmitter and the signal level in the drop are 5 dBmV.

Standard dipoles and meters are difficult to handle as troubleshooting aids, and very often unable to detect faint radiation from points which are, nevertheless, permitting noticeable ingress interference. In areas of strong radio interference, even the more sensitive equipment is sometimes incapable of finding faint radiation from leaks permitting severe ingress, for example in drops when cable signals close to 0 dBmV and the local transmitters are above 20 dBmV at that point.

Acknowledgements

Special thanks to all the service technicians who helped gather the data and who came up with some good fixes, too. ■

1. Belden Corp., CATV Cable Catalog # EL10-79, Oct. 1979, pp. 15-18.
2. Reg James, Comcast Corp. staff engineer, from a report, July 1982.
3. Based on FCC Rules and Regulations, Vol. III, part 73, pp. 189-191, 1972. From *Reference Data for Radio Engineers*; Howard W. Sams & Co., 1979, p. 30-12.
4. Based on Jerrold *CATV Reference Guide* #RD-14, April 1983, p. 36.

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Reader Service Number 41

New LAN products featured every month

Zeta's new Z64 modem.

Zeta Laboratories, which has shipped 10,000 RF modems over the past three years, has three new broadband modems. The Z19A is available in synchronous or asynchronous modes and operates at 19.2 kbps. A new feature is the improved clock recovery circuits, which allow connection to T1 and other multiplexers where the Z19A is externally clocked. Also new is the Z19V data/voice modem that takes data up to 19.2 kbps or voice and audio signals in the 300 to 3,000 Hz range. The new model Z64 operates at 64 kbps and uses the same external and 'slave' clocking features as the Z19A.

A new headend translator, the model ZC85, also is available. A rack, redundant and non-redundant power supplies and multiple-modem assemblies housing up to 64 modems fit in the single, six-foot-high cabinet. The Augat Communications Group's Broadband Communications division supplies the translator. For details circle reader service number 75.

Chipcom Corp., the Waltham, Mass.-based supplier of Ethernet over broadband products, has introduced the Ethermodem III/12, which operates over a 12 MHz bandwidth. Its predecessor is the Ethermodem, which requires 198 MHz bandwidth to operate. The product is designed for broadband network users with limited bandwidth. The new product, along with its companion Ethermodem III/12 remodulator, allows the running of two Ethernet networks along with a Manufacturing Automation Protocol network simultaneously on a single cable plant. In single quantities, the two-port version of the modem costs $5,250; the eight-port version $6,350. The III/12 remodulator costs $7,500. For details circle reader service number 76.

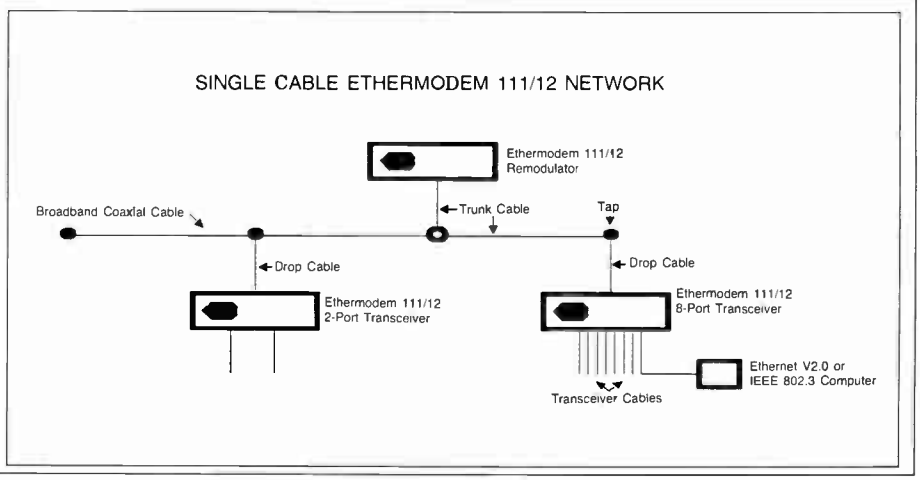
Beltsville, Md.-based broadband LAN supplier and designer Kee **Inc.** has changed its name to **LANEX Corp.** The company's product line now includes bus interface units (modems) running asynchronously to 19.2 kpbs (rack-mount and standalone versions); a synchronous modem operating to 64 kbps; and a synchronous BIU specifically used for supporting IBM 3270 environment terminals.

A gateway linking LANEX LANs with the public telephone network and a bridge that switches traffic on the network between frequencies also are available. The firm's network monitoring system includes amplifier monitoring (interfacing with C-Cor Electronics' "Quick Alert" system); traffic analysis; BIU status monitoring; network configuration reporting, changes and control and remote downloading of software to all BIUs.

A new product is an infrared link for short-range linking of two or more LANs over a 10-meter to one-kilometer distance. For details circle reader service number 77.

Concord Communications, the Marlboro, Mass.-based supplier of Manufacturing Automation Protocol (MAP) LANs, has a new Series 1300 VMEbus modem, connecting VMEbus (a current software standard for attaching controllers and other industrial automation equipment to factory networks) controllers to MAP networks. The Series 1300 is frequency agile over the three recommended MAP channel pairs (transmit at 59.75 to 71.75 MHz, receive at 252 to 265 MHz; transmit at 71.75 to 83.75 MHz, receive at 264 to 276 MHz; transmit at 83.75 to 95.75 MHz, receive at 276 to 288 MHz). The Series 1300 costs $1,150 and is available 60 days ARO (after receipt of order). Concord currently has systems running in over 150 manufacturing plants around the world. For details circle reader service number 78.

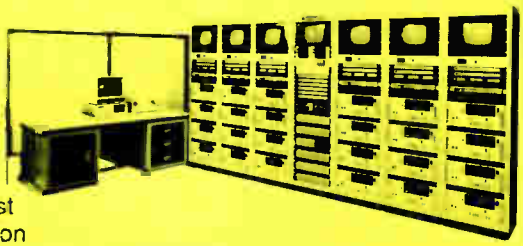
Turnkey LAN house **Allied Data Communications Group**, based in Norcross, Ga., has introduced the Mod-LAN, a small test bed-sized broadband network. Designed to meet the need many large end-users have to test actual broadband components and systems, Mod-LAN comes standard as a single- or two-trunk system, running 350 feet in the single trunk version, using flexible RG-11 cabling and no amplifiers. Generally speaking, an eight-port tap can be hung every 50 feet or so, allowing 56 outlets for NIUs (network interface units, or modems). Customers specify their own headend translators and modems. Depending on customer desires, Allied can ship the cabling and passives alone, install passives first and then ship the network cabling, or ship the headend, modem products and cabling network together. Allied also can test and certify the network or install it if desired. It basically is a product that allows testing of broadband active devices without requiring full installation of an entire network. A typical Mod-LAN costs $3,000 to $3,500 (exclusive of remodulators and modems). For details circle reader service number 79.



TV EQUIPMENT MARKETPLACE

SPOTMATIC™

You Can't Buy a Better Ad Insertion System



This is the system everyone thinks of when someone asks, "What is the most widely used random access ad insertion system?"

The fact is that there are more SPOTMATIC systems in use today than any other type of ad insertion system. The reasons are simple: high quality, proven reliability, unparalleled factory support, and an unmatched array of features.

- Completely modular for easy expansion as system grows
- Interfaces with optional Ad Manager™ billing and traffic software
- Expandable to 32 channels with 32 VCR's inserting ads
- Full random access or random pod operation
- Front-panel keyboard or optional personal computer control
- Complete turnkey packages available
- Quick delivery
- Broadcast quality vertical interval switching
- Automatic logging with advertiser-sorted printout
- Automatic bypass of malfunctioning VCR
- Automatic return to satellite in event of VCR or power failure

Channelmatic, Inc., 821 Tavern Rd., Alpine, CA 92001. Or phone (800)231-1618 or (619)445-2691.

