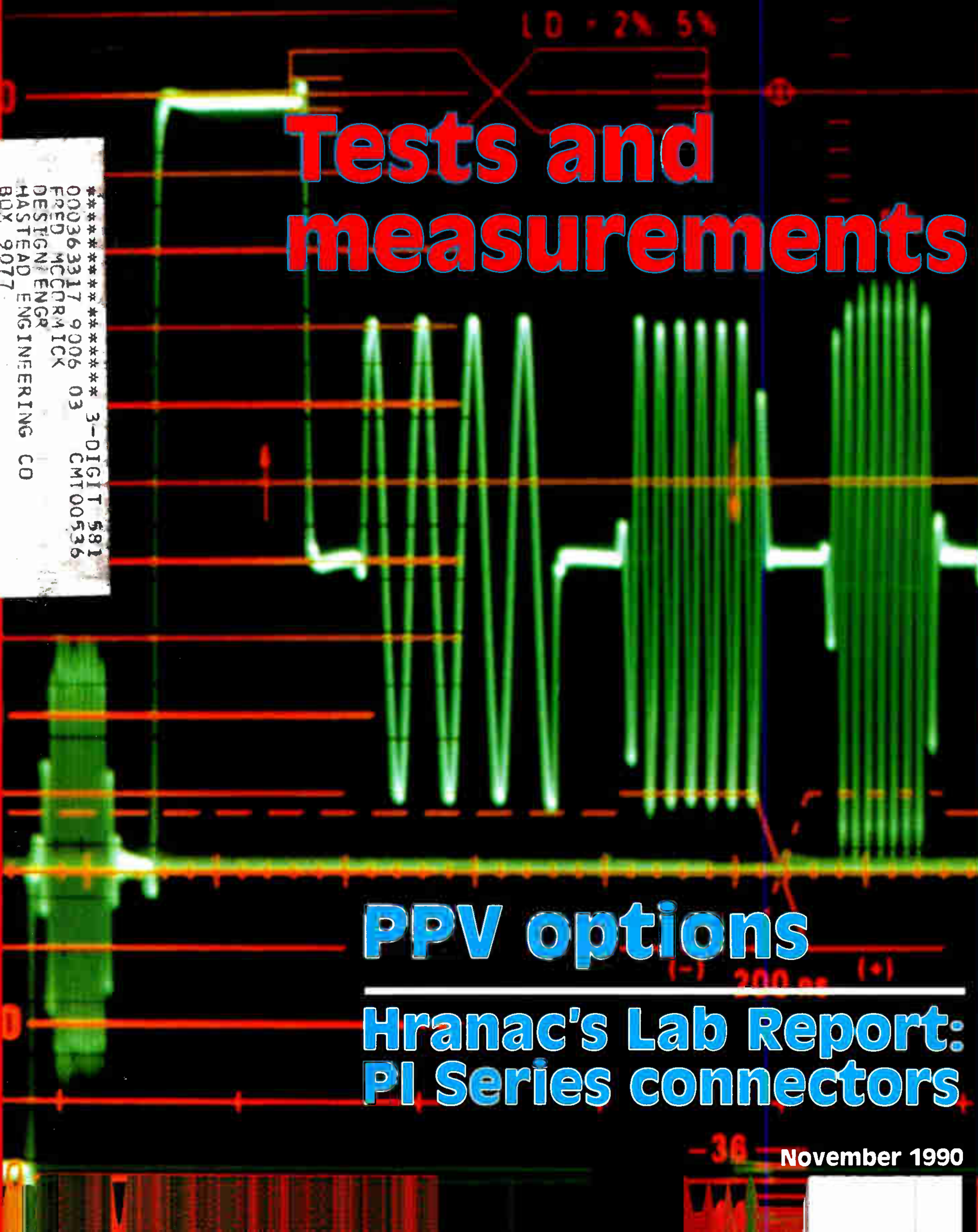
COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Television Engineers



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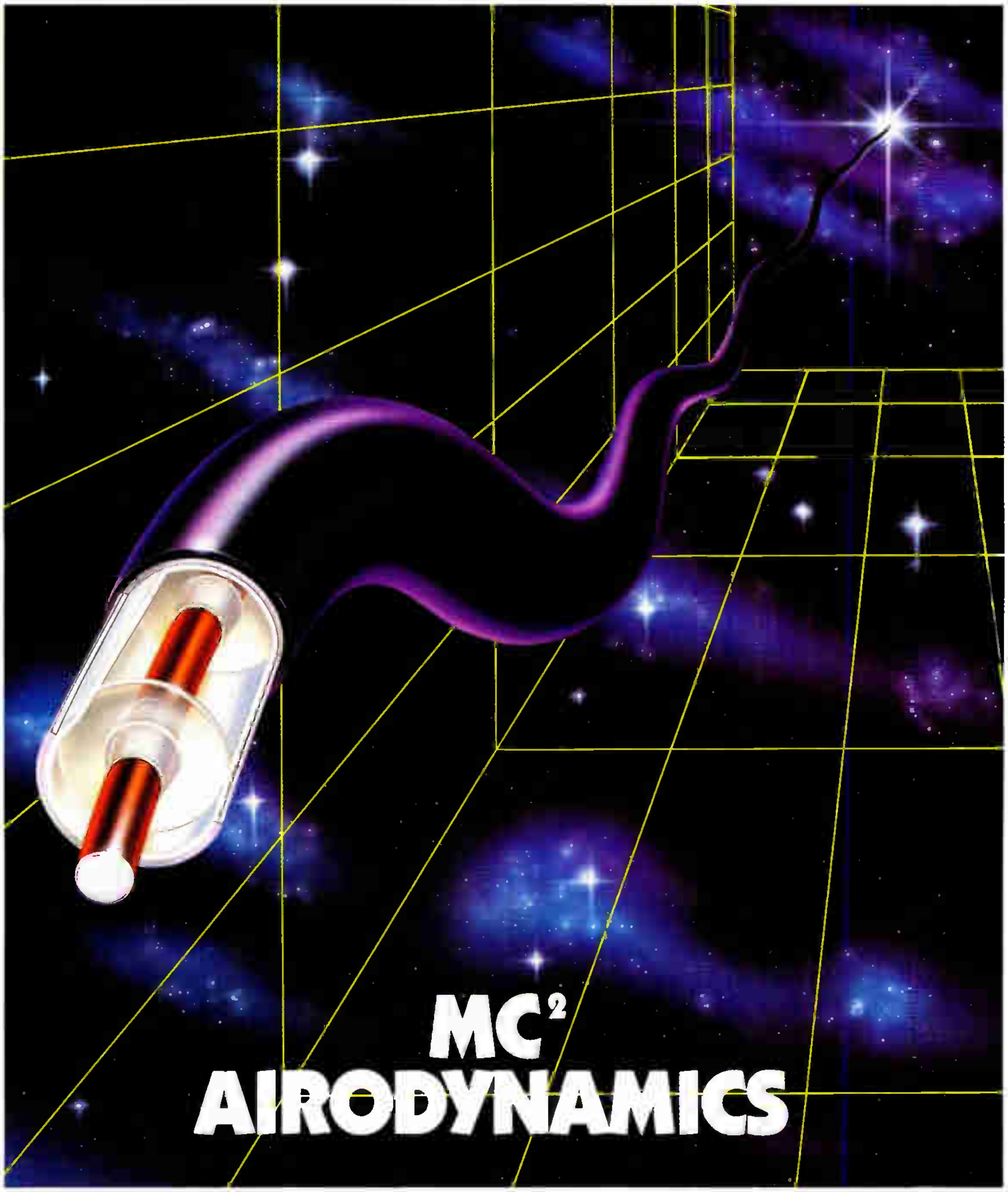
November 1990



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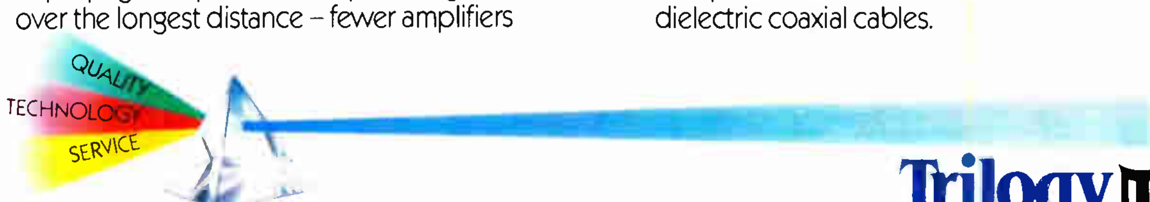

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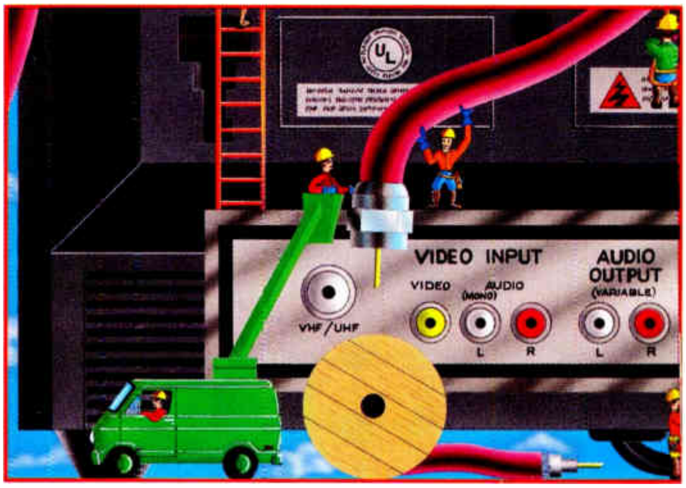

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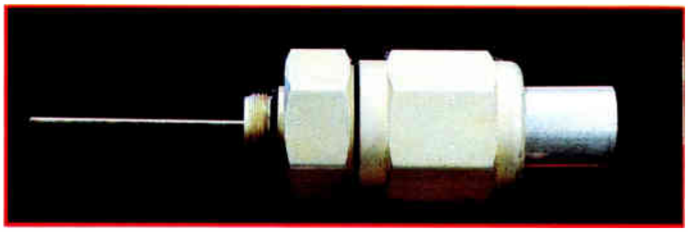
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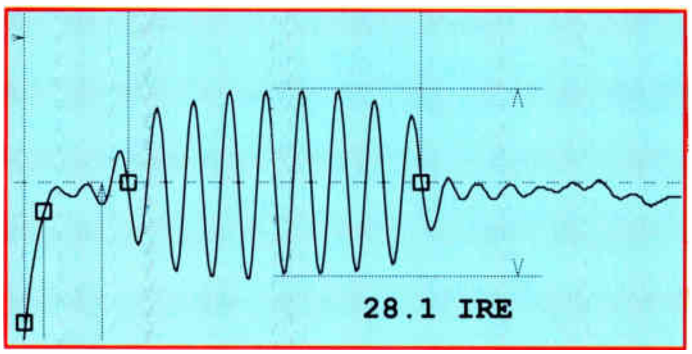

Picture quality 20

Features

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Telling our story

In the Sept. 19, 1990, issue of *CableFAX*, the "Eastern Show Notes" referenced a comment by Sen. Larry Pressler (R-S.D.) that said, "The cable industry has only itself to blame for rereg woes because it let its lobbying guard down in the early and mid-1980s."

I heard similar comments from two state legislators who were guests on a telco panel at this year's Rocky Mountain Cable Show. Both echoed sentiments that the cable industry in general has done a poor job communicating with regulatory bodies.

What gives here? I thought we were a communications industry. It's no wonder many public officials have a low opinion of cable TV. They hear from a handful of dissatisfied consumers—and our detractors make the most of those few bad examples. Sadly, I have to agree that we have not done a really good job of telling our success stories. Sure, there are exceptions such as Daniels' "Cable Cares" report. But when was the last time *you* lobbied a public official?

I remember doing some lobbying at the state level in California several years ago when I was a system engineer for Jones. The CCTA asked operators to participate by writing letters, sending telegrams and even visiting Sacramento to meet the legislators and their staffs in person. I did all of that—and what an experience! I think we as an industry became complacent with deregulation, though. I'm even guilty of not being involved since those pre-dereg days.

What should we be doing today? For starters, it would be a good idea to get to know our elected officials—at the local, state and national levels. We need to be telling our success stories and educating those officials about cable TV and its capabilities. We also need to let them know *who* and *where* we are.

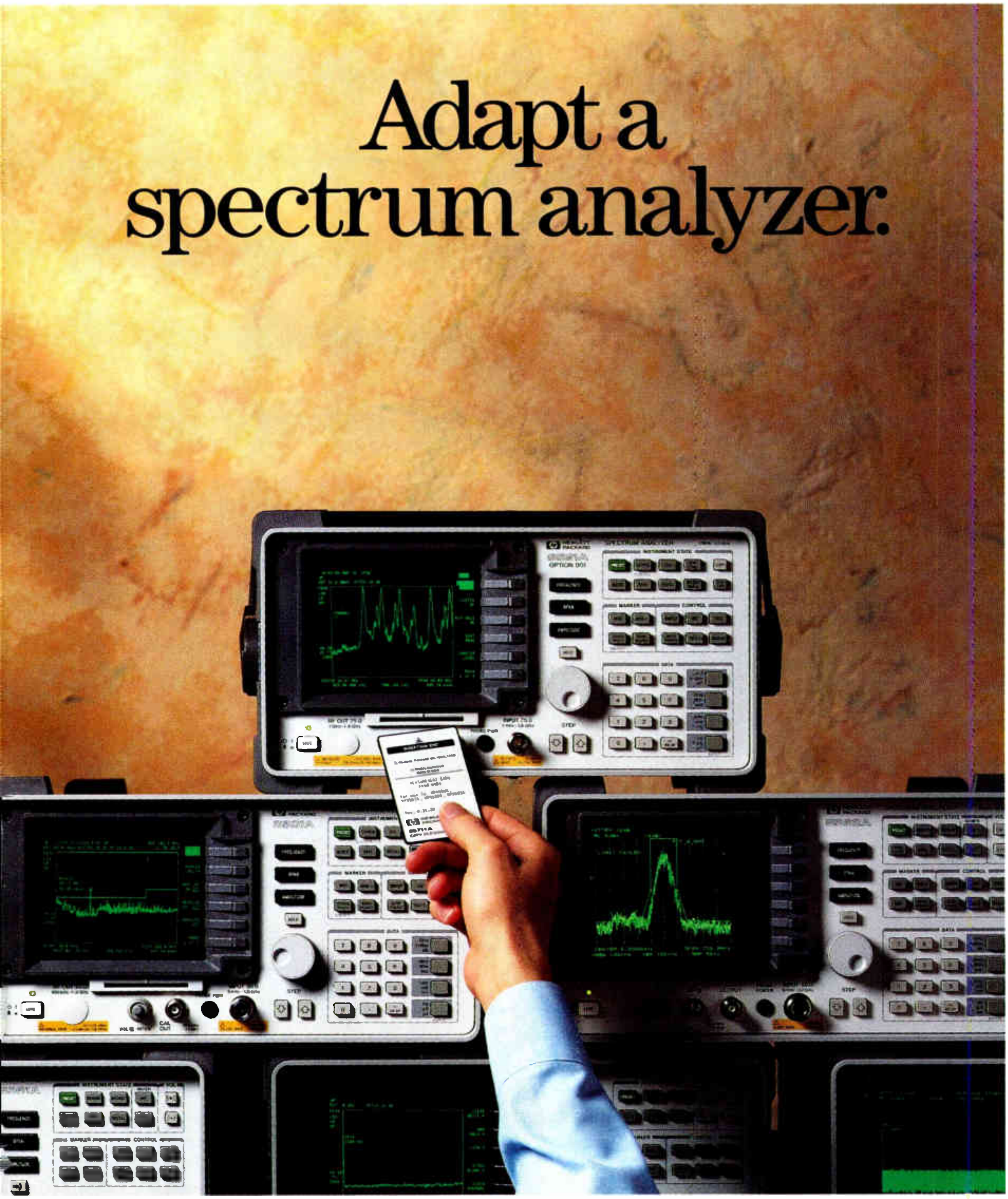
Wouldn't it be nice if, when an angry subscriber contacts a policymaker, that policymaker knew how to get in touch with the cable operator? The problem could be resolved and the public official's office informed of the resolution. And how about extending an invitation to officials (at all levels) to tour your system? Remember, most of the people you work with are voting constituents (what great incentive to encourage a visit).

We do have CATA and NCTA lobbying on our behalf in Washington, but their plates are pretty full. We need to do the same thing from the local level. And we need to do it with our mayors, our city councils, our county boards, our state legislators and the local offices of our U.S. senators and congressmen.

I know from first-hand experience that it works. Anyone can be an active participant; it's not limited to system managers or our corporate staffs. Local level involvement—whether it is by letter writing or by personal visits—does make a difference. And if you're a manufacturer, extend the same efforts. Often your plant represents a significant number of potential voters. We have the ability to make a difference from the grassroots level and show that we really are a communications industry.

Ronald J. Hranac
Senior Technical Editor

The Society of Cable Television Engineers' Interface Practices Committee will be holding its 13th meeting on Nov. 28 during the Western Show in Room A-10 at the Anaheim Convention Center. The event kicks off at 8 a.m. with subcommittee meetings until 11 a.m. when the main committee meeting begins. For more information, contact Ken Williams at (415) 361-2213.



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When is a modulator not a modulator?

Standard Communications

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NEWS

FCC makes wireless rulings

WASHINGTON, D.C.—In opening up more spectrum for "wireless cable," the Federal Communications Commission also prohibited cable TV ownership or use of MDS facilities within its service area, unless that area is otherwise unservable. However, standards for making such a determination were put off for another rulemaking.

The FCC made rule changes in MDS, MMDS and ITFS services and will allow common ownership of all 13 channels in a market, which is up from six. It increased equipment and signal quality standards, and authorized certain auxiliary and CARS frequencies for wireless.

In a separate proceeding, the FCC also ruled that SMATVs, master antenna TV systems and wireless are not cable systems under the 1984 Cable Act, and thus not subject to any of its provisions.

CableLabs supports Canadian HDTV tests

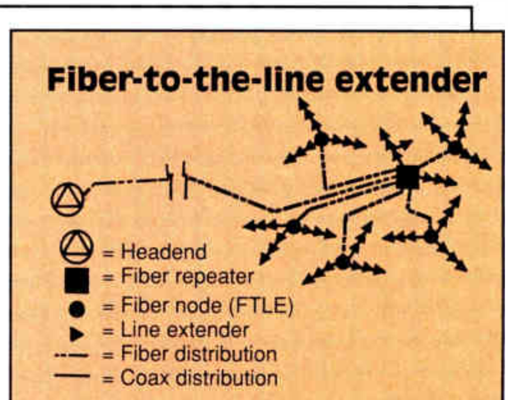
BOULDER, Colo.—Cable Television Laboratories is participating with a group of Canadian organizations to conduct tests of satellite-based advanced TV systems. Canadian Broadcasting Corp., the Communications Research Centre of the Canadian Department of Telecommunications and Telesat Canada make up the group.

The tests are like those being planned by the Federal Communications Commission Advisory Committee on ATV Service for terrestrial ATV services. Results will help determine optimum parameters for satellite transmis-

Sumitomo supplies new FTLE system

HILLSBOROUGH, N.C.—Sumitomo Electric Fiber Optics Corp. is supplying the Cablevision Industries' system here with fiber-to-the-line extender (FTLE), which involves a new system architecture. It is the first application of the system.

According to SEFOC, the architecture allows a reduction in the number of active transmission components cascaded from the head-end to the customer. "A conventional electronic design for Hillsborough would have required a cascade of up to 46 active components to the customer but the optical fiber-to-the-line extender architecture requires only five active components between the headend and the customer," says Larry Corsello, vice president for SEFOC.



sion of ATV systems and benchmark quality data to assist in identifying applications appropriate for each system. Initial plans are for testing MUSE-E from NHK in Japan and HD-BMAC from Digital Video Systems, the Canadian subsidiary of Scientific-Atlanta.

In other CableLabs news, it chose Jerrold to construct a test bed for ATV via cable and fiber. Jerrold's Applied Media Labs agreed to build the system and deliver it last month to CableLabs' Advanced Television Test Center in Alexandria, Va. CableLabs is conducting tests of six proposed ATV systems under typical cable TV impairments, including random noise, intermodulation distortions, multipath and multiple microreflections, hum and low frequency noise, incidental carrier phase modulation and discrete frequency interference.

SuperNTSC ATV two years away?

SUNNYVALE, Calif.—Faroudja Research Enterprises withdrew its SuperNTSC system as a proponent for the Federal Communications Commission's advanced television systems standard setting process and is starting to commercialize the system immediately.

According to FRE, recent correspondence from the FCC led it to believe the system is in full compliance with current regulations on color TV transmission. Now all that is needed is the SuperNTSC sets themselves, which the company says could be available within two years. FRE promises over-the-air demonstrations and consumer testing around the country "in the near future."

SuperNTSC uses a standard TV broadcast channel and is said to require only low-cost modification of broadcast and cable equipment. Consumers will see some picture improvements on current TV sets, but dramatic differences will be seen on the SuperNTSC sets, according to the company.

☛ C-COR will offer customers in the United States and Canada an opportunity to have until Jan. 31, 1991, to pay for shipments of RF amplifiers and accessories that they order and accept billing for prior to Dec. 31, 1990. The order must total $50,000 or more. In other C-COR news, it expects first quarter revenues and earnings to be down, resulting in an anticipated loss for the July through September period. Finally, C-COR signed an agreement to manufacture a special coaxial headend for Smart House L.P.

☛ Jones Intercable systems in Colorado's Jefferson County, Evergreen, Broomfield/Boulder County and Brighton installed 1,179 new subscribers in four days during an "Instant Installation" promotion. The installs were roughly 10 times greater than usual.

☛ EIP Microwave has moved its offices. The new address is 1589 Centre Pointe Drive, Milpitas, Calif. 95035. The phone is (408) 945-1477 and the facsimile is (408) 945-0977.

☛ Conifer Corp. now offers a two-year warranty on all products shipped after July 1, 1990. The company manufactures reception equipment for wireless cable (MMDS) and ITFS.

☛ Midwest CATV announced that it will stock the Noyes family of fiber-optic test equipment, which has been approved for use by Jones Intercable and Jones Spacelink.

Unbiased lab tests

Several months ago we discussed your innovative ideas particularly concerning equipment testing as an extending service to the cable industry. We all agreed if it was done in a professional and unbiased manner it would be of great value.

We have just read "CT's Lab Report" in the August 1990 issue and we are surprised and greatly concerned. Firstly, the overall layout amounts to a product promotion, stating the manufacturer's address and telephone number at the end of the report. Secondly, your whole test setup certainly shows your desire to reach a very positive conclusion. We had tested the identical product at an earlier date in our lab according to standard industry procedures and a temperature range from −40°C to +55°C.

In our test, the temperature at the resonant capacitor got as high as 108.2°C. The maximum rating of this component from the manufacturer is only 90°C. Our test report also contains a case temperature vs. life graph showing a reduced life expectancy of this capacitor to approximately 20 percent of normal life range. Furthermore, you are reporting that the PIP surge protector module failed during the short circuit test. We fail to understand why an over-voltage device should fail during a low voltage over-current condition.

All in all, we considered similar packaging almost 20 years ago but our calculations showed that reliability would be significantly compromised for only minor gains in aesthetics and uniqueness.

In order to preserve fairness, impartiality and simply professional reporting, we would like to suggest that we jointly submit the unit to an independent test lab and reporting the findings to your readership. We feel strongly that this should be done very promptly since misinformation has been disseminated to your readership and purchasing decisions may be based upon that report. The damages to all parties affected will increase over time and may affect your publication.

Thank you for your immediate attention.

Fred Kaiser
President
Alpha Technologies

Editor's note: The results presented in "CT's Lab Report" are what was measured in an unbiased evaluation at Jones Intercable's corporate engineering lab. We publish information on how to contact the manufacturer as a courtesy to our readers. As for conducting a test with the "desire to reach a very positive conclusion," I have always approached product evaluations with the intent to try to fail the test sample under realistic operating conditions. It would be a disservice to our readers and unethical on my part to intentionally present false or misleading data in "CT."

I recognize that Alpha has high standards to which their products are tested but one thing our industry has lacked is consistency in test procedures in many areas. While we do have guidelines for such things as the measurement of amplifier distortions, we have yet to establish consistent industrywide procedures for power supply testing. As such, my techniques for evaluation of a product such as the Power Cast require a somewhat arbitrary decision on my part as how to conduct the test. Working with a competitor (even using an independent lab) would—even with perfectly valid results—throw considerable doubt on the intent of such a test.

While I do not dispute your findings, our high temperature test was performed in direct sunlight at +100°F ambient (+37.8°C) on the roof of the Jones building, and the room temperature tests inside an air-conditioned lab at +68°F (+20°C). As was stated in the report, the power supply ran cooler at +100°F ambient with normal air circulation than it did in the lab with no air circulation. I would expect similar results to yours had I placed the unit in a sealed environmental chamber at +131°F (+55°C) with no air circulation (even a vented pedestal provides some air circulation). In fact, placing the Power Cast—or any active device for that matter—in an unvented pedestal would be asking for trouble. There is no question that operation of electronic components above their rated value will substantially reduce their life, but the Power Cast adequately dissipated heat in normal operation conditions.

I too questioned the failure of the PIP module, but the manufacturer stated that the failure we experienced wasn't unusual given the three-day long short-circuit operation. In spite of that, the power supply itself continued to function normally and subsequent tests with a replacement PIP module did not duplicate the failure we experienced initially.

Our environment

In the interest of cutting down on pollution specifically, will you please discontinue the practice of enclosure envelopes to distribute your magazine. I personally see no advantage; hundreds of magazines go through the mail, minus envelopes, and arrive intact.

I believe discontinuing this practice will reap a couple of side benefits for you. Specifically, you would certainly see a cost saving and surely time saving would register a positive as well.

I look forward to your next issue—minus the envelope.

S.M. Nicholas
Executive Assistant
Rogers Cable TV
Calgary, Alberta, Canada

Editor's note: Postal regulations require magazines like "Communications Technology" to be enclosed in protective envelopes whenever they are mailed outside the United States. We do occasionally ship "CT" in clear polybags domestically, but only when the subscription renewal insert is included. Otherwise, "CT" is mailed without envelopes.

NTSC generator

I'd like to thank you again for the accurate review of the Tektronix Model TSG-100 NTSC TV generator in *CT*'s April 1990 issue and the continued use of the VM700A in your lab reports. With many facilities in the TV business respecting the VM700A when it comes to performance measurements, it appears to fit in this evaluation role. If you ever need any assistance on unusual or complex applications with the VM700A (or any other Tek product for that matter) we would be glad to help.

As our division continues to provide more products tailored to cable industry requirements, we expect and look forward to working more closely with your publication in the future.

Jeff Noah
Public Relations
Tektronix Television Division

Video measurements for picture quality assurance

By Adolfo Rodriguez
Marketing Manager, TV Measurement Systems
Tektronix Inc.

The most critical measurement in television requires absolutely no technical expertise at all to make. Even a 5-year-old child can make it with as much speed and certainty as the most accomplished video expert. The measurement is judgment of picture quality. And when the picture "goes all crummy" during Saturday morning cartoons, the kids know who to blame too. "Hey, TV guys, hurry up and fix the picture will ya."

The picture is what television is all about. To keep viewers happy, picture quality must be assured. This means catching and fixing video signal degradations early, before they evolve into objectionable picture impairments. Total video signal quality—not just levels—must be maintained from headend, to hub, to subscriber drop. This implies a wide range of video signal and channel quality measurements that can be both highly complex and time-consuming. Fortunately, that needn't be the case when video measurement sets employing modern DSP (digital signal processing) techniques are used.

DSP techniques allow all standard and many special measurements to be automated within one instrument. Pressing a few buttons will execute and display a complete set of horizontal timing measurements such as shown in Figure 1. Press some other buttons and signal-to-noise ratio (S/N) is measured from a noise spectrum (Figure 2). Press a few more buttons and the measurement can be switched to frequency response and group delay. Or, in a fully automatic mode, a full range of measurements (e.g., those in RS-250B/EIA-250C, NTC-7, and RS-170A) can be continuously cycled through and compared to alarm limits.

To gain a better understanding of how a DSP-based video measurement set can be used in picture quality assurance, let's take a closer look at some measurement examples. These examples also will further explain the DSP techniques used in obtaining measurement results.

