Communications Technology

OFFICIAL TRADE JOURNAL OF THE SOCIETY OF CABLE TELECOMMUNICATIONS ENGINEERS

OCTOBER 1997

PLANNING '98

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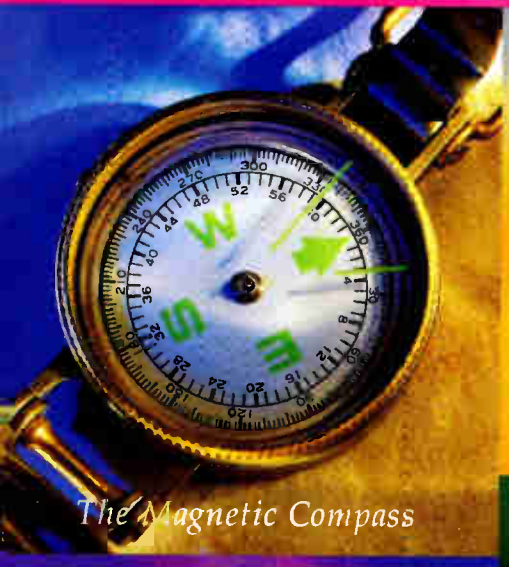
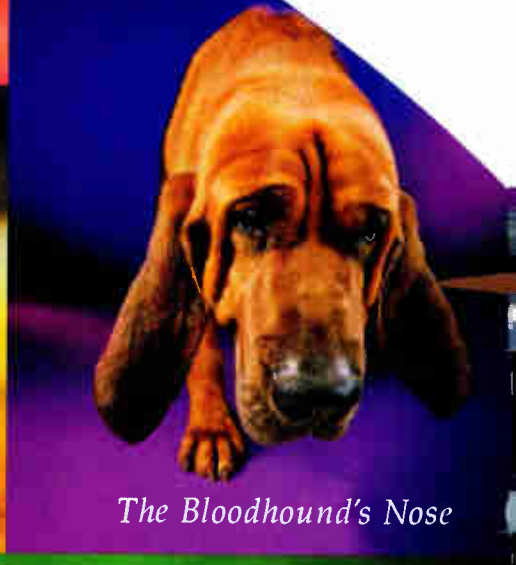
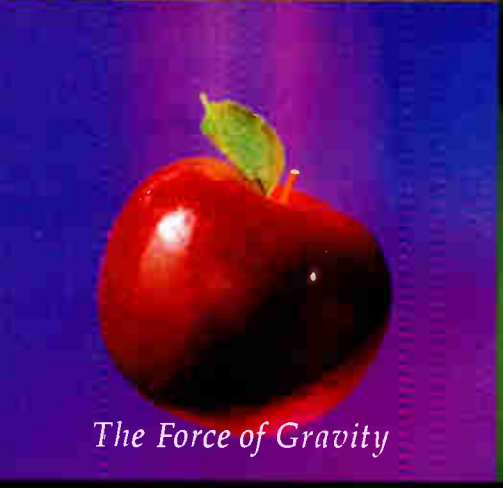


The Magnetic Compass

The Sunrise



The Bloodhound's Nose



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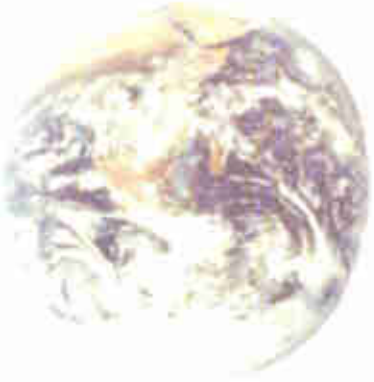

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 Communications Technology™ (ISSN 0884-2272) is published monthly, except twice in July, by Phillips Business Information Inc., 1201 Seven Locks Road, Suite 300, Rockville, MD 20854, USA. Editorial and sales offices located at 1900 Grant St., Suite 720, Denver, CO 80203 USA, (303) 839-1565. October 1997, Volume 14, Number 10. Periodicals postage paid at Rockville, MD, and additional mailing offices. POSTMASTER: Send address changes to *Communications Technology*, P.O. Box 3230, Northbrook, IL 60065-9647.

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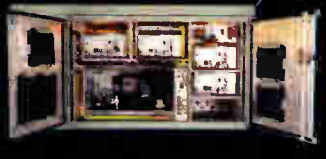

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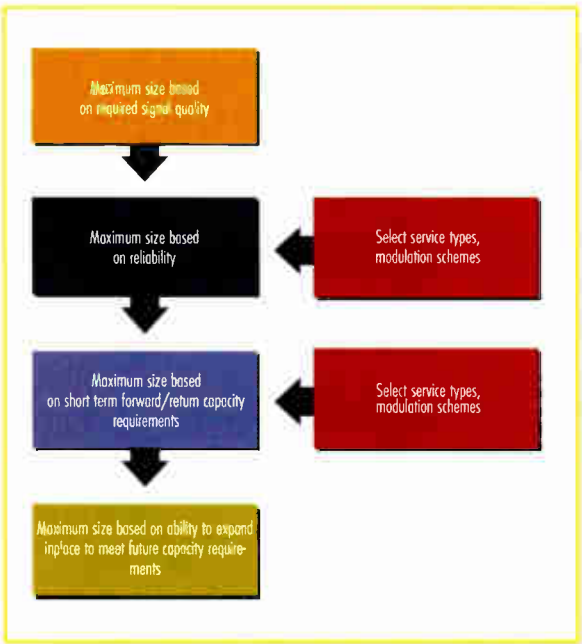

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One Company Has Delivered More Satellite & Broadband RF Technology To This Planet Than Anybody.

If you were thinking the "digital revolution" has eliminated the need for crisp, clean analog signals in the headend, you'd be wrong. In fact, the quality of picture demanded by today's subscribers is higher than ever.

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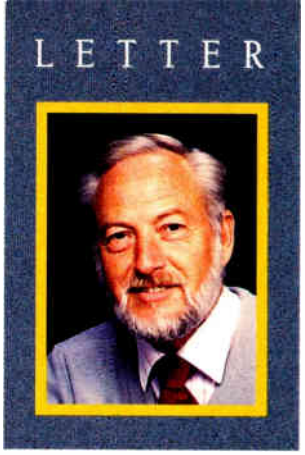
By Rex Porter



A Level Playing Field?

I am so happy the U.S. Congress is calling for new legislation "to create a level playing field for cable and direct broadcast satellite (DBS)." This is action long called for!

It seems House Telecom Subcommittee Chairman Billy Tauzin (R-LA) is upset because the U.S. Copyright Office recently decided to charge DBS providers 27 cents per subscriber, while charging cable operators 9.7 cents per sub. "Three times the rate ....that's outrageous!" says Tauzin adding that he wants to send a clear message to the Copyright Office that the rate harms the effort Congress is making to acheive real (fair?) competition between satellite distribution services and cable operators.

I would like to see Congress make the two services compete on a more even field. So, here's what I would recommend that Congress enact to truly make the playing field level:

1) Require that DBS opens a local office in each town or city in which they provide DBS service. Cable operators face this expense. We don't work out of the local electronics supply stores.
2) Require that DBS hires office managers, secretaries, engineers, technicians, marketing personnel, customer service representatives (CSRs) and installers in every town and city where they provide DBS service. Cable operators happily accept this expense, knowing we are a hometown company, putting money back into the local economy and being recognized on the streets where we serve.
3) Require that DBS pays each town or city a 5% franchise fee to operate in each community. Cable operators face this expense. You say that they don't use the easements and right-of-ways that cable uses. Well, they use the airwaves (bombarding customers and noncustomers alike with their signals) and I believe the "airwaves belong to the people". Congress and the Federal Communications Commission have preached this message to citizens for years.
4) Require that DBS provides a local access channel for local expression with modern studios, cameras, lighting, audio and video boards. Cable operators face this expense.
5) Require that DBS provides carriage of all local broadcast stations. Cable operators are forced carry local broadcast programming to protect those stations. Why not have the same requirements made of DBS? If they won't find a way of providing local broadcasts, shut them down.
6) Require that DBS provide Emergency Alert System (EAS) service to all of their customers. If DBS fails to carry local broadcasters to customers with "DBS -only" service, how would these citizens know of impending disasters and be able to protect themselves? Are DBS customers unworthy of protection from tornadoes, floods and other dangers? Cable operators will be required to provide such service.

And, as soon as these adjustments are made to make the sides of the playing field level, I really think we should address the difference in copyright charges to the poor DBS operators!

Rex Porter,
Editor

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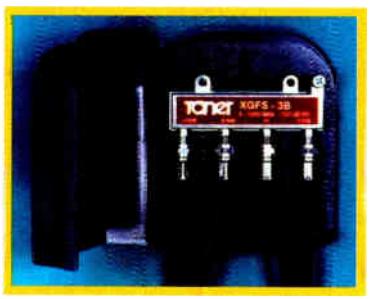
CEMA Sets Closed Captioning Standards

The Consumer Electronics Manufacturers Association has established closed captioning (CC) standards for digital TV (DTV) to support the needs of cation service providers, CC decoder and encoder manufacturers, receiver manufacturers and signal processing manufacturers.

DTV CC will allow simultaneous transmission of captions in multiple languages and at multiple reading levels. Current analog CC can be transported at 960 bps, while DTV CC, under the new standard, designated as EIA-708, will work at 9,600 bps.

In other standards news, CEMA reports that it has built upon EIA-542, the standard that defines channel allocations for cable-ready TV services and products, to develop EIA\IS-105.1, which specifies the interconnection method for attaching a basic cable decoder (a set-top box) to consumer electornics equipment such as TVs or VCRs.



After 30 Years, Splitter Redesign Is Made

Traditional cable splitters for underground plant have been redesigned by Toner Cable Equipment, combatting a 30-year old problem of damaged cable in the enclosure. Due to the design of traditional splitters, the cable was bent at radical ratios and as a result, there was little clearance room from the sides of the pedestals.

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Just the Bandwidth Ma'am

HSAnet, a high-speed Internet access provider, is targeting small- and mid-sized cable operators to help them provide Internet-related services without having to make large capital investments of their own—they only need to provide the bandwidth. St. Mary's Cable, a 20,000-subscriber system owned by GMP in Southern Maryland, will be the first operator offering its customers HSAnet's Internet access package, dubbed Cable Express.

The primary systems targeted by HASnet will be those passing from 20,000 to 50,000

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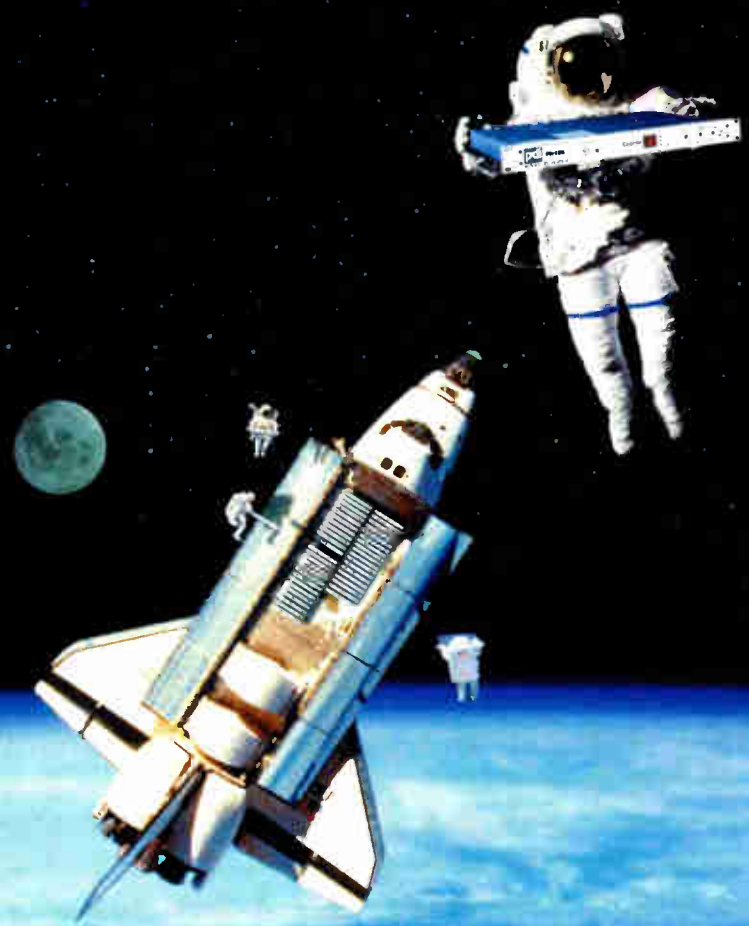

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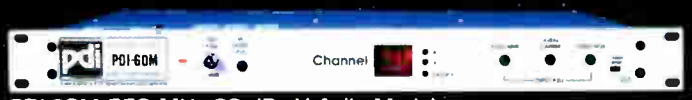

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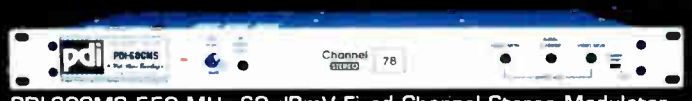

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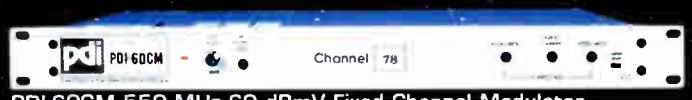

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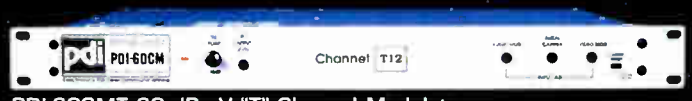

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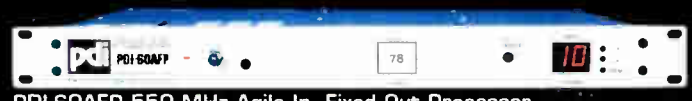

PDI-60AFP 550 MHz Agile In, Fixed Out Processor

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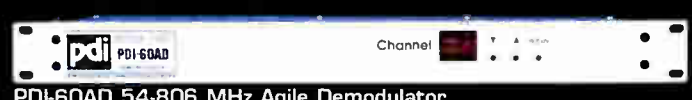

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homes and who may not have the infrastructure to offer high-speed access services.

Open Cable Initiative

Cable Television Laboratories (CableLabs) and its members have established "OpenCable," a project designed to obtain a new generation of set-top boxes that are interoperable. These new devices will enable a new range of interactive services to be provided to cable customers.

The open specifications project is patterned after the industry's data-over-cable service interface specification (DOCSIS) process. The effort will include an intellectual property (IT) pool and a certification process for testing vendor compliances.

NEWS BITES

- NextLevel Systems Broadband Networks Group has shipped its 250th digital headend for installation at a TCI Communications Inc. system in Belvidere, IL.

- Channell Commercial Corp. has acquired Standby Electronics Corp. of Mississauga, Ontario, Canada. Standby designs and supplies metal fabricated enclosures to house advanced electronics, fiber-optic cable and power systems for broadband telecommunications networks.

- Thomas J. McMahon was named director of manufacturing-cable division and Norman G. Meres was appointed plant manager of the specialty cable plant by Siecor.

- French cable TV operator Lyonnaise Cable has chosen CableData's Intelecable customer management and billing system to support its new cable telephony service in Annecy and its district, the French Alps.

- The Cable Television Association of Georgia (CTAG) and the South Carolina Cable Television Association (SCCTA) have launched an awareness campaign to emphasize the positive impact of cable in both Georgia and South Carolina—titled, "Cable...The Clear Choice."

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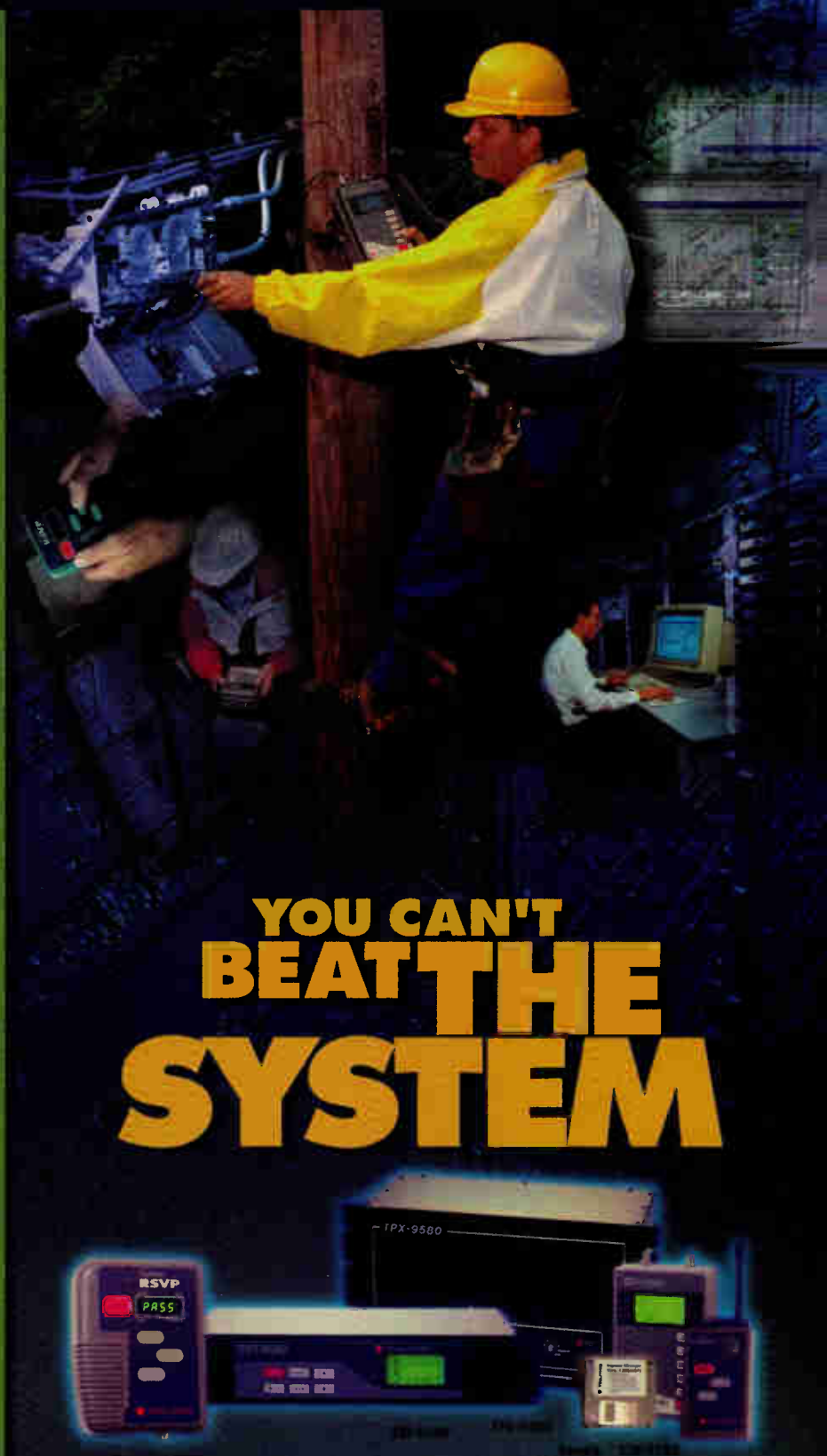

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SCTE UPDATE

SCTE Coordinates Sessions for Atlantic Cable Show

The Society of Cable Telecommunications Engineers coordinated five technical sessions at the upcoming Atlantic Cable Show in Baltimore. SCTE designed these sessions for presentation during the three-day East Coast Cable '97 event, to address some of the challenges facing broadband telecommunications professionals. The sessions featured up-to-date information from industry leaders on topics including digital technology, data transmission and two-way systems.

Justin Junkus, president of KnowledgeLink and an SCTE member, moderated a session titled "Data and Telephony Acronyms." Junkus, who helped develop the Society's monthly digital newsletter, *Digipoints*, presented this intensive introduction to the language of data communications.

SCTE Region 11 Director Dennis Quinter led a session on "High-Reliability Powering." Quinter, who is director of engineering and technical operations of Time Warner Cable's Eastern Pennsylvania division, covered the areas of standby power reliability and switching transients, among others.

SCTE At-Large Director and NCTA director of engineering Andy Scott mediated a discussion of the interface between broadband and the high-speed Internet. "TCP/IP and CATV: Do They Go Together?" answered questions relating to this emerging area of interest for the telecommunications industry. A seminar titled "Reverse System: Setup and Operation" covered the activation and maintenance of the reverse spectrum. Attendees heard real world experiences from the people who are involved on a daily basis with the setup and implementation of reverse spectrums. Robert Dattner, a long time Society member, oversaw this discussion. SCTE director of standards Ted Woo, Ph.D., "Digital Video Development: Where Are The Standards?" presented a history of the Society's digital video standards development effort. Since its inception in May 1996, the SCTE digital video subcommittee has developed more than 25 documents.

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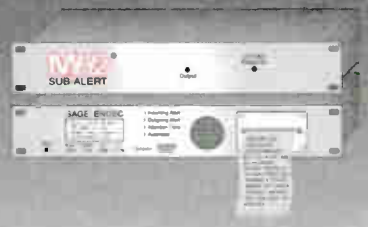

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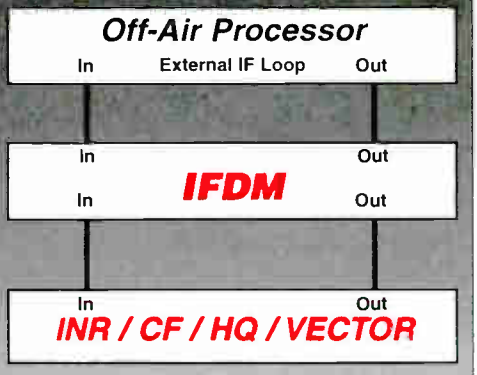

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hardware trends through regional training events. SCTE Vendor Days were created to bring broadband products, services and information to the operational level. The annual shows, which focus on education rather than sales, provide a wide variety of learning experiences. SCTE director of chapter development Steve Townsend said, "Vendor Days let attendees ask their questions and obtain instant answers and practical solutions about broadband products and services that can save cable systems time, money and other resources."

Tim Carvis, a chief technician at Wade Cable and a recent Delaware Valley Chapter Vendor Day attendee, described his experience as extremely positive."

Upcoming SCTE Vendor Days across the country include: Oct.1, Gateway Chapter (St. Louis, MO); Oct. 8-9, Southern California Chapters (Norwalk, CA); Oct. 28-29, Rocky Mountain Chapter (Ft. Collins, CO); Nov. 20, Chesapeake Chapter (Gaithersburg, MD); Dec. 3, Ark-La-Tex Chapter and Smokey Mountain Chapter (Johnson City, TN); Dec. 10—Bluegrass Chapter (Elizabethtown, KY) and West Virginia Mountaineer Chapter (Charleston, WV).

For more information about these events, contact Steve Townsend at (610) 363-6888, Fax to (610) 363-5898, or e-mail to stownsend@scte.org. A complete calendar of our 1998 Vendor Days will soon be available. Chapter and meeting group information can also be found at SCTE's Website: www.scte.org.

Dan Pike to Head SCTE Engineering Committee

The Society is pleased to announce that Dan Pike has been appointed chairman of its engineering Committee. Former engineering committee chairman Steve Johnson selected Pike as his successor in August after Johnson assumed the role of chairman of the SCTE board of directors at Cable-Tec Expo '97 in June. "The work that' s being done by SCTE in standards development is significant," said Johnson. "Pike has worked very hard as a member of the engineering committee. I know the standards work will be in very good hands with him at the helm."

Pike, who is a long-standing member of the Society, is optimistic about his new role. "The Society does quite a lot of good work for the industry," said Pike. "I am very pleased to serve SCTE in whatever way I can." Pike has played a significant part in the industry throughout his 24-year career, having worked in engineering and engineering management at the multi-system operation level for most of that time. He currently serves as the senior vice president of science and technology for Prime Cable.

In addition to his work with the SCTE engineering committee, Pike has served on the SCTE senior member subcommittee and several conference program subcommittees. He maintains senior member status with both SCTE and IEEE, and serves on the Board of Advisors for *Communications Technology*.

Great Interview!

I enjoyed reading your interview with Alex Best. It's always interesting reading about what's on the minds of senior corporate engineers. I am a headend tech in the south, working for an MSO. Our system has over 80,000 subscribers.

The techs here, and I'm sure everywhere else, love reading about pay, what the industry wages are and what their market value is. The industry is changing, as you point out in your articles—everything is becoming more technical, the headend especially. We now work with computers and sofware, fiber and digital technologies, telephony, satellite, microwave, scrambling and others. I currently take home a little more than $400 per week not much with which to survive with a family of four. My fellow technicians here are worse off than I am. We would love to see some more articles along these lines. Everyone I work with would enjoy it as would I. *Thanks, A Dedicated Cable Engineer*

Editor's response: Thanks for your letter. Your original letter has been edited in order to protect your privacy (with your permission).

I agree that it is now time to survey the ranks of technicians and engineers for this type of information.

I have never felt technical personnel were properly compensated for their performance and dedication. The original purpose of our formation of the Society of Cable Telecommunications Engineers was to help provide equity for people such as yourself.

Minimum wages might have kept a technician with a dittle-stick, a voltmeter and a FSM in the old days.

But MSOs will soon realize they must pay technical personnel competitive wages or they will lose them to other systems, other MSOs and to other communications industries. This is a subject I promise you we will try to cover better in the future.—Rex Porter

Cable Modems Hurrays

In light of Microsoft's investment of $1 billion in Comcast, Alex Zavistovich appears either to be prescient or to have the ear of Bill Gates. Mr. Zavistovich's recent editorial, entitled "Care to Dance?" (*CT*, April '97), bemoaned the slow pace of cable modem deployment and urged the MSO's to come to the party now, before the window of opportunity closes. Clearly Bill Gates' Microsoft agrees with him. Will Comcast party down by ramping up cable modem deployment?

As a manufacturer of addressable taps and splitters we were tickled pink by Zavistovich's view that cable modem technology is the hottest technology the industry has seen since addressable taps. We agree!