BROADCASTER II™ PROGRAMMABLE VIDEOCASSETTE CHANGER

Access 15 cassettes to play in any order

- Uses one Sony VP-5000 series 3/4" VCR
- Easy to program, stores up to a full week's schedule
- Highly reliable mechanism uses no belts, chains, gears
- Suitable for broadcast, cable, industrial, educational, and government installations for any multiple-tape playback requirement

Channelmatic, Inc. 821 Tavern Rd, Alpine, CA 92001
(800)231-1618 or (619)445-2691

ADCART 2+2™

Like two systems for the price of one

A new concept in ad insertion allows low cost fully random access ad playback with one through four VCR's on one channel, two VCRs on each of two channels, or four VCRs shared between two channels. Features full stereo audio capability, preview bus, computer-adjusted audio levels, user-friendly CRT terminal interface for easy scheduling, advanced audio and video switching circuitry, front panel status display, and unlimited system expansion capability. Traffic and billing software available. Contact CHANNELMATIC, INC., 821 Tavern Rd., Alpine, CA 92001 (800)231-1618 or (619)445-2691

FREE CATALOG

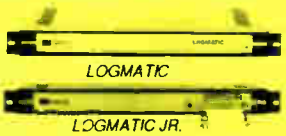
Write for our brand new catalog of television and cable system equipment. Everything from automatic ad insertion to playback systems to audio and video switching to signal processing and control.

Complete product line listing with photos, block diagrams, and comprehensive descriptions and specifications. Enough detail to spec out your own custom system. Catalog will become a valuable reference. And it's yours just for the asking. Write, call, or circle the bingo number. But do it soon.

Channelmatic, Inc. 821 Tavern Rd. Alpine, CA 92001
(800)231-1618 or (619)445-2691

ARE YOU THROWING MONEY AWAY?

Losing verification data is just the same as throwing money away, and who in their right mind would do that. Make sure when you run somebody's ad you get paid for it. The LOGMATIC™ and LOGMATIC JR.™ logging and verification systems always get their data when used in a system with SPOTMATIC JR. and LI'L MONEYMAKER low-cost ad insertion systems.



LOGMATIC

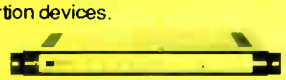
LOGMATIC JR.

The LOGMATIC contains a 4000-event memory and interfaces to an 80-column printer or to a PC for data retrieval. The LOGMATIC JR. has a built-in 20-column printer and real-time clock. It prints the event record as the event occurs. Both loggers feature automatic operation, and they record insertions on four channels.

Call or write for more information. You don't have to lose money for unverified spots. Channelmatic, Inc. 821 Tavern Rd. Alpine, CA 92001. (800)231-1618 or (619)445-2691.

NETWORK SHARE SWITCHER

- Inserts ads into four networks from one ad source.
- Inserts ads one network at a time on a first come, first served basis.
- Four Digital DTMF cue tone decoders.
- Four preroll delay timers one for each network.
- Composit sync out put to facilitate vertical interval switching.
- Cue tone decoder disable switches.
- Power fail relay bypass.
- Inputs and outputs for controlling ad insertion devices.



NSS-4A NETWORK SHARE SWITCHER

CHANNELMATIC, INC. 821 Tavern Rd. Alpine, CA 92001
(800)231-1618 or (619)445-2691

LIKE GETTING YOUR MONEY FOR NOTHING AND YOUR CHECKS FOR FREE

Make Money the Easy Way — Put either SPOTMATIC JR.™ or LI'L MONEYMAKER™ to work for you now. They are the lowest-cost tools you can use to automatically insert local ads into cable TV programming. You have one unit controlling one VCR to put ads on one channel. Equipment overhead is very low.

Switching occurs during the vertical interval for broadcast quality transitions. Once the system is programmed by the operator, it operates automatically.

The SPOTMATIC JR. has a built-in printer for verification records; however, both the LI'L MONEYMAKER and SPOTMATIC JR. inserters connect easily to a LOGMATIC™ logging and verification system. With optional software, this enables computerized data retrieval and automated billing and report generation. Write now to see just how little it takes to get into automatic ad insertion.

Channelmatic, Inc.
821 Tavern Rd., Alpine, CA 92001
(800)231-1618 or (619)445-2691

Does the high cost of monitor switchers have you behind the eightball? Then you need to

PUT AN EIGHTBALL™ UNDER YOUR MONITOR— 8x1 Very Low Cost Switcher

It is an integrated circuit-based monitor switcher featuring broadcast quality stereo audio and video switching. Lighted momentary contact pushbuttons are field-legendable. Its cost is far less than any other comparable unit on the market. Write or call for information today.

CHANNELMATIC, INC. 821 Tavern Rd Alpine, CA 92001
(800)231-1618 or (619)445-2691

Commercial insertion

AD Systems Inc.

The Ad Lieutenant, Model ADL-100, from AD Systems uses one VCR to insert spots on a "first come, first serve" basis onto four satellite channels. Based on IBM-PC technology, the ADL-100 can be expanded to random access, four channel operation.

The Ad Commander 400R offers control of four VCRs to insert in break random fashion onto four channels. The unit features dual disk drives, an 80-column printer and log sort program. Also from AD Systems, the Automated Break Compiler ABC-100 automatically creates "on air" tapes for most types of insertion equipment.

For more information, contact AD Systems, (801) 263-1661.

Adams-Russell

The ARVIS line of commercial insertion equipment offers a full range of options and system configurations. The ARVIS series includes the ARVIS-1000; the ARVIS 7000 series which includes the 7000 Compact system for smaller cable operations, the 7100 Basic system for systems with growing advertising volume and the 7200 Standard system. Each series 7000 system handles several headends from a central workstation and is fully upgradeable. The ARVIS 8000 system allows automatic scheduling, playing and logging of movies and local origination programming.

Features of the ARVIS line of insertion gear include: complete automated operation of scheduling, trafficking, insertion and billing for up to seven days; true random access capability without the need for sequential podding or tape striping; system self-diagnostics and data protection; automatic real-time scheduling; hardware flexibility with a variety of formats; comprehensive reporting of sales, accounting and scheduling activity, plus invoicing; and the ability to handle simultaneous cue tones, enabling the system to carry multiple networks with microwave, fiber or coax interconnect.

For more information, contact Adams-Russell Electronics Co. Inc., (800) 272-7847, in Massachusetts, (617) 890-5850.

Channelmatic

Channelmatic offers a variety of ad insertion products to cable system operators. The Channelmatic line of sequential ad insertion gear includes the Li'L Moneymaker, a single-channel, single-VCR, playback system and the SPOTMATIC JR, which offers built-in verification and circuitry and printer.

Random pod insertion equipment from Channelmatic includes the RA-1111 SPOTMATIC. The RA-1111 is a four-channel system with one VCR assigned to each channel. Each channel within the RA-1111 system can be expanded to 32 channels having one VCR per channel by adding additional plug-in modules and frames. Features of the RA-1111 include: random access of up to 100 30-second spots per tape, automatic logging with advertiser sorted printout, vertical interval switching and digital DTMF cue tone decoding.

Channelmatic's line of full random access insertion systems includes the RA-4422 SPOTMATIC. The RA-4422 is a four-channel system with four VCRs assigned to each of two channels and two VCRs assigned to each of two additional channels. The RA-4422 can be expanded to control 32 VCRs on a maximum of 32 channels by adding additional plug-in modules and frames. The ADCART 2+2 random access ad insertion system can be operated in random pod or full random access modes. The 2+2 system can be configured to have one, two, three or four VCRs on one channel or up to four VCRs shared between two channels.

Channelmatic also offers a full line of logging systems, billing/trafficking software, switchers, and video and audio amplifiers for insertion applications.

For more information, contact Channelmatic Inc., (619) 445-2691.

Core Analytic

The Local Advertising Channel System (LACS) from Core Analytic enables cable operators to offer classified advertising. The LACS system includes an IBM-PC, AT&T video board, a powerful artwork package including many wipes, automatic scheduling and billing functions, installation and training.