Figure 1: Automated DSP horizontal timing measurement display

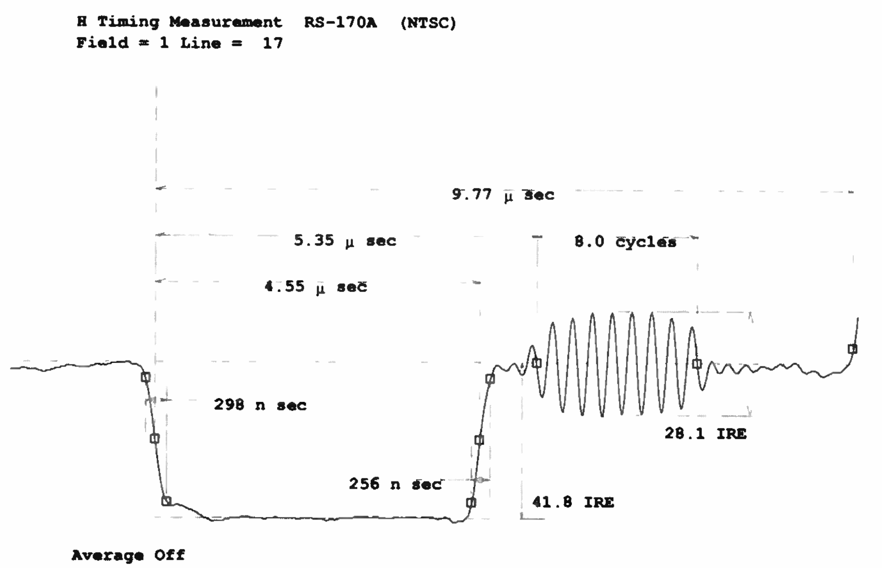
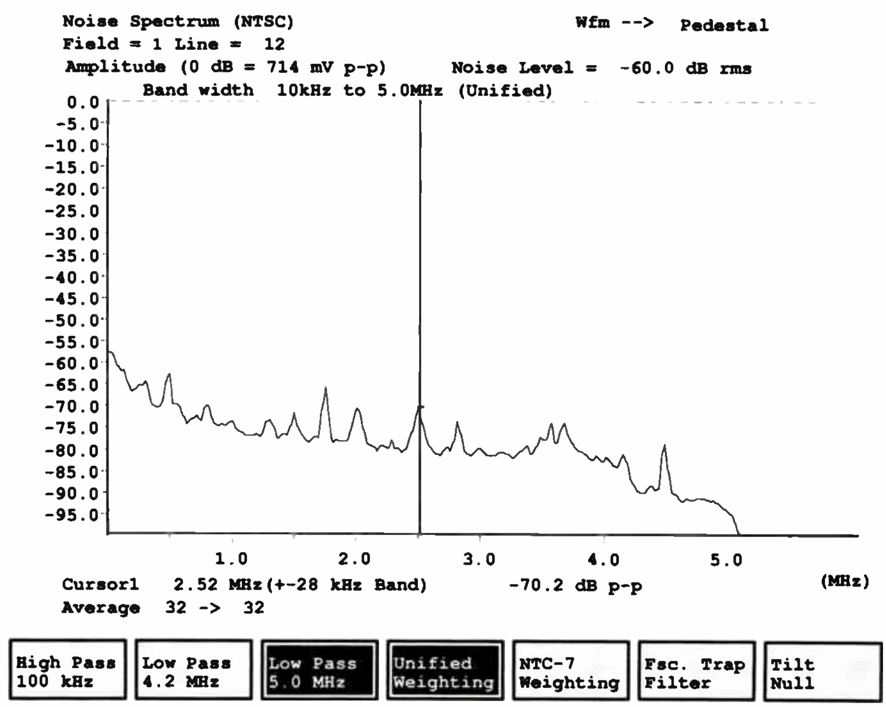


Figure 2: S/N measurement from FFT of a quiet line



In-service measurements

Figure 3 shows a block diagram for a conceptual test setup using a DSP-based video measurement set. Actual test configurations will vary depending on the type of distribution plant and where testing is done in the plant. Notice in Figure 3 that the test setup is essentially the same as would be used in applying a conventional waveform monitor or vectorscope. Where the signal has not been demodulated down to baseband NTSC composite video, a demodulator must precede the measurement set.

A key goal, as indicated in Figure 3, is to make all measurements in-service, without interrupting subscriber viewing. This requires use of vertical interval test signals (VITS). Usually the program originator inserts VITS for tests at the program source. These may be color bar, multiburst, NTC-7 Combination, or whatever other standard test signals the originator deems necessary. If these signals are left in the transmitted video they are available for test use in the cable distribution plant.

It should be kept in mind, however, that VITS existing in received signals will contain any degradations encountered in the original transmission path. Thus, any downline measurements will need to be made relative to received, rather than absolute, VITS quality. When the needed VIT signal is not present, or when absolute measurements are desired, you may want to insert test signals into the desired vertical interval lines. A VITS inserter will be necessary for this.

As a final point regarding test signals, program originators may use different vertical interval lines for VITS. This means that you will probably need to search the vertical interval lines on each channel and prepare a channel-by-channel reference chart for the available VITS. However, with modern DSP-based video measurement sets, creating such VITS charts becomes unnecessary. This is because the automated measurement procedures use vertical interval searches to find the specific signals necessary for the selected measurements. When the signal is found, the measurement proceeds automatically. If the necessary signal is not present the instrument issues a message that the necessary test signal is not present.

Figure 3: Conceptual in-service measurement setup

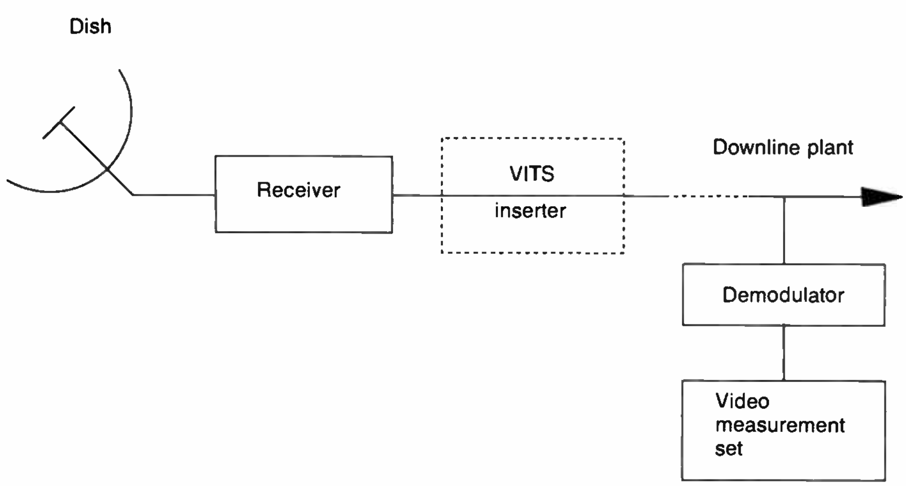
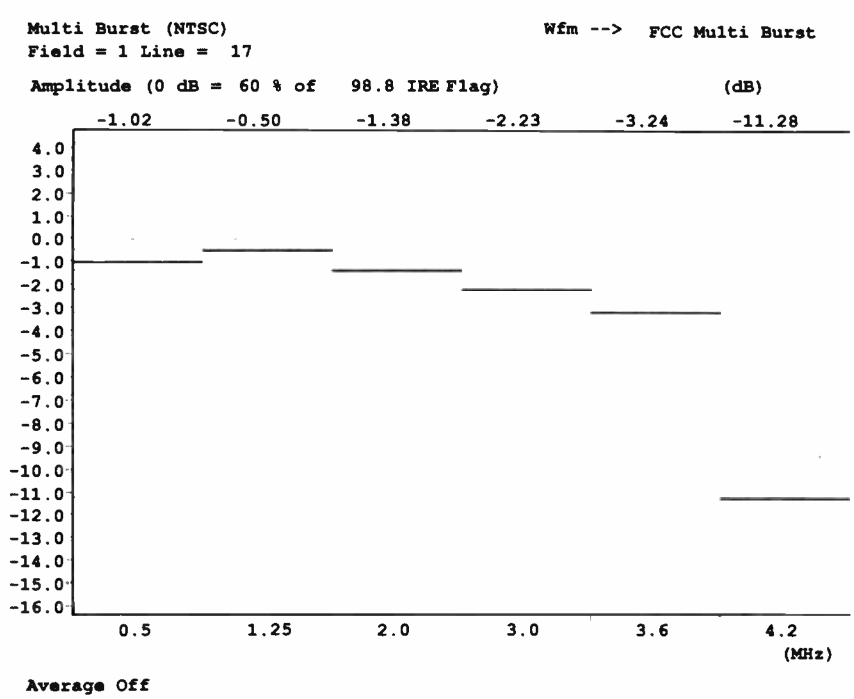


Figure 4: Multiburst measurement of frequency response



Establishing headend references

Signal-to-noise ratio and frequency response are two basic overall tests for channel quality, and thus picture quality, assurance. These tests should be performed first at the system's headend to establish a received signal quality reference. The tests are then repeated downline in the system to establish channel quality relative to the received reference.

In the case of Figure 2, S/N has been measured using the DSP techniques of the Tektronix VM700A video measurement set. The video signal is digitized by the instrument and all measurement processing, including display construction, is done digitally. This offers several measurement advantages. Since displays of results are digitally generated, they can be output over the instrument's RS-232C port to a printer. This is what was done to obtain Figure 2, which is a printer's duplication of the CRT display. Such printouts are useful for documenting channel or signal quality measurements for later reference or comparison to other downline measurements.

For more immediate, interactive needs, digitally acquired signals also can be stored as references. The stored reference then can be displayed on-screen for comparison with subsequent signal acquisitions.

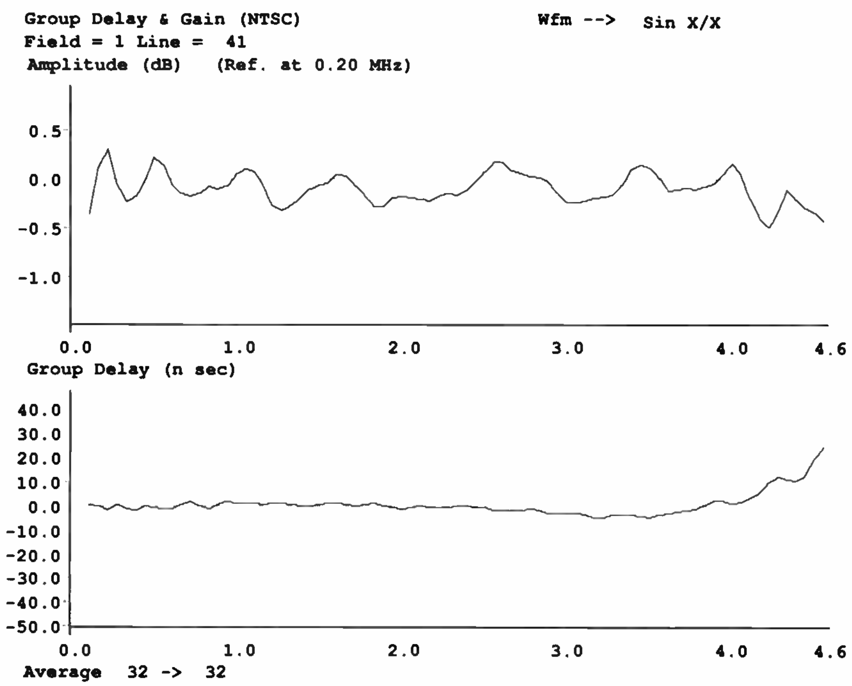
S/N measurements

The DSP process used in making the S/N measurement of Figure 2 involves first digitizing a quiet line from the vertical interval. As previously mentioned, the more modern video measurement sets automatically find and digitize the necessary signal line for S/N or any other selected measurement.

Once the quiet line is acquired, the instrument automatically applies a fast Fourier transform (FFT) to obtain a noise spectrum (Figure 2). S/N is then computed automatically from the noise spectrum and displayed in the measurement readout.

"Regular...testing... provides an excellent historical reference for spotting channel degradations before they become noticeable picture quality problems."

Figure 5: A test using (sin x)/x provides measurement results for both amplitude and group delay vs. frequency



Noise measurements should be made to establish a reference for each channel at the headend. Measurements then are made downline to establish each channel's noise contribution. Repeated measurements on a particularly noisy channel will help zero in on the noisy segment of equipment. Also, a measurement cursor (vertical line on the display) can be positioned on any suspicious noise peak. The frequency readout for the cursor location (bottom of the display) is useful for identifying possible noise or interference sources.

Repeating the noise measurements as often as necessary is relatively easy because the measurement process is automated. Also, it should be noted that the DSP-based noise spectrum approach does not require ancillary noise measurement equipment. Noise reference generators or noise test sets are not necessary for the DSP-based noise spectrum approach. However, various weighting filters still may be required for some specific noise measurement procedures. But the necessary filter functions can be digitally implemented by the video measurement set, as indicated by the menu selections at the bottom of Figure 2. This built-in digital filtering eliminates the need for externally connected hardware filters.

Example short-haul limits file for automated multiburst testing

	Caution		Alarm	
	Lower	Upper	Lower	Upper
FCC multiburst flag (% carr)	10.6	14.4	10.0	15.0
FCC multiburst flag (% bar/IRE)	92.5	107.5	90.0	110.0
FCC MB packet #1 (% flag)	—	—	59.2	60.8
FCC MB packet #2 (% flag)	—	—	58.9	61.1
FCC MB packet #3 (% flag)	—	—	58.8	61.2
FCC MB packet #4 (% flag)	—	—	58.7	61.4
FCC MB packet #5 (% flag)	—	—	59.3	60.7
FCC MB packet #6 (% flag)	—	—	—	—
NTC7 multiburst flag (% carr)	10.6	14.4	10.0	15.0
NTC7 multiburst flag (% bar/IRE)	92.5	107.5	90.0	110.0
NTC7 MB packet #1 (% flag)	—	—	49.3	50.7
NTC7 MB packet #2 (% flag)	—	—	49.1	50.9
NTC7 MB packet #3 (% flag)	—	—	49.0	51.0
NTC7 MB packet #4 (% flag)	—	—	48.9	51.2
NTC7 MB packet #5 (% flag)	—	—	49.4	50.6
NTC7 MB packet #6 (% flag)	—	—	48.9	51.2

Frequency response evaluation

Along with low noise, picture quality also relies on uniform gain and linear phase transmission across the video frequency band. The most common test for gain uniformity is to measure the packet amplitudes of a multiburst signal. Such a measurement is shown in Figure 4, where packet amplitudes are plotted against frequency.

The advantage of the multiburst ap-

(Continued on page 50)

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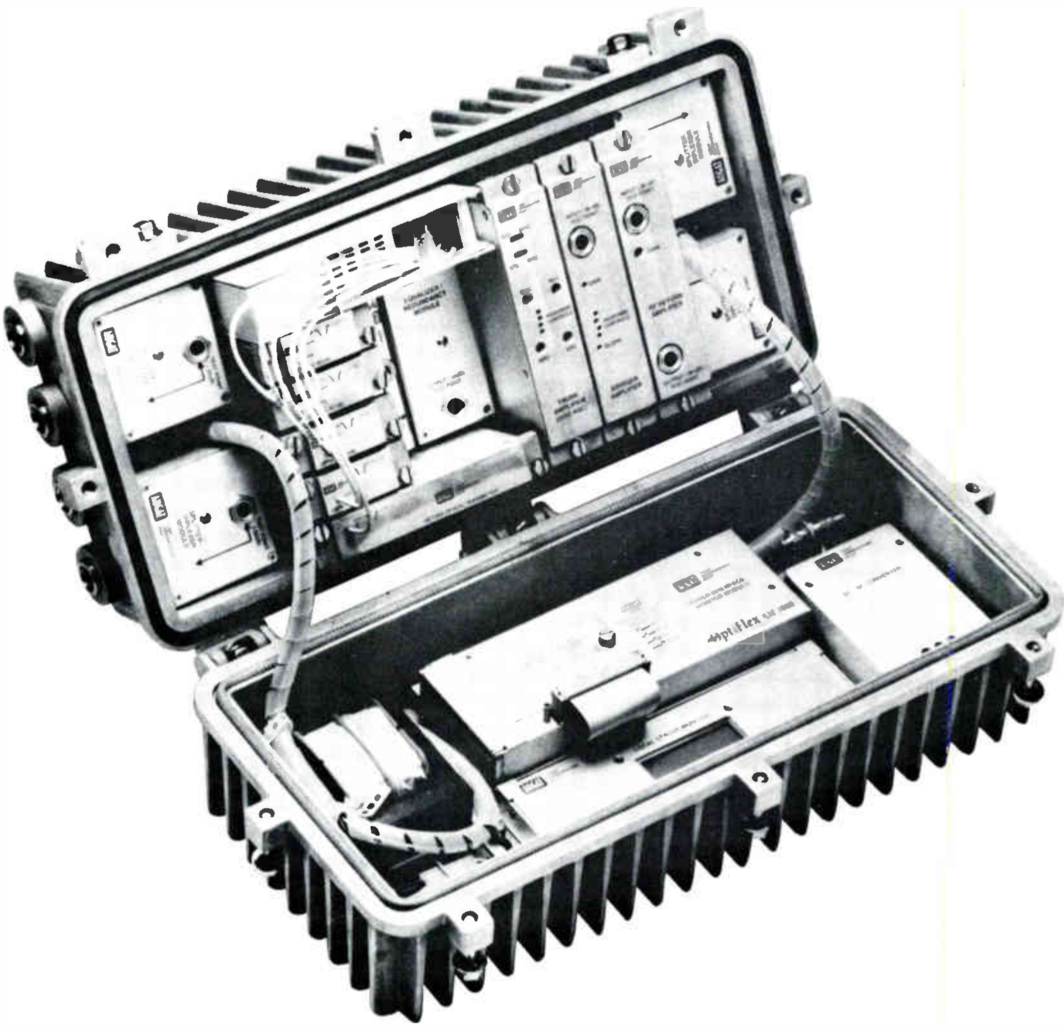

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Reader Service Number 16

Cross-modulation redefined

By Earl Langenberg
Vice President of Engineering and Technology, US West

In 1968, Ken Simons described that cross-modulation is one of two third-order distortion effects that do not result in components at new frequencies[1] (the other being compression). Cross-modulation (X-mod) was once the dominant distortion of a 12-channel system. However, at today's higher channel loadings, composite second order (CSO) and composite triple beat (CTB) have become the dominant distortions. Even though no longer dominant, it is important that X-mod be understood and measured.

Testing for X-mod is somewhat controversial because of the way phase components are dealt with. Early on, engineers learned that attempting to correlate measured data between a spectrum analyzer and a selectively tuned voltmeter (or wave analyzer) was compromised by phase modulation[2,3]. While initially thought of as an amplitude modulation distortion, phase X-mod exists at frequencies above 100 MHz. Some engineers feel that the phase component for CATV performance testing should be handled in a manner that best emulates the detector of a TV tuner and so use a frequency-selective voltmeter to make the test.

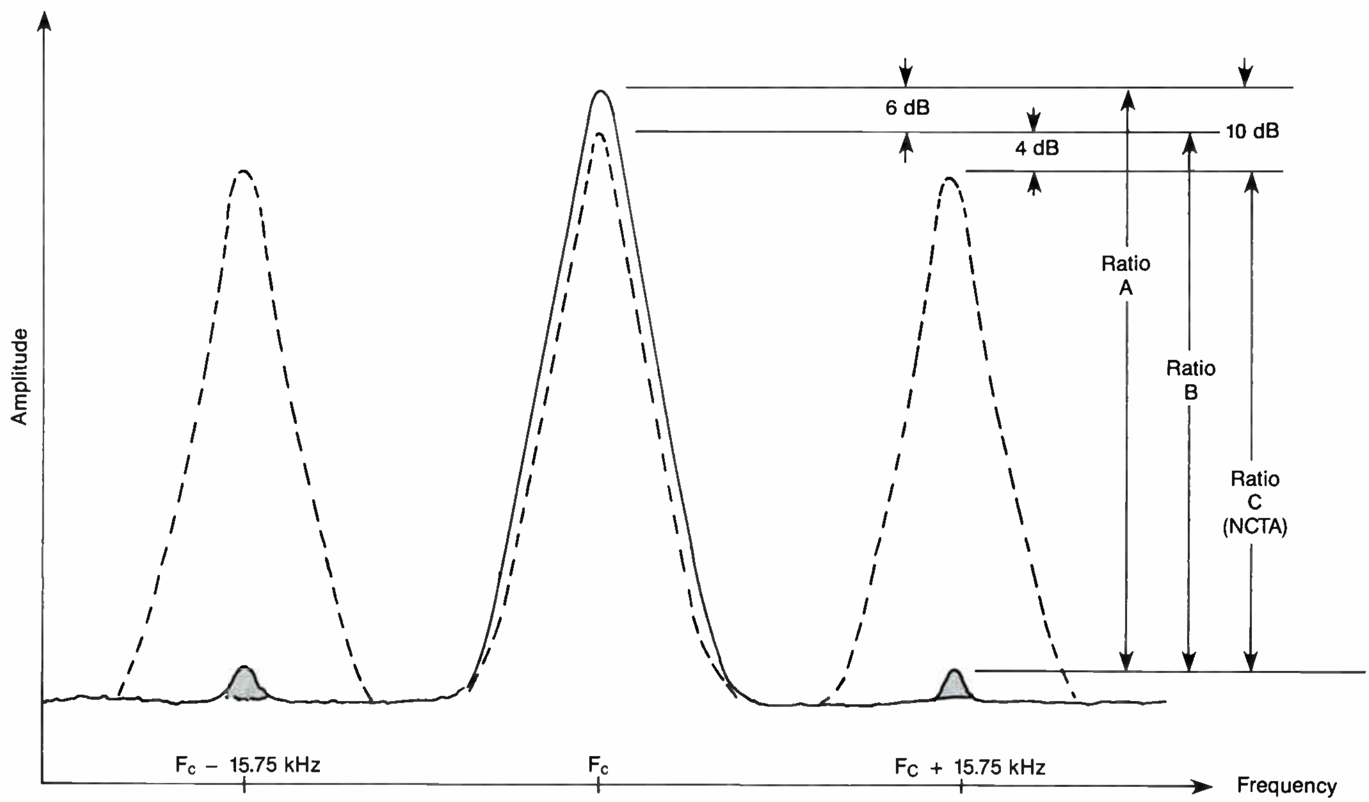
Spectrum analyzers measure and display the absolute magnitude of vectors within the selected resolution bandwidth without regard for phase relationships. Wave analyzers and tuned frequency-selective voltmeters on the other hand measure and display the resultant magnitude of vectors in the passband taking into account phase relationships. X-mod measurements taken with a spectrum analyzer can measure 0 to 10 dB worse than measurements taken with a selectively tuned voltmeter because of the way the two instruments handle phase components.

The second edition of the NCTA's recommended practices for measurements on cable systems[4] defines X-mod as "a distortion, resulting from the non-linearity of a system, which causes a carrier in the system to be modulated by the various desired signals carried on the other channels in the same system. Cross-modulation is specifically defined as the ratio of the peak-to-peak amplitude of the modulation on the test carrier (caused by the signals on the other modulated carriers) to the peak level of the test carrier."

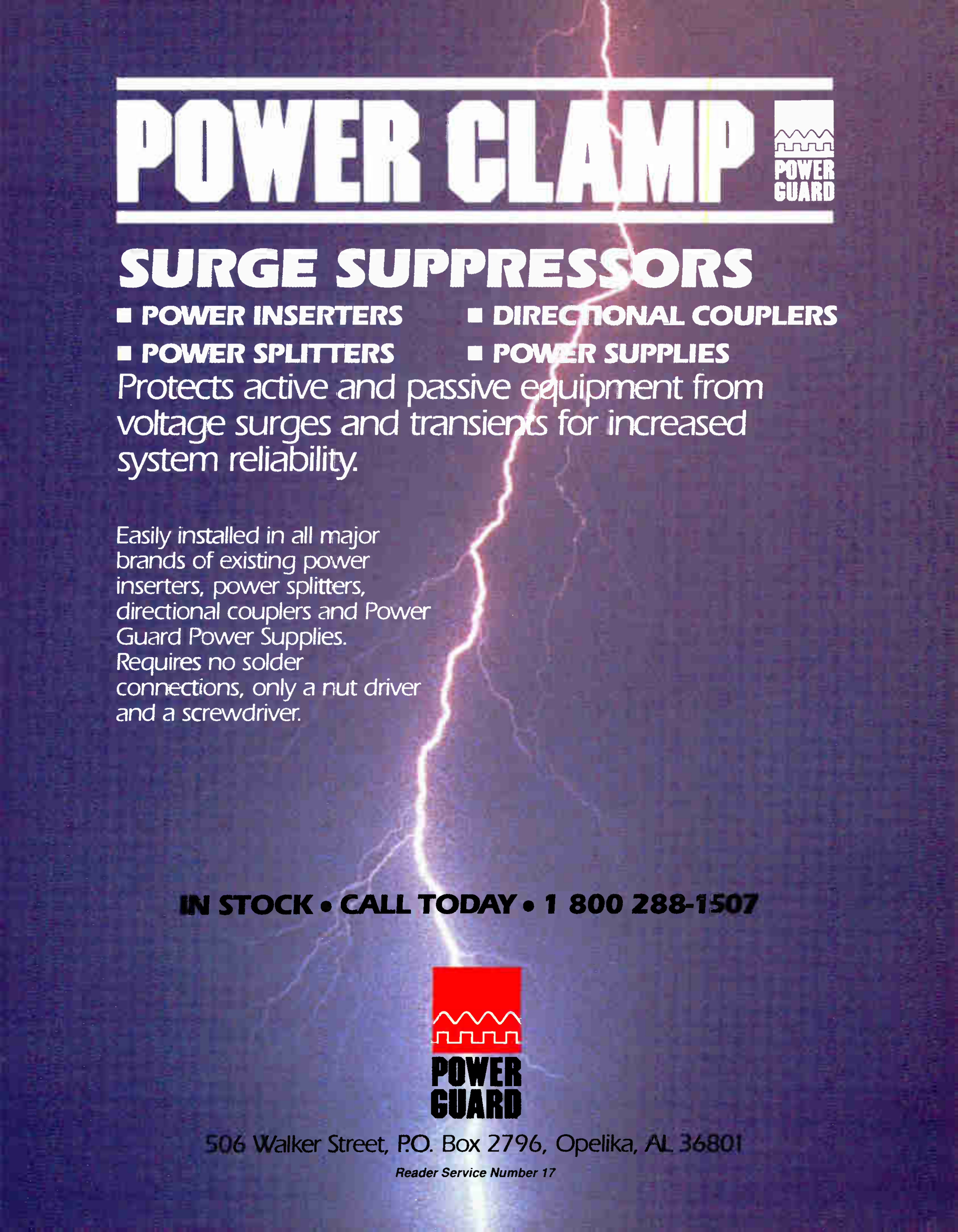
It is important to understand that at the time X-mod ratios were defined the only practical way to measure them was in time domain using oscilloscopes or tuned RF voltmeters. In the time domain, RF carriers are eliminated in the detection process. Consequently, there is little or no ambiguity between the ratio as defined vs. what is actually measured. Terms like "desired

(Continued on page 74)

Figure 1: Frequency domain



Key: ——— Unmodulated (CW) carrier with undesired X-mod.
— — — Modulated carrier (modulated 100 percent with 15.75 kHz square wave having 50 percent duty cycle).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1 GHz cable testing using variable bridges

Comm/Scope has continually evaluated and developed methods of automatic cable testing procedures. A new system—in production for 18 months—is called the Automatic Cable Testing System (ACTS). It is a culmination of approximately 10 years of research and development. Being a large manufacturing company introduced some unique testing problems (due to volume) and many technical problems had to be resolved. This article will address these areas.

By Pete Stulginski
Analysis and Network Manager, Comm/Scope Inc.

Several early attempts to automate the cable testing procedure were burdened by the level of technology in analyzer equipment, control systems and the economic environment. The Hewlett-Packard HP8505 was one of the first in the network analyzer family that had some promise in solving the limitations in measurement equipment. Although not a powerful enough piece of equipment, it did allow us to develop the definition of the requirements to accomplish autotesting of our products.

The introduction of the Hewlett-Packard HP8753 analyzer ushered in the new generation of network analyzers. Other elements that helped move along testing technology were the advancements of distributed computer systems such as the Hewlett-Packard HP9000 Unix systems and the growth of the industry, which made developments more economical to pursue.

Early on we learned that one of the best resources at our disposal is our people. Our inspectors gained a lot of knowledge in identifying good product by evaluating waveform patterns, which is near impossible to detect programically. This was the driving factor that made us pursue the variable bridge measurement vs. predicted measurements using a fixed bridge.

Our first attempts at automated testing used the network analyzer with a standard fixed bridge S-parameter test set. The following formula illustrates the calculation used to predict the return loss (RL):

$$RL_i = -20\log_{10}\left(\frac{\left[Z_{meas_i} - Z_{ref}\right]}{\left[Z_{meas_i} + Z_{ref}\right]}\right)$$

Where:

$$Z_{meas_i} = 75 * \frac{(1+\rho_i)}{(1-\rho_i)}$$

$$Z_{ref} = \frac{1}{n} * \sum_{i=1}^{n} Z_i$$

This result can be very predictable provided the characteristic impedance is measured accurately. Factors that can lead to inaccuracies in the impedance measurement are:

- The test leads located between the bridge and the cable are critical in RL measurements. With the volume of tests performed daily the stability in electrical characteristics cannot be maintained.
- Discontinuities in the cable will vary the impedance measurement.