John Vincent, president and CEO
Electroline Equipment Inc.
Montreal, Canada

Editor's response: Thanks for your kind words; sometimes I think I sound like a broken record when I talk about speeding up deployment of cable modems. The fact is that cable's competitors are doing a better job than cable companies in getting a foothold in non-traditional revenue areas. Power companies are now delivering or are planning to deliver telephony, Internet and cable service, and you can't even get high-speed data access over cable in Washington, DC! That's out of whack, and the cable industry stands to lose market share if it doesn't focus on serving customer needs outside of program delivery.—Alex Zavistovich

Security Semantics

[An earlier letter to the editor from Ronald Mohar appeared in the March 1997 issue of "Communications Technology"—Bill Billingsly responds below]

Although I appreciate the point Ronald Mohar wishes to make, I'm afraid he has only added to the existing confusion. The term communications security (COMSEC) does not include the term "signal security (SIGSEC)." Rather, it is the other way around. Joint Publication 1-02, 22 March 1994, published by the Chairman of the Joint Chiefs of Staff, defines (on page 347) signal security as: "a generic term that includes both communications security and electronics security." Mohar also errs in defining traffic analysis as a component of signal security (with the caveat that signal security is the inclusive term). Traffic analysis is actually the attack against a specific component of COMSEC, "transmission security." According to Joint Pub 1-02 (page 83), COMSEC includes as separate components: "cryptosecurity," "transmission security," "emission security," and "physical security."

Although the Department of Defense changes its terminology from time to time, I can't recall any changes to these definitions since I entered the field of COMSEC in 1959. The entire field of SIGSEC is complex and made unusually difficult to understand because of the secrecy necessarily surrounding the details, so I don't intend any criticism of Mohar by pointing out these subtleties of definition.

Mohar's interesting example of low-level teletypewriter emissions illustrates a particular concern when teletypewriter emissions record communication. But your readers might be interested to know the problem didn't disappear with the decline of teleprinters and teletypewriters. I'm certain I can easily capture the contents of this message from a considerable distance from the emissions of the "state-of-the-art" monitor upon which I'm composing it.

Bill Billingsly, manager, network and telecom engineering
MEVATEC Corp.
Huntsville, AL

Editor's response: Now I understand why, during my eight years in thr Air Force, the cryptographers only let me in their crypto room once. Talk about a complex field! I always wondered how you guys performed your jobs—I still do! Seriously, thanks for writing—I'm just a little jealous of the fact that I wanted to get into the cryptography field and didn't have what it takes!—RP

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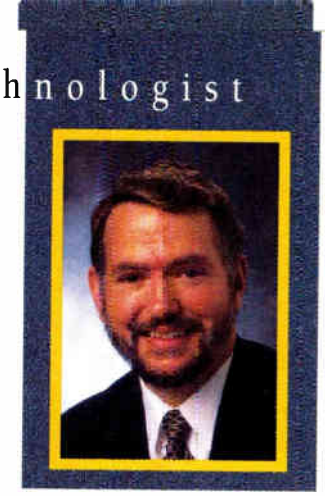
Reader Service Number 84

By Ron Hranac



Learn How to Make Two-Way Work

At this year's Society of Cable Telecommucations Engineers Cable-Tec Expo in Orlando, FL, Tom Staniec and I teamed up to teach the workshop "Making Two-Way Work (Part II)." Judging from the attendance at our workshop and another one on two-way by General Instrument's Dean Stonebeck ("Return Path Problems and Their Solutions"), this continues to be a popular subject. I thought it would be a good idea to pass along some of the material from our workshop for the benefit of those of you who were unable to attend Expo this year.

Most CATV systems use a sub-split bandplan for signal transmission. This means that downstream signals—those going from the headend to the subscriber—occupy the RF spectrum from, say, 50 to 550 MHz. Upstream signals—those being sent from the subscriber premises back to the headend—are carried in the 5 to 40 MHz range.

Sub-split band plans work very well for one-way operation, where a cable operator is sending signals from one point (the headend) to many points (the subscribers). But there can be a variety of problems with sub-split two-way operation. They include the effects of upstream noise funneling, where signals and potential interference from many points "funnel together" back to one point: the headend. Interference from just one location can disrupt upstream signals from the entire system.

Other problems include the prevalence of manmade noise in the 5 to 40 MHz upstream spectrum, such as shortwave broadcasts, ham and other two-way radio transmissions, and electrical interference. If enough of this manmade noise gets into a two-way cable system's upstream spectrum through a loose connector, bad drop, or poorly shielded TV set, normal operation will be disrupted.

Unlike the downstream, the upstream generally has no continuous reference carriers for setting levels. In the downstream spectrum, you have a bunch of TV channels that are there all the time. They make great reference signals for adjusting fiber links, amplifiers, etc. However, much of the upstream traffic consists of digitally modulated signals, which require different measurement techniques than traditional analog TV channels. Some of the digital signals may be bursty in nature, making them even more difficult to capture and measure.

"When problems such as ingress affect the upstream signal path, they can be difficult to isolate and troubleshoot."

When problems such as ingress affect the upstream signal path, they can be difficult to isolate and troubleshoot. This is because the ingress can be coming from one or more of potentially hundreds or even thousands of points in the network. To make matters worse, an estimated 95% of ingress and other problems affecting the upstream path originate in subscriber drops. 25% of the problems happen between the tap and the side of the subscriber's house (exterior drop wiring), 70% occur between the side of the house and the TV set (interior wiring), and only 5% are network related. There are exceptions, of course, but these figures seem to be fairly typical.

Upstream impairments

There are three primary categories of impairments that can affect upstream signal transmission. The first is known as *stationary impairments*, and includes such things as thermal noise, intermodulation distortion, and frequency response problems. The second, and probably the most troublesome, is *transient impairments*. Problems include RF ingress, impulse noise, and signal clipping. The third category is known as *multiplicative impairments*. (Please don't ask me to pronounce it.) They are less common than the first two, and include transient hum modulation and intermittent connections. Let's look at these impairments in a bit more detail.

Thermal noise is generated in all active components, and to a lesser degree in passive components. There are really only two things you can do to reduce thermal noise: choose active devices with a lower noise figure, and make sure the network is properly aligned. Common sources of thermal noise in the upstream network include lasers and receivers, amplifiers, and in-home equipment such as converters, cable

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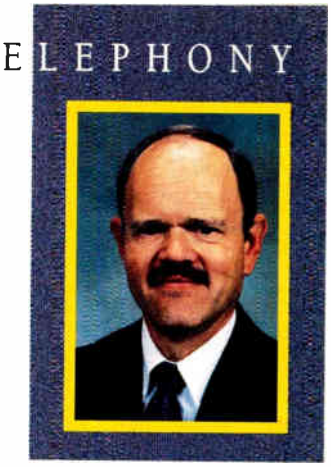
Reader Service Number 159

By Justin J. Junkus



Training for Personal Gain

There is no question in my mind that telephony is a career growth opportunity for cable technical personnel. Those who have the skills early in the game will have the edge in performance and the associated personal and professional recognition. This month, I am suggesting an organized system to gain or sharpen those skills.

The skill set is, of course, going to be different for different job classifications. It also will be different within the job classification for different companies, since not every cable company will be providing every telephony service. The tables on this page and page 30 in this column will give you some guidelines.

Planning is the key to becoming a valuable asset to your company. Starting with the tables, develop a checklist of where you are already proficient, and where you need more knowledge. Then, come up with your own timetable to fill the voids. Give yourself calendar deadlines to accomplish that development. Practical skills will require either a formal class or on-the-job training, so advance planning here is critical. Theoretical skills, while often more difficult to master, can be gained through alternatives to a classroom program, such as regular reading of trade literature and reference materials, or enrollment in computer-based training.

Practical skills

These are the "hands-on" skills. From the perspective of a 25-year veteran of the telecommunications industry, here's my list of practical skill categories and what they include:

- *Plain old telephone service (POTS):* This is basic maintenance and troubleshooting of telephony service. Examples would be finding out why there is no dial tone when the receiver is taken off hook, or why dial pulses will not transmit when the station set keys are depressed.
- *Access service provisioning:* This is the physical connection of service between the customer and the service provider. I would focus on installing, maintaining, and troubleshooting the connection from the customer to the first node in the distribution system.
- *Switching service provisioning:* This is how you tell the network switch who your customer is and what features they are entitled to use.
- *Single family residential wiring:* This is the wiring from the demarc (traditional point where the phone company's ownership of wiring ends) to the customer premises equipment. You must know how to prepare cable and make connections that are different from those found in typical coaxial cable systems.
- *Unit wiring:* Although this is similar to single family residential wiring, it differs in its magnitude. Multidwelling units may combine business and residential units, and often span multiple floors.
- *Business premises telephony systems:* These are the customer-owned telephone switching systems that are installed at the

Table 1

Job title	Responsibility	Telephony - Practical skills						
		Plain old telephone service (POTS) servicing	Access service provisioning	Switching service provisioning	Single family residential wiring	Multidwelling unit wiring	Business premises telephony systems	Vote messaging systems provisioning and mtc.
Installer technician	Initial installation	x	x		x	x	x	x
Service technician	Bridger or tap to CPE	x	x		x	x	x	x
Maintenance technician	Amps and trunks	x	x				x	
Headend/Hub technician	Headend	x		x				x
Engineering management	All	x	x	x	x	x	x	x
Service representative	Customer care	x		x	x	x	x	x

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Table 2

Job title	Responsibility	Telephony - Theory of operation								
		History and regulation	Customer premises equipment (CPE)	Network hierarchies and numbering plans	Switching	Traffic theory	Powering	Transmission	Computer telephony integration (CTI)	Telephony safety
Installer technician	Initial installation		x				x			x
Service technician	Bridger or tap to CPE	x	x	x			x		x	x
Maintenance technician	Amps and trunks	x	x		x		x	x		x
Headend/Hub technician	Headend	x	x	x	x	x	x	x	x	x
Engineering management	All	x	x	x	x	x	x	x	x	x
Service representative	Customer care		x	x	x				x	x

customer's location. They range in size from simple key systems with 3 or fewer stations, to large private branch exchanges that look and behave like service provider switches. While customers usually maintain their own equipment, cable personnel must be knowledgeable in at least general maintenance and features because the equipment connects to your network. Also, in some cases, the customer may want to contract this maintenance and provisioning to your company.

- *Voice messaging systems:* The most visible applications of these systems are for voice mail and automated attendant. Voice messaging can be provided at the customer's site or at the service provider's switch location. Technical personnel should be knowledgeable in interconnections, provisioning and maintenance. These systems include applications of data communications and software as well as telephony. ➤

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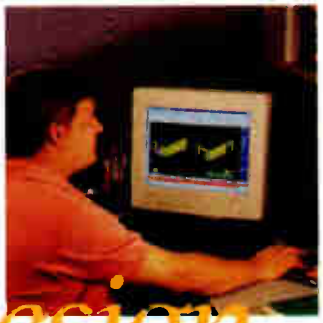

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SCTE MEMBER

Reader Service Number 106

Theoretical skills

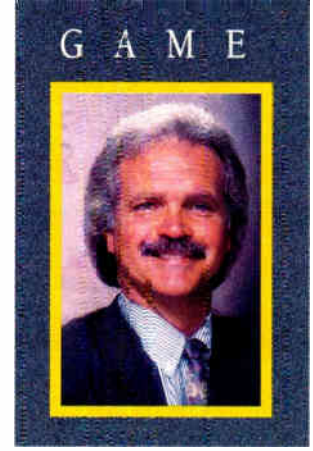
Most of these knowledge-based skill categories correlate with those listed for SCTE telephony certification. Passing that program is therefore an excellent way to measure and document the acquisition of these skills. Here's my quick definition of what these categories include:

- *History and regulation:* While it may sound like this nontechnical subject matter is extra baggage, it's really a necessity to understand why some technically correct solutions aren't acceptable from a regulatory standpoint.
- *Customer premises equipment:* It's a lot easier to install and troubleshoot customer premises equipment if you know its use, components, and their functions.
- *Network hierarchies and numbering plans:* Telephony routing is based on well-defined dialing plans and network architectures. Connections to other carriers and proper call routing depend on following established rules.
- *Switching:* Before you can master access services and switching services provisioning, you need to understand the hardware and software that operates on dialed numbers and electrical signals from customer premises equipment.
- *Traffic theory:* If you don't know the basics here, you won't be able to tell your company how much hardware it needs to be in the telephony business.
- *Powering:* Grounding and backup are important here, just as they are in cable, but there are also specific electrical specifications for telephony.
- *Transmission:* You need to understand analog to digital conversion, multiplexing, signaling, and timing.
- *Computer telephony integration:* The days of the answering machine are limited. When your company provides telephony, chances are it also will offer some type of messaging service. Call centers such as those used in customer service operations are now also an integral part of a business telephony offering. Because you may be involved in the installation and provisioning of these systems for your company, you'll want to become familiar with voice messaging features and interfaces and the functions of an automatic call distribution (ACD) system.
- *Telephone safety:* This one should be self-evident. The legal and personal liabilities for nonconformance to safety practices are high.

How do you implement your plan? Talk to your supervisor. He or she may have to discuss this with your human resources person because in a lot of cases, they haven't completely defined a training program to develop telephony skills. If you really want to be proactive, suggest your own personal training program as a model. Who knows? You may become a leader in more ways than one. CT

Justin J. Junkus is president of KnowledgeLink Inc., a training and consulting firm specializing in the cable telecommunications industry. To discuss this topic further, or to find out more about KnowledgeLink Inc., you may e-mail him at jjunkus@aol.com.

By Terry Wright



Cable's Re-Evolution

It's rare that an entire industry has the opportunity to re-define and re-assert itself in its traditional marketplace, and at the same time help shape the next major age in the evolution of society. All things considered, this seems to be precisely the case with the cable TV industry today.

Similar defining opportunities have occurred before, but not quite of the same magnitude. For example, early railroad companies, had they realized that they were in the shipping and transportation business (vs. the railroad business), could have leveraged their initial dominance into a much more significant role in *all forms* of transportation common today. But numerous modes of transportation did not usher in the "Transportation Age"; they were fundamental enablers of the *Industrial Age*.

Cable operators have the opportunity to shape the "Information or Knowledge Age." This is due to two primary factors: 1) They are already providers of entertainment (content), and 2) they have a deployed broadband infrastructure that, when properly enabled, can deliver the performance necessary to consume the multimedia-rich content the Internet/Web is becoming. The on/off ramps to cyberspace are to the Information Age what novel forms of transportation were to the birth of the Industrial Age.

But does the cable industry *really* recognize the magnitude and implications of its data services opportunity? Let's look beyond the Internet, and the revenue potential associated with providing high-speed access to it. Instead, let's look at data services from the perspective of mainstream entertainment, and how the ongoing convergence of computing, telecommunications, and entertainment/consumer electronics is transforming cable's traditional core business.

Entertainment has many forms is completely subjective, and constantly shifts in response to what an evolving market wants and will pay for. Many believe the Internet is destined to replace network-delivered entertainment. Hogwash, you say? I frequently hear the phrase "million channel cable TV" applied to descriptions of the where many experts believe the Internet is headed. Can't happen, you say? Remember when there were only three or four channels to choose from? How many are now available? Remember when there were, say, 30 or 40 magazines? The last credible count I am familiar with (from a popular business bestseller published over 10 years ago) claimed this number had mushroomed to more than 6,000 magazines. In the span of only a few generations, the delivery of news and entertainment has evolved from radio, to broadcast TV, to cable TV, to direct broadcast satellite (DBS), and soon, high definition TV (HDTV). The underlying themes driving this evolution have been the market's preference for video and audio content (vs. audio-only), greater user choice (content diversity), improved user control, and greater convenience.

For the past few decades an initially benign phenomenon that encapsulates all of the above themes has been gaining incredible momentum. It also provides:

- Complete individual user control,
- Complete interactivity,
- Real-time and batch communication on a one-to-one, one-to-many, and/or many-to-one basis,
- Global reference information,
- A global forum, and
- A sound basis for the future of commerce.

Existing forms of the Internet/Web phenomenon provide the ultimate in content diversity, user control and instant gratification with respect to *information access*. As is already evident through the increasing extent of multimedia content available on it today, the future of this phenomenon will offer both information *and* entertainment. What's important from cable's perspective is that entertainment is fast becoming digital data in form, and the Internet/Web is fast encroaching on entertainment in substance. Both will continue to need increasingly sophisticated two-way high-performance access networks in order to deliver what is best described as "info-tainment."

So the question is "who" will provide the access performance and enable the Internet/Web to become the million channel interactive TV of the future? Will it be cable TV? Utilities or municipalities? Perhaps the telcos with their variety of digital subscriber line (DSL) technologies? How about the wireless/personal communication services (PCS) folks?

The most likely scenario is that it will be a combination of all these, plus a variety of sophisticated gadgets that make it easy for ordinary folks to use. Thus, the cable industry is at a critical juncture in its evolution. Its core business, as well as the cyberspace to which many operators are considering providing access, will continue to be shaped by the entire telecommunications industry.

The evolution of (especially digital data) telecommunications is *the* fundamental driver of the next human "age." As the industry capable of delivering the highest performance access to the growing cyber world, cable can and must play a defining role if it is to survive. CT

Terry Wright is chief technology officer at Atlanta, GA-based Convergence Systems Inc. He can be reached at (770) 416-9993.

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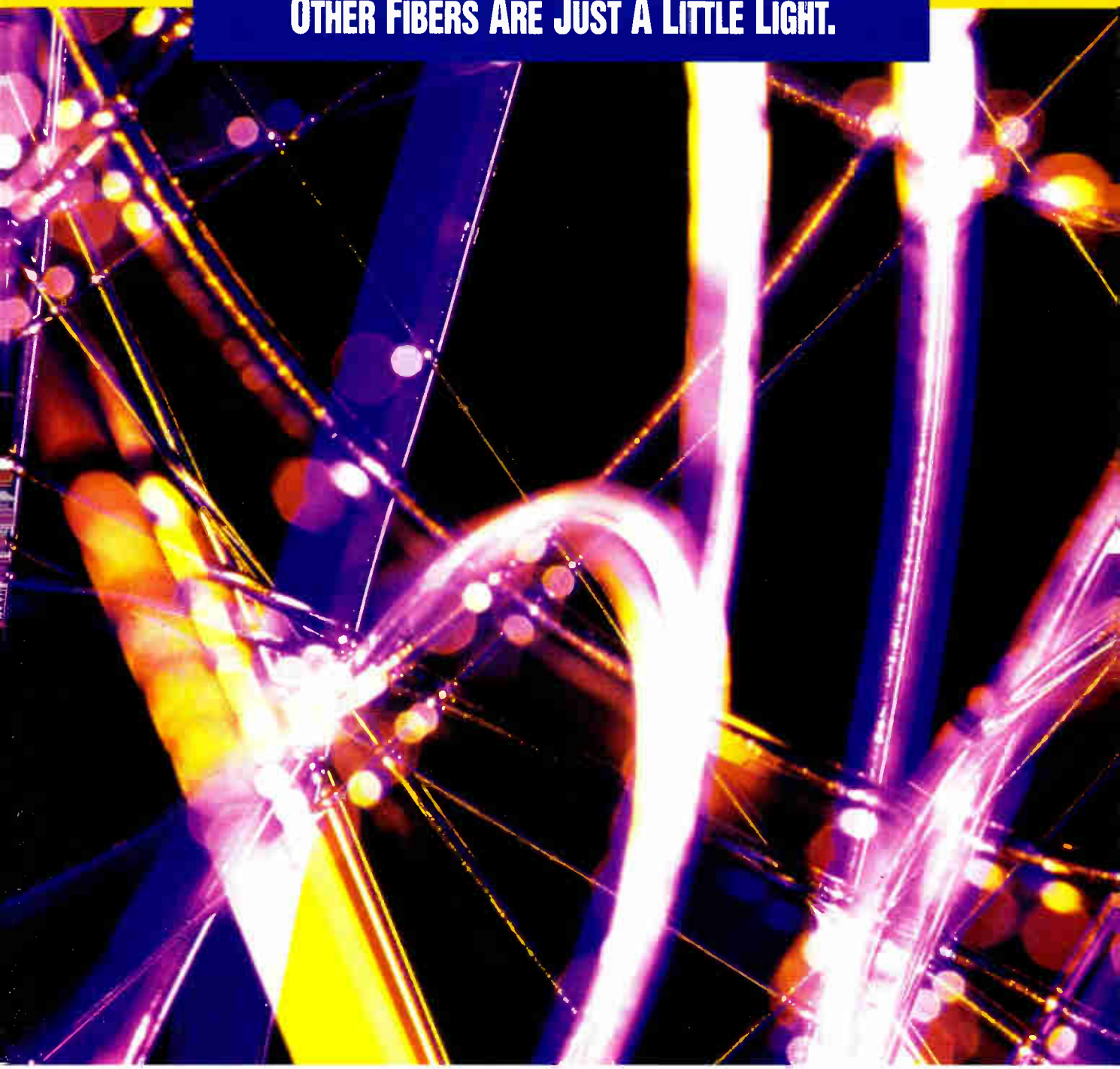

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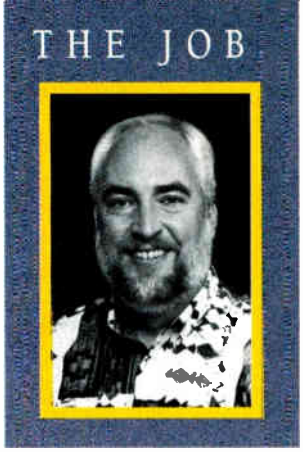
By Alan Babcock



Re-Energized And Eager To Boost Your Career

The Society of Cable Telecommunication Engineers is embarking on a path to aggressively develop and implement exciting new programs for its members. Last month this column gave you a "big picture" look at SCTE's training committee. This month we'll take a look at specific issues that committee is addressing.

In late July, the training committee met at SCTE national headquarters in Exton, PA, to plan for the coming years. This type of meeting was a first for the training committee. While the Society has offered proactive programs to its members, moving quickly in a volunteer organization is difficult. Through this special planning meeting, the committee is poised to get out in front of the rapid changes in our industry.

The reorganized committee will respond better to the needs of companies and individuals who are SCTE members. A new subcommittee will focus on curriculum design and review. This subcommittee, under the leadership of Pam Nobles of Jones, will keep its eyes on the road ahead and its ears to the ground, sensitive to the frequently changing directions of operators and manufacturers.

We must keep the training and certification programs we offer in tune with industry needs. For this reason, the curriculum design and review subcommittee is comprised of training, human resources and engineering professionals

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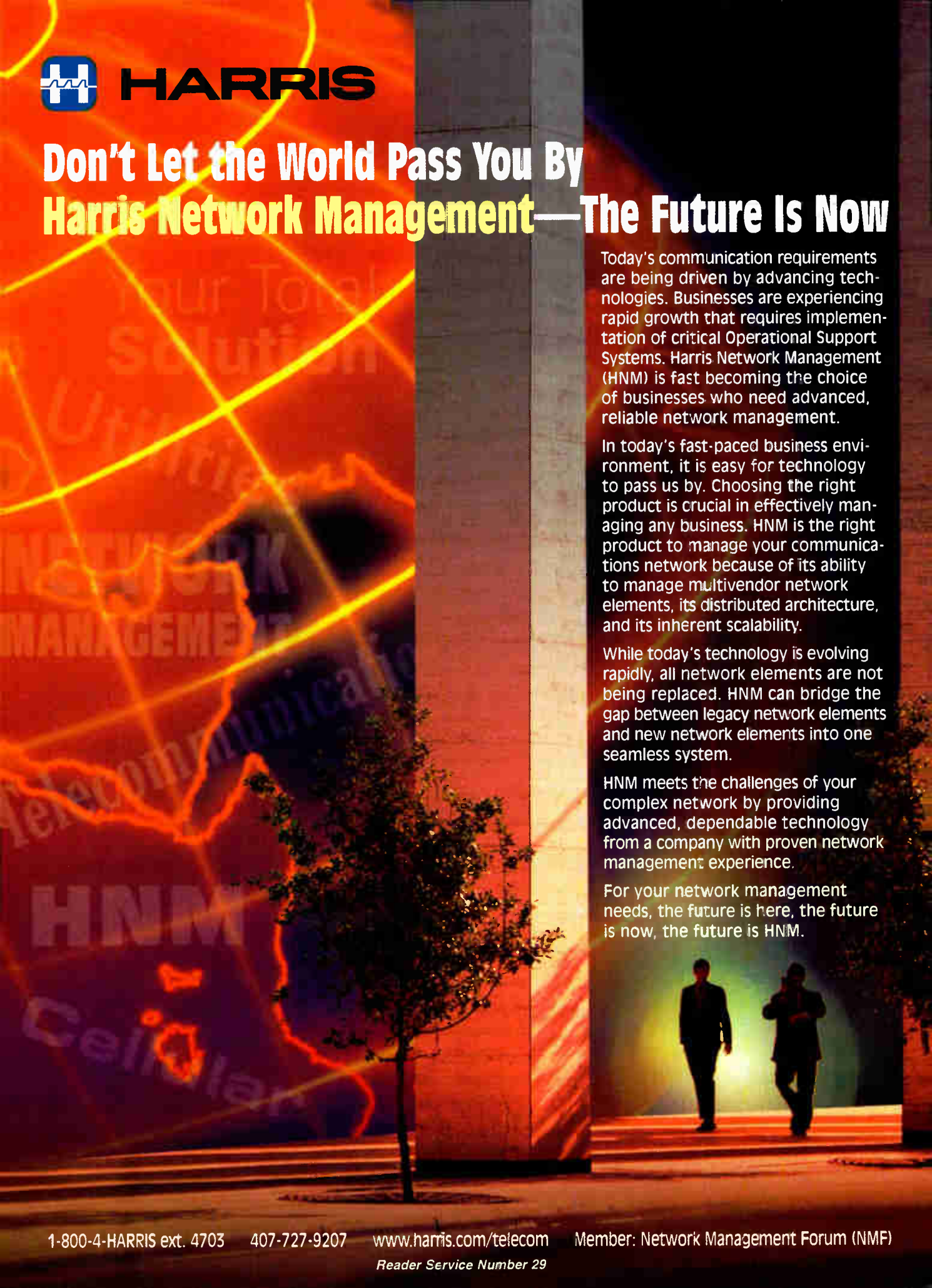
from many operators and manufacturers. The training and HR members will assure new programs are consistent with sound instructional design, written so that learning is easier and skills can be transferred to job performance. The engineering members will steer us to provide training "just-in-time" rather than "just-behind" introductions of new technologies.