The LACS Ultimate system uses the high-resolution AT&T Targa board and has a built-in capacity of 700 ads, expandable to 2,500. Features of the Ultimate system include: multiple channel capability, remote headend operation and digital audio.

For more information, contact Core Analytic Inc., (201) 218-0900.

Falcone

The 1200 series from Falcone is a hardware/software system designed to meet a variety of needs for local cable advertising. The 1200 system is designed around the Falcone Autoserter and an IBM PC-XT. Other components include: an IO port board, "trunk master" board, intelligent machine control boards and a 1200/300 baud modem. The basic Falcone 1200 system handles four networks and is expandable to 12. Four system configurations are available to meet operator needs.

The system 1201 is a pod random multi-network system with one dedicated VCR for each network. The system 1202 is a multi-network system which shares VCRs with pod random commercials. The system 1203 is a multi-machine per network system with dedicated VCRs for each channel. The system 1204 is a multi-machine, multi-

LaKart tells you where to put it.

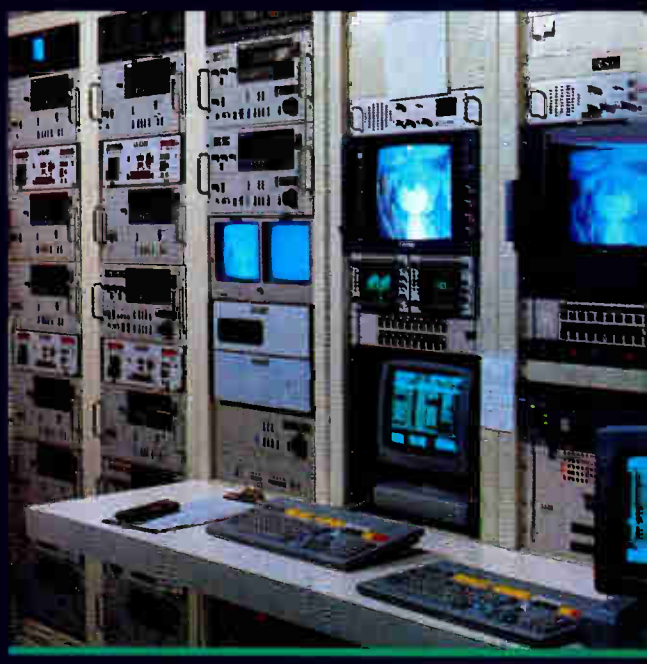
LaKart is a commercial insertion system for cable operations that puts out broadcast quality at a cable price.

Just program in the day's traffic log and LaKart goes to work. Proven hardware and software (Over 50 LaKart systems are in operation, today.) keep up a constant interface with traffic uploading and downloading is done on multiple channels automatically.

LaKart excels in any automated programming situations. It can be used for Pay-Per-View applications. And it can even be controlled by satellite tones.

Use LaKart in its "mini" version -- Mini LaKart -- without random access capability. Or, use Macro LaKart with random access. Either way, both deliver component quality signals from ¾" tape.

Call us or write us for more information.



LAKE
The Systems Company

Lake Systems Corporation
287 Grove Street
Newton, MA 02166
(617)244-6881

Reader Service Number 43

The Lake Systems line of commercial insertion gear includes the Micro-Kart.

network system which randomly selects the VCR depending on the programming sequence.

For more information, contact Falcone, (404) 427-9496.

Grumman Electronics Systems

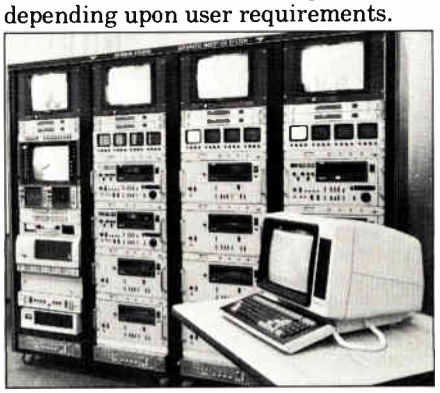
An Operating Division of
Grumman Corporation

Sunrise Highway
Great River, New York 11739

Edward Youskites
Marketing Manager
Broadcast Systems
Great River Operations 516-435-6089

Grumman

The Grumman AIS 5000 is a random access, computer controlled ad insertion system that offers complete automation capability from sales, through traffic and machine control, to billing. Grumman's basic system offers the capability to automate four channels and control 12 tape machines. The system is of modular design and can be configured to automate either a single channel or up to 256. Tape machines may be dedicated to specific channels or shared among channels depending upon user requirements.



Grumman's AIS-5000

For accuracy, SMPTE time code is used to locate ad spots and programs on the tapes. A directory is written onto the beginning of each tape that uniquely identifies each spot or program and its location. Because of this, tape searching is reduced and the chances of playing the wrong spot are minimized.

Grumman's AIS 5000 system is user friendly and contains built-in self-test diagnostics. A lease/purchase plan is offered by the company and a nationwide service network is provided for system support.

For more information, contact Grumman Electronics Systems, (516) 435-6001.

Lake Systems Corp.

The Lake Systems line of commercial insertion gear includes the Micro-Kart, which controls up to six videocassette recorders that can insert

Texscan
Cross Channel Promoter

CHURN

NOW EVERYONE CAN CUT CHURN

1. Low cost
2. Simple operation
3. Monitors any four networks simultaneously
4. Differentiates one and two-minute avails; fills entire break
5. Includes single VCR which inserts on any four networks
6. Sequential (ROS insertion of pre-recorded tune in promo's)
7. Built in cue tones generator
8. Modular design
9. Vertical interval switching
10. Two-year manufacturer's warranty

See us at NCTA Booth 2348

Cross Channel Promoter XCP291
(Any two networks)
$3,995.00
Includes VCR

Cross Channel Promoter XCP491
(Any four networks)
$4,995.00
Includes VCR

To take advantage of this one time special offer you must order by May 20, 1992 and take delivery by July 20, 1992.

OFFER EXPIRED

Texscan 124 North Charles Lindbergh Drive, Salt Lake City, Utah 84116
MSI CORP **(800) 367-6011**
Reader Service Number 45

The Monroe Electronics Model 300R-14 video recorder is a commercial insertion controller.

spots on up to six channels in the sequential mode. An SMPTE time code is used to cue and control the VCRs. The Micro-Kart is able to accept a record command by phone and record new spot reels with material downloaded by satellite.

The Lake System Mini-Kart is a true random access controller, modular in design and capable of controlling up to 96 VCRs and channels. A Mini-Kart or network of Mini-Karts receives a multi-channel execution log from a central traffic and billing system (Lake provides Compulink) over telephone lines. Thousands of events can be listed, and verification logs are transmitted back to the central billing computer.

For more information, contact Lake Systems Corp., (617) 244-6881.

Monroe's model 300R-14

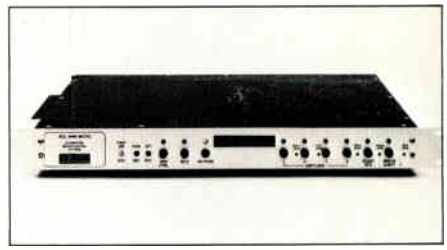
Monroe Electronics

The Monroe Electronics Model 300R-14 video recorder is a commercial insertion controller designed to provide automatic unattended switching to local video-taped commercials in response to CATV program source cues. It serves as the controller for an ROS commercial insertion system, providing cue tone detection, VCR control and audio/video switching. The unit is of modular construction, thereby allowing the user to expand as ad volume increases. Each 300R-14 channel inserts commercials from one (customer provided) VCR onto one cable channel in the order in which the spots are placed on the video tape.

Monroe's 300R-14 operates single or dual channels and is available with or without verification and logging. Audio/video switching and self-test software are built in, and pre-roll times and commercial lengths are user programmable.

For more information, contact Monroe Electronics Inc., (716) 765-2254.

Solutec's SOL 6800 U.I.S.