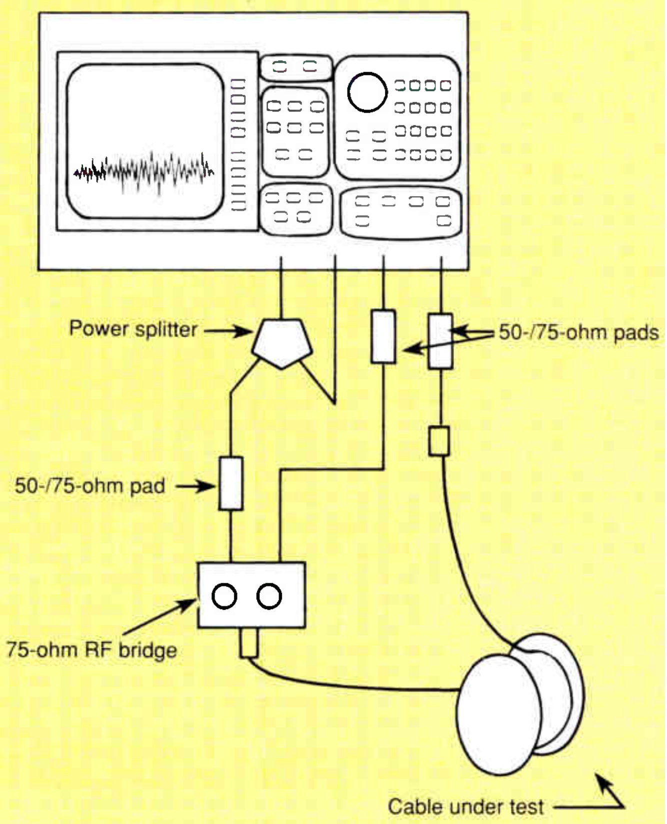
The advantages of using variable bridges are:

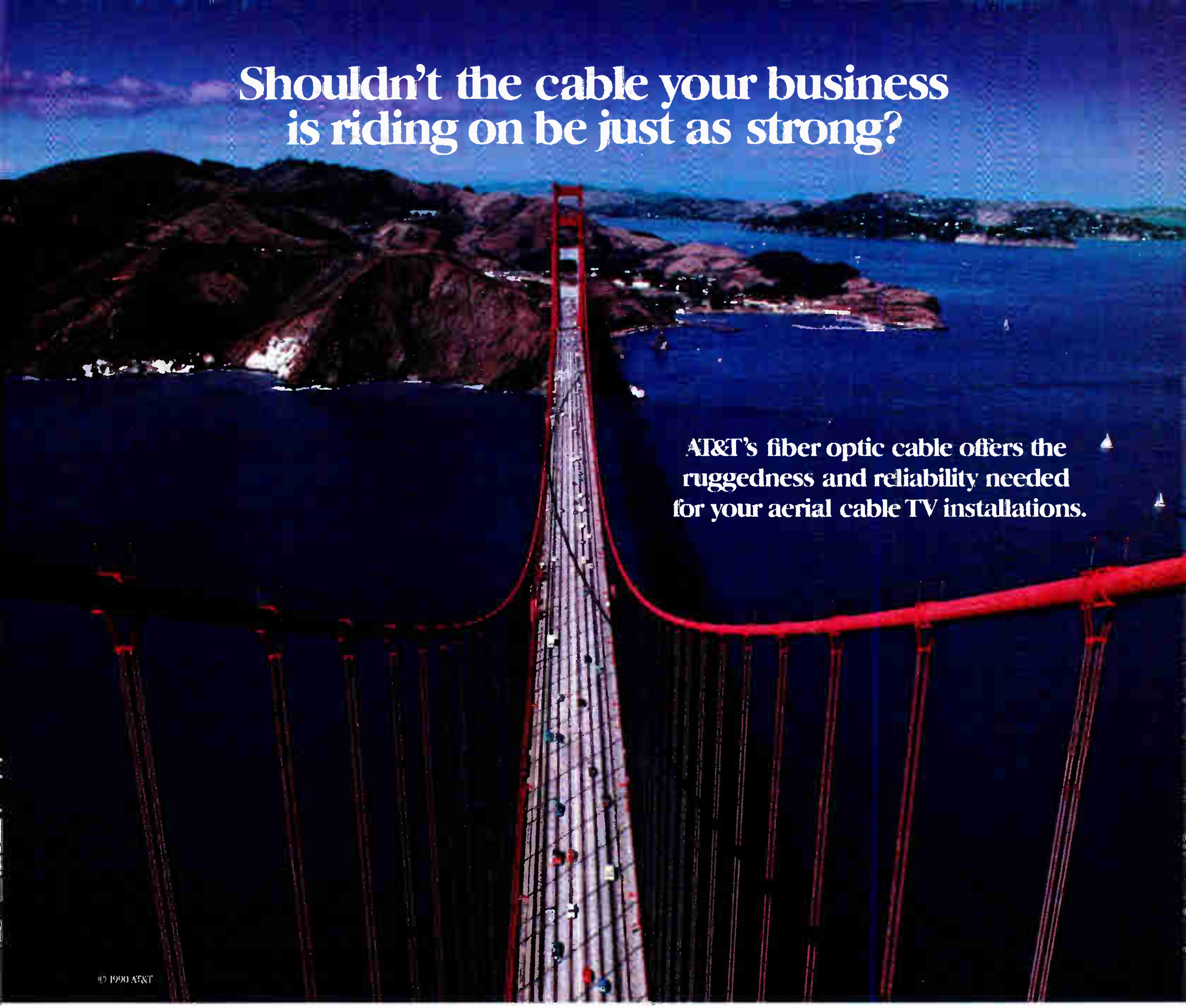
- It has the ability for direct readings of variable bridge impedence and RL measurements.
- The test ports are physically at the ends of the cable.
- Waveform and patterns are available to the operator for direct feedback.
- Tests can be performed manually without the use of controlling equipment.
- Fixed bridge measurement is possible.

The ability to tune or balance the bridges, matching the characteristic impedance of the cable, provides information on the maximum power that the cable is capable of transmitting while uncovering any return loss peaks that might be hidden in noise of fixed bridge measurements.

(Continued on page 76)

Manual test system





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AT&T
Network Systems

Evaluating pay-per-view ordering technologies

By Dan Moloney
Director, Product Management
Subscriber Systems Division, Jerrold Communications

As addressability becomes the norm, the type of pay-per-view (PPV) service and, concurrently, the type of ordering methodology used to deliver it become serious topics of discussion for cable operators. There are several methods at varying costs for an operator to consider when offering PPV.

Will PPV be as common as a pay service with almost hourly offerings? Will the cable system offer more than one channel? Will the service be limited to occasional blockbuster events such as prize fights? Or will a steady diet of movies and other features be offered? The answers to each of these will determine what type of ordering method is best.

System architectures

First, let's distinguish between system architectures. The two basic choices are one-way and two-way systems.

In a conventional one-way addressable system, a customer orders a PPV program by calling a customer service representative (CSR) before the event. The CSR enters the program selection into a billing computer, which forwards the request to the addressable controller and enters this purchase information into the subscriber's data base for later invoicing. This approach, while the least expensive to implement in terms of capital outlay, requires subscribers to order significantly in advance and may require a larger staff of phone operators, depending on the anticipated volume of incoming calls. Call-in PPV operations represent a high variable cost, or cost for purchase, for processing the order.

Experience shows a general sub reluctance to order well in advance of an event. This reluctance is based on the sub's reticence to make concrete advance plans. Important or special programs around which a viewing schedule can be planned can overwhelm this reticence.

Two-way systems offer another architecture. These remove the operator's intervention in the ordering cycle and reduce the possibility of errors. Subs enter a purchase request and the order is automatically executed.

Two-way systems are divided into two broad categories: advanced order (or real-time) processing and store-and-forward systems. Each category can be further divided into two-way RF and two-way telephone return. Two-way RF systems use a return RF path provided by a two-way cable distribution plant. Two-way phone systems use the public switched telephone network to communicate ordering information back to the headend.

Real time

There are many real-time ordering concepts. Real-time RF systems use a device in the home that accepts order information and forwards the information to the headend control system through the return RF path. The headend computer checks the credit worthiness of the sub, records the purchase and forwards an authorization to the converter.

While this process is generally not time-consuming for a large system, it may require the sub to order in advance. If the control system is down or there is noise or ingress in the return spectrum during a broadcast, potential customers will be lost.

Real-time telephone systems take on several different forms. These include the automated response unit (ARU) voice response systems, which use a computer at the headend to answer subs' calls. Synthesized or taped verbal cues ask a series of questions and the sub responds by entering codes using a touch-tone telephone keypad.

A purchase session with a voice response system requires an average connection time between 60 and 90 seconds. When multiplied by many subs, this represents a serious limitation on the volume of traffic the system can handle. A voice response system requires a capital outlay for headend equipment, phone lines and touch-tone devices for those subs without this service.

"Many cable operators may find that the hybrid store-and-forward IPPV approach provides the greatest flexibility in confirming operational parameters of the system and using the available communication resources."

Auto-dial devices let subs order programs by entering information into a terminal connected to the telephone line. The microcomputer in the terminal communicates with the headend computer. Once an order has been phoned in, the customer's credit checked and a record established for invoicing, the addressable controller downloads the appropriate authorization over the one-way addressable system.

Call duration (including connect/disconnect and line recovery) is estimated at 15 seconds. This, again, represents a serious bottleneck when extended over a reasonably sized sub base. If many telephone lines are used, the bottleneck will shift to credit verification, order recording and converter authorization steps. The system requires a capital outlay for headend equipment and significant outlay for sub equipment but enjoys a low variable cost for purchase processing.

Automatic number identification (ANI) uses the telephone switching equipment to accept purchase requests. With this feature the telco computer identifies calling parties, accepts program ordering information and forwards it to the cable operator's computer. The cable company's billing system cross-references a telephone number with a subscriber ID, checks credit, verifies personal identification data, records the purchase for invoicing and forwards an authorization to the sub over the one-way addressable system. The system requires a communication path from each telco switch serving the franchise area to the cable computer.

A few bottlenecks exist in an ANI system. First, a typical telephone switch center is equipped with call receivers (CDRs) that create the dial tone and accept dialing inputs. The number of CDRs in a switch is dependent on the peak traffic load anticipated when the switch was designed. This is typically less than 1 percent of the number of telephone subs served by the switch. A barrage of calls created by last-minute PPV ordering could use all the available CDRs.

(Continued on page 77)

What to consider in PPV sources

The following is adapted from the "1990 NCTA Technical Papers."

By Robert H. Shaw
Systems Engineer
Pioneer Communications of America Inc.

Pay-per-view (PPV) programming is becoming an increasingly important source of revenue for the cable operator. To boost the subscriber buy rate, it is necessary to offer a wide variety of programming that will entice the subs to buy more frequently.

The current use of satellite distribution allows many systems to provide quality programming as well as frequent blockbuster events. However, the satellite-delivered system does not allow for customization of program offerings.

Videotape systems allow for customization but at the expense of lower equipment reliability and higher maintenance requirements. A laserdisc-based system can offer customized programming with low maintenance, high reliability and a quality signal.

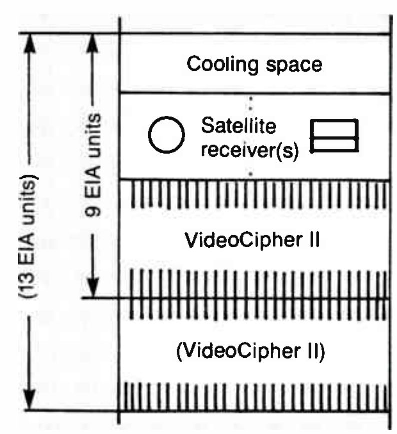
In this article I intend to present a comparison of the different technologies available to allow operators to determine which system would work best in their particular application.

Satellite-delivered

Geosynchronous orbiting satellites have been used for many years for the distribution of most CATV programming. This technology is a tried-and-true means for providing nationwide programming for the likes of movie and sports programmers and superstations.

After initial setup and alignment, the satellite receive system requires relatively low maintenance and only occasional readjustment of the receive components. Maintenance of other support equipment may require more frequent attention (e.g., compressed air or gas feed line pressure hardware). Signal quality is generally very good although occasional problems may appear, such as rain or snow fade, sun-outages and satellite drift.

Figure 1: Satellite hardware (single- or dual-channel)



Although these problems should not pose a long-term threat, the operator must be prepared to deal with customers that call with related complaints and deal with them in a diplomatic manner.

Videotape

Videotape has been used for many years as a source for commercial insertion as an economical means to provide fast, flexible service to advertisers. It also was used as a PPV video source in the early days of cable before the widespread use of satellite-delivered signals.

Using videotape players for PPV causes many operational problems—the main one being maintenance. Unless the operators can spend many dollars on a CART machine, they are forced to use human labor as the means to keep the videotape recorders (VTRs) stocked with tapes ready for playing. Tapes must be changed every hour for an uninterrupted source of video. This requires continuous manning and can become even more costly over the long-term when salaries for the tape operators are considered.

Preventive maintenance on the equipment also is very high requiring frequent head cleanings, lubrication and mechanical repairing of broken or worn parts. The occasional "devouring" of tapes by the VTRs also must be considered when stocking the movies and ordering tapes. The potential for video noise due to tape drop-outs and/or other problems can cause much customer dissatisfaction with the PPV programs.

Although videotape presents many problems, the one main advantage is the ability to provide localized programming to subs. This ability to custom tailor the video selection to the market makes videotape a highly desirable means for providing PPV.

Laserdisc

The use of laserdisc players is fairly new to the cable industry. They can provide advantages of videotape players without their disadvantages.

A clean video signal can be obtained without the degradation caused by repeated playing of the laserdiscs. This is because the laserdisc pickup does not contact the disc in any manner, unlike the videotape player head that is constantly spinning in contact with the tape surface. A dirty videotape head can grind the oxide layer off the videotape causing picture degradation and eventually render the tape useless. Multidisc players also are available to eliminate the need for the operator to manually remove and insert discs for continuous play.

All of these factors add up to low attending maintenance, consistent program picture and audio quality and the capability

Figure 2: Satellite system wiring

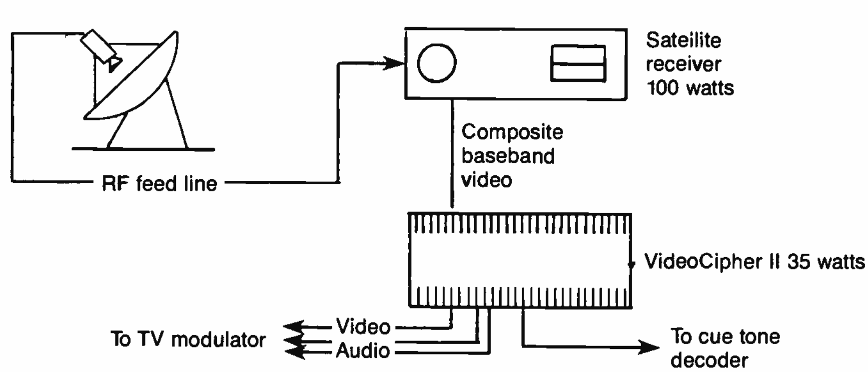


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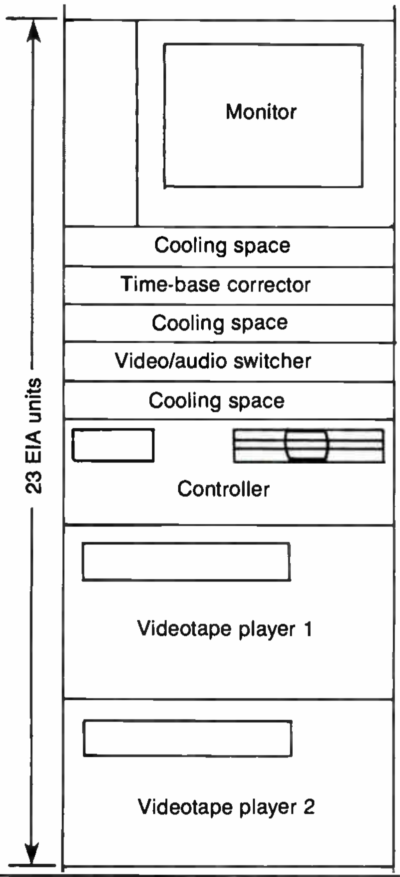
Figure 3: Videotape hardware



for localized custom programming.

Signal quality

One of the first considerations almost any operator will make is the overall quality of the signal source available. For a satellite receiver system, the limiting factor of the signal quality is the descrambler unit (assuming a scrambled satellite signal). A VideoCipher II typically has a weighted signal-to-noise ratio (S/N) of 57 dB. This measurement compares to 47 dB for a ¾-inch (U-matic) VTR[1], and 57 dB for the laserdisc player.

When using videotape as the program source, signal degradation caused by the cable plant must be evaluated carefully. Subscriber satisfaction with the PPV service will depend on the end point quality of the signal. The following table compares S/N among the three PPV sources.

Satellite receiver/decoder	57 dB
Videotape player	> 47 dB
Laserdisc player	57 dB

Mechnical considerations

Depending on the particular system being used to provide PPV service, the amount of space required for the hardware varies widely. Headend space is usually at a premium and efficient use of it must be well-planned to accommodate the equipment needed for PPV service. Not considered in this comparison is any of the associated headend gear such as modulators and scramblers that would be installed in the headend regardless of the type of system used.

- *Satellite system.* A satellite system consumes the least amount of space in the headend. (Refer to Figure 1.) A typical satellite receiver is three EIA units high per channel. (An EIA unit is 1.75 inches in height for a normal 19-inch wide rack.)

Some receiver models, however, can fit two receivers into this same package size. Additional space of at least one EIA should be included for proper cooling of the receiver with two EIA being the ideal spacing. A VideoCipher decoder is four units high and includes its own cooling space with the unit. The design of the decoder allows cool air to circulate over the main circuit board even in systems without forced-air cooling. This totals nine EIA units per channel (13 EIA units per two channels if a dual receiver configuration is used).

If video switching is implemented to switch to an alternate program source in case of receiver failure (fail-safe system), this equipment will require more space. However, the additional space can be considered negligible in this discussion since it usually can be used for multiple channels.

Most satellite equipment is bolted directly into the rack where it is mounted. No special hardware is needed to accom-

(Continued on page 80)

Figure 4: Videotape system wiring

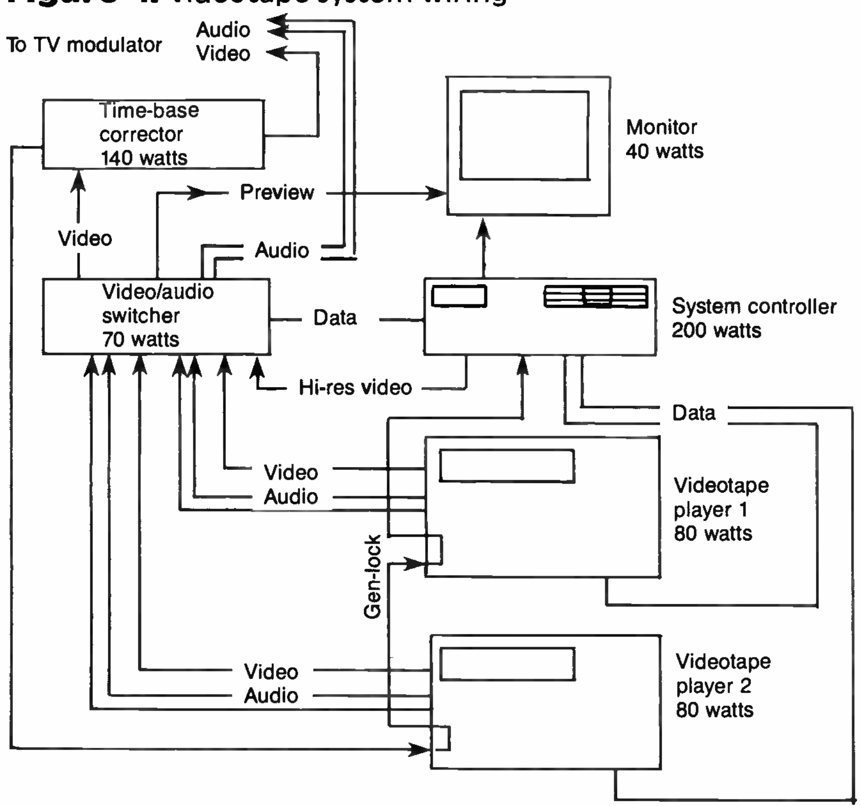
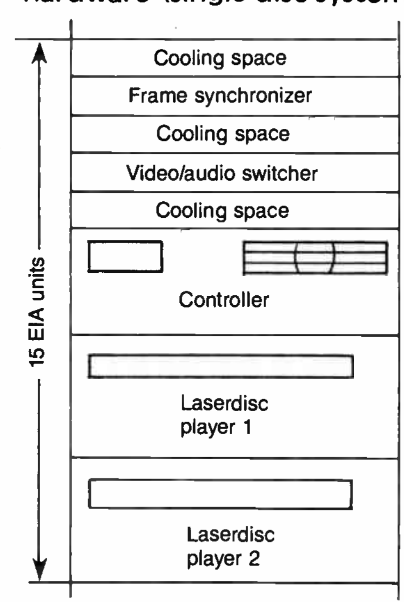


Figure 5: Laserdisc hardware (single-disc system)



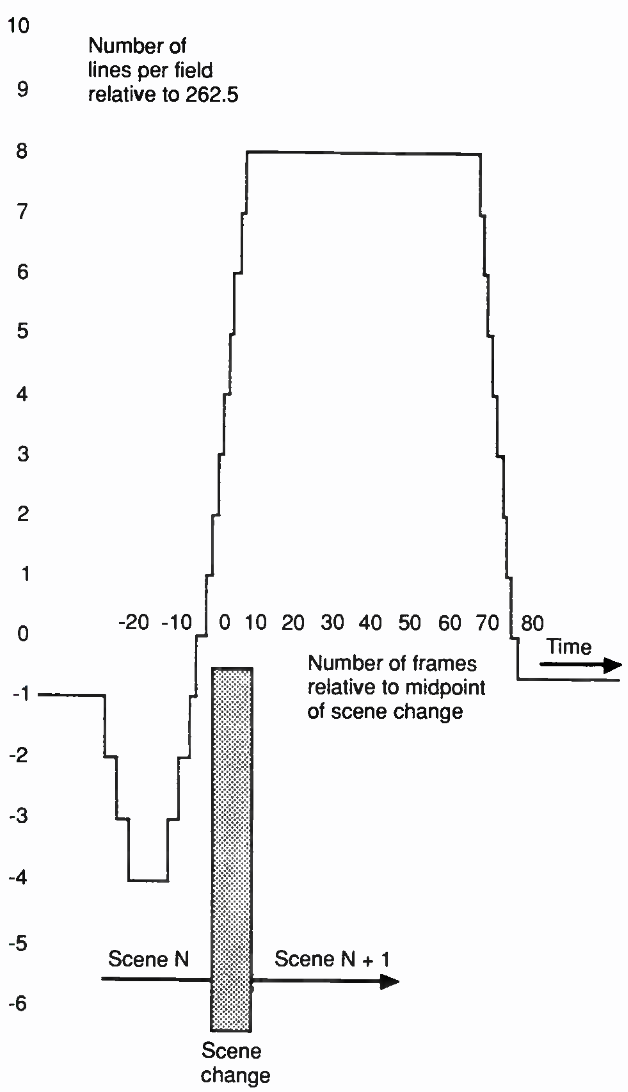
Copy-protection update: The Eidak tests

By Bill Perlman
Director of Operations

And Linda Beech Cutler
Vice President of Marketing Communications
Eidak Corp.

The potential opportunity for earlier pay-per-view release dates and the revenue potential for later markets for PPV programming has created a demand for some form of control over unauthorized copying of program material. Electronic copyright protection has been developed and tested and is now available for PPV programs.

Figure 1: Typical Eidak time profile



Eidak's electronic copy-protection is achieved by modification of the video signal in such a way that a program still can be readily displayed on a standard receiver or monitor, however, an attempted recording using a videocassette recorder has no commercial or entertainment value. Copy-protection methods rely on differences in sensitivity on the part of VCR and TV receivers to modifications of the video waveform 1,2,3. For the transmitted PPV signal, the Eidak technique uses modification of the TV frame rate. It has been developed and tested specifically for operation in cable systems, with emphasis on security and compatibility with other equipment.

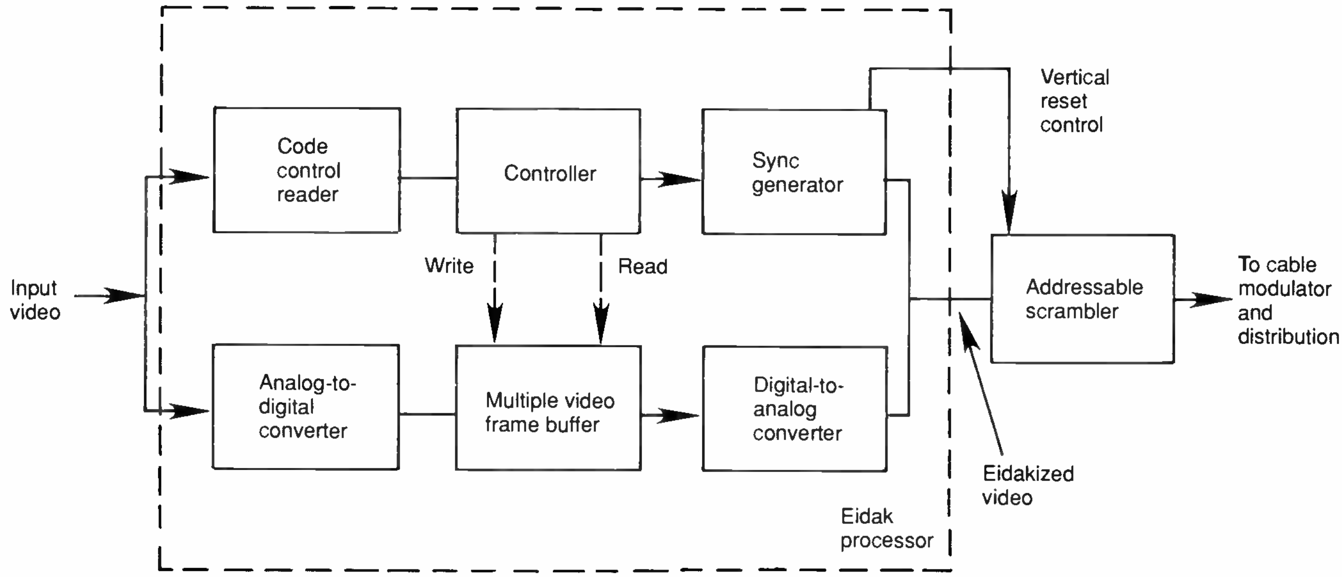
Eidak protection method—A recap

The PPV copy-protection technique varies the field rate in such a way that proper synchronization is upset, the VCR servo loses lock and the video signal is improperly applied to the recording tape. The effect on playback is to create interruptions in the program material (i.e., goes to snow), on-screen artifacts due to non-synchronized head switching and other video distortions. Because of the all-electronic nature of the TV servo circuits they are left virtually undisturbed by this process. The variation in field rate is achieved by adding or deleting horizontal lines. For maximum effect, the technique is applied periodically as shown in Figure 1.

Analysis of program material to determine the optimum profile timing (e.g., scene changes) occurs prior to transmission for prerecorded material. A data file is created that associates this information with the program's time code track. This information then either is inserted in the vertical blanking interval (VBI) on the prerecorded medium (i.e., tape) or kept on file for use with the copy-protection processing equipment. For live events the scene change analysis is performed automatically in real time.

Variation of frame length is accomplished digitally by changing the rates at which frames of digitized video are written into and out of a multiple frame store buffer memory. Within the Eidak headend processor (Figure 2), the control code reads the profile timing data and uses it to control the variation in number of lines per frame. (Alternately, the control code reader extracts this information from a data file and matches it to the time code.) Another important function of the processor is the scrambler interface. Because the copy-protected signal inherently contains non-standard vertical

Figure 2: Eidak processor



sync, some resynchronization must be provided for cable scramblers, which typically are dependent on precise VBI timing. For remote hub operations of scramblers, frame length data is encoded into the VBI and at the hub location an Eidak scrambler interface (ESI) converts the frame length information into resynchronization signals for the scrambler.

Although the copy-protected process for PPV is performed in real time for a transmitted signal, it also can be applied to a prerecorded medium (e.g., laser disc). In this case the copy-protection process is applied to the video signal during the mastering of the disc. When such a copy-protected disc is used later for program origination, the resulting video signal is already copy-protected (Figure 3).

Technical field testing

System operation with video signals that depart in any way from the NTSC standard of 525 lines per frame require attention to compatible operation of equipment. Cable system segments in which particular care must be taken to assure compatibility are:

•Headend—video processing equipment and addressable scramblers.

•Hubs—link transmission equipment and addressable scramblers.

•Subscriber equipment—addressable converters and TV receivers.