Additionally, the training committee prioritized programs that SCTE will pursue over the next few months and into at least 1999. Some highlights are as follows:

- Materials are being created to provide training support for the Service Technician Certification program. This will include a computer-based training (CBT) package to support the "Troubleshooting" portion of the Service Tech Certification exam. Also planned are leader guides and student workbooks for many of the videotape programs already available through SCTE. Kent Vermillion of Time Warner will chair the Installer and Service Technician Certification curriculum subcommittee.
- New regional seminars are being considered on specific topics of immediate interest to you. M.J. Jackson of Gilbert Engineering and Region 4 director will chair the subcommittee charged with this effort.
- Keith Hayes of Bell South Entertainment will direct the Broadband Communications Technician/Engineer (BCT/E) Curriculum Subcommittee. It is paramount that the content in these programs is kept current. A working group exists for each of the BCT/E's seven categories.
- The Telephony Certification program, announced at Cable-Tec Expo '97 in Orlando, FL, is guided by Andy Scott of NCTA and an at-large director.
- A special task force was named to significantly market our programs. Don Oden of the National Cable Television Institute will determine ways to increase participation at the chapter level, encourage MSOs to adopt our programs and stimulate awareness and sales of SCTE-produced materials and programs.
- Industry personnel can anticipate videotape-training programs that incorporate adult learning styles for easier comprehension and better transfer of skills. The first will be a set of tapes dealing with mathematical solutions to common technical problems encountered in the field.
- As more companies realize the value of certification, it is important to assure the rules that govern programs make sense to candidates and enable consistent administration. The certification administration subcommittee headed by Dennis Quinter of Time Warner and Region 11 director will perform this function.

Training of technical employees is essential to the successful operation of current services and the introduction of new services. An active, effective training committee is helping to create and promote training programs you need to succeed in your career. T

Alan Babcock is director of training development for the Society of Cable Telecommunications Engineers. He can be reached by e-mail: ababock@scte.org.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PLANNI

Designing For

By Rex Porter

New technology can be friend or foe. For entrepreneurs, it is a path to success and a source of profit. They look for uses and have a vision for the future. For the faint-hearted, it is troublesome and viewed as unwanted change.

NG '98

New Revenues

As we approach a new century, new technology swirls around us. These are good technologies—data, telephony, and digital TV. They are good technologies because we have proof they can be used to advance cable telecommunication as a platform for solving many of today's problems.

Identifying problems

What are these problems? First, we recognize analog signals to be problematic and have proven that digital signals are vastly superior. Then, the public is begging for a better infrastructure for the Internet than is being provided by the telephone system. They may not necessarily understand the problem to be caused by the infrastructure but they understand that something is causing delays when dialing into the 'Net, something is causing them to be disconnected from the 'Net and they would like to have the speed they require to download quickly. And, if the telephone industry wants to enter the cable telecommunications arena, there is no reason why we should not be able to enter their arena.

Identifying solutions

What are the solutions? Manufacturers are rolling out digital equipment to mix with or replace analog equipment. Digital compression will allow us to compete on a more level playing field with direct broadcast satellite services. In fact, digital compression should give us huge advantages over them. High-speed cable modems are impressive but they will require a new system between Internet users. By itself, cable modem's high speed will not overcome the excruciatingly slow transportation of the signals along the archaic backbone.

The solutions will not be magic or simple. Cable systems must plan a systematic rebuild/upgrade program that will allow the addition of any or all of the three technologies. We have proved we can provide some of the services with effective signal leakage programs and limited upgrades. But the future of cable is too important for us to continue to patch up our own infrastructure. Trunk lines with multiple splices must be replaced. Cables that were limited in bandwidth will have to be replaced. And systems that haven't been upgraded in the last few years will probably require a total rebuild. Too expensive, you say? The potential for profits says differently. Some of the MSOs are beginning to recognize the fact that no system will be excluded from the "full-service" wave of the future.

I am not proposing that every cable system start replacing their plant this year or next year. What I am proposing is long-range planning aimed at some time in the near future so we can offer a strong, secure infrastructure as a replacement for the present telephone data-transportation network. If we start with data delivery on our systems, planning should ensure that the other services could be added without having to rebuild our basic plant, introduce new powering, or relocate our headends.

Cables and fiber purchased in the future should be spec'd out to the maximum bandwidths. Components should be purchased for their quality and not their price. Nodes should be located to allow addition of other services if you choose to selectively add them over a period of time. Some operators are studying the possibility of starting with digital signals from the headend in the sky (HITS) service to the customer's residence. Some have decided to convert analog signals at the headend and supply digital TV throughout their system. ➤

Whichever choice is made, networks should be designed for a "one-time" upgrade or rebuild to allow new services without new construction every few years. The cable industry cannot point out deficiencies and failures in the present telephone infrastructure if they can quickly point out ours at the same time. Engineers will not have an easy time in pushing for system upgrades and rebuilds. These projects will cost enormously. And some owners will not want to hear that plant, which "works today," won't continue to transport signals and services of the future.

Old connections that have been retightened may have solved problems for the short term, but,

- Will they continue to provide security against ingress/egress?
- Will cables which were hung with limited bandwidths become a future problem?
- Is the ratio of fiber to cable in present hybrid fiber/coax (HFC) networks sufficient to provide high-speed transportation of data once we begin to replace the present telephone network?

One project that should be undertaken as we enter the era of "full-service" networking is some standardization in plant layout and construction. I hope some engineer will design a working model of a "full-service" network. That model should encompass entertainment TV (both in the analog and digital modes), telephony and data transportation for the Internet. All of the equipment needed would be illustrated, with the specific locations throughout the system.

"In the past, smaller operators have left the imagination for the future up to the 'big' MSOs."

In the past, smaller operators have left the imagination for the future up to the "big" MSOs. But all systems, must recognize our future is not simply bringing more channels of entertainment television to our customers. Our customers have recognized that we can supply these services. They read about it daily in their newspapers and magazines. No system is too small. Imagine a small telephone company deciding it is too small to provide long distance service and therefore will only offer local calls.

"Oh," you respond, "the customers would scream to the city officials or the PUC and their company would be barred from serving the public." Well, are our franchises nonrevokable or exclusive? CT

Rex Porter is editor of "Communications Technology." He can be reached in Mesa, AZ at (602) 807-8299 or via e-mail at tvrex@earthlink.net.

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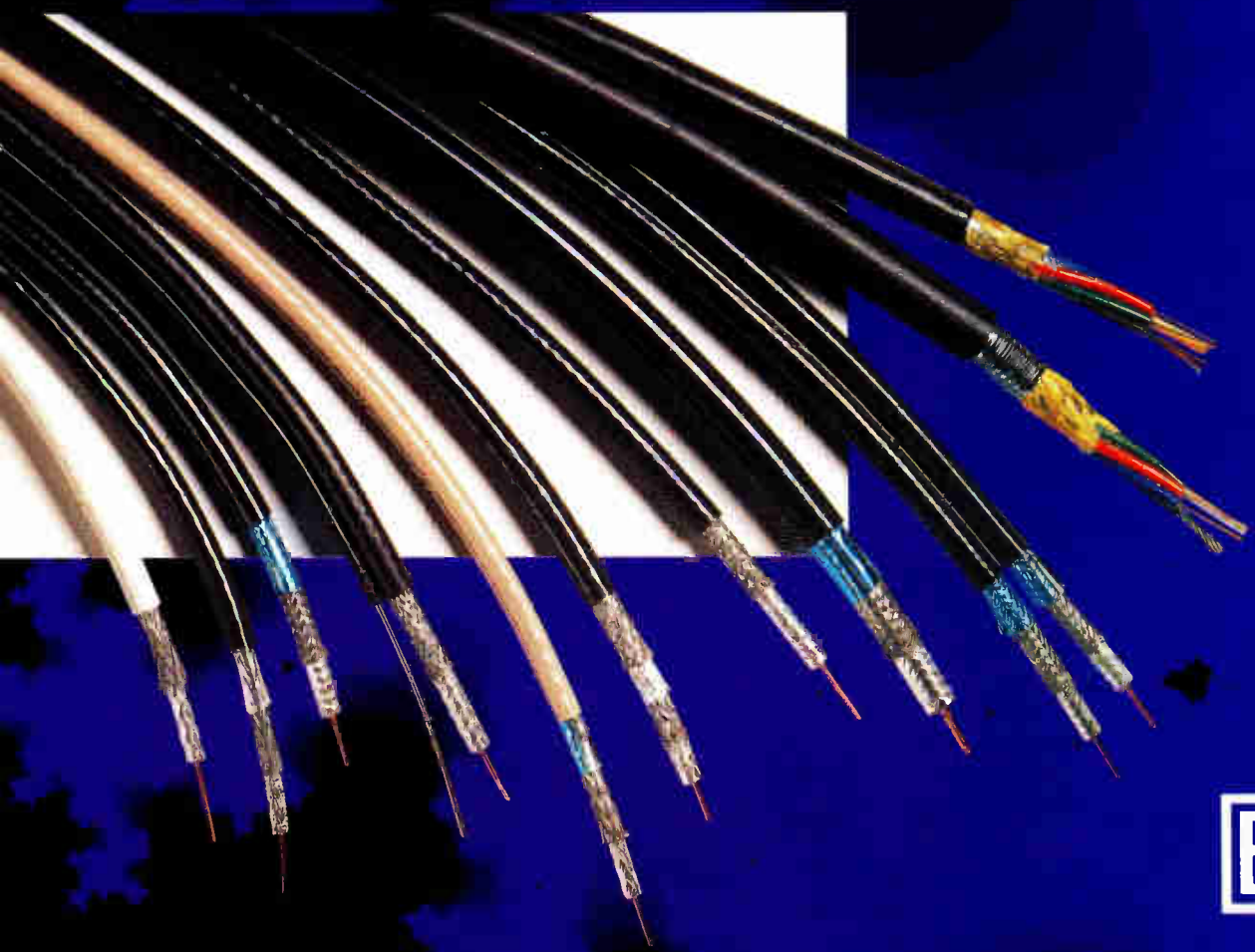

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Reader Service Number 176

PLANNING '98 New

By Angela Holloway-Martinez

Although it may be true that the only constant in life is change, new technology and business opportunities have been cause for swift transformations in our purchasing methods at Jones Intercable.

We saw, early on, we needed to continue support of core CATV-related purchasing while becoming more involved as new technology/business opportunities grew. We reorganized into three groups: core CATV, new business and non-CATV purchasing. Our areas of focus include: planning involvement, vendor qualification and approval, centralization, standardization and, of course, procurement.

It would be impossible to talk about planning without pointing out that we must stay highly involved with our end-users and business development groups. On post-deployment and core CATV product management we work with the systems in developing and implementing a plan and forecast to support their budgets.

RFPs

As new products and technologies are introduced to us, we need to obtain vendor and complex product information in a quick and uniform manner. Team involvement and the use of requests for proposals (RFPs) have been critical in acquiring and updating required information.

The RFP process allows us to get all pertinent information to properly select the best vendor not only for technical reasons but for business reasons including service, tech support, training, warranties, vendor facility, manufacturing processes, financial background, maintenance and, of course, price. Our purchasing staff is responsible for managing all aspects of the RFP and ultimately closing any resulting contract "awards."

The criteria of each RFP is created by a team of subject matter experts who represent the affected areas in our organization. These teams include purchasing, engineering, marketing, finance and operations. We weigh the RFP criteria by level of importance and rate it based on the response. We use the RFP as a tool to solicit information for immediate and long-term corporate-wide "roll-out" analysis.

The RFP process has proven to be an effective tool for us in assessing the suppliers and getting an ongoing education on products and technology. We have streamlined the RFP process and it has changed from a lengthy, thick, dreaded document to an efficient, thorough study of the product as well as the vendor.

We're seeing more proposed contracts as we continue to move into long-term agreements and software-intensive hardware, particularly as it relates to new technology. Purchasing must get involved with engineering, legal and operations to understand the agreements, proposed terms and conditions. Boilerplate purchase order terms and conditions may not address many relevant areas such as acceptance criteria prior to payment, software maintenance conditions, warranty to published specifications and proposals, etc.

Forecasting and standardization

We're not as large as some other MSOs so we have to combine requirements to forecast quantities and gain volume leverage. If we spread purchasing requirements out through the systems, we lose major efficiencies. We have implemented a state-of-the art, fully integrated software package that allows us to electronically communicate with all of our systems on their material requirements.

BOTTOM LINE

Do You Need to Reorganize Purchasing?

As the industry started moving toward future services, the MSO Jones Intercable adopted a basic truth: It needed continued support of core CATV-related purchasing while becoming more involved as new technology/business opportunities grew. What can you learn from Jones' realignment experience?

Reorganization was key: Jones reorganized its purchasing into core CATV, new business and non-CATV. More specific areas of focus included planning involvement, vendor qualification and approval, centralization, standardization and, of course, procurement.

RFPs and POs: Jones streamlined the request for proposal (RFP) and purchase order processes. RFPs have changed from lengthy, thick, dreaded documents to efficient, thorough studies of the product as well as the vendor. The MSO also has cut and/or decreased operational costs by eliminating old manual clerical functions. That means no more multipart purchase orders (POs), filing, mailing hard copy POs, etc.

Standardization: Jones has uniform corporate practices for qualifying contractors, CATV products and new technology. By standardizing, it saves on material, labor and internal overhead required to support numerous products/brands while also maintaining lower inventories.

Purchasing Dilemmas

Here's How Jones Is Handling Industry Changes

This software gives us the ability to support our systems as if they were physically right across the hall. This communication has lessened the distance barrier between our corporate office and our end-users. The systems can go on-line to request product from our distribution centers, check orders, inventory, receipt status and re-order requirements. Purchasing uses the software to place orders, data fax orders, monitor receiving, maintain real-time order status and check inventories at each location. All Jones' systems, distribution centers and corporate associates are using this integrated software to communicate, inquire, update and manage the business electronically, on-line.

From a standardization perspective, we have uniform corporate practices for qualifying contractors, CATV products and new technology. We don't want each of our systems picking their own product brands. By standardizing, we save on material, labor and internal overhead required to support numerous products/brands while also maintaining lower inventories.

As it relates to overall procurement practices, industry changes have motivated our adoption of proactive positioning in the way we do business. This positioning has allowed us to recognize major cost savings in all product areas. We have cut and/or decreased operational costs by eliminating old manual clerical functions. That means no more multipart purchase orders (POs), filing, mailing hard copy POs, etc.

Our inventories are being managed more efficiently and we are dealing more professionally with our end-users and vendors. Most importantly, we are communicating better with the systems and are able to support their requirements more effectively. CT

Angela Holloway-Martinez is the purchasing manager, new business, for Jones Intercable.

PLANNING '98

By Mike Sparkman

Considerations In Activating The Return Path

In the wake of Bill Gates' recent $1 billion vote of confidence in advanced cable services, MSOs may want to review their own plans for return path activation. Gates' bet on interactive TV is another harbinger that two-way plant is coming, but what cable operators need to determine is how soon (it will arrive), how extensive (it should be) and how much (it will cost). The following is a brief overview to stimulate thinking about these key issues.

The problem is that the economics and marketing rationale for activating the return path remain unclear. What is known for sure is that the marketing and engineering challenges are daunting, and the cost is potentially vast. Yet the opportunities, while often over-hyped in the past as part of the much-vaunted information superhighway, are likely to be extraordinary. And given emerging competition, upgrades can be a matter of survival. Two-way capability and high channel capacity are a major competitive advantage.

That's why projections for return path activation look like the proverbial hockey stick. While only 8% of U.S. operators have true two-way capability today, that figure is projected to double within a year and double again by the end of the decade.[1] To take one application, fewer than 9 million U.S. users were connected to the Internet in 1995; by 2000 that figure is expected to exceed 30 million.[2] Total revenue potential from possible two-way applications—including data access, telephony and interactive video—is expected to approach $200 billion within five years.[3] Given those kinds of figures, no cable operator of any size or ambition should neglect to explore the business case scenario for powering up the return path.

Doing the research

There are three obvious reasons why an MSO considers two-way: franchise renewal requirements, competition and revenue generation. Obviously, these factors vary over time and by market, geography and demographics. Yesterday's cable monopoly is today's satellite competition and tomorrow's telco overbuild. Clearly, some markets and nodes are good candidates for two-way services and some aren't: Witness Cox's impressive take rate for high-speed data and telephony in an affluent section of California's Orange County. The take rate just a few miles away from this pocket of wealth might be just a fraction for any but the most basic services.

A further consideration for any cable operator is the growing number of service offerings available, from video-on-demand and digital video to cable telephony, Internet access, equipment monitoring and energy management, to name but a few.

With all those supply and demand variables, it is incumbent on MSOs to do the marketing research to determine what services are likely to thrive in which areas. Doorbell surveys, phone interviews, focus groups, questionnaire stuffers and other marketing intelligence can yield reasonable estimates, and are imperative in determining service demand.

The other side of the marketing equation is engineering feasibility: Can two-way work at a cost that isn't prohibitive? To determine the profit potential requires a rigorous consideration of numerous critical plant issues, including but not limited to:

- *Powering:* Is a 90-volt upgrade necessary? Is it more cost-effective to centralize powering through one superpower node? And at what stage are these and other critical powering decisions made? The conventional approach is to design power requirements last, after the plant is laid out and installed. But experts say power should be designed first; without it, no network can work efficiently.
- *Hub design:* MSO engineers and consultants can determine how much work is

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W W W . A D C . C O M

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needed at the headend to redesign or adapt the physical layout, floor space, cable management, racking, and bay design to meet two-way needs. An excellent primer on this subject is "Engineering a Hub for Advanced Services" by Keith Kreager.[4]

- *Ingress:* Ingress is a major problem with activating the two-way path. According to one recent study, a huge proportion of return path activation problems emanate from the home, with some problems occurring at the drop and a small percentage along the hardline cable plant.[5] Cleaning or replacing loose or dirty connectors and correcting insufficient shielding at the drop cable can make a major difference. Some operators use high pass or windowed filters to eliminate interference from the home, while others feel they can clean up drops as they find problems. Obviously the age of the plant, and the quality of the hardware, will be indicators of likely ingress problems.
- *Plant reuse:* The number one prescription for cutting costs is reuse of existing plant. Considerable time and study need to be expended evaluating which nodes, amps, taps, drops and locations can be

BOTTOM LINE

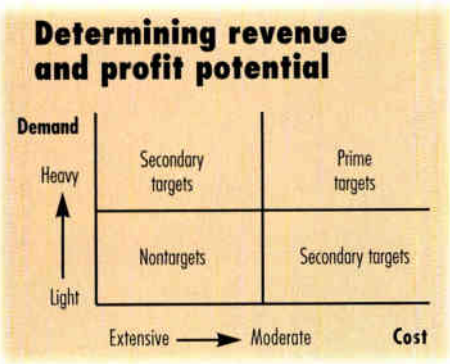
Review Your Plans

In the excitement of planning to upgrade and "power up" your system, don't forget to explore the necessary business side of your return path plans. Here are three reasons why:

- Franchise renewal requirements
- Competition
- Revenue generation

You'll need to decide on how to activate your return path after reviewing the following considerations:

- Powering
- Hub design
- Ingress
- Plant reuse



used as is or modified to add service and activate the upstream path. As a general rule of thumb, a "light" upgrade involves electronics: swapping out active modules for amps, etc. A "medium" upgrade means keeping the cable but (due to the age or limited capacity of the plant) replacing taps, actives and passives. "Heavy" upgrades obviously require a total rip-out and rebuild. The lighter the needed upgrade, the better the business case for two-way services.

How is one to make sense of all these supply and demand variables? One easy way is through a simple chart or matrix. (See accompanying figure.) The vertical axis measures demand for two-way services, from low at the base to high at the top. The horizontal axis measures cost, from high at the base to moderate. (We assume there is no "low" cost to activate a return path!) A given node or neighborhood is then plotted on the chart as an X,Y coordinate.

An area with a high projected demand for two-way services, but a high cost to activate, would fall on the upper left quadrant of the chart. Low demand and low cost would fall on the lower right quadrant. Obviously the prime targets for two-way activation are those areas in the upper right corner: high demand at a moderate cost. Plotting the demand and cost coordinates of all localities in a given service area should give operators a fairly clear picture of where two-way activation represents "low hanging fruit" that will yield maximum revenues.

Once the engineering, equipment and marketing studies have been completed, an important intangible remains: long-term vision. Is it cheaper in the long run to spend now to support future services, even if current demand is weak or indeterminate? Or is it better to ramp up slowly, trying to match short-term revenues with current expenditures, as many MSOs believe is necessary?

The long run is always hard to gauge, but consider that with cable in particular, and high-tech innovation in general, it is almost always more expensive to upgrade later. How many operators have upgraded from 450 to 550 MHz in the last few years, thinking that was sufficient to carry them through the end of the decade, yet are already contemplating the necessity to go to 750 MHz?

The good news is that it doesn't always have to be that much more expensive to future-proof the network now. Adding the redundancy to nodes necessary to support telephony, for example, may only cost several hundred dollars a node more than doing without. The alternative can be an expensive retrofit later, when competition or franchise renewal requirements force an upgrade, and labor, engineering and the cost of capital are a lot more expensive.

That's why cable operators will need to take a long and hard look at the cost-benefit analysis of taking the plunge. They must be able to answer with reasonable assurance the difficult and critical questions: Is two-way economically viable, is the demand there, is it affordable based on realistic market assumptions?

Still, in the end, we all know the future is arriving soon. For cable ever to fulfill its promise and potential as the "pipeline to the 21st century," it must close the loop and activate the return path for true two-way communication. The hard work starts with figuring out the best, most cost-effective way to do it.

The author would like to acknowledge the help of Keith Kreager, Jim Farmer, Emmanuel Vella, Marty de Alminana, and Jim Jennings, from Antec, in putting together this article. CT

1-3 SCTE: "Return Path Basics" videotape.
4 "Engineering a Hub for Advanced Services," Keith Kreager, SCTE Engineering Conference, 1997.
5 "Solving Return Path Problems," Bill Morgan, Jerry Green and Dan Kahn, *Cable-Tec Expo '96 Manual*, June 1996 .

Mike Sparkman is senior vice president of ANTEC Corp. He can be reached at (303) 708-8110.

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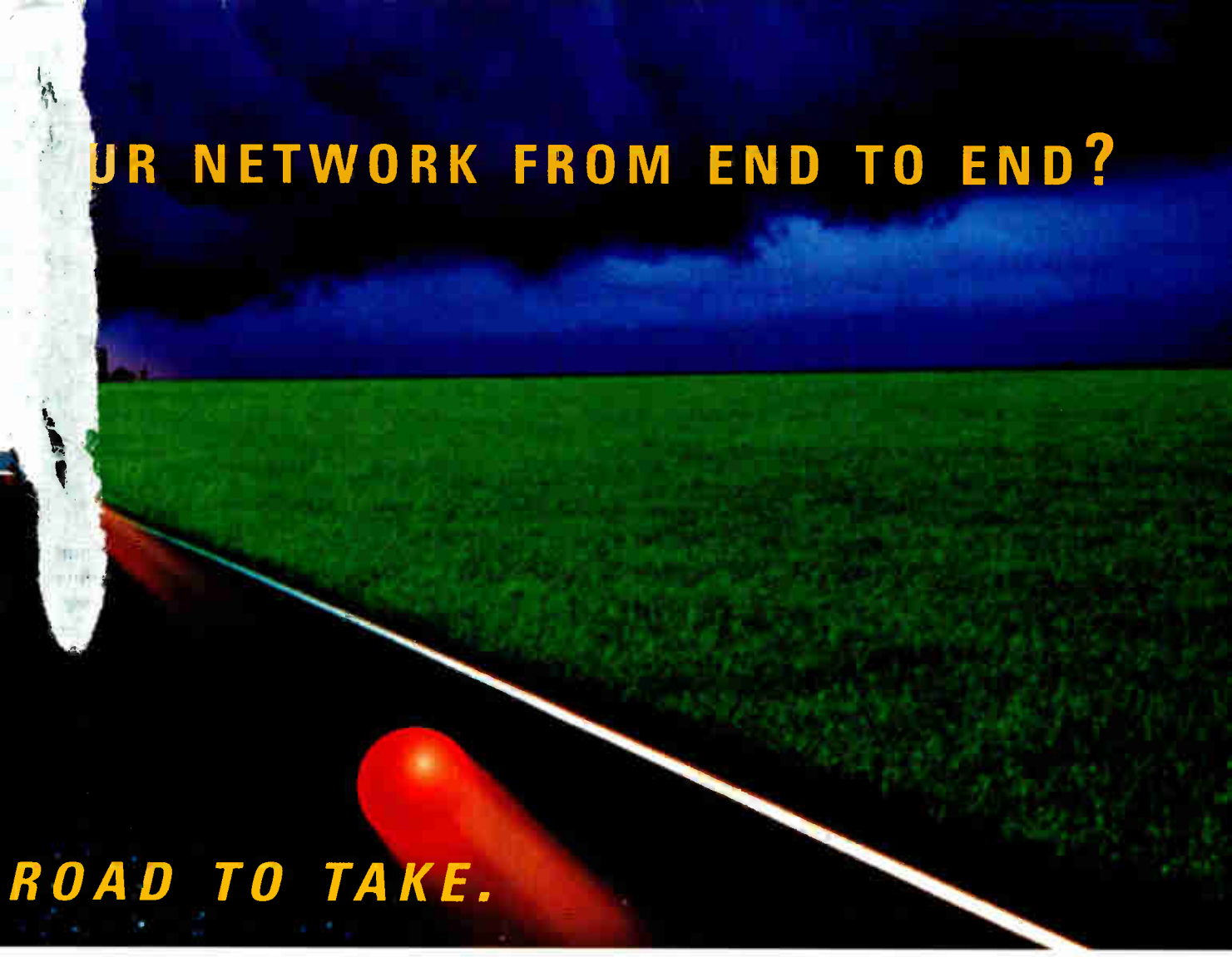

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PLANNING '98

By Jim Albrycht

Get "Reasonable"

Data-Ready Doesn't Necessarily Mean "Perfect Plant"

For the successful transportation of data signals via cable, we must assure the broadband cable network is "reasonable."

Frequent use of equalization in data transmission equipment means the cable plant doesn't have to be perfect. Small frequency response problems in amplifiers and passive devices can be overcome by most equalization schemes. Much of the criticality exists in the installation and operation of the equipment to be installed in the cable headend. A properly configured server also is critical to a data over cable project.

Forward path

Cable networks—hybrid fiber/coax (HFC) or typical tree-and-branch—are designed, built and maintained to high-quality standards for the delivery of forward video. Implementing data over cable doesn't require much in the way of special considerations for the forward signals. Thought and planning should be given to noise, ingress and overall power loading in the forward plant. Receivers (modems) are installed at customer sights much like converters. These receivers are susceptible to permutations caused by excessive noise or ingress. Data errors will occur if the plant isn't well maintained to keep these problems "reasonable." The Multimedia Cable Network System (MCNS) standards being discussed and planned with the help of Cable Television Laboratories will address these noise and ingress thresholds in the forward plant.