Solutec's 6800 Micro

Solutec

H.A. Solutec Ltd. offers the SOL 6800 automated broadcasting system for interface with up to eight VCRs. The SOL is fully programmable and features a 12-input audio/video switcher. The SOL 6800 also can be ordered in the fixed sequence mode, upgradeable to programmable as the user's needs increase. The SOL 6800 Mini will interface with up to four VCRs and features a six input audio/video switcher. The Mini also is fully programmable. The SOL 6800 Micro is a networkable control system with a four-input audio/video switcher.

Options available for the SOL 6800 line include: stereo, component switching, message identification, log printout, single- or multi-channel software and VCR/VTR interface.

For more information, contact H.A. Solutec Ltd., (514) 524-6893.

Telecommunication Products Corp.

The NEXUS 1 is a microprocessor-controlled commercial insertion system that incorporates the features of a satellite tone decoder, a random access VTR controller and a vertical interval audio/video switch in one unit. A commercial verification unit is optional. The NEXUS inserter receives audio and video output from both the satellite receiver and up to three VTRs.

NOBODY DOES IT BETTER.

ARVIS automated video insertion equipment is the standard of excellence in large and small markets worldwide. Nobody else even comes close. Because ARVIS is *the* complete-system supplier for everything from state-of-the-art software to playback and workstations. Whatever your operational and budget requirements, there's an ARVIS system to meet them. And all ARVIS systems are totally upgradable to grow with you. Once you install ARVIS, you're never alone. Because our development and service teams are constantly available with technical upgrades and responsive service – including overnight parts delivery when needed. Choose ARVIS. Because nobody does it better.

1-800-272-7847
In MA, Call 617-890-5850

ARVIS™

The Right Spot At The Right Time

Adams-Russell Video Information Systems is a Division of Adams-Russell Electronics Co., Inc.

Reader Service Number 47

The Q-Star IIA from Videomedia can perform in the random access and/or sequential mode of operation.

Upon receiving a control tone from the satellite receiver, the NEXUS 1 will automatically sequence through each insert of a programmed commercial event. In the case of programmed source failure, an automatic bypass to primary satellite source system has been incorporated into the NEXUS 1.

For more information, contact Telecommunication Products, (800) 233-7600, in Pennsylvania, (800) 692-7370.

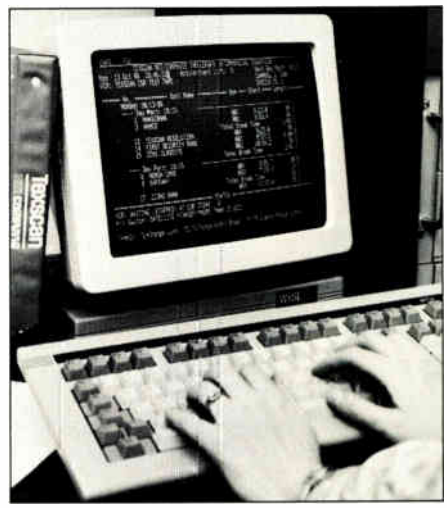
Tele-Engineering

The AD CUE series from Tele-Engineering offers a variety of options in commercial insertion for cable systems. The AD CUE JR will support between 1 and 4 or 1 and 8 channels with one VCR per channel. AD CUE JR is a "start-up" sequential ROS system upgradeable to support break random access logging and computerized billing. The AD CUE 100 operates in the break or spot random access modes and can support up to 12 channels with up to 4 VCRs per channel. The AD CUE 2000 is a PC-based spot random access system with VCR load-sharing. The system features a built-in tape duplication/consolidation system and local or remote status monitoring.

For more information, contact Tele-Engineering Corp., (800) 832-8363 or (617) 877-6494.

Texscan MSI

The Comserter line of commercial inserters from Texscan MSI offers full control of up to four VCRs for insertion into one or two channels. Programming can be done in the random sequential,



Texscan's MSI Compuvid

random access or full random access modes. Printer output is available for logging and verification. Several levels of traffic and billing systems are available, and printouts include verification of good video. All Comserter models are capable of remote control of many headends and can be mixed and matched to expand system capabilities.

For more information, contact (800) 367-6011 or (801) 262-8475.

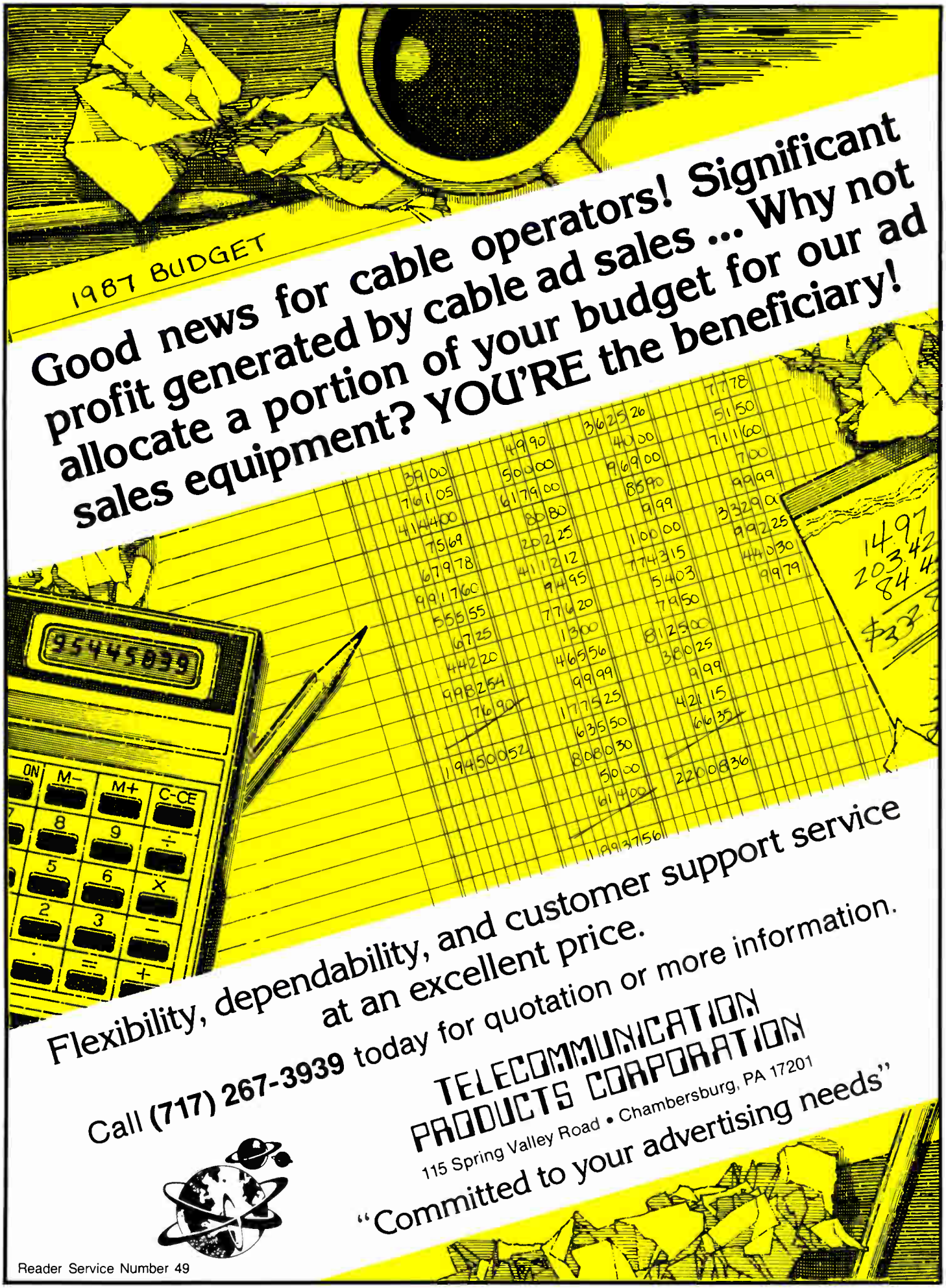
Videomedia

The Q-Star IIA from Videomedia can perform in the random access and/or sequential mode of operation, manually or automatically. The system features the VSIO control unit—six of which are linked to a switcher and four VCRs in a basic Q-Star IIA configuration. Up to 500 events can be inserted, and cueing information can be received from either tones on the audio channel, SMPTE time code, FSK data or any combination. The FSK data option tells the system exactly what is on the tape, produces error messages and ejects the tape if the wrong tape is inserted.