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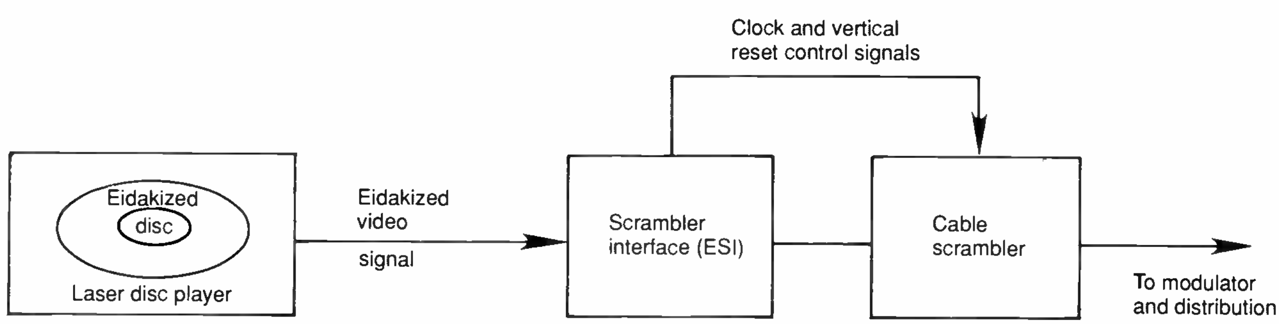
Figure 3: Stand-alone PPV with Eidakized laser disc



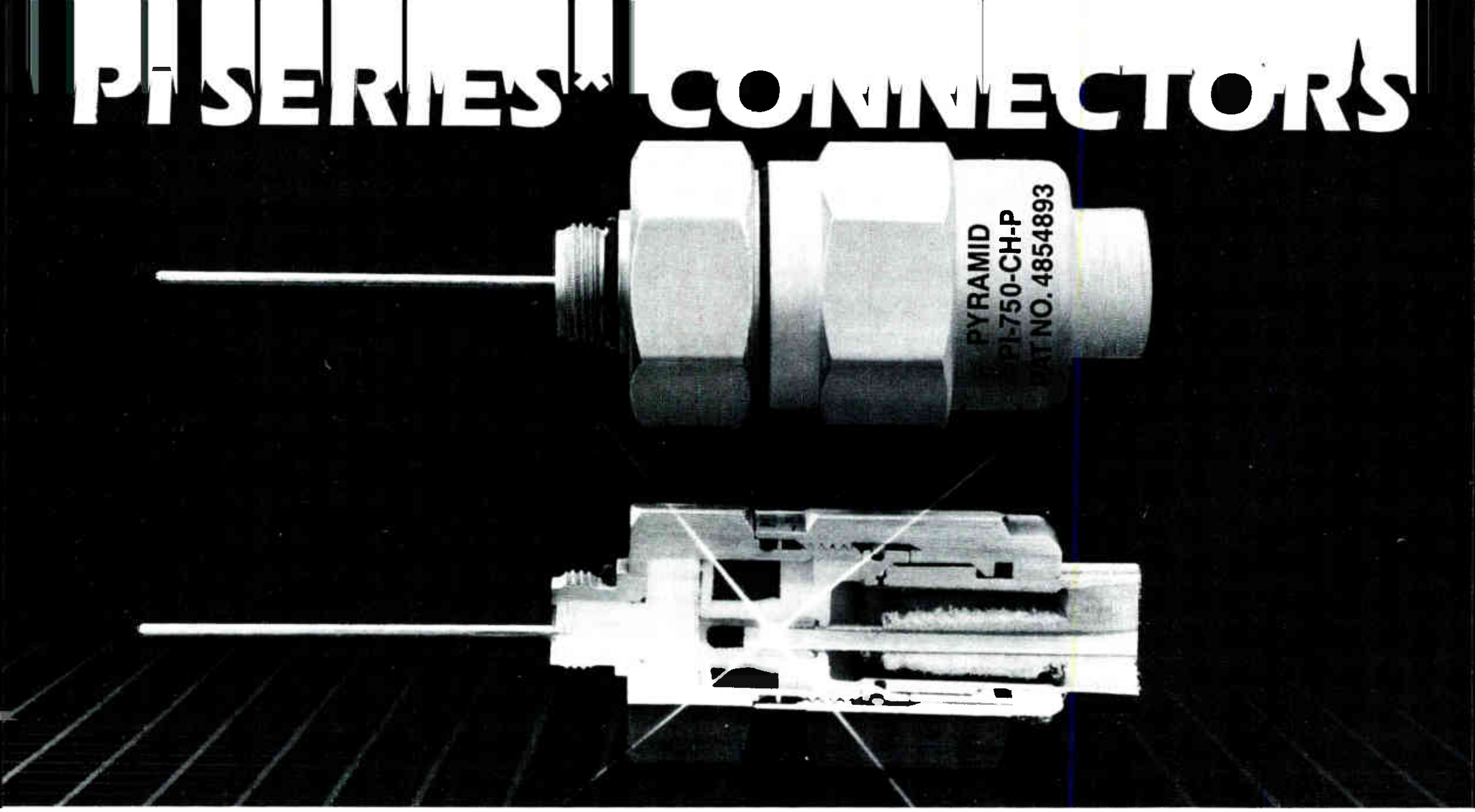


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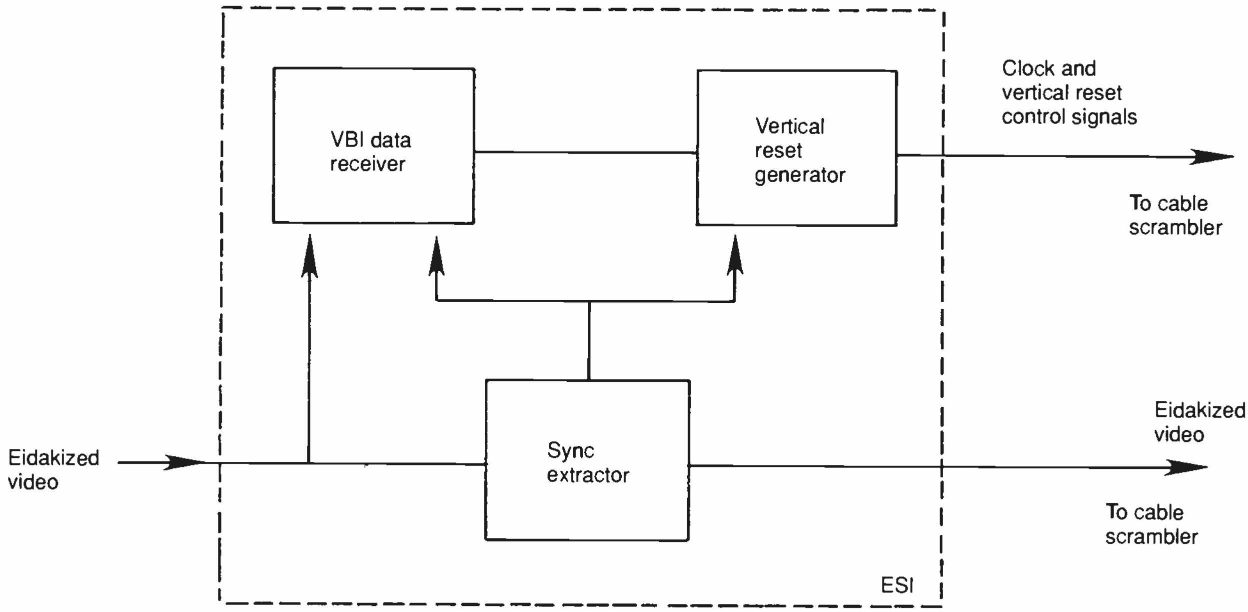
Figure 4: Scrambler interface (ESI)



has been field and market tested in three cable systems, each representing a unique system configuration and thus an opportunity to specially address these segments. The installations were: Viacom Cablevision in Milwaukee (February-June, 1989), Continental Cablevision, in Newburyport, Mass. (April-December 1989), and Warner Cable Communications in Medford, Mass. (April-September 1990).

In each case, a stand-alone copy-protected PPV channel was offered that provided movies at the same time they were made available to the video store, whereas the typical PPV release is four to six weeks after home video. Thus the objectives of these tests were twofold. The technical objective was to evaluate cable system compatibility issues; the marketing objective was to assess consumer response to non-recordability in light of a more favorable PPV release.

In the initial installation in Milwaukee rigorous technical testing was conducted. As a result, the profile shape was perfected (Figure 1) to maximize effectiveness against recording and to minimize visible effects of system or receiver artifacts.

In each test location the cable system's distribution equipment, including AML microwave and supertrunk links, was transparent to protected signals. It should be noted, however, that once a video signal is copy-protected it should not be passed through any other sync-sensitive or sync-restoring video processing.

Compatible operation with headend equipment is the key to satisfactory distribution of copy-protected signals within the cable system. Addressable scramblers almost always use vertical field rate timing for one or both of two purposes. Usually address control and/or program identification data is transmitted either within the VBI or applied to the sound carrier and timed to coincide with the VBI. It is common practice for the scrambler to determine VBI timing by counting lines or clock pulses from a previous VBI, with the assumption that frame rate timing is standard 525 lines/frame. In order to accommodate video with an Eidakized signal's variable field length it was necessary to provide the scrambler with field reset information, either in the form of a reset timing signal or by interruption of the scrambler's internal timing clock.

The systems involved in the three tests each used different headend scramblers, specifically Zenith Z-TAC, Jerrold RF and Pioneer. (All other major scrambling systems also have been laboratory tested for compatibility.) In each case, minor modifications to the headend scrambler were made to achieve compatible operation with the Eidak signal. It should be noted that no changes or modifications were required in the addressable converters.

In the Medford test, a multiple hub configuration was encountered for the first time, affording the opportunity to field test the scrambler interface (ESI). In cases where the scrambler is remote from the location where the copy-protection is applied (e.g., satellite delivery of copy-protected signals, hubs or origination from laser discs), the ESI is used to derive the reset control signals from the copy-protected video signal. The ESI (Figure 4) consists of a data receiver that extracts the frame length data encoded in the VBI. The frame length data is used to generate properly timed reset or clock interruption pulses for the scrambler; the ESI is configured for each type of addressable scrambler.

In addition to the ESI, the production model of the Eidak headend processor was installed and tested in Medford, whereas in the preceding tests prototype units were used. Both the ESI and headend processor performed exactly as expected.

The effect of the Eidak signal on consumers' TV sets was

(Continued on page 85)

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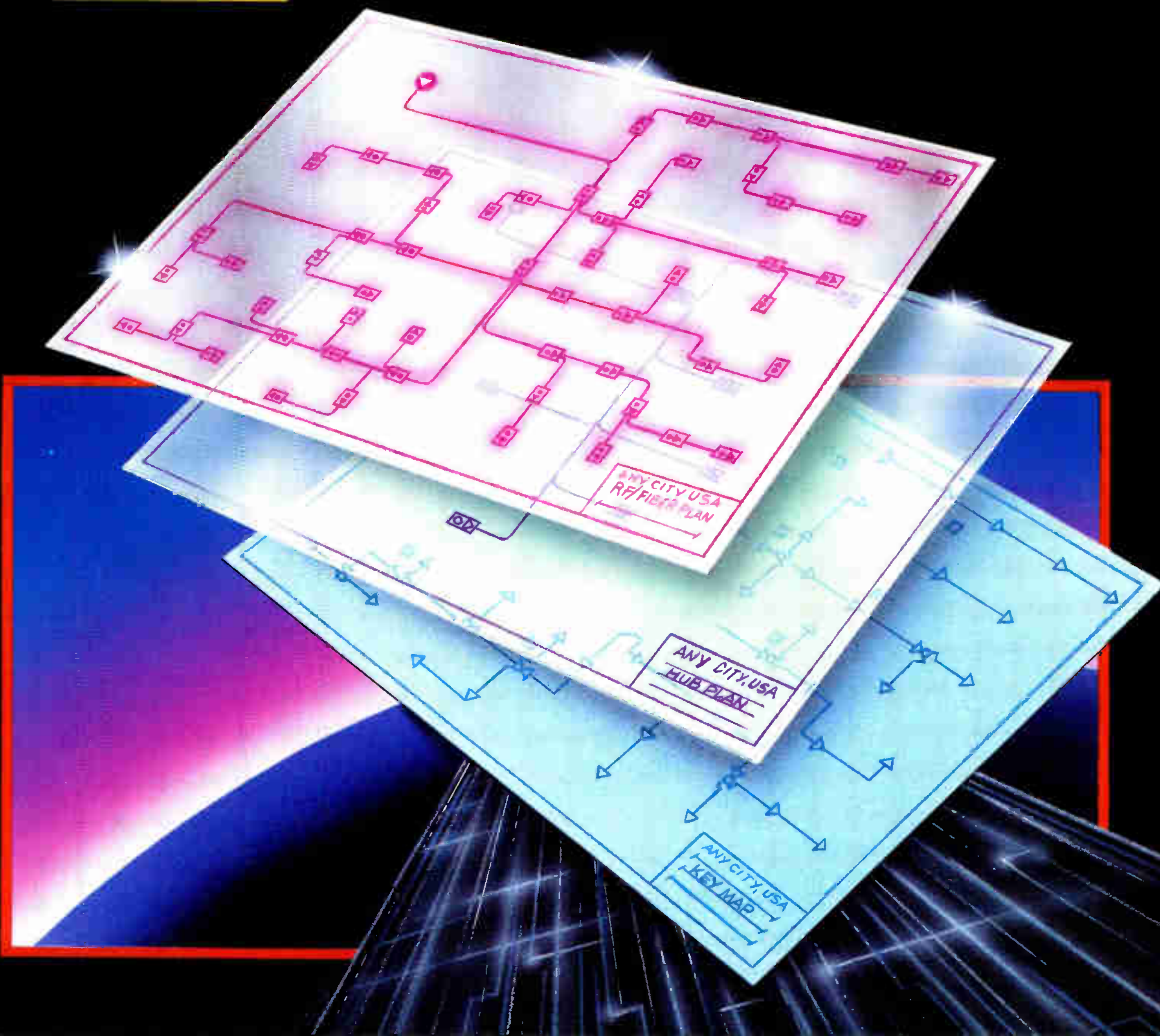

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Supervisor's name ____________________ Ph. # (   )__________

Supervisor's signature ______________________________

CT 11/90

Video testing

(Continued from page 22)

proach is that multiburst signals are often available as VITS. The disadvantage is that frequency response is only tested at the six packet frequencies in the multiburst signal. There's no information about any response anomalies that might exist in the frequency bands between packets. Also, the multiburst approach does not provide phase response information.

A more comprehensive approach is to use a (sin x)/x pulse signal. This essentially provides a band-limited impulse response of the system. A video measurement set that accommodates (sin x)/x testing will use an FFT to transform the impulse response to the frequency domain. The result is a complete frequency response description of the channel in terms of amplitude and group delay vs. frequency. This measurement is shown in Figure 5. (Note: Group delay, or envelope delay, is the negative derivative of phase response.)

Whether you use the multiburst or (sin x)/x approach, the end goal is always the same. From headend to hub to drop, the frequency response for each program channel should remain uniform. Any frequency peaking or early rolloff can result in a wide range of disturbing picture anomalies.

Automated limits monitoring

Regular headend and hub testing for channel-by-channel S/N and frequency response provides an excellent historical reference for spotting channel degradations before they become noticeable picture quality problems. How often such testing should be done depends on typical system stability and engineering resources available. With the automated testing offered by a DSP-based video measurement set, demands on engineering time are kept at a minimum.

Depending on the level of automation available, it even may be possible to leave the measurement set unattended in an automatic monitoring mode. In this mode, the video measurement set automatically cycles through a list of measurements. As each measurement is made, it checks the results against preset limits (see accompanying table). Limit violations then can be automatically logged and printed out. This leaves engineers and technicians free to pursue other activities until sufficient data is collected to warrant further testing and troubleshooting. **CT**

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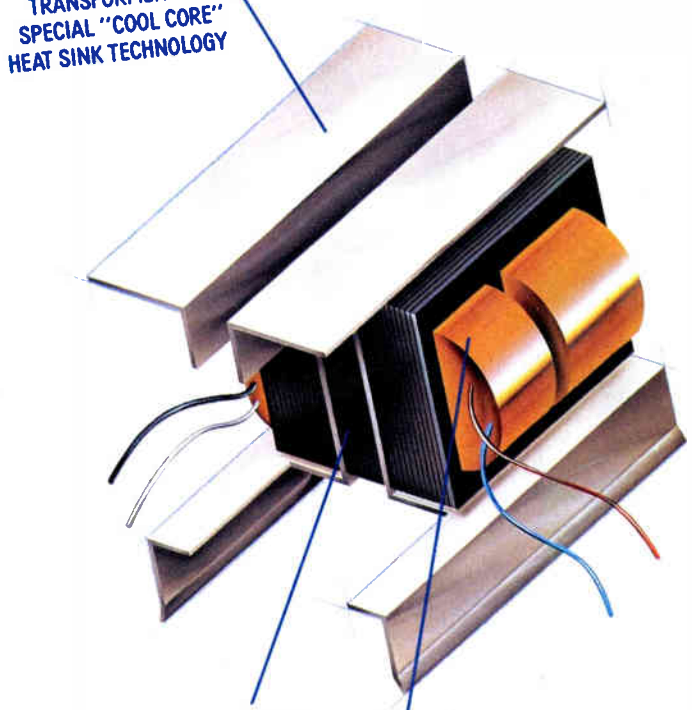

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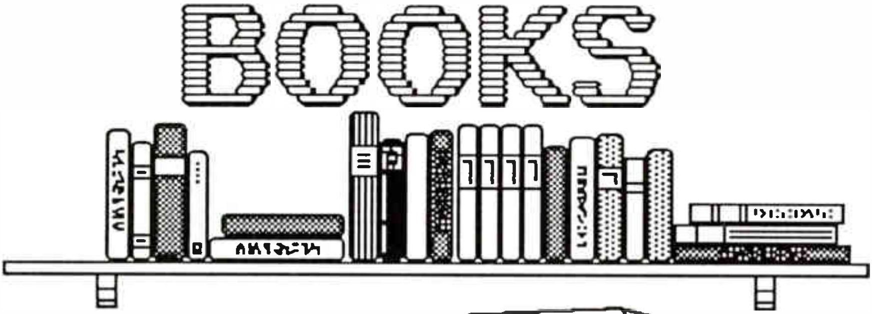

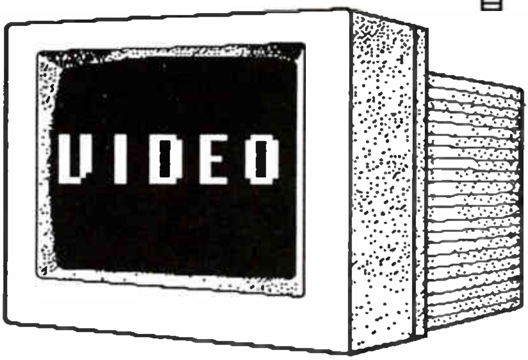

SPECIAL ISSUE

Publications and Videotapes

Revised 1990 Catalog

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REDUCED PRICES ON MANY ITEMS

including

- ✳ Educational Publications
- ✳ SCTE Premiums
- ✳ Videotapes
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Publications

DT-1, *Template, CATV Symbols*—A handy and versatile template featuring graphic symbols for power supplies, terminators, couplers, taps, amplifiers, equalizers and filters. Member: $6, Non-Member: $8.

DT-2, *Graphic Symbols for CATV Systems*—This thorough compilation of graphic symbols currently used in cable system drawings and diagrams was jointly developed by SCTE and the National Cable Television Association. Includes fiber-optic symbols and 22 other groups of symbols. Member: $5, Non-Member: $7.

DT-3, *NAB Engineering Handbook for Radio and Television*, Seventh Edition—Over 1,200 pages of information vital to industry engineers. This special handbook was published by the National Association of Broadcasters and is a recommended reference for Category II of the BCT/E Certification Program. Member: $160, Non-Member: $220.

New Item! DT-4, *Glossary of Cable Television Technical Terms*—Jointly published by SCTE and NCTA, this book contains over 60 pages of technical terms used daily by the cable TV engineering community. Member: $5, Non-Member: $7.

DT-5, *Jones Dictionary of Cable Television Technology*, Third Edition by Glenn Jones—This dictionary defines more than 1,600 terms covering such areas as operations, marketing, management, programming, systems and regulatory issues and includes related computer and satellite definitions. Member: $15.50, Non-Member: $17.50.

TM-1, *Cost-Effective Designs for Rural CATV Systems* by William Grant—An informative approach to rural cable TV system design and operation based upon the tapped trunk theory (single-cable distribution). Includes design specifications for four, eight and 12 taps per mile with up to 17 miles of cable and 45 amplifiers in cascade. Also provides guidelines to develop an effective cost estimate for rural cable build. Member: $10, Non-Member: $15.

TM-2, *Introduction to Digital Electronics* by Joseph Carr, MSEE—A basic course in digital electronics including logic theory, logic families, gates, flip-flops, multivibrators and digital circuit design. Member: $12, Non-Member: $17.

TM-3, *Operational and Linear IC Amplifier Circuit Design-A Practical Short Course for Engineers* by Joseph Carr, MSEE—Provides basic theory and practical application for technicians and engineers, including various circuit designs, operational amplifier problems, audio amplifiers and video and wideband amplifiers. Member: $12, Non-Member: $17.

TM-4, *Practical Design of DC Power Supplies* by Joseph Carr, MSEE—Technical theory and data on DC power supplies for the technician and engineer. Includes basic information on the elements of a DC power supply, including transformers, rectifiers, voltage multipliers, filters, voltage regulators, overvoltage protection and current limiters. Also includes several specific DC power supplies. Member: $12, Non-Member: $17.

TM-5, *FCC Compliance Audit Checklist* by Neal McLain—This publication covers the requirements of Parts 17, 76, 78, 90 and 95 of the Federal Communications Commission rules as applicable to cable TV. Even though some changes have been made to the rules since the third printing of this manual, the information on system proof-of-performance tests is still useful in maintaining good technical

Bill Riker

standards. Member: $12, Non-Member: $20.

TM-6A, *System Design Program - IBM Compatible Version*—A hard copy printout of a computer program facilitating system design. Created by Steve Johnson of ATC and the Society's Rocky Mountain Chapter. Member: $12, Non-Member: $20.

TM-7, *CATV Wizard*—This IBM-compatible computer disk containing 30 CATV formulas is a vital resource for industry personnel. Compiled by SCTE member Jim Kuhns, *CATV Wizard* is a collection of thoroughly researched and well-tested programs submitted by SCTE members and other industry leaders. Includes formulas for CATV systems, earth stations, attenuators, decibel conversions, CLI, Ohm's and Watt's laws, microwave path clearance and many more! Member: $15, Non-Member: $22.

TM-8, *Biro Co-Channel Atlas* by Steven Biro—This manual shows the location of VHF television transmission stations in the continental United States and Canada to help identify probable sources of co-channel TV interference. Also included is helpful theory of antennas and hints on how to reduce the effects of or eliminate co-channel interference. Member: $12, Non-Member: $20.

New Item! TM-9, *Apogee*—A new IBM-compatible computer disk from Jim Kuhns containing formulas for calculating microwave path loss, azimuth and elevation for earth stations, site plotting on maps' fresnel zones and a C-Band transponder frequency chart. Member: $15, Non-Member: $22.

New Item! TM-10, *Installer Certification Manual*—Published as a comprehensive reference for the Society's Installer Certification Program, this manual offers recommended installation practices that will be invaluable to all installers. (Manual is included in $25 Installer Membership fee.) Member: $15.

Special Reprint! TM-11, *Identifying Picture Problems in CATV Systems* by Ken Simon—A classic technical manual by a noted industry authority, this book focuses on the effects of thermal noise and echoes on TV pictures, AM and FM, cross-modulation and overloads. It features numerous illustrations, figures and tables. Member: $15, Non-Member: $17.

TF-1, *Test Form: 24 hour System Variations Data* (50/pad)—Loose-leaf binder forms for recording data on system variations over a 24-hour period. Member: $7, Non-Member: $9.

TF-2, *Test Form: 24 hour System Variations* (50/pad)—Loose-leaf binder forms for testing system variations. Member: $7, Non-Member: $9.

TF-3, *Test Form: Subscriber Tests Data* (50/pad)—Loose-leaf binder forms for recording data from subscriber tests. Member: $7, Non-Member: $9.

TF-4, *Test Form: Headend Tests Data* (50/pad)—Loose-leaf binder forms for recording data from headend tests. Member: $7, Non-Member: $9.

TF-5, *Test Form: System Test Data* (50/pad)—Loose-leaf binder forms for recording data from system tests. Member: $7, Non-Member: $9.

TF-6, *Signal Leakage Log Sheets* (50/pad)—Forms for the periodic logging of signal leakage. Member: $7, Non-Member: $9.

NB-2, *2-1/2" Loose-Leaf Binder: System Tests*—Holds forms listed as TF-5. Member: $10, Non-Member: $15.

NB-3, *2-1/2" Loose-Leaf Binder: Subscriber Tests*—Holds forms listed as TF-3. Member: $10, Non-Member: $15.

NB-4, *2-1/2" Loose-Leaf Binder: Headend Tests*—Holds forms listed as TF-4. Member: $10, Non-Member: $15.

NB-5, *The Interval Loose-Leaf Binder*—This special binder will hold your collection of *The Interval*, the official SCTE monthly newsletter. A perfect way to catalog the Society's events. Copies of *The Interval* not included. Member: $8, Non-Member: $12.

HS-2, *CATV Health and Safety Compendium*—A concise compendium of proper safety practices to be utilized in the operation of CATV systems. Member: $12, Non-Member: $18.

Special Reprint! TR-2, *FCC Advisory Committee: Signal Leakage*—By popular demand, SCTE has reprinted this comprehensive 1980 report on signal leakage. A must-read for those wishing to understand this vital issue. Member: $18, Non-Member: $25.

TR-3, *Report on a Field Test Program to Evaluate the REA Design Concept for Rural Cable Television Systems* by William Grant—A study on test evaluations of rural cable systems using the tapped trunk design outlined in the author's publication of *Cost Effective System Design for Rural Cable Television*. Member: $12, Non-Member: $18.

TR-4, *Primer on CATV Signal Leakage-Methods of Managing and Controlling CATV RFI*—This publication is possibly the most complete study in print on signal leakage and CATV systems. It includes signal leakage programs established by some of the industry's leading engineers, understanding and correcting plant signal leakage and standards of good engineering practices for measurements on cable TV systems. This book should be a must for every cable system engineer, chief technician and system technical library. Member: $20, Non-Member: $45.

TR-5, *Cable Television* by William Grant—A comprehensive guide to CATV technology, examining its equipment, systems and methodology, as well as many other important facets of the workings of cable TV. Perfect for beginners and veterans alike. Second edition. Member: $30, Non-Member: $35.

TR-6, *Understanding Lightwave Transmission: Applications of Fiber Optics* by William Grant—An introduction to lightwave transmission systems and the equipment and optical fibers used in such systems. It also explains the characteristics of lightwaves and optical fibers themselves. This excellent book will give you the edge on this important technical area. Member: $37, Non-Member: $43.

TR-7, *Cable Communications* by Thomas F. Baldwin and D. Stevens McVoy—An insightful look at the

Bill Riker

CATV industry, encompassing its technology, services, organization, operations and future. Features special appendices on cable regulations, networks, policies, costs and audience survey methods. Second edition. Member: $42, Non-Member: $48.

PD-1, *Secrets of Supervision-A Concise Guide to Good Management*—This National Safety Council publication is an excellent guide for supervisors at any level. It contains all of the basic rules and requirements of being an effective supervisor in simple, easy-to-understand language. Member: $4, Non-Member: $6.

PD-2, *Employee Management and Personnel Development*—An excellent publication for managers and supervisors. Includes information on good personnel and management practices, developing job descriptions, providing employee motivation, delegating authority, training programs and much more. Member: $15, Non-Member: $22.

PD-5, *Equal Employment Opportunity in Cable Television-SCTE Guidelines on Women and Minorities in CATV*—An excellent guide for meeting the industry's obligations under the EEO requirements, as well as establishing and operating an effective affirmative action program. Member: $10, Non-Member: $17.

New Item! PD-7, *Handbook: NCTA Recommended Practices for Measurements on Cable Television Systems (Second Edition)*—A loose-leaf binder containing recommended measurement procedures for system proof-of-performance and guidelines for acceptable results. Provides detailed information on how to perform the measurements listed on SCTE test forms TF-1, TF-2, TF-3, TF-4, TF-5 and TF-6. Also includes NTC-7 measurement guidelines for baseband signals. Member: $55, Non-Member: $75.

New Item! PM-1, *Fiber Optics 1990 Proceedings Manual*—Over 20 technical papers were presented by leading authorities on this vital topic at SCTE's "Fiber Optics 1990" conference. Now you can benefit from these papers, which have been collected in this deluxe manual. Member: $35, Non-Member: $50.

New Item! PM-2, *Fiber Optics 1990 Audio Transcripts*—Each of the presentations given at the "Fiber Optics 1990" conference was recorded. The complete set of cassettes is now available. Member: $75, Non-Member: $95.

New Item! PM-3, *Cable-Tec Expo 1990 Proceedings Manual*—A collection of technical papers presented at the 1990 SCTE Engineering Conference, as well as supplementary material for workshops conducted at Cable-Tec Expo '90. This deluxe publication offers important information on a variety of vital technical topics. Member: $35, Non-Member: $50

Videotapes

Members: Prices as Listed
Non-Members: Please Add 20 percent

T-1001, *Diagnosing Common Cable Faults*—Shows basic FCC and Canadian Radio-Television and Telecommunications Commission standards for proper cable system operation levels on various distortions. Distortions are identified and explained. An excellent training tool for all system employees and local community groups to explain how the cable system functions within its environment. (30 min.) VHS: $35. **B-I**

T-1002 *Confident Climbing: Classroom Session*—Produced by Viacom Communications. Classroom setting covers basics of theory, equipment, safety and clothing, climbers, body belts, hard hats, straps and gaffs. Safe climbing techniques such as proper aim, angle and depth of penetration are discussed. Detailed instructions include hand and foot movements, balancing, knee and leg angles, posture and ascending and descending the pole. (30 min.) VHS: $35. **I/T**

T-1003, *Confident Climbing: Field Demonstration and Technique*—Produced by Viacom Communications. On-the-pole demonstrations emphasize proper footwear, what to avoid, setting the gaff and physical stress. Hazards of hesitation, proper belting-in procedures, maintaining balance, estimating clearance, circling the pole and work positioning are included. Practice exercises, "hitchhiking" and "reaching out" are demonstrated. (30 min.) VHS: $35. **I/T**

T-1005, *CATV Signal Level Meter Basics*—Basic definitions, design techniques, features, limitations, controls and functions of the signal level meter. Detailed discussion focuses on tuned radio frequency, superheterodyne-downconvert and upconvert-downconvert. Explains signal reception and effects of the SLM. Accuracy, visual/color, types and amount of frequency and amplitude modulation are discussed. (30 min.) VHS: $35. **I/T**

T-1006, *CATV Signal Level Meters: Errors and Accuracy*—Graphics and discussion cover linearity, calibration, measurement range and increments, resolving power capabilities, attenuator steps and peak detector error. On-camera demonstration shows proper use of meter scale. Program covers gain changes, temperature and calibration, shape factors and intermediate frequency (IF) bandwidth. (30 min.) VHS: $35. **B-IV**

T-1007, *Video Test Signals*—Program concentrates on evaluation of video testing techniques. Blackboard presentations examine frequency domain, baseband video signals and Institute of Radio Engineers (IRE) unit scales. Common video waveforms are defined, including multiburst, sine pulse, window, line time distortion, modulated stair step/differential gain and phase, luminance nonlinearity, modulated 12 1/2T, modulated pedestal, field rate square wave and vertical interval reference (VIR). (30 min.) VHS: $35. **B-II**

T-1008, *Video Waveform Measurements*—Using actual equipment setups, various measurements are discussed. Topics include baseband video, demodulators, envelope-type detection, synchronous detection, depth of modulation on radio frequency (RF) signals and zero choppers. Full-field video waveform testing includes multiburst, depth of modulation, sine pulse, 2T window, field rate square wave and tilt. Includes information on use of vectorscope, average picture levels and video signal-to-noise. (30 min.) VHS: $35. **B-II**

T-1009, *High Frequency RF Sweep Generator Basics*—Using test setups, graphics and blackboard discussion, this tape details major measurements by comparison, attenuators as precision instruments, measuring gain and flatness, peak-to-valley, loss, return loss/voltage, standing wave ratios on passives and cable and delay scan loss. (30 min.) VHS: $35.