Total power loading is affected in the forward direction and is a function of data density calculated in power/Hz. The power addition of data carriers when added to the forward channel loading must be considered when planning amplifier levels.

Return path

As most cable technicians and engineers are learning, noise and ingress are "funneled" together in the reverse direction. Return noise originates in thousands of locations and terminates in just one. This noise can be translated to the forward and affect the receivers at the customer premise.

Combining multiple return paths compounds this funneling. While HFC topology helps reduce amplifier cascades and generally improves signal quality in the network, little happens in the return path to reduce the addition of multiple noise funnels. Significant consideration needs to be given to the reverse path design to reduce the number of additions and funneling.

Cable modems generally employ an automatic adjustment of transmit levels. For this reason it becomes important to assure the reverse levels are maintained for unity gain. Unity gain in the return path allows the modem to self-adjust its transmit levels regardless of location. Improper levels in just one return path can impact the transmitter levels for many forward paths.

Consideration should be given to the number of modems planned for a segment of cable plant. Because the return spectrum is shared by all modems, careful planning will help improve the utilization and access. If too many customers are utilizing the service simultaneously, the network may become saturated if proper design didn't segment the users on the network. Improper segmentation will result in throughput problems and slow the network response for a given user. Unfortunately, even the most careful planning can occasionally result in a saturated network. CT

Jim Albrycht is a technical consultant for Bay Networks' Data Over Cable Division.

BOTTOM LINE

Plan Reasonably For Data

For the successful transportation of data signals via cable, we must assure the broadband cable network is "reasonable."

As we all know, most issues that need addressing lie in the return path, particularly because noise and ingress are "funneled" together in the reverse direction. While hybrid fiber/coax (HFC) topology helps reduce amplifier cascades and generally improves signal quality in the network, little happens in the return path to reduce the addition of multiple noise funnels.

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Therefore, the largest serving area = 222 kHz/250 kHz * 1200 = 1065 homes.

This example assumes a dedicated forward path transmitter per serving area. To compute using multiple nodes per transmitter, simply divide the forward path addressable bandwidth by the number of areas served by the transmitter. See Figure 1 for a decision chart for optimized node size.

In many cases, return path capacity limitations may dictate the serving area size, especially in an environment where high two-way service deployment is anticipated. In the return path, limitations are based typically on return capacity and attainable return path performance based on the types of services to be carried.

A common misconception is that if a return optical path is 5 MHz - 40 MHz, it can carry any services simultaneously in that return until the spectrum is exhausted. As opposed to forward path performance, which is easily characterized based on the demands of VSB/AM video, return path performance is dependent on the types of signals carried in the return spectrum. Return path performance is also dependent on the return path ingress noise, especially impulse noise, which are more complicated in the low band than in the forward band above 50 MHz.

To further complicate the return path calculation, return path performance differs significantly by system supplier. Some operators have attempted to qualify return paths based on the laser technology employed. Three types of lasers are used in return path lasers: Fabry-Perot, intercooled distributed feedback (DFB) or non-intercooled DFB lasers. In reality, the performance or capacity of a non-cooled DFB from one manufacturer may actually exceed the performance or capacity of an intercooled DFB laser from another manufacturer.

Another key is the type of modulation scheme used for services. Quantifying return path performance and capacity requirements are more difficult in the return path than the forward path, since return path spectrum cannot be treated as generically as in the forward path.

The first step in determining return path capacity is to characterize the types of services required, and then work with a manufacturer to determine return path capacity based upon the capability of the return path link for those types of signals. Once this is established, a calculation can be made similar to the forward path spectrum calculation to determine if adequate return path spectrum is available. If not, then the serving area must be decreased in size to accommodate this requirement.

Equipment effects on serving area sizes

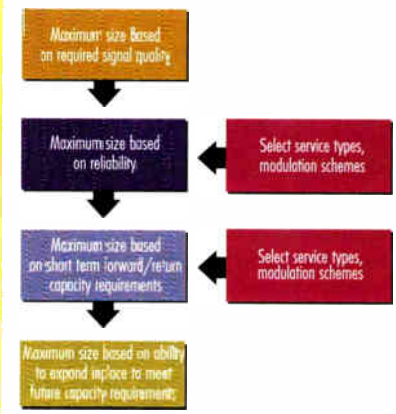
Given the previous calculations, one can design a node to meet any future anticipated capacity requirements. The problem with this technique, taken by itself, is that historically it has been difficult, if not impossible, to predict which services will take off in the future. For example, three years ago most experts were predicting that the "killer application" of the future would be true video-on-demand. Virtually no one foresaw the coming of high-speed services as fueled by the Internet explosion.

To design serving area sizes today to meet all anticipated future forward and return path spectrum requirements is very costly, and results in excess network capacity, which provides no incremental return on capital investment. An alternative approach is to design the network to allow scalable addition of bandwidth. For example, if a network can be initially activated with enough capacity to support its requirements for the next two years, but each serving area can be modularly upgraded to a 100% expansion in forward bandwidth and 300% in return bandwidth, then considerable savings in initial capital cost, and therefore higher return on investment, can result.

Forward path scalability

Given that forward path transaction-based services are not overwhelming today, a common approach is to share the 750 MHz spectrum from a transmitter among two or more serving areas by employing optical splitters. This reduces initial forward path transmitter costs significantly. In the future, as bandwidth becomes exhausted, optical splitters can be removed and new lower power transmitters can be added to serve nodes individually. Older, higher power transmitters can either be re-deployed or optically attenuated and kept in place.

Figure 1: Optimizing node size selection



BOTTOM LINE

Optimize Your Node Size

Stuck on what your optimal node size should be? You'll need to balance these five basic variables:

- Delivered signal quality to the subscriber,
- Forward addressable bandwidth capacity per subscriber,
- Return addressable bandwidth capacity and service types per subscriber,
- Overall initial capital cost of fiber and electronics, and
- System reliability and fault isolation.

What about the return? If you need more return path spectrum, consider the following options. Each one can let you divide the return path into several parallel returns, each 5-40 MHz. The techniques to do this consist of the following:

- Add multiple return path optical receivers in the node, each with its own return path fiber;
- Block upconvert multiple return paths (typically four) into a 5-300 MHz spectrum. The upconverted paths are carried on one return path transmitter, then received and down-converted at the hub or headend into four 5 - 40 MHz signal streams.
- Use multiple return path transmitters, each on a separate optical wavelength, combined with a wave division multiplexer and sent back over a single fiber to the hub.

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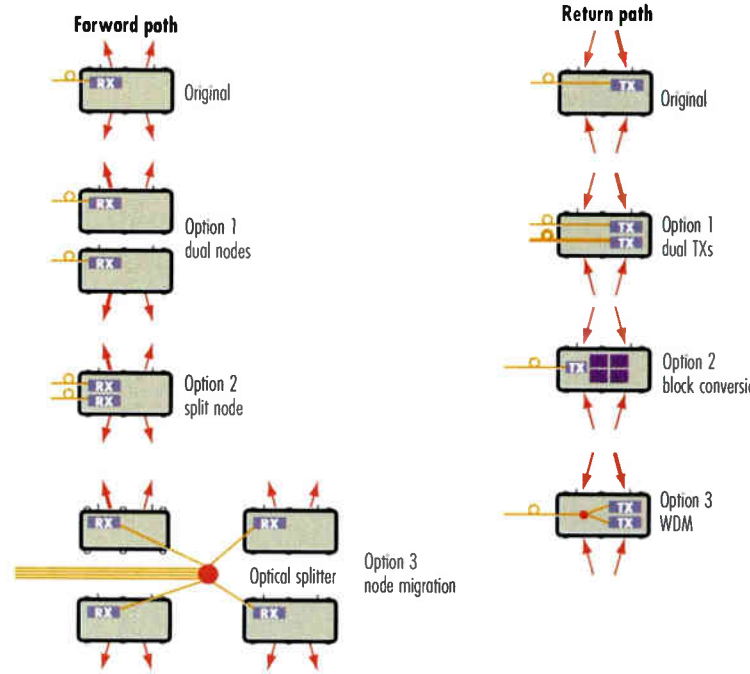
Figure 2: Serving area capacity expansion



If additional forward bandwidth is required, the optical serving area must be divided in half. There are multiple approaches to this. One argues that simply another forward path node should be installed side-by-side with the original node, with half of the coaxial cables leaving the node moved to the second node. Another argument calls for installing an initial node with the internal capability of dividing the paths in half internally, and adding another optical receiver module in the node. This approach raises the capital cost of the original node.

A third approach is to locate smaller forward path nodes at the end of express feeders at the time that expansion is necessary, thereby eliminating one amplifier in the forward cascade at the time of system expansion.

Return path scalability

If additional return path spectrum is required, a number of techniques have been proposed. Each allows division of the return path into a number of parallel returns, each 5-40 MHz. The techniques to do this consist of the following:

1) The ability to add multiple return path optical receivers in the node, each with its own return path fiber;
2) Block upconversion of multiple (typically four) return paths into a 5-300 MHz spectrum which is carried on one return path transmitter, then received and down converted at the hub or headend into four 5-40 MHz signal streams; and
3) Future potential of multiple return path transmitters, each on a separate optical wavelength, combined with a wave division multiplexer and sent back over a single fiber to the hub (see Figure 2).

Future advances

One of the current limitations on reducing node sizes is that the amount and overall cost of the fiber plant increases at the square of the average distance from the hub. In the future, the potential exists for ring architectures employing wave division multiplexing in both directions, which can significantly reduce fiber costs and therefore allow further penetration of fiber into the network while improving overall network reliability.

Selection of serving area size requires a balance of initial capital cost plus performance and capacity. In any given design either forward path or return path requirements may be the ultimate determinant. A well-planned network will allow initial high return on capital investment while supporting future needs for capacity and services expansion. CT

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Internet Compression

By Xuemin Chen, Sati Banerjee and Krit Panusopone

Delivering high-quality visual content over the Internet requires very high compression for various image resolutions. The Moving Pictures Experts Group recognizes this need and has declared Internet visual communication service one of the most important applications for multimedia delivery.

Core components of Internet visual content for multimedia communication include video, images and graphics. To accommodate them, MPEG is developing the MPEG-4 visual standard. MPEG-4 is a still image compression mode designed to achieve efficient representation and delivery of digital visual images over the Internet to reduce storage and transmission costs.

Still image compression is a part of general texture coding. In the MPEG-1 and MPEG-2 video compression standards, an 8 x 8 discrete cosine transform (DCT) is employed in texture coding to pack the energy of each 8 x 8 pixel block in the image into low frequencies. Then, subsequent quantization and run-length coding reduces the transformed data. The quantization step eliminates small transform values at high frequencies, while the run-length coding packs the quantized data into a compact stream. Finally, lossless entropy coding, specifically Huffman coding, further compresses the compact stream.

High compression performance, or high coding efficiency, is always a key requirement for Internet image or video service. Multiresolution and scaleable-quality service also are requirements in the Internet image service environment. High (lossy) compression is subject to a high quantization level and often generates visual artifacts in reconstructed images.

The main visual artifact in a DCT-based coding scheme is called a block effect. The block effect becomes more noticeable with high compression, since the high frequencies in the transformed coefficients are heavily quantized.

Layered coding scheme

Layered coding, also called scaleable coding, refers to coding techniques that partition image data into a number of layers according to the data's importance. The term "layered coding" actually has two meanings. One refers to a system of image or video services at multiple quality levels.

Figure 1: A model of layered images

Spatial Resolution (Num. of Pixels)		Example of Layers
4K x 4K	V	V (Extended) Graphic pictures
1920 x 1080	IV	IV (High) HDTV
720 x 576	III	III (Normal) Digital TV
352 x 288	II	II (Medium) MPEG-1 video
176 x 144	I	I (Low) videophone

This layered coding gives users more freedom to select the quality level they need. The conceptual table in Figure 1 categorizes layers into spatial resolutions ranging from video telephone image (which can be as small as 176 x 144 pixels) to high-resolution graphics or medical images (which can be as large as 2,048 x 2,048 pixels).

Such a layering scheme is valuable because it provides services at various levels of quality and allows users to select the proper level to meet their needs. For example, users may select low bit-rate transmission if they only have a low-resolution display or a low-power processor (slow and with a small memory) and want to economize on service access fees. A netcasting image service must meet the needs of a large, varied audience. Therefore, a unified layering system that can be accessed at different resolutions becomes especially important. ➤

BOTTOM LINE

MPEG-4: Making Wavelets

MPEG-4 wavelet-based coding has been proposed as a flexible image transmission service for Internet applications. This visual standard improves visual quality at low bit rates and separates image data into layers for transmission.

In the MPEG-1 and MPEG-2 video compression standards, discrete cosine transform (DCT) is used in texture coding to pack the energy of each 8 x 8 pixel block in the image into low frequencies.

The basic modules of a wavelet-based coding scheme are:

- Decomposition of the texture by the use of a discrete wavelet transform (DWT),
- Quantization of the wavelet coefficients,
- Coding of the lowest frequency subband using a predictive scheme,
- Zero-tree scanning of the higher order subband wavelet coefficients, and
- Arithmetic coding (AC) of the scanned quantized wavelet coefficients.

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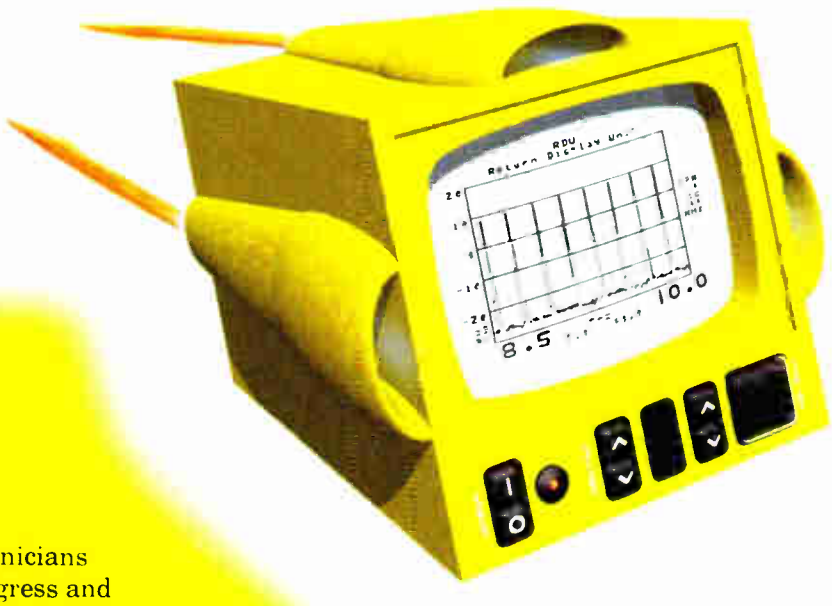

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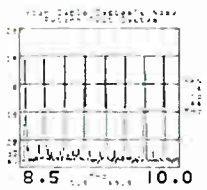

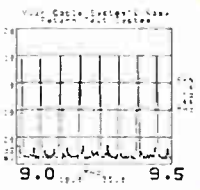

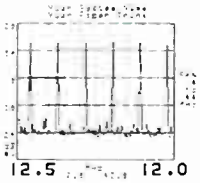

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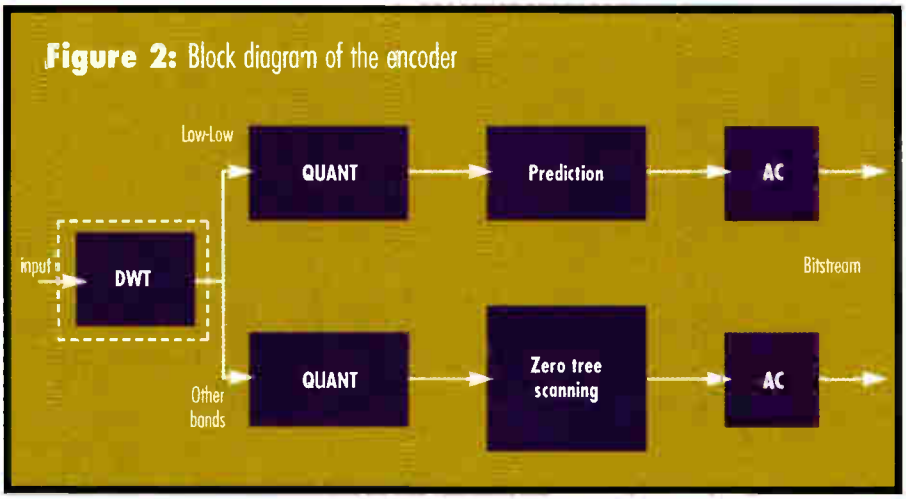

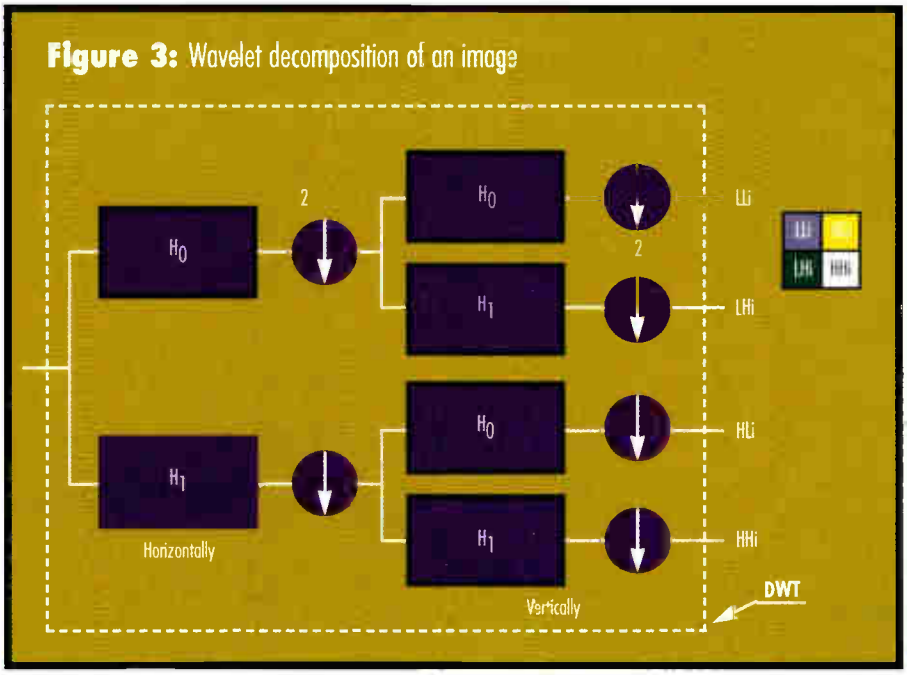

Layered coding also refers to a useful means of ensuring quality in network transmission. A single image source is partitioned into layers, and differing transmission qualities are established for each level. For example, layers with low significance are sent over a low-priority channel, while high-significance layers are sent over a high-priority channel. This layering minimizes the degradation of image transmission due to network congestion.

The MPEG-4 wavelet-based coding scheme has been proposed as a flexible image transmission service for Internet applications. This visual standard addresses improved visual quality at low bit rates and separation of image data into several layers for transmission.

Wavelet-based texture coding

Wavelet theory provides a unified framework for multiresolution image compression. The wavelet-based texture coding tools proposed in MPEG-4 enable the coding of still image textures with a high coding efficiency as well as scaleable spatial resolutions at fine granularity. The encoder can select the granularity of resolutions from a wide range of possible layers. Figure 2 shows the wavelet-based coding scheme defined in the video verification model of MPEG-4 for still image compression.

The basic modules of a zero-tree wavelet-based coding scheme are as follows:

- Decomposition of the texture by the use of a discrete wavelet transform (DWT)
- Quantization of the wavelet coefficients
- Coding of the lowest frequency subband

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using a predictive scheme,

- Zero-tree scanning of the higher order subband wavelet coefficients, and
- Arithmetic coding (AC) of the scanned quantized wavelet coefficients.

DWT and subband decomposition

Applying wavelet decomposition to frame-based images requires two-dimensional wavelet transforms. For simplicity, "separable wavelet" transforms are obtained from products of one-dimensional wavelets and scaling functions. The wavelet decomposition is performed by the use of a Daubechies (9,3) tap filter bank, which provides good compression performance. The tap values in the low-frequency filter bank, H0, and the high frequency band, H1, are shown in Figure 4. Also, a certain group delay is applied to each filter to avoid the phase shift on both the image domain and the wavelet domain. At the analysis stage, downsampling for each band is performed, as seen in Figure 3 on page 62. In this figure, LLi, HLi, LHi, and HHi correspond to the transformed data of low-low subband, high-low subband, low-high subband, and high-high subband, respectively for the stage or layer i.

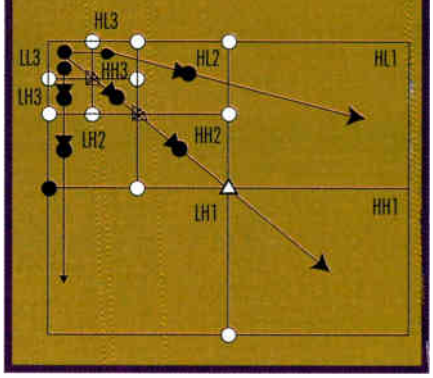
The number of decomposition levels varies with the image format. For the QCIF format (176 x 144 pixels), four levels of decomposition for luminance and three levels of decomposition for chrominance are performed. For the CIF format (352 x 288 pixels), five levels for luminance and four levels for chrominance are carried out. The wavelet coefficients are represented by a structure known as a wavelet tree, in which the nodes of the tree correspond one-to-one with the wavelet coefficients. The coefficient at the coarse scale is called a parent, and all coefficients at the same spatial location and of similar orientation at the next finer scale are that parent's children. Figure 5 shows such a wavelet tree with three levels of decomposition.

Figure 4

H0 = [0.03314563036812, -.06629126073624, -0.17677669529665, 0.41984465132952, 0.99436891104360, 0.41984465132952, -0.17677669529665, -0.06629126073624, 0.03314563036812],

H1 = [-0.35355339059327, 0.70710678118655, -0.35355339059327].

Figure 5: Wavelet tree



Quantization of the wavelet coefficients

Explicit quantization is performed depending upon the location of the transform coefficients in the wavelet tree. The quantizer in the MPEG-4 scheme is a mid-riser uniform quantizer with a dead zone around zero. The transform coefficients are organized into wavelet blocks that comprise coefficients at all scales and orientation that represent the frame at the spatial location of the particular block. A quantization factor is specified and adapted for each block based on the content present.

Coding of the lowest subband

After the quantization of the lowest subband coefficients (LL0), a DPCM coding scheme is applied to code the quantized values. Each of the current coefficients, w_x, is predicted from three other quantized coefficients in its neighborhood, i.e., w_A, w_B, and w_C (see Figure 6), and the predicted value $\hat{w}_x$ is subtracted from the current coefficient. That is,

If $(|W_A - W_B|) < (|W_A - W_C|)$

$\hat{w}_x = wc$

$w'_x = Wx - \hat{w}x$

Else

$\hat{w}_x = wA$

$w'_x = W_x - \hat{w}_x$

The coefficients after the DPCM, w'_X, are then entropy-coded.

Zero-tree coding of the higher bands

Zero-tree is a data structure that is built on the parent-child relationship in the wavelet tree. Figure 4 on page 64 provides an example of a zero-tree for three levels of decomposition. The zero-tree structure is based on the premise that if a wavelet coefficient at a coarse scale is quantized to zero with respect to a given threshold, then all wavelet coefficients of the same orientation at the same spatial location at finer wavelet scales also are likely to be quantized to zero with respect to the same threshold.

Zero-trees exist at any tree node where the coefficient is zero and the node's children are all zero-trees. The zero-tree scanning method assumes that most natural images have decaying spectrums.

In the zero-tree coding technique, all coefficients that represent a higher-band spatial block are scanned in ascending frequency order from parent to child to grandchild and so on before the coefficients of the next adjacent spatial location are scanned. The arrows in Figure 5 on page 64 show this coefficient scanning order. Nodes of the wavelet trees are assigned one of three symbols:

1) Zero-tree root: coefficient that is the root of a zero-tree; such a zero-tree does not need to be further scanned,
2) Valued zero-tree root: coefficient is nonzero but all children are zero-tree roots, or
3) Value: node with coefficient either zero or nonzero; however some descendants are nonzero.

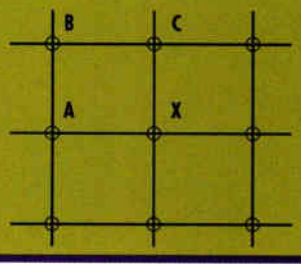
Entropy coding

Symbols and quantized coefficient values generated by the DPCM coding and zero-tree coding are all encoded using an adaptive arithmetic coder and a three-symbol alphabet. The valued zero-tree root symbols are coded using an alphabet that does not include zero, while the value symbols' encoding alphabet is zero-inclusive. In the arithmetic coder, three different tables (type, valz, valnz) are coded at the same time using different probability models. At the end of each wavelet block, the number of bits used is calculated to feed back to the rate control algorithm in order to adjust the quantization levels for next wavelet blocks.

Applications

In certain medical imaging applications, like an ECG for instance, wavelet-based compression outperforms other compression techniques. The perceptual quality in either technique is similar at high bit rates. At medium bit rates, wavelet-based transforms perform slightly better than DCTs, which may display ringing artifacts. At low bit rates, blocking artifacts are present in DCT-based coding schemes, while the wavelet based technique might display ringing artifacts.

Figure 6: DPCM coding of lowest band coefficients



The basis functions in any compression technique should be chosen such that the length of the function is reasonably short to avoid excessive ringing and reasonably long to avoid blocking. Intuitively, it appears that textures should be represented by short basis functions—wavelets at medium to low bit rates. In other comparative measures, wavelets preserve the edges in images, which are often lost in DCT-based techniques. The low-frequency component of DCTs is often a blur and the output from the lowpass channel of the wavelet-based techniques provides useful compression.

Wavelets are based on the concept of scales, which leads to the natural multiresolution of images. Enhanced scalability—both in the spatial as well as in the SNR domain—is the biggest advantage of a wavelet-based coding scheme over that of a DCT-based one. The encoder can select the granularity of these scalabilities from a wide range of possible levels.

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A Brave New Digital World

Testing Digital Products

By Edwin Cooper and Neil Abramson

With the onset of new digital services being deployed over cable telecommunications networks, a common question arises pertaining to digital testing. Do cable operators need to perform special "digital-only" network testing to successfully deploy these new services, or are the analog tests currently being performed adequate? Likewise, a similar question is posed which relates to the digital products being deployed: Are there any special digital tests required to qualify the product before being successfully deployed over a cable telecommunications network?