A continuous log of daily operations and special lists is available through printer output. The battery back-up RAM protects all clock/calendar, event memory and special set-up data. VCRs are rewound and recued automatically if a power failure occurs.

For more information, contact (408) 745-1700.

—Lesley Camino



Good news for cable operators! Significant profit generated by cable ad sales ... Why not allocate a portion of your budget for our ad sales equipment? YOU'RE the beneficiary!

Flexibility, dependability, and customer support service at an excellent price.

Call **(717) 267-3939** today for quotation or more information.

TELECOMMUNICATION PRODUCTS CORPORATION

115 Spring Valley Road • Chambersburg, PA 17201

"Committed to your advertising needs"

Reader Service Number 49

classifieds

HELP WANTED

western audio video

CATV and LAN Personnel:
* Project Engineers
Experience in 2–Way Design
CAD Operations
* System Technicians
2 Years Experience in 2 Way System Operation
Jerrold and C–Cor Systems
Capable of Operating Wavetek Sweep System
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818 Douglas Avenue
Redwood City, CA 94063
(415) 366–8294
Excellent Benefits & Opportunities

TECHNICAL PERSONNEL

Prime Cable of Maryland has immediate openings for a qualified headend technician and an experienced sweep technician. Excellent career opportunities and benefits package in this dual system of 56,000 subs. Salaries commensurate with experience. Please send resumes to:

Prime Cable of Maryland
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Lanham, MD 20706
ATTN: Personnel Director
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For more information, call Christina Panczyk at (303) 860-0111, or write: 600 Grant St., Suite 600, Denver, CO 80203.

LINE/SERVICE TECHNICIANS

Positions available immediately. 2 years experience preferred. $7-12 per hour. Send resume to:

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INCLUDES PARTS AND 90 DAY LIMITED WARRANTY
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Large selection geared for CATV
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BUCKET TRUCKS

BUSINESS DIRECTORY

Advertiser's Index

Impulse focus of new products

Because of the programming services' dominance of the NCTA National Show this year, news about products and technology was at a premium. If there is one trend that could be identified from the products shown this year, it had to be within the narrow scope of impulse technology.

Leading the charge was **Jerrold**, which went so far as to slash the prices of its sidecars, guarantee high buy rates and build a whole new "world of impulse" to show off the different uses of its products. Joined by **TV Answer Inc.**, **Zenith**, **Universal Remote Systems** and others, clearly the focus in Las Vegas was on how to provide subscribers with instant access to pay-per-view programming.

As alluded to above, **Jerrold** announced a massive price reduction on its IPPV sidecars. Starfone units will now cost $20 each and Starvue for two-way systems will cost $15 each. "We're trying to get impulse capability into the marketplace," explained Hal Krisbergh of Jerrold. "Jerrold is making a move to help drive the industry," he added. Krisbergh noted that the price reduction will eliminate the price issue associated with the decision to add impulse capability. "The sidecar will become an automatic purchase," he predicted.

The price reduction was complemented by a guarantee from Jerrold that Cable Video Store affiliates will receive buy rates of at least 150 percent, allowing operators to recoup the money invested in the sidecars within six months. The buy rate, based on an average event price of $3.25, with 42 percent of the revenue going to operators (plus a $1.95 per month access fee) will net those operators $4 per month. Reader Service number 80

On the **Tocom** side, a new Micro-ACS addressable control system featuring the Compaq 386-PC (replacing the IBM-AT) was introduced. It's targeted at large cable systems where the typical customer base exceeds 75,000 subs, according to Rick Brown, manager of marketing. He added that the AT computer will continue to be used in smaller systems. System features include complete addressing control, converter authorization, subscriber initiation and changes and IPPV program management. Reader Service number 81

Meanwhile, increased demand and complaints about lack of availability has forced the **VideoCipher** division to invest an additional $4 million to expand production of the VC II decoders. The goal is to be producing as many as 100,000 units per month by the end of September, said J. Lawrence Dunham, division executive vice president. By that time, more than 400,000 units will have been shipped to distributors since the beginning of 1986.

Also, a second round of electronic countermeasures has been undertaken to shut down more than 6,000 illegal home satellite decoders, the company announced. Dunham said the first round was "99.96 percent accurate" in shutting off targeted illegal decoders and added that additional countermeasures will be undertaken until all illegal decoders are shut down. Reader Service number 82

The promise of impulse ordering capability has also spawned new vendors. Tucked into one of the convention halls' corners was a booth for **TV Answer Inc.** The company, headed by Oscar Morales and Steve Symonds, plans to offer PPV over-the-air. Utilizing a video inserter, microcomputer and master control unit that encodes a message on the TV signal, viewers would respond to on-screen queries using their remote control units. A 20-watt receiver/transmitter is used to decode the messages and send responses back to the headend.

The equipment is presently undergoing final lab testing and tests of the entire system, using the 216.25 to 219.75 frequency spectrum, are expected to begin in the Washington, D.C., area later this summer. Tests utilizing cable, broadcast and local ITFS technologies are planned. Reader Service number 83

Zenith Electronics kept the industry abuzz with the introduction of its pre-programmed "universal" remote control unit, dubbed Personal Control Center. The unit controls at least 18 color TV brands, 19 VCR brands and eight cable converters and costs $21.50 with a minimum order. The PCC controls power, volume, mute and channel functions on TVs; all VCR functions; and power, channel selection and volume control on most converters. Additional features are available when using Zenith's Z-TAC or PM addres-

James Bonfiglio, CEO of Texscan Corp., and David Waller, vice president and general manager of Texscan's MSI division, presented certificates of recognition in Honolulu to Jim Chiddix and Steven Rose for the design of MSI's ComSerter line of commercial insertion products. The design and prototype were developed by Chiddix and Rose at CRC Engineering in Hawaii.

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Reader Service Number 60

The 'universal' remote unit was taken one step further by Universal Remote Systems.

sable converters.

The units are pre-programmed (no "learning" function is necessary) and homeowners set PCC for their own equipment by manipulating a series of toggle switches located near the battery compartment.

Also, a new family of system controllers was unveiled. The new controllers are built around a Zenith Data Systems Z-248 personal computer and are designed to authorize 10 decoders per second in any of Zenith's IPPV approaches. A one-way system can be configured for less than $10,000, said officials. Reader Service number 84

The "universal" remote unit was taken one step further by **Universal Remote Systems** which debuted Unicom (Universal Infrared Communicator) at the Burnup & Sims booth (Burnup is the exclusive marketer and distributor of the remote unit). The Unicom remote performs the same functions as listed above, but on a grander scale. In addition to controlling TVs, VCRs and converters, this unit will also control compact disc players and anything else controlled by infrared remote built since 1981.

The product, which is being marketed to MSOs and operators only, never becomes obsolete because it can be field reprogrammed via a microcomputer and an RS 232 port built into the back of the remote unit, officials said. So, new products and ideas like IR controlled AC outlets, can be controlled simply by updating the unit's software library. This feature, by keeping subscribers tied to their cable operators, allows those operators to retain revenue from remote rentals.