T-1010, *RF Sweep Generator Applications*—System sweeping shown with graphics and discussion on low-level vs. high-level sweeping. Measuring at the headend and at the cable is shown. Equalizers, trunk measurements, mismatch in cable and swept response are covered. (30 min.) VHS: $35.

T-1011 *CATV Converter Repair Procedures*—Basic block diagrams explain multichannel varacter converters, RF modules, power supply and control box functions. Electrical and mechanical features, tuning voltages, disassembly and testing, meter leads, lifting loads on power supply and troubleshooting are addressed. Test points are identified. Overall converter repair procedures are presented. (30 min.) VHS: $35.

T-1012, *Multichannel Cable Converter Alignment*—The setting for this video program is the converter repair bench. Block diagrams, demonstrations of alignment techniques and procedures and final assembly are presented. The videotape stresses the importance of following proper procedure in order to maintain low service call rates. (30 min.) VHS: $35.

T-1013, *Cable Television Relay Station (CARS) Application*—This videotape is a step-by-step review of FCC Form 327 and its requirements. The complete series of five schedules included in Form 327 (A through E) are covered in detail. Checklists are provided and relationships of exhibits to required schedules are explained. Federal Aviation Administration requirements, environmental studies, use of government property and tower heights are included. (1 hr.) VHS: $35.

T-1014, *Developing an Effective Preventive Maintenance Program*—Planning and forecasting problems and formulation of solutions are addressed. Distortion, electrical specifications, mechanical bugs, signal leakage and ingress measurement are discussed. Proper testing and test equipment are stressed. Functions of signal level meters sweep devices, cross-modulation and hum or low-frequency tests are covered. (30 min.) VHS: $35.

T-1015, *Construction Techniques for Extended System Life*—Cable, strand, connectors and mechanical devices are detailed. Loop configurations, bonding clamps, lashing wire and strand are examined. Construction techniques to minimize plant problems are outlined. The program also deals with placement of loops and installation of equipment on the pole. (30 min.) VHS: $35.

T-1016, *Safety Awareness Around Electrical Conductors*—Using slides, movies and demonstrations, this videotape provides information about the hazards of working around power. It reviews amperage and its effects and graphically depicts the results of injuries and burns. Clearances and dangers of energized conductors are discussed. Power line handling techniques, clothing, flashes and insulators, wire, aerial and underground cable and wire, conductors and their hazards are included. Produced by the New Jersey Cable Television Association with the cooperation of the Office of Cable Television of New Jersey, New Jersey Bell, Public Electric and Gas, Suburban TV-3 and Maclean Hunter. (30 min.) VHS: $35.

T-1017, *Broadband Cable System Spare Parts and Documentation Procedures*—Procedures to develop, document and maintain a spare parts program are outlined. Program stresses importance of proper training in a spares program. Suggestions are offered on what the CATV field technicians should carry on the job. Cannibalization of stock items is discussed. Various recommendations of stock levels for trunk-related materials, distribution equipment, passives, trunk cable and feeder are provided. (30 min.) VHS: $35.

T-1018, *Broadband Coaxial Cable Basics*—Addresses proper handling techniques for coax. Cable construction is detailed and special features explained. Dielectrics, adhesion and compression are covered. Hazards of improper unloading procedures are outlined. Stacking and storage of reels, wrapping, dealing the rolling edge and benefits of lagging are included. Velocity of propagation, TDR settings and testing problems are highlighted and techniques for moisture protection are covered. (30 min.) VHS: $35.

T-1019, *Selecting Mechanical Equipment to Ensure Extended System Life*—Mechanical integrity and environmental considerations of housings, sealings, elastic limits, pressure, volume, finish, alloys, heat and moisture are outlined. Problems that may cause signal leakage are included. Clamps, pressure deformed sheaths, deterioration problems, tightening, equilibrium of pressure and torque are discussed. Preventive maintenance on mechanical components is stressed. (30 min.) VHS: $35.

T-1020, *Broadband Coaxial Cable Handling and Installation*—Techniques used to pull cable into the pole line, locating cable reels, separation and placement, angle, bending the cable, and using the reel for support are displayed with graphics. Short clearances, "chutting" to the first pole, braking and pressure are explained. Sag and temperature, cable twisting or swivel, single and multiple cables, tools, backlash, playing the loop, lashing techniques and internal tension are covered. Temperature coefficients are explained and shown on graphics. (30 min.) VHS: $35.

T-1021, *Signal Leakage, CLI and the FCC*—A complete three-camera video production of SCTE's technical seminar on signal leakage held September 1985 in Denver. This 12-hour program includes presentations by Bob Luff, Sruki Switzer, Robert V.C. Dickinson and Cliff Paul concerning leakage monitoring practices, plus a satellite teleconference with engineers from the FCC discussing compliance with the commission's new rules regarding cable system leakage. (12 hrs.) VHS: $250.

T-1021A, *Signal Leakage, CLI and the FCC Teleconference*—This excerpt of T-1021 features the live satellite teleconference between the seminar in Denver and members of the FCC in Washington. Panelists include John Wong, Ralph Haller, Wendell Bailey and Archer Taylor. Tom Polis moderates. (2 hrs., teleconference only) VHS: $45.

T-1022, *Video Signals and their Measurement*—This four-hour seminar features instructors from Tektronix and provides an in-depth discussion of baseband video signals and their components, proper usage of video test equipment and recommended procedures for making measurements. (4 hrs.) VHS: $95. **B-II**

T-1023, *dBs and dBmVs*—Veteran instructor Richard Covell discusses the mathematical theory behind the "decibel" and its use in basic engineering calculations. System performance measurements also are covered during this seminar. (1-1/2 hrs.) VHS: $45. **B-IV**

T-1024, *Basic System Design*—Sally Kinsman of Kinsman Design Associates reviews the various approaches to coax plant design. System extensions, rebuilds and new construction are discussed during this seminar. (1 hr.) VHS: $45.

T-1025, *Developing a Preventative Maintenance Program*—Ron Hranac, then of Jones Intercable, now with Coaxial International, discusses one of the most important aspects of subscriber satisfaction: system preventive maintenance. Recommended practices for the reporting and correction of system problems are addressed in this seminar, which also includes maintenance procedures for correcting potential problems before they occur. (1 hr.) VHS: $45.

T-1026, *Choosing Advanced Amplifiers for Your Cable Television System*—Herb Longware of Magnavox CATV Systems discusses the theories behind push-pull, feedforward and power doubling amplifier technologies. These three technologies are then evaluated as to their advantages or disadvantages in a wide variety of plant design applications. (30 min.) VHS: $35.

T-1027 *SCTE Chapter Development Workshop*—SCTE Director of Chapter Development and Training Ralph Haimowitz discusses recommended procedures for starting a local SCTE meeting group and offers tips he has used in presenting quality technical seminars to area technicians and engineers. (A dub of this tape is available free of charge if tape stock is supplied to SCTE in advance.) VHS: $20.

T-1028, *Cable Preparation and Connector Installation*—This three-part presentation, produced by Augat/LRC Electronics, discusses recommended practices for preparing the ends of coax and proper methods for the installation of cable connectors. (30 min.) VHS: $35.

T-1029, *Video and Audio Signals and Systems (BCT/E Review Course)*—Category II Curriculum Committee Chairman Paul Beeman presents this overview of Category II of the BCT/E Certification Program. Emphasis is placed on audio and video terminology, plus test and measurement procedures. From Cable-Tec Expo '86. (1-1/2 hrs.) VHS: $55. **B-II**

T-1030, *Basic Electronic Fundamentals in the Analysis of Cable System Powering*—National Cable Television Institute's Ray Rendoff discusses the fundamental characteristics of AC and DC voltage, AC, standby power supplies, coaxial cable and various amplifier configurations that establish overall system powering requirements. Mathematical calculations using Ohm's law are performed on a sample system powering configuration. Typical powering problems and corresponding troubleshooting techniques conclude this technician level program on system powering analysis. (1 hr.) VHS: $45.

T-1031, *One-On-One with the FCC*—Former FCC engineer and current consultant Cliff Paul and the FCC's Syd Bradfield discuss how to deal with current regulatory changes and answer questions from the audience concerning their own systems compliance in this workshop from Cable-Tec Expo '86. (1 hr.) VHS: $45.

T-1032, *SCTE and You*—An updated version of the SCTE promotional videotape describing the many services offered by the Society. (8 min.) VHS: $9.

T-1033, *Category IV Review Course: Distribution Systems*—Category IV Curriculum Committee member Bill Grant presents a five-hour review course on the basics of distribution systems in preparation for technician level certification exams. (5 hrs.) VHS: $130. **B-IV**

T-1034, *Category II Review Course: Video and Audio Signals and Systems*—Category II Curriculum Committee Chairman Paul Beeman presents an in-depth look into his committee's category. Information concerning both technician and engineering level certification exams is presented in this tape. (4 hrs.) VHS: $95. **B-II**

T-1035, *Engineering and Technical Management Development Seminar*—This seminar, sponsored by national SCTE and its Chattahoochee Chapter, features a university professor and several industry personnel and management specialists in a series of discussions on how to improve your effectiveness as a manager. (5 hrs.) VHS: $145.

T-1036, *Ku-Band Technology and TVRO Calculations*—HBO Vice President of Engineering Paul Heimbach discusses the technical characteristics of this new satellite technology and the proper preparations for being able to receive Ku-Band transmissions in this workshop from Cable-Tec Expo '87. (1 hr.) VHS: $45.

T-1037 *Interference Elimination with Antennas and Antenna Array*—Biro Engineering's Steven Biro conducts a workshop from Cable-Tec Expo '87 on antenna array and phasing techniques for use in interference elimination at headend sites. (1 hr.) VHS: $45.

T-1038 *Performing Measurements on Basic Test Equipment*—Wavetek's Terry Bush reviews operation of cable system test equipment and proper measurement techniques in this workshop from Cable-Tec Expo '87. (1 hr.) VHS: $45.

T-1039 *Questions and Answers with FCC Engineers*—Former FCC engineer and current consultant Cliff Paul and FCC Engineering Advisor John Wong discuss FCC rules and regulations with Cable-Tec Expo '87 attendees in this interactive workshop. (1 hr.) VHS: $45.

T-1040 *Category I Review Course: Signal Processing Centers* (Technician Level)—Category I Curriculum Chairman Alex Best presents a one-hour review course on the technician level of his committee's category. This workshop from Cable-Tec Expo '87 offers technicians an overview of material contained in the certification exam. (1-1/2 hrs.) VHS: $45. **B-I**

T-1041 *Category VII Review Course: Management and Professionalism*—Category VII Curriculum Committee Chairman Wendell Bailey discusses the purposes and prerequisites for his category's essay examination. A sample question is presented and discussed with BCT/E candidates in attendance. (1 hr.) VHS: $35. **B-VII**

T-1042 *Pole Climbing*—A comprehensive course produced by the Atlee Cullison Training School that develops climbing skills and safety habits. Includes valuable information on climbing apparel and equipment, safe methods of ascending, descending and testing poles to ensure safe climbability. *Previously sold at $250!* (1 hr.) VHS: $170. **I/T**

T-1043 *Extension Ladders*—A course designed to provide thorough and comprehensive instruction on the safe use of extension ladders. Includes segments on ladder positioning, transporting and carrying, securing, climbing and safety. Produced by the Atlee Cullison Training School. *Previously sold at $175!* (35 min.) VHS: $145. **I/T**

T-1044 *Digital TDRs, an Investment You Can Find Fault With*—Riser-Bond presents a discussion and instruction on the proper use of its line of digital time domain reflectometers. From SCTE's Product-Specific Tele-Seminar Program. (Approx. 20 min.) VHS: $30.

T-1045 *Balance and Alignment Techniques for Scientific-Atlanta Series 6500 and 6800 Distribution Equipment*—Scientific-Atlanta engineers discuss components and proper alignment techniques for this particular series of distribution equipment in this video produced exclusively for SCTE's Product-Specific Tele-Seminar Program. (30 min.) VHS: $30.

T-1046 *Implementing Stereo Headend Equipment*—Audio engineers Tom Williams and Steve Fox discuss BTSC stereo technology and its proper testing through specific headend equipment in this workshop from Expo '87. (1 hr.) VHS: $35.

T-1047, *Category V Review Course: Data Networking and Architecture*—Category V Curriculum Committee Chairman Ernie Tunmann presents an overview of material covered in his category's BCT/E certification examination. (1 hr.) VHS: $35. **B-V**

T-1048, *Category VII Review Course: Engineering Management and Professionalism*—Category VII Curriculum Committee Chairman Wendell Bailey presents an in-depth discussion of his committee's BCTE certification category. (Similar material to T-1041 except covered in greater detail.) (2 hrs.) VHS: $45. **B-VII**

T-1050, *Signal Leakage Detection*—Equipment used in locating leakage problems within a cable system is discussed by ComSonics in this video produced for SCTE's Product-Specific Tele-Seminar Program by ComSonics. (30 min.) VHS: $30.

T-1051, *Channel Deletion and Reprocessing Networks*—Microwave Filter Co. explains the construction of RF filters and their applications in cable system headend processing in this video produced by Microwave Filter Co. for the SCTE Product-Specific Tele-Seminar Program. (30 mins.) VHS: $30.

T-1052, *Standby Power Supply Maintenance*—Alpha Technologies produced this in-depth program on this important topic, which features company representative Bob Bridge, for the SCTE Product-Specific Tele-Seminar Program. (1 hr.) VHS: $35.

T-1053, *RF Field Strength: Principles and Practices*—An effective presentation of the basics of an RF field - what it is and how it reacts both inside and outside of a cable. Ron Adamson of Texscan covers the principles of shielding, wavelength and the use of a dipole antenna for detection. In addition, the terminology of the FCC's "microvolt per meter" is discussed in relation to cable's "dBmV." (1 hr.) VHS: $35.

T-1054, *Manufacturing Fiber-Optic Cable*—Produced by Corning Glass, this program offers valuable insight into the manufacture of fiber-optic cable. (1 hr.) VHS: $35.

Note: T-1056 to T-1065 were videotaped at Cable-Tec Expo '88 in San Francisco.

T-1056, *High-Definition Television Technology*—This panel discussion from the 1988 Engineering Conference features Walt Ciciora of ATC, Donald Wilkinson of Fisher Broadcasting Co., Lawrence Lockwood of Contel, Paul Resch of The Disney Channel and William Thomas of Nielsen Media Research.(1-1/2 hrs.) VHS: $45.

T-1057, *Frontline: Senior Cable Engineers*—This video features technical leaders from the cable industry and related fields in a panel discussion moderated by Wendell Bailey of NCTA. The discussion focuses on changes in delivery systems, as well as interfacing newer consumer equipment to CATV systems, issues that every cable engineer and technician will face in years to come. (1-1/2 hrs.) VHS: $45.

T-1058, *Fiber Optics - Here and Now*—Jim Chiddix of ATC, David Grubb of General Instrument/Jerrold Division, James Hood of Catel, Vince Borelli of Synchronous Communications and Lawrence Stark of Ortel discuss this vitally important topic. (1 hr.) VHS: $45.

T-1059, *The Future of the CATV Business*—Industry leaders Edward Allen of InterMedia Partners, John Goddard of Viacom Cablevision, Bill Johnson of Scientific-Atlanta and Hal Krisbergh of Jerrold Communications discuss the industry's future horizons. (1 hr.) VHS: $45.

T-1060, *Signal Leakage and CLI Testing*—A basic presentation of signal leakage and CLI testing - what they are and how to deal with them. This program, which features Tom Polis of Communications Construction Group and Robert V.C. Dickinson of Dovetail Systems provides necessary information concerning FCC rules and limits, grandfathering, filing and equipment. Ground measurement techniques and flyover procedures also are discussed. This is a useful tool for developing your own plan to deal with FCC requirements. (1 hr., 10 min.) VHS: $45.

T-1061, *Category V Review Course: Data Networking and Architecture*—Al Kuolas of American Cablesystems discusses digital data and methods of transmission, covering such topics as bits and bytes, parity bits, verification, formats of information, networking, modulation and multiplexing. *Note: This updated version of T-1047 features a different instructor.* (1 hr.) VHS: $35. B-V

T-1062, *Category VI Review Course: Terminal Devices*—William Cohn and Mike Long of Zenith Electronics Corp. discuss regulatory agencies and standards, signal levels, noise figures, locating the source of ingress, installation equipment and practices, converters, remote controls, interfacing with consumer equipment and emerging technologies. (1-1/2 hrs.) VHS: $45. B-VI

T-1063, *Category III Review Course: Transportation Systems*—Dr. Tom Straus of Hughes Microwave provides a technical look at transportation systems, including the benefits and trade-offs of different methods. This program begins with a basic discussion of the decibel and then goes on to cover baseband video and its waveform, distortion, harmonics, ingress and satellite transmission. It also deals with microwave transmission and refraction, including AM & FM transmitters and receivers. (1 hr.) VHS: $35. **B-III**

T-1065, *Developing a Technical Training Program*—Roger Keith, formerly of Warner Cable Communications, discusses the design and development of a system level CATV technical training program. (1 hr.) VHS: $35.

Note: T-1066 to T-1077 were videotaped at Cable-Tec Expo '89 in Orlando, Fla.

T-1066, *High Definition Television*—Walt Ciciora of ATC, Wayne Luplow of Zenith Electronics and Norman Hurst of David Sarnoff Research Center briefly review the basics of high definition TV (HDTV), going on to discuss intermediate technologies such as advanced TV (ATV) and ACTV. Delivery of these signals by cable, as well as competitive technologies, are also discussed. This program provides an understanding of how HDTV can affect your systems in the years to come. (1-1/2 hrs.) VHS: $45.

T-1067, *Digital Video, A Future Alternative*—Steffen Rasmussen of ABL Engineering discusses the basics of digital video signals, including generating a digital signal from an analog source, coding and decoding, time division multiplexing and some attributes of digital signals. This program explores how digital video can be used in the present and future. (1 hr., 10 mins.) VHS: $45.

T-1068, *Cable vs. the Telcos*—Will the telephone companies emerge as a major competitor with cable technology in the next two years? Is the end of the cable TV industry just around the corner? Gary Kim of Focus Communications, Steve Wilkerson of Florida Cable Television Association, Gary Moore of Southern Energy Consultants Ltd. and Mark Balmes of Southern Bell discuss these issues from political and economic viewpoints. (1 hr., 20 mins.) VHS: $45.

T-1069, *Fiber-Optic Technology*—Jim Chiddix of ATC and Scott Esty of Corning Glass review the basics of fiber-optic communications—how it works, how fiber is constructed and some of the design parameters for using fiber technology in your system. This program also examines, from an operator's point of view, what fiber will mean to the cable industry in the next five years. (1 hr., 5 mins.) VHS: $45.

T-1071, *SCTE Installer Certification, Assuring Quality Performance*—SCTE Director of Chapter Development and Training Ralph Haimowitz provides an overview of the Society's new Installer Certification Program: What it is, what it covers and how it works. The Installer Program fills a critical need in the industry and this videotape will aid in the implementation of this program in your company. (A dub of this tape is available free of charge if tape stock is supplied to SCTE in advance.) (45 mins.) VHS: $20. **I/T**

T-1073, *Signal Leakage, CLI and the FCC*—Robert V.C. Dickinson of Dovetail Systems, Brian James of NCTA and John Wong of FCC give a frank discussion of the new rules for signal leakage, including maximum leakage levels, methods of measuring, computations and offsets. Wong and James humorously act out scenarios of both positive and negative FCC system evaluations. (1 hr., 20 mins.) VHS: $45.

T-1074, *Supervisory and Management Skills*—Rollins University Professor Dr. Bill Brown deals with such topics as employee turnover, absenteeism and poor job performance.

How can you turn these problems around? Is money the answer? What do employees hope for in an ideal effective and motivating leader? This program provides insight to these problems that face every cable operator. (1 hr., 15 mins.) VHS: $45. **B-VII**

T-1075, *AM Fiber-Optic Transmission*—Wes Schick and J.R. Anderson of Anixter Cable TV join Clive Holborow of AT&T Bell Labs to explore the integration of AM technology into a system, discussing its benefits, architectures and applications, as well as lasers, NCTA fiber-optic symbols, AM technology as compared to FM and digital technologies and actual performance experience. (1 hr.) VHS: $45.

T-1076, *Data Transmission Techniques*—Anixter Cable TV's Andy Paff and Don Patton discuss alternative access and the CATV industry's competition with the telcos for the lucrative data transmission market, providing an analysis of the regulatory and operational problems that CATV companies will face in this market. Required equipment is also discussed. (1 hr., 10 mins.) VHS: $45. **B-VI**

T-1077, *Installing Fiber-Optic Cable*—If your system is planning to install fiber, or would just like to see the techniques, this presentation, which features Ken Carter of ATC, Larry Nelson of Comm/Scope and Dan Pope of AT&T Bell, is for you. This practical overview also offers solutions to common problems encountered in such installations. (1 hr.) VHS: $45.

Special Reduced Price! T-1078, *NCTA Signal Leakage Seminar*—Save $50 on this amazing 7-hour videotape set of the complete presentation on signal leakage given by the NCTA Science and Technology Department in 1989. (7 hrs.) VHS: $145.

T-1079, *SCTE Trilogy*—This videotape features three programs produced for SCTE, including a promotional video that describes the Society's history and its goals in providing technical training. The "Tech Marketing Training Tape," produced by Metrovision through a grant from CCI, provides information on customer relations for installers and technicians. "The SCTE Music Video" features the SCTE Band and is sure to inspire enthusiasm for the Society. (A dub of this tape is available free of charge if tape stock is supplied to SCTE in advance.) (1 hr.) VHS: $20.

T-1080, *Digital Data Transmission*—Join Robert V.C. Dickenson of Dovetail Systems and Harry Perlow of Gilbert for a lively discussion of why CATV systems are an excellent medium for data transmission, as well as the binary numbering system, the hexadecimal system and ASCII. (5 hrs.) VHS: $120.

T-1081, *How to Fill Out Form 320*—John Wong of the FCC's Cable TV Branch gives a detailed explanation of how to properly and accurately fill out the FCC Form 320 for CLI. This exclusive video presentation answers numerous questions commonly asked about CLI. (1 hr.) VHS: $35.

New Videos from Cable-Tec Expo '90

Note: T-1082 to T-1091 were videotaped at Cable-Tec Expo '90 in Nashville, Tenn.

T-1082, *Cable's Weak Link-Tap to TV*—Walt Ciciora of ATC, Richard Amell of Metrovision, Dana Eggert of Performance Plus, Tom Elliot of CableLabs and Larry Nelson of Comm/Scope discuss in-home wiring in terms of its facts, figures, problems and potentials (1-1/2 hrs.) VHS: $55.

T-1083, *Getting It Right the First Time: Field Supervision Techniques*—Wendell Bailey of NCTA, Alan Babcock of Warner Cable Communications, Dana Eggert of Performance Plus and Kathy Keating of ATC discuss the responsibilities and skills needed of cable installation personnel. Includes information on hiring, training and motivating installers. (1-1/2 hrs.) VHS: $55.

T-1084, *Cable in the 1990s: Boom or Bust?*—Paul Maxwell of Transmedia Partners, Jim Chiddix of ATC, Tom Gillette and Craig Tanner of CableLabs and Gary Kim of *Multichannel News* discuss cable's role in the media and information infrastructure, the effect of future technology on the cable industry and cable TV data and voice architectures. (1-1/2 hrs.) VHS: $55.

T-1085, *Advances in Corrosion Protection*—Dr. Chak Gupta of Comm/Scope and Barry Smith of Times Fiber Communications give a presentation on the susceptibility of the convention F connector to environmental contamination, focusing on many of the protection devices and premium fittings currently available. (1 hr.) VHS: $55.

T-1086, *CLI Ninjas*—Have some fun! Here's a chance for you to review the FCC's form 320 for CLI. The "CLI Ninjas," Brian James of CableLabs and John Wong of the FCC, wrap up signal leakage issues and focus on questions and problems encountered with the form. (1-1/4 hrs.) VHS: $55.

T-1087, *Fiber-Optic Testing*—Mark Connor of Siecor and Louis Williamson of ATC discuss fiber-optic test equipment and its use during installation and maintenance of a CATV system. (1 hr.) VHS: $55.

T-1088, *OSHA's Gonna Get You If You Don't Watch Out*—This presentation covers the requirements of the Occupational Safety and Health Act (OSHA), including reporting and record keeping. It includes an overview of a typical OSHA inspection and the types of fines and covers the possible state prosecution for criminal negligence in cases of systems failing to provide proper safety equipment and training. (1-1/4 hrs.) VHS: $55.

T-1089, *Painless Technical Writing*—Bill Cologie of the Pennsylvania Cable TV Association and Rikki Lee, editorial consultant, address the issue of overcoming the fear of writing and putting ideas on paper. They also discuss preparing memos, reports and technical articles in a CATV-specific environment. (1-1/4 hrs.) VHS: $55.

T-1090, *Signal Leakage Equipment Calibration*—Don Runzo of ComSonics and Steve Windle of Wavetek RF Products focus on different aspects of signal leakage equipment calibration, including receiver measurement accuracy, setting up a calibrated leak and calibrating the vehicle-mounted leakage test system. Internal and external calibration and wave propagation are covered. (1 hr.) VHS: $55. **B-II**

T-1091, *Video and Audio Measurements*—Ron Hranac of CT Publications and Coaxial International and Steve Johnson of ATC demonstrate headend video and audio measurements, covering video level, video depth of modulation, audio level and audio deviation measurements with actual test equipment. (1-1/4 hrs.) VHS: $55.

T-1092, *How a Cable System Works*—Produced by Jones Intercable, this video presentation offers a comprehensive look at the operations and functions of a working cable system. (3 hrs.) VHS: $75.

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Notes on Videos

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Non-members must add 20 percent to the listed prices when ordering videotapes. Orders without a valid SCTE member number will be invoiced at the non-member rate.

All videotapes listed from T-1001 to T-1020 were produced in 1981. Additionally, it should be noted that videotapes T-1021 to T-1032 were produced prior to 1988.

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Bill Riker

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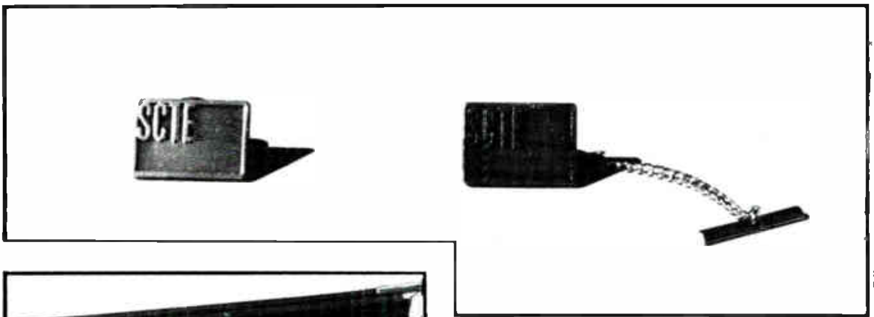
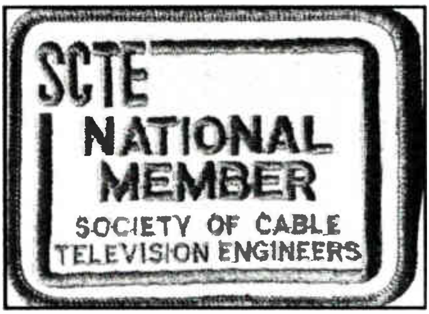


Bill Riker

Bill Riker



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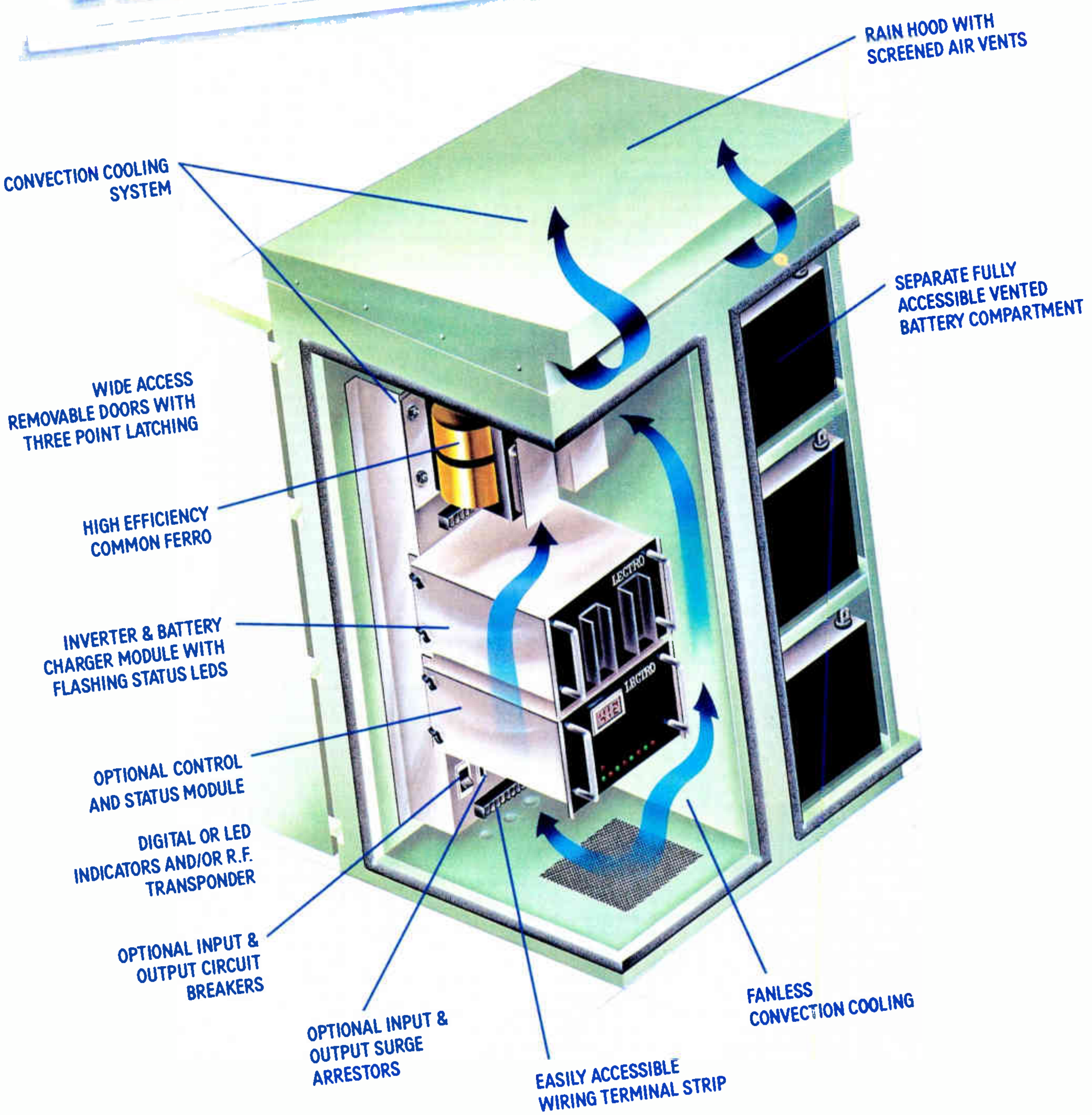


Cross-modulation testing

(Continued from page 24)

carrier" and "peak level of the test carrier," while somewhat misleading, have little impact on what was measured. The ratio defined by the NCTA today is the same as that defined back in the mid-60s[5]. However once spectrum analyzers came onto the scene things changed. In the frequency domain terms like "desired carrier" and "peak level of the test carrier" become significant.