This article examines the specific testing methods used to qualify digital products such as cable modems, digital video and telephony. It also discusses tests and test equipment common to all digital products.

Trial testing procedures

In the cycle of deploying any new product onto a cable telecommunications network, the first series of tests usually witnessed by the operator are the acceptance test procedures (ATP). These tests are rigorous product tests that include a full range of special analog, RF and digital tests under various loading conditions, as well as environmental tests such as temperature cycling.

Since the new product has to work over various conditions and ages of a telecommunications network, it is imperative that the operator first specify the *minimum performance* of the network. These conditions can then be simulated during the acceptance testing. When the new product passes this test, it is ready for field testing. Field testing is a crucial period for both operators and manufacturers, because it introduces both parties to the realities of operating the new product in a real system environment.

This is usually the time where heated debates occur between the operator and the product manufacturer. During a field test—when things never work as expected—these debates can result in strong differences of opinion. The manufacturer may assert that a system plant is operating below its minimum specifications and the system operator may assert that the new product is not performing to its specifications.

Perform traditional measurements

At this digression point, the operator can prove that the system is operating at or above its specifications using traditional cable analog measurements. These measurements include carrier-to-noise (C/N), distortions (composite triple beat/composite second order and hum) and frequency response (sweep). Analog measurements are used to prove that—at a particular point in time—certain parameters are acceptable. If not, the measurements help to steer the technician in the right direction to identify and repair the problem.

The problem with traditional analog tests is that it does not provide a *continuous measurement over a period of time.* Analog tests do not measure random or nonrepetitive impulsive events. This is normally the argument used by the manufacturer in an attempt to prove that a system plant is operating below specifications at a given moment in time.

Know thy bit error rate

This should be a mantra for all operators contemplating deployment of new digital products. Historically, this is usually where digital testing is introduced. A bit error rate (BER) is defined as the ratio of the *errored* bits received to the total number of bits received. It is a critical measurement of digital product performance because it directly affects the quality of service the customer perceives is being provided. As the BER increases, the quality of service decreases and can have extremely adverse effects on service. Digital video will exhibit "tiling"; telephone calls will have static and noise; and cable modems will suffer from decreased throughput and multiple retransmissions of data. This type of testing can perform a continuous measurement over a given time period, and capture those random, impulsive events. However, it will not identify the *cause* of these events.

It is extremely important to know how a new digital product performs bit error-wise, especially in the presence of noise. Digital products that use the 5 to 40 MHz return path are particularly vulnerable to noise-induced BER problems. These products must be tested rigorously for BER performance in the presence of impulse noise and ingress. It has been demonstrated in numerous digital product trials that the most robust products—that is, the products having the lowest BER in the presence of noise—produced

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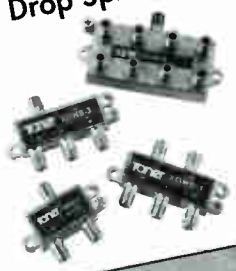

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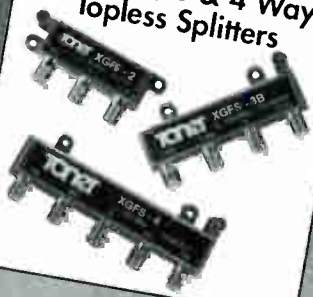

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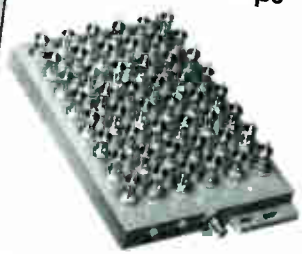

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the highest levels of customer satisfaction. The goal of this testing is to evaluate the sensitivity of the system under test as BER degrades.

There are many events that can trigger the impulses that cause bit errors. These events include laser clipping (which can be caused by overdriving signals), lightning, bad connections, ingress or poor grounding—just to name a few. However, experience from field trials has proven that a major culprit is improperly set digital levels.

Since digital signals are broadband in nature, the disconnect between the manufacturer and system operator occurs when setting these levels. For example, if the system operator states that these signals are to be 10 dB lower than the highest analog video carrier, there also needs to be an agreement on the bandwidth within which the measurement is made. Measurement error as great as 23 dB could be realized if proper accounting of the measurement bandwidth is not made. (See sidebar.)

Other analog test equipment needed to support BER testing of competing products include: a spectrum analyzer, a noise generator and a signal generator. Typically, the signal levels are adjusted using a spectrum analyzer. However, a new piece of test equipment known as a BERT (bit error rate test) test set will be needed to actually measure the transmitted bit error rate. There are different types of BERTs, the most typical being T-1 or T-1/DS0 transmission test sets made by various manufacturers. Specific test setups will depend on the network configuration and characteristics of the product being tested, but an example set up for cable telephony is shown in the accompanying figure on page 70.

Direct and objective comparisons can be made using this equipment. For a given level of fixed RF interference (dBmv) the product with the lower BER will provide better service. As an example, if Product "A" produces a BER of $1x10^{-8}$ and Product "B" has a BER of $1x10^{-6}$ in the presence of interference 16 dB higher than the desired signal, then Product "A" is more robust and will provide better service.

Of course, it is never this simple in reality. There are several factors in the digital world that must be taken into consideration when testing BER. One key aspect of digital transmission that must be accounted for is whether or not the product utilizes forward error correction (FEC). If it does, the operator should run BER testing with FEC enabled and then disabled. This determines whether or not the BER results were masked by the forward error correction and to what extent.

Other recommended testing

Once operators and manufacturers get past their points of contention, and once operators have determined that the plant is ready to handle digital services, there are certain critical tests that are common to all digital products.

Spurious output generation

One unfortunate side effect of modulating a digital signal onto an analog carrier—regardless if it's frequency shift keying (FSK), quadrature phase shift keying (QPSK), or quadrature amplitude modulation (QAM)—is the creation of unwanted spurious "beats" or harmonics. Depending on the frequencies of the harmonics and the relative strength of the signal, these spurious outputs can impair the quality of analog video signals downstream and interfere with other services occupying the upstream spectrum.

Testing for spurious beats is accomplished using a spectrum analyzer and a directional coupler. With no other carriers present, the only power measured on the spectrum analyzer in both the downstream and upstream directions should be those associated with the assigned primary carriers of the system under test. If there are other carrier frequencies outside the assigned carrier group, these are spurious signals. To eliminate the possibility of perceptible interference with desirable services, the cable operator should have established minimum acceptable level criteria for spurious signals. Some examples of minimum acceptable levels might be that the level at any other carrier frequency outside the assigned carrier group is at least 45 dB below a 0 dBmv reference level in the upstream or at least 40 dB below downstream carriers.

Bit error rate and spurious signal generation are two of the most critical digital tests to perform during product evaluation. There are several other tests that need to be performed prior to deploying a new digital product. These include: minimum and maximum RF transmit levels, RF insertion loss, and frequency agility tests (for those products employing agile technology), along with platform-specific tests. The good news for cable operators is that the majority of testing needed for new digital products can be accomplished using existing analog test equipment. Minimal additional test equipment will be needed for digital product specific testing. Unless, of course, the plans are for more advanced digital product deployment such as SONET (synchronous optical network) or ATM (asynchronous transfer mode).

Bursting digital signals

An even a bigger problem is measuring the power of bursting digital signals. The

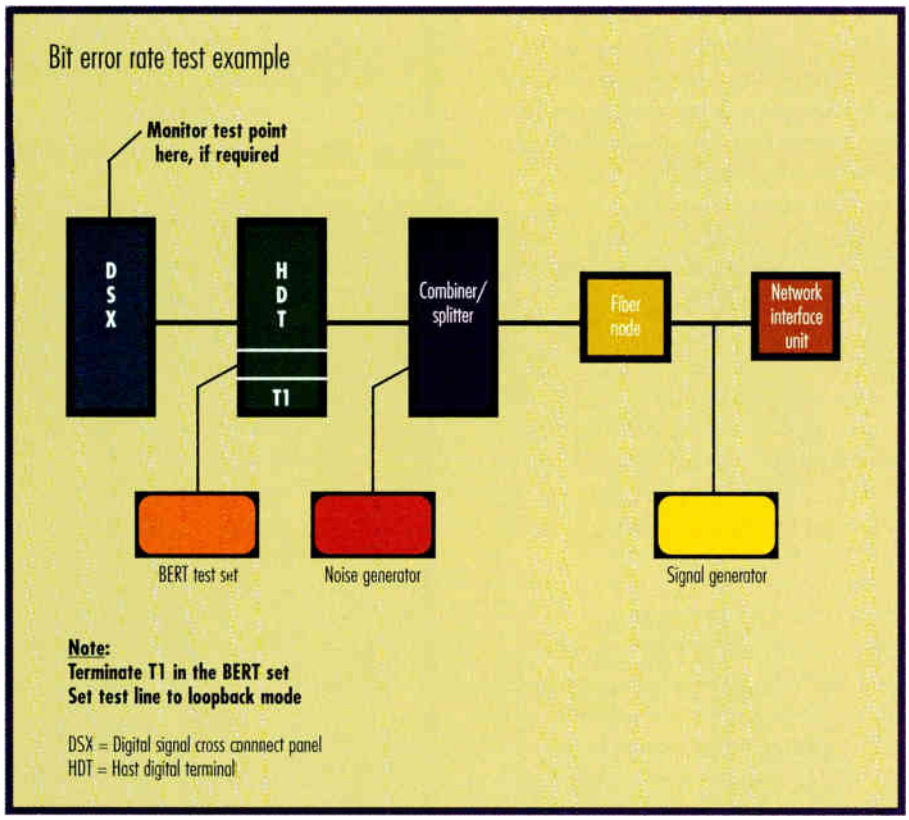
BOTTOM LINE

Cable World Evolution

The cable world has evolved. Instead of operators telling customers the services being offered, customers are now telling operators what they expect for their consumer dollars. Options abound (for consumers) and the final fallout is yet to be decided. But one thing is certain. Delivering these new services to high-end customers won't be as easy as introducing services in the old days. As a minimum, today's consumers expect speed and reliability in the delivery of advanced services such as digital video, data and telephony.

Questions to ask:

- What does an operator have to do to monitor the introduction of new digital products onto an existing network?
- Is special digital testing required or can operators use the traditional analog testing methods?
- Who's right and who's wrong about testing?



Measuring Continuous Digital Signals

To measure continuous digital signals (not bursting), the resolution bandwidth of the spectrum analyzer must be set to the signal's measurement bandwidth. If the spectrum analyzer cannot be set to the specified bandwidth, then the level must be mathematically calculated/corrected using the following equation:

Actual Digital Level = (Measured Level) + 10*LOG((Agreed BW)/(Spec An's RBW))

where Measured Level is the average digital level read from the spectrum analyzer
Agreed BW is the agreed bandwidth to measure these digital levels
Spec An's RBW is the resolution bandwidth of the spectrum analyzer

For example, suppose a product's digital bandwidth is 2 MHz and the operator requires that the level should be set at 6 MHz bandwidth. If the level is set to the product's 2 MHz bandwidth, this measurement will be in error by almost 5 dB. Even worse, if the measurement is made using an older signal level meter (SLM) with a 30 kHz bandwidth, this measurement could be off by as much as 23 dB. [Editor's note: Ideally, the digital signal's average power level as measured on a spectrum analyzer or other instrument should closely correlate with a measurement made using a thermocouple power meter.

important lesson to remember with bursting is to agree on the level setting procedure *before* the product is installed on the system. Also, verify that the other signals present on the system have acceptable levels. This could help prevent interoperability issues.

Frequency response

Another test operators may want to perform when introducing digital products into the network is the in-band flatness (or frequency response). For digital products, the in-band frequency response requirement could be as low as 1.5 dB peak-to-valley, depending on the type of equalization being used within the product. Other sensitivities for digital products are group delay, which results in phase errors in digital products. Usually this is not a problem, unless there is excessive equalization being used in the system amplifiers or the product's frequency carrier is close to a diplexer's band edge.

Conclusion

Ultimately, all errors in digital systems are the result of amplitude and phase distortions. Every effort made to minimize these distortions results in a more robust system for the operator—and more desirable services with less interruption in service for the consumer.

So, should cable operators perform special "digital-only" network testing? Yes, it is important to perform proper digital testing, but it doesn't require fancy, expensive equipment. Operators should concentrate on testing new products using a continuous measurement over time to collect accurate data. This type of testing is also valuable because of the wealth of service affecting performance information that it provides. C_T

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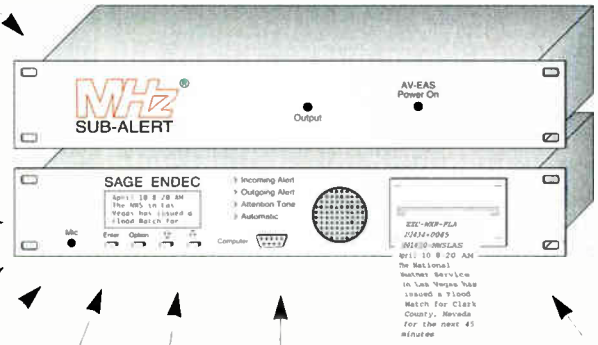

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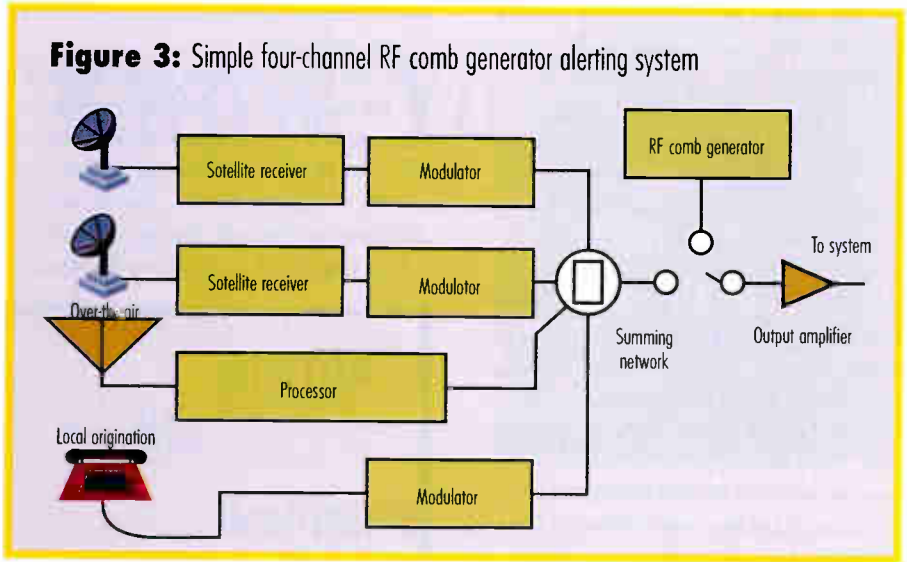


Figure 3: Simple four-channel RF comb generator alerting system

network programs will be the same as the alert that appears on pay-per-view channels, for instance.

A text messaging system places a character generator in-line with the baseband video and providing independent switching for the audio for each channel (Figure 4). These character generators are controlled from a central controller to enable messages to be independently displayed on any of the channels. Furthermore, the character generator is sync-locked and therefore is able to display a crawl message over the original program material.

There are a number of reasons why an operator would prefer placing a text messaging system on all channels. First, each channel can be treated as independent. A text message could be used to direct the subscriber to the appropriate details channels. Second, programming would remain intact and the message could be as simple as a text crawl along a portion of the screen.

More mileage

Both the baseband switching and text messaging methods of EAS distribution provide enough flexibility to serve purposes other than EAS. Some of the possible uses include:

- Switching for syndicated exclusivity or sports blackout can be scheduled to automatically switch at the designated time.
- Messages can be displayed on specific channels for pay-per-view or cross-channel promotions.
- New channels or planned channel expansions can be announced (full screen message) on those channels before programming is available.

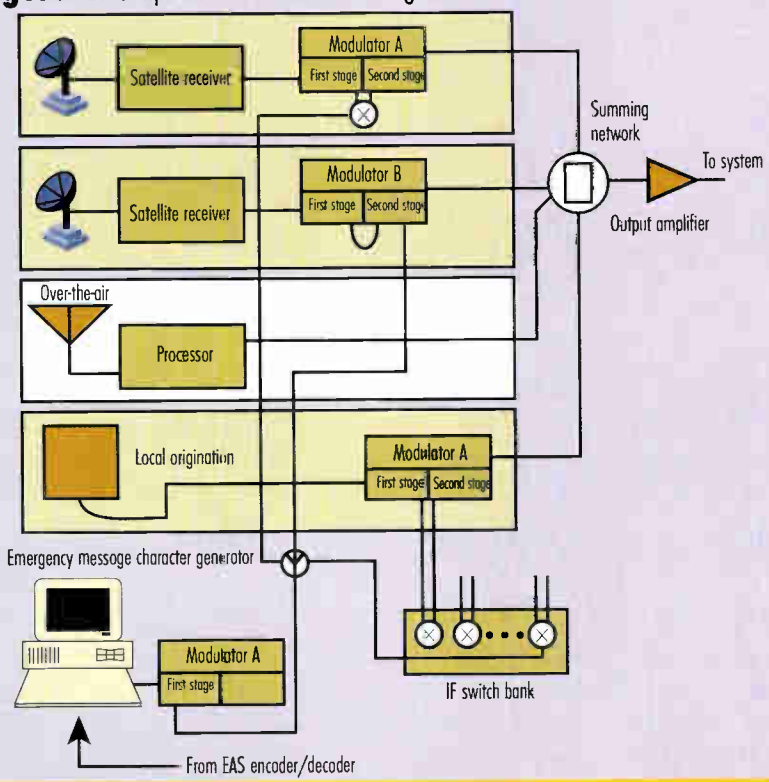
- Messages can be added to inform subscribers of systems information. Informed subscribers don't need call the customer service department.
- If the character generator is capable of displaying a graphic image, then multichannel multipoint distribution service (MMDS) systems can provide channel identification on each channel at intervals specified by government regulations.

EAS reminders

One of the most important points to remember when choosing a method of EAS distribution is that, as an operator, you do not control when the alert is sent. Someone else is given control over the presentation of your system. This is a frightening prospect and one that heretofore has never been a issue to the operator. The best possible solution would be the least disruptive. CT

William G. Robertson is chief technical officer with Frontline Communications. He can be reached at (801) 464-1600 or w.robertson@frontlinecom.com.

Figure 4: Simple four-channel IF switching EAS



The "Right" Stuff

Measuring Signal Levels for Digital Carriers

By Dave Duffield

There are some important considerations in measuring a digital signal's level in the cable plant. Specifically, several methods exist to measure average digital power, many are "right" in their own way, but can yield different answers.

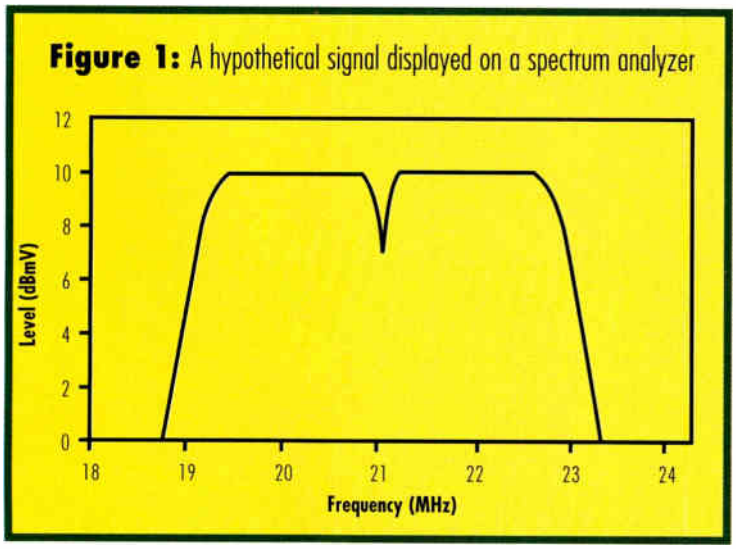
Many new products and revenue opportunities exist for cable operators today. Most of these products use some form of digital signal transmission. Pay-per-view data from an addressable set-top, cable modem data, and digital video all use digital modulation to move from place to place. The user needs to be careful when measuring the level of digital channels. When using test equipment with these signals, technical staff must consider exactly how measurements are taken in order to understand what they really mean.

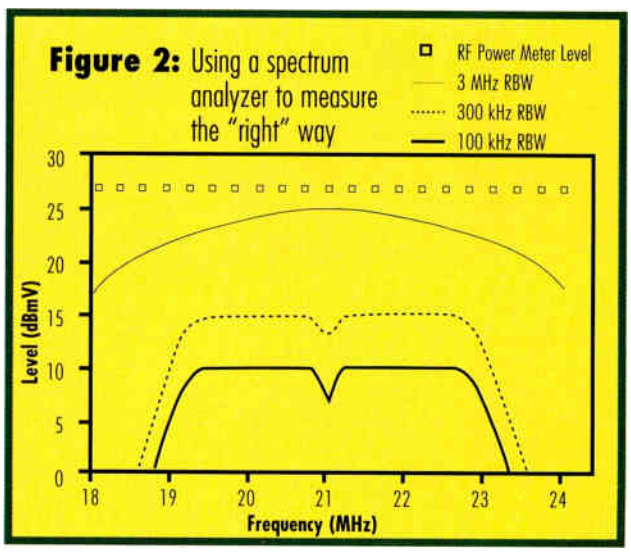
To understand exactly what the "right" answer really means, a user must understand what the effects of any spectrum irregularities might be; what the channel bandwidth is; and what the guardbands are. For the sake of discussion, we will use a hypothetical signal that would display as shown in Figure 1 on a spectrum analyzer with 100 kHz resolution bandwidth (RBW). It occupies a channel from 18 to 24 MHz. This is a combination of attributes from several real signals put together to show all the possible problems in measuring signal level.

The right way

Perhaps the "most right" way to measure a digital channel is to use a precision filter that passes the entire channel, and stops all other frequencies. The output of this filter is then fed into a thermocouple power meter and measured. For our example signal, assuming the filter was perfect, we would get a power reading of +25.9 dBmV. This represents the average power level of all the signal components in the 18 to 24 MHz channel. While this does a wonderful job of handling the uneven spectrum, guardbands, and channel width, it has some severe limitations. We assumed the filter was perfect. A perfect filter is impossible to create. We also would need a separate "perfect" filter for each channel we used. Each one would need to be calibrated to the right bandwidth and frequency. Clearly, this method quickly becomes unfeasible to use in the real world.

Another way to measure a digital signal is with a spectrum analyzer. (See Figure 2.) We could take the highest level measurement seen within the channel, but that varies with analyzer RBW





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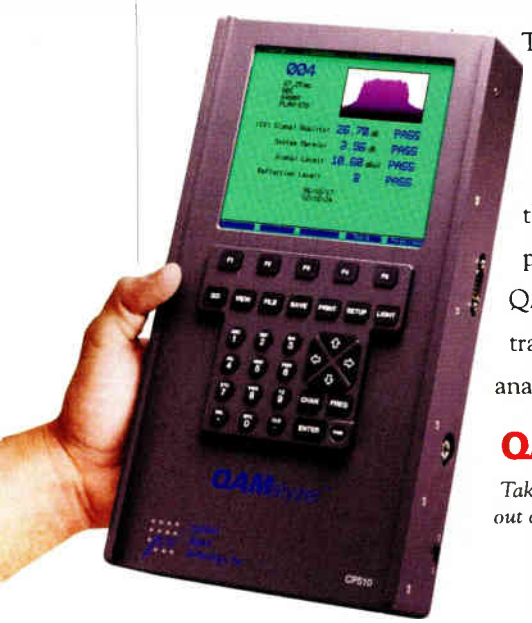

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settings. At 100 kHz RBW, the curve shown in Figure 2 would result. The peak value is +10 dBmV. At 300 kHz RBW, the analyzer would "smooth" the displayed curve. The valley in the center of the channel would be wider and shallower (about 2 dB deep and 500 kHz wide), and the two peaks would be at a level of +14.8 dBmV. At 3 MHz RBW, the valley would disappear and one peak would exist at +24.8 dBmV.

What's going on?

The RBW of the analyzer creates a "window" through which the analyzer looks at the signal. The analyzer adds up and reports all the power it can see through this window. When the window is only 100 kHz wide, the valley of our example can be seen clearly because only a narrow section of frequencies are added together for each point. At 300 kHz, some of the surrounding area is seen. At 3 MHz, the analyzer is looking through a window wide enough that most of the energy in our test signal can be seen all at once. This works properly, as long as the analyzer can use a RBW large enough to see the entire signal we want, but narrow enough so

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Getting a number out of a piece of test equipment to show the level of a digital signal is easy. Getting the right number is a little harder.

Best practices: The "most right" way to measure a digital channel is to use a precision filter that passes the entire channel, and stops all other frequencies. Another method to measure digital signals is to use a known bandwidth RF receiver, slice the channel into small pieces that are each one bandwidth wide, and then step through the entire spectrum to get an accurate measurement.

To accurately measure a digital carrier, you need to understand both the how the equipment works, and what the characteristics of your signal are.

Important things to know about the test equipment:

- What is the resolution bandwidth for the measurement?
- Does it use one measurement, or several "slices" to get its reading?
- How big is a "slice"?

Important things to know about the signal:

- What are the channel spacings, guardbands and signal bandwidths?
- What is the spectrum shape within the transmitted signal?

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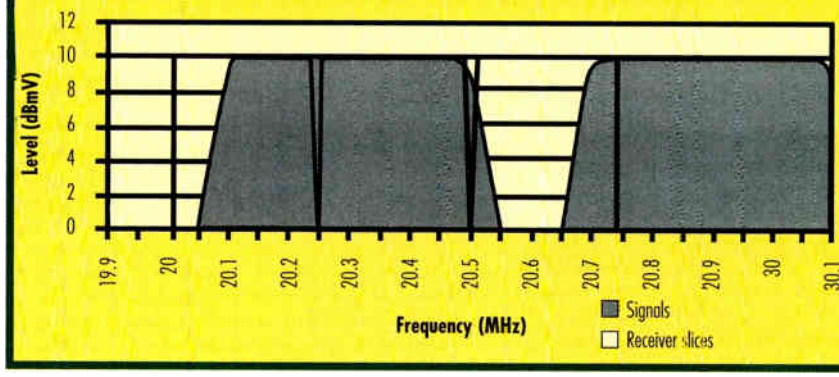
Figure 3: RF slicing of 600 kHz "channel"



that it does not see anything from any adjacent channels. Frequently, however, this is not possible. To measure our test signal, a RBW between 4 and 6 MHz would get us fairly close to the right answer, but most spectrum analyzers limit RBW to 3 MHz maximum.