In addition, one-button "macros" allow multiple functions to be stored and implemented by a single keystroke. List price is $79 and units are available. Reader Service number 85

An example of what can emerge from **Pioneer's** merging of cable and laserdisc technologies was shown in Las Vegas. Home Music Video allows subscribers to request their favorite music videos to watch at home. The system, which closely mimics the video jukebox concept found in restaurants and nightclubs, allows an operator to designate one channel as the Home Music Channel. Using the LC-V12 auto changer in his headend, operators can store 240 videos on eight-inch laserdiscs. Subscribers then select available videos via an ARU and are later billed for their order. The device is not yet commercially available. Reader Service number 86

Scientific-Atlanta announced an addition to its product line. The new 9260 frequency agile modulator is designed for use as either a primary or standby headend modulator by providing full frequency agility in all EIA channels from 54 to 300 MHz. The 9260 provides RF performance that combines multiple 9260 modulators into a single headend system. Other features include: SAW vestigial sideband filter; video AGC, BTSC compatibility; a video delay pre-distortion network that meets FCC requirements; and full temperature stability.

Also, S-A announced during the show that it had inked a deal with Viacom to supply earth station equipment for the programmer's transition to Galaxy III. S-A will provide both 3.2 and 2.8-meter antenna systems to affiliates of VH-1, MTV, Viewers Choice and Nickelodeon East feeds as well as The Weather Channel and C-Span. Shipments will begin immediately. Cost of the agreement was not disclosed. Reader Service number 87

Texscan Instruments, emerging as an independent division from Chapter 11 bankruptcy proceedings, is staking its future on a firm commitment to the CATV market and a focus on world class products. Texscan Instruments "will be a technological leader," said Gary Gerhold, company vice president and general manager. Over the past 18 months, as the firm has repositioned itself, the company has been "aggressively addressing the quality issue," said Mike Richardson, national accounts manager. An example is the company's new, two-year warranty on its entire SLM line, adds Brenda Bangel-Gentry, marketing manager, CATV products. Building to mil spec is another example. The company also is replacing its older line of SLMs with new models. The new Spectrum 2 hand-held SLM checks a high and a low channel preset at the factory. Designed for belt attachment, it conserves power by automatically powering down whenever it isn't being actively used.

The Spectrum 600 SLM, made of

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Reader Service Number 54

GENERAL INSTRUMENT

Waiting in the wings: a status monitoring product that works on one-way plant.

reinforced metal, is designed to handle the rough handling it may face in the field—such as being thrown into the back of a truck. Drop testing on the model 600 has been done to mil spec. The new 1075 Spectrum Analyzer replaces the older VSM line.

The company also will step up marketing of its Vital Signs status monitoring system, already installed at 200 systems worldwide. Vital Signs modules come in standalone and amplifier housing versions and are vendor independent. Vital Signs works with any make or model of amplifier. Interfaces now are available for monitoring power supplies made by Alpha Technologies, Data Transmission Devices and Lectro.

Waiting in the wings: a status monitoring product that works on one-way plant. Richardson says the new product will involve limited activation of the reverse path, and will require no reverse hardware or special maintenance. Bridger switching won't be required. It will require some modification to actives and passives, though. A Beta test site is expected early in the fall and Richardson says the system will "be interesting for small one-way systems clustered in rural areas." Reader Service number 88

Data Transmission Devices, responding to customer demand, has introduced a 15-amp standby power supply, the SP-900-24. Like the other products in DTD's line, the SP-900-24 features power modules that are interchangeable and also uses two power supply modules in each housing. Either module can be removed from the circuit without interrupting power to the cable. Over the past year or so, at the very least, DTD has "spent a fortune" on customer support, said DTD President Stan Johnson. In fact, the company now plans to add more staffing and office locations to handle the increased after-sale support given its customers. Surviving an important top-level management change, DTD appears to have earned itself a billing among the top three power supply vendors in the industry. It also appears the company is receiving significant business from local area network installers and system integrators. Reader Service number 89

On the other hand, **C-Cor Electronics** has announced a retreat from the standby power supply arena to concentrate on uninterruptible supplies for the data market. Under the new plan, the PS 750 conventional power supply will be offered for the cable market while the PS 850, 1000R and 1000W conventional and redundant supplies will be offered to the data market. The NB 113 and NB 213 standby supplies have been discontinued. The Power Products Division is introducing the 300 VA, 500 VA and 1000 VA PowerVision power systems for the data market. Available now, the units offer backup power in the event of spikes, surges, brownouts and blackouts.

Along with those moves, C-Cor has drastically restructured itself, shrinking employee headcount, adding a plain vanilla converter to its product line and making a renewed commitment to the CATV market. "We want to be thought of when people think of Jerrold and Scientific-Atlanta," said John Hastings, national market manager for CATV products. The company apparently rules out nothing. Depending on the deal, it might get into the addressable converter market or offer cabling. In short, the company plans to position itself more logically as a "one-stop shopping" supplier. Reader Service number 90

Wavetek's 1882 system analyzer

Wavetek introduced its model 1882 system analyzer/sweepless sweep. The sweep function operates by placing a horizontal marker across the carriers on the spectrum display for reference. The function is then implemented, carrier levels measured, and results stored in one of four non-volatile memories. The test point response can then be compared to the reference through normalization. A typical sweep response display is given with horizontal markers to identify different response levels. A max/min function holds the response and moves the markers to the peak and valley. Reader Service number 91

Meanwhile, **Lindsay Specialty Products** is introducing a downsized version of its existing feedforward product line. It uses the same gain blocks as its larger cousin, but features a much smaller housing and motherboard. Reader Service number 92

A wireless line extender was unveiled by **General Electric**. The microwave-based system can transmit over MDS, MMDS, ITFS and OFS frequencies and can cover areas that are costly to build with conventional cable. It requires no franchise fees, pole rentals, or cable to build. And because no hardware is needed for non-subscribing homes the cost of providing service to subscribers, including in-home electronics, can be well below $400 each, the company stated. Up to 33 frequencies are available and can be used in conventional systems of up to 450 MHz. Features like PPV, channel mapping, parental control and stereo compatibility are available. Reader Service number 93

A new BTSC stereo generator was highlighted by **Catel**. The TVS-2000 utilizes dbx companding and provides either a baseband composite signal or a 4.5-MHz modulated subcarrier signal. Operating controls are front panel mounted and dual LED modulation meters are used.

Also, the new AAS-1000 automatic audio switch provides operators with audio continuity. The switch accepts baseband left and right audio signals from a satellite decoder and a local source and a separate mono input. In the event of loss of a primary satellite signal, the AAS-1000 automatically switches to the local source or mono input until the primary signal is restored. Secondly, the switch functions as a mini control point by accepting a control signal from local commercial insertion gear and switching to the commercial audio source then returns to the prior mode when the commercial is over. Local override is provided for. Reader Service number 94

New features have been added to **Magnavox**'s Digital System Sentry

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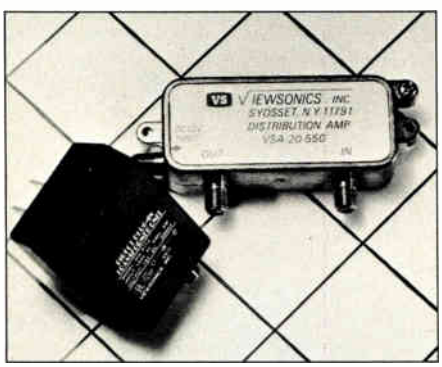
Reader Service Number 52

The Model 525 Cable Designator 'Six Pack' has been announced by Riser-Bond Instruments.

status monitoring software. Remote monitoring, feedforward polling and automatic power supply polling are now available. Using any personal computer and a telephone, status information previously available only at the headend can now be viewed. The other features allow polling of all feedforward amps and standby power supplies at a fixed time each day or at any time using a single key on a personal computer. Reader Service number 95

Catching up on new products announced before the convention: **American Lightwave Systems** has designed a new fiber optic system that uses 1300 nm single mode technology to deliver 16 channels up to 30 kilometers. Every channel is capable of carrying either one uncompressed high quality video channel, a DS3 trunking channel at 44.736 Mb/sec., seven DS1 channels or a combination of FDM data cahannels compatible with LANs. Any mix is possible. The FT1300 system delivers 60 dB signal-to-noise ratio signals at a cost per channel of $6,000 plus fiber. The system includes modulators, demodulators, multiplexors, demultiplexors, optical transmitters and APD and PIN receivers. Reader service number 96