Before going further, it may be helpful to visualize the possible relationships of X-mod graphically. The accompanying figure outlines a superimposed trace in the frequency domain of both an unmodulated carrier with X-mod present and the same carrier modulated 100 percent with a 15.75 kHz square wave having a 50 percent duty cycle.

What's being measured?

When the NCTA definition (time domain) is used and the test procedures outlined in that recommendation are followed, Ratio C (see figure) in the frequency domain is measured. However, in the frequency domain other interpretations of the X-mod ratios have been made. One interpretation used by some members of our vendor community is the ratio of undesired modulation (caused by other modulated carriers) to the unmodulated (CW) peak carrier under test (Ratio A). Another interpretation less frequently used is the ratio of undesired modulation (caused by other modulated carriers) to the modulated peak carrier under test (Ratio B). When the recommended test carriers as defined earlier are used, these interpretations differ by 0, 4 or 10 dB. It is important to know which ratio is being specified and measured.

Perhaps a better definition of X-mod would simply be: the ratio of desired modulation on a test channel to the undesired modulation on a test channel caused by other modulated signals.

A common measurement technique is to use a detector (sometimes a spectrum analyzer in zero span) in combination with an audio spectrum analyzer (or wave analyzer or frequency-selective voltmeter) tuned to 15.75 kHz. A comparison is then made of the total detected sideband energy present with and without modulation on the carrier under test. What is actually being measured in this case is the ratio of the two shaded areas identified in the figure. When the two sidebands are symmetrical, as they should be, measurement results are identical to Ratio C.

The level of perceptibility for X-mod is well-defined. Some of the most comprehensive work on this subject comes from Willem Mostert at Magnavox. Magnavox has isolated X-mod from other distortions and identified the level of perceptibility to be as follows:

Non-synchronous carriers	−39 dB to −41 dB
Synchronous carriers (using Matrix test carriers)	−46 dB to −48 dB

The 7 dB difference between synchronous vs. non-synchronous modulated carriers has to do with the way test instruments measure power vs. the resolving capabilities of the human eye. These levels of perception apply for measurements made using CW test carriers that are modulated 100 percent with a 15.75 kHz square wave having a 50 percent duty cycle, and are measured in the time domain. Changing the duty cycle does not affect measured results in the time domain or in the frequency domain when Ratio C is referenced.

In addition to the 7 dB of perceptible headroom between synchronous and non-synchronous carriers, additional headroom results from the fact that test carriers are 100 percent modulated. Cable TV video is modulated to a maximum of 87.5 percent with averages in the 50 percent range. Changes in the depth of modulation impact the level of perceptibility, how much is not well-understood and is worthy of more rigorous testing.

Barely perceptible two-channel X-mod appears on a TV screen as a vertical bar rolling slowly from right to left (windshield wiper effect). As the number of channels contributing to X-mod increases, the barely perceptible image on a TV screen begins to resemble more of a subtle flicker. Worst-case X-mod looks like worst-case co-channel. However, long before X-mod degrades to this level, CTB would have obliterated the picture. An undesirable yet viewable image appearing in the background of the desired video is almost always due to co-channel.

In summary

- Spectrum analyzers measure a 0 to 10 dB worse cross-modulation than do frequency-selective voltmeters due to the way phase contributions are measured. Frequency selective voltmeters are recommended because they behave more like the envelope detector on a TV set.
- The NCTA definition of X-mod has become subject to interpretation. When viewed in the frequency domain, results can differ by 0, 4, 6 or 10 dB, depending on the reference carrier used (see figure). Care should be exercised when comparing X-mod specifications and test results.
- The −46 dB to −48 dB level of perceptibility is well-defined for CW carriers synchronously modulated 100 percent with a 15.75 kHz square wave having a 50 percent duty cycle, in the time domain or in the frequency domain when referenced to Ratio C.
- The NCTA X-mod ratio should be redefined to eliminate the ambiguity associated with frequency domain carrier relationships.
- The NCTA tested −48 dB level of perceptibility is a conservative number. Contained within this number is 7 dB of known headroom associated with synchronously modulated carriers, plus some additional (not well-defined) headroom for using 100 percent modulation. The NCTA recommends a −53 dB specification for an operating cable TV system. **CT**

References

[1] Simons, K.A., *Technical Handbook for CATV Systems*, Jerrold Electronics Corp.

[2] Maquisi, M., "CATV Distortion Analysis in Cable Television Systems," Sylvania Technical NSTE (August 1980).

[3] Pidgeon Jr., Rezin, "Characteristics and Perceptibility of s-Cross-Modulation," Scientific-Atlanta.

[4] *NCTA Recommended Practices for Measurements on Cable Television Systems*, Second Edition.

[5] National Cable Television Standard Number NCTA-002-0267, "CATV Amplifier Distribution Characteristics" (undated).

My thanks to Willem Mostert, Magnavox CATV Systems, for helping me to understand what I thought I already knew on this subject.

Cable testing

(Continued from page 26)

An important safeguard is for the operators to stay in touch with the product. They are responsible for the ultimate quality of the products. The system must be responsive and provide all necessary information.

The system

Using the HP8753 network analyzer with the variable bridges met the requirements of the measurement equipment. Remaining was the selection of controller equipment and a method to communicate with our IBM data processing center. Existing platforms do not offer the performance and functionality required.

The HP9000 controller was selected due to its performance, Unix standard, multitasking, networking, reliability and service. The drawback was that software able to control the equipment, interface with the operator and communicate with the data processing center had to be written. This allows us to optimize the use of the system by making it responsive.

Measurements

RL measurements, in general, are the periodic occurrences of deviation of impedance along the length of the cable. If they occur at a fixed interval for any duration in the cable, it will create a reflection back at a frequency with a half wavelength equal to the impedance deviation interval. The significance of the deviation and the duration will determine the amplitude of the RL signal. Any peak in the spectrum greater than –30 dB is considered a downgrade of the product. Signal return loss (SRL) in the cable industry is commonly called structural return loss, the reason being that significant occurrences of impedance deviation in the cable are due to structural defects such as diameter variations.

As bandwidth requirements increase, test connectors become more critical and more dynamic range is needed. Having the bridges physically at the ends of the cable minimizes the effects on the measurements. The life of the test connectors is extended by making connections to both ends only once and measuring all test results.

Attenuation measurements increase proportionally to the square root of the frequency. As bandwidths are pushed to 1 GHz the usable dynamic range of the equipment becomes the limiting factor. Without modifications, the equipment can obtain a repeatable reading of approximately 60 dB after calibration. Gain of at least another 20 dB of range has been achieved.

Time domain reflection (TDR) measurements are used to locate isolated changes in impedance measurements usually due to damage. TDR and length measurements are dependent on the velocity of propagation (Vp) of the cable under test. The Vp of our cable is usually constant (approximately 87-89 percent), but is proportional to the characteristic impedance that is obtained from the variable bridge settings.

The accompanying figure diagrams the equipment and configuration necessary to perform these tests in a manual mode. All that is required is to set the bridge to 75 ohms and 0 pf capacitance and then to set the analyzer for the measurements of interest and perform a one-port calibration. **CT**

PPV technologies

(Continued from page 30)

Second, the process of cross-referencing sub IDs with telephone numbers, verifying credit, recording purchase data for invoicing and authorizing the converter is time-consuming. Handling orders from multiple switches in real time is a difficult task. If the volume of orders is as high as anticipated, purchase requests are likely to back up or be lost if the system cannot queue them.

ANI system implementation requires a small capital investment in headend equipment and installation. The phone company may need to make anywhere from a small investment to significant expansion of the switching facility. The variable cost per purchase will be somewhat higher using this type of system.

All real-time systems require the establishment of a closed-loop communication link between the sub and the headend computer system before a sub can get PPV. The transaction time is not instantaneous and requires closed-loop communications for order processing for each participating sub. It is not unreasonable to expect that with a substantial sub base, they will have to order programs before the showing to guarantee sufficient time for processing and communication of program authorization.

Real-time systems also demand the entire ordering system be operational during the ordering process or potential orders will be lost. A last-minute equipment or communication link failure will result in lost revenue opportunity and frustrated subs.

Store-and-forward

Seeking to overcome the limitations of real-time ordering systems led to the development of store-and-forward impulse technology. This type of system provides an effective solution to anticipated operational problems associated with traffic bottlenecks caused by peak order loads. Impulse poses no limits to the number of subs who can order an event and provides instantaneous program authorization for immediate viewing.

In a store-and-forward system, converters are pre-loaded with purchase credits against which subs order PPV programming. The sub orders a program by pressing a selection key and entering an optional secret personal identification code. If the sub has sufficient credit, instant authorization to view the program is given. The converter need not communicate with the headend system for programs to be cleared for viewing.

When a program is purchased, a program identifier and time stamp are stored in the converter's non-volatile memory. Later, on a non-real-time basis, the addressable controller collects this program purchase information for subsequent billing. Every sub in the system can order an event or program up to the last minute before a showing (or even during the first few minutes of a program) depending on the cutoff ordering time. In this way, consumers can buy on a true impulse basis.

The store-and-forward technique is the only impulse PPV scheme that does not require real-time communication and data processing; it totally avoids real-time bottlenecks in the control system. Store-and-forward technology is available in impulse PPV (IPPV) products that use both the RF and telephone return paths.

Using the telco return path

The telephone return path option makes IPPV available without incurring the cost of installation and maintenance of a two-way distribution plant. The operator uses the standard addressable system for one-way control functions (subscriptions, terminal control and advance order PPV purchases) and uses the public switched telephone network as a return reporting path for collecting billing information related to purchases made through the sub's converter.

Purchase reporting occurs automatically and requires no specific sub action. Also, this hybrid system does not impose restrictions on the sub's normal phone use, nor does it exhibit signs of the collection process.

At the headend, each telephone line requires a modem and each addressable controller handles up to 12 modems. Phone lines are configured in a hunting arrangement that allows a single number to access the first available line in the group. More phone lines and modems can be added to accommodate any increased load resulting from growth in the sub base or penetration rate.

Data collection load handling capability can be illustrated using the following example. Assume a system with 50,000 subs and 25 percent of converters with data to report. With 10 phone lines, the addressable system can collect all billing data in approximately five hours. There's an approximate linear relationship between the sub base, penetration rate, number of phone lines and the time required for data collection. If the sub base or penetration rate grows, the collection time can be held constant or reduced by adding more phone lines.

"All real-time systems require the establishment of a closed-loop communication link between the sub and the headend computer system before a sub can get PPV."

The following scheme is used to collect data from subs:

1) The addressable control computer instructs (over one-way cable data path) a group of terminals to call in if they have transactions to report.
2) Terminals in the group with data begin to call in. If they don't make a connection the computer makes note that a converter in the call group did not respond.
3) The addressable controller at the headend answers the call via the auto-answer modems and collects purchase data from subs. Data is stored in bulk data files for later transfer to the billing computer. When the controller completes its transactions with a sub's terminal, it hangs up and answers the next call. This process is duplicated for each modem on the system.
4) The addressable controller manages incoming transactions to determine whether all subs in the group have reported. When one cycle is complete the addressable controller initiates the next cycle.

Sub eq pment consists of a one-way addressable converter, upgraded to two-way capability with the addition of a module that houses the phone interface and modem. All operational parameters, including the phone number and call timing, are downloaded over the one-way RF addressable data stream and may be verified or changed via the telephone path.

The impulse controller is a high performance addressable controller. It collects IPPV billing data from subs' terminals over the telephone link and transfers the data in bulk (store-and-forward again) to a billing computer. In addition, the controller downloads and verifies other operating parameters in the system on a converter-by-converter basis by establishing a direct phone link to that converter.

Another benefit of this architecture is its remote diagnostic capability. If there's a troublesome converter somewhere in the system the operator can command the converter to call in so its operating status and memory contents can be examined before rolling a truck for a service call (thus reducing unnecessary trips).

Converter verification is accomplished concurrent with data collection by assigning an alternative phone number to the converter in question over the one-way data path. The addressable controller initiates a collection cycle by commanding a group of impulse converters to dial if they have non-collected entries to report. This command is communicated over the one-way addressable data stream. The number of terminals in the group is based on the number of available phone lines and the expected IPPV penetration rate.

Included in the command to dial is an encryption key used by the impulse controller and converter to encrypt and decrypt data transmitted over the telephone link. Also included is a password used to validate the converter's identity when it establishes communications with the impulse controller. Any converter in the group with data to report dials the phone number (downloaded to the converter during initialization) and waits to be interrogated by the impulse controller, which stores the collected data and status indicators in its non-volatile memory. If a power outage occurs during collection, the addressable controller collects all data in the impulse controller buffer. When the power is restored it reinitiates the cycle that was in progress when the power outage occurred.

The store-and-forward system requires an investment in subscriber equipment and a connection to the telephone system in the home. For systems with a sizeable sub base, multiple data collection modems may be necessary.

Using the RF path

The two-way system uses the return spectrum of the distribution plant for reporting IPPV purchases, opinion polling responses and viewership polling data. It also employs the store-and-forward technology to avoid ordering bottlenecks.

The return transmitter in a converter equipped with the two-way module may be tuned to frequencies between 8.3 and 10.4 MHz at the command of the headend controller. The transmit level also is agile under command of the headend. The agile nature of the return transmitter allows the system to strategically avoid ingress, interference or runaway transmitters blocking specific frequencies of the distribution plant's return spectrum.

The store-and-forward system has advantages over real-time PPV systems, most importantly program purchase capability up to the last minute for the entire sub base, despite size. This type of system can operate during a control system outage (such as for preventive maintenance) and continue to allow subs to purchase and view PPV events shown during the downtime. Many operators may find that the hybrid store-and-forward IPPV approach provides the greatest flexibility in confirming operational parameters of the system and using the available communication resources. It also offers sufficient capacity to handle the peak ordering loads as the sub base grows.

The best ordering method for PPV is directly dependent upon the type of programming to be offered. If a system does not intend to implement PPV as a routine service, ANI may be an appropriate technology to consider. However, implementation of PPV and a routine, high-volume service requires the impulse ordering capability and low transaction costs of the store-and-forward system. **CT**

PPV sources

(Continued from page 34)

modate normal maintenance procedures. Optional rack-mounted slides can make maintenance easier for the technician but is not required.

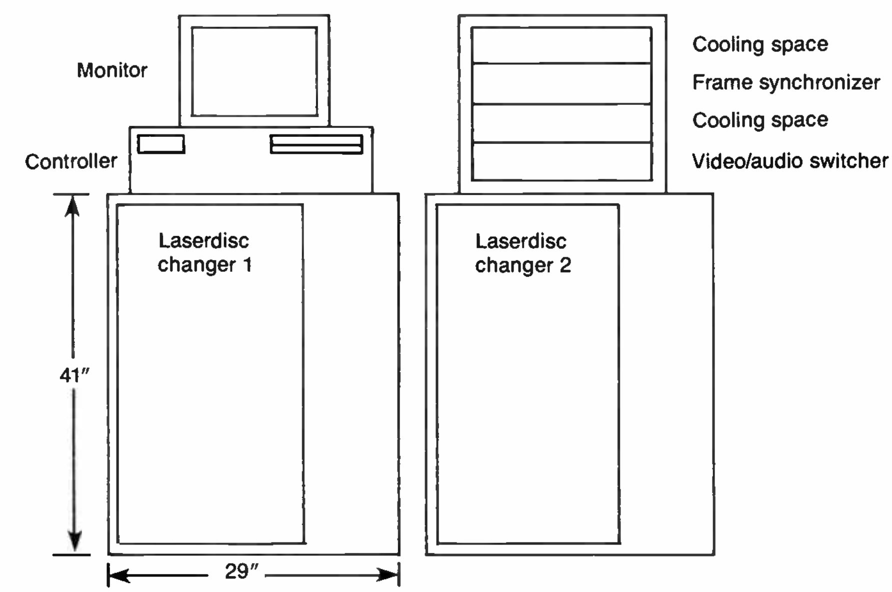
Cabling for the satellite receive system also is very straightforward, consisting mainly of video/audio cabling from the receiver and VideoCipher and an RF feed to the receiver (see Figure 2). Occasionally implemented are special cables from the audio channels for cue tone or special subcarrier detection by commercial insertion equipment. Powering requirements for the receiver and decoder are modest. The receiver typically draws 100 watts and the VideoCipher 35 watts.

- *Videotape system*. Modern videotape players do not consume as much space as their predecessors. VTRs now fit into the standard 19-inch equipment rack, some requiring shelves for support, others able to rack-mount directly without adaptation. (Refer to Figure 3.)

However, most VTRs are five EIA units high and each channel must have a minimum of two VTRs for continuous play. Other associated equipment for the VTR PPV system is a sync generator/time-base corrector, a video/audio switcher, a preview monitor and a system controller with high resolution video generator. *All* of these components are necessary to enable the VTR system to operate in an encoding environment (see Figure 4).

The sync generator provides a "genlock" signal to the VTRs to keep the video signals from each unit synchronized to one standard. Without this the encoder will lose sync with the video signal causing the descramblers also to lose sync, generating an annoying glitch when switching from one VTR to another. A

Figure 6: Laserdisc hardware (laserdisc changer units)



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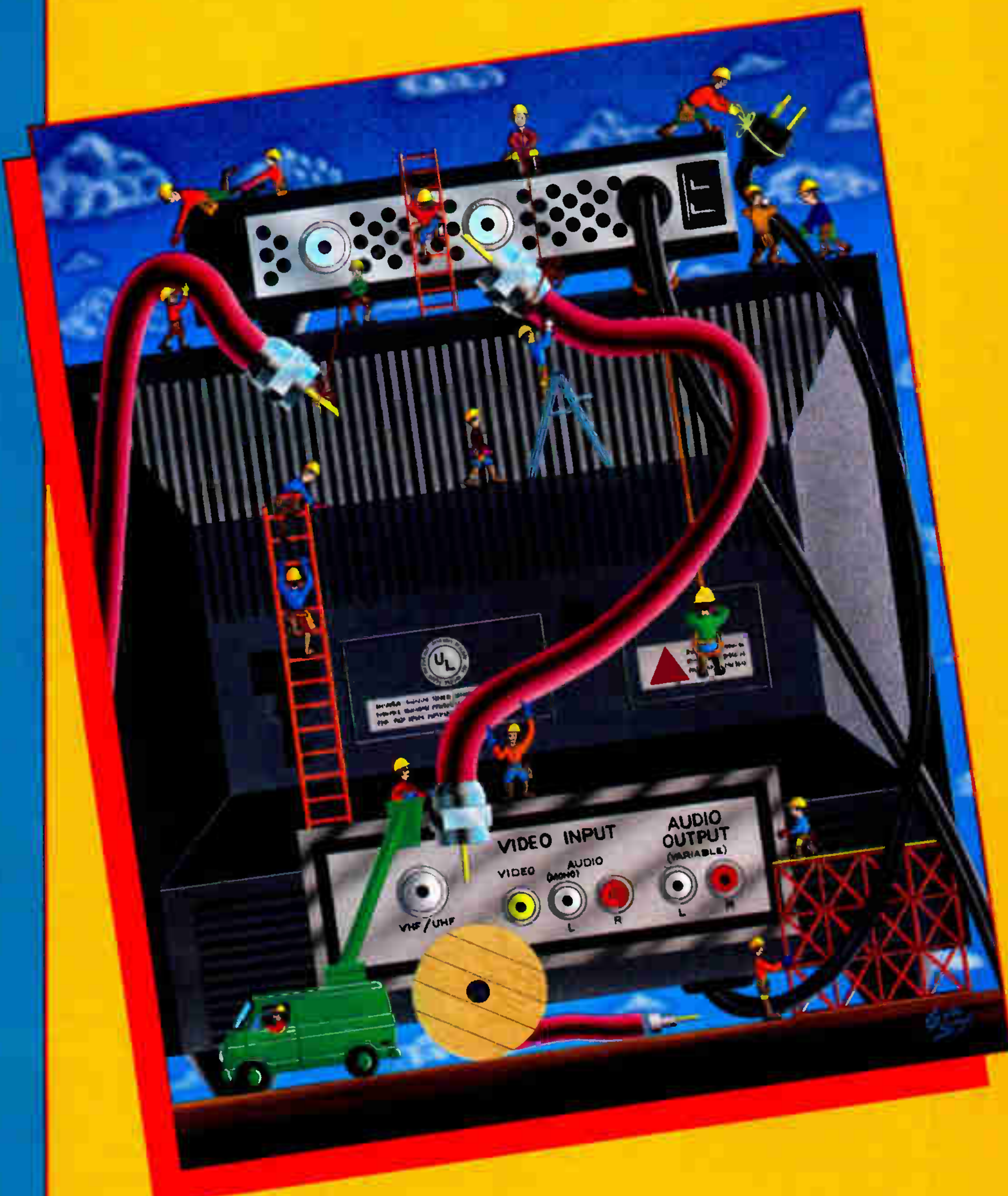
Reader Service Number 38

November 1990

BACK TO BASICS

Installation procedures

The training and educational supplement to Communications Technology magazine.



Geri Saye

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Formerly Installer/Technician

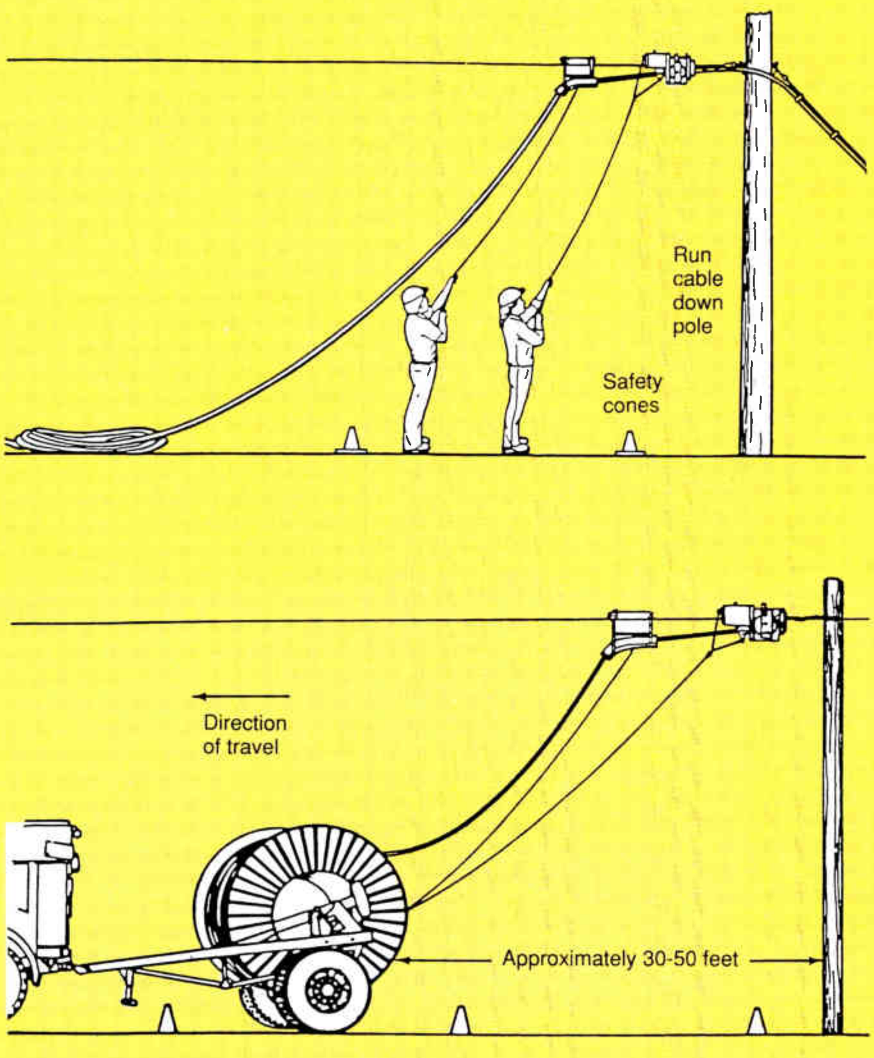

Courtesy Times Fiber

Outdoor fiber installation: Part 2

By Jim Hartman
Project Manager and Trainer, FiberLite International

Because of its light weight, small diameter and immunity from electrical interference it would first appear that fiber-optic cables would be highly suited for aerial installation (Figure 9). Yet, there are special problems to overcome. The usual problems with aerial lines are caused by ice and wind, and the danger of falling trees, runaway cars and bullets. With fiber you have the added concern of extreme temperature variations in harsh environments and the danger of ice forming and crushing the cable. I don't recommend aerial cable installation unless there is absolutely no other alternative.

Figure 9: Aerial installation



When splicing aerial closures be sure to leave enough extra cable to bring the splice point down into the splice trailer or van. This leaves lots of extra cable and there is no great way to store the extra cable in an aerial installation. One possibility is to mount a protective enclosure on a pole at the splice point. Another option is to loop one incoming cable and tie wrap the cable and closure down the strength member. If you have 30 extra meters of cable then the closure would end up 30 meters away from the pole.

Because of fiber's immunity to electrical interference some companies are attempting to exploit the high voltage transmission lines as ready sources for attaching fiber-optic cables. There are dielectric cables such as the free-span variety that can be strung from power pole to power pole without any steel strength member or steel support strand. The electromagnetic field is so strong near the high voltage power lines the fibers need to be an appropriate distance away (minimum of three feet). Fiber also is laid inside a hollow core high voltage cable. This is a very protected environment except for potential heat stress. These lines are sometimes strung by helicopter.

A main problem with cable laying concerns "rights of way." Railroads, privately owned toll highways, pipelines and power transmission lines provide ready paths for the telecommunication

Figure 10: Pulling cable

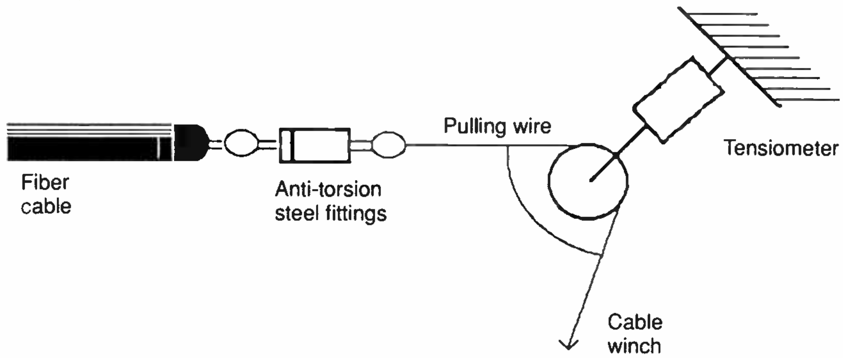


Figure 11: Pulling tape

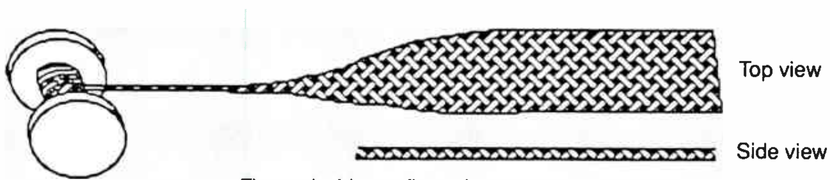
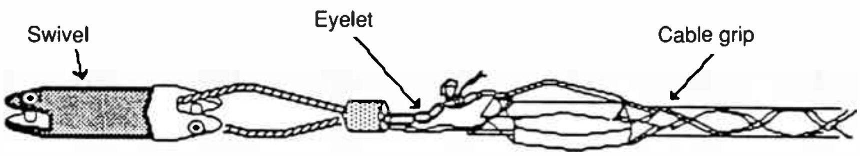


Figure 12: Wire mesh pulling grip



companies to negotiate rights of way. Rights of way can be difficult to obtain and costly in both time and money. A project manager for a major install company explained to me how his firm dealt with right of way: "We plow now and let the lawyers catch up later."

The third main way of placing cable is through existing ducts, which can be within cities, between existing buildings or inside a large building. The main problem here is that most are crammed full of various types of copper cables. Be careful when working in manholes to protect the fiber cable from pressure from heavier cables being placed on top of it or from the way the cable is racked. There is also the problem of the tendency of a cable to twist around other cables when they are pulled through the ducts. This can put enough pressure on the cable to result in micro bending or in extreme cases to break the cable.