How to fix it?

So how do we fix the problem? If the relative levels across the channel stay the same, then we can calculate an offset to add to what the spectrum analyzer measures and compensate for the energy spectrum that is not within the RBW. The simplest method would just be to scale up the result assuming the spectrum has the same level across the band. The formula for this would be:

Compensation = 10 x $\log_{10}$(Channel BW/Resolution BW)

For 100 kHz (relative to a 6 MHz channel BW), this is 17.8 dB, for 300 kHz, it is 13 dB, and for 3 MHz, it is 3 dB. This would change our measurements to 27.8 dBmV for all three spectrum analyzer measurements. Now we're too high, though. The simple calculation of compensation uses the whole channel width. As can be seen, the guardbands, "skirts," and the center of the digital signal are lower in power than the most of the channel we are measuring.

By doing a little more work, a better compensation factor can be derived. Performing the bandpass filter/power-meter measurement, analyzing the ideal signal on a computer, or using a digital signal processor (DSP) spectrum analyzer can create a better compensation adjustment. If the relative spectrum levels are always the same and the measurement is always taken at the same frequency within the channel, then using this compensation factor will work properly. Even if the measurement is taken in the middle of the valley of our example, the offset from the total-power level will always be constant.

Many lower-priced digital signal level meters (SLMs) use an RF voltmeter that has a known RBW and the scaling factor as outlined previously. In fact, some meters build in the ability to calculate the full-channel compensation automatically. Unfortunately, the relative spectrum across the channel frequently is not the same. In fact, this may be the very problem we are trying to find with the test equipment.

Another method

A much better way to measure digital signals is to use a known bandwidth RF receiver, slice the channel into small pieces that are each one bandwidth wide, and then step through the entire spectrum to get an accurate measurement. This is the method used by most premium digital-capable SLMs. It has the advantage of being feasible in a field meter and producing an accurate result. It does, however, still have some shortcomings. First, it is slower because many measurements are required. Second, it may not always be possible to slice up a channel evenly. This is most significant on narrow channels. These typically have smaller guardbands, and each extra "slice" makes a much larger difference in the measured value.

As an example of this uneven slicing problem, assume the signals to be

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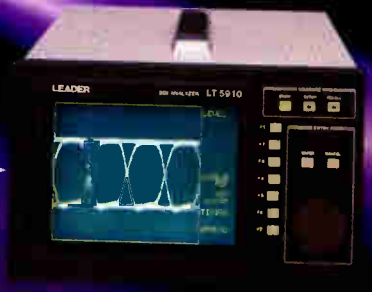

Whether you are testing SDI transport path, verifying digital video protocol or performing quality assurance checks on program material, Leader's new "Digital Detectives" are a dynamic solution for meeting SDI testing needs. Designed to operate in today's "transition" environment where analog and digital are present, these advanced design instruments provide superior flexibility and ease of use for quick, painless transition from analog to digital. Yes, each "Digital Detective" is a stand-alone product, but...the sum is greater than the parts!

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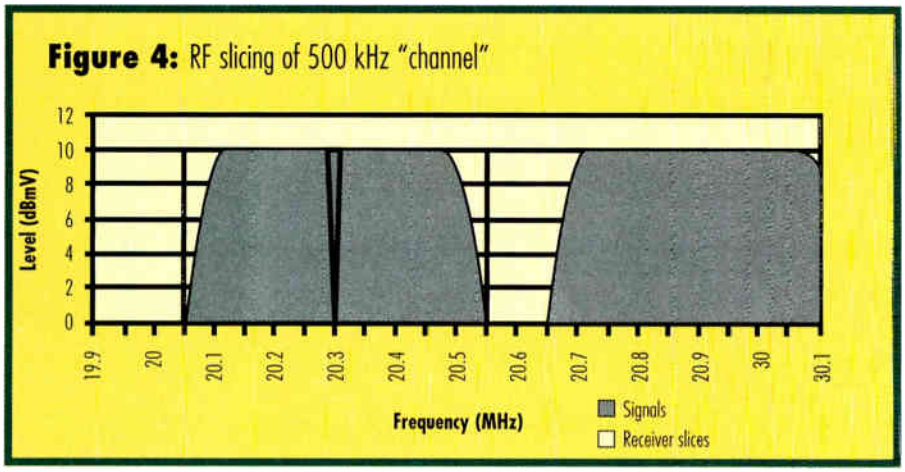

measured are at 600 kHz spacing with 50 kHz internal guardbands on each side, and the RF "slices" are 250 kHz each. If the meter is programmed with a 600 kHz channel centered at 20.3 MHz, it needs to take three slices to cover the band completely, and measures a total bandwidth of 750 kHz. If there is a guardband next to the signal to be measured, this is OK, but extra power may be measured if another signal is in the next 600 kHz channel space. This situation is shown in Figure 3 on page 82.

The safest way to measure power with one of these meters is to set the digital channel width to the actual bandwidth of the carrier to be measured (excluding the internal guardbands). This will minimize any extra RF bandwidth that might be scanned, although it will not add in the power from any noise source that may be in the guardband of the channel. In our second example of 600 kHz channel spacing, this would be a signal centered at 20.3 MHz with a bandwidth of 500 kHz. The resulting slices are shown in Figure 4.

Use care

Be very careful when setting up to make level measurements for digital carriers. At a minimum, the person responsible for setting up the channel plan for SLMs needs to understand what the signal characteristics are, and exactly how his particular equipment works. Taking the obvious approach may lead to incorrect readings and alignments. Ask your supplier how its equipment makes digital measurements if you want to avoid headaches later. CT

Dave Duffield is a product marketing manager for Wavetek's Stealth product line. He can be reached by e-mail at david.duffield@wavetek.com, or by phone at (317)781-3499.

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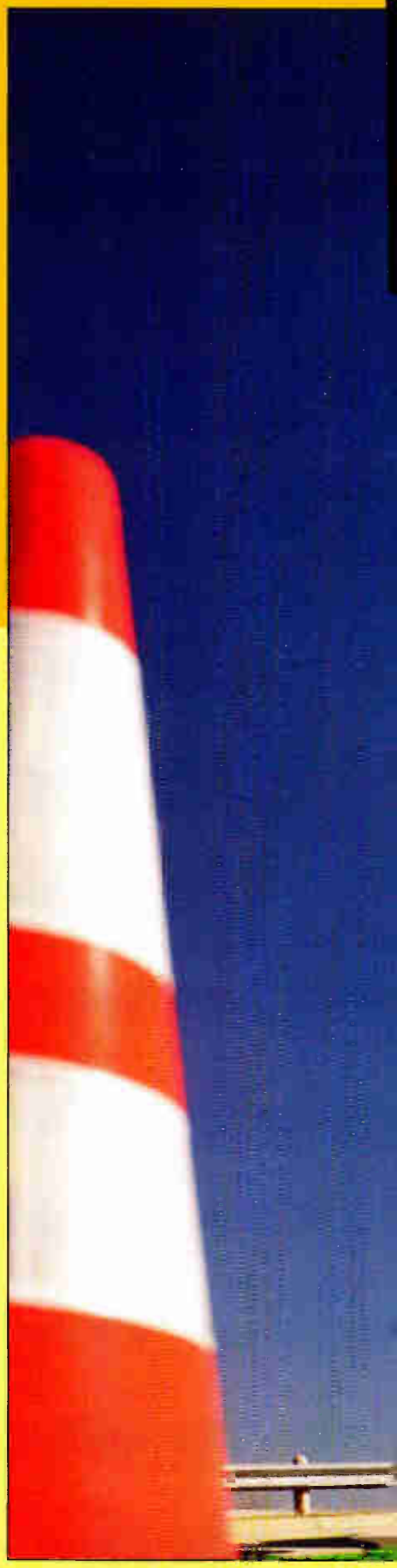

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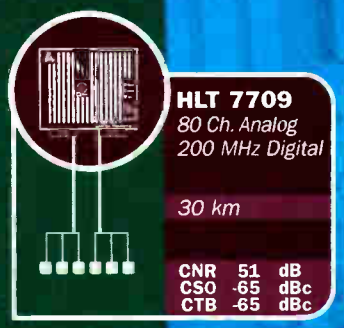

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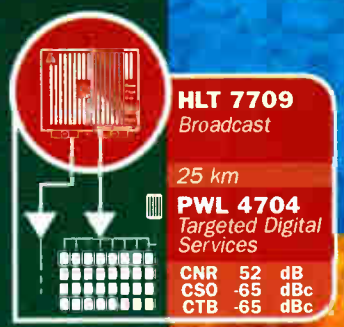

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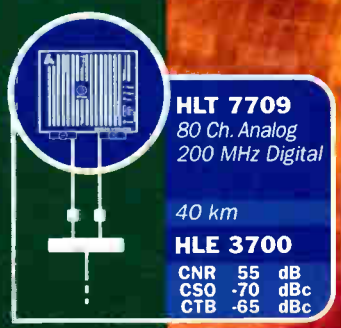

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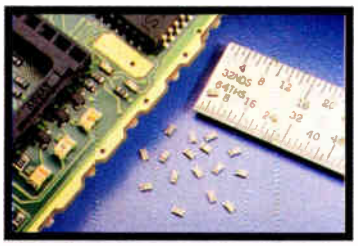

Surface Mount Fuse Ratings Increased

Littelfuse Inc. has expanded the available ratings for its thin-film mount fuse. The fuse's current ratings range from 1/4 to 5 amperes at 32 volts. The Littlefuse 0603 SMF incorporates high reliability thin-film processing techniques to ensure consistent performance in its sub-miniature package.

Reader service #310

Compression Assembly Tool

The compression assembly tool (CAT) for 6 and 59 series compression connectors is now available from Ripley Co. The tool is designed to provide a clear view of the connector assembly compression action. The CAT is lightweight with spring-loaded, split jaws to position the cable and connector for ease of insertion and removal. Tools are available for the following 6 and 59 series connectors: CMP: Production Products Co, EZF: Raychem, Push/Pull and SPL: Stirling Connectors, Snap-n-Seal: Thomas & Betts and TAC: Gilbert Engineering Co.

Reader service #305

Fiber Splice Enclosure

ANTEC Network Technologies, the manufacturing division of ANTEC Corp., has unveiled MaxPak, the newest addition of the company's FiberPak family of fiber splice closures. The MaxPak is a high fiber count butt configuration style splice closure. The addition to the FiberPak line allows users to utilize the right closure for specific applications providing maximum value for each splice location. The closure houses up to 216 single-fusion splices or 432 ribbon fiber splices.

Other features of MaxPak include: individually sealed ports to add cables without disturbing previously installed cables; built-in fiber splitting and storage areas to facilitate fiber transition and midspan storage; and flame-retardant plastic for use in indoor applications.

Reader service #301

Customer Premise Enclosures

The customer premise enclosures for splicing and termination of fiber-optic cable, developed by TII-Ditel, a division of TII Industries Inc., are available in two sizes. The enclosures may be used to directly terminate or splice to outside plant or intra-building cable. The CPE-12 accommodates up to 12 fibers, while the CPE-24 accommodates up to 24. A two-sided design provides separation between the service provider and customer sides. Units come standard with a lock and key for the service side, while the customer side is accessible via a captive push/pull fastener.

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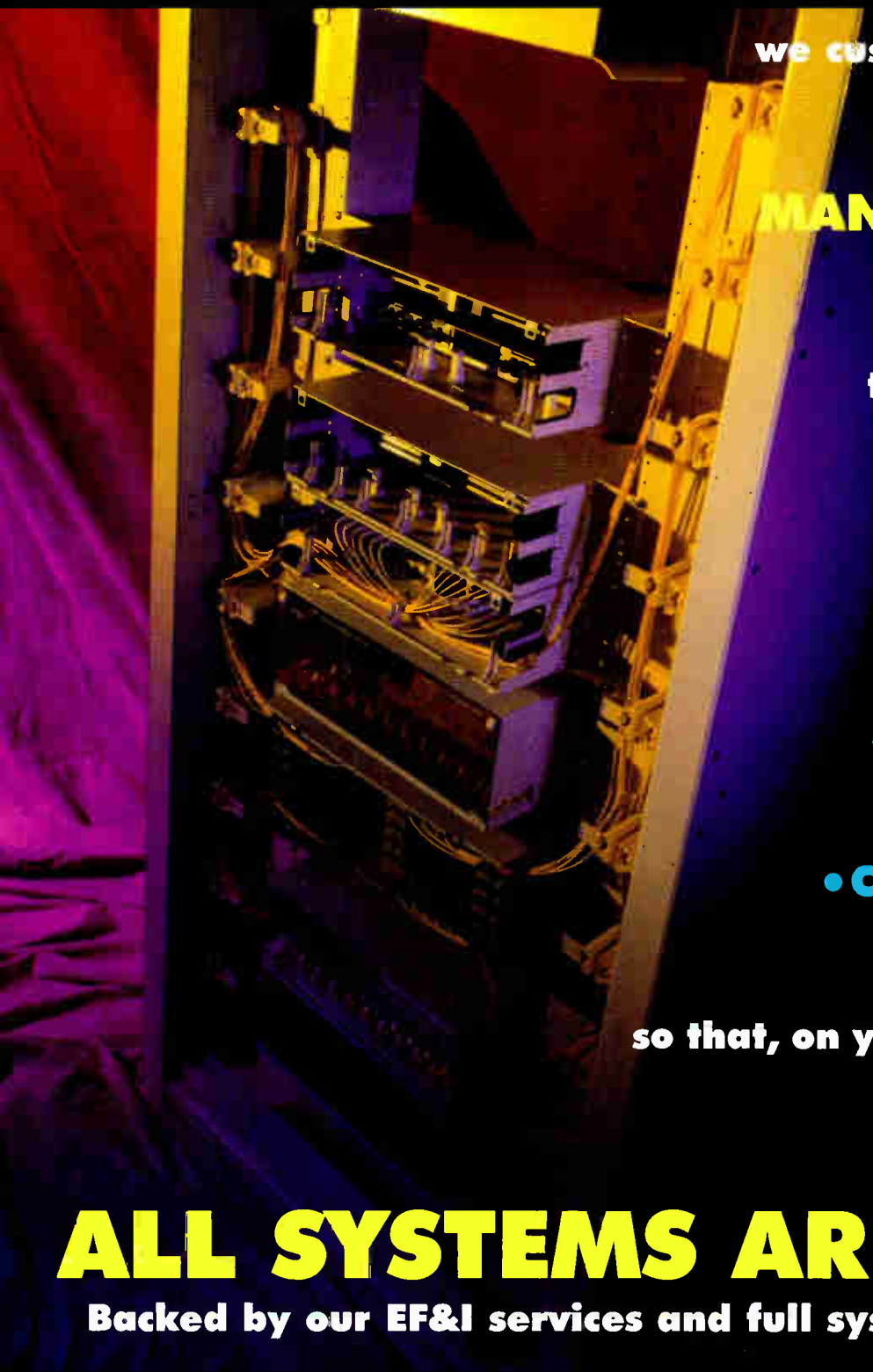

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Reader Service Number 4

Tracing System

Siecor Corp. has introduced its SearchLite tracing system that allows for identification of the origin and termination points of traceable fiber-optic patch cords in central office applications. The system can be used to locate patch cords in Siecor's FiberManager (FMS) family of products or in other distribution frames.

The unit can be held in the palm of the hand or mounted to a distribution frame. SearchLite uses a replaceable 9-volt battery that provides over 50 hours of continuous operation. A magnet on the back of the unit allows the SearchLite tracing system to be easily attached to a metal frame while testing.

Reader service #303

Ready-to-Use HFC Kit

Stanford Telecommunications' STEL-9252 upstream modulation/demodulation kit is now available for evaluation and testing of its modulator and demodulator products designed for hybrid fiber/coax (HFC) systems. The kit provides a matched-feature set of products for pretrial testing and verification of performance in HFC upstream transmission applications. It contains the STEL-1109 burst modulator and STEL-1209 modulator evaluation assembly, the STEL-9257 headend demodulator, interface board, cabling, PC-based software, and instructions.

Reader service #308

Network Power Protection

Exide Electronics Group has announced a new generation of cable TV network power protection with the Lectro ZTT/Plus (zero transfer time) uninterruptible power system. The product contains a digital microprocessor and ruggedized transformer for reliability, enhanced user interface and improved overload capabilities for cable and broadband networks.

The Lectro ZTT/Plus is available in 120 VAC, 60 Hz and 60/90 VAC output versions. The product also uses a charging topology that maximizes battery life by adjusting charging levels according to environmental conditions.

Reader service #304

Message System Has New Fonts

FrontLine Communications has announced the availability of 28 new fonts for its All Channel Message (ACM) system. The new font selection allows users to create more stylized and unique looks for their scrolling messages and pages and is useful in applications for community bulletin boards and cross-channel promotion.

Reader service #306

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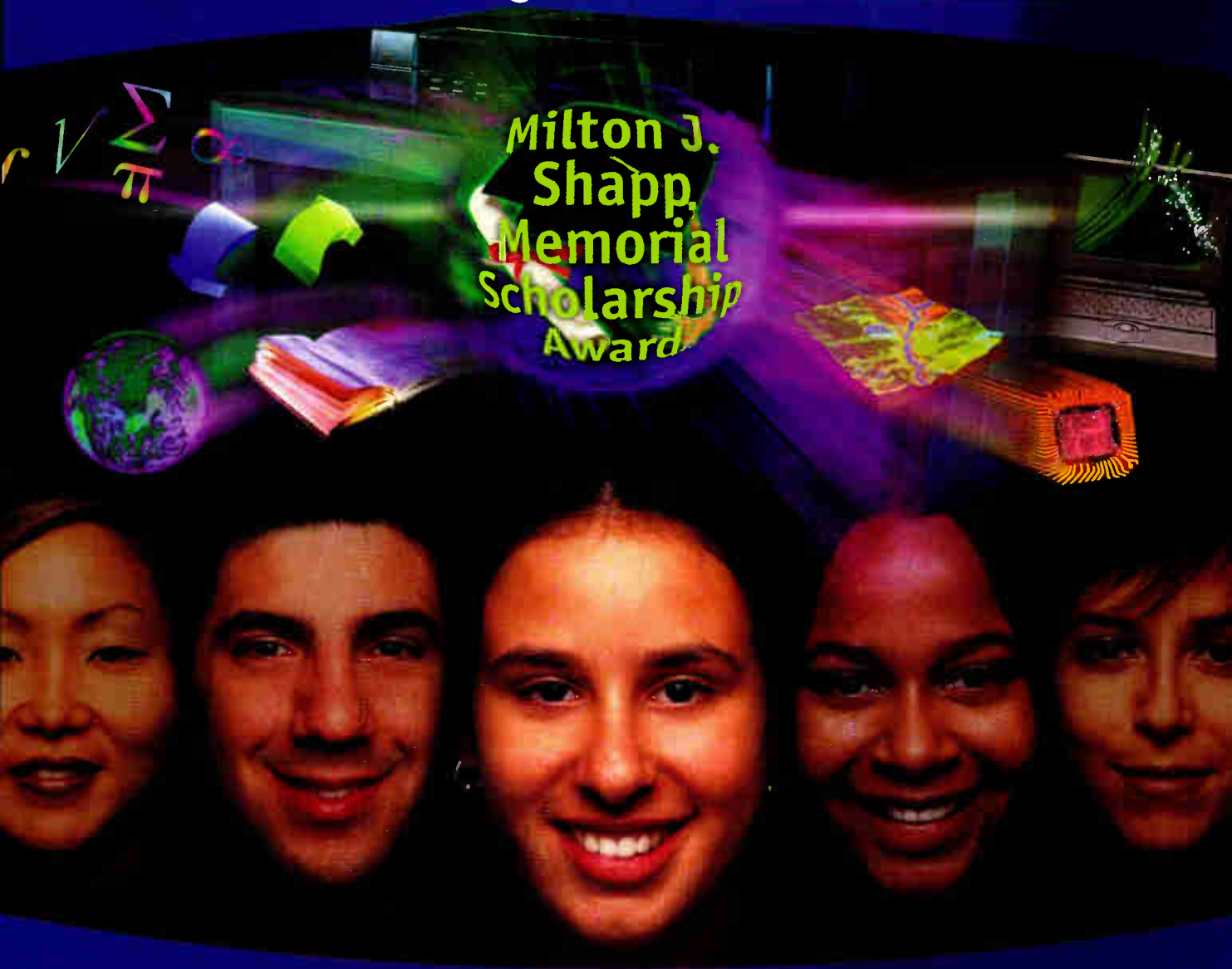

Personal Achievement

We congratulate Erin R. Sandifer, the 1997 winner of the Milton Jerrold Shapp Memorial Scholarship award. Erin is a recent graduate of Carlisle High School, where she ranked in the top 5% of her class and is a member of the National Honor Society.

The spirit of achievement and the drive to excel begins at a young age. We believe it's critical to give young people our guidance and encouragement... to open their eyes to their own potential. That's why we support our youth in as many ways as possible.

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and Where It All Starts.

It's never too early to inspire children to think about their future. That's why we embrace programs like "Bring Your Daughters - and Sons - To Work". And before long, they'll be able to teach us a thing or two.

Imagination and creativity are already evident in these works of art by the young ladies who visited us on "Bring Your Daughter To Work Day."

NEXTLEVEL™
Broadband Networks Group
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Cable, DBS Management System

Columbine JDS has released a totally integrated management information system that electronically links all critical business processes of cable network or direct broadcast statellite (DBS) operations (including ad sales, programming, traffic, finance and master control animation). Paradigm includes a suite of functions for cable networks, DBS and other multichannel environments by integrating all business processes in a single relational database. At the center of the Paradigm solution is the Traffix module. Up-to-the-minute data is available on a real-time basis to anyone in the organization who needs it, from sales representatives and program schedulers to billing personnel.

Reader service #300

Video Signal Tester

Kramer Electronics has produced the video tester, a pocket-sized video signal tester that eliminates the need to carry an oscilloscope, vectorscope or waveform monitor to trace and rectify bad video connections, cable breaks or faulty sources that can destory a video signal.

The battery-operated device comes in a "beeper"-type enclosure with a pocket clip. The tester traces missing signals, distinguishes between accepted and jittery (VCR sourced) signals, and identifies the presence of good signals by pressing a one-touch switch. It also checks for sync and odd/even data in the signal, and isn't triggered by noise, hum or a 15 kHz nonvideo source.

Reader service #298

HDSL Modem

Telebyte Technology's new HDSL (high-speed digital subscriber line) product, a T-1/E-1 modem, was designed for high-speed transmission of synchronous data. The Model 681 for T-1 rates and the Model 682 for E-1 rates reach distances over 12,000 feet with a high degree of data reliability using 2B1Q signaling technology.

Reader service #309

Cable Pulling Lubricant

American Polywater has introduced Network Loop lubricant, a liquid lubricant formulated for the unique requirements of network cabling.

The product is a silicone-enhanced lubricant recommended for use with all types of communications cable, including copper, fiber-optic and coaxial. Network Lube is a clean, slow-drying pulling compound that offers friction reduction and universal compatibility on all known communication cable types.

Reader service #302

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B. Please check the category that best describes your firm's primary business (check only one):

Cable TV Systems Operations combined

03. ❑ Independent Cable TV Systems
04. ❑ MSO (two or more Cable TV Systems)
05. ❑ Cable TV Contractors
06. ❑ Cable TV Program Networks
07. ❑ SMATV, DBS Operator
08. ❑ MMDS, STV or LPTV Operations
9A. ❑ Microwave
9B. ❑ Telecommunications Carrier
9C. ❑ Electric Utility
9D. ❑ Satellite Manufacturer
9E. ❑ Satellite Distributor/Dealer
9F. ❑ Fiber-Optic Manufacturer
10. ❑ Commercial TV Broadcasters
11. ❑ Cable TV Component Manufacturers
12. ❑ Cable TV Investors
13. ❑ Financial Institutions, Brokers & Consultants
14. ❑ Law Firm or Govt. Agencies
15. ❑ Program Producers, Distributors and Syndicators
16. ❑ Advertising Agencies
17. ❑ Educational TV Stations, Schools and Libraries
18. ❑ Other (please specify) _____

C. Please check the category that best describes your job title: (check only one)

19. ❑ Corporate Management
20. ❑ Management
21. ❑ Programming

Technical/Engineering

22. ❑ Vice President
23. ❑ Director
24. ❑ Manager
25. ❑ Engineer
26. ❑ Technician
27. ❑ Installer
28. ❑ Sales
29. ❑ Marketing
30. ❑ Other (please specify) _____

D. Which one of the following best describes your involvement in the decision to purchase a product/service? (check only one)

31. ❑ Recommend
32. ❑ Specify
33. ❑ Evaluate
34. ❑ Approve
35. ❑ Not involved

PLS-125™, PLS-225™, PLS-220™ Power Line Surge Suppressors

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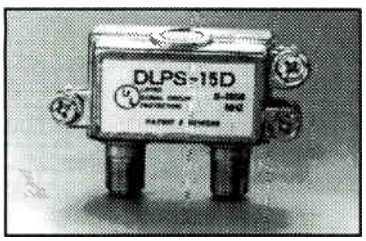
Reader Service Number 301



DLPS-15D™ Drop Line Power Suppressor

Developed and patented by Cable Innovations, the 1 Ghz., UL approved DLPS-15D protects drop line electronics from damaging faults due to surges, transients, spikes, and lightning. The DLPS-15D, using dual direction Sidactor technology, protects both directions (from the house and into the house). With a trigger sensing time of one nanosecond, the DLPS-15D will virtually eliminate damage to drop line electronics caused by overvoltages.

If you are currently using Zener diodes, gas discharge tubes, MOV's or just a ground block, you are taking unnecessary risks with your equipment and with your subscriber's electronics. The DLPS-15D offers a longer life, greater current handling capacity and faster response than any other type of protection.

Reader Service Number 302

DLPS-15DF™ High Pass Filter/Drop Line Power Suppressor

The DLPS-15DF is an essential ingredient in achieving the reliability and subscriber satisfaction necessary in those systems that need to eliminate return path noise and protect both their equipment and the subscriber's electronics.

The DLPS-15DF offers the same suppression as the DLPS-15D, taking any overvoltage directly off the center conductor and zapping it to ground instantaneously before any damage can occur to cable line electronics or the subscriber's electronics.

The DLPS-15DF offers a wider and deeper filter, longer life, greater current handling capacity and faster response than any other type of protector/filter.