Viewsonics' wideband distribution amp

New wideband distribution amps were announced by **Viewsonics**. Models VSA-10-550 and VSA-20-550 cover frequencies from 50 MHz to 550 MHz and a virtually flat signal gain of 10 or 20 dB can be obtained, depending on the model used. Typical noise figure is 7 dB. Impedence is 75 ohms. The line cord between the power adpater and amp module has been eliminated, replaced by F-fittings. This allows standard coax to be the connecting medium. Reader Service number 97

Pirelli Optronic Systems has announced the 800 series, a new line of frequency modulation equipment. All plug-in modules use large-scale integrated hybrid circuits to reduce noise and discrete components. Video frequencies are selectable in 1 MHz steps from 40 MHz to 540 MHz; audio is selectable in half-MHz steps from 5 to 7.5 MHz. Reader Service number 98

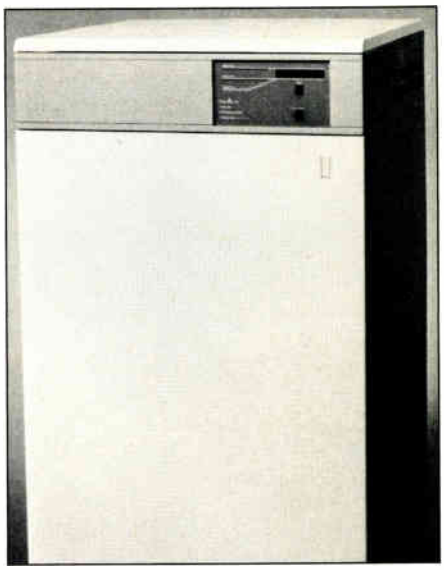
Hughes Aircraft intro'd a high-power microwave line extender that provides up to 5 dB more output than the standard OLE-111 outdoor line extender. The solid-state AML-HPOLE-112 can deliver from one to 60 channels to small pockets of subscribers. The transmitter accepts VHF inputs in the 54 MHz to 450 MHz range and uses block upconversion to reach the CARS band. Price: 52,840. Reader Service number 99

A portable RF tuner/video detector has been introduced by **Advanced Technical Products**. Used with a converter and oscilloscope, Scramble Lock accurately monitors the timing adjustment on scramblers and descrambling converters and amplitude measurement of scrambled satellite video without a calibrated converter, spectrum analyzer or cross-pulse monitor. Reader Service number 100

Sadelco said that the Sadelette hand-held signal level meter is now being manufactured with the input F-connector user replaceable. Return loss, worse case, is 16 dB and the unit is fully shielded. The 10-segment bar graph is vertically mounted allowing a 1 dB resolution. Total input dynamic range of 24 dB is divided into three attenuator columns from -2 dBmV to 22 dBmV. Reader Service number 101

New from **FM Systems Inc.** is the ADS-75 Audio Deviation Standard that operates at 100.1 MHz and produces a precision ±75 KHz calibration standard. When used with an audio deviation monitor and FM tuner, the ADS-75 can calibrate and measure deviation of live program FM signals. It can operate in a standalone mode with DC power or can derive power from the audio deviation monitor. Reader Service number 102

The Model 525 Cable Designator "Six Pack" has been announced by **Riser-Bond Instruments**. The cable identification instrument used for ID'ing individual cables in a common bundle can transmit through taps and splitters. The test set consists of a receiver and multiple transmitters, allowing the identification of up to five cables at one time. List price is $395. Reader Service number 103



Topaz's Powermaker E/S

New from **Topaz** is the Powermaker E/S, a microcomputer-controlled uninterruptible power supply for computer protection. It features intelligent AC power control to adapt itself to the specific AC power requirements of the equipment it protects. Reader Service number 104

Control Technology Inc. has announced a retrofit assembly for the Citation II. The retrofit includes improved cycle charger, beefed-up inverter output circuitry, faster switching speeds and built-in diagnostics. Cost is $375. Reader Service number 105

Western Electronic Products has introduced two new coaxial cable strippers. The CX-1 prepares most cable from .075 to .485 diameter in a single operation with any desired stripped configuration. Three independent cutting members plus a replaceable cable holder allow the user to turn the cable in contact with the cutters and sever the insulation and shielding. Cutting depth is adjustable. List price is $53.95 each. Also, the CX-2 motorized stripper prepares a three-level strip for any

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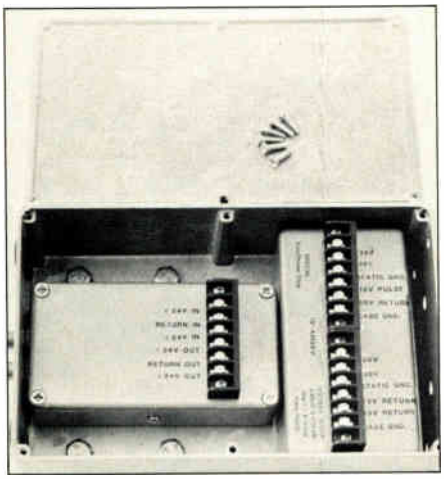
Reader Service Number 50

PolyPhaser Corp. unveiled a TVRO lightning protection system that protects all LNB's.

connector configuration. Three rotating blades cut the cable at a predetermined depth and length. List price is $645. Reader Service number 106

An improved line-of-sight laser transmission link has been developed by **Telescript Industries**. The L-5000 can transmit 40 channels up to a half-mile and features univeral mounting capabilities, a RF shielded housing, high resoluting tracking for ease of alignment and weighs less than 30 pounds. Because it can transmit through glass, the L-5000 doesn't have to be mounted on the roof. Each unit costs less than $10,000. Reader Service number 107



LPS's ALS-3000

Lightning Prevention Systems's ALS-3000 arrays can prevent lightning strikes by dissipating positive charges into the atmosphere, neutralizing the negative charges accumulated by storm-associated cloud formations. Each element in the arrays contains 5,500 stainless steel points that can dissipate a greater amount of ions than blunt, flat or spherical objects do. Buried copper radials collect positive charges, which then travel to the arrays. Reader Service number 108

Also on the lightning protection front, **PolyPhaser Corp.** unveiled a TVRO lightning protection system that protects all LNBs down converting in the 450 MHz to 1450 MHz range with low loss and low VSWR. It also protects the polarization motor and has an optional module for actuator control lines. The company also announced three new lightning strike counters. The LSC-1 is weatherproof and can be used on any conductive structure; the LSC-2 plugs into 120V AC and counts lightning surges on power lines; and the LSC-3 bridges across phone and data lines. All are sensitive enough to record surges down to one Joule of energy. List price is $54.95. Reader Service number 109

New features have been added to **ADS/Linex**'s Linex 201 Scriber, an automated lettering machine. Designed to increase productivity and efficiency in any discipline using drafting, the scriber now has the capability to automatically center text. Other function keys include size, slope, rotation, vector and tab. Reader Service number 110

Also during the National Show in Las Vegas, **Robert Mathews**, founder and chairman of the board at **CableData**, and **Walt Ciciora**, vice president of strategy and planning at **ATC**, received Vanguard Awards for Associates and Science and Technology, respectively. Mathews, who recently died after a bout with cancer (see this month's Spotlight) was honored for his pioneering role in bringing operational efficiency to cable through computerized management services. Ciciora was honored for his role in assuring that consumer electronics and cable system design are compatible. Meanwhile, **Ben Reichmuth** has been promoted to executive vice president of **Gill Industries** and general manager of Gillcable. Also, **Dave Large** was named senior vice president, engineering, for Gill Industries.

Oak Communications has named **Carl Brown** vice president of marketing and sales. Brown previously was national sales manager for American Satellite Co. in Maryland. He is responsible for all national sales and marketing, customer service and support at Oak.