Pulling cable

Given the special nature of the fiber-optic cable there are factors that must be carefully considered in pulling procedures. Each manufacturer will specify the bending radius of each individual cable. Special devices are used to prevent the cable from being bent beyond the specifications during the installation. The cable also will have the pulling tension in pounds, generally around 600 lbs. A fully equipped fiber-optic cable puller will have a special measuring device on it to stop the whole process if too much tension is applied to the cable.

The established procedures for placing the cable into a duct system are similar to those used for other types of cables. Often the cable will be pulled by hand in tight situations to assure that it will not be damaged in the pull. When this is done portable measuring devices may be used to assure that the pulling tension is not exceeded (Figure 10). Another problem in pulling through conduits with other cables is that the pulling rope may twist around the other cables and cause the cable to do the same when it is pulled through. This can add to the drag or damage the cable.

The basic tools are a blow line, pull rope, cable lubricant, pulling swivel and a Kellem grip that is sometimes known as "Chinese fingers" (Figures 11 and 12). These are standard tools that also are used in copper cable installation.

However, two cable specifications must be carefully observed to assure that no damage will occur during the installation:

1) *Maximum pull strength of cable*—Each cable is limited to specified loads based on type and quantity of materials. A standard pull strength for outdoor cable is 600 lbs.

2) *Minimum bend radius*—This is to avoid fiber breakage or micro bending that results in signal disruption. A standard bend radius without assist is nine inches for outdoor cable.

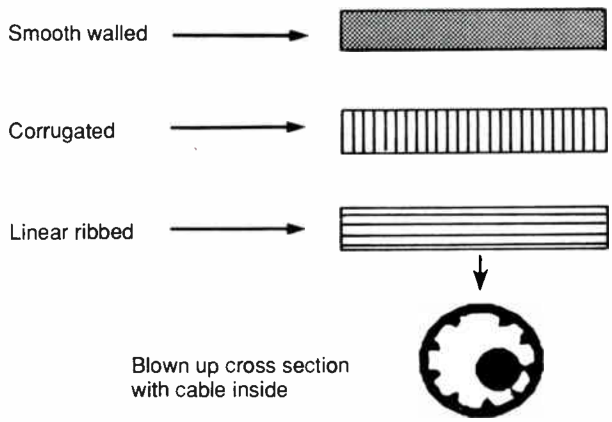
Failure to follow the preceding guidelines may result in cable damage! As well, additional factors that should be considered in the installation are:

- •The type of ducts
- •Expected installation loads
- •Length of pull
- •Lubricant usage
- •Type of cable and sheathing

There are three ways to pull the cable. Because fiber-optic cable is so light and flexible, on short runs it can be pulled by hand. The next best way is by Kevlar tie-off (using the Kevlar in the cable) and last is to use a Kellem grip.

Hand pulling may involve placing the cable in open trays. Since optical cables are usually smaller than others in the tray, it is recommended that the optical cable be placed in a subduct for added protection. Always remember to observe the bending radius of the cable and when tying or securing it be

Figure 13: Subduct, 1-1/4 inch



careful not to crimp or squeeze it. In a cold climate, care must be taken to keep it from being exposed to water that might freeze and crush the cable. If extra cable is to be placed to allow for future repair or expansion, this should be stored in a secured closure and not left exposed to possible damage.

For long pulls, the Kevlar and strength member of the cable are attached to a "slug" or pulling eye. Strip the cable back about eight inches to expose the Kevlar and whatever other strength member(s) may be in the cable. Cut off all other materials and tie the strength member(s) to the pulling eye with a fisherman's knot. Tape the Kevlar back to the slug.

The slug in turn is attached to a pulling rope. For longer distances, a swivel should be used to prevent the cable from twisting during the pull. Generally, you will be pulling through a four-inch duct, either adding to existing cables in the duct or to allow for more cables to be added in the future. Braided hemp or manila ropes tend to cut into the duct at the bend points so newer nylon ropes are used to reduce the friction. They are called "pulling tape" and have a flat appearance instead of the braided, round shape of a rope.

The subduct may be smooth-walled or corrugated (Figure 13). A newer development is a type of corrugation that has the channels running lengthways in the ducting material instead of crossways to the flow of the cable. Designers such as Arnco show that this creates less friction than the smooth or older type of corrugated duct. The vertically ribbed design may scrape off and trap the pulling lubricant, thus negating its positive effect.

Some cable manufacturers will attach a cable pulling device to the cable before it leaves the factory. These are to be attached to standard pulling devices and then when the cable is in place they are removed and

Figure 14: Center pull through duct

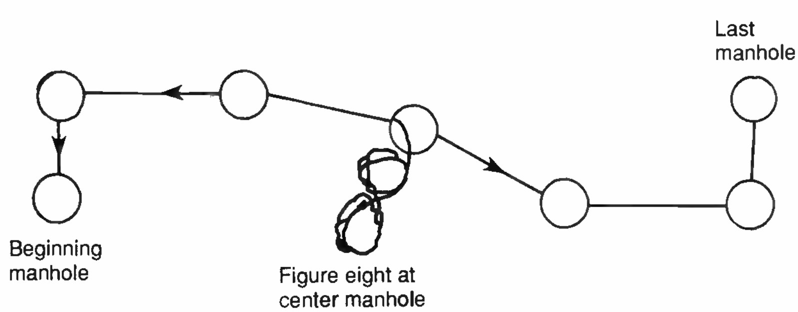
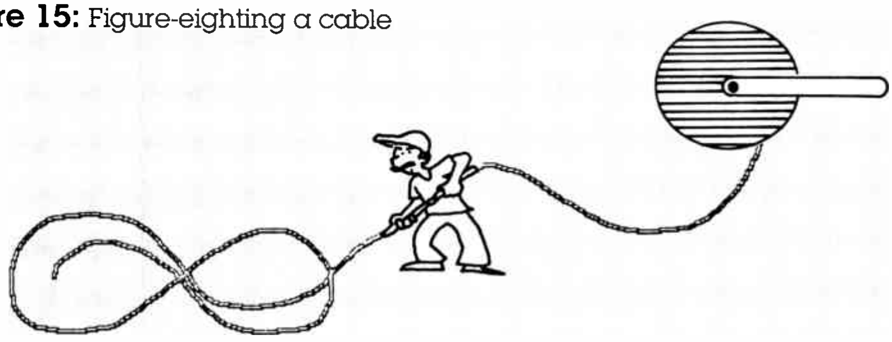


Figure 15: Figure-eighting a cable



disposed of.

Planning the cable run

It is essential that the route of the cable be reviewed ahead of time and the method of pulling through each section be planned. There are places where a center pull is best. Cables can be specially placed on their reels by the manufacturer to allow for this. But, you also can do this by taking the reel to the center point and pulling half the cable off the reel into the ducts (Figure 14). With that half in place, the other half is figure-eighted on the ground. When laying cable in a figure eight take care to keep the loops large enough to not violate the bend radius of the cable (Figure 15). The open end of the cable is pulled in the remaining duct. Another option is to use a pulling sheave to help in going around corners such as when entering a manhole (Figure 16). When setting up the cable reel when entering a manhole, always pull from the top of the reel as this minimizes your pulling tensions (Figure 17).

If the route of the cable has more than two bends in it, consider allowing for a hand assist in moving the cable beyond those bends. An in-line pull box is useful to allow hand assists. The cable pulling force in one 90° elbow is equivalent to 200 meters of straight pulling. Always pull through a bend at the beginning of a run instead of at the end. You can approximately double the pulling force going through a 90° angle. So if the tension is 15 psi as it may be early in the pull, it doubles to 30 after the bend. If it is 200 psi as it may be later in the pull, then the tension would double to 400 psi at the bend. The bend radius is generally 20 times the diameter of the cable for outdoor cable or a three-foot radius at maximum installation load. Be sure to check the manufacturer's specs.

Safety and management

In all phases of working with optical fibers, safety is an important factor to

"Always remember to observe the bending radius of the cable and when tying or securing it be careful not to crimp or squeeze it."

keep in mind. How could such a small cable or such tiny fibers be a safety concern? The fibers themselves are sharp and can puncture an eye or get under your skin. Various aspects of installation present hazards to your health, especially when working around large pieces of equipment.

All companies have safety requirements. The railroads are especially rigid and demanding when it comes to safety practices, for many good reasons. Take the time to learn the rules and make an effort to follow them for your safety and welfare, even when

Figure 16: Using a sheave at the feed manhole

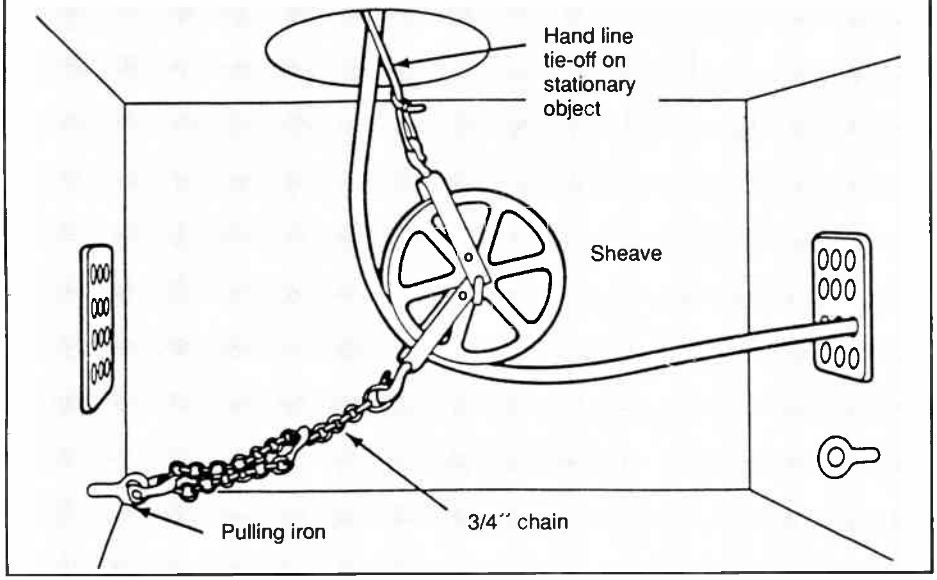
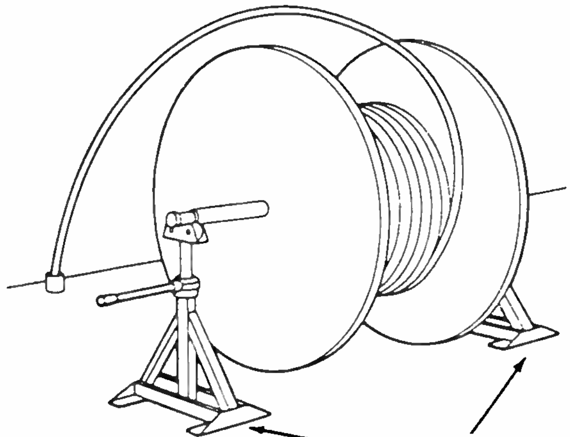


Figure 17: Cable reel setup



they seem overprotective. It is true that organizations create bureaucrats who in turn come up with "made-do" work, but behind every rule is some cause for safety concern. Remember, it is our nature that after a period of exposure to danger we tend to loose our fear of it and thus begin to relax; that is when accidents can happen.

A good crew is crucial for effective installation. A goal needs to be set that the installation group can achieve. If a manager only tells his crew to go as fast as they can, then they won't have good incentives to continue to work hard. Employees need both recognition and compensation for their achievement.

Project managers need a certain amount of authority to accomplish their task and to prevent the upper management from getting bogged down in the vicious micromanagement cycle. On the other hand upper management people definitely need to be the leaders of the company. I've seen several examples where the top managers failed to take charge and the project managers seized control by proxy or ended up starting their own firm. **CT**

Choosing the right clip

By Gregory R. Hayward
Sales Manager, ITW Linx

Cable operators can avoid expensive call-backs and ensure trouble-free wire and cable routing by selecting the proper wire routing clip. The right clip is a function of the size and number of cables to be secured, the substrate into which the clip is installed and whether the clip is for interior or exterior use.

Attention to these factors results in time savings during installation, an aesthetically pleasing final product, longevity of the clip and avoidance of cable puncture resulting in signal leakage. Since clips used for exterior fastening receive the most punishment, this article will focus on choosing the correct exterior clip.

Specify clip design

Routing clips fall into two general categories. Nail-in clips will attach into wood, mortar/brick, concrete block, stucco and cement. Snap-in clips will fasten into asbestos, aluminum and vinyl siding, and composite insulation board.

To avoid drilling holes prior to fastening, select clips using pins for installation. Drilling holes every 10 to 24 inches before fastening clips costs an average of 50 cents per hole.

Significant cost savings are achieved by using nail-in clips. Installers attach the clip to the cable as they progress and then pound the pin into the building surface with a common 2- to 3-pound ground rod (lineman's or drilling) hammer.

Clips typically have either one or two pins. One-pin clips are installed more quickly and are ideal for corner mount applications. Two-pin clips don't rotate and typically hold more securely. All pins should be made of tempered, rust-proof steel and should be perpendicular to the building surface.

"The right clip is a function of the size and number of cables to be secured, the substrate into which the clip is installed and whether the clip is for interior or exterior use."

Aluminum- or vinyl-sided homes require special clips to hold cable either vertically or horizontally. Each clip has a barb that is pushed into position between the overlap of the siding joint. Each clip snaps securely into the overlap seam to resist pullout while maintaining the integrity of the siding's weather seal.

These snap-in single-piece clips have a unique design. Horizontally, the clip holds cable securely beneath the siding lip. Vertically, the clip surrounds the cable in an angled channel around the edge of the siding overlap and holds it snugly against the wall surface.

Installed with a screwdriver, these clip designs provide an attractive alternative for aluminum- or vinyl-sided buildings while reducing inventory for the cable installer.

Thirty to 40 percent of non-UV stable clips break within the first year after installation and 55 to 70 percent of all non-UV clips will break by the end of the second year.

Quality cable clips should be constructed of high-impact, cold weather resistant, UV stable materials. Plastic clips that don't meet these criteria can break during installation, smash the cable, crack or break in cold weather, or deteriorate when exposed to the UV radiation found in sunlight, and thus become an expensive call-back statistic.

In addition, high quality plastic cable clips do not have sharp edges like metal clips. Plastic clips with smooth edges prevent the cable jacket from being cut or damaged. A damaged cable sheath can cause signal leakage and result in fines from the FCC for exceeding egress limits.

Don't forget aesthetics

While clips are typically available in black, white and clear, cable companies can reduce inventories by stocking clear clips that blend with all backgrounds. This also will ensure that clips are as unobtrusive as possible.

Cable companies should select clip suppliers based on the quality of the clips, as well as the breadth of the product line. This is especially true now, when all companies are trying to reduce their vendor base.

Clip suppliers should make each clip design available in a variety of sizes, supply clips with longer pin lengths for situations calling for extra holding power in porous building material applications and supply a complete range of clips for different substrates.

Selecting the right exterior clip will ensure that cable companies prevent expensive, profit-sapping call-backs both today and in the future. **CT**

How to install utility anchors

By David Chandler
President, Foresight Products Inc.

A 50-mile aerial CATV system is under construction 6,500 feet above sea level in California's San Jacinto Mountains in an area called Idyllwild. Rugged, rocky, wooded and desolate, Idyllwild is about 100 miles east of Los Angeles.

Cable Crafters Construction Inc. of Westminister, Calif., is doing the job for Inland Valley Cablevision of San Jacinto. Wayne Klemm, president of Cable Crafters, says there is more rock than dirt in those mountains. Placing guy strand and lashing coaxial cable on existing utility poles in the system calls for installing about 250 new anchors for the poles and this is one of the toughest jobs in the entire project.

"We have to core drill 4-inch holes in decomposed granite," Klemm said, "and it takes anywhere from six to 12 hours to drill one hole. The only type of anchor we can get into that rock is the Manta Ray Utility Anchor. Screw anchors are out of the question and if we were to use conventional cross plate anchors it would take two men three to four days to jack hammer a hole 28″ × 28″ × 9 feet deep for each anchor.

"We use a two-man crew to install most of the anchors and they use a 90-lb. hydraulic jackhammer because there's no way to get anything bigger into those tight, hard-to-reach spots. On a very few occasions we find a spot where we can get our track-mounted well drilling unit in to drill a hole and on those occasions it takes about 30 minutes to do the drilling job.

"Once we get a hole drilled, it takes about 35 to 40 minutes to install the anchor and lock it in with a Load Locker

Photo 1: Installer starts anchor into ground.

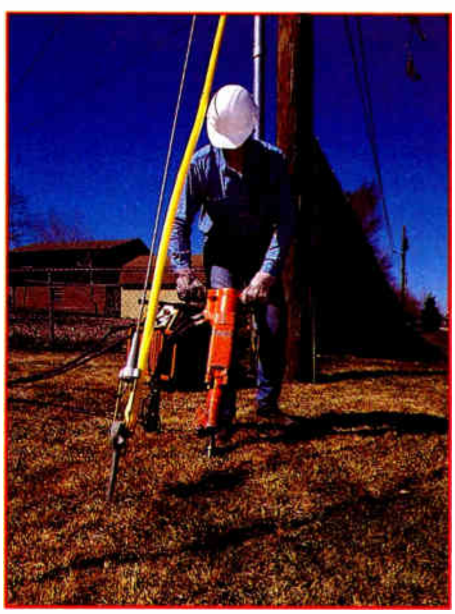


Photo 2: The anchor is now at the desired depth.

Photo 3: Installer pulls drive gad out of ground.

Photo 4: End of anchor rod is at ground level.

Photo 5: Adapter setting bar is screwed onto end of anchor rod. Load Locker base and hydraulic ram system are placed over the adapter setting bar.

Photo 6: Power source operates Load Locker, pulls up on adapter setting bar, rotating anchor into position, to the desired capacity as indicated by the gauge on the Load Locker.

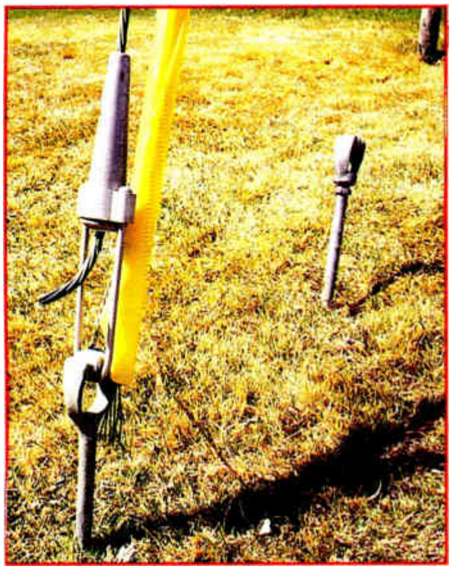


Photo 7: After Load Locker is removed, thimble is screwed onto end of anchor rod, ready for guying.

and an 18 HP hydraulic compact power unit. There's a gauge on the Load Locker that tells us exactly how many pounds of holding capacity we have locked in and we load each anchor to a 16,000-pound holding capacity, though I'm sure each anchor would hold at least 25,000 pounds in the rock. But if it weren't for that gauge there is no way we could be sure what holding capacity we have locked in."

The utility anchors, which are manufactured in Commerce City, Colo., by Foresight Products Inc., are drive-type anchors that one or two people install at ground level using ordinary contractors' equipment plus the Load Locker, which sets the anchor underground at the desired holding capacity. Klemm uses this type of anchor for all anchoring jobs, including those in normal soils and figures he saves 70 to 80 percent of the installation costs other types of anchors require since no digger derrick trucks or hole digging crews are needed. Let's explore how these anchors are installed.

The Installation

The accompanying photos show how these specific anchors are installed. The anchors are driven into the ground by one person at ground level using an ordinary jackhammer (see Photo 1). The installer drives the anchor at any desired angle to a depth of about 7 feet (see Photo 2). Photo 3 shows that the installer then pulls the drive gad out of the ground. The end of the anchor rod is now at ground level as in Photo 4. The anchor can be driven deeper if the installer so desires.

Photo 5 shows that once the anchor has been driven, the installer screws an adapter setting bar onto the anchor rod, places the Load Locker over the adapter setting bar and causes the Load Locker to pull up on the anchor rod (see Photo 6). This rotates the anchor into position underground in undisturbed earth. A gauge on the Load Locker tells the installer exactly how many pounds of holding capacity have been locked in by the anchor. Photo 7 shows that after the Load Locker has been removed, the thimble is screwed onto the end of the anchor rod, ready for guying to the pole.

No digger derrick truck is needed. No hole digging crew is needed. No mess is made and the soil remains undisturbed. Because of these facts, my company recommends these anchors for installation in tight, hard-to-reach places, such as in residential backyards, in alleys, among trees, between buildings and between curbs and sidewalk along streets.

The Load Locker used is a hydraulic ram device using hydraulic pressure to raise the ram. If the installer is using pneumatic equipment, a portable gasoline hydraulic power unit can be used to provide power to the hydraulically powered ram. The total time to drive the anchor and set it averages 15 minutes. **CT**

Hybrid amps

By Jud Williams
Owner, Performance Technological Products

When a device called a gain block arrived on the scene a number of years ago, a veritable revolution took place in the design of cable TV amplifiers. These devices were known as *hybrids* and have replaced a multitude of discrete components.

Prior to their introduction, CATV trunk, bridger and line extender amps were made up of an array of resistors, coils, capacitors and transistors. The earliest of these were called *single-ended* amplifiers because their final stage was a solitary transistor. Performance was limited to 13 channels with a practically useless midband due to distortion. Each section of the amplifier contained trimmer pots and capacitors requiring stage-by-stage alignment. This was done by placing the module in series with a length of 18 to 22 dB of cable and adjusting it so its output was flat.

Push-pull amplifiers came next and replaced single-ended types. Their output was made up of a pair of transistors, which had the effect of canceling the distortion caused by the previous stages of amplification. This was a great improvement and the alignment procedure was simplified so the amps could be made flat without cable as mentioned before.

This set the stage for *hybrid gain blocks.* The earliest hybrids were limited to a frequency response of less than 300 MHz. Manufacturers of cable amplifier modules had their own design criteria so that there was a proliferation of different gains available. Gradually, there was a trend toward standardization so that today the majority of manufacturers use 18 and 34 dB hybrids.

The hybrid amps are a miniaturized version of the older push-pull amplifiers but with many refinements. The circuitry inside the module is on what is called a thin-film substrate. The resistors and transistors are bonded to this ceramic-like wafer and have interstage transformers attached. The 18 dB modules contain two pairs of transistors in what is called a cascade arrangement. The input pair is configured in such a way as to minimize the noise reaching the output stage, which operates at a lower gain. The push-pull arrangement reduces the second order beat by mutual cancellation of second order components. A 34 dB module contains two such amplifiers in tandem, built on the same substrate.

If two of these modules were connected in parallel, the power output would almost double. That is, in fact, what is done to produce what is called a *power-doubler* amplifier. Two amplifiers are arranged side by side within a standard hybrid package whereby nearly twice the power output results. As would be expected, the module draws considerably more current.

At present, the only available version of this amplifier is 18 dB, designed for use in 450 to 550 MHz applications. To achieve the necessary gain usually required by line extenders, a standard 18 dB hybrid often preceeds a power-doubler. Two benefits of power-doubler amps are that they have improved distortion over conventional hybrids and they may be operated at higher output levels.

The latest entry into the field of hybrids is the *feedforward* amp. They are most often used in trunk or bridger modules. These very expensive modules cost in the range of $218 to $253 to replace. The outstanding feature is that the distortion component is reduced by more than 20 dB over conventional amplifiers.

As with any improvement, there are certain trade-offs and with these units it is reduced flatness. The effects of this can be minimized since these amplifiers may be used intermixed with modules containing conventional push-pull hybrids. Other drawbacks for these units are a slight degradation of noise and greater power consumption.

Feedforward amps are made up of two loops: one containing a 34 dB main amplifier and delay line, and the other with a 34 dB error amp and delay line. Since all amplifiers have a certain delay characteristic caused by propagation time, delay lines are used to compensate.

The input signal containing a distortion component is split into two paths by a 10 dB directional coupler. A portion of the signal enters the low noise main amp adding gain. Part of this signal is sampled by a 24 dB directional coupler at its output and enters the error amplifier in the second loop where the distortion is suppressed by approximately 20 dB. The composite triple beat at the output coupler is thus optimized. Feedforward amps have a power gain of 24 dB. **CT**

Wavelength, frequency and period

By Ron Hranac
Senior Technical Editor

A basic electromagnetic signal such as an unmodulated video carrier is an alternating current (AC) waveform (Figure 1). Its amplitude increases from zero to maximum in a positive direction, decreases to zero continuing to maximum in a negative direction, then returns to zero. This process is called a cycle and repeats over and over. The number of full cycles the waveform completes each second is its frequency, which is expressed in cycles per second or hertz (Hz).

The wavelength is the distance that the electromagnetic wave will travel in the time it takes to complete a cycle. From this, frequency and wavelength are inversely proportional; that is, as frequency increases, the wavelength decreases. The period of such a signal is the amount of time that the wave takes to complete a cycle. Figure 2 shows these relationships.

The following formulas mathematically describe these relationships. Examples of their use are on the next page.

Free space wavelength:

$\lambda_{m} = 300/f_{MHz}$
$\lambda_{ft} = 984/f_{MHz}$

Frequency:

$f_{MHz} = 300/\lambda_{m}$
$f_{MHz} = 984/\lambda_{ft}$

Period

$f_{Hz} = 1/T_{sec}$
$T_{sec} = 1/f_{Hz}$

Where:
λ_{m} = wavelength in meters
λ_{ft} = wavelength in feet
f_{MHz} = frequency in megahertz (million cycles per second)
f_{Hz} = frequency in hertz (cycles per second)
T_{sec} = period in seconds

Figure 1

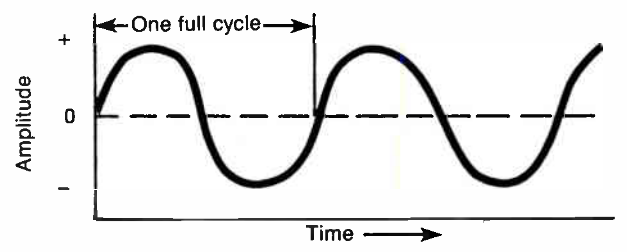
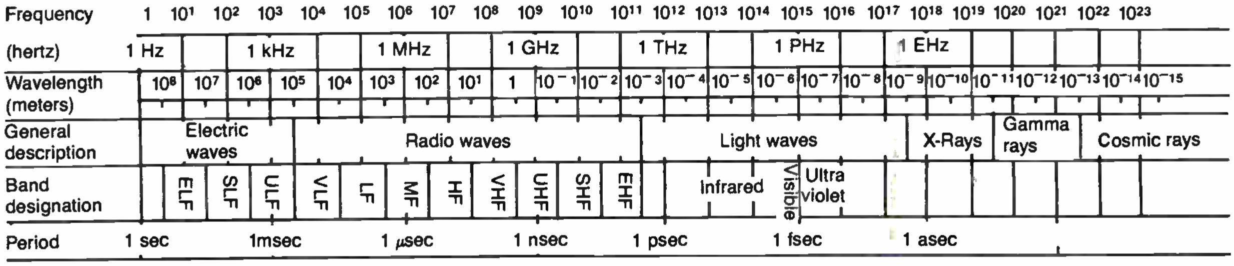


Figure 2



Problem: What is the wavelength in feet of Ch. 2's video carrier (55.25 MHz)?

Solution: Use the formula

$$\lambda_{ft} = 984/f_{MHz}$$
$$= 984/55.25$$
$$= 17.81 \text{ feet}$$

□ □ □

Problem: What is the wavelength in meters for the same signal?

Solution: Use the formula

$$\lambda_{m} = 300/f_{MHz}$$
$$= 300/55.25$$
$$= 5.43 \text{ meters}$$

□ □ □

Problem: What is the period of the Ch. 2 video carrier?

Solution: Use the formula

$$T_{sec} = 1/f_{Hz}$$
$$= 1/55{,}250{,}000$$
$$= 0.0000000181 \text{ second or } 18.1 \text{ nanoseconds (nsec)}$$

□ □ □

Problem: What is the frequency (in MHz) of a signal with a 1 microsecond (μsec) period?

Solution: First convert 1 μsec to seconds; since micro is one millionth, the period in seconds is 0.000001. Then use the formula

$$f_{Hz} = 1/T_{sec}$$
$$= 1/0.000001$$
$$= 1{,}000{,}000 \text{ Hz}$$
$$= 1 \text{ MHz}$$

□ □ □

Problem: What is the free space *half* wavelength in inches of cable Ch. 16's video carrier (133.2625 MHz)?

Solution: First determine the carrier's wavelength using the formula

$$\lambda_{ft} = 984/f_{MHz}$$
$$= 984/133.2625$$
$$= 7.38 \text{ feet}$$

To find its half wavelength, simply divide by 2:

$7.38 \text{ feet} \div 2 = 3.69 \text{ feet}$.

To convert this figure to inches, multiply by 12:

$3.69 \text{ feet} \times 12 = 44.3 \text{ inches}$.

How to get ideas for articles

By Rikki T. Lee
Editorial Consultant

If you're lucky, writing comes easily and words flow freely from your mind and onto paper. But if you're not so fortunate, you could encounter hazards on the road to a technical article you've always wanted to write. We've covered two of these in past columns—writer's block (June 1990) and lack of time (August 1990). Now let's discuss one more: inability to get ideas.

A question frequently asked by the anxious or the experienced is, "Where do you get ideas?" There are many answers; not all are helpful:

- "I read journals carefully and often find something the writers didn't explain to my satisfaction. Or I take another slant." (Excellent!)
- "I keep a notebook handy and whenever I get a stray thought—no matter how strange—I jot it down and file it later on." (Good approach!)
- "I ask all of my employees to tell me *their* ideas. Then I pick the best one to write about and acknowledge the employee." (Forget it!)
- "I go to The Idea Supermarket on Fourth and Main." (Thanks a lot!)

What works for someone else might not work for you; it's essential to discover your own method. And if you follow a few suggestions, you'll be on your way toward generating your own ideas for technical articles.