Reader Service Number 303

GB-401™ Direct Pickup Filter

Eliminates ghosting and diagonal lines due to direct pick problems The GB-401 (Ghost Buster) is a patented filter used to solve direct pickup problems caused by cable ready TV's and VCR's (ghosting & diagonal lines). A high percentage of "cable ready" televisions and VCR's are manufactured with a shielding deficiency problem. Most brandnames and models are susceptible to this problem, regardless of how new or expensive the set is. These poorly shielded units may experience degraded picture quality because strong local TV signals get into the tuner and mix the cable signals inside the set. When a television receives two channels at once, the picture will have interference in the background. The GB-401 eliminates this problem.

Reader Service Number 304

The 99.99% Reliability Factor

[Cable Innovation's CLPS-4065 Surge Suppressor]

Cable Innovations surge suppression products are an essential ingredient in achieving the 99.99% reliability necessary in CATV systems today. The CLPS-4065 and CLPS-4065PI (power inserter), patented surge suppression technology, protects trunk line and feeder line electronics from overvoltages, and virtually eliminates overvoltage related outages. The CLPS-4065 and CLPS-4065PI are simply the very best surge suppressors available. If you're concerned about the reliability of your system, call us today.

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Reader Service Number 75

See the Cable Innovations Showcase Products on this page!

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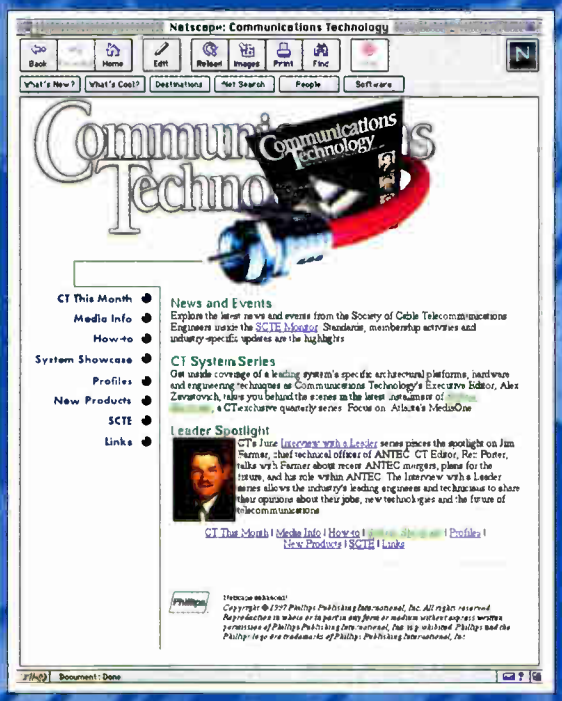

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Handling Leakage

By Ken Eckenroth

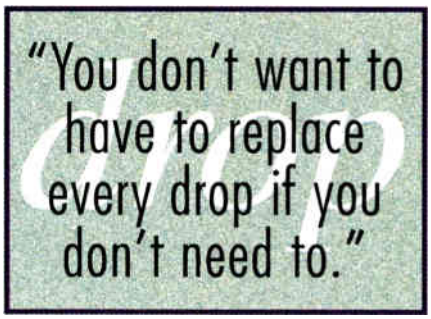
Flashback: In the early '80s, a 300 MHz, dual, pay-per-view capable, two-way plant with status monitoring is built. It was touted as state-of-the-art. However, this system was ahead of its time. It was destined to fail. Signal leakage laws were not yet implemented. Bridger gates were wide open, introducing cumulative ingress from all the distribution. Return techs were constantly chasing PSK (phase shift keying) lock-ups from noise. Customers would receive free PPVs during these return outages.

1990: Federal Communications Commission leakage laws were implemented. This is the beginning of the answer. The FCC mandates that 20 µV/m leaks and higher be searched for every 90 days and repaired.

1995: Tagging systems are introduced. Finally, a reliable way to identify leakage. Software and hardware can now do what the human ear was responsible to sort out. Also, the speed and sensitivity of tagging systems provides an exceptional tool for finding leaks as low as 1 µV/m.

1997: Competition is fierce from direct broadcast satellite (DBS) systems. Subsequently, terrestrial cable operators are rapidly deploying digital systems. These systems must be protected from ingress. This is an entirely new ballgame. We are now in an age where 99.99% reliability is the ideal goal to be achieved. An analogy is the old days of -15 dB signal at the subscribers' set and the resulting snowy picture being labeled a nonoutage are over. There are more robust return modulation techniques these days to choose from, but like most things, they will operate to a popint where they drop off. The full service network can ill afford an outage caused by Digital Broadband Enemy Number 1—ingress.

Ingress would not be a problem in a perfect world. A perfect world with a quiescent environment. Electropollution would not exist in this perfect world. Impulse noise would just be a rumor. Power line noise would be unheard of. Extraneous broadband RF would not be a problem. Now where in the United States could this place exist? Maybe in an Amish community in Pennsylvania. However, a problem jumps right out at you: There are no paying customers there. The opposite of this perfect world might be a place like Las Vegas. Impulse noise is everywhere. I suppose if you could get a full service network with a 99.99% reliability rate in Vegas, you could do it anywhere. So we could conclude from this that Las Vegas is not a perfect world (unless you are good at counting cards), but it is a perfect test bed.



It's easy to get discouraged about the subject of RF electropollution. Realistically, we know it will never go away. However, we can be encouraged to see improvements on the horizon. The FCC is requesting comments on the best method to extend signal leakage limits for satellite master antenna TV systems (SMATVs) and multiple dwelling units (MDUs).

Once we've accepted the fact that RF electropollution will never go away, we can concentrate on the task at hand: Controlling ingress. This is not an impossible task. It just takes an aggressive leakage program for ingress and egress. There are many tools, old and new, for just such a program. The new one, that I would place at the top of the list is tagging systems. With such a tool at a customer's disposal, he can categorize his plant for degrees of aggressive patrol. Obviously, if you have an older system, you will have to fix your leaks 20 µV/m and above before looking for the lower level leaks. But, if you have brand new plant that has just been turned over to you, inspect it closely for low level leakage. This also will probably be great construction quality check to determine if the contractors are using proper torque on the hardline cable connectors. Also, once you have a tight plant, patrol it to keep it a tight plant.

Another tool that is available is the RF meter engineered to test the drops for ingress. Here's how it works: A signal is injected on one side of the drop and measured at the other. This makes a lot of sense economically because you don't want to have to replace every drop if you don't need to. The backbone plant can be rebuilt and the drops dealt with later. As in any huge job, you must prioritize your tasks.

It is a smart idea to place blocking filters on every drop at the tap. The majority of noise comes from the home. That way, operators can clean up each drop as they subscribe to two-way service while they concentrate on the trunk and feeder. That makes good economic sense.

A tool that has been around for years, but could probably use some emphasis is analyzing your leakage cause codes. Every 90 days, the feedback from repairing your leaks is extremely valuable data. You could be installing defective connectors and are just about to install several more. Look at your most common repair items and constantly search for ways to minimize them. CT

Ken Eckenroth is vice president of technology for Cable Leakage Technologies. He can be reached at (214) 907-8100.

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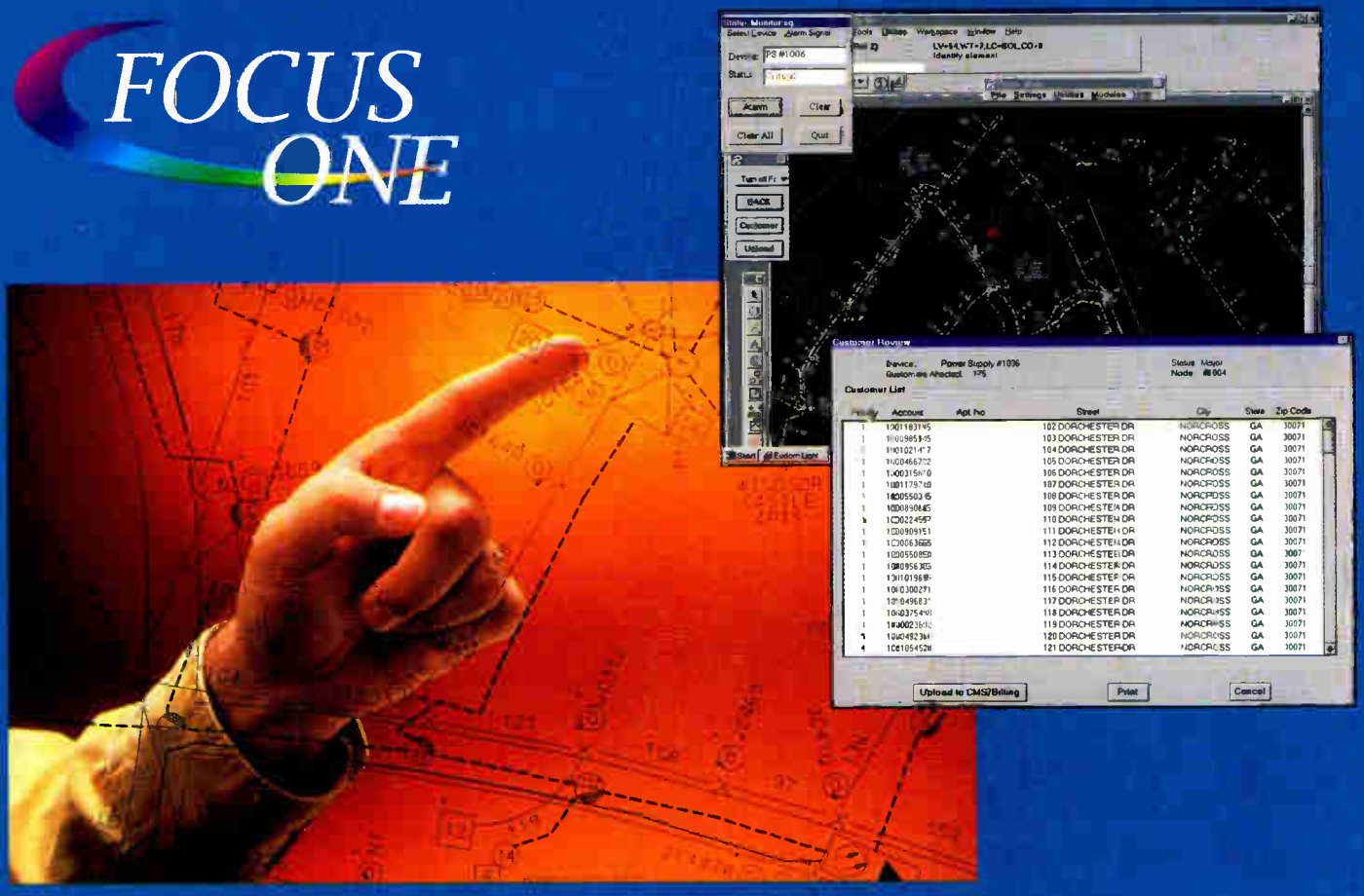

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CALENDAR

October

1: SCTE Ark-La-Tex Chapter, technical seminar, "System Towering and Surge Protection." Contact: Terry Temple, (318) 631-3322.

1: SCTE Gateway Chapter, technical seminar, "Vendor Day," Comfort Inn, St. Louis, MO. Contact: Chris Kramer, (314) 579-4627.

1: SCTE Great Plains Chapter, testing session, BCT/E and Installer certification exams to be administered. Bellevue, NE. Contact: Herb Dougall, (402) 597-5666.

6: The Light Brigade training course for installers, maintenance personnel and engineer designers, "Introduction to Fiber Optics—the Basics," course. Contact (800) 451-7128.

6-7: Society of Cable Telecommunications Engineers regional training seminar, "Introduction to data communications," Toronto, Canada. Contact SCTE National Headquarters, (610) 363-6888.

7-8: SCTE Wheat State Chapter, testing session, BCT/E certification exams to be administered. Wichita, KS. Contact: Vicki Marts, (316) 262-4270.

8-10: Society of Cable Telecommunications Engineers regional training seminar, "Introduction to Fiber Optics," Toronto, Canada. Contact: SCTE National Headquarters, (610) 363-6888.

8: SCTE Bluegrass Chapter, technical session, "Quality Installations," Frankfort, KY. Contact: Max Henry, (502) 435-4433.

9: Society of Cable Telecommunications Engineers Satellite Tele-Seminar Program, "Return Spectrum Issues (Part Two)", Galaxy 1R, Transponder 14, 2:30-3:30 pm. Eastern Time. Contact: SCTE National Headquarters, Janene Martin, (610) 363-6888, ext. 220.

8-10: Private & Wireless Show, Dallas. Contact JoAnn Vysocky, (713) 975-0030.

14-16: Mid-America Cable Show, Kansas City. Contact (913) 841-9241.

16: Interop NetSwitch '97 Tour, Denver. Contact (800) 506-9517.

17: Tektronix's seminar series on emerging video and telecommunications technologies, Toronto, Ontario. Contact (800) 763-3133.

20-21: Society of Cable Telecommunication Engineers regional training seminar, "Introduction to Telephony," Minneapolis, MN. Contact: SCTE National Headquarters, (610) 363-6888.

20-22: Eastern Cable Show, Atlanta. Contact Southern Cable Television Association, (404) 255-1608.

20-22: 20th Annual Newport Conference on Fiberoptics Markets sponsored by KMI Corp., Newport, RI. Contact Carole McCormick, (401) 849-6771; e-mail: kmi@ids.net.

22-24: Society of Cable Telecommunications Engineers regional training seminar, "Introduction to Fiber Optics," Minneapolis, MN. Contact: SCTE National Headquarters, (610) 363-6888.

27-29: SCTE Rocky Mountain Chapter 2nd annual Cable TEC symposium, Ft. Collins, CO. Contact Hugh Long, (303) 603-5236.

Planning Ahead

Dec. 26-28: Southern Cable Telecommunications Association's 1998 Eastern Show, Orlando, FL. Contact Patti Hall, (404) 255-1608.

Jan. 8: SCTE Satellite Tele-Seminar Program, "Data Over Cable (Part Two)," Galaxy 1R, Transponder 14, 2:30-3:30 pm. Eastern Time. Contact: SCTE National Headquarters, Janene Martin, (610) 363-6888, x220.

Jan. 28-30: SCTE Conference on Emerging Technologies, San Antonio, TX. Contact: SCTE National Headquarters, (610) 363-6888.

May 12-14: Pacific Equipment & Technology Expo, Orlando, FL. Contact Robert Morock, (800) 525-7383.

November

3: Tektronix's seminar series on emerging video and telecommunications technologies, Gaithersburg, MD. Contact (800) 763-3133.

4: SCTE West Virginia Mountaineer Chapter, technical seminar, South Charleston, WV. Topic and speakers to be announced. Contact: Steve Johnson, (614) 894-3886.

5: SCTE Great Plains Chapter, technical seminar, . "Test Equipment" with speakers to be announced, Bellevue, NE. Contact: Herb Dougall, (402) 597-5666.

5: SCTE Mid–South Chapter, testing session, installer certification exams to be administered., Memphis, TN. Contact: Kathy Andrews, (901) 365-1770 x4110.

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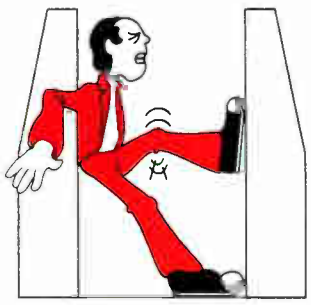

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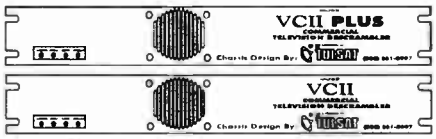

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engineer designers, "Introduction to Fiber Optics—the Basics," course. Contact (800) 451-7128.

12: SCTE Old Dominion Chapter, technical seminar and testing session, "Annual Membership Meeting, Data Communications and BCT/E Tutorial - Category V, Data Networ ing," with speakers to be announced BCT/E and Installer certification exams to be administered, Richmond, VA. Contact: Margaret Fitzgerald, (800) 231-0237.

13: Society of Cable Telecommunications Engineers Satellite Tele-Seminar Program "Fiber-Related Issues," Galaxy 1R, Transponder 14, 2:30-3:30 pm. Eastern Time. Contact: SCTE National Headquarters, Janene Martin, (610) 363-6888, ext. 220.

15: SCTE Cascade Range Chapter, testing session, Salem, OR. BCT/E certification exams to be administered. Contact: Betty Reed, (360) 891-3295.

17-18: Wireless Cable Association International's 4th annual technical symposium, San Diego, CA. Contact (202) 452-7823.

17-18: Society of Cable Telecommunications Engineers regional training seminar, "Introduction to Telephony," Sacramento, CA. Contact: SCTE National Headquarters, (610) 363-6888.

19-20: Society of Cable Telecommunications Engineers regional training seminar, "Introduction to Data Communications," Sacramento, CA. Contact: SCTE National Headquarters, (610) 363-6888.

December

2: 1997 CDMA North AmericanRegional Congress, Orlando, FL. Contact (619) 535-8252.

2: The Light Brigade training course for installers, maintenance personnel and engineer designers, "Introduction to Fiber Optics—the Basics," course. Contact (800) 451-7128.

2-4: Converging Technologies Expo & Conference, Los Angeles. Contact John Golicz, (203) 256-4700, ext. 121.

3: SCTE Great Plains Chapter, testing session, . BCT/E and Installer certification exams to be administered. Bellevue, NE. Contact: Herb Dougall, (402) 597-5666.

3: SCTE Heart of America Chapter, technical seminar, "Cable Modems/Local Internet Projects," "DBS/HITS Update," and "Digital Compression Update" with speakers to be announced, Jones Intercable Technical Center, Independence, MO. Contact: Ken Covey, (816) 795-8377.

3: SCTE Smokey Mountain Chapter, technical seminar, "Vendor Show," Johnson City, TN. Contact: Roy Tester, (615) 878-5502.

4: SCTE New England Chapter, technical seminar, Topic and speakers to be announced, Boxborough, MA. Contact: Tom Garcia, (508) 562-1675.

10-12: The Western Show, Anaheim, CA. Contact the California Cable Television Association, (510) 428-2225.

11: Society of Cable Telecommunications Engineers Satellite Tele-Seminar Program, "Data Over Cable (Part One)," Galaxy 1R, Transponder 14, 2:30-3:30 pm. Eastern Time. Contact: SCTE National Headquarters, Janene Martin, (610) 363-6888, ext. 220.

11: SCTE Delaware Valley Chapter, technical session, "Troubleshooting the New System (Digital, 2-way, HFS)," Horsham, PA. Contact: Chuck Tolton, (215) 961-3882.

11: SCTE Music City Chapter, testing session, BCT/E and Installer certification exams to be administered, Nashville, TN. Contact: Ken Long, (615) 244-7462 ext. 319.

17: SCTE New England Chapter, testing session, installer certification exams to be administered, Worcester, MA. Contact: Tom Garcia, (508) 562-1675.

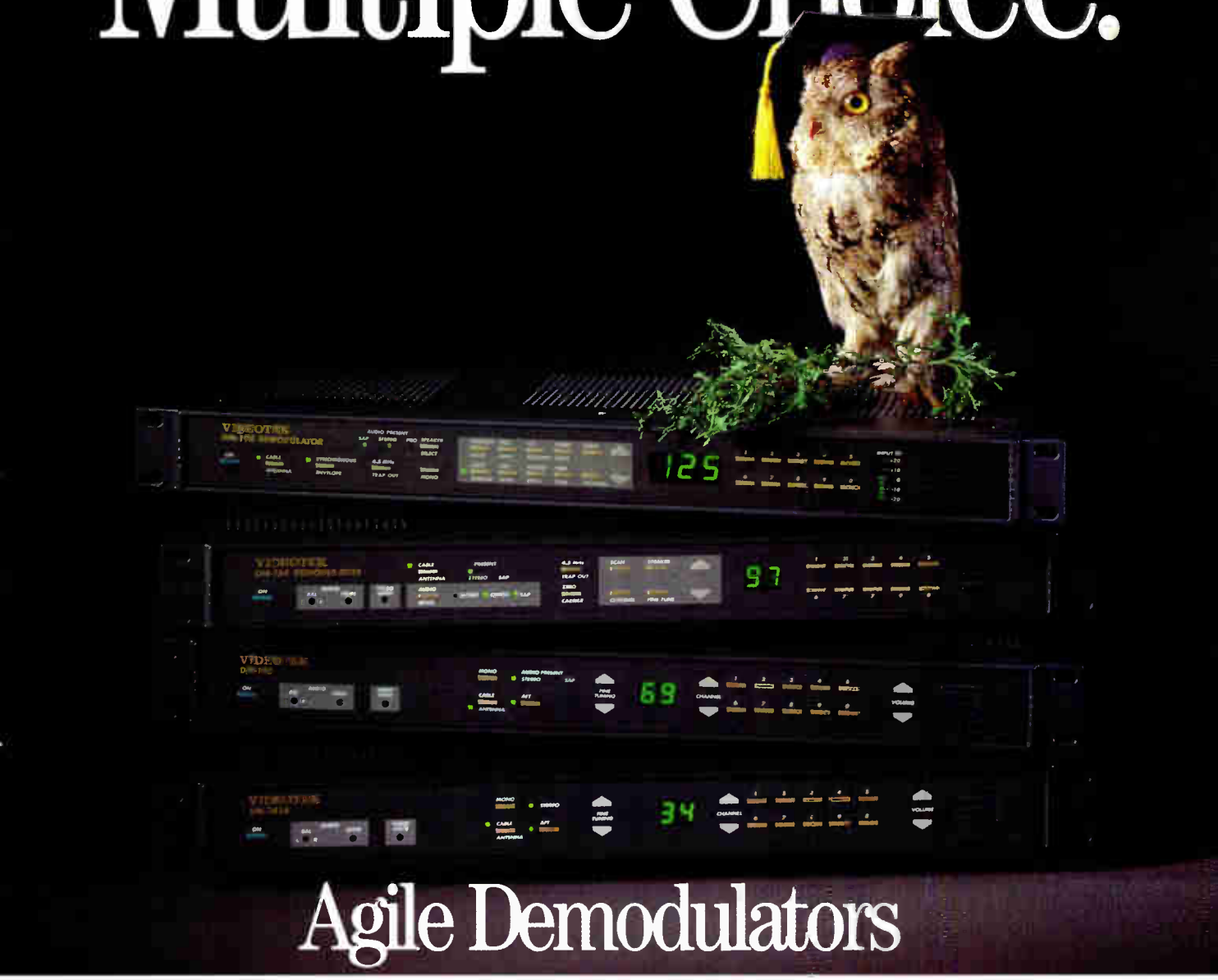
18: SCTE Gateway Chapter, testing session, BCT/E and Installer certification exams to be administered, St. Louis, MO. Contact: Chris Kramer, (314) 579-4627.

18: SCTE Shasta/Rogue Chapter, testing session, BCT/E and Installer certification exams to be administered, Medford, OR. Contact: Mike Smith, (541) 779-1814.

19: SCTE Oklahoma Chapter, testing session, BCT/E certification exams to be administered, Edmond, OK. Contact: Doug Huston, (405) 348-4225.

19: SCTE Wheat State Chapter, testing session, BCT/E certification exams to be administered, Great Bend, KS. Contact: Vicki Marts, (316) 262-4270. CT

Multiple Choice.



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Reader Service Number 178

CABLE TRIVIA

By Rex Porter

Our historical guru (aka Editor Rex Porter) has provided us with these trivia questions on the cable industry. Answers to the last set of questions appear first. (The last "Cable Trivia" ran on page 106 of the September issue.) Look for answers to this month's questions in a future issue (along with a new set of questions). The person supplying the most correct answers will be awarded a special Trivia T-shirt. You may only win once per calendar year.

To be in the running for a prize, your answers need to be postmarked or faxed to us by the 20th of the month of the issue date that the specific trivia test appears in. The first person who sends in the most correct answers will be the award winner. Good luck!

Your answers need to be sent to: The Trivia Judge, *Communications Technology*, 6565 E. Preston, Mesa, AZ 85215 or fax: (602) 807-8319.

Trivia #17 answers

1) Said to be the first broadcaster incable, he ran Cox Communications in the early years of cable. His name: Leonard Reinsch.

2) The first major bank to lend money to cable TV was: The Bank of New York.

3) At the 1984 SCTE Cable-Tec Expo in Nashville, an important paper, "Reliability in CATV Data Communication" was presented.

It discussed the STAR topology, CSMA and token passing packet techniques. Also, the seven layer OSI open system interconnect model was discussed. This presentation was made by: Burnup & Sims.

4) Cable systems were first required to submit annual proof-of-performance testing to the FCC in the year: 1977.

5) In 1971, the FCC made CBS spin off its cable and syndication interests. So, CBS simply formed a new company, with CBS officers and directors holding the stock of: Viacom.

Trivia #18

1) This Long Island City, NY, based company produced aluminum sheathed coax for trunk and feeders, corrugated copper shield and a full-line of drop cables:

A) Plastoid Corp.
B) Amphenol Cable
C) Columbia Wire & Supply
D) Rome Cable

2) On February 5-6, 1975, the SCTE and IEEE held their first Annual Conference on CATV Reliability. The conference took place at the Holiday Inn in:

A) Dallas
B) Philadelphia
C) Chicago
D) San Francisco

3) About this time, this year, Turner employees will celebrate which anniversary of CNN?