Scientific-Atlanta appointed **J. Larry Bradner** to the newly created position of president, Broadband Communications Division. Bradner joined S-A in 1977 and was most recently vice president and general manager of the division.

Dieter Brauer has been appointed director of engineering for **Magnavox CATV Systems**. Brauer came to Magnavox from M/A-Com PHI Inc. where he was business center manager, RF modules. Prior to that, he was with Jerrold.

Bruce Van Wagner has been elected chairman of the executive committee of **Anixter Bros.** After beginning his career with Anaconda Wire and Cable in 1947, Van Wagner has been with Anixter since 1968.

At **Oxford Development Corp.**, **Thomas Lewis** has been named president and chief operating officer. Prior to joining Oxford in 1985, Lewis was president and CEO of Datamail. ODC provides cable services to multifamily communities.

Frank Drendel has been tapped to handle operations of **General Instrument**'s cable TV and satellite operations. Drendel has been at GI since the company acquired M/A-COM Cable/Home Communications. He will oversee the Jerrold, Tocom, Jerrold International, Comm/Scope and VideoCipher divisions at GI.

At **CableData**, **Susan Mathews** has been named vice president of software development. A 12-year CableData employee, Mathews was a force behind the development of the firm's DDP and QBS software systems.

At **Anixter**, **Rich Moburg** is the new vice president, voice and telephone products. Prior to joining Anixter, Moburg worked at Graybar Electric.

Texscan has several promotions to announce. **John Shaw** is the new head of sales and marketing; **Brenda Bangel-Gentry** is marketing manager of CATV products for Texscan Instruments; and **Barry Kenyon** is national CATV sales manager for Texscan MSI.

CMS has announced that **RJ Smith** has joined the firm as vice president of corporate marketing. Smith came to CMS most recently from Oak Communications and CableData.

Stan Durey has joined **Jerrold** as a software applications support coordinator. He comes to Jerrold from First Data Resources and will coordinate addressable software support for billing services and addressable users.

And finally, **Robert Chalfant** has been named planning manager of **Panasonic Industrial Co.**'s planning and market development division. Chalfant joined Panasonic in 1984 after a stint as product manager at Jerrold.

—Roger Brown

EFFICIENCY EXPERT

New SUPER SENTRY Standby Power Is 92% Efficient

If an inefficient power supply has been robbing you of profits, it's time to call in the efficiency experts, LECTRO. The new SUPER SENTRY standby power supply operates at 92% efficiency in normal full load mode. And that can mean significant savings on your electric bill. As much as 10% over other power supplies.

The SUPER SENTRY is the newest innovation in Lectro's Super Line. To get all the facts about the Super Sentry, the Super Ferro, and the Super Brute, call 1-800-551-3790. Ask for the efficiency expert.

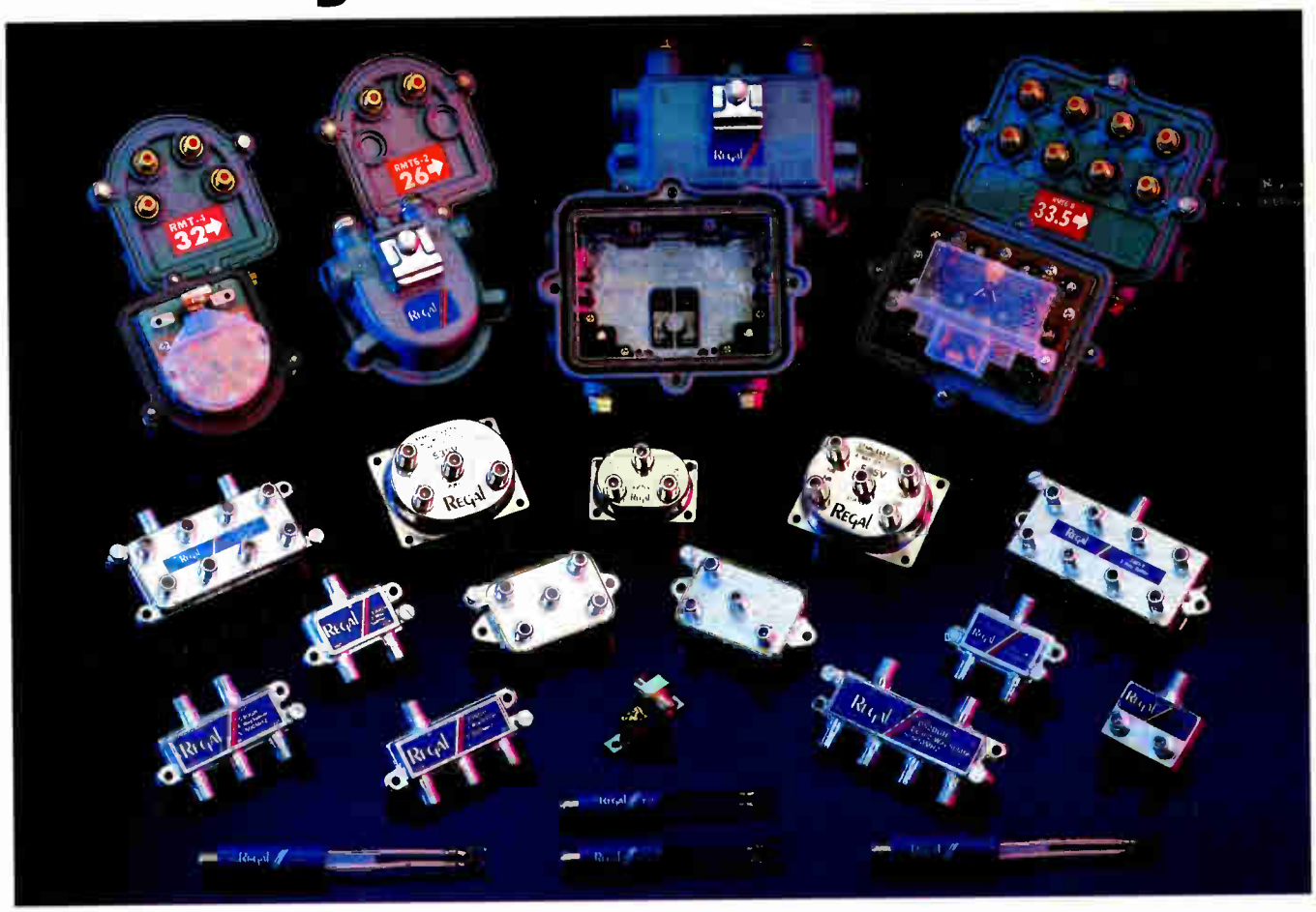
LECTRO

A Burnup & Sims Cable Products Group Company

Reader Service Number 55

92%

Let ANIXTER deliver REGAL for your next rebuild!



REGAL is the quality name in distribution passives. When planning your next rebuild remember that only Anixter stocks a complete line of Regal taps, splitters and matching transformers.

- 500 & 600 MHz bandwidths available
- "F" ports are machined brass
- TAP Housings are 360 aluminum alloy
- "F" ports are compatible with EZF connector
- Full use of P.C. boards insures consistency
- Brass "F" ports are cadmium rated to minimize corrosion
- Threads machined to insure perfect "F" conn. fit
- TAPS have epoxy coating to protect against elements
- RFI shielding (110 db typical) for 2, 3, & 4-way horz. splitters.

ANIXTER®

WIRING SYSTEMS SPECIALISTS
VOICE/VIDEO/DATA/POWER

Call our toll-free HOTLINE 1-800-323-0436

or call your nearest Anixter Stocking Location for details.

In an emergency, weekends and holidays or after 5 P.M. call toll-free 1-(800) 323-8167.
CORPORATE OFFICES, ANIXTER BROS., INC., 4711 Golf Road, Skokie, IL 60076, (312) 677-2600

ANIXTER

DEPT. REGAL
4711 Golf Rd., Skokie, IL 60076

☐ Please send me more information on Regal taps, splitters and matching transformers.

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CED71

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