What are you doing?

For some of you, a way to get ideas is to lock yourself in a dark room and "blank out" your mind. This allows thoughts to rush in. But it's time-consuming and counterproductive. Would you deliberately leave your office to find something you know is located in your office file?

Instead, take inventory of your surroundings: the project you're working on, the tools and equipment you use, the people you work with or the way your department works as a team. If you're alert you'll notice that problems arise, some procedures are ignored and things can be performed better. So write down a list of problems and possible solutions, improvements, etc. Choose the most flagrant violation and address that one in a generic manner—don't use specific names—in your article.

On the other hand, if you try but can't

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PS Form 3526, Feb. 1989 (See instructions on reverse) find anything wrong in your job or workplace, you can still get ideas. For example, you can spotlight that preventive maintenance or safety program your company initiated. Describe in detail just how it works. Or you can play "What if?" Just present a situation that's orderly and smooth, then throw a monkey wrench into it. What if your PM program lost half of its budget? What if you saw your new safety coordinator endorsing an unsafe practice?

Another suggestion: be flexible. In some cases there's neither a right nor a wrong way. If you're satisfied with the way you've always done something, think of other ways that might be just as good or even better. Example: When you purchase new hardware, you ask the vendor's representative to visit and teach your staff how to use the gear.

But what could you do instead? Well, visit with the vendor alone, then teach your workers a few at a time until they do understand. Or you could ask your staff members to study the user's manual and allow them hands-on practice before you test their knowledge. And so on. In your article, list the pros and cons of as many of the alternatives you can imagine. And leave it up to your readers to make their own decisions.

"You might consider leaving the safety of your everyday world and sailing into uncharted territory."

Random idea generator

Who?	What?	What?	Where?	When?
Installer	Pay-per-view	Maintenance	Headend	Past
Technician	HDTV	Troubleshooting	Aerial plant	Present
Engineer	Amplifier	Rebuild	Underground plant	Future
Engineer/manager	Converter	Purchase	Home	Maybe
Subscriber	Fiber optics	Lightning protection	Truck	———
Vendor	DBS	Outage	Engineering department	
Non-tech employee	AML microwave	Upgrade	Antenna site	
Contractor	BTSC stereo	Inventory	Corporate	
Bench tech	Interdiction	Construction	Congress	
Regulatory agency	Test equipment	Destruction	Classroom	

Stretching exercises

So far we've discussed how to generate ideas based upon analyzing the elements of your daily routine. By examining closely what you and your co-workers do on the job, you'll compile a long list of article ideas. But sometimes, even this amount of inspiration won't provide enough spark to light your fuse. So you might consider leaving the safety of your everyday world and sailing into uncharted territory. In other words, try stretching your imagination. Here's how to do it:

1) Make the initial assumption that anything can happen to anyone (or anything) anywhere and at anytime. Free from the confines of "but that can't happen," you can go wherever your brainstorming takes you. At first, you'll concoct weird ideas. By revising your notions toward a more down-to-earth version, your article idea will finally take shape.

Idea: Your headend gets smashed by a large meteorite, leaving a crater. Revision #1: Your plant's downwind from a meltdown; how to rebuild in a radioactive field. Revision #2: How to deal with catastrophic damage. Revision #3: How to protect the plant from tornadoes. And so on, until you know you can find supporting data to write the article.

2) Create a "random idea generator." The object is to connect related words to form an idea. First, make several lists of words that fit particular headings. The accompanying example uses "who," "what," "where" and "when"; you can add "how," "why," etc. Under "who" you'd list job titles. "What" might be a list of equipment, topics, etc. The example uses two different "what" lists but you can use three or more.

After constructing the generator, choose one word—at random—from each column; e.g., subscriber, converter, destruction, overseas, future. With help, this list is transformed into an idea: "Preventing converter damage by subscribers in another country." Some combinations won't make sense (installer, HDTV, purchase, truck, maybe). So just play with the generator, plugging in different words, until fanciful outputs become minimal and good, usable article ideas come cranking out. **CT**

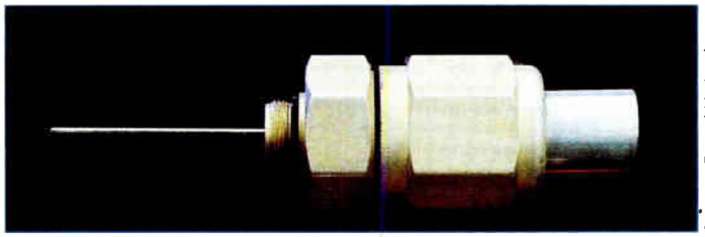
Pyramid Industries' PI pin connectors

By Ron Hranac
Senior Technical Editor

I first became involved with testing Pyramid's PI-*-CH-P two-piece pin connector for aluminum trunk and feeder cable almost two years ago at Jones Intercable (in the actual part number, the asterisk is replaced by the cable size). Our first evaluation of that connector showed that it did not meet Jones' corporate RF shielding spec and it was subsequently disapproved. Several months later we looked at it again, after Pyramid had performed some slight manufacturing changes to improve shielding effectiveness.

While this design passed the RF shielding test, we found that when tightening the connector the cable would rotate 270 to 300°, definitely an undesirable characteristic! Pyramid responded with a Teflon insert; this kept the cable from turning, but now it failed the shielding test again.

In early 1990 the company completed additional modifications to the design, and this report deals with the current connector being manufactured by Pyramid.



Courtesy Pyramid Industries

The product

Pyramid's PI series of connectors are two-piece construction, machined from 6262-T6 aluminum stock. They are available for most common sizes of hardline aluminum cable and are protected by a gold irridite finish. The manufacturer rates their performance to 1 GHz (1,000 MHz). A two-inch long center conductor pin is standard.

One unique feature of this particular connector is the use of a patented floating stainless steel RFI sleeve. Most other designs use a fixed RFI sleeve. Furthermore, the sleeve in the Pyramid connector is almost flush with the rear of the back nut, in contrast to a more typical recessed sleeve. As with other two-piece connectors, a "positive stop" indicates that the back nut has been properly tightened. Preparation of the cable for these connectors is straightforward, requiring a 5/8-inch long center conductor and 7/8-inch core depth.

Part numbers are printed on the back nut; the "PI" designates two-piece and the "CH" is pin style rather than feedthrough. Other versions of this series are available, including extension fittings, splices, cable-to-F (male or female) and terminators. We tested only the two-piece pin connectors in .500 and .750 sizes.

Lab measurements

One concern in this evaluation was the manufacturer's use of a floating RFI sleeve. It turns out that it is *not* removable, easing a possible fear that the sleeve might find its way in the weeds before the connector is installed.

The near-flush location of the end of the sleeve caused concern in early tests about a possible cable shield fatigue point at the rear of the connector's RFI sleeve. A test jig was fabricated at TCI's lab to simulate rather severe cable flexure. Both Pyramid and Gilbert connectors were cycled until

Figure 1: RF shielding prior to temperature cycling; the shielding is at the noise floor of the measurement system, which is in excess of –130 dB

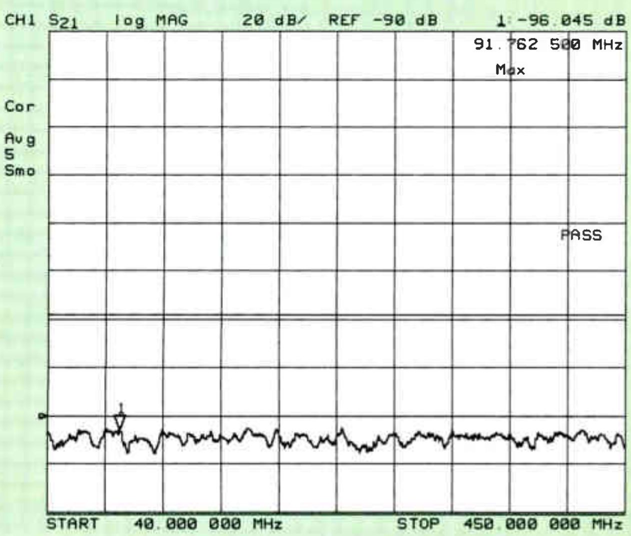
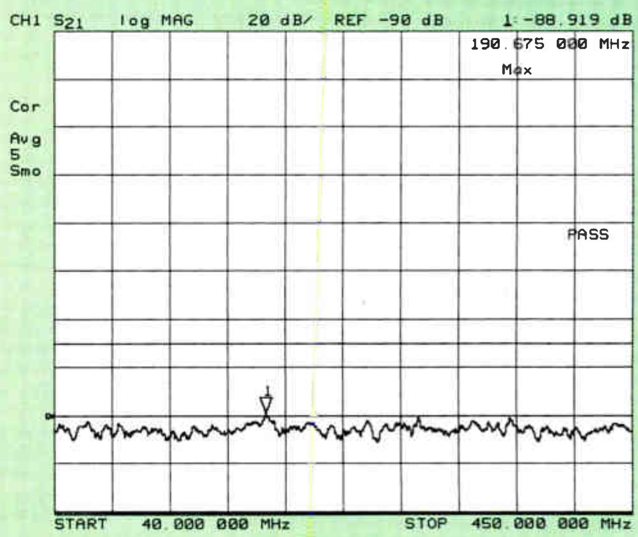


Figure 2: Typical RF shielding after temperature cycling from –40 to +60°C; again the shielding is at the noise floor of the measurement system



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Back To Basics

Figure 3: Return loss of all .500 connectors tested exceeded 30 dB from 300 kHz to 1 GHz

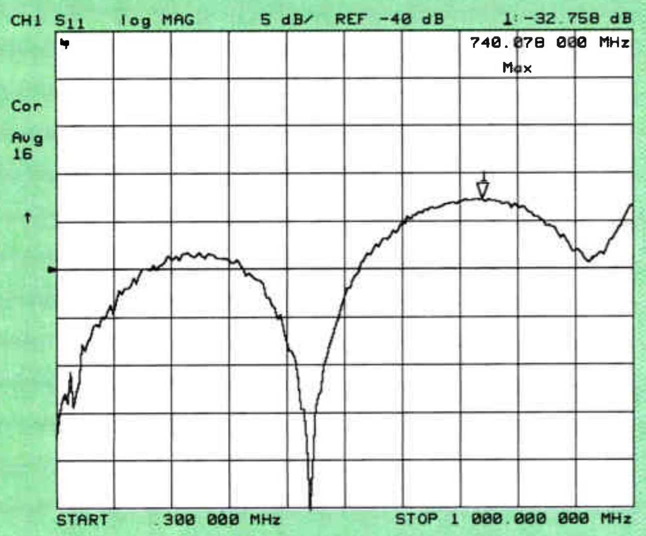
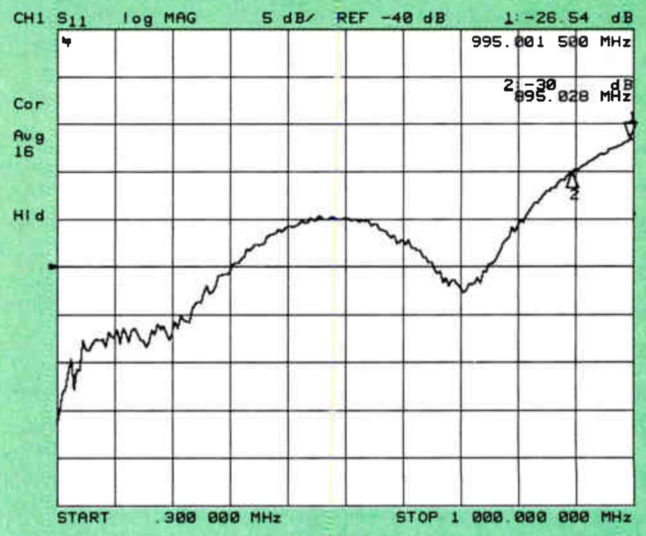


Figure 4: The .750 connectors had 30 dB or better return loss up to over 890 MHz (Marker 2) and 26.5 dB at 1 GHz



fatigue resulted in a cracked shield (Gilbert connectors have a recessed sleeve). Both designs survived several thousand "rotations," with all failures occurring at the point where the cable and O-ring meet. None of the samples from either manufacturer failed at the end of the sleeve.

Connector pullout strength also was tested on several samples. The center conductor and shield pullout were tested separately. For the .500 connectors, average center conductor pullout force was 131 pounds; the shield pullout force averaged 486 pounds (on most of the .500 samples the cable broke before the shield pulled out). For the .750 connectors, average center conductor pullout force was 189 pounds and the shield pullout force averaged 592 pounds.

Electrical performance was measured in Jones Intercable's lab. RF shielding was tested from 40 to 450 MHz (the RFI chamber's 42 dB gain post amplifier bandwidth limited measurements at higher frequencies). For both the .500 and .750 connectors, shielding measurements were at the –130 dB noise floor of the chamber before and after temperature cycling (Figures 1 and 2).

Return loss was measured on an H-P 8753B network analyzer from 300 kHz to 1 GHz, using a 75-ohm S-parameter test set. The .500 connectors exceeded 30 dB return loss up to 1 GHz (Figure 3), and the .750 connectors exceeded 30 dB up to over 800 MHz, dropping to about 26.5 dB at 1 GHz (Figure 4).

Comments

Pyramid was responsive to constructive criticism about early problems with the PI series connector and has evolved the designs to produce connectors with good performance. Fears about their departure from conventional RFI sleeve construction faded after tests showed that the position of the sleeve relative to the rear of the connector does not contribute to elevated fatigue, pullout or shielding problems. The sleeve's floating design also exhibited no problems and it becomes fixed when the connector back nut is tightened anyway.

Perhaps the only problem noted in this evaluation was the return loss of the .750 connectors at 1 GHz. The manufacturer's specs call for 30 dB return loss all the way to that frequency (which the .500 connectors easily met), but we measured about 3.5 dB lower than that on the .750 connectors. Even 26.5 dB return loss at 1 GHz is quite good (1.099:1 VSWR), and the network analyzer indicated 30 dB or better up to about 890 MHz.

The two-inch long center pin is a nice feature, easily accommodating almost any requirement without the need for a pin extender or different connector. UV resistant O-rings and Teflon and Delrin insulators will contribute to longevity.

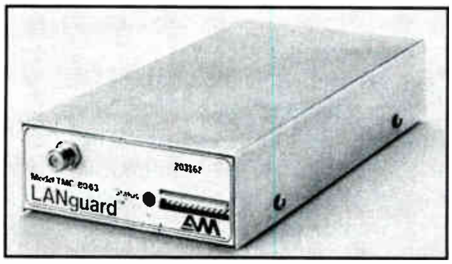
For more information, contact Pyramid Industries, P.O. Box 23169, Phoenix, Ariz. 85063, (602) 269-6431. **CT**

Surge device

Power Guard released a new surge arresting device, the Power Clamp, for use in all makes of power inserters and in the company's power supplies. It is thyristor-based and behaves like a bi-directional crow-bar circuit, providing a low impedance path for surges or spikes greater than 104 volts peak that would otherwise appear between the cable sheath and center conductor.

According to the company, the field-proven low impedance clamping action is capable of withstanding much greater surges than high impedance devices such as MOVs or transzorbs without self-destruction. Kits are available for retrofitting all major brands of power inserters and for Power Guard power supplies. The products are said to be easily installed or replaced in the field with a common screwdriver.

Reader service #113



LAN transponder

The TMC-8063 LANguard transponder was announced by AM Communications. It is designed to be mounted inside the Lectro Sentry II standby power supply cabinet and provides continuous monitoring of all critical power supply functions including battery voltage, AC output current and standby power status.

With LANguard monitoring of standby power supplies, outages caused by run-down batteries can be virtually eliminated, according to the company. When a power unit switches to battery backup, the software will immediately sound an alarm so that an auxiliary power unit can be dispatched to the site. In addition, power supply batteries can be tested remotely without disruption to normal system performance.

Reader service #112

OTDR

Photon Kinetics introduced its Model 3240 optical time domain reflectometer, which is said to be the industry's first OTDR with built-in reflectance measurement and internal attenuation capabilities. Its reflectance measurements determine the amount of light reflected by individual network components with built-in attenuation to eliminate clipped reflections.

According to the company, the product improves the measurement capabilities of anyone working on reflective networks, eliminating the need for calculations and reducing opportunities for error.The single button operation of the product is said to make it easy for installation and maintenance crews to get precise reflectance measurements of every feature in a network.

Reader service #111

Utility software

Tektronix introduced its Model S26UT10 GPIB utility software to run on MS-DOS computers for Model 2710 spectrum analyzer users. It automates selected test and measurement routines and provides for the storage, cataloging and documentation of all waveform displays and measurement data acquired by the Model 2710.

In addition, the software can transfer user-defined key sequences between 2710 spectrum analyzers and is said to have consistent results from repeatable tests. It eliminates repetitious test setups for frequency swept response and total harmonic distortion measurement routines. It has visual aids for learning GPIB commands, built-in print capability for all graphic displays and an optional source code serves as a foundation or model for writing additional applications.

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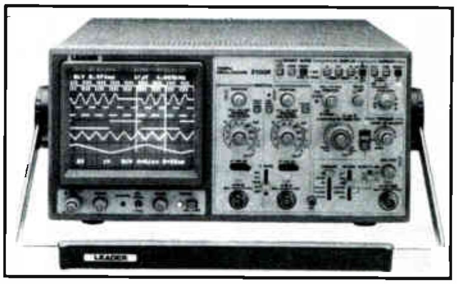


Oscilloscope

The Model 2100R is a 100 MHz CRT readout oscilloscope with cursors introduced by Leader Instruments. It allows the user to observe waveforms, setting conditions and measured values on a single display. It reduces setup time by displaying the salient setting conditions like factor, input coupling vertical mode, main and delayed sweep time and triggering controls.

On-screen cursors provide the ability to directly read measured values. Two cursors provide readout of voltage and time difference frequency, phase and voltage and time difference ratios. The voltage ratio is said to be ideal for doing overshoot measurements and the time ratio also is said to be perfect for measuring duty cycles. The unit offers three-channel capability, alternate triggering for simultaneous display of two asynchronous signals, alternate time base and six trace capability. The vertical input sensitivity of the unit is 0.5 mV and a Ch. 1 output is provided on the rear panel so additional instruments such as a frequency counter may be connected.
Reader service #123

Jumper storage

Literature is available from Siecor describing features and configuration options of the new jumper storage module (JSM), used with the FDC patch panel from the company. The JSM provides storage for spare jumpers and jumper slack within an FDC system. Two modules fit in the space normally used by a single FDC unit connector panel or module.

FDC units already in the field can be retrofitted with JSM using a snap-in adaptor plate included with each module. Units purchased from the company or authorized distributors will provide additional mounting holes for up to 24 jumper storage modules each.
Reader service #122

Hot stamping

Panduit announced custom hot stamping to provide permanent identification for the company's cable ties and marker plates. This custom capability is said to provide a convenient, economical way to custom marker the full line of nylon cable ties, marker ties, marker plates and cable marker straps to meet specific applications.

Both 1/8- and 1/4-inch high characters are available. Special logos, type styles and sizes also can be provided. The hot stamping is available in black, blue, red, white and orange.
Reader service #121

RF connector guide

AMP Inc. made available its 208-page catalog that covers the company's RF product line and offers information on connector selection, theory and application. It also provides connector and cable-to-connector selection guides and other technical support information.

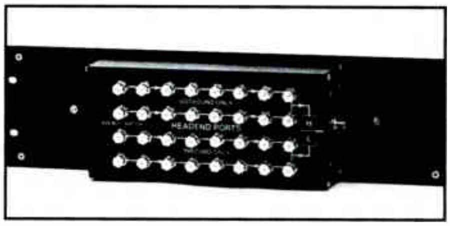
The catalog is said to detail virtually all of the company's coaxial offerings including BNC, TNC, N, C, SHV, UHF, SMA, SMB and SMC connectors; blindmate connectors for semirigid cable; triax connectors; miniature threaded connectors; twin BNC and threaded connectors; and twin-ax connectors. Additionally, the catalog covers network/premises interconnect products, shielded wire ferrules, braid termination contacts and terminals and multiple coaxial connectors and contacts.
Reader service #120

Identification tape

The Tuff-Tape line of eight different utility identification tape products was announced by Carsonite International. Six are designed for below-ground use and the other two are for above-ground.

Included in the line is Tuff-Weave

with over 8,000 psi of tensile strength. Super-Stretch has the ability to elongate over 1,000 percent, according to the company. Standard detectable and non-detectable products are available as well.
Reader service #119



Translator/remod panel

Broadband Networks Inc. introduced its Model HTRP series headend translator/remodulator panels, which provide 32 F connections with 16 inputs, 16 outputs and a high-performance diplex filter in a single package requiring only 3U (5.25 inches) of rack space. Inputs and outputs are clearly labeled and located on the rear of the units. This is said to provide an easy-to-use array of translator or remodulator connection points.

Model HTRP-HS is used for high-split systems and the Model HTRP-MS is used for mid-split systems. The units meet all specifications for MAP and IEEE 802.7 connections at the headend, using RF splitters for low-loss and high isolation between adjacent ports, while providing over 55 dB isolation between transmit and receive ports.
Reader service #118

Memory expansion

LeCroy Corp. is offering optional waveform memory expansion for its 9100 series arbitrary function generators. These expansion options have maximum capacities of 1/2, 1 or 2 Mbytes on non-volatile, battery backed RAM. The enlarged waveform memory is supported by direct GPIB access at data transfer rates of up to 200 kbytes per second.

Expanded waveform memory is said to allow longer non-repetitive waveforms to be generated by the arbitrary function generator. The expanded memory permits fast random access to large numbers of waveforms for dynamic simulations when combined with the 9100/RT real-time waveform selection option.
Reader service #117

Recorder brochure

Astro-Med's new Dash IV four-channel field and lab recorder is described in a new 10-page brochure. The brochure details the Dash IV, which has frequency response to 25 kHz real-time, individual or overlapping channels, data capture and playback, automatic self-calibration and menu-driven operation. The unit is compact and lightweight and is built into a carrying case.

The brochure goes on to describe the unit's other features. The Dash IV operates with no moving parts, which is said to assure reliable and accurate performance under adverse conditions. Actual chart samples are provided in the brochure as well as a listing of available signal conditioners.
Reader service #116

Satellite receiver

The Model ESR 1424 is a new satellite receiver from R.L. Drake. It offers a computerized satellite locator system, which tracks over 25 active C- and Ku-band satellites automatically. Included with the unit is a full function UHF remote, a state-of-the-art descrambler, the VideoCipher II Plus as well as on-screen color menus.

The product has extended threshold video and users can have discrete, matrix or digital stereo sound depending on the program source. Other features include a built-in VCR timer and a built-in actuator control system with pulse interface that moves the antenna precisely to any of 50 satellite positions.
Reader service #115

Bandwidth delay

Faraday Technology expanded its range of wide bandwidth delay lines developed for the high definition TV (HDTV) market. The company's range of passive 30 MHz video delay lines is designed to delay 30 MHz bandwidth video signals with the minimum of distortion. The maximum delay time of 100 ns was extended to 200 ns without cascading.

The 30 MHz delay lines were designed specifically for HDTV. The company also produces two other standard delay lines, the 5.5 MHz and the 11 MHz with delay times ranging from 10 ns to 1,000 ns and 500 ns respectively, both programmable for fine tuning.
Reader service #114

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EOE

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d. all the above

COMMUNICATIONS TECHNOLOGY
Official trade journal of the Society of Cable Television Engineers

To place a classified, contact Patty Linster at 1-800-325-0156.

November

Nov. 14-16: Private Cable Show, Caesar's Tahoe, Lake Tahoe, Nev. Contact (713) 342-9826.

Nov. 14: SCTE Appalachian Mid-Atlantic Chapter technical seminar on microwave transportation systems (tentative), Holiday Inn, Chambersburg, Pa. Contact Richard Ginter, (814) 672-5393.

Nov. 14: SCTE Greater Chicago Chapter technical seminar on BCT/E Category V—Data Networking and Architecture. Contact John Grothendick, (800) 544-5368.

Nov. 14: SCTE Dixie Chapter technical seminar, Birmingham, Ala. Contact Rickey Luke, (205) 277-4455.

Nov. 14: SCTE North Country Chapter technical seminar on fiber optics and feedforward, Sheraton Midway, St. Paul, Minn. Contact Rick Henkemeyer, (612) 522-5200.

Nov. 15: SCTE Sierra Chapter technical seminar on computer-aided design, Community Center, Roseville, Calif. Contact Steve Allen, (916) 786-2469.

Nov. 19-21: Magnavox CATV mobile training center seminar, Syracuse, N.Y. Contact Amy Costello Haube, (800) 448-5171 or (800) 522-7464 in New York state.

Nov. 21: SCTE Razorback Chapter technical seminar. Contact Jim Dickerson, (501) 777-4684.

Nov. 26-29: Backbone Networks Corp. hands-on fiber-optic workshop, Worcester, Mass. Contact (508) 754-4858.

Nov. 27: SCTE Satellite Tele-Seminar Program, "Installer certification program" and "Data transmission techniques (part one)." To air 12-1 p.m. ET on Transponder 2 of Galaxy III. Contact (215) 363-6888.

Nov. 28: SCTE Great Lakes Chapter technical seminar. Contact Daniel Leith, (313) 549-8288.

Nov. 28: SCTE Greater Chicago Chapter technical seminar, Embassy Suites Hotel, Palatine, Ill. Contact John Grothendick, (800) 544-5368.

Nov. 28: SCTE North Country Chapter testing for BCT/E Categories II, III, V and VI, Community Center, Edina, Minn. Contact Rick Henkemeyer, (612) 522-5200.

Nov. 28: SCTE Piedmont Chapter technical seminar on safety, grounding and bonding and annual membership meeting. Contact Rick Hollowell, (919) 968-4631.

Nov. 28-30: California Cable TV Association Western Cable Television Conference and Exhibition, Anaheim Convention Center, Anaheim, Calif. Contact (415) 428-2225.

Nov. 29: SCTE Upstate New York Chapter technical seminar on addressable technology, Buffalo, N.Y. Contact Ed Pickett, (716) 325-1111.

Planning ahead

Dec. 5-7: DBS '90 conference, Bermuda.
Feb. 27-Mar. 1: Texas Cable Show, San Antonio, Texas.
Mar. 24-27: National Show, New Orleans.
Apr. 15-18: NAB '91 and HDTV World conference, Las Vegas, Nev.
June 13-16: Cable-Tec Expo, Reno, Nev.

CT's index of articles

(Continued from page 48)

CT

JULY 1990

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Reader Service Number 24

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What's our goal?

By Wendell Woody
President, Society of Cable Television Engineers

When Tom Elliot of CableLabs was elected to the SCTE national board of directors this past year, he stated, "Woody, the SCTE needs a goal statement." I immediately replied that we do have one. It is printed on some of our literature and reads: "Serving the broadband industry's technical community."

However, upon analyzing this subject, I do question if our Society truly has a "goal" or do we merely express a "motto?"

- *Goal:* "Something toward which effort or movement is directed; an end or objective."
- *Motto:* "A sentence, phrase or word expressing a rule of conduct, principle or indicative of its character."

Naming our goal

It is a business fundamental that managers must know what they are trying to accomplish before they can perform any meaningful planning. Goals furnish direction to the activities of management. Likewise, the Society's objectives are the intended goals that prescribe definite scope and direction to efforts of the board of directors and all chapter officers. A clear and complete statement of our SCTE goal is essential and it should be made known to all members of the Society so that our managerial activities can be directed in a unified, orderly, gainful and effective manner.

During my visits with SCTE members and chapters in my travels I ask the following question: How would you state the goal of our Society? I've asked this question at the Eastern Show in Washington, D.C.; the Great Lakes Show in Indianapolis; the Atlantic City Cable Show; the Society of Broadcasting Engineers conference in St. Louis; and the Mid-America Cable Show in Kansas City, Mo.

The general response received is not a defined goal statement but instead a description or listing of our functions that are really the means toward a goal. It is sort of like we all have road maps and it's easy to discuss all the various roads and freeways. But until we establish a definite goal (like everyone meet in Exton, Pa., tomorrow night at Bill Riker's house for dinner) we won't experience the unification of our Society's needs to meet our levels of desired accomplishments. (There is one pseudo-merit in not having an established goal. You never make a mistake. Any road you take is OK because you don't know where you are going anyway.)

A new statement

Tom Elliot proposed a good positive action goal statement for the SCTE: *"The professional engineering society for the broadband communications industry."* I consider it has merit to be officially adopted.

I wish to challenge each of you SCTE members to respond on this subject. Are you pleased with the above goal statement? Do you have a submission? I do plan to have this as an agenda item at our next national board of directors meeting; your input will be valued.

"Tom Elliot proposed a good positive action goal statement for the SCTE: 'The professional engineering society for the broadband communications industry.'"

Restructured committees

We have restructured the national board of directors' working committees from 23, 39 or 41 (or whatever number existed at a given point in time). There now are five newly restructured managing committees for your Society.

The new committees and their respective chairmen are:

- Operations—Jack Trower
- Engineering—Tom Elliot
- Finance—Leslie Read
- Training—Walt Ciciora
- Planning—co-chaired by Bill Kohrt and Bob Luff

In addition, we have appointed non-board members to each of these committees. These appointments represent the highest level of achievement in managing our Society next to having an elected position on the board. These non-board member appointments were: Hugh McCarley, Cox Cable; Rex Porter, Midwest CATV; David Franklin, American Television and Communications; Dan Pike, Prime Cable; Pam Nobles, Jones Intercable; Tom Brooksher, National Cable Television Institute; Wendell Bailey, National Cable Television Association; and Mike Aloisi, Viacom Networks.

All remaining former committees will be reviewed and those serving a need and function will become subcommittees under one of the five major working committees. Once again, the subcommittee members will be aggressively recruited from the national membership and not just from the national board.

This new structure is the result of our small Society growing up and maturing into a large organization. To be efficient, continue to grow and properly serve our membership is the basis for this change after 21 years. **CT**

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