A) 12th anniversary
B) 14th anniversary
C) 16th anniversary
D) 18th anniversary

4) This major U.S. city (incorporated in 1837) advertised for franchise applicants to serve its five franchise areas, ranging in size from 188,000 to 273,000 households during 1982. It was:

A) Milwaukee
B) Chicago
C) Dallas
D) Sacramento

5) Trygve Myhren joined ATC on May 1:

A) 1975
B) 1972
C) 1976
D) 1970

6) A manufacturer of hardware, such as splitters and taps, it was based in Lancaster, OH. Its four-way tap was the 3600B. The company was:

A) Pico
B) Antronix
C) Arvin
D) Cerro

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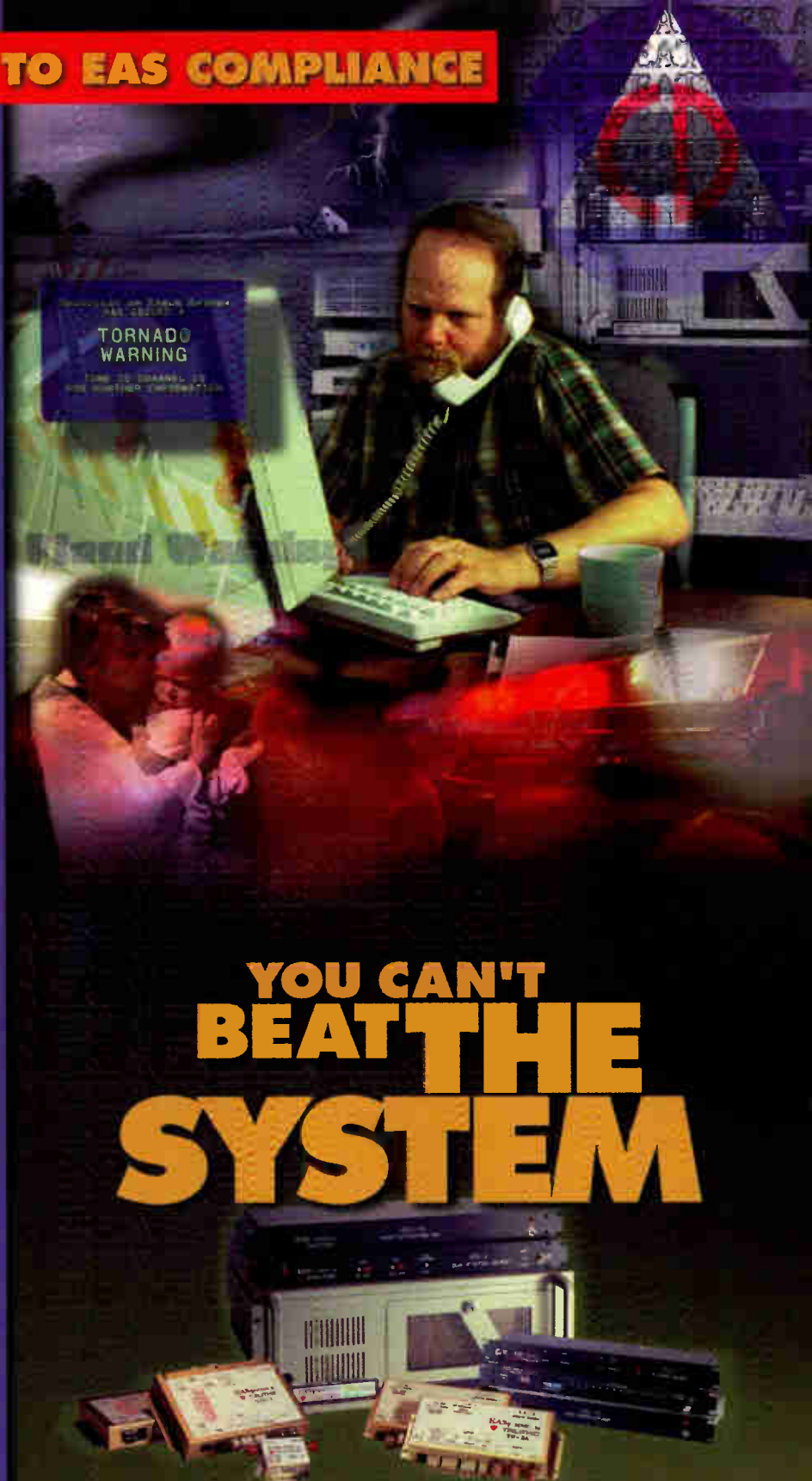

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Reader Service Number 172

7) FCC approved the construction permit for the Southern Satellite Systems uplink that would allow WTBS (Channel 17) to be on the RCA satellite by Oct. 1 in the year:

A) 1978
B) 1976
C) 1979
D) 1975

8) In the mid-1960s, Jerrold Electronics introduced to the market their first solid-state AGC trunkline amplifier, the model TAGC. The amplifier's list price at that time was:

A) $280
B) $200
C) $165
D) $400

9) If you used a Model 880 automatic slope control, a Model 222A chain amplifier, with a Model 830B automatic level control amplifier station from this company located at 1320 Soldiers Field, in Boston, you used equipment from:

A) SKL
B) CAS Mfg.
C) Delta-Benco
D) Craftsman Electronics

10) This company's ads read: "Pick A Cable—Any Cable." They manufactured cable from their plant in Phoenix, AZ, as well as amplifiers. They were:

A) Times Wire & Cable
B) Systems Wire & Cable
C) Theta-Com Cable
D) Anaconda Cable

11) This company manufactured "Olympic" series amplifiers and line extenders. It is:

A) Pencore
B) C-COR
C) Cohu
D) RCA

12) In the mid-1950s the nation's largest multiple system operator (MSO) was:

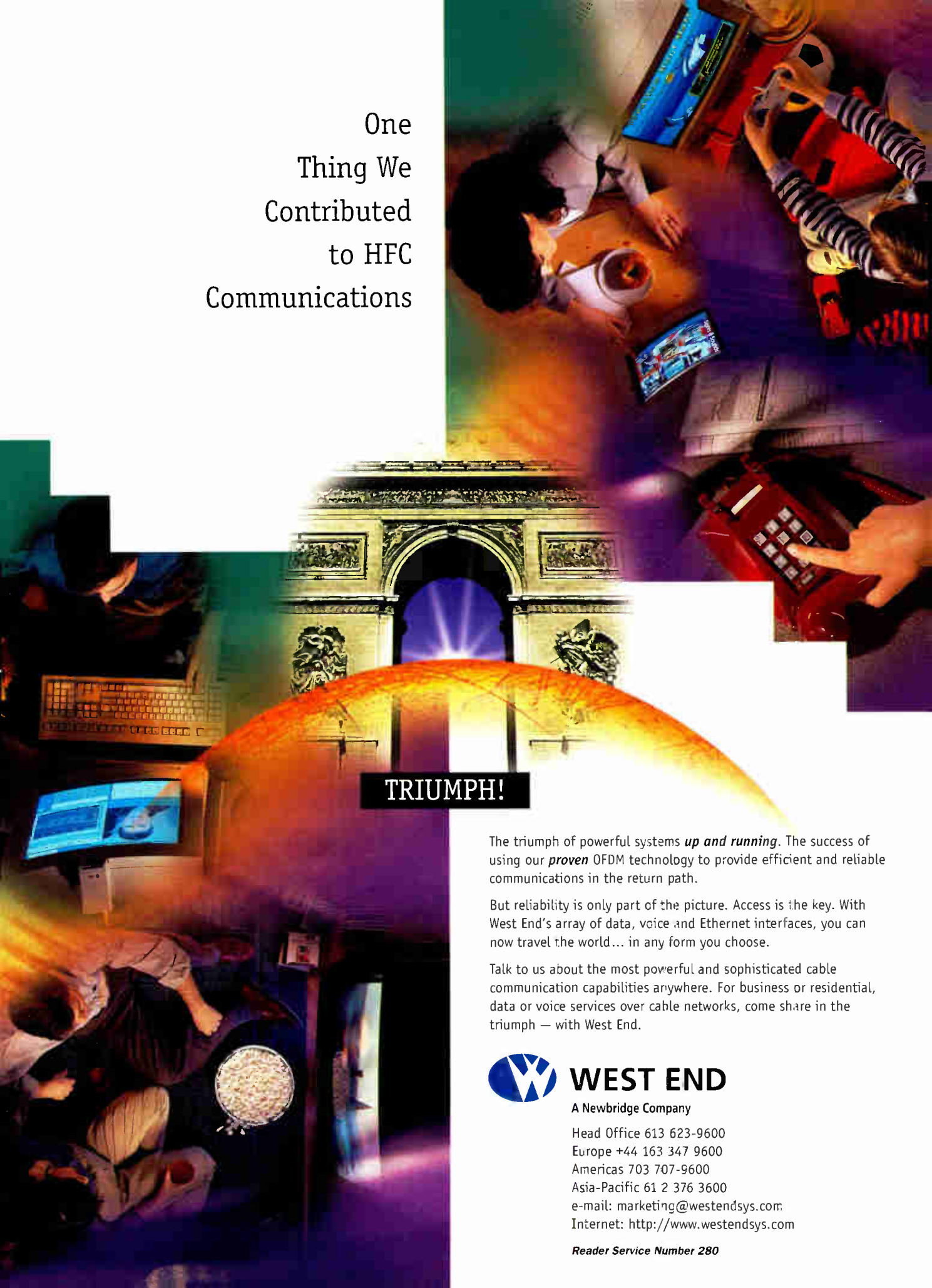
A) Sammons
B) CableCom General
C) United Video Systems
D) Jerrold Corp.

13) The son of Roy E. and Nellie, he was born in Casper, WY. After attending ASU, in Tempe, AZ, he began his career with Worland Cablevision in 1955, then moved on as marketing manager with Ameco and Sperry Rand Flight Systems Division. He then headed up United Video Inc. He is:

A) Earl Quam
B) Roy L. Bliss
C) Clay Blanco
D) Homer Harmon

And the winner is...

The winner for Cable Trivia #17(which ran in the September issue) is Brenda Hunt with Cox Cable in Tempe, AZ. Congratulations Brenda! CT



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Reader Service Number 280

BOOKSHELF

The following is a listing of some of the videotapes currently available by mail order through the Society of Telecommunications Engineers. The prices listed are for SCTE members only. Nonmembers must add 20% when ordering.

- *TV, Your Primary Diagnostic Instrument*—This program, which is the 1994 version of the old *Diagnosing Common Cable Faults* videotape, clearly demonstrates picture impairments found in modern day cable systems. Picture impairments demonstrated include carrier-to-noise, composite triple beat, low signal, low modulation, excessive signal, excessive modulation, hum, impulse noise, ghosting (reflective, ingress/direct pickup), cross-modulation, terrestrial interference, chroma/luma delay and differential phase. (40 min.) Order #T-1001-A, U-matic format: $59; VHS format: $45.
- *How a Cable System Works*—This provides a valuable overview of the business of cable TV, covering how systems evolved and currently operate. It also provides a video tour to acquaint new personnel with the components and equipment used in a CATV system. (3 hrs.) Order #T-1092, $75.
- *SLMs: The Technician's Edge*—Co-funded by CaLan, ComSonics, Trilithic, Sencore and Wavetek, this program provides an in-depth discussion of signal level measurement basics, as well as operating instructions for the CaLan Star, ComSonics' Window Lite Plus, Trilithic's Tricorder, the Sencore SL750 and Wavetek's line of meters. Topics covered include dBmVs, gain/loss measurements, meter design theory, detectors, pre microprocessor-based meters and interpolating results. (105 min.) Order #T-1135, $22.
- *Sweep*: The Complete Story—Co-funded by CaLan, Hewlett-Packard and Tektronix, this program provides a thorough treatment of sweep technology and applications. Detailed operating instructions are provided for the CaLan 1776/1777, HP 8591C and Tektronix 2722A/2721A systems. This program covers passband, frequency response theory, definition of sweep, resolution/scan loss, potential interference, TV scan theory, high level/low level/ no level sweeps, CATV transmission techniques, amplifier signatures and standing wave analysis. (105 min.) Order #T-1149, $22.
- *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.) Order # T-1016, $30.
- *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.) Order #T-1022, $95. CT

Note: The videotapes are in color and available in the NTSC 1/2-inch VHS format only. They are available in stock and will be delivered approximately three weeks after receipt of order with full payment.

Shipping: Videotapes are shipped UPS. No P.O. boxes, please. SCTE pays surface shipping charges within the continental U.S. only. Orders to Canada or Mexico: Please add $5 (U.S.) for each videotape. Orders to Europe, Africa, Asia or South America: SCTE will invoice the recipient for additional air or surface shipping charges (please specify). "Rush" orders: a $15 surcharge will be collected on all such orders. The surcharge and air shipping cost can be charged to a Visa or MasterCard.

To order: All orders must be prepaid. Shipping and handling costs are included in the continental U.S. All prices are in U.S. dollars. SCTE accepts MasterCard and Visa. To qualify for SCTE member prices, a valid SCTE identification number is required, or a complete membership application with dues payment must accompany your order. Orders without full and proper payment will be returned. Send orders to: SCTE, 140 Philips Rd., Exton, PA 19341-1318 or fax with credit card information to (610) 363-5898.

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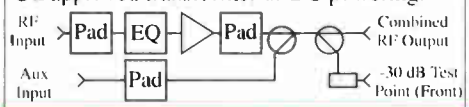

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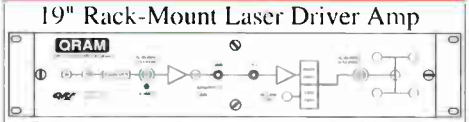

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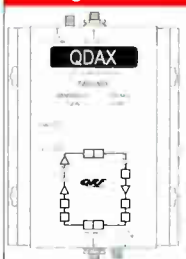

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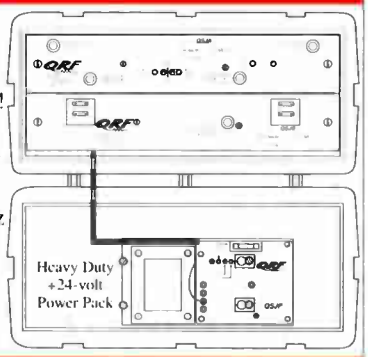

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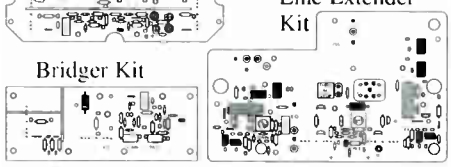

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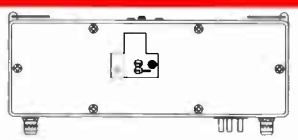

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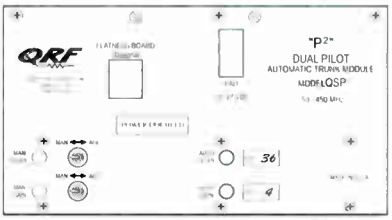

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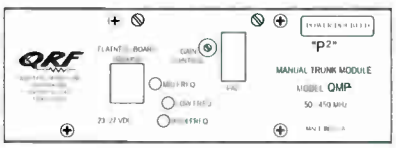

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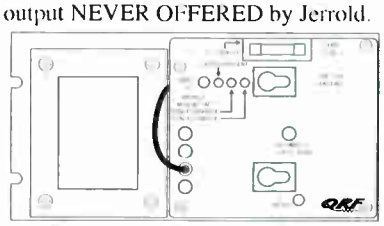

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VENDOR CONNECTION

Vendor Connection is *Communications Technology*'s latest resource for up-to-date information on the cable industry's leading technology suppliers. All of these vendors have advertised in this issue. Check their ads for products and services that will improve your cable systems reliability, efficiency and capacity.

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TRAINING

By the National Cable Television Institute

Troubleshooting the Drop System: Part 2

This month's installment continues the series on troubleshooting hot chassis conditions. The material is adapted from NCTI's Installer Technician Course, complemented by performance training suggestions to reinforce the material in a hands-on classroom setting. © NCTI.

Polarized two-slot receptacles (slots of unequal length and no ground hole) may be found in homes built prior to the mid-1950s. Check the wiring polarity of this type receptacle with either: 1) a polarized grounding adapter and an AC outlet tester, or 2) a volt ohm meter (VOM).

To use an AC outlet tester, first remove the AC outlet wall plate screw. Plug the grounding adapter's polarized prongs into the receptacle by inserting the adapter's wide blade into the long slot and the narrow blade into the short slot. Fasten the

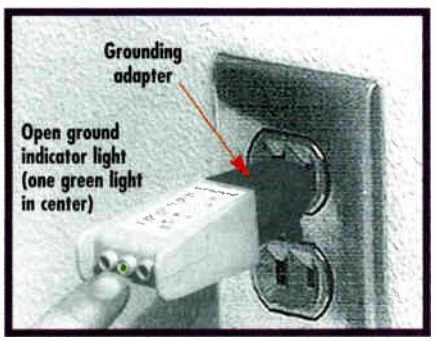

Figure 1: Reading "open ground" indication on AC outlet tester

adapter's green grounding tab to the receptacle with the wall plate screw. Plug the AC outlet tester into the grounding adapter. Determine the wiring condition by correctly interpreting the displayed indicator lights according to your AC outlet tester's chart of test results.

Figure 1 shows an example in which the AC outlet tester indicates the polarized two-slot receptacle is not grounded. In this case, do not use this receptacle to power the TV set, VCR or set-top terminal. However, temporarily grounding the receptacle at this point allows you to further test whether the receptacle has correct wiring polarity. This knowledge helps determine if the outlet is the cause of the hot chassis condition. To temporarily ground the receptacle, connect an insulated ground wire between the broadband cable wall plate F-81 barrel connector and the AC outlet wall plate screw, as shown in Figure 2. Then check the outlet tester's indicator lights again.

If the outlet tester shows the hot and neutral wires are reversed, the receptacle does not have correct wiring polarity. Do not use this receptacle for powering the TV set or any other devices. Tell the customer to not use this outlet until it is repaired by a licensed electrician.

If the outlet tester indicates all wiring is correct, then the hot and neutral wiring in the receptacle is correct. So long as this receptacle is temporarily grounded, and if a properly wired AC outlet is not available, you may use the receptacle to power the TV set and other customer premises devices while you check whether any of those devices are causing the hot chassis condition. However, do not use this receptacle for permanent powering of the TV set or any other devices. Tell the customer to have the receptacle repaired by a licensed electrician. Do not plug any AC power cords into an improperly wired AC wall outlet.

To use a VOM to check the wiring polarity of a polarized two-slot receptacle, perform and confirm all of the following voltage measurements: 1) no significant voltage between the long slot and the wall plate screw, 2) 115 VAC ±10% between the long slot and the short slot, and 3) 115 VAC ±10% between the short slot and the AC wall plate screw. If any of these measurements are not as described, the AC receptacle is not correctly wired. Do

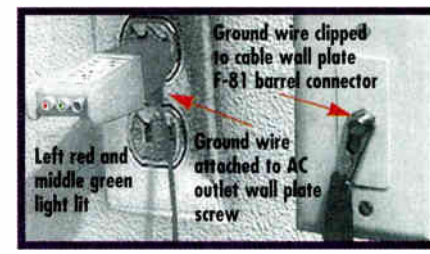

Figure 2: Temporarily grounding ungrounded polarized two-slot receptacle

not use it to power any devices. For example, measuring 0 VAC or near 0 VAC between the AC wall plate screw and the short slot indicates either improper wiring or an improper absence of AC voltage. Measuring 115 VAC ±10% between the longest receptacle slot and the broadband cable wall plate connector indicates that the hot and neutral wires are reversed. Do not plug any AC power cords into an improperly wired AC wall outlet.

Next month's installment will cover identifying a hot chassis condition caused by a defective electronic device.

Hands-on performance training

Proficiency objective: Check the wiring polarity of a polarized two-slot AC receptacle to determine if it is causing a hot chassis condition.

Ensure that you have enough two-slot polarized AC outlets for your number of students to practice on. You may want to have some outlets incorrectly wired. (If so, make sure these outlets are appropriately labeled so they are only used for testing purposes.)

Demonstrate checking a two-slot polarized receptacle using a polarized grounding adapter and an AC outlet tester, and/or a VOM (depending on your system's preference). Emphasize the importance of never using any faulty AC wall outlet. Have students practice checking polarity of polarized two-slot outlets.

Verify that each student can correctly check wiring polarity of a two-slot polarized AC receptacle using a polarized grounding adapter and AC outlet tester, and/or a VOM. CT

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CT1097

By William W. Riker

Board Elections: The Voice Of SCTE Membership

Right now, Society of Cable Telecommunications Engineers members have the potential to effectively shape the future of broadband telecommunications. If you are wondering what I mean, let me ask you this: How much impact do you have on the world around you? If you're a member of SCTE, it's more than you might think.

In the United States alone, there are more than 1.2 million miles of operable coaxial cable connecting our homes and businesses—that's enough cable to circle the world about 48 times. At some point, every inch of that cable has been designed, installed, spliced, activated, tested, serviced or even replaced. Since thousands of industry field personnel also are members of our Society, chances are pretty good that an SCTE member has worked on the line that feeds into your own home.

Clearly, SCTE members play an important role in this industry. As a result, they have an opportunity to mold the future of broadband telecommunications by contributing to the Society's decision-making processes. In turn, they are responsible to all industry personnel to ensure that the choices the Society makes are in the best interest of everyone involved in cable telecommunications.

A few months from now, SCTE members will be asked to vote for nominees to fill eight open seats on the Society's 1998-1999 board of directors. They include Region 3 (Idaho, Montana, Oregon, Washington); Region 4 (Oklahoma, Texas); Region 5 (Illinois, Iowa, Kansas, Missouri, Nebraska); Region 7 (Michigan, Ohio, Wisconsin); Region 8 (Alabama, Arkansas, Louisiana, Mississippi, Tennessee); Region 10 (Kentucky, North Carolina, Virginia, West Virginia); Region 12 (Maine, Massachusetts, New Hampshire, New York, Rhode Island, Vermont) and one at-large position that represents the organization as a whole.

I look upon the annual election process as an invaluable opportunity for our members to significantly contribute to the industry. Our board of directors collectively represents 15,000 industry personnel in the United States and 70 foreign countries. From service technicians to engineering management, SCTE members on six continents will be influenced by our board's decisions. That is why member involvement in the entire election process, from initial nominations to the inauguration of new directors, is key to SCTE's progress as a member-driven organization.

Although elections are still several months away, nominating qualified candidates is your responsibility today. Those of you who are involved with the Society should have received a nominations form. This is an essential first step in our annual election. Take the time and look around you; who, of your co-workers, peers and mentors in the industry, would best represent you on the SCTE board of directors? Who would listen to your concerns and express those needs to appropriate individuals who can bring about changes in the Society and in the industry? That individual should respect his or her peers and be an active part of the advancement of our Society. Choose someone who will accurately fill the members' needs in your region. Keep in mind that whoever you nominate will represent you for two years.

Each SCTE board member is responsible to all of our members. His or her duties include visiting with and promoting the growth and development of chapters and meeting groups in their region or internationally, and reporting local activities to the rest of the board. As the Society expands, it is more important than ever that it maintains a continuous flow of communication among these groups and the board of directors is an important part of that interaction.

Another aspect of a director's duties and responsibilities is reviewing existing and future SCTE programs, benefits and services. In the past year, we've seen the development of two new certification programs, the SCTE World Wide Website and the introduction of computer-based training programs, which can provide a convenient, cost-effective method of expanding your technical knowledge. In addition, ANSI/SCTE Standard SP 400-1996 "F" Port (Female Outdoor) Physical Dimensions became the first American National Standard for the cable telecommunications industry last December. Now, more standards are being developed that will continue to foster technological development.

All of these accomplishments are a direct result of the members who get involved with their Chapters, who participate in SCTE events, and who elect a board of directors that wishes to continue this success. These members have the opportunity to influence the world around them.

As we enter the final months of 1997, many of us are beginning to set goals for the year ahead. One of my goals is to achieve even greater member participation in this year's election. Your nominations and choices today will shape not only our Society's future, but the direction of broadband telecommunications...and your career.

That's what I call impact. ⟨ T

Bill Riker is president of the Society of Cable Telecommunications Engineers.

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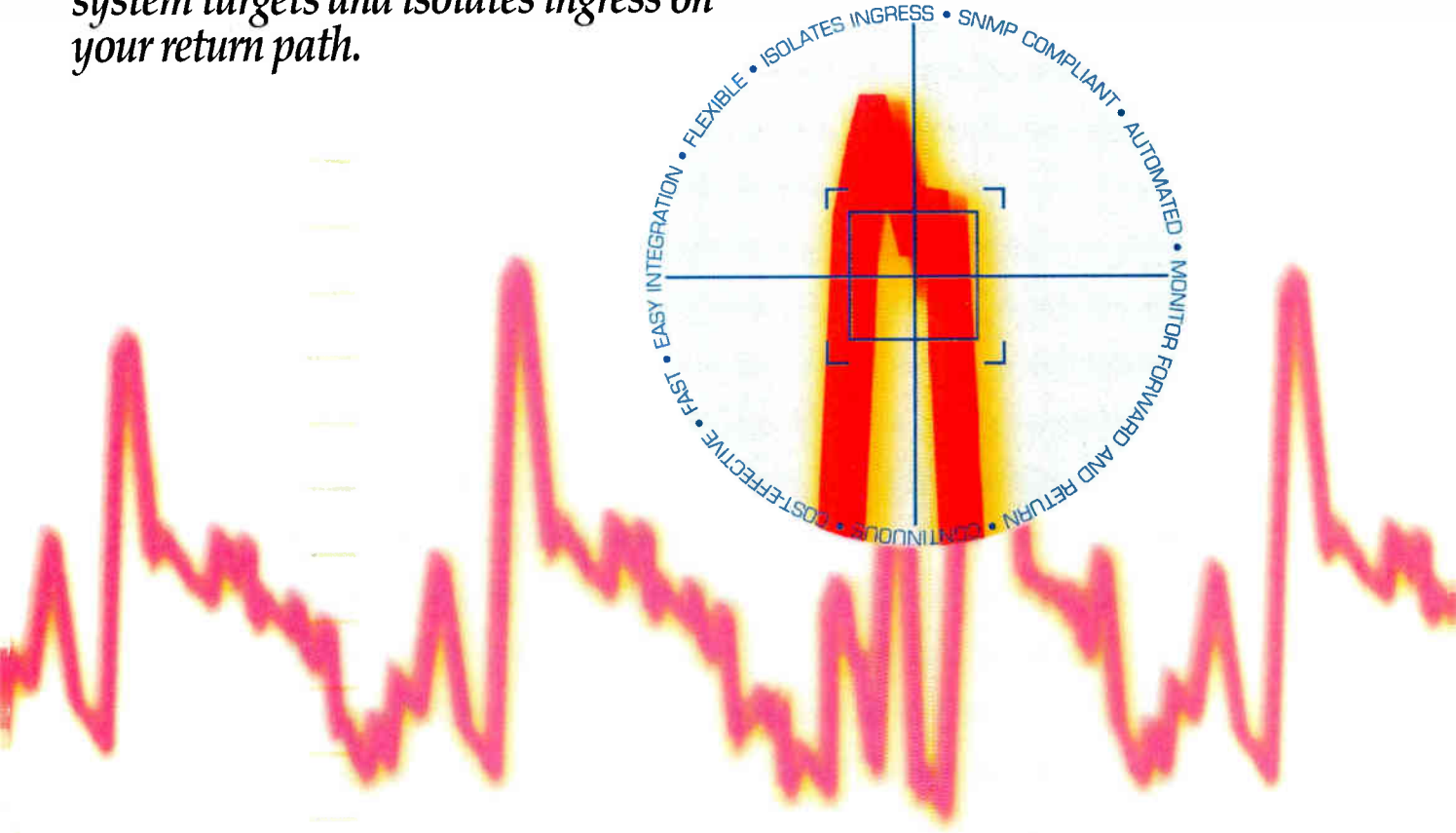

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